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11th Annual CMMI Technology Conference and User Group

Denver, Co

14 -17 November 2011

Agenda

Tuesday, November 15, 2011

MONDAY TUTORIAL SESSIONS

TRACK 2 - WIND STAR

- 13304 - Making Process Improvement Work – Tying Improvement and CMMI® Directly to What You Care About, Mr. Neil Potter, The Process Group
- 13555 - Architecture: Why Your CMMI® V1.3 Implementation is Incomplete Without It!, Dr. Lawrence Jones & Dr. Michael Konrad, Software Engineering Institute

TRACK 3 - HIGHLANDS

- 13492 - Lesson Learned from Pilot Implementation of Organizational Performance Management (OPM) Process Area, Mr. Kobi Vider, K.V.P. Consulting
- 13493 - Leveraging Your Service Quality Using ITIL V3, ISO 20000 and CMMI®-SVC, Mr. Kobi Vider, K.V.P. Consulting

TRACK 4 - WIND RIVER

- 13431 - Risk and Issue Management, Mr. Al Florence, MITRE
- 13479 - Software Safety, Mr. Tim Kasse, National Renewable Energy Laboratory (NREL)

Tuesday, November 15, 2011

Keynote Speaker

- Maj Gen Paul Neilsen, USAF (Ret), Director, Software Engineering Institute

Future of CMMI® - Panel Discussion

- Mr. Brian Gallagher, Northrop Grumman Corporation

- Mr. Rusty Young, Software Engineering Institute

CONCURRENT SESSIONS

TRACK 1 - MESA VERDE

- 13488 - Just Getting Started with CMMI®, Ms. Mary Beth Chrissis, Software Engineering Institute.
- 13481 - Are Your Customers Happy? Using Customer Satisfaction to Drive Improvement Efforts, Ms. Susan LaFortune, Department of Defense
- 13510 - Lessons Learned in Overcoming Resistance to CMMI Dr. Rick Hefner, Northrop Grumman Corporation
- 13456 - Diagnosis PIF: Avoiding Process Improvement Fatigue, Mr. Craig Hale, Esterline Control Systems - AVISTA

TRACK 2 - WIND STAR

- 13427 - Why Do Developers Make These Dangerous Software Errors?, Mrs. Michele Moss, Booz Allen Hamilton
- 13365 - Some Assembly Required: Using Agile Methodologies to Develop an Interactive Software User's Guide, Mr. Ronald Stauffer, Raytheon Company

TRACK 3 - HIGHLANDS

- 12936 - Applying CMMI®-SVC Process Areas as an Extension to CMMI®-DEV, Ms. Mary Lynn Penn, Lockheed Martin IS&GS
- 13263 - A LEAN and RACI Approach to CMMI® for Services (CMMI®-SVC), Mr. Ahn Nuzen, SPAWAR Systems Center Pacific (SSC PAC)
- 13291 - A Real-Life Example of Appraising and Interpreting CMMI®- Services Maturity Level 2, Mr. Neil Potter, The Process Group
- 13520 - CMMI®-DEV: Where "Build Stuff" Happens in CMMI®-SVC, Ms. Eileen Forrester, Software Engineering Institute

TRACK 4 - WIND RIVER

- 13288 - Comparing Scrum And CMMI® - How Can They Work Together?, Mr. Neil Potter, The Process Group
- 13446 - Utilizing Lean Six Sigma to Attain CMMI® Maturities, Mr. Steven Moffat, SAIC
- 13465 - Design Your Business Processes to Embrace People in an Agile Approach and Support High Maturity (OPM), Mr. Kobi Vider, K.V.P. Consulting

Wednesday, November 16, 2011

CONCURRENT SESSIONS

TRACK 1 - MESA VERDE

- 13514 - The Fundamental Value of Every Single CMMI® Practice, Dr. Rick Hefner, Northrop Grumman Corporation
- 13475 - Questions from the Trenches: What Over 1000 Students Want to Know Most About the CMMI®, Mr. Bill Smith, Leading Edge Process Consultants
- 13450 - CMMI® Training – Avoiding Waste and Ineffectiveness, Ms. Sari Schneider, The Boeing Company
- 13498 - Communication Loops in CMMI® v.1.3, Mr. Shawn Presson, TestPros, Inc.
- 13472 - Why Project Managers (Understandably) Hate the CMMI® and What to Do About It, Mr. Bill Smith, Leading Edge Process Consultants
- 13495 - CMMI® Level 1 to 3 in 15 Months: AIM for a Performance Upgrade, Dr. Gene Miluk, Software Engineering Institute, Carnegie Mellon University
- 13458 - Project Driven Process Improvement: A large Scale Lean Six Sigma Deployment in Egypt Across Multiple Small and Medium Sized Software Organizations, Dr. Radouane Oudrhiri, Systonomy

TRACK 2 - WIND STAR

- 13318 - Chutes and Ladders - CMMI® - ISO Considerations, Ms. Kimberley Eley, ManTech
- 13477 - A Tale of Two Cultures Ms. Beth Layman, Layman & Layman
- 13303 - Using Lessons Learned from Medical Checklists to Simplify CMMI® Processes, Mr. Neil Potter, The Process Group
- 13480 - Creating an SQA Program at the National Renewable Energy Laboratory (NREL) – A DOE FFRDC Based on the NDIA/DoD Sponsored CMMI®, Mr. Tim Kasse, National Renewable Energy Laboratory
- 13496 - TSP and Architecture in the Real World, Mr. James McHale, Software Engineering Institute
- 13433 - Risk Management Mr. Al Florence, The MITRE Corporation
- 13511 - Effective, CMMI-Compliant Project Plans (in Less Than 10 Pages), Dr. Rick Hefner, Northrop Grumman Corporation

TRACK 3 - HIGHLANDS

- 13459 - A Process Performance Models Case Study, Mr. Kobi Vider, K.V.P. Consulting
- 13500 - Use Causal Analysis and Resolution (CAR) & Quantitative Project Management (QPM) to Monitor and Control the Quality and Process-Performance, Mr. Yasir Madi, OST Global
- 13508 - Strategies for Retaining CMMI® Maturity Level 5 in v1.3, Dr. Rick Hefner, Northrop Grumman Corporation
- 13516 - Assembling a Multi- Model Approach to Improving Service Quality and Ensuring Service Resilience in Complex Risk Environments, Ms. Eileen Forrester, Software Engineering Institute

12935 - CMMI® for Acquisition (CMMI®-ACQ)/CMMI® for Services (CMMI®-ACQ) and Their Potential Contribution on the Rapid Acquisition of IT Systems in Support of Public Law 111, Dr. Kenneth Nidiffer, Software Engineering Institute

- 13452 - Implementation of Process Improvement in a Multi-Model/Standard Government Environment, Mr. Nathaniel Becker, U.S. Army ARDEC

TRACK 4 - WIND RIVER

- 13290 - Appraisals and CMMI® Gotchas - Lessons in CMMI® Use and Appraisal Preparation, Mr. Neil Potter, The Process Group
- 13451 - Streamlining Process Deployment and Compliance, Mr. Gary Natwick, Harris Corporation
- 13512 - How to Successfully and Cost-Effectively Conduct a Re-Appraisal, Dr. Rick Hefner, Northrop Grumman Corporation
- 13240 - CMMI® Maturity Level 5 A Bargain!, Mrs. Jayne Perkins, Raytheon IDS
- 13402 - CMMI® Surveillance Appraisals: A Modest Proposal, NDIA CMMI®Working Group
- 12987 - SCAMPI Planning with v1.3,Ms. Dorna Witkowski, Lockheed Martin Corporation
- 13506 - Increasing Efficiency and Saving Costs with New SCAMPI Approaches, Mr. Paul Byrnes, ISD, Inc.
- 13485 - Experiences in the Applying of MDD (Method Definition Document) v1.3 Sampling Factors and Sampling Algorithm, Mr. Bradley Bittorf, Raytheon Company

Thursday, November 17, 2011

CONCURRENT SESSIONS

TRACK 1 - MESA VERDE

- 13644 - CMMI for Executives, NDIA CMMI®Working Group
- 13471 - Cracking the Code for Improving the Productivity of Knowledge Workers, Mr. Peter Voldby Petersen, Callis
- 13455 - Improving Process Quality While Lowering Costs, Mr. Craig Hale, Esterline Control Systems - AVISTA,
- 13505 - The Change Comes from the Inside! Divide and Conquer: A Top Down and Bottom Up Approach, Mr. Surya Kanchiraju, OST, Inc.

TRACK 2 - WIND STAR

- 13028 - Process Acceptance Through Use Cases, Dr. Juergen Schmied, Method Park
- 13482 - How a Focus on High Maturity CMMI®-Based Process Improvement Can Add Value to the Organizations Even When There are Only Limited Resources, Mr. Edmond Sung, Processis, LTD
- 12962 - Parametric Estimation for ERP Implementations, Mr. Donald Beckett, Quantitative Software Management
- 13434 - Writing Requirements Properly, Mr. Al Florence, The MITRE Corporation

TRACK 3 - HIGHLANDS

- 13491 - CMMI®, ISO and AS9100, An Efficient and Effective Approach, Mrs. LaKeisha Souter, Northrop Grumman Corporation
- 13468 - Using the SEI Models and Practices to Assure your Subcontractors quality with Cross Constellations and Multi-Models Inspiration, Mr. Kobi Vider, K.V.P. Consulting
- 13460 - Lean Six Sigma, Towards an Empirical and Experimental Approach to Software Process, Dr. Radouane Oudrhiri, Systonomy
- 13419 - Raytheon Pasadena Operations, CMMI®-DEV versus CMMI®-SVC Analysis, Mrs. Rose-Marie Gonzalez, Raytheon

TRACK 4 - WIND RIVER

- 13449 -CMMI® Without Appraisals Mr. Alan Gellis, The Boeing Company
- 13643 - SCAMPI A V1.3 MDD Usage and Profile, Mr. Michael Campo, Raytheon Company
- 13421 - You are a CMMI®-DEV Appraisal Expert? What Do You Do If Your Organization Wants to Do a CMMI®-SVC Appraisal?, Mr. Joseph Trujillo, Raytheon

- 13404 - Managed Discovery? PIIDs? How Do I Decide Which SCAMPI Data Collection Techniques are Right for My Organization, Mr. Sam Fogle, ACE Guides

2011 CMMI-CREATE Survey

2011 CMMI-CREATE Survey Results

NDIA
National Defense Industrial Association

PROMOTING NATIONAL SECURITY SINCE 1919

CMMI®

11TH ANNUAL CMMI® TECHNOLOGY CONFERENCE AND USER GROUP

Who Should Attend?

Defense, aerospace and commercial companies, CMMI® Transition Partners, Department of Defense organizations, small companies specializing in software and systems engineering development, tools and processes, acquisition, or services, and other government agencies.

What Will Be Presented?

A wide variety of presentations, including the new CMMI® for Services, integrated process improvement, Lean/Agile and Six Sigma approaches, and evolving approaches and lessons learned involving SCAMPI (SM) appraisal methods.



SPONSORED BY THE NDIA SYSTEMS ENGINEERING DIVISION

NOVEMBER 14-17, 2011

HYATT REGENCY TECH CENTER ▸ DENVER, CO

WWW.NDIA.ORG/MEETINGS/2110

EVENT #2110

SUNDAY, NOVEMBER 13, 2011

4:00 pm - 6:00 pm **Registration Open**
Located in Grand Mesa Foyer, 2nd Floor

MONDAY, NOVEMBER 14, 2011

7:00 am - 6:00 pm **Registration Open**
Located in Grand Mesa Foyer, 2nd Floor

7:00 am - 8:00 am **Continental Breakfast (Tutorial Attendees Only)**
Located in Grand Mesa Foyer, 2nd Floor

8:00 am - 5:00 pm **Tutorial Sessions (Tutorial Attendees Only; Additional Cost Required)**

9:45 am - 10:15 am **Break (Tutorial Attendees Only)**
Located in Grand Mesa Foyer, 2nd Floor

11:45 am - 1:00 pm **Lunch (Tutorial Attendees Only)**
Located in Grand Mesa ABC, 2nd Floor

2:45 pm - 3:15 pm **Break (Tutorial Attendees Only)**
Located in Grand Mesa Foyer, 2nd Floor

5:00 pm - 6:00 pm **Reception (Open to ALL ATTENDEES)**
Located in Atrium Display Area, 2nd Floor

TUESDAY, NOVEMBER 15, 2011

7:00 am - 6:00 pm **Registration Open**
Located in Grand Mesa Foyer, 2nd Floor

7:00 am - 8:00 am **Continental Breakfast**
Located in Atrium Display Area, 2nd Floor

8:00 am - 8:15 am **Welcome and Opening Remarks**
Located in Mesa Verde, 2nd Floor
- Mr. Sam Campagna, *Assistant Vice President, Operations, NDIA*
- Mr. Bob Rassa, *Director, Engineering Programs, Raytheon Company*

8:15 am - 9:15 am **Keynote Speaker**
Located in Mesa Verde, 2nd Floor
- Maj Gen Paul Neilsen, USAF (Ret), *Director, Software Engineering Institute*

9:15 am - 10:00 am **State of CMMI®**
Located in Mesa Verde, 2nd Floor
- Mr. Mike Phillips, *Software Engineering Institute*

10:00 am - 10:30 am **Break**
Located in Atrium Display Area, 2nd Floor

10:30 am - 12:00 pm **Future of CMMI® - Panel Discussion**
Located in Mesa Verde, 2nd Floorr
- Mr. Michael Campo, *Raytheon Company*
- Mr. Brian Gallagher, *Northrop Grumman Corporation*
- Ms. Lynn Penn, *Lockheed Martin Corporation*
- Mr. Rusty Young, *Software Engineering Institute*





12:00 pm - 1:30 pm **Luncheon Speaker**
Located in Grand Mesa ABC, 2nd Floor
"What Do You Know about Process Improvement and Physics-Based Modeling"
- Mr. Geoff Draper, *Harris Corporation*

1:30 pm - 3:00 pm **Concurrent Sessions**

3:00 pm - 3:30 pm **Break**
Located in Atrium Display Area, 2nd Floor

3:30 pm - 5:00 pm **Concurrent Sessions**

5:00 pm - 6:00 pm **Reception**
Located in Atrium Display Area, 2nd Floor

WEDNESDAY, NOVEMBER 16, 2011

7:00 am - 5:00 pm **Registration Open**
Located in Grand Mesa Foyer, 2nd Floor

7:30 am - 8:30 am **Continental Breakfast**
Located in Atrium Display Area, 2nd Floor

8:30 am - 10:00 am **Concurrent Sessions**

10:00 am - 10:30 am **Break**
Located in Atrium Display Area, 2nd Floor

10:30 am - 12:00 pm **Concurrent Sessions**

12:00 am - 1:30 pm **Luncheon**
Located in Grand Mesa ABC, 2nd Floor

1:30 pm - 3:00 pm **Concurrent Sessions**

3:00 pm - 3:30 pm **Break**
Located in Atrium Display Area, 2nd Floor

3:30 pm - 5:00 pm **Concurrent Sessions**

5:00 pm **Conference Ajourns for the Day**

THURSDAY, NOVEMBER 17, 2011

7:00 am - 12:00 am **Registration Open**
Located in Grand Mesa Foyer, 2nd Floor

7:30 am - 8:30 am **Continental Breakfast**
Located in Grand Mesa Foyer, 2nd Floor

8:30 am - 10:00 am **Concurrent Sessions**

10:00 am - 10:30 am **Break**
Located in Grand Mesa Foyer, 2nd Floor

10:30 am - 12:00 pm **Concurrent Sessions**

12:00 pm **Conference Ajourns**

Please note that the agenda is subject to change

MONDAY, NOVEMBER 14, 2011
TUTORIAL SESSIONS

	Track 1 Mesa Verde	Track 2 Wind Star	Track 3 Highlands	Track 4 Wind River
8:00 am - 9:45 am **Session A**	1A1 - Tutorial 13435 - How to Design Lean CMMI® Processes and Procedures Using Architectures and Models *Mr. Tim Olson, Lean Solutions Institute, Inc.*	1A2 - Tutorial 13304 - Making Process Improvement Work – Tying Improvement and CMMI® Directly to What You Care About *Mr. Neil Potter, The Process Group*	1A3 - Tutorial 13492 - Lesson Learned from Pilot Implementation of Organizational Performance Management (OPM) Process Area *Mr. Kobi Vider, K.V.P. Consulting*	1A4 - Tutorial 13431 - Risk and Issue Management *Mr. Al Florence, MITRE*
Break in Grand Mesa Foyer, 2nd Floor				
10:15 am - 11:45 am **Session B**	1B1 - Tutorial (Continued) 13435 - How to Design Lean CMMI® Processes and Procedures Using Architectures and Models *Mr. Tim Olson, Lean Solutions Institute, Inc.*	1B2 - Tutorial (Continued) 13304 - Making Process Improvement Work – Tying Improvement and CMMI® Directly to What You Care About *Mr. Neil Potter, The Process Group*	1B3 - Tutorial (Continued) 13492 - Lesson Learned from Pilot Implementation of Organizational Performance Management (OPM) Process Area *Mr. Kobi Vider, K.V.P. Consulting*	1B4 - Tutorial (Continued) 13431 - Risk and Issue Management *Mr. Al Florence, MITRE*
Lunch in Grand Mesa ABC, 2nd Floor				
1:00 pm - 2:45 pm **Session C**	1C1 - Tutorial 13437- How to Design the 'Vital Few' Lean Metrics *Mr. Tim Olson, Lean Solutions Institute, Inc.*	1C2 - Tutorial 13555 - Architecture: Why Your CMMI® V1.3 Implementation is Incomplete Without It! *Dr. Lawrence Jones & Dr. Michael Konrad, Software Engineering Institute*	1C3 - Tutorial 13493 - Leveraging Your Service Quality Using ITIL V3, ISO 20000 and CMMI®-SVC *Mr. Kobi Vider, K.V.P. Consulting*	1C4 - Tutorial 13479 - Software Safety *Mr. Tim Kasse, National Renewable Energy Laboratory (NREL)*
Break in Grand Mesa Foyer, 2nd Floor				
3:15 pm - 5:00 pm **Session D**	1D1 - Tutorial (Continued) 13437- How to Design the 'Vital Few' Lean Metrics *Mr. Tim Olson, Lean Solutions Institute, Inc.*	1D2 - Tutorial (Continued) 13555 - Architecture: Why Your CMMI® V1.3 Implementation is Incomplete Without It! *Dr. Lawrence Jones & Dr. Michael Konrad, Software Engineering Institute*	1D3 - Tutorial (Continued) 13493 - Leveraging Your Service Quality Using ITIL V3, ISO 20000 and CMMI®-SVC *Mr. Kobi Vider, K.V.P. Consulting*	1D4 - Tutorial (Continued) 13479 - Software Safety *Mr. Tim Kasse, National Renewable Energy Laboratory (NREL)*

Additional Cost Required

TUESDAY, NOVEMBER 15, 2011

	Track 1 Mesa Verde	Track 2 Wind Star	Track 3 Highlands	Track 4 Wind River
	CMMI® and Process Improvement Session Chairs: Mr. Mike Campo, Raytheon Company; Ms. Mary Beth Chrissis, Software Engineering Institute	Practical Guidance Session Chairs: Ms. Juliet Davis, The Boeing Company; Mr. Geoff Draper, Harris Corporation	Services Session Chair: Mr. Steve Henry, Northrop Grumman Corporation	Agile/Lean Session Chairs: Dr. Mike Konrad, Software Engineering Institute; Ms. Beth Layman, Layman and Layman, Inc.
1:30 pm - 2:15 pm	13488 - Just Getting Started with CMMI® *Ms. Mary Beth Chrissis, Software Engineering Institute*	13427 - Why Do Developers Make These Dangerous Software Errors? *Mrs. Michele Moss, Booz Allen Hamilton*	12936 - Applying CMMI®-SVC Process Areas as an Extension to CMMI®-DEV *Ms. Mary Lynn Penn, Lockheed Martin IS&GS*	13288 - Comparing Scrum And CMMI® - How Can They Work Together? *Mr. Neil Potter, The Process Group*
2:15 pm - 3:00 pm	13481 - Are Your Customers Happy? Using Customer Satisfaction to Drive Improvement Efforts *Ms. Susan LaFortune, Department of Defense*	13483 - Your Destiny, It's In Your Defect Density *Ms. Margaret Tanner Glover, MITRE*	13263 - A LEAN and RACI Approach to CMMI® for Services (CMMI®-SVC) *Mr. Ahn Nuzen, SPAWAR Systems Center Pacific (SSC PAC)*	13439 - Using a Lean Measurement Framework to Design CMMI® Metrics *Mr. Tim Olson, Lean Solutions Institute, Inc.*
Break in Atrium Display Area, 2nd Floor				
	CMMI® and Process Improvement Session Chairs: Mr. Mike Campo, Raytheon Company; Ms. Mary Beth Chrissis, Software Engineering Institute	Practical Guidance Session Chairs: Ms. Juliet Davis, The Boeing Company; Mr. Geoff Draper, Harris Corporation	Services Session Chair: Mr. Steve Henry, Northrop Grumman Corporation	Agile/Lean Session Chairs: Dr. Mike Konrad, Software Engineering Institute; Ms. Beth Layman, Layman and Layman, Inc.
3:30 pm - 4:15 pm	13510 - Lessons Learned in Overcoming Resistance to CMMI *Dr. Rick Hefner, Northrop Grumman Corporation*	13429 - NAVSEA Efforts to Bring Reliability and Maintainability Engineering into Software Reliability *Mr. Paul Dube, NAVSEA*	13291 - A Real-Life Example of Appraising and Interpreting CMMI®-Services Maturity Level 2 *Mr. Neil Potter, The Process Group*	13446 - Utilizing Lean Six Sigma to Attain CMMI® Maturities *Mr. Steven Moffat, SAIC*
4:15 pm - 5:00 pm	13456 - Diagnosis PIF: Avoiding Process Improvement Fatigue *Mr. Craig Hale, Esterline Control Systems - AVISTA*	13365 - Some Assembly Required: Using Agile Methodologies to Develop an Interactive Software User's Guide *Mr. Ronald Stauffer, Raytheon Company*	13520 - CMMI®-DEV: Where "Build Stuff" Happens in CMMI®-SVC *Ms. Eileen Forrester, Software Engineering Institute*	13465 - Design Your Business Processes to Embrace People in an Agile Approach and Support High Maturity (OPM) *Mr. Kobi Vider, K.V.P. Consulting*

WEDNESDAY, NOVEMBER 16, 2011

	Track 1 Mesa Verde	Track 2 Wind Star	Track 3 Highlands	Track 4 Wind River
	CMMI® and Process Improvement Session Chairs: Mr. Mike Campo, Raytheon Company; Ms. Mary Beth Chrissis, Software Engineering Institute	Practical Guidance Session Chairs: Ms. Juliet Davis, The Boeing Company; Mr. Geoff Draper, Harris Corporation	High Maturity Session Chair: Mr. Steve Henry, Northrop Grumman Corporation	Appraisals Session Chairs: Dr. Mike Konrad, Software Engineering Institute; Ms. Beth Layman, Layman and Layman, Inc.
8:30 am - 9:15 am	13487 - Ask an Author: Questions about CMMI® v1.3 *Ms. Mary Beth Chrissis, Software Engineering Institute*	13318 - Chutes and Ladders - CMMI® - ISO Considerations *Ms. Kimberley Eley, ManTech*	13454 - Hardware High Maturity - It's Not Software or Defects *Mr. Tom Lienhard, Raytheon*	13290 - Appraisals and CMMI® Gotchas - Lessons in CMMI® Use and Appraisal Preparation *Mr. Neil Potter, The Process Group*
9:15 am - 10:00 am	13514 - The Fundamental Value of Every Single CMMI® Practice *Dr. Rick Hefner, Northrop Grumman Corporation*	13477 - A Tale of Two Cultures *Ms. Beth Layman, Layman & Layman*	13459 - A Process Performance Models Case Study *Mr. Kobi Vider, K.V.P. Consulting*	13451 - Streamlining Process Deployment and Compliance *Mr. Gary Natwick, Harris Corporation*
Break in Atrium Display Area, 2nd Floor				
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10:30 am - 11:15 am	13475 - Questions from the Trenches: What Over 1000 Students Want to Know Most About the CMMI® *Mr. Bill Smith, Leading Edge Process Consultants*	13303 - Using Lessons Learned from Medical Checklists to Simplify CMMI® Processes *Mr. Neil Potter, The Process Group*	13500 - Use Causal Analysis and Resolution (CAR) & Quantitative Project Management (QPM) to Monitor and Control the Quality and Process-Performance *Mr. Yasir Madi, OST Global*	13512 - How to Successfully and Cost-Effectively Conduct a Re-Appraisal *Dr. Rick Hefner, Northrop Grumman Corporation*
11:15 am - 12:00 pm	13450 - CMMI® Training – Avoiding Waste and Ineffectiveness *Ms. Sari Schneider, The Boeing Company*	13480 - Creating an SQA Program at the National Renewable Energy Laboratory (NREL) – A DOE FFRDC Based on the NDIA/DoD Sponsored CMMI® *Mr. Tim Kasse, National Renewable Energy Laboratory*	13508 - Strategies for Retaining CMMI® Maturity Level 5 in v1.3 *Dr. Rick Hefner, Northrop Grumman Corporation*	13240 - CMMI® Maturity Level 5 — A Bargain! *Mrs. Jayne Perkins, Raytheon IDS*

WEDNESDAY (CONTINUED)

	Track 1 Mesa Verde	Track 2 Wind Star	Track 3 Highlands	Track 4 Wind River
	CMMI® and Process Improvement Session Chairs: Mr. Mike Campo, Raytheon Company; Ms. Mary Beth Chrissis, Software Engineering Institute	Practical Guidance Session Chairs: Ms. Juliet Davis, The Boeing Company; Mr. Geoff Draper, Harris Corporation	Multi-Model Improvement Session Chair: Ms. Eileen Forrester, Software Engineering Institute	Appraisals Session Chairs: Dr. Mike Konrad, Software Engineering Institute; Ms. Beth Layman, Layman and Layman, Inc.
1:30 pm - 2:15 pm	13498 - Communication Loops in CMMI® v.1.3 *Mr. Shawn Presson, TestPros, Inc.*	13496 - TSP and Architecture in the Real World *Mr. James McHale, Software Engineering Institute*	13438 - Using the U.S. Malcolm Baldrige National Quality Award Performance Criteria to Measurably Improve CMMI® Results *Mr. Tim Olson, Lean Solutions Institute, Inc.*	13402 - CMMI® Surveillance Appraisals: A Modest Proposal *NDIA CMMI®Working Group*
2:15 pm - 3:00 pm	13472 - Why Project Managers (Understandably) Hate the CMMI® — and What to Do About It *Mr. Bill Smith, Leading Edge Process Consultants*	13433 - Risk Management *Mr. Al Florence, The MITRE Corporation*	13516 - Assembling a Multi-Model Approach to Improving Service Quality and Ensuring Service Resilience in Complex Risk Environments *Ms. Eileen Forrester, Software Engineering Institute*	12987 - SCAMPI Planning with v1.3 *Ms. Dorna Witkowski, Lockheed Martin Corporation*
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9:15 am - 10:00 am	13471 - Cracking the Code for Improving the Productivity of Knowledge Workers *Mr. Peter Voldby Petersen, Callis*	13482 - How a Focus on High Maturity CMMI®-Based Process Improvement Can Add Value to the Organizations Even When There are Only Limited Resources *Mr. Edmond Sung, Processis, LTD*	13468 - Using the SEI Models and Practices to Assure your Subcontractors quality with Cross Constellations and Multi-Models Inspiration *Mr. Kobi Vider, K.V.P. Consulting*	13643 - SCAMPI A V1.3 MDD Usage and Profile *Mr. Michael Campo, Raytheon Company*
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ADDITIONAL AUTHORS

ABSTRACT #	ABSTRACT TITLE	ADDITIONAL AUTHORS
13240	CMMI Maturity Level 5 ..... A Bargain!	Mrs. Mary Ellen Christopher; Mr. Ralph Williams
13263	A LEAN and RACI Approach to CMMI for Services (CMMI-SVC)	Mr. David A. Dayton
13318	Chutes and Ladders - CMMI-ISO Considerations	Ms. Kate Roehling
13402	CMMI Surveillance Appraisals: A Modest Proposal	Mr. Michael Campo
13403	CMMI: Back to the Future?	Mr. Michael Campo
13419	Raytheon Pasadena Operations, CMMI-DEV versus CMMI-SVC Analysis	Mr. G. Doug Mazezka
13421	You are a CMMI-DEV appraisal expert? What do you do if you org wants to do a CMMI-SVC appraisal?	Ms. Debra L. Smith
13446	Utilizing Lean Six Sigma to attain CMMI maturities	Mr. Ahn T. Nuzen
13458	Project Driven Process Improvement – A large scale Lean Six Sigma deployment in Egypt across multiple small and medium sized software organisations	Dr. Amr Kamel
13477	A Tale of Two Cultures	Ms. Marie Johnson
13481	Are Your Customers Happy? Using Customer Satisfaction to Drive Improvement Efforts	Ms. Kathleen A. Demery
13482	How a focus on high maturity CMMI-based process improvement can add value to the organization even when there are only limited resources	Mr. Tim Kasse
13491	CMMI, ISO, and AS9100, an Efficient and Effective Approach	Mr. Albert I. Chatmon
13495	CMMI Level 1 to 3 in 15 Months: AIM for a performance upgrade	Mr. Timothy A. Chick
13500	Use Causal Analysis and Resolution (CAR) & Quantitative Project Management (QPM) to monitor and control the quality and process-performance	Mrs. Kusum Dhyani
13505	The change comes from the inside! Divide and Conquer: A Top Down and Bottom Up Approach	Ms. Carolina Rivero
13506	Increasing efficiency and saving costs with new SCAMPI approaches	Mr. Jeff McGarry
13511	Effective, CMMI-Compliant Project Plans (in Less Than 10 Pages)	Mr. Ferol Lewis
13555	Tutorial - Architecture: Why your CMMI V1.3 implementation is incomplete without it!	DR. Michael Konrad

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(703) 522-1885
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What Do You Know About Process Improvement and Physics-Based Modeling?

CMMI Technology Conference and User Group

Physics-based Modeling in Design & Development for U.S. Defense Conference

November 16, 2011

Welcome!

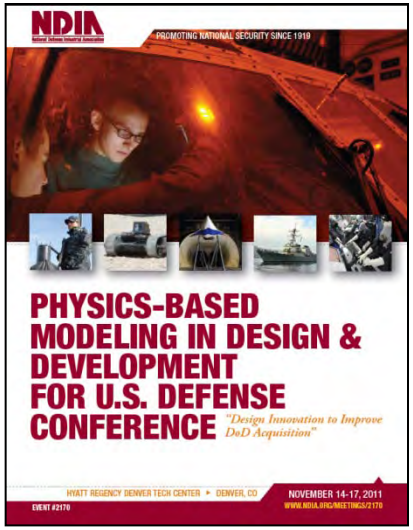
Objective:

- Help build awareness and interest in process improvement and physics-based modeling
- Facilitate integration between communities

Approach:

- Brief overview of fundamental concepts
- Interactive responses to targeted questions for community feedback

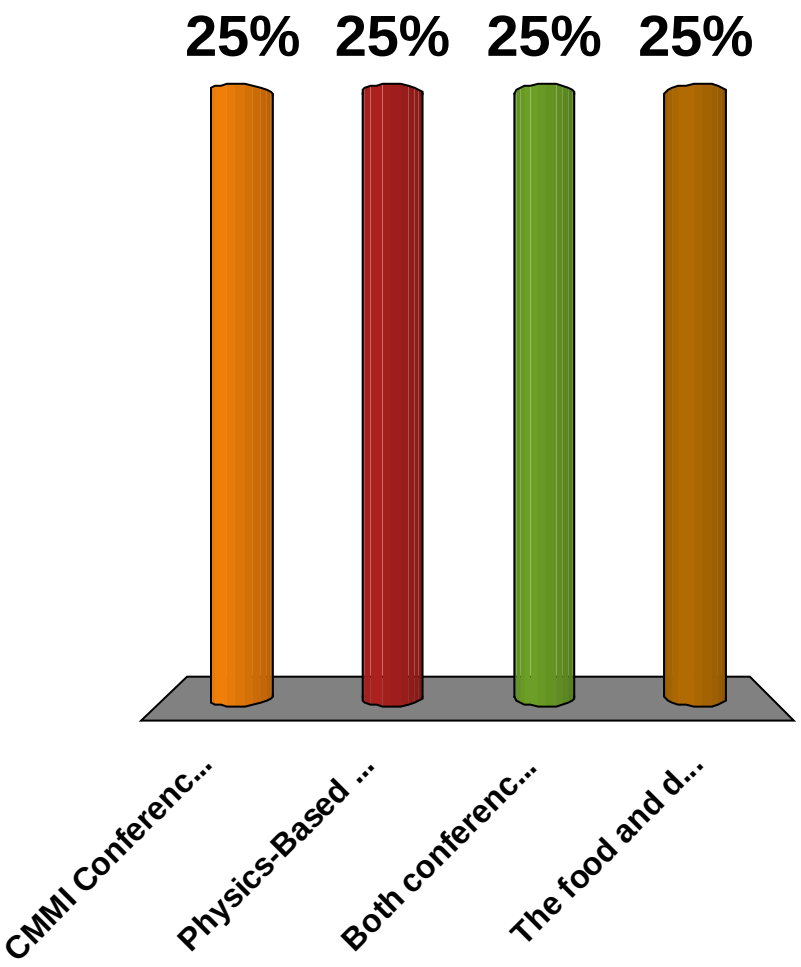




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I am here primarily for…

1. CMMI Conference
2. Physics-Based Modeling Conference
3. Both conferences
4. The food and drinks

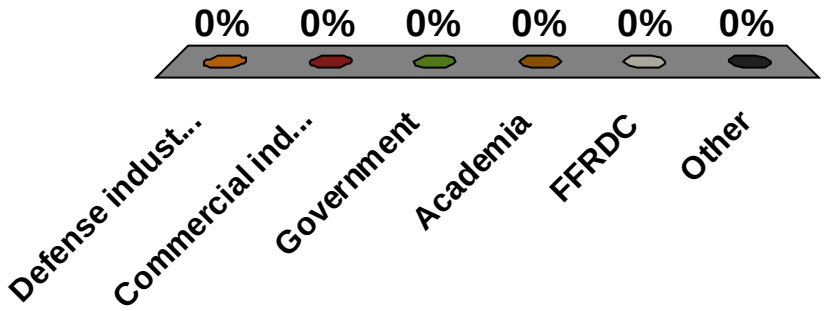


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What domain are you representing?

1. Defense industry
2. Commercial industry
3. Government
4. Academia
5. FFRDC
6. Other

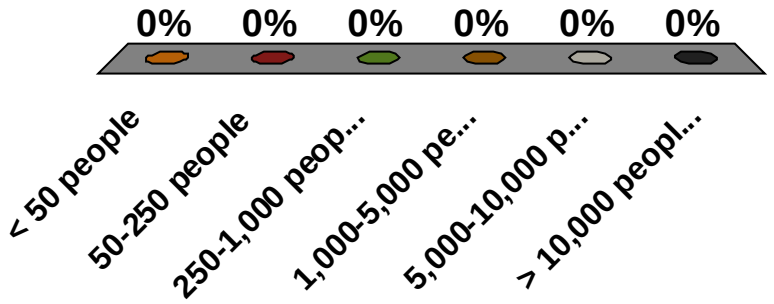


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How large is your organizational unit?

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What Is CMMI?

CMMI is a model representing a collection of best practices proven effective in industry

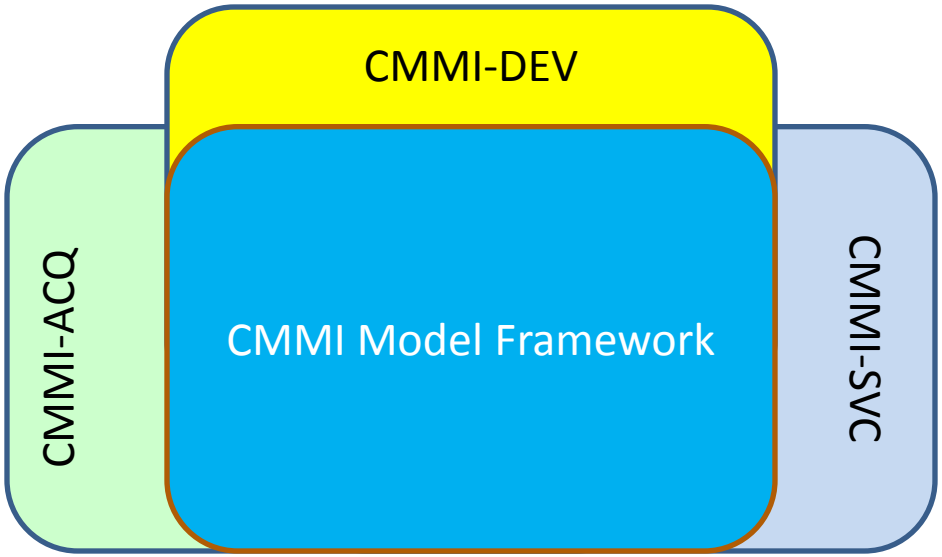
- A framework for developing, improving, and sustaining business performance
- Provides a process focus on work activities
- Developed by industry (commercial and defense), government, academia

CMMI targets three primary environments:

- Development -
  Engineering a product or service
- Services –
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- Acquisition –
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The CMMI product suite consists of:

- Models and primers
- Appraisal methods
- Training courses

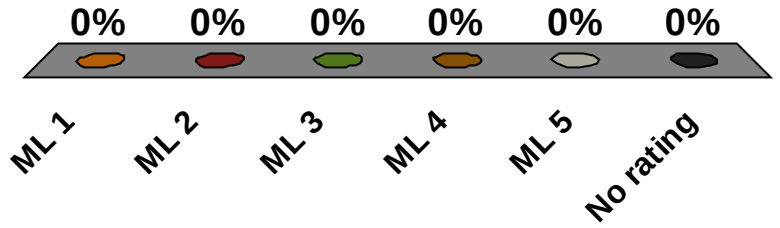


Capability Maturity Model Integration (CMMI®)

Source: CMMI® for Executives, NDIA Systems Engineering Division.
http://www.ndia.org/Divisions/Divisions/SystemsEngineering/

Does your organization have a CMMI maturity level rating?

1. ML 1
2. ML 2
3. ML 3
4. ML 4
5. ML 5
6. No rating

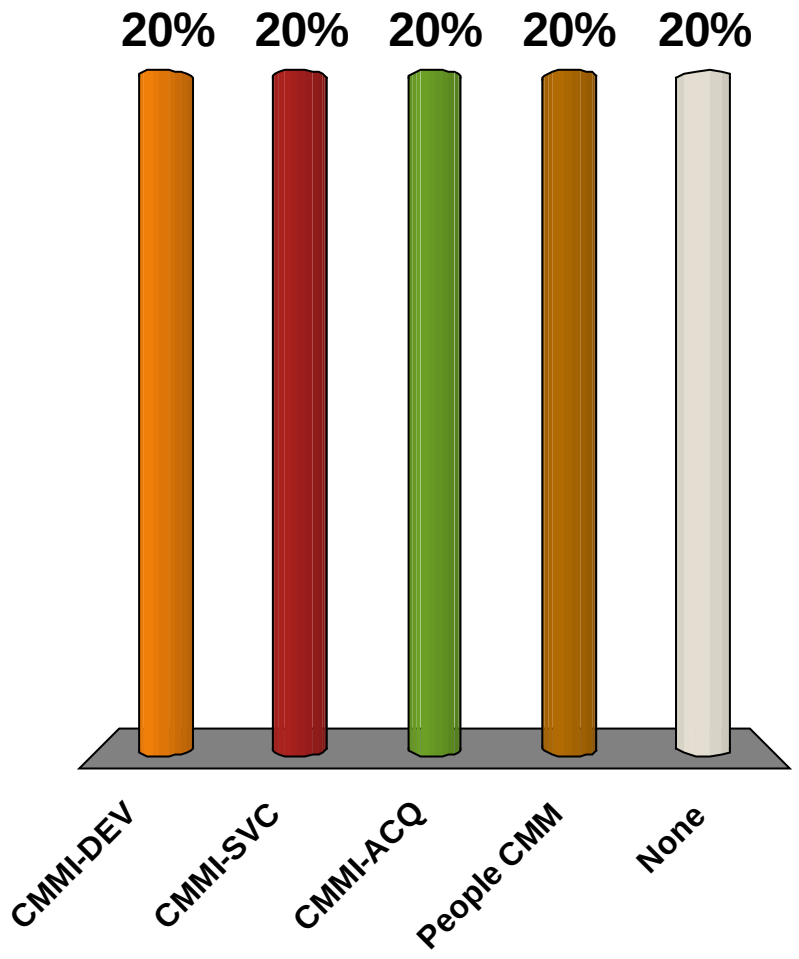


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Which model constellations has your organization used, or will use in the next year? (select all that apply)

1. CMMI-DEV
2. CMMI-SVC
3. CMMI-ACQ
4. People CMM
5. None

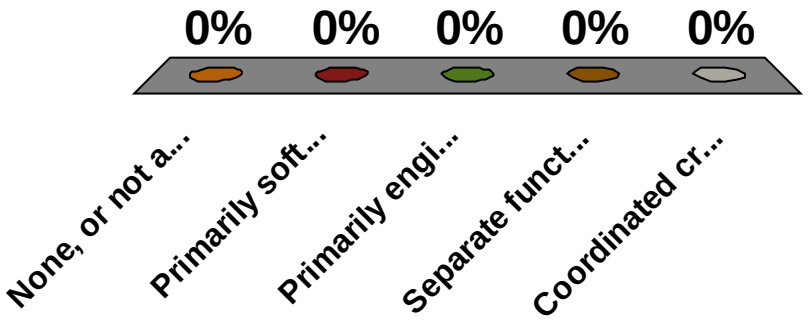


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How does your organization implement process improvement?

1. None, or not applicable
2. Primarily software
3. Primarily engineering
4. Separate functional process groups
5. Coordinated cross-functionally (Engineering, PM, Mfg, Quality, etc.)

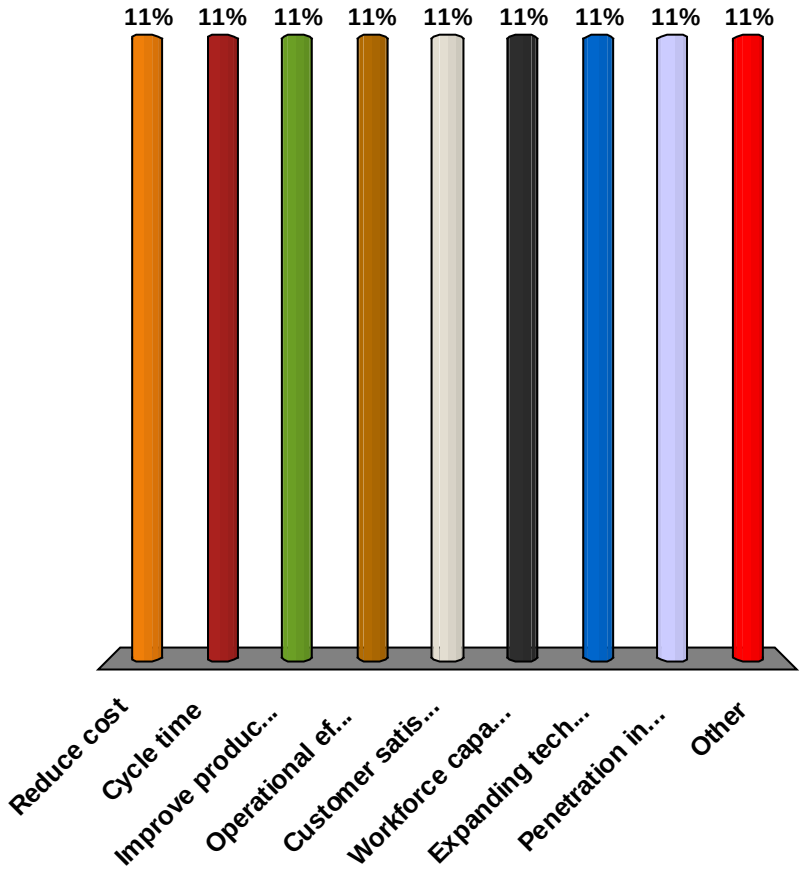


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What top organizational improvement goals drive your measurable improvement initiatives? (select up to 3)

1. Reduce cost
2. Cycle time
3. Improve product quality (reduce rework)
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5. Customer satisfaction
6. Workforce capability/skills
7. Expanding technologies (e.g., Agile)
8. Penetration into new markets
9. Other

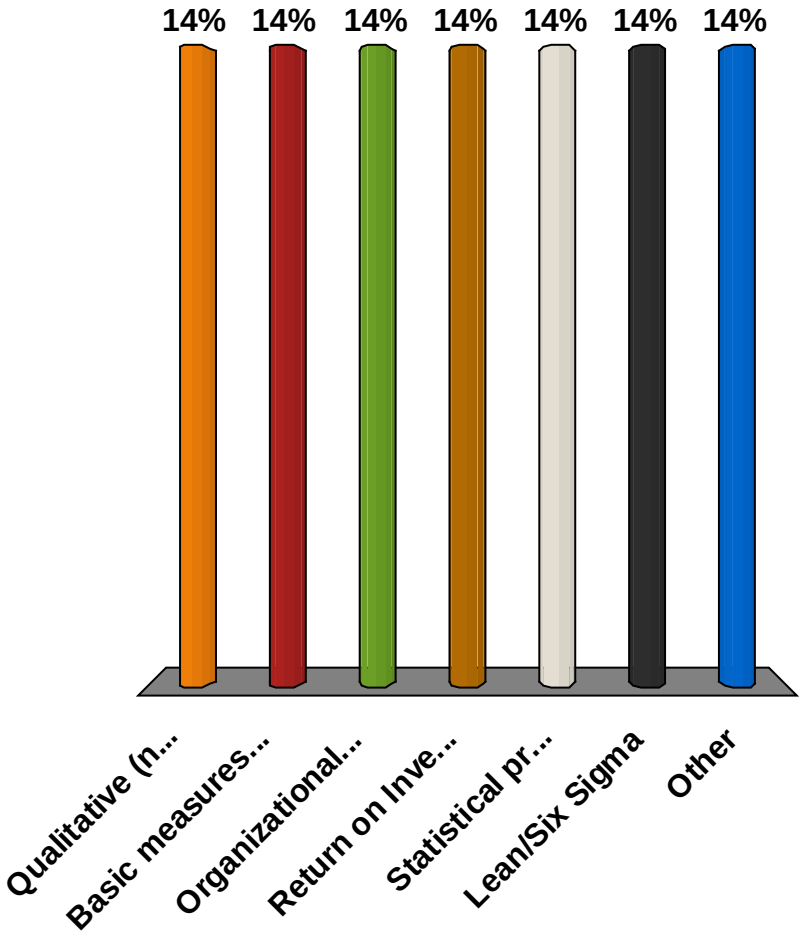


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How do you measure the effectiveness of your improvement initiatives? (select up to 3 choices)

1. Qualitative (not measured)
2. Basic measures for individual initiatives
3. Organizational improvement trends (e.g., across projects)
4. Return on Investment (ROI)
5. Statistical process control (SPC)
6. Lean/Six Sigma
7. Other

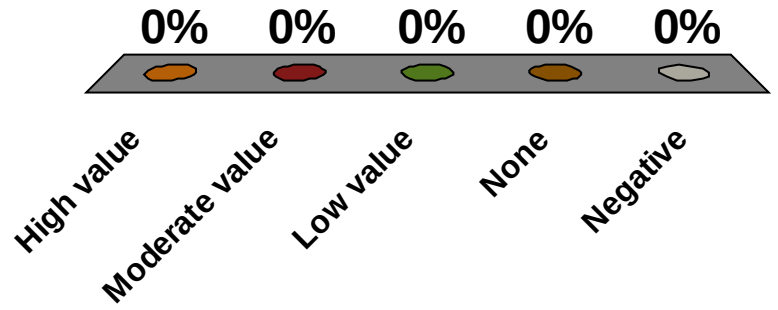


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What real impact has process improvement had on your business performance?

1. High value
2. Moderate value
3. Low value
4. None
5. Negative



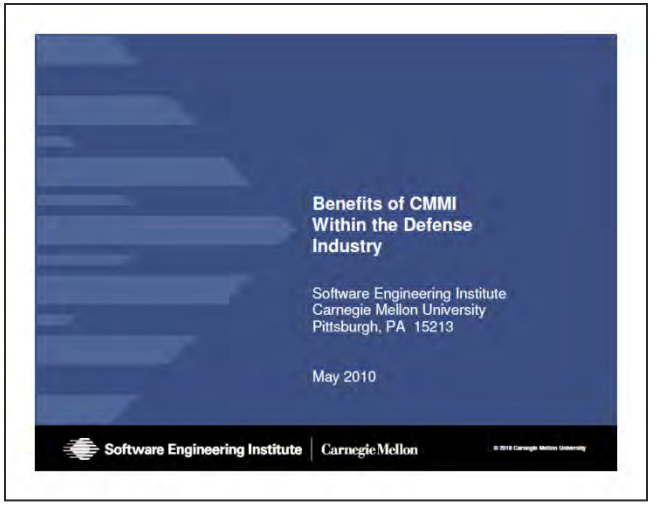
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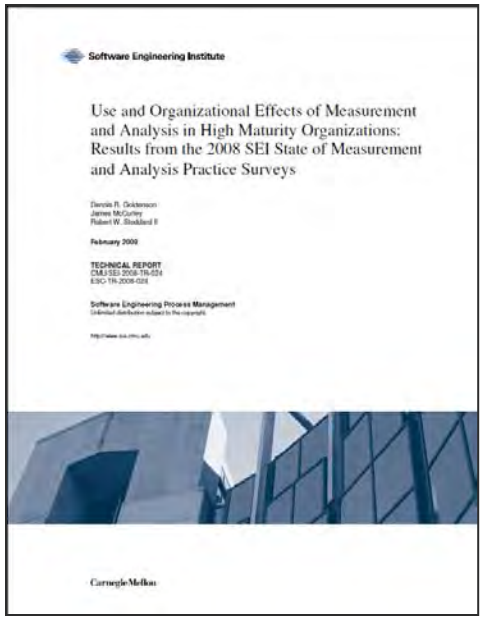
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Measures of CMMI Adoption and Performance Benefits

- Studies
- Reports
- Workshops
- Analyses

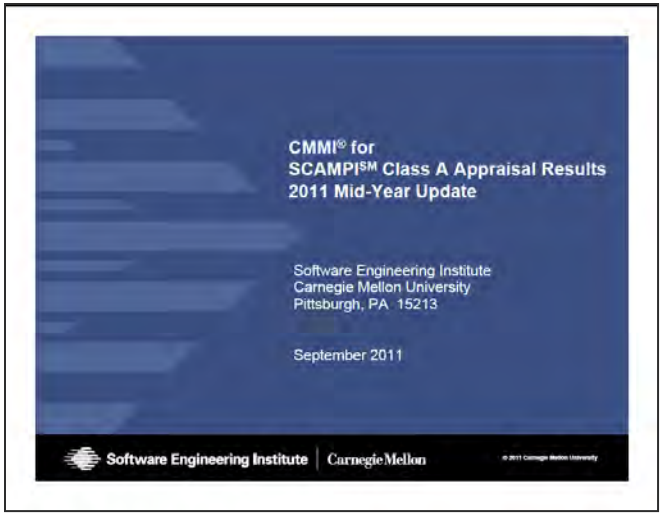
http://www.sei.cmu.edu/library/assets/presentations/CMMI%20Benefits.pdf



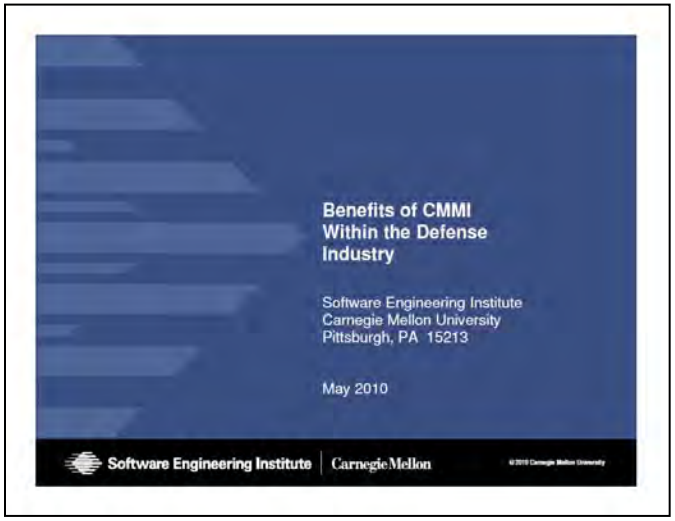


http://www.sei.cmu.edu/library/abstracts/reports/08tr024.cfm

http://www.sei.cmu.edu/cmmi/casestudies/profiles/pdfs/upload/2011SepCMMI.pdf



Industry Benefits from CMMI



Example measures reported by NDIA member companies:	
Defect repair effort	•Defect repair hours: -58% (ML3 to ML5) •Defect cost savings: -105 hrs per defect •I&T hrs/defect: -24% •Hours/KLOC: -22% *(ML3 to ML5)*
Defect density	•62% fewer high-severity defects *(ML5)* •Defect phase containment: +240% *(ML5)* •>85% defects removed prior to sys test •Acceptance test: < 0.15 defects/KLOC
Development cost	•SW development cost: -28% *(ML3 to ML5)* •Potential project savings: $1.9M–$2.3M
Productivity	•Productivity gain: +42% *(ML5, 9 yrs)*
Cost/schedule	•Over 6X less likely cost/schedule impact

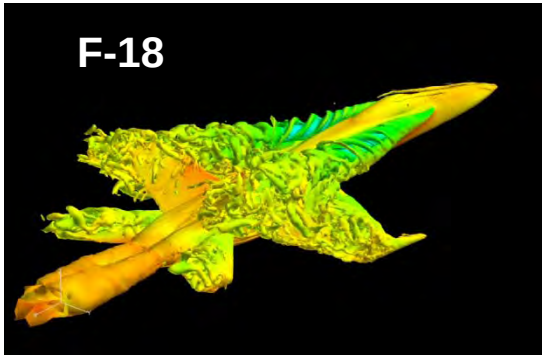
The new data presented in this report demonstrates that effective implementation of good practices aided by use of CMMI can improve cost, schedule, and quality performance.

Benefits of CMMI in the Defense Industry, Software Engineering Institute, May 2010.
http://www.sei.cmu.edu/library/abstracts/presentations/CMMI-Benefits-to-Defense-Industry.cfm

Source: CMMI® for Executives, NDIA Systems Engineering Division.
http://www.ndia.org/Divisions/Divisions/SystemsEngineering/

What is Physics-Based Modeling?

- Physics-Based Modeling is the use of computer software applications to design and analyze the performance of systems by solving the physics equations that govern the behavior of the system
- Reduces the need for physical testing
- Examples:
  - Air Vehicles—predict air vehicle performance by solving the equations that describe the airflow over the wings and other components (i.e. lift and drag) together with the deformation of the air vehicle structure due to the airflow loads.
  - Tires—predict tire performance by solving the equations that describe tire flexing, deformation, and treadwear e.g. behavior of rubber, steel belts, water flow in treads, etc.



Vortex induced Tail Buffet



~ 60 Million Cycles During an 80,000 Mile Tire Lifetime

CREATE Program

The **Computational Research & Engineering Acquisition Tools and Environments** (CREATE) project was initiated by the Department of Defense in 2008 as a long term effort to enable major improvements in the acquisition process with the following goals:

- Prevent defects and design flaws early in the acquisition process
- Reduce rework thereby enabling faster system deployment
- Reduce experimental testing time and effort through analysis of virtual prototypes

It would accomplish this by injecting multi-physics based predictions early within the design and analysis process, by developing and deploying production quality design and analysis software that is adaptable and maintainable, and developing and deploying multi-physics based Computational Engineering tools that exploit next generation high-speed computer resources. These tools have the real potential to dramatically reduce the overall time and effort required to design and develop DoD systems and products in fixed and rotary wing aircraft, ships, propulsion systems, antennae, and related systems, while greatly improving accuracy as well.

CREATE Products

Air Vehicles

DaVinci - Rapid conceptual design development and initial system integration

Kestrel - High-fidelity, full vehicle, multi-physics analysis tool for fixed-wing aircraft- Release 1.0 Provides Rigid body CFD fixed wing AV with preliminary aeroelastics

Helios - High-fidelity, full vehicle, multi-physics analysis tool for rotary-wing aircraft – Release 1.0 Provides highly accurate calculation of rotorcraft vortex shedding

Firebolt - Module for propulsion systems in fixed and rotary-wing air vehicles

Ships

RDI - Rapid Design and Synthesis Capability—Partnership with ONR and NAVSEA

NESM - Ship Shock & Damage-prediction of shock and damage effects – Release 0.1 provides initial ship shock vulnerability analysis for underwater explosions

NAVYFOAM - Ship Hydrodynamics-predict hydrodynamic performance

IHDE - Environment to facilitate access to Naval design tools – Release 1.0 provides initial user interface for ship hydrodynamics

RF Antenna

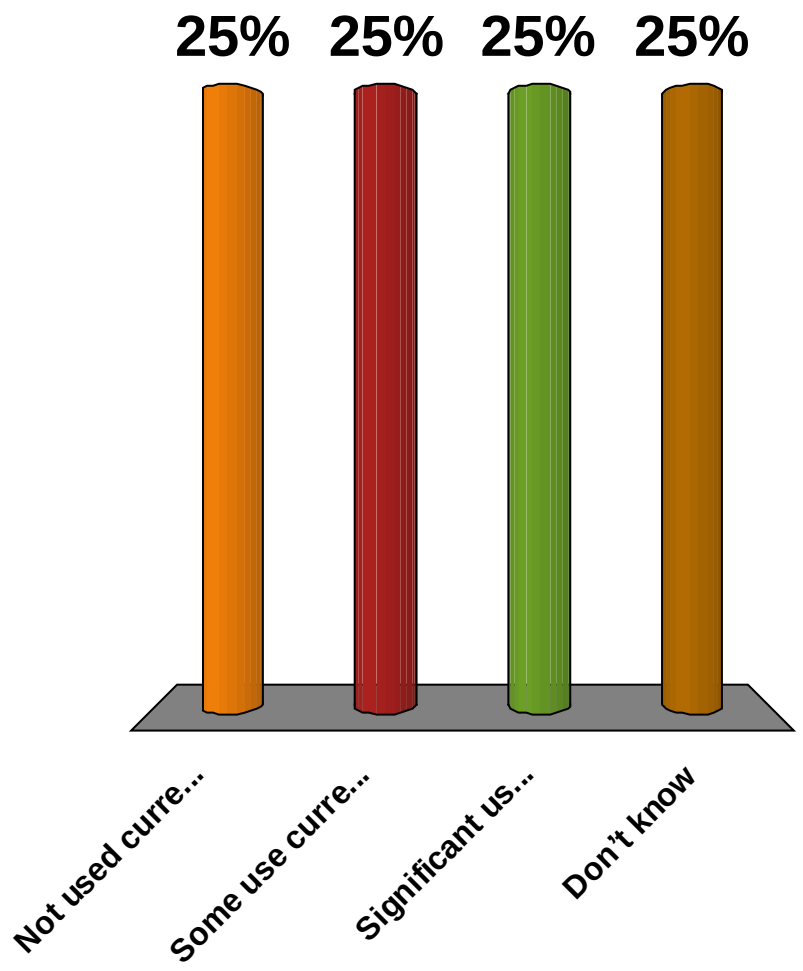
SENTRI - Electromagnetics antenna design integrated with platforms – Release 1.0 and 1.5 provides Initial RF antenna design and analysis with V&V

Meshing and Geometry

Capstone - Components for generating geometries and meshes

Does your organization now use any physics-based modeling as part of your design environment?

1. Not used currently
2. Some use currently
3. Significant use currently
4. Don't know

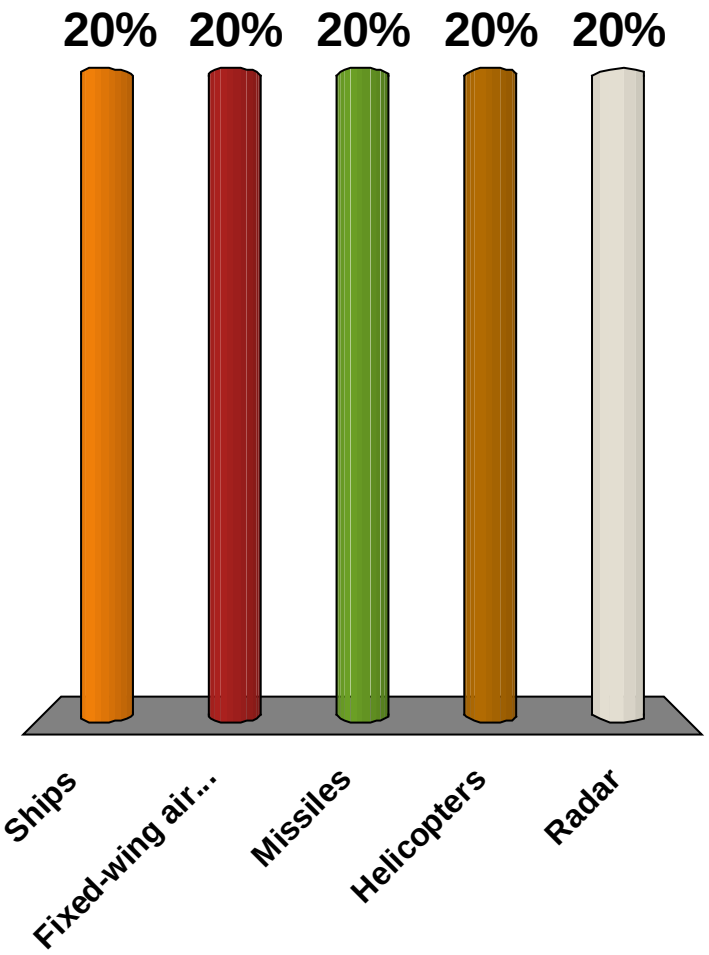


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What is your design domain? (select all that apply)

1. Ships
2. Fixed-wing aircraft
3. Missiles
4. Helicopters
5. Radar



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0 of 5

Thank you for your participation!

- To learn more about CMMI or Physics-Based Modeling contact the NDIA SE Division chair
  - Bob Rassa (rcrassa@raytheon.com)

Please return the interactive voting devices!

What Do You Know About Process Improvement and Physics-Based Modeling?

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November 16, 2011

® CMMI is a registered trademark of the U.S. Patent and Trademark Office by Carnegie Mellon University.

Welcome!

National Defense Industrial Association

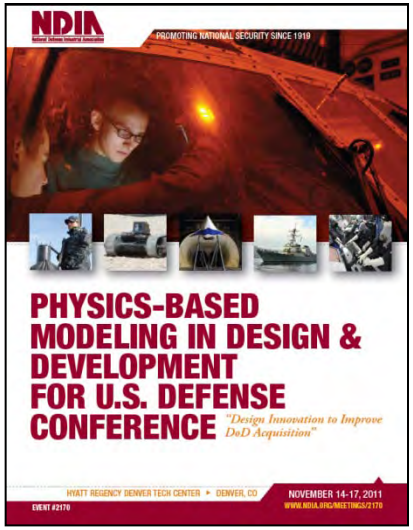
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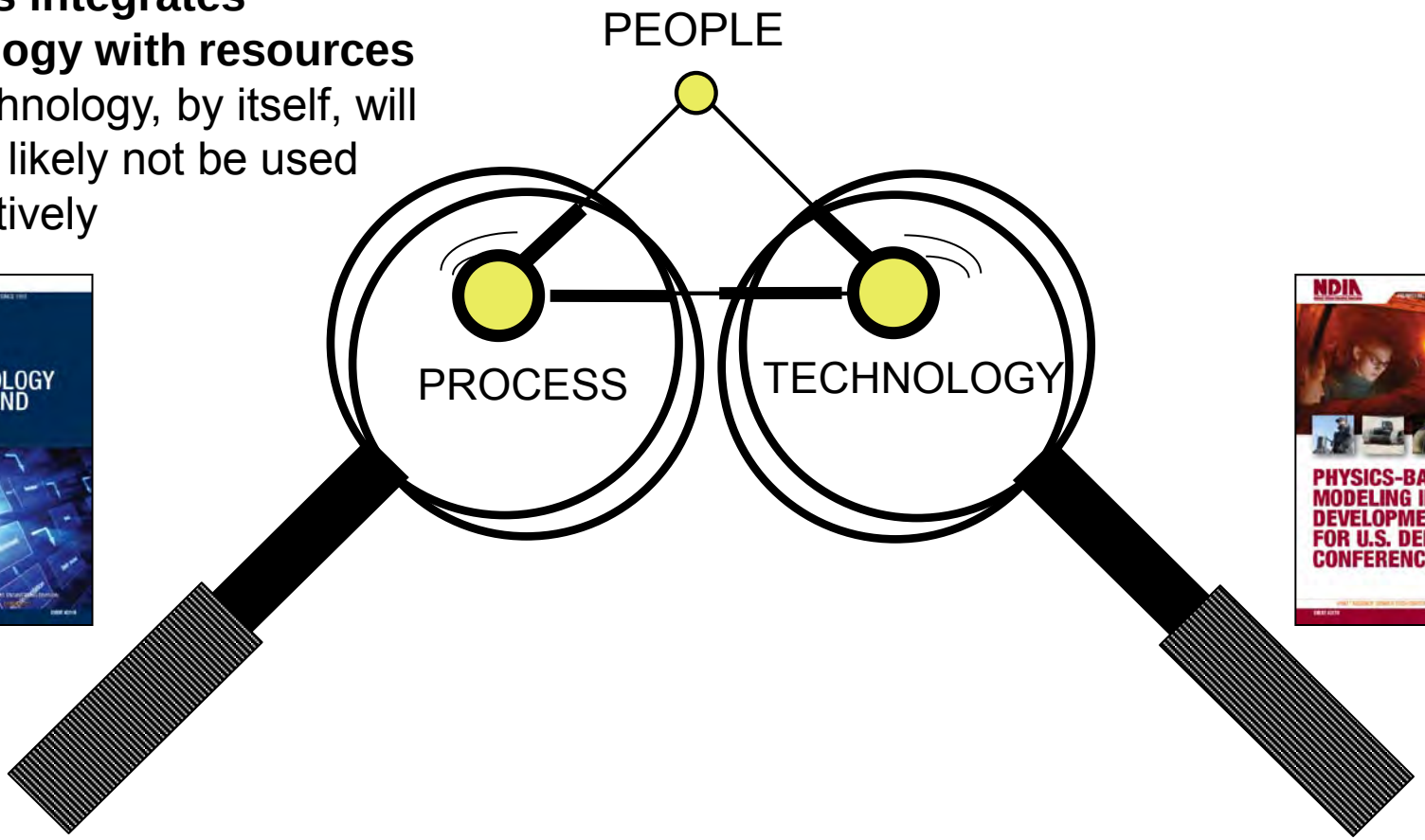


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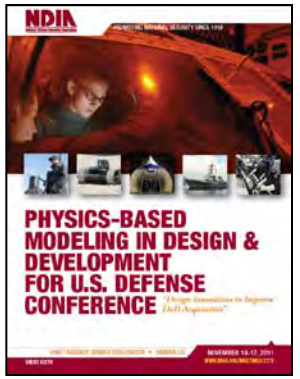
What's the Relationship between CMMI and Physics-Based Modeling?

Process integrates technology with resources

- Technology, by itself, will most likely not be used effectively





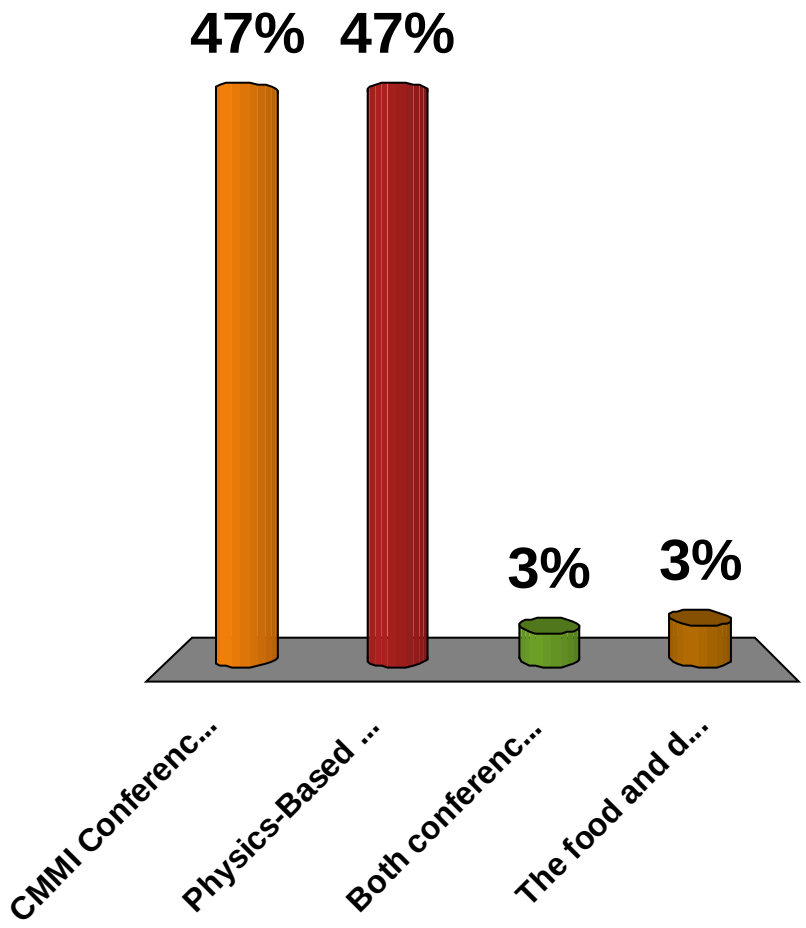


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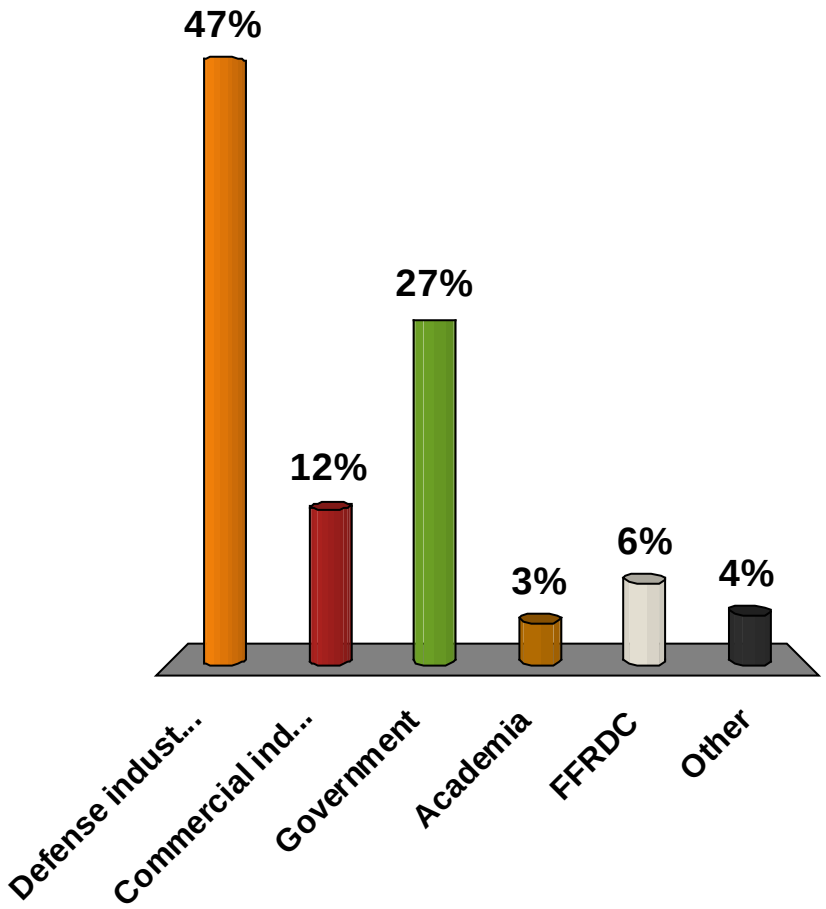
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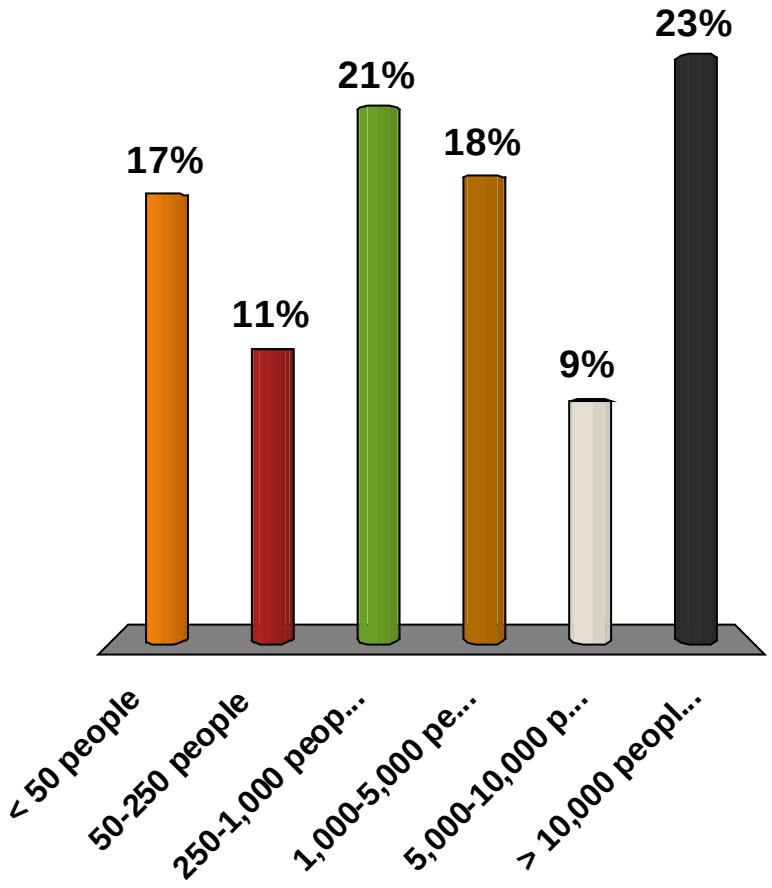
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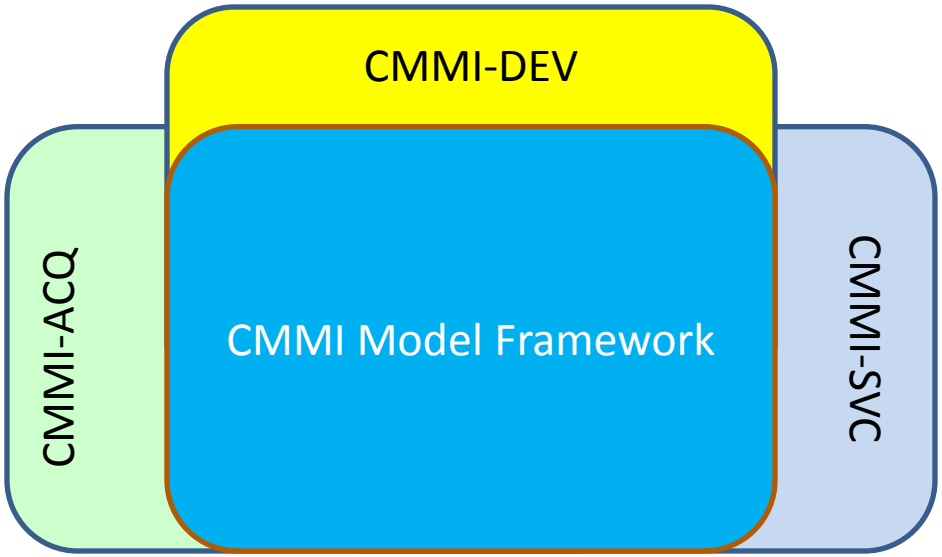
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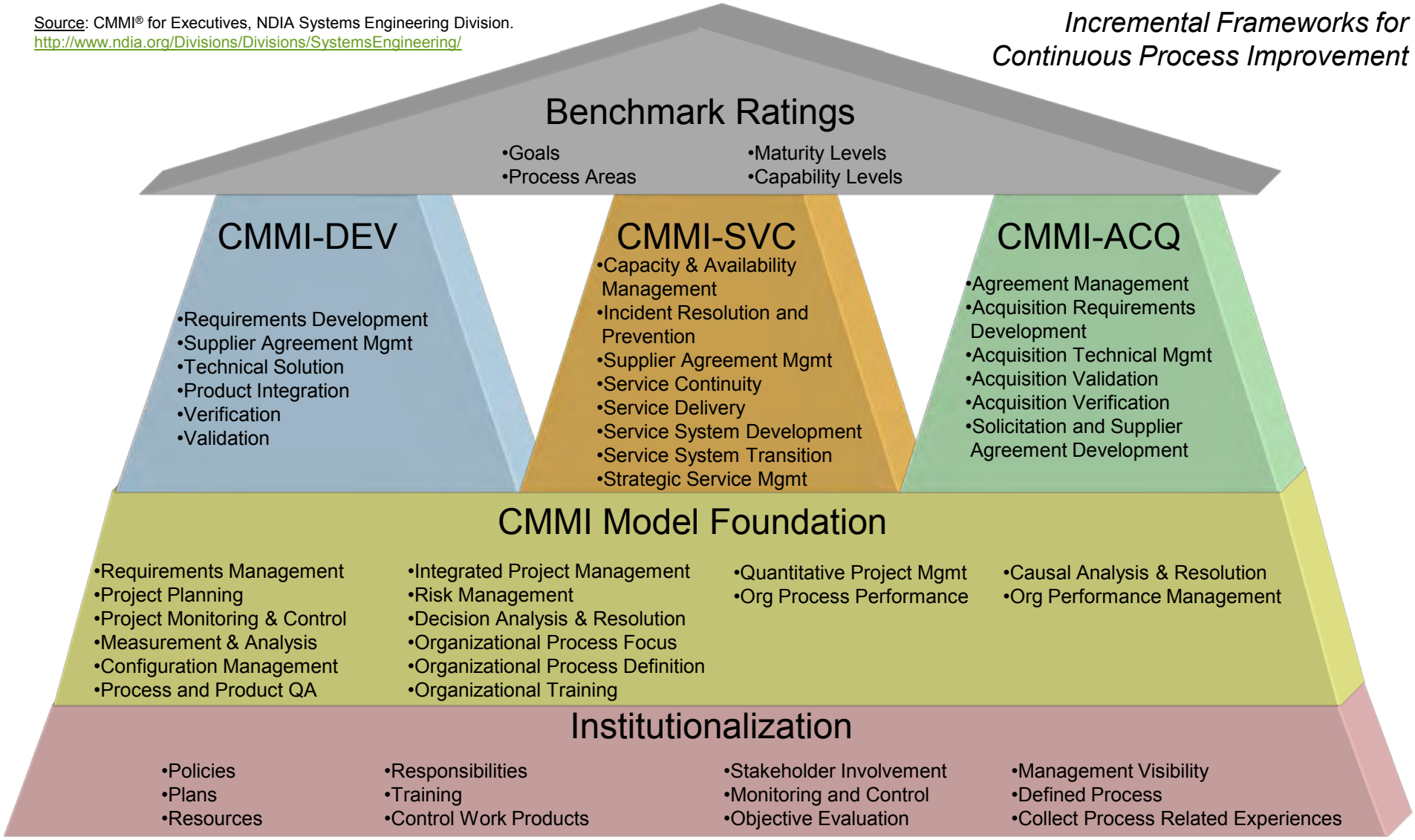
Capability Maturity Model Integration (CMMI®)

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CMMI Model Structure

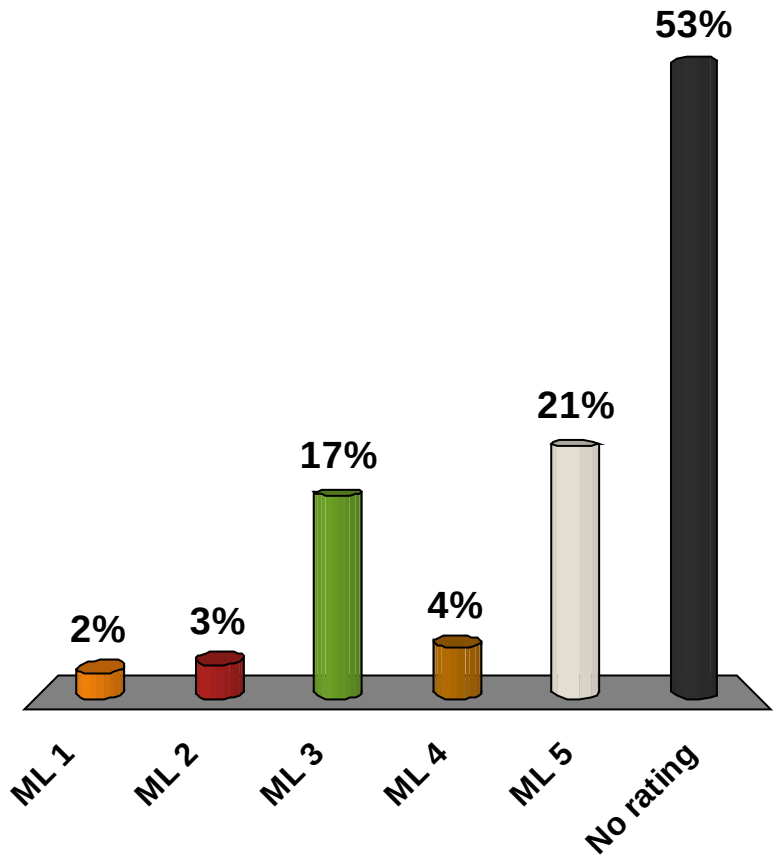
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Incremental Frameworks for Continuous Process Improvement



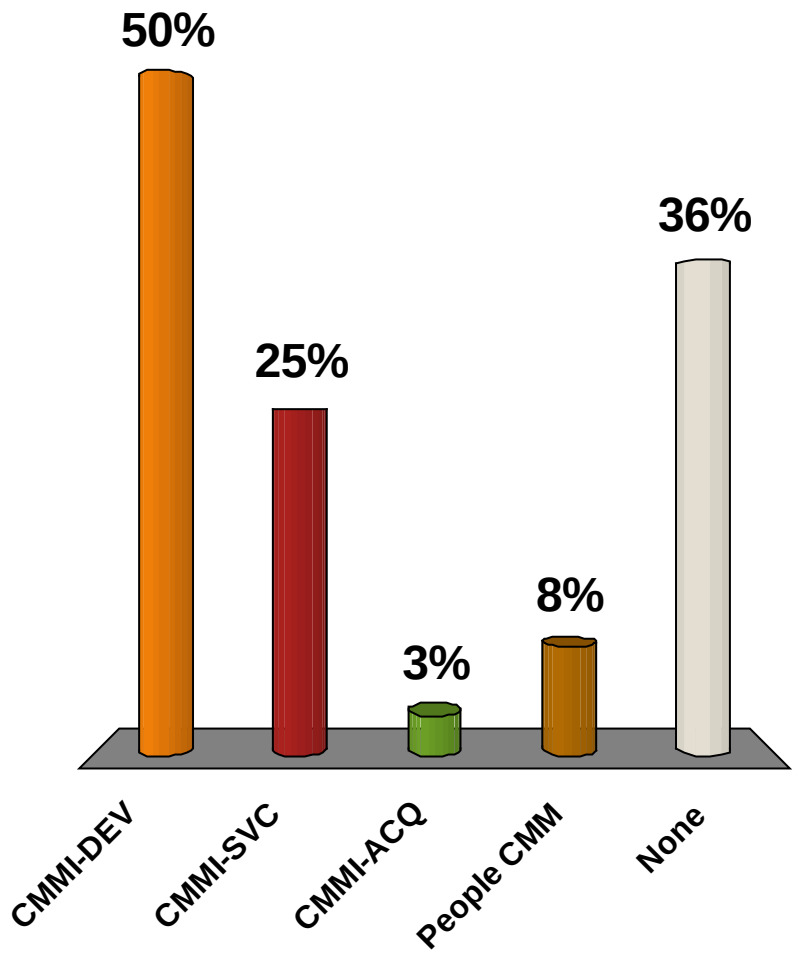
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4. ML 4
5. ML 5
6. No rating



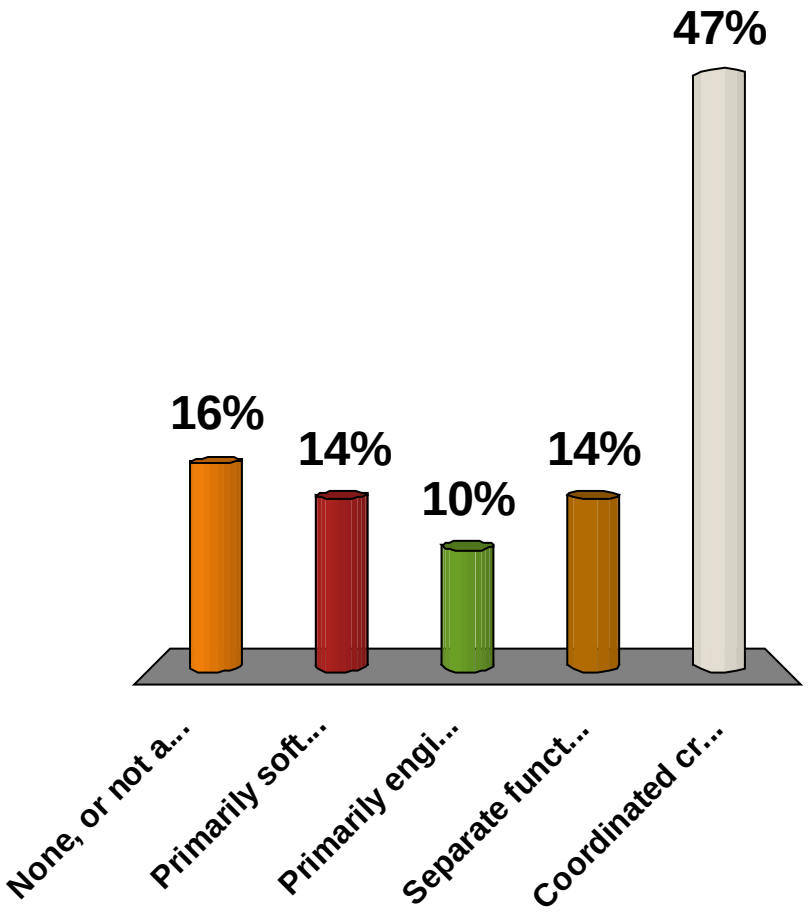
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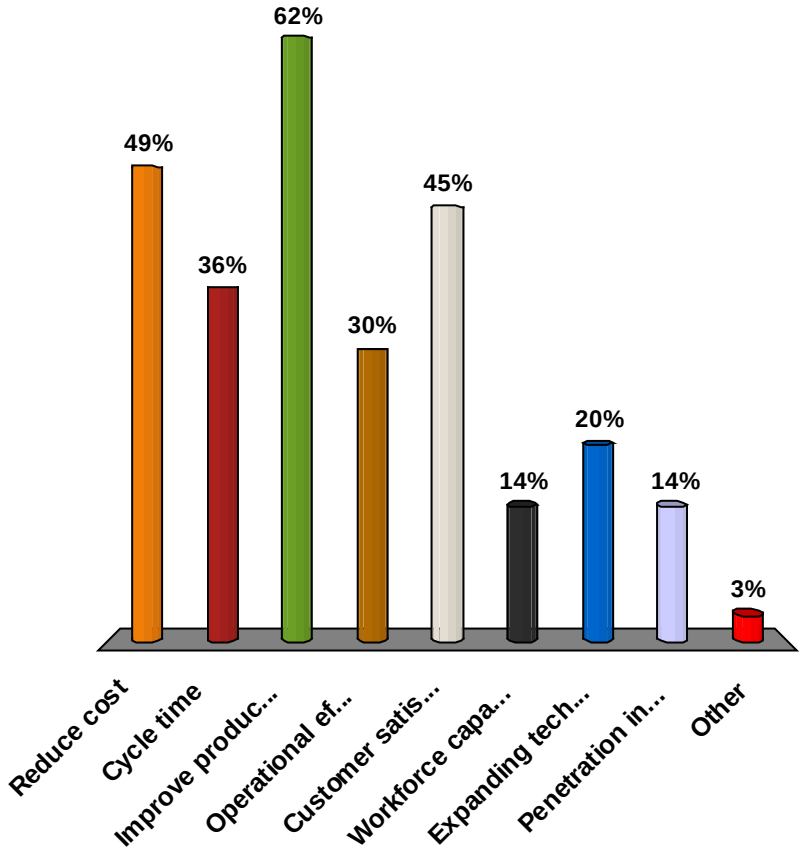
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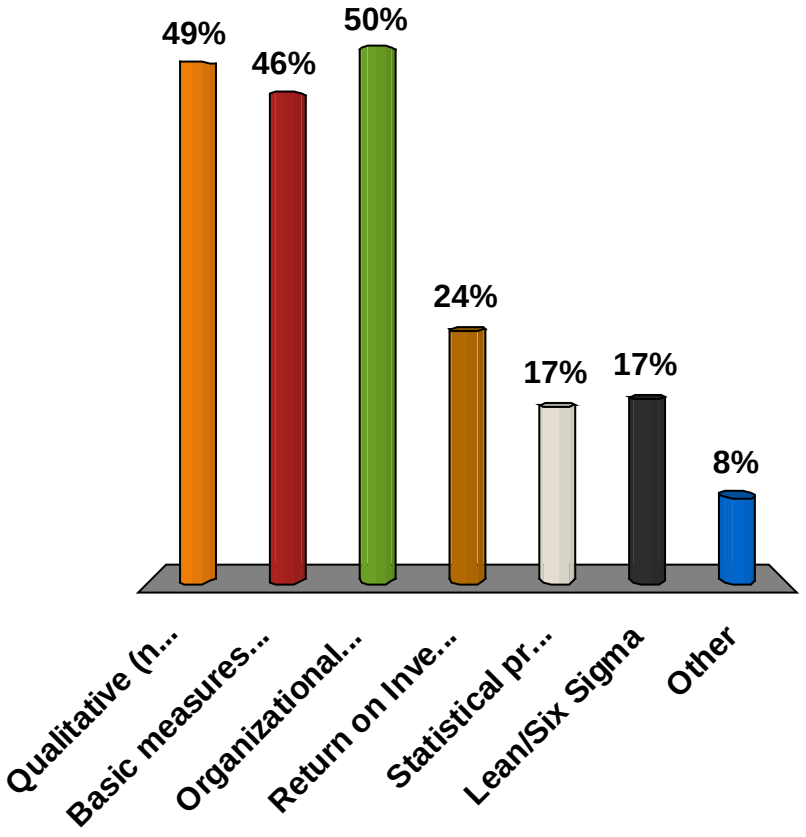
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8. Penetration into new markets
9. Other



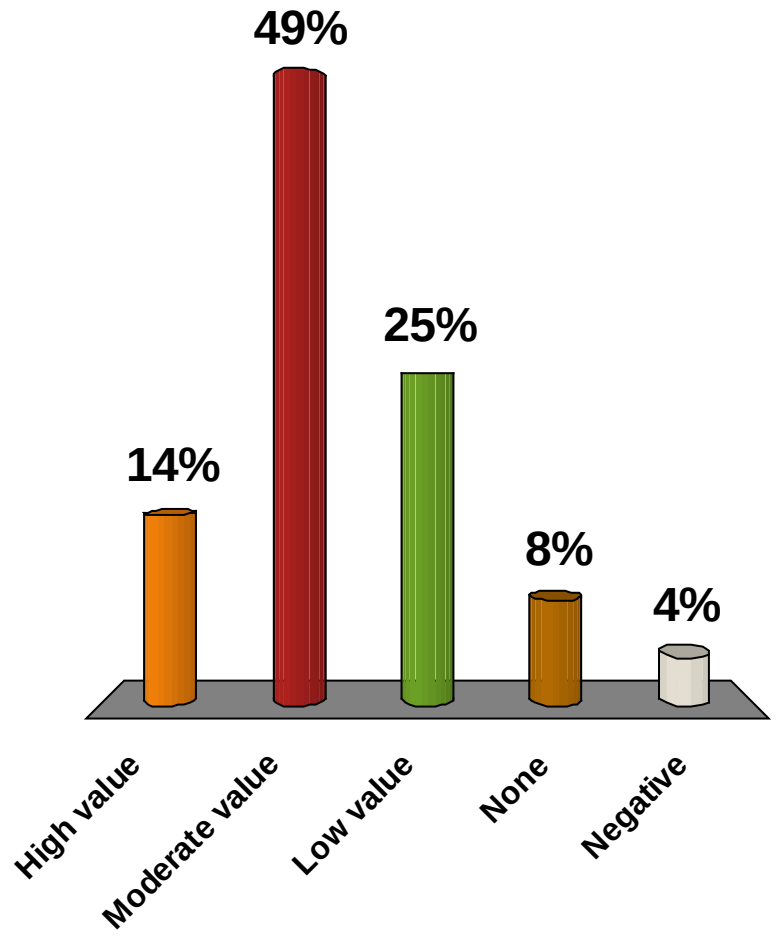
How do you measure the effectiveness of your improvement initiatives? (select up to 3 choices)

1. Qualitative (not measured)
2. Basic measures for individual initiatives
3. Organizational improvement trends (e.g., across projects)
4. Return on Investment (ROI)
5. Statistical process control (SPC)
6. Lean/Six Sigma
7. Other



What real impact has process improvement had on your business performance?

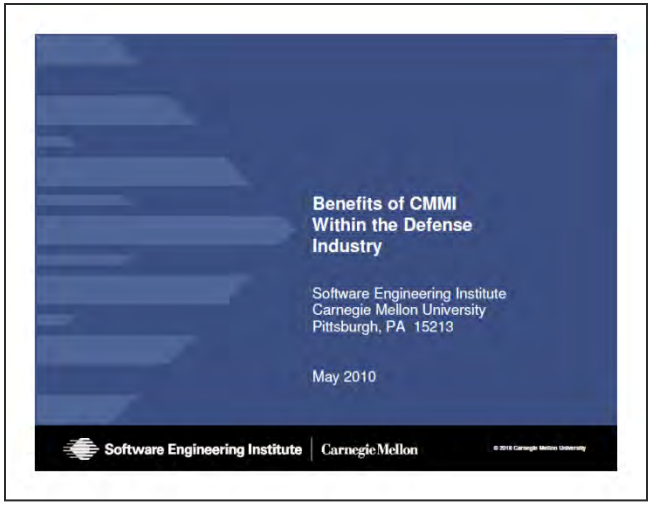
1. High value
2. Moderate value
3. Low value
4. None
5. Negative

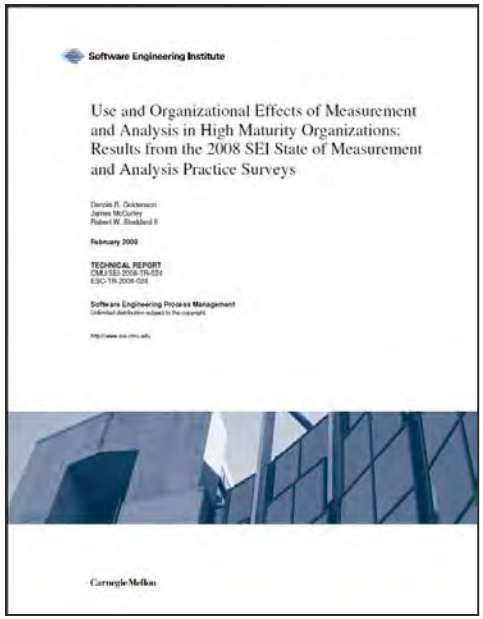


Measures of CMMI Adoption and Performance Benefits

- Studies
- Reports
- Workshops
- Analyses

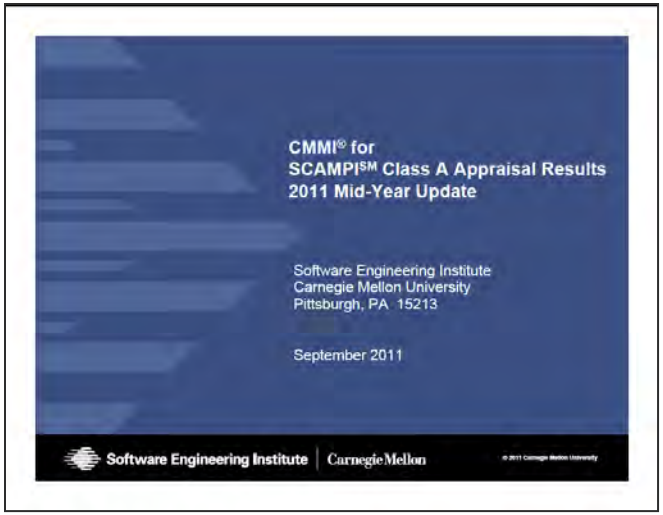
http://www.sei.cmu.edu/library/assets/presentations/CMMI%20Benefits.pdf



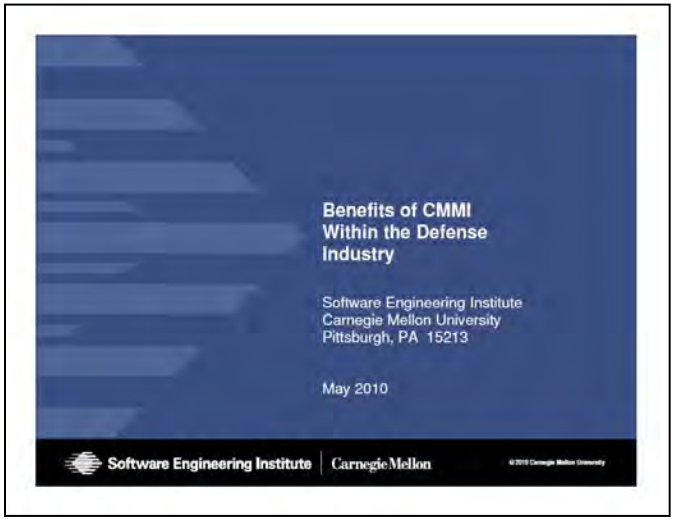


http://www.sei.cmu.edu/library/abstracts/reports/08tr024.cfm

http://www.sei.cmu.edu/cmmi/casestudies/profiles/pdfs/upload/2011SepCMMI.pdf



Industry Benefits from CMMI



Example measures reported by NDIA member companies:	
Defect repair effort	•Defect repair hours: -58% (ML3 to ML5) •Defect cost savings: -105 hrs per defect •I&T hrs/defect: -24% •Hours/KLOC: -22% *(ML3 to ML5)*
Defect density	•62% fewer high-severity defects *(ML5)* •Defect phase containment: +240% *(ML5)* •>85% defects removed prior to sys test •Acceptance test: < 0.15 defects/KLOC
Development cost	•SW development cost: -28% *(ML3 to ML5)* •Potential project savings: $1.9M–$2.3M
Productivity	•Productivity gain: +42% *(ML5, 9 yrs)*
Cost/schedule	•Over 6X less likely cost/schedule impact

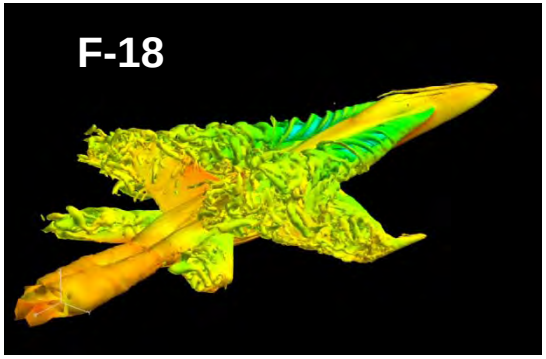
The new data presented in this report demonstrates that effective implementation of good practices aided by use of CMMI can improve cost, schedule, and quality performance.

Benefits of CMMI in the Defense Industry, Software Engineering Institute, May 2010.
http://www.sei.cmu.edu/library/abstracts/presentations/CMMI-Benefits-to-Defense-Industry.cfm

Source: CMMI® for Executives, NDIA Systems Engineering Division.
http://www.ndia.org/Divisions/Divisions/SystemsEngineering/

What is Physics-Based Modeling?

- Physics-Based Modeling is the use of computer software applications to design and analyze the performance of systems by solving the physics equations that govern the behavior of the system
- Reduces the need for physical testing
- Examples:
  - Air Vehicles—predict air vehicle performance by solving the equations that describe the airflow over the wings and other components (i.e. lift and drag) together with the deformation of the air vehicle structure due to the airflow loads.
  - Tires—predict tire performance by solving the equations that describe tire flexing, deformation, and treadwear e.g. behavior of rubber, steel belts, water flow in treads, etc.



Vortex induced Tail Buffet



~ 60 Million Cycles During an 80,000 Mile Tire Lifetime

CREATE Program

The **Computational Research & Engineering Acquisition Tools and Environments** (CREATE) project was initiated by the Department of Defense in 2008 as a long term effort to enable major improvements in the acquisition process with the following goals:

- Prevent defects and design flaws early in the acquisition process
- Reduce rework thereby enabling faster system deployment
- Reduce experimental testing time and effort through analysis of virtual prototypes

It would accomplish this by injecting multi-physics based predictions early within the design and analysis process, by developing and deploying production quality design and analysis software that is adaptable and maintainable, and developing and deploying multi-physics based Computational Engineering tools that exploit next generation high-speed computer resources. These tools have the real potential to dramatically reduce the overall time and effort required to design and develop DoD systems and products in fixed and rotary wing aircraft, ships, propulsion systems, antennae, and related systems, while greatly improving accuracy as well.

CREATE Products

Air Vehicles

DaVinci - Rapid conceptual design development and initial system integration

Kestrel - High-fidelity, full vehicle, multi-physics analysis tool for fixed-wing aircraft- Release 1.0 Provides Rigid body CFD fixed wing AV with preliminary aeroelastics

Helios - High-fidelity, full vehicle, multi-physics analysis tool for rotary-wing aircraft – Release 1.0 Provides highly accurate calculation of rotorcraft vortex shedding

Firebolt - Module for propulsion systems in fixed and rotary-wing air vehicles

Ships

RDI - Rapid Design and Synthesis Capability—Partnership with ONR and NAVSEA

NESM - Ship Shock & Damage-prediction of shock and damage effects – Release 0.1 provides initial ship shock vulnerability analysis for underwater explosions

NAVYFOAM - Ship Hydrodynamics-predict hydrodynamic performance

IHDE - Environment to facilitate access to Naval design tools – Release 1.0 provides initial user interface for ship hydrodynamics

RF Antenna

SENTRI - Electromagnetics antenna design integrated with platforms – Release 1.0 and 1.5 provides Initial RF antenna design and analysis with V&V

Meshing and Geometry

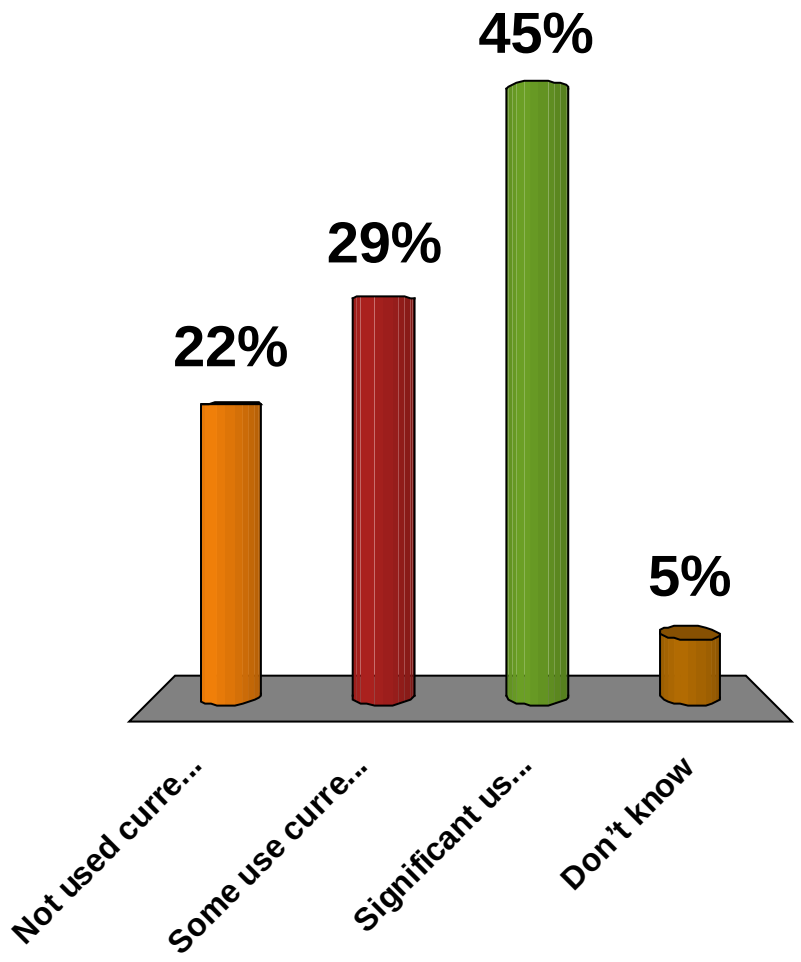
Capstone - Components for generating geometries and meshes

Other Computational Applications for Defense

- Fluid Dynamics
- Structural Mechanics
- Computational Chemistry
- Weather and Climate Prediction
- Electromagnetics
- Electronics Design
- Signal Processing
- Materials Design
- Acoustics
- Space Weather Prediction
- Land Vehicle Design
- Munitions Design
- Armor Design

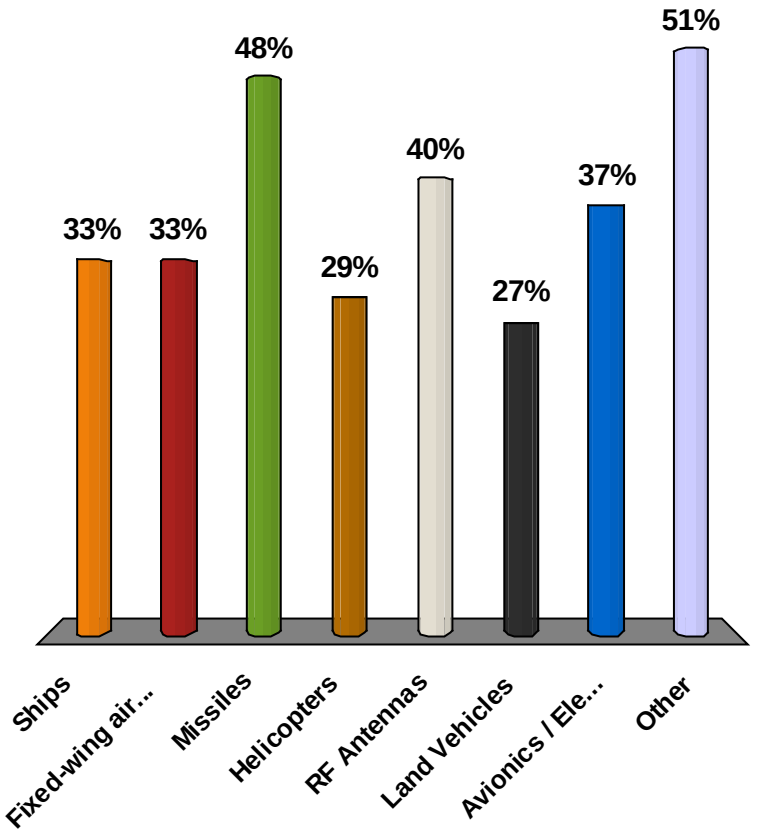
Does your organization now use any physics-based modeling as part of your design environment?

1. Not used currently
2. Some use currently
3. Significant use currently
4. Don't know



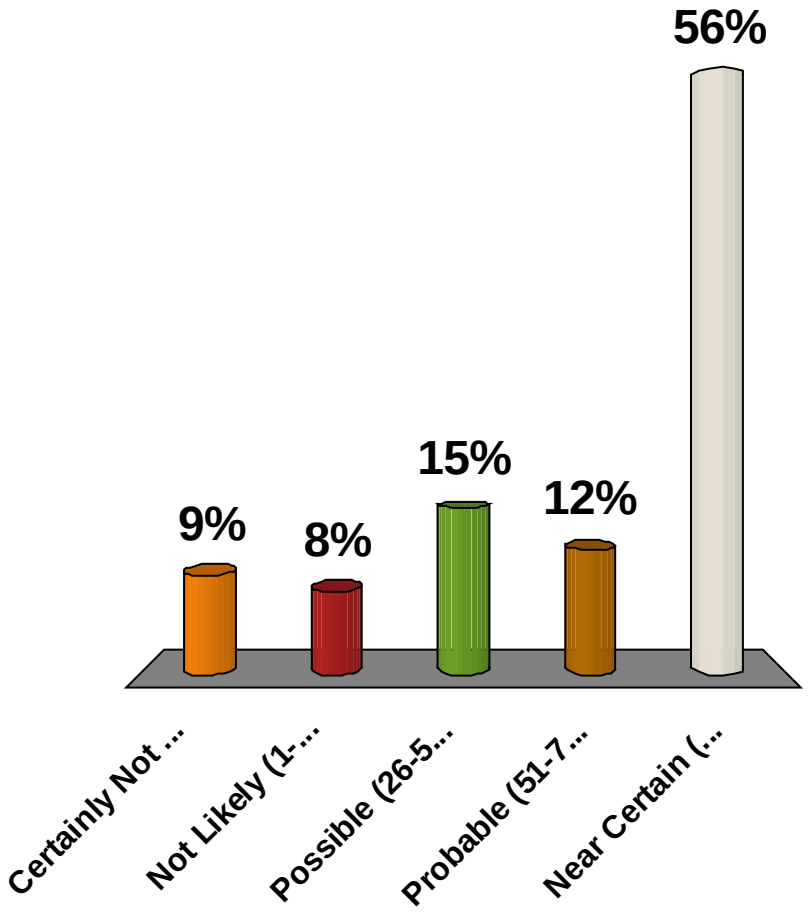
What is your design domain? (select all that apply)

1. Ships
2. Fixed-wing aircraft
3. Missiles
4. Helicopters
5. RF Antennas
6. Land Vehicles
7. Avionics / Electronics
8. Other



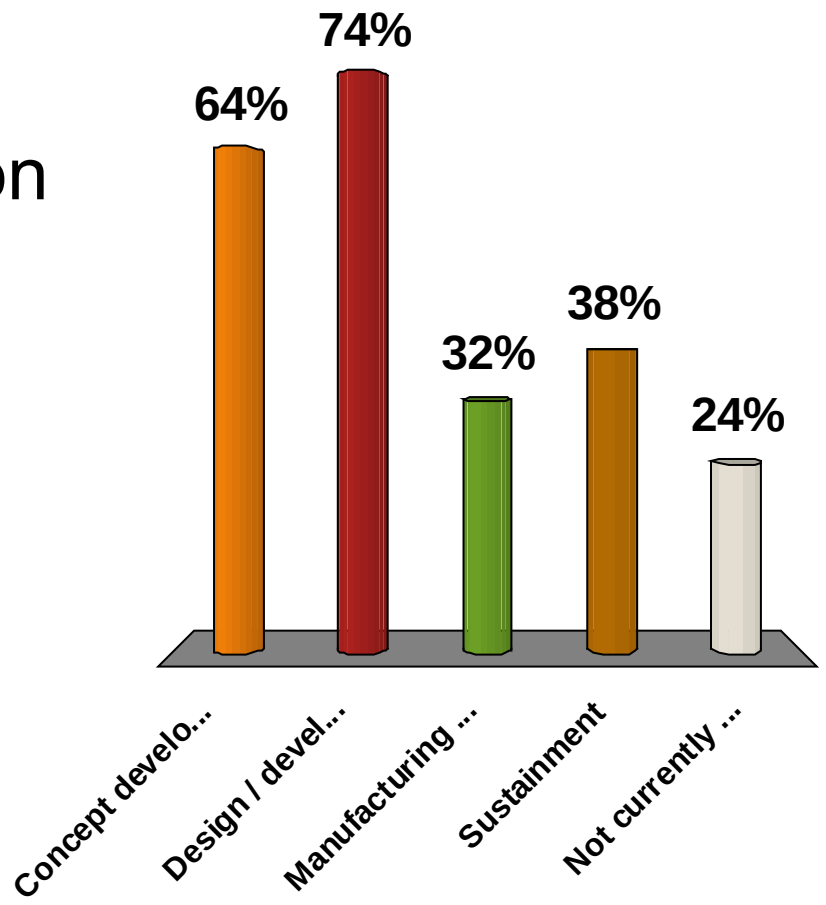
What is the likelihood your organization will adopt physics-based modeling in the next 5 years?

1. Certainly Not (0%)
2. Not Likely (1-25%)
3. Possible (26-50%)
4. Probable (51-75%)
5. Near Certain (76-100%)



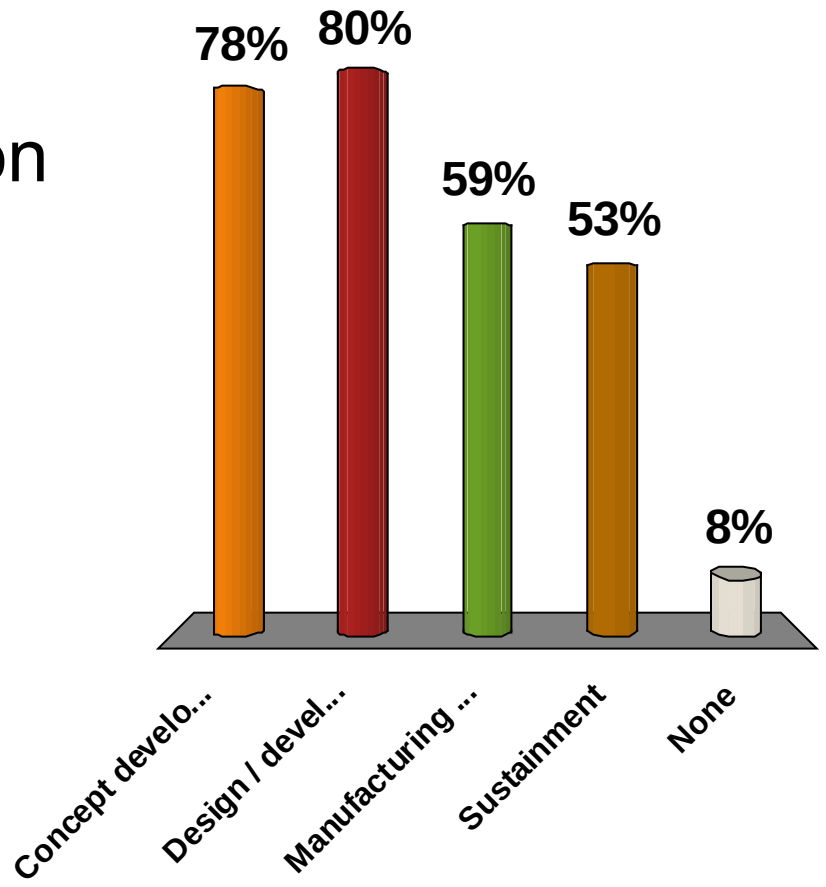
In what phases of the product development lifecycle are you currently using physics-based modeling? (select all that apply)

1. Concept development
2. Design / development
3. Manufacturing / Production
4. Sustainment
5. Not currently using



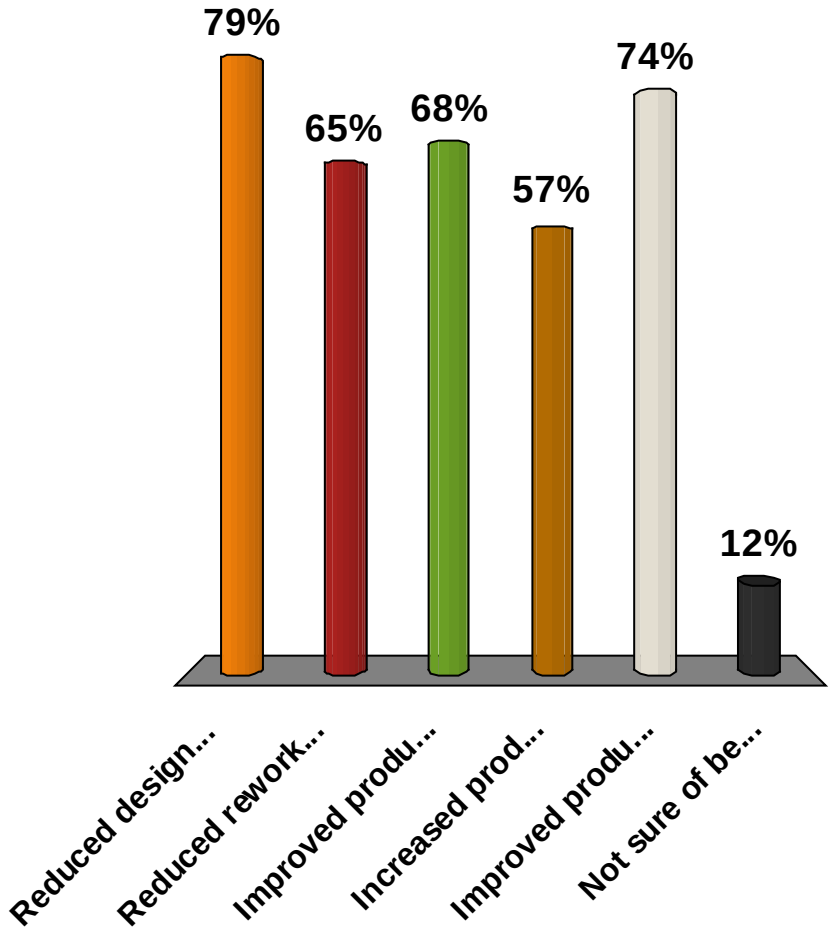
In what phases of the product development lifecycle would physics-based modeling be useful in the future? (select all that apply)

1. Concept development
2. Design / development
3. Manufacturing / Production
4. Sustainment
5. None



What do you believe are potential benefits of physics-based modeling in your organization? (Select all that apply)

1. Reduced design time and cost
2. Reduced rework during production
3. Improved product quality
4. Increased product innovation
5. Improved product performance
6. Not sure of benefits at this time



Thank you for your participation!

- To learn more about CMMI or Physics-Based Modeling contact the NDIA SE Division chair
  - Bob Rassa (rcrassa@raytheon.com)

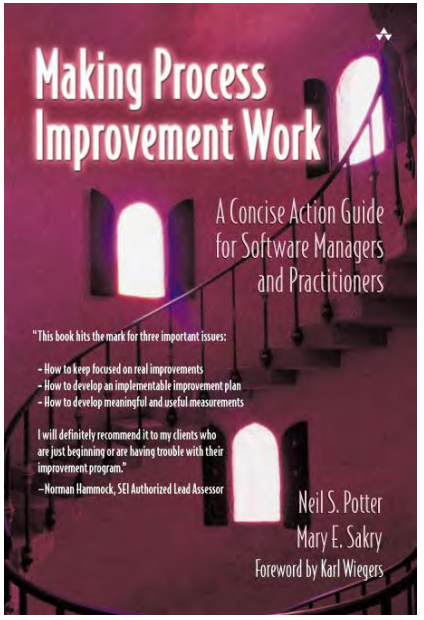
Please return the interactive voting devices!

Making Process Improvement Work

A Concise Action Guide for Software Managers and Practitioners

Neil Potter

Mary Sakry



The Process Group
help@processgroup.com
www.processgroup.com

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Your Expectations

- **Your job**
- **Experiences with process improvement and frameworks**
  - (e.g., CMM, CMMI, ISO9001)
- **Expectations for this class (5/5 score?)**

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Introduction

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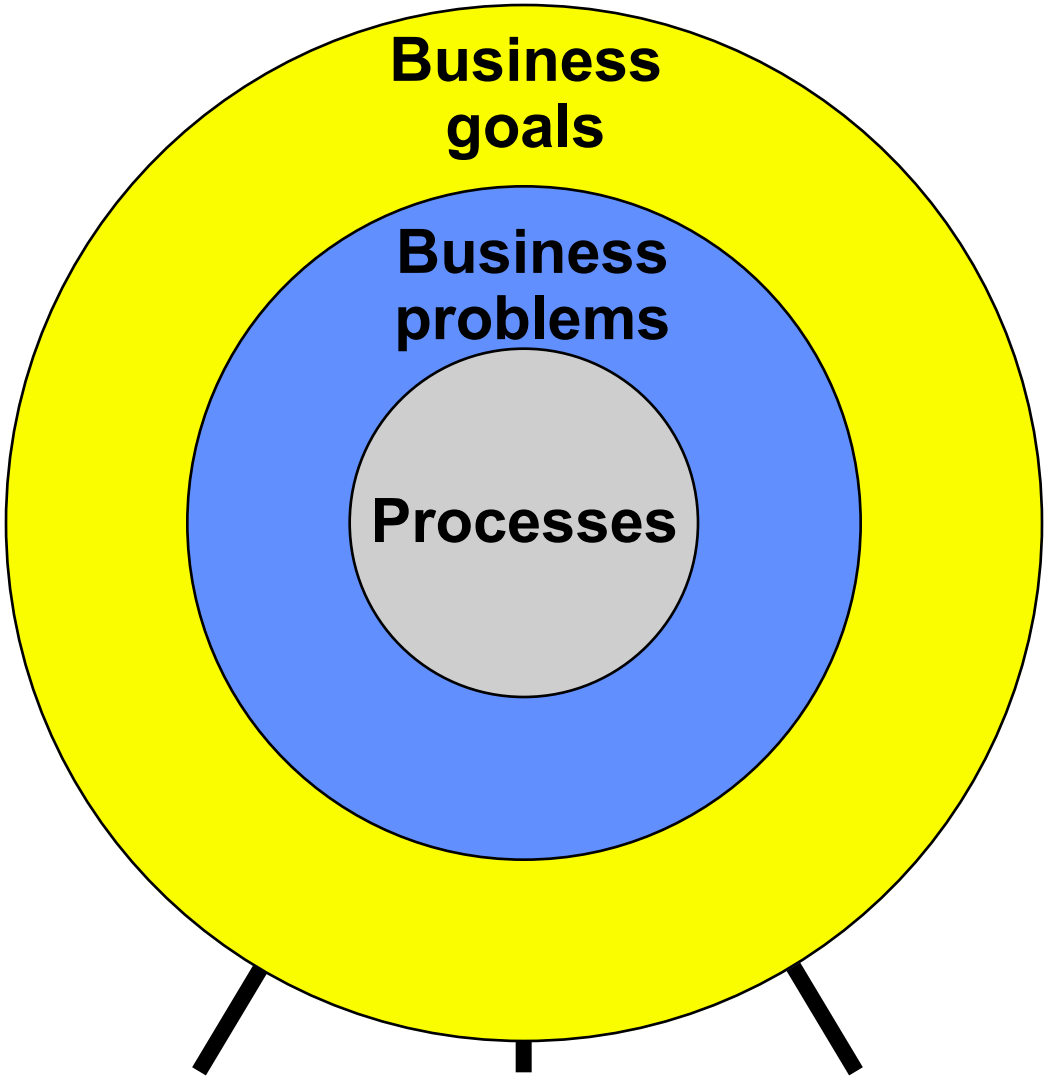
The "Classic" Approach to PI

Process-centric improvement

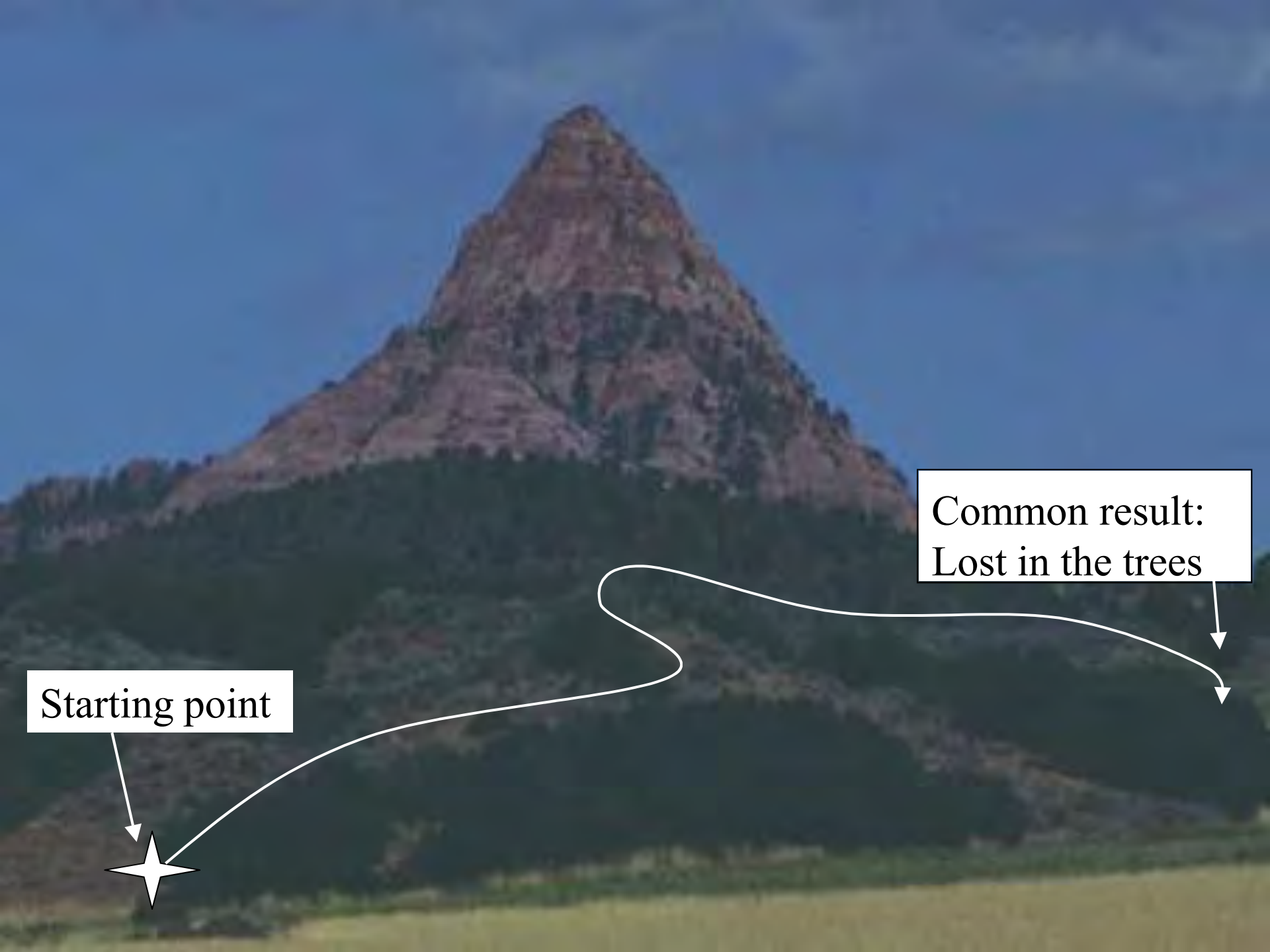
- SEI CMMI
- ISO9001
- Bellcore

It can work!

- High risk of failure



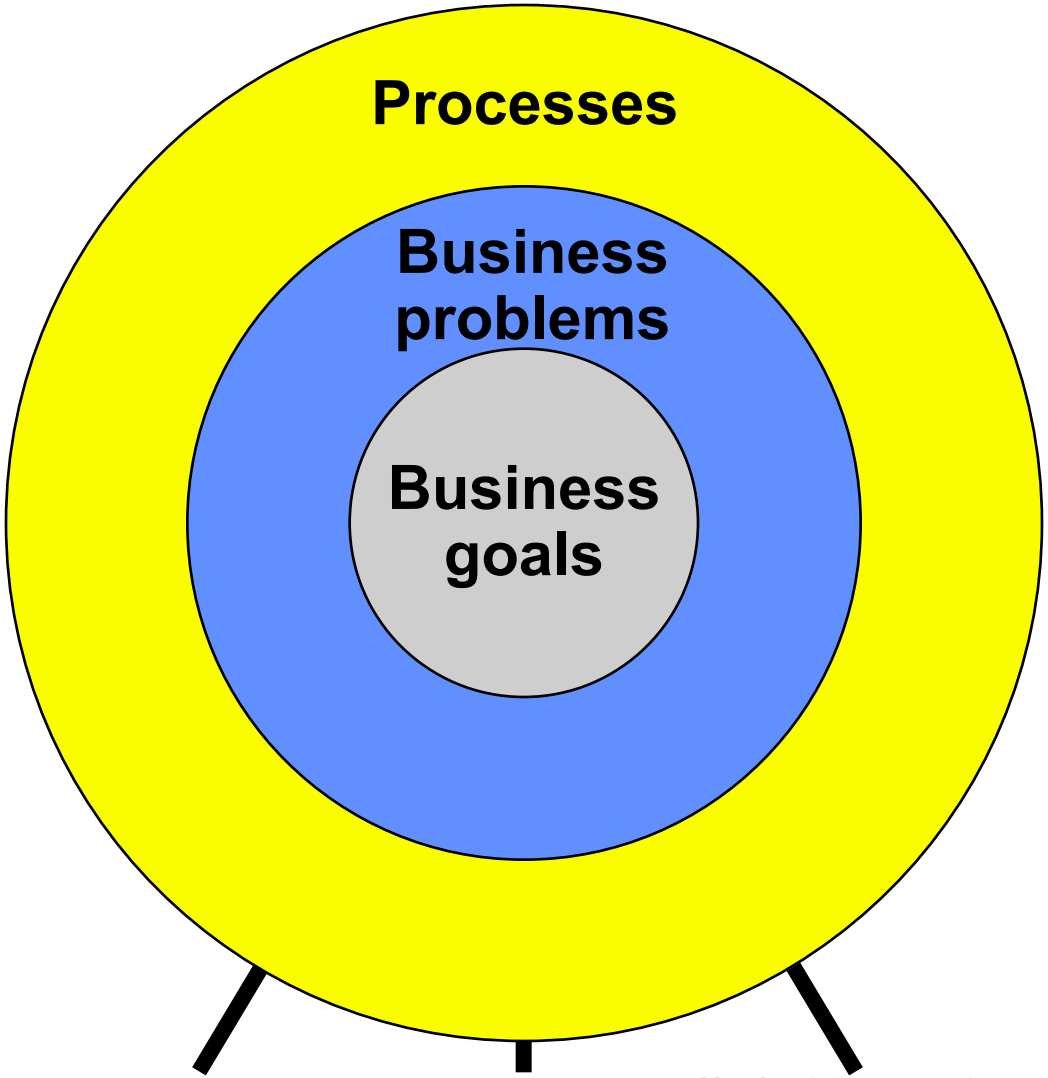
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Common result:
Lost in the trees
Starting point

A Solution

Goal-problem-centric improvement

Goals and problems can be used to scope and sequence the improvement effort

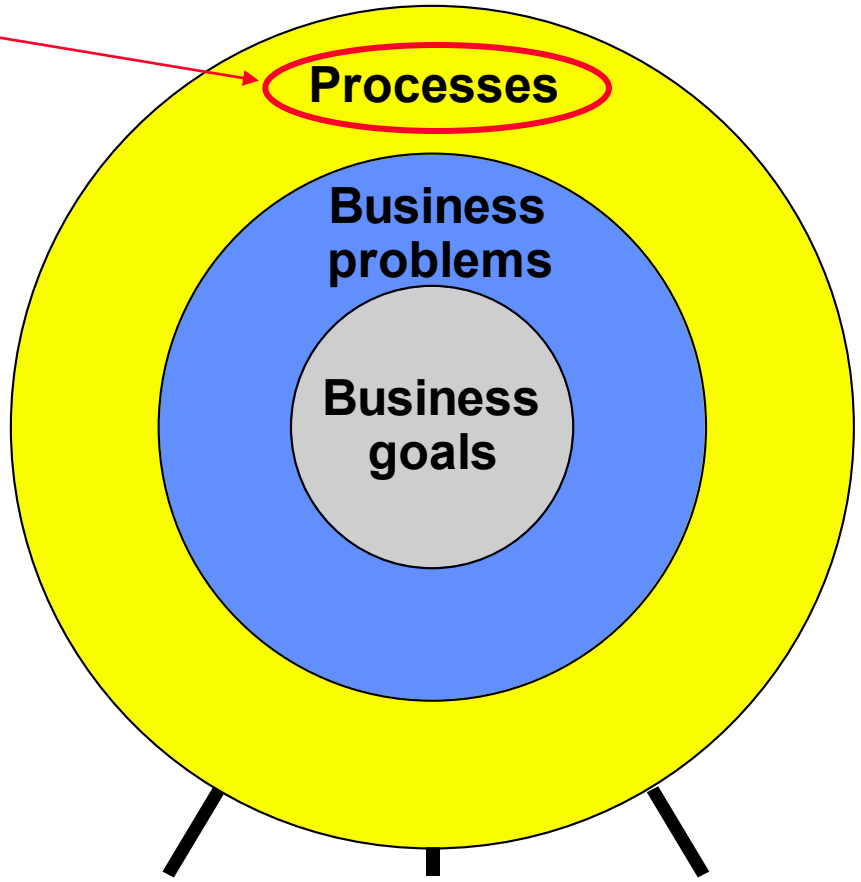


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Goal
Problem areas
Starting point
• Goal actions
• Improvement actions

Frameworks

- **Frameworks provide an optional source of improvement ideas, e.g.,**
  - Life cycle
  - SEI CMMI
  - ISO9001
  - Bellcore
- **In this workshop, either use:**
  - No framework
  - Current organization's life cycle and defined practices
  - Published framework



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Developing a Plan

—Unplanned process improvement is wishful thinking."

—Watts Humphrey, *Managing the Software Process*

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Developing a Plan

- **Scope the Improvement**
  1. Establish plan ownership
  2. State the major goals and problems
  3. Group the problems related to each goal
  4. Ensure that the goals and problems are crystal clear and compelling
  5. Set goal priorities
  6. Derive metrics for the goals
- **Develop an Action Plan**
- **Determine Risks and Plan to Mitigate**

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1. Establish Plan Ownership



- **The plan meets the owner's needs, e.g.,**
  - Business goals and problems
- **The owner can be a project manager, program manager, senior manager, or division head**
- **The primary owner ≠ EPG or QA group**
  - Support functions can share ownership
- **Different individuals can be responsible for each section of the plan**

EPG = engineering process group
QA = quality assurance group

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2. State the Major Goals and Problems - 1

Example Goals

1. Create predictable schedules
2. Successfully deliver product X
3. Reduce rework
4. Improve the performance of our core product
5. Keep customers happy
6. Keep making a profit

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State the Major Goals and Problems - 2

Example Problems

1. Need better requirements. Requirements tracking not in place. Changes to requirements are not tracked; code does not match specification at test time.
2. Management direction unclear for product version 2.3. Goals change often.
3. Quality department does not have training in product and test skills.
4. Unclear status of changes.
5. Lack of resources and skills allocated to design.

⋮

9. Defect repairs break essential product features.
10. Wrong files (for example, dynamic link libraries) are put on CD. Unsure of the correct ones.
11. Revising the project plan is difficult. Items drop off, new things are added, plan is out of date.
12. We don't understand our capacity and do not have one list of all the work we have to do.
13. Schedule tracking and communication of changes to affected groups is poor.

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3. Group the Problems Related to Each Goal - 1

- **Simplify the list by grouping the problems that prevent each goal from being achieved.**

Goal	Problem	Problem Description
1. Create predictable schedules	Problem 11	Revising the project plan is difficult. Items drop off, new things are added, plan is out of date.
	Problem 12	We don't understand our capacity and do not have one list of all the work we have to do.
	Problem 13	Schedule tracking and communication of changes to affected groups is poor.

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Group the Problems Related to Each Goal - 2

Goal	Problem	Problem Description
2. Successfully deliver product X	Problem 1	Need better requirements. Requirements tracking not in place. Changes to requirements are not tracked; code does not match specification at test time.
	Problem 2	Management direction unclear for product version 2.3. Goals change often.

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Group the Problems Related to Each Goal - 3

Goal	Problem	Problem Description
3. Reduce rework	Problem 3	Quality department does not have training in product and test skills.
	Problem 4	Unclear status of changes.
	Problem 5	Lack of resources and skills allocated to design.
	Problem 9	Defect repairs break essential product features.
	Problem 10	Wrong files (for example, dynamic link libraries) are put on CD. Unsure of the correct ones.

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4. Ensure That the Goals and Problems Are Compelling - 1

If there is a big enough reason, people will change in a heart beat!







Pain | **PI** | **Pleasure**

- Crisis
- Business loss
- Unhappy customers

- High development cost
- Low profit
- Leadership

- New business
- Increase volume
- Reduce costs

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Ensure That the Goals and Problems Are Compelling - 2

- **Example goals that are not compelling:**
  - Document all processes.
  - Develop a detailed life cycle.
  - Establish a metrics program.
- **Example goals that are more compelling:**
  - Deliver product X by Dec 15th.
  - Increase product quality to a maximum of 10 defects per release, gaining back customers X, Y, and Z, and increasing our market share by 10 percent.
  - Reduce rework to 5 percent of project effort. Use that time to create new product Y.
  - Improve schedule prediction to ± 5-day accuracy, eliminating forced cancellation of vacations.

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Making Existing Goals More Compelling

- **If you are promoting an idea:**
  - Ask **WHY (<idea>)** to elicit a more compelling reason
  - e.g., WHY (Level 2) may give:
    - » **Meet schedules, less rework, more sanity, happier customers**
- **Make the compelling reason the goal, not the process idea**
  - e.g., **goal**: low maintenance **OR** formal inspection?

If the reason is not compelling enough, action will probably not be taken!

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Ensure That the Goals and Problems Are Crystal Clear

Original Goals	Goals Reworded for Clarity
1. Create predictable schedules	Meet all our cost and schedule commitments
2. Successfully deliver product X	Deliver product X by mm/dd/yy
3. Reduce rework	Reduce rework to less than 20 percent of total project effort
4. Improve the performance of our core product	Improve the performance of our core product (target to be defined)
5. Keep customers happy	Achieve customer rating of 9/10 on product evaluation form
6. Keep making a profit	Keep profits at 15 percent (and costs at the same level as last year)

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5. Set Goal Priorities

Goal	Relative Benefit of Goal (1-10)	Relative Cost of Goal (1-10)	Priority (Benefit/ Cost)	Phase* (1,2,3)
2. Deliver product *x* by mm/dd/yy.	10	4	2.5	1
1. Meet all our cost and schedule commitments.				
5. Achieve customer rating of 9/10 on product evaluation form.				
3. Reduce rework to less than 20 percent of total project effort.				
6. Keep profits at 15 percent (and costs at the same as last year).				
4. Improve the performance of our core software product. (Target to be defined.)				

***Phase is based on goal interdependencies, logical ordering, or timing**

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6. Derive Metrics for the Goals

- **The Goal-Question-Metric (GQM) approach from Basili states that you:**
  - Define the principal goals for your activity
  - Construct a comprehensive set of questions that, when answered, helps assess where you are relative to each goal
  - Define and gather the data required to answer these questions

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Goal-Question-Metric Approach - 1

Goal	Questions	Metrics
Meet all our cost and schedule commitments.	Are we spending the planned number of hours on the project to complete it? Are we hitting our milestones?	Planned versus actual effort for each project. The number of days each milestone is early or late.
Deliver product X by mm/dd/yy.	Are we spending the planned number of hours on the project to complete it? Are we hitting our milestones?	Planned versus actual effort for each project milestone. The number of days each milestone is early or late.
Reduce rework to less than 20 percent of total project effort.	How much time do we spend on rework now? How does this compare with our development time and are we improving?	Percentage of project time spent on rework.
	How many defects do we have in the product during design and coding?	Defect density: Number of defects found per unit size of work product (e.g., number of pages of design, number of lines of code).
Improve the performance of our core software product.	What is our current performance?	Average screen response time during peak system usage.

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Goal-Question-Metric Approach - 2

Goal	Questions	Metrics
Achieve customer rating of 9/10 on product evaluation form.	How satisfied are they now? Are we improving?	Annual customer satisfaction survey.
Keep profits at 15 percent (and costs at the same as last year).	What is our profit? Is it getting better or worse?	Annual net profit.

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Using the Approach for a Single Project

What is your goal?

Reduce product development cycle to six to nine months for product X.

What is preventing you from achieving the goal?

1. Changing requirements.
2. Loss of resources; difficult to replace people with specialized skills who leave the project.
3. Too many features for the six- to nine-month development cycle.
4. Poor quality of incoming code from other groups.
5. Inadequate availability of test equipment.
6. Lack of visibility within each life cycle phase. It is difficult to know whether we are ahead or behind schedule.
7. Don’t always have the resources available to complete the planned work.
8. Difficult to find defects early.

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Using a Process Appraisal to Obtain a Problem List

- **A scalable data collection method for groups of ~5-150 people, that results in:**
  - a list of strengths and highest-priority problems (& maturity rating)
  - buy-in for the problems
  - buy-in for process improvement direction
- **Surfaces key problems that might not have been visible before:**
  - e.g.,communication, systems engineering, PI implementation
- **Raises awareness of key issues facing the organization**
- **Brings management and engineering together**

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Exercise: Scope the Improvement



1. **Form project teams**
2. **Determine the primary business goals and problems of your group**
   - Simplify the list of goals and problems by grouping the related problems under each goal
   - Verify that the scope of your improvement program is compelling
     - » If not, ask: Why do I want to achieve these goals?
3. **Discuss lessons learned**

Result:

What is your goal? 3

What is your goal? 2

What is your goal? 1

Reduce product development cycle to six to nine months for product X

What is preventing you from achieving the goal?

1. Changing requirements
2. Loss of resources; difficult to replace people with specialized skills who leave the project
3. Too many features for the six- to nine-month development cycle
4. Poor quality of incoming code from other groups
5. Inadequate availability of test equipment
6. Lack of visibility within each life cycle phase. It is difficult to know whether we are ahead or behind schedule
7. Don't always have the resources available to complete the planned work
8. Difficult to find defects early

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Developing a Plan

- Scope the Improvement
- **Develop an Action Plan**
  1. Enumerate actions using brainstorming and a process framework
  2. Organize the action plan based on the goals and problems
  3. Add placeholders for checking progress and taking corrective action
- **Determine Risks and Plan to Mitigate**

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Develop an Action Plan

- **Develop an Action Plan**
  1. Enumerate actions using brainstorming and a process framework
     - » **1a. What actions are needed to address the problems and achieve the goals?**
     - » **1b. If a process improvement framework is being used, which elements will help the problems and goals listed?**
  2. Organize the action plan based on the goals and problems
  3. Add placeholders for checking progress and taking corrective action

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1a. Actions for Two of the Problems - 1

Problem	What actions are needed to address the problems and achieve the goals?
1. Changing requirements	Baseline the requirements before design commences
	Only allow changes to the application interface, not to the kernel routines
	Improve the library control system to minimize version control errors
	Investigate requirements management tools

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Actions for Two of the Problems - 2

Problem	What actions are needed to address the problems and achieve the goals?
3. Too many features for the six- to nine-month development cycle	Establish a review process with clients to negotiate features for a six- to nine-month development cycle
	Rate each feature based on value to the customer (1–10 points) and cost to develop (1–10 points)
	Establish an incremental delivery plan to phase in lower priority features

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1b. Framework Elements for Two of the Problems - 1

Reworded for clarity

Problem	Which elements will help the problems and goals listed?
1. Changing requirements	Develop an understanding with the requirements providers on the meaning of the requirements. (REQM sp1.1)
	Assign responsibility and authority for performing the REQM process. (REQM gp2.4)
	Track change requests for the configuration items. (CM sp2.1)

REQM = Requirements Management. CM = Configuration Management

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Framework Elements for Two of the Problems - 2

Reworded for clarity ↓

Problem	Which elements will help the problems and goals listed?
3. Too many features for the six- to nine-month development cycle	Reconcile the project plan to reflect available and estimated resources. (PP sp3.2)
	Identify and analyze project risks. (PP sp2.2)

PP = Project Planning

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Progress on Chosen Framework -1

95% map to Level 2

Example Goals

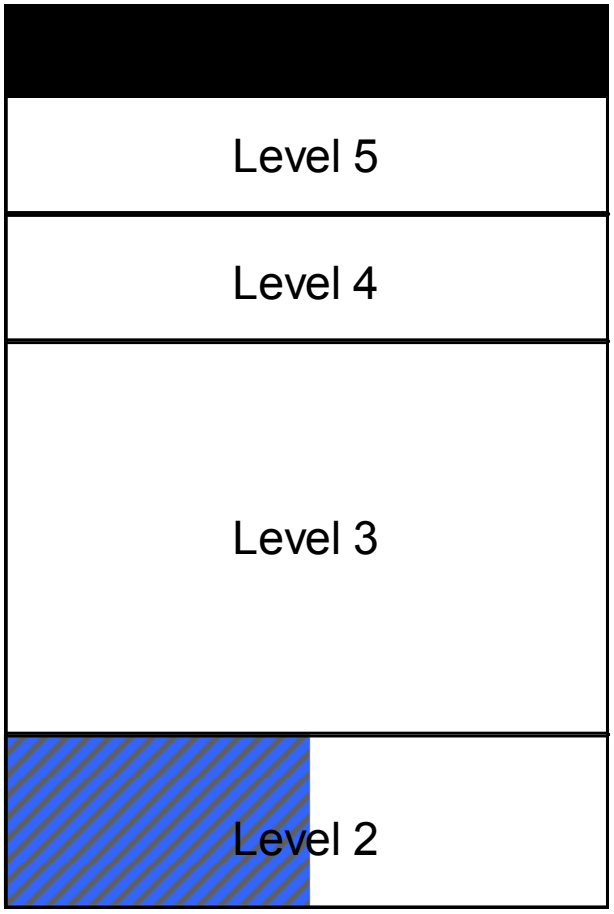
1. Create predictable schedules
2. Successfully deliver product X
3. Reduce rework
4. Improve the performance of our core product
5. Keep customers happy
6. Keep making a profit

Example Problems

1. Need better requirements. Requirements tracking not in place. Changes to requirements are not tracked; code does not match specification at test time.
2. Management direction unclear for product version 2.3. Goals change often.
3. Quality department does not have training in product and test skills.
4. Unclear status of changes.
5. Lack of resources and skills allocated to design.

9. Defect repairs break essential product features.
10. Wrong files (for example, dynamic link libraries) are put on CD. Unsure of the correct ones.
11. Revising the project plan is difficult. Items drop off, new things are added, plan is out of date.
12. We don't understand our capacity and do not have one list of all the work we have to do.
13. Schedule tracking and communication of changes to affected groups is poor.

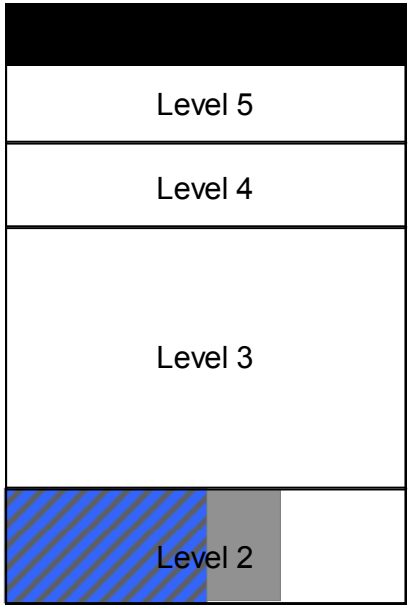
Initial goals and problems address 43% of Level 2

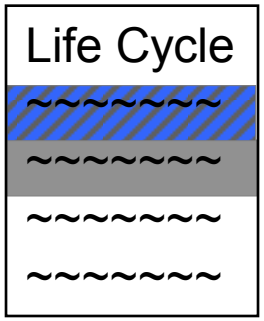


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Progress on Chosen Framework -2

Next set of goals
and problems

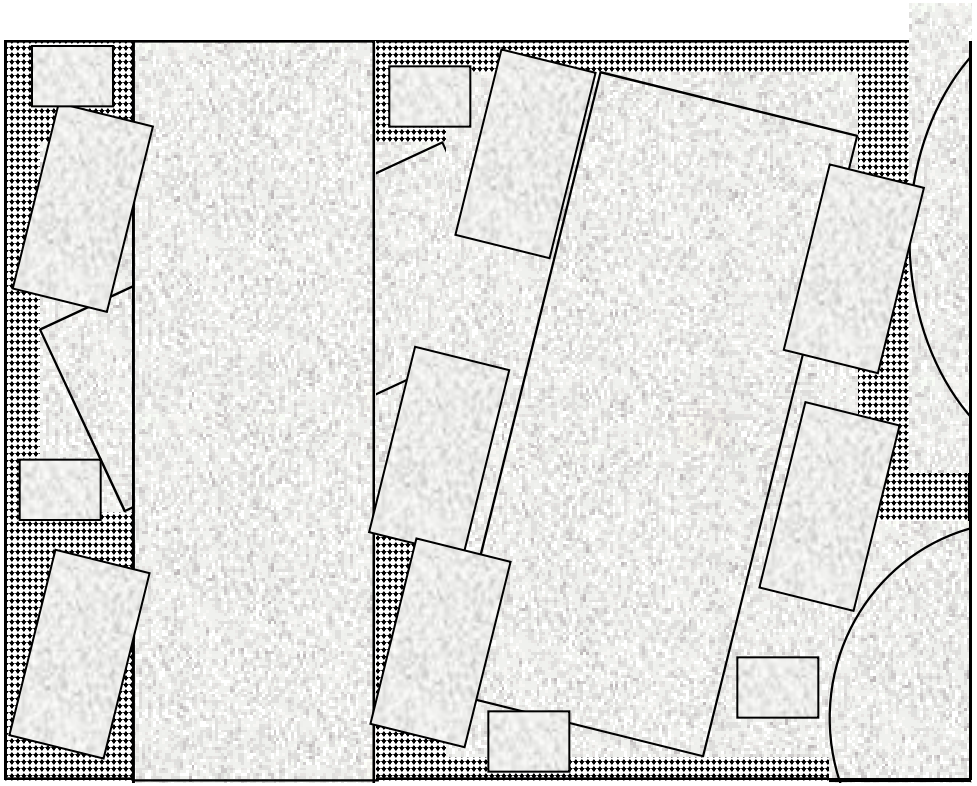




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What to Do With the Remaining Elements?

- **Put each to good use**
  - –What problem could it solve?
- **Declare them not applicable**
  - –Check with your appraiser / auditor!
- ~~**Meet the letter of the law**~~



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2. Organize the Action Plan

Action Plan Owner: _____

Primary Goal and Intermediate Goals (The result you want)	**Purpose of Goal** (Why do you want to achieve this goal?)	**Actions**	**Priority** (*=essential)	**Time Estimate**	**Who**
PRIMARY GOAL 1	**PURPOSE OF PRIMARY GOAL 1**				
Small intermediate goal (based on problem statement)	Purpose of small intermediate goal	Action	1*		
		Action	2*		
		Action	3		
		Action	4		
Next intermediate goal	Purpose of next intermediate goal	Action	1*		

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Example Improvement Plan - 1

Primary Goal and Intermediate Goals (The results you want)	**Purpose of Goal** (Why do you want to achieve the goal?)	**Actions**	**Priority** (*=essential)
Reduce product development cycle to six to nine months for product X.	**Deliver earlier than competition.**		
Manage changing requirements (based on problem 1).	Prevent schedule slips resulting from expensive scope changes.	Only allow changes to the application interface, not the kernel routines.	1*
		Assign responsibility and authority for performing the REQM process.	2*
		Check progress and take corrective action .	-
		Improve the library control system to minimize version control errors. Investigate requirements management tools.	3
		Track change requests for the configuration items.	4
		Develop an understanding with the requirements providers on the meaning of the requirements .	5
		Baseline the requirements before design commences.	6

Step 3: Add placeholder for checking progress and taking corrective action

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Example Improvement Plan - 2

Primary Goal and Intermediate Goals (The results you want)	**Purpose of Goal** (Why do you want to achieve the goal?)	**Actions**	**Priority** (*=essential)
Set feature priorities for a six- to nine-month development cycle (based on problem 3).	Ensure commitments are achievable.	Establish a review process with clients to neg otiate features for a six - to nine-month development cycle.	1*
		Rate each feature based on value t o the customer (1-10 points) and cost to develop (1 -10 points).	2*
		Check progress and take corrective action .	-
		Reconcile the project plan to reflect available and estimated resources.	3
		Identify and analyze project risks.	4
		Establish incremental delivery plan to phase in lower priority features.	5

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Choose Actions That Are Appropriate for the Problem - 1

Problem	Inappropriate and Overly Complex Solution
Unable to get requirements from customers	Adopt quality function deployment
No time allocated for design	Adopt a detailed object-oriented design process
Inaccurate estimates	Create a new historical database, built from scratch, and available on four platforms
Poor-quality products	Define a detailed life cycle, containing numerous engineering methods

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Choose Actions That Are Appropriate for the Problem - 2

Problem	Simpler Solution
Inaccurate estimates	Learn an estimation process that addresses some of the root causes of the inaccurate estimates (for example, the Wideband Delphi method)
	Start collecting actual data for current projects so that they can compare their estimates with actual effort expended

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Choose Actions That Are Appropriate for the Problem - 3

Problem	Simpler Solution
Poor-quality products	Inspect (peer review) all critical documents and code.
	Improve estimation of test time needed.
	Train test engineers in test skills.
	Send test engineers to a customer site to understand how the customer uses the product. Factor this knowledge into the test strategy.

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Exercise: Develop an Action Plan



1. **Form project teams**
2. **Select 2-3 goals (and related problems) to develop actions for**
3. **Develop actions:**
   - Brainstorming
   - Select elements from an improvement framework
   - Establish priorities and essential actions
4. **Discuss lessons learned**

Result:

Primary Goal and Intermediate Goals (The results you want)	**Purpose of Goal** (Why do you want to achieve the goal?)	**Actions**	**Priority** (*=essential)
Reduce product development cycle to six to nine months for product X.	**Deliver earlier than competition.**		
Manage changing requirements (based on problem 1).	Prevent schedule slips resulting from expensive scope changes.	Only allow changes to the application interface, not the kernel routines.	1*
		Assign responsibility and authority for performing the REQM process.	2*
		Check progress and take corrective action .	-
		Improve the library control system to minimize version control errors. Investigate requirements management tools.	3
		Track change requests for the configuration items.	4
		Develop an understanding with the requirements providers on the meaning of the requirements .	5
		Baseline the requirements before design commences.	6

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Developing a Plan

- Scope the Improvement
- Develop an Action Plan
- **Determine Risks and Plan to Mitigate**
  1. Determine Scope of Risk Session
  2. Select the Team and Moderator
  3. Identify Risks
  4. Analyze Risks
  5. Plan to Mitigate
  6. Plan for Periodic Risk Review

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What is a Risk?



A risk is anything negative that could happen

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1 + 2. Scope, Team and Moderator



- **Scope**:
  - The complete list of goals and problems, or subset
- **Team**:
  - Improvement team
  - People who have done similar improvement projects and tasks
  - Technical experts
  - Customer champions
- **Moderator**:
  - Any team member

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3. Identify Risks

Create a list of potential future problems

- **Weak areas such as unknown technology**
  - e.g., tools, vendors, and methods that are new to the team
- **Aspects that are critical to the improvement project**
  - e.g., the timely delivery of a vendor's training program, continued buy-in from management, and the creation of training materials
- **Problems that have plagued past projects**
  - e.g., loss of essential staff, resistance to change, and changing priorities

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4. Analyze Risks

For each risk item:

- **Does the team understand this risk item?**
  - » If necessary, split into separate risk items

    "Lack of management buy-in" is replaced by:

    -> "Jane could decide that the new method is not beneficial"

    -> "Robert (VP) does not see any gains from money spent"
- **Discuss and determine its scope:**
  - » What would the consequences be if this risk item did occur?
- **Determine what the impact (I)** would be if the worst happened, using a scale of **one to ten.**
- **Determine how likely (L)** it is that the risk item will occur, using a scale of **one to ten.**
- **Determine the priority (P)** of the risk items using **impact x likelihood.**

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Risk Analysis Example

Risk Items	Consequence	L	I	P = L x I
Management buy-in for improvement diminishes	Improvement program fails	9	10	90
Management changes priorities before we complete any milestone	Improvement program loses credibility	9	9	81
New requirements management tool has long learning curve	Developers give up in frustration	9	8	72
Library control person might leave	Wasted time training a new person	7	8	56
New group to manage baseline changes is not accepted by project managers	Duplication of effort or baseline changes are not managed	6	9	54
Creation of specialized training materials for new staff takes too long	Improvement implementation delayed	5	7	35
Requirements management tool is delivered to us late	Pass up the opportunity to try the tool	4	3	12

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5. Plan to Mitigate

- **Select the most important risk issues, such as the top 2-3, or top 20%**
- **Brainstorm on actions that could be taken to reduce the likelihood of the risk item occurring** (risk mitigation)
  - Make actions specific
- **Brainstorm on actions that could be taken to reduce the impact if the risk item does occur** (risk contingency planning)
- **Decide which actions to pursue**
- **Select a person to be responsible for each action chosen**
- **Document the information in the risk management plan**

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Risk Planning Example

Risk item:

- Management buy-in for improvement diminishes

Possible actions to reduce likelihood of risk item:

- Ensure that the improvement program addresses the management team's problems and goals
- Establish a steering committee to oversee the improvement effort
- Publicize early results to management
- Provide four funding options for the improvement program: full-time, part-time, short bursts, and investment spread over two years

Possible actions to reduce impact of risk item if it does occur:

- Determine improvements that can be made at a project level without major funding
- Explain the problems and goals that will not be addressed because of reduced funding

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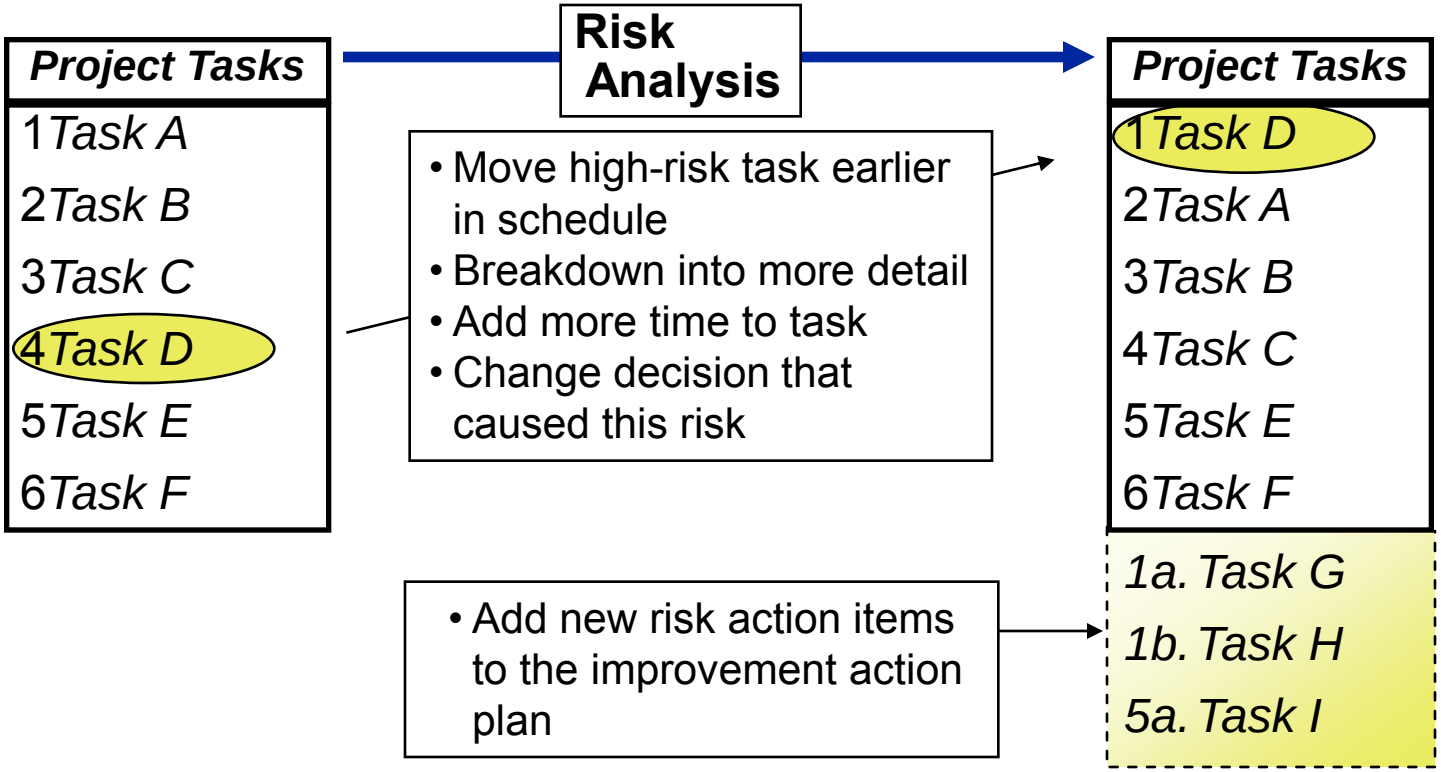
Risk Management Plan

Risk Item	Consequence (If Risk Item Does Occu r)	L	I	P	Actions to Reduce Likelihood of Risk Occurring	Actions to Reduce Impact if Risk Does Occur	Who is Responsible for These Actions?	When Actions Should be Complete	Status of Action

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Using the Risk Information



The improvement team should direct its attention to the higher risk, rather than the easier (lower risk) tasks

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6. Plan for Periodic Risk Review

Purpose:

To determine if the identified risks have changed and update the plan accordingly

- **Be sure that periodic risk reviews are held to monitor the risks identified**
- **Establish how often risks should be reviewed (once a month is typical)**
- **Risk reviews can be incorporated into existing project status and phase reviews**
- **Update the list based on risk review sessions**

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Exercise: Determine Risks & Plan to Mitigate



1. Form project teams.
2. Determine the scope of the risk session and establish the goal (i.e., which goals and problems).
3. Determine the risks and priorities. Consider your assumptions and improvement actions.
4. Determine the action items for top 2-3 risks.
5. Discuss lessons learned.

Result:

Risk Items	Consequence	L	I	P = L x I
Management buy-in for improvement diminishes	Improvement program fails	9	10	90
Management changes priorities before we complete any milestone	Improvement program loses credibility	9	9	81
New requirements management tool has long learning curve	Developers give up in frustration	9	8	72
Library control person might leave	Wasted time training a new person	7	8	56
New group to manage baseline changes is not accepted by project managers	Duplication of effort or baseline changes are not managed	6	9	54
Creation of specialized training materials for new staff takes too long	Improvement implementation delayed	5	7	35
Requirements management tool is delivered to us late	Pass up the opportunity to try the tool	4	3	12

Action Items

~~~
~~~

Summary - Developing a Plan

- **All improvements are tied to specific needs of the organization**
- **Goals and problems help the organization identify which pieces of an improvement framework to implement next**
- **Goals and problems establish the scope and context for each improvement**
  - When a problem has been solved or a goal addressed, a team can stop defining the process or standard
- **Practitioners and managers are motivated to work on improvement because the effort is directed toward the group's needs**

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Implementing the Plan

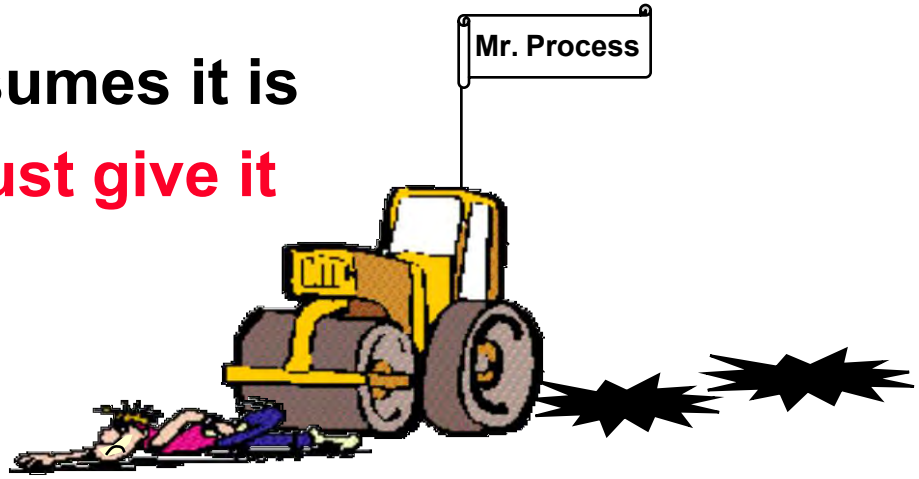
—Proving that the true skeptics are indeed truly skeptical achieves nothing, except that you've dented your pick and probably permanently diminished your credibility (and failed to appreciate the vital importance of building a fragile momentum)."

—Tom Peters, *A Passion for Excellence*

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What Too Often Happens

- A (big) process document is written
- The improvement team assumes it is done and deployment is "just give it to the people"
- The process is "deployed"



- The process is ignored, or significant resistance occurs
- The organization gives up or continues to struggle

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Implementing the Plan

- Sell Solutions Based on Needs
- Work with the Willing and Needy First
- Keep Focused on the Goals and Problems
- Align the Behaviors of Managers and Practitioners
- Avoiding a Documentation Glut

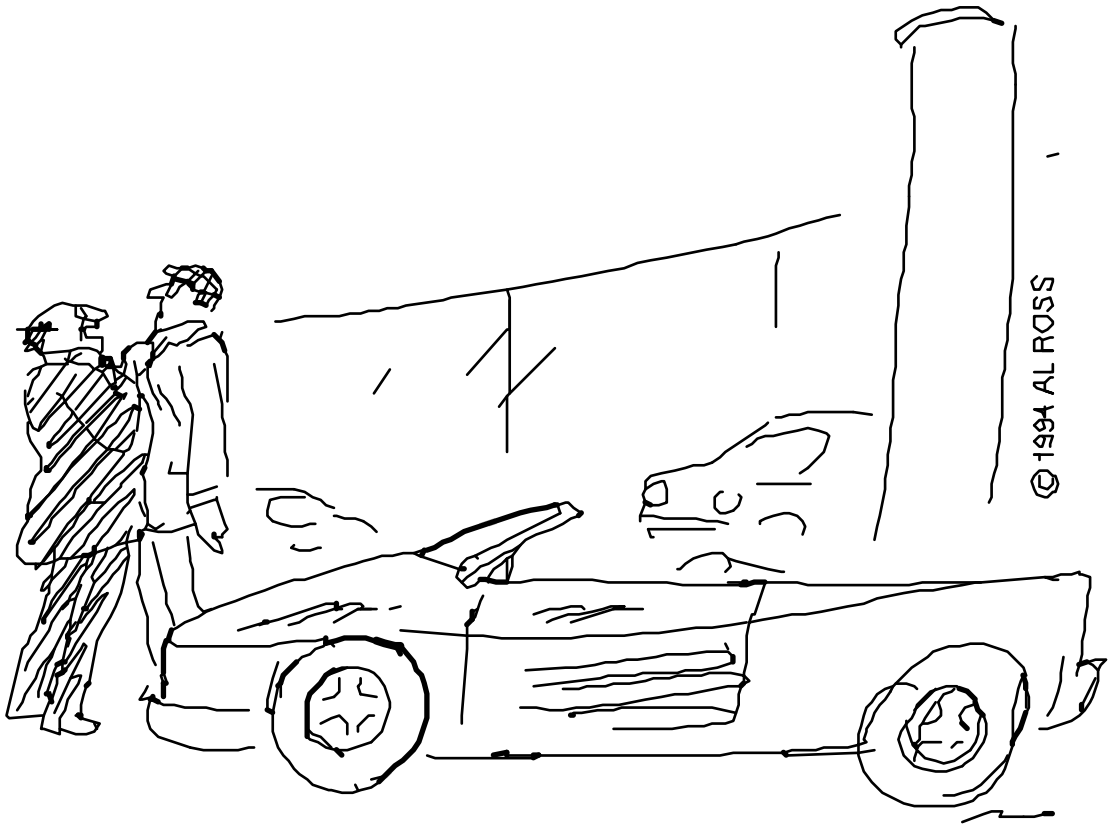
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The Selling Aspect of Getting People to Change

- **What did the sales person do in your best sales experience?**

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Individuals Want to be Understood First and Then Have Their Problems Solved



"And I say you can afford it!"

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How to Use *Selling*



PROCESS

- **Forget** what you are selling
- **Understand** what the customer wants in his/her terms
  - Problems and goals
- Determine the **match** with what you have and what the customer wants
- **Solve** the customer's problem
  - may be a standard or customized solution

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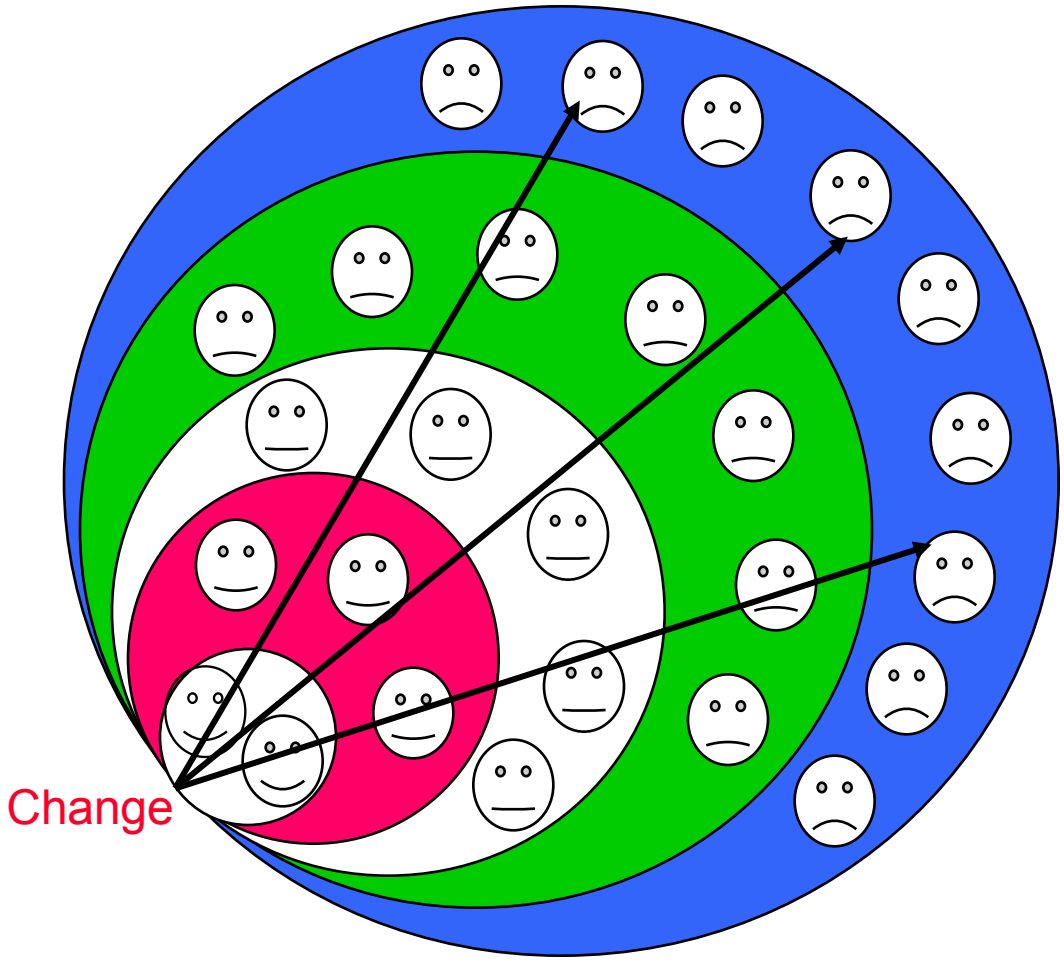
Implementing the Plan

- Sell Solutions Based on Needs
- Work with the Willing and Needy First
- Keep Focused on the Goals and Problems
- Align the Behaviors of Managers and Practitioners
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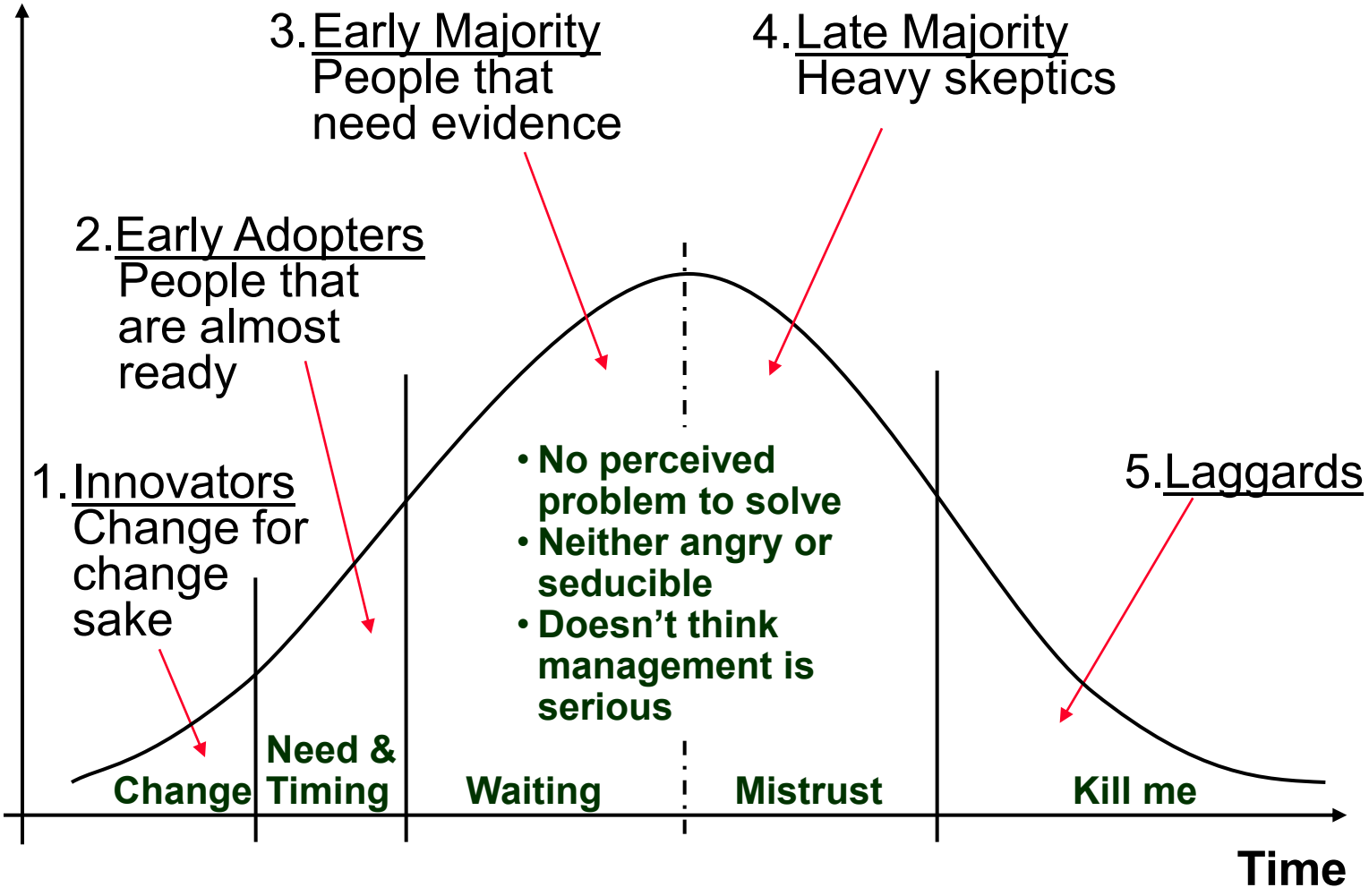
Work with the Willing and Needy First

- **A planned and staged approach:**
  - Builds momentum
  - Leverages success stories
  - Provides feedback to refine the solution(s)
  - Easier to manage



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What Stages?

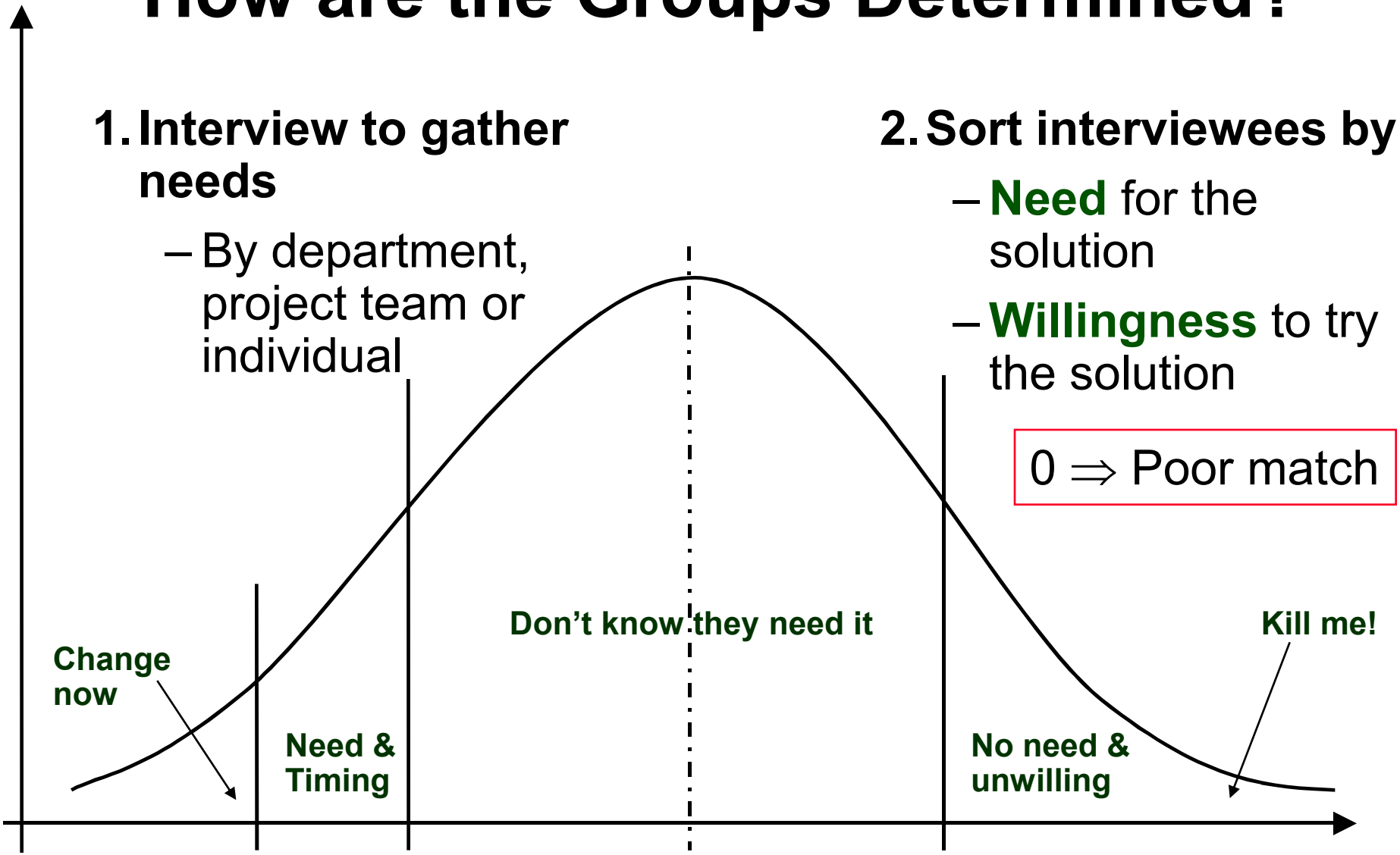


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How are the Groups Determined?

1. **Interview to gather needs**
   - By department, project team or individual
2. **Sort interviewees by**
   - **Need** for the solution
   - **Willingness** to try the solution

0 ⇒ Poor match



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Three Uses of the Adoption Curve

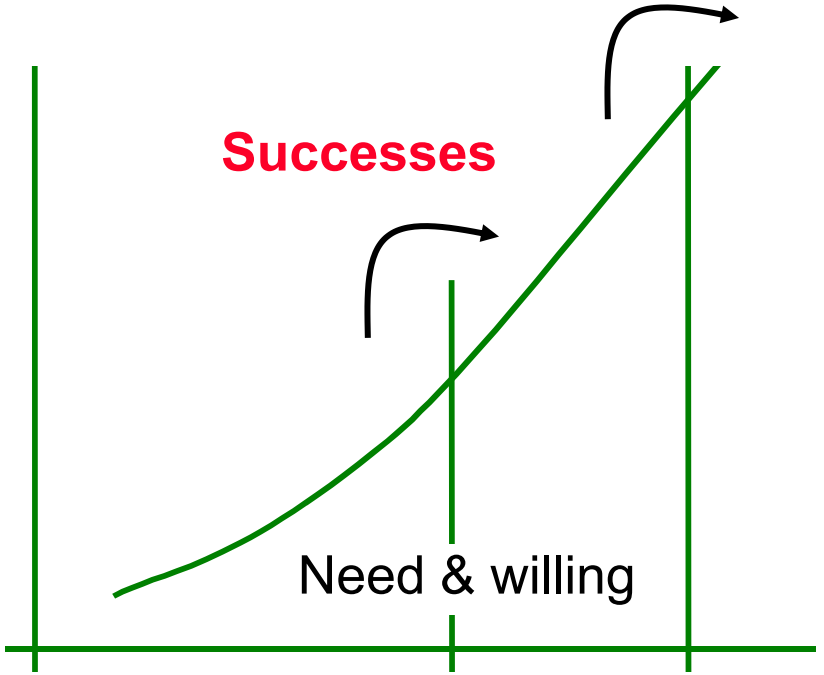
1. Increase the speed of deployment by determining with whom to work and in which order
2. Reduce the risk of failure by building and deploying the solution in increments
3. Determine when to develop a policy and issue an edict

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Use 1: Increase Speed of Deployment

Speed comes from:

- **Increasing motivation to adopt - based on need**
- **Decreasing resistance - based on willingness**
- **Using previous successes to influence the next group**



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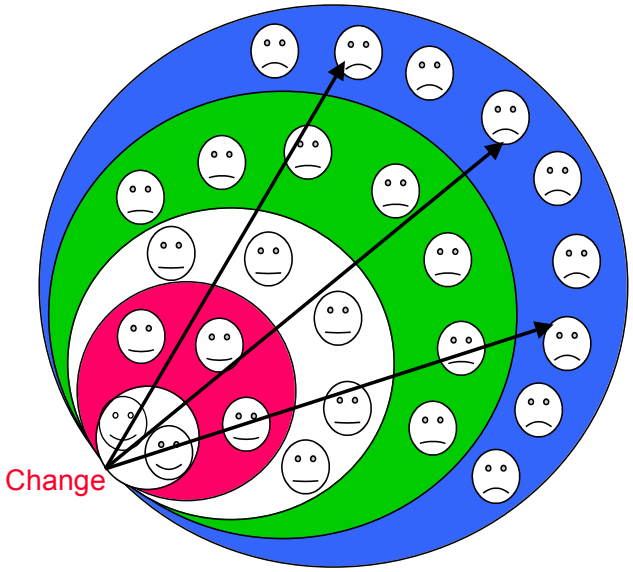
Successes: Getting the Word Out

- How to reach your audience

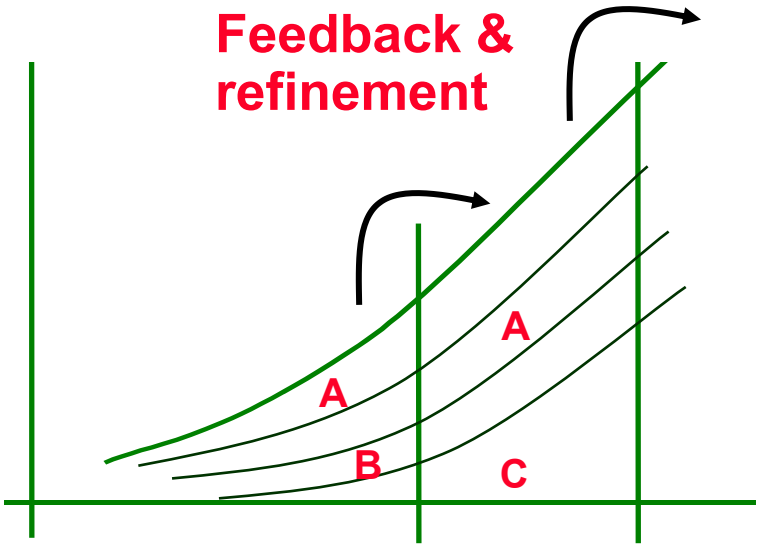


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Use 2: Reduce the Risk of Failure



Innovators and early adopters can provide specific requirements for and feedback on early versions of the solution



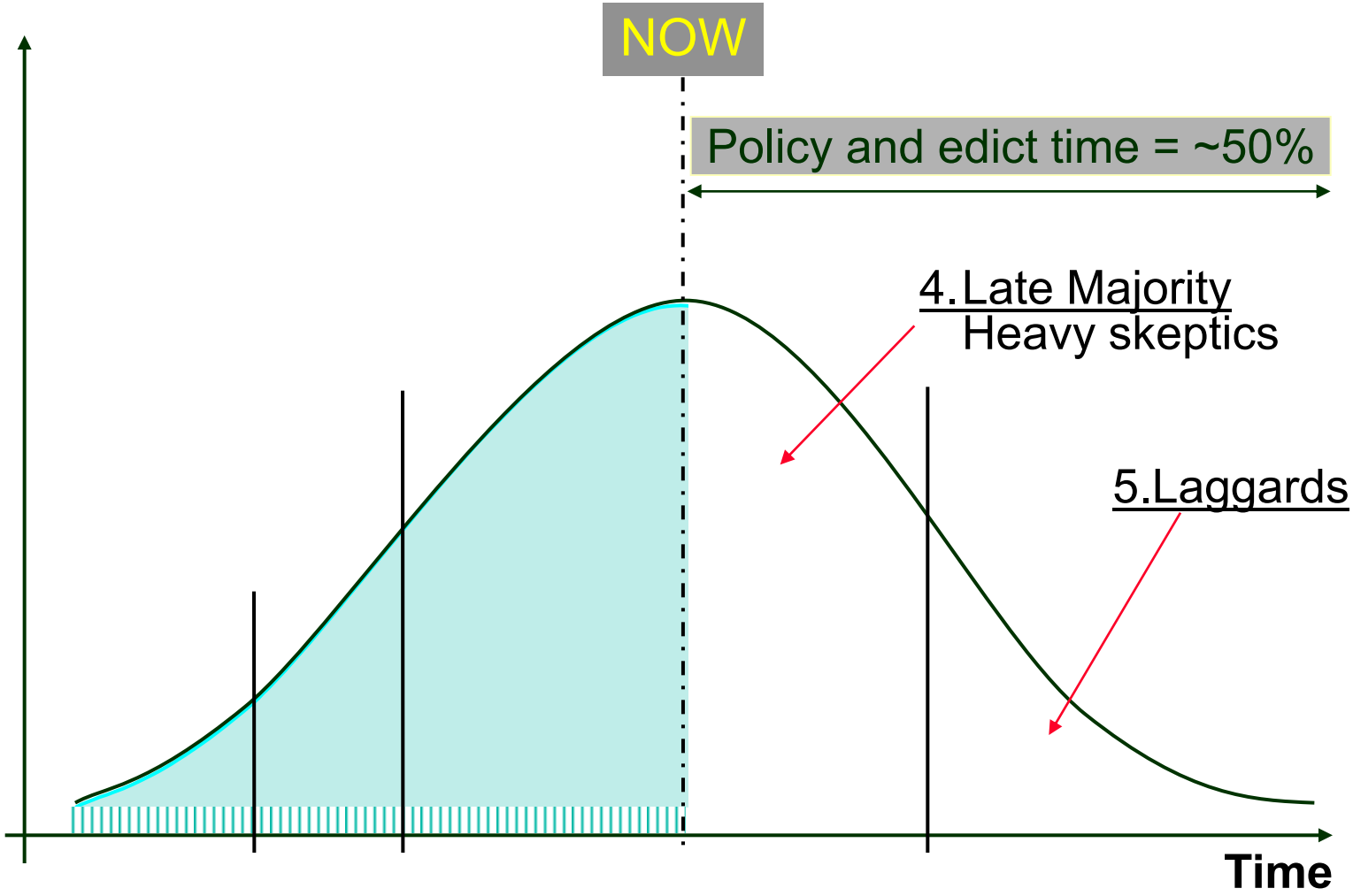
For example:

Planning solution for 3 teams

- Team A: Estimation
- Team A: Negotiation
- Team B: Risk management
- Team C: Metrics / tracking

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Use 3: Developing a Policy & Issuing an Edict - 1



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Use 3: Developing a Policy & Issuing an Edict - 2

- **Policy states:**
  - When and where a practice should be used.
- **In the beginning:**
  - You might not have any idea!

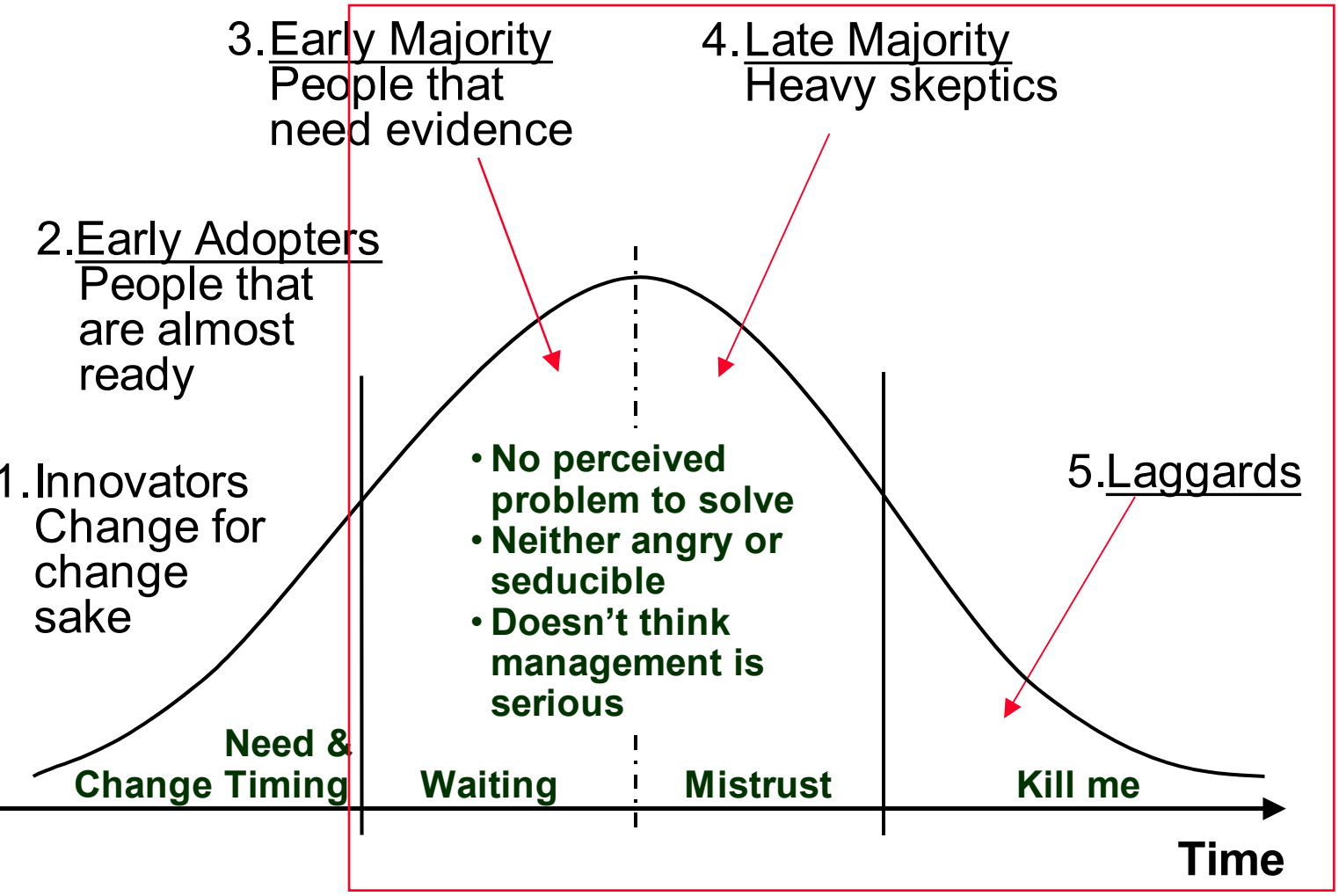
Wait until you get some experience and <u>feedback</u>

- **Edict states**:
  - —Do it now, this is important.”
- **In the beginning**:
  - You don’t necessarily have proof or credibility.

Wait until you get some experience and <u>ownership</u>

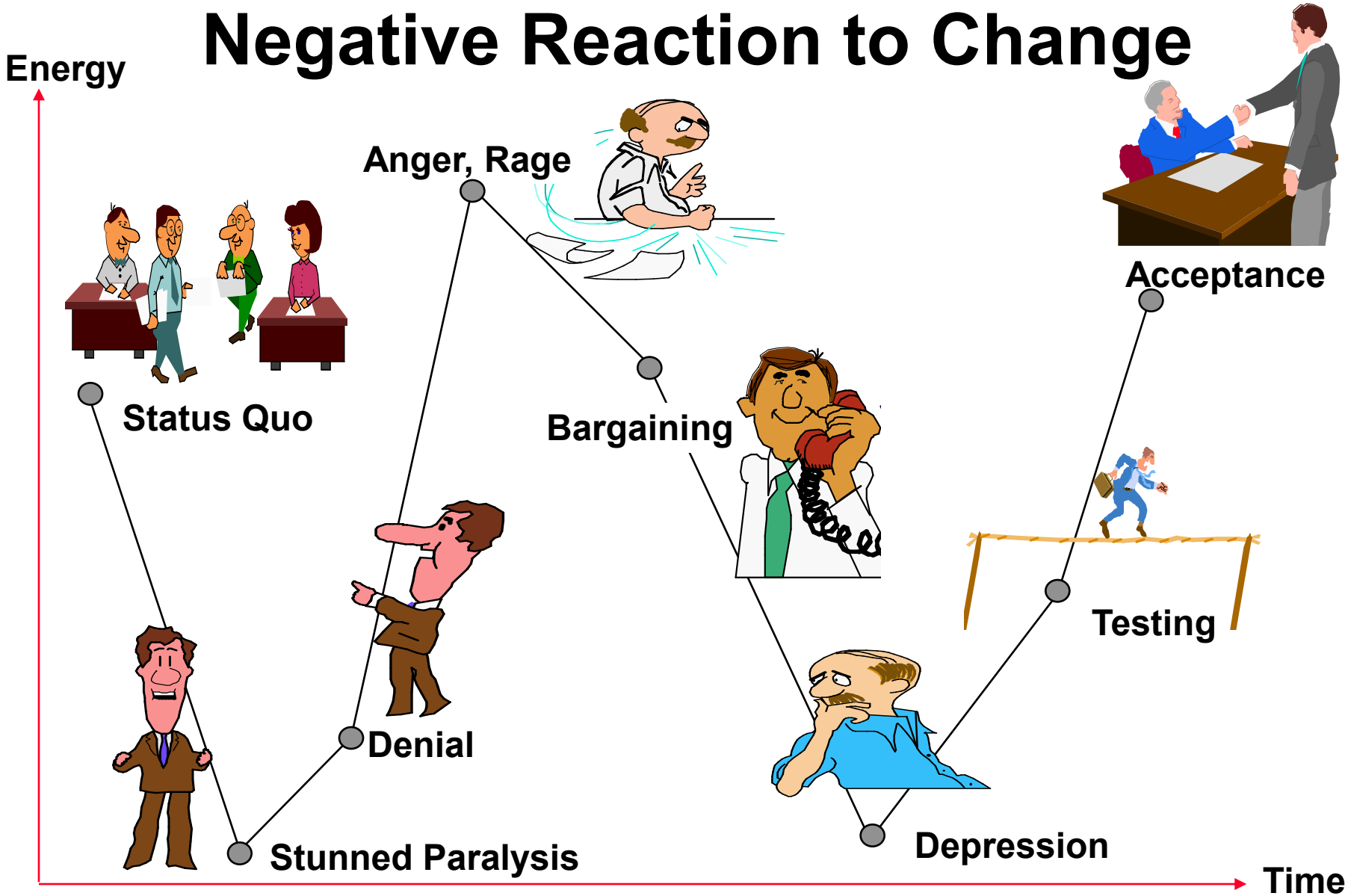
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Resistance



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Negative Reaction to Change



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Overcoming Resistance

Resistance has two common causes:

1. **It is not apparent to the person resisting that your solution will meet his or her current needs**
2. **The person believes that your solution brings more pain than benefit; examples of pain include:**
   - embarrassment (if the change is unsuccessful)
   - wasted time using a poorly constructed solution
   - fear of stepping into the unknown (when the status quo is comfortable)

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Overcoming Resistance - Needs -1

- **Address the first common cause by:**
  - identifying and clarifying the needs of your audience
    - » What is the problem and what are they trying to accomplish?
    - » Do they understand your proposed solution and is this an appropriate time to adopt the idea?
    - » What are their concerns regarding costs (or effort / timing)?
- **If your solution does not match the need, then say so, and investigate other solutions that do**
- **If the issue is timing or cost:**
  - determine a more appropriate occasion to deploy the new skill, or
  - propose a smaller, more economical solution

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Overcoming Resistance - Needs - 2

Understand the benefit of the current behavior. The new behavior must give them at least the benefit of the old.



Example:

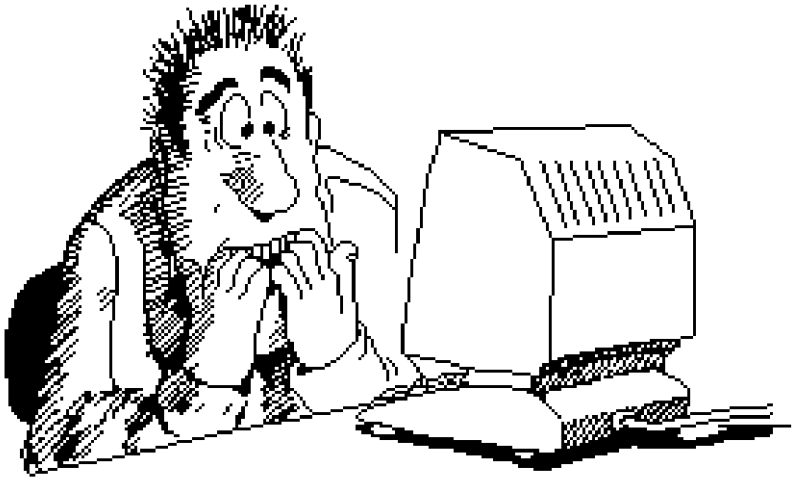
- **Quarterly product releases:**
  - Keeps customers happy
  - Helps keep team focused
  - Generates constant revenue
- **Semi-annual releases may also:**
  - Keeps customers happy
  - Helps keep team focused
  - Generates constant revenue

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Adoption Requires Leverage

(Some identified pain, or missing pleasure, associated with the current behavior)

"I'll do this peer review stuff if it can help me make tomorrow's demonstration for the CEO"



Unless you find that area of leverage (pain or pleasure), the change may never happen

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Overcoming Resistance - Beliefs - 1

Events lead to beliefs (things we feel certain about). Beliefs combined with values (what is important) lead to behaviors.



Event or Information
Bad code review

+

Beliefs
Reviews grade the author

Values
- Deadline
- Ego
- Respect

=

Behavior
Never attend another code review

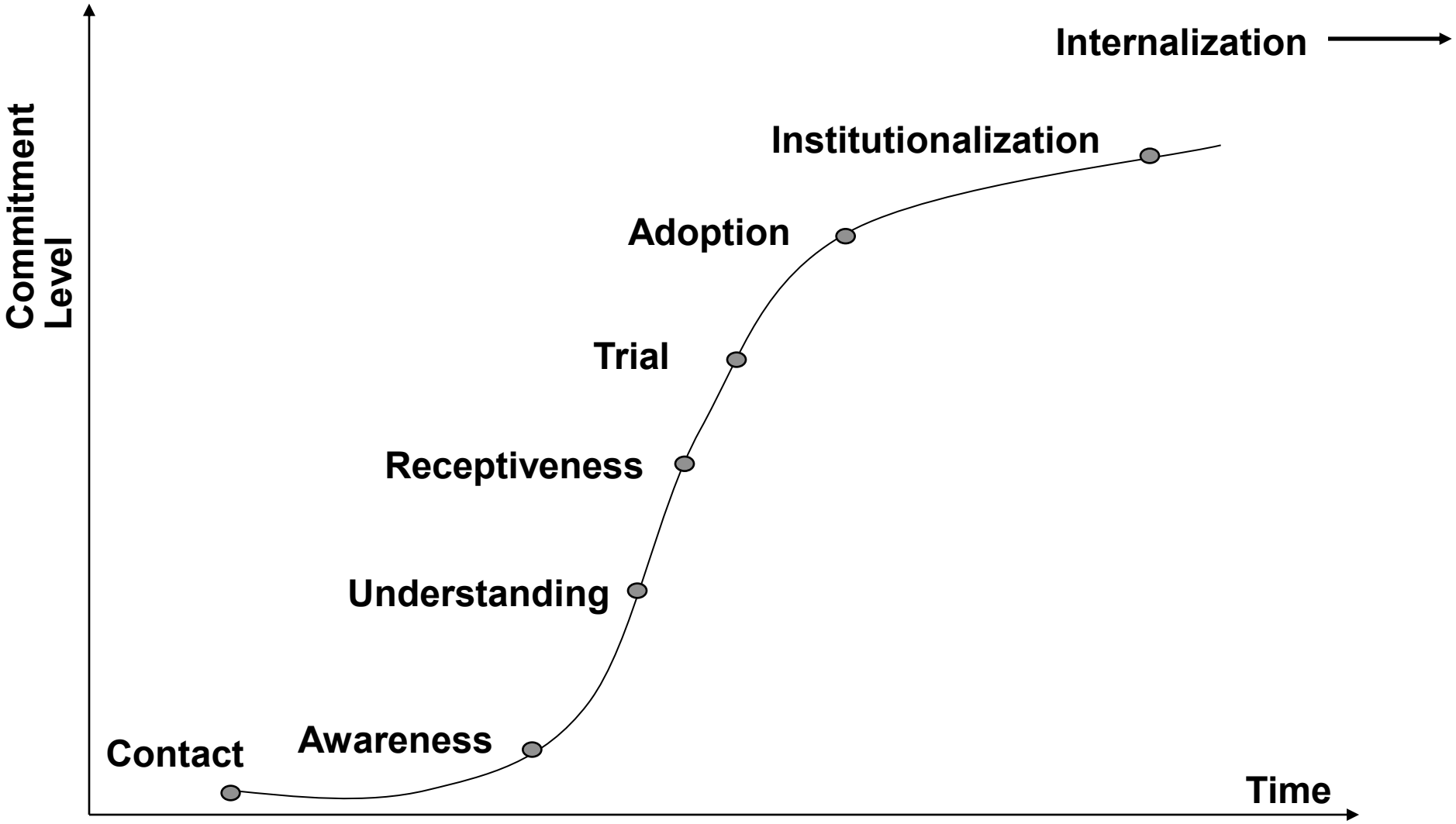
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Overcoming Resistance - Beliefs - 2

- **Understand customer's values**
  - What is most important to you?
  - What is most important to you about planning?
- **Understand beliefs**
  - What have you heard about code reviews?
  - What have your experiences been with process improvement?
- **Use discussion, new information and events to help correct any inaccurate beliefs**
  - For example:
    - ensure that the trial of a new idea is successful
    - use testimonials

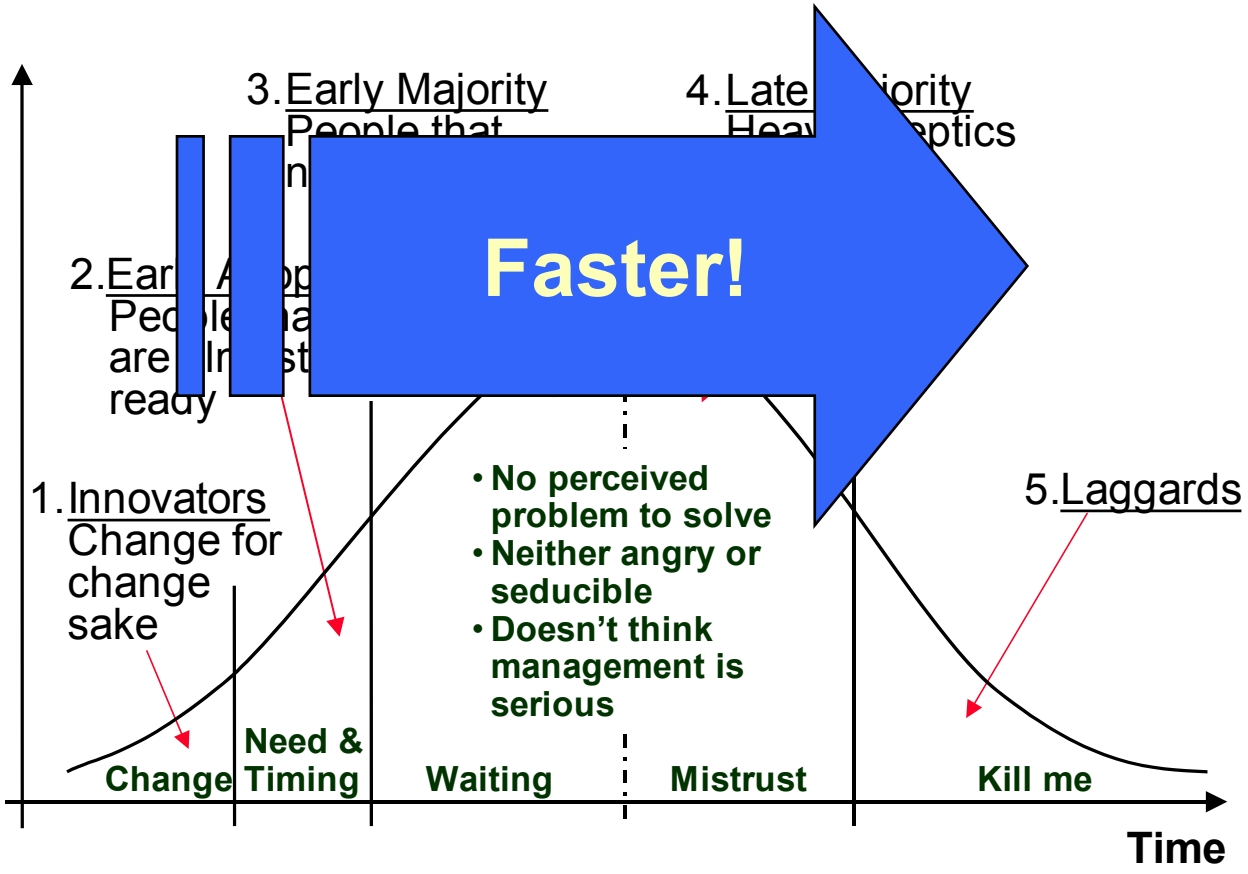
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Plan to Reduce Resistance



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Accelerating Adoption Through Training and Consulting - 1

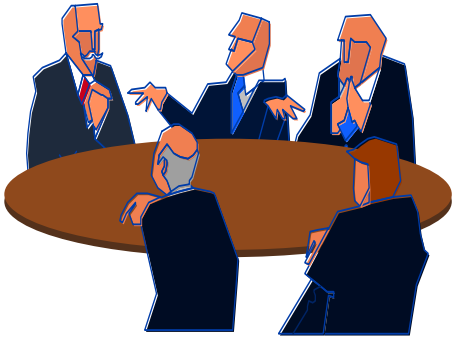


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Accelerating Adoption Through Training and Consulting - 2



Coach



Facilitator



Presenter / teacher

- Change Agents: get out of your office and help!
- Always work on real problems
- Get other process champions to help you deploy solutions



Politician / go-between

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Process Champions and Train-the-trainer

- **Process Champion characteristics:**
  - Highly respected (by the target audience)
  - Some dedicated time to help
  - Able to share information practically
- **Train-the-trainer guidelines:**
  - Provide the champion with materials
  - Observe the champion train an audience
  - Keep training to small (2-4 hr), manageable topics, e.g.,
    - » **Risk management**
    - » **Inspection**
    - » **Estimation**

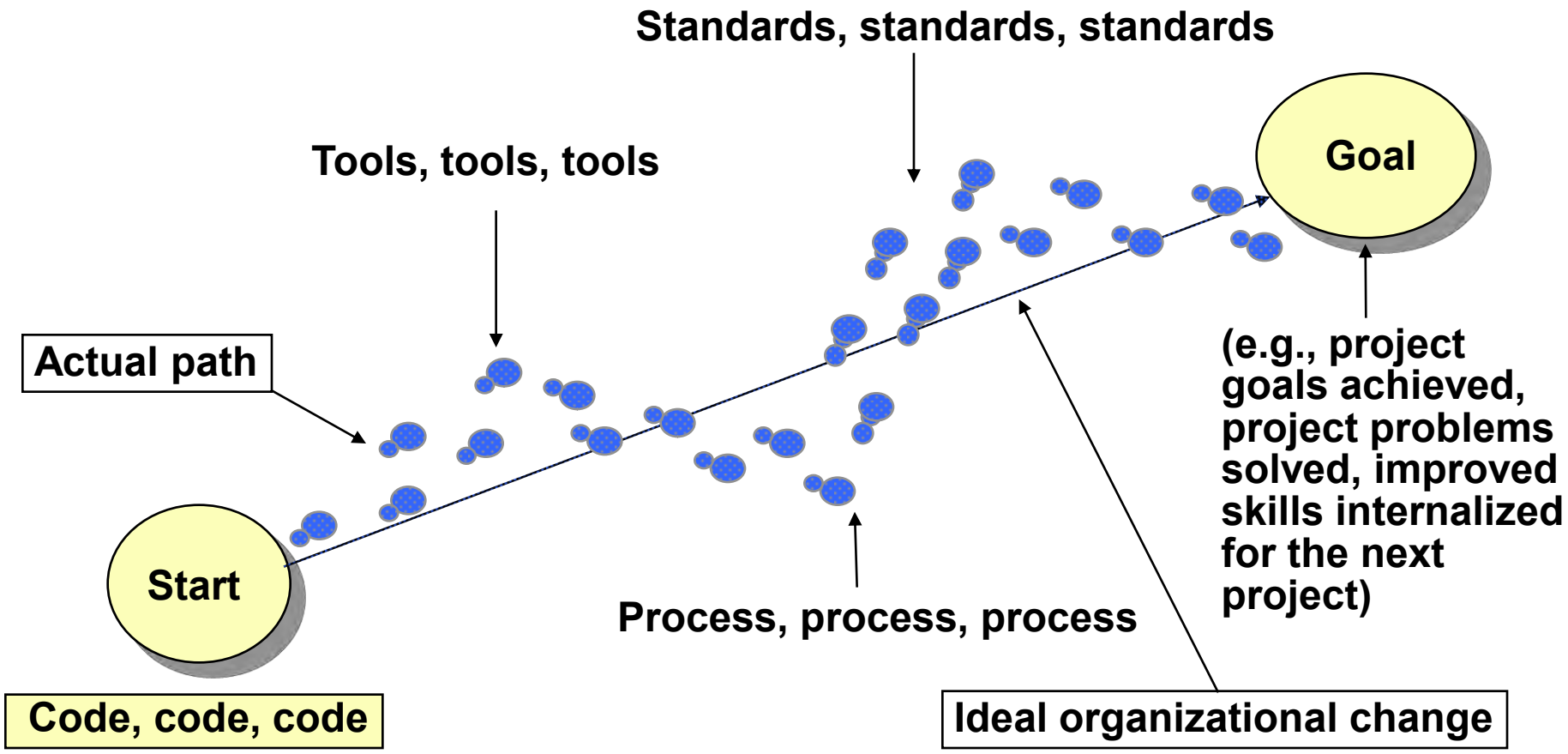
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Implementing the Plan

- Sell Solutions Based on Needs
- Work with the Willing and Needy First
- Keep Focused on the Goals and Problems
- Align the Behaviors of Managers and Practitioners
- Avoiding a Documentation Glut

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Keep Focused on the Goals and Problems - 1



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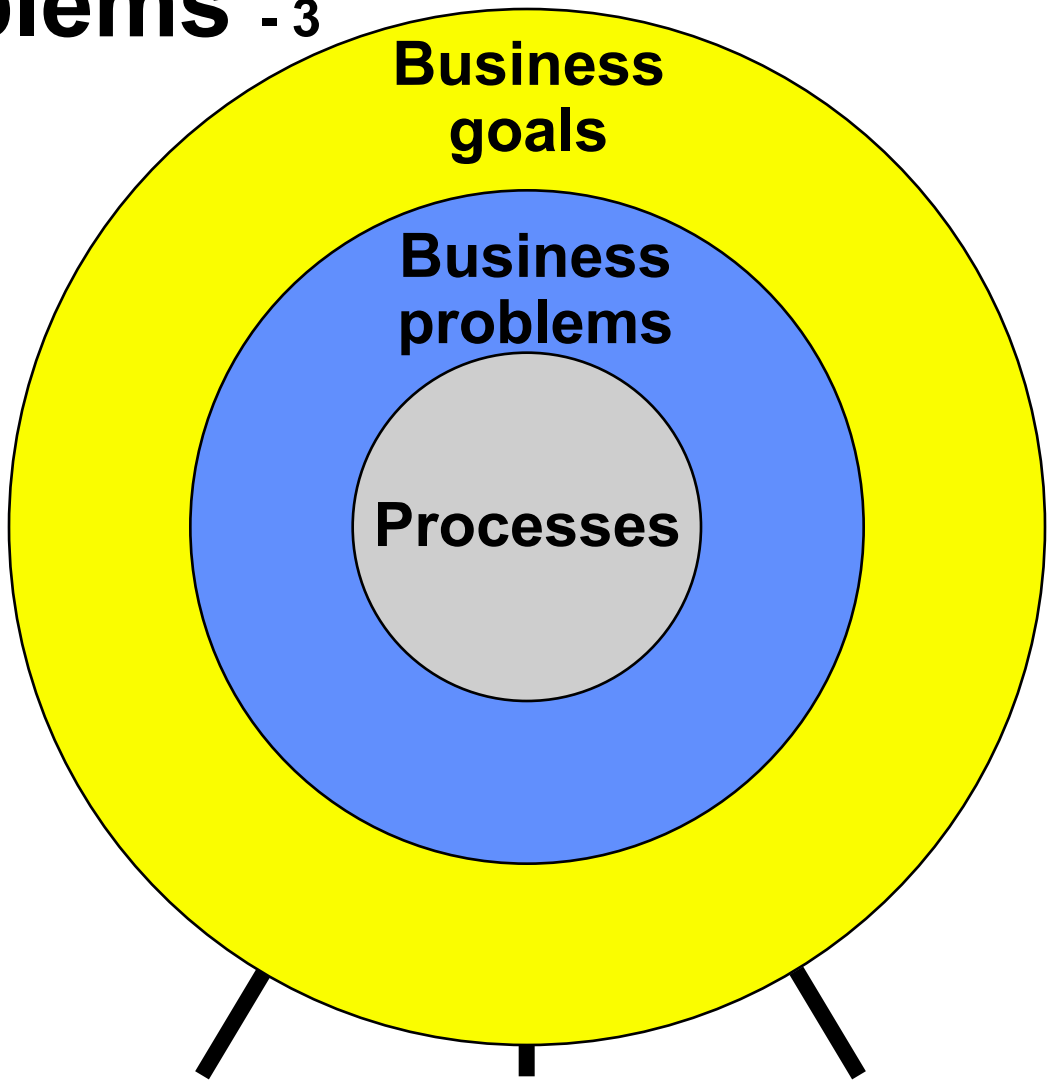
Keep Focused on the Goals and Problems - 2

- **Review improvement plans periodically during departmental and project meetings.**
  - If you are not making weekly gains in your improvement program, you may be off track. Weekly gains come from fixing numerous, small project-level problems.
- **Are improvement activities tied to the business goals and problems experienced by the organization?**
- **Are projects getting better results?**
  - e.g., improved customer satisfaction, less rework, fewer surprises, fewer communication problems, meeting deadlines etc.

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Keep Focused on the Goals and Problems - 3

- **Don't revert back to process-centric improvement**
  - One framework topic at a time
- **Practice and internalize goal-problem approach**



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Keep Focused: Doing Too Much at Once - 1

- **Monday's plan** →

Primary Goal and Intermediate Goals (The results you want)	Purpose of Goal (Why do you want to achieve the goal?)	Actions	Priority (*=essential)
Reduce product development cycle to six to nine months for product X	**Deliver earlier than competition**		
Manage changing requirements (based on problem 1).	Prevent schedule slips resulting from expensive scope changes.	Only allow changes to the application interface, not the kernel routines.	1*
		Establish a group with the authority for managing the project's software baselines.	2*
		Check progress and take corrective action.	-
		Improve the library control system to minimize version control errors. Investigate requirements management tools.	3
		Record and track change requests and problem reports for all configuration items.	4
		Review the initial requirements and changes before they are incorporated into the project plan.	5
		Baseline the requirements before design commences.	6

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

- **Tuesday's plan** →

Primary Goal and Intermediate Goals (The results you want)	Purpose of Goal (Why do you want to achieve the goal?)	Actions	Priority (*=essential)
Set feature priorities for a six- to nine-month development cycle (based on problem 3).	Ensure commitments are achievable.	Establish a review process with clients to negotiate features for a six- to nine-month development cycle.	1*
		Rate each feature based on value to the customer (1-10 points) and cost to develop (1-10 points).	2*
		Check progress and take corrective action.	-
		Review project commitments with senior managers, engineers and the customer to obtain agreement.	3
		Perform risk management related to the schedule, resource and technical aspects of the project.	4
		Establish incremental delivery plan to phase in lower priority features.	5

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Keep Focused: Doing Too Much at Once - 2

- **Success in any discipline is accomplished by focusing on a few items at a time**
  - Stick to the priorities you established in your plan
- **See a few improvements to completion so the organization can experience success**
- **Early successes provide fuel and motivation to address the remaining goals and problems**

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Implementing the Plan

- Sell Solutions Based on Needs
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- Avoiding a Documentation Glut

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What Management Can Do - 1

- **At all management levels:**
  - Place improvement in **top five priorities**
  - Communicate PI **for progress on business goals and problems**
    - » PI is not documentation for some appraiser! (Documentation captures a solution to a problem)
  - Maintain overall **department improvement plan** and track publicly
  - Ensure that improvement actions are in **current plans**
    - » Fix current project problems as we go
    - » Mitigate current project risks as we go
    - » Include time in schedules for improvement + use allocated rework time
  - Lead by **example** (PP, CM, REQM, vendor selection)

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What Management Can Do - 2

- **At all management levels:**
  - Maintain **consistency of purpose**
    - » Avoid flavor-of-the-month
    - » Internalize the use of process models
    - » Understand how this practice helps us
  - Establish, track and use **measures**
    - » E.g., customer satisfaction, defect density, planned vs. actual time
  - Provide **forums** for sharing **good practices**

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What Management Can Do - 3

Reinforcement and reward will condition a new behavior long-term. The reward must be timely and meaningful.

- **Meaningful: valuable to the person or group getting the reward.**
- **Timely: as soon as possible after the event.**
- **Don't reward firefighting or heroism, unless that is a long-term goal!**

Examples:

- **Benefit from the improvement**
- **Recognition**
- **Increased responsibility**
- **Money**
- **Free time**

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What Management Shouldn't Do

- **At all management levels, DON'T:**
  - Manage PI as an activity **completely unrelated to running the business** - a documentation exercise!
  - Make the **EPG solely responsible** for achieving CMMI Level N
  - **Undermine** improvements
    - » e.g., —Forget CM, E-mail the product now!"
  - **Overcomplicate** solutions
    - » 25 metrics
    - » Globally available historical database, 15 countries
    - » Every CMMI practice uniquely met, instead of merging them together
    - » Documentation = 20 pages per process

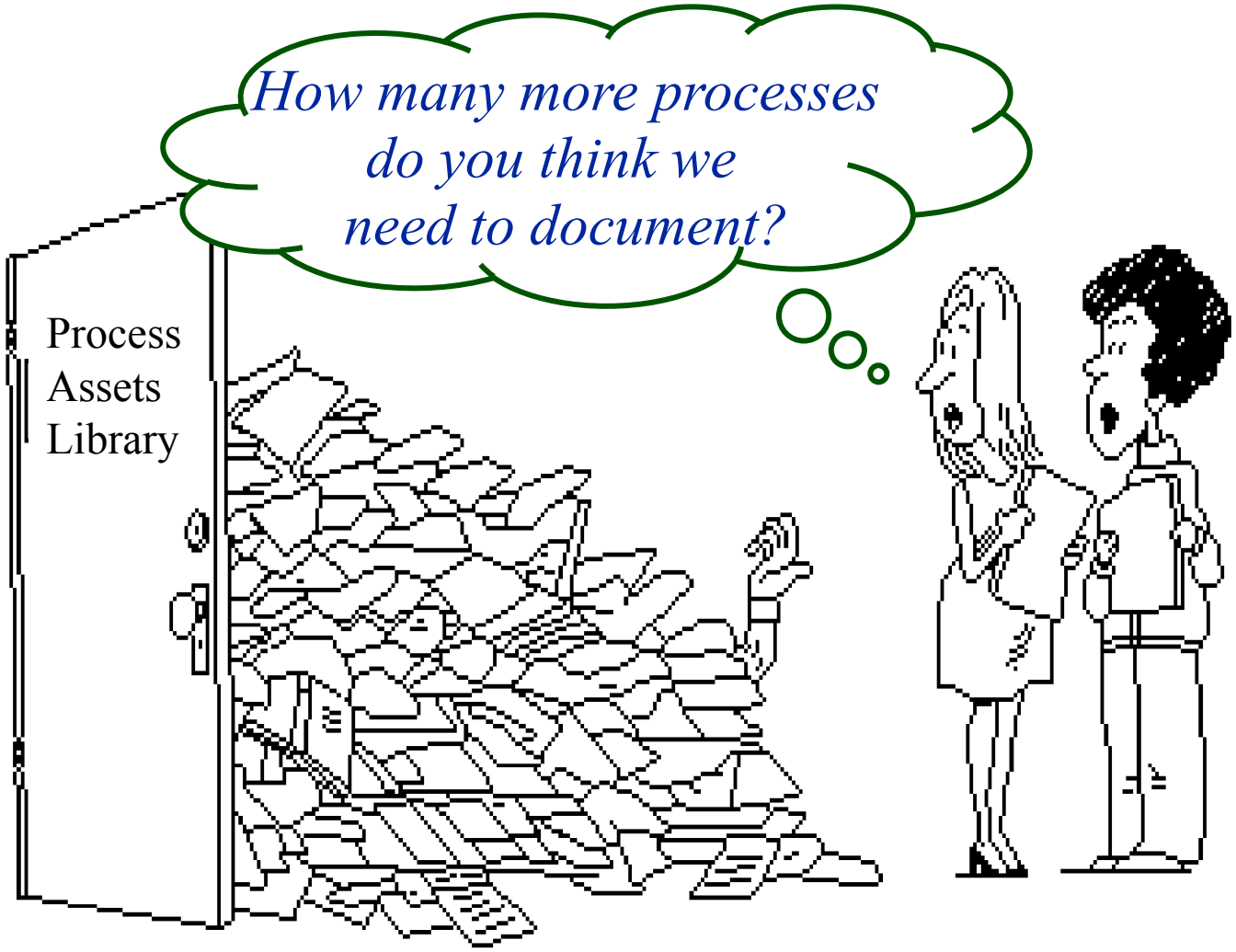
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Implementing the Plan

- Sell Solutions Based on Needs
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Avoiding a Documentation Glut



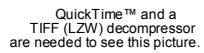
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Documentation Key Issues

1. Focusing on the organization's needs
2. Keeping processes concise
3. Knowing when you are in trouble
4. Knowing if you are meeting the intent of the framework (e.g., CMMI process areas)

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1. Focus on the Organization's Needs



- **Keep process documentation concise by focusing it on specific needs (e.g., business goals and problems)**
- **Begin with a simple version of the process. When the need is addressed, stop**
  - Refine further when the process no longer meets the need

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Focus on the Organization's Needs
Example

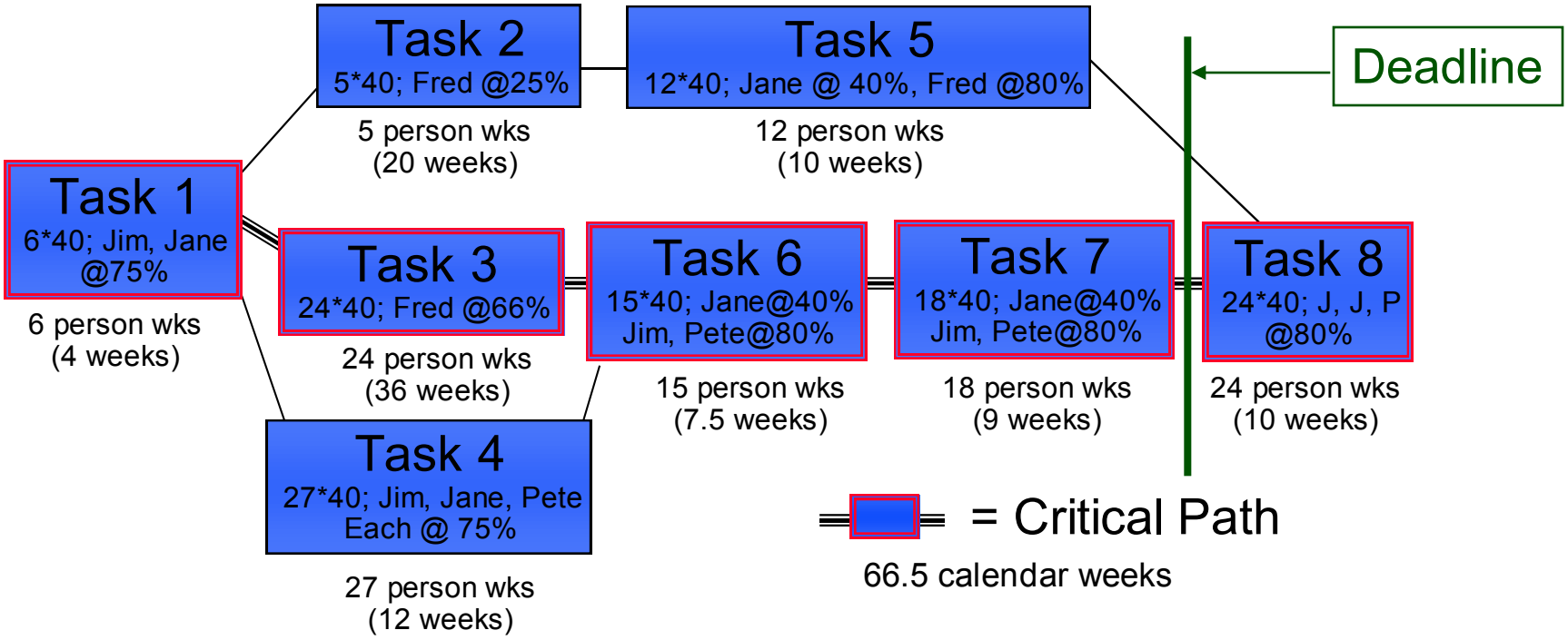
Project Needs	SEI CMMI Practices That Would Help
Changing requirements.	**Level 2: PP - Specific Practice 2.1** Establish and maintain the projectÕs budget and schedule.
The poor quality of incoming code from other groups.	
We routinely over commit.	
Inadequate availability of test equipment.	**Level 2: PP - Specific Practice 3.2** Reconcile the project plan to reflect available and estimated resources.
Too many features are required for the 6- to 9-month development cycle.	
Difficult to find defects early.	

Use the need(s) to scope the process

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Example Process for Schedule Creation

(Level 2: PP - Specific Practice 2.1 <Schedule>)



1. Determine task dependencies.
2. Add task EFFORT estimates.
3. Add resources - people, equipment, resource assumptions.
4. Add resource availability - %allocation, calendar days out.

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Example Process for Reconciling Commitments

(Level 2: PP - Specific Practice 3.2)

Step 1: Project team determines high-level product needs (or scope of work), from customer and marketing input

Step 2: Project team develops an initial project plan and estimates to determine what is feasible

Step 3: Project team meets with management, marketing, customers and related groups to determine whether:

- the change or product is feasible
- there is agreement to the resource, cost and schedule estimates
- the risk is acceptable

Step 4: A commitment is made OR further negotiation is held

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2. Keep Processes Concise - 1

- **Always consider 1 page (small) for each process or sub process!**
  - Refine what you have defined, don't necessarily add more
- **A Defined/Managed Process can be the instructions embedded in a work product template; e.g.,**
  - The template for an CM, QA or project plan
- **A standing agenda can be the process for a project review**
  - With instructions for use

CM Plan Template

1. List Configuration Items

   x, y, z

2. Establish File Naming Convention

   File-x<n>.doc

3. Establish Baseline File Structure

   ~~~~~~

4. ~~~~

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   ~~~~~~

Example Milestone Review Process

(Level 2: Project Monitoring & Control - Specific Practice 1.7)



- **For the last period:**
  - The **original plan**
  - **Accomplishments**
  - The **critical path** of the project
  - **High-risk areas** that need attention (top 2-3)
  - **Problems** that are impacting quality, cost and the schedule
  - **Status of action items** (open and closed)
- **For the next period:**
  - **The plan**

Instructions for use:

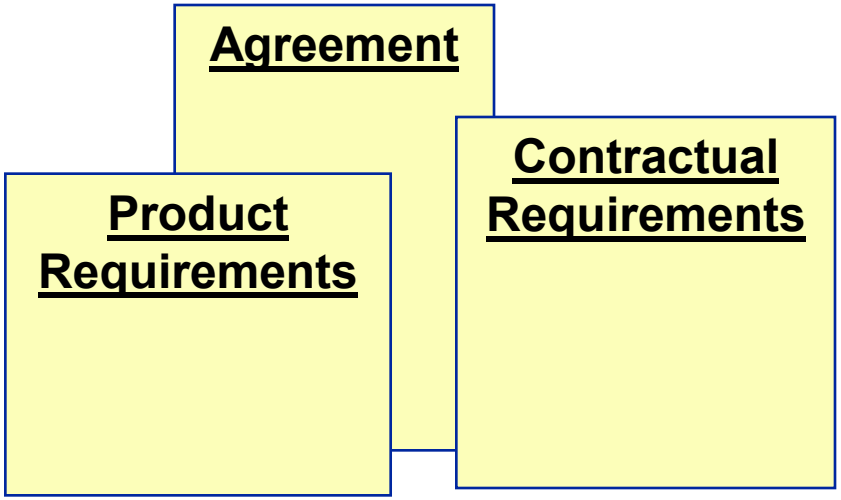
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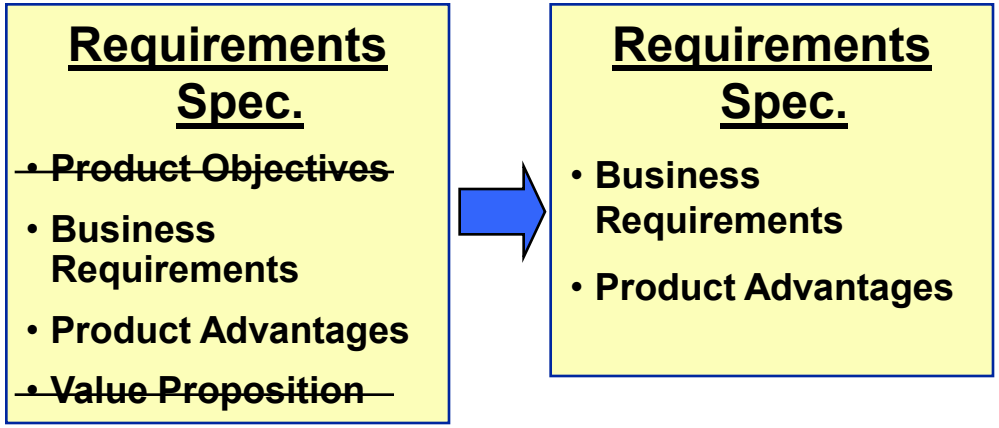
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Keep Processes Concise - 2

- **Merge duplicate work products, e.g.,**
  - Just because they might be listed separately in the CMMI does not mean that you can't merge them



- **Remove redundancy in templates**



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Keep Processes Concise - 3



- **Don't have separate QA checklists that repeat the original process. Use the original process as the checklist.**
  - Add specific QA pointers and guidelines.
- **Look for reuse in your CMMI implementation, e.g.,**

CMMI Practice	This CMMI Practice Can be Used Here Too
Level 2: PP - Specific Practice 1.1 Establish a top-level work breakdown structure (WBS) to estimate the scope of the project	**GP 2.2 in all Process Areas** Plan the Process + use PA process description
Level 3: VER - Specific Practice 2.2 Conduct Peer Reviews	**Level 3: TS - Generic Practice 2.9** Evaluate adherence of the technical solution process

VER = Verification, TS = Technical Solution

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Keep Processes Concise - 4

- **Consider one representation**
  - e.g., PowerPoint can be printed, shared and presented
- **Embed tailoring guidelines**
  - A separate document can be difficult to find and update
- **Have one policy**
  - e.g., —Perform the life cycle" Follow the tailoring guidelines in the lifecycle

Estimation Process

Step 5: Use the historical database to verify the estimate for each task

Purpose: To search the organization's historical data to see if a similar task (or group of tasks) exists.

Tailoring guideline: This step should be performed whenever applicable data exists. It can be discarded when a new language or technology is being used.

Risk if omitted: Failure to use the database could result in significant oversight about schedule estimates, and could lead to a loss in revenue.

Minimum requirement: Data that exists, but is not considered applicable for the current estimate, must be reviewed with one other manager to verify non-applicability.

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3. Know When You are in Trouble

- Project team members create process and project documentation to please an appraiser or auditor

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Photo - JPEG decompressor
are needed to see this picture.

- It has been 6 months and still the process is not ready to use

- Project managers –~~s~~tudy" the documentation in preparation for the appraisal



- The ink refuses to dry, and the appraisal interview is about to start!

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4. Know if You are Meeting the Intent of the framework

(e.g., CMMI Process Areas)

- **The problems related to those Process Areas have been solved and the solutions are captured in the processes.**
- **Project and process documents are used to run the project and the business.**
  - The practices within the CMMI have been institutionalized. The process —lives.”
  - No —extra paperwork”.
- **The processes have “institutionalized” characteristics.**
  - E.g., documented, planned, resourced, trained, someone assigned, under control, meet needs, monitored.

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Documentation Summary

Process documentation is:

- **Only a small part of process improvement**
- **A method of capturing and sharing engineering and management practices**

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Summary: Implementing the Plan



- Don’t go after the hardest nut (laggard) first
- Focus on real needs (who needs what, when)
- The process provider needs to be flexible and provide appropriate, timely solutions
- PI is not *about* documentation
- Management can lead

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Exercise: Implementing the Plan

1. **Make notes on which project members are the innovators and early adopters, and what they are ready to adopt. Refine your current improvement action plan using this information. What other interviews do you need to conduct?**
   - Also, consider the late majority (skeptics) and laggards.
2. **Review your improvement plan: Is it aimed at deploying solutions in small pieces based on project needs and priorities?**
   - For example, a complete project planning process can be broken into estimation, negotiation, risk identification, and scheduling.
3. **Develop a plan to interview some managers and find one who can use some of the techniques you are advocating, such as:**
   - Estimating, planning or peer reviews.
4. **Identify someone who can help deploy well-tried improvements in parallel with your efforts.**

Result:



Action Items

1. ~~~~~~~~~~
~~~~~~~~~~~~
2. ~~~~~~~~~~
~~~~~~~~~~~~
~~~~~~~~~~~~
3. ~~~~~~~~~~
~~~~~~~~~~~~
~~~~~~~~~~~~
4. ~~~~~~
~~~~~~~~

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Checking Progress

—You can design a measurement system for any conclusion you wish to draw.”

—Gerald Weinberg, *Quality Software Management*

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The Purpose of Checking

- **Checking progress:**
  - lets you know how well your improvement program is going
  - provides visibility to detect problems early
  - gives you data to make your future plans more effective
- **Corrective action consists of:**
  - mid-course changes based on results and lessons learned from the planning and implementation phases

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Goal-Question-Metric Approach - 1

Goal	Questions	Metrics
Meet all our cost and schedule commitments.	Are we spending the planned number of hours on the project to complete it? Are we hitting our milestones?	Planned versus actual effort for each project. The number of days each milestone is early or late.
Deliver product X by mm/dd/yy.	Are we spending the planned number of hours on the project to complete it? Are we hitting our milestones?	Planned versus actual effort for each project milestone. The number of days each milestone is early or late.
Reduce rework to less than 20 percent of total project effort.	How much time do we spend on rework now? How does this compare with our development time and are we improving?	Percentage of project time spent on rework.
	How many defects do we have in the product during design and coding?	Defect density: Number of defects found per unit size of work product (e.g., number of pages of design, number of lines of code).
Improve the performance of our core software product.	What is our current performance?	Average screen response time during peak system usage

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Goal-Question-Metric Approach - 2

Goal	Questions	Metrics
Achieve customer rating of 9/10 on product evaluation form.	How satisfied are they now? Are we improving?	Annual customer satisfaction survey.
Keep profits at 15 percent (and costs at the same as last year).	What is our profit? Is it getting better or worse?	Annual net profit.

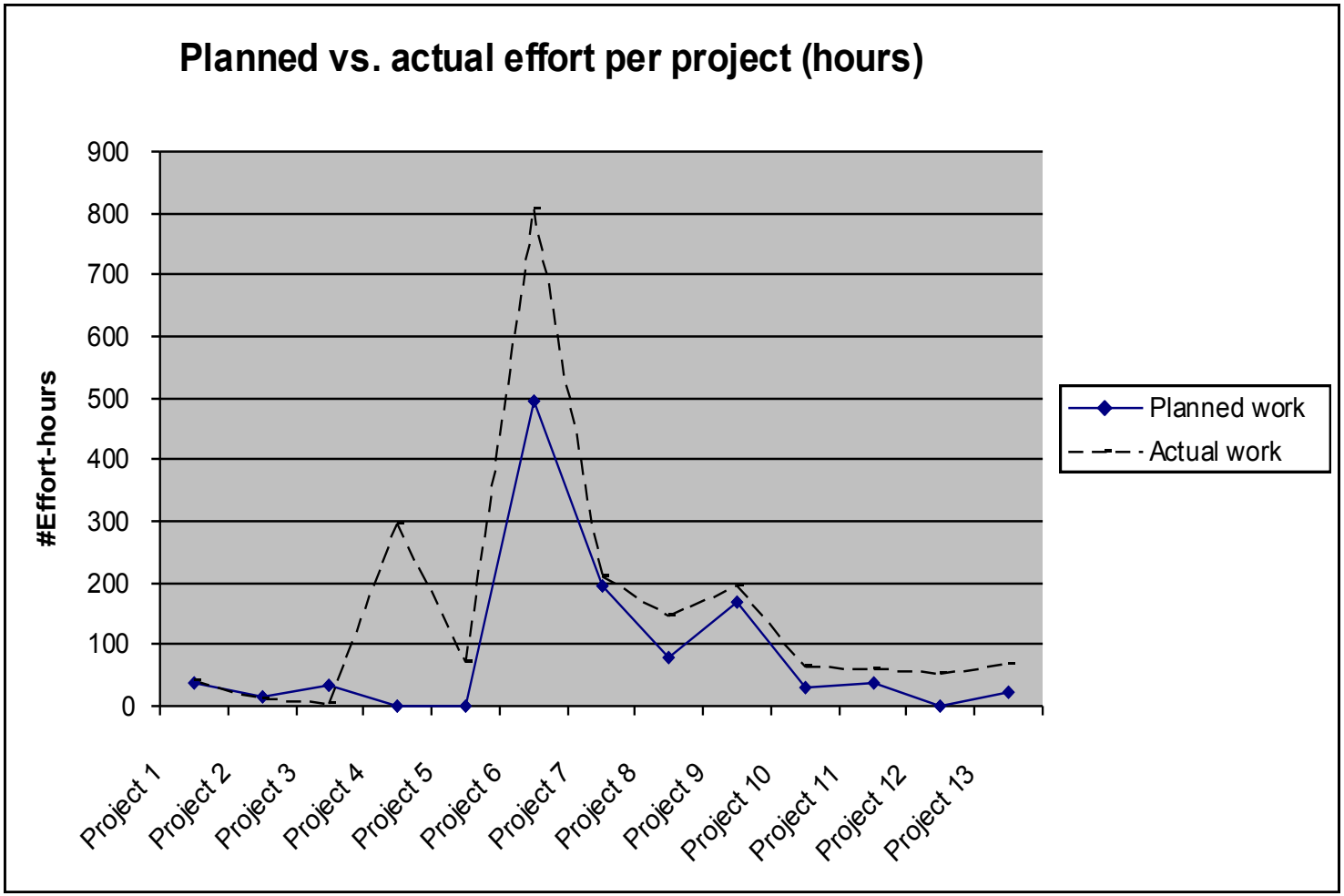
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Checking Progress

- Are We Making Progress on the Goals?
- Are We Making Progress on Our Improvement Plan?
- Are We Making Progress on the Improvement Framework?
- What Lessons Have We Learned So Far?

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Goal: Meet all Our Cost and Schedule Commitments



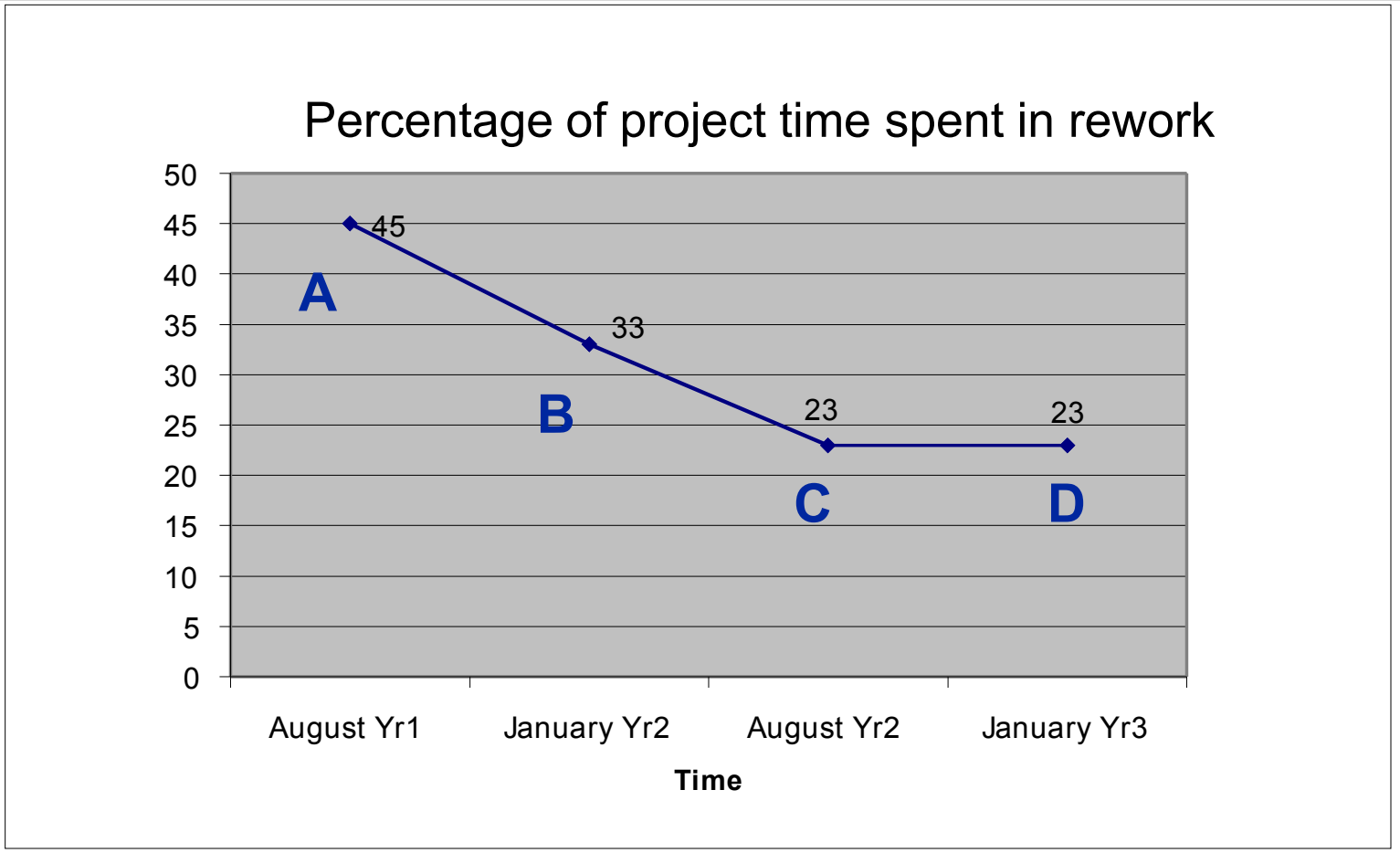
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Observations and Corrective Actions

- **Tracking the data for each project showed:**
  - a trend of consistently underestimating the number of hours needed
  - that although the group met the majority of their deadlines, the hours expended to do so were causing some financial loss
- **Corrective actions:**
  - develop a spreadsheet of historical information and use it when estimating new projects
  - use the Wide Band Delphi technique for deriving estimates
  - share the data with the sales staff to develop a joint understanding of how to bid on future projects

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Goal: Reduce Rework to Less Than 20 Percent of Total Project Effort - 1



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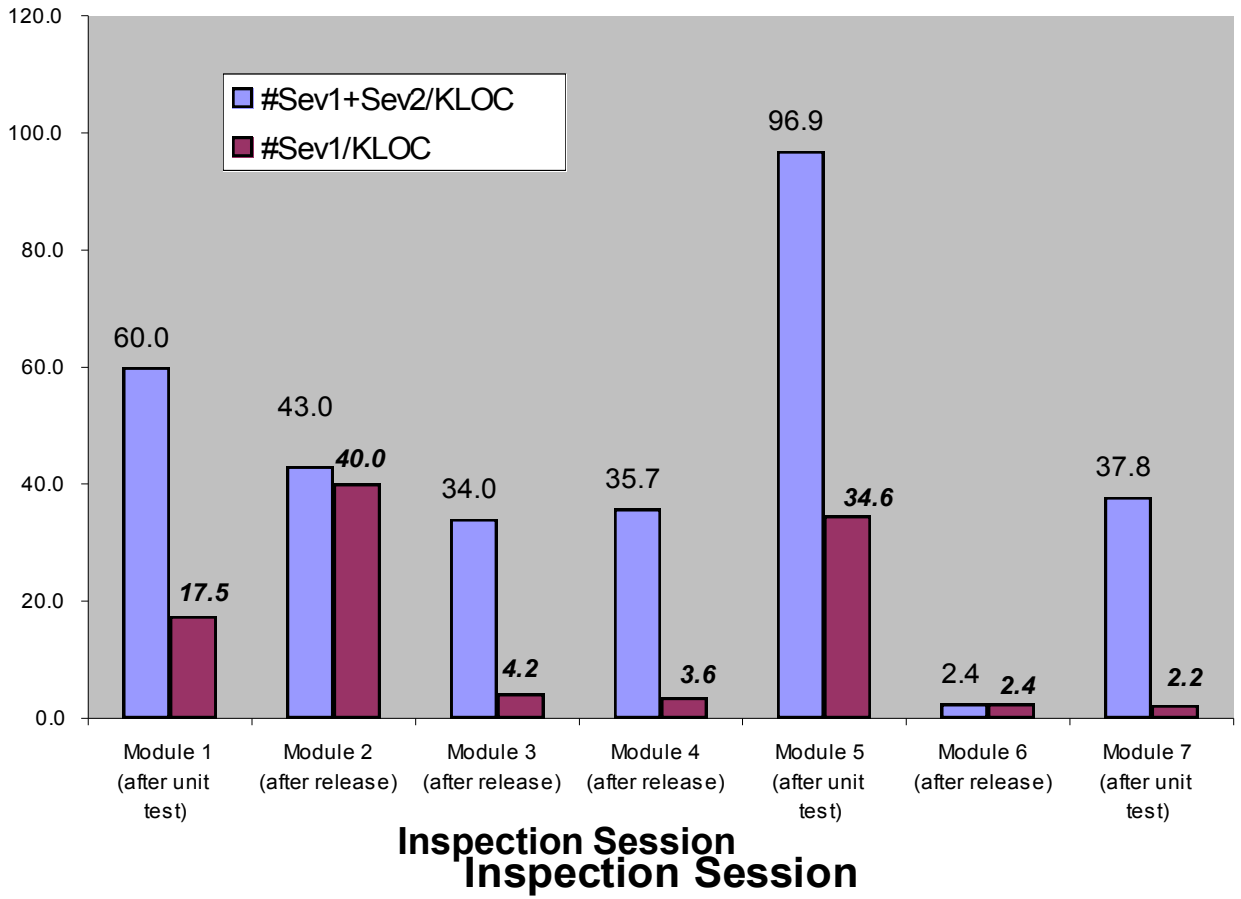
Observations and Corrective Actions

- **The graph showed:**
  - a trend of improvement in how engineering time was used
  - that further improvements were necessary to achieve the goal
- **Corrective actions:**
  - A⇨B: effort estimation, risk management, schedule creation, project tracking, inspection of design documents
  - B⇨C: inspecting code and requirements documents, formal CM, improved testing, process assurance, post-project sessions on lessons learned
  - D⇨:plan to adopt use cases and design process

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Goal: Reduce Rework to Less Than 20 Percent of Total Project Effort

Java/C++ Inspections – Severity 1 + Severity 2 Defects per Thousands of Lines of Code



Inspection Session

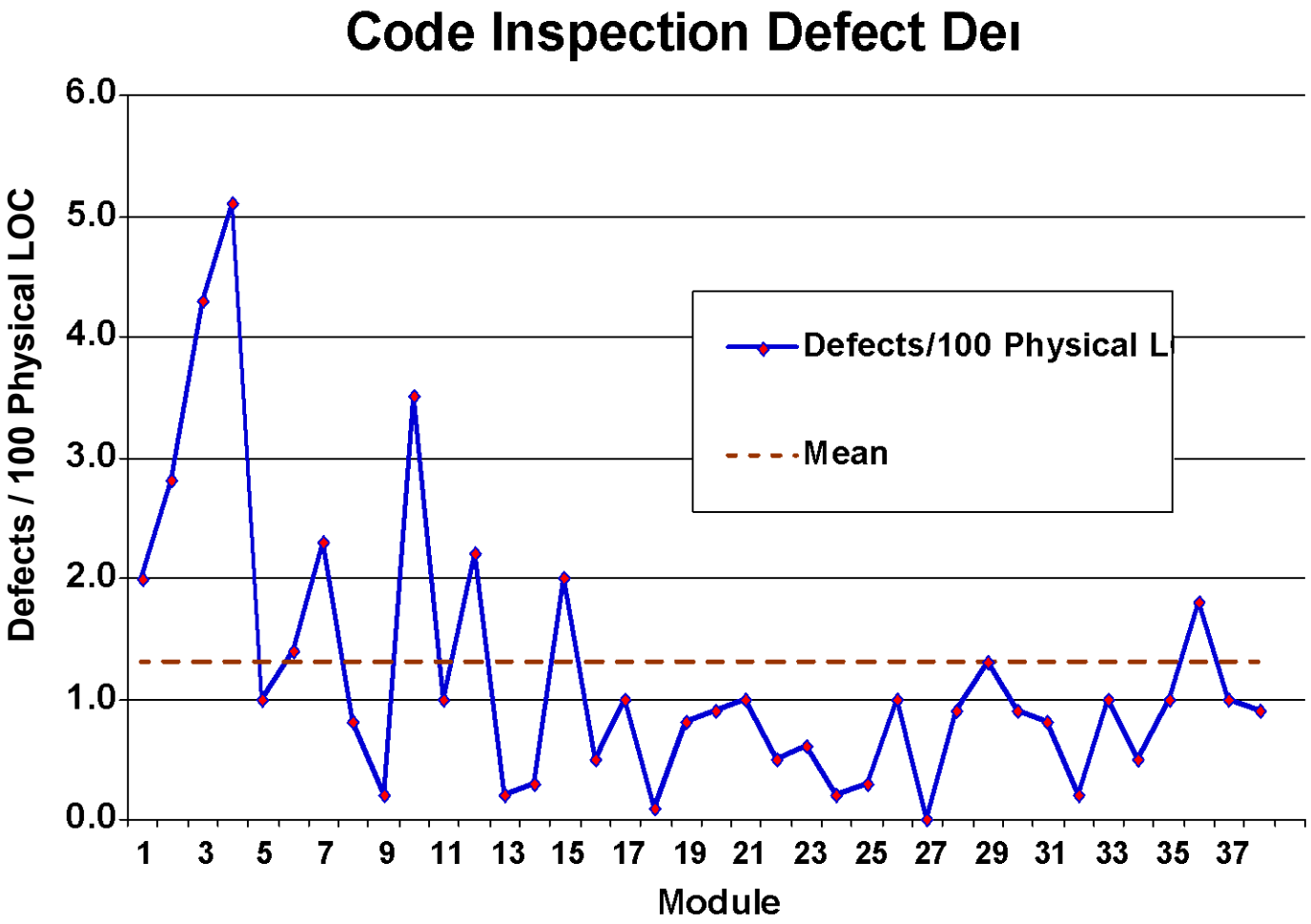
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Observations and Corrective Actions

- **Defect density of released and tested software is extremely high**
  - a cause of chaos and 70% rework
- **Corrective actions:**
  - inspect a larger portion of current code base
  - develop common errors checklist to capture coding mistakes

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Goal: Reduce Rework to Less Than 20 Percent of Total Project Effort - 3



- Manufacturing control system
- OO/C++
- 167KLOC
- 13 defects/KLOC in code
- 1.38 defects/KLOC in test

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Observations and Corrective Actions

- **Defect density of released and tested software is extremely low**
  - only 1-3% of project effort spent on rework
- **Corrective actions:**
  - continue to inspect all work products

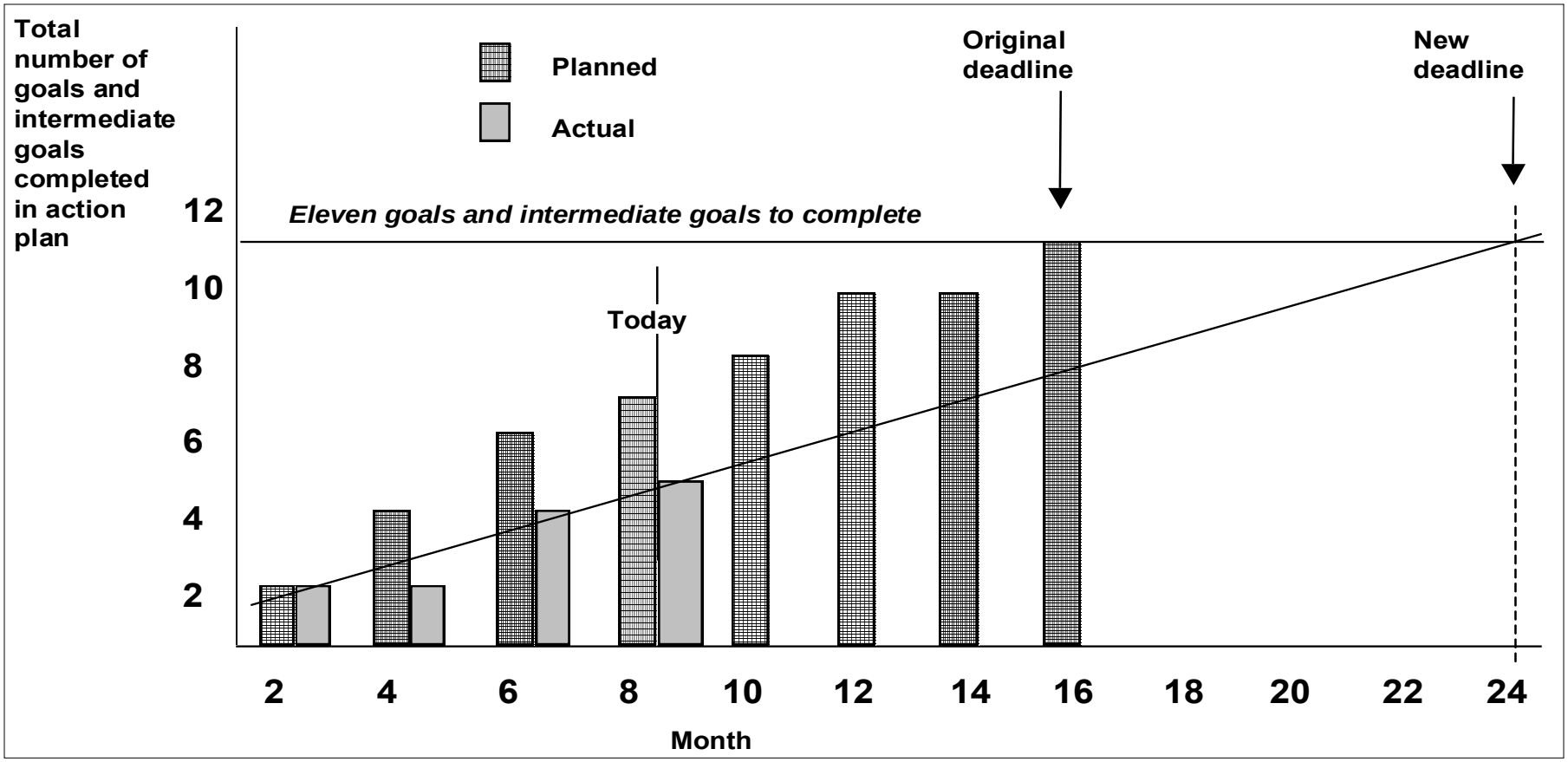
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Checking Progress

- Are We Making Progress on the Goals?
- Are We Making Progress on Our Improvement Plan?
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Are we Making Progress on Our Improvement Plan?



Trend diagram tracking goal and intermediate goal completion

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Observations and Corrective Actions

- **No way of meeting initial deadline of 16 months**
- **Corrective actions:**
  - revise completion date to 24 months
  - dedicate more time for improvements
  - use successes from early adopters to motivate others
  - ensure that the solutions we are developing do not exist somewhere else

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Checking Progress

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- What Lessons Have We Learned So Far?

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Are We Making Progress on the Improvement Framework? - 1

Method 1: Count actions that are from the framework

Primary Goal and Intermediate Goals (The results you want)	Purpose of Goal (Why do you want to achieve the goal?)	Actions	Priority (*=essential)
Reduce product development cycle to six to nine months for product X.	**Deliver earlier than competition.**		
Manage changing requirements (based on problem 1).	Prevent schedule slips resulting from expensive scope changes.	Only allow changes to the application interface, not the kernel routines.	1*
		Assign responsibility and authority for performing the REQM process.	2* ✓
		Check progress and take corrective action .	-
		Improve the library control system to minimize version control errors. Investigate requirements management tools.	3 ✓
		Track change requests for the configuration items.	4 ✓
		Develop an understanding with the requirements providers on the meaning of the requirements .	5 ✓
		Baseline the requirements before design commences.	6

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Are We Making Progress on the Improvement Framework? - 2

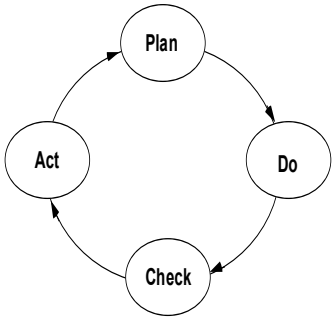
Method 2: Conduct a mini-assessment to establish adoption of practices*

Purpose:

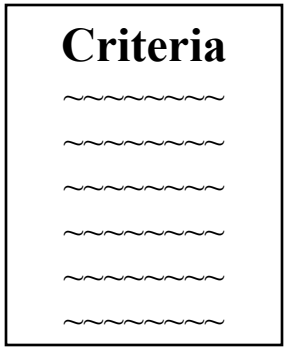
- To **evaluate improvement progress** and make necessary adjustments

Method:

- Develop a **checklist for a verbal interview with each project**
- Conduct interviews with each project (2-3 times per year)



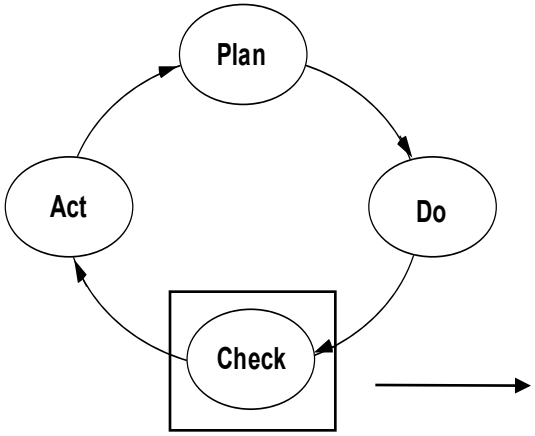
Mini-assessment



*Potter, N., Sakry, M., —Making Process Improvement Work - A Concise Action Guide for Software Managers and Practitioners," Appendix F. Addison-Wesley, 2002.

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Mini-assessment Process



- Plan the assessment
- Meet with interviewees to explain what will be checked, how and why (answer questions and concerns)
- Perform the mini-assessment (interviewing with questionnaire)
- Communicate the results (organization summary)
- Debrief the mini-assessment process to obtain feedback and buy-in from the organization
- Improve the questionnaire (emphasize intent and remove ambiguity)
- Take corrective action

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Mini-assessment Questions

Sample mini-assessment questions

- **Describe how your team**
  - Performs inspections or walkthroughs for key work products (such as code, design, test cases, and test plans)
  - Performs black-box testing
  - Performs white-box testing
  - Performs version control of all significant work products (from plans to code)
- **Do you have adequate computer network stability (compared with the problem reported in the last assessment)?**

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Mini-assessment Findings

Project A: Strengths and areas for improvement

Strengths

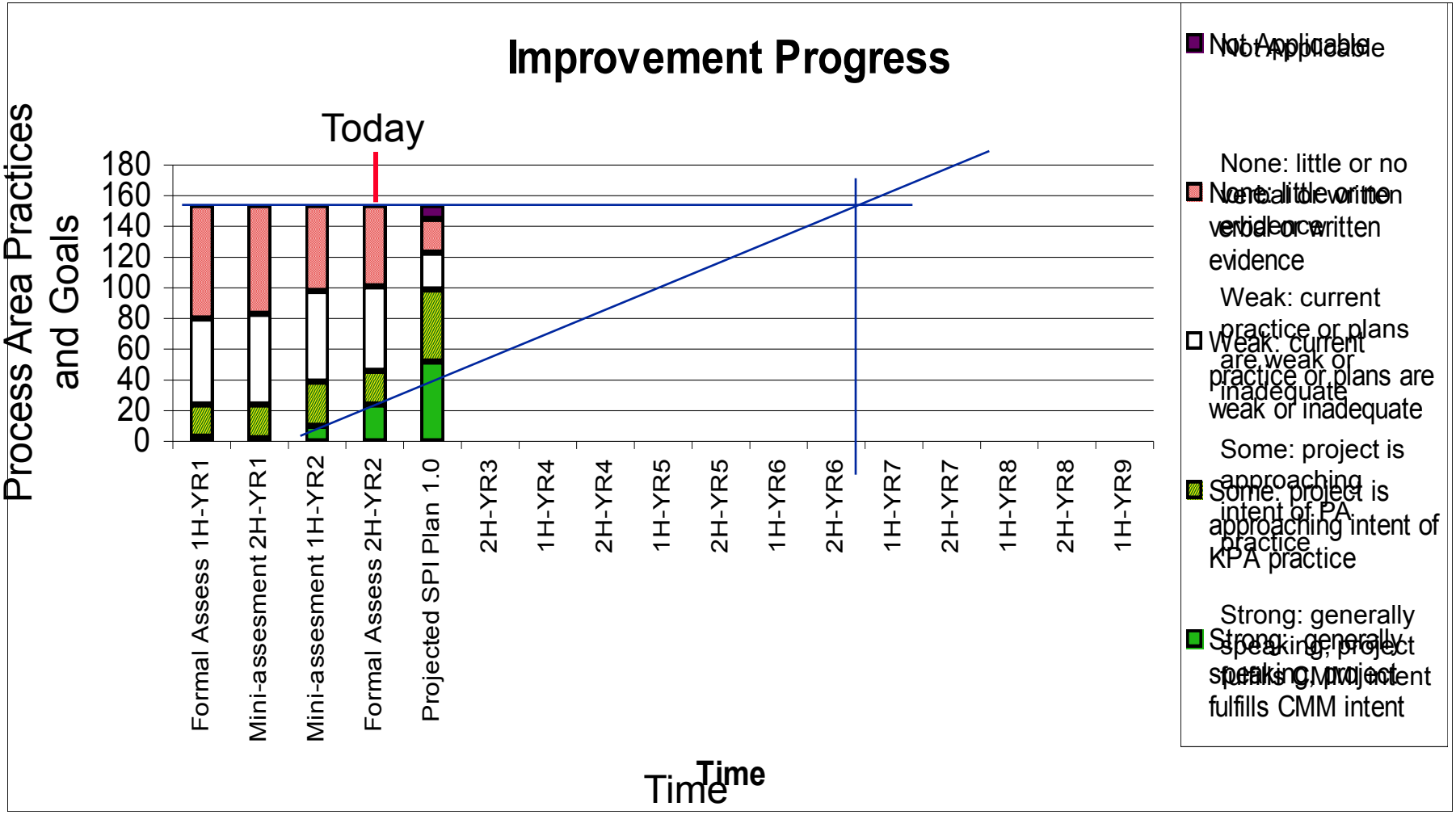
- Inspections are performed on requirements and code.
- Black-box testing is performed against the requirements.
- White-box testing is performed on critical code.
- Work products are under configuration management (in other words, project plans, requirements, code, test plans, and test cases).

Areas for improvement

- Computer network stability has not changed since it was reported in the last assessment.
- Project plans for projects larger than three months would benefit from inspection.
- Test plans would benefit from inspection to reduce the amount of redundancy in the test approach.

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Example Mini-assessment Data - 1



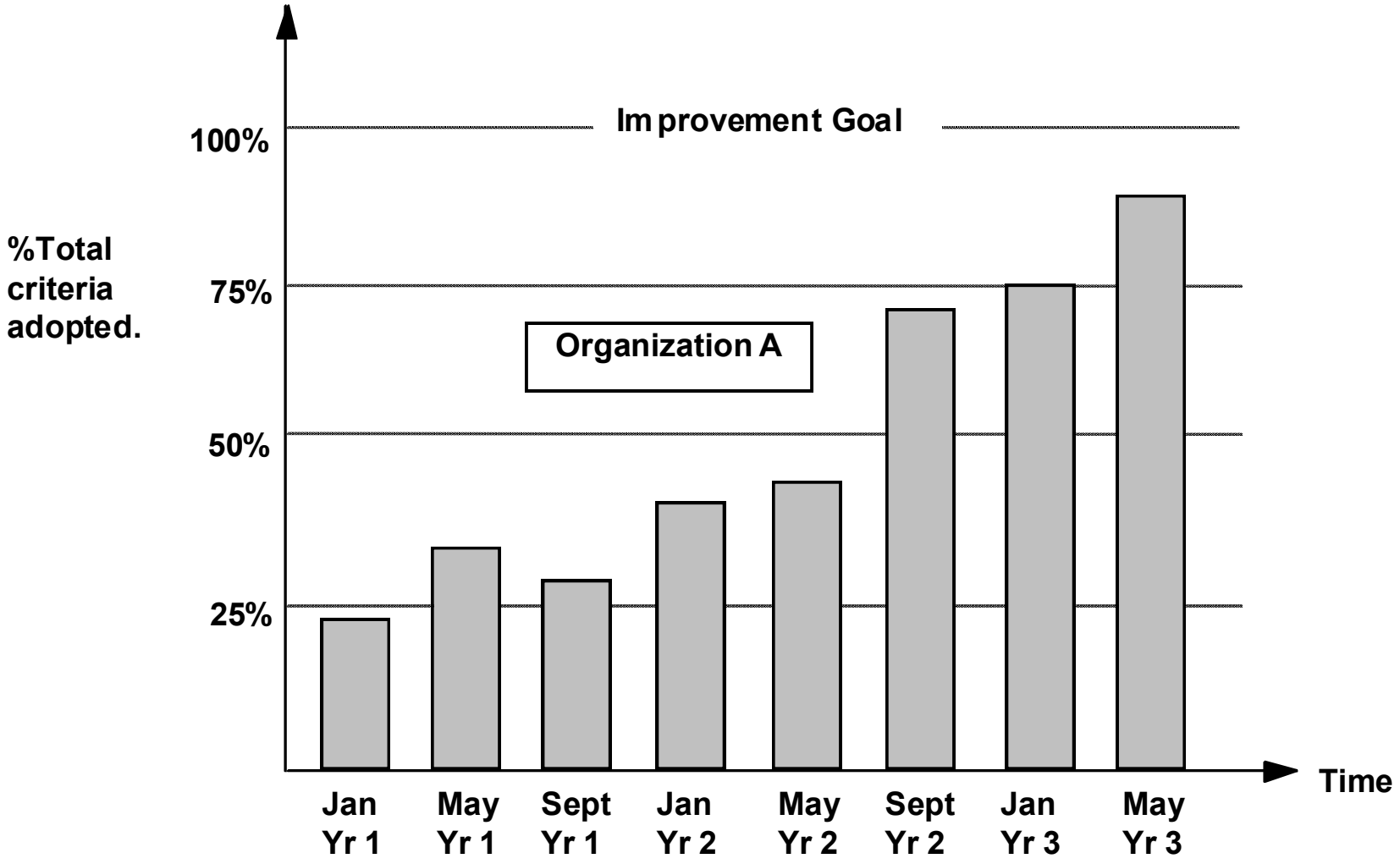
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Observations and Corrective Actions - 1

- **Little progress**
- **Will likely be Level 2 by second-half of year 6**
- **Corrective actions:**
  - Report mini-assessment data (overall score and trend) to CEO and division heads - get executive visibility
  - Replan improvement effort for each project (goals and problems)
  - Task new engineering manager with pulling Level 2 practices into each project using bi-weekly project reviews and EPG assistance

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Example Mini-assessment Data - 2



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Observations and Corrective Actions - 2

- **Progress is good**
- **Large jump between May and Sept (year 2) due to adoption of change management process, build process, and process assurance**
- **Corrective actions:**
  - Adopt remaining Level 2 practices based on current project problems

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Rules of Thumb for Measuring Adoption - 1

- **Always be careful when making measurements:**
  - **what you measure might change** when you measure it
  - always keep in mind the **quality** of the answer; a YES should be followed with:
    - **how well does that work?**
    - **does it help you?**
    - **how often do you do that?**
    - **do you do this in a crisis?**

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Rules of Thumb for Measuring Adoption - 2

- **Use balanced metrics - don't just have a goal:**
  - —Adopt 50 percent of all Level 2 practices by December"
- **It may be tempting for a project team to implement the easiest 50 percent of the elements in the framework**
- **Balance this with a metric that tracks progress toward a business goal, e.g.,**
  - —Reduce defects reported from the field by 30 percent"
  - —Ensure product deliveries are no more than 15 percent late"

Tracking and observing multiple indicators show whether progress is being made on issues that impact the business

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Rules of Thumb for Measuring Adoption - 3

- The goal is to establish whether the practice is a common and beneficial behavior of the project team
- Measurements take time to become refined, accurate, useful and effective
- Measurement results MUST be treated with care - don't attribute project names
- The intent of the measure must be explicitly stated to explain how the results will be used

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Checking Progress

- Are We Making Progress on the Goals?
- Are We Making Progress on Our Improvement Plan?
- Are We Making Progress on the Improvement Framework?
- What Lessons Have We Learned So Far?

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What Lessons Have we Learned so Far?

- **Invite people who are willing to be frank and candid**
  - e.g., PI users, skeptics, managers
- **Select a good objective facilitator**
- **Two hours or less to avoid team fatigue**



Lessons learned agenda

1. **Clarify the scope of the session [10 mins]**
2. **Determine strengths (what went well) [20 mins]**
3. **Determine areas for improvement [30 mins]**
4. **Set priorities [30 mins]**
5. **Determine corrective actions [30 mins]**
   1. Where to use the lesson
   2. Specific corrective actions

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Lessons Learned - Strengths

Lesson	Where to Use Lesson
Decentralizing the action plan gives each project team ownership over its plan. Corrective action (CA) = Continue having three separate action plans, one for each of the three product lines.	Planning
Don't preach when an example can say everything for you. CA = Have one project each month conduct a one-hour briefing describing the use and benefits of a new technique.	Implementing
Guide people in applying each new technique to their work. People have so much going on that they do not know where to start. CA = For each process in the process assets library (PAL), add tailoring guidelines to explain when the process should be used. Provide one-on-one coaching to new project teams.	Implementing

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Lessons Learned - Improvement Areas

The process-centric approach was very difficult to sell. CA = adopt the goal-problem approach.	**Planning**
Using the same communication technique as everyone else allows the message to be lost. CA = use bright pink 8.5 x 11-inch cards & pizza lunches.	**Implementing**
Allowing private data to become public sets perilous expectations. CA = brief management on new metrics policy.	**Planning**
Be careful of what information you ask for! [Process Assets Library] CA = stop measuring the % of projects that submit to the PAL. Clean out the PAL.	**Planning**
Using a scoring system for process adoption can encourage inappropriate behavior. CA = stop measuring #inspections/year. Re-look at all metrics that can be optimized but lead to little benefit.	**Checking**

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Summary - Checking Progress

- Measure what you care about
- Practice measuring
- Lessons-learned data provides additional feedback
- Take corrective action based on what you learn

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Exercise: Checking Progress

1. Pick 1-3 goals and use the GQM approach to determine the metrics you need to track progress toward this goal
2. If your improvement program is already well underway, develop a plan to conduct a mini-assessment for one or more projects to assess current progress and next steps
3. Discuss lessons learned regarding your improvement program with some of the program's participants

Result:



Action Items

1. ~~~~~~~~~~
~~~~~~~~~~~~
2. ~~~~~~~~~~
~~~~~~~~~~~~
~~~~~~~~~~~~
3. ~~~~~~~~~~
~~~~~~~~~~~~
~~~~~~~~~~~~

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Appendix

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Engineering Process Group

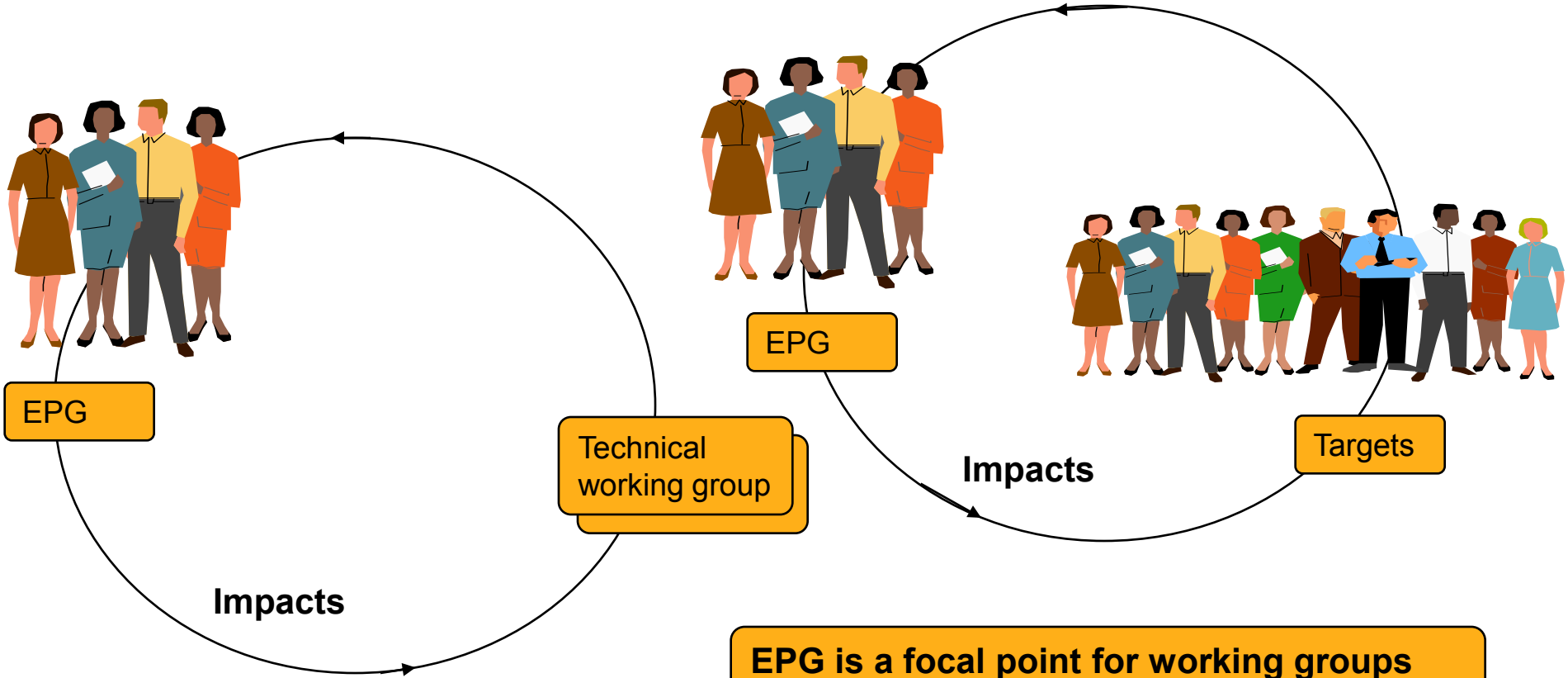


A means of implementing a successful process improvement program

A Engineering Process Group is a group chartered to facilitate engineering process improvement within an organization. It helps the organization determine areas for improvement, plan the improvement effort and implement it.

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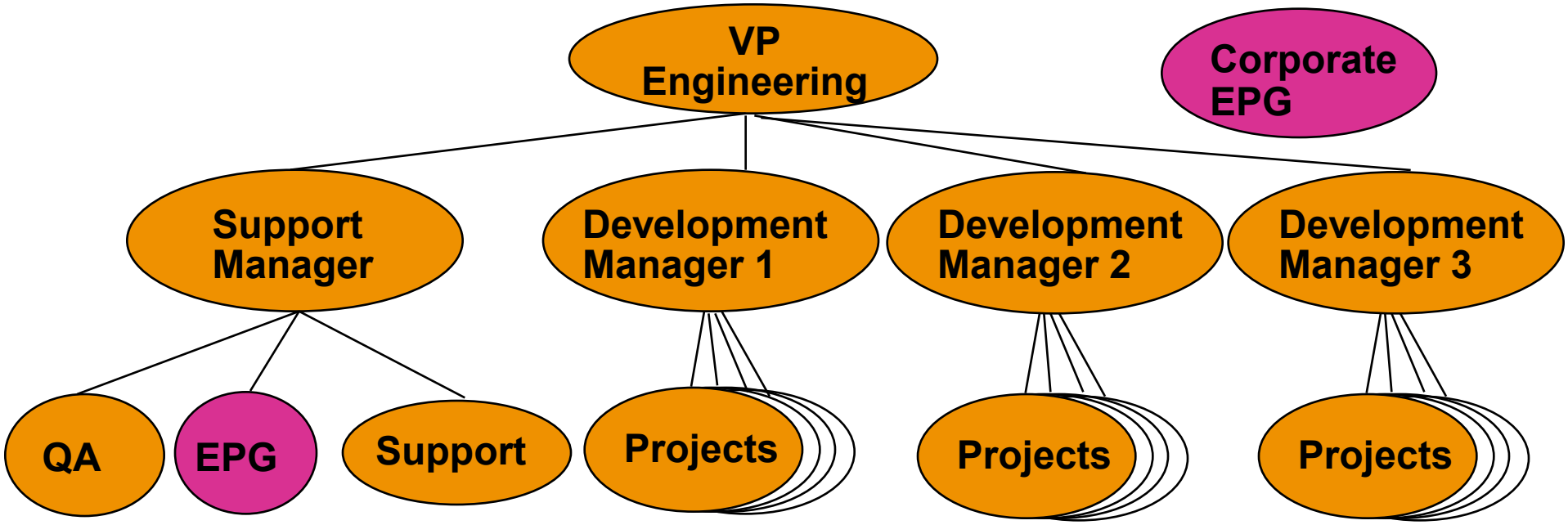
Two Parallel Activities



EPG is a focal point for working groups and helps targets adopt new practices

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EPG Position



- Not part of QA. Not tied to any one project.
- Geographical and cultural dispersion.
- Career path: may be rotational (2 years), good for project leaders and managers.
- Must be seen as a respected support function to the projects.
- Champions often become EPG members. Others must be recruited. Do not accept the unwanted, idle, or disliked!

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EPG Roles

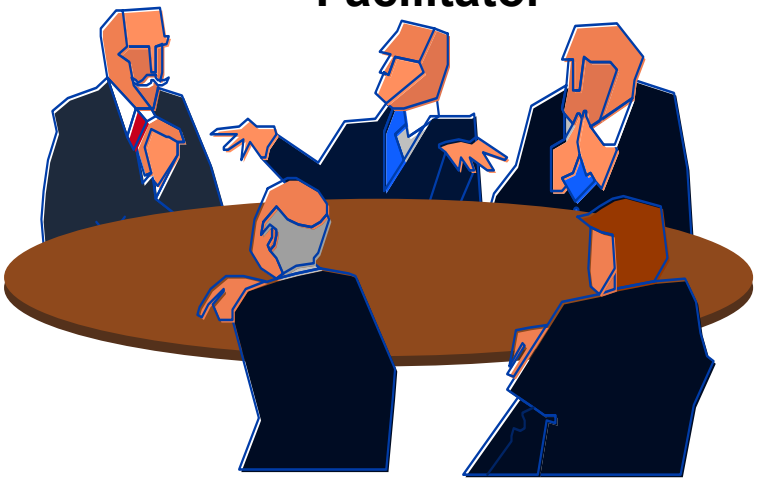


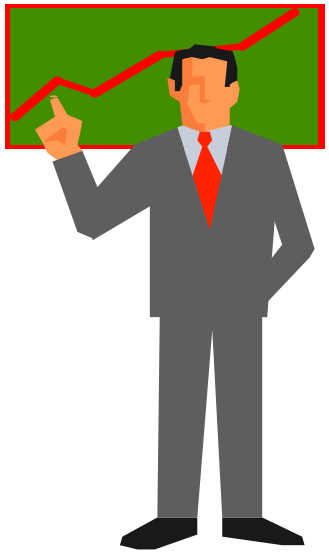
Assessor



Coach

Facilitator





Presenter / teacher

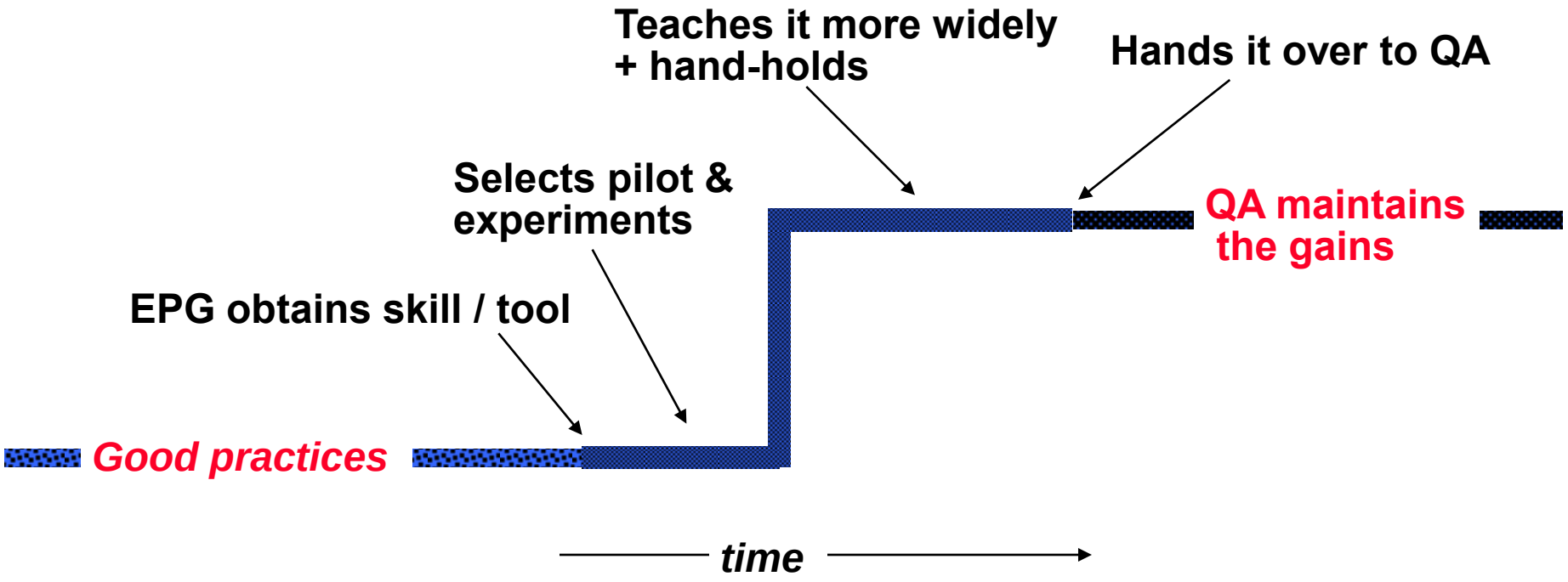


Politician / go-between

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Relation of an EPG to QA

- Perceived as helping the practitioners and managers adopt new practices
- Not QA (Quality Assurance)

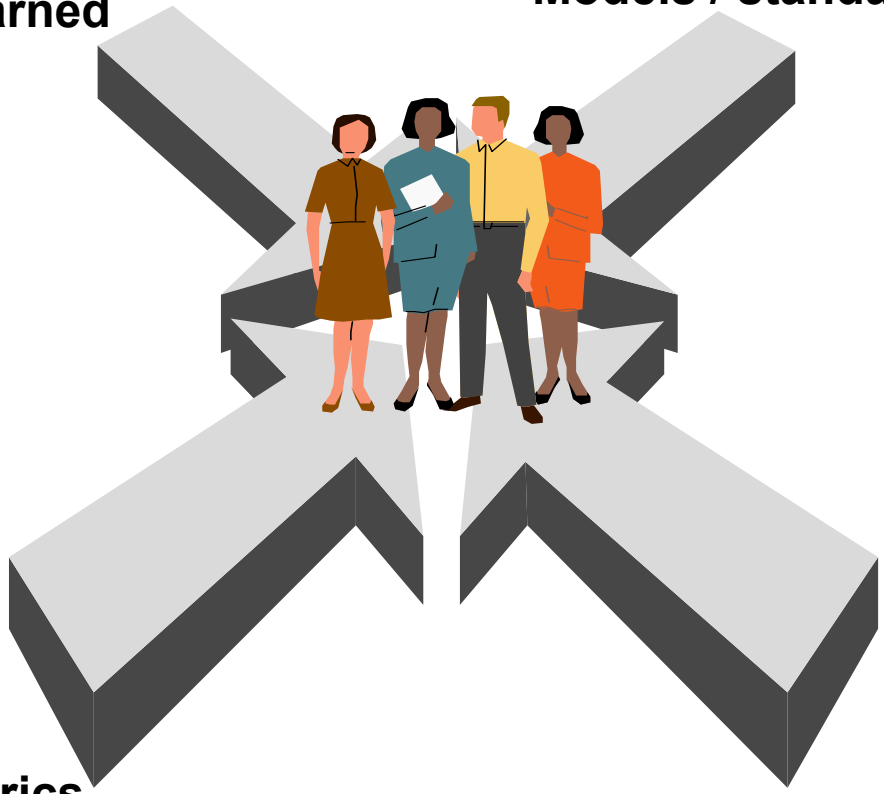


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Focal Point for Improvement and Conveyer of Information

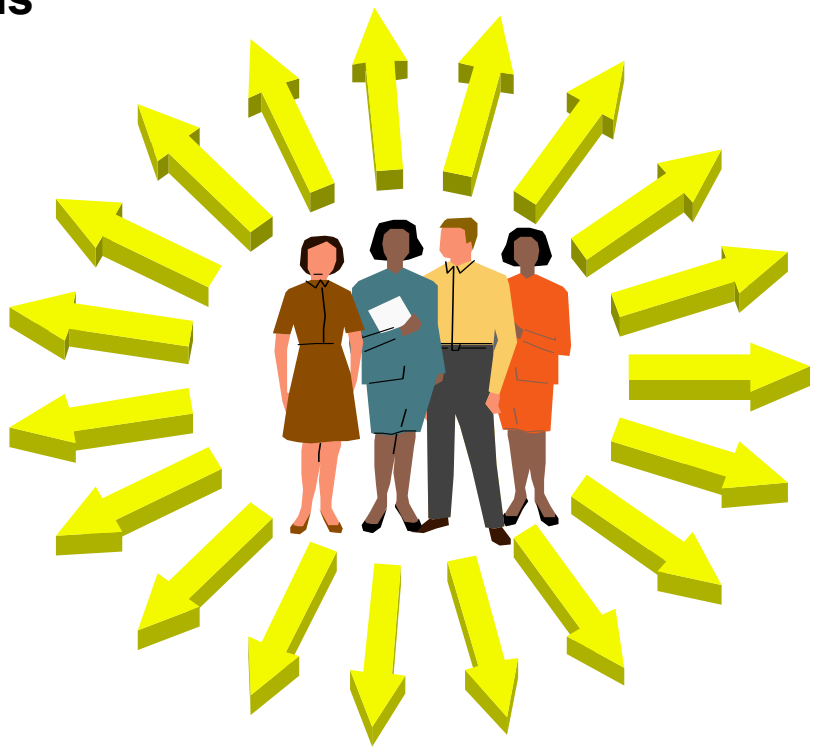
Lessons learned

Models / standards



Metrics

Study / reading



Deploys new concepts in a usable form

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Staffing Your EPG

Skills

Must	Intense interest in process improvement
	Available full-time for EPG work (or dedicated part-time)
	Experience of and project management problems
	Able to work well with people
	Persuasive, resourceful (will try many different things)
	Attitude of helping others and good rapport with organization
	Communication skills (able to make all concepts practical)
Nice	Good coach and quality advocate
	Sensory acuity (able to adjust approach based on results)
Wish	Knowledge of process improvement, SEI, Deming, Crosby

Training

e.g., CMMI, process appraisals, consulting, engineering and management skills, metrics

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Typical Things that an EPG Does

- Helps analyze expectations versus current practices
- Conducts engineering process assessments
- Helps write plans for improvement
- Helps implement the plans - facilitates improvement
- Maintains sponsorship
- Acts as an information source, sharing information across the organization
- Promotes and teaches new behaviors (process consultation and technology insertion focal point)
- Helps write processes and work aids
- Measures process improvement

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Things that an EPG Does Not Do

- Reveal specific confidential information to management or others
- Take sole responsibility for the actual improvement
- Write processes or procedures in a vacuum
- Issue edicts or strong-arm changes

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EPG Steering Committee

- Select key sponsors, champions and managers to ensure buy-in
- Explain issues, ideas, practices
- Review the status of improvement efforts
- Tell them what they need to do to help
- Tell them what resources you need
- Ask them to help resolve issues
- Obtain support for additional staffing
- Include targets with success stories
- Include related efforts such as quality teams and working groups (credit and praise)

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Risk & Issue Managment



2011 NDIA CMMI Conference
Denver, Colorado

Presented by
Al Florence
The MITRE Corporation

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Agenda

- ***Tutorial Objectives***
- Introduction
- Reasons for Risk/Issue Management
- Opportunities
- Risk Management
- Issue Management
- Risk/Issue Avoidance
- Risk/Issue Opportunities
- Questions/Discussion
- References
- Contact Information

Tutorial Objectives

- Emphasize the importance of identifying and managing program risks and issues
- Clarify the difference between risks and issues
- Present Risk/Issue Avoidance
  - The elimination of the sources of high risk by replacing them with a lower-risk alternatives
  - The establishment of sound technical, programmatic and management practices and activities early and their execution throughout the entire life cycle to reduce risks and issues
- Present opportunities associated with risks/issues
  - When perusing new opportunities risks and issues are encountered
    - By taking calculated risks organizations may realize future opportunities
  - Opportunities to improve program and project performance may surface while resolving risks and issues

Where Are We

- Tutorial Objectives
- ***Introduction***
  - ***Definitions***
- Reasons for Risk/Issue Management
- Opportunities
- Risk Management
- Issue Management
- Risk/Issue Avoidance
- Risk/Issue Opportunities
- Opportunity/Risk/Issue/Opportunity Scenario
- Questions/ Discussion
- References
- Contact Information

Introduction

Definitions

- Risks (IEEE Std 1540-2004; Standard for Software Life Cycle Processes)
  - Program and project risks are the likelihood of an event, hazard, threat, or situation occurring and its undesirable consequences
- Risk (Project Management Body of Knowledge PMBOK)
  - An uncertain even or condition that, if it occurs, has a positive or negative effect on project's objectives
- Issues (QATAR National Project Management)
  - An issue is something currently happening that is having a negative impact on the project and requires resolution for the project to proceed successful
- Issues
  - An issue can be associated with a risk if the risk is realized; has occurred
- Opportunity (The American Heritage Dictionary)
  - A favorable or advantageous combination of circumstances
  - A chance for progress or advancement
- Opportunity (PMBOK)
  - A condition or situation favorable to the project, a positive set of circumstances, a positive set of events, a risk that will have a positive impact on project objectives, or a possibility for positive chances

Introduction

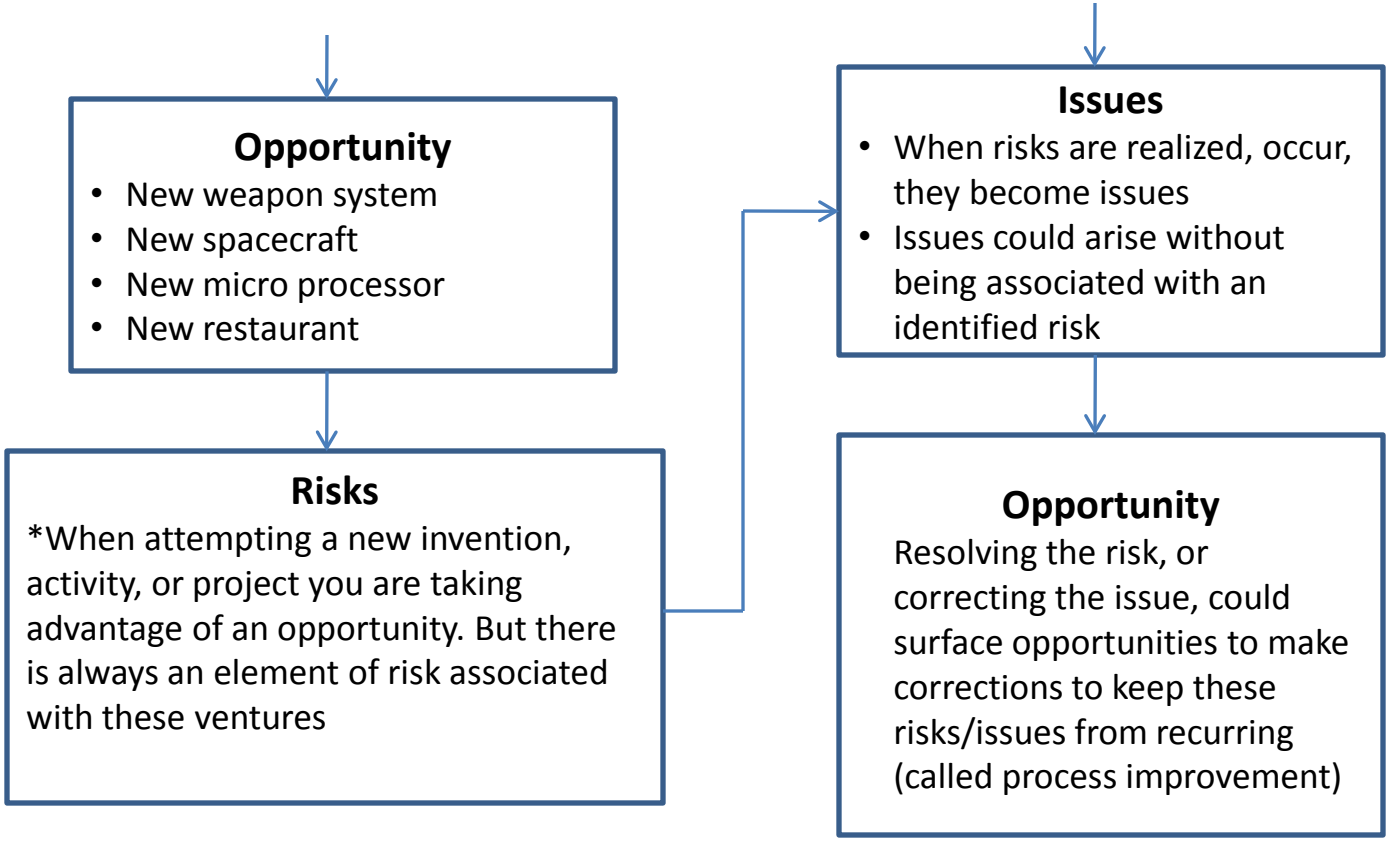
Definitions

- Risk Response
  - The process of developing options and actions to enhance opportunities and reduce threats to project objectives PMBOK
  - Includes Mitigation and Contingencies
  - Includes acceptance of the risk or issue consequence
- Mitigation
  - Risk mitigation implies an elimination or reduction in the probability of risk occurrence PMBOK
- Contingency
  - Issue contingency implies an elimination or reduction of the impact of issues or alternative actions taken

Introduction

- We will start with Opportunities and end with Opportunities
  - Opportunity
  - Risk
  - Issue
  - Opportunity

Introduction



**Managing Risks, Methods for Software Systems Development; Dr. Elaine M. Hall, SEI Series in Software Engineering*

Where Are We

- Tutorial Objectives
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- ***Reasons for Risk/Issue Management***
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- Issue Management
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Reasons for Risk/Issue Management

- When developing, delivering, and acquiring systems and products
  - developers and acquirers face many challenges
- Challenges can exist with many items and activities:
  - Cost
  - Schedule
  - Technical
  - Management
  - Programmatic
  - Process
  - Performance
  - Others?

Reasons for Risk/Issue Management

- Consequences may be numerous if challenges are not mitigated
  - Cost overruns
  - Late deliveries
  - Technically inadequate
  - Programmatic difficulties
  - Irate management
  - Irate customer
  - Canceled project
  - Loss of market share
  - Missed opportunities
  - Others?

Reasons for Risk/Issue Management

- There are solutions for an organization to help mitigate these challenges
  - Proper program/project management
  - Proper program/project planning
  - Program/project monitoring and control
  - Adequate budgets
  - Adequate schedules
  - Proper requirements development and management
  - Contract tracking and oversight
  - Product evaluation
  - Performance management
  - ***Risk/Issue management***
  - Quality assurance
  - Configuration management
  - Independent Verification and Validation (IV&V)
  - Others?

Reasons for Risk/Issue Management

- It is important to recognize risks and issues early and manage them to reduce or eliminate their impact if they occur
- Often organizations neglect risk and issue management or do not provide sufficient attention to them

Compliance with CMMI ®

- Software Engineering Institute (SEI) Capability Maturity Model Integration (CMMI)
  - CMMI for Development v1.3
  - CMMI for Acquisition v1.3
  - CMMI for Service v1.3

All have
Risk Management and
*Issue Management
Process Areas

In order for organizations to be compliant with CMMI they need to establish risk and issue management capabilities

* Issue management is implied in the Project Planning, Project Monitoring and Control, Quality Assurance and Configuration Management

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Take Advantage of Opportunities

- Risks are not always undesirable events
  - Taking risks can sometimes be necessary
  - If we are not willing to take calculated risks our advancement in technology and business may be hindered
- We have to be circumspect with the risks we are willing to take
  - And *MANAGE* them properly

Need to balance Opportunities with Risks and Risks with Opportunities

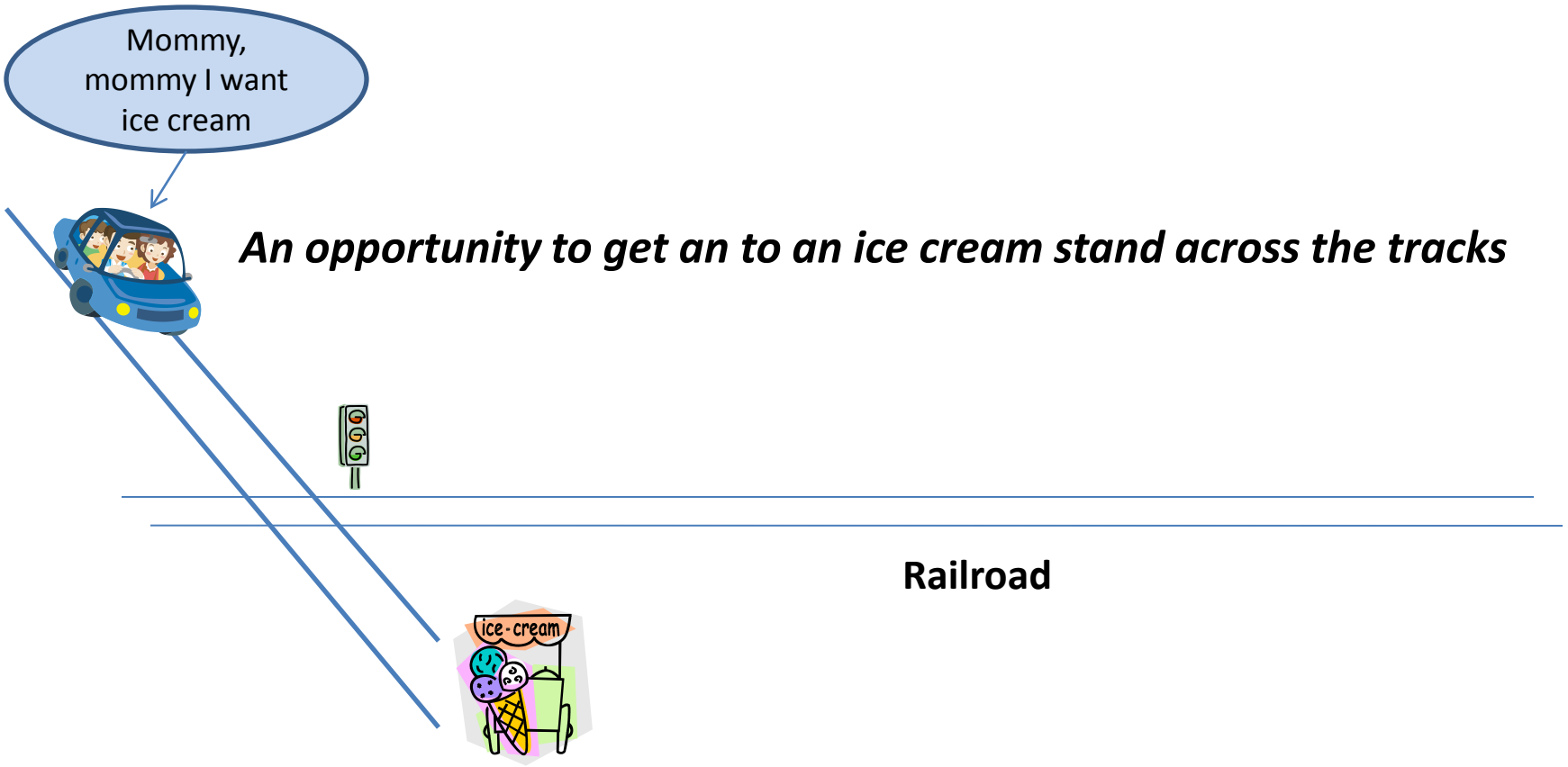
Take Advantage of Opportunities

Opportunities/Risks

*Running away from risk is a no-win strategy. Unless your organization has been sound asleep for the past 30 years, all the relatively risk-free opportunities have long since been exploited. The remaining high-opportunity areas are rife with risk. It is in these areas and these alone where you need to focus your attention, skills and resources.

Managing Risks, Methods for Software Systems Development; Dr. Elaine M. Hall, SEI Series in Software Engineering

Ice Cream Opportunity



Where Are We

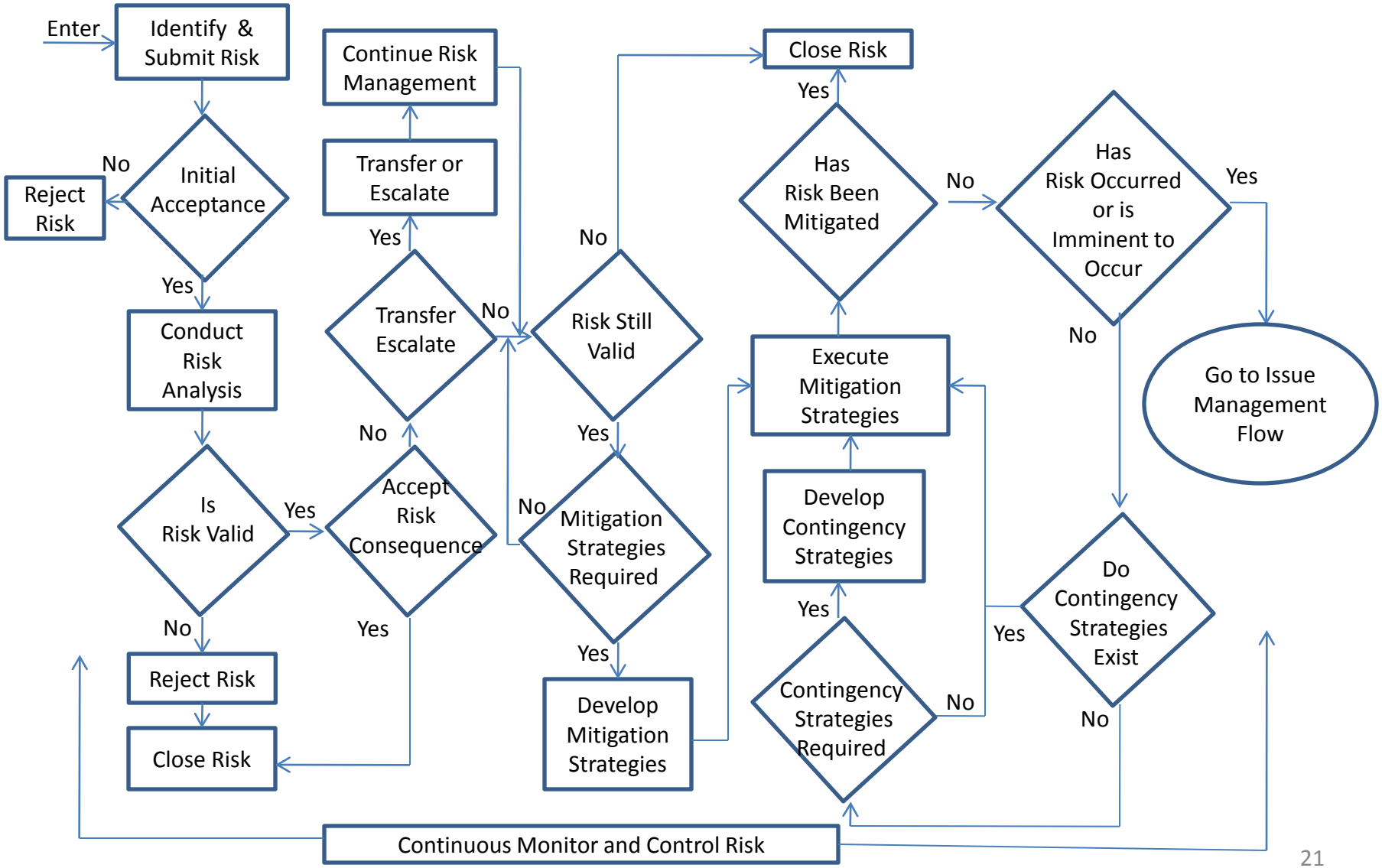
- Tutorial Objectives
- Introduction
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- Issue Management
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Risk Management Process

- Risk Management is an overarching process that encompasses
  - Risk Planning
  - Risk Identification
  - Risk Analysis
  - Risk Response
  - Risk Monitoring and Control

  PMBOK

Risk Management Flow



Risk Management Planning

- Risk management planning is the process of deciding how to approach and conduct the risk management activities for a project
- Planning is important to
  - Ensure the level, type and visibility of risk management are commensurate with both the risk and importance of the project to the organization
  - Provide sufficient resources and time for risk management activities
  - Establish an agreed-upon basis for evaluating risks
- Risk planning should be completed early during project planning

PMBOK

Risk Management Team

- The Risk Managment planning activity may assign a Risk Management Team to administer the Risk Management Program
- A Risk Manager may be assigned to manage the Risk Management Team
- A Risk Management Board may be chartered to review, accept, decline, transfer and escalate risks
- Hierarchy Governance Boards may exist for escalation of risks based on thresholds
- Everyone on the program/project is responsible for risk management

The level of this implementation depends on the size, scope, critically, safety, security, etc. of the application

Risk Management Plan

- Risk management planning needs to be part of project planning
- A risk management plan can be a stand alone plan or part of the project plan
- The risk management plan needs to be tailored to the scope of the application
- The concepts provided in this tutorial can be used to develop the plan

Risk Management Plan Outline

- Introduction
- Project Description
- Risks/Issue/Opportunity Descriptions
- Risk Identification
- Risk Analysis
- Risk Response
  - Risk Acceptance
  - Risk Avoidance
  - Risk Transfer
  - Risk Escalation
  - Risk Mitigation
- Risk Monitor and Control
- Risk Register
- Issue Management
- Issue Contingency
- Risk/Issue Opportunities
- Risk/Issue Training
- Glossary
- References

Risk Management Artifacts

- Risk Management is supported with:
  - Risk Management Policy
  - Risk Management Charter
  - Risk Process Description
  - Risk Management Plan
  - Risk Management Procedures
  - Risk Management Guidelines
  - Risk Management Training
- This presentation will not dwell on these but content of this presentation can support their construction/implementation

Risk Identification

- Risk Identification is the activity that:
  - Identifies potential and current risks
  - Examine elements of the program to identify associated potential root causes of risks
  - Begin their documentation
  - Sets the stage for their successful management
  - Risk identification begins as early as possible in successful programs and continues throughout the life of the program
  - Project and stakeholders from outside and inside the project should be involved in risk identification

Risk Identification

- Risk can be associated with all aspects of a program; e.g.
  - Requirements
  - Threat
  - Security
  - Technology maturity
  - Supplier capability
  - Design
  - Schedule
  - Cost
  - Performance
  - Etc.

Risk Description

- As risks are identified it is important to correctly describe them
- A well-written risk statement contains three main components:
  - Cause – The negative conditions that currently exist relative to the risk
    - Identification of root cause(s) of the risk
    - This provides justification that a risk exists
  - Probability of Occurrence – The likelihood of the occurrence of the risk
    - Within a future time frame
    - Or a future event
  - Consequence – The effect(s), negative impact(s) to the program(s) in case the risk occurs
    - The consequence should be related to at least cost, schedule, scope and performance
    - Consequence could also result in opportunities that may surface in correcting the problems

Risk Description

- The risk is written in a chain of: Cause: IF; THEN

Example

An Interface Working Group has not been formed and a plan to form one does not exist.

IF key stakeholders cannot agree on interface protocol by 11/14/2011;

THEN the schedule for development and delivery will be delayed causing cost overruns.

NOTE: The cause includes assurance that the reason for the risk is valid. I.e., is there a compelling reasons(a root cause) to assume that stakeholders cannot agree on the interface protocol by 11/14/2011? *Not just pie in the sky.*

Risk Description

- Proper risk descriptions helps manage the right risks
  - Risk management is time and resource consuming
  - Managing “non-risks” is not cost effective
- Example
  - A risk may be identified as a risk that component YYY will be provided late
  - Writing this risk as:
    - **IF** component YYY is delivered late; **THEN** …
  - May fail to inspire interest and action
    - The risk is too vague, or
    - There is no clear reason why this is a risk
  - In this case one needs to identify causal conditions that may prevent timely delivery of YYY. *If there are none this is not a risk!*

Risk Description

- The cause may be included in the “IF” statements for some risk**s**

IF scheduled delivery of component YYY continues to slip beyond 11/14/2011; **THEN** system integration will also slip causing the system to incur cost and schedule overruns.

- Cause
  - Written in the IF statement
  - Schedule continues to slip
- Occurrence
  - Schedule delivery slips beyond 11/14/2011
- Consequence
  - Cost and schedule overruns

Risk Description

- Avoid writing the mitigation strategy into the risk description
  - A mitigation strategy is developed after the risk has been approved and analyzed

Examples

Requirements have always been a problem in passed projects within this organization. **IF** requirements are not reviewed and verified; **THEN** requirement defects will migrate into the design**.**

- Reviewed and verified are possible mitigation strategies
- Write the risk in a chain of cause, occurrence, consequence

Requirements have always been a problem in passed projects within this organization. **IF** defective requirements are not discovered and corrected by PDR; **THEN** requirements defects will migrate into the design and implementation causing rework, and cost and schedule impacts.

Risk Description

- Risks must be written in a clear, concise and unambiguous fashion
- Words and phrases that may have confusing and multiple interpretations must be avoided

Ambiguous Words

- Avoid ambiguous words in describing risks, some examples:
  - Adequate
  - Ad hoc
  - All
  - Always
  - Appropriate
  - Clearly
  - Easy
  - Existing
  - Fast
  - Flexible
  - Future
  - If required
  - Immediately
  - Large
  - Light
  - Limited
  - Near real time
  - Periodic
  - Portable
  - Rapid
  - Several
  - Slow
  - Small
  - Sometimes
  - State of the art
  - Sufficient
  - Usable
  - User-friendly
  - Weight
  - When required
  - Others?

From IEEE standards and some preparatory requirements management plans

Also: http://www.ppi-int.com/newsletter/SyEN-017.php#article

Risk Analysis

- The risk is submitted to the Risk Management Board
- The risk is accepted or declined by the Board
  - If declined rational is conveyed to the submitter
- If accepted the Risk Management Board assigns:
  - A Risk Analyst responsible for conducting risk analysis on assigned risks
    - Supported by Subject Matter Experts (SMEs)
  - A Risk Owner responsible for ensuring risks are properly managed throughout their life
  - Risk Analyst and Owner could be one in the same

Risk Analysis Components

- Risks have the following components:
  - A future root cause(s) (yet to happen) which
    - if eliminated or corrected, would prevent a potential consequence from occurring
  - A probability of occurrence (or likelihood)
    - assessed at the present time and updated when necessary of the future root cause occurring
  - The consequence (or effect/impact) of that future occurrence
  - The time horizon during which the consequences will occur if the risk is not mitigated
  - Risk Priorities
    - Mapping of probability of risk occurrence and risk consequence
  - Risk Triggers
    - Specific events or conditions that indicate when to develop and execute mitigation or contingency strategies

.

Risk Analysis

- **Qualitative Risk Analysis**
  - Relative measure of risk or asset value based on ranking or separation into descriptive categories such as low, medium, high; not important, important, very important; or on a scale from 1 to 10.

    BusinessDictionary.com
  - An examination and prioritization of the risks based on their probability of occurring and the impact on the project if they do occur. Qualitative risk analysis guides the risk reaction process.
    pmpbank.googlepages.com/glossary

- **Quantitative Risk Analysis**
  - Incorporates numerical estimates of frequency or probability and consequence. In practice, a sophisticated analysis of risk requires extensive data which are expensive to acquire or often unavailable. Fortunately, few decisions require sophisticated quantification of both frequency and consequences
  - Shortly spoken one might say that "quantitative risk analysis breaks down risks from a high medium low ranking to actual numerical values and probabilities of occurrence" for being able to compute the overall effects

    (comp. CROSSWIND7, p. 423)

Root Causes

- A future root cause is the most basic reason for the presence of a risk
- The cause of the risk has to be isolated and defined
  - Root causes should be initially identified when risks are identified
  - Once initial root cause are identified they may need to be analyzed further to determine the actual deep rooted causes of the risks
  - Root causes are documented and they support:
    - Establishing risk mitigation and contingency strategies
    - Improvement opportunities
- Root causes can also be referred as risk drivers

Root Cause Analysis. An analytical technique used to determine the basic underlying reason that causes a variance or a defect or a risk. A root cause may underlie more than one variance or defect or risk. ((PMBOK® Guide) -- Fourth Edition) Syn: root-cause analysis

Root Causes

- Typical root causes may be associated with:
  - Threat
  - Requirements
  - Technical Baseline
  - Test and Evaluation
  - Modeling and Simulation
  - Technology
  - Logistics
  - Management
  - Schedules
  - External Factors
  - Budget
  - Earned Value Management
  - Production
  - Industrial Capabilities
  - Cost
  - Others?

Root Causes

Background Information

- Threat - The sensitivity of the program to uncertainty in the threat description, the degree to which the program would have to change if the threat's parameters change
- Requirements - The sensitivity of the program to uncertainty in the system requirements
- Technical Baseline - The approved and fixed configuration of a technical item at a specific time in its lifecycle that serves as a reference point for change control
- Test and Evaluation - The adequacy and capability of the test and evaluation program to assess attainment of significant performance specifications and determine whether the system is operationally effective, operationally suitable, and interoperable with the system

Root Causes

Background Information

- Modeling and Simulation - The adequacy and capability of M&S to support all life-cycle phases of a program using verified, validated, and accredited models and simulations
- Technology - The degree to which the technology proposed for the program has demonstrated sufficient maturity to be realistically capable of meeting all of the program's objectives
- Logistics - The ability of the system configuration and associated documentation to achieve the program's logistics objectives based on the system design, maintenance concept, support system design, and availability of support data and resources

Root Causes

Background Information

- Management - The degree to which program plans and strategies exist and are realistic and consistent. The program support team should be qualified and sufficiently staffed to manage the program
- Schedule - The sufficiency of the time allocated for performing the defined tasks
- External Factors - The availability of resources external to the program that are required to support the program such as facilities, resources, personnel, government furnished equipment, etc.
- Budget - The sensitivity of the program to budget variations and reductions and the resultant program turbulence
- Earned Value Management (EVM) - The adequacy of the EVM process and the realism of the integrated baseline for managing the program

Root Causes

Background Information

- Production - The ability of the system configuration to achieve the program's production objectives based on the system design, manufacturing processes chosen, and availability of manufacturing resources
- Industrial Capabilities - The abilities, experience, resources, and knowledge of the contractors to design, develop, manufacture, and support the system
- Cost - The ability of the system to achieve the program's life-cycle cost objectives. This includes the effects of budget and affordability decisions and the effects of inherent errors in the cost

Probability of Occurrence

- Probability of occurrence assessed, at the present time, is the probability of a future root cause occurring
- The chance of a risk occurring is rated on a scale between >0 and 1
- When the probability of occurrence = 1; (100%)
  - The risk has occurred; it then becomes an issue and is managed as an issue
- For most risks, estimating the precise probability of occurrence may be difficult
  - Analysis by SMEs may be necessary, and often using Best Engineering Judgment

Probability Scores

- Probability of occurrence may begin with a qualitative description of probability, which will tie to a numeric range of probability.

Sample Risk Probability Scores

Probability Description	Probability % of Occurrence
Very High (Extremely likely)	≥81% and =100%
High (Probable)	61% – 80%
Medium (Possible)	41% – 60%
Low (Unlikely)	21% – 40%
Very Low (Highly improbable)	>I% – ≤20%

Consequence of Risk Occurrence (Impact)

- Risks are reviewed for the effect that they would have on the project's objectives and other elements of the program
- The level of impact, may be rated from very low (1) to very high (5), and is assessed against at least four categories:
  - Cost
  - Schedule
  - Scope
  - Performance

Consequence of Risk Occurrence

Program/Project Objective	Very Low Minor	Low Moderate	Medium Serious	High Critical	Very High Catastrophic
Cost	Insignificant increase	Increase < 2% of budget baseline	Increase 2–5% of budget baseline	Increase 6–10% of budget baseline	Increase > 10% of budget baseline
Schedule	Insignificant slippage	Slippage < 2% of project baseline schedule	Slippage 2–5% of project baseline schedule	Slippage 6–10% of project baseline schedule	Slippage > 10% of project baseline schedule — OR — Slippage past a milestone mandated by Congress
Scope	Scope decrease barely noticeable	Minor areas of scope affected	Major areas of scope affected	Scope reduction unacceptable to sponsor	Project outcome is effectively useless
Performance	Performance degradation barely noticeable	Performance degradation noticeable, but does not fail acceptance criteria	Performance reduction requires sponsor approval	Performance reduction unacceptable to sponsor	Project outcome is effectively useless

Time Horizon

- There are at least three dates that may be specified for each risk:
  - Near risks are those in which the earliest date of the risk impact is within xx days of the present date
  - Mid risks are those in which the earliest date of risk impact is between xx and zz days from the present date
  - Far risks are those in which the earliest dates of the risk impact are greater than zz days from the present date

  (xx<zz)
- These dates are used as triggers to track when the risk will begin to impact the program and/or when the risk has been overcome by events



Risk Exposure

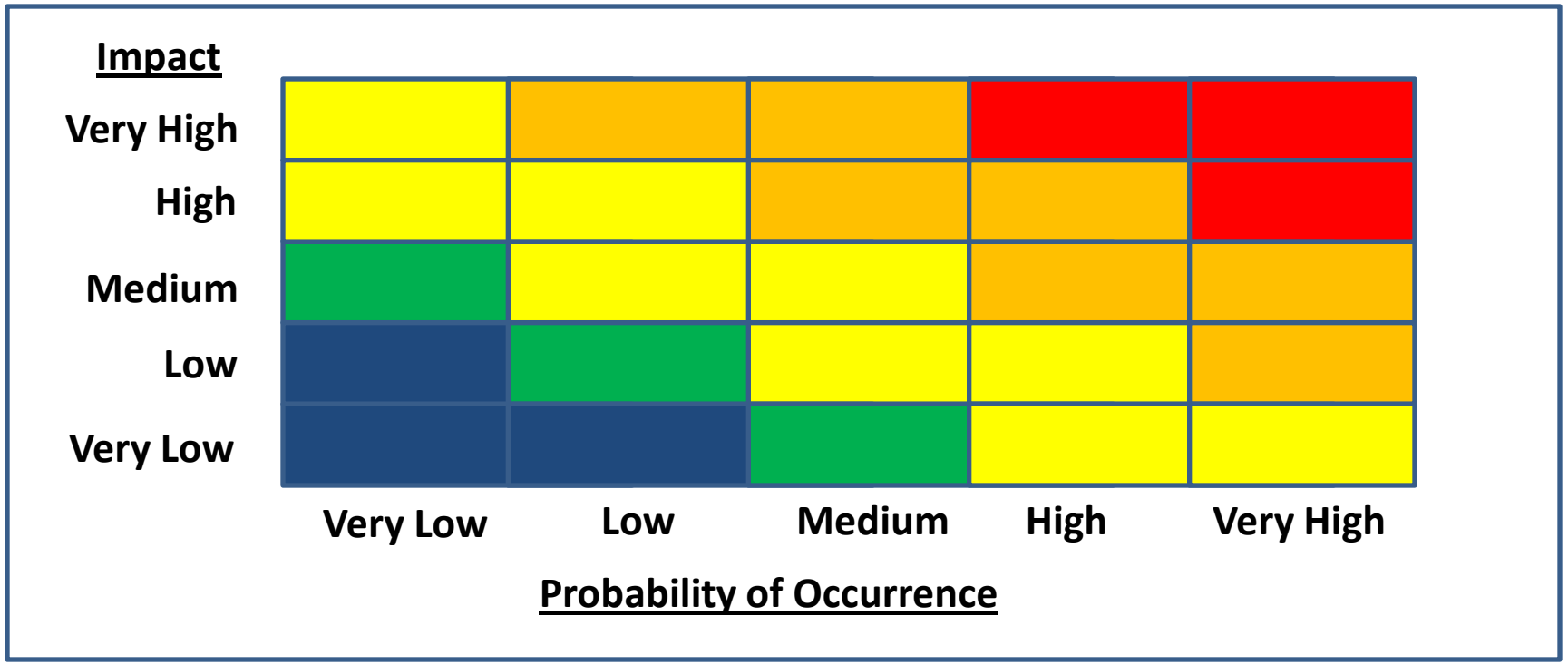
- Risk exposure. (ISO/IEC 16085:2006 Systems and software engineering--Life cycle processes--Risk management

  (1) the potential loss presented to an individual, project, or organization by a risk

  (2) a function of the likelihood that the risk will occur and the magnitude of the consequences of its occurrence

- Risk exposure can also be called **Risk Priority**
  - The priority of a risk helps to determine the amount of resources and time that should be dedicated to managing and monitoring the risk
  - Very Low, Low, Medium, High, and Very High priority is assessed by using probability and impact scores
  - The potential timing of a risk event may also be considered when determining risk management actions

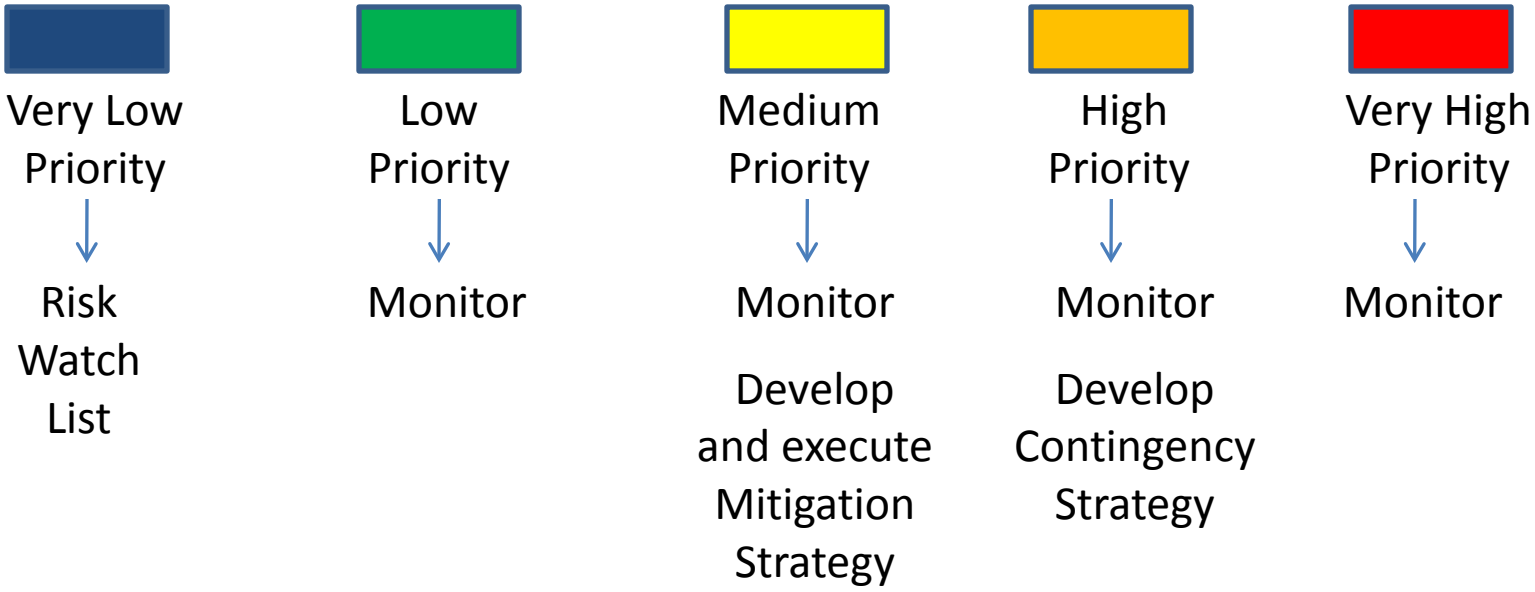
Risk Priorities





Very Low Priority | Low Priority | Medium Priority | High Priority | Very High Priority

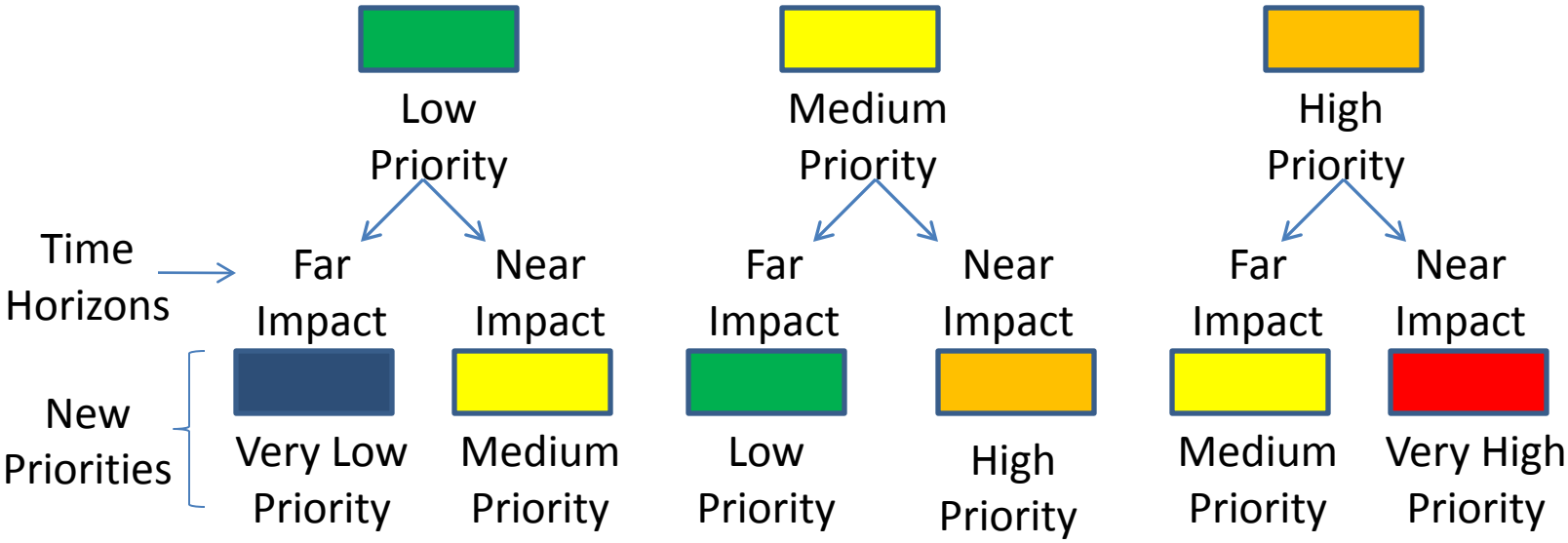
Risk Priority vs. Mitigation/Contingency



Very Low Priority Risks are placed in a Risk Watch List which are periodically monitored.
Other Risks are monitored more aggressively.

Risk Priorities & Time Horizon

The potential timing of a risk event may also be considered when determining risk management actions



Time Horizons may influence the Risk Priority

(Mid Time Horizon should not influence risk priority change)

Priorities may change over time

Identifying Triggers

- Triggers are specific events or conditions that indicate when to execute mitigation or contingency strategies
- Unless a condition is immediate, a trigger should be defined
- Examples of triggers may include:
  - Cost performance
  - Schedule performance
  - Results of management reviews
  - Occurrence of the risk
    - as a trigger for execution of contingency strategies

Risk Response

- Risk response is the process of developing options and determining actions to enhance opportunities and reduce threats to the project's objectives
- Risk response must be
  - Appropriate to the significance of the risk
  - Cost effective in meeting the challenge
  - Timely and realistic within the project contend
  - Agreed to by all parties involved

PMBOK

Risk Response

- Risk Responses has at least five components
  - Acceptance
  - Avoidance
  - Transfer
  - Escalate
  - Mitigate *(contingencies – for issues)*
- Acceptance – Accept the consequences of the risk occurring
  - Other responses may not be possible
  - Cost to respond may be greater than the benefit
  - May not be possible to prevent the impact if the risk occurs
  - Impact may be negligible
  - Risk may be imminent and should be handled as an issue

Risk Avoidance/Transfer

- Avoidance *(covered later in presentation*)
  - Eliminate the sources of high risk and replace them with a lower-risk alternative
  - Avoid risks with good management and engineering practices
- Transfer - Shift the responsibility of managing and resolving the risk to another party
  - May be better able to manage the risk
  - May be the proper owner of the risk
  - Transfer could be from one party to another within the same organization
  - Transfer could be to a completely different organization

Risk Escalation

- Escalation - Risks should be managed at the lowest practical level
  - But conditions may arise where a risk should be escalated to higher levels of management or beyond the program/project
  - The next higher organizational (Governance) entity may be able to better to handle the risk/issue
  - Thresholds may exist that determine escalation
    - Cost of impact
    - Schedule effect of Impact
    - Scope of impact
    - Performance effect of impact
    - Time critical
    - Cost critical

Risk Mitigation

- Taking early action to reduce the probability and/or impact of a risk occurring is often more effective that trying to repair the damage after the risk has occurred
- Adapting less complex processes, conducting more tests, or choosing a more stable supplier are examples of mitigation actions

PMBOK

Risk Mitigation

- The following are important guidelines for effective risk mitigation:
  - Prepare detailed mitigation strategies for all medium, high and very high risks
    - With sufficient detail about what is to be done, when, where, and by whom
  - Develop mitigation strategies as early as possible, allowing time to address risks needing special attention or action
    - Helps reduce the chance of having high-priority risks appear at the last moment on the critical path
  - Prepare contingency strategies for all high and very high priority risks and risks imminent to occur

Risk Mitigation

Background Information

- Adaptations of the following strategies can be applied to a range of risks. This list is intended merely as a starting point for thinking about risk mitigation
  - Multiple Development Efforts - Create competing systems in parallel that meet the same scope and performance requirements
  - Alternative Design - Create a backup design option that uses a less risky approach
  - Trade Studies – Conduct studies to arrive at the least risky solution
  - Early Prototyping - Build and test prototypes early in the system development
  - Incremental Development - Design with the intent of upgrading system parts in the future

Risk Mitigation

Background Information

- Technology Maturation Efforts - Normally, technology maturation is used when the desired technology will replace an existing technology that is available for use in the system
- Robust Design - This approach, while it could be more costly, uses advanced design and manufacturing techniques that promote quality through design
- Reviews, Walk-Throughs, and Inspections - These three actions can be used to reduce the probability/likelihood and potential consequences/impacts of risks through timely assessment of actual or planned events
- Design of Experiments - This engineering tool identifies critical design factors that are sensitive, and therefore potentially high-risk, to achieve a particular user requirement

Risk Mitigation

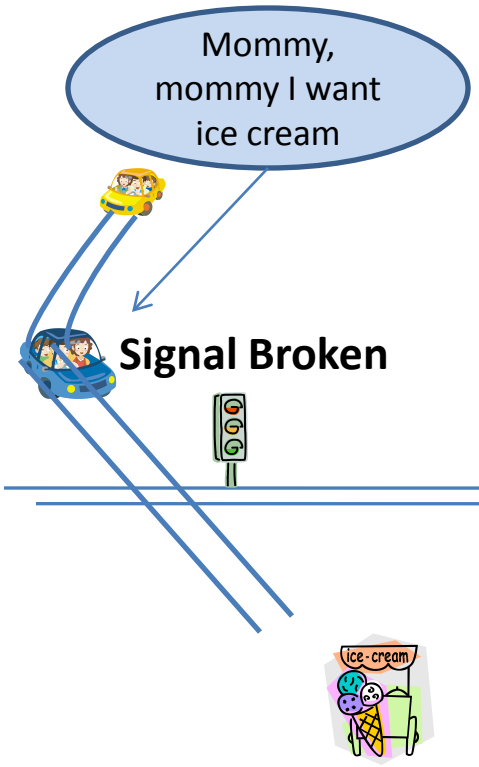
Background Information

- Open Systems - Carefully selected commercial specifications and standards, which can result in lower risks
- Use of Standard Items/Software Reuse - Use of existing and proven hardware and software, where applicable, can substantially reduce risks
- Use of Mock-Ups - The use of mock-ups, especially man-machine interface mock-ups, can be used to conduct early exploration of design options
- Modeling/Simulation - Modeling and simulation can be used to investigate various design options and system requirement levels
- Key Parameter Control Boards - The practice of establishing a control board for a parameter may be appropriate when a particular feature (such as system weight) is crucial to achieving the overall program requirements

Issue Contingency

- Issue contingencies are developed for high and very high priority risks
- Covered further under issues

Ice Cream Risk



Probability of occurrence 40% – Low
Consequence of occurrence – Very High
Risk Priority – Medium
Mitigation – Hit breaks



Train approaching 2 mile away going 60 mph

Risk Monitoring and Control

- In order to effectively monitor and control risks a Risk Repository needs to be established
  - Also called a Risk Register
- There are many risk tools that provide repository capabilities:
  - Home developed tools
  - Commercial tools
  - Corporate/agency tools

Note: Risk register implementation may depend on project size. A month long project might just need a spread sheet table whereas a multi-year, geographically dispersed project may require an internet and SQL-based database tool.

Risk Control

- Risk control involves:
  - Plan and execute actions that reduce the probability/impact of a risk on the project's objectives (i.e., mitigation); and/or
  - Establish a feasible impact control plan for the realization of the risk (i.e., contingency)
  - Control includes the decision to:
    - Close risks
    - Mark risks as occurred
    - Update probability and impacts and other details (conduct additional analysis)

Risk Records

- Risk and Issue records in a risk/issue repository serve several purposes:
  - Reporting and communicating information to others who might be impacted or who might be able to help manage an item
  - Providing risk lists and status for reviews with stakeholders
  - Assisting the risk originator and owner the collection of information about an item
  - Helping risk owners and others to easily access risk and issue information, and manage that information to the benefit of the organization

Risk/Issue Repository

- Suggested contents of repository
  - Category of risk (schedule, cost, technical, management, etc.)
  - Risk Identifier
    - Unique alpha numeric identifier of each risk/issue
  - Risk Name
    - Descriptive name of risk or issue
  - Risk Description
    - Cause
    - Probability of Occurrence - **IF**
    - Consequence - **THEN**

Risk/Issue Repository

- Suggested contents of repository
  - Stage in which the risk exists at time
    - Analysis, Mitigation, Contingency, Issue, Closed
  - Priority
    - Very Low, Low, Medium, High, Very High
  - Impact
    - Very Low, Low, Medium, High, Very High
  - Probability of Occurrence
    - Larger then zero equal to 1 for risks
    - If 1 it becomes an issue
  - Risk Triggers
  - Mitigation Strategies
  - Contingency Strategies
  - Notes

Risk Monitoring

- Risk monitoring involves
  - Tracking individual risks, primarily by reviewing the status of their mitigation strategies, probability, consequence, and other information
  - Risk Monitoring includes:
    - Continuous reassessment of risks
    - Reporting on risks
  - Continuously analysis and status updates in the Risk/Issue Repository
  - Providing evidence to outside governance bodies that the program and its projects have identified sources of uncertainty and possible failure

Risk Monitoring provides data and status for Risk Control activities

Risk Monitoring

- Critical review makes certain that the solution is fixing the root cause wherever possible and prepares the risk owner and project to answer the following questions:
  - What is the expected reduction of probability and impact? Is it documented? Is it a sufficient reduction?
  - Can the option be feasibly implemented and still meet the user's needs?
  - Is time available to develop and implement the option?
  - Is the mitigation strategy affordable in terms of cost and other resources (e.g., use of critical materials, test facilities, etc.)? Does the benefit outweigh the cost?
  - What effect does the option have on the overall program schedule?
  - What effect does the option have on the system's technical scope and performance?

Risk Monitoring

- Risk reports can be in the form of text reports and/or graphs
- The following are examples of reports and metrics that can be reported:
  - Open Risk/Issues by Priority by Month
  - Closed Risks/Issues Current Month
  - Risk/Issue Plans
    - Current and next month
  - Risk/Issue Transfer Current Month
  - Risk/Issue Escalation Current Month
  - Risk/Issue Activity History
  - Risk/Issue for Management Attention

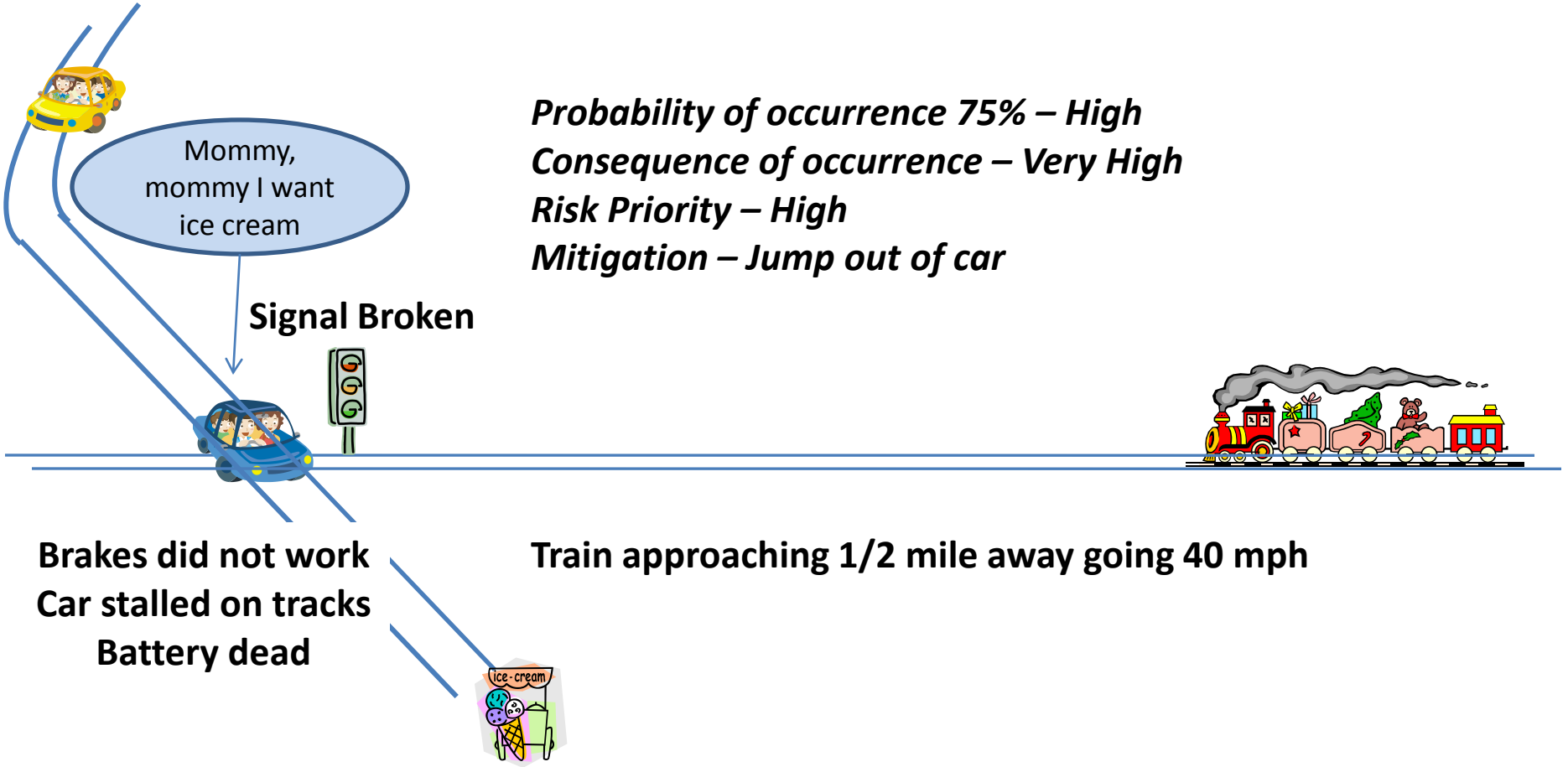
Risk Status

- Risk monitoring includes constant monitoring and providing status of the risks including
  - Analysis of the current status of the risks
  - Updates to the
    - Probability of occurrence
    - Impact of occurrence
    - Other risk parameters
    - Mitigation strategies
    - Contingency strategies

Risk Closure

- Risks are closed when:
  - They are no longer a threat (the risk lessened or vanished)
  - They have been mitigated
  - They have been transferred or escalated
    - The new owners now manage and monitor the risk
- When risks occur they now become Issues and may be closed as risks or left open in the repository as Issues

Risk

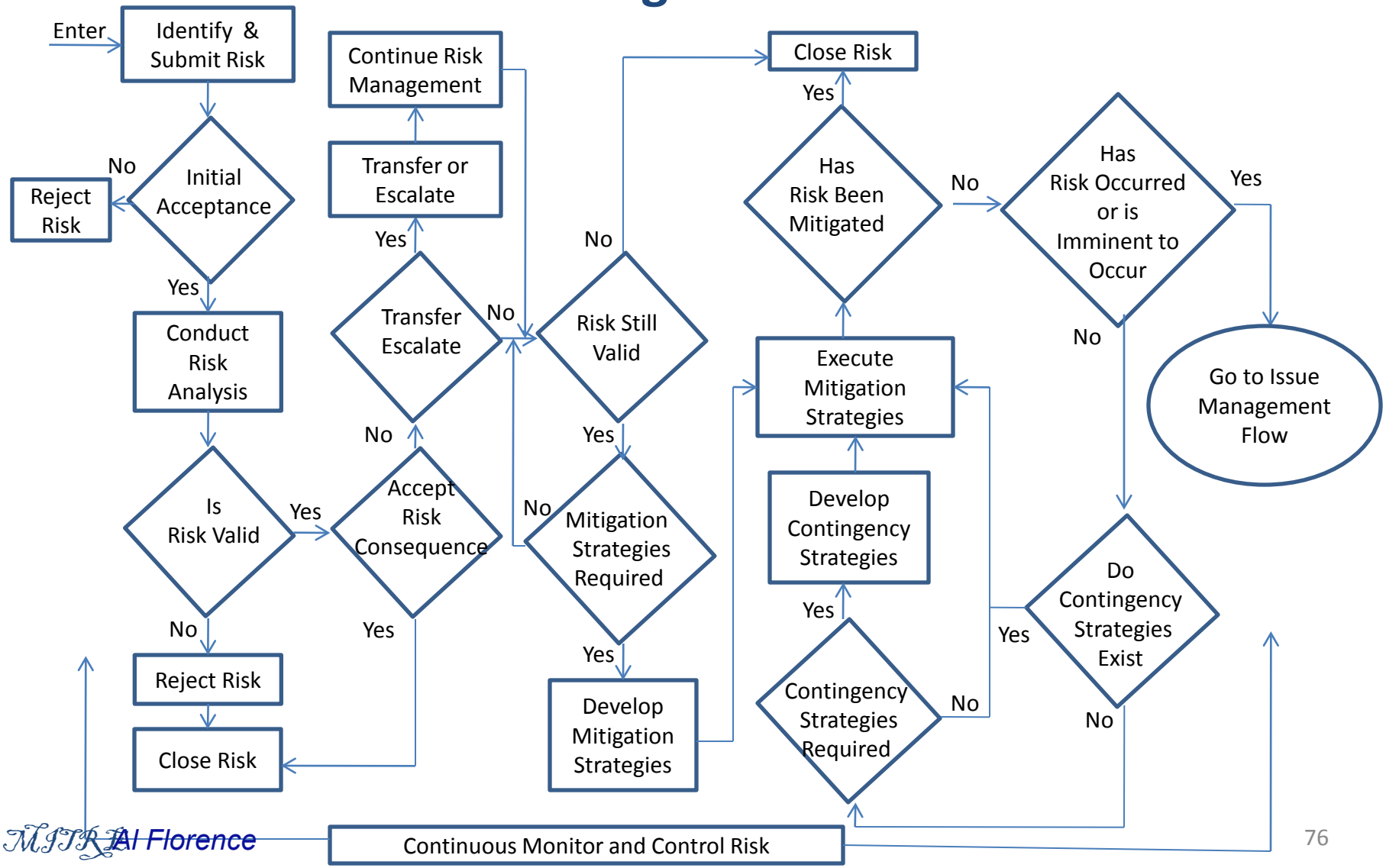


Probability of occurrence 75% – High
Consequence of occurrence – Very High
Risk Priority – High
Mitigation – Jump out of car

Train approaching 1/2 mile away going 40 mph

In Review

Risk Management Flow



Where Are We

- Tutorial Objectives
- Introduction
- Reasons for Risk/Issue Management
- Opportunities
- Risk Management
- ***Issue Management***
- Risk/Issue Avoidance
- Risk/Issue Opportunities
- Questions/ Discussion
- References
- Contact Information

Issue Management

- An issue is an event that has occurred or will *occur with certainty* and *adversely affects* the ability of the project or program to meet its objectives

Used in Next slide

a) A formally identified adverse condition related to a program

a1) Had not been identified as a risk prior to its occurrence

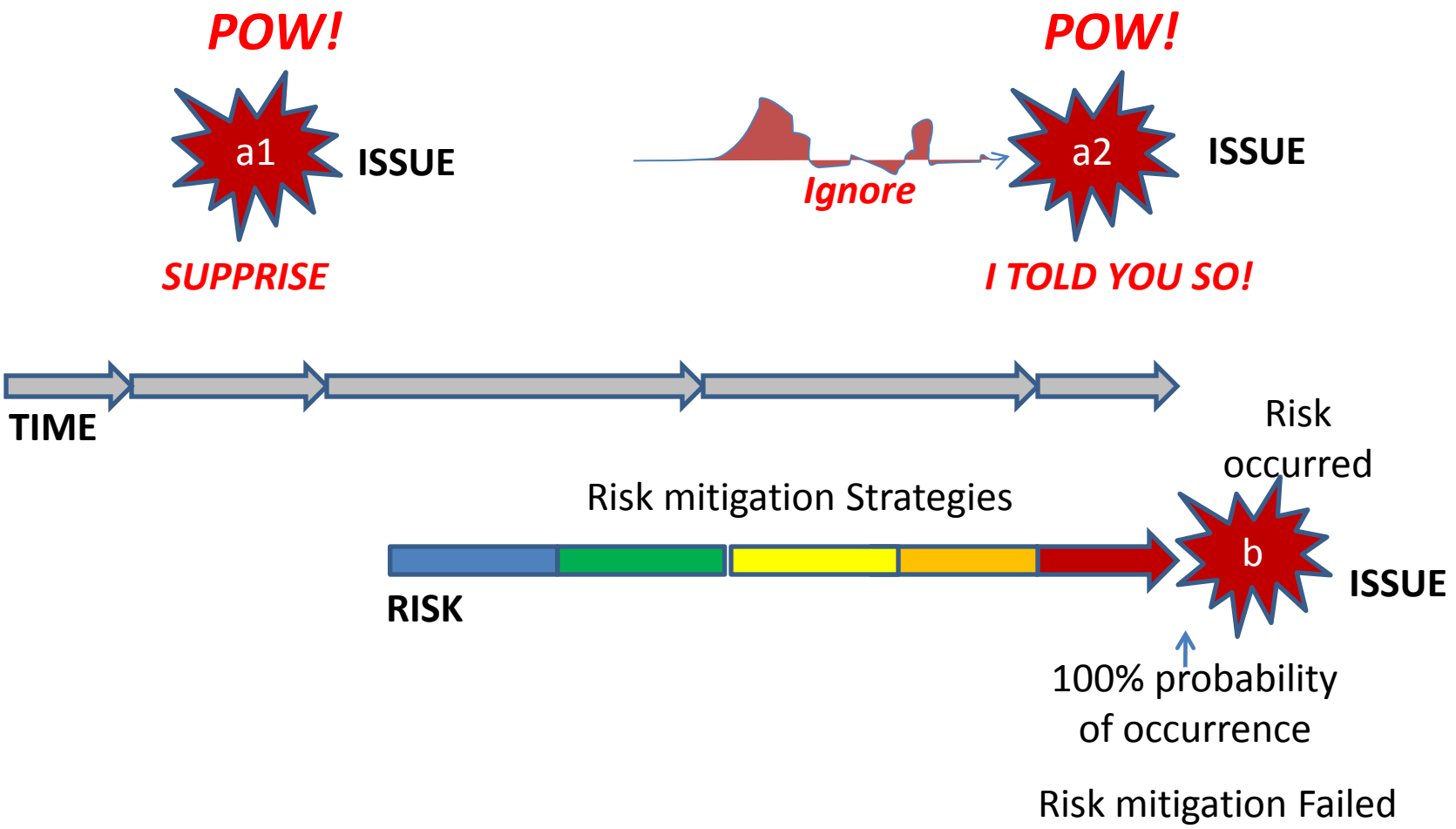
a2) Had been identified as a risk prior to its occurrence but had not been managed as a risk

b) A program risk that has occurred or is imminent to occur

- Reached its probability of occurrence of 1 (one) or 100%
- Not yet occurred but the probability of occurrence is approaching 100%
  - At this time should be managed as an issue

Some concepts from: PM@UTS Learning Program Step by step guide to project management

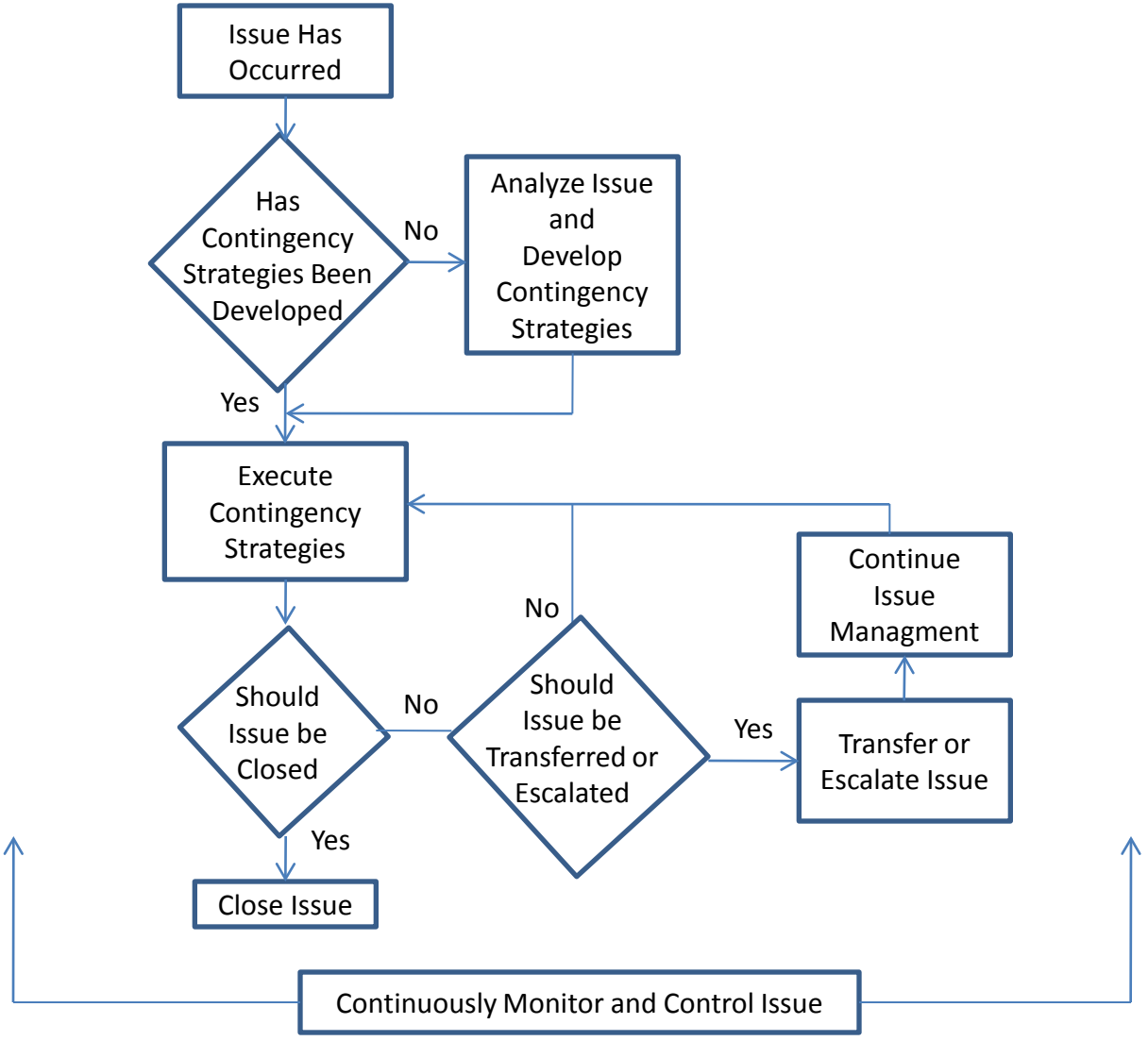
Issue Management



Issue Management

- If program/project issues are not addressed they may:
  - Affect program/project schedule
  - Increase program/project cost
  - Change program/project scope
  - Diminish program/project performance
- Issues can be associated with all aspects of a program (e.g., threat, technology maturity, supplier capability, design, performance against plans) as these aspects relate across the Work Breakdown Structure and Integrated Master Schedule

Issue Management Flow



Issue Management

- Issue Management quickly identifies and effectively resolves problems as they occur and involves:
  - Issue Identification
  - Issue Analysis
  - Issue Response
  - Issue Monitoring and Control

Issue Identification

- Issue identification activities are similar to those for risk identification
- If the issue is one that occurred, without being associated with a risk, then it needs to be identification
- Issue identification would have been done if the issue resulted from a risk occurring
  - Regardless issues may need additional identification
    - Especially in identifying root causes

Issue Description

- If the issue was a risk that occurred it should have been described with the risk description
- If the issue was not related to a risk the issue needs to be described
  - The conditions that caused an issue to occur along with root cause(s) need to be identified and described
    - This includes the consequences of the issue occurrence
  - The risk writing guidelines presented earlier can be used as appropriate to issues

Issue Analysis

- Issue analysis activities are similar to those for risk analysis
  - If an issue is a risk that has occurred, some, if not all, risk analysis may be sufficient for the issue
    - The issue may need additional analysis due to its impact on program/project activities and products
  - If the issue is one that occurred without it being associated with a risk then issue analysis needs to be conducted
    - The root cause needs to be identified
    - Impact level, rated from very low (1) to very high (5), is assessed in at least four categories:
      - Cost
      - Schedule
      - Scope
      - Performance

Issue Response

- Issue response could include
  - Acceptance
    - Accept the consequence of the issue
    - Same reasons as acceptance of risks
  - Transfer
    - If the occurred risk had not been transferred the issue responsibility may now be shifted to another party who is better equipped to deal with the issue
  - Escalate
    - If the occurred risk had not been escalated the issue responsibility may now be escalated to higher authority based on threshold described earlier
  - Contingencies
    - Can be developed using the similar methods described for risk mitigations

Issue Response

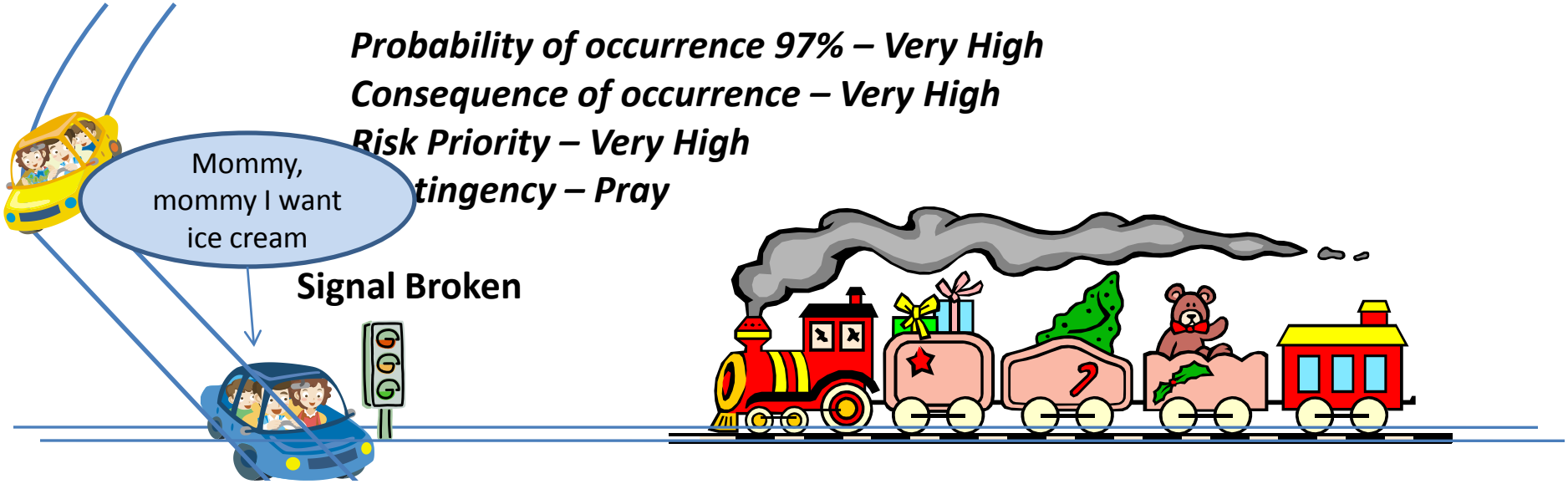
- Issue contingencies are strategies to eliminate or reduce the negative effect of the issue
- Issue contingencies should have been developed for issues that were the result of a risk occurring
  - If not they need to be developed
  - They may need to be enhanced
    - If they were associated with risks earlier
- For issues that were not the result of a risk occurring contingencies need to be developed

Issue Monitoring and Control

- Issues are monitored and controlled until they are closed
- Issues are monitored and controlled using similar methods described for risk monitoring and control

Ice Cream Risk/Issue

Probability of occurrence 97% – Very High
Consequence of occurrence – Very High
Risk Priority – Very High
tingency – Pray

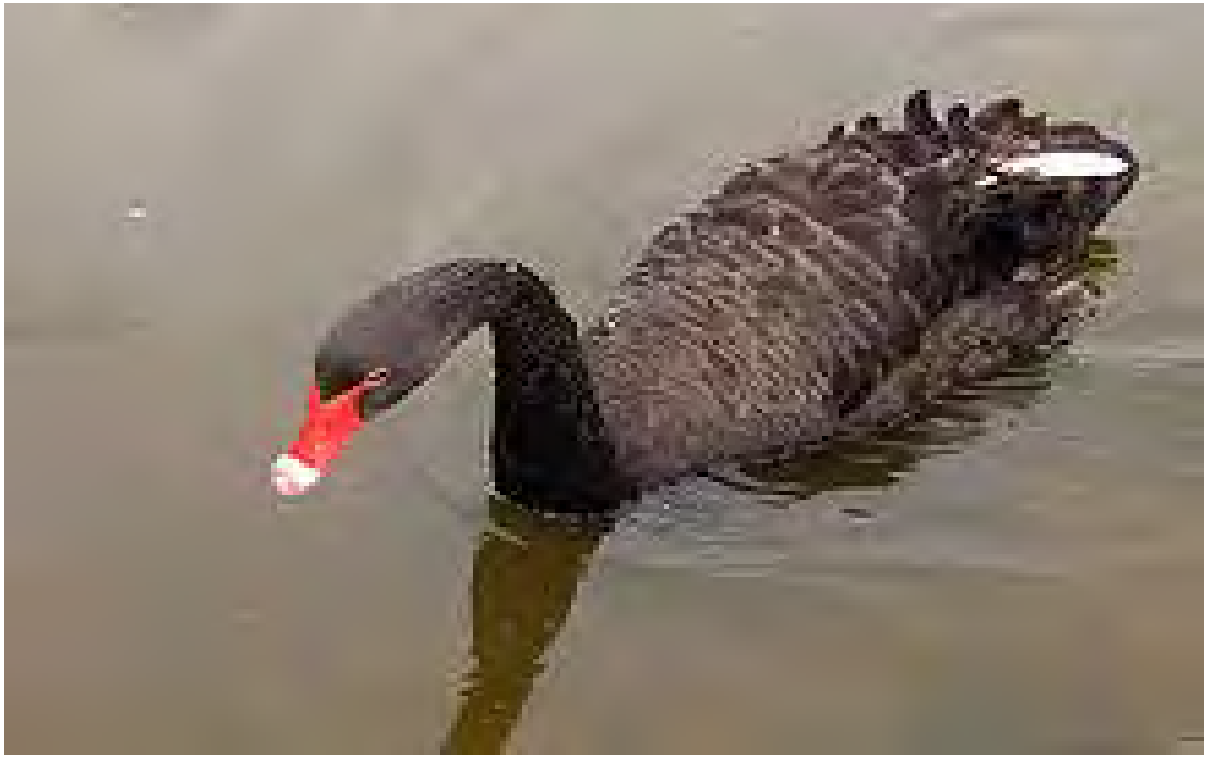


Black Swan Events

***The Black Swan: The Impact of the Highly Improbable*;**

Nassim Nicholas Taleb

WIKIPEDIA



Black Swan Events

- Black Swan Events were described by Nassim Nicholas Taleb in his 2007 book, *The Black Swan*
- Taleb regards almost all major scientific discoveries, historical events, and artistic accomplishments as "black swans"—undirected and unpredicted
- He gives the rise of the Internet, the personal computer, World War I, and the September 11, 2001 attacks as examples of Black Swan Events

We can add the 2004 Indonesian Tsunami, The Haiti Earthquake, Columbia, Challenger, Killer Whale Tilikum, Toyota Recalls-to Stock Holders and Owners, not sure about Toyota Executives - Al Florence

Black Swan Theory

- The Black Swan Theory is used by Nassim Nicholas Taleb to explain the existence and occurrence of high-impact, hard-to-predict, and rare events that are beyond the realm of normal expectations
- Such events are considered extreme outliers

Black Swan Events

- The main idea in Taleb's book is not to attempt to predict Black Swan Events
  - but to build robustness into negative ones that occur and being able to exploit positive ones
- Taleb contends that banks and trading firms are very vulnerable to hazardous Black Swan Events and are exposed to losses beyond that predicted by their defective models
  - *Sounds familiar? Al Florence*
- Taleb states that a Black Swan Event depends on the observer
  - using a simple example, what may be a Black Swan surprise for a turkey is not a Black Swan surprise for its butcher
  - hence the objective should be to "avoid being the turkey" by identifying areas of vulnerability in order to "turn the Black Swans white"

The same can be said about 9/11; Black Swan for Americans, White Swan for terrorists! - Al Florence

Black Swan Bottom Line

- Black Swan Events are events that have an extremely low probability of occurrence
  - cannot be predicted
- But have a very high consequence if occur
  - positive or negative
- Mitigation is near impossible for negative ones since it is not known when, where and how or if they will occur

Al Florence

How about an All Black Penguin?
Discovered March 11, 2010 near Antarctica
One in a zillion occurrence
So, what would a All Black Penguin event be?

Where Are We

- Tutorial Objectives
- Introduction
- Reasons for Risk/Issue Management
- Opportunities
- Risk Management
- Issue Management
- ***Risk/Issue Avoidance***
- Risk/Issue Opportunities
- Questions/ Discussion
- References
- Contact Information

Risk/Issue Avoidance

- Risk/Issue Avoidance has at least two components:
  - Eliminate the sources of high risks and issues and replace them with a lower-risk alternatives
  - The establishment of sound technical, programmatic and management processes, and activities early and their continued execution throughout the entire lifecycle
    - This helps remove common risks/issues root causes

Low-Risk Alternatives

- Eliminate the sources of high risk and replace them with a lower-risk alternatives
  - The selection and implementation of alternative activities or products without, or with lower, risk to replace the riskier activities or products
  - These alternatives may eliminate or reduce the impact if the risk occurs

Alternative Approaches

- Risk analysis and mitigation involves the investigation and implementation of alternative approaches which may include:
  - Technical
    - Example: substitute COTS products, relax requirements
  - Management
    - Example: reassign tasks, augment teams
  - Programmatic
    - Example: manipulate schedules, reduce documentation, increase budgets

Industry Best Practices

- Implementing industry best practices within organizations and executing them on projects can drastically reduce risks and issues
- Best practices include technical and programmatic processes and procedures

By doing this organizations will go a long way in reducing risk and issues

SEI CMMI

- Software Engineering Institute (SEI) Capability Maturity Model Integration (CMMI)
  - CMMI for Development v1.3– For suppliers developing/supplying
    - Software
    - Hardware
    - Systems
    - Commercial of the Shelf (COTS)
  - CMMI for Acquisition v1.3
    - For customers acquiring systems, products and services
  - CMMI for Service v1.3
    - For organizations providing services

All these CMMIs have process areas for most activities associated with program/project development and acquisition

Their proper implementation would result in best practices

SEI CMMI

CMMI Process Areas for CMMI for Development v1.2



Risk Reduction

Level	Process Areas
5 - Optimizing	Organizational Innovation and Deployment Causal Analysis and Resolution
4 - Quantitative Managed	Organizational Process Performance Quantitative Project Management
3 - Defined	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organizational Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis and Resolution
2 - Managed	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management
1 - Initial Competent people and heroics, sometimes ad hoc ***(Subject to high incidence of RISKS)***	

SEI CMMI

The CMMI is itself a Risk Management Plan

Managing Risks, Methods for Software Systems Development; Dr. Elaine M. Hall, SEI Series in Software Engineering

Other Frameworks

- Other Methodologies/Frameworks
  - 6 Sigma
    - Process Improvement
    - Reduce variation
    - Statistical/quantitative
  - Lean 6 Sigma
    - Process Improvement
    - Reduce Waste
    - Less statistically rigorous then 6 sigma
  - ITIL – Information Technology Infrastructure Library
    - For Information Technology
    - Services Focused

Other Frameworks

- ISO 9000 standards
  - ISO 9001 - applies to companies required to design, develop, produce, install, service and supply a product or service
  - ISO 9002 - applies to companies required to produce, install, service and supply a product or service according to an existing design
  - ISO 9003 - addresses only the requirements for detection and control of problems during final inspection and testing
- Others

Reducing Risks with the Proper Specification of Requirements

The next presentation was published as a paper in Crosstalk, The Journal of Defense Software Engineering, April 2002 by Al Florence
Title of the publication:

RISKY Requirements

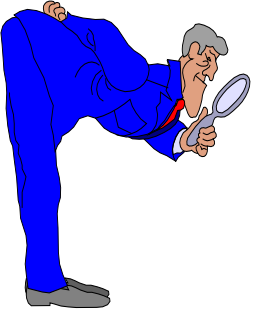
It also received an award in the best paper competition at MITRE

December 17, 2008 — **Computerworld** —
Melinda-Carol Ballou, an analyst with IDC in Framingham, Mass., said that 70% to 80% of IT project failures relate directly to poor requirements gathering, management and analysis.

And specification – Al Florence

Proper Specification of Requirements

- A government agency, while modernizing their information systems, reverse-engineered requirements
- With domain knowledge of the application, several teams were involved
  - They represented
    - Users
    - Contractors
    - Acquisition organization
- This author was assigned as a consultant to guide the teams in the proper specification of requirements
- The examples presented show some of the requirements:
  - As initially specified by the teams
  - Next a critique of the requirements by this author
  - Finally the re-specified requirements based on the critique



Criteria for Specifying a Good Requirement

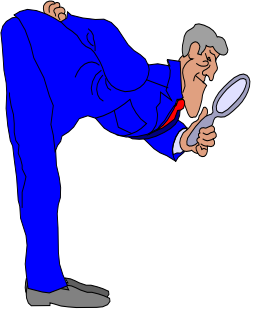
The following are some critical attributes that requirements must adhere to: *(Used to critique requirements)*

- Completeness: Requirements should be complete

  They should reflect system objectives and specify the relationship between the software and the rest of the subsystems

- Consistency: Requirements must be consistent with each other; no requirement should conflict with any other requirement

  Requirements should be checked by examining all requirements in relation to each other for consistency and compatibility



Criteria for Specifying a Good Requirement

- Traceability: Each requirement must be traceable to some higher-level source, such as a system level requirement

  Each requirement should also be traced to lower level design and test abstractions such as high-level and detailed-level design and test cases

- Testability: All requirements must be testable in order to demonstrate that the software end product satisfies its requirements

  In order for requirements to be testable they must be specific, unambiguous, and quantitative whenever possible. Avoid negative, vague and general statements

Criteria for Specifying a Good Requirement

- Feasibility: Each requirement must be feasible to implement

  Requirements that have questionable feasibility should be analyzed during requirements analysis to prove their feasibility

- Unique identification: Uniquely identifying each requirement is essential if requirements are to be traceable and testable

  Uniqueness also helps in stating requirements in a clear and consistent fashion

Criteria for Specifying a Good Requirement

- Design Free: Software requirements should be specified at a requirements level not at a design level

  The approach should be to describe the software requirement functionally from a system (external) point of view, not from a software design point-of-view, i.e. describe the system functions that the software must satisfy. Some requirements may have design embedded due to constraints placed on them by the system, interfaces or legacy

- Use of “shall” and related words: In specifications, the use of the word "shall" indicates a binding provision

  Binding provisions must be implemented by users of specifications. To state non-binding provisions, use "should" or "may". Use "will" to express a declaration of purpose (e.g., "The Government will furnish..."), or to express future tense. MIL-STDs

Note: Methods other that the use of “shall” can be used to specify requirements such as using a matrix with a column for requirements and another column for comments or italics or underlines for comments.

Example 1

- Initial specification

  The Financial Agent sends to the government by 6:00 PM ET on the same day after receipt of the file CRDF that includes only critical data collected from the enrolled individual.

- Critique
  - No unique identifier provided
  - The word “shall” is missing
  - How is the file sent?
  - Has design implications: “CRDF”
    - Should define data, not name of data file - this should be done in the design
  - The critical data has to be identified

Example 1

- Re-specification

  3.3.1.3 The Financial Agent shall send the government, via electronic transmission, the following critical data collected from each enrolled individuals by 6:00 PM ET on the day of receipt:

  a. Name

  b. Address

  c. Zip Code

  d. Social Security Number

Example 2

- Initial specification:

  3.2.5.7 The system shall process two new fields (provides production count balancing info to states) at the end-of-state record

- Critique:
  - This requirement cannot be implemented or tested.
  - It is incomplete. What are the two new fields?
  - “Info” should be spelled out
- Re-specification:

  3.2.5.7 The system shall provide the following data items (provides production count balancing information to states) at the end-of-state record:

  a. SDATE, and

  b. YR-TO-DATE-COUNT

Example 2

- Re-Critique:
  - This rewrite has design implications SDATE record and YR-TO-DATE-COUNT
    - From a requirements viewpoint it should specify what the data in the records are, not the name of the record as it exists in the design and implementation
- Re-Re-Specification:

3.2.5.7 The system shall provide the following data items (provides production count balancing information to states) at the end-of-state record:

a. Submission date and time

b. Year-to-date totals

Example 3

- Initial specification:

  3.2.5.9 All computer-resident information that is sensitive shall have system access controls. Access controls shall be consistent with the information being protected and the computer system hosting the data.

- Critique:
  - Two “shalls” under one identifier
  - The requirement is vague and incomplete. Need to identify the sensitive information.
  - What does “consistent” mean?
  - As specified it cannot be implemented or tested

- Re-specification:

  3.2.5.9 All sensitive computer-resident information shall have system access controls, consistent with the level of protection. (Reference Sensitive Information, Table 5.4.1 and Level of Protection for Sensitive Information, Table 5.4.2)

Example 4

- Initial specification:

  Software will not be loaded from unknown sources onto the system without first having the software tested and approved
- Critique:
  - If it is tested and approved, can it be loaded from unknown sources?
  - If the source is known, can it be loaded without being tested and approved?
  - Requirement is ambiguous and stated as a negative requirement, which makes it difficult to implement and test
  - A unique identifier is not provided, which makes it difficult to trace
  - The word “shall” is missing

Example 4

- Re-specification:

  3.2.5.2 Software shall be loaded onto the operational system only after it has been tested and approved

Example 5

- Initial specification:

  3.2.7.1 The system shall purge state control records and files that are older than the operator or technical user-specified retention period

- Critique:
  - Requirement is incomplete and vague without specifying the retention period or providing a reference as to where the information can be obtained
  - Requirement cannot be implemented or tested as stated
- Re-specification:

  3.2.7.1 The system shall purge state control records and files that are older than the retention period input into the system by either the

  a. operator, or
  b. technical user

Example 6

- Initial specification:

  3.3.2.1 The system shall have no single point failures

- Critique:
  - This is an ambiguous requirement. Needs identification of what components and/or functions the “no single point failures” applies to
  - As specified it cannot be implemented or tested
- Re-specification:

  3.3.2.1 The following system components shall have no single point failures:

  a. Host servers
  b. Networks
  c. Network routers
  d. Access servers
  e. Hubs
  f. Switches
  g. Firewalls
  h. Storage devices

Example 7

- Initial specification:

  3.2.6.3 The system shall receive and process state return data from the State Processing Subsystem. The system shall provide maintenance of the state data files and generate various reports.

- Critique:
  - Two “shalls” under one requirement number and multiple requirements in the specification
  - The word “process” in the first shall is vague; need to define the processing required
  - The second “shall” does not provide for valid requirements; they cannot be implemented or tested as stated
    - Needs identification of type/amount of maintenance required
    - “various reports” is ambiguous

Example 7

- Re-specification:

  3.2.6.3 The system shall receive:

  a. production data that contains data from multiple states, and

  b. state total amount for one or more states,

  extracted by the Returns Processing Subsystem.

  3.2.6.4 The system shall parse multi-state data to respective state files

  3.2.6.5 The system shall display a summary screen reporting the results of processing for each state containing:

  a. state totals,

  b. state generic totals, and

  c. state unformatted totals.

Example 8

- Initial specification:

  3.2.9.1 When doing calculations the software shall produce correct results.

- Critique:
  - Really? This is not a requirement.
  - This type of non-requirements should not be specified!
  - It should be deleted.
- Re-specification:

  Requirement deleted.

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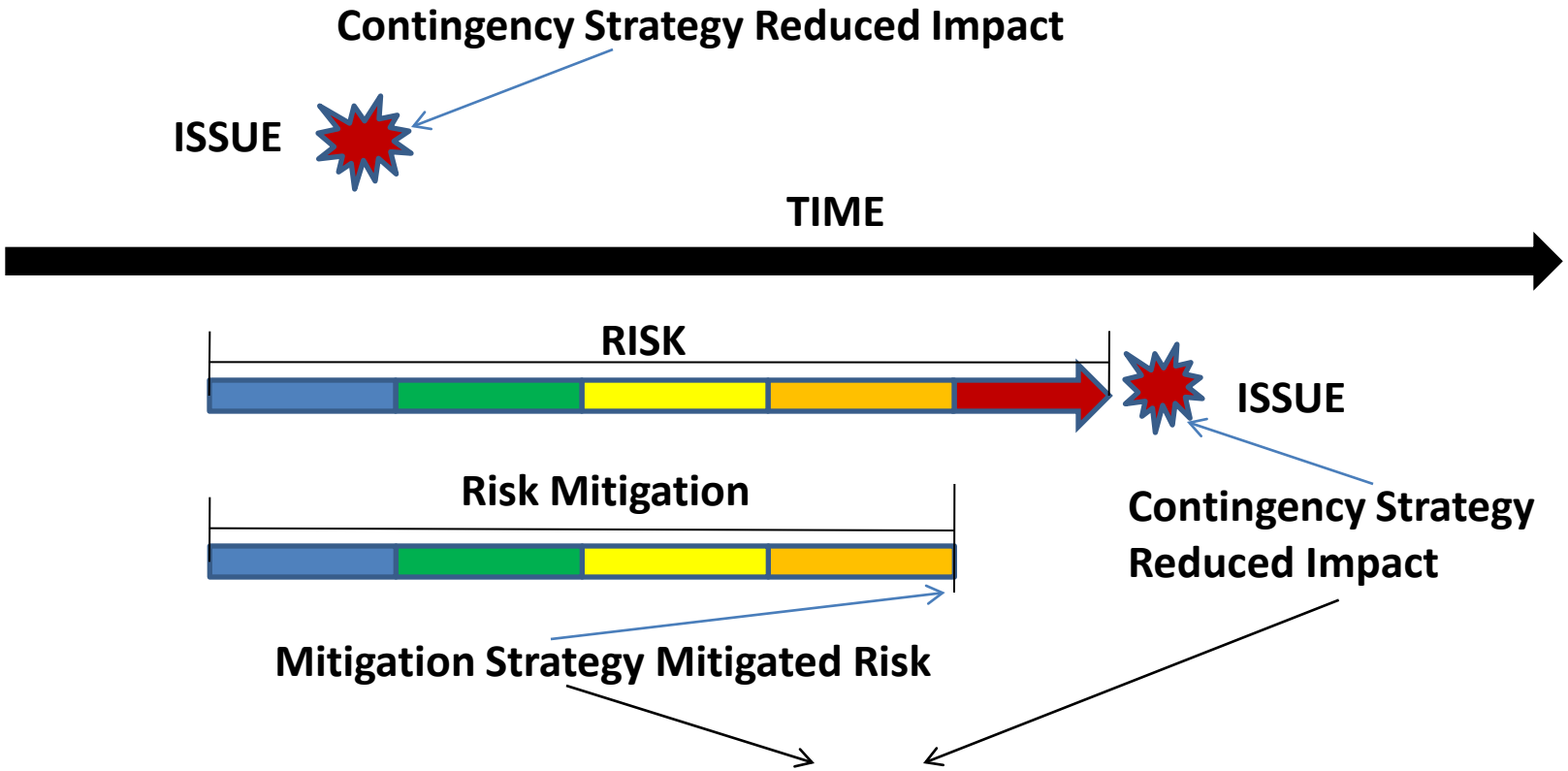
Risk/Issue Opportunity

- An Opportunity is a *potential* event which, if *taken advantage* of, will *positively affects* the ability of the project or program to meet its objectives
  - Opportunities to improve project performance may surface while applying mitigation or contingency strategies
  - The mitigation or contingency strategies could be used as best practices on the project or other projects to keep the risk from recurring

Risk / Opportunity

- An opportunity may be the potential of improving the value of project results; the project itself is the paramount opportunity
- A risk is the potential of not achieving the project strategic opportunity
- Taking risks can lead to opportunities but risk taking can itself be quite risky unless the risk is well thought out and well managed

Capturing Lesson Learned in Support of Opportunities



Stored in lessons learned database which can be documented as a best practice opportunity to be reused on this or other projects to keep the risk or issue from recurring
(Hopefully Identified and corrected Root Cause) (Also Called Process Improvement)

Real Project Example

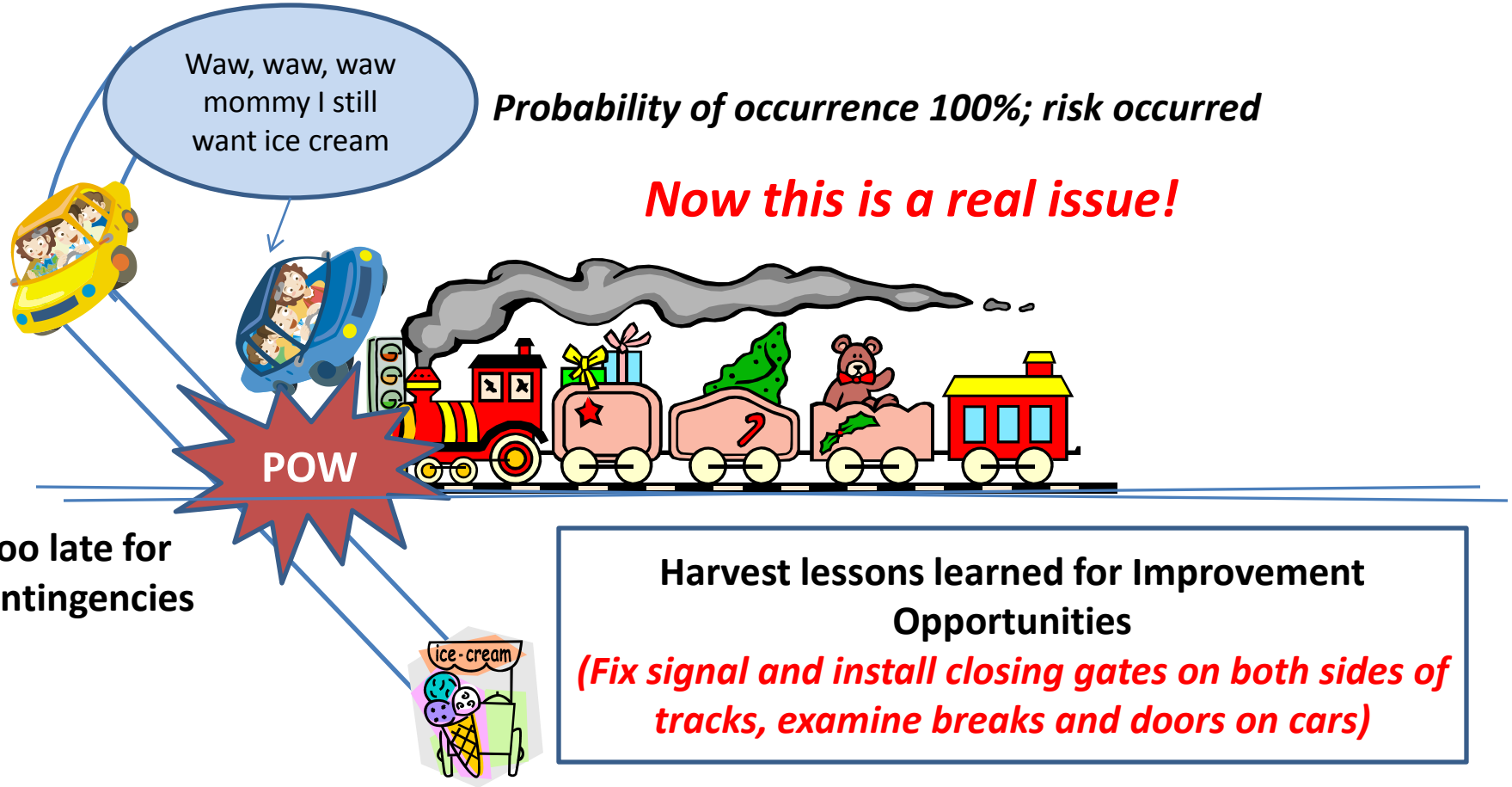
- Opportunity
  - Galileo Space Probe to Jupiter to investigate the Jovian atmosphere and gather scientific information
- A Risk
  - Voyager Space Craft on flyby of Jupiter discovered high radiation, which destroys electrical components, and high incidences of cosmic ray events, which flips volatile computer bits
  - **IF** the Galileo Probe is not designed to protected against this phenomena prior to launch
  - **THEN** the microprocessor may fail before the mission is accomplished resulting in less science collected or complete mission failure
- A mitigation strategy was developed and deployed
  - Redesign the configuration of the probe to protect volatile bits and electronic components
- Issue
  - Did not materialize
- Opportunities
  - Galileo Probe was successful and accomplished its full mission
  - Lessons learned were used on other space missions

Real Project Example

- Mitigation
  - Initial design had one microprocessor to command and control the instruments, collect scientific data and telemeter to orbiter
  - Eliminate 2 experiments and install 2nd microprocessor
    - Both redundantly collecting same data and sending to orbiter
    - Place processors in the center of probe
  - Provide for redundant triple collection and triple voting on both processors on critical parameters such as timing
  - Hopefully when one processor destroyed the other may continue to operate

This mitigation (redesign) extended the life of science gathering until probe implosion

Ice Cream Issue/Opportunity



Probability of occurrence 100%; risk occurred

Now this is a real issue!

Too late for Contingencies

Harvest lessons learned for Improvement Opportunities

(Fix signal and install closing gates on both sides of tracks, examine breaks and doors on cars)

The good news is that no one was hurt, obviously this is a toy train and toy cars

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NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Software Safety Program at NREL
(It is Not Just for Nuclear Sites)



CMMI Conference – 2011

Denver Technology Center

Tim Kasse

14 November 2011

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

Software Safety
What Does it Mean?
How Do We Do It?

Software and Systems Safety

Creating a Safe System is a “team effort”

Software is a vital part of most systems

- What hardware and software does it control?
- How do we know if our software is “safe” or “unsafe”?
- What are the hazards that software contributes to or that software controls?

Why Should Anyone Care About Software Safety?

Why should anyone care about software safety?

- When a device or system can lead to injury, death, the destruction of loss of vital equipment or damage to the environment, software safety is critical!
- Software can respond quickly to potential problems, provide more functionality than equivalent hardware and can even be changed in real time
  - Software is flexible as long as those who develop it and integrate it into the other system components understand the consequences of its possible failure
- Software safety includes all software that can impact hazardous software or hardware
  - All such software is “safety-critical”

Hazardous and Safety-Critical Software Definitions

Hazard – A hazard is the presence of a potential risk situation that can result in or contribute to a mishap

- Every hazard has at least one cause which can turn into a number of effects (damage, illness, failure)

Hazard Cause – A hazard cause may be a defect in hardware or software, a human operator error or an unexpected input or event which results in a hazard

Hazard Control – A hazard control is a method of preventing the hazard, reducing the likelihood of the hazard occurring, or the reduction of the impact of that hazard

Hazardous and Safety-Critical Software Definitions - 2

Hazard Controls use:

- Hardware (e.g., pressure relief or valve)
- Software (e.g., detection of stuck valve and automatic response to open secondary valve
- Operator procedures
- Combination of methods to avert the hazard

Hazard Control Method – For every hazard cause, there must be at least one control method which is usually a design feature or a procedural step

Hazardous and Safety-Critical Software Definitions - 3

Hazard Control Verification – Each hazard control will require verification

- Test
- Analysis
- Inspection
- Demonstration

Software – Software can be used to detect and control hazards, but software failures can also contribute to the occurrence of hazards!

Safety-Critical Software

Safety-critical software includes:

- Hazardous software which can directly contribute to, or control a hazard
- All software that influence this hazardous software
- Software that monitors hazardous or safety-critical hardware or software

EXAMPLE: Software that controls a high-powered laser is hazardous and safety-critical

Safety-Critical Software - 2

Software that provides information required for a safety-related decision falls into the safety-critical category

- If a human must shut down a piece of hardware when the temperature goes over a threshold, the software that reads the temperature and displays it for the human operator is safety-critical
- All the software along the chain, from reading the hardware temperature sensor, converting the value to appropriate units, to displaying the data on the screen are safety-critical

Safety-Critical Software - 3

Software is safety-critical if it performs any of the following:

- Controls hazardous or safety-critical hardware or software
- Monitors safety-critical hardware or software as part of a hazard control
- Provides information upon which a safety-related decision is made
- Verifies hardware or software hazard controls
- Can prevent safety-critical hardware or software from functioning properly

Software Safety Program

A System Safety Program Plan is a prerequisite to performing development or analysis of safety-critical software. The Safety Plan should:

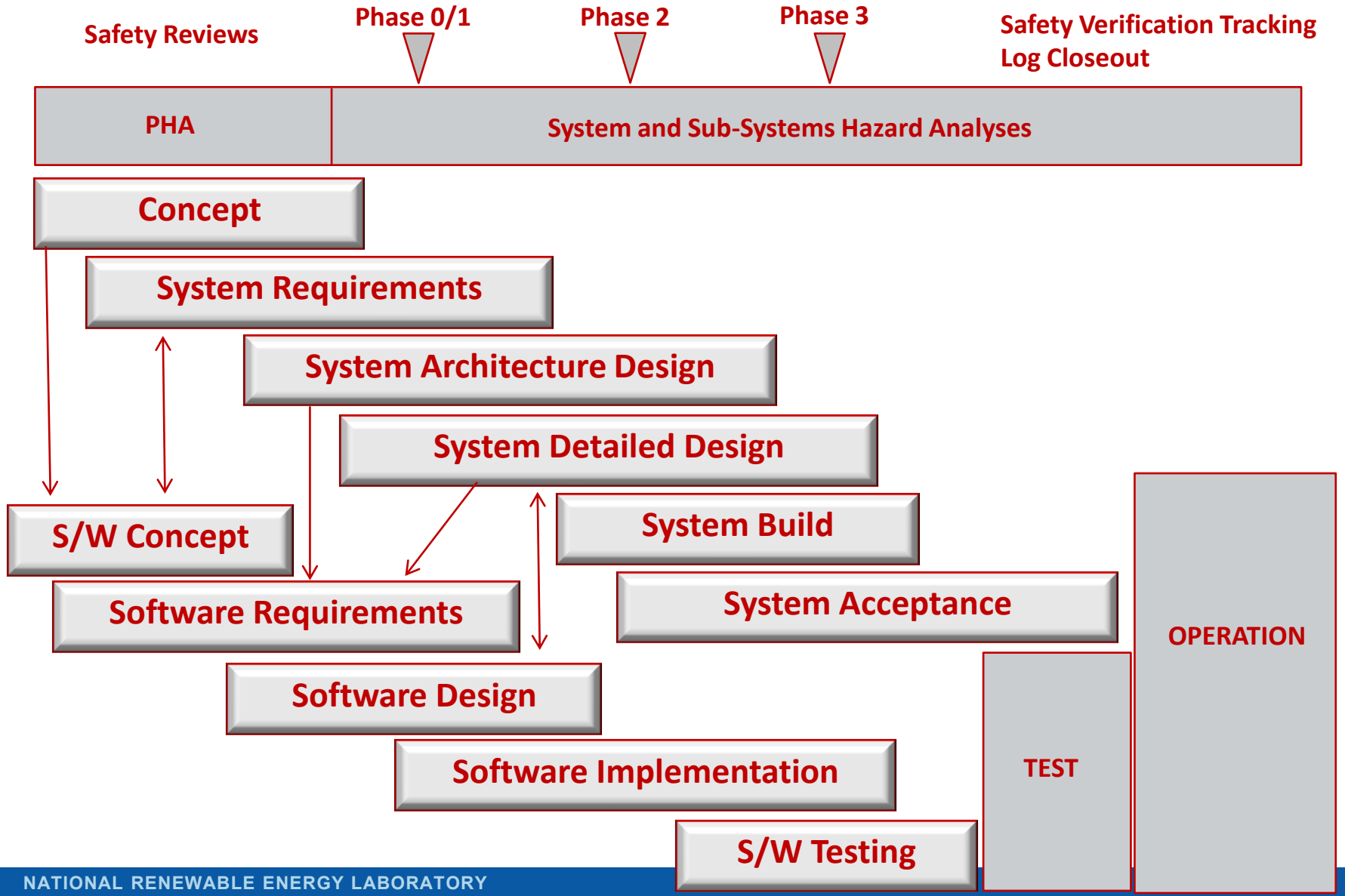
- Describe forms of analysis
- Provide a schedule for performing a series of these system and subsystem level analysis throughout the development schedule

System safety analysis follow the lifecycle of the system development efforts

- The system is compromised of the hardware, the software, and the interfaces between them, including human operators

System/ Software Safety Lifecycles

Safety, System, and Software Timeline
(All Inclusive View)

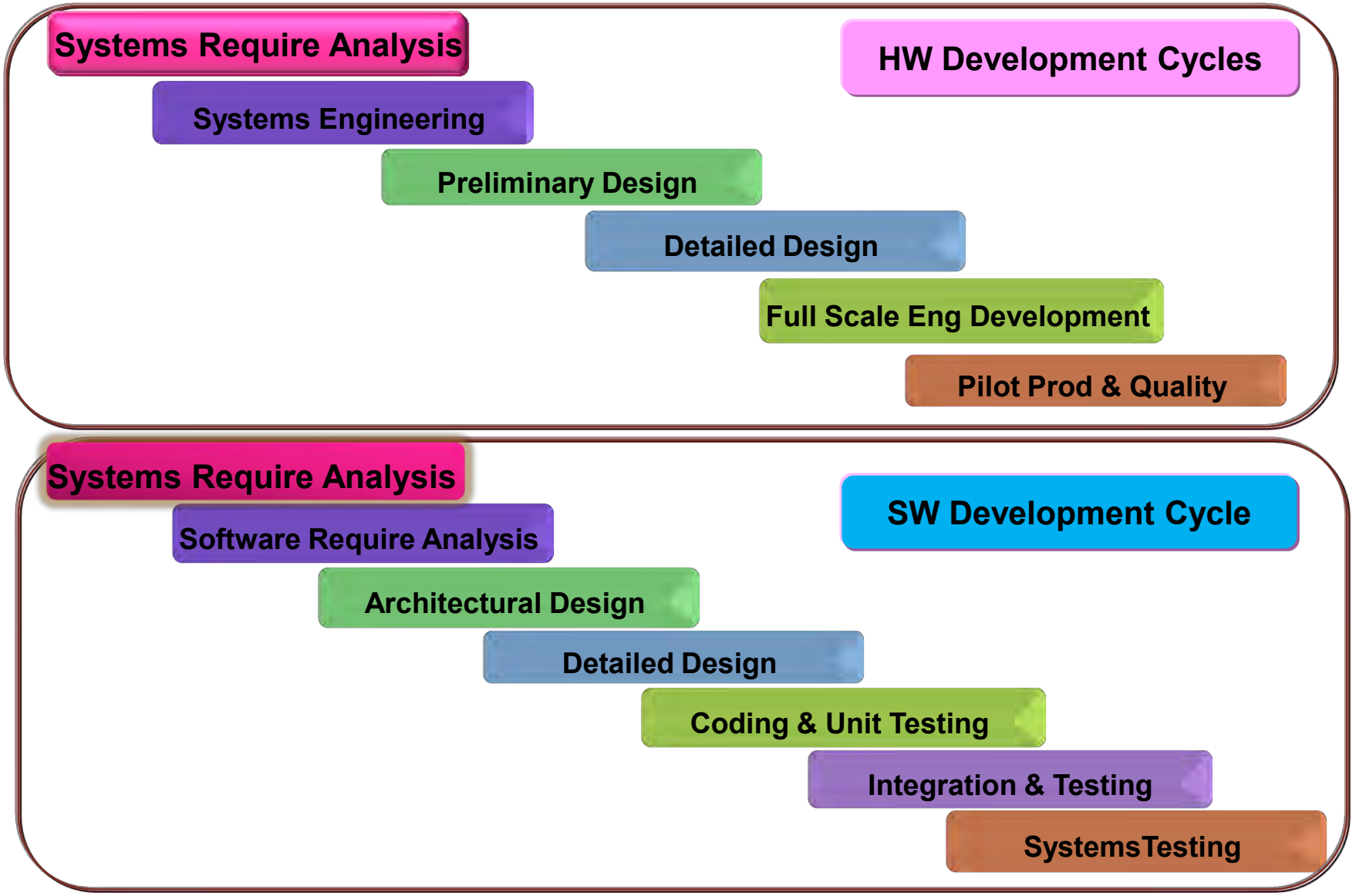


Systems Lifecycle

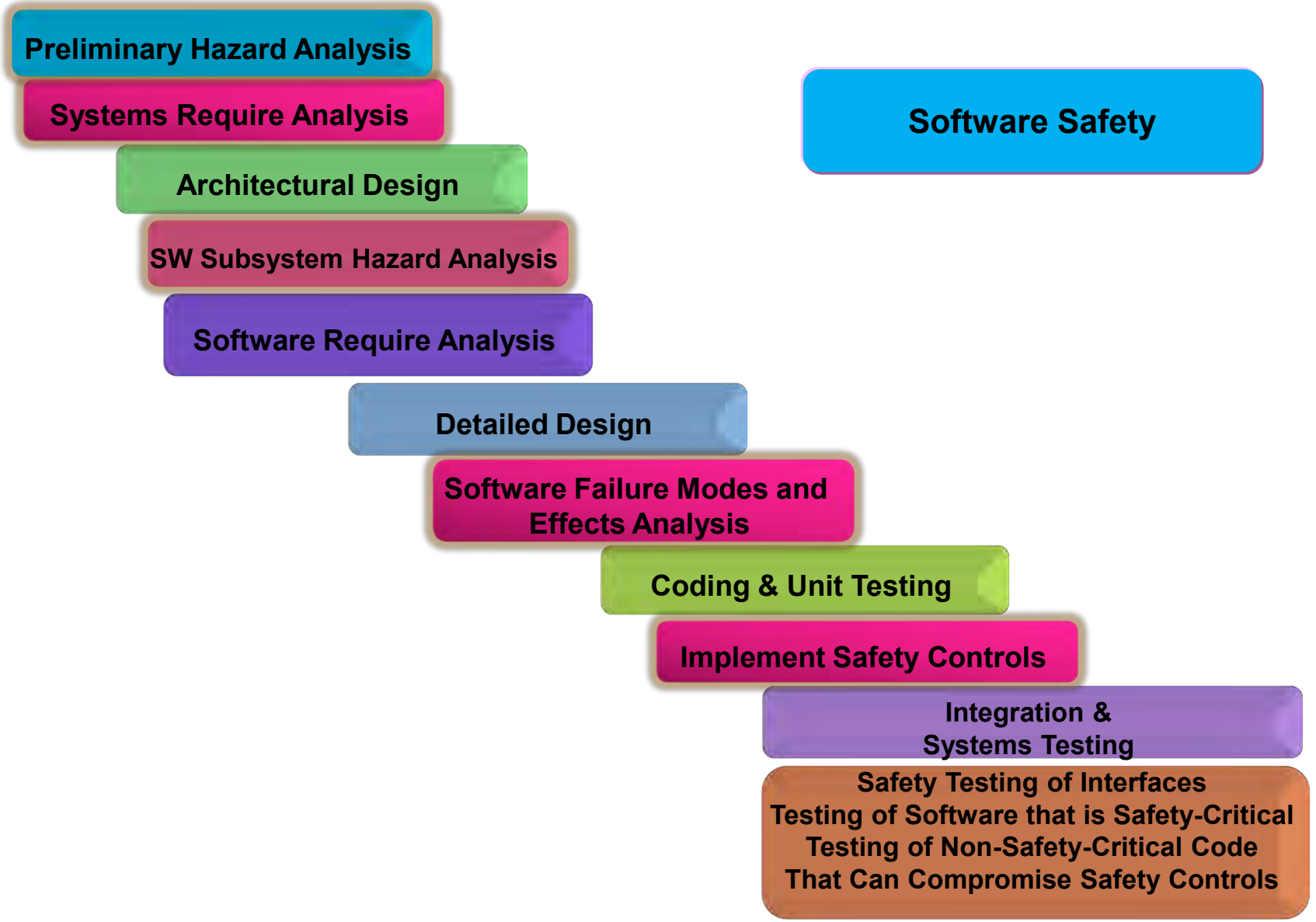
Software Cycle

Software Safety Lifecycle Overlay

Systems / Software Product Lifecycles



Software Safety Lifecycle Overlay



Safety Requirements and Analysis

The first step to any safety analyses is asking the right questions:

- What could go wrong?
- Why won't it?
- What if it did?

Everyone involved in each activity throughout the product lifecycle should think about all the ways the system or software can fail, how to prevent the failure from occurring and how to prevent or mitigate an accident if the failure occurred

Safety Requirements and Analysis - 2

In general there are two types of safety requirements:

- Imposed by standards and regulations
- Technically specific to the project and its operating environments

The most commonly used assessment tool used during this beginning activity is the Preliminary Hazard Analysis (PHA) as illustrated in the Software Safety Lifecycle Overlay

Preliminary Hazard Analysis (PHA)

Before any system with software can be analyzed or developed for use in hazardous operations or environments, a system PHA must be performed

The PHA is the first source of “specific” system safety requirements which may go to the level of pointing out the specific software safety requirements

When a system is decomposed into subsystems, how the software relates to each component must be considered

Software Subsystem Hazard Analysis

Software Subsystem Hazard Analysis determines which of the hazards including hazard causes, hazard controls, hazard mitigations, or hazard verifications have software as a component

Software may impact a hazard in a variety of ways:

- Software failure may lead to a hazard occurring (Hazard Cause)
  - A failure in a data conversation function could incorrectly report a temperature valve resulting in personal damage
- Failure of a Software Hazard May Allow a Hazard to Occur
  - Failure that monitors pressure and opens a valve when it reaches a threshold may be a hazard control
  - Failure of that software would allow an over-pressurization of the vessel and a potential for a rupture or other hazard

Software Subsystem Hazard Analysis - 2

- Software Safing Mode May Fail
  - Failure of the software to detect or shut down a runaway electromechanical device is an example of such an impact
- Software Used to Mitigate the Consequences of An Accident May Fail
  - Software controlling the purging of toxic gas may fail, allowing the gases to remain in the chamber or be vented inappropriately to the outside air
- Software Used to Verify Hazard Hardware or Software Hazard Controls May Fail
  - Failure in this situation would be due to invalid results
  - False positives may allow a potentially hazardous system to be put into operation

Software Safety Planning

If the Preliminary Hazard Analysis (PHA) reveals that any software is safety-critical, a software safety process must be initiated

Standard Participant's in a Successful Safety Process include:

- Project Manager
- Systems Engineers
- System Safety Engineers
- Software Safety Engineers
- Software Developers
- Software Quality Assurance
- Independent Verification & Validation

Standard Participants in a Successful Safety Process

Project Manager

- The Project Manager maintains a high-level overview of the whole process, works with the team to include the extra software development and analysis tasks in the schedule and budget, and can be called upon to help in negotiations between team members
- Ultimately, the Project Manager carries the responsibility for determining the amount and types of risk they are willing to accept for their project

Standard Participants in a Successful Safety Process - 2

Systems Engineers

- Systems Engineers are responsible for designing the system and partitioning the elements between hardware and software.
- Systems Engineers own the “big picture”
- Systems developers can make sure that safety-critical elements are not overlooked in the initial analysis
- Systems Engineers makes sure that “criticality” of the design component is transferred to software later in the design process

Standard Participants in a Successful Safety Process - 3

System Safety Engineers

- System Safety Engineers determine what components of the systems are hazardous
- They look at the system as a whole entity, but also try to understand how the different elements function or fail to function

Software Safety Engineers

- Software Safety Engineers build on the work of the system safety engineers
- They look closely at the requirements and development process to verify that software safety requirements are present and being designed in
- They perform analyses, and tests to verify the safety of the software

Standard Participants in a Successful Safety Process - 4

Software Developers

- Software Developers are the “in the trenches” engineers who design, code, and often test the system
- Software developers can have a great impact on the safety of the software by the design chosen and by implementing defensive programming techniques

Software Quality Assurance

- Software Quality Assurance engineers work with the software developers and software safety engineers to assure that safe software is created
- Software Quality Assurance monitors development processes, assures the traceability of all requirements, performs or reviews analyses, witnesses or performs tests, and provides an “outside” view of both the software process and products

Standard Participants in a Successful Safety Process - 5

Independent Verification & Validation

- For all safety critical projects, the Project Manager is required to perform a self assessment of the project software and report the findings
- IV&V may then perform their own review and present the Project Manager with their estimate for additional analyses
- IV&V is, in addition to Software Quality Assurance and Software Safety and not a replacement for those roles

Identifying Safety-Critical Software

Identifying Safety-Critical Software

Software that can cause a hazard if it malfunctions is considered safety-critical software

- Software which is required to recognize hazardous conditions
- Software which implements automatic safety control actions
- Software which provides a safety-critical service
- Software which inhibits a hazardous event

Complexity

Greater complexity of the software system increases the chances of errors

- Software complexity is increased as the number of safety related software requirements for hazards control increases
- Rough measures of complexity include the number of subsystems controlled by the software and the number of interfaces between:
  - Software to Software
  - Software to User
  - Software to Software Subsystems

Time Criticality

The speed at which a system with software hazard control must react is a major factor

- Does control need to be exercised faster than a human or mechanical system can react?

System and Software Concept Phase

Initial Planning of the Software Development Effort

During the System Concept phase, the software team should involved in the initial planning of the software development effort

Plans typically developed in the Concept Phase include:

- Software Project Plan / Software Management Plan
- Software Development Plan
- Software Quality Assurance Plan
- Software Configuration Management Plan
- Software Safety Plan
- Software Verification and Validation Plan
- Software Acquisition Plan

System Concept Phase Tasks

Software Engineering Tasks	System and Software Safety Tasks
Provide input to project concept and software concept documents	Create the Software Safety Plan, including planning and tailoring the safety effort.
Provide input to Software Safety Plan	Conduct Preliminary Hazard Analysis (PHA)
Plan the software management and development processes	Set up hazards tracking and problem resolution process
Plan the Configuration Management System	Prepare hazard verification matrix
Plan the verification and validation process	Review PHA for safety-critical software
Participate in “make or buy” decisions for software Review software acquisition	Participate in “make or buy” decisions for software Review software acquisition Develop safety-critical software tracking process Conduct Software Subsystem Hazard Analysis

Project / Software Conception Documentation

Document	Software Safety Section
Software Safety Plan	Include software as a subsystem. Identify tasks and personnel
Software Concepts Document	Identify safety-critical processes
Software Management Plan	Discuss coordination with systems safety tasks, flow-down incorporation of safety requirements and applicability to safety-critical software
Software Security Plan	Determine security of safety-critical software
Risk Management Plan	Identify software risks, especially those related to safety and reliability
Software Configuration Management Plan	Identification and handling of safety-critical components
Software Verification and Validation Plan	Discuss verification and validation of safety-critical components
Software Quality Assurance Plan	Identify quality assurance support to software safety function, verification of software safety requirements, and safety participation in software reviews and inspections

Project Management

Project Management

Project Management can be thought of as the establishment and maintenance of an environment that enables work to be performed efficiently and effectively

To effectively manage and control a project, the project leader must be able to:

- Identify the customer(s)
- Define and manage the requirements
- Understand the system that must be built
- Establish the necessary project roles
- Understand the project factors that must be managed
- Establish the project management lifecycle
- Choose a product lifecycle

Project Management - 2

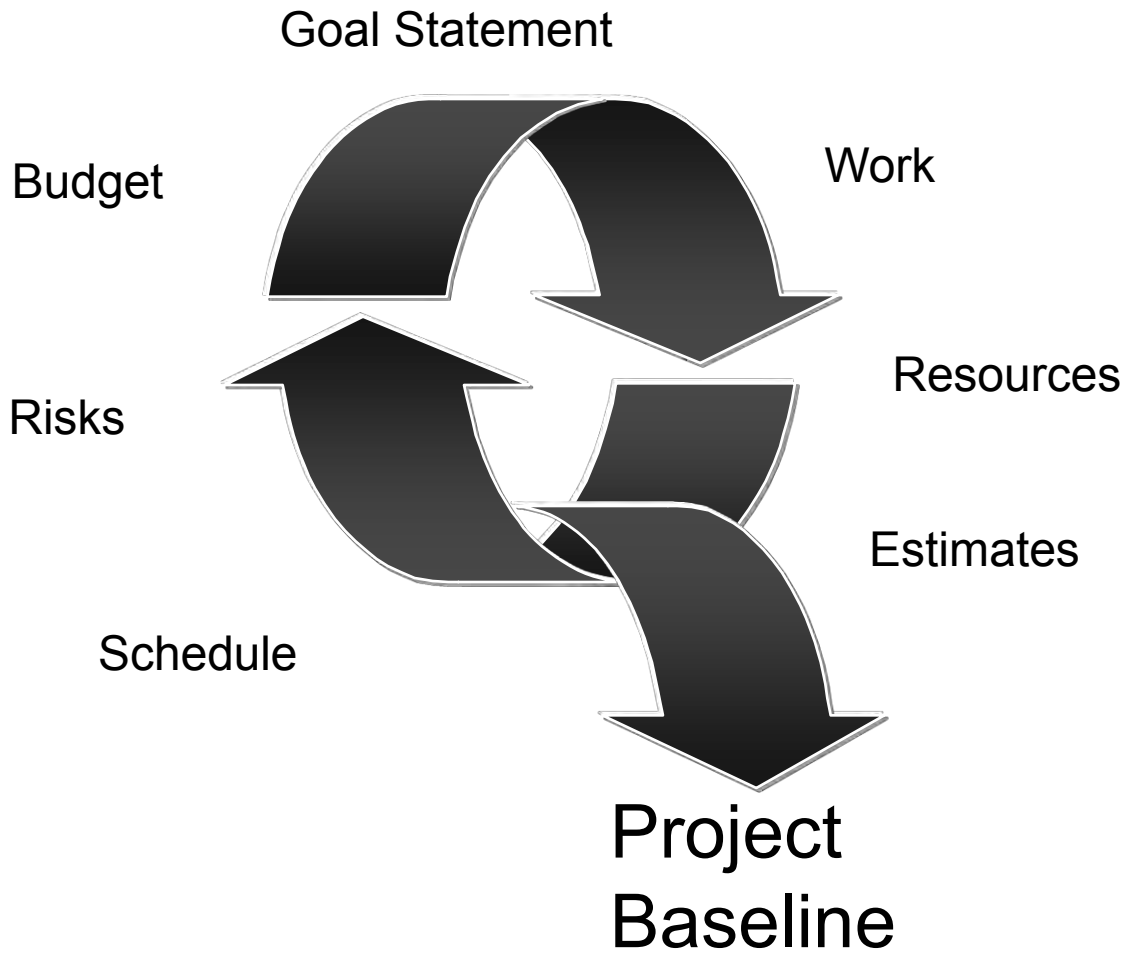
The purpose of project planning is to establish and maintain plans that define project activities and activities of other relevant stakeholders that affect the project and includes:

- Estimating
- Developing the project plan
- Interacting with the relevant stakeholders
- Resolving conflicts

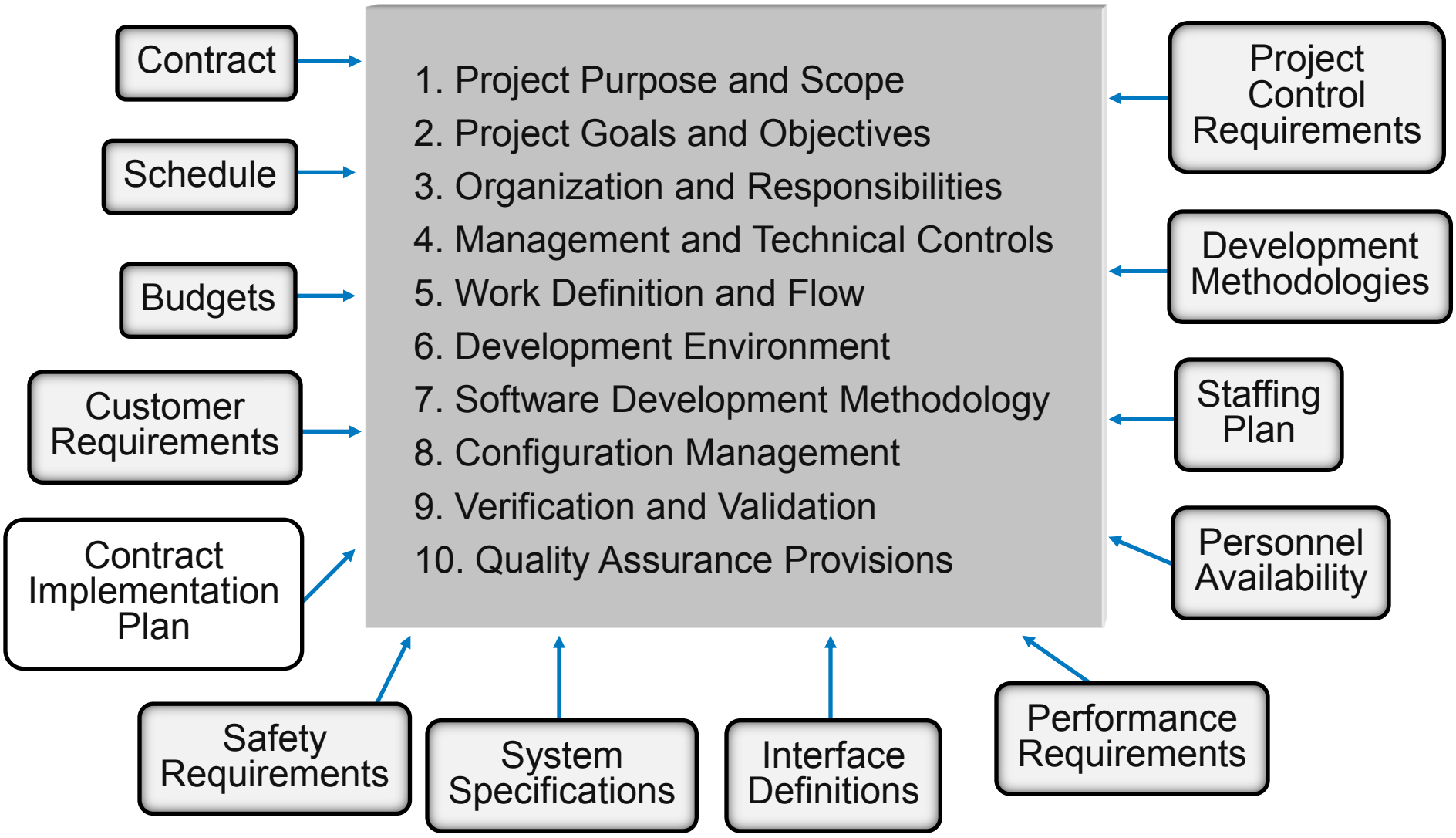
The project plan will need to be revised as the project progresses

- During the project's lifecycle it will become necessary to address changes in requirements, commitment changes, inaccurate estimates and assumptions, necessary corrective actions and process improvements

Iterative Nature of Planning



The Project Plan



Plans That Affect the Project

All plans that affect the project should be reviewed.
Candidate plans that affect project success include:

- Quality Assurance plans
- Configuration Management plans
- Risk Management strategy
- Integration strategy
- Verification strategy
- Validation strategy
- Product integration plans
- Software Safety plans
- Documentation plans
- Stakeholder involvement
- Knowledge and skills development

Risk Management

Risk Management

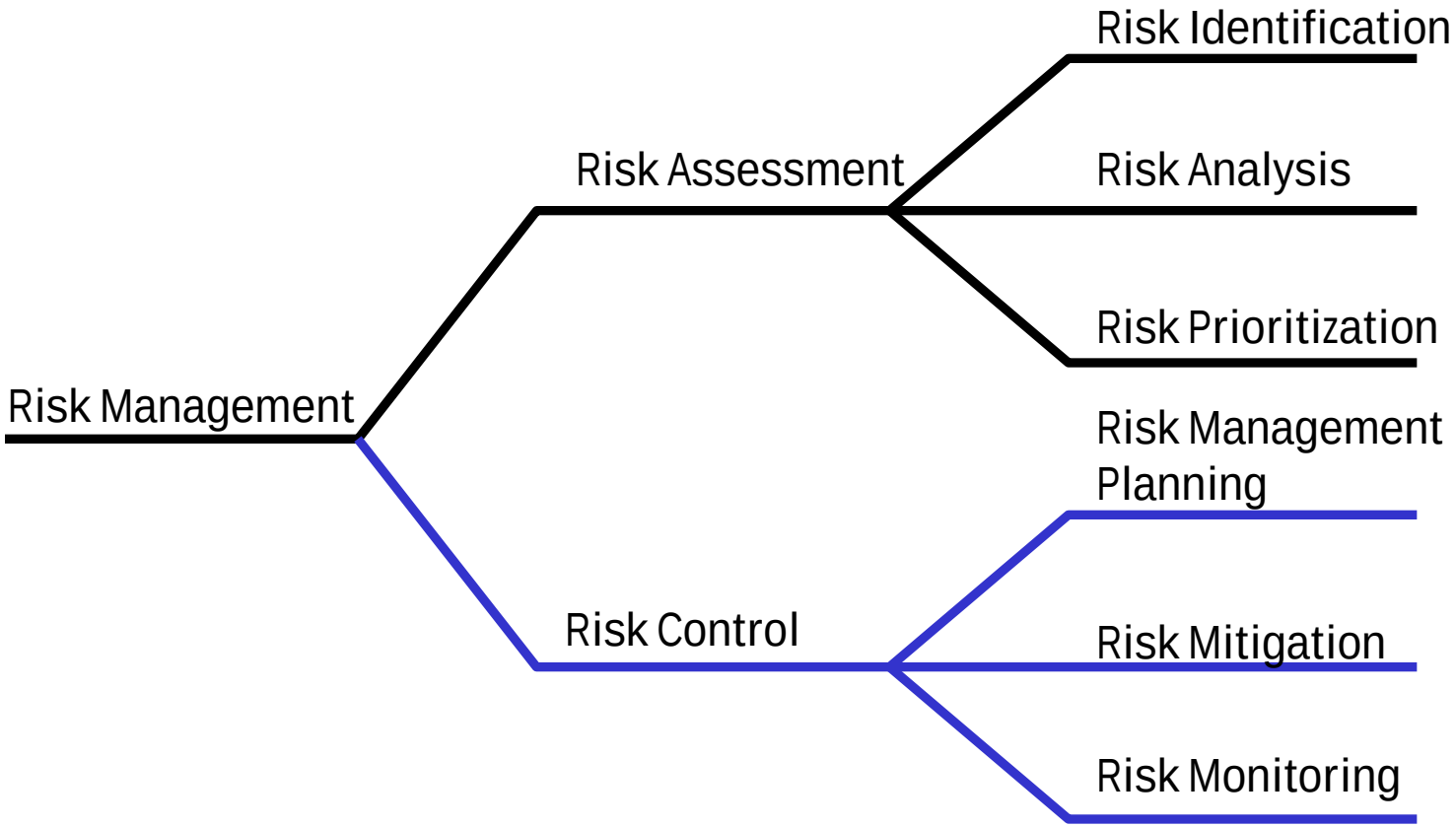
Risk management is a continuous, forward-looking process that is an important part of project management

Risk management should address issues that could endanger achievement of critical objectives

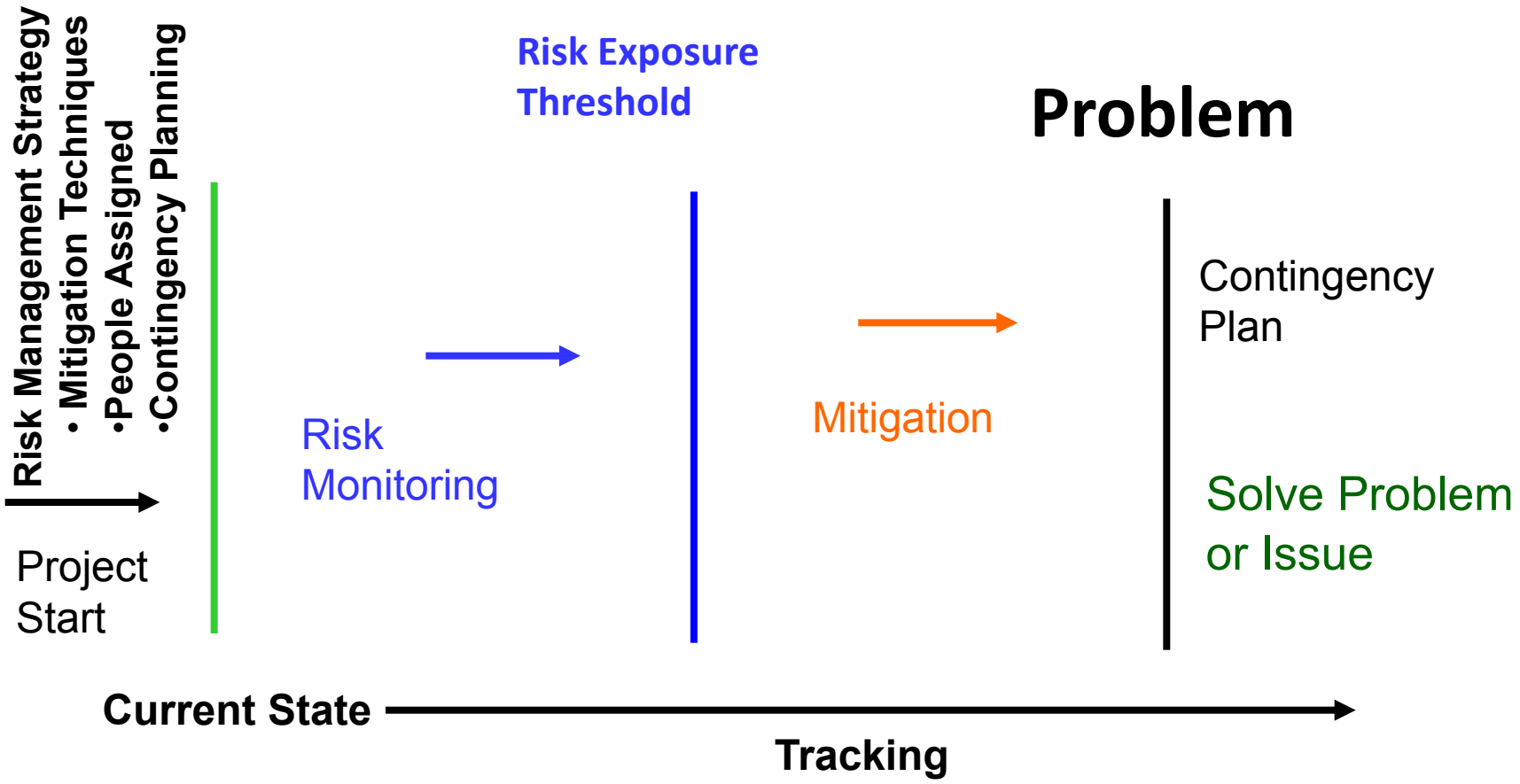
A continuous risk management approach effectively anticipates and mitigates risks that may have a critical impact on a project

- Enables project participants to share a future view of the project and business
- Adds to project members individually and collectively owning the project

Elements of Risk Management



Establishing Risk Thresholds



Hazards and Risks

Hazard analyses such as the PHA are not primarily concerned with whether the hazard is likely to occur or not

All Hazards are bad!

However without unlimited time and money the hazards must be prioritized!

Risk is the combination of:

- The probability that a program will experience an undesired event such as a safety mishap, compromise of security or system component failure
- The consequences, impact, or severity of the undesired event were it to occur

Hazards and Risks - 2

Each project or program needs to define a set of "hazard severity" levels

"Relative risk terms" may be used as long as they are accompanied by explanations or ranges of values that contribute to a common vocabulary among project and program members when discussing hazard severity levels

Combining these two concepts (severity and likelihood) leads to a single risk index value for the hazard

- ***Risk index for hazards is equivalent to risk priority for product development***

Hazard Severity Definitions

	**Catastrophic** Loss of human life or permanent disability; loss of entire systems of ground facility; severe environmental damage	**Critical** Severe injury or temporary disability; major system or environmental damage
	Moderate Minor injury; minor system damage	**Negligible** No injury or minor injury; some system stress, but no system damage

Likelihood of Occurrence Definitions

	**Likely** The event will occur frequently, such as greater than 1 out of 10 times	**Probable** The event will occur several times in the life of an item
	Possible Likely to occur sometime in the life of an item	**Unlikely** Remote possibly of occurrence during the life of an item
	Improbable Very rare, possibility is like winning the lottery	

Hazard Prioritization

Severity Levels	Likelihood of Occurrence				
	Likely	**Probable**	**Possible**	**Unlikely**	**Improbable**
Catastrophic	1	1	2	3	4
Critical	1	2	3	4	5
Moderate	2	3	4	5	6
Negligible	3	4	5	6	7

System Risk Index

System Risk Index	Class of Safety Activities Recommended
1	Not Applicable as is (Prohibited)
2	Full
3	Moderate
4,5	Minimum
6,7	None (Optional)

Requirements Engineering

Requirements

Requirements elicitation, analysis, review, traceability and management are key elements of a successful and safe software development process

Many of the costly and critical system failures that are attributed to software can ultimately be traced back to missing, incorrect, misunderstood, or incompatible requirements

Requirements - 2

Software requirements flow down from many sources including:

- System Requirements
- Safety and Security Standards
- Hazard and Risk Analyses
- System Constraints
- Customer Input
- Software Safety “Best Practices”

Requirements - 3

The software system must be evaluated to determine if any of it is safety-critical or has safety-critical characteristics.

- Top-down analyses such as Software Fault Tree Analysis are often used to identify safety-critical software
- Any safety-critical characteristics found during the requirements analysis should be written into the software and system requirements

Requirements - 4

Software Safety requirements are derived from the system and subsystem safety requirements which were developed to mitigate hazards identified in the Preliminary Hazard Analysis (PHA)

Software Safety requirements should be included in:

- Software Requirements Specification
- Software Interface Specification or Interface Control Document
- Requirements Traceability Matrix [See Diagrams on Traceability Below]

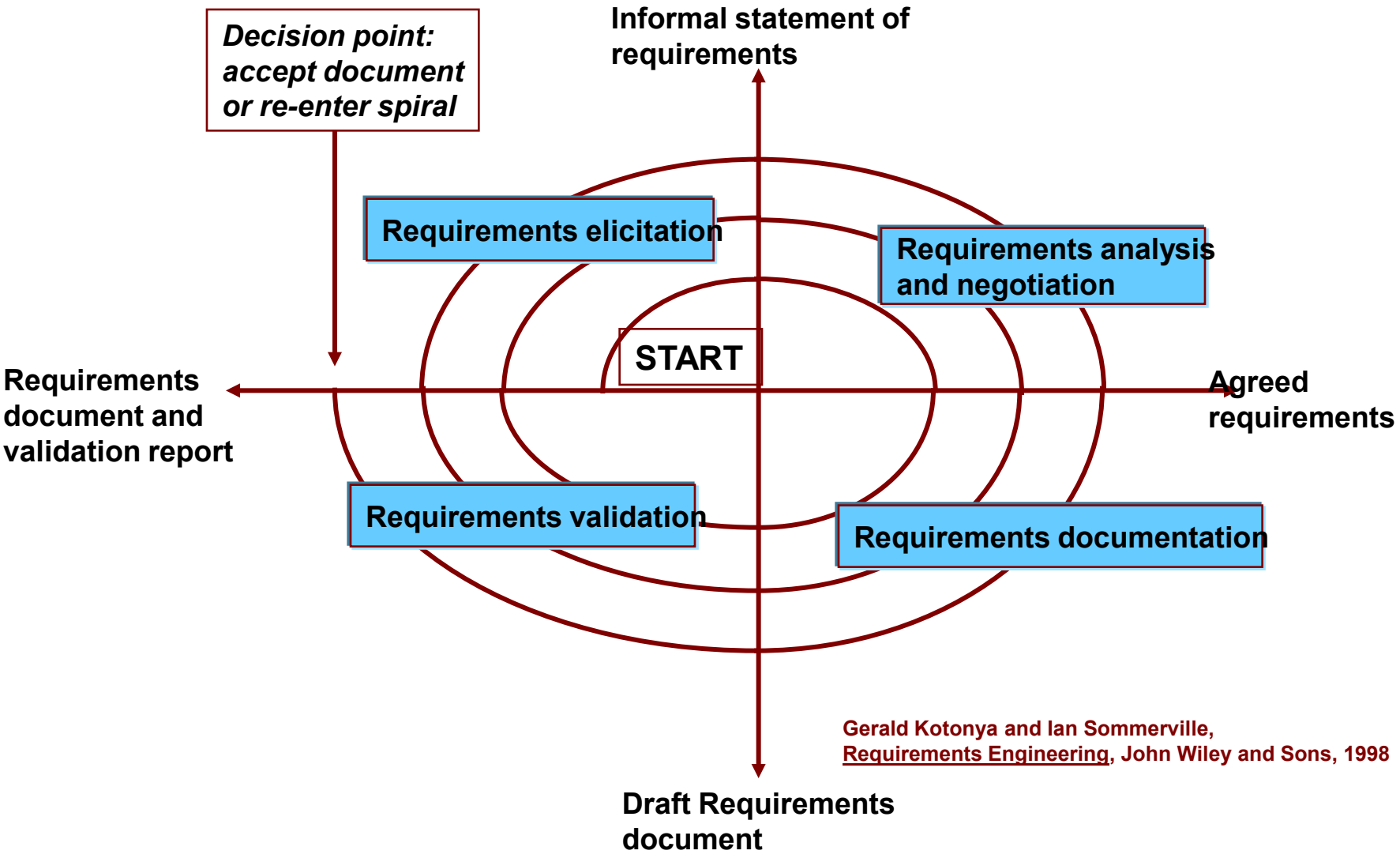
Early Phase Requirements Validation

Customer requirements should be **validated** early in the development schedule to **gain confidence** that the customer requirements are capable of guiding a development that results in the customer's operational needs being met

- Simulations
- Prototypes,
- Analyses
- Scenarios
- Storyboards

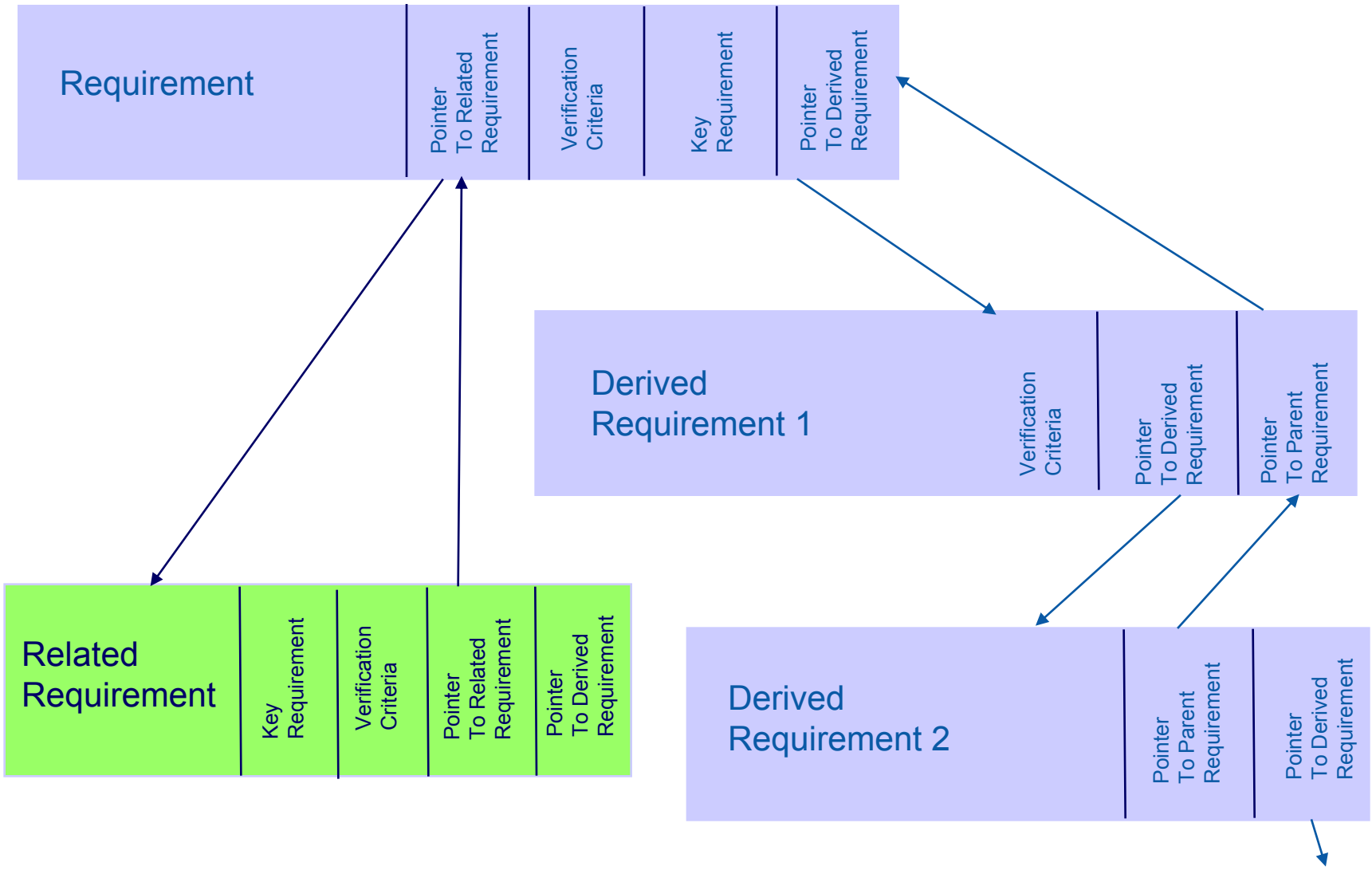
Validation of requirements acts as elicitation of requirements for the "next round"

Spiral Model of the Product Requirements Engineering Process

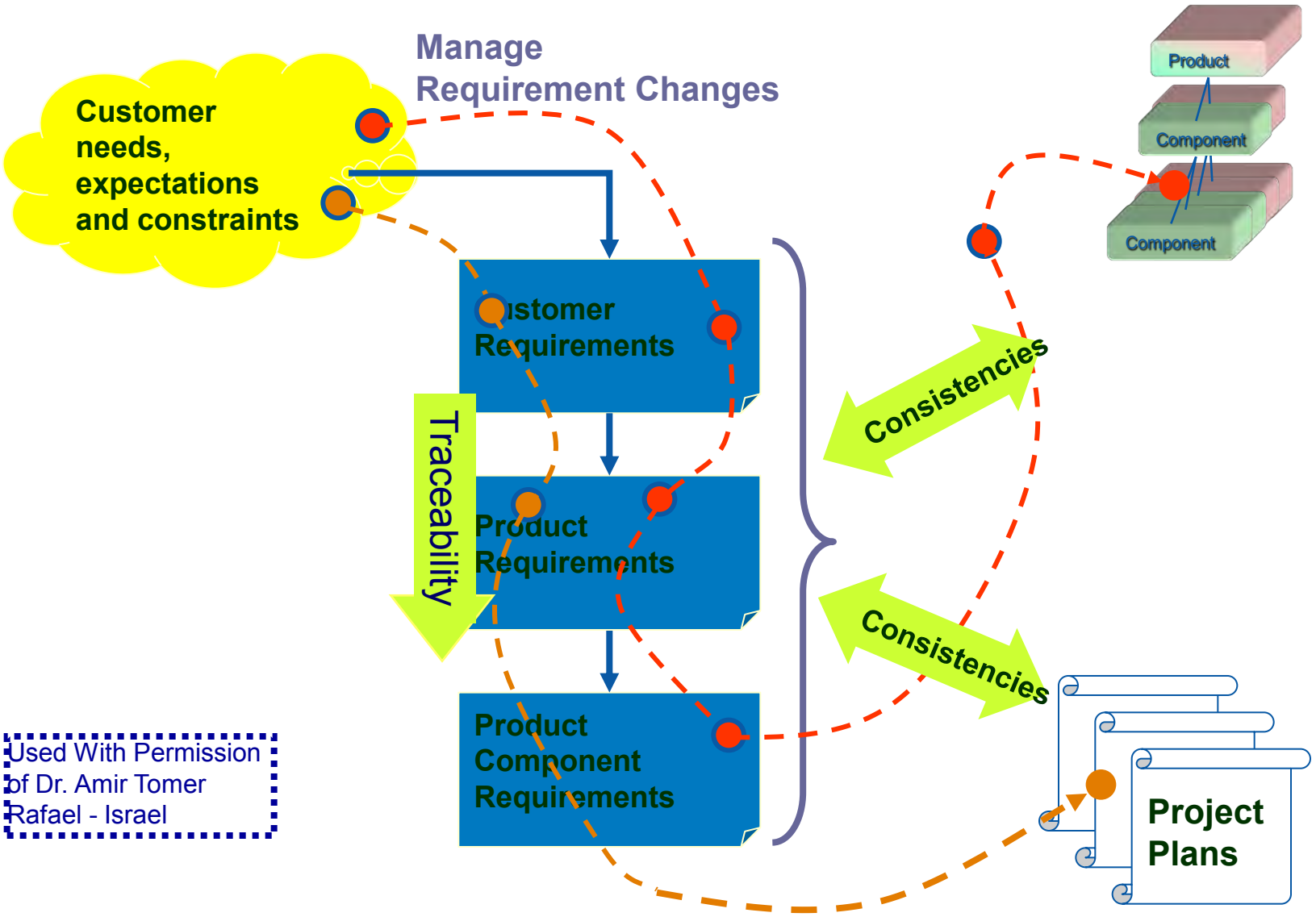


Gerald Kotonya and Ian Sommerville, Requirements Engineering, John Wiley and Sons, 1998

Bi-Directional Requirements Traceability

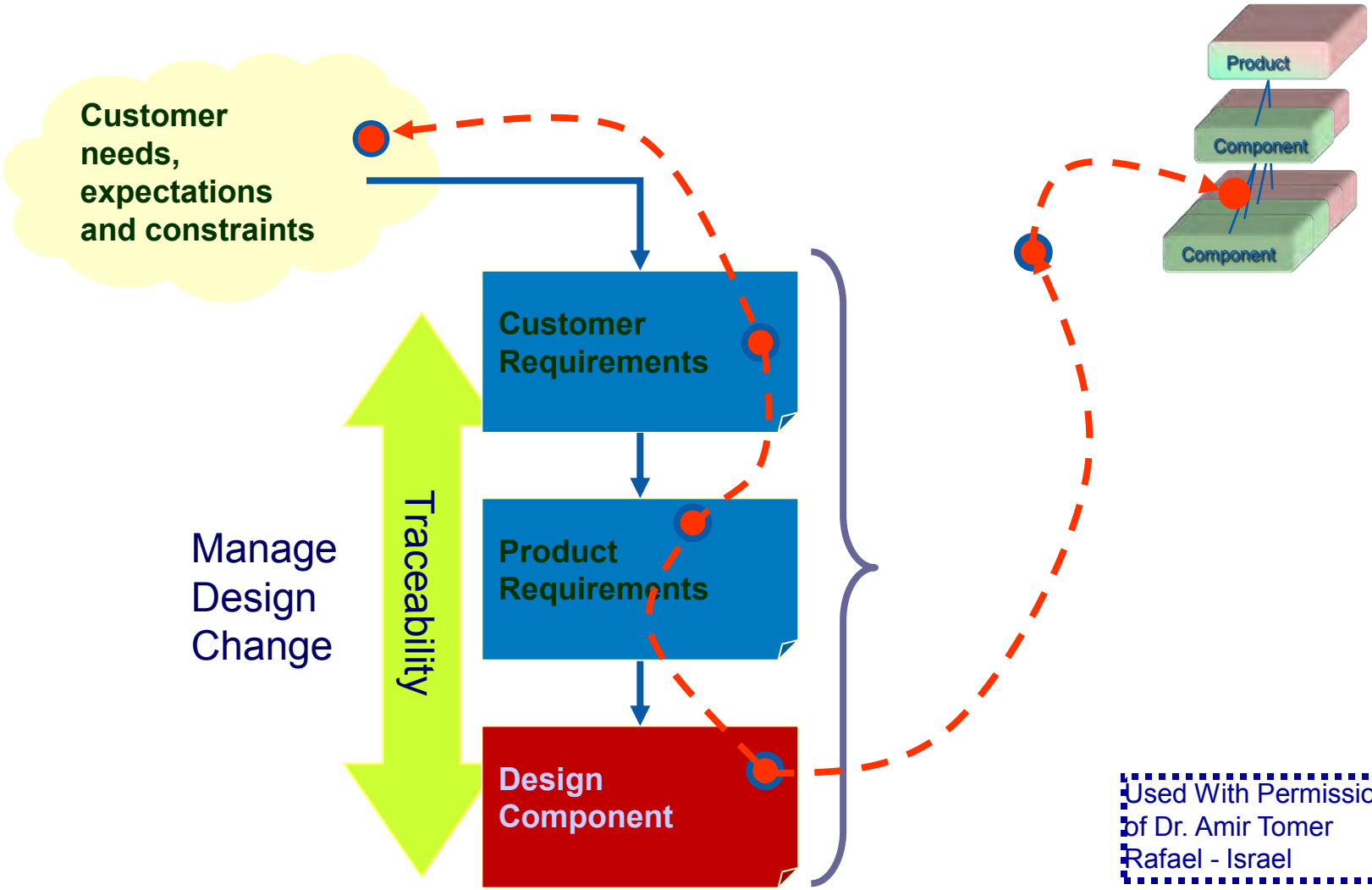


Requirement Traceability



Used With Permission of Dr. Amir Tomer Rafael - Israel

Bi-Directional Traceability



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Development of Software Safety Requirements

Development of Software Safety Requirements

Software safety requirements are obtained from various sources and are usually classified as generic or specific

Generic Software Safety Requirements – Generic software safety requirements are derived from sets of requirements and best practices used in different programs and environments to solve common software safety problems

- Capture lessons learned and provide a valuable resource for developers
- Prevent costly duplication of effort by taking advantage of existing proven techniques and lessons learned rather than reinventing techniques or repeating mistakes

Development of Software Safety Requirements - 2

Specific Software Safety Requirements – Specific software safety requirements are system-unique functional capabilities or constraints that are identified in the following ways:

- Method 1 – Through top-down analysis of system design requirements and specifications
- Method 2 – From the Preliminary Hazard Analysis (PHA)
- Method 3 – Through bottom-up analysis of design data (e.g., flow diagrams, Failure Mode Effects and Criticality Analysis (FMECA)

Fault and Failure Tolerance

A fault is an error that does not affect the functionality of the system

- Bad data
- Unknown command
- Command or data coming at an unknown time

A failure is the inability of a system or system component to perform its required functionality within specified performance requirements

Consequences of Failures and Faults

- A fault may or may not lead to a failure
- One or more faults can become a failure
- All failures are the result of one or more faults

Fault Tolerance - 2

Fault Tolerance (system failure) is the ability of the system to withstand an unwanted event and maintain a safe and operational condition

- It is determined by the number of faults that can occur in a system or subsystem without the occurrence of a failure

Software fault tolerance is usually concerned with detecting and recovering from small defects before they can become larger failures

- EXAMPLE: Error detection and handling is one example of fault-tolerant software coding practices

Hazardous Commands

A “Hazardous” command is one whose execution could lead to an identified critical or catastrophic hazard or a command whose execution can lead to reduced control of a hazard

Commands can be internal to a software set

- From one component to another
- External crossing an interface to/from hardware or a human operator
- Longer command paths increase the probability of an undesired or incorrect command response due to noise on the communication channel, link outages, equipment malfunctions or human error

Timing, Sizing, and Throughput Considerations

System design should consider real-world parameters and constraints including human operator and control system response times, and flow these down to software

- Adequate margins of capacity should be provided for all of these critical resources

Guidance for developers in specifying software requirements to meet safety objectives are provided here in overview fashion and discussed later in Software Safety Requirements Analysis

Timing, Sizing, and Throughput Considerations - 2

Time to Criticality – Safety-critical systems have a characteristic "time to criticality" which is the time interval between a fault occurring and the system reaching an unsafe state

- This interval represents a time window in which automatic or manual recovery and/or safing actions can be performed either by software, hardware, or by a human operator

Automatic Safing – Required if the time to criticality is shorter than the realistic human operator response time, or if there is no human in the loop

Timing, Sizing, and Throughput Considerations - 3

Control System Design – Control system design defines system timing requirements

- Computerized control systems use sampled data (versus continuous data)

Sampling Rates – Sampling rates should be selected with consideration for noise levels and expected variations of control system and physical parameters

- For measuring signals that are not critical, the sample rate should be at least twice the maximum expected signal frequency
- For critical signals and parameters used for a closed loop control, the sampling rate is normally much higher

Timing, Sizing, and Throughput Considerations - 4

Dynamic Memory Allocation – Whether a dynamic allocation will fail or succeed depends on

- How much actual memory is available
- Whether virtual memory is to be used
- How much memory the software programs and the operating system use statically
- How much memory is intended to be dynamically allocated

How the software will deal with failed dynamic allocation should be specified

- Allowing a default like “abort, retry, fail” is a very bad idea for safety-critical software

Formal Inspections of Software Requirements

An Inspection is a formal verification technique in which life-cycle work products are examined in detail by a group of peers for the explicit purpose of detecting and identifying defects

The process is led by a Moderator or Facilitator or Inspection Leader who is not the author and is impartial to the life-cycle work products under review

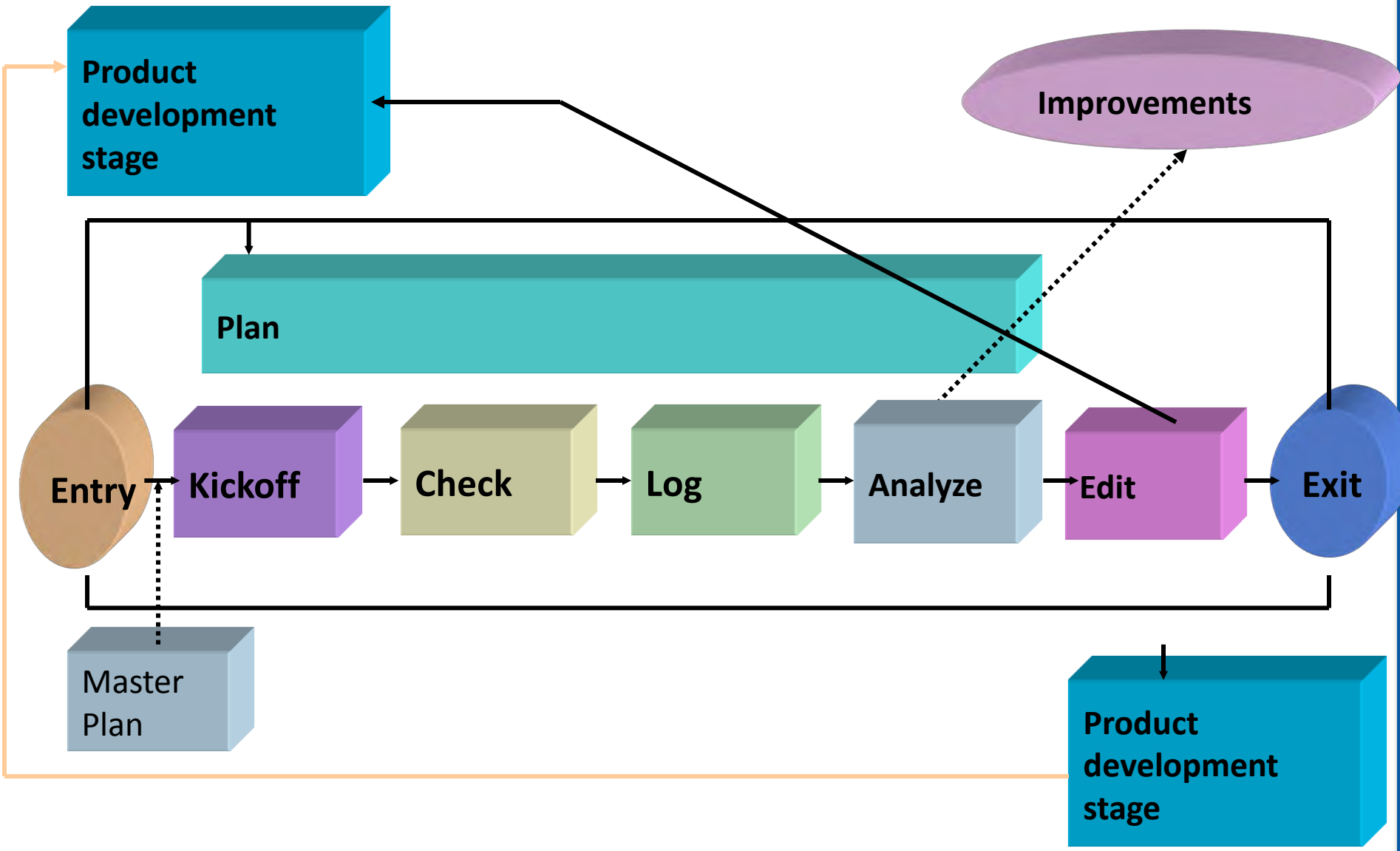
The author is not allowed to act as the Moderator

Defect resolution is mandatory and rework is formally verified

Defect data is systematically collected and stored in an inspection database

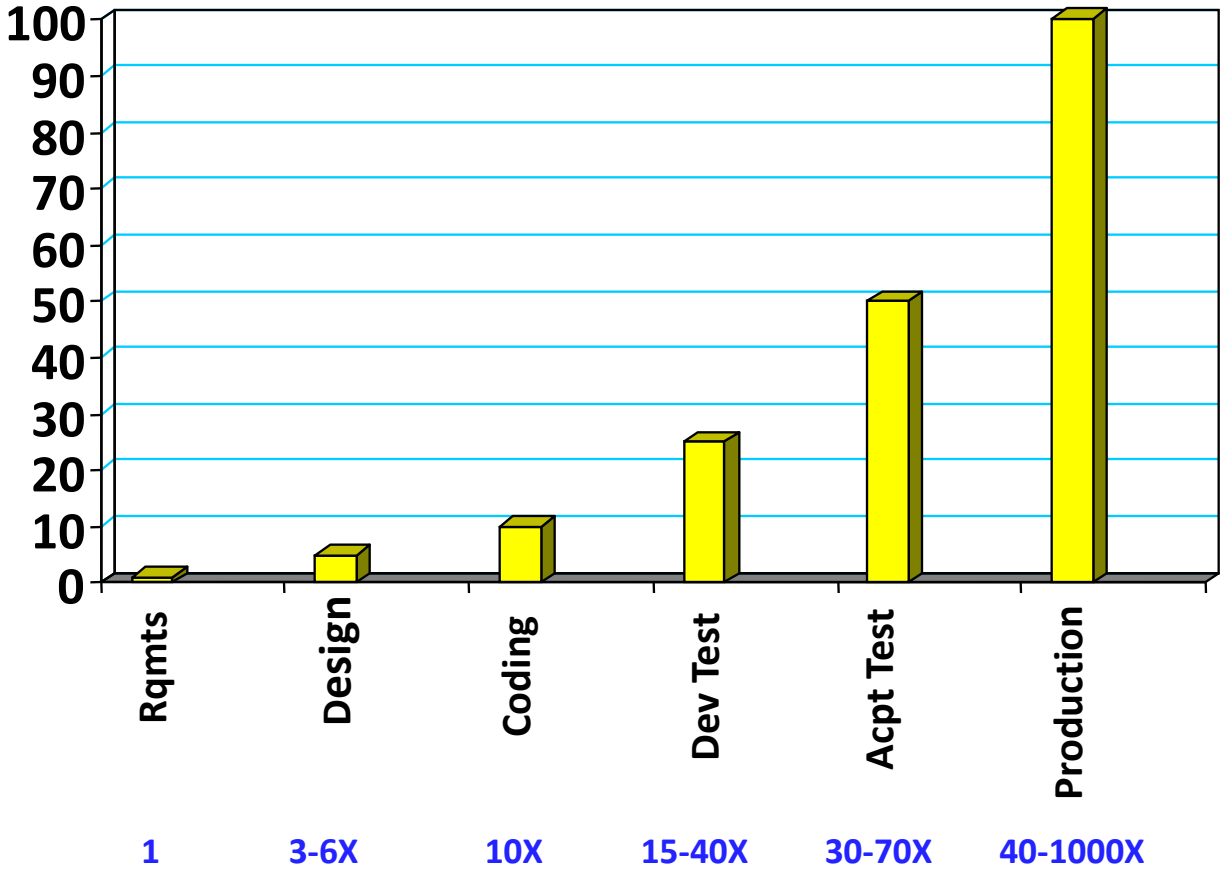
Data is analyzed to improve the product, the process and the effectiveness of the inspection

Steps in the Software Inspection Process



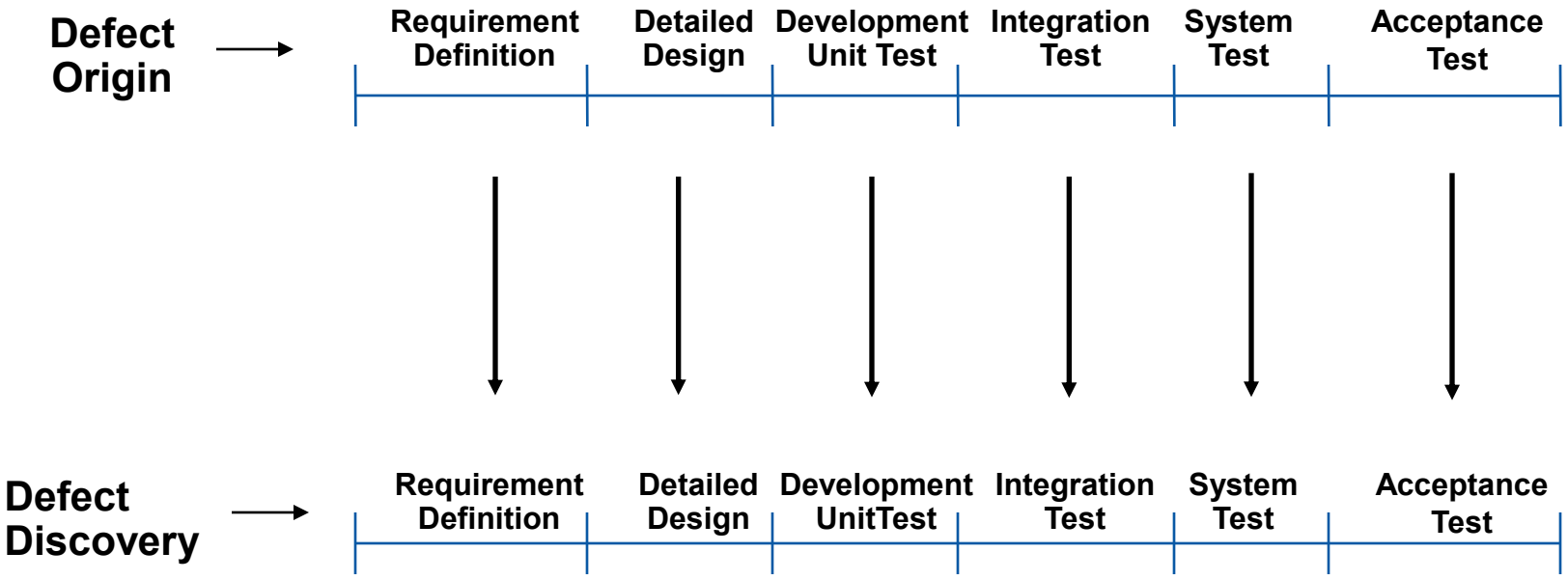
Why We Should Conduct Peer Reviews?

The sooner a defect is found, the cheaper it is to fix



Source: Boehm

What Is the Ultimate Objective?



Peer Reviews aim to minimize the number of defects being passed along from one segment to the next, by finding and fixing the defects in the segment in which they were created.

Test Planning

Safety tests of the system should also be designed at the time the systems tests are defined.

- System tests are designed to verify the functional aspects of the software under nominal conditions as well as performance, load, stress and other tests that verify acceptable behavior in non-standard situations
- Non-functional requirements such as the quality factors of reliability, maintainability, safety, security and usability should also be included in Systems Testing
- Safety tests should demonstrate how the software and system meets the safety requirements in the Software Requirements Document

Software Safety Requirements Analysis

Software Safety Requirements Analysis

The Requirements Analysis activities verify that safety requirements:

- Were properly flowed down from the system safety requirements
- Are correct, consistent, and complete
- Have covered all hazards, even new hazards such as software functions that can impact hazard controls and ways the software can behave that are unexpected
- These analysis activities are primarily top down analyses

Software Safety Requirements Analysis - 2

Bottom-up analysis of software requirements such as Requirements Criticality Analysis are performed to identify possible hazardous conditions

- Results in another iteration of the PHA or Software Subsystem Hazard Analysis
- May generate new software requirements

Software Safety Requirements Analysis - 3

Analyses related to the Software Requirements include:

- Software Safety Requirements Flow-down Analysis
- Requirements Criticality Analysis
- Specification Analysis
- Formal Methods
- Timing, Throughput and Sizing Analysis
- Preliminary Software Fault Tree Analysis
- Preliminary Software Failure Modes and Effects Analysis

Software Safety Requirements Flow-down Analysis

Generic safety requirements should be established “a priori” and placed into the system specification and overall project design specifications

- They then should be flowed into the subsystem specifications, such as the software subsystem requirements
- Top-down analysis

Other safety requirements are derived from bottom-up analysis

- They are flowed up from subsystems and components back to the system level requirements
- These new system level requirements are then flowed back down across all affected subsystems

Problems in the flow-down process can be caused by:

- Incomplete analysis
- Inconsistent analysis of highly complex systems
- Use of ad hoc techniques by inexperienced analysts

Requirements Criticality Analysis

Criticality analysis identifies program requirements that have safety implications

- Analyze the hazards of the software / hardware system and identify those that could present catastrophic or critical hazards
  - This evaluates each program requirement in terms of safety objectives derived for the software component
- For those requirements that have safety implications, designate the requirement as “safety-critical”
- Place the safety-critical requirement into a tracking system to ensure traceability of the software safety requirements throughout the software development cycle
  - From the highest level specification all the way to the code and test documentation

Requirements Criticality Analysis - 2

The System Safety organization should coordinate with the Project System Engineering organization to review and agree on the criticality designations

- Software Safety Engineers and Software Development Engineers should be included in the discussion
- The “software” viewpoint must be part of any systems engineering activity
- Requirements may be consolidated to reduce the number of critical requirements or flagged for special attention during design to reduce the criticality level
- It is always better to remove or reduce requirements later than to try to add them in when they did not exist before

Requirements Criticality Analysis - 3

Requirements Criticality Analysis Steps:

- Analyze all software requirements to identify additional potential system hazards that the system PHA did not reveal
- Use a checklist to identify PHA-designated hazards that are not reflected in the software requirements and new hazards missed by the PHA
- Look for areas where system requirements were not correctly flowed to the software
- Flow potential hazards added to the system requirements down to the subsystems (hardware, software and operations)
- Review the system requirements to identify hardware or software functions that receive, pass, or initiate critical signals or hazardous commands

Requirements Criticality Analysis - 4

- Review the software requirements to verify that the functions from the system requirements are included
- Look for any new software functions or objects that receive/pass/initiate critical signals or hazardous commands
- Look through the software requirements for conditions that may lead to unsafe situations
  - Out of sequence
  - Wrong event
  - Inappropriate magnitude
  - Incorrect polarity
  - Inadvertent command
  - Adverse environment
  - Deadlocking
  - Failure-to-command modes

Requirements Criticality Analysis - 5

Software safety analysis must also examine the characteristics of the software system

- All characteristics of safety-critical software must be evaluated to determine if they are safety-critical [See list of characteristics – next slide]
- Safety-critical characteristics should be controlled by requirements that receive rigorous quality control in conjunction with rigorous analysis and test

Requirements Criticality Analysis - 6

Safety-critical characteristics to be considered include:

- Specific limit ranges
- Out of sequence event protection requirements
- Timing
- Relationship to logic for limits (EXAMPLE: Temperature may be more constrained during an experiment run than when the system is idle)
- Voting logic
- Hazardous command processing requirements
- Fault response
- Fault detection, isolation, and recovery
- Redundancy management / switchover logic
  - What components to switch, and under what circumstances

Requirements Criticality Analysis - 7

Resources that serve as input to Requirements Criticality Analysis

- Software Development Plan
- Software Quality Assurance Plan
- Software Configuration Management Plan
- Risk Management Plan
- System Requirements
- System Design Document
- Software Requirements Specification
- External Interface Specification
- Functional Flow Diagrams
- Information from the system PHA on hazardous sources that may be controlled directly or indirectly by software

Specification Analysis

Specification analysis evaluates the completeness, correctness, consistency, and testability of software requirements.

- Well-defined requirements are strong standards by which to evaluate a software component

Specification analysis should evaluate requirements individually and as an integrated set.

Techniques to perform specification analysis include:

- Reading Analysis
- Traceability Analysis
- Control-flow Analysis
- Information-flow Analysis
- Functional Simulation

Specification Analysis - 2

The Safety Organization should ensure the software requirements appropriately influence the software design and the development of the operator, user, and diagnostic manuals.

The Safety Representative normally reviews:

- System Specification
- Software Requirements Specification
- Interface Requirements Specification
- Functional Flow Diagrams
- Storage allocation and program structure documents
- Information concerning system energy and other hazardous event sources that may be controlled directly or indirectly by software
- Software Development Plan, Software Configuration Management Plan, Software Quality Assurance Plan and Historical Data

Formal Methods

Formal methods represents the process of writing the requirements (specification) in a formal, mathematical language

- Even if Formal Verification is not used to verify the specifications, the act of creating a Formal Specification often catches many errors

Formal Specification removes ambiguity and uncertainty

- It allows errors or omission to be discovered including undocumented assumptions and inadequate off-nominal behavior
- Conflicting requirements and logic errors are also uncovered
- Defects found and corrected early in the lifecycle are much less costly to fix

Formal Methods - 2

"Model Checking" is a form of Formal Methods that verifies finite-state systems

- Model Checking is now used by many projects as an analysis and verification technique
- Model Checking is especially oriented at the verification of reactive, embedded systems or systems that are in constant interaction with the environment
- Model Checking can be easily applied at any stage of the existing software process without causing major disruptions

Timing, Throughput and Sizing Analysis

Timing, throughput, and sizing analysis for safety-critical functions evaluates software requirements that relate to execution time, I/O data rates and memory/storage allocations

- The analysis focuses on program constraints

Typical constraints include:

- Maximum execution time
- Maximum memory usage
- Maximum storage size for programs
- I/O data rates the program must support

The Safety Organization should evaluate the adequacy and feasibility of safety-critical timing, throughput, and sizing requirements

- I/O Channels may be overloaded by many error messages, preventing safety-critical features from operating

Timing, Throughput and Sizing Analysis - 2

Factors to consider for quantifying timing/sizing resource requirements:

- Memory Usage Versus Availability
  - Dynamic Memory Allocation – Can lead to problems from not freeing allocated memory, freeing memory twice or buffer overruns that overwrite code or other data areas
  - When data structures are dynamically allocated, they often cannot be statically analyzed to verify that arrays, strings, etc., do not go past the physical end of the structure

Timing, Throughput and Sizing Analysis - 3

- I/O Channel Usage (Load) Versus Capacity and Availability
  - Look at the amount of input data (science data, housekeeping data, control sensors) and the amount of output data (communications) generated
  - I/O Channel should include:
    - Internal hardware (sensors),
    - Interprocess communications (messages)
    - External communications (data output, command, and telemetry interfaces)

Timing, Throughput and Sizing Analysis - 4

- Execution Times Versus CPU Load and Availability
  - Investigate the time variations of CPU load and determine the circumstances that generate peak load
  - Is the execution under high load conditions acceptable?
  - Consider the timing effects from multitasking
    - Message passing delays
    - Inability to access a needed resources because another task has it
    - Excessive multitasking can result in a system instability leading to “crashes”

Timing, Throughput and Sizing Analysis - 5

- Sampling Rates Versus Rates of Change of Physical Parameters
  - Analysis should address the validity of the system performance models used, together with simulation and test data
- Program Storage Space Versus Executable Code Size
  - Estimate the size of the executable software in the device it is stored in
  - The program size includes the operating system as well as the application software

Timing, Throughput and Sizing Analysis - 6

- Amount of Data to Store Versus Available Capacity
  - Consider how much science, housekeeping, or other data will be generated and the amount of storage space available
  - Under some conditions, being unable to save data or overwriting previous data could be a safety related problem

Software Fault Tree Analysis

It is possible for a system to meet requirements for a correct state and still be unsafe

- Complex systems increase the chance that unsafe modes will not be caught until the system is in the field
- Fault Tree Analysis (FTA) is one method that focuses on how errors can lead to hazards
- Software Fault Tree Analysis (SFTA) is an extension of the hardware FTA into the software arena
- The requirements phase is the time to perform a preliminary SFTA
  - The Preliminary Hazard Analysis or Software Subsystem Hazard Analysis is the primary source for hazards along with the Requirements Criticality Analysis
- The result of a fault tree analysis is a list of contributing causes (e.g., states or events) that can lead to a hazard

Software Fault Tree Analysis - 2

Software Fault Tree Analysis (SFTA) works well in combination with the Software Failure Modes and Effects Analysis (SFMEA)

- The SFTA is top-down working from the hazard to possible causes
- The SFMEA starts with individual components and works from the bottom (component) up to a hazard
- When used together, these two analyses are very good at finding all of the possible failure modes or areas of concern

Software Failure Modes and Effects Analysis

Failure Modes and Effects Analysis is a bottom-up technique that looks at:

- How each component could fail
- How the failure propagates through the system
- Whether it can lead to a hazard or not
- A detailed design is required for an effective FMEA to be conducted

Software Failure Modes and Effects Analysis (SFMEA) uses the methods of a standard (hardware) FMEA, substituting software components for hardware components in each case

Software Failure Modes and Effects Analysis - 2

There are several types of FMEAs:

- System – focuses on global system functions
- Design – focuses on components and subsystems
- Process – focuses on manufacturing and assembly processes
- Service – focuses on service functions
- Software – focuses on software functions

Software Failure Modes and Effects Analysis - 3

Benefits of FMEA

- Provide the engineer with a tool that can assist in providing reliable, safe, and customer pleasing products and processes
- Improve product/process reliability and quality
- Increase customer satisfaction
- Early identification and elimination of potential product/process failure modes
- Prioritize product/process deficiencies
- Capture engineering/organization knowledge
- Emphasizes problem prevention
- Documents risk and actions taken to reduce risk
- Provide focus for improved testing and development
- Minimizes late changes and associated cost
- Catalyst for teamwork and idea exchange between functions

Software Failure Modes and Effects Analysis - 4

FMEA Procedure – Overview

- 1. Describe the product/process and its function - It is important to consider both intentional and unintentional uses since product failure often ends in litigation, which can be costly and time consuming.
- 2. Create a Block Diagram of the product or process - The diagram shows the logical relationships of components and establishes a structure around which the FMEA can be developed
- 3. Complete the header on the FMEA Form worksheet. (See Example)
- 4. Use the worksheet to begin listing items or functions

EXAMPLE FMEA - Spreadsheet

Part/Product Name and No.:
Process Name:
Other Areas Involved:

Part/Product Owner:
Process Owner:

Prepared By:
FMEA Date (Orig.): (Rev.):

Item/ Function	Potential Failure Mode	Potential Failure Effects	SEV	Potential Causes	OCC	Current Design Controls	DET	RPN	Recommended Actions	Actions or Plans	pS	pO	pD	pRPN

Software Failure Modes and Effects Analysis - 5

- 5. Identify Failure Modes – A failure mode is defined as the manner in which a component, subsystem, system, process, etc. could potentially fail to meet the design intent. Examples of potential failures modes include:
  - Corrosion
  - Hydrogen embrittlement
  - Electrical Short or Open
  - Torque Fatigue
  - Deformation
  - Cracking
- 6. List failure modes for function of each component or process step – a failure mode in one component can serve as the cause of a failure mode in another component

Software Failure Modes and Effects Analysis - 6

- 7. Describe the effects of those failure modes – A failure effect is defined as the result of a failure mode on the function of the product/process as perceived by the customer. Examples of failure effects include:
  - Injury to the user
  - Inoperability of the product or process
  - Improper appearance of the product or process
  - Odors
  - Degraded performance
  - Noise

Software Failure Modes and Effects Analysis - 7

- 8. Identify the causes for each failure mode – A failure cause is defined as a design weakness that may result in a failure. Examples of potential causes include:
  - Improper torque applied
  - Improper operating conditions
  - Contamination
  - Erroneous algorithms
  - Improper alignment
  - Excessive loading
  - Excessive voltage

Software Failure Modes and Effects Analysis - 8

- 9. Enter the Probability Factor – A numerical weight should be assigned to each cause that indicates how likely that cause is to occur

- 10. Identify Current Controls (design or process) – Current controls (design or process) are the mechanisms that prevent the cause of the failure mode from occurring or which detect the failure before it reaches the customer.
  - Controls should be assessed to determine how well it is expected to identify or detect failure modes
  - Previously undetected or unidentified failure modes should be used to update the FMEA

Software Failure Modes and Effects Analysis - 9

- 11. Determine the likelihood of Detection – Detection is an assessment of the likelihood that the Current Controls will detect the Cause of the Failure Mode or the Failure Mode itself thus preventing it from reaching the Customer

- 12. Review Risk Priority Numbers – The Risk Priority Number is a mathematical product – RPN = (Severity) x (Probability) x (Detection)

Software Failure Modes and Effects Analysis - 10

- 13. Determine Recommended Actions to address potential failures that have a high RPN – These actions could include:
  - Specific inspection, testing, or quality procedures
  - Selection of different components or materials
  - Limiting environmental stresses or operating range
  - Re-design of the item to avoid the failure mode
  - Performing preventative maintenance
  - Inclusion of back-up systems or redundancy
- 14. Assign Responsibility and a Target Completion Date for these actions – Make responsibility clear cut!

Software Failure Modes and Effects Analysis - 11

- 15. Indicate Actions Taken – After the actions have been taken, re-assess the severity, probability and detection and review the revised RPNs
  - Are further actions needed?

- 16. Update the FMEA as the design or process changes

Software Requirements Tasks

Software Engineering Tasks	System and Software Safety Tasks
Software Requirements Development	Development of software safety-critical requirements
Requirements Management	Safety Requirements Flow-down Analysis
Formal Methods for Specification	Requirements Criticality Analysis
Formal Inspection of Software Requirements	Specification Analysis of Safety-Critical Requirements
System Test Planning	Software Fault Tree Analysis
Timing, Throughput and Sizing Considerations	Software Failure Modes and Effects Analysis Formal Inspections of Software Requirements

Software Requirements Documentation

Document	Software Safety Section
Software Requirements Document	Identification of all safety-critical software requirements
Software Interface Specification	Identification of any interfaces that are part of safety-critical elements
Formal Inspection of Software Requirements	Identification of any safety-critical requirements defects that are considered major (must be fixed)
Requirements Traceability Matrix	Special identification given to safety-critical requirements
Analysis Reports	Identification of any safety-related aspects or safety concerns
Acceptance Test Plan	This is the customer acceptance test. Includes all safety testing necessary to assure the customers that the system is safe
Systems Test Plan	Includes stress, load, disaster, stability, and other tests including functional testing. Verifies that the system cannot go into an unsafe mode under adverse conditions

Software Configuration Management and Software Quality Assurance

Software Configuration Management

Software Configuration Management (SCM) is a critical Project Management support function

- One cannot product “safe” software without software configuration management
- The system or system component cannot be declared “quality” if there is no control over the pieces that have been developed
- SCM is a process to maintain and monitor the software development process

Software Configuration Management - 2

Software Configuration Management includes:

- Identification
  - Identifying the structure and kinds of components
  - Making them unique and accessible in some form by giving each component a name, version identification and configuration identification
- Control
  - Controlling the release of a product and changes to it throughout the project/product lifecycle by having controls in place that ensure consistent software via the creation of a baseline product

Software Configuration Management - 3

- Status Accounting
  - Recording and reporting the status of components and change requests
  - Gathering vital statistics about components in the product
- Configuration Auditing
  - Validating the completeness of a product
  - Maintaining consistency among the components by ensuring that the components are reviewed for possible change when the requirements they are associated with are changed

Software Configuration Management - 4

- ***Change Control***
  - Change control is an important part of developing safe software
  - Arbitrary changes should be avoided
  - Once a piece of software has reached a level of maturity, any subsequent change request should go through a formal change control process
  - Changes to the lifecycle work products, especially the code should be accompanied by comments that indicate
    - Why the change occurred
    - What was changed
    - When it was changed
    - Who changed it

Software Configuration Management - 5

- ***Defect Tracking***
  - Record all the defects for future reference
  - Having defect information from previous projects can be a big plus when debugging the next project
  - Recording the defects allows metrics to be determined
    - One of the easiest ways to judge whether a program is ready for serious safety testing is to measure its defect density, the number of defects per line of code

Software Quality Assurance

Software Quality Assurance should begin in the early phases of a project to establish plans, processes, standards, and procedures that will:

- Add value to the project
- Satisfy the requirements of the project and organizational policies

SQA Representatives should participate in the establishment of those plans, processes, standards, and procedures to ensure they will fit or can be tailored to fit the project's needs and that they will be usable for performing quality assurance evaluations

SQA Representatives provides project staff and managers at all levels with appropriate visibility into, and feedback on, processes and associated work products throughout the life of the project

Software Quality Control vs. Software Quality Assurance

Quality Control evaluates the products

- Checks to see if the requirements for the product or product components are satisfied (Verification)
- Checks the quality of the product(s)
  - Is the product within tolerance?
  - Is the product (or life-cycle work product) of an acceptable quality?
- Tools and Techniques
  - reviews
  - tests
  - inspections

Software Quality Control vs. Software Quality Assurance - 2

Quality Assurance evaluates the process

- Checks that the process is working
  - Is the process being followed?
  - Are the QC checks being applied?
  - Are the QC checks efficient?
  - Is the process causing quality problems?
  - Is the process working for the organization?
- Tools and Techniques
  - Audits / Objective Evaluations
  - Assessments / Appraisals

Software Quality Reports to Management

Software Quality Reporting should include comments about the processes, standards, etc., to the following questions:

- Are they efficient?
- Are they effective?
- Does following these processes result in the necessary product quality?
- If Software Safety is required, the quality report must indicate if the processes are being followed and are adequate to produce “safe software”

Quality reports are sent to Higher-level Management for their analysis and action

Safety as a Quality Factor

Concepts Taken from "Common Concepts Underlying Safety, Security, and Survivability Engineering"

Donald G. Firesmith

December 2003
CMU/SEI-2003-TN-033

Analysis of Software Intensive Systems

Software-intensive systems are commonplace, and society relies heavily upon them

- Software is found in automobiles, airplanes, chemical factories, power stations and other mission critical systems
- Software-intensive systems are neither perfect nor invulnerable
  - They fail due to software defects, hardware breakdowns, accidental misuse and deliberate abuse

Analysis of Software Intensive Systems - 2

Safety, security, and survivability engineering are three very close related disciplines

- Analysis of all three is inherently difficult – these requirements specify what is to be prevented such as attacks and safety hazards rather than a desired capability
- They deal with assets that must be protected and with the risks of harm to these assets that must be managed
- There is an inherent level of uncertainty because what these requirements seek to prevent may or may not ever happen!
- This is especially true of safety requirements!
- Hazards and threats associated with software-intensive systems are also constantly changing, making the risks very difficult to quantify

Analysis of Software Intensive Systems - 3

Quality means much more than merely meeting functional requirements

- An application that meets all of its required features and fulfills each of its use cases can still be totally unacceptable
  - Inadequate availability
  - Capacity too low
  - Performance too slow
  - Not interoperable with other systems
  - Not safe to use
  - Numerous security vulnerabilities
  - Not considered to be user friendly

It is not adequate to specify required quality by stating that an application shall have high capacity and be safe, secure and usable

Analysis of Software Intensive Systems - 4

Quality Model

- A quality model decomposes quality into its component quality factors
  - Attributes
  - Subfactors
- It provides specific quality criteria (descriptions)
- It provides metrics or means of measurement
  - Turns general high-level quality factors into detailed and specific measureable descriptions
- It describes the capabilities of a systems beyond its functionality

Analysis of Software Intensive Systems - 5

Quality Model – a hierarchical model for formalizing the concept of quality in terms of its component quality factors and subfactors

Quality Factor (Quality Attribute) – a high-level characteristic or attribute of something that captures an aspect of its quality

- Quality has to do with the degree to which something possesses a combination of characteristics, attributes, aspects, or traits that are desirable to its stakeholders
- Quality Factors include availability, expandability, maintainability, reliability, reusability, safety, security and usability

Analysis of Software Intensive Systems - 6

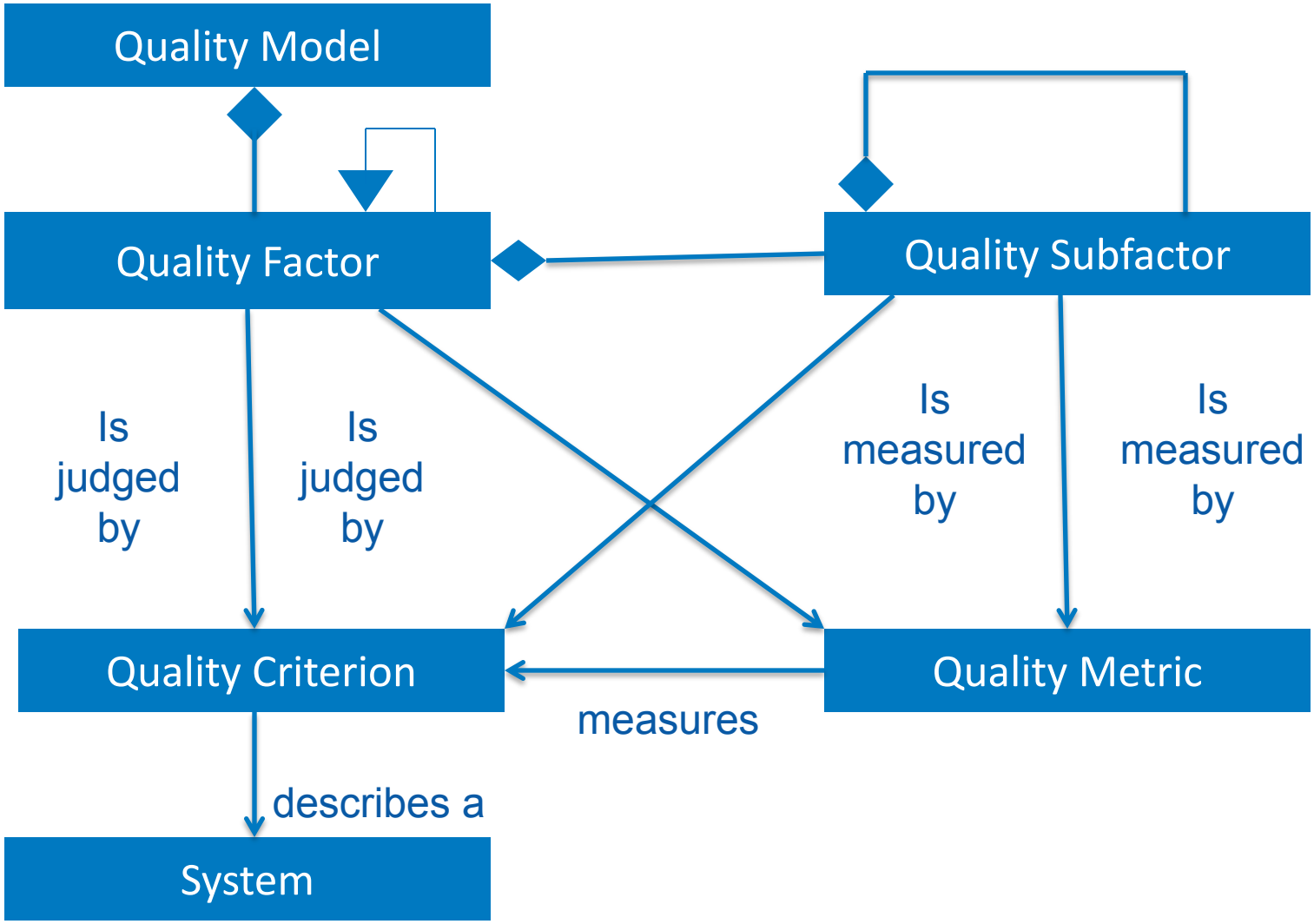
Quality Subfactor – a major component (aggregation) of a quality factor or another quality subfactor

Quality Criterion – a specific description of something that provides evidence either for or against the existence of a specific quality factor or subfactor

Quality Metric – a metric that quantifies a quality criterion and thus makes it measurable, objective, and unambiguous

System – an integrated collection of data components, hardware components, software components, human-role components and document components that collaborate to provide some cohesive set of functionality with specific levels of quality

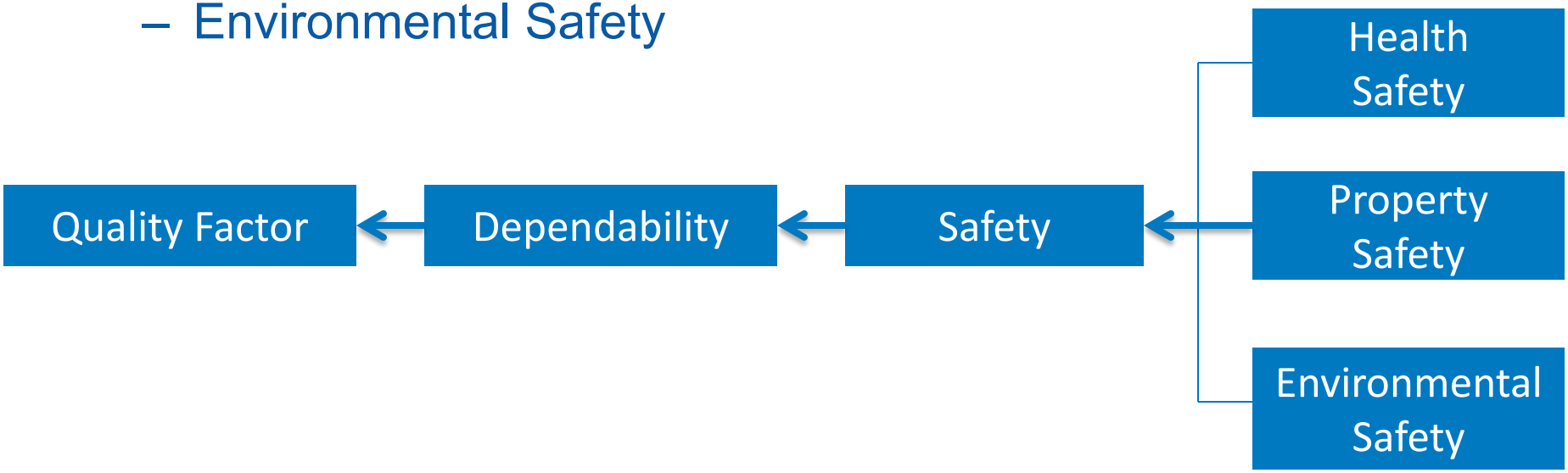
Model for a Quality Model



Safety as a Quality Factor

Safety – as a Quality Factor, safety can be classified into subclasses:

- Health Safety
- Property Safety
- Environmental Safety



Safety as a Quality Factor - 2

Safety – the degree to which accidental harm is prevented, detected, and properly reacted to

- People are not considered safe unless they are safe from both accidental and malicious harm

Health Safety – the degree to which illness, injury, and death are prevented, detected, and properly reacted to

- Health safety involves all people who may reasonably be expected to be harmed by the system during an accident

Property Safety – the degree to which accidental damage and destruction or property is prevented, detected, and properly reacted to

Environmental Safety – the degree to which accidental damage to and destruction of parts of the environment is prevented, detected, and properly reacted to

Tailoring the Software Safety Effort

Once the scope of the software safety effort has been determined, the project or program processes can be tailored

The safety activities should be sufficient to match the software development effort and yet ensure that the overall system will be safe!

Tailoring the Software Safety Effort - 2

Development	The use of safety features such as firewalls depends on where it is best applied and needed. The degree to which each of these activities is performed is related to the software risk. Software Safety features should be reflected in the requirements
Analysis	There are many types of analyses that can be completed during software development. The analyses can range from Requirements Criticality Analysis to Software Fault Tree Analysis of the design to Formal Methods

Tailoring the Software Safety Effort - 3

Inspections	Inspections can take place in a number of settings and with varying products (requirements to test plans). The number of inspections and products is dependent on the risk related to the system. Inspections is a form of Peer Reviews that can include Structured Walkthroughs, Walkthroughs, Circulation Reviews, and Buddy Checks. Technical Reviews that involves a group of complementary disciplines to seek alternative solutions is a Review but not normally considered a Peer Review.
Reviews	The number of formal reviews and the setting up of delta or follow-up reviews can be used to give the organization more places to look at the products as they are being developed.

Tailoring the Software Safety Effort - 4

Verification Activities	Verification includes verification of the product and intermediate work products against selected requirements, including customer, product, and product component requirements. Verification is inherently an incremental process. It begins with verification of the requirements and progresses through the verification of the evolving work products. Verification culminates in the verification of the completed product normally in Systems Test although sometimes Acceptance Testing serves as the final Verification activity. Verification methods should address re-verification to ensure that rework performed on work products do not cause unintended defects. Methods of verification include but are not limited to: • Inspections and Structured Walkthroughs • Audits • Path coverage testing • Simulations • Modeling • Functional testing • Decision table-based testing • Load, stress, and performance testing • Operational scenario testing • Observations and demonstrations Verification and Validation environments may be built, reused, purchased, or shared or some combination of these.

Tailoring the Software Safety Effort - 5

Validation	Validation demonstrates that a product or product component fulfills its intended use when placed in its intended environment (operational environment) by the intended end users who must use the system in that operational environment. Validation methods are selected based on their ability to demonstrate that user needs are satisfied. To support validation, the requirements must be defined for a realistic environment including: • Functionality (implementation) • Maintenance • Sustainment • Reuse • Installation • Training • Support • Performance • Quality Attributes • Disposal as appropriate

Verification and Validation Tailoring

Verification and Validation activities may be tailored by determining the types of testing based on the software risk, complexity and criticality of the software product or product component

Unit Testing may be performed by the software developer, by a peer developer or by an outside supplier depending on those factors, the mission and the expectations of the customer as well as the end users and the operational environment the product must operate in

Maintenance and expansion constraints or requirements, support, training, usability and reliability requirements all may have an effect on the tailoring of the Verification and Validation activities

"Full" Software Safety Effort

Systems and subsystems that have severe hazards which can escalate to major failures in a very short period of time require the greatest level of software safety effort

- These systems may require a formal, rigorous program of quality and safety assurance to ensure complete coverage and analysis of all requirements, design, code, and tests
- Safety analyses, software development analyses, safety design features, and Software Quality Assurance oversight are highly recommended

"Moderate" Software Safety Effort

Systems and subsystems which fall into this category typically have either

- 1)A limited hazard potential
- 2)The response time for initiating hazard controls to prevent failures is long enough to allow for human operators to respond to the hazardous situation

These systems require a rigorous program for safety assurance of software identified as safety-critical

- Some analyses are required to assure there are no "undiscovered" safety-critical areas that may need software safety features

"Minimum" Software Safety Effort

For systems in this category, either the inherent hazard potential of a system is very low or control of the hazard is accomplished by non-software means

- Software development in these types of systems must be monitored on a regular basis to ensure that safety is not inadvertently compromised or that features and functions are added which make the software safety-critical

Projects With Mixed Levels of Effort

Not all projects fall into neat categories for classification

- Some projects may be large and complex, but with a small portion of safety-critical, low risk software
- Other projects may be small, but a significant portion of software is safety-critical and high risk

Too often smaller projects argue that they have no safety-critical software out of concern that the label will lead to massive amounts of work

- Partitioning of the safety-critical software from code that is not safety-critical allows the safety effort to be applied to the appropriate safety-critical portion

Summary

Creating a safe system is a team effort and safety is everyone's responsibility

Software is a vital part of most systems

Software, by itself cannot injure you, but software normally operates in an electronic system and often controls other hardware

Software is hazardous if it can directly lead to a hazard or is used to control a hazard

- Hazardous software includes all software that is a hazard cause
- Is a hazard control
- Provides information upon which safety-critical decisions are made
- Is used as a means of failure/ fault detection

Tim Kasse – Contact Information

Tim Kasse

QMS&A

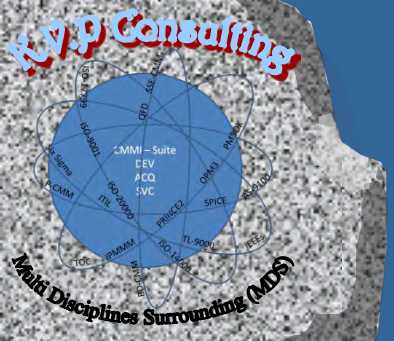
Program Manager – Software Quality Assurance Program

National Renewable Energy Laboratory (NREL)

1617 Cole Blvd.

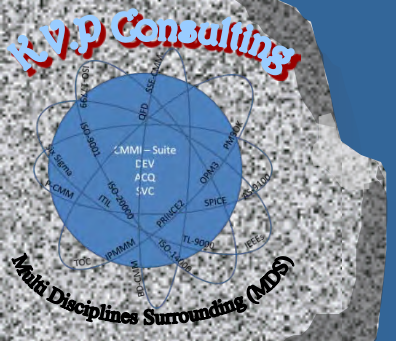
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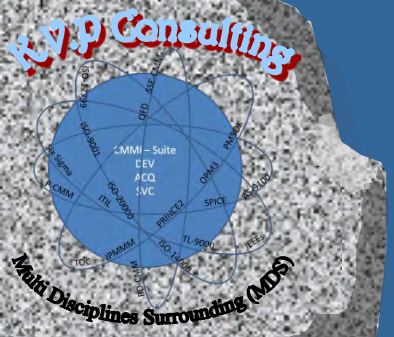
Lesson Learned from Pilot Implementation of Organizational Performance Management (OPM) Process Area

Monday Half-Day Tutorial



Specific Goal and Practice Summary

- SG 1 Manage Business Performance
  - SP 1.1 Maintain Business Objectives
  - SP 1.2 Analyze Process Performance Data
  - SP 1.3 Identify Potential Areas for Improvement
- SG 2 Select Improvements
  - SP 2.1 Elicit Suggested Improvements
  - SP 2.2 Analyze Suggested Improvements
  - SP 2.3 Validate Improvements
  - SP 2.4 Select and Implement Improvements for Deployment
- SG 3 Deploy Improvements
  - SP 3.1 Plan the Deployment
  - SP 3.2 Manage the Deployment
  - SP 3.3 Evaluate Improvement Effects



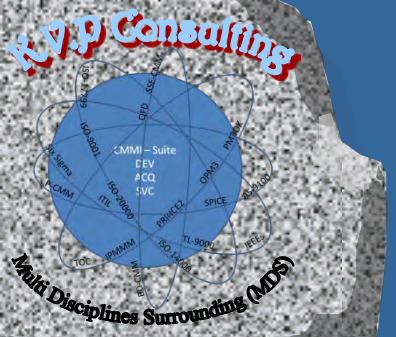
Tutorial Leading Concept

Organizational Performance Management (OPM) purpose is to proactively manage the organization's performance to meet its business objectives. In Maturity Level 5 the organization is expected to continually improve its processes (methods) and deliverables (systems, software, services and acquisitions) based on a quantitative understanding of its business objectives and performance needs.



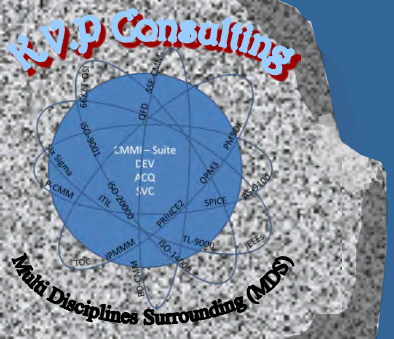
Some Questions
(from first case study)

- Can we justify a tool with OPM
- How to do it

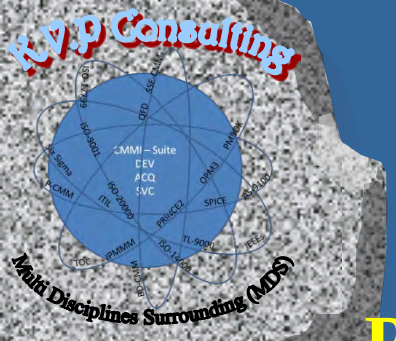


Some Questions
(from second case study)

- We have only financial business objectives
- Our PPMs dose not provide PMs practical insights
- We are lacking a system level insights
- We don't know how to map and connect our objectives to quantitative targets at process / deliverable level



Case Study #1
Requirements Analysis and Management



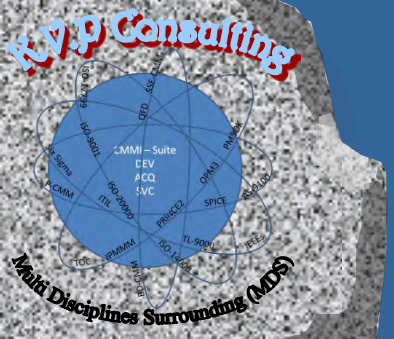
Process ROI

Project Idea and Proposal Preposition Development

- If an average developer day cost is ~7000
- The total Program effort was 10220 day (100%)
- The testing phase was 1480 day (14.5%)
- Defect that are the result of documentation are 69% of all defects

- If we will assume the to correct 69% of all defects will take around 40% of the testing duration; ☞ means that:
  - that will be 740 day
  - With the overall cost of 518000
- However to add 100 review days in the static tests and another 20 of code inspection will end with the cost of 2100000

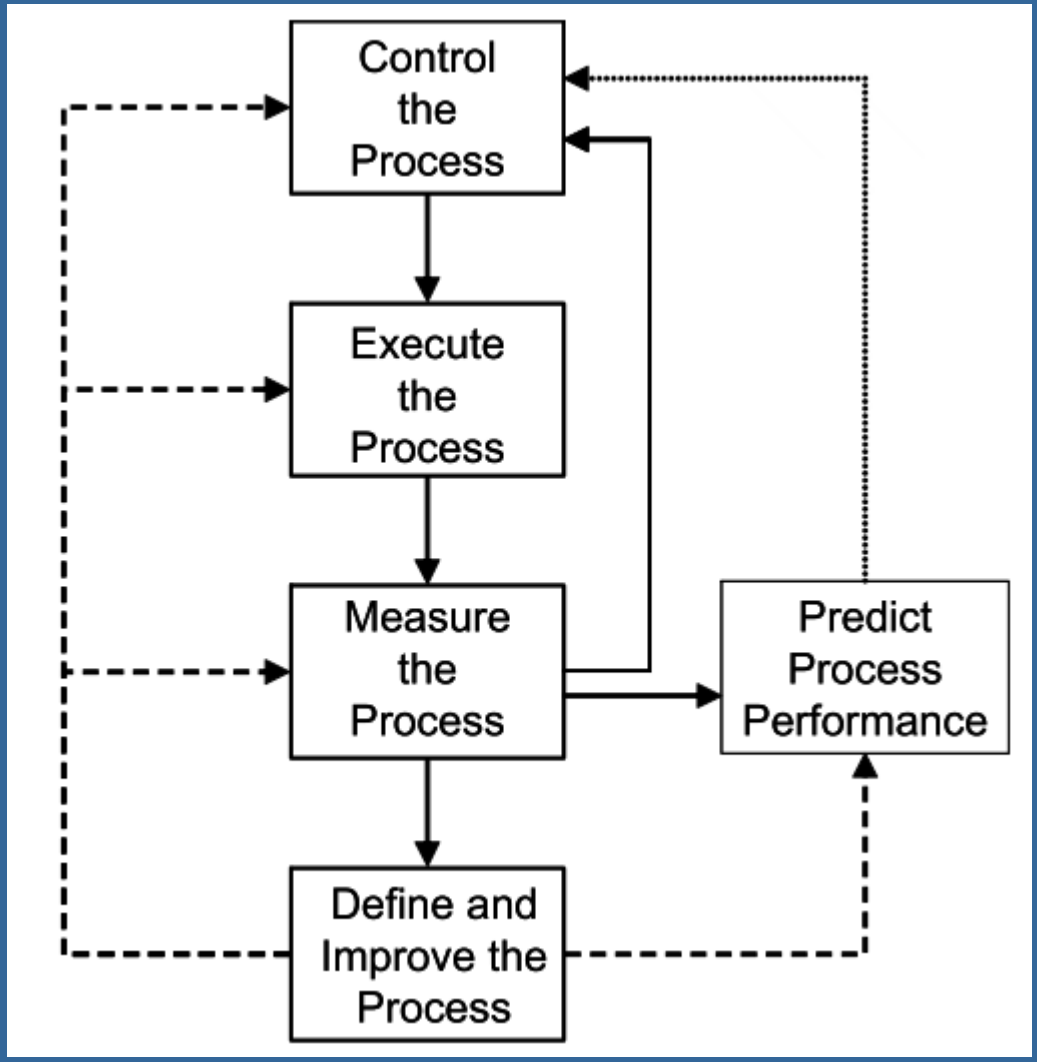
- And still we have saved at least 3080000 (440 days)
- Means that we ware able to reduce 4.5% of the project time



Definition of Process

- A set of interrelated activities, which transform inputs into outputs, to achieve a given purpose.

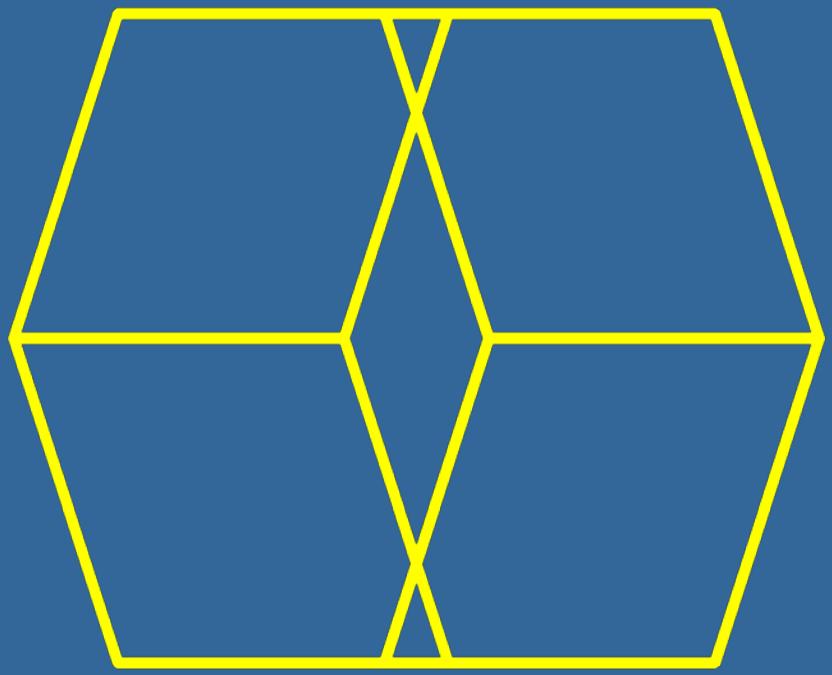
Process Control



Process Levels and Dimensions

Architected and Improved Process

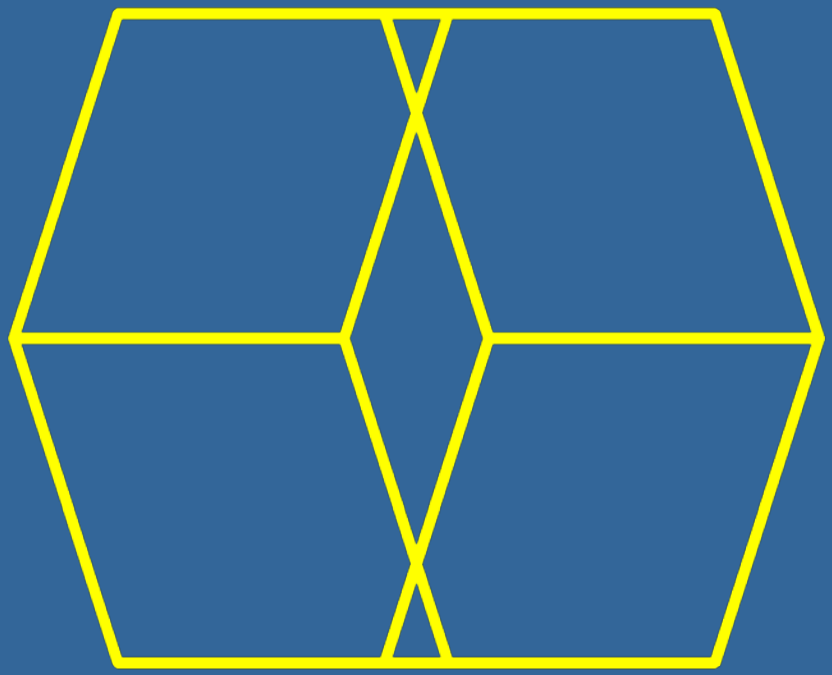
- Objectives
- Structured
- Monitored / Measured
- Effective / Efficient
- Process Interfaces and Integration in Lifecycle
- Prioritize and Balance Resource Utilization within Larger Context



Suggested Measures

Architected and Improved Process

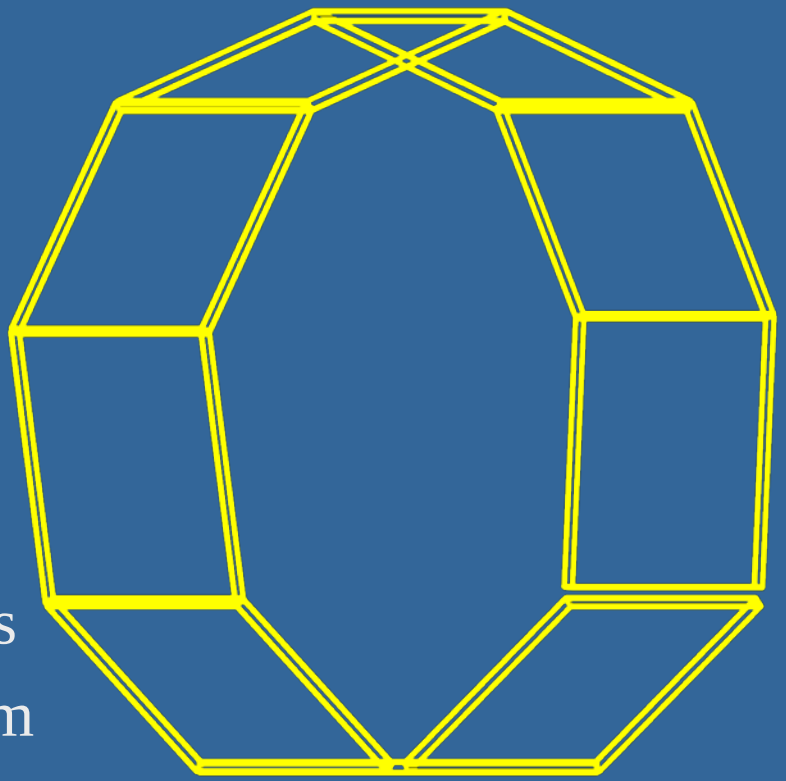
- Process productivity
- Process resources utilization effectiveness
- Process resources utilization efficiency
- Meeting the process objectives
- Other processes interfaces efficiency
- Process related defects density



Process Levels and Dimensions

Operationally Optimized Process

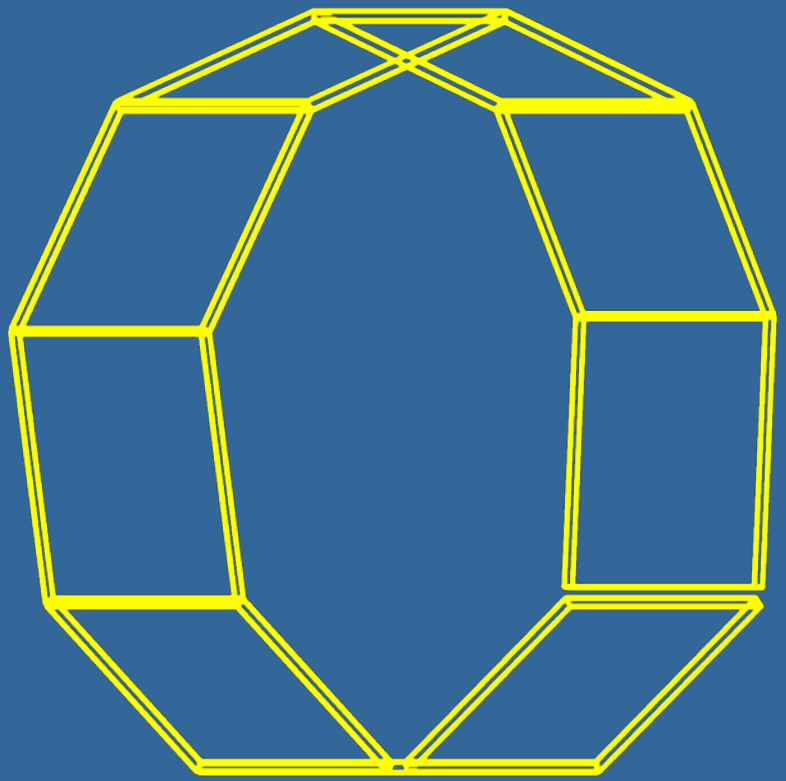
- Known Capability and Stable
- Defined Ingredients
- Known Critical Elements
- Meeting Objectives
- Controlled Interfaces
- Responsive / Modifiable
- Resilience / “Agile”
- Relevant ‘What If’s Scenarios
- Accepted Tolerance / Freedom Boundaries
- Predictable Outcomes

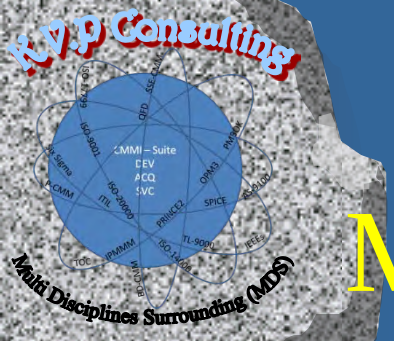


Suggested Measures

Operationally Optimized Process

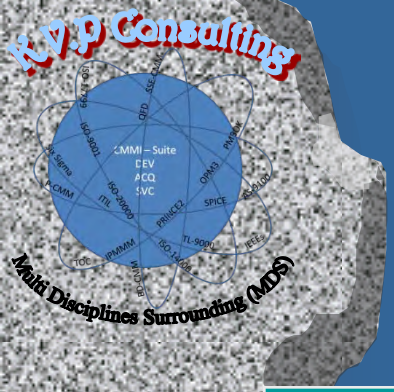
- Influence of Critical Elements on process output
- Process resources utilization ‘What If’s Scenarios
- Process elements capability
- Quantitative definition of process ingredients





Measuring Process Performance

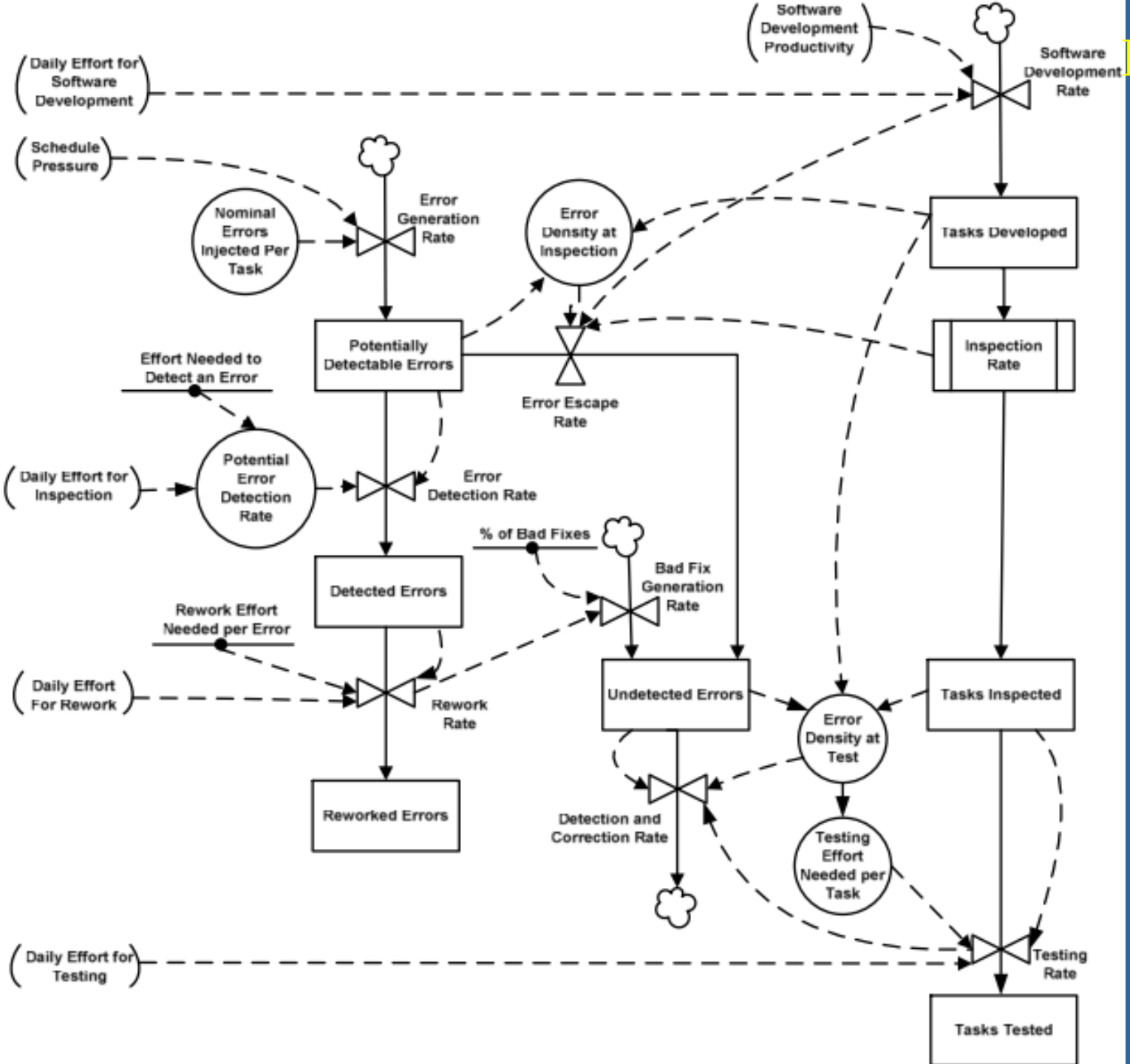
- Key Questions
  - What is the current performance?
  - Is this value "good"?
  - Is it changing?
  - How can I make the value “better”?
- Candidate Attributes
  - Definition (completeness, compatibility)
  - Usage (compliance, consistency)
  - Stability (repeatability, variability)
  - Effectiveness (capability)
  - Efficiency (productivity, affordability)
  - Predictive Ability (accuracy, effects of tailoring and improvements)

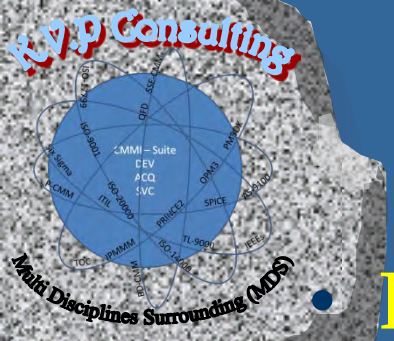


Some Examples

Goal	Measure
Completeness	The number of process elements added, changed, and deleted during tailoring.
Compliance	Number of discrepancy reports generated by Quality Assurance audits
Stability (volatility)	The number of process elements changed within a specified time interval.
Effectiveness	Product quality
Effectiveness	Defect leakage to subsequent phases
Efficiency	Productivity (or production coefficient)
Efficiency	Rework as a fraction of total effort
Predictability	Probability distribution for an estimated quantity or related population statistics

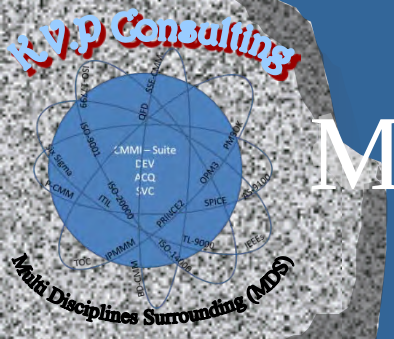
Relationships for CoQ





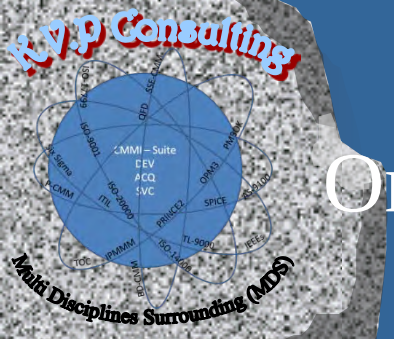
Process Quality Audits and Progress Check Calibration

- As for today the organization is managing its programs as large and complex programs and need to comply with more than just one quality standards in many disciplines (e.g. HW, optics, software) and use large groups of internal and external assessors that perform implementation checks, progress checks, readiness reviews and formal appraisals.
- These assessment teams are typically composed from groups of very experienced and professional individuals that have the best knowledge in their professional domain but not necessarily on how to conduct an efficient and effective appraisal which provide meaningful results
- The combination of the effort and expected resources increase the risks on qualification of auditors, domain knowledge, and calibration of results and findings effectiveness



Main Steps for Process Improvement

- During our analysis and planning, we were able to identify improvement targets in main lifecycle areas such as
  - operations,
  - information,
  - governance,
  - people
  - organizational structure,
  - portfolios,
  - project execution,
  - finance.
- And as in core process that are critical to the system success such as stakeholder management, technical interfaces and integration.



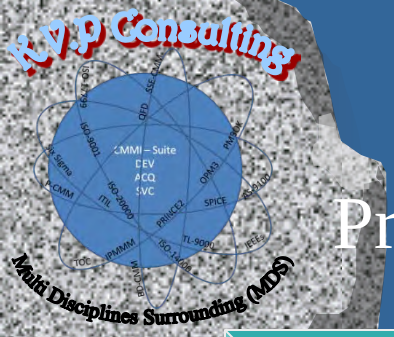
Organizational Background and Process ROI

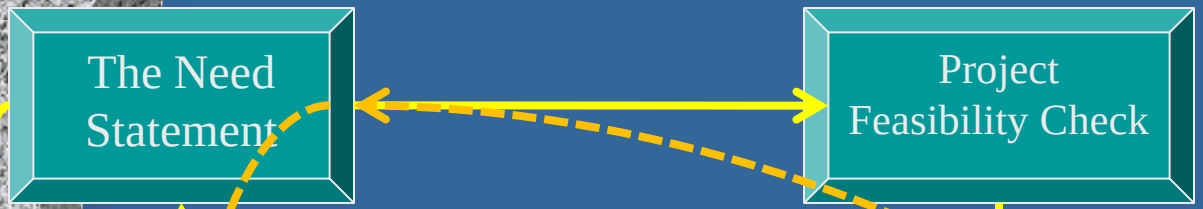
Quality Audits and Progress Check Calibration

- By measuring the following attributes, we were able to increase usability of the process and progress checks by 47%, and quality of deliverables by 37%
  - Role based profile and criteria
  - Calibration mechanism and criteria
  - Evaluation mechanism and criteria
  - Leveling the different quality engineers and ‘auditors’
  - Flowing specific trainings (on different levels) as personal development and qualification criteria
  - Listing specific performances as indicators for leveling justifications
  - Structuring the different audits and reporting guidelines in a single mandatory to follow process,

Process

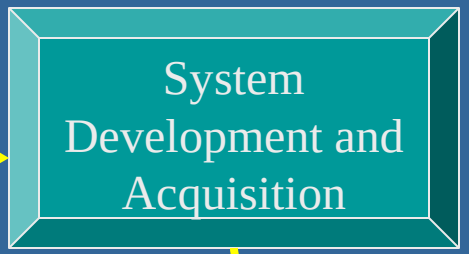
Project Idea and Proposal Preposition Development

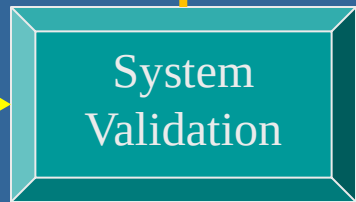


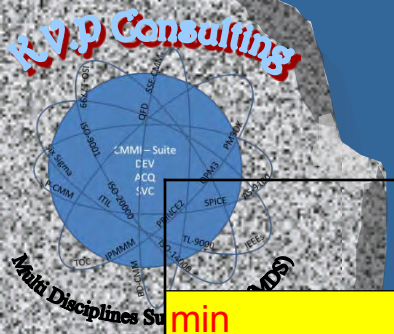




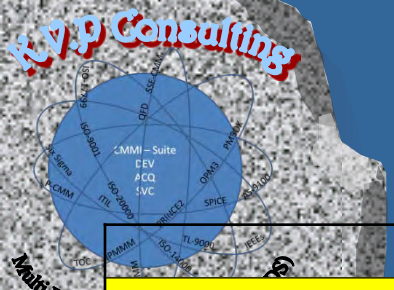






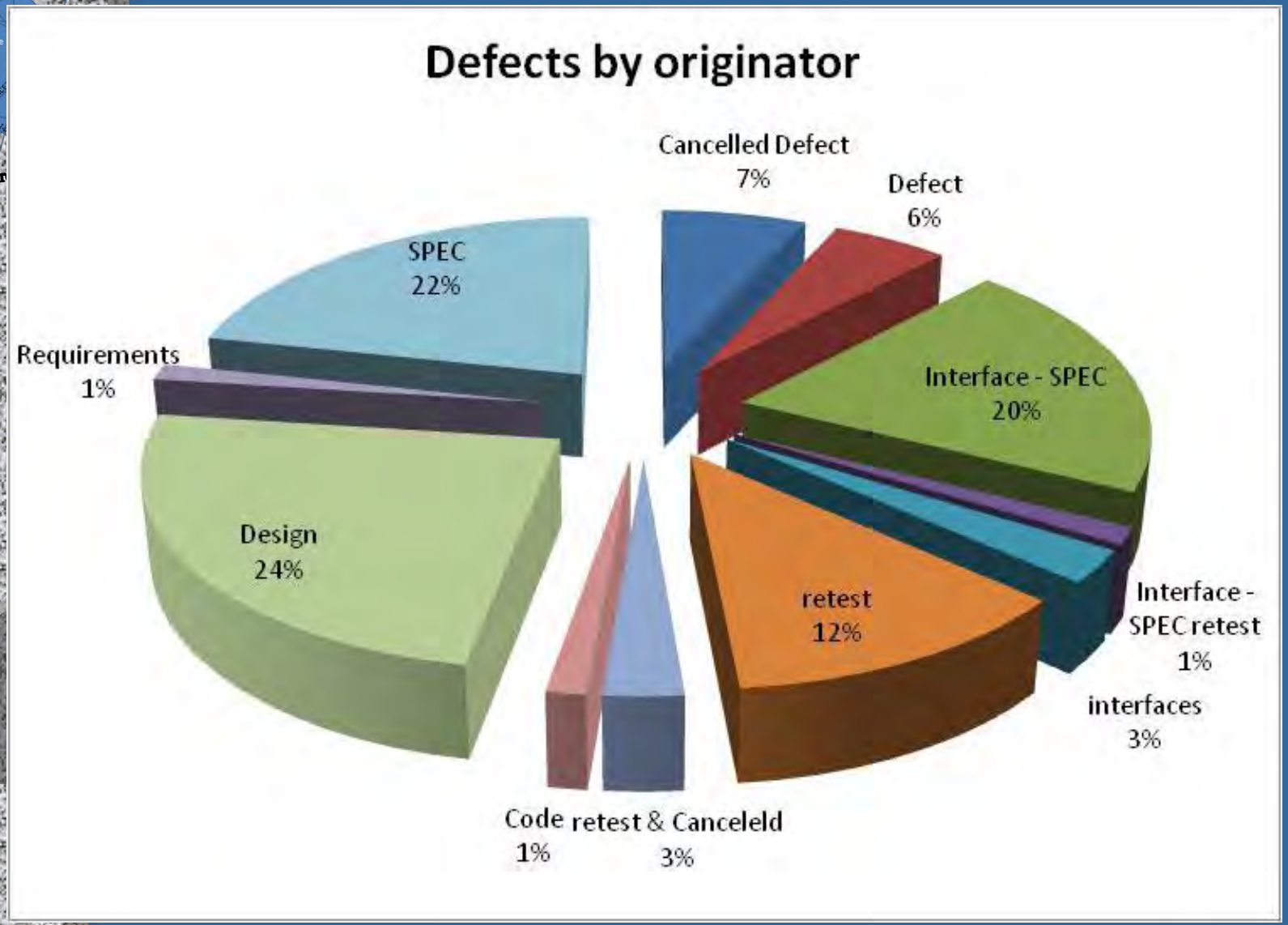


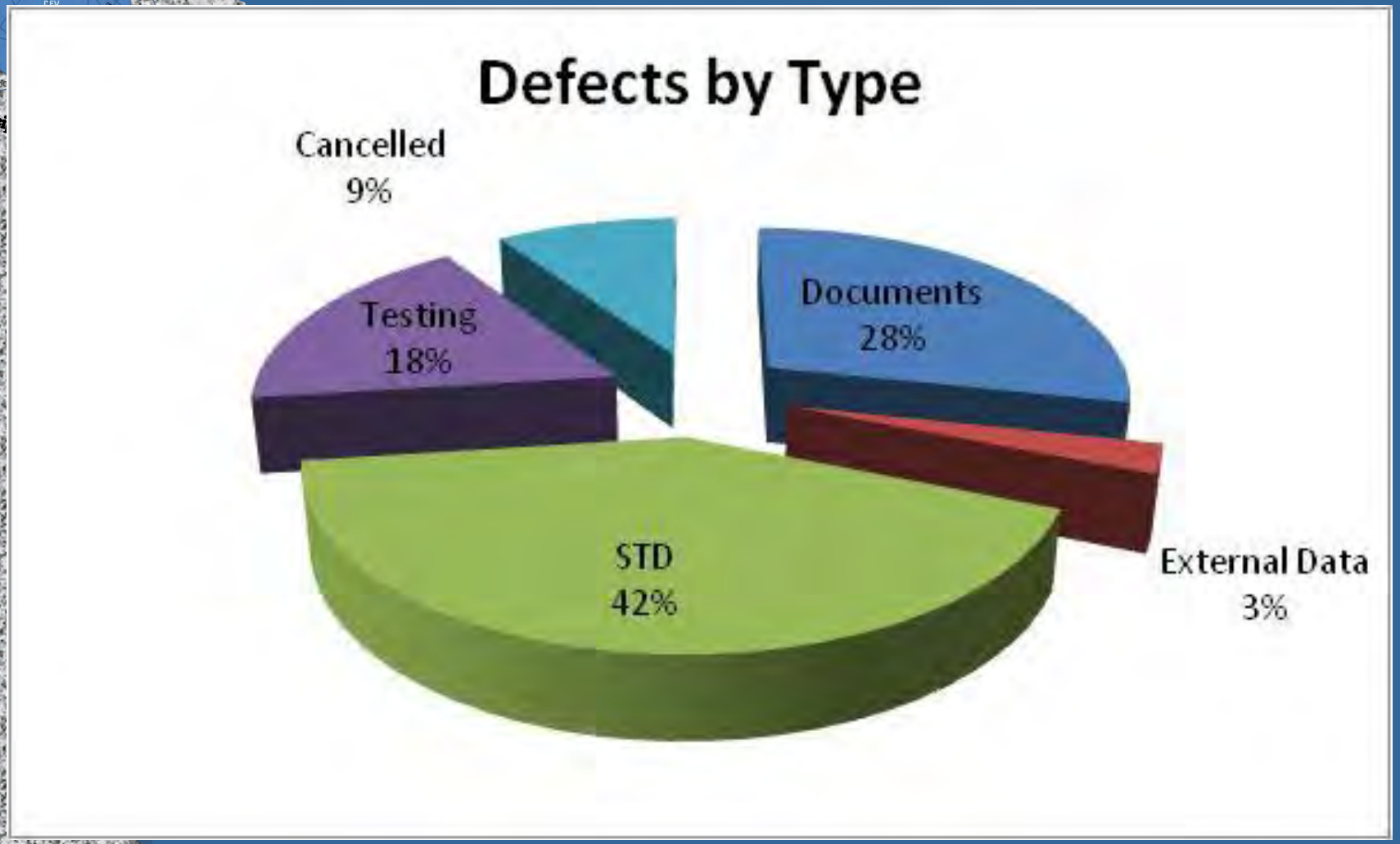
Center	
min	0%
max	100%
ave	50%
sample Projects	104
% From ORG	100.00%
Sample Practices	19629
% From Sample	100.00%
is 0	2649
% of is 0	13.50%
>4	9147
% of >4	46.60%
<4	7828
% of <4	39.88%
is 4	2654
% of is 4	13.52%
>6	4818
% of ≥6	24.55%
mean	#NUM!
median	4
mode	8
VAR	7.279



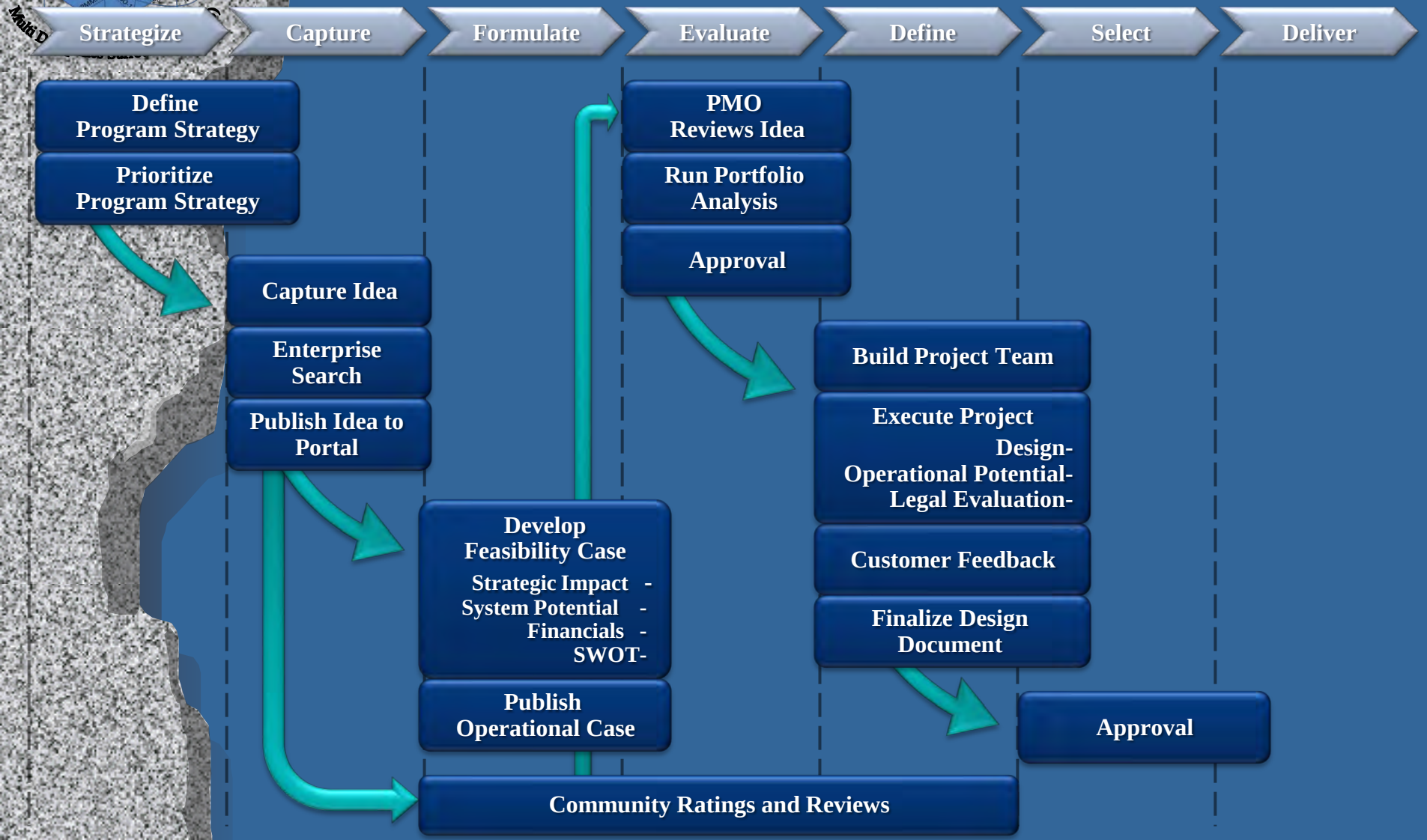
Areas

	A1	A2	A3	A4	A5	A6	A7
min	0%	0%	0%	0%	0%	0%	0%
max	100%	100%	100%	100%	100%	100%	100%
ave	50%	50%	37.5%	62.5%	50%	50%	75%
sample Projects	22	6	3	13	23	13	24
% From ORG	21.15%	5.77%	2.88%	12.50%	22.12%	12.50%	23.08%
Sample Practices	3733	957	647	2069	4961	2914	4348
% From Sample	19.02%	4.88%	3.30%	10.54%	25.27%	14.85%	22.15%
is 0	526	127	154	195	914	378	355
% of is 0	14.09%	13.27%	23.80%	9.42%	18.42%	12.97%	8.16%
>4	1575	476	213	1092	1850	1413	2528
% of >4	42.19%	49.74%	32.92%	52.78%	37.29%	48.49%	58.14%
<4	1626	347	322	705	2358	1165	1305
% of <4	43.56%	36.26%	49.77%	34.07%	47.53%	39.98%	30.01%
is 4	532	134	112	272	753	336	515
% of is 4	14.25%	14.00%	17.31%	13.15%	15.18%	11.53%	11.84%
>6	779	211	82	579	775	733	1659
% of >6	20.87%	22.05%	12.67%	27.98%	15.62%	25.15%	38.16%
mean	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
median	4	4	4	5	4	4	6
mode	2	6	0	6	0	6	8
VAR	7.058	6.898	6.750	6.853	6.654	7.142	7.265

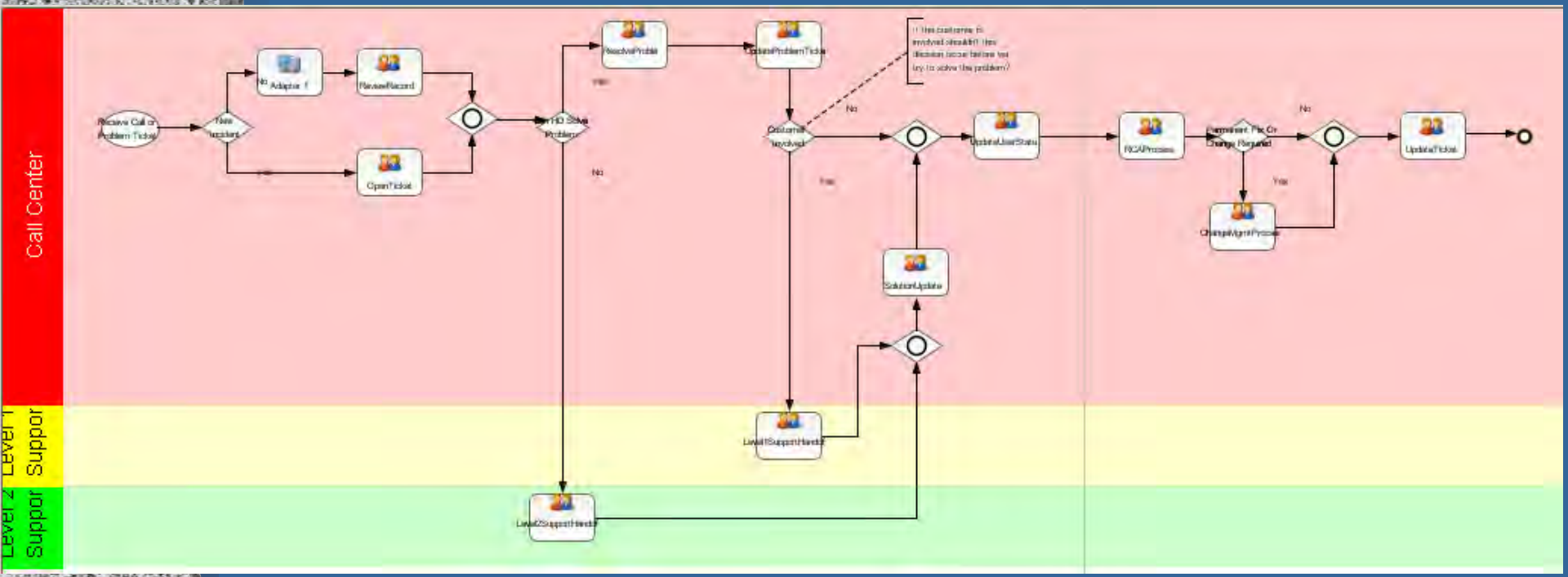

Defects by originator
Cancelled Defect
7%
Defect
6%
SPEC
22%
Requirements
1%
Interface - SPEC
20%
Design
24%
retest
12%
Interface -
SPEC retest
1%
interfaces
3%
Code
1%
retest & Canceleld
3%


Defects by Type
Cancelled
9%
Testing
18%
Documents
28%
STD
42%
External Data
3%

Managed Process for Innovation



Case Study


Call Center
Level 1 Suppor
Level 2 Suppor
Receive Call or Problem Ticket
New Incident
Adaptor 1
ReviewRecord
OpenTicket
HD Solve Problem
ReactivateProblem
UpdateProblemTicket
Customer Involved
UpdateUserStatus
RCAProcess
UpdateTicket
SolutionUpdate
Level1SupportHandoff
Level2SupportHandoff

Case Study

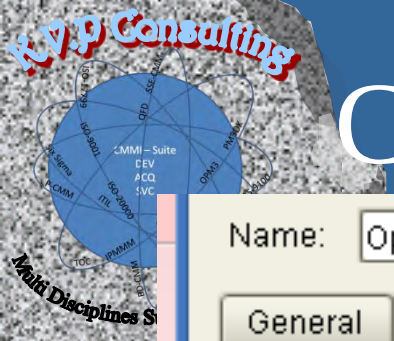
General | Fields | Simulation

Dataslot: AllDataslots

	Name	Type	Label	Editable	Required
✓	HDResolution	Boolean	H d resolution	✓	
	ScheduledDate	Date	Scheduled date	✓	
	Attachments	Document	Attachments	✓	
A	CustomerConta...	String	Customer conta...	✓	
A	CustomerName	String	Customer name	✓	
A	Description	String	Description	✓	
A	EstimatedDurat...	String	Estimated durat...	✓	
A	Installation	String	Installation	✓	
A	Skid	String	Skid	✓	
A	TicketPriority	String	Ticket priority	✓	

Dataslots

Case Study



Name: OpenTicket

General | Fields | Simulation

Scenario: (default)

Work Time: 2 hours ...

Randomize duration using: Normal Distribution (StDev=(none)) ...

Resources

Name	Value	Unit	Cost per unit	Threshold

Modify...

Reset

OK | Cancel | Help

Case Study

General | Fields | Simulation

Scenario:

Work Time:

Randomize d

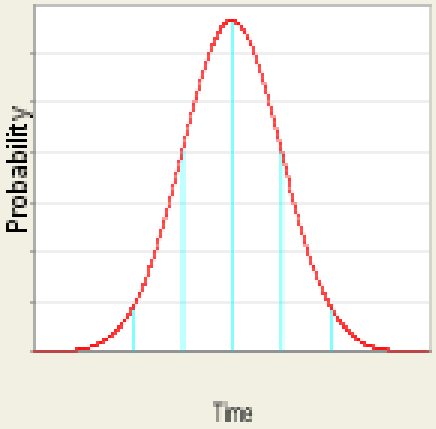
Resources

Name

Modify...

Reset

Distribution of Probability



Type: Normal

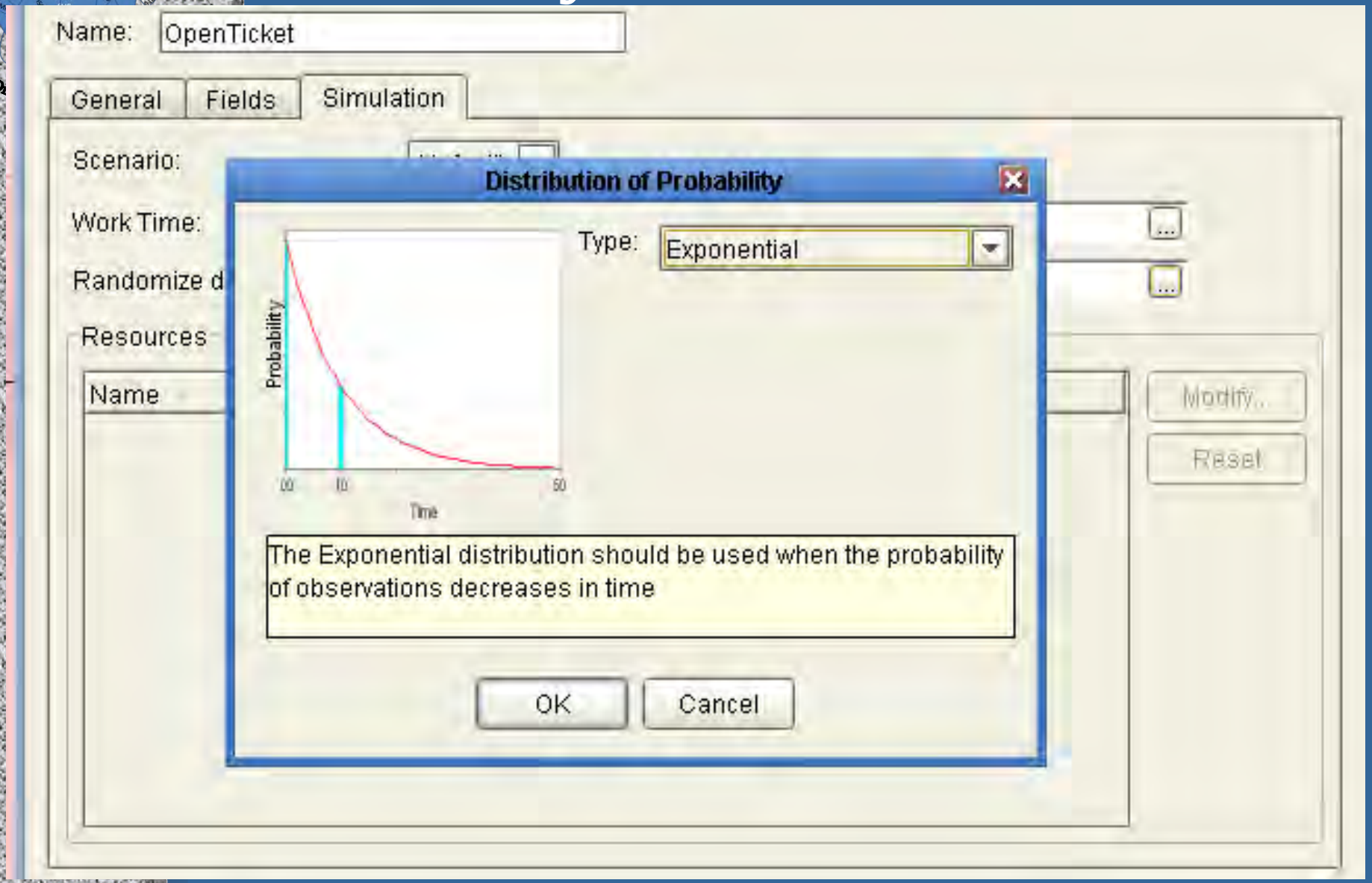
StDev:

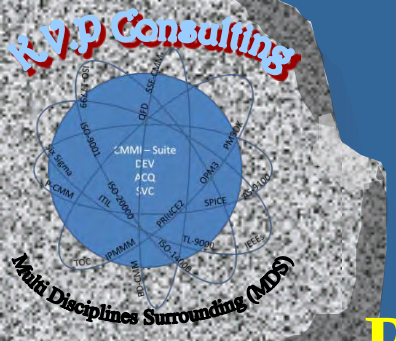
- Constant
- Exponential
- Normal

The Normal Distribution should be used when observations tend to accumulate around a particular value rather than spread evenly across a range of values

OK | Cancel

Case Study


Name: OpenTicket
General
Fields
Simulation
Scenario:
Work Time:
Randomize d
Resources
Name
Modify...
Reset
Distribution of Probability
Type:
Exponential
Probability
Time
The Exponential distribution should be used when the probability of observations decreases in time
OK
Cancel



Process ROI

Project Idea and Proposal Preposition Development

- If an average developer day cost is ~7000
- The total Program effort was 10220 day (100%)
- The testing phase was 1480 day (14.5%)
- Defect that are the result of documentation are 69% of all defects

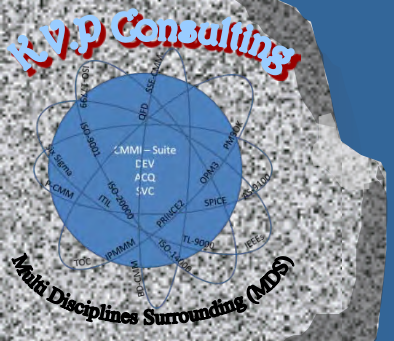
- If we will assume the to correct 69% of all defects will take around 40% of the testing duration; ☞ means that:
  - that will be 740 day
  - With the overall cost of 518000
- However to add 100 review days in the static tests and another 20 of code inspection will end with the cost of 2100000

- And still we have saved at least 3080000 (440 days)
- Means that we ware able to reduce 4.5% of the project time

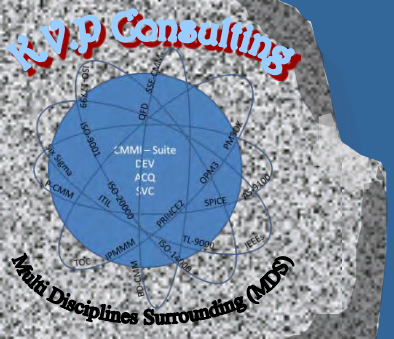
Process
Quality Audits and Progress Check Calibration



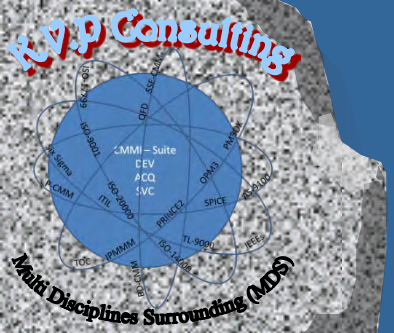



K.V.P Consulting
CMMI – Suite
DEV
ACQ
SVC
Multi Disciplines Surrounding (MDS)

Questions ?



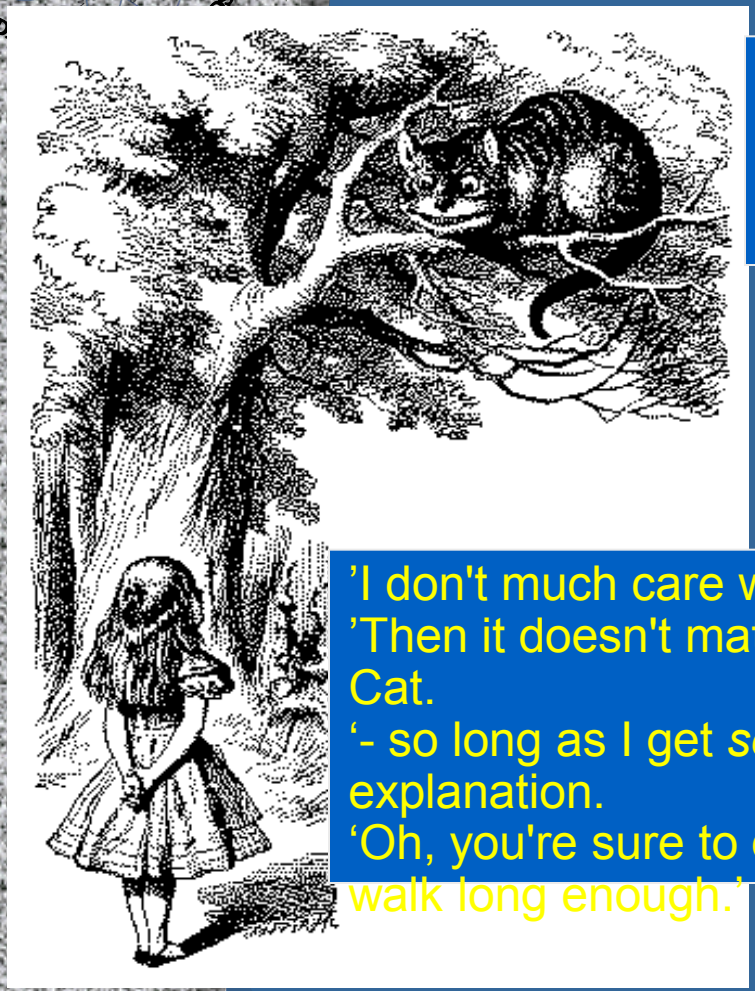
Case Study #1 Business Objectives Development and Quantitative Targets Management



The Challenge

- We have vision and business strategy
- We are focused on financial results that we can report on P&L
- Why we need other ‘business’ quantitative objectives and targets
- What are the benefits for the system and program mangers
- How we do it

The Concept in Plain English



‘Cheshire Puss,’ she began, … `Would you tell me, please, which way I ought to go from here?’
‘That depends a good deal on where you want to get to,' said the Cat.

’I don't much care where –’ said Alice.
’Then it doesn't matter which way you go,' said the Cat.
‘- so long as I get *somewhere*,' Alice added as an explanation.
‘Oh, you're sure to do that,' said the Cat, ‘if you only walk long enough.’



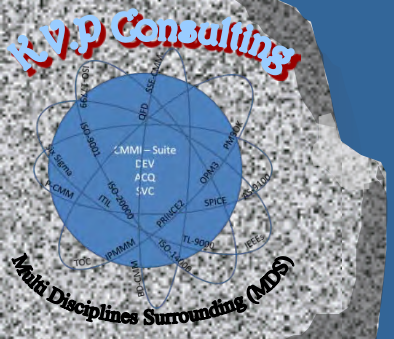
Tell me where you want to be and I will show (measure) you the way



And

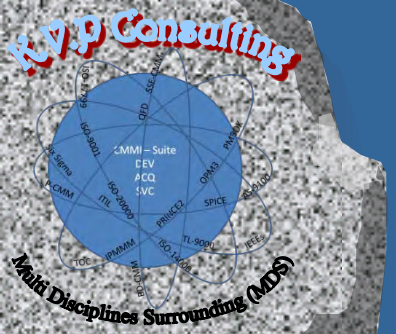
- "When people consult me, it's not that I am reading the future; I am guessing at the future. … How do I guess at the future? Based on the omens of the present. The secret is here in the present. If you pay attention to the present, you can improve upon it. And, if you improve on the present, what comes later will also be better"

The Alchemist – Paulo Coelho



The Solution We Chose

Strategic Policy Deployment (SPD)



Strategic Policy Deployment

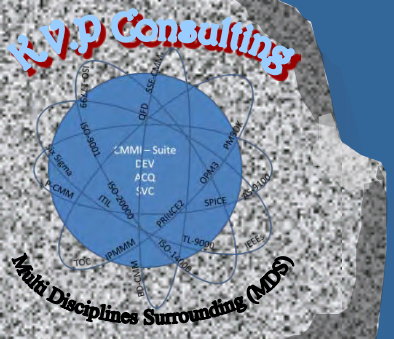
- Combination of:
  - Clear & Aligned Priorities
  - Behavior Changes
  - Change in Thinking (PDCA)
  - Elimination of Waste

…to achieve Business Results

Snap Look to The Tool

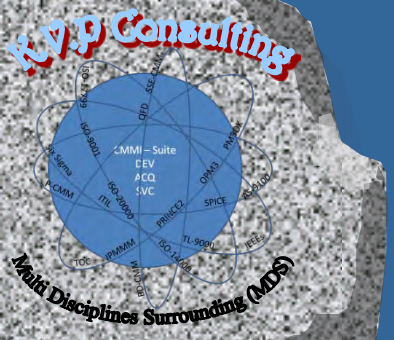


Microsoft Excel
Worksheet



Strategic Policy Deployment

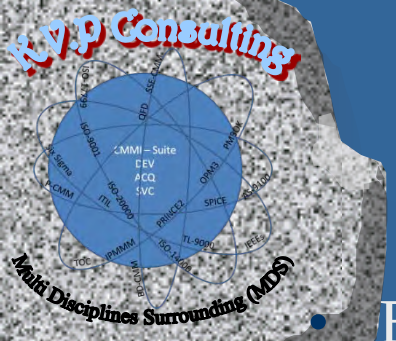
- A process to *focus* upon Goals, that cut across the corporation
- *Aligns & links* resources & action in pursuit of those Goals.
- Enables progress towards the Goals to be *measured*
- Enables rapid *root cause corrective action* if results vary from goals
- Drives *process* improvement
- Individuals & teams get clarity on their impact upon the Goals
- It becomes the yearly implementation of our long term strategic planning process.



Policy Deployment as a Tool

Policy Deployment is an effective tool to use for answering the following questions:

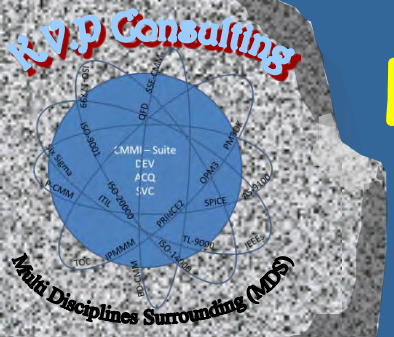
- How do we identify our critical goals?
- How do we develop plans and align our activities?
- How do we communicate our goals and activities level by level?
- How do we align the abundant talent of our team members on the critical few?
- How do we sustain our activities?
- How do we quickly change course when required?
- How do we learn from our experience?



Magnitude of Change

- Behavior Change
  - Discipline
  - Emphasis on ***how*** the organization will deliver the priorities
  - Catchball to understand the priorities and the means to deliver them
  - Gemba – look for evidence the plan is proceeding and in control
- Clear and Aligned Priorities
  - Start with top management priorities and link/translate at every level
  - Critical few metrics match Excel commitments
  - Must deselect

Highway



Your Destination
(Vision)

Keep improvement efforts focussed on the 'road' not out here !

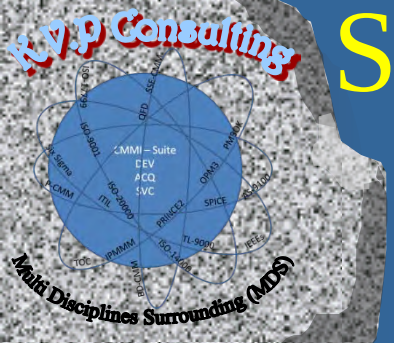
Use continuous improvement to remove the small obstacles on an ongoing basis

The 'road' is typically strewn with obstacles (boulders) some are large, some are small

Use policy deployment to remove the big boulders one at a time

Your Start Point
(Present situation)

Strategic Policy Deployment Process



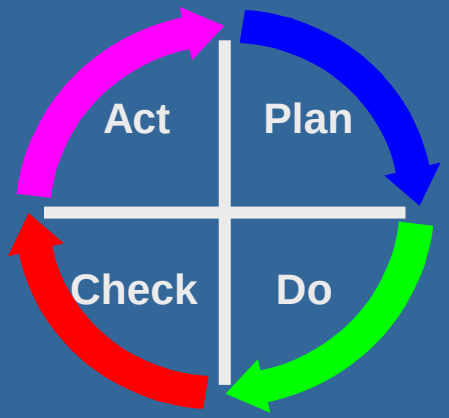
Step 1
Choose the Focus

Step 2
Align the Organization

Step 3
Implement the Plan

Step 4
Review and Improve

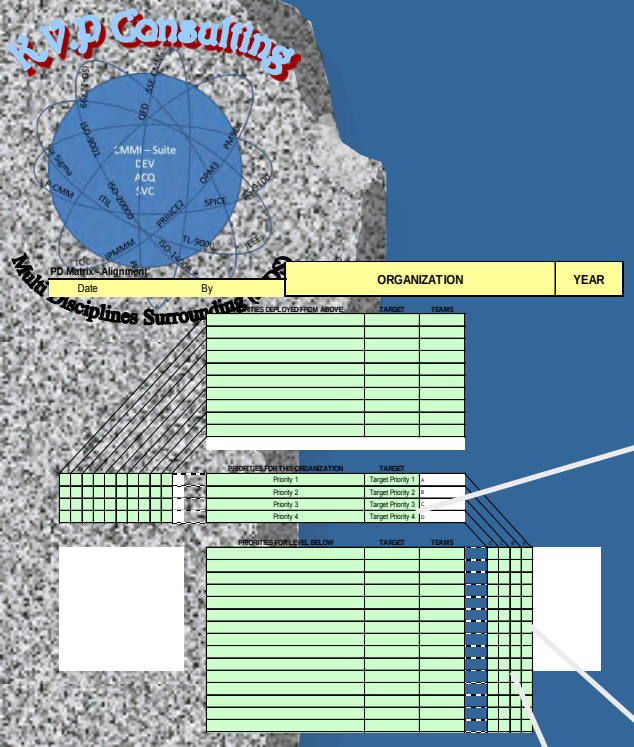
Strategic Focus



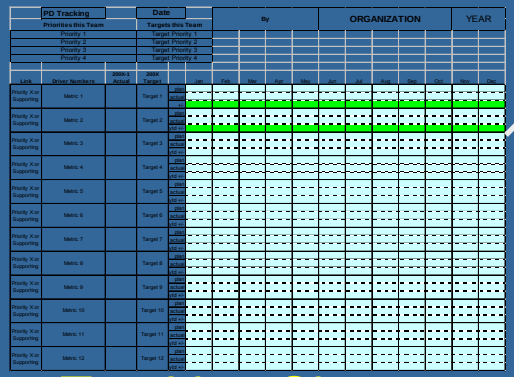
Operational Focus

frequently

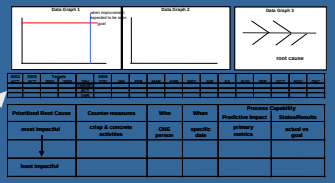
The Forms Link…

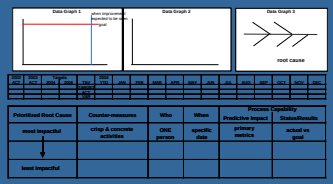


Alignment Sheet

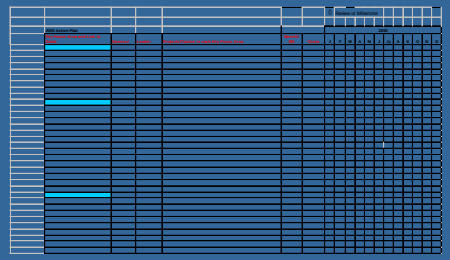


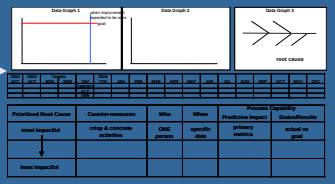
Tracking Sheet



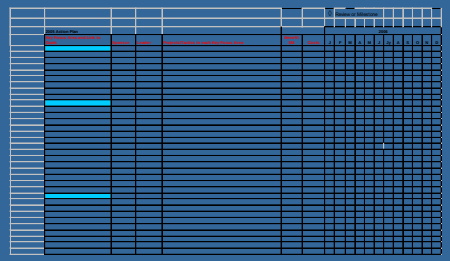


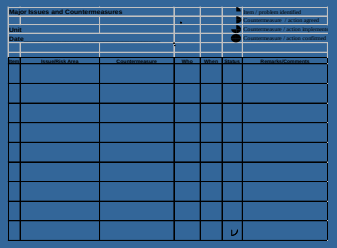
Red items





Problem strip for red items





Program Plan (multiple)

Catchball

- Process to build consensus through dialog about the goals and how to achieve them.
- Two way communication that arrives at a collective wisdom on the priorities and the plans to deliver the results.
- Leader needs to have a vision of what is needed and how it may be achieved.
  - Team will provide input on the specific how.
  - The leader will confirm the plan:
    - Push the team to stretch further if the plan comes short of what he had in mind.
    - Question and develop understanding of the plan if the plan exceeds what he had in mind.



Targets

All priorities require a target so they can be measured.

Targets have to be achievable, challenging, based on reliable data, and SMART.



S - specific

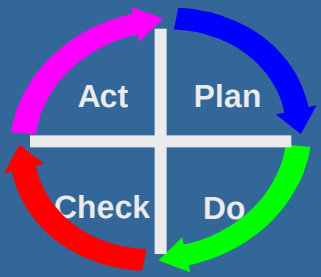
M - measurable

A - agreed

R - realistic

T - timed

The DO Phase

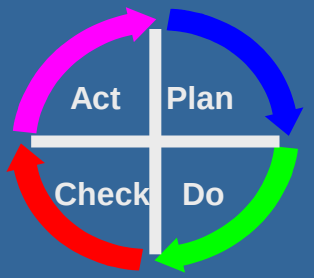


- Stay ***focused*** on the ***plan***.
- Make ***execution*** of the plan as visual as possible.
- ***Review*** the plan on a regular basis.
  - Look at metrics daily/weekly
  - Formal reviews monthly
    - results vs. expected, as well as the ***countermeasure*** to fill the gap
- Ask ***why*** if the team is doing things that are not in the plan.
- Question frequently by ***going to see***.
  - Schedule the time to look for evidence that the plan is proceeding and in control.

The CHECK Phase

Holding reviews maintains the discipline of the process:

- Confirm progress of current activities to expectations.
- Confirm the results to target. Look for trends.
- Evaluate the plan and results.
- Be visual.
- Hold timely, regular reviews daily/weekly/monthly, dependent on level.
  - Look at metrics daily/weekly
  - Hold formal reviews monthly
    - results vs. expected, countermeasures to close any gaps
- Reviews should be disciplined and structured.



A mini PDCA cycle takes place everyday as activities are checked constantly.



The CHECK Phase

- Counter measures are data driven looking at root cause.
- Check if previously identified counter measures are working and on track.
- Don’t react to noise.
- Escalate issues that can not be resolved to the next level.

The CHECK Meeting

The manager runs the review meeting.



The manager should focus on standard work:

- Metrics Chart
- Action Plan
- Corrective Action for RED Items
- Key Items at Risk

- Asking clarifying questions during the review process.
- Making sure that each person knows what is expected of them to move forward.
- Confirmation check – will this plan get us there?
- Follow up at Gemba before the next review for key issues.



Check Questions

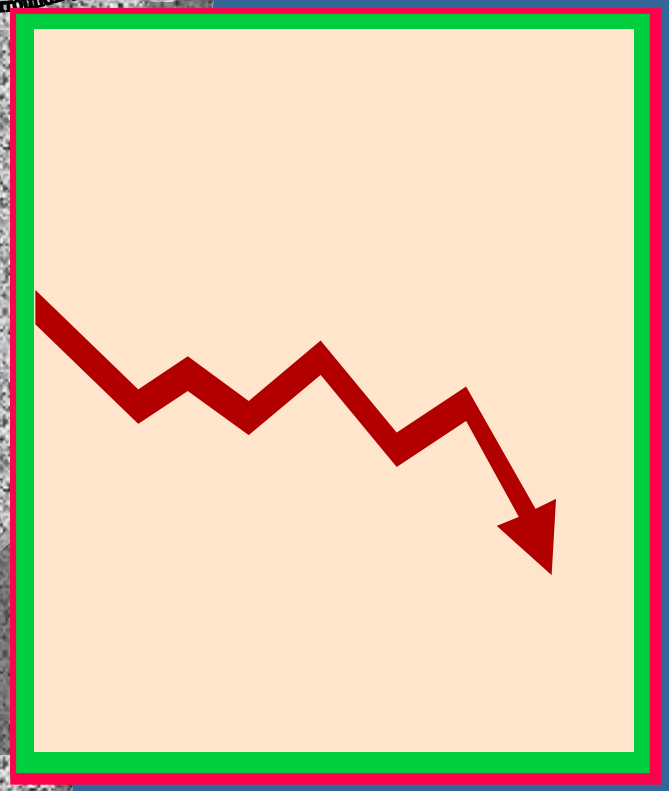
Policy Deployment – Questions to Ask

1. Do you have a plan?
2. Does the plan close the gaps to the goal?
3. Is the plan being executed on time?
4. Is the plan generating the expected business results?

If the answer is no for any of these, generate a countermeasure

Monitor effectiveness of countermeasure

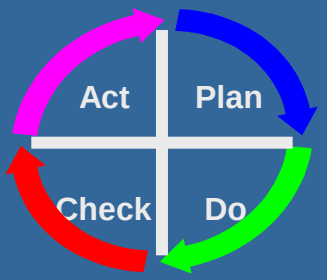
Look for trends – not just red/green

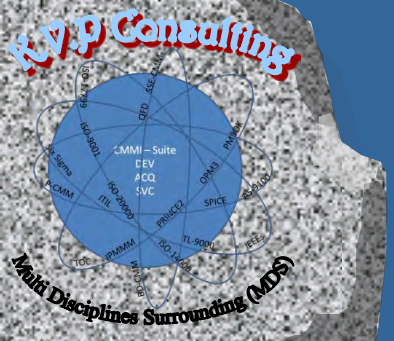


- Metrics chart gives an overall view if on track
- Use graphs and charts to see what is really happening.

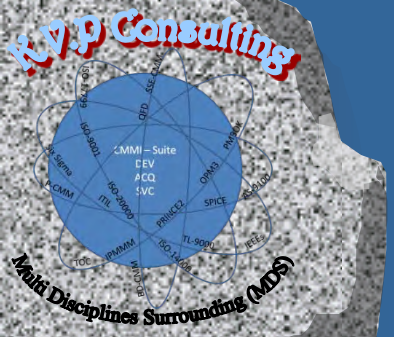
The ACT Phase

- If off track:
  - Review the plan and countermeasures to confirm that gap from the plan can be closed.
    - Is the plan itself valid or does it need to be modifid?
  - Follow up to determine if actions on the countermeasures have been done.
  - Go to GEMBA to check to see if progress is being made on critical issues
- If on track
  - Lock in the condition with standardized work
- Confirmation Check
  - Does the plan and countermeasures link to the goal/vision?
  - Does it seem reasonable?



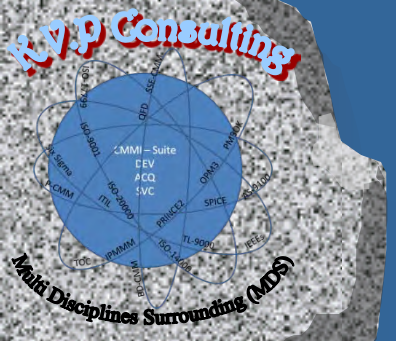

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How We Did It



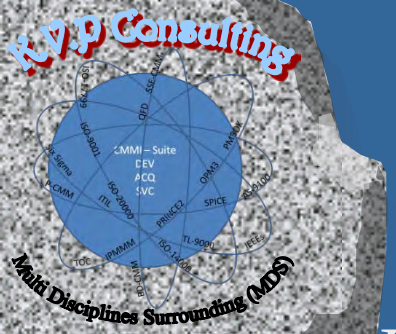
<BU ABC> Business Objectives

- The strategy document has 53 quotes the leading us to an optional list of Business Objectives and Quantitative Targets



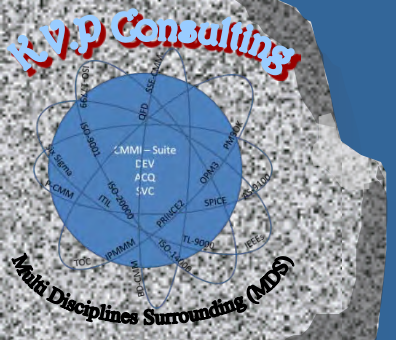
Business Objectives

- Supporting professional and personal service on competitive terms
- Flexible adjustments to changing market conditions at the lowest possible cost and a satisfactory time-to-market
- Keep its leading position
- Group's systems must be capable of handling growth in the Group's business, organically as well as through mergers and acquisitions



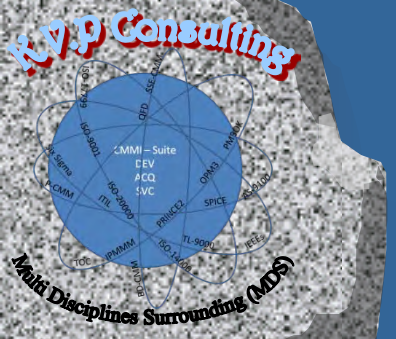
Business Objectives

- Prioritizes resources and projects based on cost-benefit considerations
- Manages the actual development process
- Systems must be designed for group-wide deployment
- Systems and functionality are reused across products, distribution channels, brands and markets
- Systems must optimize cross-organisational processes and make it possible to combine parts of the Group’s products into new products



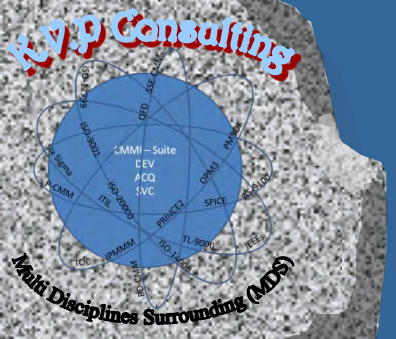
Business Objectives

- By reusing system elements, even across different technical platforms, significant efficiencies are gained in the development of systems
- Integrate third party systems into the whole system complex, regardless of the technical deployment platform
- Minimize the costs associated with the integration of applications and tools across systems and platforms
- Limited but adequate set of market leading technologies are used as standard tools



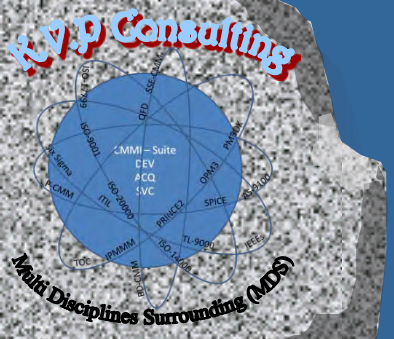
Business Objectives

- SyDLC and TCO must be implemented in such a way that the integrity of the business cannot be compromised
- level of security and operations must be high and financially sound
- Systems and platforms must have a high quality level, protecting the Group against errors, down time, security breaches and data loss
- Quality level must correspond with risks, consequences and not least the expectations of the customers



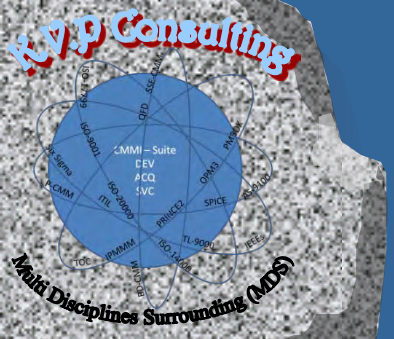
Business Objectives

- Systems must adhere to the agreed service levels and be delivered with the agreed functionality
- Simple and accessible user interfaces, adapted to the user's role or the customer's needs
- Access is given to the necessary functionality and information from the underlying business system based on consolidated data
- Systems must constantly support the chosen set of distribution channels and user interfaces, enabling the Group to meet the customer at any given point



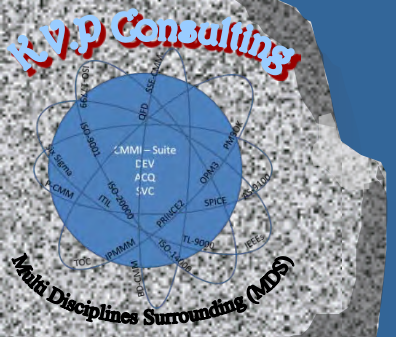
Business Objectives

- Knowledge about the customers and their behavior must be gathered in a structured way on each customer interaction, and related to the Group's products
- Integrated and customer-facing sales and advisory system ensures that products and services can be developed and deployed across business units, customer segments and distribution channels
- Reduce the Group's costs by optimizing the whole value chain



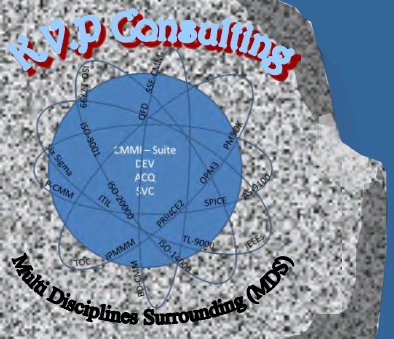
Business Objectives

- Costs associated with the rationalisation of processes must be minimal, enabling economically feasible automation of even small business processes
- Business procedures must be implemented direct as supported processes, guiding employees and customers through the activities with as little prior knowledge as possible, letting them concentrate on the products and actual business.
- Enables conversion of manual activities into automatic sequences without changing the basic design of the underlying processes.



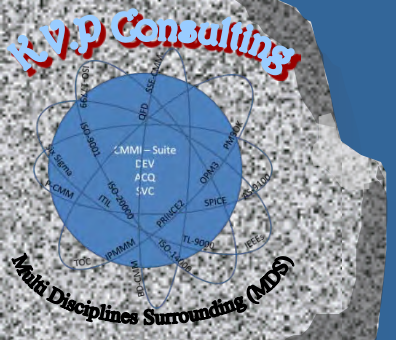
Business Objectives

- Combine activities efficiently and flexibly across distribution channels, partners, brands and markets, wherever this is desirable from a business point of view
- Systems must support the processes which gather, organize, share and analyse the entire knowledge platform that exists about customers, products, business initiatives, organization, employees, etc
- Information must be available at any time and anywhere to those it is meant for
- Group's management processes and pricing, they must be based on consolidated and sufficiently current data



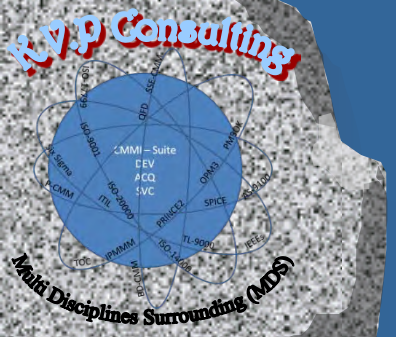
Business Objectives

- Increase flexibility gradually without compromising on efficiency and stability
- Diversity is handled systematically and efficiently by using an infrastructure, which efficiently integrates systems, processes and manual activities across platforms and technologies
- Infrastructure is provided to developers, freeing them from having to programe integration and flexibility into each system
- Use of market leading standards
- Design of system elements focusing on flexibility



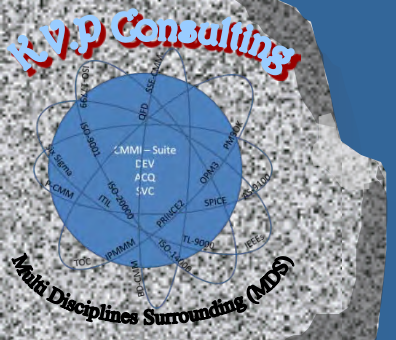
Business Objectives

- System elements must be designed to scale in line with business growth and expansion
- System elements must be capable of handling unexpected events
- Ensure that systems can continue normal operations with the least impact on the business
- Business continuity during normal operating conditions as well as in disaster-like situations
- Systems design must if possible take into account the changeability of externally controlled data and processes
- Readiness for change by implementing changes for the entire group



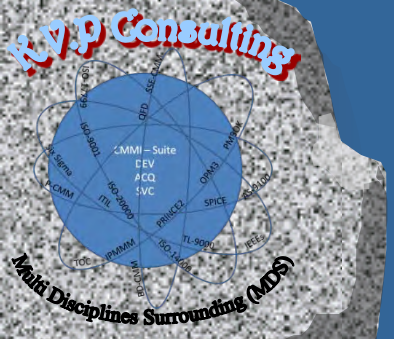
Business Objectives

- Resources can thus be reused in any other project or area in the Group in a simple and efficient way, thereby ensuring consolidation of both data and functionality
- It must be possible to combine scattered IT resources into complete systems, applications and actual business processes
- Infrastructure must handle the coupling dynamically and parameterized
- Selection of coupling method must not be based on a technology choice made by the developers



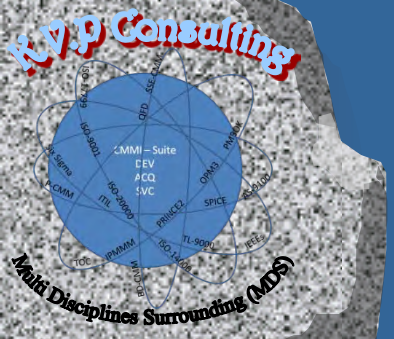
Business Objectives

- Infrastructure and development methods must as a minimum support a layering of systems into user interfaces, business logic and data
- Service levels must if possible be based on dynamic and flexible policies, which are directly definable in the operational environment
- Infrastructure must efficiently handle error detection and quality control of complete system
- Infrastructure must efficiently support the integration
- Architecture is an essential parameter when choosing a third-party system



Business Objectives

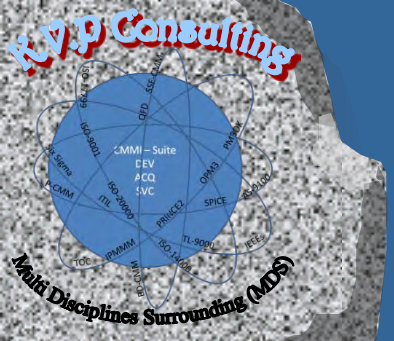
- Program managment must ensure consistency across manual and system-supported processes, by enabling any given process to involve both manual and automated work items
- Infrastructure must provide simple and efficient methods for supporting business procedures, processes and routines



Specify Measures



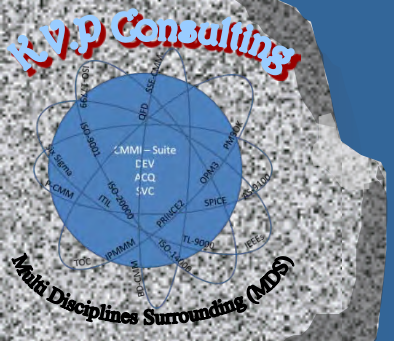
Microsoft Excel Worksheet



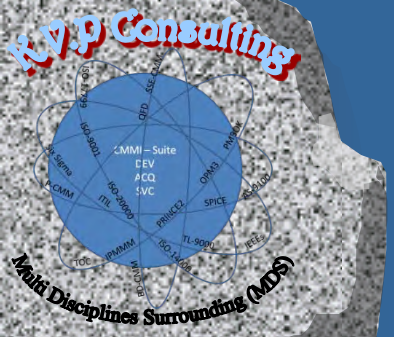
Manage Measures



Microsoft Excel Worksheet


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Questions ?



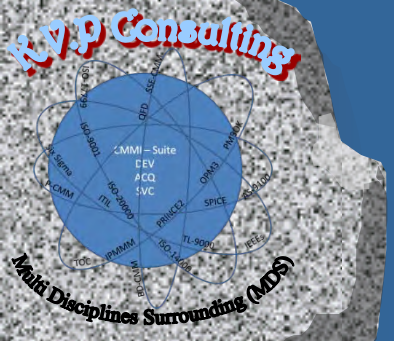
Contact

Kobi Vider

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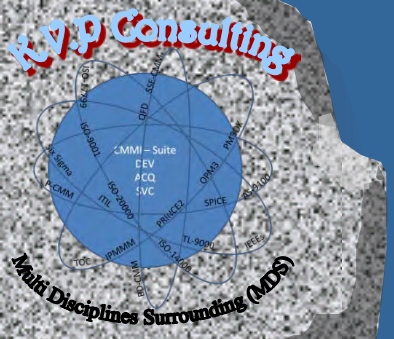
Kobi.Vider@hotmail.com

Phone: +972522946676



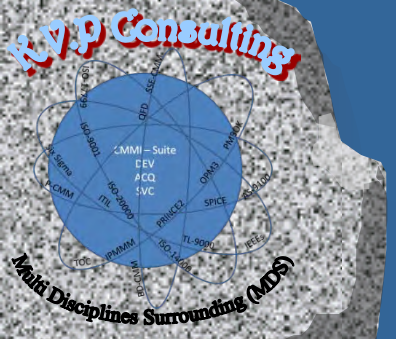
Leveraging Your Service Quality Using ITIL V3, ISO 20000 and CMMI-SVC

Monday Half-Day Tutorial



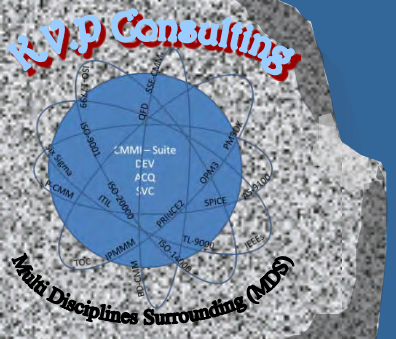
Definitions

- Service - Employment in duties or work for another



The Challenge

- This situation where organization is running a system lifecycle a matrix with internal or external contractors = service providers, with
  - separate quality management systems and with compliance to different standards (e.g. AS9100c) and qualification (e.g. MIL-STD 217) on different parts of the system / product lifecycle



The Challenge

- This situation where organization is running a system lifecycle a matrix with internal or external contractors, with
  - With partial overall view in interactions and handshakes between these groups is introducing inefficient usage of
    - resources,
    - expensive maintenance of duplicate infrastructures
    - and Organizational Sets of Standards Processes as well as assets,
  - May result in less quality and impacting the end product / system.


PROGRAMS
COUNTERMEASURES
Non-Lethal Weapons
Nuclear
Chem/Bio Weapons
LO/CLO
Special Access Programs
Personnel Security
Industrial Security
Operations Security
Physical Security
Information Security
Critical Infrastructure
Foreign Disclosure
Electronic/Command & Control Warfare
COMSEC
Information Technology
Information Assurance
Transportation Mgmt
Emanations Security
Space
Anti-Tamper
Supplier Assurance
ABOUT THIS CHART
Example of Safety & Security Required Standards



Known

Unknown

Known
Unknown

Unknown
Unknown

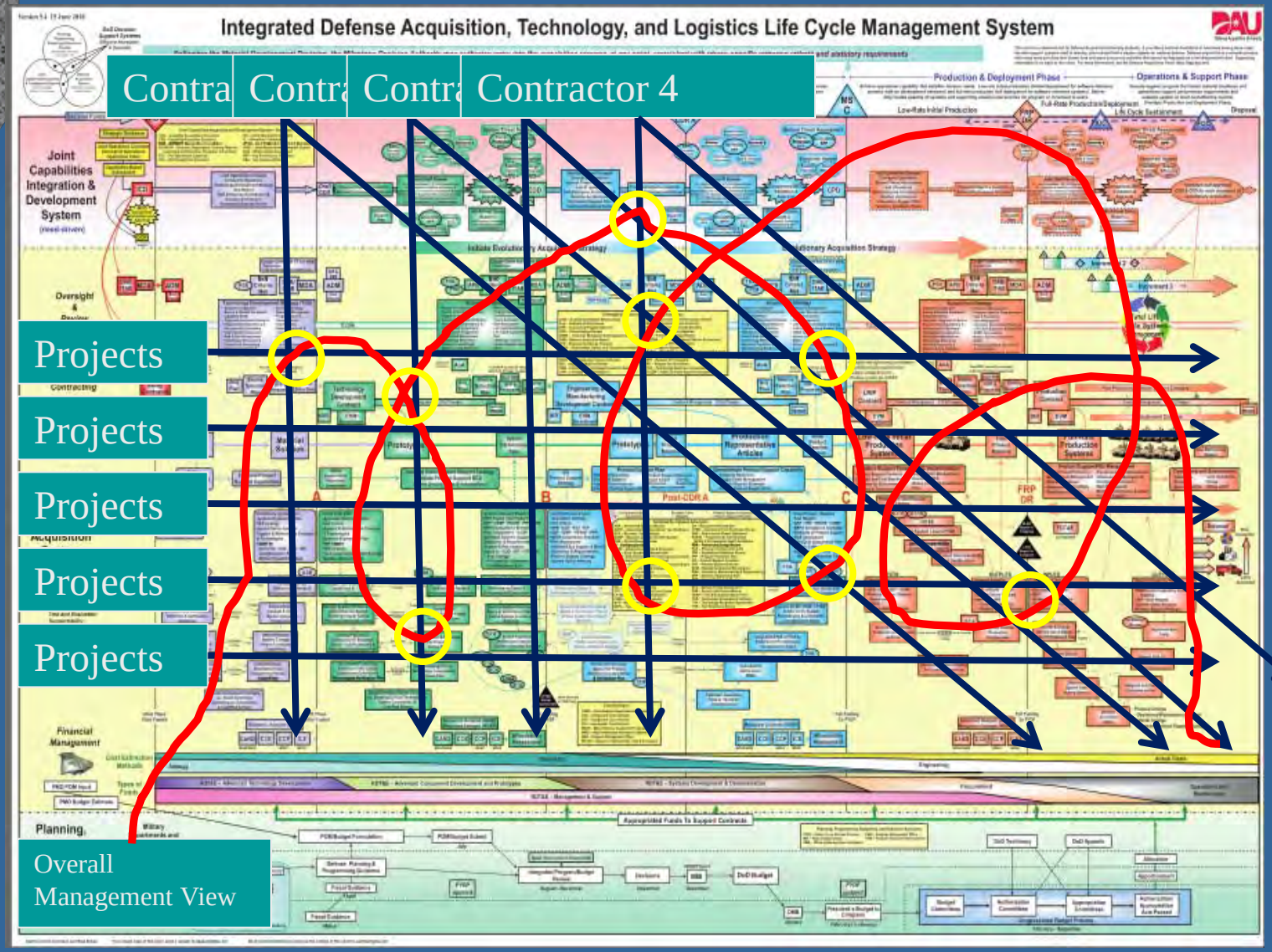
Known
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The Lifecycle Challenge



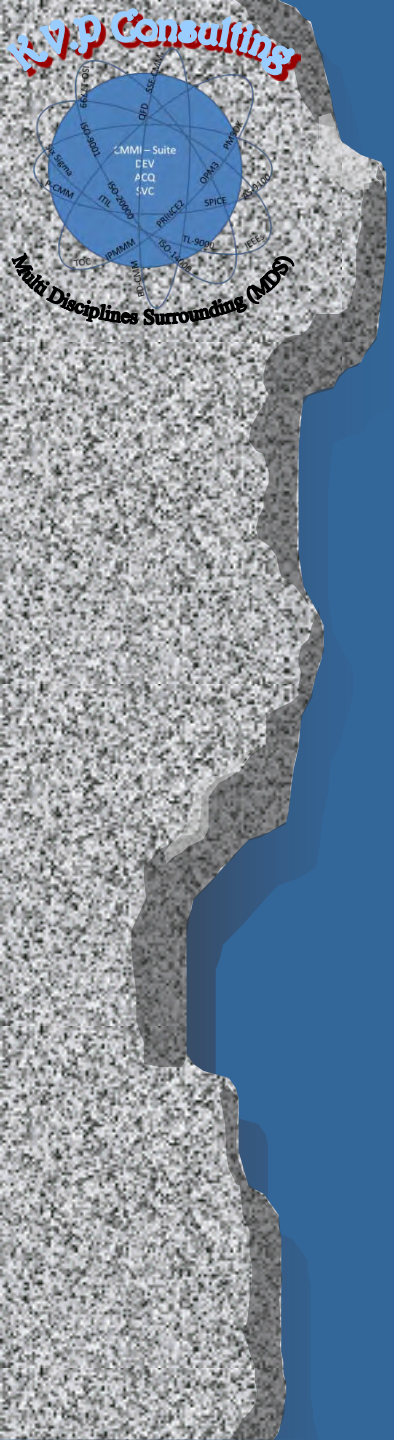


The Theory in the Models is Nice

However

Real Life is More Complicated

Much More


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F12

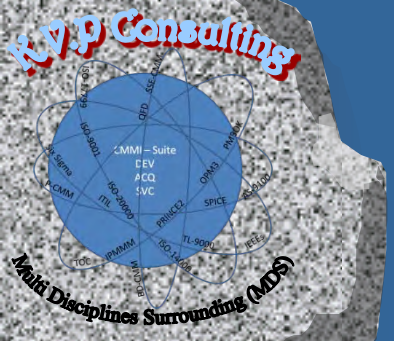








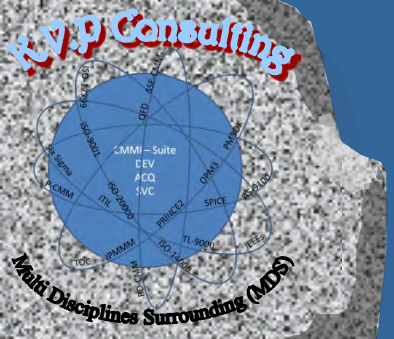




Common Failures - 1

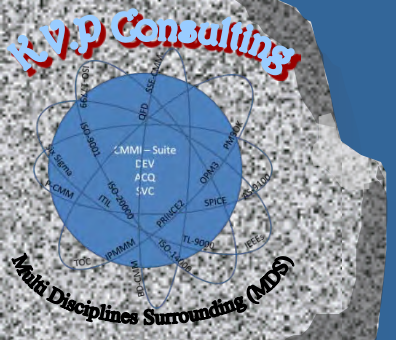
Organizational risk events are predominantly managerial, not technical.

- Lack of defining business objectives in quantitative terms and structure
- Inadequate definition of 'Good Enough' level
- Inability to differentiate different business objectives and success factors for the different domains and lifecycle phases
- Inadequate resource usage and adjustment to Plan and Objectives
- Failure to identify and manage risks
- Poor or mismanaged service / operational requirements
- Uncontrolled baselines, no configuration management
- Misunderstood business / operational needs and objectives



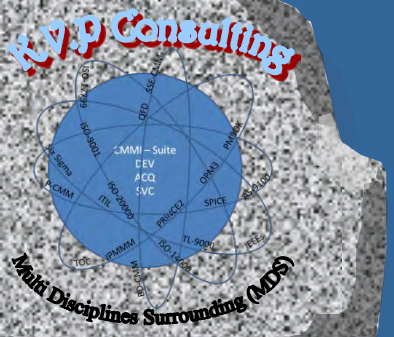
Common Failures - 2

- Poor contractor acquisition or management
- Lack of skills, capability and training
- Poor planning and tracking
  - Value Stream
  - Equipment
  - Resources
  - Finance
- Poor / misuse of data and measurements
- Inability to estimate accurately
- No quality assurance / control
- Poor communications



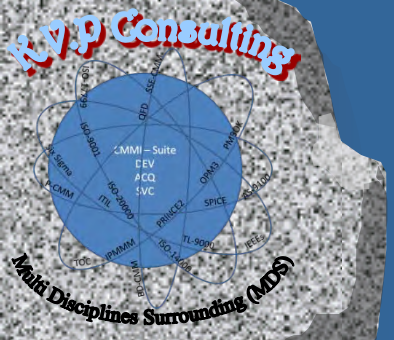
The Operational Need

- Management capability level from both professional and knowledge level
- Performance and reporting norms
- Self management and self discipline maintaining personal professional and knowledge capabilities
- Individual and team discipline
- Cooperation and knowledge and resource sharing
- Appropriate visibility of information, data and capabilities
- Quality of readiness and preparedness for performing mission



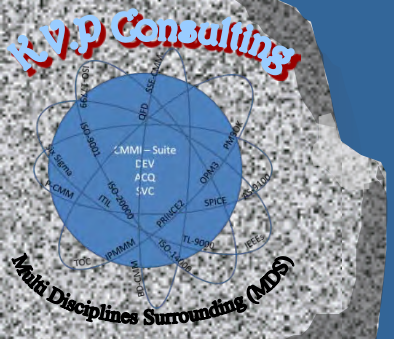
The Approach to the Solution Concept

- Best practices in the model focus on activities for providing quality services to the customer and end users
- To identify improvement targets in main lifecycle areas such as operations, information, governance, people and organizational structure, portfolios, project execution, and finance
- Select processes that are critical to the system success such as stakeholder management, technical interfaces and integration



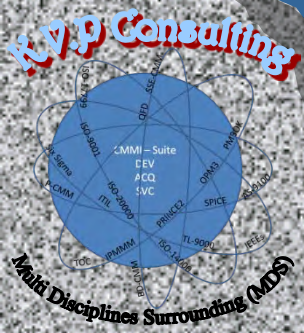
The Approach to the Solution Concept

- Build an action plan composed from the following main steps
  - Organizational map
  - Functional team and groups size and role in the lifecycle
  - Full lifecycle map
  - Setting improvement targets
  - Gap analysis
- Suggesting to the senior management to address the lifecycle and process (as a whole) as a complex of crossing interfaces and to add additional content to the lifecycle map (as a layer)



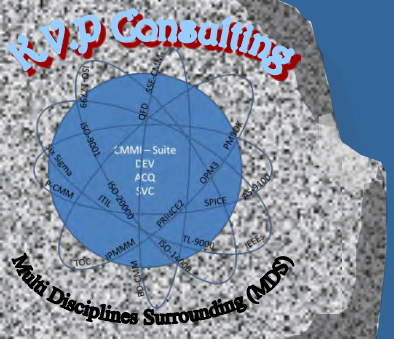
The Conceptual Solution

- Building on contingency theory, it outlines a comprehensive framework suggesting a fit between the level of Mission interoperability and environmental as well as internal contingencies.
- Moving from the current environment of basic process and way of thinking toward a more controlled and measured process to reduce the overwhelming amount of information that build decisions



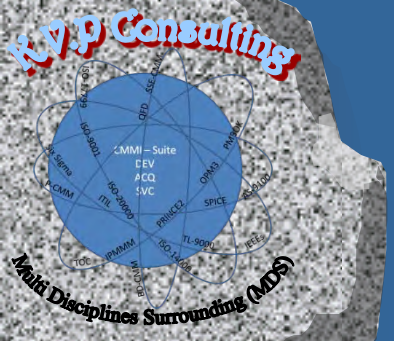
The Proposed Solution Concept

- Using the CMMI-SVC as an overall umbrella, to:
  - Increase results and effectiveness
  - Reduce quality related activities costs by reducing overlaps and choosing the appropriate parts only as part of the ‘whole’
  - Reduce administration costs by improving the ability to manage the lifecycle network
  - Converged working network helps businesses to save procurement costs of infrastructure

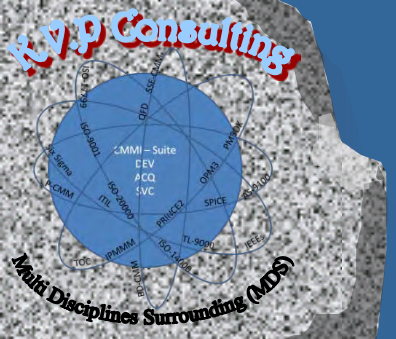


Process Improvement Effort Objectives

- Group Target is Process Improvement:
  - Increase Processes Efficiency
  - Increase Budget utilization
  - Reduce Cost of Poor Quality
  - Increase Uniformity in Processes
- Leading Standards to Compliance with
  - ITIL
  - ISO 20000
  - ISO 25999

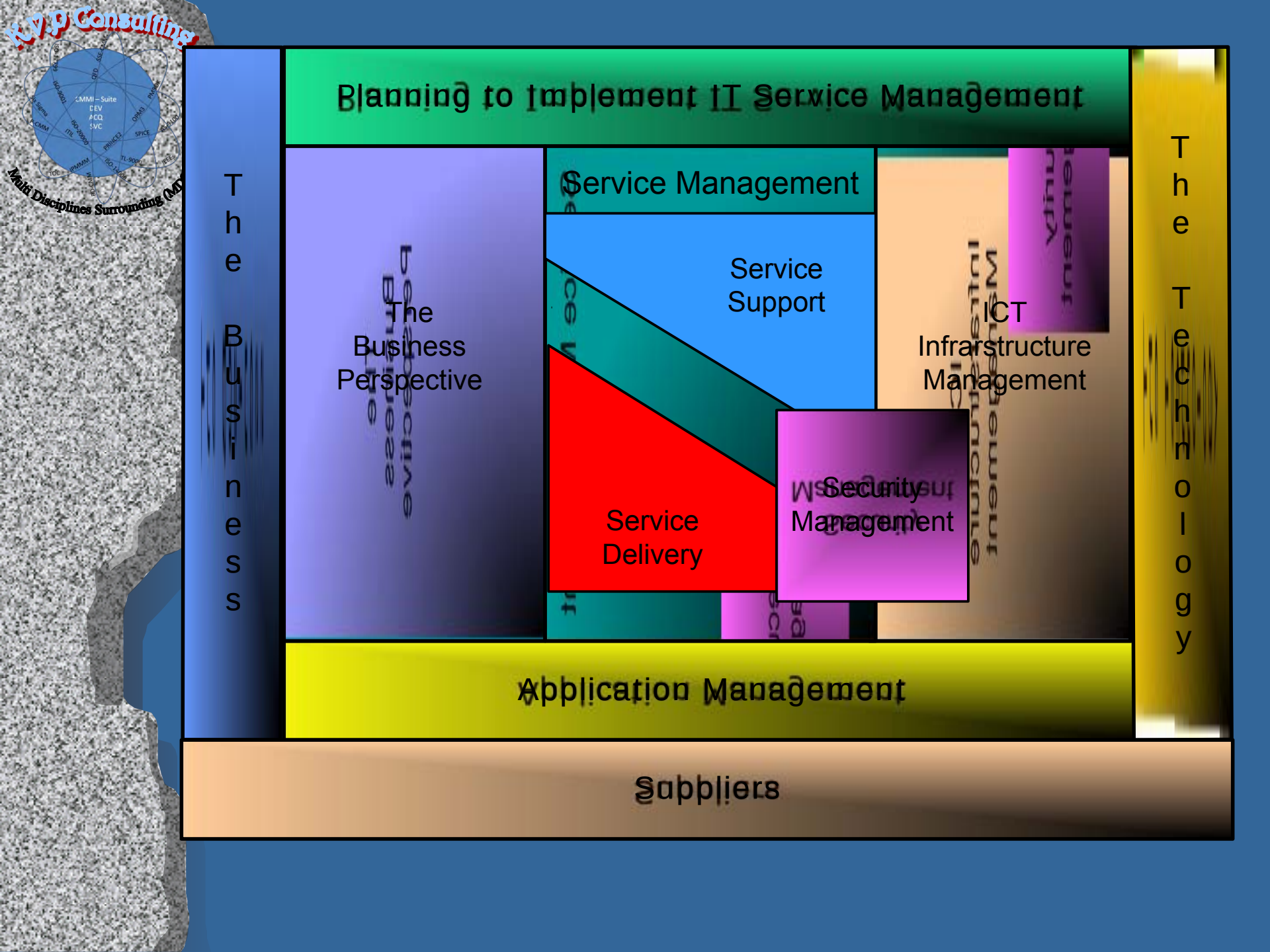


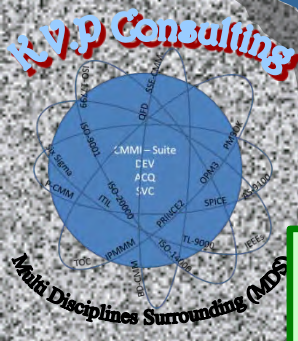
Mapping Sample



IT Infrastructure Library - ITIL

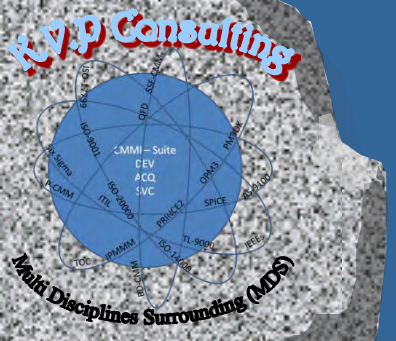
- Is “best practice” in IT Service Management, developed by OGC and supported by publications, qualifications and an international user group
- Assist organizations to develop a framework for IT Service Management and to certify the service managers
- Worldwide, most widely used best practice for IT Service Management
- Consists of a series of Core books giving guidance on the provision of quality IT services


Planning to Implement IT Service Management
The Business
Service Management
Service Support
Service Delivery
Security Management
The Business Perspective
ICT Infrarstructure Management
Application Management
Suppliers
The Technology



ITIL Processes & Function

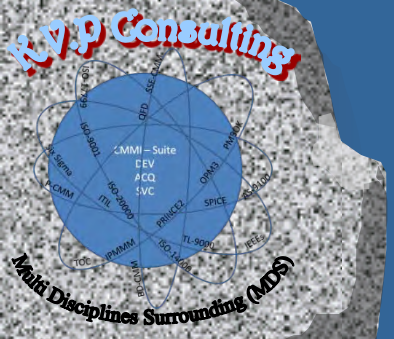
ITIL Processes	
Service Support	Service Delivery
Incident Management	Service Level Management
Problem Management	Availability Management
Change Management	Capacity Management
Release Management	IT Service Continuity Management
Configuration Management	Financial Management for IT Services
ITIL Functions	
Service Desk	



What is ISO 20000

ISO 20000 can be summarised as:

- A standard to promote the adoption of an integrated process approach for the effective delivery of managed services to meet business and customer requirements
- A set of “controls” against which an organization can be assessed for effective IT Service Management processes
- The ISO 20000 standard defines the requirements for an organization to deliver managed services of an acceptable quality for its customers



Structure of ISO 20000

The Standard is divided into two distinct parts:

- Part 1 - provides the requirements for IT service management to gain certification
- Part 2 - Code of Practice for Service Management
  - Provides guidance to internal auditors and assists service providers planning service improvements or preparing for audits against ISO 20000

ISO 20000 Processes

Management Systems	Management Responsibility, Documentation Requirements, Competences, Awareness & Training
Planning & Implementation	Plan, Implement, Monitor, Improve (Plan…. Do…. Check….. Act……)
Planning New Services	Planning & Implementing New or Changed Services

Service Delivery Processes

Capacity Management
Service Continuity & Availability Management

Service Level Management
Service Reporting

Information Security Management
Budgeting & Accounting for IT Services

Control Processes

Configuration Management
Change Management

Release Processes

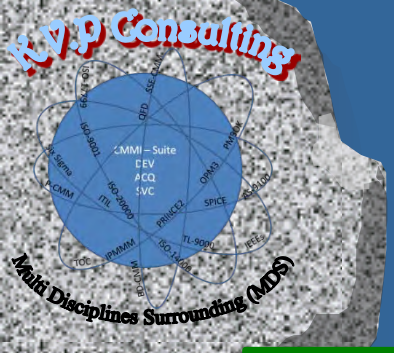
Release Management

Resolution Processes

Incident Management
Problem Management

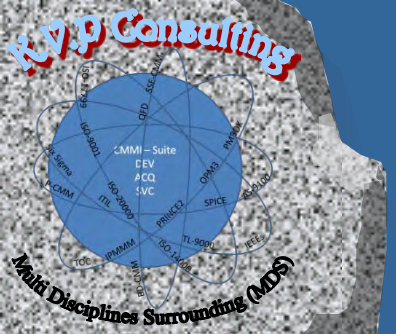
Relationship Processes

Business Relationship Management
Supplier Management



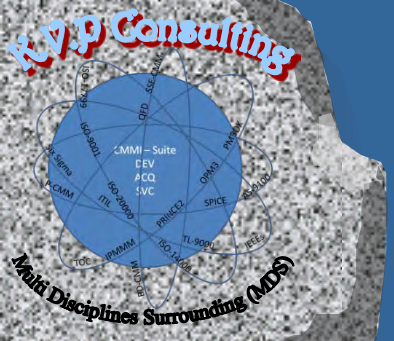
ITIL Service Support Processes & Functions

ISO 20000	ITIL
Resolution Processes	Incident Management
	Problem Management
Control Processes	Change Management
	Configuration Management
Release Process	Release Management
No formal Process	Service Desk

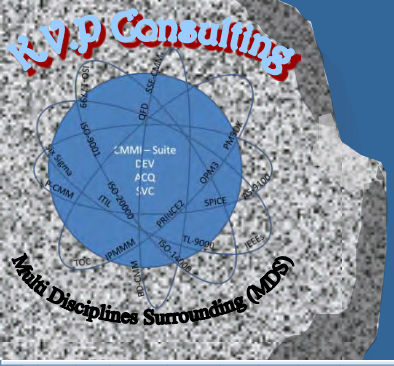


ITIL Service Delivery Processes

ISO 20000	ITIL
Service Level Management	Service Level Management
Service Reporting	
Business Relationship Management	
Supplier Management	
Service Continuity & Availability Management	IT Service Continuity Management
	Availability Management
Budgeting & Accounting for IT Services	Financial Management for IT Services
Capacity Management	Capacity Management
Information Security Management	No formal Process



CMMI Calibration Process



CMMI-SVC V 1.2

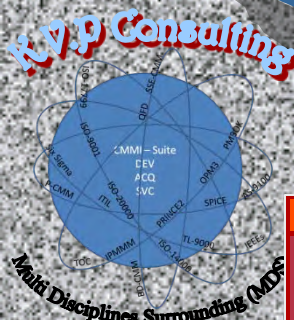
Con	Mat	Processe	Process	Proc	SG N	SP N	Title
SVC	5	Process Man	Causal Anal	CAR	Purpose		The purpose of Causal Analysis and Resolution (CAR) is to identify causes of defects and problems and take action to prevent them from occurring in the future
							Determine Causes of Defects and Problems
SVC	5	Process Man	Causal Anal	CAR	1		Root causes of defects and problems are systematically determined
							Select Defects and Problems
SVC	5	Process Man	Causal Anal	CAR	1	1.1	Select defects and problems for analysis
SVC	5	Process Man	Causal Anal	CAR	1		1. Gather relevant defect and problem data
SVC	5	Process Man	Causal Anal	CAR	1		2. Determine the defects and problems to be analyzed further
							Analyze Causes
SVC	5	Process Man	Causal Anal	CAR	1	1.2	Perform causal analysis of selected defects and problems and propose actions to address them
SVC	5	Process Man	Causal Anal	CAR	1	1.2	1. Conduct causal analysis with those responsible for performing the task
SVC	5	Process Man	Causal Anal	CAR	1	1.2	2. Analyze selected defects and problems to determine their root causes
SVC	5	Process Man	Causal Anal	CAR	1	1.2	3. Group selected defects and problems based on their root causes
SVC	5	Process Man	Causal Anal	CAR	1	1.2	4. Propose and document actions to be taken to prevent the future occurrence of similar defects and problems
							Address Causes of Defects and Problems
SVC	5	Process Man	Causal Anal	CAR	2		Root causes of defects and problems are systematically addressed to prevent their future occurrence
							Implement Action Proposals
SVC	5	Process Man	Causal Anal	CAR	2	2.1	Implement selected action proposals developed in causal analysis
SVC	5	Process Man	Causal Anal	CAR	2	2.1	1. Analyze action proposals and determine their priorities
SVC	5	Process Man	Causal Anal	CAR	2	2.1	2. Select action proposals to be implemented
SVC	5	Process Man	Causal Anal	CAR	2	2.1	3. Create action items for implementing the action proposals
SVC	5	Process Man	Causal Anal	CAR	2	2.1	4. Identify and remove similar defects and problems that may exist in other processes and work products
SVC	5	Process Man	Causal Anal	CAR	2	2.1	5. Identify and document improvement proposals for the organization's set of standard processes
							Evaluate the Effect of Changes
SVC	5	Process Man	Causal Anal	CAR	2	2.2	Evaluate the effect of changes on process performance
SVC	5	Process Man	Causal Anal	CAR	2	2.2	1. Measure the change in performance of the project's defined process or of subprocesses as appropriate
SVC	5	Process Man	Causal Anal	CAR	2	2.2	2. Measure the capability of the project's defined process or of subprocesses as appropriate
							Record Data
SVC	5	Process Man	Causal Anal	CAR	2	2.3	Record causal analysis and resolution data for use across the project and organization
SVC	2	Support	Configurati	CM	Purpose		The purpose of Configuration Management (CM) is to establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits

CMMI-ACQ V 1.2

Con	Mat	Proc	Proc	Proc	SG N	SP Num	Title
ACQ	5	Sup	Cau	CAR			The purpose of Causal Analysis and Resolution (CAR) is to identify causes of defects and other problems and take action to prevent them from occurring in the future
							Determine Causes of Defects
ACQ	5	Sup	Cau	CAR	1	1	Root causes of defects and other problems are systematically determined
							Select Defect Data for Analysis
ACQ	5	Sup	Cau	CAR	1	1.1	Select defects and other problems for analysis
ACQ	5	Sup	Cau	CAR	1	1.1	1. Gather relevant defect or problem data
ACQ	5	Sup	Cau	CAR	1	1.1	2. Determine the defects and other problems to be analyzed further
							Analyze Causes
ACQ	5	Sup	Cau	CAR	1	1.2	Perform causal analysis of selected defects and other problems and propose actions to address them
ACQ	5	Sup	Cau	CAR	1	1.2	1. Conduct causal analysis with those responsible for performing the task.
ACQ	5	Sup	Cau	CAR	1	1.2	2. Analyze selected defects and other problems to determine their root causes
ACQ	5	Sup	Cau	CAR	1	1.2	3. Group selected defects and other problems based on their root causes
ACQ	5	Sup	Cau	CAR	1	1.2	4. Propose and document actions to be taken to prevent the future occurrence of similar defects or other problems
							Address Causes of Defects
ACQ	5	Sup	Cau	CAR	2	2	Root causes of defects and other problems are systematically addressed to prevent their future occurrence
							Implement Action Proposals
ACQ	5	Sup	Cau	CAR	2	2.1	Implement selected action proposals developed in causal analysis
ACQ	5	Sup	Cau	CAR	2	2.1	1. Analyze action proposals and determine their priorities
ACQ	5	Sup	Cau	CAR	2	2.1	2. Select action proposals to be implemented
ACQ	5	Sup	Cau	CAR	2	2.1	3. Create action items for implementing the action proposals
ACQ	5	Sup	Cau	CAR	2	2.1	4. Identify and remove similar defects that may exist in other processes and work products
ACQ	5	Sup	Cau	CAR	2	2.1	5. Identify and document improvement proposals for the organization's set of standard processes
							Evaluate the Effect of Changes
ACQ	5	Sup	Cau	CAR	2	2.2	Evaluate the effect of changes on process performance
ACQ	5	Sup	Cau	CAR	2	2.2	1. Measure the change in performance of the project's defined process or of subprocesses, as appropriate
ACQ	5	Sup	Cau	CAR	2	2.2	2. Measure the capability of the project's defined process or of subprocesses, as appropriate
							Record Data
ACQ	5	Sup	Cau	CAR	2	2.3	Record causal analysis and resolution data for use across the project and organization
ACQ	2	Sup	Con	CM			The purpose of Configuration Management (CM) is to establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits

CMMI-DEV V 1.2

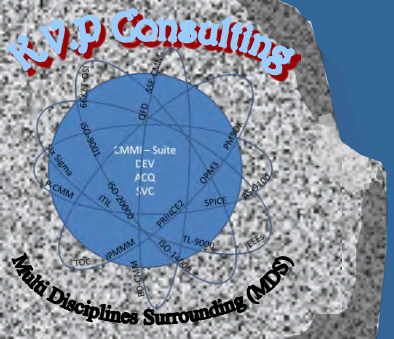
Con	Mat	Proc	Proc	Proc	SG	SP	Num	Title
DEV	5	Sup	Cau	CAR				The purpose of Causal Analysis and Resolution (CAR) is to identify causes of defects and problems and take action to prevent them from occurring in the future
								Root causes of defects and other problems are systematically det
DEV	5	Sup	Cau	CAR	1		1	A root cause is a source of a defect such that, if it is removed, th
								Select Defect Data for Analysis
DEV	5	Sup	Cau	CAR	1	1.1		Select the defects and other problems for analysis
DEV	5	Sup	Cau	CAR	1	1.1		Gather relevant defect or problem data
DEV	5	Sup	Cau	CAR	1	1.1		Determine which defects and other problems will be analyzed fu
								Analyze Causes
DEV	5	Sup	Cau	CAR	1	1.2		Perform causal analysis of selected defects and other problems a
DEV	5	Sup	Cau	CAR	1	1.2		Conduct causal analysis with the people who are responsible for
DEV	5	Sup	Cau	CAR	1	1.2		Analyze selected defects and other problems to determine their ro
DEV	5	Sup	Cau	CAR	1	1.2		Group the selected defects and other problems based on their ro
								Propose and document actions that need to be taken to prevent t
DEV	5	Sup	Cau	CAR	1	1.2		defects or other problems
								Address Causes of Defects
DEV	5	Sup	Cau	CAR	2	2		Root causes of defects and other problems are systematically add
								occurrence
								Implement the Action Proposals
DEV	5	Sup	Cau	CAR	2	2.1		Implement the selected action proposals that were developed in
DEV	5	Sup	Cau	CAR	2	2.1		1. Analyze the action proposals and determine their priorities
DEV	5	Sup	Cau	CAR	2	2.1		2. Select the action proposals that will be implemented
DEV	5	Sup	Cau	CAR	2	2.1		3. Create action items for implementing the action proposals
DEV	5	Sup	Cau	CAR	2	2.1		4. Identify and remove similar defects that may exist in other pro
DEV	5	Sup	Cau	CAR	2	2.1		5. Identify and document improvement proposals for the organiz
								Evaluate the Effect of Changes
DEV	5	Sup	Cau	CAR	2	2.2		Evaluate the effect of changes on process performance
DEV	5	Sup	Cau	CAR	2	2.2		1. Measure the change in the performance of the project's defined
DEV	5	Sup	Cau	CAR	2	2.2		2. Measure the capability of the project's defined process as appr
								Record Data
DEV	5	Sup	Cau	CAR	2	2.3		Record causal analysis and resolution data for use across the pro
DEV	2	Sup	Con	CM				The purpose of Configuration Management (CM) is to establish a products using configuration identification, configuration contro and configuration audits



First Level Filtering (PA Level)

DEV	ACQ	SVC
Project Planning	Project Planning	Project Planning
Project Monitoring and Control	Project Monitoring and Control	Project Monitoring and Control
Process and Product Quality Assurance	Process and Product Quality Assurance	Process and Product Quality Assurance
Requirements Management	Requirements Management	Requirements Management
Configuration Management	Configuration Management	Configuration Management
Measurement and Analysis	Measurement and Analysis	Measurement and Analysis
Organizational Process Definition +IPPD	Organizational Process Definition	Organizational Process Definition
Organizational Process Focus	Organizational Process Focus	Organizational Process Focus
Organizational Training	Organizational Training	Organizational Training
Decision Analysis and Resolution	Decision Analysis and Resolution	Decision Analysis and Resolution
Integrated Project Management +IPPD	Integrated Project Management	Integrated Project Management
Risk Management	Risk Management	Risk Management
Quantitative Project Management	Quantitative Project Management	Quantitative Project Management
Organizational Process Performance	Organizational Process Performance	Organizational Process Performance
Causal Analysis and Resolution	Causal Analysis and Resolution	Causal Analysis and Resolution
Organizational Innovation and Deployment	Organizational Innovation and Deployment	Organizational Innovation and Deployment
Supplier Agreement Management		Supplier Agreement Management
Requirements Development	Acquisition Requirements Development	
Validation	Acquisition Validation	
Verification	Acquisition Verification	
Technical Solution	Solicitation and Supplier Agreement Development	Capacity and Availability Management
Product Integration	Agreement Management	Incident Resolution and Prevention
	Acquisition Technical Management	Service Continuity
		Service Delivery
		Service System Development
		Service System Transition
		Strategic Service Management

ITIL – CMMI Correlation Snapshot



Service Delivery

- Financial Management for IT Services
- Capacity Management
- IT Service Continuity Management
- Availability Management
- Service Level Management

REQM SSD OPP DAR RSKM

CAM OT QPM M&A IRP

SAM OPD SST PPQA SCON

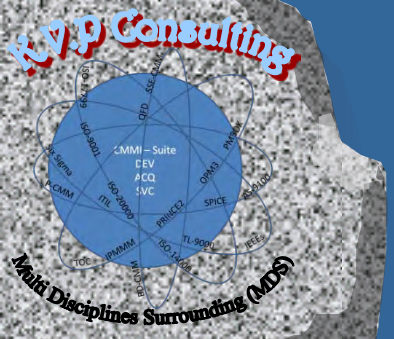
PMC OPF IPM OID SD

PP CM STSM CAR

CMMI V1.2

ITIL – CMMI Correlation Snapshot

Service Support



The Service Desk

Incident Management

Problem Management

Configuration Management

Change Management

Release Management

PEQM SSD OPF DAR RSKM

CAM OT QPM M&A IRP

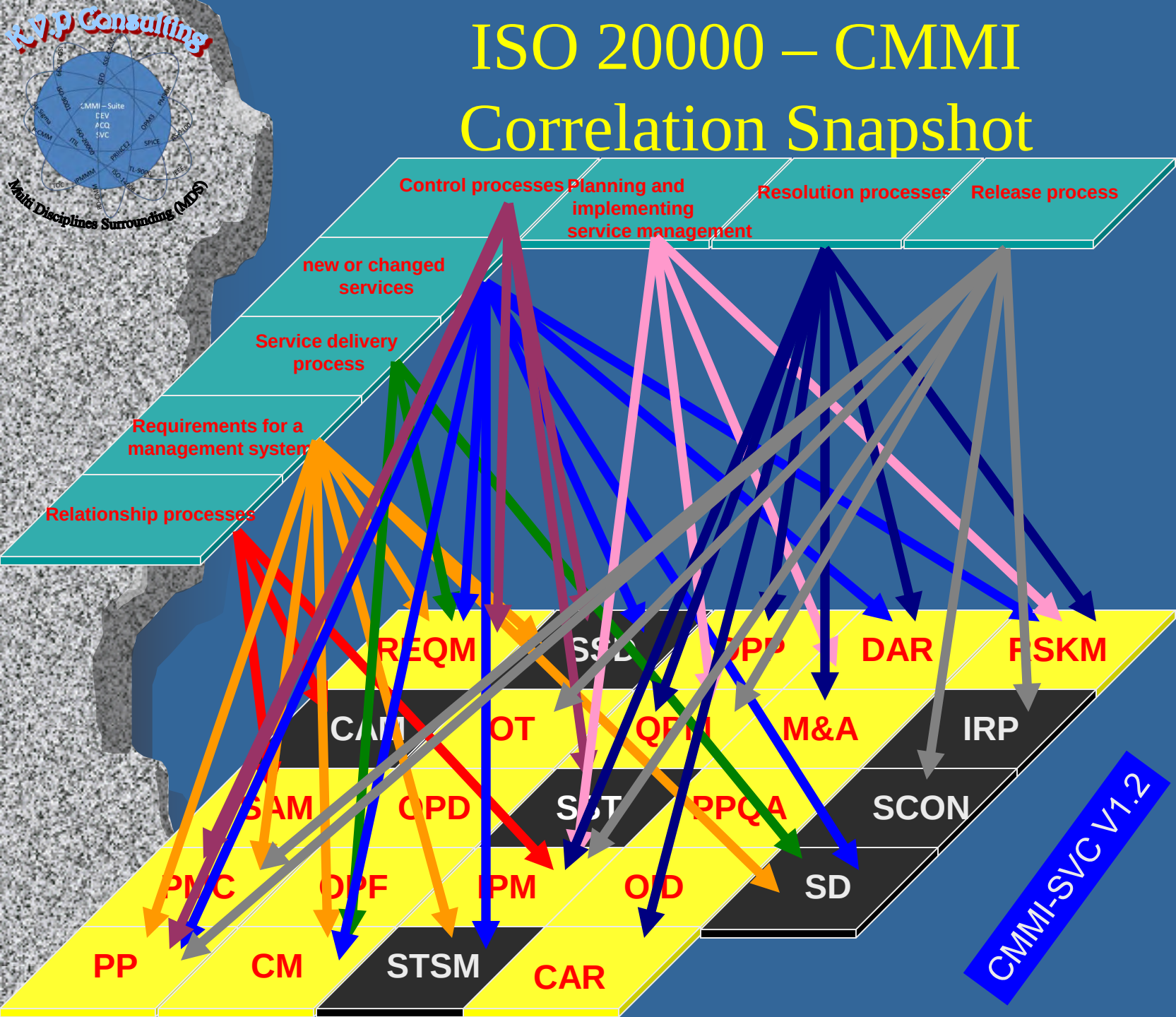
SAM OPD SST PPQA SCON

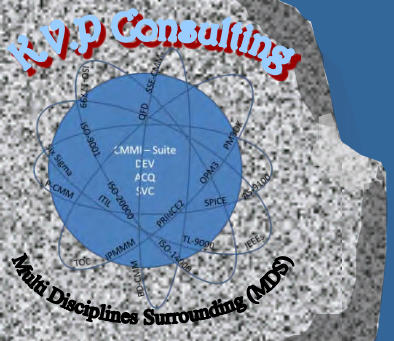
PMC CPE IPM OID CD

PP CM STSM CAR

CMMI V1.2

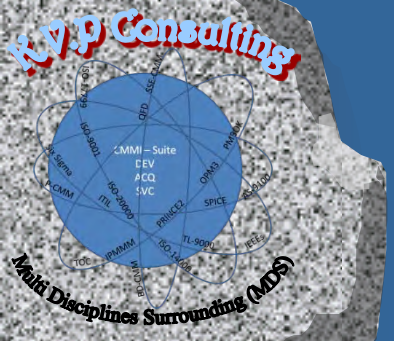
ISO 20000 – CMMI Correlation Snapshot



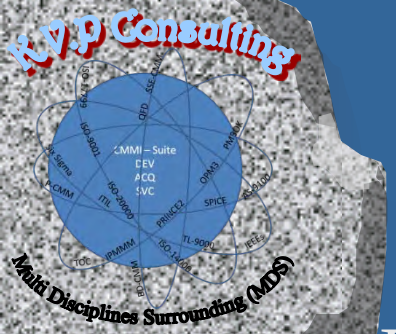


The Implementation

What we did

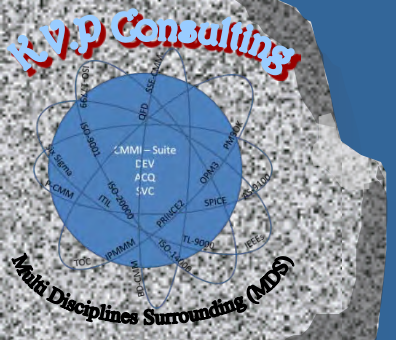


Our Organizations (Group) Structure



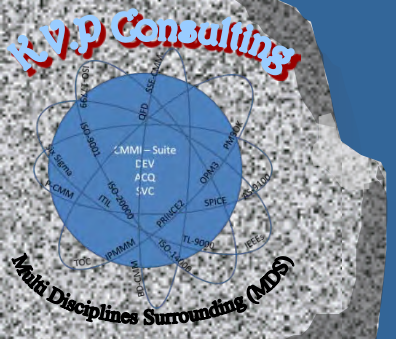
Business Objectives

- Prioritizes resources and projects based on cost-benefit considerations
- Manages the actual development process
- Systems must be designed for group-wide deployment
- Systems and functionality are reused across products, distribution channels, brands and markets
- Systems must optimize cross-organisational processes and make it possible to combine parts of the Group’s products into new products



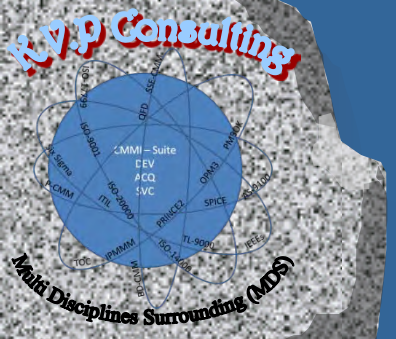
Business Objectives

- By reusing system elements, even across different technical platforms, significant efficiencies are gained in the development of systems
- Integrate third party systems into the whole system complex, regardless of the technical deployment platform
- Minimize the costs associated with the integration of applications and tools across systems and platforms
- Limited but adequate set of market leading technologies are used as standard tools



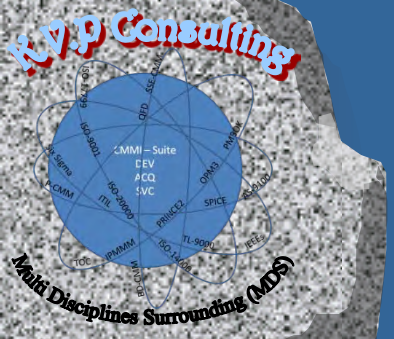
Business Objectives

- SyDLC and TCO must be implemented in such a way that the integrity of the business cannot be compromised
- level of security and operations must be high and financially sound
- Systems and platforms must have a high quality level, protecting the Group against errors, down time, security breaches and data loss
- Quality level must correspond with risks, consequences and not least the expectations of the customers



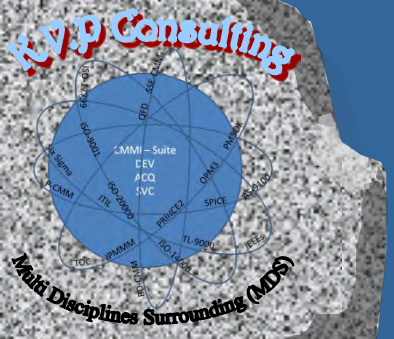
Business Objectives

- Systems must adhere to the agreed service levels and be delivered with the agreed functionality
- Simple and accessible user interfaces, adapted to the user's role or the customer's needs
- Access is given to the necessary functionality and information from the underlying business system based on consolidated data
- Systems must constantly support the chosen set of distribution channels and user interfaces, enabling the Group to meet the customer at any given point



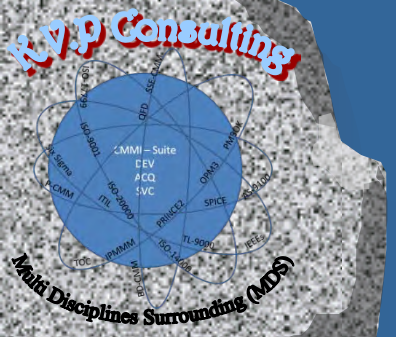
Business Objectives

- Knowledge about the customers and their behavior must be gathered in a structured way on each customer interaction, and related to the Group's products
- Integrated and customer-facing sales and advisory system ensures that products and services can be developed and deployed across business units, customer segments and distribution channels
- Reduce the Group's costs by optimizing the whole value chain



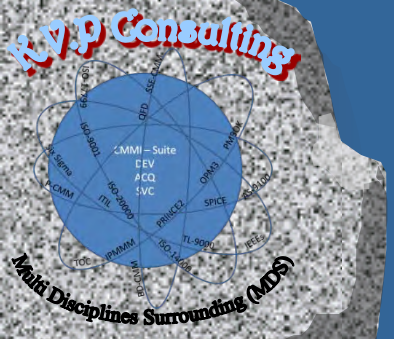
Business Objectives

- Costs associated with the rationalisation of processes must be minimal, enabling economically feasible automation of even small business processes
- Business procedures must be implemented direct as supported processes, guiding employees and customers through the activities with as little prior knowledge as possible, letting them concentrate on the products and actual business.
- Enables conversion of manual activities into automatic sequences without changing the basic design of the underlying processes.



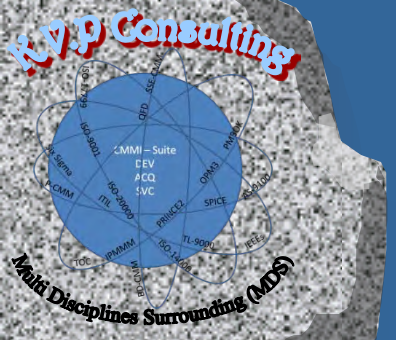
Business Objectives

- Combine activities efficiently and flexibly across distribution channels, partners, brands and markets, wherever this is desirable from a business point of view
- Systems must support the processes which gather, organize, share and analyse the entire knowledge platform that exists about customers, products, business initiatives, organization, employees, etc
- Information must be available at any time and anywhere to those it is meant for
- Group's management processes and pricing, they must be based on consolidated and sufficiently current data



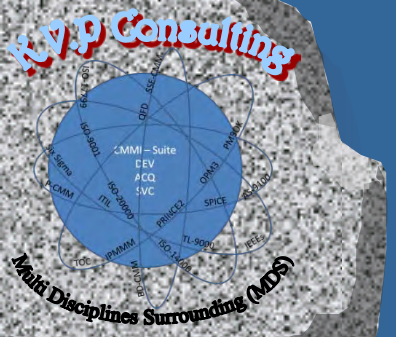
Business Objectives

- Increase flexibility gradually without compromising on efficiency and stability
- Diversity is handled systematically and efficiently by using an infrastructure, which efficiently integrates systems, processes and manual activities across platforms and technologies
- Infrastructure is provided to developers, freeing them from having to programe integration and flexibility into each system
- Use of market leading standards
- Design of system elements focusing on flexibility



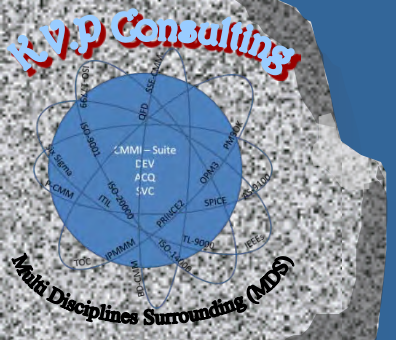
Business Objectives

- System elements must be designed to scale in line with business growth and expansion
- System elements must be capable of handling unexpected events
- Ensure that systems can continue normal operations with the least impact on the business
- Business continuity during normal operating conditions as well as in disaster-like situations
- Systems design must if possible take into account the changeability of externally controlled data and processes
- Readiness for change by implementing changes for the entire group



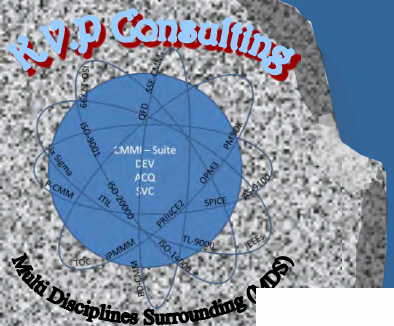
Business Objectives

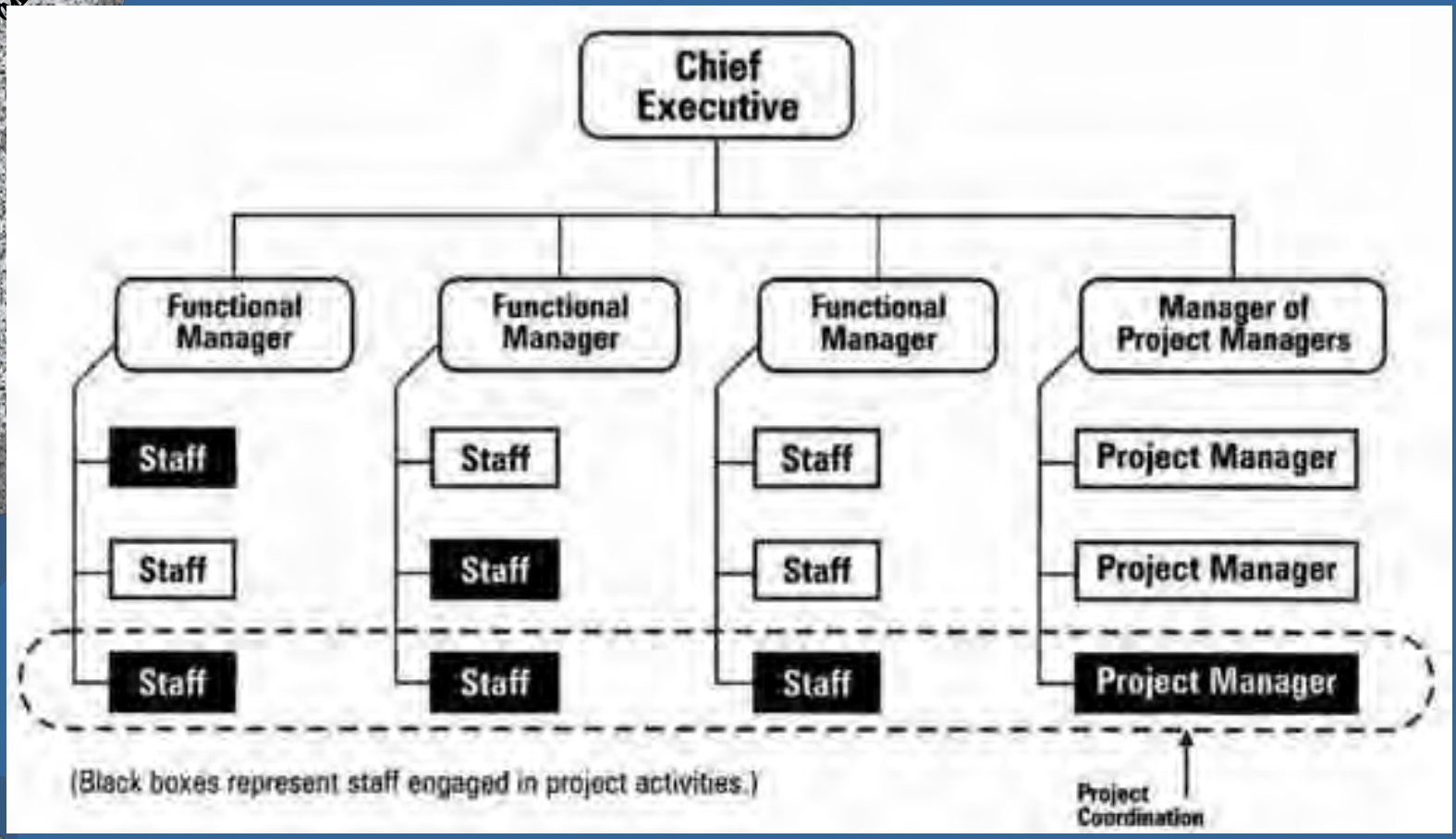
- Resources can thus be reused in any other project or area in the Group in a simple and efficient way, thereby ensuring consolidation of both data and functionality
- It must be possible to combine scattered IT resources into complete systems, applications and actual business processes
- Infrastructure must handle the coupling dynamically and parameterized
- Selection of coupling method must not be based on a technology choice made by the developers



Business Objectives

- Infrastructure and development methods must as a minimum support a layering of systems into user interfaces, business logic and data
- Service levels must if possible be based on dynamic and flexible policies, which are directly definable in the operational environment
- Infrastructure must efficiently handle error detection and quality control of complete system
- Infrastructure must efficiently support the integration
- Architecture is an essential parameter when choosing a third-party system


K.V.P Consulting
CMMI – Suite
DEV
ACQ
SVC
Multi Disciplines Surrounding (MDS)


Chief Executive
Functional Manager
Functional Manager
Functional Manager
Manager of Project Managers
Staff
Staff
Staff
Staff
Staff
Staff
Staff
Staff
Staff
Project Manager
Project Manager
Project Manager
(Black boxes represent staff engaged in project activities.)
Project Coordination



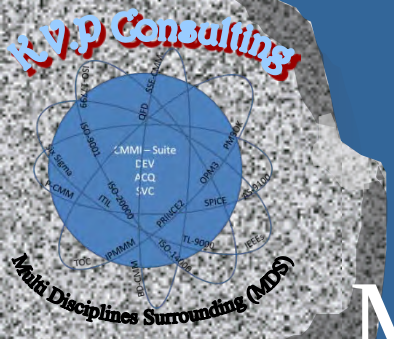
Organizational Size and Functions

- Senior manager
- 15 ‘Division’ managers
- ~80 Mid Level mangers
- ~X00 project / program / acquisition and line mangers
- X,000 working level staff relevant to the effort
- ~800 Quality related personal
- ~1000 ‘auditors’



Organizational Background Size and Functions

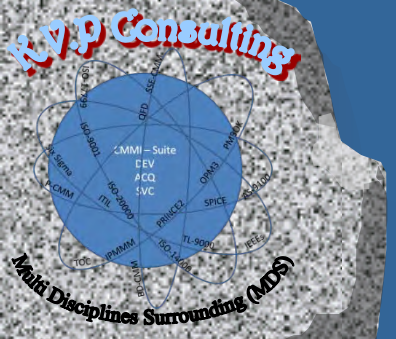
- Acquisition
- Project and program management
- In-house full development
- System integration
- Service units (i.e. IT, Civil Eng)
- HR
- Security (Information and data)
- Facilities and infrastructure
- In-house system engineering
- Maintenance and support
- Web centric operational architecture



Organizational Background
Main Related Quality Standards

- Internal Quality Standard
- EFQM
- CMMI Suite (SVC / ACQ / DEV)
- PMBOK & OPM3
- DoD 5000.01 & 5000.02
- ISO 14000
- OHAS 18000
- ITIL V 3
- ISO 20000
- ISO 27001 & 27002
- ISO 9001
- Other SEI technologies (RMM / P-CMM / TSP / PSP)

IT Quality Management Strategy



L6 Strategic Framework
EFQM / Baldrige

L5 Continuous process improvements (CMMI)

L4 Organizational (Cross Units) QMS Integration

L3 Automation (QMS Application)

L2 Processes & Implementation of best practices & standards (ITIL)

L1 Planning & Design of QMS (based on ITIL guidance and ISO9001:2000 preparation and certification)

Process Performance

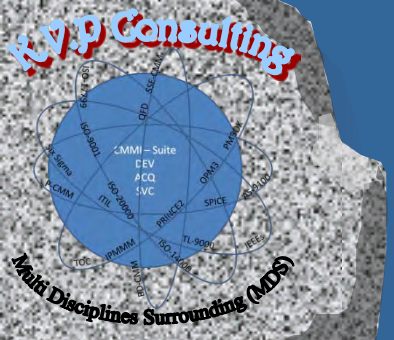
People & Performance (Culture change; individual & team metrics)

QMS = Quality Management System; ITIL = Information Technology Infrastructure Library; ; ISO = International Standards Organisation; CMMI = Capability Maturity Model Integration



Sample Improvement Targets

- Service reuse
- Improved perception and response time
- Interoperability
- Business agility.
- Service performance and its impact on the organization governance



IPT Structure

Group Level

Overarching IPT
'Division'
Program IPT

Test IPT

Cost Performance IPT

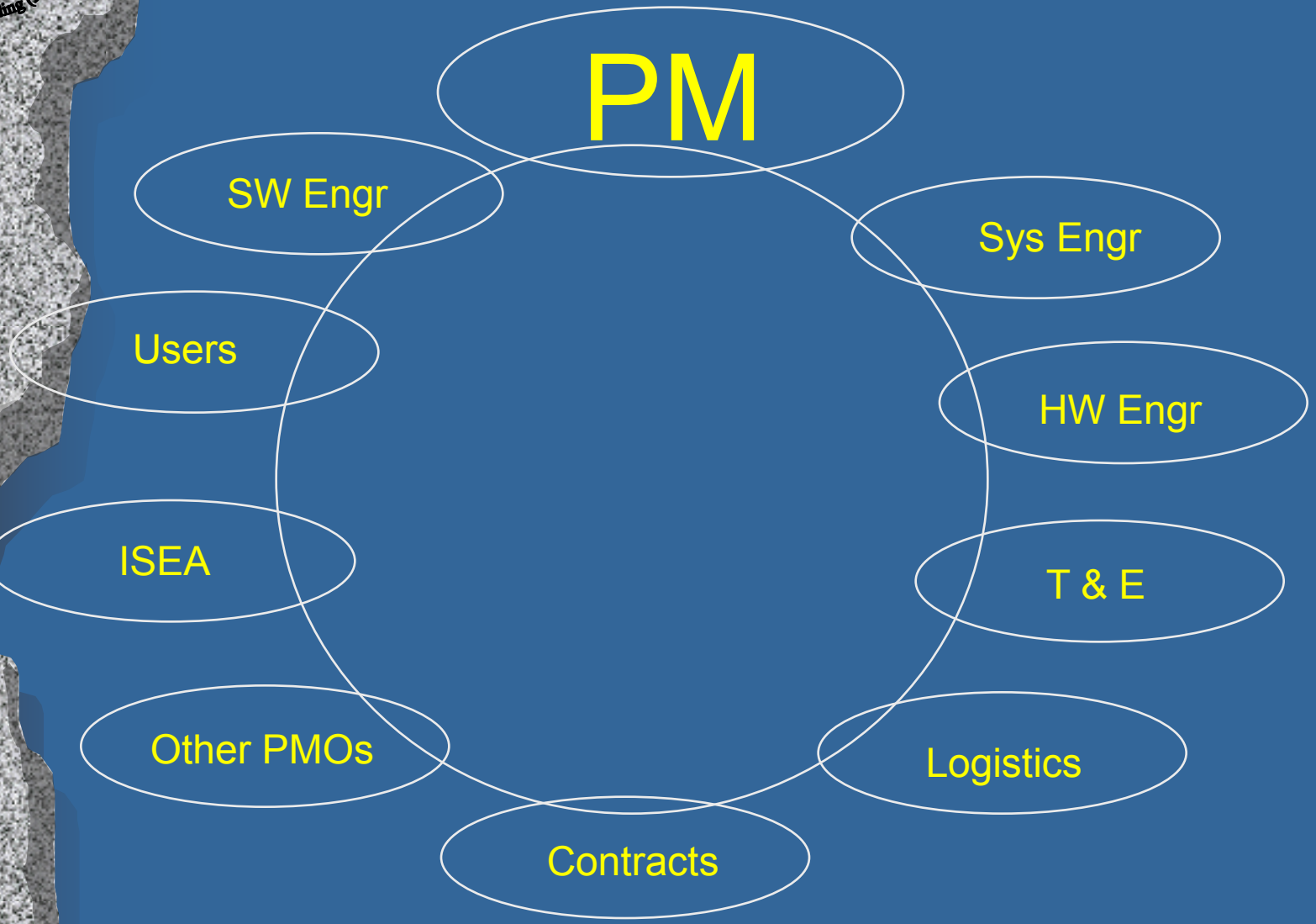
Contracting IPT

Other IPTs
(as needed)

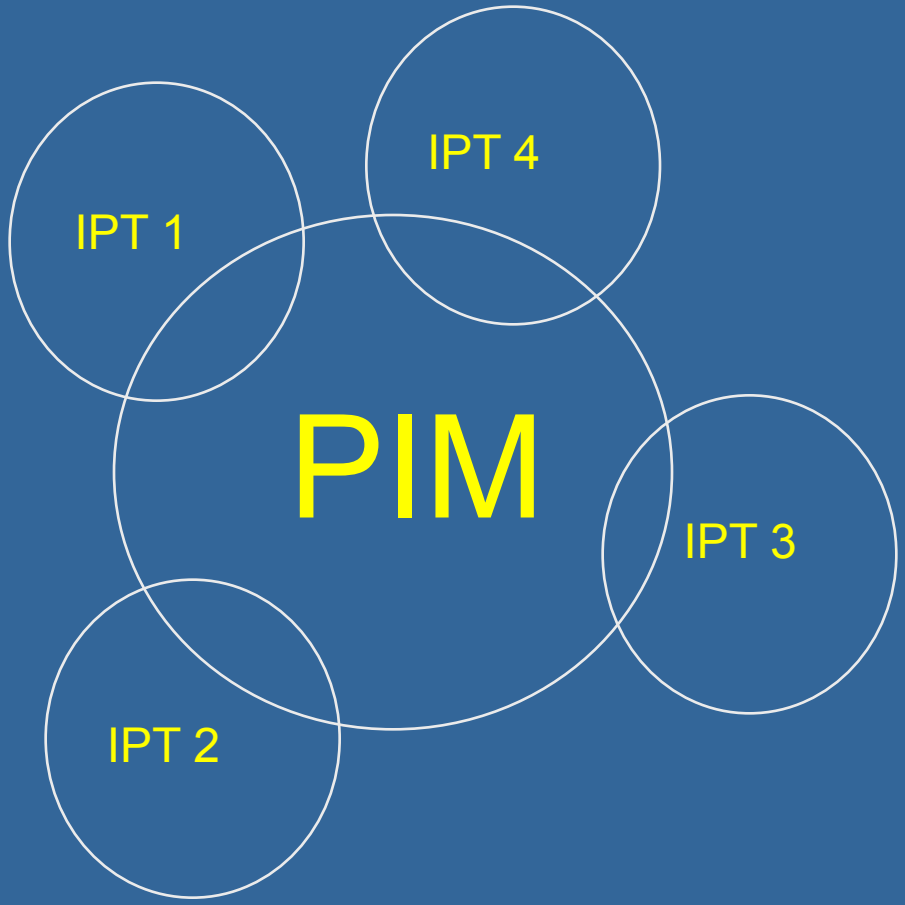
Project / Task Management Environment



Project Team Structure,

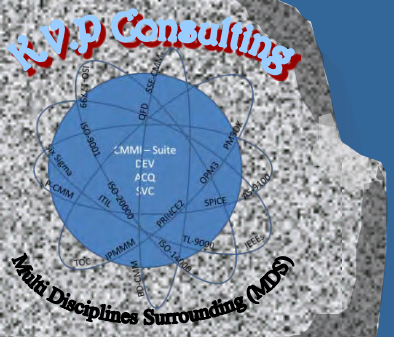


Multiple Teams
Task Force (Integration)





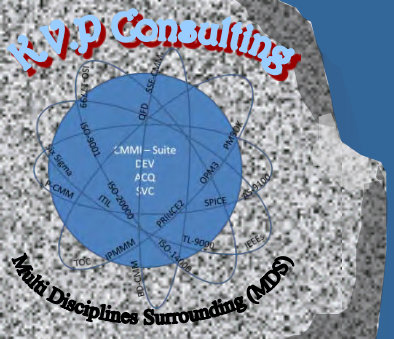
http://wiki.exoplatform.com/xwiki/bin/download/Main/WebOS+concept/web_as_a_platform.png?heigh



The Approach to the Solution Concept

- Best practices in the model focus on activities for providing quality services to the customer and end users
- To identify improvement targets in main lifecycle areas such as operations, information, governance, people and organizational structure, portfolios, project execution, and finance
- Select processes that are critical to the system success such as stakeholder management, technical interfaces and integration


Full Name
Current Groups
QA
IS
TW
PMID
Reliance
HD
PMO
DEV
R&D
PS
System Analysis
RA
SA
Infrastructure
DRA
ALM
CM
IT
New Functional Groups
QAIP
Management
M&A
IS
HMI
Process Group
Causal Analysis and Resolution
Configuration Management
Decision Analysis and Resolution
Integrated Project Management
Integrated Project Management -IPPD
Measurement and Analysis
Organizational Innovation and Deployment
Organizational Process Definition
Organizational Process Definition -IPPD
Organizational Process Focus
Organizational Process Performance
Organizational Training
Product Integration
Project Monitoring and Control
Project Planning
Process and Product Quality Assurance
Quantitative Project Management
Requirements Development
Requirements Management
Risk Management
Supplier Agreement Management
Technical Solution
Validation
Verification
Capacity and Availability Management
Incident Resolution and Prevention
Service Continuity
Service Delivery
Service System Development
Service System Transition
Strategic Service Management
GP 2.1 Establish an Organizational Policy
GP 2.2 Plan the Process
GP 2.3 Provide Resources
GP 2.4 Assign Responsibility
GP 2.5 Train People
GP 2.6 Manage Configurations
GP 2.7 Identify and Involve Relevant Stakeholders
GP 2.8 Monitor and Control the Process
GP 2.9 Objectively Evaluate Adherence
GP 2.10 Review Status with Higher Level Management
GP 3.1 Establish a Defined Process
GP 3.2 Collect Improvement Information
GP 4.1 Establish Quantitative Objectives for the Process
GP 4.2 Stabilize Subprocess Performance
GP 5.1 Ensure Continuous Process Improvement
GP 5.2 Correct Root Causes of Problems
CL5
CL4
CL3
CL2
Sheet1
Sheet2
Sheet3

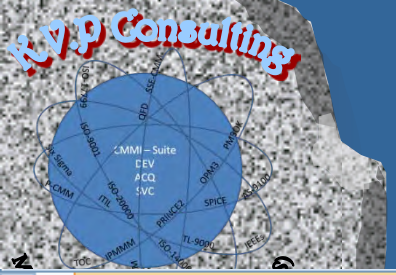


The Gap analysis Phase



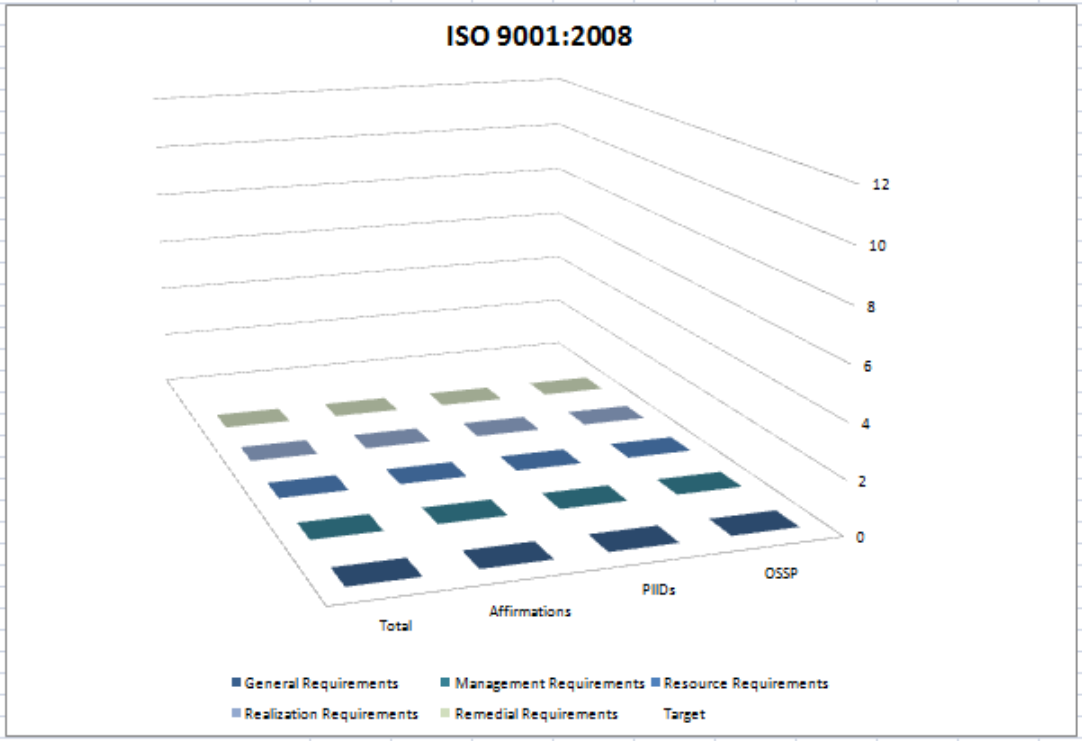
To Index

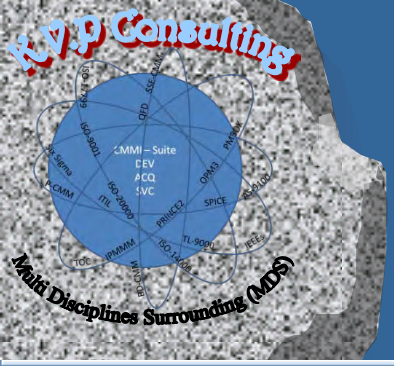
Chapter	Section			Requirements	OSSP	PIIDs	Affirmations	Total
4 General Requirements					0	0	0	0
	4.1 Develop Your Quality Management System (QMS)				0	0	0	0
		4.1.1		*Establish your organization's QMS.*	0.00	0.00	0.00	0.00
		4.1.2		*Document* your organization's QMS.	0.00	0.00	0.00	0.00
		4.1.3		*Implement* your organization's QMS.	0.00	0.00	0.00	0.00
		4.1.4		*Maintain* your organization's QMS.	0.00	0.00	0.00	0.00
		4.1.5		*Improve* your organization's QMS.	0.00	0.00	0.00	0.00
	4.2 Document Your Quality Management System (QMS)				0	0	0	0
		4.2.1		*Manage Quality Management System Documents*	0	0	0	0
			4.2.1.1	Develop documents for your organization's QMS.	0.00	0.00	0.00	0.00
			4.2.1.2	Make sure that your organization's QMS documents respect and reflect what you do and how you do it.	0.00	0.00	0.00	0.00
		4.2.2		*Prepare Quality Management System Manual*	0	0	0	0
			4.2.2.1	Establish a quality manual for your organization.	0.00	0.00	0.00	0.00
			4.2.2.2	Maintain your organization's quality manual.	0.00	0.00	0.00	0.00
		4.2.3		*Control Quality Management System Documents*	0	0	0	0
			4.2.3.1	Control your organization's QMS documents.	0.00	0.00	0.00	0.00
			4.2.3.2	Control documents that are used as QMS records.	0.00	0.00	0.00	0.00
		4.2.4		*Establish Quality Management System Records*	0	0	0	0



[To Index](#)

		OSSP	PIIDs	Affirmations	Total
		12	12	12	12
4	**General Requirements**	**0**	**0**	**0**	**0**
4.1	Develop Your Quality Management System (QMS)	0	0	0	0
4.2	Document Your Quality Management System (QMS)	0	0	0	0
5	**Management Requirements**	**0**	**0**	**0**	**0**
5.1	Show Your Commitment to Quality	0	0	0	0
5.2	Focus On Your Customers	0	0	0	0
5.3	Support Your Quality Policy	0	0	0	0
5.4	Carry Out Your QMS Planning	0	0	0	0
5.5	Allocate QMS Responsibility and Authority	0	0	0	0
5.6	Perform QMS Management Reviews	0	0	0	0
6	**Resource Requirements**	**0**	**0**	**0**	**0**
6.1	Provide Required QMS Resources	0	0	0	0
6.2	Provide Competent QMS Personnel	0	0	0	0
6.3	Provide Necessary Infrastructure	0	0	0	0
6.4	Provide Suitable Work Environment	0	0	0	0
7	**Realization Requirements**	**0**	**0**	**0**	**0**
7.1	Control Product Realization Planning	0	0	0	0
7.2	Control Customer-Related Processes	0	0	0	0
7.3	Control Product Design and Development	0	0	0	0
7.4	Control Purchasing and Purchased Products	0	0	0	0
7.5	Control Production and Service Provision	0	0	0	0
7.6	Control Monitoring and Measuring Equipment	0	0	0	0
8	**Remedial Requirements**	**0**	**0**	**0**	**0**
8.1	Establish Monitoring and Measurement Processes	0	0	0	0
8.2	Carry Out Monitoring and Measurement Activities	0	0	0	0
8.3	Identify and Control Nonconforming Products	0	0	0	0
8.4	Collect and Analyze Quality Management Data	0	0	0	0
8.5	Make Improvements and Take Remedial Actions	0	0	0	0

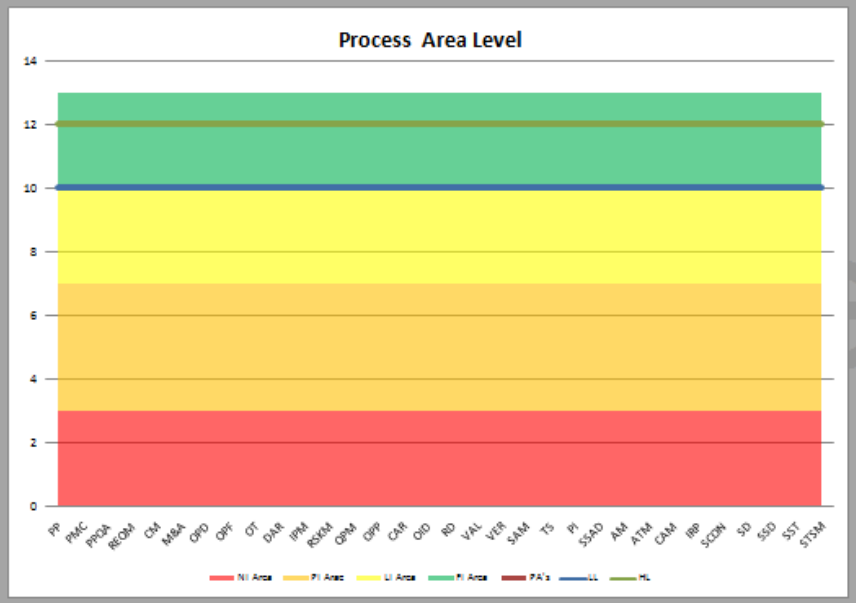


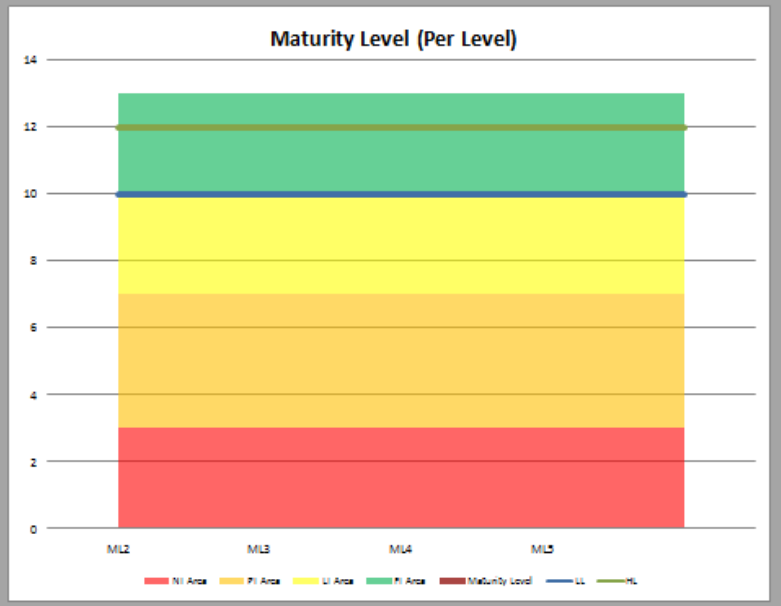


Process Level	
REQM	
PP	
PMC	
M&A	
PPQA	
CM	
SAM	
RD	
TS	VAL
PI	
VER	
VAL	
OPF	
OPD	
OT	
IPM	
RSKM	
DAR	
OPP	
OPM	
OID	
CA&R	

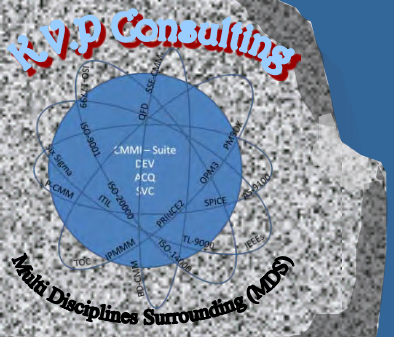
Color	EV	Rating	LL	HL
red	1~3	NI	1.00	3.00
orange	4~6	PI	4.00	6.00
yellow	7~9	LI	7.00	9.00
green	10~12	FI	10.00	12.00

Maturity Level (Per Level)	
ML2	
ML3	
ML4	0.00
ML5	0.00





Definitions | Rating Guidelines | OSSP-ML_dashboard | OSSP-SP_dashboard | OSSP-CL_dashboard | OSSP-ML vsCL_dashboard | OSSP | CMMIs SPs Kobi | CMMIs GPs



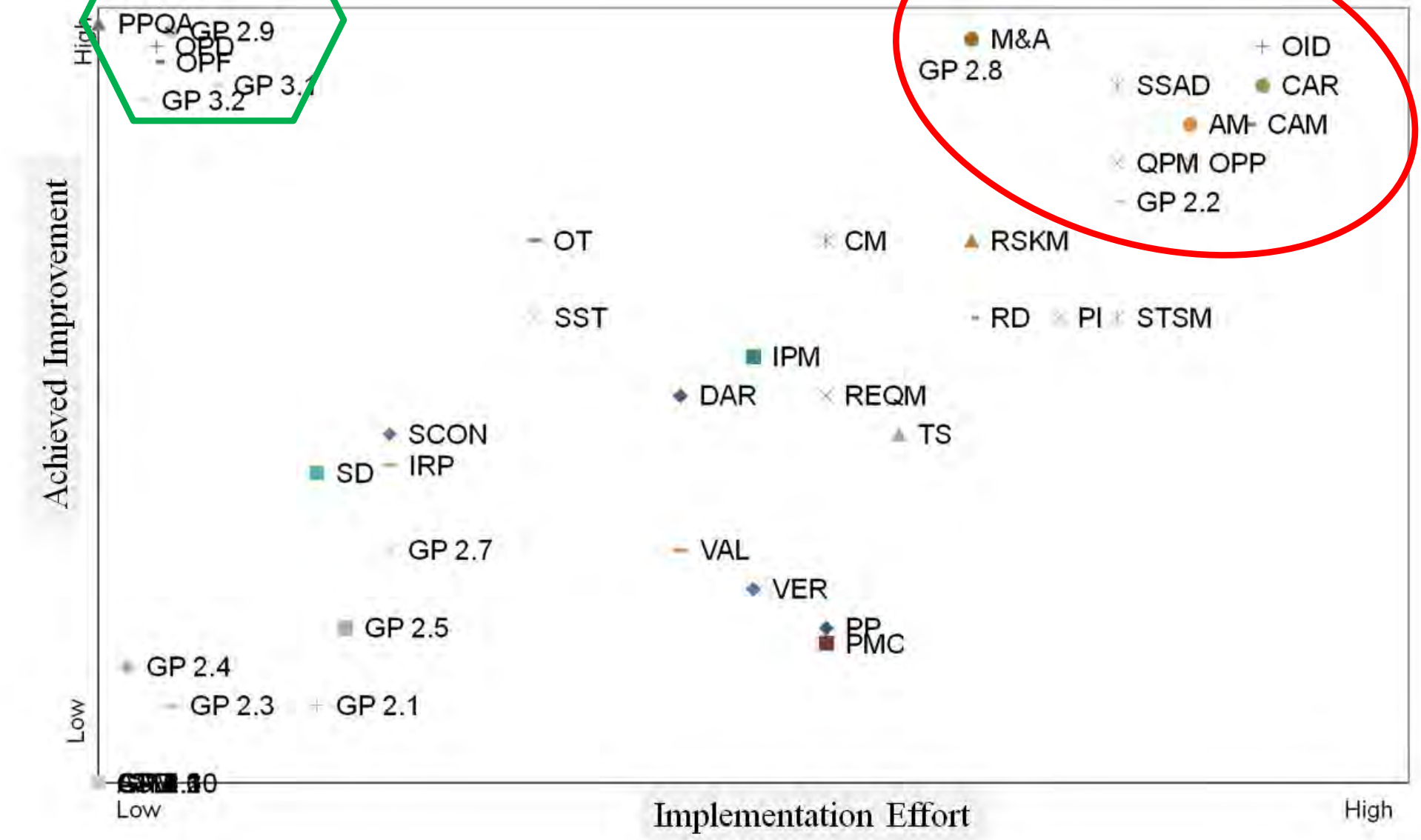
Main CMMI-SVC PA

- During the project we have used CMMI-SVC as a synchronisation mechanism to this quality and process improvement orchestra under its guidance and by using the other constellations and standards as well
- The main leading PA with the most benefits and use (in this project) are:

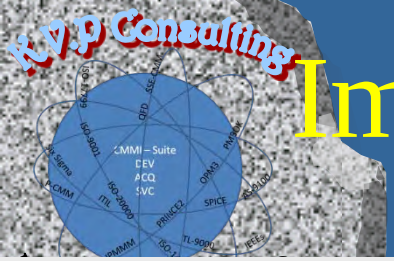
Improvement vs. Implementation

Process Improvements

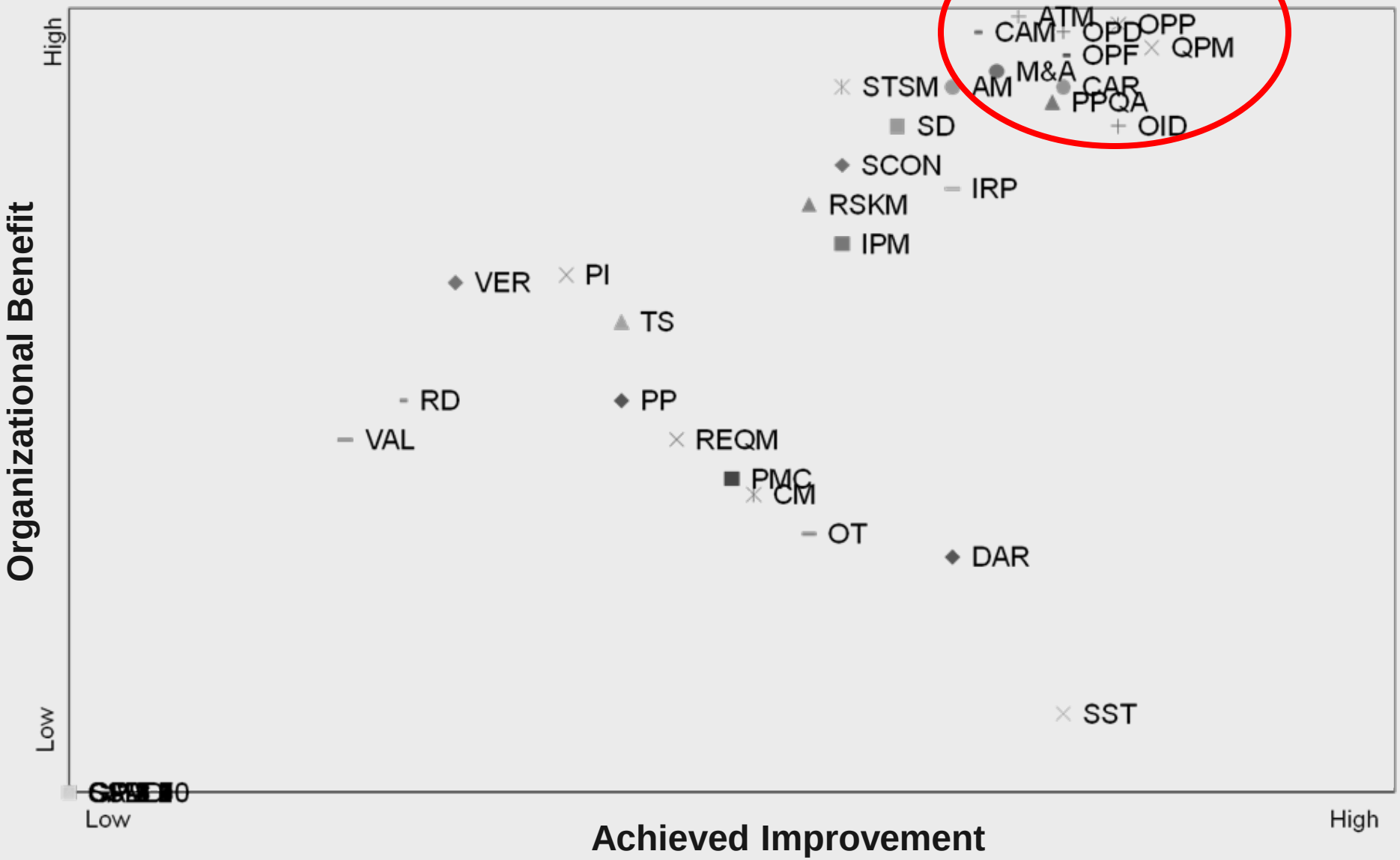
ROI

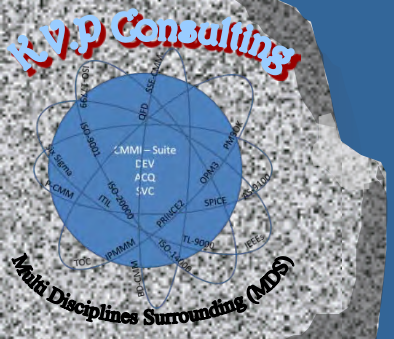


Improvement vs. Benefit



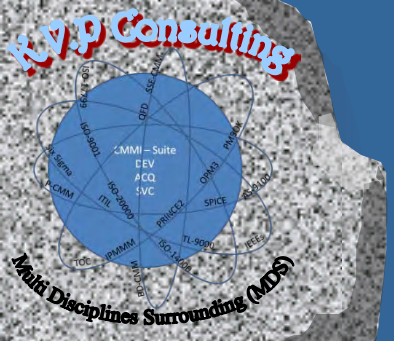
Add Value





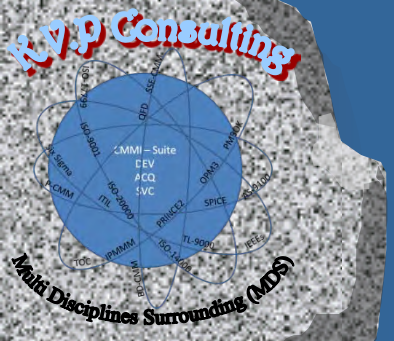
Main CMMI-SVC PA

- Strategic Service Management (STSM)
  - The purpose of Strategic Service Management (STSM) is to establish and maintain standard services in concert with strategic needs and plans.



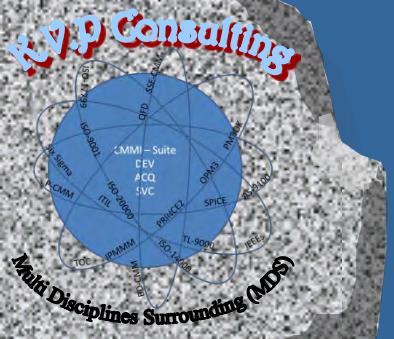
Main CMMI-SVC PA

- Service System Development (SSD)
  - The purpose of Service System Development (SSD) is to analyze, design, develop, integrate, verify, and validate service systems, including service system components, to satisfy existing or anticipated service agreements



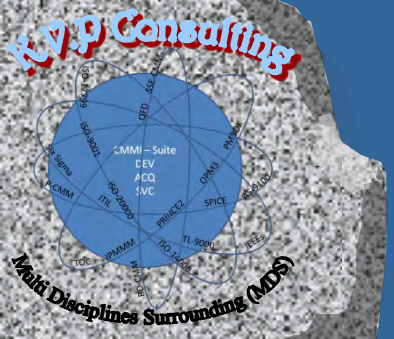
Main CMMI-SVC PA

- Capacity and Availability Management (CAM)
  - The purpose of Capacity and Availability Management (CAM) is to ensure effective service system performance and ensure that resources are provided and used effectively to support service requirements



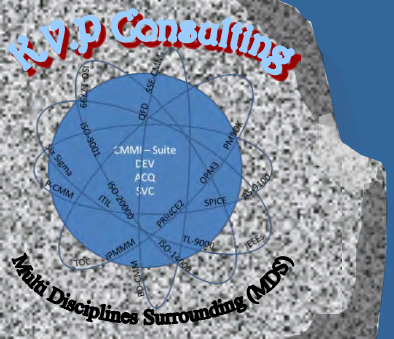
Main CMMI-SVC PA

- Decision Analysis and Resolution (DAR)
  - The purpose of Decision Analysis and Resolution (DAR) is to analyze possible decisions using a formal evaluation process that evaluates identified alternatives against established criteria



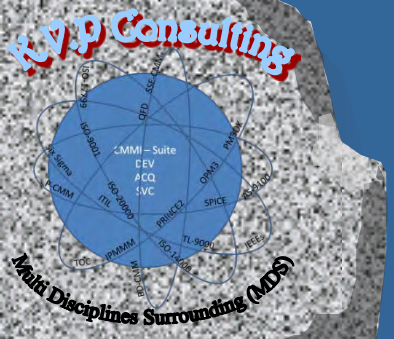
Main CMMI-SVC PA

- Integrated Project Management (IPM)
  - The purpose of Integrated Project Management (IPM) is to establish and manage the project and the involvement of relevant stakeholders according to an integrated and defined process that is tailored from the organization's set of standard processes



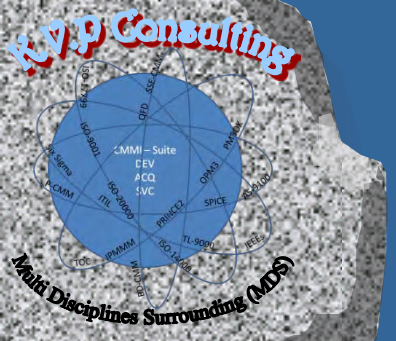
Main CMMI-SVC PA

- Incident Resolution and Prevention (IRP)
  - The purpose of Incident Resolution and Prevention (IRP) is to ensure timely and effective resolution of service incidents and prevention of service incidents as appropriate



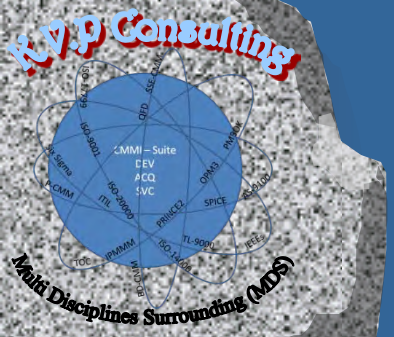
Main CMMI-SVC PA

- Organizational Process Performance (OPP)
  - The purpose of Organizational Process Performance (OPP) is to establish and maintain a quantitative understanding of the performance of the organization's set of standard processes in support of achieving quality and process-performance objectives, and to provide process-performance data, baselines, and models to quantitatively manage the organization's projects



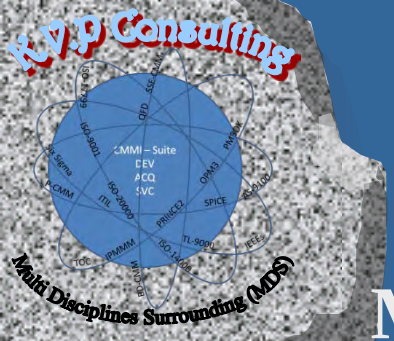
Main CMMI-SVC PA

- Service Continuity (SCON)
  - The purpose of Service Continuity (SCON) is to establish and maintain plans to ensure continuity of services during and following any significant disruption of normal operations
- Service Delivery (SD)
  - The purpose of Service Delivery (SD) is to deliver services in accordance with service agreements



Second Line of Use CMMI-SVC PA

- **Service System Transition (SST)**
  - **The purpose of Service System Transition (SST) is to deploy new or significantly changed service system components while managing their effect on ongoing service delivery**



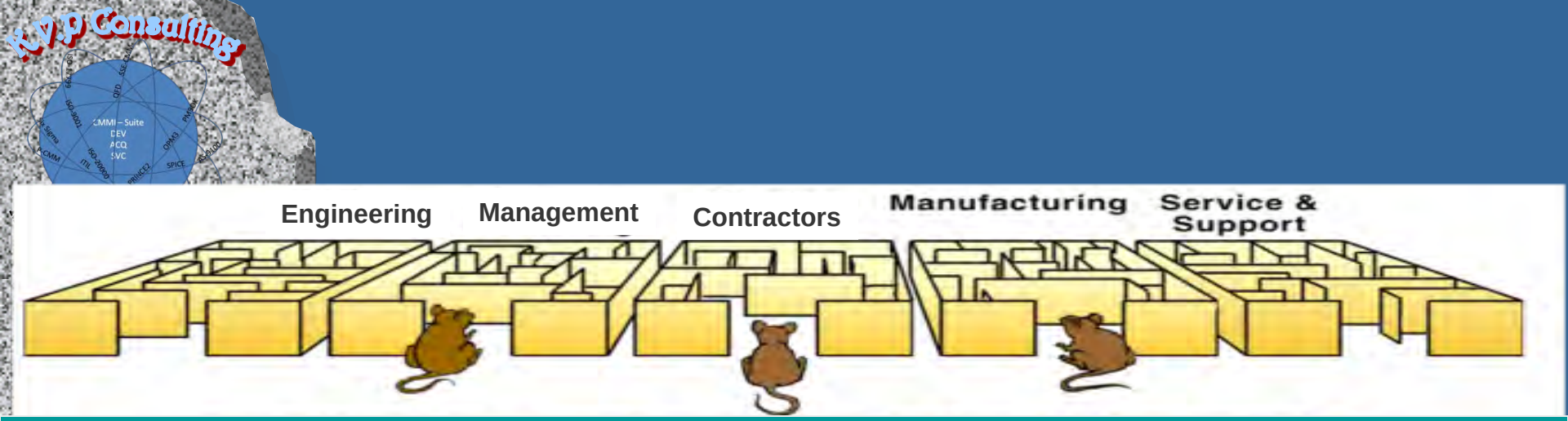
Results and Benefits

Methodology conclusions.

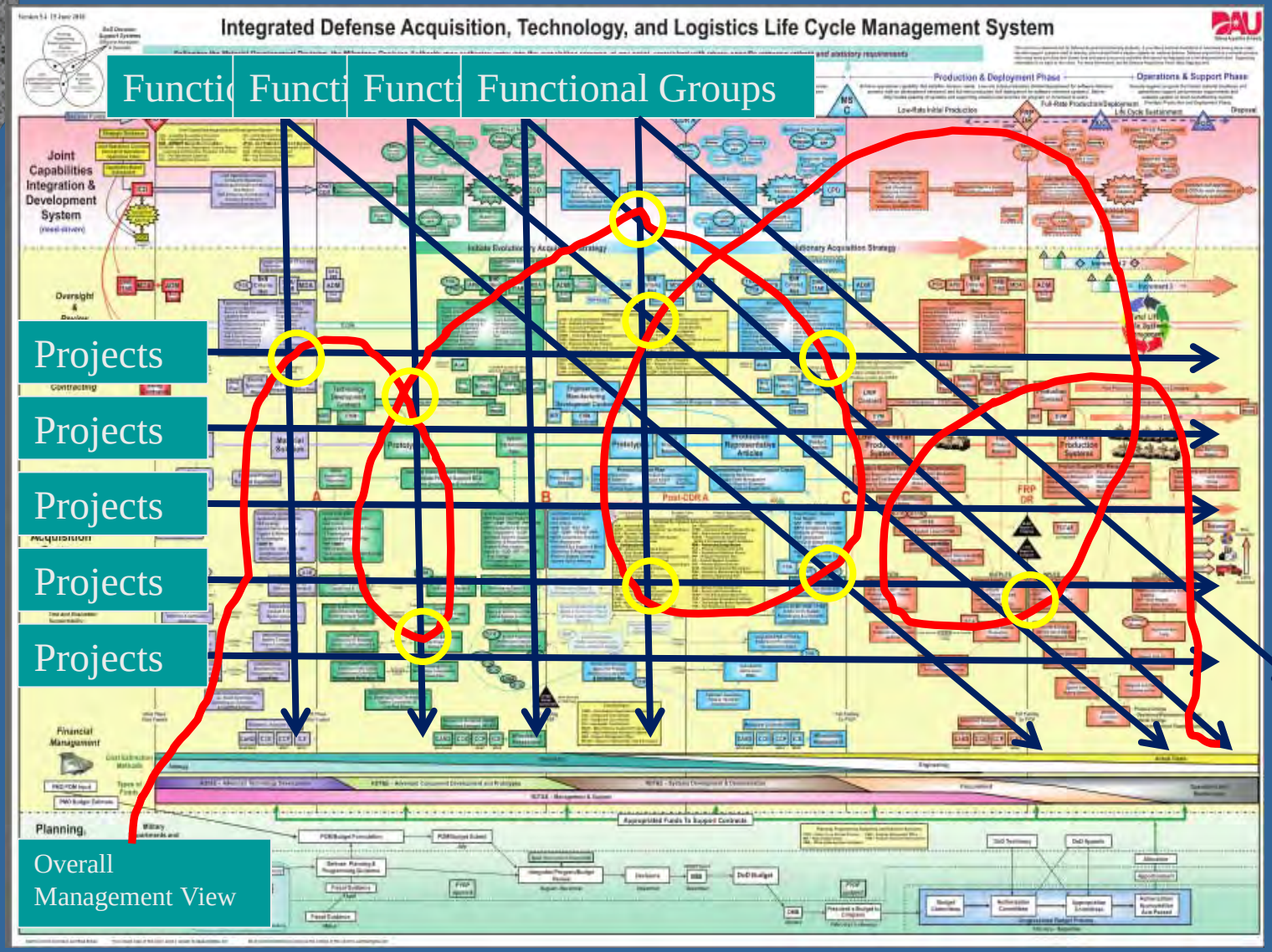
- Model formulation is complex, but evaluation is straightforward.
- Standard tools, and the mappings make it easy to integrate on domains.
- Method is better at capturing SMEs insights and project dynamics.
- Opportunity to further include additional domains

SME related conclusions (preliminary).

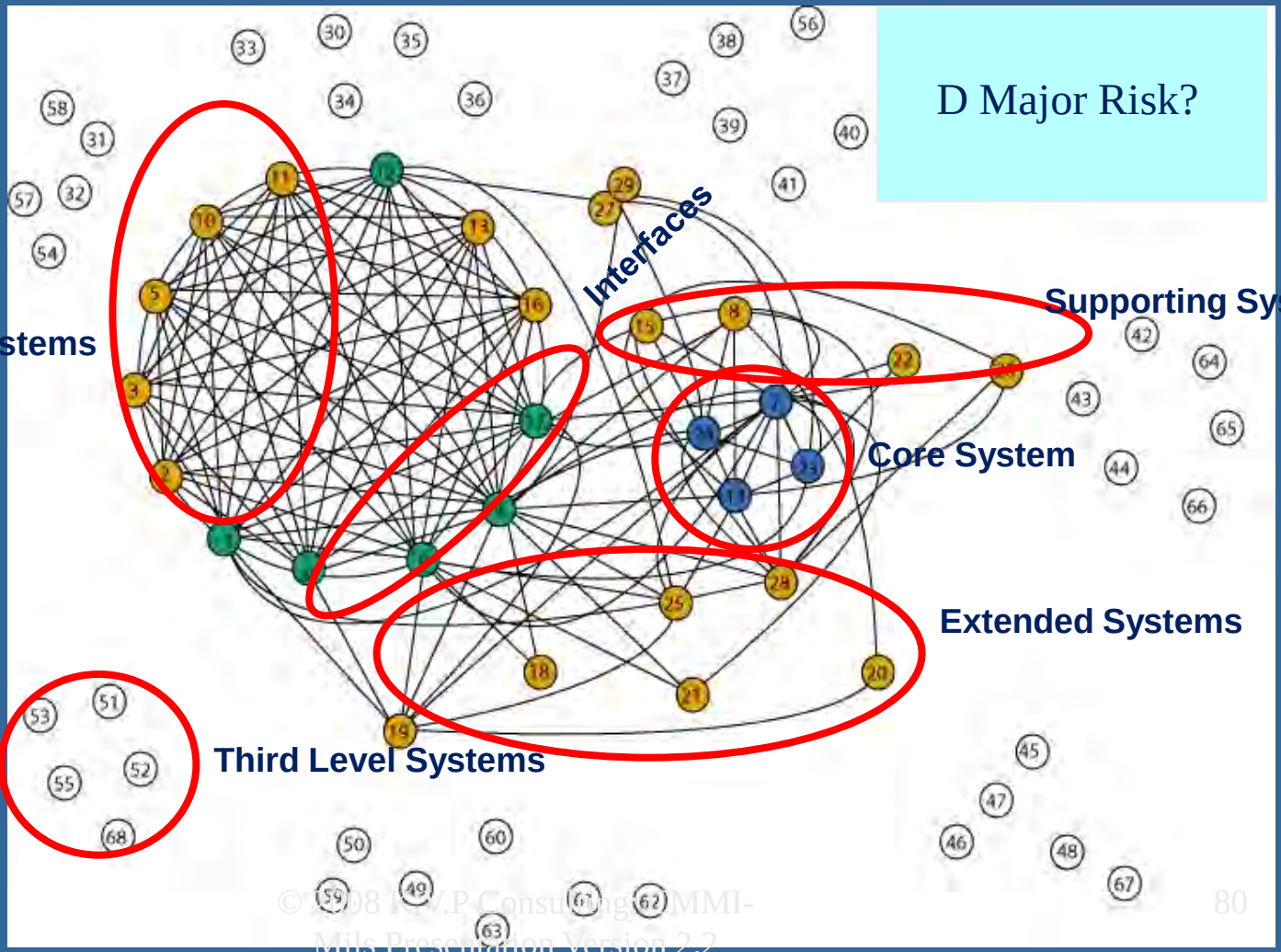
- Small units have better acceptance for quality activities
- Engineering related organizations have a good case for higher performances
- Critical dependency must be mapped in the OSSP.
- Benefits for organizations operating at volatile (uncertain) segments.

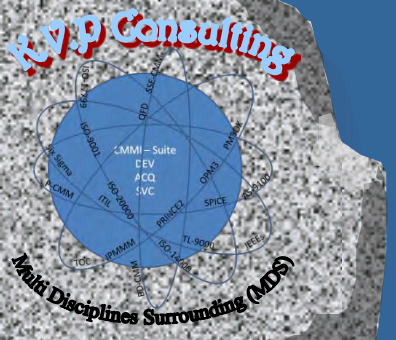

Engineering
Management
Contractors
Manufacturing
Service &
Support

Typical Lifecycle Description



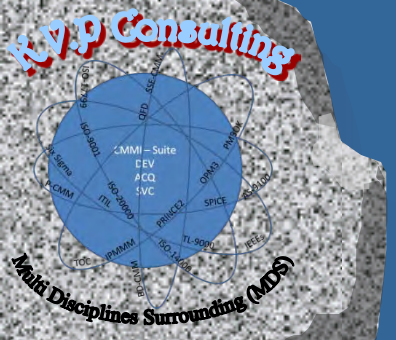
Military Combat Services Support Challenges in the Battlefield C4ISR Systems





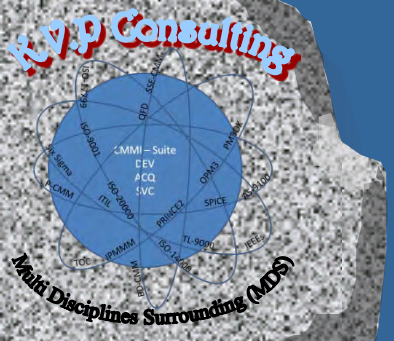
Future Plans

- Continue refinement of model.
  - Parameter ranges.
  - Roadmap involving multiple lifecycles and external activities.
  - Complete Validation and Verification.
- Integrate work and receive feed from other initiatives.
- Continue sharing with other domains

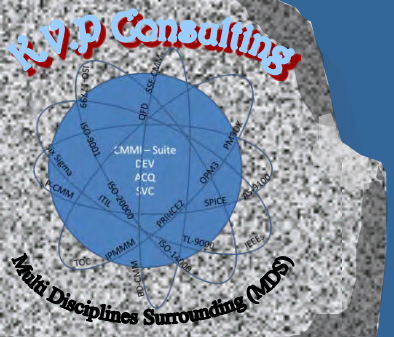


Discussion Points

- Performance data
- Cost of poor planning
- Quantifying the operational impact
- Effecting and effected stakeholders mapping
- Quantifying the impact of support planning on the development teams
- Appling this model on other domains


K.V.P Consulting
CMMI – Suite
DEV
ACQ
SVC
Multi Disciplines Surrounding (MDS)

Questions ?



Contact

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Architecture: Why Your CMMI V1.3 Implementation is Incomplete Without It!

11th CMMI Technology Conference and User's Group

Denver, CO
November 14, 2011

Larry Jones
Mike Konrad

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213-2612

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Introductions

Instructor Introduction

Participant Introductions

(mechanics depends on group size – individual or show of hands)

- name (if our group is small enough)
- company/position - or type of company (government, defense industry, commercial industry, other)
- background – or job type (manager, technical, process group, other)
- software architecture background / systems architecture background



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Tutorial Learning Outcomes



After completing this half-day tutorial, attendees should

- know the importance of architecture to the achievement of business, product, or mission goals
- know that quality attributes have a dominant influence on a system's architecture
- be familiar with essential architecture-centric engineering activities and some example methods
- know how to specify quality attributes meaningfully through scenarios
- be able to identify where architecture-centric activities and work products are described in CMMI V1.3
- appreciate how to interpret the new architecture-centric material in CMMI V1.3
- know where to find out more about architecture-centric engineering practices

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What Have We Learned Over the Past Year? Something was Missing.

A lot of people overlooked the new architecture emphasis.

- Changes in the model that explicitly use the term "architecture" are in the informative material and glossary.
- Those who understand CMMI may overlook the *new expectation* that quality attributes are an equal partner to functionality.
  - Architecture practices thus need to be considered.



Hence we decided to be much less subtle about architecture in the title and we have allowed more time to discuss the "whereabouts" of architecture in the V1.3 model.



Good architecture practices are essential for success with CMMI V1.3!

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Conventions & Caveats for the Tutorial



The coverage of architecture-centric practices in CMMI V1.3 is broad, focused on “products” and “solutions” – not just on software.

- But much of the tutorial material came from SEI assets whose focus was software-intensive systems. Please bear this in mind. We believe the principles apply beyond simply software.

Our focus in the tutorial will be on CMMI for Development because that is where the architecture-centric practices are most deeply covered but similar changes were also made to the other two CMMI models.

CMMI uses the term “product” to refer to what is delivered to the customer or end-user. In this tutorial, we will often use the term “system” to refer to the product.

This tutorial cannot completely convey everything you might like to learn about architecture-centric engineering.

- References are provided at the end for you to learn more.

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Expected Background of Participants

Participants must have an understanding of the basics of CMMI models.

- This tutorial is not an introduction to CMMI.
- It is not a substitute for V1.3 Upgrade Training.

Familiarity with product, system, or software design is useful, but not required. (Such familiarity will be of benefit to you in the hands-on exercises, which are intended to give you a grounding in some key concepts.)

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Presentation Outline

CMMI V1.3 – Context for modern engineering practices changes

Introduction to Architecture

Essential Architecture Practices

Where Are the Architecture-Centric Practices in CMMI V1.3?

Summary

Questions and Answers

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The Problem: CMMI V1.2 Did Not Adequately Cover Modern Engineering Approaches

Much of the engineering content of CMMI-DEV V1.2 was ten years old.

As DEV was a starting point for the other two constellations, no V1.2 model adequately addressed modern engineering approaches such as architecture-centric engineering.

For example, both RD SG 3 and RD SP 3.2 emphasized functionality and not non-functional requirements.

Also, Engineering and other PAs rarely mention the following concepts:

- Quality attributes
- Allocation of product capabilities to release increments
- Product lines
- System of systems
- Technology maturation (and obsolescence)
- Agile methods

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The Solution: Modernize the Engineering Content in CMMI V1.3

The slides that follow portray where the development community should be today relative to architecture-centric practices – as opposed to how they were portrayed in CMMI V1.2.

Towards the end of today's half-day tutorial, we will revisit how CMMI Version 1.3 addresses these and other modern development approaches.

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What Is an Architecture?

Informally, an architecture is the blueprint describing the structure of a system.



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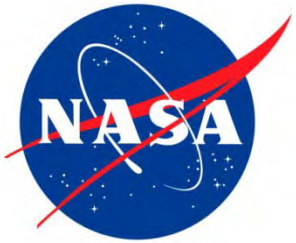
Architecture is Important

The quality and longevity of a software-reliant system is largely determined by its architecture.

In recent studies by OSD, the National Research Council, NASA, and the NDIA, architectural issues are identified as a systemic cause of software problems in DoD systems.



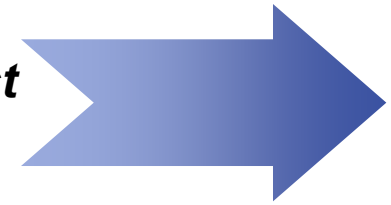
NDIA
National Defense Industrial Association



NRC The National Research Council

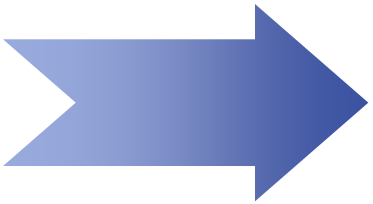
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Why Is Architecture Important?



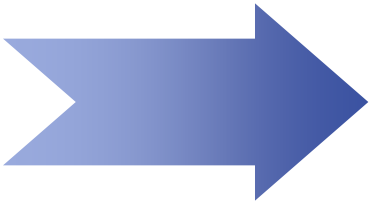
Represents ***earliest*** design decisions

- hardest to change
- most critical to get right
- communication vehicle among stakeholders



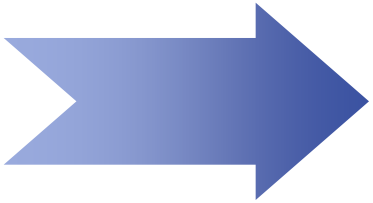
First design artifact addressing

- performance
- modifiability
- reliability
- security



Key to systematic ***reuse***

- transferable, reusable abstraction



Key to system ***evolution***

- manage future uncertainty
- assure cost-effective agility

The **right architecture** paves the way for system **success**.
The **wrong architecture** usually spells some form of **disaster**.

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Architecture is About Structure and Decisions

Structures result from decisions

- Business / mission goals provide a reasoned basis for decisions.
- Each decision is a tradeoff that enables something and precludes other things.
- Tradeoffs are driven by quality attribute requirements.

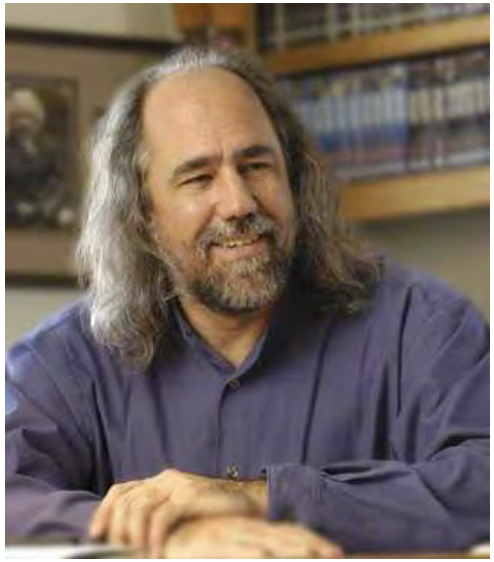
This is true regardless of the domain – commercial or defense.



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“Every system has an architecture…

…encompassing the key abstractions and mechanisms that define that system's structure and behavior… In every case - from idioms to mechanisms to architectures - these patterns are either



intentional

or

accidental”

- Grady Booch in the Preface to *Handbook of Software Architecture*

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Architecture and Strategy

An *Intentional Architecture* is the embodiment of your business strategy

- Intentional Architecture links technology decisions to business goals



An *Accidental Architecture* limits strategy options

- Accidental Architecture becomes your de facto strategy



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Class Exercise 1

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A Warning (PERMISSION REQUESTED)

"Architecture" is a very overloaded word.

- All the good words are taken.
- We will explain some common uses of the term and how they differ.



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Formal Definition of Software Architecture

"*The **software architecture** of a computing system is the set of **structures** needed to reason about the system, which comprise **software components, relations** among them and **properties** of both.*"

Clements et al, *Documenting Software Architectures, Second Edition.* Addison-Wesley, 2011



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Formal Definition of System Architecture

A ***system architecture*** describes the elements and interactions of a complete system including its hardware elements and its software elements.

System Architecture: "*The fundamental and unifying system structure defined in terms of system elements, interfaces, processes, constraints, and behaviors.*"[1]

Systems Engineering is a design and management discipline useful in designing and building large, complex, and interdisciplinary systems.[2]

[1] Rechtin, E. *Systems Architecting: Creating and Building Complex Systems*. Englewood Cliffs, NJ : Prentice-Hall, 1991.

[2] International Council On Systems Engineering (INCOSE), Systems Architecture Working Group, 1996.

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Implications



Architecture is an abstraction of a system.

Architecture defines the properties of elements.

Systems can and do have many structures.

Every software-intensive system *has* an architecture.

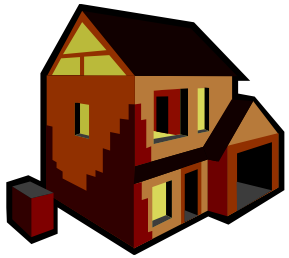
Just having an architecture is different from having an architecture that is known to everyone.

If you don't develop an architecture, you will get one anyway –
and you might not like what you get!

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Structures and Views - 1

One house, many views



- Carpentry view
- Plumbing view
- Electrical view
- Ductwork view

No single view accurately represents the house.

No single view can be used to build the house.

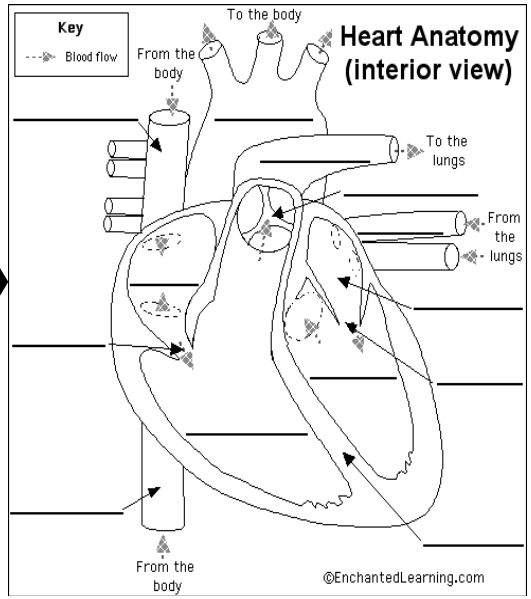
Although these views are pictured differently, and each has different properties, all are related. Together, they describe the architecture of the house.

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Structures and Views - 2



A human body comprises multiple *structures*.



a *static view* of one human *structure*



a *dynamic view* of that *structure*

One body has many structures, and those structures have many views. So it is with software and systems.

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Presentation Outline

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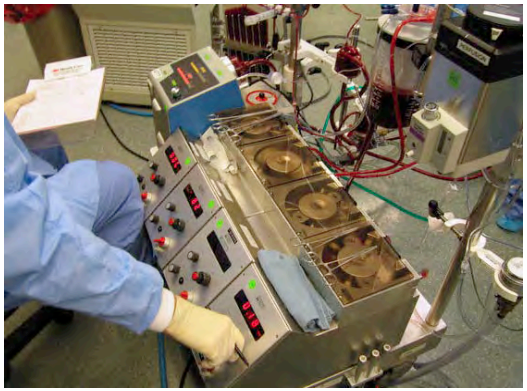
Questions and Answers

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What is Architecture-Centric Engineering?

Architecture-Centric Engineering (ACE) is the discipline of using architecture as the focal point for performing ongoing analyses to gain increasing levels of confidence that systems will support their missions.

> ***Architecture is of enduring importance*** *because it is the right abstraction for performing ongoing analyses throughout a system's lifetime.*



The **SEI ACE Initiative** develops principles, methods, foundations, techniques, tools, and materials in support of creating, fostering, and stimulating widespread transition of the ACE discipline.





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System Development



Functional Requirements

If function were all that mattered, any monolithic implementation would do, ..***but other things matter***…

The important quality attributes and their characterizations are key.

- Modifiability
- Interoperability
- Availability
- Security
- Predictability
- Portability

analysis, design, development, evolution

Quality Attribute Drivers → **Software & System Architectures** → **Software & System**

has these qualities

The Non-functional Requirements

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Specifying Quality Attributes



Quality attributes are rarely captured *effectively* in requirements specifications; they are often vaguely understood and weakly articulated.

Just citing the desired qualities is not enough; it is meaningless to say that the system shall be “modifiable” or “interoperable” or “secure” without details about the context.

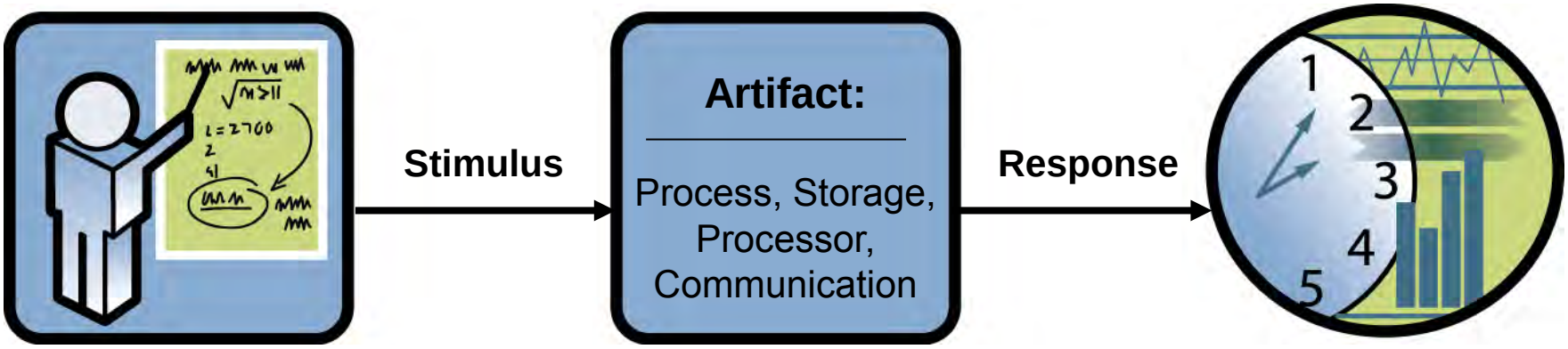
The practice of specifying quality attribute scenarios can remove this imprecision and allows desired qualities to be evaluated meaningfully.



A quality attribute scenario is a short description of an interaction between a stakeholder and a system and the response from the system.

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Parts of a Quality Attribute Scenario

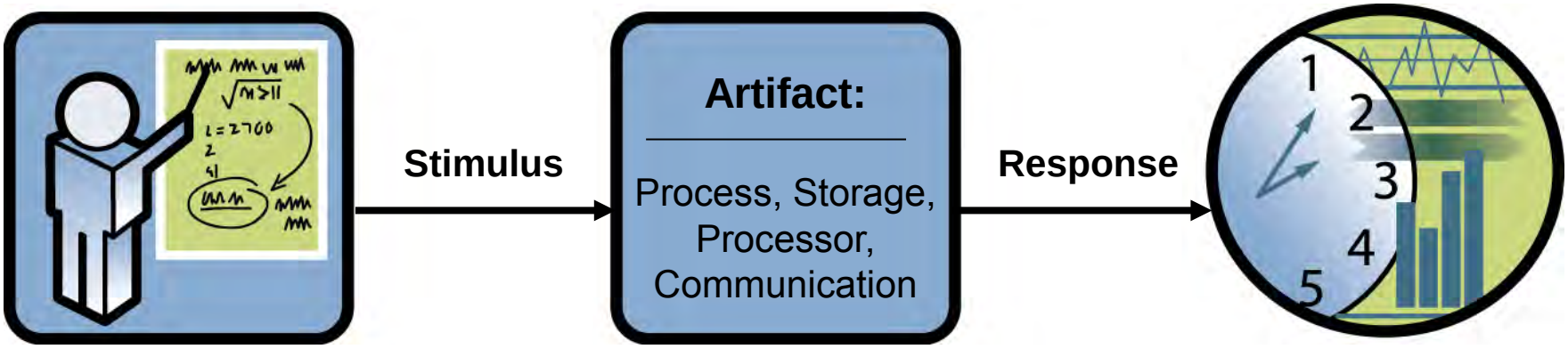


SOURCE **ENVIRONMENT** **RESPONSE MEASURE**

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Example Quality Attribute Scenario

A "performance" scenario: A remote user requests a data base report under peak load and receives it in under 5 seconds.



SOURCE

Remote user

ENVIRONMENT

Database under peak load

RESPONSE MEASURE

under 5 seconds

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Additional Example Scenarios

Security: "A correctly identified individual modifies system data from an external site incorrectly. The system maintains an audit trail and the correct data is restored within one day."

Modifiability: "A user requests a change to the user interface; The modification is made by a developer with no side effects, in three hours."

Availability: "An unanticipated external message is received by a process during normal operation. The process informs the operator of the message's receipt, and the system continues to operate with no downtime."

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Class Exercise 2

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Architecture-Centric Activities



Architecture-centric activities include the following:

- creating the **business case** for the system
- understanding the **requirements**
- **creating and/or selecting** the architecture
- **documenting and communicating** the architecture
- **analyzing or evaluating** the architecture
- **implementing** the system based on the architecture
- ensuring that the implementation **conforms** to the architecture
- **evolving** the architecture so that it **continues to meet business and mission goals**

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Some SEI Techniques, Methods, and Tools

creating the **business case** for the system	
understanding the **requirements**	*Quality Attribute Workshop (QAW) * Mission Thread Workshop (MTW) **
creating and/or selecting the architecture	*Attribute-Driven Design (ADD) and ArchE*
documenting and communicating the architecture	*Views and Beyond Approach; AADL*
analyzing or evaluating the architecture	*Architecture Tradeoff Analysis Method (ATAM) *; SoS Arch Eval *; Cost Benefit Analysis Method (CBAM); AADL*
implementing the system based on the architecture	
ensuring that the implementation **conforms** to the architecture	*ARMIN*
evolving the architecture so that it **continues to meet business and mission goals**	*Architecture Improvement Workshop (AIW)* and ArchE*
ensuring **use of effective architecture practices**	*Architecture Competence Assessment*

*** = indicates a software engineering method that has been extended to systems engineering**

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Building the Business Case for the System

How to do this is beyond the scope of this tutorial.

Some common business / mission drivers for systems include

- Reduce total cost of ownership
- Improve capability/quality of system
- Improve market position
- Support improved business processes
- Improve confidence in and perception of system



Results gleaned from

- 25 architecture evaluations
  - 18 government systems, 7 commercial systems
- 190 distinct business goals

Kazman & Bass, *Categorizing Business Goals for Software Architectures*, CMU/SEI-2005-TR-021

http://www.sei.cmu.edu/reports/05tr021.pdf

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Understanding the Requirements – The SEI's Quality Attribute Workshop

The purpose of the SEI Quality Attribute Workshop (QAW) is to discover, early in the life cycle, the driving quality attribute requirements of a software-intensive system.

QAW Steps

1. QAW Presentation and Introductions
2. Business/Programmatic Presentation
3. Architectural Plan Presentation
4. Identification of Architectural Drivers
5. Scenario Brainstorming
6. Scenario Consolidation
7. Scenario Prioritization
8. Scenario Refinement

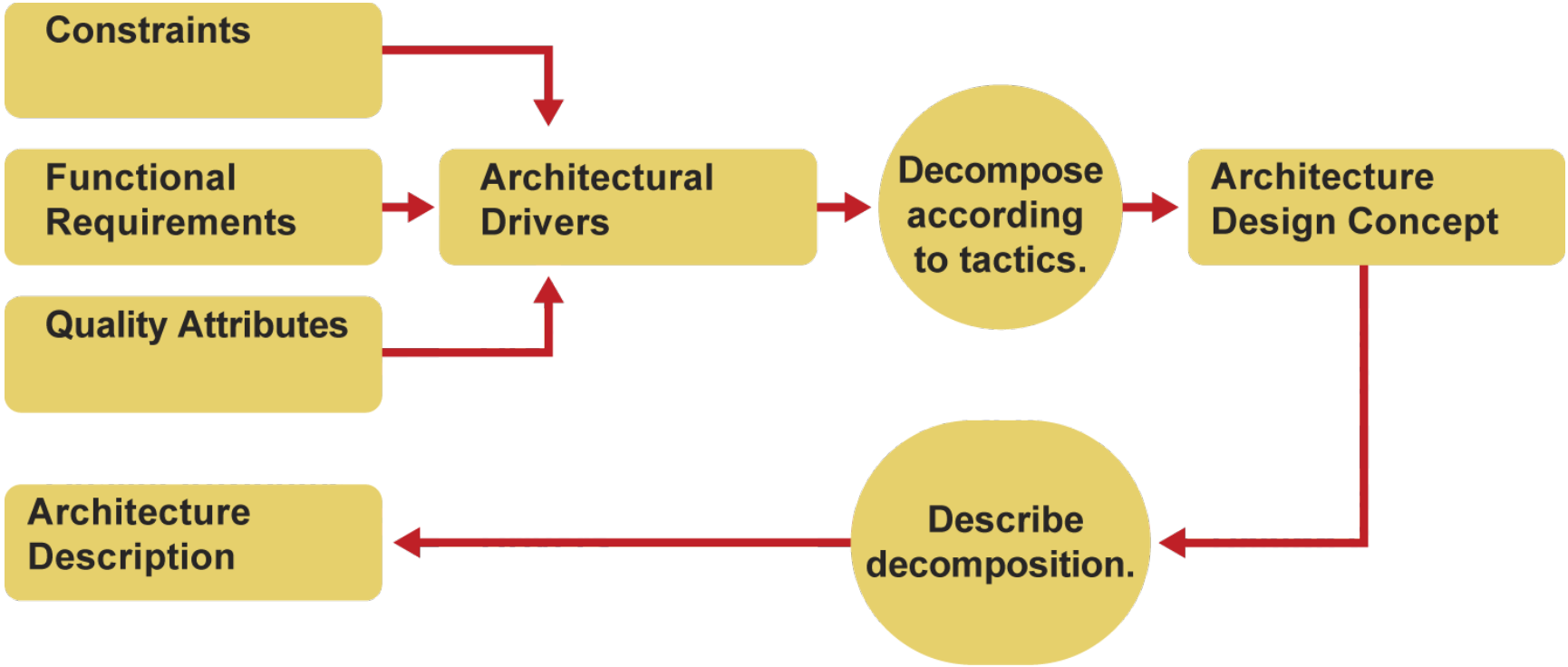


Barbacci, et al., *Quality Attribute Workshops (3rd Ed.),* CMU/SEI-2003-TR-016
http://www.sei.cmu.edu/library/abstracts/reports/03tr016.cfm

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An Approach to Architecture Creation

The Attribute-Driven Design (ADD) method is an approach to defining a software architecture by basing the design process on the quality attribute requirements of the system.



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Class Exercise 3

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Creating the Architecture

How to do this is beyond the scope of this tutorial.

Part of the ADD approach is to pick architectural *patterns* and *tactics* that address particular quality attributes.

Patterns represent a packaging of a number of design decisions we refer to as *tactics*.

Each *tactic* is a design option available to the architect.

A pattern typically employs several different tactics to promote various quality attributes.

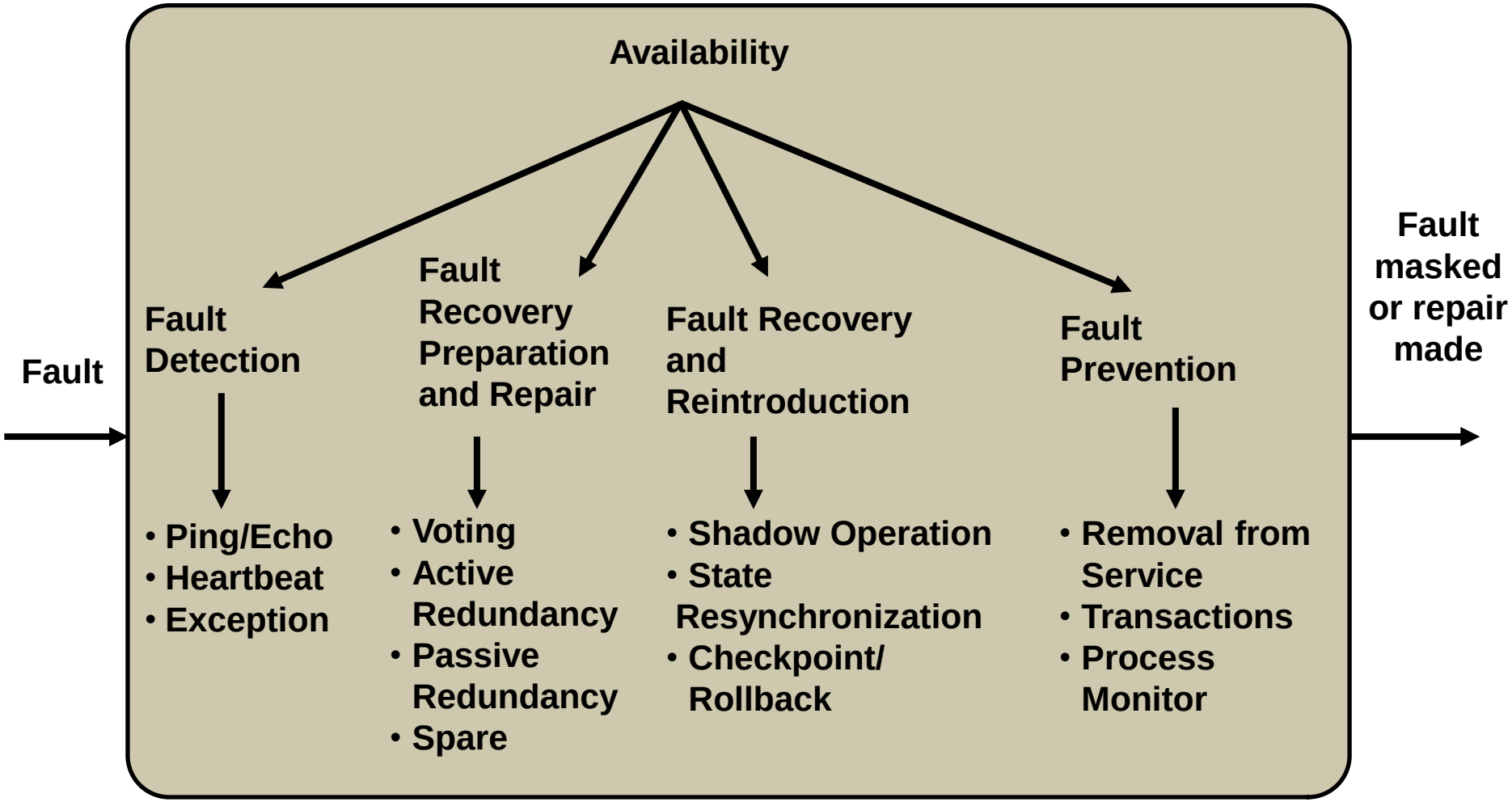
Example: Tactics to influence *availability* (keep faults from becoming errors) include

- Fault Detection
- Fault Recovery
- Fault Prevention



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Summary of Availability Tactics

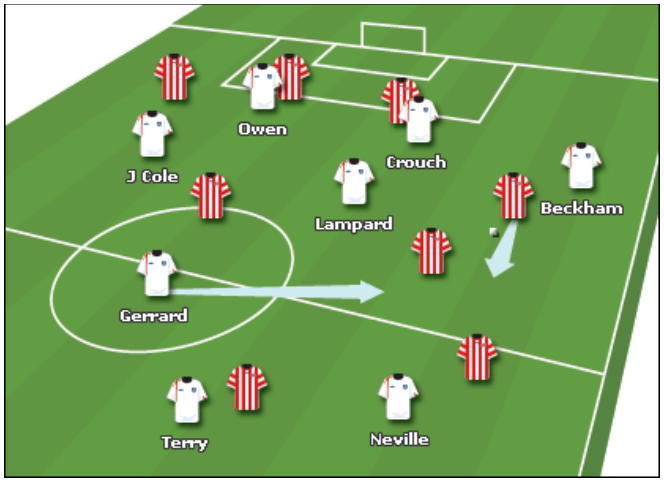


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Other Tactics

There are tactics for

- modifiability
- performance
- security
- testability
- usability

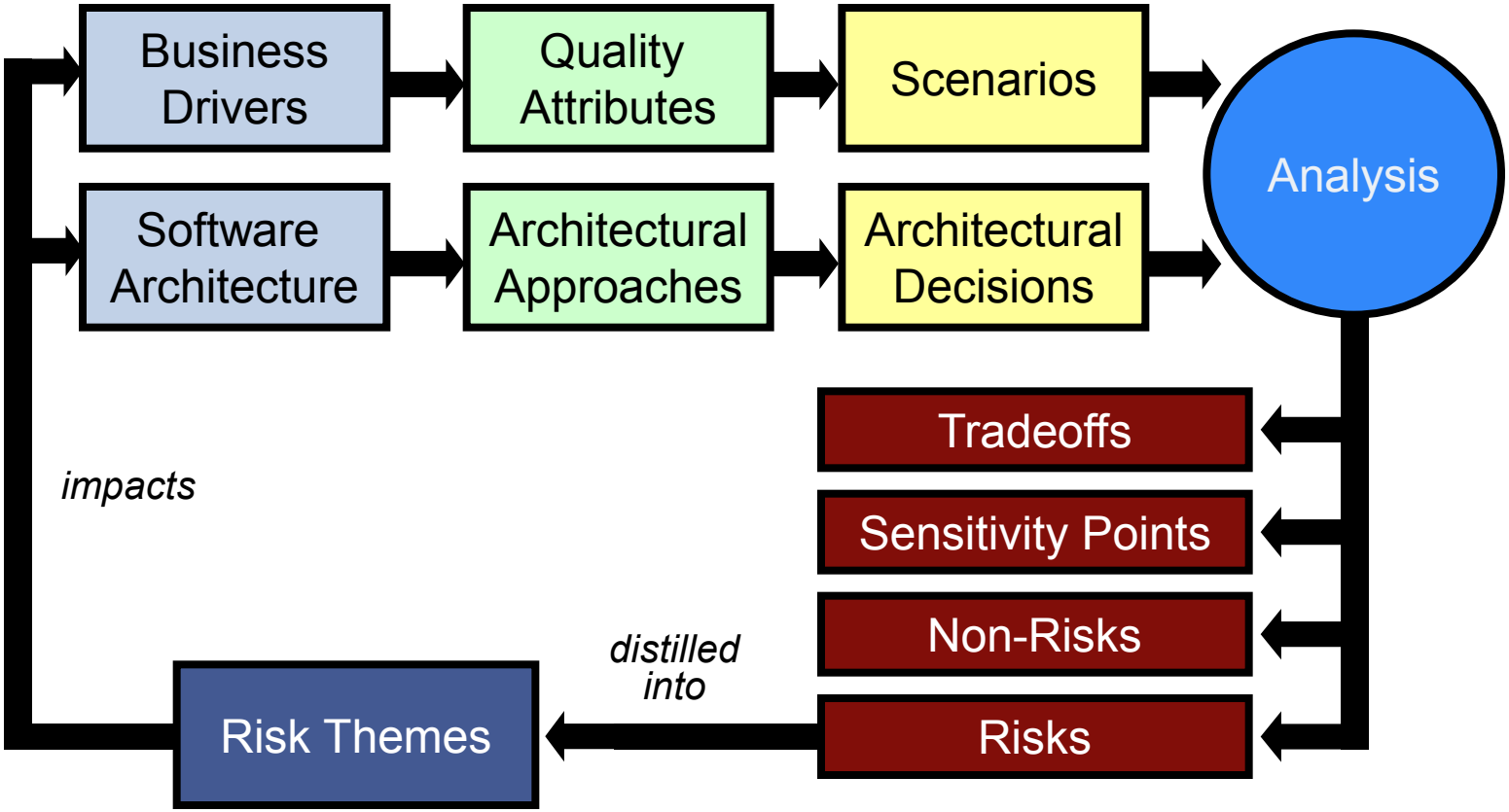


See *Software Architecture in Practice* for a more complete treatment of the subject.

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Analyzing the Architecture – SEI's Architecture Tradeoff Analysis Method® (ATAM®)

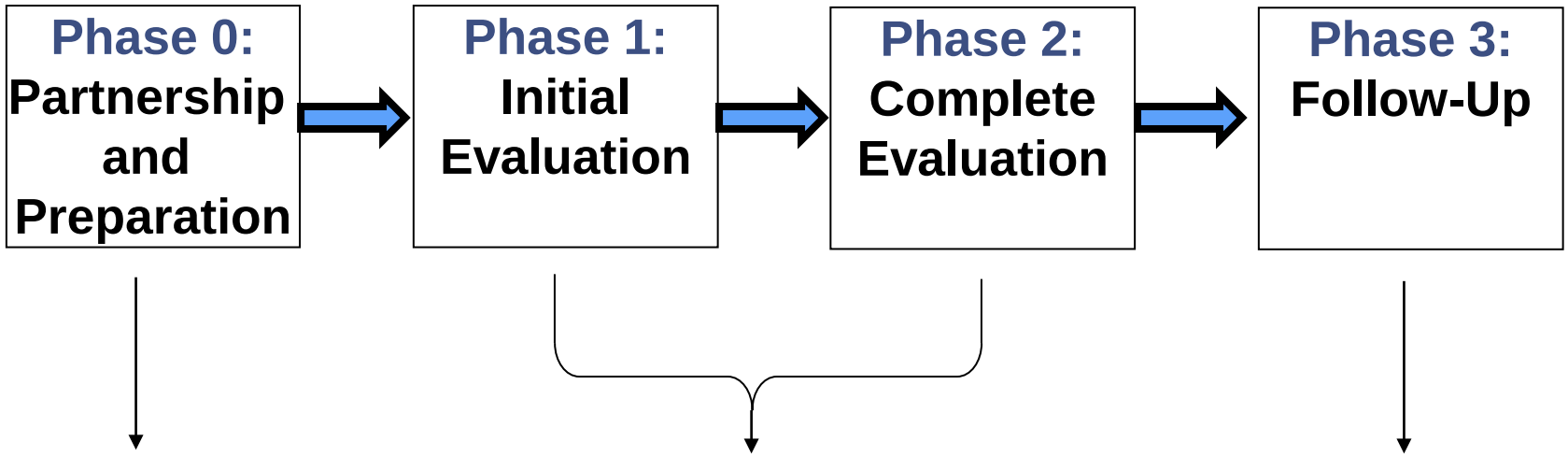
The ATAM is an architecture evaluation method that focuses on multiple quality attributes.



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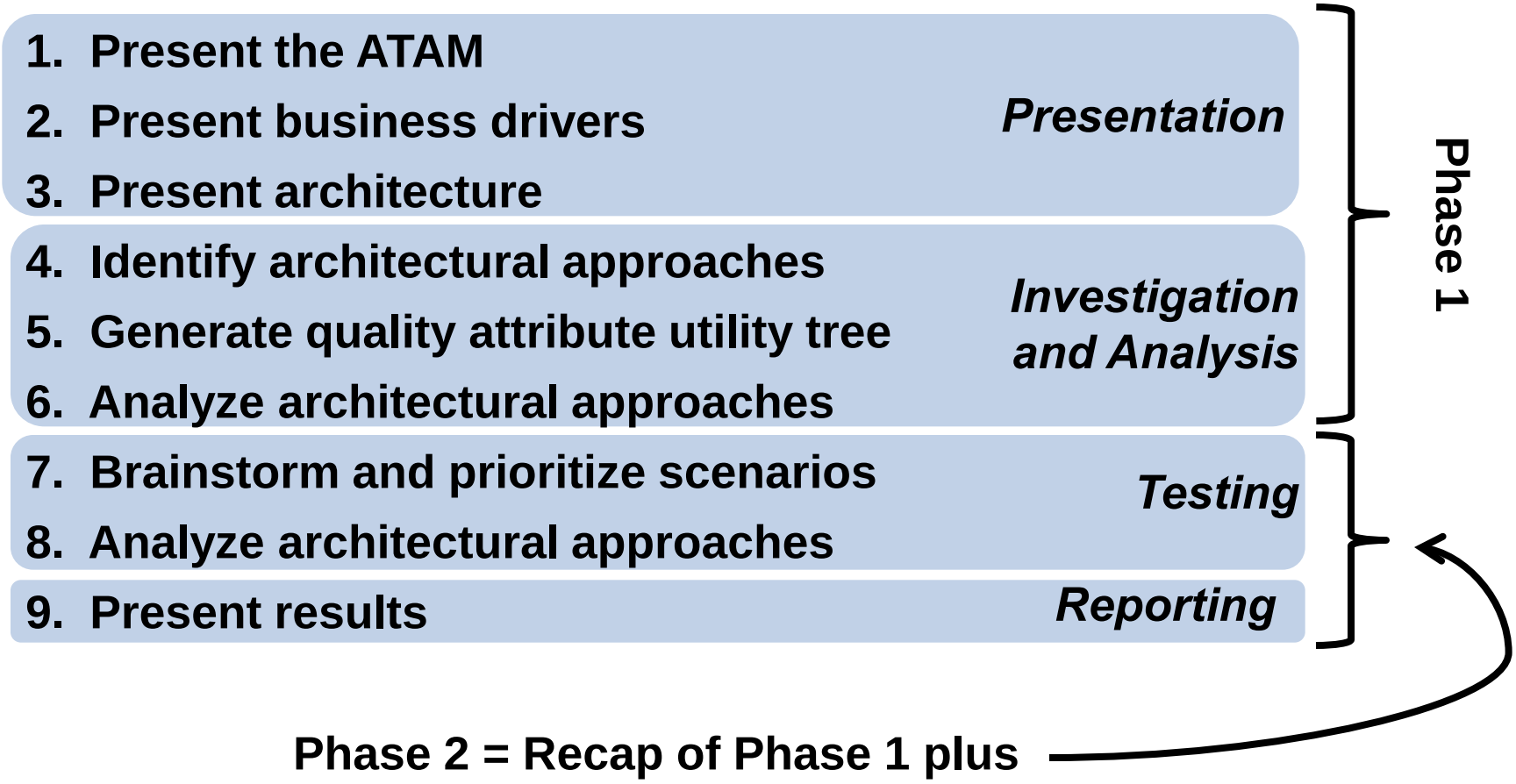
ATAM Phases

ATAM evaluations are conducted in four phases.



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ATAM Evaluative Phases (1 & 2)



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Documenting the Architecture

Architecture documentation establishes the set of design decisions that must be made along the way to establishing and maintaining the architecture.

An architecture is a multidimensional construct, too involved to be seen all at once.

Recall: systems are composed of many structures.

A view is a representation of a structure.

We use views to manage complexity by separating concerns.



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Three Types of Views

Different types of views show different types of information:

1. **Module views** show how the system is structured as a set of code units.
2. **Component-and-connector views** show how the system is structured as a set of elements with runtime behaviors and interactions.
3. **Allocation views** show how the system relates to non-software structures in its environment.

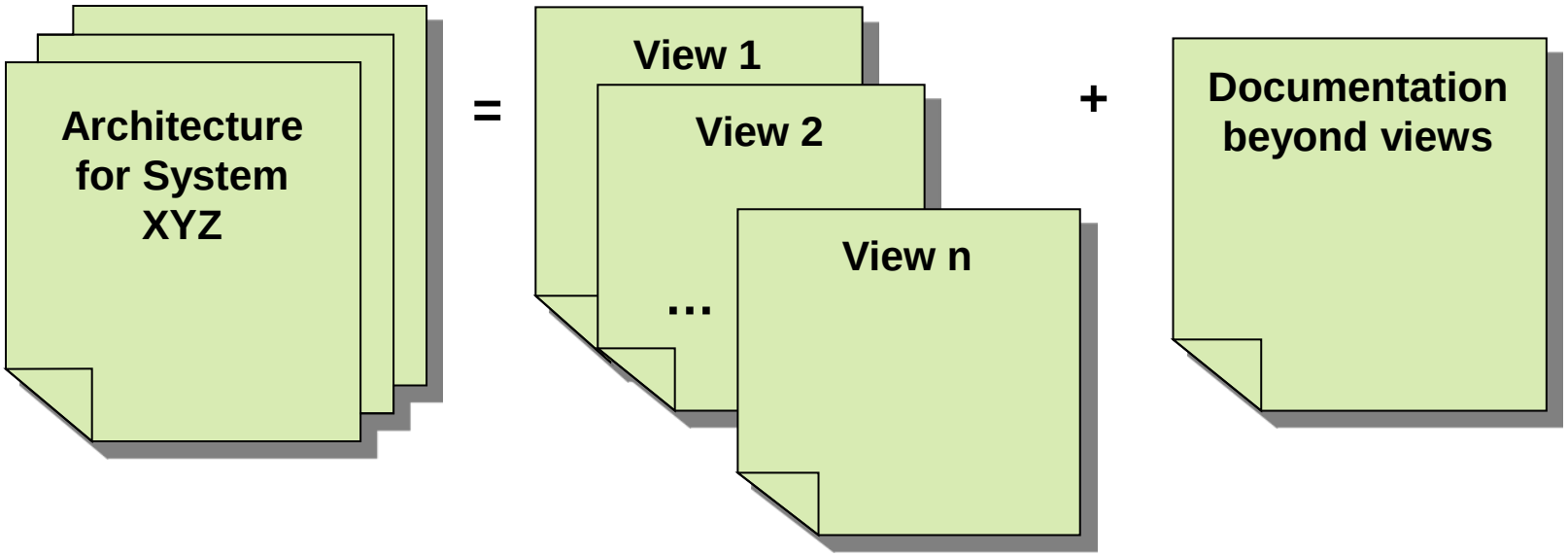
Every view contains information from at least one of these categories.

Some views contain information from more than one category, but these are often difficult to understand.

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View-Based Documentation

Views give us our basic principle of architecture documentation



Documenting an architecture is a matter of documenting the relevant views, and then adding documentation that applies to more than one view.

The choice of views used depends on the nature of the system and the stakeholder needs.

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Software Architecture Documentation Needs

Runtime views to show how software will handle:

- hazards, faults, and errors
- fault tolerance/reconfigurations
- performance
- data (e.g., quality, timeliness, ownership, access privileges)
- interface boundaries

Non-runtime views of software (vital to project planning, allocating work assignments, designing for modifiability, reusability, portability, extensibility, etc., facilitating incremental development, and a host of other critical purposes)

Architectural decisions and the rationale/implications/impact of those decisions on key system qualities

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Implementing and checking conformance

Press on to implementing the system in accordance with the architecture.

Have processes and supporting tools to check for conformance with the architecture.

Unfortunately, a lot of this work today is often not automated.



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So How Well Does This Work?
Study: Impact of Army Architecture Evaluations

Twelve Army programs that had conducted ATAM or QAW exercises in a study to elicit the perceived impact the ATAM evaluations and QAWs had on system quality and the practices of the acquisition organization.

Results showed

- 6/12: cost less than or equal to traditional techniques
- 10/12: quality of results greater than or equal to traditional techniques
- 10/12: helped understand and control cost and schedule
- 12/12: increased understanding of system's quality attribute requirements, design decisions, and risks
- 12/12: good mechanism for communication among stakeholders
- 8/12: improved the architecture



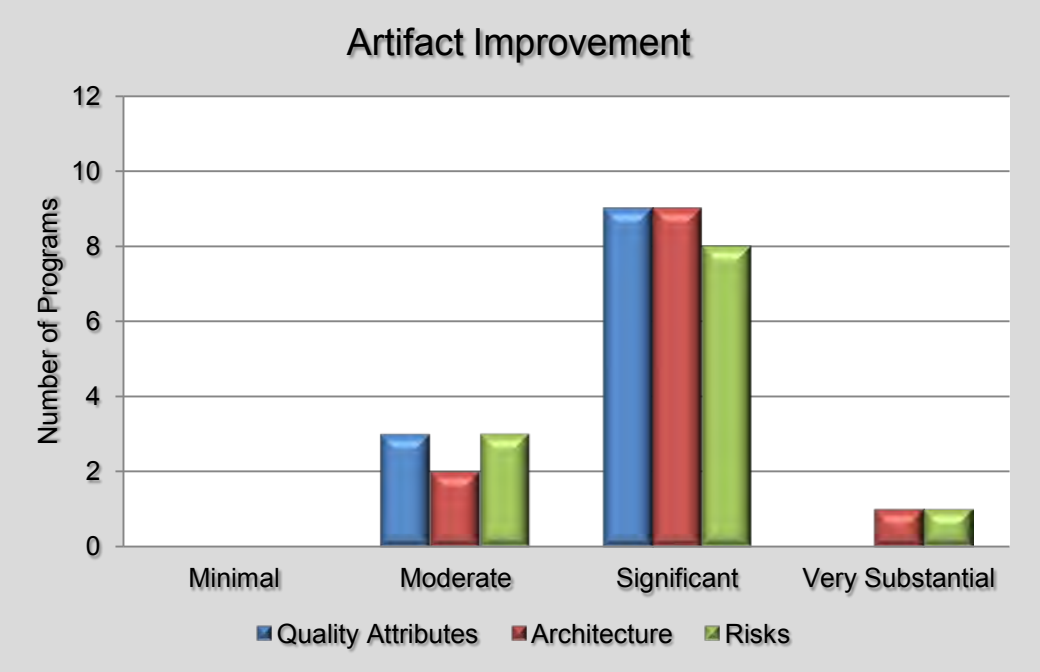
The context of use had a significant impact on the results enjoyed.

Architecture-centric acquisition is key to reaping maximal benefit.

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Architecture Practices are Having an Impact 1 of 2

Results of 2008 survey of 12 Army projects that employed ATAM/QAW[2]



- Most reported *significant* improvement in their architecturally-significant artifacts
- Architecture teams were able to achieve understanding of stakeholder expectations and the implications of architectural decisions on user needs

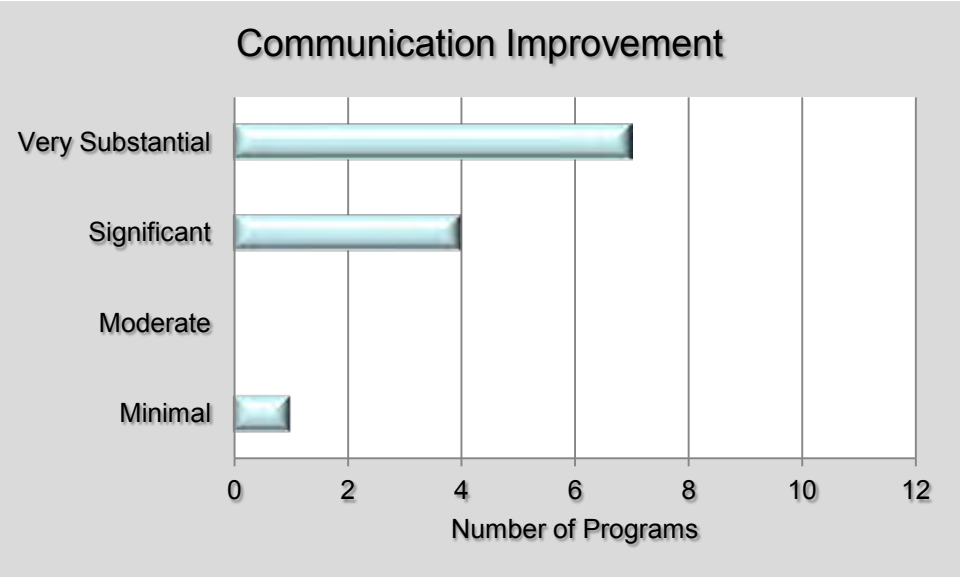
[2] Source: Impact of Army Architecture Evaluations, CMU/SEI-2009-SR-007

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Architecture Practices are Having an Impact 2 of 2

Results of 2008 survey of 12 Army projects that employed ATAM/QAW

- Majority reported *very substantial* or *significant* improvement in stakeholder communication
- Stakeholders, collectively, are able to achieve a common understanding of the system under development
  - Increases likelihood that product will address expectations/user needs
  - Improves chances for program success



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What About System of Systems (SoS)? - 1

The software-intensive systems in an SoS are likely to have been developed independently of each other.

Severe integration and runtime problems thus arise due to inconsistencies in how quality attributes are addressed.

Thus, architecture is even more important in an SoS context, not less.

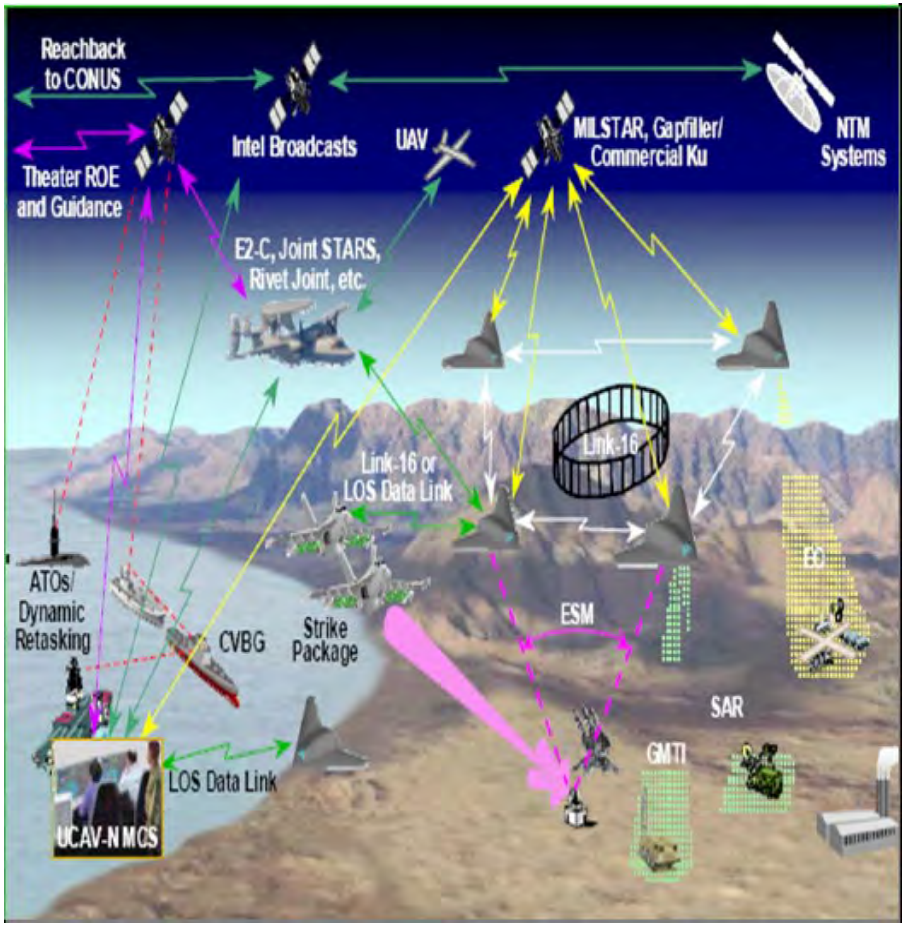
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What About System of Systems (SoS)? - 2

Therefore, in an SoS context:

- Each software-intensive system in an SoS has its own architecture that addresses both system and software aspects.
- The SoS itself has an architecture whose elements are the architectures of the individual software-intensive systems.

A uniform approach for specifying quality attribute requirements and evaluating SoS and software-intensive system architectures against such requirements is thus needed.



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The Need for Augmented Mission Threads in DoD SoS Architecture Definition

DoDAF is the SoS architecture framework for the DoD.

- It provides a good set of architectural views for an SoS architecture.
- It inadequately addresses cross-cutting quality attribute considerations.

System use cases focus on a functional slice of the system.

More than DoDAF and system use cases are needed to ensure that the SoS architecture satisfies its end-to-end functional requirements *and* quality attribute needs.

SoS end-to-end mission (operational or user) threads augmented with quality attribute considerations are needed to help develop, and later evaluate, the SoS architecture.

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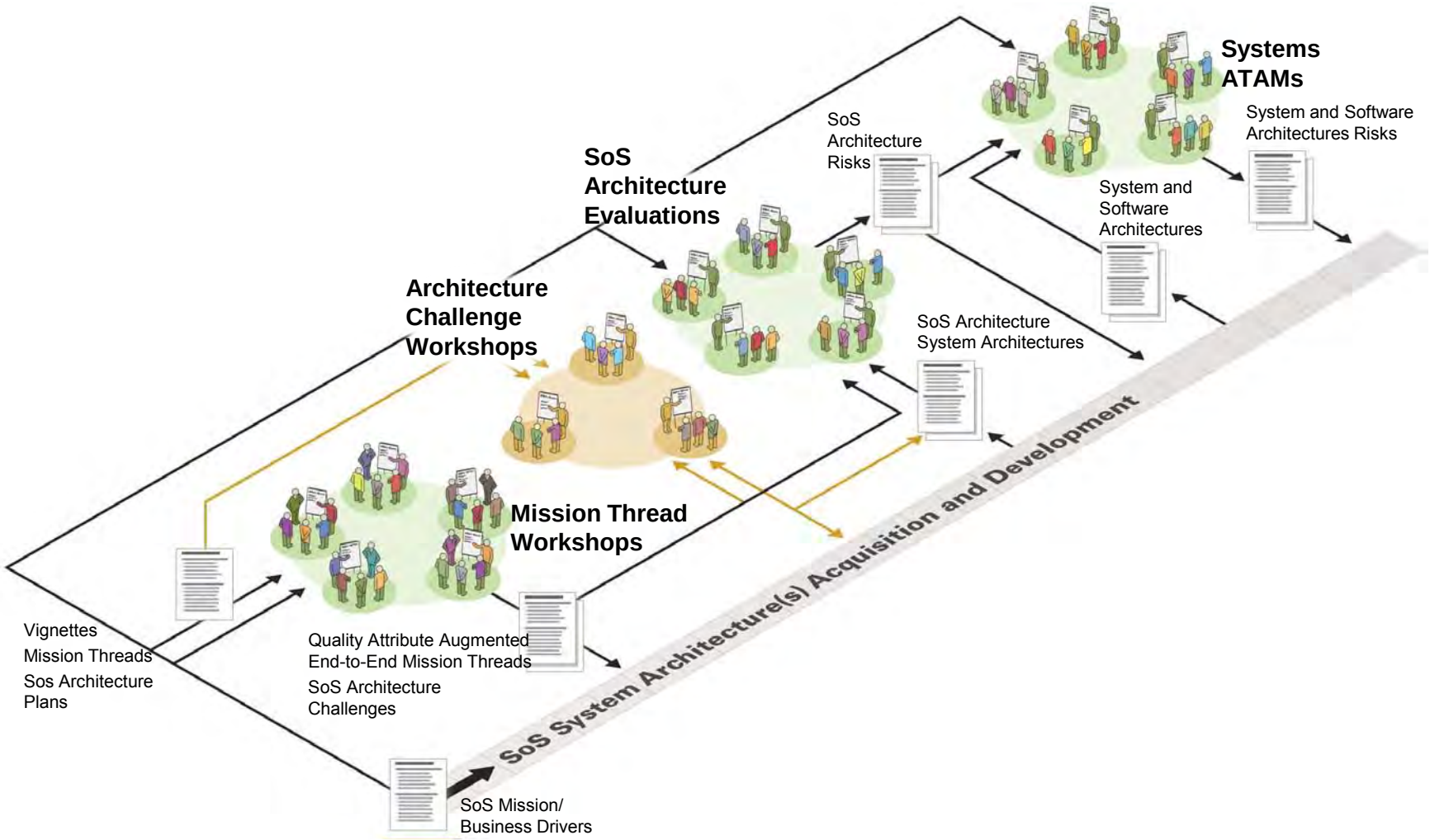
One Approach

SEI developed and applied a two-pronged approach to address the early identification of quality attribute inconsistencies, ambiguities, and omissions within system and SoS architectures (in Directed and Acknowledged SoS contexts).

1. Perform a "first pass" identification of inconsistencies, ambiguities, and omissions across the constituent systems, at the SoS level, using end-to-end mission threads that are augmented with quality attribute concerns from SoS stakeholders.
   The approach involves a series of workshop and evaluations.
   - Mission Thread Workshop
   - Architecture Challenge Workshop
   - SoS Architecture Evaluation
2. Constituent systems that are “problematic” are further evaluated using the system and software architecture evaluation method (based on the ATAM), using the augmented mission threads from the Mission Thread Workshops.
   - System and Software ATAM

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SoS and Quality Attribute Elicitation, Specification, and Analysis



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Architectural Reuse

An architecture represents a significant investment.

Why use it for only one system?

Most organizations produce families of similar systems, differentiated by features.







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Software Product Lines

A software product line is a ***set*** of software-intensive systems sharing a ***common, managed set of features*** that satisfy the specific needs of a ***particular market segment or mission*** and that are ***developed from a common set of core assets*** in a ***prescribed way.***

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Successful Software Product Lines

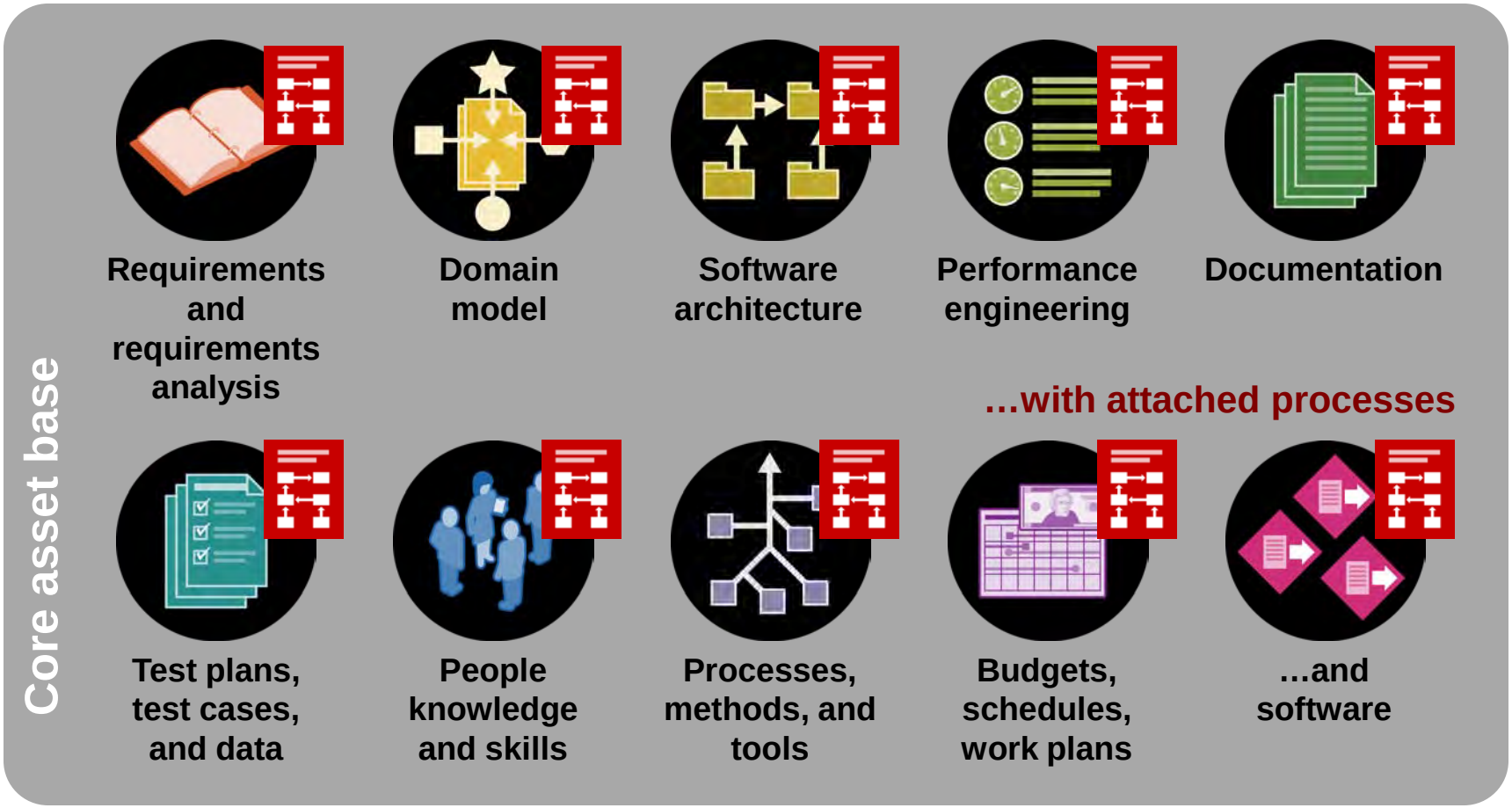
Improvements in cost, time to market, and productivity that come with successful product lines abound.

- **Cummins** reduced the time it takes to produce software for a diesel engine from one year to one week.
- **Motorola** realized a 400% productivity improvement in a family of one-way pagers.
- **Hewlett-Packard** reduced time to market by a factor of seven and increased productivity by a factor of four in a family of printers.
- The **NRO** built a ground control system with 10% of the expected number of developers and reduced defects by 90%.
- **Nokia** reports producing 25 to 30 different phone models per year by using a product line approach.

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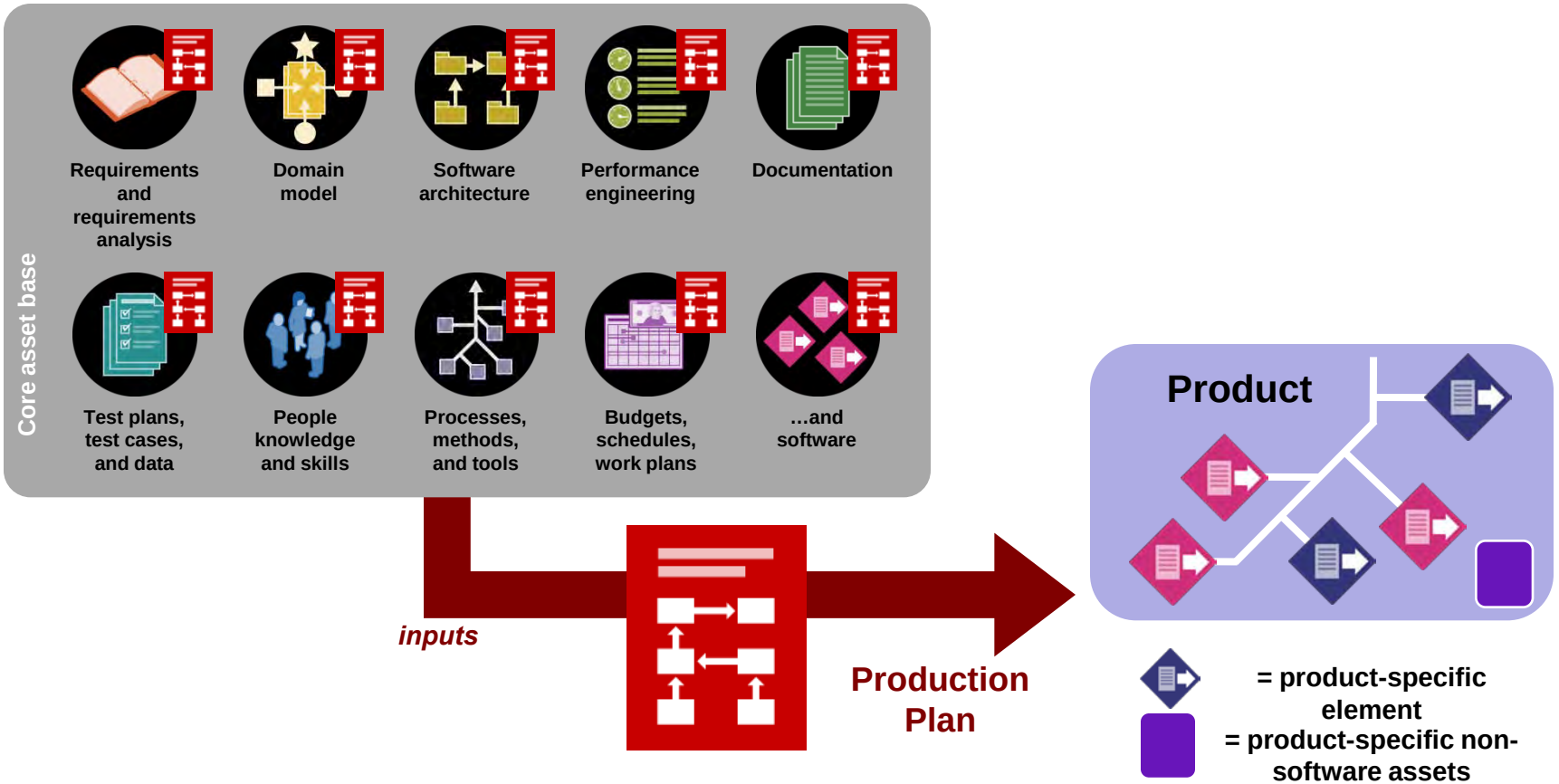
Building the Core Asset Base

Core assets include:



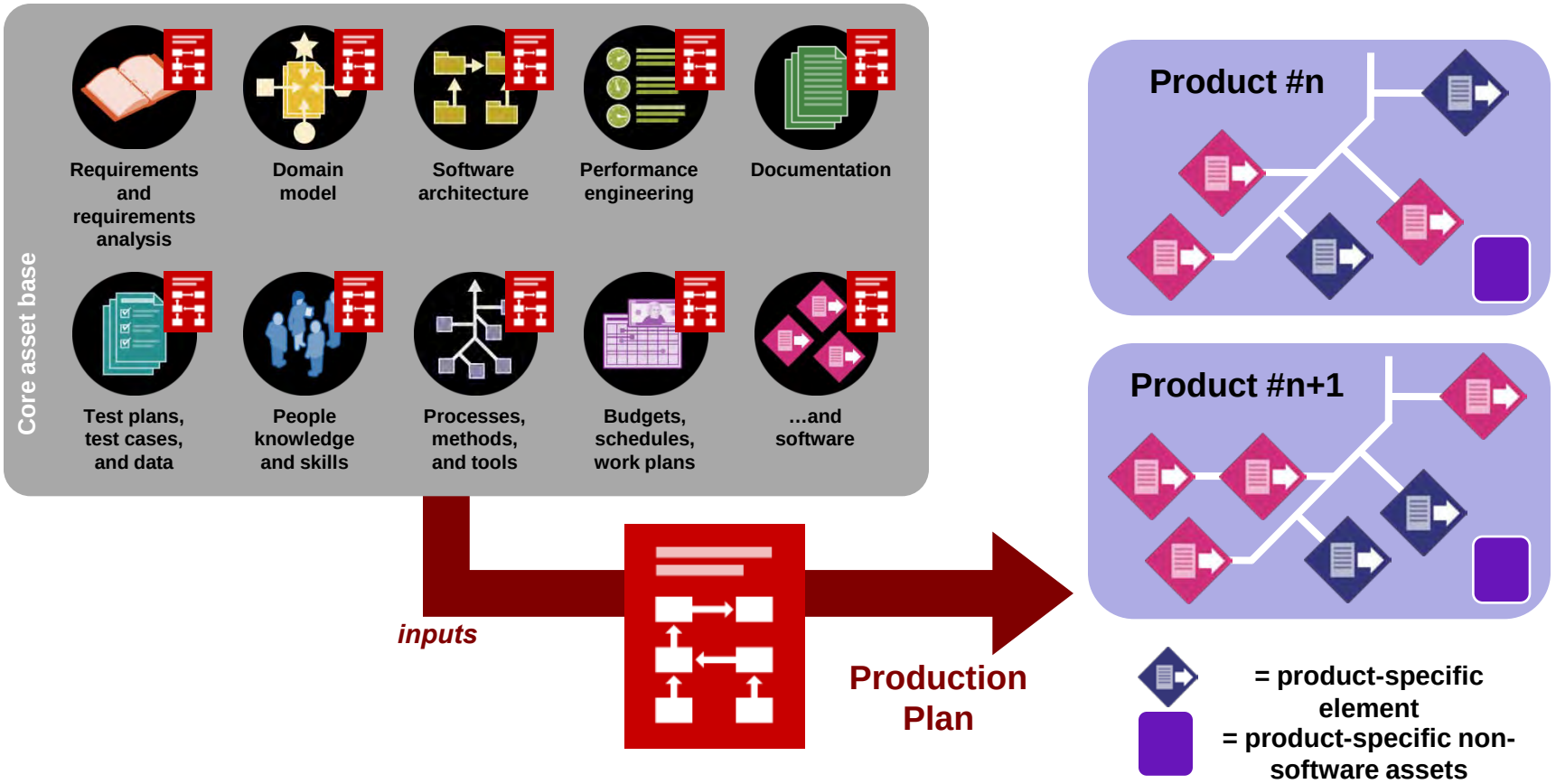
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Building a Product...



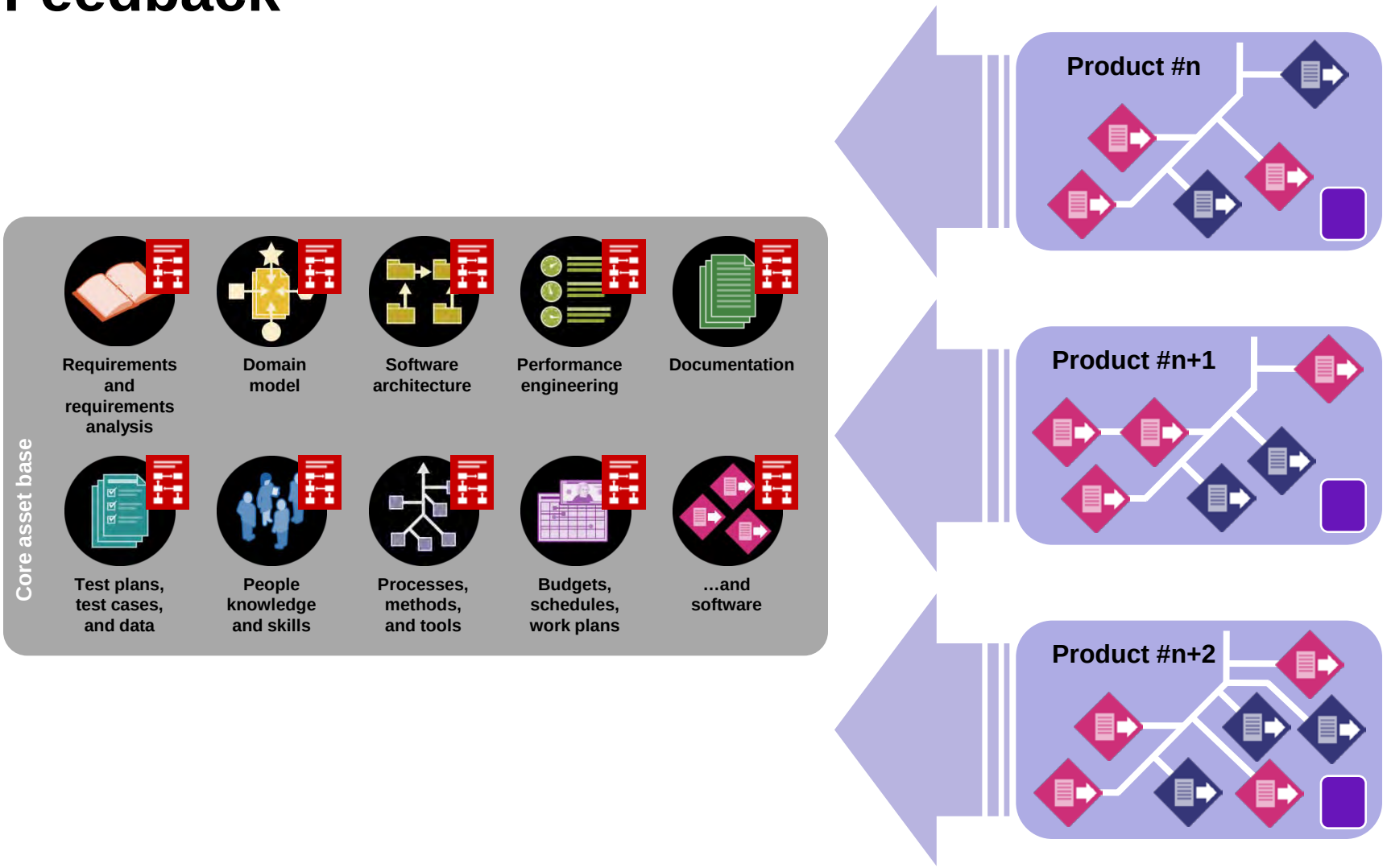
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Building Subsequent Products...



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Feedback



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Widespread Application - 1

akvasmart

Feed control and farm management software

ABB **Asea Brown Boveri**

Gas turbines, train control, semantic graphics framework

AXIS COMMUNICATIONS

Computer printer servers, storage servers, network camera and scanner servers

BOEING

Bold Stroke Avionics

Dialect

Internet payment gateway infrastructure products

DNV

Customized solutions for transportation industries

E-COM Technology Ltd.

Medical imaging workstations

ERICSSON

AXE family of telecommunications switches

GM

Software for engines, transmissions and controllers

hp invent

Firmware for computer peripherals

LG

Elevator control systems

LSI LOGIC

RAID controller firmware for disk storage units

Lucent Technologies
Bell Labs Innovations

5ESS telecommunications switch

NOKIA

Mobile phones, mobile browsers, telecom products for public, private and cellular networks

NASA

Interferometer product line

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Widespread Application - 2

PHILIPS

High-end televisions,
PKI telecommunications switching system,
diagnostic imaging equipment

Rockwell Collins

Commercial flight control system avionics,
Common Army Avionics System (CAAS),
U.S. Army helicopters

symbian

EPOC operating system

NAVSEA WARFARE CENTERS

Test range facilities

RICOH

Office appliances

SALION TARGET. WIN. DELIVER.

Revenue acquisition
management systems

TELVENT

Industrial supervisory control
and business process
management systems

U.S. ARMY

Command and control
simulator for Army fire
support

BOSCH

Automotive gasoline systems

SIEMENS

Software for viewing and quantifying
radiological images

testo

Climate and flue gas
measurement devices

elltel FIDELITY NATIONAL FINANCIAL

Support software

MOTOROLA

Pagers product line

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Presentation Outline

CMMI V1.3 – Context for modern engineering practices changes

Introduction to Architecture

Essential Architecture Practices

Where Are the Architecture-Centric Practices in CMMI V1.3?

Summary

Questions and Answers

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Modern Engineering Approaches in CMMI - 1

For Version 1.3, CMMI provides better coverage of architecture-centric practices (mostly by changes to informative material):

- creating the **business case** for the system (partially in RD and TS)
- understanding the **requirements** (RD)
- **creating and/or selecting** the architecture (TS)
- **documenting and communicating** the architecture (RD, TS)
- **analyzing or evaluating** the architecture (RD, TS, VAL, VER)
- **implementing** the system based on the architecture (TS; A/PL notes)
- ensuring that the implementation **conforms** to the architecture (VER)
- **evolving** the architecture so that it **continues to meet business and mission goals** (implicit in the phrase “establish and maintain”)

RD = Requirements Development PA

TS = Technical Solution PA

VER = Verification PA

VAL = Validation Pa

A/PL = Agile and Product Lines notes (primarily in the Introductory Notes of a PA)

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Modern Engineering Approaches in CMMI - 2

CMMI V1.3 also provides an improved terminology to support understanding and use of architecture-centric practices

- Updated the glossary to include new terms (and modified some old terms)
- Updated the informative material (especially ARD and ATM in ACQ; RD, TS, and VER in DEV; and SSD in SVC) to:
  - make use of the new terms
  - bring more emphasis to quality attributes and thus strike a better balance between functional and non-functional requirements
- Replaced selected uses of overloaded terms such as “performance” with an appropriate qualifying phrase.

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Modern Engineering Approaches in CMMI - 3

Added and revised the informative material throughout the Engineering PAs (in particular) to appropriately mention the following engineering concepts:

- quality attributes (i.e., non-functional requirements or “ilities”)
- architecture-centric practices
- product lines, system of systems
- allocation of product capabilities to release increments
- technology maturation (and obsolescence)

These concepts are mentioned in example boxes, in examples provided in the notes, and in discussions that mention various approaches that can be used.

When functional requirements are discussed, mention of quality attributes is added to balance the view of requirements.

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Requirements Development

SG 1: Develop Customer Requirements
- SP 1.1 Elicit Needs
- SP 1.2 Transform Stakeholder Needs into [Prioritized] Customer Requirements

SG 2: Develop Product Requirements
- SP 2.1 Establish Product and Product Component Requirements
- SP 2.2 Allocate Product Component Requirements
- SP 2.3 Identify Interface Requirements

SG 3: Analyze and Validate Requirements
- SP 3.1 Establish Operational Concepts and Scenarios
- SP 3.2 Establish a Definition of Required Functionality and Quality Attributes
- SP 3.3 Analyze Requirements
- SP 3.4 Analyze Requirements to Achieve Balance
- SP 3.5 Validate Requirements

In SP1.2, added that customer requirements should be **prioritized** based on their criticality to the **customer** and other stakeholders "representing all phases of the product's lifecycle … including *business* as well as technical functions."

In SP 2.1, added a focus on **architectural requirements** and quality attribute **measures**.

In SP 2.2, added a subpractice allocating requirements to **delivery increments**.

Addressed "**Quality attributes**" (QAs) as well as functionality in SG3 and SP 3.2 statements.

In SP 3.1, broadened emphasis to **"operational, sustainment,** and **development"** scenarios.

In SP 3.2, determined **architecturally-significant QAs** from mission and business drivers.

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Technical Solution

SG 1: Select Product Component Solutions
- SP 1.1 Develop Alternative Solutions and Selection Criteria
- SP 1.2 Select Product Component Solutions

SG 2: Develop the Design
- SP 2.1 Design the Product or Product Component
- SP 2.2 Establish a Technical Data Package
- SP 2.3 Design Interfaces Using Criteria
- SP 2.4 Perform Make, Buy, or Reuse Analyses

SG 3: Implement the Product Design
- SP 3.1 Implement the Design
- SP 3.2 Develop Product Support Documentation

Intro Notes: "QA **models, simulations, prototypes or pilots** can be used to provide additional information about the properties of the potential design solutions to aid in the selection of solutions. Simulations can be particularly useful for projects developing systems-of-systems."

In SP 1.1, Added an example selection criterion, "Achievement of key quality attribute requirements" and a new subpractice: "Identify **re-usable solution** components or applicable **architecture patterns.".**

In SP 2.1, described architecture definition tasks such as selecting **architectural patterns** and formally defining component behavior and interactions using an **architecture description language.**

In SP 2.2, added subpractice to determine **views** to document structures and address stakeholder concerns.

In SP 2.3, mentioned exception and error handling,

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Product Integration

SG 1: Prepare for Product Integration
- SP 1.1 Establish an Integration Strategy
- SP 1.2 Establish the Product Integration Environment
- SP 1.3 Establish Product Integration Procedures and Criteria

SG 2: Ensure Interface Compatibility
- SP 2.1 Review Interface Descriptions for Completeness
- SP 2.2 Manage Interfaces

SG 3: Assemble Product Components and Deliver the Product
- SP 3.1 Confirm Readiness of Product Components for Integration
- SP 3.2 Assemble Product Components
- SP 3.3 Evaluate Assembled Product Components
- SP 3.4 Package and Deliver the Product or Product Component

Revised the purpose to ensure proper **behavior** instead of proper function, thereby more implicitly including **quality attributes** as well as functionality.

Changed emphasis from integration sequence to an emphasis on **integration strategy**, i.e., the approach to receiving, assembling, and evaluating product components. The **architecture** will significantly influence the selection of a product integration strategy.

In the PA notes, addressed: **interfaces** to data sources and middleware; APIs, **automated builds, continuous integration**

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Validation

SG 1: Prepare for Validation

- SP 1.1 Select Products for Validation
- SP 1.2 Establish the Validation Environment
- SP 1.3 Establish Validation Procedures and Criteria

SG 2: Validate Product or Product Components

- SP 2.1 Perform Validation
- SP 2.2 Analyze Validation Results

Reinforced when validation occurs in the product lifecycle: "validation is performed early (concept/exploration phases) and incrementally throughout the product lifecycle (including transition to operations and sustainment)."

In VAL SP 1.1, included **access protocols** and data interchange reporting formats as examples of what to validate.

Also, included **incremental delivery of working and potentially acceptable product** as an example validation method.

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Verification

SG 1: Prepare for Verification
- SP 1.1 Select Work Products for Verification
- SP 1.2 Establish the Verification Environment
- SP 1.3 Establish Verification Procedures and Criteria

SG 2: Perform Peer Reviews
- SP 2.1 Prepare for Peer Reviews
- SP 2.2 Conduct Peer Reviews
- SP 2.3 Analyze Peer Review Data

SG 3: Verify Selected Work Products
- SP 3.1 Perform Verification
- SP 3.2 Analyze Verification Results

In SP 1.1, added example verification methods**: software architecture evaluation and implementation conformance evaluation** and continuous integration.

In SP 1.3, added example sources of verification criteria: customers reviewing work products collaboratively with developers.

In SP 2.1, added example type of peer review: **architecture implementation conformance evaluation**

In SP 2.3, added examples of peer review data that can be analyzed: **user stories** or case studies associated with a defect and the end-users and customers who are associated with defects

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Addressing Agile - 1

Changes Supporting Use of Agile Methods

Because CMMI practices are written for use in a broad variety of contexts, business situations, and application domains, it is not possible (even if it were appropriate) to advocate any specific implementation approach.

However, Agile methods and approaches are now in wider use, and so for V1.3, it seemed appropriate to acknowledge this, identify how Agile approaches can address CMMI practices and conversely, identify the value that CMMI can bring to Agile implementations.

The next set of slides describe how CMMI V1.3 addresses Agile methods.

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Addressing Agile - 2

The Problem

Developers that use Agile methods sometimes resist using CMMI because they can't see how CMMI practices can complement or improve the effectiveness of Agile methods.

Overview of Solution

Added guidance to the appropriate PAs to do the following:

- Help users interpret the practices in a context where Agile methods are used
- Reinforce the applicability of the practices in an Agile environment
- Send the message that CMMI is a robust best practice framework meant to be used in Agile environments as well as other development environments

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Addressing Agile - 3

Solution

Added a new section to DEV Chapter 5 entitled “Interpreting CMMI When Using Agile Approaches”

- This section describes how CMMI practices can apply in a variety of development environments. It also describes the interpretive guidance that has been added to selected PAs for use in Agile environments.

Added interpretive guidance to the following PAs:

- In DEV: CM, REQM, PP, RD, TS, PI, VER, PPQA, and RSKM
- In ACQ: AM, ATM, PMC, and PP
- In SVC: SSD

Added in DEV and SVC (SSD only) Agile-related examples as bullets in example boxes (informative material).

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Addressing Agile - 4

A note added in the RD Intro Notes:

> In Agile environments, requirements are communicated and tracked through mechanisms such as product backlogs, story cards, and screen mock-ups. [snip] Traceability and consistency across requirements and work products is addressed through the mechanisms already mentioned as well as during start-of-iteration or end-of-iteration activities such as "retrospectives" and "demo days." *[Emphasis added]*

A note added in the TS Intro Notes:

> In Agile environments, the focus is on early solution exploration. By making the selection and tradeoff decisions more explicit, the Technical Solution process area helps improve the quality of those decisions, both individually and over time. [snip] When someone other than the team will be working on the product in the future, release information, maintenance logs, and other data are typically included with the installed product. To support future product updates, rationale (for trade-offs, interfaces, and purchased parts) is captured so that why the product exists can be better understood. [snip] *[Emphasis added]*

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Addressing Product Lines - 1

Likewise, notes have been added to the Intro Notes of selected PAs to explain how the PA can be effectively applied in a product line environment.

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Addressing Product Lines - 2

An example of a note added in the RD Intro Notes:

> For product lines, engineering processes (including requirements development) may be applied to at least two levels in the organization. At an organizational or product line level, a “commonality and variation analysis” is performed to help elicit, analyze, and establish core assets for use by projects within the product line. At the project level, these core assets are then used as per the product line production plan as part of the project’s engineering activities. *[Emphasis added]*

An example of a note added in the TS Intro Notes:

> For product lines, these practices apply to both core asset development (i.e., building for reuse) and product development (i.e., building with reuse). Core asset development additionally requires product line variation management (the selection and implementation of product line variation mechanisms) and product line production planning (the development of processes and other work products that define how products will be built to make best use of these core assets). *[Emphasis added]*

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Changes in CMMI Terminology - 1

Allocated requirement

DEFINITION

Requirement that ~~levies~~results from levying all or part of ~~the performance and functionality of~~ a higher level requirement on a lower level architectural element or design component.

More generally, requirements can be allocated to other logical or physical components including people, consumables, delivery increments, or the architecture as a whole, depending on what best enables the product or service to achieve the requirements.

The improvements to the above definition make the substance of the solution space and the allocation of requirements to it more explicit, enabling insightful analyses (including verification) of requirements, architectures, and implementations.

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Changes in CMMI Terminology - 2

Architecture

DEFINITION

The set of structures needed to reason about a product. These structures are comprised of elements, relations among them, and properties of both.

In a service context, the architecture is often applied to the service system.

Note that functionality is only one aspect of the product. Quality attributes, such as responsiveness, reliability, and security, are also important to reason about. Structures provide the means for highlighting different portions of the architecture. (See also “functional architecture.”)

This term and its use throughout the rest of the model is intended to encourage use of proven, architecture-centric practices and the recognition of “architecture” as a principal engineering artifact.

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Changes in CMMI Terminology - 3

Definition of required functionality and quality attributes

DEFINITION

A characterization of required functionality and quality attributes obtained through "chunking," organizing, annotating, structuring, or formalizing the requirements (functional and non-functional) to facilitate further refinement and reasoning about the requirements as well as (possibly, initial) solution exploration, definition, and evaluation.

As technical solution processes progress, this characterization can be further evolved into a description of the architecture versus simply helping scope and guide its development, depending on the engineering processes used; requirements specification and architectural languages used; and the tools and the environment used [snip].

The term "definition of required functionality" that appeared in V1.2 has been removed from CMMI because of the implicit suggestion that functionality be addressed first or has higher priority. The term has been replaced with the one above, which is intended to help ensure a sufficiently balanced and concurrent focus (functional *and* non-functional) in requirements analysis.

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Changes in CMMI Terminology - 4

“Functional analysis” and “functional architecture”

These terms, which appeared in earlier versions of CMMI, are now “cul de sacs” in the model.

The only places these terms now appear in CMMI-DEV V1.3 outside of the Glossary are in the first note of RD SP 3.2 and as an example work product.

The note in RD SP 3.2 contrasts the approaches implied by these terms with “modern engineering approaches” that encourage a more balanced and concurrent treatment of requirements, functional and non-functional.

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Changes in CMMI Terminology - 5

Product line

DEFINITION

A group of products sharing a common, managed set of features that satisfy specific needs of a selected market or mission~~.~~ and that are developed from a common set of core assets in a prescribed way.

The development or acquisition of products for the product line is based on exploiting commonality and bounding variation (i.e., restricting unnecessary product variation) across the group of products. The managed set of core assets (e.g., requirements, architectures, components, tools, testing artifacts, operating procedures, software) includes prescriptive guidance for their use in product development. Product line operations involve interlocking execution of the broad activities of core asset development, product development, and management.

Many people use “product line” just to mean the set of products produced by a particular business unit, whether they are built with shared assets or not. We call that collection a "portfolio," and reserve "product line" to have the technical meaning given here.

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Changes in CMMI Terminology - 6

Quality attribute

DEFINITION

A property of a product or service by which its quality will be judged by relevant stakeholders. Quality attributes are characterizable by some appropriate measure.

Quality attributes are non-functional, such as timeliness, throughput, responsiveness, security, modifiability, reliability, and usability. They have a significant influence on the architecture.

This term is now included in the Glossary for the first time. This term is intended to supplant others – especially those focusing on only a few dimensions (e.g., "performance") – to encourage a broader view of non-functional requirements. The term was refined through much effort, as neither ISO 25030 (SQuaRE) nor the original SEI definitions were quite satisfactory.

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Changes in CMMI Terminology - 7

“Performance” used by itself can be ambiguous

A “quality attribute” for CMMI is clarity ☺. One term that has repeatedly caused problems in translations was “performance.” For V1.3, each use of the term was examined to ensure it was unambiguous, correctly used, and where appropriate the term was qualified:

- supplier performance
- project performance
- product performance
- technical performance
- organization’s performance
- cost, schedule, performance
- performed process (CL1)
- process performance
- period of performance
- service delivery performance
- project progress and performance
- fit, form, function, performance

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Changes in CMMI Terminology - 8

Establish and maintain

DEFINITION

Create, document, use, and revise . . . as necessary to ensure ~~it remains~~ they remain useful.

The phrase "establish and maintain" ~~means more than a combination of its component terms;~~ . . . plays a special role in communicating a deeper principle in CMMI: work products that have a central or key role in work group, project, and organizational performance should be given attention to ensure they are used and useful in that role.

This phrase has particular significance in CMMI because it often appears in goal and practice statements . . . and should be taken as shorthand for applying the principle to whatever work product is the object of the phrase.

The above term appears in many CMMI practices. This term was changed in V1.3 to emphasize that artifacts that have a long-term role need to evolve to remain useful. Example from RD SP 2.1 note: "The modification of requirements due to approved requirement changes is covered by the "maintain" aspect of this specific practice…" The issue of how much to document is also addressed, e.g., TS SP 2.2.

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Questions and Answers

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Summary & Conclusions



The quality and longevity of a software-intensive system is largely determined by its architecture.

Early identification of architectural risks saves money and time.

There are proven practices to help ensure that suppliers and acquirers can develop and acquire systems that have appropriate architectures.

CMMI V1.3 has a new emphasis on architecture.

The efficacy of the architecture has a direct impact on program or mission success, and customer satisfaction.

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References - 1

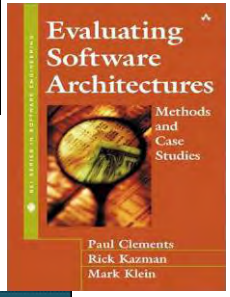
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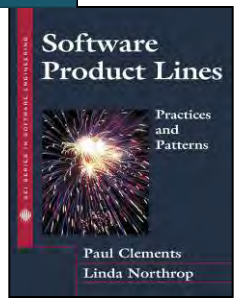
Documenting Software Architectures: Views and Beyond, Second Ed.
Clements, P.; Bachmann, F.; Bass, L.; Garlan, D.; Ivers, J.; Little, R.; Nord, R.; & Stafford, J. Reading, MA: Addison-Wesley, 2010.

Software Product Lines: Practices and Patterns
Clements, P.; Northrop, L. Reading, MA: Addison-Wesley, 2001.









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References - 2

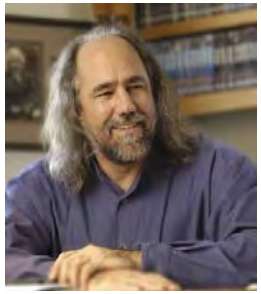
You can find a moderated list of references on the “Software Architecture Essential Bookshelf”

http://www.sei.cmu.edu/architecture/start/publications/bookshelf.cfm



Grady Booch: Handbook of Software Architecture (currently only an on-line reference):

http://www.handbookofsoftwarearchitecture.com/index.jsp?page=Main

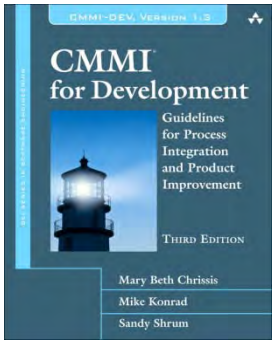


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http://www.sei.cmu.edu/library/abstracts/reports/10tr033.cfm

(also available as a book from the SEI Series on Software Engineering)

Chrissis, Mary Beth; Konrad, Mike; & Shrum, Sandy. CMMI: Guidelines for Process Integration and Product Improvement, 3rd Edition. Boston: Addison-Wesley, 2011.



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The SEI Software Architecture Curriculum

Six Courses	*Three Certificate Programs*		
	Software Architecture Professional	**ATAM Evaluator**	**ATAM Leader**
Software Architecture Principles and Practices*	✓	✓	✓
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✓ **: required to receive certificate**

***: available through e-learning**

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Questions



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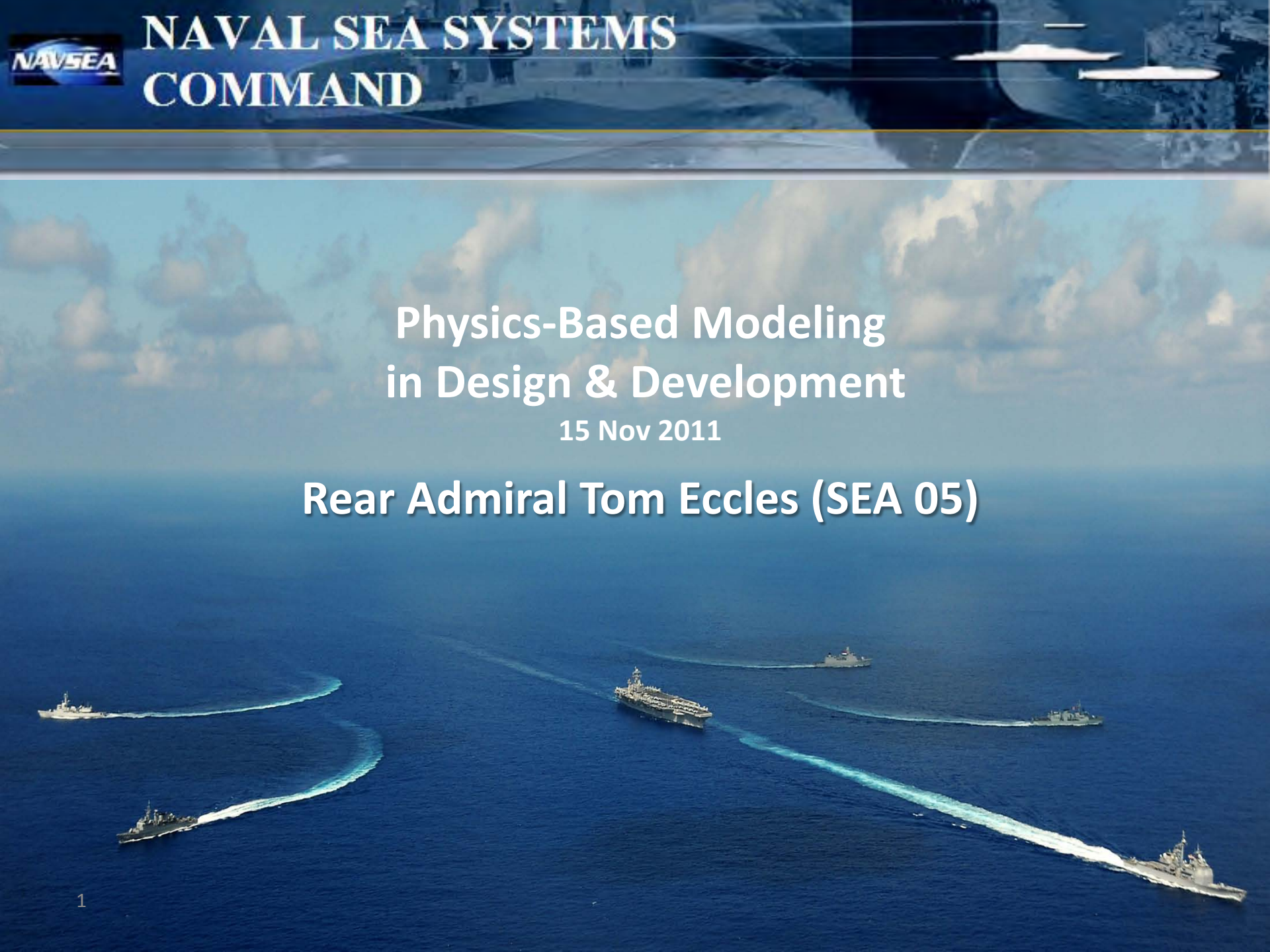
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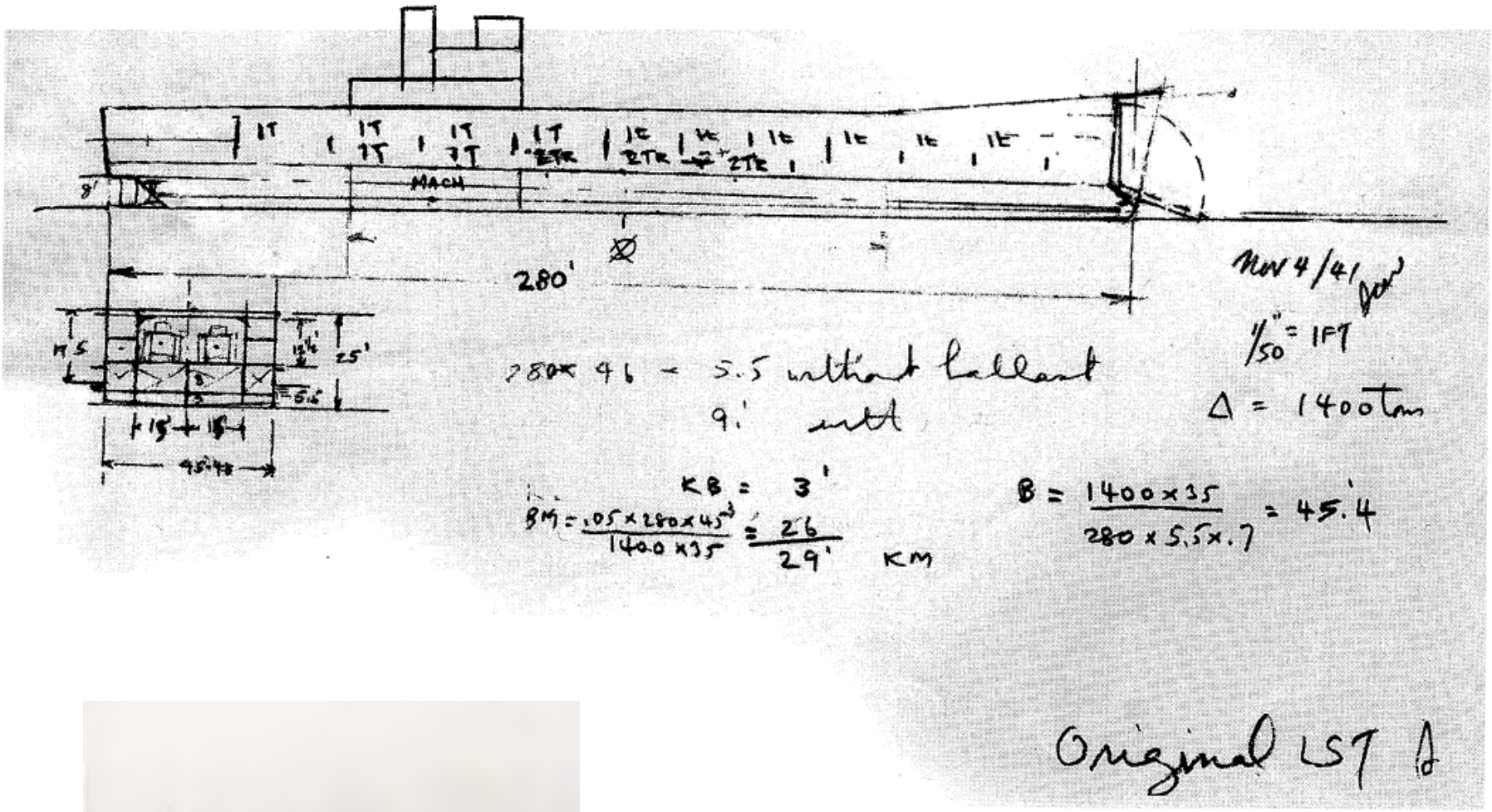
NAVAL SEA SYSTEMS COMMAND

Physics-Based Modeling in Design & Development

15 Nov 2011

Rear Admiral Tom Eccles (SEA 05)

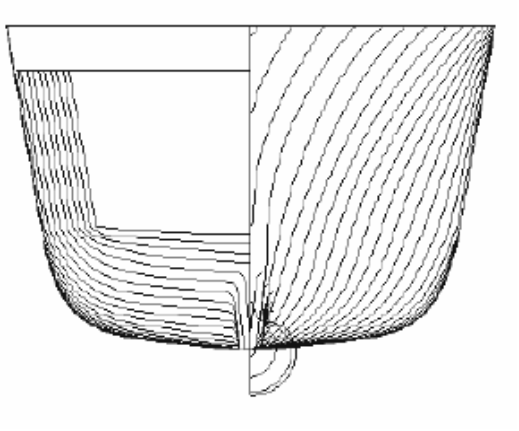


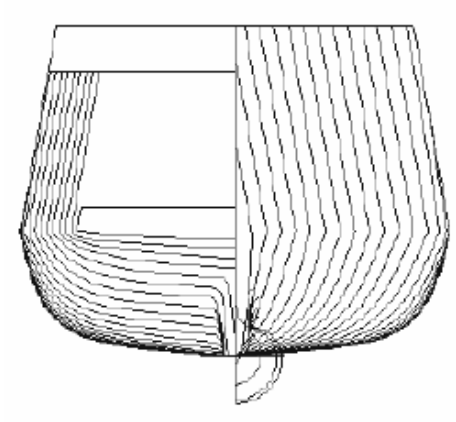


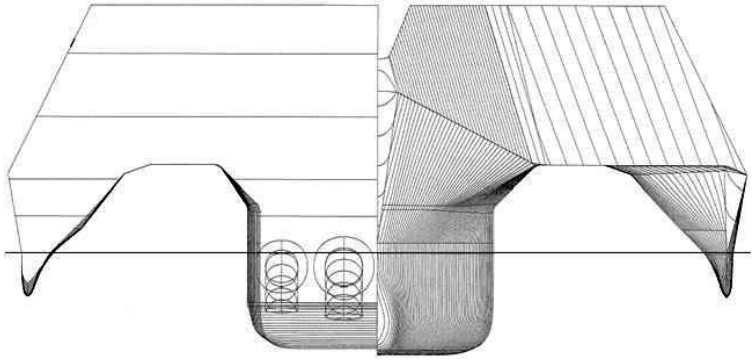


Original LST Napkin Sketch
J.C. Neidermair
Director of Preliminary Design
Bureau of Ships
1939 - 1959

Ship Hull Forms Require Complex Hydrodynamic Analysis









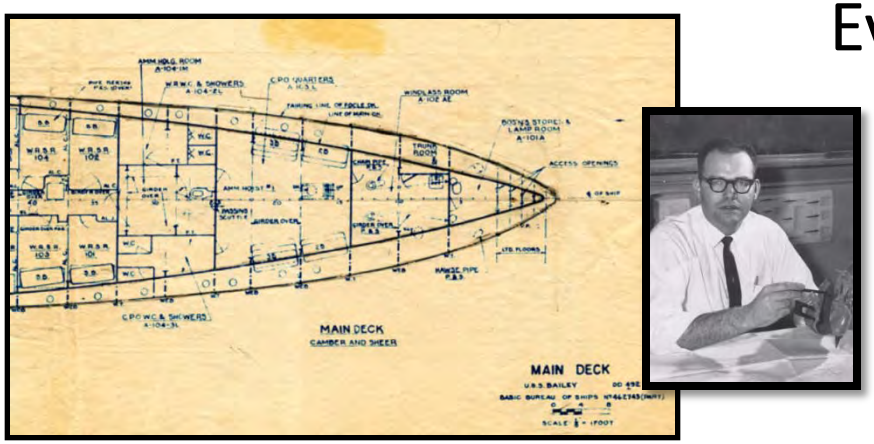




Evolution Of Ship Arrangements

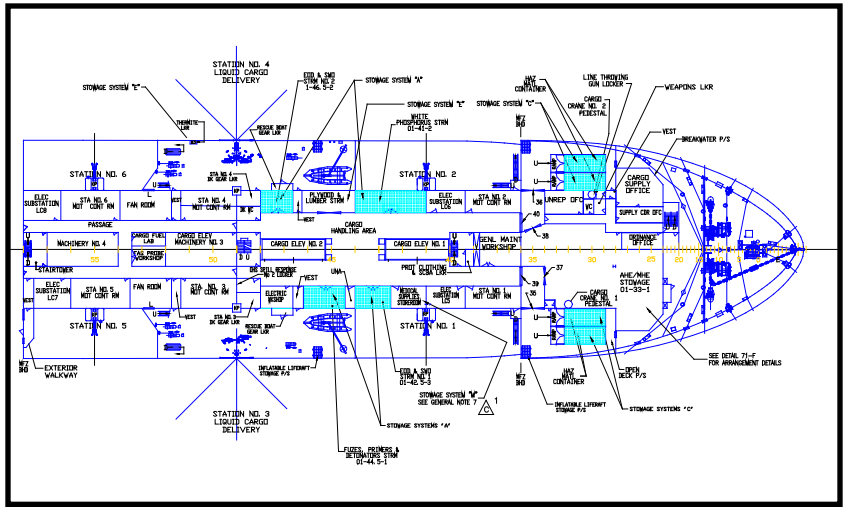
Pencil and paper

1980s and before



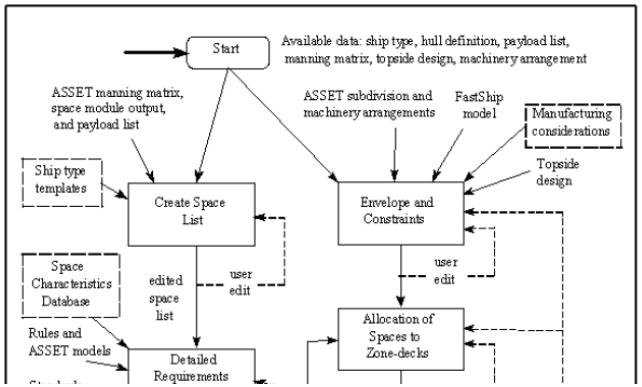
Computer Aided Design

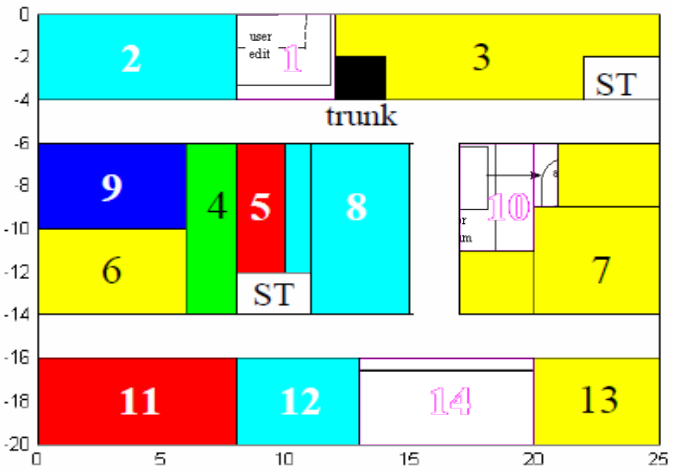
1990s to ~ 2017



Intelligent Ship Arrangements

2018 and beyond









Parametric Estimation for ERP Implementations

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Email: info@qsm.com
Web: www.qsm.com

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Objectives

- Provide conference attendees with a practical method for estimating the project size of ERP implementations that is both easy to learn and apply
- Compare the behavior of ERP implementations to other business IT projects
  - Size vs. Schedule
  - Size vs. Effort

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Outline

- Key differentiators between ERP implementations and software development
- Sizing ERP implementations
  - Determining size
  - RICEF objects
  - Configuration items
  - Normalizing to a common metric
- Estimating ERP implementations

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Quotations

"Perfection is the enemy of the possible"

- Voltaire (paraphrased)

"Precision is not accuracy"

- William Horton

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Key Differentiators

- Software projects create code
  - Develop new systems
  - Modify existing systems
  - Are measured (sized) by the functionality they deliver and/or the code they create
- Software projects *may*
  - Develop interfaces
  - Have hardware, network, telecom components
  - Convert data
  - Have system setup and configuration

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Key Differentiators

- ERP Implementations *have*
  - Significant system setup & configuration
  - Hardware, network, & telecom components
- ERP Implementations *may*
  - Develop interfaces
  - Convert data
  - Create additional functionality
  - Modify existing functionality

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Determining Size

- Software project size is **not** how much it costs nor how long it takes
- Size measures the functionality a software project delivers
- Parametric estimation (SLIM, COCOMO, etc.) uses size as a key input to determine cost and schedule
  - Lines of code, function points, requirements, use cases are traditional size measures
- What size measures capture the functionality of an ERP implementation?

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Sizing ERP Implementations

- ERP Implementation size: two components
  - Configurations
  - Customizations
- Configurations include parameters, properties, rules, values, table setup
- Customizations are principally code
- Proportions vary between projects
- ERP sizing must consider both

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Configurations

- Estimate the number of configuration items (by category & complexity)
  - Best case, worst case, most likely scenarios
- Alternatively, identify number of high level business processes that must be configured
  - SAP Solution Composer is an example
- Normalize them to a common elementary unit (using gearing factors)

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Configuration Example: Tables

- Average table has
  - 3 indices to define
  - 20 columns to define
  - 20 data types (one per column)
- Average table (in this example) requires 43 elementary activities (or implementation units) to create
  - Gearing factor of 43

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Customizations

- RICEF objects: **R**eports, **I**nterfaces, **C**onversions, **E**nhancements, **F**orms
- Estimate counts of each item (by complexity)
- Normalize them to a common elementary unit (using gearing factors)
- Add to normalized configuration items count for an estimated project size

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Sample Gearing Factor Table: RICEF Objects

Component	Gearing Factor	Number	Size
Simple Reports	100	10	1000
Average Reports	200	5	1000
Complex Reports	300	20	6000
Simple Interfaces	320	2	640
Average Interfaces	620	12	7440
Complex Interfaces	1520	1	1520
Simple Conversion	100	2	200
Average Conversions	200	5	1000
Complex Conversions	300	2	600
Simple Enhancements	100	2	200
Average Enhancements	500	1	500
Complex Enhancements	1000	3	3000
Simple Forms	100	2	200
Average Forms	200	15	3000
Complex Forms	300	3	900
		Total	27,200

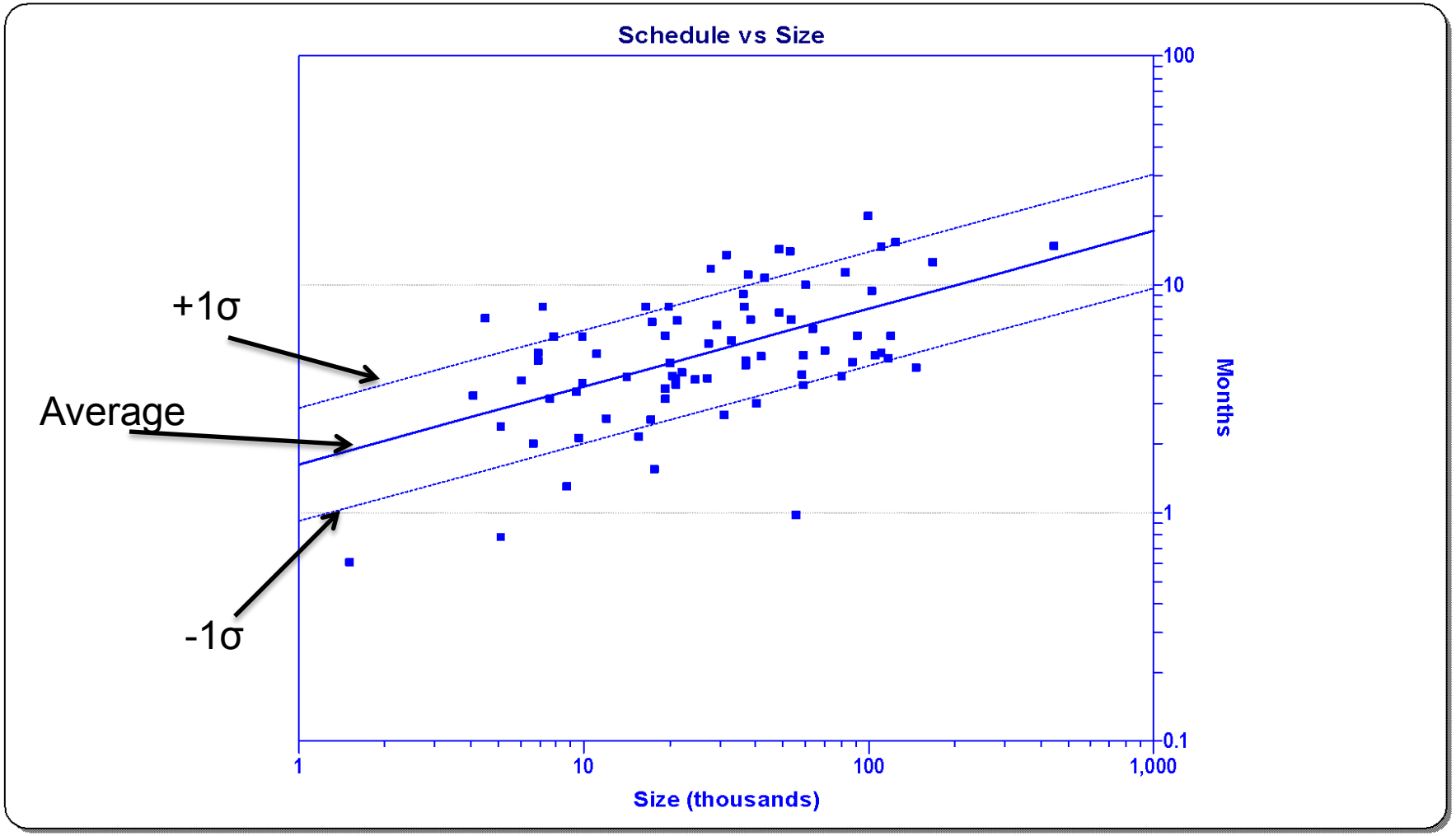
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But, Does it Work?

- Step 1: Size completed ERP implementations using configuration items and RICEF objects
- Step 2: Compare trends for Effort, Schedule, Staffing, and Productivity to trends for Business IT projects (non-ERP)

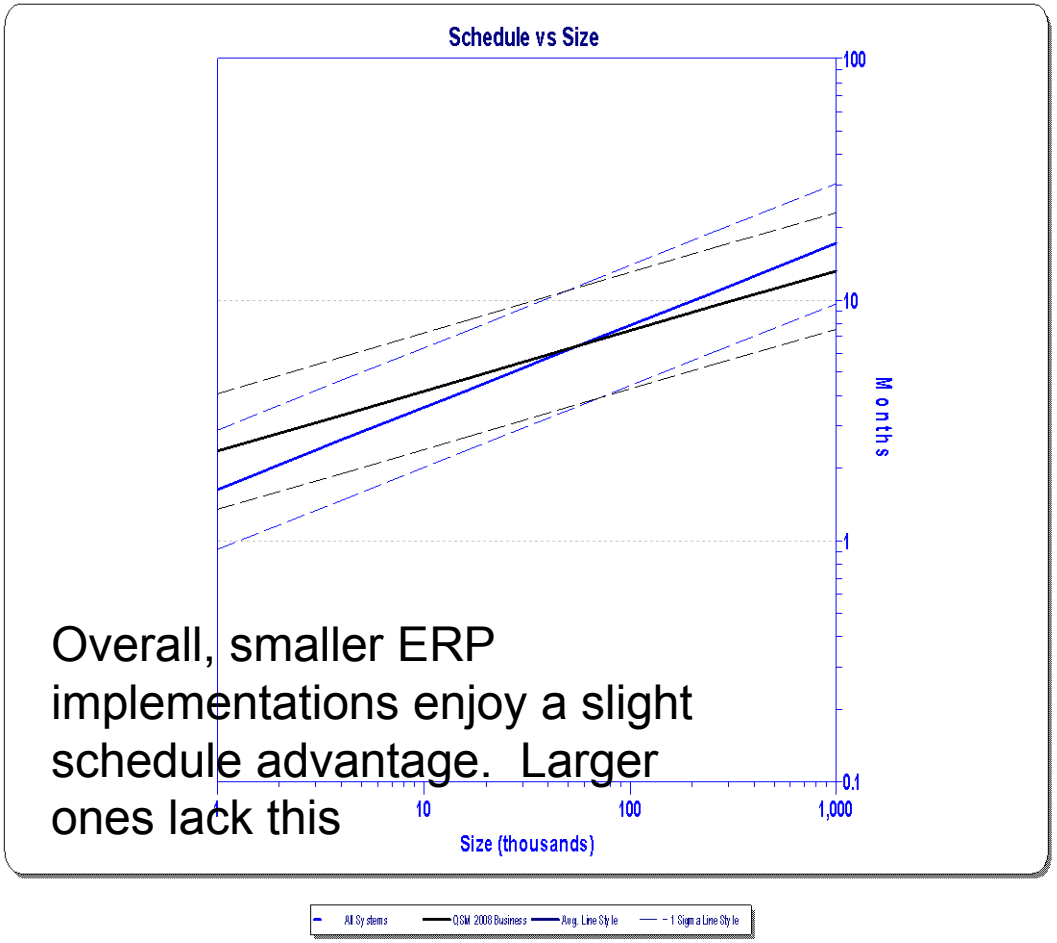
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Schedule


Schedule vs Size
+1σ
Average
-1σ
100
10
1
0.1
Months
1
10
100
1,000
Size (thousands)
All Systems
Avg. Line Style
1 Sigma Line Style

Schedule

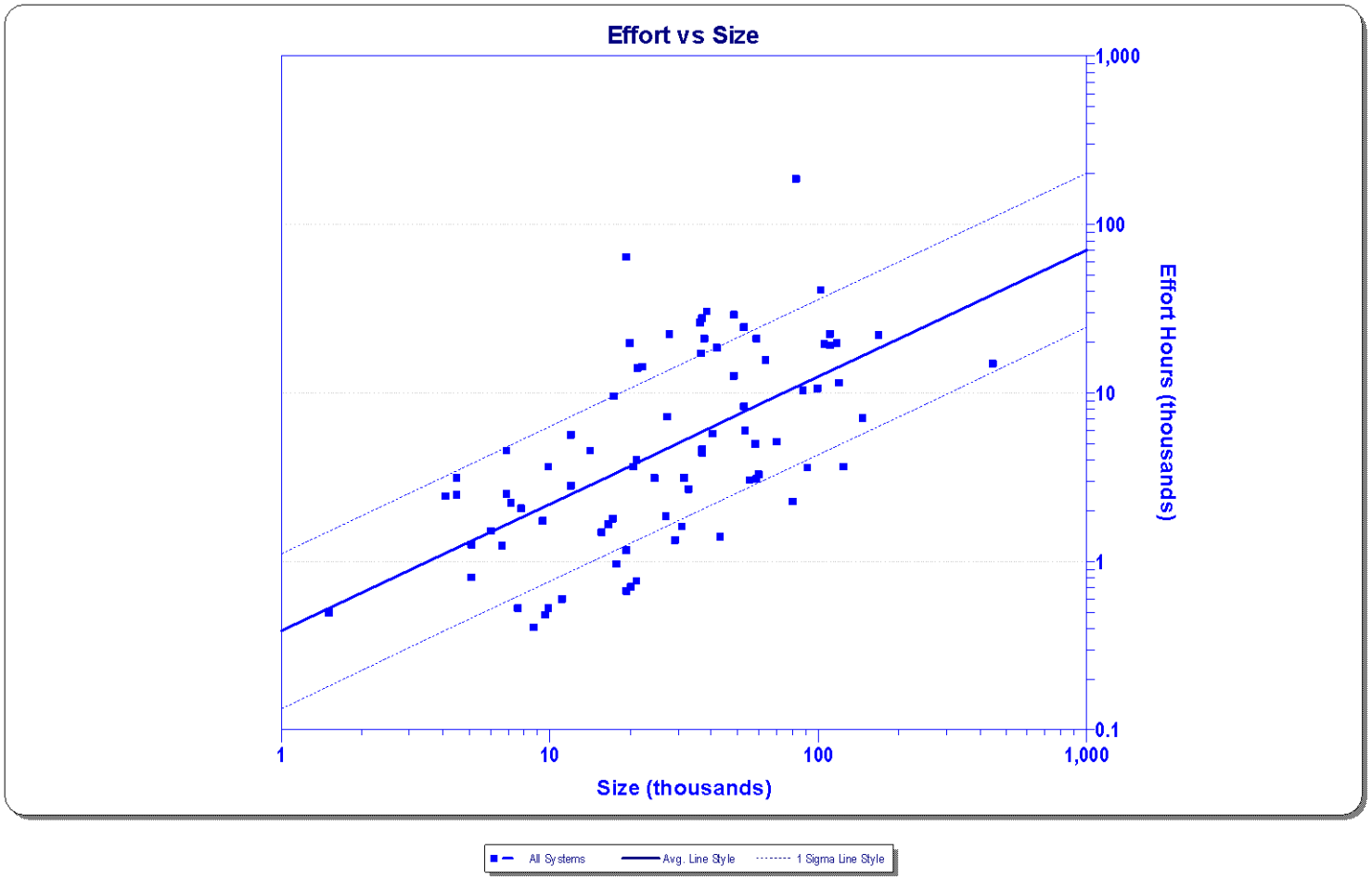
Blue lines are trends for ERP implementations
Black lines for Business IT projects



Overall, smaller ERP implementations enjoy a slight schedule advantage. Larger ones lack this

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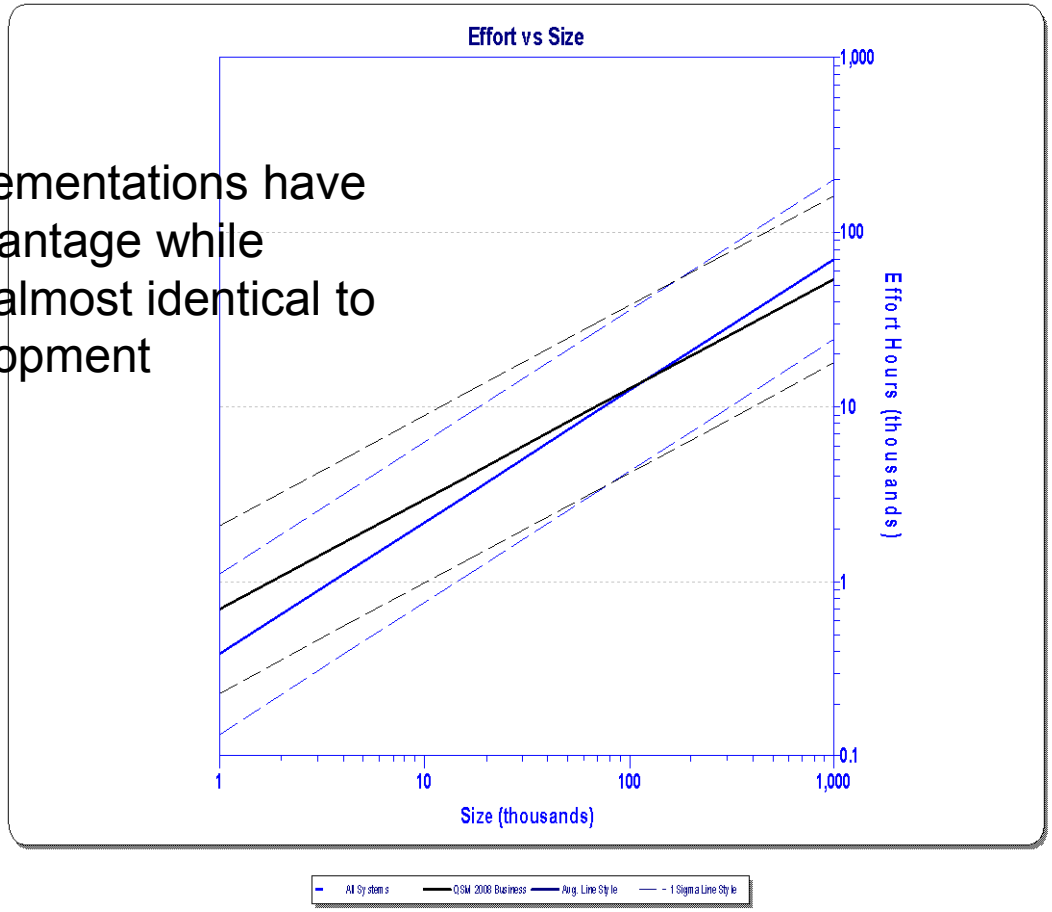
Effort



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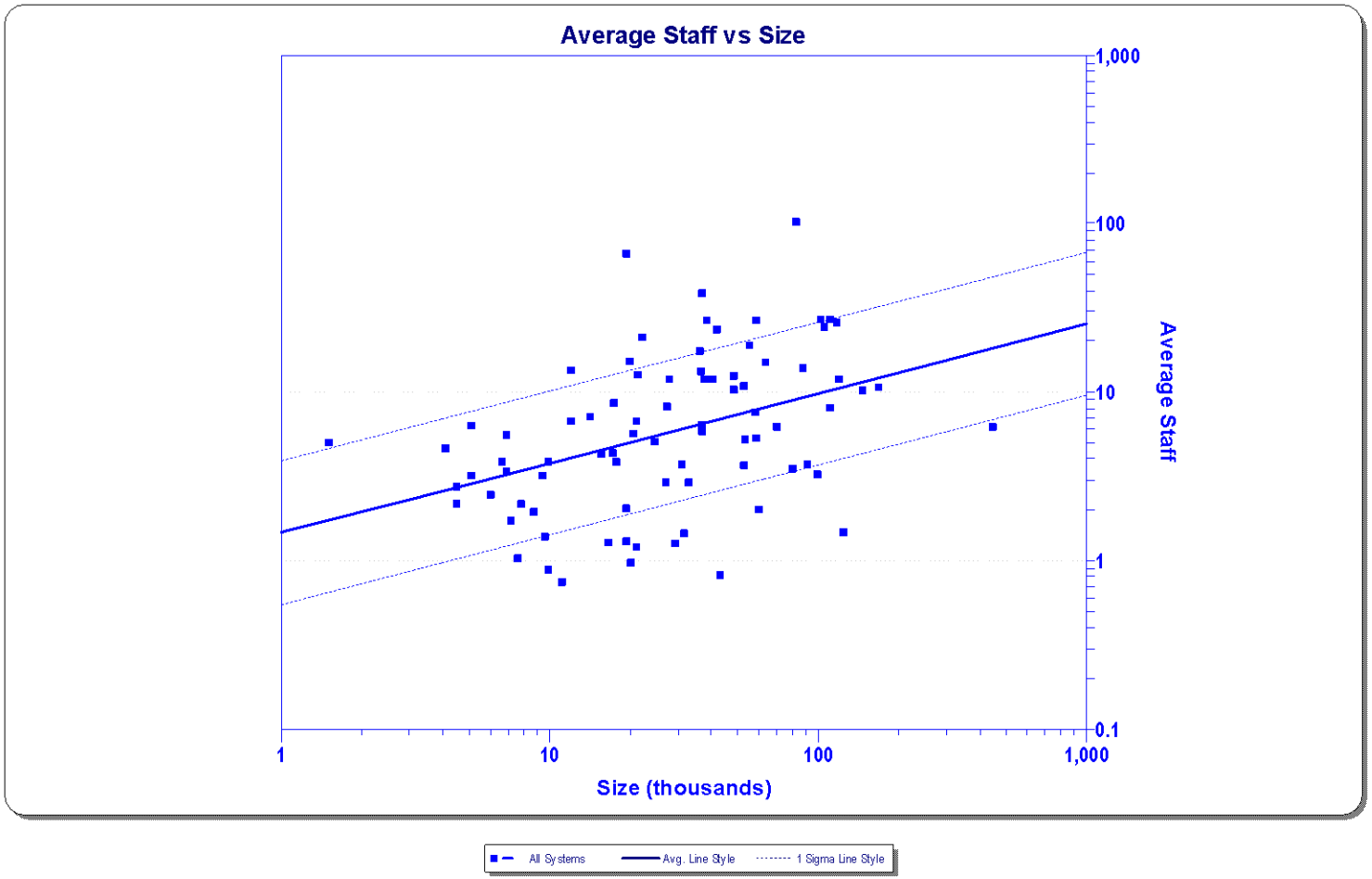
Effort

Small ERP implementations have a cost/effort advantage while larger ones are almost identical to traditional development



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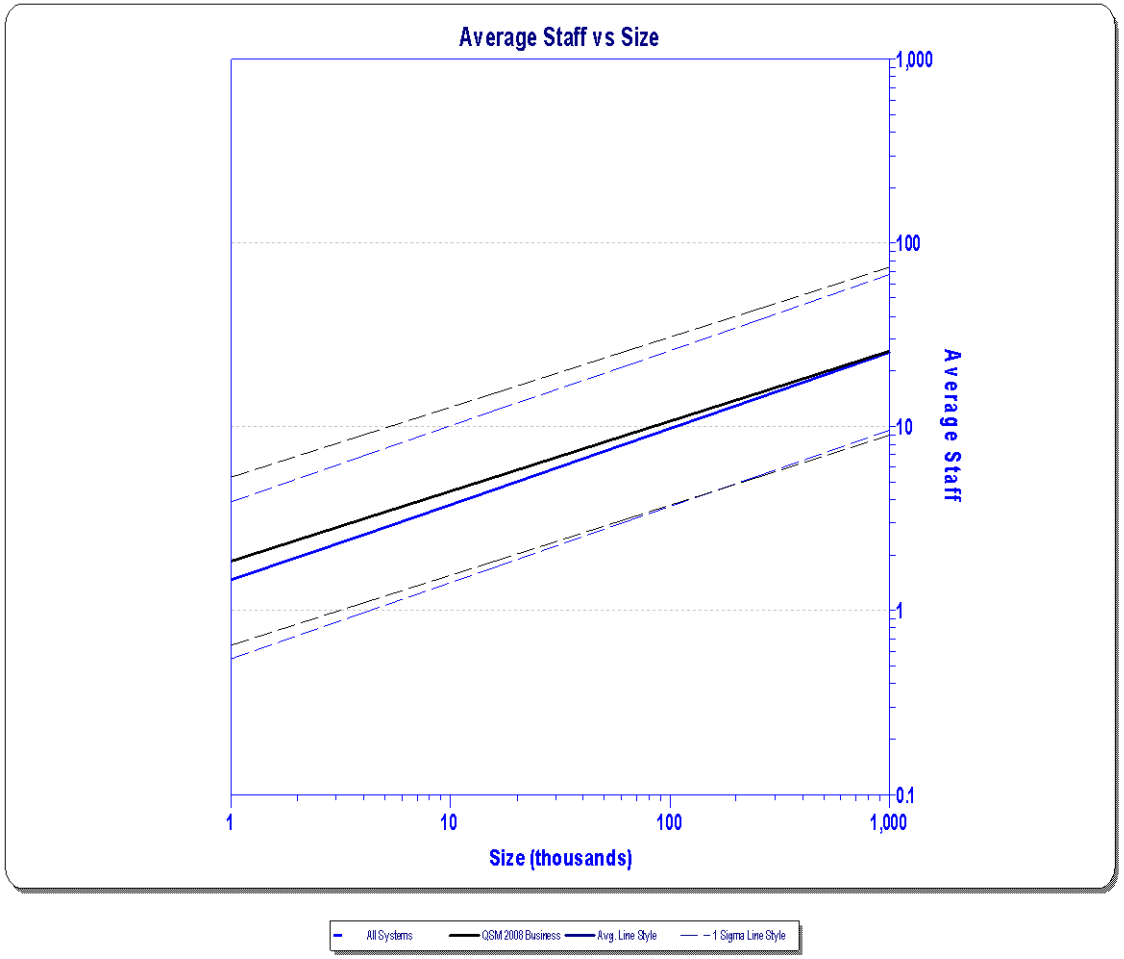
Average Staff



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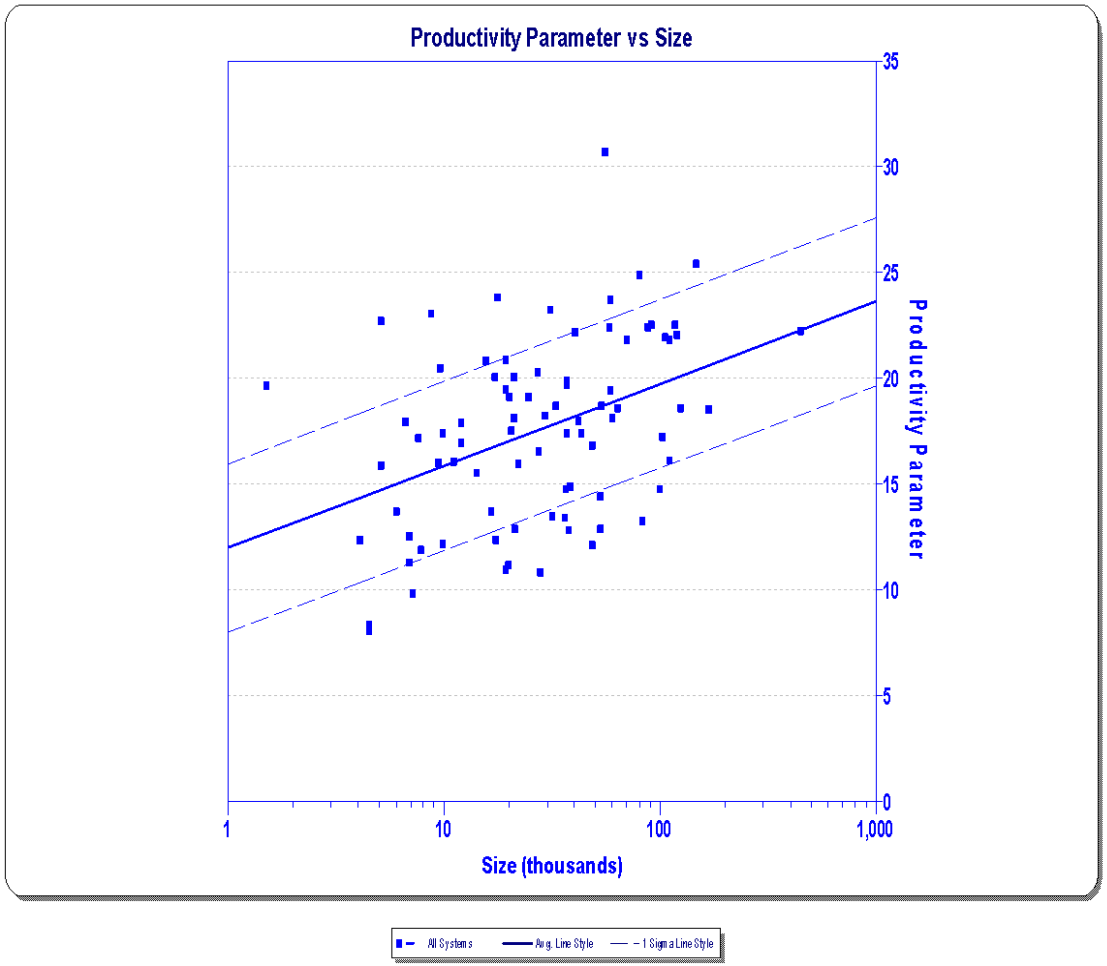
Average Staff

ERP implementations use slightly smaller teams for most projects although the trends and the amount of variability are very similar



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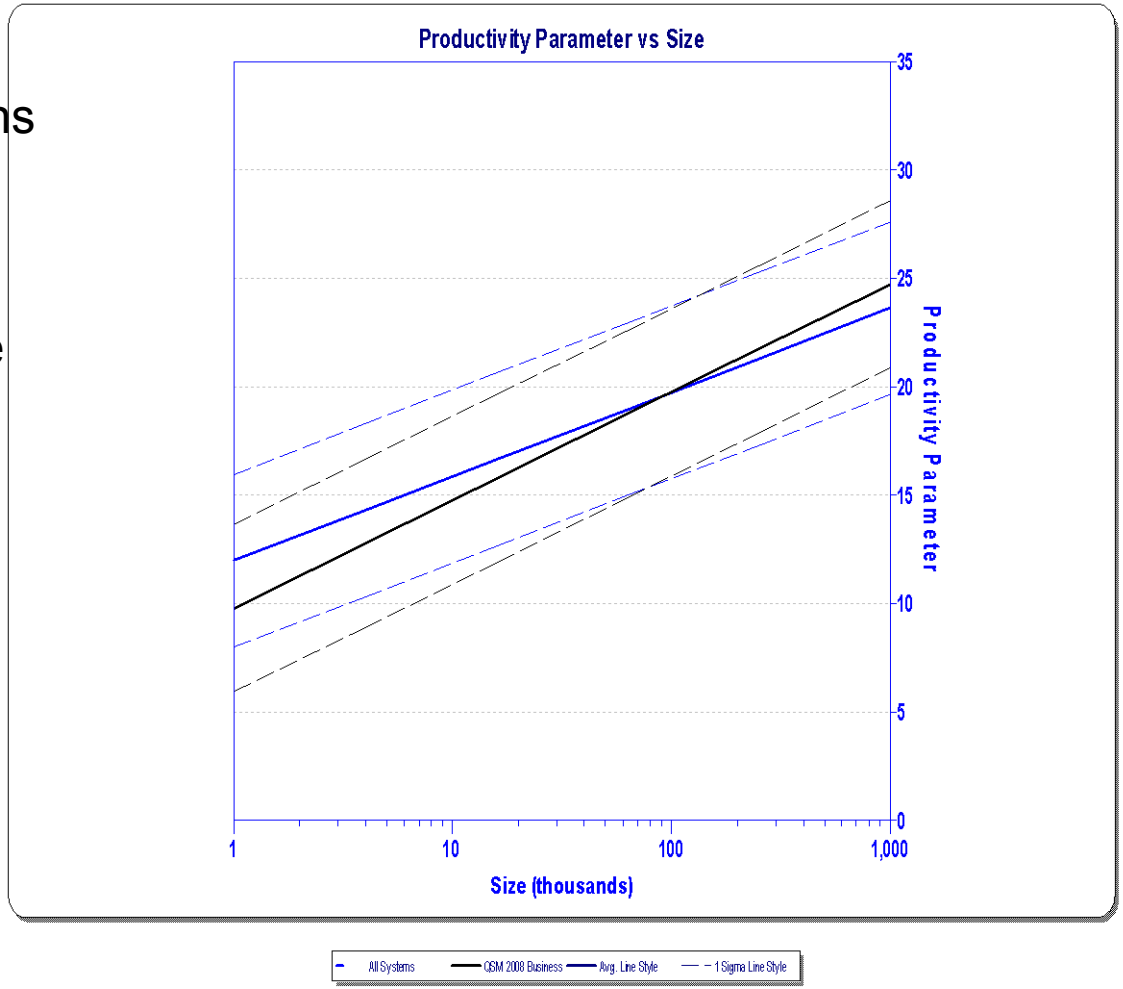
Productivity Parameter



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Productivity Parameter

ERP Implementations are more productive than Business IT for smaller projects but lose their advantage as size grows



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Conclusions

- ERP Implementations have very similar behavior to other Business IT projects
  - Schedule, effort, staffing, productivity
- Parametric estimation techniques used for Business IT projects are applicable to ERP implementations
- ERP Implementation size can be effectively estimated using Configuration Items and RICEF Objects
  - Widely used by U.S. government for estimation and tracking

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Conclusions

- Although smaller ERP implementation projects are slightly more productive than traditional Business IT, the cost of the package should be included in cost estimates if it is being purchased
- While larger ERP implementations do not enjoy cost or schedule advantages, larger traditional Business IT projects have a higher probability of failure, which must also be considered when choosing an alternative

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Questions?

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Process Acceptance through Use Cases

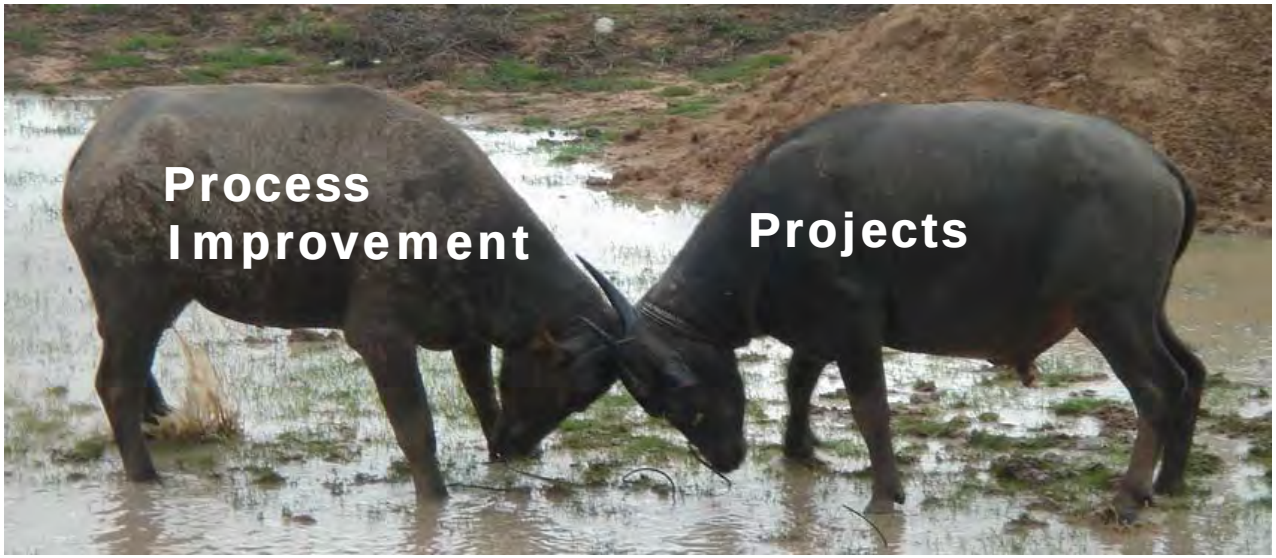
NDIA CMMI Conference 2011, Denver (CO)

Juergen Schmied, Method Park

From Process Models to Projects

Corporate Initiatives
Six Sigma
ISO 9000
V-Model XT
SPICE ISO15504
EFQM Baldridge
PMI
CMMI
Prince
ITIL

One group, filtering and translating the requirements into the organization's language



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Analogy “Management Commitment”



Analogy “Uses Cases”

methodpark

Context: Product Development

Wikipedia:

- *“A **use case** in […] system engineering is a description of a **system’s behaviour** as it responds to a **request** that originates from outside of that system. In other words, an use case describes **"who" can do "what"** with the system in question. The use case technique is used to capture a **system's behavioral requirements** by detailing **scenario-driven threads** through the functional requirements.”*

- *A use case should:*
  - *Describe what the system shall do for the **actor** to achieve a particular **goal**.*
  - *Include no implementation-specific language.*
  - *Be at the **appropriate level of detail**.*

Context: Process Development

- process(es) (and output)
- process input
- role model
- activities
- process requirements
- process tailoring

- relevant stakeholder
- process objective(s)

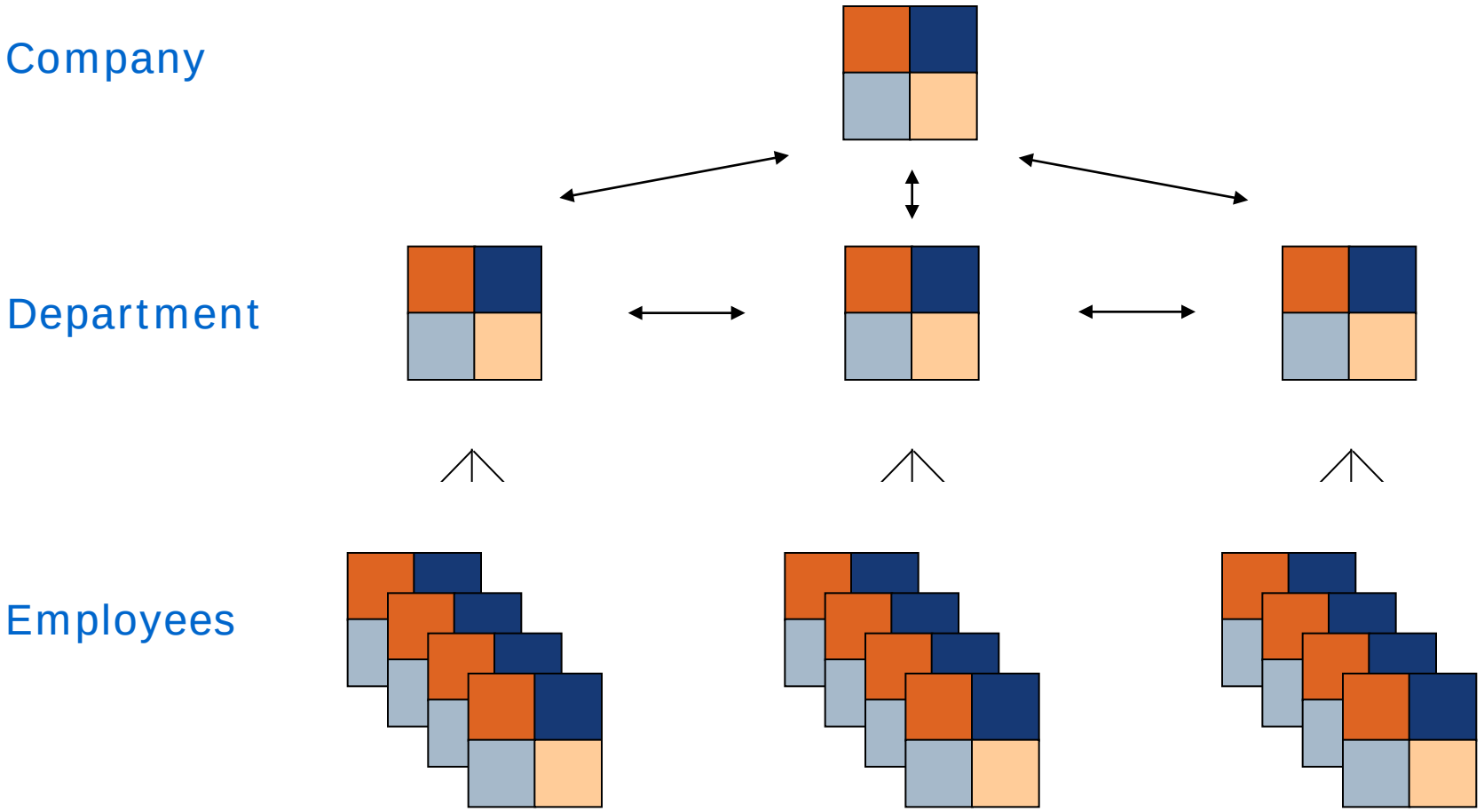
- appropriateness

- Analogies to talk about:
  - What’s an “**actor**” in a process improvement scenario?
  - What are the **actor’s goals** in a process improvement scenario?
  - What is “**appropriate level of detail**” in a process improvement context?
  - What’s the “**system**” and the “**system behaviour**” in a process improvement scenario?

“Goal Orientation” and “Appropriateness”



“Goals” and “Appropriate Level of Detail”



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An Example on Company Level



- Does the company's vision and the project's vision conform to each other?
- Scenario based business planning (→ Use Cases?)
- Typical questions (from the management viewpoint):
  - Where are we (the organization) in 5 years?
  - Who is then our customer? What does he need?
  - Which products do we have then?
  - Which kind of services will we offer?
  - Who will be our competitor?
- Derived questions:
  - Which organizational structure do we need then?
  - With whom will we cooperate?
  - Which new technologies will we use?
  - Which quality goals do we have to fulfill?
  - What kind of culture do we need in the organization?
  - What kind of skills do we need for this?

Actors = Process Stakeholder

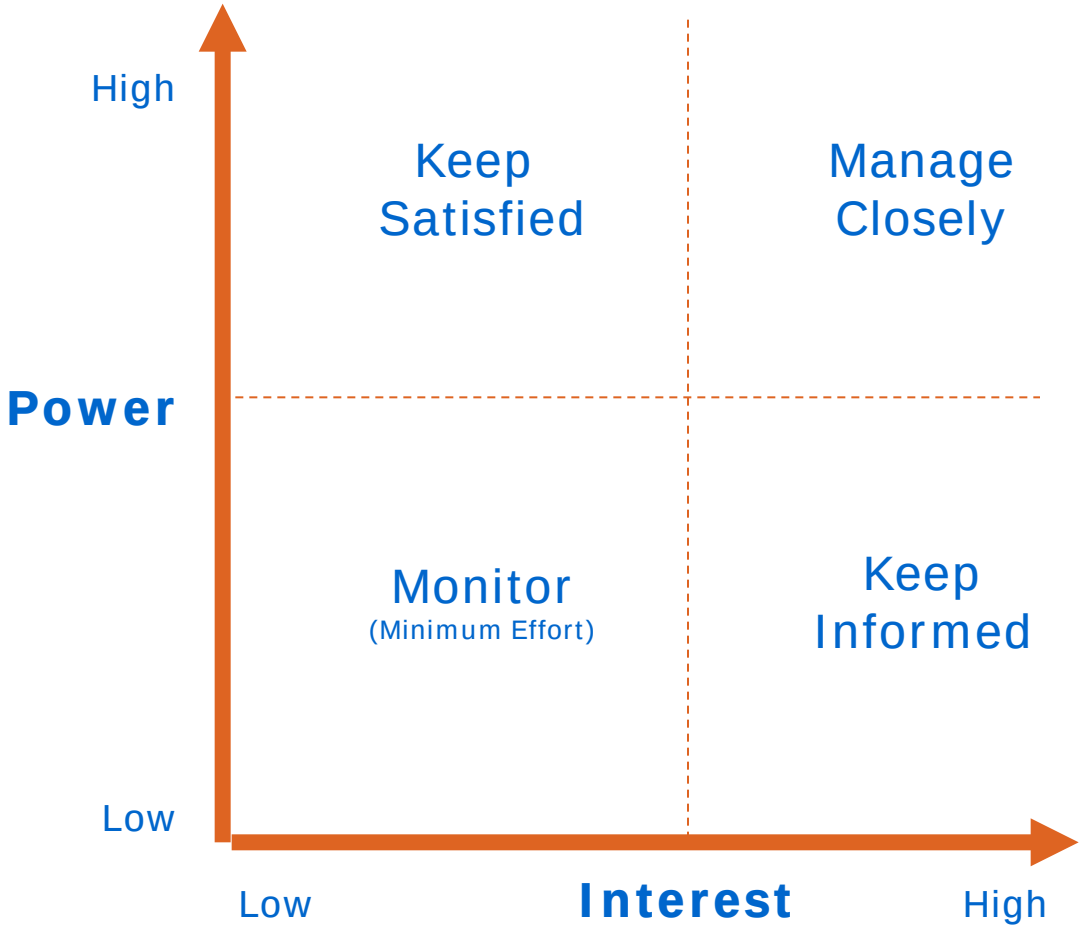


Actors: Stakeholder Analysis



- Document the Stakeholders
  - For each Stakeholder
    - Name
    - Function (Role)
    - Additional personal data / contact data
    - Availability (time and region) during the project
    - Relevance of the Stakeholder
    - Knowledge area and scope
    - Personal goals / interests regarding the project
- Stakeholder Relationship Management
  - Convince Stakeholders about the project‘s benefit (Motivation!)
  - Prevents conflicts
  - Basis for active Stakeholder Involvement during the project

Stakeholder Analysis



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More Details about “Use Cases”

- User‘s point of view
- What is the apparent functionality of the system?
- What are the neighbouring systems and users?
- Where are the system boundaries?
- Use cases describe the operational flow of the system.
- What the system should do, and not how!
- Semi-formal, and can be easily understood.

team members

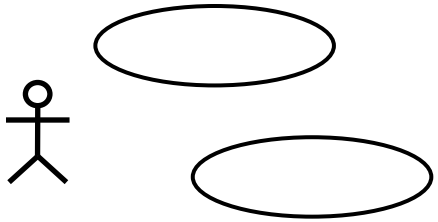
process outcomes

interfaces between processes and tools

responsibilities

activities

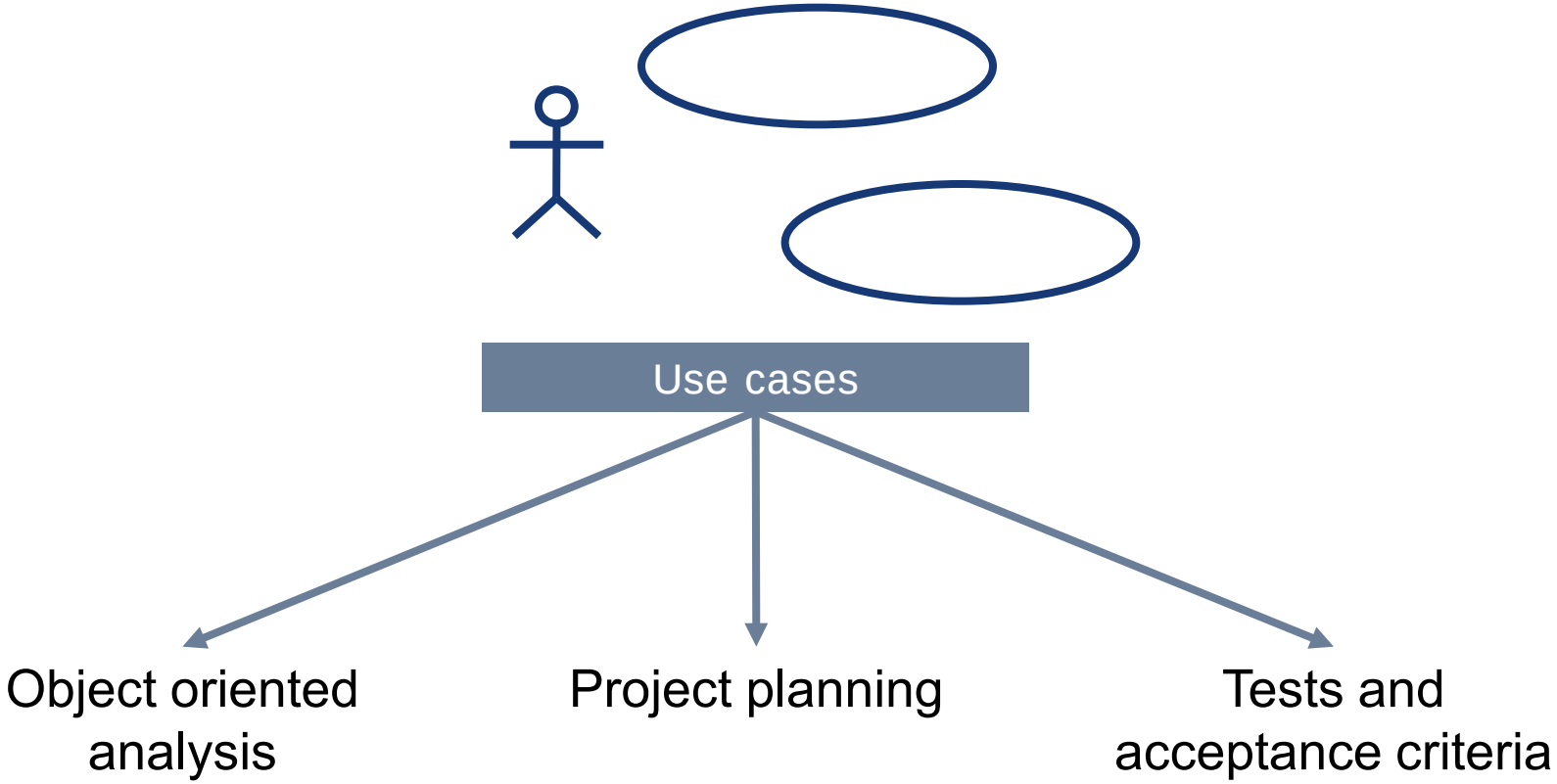
Mmmhhh…..
processes and methods



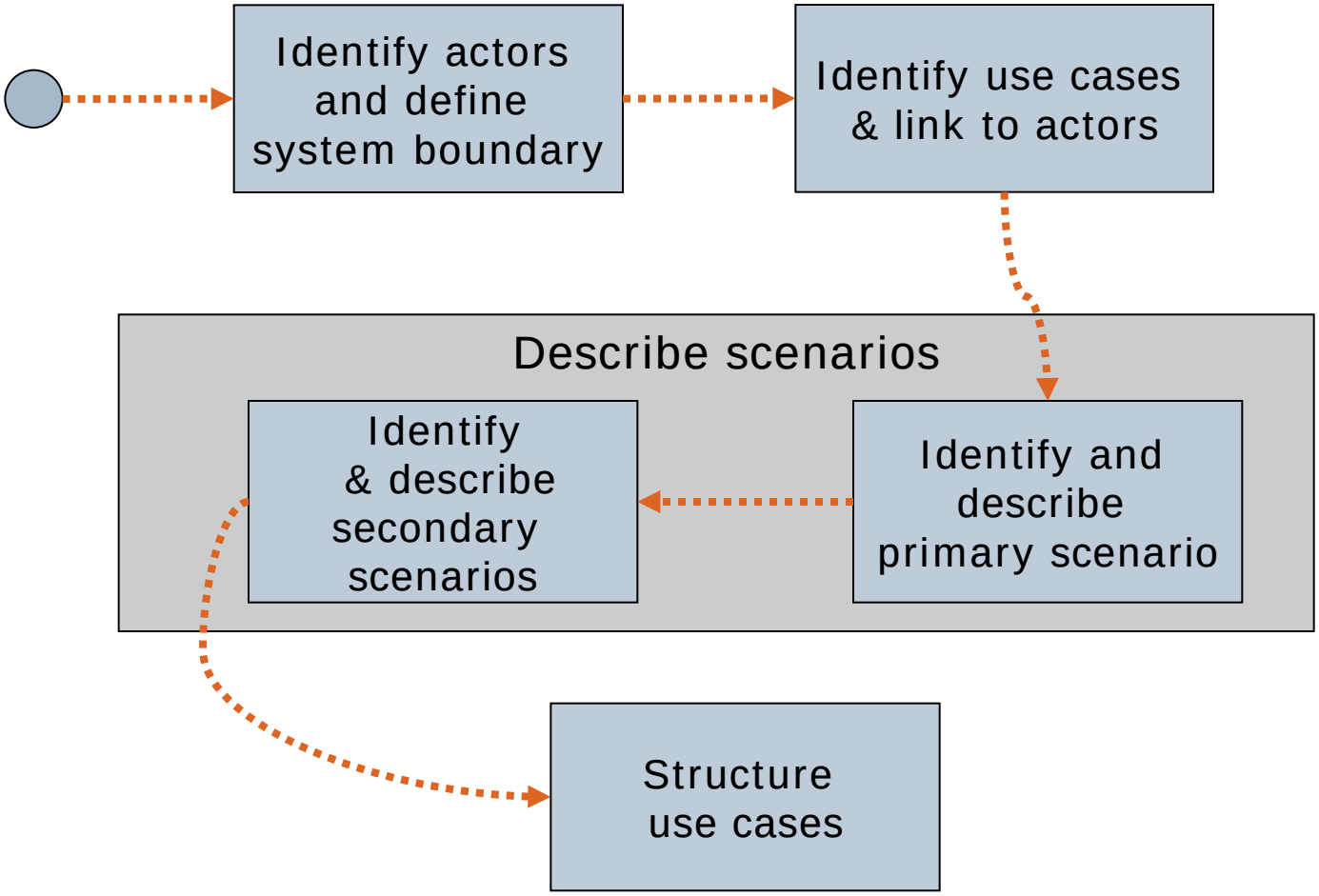
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Use Cases for Use Cases

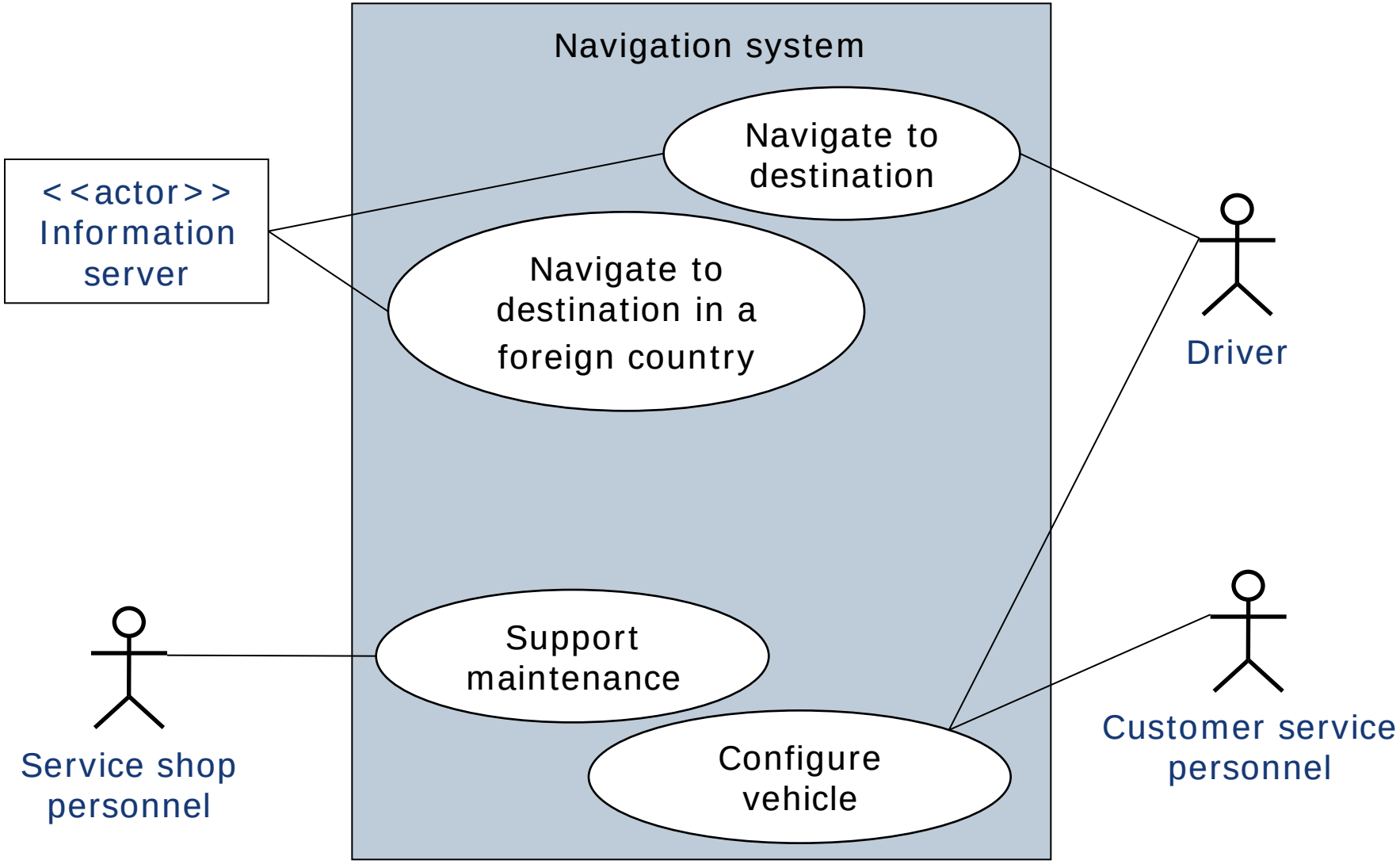
- In Engineering: “Use Case Driven Development”



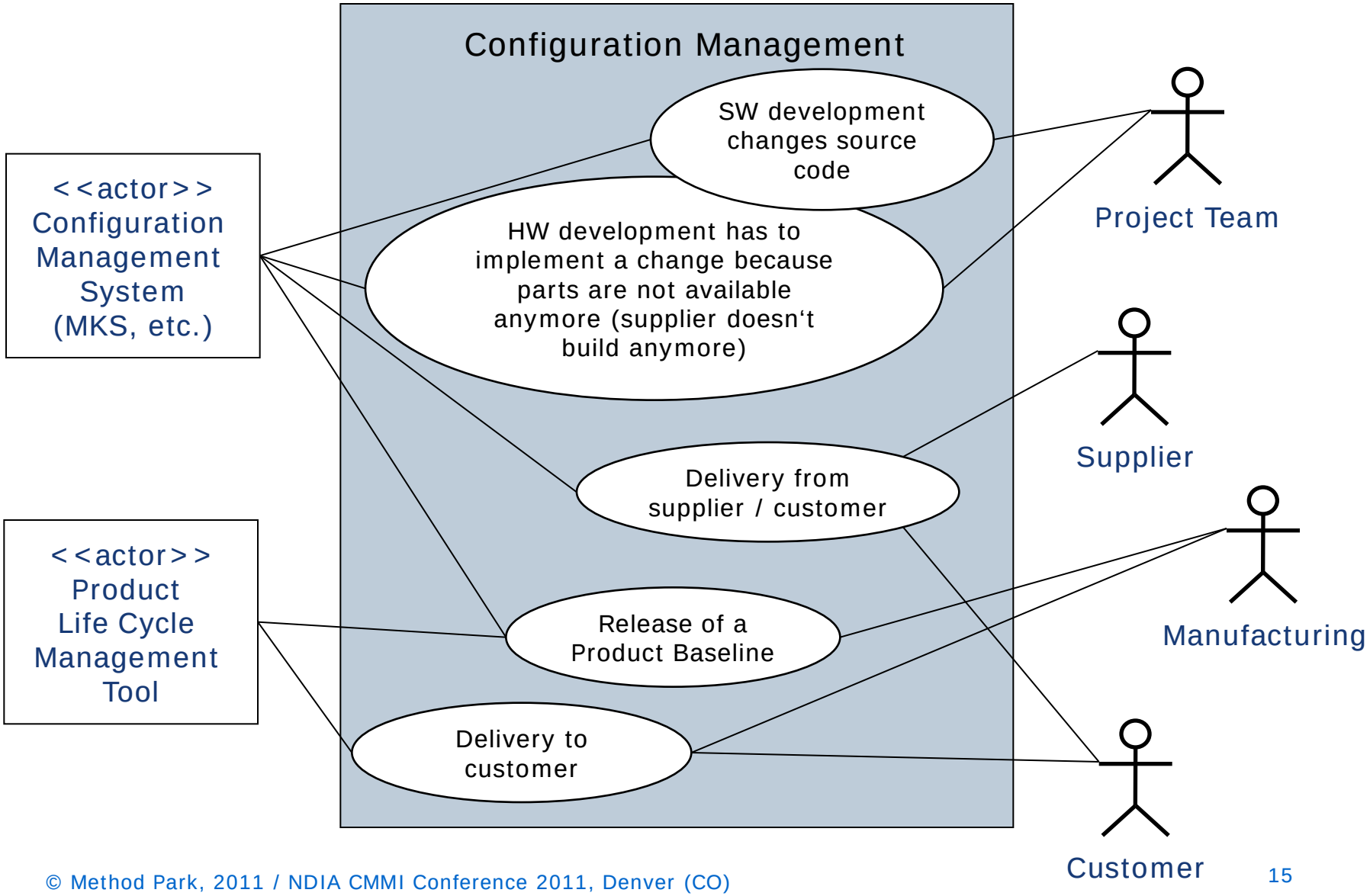
Use Cases: How to Define



Example: Use Cases for Products



Example: Use Cases for Processes



Example Configuration Management



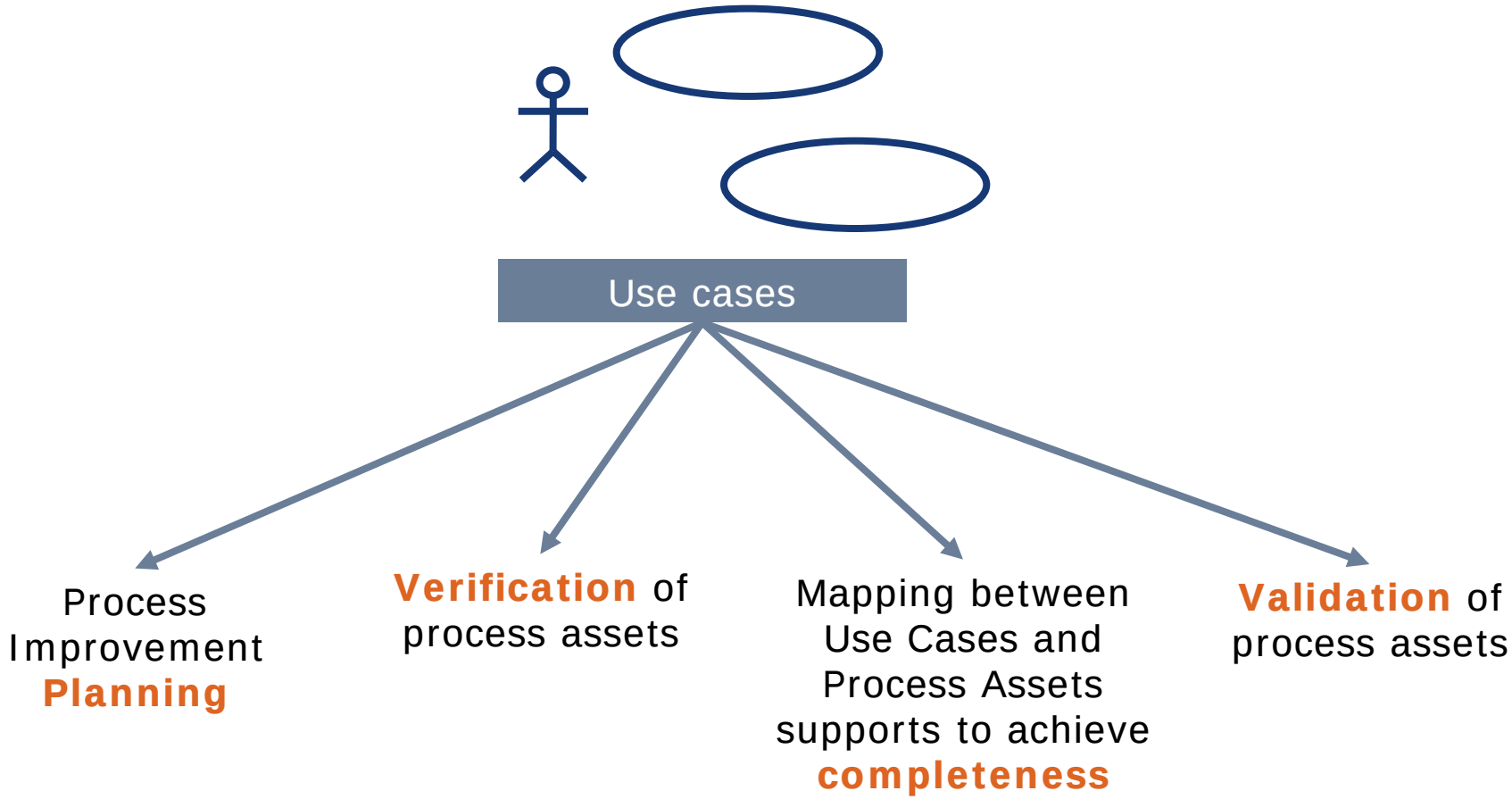
- Stakeholder, e.g.:
  - Controlling
  - Purchasing
  - Development (SW, EE, ME)
  - Manufacturing
- Challenges:
  - Ensure information flow
    (The right information to the right place at the right time)
  - Different tools per discipline / department
- Prerequisite:
  - Know who are the Stakeholders
  - Understand the Stakeholder's needs
  - Understand their current problems:
    Terms, Processes, Tooling

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Summary Use Case Analysis

- Systematic Use case Analysis
  - Leads to an **overview of actors**
    - Process Stakeholders (team and management roles, external stakeholder)
  - Places the **focus on the actors** (stakeholders) and therefore focus automatically **on the business needs** (instead on the "level")
  - **Reduces complexity** because the whole process is subdivided in smaller use cases and scenarios
  - **Best practice**:
    - While discussing use cases ask the process stakeholders for current issues with this process!
    - Trace Use Cases and Process Issues to the solution!
  - Supports to create a **tool map** (overview of tools and interfaces between them)

Use Cases for Use Cases



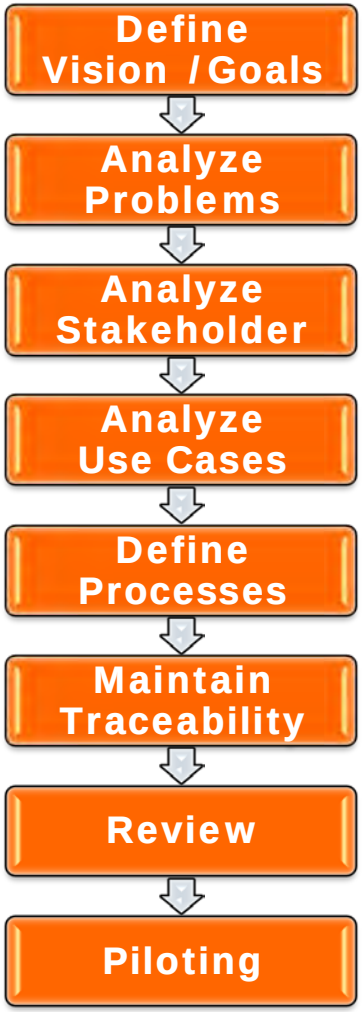
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Keep it Simple and Smart!



Lessons Learned





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Summary

- Focus on Stakeholder **Goals & Needs**
  - Traceability
    Vision – Goals – Strategy –
    Use Cases – Problems – Solutions
- Focus on **Process Integration**
  - Mutual Comprehension
  - What does my colleague need to be able to do the work?
  - Build the “Big Picture”
    - Terms (Glossary)
    - Visualize Process Interfaces





Help the business, help the people!
Think about what do they really need!



Thank You for your Attention!

Questions? Now or later:

juergen.schmied@methodpark.com

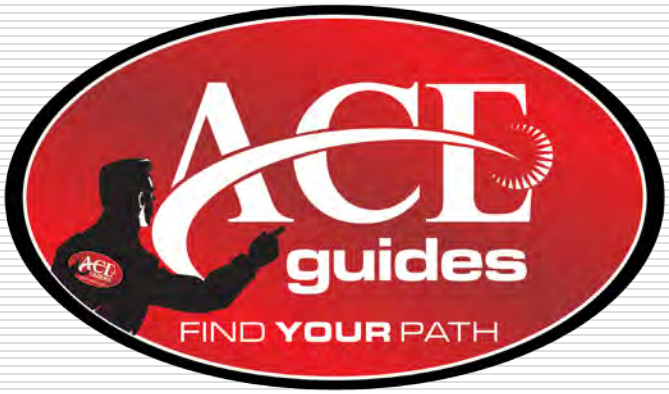
Managed Discovery? PIIDs?

How do I decide which SCAMPI data collection techniques are right for my organization?

Sam Fogle

SCAMPI High-Maturity Lead Appraiser

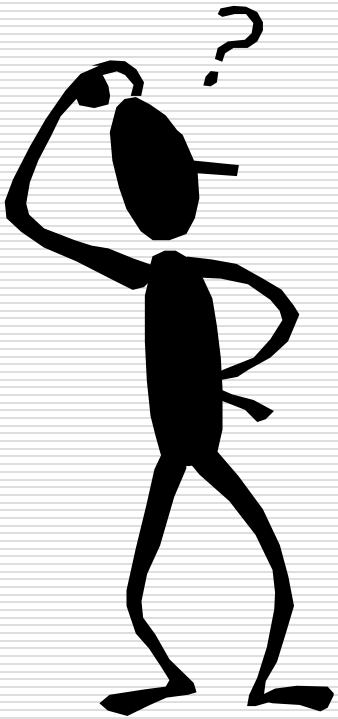
ACE Guides, LLC



Agenda

- Data Collection Approaches
- So, What Do I Build?
- Got Any Tips?
- Problems We Have Met & Lessons We Have Learned

Data Collection Approaches



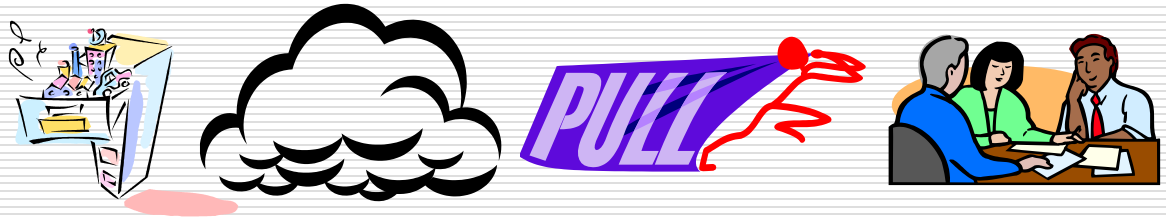
Appraisal Terms and Concepts

- "To make reasonable judgments regarding an organization's implemented processes relative to the appraisal reference model, appraisal teams base their judgments on the collection of objective evidence for each specific and generic practice applicable to process area goals within the appraisal scope."*
- Objective evidence or "footprints", left behind after a practice has been implemented, are Practice Implementation Indicators (PIIs)
- A mapping between model practices and the PIIs is called the Objective Evidence Database

*From the SCAMPI^{SM} A, V 1.3: Method Definition Document

Appraisal Approaches

1. Full Discovery



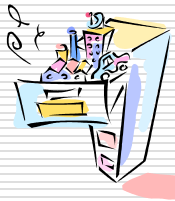
Full discovery requires that the appraisal team do a search for evidence for each practice

SCAMPI^{SM} pilots took more than a month

Appraisal conduct needed to be streamlined

Appraisal Approaches

2. Full Verification



Complete Mapping





In full verification, the organization provides a mapping of evidence for each practice. The appraisal team only searches when the data provided is not clear or convincing

This mapping could require >1K hrs to develop

A streamlined option for appraisal preparation was needed

Appraisal Approaches

3. Managed Discovery



Mapping of Key Artifacts





Managed discovery has the organization provide key artifacts that address the majority of the practices and the appraisal team asks for additional evidence as required

The appraisal conduct may require additional time but preparation is simplified

Appraisal Approaches

Comparison of the three approaches:

	Preparation	Conduct	Risk
Full Discovery	Low	High	High
Full Verification	High	Low	Low
Managed Discovery	Moderate	Moderate	Moderate

SCAMPI V1.3 allows all of the above or anywhere in between

It is up to the organization and lead appraiser to plan a data collection strategy that best meets the organization's needs

Do I still need some form of PIID?

Probably!

For many appraisals, the decision will be made that some level of Objective Evidence Database or Mapping that relates CMMI practices to your data will be required

So, What Do I Build?



An Appropriate Set of Artifacts?

- Enough to convince the appraisal team that a practice has been implemented*
  - Multiple instances for items that are produced frequently, e.g. meeting minutes
  - Cover the breadth of the practice

*Talk to your Lead Appraiser

Who Should Build Your Mapping?

What kind of knowledge is needed?

- Understanding of the model practices
- Understanding of the appraisal method
- Understanding of how the project's data is organized

Do you have one person with all 3?

If not, then you need a team

- Process person?
- Project representative?
- Consultant?



Mapping Contents

- CMMI ® practice name
- Artifact name
- Artifact location
- Basic Unit (Project) or Support Group
- Comments (may explain relevance of data)
- …

Mapping Format

- Does your Lead Appraiser have a tool that they recommend?
- Will you use the data for internal purposes?
- How easy is it to insert or retrieve data?
- How easy is it to correct/update the data?
- Will you map practices to artifacts or artifacts to practices?

Cost & Timing

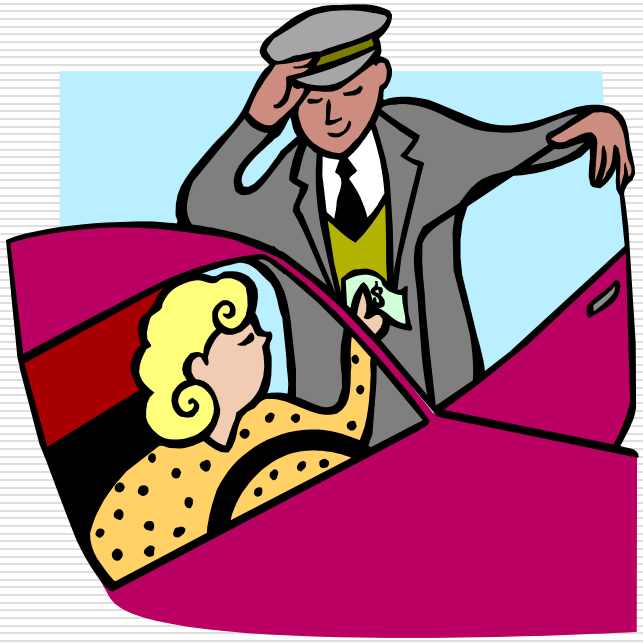
- Objective Evidence Database development can be a major driver of total appraisal cost
- The highest quality will come from developing the Objective Evidence Database in several iterations, so start early
- If it is possible to use the same sampling in a series of appraisals (SCAMPI B, then SCAMPI A), then going through the SCAMPI B will identify many of the Objective Evidence Database issues and allow corrections to the data collection process prior to the SCAMPI A

Validation

- Involve team members in quality checks
- Don't wait for Readiness Review to check the quality of the Objective Evidence Database
- Evolve mapping over a series of appraisals
- Effort devoted to the Objective Evidence Database (including quality checks) should be proportional to the importance of achieving the ratings

Remember: having an inaccurate mapping does not just make it harder to find the correct data, it may convince the appraisal team that appropriate data does NOT exist

Got Any Tips?



Potential Work Saver

Is the standard process detailed enough so that it will be fairly consistent between implementations where a specific type of data will be found?

If so, then provide the units/projects with a mapping that already tells them where to find the evidence

e.g.

PP SP 2.2 Identify Project Risks

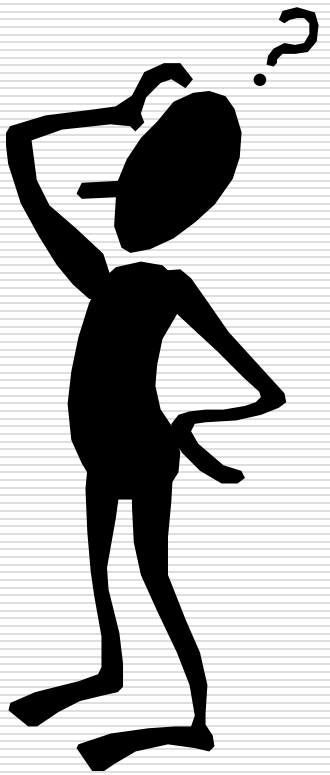
see section 3.4 of the Risk Management Plan

Use Directories

When the evidence you want to include is a frequently generated item (e.g. monthly meeting minutes or peer review reports) linking to the directory where the items are stored will provide advantages

- The link will not go stale – new items will continue to be populated into the directory so fresh evidence is available
- The appraisal team is free to sample from the set, thus aiding confidence in institutionalization

Problems We Have Met & Lessons We Have Learned



Problems

- What sort of problems have you encountered in trying to plan for or develop your mappings?

- Have others encountered this same problem? And if so, were you able to solve it?

Lessons Learned

- What other lessons have you learned related to Objective Evidence Databases?

Mapping Preparation

If done poorly

- Can consume vast resources to prepare
- Will reflect a poor understanding of what is needed
- Will cause appraisal to proceed very slowly
- Can confuse the true state of the practice

If done well

- Will require limited restarts or rework
- Accurately reflects the work done in the organization
- Provides an efficient means for an appraisal team to find appropriate evidence
- Identifies appraisal risks by uncovering holes in implementation

Questions



Contact Info

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- 240-308-0767

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Raytheon

Customer Success Is Our Mission

Raytheon Pasadena
CMMI-DEV vs. CMMI-SVC
Evaluation & Recommendation

November 17, 2011

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Agenda

- CMMI History
- Operations Goals
- Understanding CMMI-DEV v1.3 and CMMI-SVC v1.3
- What Does SEI Recommend?
- Evaluation Approach
- Evaluation Analysis
  - Costs and Effort
  - Evaluation Parameters
  - Decision Analysis and Resolution (DAR)
- Recommendation
- Current Activities and Plans
- Conclusion

CMMI Background and Highlights

Raytheon
Intelligence and
Information Systems

- 1998 SDSIO Contract Awarded to Raytheon by NASA's Jet Propulsion Laboratory

– 2004 Achieved CMMI Maturity L3 for Services (CMMI-Dev, Version 1.1)
  - Innovative approach of to applying CMMI-DEV to Services Organization
  - Received patent (05E095)
– 2007 Achieved CMMI Maturity L3 for Services (CMMI-Dev, Version 1.2)
– 2007 Achieved CMMI Engineering Capability for Raytheon Web Solutions (RWS) (CMMI-Dev, Version 1.2)
  - Pasadena Innovative approach was published as a use case in the CMMI-DEV Version 1.2 book

- 2008 Won the re-compete, DSIO Contract Awarded.
  - CMMI was a key discriminator
  - CMMI is a DSIO contract requirement

– 2010 Achieved CMMI L3 Maturity L3 for Services (CMMI-DEV, version 1.2)

Continuous process improvement culture

Operations Goals

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❑ Overview

- CMMI-DEV v1.1 was implement for 2004 certification
- CMMI-DEV v1.2 was implemented for 2007 & 2010
- CMMI-DEV v1.3 and CMMI_SVC v1.3 released late 2010

❑ Raytheon Pasadena Operations Goals

- Maintain customer focused approach to processes
- Maintain Raytheon Pasadena CMMI certification
- Re-evaluate CMMI constellation selection
- Identify, document and make a recommendation to leadership on which CMMI constellation is best suited for Raytheon Pasadena

CMMI is aligned with Raytheon Pasadena goals

Understanding CMMI-DEV and CMMI-SVC

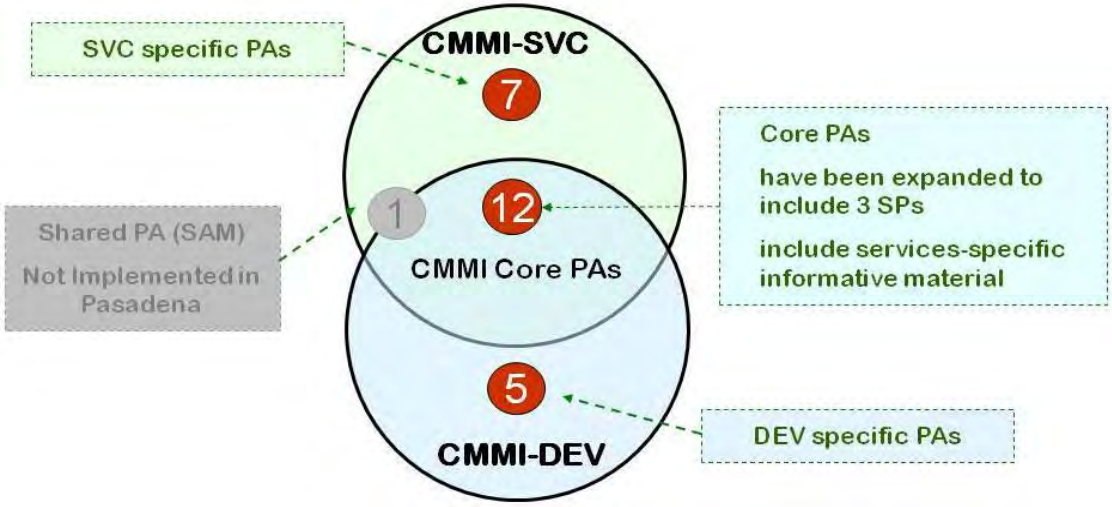
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CMMI-DEV v1.3

- Has a total of 18 Process Areas (PAs)
- From which 17 PA directly apply to Pasadena Operations
  - The Supplier Agreements Management (SAM) PA is not implemented
- For Maturity Level 3 12 out of the 18 PA are the same for CMMI-DEV and CMMI-SVC
- For Maturity Level 3 5 PAs are unique to CMMI-DEV

CMMI-SVC v1.3

- Has a total of 19 PA
- Could primarily re-use 12 PAs from the existing implementation of CMMI-DEV



Could we leverage the overlap between CMMI-DEV and CMMI-SVC?

CMMI-SVC mapped to Existing Process

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SVC Practice Area	Coverage Rating	Comments
Service Delivery (SD)		Covered well with existing processes. No gaps. Service Agreement is the SWO (Subcontract Work order); Service system is the combination of the 5 service components and is defined by the WCP; Service System component is one of the golden 5 service provision requirements; Service System Delivery is the DSIO Contract Tool; Service Request is the SOW;
Incident Resolution and Prevention (IRP)		Little or No coverage with existing processes. Many gaps. An incident is and indication of a problem or interference with service delivery. Typical instantiation of this would be help desk with tickets. A possible approach would be to use the DSIO contract tool to record incidents from the customer.
Service System Design (SSD) (optional)		Covered well with existing processes. No gaps. Well-covered with existing Engineering PAs; however opportunity exists to minimize engineering processes with SVC.
Service System Transition (SST)		Covered well with existing processes. No gaps. A Service system is represented and defined by the WCP; Service Systems are all of the WCPs under the DSIO contract. A request for a change (MOD) in service would be a service request; so a service transition would occur as a result.
Strategic Service Management (STSM)		Some coverage with existing processes. Some Gaps. Unclear as to what the standard services are and how they are presented to current and potential customers.
Capacity and Availability Management (CAM)		Some coverage with existing processes. Some Gaps. Personnel and Facilities planning exist; would need more emphasis of coordination across all services, as well as modelling, measurement, and analysis to make sure that all necessary resources for service delivery are at the right levels and available when needed.
Service Continuity Management (SCON)		Little or No coverage with existing processes. Many gaps. No continuity planning in place.

3 PAs coverage – 2 PAs some coverage – 2 PAs little or no coverage

What does SEI recommend?

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- Excerpts from CMMI for Services, v1.3 technical report

"Organizations interested in evaluating and improving their processes to develop systems for delivering services can use the CMMI-DEV model. This approach is especially recommended for organizations that are already using CMMI-DEV or that must develop and maintain complex systems for delivering services. However, the CMMI-SVC model provides an alternative, streamlined approach to evaluating and improving the development of service systems that can be more appropriate in certain contexts."

"Service provider organizations can also choose to use the CMMI-DEV model as the basis for improving and appraising their service system development processes. This use of the CMMI-DEV model is preferred for organizations that are already experienced with CMMI-DEV and for organizations that develop large-scale, complex service systems."

"Even organizations that use the CMMI-DEV model for service system development may wish to refer to the Service System Development process area for helpful guidance on applying development practices to service system components such as people, processes, and consumables."

SEI: Considers the organization's needs and context

Evaluation Approach

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- Would CMMI-SVC work in our environment?
  - We were able to map our business model to the CMMI-SVC model
  - However, typical industry service agreements are repetitive; the same service is offered to multiple customers.
  - Our customer service agreements/sub-contracts are unique
  - The process to instantiate a new sub-contract is the repetitive component

Addressing our customer needs and requirements

Analysis – Effort & Costs

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- What is the impact of changing to CMMI-SVC in Pasadena?
  - Is what we're doing good enough?
  - Are we meeting our customer requirements and is our customer happy?
  - How are our operations impacted with the implementation of CMMI-SVC?

- CMMI-SVC Implementation Effort
  - Cost associated with implementation of 7 new PAs
    - 5 PAs effort to implement is "easy" to "moderate"
    - 2 PAs: Incident Resolution and Prevention (IRD), and Service Continuity Management (SCON) are high impact to our current operations and complex to implement
  - Cost associated with creating the support infrastructure
  - CMMI-SVC has 2 more PAs than CMMI-DEV this may increase evidence collection and SCAMPI effort

Add value to our customers – no additional costs

Analysis - Solution Alternatives

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- How does Raytheon Pasadena want to be recognized?
  - As a product developer?
  - As a service provider?
  - As both a product developer and a service provider?
  - As a combination or mixture of the two?
  - As not interested in CMMI?

Maintain positive customer relationships and reputation

Analysis – Evaluation Parameters

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❑ Identified Key Evaluation Parameters

- Selected alternatives
  - Continue using CMMI-DEV
  - Implement CMMI-SVC
  - Continue using CMMI-DEV and implement CMMI-SVC
  - Continue using CMMI-DEV and implement CMMI-SVC capability
  - No CMMI re-certification
- Defined evaluation criteria
  - Impact to Raytheon Pasadena
  - Reputation
  - Costs
  - Benefits to the Organization
  - Customer Satisfaction
- Assigned weights to evaluation criteria
  - Sane weights were assigned to identified evaluation criteria based on identified goals

Essential characteristics of Raytheon Pasadena CMMI efforts

Analysis – Decision, Analysis, and Resolution (DAR)

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❑ Evaluate Alternative Solutions

- Assign values (1,3 or 9) to identified solutions based on analysis and experience

Decision Analysis and Resolution
DAR

Raytheon Proprietary

Raytheon

CMMI-DEV vs CMM-SVC

	Criteria						NOTE- This summa 100, when the nun into the yellow ce
Criteria Weight	Less Impact to Ops	Reputation (Internal)	Cost	Increased Benefit to MOS	Increased Customer Satisfaction	Σ 100	
	20	20	20	20	20		
Alternatives	1 3 9	1 3 9	1 3 9	1 3 9	1 3 9	Totals	Ranking
CMMI-DEV	9 180	9 180	3 60	3 60	3 60	540	I
CMMI-SVC	3 60	3 60	3 60	3 60	3 60	300	V
CMMI-DEV **and** CMMI-SVC	3 60	9 180	1 20	9 180	3 60	500	II
CMMI-SVC + CMMI-DEV Capability in Engineering	3 60	3 60	1 20	3 60	3 60	260	VI
CMMI-DEV + CMMI-SVC Capability	3 60	9 180	1 20	3 60	3 60	380	IV
No CMMI re-certification	9 180	1 20	9 180	1 20	3 60	460	III

Recommendation

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- **Based on DAR – Recommended to continue using CMMI-DEV for Raytheon Pasadena**
  - Less impact to current operations
  - No increase costs
  - CMMI-DEV has a perceived “reputation” value
  - CMMI-DEV has potential to increase benefits to parent organization to attract new business (Specialized Services Development)
- **A close second – Continue using CMMI-DEV and add CMMI-SVC PA**
  - This would mean implementing and assessing 7 new Process Areas. This would exceed existing budgets.
  - Recommend to see about implementing some services best practices from CMMI-SVC such as Incident Resolution and Prevention (IRP), Capacity and Availability Management (CAM) and Service Continuity (SCON) to provide higher value to the organization.

“In God We Trust, all others bring data”

Raytheon Pasadena
Current Activities and Future Plans

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Intelligence and
Information Systems

❑2011 CMMI Activities

- White paper on CMMI-DEV v1.3 versus CMMI-SVC v1.3 evaluation and recommendation
- Recommendation is to continue using CMMI-DEV
- Transitioned from CMMI-DEV v1.3 from v1.2
- SCAMPI C scheduled for December 12-14, 2011

❑ 2012

- Continue process improvements and process simplification efforts
- Consider implementing identified CMMI-SVC PAs
- Conduct SCAMPI B2

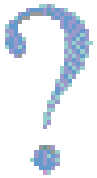
❑ 2013

- Conduct SCAMPI A: Achieve CMMI-DEV Maturity L3 (Services adaptation)

Raytheon Nominated by JPL as Contractor of the Year

Customer Success Is Our Mission!

Questions



Raytheon

Customer Success Is Our Mission

One if by Land, Two if by Sea…

You are a CMMI-DEV appraisal expert. What do you do if your org wants to do a CMMI-SVC appraisal?

Debra Smith
Kerry Trujillo

November 14-17, 2011

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Raytheon

Agenda

- Overview
- Beginning of the Story
- Raytheon IDS Organization and Service
- Process/Tools/Roles
- Summary
- End of the Story
- Questions
- Presenters' Biographies

® CMMI is registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

Overview

How do you collect evidence the first time an organization has a CMMI® for Services appraisal after only being appraised against CMMI for Development?

How do you know what evidence to gather when you've done CMMI for Development appraisals for years?

Raytheon Integrated Defense Systems (IDS) worked with Cooliemon LLC, an external CMMI appraisal lead, to focus on the process, tools, and personnel roles that would create a successful appraisal.

Beginning of the Story

- The time: April 1775
- The Place: Boston, Massachusetts
- The Story:

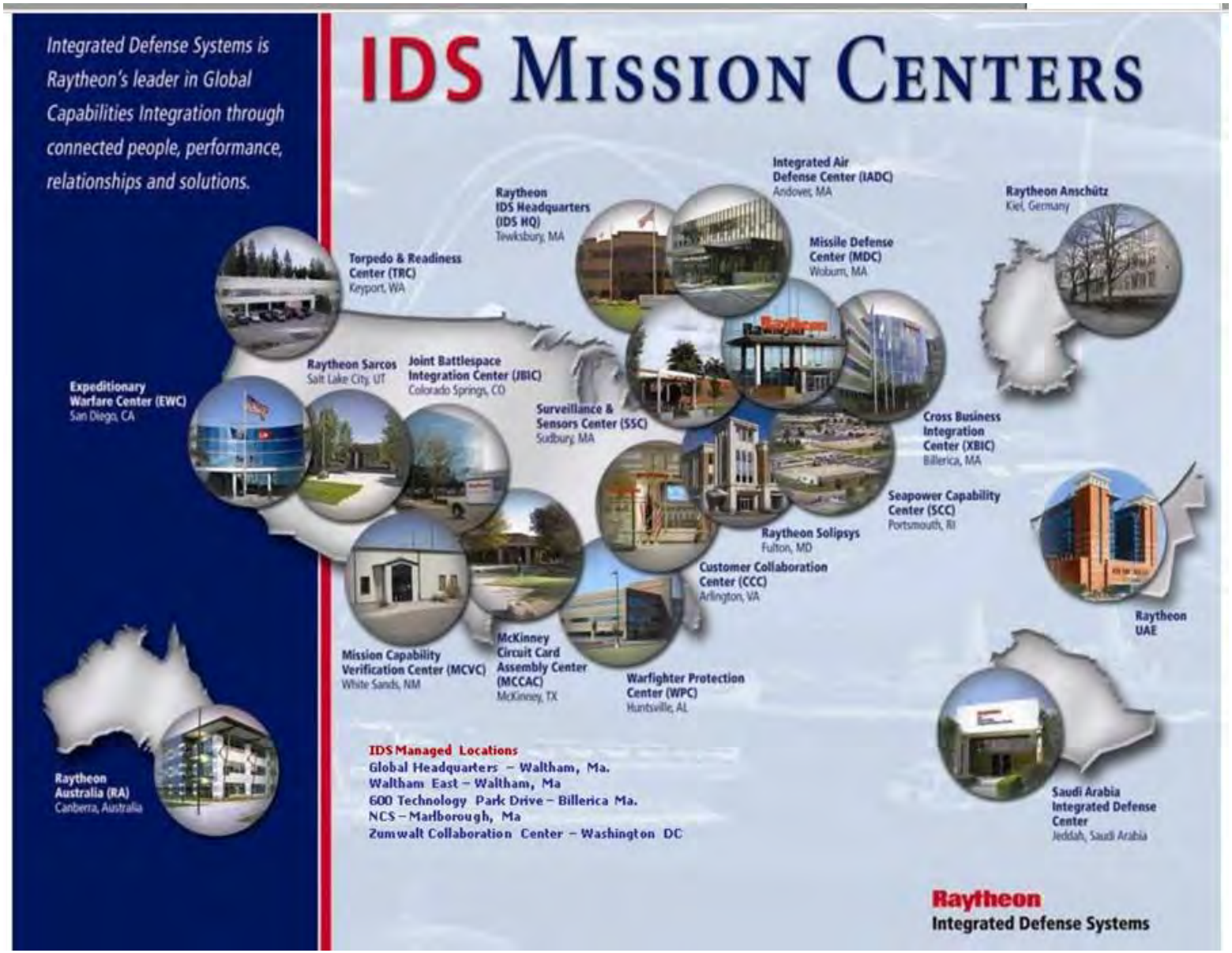
Paul Revere had many occupations; silversmith, dentist, Lieutenant in the Massachusetts militia, and Son of Liberty.

As a successful businessman he planned his activities, worked with suppliers, and dealt with product defects and customer complaints.

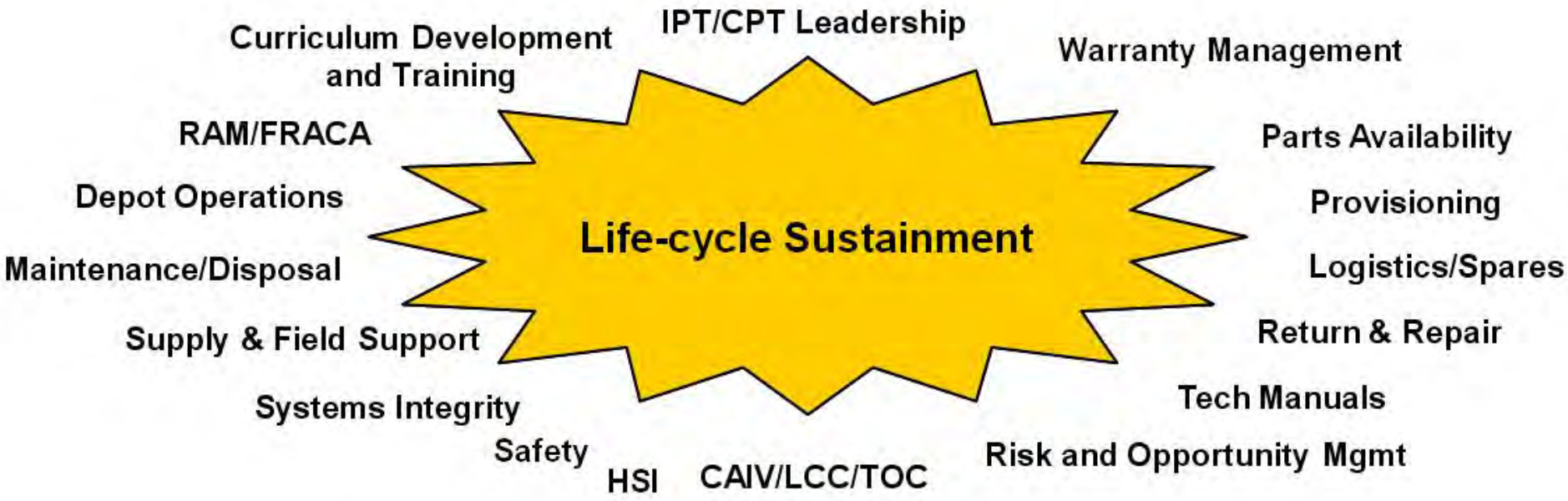
He also became a courier for the Boston Committee of Correspondence and the Massachusetts Committee of Safety . He provided news on British movements to people in towns from Boston to New York.



Raytheon - Integrated Defense Systems (IDS)



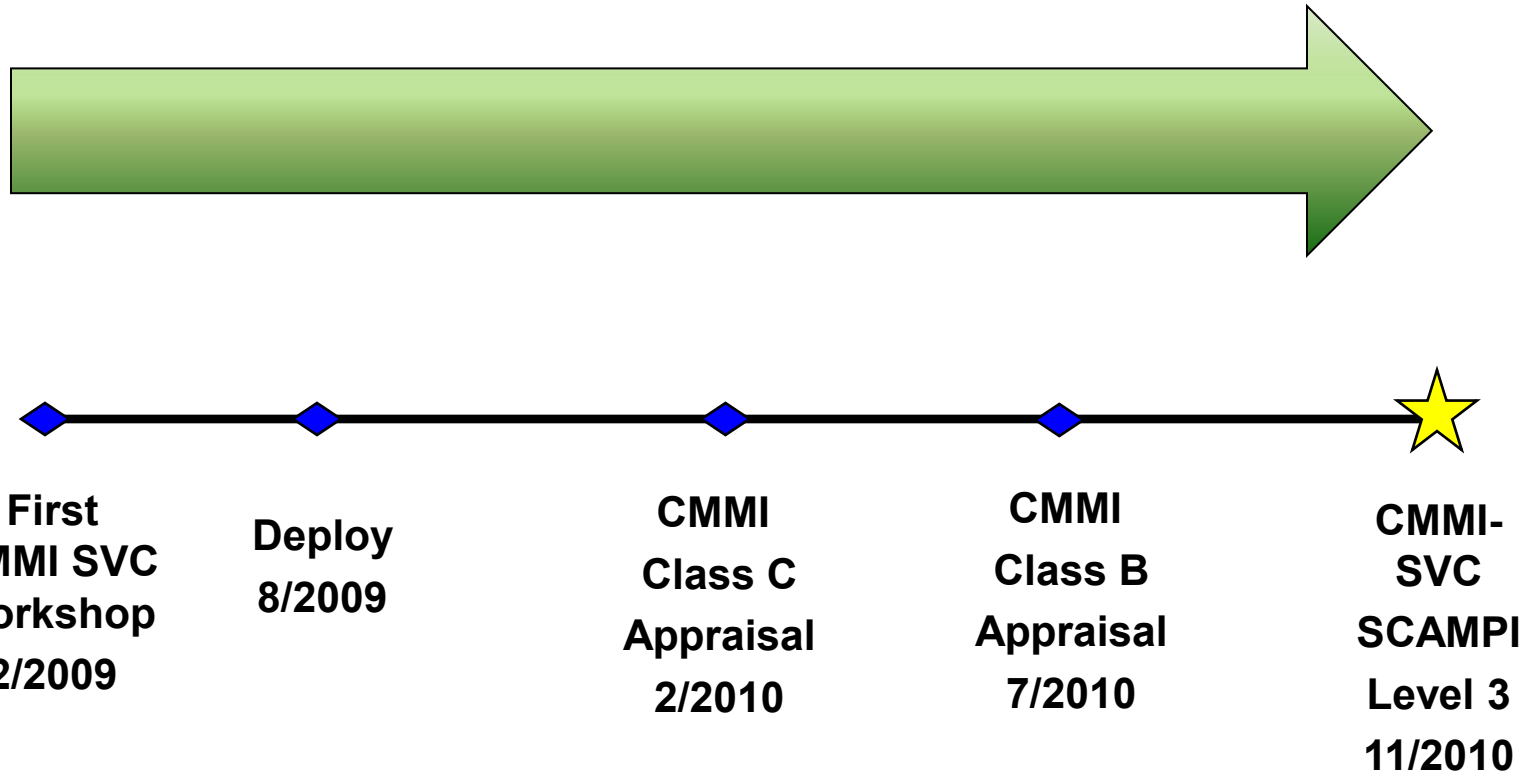
IDS Life-cycle Sustainment Service



Providing a solution that ensures the system's availability/sustainability/supportability, as documented in a contract. It consists of multiple functions that are required to fulfill the contract.

Note: Acronyms spelled out in the slide notes

IDS CMMI – SVC Timeline



CMMI Class C Appraisal – Looked at evidence and conducted interviews. Lots of discovery.

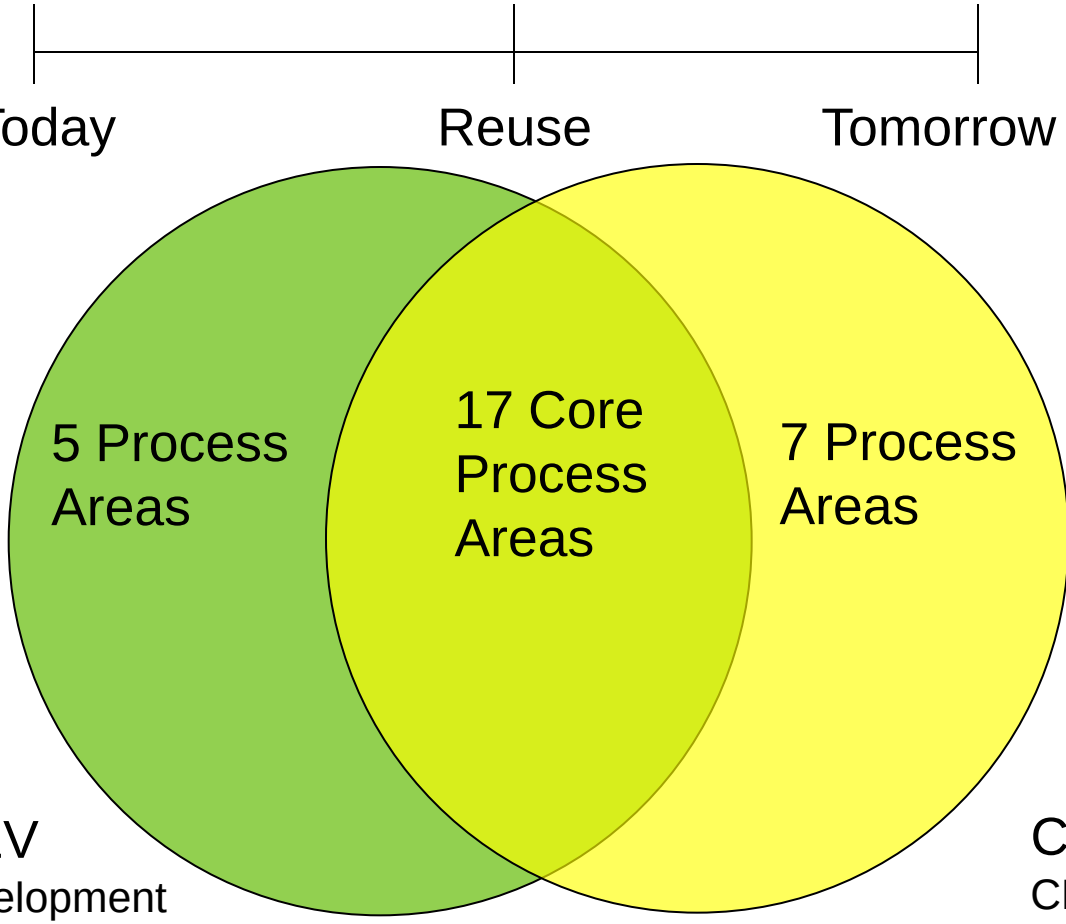
CMMI Class B Appraisal – Looked at evidence and conducted interviews. Very little discovery.

SCAMPI Appraisal – Official appraisal that results in a Maturity Level rating.

Process / Tools / Roles

CMMI-SVC and CMMI-DEV - 1





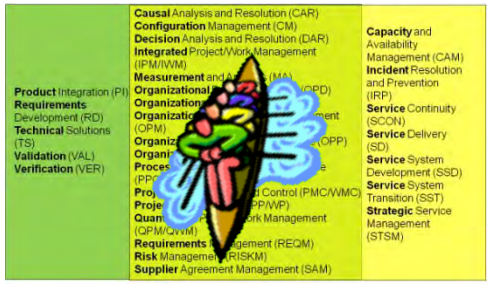


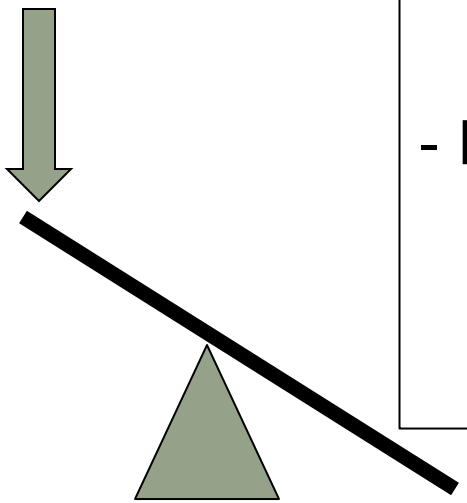
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CMMI-SVC and CMMI-DEV - 2

CMMI – DEV CMMI for Development		CMMI – SVC CMMI for Services
Product Integration (PI) **Requirements** Development (RD) **Technical** Solutions (TS) **Validation** (VAL) **Verification** (VER)	**Causal** Analysis and Resolution (CAR) **Configuration** Management (CM) **Decision** Analysis and Resolution (DAR) **Integrated** Project/Work Management (IPM/IWM) **Measurement** and Analysis (MA) **Organizational** Process Definition (OPD) **Organizational** Process Focus (OPF) **Organizational** Performance Management (OPM) **Organizational** Process Performance (OPP) **Organizational** Training (OT) **Process** and Product Quality Assurance (PPQA) **Project/Work** Monitor and Control (PMC/WMC) **Project/Work** Planning (PP/WP) **Quantitative** Project/Work Management (QPM/QWM) **Requirements** Management (REQM) **Risk** Management (RISKM) **Supplier** Agreement Management (SAM)	**Capacity** and Availability Management (CAM) **Incident** Resolution and Prevention (IRP) **Service** Continuity (SCON) **Service** Delivery (SD) **Service** System Development (SSD) **Service** System Transition (SST) **Strategic** Service Management (STSM)

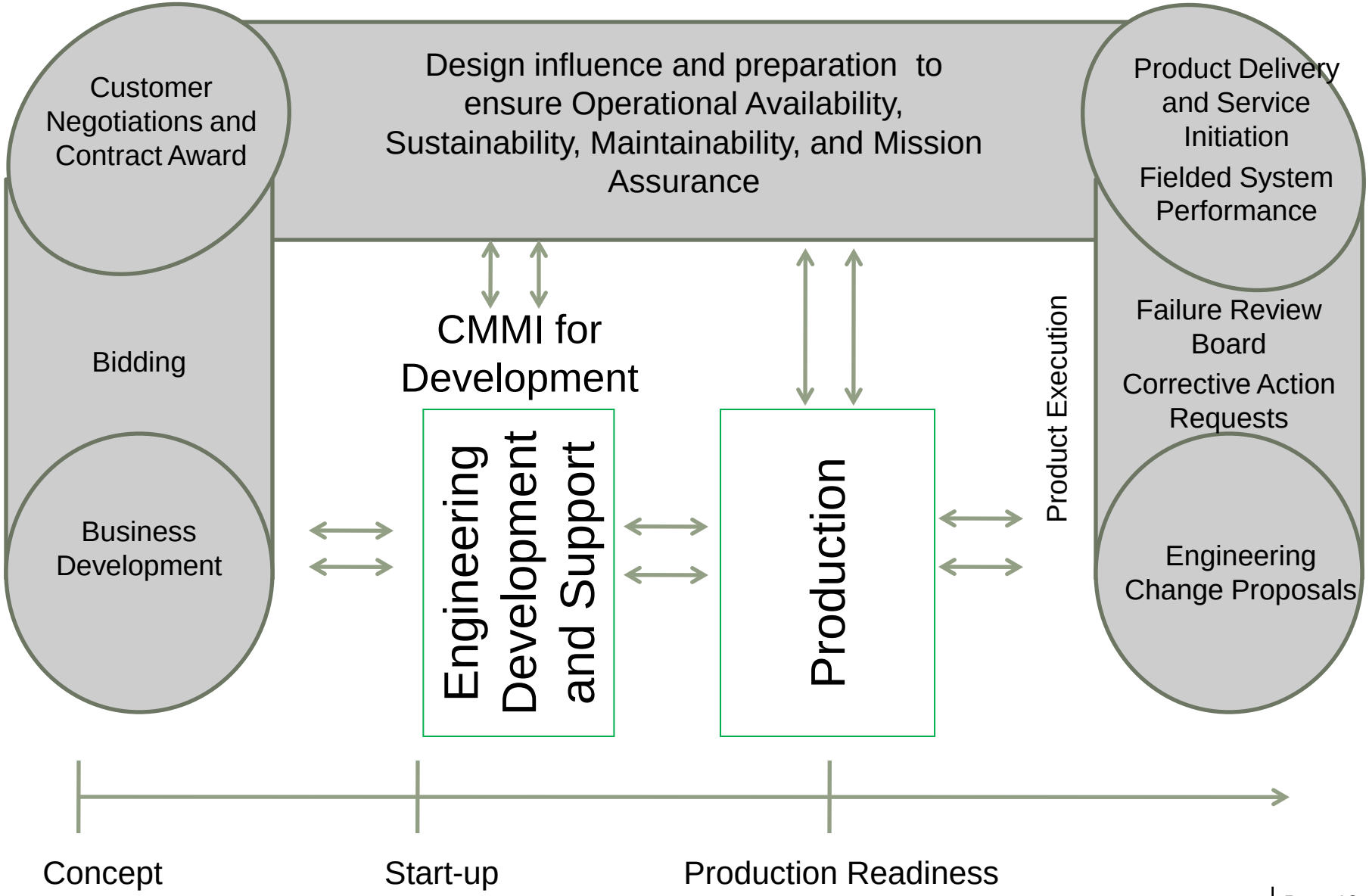
Leverage from the Common Process Area Evidence





- Configuration Management (CM)
  - CM Plan is program level
- Risk Management
  - Risk Management Plan is program level
- Work Monitor Control
  - Overall Program Schedule
- Measurement and Analysis
  - Measurement Analysis Plan
  - Program Monitor Package

CMMI for Services for IDS



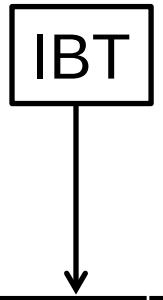
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IDS Organization Example

CBT / IBT	IBT 1	IBT 2	IBT 3
Engineering			
Finance			
Contracts			
Business Development			
Supply Chain			
Operations			
Quality			

IBT = Integrated Business Team is the portion of the IDS organization representing a grouping of programs that provides products and services.
CBT = Cross Business Team is the portion of the IDS organization that provides people, processes, tools and technologies across IDS Integrated Business Teams (IBT).

Program Organization Example



CPT = Cross Product Team is a functional team responsible for establishing the process and providing resources to support the IPT.

IPT = Integrated Product Team is a multi-functional team responsible for delivering a product or service.

CPT / IPT	IPT 1	IPT 2	IPT 3
Sys, SW, HW Engineering		X	
WL Engineering	X	X	X
Finance	X	X	X
Contracts	X	X	X
Business Development	X	X	X
Supply Chain	X	X	X
Operations		X	
Quality	X	X	X

X = Represented in Appraisal

Appraisal Preparation Roles

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Appraisal Team Representative/Member

- Provided CMMI-SVC model interpretation



SME for each function

- Created “long” evidence list
- Provided experiential knowledge
- Did not need to know the model

Point of contact for each program

- Deployed updated process
- Collected evidence as the program executed
- Statused readiness

Keys (Reins) to the successful appraisal - 1

Alignment between Appraisal Team and the Programs

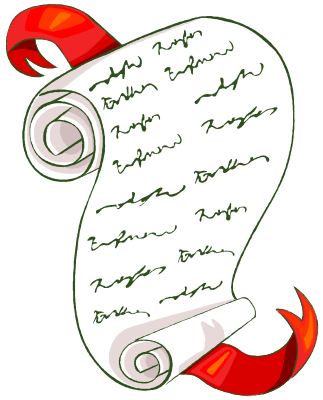
- Appraisal Team overview and discussion meetings
- War Room
  - Appraisal Team representative provided live feedback to the evidence collectors
  - Questions were answered quickly
  - Review and validation of evidence was immediate



Keys (Reins) to the successful appraisal - 2

Evidence collection tool

- Common repository
- Leverage from the evidence for the core processes
  - Plans, Measurement Reviews, Schedules, …
- Initial list provided from Execution SMEs
  - They own or use the processes everyday – use their knowledge
  - This became a long list…..



Evidence file example -1

Generic Name	Process Area	Practice	Description of Evidence	Link	Comment	Updated
CPT Meeting minutes	IWM	SP 1.5	D: IPT/CPT Meeting Logistics	https://teamexample.Repository.com		
CPT Meeting minutes	WMC	SP 1.1	D: CPT Meeting Logistics	https://teamexample.Repository.com	Supportability merged into Logistics CPT after reorg in 2009- hence no meeting	
CPT Meeting minutesx1	WMC	SP 1.5	PMT meeting minutes	https://teamexample.Repository.com	PMT Meeting minutes folder - see 3/23/10 file	
CPT Meeting minutesx2	WMC	SP 1.5	Team Handbook	https://teamexample.Repository.com	See page 14 (Fig 7) for names of each roles	
CPT Meeting minutes	WMC	SP 1.2	D: - CPT Meeting Logistics	https://teamexample.Repository.com		
CPT Meeting minutes	SD	SP 2.2	D: CPT Meeting Logistics	https://teamexample.Repository.com	Folder includes examples of CPT meeting minutes	
IPT Meeting minutes	DAR	GP 2.8	D: IPT Meeting Minutes where trade study discussed.	https://teamexample.Repository.com		Updated 6/22 with Comm Pwr mm
IPT Meeting minutes	DAR	GP 2.7	D: IPT Meeting Minutes where trade study discussed.	https://teamexample.Repository.com		
IPT Meeting minutesx1	SD	SP 2.2	D: IPT Meetings	https://teamexample.Repository.com	IPT Meeting minutes; Operations is an IPT within program structure; Fire Unit meetings is part of the test Radars IPT that is responsible for maintaining radar	Done - 5/17/10

Meeting minutes were used in 31 instantiations

Evidence file example - 2

Generic Name	Process Area	Practice	Description of Evidence	Link	Comment	Updated
Management Plan	WP	SP 1.4	D:Management Plan Section 4.1.1	https://teamexample.Repository.com	See WLPMP in PDM	
Management Plan	WP	SP 2.7	D: Management Plan	https://teamexample.Repository.com		
Management Plan	WP	SP 3.1	D: Management Plan	https://teamexample.Repository.com		
Management Plan	WP	GP 2.4	D: Management Plan Section 6.2.3 (Roles and Responsibilities)	https://teamexample.Repository.com		
Management Plan	CAM	GP 2.2	D: Mgmt Plan, CAM planning sect 4, Execution, Sect 5	https://teamexample.Repository.com		
Management Plan	CM	GP 2.2	D: Management Plan	https://teamexample.Repository.com		
Management Plan	DAR	GP 2.4	D: Management Plan - Roles & Resp. Table 4-1 - Program Management Team does program management iaw with section 4	https://teamexample.Repository.com		
Management Plan	DAR	GP 2.2	D: Management Plan section 4.12	https://teamexample.Repository.com		Updated 6/7
Management Plan	IWM	SP 1.4	D: Management Plan	https://teamexample.Repository.com		

The program plan was used in 42 instantiations

Keys (Reins) to the successful appraisal - 3

After a C appraisal the evidence list was abridged to the important few

- 5% reduction in total evidence count after the C appraisal
- 8% reduction in total evidence count after the B appraisal
- Evidence collection and validating activities prior to event significantly improved, with less discovery between the C and the B appraisals
  - 85% reduction in number of Document Requests written during the B appraisal



Summary

Organizational support

- Knowledgeable Appraisal Lead
- Service SMEs
- Appraisal SMEs
- Program points of contact



Tie your "Service" to your business goals and objectives.

- Collect evidence that is already part of how you do business.
- Have CMMI model SMEs and service SMEs collaborate.

Reduction in evidence collection churn

- Tool that identifies the top pieces of evidence to collect with mapping to the model
- Leverage from the CMMI-DEV evidence list

COLLABORATION

End of the Story

Paul Revere was successful in delivering his message that the Regulars were coming. We have evidence that he planned for his service, handled resources and incidents, and executed to the plan.



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Questions



Presenters Biographies

Kerry Trujillo

Raytheon, Affordability Engineering Section Manager

- Kerry has 20 years of experience in military, commercial, and government contractor environments. He has also held roles as individual contributor, process engineer, line supervisor, automation engineer, project lead, process group lead, and Naval Officer. He has utilized the CMMI for Services model in a business that maintains multiple sustainment types of contracts (e.g. Repair and Return, Performance Based Logistics, Depot Support, and Field Operations).

Debra Smith

Raytheon, Process Group Lead

- Debra has worked more than 15 years in commercial and government contractor environments. Her roles have included research biologist, software engineer, process engineer, IPT Lead, six sigma black belt, line supervisor, and project manager. Debra is currently working for a large aerospace company on business improvement initiatives that involve both CMMI for Development and CMMI for Services.

Acronyms

CAIV = Cost As an Independent Variable

CBT = Cross Business Team

CMMI = Capability Maturity Model Integration

CPT = Cross Product Team

FRACA = Failure Reporting Analysis and Corrective Action

HW = Hardware Engineering

HSI = Human Systems Integration

IBT = Integrated Business Team

IPT = Integrated Product Team

LCC = Life Cycle Cost

RAM = Reliability Availability and Maintainability

SCAMPI = Standard CMMI Appraisal Method for Process Improvement

Sys = Systems Engineering

SW = Software Engineering

TOC = Total Ownership Cost

WL = Whole Life Engineering (Specialty Engineering)

Acronyms – CMMI DEV and SVC Process Areas

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CAM = Capacity and Availability Management
CAR = Causal Analysis and Resolution
CM = Configuration Management
DAR = Decision Analysis and Resolution
IPM = Integrated Project Management
IRP = Incident Resolution and Prevention
IWM = Integrated Work Management
MA = Measurement and Analysis
OPD = Organizational Process Definition
OPF = Organizational Process Focus
OPM = Organizational Performance Management
OPP = Organizational Process Performance
OT = Organizational Training
PI = Product Integration
PMC = Project Monitor and Control
PP = Project Planning
PPQA = Process and Product Quality Assurance
QPM = Quantitative Project/Work Management
QWM = Quantitative Work Management
RD = Requirements Development
REQM = Requirements Management
RISKM = Risk Management
SAM = Supplier Agreement Management
SCON = Service Continuity
SD = Service Delivery
SSD = Service System Development
SST = Service System Transition
STSM = Strategic Service Management
TS = Technical Solutions
VAL = Validation
VER = Verification
WMC = Work Monitor and Control
WP = Work Planning

Writing Requirements Properly

2011 NDIA CMMI Conference
Denver, Colorado

Presented by
Al Florence
The MITRE Corporation

The authors' affiliation with The MITRE Corporation is provided for identification purposes only, and is not intended to convey or imply MITRE's concurrence with, or support for, the positions, opinions or view points expressed by this presenter.

Class Participation

Determine the problems with these 2 requirements:

- All computer-resident information that is sensitive shall have system access controls. Access controls shall be consistent with the information being protected and the computer system hosting the data.

The interval for propagating changes to suppliers shall be configurable.

Introduction 1 OF 3

- A Government agency, while re-developing legacy systems, reversed engineered the existing requirements.
- The examples represent several legacy systems that are in the process of redevelopment in a modernization effort.
- The examples depict only the requirements effort – they do not reflect any other lifecycle activities: design, implementation, test or operation.

Introduction 2 of 3

- It needs to be noted that requirements do not “live alone”
  - They depend on other requirements and/or
  - on clarifying comments

    to present a complete view of the functionality associated with a related set of requirements.
- A related set of functional requirements may be introduced with a preamble describing the capability of the functional set.
  - The preamble does not itself establish requirements; this is done later in the requirements’ specifications.
- Some requirements may be amplified with clarifying comments which are, again, not part of the requirements, but add understandability.

Introduction 3 OF 3

- Some requirements are documented sequentially with the requirements stated first setting the “stage” for the following requirements which add more and more capability.
  - The later stated requirements depend on the earlier requirements to complete their functionally.
  - An example may be the use of the word “processing”. If the processing of a functional set of related requirements has been described in earlier requirements the later requirements may amplify and/or reference the processing without having to restate the processing.



Critical Attributes 1 OF 3

The following are some critical attributes that requirements must adhere to:

Completeness: **Requirements should be as complete as possible.**

(They should reflect system objectives and specify the relationship between the software and the rest of the subsystems.)

Traceability: **Each requirement must be traceable to some underlying source, such as a system-level requirement.**

(Each requirement should have a unique identifier so that the software design, code, and test plans can be precisely traced back to the requirement.)

Testability: **All requirements must be testable in order to demonstrate that the software end product satisfies its requirements.**

*(In order for requirements to be testable they must be specific, **unambiguous**, and quantitative whenever possible. Avoid vague, general statements.)*



Critical Attributes 2 OF 3

Consistency: **Requirements must be consistent with each other; no requirement should conflict with any other requirement.**

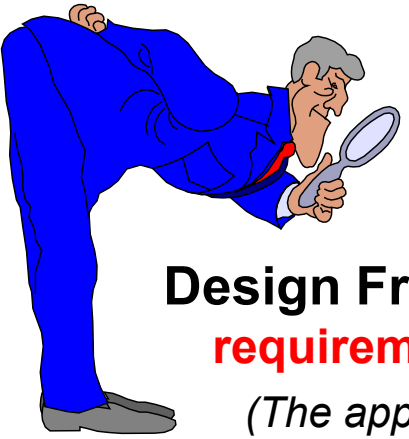
(Requirements should be checked by examining all requirements in relation to each other for consistency and compatibility.)

Feasibility: **Each requirement must represent a feasible representation.**

(Requirements that have questionable feasibility should be analyzed during requirements analysis to prove their feasibility.)

Unique identification: **Uniquely identifying each requirement is essential if requirements are to be traceable and testable.**

(Uniqueness also helps in stating requirements in a clear and consistent fashion.)



Critical Attributes 3 OF 3

Design Free: **Software requirements should be specified at a requirements level not at a design level.**

(The approach should be to describe the software requirement functionally from a system point of view, not from a software design point-of-view, i.e. describe the system functions that the software must satisfy. A requirement reflects "what" the software shall accomplish while the design reflects "how" the requirement is implemented.)

Use of "shall" and related words: **In specifications, the use of the word "shall" indicates a binding provision.**

(Binding provisions must be implemented by users of specifications. To state non-binding provisions, use "should" or "may". Use "will" to express a declaration of purpose (e.g., "The Government will furnish..."), or to express future tense.[2)]

Ambiguity

- Requirements must be written in a clear, concise and unambiguous fashion
- Words and phrases that may have confusing and multiple interpretations must be avoided
  - Adequate
  - Ad hoc
  - All
  - Always
  - Appropriate
  - Clearly
  - Easy
  - Existing
  - Fast
  - Flexible
  - Future
  - If required
  - Immediately
  - Large
  - Light
  - Limited
  - Near real time
  - Periodic
  - Portable
  - Rapid
  - Several
  - Slow
  - Small
  - Sometimes
  - State of the art
  - Sufficient
  - Usable
  - User-friendly
  - Weight
  - When required

Also:
http://www.ppi-int.com/newsletter/SyEN-017.php#article

Examples

- With domain knowledge of the system, several teams reverse-engineered and defined requirements.
- They represented:
  - the users
  - the contractors
  - the acquisition organization
- This author was assigned as a consultant to guide the teams in the proper specification of requirements.
- The following examples show some of the requirements:
  - as initially specified by the teams
  - followed by this author's critique (against the critical attributes)
  - and as re-specified based on the critique

Example 1

Initial specification:

Software will not be loaded from unknown sources onto the system without first having the software tested and approved.

Critique:

- If it's tested and approved, can it be loaded from unknown sources?
- If the source is known, can it be loaded without being tested and approved?
- Requirement is ambiguous and stated as a negative requirement, which makes it difficult to implement and test.
- A unique identifier is not provided, which makes it difficult to trace.
- The word "shall" is missing.

Re-specification:

3.2.5.2 Software shall be loaded onto the operational system only after it has been tested and approved.

Example 2

Initial specification:

3.4.6.3 The system shall prevent processing of duplicate electronic files by checking a new SDATE record. An e-mail message shall be sent.

Critique: .

- Two “shalls” under one requirement number.
- Vague requirement: need to define the e-mail message.
- The requirement has design implications, SDATE record.
- A requirement should specify what the data in the record are and not the name of the record as it exists in the design and implementation..
- As specified it cannot be implemented or tested.

Re-specification:

3.4.6.3 The system shall:

a. prevent processing of duplicate electronic files by checking the date and time of the submission, and

b. send the following e-mail message:

1. request updated submission date and time, if necessary, and
2. the processing was successful, when successful.

Example 3 1 OF 2

Initial specification:

3.2.5.7 The system shall process two new fields (provides production count balancing info to states) at the end-of-state record.

Critique:

- This requirement cannot be implemented or tested.
- It is incomplete. What are the two new fields?
- “Info” should be spelled out.

Re-specification:

3.2.5.7 The system shall provide the following data items (provides production count balancing information to states) at the end-of-state record:

a. SDATE, and

b. YR-TO-DATE-COUNT

Example 3 2 OF 2

Re-Critique:

- This rewrite has design implications SDATE record and YR-TO-DATE-COUNT.
- From a requirements viewpoint it should specify what the data in the records are, not the name of the record as it exists in the design and implementation.

Re-Re-Specification*:*

3.2.5.7 The system shall provide the following data items (provides production count balancing information to states) at the end-of-state record:

a. submission date and time, and

b. year-to-date totals.

Example 4

Initial specification:

3.2.5.9 All computer-resident information that is sensitive shall have system access controls. Access controls shall be consistent with the information being protected and the computer system hosting the data.

Critique:

- Two “shalls” under one identifier.
- The requirement is vague and incomplete. Need to identify the sensitive information.
- What does “consistent” mean?
- As specified it cannot be implemented or tested.

Re-specification:

3.2.5.9 All sensitive computer-resident information shall have system access controls, consistent with the level of protection. (Reference *Sensitive Information,* Table 5.4.1 and *Level of Protection for Sensitive Information*, Table 5.4.2)

Example 5

Initial specification:

3.3.2.1 The system shall have no single point failures.

Critique:

- This is an ambiguous requirement. Needs identification of what components and/or functions the “no single point failures” applies to.
- As specified it cannot be implemented or tested.

Re-specification:

3.3.2.1 The *following* system components shall have no single point failures:

a. host servers,
b. networks,
c. network routers,
d. access servers,
e. hubs,
f. switches,
g. firewalls, and
h. storage devices.

Example 6

Initial specification:

3.2.7.1 The system shall purge state control records and files that are older than the operator or technical user-specified retention period.

Critique:

- Requirement is incomplete and vague without specifying the retention period or providing a reference as to where the information can be obtained.
- Requirement cannot be implemented or tested as stated.

Re-specification:

3.2.7.1 The system shall purge state control records and files that are older than the retention period input into the system by either the:

a. operator, or
b. technical user.

Example 7 1 OF 2

Initial specification:

3.2.6.3 The system shall receive and process state return data from the State Processing Subsystem. The system shall provide maintenance of the state data files and generate various reports.

Critique:

- Two “shalls” under one requirement number and multiple requirements in the specification.
- The word “process” in the first shall is vague. Need to define the processing required.
- The second “shall” does not provide for valid requirements; they cannot be implemented or tested as stated.
  - Needs identification of type/amount of maintenance required.
  - “various reports” is ambiguous.

Example 7 2 OF 2

Re-specification:

3.2.6.3 The system shall receive:

a. production data that contains data from multiple states, and
b. state total amount for one or more states,

extracted by the Returns Processing Subsystem.

3.2.6.4 The system shall parse multi-state data to respective state files.

3.2.6.5 The system shall display a summary screen reporting the results of processing for each state containing:

a. state totals,
b. state generic totals, and
c. state unformatted totals.

Example 8

Initial specification:

3.2.7.1 The system shall not prevent the individuals from entering the year for which they intend the payment, but shall provide a check-point for them to ensure that they are not making a mistake in entering the correct year.

Critique:

- This is a negative requirement, negative requirements should not be specified. They cannot be implemented.
- A requirement should have all conditions that are required. If conditions are not required they will not be implemented.
- Two “shalls” under one requirement number.
- Suggest that this requirement be structured in a positive fashion.

Re-specification:

3.2.7.1 The system shall:

a. allow individuals to enter the payment year, and
b. provide a check-point to ensure that individuals enter the correct payment year.

Example 9 1 OF 2

Initial specification:

After the system receives the Validation file, the system shall:

- notify the individual about acceptance or rejection.
- the acceptance file must contain the name and ZIP code of the individual.
- rejected validation request must include the Reason Code.

Critique:

- The second and third bullets don't make sense, try to read them as such:
  - the system shall the acceptance file must...
  - the system shall rejected Validation…
- Use of both "shall" and "must".
- No unique identifier, use of bullets. Bullets cannot be traced.
- This requirement is ambiguous and cannot be implemented or tested.

Example 9 2 OF 2

Re-specification:

3.2.7.3 When the system receives a validation file, the system shall:

a. reject the file if it does not contain the individuals:

1. name, or
2. ZIP code, and

b. notify the individual about acceptance or rejection with a reason code. (Reference *Reason Code*, Table 5.4.8)

Example 10

Initial specification:

3.2.8.2 The enrollment process shall take from one to ten calendar days to complete for all payment types.

3.2.8.3 The enrollment process shall take no more than three days to complete for:

a. credit payment, and/or
b. note payment.

Critique:

These requirements are inconsistent and in conflict with each other.

Re-specification:

3.2.8.2 The enrollment process shall take:

a. one to three calendar days to complete for:
    1. credit payment, and
    2. note payment, and
b. one to ten calendar days to complete for all other payment types.

Example 11

Initial specification:

3.2.9.1 When doing calculations the software shall produce correct results.

Critique:

- Really? This is not a requirement.
- This type of requirements should not be specified!
- It should be deleted.

Re-specification:

Requirement deleted.

Summary

- The teams identified over 1000 requirements.
- The issues with their initial specification represented the entire spectrum of the following critical attributes:



  - completeness
  - traceability
  - testability
  - consistency
  - feasibility
  - unique identification
  - design free
  - use of shalls
- The teams were receptive to the critique, resolved issues and implemented the recommendations willingly.
- The requirements resulting from this effort were:
  - reviewed with senior management
  - accepted as specified
  - baselined, and
  - allocated to development teams for implementation.

Conclusion

- If sufficient time and proper effort is taken to validate requirements against critical attributes during their definition and specification, software projects will improve their probability of success considerably.

- If this is not done, projects pay the consequences during implementation, integration and test – not to mention during operation.



But you *knew* that, didn't you?
(I hope!)

Contact Information

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303 955 2286 – Home



CMMI® Without Appraisals

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Defense, Space & Security
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Mobility - Philadelphia
November 17, 2011

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CMMI® Without Appraisals

- At this time of economic challenges, many companies are looking at the cost of CMMI appraisals* as an area that needs to be evaluated. This paper explores some of the issues, challenges, and decisions involved in that evaluation and the resulting course of action.
- Because there are so many variations in company situations regarding market requirements, competition, their own capabilities, and their objectives, there is no single approach that is best for all.
- As a result, this paper is intended to explore the issues and choices in a way that may make it easier to reach sound decisions in individual situations.

---

*As used in this paper, “Appraisals” refers to formal, Class A SCAMPI Appraisals.

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Starting Point – If you have a rating

- **Some companies currently have a rating achieved through a formal SCAMPI Class A appraisal. The issues they face include:**
  - **Maintaining the appraised level**
  - **Seeking a higher or lower level**
  - **Terminating appraisal activities**
  - **Expanding the area covered by their appraisal**
  - **Reducing the area covered by their appraisal**
  - **Maintaining the capability to pass an appraisal in the future if the need arises, while not having one now**

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Starting Point – Without a rating

- **Some companies have not achieved a rating through a formal appraisal, or no longer have one. The issues they face include:**
  - **Evaluating their processes to see if they would qualify for a rating**
  - **Evaluating their performance to see if pursuit of a rating would be cost-effective as a way to improve**
  - **Evaluating their market, customer requirements, and competition to see if a rating is necessary now or in the future**
  - **Evaluating other methods and standards as a way to improve performance**

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Evaluating the Market – First Steps

- **Before the evaluation of the market becomes a prime factor, a company must go through a thought process that evaluates these factors:**
  - **Process improvements are necessary**
  - **CMMI is a good way to achieve improvements**
  - **CMMI requires an evaluation to be effective**
  - **A Class A appraisal is a better evaluation than a more informal appraisal, or an unofficial review**
  - **Although process improvements and CMMI may eventually result in lower cost, there is an up-front cost to pursue an appraisal and formal rating. This cost will depend on how much will need to be changed to achieve the rating.**
  - **There may be better uses for the investment – e.g., factory improvements**

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Evaluating the Market

- Once a company decides that market factors are "drivers" for a decision to pursue an appraised rating, it must consider these factors:
  - Does a customer currently require a rating?
  - Does a customer require use of CMMI equivalent processes (many phrases for this) without appraisals?
    - Not just mapping
    - Will a rating be a discriminator?
  - Do competitors have appraised ratings?
  - Are current processes "good enough" to get a rating?
  - What are cost and time to get to a rating, if needed?
  - What is risk of having to forego business if no rating? [Use risk management process]

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If the Market is not a factor

- Is the business software intensive?
  - If Yes, CMMI more likely to be necessary
  - If No, CMMI less likely to be necessary, but may still add value
- Is cost/ quality improvement a competitive or market factor?
  - If Yes, CMMI may be a good choice – must evaluate
  - If you say No, you probably don't understand your situation
- Can advantages of CMMI be achieved without appraisals? Whole set of issues!

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Can advantages of CMMI be achieved without appraisals?

- If a company has superlative processes and execution, CMMI won't add – but may make management easier
- If a company has less competent processes and execution, CMMI can provide advantages
  - Better Quality; lower cost; customer satisfaction
  - Cost/ benefit test
- If a company's processes and execution are inadequate, anecdotal evidence suggests that following just a few CMMI practices may help – question of how much
  - Following "Good Requirements Definition" and Peer Reviews may be an "80% solution" at less than 80% cost – numbers are hard to substantiate, and would depend on starting point
- Other initiatives may be alternatives
  - ISO/AS9100, 6 Sigma, Baldridge
  - May cost as much; may have less "market value"

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Evaluating the "Real" cost of appraisals

- People tend to lump related work into cost of appraisals;
  1. Conducting the appraisal, itself, including cost of appraiser
     - There is a real cost of an appraisal, but it can be managed or reduced
  2. Developing compliant processes
     - Should be done, even without appraisals
  3. Managing compliant processes
     - Should be done, even without appraisals
     - CMMI does not require micromanagement, excessive detail, or "churning" on improvements and details, but many people mistakenly think it does
  4. Process Training
     - If done right, no extra costs – skill training is separate issue
  5. Preparation for appraisals, including artifact "systems"
     - Many opportunities to reduce costs, use existing systems

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Going for “a number” vs. real improvement

- Despite all the advice against it, many companies go for an appraised level as a “qualification” they can publicize, and do not work to get real improvement
- Internal incentives often drive this behavior
- These companies don’t get the real advantages of CMMI even with an appraisal, so they will get even fewer without one
- To be useful, we need to confine our study to companies seeking real cost and quality improvement through process improvements, and their evaluation of the pros and cons of having formal appraisals

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“Lean” vs. CMMI

- It is possible to pursue CMMI, get an appraised Level 5, have effective and well managed processes, and still have high costs
- Lean is an additional discipline or technique that can help reduce costs and provide greater efficiency. Reduced costs make the cost/benefits test for appraisals easier to pass
- The best and most cost effective results occur when both CMMI and Lean are used together
- This is not easy to do and it can take a long time to get optimum results
- Dependencies:
  - Level and rate of expenditure on these initiatives
  - Leaders’ creativity and authority to make changes
- Cannot properly evaluate choices regarding appraisals without considering Lean component in both processes and appraisals

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Large/Diverse company considerations

- A large/diverse company may have very different operations at different locations:
  - Some may do development where CMMI is appropriate
  - Some may only do “cookie cutter” manufacturing where traditional quality control approaches work better
- A large company has opportunity to develop common processes at low cost on a small scale, and then deploy them across the company – but one size does not always fit all
- A company may have some areas with customers and markets that require ratings, and others that do not
- If not careful, a large company can find increased bureaucracy and overhead costs across its businesses, rather than efficiencies of scale
- A strategy is needed that matches the company’s needs – no universal approach here

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Different CMMI Constellations

- Most of the material in this presentation was written with CMMI for Development in mind, but it would also apply, in general, to CMMI for Acquisition and CMMI for Services, with a little change in emphasis
- The main issue is whether the activity is being pursued and performed via disciplined processes, and whether it can benefit from an organized approach to that effort
- Historically, it has taken many companies several years to get their process sets developed and performed with sufficient skill and discipline to be ready for a CMMI appraisal. This would be the case with each of the Constellations, depending on individual company situations
- The first step is a determination that a company wants to work to processes at the level of sophistication of the CMMI Constellations, and then embark on a journey of improvement

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Is a simple checklist possible?

- It would be nice to have a simple checklist to see whether a company should seek an appraised CMMI level through a formal appraisal, but this is not possible
- Except for the situation where a customer requires it, all of the other situations involve some evaluation and discretion, and a checklist is inadequate for them
- If a company is not interested in process discipline as a way to manage and improve its business, CMMI never comes up, so we can ignore those cases
- If a company only makes hardware and is convinced that a standard such as ISO 9001 or AS9100 is adequate, CMMI also does not come up
- In all other cases, we are dealing with cost/ benefit/ risk issues, and must do an evaluation accordingly

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The risk situation

- If there is a significant risk that a customer will require a CMMI level as a condition to bid, and that business is important to a company, it is hard to justify not pursuing the necessary appraised level. The issue becomes how to pursue it efficiently, and that gets into Lean considerations.
- If a customer requires "CMMI-like" processes, but no appraisal, and competitors have ratings, there is a risk of self-deception by thinking your processes are "good enough" when they are not. In this case, not having an appraised level presents a higher risk than spending the money on an appraisal and not needing it. This is a risk evaluation/ management situation.
- If a customer requires a CMMI rating within some period after award, the question becomes, "Why wait?" This is not just a cost issue, but recognition that the transition to CMMI processes and the appraisal that follows can add a measure of disruption that can adversely affect contract performance. However, this is a judgment call. This is also a risk evaluation/ management situation.

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The hard question

- It is easy for companies not faced with any customer CMMI requirements to say something such as “We have good processes that are CMMI ‘compliant’, so if we just follow them without having an appraisal, we get all of the advantages and we don’t have to incur the costs of an appraisal.”
- But –
- The processes are usually not compliant and not managed as well as they should be, so this is a form of self-deception. In practice, a CMMI appraisal may be the only good way to validate your processes
- That gets to the hard question, “Can we afford *not* to have a CMMI appraisal?”

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The complex answer to the hard question

- **If a company has asked itself, "Can we afford *not* to have a CMMI appraisal?", then the answer depends on:**
  - **Having good processes and process management**
  - **Having a corporate will to do better, and to do it in a disciplined way**
  - **Having the desire *and ability* to apply a Lean approach so that an appraisal will cost no more than is absolutely necessary**
- **If all of these are present, it probably pays to have the appraisal**
- **If not all are present, it probably will be costly to have an appraisal, and the choice of having the appraisal will depend on whether the company wants to choose this path toward process improvement**

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Conclusion

- Except for the situation where having an appraised CMMI rating is a customer's condition for getting necessary new business, there are choices involved in deciding whether to undertake the appraisal
- Those choices depend on a number of factors, including
  - The nature of the business (e.g., software or not)
  - The current state of their processes (good or not)
  - The corporate will to improve, and to pursue CMMI
  - The ability to apply a Lean approach to processes and appraisals to reduce the costs of appraisals
  - Whether the company will be content with self-appraisals of their processes, with the recognition that they almost certainly won't be as good as if validated by a formal appraisal

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Conclusion (continued)

- The Thought process:
  - You need to improve both processes and execution
  - That can be done either with or without help from a proven system
    - Without the help – inconsistent results, hard to maintain
    - With help of a proven system – better results if done right
    - CMMI can be the system of choice, but must be done right. Type of business can influence this choice.
  - CMMI can be used with or without appraisals
    - Hard to validate approach without appraisals – temptation is to declare victory with insufficient data. Management must make up for what is lost with no appraisals. Is there really a saving this way?
    - Having appraisals in one area and using same processes elsewhere ignores the factor of execution that is improved with appraisals
    - Appraisals give basis for correcting where needed; validation
    - Real cost of appraisals must consider both effort and value added
    - Cost can be reduced with a Lean approach. (This is not necessarily easy or quick, but should be considered in the thought process.)
    - Using CMMI by adopting only a few practices or processes will add a little value, but will still leave considerable room for improvement
      - Why do this, when full adoption gives better results?
  - Path to improvement must be selected

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Conclusion (continued)

- There is no single answer that fits all situations
- Arriving at the right answer depends on going through an evaluation process
- It is hoped that this presentation will assist those considering whether to have a formal appraisal to arrive at the right decision for them
- Just remember that CMMI without formal appraisals is not really CMMI, and if this is your choice, you must be prepared to live with the shortcomings

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BOEING







Improving Process Quality While Lowering Costs

Presented by Craig Hale

Esterline Control Systems - AVISTA

November 2011

Esterline
Control Systems

We Don’t Know it All



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Create a Plan for Success



Gain Buy-in

1

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Be a Role Model



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We’re All In It Together



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Make It Transparent



Use a Quantitative Approach

2

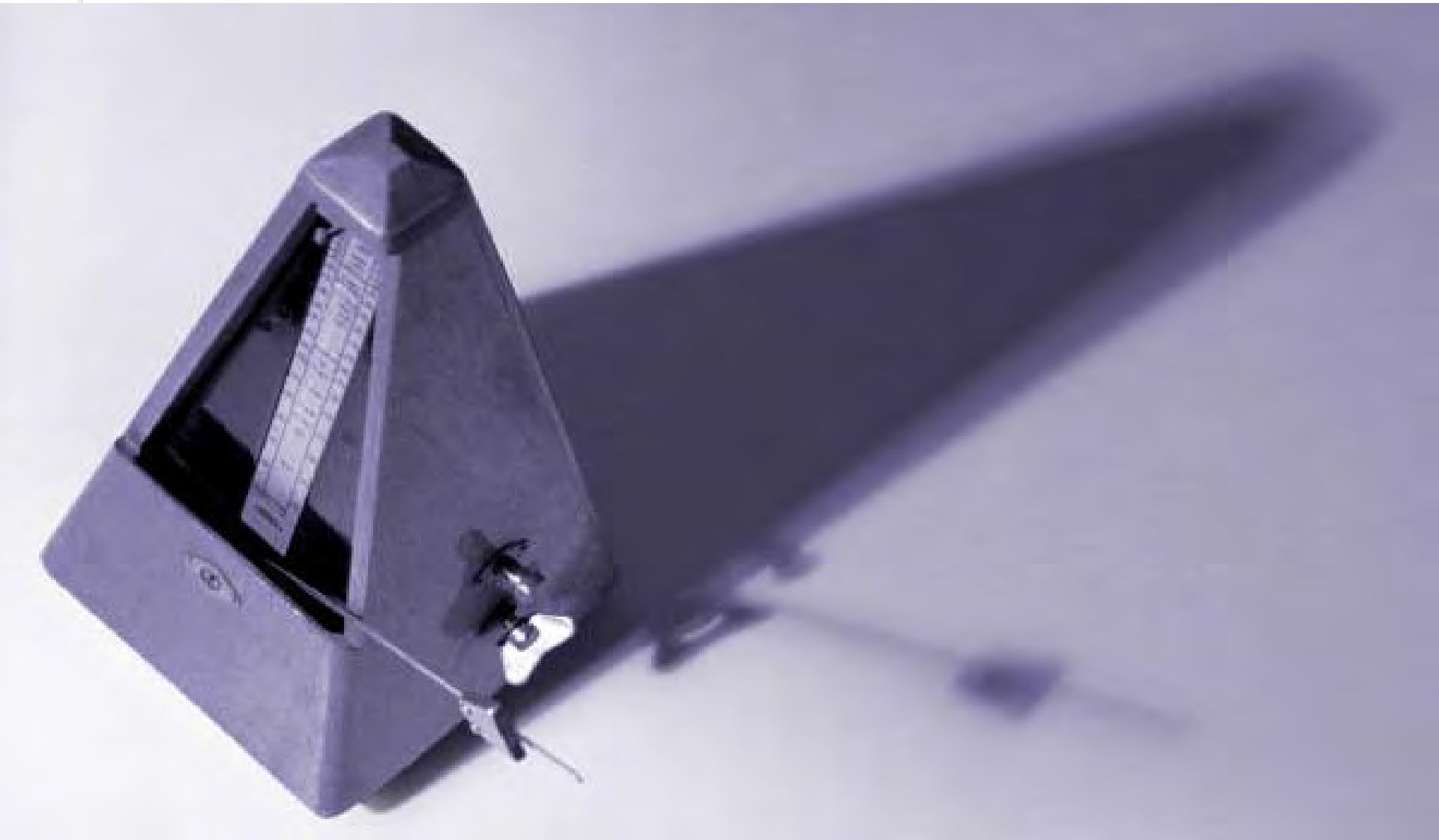
Esterline
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Run It Like a Project



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Think Metrics



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You Can’t Do Everything



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Use the Right Instruments



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Prepare for Challenges



Measure It

3

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Capture Lessons Learned

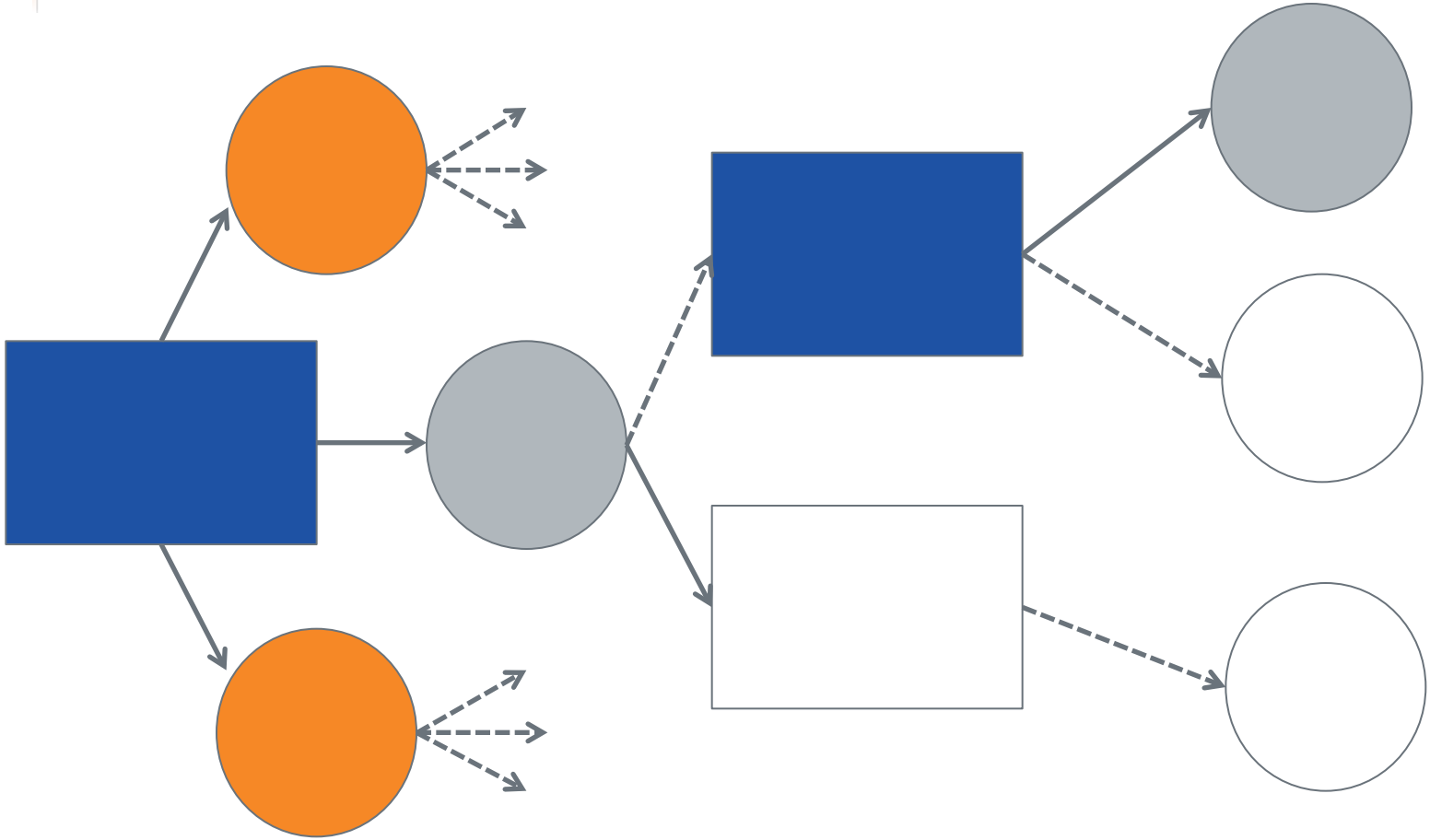


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Aim for Greatest Return



Use Decision Analysis



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Prepare for Risks

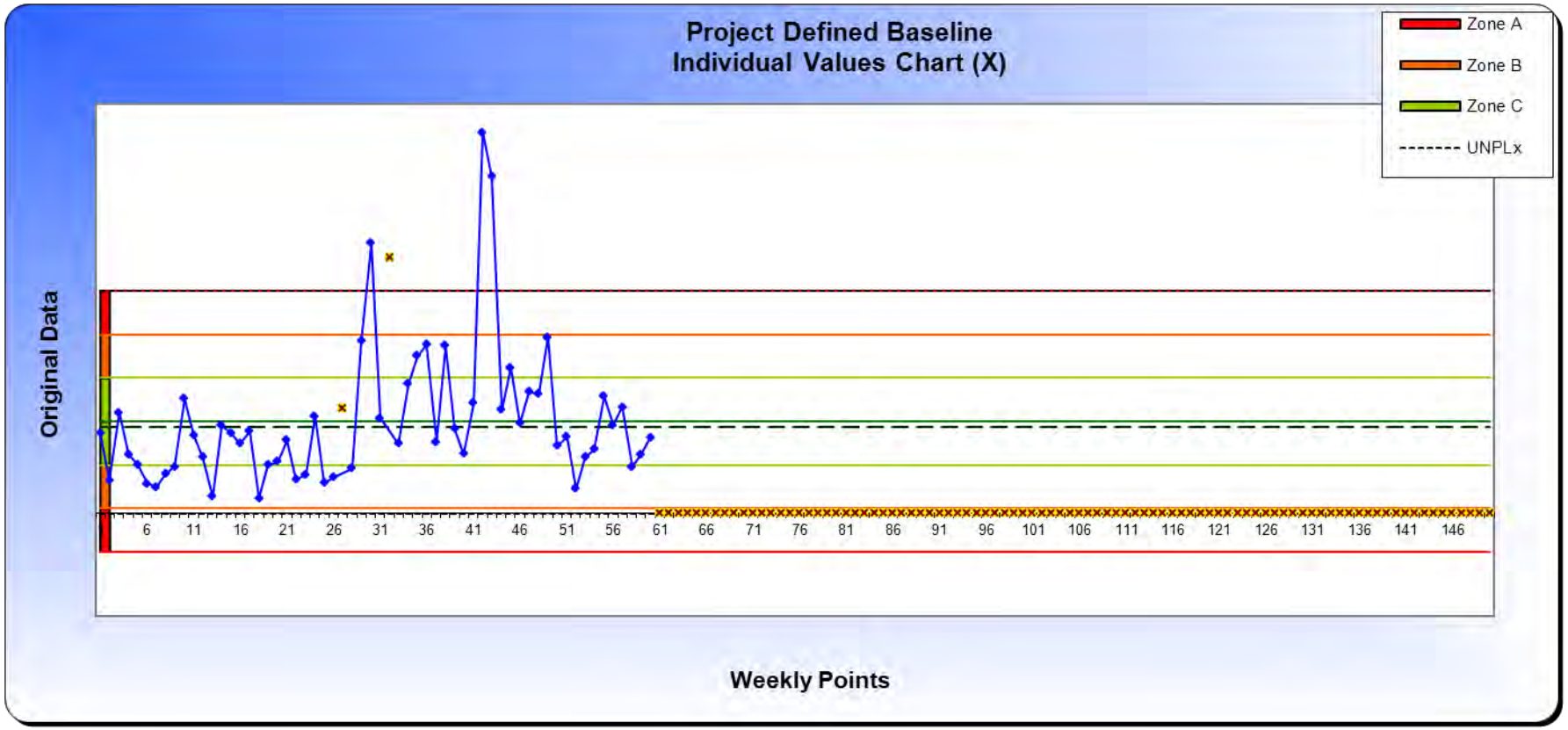


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Control Systems

Example: QPM on Process Improvement

- **Factors:**
  - Experienced Process Implementers
  - Appraisal Team Members
  - Primary EPG Members
- **Issues:**
  - Inexperienced Process Implementers Assigned
  - Non-Appraisal Team Members Assigned
  - Non-EPG Members Assigned

Example: QPM on Process Improvement



Example: Lowering Costs

- **Actions:**
  - Provide Stability
  - Change in Process
- **Results:**
  - ISF Average rate reduced by 33.9%
  - ISF Variation rate reduced by 58.4%

Esterline
Control Systems

Take the Lead



Esterline
Control Systems

Build Respect for SEPG and CMMI



Questions?

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Email Craig.Hale@esterline.com
www.esterline.com/controlsystems/avista

Six Sigma: A Journey Toward an Empirical and Experimental Approach to Software Process Improvement

Dr Radouane Oudrhiri, Systonomy Limited

radouane@systonomy.com

11th Annual CMMI Technology Conference and User Group
November 14-17, 2011 - Denver, Colorado

Topics

- **Systonomy - company overview and approach**
- **Empirical and Experimental approach**
- **Introduction to Six Sigma**
- **Application of Six Sigma to Software process improvement**
  - Six Sigma an Empirical Approach
  - Case Study
- **Conclusions**

Systonomy background

Founded in April 1999, Systonomy is dedicated to the application of Empirical and Experimental Software engineering, Six Sigma and DFSS for IT and Software Development from real-time and embedded systems to Management Information Systems (MIS) including the implementation and integration of COTS, EAI, ERP systems, CRM, Financial Systems etc.



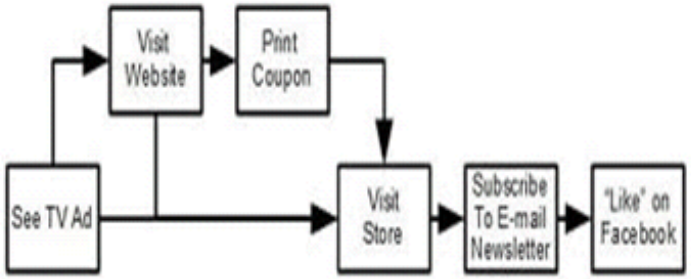
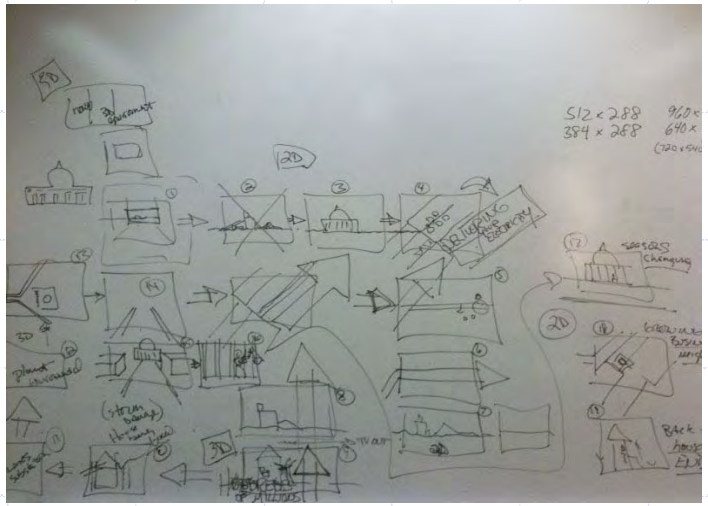
Systonomy has devised a unique Six Sigma and DFSS framework for IT and Software Engineering that is at the forefront of current knowledge and is investing heavily in research into new methods. Our training has been designed from the ground up as an IT/Software Six Sigma and DFSS training programme and is not a superficial modification of manufacturing or transactional Six Sigma. Our adaptive approach offers our clients an innovative and low risk move from defensive strategies to those of growth.

Our Change Managers, Advisors, Engineers, Black Belts, Master Black Belts and Instructors are IT professionals first and statisticians second



Software Engineering Culture

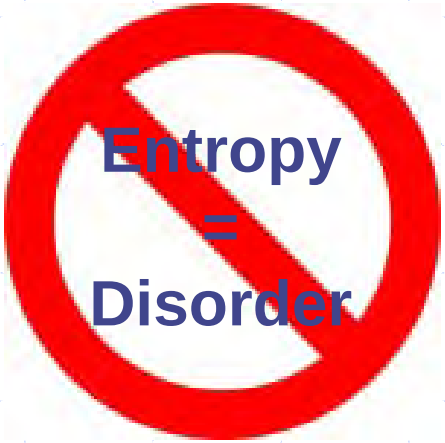
What do these have in common?

	Fiction	Reality
Room		
Process		

Entropy... Energy dispersal

Spontaneous Processes and Entropy

- **The idea that Entropy = Disorder is an obsolete and misleading concept**

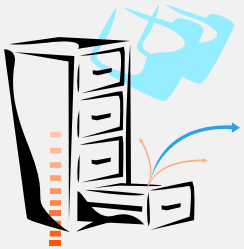


- **Entropy is about probability of all possible choices, … not whether a given arrangement looks neat or messy.**

- **Spontaneous processes go towards state with the most possible options**
  - "Driven" by simple statistics
  - Random process, not actually driven
- **Entropy is the number of available options**
- **Statistical Definition of Entropy**
  - $S = k \ln(W)$
  - *W = # of available states of equal energy*
  - *(Entropy = Delocalization of energy)*

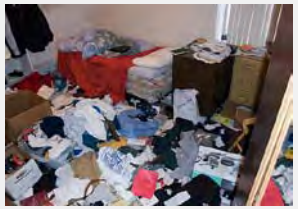
3 Shirts: Red, Blue, Green

Shirts limited to pile in drawer



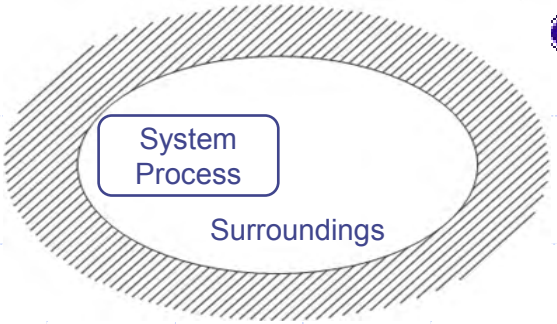
W = 6
red / blue / green,
blue / red / green, etc.

Shirts anywhere in room



W = Lots
red on chair / blue on floor, …

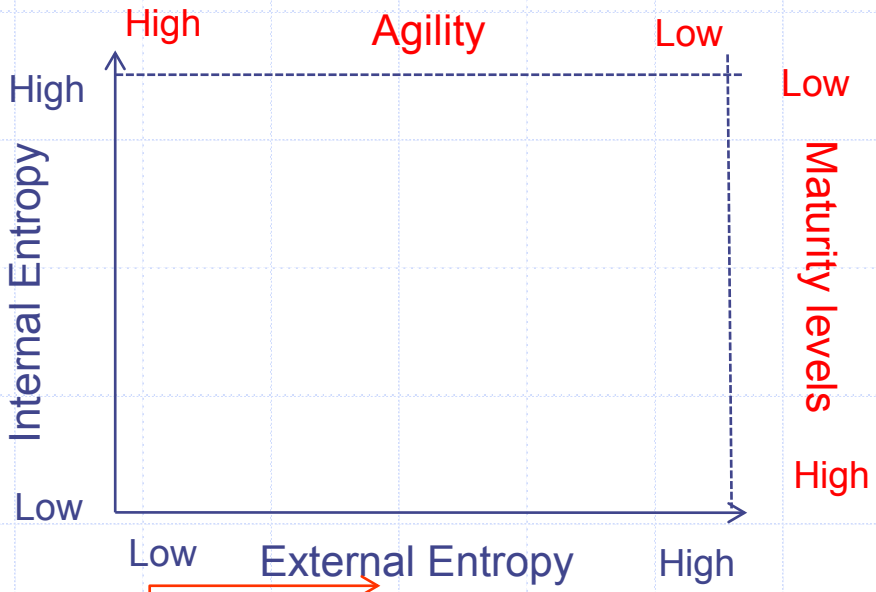
Internal and External Entropies



- **Two types of entropy:**
  - Internal entropy
  - External entropy

- $Entropy_{Solid} < Entropy_{Liquid} < Entropy_{Gas}$
- Increased Rigidity → Decreased Entropy
- Increased # Atoms (elements) → Increased Entropy
- Increased Mass (Complexity) → Increased Entropy

Maturity-based models value more the control of Internal Entropy



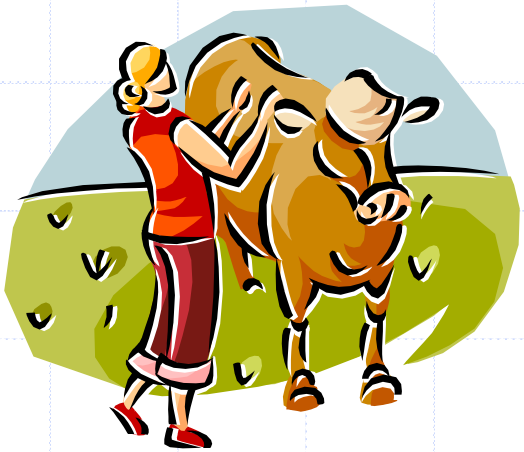
Agile methods value more the understanding of External Entropy

Working software over comprehensive documentation
Customer collaboration over contract negotiation
Responding to change over following a plan

Maturity versus Capability demystified

The Cow Maturity Model℠

The Milking Process





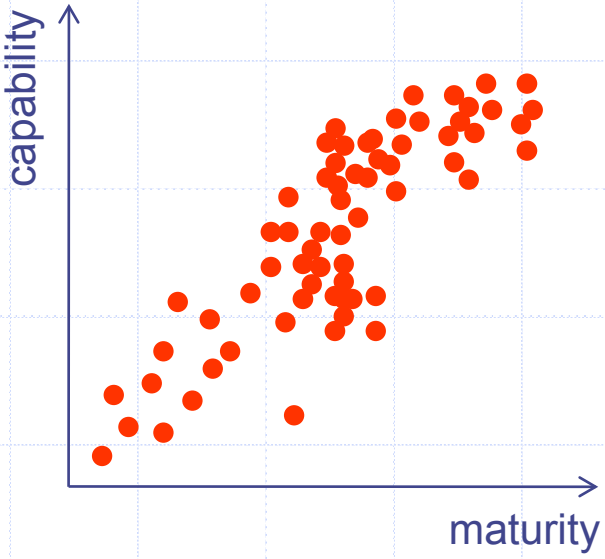
X's:

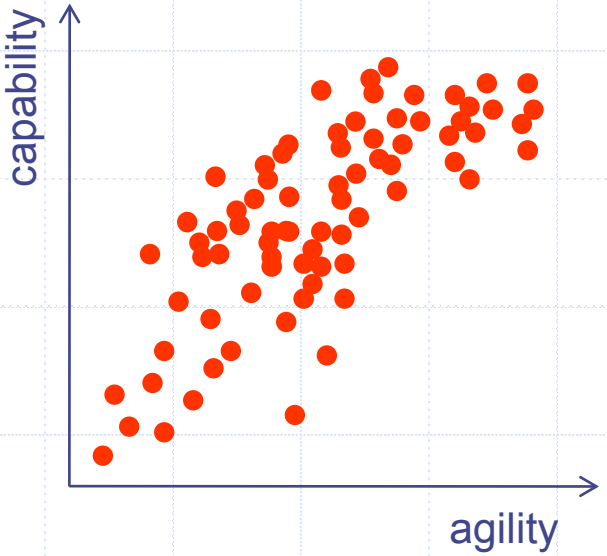
- Quality of the Cows
- Grass, Food
- Massaging cows
- Discipline
- Sophistication

Y's:

- Litre/Cow/Day
- Density of cream/litre
- Defective milk

Maturity and agility versus Capability





- **Maturity-based models, agile methods and other methods claim some kind of positive relationship between their intrinsic property and Capability (performance)**
  - Maturity and Capability
  - Agility and Capability
  - etc

Superstition is merely the confusion of correlation and causality

- Superstitious behaviour: believes that the action has an immutable cause-and-effect to the outcome, whereas the action might or might not be functional
- "*I behave this way, and I achieve results. Therefore, I must achieve results because I behave this way*."
- Superstition: information accepted on faith, without personal knowledge or examination.
- People pass along "everyone knows" data without questioning it, and others accept the superstition as undeniably true
- Confidence isn't knowledge; .... confidence can *prevent* knowledge and innovation from happening, Unquestioned belief means you never measure, never test, never look at alternatives

http://www.youtube.com/watch?v=vGazyH6fQQ4
http://www.youtube.com/watch?v=TtfQIkGwE2U&NR=1



- Skinner Experiment
  - He deprived pigeons of food for a period of time to ensure high responsiveness to anything which resulted in food.
  - Placed them in a cage which delivered a food pellet every 15 seconds, regardless of what the pigeon did or did not do.
  - The pigeon cannot do anything to obtain the food or ensure the supply would continue.
  - The pigeons began recalling their actions before the food was delivered. Some pigeons turned in circles, others tilted their heads, others tapped their feet, others swayed their bodies, and others tossed their heads.
  - The pigeons associated these particular actions with food delivery and began repeating them in the manner of a ritual
- Skinner drew the following conclusions:
  - The pigeon behaves as if there were a causal relation between its behaviour and the supply of food, although such a relation is lacking.
  - A few accidental connections between a ritual and favourable consequences suffice to set up and maintain the behaviour in spite of many unreinforced instances
  - Such a stimulus has reinforcing value and can set up superstitious behaviour.
  - The experiment might be said to demonstrate a sort of superstition.
  - There are many analogies with human behaviour

Examples of Superstitions in software engineering

- **Unfounded opinions and beliefs**
  - Java is better than C or C++ or C#
  - COBOL is an extinct language and not useful for anything
  - Open source languages are free!
  - CMMi is old fashion, Agile is great
  - Agile is not a proper method

- **Requirements Gathering:**

  The requirements gathering process has an inevitable speculative element to it.

Superstitions

*C*ommon superstition is that all requirements must be clearly defined before the project can start.

We also know it is the worst time to define all the requirements because it is the furthest point away from the time of use..

- **Project Planning**

  Planning is another inherently speculative activity. In order for planning activities to have any bearing on reality they must be closely and interactively allied to actual outcomes.

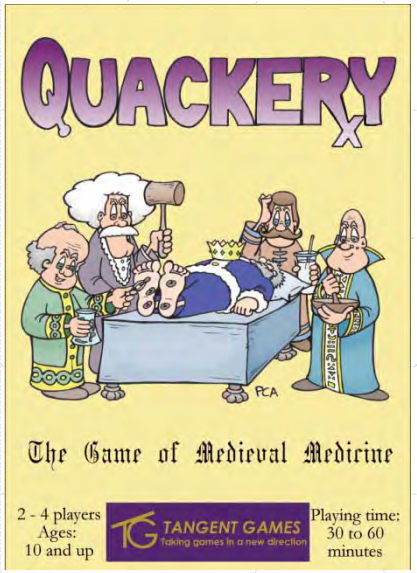
Superstition

One of the most pervasive superstition: the best plan is a complete plan, the more detail the better, the more accurate we make our forecasts, the more realistic our plan will be.

The project becomes schizophrenic, it has two independent realities. One is the “reality” of the plan, effort is expended trying to force-fit what really happened into a shape that we pretend it was the same as we thought would happen.

SE - Software Engineering discipline

- **The term "Software Engineering" was coined the first time in 1968 at a NATO conference**
- **The discipline of SE is, unfortunately, still in its infancy**
- **SE has reached a stage that is more resembling to *quackery* than engineering**
- **The *modus operandi* of ideas adoption within SE is similar to *fashion industry* rather than true Engineering**
  - The certainty of ideas in SE are judged by whether people use the idea
- **SE may be a field whose progress is threatened by analogies and beliefs**
  - Are we sure that our beliefs are true?
  - Which claims made by the software community are valid?
  - Under which circumstances are they valid?



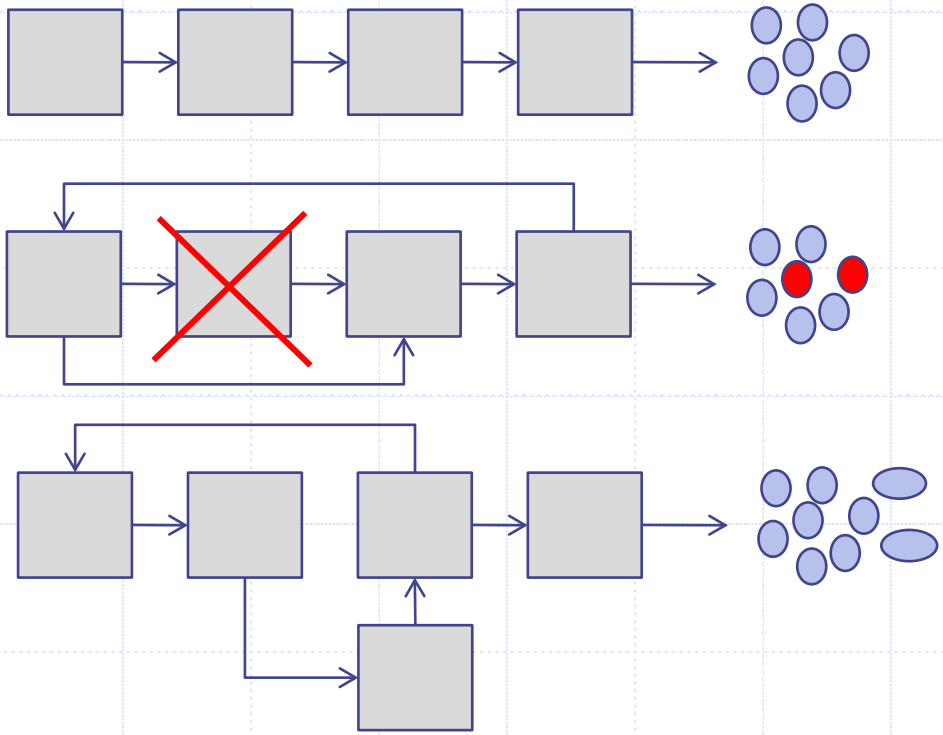




Empirical and Experimental Software Engineering

Empirical Methods

- Empirical methods provide us with insights into how software engineering works in practice and how changes to the process can results in changes to the outcomes of the process (improvements)



[SEA 07]

Empirical Software Engineering

- **Empirical Software Engineering is a discipline which attempts to understand phenomena and at the same time try to change those phenomena in order to improve them.**

- **It is, therefore, about contemplation and action; it has two aims:**
  - Understand how software is actually developed and maintained
  - Understand what improvements should be made to software development (engineering) and how these improvements should be implemented

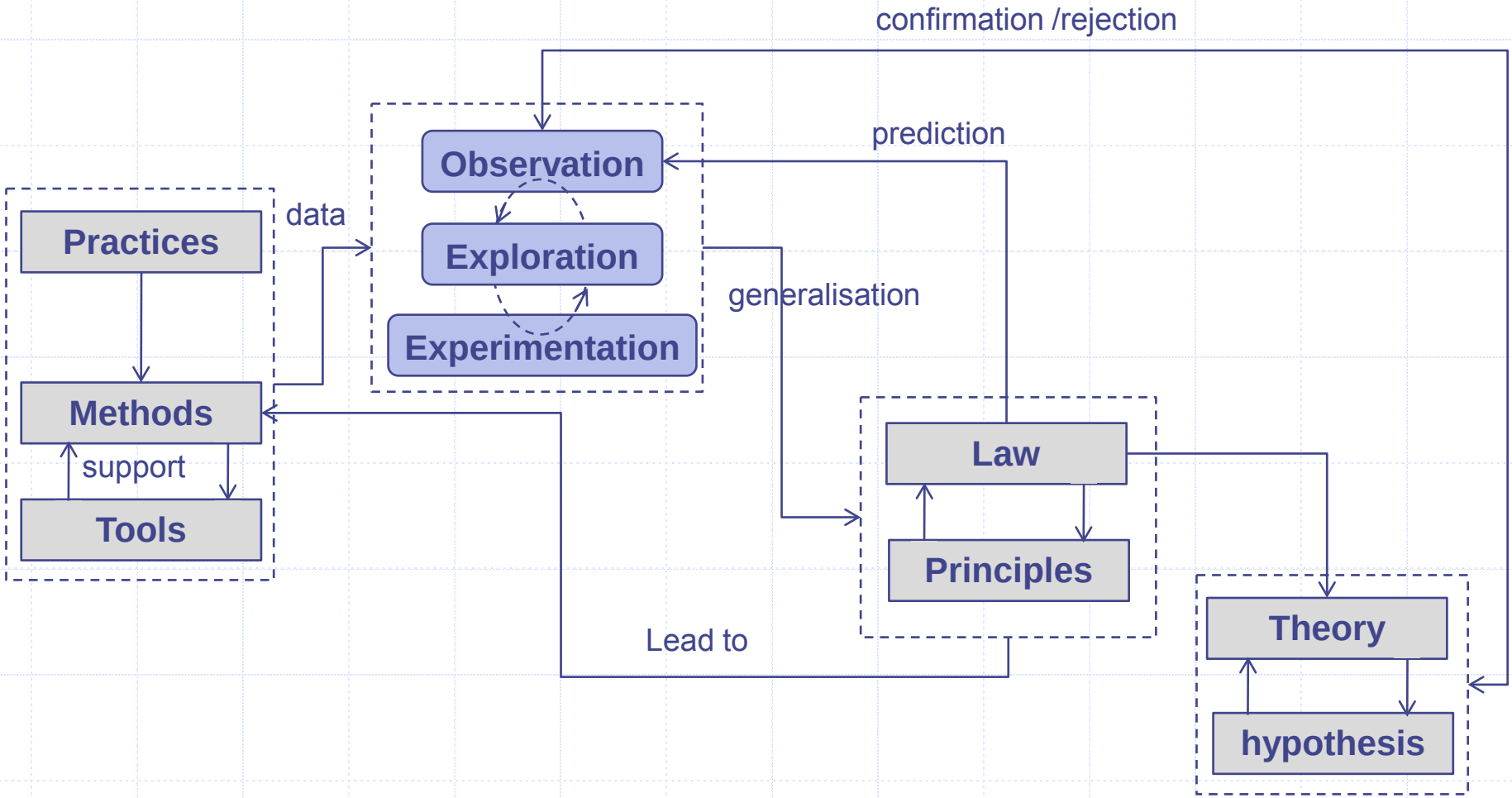
- **It promotes empirical evidence as the primary source of reliable knowledge to achieve these two goals**
  - Exploratory – forming hypothesis
  - Experimental - involves planned experiment designs in to prove causation and not only correlation

Empirical = Exploratory + Experimental

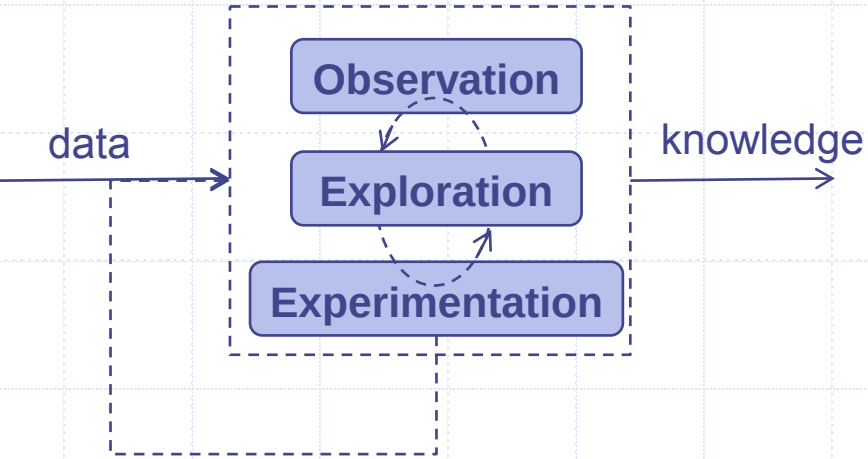
- **It is a necessary technology or a natural approach for goal-oriented, sustained process improvement**

[RAI 07]

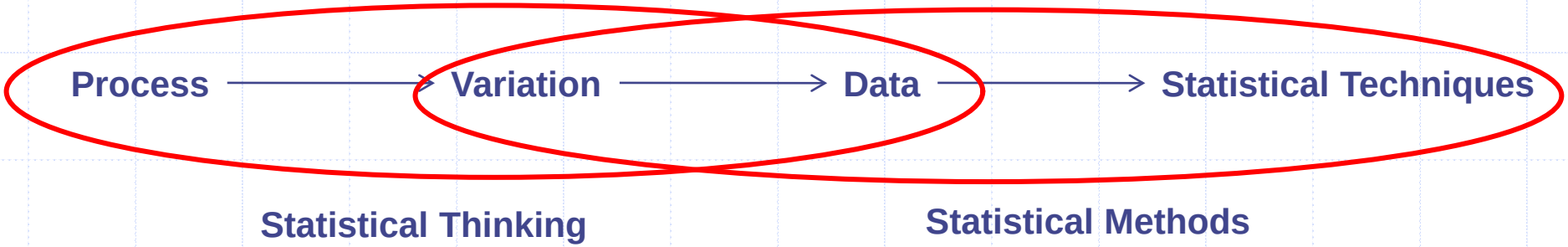
Empirical Cycle
Closing the gap between theory and practices



Empirical and Experimental approaches often rely on Statistical Thinking



- **Statistical Thinking**
  - All work is process
  - Variation exist in any process
  - Understanding and reducing variation are keys to success
- **Five fundamental habits are operating simultaneously:**
  - The need for data
  - The importance of data production
  - The omnipresence of variability and uncertainty
  - The measuring and modelling of variability and uncertainty
  - Interpreting results in a context



Learning…and Knowledge acquisition

- **The purpose of Empirical and statistical Thinking is Learning and Knowledge acquisition**

> ***"Learning is not compulsory…. neither is survival"***
>
> **W. Edwards Deming**





Empirical and Experimental software engineering is for all professionals who have (and want to keep) a child's mindset and ask the question *why?*



Software Six Sigma

A Problem Solving Methodology

Is Six Sigma another fad?

YES... If

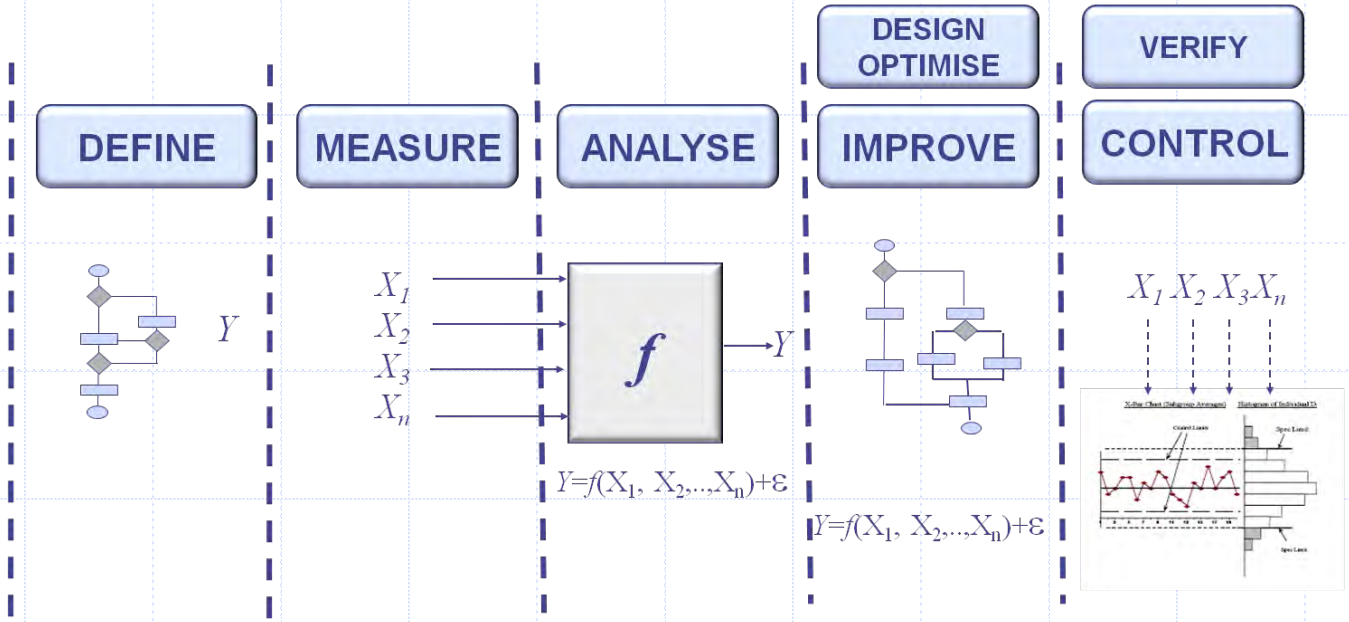
- It is used as a façade
- It is used as a label or a branding
- It is used for “compliance” purposes
- Statistics are (ab)-used to justify early decisions



NO... If

- It is used as a real problem solving methodology
- Improvements solutions are linked to the organisations goals, values and tangible benefits
- it used to gain insights on our practices

Problem Solving Methodology

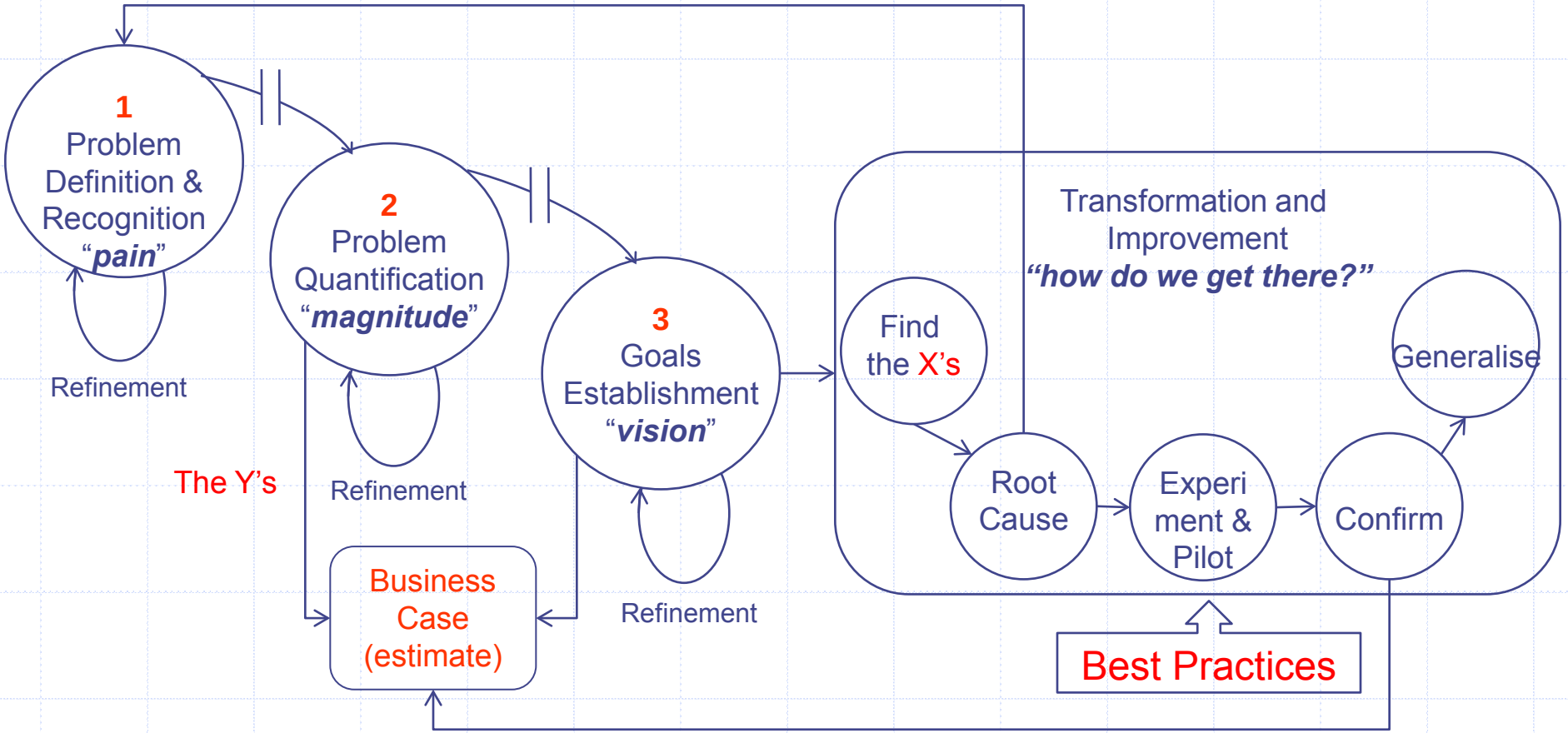


Six Sigma is a pragmatic approach to Empirical and Experimental Process Improvement

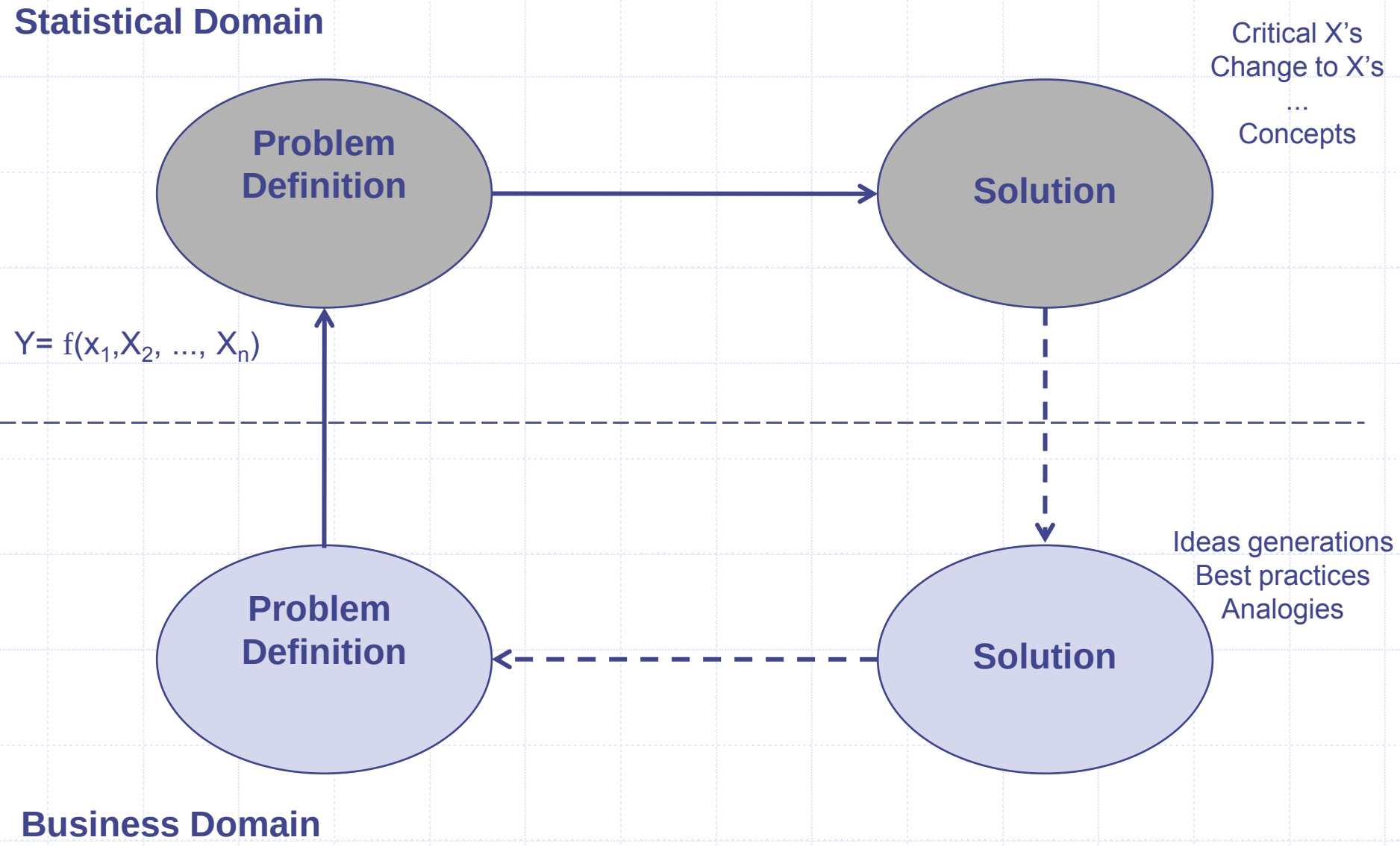
KEYWORDS:

- **Pragmatic**: Six Sigma is about solving problems. The focus is on business problems that cause "pain" and extra costs to the organisation
- **Experimental**: Six Sigma is not a catalogue of best practices or methods. Every organisation is different and so are the problems they face. Six Sigma rejects pre-defined solutions and investigates problems to the level of their root causes

Problem Solving Methodology
A rigorous approach to process improvement



Six Sigma Problem Solving cycle



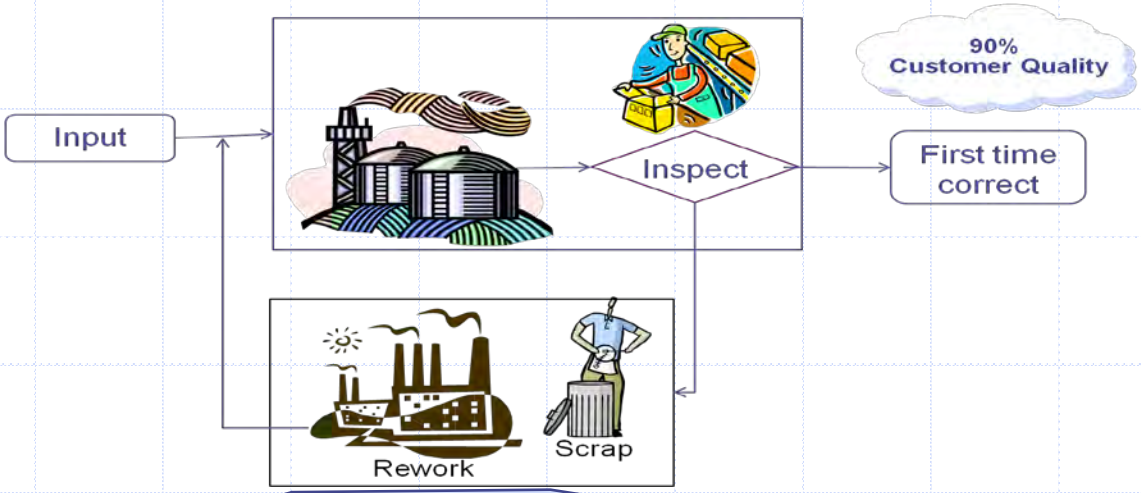
Six Sigma vs. Other SPI approaches

Six Sigma	Catalogue Based Improvement models
Focus on Problems	Focus on Best Practices (Solutions)
Emphasis on measurement of process capability	Emphasis on assessment of process maturity
Business results oriented	Quality improvement oriented
More prescriptive in nature	More descriptive in nature
Improvement “is by experiment”	Improvement is “by the book”
Provides the “how to”: solve a process problem	Provides the “how to”: manage the process according to best practices

The two approaches complement and reinforce each other!

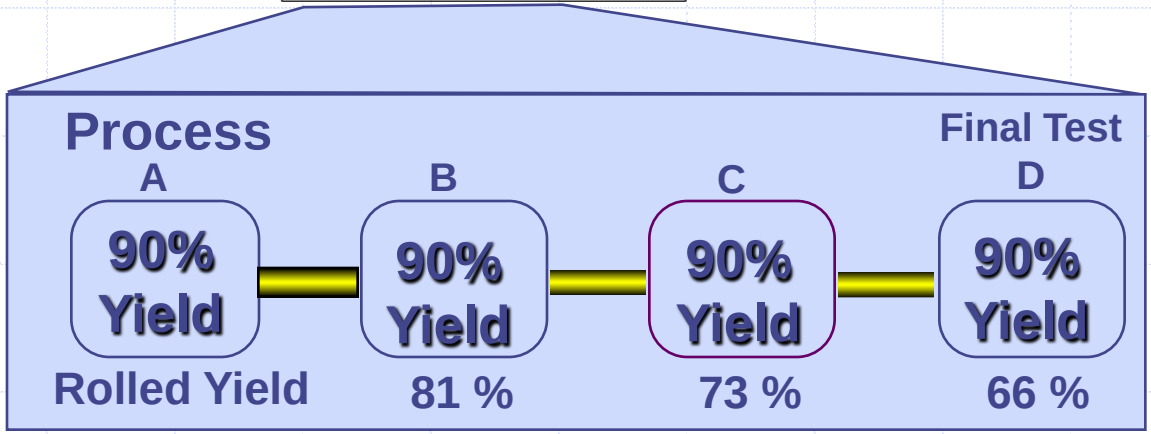
Six Sigma integrates pragmatism into Empirical approaches without loosing the scientific rigour

Key Six Sigma Concept: Hidden Factory



Manufacturing Variation Causes a "Hidden Factory" Increased Cost - Lost Capacity

- **Wasted Time**
- **Wasted Money**
- **Wasted Resources**
- **Wasted Floor space**



Rolled-Throughput Yield

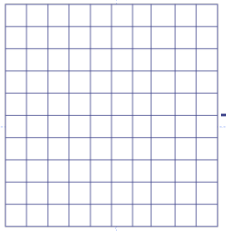
66% ≠ 90%

Classical First-Time Yield

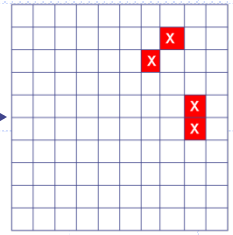
DPMO forces you to look at the “hidden factory” where expediting, rework and delays occur, but would likely not show up in classical yield metrics. The resulting detail from DPMO determinations can then help to prioritize where improvements can be made.

The hidden Factory in Software Process development

Unit of work
- Function Points
- use case points
- . widgets



Software Development Process

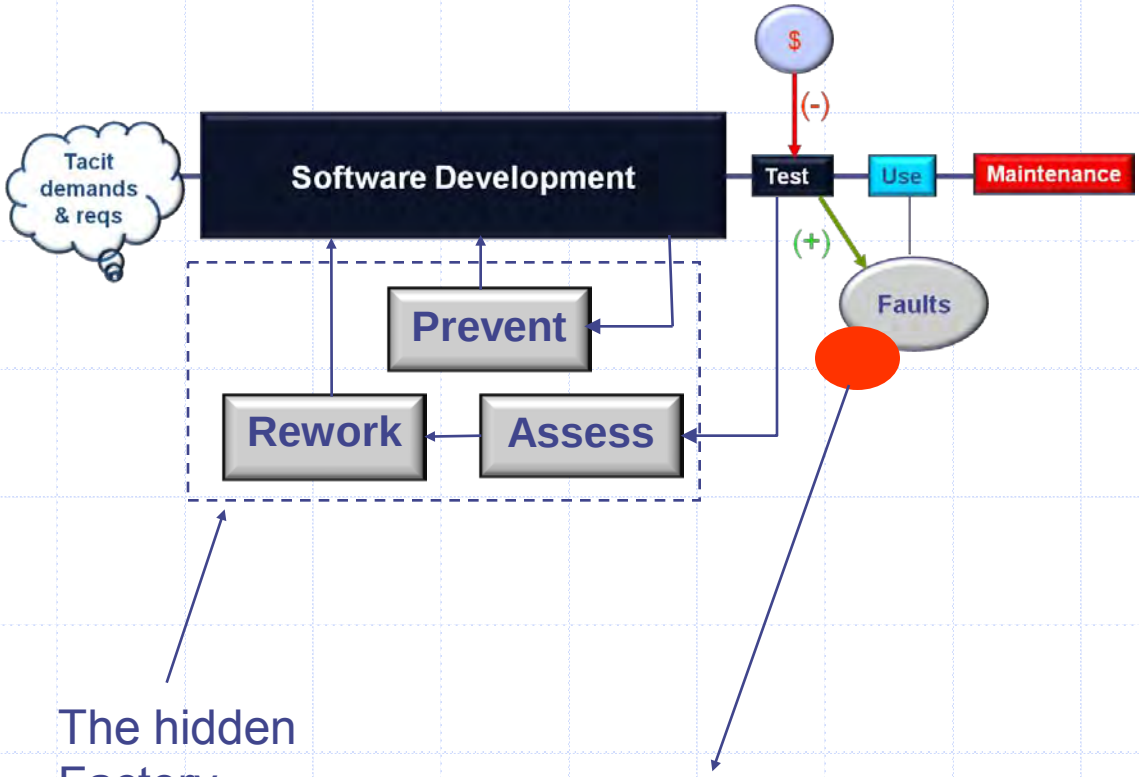


Delivered unit of work
- Function Points
- use case points
- . widgets

Area of opportunities (x10^6)

Delivered defects per area of opportunities (x10^6)

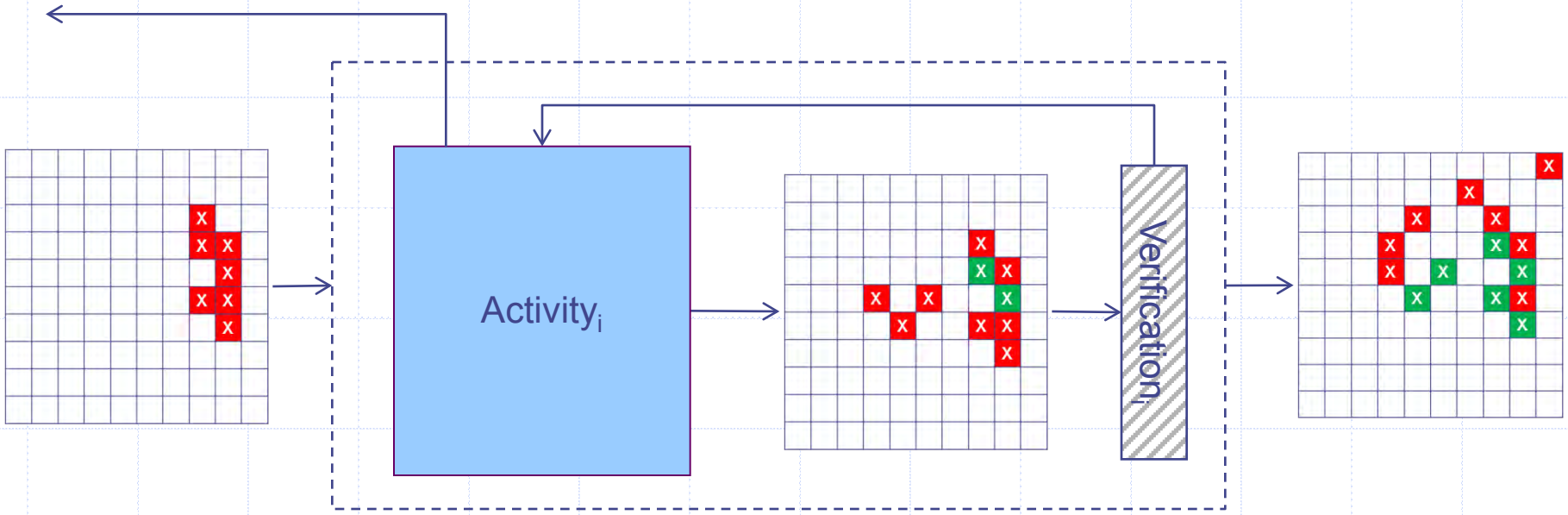
The hidden Factory in Software Process development



$$Yield = \frac{n_{system}}{(n_{system} + n_{leaked}})$$

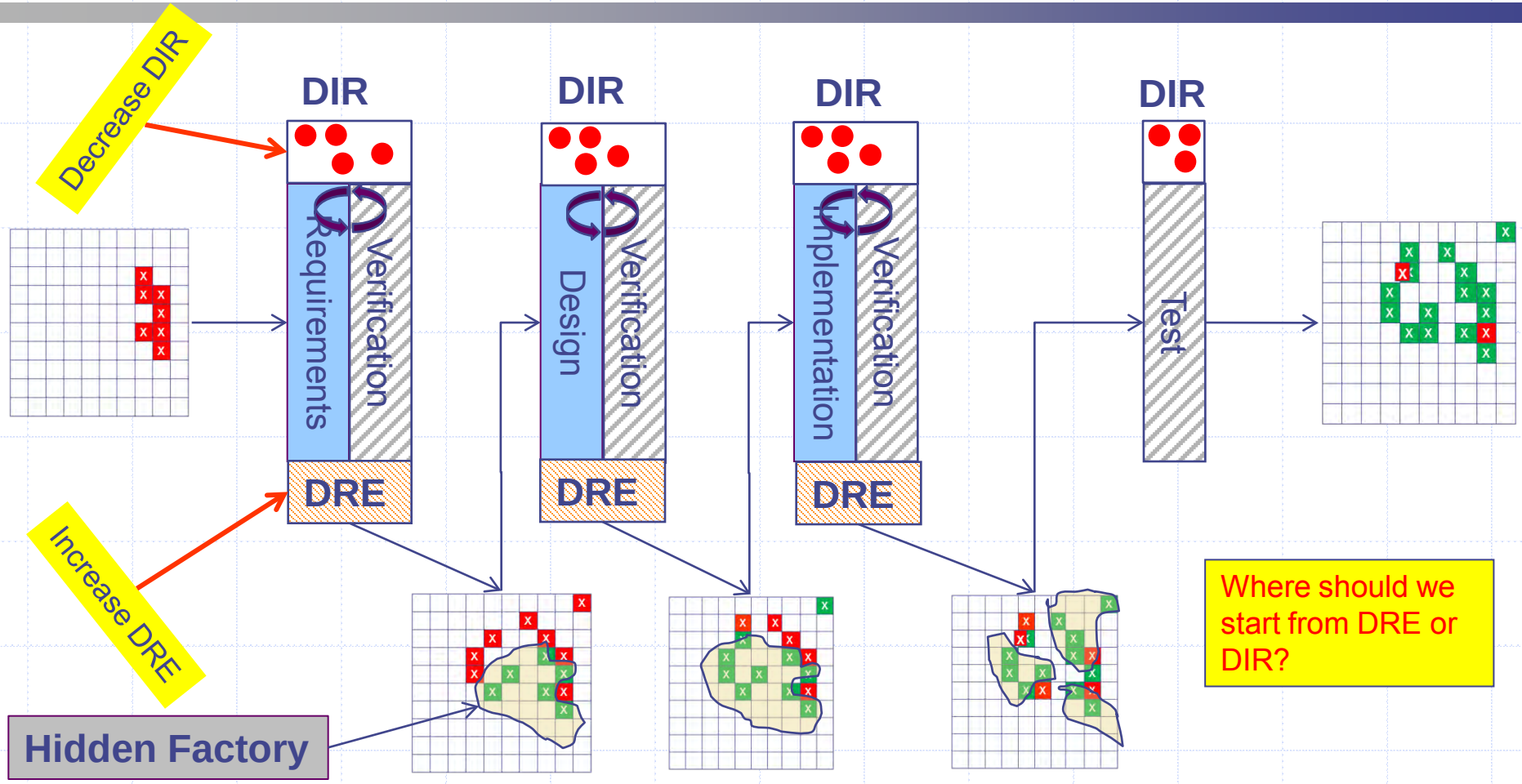
- The *Hidden Factory*
- Defects are not recorded prior to system test
- We are not recording the True Yield
- The Box called Software Development is a black box and hides other defects and reworks that could be avoided.

The hidden Factory in Software Process development



- **Activity$_i$ inherited a widget with 7 defects**
- **Activity$_i$ introduced 3 new defects, but also detected 2 existing defects to be fixed by Activity$_i$ or Activity$_{i-1}$, ...**
- **Verification$_i$ detected 4 defects, but introduced 3 new defects**
- **We have two types of Yields:**
  - Ability to produce non-defective units (equivalent to the classical Yield)
  - Ability to detect defects present at a given stage (mainly related to verification & validation activities)

The hidden Factory in Software Process development



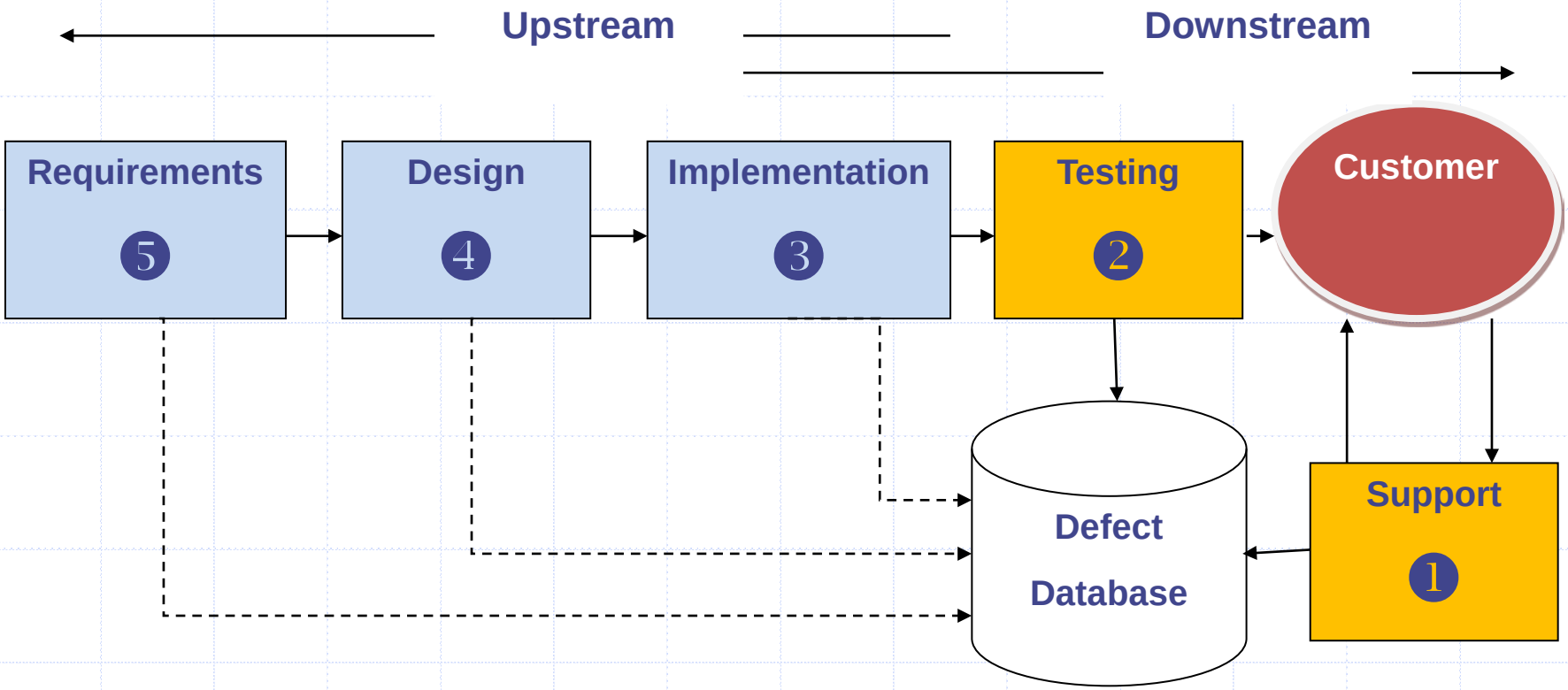
- **The activity yield and the total process yield depends on two parameters:**
  - The Defect Injection Rate (DIR)
  - The Defect Removal Effectiveness (DRE)

Reality of Six Sigma and Experimental approaches

Our observation

- **Understanding and characterising defects provides insight for process improvement**
  - Help prioritising effort
  - Provide a quantification of the “pain” (how big): Cost!
  - Type of techniques to prevent, contain or remove
- **The defects data (frequency and cost) is very much contextual**
- **Not many organisations are conscious of the cost of their defects**
- **The theory and even logic may dictate that we should start from Requirements and DIR**
- **In reality it is very difficult to define what is a defect for requirements and for Design... Because that means we know what is a “good” Requirement and a “good” design. Therefore we should:**
  - Start from defects that are close to the field
  - Characterise and profile defects to learn about the process
  - Start from problems related to effectiveness first and efficiency second

Stop the bleeding first...



In theory, there is no difference between theory and practice.... but in practice there is.

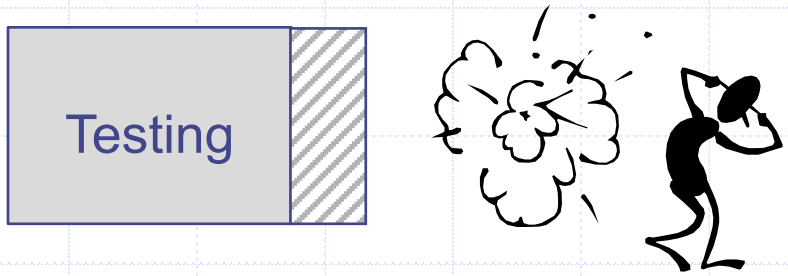
attributed to Jan L. A. van de Snepscheut/Yogi Berra

Six Sigma
Case Study

Case Study

- **Objective of the case study is to show how:**
  - The Six Sigma DMAIC roadmap is a continuous learning process
  - The problem perception and formulation keep changing throughout the entire DMAIC

- **The project started as: "*We have a problem with the testing process*"**

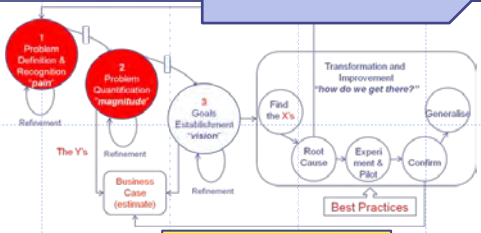


- **Questions to the audience:**
  - What are the typical problems for a testing process?
  - Think of a "pain" and why would that be a pain..
  - How would you quantify the problem ("pain")?

Problem Definition – “Pain”

DEFINE

- A typical dialogue...
  - -- *Our Testing process is not capable*
- What do you mean by “not capable”? Are there too many defects reaching the customer?
  - -- *YES*
  - -- *Actually NO... Customers are happy. However we spent too much time on the testing process.*
- Do you know how long your test process takes?
  - -- *NO... 35% to 45% of the development cycle*
- But that’s another problem it is not capability (effectiveness)... It is efficiency
  - -- *Yes, we want to reduce the testing cycle*
  - -- *May be we are testing too much*
  - -- *We were thinking about automating the test cases*
- Yes but these are solutions...



Exploratory

Is this normal? acceptable?

Questions to the audience:

- What would be your approach?

Problem Definition – "Pain"

systonomy

DEFINE

Exploratory

- Maybe there are (too) many defects leaking from previous phases?
  - -- Yes... But we have already tried code reviews and design reviews...

    The developers said they do not work.

    They said that we find only trivial defects and code style errors. These can be found automatically by code analysers

    ...

Maybe your code review is inadequate?

- Anyway, you agree that one potential reason that your testing process is taking too long or is expensive is the fact that we have too many defects leaking from the previous phases

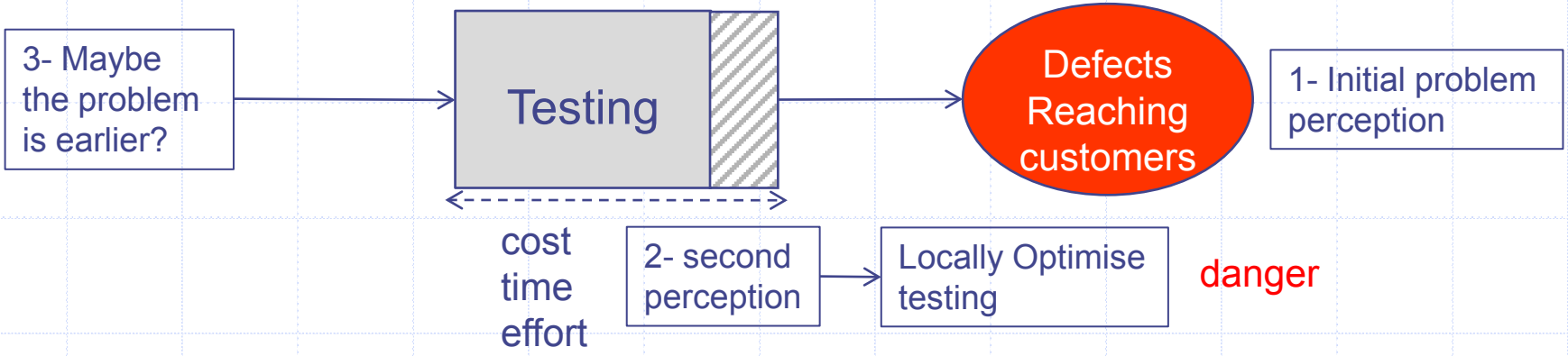
  The only way to know is learn more about the number of defects, the type of defects found during testing, how much they cost...

- Do we have this data?
  - -- Yes, not all of it

Problem Definition – “Pain”

DEFINE

Exploratory

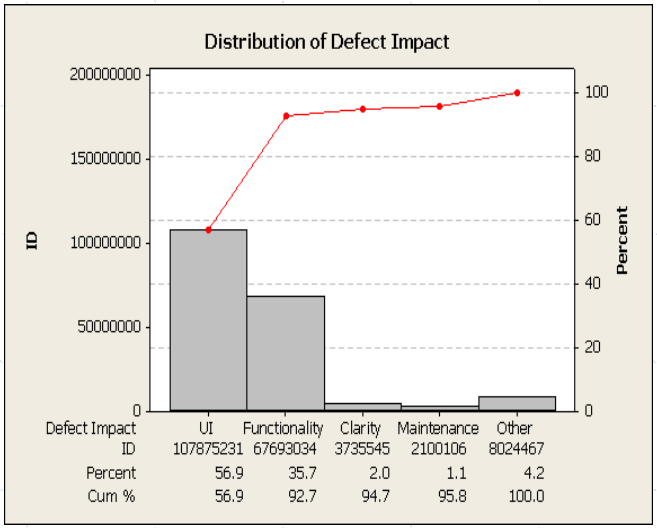


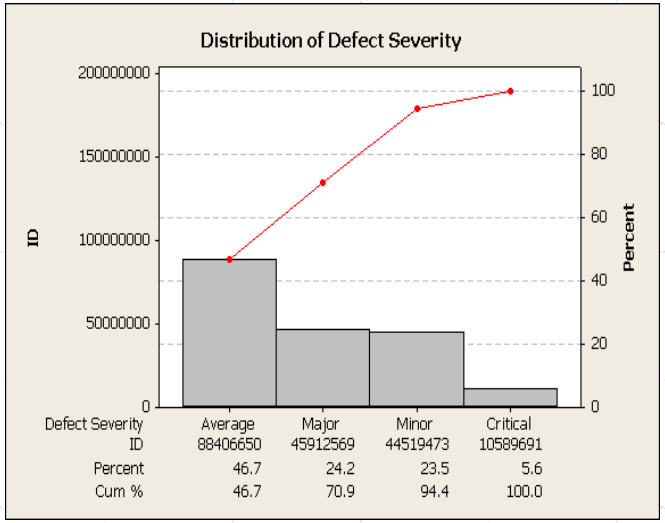
- **Initial Problem formulation:**

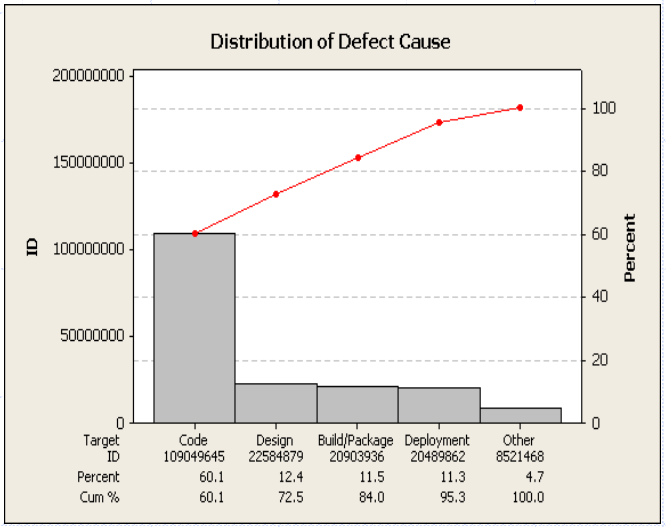
  Low process yield before QC (testing). This results in high number of defects that are discovered by the QC team relatively to the total number of defects found in process. The majority of the projects (76%) find between 70% to 100% of defects during the QC phase.

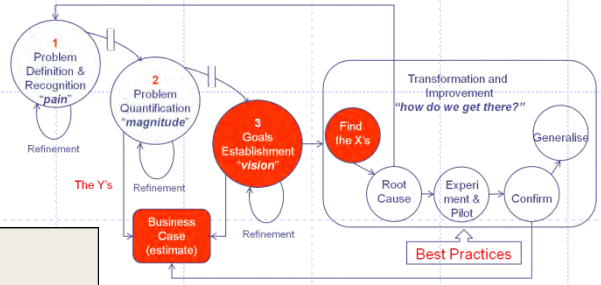
Defects Characterisation

MEASURE









92% of defects found during testing are either UI or Functional

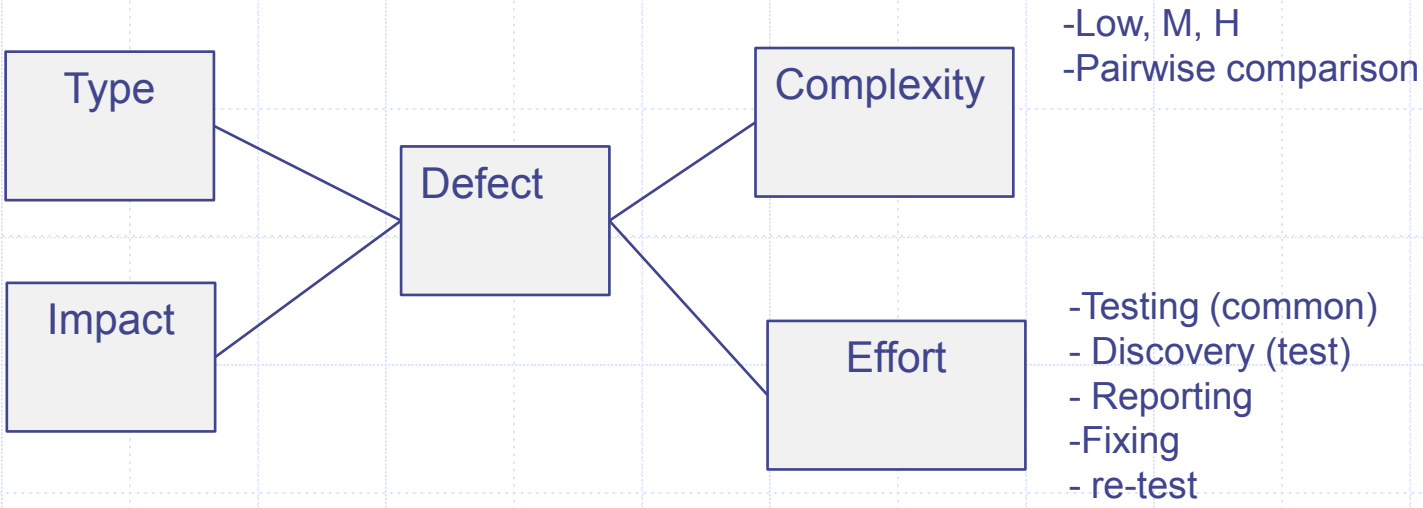
They both affects the User but may be originated from different sources

We can also question the quality of the defects categorisation

Elements of cost related to Defects

MEASURE

- Assess the defects on multiple dimensions

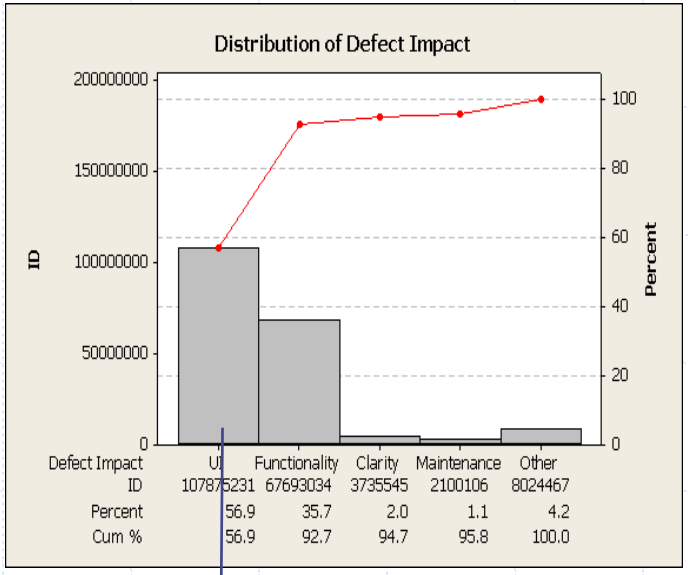


- Rough Estimate for the business case
  - Effort use Median with 5 estimation (97% probability that the median is within the min and max of the 5 values)

- Detailed estimate
  - Calibration phase
  - Estimation phase
  - Experimentation for assessing the capability of the defect categorisation (measurement)
    - Attribute Agreement Analysis

Root causes

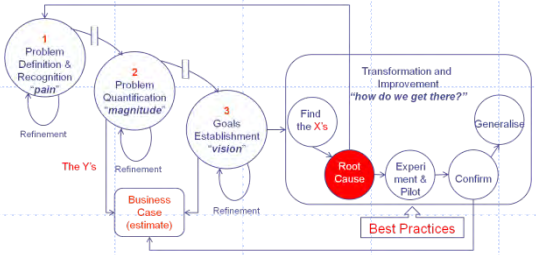
ANALYSE



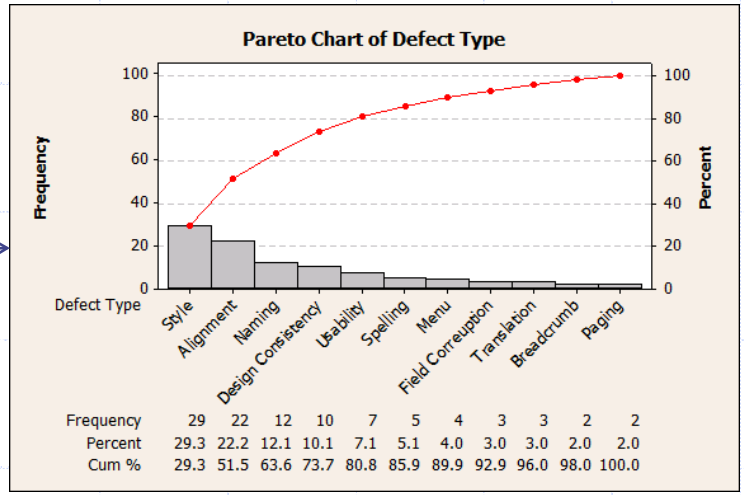
UI and Functional defects have probably different origins

You don't address and you don't verify UI defects and Functional defects the same way.

Two different streams

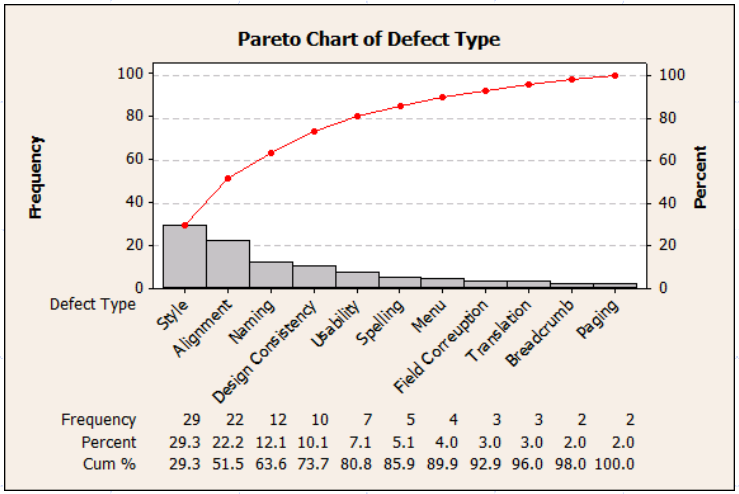


1	Alignment	Code
2	Design consistency	D
3	Field Corruption	F
4	Functionality	Ignored in UI
5	Naming	N
6	Menu	M
7	Paging	P
8	Translation	T
9	Spelling	S
10	Style	Y
11	Usability	U
12	breadcrumb	B



Root causes – problem focus

ANALYSE



4- the problem is likely in the UI design process

?

These types of defects will not be caught by review (maybe visual inspection)
UI defects are not worth addressing by reviews

UI Design

Code

V&V

Testing

Defects Reaching customers

1- Initial problem perception

3- Maybe the problem is with code containment

cost
time
effort

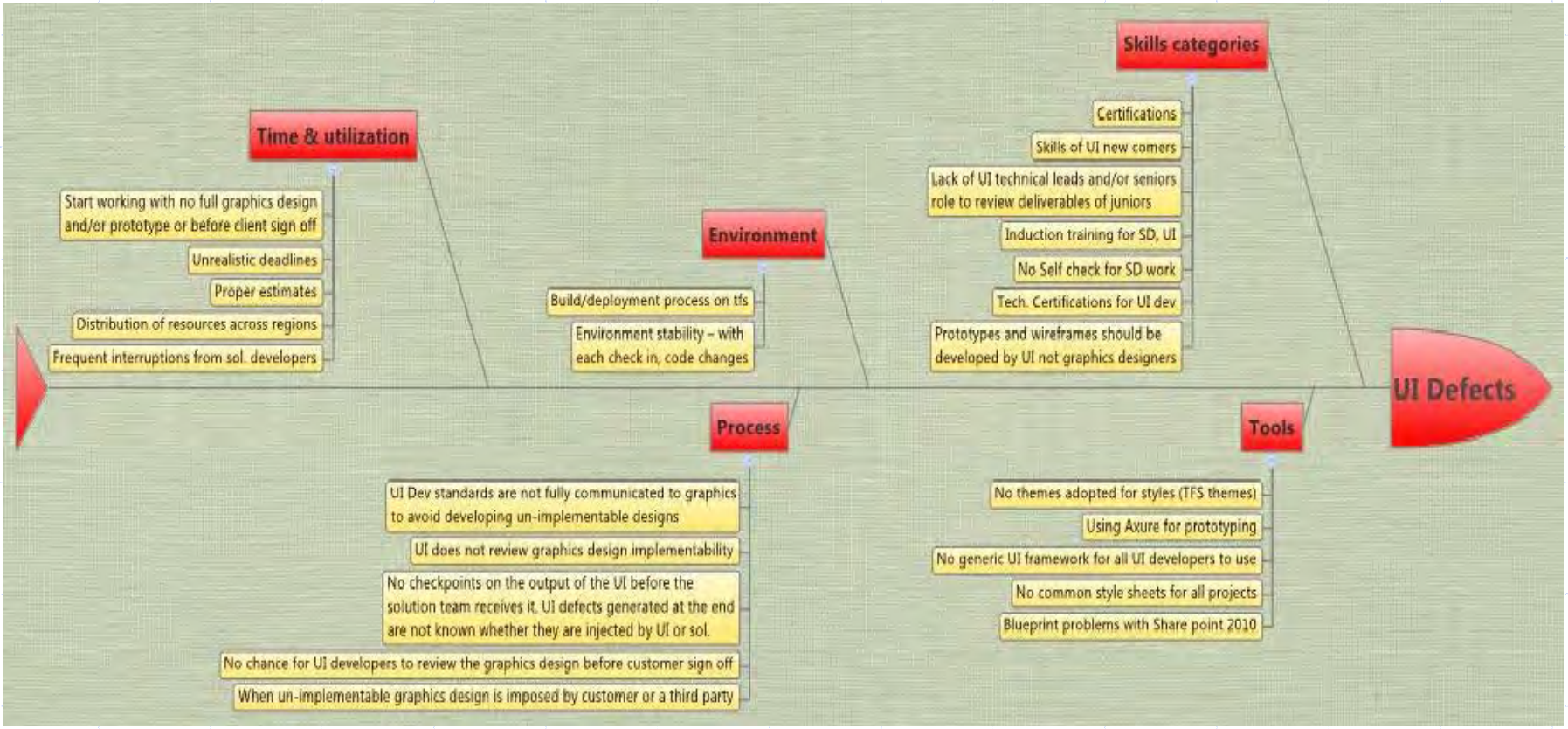
2- second perception

Locally Optimise testing

danger

Root causes – problem focus

ANALYSE

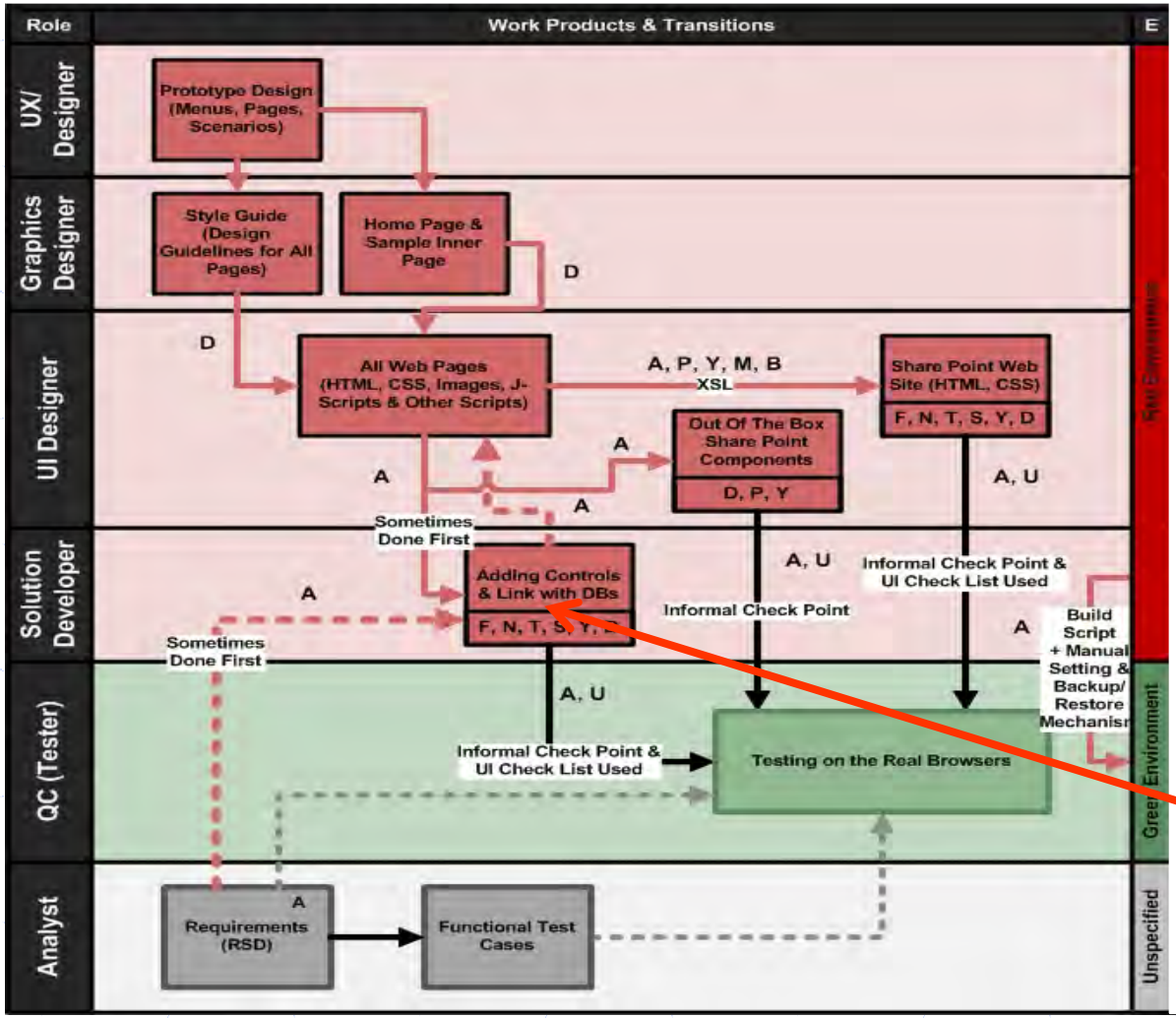


Detailed Process Map x Defects

Gemba 現場

ANALYSE

Observation



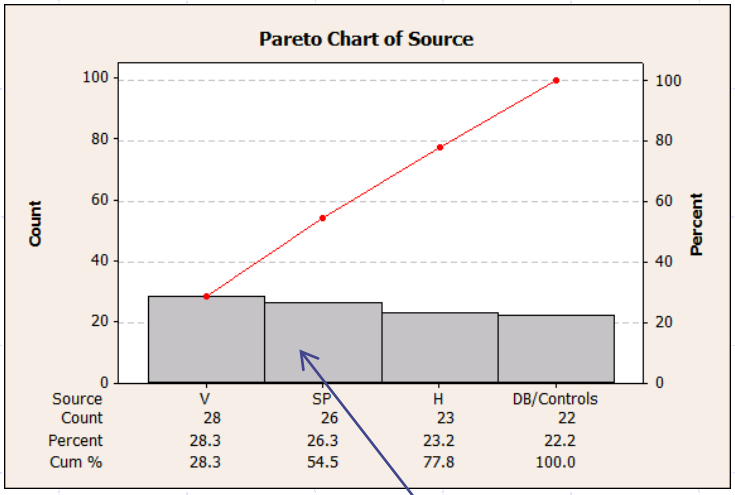
- **Defects occur either at:**
  - Handover from one level to another (V)
  - the transition from one tool/environment to another
  - Within the same activity
- **Which type of defects occur and at what level of interaction?**

Other factors influencing this step:
-- Complexity
-- Size
-- Number of components/widgets
-- Skills
-- Tools

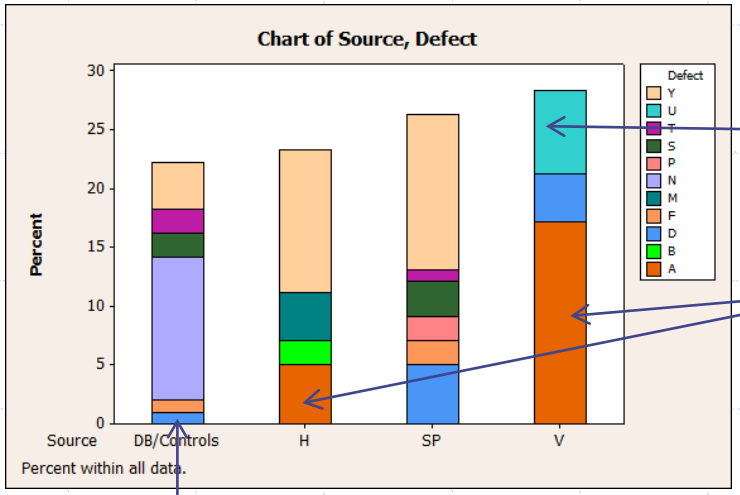
Data Analysis

ANALYSE

- **Defects occur either at:**
  - Handover from one level to another (V)
  - the transition from one tool/environment to another
  - Within the same activity
- **Which type of defects occur at what level of interaction?**



Large number of defects due to the technology/environment



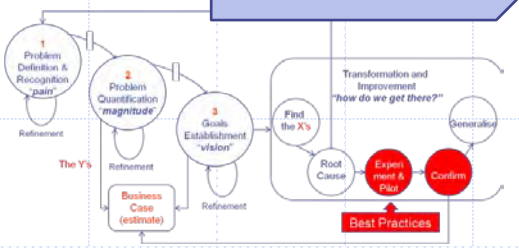
Usability problems at handover

Large number of alignment defects (trivial defects) due to handover

Human activity, consists in adding controls, links to DB, etc.

Solutions Identification and Evaluation

IMPROVE

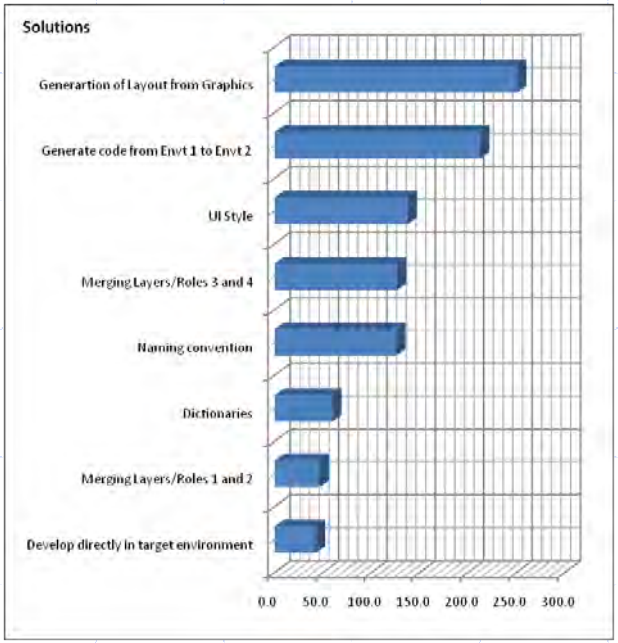


- **Sources:**
  - Handover
  - Transition
  - SP Technology
  - DB/Controls

Hypothesis

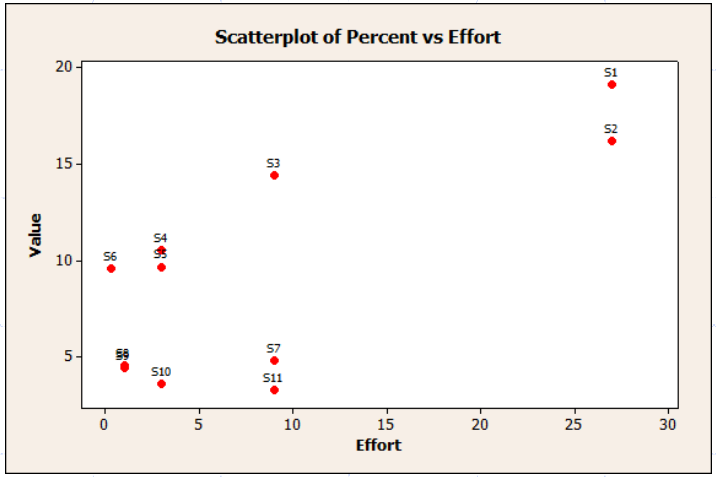
Solutions

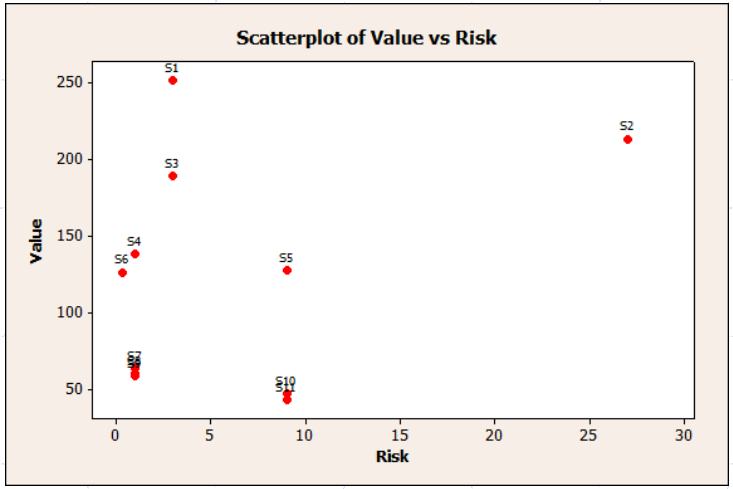
UI Defects	Importance	Generartion of Layout from Graphics	Generate code from Envt 1 to Envt 2	UI Reviews	Define UI Style	Merging Layers/Roles 3 and 4	Naming convention	Training/Education	Dictionaries	Establish Checklists	Merging Layers/Roles 1 and 2	Develop directly in target environment	Total	%
Field Corruption	3.0	L	M									M	21.0	02
Breadcrumb	2.0	L	M					L				M	16.0	01
Paging	2.0	H			L	M		M			M	H	56.0	04
Style	29.0			M	M	M				L			290.0	22
Alignment	22.0	H	H										396.0	30
Naming	12.0			M	L		H		M	L			204.0	16
Design Consistency	10.0	M			M	M	L	M		L	M	L	180.0	14
Usability	7.0			H	L			M		L	L		105.0	08
Spelling	5.0						L		M				20.0	02
Menu	4.0					L		L			L		12.0	01
Translation	3.0			L			L		M				15.0	01
Total		251.0	213.0	189.0	138.0	127.0	126.0	63.0	60.0	58.0	47.0	43.0		
%		19	16	14	10	10	10	05	05	04	04	03		
Cost/Effort		VH	VH	H	M	M	VL	H	L	L	M	H		
Risk		M	VH	M	L	H	VL	L	L	L	H	H		

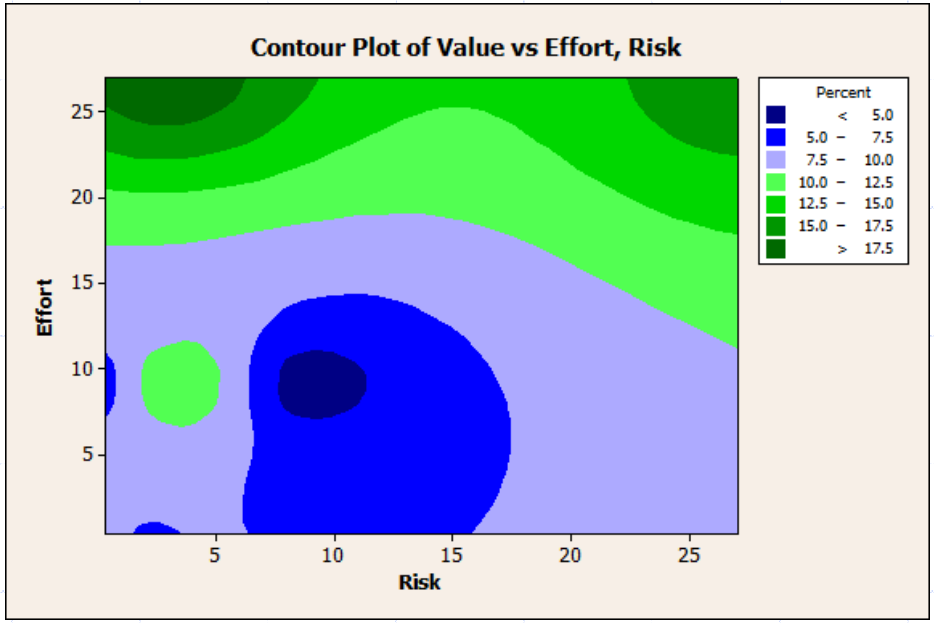


Solutions Identification and Evaluation

IMPROVE

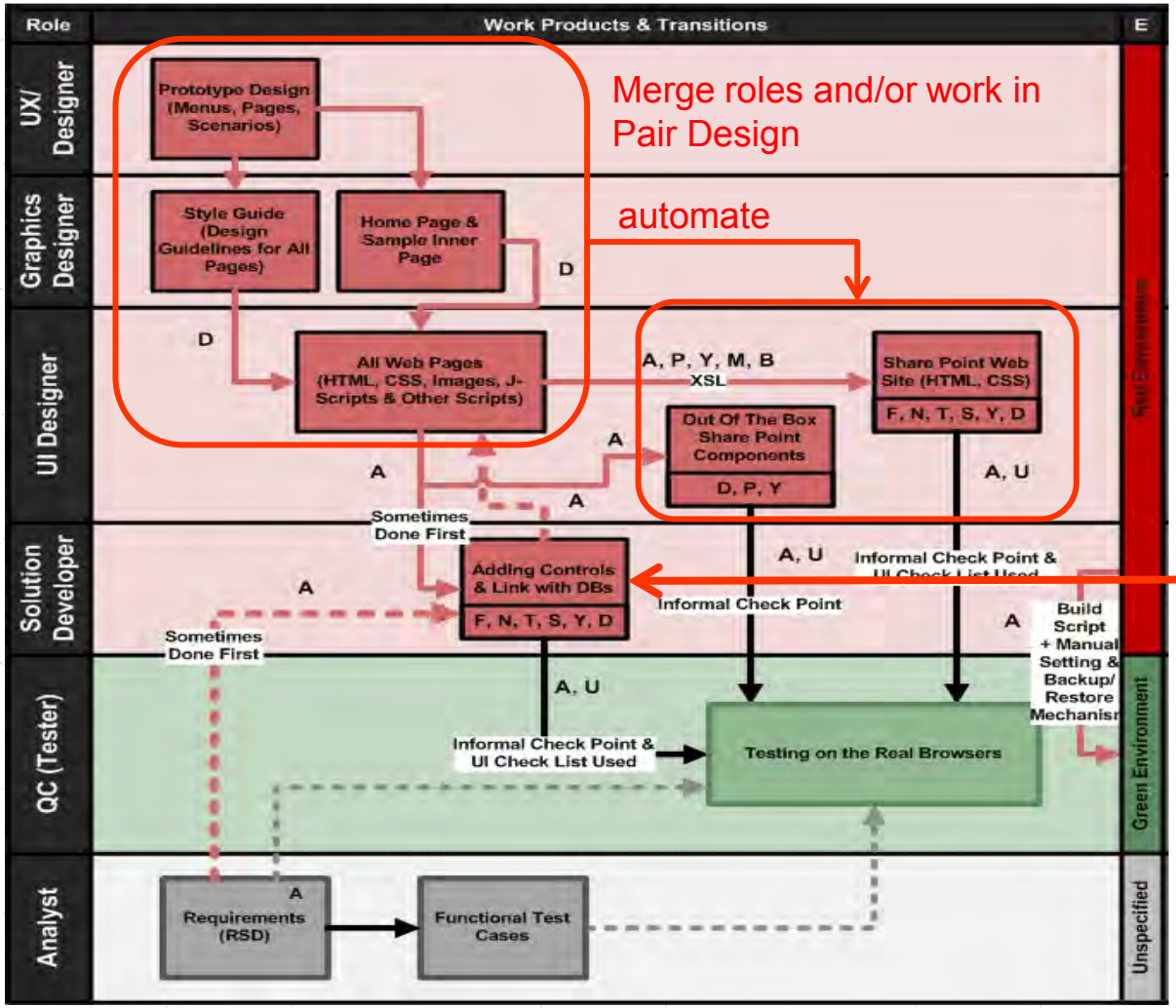


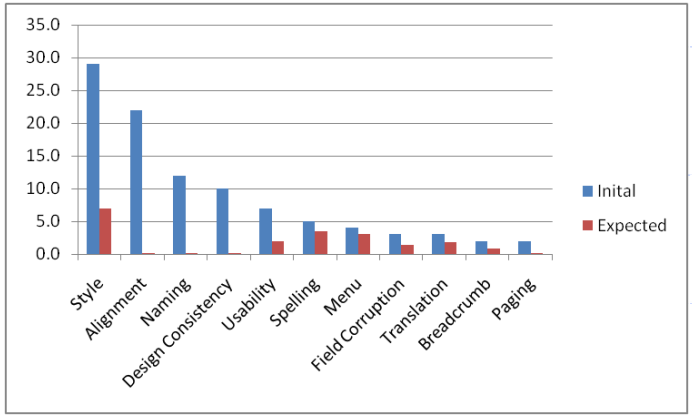




Process alterations and experiments

IMPROVE





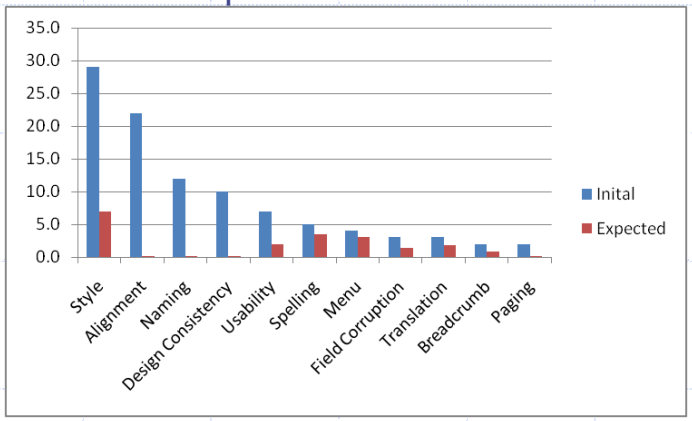
Checklists
Reviews/Usability Reviews
Education
Role merge is difficult
Due to cultural barriers

Improvement associated to all actions and not to single actions

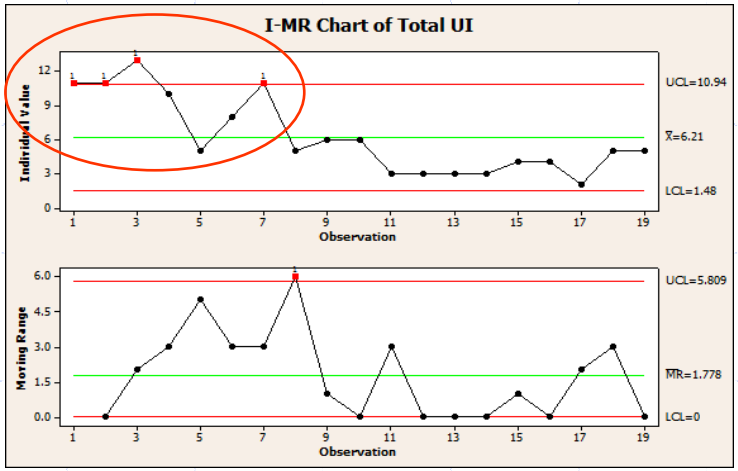
CONTROL: show and validate improvement

CONTROL

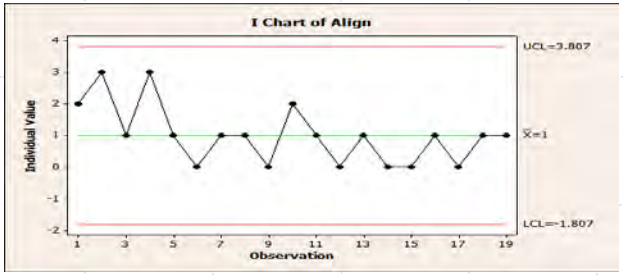
- A quick visual summary can show the actual improvement in effectiveness

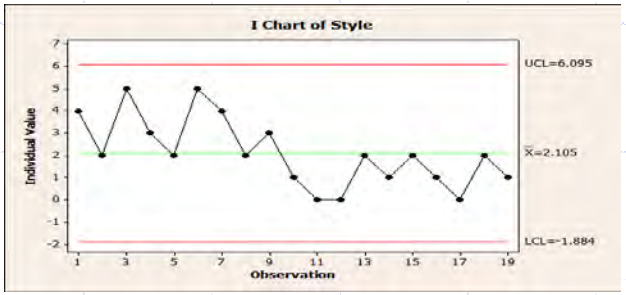


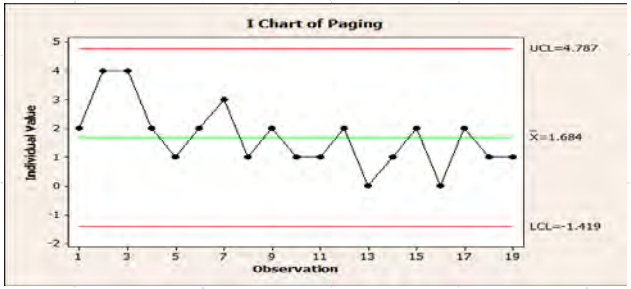
Learning and adaptation phase



Total UI defects per test cycle







UI defects per type per test cycle

Summary

- **The mother of all Six Sigma tools is *naive* questioning**
- **We don't take time to observe our processes**
- **Studying defects provide lot of insights on process improvements and applicable techniques**
- **Data is A-Political**
  - Test two alternatives and see what the data will say...
  - Drive things by consensus (even if the solution seems obvious)
- **Empirical software engineering is practical with lot of pragmatism**
- **Economics of software engineering is a key ingredient to Empirical Software Engineering**

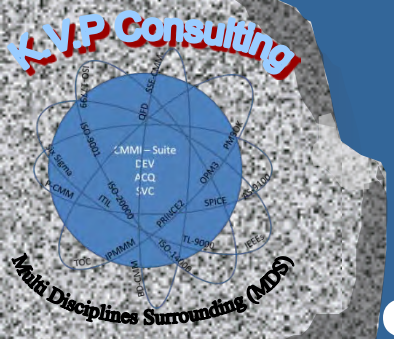
Other key takeaways...

- Do not focus on the tools, but rather on the principles
- Do not apply the method by the books
- Do not just Copy and Paste a practice or a technique
- Do not just dismiss a practice because someone has, understand why?
- Adopt the method to your business, context and environment
- Do not follow the process for the sake of the process
- Recognise that there is no perfect project
- Recognise that human are not perfect... and engineers and customers are humans
- Recognise the importance of human factors... and culture

Never forget the Business

References

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- [Harry 00] M Harry, and R Schroeder “Six Sigma: The Breakthrough Management Strategy Revolutionizing the World’s Top Corporations”, 2000
- [RAI 07] A. Rainer, “The Value of Empirical Evidence for Practitioners and Researchers”, in Empirical Software Engineering Issues, Critical Assessment and Future Directions, Internal Workshop, Dagstuhl Castle, Germany June 26-30, 2006 Revisited Papers, Springer-Verlag, pp. 24,2007.
- [OUD 05] Oudrhiri: Six Sigma and DFSS for IT and Software Engineering, TikciT Magazine, Q2’05 issue, 2005
- [OUD 06] Oudrhiri R, Pellizzetti F, Using maturity models for Six Sigma and strategy execution, IQPC 7 Annual conference, Amsterdam, 2006
- [SEA 07] C. B. Seaman, “Empirical Paradigm: Position Paper”, in Empirical Software Engineering Issues, Critical Assessment and Future Directions, Internal Workshop, Dagstuhl Castle, Germany June 26-30, 2006 Revisited Papers, Springer-Verlag, pp. 23,2007.
- [Weinberg 92-97] Weinberg G., Quality Software Management (all- volumes 1-4), Dorset Publishing, 1992-1997



How to Assure your Subcontractors Quality with Cross Constellations and Multi Models Inspiration

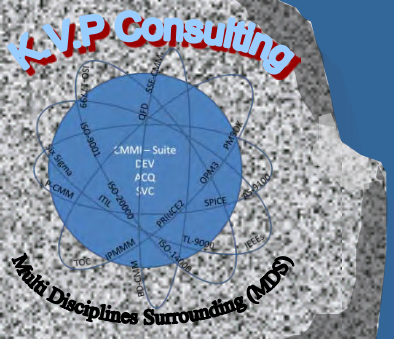
Continues Process Improvement Initiatives

Kobi Vider

K.V.P Consulting

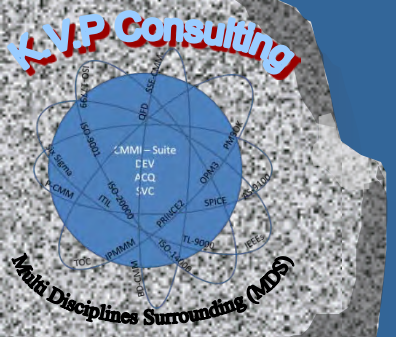
Kobi.Vider@hotmail.com

+972522946676



Agenda

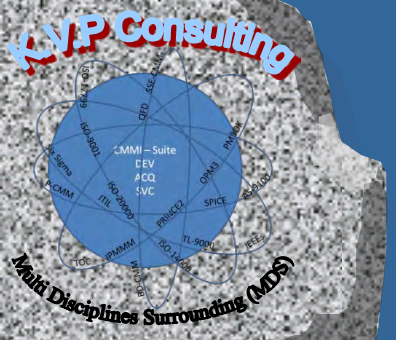
- Background
- The Challenge
- The Solution
- Tips For You



Background

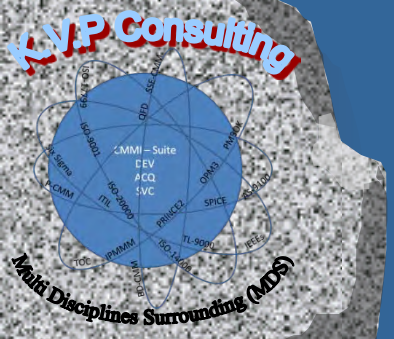
- Complex and large organizations or divisions that run a system / product lifecycle End to End, need to use more than just ‘one’ CMMI or on quality related standard.

- Our experience shows that these organizations are typically structured as matrix organizations, with functional teams or as a complex of independent smaller business units.



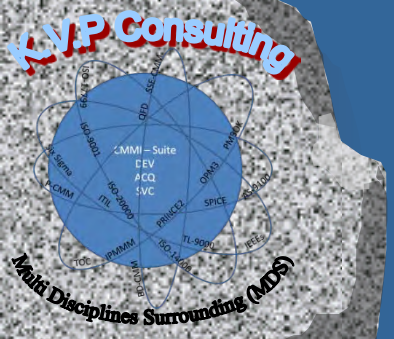
The Challenge

- This situation where organization is running a system lifecycle a matrix with internal or external contractors, with
  - With partial overall view in interactions and handshakes between these groups is introducing inefficient usage of
    - resources,
    - expensive maintenance of duplicate infrastructures
    - and Organizational Sets of Standards Processes as well as assets,
  - May result in less quality and impacting the end product / system.



The Challenge

- This situation where organization is running a system lifecycle a matrix with internal or external contractors, with
  - separate process improvements on different parts of the system / product lifecycle



The Challenge

- This situation where organization is running a system lifecycle a matrix with internal or external contractors = service providers, with
  - separate quality management systems and with compliance to different standards (e.g. AS9100c) and qualification (e.g. MIL-STD 217) on different parts of the system / product lifecycle

Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System

Following the Material Development Decision, the Milestone Decision Authority may authorize entry into the acquisition process at any point, consistent with phase-specific entrance criteria and statutory requirements

Material Solution Analysis Phase | Technology Development Phase | Engineering & Manufacturing Development Phase | Production & Deployment Phase | Operations & Support Phase

MDD | MS A | MS B | Post-CDR A | MS C | FRP DR | IOC | FOC | Disposal

Low-Rate Initial Production | Full-Rate Production/Deployment | Life Cycle Sustainment

Integrated System Design | System Capability & Manufacturing Process Demonstration

Joint Capabilities Integration & Development System (need-driven)

Initial Evolutionary Acquisition Strategy | Evolutionary Acquisition Strategy

Oversight & Review

Contracting

Major Products

Logistics/ Sustainment

Defense Acquisition System (event-driven)

Technical

Financial Management

Planning, Programming, Budgeting & Execution Process (annual-calendar-driven)

Military Departments and Defense Agencies

Office of the Secretary of Defense and Joint Staff

White House

Appropriated Funds To Support Contracts

Prototypes | Production Representative Articles | Low-Rate Initial Production Systems | Full-Rate Production Systems

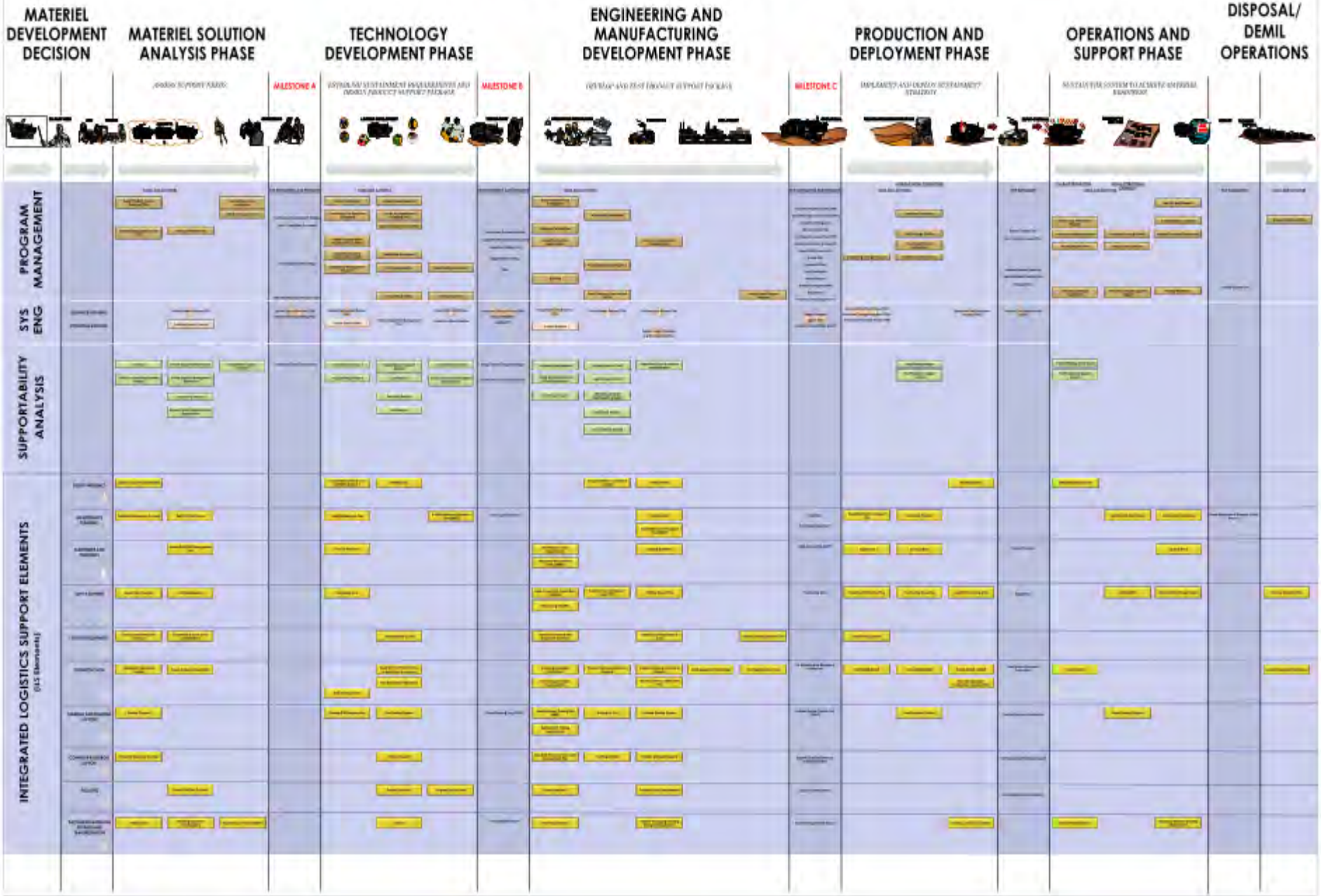
Technology Development Contract | Engineering & Manufacturing Development Contract | LRIP Contract | Production Contract

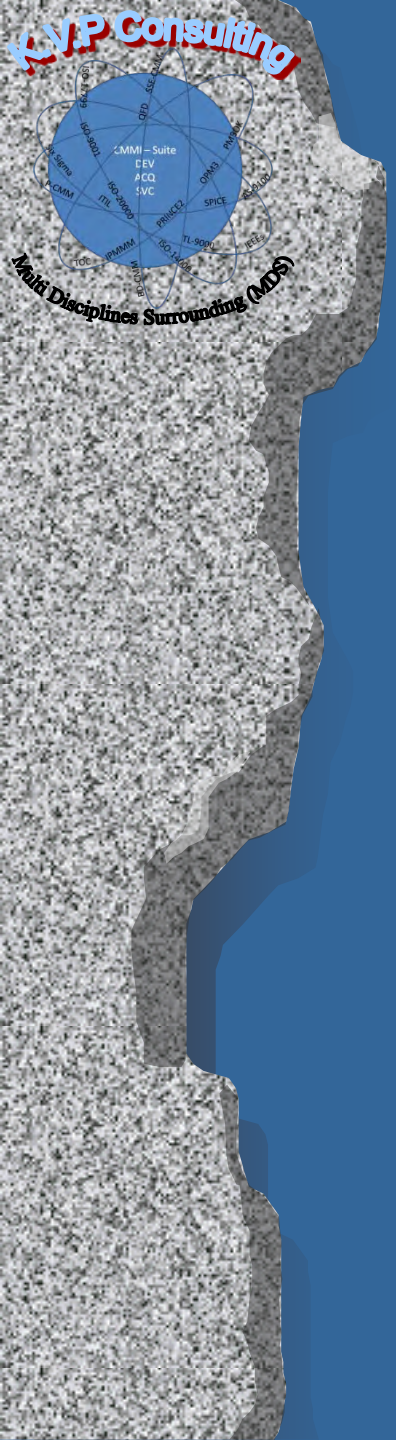
Material Solution

Budget Committees | Authorization Committees | Appropriation Committees | Authorization Bill Passed

DAU

LIFE CYCLE LOGISTICS CHART



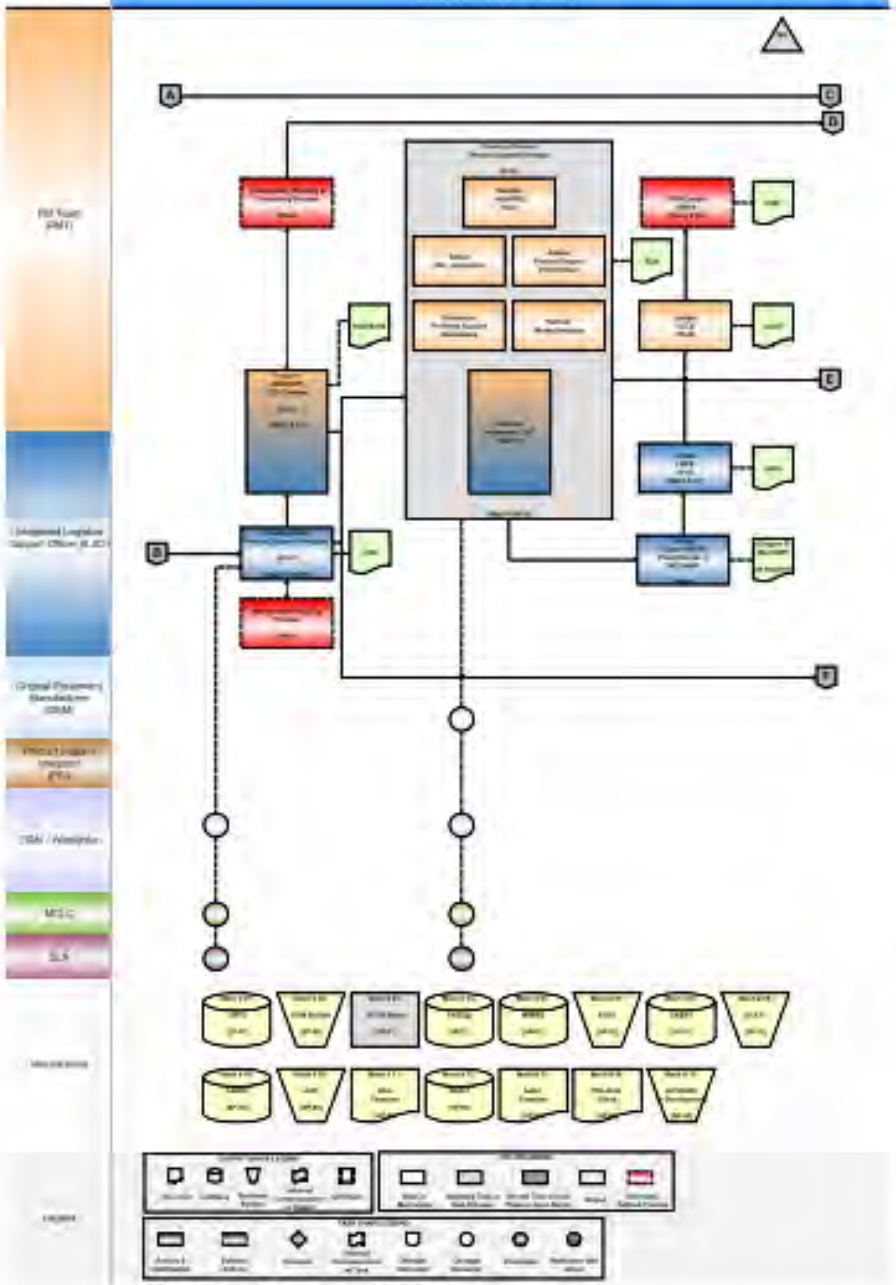


DRAFT

Performance Based Logistics (PBL)

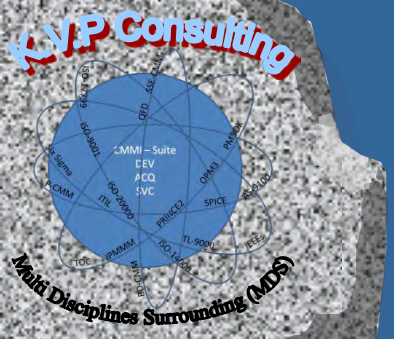
DRAFT

Support Planning



POC: Mr. Randall Shockey, MCSC ACLOG


PROGRAMS
COUNTERMEASURES
Non-Lethal Weapons
Nuclear
Chem/Bio Weapons
LO/CLO
Special Access Programs
Personnel Security
Industrial Security
Operations Security
Physical Security
Information Security
Critical Infrastructure
Foreign Disclosure
Electronic/Command & Control Warfare
COMSEC
Information Technology
Information Assurance
Transportation Mgmt
Emanations Security
Space
Anti-Tamper
Supplier Assurance
ABOUT THIS CHART
Example of Safety & Security Required Standards

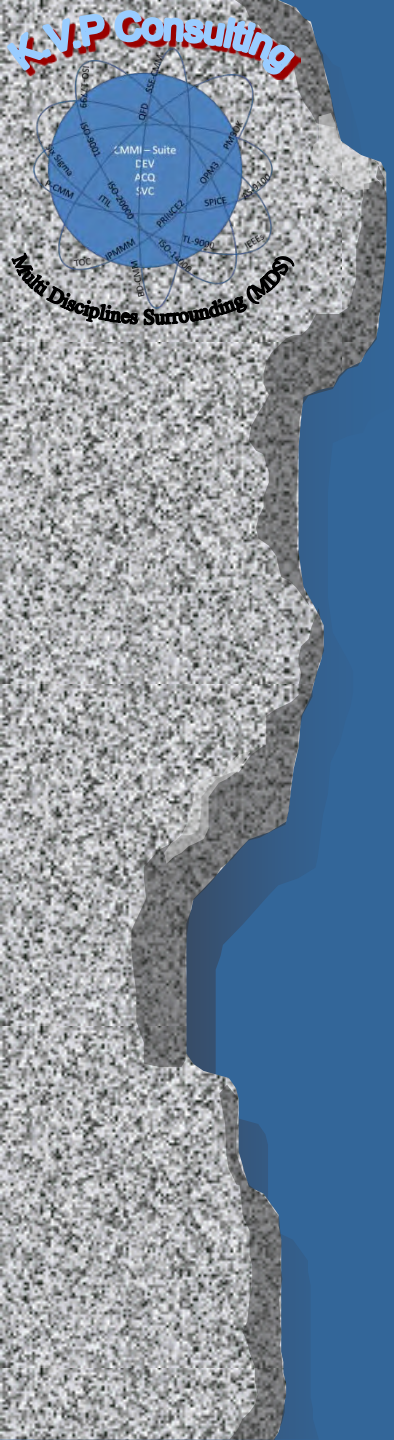


The Theory in the Models is Nice

However

Real Life is More Complicated

Much More


V.P. Consulting
CMMI – Suite
DEV
ACQ
SVC
Multi Disciplines Surrounding (MDS)

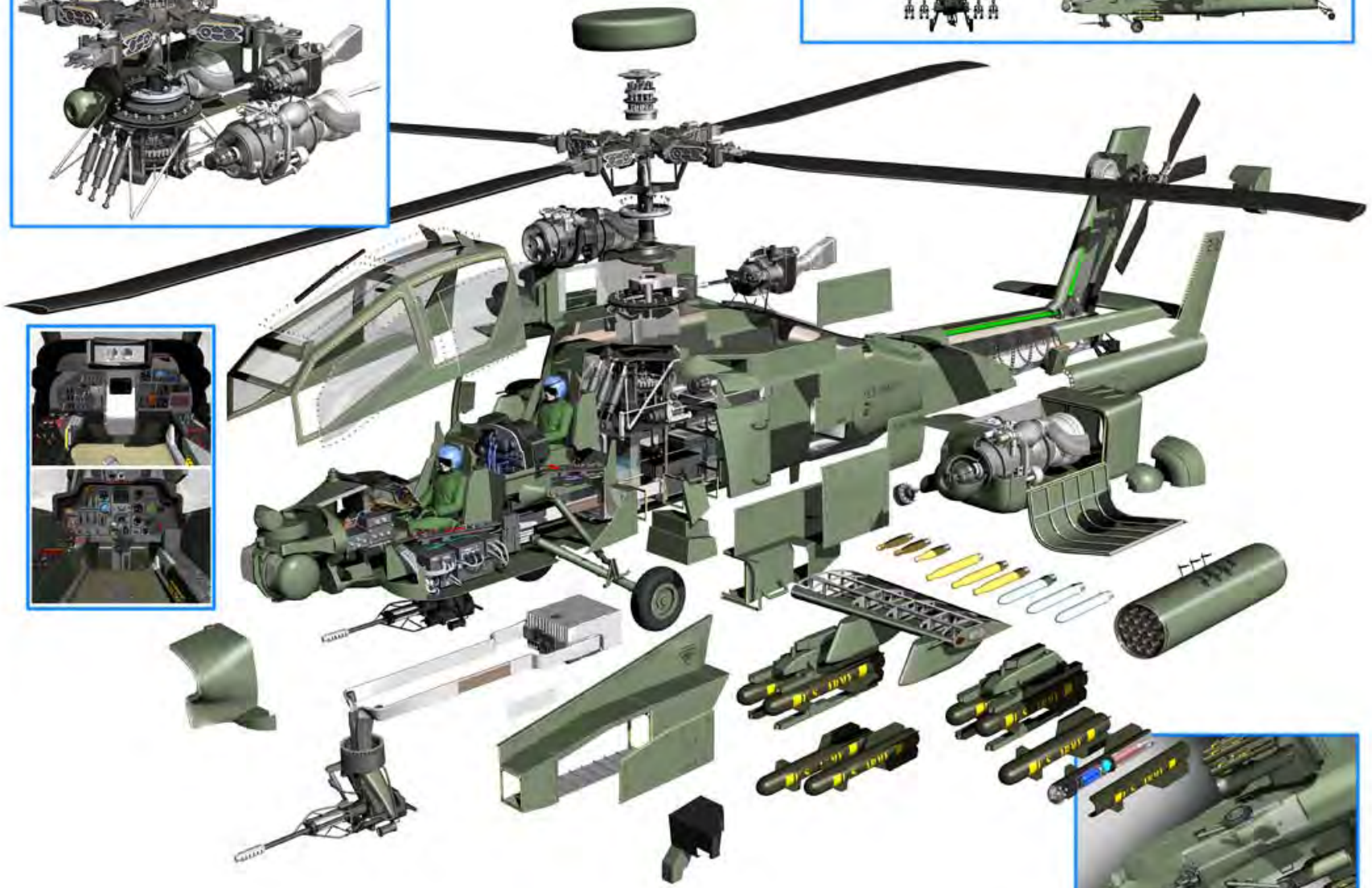




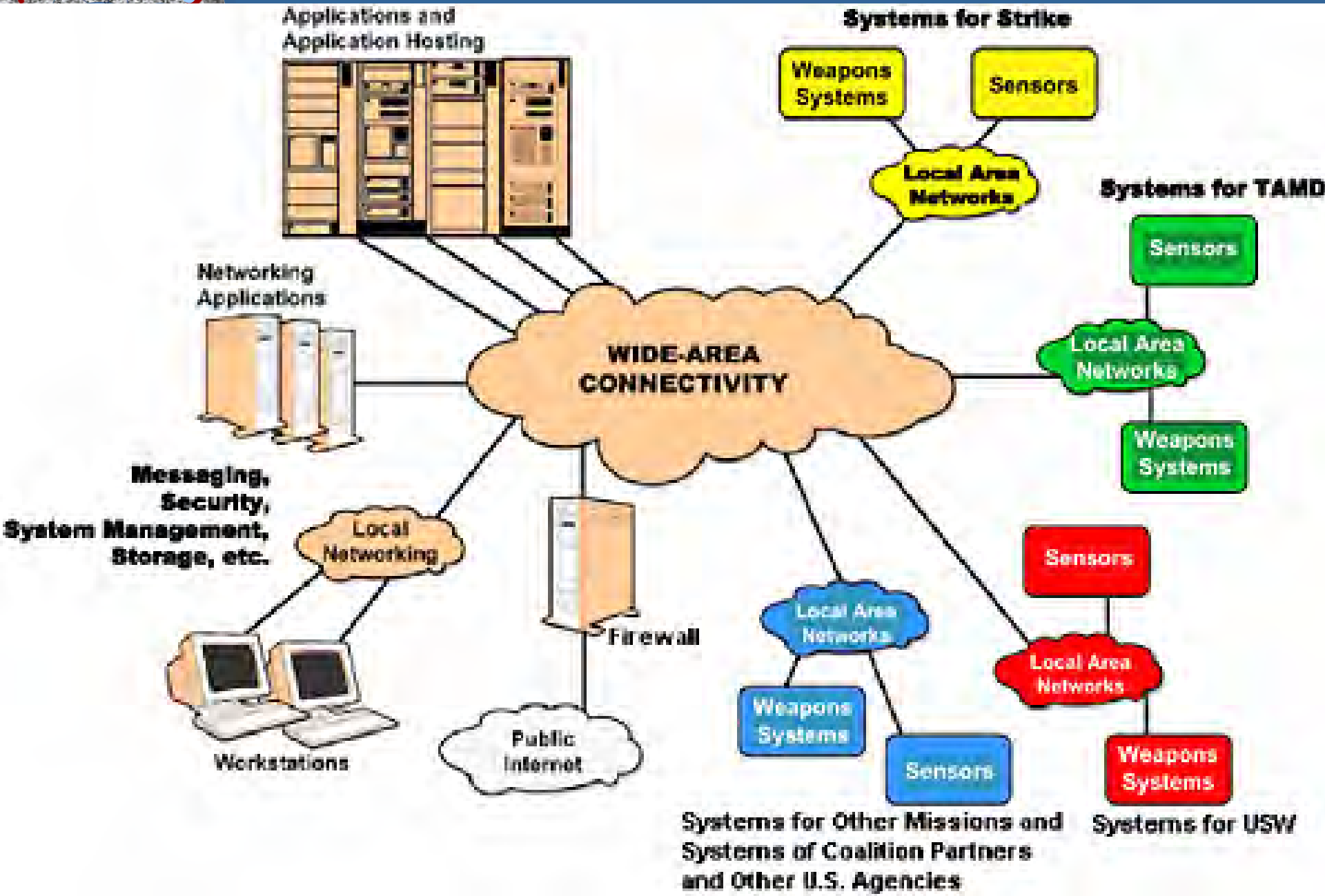






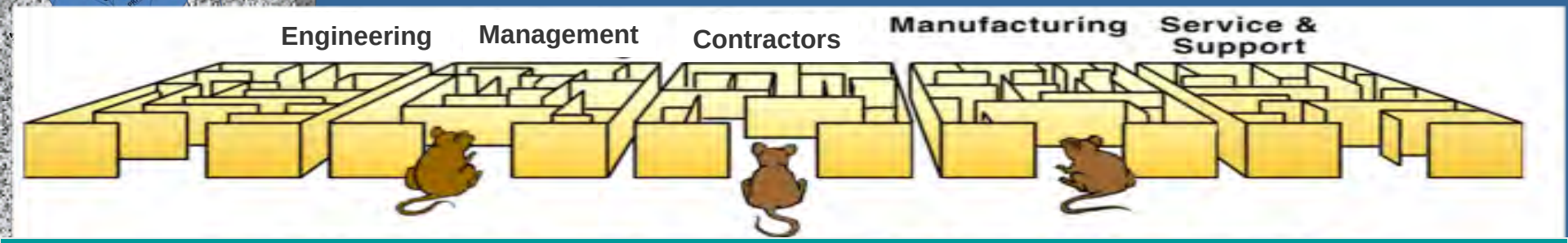


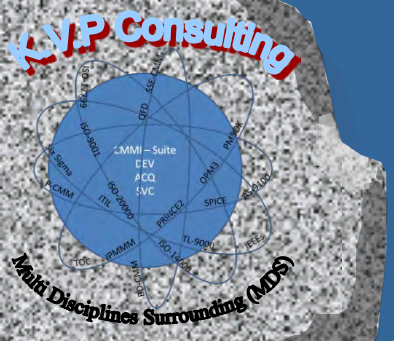



Applications and
Application Hosting
Systems for Strike
Weapons Systems
Sensors
Local Area Networks
Systems for TAMD
Sensors
Networking Applications
WIDE-AREA CONNECTIVITY
Local Area Networks
Weapons Systems
Messaging, Security, System Management, Storage, etc.
Local Networking
Firewall
Sensors
Local Area Networks
Local Area Networks
Weapons Systems
Sensors
Weapons Systems
Workstations
Public Internet
Systems for Other Missions and Systems of Coalition Partners and Other U.S. Agencies
Systems for USW

V.P Consulting

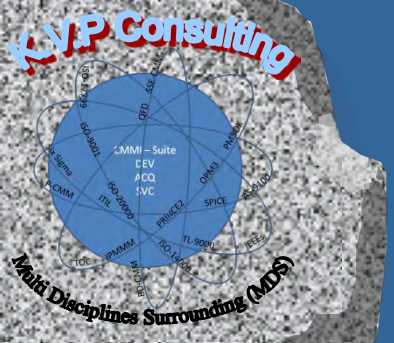



Engineering
Management
Contractors
Manufacturing
Service &
Support



The Case Study Organization

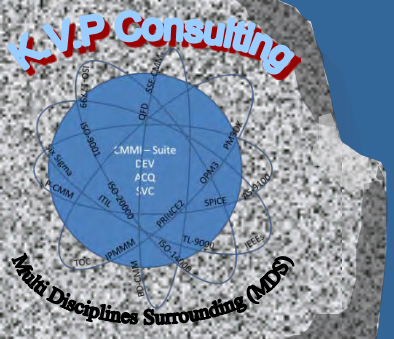
- Government Agency
- Structure and Size
  - 6 Senior Managers
  - ~250 Project / Program Managers (running ~450 tasks / projects per year)
  - ~900 In-house Development, Service and Maintenance Personal
  - ~2000 External Contractors
  - Internal R&D Team
  - Internal Reliability and Performance Team
  - Internal maintenance and support units
  - Internal manufacturing and assembly units



Common Failures - 1

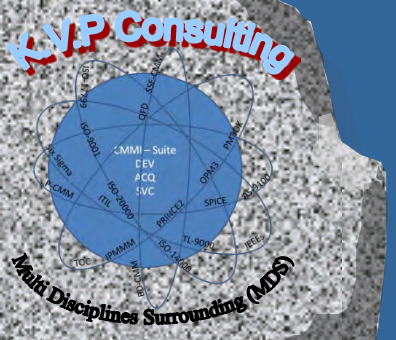
Organizational risk events are predominantly managerial, not technical.

- Lack of defining business objectives in quantitative terms and structure
- Inadequate definition of 'Good Enough' level
- Inability to differentiate different business objectives and success factors for the different domains and lifecycle phases
- Inadequate resource usage and adjustment to Plan and Objectives
- Failure to identify and manage risks
- Poor or mismanaged service / operational requirements
- Uncontrolled baselines, no configuration management
- Misunderstood business / operational needs and objectives



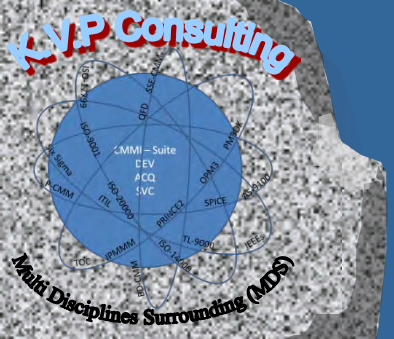
Common Failures - 2

- Poor contractor acquisition or management
- Lack of skills, capability and training
- Poor planning and tracking
  - Value Stream
  - Equipment
  - Resources
  - Finance
- Poor / misuse of data and measurements
- Inability to estimate accurately
- No quality assurance / control
- Poor communications



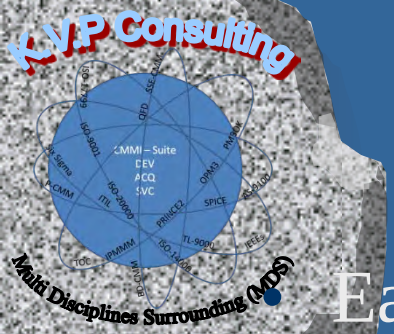
The Operational Need

- Management capability level from both professional and knowledge level
- Performance and reporting norms
- Self management and self discipline maintaining personal professional and knowledge capabilities
- Individual and team discipline
- Cooperation and knowledge and resource sharing
- Appropriate visibility of information, data and capabilities
- Quality of readiness and preparedness for performing mission



The Operational Need

- Centralized resource management and appropriate utilization and usage of it
- Multidimensional management (future planning, unit strategy, short term objectives, the immediate objectives)
- Initiating, developing and implementation management of new processes and technologies
- Balanced planning and deploying new processes and tools improvements and new technologies in a measured way that will quantify the improvement vs. expectations
- Information, data and communication security



The Operational Need

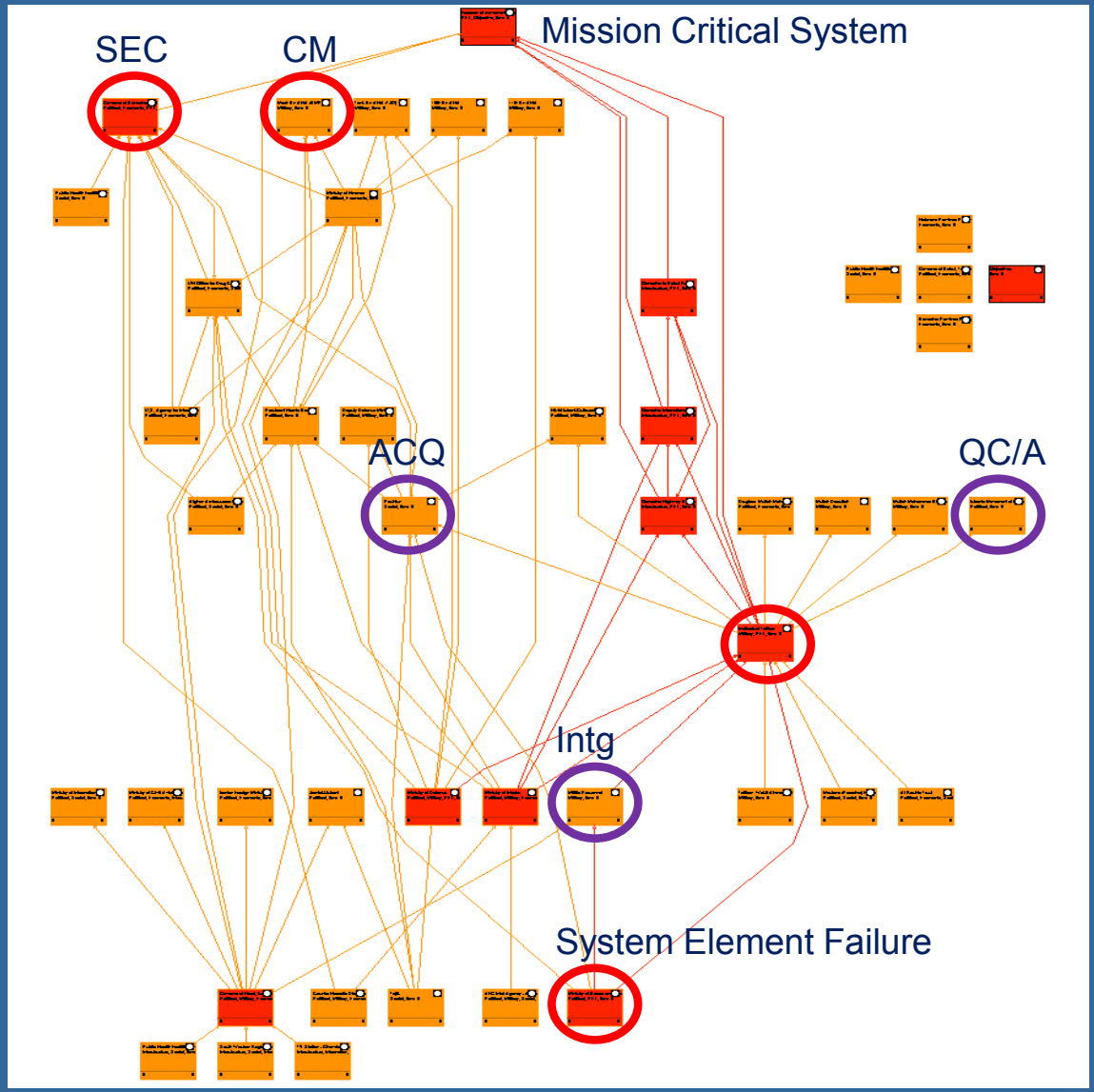
Each person working in the implementation organization will need to do the following:

- Access the processes descriptions
- Understand the lifecycle at a top level
- Understand in detail of the processes that he or she performs

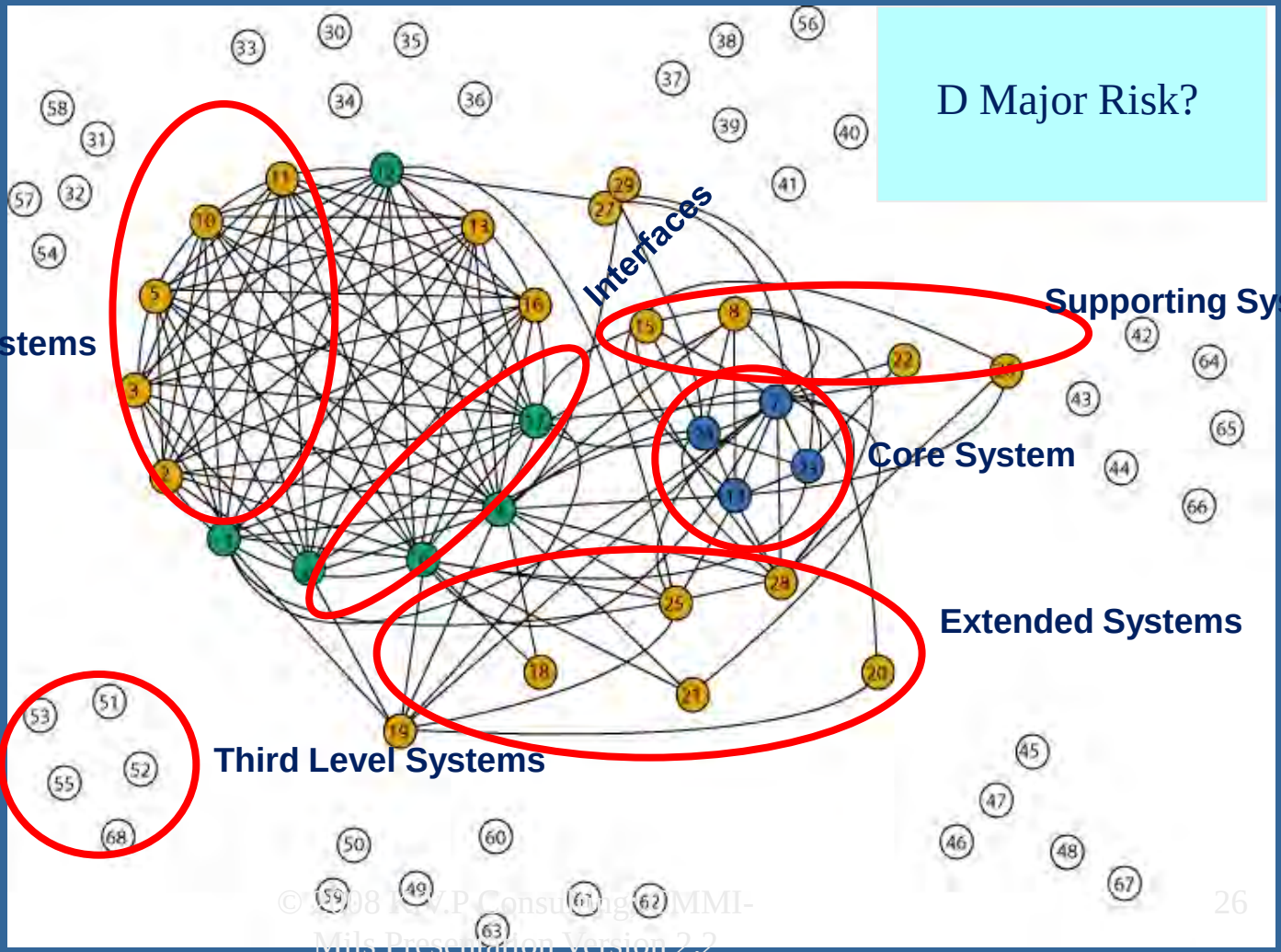
In addition, managers must do the following:

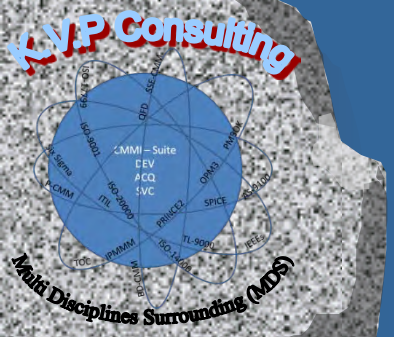
- Understand the lifecycle at a top level
- Understand the leadership change management expectations in detail
- Understand how to lead the unit using the new processes
- Access historical measurement data for all processes and product versions performance
- Support implementation of new processes in their own surroundings
- Remove roadblocks to implementation

A Complex Effects-based Environment



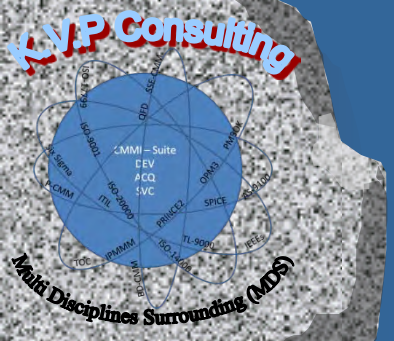
Military Combat Services Support Challenges in the Battlefield C4ISR Systems





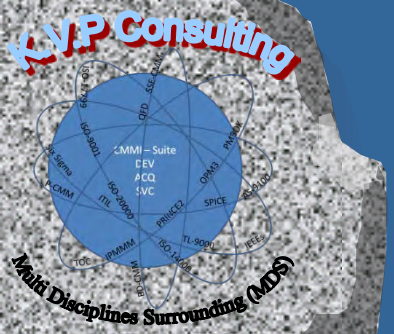
The Approach to the Solution Concept

- Best practices in the model focus on activities for providing quality services to the customer and end users
- To identify improvement targets in main lifecycle areas such as operations, information, governance, people and organizational structure, portfolios, project execution, and finance
- Select processes that are critical to the system success such as stakeholder management, technical interfaces and integration



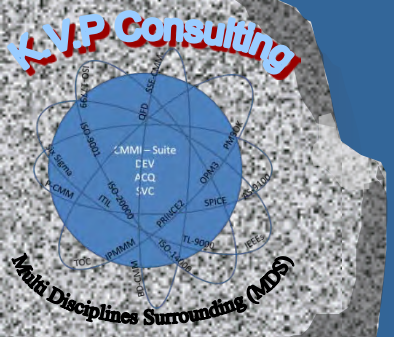
The Approach to the Solution Concept

- Build an action plan composed from the following main steps
  - Organizational map
  - Functional team and groups size and role in the lifecycle
  - Full lifecycle map
  - Setting improvement targets
  - Gap analysis
- Suggesting to the senior management to address the lifecycle and process (as a whole) as a complex of crossing interfaces and to add additional content to the lifecycle map (as a layer)



The Conceptual Solution

- Building on contingency theory, it outlines a comprehensive framework suggesting a fit between the level of Mission interoperability and environmental as well as internal contingencies.
- Moving from the current environment of basic process and way of thinking toward a more controlled and measured process to reduce the overwhelming amount of information that build decisions

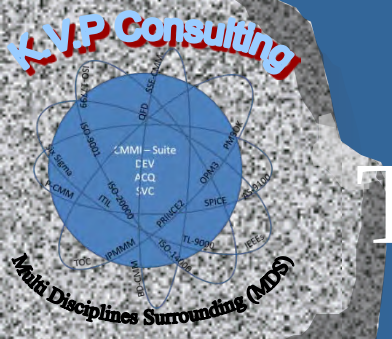


The Conceptual Solution

- We have found that Maturity Models and practices combined with some other industry standards and methods as a new integrated approach can be used as tools to leverage procedures to support the lifecycles and the organizational business objectives and capability, readiness and preparedness to achieve improvement and excellence.

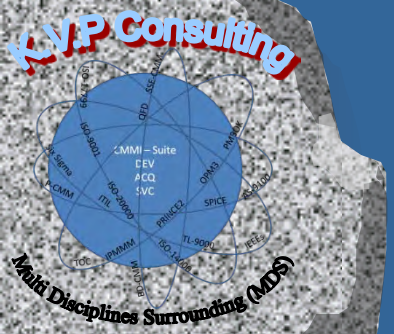


http://wiki.exoplatform.com/xwiki/bin/download/Main/WebOS+concept/web_as_a_platform.png?heigh



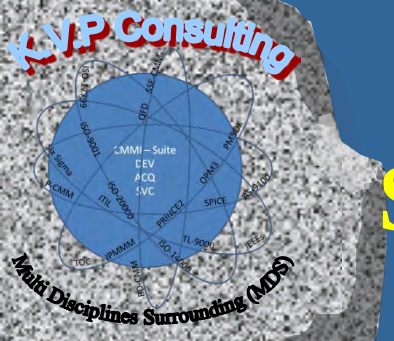
The Proposed Solution Concept

- Using the CMMI-SVC as an overall umbrella, to:
  - Increase results and effectiveness
  - Reduce quality related activities costs by reducing overlaps and choosing the appropriate parts only as part of the ‘whole’
  - Reduce administration costs by improving the ability to manage the lifecycle network
  - Converged working network helps businesses to save procurement costs of infrastructure



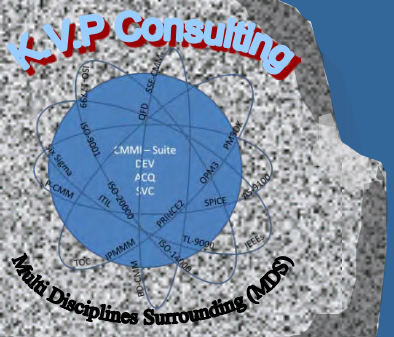
Process Improvement Effort Objectives

- Group Target is Process Improvement:
  - Increase Processes Efficiency
  - Increase Budget utilization
  - Reduce Cost of Poor Quality
  - Increase Uniformity in Processes
- Leading Standards to Compliance with
  - Internal Quality Standard
  - EFQM
  - CMMI Suite

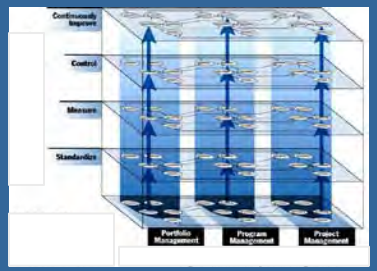


Supporting Quality Standards Scope

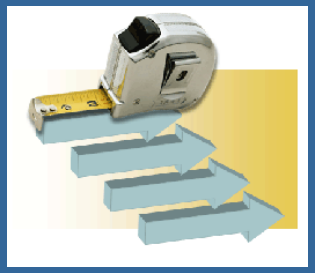
- All Groups
  - Smart Grid
  - ISO 25999
- ACQ PMs / PMO
  - PMBOK
  - DoD 5000.01 & 5000.02
- Maintenance and Service
  - MIL-STDs
  - ISO 14000
  - OHAS 18000



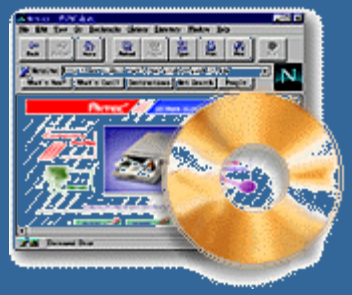
Supporting Quality Standards Mapping



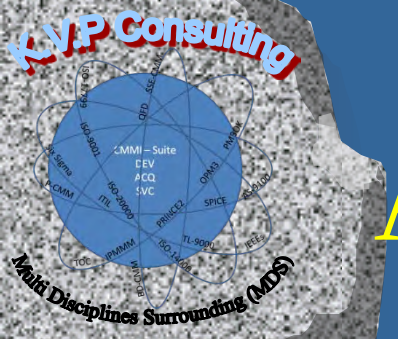
SGMM



Tool



Slides



Additional Standards Elements

(applied internally and to contractors)

- ISO 9001-2008 = 216
- OHSAS 18001 = 132
- ISO 27001 = 126
- ISO 27002 = 134
- ISO 14001 = 139
- PMBOK 3rd = 804
- OPM3 = 1402
- DoD-AF V2 = 40
- ISO 20000 = 196
- ITIL V2.0 = 741
- Six Sigma = 148
- MIL-STDs = 127
- EFQM = 804

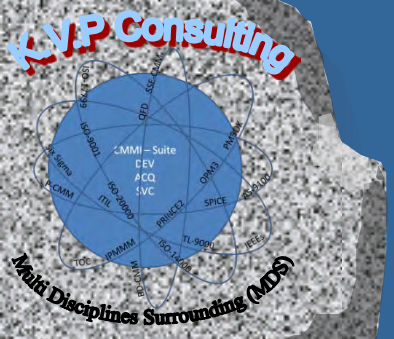
Total of

5009

‘Additional’ Elements

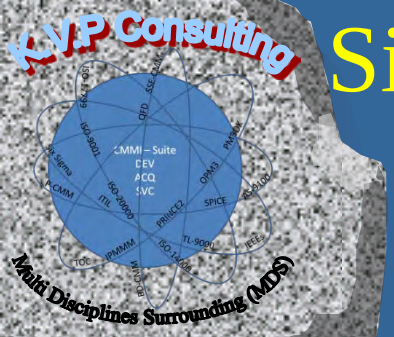
IS IT?

- Not Counted
  - Domain Specific Regulations
  - LEAN
  - SOA-MM



Some Mapping Examples

Six Sigma Correlation Snapshot



14 out are covered

DEFINE

MEASURE

ANALYZE

IMPROVE

CONTROL

REQM SSD ORP DAR RSKM

CAM CT QPM M&A IRP

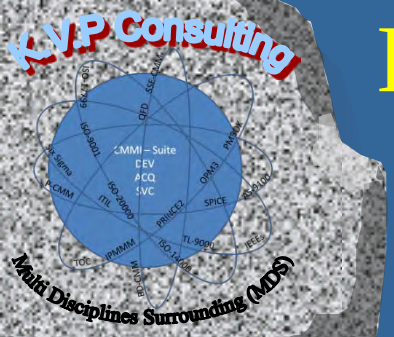
SAM OPD SST PPQA SCON

PMC OPF IPM OID SD

PP CM STSM CAR

CMMI V1.2

ISO 9000:2008 Correlation Snapshot



20 are covered

Management Responsibility

Measurement Analysis & Improvement

Product Realization

Resource Management

Quality Management System

DAR

RSKM

CAM

M&A

IRP

SCON

SST

SD

PP

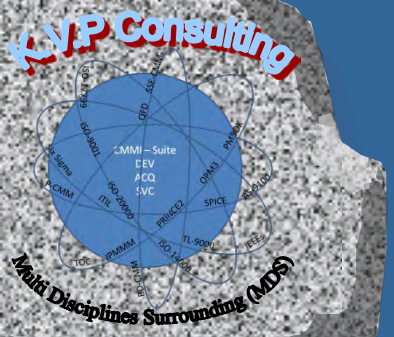
CM

STSM

CAR

CMMI V1.2

ITIL – CMMI Correlation Snapshot



Service Delivery

- Financial Management for IT Services
- Capacity Management
- IT Service Continuity Management
- Availability Management
- Service Level Management

REQM SSD OPP DAR RSKM

CAM OT QPM M&A IRP

SAM OPD SST PPQA SCON

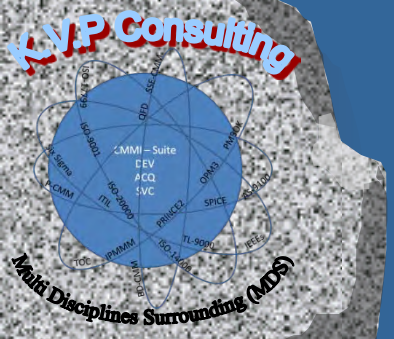
PMC OPF IPM OID SD

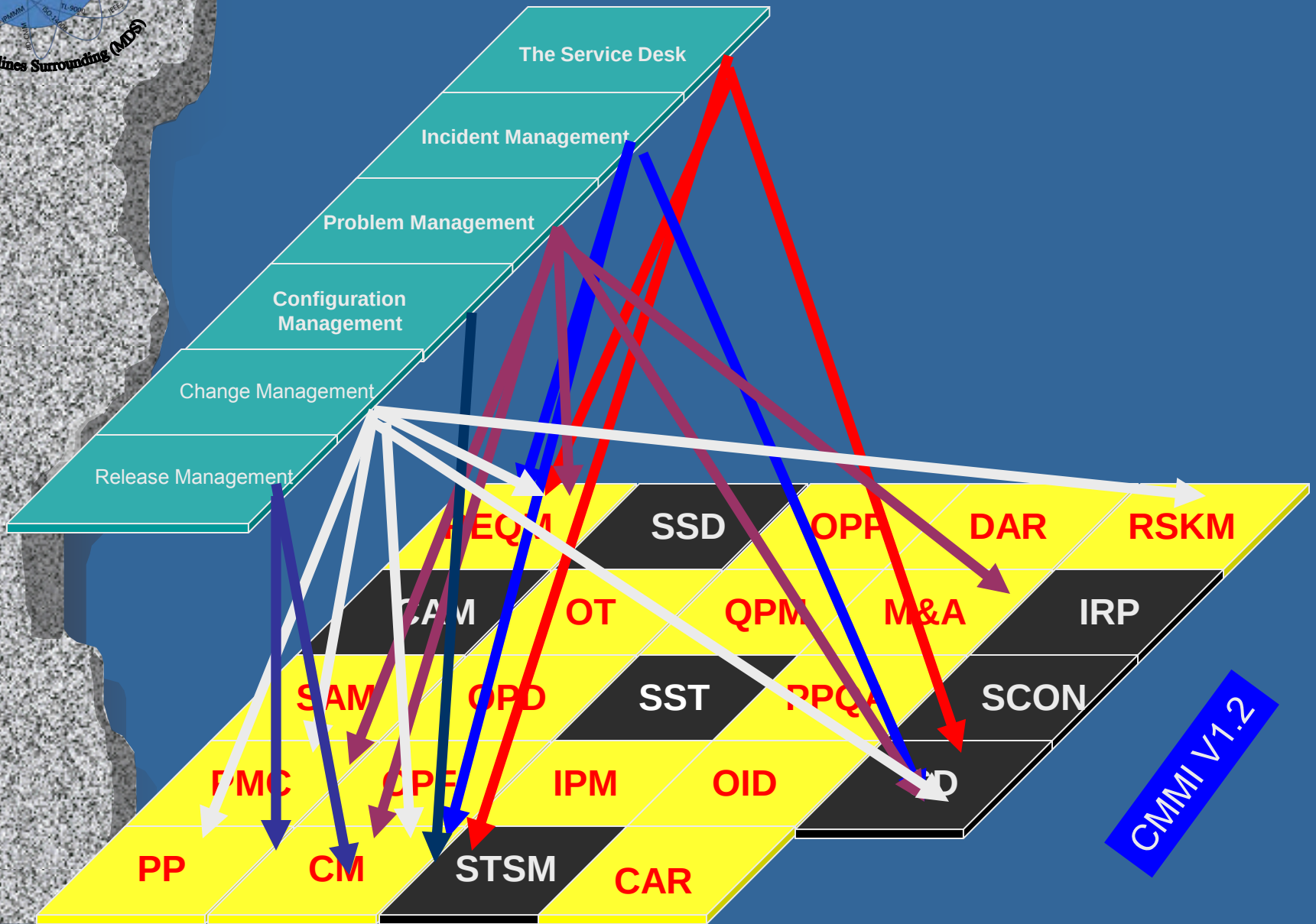
PP CM STSM CAR

CMMI V1.2

ITIL – CMMI Correlation Snapshot

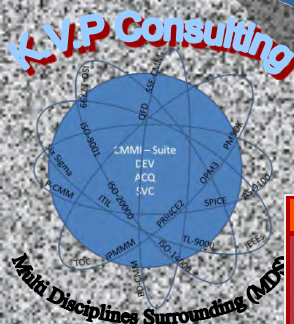
Service Support





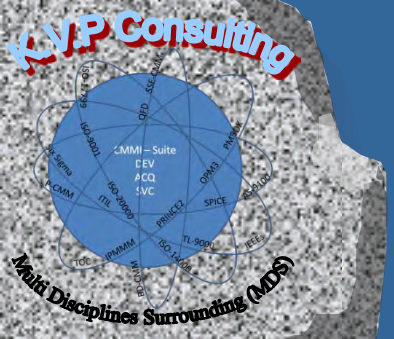
CMMI Harmonization Process Tool





First Level Filtering (PA Level)

DEV	ACQ	SVC
Project Planning	Project Planning	Project Planning
Project Monitoring and Control	Project Monitoring and Control	Project Monitoring and Control
Process and Product Quality Assurance	Process and Product Quality Assurance	Process and Product Quality Assurance
Requirements Management	Requirements Management	Requirements Management
Configuration Management	Configuration Management	Configuration Management
Measurement and Analysis	Measurement and Analysis	Measurement and Analysis
Organizational Process Definition +IPPD	Organizational Process Definition	Organizational Process Definition
Organizational Process Focus	Organizational Process Focus	Organizational Process Focus
Organizational Training	Organizational Training	Organizational Training
Decision Analysis and Resolution	Decision Analysis and Resolution	Decision Analysis and Resolution
Integrated Project Management +IPPD	Integrated Project Management	Integrated Project Management
Risk Management	Risk Management	Risk Management
Quantitative Project Management	Quantitative Project Management	Quantitative Project Management
Organizational Process Performance	Organizational Process Performance	Organizational Process Performance
Causal Analysis and Resolution	Causal Analysis and Resolution	Causal Analysis and Resolution
Organizational Innovation and Deployment	Organizational Innovation and Deployment	Organizational Innovation and Deployment
Supplier Agreement Management		Supplier Agreement Management
Requirements Development	Acquisition Requirements Development	
Validation	Acquisition Validation	
Verification	Acquisition Verification	
Technical Solution	Solicitation and Supplier Agreement Development	Capacity and Availability Management
Product Integration	Agreement Management	Incident Resolution and Prevention
	Acquisition Technical Management	Service Continuity
		Service Delivery
		Service System Development
		Service System Transition
		Strategic Service Management



The Most Effective Practices to Ensure Contractors Qualification and Quality

Based on ~1600 tasks and projects analysis

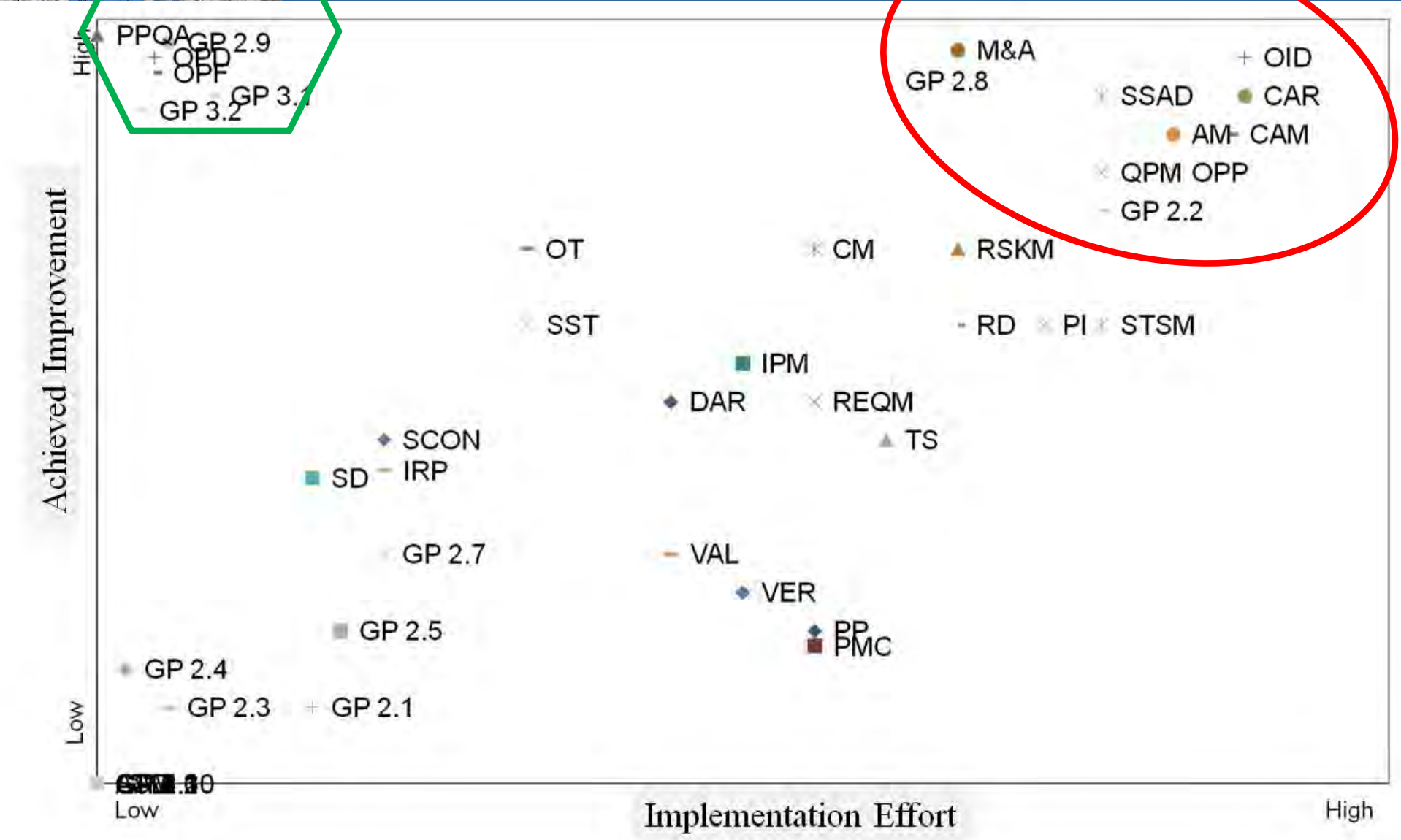
and

Presented with practical usage and implementation tips

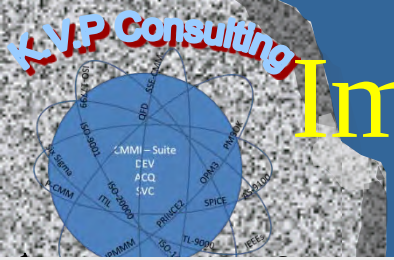
Improvement vs. Implementation

Process Improvements

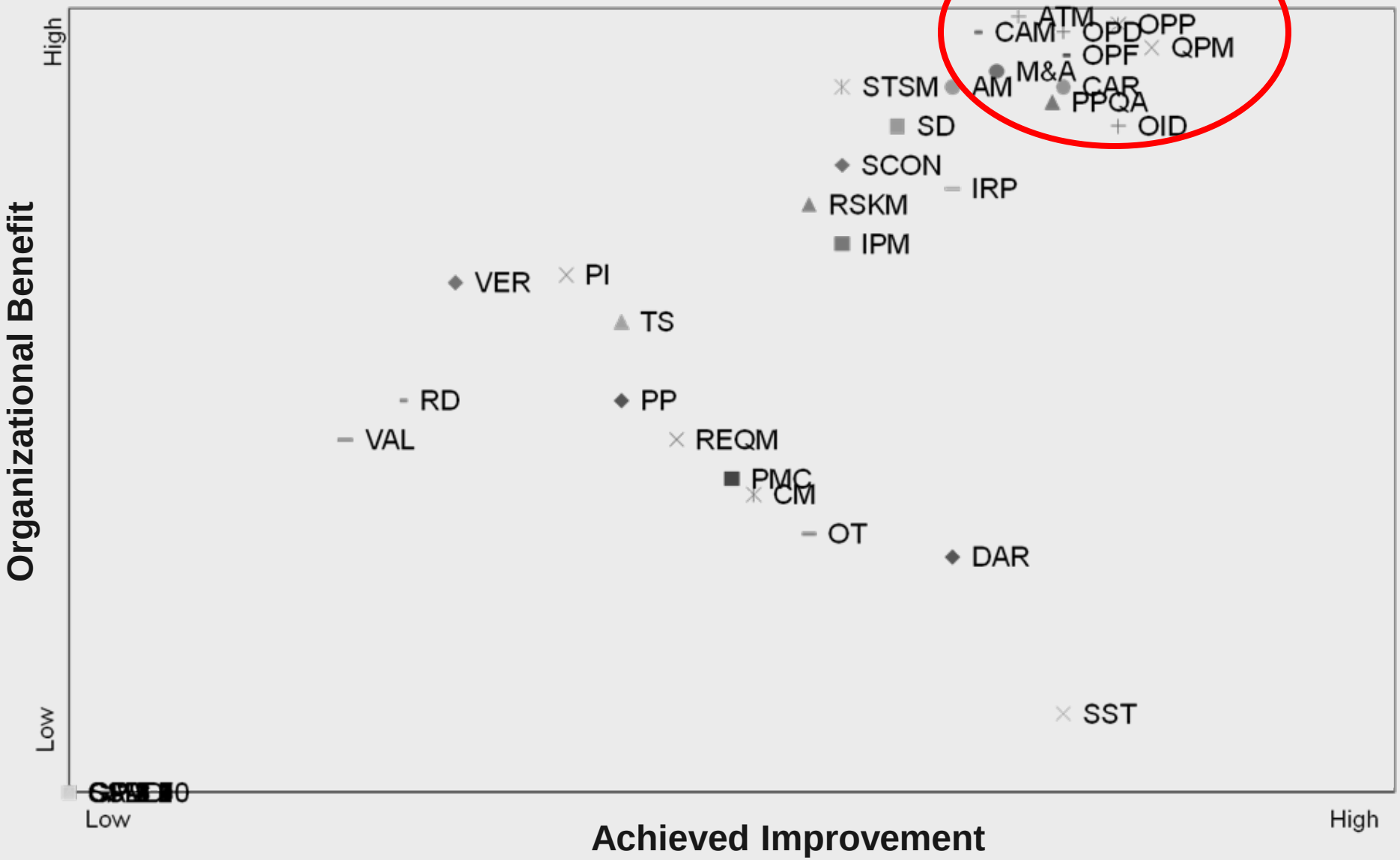
ROI

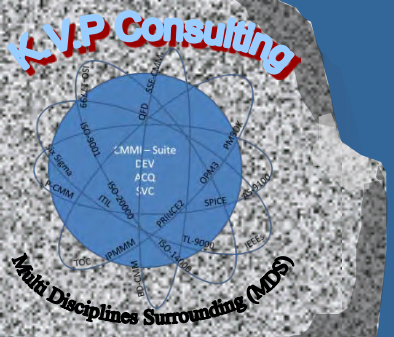


Improvement vs. Benefit



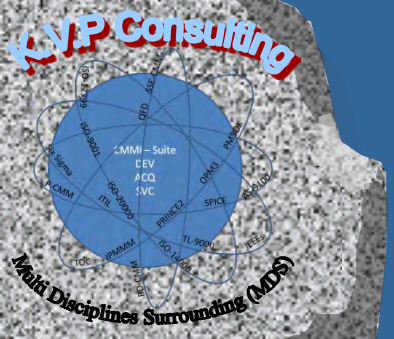
Add Value





Some of Our Suggestions

Don’t try this at Home without adult helping you


S.V.P. Consulting
CMMI – Suite
DEV
ACQ
SVC
Multi Disciplines Surrounding (MDS)

Questions

Cracking the Code for Improving the Productivity of Knowledge Workers



Peter Voldby Petersen
pvp@callis.dk
www.callis.dk

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Force multiplication!

- **Force multiplication** refers to a combination of attributes or advantages which makes a given force more effective than another force of comparable size.
- A **force multiplier** refers to a factor that dramatically increases (hence "multiplies") the effectiveness a group.
- Some common force
  - Morale
  - Technology
  - Geographical features
  - Weather
  - Recruitment through diplo
  - Training and experience
  - Fearsome reputation
  - Deception

*What are the "**force multipliers**" when talking about **improving the productivity** of **knowledge workers**?*



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The idea with this presentation

- The idea is to convey some of our ideas and thoughts about aspects are important related to the **technical infrastructure** supporting process modeling, authoring, tailoring, use, and improvement in **knowledge worker environments**

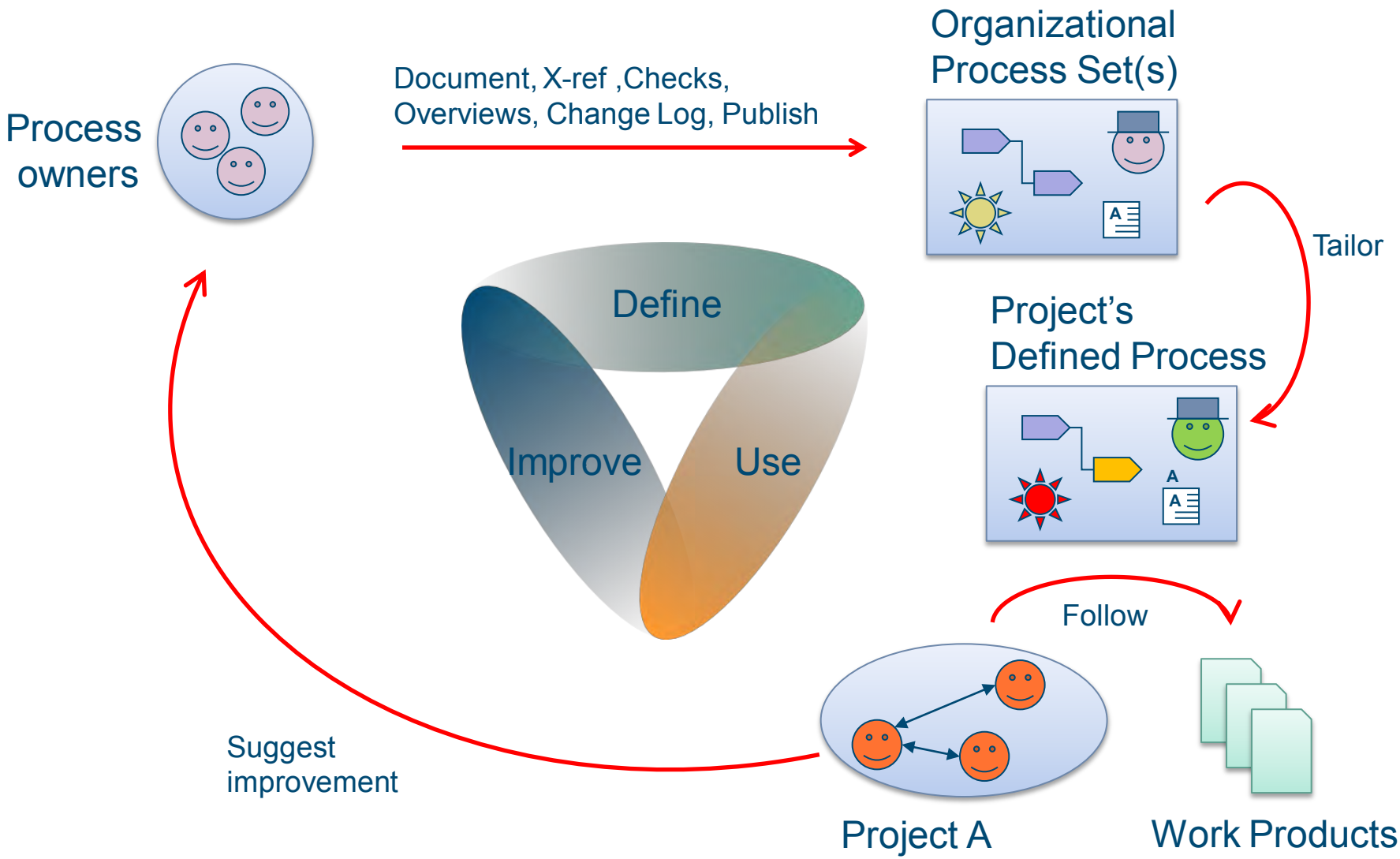
- Hopefully, you can use this as inspiration when building, improving or evaluating process infrastructures to make them true **force multipliers** for your organization



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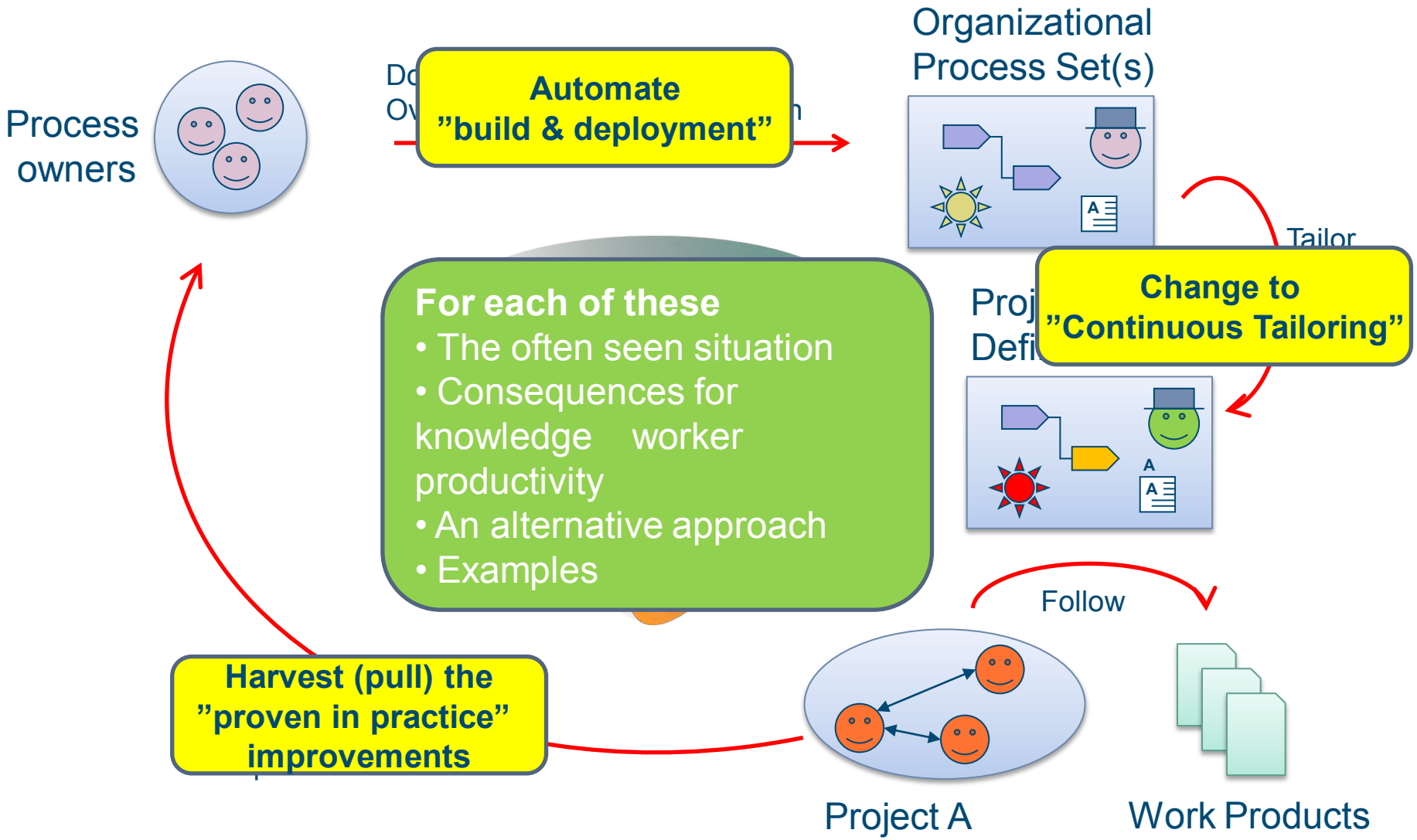
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(Simplified) Concept of Operation



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The Force Multipliers



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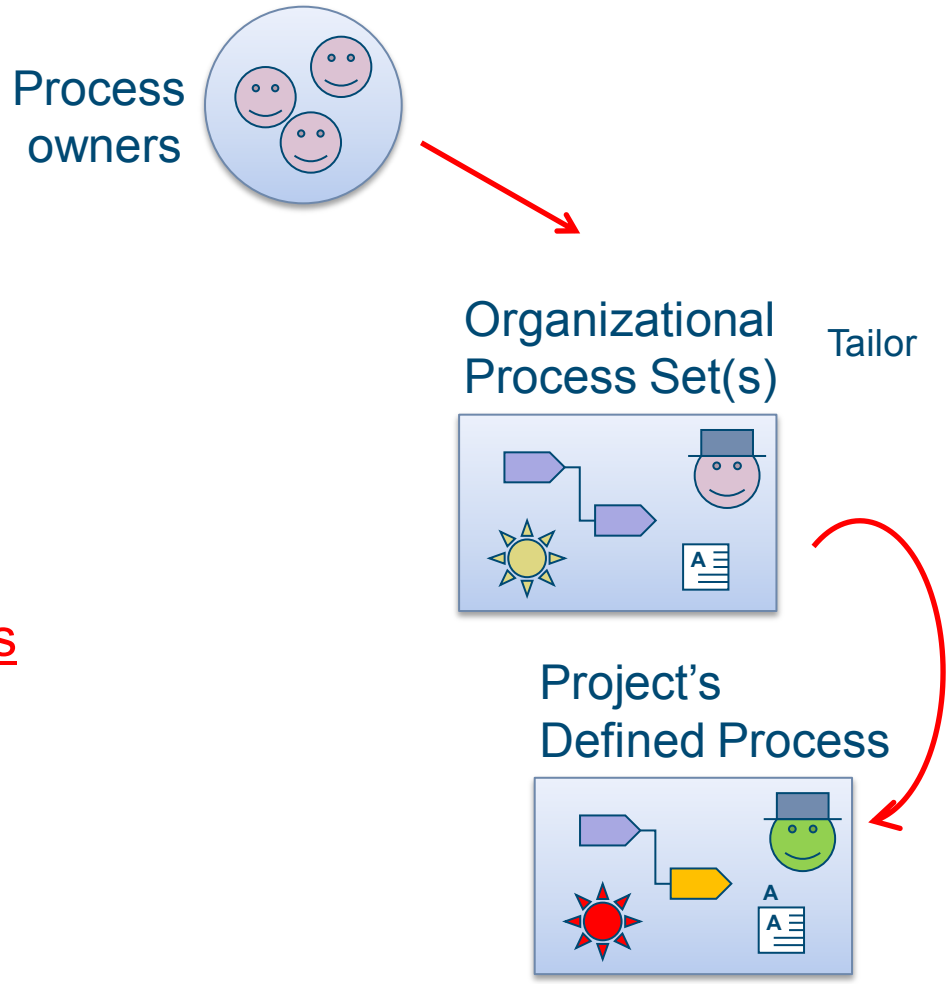
Automate ”build and deployment”

Often seen practice

- Lots of manual work and schedule required to from change to release
- Resistance to change in process group
- Bi-yearly releases of process sets

Consequences for Know. Workers

- Non-optimal presentation of process sets (process group starts to think of ”ease of maintaining” insted of ”ease of use”)
- Not updated to “real practice”
- Lower quality of documentation
- Slows down the “learning loop”



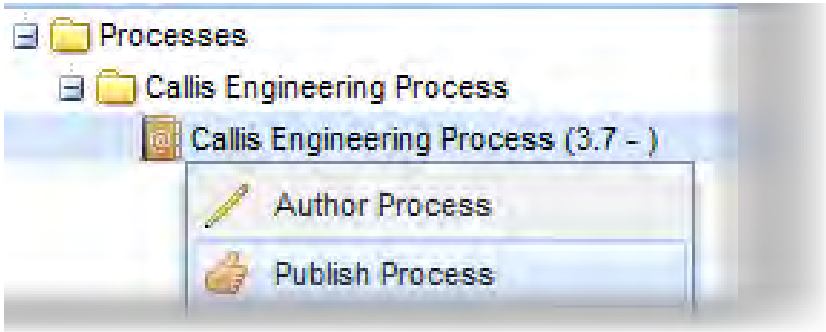
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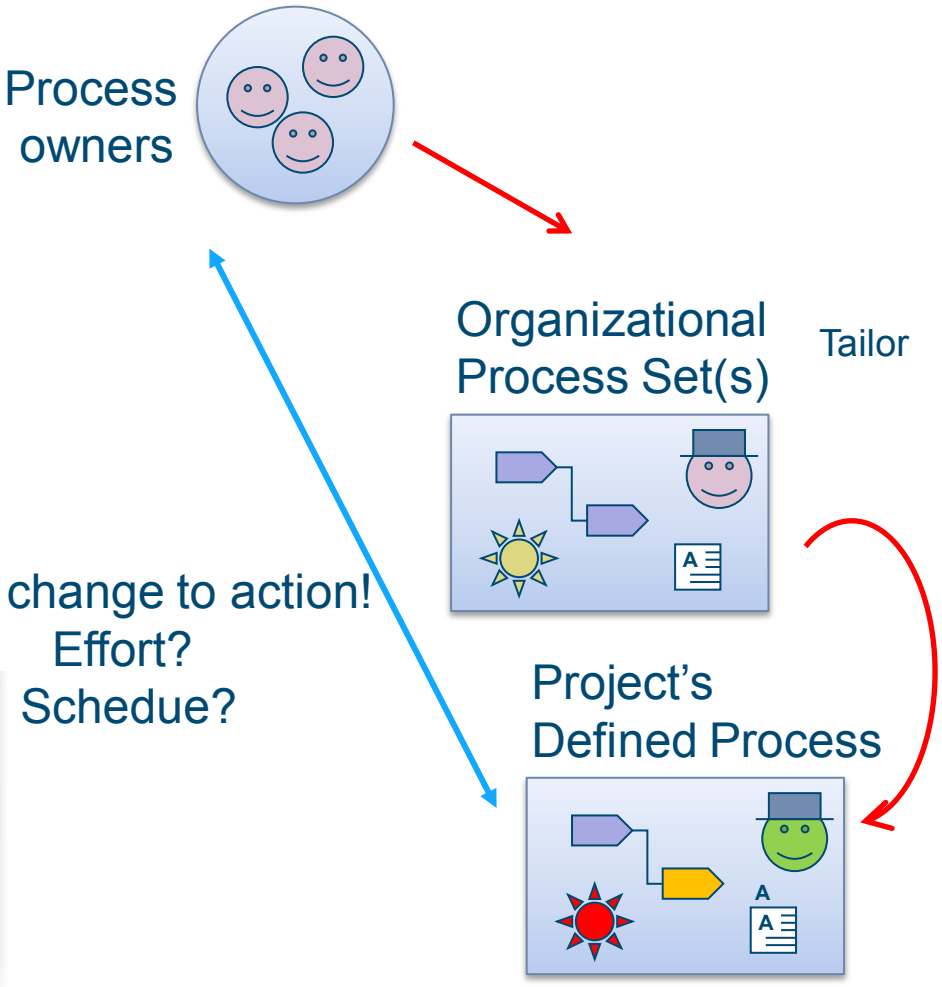
Automate ”build and deployment”

An alternative apprach

- Strive towards ”Continuous build & deployment” setup
- ”Do things which are hard often”
- Drive down the effort and schedule required to build & publish

Example





...in less than 5 min...

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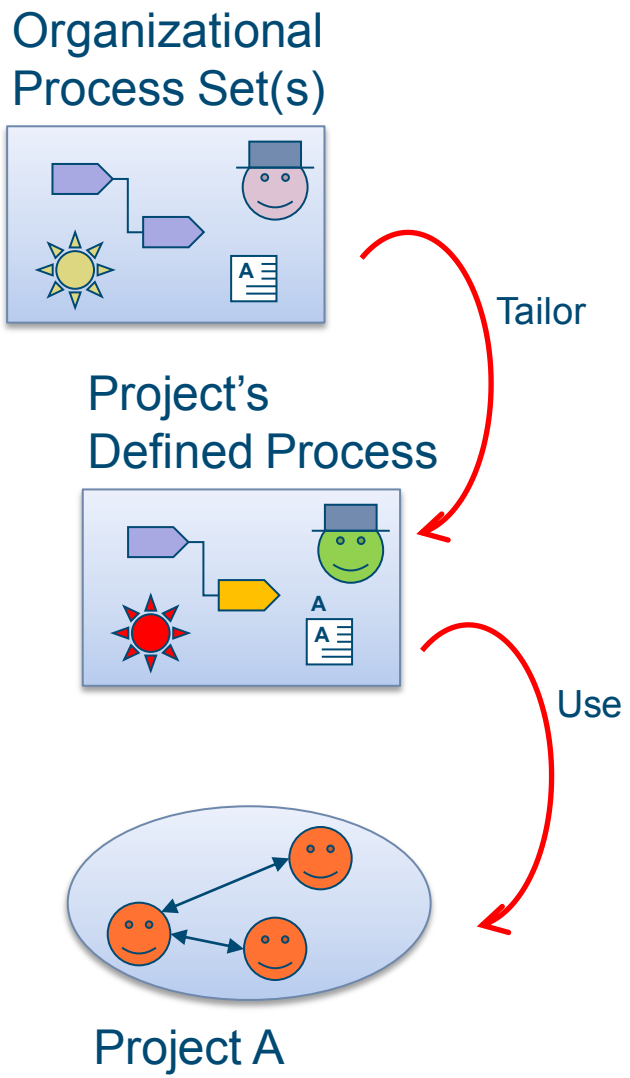
Change to ”Continuous Tailoring”

Often seen practice

- Tailoring by copy-paste process descriptions
- Tailoring in a file separate from process set
- Tools where tailoring is practically impossible
  - Yes, we can do that, but it requires an army of consultants and a phd in process modelling

Consequences for Know. Workers

- Doesn’t capture the real process
- Tailoring turns into a “formal thing”
- Limited ”connection” between documented process and real process – the WIKIs take over...
- Improvements are not based on existing processes



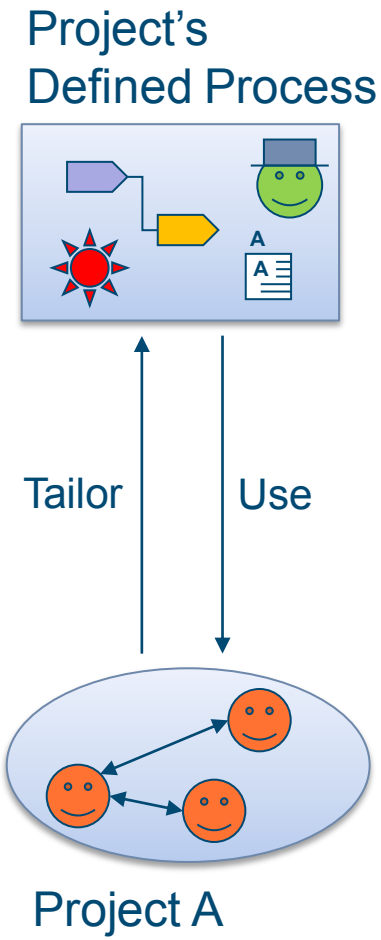
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Change to ”Continuous Tailoring”

An alternative apprach

- Combine structured processes with wiki approach – ”continious tailoring”
- Make it easy to add operational comments directly into the process set

Example



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Change to ”Continuous Tailoring”

2	Requirements Manager	**Document needs and expectations** The needs and expectations should be documented in the Requirements Management Plan.
3	Requirements Manager	**Decide which Requirements Management System to use** If no special technical or customer related needs mandates the use of a special Requirements Management System, the organizational standard system must be used.
4	Requirements Manager	**Prepare specification of project specific setup of Requirements Management System**

Document needs and expectations

The needs and expectations should be documented i
Management Plan.

Decide which Requirements Management System t

If no special technical or customer related needs mar
Requirements Management System, the organizatio
used.

Prepare specifi
System

Comment

HTML B I U ABC

We need to use RM-Pro in our project - this is a part of the contract with the custo

2	Requirements Manager	**Document r** The needs a Managemen
3	Requirements Manager	**Decide whi** If no special Requirement used. We need to use RM-Pro in our project - this is a part of the contract with the customer Project E | 2009.11.03 13:28 by pvp
4	Requirements Manager	**Prepare specification of project specific setup of Requirements Management System**

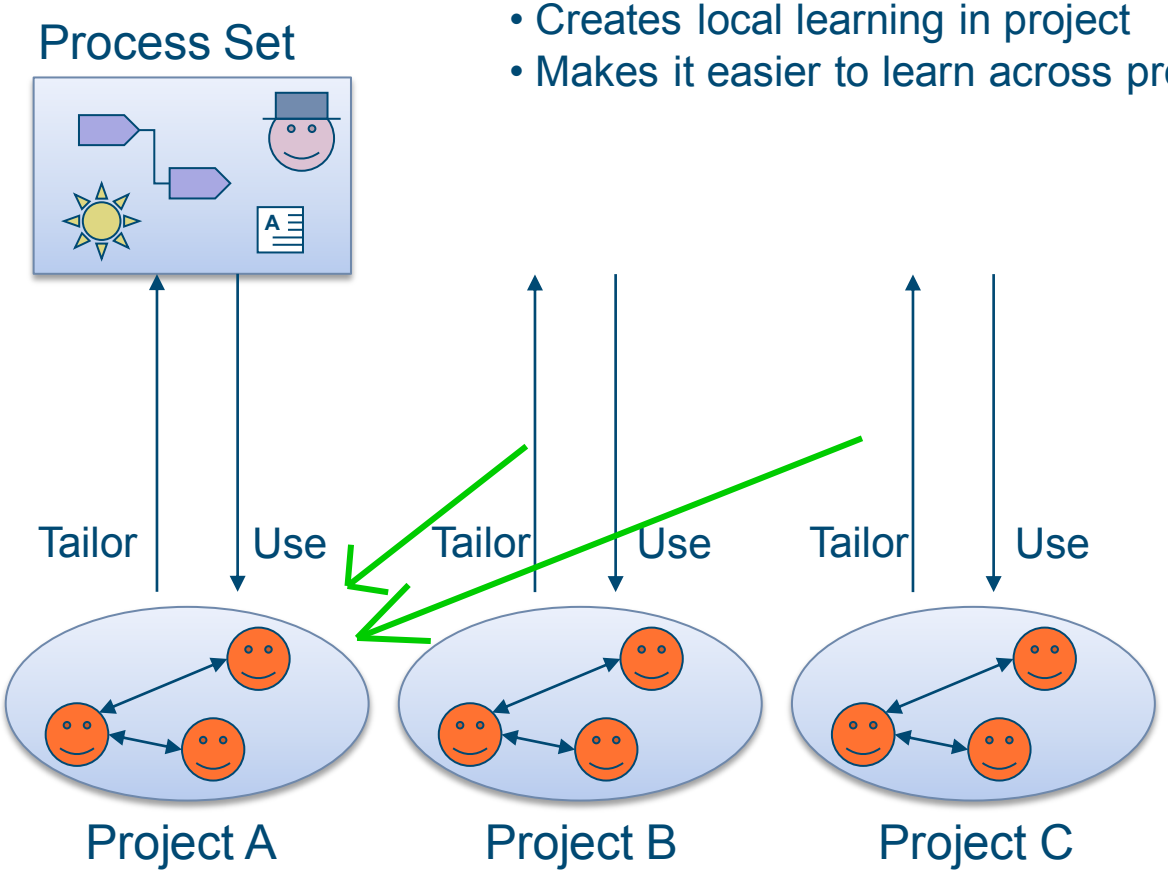
Low ceremony
Empowers people
Practical project learning

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Learning Across Projects

Short circuit knowledge generation

- Creates local learning in project
- Makes it easier to learn across projects



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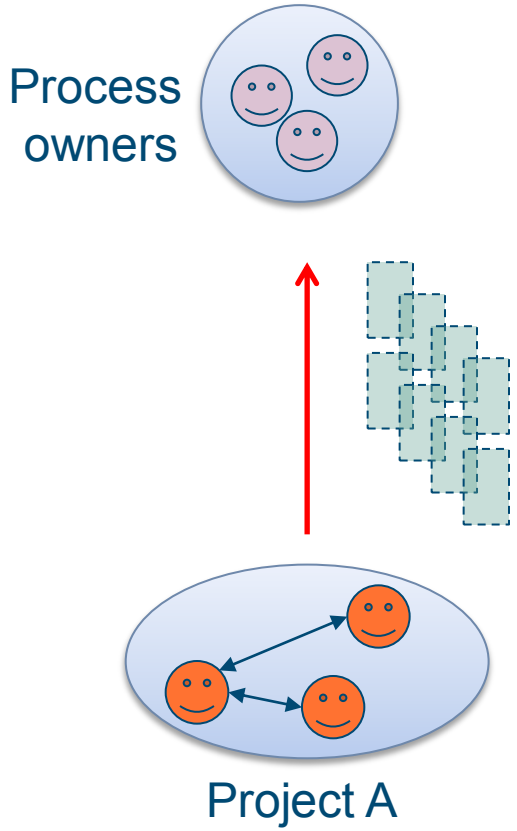
Harvest (pull) the ”proven-in-practive” improvements

Often seen practice

- Employee ”push” improvement suggestions to a queue
- Hard to see the ”quality” of the improvement suggestion
  - Theory or ”proven in practice”
- Improvement suggestions queue up, action slows down
- Learning loop does not work

Consequences for Know. Workers

- “The EPG / process owners don’t do anything”
- Outdated process descriptions
- Slow/limited build-up of intellectual capital



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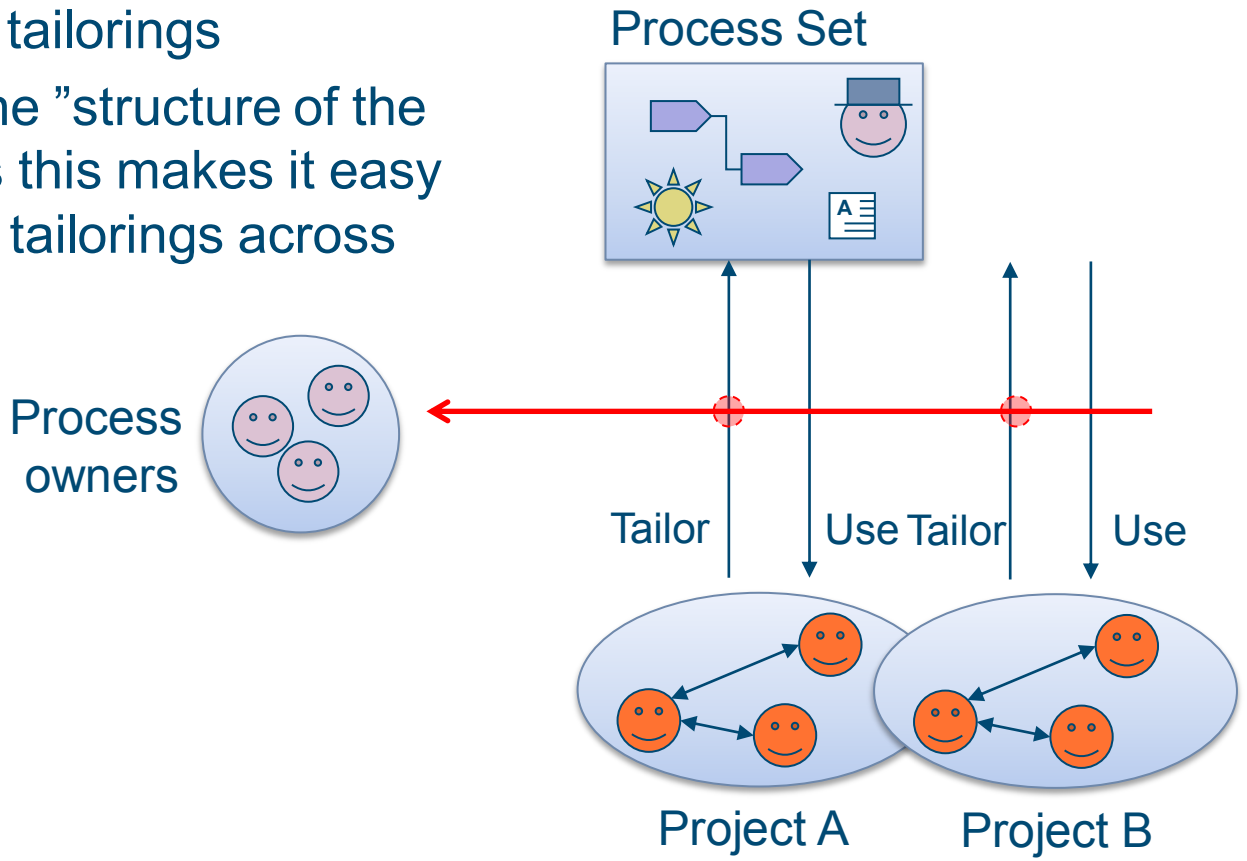
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Harvest (pull) the ”proven-in-practive” improvements

An alternative apprach

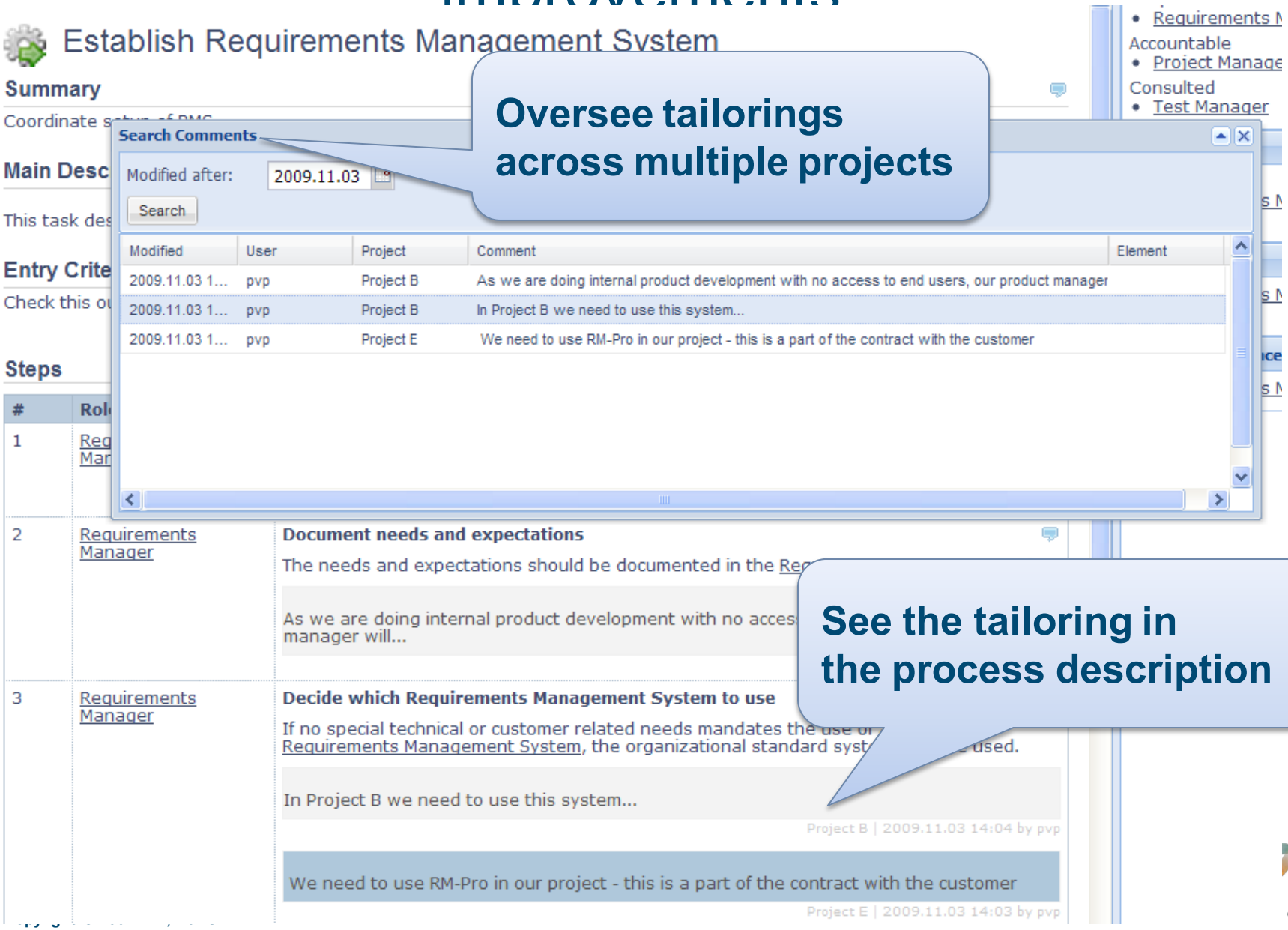
- ”Pull” the ”proven-in-practice” operational tailorings
- Do this in the ”structure of the process” as this makes it easy to compare tailorings across projects

Example



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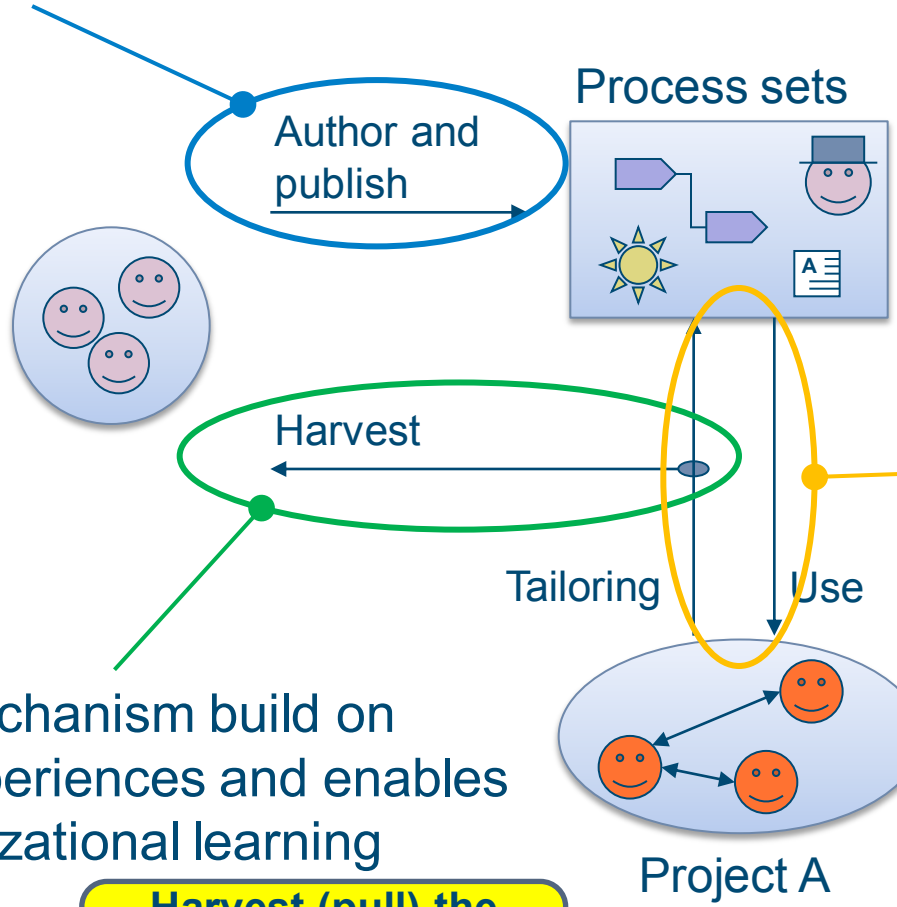
Harvest (pull) the ”proven-in-practive” improvements



The new ”Concept of Operation”

Automated ”model, author, build, and publish” mechanism

Automate ”build & deployment”



Change to ”Continuous Tailoring”

Low ceremony, tailoring mechanism, empowers people and enables local learning and improvement

Pull mechanism build on practical experiences and enables organizational learning

Harvest (pull) the ”proven in practice” improvements

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Thank you!



- **Please contact pvp@callis.dk for demos and trials**
  - Or just to discuss the concepts ☺

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Stuff you need to address...

- Well defined process architecture supporting re-useable process content / method libraries
- Automated consistency checking
- Generate and/or integrate graphics (MS Visio AddIn)
- Multi-model compliance mapping / cross referencing
- Multiple views, multiple variants, multiple output formats
- Activation – e.g. instantiating roles and best practices (MS Sharepoint integration)
- Lightweight tailoring / operationalization
- Understand tailoring across projects
- Profiling use of processes
- Automated compare (diff) process definitions / change list

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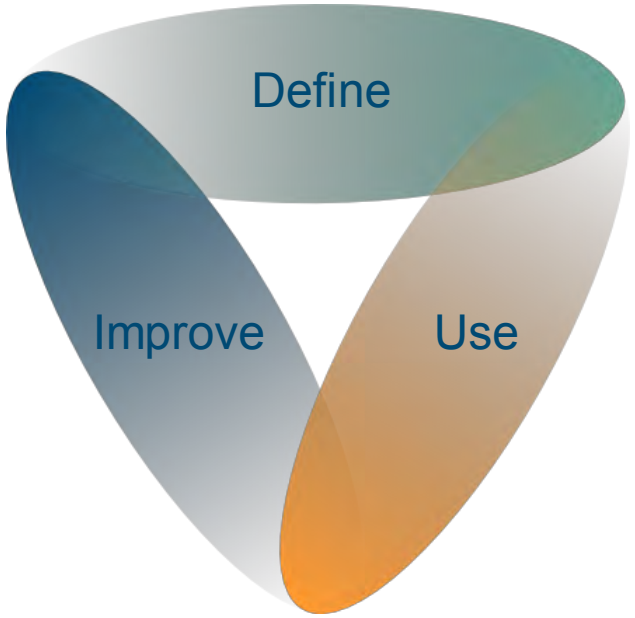
Supporting knowledge workers is supporting the lifecycle of processes!

Organize, structure, and author process sets

Manage compliance to standards and requirements

Consistency and uniformity (in text and graphics)

Automated publishing of multiple versions



Compare process sets

Effective access to process sets and assets

Lightweight and practical tailoring

Understand tailoring across projects

Integrate best practices

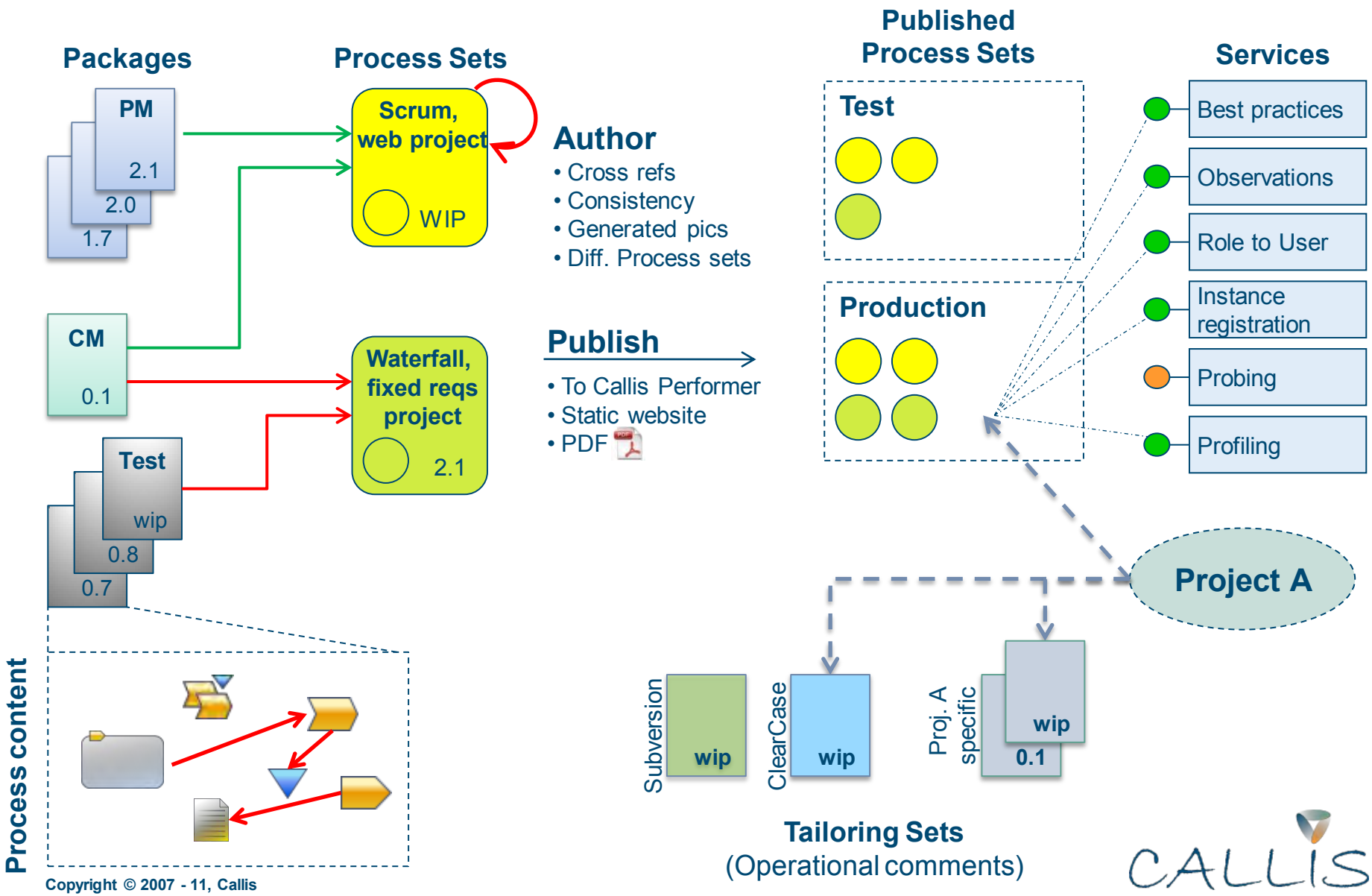
Profile use of process sets

Activate the process, e.g. artifact and role instantiation

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From Process Modelling to Process Execution



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BaiGuo ML4 Journey



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Bienvenido

Bienvenue

Wilkommen

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Bienvenuto

Välkommen

Tervetuloa

Witamy

ברוכים הבאים



Pamelia Rost – EVP Business Development Kasse Initiatives

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How a focus on high maturity CMMI-based process improvement can add value to the organization even when there are only limited resources

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Presentation Topics

- BAI GUO Background and Culture
- BAI GUO Process Improvement Methodology
- GQ(I)M method used to align business goals to indicators and metrics
- Data Analysis Interpretation
- Developing and Evolving the Prediction Model
- Project Managers and Quantitative Project Management
- QPM Story
- Summary of Six Sigma Techniques Used
- Lessons Learned

® Capability Maturity Model, Capability Maturity Modeling, and CMM, and CMMI are registered in the U.S. Patent & Trademark Office.

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BAI GUO Background and Culture

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Sponsorship for CMMI-DEV Class A ML 4 Appraisal



BAI GUO Background

- BaiGuo Info-Tech Co. Ltd is a high-tech enterprise professional on automation of health care in Shanghai
- 30% of leading staff in R&D department have been working on medicine information industry and long-distance info processing industry for more than 10 years in America
- International advanced CMMI quality management model was chosen to be applied to assure high quality products and services

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Culture

- Senior Management and other key members of the organization had a CMMI-based process improvement background from other companies before they formed or joined BAI GUO
- A culture of “sharing” and supporting colleagues is pervasive and supported by Senior Management
- Peer Reviews are a key process component of all projects
  - While the “peer” part of the reviews is honored anyone who has the necessary expertise, including the senior management participates in the peer reviews and truly acts as a “peer” during those sessions.
  - The focus of these peer reviews is to improve the product and processes that were followed to create that product
- Project Leaders are not only asked to manage their projects but to look at their project and other projects from an organizational point of view

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Culture - 2

- CMMI ML3 thinking and actions are considered the minimum required for BAI GUO to control costs and manage risks
- High Maturity is seen to be the necessary component to increase the control and accuracy of Management decision making
- All Project Managers are aware of and can share / teach the Organization's Set of Standard Processes to other managers and employees
- EPG Lead not only promotes the Organization's Set of Standard Processes but also serves as BAI GUO's Measurement Lead

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Initial readiness check

- How ready is the organization for starting the ML4 journey?
- On-site check, using a predefined HM checklist, before taking up the project:
  - Meet the senior management, EPG, project leaders, and their measurement group (if it exists)
  - Who will analyze the data? Experience?
  - Capability of the project leaders to interpret the analysis results for managing their projects
  - Questions covering:
    - Vision, business objectives
    - Process: solid ML3 foundation ?
    - Measurement repository, measurement system, tools ?
    - Stable processes?
    - PPB , PPM

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Vision

- Improve customer satisfaction
- Obtain more repeat orders.
- Increase company size to 100 in 3 years, and
- IPO in 2015.

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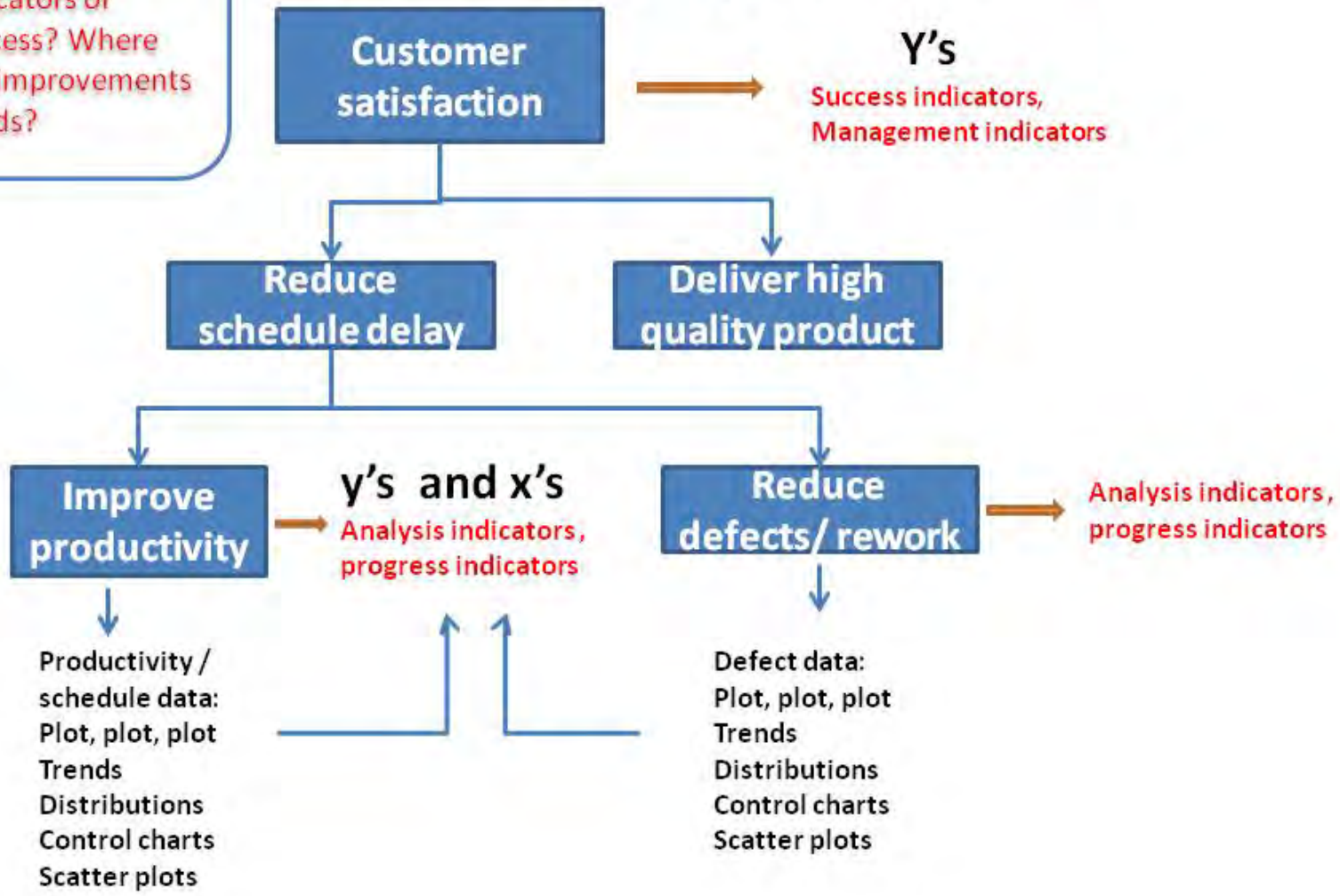
Business Objectives

- Improve the Customer Satisfaction by:
  - Improving schedule performance (reduce delivery delays)
  - Improving the quality of the delivered product
- Improve the development work by:
  - Controlling or reducing project costs
  - Improving the productivity

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Business Objectives

Project: what are leading in-process indicators of success? Where are improvements needs?



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Quantitative Objectives

Derived quantitative objectives:

By **12/31/2010** our organization will improve **Productivity (FP/man-hr)**

from today's performance baseline of:

Mean = 0.26 Std. Dev =0.08

to a new performance baseline of:

Mean = 0.28 Std. Dev =0.06

with at least **95%** of confidence.

without sacrificing the product quality:

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Quantitative Objectives - 2

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Derived quantitative objectives:

By **12/31/2010** our organization will improve **Defect Density (Defects/FP)**

from today's performance baseline of:

Mean = 0.46 Std. Dev =0.2

to a new performance baseline of:

Mean = 0.43 Std. Dev =0.18

with at least **95%** of confidence.

Project delivery time is closely related to the staff productivity and the amount of defects / rework (quality). In Baiguo , it is believed that if productivity and quality are in control, the delivery is also in control.

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The Appraisal Team



BAI GUO Process Improvement Methodology

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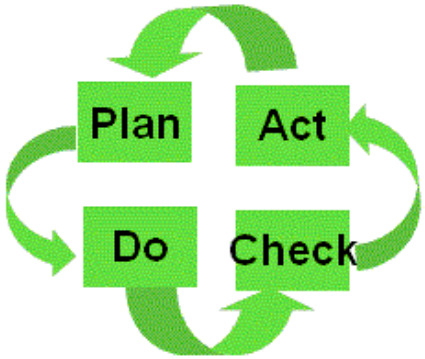
Problem and goal statement (Y)

Define → Measure → Analyze → Improve → Control

- Clarify Business Goals
- Process maps
- Prioritize issues

- Define measures
- Collect & verify measures

- **Discovery:** plots, paretos, histograms, distributions, fishbone
- **Understanding:** root cause, critical factors
- **Performance:** Process stable? Process capable?
- Corrective actions to **Improve** Process



Y=f(method, review rate, experience .....)

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High Maturity Improvement Cycle

- Duration of an improvement cycle depends on:
  - Project cycle / duration
  - Number of projects per year
  - Quality of project measurement data
  - How long it takes to deploy a change
- Each improvement cycle is around 3 months in BaiGuo
- **Key points** to consider in preparing for appraisal:
  - Any statistics specialist in the team to analyze the data (Project leaders / EPG should be able to **INTERPRET** the data)
  - For the HM PA, evidences should be prepared to the subpractice level
  - Use a Q&A at SP/GP level to set the appraisal expectation to the organization

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6 Sigma techniques used – an overview

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Define	Measure	Analyze	Improve	Control
Voice of Customer	Metrics: defects, project mgmt	Regression	Design of Experiments	Statistical Controls
Voice of Business	Data Collection Methods	Cause & Effect	Modeling	Control Charts
Project Charter	Sampling Techniques	Diagrams , Matrix	Eliminate waste	Time Series methods
Kano model	Measurement System Evaluation	Failure Model Effects Analysis FMEA	Robust Design	Other control tools
QFD	Quality of Data	7 Basic Tools	Kaizan	Sustain improvement
Process Flow Map		Hypothesis Tests	Decision & Risk Analysis	Procedural adherence
"Management by Fact"		Root Cause Analysis		
		Reliability Analysis		

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Measurement and Analysis

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Measurement and Analysis Highlights

- Descriptive statistics are provided to show mean and standard deviation for Productivity and Total Defects
- Statistical techniques used through MiniTab and Crystal Ball include:
  - Scatter Plots to determine correlation between Requirements elicitation and size in Function Points and Design and size in Function Points and CUT and size
  - Regression Analysis was used for Requirements elicitation and size, Design, and Code and Unit Test
  - Analysis of Variance was run to determine statistical significance
  - Stepwise regression was run for Requirements Elicitation, Design, and CUT vs. Size FP vs. Team Experience vs. Requirements Volatility

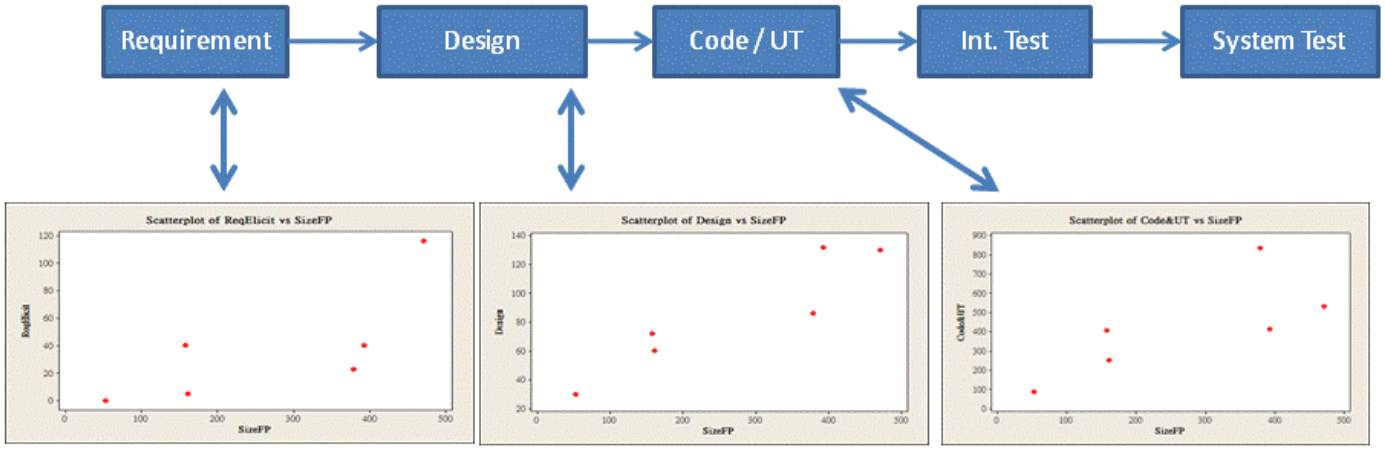
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Measurement and Analysis Highlights - 2

- A linear regression relationship was able to be built between Requirements elicitation effort and the size:
  - A similar regression relationship was built for Coding and Size
  - For the design effort it was found that Team Experience is also a factor in addition to size (in FP) for predicting the design effort.
  - Scatterplots, Regression Analysis and Stepwise regression were also applied to Reviews
    - Regression Analysis: Prep versus Reviewed Size
    - Regression Analysis: Conduct Review versus Reviewed Size
- Boxplots and ANOVA were applied to Preparation Time + Conduct Review time versus Review Type

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Regression analysis – an example



1. *Relationship of Requirement, Design, Coding to Size (FP)?*

2. *Regression analysis:*

   Design [Y] = 24.8 + 0.224 x Size (FP)
   P=0.008 significant

3. *Effect of independent factors, such as team experience, reuse, requirement volatility ?*

   Design = f(team experience, size)
   R^2 (adj.) = 92% , P=0.007 significant

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Software Development Process Map and Measures

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Organizational Process Performance

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Organizational Process Performance Highlights

- **Establish Quality and Process-Performance Objectives**
  - Quantitative Measurement Objectives for Quality and Process Performance are documented in BAI GUO Organization Strategy document
  - SMART Objectives were used to define the Quantitative Measurement Objectives
  - ***BAI GUO is in the Medical Hospital Industry and has built IT systems to transfer patient records from remote farming areas to nearest Hospitals and from Hospitals to Hospitals in bigger cities. Time to market and quality are crucial.***
- GQM approach is used to determine the measures for each objective

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Organizational Process Performance Highlights - 2

- The definitions of all the required measures are documented in the metrics definition guideline – BAI GUO Metrics Definition Guideline
  - Name of metric
  - Business objective
  - Unit of measure
  - Formula
  - Source of data
  - Frequency of collection
  - Where the data is stored
  - Owner of the data
  - Tool used to collect basic measures (automatic collection for basic measures)
  - Collecting requirements to ensure data validation
  - Recommended statistical technique

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Organizational Process Performance Highlights - 3

- A Table of Basic measures with their units of measure has been created and is part of the Metrics Definition Guideline
  - Significant time was put in to define what basic measures were needed along with their units of measure

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Organizational Process Performance Highlights - 4

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- **Select Processes -** Approach taken in BAI GUO
  - Looked at all the available historic data, by project phase
  - Tried to validate the data by scatter plot, and calculate the summary statistics (mean, standard deviation) to see if the data were reasonable
  - Correlation was used to see what factors affected the effort and build the regression relationship between the outcomes and the factors
  - Steps were repeated by decomposing the subprocesses. Again correlation was used to see what factors affected the effort and the regression relationship was built
  - Preliminary findings were validated with the consumers (Project Leaders) to ensure the model and analysis made sense

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Organizational Process Performance Highlights - 5

- **Total Defects Segmentation**
- Opportunities for Improvement were identified
  - Improve development work
  - Improve productivity
  - Reduce rework and Cost of Quality to improve overall productivity (Total Rework and rework per defect)
  - Defects from each lifecycle phase were examined
  - Defect Data was collected from multiple small projects

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Organizational Process Performance Highlights - 6

- **Defects were broken down by A, B, and C defect categories** with full explanation behind them in the Testing Process document
  - A - Serious
  - B – Major
  - C – Minor
- Systems Testing produced the most defects → Upstream activities were examined
- **Pareto Charts of A, B, and C categories of** defects that contributed to rework were developed by lifecycle phase

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Organizational Process Performance Highlights - 7

- **FMEA** was conducted to further categorize the CAT B defects per lifecycle phase and reduce the defects coming into and going out of Systems Test
  - Invite all project leaders, and EPG; Delphi Method were used
  - FMEA Table included:
    - Potential Failure Mode
    - Potential Failure Effects
    - Severity (1-10)
    - Potential causes
    - % of Occurrence (1-10)
    - Current Control
    - % of detection (1-10)
    - RPN = Severity x Occurrence x Detection

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Process Step	Potential Failure Mode （from checklist）	Potential Failure Effects	SEV (1-10)	Potential Cause	OCC (1-10)	Current Controls	DET (1-10)	R P N	Actions Recommended	Responsibility	Action Taken
Require-ment	Contradicting/ repeated requirements		8		7		4	224			
	Non-functional requirements not clear		8		8		3	192			
	Others		6		8		3	144			
Design	Incomplete, not testable		7		6		4	168			
	Design not traceable to requirement		5		7		4	140			
	Not match interface spec		8		6		3	144			
	Others		8		4		4	128			
Coding	Module too complicated / complex		6		5		6	180			
	Did not avoid floating point operation		7		5		5	175			
	Loop, branch, logic not correct		7		5		6	210			
	No checkfor input parameters		7		6		6	252			
	Others		6		7		5	210			

Purpose

The purpose is to reduce the rework effort in project, to find out the defect source from review checklist which impacts rework effort most.
Here lists the checklist items which impact the defect most.

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Organizational Process Performance Highlights - 8

- Highest priority areas were examined as input and a Cost-Tradeoff Analysis was conducted
- Defects coming out of Coding were focused on first as the most practical and cost effective area to concentrate on
  - Upgraded Code Review guidelines were developed with enhanced guidelines which emphasized lower level categories from Coding
- If results from the focus on Coding were not sufficient, the next alternative solution was discussed with Senior Management to determine feasibility

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Organizational Process Performance Highlights - 9

- **Subprocess Selection Guideline**
- Developed to support the traceability of subprocesses back to Business Objectives and vice versa
  - Business Goal
  - Goal type
  - Stakeholder Perspective
  - Typical Questions
  - Metrics
  - Impacting Sub-processes
  - Sub-process control measure

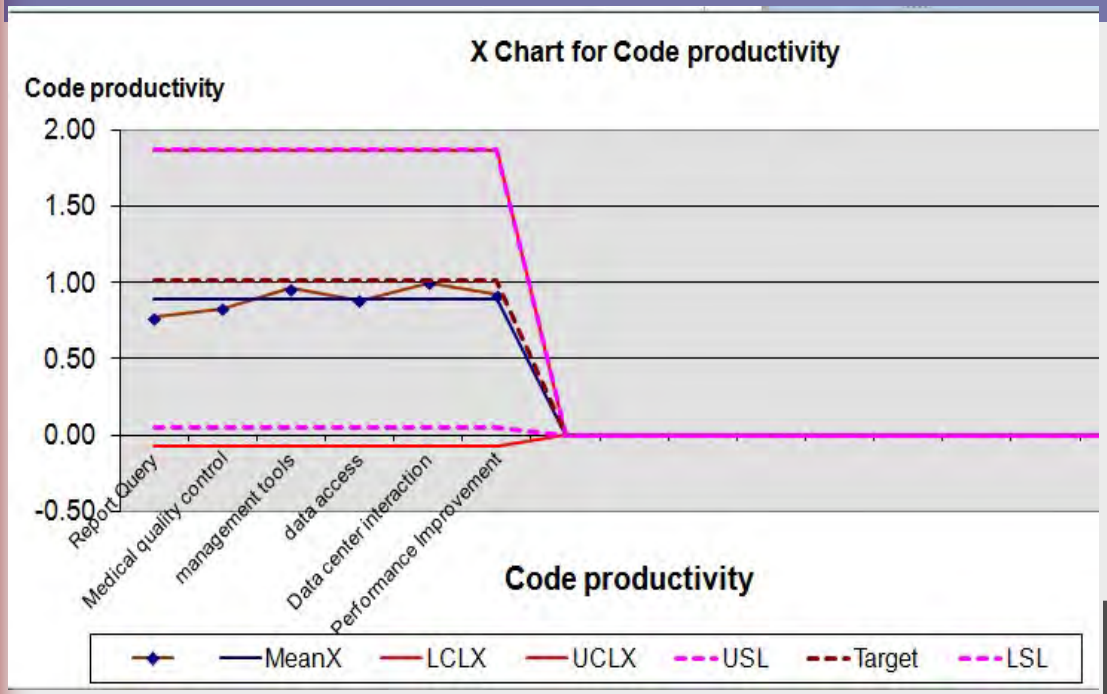
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Organizational Process Performance Highlights - 10

- **Statistical Control (Stable Processes)**
- XmR control charts are used for Requirements and Coding to ensure productivity is statistically managed
  - EXAMPLE: A spike in productivity was noticed. Causal analysis was conducted. It was determined that there was a high use of “re-use” at that point. However, it was decided that this was an anomaly and the control limits were not changed

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Control chart - example



Process Stability	Process Capability	Cpk	Cpm
Stable	Capable	3.25	2.11

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Organizational Process Performance Highlights - 11

Process Performance Baselines (PPBs)

- The organization's Process Performance Baselines (PPBs) were derived through analyzing the distribution of the data to establish the central tendency and dispersion (sigma) to characterize the expected performance and variation for the selected processes or subprocesses.
  - EPG provides templates to Project Teams and provides training on their use
  - Project Teams collect required data and give it to the EPG - automated
  - Training was also provided on how to interpret the Excel or Minitab analysis results based on historic data

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Organizational Process Performance Highlights - 12

- The PPB and related measurements are reviewed regularly in the EPG meetings (by the EPG group and the PMs), in the project meetings (by PMs and project team members), and the senior management meetings (by GM, EPG, QA, PMs).
- PPB Summary Report
  - Processes
  - Subprocesses
  - XmR Charts for productivity
- PPBs are updated every six months – ANOVA is used to determine statistical significance of productivity change

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Organizational Process Performance Highlights - 13

- **Process Performance Models (PPMs)**
- There is a Crystal Ball predictive model for productivity and quality.
- Besides the crystal ball, there are also other PPMs (e.g. linear regression) for Project Leaders to reference to.
  - E.g. relating the upstream process factors to predict the activities downstream in the Minitab.

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Crystal Ball prediction model – an example

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		Prototyping				Std Interview				
		LL	Avg	UL		LL	Avg	UL		LL
Requirements Elicitation	Effort	48	66	84		37	55	73		50
	Cycle Time	15	20	25		30	35	40		30
	Quality	0	18	37		0	23	46		0

		PeerReview(Low)				ExpertReview(Low)				Pee
		LL	Avg	UL		LL	Avg	UL		LL
Reqts Review	Effort	26.128	26.368	26.608		11.806	11.926	12.046		28.452
	Cycle Time	1	2	3		1	4	7		1
	Quality	82.00%	95.00%	98.00%		97.00%	93.00%	99.00%		82.00%

		SA / SD				Hig Exp SA / SD		
		LL	Avg	UL		LL	Avg	UL
Design	Effort	43.748	68.948	94.148		24.252	49.452	74.652
	Cycle Time	40	45	50		50	55	60
	Quality	0	9.96	19.92		0	9.13	18.26

		PeerReview(Low)				ExpertReview(Low)				Pee
		LL	Avg	UL		LL	Avg	UL		LL
Design										

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Integrated Project Management

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Integrated Project Management Highlights

- Project Closure meeting is held at end of each project to capture
  - Project size and effort tracking results
  - Actual work effort for each phase
  - Deviation of effort/schedule for every milestone
  - Measurements to update PPBs
  - Sent to EPG Lead for consideration to be included in the Organization's Measurement Repository or Process Asset Library

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Project Monitoring and Control – Highlights

- Actuals to estimates tracked include:
  - Size, Effort, Risks, Stakeholder Involvement, Resources, Quality, Non-compliances
- Schedule Variance is calculated and acts as a threshold for corrective action
- Cost Variance is calculated and acts as a threshold for corrective action
- XmR Control Charts are used to ensure process stability – Special Causes of Variation are analyzed and corrected
- At the end of each Milestone, Crystal Ball is run using last phase's data to predict next phase results (Interim targets) and all subsequent phases

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Quantitative Project Management

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Quantitative Project Management Highlights

- Projects make use of Organizational selection of processes and subprocesses created from OPP
- Project Managers conduct an analysis of data in the PPB to determine which subprocesses will contribute most to meeting the measurement objectives of the project. These are placed into the Project Quantitative Management Plan
- Crystal Ball model was also rerun after each phase (e.g. req ph) milestone to predict the outcome from the downstream processes.

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Quantitative Project Management Highlights - 2

- Subprocesses with the most variation were selected - Requirements, and Coding+UT.
  - Other subprocesses are less affected, and have less variation.
  - E.g. defects at the requirement phase will affect the defects and rework in the testing phase.
- Similar to OPP, analysis was carried out on various factors to determine the critical subprocesses
- XmR charts were used on past project data to show that the productivity of those subproceses were stable

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Quantitative Project Management Highlights - 3

- At the end of each phase the control chart was used to show if the selected subprocess are meeting the specification
- Cpk was calculated to see that the degree of meeting the customer specification limits are met
- Crystal Ball was used to recalculate confidence level for to predict meeting the overall project goals at the end of each phase

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Quantitative Project Management Highlights - 4

- The definitions of the common measures, units are found in the organizational guideline BG Metrics Definition Guideline
- The USL and LSL of the objectives of the critical subprocesses were specified in the Project Performance Measurement Plan
  - These USL/LSL are compared with the model and the baseline figures in a summary table
  - The correctness of these USL/LSL of selected critical subprocesses are reviewed
- Statistical techniques used include: XmR charts, u-chart, confidence interval, and Pareto charts for the defects by category

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Quantitative Project Management Highlights - 5

- The Project Performance Measurement Plan contains the description of the 'responsibilities', 'by/to whom', 'how often', 'data storage', 'analysis'
  - Quality objective
  - Priority
  - Metric – Unit of Measure
  - Target
  - USL – Upper Specification Limit
  - LSL – Lower Specification Limit
  - Reason for Target
  - PPM used
  - Remarks

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Quantitative Project Management Highlights - 6

- **Operational Definitions** found in the **Metrics Definition Guideline [See OPP Sp 1.3]**
  - Name of metric
  - Business objective
  - Unit of measure
  - Formula
  - Source of data
  - Frequency of collection
  - Where the data is stored
  - Owner of the data
  - Tool used to collect basic measures (automatic collection for basic measures)
  - Collecting requirements to ensure data validation
  - Recommended statistical technique

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Quantitative Project Management Highlights - 7

- Data was collected at Project Closure and presented to EPG
- PPBs were updated by EPG Lead as appropriate
- Metrics Definition Guideline was updated as appropriate

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Summary and Lessons Learned

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- **Look before you jump** – a thorough initial readiness check before starting the high maturity journey
- **Upfront high maturity training** to the process champions so that they, who understand the strengths and weaknesses of the current processes, can drive the SPI
- **Periodic assessment** – a knowledgeable Appraisal Team, mostly from the organization, can also direct the organization towards the right direction
- **Talk, talk, talk** – the measurement team and the external consultant(s) should communicate with the project managers periodically to validate the measurement findings; the Project managers are always the people best equipped to 'interpret' the analysis findings

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Processis



Edmond Sung

Processis
Training Consulting & Solutions

- **President & Principal Consultant of Processis Ltd.**
- Edmond has more than 25 years of experience in the information technology and related service industry
- Edmond's current focus is to assist companies to improve their processes, products and service quality using an effective combination of CMMI and Six Sigma.
- Edmond has more than eight years of experience in CMMI-based training / consulting/ and appraisal services.



Tim Kasse

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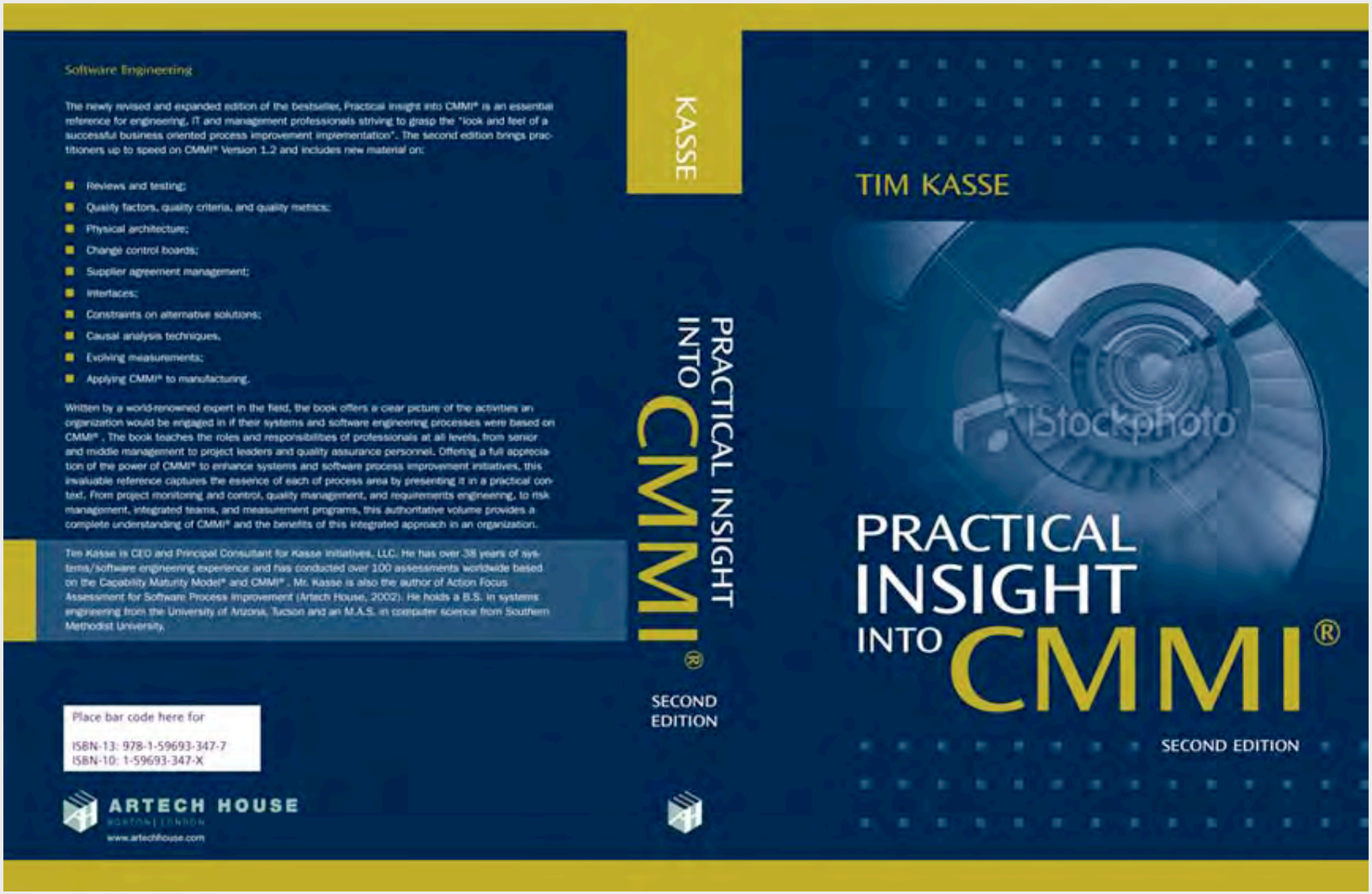
- CEO and Principal Consultant of Kasse Initiatives LLC
- Visiting Scientist - Software Engineering Institute
- Visiting Fellow - Institute for Systems Science / National University of Singapore
- Author of Action Focused Assessment for Software Process Improvement
- Author of Practical Insight Into CMMI



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Practical Insight Into CMMI – 2nd Edition (Sept 2008)

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Books from Kasse Initiatives



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CMMI, ISO and AS9100:
An Efficient and Effective Approach

CMMI Technology Users Conference
Denver, CO



LaKeisha M. Souter

Al Chatmon

Certified SCAMPI Lead Appraisers

November 17, 2011

Agenda

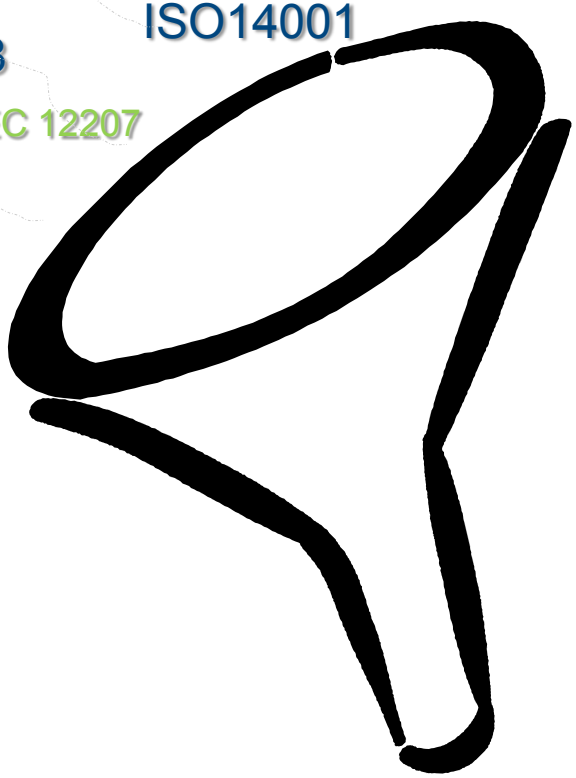
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- Standards: A Necessity for Doing Business
- Standards Across Our Organization
- An Integrated Approach
- Standards Comparisons
- Steps to Developing and Integrated Approach

Compliance Standards:
A Necessity for Doing Business

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ISO TickIT
CMMI
IEEE 1220
ISO/IEC 42010
Sarbanes-Oxley
AS9100
ISO/IEC 15288
ISO14001
ISO9001:2008
ISO/IEC 12207
EIA/IS 632



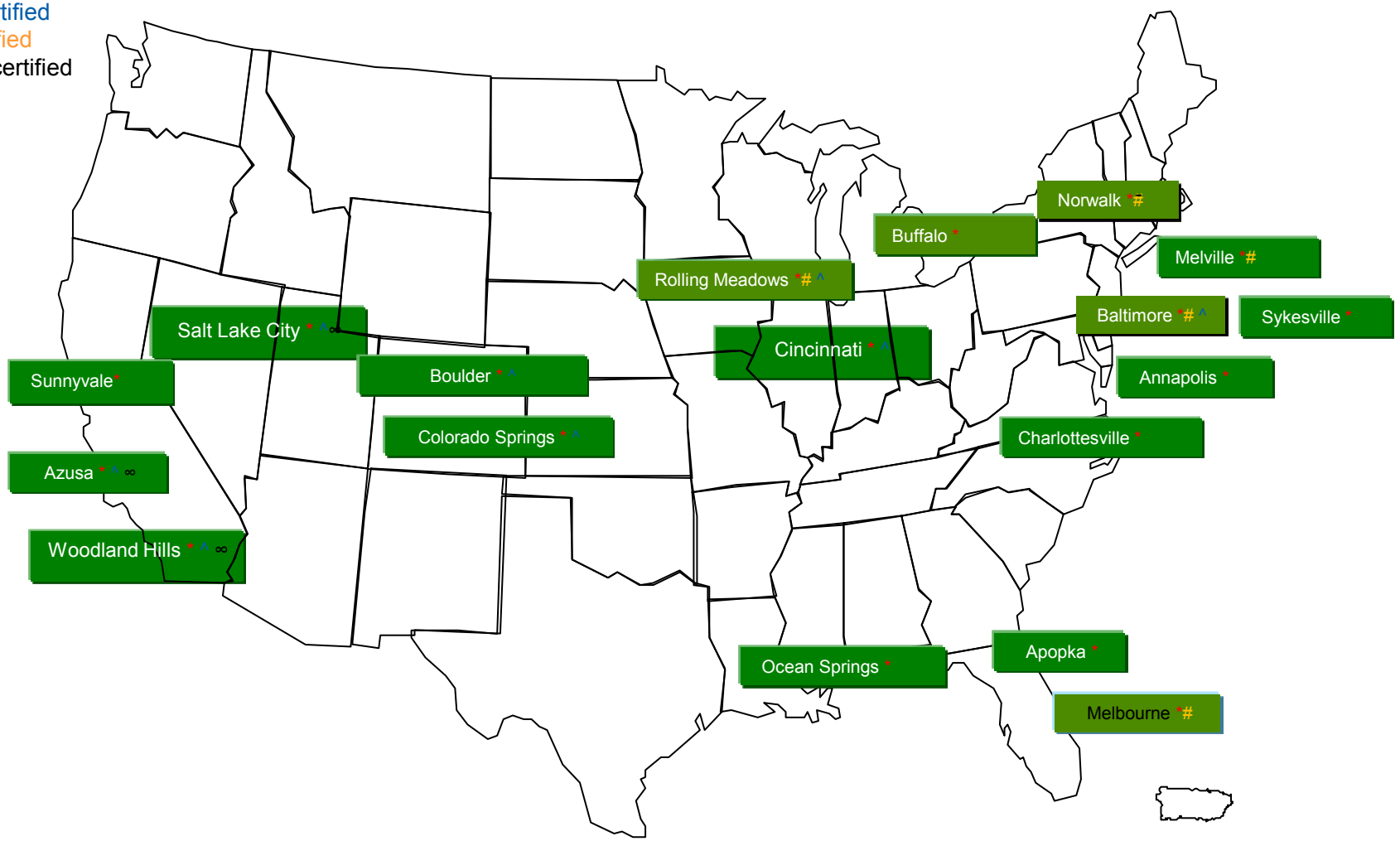


NGES Standards Compliance and Certifications

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CMMI Certified

*ISO Certified
^AS9100 Certified
#TickIT Certified
∞ISO14001 certified



Compliance Standards: Driven by the Business

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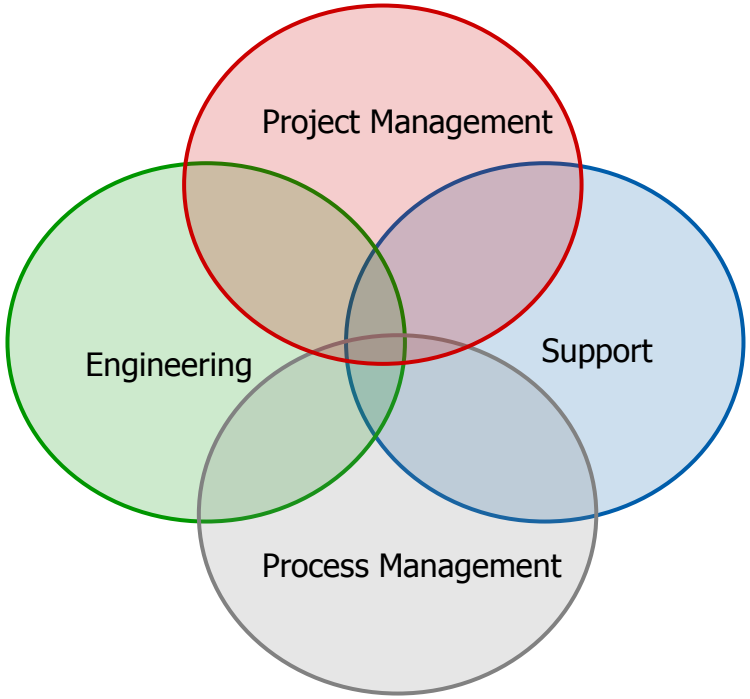
For Our Customers	**Innovative, high-performance, affordable products and services, delivered on time and with the promised performance, quality and reliability, that ensure our customers' success in their operations**
For Our Shareholders	**Business performance that is predictable and reliable, delivering sustained returns on shareholders' investments**
For the Corporation and the Sector	**Technical and business processes that are faster, more profitable, and able to deliver products and service with more performance, better quality, and lower cost than our competitors**
For Our Businesses & Programs	**Deliverable products & services and internal technical & business processes that ensure our ability to meet or exceed the contract commitments we have made.**
For Our Employees	**A work environment that makes it easy for employees to apply their natural talents with passion and excellence and to gain new skills and capabilities that will open up future opportunities for success**

Compliance is the cost of doing GOOD business

The CMMI® (Capability Maturity Model Integration) model

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- It is a model with 22 inter-related process areas grouped by category: Engineering, Support, Project Management, Process Management
- It is used to measure project management and development activities across project lifecycles.
- The CMMI is a process model that:
  - Is a collection of industry best practices
  - Contains a framework for organizing and prioritizing process improvement activities
  - Is used to emphasize the alignment of process improvement objectives and organizational business objectives



ISO: The Quality Management System

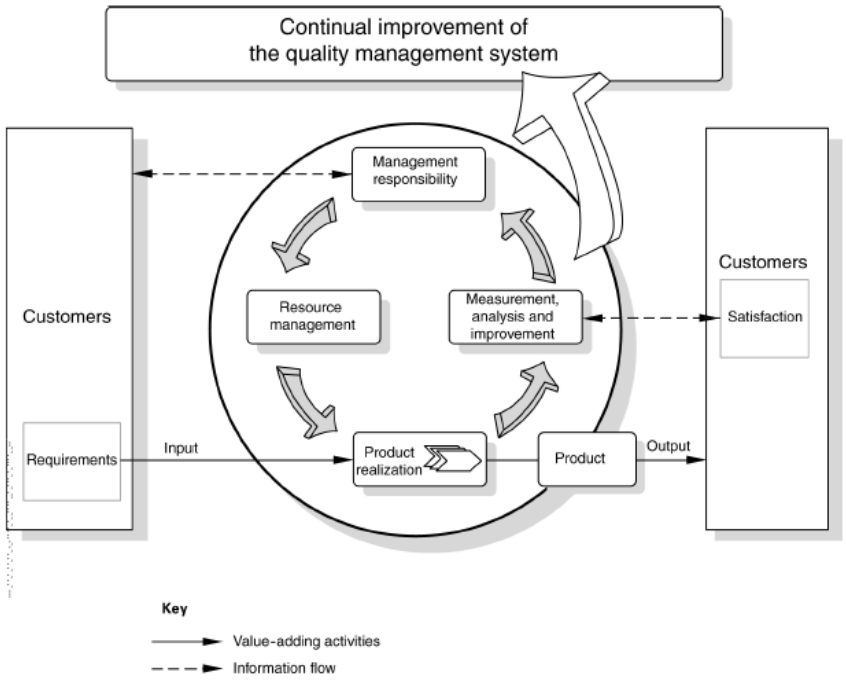


Figure 1 — Model of a process-based quality management system

International Organization for Standardization
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- Section 4: Quality Management System
- Section 5: Management Responsibility
- Section 6: Resource Management
- Section 7: Product Realization
- Section 8:Measurement, Analysis and Improvement

We use ISO to meet the needs of customers and other stakeholders.

AS9100

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- AS 9100 Quality Systems - Aerospace - Model for Quality Assurance in Design, Development, Production, Installation and Servicing
  - **AS9100** is a widely adopted and standardized quality management system for the aerospace industry
  - The current version of AS9100 aligns the standard with ISO 9001:2008 and has extra requirements regarding Regulatory Compliance and the following aerospace-sector specific requirements:

ISO14001

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- ISO 14001:2004 specifies requirements for an environmental management system

- Enable an organization to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organization subscribes, and information about significant environmental aspects. It applies to those environmental aspects that the organization identifies as those which it can control and those which it can influence. It does not itself state specific environmental performance criteria.

ISO TickIT

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- ISO TickIT is a quality-management certification program for software development
- Major objective was to provide industry with a practical framework for the management of software development quality by developing more effective quality management system certification procedures. These involved:
  - publishing guidance material to assist software organizations interpret the requirements of ISO 9001
  - training, selecting and registering auditors with IT experience and competence, and
  - introducing rules for the accreditation of certification bodies practicing in the software sector

One Approach:
Linear, One-to-One Compliance

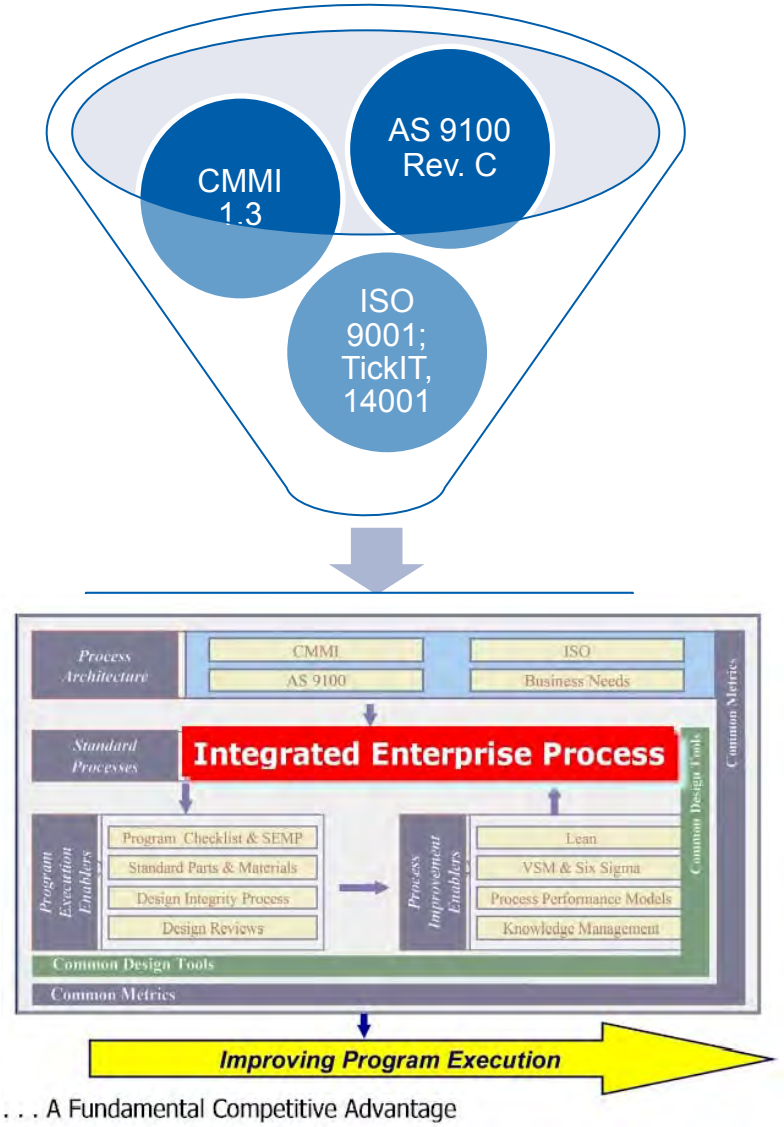
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Develop an organizational process for each major standard.

- AS 9100 Rev. C ⟹ AS 9100 Organizational Process
- CMMI 1.3 ⟹ CMMI Organizational Process
- ISO 9001:2008 ⟹ ISO 9001Organizational Process
- ISO TickIT ⟹ ISO TickIT Organizational Process
- ISO 14001
- Sarbanes-Oxley Act of 2002

What do you do when there are multiple compliance requirements?

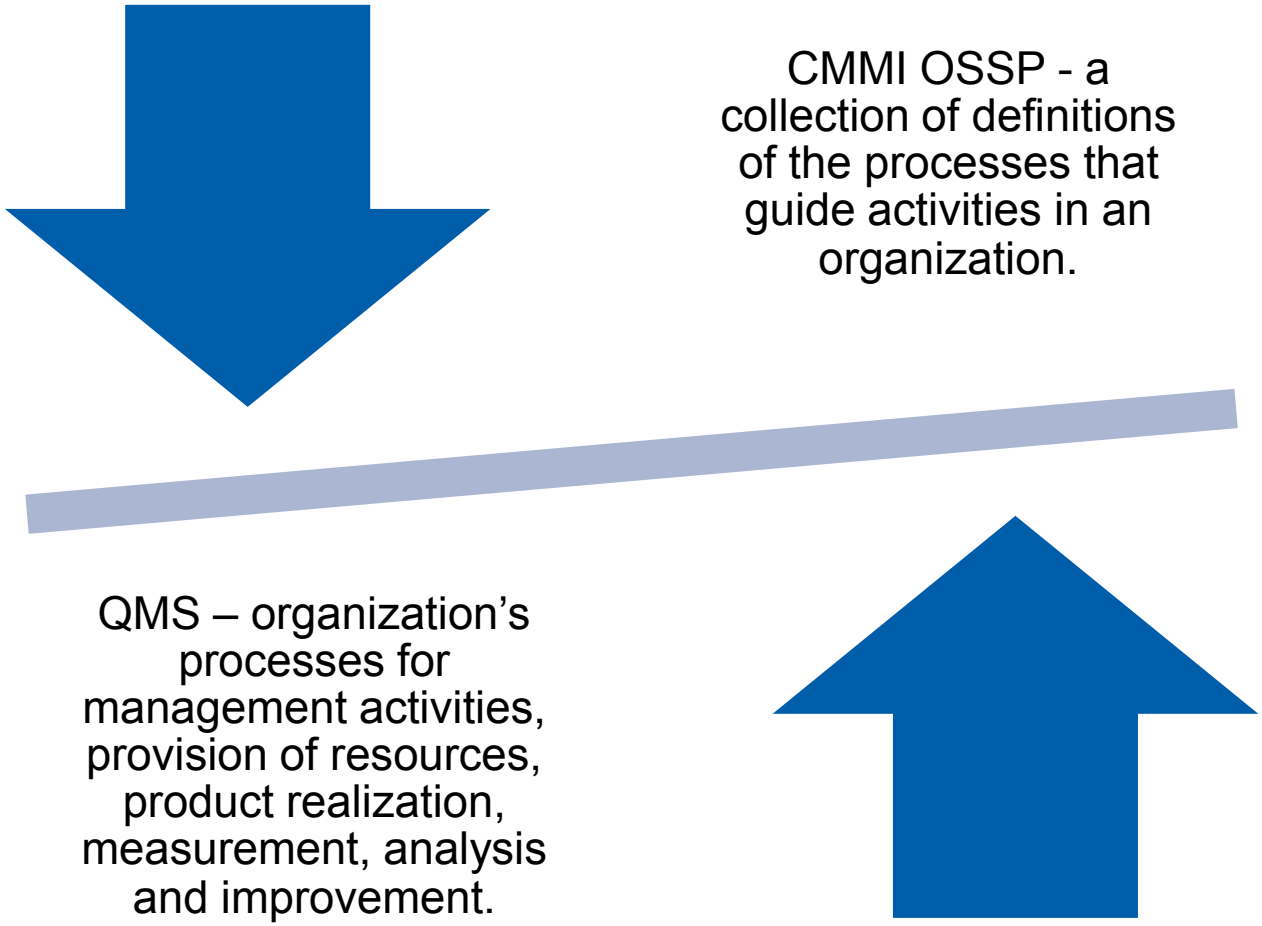
Our Approach: Integrated Enterprise Process



- Complies with key standards
- Encourages integration of all disciplines
- Eliminates duplications
- Implements “good” approaches to resolving “conflicts” between standards

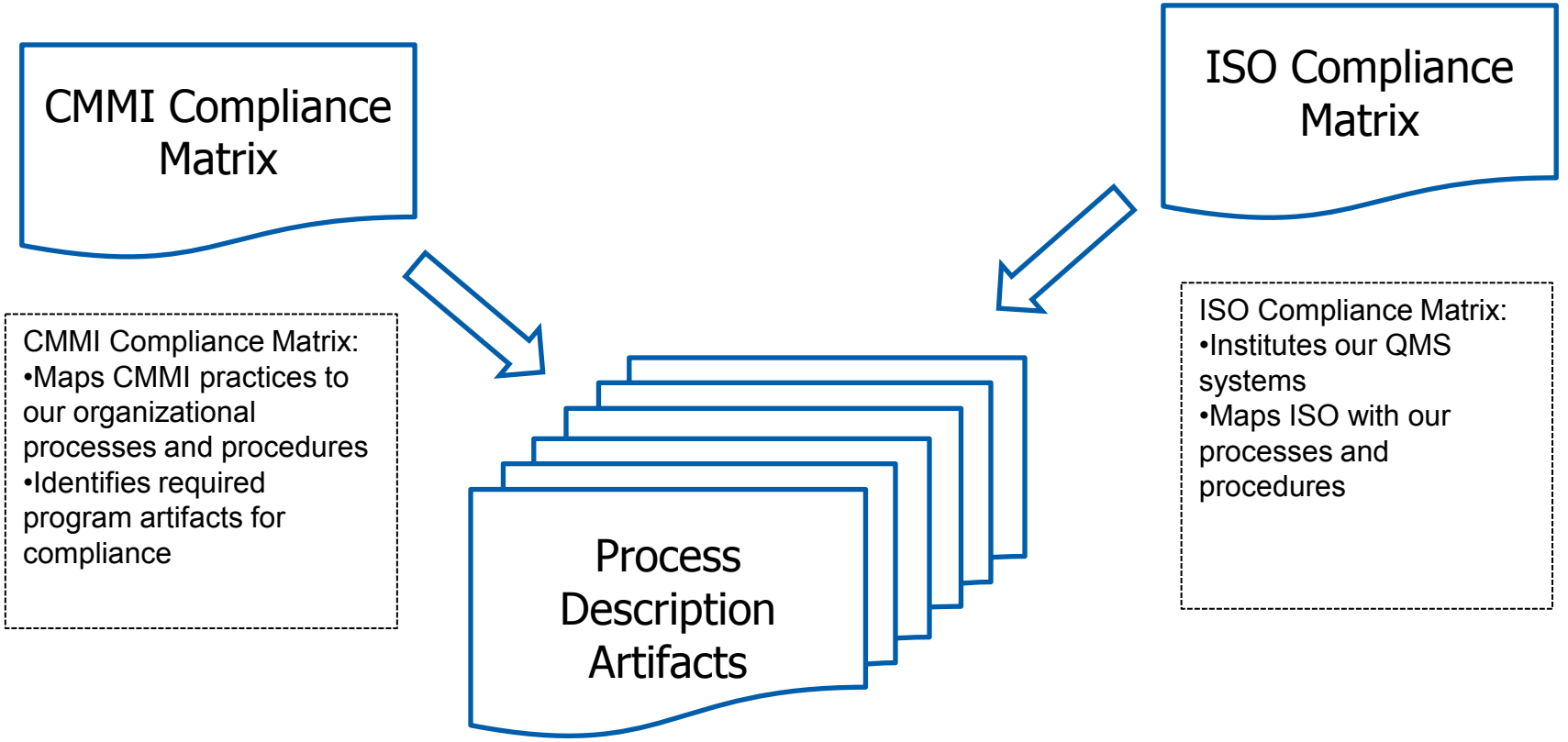
CMMI's OSSP vs. ISO's QMS (1 of 2): How did we balance the two?

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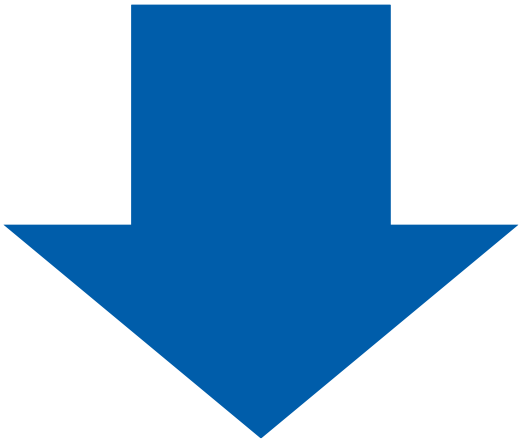
CMMI's OSSP vs. ISO's QMS (2 of 2): Compliance Matrixes

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CMMI Evaluations vs. ISO Internal Audits: How did we balance the two?

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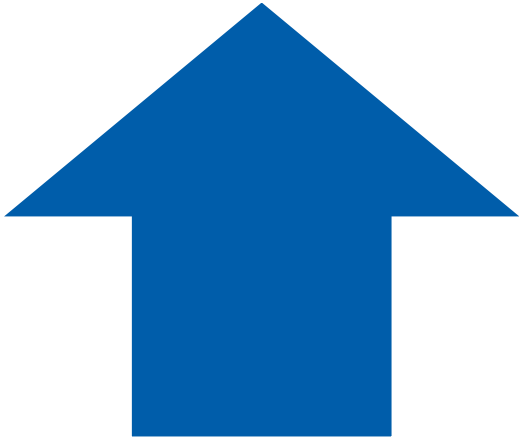
CMMI's Objective Evaluation (PPQA) involve:

- Objectively evaluating performed processes and work products against applicable process descriptions, standards, and procedures
- Identifying and documenting noncompliance issues
- Providing feedback to project staff and managers on the results of quality assurance activities
- Ensuring that noncompliance issues are addressed



ISO's Internal Audits are conducted at planned intervals to determine whether the quality management system

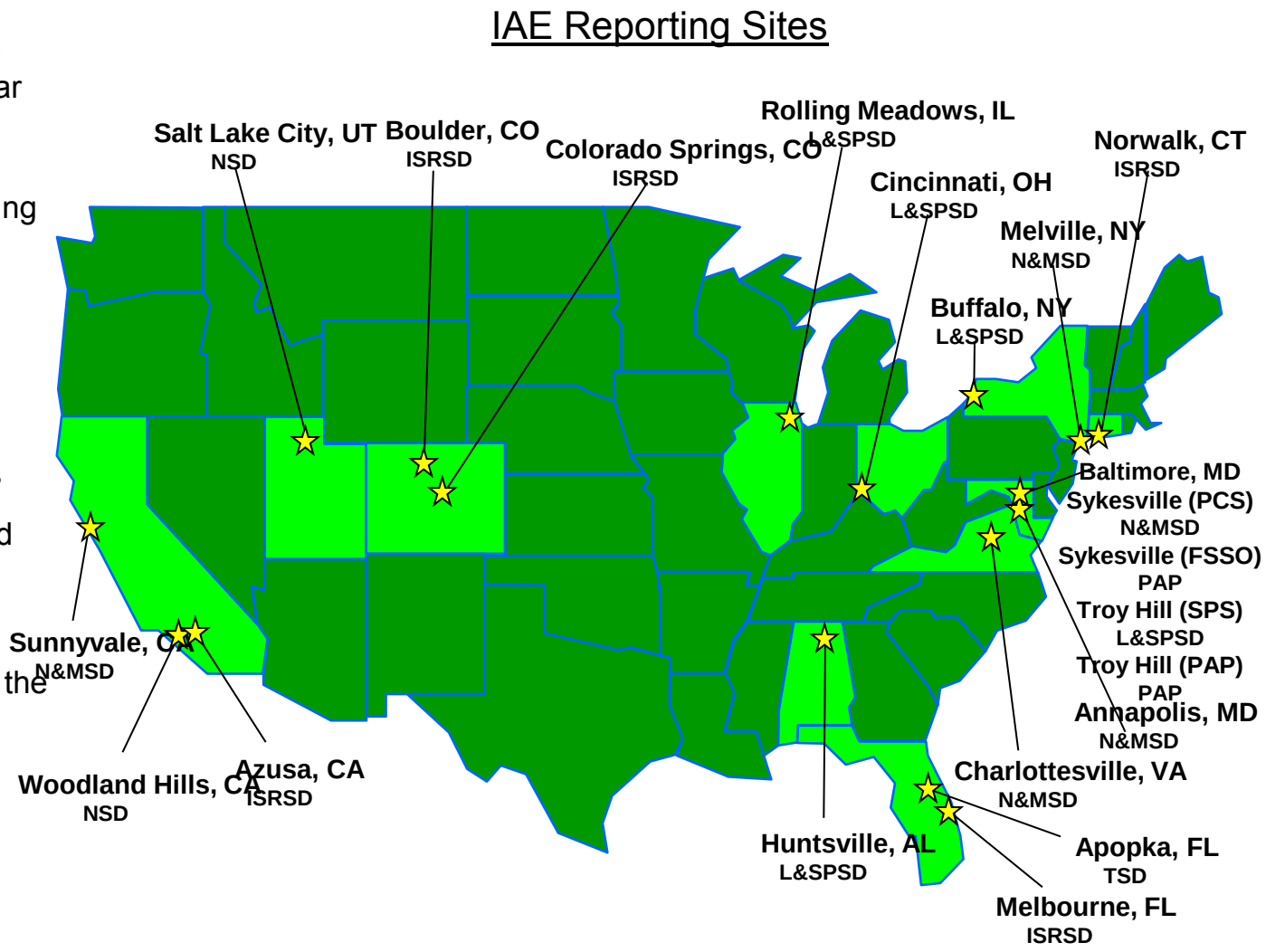
- Conforms to the planned arrangements (product realization plan), to the requirements of the ISO standard, and to the quality management system requirements established by the organization, and



CMMI Evaluations vs. ISO Internal Audits: Internal Audit Effectiveness

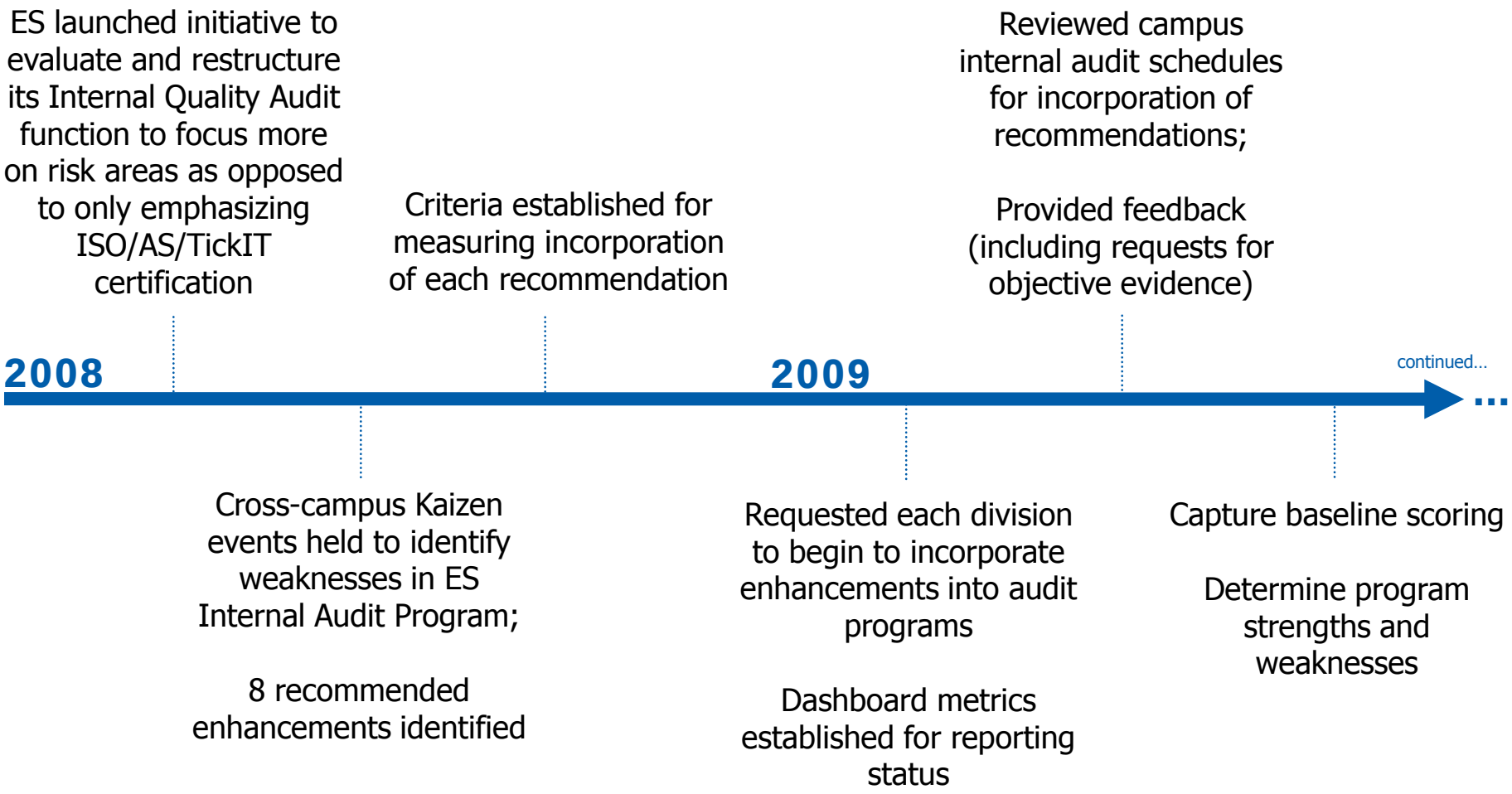
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- Performs approximately 400 internal audits a year across the Baltimore campus covering programs, functional organizations, engineering disciplines and laboratories.
- Ensures compliance to IEP.
- Satisfies CMMI Process and Product Quality Assurance practices and ISO internal auditing requirements.
- Satisfies GP 2.9 across the CMMI Process Areas.



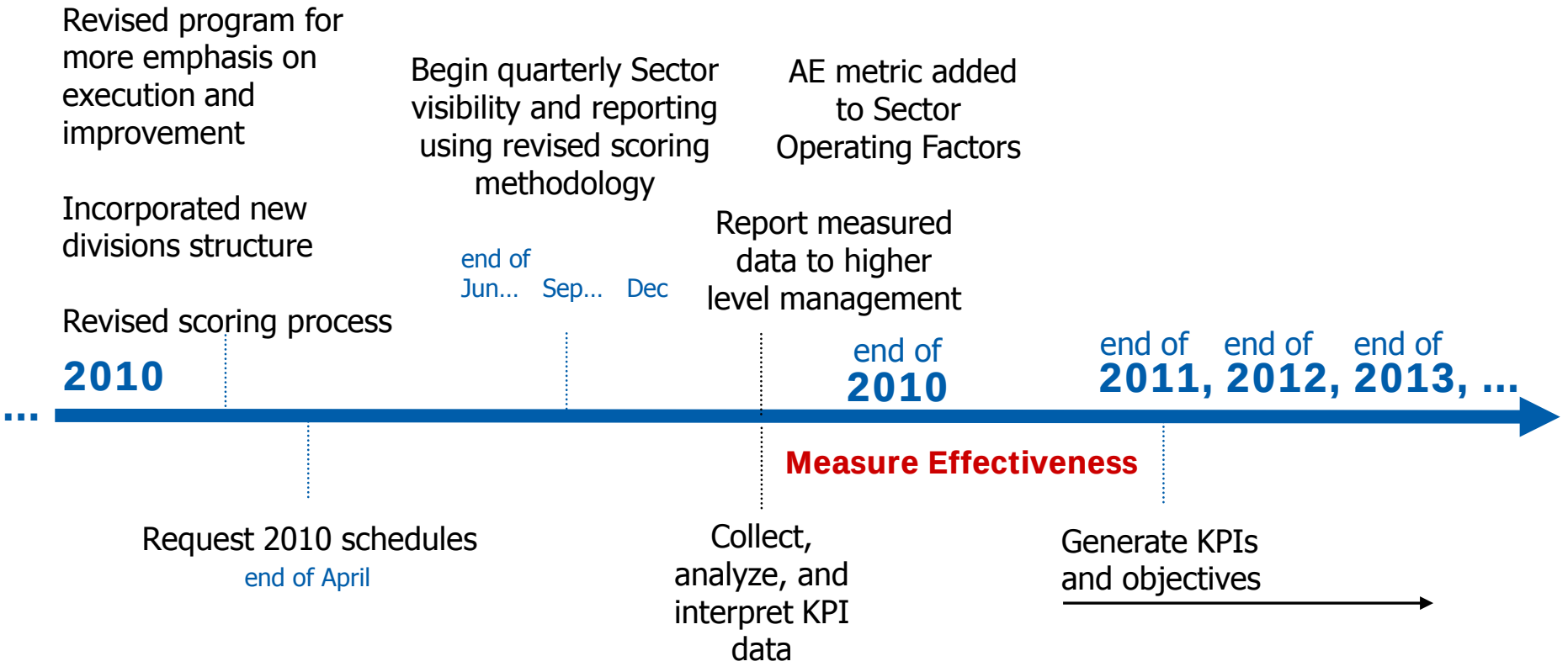
CMMI Evaluations vs. ISO Internal Audits: IAE Timeline – Implementation & Baseline

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Incorporation of recommended enhancements = improvement

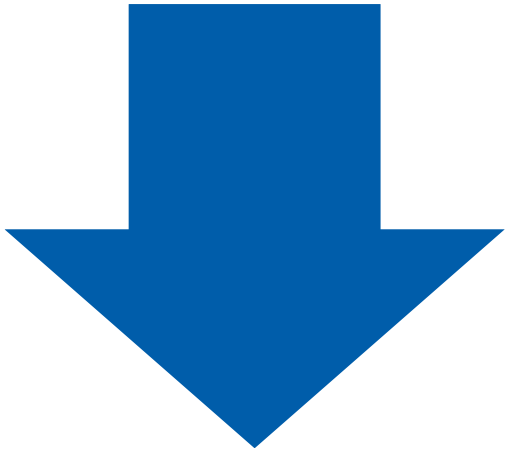
CMMI Evaluations vs. ISO Internal Audits: IAE Timeline – Implementation & Baseline (cont.)



Formal AE Implementation & Measurement

CMMI Higher Level Management Reviews vs. ISO Top Management Review (1 of 2)

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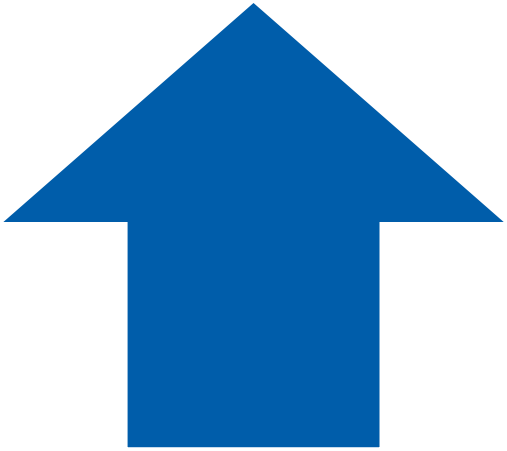


CMMI's Higher Level Management Reviews :

provide higher level management with appropriate visibility into the process. Different managers have different needs for information about the process. These reviews help ensure that informed decisions on the planning and performing of the process can be made. Therefore, these reviews are expected to be both periodic and event driven.

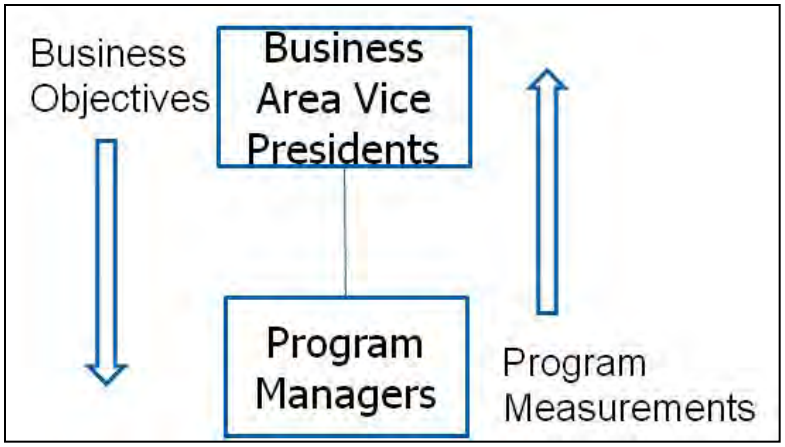
ISO Top Management Review:

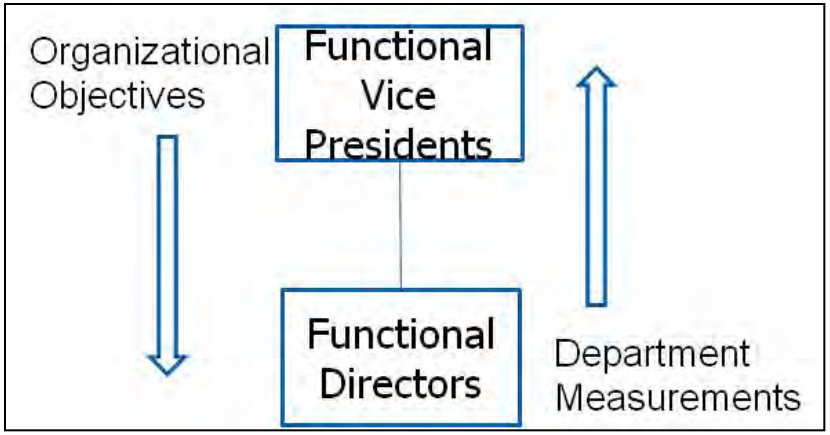
Top management shall review the organization's quality management system, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness. This review shall include assessing opportunities for improvement and the need for changes to the quality management system, including the quality policy and quality objectives.

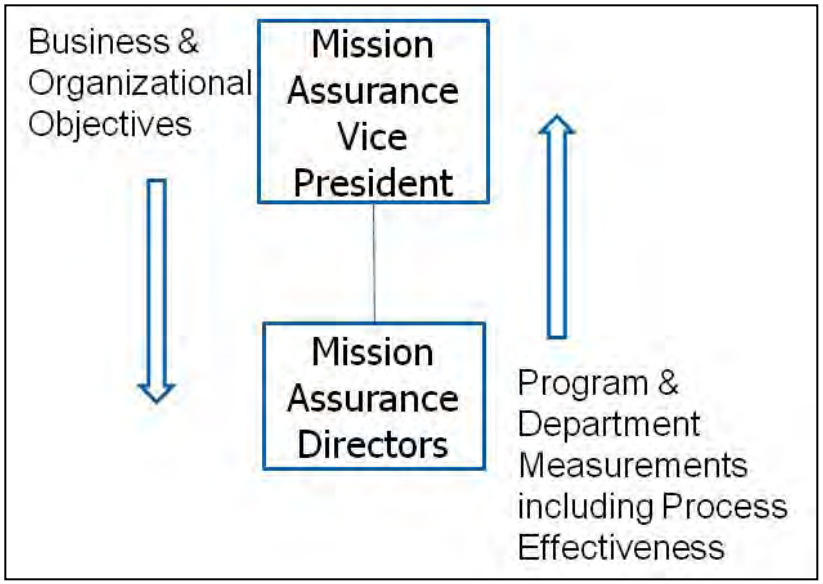


CMMI's Higher Level Management Reviews vs. ISO's Top Management Review (2 of 2)

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Steps to Developing a Multi-Standard Compliant Organizational Process

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1. Assess the various process architectures/frameworks and decide which is best for your organization.

2. Identify the major process elements that comprise your organizational process.
   - Consider the Process Areas of CMMI, but don't overlook other important elements that may be significant to your business.
   - Consider the needs of the various disciplines required for your business.
   - Develop a process "model" identifying the order of execution of the process elements. *Note: there maybe more than one order required. Each discipline may have a more detailed process "model"..*

3. For each process element, identify the most stringent standard.

Steps to Developing a Multi-Standard Compliant Organizational Process

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4. Develop the process element description to meet the requirements of the most stringent standard.
   - Attempt to retain, or slightly modify when necessary, the current practices that are working for the organization.
   - Develop new process only when absolutely necessary to comply. *Note: we don't recommend doing other process improvements at the same time.*
   - Build a matrix or equivalent identifying how compliance is achieved.
   - Include the appropriate process user representatives in the review activities.
   - Resolve discovered issues.

5. Validate that compliance is achieved.
   - Include an expert of the standard and quality.
   - Resolve discovered issues. Resolution may require further review by the process user representation.

6. Check to see if the other applicable standards are also achieved.

7. Integrate the process elements. Consistent with the process "model"

Steps to Developing a Multi-Standard Compliant Organizational Process

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8. Check to see if the other applicable standards are also achieved.
   - If not, amend the process element description appropriately ensuring that compliance to the detailed standard is not lost.
   - Build matrices or equivalents identifying how compliance is achieved. *Note: each standard will have its own matrix or equivalent.*
   - Include the process user, the standard expert, and quality in the review activities.

9. Integrate the process elements. Consistent with the process "model":
   - Ensure that the inputs to each process element are in fact created by another process or available from a library, reference, or storage.
   - Ensure that the outputs from each process element supports follow-on activities or challenge its need.
   - If the integration drives changes to the process element, ensure the applicable compliances are sustained and update the compliance matrices as required.
     - Standard experts, process users and quality should participate in the review of changes as required.

Summary

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- Rank compliance standard in order of importance to your business
- Leverage similarities between the standards
- Think Organizationally


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The change comes from the inside!
Divide and Conquer:

A Top Down and Bottom Up Approach

OST®

CMMI LEVEL 5 | ISO 9001:2008

Agenda

- Purpose
- Background
- Let's talk about Change
- Our Change Management Plan
- Change Management Team
- Conclusions



Purpose

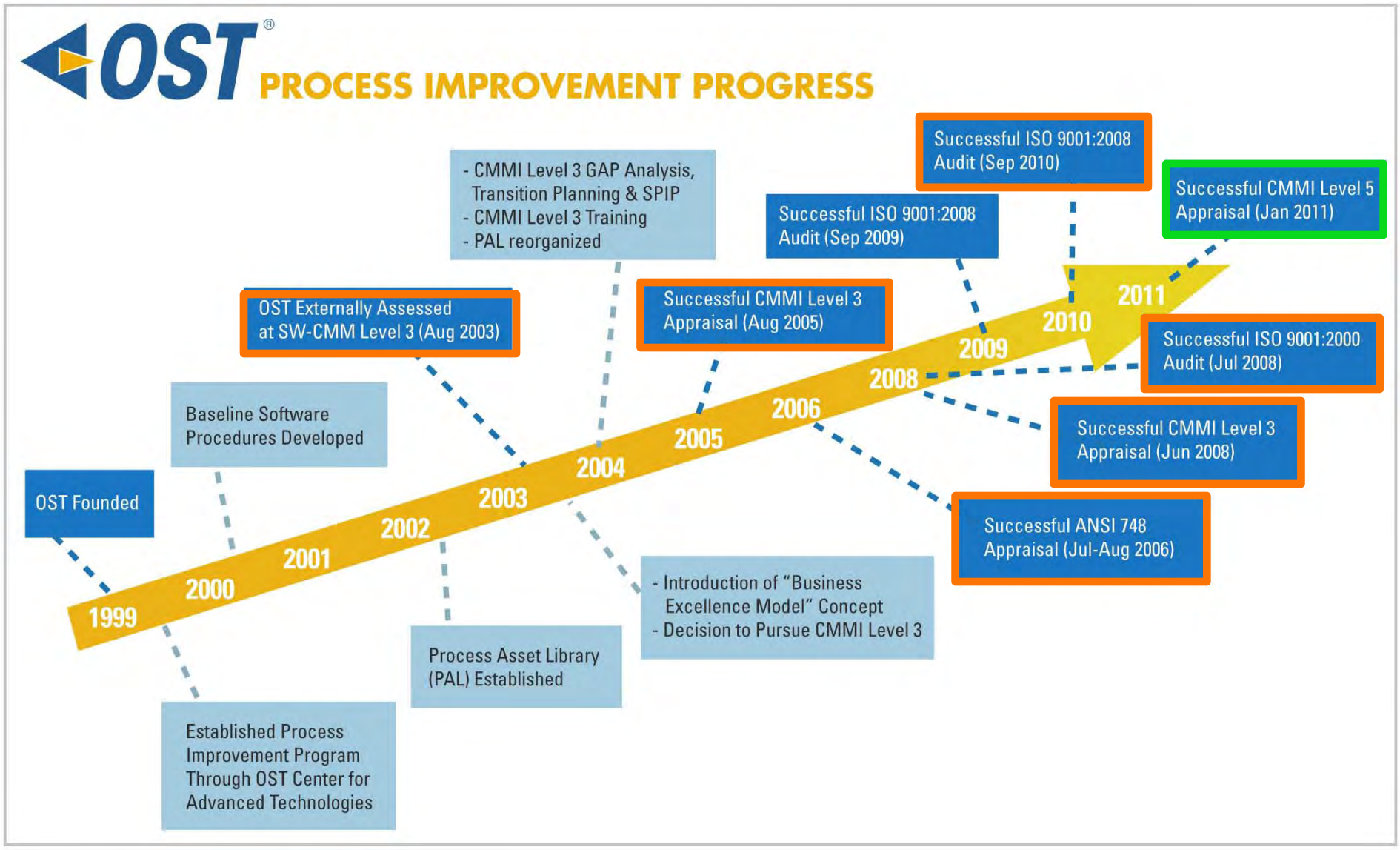
- What is Change and how can a small business achieve Process Improvement Change?
- OST's case study on achieving change
  - Our Change Management Plan & transition to a high maturity organization
  - Our Change Management team
    - How we defined our 80/20
    - Our early adopters
    - What to do with detractors?

Background – Who we are

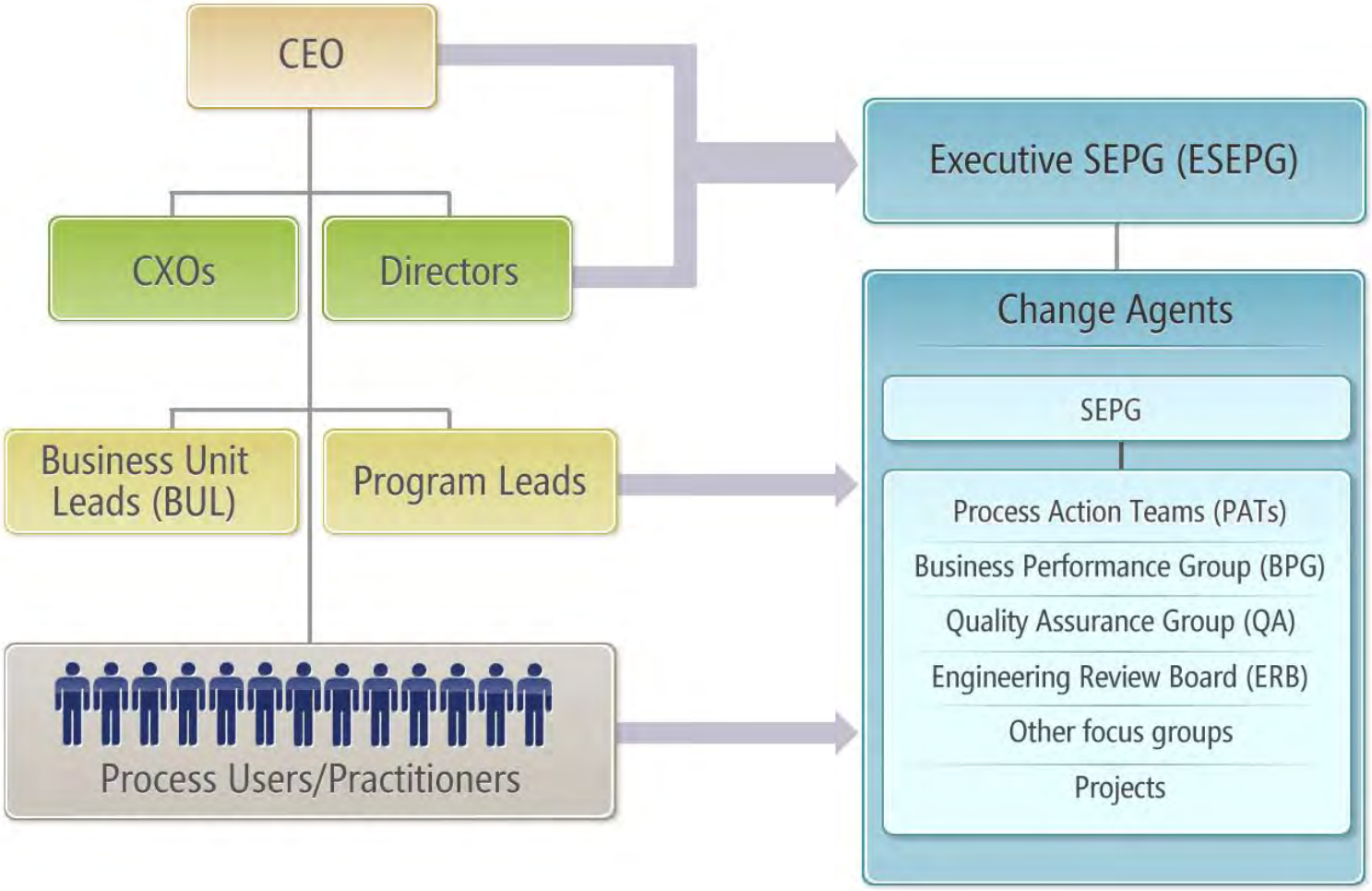
- OST, Inc
- Washington DC-based, founded in 1999
- Core competencies
  - Integrated IT solutions
  - Managed Services
  - Management consulting
  - Research, development & engineering
- CMMI L5 (CMMI-DEV v1.2)
- ISO 9001:2008 certified
- ANSI 748 compliant



Background - Our Process Improvement Timeline



Background- Our Process Improvement Structure



What is change?



Change @ OST – A case study

- Wanted to apply lean concepts
  - Use smartly limited resources
  - Use existing framework
- Wanted to get away from the gut-feeling improvements
  - To proven-improvements
- Competitive advantage





Top down- Senior Management's Support

- They saw the value from the beginning
- Communicated the main message
  - Towards the company's vision
  - Benefits of the change at different levels
- Maintained the enthusiasm and motivation
- Head of communication channel



Change Management Plan

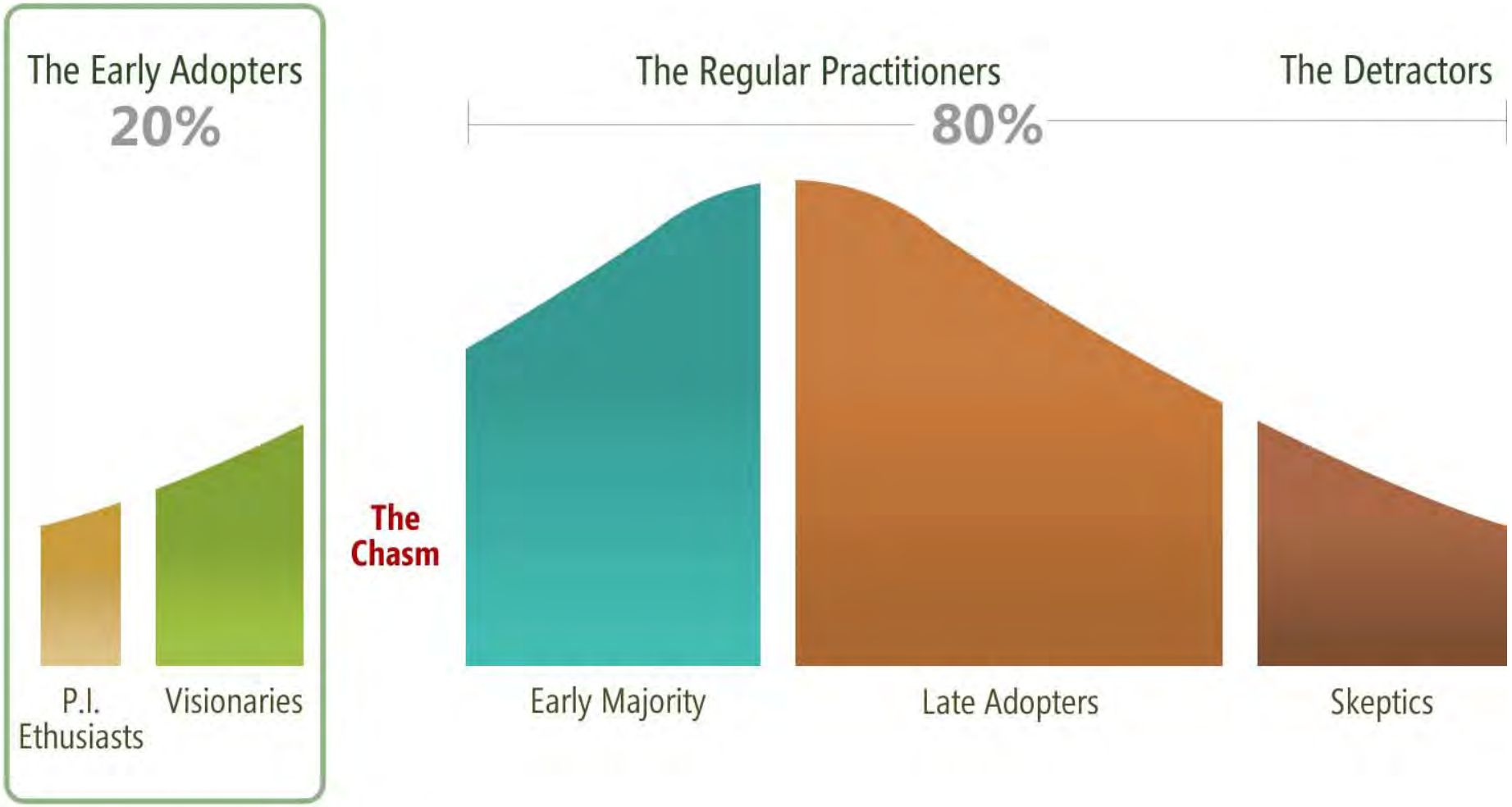


The 80/20- Our people



How to define your 80/20 – Bringing change

- Crossing the chasm -



Source: Crossing the Chasm. Geoffrey A. Moore. Collins Business Books essentials; revised Edition 2002. ISBN 13: 9780060517120 ISBN 10: 0060617123

Early Adopters- Change Management Team

- Creation of Business Performance Group (BPG)
  - Group to take process improvement to the next level
    - "Early adopters" from several projects and backgrounds
  - SEPG leaders selected the team
    - Interaction from governance activities, audits, focus group participations
- Characteristics
    - Humble – Attitude counts
    - Hungry
      - Challenge you
      - Ownership
      - Leadership
    - Trustworthy
    - Availability and Commitment
- Got buy-in from respective PMs and Business Unit Leads
  - Before talking to potential members

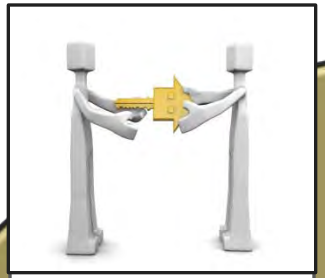


Change Management Team- From Group to Team



- Invested time for the members to know each other
  - Myers- Briggs – Learn how to work among team members
  - Meet in person as often as possible
  - Build team values
- Let them know about the distinction
  - What they bring to the table
  - Let their peers know
  - Sr. Mgt reinforced` the message and kept them motivated
- Gave them authority for their area of work
- Let them take ownership in tasks in their area of interest
  - Sometimes challenged them with other tasks

Change Management Team - Responsibilities



Transition



Vision



Alignment



Empowerment

Change Management Team Responsibilities



Resources



Dialogue



Congruence



Anticipation

Change Management Team- What they accomplished

- Planned and implemented change management action plans
  - Provided feedback from the practitioner's perspective
  - Ensured *ease of use* and *usefulness** of new processes
- Led by example
  - Implemented on their projects
  - Introduced change to their peers
  - Established the buddy program to ensure understanding
- Became the main channel of communication
  - Gather first source feedback
  - Gained the trust of other peers
  - Are still supporting implementation of L5



* *Medha Umarji,* Gauging acceptance of software metrics: Comparing perspectives of managers and developers

Detractors?- What to do

- Identified skeptics
  - Through the feedback provided
  - Their attitude toward process changes
- Analyze their feedback
  - Found the root cause
    - Commonalities- role, activities, concerns
  - Incorporated feedback in the process
  - Establish action plans to get buy-in
- PMs shared concerns
  - Project Managers that had concerns about sustainability
  - Impact on the project constructs
  - Created a group with early adopter PMs and BULs
    - Helped us getting understanding of where others were coming from



Change Management- Did it work?

- Practitioners start driving the change
  - Make requests
  - Provide feedback
  - Provide new ideas
- Their language changed
  - Practice interviews- L5 institutionalized
  - Practitioners started inquiring to implement in their projects
- Our business outlook changed
  - Strategic and goal oriented
  - Replaced gut feeling with quantitative decision making



What we learned

- If you are having a bumpy road…
  - A lot of noise is coming back
    - Don’t worry, it shows they are listening
- Don’t assume all resistance comes from being a detractor…
  - Most times is miscommunication
- Don’t wait for a fully cooked recipe to share…
  - Share a little bit on the way to get feedback and adjust
- Keep your cool and remember your core values…
  - People drive the change
- Don’t forget about the middle

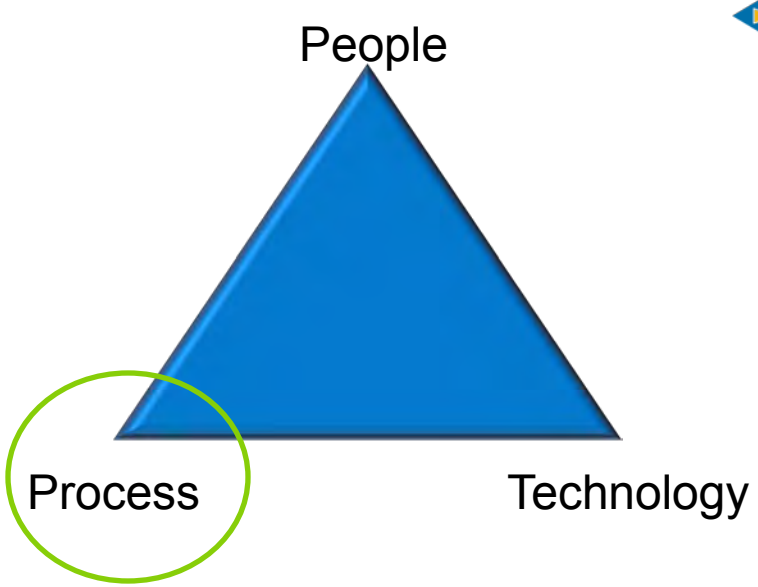


What we learned



Conclusion- The Pursuit of True Change

- People, process, and technology impact quality
- Process is a sequence of steps performed for a given purpose (IEEE)
- Process changes have the most impact



Conclusion- A Suggested Roadmap

Define the Battle

- Why are you pursuing the change?
- Does it align to your vision?
- Define benefits at all levels
- Get Senior Management's commitment
- Create a Plan- Use your GPs

Target the Point of Attack

- Find your early adopters- They will become your best sellers and provide feedback
- Create a Change Management Team – for practitioners and PM level
- Find your skeptics- Analyze why and how to bring them over

Assemble and Invasion Force

- Create the "whole product"- processes, solutions, support structure, etc
- Ensure its *ease of use* and *usefulness*- Otherwise, who wants it?
- Establish support mechanisms- trainings, buddy programs, etc
- Ensure the outputs provide the expected benefit

Launch the Invasion

- Define and manage channels of communication
- Use your change management team as your "sales force"
- Beat the drums- Sr. Mgt, SEPG, Practitioners

Summary

- ✓ What is Change and how can a small business achieve PI Change?
- ✓ OST's case study on achieving change
  - ✓ Our Change Management Plan & transition to a high maturity organization
  - ✓ Our Change Management team
    - ✓ How we defined our 80/20
    - ✓ Our early adopters
    - ✓ What to do with detractors?

Questions & Answers

Any Questions?



Appendix- Reference Material

- *Crossing the Chasm*: Geoffrey A. Moore, Collins Business Books essentials,revised Edition, 2002. ISBN 13: 9780060517120 ISBN 10: 0060617123
- Gauging acceptance of software metrics: Comparing perspectives of managers and developers, *Medha Umarji,*. http://www.spamcast.libsyn.com/index.php?post_category=Measurement



Raytheon

Customer Success Is Our Mission

SCAMPI^{SM} A V1.3 MDD Usage Profile

Michael Campo

Raytheon Integrated Defense Systems

NDIA CMMI® Technology Conference and User Group

November 17, 2011

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MDD V1.3 Glossary Definitions

- **Basic unit** – A managed set of interrelated resources which delivers one or more products or services to a customer or end user and typically operates according to a plan (e.g., projects, work groups).
- **Sampling factor** – organizational or work context that reflects meaningful differences in the way work is performed across different basic units within the organizational unit (e.g., size, location, customer).
- **Subgroup** – Cluster of basic units that share common sampling factor alternatives and exhibit similar process implementations.
- **Support function** – An organizational group that provides products and/or services for a bounded set of activities needed by other portions of the organization (e.g., Configuration Management group, Quality Assurance group).
- **Organizational scope** - The collection of basic units and support functions that provides instantiations of practices used within, and representative of, an organizational unit.

Sampling Factors in Action

Determining Subgroups and Samples Example: BINDY Co.

1. Identify Sampling Factors
   - Location: Indianapolis, Boston
   - Type of Work: new, maintenance
   - Customer: DoD, commercial
2. Combine sample factors, sort basic units (BUs), determine min. sample
   - Minimum # of BUs per subgroup = (# BUs in subgroup × # subgroups) / total # BUs

BINDY Co.		Location	Type of Work	Customer	# of BUs in subgroup	# subgroups X # BUs in subgroup	...divided by total # BUs	Min. Number Sampled
		Boston	new	comm	0	0	0.00	0
	Subgroup 1	Boston	new	DoD	4	20	0.13	1
	Subgroup 2	Boston	maint	comm	49	245	1.64	2
		Boston	maint	DoD	0	0	0.00	0
	Subgroup 3	Indy	new	comm	5	25	0.17	1
	Subgroup 4	Indy	new	DoD	16	80	0.54	1
		Indy	maint	comm	0	0	0.00	0
	Subgroup 5	Indy	maint	DoD	75	375	2.52	3
Totals	5				149			8

#sampling factors => # subgroups => # BUs sampled

Outline

- Introduction
- CMMI V1.3 Appraisals
- Sampling Factors
- Subgroups
- Basic Units
- Support Functions
- Organizational Unit Size
- Data Relationships
- SCAMPl Infrastructure Implications
- Comparing MDD V1.2 and MDD V1.3 CMMI V1.3 Appraisals
- Coda

Introduction - Purpose

- Understand adoption and usage of MDD V1.3
- Provide guidance to future MDD V1.3 users

- Ensure MDD V1.3 is working and being used as intended
- Identify possible SCAMPI infrastructure implications based on usage within the community
  - MDD, SAS, PARS, ADS, Training Material

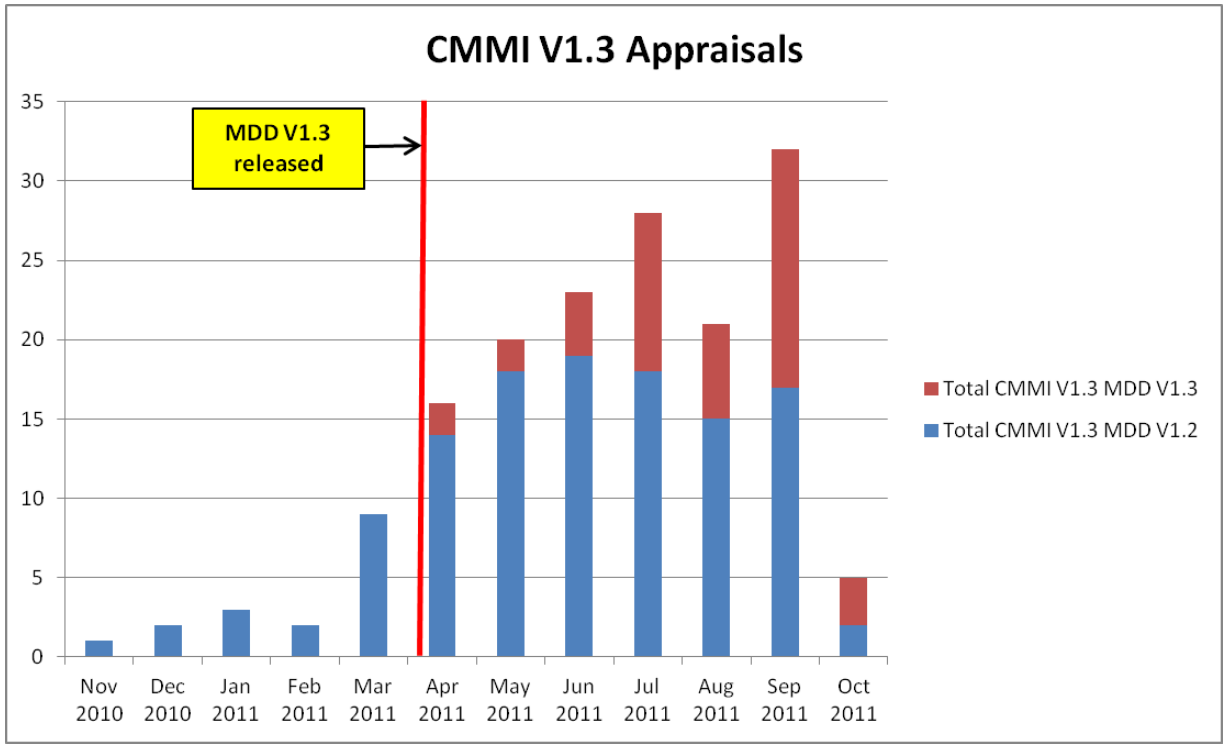
Introduction – Briefing Contents

This briefing includes:

- MDD V1.3 Adoption
- Sampling Factor Analysis
- Subgroup Analysis
- Basic Unit Analysis
- Support Function Analysis
- Organizational Unit Analysis
- Data Relationships
- SCAMPI Infrastructure Implications
- Comparing MDD V1.2 and MDD V1.3 CMMI V1.3 Appraisals

- Notes:
  - All data comes from the SEI Published Appraisal Results Site (PARS)
  - Data includes SCAMPI A appraisals posted to PARS by November 1, 2011

MDD V1.3 Adoption Data



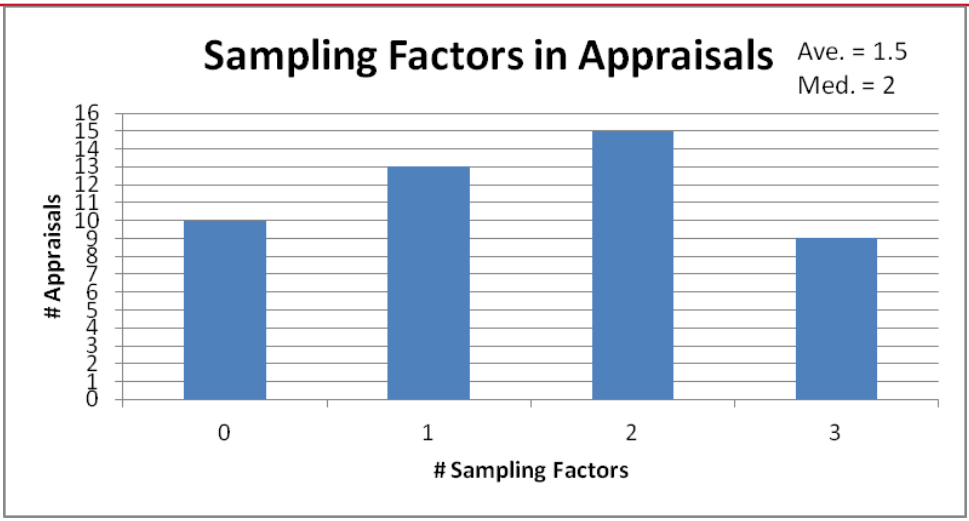
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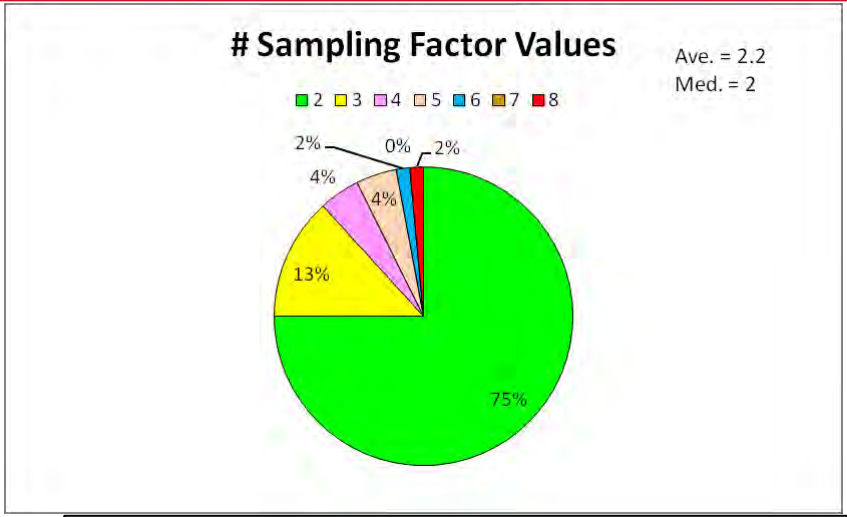
1. 47 MDD V1.3 appraisals reported in PARS, 42 with CMMI V1.3 models (see graph/data).
2. 5 CMMI V1.2 MDD V1.3 appraisals were reported (not shown on this chart), 2 in 1 multi-model appraisal.
3. No P-CMM MDD V1.3 appraisals have been conducted.
4. 2 CMMI V1.3 MDD V1.3 multi-model appraisals were conducted.

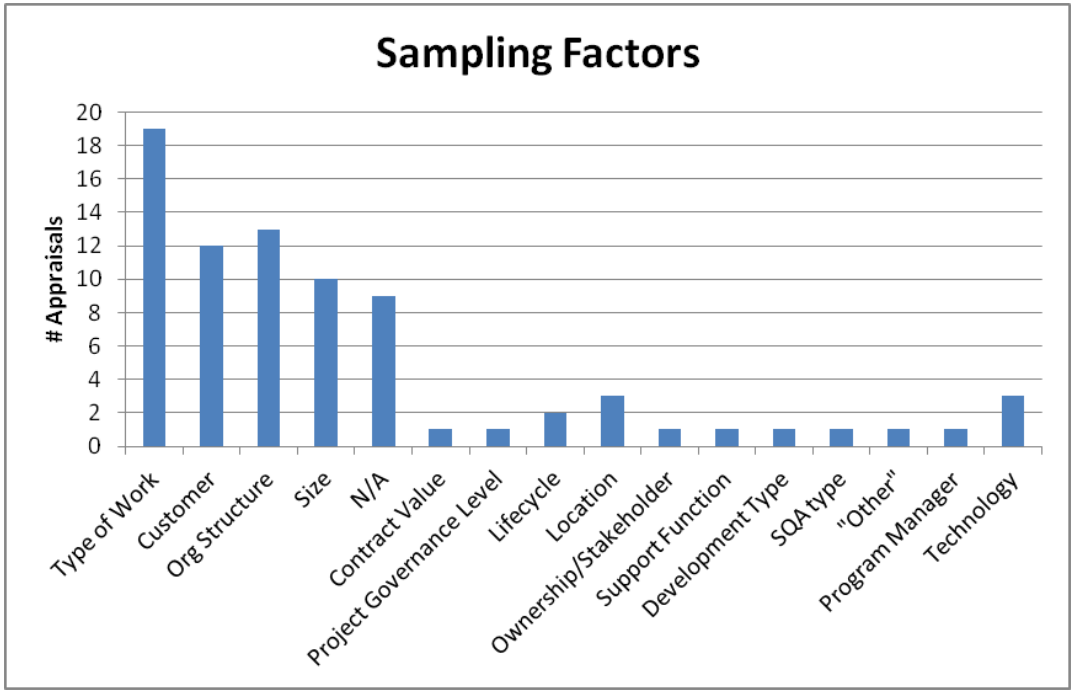
	Nov 2010	Dec 2010	Jan 2011	Feb 2011	Mar 2011	Apr 2011	May 2011	Jun 2011	Jul 2011	Aug 2011	Sep 2011	Oct 2011	total		since MDD V1.3 release	
CMMI-DEV V1.3 MDD V1.2	0	1	3	2	7	12	15	15	17	12	14	2	100	73%	87	70%
CMMI-DEV V1.3 MDD V1.3	0	0	0	0	0	1	2	4	9	5	13	3	37	27%	37	30%
CMMI-SVC V1.3 MDD V1.2	1	1	0	0	1	2	3	4	1	3	3	0	19	79%	16	76%
CMMI-SVC V1.3 MDD V1.3	0	0	0	0	0	1	0	0	1	1	2	0	5	21%	5	24%
CMMI-ACQ V1.3 MDD V1.2	0	0	0	0	1	0	0	0	0	0	0	0	1	100%	0	
CMMI-ACQ V1.3 MDD V1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0%	0	
Total CMMI V1.3 MDD V1.2	1	2	3	2	9	14	18	19	18	15	17	2	120	74%	103	71%
Total CMMI V1.3 MDD V1.3	0	0	0	0	0	2	2	4	10	6	15	3	42	26%	42	29%

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Sampling Factors



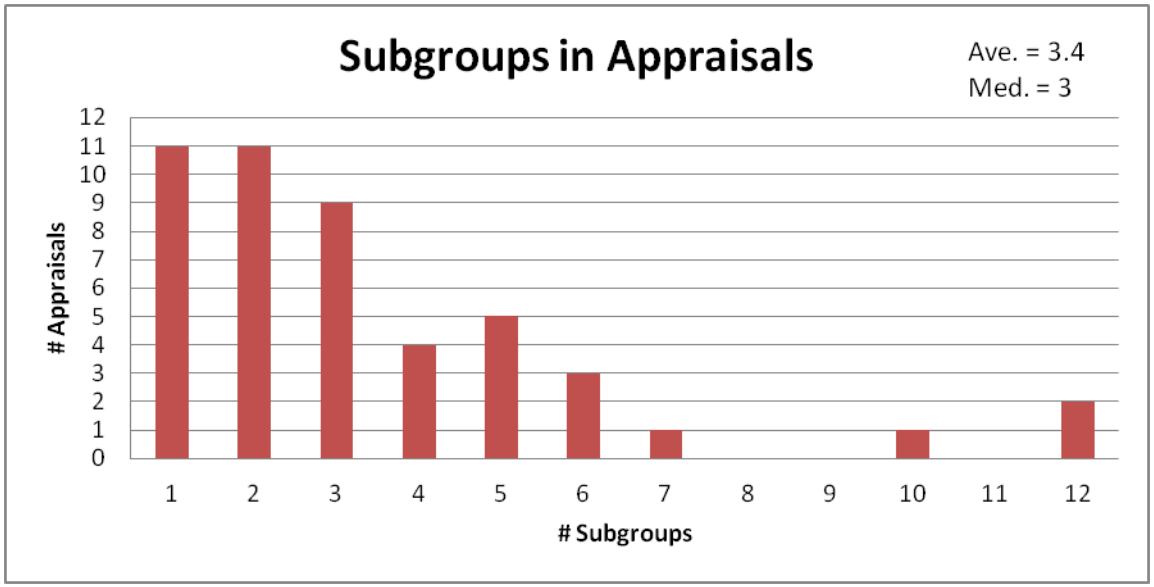




Notes:

1. No appraisals have > 3 sampling factors.
2. 8 of the 10 “zero-sampling factor” appraisals included 100% of OU basic units.
3. [Type of Work, Customer, Org Structure, Size] constitute 77% of sampling factor usage (not counting N/As).
4. “Location” (required to be considered) is not typically a sampling factor.
5. Sometimes “sampling factors” appear to be “forced” (e.g., “Customer” identified as a sampling factor, but description says “Though the OU has different customers, the work is performed the same way for all customers.”) SEI Appraisal System problem.

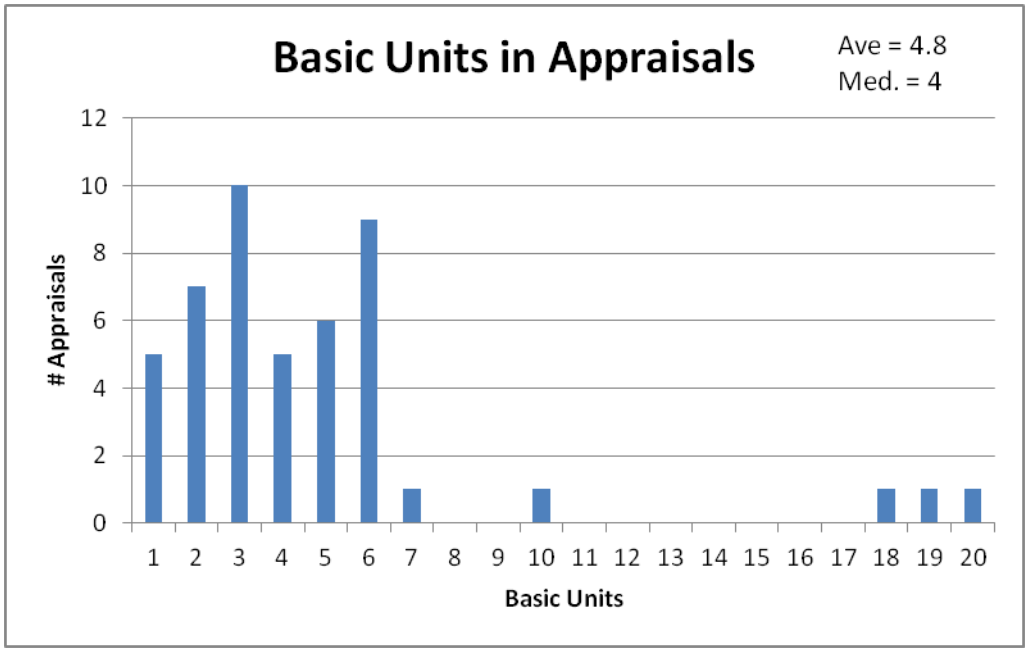
Subgroups



Notes:

1. If average #sampling factors = 2 and average #sampling factor values = 2, an average of 3-4 subgroups seems reasonable.
2. One appraisal had 2 sampling factors, each with 2 sampling factor values, but only 1 subgroup. Questionable data: "forced" sampling factors.
3. In 5 appraisals, the #basic units in the organizational scope is less than the #subgroups. Questionable data: #basic units should be ≥ #subgroups (MDD Data Coverage Rule 1 for Basic Units).
   - In 4 of the 5 appraisals, support functions (QA, HR, Training, EPG) were being called subgroups, and sometimes also called sampling factors and/or sampling factor values. Questionable data: MDD definition of subgroup is "Cluster of basic units that share common sampling factor alternatives…"
   - In 1 "zero-sampling factor appraisal", 100% of the OU was contained in the organizational scope, and was segmented into "subgroups" that don't align with MDD usage of the term subgroup. Questionable data: misuse of the term subgroup.

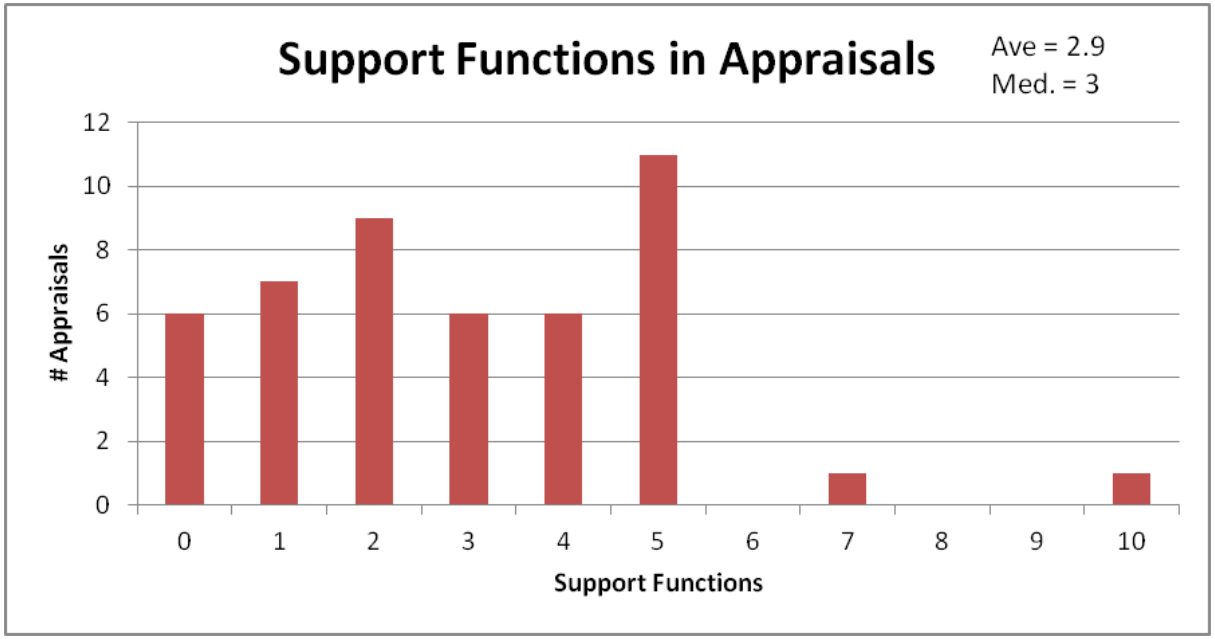
Basic Units



Notes:

1. If the average #subgroups = 3, then the average #basic units = 4-5 seems reasonable.
2. The "18 basic unit" example was a large organization (2000+), with 6 subgroups, some of which contained as many as 100 basic units).
3. The "19 basic unit" example was a small (< 100) organization whose appraisal also contained 5 support functions and 6 subgroups. 15 basic units had just 1 person each. 4 of the 5 support functions had just 2 people each.
4. The "20 basic unit example" was a large organization (2000+) that chose to broaden OU coverage beyond MDD V1.3 minimum requirements in order to include projects of strategic importance and to include projects from various locations even though location was not considered a sampling factor.
5. 47% of appraisals still have 3 or fewer basic units (an MDD V1.2 concern).

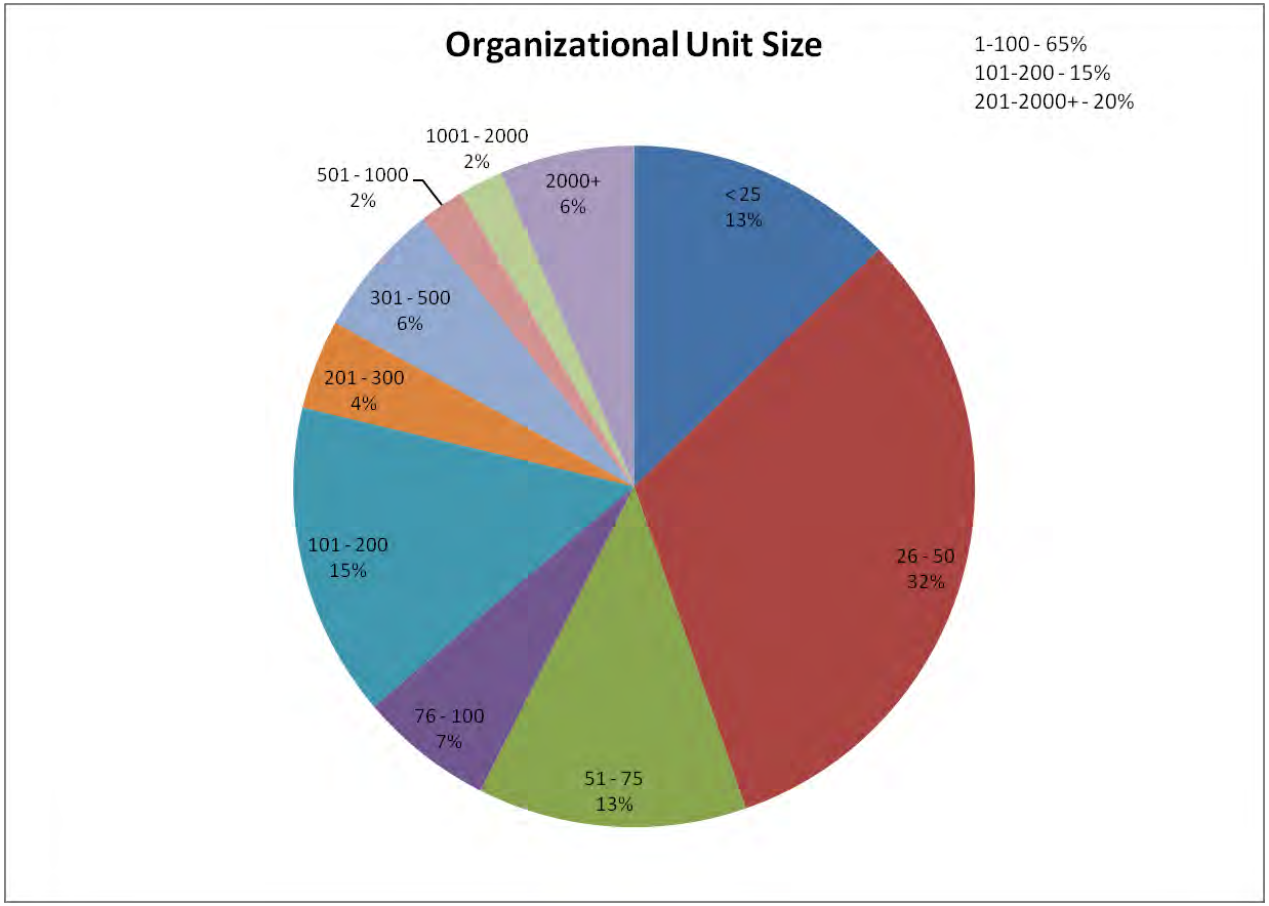
Support Functions



Notes:

1. Type of support function is not always entered into PARS (sensitive). 29 appraisals contained some identifying information about the support functions.
2. QA, CM, Training, and EPG are the most common support functions.
3. MA identified as a support function 3 times.
4. In some cases, support functions were being called subgroups, and sometimes also called sampling factors and/or sampling factor values. Questionable data.

Organizational Unit Size



CMMI 3/2011 Maturity Profile	
1-100	61%
101-200	17%
201-2000+	22%

OU Size	# Appraisals
< 25	6
26 - 50	15
51 - 75	6
76 - 100	3
101 - 200	7
201 - 300	2
301 - 500	3
501 - 1000	1
1001 - 2000	1
2000+	3
total	47

Notes:

1. MDD V1.3 OU Size Percentages are comparable to CMMI Maturity Profile data.
2. OU size is estimated based on basic unit and support function "number of people", and "% of people included" fields in PARS.

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Data Relationships (1 of 4)

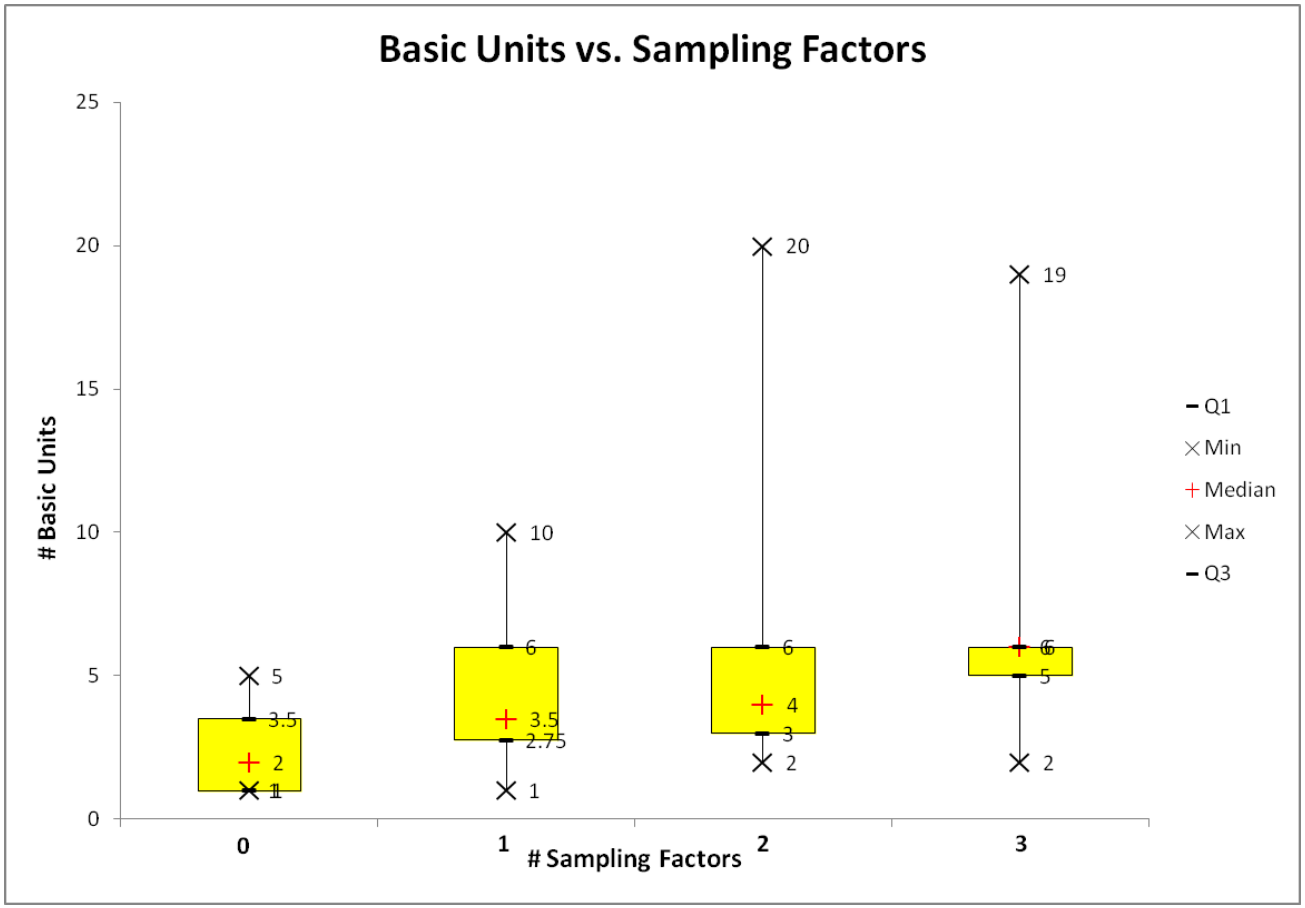
#Sampling Factors and #Basic Units = f(OU Size)?…too early to tell. Current data does not show a relationship.

OU Size	# Appraisals	# Sampling Factors in Appraisals															Basic Units in Appraisals														
< 25	6	0	1	0	1	0	0										2	1	2	3	1	1									
26 - 50	15	0	2	2	2	1	1	1	1	3	2	1	2	2	2	1	1	4	3	3	2	2	6	6	2	3	3	5	3	4	3
51 - 75	6	2	0	3	1	2	1										3	5	19	6	4	4									
76 - 100	3	2	0	2													3	1	7												
101 - 200	7	3	3	3	2	3	2	3									6	6	5	6	6	2	5								
201 - 300	2	2	1														4	5													
301 - 500	3	3	1	0													6	6	3												
501 - 1000	1	0															5														
1001 - 2000	1	1															10														
2000+	3	2	2	0													20	18	2												

Data Relationships (2 of 4)

#Basic Units = f(#Sampling Factors)?…too early to tell.

- #Basic Units appears to be rising as #Sampling Factors rises
- Nominally #Subgroups = f(#sampling factors, #sampling factor values) and #Basic Units = f(#Subgroups).



Data Relationships (3 of 4)

#Basic Units = f(#Subgroups)?

- Nominally #Subgroups = f(#sampling factors, #sampling factor values) and #Basic Units = f(#Subgroups)…

- Data in red are questionable

- **In 5 appraisals, the #Basic Units in the organizational scope is smaller than the #Subgroups.**

- **Coverage Rule 1 for Basic Units: For each subgroup, both artifacts and affirmations shall be provided for at least one basic unit for every process area implemented by basic units in the subgroup.**

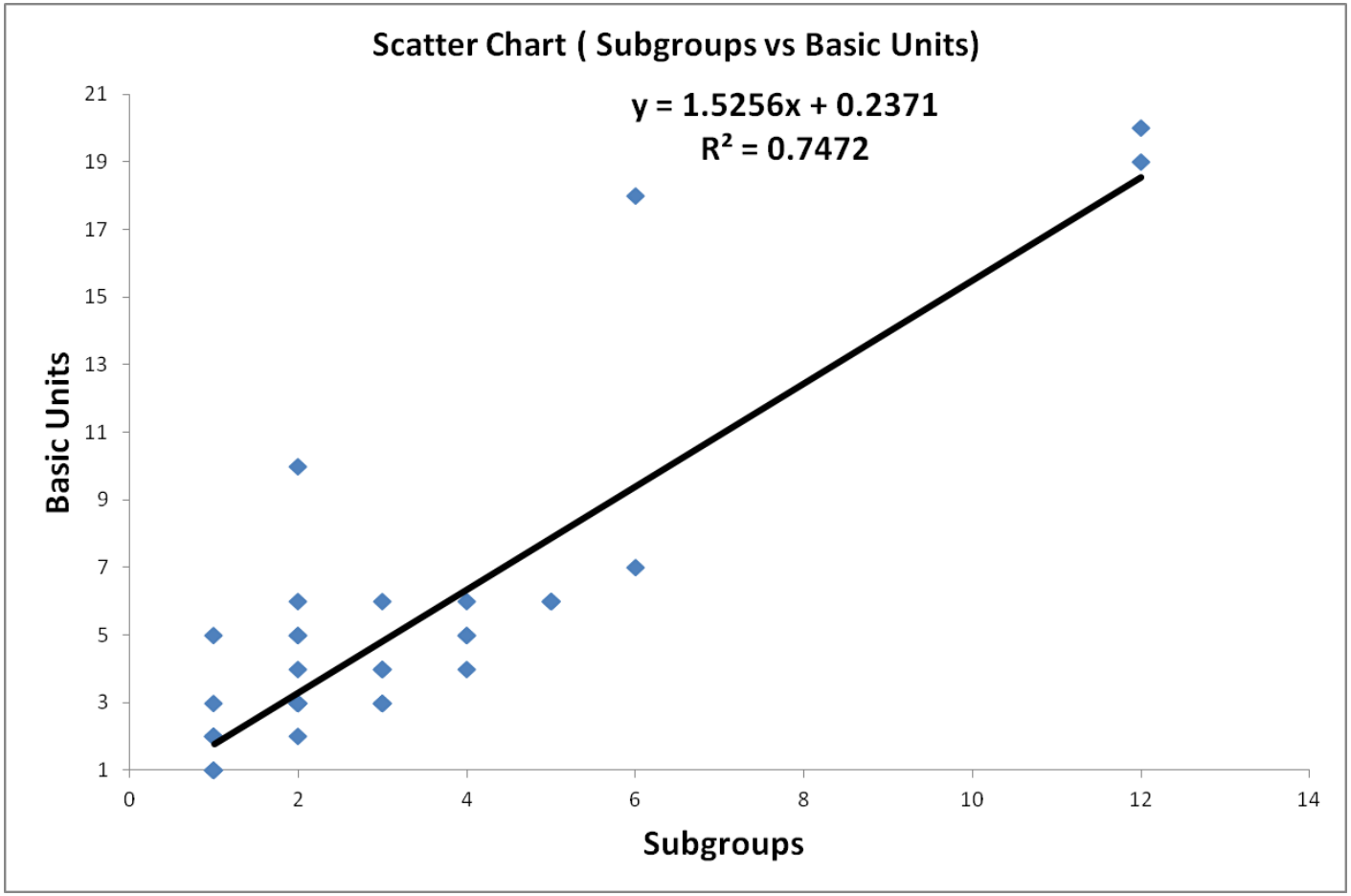
- **2 appraisals have 2 sampling factors but only 1 subgroup. Questionable data – forced sampling factor.**

Sampling Factors	Subgroups	Basic Units	Average (BUs)	Median (BUs)
0	1	1	2.3	2
0	1	5		
0	1	2		
1	1	1		
0	1	2		
0	1	1		
2	1	5		
0	1	3		
0	1	2		
0	1	1		
2	1	2		
0	2	5	4.3	3
1	2	10		
1	2	2		
2	2	3		
1	2	6		
1	2	3		
1	2	3		
1	2	5		
1	2	4		
1	2	3		
2	2	3		
1	3	2	3.6	3
2	3	3		
2	3	4		
2	3	3		
2	3	3		
2	3	4		
2	3	3		
2	3	4		
3	3	6		
1	4	6		
3	4	5		
3	4	5		
2	4	4		
0	5	1	5	6
1	5	6		
1	5	6		
3	5	6		
3	5	6		
3	6	2		
2	6	18		
2	6	7		
2	7	6		
3	10	6		
2	12	20		
3	12	19		

Data Relationships (4 of 4)

#Basic Units = f(#Subgroups)

With questionable data removed, a reasonably strong relationship emerges



SCAMPI Infrastructure Implications (1 of 2)

Possible MDD changes

- If "location" continues to be a little-used sampling factor, consider removing it from list of mandatory sampling factors to be considered.
- The MDD does not address "zero-sampling factor" appraisals.
  - Using the MDD definition of subgroup ("Cluster of basic units that share common sampling factor alternatives…"), zero sampling factors implies #subgroups = 0…
  - …but if #subgroups = 0, there are no minimum basic unit sampling requirements in the MDD.
  - Most "zero-sampling factor" appraisals shows #subgroups = 1, but one case = 5 and another = 2.
  - Recommendation:
    - Amend the definition of "subgroups" to allow for cases where there are no meaningful differences in the entire OU process implementation (i.e., #sampling factors = 0).
    - Note that if #sampling factors=0, #subgroups=1 (i.e., the "subgroup" is the whole OU).
- Clarification appears to be needed in the MDD (or training material or a bulletin) on the usage of sampling factors, subgroups, basic units, and support functions
  - Support functions are not subgroups.
  - Sampling factors should not be "forced" to create subgroups.
  - The #basic units should be ≥ the #subgroups (per Coverage Rule 1 for Basic Units).
  - If #sampling factors = 0, #subgroups = 1.
  - If #sampling factors > 0, #subgroups ≥ 2 (because each sampling factor has at least 2 values).
- Need to keep watching key data relationships to ensure MDD is working as intended (Sampling Factors, Subgroups, Basic Units, OU Size…)

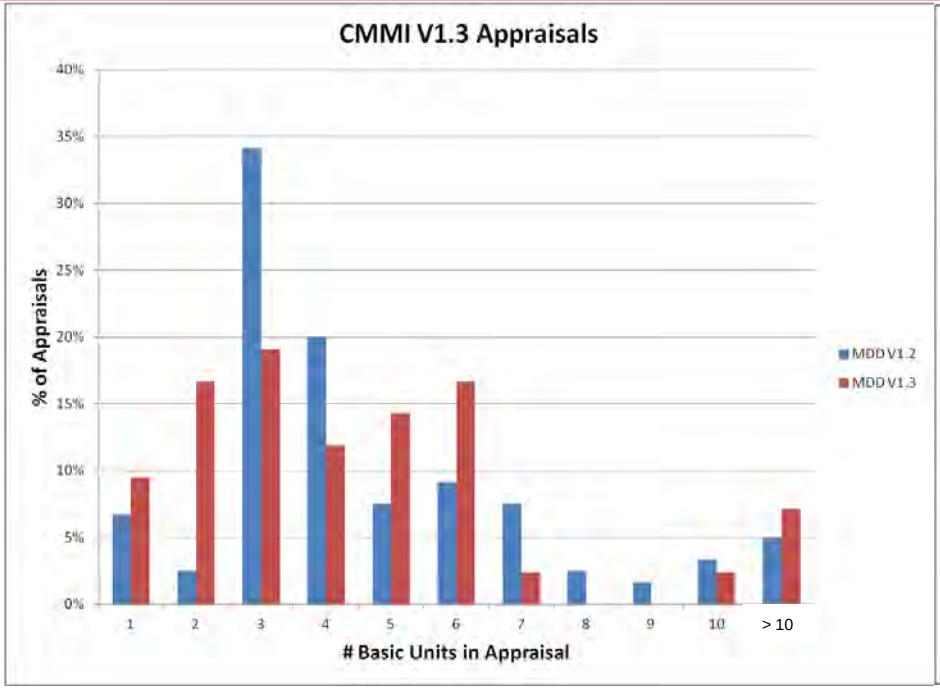
SCAMPI Infrastructure Implications (2 of 2)

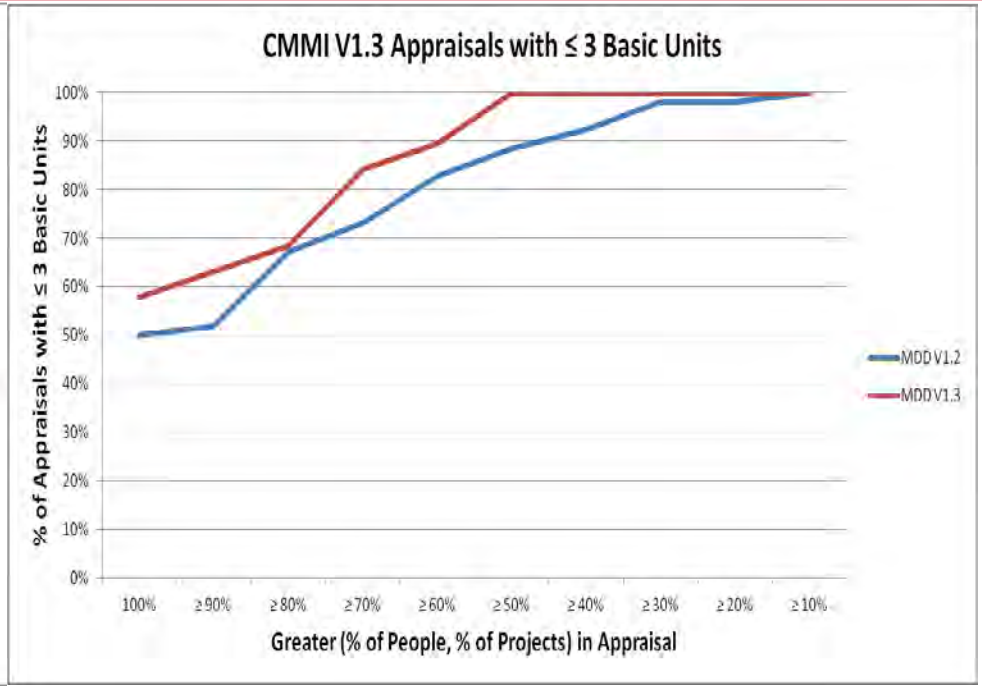
SAS/PARS/ADS

- Use recommended guidance for “zero-sampling factor” appraisals.
  - If #sampling factors=0, #subgroups=1 (i.e., the “subgroup” is the whole OU).
  - SAS Workaround
    - Set #subgroups = 1
    - Identify 1 sampling factor with 2 values (all basic units, no basic units)
- May need some cross-checking of data
  - Several data entries appear questionable:
    - One entry has 2 sampling factors, each with 2 sampling factor values, but only 1 subgroup.
    - One entry has 6 subgroups but only two basic units.
  - The #basic units should be ≥ the #subgroups (per Coverage Rule 1 for Basic Units).
  - If #sampling factors > 0, then
    - the #values for each sampling factor ≥ 2…
    - and #subgroups ≥ 2…
    - and #basic units ≥ 2.
    - For example, an OU identifies only 1 sampling factor, containing 2 values:
      - Customer (commercial, military)
      - Subgroup 1 = commercial, with at least one basic unit in the organizational scope
      - Subgroup 2 = military, with at least one basic unit in the organizational scope
- The ability to filter PARS data by “Appraisal Method” would facilitate analysis.

Comparing MDD V1.2 and MDD V1.3 CMMI V1.3 Appraisals (1 of 2)

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Notes:

1. Total data include 120 MDD V1.2 appraisals and 42 MDD V1.3 appraisals.
2. Distribution of Basic Units in MDD V1.3 CMMI V1.3 appraisals is more even than MDD V1.2, which spikes at 3 Basic Units.
3. Percentage of CMMI V1.3 appraisals with ≤ 3 Basic Units is virtually the same for MDD V1.3 (45%) and MDD V1.2 (43%).
4. CMMI V1.3 appraisals with ≤ 3 Basic Units sampled (52 MDD V1.2 data points, 19 MDD V1.3 data points) have comparable OU coverage percentage using MDD V1.2 or MDD V1.3 (difference is not statistically significant).

Comparing MDD V1.2 and MDD V1.3 CMMI V1.3 Appraisals (2 of 2)

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	# CMMI V1.3 Appraisals	# Basic Units (Ave.)	# Basic Units (Median)	% of OU Projects (Ave.)	% of OU Projects (Median)	% of OU People (Ave.)	% of OU People (Median)
MDD V1.2	120	5	4	60%	60%	63%	64%
MDD V1.3	42	5	4	65%	67%	67%	69%

Overall Observations

1. Organizational Scope of CMMI V1.3 MDD V1.2 and MDD V1.3 appraisals are very similar.
   - # Basic Units included in the organizational scope are comparable.
   - Differences in % of OU projects and people included in the appraisal are not statistically significant.

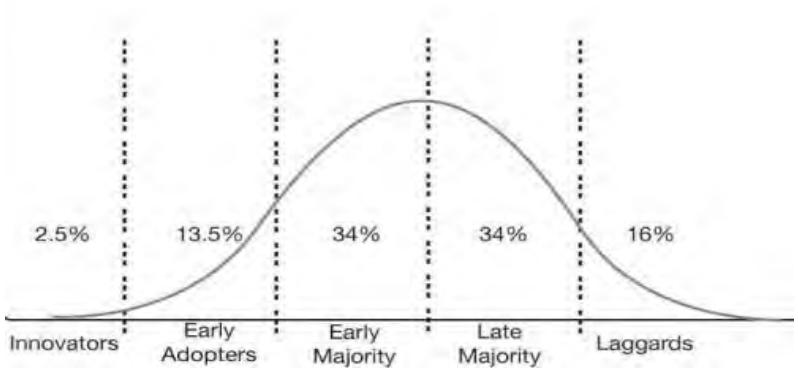
2. The use of sampling factors in MDD V1.3 appraisals provides more insight into how the basic unit sample set was determined.

3. The Published Appraisal Results site provides no information on objective evidence coverage.
   - Cost differences between MDD V1.2 and MDD V1.3 appraisals cannot be determined from this analysis alone.
   - Organizational scope does not appear to be a cost driver. Impact of MDD V1.3 data coverage rules would need to be examined.

Coda

Kudos to the “innovators” and “early adopters” who have used MDD V1.3, paving the way for the rest of the community!

Innovation Adoption Lifecycle



Adopter Category	Description
Innovators	Venturesome, interested in new ideas, risk takers
Early Adopters	More discrete in adoption choices than innovators. Realize judicious choice of adoption will help them maintain central communication position.
Early Majority	Slower in the adoption process, have contact with early adopters, and seldom hold positions of opinion leadership.
Late Majority	Will adopt an innovation after the average member of the society, skeptical about an innovation, in contact with others in late majority and early majority, very little opinion leadership.
Laggards	Last to adopt an innovation, have an aversion to change-agents, tend to be focused on “traditions”, very little to no opinion leadership.

Source: Wikipedia description of Everett Roger’s *Diffusion of Innovations.*

Questions



Raytheon

Contact Information

- For future questions the presenter contact information is:

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Tewksbury, MA 01876

Presenter Biography

- Michael Campo is a Principal Engineering Fellow at Raytheon Company, with 33 years experience that includes roles as a software developer, software/system integrator, manager, software project manager, and process group leader. As process group leader for Raytheon Integrated Defense Systems, Mike developed and deployed processes that led to achievement of CMMI Maturity Level 3 in 2003, Maturity Level 4 in 2005, and Maturity Level 5 in 2008.
- Mike's present position is IDS Process Technical Director. He is a certified CMMI Instructor. Mike is a member of the CMMI V1.3 Core Model Team, the CMMI V1.3 Training Team, the CMMI Configuration Control Board, and the NDIA CMMI Working Group.





CMMI® for Executives

NDIA Systems Engineering Division

in partnership with:
Software Engineering Institute
Carnegie Mellon University

November 2011

® CMMI is registered in the U.S. Patent and Trademark Office by Carnegie Mellon University

Topics

Do You Need CMMI?

What Is CMMI?

How Can CMMI Benefit You?

Who Is Using CMMI?

How Can You Get Best Value from CMMI?



Do You Need CMMI?

Recognize these symptoms?

- **Missed commitments**
  - Late delivery
  - Last minute crunches
  - Spiraling costs
- **Inadequate management visibility**
  - Too many surprises
- **Quality problems**
  - Too much rework
  - Functions not working correctly
  - Customer complaints
- **Poor morale**
  - Crisis atmosphere
  - High turnover
  - Low productivity

Does the following occur?

- **Poor planning**
  - Plans not realistic or followed
  - Work is not tracked against the plan; plans are not adjusted.
- **Baselines not controlled**
  - Inconsistent requirements
  - Changes not managed
- **Ineffective organizational structure**
  - Functions not well integrated
  - Designs not producible
- **Unable to repeat successes**
  - Staff skills and knowledge not available when needed
  - Dependent on heroic individuals

CMMI Features Help Address Common Issues

CMMI Feature	Description and Examples
Results Oriented	• Industry best practices for project planning and execution • Performance-driven measures for consistent outcomes
Priorities Based on Business Value	• Investments and maturity prioritized to align with business goals • Appraisals relative to model to set direction (“map and compass”)
Customer Focus	• Validation of customer needs across the project life cycle • Manage product/service quality (verification, validation, reviews)
Proactive Management	• Forward-looking measurement, monitoring, risks, corrective action • Management decisions based on plans, data, alternatives
Flexibility	• Adaptable to a variety of businesses (domain, size, products) • Non-prescriptive (required, expected, informative components)
Business Process Integration	• Cross-functional stakeholder involvement • Coordinate various improvement strategies and methods (Lean, Six Sigma, ISO, Agile, etc.)
Continuous Learning	• Standardized assets tailored for project characteristics • Leverage experience and history across projects

Why Focus on Process?

The quality of a system is highly influenced by the quality of the process used to acquire, develop, and maintain it.

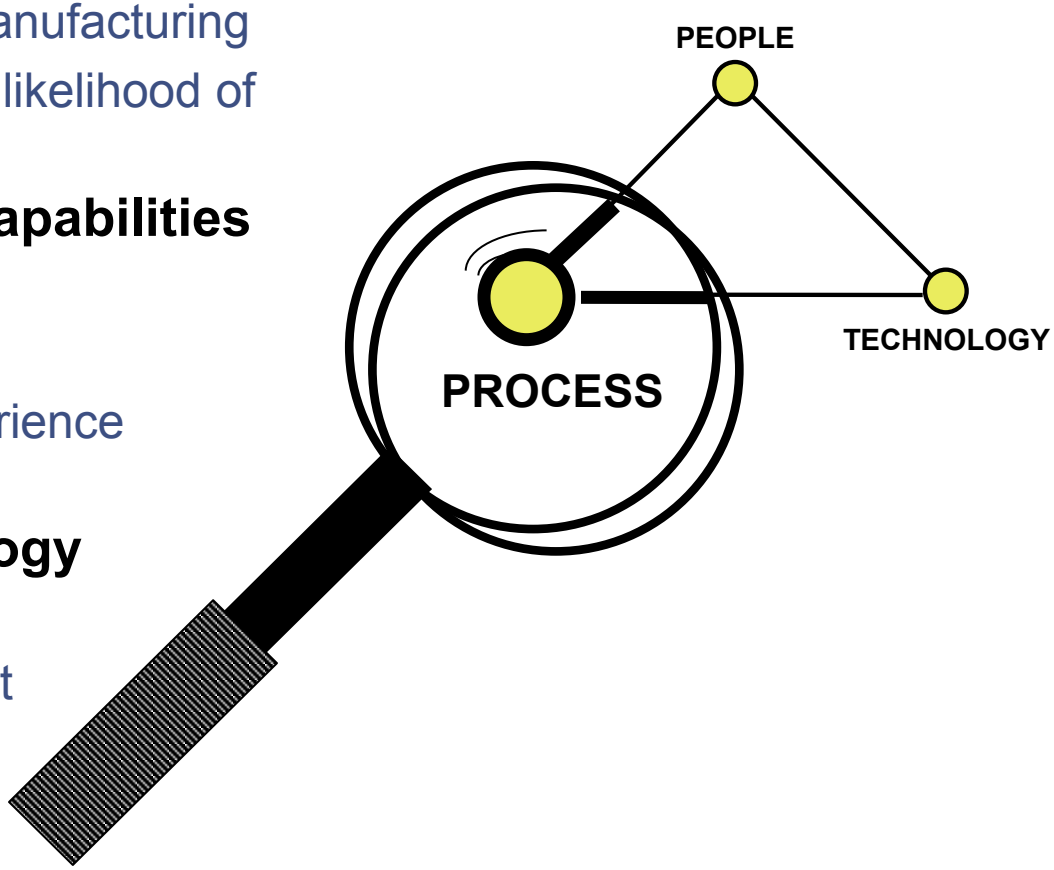
- A long-standing premise in manufacturing
- Good processes increase the likelihood of successful projects

Process can enhance the capabilities of your workforce

- Work smarter, not just harder
- Leverage organizational experience and best practices

Process integrates technology with resources

- Technology, by itself, will most likely not be used effectively



Topics

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What Is CMMI?

CMMI is a model representing a collection of best practices proven effective in industry

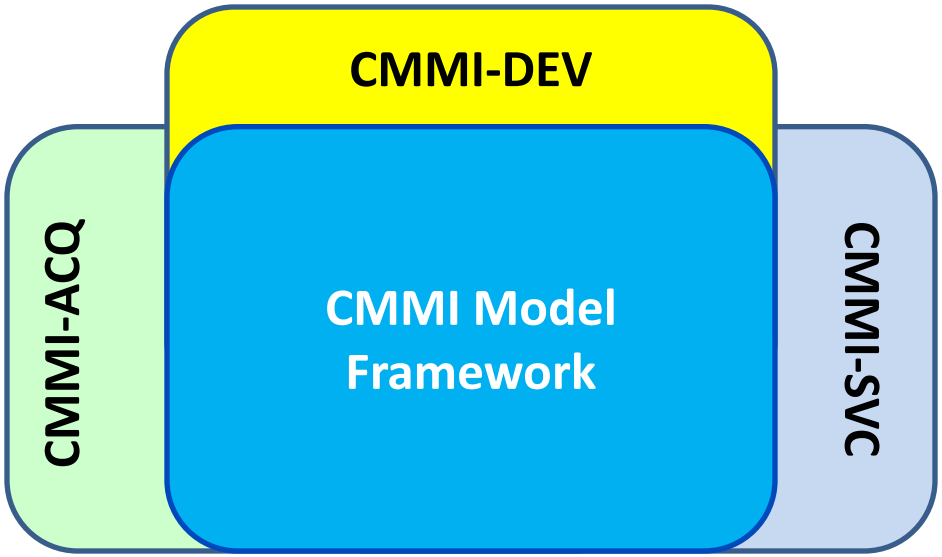
- A framework for developing, improving, and sustaining business performance
- Provides a process focus on work activities
- Developed by industry (commercial and defense), government, academia

CMMI targets three primary environments:

- Development -
  Engineering a product or service
- Services –
  Providing services
- Acquisition –
  Acquiring products and services

The CMMI product suite consists of:

- Models and primers
- Appraisal methods
- Training courses



Capability Maturity Model Integration (CMMI®)

What CMMI Can Add to Your Organization

- Integration of business processes across functions based on industry best practices
- Visible project and organizational measures aligned with achievement of business objectives
- Commonly accepted process framework for inter-company coordination and competitor benchmarking
- Repeat project successes through standardization, tailoring, and capture of organizational process assets
- Avoid project performance issues through process discipline, proactive management, and early stakeholder engagement
- Predictable project performance, with fewer surprises

CMMI Model Overview

Process Areas	**Clusters of related practices, in several categories** •**Project Management** – planning, monitoring, suppliers, risk, … •**Support** – CM, QA, measurement, decision analysis, … •**Process Management** – organizational processes, training, … •**Engineering** – requirements, development, integration, … •**Services –** development, delivery, transition, … •**Acquisition** – requirements, solicitation, agreements, …
Generic Practices	**Enable process management, deployment and improvement** •Plans, monitoring, CM, stakeholders, objective evaluation, …
Goals	**Describes characteristics for implemented processes**
Capability Levels	**Achievement of process improvement within an individual process area**
Maturity Levels	**Achievement of overall process improvement across a predefined set of process areas (stages)**

CMMI Appraisals

Appraisals compare organization and project processes against CMMI models to determine improvement priorities

Senior management's role in appraisals:

- Provide sponsorship and resources
- Set appraisal scope and objectives
- Ensure follow-through on appraisal findings and prioritized improvement actions

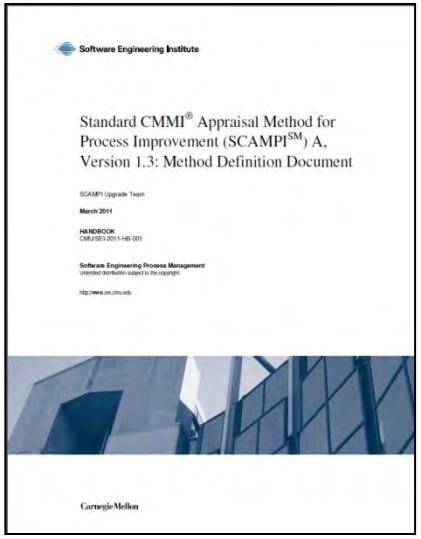
CMMI provides a family of appraisal methods, with varying intent, confidence levels, data collection, resources needed

- Flexible focus: approach, deployment, institutionalization
- Rigorous benchmark rating method (for maturity levels)
- "Quick look" diagnosis of process weaknesses

Licensed SEI partners deliver SCAMPI^{SM} appraisal services

- http://www.sei.cmu.edu/partners/directory/

Note that for internal process improvement, company-developed and other methods can be effective



Topics

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Reasons You Should Adopt CMMI

1. **Increase customer satisfaction**
   - Deliver products and services that satisfy user needs
   - Deliver products and services on time and within budget
2. **Increase probability of capturing new and repeat business**
   - Improved ability to meet commitments
   - Reduces customer-perceived risk of award to your organization
   - Can be a discriminator relative to your competition
3. **Increase profit through improved quality and less rework**
   - Better predict actual costs through repeatable processes
   - Better visibility into projects due to established measures and analysis techniques
   - Significantly reduce the probability of problem programs
   - Reduce costs by capitalizing on organizational infrastructure, processes, training, tools and early/often stakeholder involvement
4. **Increase productivity**
   - More efficiency through implementation of common processes, tools and training
   - Improved productivity by implementing process improvement that are directly aligned key organizational goals and objectives.
   - Higher employee morale and less turnover

Benefits of CMMI-Based Process Improvement

Many companies cite performance benefits from CMMI

- Published in conferences, articles, papers, studies, surveys, reports

SEI collects quantitative measures of CMMI performance improvement

- Technical reports, including:
  - "Performance Results of CMMI-Based Process Improvement" (http://www.sei.cmu.edu/pub/documents/06.reports/pdf/06tr004.pdf)

Performance Category	Median Improvement
Cost	34%
Schedule	50%
Productivity	61%
Quality	48%
Customer Satisfaction	14%
ROI	4.0 : 1

CMU/SEI-2006-TR-004.
Data from 35 organizations.

Industry Benefits from CMMI



Example measures reported by NDIA member companies:	
Defect repair effort	•Defect repair hours: -58% (ML3 to ML5) •Defect cost savings: -105 hrs per defect •I&T hrs/defect: -24% •Hours/KLOC: -22% *(ML3 to ML5)*
Defect density	•62% fewer high-severity defects *(ML5)* •Defect phase containment: +240% *(ML5)* •>85% defects removed prior to sys test •Acceptance test: < 0.15 defects/KLOC
Development cost	•SW development cost: -28% *(ML3 to ML5)* •Potential project savings: $1.9M–$2.3M
Productivity	•Productivity gain: +42% *(ML5, 9 yrs)*
Cost/schedule	•Over 6X less likely cost/schedule impact

The new data presented in this report demonstrates that effective implementation of good practices aided by use of CMMI can improve cost, schedule, and quality performance.

Benefits of CMMI in the Defense Industry, Software Engineering Institute, May 2010.
http://www.sei.cmu.edu/library/abstracts/presentations/CMMI-Benefits-to-Defense-Industry.cfm

Topics

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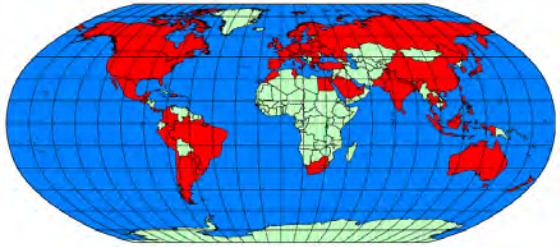
Who Is Using CMMI?

How Can You Get Best Value from CMMI?



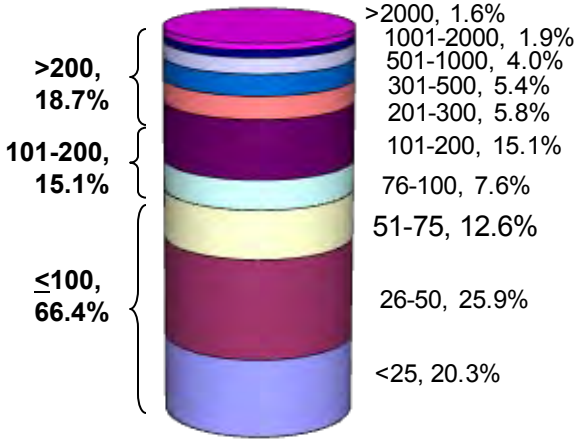
CMMI Adoption

CMMI appraisals are conducted worldwide…



	USA		Non-USA	
	Qty	%	Qty	%
Commercial In-House	316	36.6%	3040	92.0%
Contractor for Military/Government	468	54.2%	191	5.8%
Military/Government Agency	80	9.3%	73	2.2%
	864	100.0%	3304	100.0%

…in small and large organizations and projects



Organization Size (Employees)
(4197 organizations reporting)

…in a wide range of businesses

Services
- Business Services
- Engineering and Management Services
- Health Services
- Other Services

Manufacturing
- Electronic and Electric Equipt
- Transportation Equipment
- Instruments & Related Products
- Industrial Machinery
- Other Mfg Industries

Other
- Finance, Insurance, Real Estate
- Public Administration/Defense
- Transportation, Communication, Utilities

…at all levels of process maturity

	Commercial In-House	Contractor for Military/ Government	Military/ Government Agency
No Rating Given	3.5%	2.9%	15.7%
Initial (ML1)	0.4%	2.0%	0.7%
Managed (ML2)	20.4%	27.6%	43.1%
Defined (ML3)	61.7%	58.3%	39.9%
Quantitatively Managed (ML4)	1.9%	0.3%	1.3%
Optimizing (ML5)	4.6%	5.8%	2.6%
	(3356 orgs)	(659 orgs)	(153 orgs)

Source: SEI Process Maturity Profile, Sept 2011.
http://www.sei.cmu.edu/cmmi/casestudies/profiles/cmmi.cfm

Topics

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Getting Value from CMMI
Your Role as an Executive

Set the vision and direction for CMMI-based improvement

- Establish measurable objectives
- Be a visible sponsor – set expectations for involvement
- Manage process improvement like a project

Provide resources and support

- Funding, staffing, tools
- Choose the best people to lead - respected opinion leaders

Keep it real

- Maintain relentless focus on business value and program performance
- Involve projects and practitioners for the best ideas
- Hold people accountable
- Track and communicate progress
- Recognize and reward achievement

The Effective Use of CMMI®

Summary of NDIA industry position statements for obtaining best value from CMMI investments*:

1. **Good processes** increase the likelihood of achieving successful project performance
2. **CMMI is a model, not a standard** – adapt CMMI to your business environment, resources, and objectives
3. **Focus on business improvement objectives** – a primary emphasis on achieving levels may not achieve significant benefits and may increase rather than decrease costs
4. **High maturity is a business case** – justify the investment; many organizations find business value in improving processes even at lower CMMI maturity levels
5. **Maturity level ratings are not alone a predictor of project performance** – many other factors can be significant contributors
6. **Don't specify maturity levels in acquisitions** – use CMMI to probe supplier capability and process execution risks
7. **Greatest benefits of appraisals are from improvements, not evidence or ratings** - disproportionate effort on appraisal preparation risk can diminish business returns

"The Effective Use of CMMI®", NDIA Systems Engineering Division, June 2009.
http://www.ndia.org/Divisions/Divisions/SystemsEngineering/Pages/CMMI_Working_Group.aspx

Want to Learn More about CMMI?



SEI CMMI web pages:

- What is CMMI?
- Conferences
- FAQs
- Models
- Performance Results
- Background Information
- Adoption
- Appraisals
- Contacts

CMMI focus topics, guidance, technical reports:

- CMMI and Agile
- CMMI in Small Settings
- Earned Value Management
- CMMI and Six Sigma
- CMMI in Acquisition
- SW-Only Organizations
- Product Line Practices
- Interpretive Guidance
- Operations Organizations

Training:

- Process Improvement
- CMMI Level 2-3 for Practitioners
- Introduction to CMMI
- Understanding High Maturity
- Intermediate Concepts of CMMI
- SCAMPI Appraiser training

User Networks

- SEI Partner Network
- Consultants
- Newsgroups, Blogs, Wikis
- Conferences
- Books, Periodicals, Articles
- Asset Repositories

Questions? Comments?

Web: http://www.sei.cmu.edu/cmmi

Email: cmmi-comments@sei.cmu.edu

SEI Customer Relations: (412) 268-5800, customer-relations@sei.cmu.edu

LOCKHEED MARTIN

Applying CMMI-SVC Process Areas to CMMI-DEV Projects

M. Lynn Penn
Director Strategic Process Engineering
Integrated Systems & Global Solutions
Lockheed Martin Corporation
November, 2011

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Topics for Discussion

- Why look Beyond Development?
- *Sampling* of Specific Service Process Areas that enhance the Engineering Process Areas
- Benefits of Service PAs to Development Projects

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WHY????

- Expectations of the product being developed
  - Sustainment expected
  - Maintenance phase expected
  - Product Warranties
  - User Training
  - Technology Refresh

Product Development has evolved to a Service System

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Goal Setting

- Production Goal: Establish a product that can transition to ensure maintenance of the functionality of the components as well as the total functionality of the product:
  - Plan for the maintainability of the product
  - Understand Customer Needs
  - Set appropriate expectations
- Service Goal: Plan for the continued support of the product in use:
  - Establish the Service System
  - Understand Customer Needs
  - Set appropriate expectations

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Process Areas to Choose

- ALA Carte Menu, Please



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Process Area Selection

Although the Production and Service Goals are similar, it is within production that the first consideration for the service life cycle needs to be defined, communicated and established. The overlap is essential to long term success.

- The selected Process Areas are divided into three sets:
  - **SET 1** – core process areas that start implementation under a production life-cycle but include service concerns so they can successfully be instantiated into the service life cycle (a sampling),
  - **SET 2** – those service specific process areas (or goals within a PA) that MUST be considered during the production phase and NOT wait for the Services life-cycle to commence, and
  - **SET 3** – those process areas (or goals within a PA) that will be initiated and implemented during the Services life-cycle (SET 1 and SET 2 will continue to evolve during the Services life-cycle).

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Set 1

Core process areas that start implementation under a production life-cycle but include service concerns so they can successfully be instantiated into the service life cycle

- **Risk Management (RSKM)**
- **Requirements Management (REQM)**

ONLY A SAMPLE – OTHERS MAY APPLY

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Risk Management (RSKM)

SG 1 – Prepare for Risk Management

- Identify Risk Sources and Categories
  - These should include both sources from the development and operational life cycles
- Define Risk parameters
  - Evaluation of development risks should include their potential risks into the operational service of the product
  - Likelihood of occurrence needs to apply to both within development and during operation
- Establish a Risk Management Strategy
  - Strategy needs to apply to decisions made during development that could identify a risk in operation
  - Broaden the strategy to be forward looking
    - Decisions made during development could identify a risk during operation

Risk Management (RSKM) (continued)

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SG 2 – Identify and Analyze Risks

- Identify Development and Operational Risks
  - Identification must include both life cycles
  - Identification of a development risk could identify additional operational risks
- Analyze Risks
  - Analysis of a development risk could identify an additional operational risk
- Mitigation Plans
  - Mitigation plans should be seamless:
    - Including steps in development to mitigate operational risk
    - An operational risk may lead to additional development

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Requirements Management (REQM)

SG1 – Manage Requirements

- Understand Requirements
  - During development requirements must be prioritized to gain insight into the customer's priority needs
  - This is the first step in understanding the service requirements pertaining to functionality
- Manage Requirements
  - As requirements change, analysis as to the service capabilities and delivery must occur
- Bidirectional Traceability
  - Critical to ensure that the requirements do indeed meet the service requirements
- Identify Inconsistencies
  - Essential to not only look at inconsistencies when delivering the product but inconsistencies in the final delivery of service on the product

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Set 2

Those service specific process areas (or goals within a PA) that MUST be considered during the production phase and NOT wait for the Services life-cycle to commence

- **Service System Transition (SST)**
- **Strategic Service Management (STSM)**
- **Capacity and Availability Management (CAM)**
- **Service System Development (SSD)**
- **Service Continuity (SCON)**

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Service System Transition (SST)

SG 1 – Prepare for Service System Transition

- Analyze and Develop Transition plans
  - Include this analysis during both Requirements Management and Product Integration during Development
  - Requirements/ Functions/ Tools/ Components must all factor into transitioning the system
  - Analyze Warranties and Technology/ Hardware refresh needs and relate those needs to the production phase
- Prepare Stakeholders
  - With considerations around warranties and refresh – production can set the expectation for service capabilities
  - Customers should buy the product knowing what services are provided in association with the product

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Strategic Service Management (STSM)

SG 1- Establish Strategic Needs and Plans for Standard Services

- Understand the “life of product”
  - Define the typical length of time the product will be in service
- Define what is and is not applicable to “standard service”
  - Define the goal of the organization to commit to servicing this product
    - What will be covered and what will not (warranties, maintenance plans, extended warranty options…)
    - Will servicing be supplied with resources from within or will separate components be covered by suppliers
- Achieve organizational and customer agreements on what is and is not standard services
- Define the organizational strategy for service implementation and commitment
  - Understand what this means for the business future
  - Does it fit with organizational business goals
- Needs to begin during production in order to establish appropriate communication and paths going forward from production to service

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Strategic Service Management (STSM) (continued)

SG 2 – Establish Standard Service

- Once we have identified the standard services that will be provided either internally or via suppliers:
  - Define service levels
    - These should include response time/ acceptable down time/ support via phone/ support via visits/ support via mailing or visiting a central location
  - Define acceptable variation
    - Pricing/ resources/ Timetable for upgrades

Capacity and Availability Management (CAM)

SG 1 – Prepare for Capacity and Availability Management

- Strategically identify what is needed to maintain and support the product when required
  - This will influence the components that are acquired and integrated into the final product
  - Establish a commitment for the release of the product into the service domain
  - Identify any overlap on production fixes versus normal servicing and maintenance
- Imperative that commitments on service maintenance and replacement be understood as part of production choosing suppliers of individual components
- Identify measurements that the system/ production vendors can commit to as they evolve or transition into service life cycle

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Capacity and Availability Management (CAM) (continued)

SG 2 – Monitor and Analyze Capacity and Availability

- Identification of Planned Capacity and Planned Availability should be established during the Production phase so that monitoring of capacity and availability can occur during the services life cycle
  - Reports on the monitoring will be generated during the service life cycle

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Service System Development (SSD)

SG 1 – Develop and Analyze Stakeholder Requirements

- Identifying stakeholder requirements for the product after it is in use is critical to developing the service requirements. As production is going on each component may have a separate stakeholder requirement or expectation for longevity/ maintenance/ warranty
- Depending on the complexity of the product itself this exercise needs to be initiating very early in the production cycle
- Commitment and agreement on these expectations needs to be defined – if these are not validated – the product may not sell!

Service System Development (SSD) (continued)

SG 2 – Develop Service Systems

- Service system solutions should be evaluated during production
  - Critical during Technical Solutions that this be coupled
    - Trade studies on tools/ component selection
    - Allocation of requirements to functions to set service expectations
    - Developing the production design to ensure service system capability
- During Product Integration consideration to service system may come to play as the system is built – particular reference to functional deliveries (Agile environments)

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Service Continuity (SCON)

SG1 – Identify Essential Service Dependencies

- In keeping with both Requirements Development and during Requirements Management it is critical that the customer priorities on functionality be agreed to
- Prioritization of functions may be an input to Risk Management, Decision Analysis and Resolution, and Technical Solutions as the product is being developed
- As requirements/ functions are being developed, management will have an insight into the resources needed into services (number of people/ skills and knowledge of those individuals/ budget/ timeline)

Service Continuity (SCON) (continued)

SG2 – Prepare for Service Continuity

- Continuity plans and training should be accomplished during production
  - Depending on expectations of the plan – production/ product design/ product integration could be affected

SG3 – Verify and Validate the Service Continuity Plan

- An actual dry-run of the continuity plan would be worthwhile during production since results/ good and bad should go back into the production
  - If done during production continuity risks can be mitigated by a change in the product configuration – a possibility

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Set 3

Those process areas (or goals within a PA) that will be initiated and implemented during the Services life-cycle (SET 1 and SET 2 will continue to evolve during the Services life-cycle)

- **Service Delivery (SD)**
- **Incident Resolution and Prevention (IRP)**
- **Service System Transition (SST)**
- **Service System Development (SSD)**

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Service Delivery (SD)

SG1 – Establish Service Agreements

- This activity since customer expectations have been addressed during production should be understood.
  - In lieu of reviewing “existing” Service Agreements – can evaluate those commitments that were planned for during production
- Establishing the service agreement with customers is more clearly negotiated since requirements are aligned to the service

Service Delivery (SD) (continued)

SG2 – Prepare for Service Delivery

- Many of the inputs to these systems and plans have been identified during the production phase, this step within the service life cycle is more a formalization of approaches and management systems around the service
- Preparation will be based on the production expectations and service capabilities established again during production

SG3 – Deliver Services

- The product has been developed with the service expectations (internal and external) in site – service delivery should be available with a shorter start up lag time
- Management systems should be easier to identify and start up (customer expectations are understood and internal budgeting for resources have been identified)
- Operations should be focused back to agreements and requirements that were identified during production

Incident Resolution and Prevention (IRP)

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SG1 – Prepare for Incident Resolution and Prevention

- Incident definition needs to be established.
  - Definition should be based on expectations set during production
  - Differentiation of request versus incident – similar to any service start up
    - Differentiation should be defined within production context
- Establish Incident Management System
  - Resources and tools assigned to the management system based on analysis during production – Risk Management/ Product Integration alignment

Incident Resolution and Prevention (IRP) (continued)

SG2 – Identify, Control, and Address Incidents

- Periodically as well as event drive – accommodate and plan to analyze incidents to avoid recurrence
- Critical to keep communication open with customers – integrated with Service System Transition when applicable
- May require returning to production phase if component selected during production is not repairable/ if functionality is in question
  - This areas could directly result in production issues being identified

Incident Resolution and Prevention (IRP) (continued)

SG3 – Define Approaches to Address Selected Incidents

- Identification of systemic incidents or incidents whose solution may not be appropriate for a component transition
  - Identification of these incidents may require customer communication for awareness/ workarounds/ loss of functionality etc

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Service System Transition (SST)

SG2 – Deploy the Service System

- The plans should be in place for scheduled transition activities therefore deploying a refresh/ warranty component etc is already in place
  - Unplanned transitions need to address SG1 again within the operational phase
- Assessing the transition
  - This activity may change the plan or cause a re-entry to production to reevaluate the selection of that component

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Service System Development (SSD)

SG 3 – Verify and validate Service Systems

- Actual verification of the service system will not occur until the operational phase although the actual integration of the components and the service design can be accomplished during production phase
- Peer reviews should include production staff as service staff should have been included in verification activities during production
  - Both service and production are stakeholders in the product solution set

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Benefits, Benefits, Benefits…

- Product Integration coupled with Service System Transition
  - Internally – impact awareness for management/ configuration management/ test/ quality
  - Externally – confidence system will continue to operate
- Adding Service Continuity (a.k.a. System Continuity)
  - Customer and users MUST identify those requirements associated with critical functions
  - Test Engineers focus on system failure as well as individual component failures to test for continuous critical functionality
- Risk Management coupled with Capacity and Availability
  - Expands the focus from internal development to external operations
  - Bridges project evolution from production to sustainment

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Moral of the story

It is essential in this economy and environment that production needs to keep in mind that service of a product is a critical issue. The operational life cycle will indeed last a "life time" and it is imperative to give consideration to the requirements/ resources/ expectations of this phase as the product is being built.

- Encourage the use of CMMI – SVC as an extension to CMMI- DEV
- Proactively selecting process areas regardless of the constellation to meet customer needs
  - Multi-dimensional view of quality
  - Production and Operational life cycles supported

…And the Walls Come Tumbling Down



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Questions??

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A LEAN and RACI Approach to CMMI for Services (CMMI-SVC)

Ahn Nuzen & David Dayton
SPAWAR SYSTEMS CENTER PACIFIC (SSC-Pacific)
US NAVY

OUTLINE

- Background about SPAWAR Systems Center Pacific
- Why this approach?
- What is RACI?
- How to populate RACI?
- Mapping RACI into CMMI SVC Specific Practices



Space & Naval Warfare Systems Center Pacific – SSC Pacific

DOD US NAVY Organization

- 4000 + Scientists & Engineers
- Located in San Diego, and throughout the Globe



Mission ~ Information Dominance

Design, Build, and Sustain C4ISR Information Dominance Systems



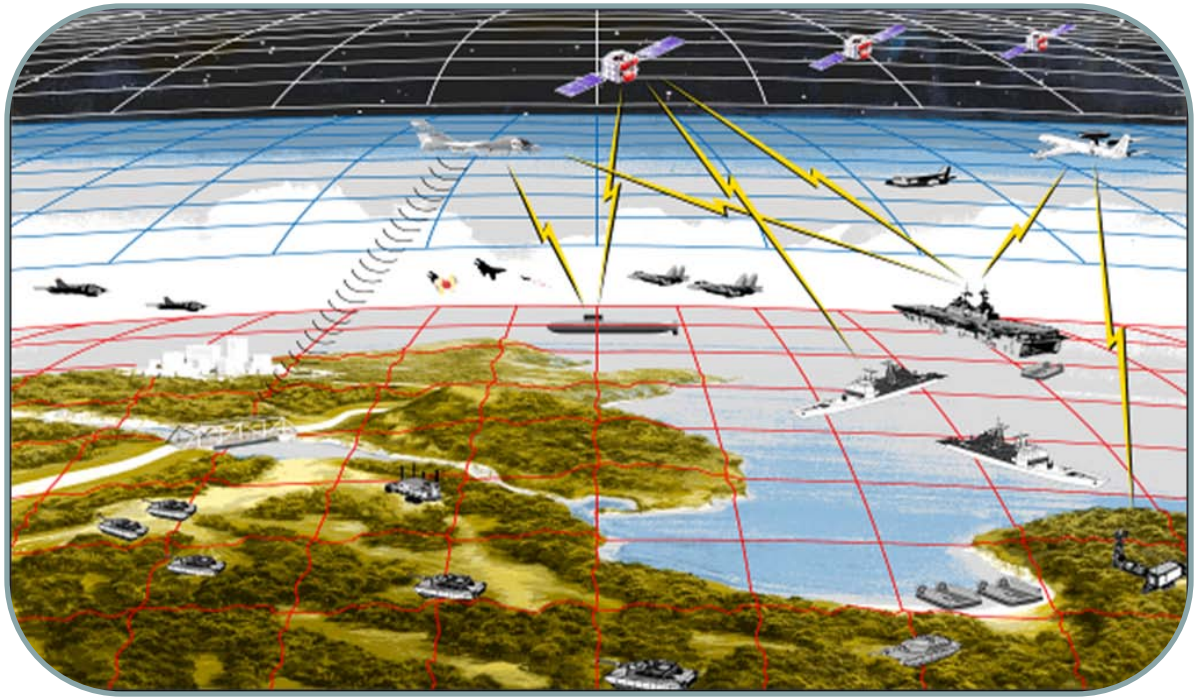


(Radar, Networks, Command and Control, Crypto Devices, Satellites communications, Submarines Electronic Systems, etc…)

Systems Engineering for Mission Success

Reliability

Availability



Maintainability

SSC Pacific CMMI Timeline

1988

- Implemented Software (SW) Capability Maturity Model CMM - predecessor of CMMI model.
- Systems Engineering Process Office (SEPO)

2000

- Attained SW-CMM Level 3 in October 2000.
- SSC PAC transited from SW-CMM to CMMI- DEV model and continues with its process improvement road.

2009

- Implementing CMMI-SVC ML2 model 1.2 for Services projects
- Achieve CMMI-DEV ML3 on 2012

SSC Pacific CMMI SERVICES

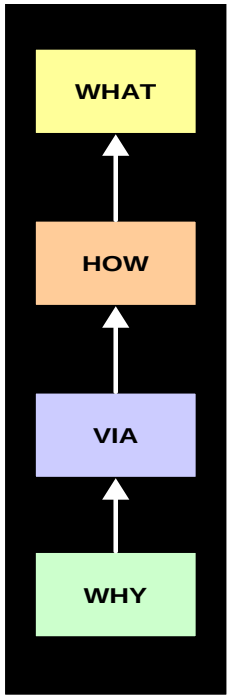
- Diversity of projects involved in systems engineering services, Research and Development (R&D), logistic, maintenance, sustainment, etc.
- Some are non-product-oriented projects do not maximize the benefits of CMMI-DEV initiative
- 2009 adopted CMMI-SVC, version 1.2 to improve the projects' performance and quality for non-product-oriented projects

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Approach to gather Artifacts for CMMI?

- Traditional
  - Mapping business process into the CMMI Model
    - Business must learn, and speak CMMI
    - Steep learning curve
    - Time consuming
- Lean
  - Begin with the existing “as-is” business process mapping
    - Ask the questions to gather the artifacts:
      1. What process is been performed?
      2. How is the process being performed?
      3. Why the process is been performed?
      4. Who are the process role-players?...

Example of “as-is” Business Process



Functions

Processes

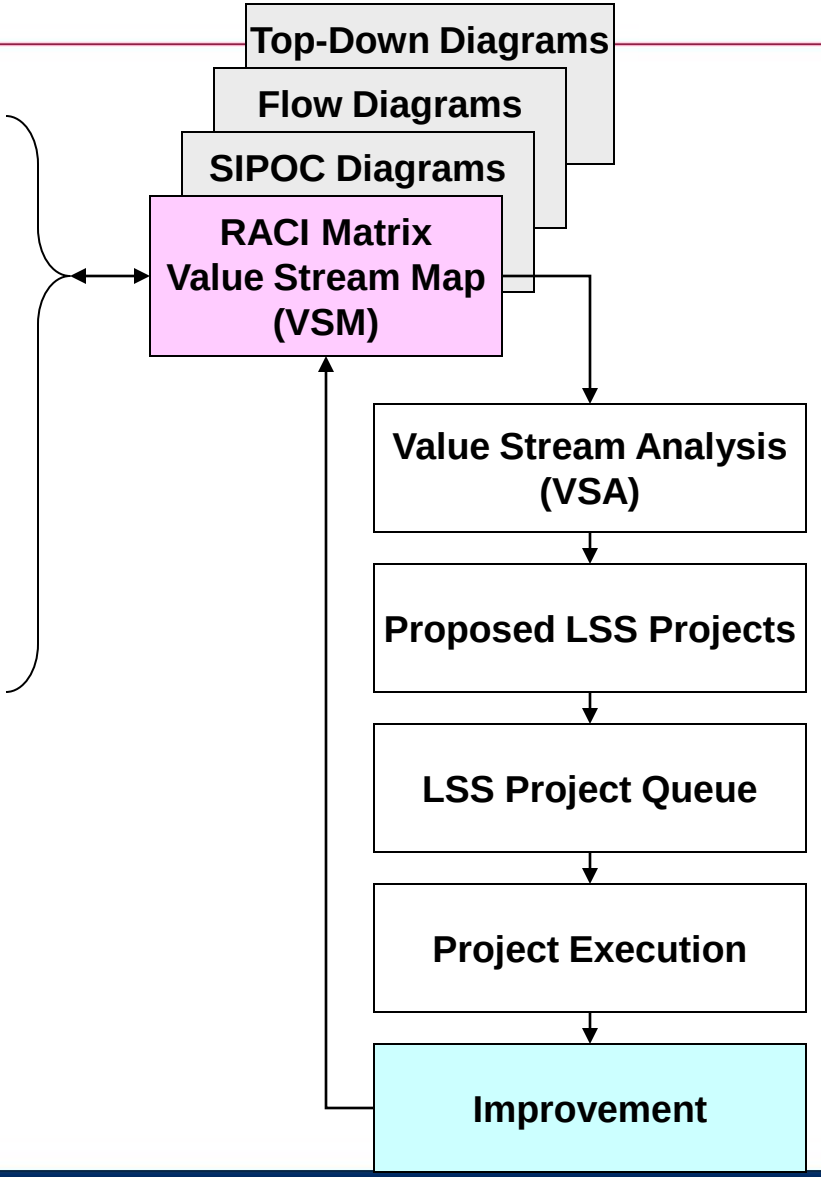
Functionaries & Tools

Drivers, Purpose Requirement REFERENCES & reasons (e.g., Best practices)

Work Plan Task Management	
Pre-Planning	Funds Management
Design Review	Cost Est V&V
POA&M Development	Actual Cost MRN&C
SKED De-confliction	Biz Mgt Grp
	CETracker
CETracker Review	ERP
SPIDER Review	EVM Reports
FPY Hot Wash Review	Performance Agreements
Performance Agreements	Minimize Est-to-Act Cost Var
GFE/GFM Timelines	

Continuous Process Improvement
A Concept of Operations (CONOPS)

Organizational Aspect	Functions	Processes
BUSINESS (What we do, day-to-day)		
OPERATION (How we do What we do IAW Policies & Processes)		



What is RACI Matrix?

- Pronounced “racy” or “rack-y”
- A.K.A. RACI-ARCI Matrix
  - Although ARCI more accurately reflects left-to-right hierarchical roles, RACI seems to be the acronym most widely used in industry
- Useful in project management
  - WHO does WHAT, WHEN
- Useful in Continuous Process Improvement (CPI) and Lean/Six Sigma; facilitates “as-is” to “to-be” organization planning and process management
  - WHO does WHAT, WHEN, WHY
  - CTQ Outcomes; Time & Cost per process step; etc.
- Used to assign or describe cross-functional process-related roles
- Used to develop business rules for process streamlining & automation

Basic RACI Matrix

Responsible	Those who do work to achieve the task. The role of Responsible includes support, which is to provide resources to complete the task. Responsible is about doing the work; several, or all, may share responsibility. Responsible is linked to the function(s) assigned to execute a particular activity. The degree of responsibility is determined by the Accountable person.
Accountable	(Also Approver or final Approving authority) Those who are ultimately accountable for the correct and thorough completion of the task. Accountable is the one to whom "R(s)" are accountable. There must be only one **A** specified for each task. The role of Accountable may include Responsible; in other words, it is not unusual that the one who is Accountable for a task is also Responsible to do the work to achieve the task. Accountability cannot be delegated.
Consulted	Those who must be 'consulted' before decision or activity is finalized. A two-way communication (a negotiated consensus).
Informed	Those who must be notified about the completion or output of decision or activity. A one-way communication.

RACI Matrix Nautical Example

(Basic scheme)

R A C I

A tool for assigning cross-functional roles.

Nautical Example

R	RESPONSIBLE	Responsible is about doing the work; several, or all, may share responsibility.
A	ACCOUNTABLE	Accountable is defined as 'the buck stops here'; only one individual can be accountable.
C	CONSULTED	
I	KEEP INFORMED	

MISSION/CHARTER TASK

"To Ready & Deploy the Ship"

	MILESTONE / TASK	CAPTAIN	NAVIGATOR	1/2 OFFICER	CHIEF ENGINEER	PURSER	STORES PROVISIONS	PORT AUTHORITY		
1	CHART ROUTE	C	R/A	I			I			
2	ORDER PROVISIONS	C			C		R/A			
3	ORDER FUEL	C			A		R			
4	GAIN APPROVAL TO LEAVE	A			R	R	R			
5	SET SAIL	A	C	R	I					
6	TAKE CONTROL FROM PILOT	R/A				I		I		

Functions
are assigned roles in the process.

Activities
include all the tasks that need to be completed, as well as the decisions that need to be made.

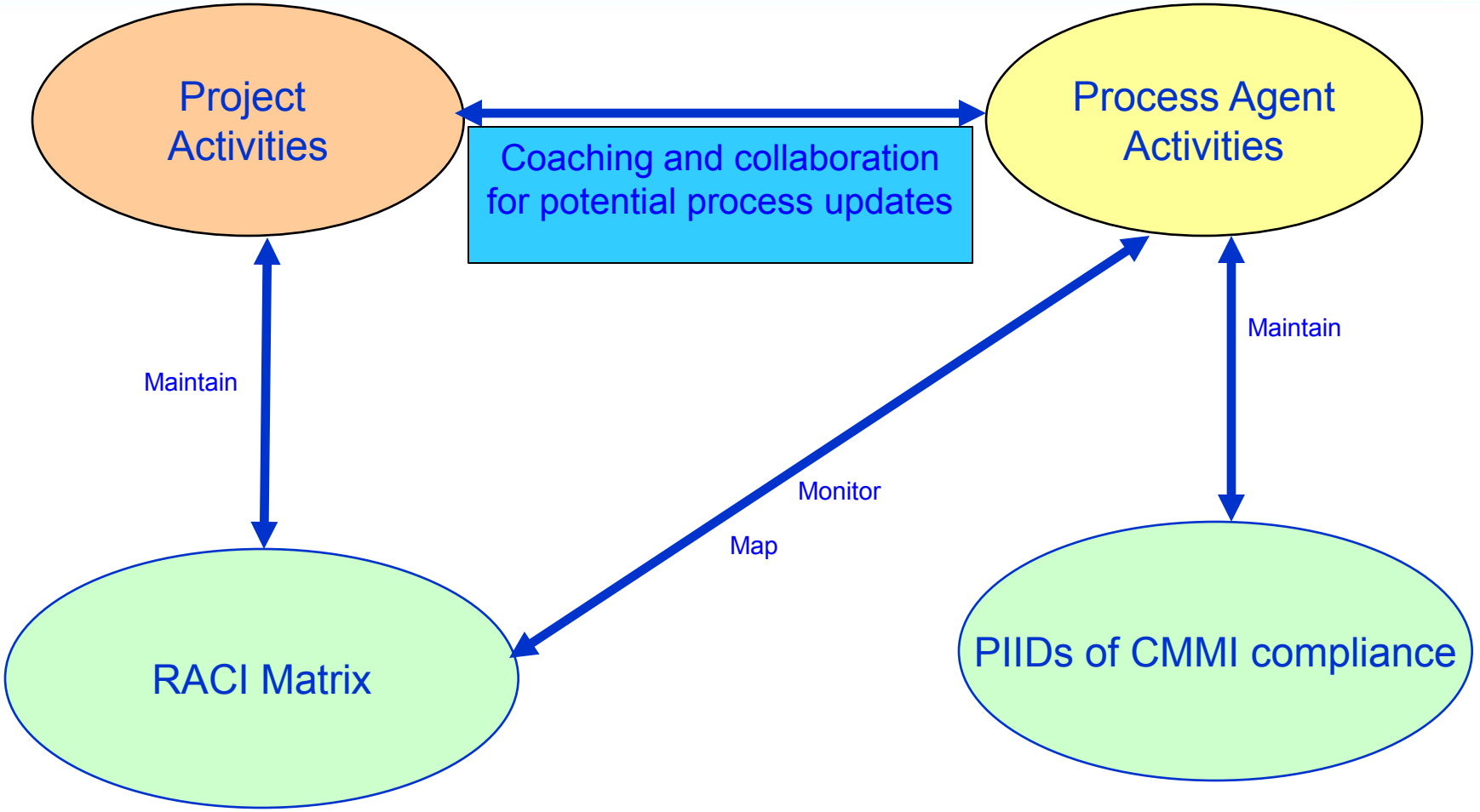
Mapping RACI – CMMI Process Areas

CPI LSS RACI MATRIX

11th Annual CMMI Technology Conference

PROCESSES	PROCESS STEPS Executed by Primary & Secondary / supporting Competencies (Roles) ---> (As possible, start with an ACTION VERB; e.g., Conduct, Review; Develop; Provide, Analyze, Test, Validate, Verify, Certify, Approve, Deliver, etc.)	CMMI/PA	PM/CHENG	Software Team	Subject Matter Expert	Install Lead	CM
Pr	S1 S2 S3 S4 S5						
Software Support Activity (SSA)							
	1. Review request for update/change to established system configuration.	REQM 1.1	A	R	C		
	2- Determine cost and feasibility of implementing the change.	MA 1.4	I/C	R			
	3- Review applicable requirements documentation	REQM		R	C		
	4- Determine if an available COTS solution exists.	MA 1.4	I/C	R			
	5- Select the best solution condidate(s).	MA 1.1	I/C	R	C		
	6- Determine if the cost of implementation over $50K?	MA 1.2	I/C	R			
	6a- If NO, then go to step 8						
	6b- If Yes, then next step.						
	7- Complete a white paper for submission with the Preliminary ECP/ECR		I/C	R			
	8- Request appropriate forms from the appropriate CM analyst.			R			
	9- Copy the SSA templates into a new folder created specifically for the software ECP/ECR in "Working Software ECPs/ECRs".						R
	10- Fill in the appropriate form after the SSA ECP/ECR forms have been filled in by a SSA rep.		I	C			R

Project-to-Process-Agent Interactions:



RACI ~ CMMI Workbook

- Mapping CMMI practices to RACI matrix
  - Completed by the Process Group (PG) who are experts in CMMI structure and content
    - CMMI practices (as mapped) cited within RACI matrix first
      - Can be easily identified and initially cited in broad percentages within project instantiations (work areas)
    - Next CMMI table of process implementation indicators (PII) is populated with RACI content
      - links to data in the RACI matrix content
    - Identify model gaps within RACI matrix and CMMI table and provide feedback to project staff in broad percentages first
      - Additional detail may or may not be deemed relevant

RACI ~ CMMI Workbook

- Mapping CMMI practices to RACI matrix
  - Gaps may be with respect to the RACI template itself or its content
  - Gaps are explained to staff in project terminology based on project needs and objectives
- “Main product” is an improved organization with evidences provided in updated and improved RACI matrices
- “By product” is a populated CMMI Process Improvement Indicator (PII) table with current artifacts of implementation organized and current for appraisal purposes

Overarching RACI Matrix

- There will be gaps from RACI because of its as-is business nature and content
  - Gaps are to be analyzed for project relevance, not automatically addressed or even assigned as action items without a “business case” first
  - If gaps result in business-case actions to be addressed, there will be facilitative communication to the project using their own pre-existing (non-CMMI) work terminology

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Thank you !!!

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Comparing Scrum And CMMI
How Can They Work Together

Neil Potter

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Agenda

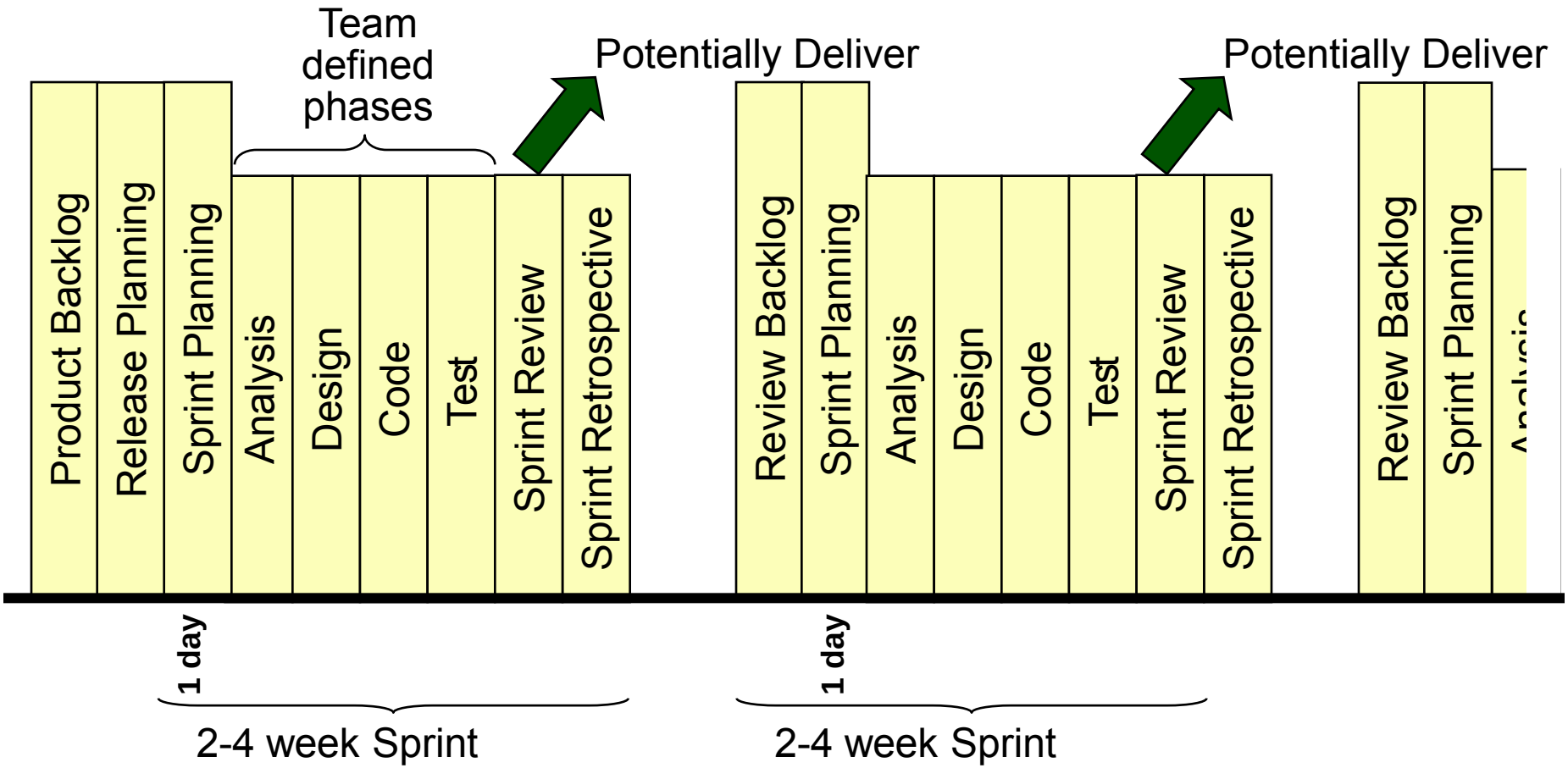
- Definition of Scrum
- Agile Principles
- Definition of CMMI
- Similarities and Differences
- CMMI and Scrum Mapping
- How About Other Components of Level 2?
- How About Level 3?
- Summary

Full comparison at: http://www.processgroup.com/pgpostmar09.pdf

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Definition of Scrum

- **Scrum is a pre-defined development lifecycle based on Agile principles.**



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Agile Principles - 1

- **Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.**
- **Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.**
- **Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.**
- **Business people and developers must work together daily throughout the project.**
- **Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.**

CMMI compatible

Source: http://agilemanifesto.org/

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Agile Principles - 2

- The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
- Working software is the primary measure of progress.
- Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
- Continuous attention to technical excellence and good design enhances agility.
- Simplicity -- the art of maximizing the amount of work not done--is essential.
- The best architectures, requirements, and designs emerge from self-organizing teams.
- At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

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Definition of CMMI v1.3

Level	Focus	Process Areas
5 Optimizing	Continuous Process Improvement	Causal Analysis and Resolution Organizational Performance Management
4 Quantitatively Managed	Quantitative Management	Organizational Process Performance Quantitative Project Management
3 Defined	Process Standardization	Decision Analysis and Resolution Integrated Project Management Organizational Process Definition Organizational Process Focus Organizational Training Product Integration Requirements Development Risk Management Technical Solution Validation Verification
2 Managed	Basic Project Management	Configuration Management Measurement and Analysis Project Monitoring and Control Project Planning Process and Product Quality Assurance Requirements Management Supplier Agreement Management
1 Initial		

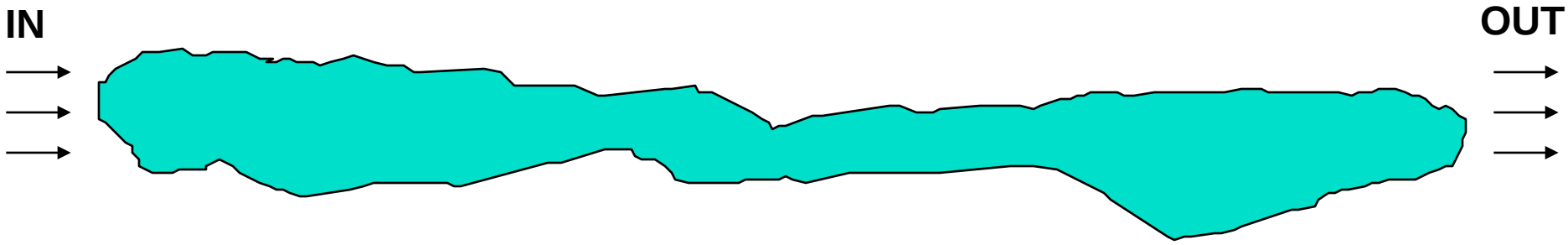


- CMMI is a collection of practices that an organization (software, hardware and IT) can adopt to improve its performance.
- Maturity Level 2 Process Areas focus on change and project management.
- Maturity Level 3 focuses on engineering skills, advanced project management and organizational learning.

Model Source: http://www.sei.cmu.edu/cmmi/tools/

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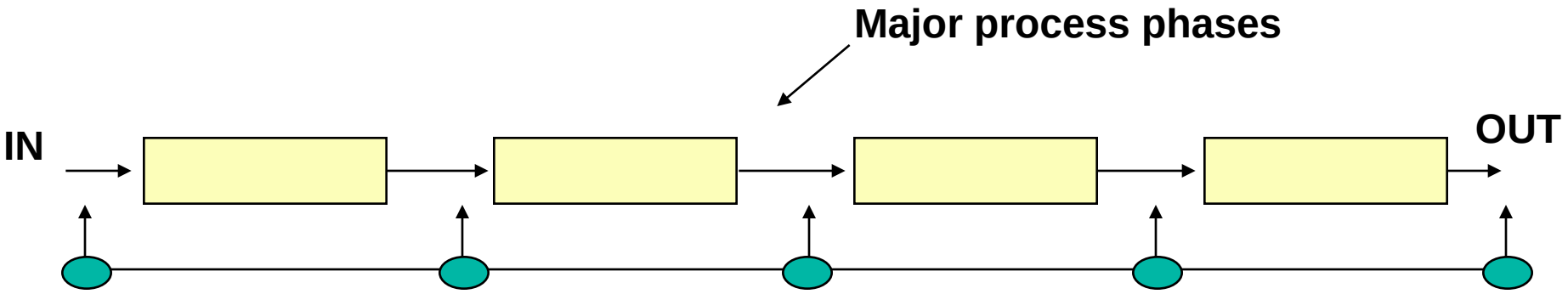
Visibility Into the Process Level 1



- **Process** is an **amorphous** entity
- **Visibility** into the project's process is **limited**
- Difficult to establish the **status** of the project's progress and activities

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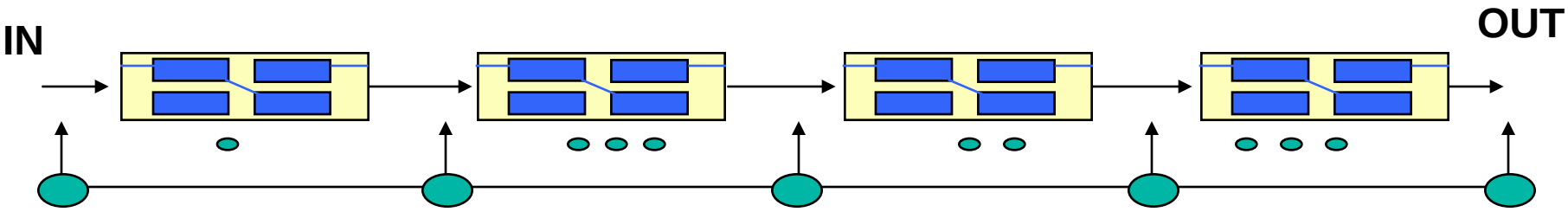
Visibility Into the Process Level 2



- Customer requirements and work products are controlled
- Basic project management practices have been established
- Management controls allow visibility into the project on defined occasions
- Management reacts to problems as they occur

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Visibility Into the Process Level 3



- **Tasks in the project's defined process are visible**
- **Accurate and rapid status updates are available**
- **Management proactively prepares for risks that may arise**

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Similarities and Differences

Level	Focus	Process Areas
5 Optimizing	Continuous Process Improvement	Causal Analysis and Resolution Organizational Performance Management
4 Quantitatively Managed	Quantitative Management	Organizational Process Performance Quantitative Project Management
3 Defined	Process Standardization	Decision Analysis and Resolution Integrated Project Management Organizational Process Definition Organizational Process Focus Organizational Training Product Integration Requirements Development Risk Management Technical Solution Validation Verification
2 Managed	Basic Project Management	Configuration Management Measurement and Analysis Process and Product Quality Assurance Requirements Management Supplier Agreement Management
1 Initial		



Approx. 47% coverage of Level 2

In Scrum?

Level 3 coverage - very dependent on how YOU define the phases

- No

- Some requirements
- Some design
- Coding
- Some test
- Some lessons learned

- Most Requirements Management
- Most Project Planning
- Most Project Monitoring/Control
- Most Measurement Analysis (effort and progress)

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CMMI and Scrum Mapping

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Requirements Management

REQM	CMMI Practice	Scrum Practice
SP 1.1	Develop an understanding with the requirements providers on the meaning of the requirements.	• Review of Product Backlog (requirements) with Product Owner and team.
SP 1.2	Obtain commitment to the requirements from the project participants.	• Release Planning and Sprint Planning sessions that seek team member commitment.
SP 1.3	Manage changes to the requirements as they evolve during the project.	• Add requirements changes to the Product Backlog. • Manage changes in the next Sprint Planning meeting.
SP 1.5	Identify inconsistencies between the project plans and work products and the requirements.	• Daily Standup Meeting to identify issues. • Release planning and Sprint Planning sessions to address inconsistencies. • Sprint Burndown chart that tracks effort remaining. • Release Burndown chart that tracks story points that have been completed. This shows how much of the product functionality is left to complete.

No traceability in Scrum

[SP 1.4 Maintain bidirectional traceability among the requirements and work products]

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Project Planning

PP	CMMI Practice	Scrum Practice
SP 1.1	Establish a top-level work breakdown structure (WBS) to estimate the scope of the project.	• The standard tasks used in a Scrum process combined with specific project tasks (Scrum Backlog).
SP 1.2	Establish and maintain estimates of the attributes of the work products and tasks.	• Story Points, used to estimate the difficulty (or relative size) of a Story (requirement).
SP 1.3	Define the project life-cycle phases upon which to scope the planning effort.	• The Scrum process.
SP 1.4	Estimate the project effort and cost for the work products and tasks based on estimation rationale.	• Scrum Ideal Time estimate (similar to billable hours or Full-time Equivalents).
SP 2.1	Establish and maintain the project's budget and schedule.	• Scrum estimates (in Ideal Time). • Estimates of what work will be in each release. • Sprint Backlog. • Project Taskboard.
SP 2.4	Plan for necessary resources to perform the project.	• Scrum estimates in Ideal Time • Release Plan, Sprint Backlog and assignments.
SP 2.6	Plan the involvement of identified stakeholders.	• Scrum process roles (including team, Scrum Master, Product Owner). • [Note: The stakeholders listed in Scrum might not be the complete list of stakeholders for the project, e.g., customers, other impacted teams.]
SP 3.2	Reconcile the project plan to reflect available and estimated resources.	• Sprint Planning meeting. • Daily Scrum meeting.

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Project Monitoring and Control

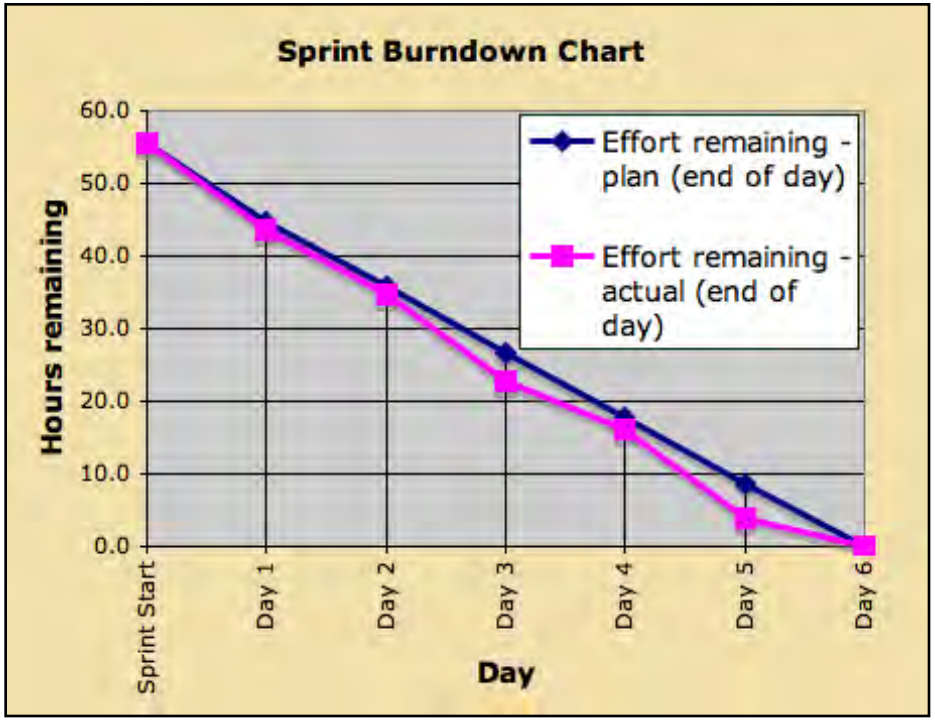
PMC	CMMI Practice	Scrum Practice
SP 1.1	Monitor the actual values of the project planning parameters against the project plan.	• Sprint Burndown chart that tracks effort remaining. • Release Burndown chart that tracks completed story points. This shows how much of the product functionality is left to complete. • Project Task Board used to track stories (requirements) that are done, in progress, or ones that need verification.
SP 1.2	Monitor commitments against those identified in the project plan.	• Discussions on team commitments at the: – Daily Scrum meeting. – Sprint Review meeting. • Sprint Burndown chart that tracks effort remaining. • Release Burndown chart that tracks Story Points that have been completed. This shows how much of the product functionality is left to complete.
SP 1.6	Periodically review the project's progress, performance, and issues.	• Daily Scrum meeting. • Sprint Review meeting. • Retrospectives.
SP 2.3	Manage corrective actions to closure.	• Tracking of actions from: – Daily Scrum meeting. – Sprint Review meeting. • [Note: This assumes that teams will track (and not lose) actions.]

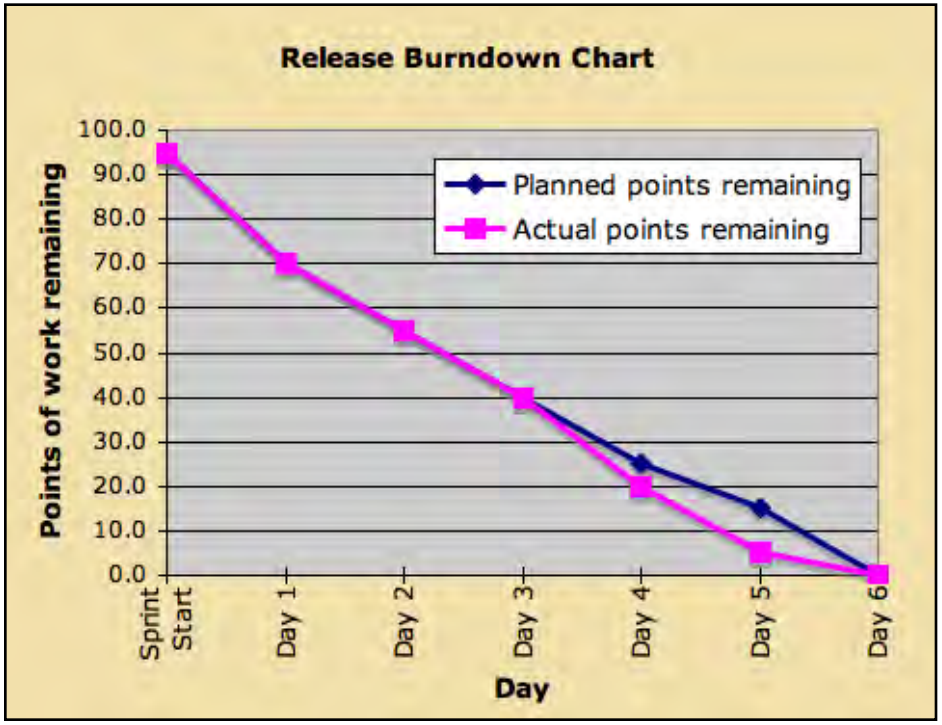
No risk assessment / tracking in Scrum

[SP 1.3 Monitor risks against those identified in the project plan]

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Burndown Charts





Implements PMC sp1.1

Monitor the actual values of the project planning parameters against the project plan.

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Measurement and Analysis

SP 1.2	Specify measures to address the measurement objectives.	• Sprint Burndown chart that tracks effort remaining. • Release Burndown chart that tracks story points that have been completed. This shows how much of the product functionality is left to complete. • [Note: These two measures could be used to track the progress of declared project objectives, such as "On time," and "On budget."]
SP 1.4	Specify how measurement data will be analyzed and reported.	• The Scrum process does describe the purpose and use the Sprint and Release Burndown charts. • [Note: CMMI expects clearly defined analysis].
SP 2.1	Obtain specified measurement data.	• Daily Scrum meeting where Sprint and Release Burndown data are collected.
SP 2.2	Analyze and interpret measurement data.	• Daily Scrum meeting where Sprint and Release Burndown data are analyzed.
SP 2.4	Report results of measurement and analysis activities to all relevant stakeholders.	• Daily Scrum meeting where Sprint and Release Burndown charts are reviewed. • [Note: Not all interested stakeholders will necessarily be at the Scrum meeting.]

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How About the Other Components of Level 2?

- **Configuration Management (CM):**
  - CM is not specifically called out in Scrum. However, in an Agile environment it is pretty easy to add a layer of CM to protect your work.
- **Product and Process Quality Assurance (PPQA):**
  - Some basic PPQA activities are being done naturally when the Scrum Master checks that the Scrum process is being followed.
  - Scrum does not specifically call out a level of objective process and product check, nor does it state that particular standards or processes should be defined and used.
- **Supplier Agreement Management (SAM):**
  - Not included in Scrum.

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Generic Practices?

- **Approximately half of the Level 2 GPs of REQM, PP, PMC and MA are implemented by Scrum.**

GP 2.2	Establish and maintain the plan for performing the REQM/PP/PMC/MA process.	• The Scrum lifecycle definition and the milestones to perform Scrum.
GP 2.3	Provide adequate resources for performing the REQM/PP/PMC/MA process, developing the work products, and providing the services of the process.	• The resources and schedule time allocated to perform Scrum planning, monitoring and requirements activities.
GP 2.4	Assign responsibility and authority for performing the process, developing the work products, and providing the services of the REQM/PP/PMC/MA process.	• The resource assignments allocated to perform Scrum planning, monitoring and requirements activities.
GP 2.6	Place designated work products of the REQM/PP/PMC/MA process under appropriate levels of control.	• [Note: Scrum does not explicitly require CM to be done. However, this can be performed using a digital camera, backed up drive, or share drive with versioning and controls turned on.]
GP 2.8	Monitor and control the REQM/PP/PMC/MA process against the plan for performing the process and take appropriate corrective action.	• Scrum Master monitoring that the steps of Scrum are followed.

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How About Level 3?

- **The following Level 3 components are not readily implemented by Scrum without additional work:**
  - Organizational Process Focus
  - Organizational Process Definition
  - Organizational Training
  - Integrated Project Management
  - Risk Management
  - Decision Analysis and Resolution
  - Engineering PAs (e.g., RD, TS, PI, VER, VAL)
  - Generic Goal 3 (i.e., using an organization-wide and tailored process with measurements and lessons-learned)

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Scrum + -'s

+ **2-4 week cycles creates team momentum, and early feedback on progress and technical solutions.**
+ **Scrum process can be learned and used in less than 2 days.**
– **Speed can be mistaken for progress:**
  – There is no "Get good requirements" phase, only "Get a list of 1-liners and prioritize." (Although some teams do more than that.)
  – There is no architecture / analysis phase, so you *could* implement yourself into a corner.
  – This is fixable by making the focus of each Sprint different.
– **Applying Scrum to large teams and systems takes extra work.**
  – e.g., System definition, integration and coordination.



90% Analysis, 10% Code
80% Analysis, 20% Code
70% Analysis, 30% Code
60% Analysis, 40% Code
50% Analysis, 50% Code

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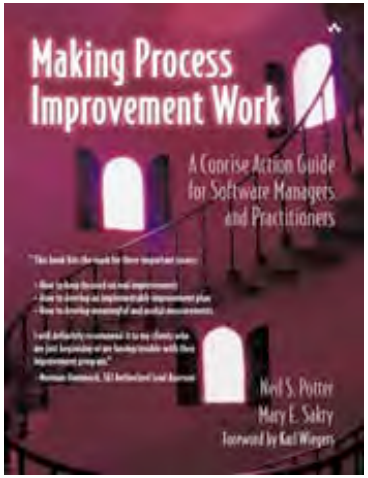
Summary

- Scrum is a good implementation for many of the practices in Level 2.
- A group can easily use Scrum and CMMI together.
- All the remaining practices in Levels 2 and 3 can be implemented while using Scrum.
- An organization at Level 2 or 3 could adopt Scrum as an additional lifecycle choice.

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A Real-Life Example of Appraising and Interpreting CMMI® Services Maturity Level 2

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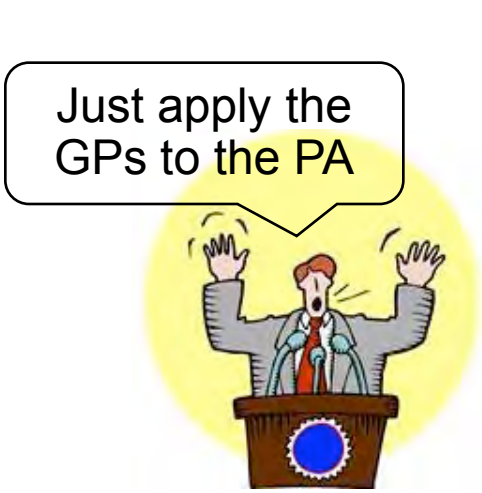
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Agenda

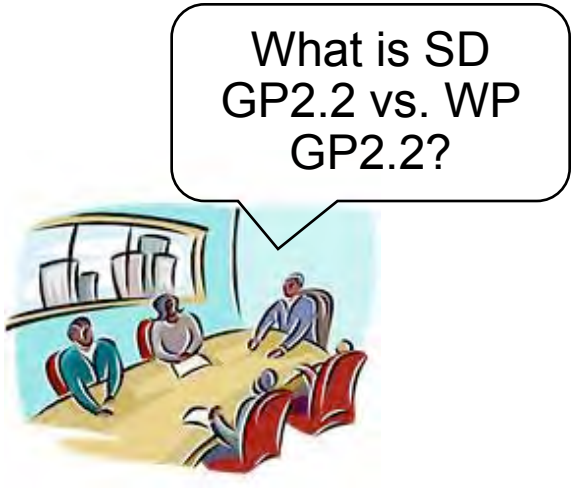
- Introduction
- Applying Requirements Management (REQM) and traceability
- Applying Work Planning (WP) and Work Monitoring Control (WMC) to the operation of a services group
- The relation between Service Delivery and WP / WMC
- Size (attribute estimation)
- Which suppliers to apply Supplier Agreement Management (SAM) to?
- What is being audited for Process and Product Quality Assurance (PPQA)?
- How to apply Configuration Management (CM) to service artifacts
- Overlap between core and service PAs at Level 2
- Appraisal issues
- Reaction of a new group to the SVC model
- Suggestions to make life easier
- Summary

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Introduction -1



Presenting



Appraising

Presenting:

- Easy to gloss over all the sticky issues - “Look how good the service PAs are.”

Appraising:

- Sort out issues such as: core PA interpretation, overlap.

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Introduction -2

- **Appraisal team:**
  - Three people experienced with DEV (5-10 years) + LA (22 years with DEV)
  - Used CMMI 1.2. (This presentation uses 1.3 text for clarity.)
- **Larger group:**
  - 200 people that design and build large airport baggage / parcel systems:
    - » Motors, steel, conveyors, electronics, software, installation, testing.
- **Groups appraised:**
  - Bids/Proposals (7 people) and Financial services (11 people).



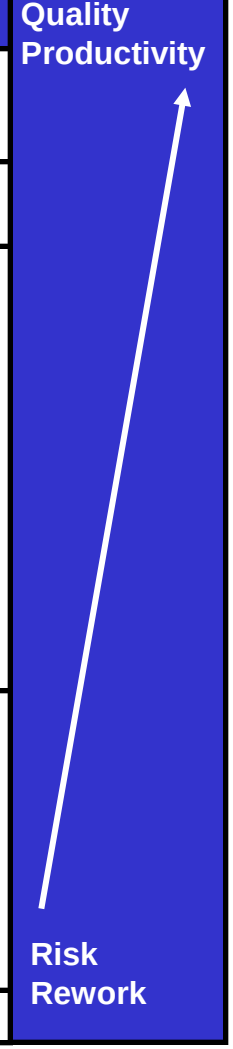


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Services Model v1.3 - Staged

Level	Focus	Process Areas
5 Optimizing	*Continuous Process Improvement*	Organizational Performance Management (OPM) Causal Analysis and Resolution (CAR)
4 Quantitatively Managed	*Quantitative Management*	Organizational Process Performance (OPP) Quantitative Work Management (QWM)
3 Defined	*Process Standardization*	Capacity and Availability Management (CAM) (svc) Incident Resolution and Prevention (IRP) (svc) Service System Transition (SST) (svc) Service Continuity (SCON) (svc) Service System Development (SSD) (svc, optional) Strategic Service Management (STSM) (svc) Organizational Process Focus (OPF) Organizational Process Definition (OPD) Organizational Training (OT) Integrated Work Management (IPM) Risk Management (RSKM) Decision Analysis and Resolution (DAR)
2 Managed	*Basic Project Management*	Service Delivery (SD) (svc) Requirements Management (REQM) Work Planning (WP) Work Monitoring and Control (WMC) Supplier Agreement Management (SAM) Measurement and Analysis (MA) Process and Product Quality Assurance (PPQA) Configuration Management (CM)
1 Initial		

Core PAs
SVC PAs



Applying REQM and Traceability

The purpose of Requirements Management (REQM) is to manage requirements of products and product components and to ensure alignment between those requirements and the work plans and work products.

- **REQM Takes A LOT of explaining to a non-familiar services group:**
  - The services groups were bidding/tracking product requirements.
    - » Caused total confusion when they were left by themselves to read CMMI.
  - Requirements defined as group roles & responsibilities.
  - Initially we had to explain why REQM and SD are separate.
    - » Then we mapped REQM and SD together - provide one front to the appraisal team and organization.
  - Too much GP!: Policy, plan, training, monitoring and auditing of roles & responsibilities definition activities?
    - » REQM might only take 1 day per year and 1 update every 6 months.
    - » The GPs need to be scaled down DRAMATICALLY to be useful OR mapped to SD GPs. We merged REQM and SD GPs.

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Explaining REQM in the Appraisal

- **The appraisal team re-wrote the PA purpose for the final findings presentation:**
  - The purpose of Requirements Management (REQM) is to manage requirements of products and product components and to ensure alignment between those requirements and the work plans and work products.
  - The purpose of Requirements Management (REQM) is to, a) define the services of the group, b) trace defined services to team activities, c) verify that resources, service definition and actual work done are aligned. [appraisal team definition]

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Bidirectional Traceability (SP 1.4)

SP 1.4 Maintain bidirectional traceability among requirements and work products.

"In a service environment, you should be able to trace stakeholder requirements to the elements of the delivered service and supporting service system that were developed from those requirements ….." [CMMI 1.2 & 1.3]

Example 1

SOX Requirement	Implementation	Test
SOX Annex - section 1	Finance role 1, report 1	SOX test 1
SOX Annex - section 2	Finance role 2, report 2	SOX test 2
SOX Annex - section 3	Finance role 3, report 3	SOX test 3

Example 2

Bid Role (defined in SLA)	Authority Level	Tasks for Role
Role 1	Approve up to $X	Obtain estimates, define bid, check bid
Role 2	Approve up to $Y	Tasks - role 2
Role 3	Approve up to $Z	Tasks - role 3

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Applying WP and WMC



- **The group performs annual resource planning.**
- **"The plan" = Annual resource plan and service-event plan.**
- **Risks are assessed monthly:**
  - E.g., Do we have resources to cover each bid / financial report?
- **Schedules consist of bid and financial report deadlines.**
- **Stakeholders are defined on approval and signature sheets.**
- **Too much GP!: policy, plan, training, monitoring and auditing of annual and service-event planning?**
  - Most planning events were a few hours in length.
  - We merged WP and WMC GPs.
  - Audits = signature approvals with checklists.



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Relation Between SD and WP / WMC



- **In SD, planning (GP2.2) is used to plan the readiness and operation of a services group:**
  - » SD GP2.2 - Establish and maintain the plan for performing the process.
  - » SD GP2.3 - Provide adequate resources for performing the process…..
  - » SD GP2.4 - Assign responsibility and authority for performing the process…...
  - » SD GP2.8 - Monitor and control the process against the plan for performing the process and take appropriate corrective action.
- **So what was WP / WMC used for?**
  - – Operations planning, of which service delivery is one significant aspect.
  - – Annual resource planning and monthly resource tracking.
  - – Special projects (non-trivial “other” work).

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Size (Attribute Estimation)

- **The group reads the practice:**
  - WP SP 1.3 Establish and maintain estimates of work product and task attributes.
  - And assumes that it is #Feet of steel, #motors……etc.
- **The bid group estimates the cost of a project:**
  - #Feet of steel, #motors, #control panels, installation labor.



- **Luckily:**
  - Finance already had:
    - » Project categorization (the size/complexity of the project being financially tracked).
  - Bids already had:
    - » Bid volume (#bid requests likely to arrive per month).

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Which Suppliers to Apply SAM to?

"The scope of this process area addresses the acquisition of products, services, and product and service components that can be delivered to the service's customer or included in a product or service system. This process area's practices can also be used for other purposes that benefit the service (e.g., purchasing consumables)." [CMMI 1.3]



- **Both services teams had no suppliers:**
  - An example would have been accounting experts, proposal writers.
- **The product team had hundreds of suppliers; this was appraised under SAM in the DEV model.**

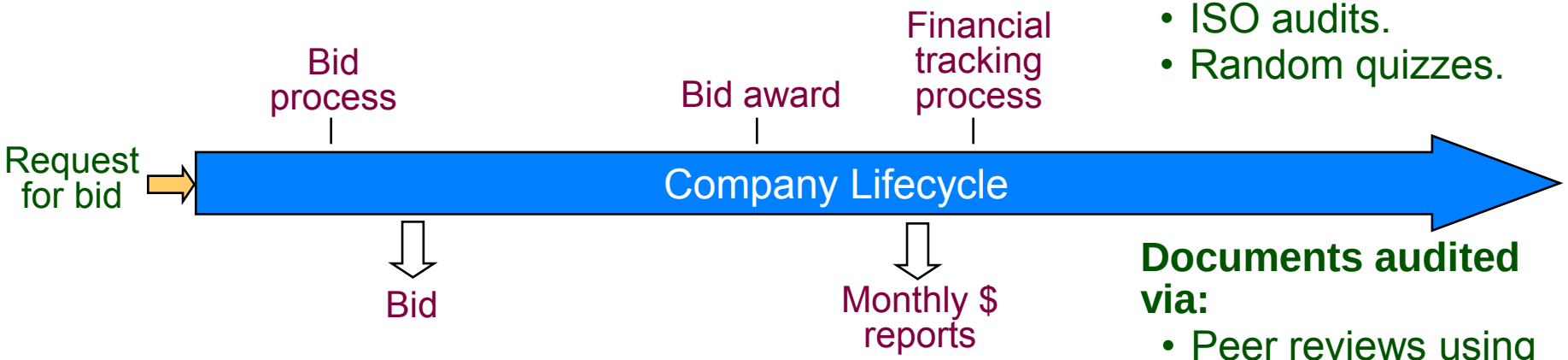
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What is Being Audited for PPQA?

- **Processes:**
  - Lifecycle and Service Delivery processes.
  - Process Area processes.
- **Work products:**
  - Service deliverables + critical internal documents.

Processes audited via:

- Extensive Management Approvals.
- SOX audits.
- Corporate finance audits.
- ISO audits.
- Random quizzes.



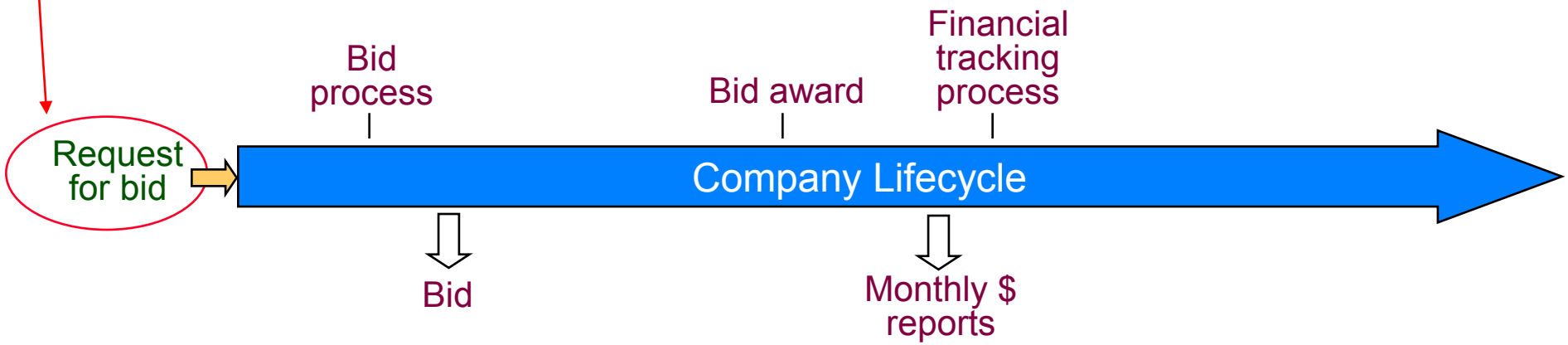
Documents audited via:

- Peer reviews using checklists.
- Signature approvals of document content.

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How to Apply CM to Service Artifacts

- **Identify documents that service groups care about, e.g.,:**
  - Internal: Annual plan, checklists, service agreement, audit results.
  - Deliverable: Requests, proposals, estimate sheets, contracts.
- **Define directory structure for all documents, and plan for archival.**
  - Merge Data Management plan in with CM.
- **GPs - keep them simple!**
  - Someone assigned to set up the folders and access.
  - Task defined to "establish CM" that can be planned/tracked.
  - Team meetings for training, random audits for objective evaluation.



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Overlap Between Core and Service PAs

- **Lots of overlap - a MUST fix before appraising, otherwise:**
  - You will be asking the same question 3-4 times.
  - The appraisal team will wear out.
  - The interviewees will think you are nuts and unsure about the model.

Practice #	REQM Practice Definition	Rewrite (Italics = exact copy of CMMI practice)
1.1	Develop an understanding with the requirements providers on the meaning of the requirements.	See SD sp1.2
1.2	Obtain commitment to the requirements from participants.	See SD sp1.2
1.3	Manage changes to the requirements as they evolve.	See SD sp1.2
1.4	Maintain bidirectional traceability among requirements and work products.	Trace service requirements to downstream group activities and back (e.g., map service descriptions to team activities and deliverables; do we implement our service definition, do we exceed it, do we have gaps?)
1.5	Ensure that plans and work products remain aligned with requirements.	Align service definition, schedule/budget, team activities. Examples: * Does the services list state to do A, but in reality, the team is doing B. * Analyze measurement, resource and service request data.

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Merging Some REQM Practices with SD

Practice #	SD Practice Definition	Rewrite (with additions from REQM SPs and GPs. Italics = exact copy of CMMI practice)
1.1	Analyze existing service agreements and service data to prepare for expected new agreements.	Analyze existing service agreements and service data. Use data as a basis for new agreements. What can we achieve based on the past - lessons; overlooked tasks?) (e.g., In the past, what has been the sales volume, #bids that can be processed, timeliness.)
1.2	Establish and maintain the service agreement.	Define the services of the group and review with staff. [REQM sp 1.1]. Obtain commitment to the services definition from the staff. [REQM sp 1.2] Establish and maintain the service agreements with customers. Manage changes to services (evaluate change).

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Overlap (Continued)

REQM (GPs)

GP 2.1	Establish and maintain an organizational policy for planning and performing the process.	See SD GP 2.1
GP 2.2	Establish and maintain the plan for performing the process.	See SD GP 2.2
GP 2.3	Provide adequate resources for performing the process, developing the work products, and providing the services of the process.	See SD GP 2.3
GP 2.4	Assign responsibility and authority for performing the process, developing the work products, and providing the services of the process.	See SD GP 2.4

Practice #	WP Practice Definition	Rewrite (with additions from WMC GPs. Italics = exact copy of CMMI practice)
1.1	Establish and maintain the service strategy.	Objectives: See MA sp1.1. Approach: See SD sp 2.1. Risks: See WP sp 2.2.

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Appraisal Issues

- **Asking CMMI questions to service professionals unfamiliar with CMMI:**
  - Plan on rewriting (some of) the CORE PA practices, so that the interpretation is consistent and uses easier words.

Practice #	CM Practice Definition	Rewrite (Italics = exact copy of CMMI practice)
1.1	Identify the configuration items, components, and related work products to be placed under configuration management.	Define a list of items (files, contracts, bids, deliverables, documents) for the group that will be placed under control (e.g., version, access, backup).
1.2	Establish and maintain a configuration management and change management system for controlling work products.	Establish and maintain a system (manual or automated) to store, manage and protect files on the list above.
1.3	Create or release baselines for internal use and for delivery to the customer.	Define naming conventions for files and documents, as they are created and released.
2.1	Track change requests for the configuration items.	Track changes made to files under CM control. Example: * Track changes in a history file or comment field of a version tool.
2.2	Control changes to the configuration items.	Establish read/write access for files under CM control.

- **Some service-specific practices need examples too:**
  - e.g., "Maintain the service system" means?

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Reaction of New Group to the SVC Model

Target audience reaction:

- "How does this relate to our function?"
  - » "What are work product attributes," "What risks?," What are configuration items?" "What is a lifecycle?"
  - » Lead appraiser had to advise "don't read the model, it will just confuse you more." [specifically the core PAs]

Appraisal team reaction :

- Initially, total confusion:
  - » Reading the model, and memorizing what each practice means was wearing.
  - » "Model needs redoing," - wording and overlap of practices.
  - » The findings of the class B appraisal acted as the new model definition for the team, along with the lead appraisers model rewrite.

The core PAs are the challenge

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Suggestions to Make Life Easier



- **Run a (very) informal appraisal first, so that:**
  - Interviewees have some idea of what your model interpretation is.
  - You can obtain experience asking interview questions and understanding the responses.
- **Clarify terms (model glossary might / might not help*):**
  - "Requirement," "stakeholders in planning," "risk" vs. "issue," "traceability," "configuration item" "monitor the monitoring process."
- **Train your team in the interpretation of the model before you appraise:**
  - The SVC Supplement class doesn't cover the core PAs.
  - The Intro to CMMI SVC class doesn't cover overlap between PAs and the GPs in detail.

*Requirement: (1) A condition or capability needed by an end user to solve a problem or achieve an objective. (2) A condition or capability that must be met or possessed by a product, service, product component, or service component to satisfy a supplier agreement, standard, specification, or other formally imposed documents. (3) A documented representation of a condition or capability as in (1) or (2).

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Summary

- **The core Maturity 2 Level PAs CAN be used in a services organization. They do work.**
  - An organization at ML2 is a more organized and efficient:
    - » E.g., #Mistakes, Response time, #Hours expended.
- **The core PA practices are written for development, not for services.**
  - Intro & Supplement classes focus on the benefit of the service PAs, not the difficulty interpreting the core PAs.
  - Plan on a rewrite, otherwise:
    - » a) You will have to explain practices every time.
    - » b) The target audience will probably forget the meaning and get totally off track.
- **Define what services or work the PAs are being applied to.**

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Questions?

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Acronyms

- SOX - Sarbanes Oxley
- SLA - Service Level Agreement
- WP - Work Planning
- WMP - Work Monitoring and Control

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Some Assembly Required: Using Agile Methodologies to Develop an Interactive Software User's Guide



Agile Methodologies
Some
Assembly Required

Presentation Agenda

- Some Assembly Required: Agile Methodologies

- Introduction / Problem Statement
  - Why pursue a new technical document development platform?

- Part 1… Background: Enabling Technologies, Software Architecture and Development Platforms
  - Object-oriented programming (OOP)
  - Rich Internet Application (RIA) / Rich Desktop Application (RDA)

- Part 2… SUG Development
  - Agile and Technical Documentation
  - The Pilot Project
  - User stories

- Part 3… SUG Lessons Learned



Why Pursue a New Development Platform?

- Current development platform (Authorware) is ‘abandonware’
  - **Vendor (Adobe) discontinued development in August of 2007**
    - **Strengths**
      - broad acceptance in the marketplace; rapid prototyping; particularly well suited to creating e-learning content
    - **Weaknesses**
      - XML handling is sub-optimal; web delivery and desktop delivery is problematic; ‘Protection Mode’ and runtime errors with IE7 and Vista



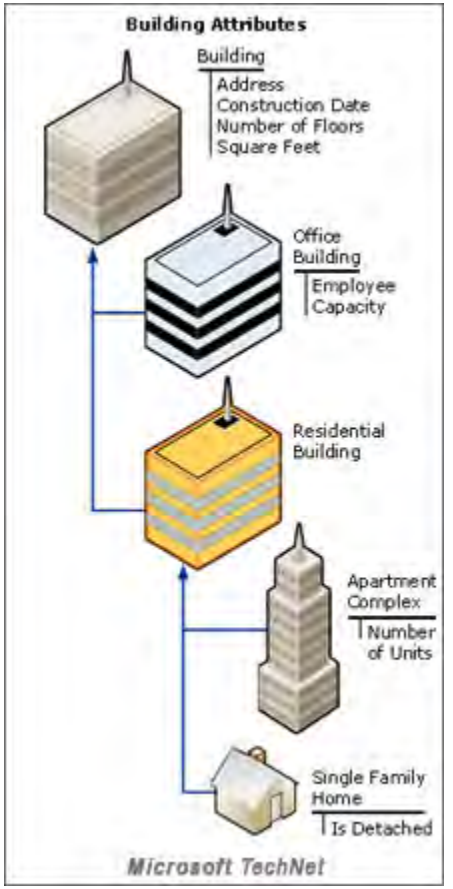
- Need a development platform that’s ‘future-proofed’
  - leverage Broadband proliferation and enabling technologies
  - accommodate multi-channel delivery: web, desktop, mobile, and print



Object-oriented programming (OOP)

- What is an Object Oriented Programming language?
  - Programming oriented around objects - self-contained collections of computational procedures and data structures.

A computer language can be said to be Object Oriented if it provides support for the following:	
Class	A class is a blueprint, or prototype, that defines the variables and the methods common to all objects of a certain kind.
Object	An instance of a class. More than one instance of the same class can be in existence at any one time.
Encapsulation	The act of placing data and the operations that perform on that data in the same class. The class then becomes the container for the data and operations.
Inheritance	The reuse of base classes to form derived classes (subclasses). Methods and properties defined in the superclass are automatically shared by any subclass.
Polymorphism	ability of objects belonging to different types to respond to method, field, or property calls of the same name, each one according to an appropriate type-specific behavior.



- Why use it?
  - OOP is an efficient methodology for minimizing development time and maximizing code reusability.
  - OOP creates a modular design that is easily modified without having to restructure the entire system.

Rich Internet Application (RIA)

Web-based application that approaches the speed and elegance of a local (installed) application

- Traditional desktop features
  - Drag and drop, windows, wizards, and panels
- Cross Platform
  - Cross Browser
    - IE, Mozilla Firefox, Safari
  - Cross Operating System
    - Windows, Linux, MAC OS
- No installation, and accessible just about anywhere
- MVC pattern on client and server
  - MVC pattern(s) can manage the interaction between user and the user interface, and requests to the server



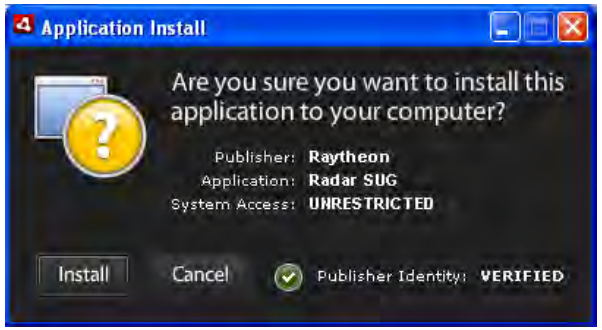


Rich Desktop Application (RDA)

Platform-independent web applications
that can be run on a user's desktop

- In contrast to RIA's, RDA's are able to run off-browser and off-line
- Applications have network connection awareness
- Cross Platform… browsers and operating systems





- Desktop security model - applications can be packaged and digitally signed

RIA in the Browser / RDA on the Desktop

Feature	RIA in the Browser	RDA on the Desktop
Application delivery	Applications can be easily discovered, explored, and used.	Installed applications have more persistence, power, and functionality.
Installation	No application installation is necessary.	Applications install seamlessly from the browser or install like a traditional application
Background capability	RIAs can only run in a visible browser window	Applications can run in the background and provide notifications like traditional desktop applications
Persistence	Activity is limited to the browser session. When the browser is closed, information is lost.	RDAs are installed on the desktop. They store information locally and operate offline.
Desktop integration	Applications are sandboxed, so desktop integration is limited.	Applications can access a desktop file system, clipboard, drag and drop events, system notifications, and more.
User interface control	RIAs run within a browser window that has its on controls, branding, and integration with the desktop.	RDAs have a customizable user interface and desktop integration, enabling branding experiences.
Data storage	Applications have limited local storage, which the browser can destroy.	Applications have unlimited local storage and access to a local database, plus encrypted local storage

RIA and RDA Development Platforms

- Adobe Flash/Flex/AIR
- Sun JavaFX
- Microsoft Silverlight
- Google GWT
- OpenLazzlo
- AJAX

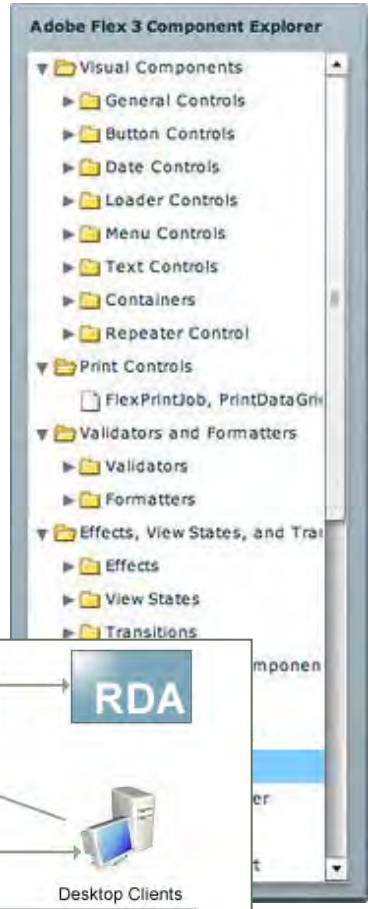


"By 2010, at least 60 percent of new application development projects will include RIA technology, and at least 25 percent of those will rely primarily on RIA."

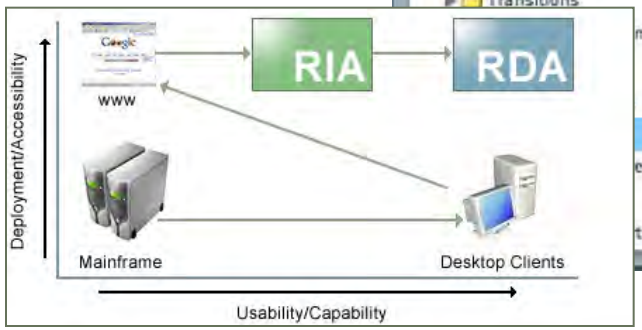
Source: Gartner RAS Core Research

Flash Builder and Adobe AIR

- Flash Builder
  - Adobe's platform for developing and deploying RIAs for the **browser**
    - Leverages the nearly ubiquitous Flash Player (98% penetration level)
    - Flex applications can be built using the free open source Eclipse framework



- Adobe AIR (Adobe Integrated Runtime)
  - Adobe's platform for deploying RIAs for the **desktop**
    - Allows you to transform a RIA into a Rich Desktop Application (RDA)
    - Air applications run outside of the browser, on multiple operating systems



Flash Builder and Adobe Air… Who's Using It?

- Flash Builder and Adobe AIR are reaching critical mass
  - SAP, HP, Google, NASDAQ, eBay, AOL, Yahoo, MINI…

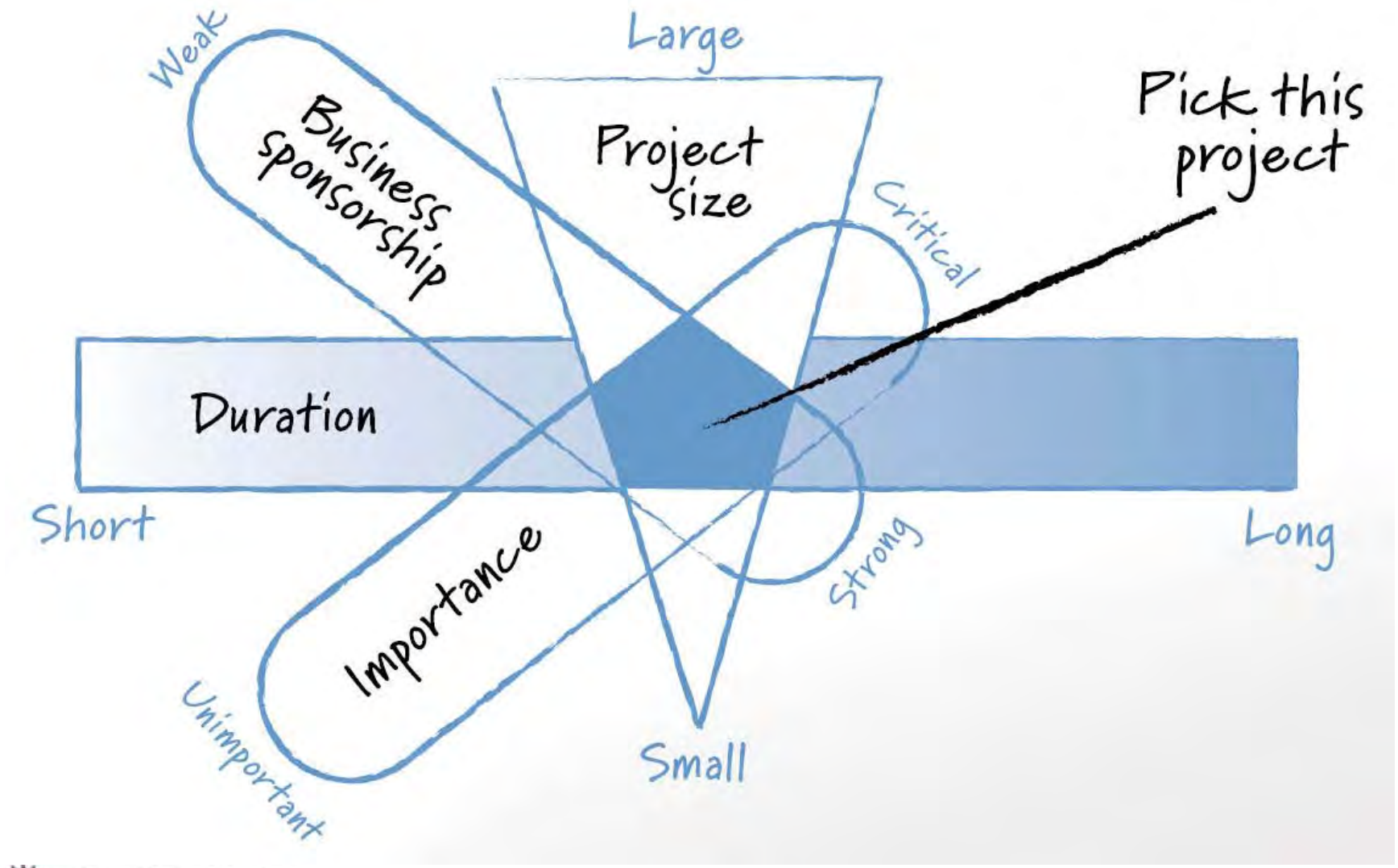


Agile and Technical Documentation

- Traditionally, Agile methodologies focused on software development or product engineering
- Recently, Agile practices have extended to other areas such as technical documentation
- Agile methodologies encourage/allow:
  - A means to accommodate content that is more and more malleable and requires more touch points
  - Effective communication and collaborative spaces for technical communicators and Subject Matter Experts (SMEs)
  - The use of Scrums and user stories to create a platform by which to develop customer-facing documentation



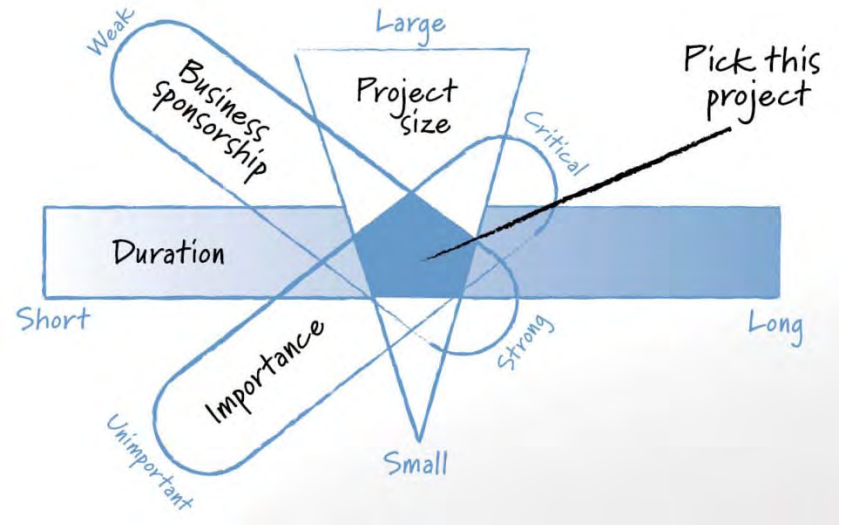
Attributes of the Ideal Pilot Project



http://blog.mountaingoatsoftware.com/four-attributes-of-the-ideal-pilot-project

Attributes of the Ideal Pilot Project

- Duration
  - A project that could be completed in 8 weeks
- Project Size
  - A project that could be supported by one team
- Importance
  - Medium priority
- Business Sponsor Engagement
  - Reasonably strong



Agile and User Stories

- Substitute of formal requirements documents
- Summaries of functionality that leave space for expansion and refinement
- Prioritized based on costs and their value

As a designer, I can customize the look and feel of my deliverable

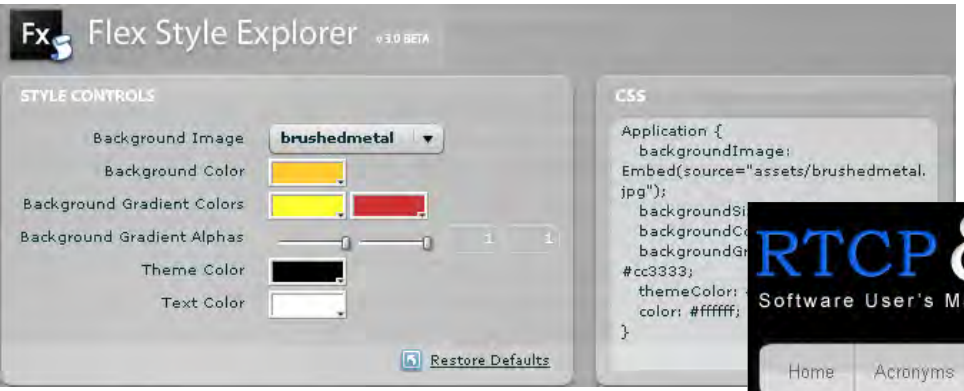
As a user, I can drill down to specific information using multi-level menus

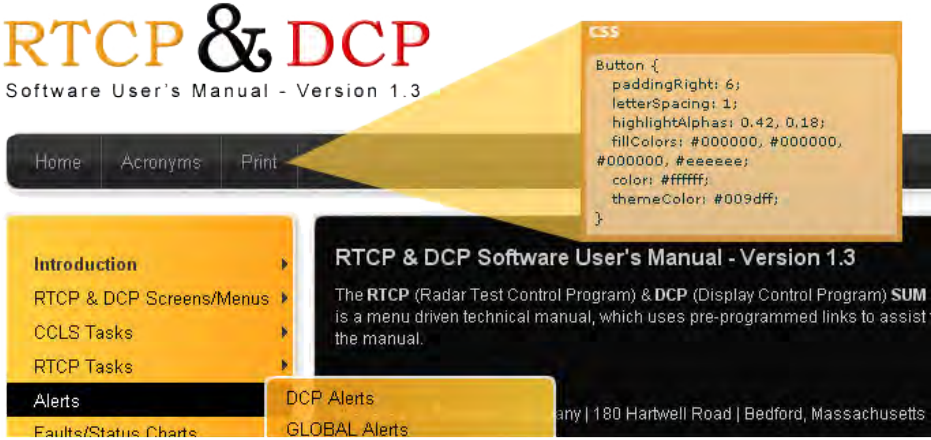
As a user, I can display/use the SUG on multiple platforms

User Stories

Software User's Guide (SUG) … Prototype

- Skinning and styling
  - As a designer, I can customize the look and feel of my deliverable



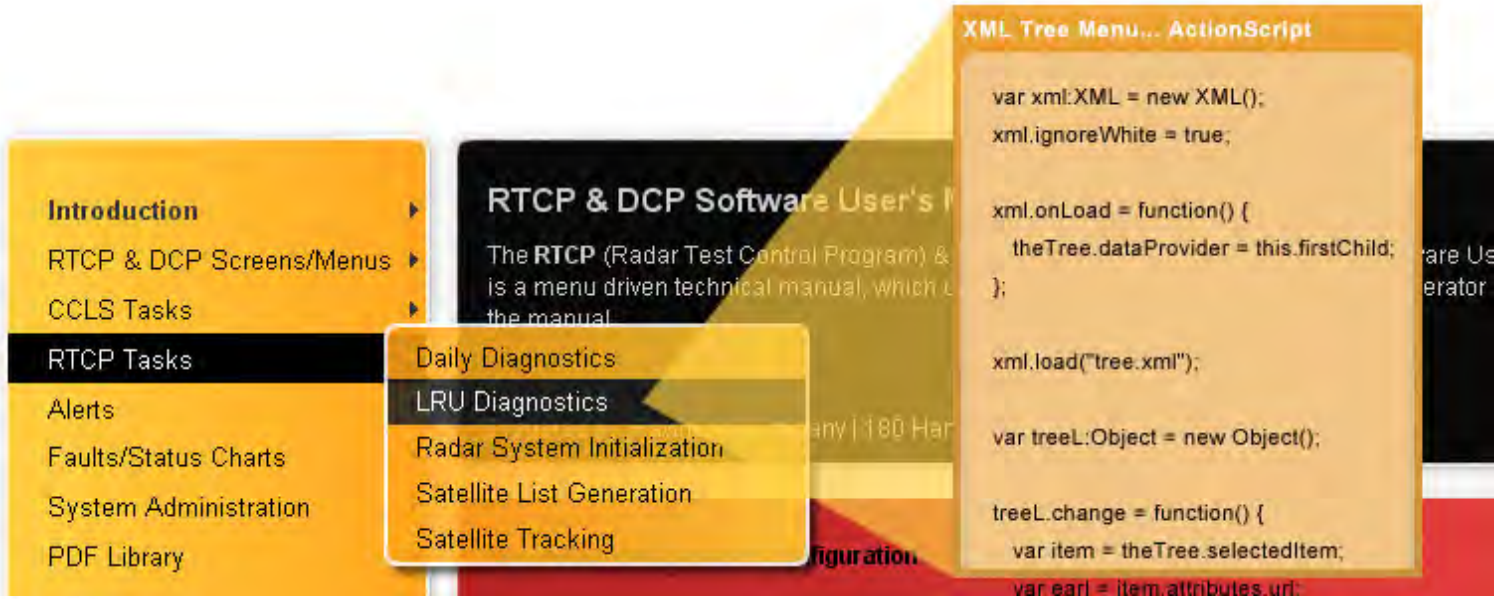




User Stories

Software User's Guide (SUG) … Prototype

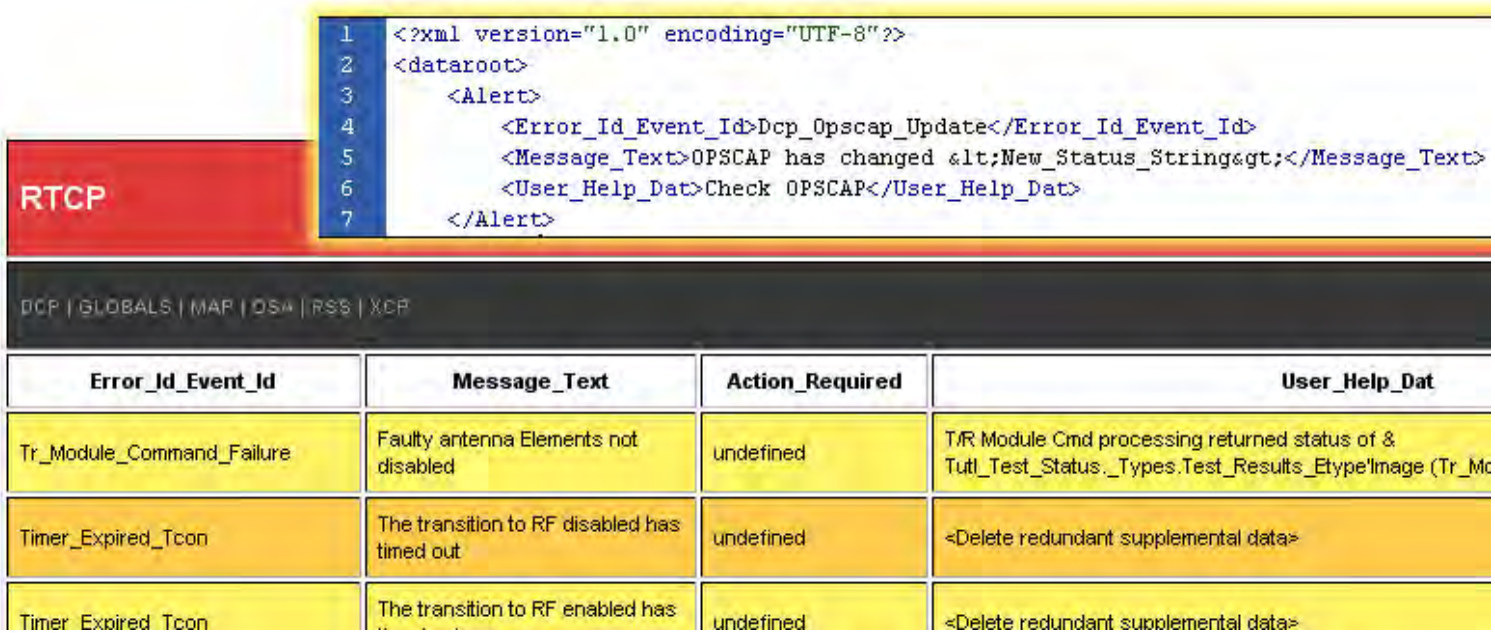
- Versatile Menu System
  - As a user, I can drill down to specific information using multi-level menus
  - As a designer, I can pull data from external XML collections



User Stories

Software User's Guide (SUG) … Prototype

- Data Grids and Tables
  - As a user I can resize, and sort column layouts



User Stories

Software User's Guide (SUG) … Prototype

- Multi-channel delivery
  - As a user, I can display/use the SUG on multiple platforms



Lessons Learning

Software User's Guide (SUG) … Prototype

- Team
  - Team was not co-located
  - Could have been better formed
- Short stories
  - Need to be short
  - Need to have clear value to the user
  - Divide the feature (story) into smaller pieces and add value incrementally
- Momentum
  - When the team sees visible progress, progress and creativity increase
  - Relates back to keeping "stories short" and fostering team communication and demanding whole team collaboration

Lessons Learning… cont.

Software User's Guide (SUG) … Prototype

- Feedback
  - Rapid feedback cycles make for quicker adjustments and improvement
  - Easy to fall into a vacuum – little feedback to sanity check decisions
  - Relates back to keeping "stories short"
- Acceptance testing
  - In hindsight – ad hoc
  - Different hardware/software platforms led to "faux" behavior/performance/scenario testing
- Conclusions
  - Practice iterative, incremental development
  - Encourage active customer participation and demand whole team collaboration
  - Deliver business value at regular intervals at a sustainable pace

Questions?

Some Assembly Required: Agile Methodologies



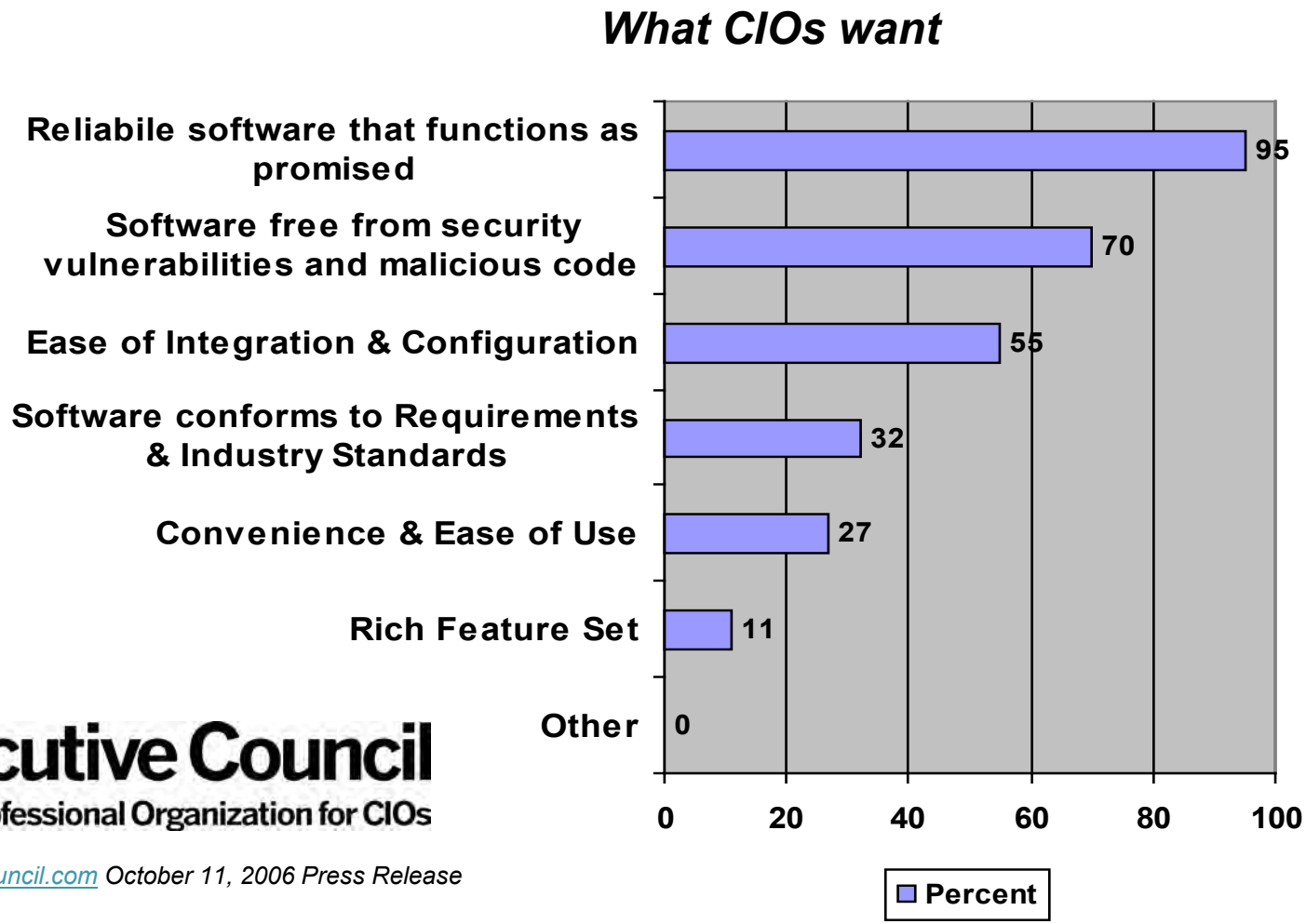
Why do developers make dangerous software errors?

Michele Moss
NDIA CMMI® Technology Conference
November 15, 2011

Key questions

- Who asks developers to develop secure code?
- Do developers know why they need to develop secure code?
- What should developers do/not do to develop secure code?
- Can developers develop secure code by themselves?
- How do developers know they have developed secure code?
- Why should developers care?
- Next Steps?

Requirements for secure code are implicitly and not explicitly stated



CIO Executive Council
The Professional Organization for CIOs

https://www.cioexecutivecouncil.com *October 11, 2006 Press Release*

“Defacto” security requirements in NIST 800-53 do not explicitly require developers to produce secure code

- Technical
  - AC-2 Account Management
  - AC-3 Access Enforcement
  - AC-4 Information Flow Enforcement
- Management
  - RA-5 Vulnerability Scanning
- Operational
  - CM-7 Least Functionality
  - SI-3 Malicious Code Protection
  - SI-10 Information Input Validation

Technical controls in NIST 800-53 contribute to application security

- AC-7 Unsuccessful Login Attempts
- AC-10 Concurrent Session Control
- AC-11 Session Lock
- AC-14 Permitted Actions without Identification or Authentication
- AC - 16 Security Attributes
- AC-17 Remote Access
- AC-20 Use of External Information Systems
- AU-2 Auditable Events
- AU-3 Content of Audit Records
- AU-4 Audit Storage Capacity
- AU-9 Protection of Audit Information
- IA-3 Device Identification and Authentication
- IA-4 Identifier Management
- IA-5 Authenticator Management
- IA-6 Authenticator Feedback
- IA-7 Cryptographic Module Authentication
- IA - 8 Identification and Authentication (Non-Organizational Users)
- SC-2 Application Partitioning
- SC-3 Security Function Isolation
- SC-4 Information in Shared Resources
- SC-7 Boundary Protection
- SC-8 Transmission Integrity
- SC-10 Network Disconnect
- SC-11 Trusted Path
- SC-12 Cryptographic Key Establishment and Management
- SC-24 Fail in Known State
- SC-25 Thin Nodes
- AC-18 Wireless Access
- AC-19 Access Control for Mobile Devices
- SC-9 Transmission Confidentiality
- SC-13 Use of Cryptography
- SC-28 Protection of Information at Rest
- SC-23 Session Authenticity
- AC-5 Separation of Duties
- AC-6 Least Privilege

Operational controls in NIST 800-53 contribute to application security

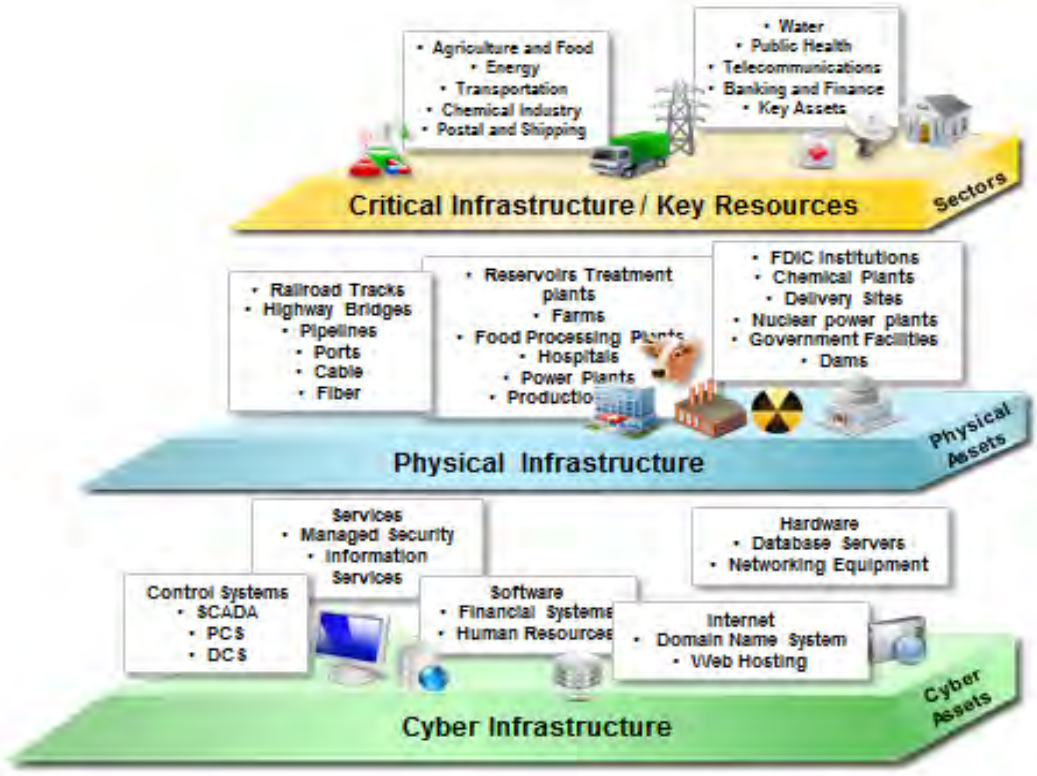
- SI-1 System and Information Integrity Policy and Procedures
- SI-2 Flaw Remediation
- AT-2 Security Awareness
- AT-3 Security Training
- CM-3 Configuration Change Control
- CM-4 Security Impact Analysis
- CM-5 Access Restrictions for Change
- SI-4 Information System Monitoring
- SI-6 Security Functionality Verification
- SI-7 Software and Information Integrity
- CA-5 Plan of Action and Milestones
- RA-3 Risk Assessment
- SA-2 Allocation of Resources
- SA-3 Life Cycle Support
- SA-4 Acquisitions
- SA-6 Software Usage Restrictions
- SA-10 Developer Configuration Management
- SA-11 Developer Security Testing
- SA-12 Supply Chain Protection
- SA-13 Trustworthiness
- PM-1 Information Security Program Plan
- PM-3 Information Security Resources
- PM-6 Information Security Measures of Performance
- PM-7 Enterprise Architecture
- PM-9 Risk Management Strategy
- SA-8 Security Engineering Principles
- CM-6 Configuration Settings
- CM- 8 Information System Component Inventory
- SI-11 Error Handling
- SI-12 Information Output Handling and Retention

Key questions

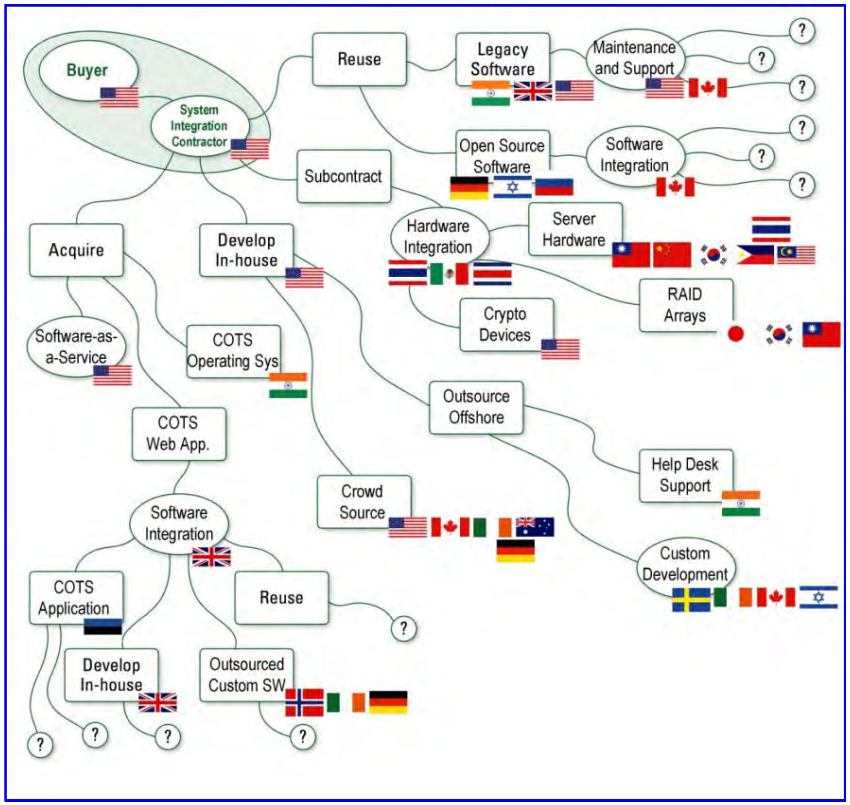
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Perspective on technology today

Technology is an integral part of our lives



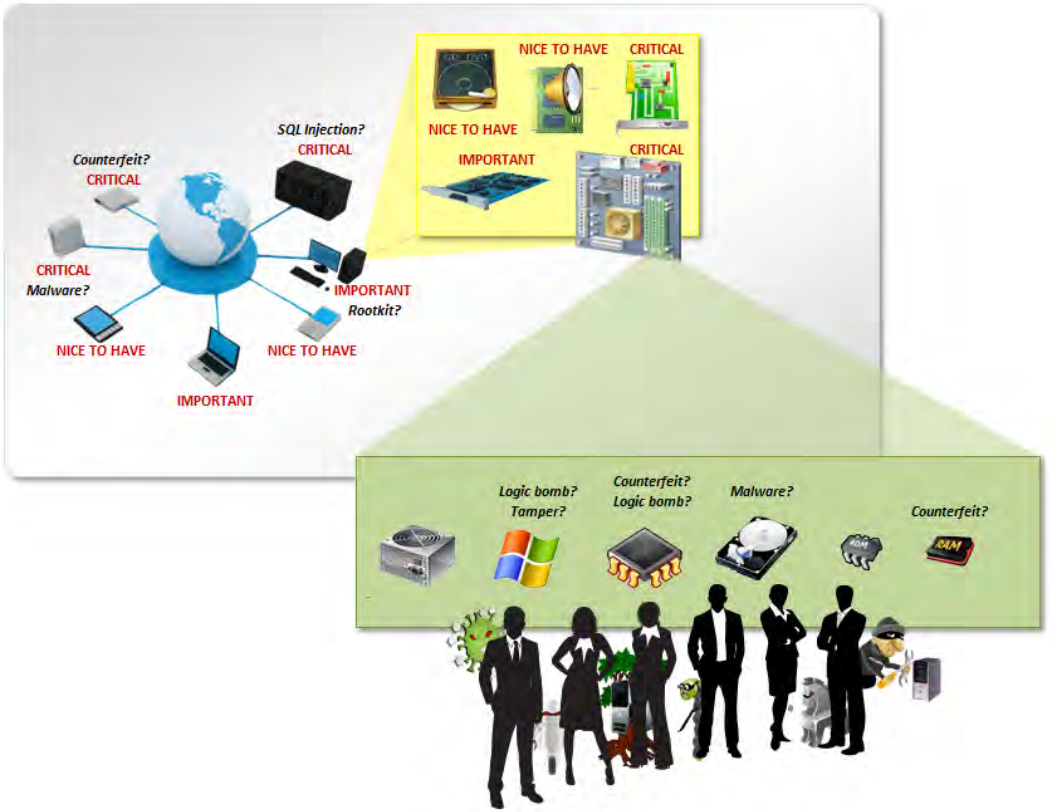
IT and Communications products are assembled, built, and transported by multiple vendors around the world



Malicious actors are taking advantage of abundant opportunities to tamper with and sabotage products …

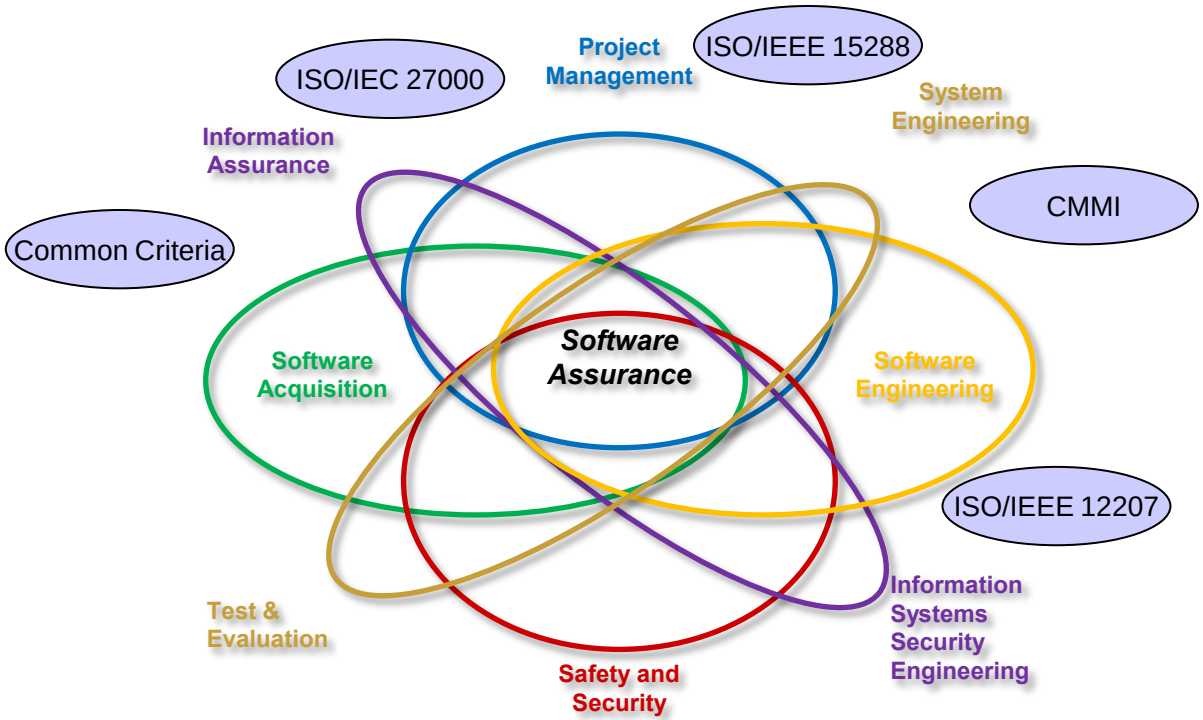
What commonalities exist?	**83%** of victims were targets of opportunity **92% of attacks were not highly difficult** **86%** were discovered by a third party **96% of breaches were avoidable through simple or intermediate controls**
How do breaches occur?	**50% utilized some form of hacking** 49% incorporated malware (lower percentages included physical attacks, privilege misuse, and social tactics)

** Source – 2011 Verizon Data Breach Investigations Report*



… ultimately compromising system integrity and operations

SwA requires multi-disciplinary collaboration



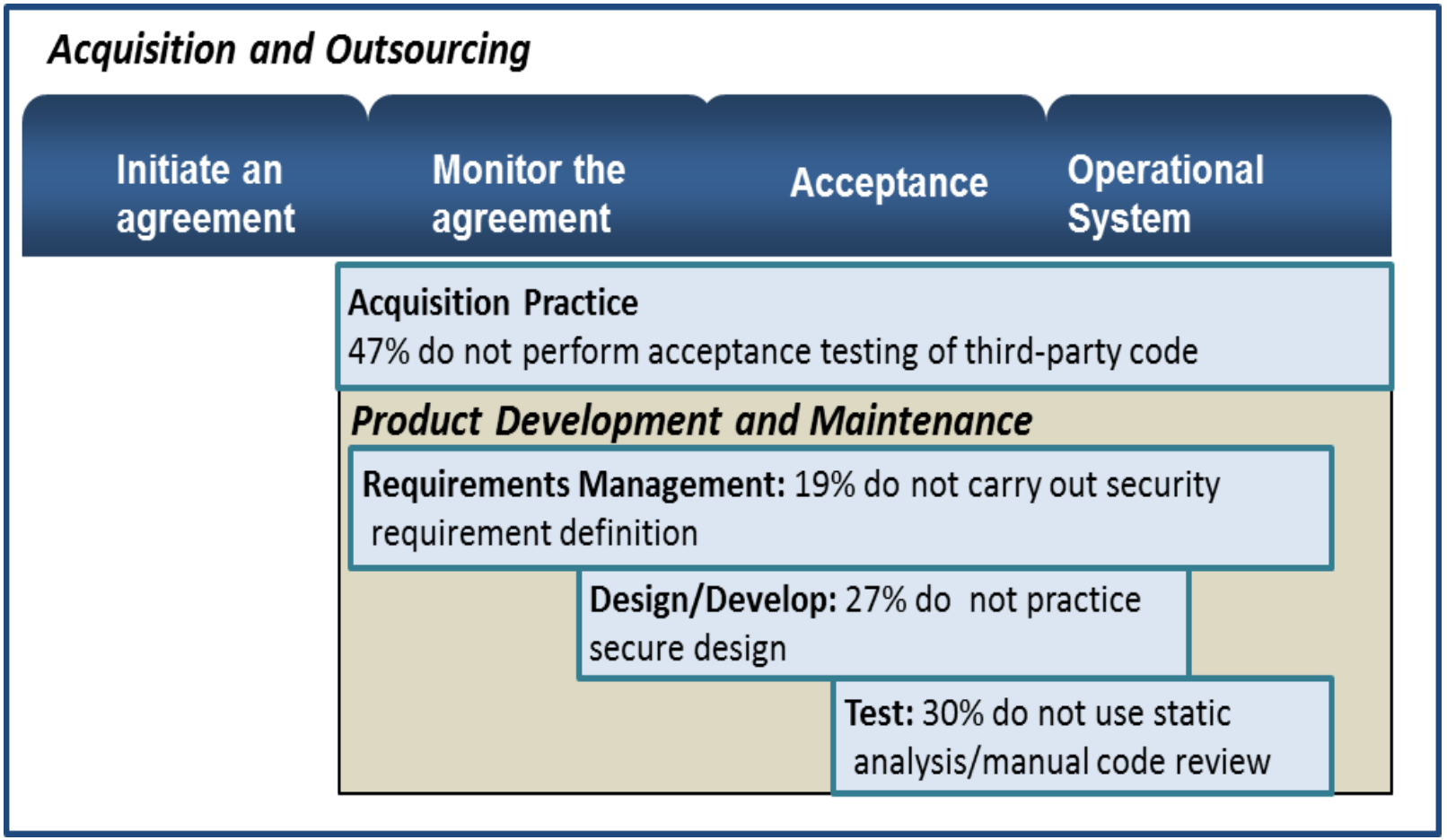
Communication Challenges

- Vocabulary
- Reserved Words
- Priorities
- Perspective
- Experience
- Objectives
- Drivers
- Risks

Source: https://buildsecurityin.us-cert.gov/swa/procresrc.html

Without a common language we cannot communicate across disciplines

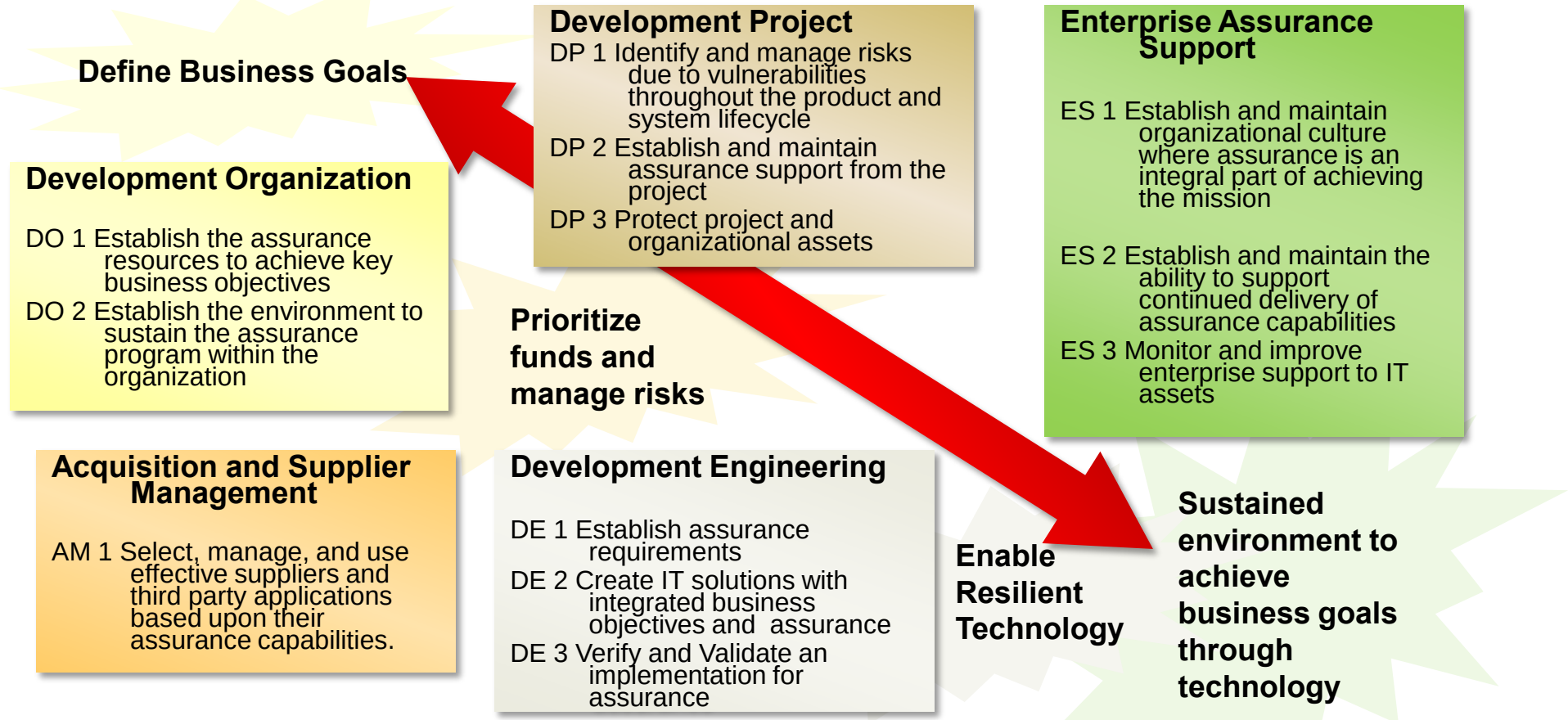
Acquirers of IT products and services trust that suppliers are addressing cyber security without validating



Key questions

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- Next Steps?

Communication across organizational stakeholders is critical to addressing SwA challenges



The Assurance PRM Is A Holistic Framework that connects CMMI and RMM to facilitate communication

https://buildsecurityin.us-cert.gov/swa/proself_assm.html

A majority of SwA best practices focus on developer-centric audiences from a security point of view

Development Organization

DO 1 Establish the assurance resources to achieve key business objectives

DO 2 Establish the environment to sustain the assurance program within the organization

Development Project

DP 1 Identify and manage risks due to vulnerabilities throughout the product and system lifecycle

DP 2 Establish and maintain assurance support from the project

DP 3 Protect project and organizational assets

Development Engineering

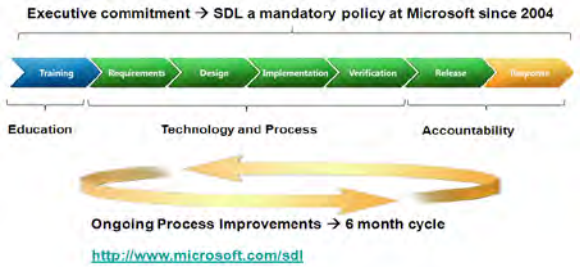
DE 1 Establish assurance requirements

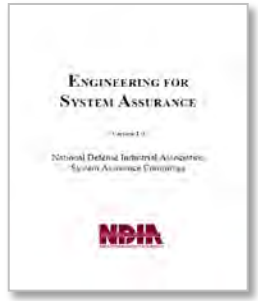
DE 2 Create IT solutions with integrated business objectives and assurance

DE 3 Verify and Validate an implementation for assurance

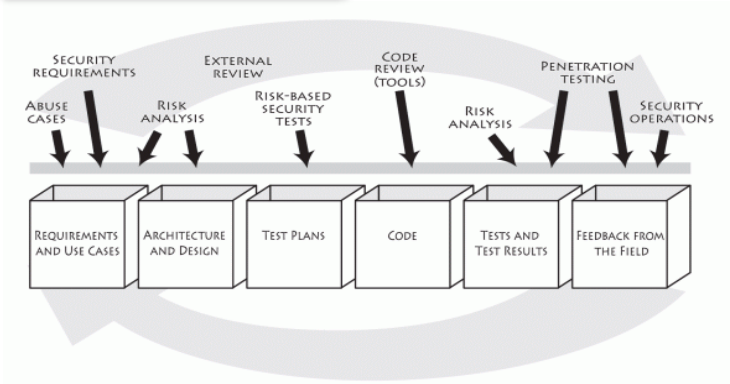








Assurance for CMMI ®





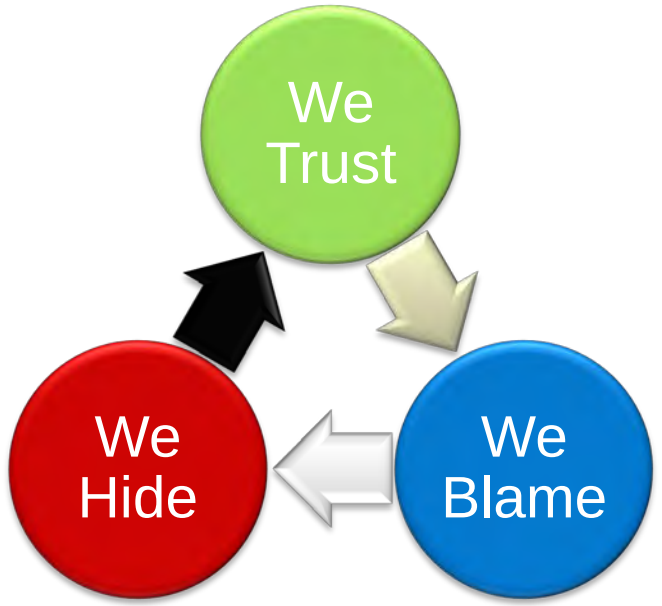


Key questions

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100 apps written by 100 developers at 100 companies

- 83 apps have serious vulnerabilities
- 72 apps have cross site scripting
- 40 apps have SQL Injection
- 100 apps contain code of unknown origin
- 90 apps use un-patched libraries with known flaws
- 5 apps have had a scan or pentest
- 1 app has had a manual security code review
- 0 apps provide any visibility into security



Why

- **1 company has a responsible appsec program**
- **1 developer has any security training**

Adapted from: The Open Web Application Security Project ,Jeff Williams, Aspect Security, SWA Forum Sept 2010

Implementation lessons learned from some of the 1/100 companies that implement SwA successfully

Who
- Secure development SMEs
- Developers

What
- Measure progress (training, secure code reviews, security change requests)
- Internal policy

When
- During product development process
- During Leadership discussions
- As part of development and acquisition reviews

Where
- IT Development Organizations
- IT Acquisition Organizations
- IT Integrator Organizations

Courtesy of September 2010 SwA Panel SwA Practices – Getting to Effectiveness in Implementation

Why
- Customer pressure
- Reaction to an incident

Why Not
- Compliance drivers don't exist
- Focus is on systems and networks
- Secure software training is not given to developers and architects

How
- *Executive leadership commitment*
- Translate ROI to project manager vocabulary (cost, schedule, quality)
- Start small and build
- Use coding standards
- Empower secure development to prevent a product from moving to the next milestone
- Avoid creating a new language
- Leverage what is already known
- Increase automation of menial tasks

Key questions

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Measure, measure, and measure again

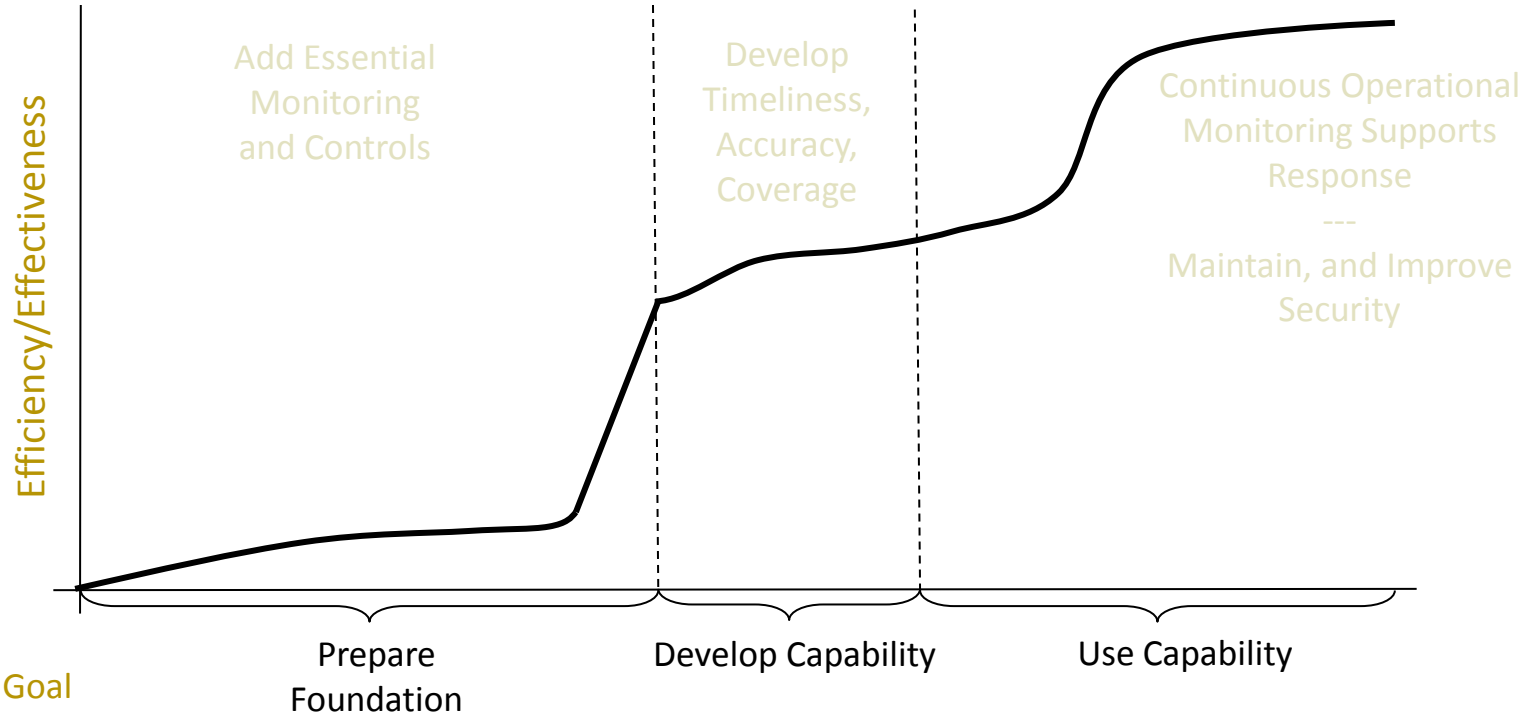
"*The only man I know who behaves sensibly is my tailor; he takes my measurements anew each time he sees me. The rest go on with their old measurements and expect me to fit them*."

- George Bernard Shaw



Source: www.CartoonStock.com

Robust measurement does not happen overnight and requires foundational capabilities in place to be effective



LINCOLN LABORATORY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Courtesy of Matt Coose, DHS

Critical success factor – long-term management commitment, focus, and appropriate expectations

Problem

- Senior management has not expressed explicit support for the program
- There is no long term funding and resource commitment
- There is a perception in the organization that measurement and monitoring are temporary and “will be done” at some point
- Security improvements are expected within a very short time period and are expected to be easily directly related to measurement and monitoring
- Program is expected to be perfectly planned and executed as if the organization has done this a million times and has the process down perfectly
- Turnover and changes in roles breaks up continuity
- Accountability for metrics is difficult to assign

Solution

- Obtain senior management commitment before you start
- Work across the organization with the stakeholders to make them a part of the solution
- Iterate the program to measure critical things
- Structure the program to begin with quick wins to continuously demonstrate increase in value
- Manage expectations continuously – explain that the long term focus is critical
- Assign roles, train your responsible parties, and communicate that continuity is key for success
- Emphasize positive reinforcement – if everyone is failing, nobody will cooperate and the program will fail

Critical success factor – realistic and well thought out data collection strategy

Problem

- Data sources not well known, well defined, and therefore not considered
- Desired data is not obtainable
- Automated data sources are dispersed throughout the organization and data is difficult to consolidate
- Authoritative data sources do not exist
- Data is collected inefficiently or incorrectly
- Collection deemed too difficult too early
- Difficulty or inability to capture historical data

Solution

- Identify all available automated and manual data sources
- Define data that you need and compare with what available
- Create data collection strategy that would balance the need for data with the current state and plan for deliberately expanding data sources and measures
- Define future changes to processes/tools or requirement for new tools early in the process and refresh as you learn more
- Use feasibility of data collection as one of the criteria for metrics selection
- Train your data collectors and information owners about what you need and then ask for it repeatedly

Critical success factor – effective use of the measures to improve security

Problem

- Metrics analysis is not prioritized according to strategic goals, risks, ROI, or other explicit criteria agreed upon by the organization
- Wrong types of measures are distributed to wrong stakeholders
- Measures are collected for compliance and are not used to improve security
- Metrics data is not used for risk-based decision making

Solution

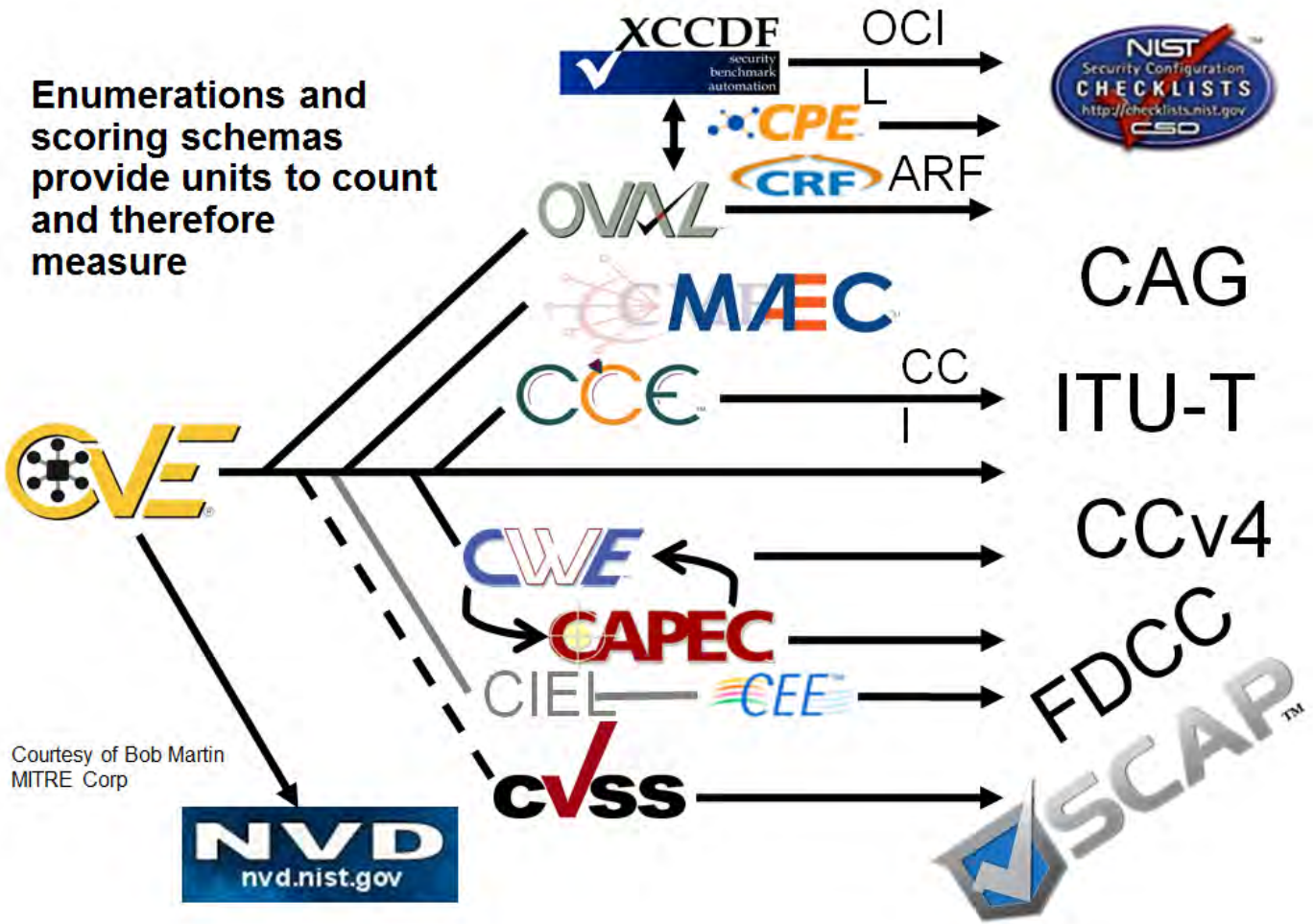
- Develop criteria for prioritizing and scoring measures early in the program and reconsider every time you expand the program
- Define who gets what data and reassess periodically – ask your customers if it is still useful
- If metrics are not used for decision making and improvement, drop them
- Communicate, communicate, communicate

Security control measures

- Percent of new systems that have completed certification and accreditation (C&A) prior to their implementation (NIST SP 800-53 Control: CA-6: Security Accreditation)
- Percent of employees who are authorized access to information systems only after they sign an acknowledgement that they have read and understood rules of behavior (NIST SP 800-53 Controls – PL-4: Rules of Behavior and AC-2: Account Management)
- Percent of the agency's information system budget devoted to information security (NIST SP 800-53 Controls – SA-2; Allocation of Resources)

Security Control Measures address compliance with the end state of the system, but not the underlying processes, structures, and code

Measurement for secure code requires understanding code level attributes …



Measurement for secure code involved understanding the effectiveness of implemented processes

- Acquisition
  - Number and percent of acquisition discussions that include SwA representative
  - Number and percent of contracting officers who received training in the security provisions of the FAR
  - Percent of documented Supplier claims verified through testing, inspection, or other methods
  - Number and percent of relevant high impact vulnerabilities (CVEs) present in the system
- Testing
  - Number and percent of tests that evaluate application response to misuse, abuse, or threats
  - Number and percent of tests that attempt to subvert execution or work around security controls
  - Percent of untested source code related to security controls and SwA requirements

How to apply…. success is ***simple***

Get Management Support

- Scope out measurement
- Obtain tangible support for security measures development and use at every management level
- Maintain support through regular reporting to stakeholders, tailored to their levels
  - Address their goals
  - Refine detail further up the management chain
  - Use Dashboards & Reports to endure

Start Small

- Expand your project/program cost, schedule, quality, and growth measures to cover security
- Start with a manageable, small set of security measures adding more measures as the project matures
- Leverage existing industry lists and select applicable measures
- Use a framework to translate measures from industry lists into your organization's approach
- Train data collectors to think in terms of metrics

Measure Behavior

- Identify and measure best and worst process and practice behaviors as well as results
- Create, display, and report measures to influence appropriate behavior
- Take advantage of unintended consequences produced by measurement
- Reuse measures where possible

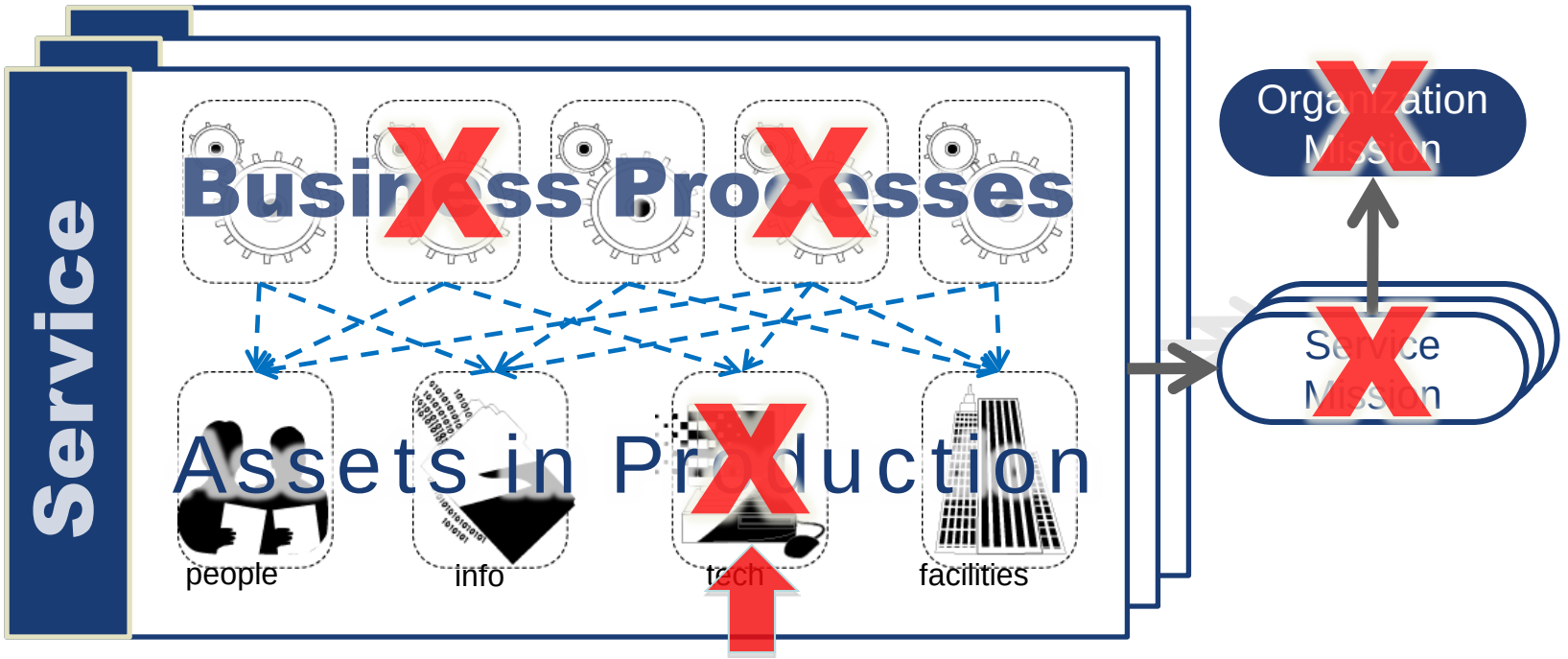
Incorporate security measures into your existing measurement activities

Source: http://www.psmsc.com/Downloads/TechnologyPapers/SwA%20Measurement%2010-08-08.pdf, accessed 4/10/09

Key questions

- Who asks developers to develop secure code?
- Do developers know why they need to develop secure code?
- What should developers do/not do to develop secure code?
- Can developers develop secure code by themselves?
- How do developers know they have developed secure code?
- Why should developers care?
- Next Steps?

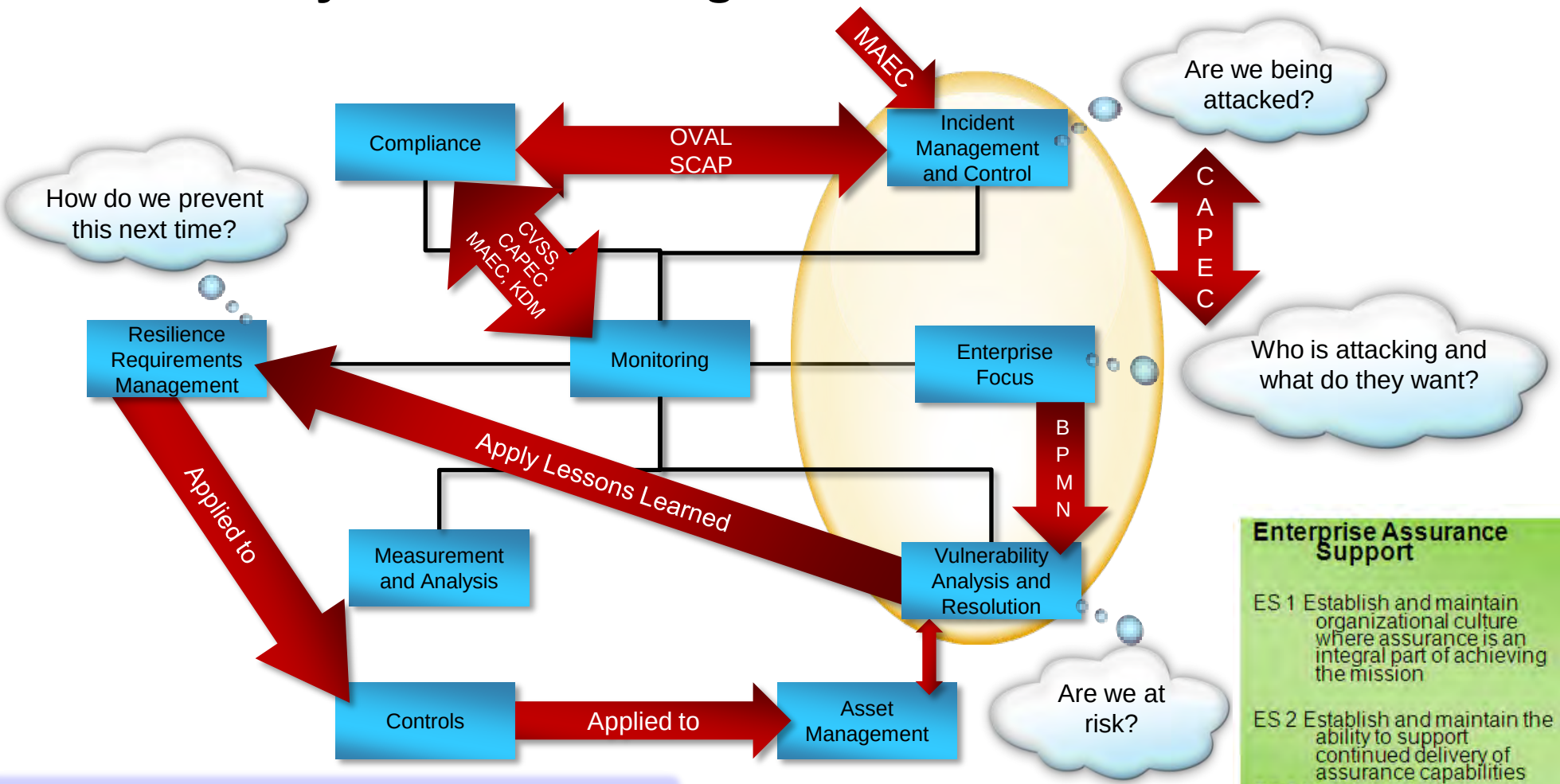
Business functions rely on accurate and reliable information from technology that functions as intended (and only as intended)

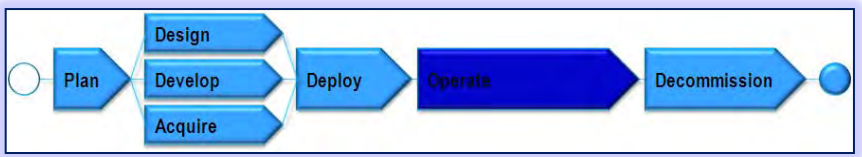


CERT | Software Engineering Institute | Carnegie Mellon.

Adapted from: November 2009 SwA Forum-Evolution in SwA Processes Panel – David White, SEI

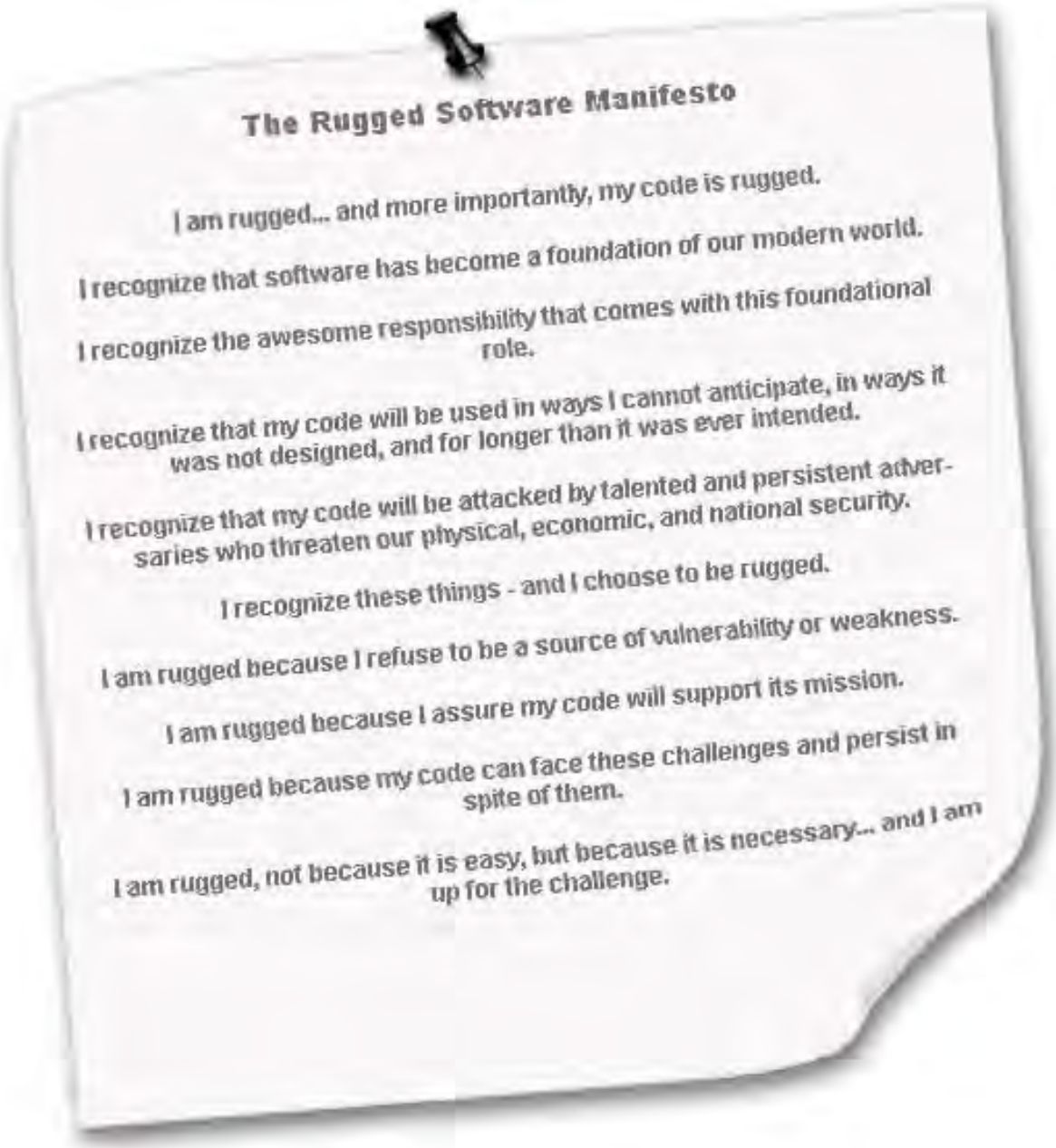
Potential impacts from threats to business functions can be understood by communicating software level vulnerabilities





Adapted from September 2010 SwA Forum, CERT RMM for Assurance , Lisa Young, SEI

http://www.ruggedsoftware.org/



The Rugged Software Manifesto

I am rugged... and more importantly, my code is rugged.

I recognize that software has become a foundation of our modern world.

I recognize the awesome responsibility that comes with this foundational role.

I recognize that my code will be used in ways I cannot anticipate, in ways it was not designed, and for longer than it was ever intended.

I recognize that my code will be attacked by talented and persistent adversaries who threaten our physical, economic, and national security.

I recognize these things - and I choose to be rugged.

I am rugged because I refuse to be a source of vulnerability or weakness.

I am rugged because I assure my code will support its mission.

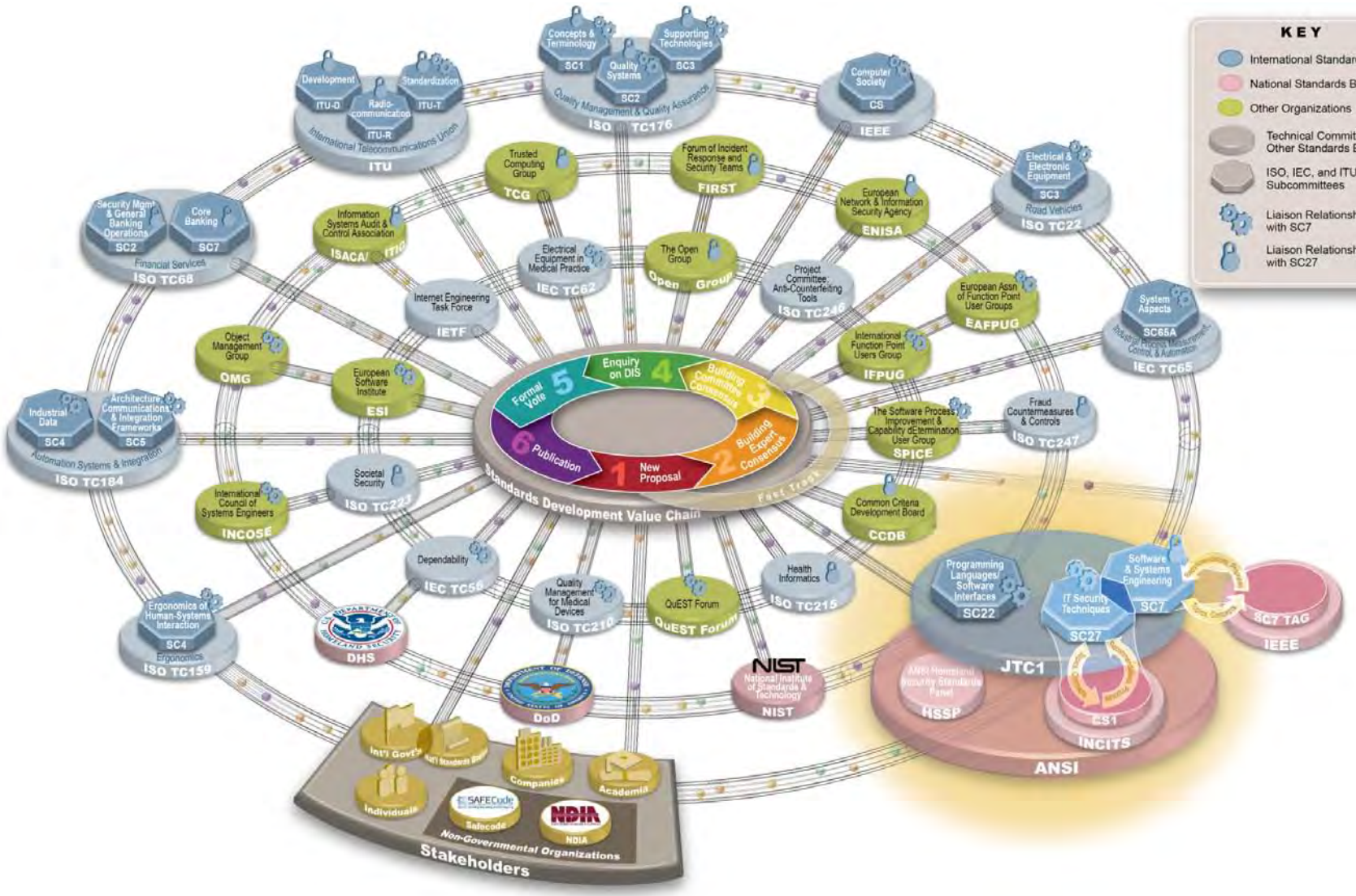
I am rugged because my code can face these challenges and persist in spite of them.

I am rugged, not because it is easy, but because it is necessary... and I am up for the challenge.

Key questions

- Who asks developers to develop secure code?
- Do developers know why they need to develop secure code?
- What should developers do/not do to develop secure code?
- Can developers develop secure code by themselves?
- How do developers know they have developed secure code?
- Why should developers care?
- Next steps?

Cyber security and software assurance standard development organization landscape



SC22 – Programming Languages, ISO/IEC TR 24772, Programming Language Vulnerabilities

- Targets building software that is inherently less vulnerable through improving the programming languages, or, at least, improve the usage of them in coding
- A catalog of 60+ issues that arise in coding when using any language and how those issues may lead to security and safety vulnerabilities
- Cross-referenced to CWE
- Each discussion includes
  - Description of the mechanism of failure
  - Recommendations for programmers: How to avoid or mitigate the problem.
  - Recommendations for standardizers: How to improve programming language specifications.

Courtesy of Jim Moore, MITRE

ISO/IEC 27036: Information technology – Security techniques – Information Security for Supplier Relationships

- Scope: This international standard covers information security in relationships between acquirers and suppliers to provide appropriate information security management for all parties. In particular, it also includes management of information security risks related to these relationships.

- The standard will be subdivided into the following parts:
  - Part 1 – Overview and Concepts
  - Part 2 – Common Requirements
  - Part 3 – Guidelines for ICT Supply Chain
  - Part 4 – Guidelines for Outsourcing

NIST IR 7622, Piloting Supply Chain Risk Management for Federal Information Systems

- Initially based on DoD ICT SCRM Key Practices document and developed in close collaboration with the industry
- Introduces the notion of supply chain players
  - Acquirer - For this document, the acquirer is always a government agency (including those agencies taking on the role of integrator).
  - Integrator – A third-party organization that specializes in combining products/elements of several suppliers to produce elements (information systems).
  - Supplier – Third-party organization providing individual elements. *Synonymous with vendor and manufacturer; also applies to maintenance/disposal service providers*
- Lays out pre-requisites of being able to address ICT SCRM challenge
- States specific practices that are consistent with DoD guidance and ISO frameworks

SAFECode (www.safecode.org)

- SAFECode is a global, industry-led effort to identify and promote best practices for developing and delivering more secure and reliable software, hardware and services

- White papers
  - Software Assurance: An Overview of Current Industry Best Practices
  - Fundamental Practices for Secure Software Development
  - Security Engineering Training: A Framework for Corporate Training Programs on the Principles of Secure Software Development
  - Framework for Software Supply Chain Integrity
  - Software Integrity Controls: An Assurance-Based Approach to Minimizing Risks in the Software Supply Chain



The Open Group
Trusted Technology Provider Framework (TTPF)

Purpose

Identify and gain consensus on common processes, techniques, methods, product and system testing procedures, and language to describe and guide product development and supply chain management practices that can mitigate vulnerabilities which could lead to exploitation and malicious threats to product integrity.

Objectives

- Identify product assurance practices that should be expected from all commercial technology vendors based on the baseline best practices of leading trusted commercial technology suppliers
- Help establish expectations for global government and commercial customers when seeking to identify a trusted technology supplier
- Leverage existing globally recognized information assurance practices and standards
- Share with commercial technology consumers secure manufacturing and trustworthy technology supplier best practices
- Harmonize language used to describe best practices

Source: Source: September 28, 2010 SwA Forum, DoD Trusted Defense Systems, Ms. Kristen Baldwin, DDR&E/Systems Engineering

What's next?

- Continued collaboration to:
  - Reach and enable developers
  - Reach and enable executives
  - Develop and promote resources for us by developers and executives
- Participation in international standardization efforts
  - SC7 TAG intersections through your SC7 TAG
  - CS1/SC27
  - IEEE representative to the SC7 TAG
  - SC22
- Participation through the SwA Working Groups and Forum
- Stay Tuned …

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Utilizing Lean Six Sigma to Attain CMMI® Maturities

Steven Moffat, Science Applications International Corporation (SAIC)
Ahn Nuzen, SPAWAR System Center Pacific, U.S. Navy
November 15, 2011

SPAWAR® Systems Center PACIFIC

ENERGY & ENVIRONMENT • NATIONAL SECURITY • HEALTH • CYBERSECURITY

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Agenda



- Presentation goal
- Background about SPAWAR PACIFIC
- Current situation
- Improvement focus
- Challenges
- Approach
- Questions



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SPAWAR is the Navy expert in delivery and sustainment of C4ISR systems

SPAWAR = Space and Naval Warfare Systems Center C4ISR = command, control, communications, computers, intelligence, surveillance, and reconnaissance

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Presentation Goal



- How the organization utilized Lean and Six Sigma® process improvement techniques to affect implementation of CMMI® practices
  - Occurs during simultaneous organizational realignment
  - Involves consolidation of five major service-oriented projects
  - Focused on early improvements for the individuals working on the projects (In the trenches)
  - Assisted with institutionalizing selected targeted practices utilizing some Level III practices

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Space and Naval Warfare Systems Center Pacific – SSC PAC



- DOD U.S. NAVY Organization
  - More than 4,000 scientists and engineers
  - Located in San Diego and throughout the globe
- INDUSTRY PATTERNS DOD U.S. NAVY Organization
  - More than 4,000 scientists and engineers
  - Located in San Diego and throughout the globe



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Mission – Information Dominance



- Design, build, and sustain C4ISR information dominance systems





(Radar, networks, command and control, crypto devices, satellite communications, submarines electronic systems, etc.)

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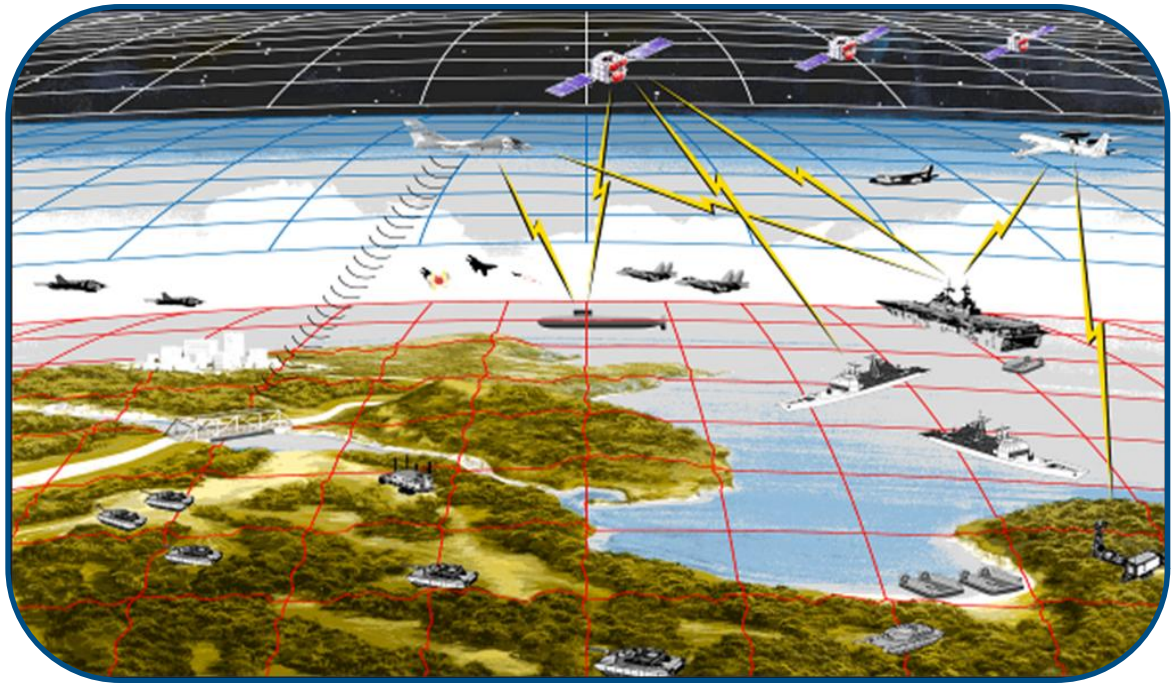
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Systems Engineering for Mission Success



- Reliability
- Availability
- Maintainability



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SPAWAR Systems Center Pacific CMMI Timeline



1988

- Implemented Software (SW) Capability Maturity Model® CMM ® predecessor of CMMI® model.
- Systems Engineering Process Office (SEPO)

2000

- Attained SW-CMM Level 3 in October 2000.
- SSC PAC transited from SW-CMM to CMMI- DEV model and continues with its process improvement road.

2009

- Implementing CMMI-SVC ML2 model 1.2 for Services projects
- Achieve CMMI-DEV ML3 on 2012

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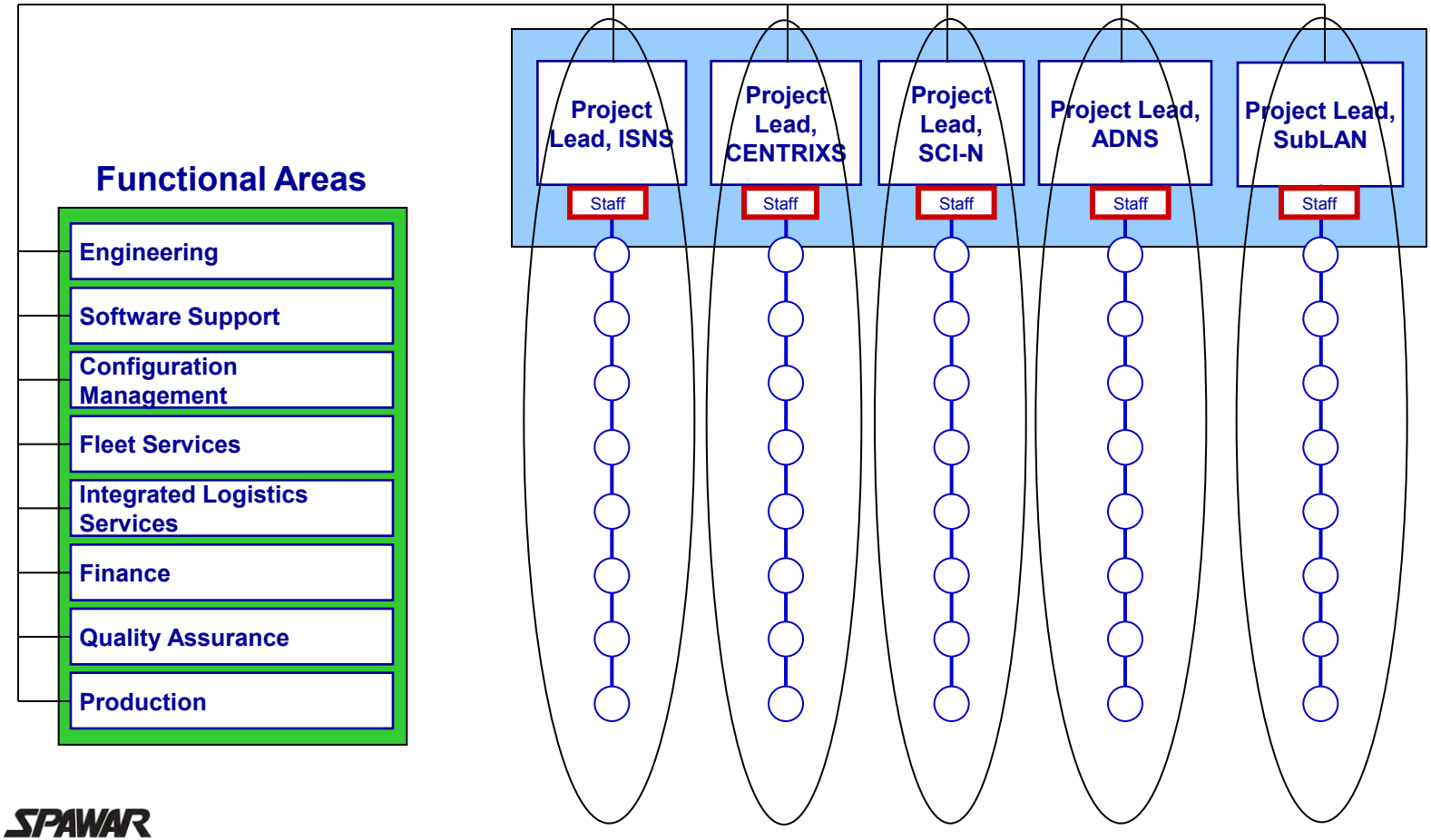
Capability Maturity Model, CMM, and CMMI are registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

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Previous Organizational Structure





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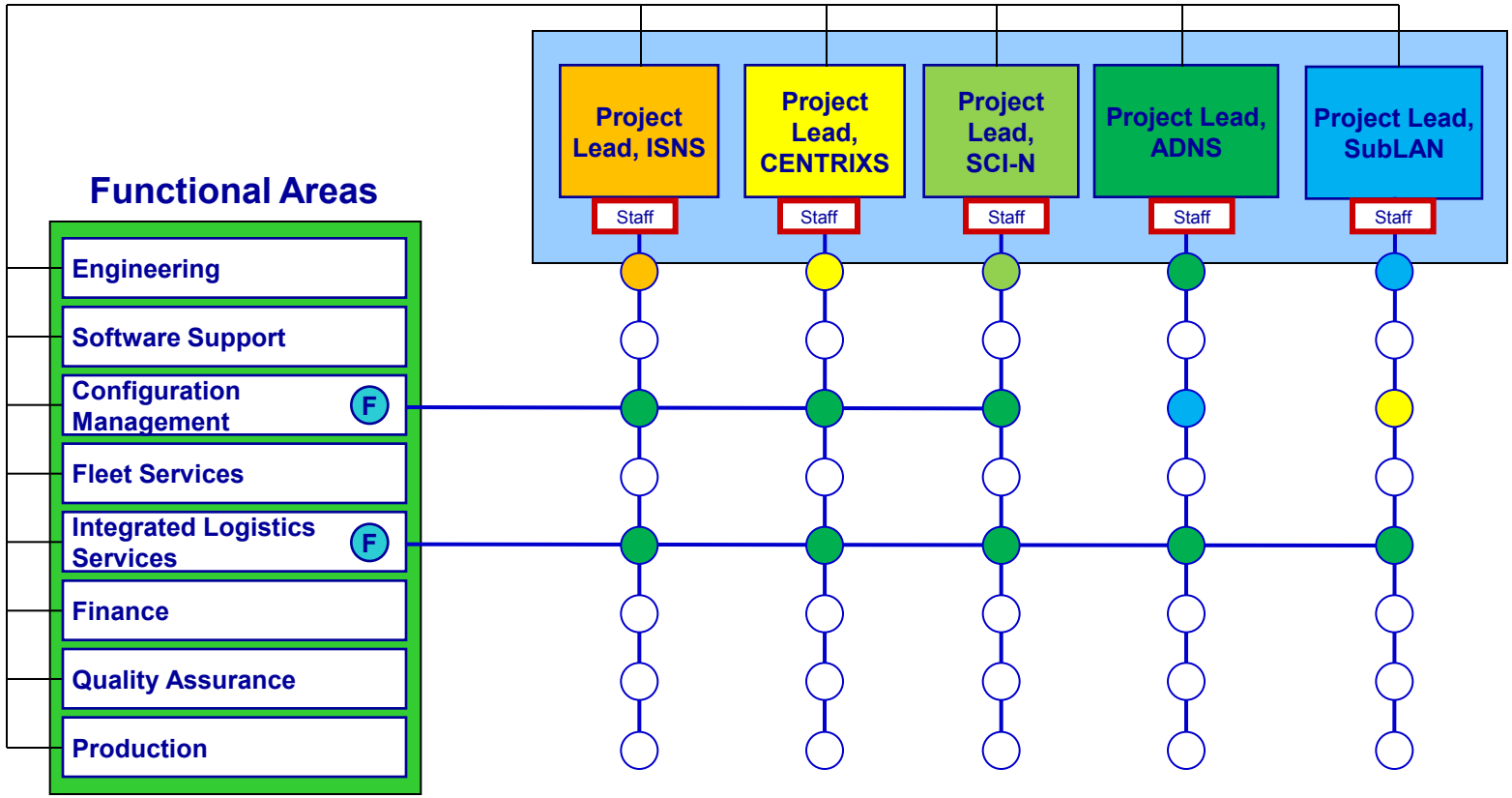
ISNS = Integrated Shipboard Network Systems CENTRIXS = Combined Enterprise Regional Exchange System SCI-N = Sensitive Compartmented Information Networks ADNS = Automated Digital Network System SubLAN = Submarine Local Area Network

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Different Levels of Existing Consolidation





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Major Challenges



- Standard organizational change resistance
- Limited budget to accomplish improvements and certification
- Individual participant perception that they were being asked to do more with limited or no additional funding
  - Consolidating existing processes
  - Addressing gaps in CMMI® practices that weren't currently being accomplished
  - Perception that improvement benefits weren't going to be easily or quickly realized
- Revolving individual roles and responsibilities

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Approach



- Defined the “organization” as part of this initial effort as the five projects while monitoring/participating in the wider organization (SSC PAC) CMMI® efforts
- Develop and utilize draft Organizational Process Focus (OPF), Organizational Process Definition (OPD) and Integrated Project Management (IPM) practices from the very beginning to support aligning five projects. Pursued a continuous versus a staged approach for the five projects.
- Simultaneous improvement emphasis on the project planning and project monitoring and control processes so that all practitioners (project managers and functional leads) are performing in a similar, integrated fashion

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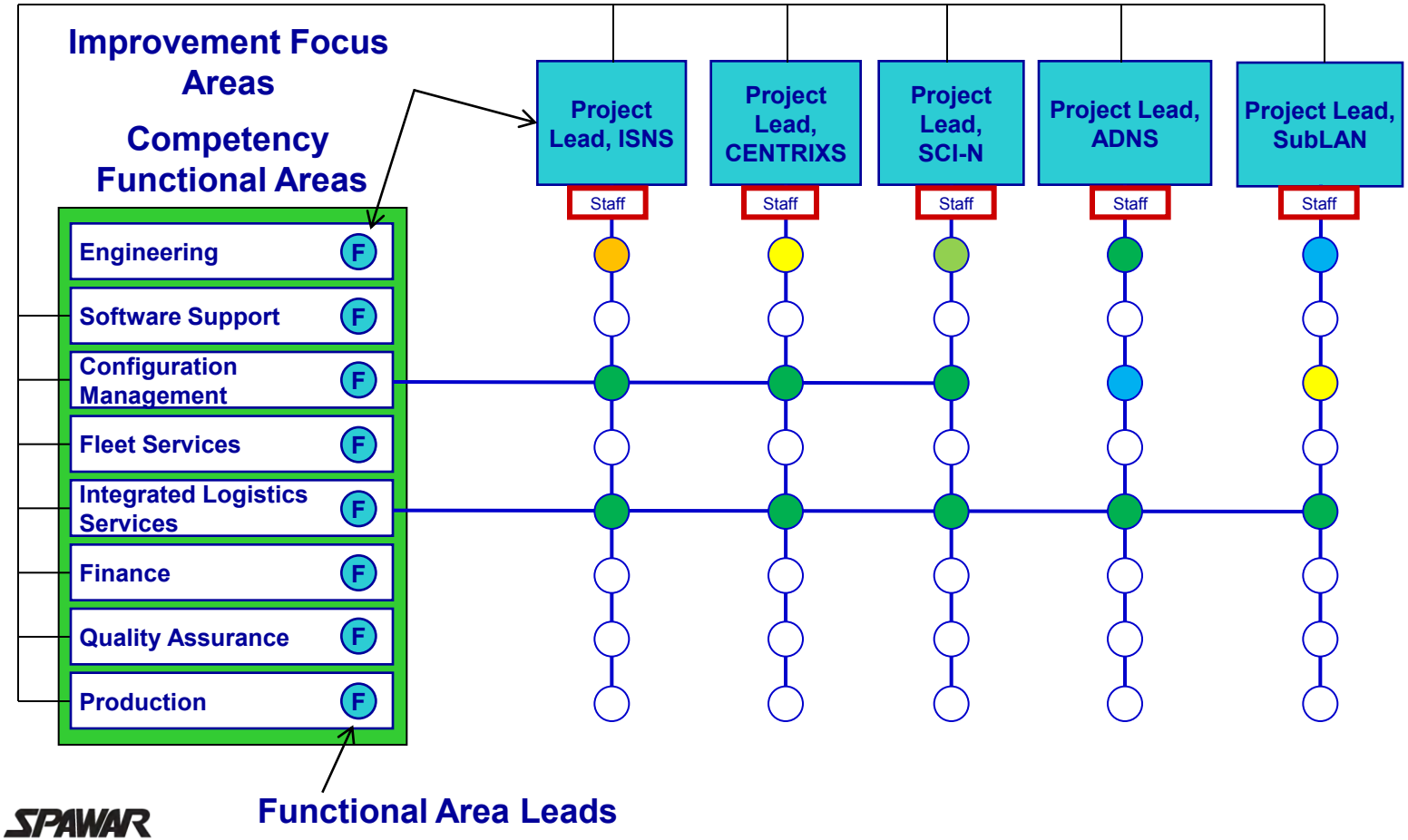
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Improvement Focus





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Improvement Focus on Effort for a Particular Process Area





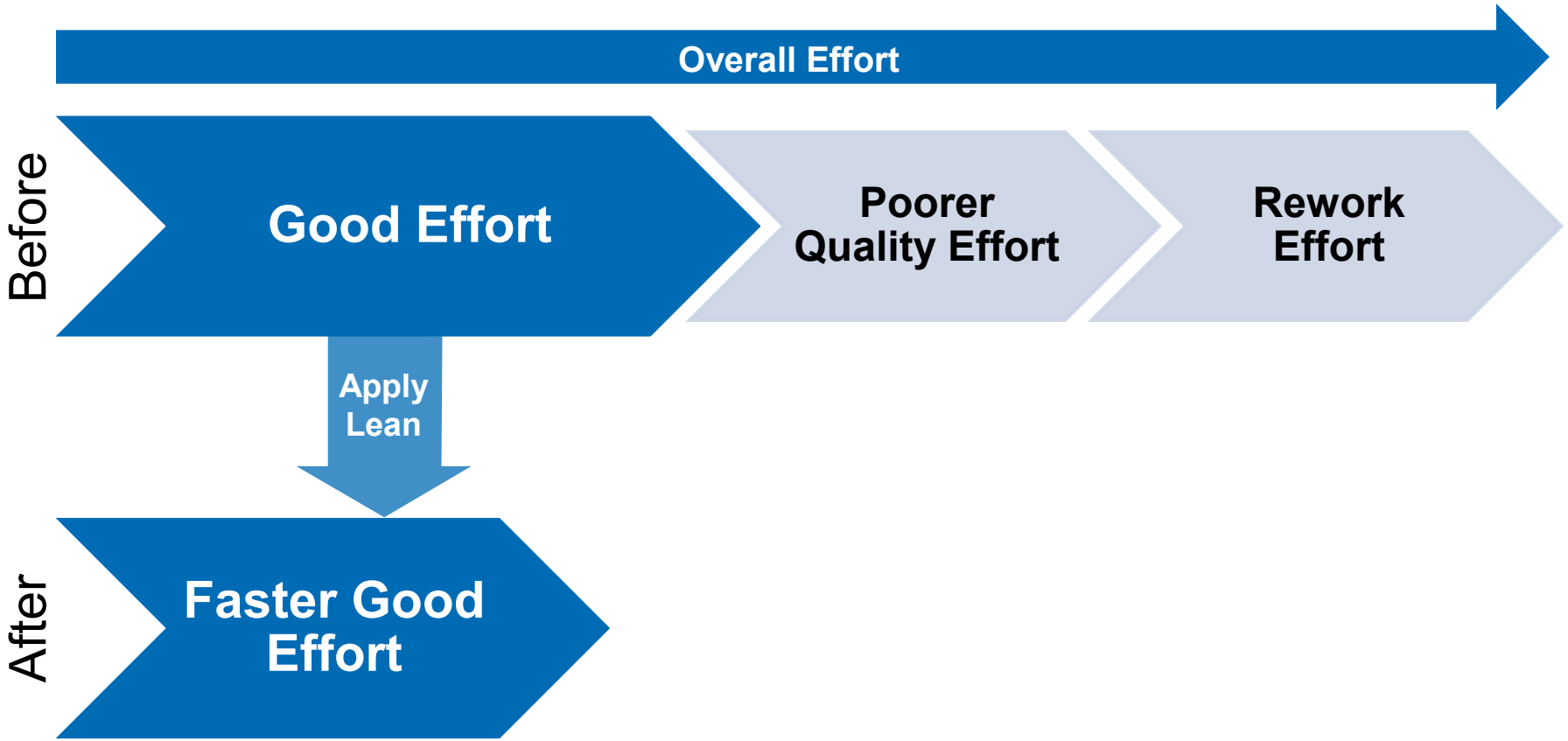
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Improvement Focus on Effort for a Particular Process Area





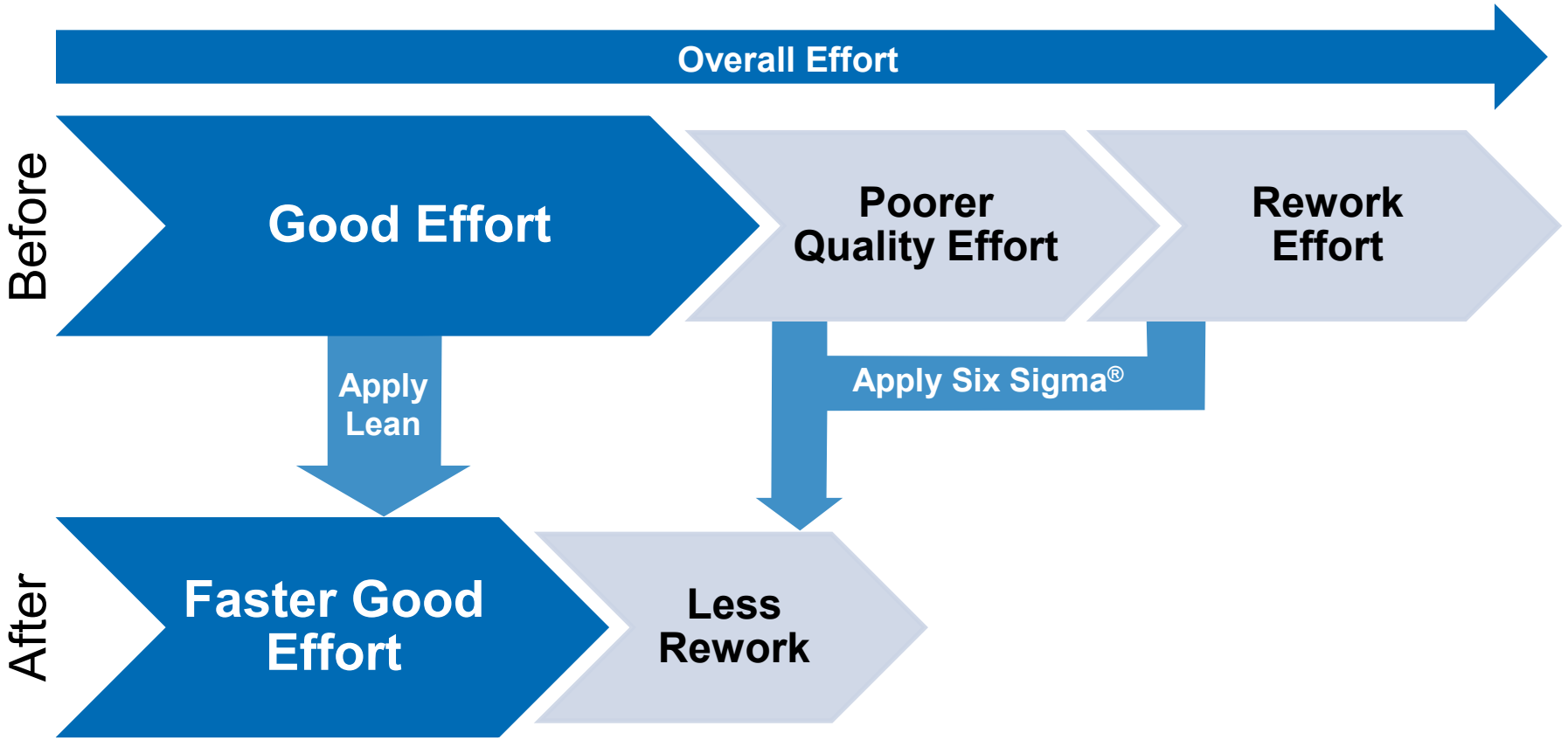
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Improvement Focus on Effort for a Particular Process Area





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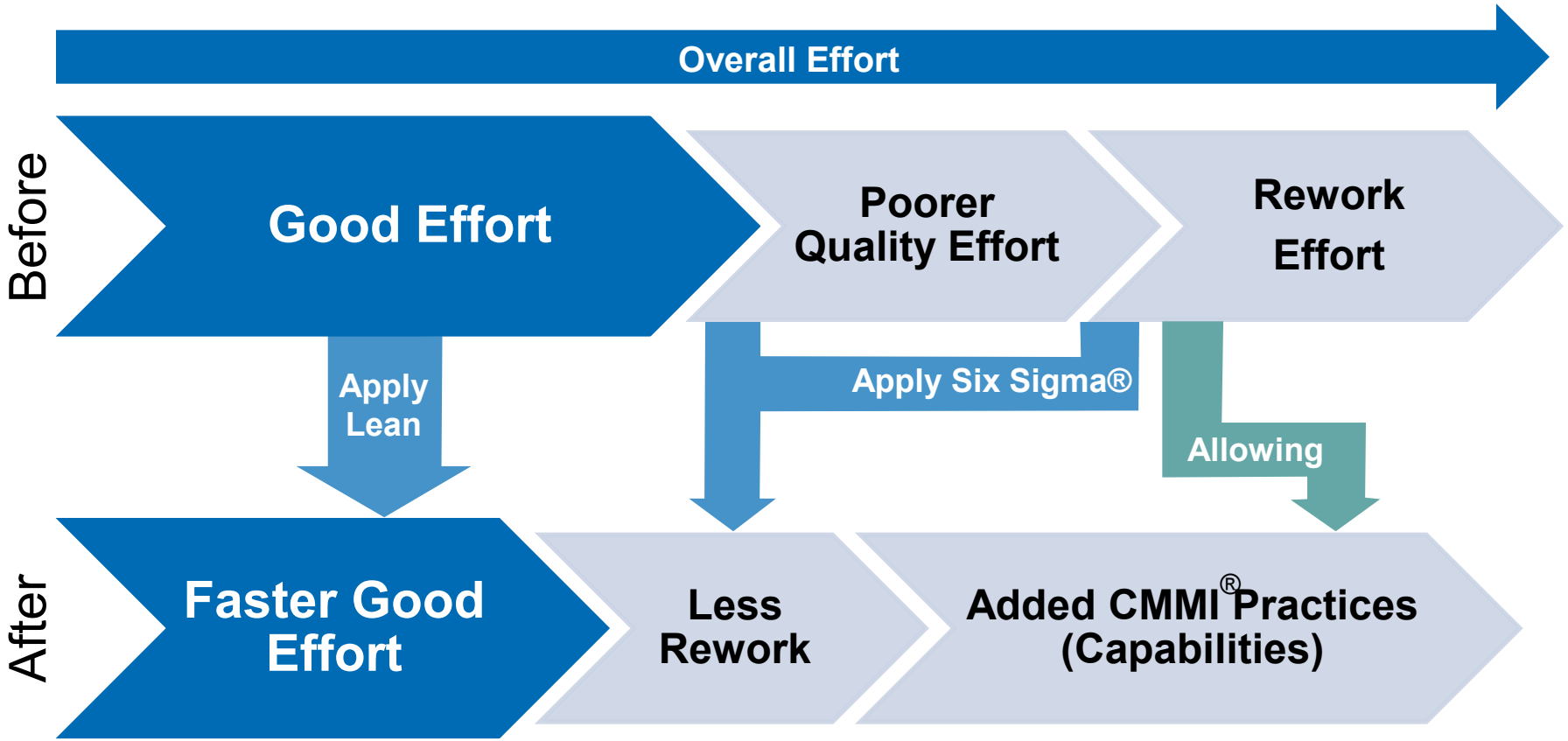
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Improvement Focus on Effort for a Particular Process Area





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Summary Approach



- Apply Lean Six Sigma® (LSS) improvement efforts to establish and/or improve the “How” of the focused project processes, making sure that you incorporate the gaps between the existing processes and the CMMI® best practices
- Simultaneously
  - Apply Lean efforts to remove waste in current, focused project processes
  - Apply Six Sigma efforts to improve the quality and reduce the rework of current focused processes
  - Ensure that the improvement phase incorporates the gaps and adapts CMMI practices to the business environment, thus improving the focused processes

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Additional Approach Considerations



- Get <u>really close</u> to the way the various personnel (practitioners) operate to apply the improvements and improve
  - To adopt practices practitioners need to be able to accomplish their work faster and with better quality and less rework
- Rather than adopt new technology (tools), we focused on improvements in the use of existing technology
  - This puts more focus on training and education as opposed to increased cost of acquiring new tools, adopting to existing processes, and conducting training
  - Practitioners are more comfortable with using existing tool sets but in improved ways as opposed to adopting newer, unfamiliar tool sets
- Design the new way (improvement) to doing business, ensuring that it incorporates the “What” of CMMI® practices for the particular process area

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Results



- Accomplished Level II certification on time for all five projects
- Continued to apply the improvement technique to mature the projects toward Level III selected process areas in a continuous approach

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Questions?



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Diagnosis PIF: Avoiding Process Improvement Fatigue

Presented by Craig Hale

Esterline Control Systems - AVISTA

November 2011

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“Ugh, not another process change!
Didn’t we just have one last month?”

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Diagnosis: PIF



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Treatment



Team Engagement



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Communicate, Really Communicate

WIIFM

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Gain Buy-In



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Work Together



Limit Impact

2

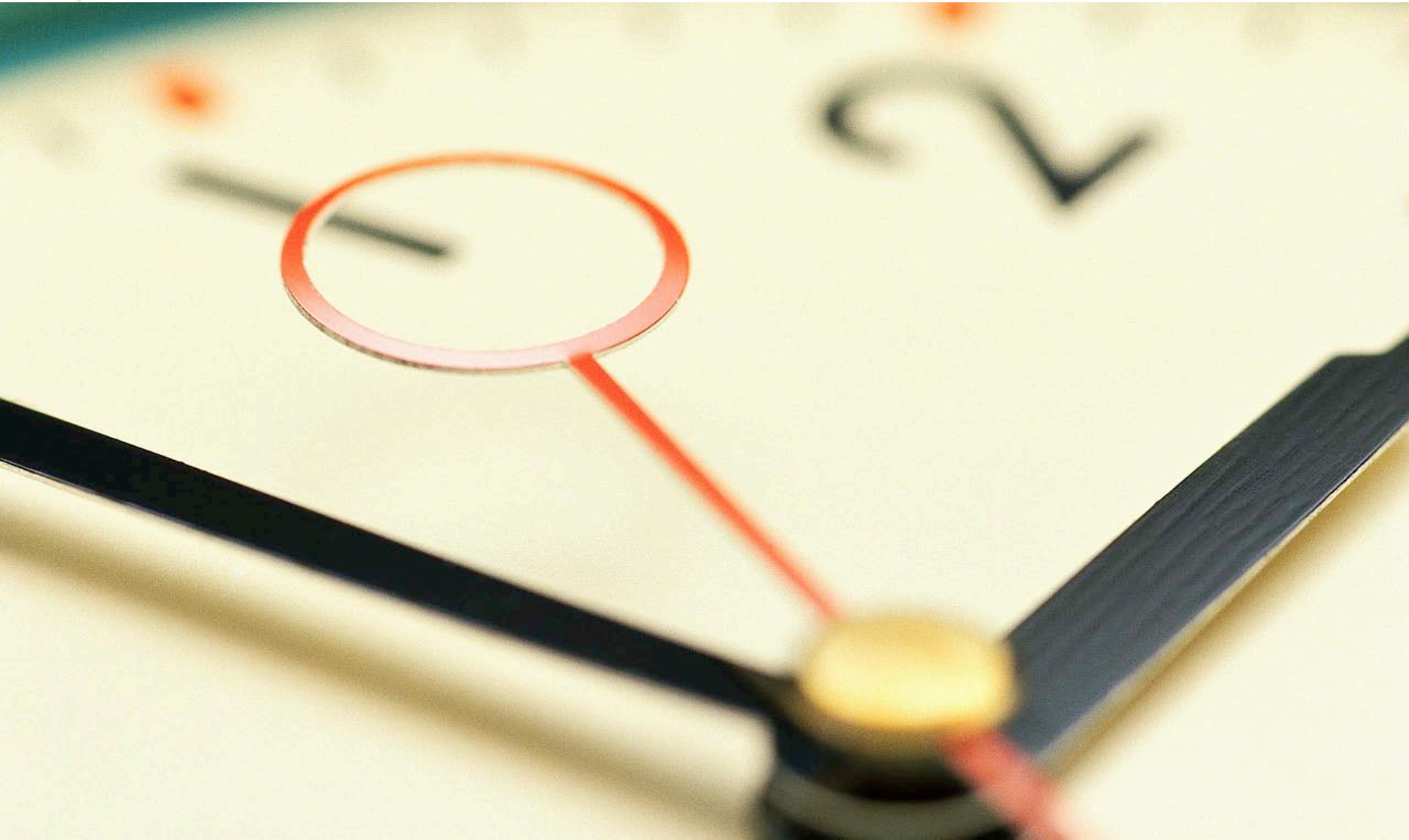
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Train



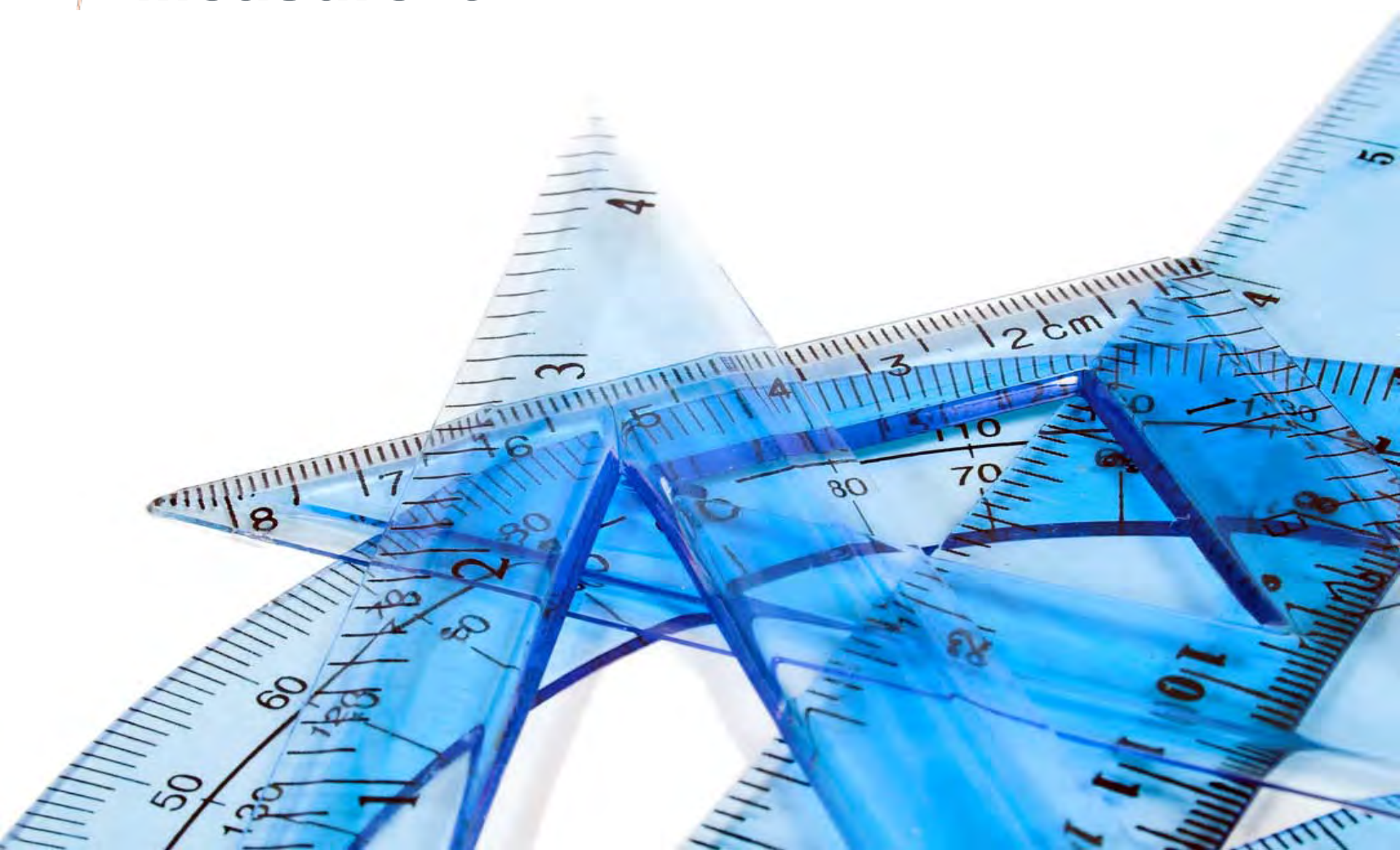
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Time it Right



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Measure It



Manage Change

3

Why Are We Doing This?

WIIFM

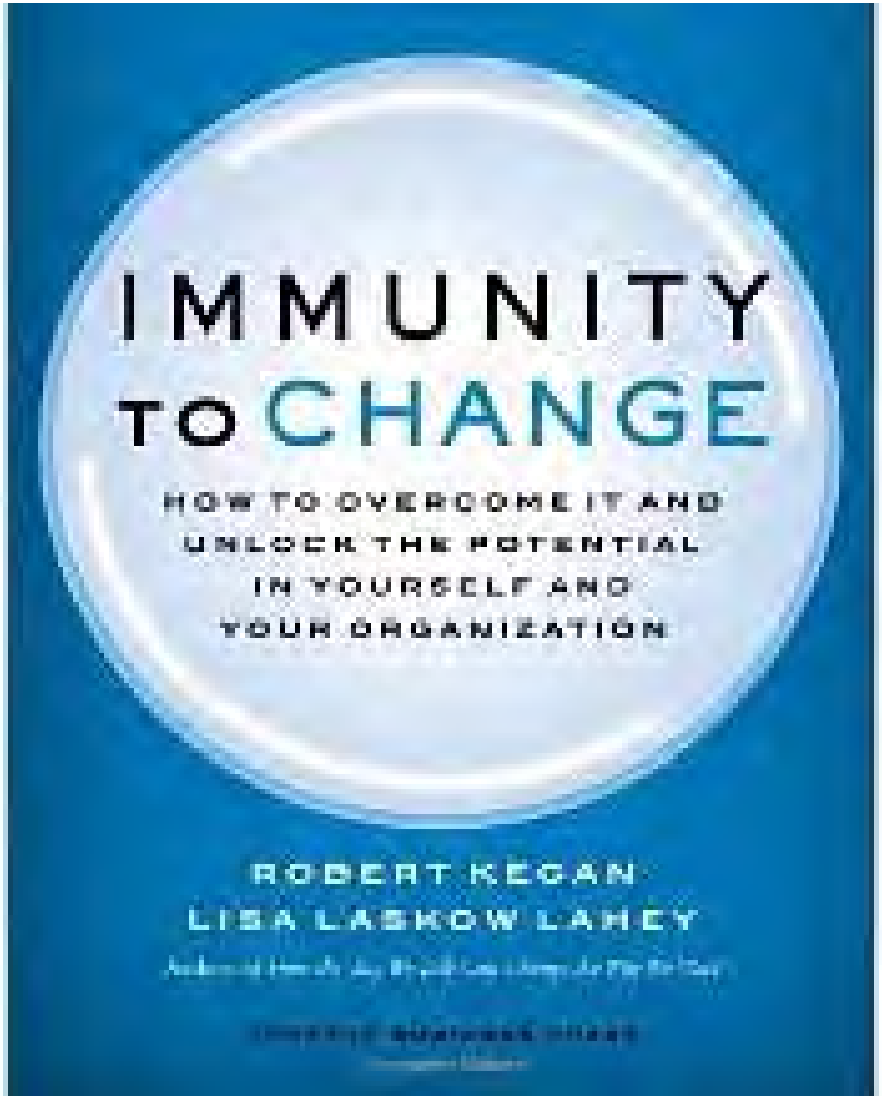
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The People Factor



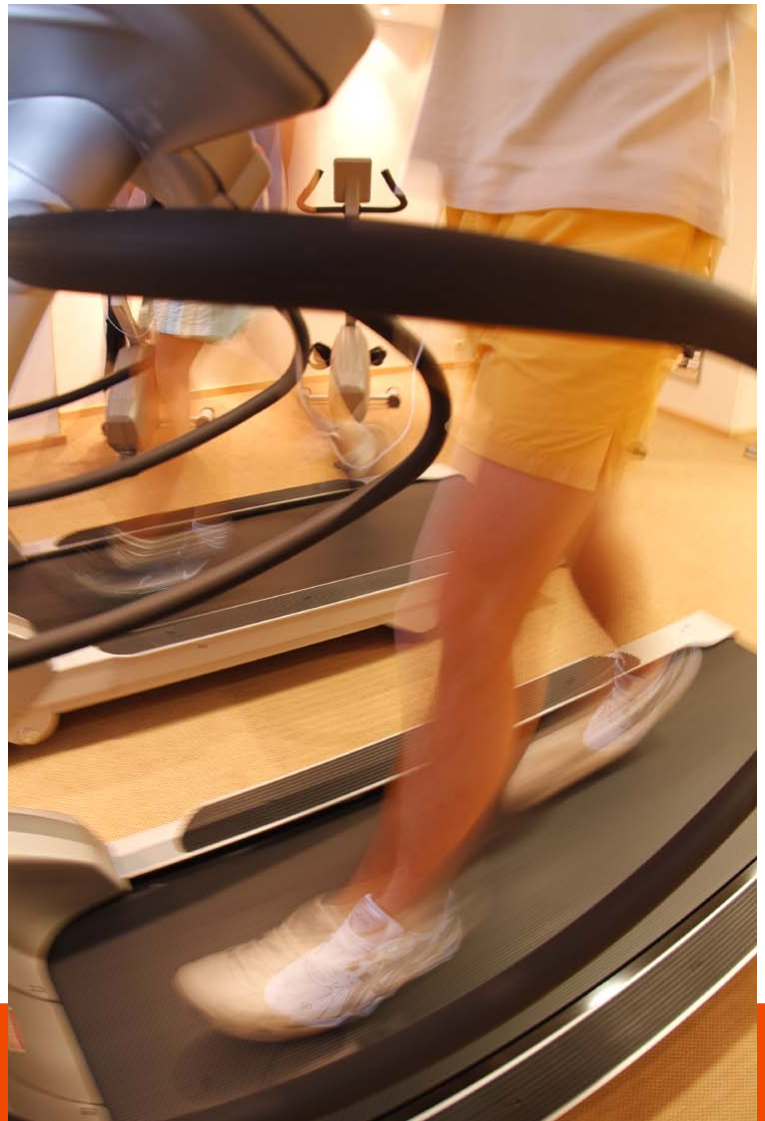
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Competing Commitments



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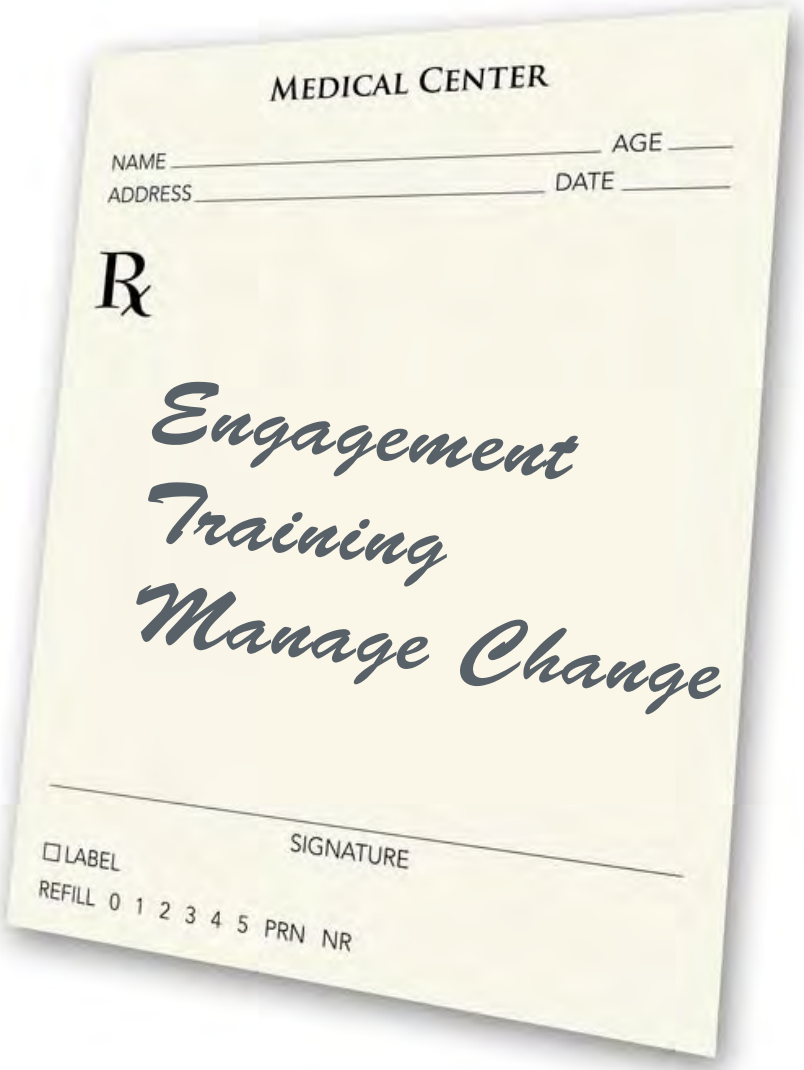
Chronic Improvement



Use a Schedule



Prescription for PIF



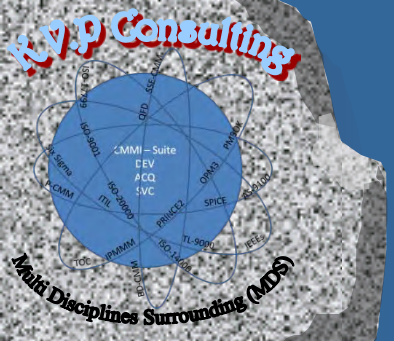
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If All Else Fails

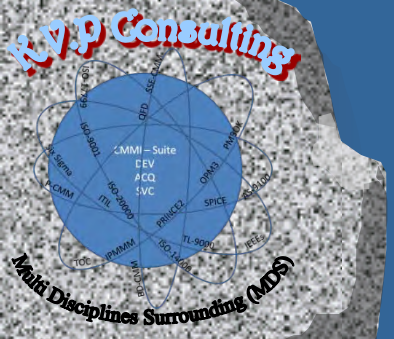


Questions?

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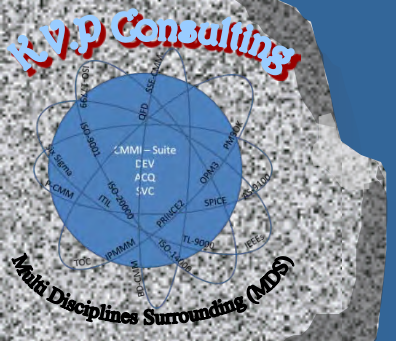


Design Your Business Processes to Embrace People in an Agile Approach and Support High Maturity (OPM)



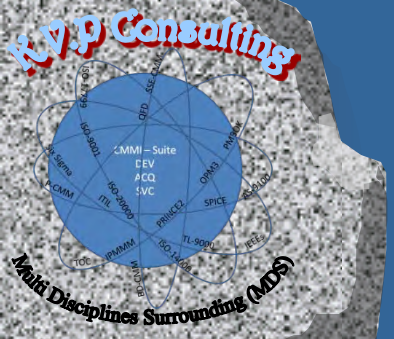
Definitions

- Agile - Agile methods emphasize face-to-face communication over written documents when the team is all in the same location
- OPM - The purpose of Organizational Performance Management (OPM) is to proactively manage the organization’s performance to meet its business objectives



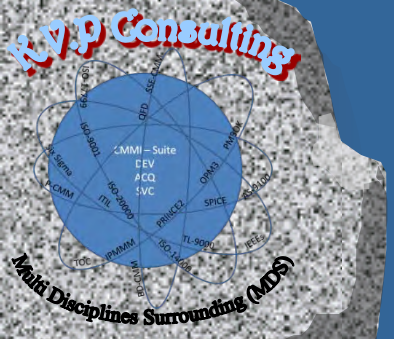
Specific Goal and Practice Summary

- SG 1 Manage Business Performance
  - SP 1.1 Maintain Business Objectives
  - SP 1.2 Analyze Process Performance Data
  - SP 1.3 Identify Potential Areas for Improvement
- SG 2 Select Improvements
  - SP 2.1 Elicit Suggested Improvements
  - SP 2.2 Analyze Suggested Improvements
  - SP 2.3 Validate Improvements
  - SP 2.4 Select and Implement Improvements for Deployment
- SG 3 Deploy Improvements
  - SP 3.1 Plan the Deployment
  - SP 3.2 Manage the Deployment
  - SP 3.3 Evaluate Improvement Effects



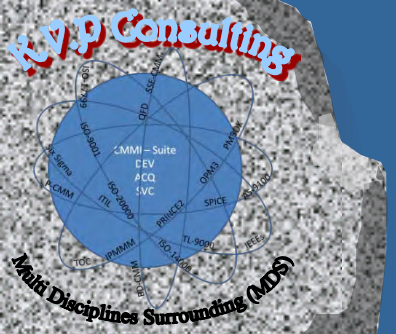
Definitions

- High Maturity - focuses on continually improving process performance through incremental and innovative process and technological improvements. The organization's quality and process performance objectives are established, continually revised to reflect changing business objectives and organizational performance, and used as criteria in managing process improvement. The effects of deployed process improvements are measured using statistical and other quantitative techniques and compared to quality and process performance objectives



The Solution We Chose

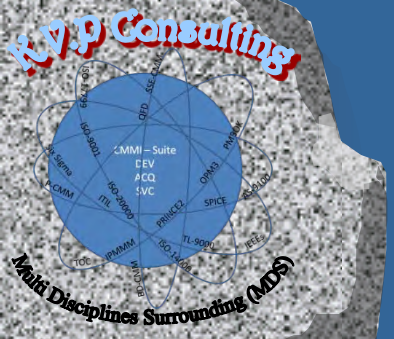
Strategic Policy Deployment (SPD)



Strategic Policy Deployment

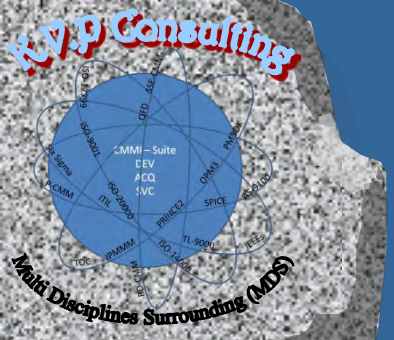
- Combination of:
  - Clear & Aligned Priorities
  - Behavior Changes
  - Change in Thinking (PDCA)
  - Elimination of Waste

…to achieve Business Results



Strategic Policy Deployment

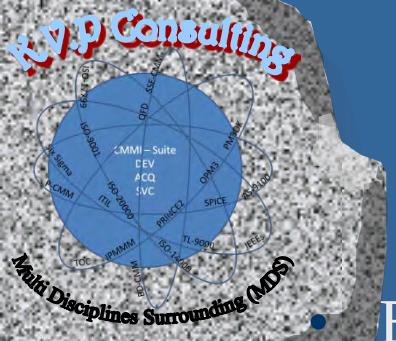
- A process to *focus* upon Goals, that cut across the corporation
- *Aligns & links* resources & action in pursuit of those Goals.
- Enables progress towards the Goals to be *measured*
- Enables rapid *root cause corrective action* if results vary from goals
- Drives *process* improvement
- Individuals & teams get clarity on their impact upon the Goals
- It becomes the yearly implementation of our long term strategic planning process.



Policy Deployment as a Tool

Policy Deployment is an effective tool to use for answering the following questions:

- How do we identify our critical goals?
- How do we develop plans and align our activities?
- How do we communicate our goals and activities level by level?
- How do we align the abundant talent of our team members on the critical few?
- How do we sustain our activities?
- How do we quickly change course when required?
- How do we learn from our experience?



Magnitude of Change

- Behavior Change
  - Discipline
  - Emphasis on ***how*** the organization will deliver the priorities
  - Catchball to understand the priorities and the means to deliver them
  - Gemba – look for evidence the plan is proceeding and in control
- Clear and Aligned Priorities
  - Start with top management priorities and link/translate at every level
  - Critical few metrics match Excel commitments
  - Must deselect

Achieving Enterprise-wide Alignment

Develop

Deploy

Execute

Catchball

Annual Strategy Review

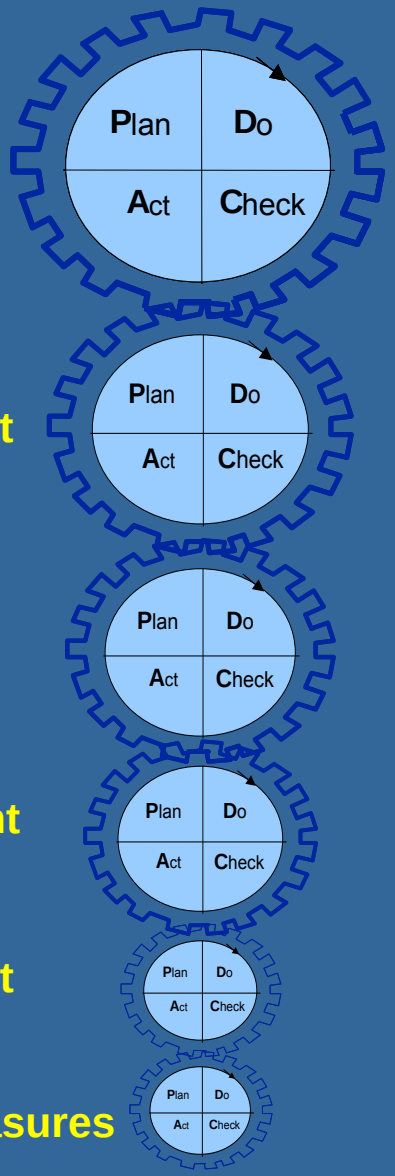
Annual Commitment Plan

Policy Deployment Plan

Improvement Tracking

Management by Fact

Countermeasures



- Clear vision and focus ("what" and "how")
- 3-Year business objectives
- Measures of success

- Quantified business objectives
- Integrated cross-organizational performance plans and funding (Corporate, Group, BU, SPG, Shared Services, Departments)

- Specific strategic initiatives to achieve business objectives
- Clear responsibility, accountability and measurable outcomes

- Performance reviewed frequently with focus on gap closure.

- Root causes of performance gaps understood
- Empowered employees taking action through Kaizen methodology

Ensure Alignment:

Management EXCEL goals

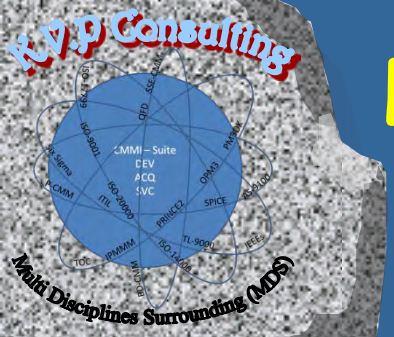
Performance Commitment Plans (PCP's)

Employee Development Plans (EDP's)

Performance Appraisals

Rewards

Highway



Your Destination
(Vision)

Keep improvement efforts focussed on the 'road' not out here !

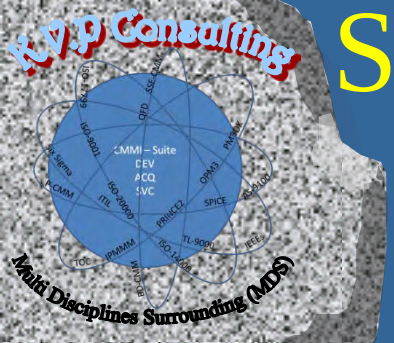
Use continuous improvement to remove the small obstacles on an ongoing basis

The 'road' is typically strewn with obstacles (boulders) some are large, some are small

Use policy deployment to remove the big boulders one at a time

Your Start Point
(Present situation)

Strategic Policy Deployment Process



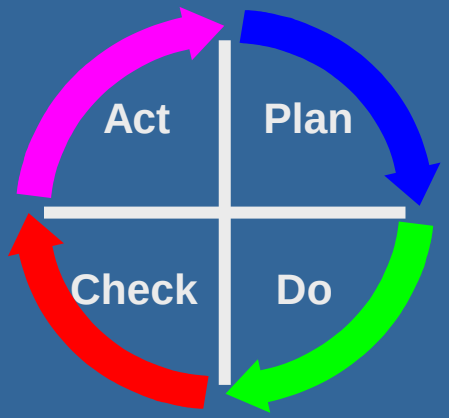
Step 1
Choose the Focus

Step 2
Align the Organization

Step 3
Implement the Plan

Step 4
Review and Improve

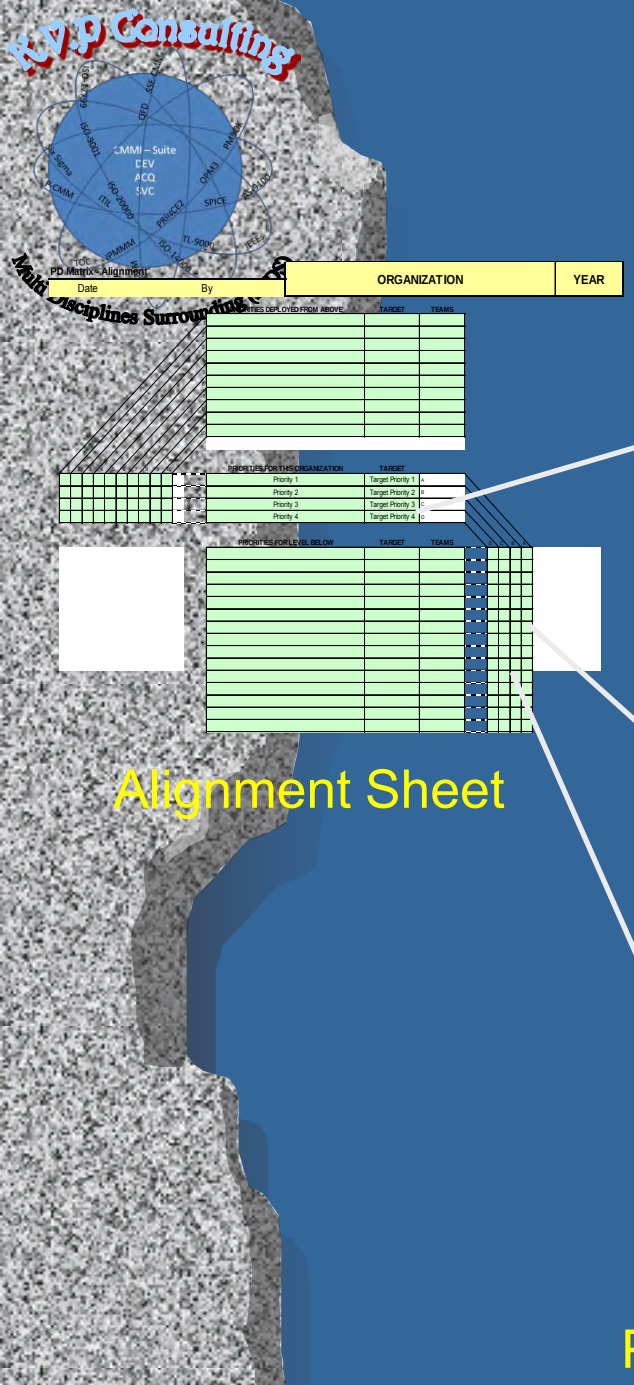
Strategic Focus



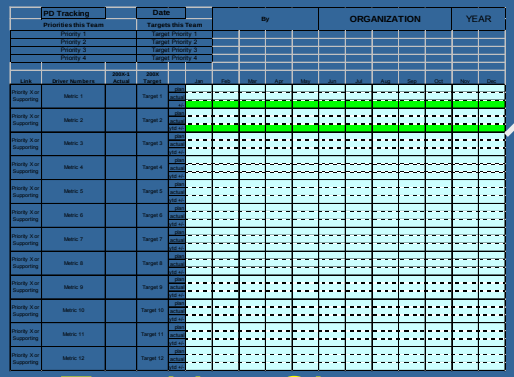
Operational Focus

frequently

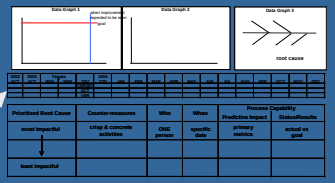
The Forms Link…

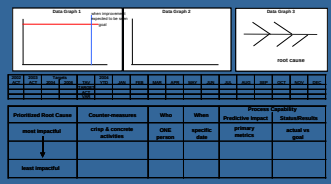


Alignment Sheet

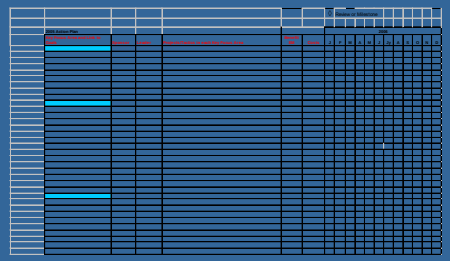


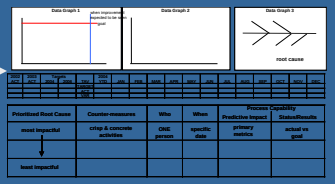
Tracking Sheet

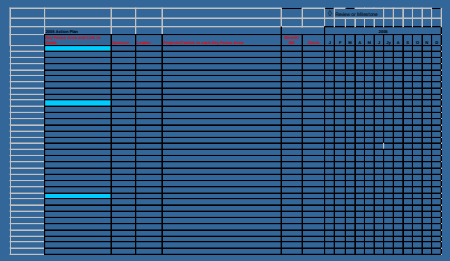




MBF for red items









MBF, Newspaper, or problem strip for red items

Program Plan (multiple)

Catchball

- Process to build consensus through dialog about the goals and how to achieve them.
- Two way communication that arrives at a collective wisdom on the priorities and the plans to deliver the results.
- Leader needs to have a vision of what is needed and how it may be achieved.
  - Team will provide input on the specific how.
  - The leader will confirm the plan:
    - Push the team to stretch further if the plan comes short of what he had in mind.
    - Question and develop understanding of the plan if the plan exceeds what he had in mind.



Targets

All priorities require a target so they can be measured.

Targets have to be achievable, challenging, based on reliable data, and SMART.



S - specific

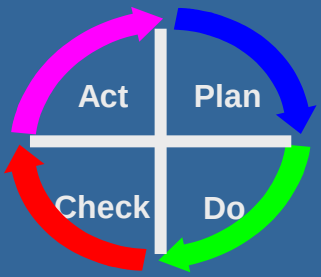
M - measurable

A - agreed

R - realistic

T - timed

The DO Phase

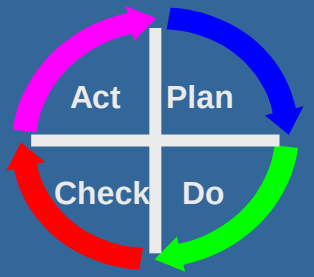


- Stay ***focused*** on the ***plan***.
- Make ***execution*** of the plan as visual as possible.
- ***Review*** the plan on a regular basis.
  - Look at metrics daily/weekly
  - Formal reviews monthly
    - results vs. expected, as well as the ***countermeasure*** to fill the gap
- Ask ***why*** if the team is doing things that are not in the plan.
- Question frequently by ***going to see***.
  - Schedule the time to look for evidence that the plan is proceeding and in control.

The CHECK Phase

Holding reviews maintains the discipline of the process:

- Confirm progress of current activities to expectations.
- Confirm the results to target. Look for trends.
- Evaluate the plan and results.
- Be visual.
- Hold timely, regular reviews daily/weekly/monthly, dependent on level.
  - Look at metrics daily/weekly
  - Hold formal reviews monthly
    - results vs. expected, countermeasures to close any gaps
- Reviews should be disciplined and structured.



A mini PDCA cycle takes place everyday as activities are checked constantly.



The CHECK Phase

- Counter measures are data driven looking at root cause.
- Check if previously identified counter measures are working and on track.
- Don’t react to noise.
- Escalate issues that can not be resolved to the next level.

The CHECK Meeting

The manager runs the review meeting.



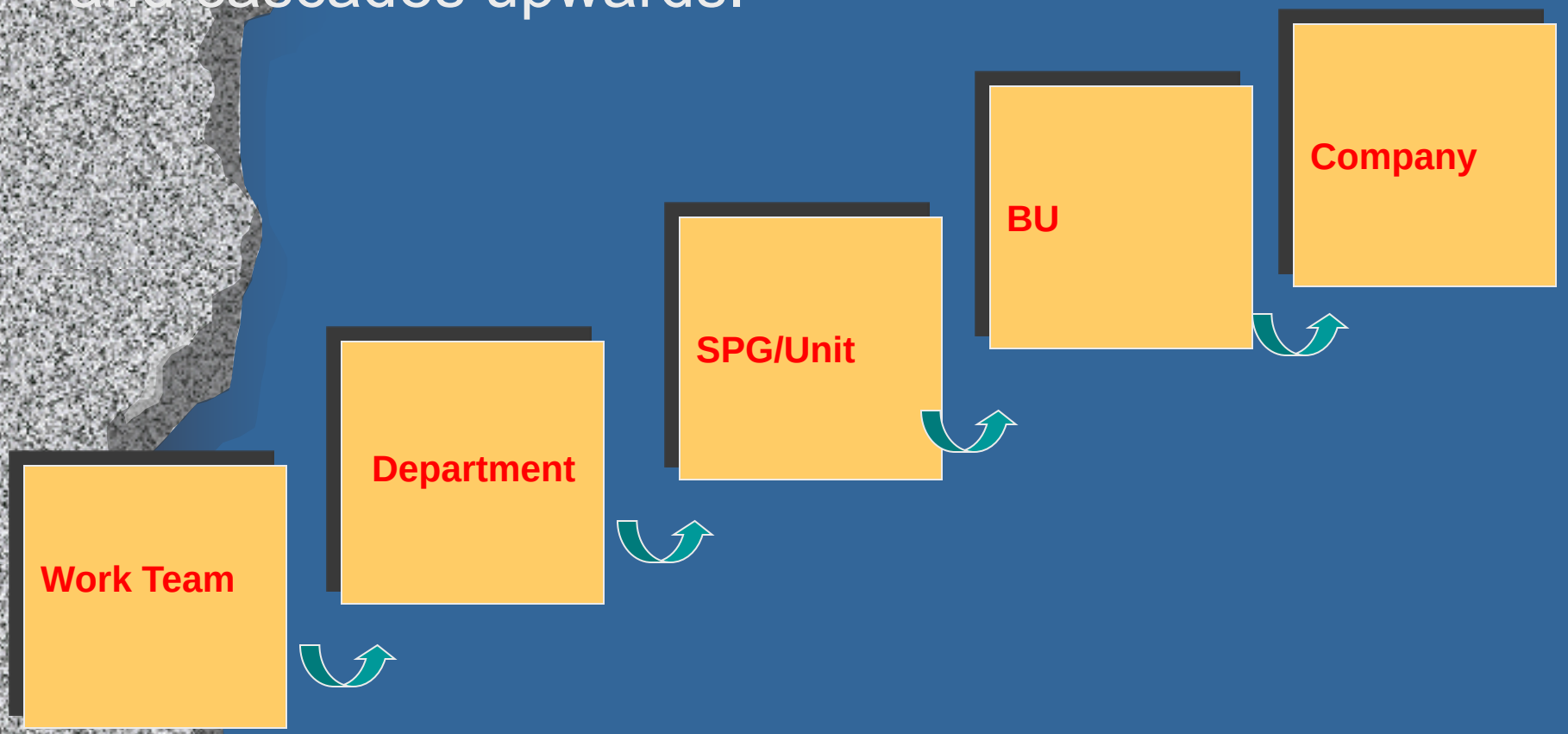
The manager should focus on standard work:

- Metrics Chart
- Action Plan
- Corrective Action for RED Items
- Key Items at Risk

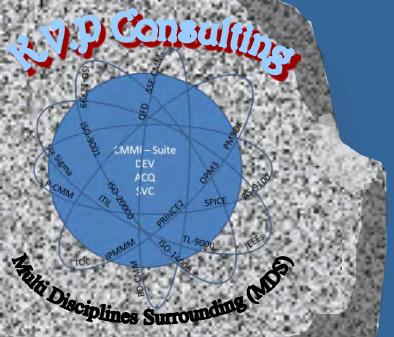
- Asking clarifying questions during the review process.
- Making sure that each person knows what is expected of them to move forward.
- Confirmation check – will this plan get us there?
- Follow up at Gemba before the next review for key issues.

Flow of the Check Process

The check/review process starts at the lower levels and cascades upwards.



- Lower levels may check more frequently.



Check Questions

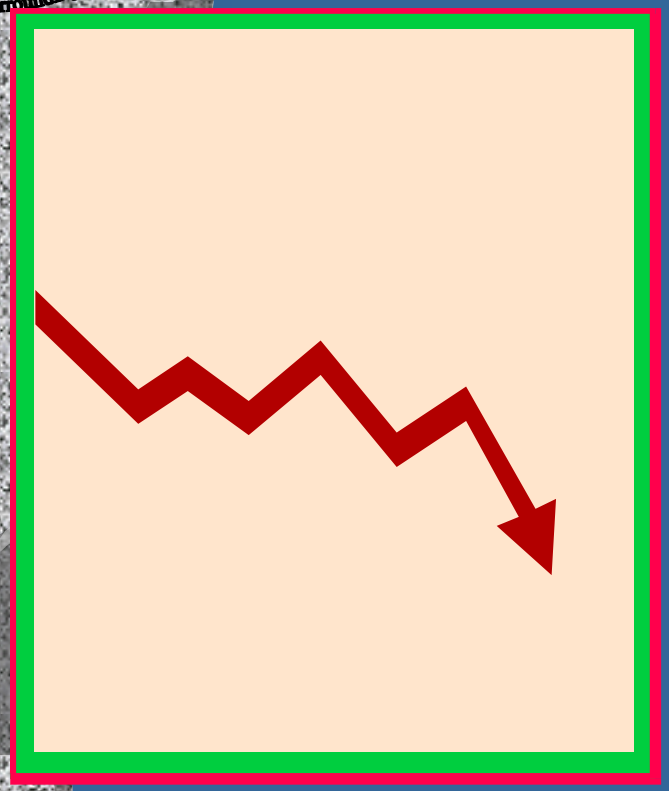
Policy Deployment – Questions to Ask

1. Do you have a plan?
2. Does the plan close the gaps to the goal?
3. Is the plan being executed on time?
4. Is the plan generating the expected business results?

If the answer is negative, take countermeasure

Monitor effectiveness of countermeasure

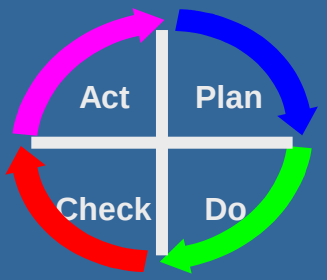
Look for trends – not just red/green



- Metrics chart gives an overall view if on track
- Use graphs and charts to see what is really happening.

The ACT Phase

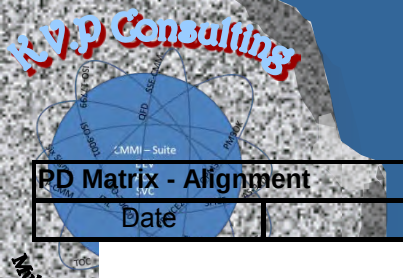
- If off track:
  - Review the plan and countermeasures to confirm that gap from the plan can be closed.
    - Is the plan itself valid or does it need to be modifid?
  - Follow up to determine if actions on the countermeasures have been done.
  - Go to GEMBA to check to see if progress is being made on critical issues
- If on track
  - Lock in the condition with standardized work
- Confirmation Check
  - Does the plan and countermeasures link to the goal/vision?
  - Does it seem reasonable?



ID		Segment	Frequency	Base Line	Target
	On Time R&D Schedule	All IL R&D	Monthly		>10%
	On Quality R&D	All IL R&D	Quarterly		TBD
	On-Spec to book: R&D rework cost	All IL R&D	Quarterly		<95%
	On-budget R&D	All IL R&D	Monthly		Equal
	On-time R&D milestones	All IL R&D	Quarterly		>10%
	Operating Profit	All IL			
	ROI	All IL			
	Customer Satisfaction scores	All IL SPGs			
	Market shares	All IL SPGs			
	Attrition rate (Top performers)	All IL SPGs			
	% emp. w/ 100% accomplishment	All IL SPGs			



	R&D Excellence	Customer focus	Build the "A" team	Benchmark financial performance	Implement SW Process	Implement Personal Accomplishment System	Implement cost models, financial reporting and responsibility process	Implementing Customer Intimacy/Loyalty process	Implementing an "A" team Growth Process
Avi							S		
Ehud					S				
Eli						L			S
Hezi					S			L	
Kuti					S			L	
Larry							L		
Ronen						S	S		L
Dov									
Kobi					L				



PD Matrix - Alignment		ORGANIZATION	YEAR
Date	By		

Multi Discip

PRIORITIES DEPLOYED FROM ABOVE	TARGET	TEAMS
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

1	2	3	4	5	6	7	8	9	10	PRIORITIES FOR THIS ORGANIZATION	TARGET	
												A
												B
												C
												D
												E

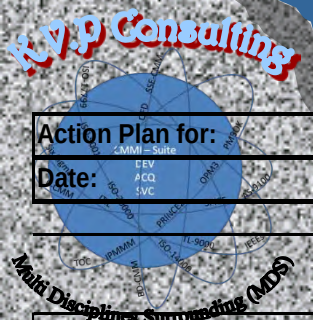
PRIORITIES FOR LEVEL BELOW	TARGET	TEAMS	E	D	C	B	A



PD Tracking	Date	By	ORGANIZATION	YEAR

Priorities this Team	Target

Linkabling	Driver Numbers	2005 Actual	2006 Target		Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	YTD
Priority X	Key Metric Priority 1		Target 1	plan													0
				act est													
				+/-													
				qtr +/-													
Priority X	Key Metric Priority 2		Target 2	plan													0
				act est													
				ytd +/-													
				qtr +/-													
Priority X	Key Metric Priority 3		Target 3	plan													0
				act est													
				+/-													
				qtr +/-													
Priority X	Key Metric Priority 4		Target 4	plan													0
				act est													
				+/-													
				qtr +/-													
Priority X	Key Metric Priority 5		Target 5	plan													0
				act est													
				+/-													
				qtr +/-													
Priority X or Supporting	Metric 6		Target 6	plan													0
				act est													
				+/-													
				qtr +/-													
Priority X or Supporting	Metric 7		Target 7	plan													0
				act est													
				+/-													
				qtr +/-													
Priority X or Supporting	Metric 8		Target 8	plan													0
				act est													
				+/-													
				qtr +/-													
Priority X or Supporting	Metric 9		Target 9	plan													0
				act est													
				ytd +/-													
				qtr +/-													
Priority X or Supporting	Metric 10		Target 10	plan													0
				act est													
				ytd +/-													
Priority X or Supporting	Metric 11		Target 11	plan													0
				act est													
				ytd +/-													



Action Plan for:		Icons for Timeline Below	? Proposed Start	? Proposed Completion
Date:			? Actual Start	? Actual Completion

							Status								
Task Details	Responsible Person	$ Cost	$ Benefit	Plan Dates Start	Plan Dates Finish	Status R/G	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep

MBF format for Red Items

Policy Deployment Improvement Target Countermeasure Analysis
Management by Fact Summary

Organization:	Leader:	Target:	Date:

Problem Statement:

What is the problem that is preventing us from being on target?

Data Graph 1

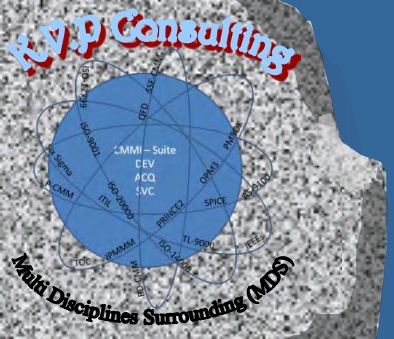
Data Graph 2

Data Graph 3

What analysis has been done to determine the root cause of the problem?

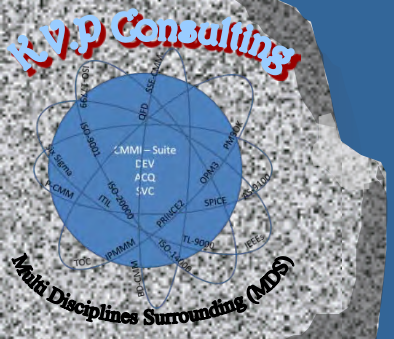
2002	2003	Targets			2004												
ACT	ACT	2004	2006	TAV	YTD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
				TARGET													
				ACT													
				VAR													

Prioritization & Root Cause	Counter Measures & Activities	Who	When	Process Capability	
				Predictive Impact	Status/Results



Tool (Excel Based) Walkthrough

We will go through a real file and data for discussion


A.N.P. Consulting
CMMI – Suite
DEV
ACQ
SVC
Multi Disciplines Surrounding (MDS)

Questions ?



Contact

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Are Your Customers Happy?

Using customer satisfaction to drive improvement efforts

Sue Lafortune, NSA Way Program Manager

Kathy Demery, NSA Way Infrastructure Lead



Who is NSA?



- The National Security Agency was established by President Harry S. Truman on November 4, 1952.
- NSA is a Defense Agency within the US Department of Defense and an Intelligence Agency within the US Intelligence Community.
  - By original charter, the Director of NSA (DIRNSA) is a general officer grade O-9 or higher selected on a rotating basis from the US Army, US Air Force, US Navy.
  - By original charter, the Deputy Director of NSA (D/DIR) is always a DoD civilian employee.

What does NSA do?

- NSA's core missions are to protect U.S. national security systems and to produce foreign signals intelligence information:
  - Information Assurance
  - Signals Intelligence
  - Network Warfare



Information Assurance Mission

The information assurance mission confronts the formidable challenge of preventing foreign adversaries from gaining access to sensitive or classified national security information.



Signals Intelligence

The signals intelligence mission collects, processes, and disseminates intelligence information from foreign signals for intelligence and counterintelligence purposes and to support military operations.



Network Warfare

NSA enables Network Warfare operations to defeat terrorists and their organizations at home and abroad.



President Barack Obama, Vice President Joe Biden and members of the National Security Team receive an update on the mission against Osama bin Laden in the Situation Room of the White House on May 1, 2011., Pete Souza / Courtesy of the White House

NSA's Mission and Systems Development

- The Information Assurance, Signals Intelligence, and Network Warfare missions are highly technical.
  - Systems development and integration— particularly software-intensive systems—are a key enabler in fulfilling these missions.
- NSA has a diverse set of software development projects.
- Facilitating timely software development that delivers quality sufficient to fulfill the mission are of great interest to NSA.



NSA Way Overview-1

- "The NSA Way is a unified framework for building large, complex, primarily software systems that meet the diverse needs of NSA missions. It is lightweight, intuitive, and independent of project size and development methodology."
- It is:
  - Based on a Customer/Supplier theme
  - Focused on outputs over processes
  - About continuous improvement
  - Applicable in Agile, Iterative, and Waterfall LCMs
  - Independent of team size

NSA Way Overview-2

- NSA Way defines core expectations and best practices for software development.
- NSA Way deploys 'coaches' into NSA systems and software development organizations to provide implementation guidance and to assess progress.
- NSA Way is implemented through:
  - Gates (Life cycle control-milestones)
  - Metrics (Quality related)
  - Processes (currently there are 8)
- Driving cultural and behavioral change first, process maturity second.
- NSA Way is results oriented.

Why Customer Satisfaction at NSA?

Customer satisfaction surveys measure and evaluate the attitudes, opinions and satisfaction levels of your customers and clients.

For NSA it is to….

- understand what is important to our customers
- focus on what we can do to meet their needs
- build true customer understanding and knowledge
- drive our improvement efforts

Why Customer Satisfaction at NSA?

For NSA it is to…

- Increase mission effectiveness, customer efficiency, realization of National Security
- Have repeat methods to increase mission agility
- Increase National intelligence value and National well being

NOT to…

- increase profits, customer loyalty, brand recognition
- have repeat business to increase market share
- increase earnings and stock profits

NSA's Customer Focused Software Engineering Approach to Integrated PI

- Flexibility of NSA Way
- Just enough process
- Focus on results not on process

Customer Driven Priorities

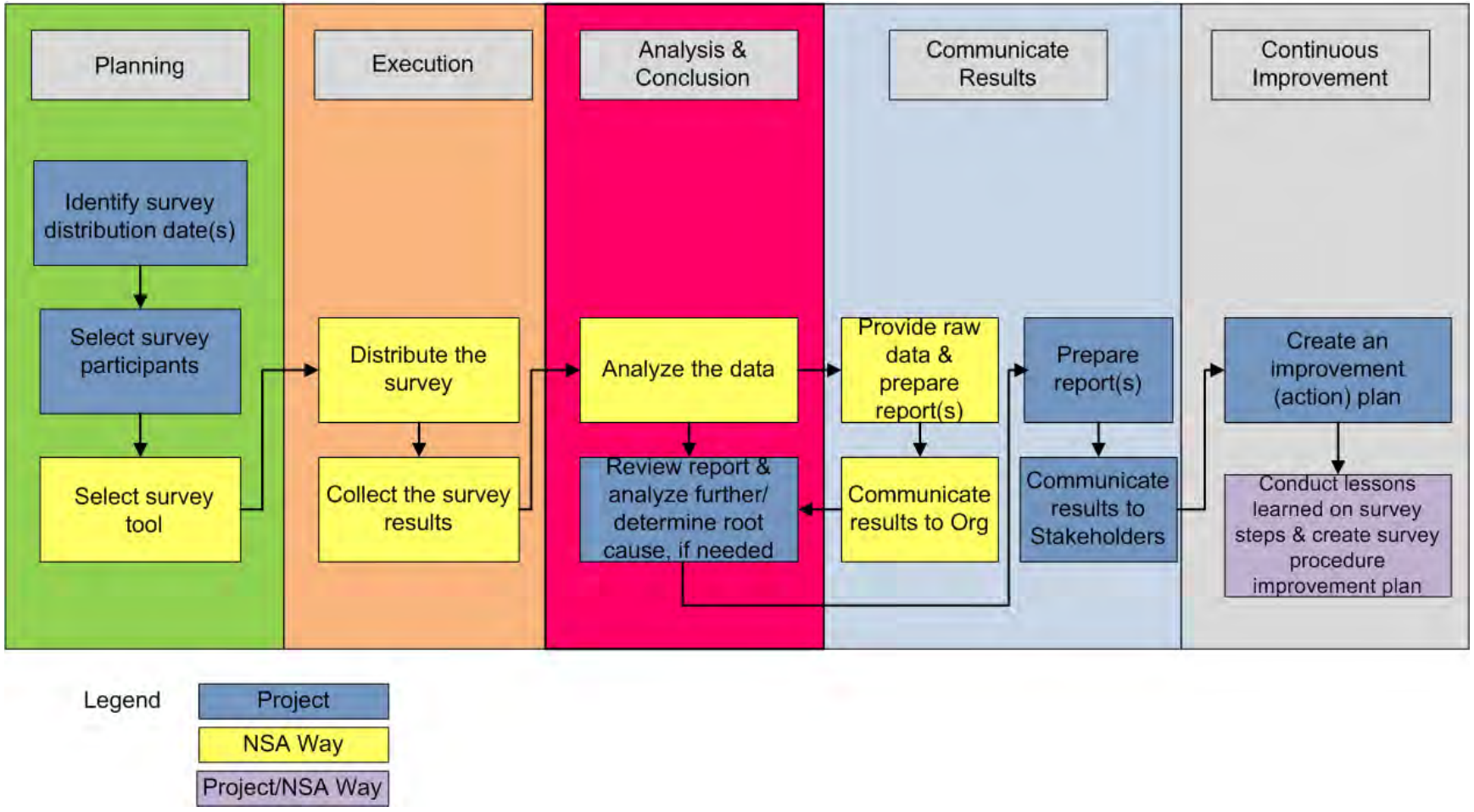
- Need to know what is most important to our customer (e.g., capabilities, timeliness, quality)
- Customer priorities are different for every project
- Vary the rigor of best practices to affect the end result
- Not process for process sake

This is What We Did

- Developed a customer satisfaction survey service
  - Developed customer satisfaction survey questions
  - Developed two-dimensional survey method
  - Researched and obtained a survey tool
- Developed and conducted training
- Piloted our Customer Satisfaction Survey Service

Customer Satisfaction Survey is just the beginning. Next, need to analyze results and develop action plans.

Customer Satisfaction Survey Service



- Optimal survey window is within 30 to 90 days following release/deployment.

Customer Satisfaction Survey Questions (Statements)

Satisfaction Area	Statement
Mission/ Business Value	The capabilities delivered provided the mission/business value expected.
Product	The capabilities delivered were as expected.
Timeliness	The capabilities were delivered when needed.
Quality	The capabilities delivered met my quality expectations.
Communication	The level of communication throughout the development and delivery of the capabilities was as expected.

Two-dimensional Survey Method

Degree of Satisfaction	Degree of Importance
Very Satisfied	Very Important
Satisfied	Important
Neutral	Neutral
Dissatisfied	Unimportant
Very Dissatisfied	Very Unimportant
Unknown	Unknown

- Knowing the customer's degree of importance helps prioritize PI efforts.

Case Study/Lessons Learned-1

- Response
  - Low response rate (~25%)
  - Sample size
  - Not statistically significant
- Gathering data
  - Other options for gathering Customer Satisfaction data
  - Customer Satisfaction Survey not be confused with other “feedback” (requirements gathering)
- Customers
  - Cherry picking the customers
  - Sampling your customer set (to prevent burnout)
  - Anonymity
  - Considerations for different types of customers

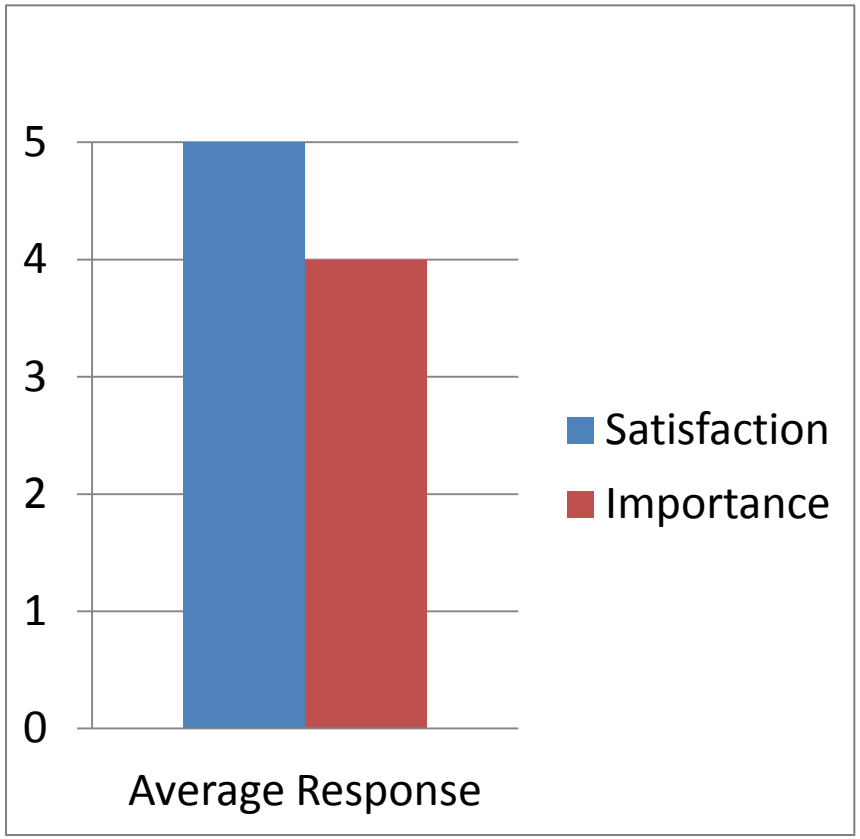
Case Study/Lessons Learned-2

- Survey tool
  - Steep learning curve
  - Difficult to use
- Customer Satisfaction Survey Service
  - Life cycle too long (~ 7 weeks)

Example: Results

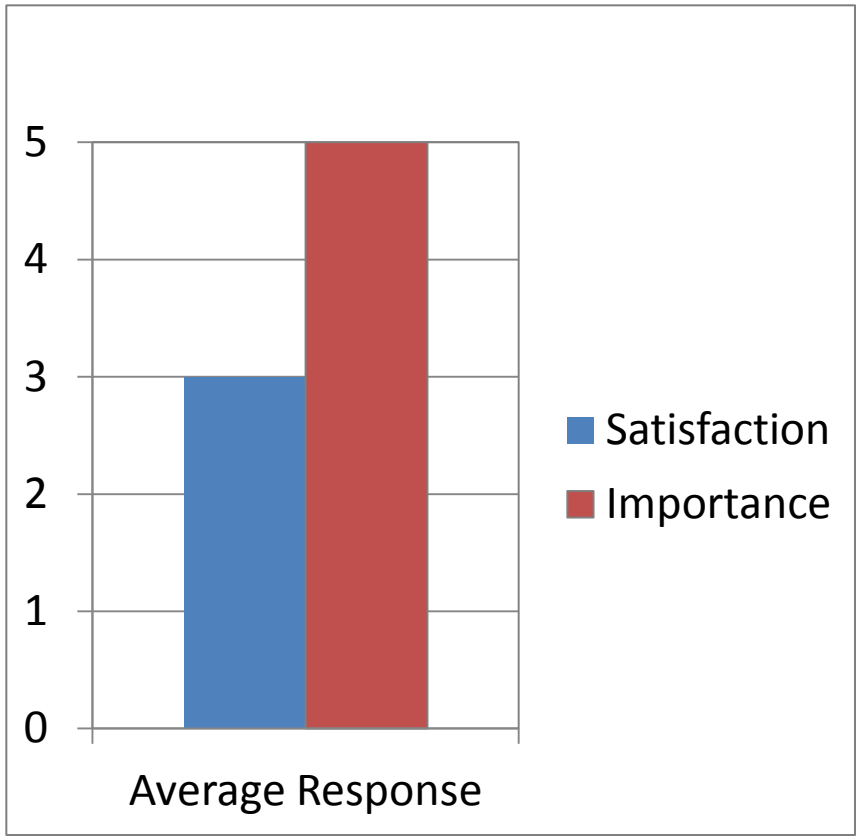
Mission Value:

The capabilities delivered provided the mission value expected.



Timeliness:

The capabilities were delivered when needed.



Value of the Comments.

Numbers are one aspect, comments are another

IT'S LIKE GOLD!

Example Comments:

- "Works about as well as can be expected for a web app."
- "The team is OUTSTANDING when it comes to responding to questions or when I am in need of assistance. Honestly, they respond quicker than any other database support team that I've dealt with in the past seven years...."
- "I feel that this organization provides quality products and results. I am a former Z product user and since discovering this product shortly over a year ago, I have no further use for the Z product, as the quality of this product is much higher than that of the Z product."

We Survey Our Customers, Too

As an improvement group, we need to know our customers' satisfaction with our products and services.

- Products
  - Website
  - Process Assets
- Services
  - Training
  - Coaching
  - Customer Satisfaction Survey Service
- Modeling the behavior

Tips for Successful Customer Satisfaction Surveys-1

- Increase sample so that the information received is statistically significant.
- If the sample size is small, look at other survey methods (e.g., face to face).
- Survey a certain percentage over a period of time or number of releases.
- Adjust guidance on question considerations based on relevance to type of customer.
- Provide feedback to the customer early.

Tips for Successful Customer Satisfaction Surveys-2

- Increase your response rate - <u>Before the Survey</u>
  - Announce the upcoming survey
  - Have upper-management promote & encourage participation
  - Survey timing (mid-week, avoid holidays)
  - Clear, easy, and quick to answer questions
  - Length of survey is short (<10-15 questions)
  - If sent survey previously, mention your improvements from the previous survey

Tips for Successful Customer Satisfaction Surveys-3

- Increase your response rate - <u>During the Survey</u>
  - Attempt contact with ONLY non-respondents at least once (difficult if anonymous)
  - Have PM personally call all or their most valuable customers asking whether they have received the invitation and if they will find the time to complete it (depends on the # of participants)
- Increase your response rate - <u>After the Survey</u>
  - Keep anonymous respondents anonymous
  - Send out thank you notes to everyone invited to participate
  - Let participants know the results (what you've done well and what needs to be improved)
  - Provide feedback on the changes you plan to make based on the customer satisfaction survey results

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Just Getting Started With CMMI

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

Mary Beth Chrissis
November 15, 2011



Software Engineering Institute | Carnegie Mellon

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Overview

Change is difficult!

A Harvard Business Review study finds that 2/3 of change initiatives fail to achieve successful results.

Fundamentals of change management are like learning your ABCs.



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A Action-Oriented

Results demonstrate execution and commitment.

Keep the momentum up.

2 - 3 weeks without visible activity causes the effort to flounder.



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B Budget Appropriately

Process improvement/change management is a project.

- plan
- budget
- resources



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Communicate At All Levels

Others won't know unless you tell them.

Yell out successes.

Acknowledge mistakes.

Provide a visible place for everyone to be informed.



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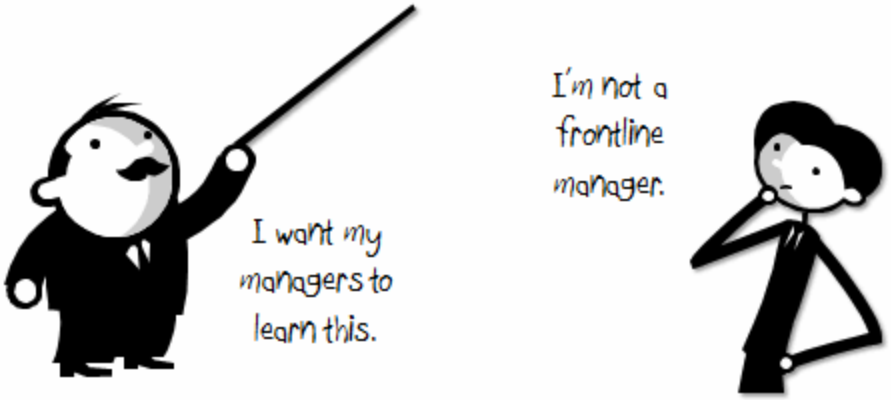
D Define the Objectives

Clearly define your objectives.

Make them available to the organization.

Connect them to real problems and your organization's business.

This change effort is going to improve our commitment process.



People in your organization know if they are relevant.

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Encourage Everyone To Get Involved

Senior Management

Mid-Level Management

Supervisors

Team Leaders

Teams

Staff

Administration





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First, Pick Low Hanging Fruit

The first change should be a problem that you believe you can successfully fix and deploy throughout most of the organization.



Targets or goals which are easily achievable and which do not require a lot of effort. (Urban Dictionary)



Pick a strawberry; not a papaya!

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Get Management Involved

Cannot be optional for management.

- Executive management must not only sponsor but buy-in.
- They must lead or get out of the way.
- The new process will have to stand on its own (aka culture), but every new change needs support and nurture.



Change efforts must be coordinated. If not, employees become confused and frustrated (and hence angry) because they are being pulled in conflicting directions.

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Hard Work

Expect the unexpected.

- Everyone expects that after the kick-off meeting, everything goes smoothly.
- There will be bumps along the way.

Make sure that you plan for the transition and adoption.

The work isn't over until the change is no longer a "difference" but is part of the culture.



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Ignore Those Not Ready to Change

Most employees are quite satisfied with the status quo--20-60-20.

Focus on the 60% in the middle--not on the 20% that will never buy-in.

They will get on the band wagon later or leave.



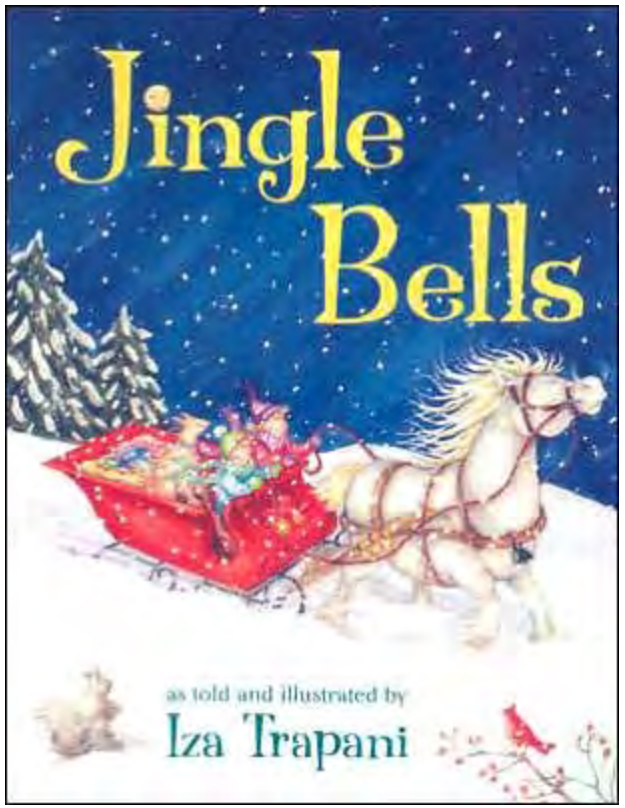
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Jingle, Jingle, Jingle

Keep it catchy!

- communication
- project name
- logo
- people

Developing clear and catchy communications that summarize the behavior change which enable people to remember the new behaviors.



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Keep It Simple

Remember both you and your organization are learning about change management.

Don’t bite off too much.

Create success early.

Try to avoid

- confusion
- lack of clarity
- lack of plan
- poor execution



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Leadership

Provide sponsorship from the top.

Identify who is involved and who is responsible.

Get participation from those affected.

Others will look for

- strength
- support
- direction

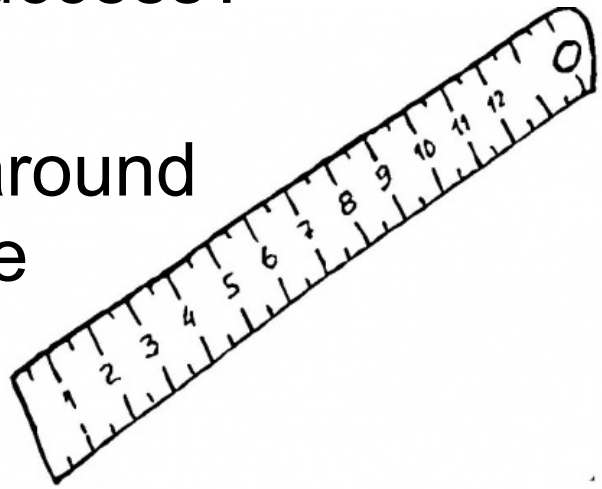


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Measurement

Managers tend to view events as successful without knowing why---they have no measurements or clear expectations about what the change will produce. Staff see the shortcomings and fewer advances. It's vital for the group to know: How will we know that we have gotten to success?

Establish measurement systems around the desired changes and report the results frequently.



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Never Give Up

Change is continuous.

Listen to the organization.

Trust your instincts.

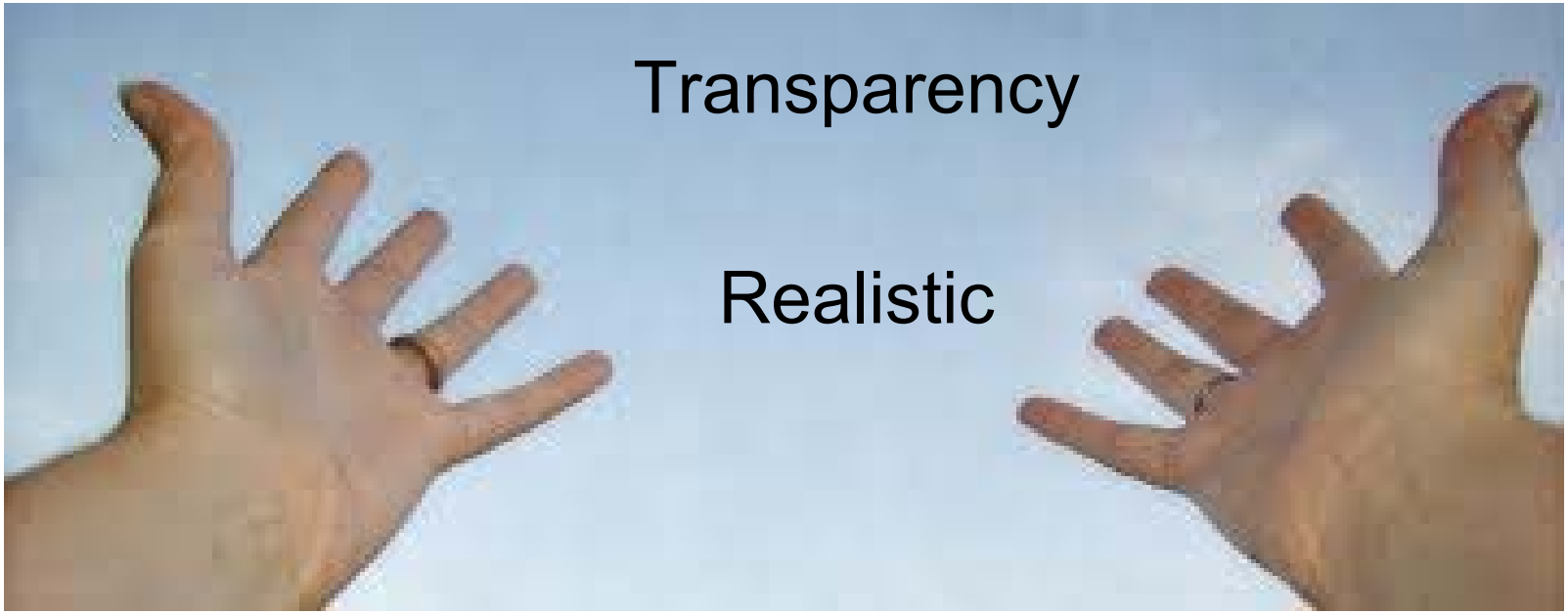
Persevere!



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Openness to Change

Expressing the reasons for change honestly and directly will help people be open to change.



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Plan

Change management and process improvement should be run like a project.

Don't fatigue people with constant small changes.

Choose big impact changes that are important.

PLAN FIRST!

THEN ACT ACCORDING TO PLAN!



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Quickly Respond to Issues

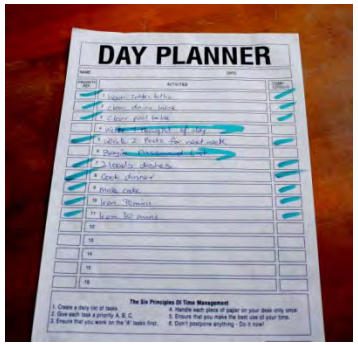
Everyone is watching.

- supporters
- those who hope you fail

Ask for help when needed!









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R Rewards and Resistance

Motivate people to change.







Tangible

- bonuses
- promotion

Intangible

- camaraderie
- sense of shared destiny

Anticipate and deal with objections and resistance.

- If they aren't addressed, people will assume they are true.
- Stay flexible. Be willing to modify the process based on people's actions and events.

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Survival of the Fittest

The basis of survival of the fittest.

- Adaptability
- Flexibility
- Resiliency



The fittest, usually not the masses.

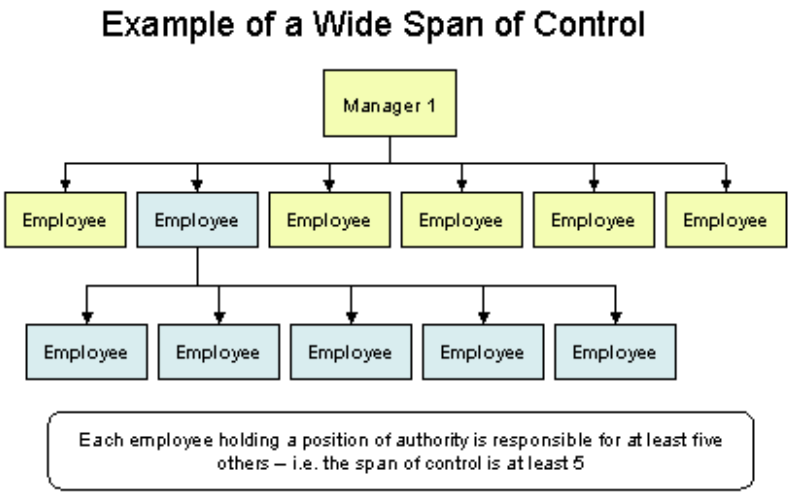
Align with the true motivations of your people.

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Think About What You Can Change

Lines of authority and control must be respected; you cannot directly change what you do not control.

You can influence those in control, but you cannot force them.



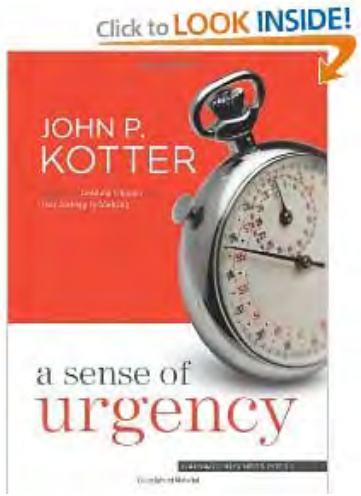
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Urgency of Need

Set the stage by creating urgency and why the change is important -- "unfreezing."



Urgency does not equal fear. Fear hurts. Urgency helps.



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Vision

Focus on the short-term

- 3-6 months

With your objectives on the near-term

- 1 year

But don't forget about the long- term

- 3 year
- 5 year



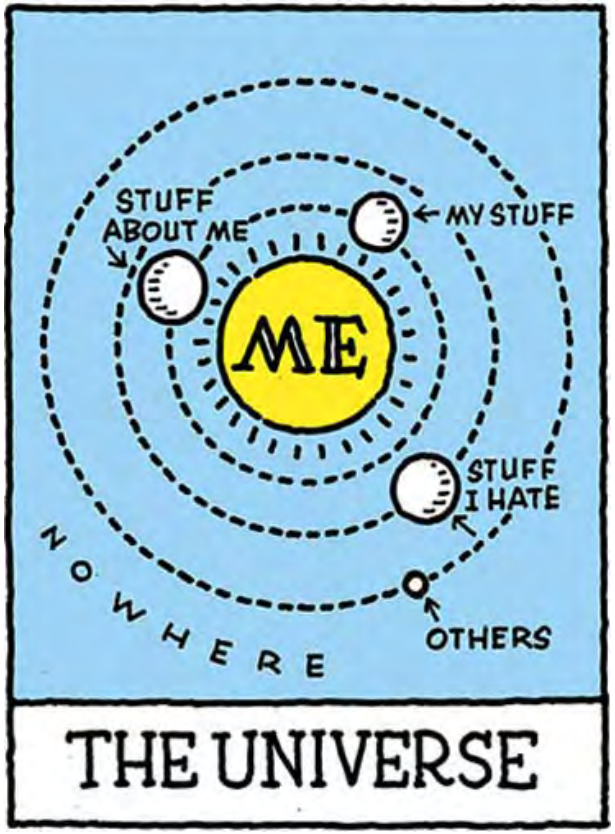
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What's In It For Me?

Relate the change to what people in the organization want.

It is a trust thing.







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eXtra, eXtra, eXtra

You will need help

- Communication
- Money
- People
- Tools
- Training



Do not assume that the level of enthusiasm will continue, think about how you will sustain that enthusiasm during the long road ahead.

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You



It's not about you; it's about them.

The organization and individuals must be able and willing to learn and take responsibility.

Change for the good of the organization and your customers first, change for profit only second, and change for yourself last.

Acknowledge and allow people to go through the stages of change.

- They will anyway, whether or not you accept it.
- Expecting it allows you to better cope with it, and not overreact to early denial or anger.

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Zeal But Not a Zealot

Everyone's buy-in is important to change.

Passion and ownership are key.



A little luck or magic doesn't hurt along the way!

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Conclusion

Basically...if you

- define the objectives
- listen to your people
- create a culture of change
- communicate at all levels
- reward success

change can be successful and as simple as your ABC's.



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Lessons Learned in Overcoming Resistance to CMMI

CMMI Technology Conference and User Group
14-17 November 2011



Rick Hefner and Ferol Lewis
Northrop Grumman Corporation
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Background

- **Successful change requires the right combination of strategy, structure, and support**
- **Your chances of success depend on your current culture, the desired end state, the resources available, the past response to change , and your ability to recognize and address resistance**
- **This presentation will provide practical approaches, tools, and techniques for overcoming resistance in your organization**

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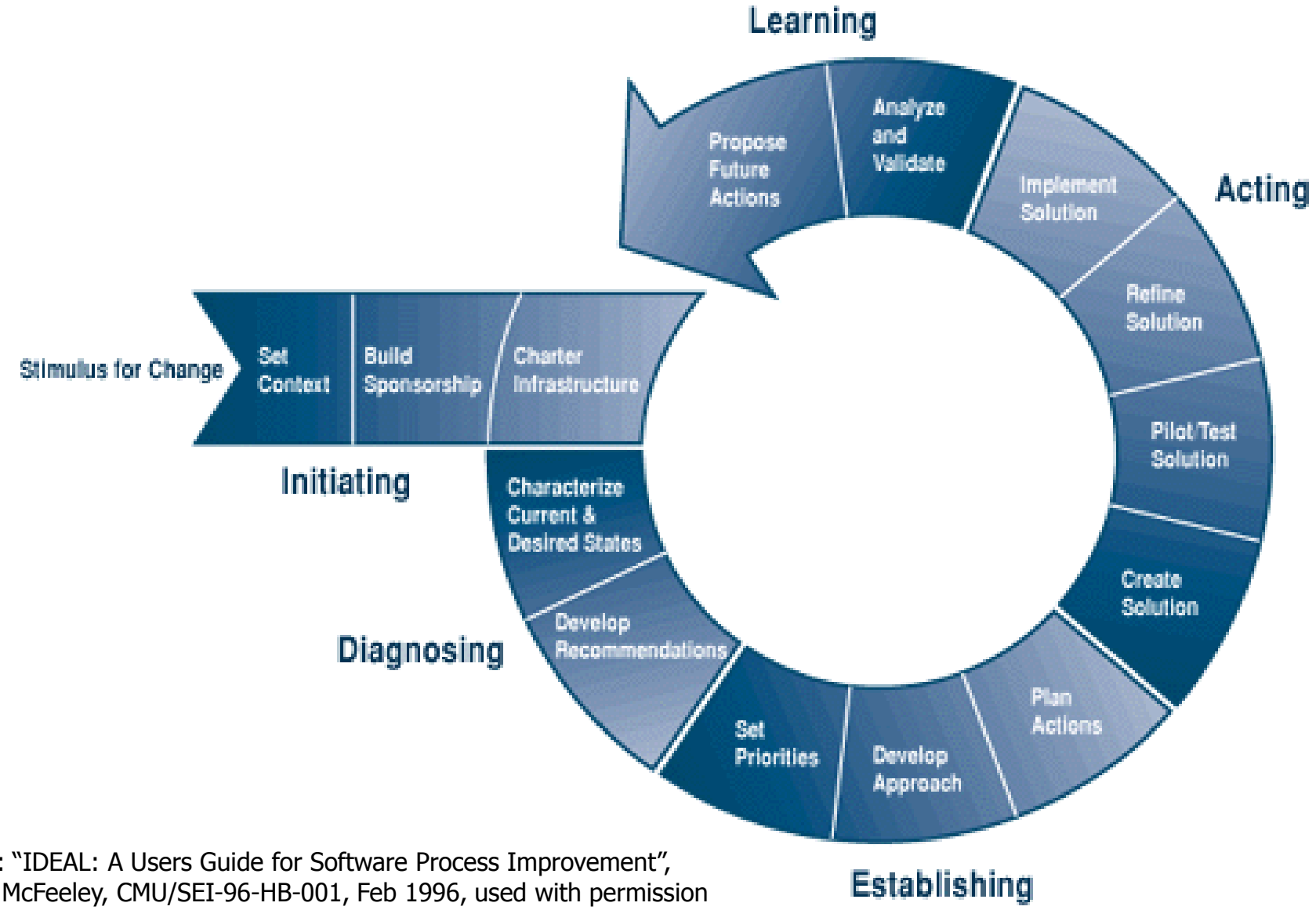
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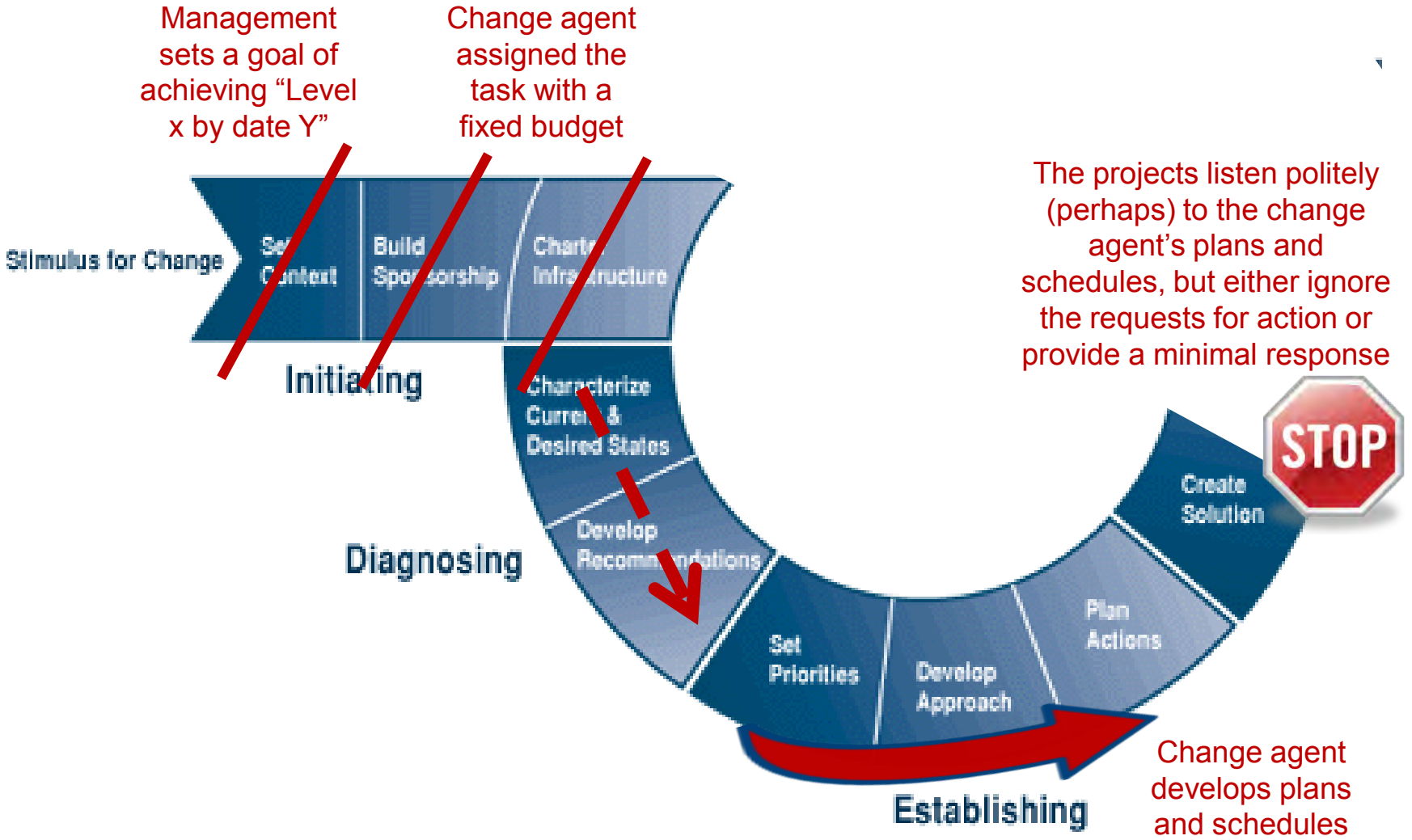
The IDEAL℠ Model



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The Non-IDEAL Model



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Topics

- **Necessary ingredients for change**
  - Why people resist change
  - Effective strategies for addressing resistance
- **Keys to leading the change**
  - Management support
  - Influence without authority

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Maslow's Hierarchy of Needs



Opportunities for innovation and creativity, learning and creating

Recognition from others, prestige and status

Being part of a group, identification with a team

Economic security, freedom from threats

Physical survival needs: food, water, shelter, etc.

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Why Do People Resist Change?



I want to stay where I am because…

…my needs are already met here

…I have invested heavily here

…I am in the middle of something important

I do not want to change because…

…the destination looks worse than where I am now

…there is nothing to attract me forwards

…I do not know which way to move

…the journey there looks painful

…the destination or journey is somehow bad or wrong

…I do not trust those who are asking me to change

I am not going to change because…

…I am able to ignore the change

…I have the power to obstruct the change

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Why Do People Resist Change?
Perceived Loss of Personal Power

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Here's the new practices you need to start implementing.



If these are essential industry best practices...

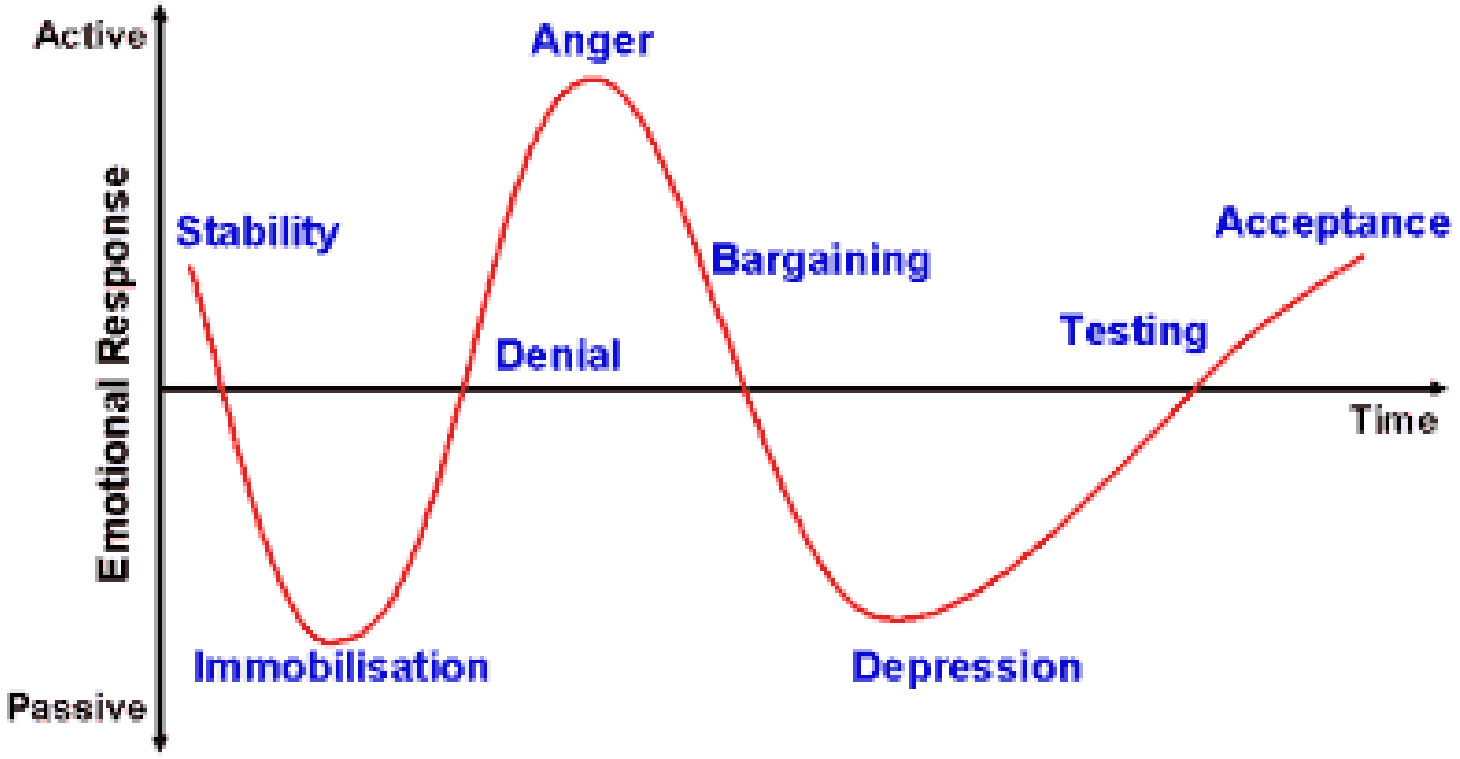
and I haven't been performing them....

then I've been wrong....

so they must not be essential industry best practices!

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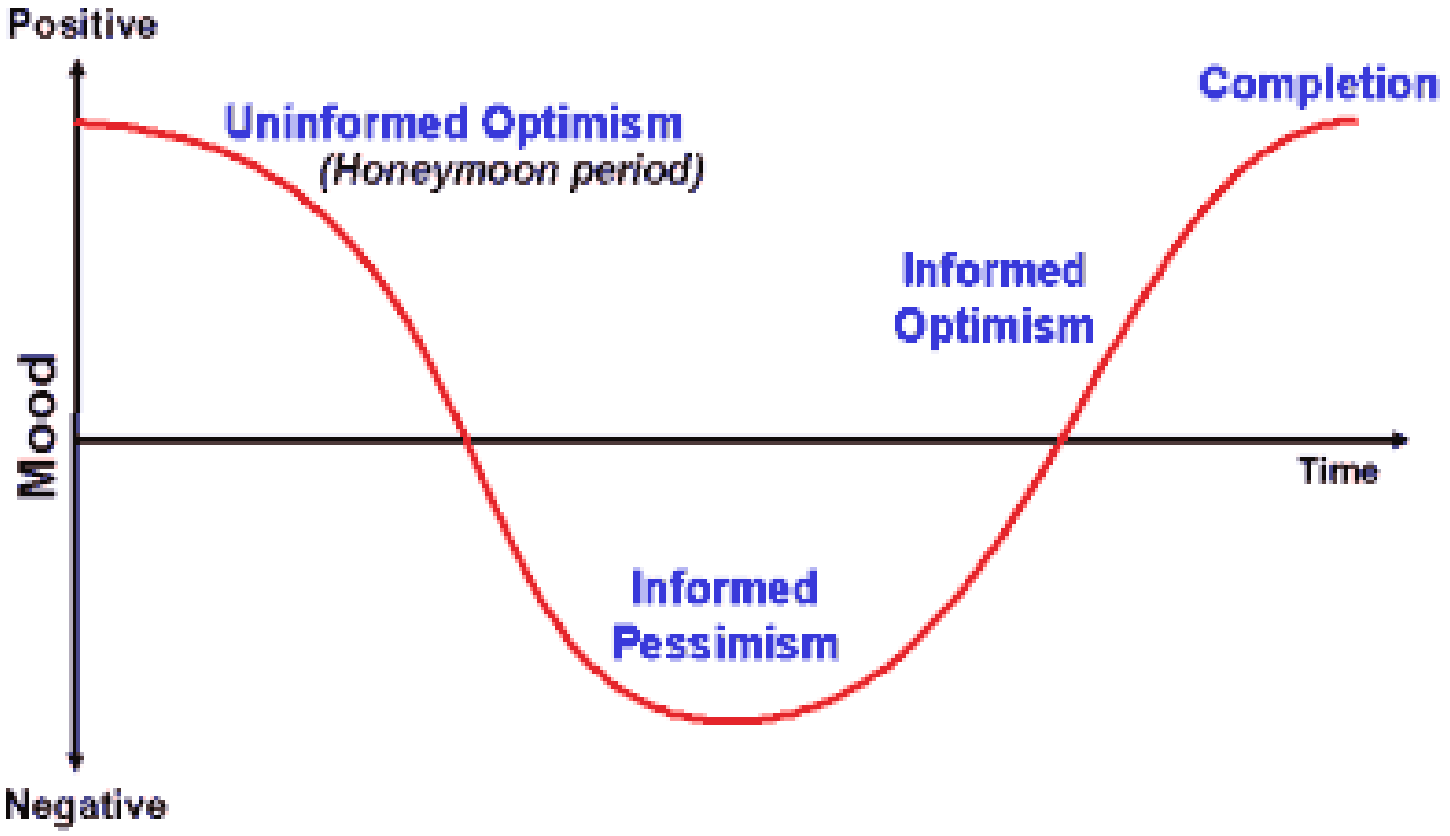
Reaction to Change Perceived as Negative: Kübler-Ross Grief Cycle



Immobilization: Initial paralysis at hearing the bad news
Denial: Trying to avoid the change
Anger: Frustration, outpouring of bottled-up emotion
Bargaining: Seeking for a way out
Depression: Final realization of the inevitable
Testing: Seeking realistic solutions
Acceptance: Finally finding the way forward

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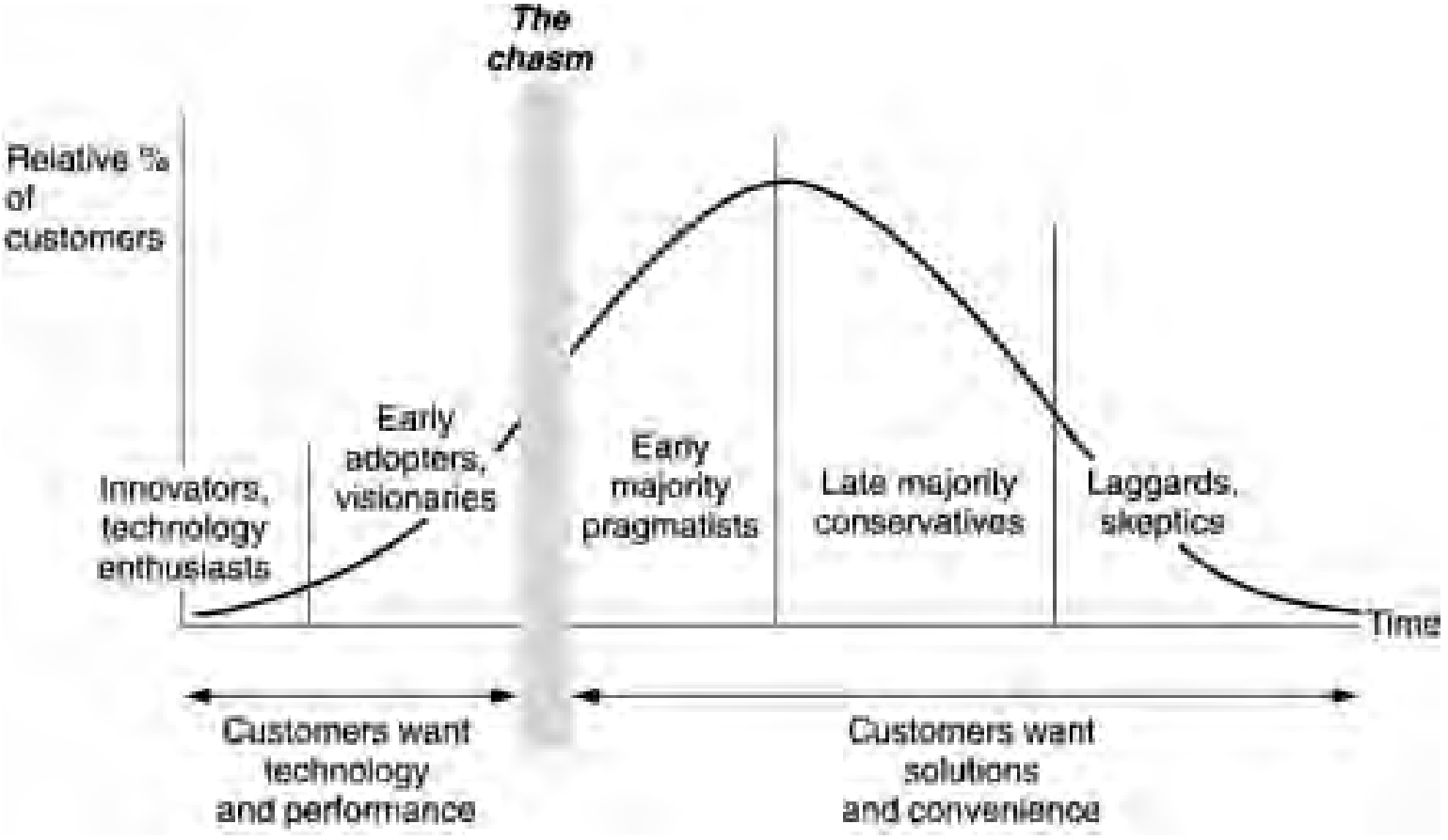
Reaction to Change Perceived as Positive



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Willingness to Change

- **Early adopters are motivated by perceived benefits**
- **Late adopters are motivated by avoiding pain**



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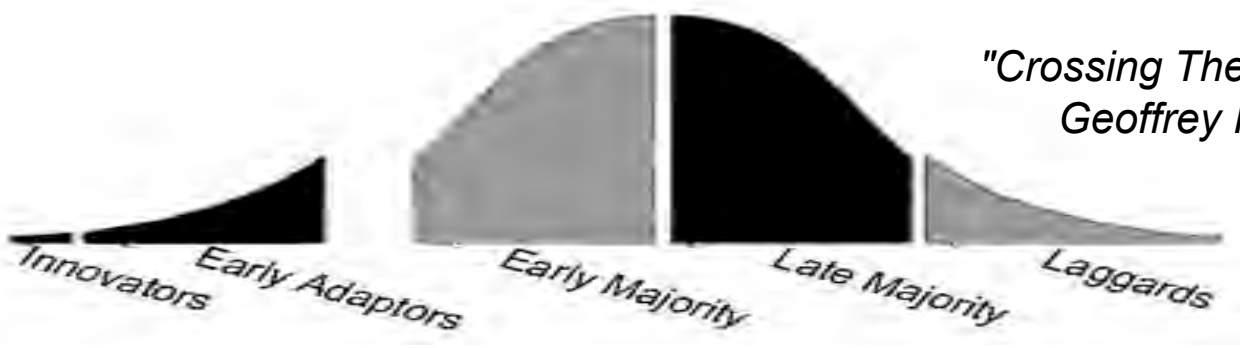
Topics

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- **Necessary ingredients for change**
  - Why people resist change
  - Effective strategies for addressing resistance
- **Keys to leading the change**
  - Management support
  - Influence without authority

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Different Practitioners Need Different Arguments



- (I, EA) Explain how the practice adds value
  - Identify a situation in which this value would be realized
- (EM) Where possible, provide data
  - It is difficult to find perfect data, which "proves" the value
  - Even perfect data may not convince a skeptic
- (EM) Identify others who have seen the (qualitative) value of this practice
- (LM) Couch the value in ways that appeal to the practitioner:
  - Reduced risk, addressing a customer issue, reduced workload, etc.
- (LM) Show ways that the practice can be done easily
- (LM) Suggest the practitioner try it and see

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Communicate the Key Messages

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- **The change is driven by proven, industry best-practices**
  - Adoption is about learning how to apply these practices to our work
  - The practices may feel awkward and have limited value until we learn them
  - It's OK to make mistakes – we will get better over time



- **Improvement involves short-term investment for long-term gain**
  - Improving is essential to meeting our business goals
- **These improvements are an enabler (not a guarantee) of success**
  - Other aspects (people, technology, customer relationship, etc.) are equally important
- **When the entire organization is improves, everyone's job becomes easier**
- **Continuous improvement is a way of life**

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Address Fear of Failure

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- **The risk of change may be seen as greater than the risk of standing still**
  - Making a change requires a leap of faith
- **The perceived loss of personal power**
  - I'm seen as competent now, but in a new culture…



Effective Strategies

- **Clearly describe why the situation favors change**
  - Business goals, WIIFM
- **Make it clear initial mistakes are expected and will be tolerated**
  - Create forums for asking and answering questions
- **Show people how they can be effective in the changed environment**

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Encourage and Support

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- **Practitioners may feel they don't have time to learn new ideas**
- **Practitioners may need role models**
  - Most change agents don't need role models, because they easily imagine new situations



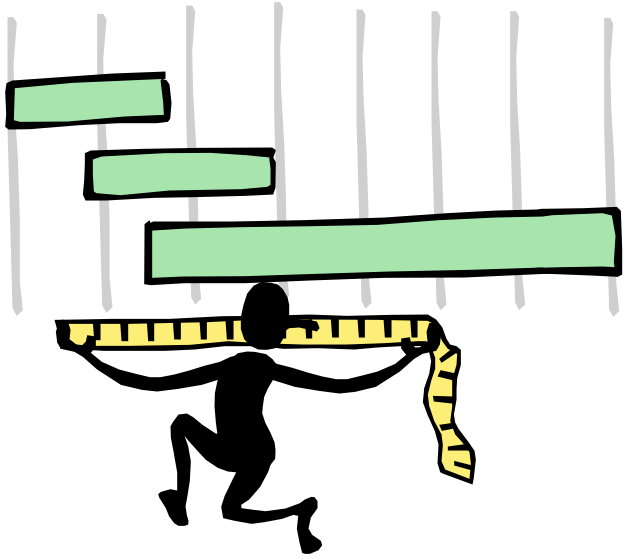
Effective Strategies

- **Ensure adequate resources during the learning curve**
- **Search out and publicize good examples and successes**
  - Set up pilot programs that model the change
- **Encourage the next step in the change process**
- **Ensure management takes accountability for action**
  - Must change short term priorities to achieve long term results

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Ensure Accountability

- **Adopting and sustaining improvements is about each practitioner learning and performing the new behaviors**
- **The role of management in cultural change is to hold people accountable for the new behaviors and conduct**



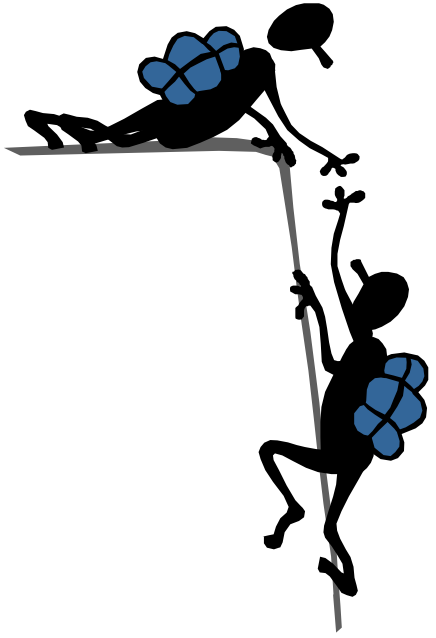
Effective Strategies

- **Change agents can enable management by:**
  - Helping them have a clear vision of the new culture
  - Identifying inappropriate behavior
  - Providing tangible, objective measures of adoption/sustainment

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Help Them Accept Change

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- **People may fear hidden agendas**
  - Late Adopters often look for messages in how resistance is handled

Effective Strategies

- **Set up mechanisms for obtaining feedback**
  - Some will prompt genuine improvements
  - Some will be based more on fear and anger than substance
- **Be honest about setbacks and negative impacts**
- **Management must enforce change in the face of objections**
  - Consensus will almost never be reached
  - Communicate that objections and uncertainty does not eliminate the need for change - "The dogs may bark, but the caravan goes on."

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Management Support

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Management must:

- **Understand the key messages**
- **Be willing to take actions to reinforce them**
- **Provide resources to support/sustain process improvement efforts**
- **Set expectations that essential project functions will be funded and processes will be followed**
  - Project planning, estimation, tailoring, CM, QA, etc.
- **Support process improvement and sustainment, rather than passing appraisals**
- **Reward mature processes development and sustainment rather than individual heroics**
  - Tell me how you will reward me, and I'll tell how I will behave

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When Faced with Unexpected Resistance

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Stop



- **The natural tendency of many people is to respond immediately, with an authoritarian or angry response**
- **This may generate sympathy for the resist galvanize the resistance, and/or make it c**

Look

- **Pause, assess the situation, and diffuse the emotion**
- **What is the person's emotional state?**

Listen

- **Is this a misunderstanding or a legitimate concern?**
- **What does their message say about their underlying beliefs, values, goals, perceptions, potential, triggers?**

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Principles of Influence

- **All interpersonal behavior involves exchange**
  - "Paying" others for what we request; being paid for what we do
  - You have influence, insofar as you can give others what they need, in exchange for what you need
- **To have influence, you must:**
  - See the other person as a potential ally
  - Clarify your goals & priorities
  - Diagnose your ally's goals & priorities
  - Possess resources to help your ally
  - Negotiate the exchange



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Possible "Currencies" to Exchange

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Inspiration

- Vision
- Excellence
- Moral/ethical correctness

Task

- Resources
- Challenge/learning
- Assistance
- Organizational support
- Rapid response
- Information

Position

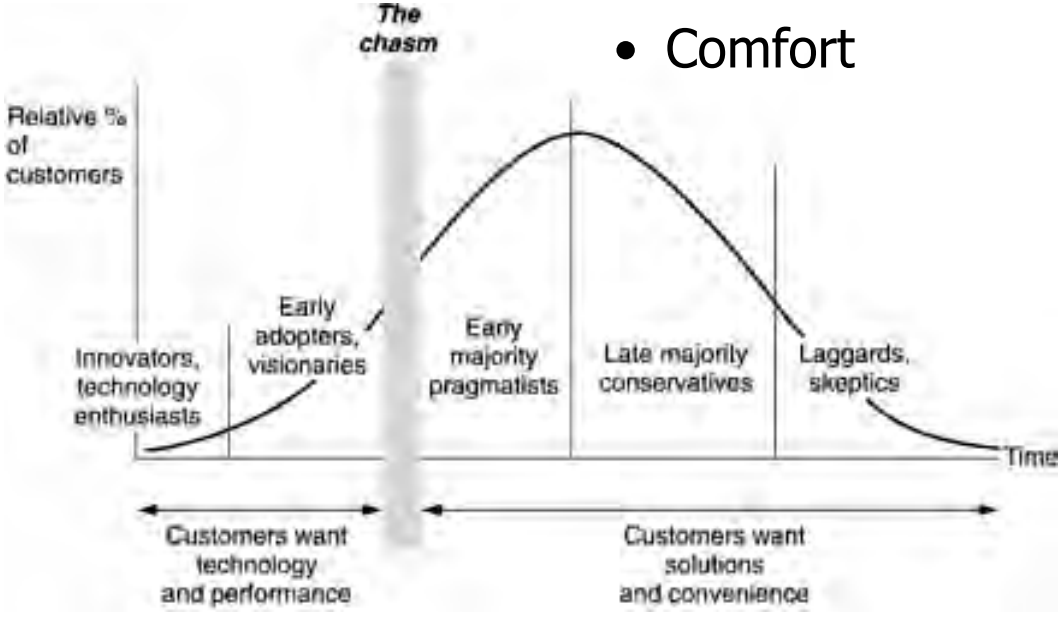
- Recognition
- Visibility
- Reputation
- Importance
- Contacts

Relationship

- Acceptance
- Understanding

Personal

- Gratitude
- Self-concept
- Comfort



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Barriers to Seeing the Value

NORTHROP GRUMMAN

"Sometimes you have to believe it to see it."

- **Practitioners may not have worked in an environment where the practice was performed**
- **Practitioners may have worked in an environment where the practice was performed poorly or in a non-value-added manner**
- **Believing the practice is an improvement may require an action the practitioner is not willing to take**
  - Awkwardness of doing something new
  - Admit they've been doing it wrong
  - Loss of personal power when perceived to be an expert in the current approach

"The Fundamental Value of Every Single CMMI Practice",
R. Hefner, Wednesday, 9:15-10:00am, Mesa Verde

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Summary

- **Successful change requires the right combination of strategy, structure, and support**
- **Your chances of success depend on your current culture, the desired end state, the resources available, the past response to change, and your ability to recognize and address resistance**

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CMMI® for Services: Where "Build Stuff" Happens

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

November 2011

Eileen Forrester

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Topics

- Combined approaches
- CMMI-SVC and CMMI-DEV
- Engineering services
- CMMI-SVC and systems of systems



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Putting All the Pieces Together



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CMMI-SVC is a Perfect Fit



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The CMMI Models

The CMMI Product Suite currently has three models relevant to improvement in a particular area of interest.

Development (CMMI-DEV)

- build stuff
- tangible, storable products made to specification in a lifecycle

Acquisition (CMMI-ACQ)

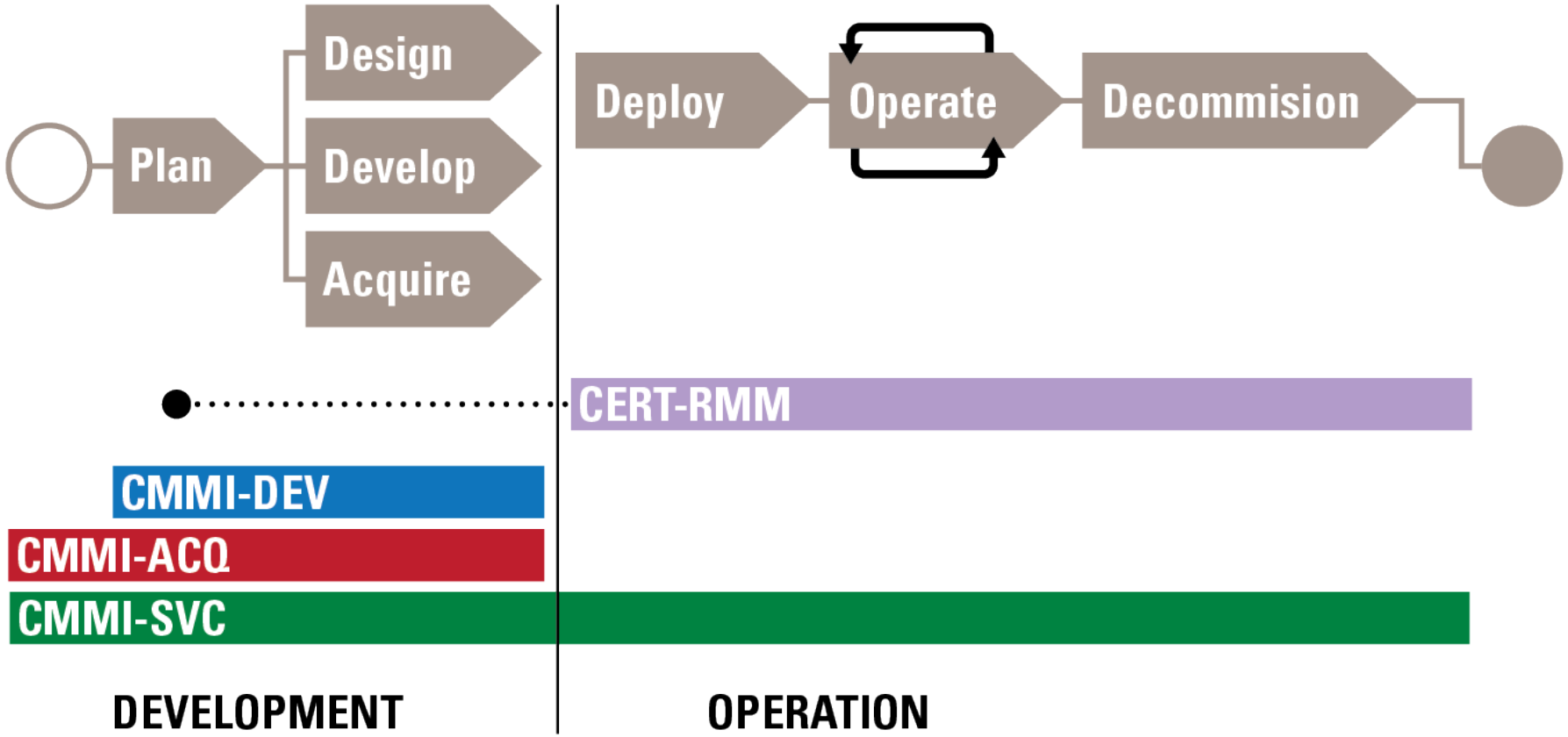
- buy stuff
- specify, solicit, select, contract, procure, accept, transition to consumer

Services (CMMI-SVC)

- do stuff
- intangible, non-storable products delivered via a service system based on explicit or implicit service requests

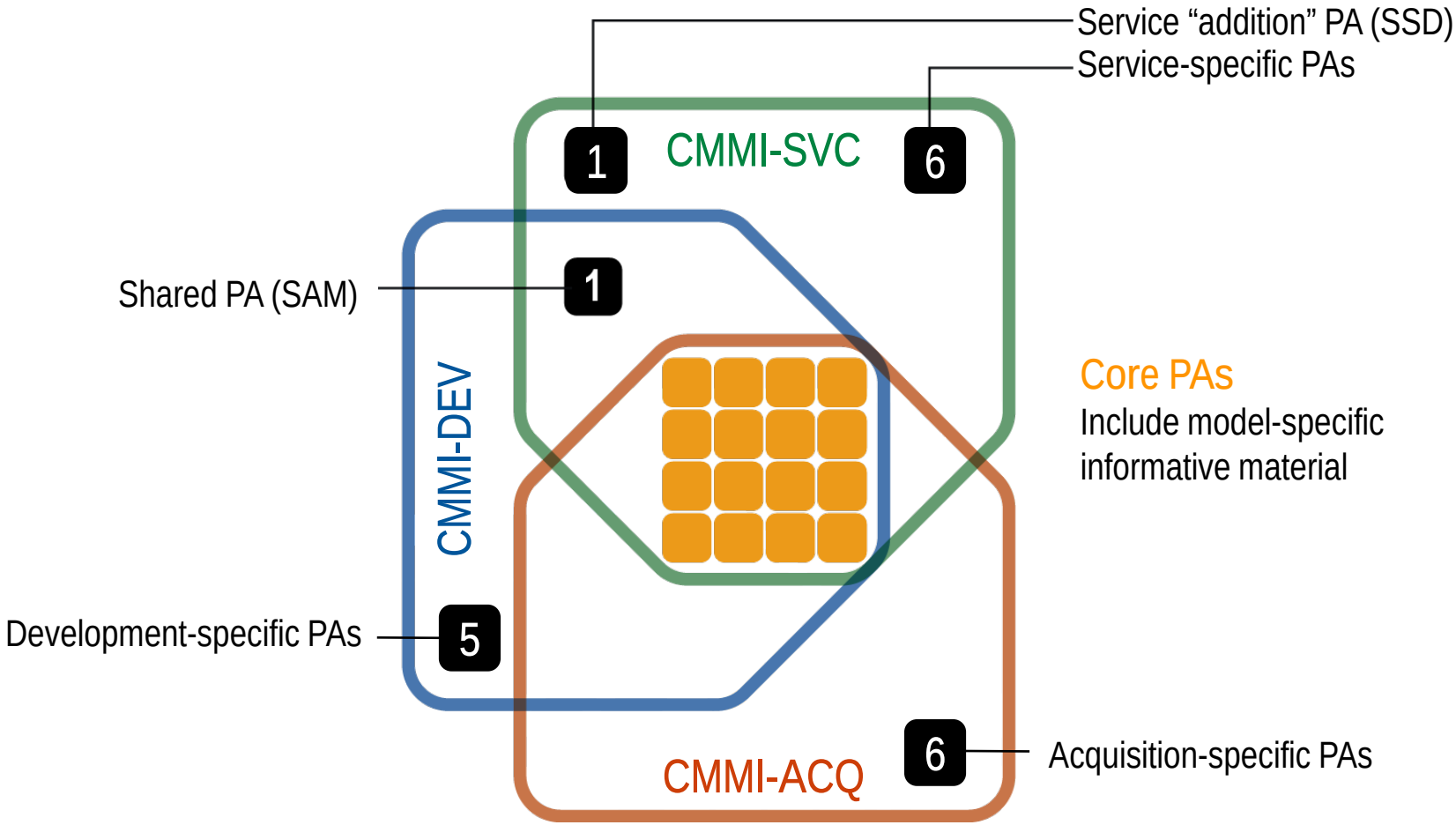
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RMM & CMMI in the life cycle



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Relationships Among CMMI Models



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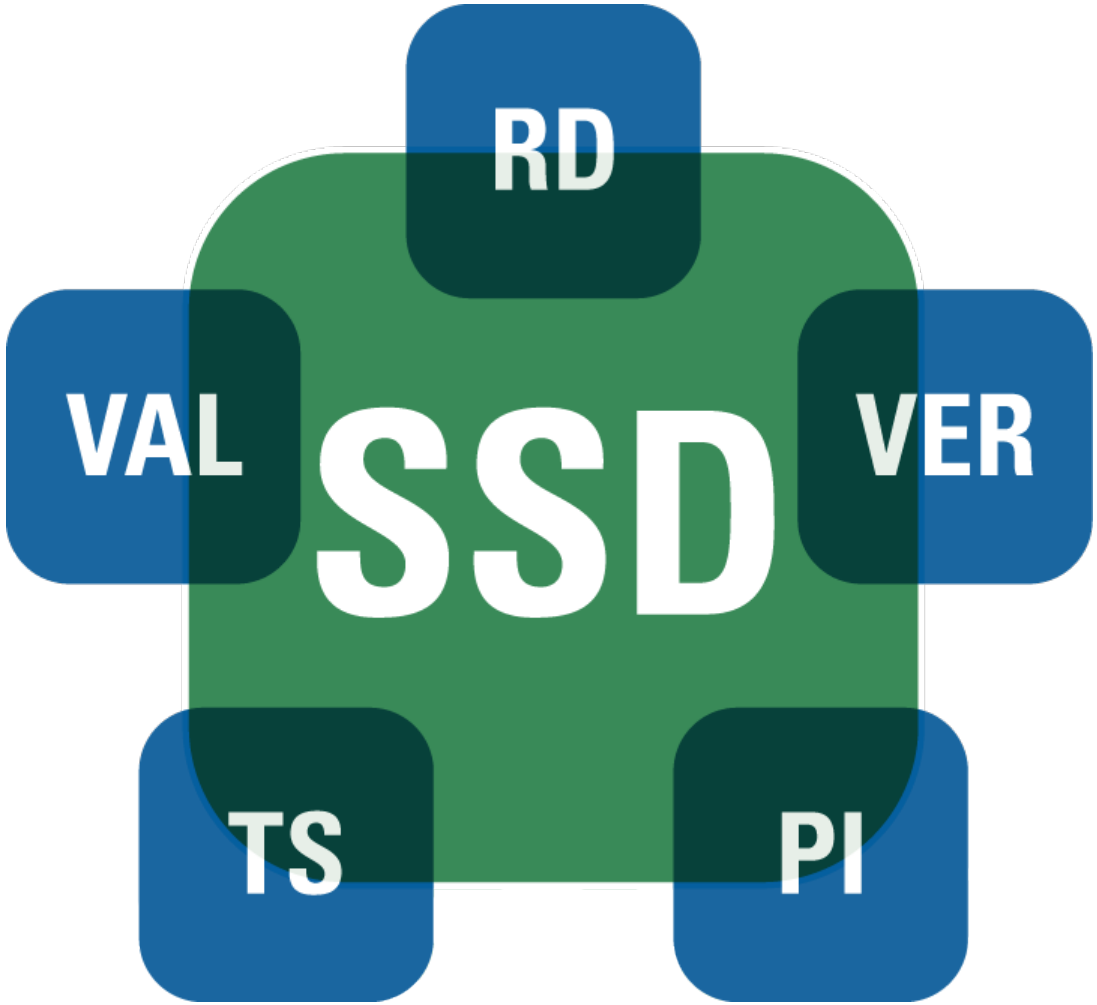
What about Software?

"CEOs don't buy software anymore…they buy service level agreements"

– George Fischer, EVP and Group Executive for CA Technologies, Speaking at NASSCOM and SEPG AP

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SSD “Summarizes” CMMI-DEV Engineering PAs



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SSD vs. CMMI-DEV Engineering PAs 1 of 4

In SSD (SVC)	In Engineering (DEV)	
SG1 Stakeholder needs, expectations, constraints, and interfaces are collected, analyzed, and transformed into validated service system requirements.	**RD – Requirements Development**	
SP1.1 Collect and transform stakeholder needs, expectations, constraints, and interfaces into prioritized stakeholder requirements.	**RD SG 1** Stakeholder needs, expectations, constraints, and interfaces are collected and translated into customer requirements.	**SP 1.1** Elicit Needs **SP 1.2** Transform Stakeholder Needs into Customer Requirements
SP1.2 Refine and elaborate stakeholder requirements to develop service system requirements.	**RD SG 2** Customer requirements are refined and elaborated to develop product and product component requirements.	**SP 2.1** Establish Product and Product Component Requirements **SP 2.2** Allocate Product Component Requirements **SP 2.3** Identify Interface Requirements
SP1.3 Analyze and validate requirements, and define required service system functionality and quality attributes.	**RD SG 3** The requirements are analyzed and validated.	**SP 3.1** Establish Operational Concepts and Scenarios **SP 3.2** Establish a Definition of Required Functionality and Quality Attributes **SP 3.3** Analyze Requirements **SP 3.4** Analyze Requirements to Achieve Balance **SP 3.5** Validate Requirements

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SSD vs. CMMI-DEV Engineering PAs 2 of 4

In SSD (SVC)	In Engineering (DEV)	
SG 2 Service system components are selected, designed, implemented, and integrated.	**TS - Technical Solution** **PI - Product Integration**	
SP 2.1 Select service system solutions from alternative solutions.	**TS SG1** Product or product component solutions are selected from alternative solutions.	**SP 1.1** Develop Alternative Solutions and Selection Criteria **SP 1.2** Select Product Component Solutions
SP 2.2 Develop designs for the service system and service system components.	**TS SG 2** Product or product component designs are developed.	**SP 2.1** Design the Product or Product Component **SP 2.2** Establish a Technical Data Package **SP 2.3** Design Interfaces Using Criteria **SP 2.4** Perform Make, Buy, or Reuse Analyses
SP 2.3 Manage internal and external interface definitions, designs, and changes for service systems.	**PI SG 1** Preparation for product integration is conducted. **PI SG 2** The product-component interfaces, both internal and external, are compatible.	**SP 1.1** Establish an Integration Strategy **SP 1.2** Establish the Product Integration Environment **SP 1.3** Establish Product Integration Procedures and Criteria **SP 2.1** Review Interface Descriptions for Completeness **SP 2.2** Manage Interfaces

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SSD vs. CMMI-DEV Engineering PAs 3 of 4

In SSD (SVC)	In Engineering (DEV)	
SP 2.4 Implement the service system design.	**TS SG 3** Product components, and associated support documentation, are implemented from their designs.	**SP 3.1** Implement the Design **SP 3.2** Develop Product Support Documentation
SP 2.5 Assemble and integrate implemented service system components into a verifiable service system.	**PI SG 3** Verified product components are assembled and the integrated, verified, and validated product is delivered.	**SP 3.1** Confirm Readiness of Product Components for Integration **SP 3.2** Assemble Product Components **SP 3.3** Evaluate Assembled Product Components **SP 3.4** Package and Deliver the Product or Product Component

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SSD vs. CMMI-DEV Engineering PAs 4 of 4

In SSD (SVC)	In Engineering (DEV)	
SG 3 Selected service system components and services are verified and validated to ensure correct service delivery.	**VER – Verification** **VAL – Validation**	
SP 3.1 Establish and maintain an approach and an environment for verification and validation.	**VER SG 1** Preparation for verification is conducted. **VAL SG 1** Prepare for validation is conducted.	**VER SP 1.1** Select Work Products for Verification **VER SP 1.2** Establish the Verification Environment **VER SP 1.3** Establish Verification Procedures and Criteria **VAL SP 1.1** Select Products for Validation **VAL SP 1.2** Establish the Validation Environment **VAL SP 1.3** Establish Validation Procedures and Criteria
SP 3.2 Perform peer reviews on selected service system components.	**VER SG 2** Peer reviews are performed on selected work products.	**VER SP 2.1** Prepare for Peer Reviews **VER SP 2.2** Conduct Peer Reviews **VER SP 2.3** Analyze Peer Review Data
SP 3.3 Verify selected service system components against their specified requirements.	**VER SG 3** Selected work products are verified against their specified requirements.	**VER SP 3.1** Perform Verification **VER SP 3.2** Analyze Verification Results
SP 3.4 Validate the service system to ensure that it is suitable for use in the intended delivery environment and meets stakeholder expectations.	**VAL SG 2** The product or product components are validated to ensure they are suitable for use in their intended operating environment.	**VAL SP 2.1** Perform Validation **VAL SP 2.2** Analyze Validation Results

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Different Names and Abbreviations of Some Core PAs

SVC	DEV
Work Planning (WP)	Project Planning (PP)
Work Monitoring and Control (WPM)	Project Monitoring and Control (PMC)
Integrated Work Management (IWM)	Integrated Project Management (IPM)
Quantitative Work Management (QWM)	Quantitative Project Management (QPM)

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Differences in PAs and Categories

CMMI-SVC PAs by Category

Process Management

OPD OPF OPM OPP OT

Project and Work Management

CAM IWM REQM RSKM QWM

SCON SAM WMC WP

Support

CAR CM DAR MA PPQA

Service Establishment and Delivery

IRP SD SSD SSM SST

CMMI-DEV PAs by Category

Process Management

OPD OPF OPM OPP OT

Project Management

IPM REQM RSKM QPM

SAM PMC PP

Support

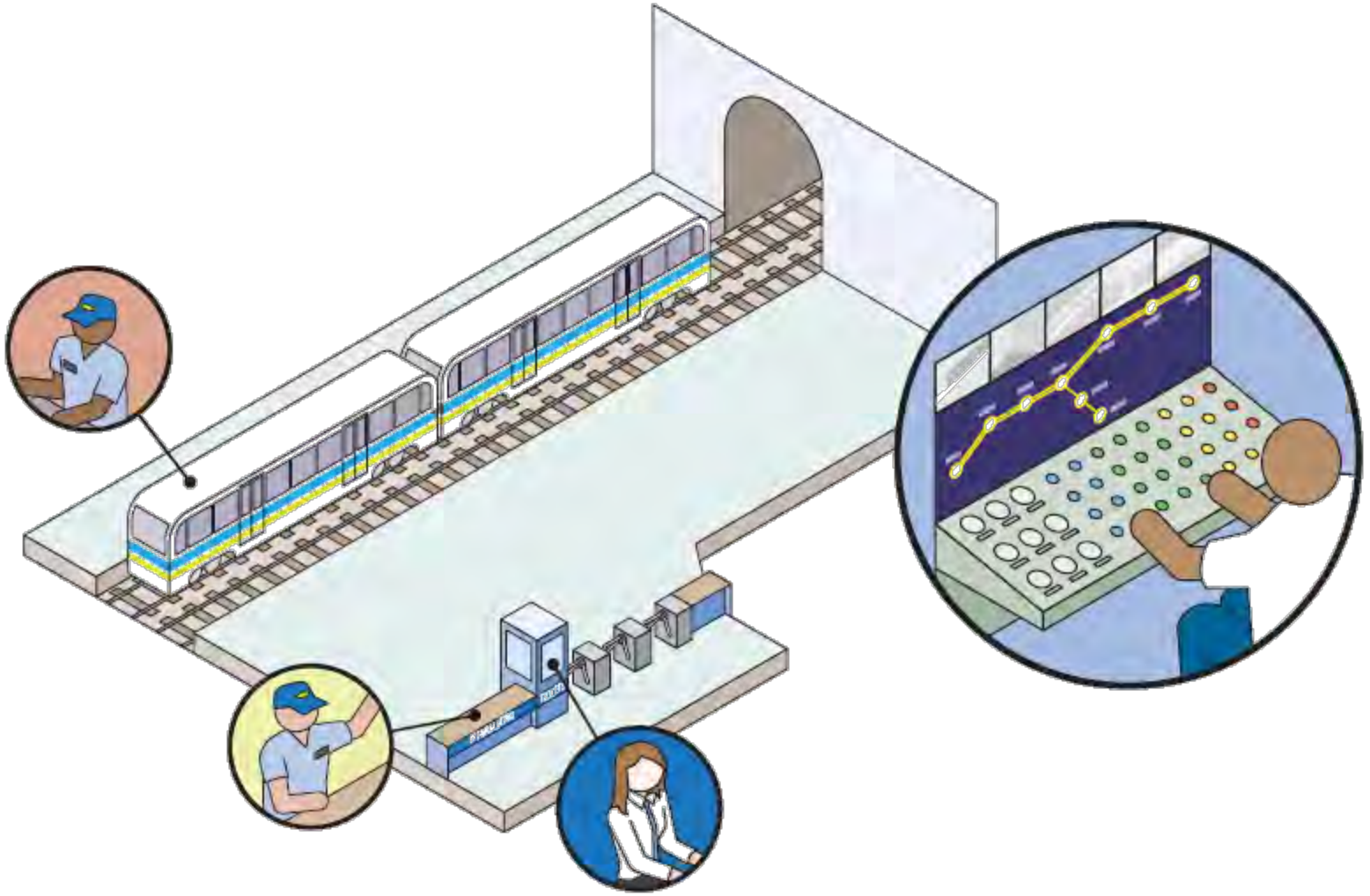
CAR CM DAR MA PPQA

Engineering

PI RD TS VAL VER

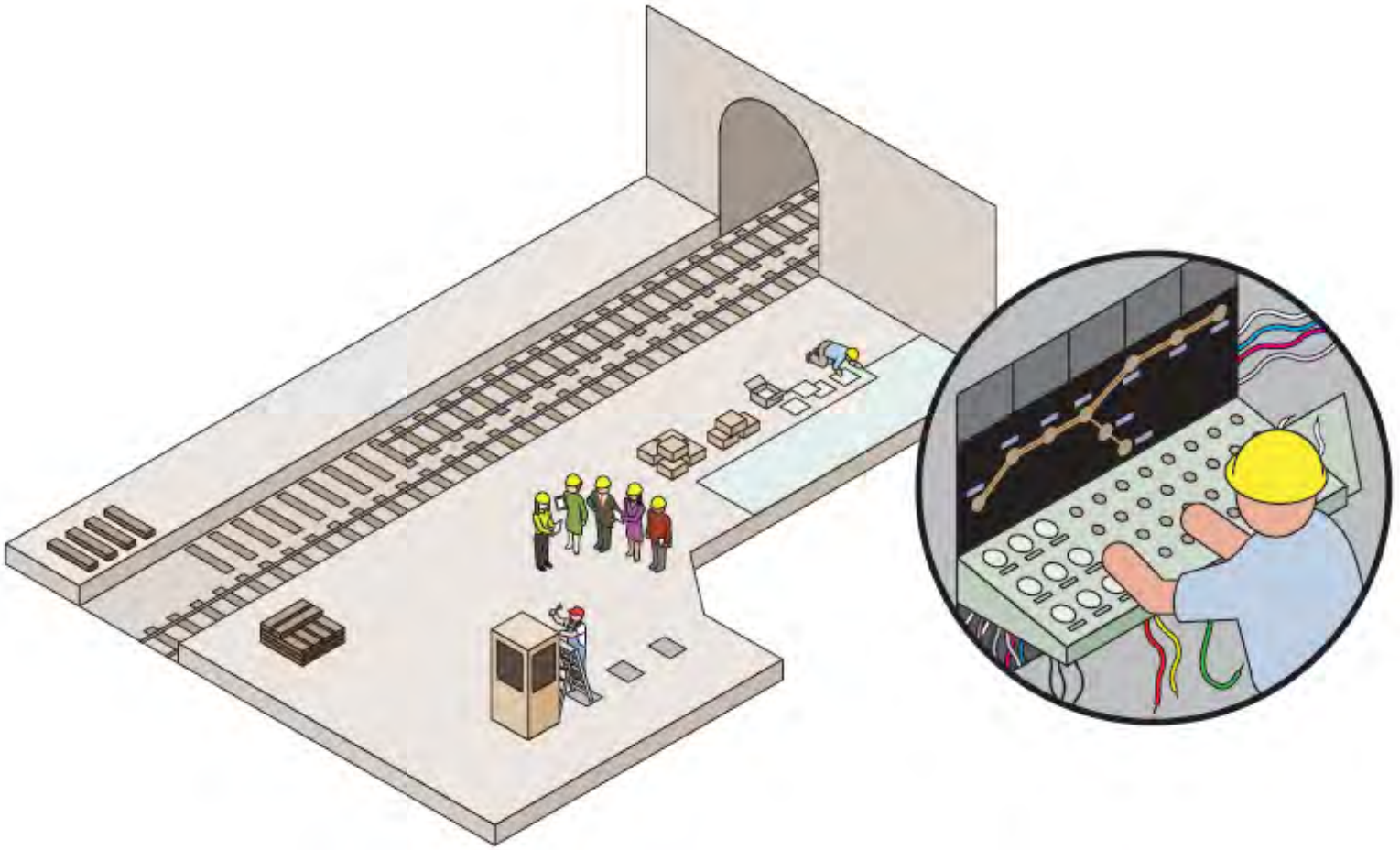
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One Example Group: Urban Transit Authority



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Another Group: Suppliers of Trains, Control Systems, Entry Gates, etc.



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Transit Authority vs. Equipment Suppliers: What Do They Have in Common?

Both are trying to deliver value to a customer.

Both need to understand the customer's needs.

Both need to plan a solution to those needs.

Both need to validate and deliver that solution.

Both need good results to stay in business.

Other ideas?

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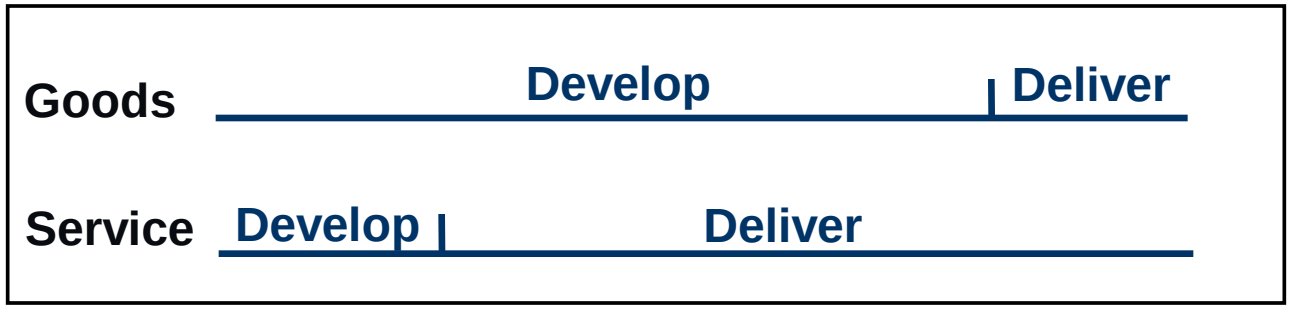
Transit Authority vs. Equipment Suppliers: How Do They Differ?

Transit Authority

- delivered solution is intangible, non-storable
- ongoing relationship based on a service agreement
- services often simultaneously produced and consumed
- more time spent on delivery

Equipment Suppliers

- delivered solution is a tangible, physical
- fixed-term relationship based on a delivery contract
- delivery of product generally takes place after development (and maybe after manufacturing)
- more time spent on development



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Differences in Process Improvement Between Services and Development

Services

- Changes are made to the service system, which immediately affects delivery of services to customer.
- Performance of the service system is inseparable from quality of service.
- Feedback from service users to providers is typically direct and rapid.
- Repeated service delivery provides numerous and frequent opportunities to measure.

Development

- Changes are made to development methods and tools, but impacts may not be visible to the customers until later product deliveries.
- The distinction between development process performance and product performance is clear.
- Feedback from product end users to developers is often indirect and slow.
- Longer development cycles provide more limited and less frequent opportunities to measure.

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How Might Services PAs Help Development?

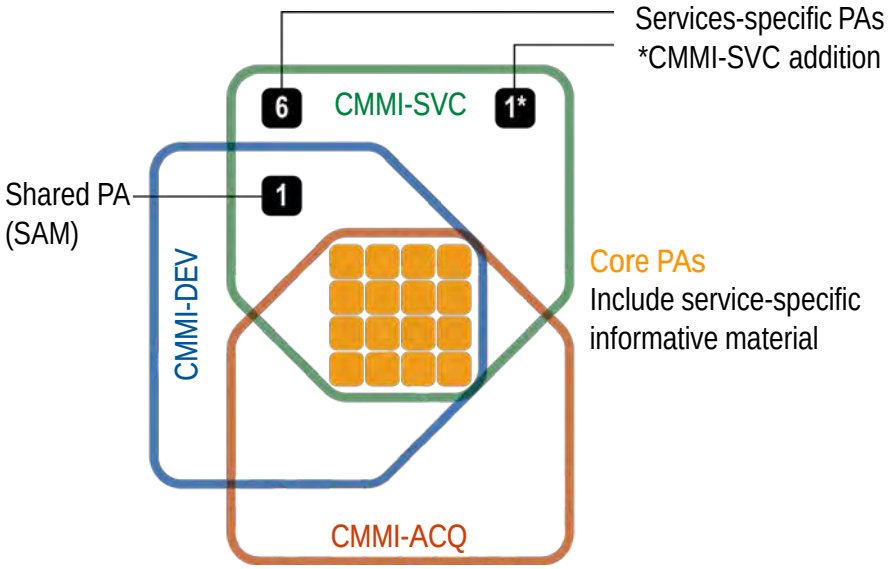
Although they are not included in the CMMI-DEV model, each of the following CMMI-SVC process areas could be used by a development group:

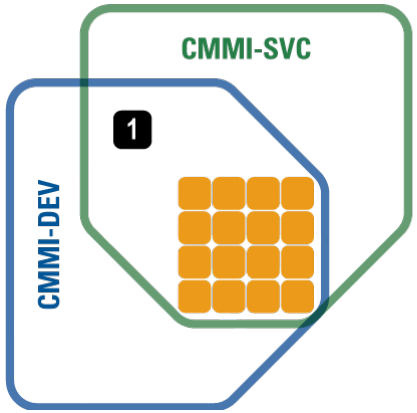
- Capacity and Availability Management
- Service Continuity
- Incident Resolution and Prevention
- Service System Transition
- Strategic Service Management

We have examples of high maturity development organizations doing system of systems engineering who are finding the CMMI-SVC PAs add new capability.

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A Look at CMMI-SVC





CAM Capacity and Availability Management

IRP Incident Resolution & Prevention

SCON Service Continuity

SD Service Delivery

STSM Strategic Service Management

SST Service System Transition

SSD Service System Development

Define, and Establish, and Deliver Services

SD REQM WP SSD

Monitor and Control Service and Work Products

CAM WMC CM

Ensure Service Mission Success

IRP RSKM SCON SST

Make Work Explicit and Measurable

MA OPP QWM CAR OPM

Manage Decisions, Suppliers, and Standard Services

SAM DAR STSM

Create a Culture to Sustain Service Excellence

PPQA OPD IWM OT OPF

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Another look at STSM

Strategic Service Management (STSM):

STSM is about portfolio management or deciding what services you should be providing, making them standard, and letting people know about them.

Why do the practices in STSM? Because you have standard services, developing new services is faster and cheaper. You can increase business capture and market share. You and your customers agree about what you have to offer.

In an engineering services context:

- For a customer-intensive service like this, it's tempting to do anything asked. Using the practices of this PA to get clear about what offerings are in your best interest along with your clients' interests can give you business advantage. Retire and improve services as well as adding to your catalogue.
- Describing your offerings appropriately for your customers may be obvious. Less obvious are the benefits from being disciplined inside your engineering service company about what products you offer and why—good internal descriptions can help to foster that discipline.

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You run a service group inside a larger company.

You are thinking of applying the practices of STSM in your organization.

Do you have to wait for “corporate” to build their service catalog before you build one?

1	No
2	Yes
5	Not Sure

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Another look at SD

Service Delivery (SD):

SD is about setting up agreements, taking care of service requests, and operating the service system.

Why do the practices in SD? You and your customer have the same expectations, your services are consistent and cost-effective, and customers know how to make requests.

In an engineering services context:

- Service agreements often begin during the proposal period and are refined after a win. They should also be maintained regularly.
- Thinking of “readiness” of your service system as an ongoing quality attribute, not something done just at the beginning of an engagement. This orientation is one of the key differences between service and development, and particularly likely when your service is related to development.
- Request management appears to be one of the strong leverage points for business results in this type of service.

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Another look at CAM

Capacity and Availability Management (CAM):

CAM is about making sure you have the resources you need to deliver services and that they are available when needed—at an appropriate cost.

Why do the practices in CAM? Customer satisfaction is increased because of high availability of service. Your costs are managed and the risk of service failure is reduced.

In an engineering services context:

- Like other people-intensive services, treating your people as the key resource that concerns you for capacity and availability will be part of your CAM strategy. In addition to number and availability of staff, skill availability is also crucial.
- Patterns of surge and lag times, and issues like overwork for favorite or productive or skilled staff deserve attention.

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Another look at SSD

Service System Development (SSD):

SSD is about making sure you have everything you need to deliver the services, including people, processes, consumables, and equipment.

Why do the practices in SSD? You anticipate service requirements and avoid costly changes. The service system does what is required for both the service provider and customer.

In an engineering services context:

- You probably have a service system that is enterprise wide, or specific to a product line, or in some way larger than one engagement or customer. The practices in this PA should also be used to alter, adjust, or tailor for individual agreements.
- This PA, and its wording that relies heavily on IT and engineering can be difficult or misleading for services that are NOT based in engineering; here's one place in the model where engineering services has an advantage!

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When to use Service System Development (SSD)

Engineering PAs in DEV are recommended for improving product development process, large complex systems, and those very familiar with DEV.

Using SSD may be preferred by service provider organizations that are new to CMMI—especially those organizations with simple services.

Even organizations that use the CMMI-DEV model for service system development may refer to the SSD process area for helpful guidance on applying development practices to service system parts like people, processes, and consumables.

Two places in the model to look for help for small, simple services if SSD is too much:

- Goal 2 in Service Delivery
- SP 1.3 in IWM, Establish the Project's Work Environment

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SAM is to CMMI-ACQ as ____ is to CMMI-DEV

1	SD
2	CAM
3	SST
4	SSD
5	I don't have a clue

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Your service is vehicle maintenance.

Though maintenance is your major service, occasionally you build a small widget and install it on the vehicles you maintain. You are arguing with your process improvement consultant about which model content to apply, partly because you have a SCAMPI appraisal coming, and she wants you to do well. What model content would you apply in your context?

1	SSD can be applied to developing the widget.
2	SSD covers the service system, but engineering PAs should be used for developing the widget.
3	Engineering PAs could be used for widget and service system.
4	What does it matter? Apply whichever practices help us to improve. Ignore the appraisal.
5	This kind of question is what makes me crazy about CMMI.

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Another look at SST

Service System Transition (SST):

SST is about getting new systems in place, changing existing systems, or retiring obsolete systems—all while making sure nothing goes terribly wrong with the service.

Why do the practices in SST? Your service delivery doesn't degrade when you make a major change. You minimize customer and user dissatisfaction and transition smoothly into and out of operations.

In an engineering services context:

- Smoothly handling changes in any component: your people, tools, consumables, and more is an essential element of superior service.
- It's not unusual in this service to take over from or hand over to another vendor. You also must end your service gracefully. All of these conditions are aided by the practices in SST.
- For all service types, including stakeholders appropriately during transition is a capability that distinguishes excellent providers from their peers.

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Another look at SCON

Service Continuity (SCON):

SCON is about being ready to recover from a disaster and get back to delivering your service.

Why do the practices in SCON? After 9/11 and Katrina, service businesses have proof that those who prepare for disaster are better able to recover and stay in business.

In an engineering services context:

- It may be tempting to think this business is relatively resilient to disastrous disruption. With recent natural disasters, it may look different now. With a community disaster, even if you've considered your essential resources and dependencies, can you withstand a protracted delay in getting back to business?
- With people being the key resource, how can you equip them to be resilient to a range of disasters or significant disruptions?

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Another look at IRP

Incident Resolution and Prevention (IRP):

IRP is about handling what goes wrong—and preventing it from going wrong before it occurs if you can.

Why do the practices in IRP? Services can continue, even when something goes wrong, because you know how to work around incidents. You address underlying causes of incidents so that you reduce costs and other adverse impacts.

In an engineering services context:

- Stay clear that "incidents" are disruptions to your engineering service, not bugs or defects you may hired to find or resolve.
- Have a strategy for deciding what to work around and what calls for root cause analysis and prevention.

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CMMI-SVC Service PAs in Plain Language

Capacity and Availability Management (CAM):

making sure you have enough of the resources you need to deliver services and that they are available when needed—at an appropriate cost

Incident Resolution and Prevention (IRP):

handling what goes wrong—and preventing it from going wrong ahead of time if you can

Service Continuity Management (SCON):

being ready to recover from a disaster and get back to delivering your service

Service Delivery (SD):

setting up agreements, taking care of service requests, and operating the service system

Service System Development (SSD):

making sure you have everything you need to deliver the service, including people, processes, consumables, and equipment

Service System Transition (SST):

getting new systems in place, changing existing systems, and retiring obsolete systems, all while making sure nothing goes terribly wrong with service

Strategic Service Management (STSM):

deciding what services you should be providing, making them standard, and letting people know about them

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Core and Shared PAs in Plain Language – 1 of 3

Causal Analysis and Resolution (CAR):

getting to the sources of important outcomes and taking effective action to correct or repeat them

Configuration Management (CM)

controlling changes to your crucial work products

Decision Analysis and Resolution (DAR):

using a formal decision making process on the decisions that matter most in your business

Integrated Work Management (IWM):

making the most of your participants and defined processes, even when it's complex

Measurement and Analysis (MA):

knowing what to count and measure to manage your service

Organizational Performance Management (OPM):

managing your improvements and innovations using a statistical understanding of your process performance

Organizational Process Definition (OPD):

establishing standard processes and relaying them throughout your organization

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Core and Shared PAs in Plain Language – 2 of 3

Organizational Process Focus (OPF):

figuring out your current process strengths and weaknesses, planning what to do to improve, and putting those improvements in place

Organizational Process Performance (OPP):

making sure you understand your process performance and how it affects service quality

Organizational Training (OT):

developing the skills and knowledge your people need to deliver superior service

Process and Product Quality Assurance (PPQA):

checking to see that you are actually doing things the way you say you will in your policies, standards, and procedures

Quantitative Work Management (QWM):

managing service to quantitative process and performance objectives

Requirements Management (REQM):

keeping clear with your customers and other stakeholders about the service you provide, and adjusting when you find inconsistency or mismatched expectations

Supplier Agreement Management (SAM):

getting what you need and what you expect from suppliers who affect your service

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Core and Shared PAs in Plain Language – 3 of 3

Risk Management (RSKM):

supporting the success of your service mission by anticipating problems and how you will handle them—before they occur

Work Monitoring and Control (WMC):

making sure what's supposed to be happening in your service work is happening and fixing what isn't going as planned

Work Planning (WP):

estimating costs, effort, and schedules; getting commitment to the work plan; and involving the right people—all while watching your risks and making sure you've got the resources you think you need

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CMMI-DEV Engineering PAs in Plain Language

Product Integration (PI):

putting together all the product components so that the overall product has expected behaviors and characteristics

Requirements Development (RD):

understanding what stakeholders think they need and documenting that understanding for the people who will be designing solutions

Technical Solution (TS):

using effective engineering to build solutions that meet end user needs

Validation (VAL):

making sure that the solution actually meets the needs of users in the service environment

Verification (VER):

making sure that the solution you ended up with meets your agreement about the needs

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Putting All the Pieces Together



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CMMI-SVC is a Perfect Fit



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What's the Summary?

CMMI-SVC has a PA that "summarizes" the engineering PAs in DEV, for those occasions when more detailed practice information is needed.

CMMI-SVC and CMMI-DEV can be used and appraised together.

Development or engineering tasks can be treated as a service, and managed with the practices in CMMI-SVC.

Advanced development may use all of the CMMI-DEV, and then add CMMI-SVC for additional practices: SCON, SST, CAM.

If we take a life cycle view and consider total cost of ownership, may need multiple models, a mash up or composition from CMMI and other models.

Other ideas?

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The Future of CMMI ®

Industry Panel

CMMI Technology Conference and User Group

November 15, 2011

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The Future of CMMI - Panel

National Defense Industrial Association

Introduction:

- How well does CMMI meet the needs of your organizations, and the marketplace in general?
- What works? What doesn't? Where does CMMI need to go to better fit the needs of organizations in the future?

Format:

- Panelist responses to topic statements
- Open discussion / Q&A

Panelists

- **Mike Campo** (Raytheon Company)
- **Brian Gallagher** (Northrop Grumman)
- **Jim Gill** (The Boeing Company)
- **Lynn Penn** (Lockheed Martin)
- **Rusty Young** (Software Engineering Institute)

Raytheon

Customer Success Is Our Mission

The Future of CMMI®

Michael Campo

Raytheon Integrated Defense Systems

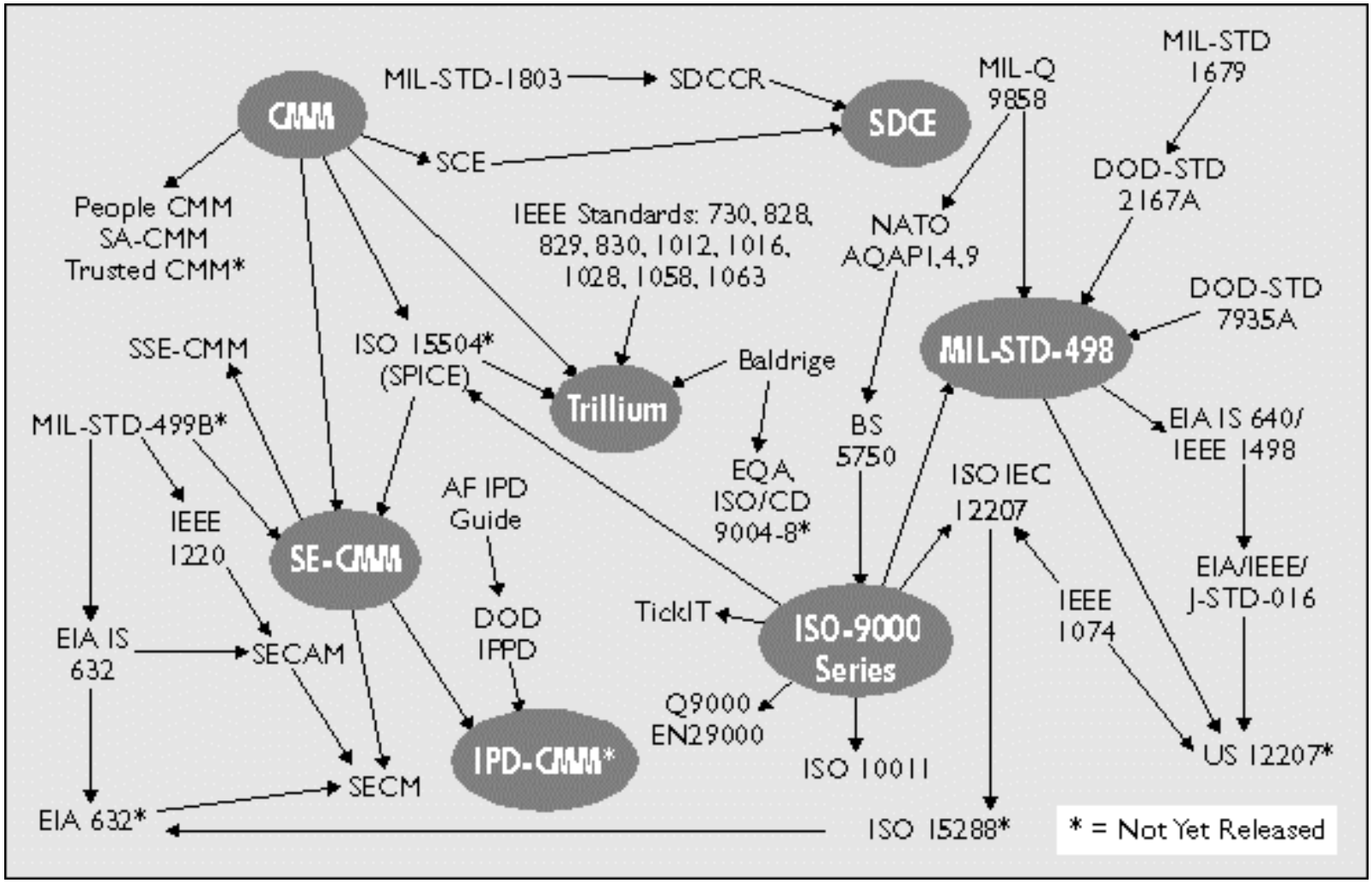
NDIA CMMI® Technology Conference and User Group

November 15, 2011

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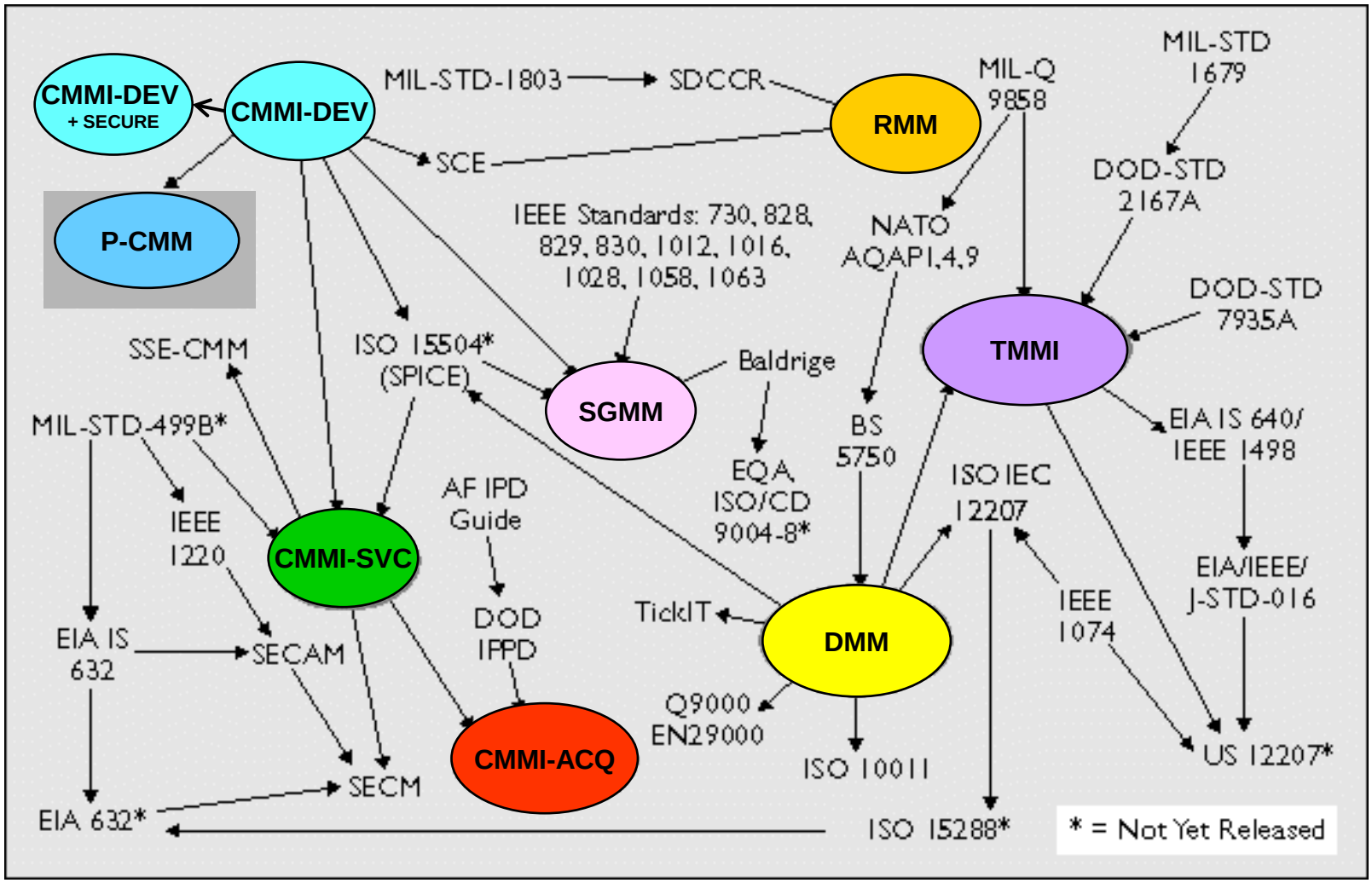
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The Frameworks Quagmire[1]



1. Sheard, Sarah, "The Frameworks Quagmire," *CrossTalk*, STSC, Hill Air Force Base, Utah, Sept. 1997.

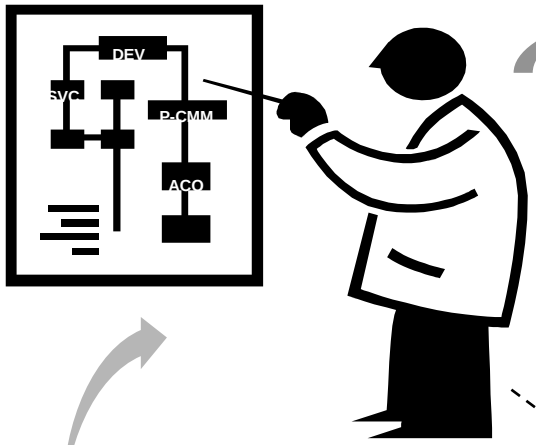
The Framework Quagmire - 2011



Adapted from Sarah Sheard, Software Productivity Consortium

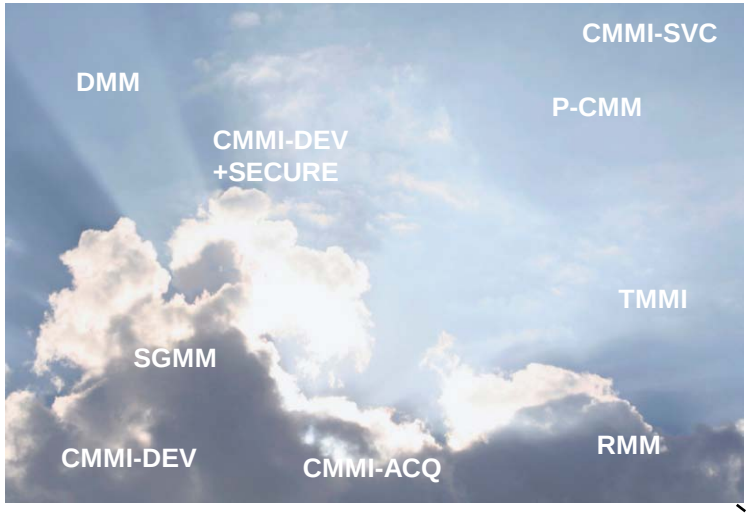
The Future…?

Set configuration flags

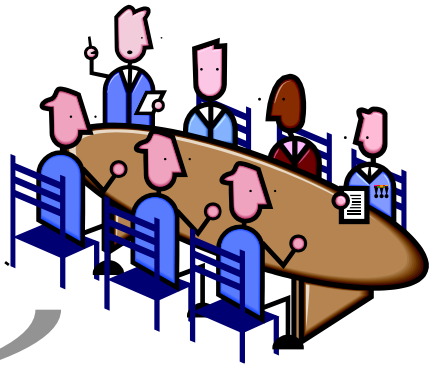


Dynamically create a model

PP DEV, ACQ, SVC	**RD** DEV, ACQ	**TS** DEV, +SECURE	**SD** SVC
REQM DEV, ACQ	**SCON** SVC, RMM	**VER** DEV,TMMI	**CM** DEV, DMM



Conduct one appraisal





Focus on the needs of the organization and its customers



Photo by Michael Campo

NORTHROP GRUMMAN

CMMI User's Group Conference, 2011

November 15, 2011

Brian P. Gallagher
Division Director
Cyber Intelligence Division
Northrop Grumman Information Systems



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NGC
Capabilities at a Glance

NORTHROP GRUMMAN

- Weaponized Platforms
- Resilient Systems

- Weaponized Payloads
- Non-Kinetic Effects
- Secure Supply Chain
- Cyber Capability

- Training Programs
- Facility Staffing

- CND Operations (IC, DoD, Fed)
- Title 50 & Title 10 Operations
- Intelligence Fusion & Analysis
- NCC, Kinetic & Non-Kinetic C2
- Next Generation Networks

Aerospace Systems



Electronic Systems



Technical Services



Information Systems



Integrated Cyber Security Goals and Future Vision

Corporate Cross Sector Initiatives

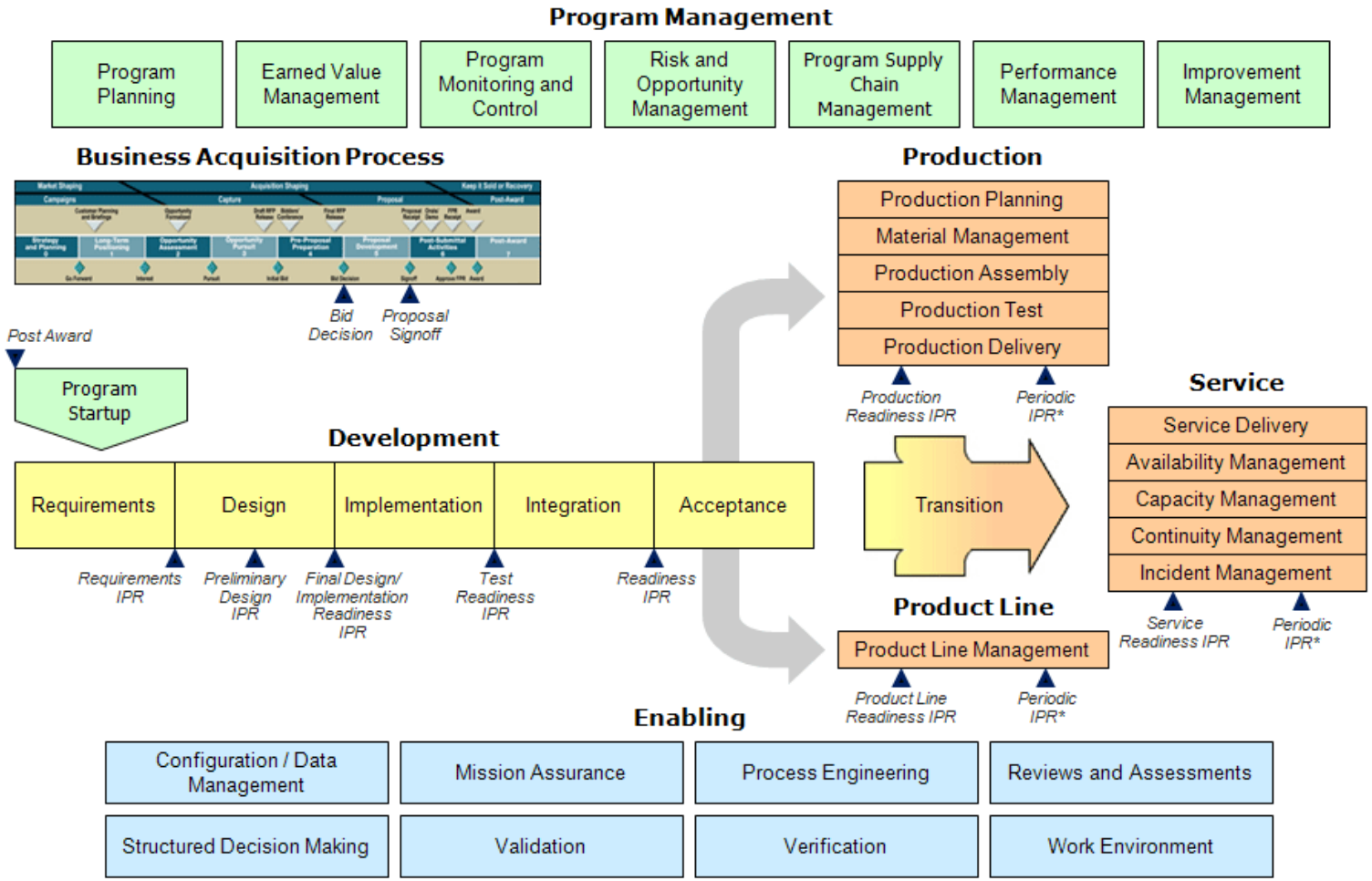
- Project Viceroy
- Project NKE

- Multi-Int, Multi-Sensor Mission Assurance
- Coordinated Non-Kinetic and Kinetic Mission Assurance

Committed to Addressing The Nation's Challenges

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Standardization: The Program Execution Framework (PEF) Reference Model



Reference model shows all activities for all program types

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PEF program types

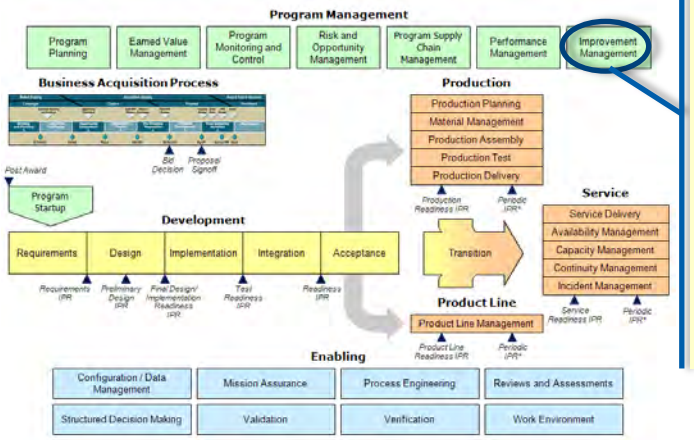
NORTHROP GRUMMAN

1. Product Development. Activities involved in the transformation of customer needs to delivered products or service systems required to deliver services.
2. Product Maintenance. Activities involved in the adaptive, corrective, improvement, enhancement and sustainment of delivered products
3. Production / Manufacturing. Activities to repetitively produce products with no or slight variations on an approved core design.
4. Staff Augmentation. Activities related to providing consulting expertise with process ownership of program management only; delivering hours only. Management of the activities is done by the customer.
5. Professional Services. Activities related to providing services as specified, including ownership of essential processes. Unique program management of the activities is done by NG.
6. IT Managed Services. Activities related to providing Information Technology infrastructure services to organizations.
7. Operations. Operations, routine maintenance, and / or support to accepted, deployed, operational systems.
8. Product Line. Activities to build a set of systems or products sharing a common, managed set of features that satisfy the specific needs of a particular market segment or mission and that are developed from a common set of core assets in a prescribed way.

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NGIS Program Execution Framework (PEF)

NORTHROP GRUMMAN



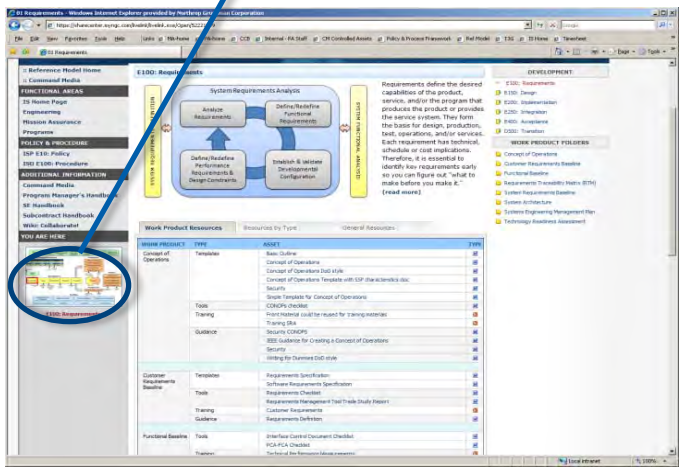
Reference Model defines:
- Core activities for Programs, Engineering, Mission Assurance
- Review gates

Each activity defined by:
- Policy (Command Media ISP)
- Procedure (Command Media ISO)
- Work products and success criteria

NG PM Pro tool encapsulates:
- Program types
- Work products and success criteria
- Business rules to select applicable work product elements, success criteria, and gates

For each activity, T3G defines:
- Templates
- Tools
- Training
- Guidance





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Key Tenets

- Affordability is the practice of ensuring program success through ***the balancing*** of system performance (KPPs), total ownership cost , and schedule constraints ***while satisfying mission needs*** in concert with long-range investment, and force structure plans of the DoD
- To meet these principles we are recommending guidance for *Affordability and SE Tradeoff Analyses* that ***yield visibility*** into the relationship among the life-cycle phases, the KPPs and mission effectiveness. Key issues to be resolved
  - Quality of empirical data for estimation
  - Ensuring compatibility of affordability principles with budget and competitive procurement policies and processes
  - Life-cycle RAA (responsibility, authority & accountability)

Summary

NORTHROP GRUMMAN

- CMMI can help diverse cultures establish a common process framework to enable Program Execution success
- Strong, disciplined acquisition and development processes based on CMMI models (ACQ, DEV, SVC) is essential for meeting affordability challenges

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CMMI User's Group Conference, 2011



November 15, 2011

Brian P. Gallagher
Division Director
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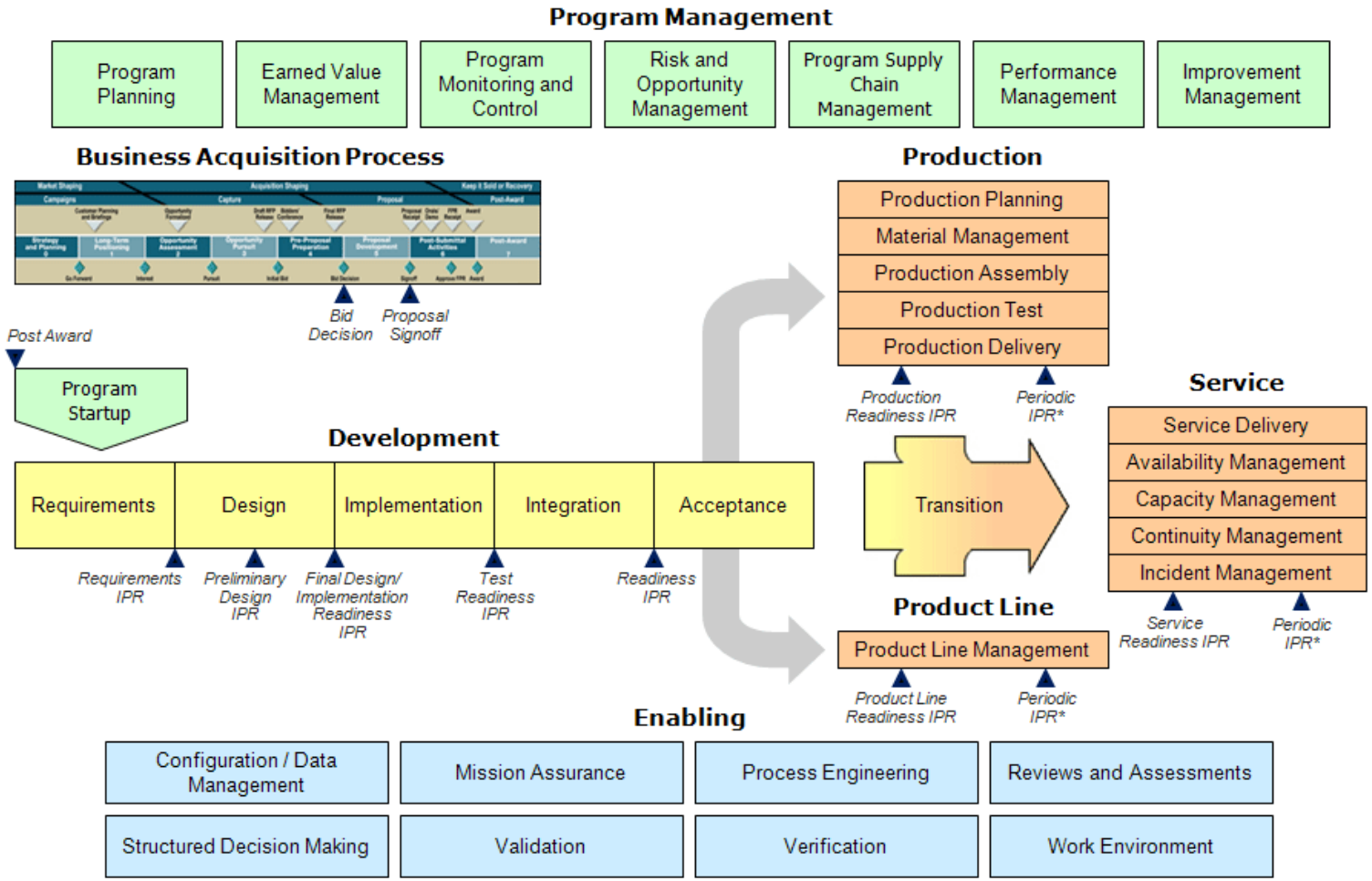
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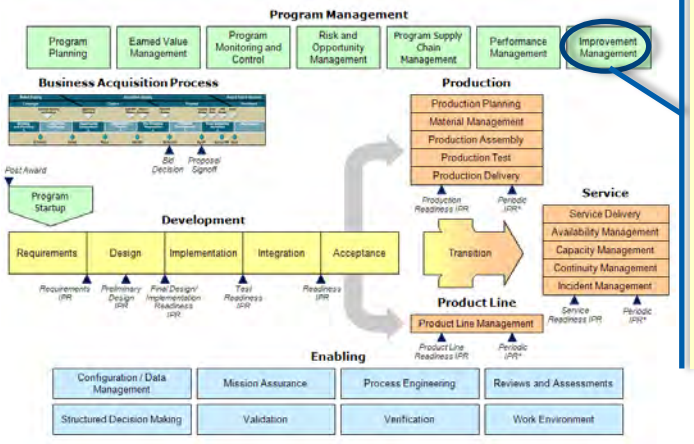
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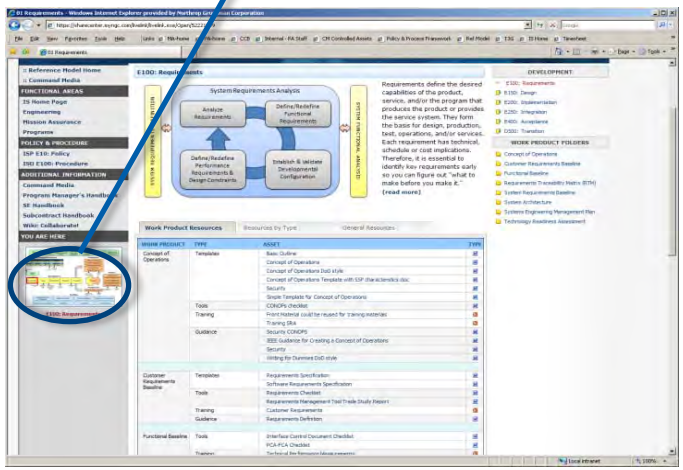
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Complexity and Software: How to Meet the Challenge

NDIA CMMI Technology Conference

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

Paul Nielsen
November 15, 2011

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Overview

Complexity

Software

How to Meet the Challenge

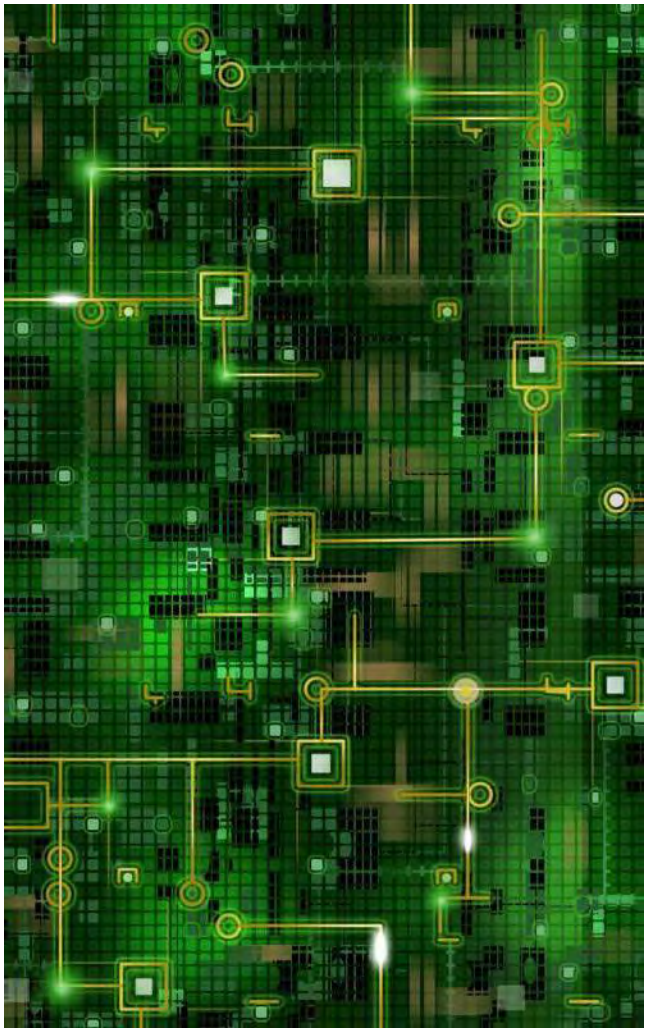
Summary

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Complex Systems

- Complex systems are already woven tightly into our everyday lives
- 21st century systems will be increasingly complex
- How failing to understand them, their risks, and their management challenges poses a 21st-century hazard





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The Rise of Complexity

- Scale
- Interconnectedness
- Autonomy
- Time criticality
- Security
- Safety
- Regulation







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Complexity Brings Rewards – and Perils

Bad things happen when we …

- Misdesign
- Mismanage

… complex systems

Average person does not know or care about root cause of problem in system complexity





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Examples: Good … and Bad









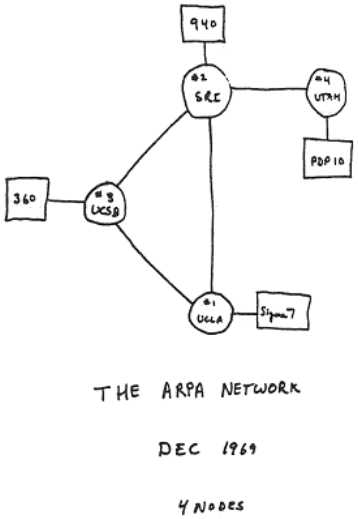




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An Interconnected Society

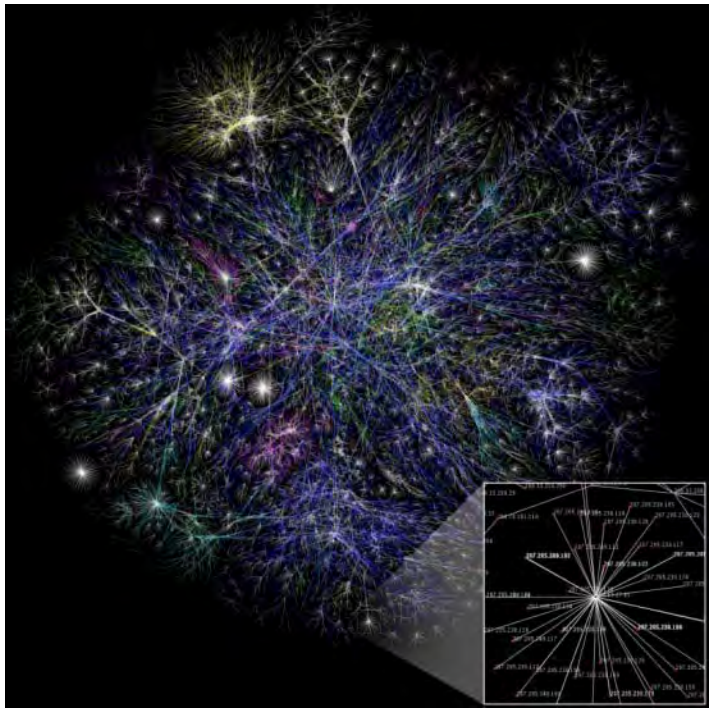




The Internet, 1969



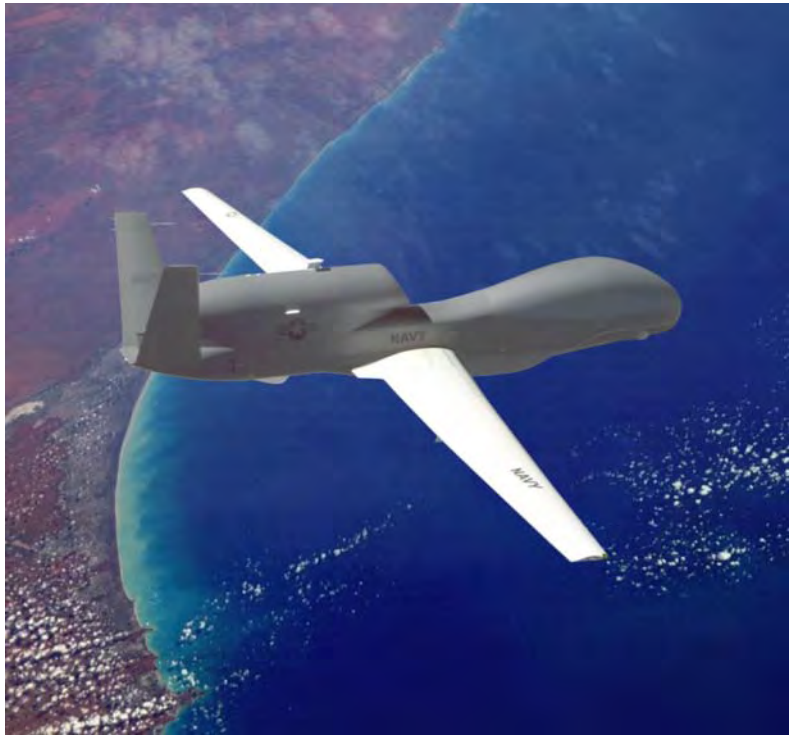
The Internet, Today



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Autonomous Systems



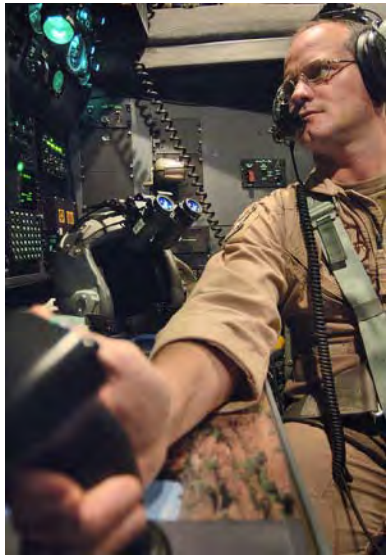




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Human System Interaction









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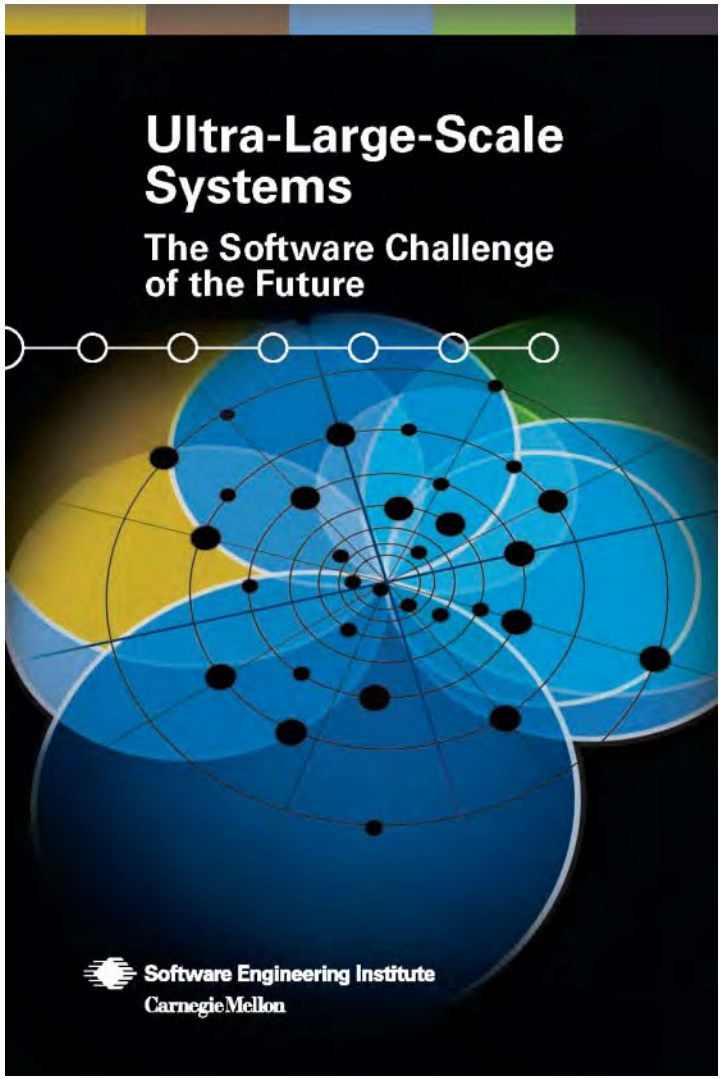
Complex Systems at the SEI

The SEI is at the nexus of systems and complexity:

- We study them side-by-side
- For 25 years, we've been helping engineers design and manage software systems
- It's our job to "ring the bell" on the importance of managing complexity

We also appreciate risk and the importance of managing it

- Process improvement
- Risk management and resilience
- Architectural approaches
- Multi-view models



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Software is Everywhere















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Software is Important



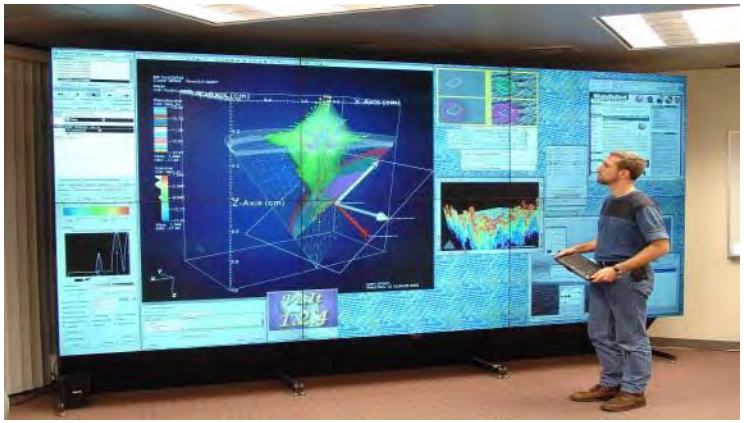
Manufacturing



Finance



Space



Engineering

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Software is Increasingly Complex

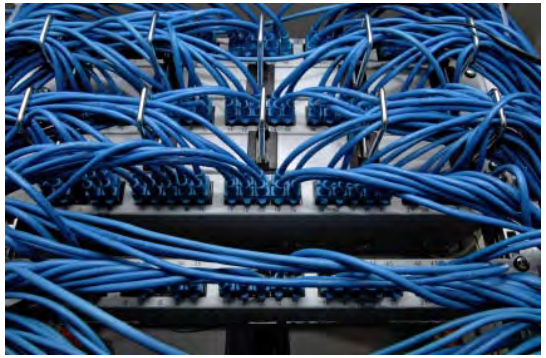








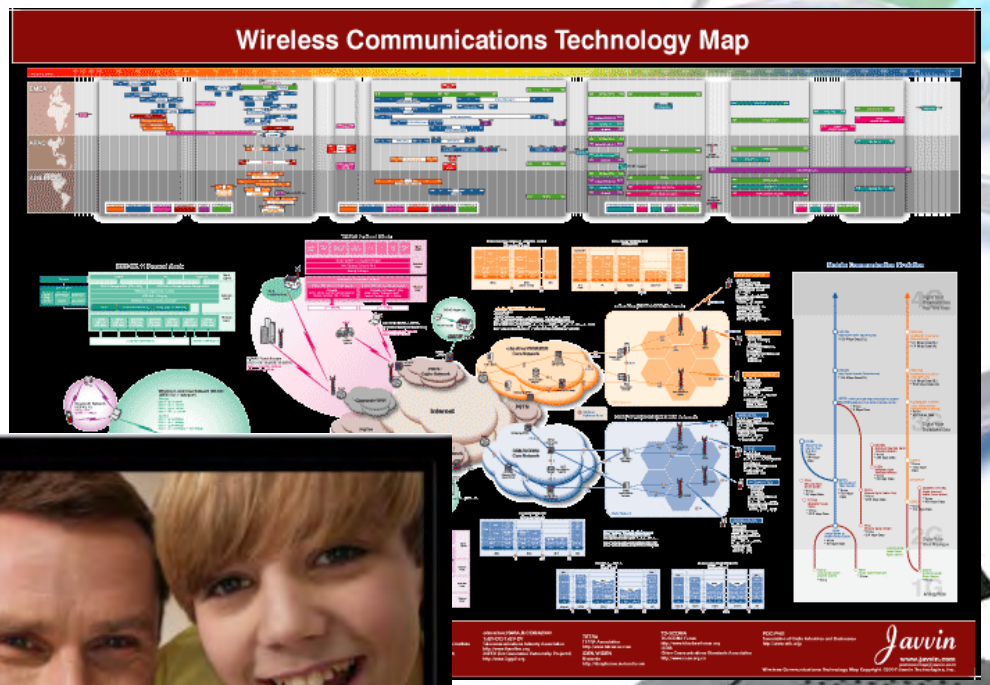




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Software Connects Us









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Software is Becoming More Personal











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“Software is Eating the World”

Marc Andreessen essay, August 20, 2011

- Software is eating the world … it is everywhere
- “A trend I've observed, one that makes me optimistic about the future growth of the American and world economies … “
- “More and more major businesses and industries are being run on software and delivered as online services—from movies to agriculture to national defense.”





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How to Handle Complexity

Models, Process and Process Improvement

Architecture

Risk Management and Resiliency

Evolution and Disruption

People



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Process Improvement, People, and Models

Process Improvement helps us standardize, examine and improve how we work

- Process improvement also lets us learn from others and ourselves

Models help us simplify complex systems and give us insightful views

Process improvement and models are tools for people, not their masters

- People design, develop and operate systems



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Why Use CMMI?

Makes you more competitive
Improves your quality
Links you with a global market
Scales to your needs
Helps you prioritize







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The Key Ideas of CMMI

Elements:

- know your customer
- know your company
- focus on quality
- commit to continuous improvement
- make decisions based on data



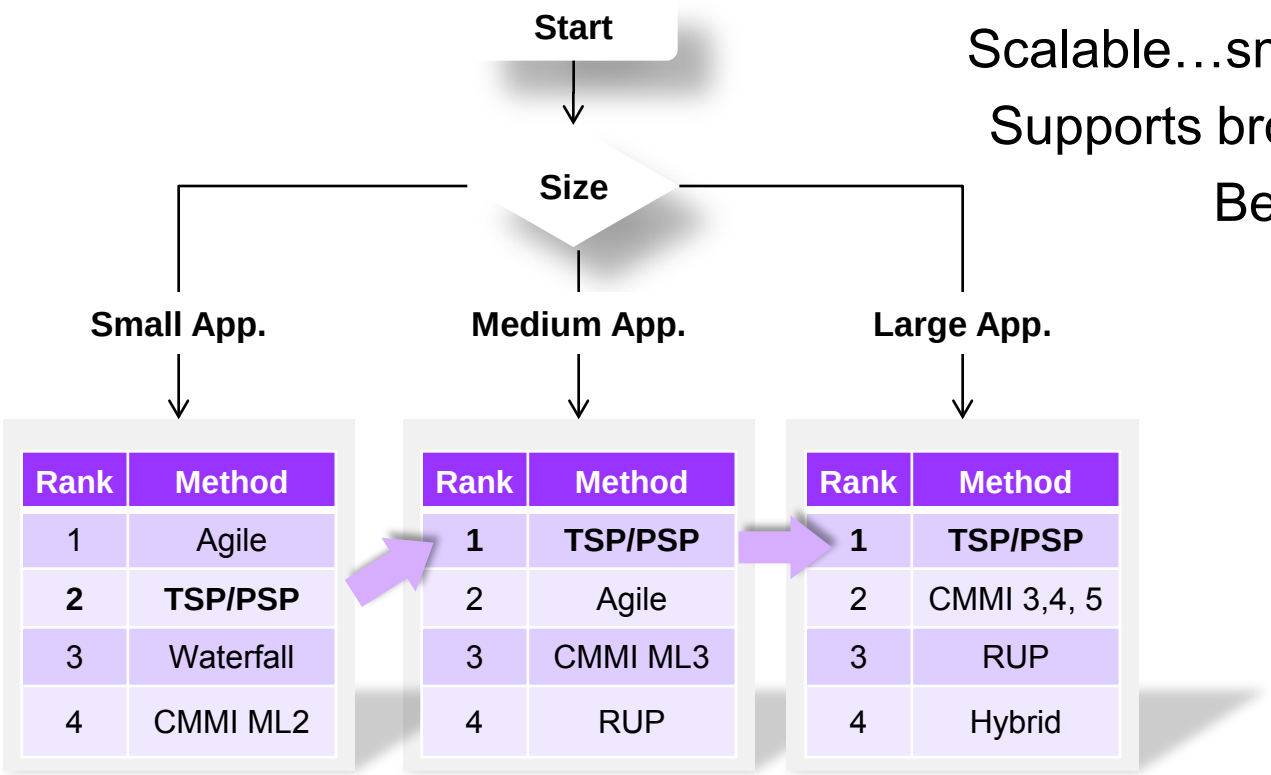
Benefits:

- deliver quality products
- fewer delivered defects
- less rework
- meet schedules
- reduce costs profits
- quicker, more agile cycles
- more business



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TSP – Software Engineering Best Practice



Rank	Method
1	Agile
2	**TSP/PSP**
3	Waterfall
4	CMMI ML2

Rank	Method
1	**TSP/PSP**
2	Agile
3	CMMI ML3
4	RUP

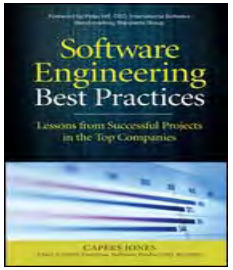
Rank	Method
1	**TSP/PSP**
2	CMMI 3,4, 5
3	RUP
4	Hybrid

Scalable…small to large projects

Supports broad portfolio of work

Best standard practice

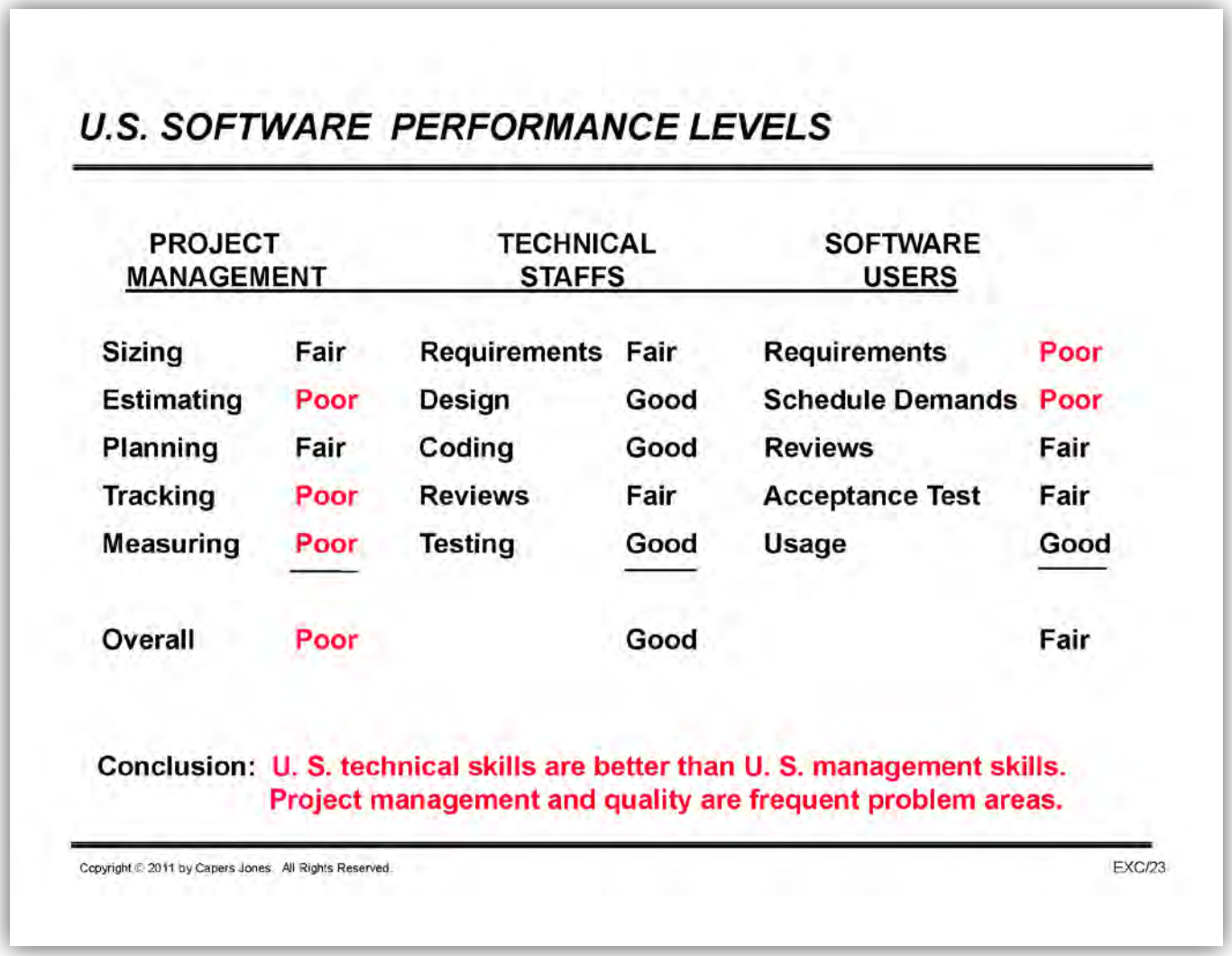
Best development practices by size of application[1]



1. Software Engineering Best Practices, C. Jones, 2010

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Software Engineering Issues in R&D



U.S. SOFTWARE PERFORMANCE LEVELS

PROJECT MANAGEMENT		TECHNICAL STAFFS		SOFTWARE USERS	
Sizing	Fair	Requirements	Fair	Requirements	Poor
Estimating	Poor	Design	Good	Schedule Demands	Poor
Planning	Fair	Coding	Good	Reviews	Fair
Tracking	Poor	Reviews	Fair	Acceptance Test	Fair
Measuring	Poor	Testing	Good	Usage	Good
Overall	Poor		Good		Fair

Conclusion: U. S. technical skills are better than U. S. management skills.
Project management and quality are frequent problem areas.

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EXC/23

From *Team Software Process (TSP) in Context*, by Capers Jones

Accelerated Improvement Method (AIM)

Integrates and Leverages SEI Technologies



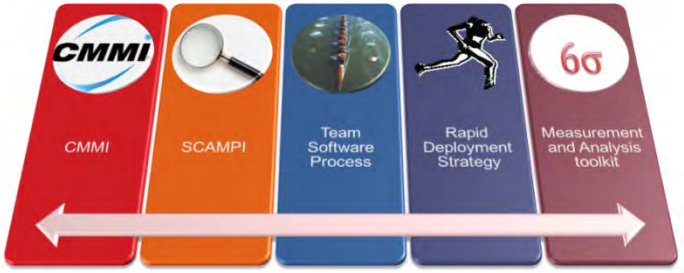
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AIM – Predictably Improves Software Engineering Practice

Summary of field trial results

- rapid deployment – 15 months
- tactical project-focused approach
- supports implementation in-progress on critical software engineering projects
- predictable improvement timeline and cost
- faster, higher ROI addresses “no-time” and “can’t afford” barriers to change
- same TSP performance benefits

AIM Results	CGI Results	Typical Range
CMMI-DEV ML1 to ML3 (months)	15	36 to 48
Schedule Variance	<10%	25% to 100%
Effort Variance	7%	25% to 100%
Productivity	up 35%	
Quality (defects)	down 50%	



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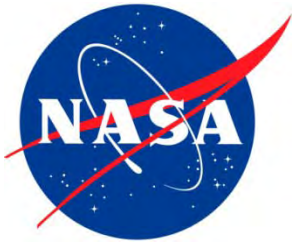
Architecture is Important

The quality and longevity of a software-reliant system is largely determined by its architecture.

In recent studies by OSD, the National Research Council, NASA, and the NDIA, architectural issues are identified as a systemic cause of software problems in DoD systems.



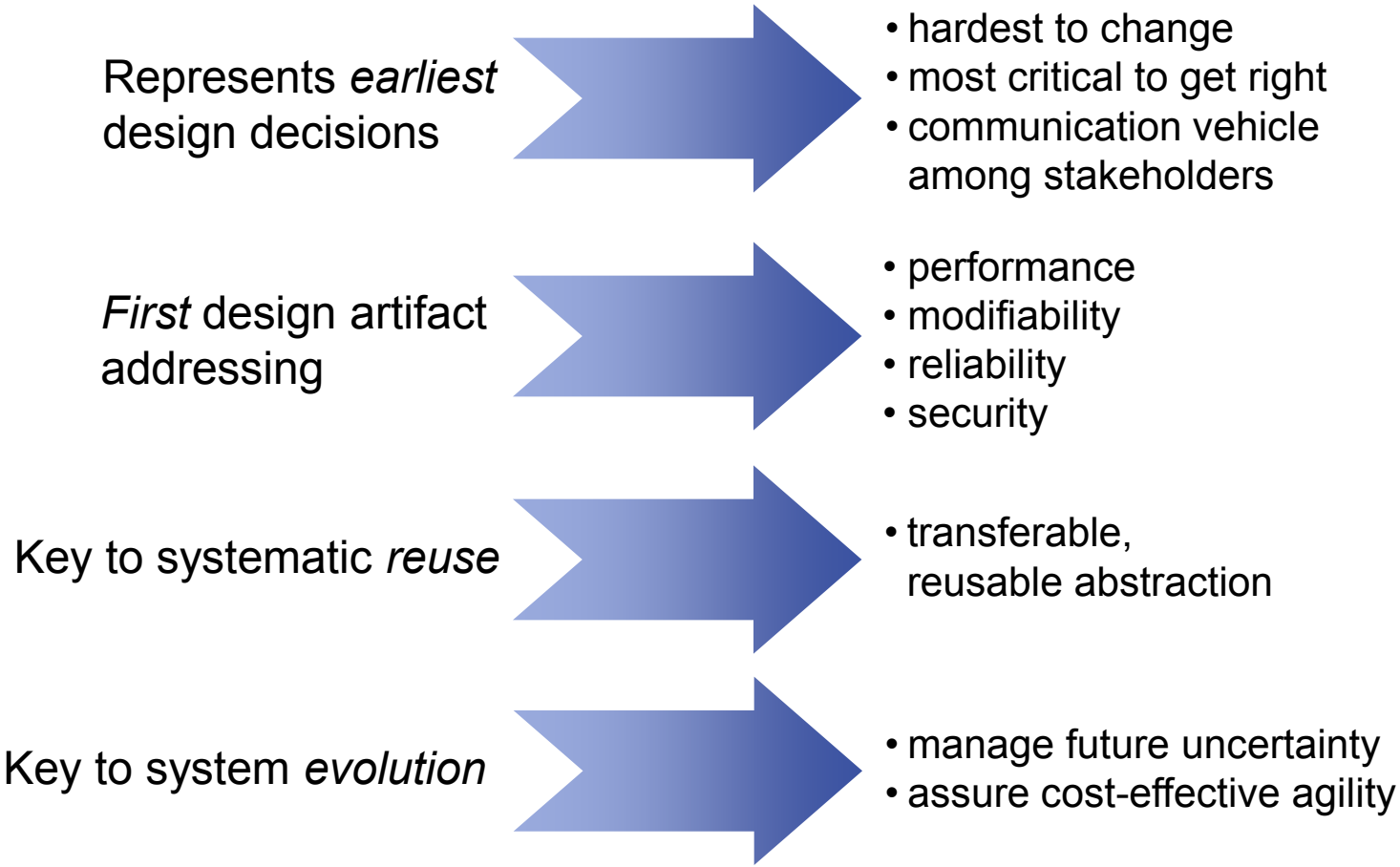
NDIA
National Defense Industrial Association



NRC The National Research Council

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Why is Software Architecture Important?



The right architecture paves the way for system success.
The wrong architecture usually spells some form of disaster.

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Trends Leading to Architecture Challenges

Scale and complexity

Increased operational tempo

Decentralization and distribution

Disruptive technologies

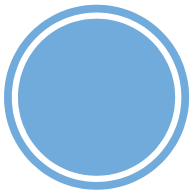


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Architecture Challenges Extend Across a Spectrum of System Types and Scale

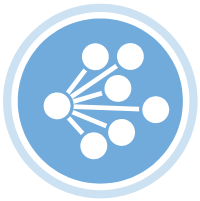
Challenges include:

- determining how to structure and adapt systems at all scales
- managing interactions among these types of systems
- assuring software-reliant capabilities that are sufficiently reliable, secure, responsive, and adaptable to change



Stand-alone Systems

software applications



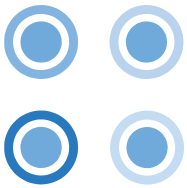
Embedded Systems

software embedded in hardware devices



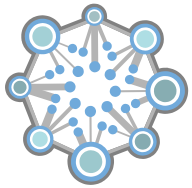
Cyber-Physical Systems

mutually dependent computational systems and physical processes



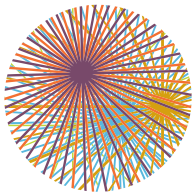
Software Product Lines

families of similar systems



Systems of Systems

federations of independent systems



Ultra-Large-Scale Systems

webs of software-reliant systems, people, economies, and cultures

Predict and control behavior

Assure and bound behavior

Coupling to organizational structure and practices increases

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Quality Attribute Requirements



Quality attributes include

- performance
- availability
- interoperability
- modifiability
- evolvability
- usability
- security
- etc.

Quality attribute requirements stem from business and mission goals. Key quality attributes need to be characterized in a system-specific way. Otherwise, they are not operational.

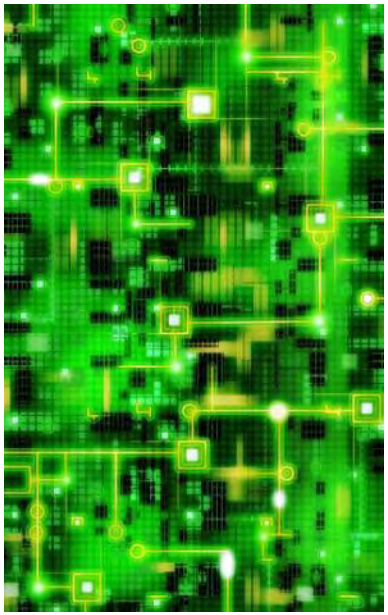
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Key Principles of Resiliency

Resilience is the ability to provide and maintain an acceptable level of service in the face of faults and challenges to normal operation.

- security “built in”
- failure scenarios understood, planned for
- redundancy is provided for in key areas
- capability remains available under adverse conditions

resilience



At SEI, both organizational and software:

- Resilience Maturity Model (RMM)
- Security Quality Requirements Engineering (SQUARE)
- Current blog series topic (http://blog.sei.cmu.edu/)

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Continuity

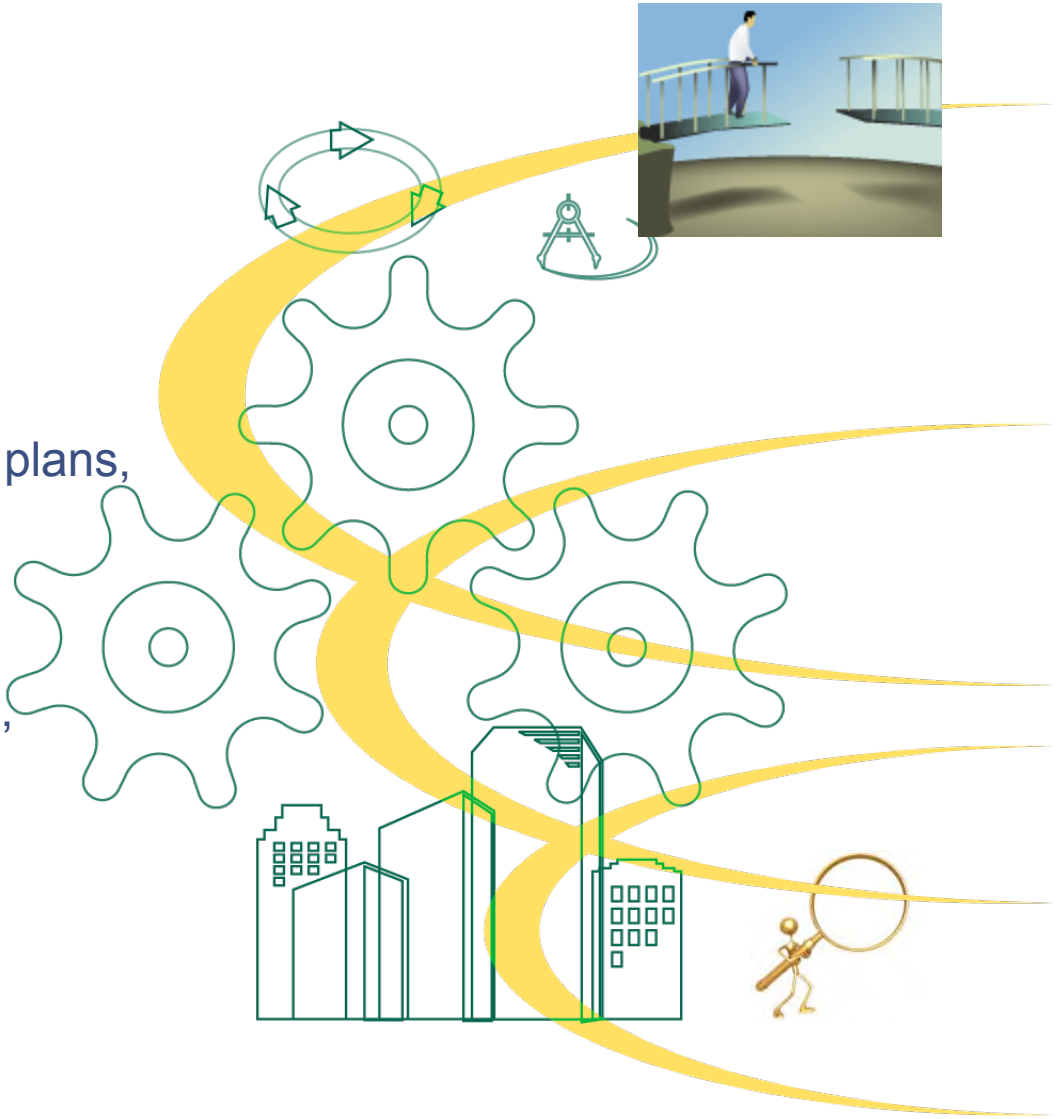
A key aim of resiliency (and managing operational risk)

Business Functions:

- Developing and executing continuity plans, recovery plans, and restoration plans

IT Function:

- Developing, implementing, and managing processes to deliver IT services and manage IT infrastructures



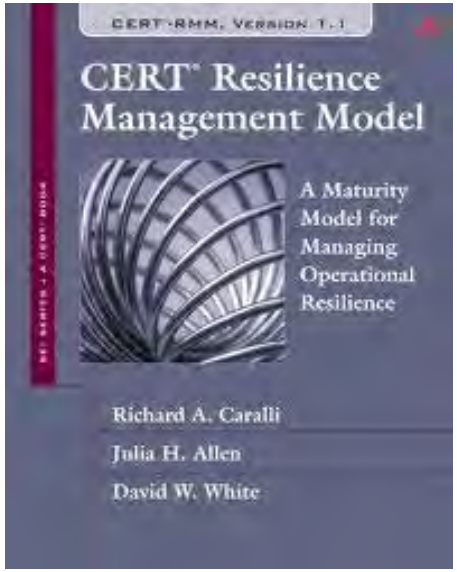
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Resiliency Maturity Model

What is CERT-RMM?

CERT-RMM is a maturity model for managing and improving operational resilience.

- Guides implementation and management of operational resilience activities
- Converges key operational risk management activities: security, business continuity/disaster recovery, and IT operations
- Defines maturity through capability levels (like CMMI)
- Improves confidence in how an organization responds in times of operational stress

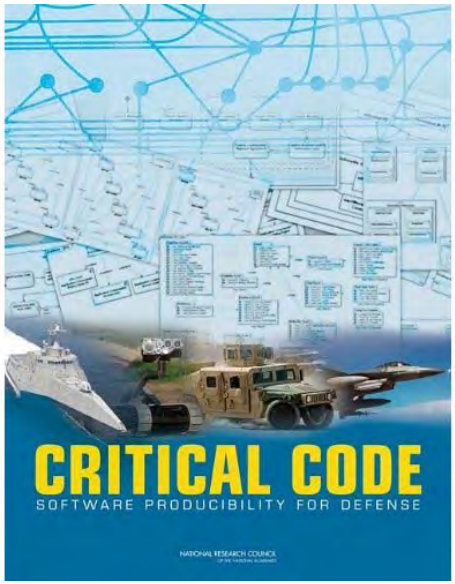


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Key Ideas in Software Engineering -1

Critical Code—Software Practice and Research

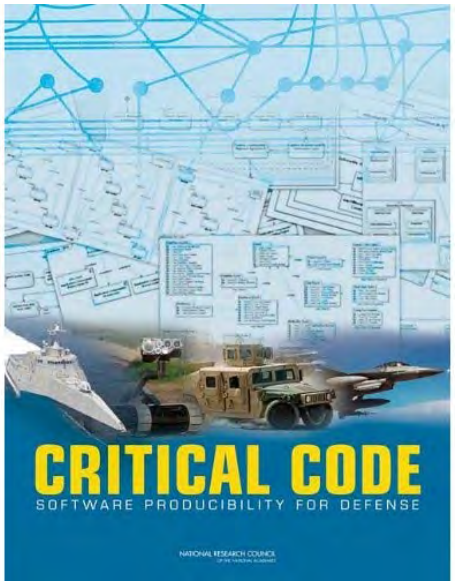
1. There is a rapid growth in the strategic significance of software for DoD
   - DoD needs to actively address its software producibility needs
   - DoD cannot rely on industry alone to address software challenges for defense
2. Iterative engineering of innovative software can be successfully managed
   - Apply advanced technologies and practice for iterative incremental development of software intensive systems
   - Update earned value models and practices to support management process
3. There is insufficient DoD-aligned software experience
   - DoD needs to be a smart software customer



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Key Ideas in Software Engineering -2

4. Assert DoD architectural leadership
   - In highly complex systems, architecture decisions may need to dominate functional capability choices
5. Adopt a strategic approach to software assurance
   - Integrate preventive practices into development to support ongoing creation of evidence in support of assurance
6. It is essential to reinvigorate DoD software engineering research
   - NITRD data reveal the extent of the S&T disengagement
   - Apply appropriate criteria in identifying goals for research programs
   - Focus research effort on identified goals in seven technological areas



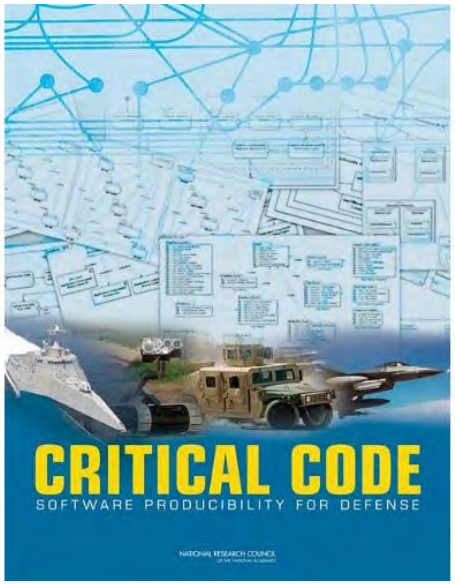
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Recommendations -1

Summary of recommendations

Improve critical areas of current practice

- Process and measurement
  - Enable incremental iterative development at arm's length
- Architecture
  - Enable architecture leadership, interlinking, flexibility
- Assurance and security
  - Enable high assurance at scale with rich supply chains

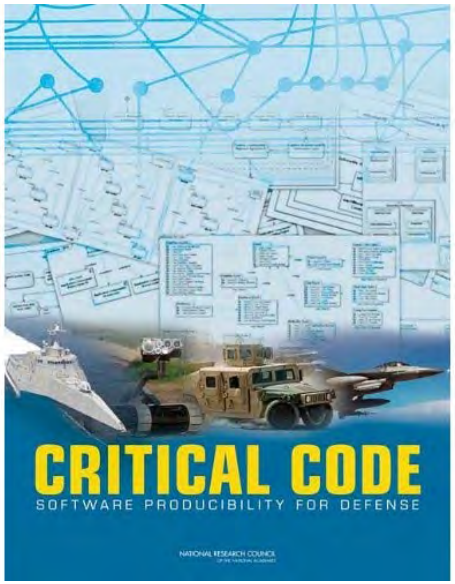


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Recommendations -2

Undertake research to support the critical areas of practice

1. Architecture modeling and architectural analysis
2. Validation, verification, and analysis of design and code
3. Process support and economic models for assurance
4. Requirements
5. Language, modeling, code and tools
6. Cyber-physical systems
7. Human-system interaction



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People









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Summary

Software has increasing impact

Software challenges are growing

Software engineering provides useful tools

Great people are crucial







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CMMI Status and Future

Rusty Young

November 2011



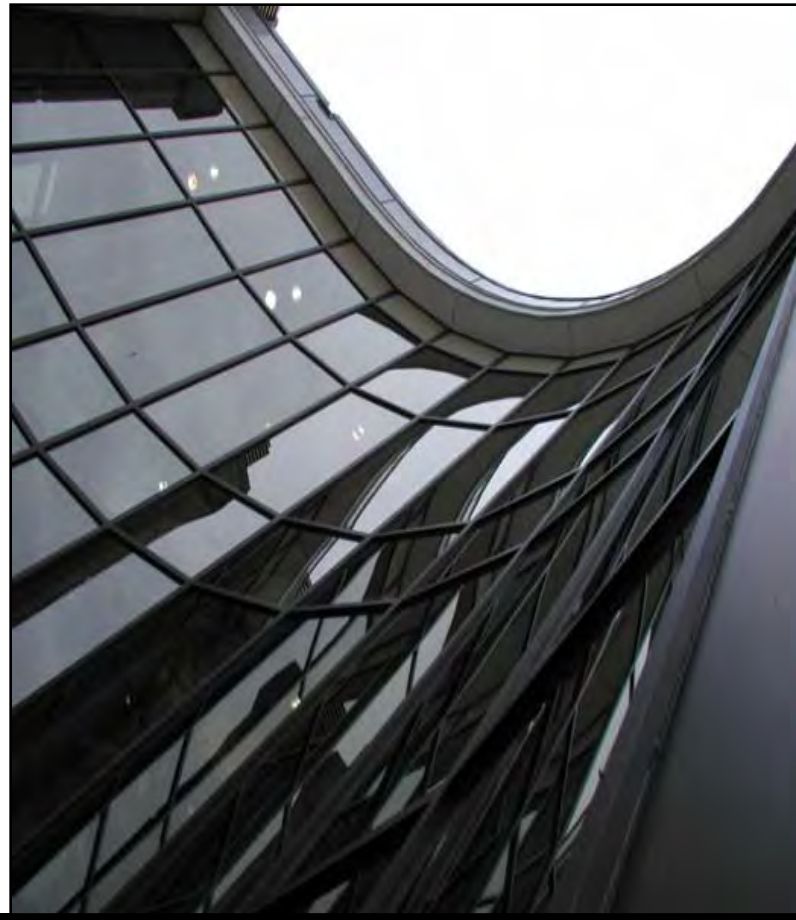
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Topics

- [x] 2011 Highlights

SEI Family of Models: Status & Plans

Future of the CMMI Product Suite



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2011 Highlights

131,664 students trained in Introduction to CMMI as of 30 September 2011:

- **2011 Delivery**: SEI: 198 Partner: 10,133
- **Total Delivery**: SEI: 7,596 Partner: 124,068

Release of the Resilience Management Model (RMM)

Release of the Smart Grid Maturity Model (SGMM)

CMMI Translations

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CMMI Translations

What's New?

- New Translations
  - CMMI-DEV V1.3 Dutch
  - CMMI-DEV V1.3 French
  - Intro to CMMI-DEV V1.3 course French

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CMMI Translations

What's Next?

- CMMI-DEV V1.3
  - German
  - Korean
  - Portuguese
  - Simplified Chinese
  - Spanish
  - Traditional Chinese
- CMMI-SVC V1.3
  - Arabic
- Intro to CMMI-DEV course
  - German

http://www.sei.cmu.edu/cmmi/solutions/translations/



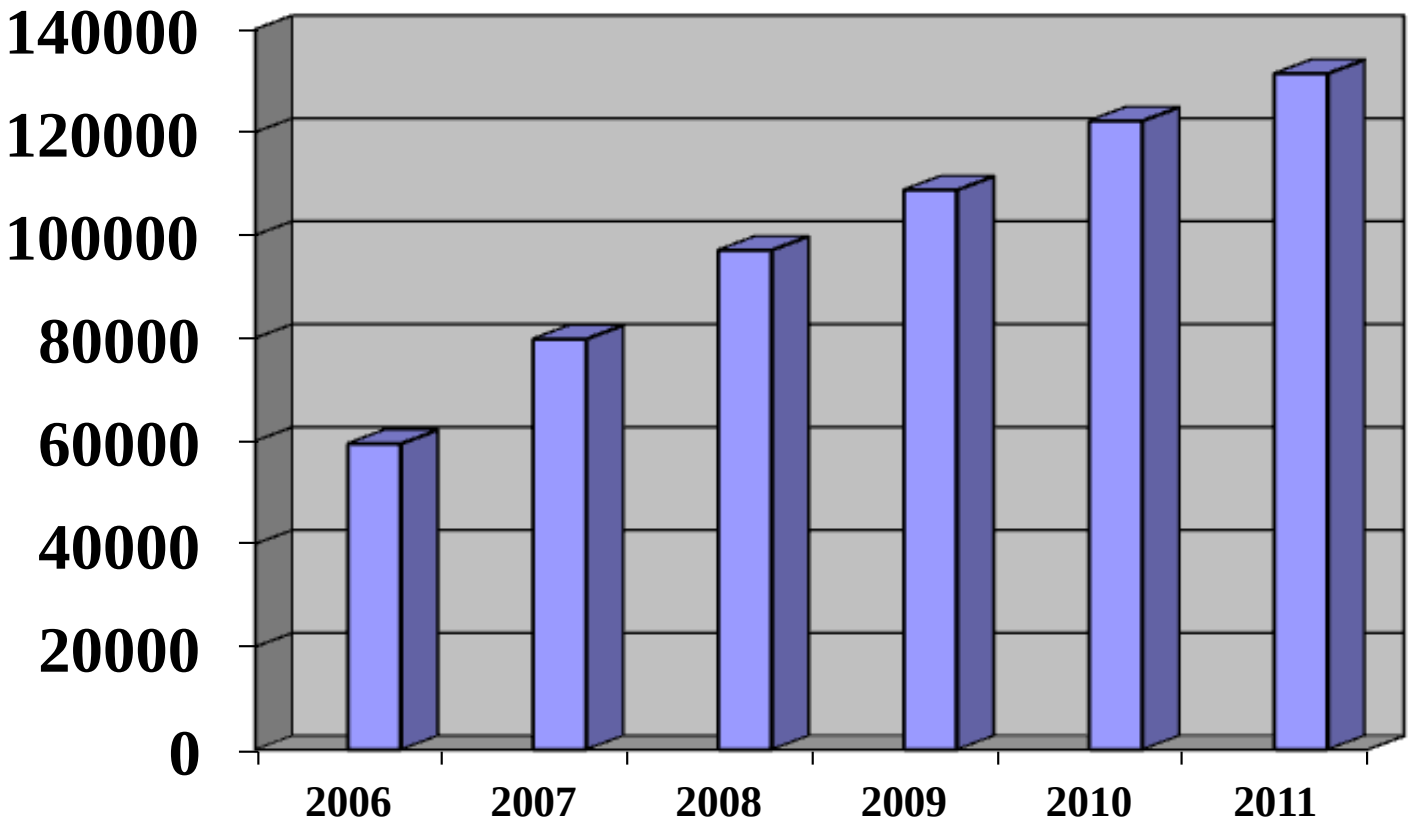
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CMMI Transition Status
Reported to the SEI as of 10-31-11

Training	
Introduction to CMMI DEV (cumulative/v1.3)	131,345/7,485
Intermediate Concepts of CMMI (cumulative/v1.3)	3,276 / 54
Understanding CMMI High Maturity Practices (cumulative/v1.3)	682 / 47
Acquisition Supplement for Development (cumulative/v1.3)	1,556 / 208
Services Supplement for CMMI for Development	3231
Introduction to CMMI for Services	1094
Development Supplement for CMMI for Services	151
Certifications	
SEI-Certified Introduction to CMMI for Development Instructors (v1.2/v1.3)	388 / 386
SEI-Certified Acquisition Supplement for CMMI –DEV Instructors (v1.2/v1.3)	64 / 70
SEI-Certified Services Supplement for CMMI –DEV Instructors	158
SEI-Certified Introduction to CMMI for Services Instructors	88
SEI-Certified Development Supplement for CMMI-SVC Instructors	42
SCAMPI-DEV Lead Appraisers (v1.2/v1.3)	421 / 321
SCAMPI High Maturity Lead Appraisers	140
CMMI-ACQ Lead Appraisers (v1.2/v1.3)	76 / 53
CMMI-SVC Lead Appraisers (v1.2/v1.3)	171 / 138

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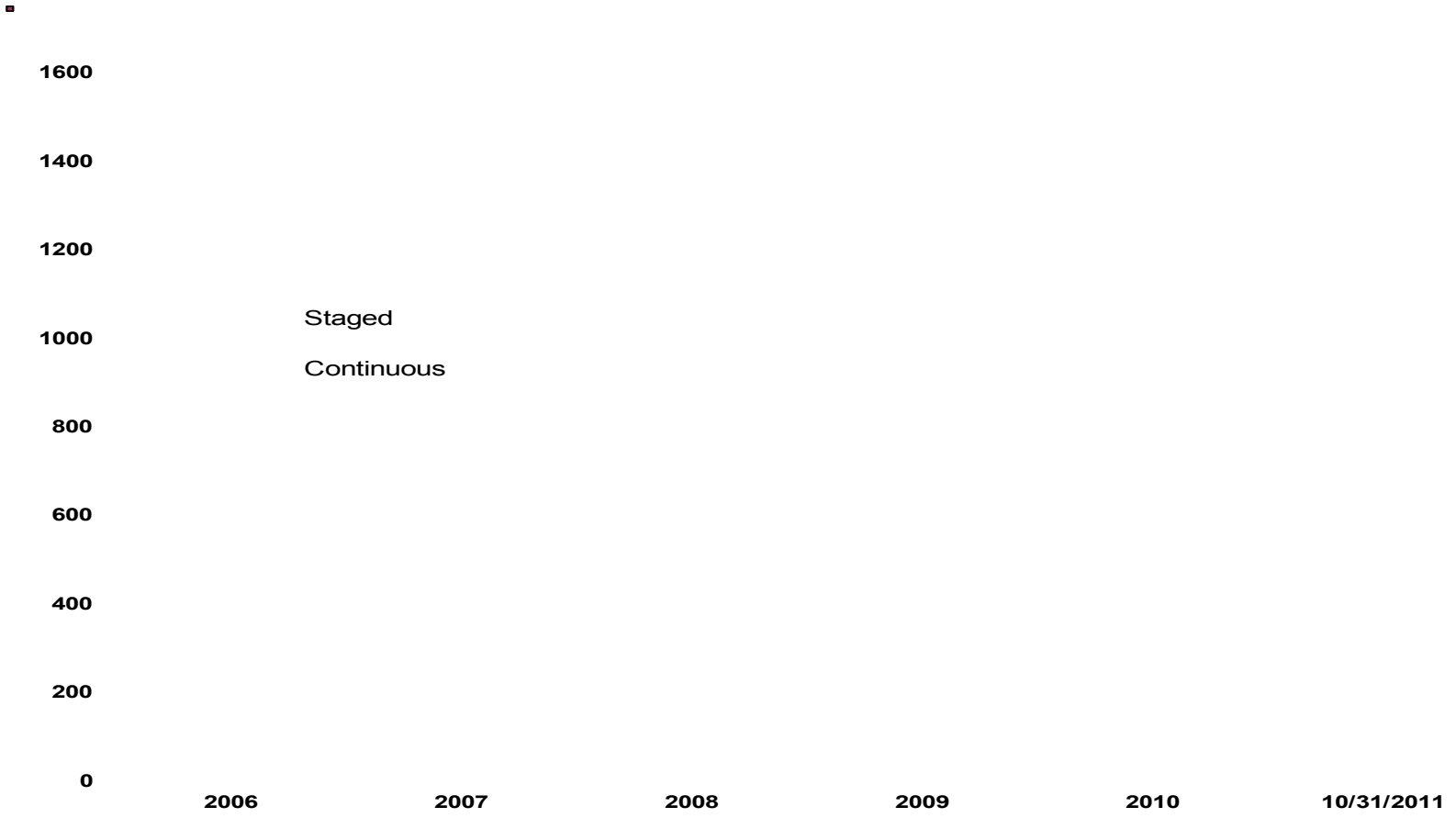
Introduction to CMMI-DEV Attendees Cumulative as of 10-31-11



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Number of SCAMPI V1.2/V1.3, Class A Appraisals Conducted by Year by Representation* Reported as of 10-31-2011

***Where Representation is reported**



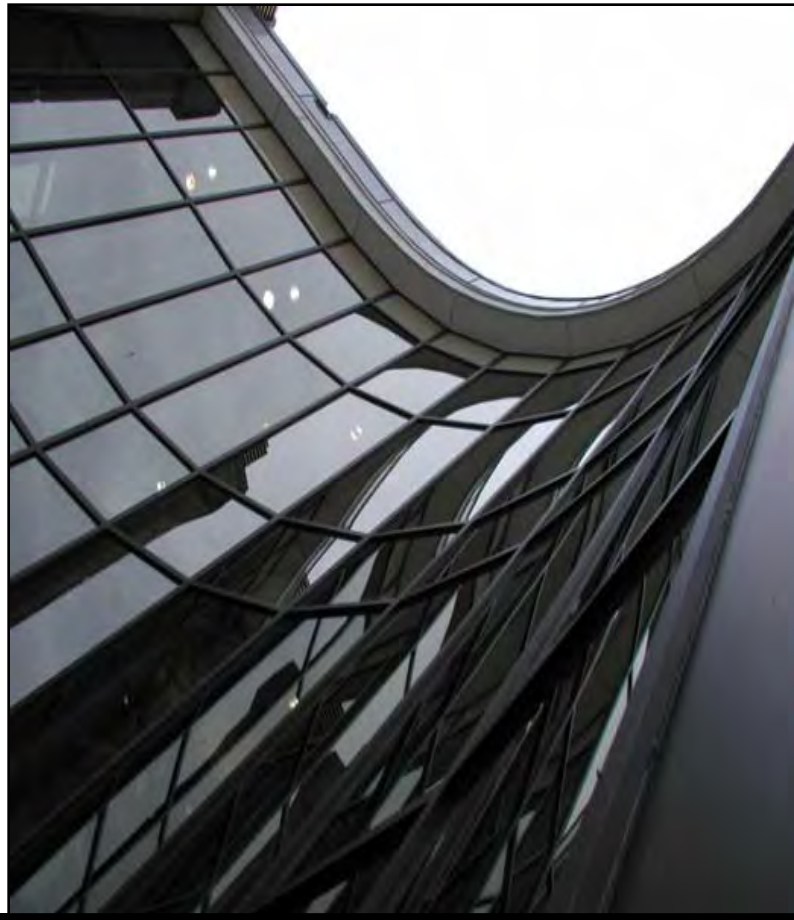
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Topics

2011 Highlights

- [x] SEI Family of Models: Status & Plans

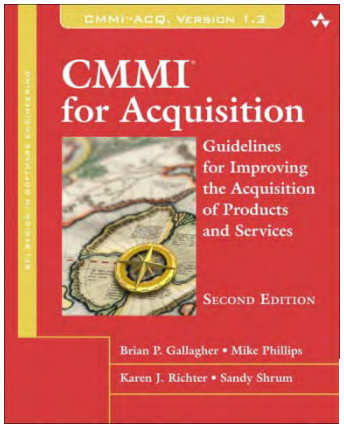
Future of the CMMI Product Suite

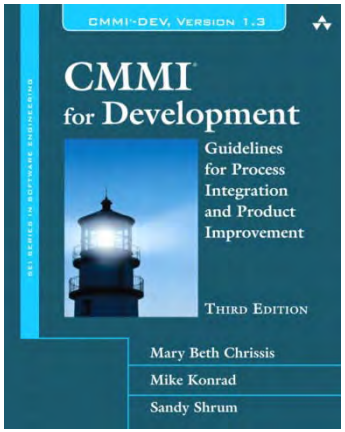


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SEI Family of Models



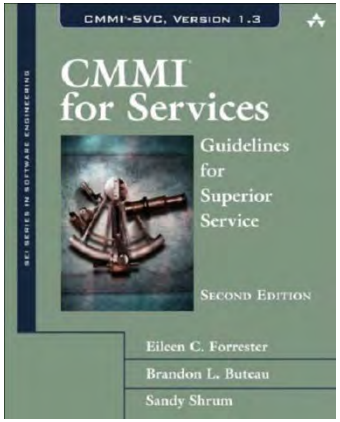


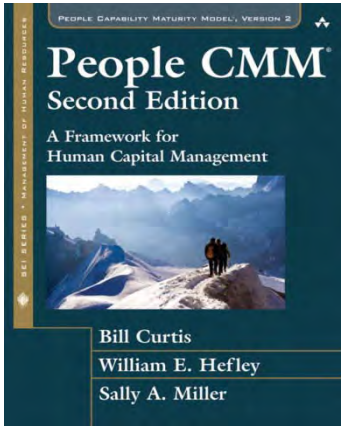












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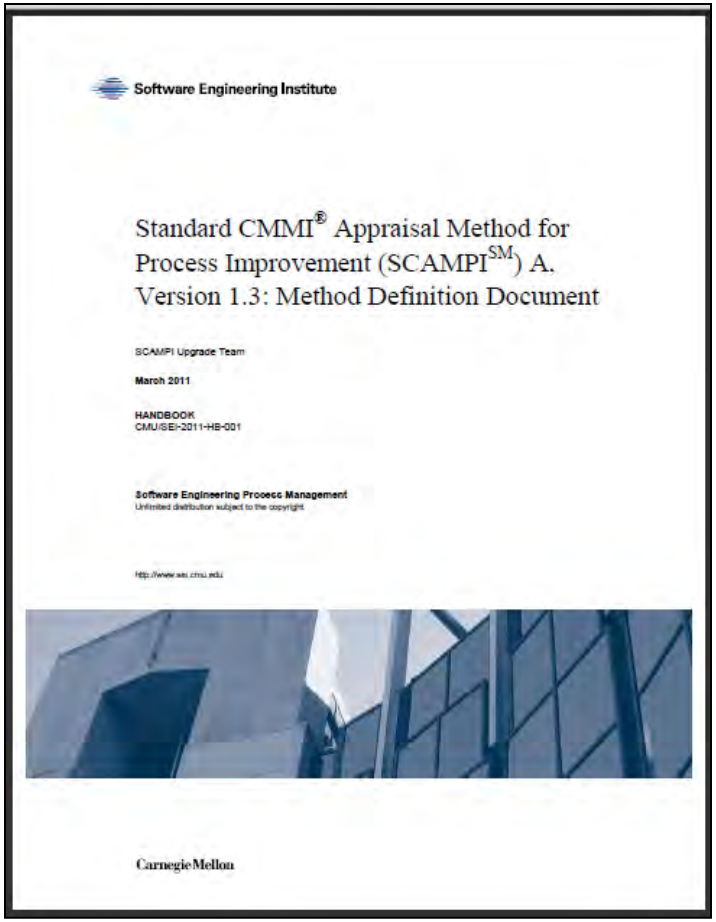
SCAMPI Appraisal Program

Status

- Release of SCAMPI Lead Appraiser Training (SLAT) course
- First delivery in September
  - Feedback was positive

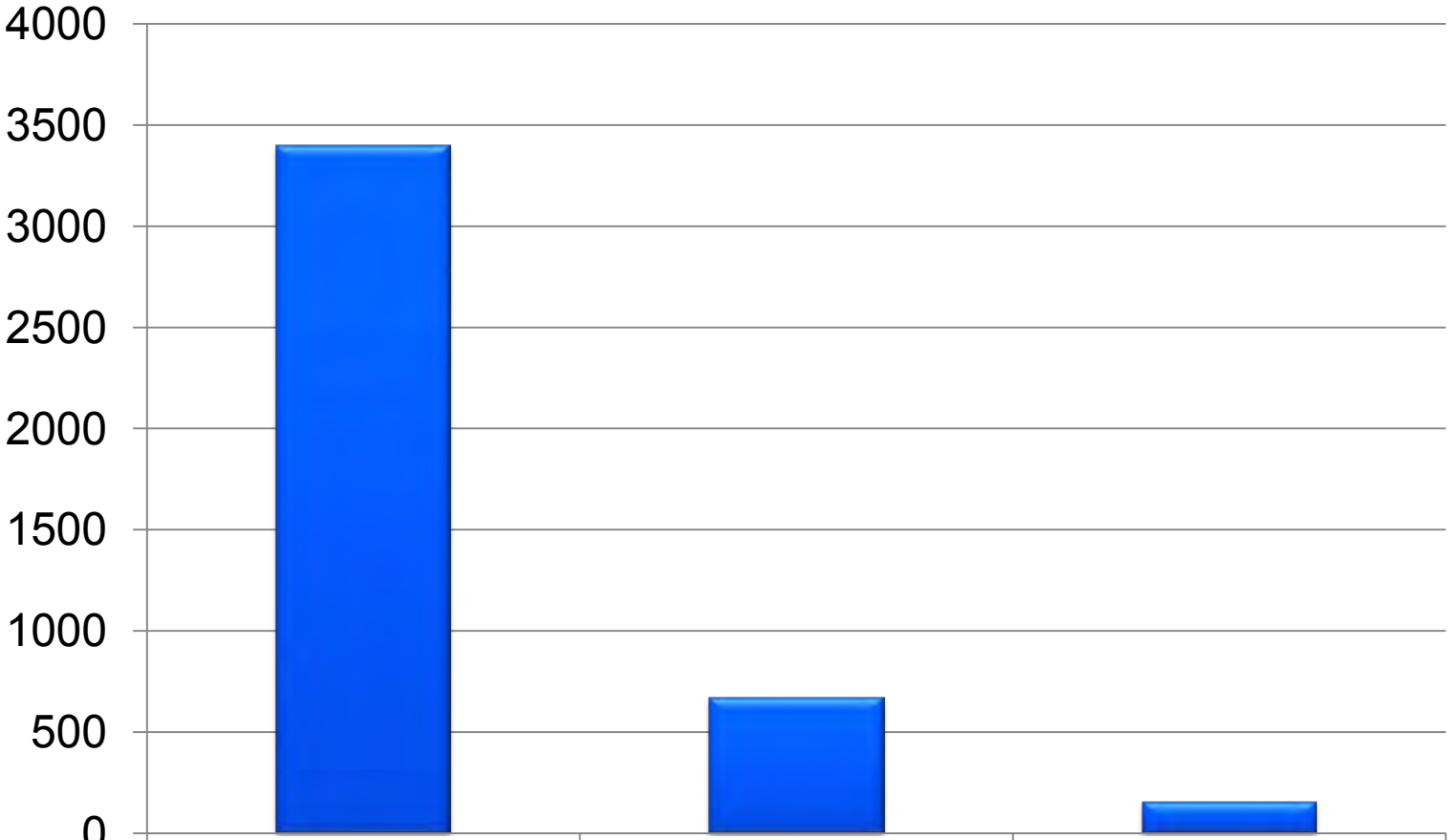
Plans

- Merger of B&C handbook into the Method Description Document (MDD)
- Completion of On-line SLAT



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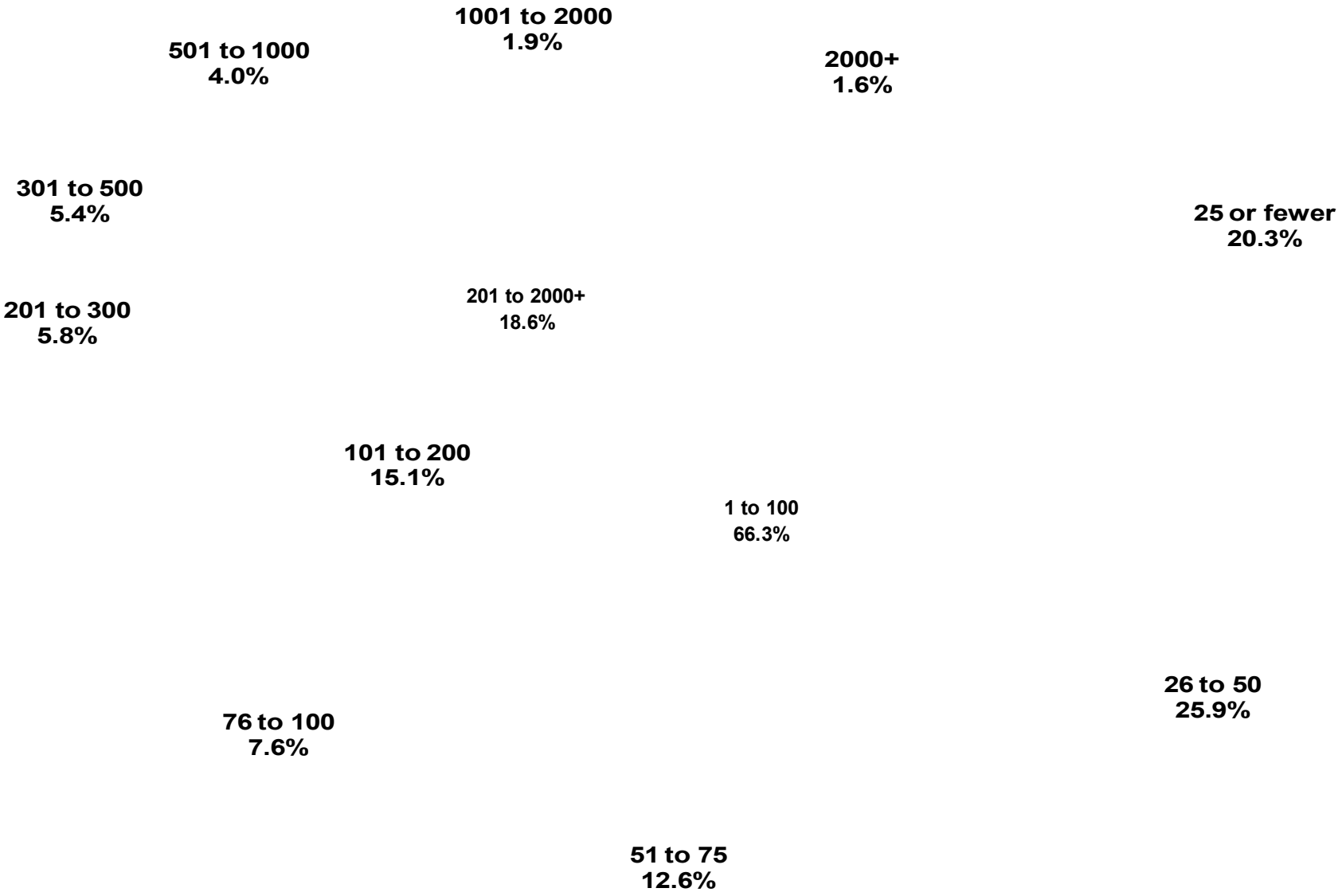
SCAMPI Appraisals - Organization Type



	Commercial/ Internal-Use	Contractor (for Military/Government)	Military/Government Agency
Number of Organizations	3397	667	156

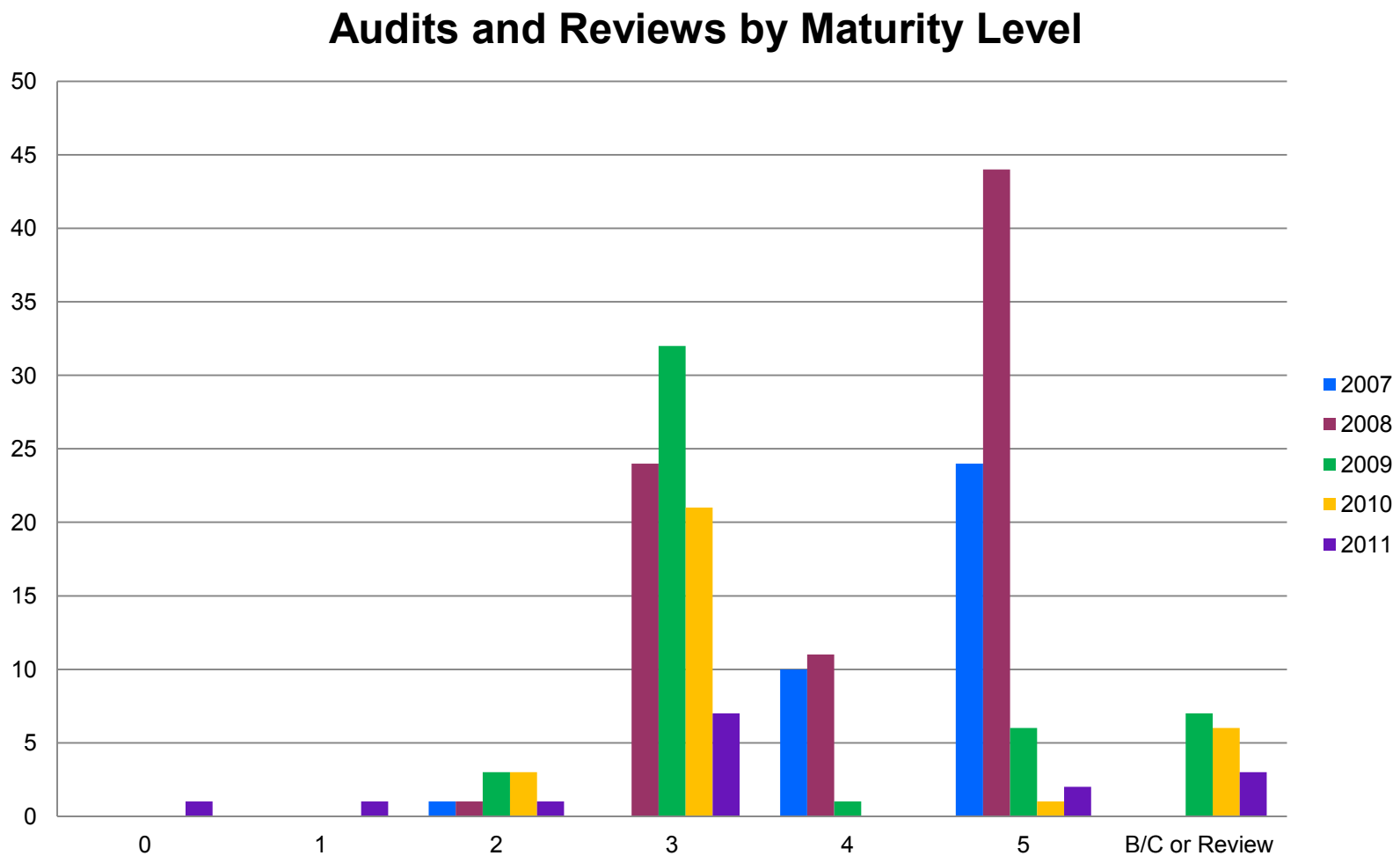
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Size of Appraised Organizations



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Appraisal Maturity Levels Audited or Reviewed



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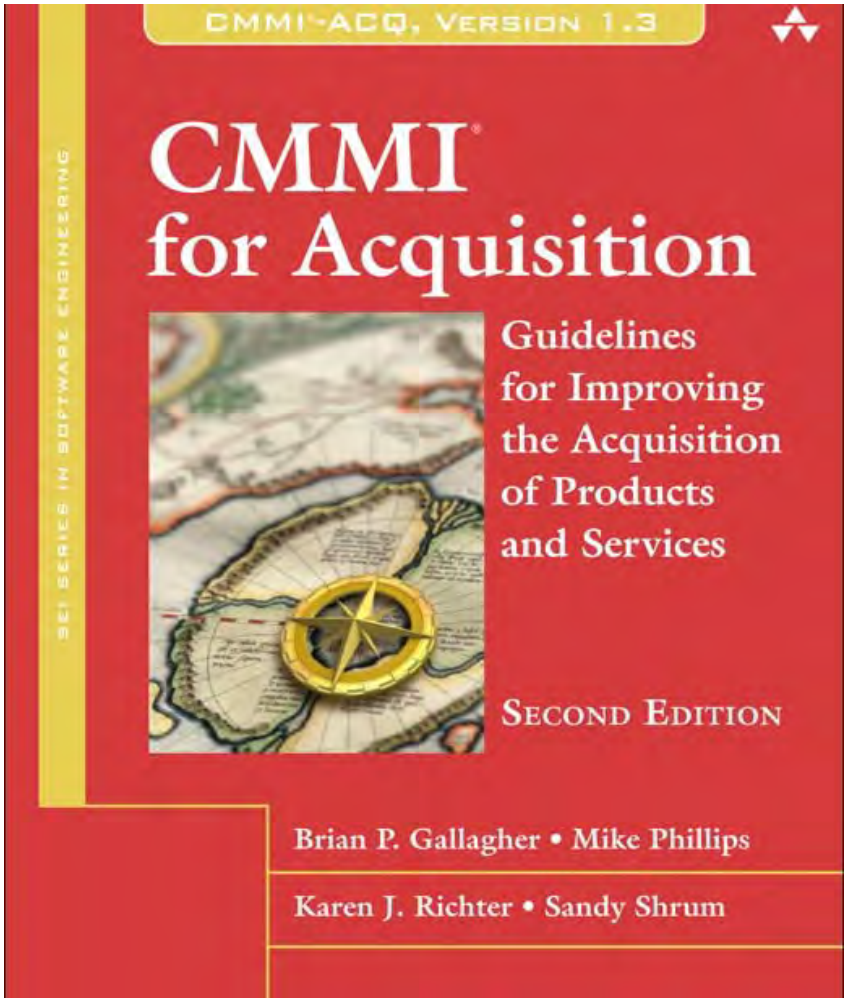
CMMI-ACQ

Status

- Alex Stall has accepted the product manager role for CMMI-ACQ

Plans

- Define the market(s)
- Define what acquisition is to the non-DoD market
- Increase interest and adoption



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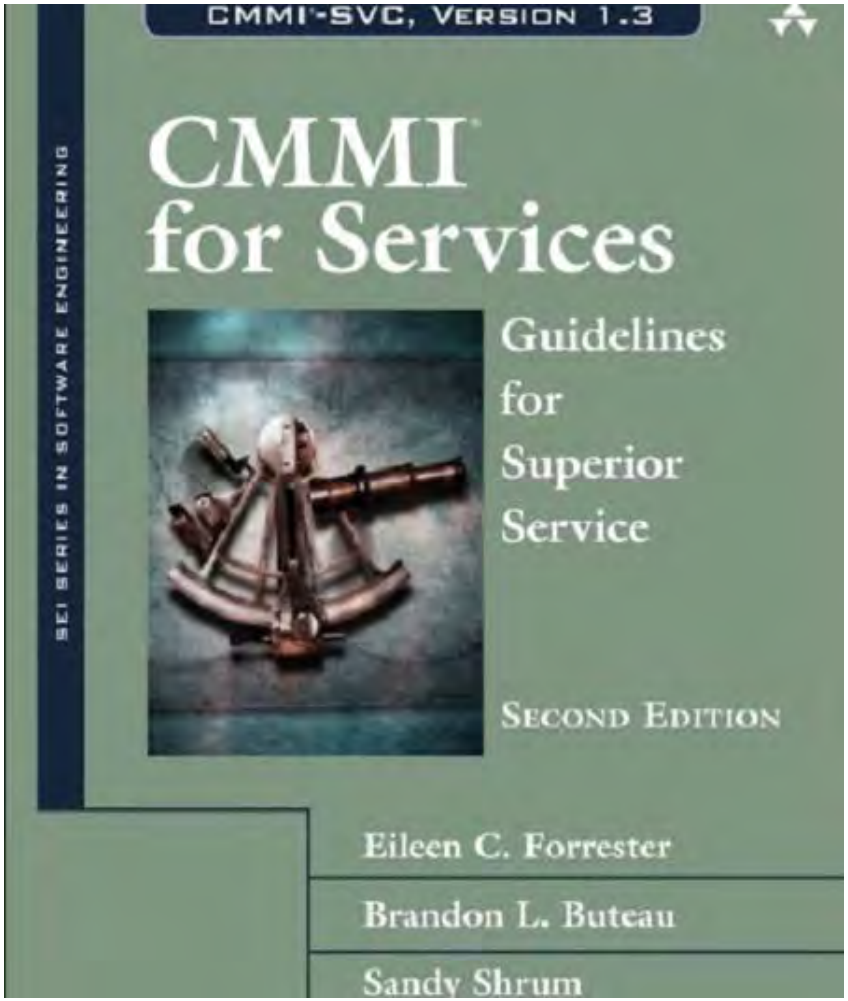
CMMI-SVC

Status

- More than 130 appraisals reported
  - 25% increase quarter over quarter in appraisals
- Documented ROI examples from partners
- Five graduate dissertations /theses have been written on CMMI-SVC
- Two books by partners featuring CMMI-SVC have been published, and a third book by a partner is under way
- Over 100 examples submitted about SVC implementation

Plans

- Advanced SVC training
- Produce guidance on high maturity in service settings
- Evaluating new pricing and certification path
- Focus sessions for Partner input



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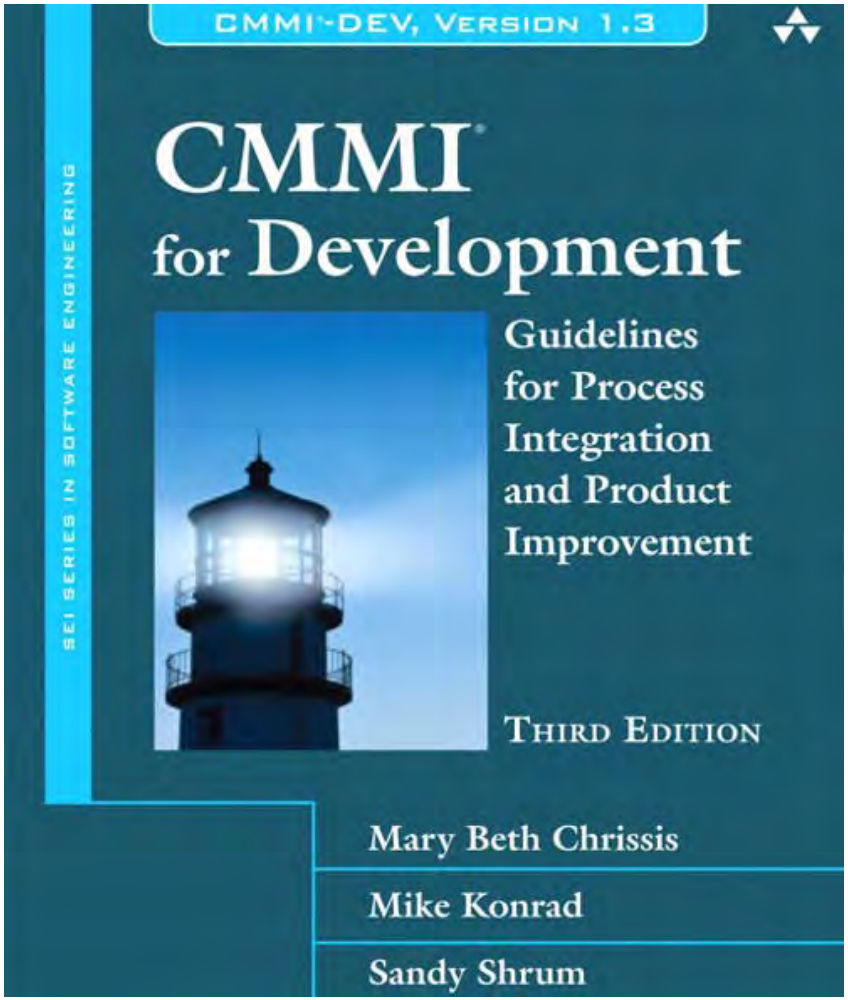
CMMI-DEV

Status

- Ten CMMI translations on-going
- CMMI courses were updated
- Intro to CMMI v1.2 will be retired on November 30, 2011
- 95% of the CMMI-DEV instructors have upgraded to V1.3

Plans

- Incorporate Lean and Agile principles
- Devise lightweight, cost effective solutions
- Selected training to eLearning
- Re-focus use of CMMI on achieving superior attention, motivation, and cooperation to improve performance



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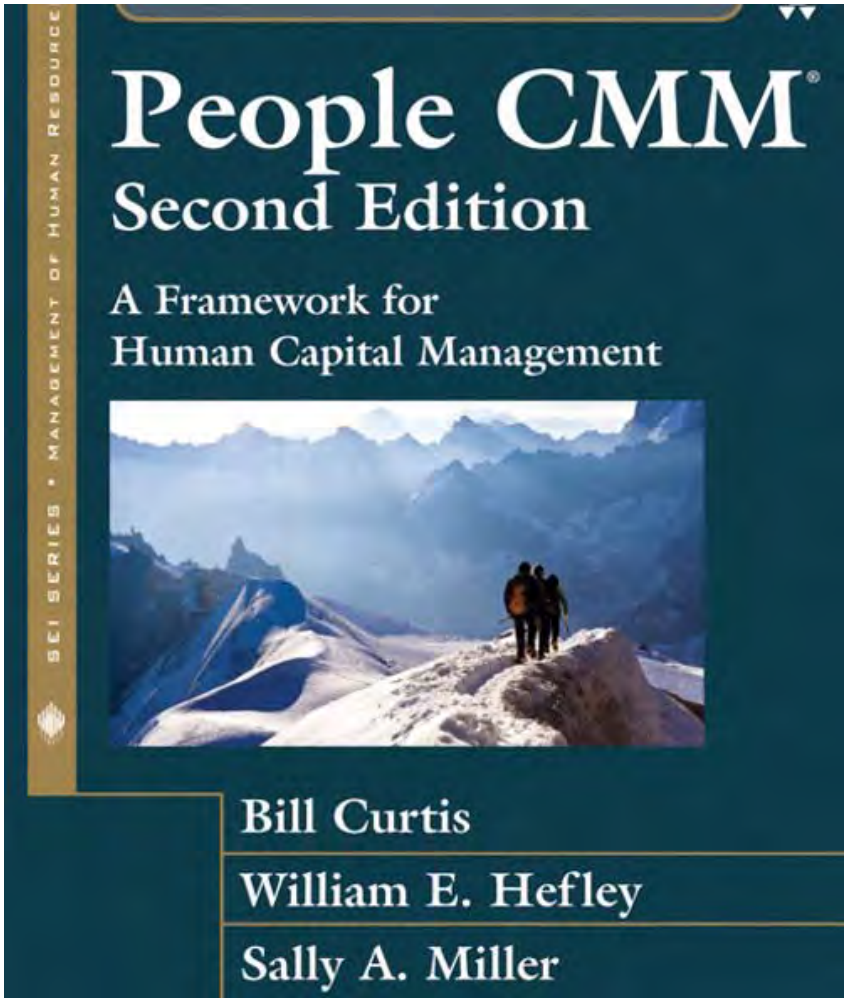
People CMM

Status

- Ongoing revisions to model aimed at version 2

Plans

- Continue working on change packages for the next version of the People CMM which will bring the People CMM in line with V1.3 of CMMI
- SEI People CMM SCAMPI



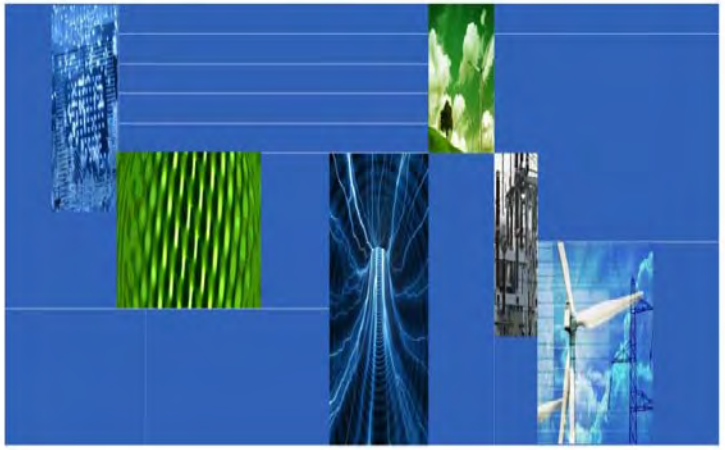
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Smart Grid Maturity Model

Status

- Creation of a management tool for the utility industry Smart Grid transformation
- Utilities need to use the SGMM to:
  - Develop effective roadmaps
  - Track progress
  - Understand their posture in comparison to peers
- SEI Training and licensing available





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CERT Resilience Management Model (RMM)

Status

- Model v1.1 and appraisal method published
- Introductory courses
  - Model training
  - “How-to” CERT courses
  - Executive workshops
- Advanced courses
  - User Groups
  - Practitioner training
  - Appraisal leader training
  - Instructor training

Plans

- Certifications
  - Lead Appraiser
  - Navigator
  - Coach
  - Instructor



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Data Management Maturity Model (DMM)

Status

- Created in collaboration with data practitioners of the financial information industry
- Focus on how to turn ‘art and practice’ into ‘science and discipline’.

Plans

- The final output will be a framework document and accompanying assessment methodology (SCAMPI) for
  - Evaluating the efficiency of data management practices
  - Measuring the maturity of operational integration
  - Establishing best practices that can be adopted in varying domains worldwide



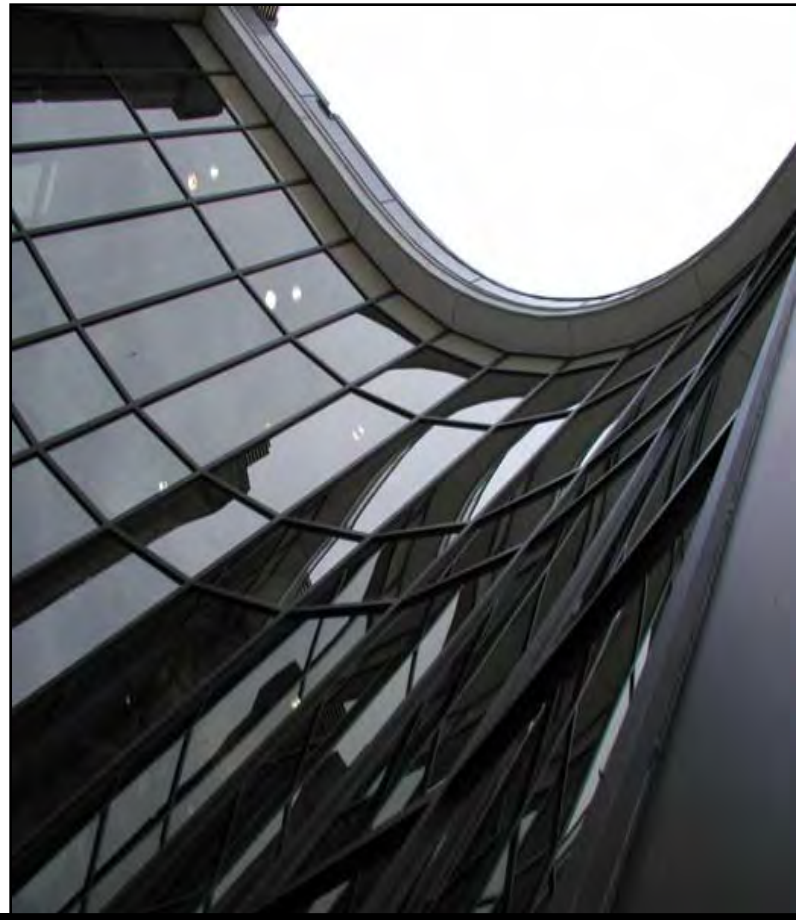
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Today's Discussions…

2011 Highlights

SEI Family of Models: Status & Plans

☑ Future of the CMMI Product Suite



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"The best way to predict the future is to invent it!"

Alan Kay, 1971, American computer scientist, researcher, and visionary

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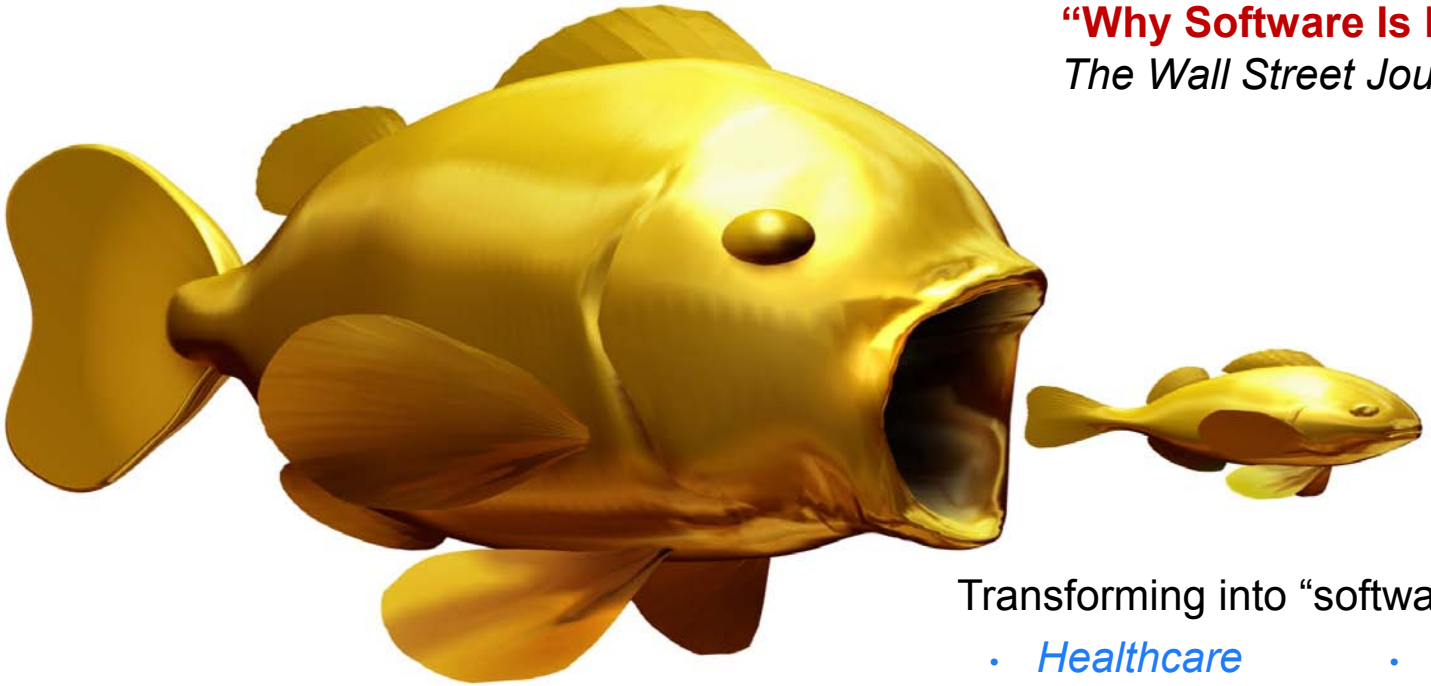
Software Has Come of Age

"…we are in the middle of a dramatic and broad technological and economic shift in which software companies are poised to take over large swathes of the economy."

--Marc Andreessen

"Why Software Is Eating the World"

The Wall Street Journal, August 2011

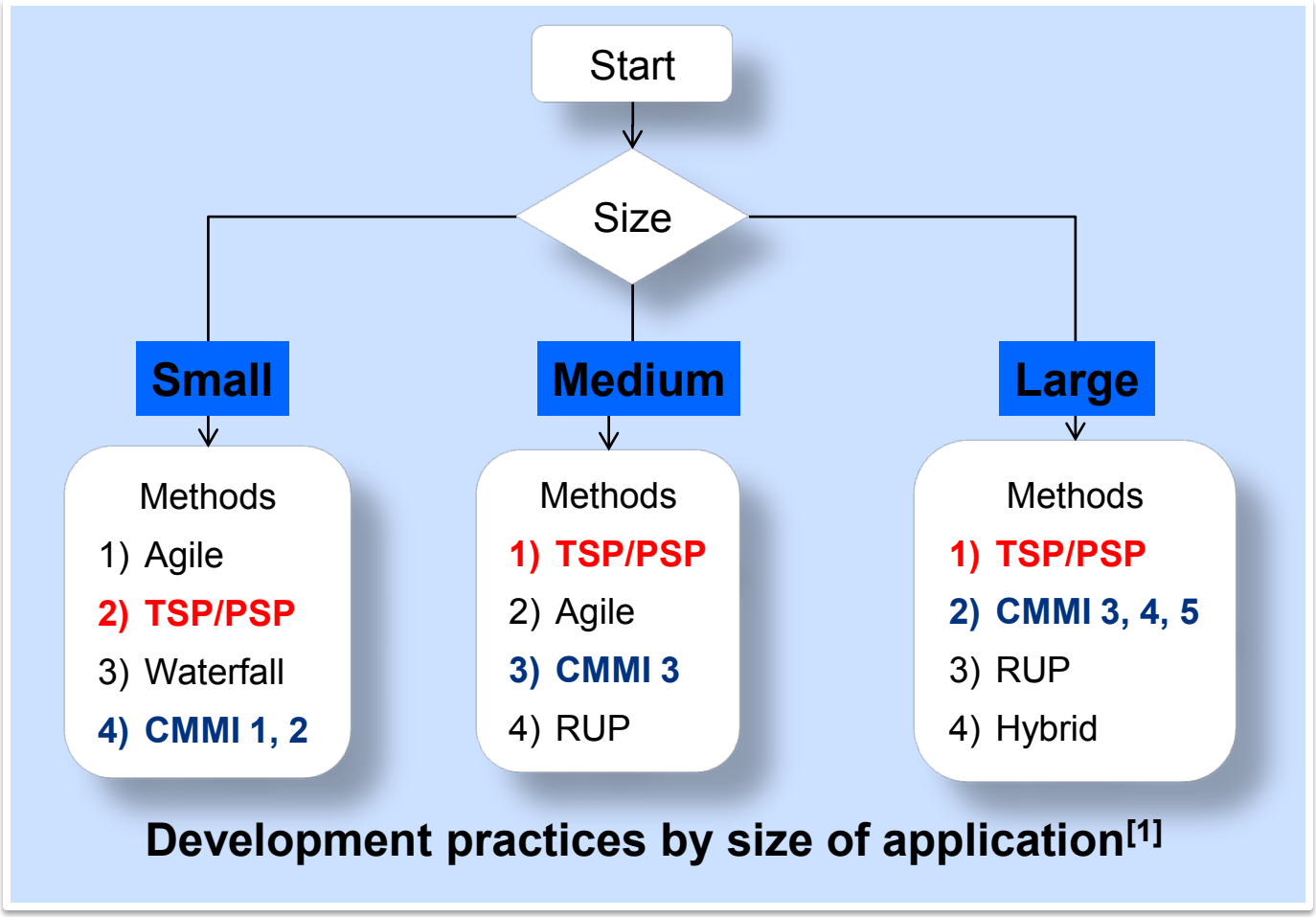


Transforming into "software" companies:

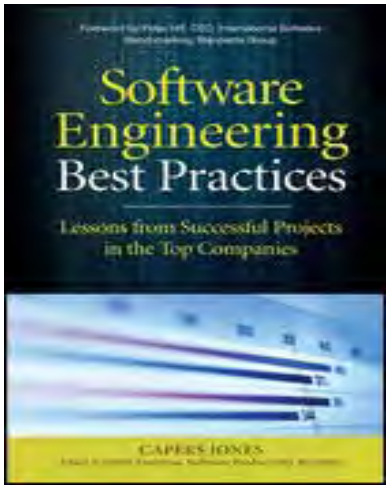
- *Healthcare*
- *Music companies*
- *Telecom*
- *Entertainment Companies*
- *Booksellers*
- *Movie production*
- *Financial services*
- *Education*
- *…*

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CMMI & TSP are Ranked Top Software Engineering Best Practices!



Development practices by size of application[1]



[1] Software Engineering Best Practices, by Capers Jones, 2010.

Based on a comprehensive study of 630 organizations and 13,000 projects.

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SEI Response: Broader Outreach

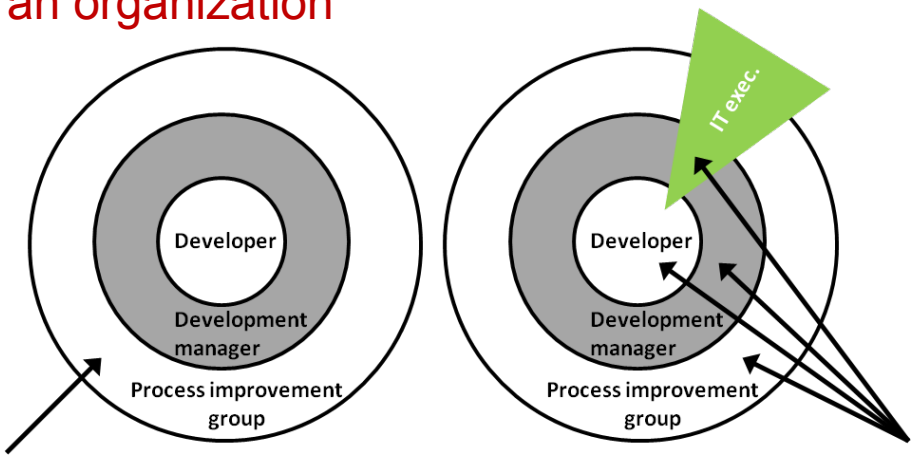
Responsibility for improving software development process



Base: 81 IT professionals

Source: 2009 Global Software Development Process Online Survey

Shifting SEI process improvement brand messaging to multiple targets in an organization



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New Directions: Multi-Model Implementations

"Forrester Research's survey of Dr. Dobb's readers underscores what the SEI and Partners already know: software development process is a multi-model world."

--SEI Market Insights Research Report

The SEI is developing a common language for development and a way to attain and measure improvement in multi-model environments.

CECOM Application

- CECOM Software Engineering Center is applying CMMI-DEV, CMMI-ACQ, and CMMI-SVC to meet its complex needs.
- "Hybrid" model approach offers each Mission Area Directorate to concentrate on their specific process improvement needs.



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CMMI: What's Next? - 1

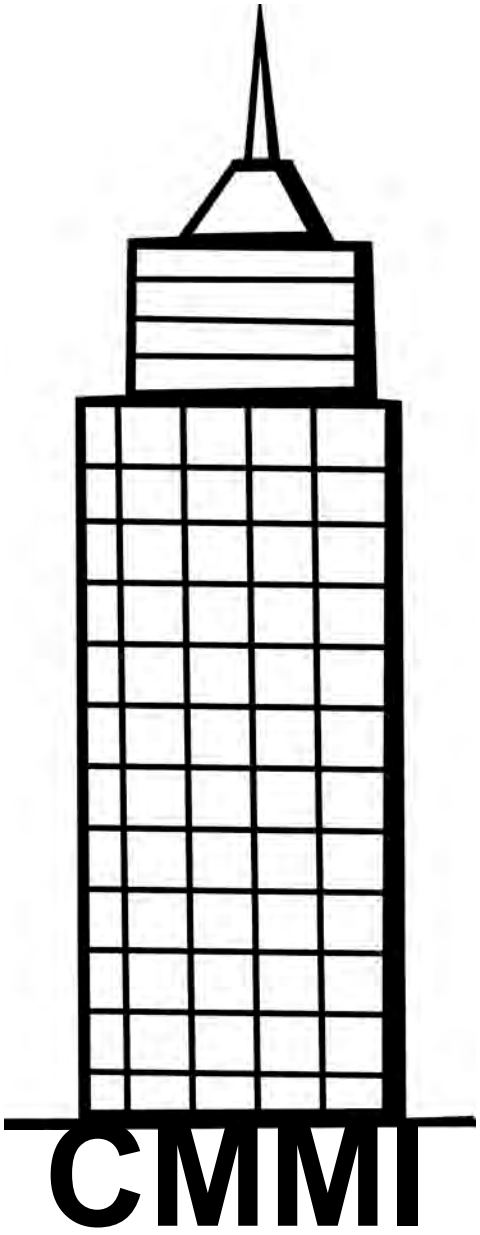
New Positioning:

- Drive down the costs of using CMMI by providing innovative technology-supported solutions
  - On-line tools for CMMI Assessments/Appraisals
  - Contextual help for key processes and key practices
  - eLearning (bite-sized CMMI training segments delivered just in time)
  - manage adoption of disruptive technologies (e.g., mobile apps, cloud, social networks, …)

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CMMI: What's Next? - 2

- Marketing/Imaging/Messaging:
  - Initiate faster, better, cheaper thinking without sacrificing quality and brand image
  - Market our products and services as an expert's toolkit
- Consider approaches to Small and Medium Enterprise market (low cost, high volume, high automation)
- Investigate marrying CMMI with more performance-oriented approaches
- Address Multi model integration for SEPM and NON-SEPM products and performance measures



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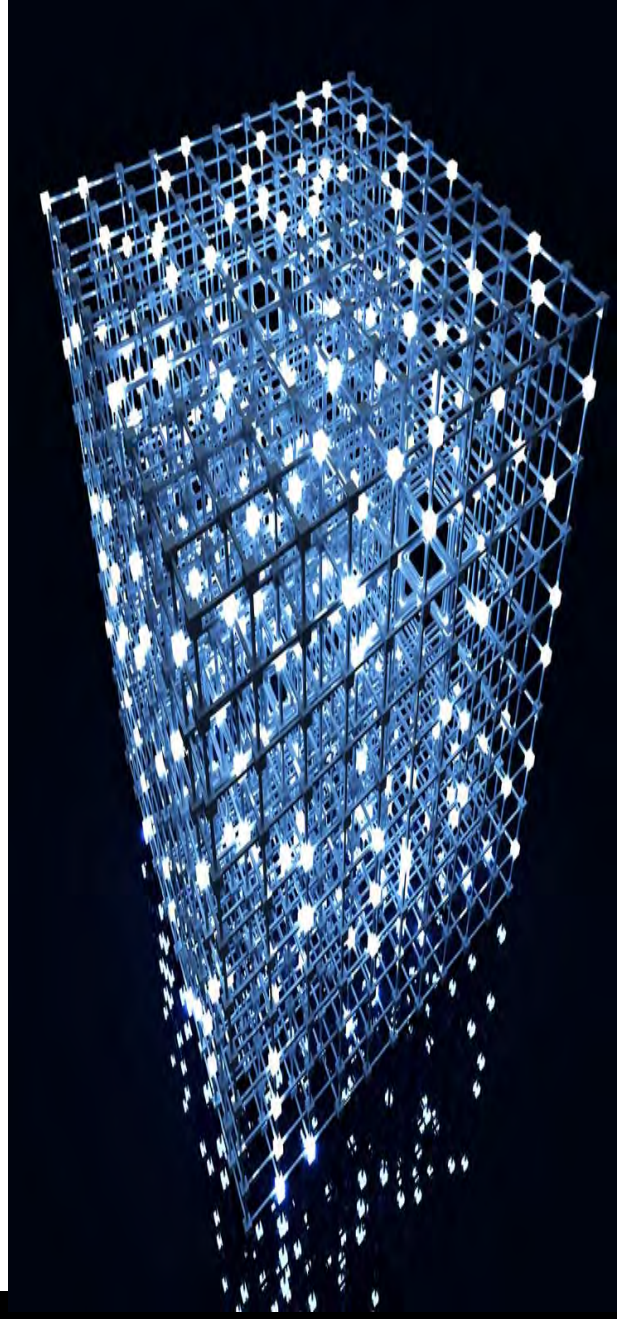
Program Direction

Better integration of SEI process and measurement products and efforts.

Development of next-generation integrated software models, methods, and practices.

Increased focus on the transition and application of SEI solutions to the problems of industry and the world.

Increased research focus on software engineering methods, models, and measurement practices



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One Vision of the Future CMMI Product Suite

Process Integration

- Models, Methods, Standards
  - CMMI, ISO, COBIT, Six Sigma, IT Mark, TSP, AIM, CENELEC, RMM, SGMM, Lean, and Agile, etc.
- Dynamically build models/hybrids of other models, methods, and standards
  - Use only the practices/parts the organization needs
  - Build the appraisal rules
- Performance data submissions as a part of appraisals

Project and Program Management using High Maturity Techniques

Coach/Mentor Credentials for Process Improvement

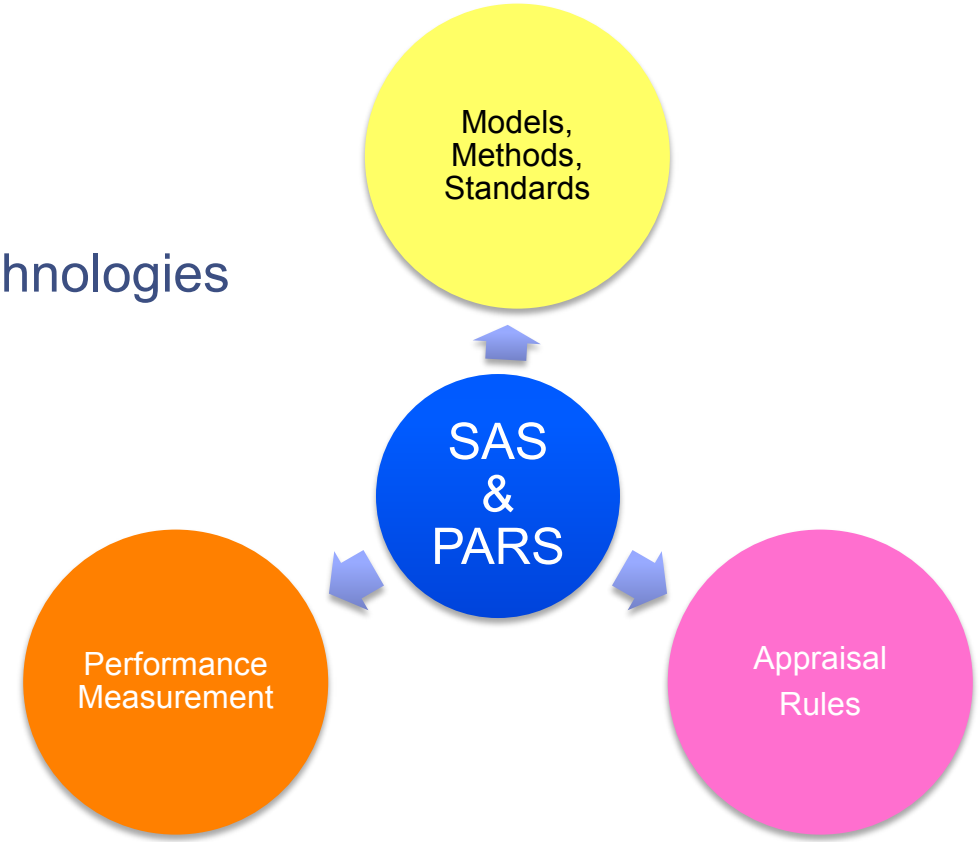
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Moving to the Future

We need to move the technology forward.

We need to capitalize on our strengths:

- Model technology
- Appraisal technology
- Measurement technology
- Process & engineering technologies
  - TSP
  - Architecture
- Trusted broker
  - SAS
  - PARS



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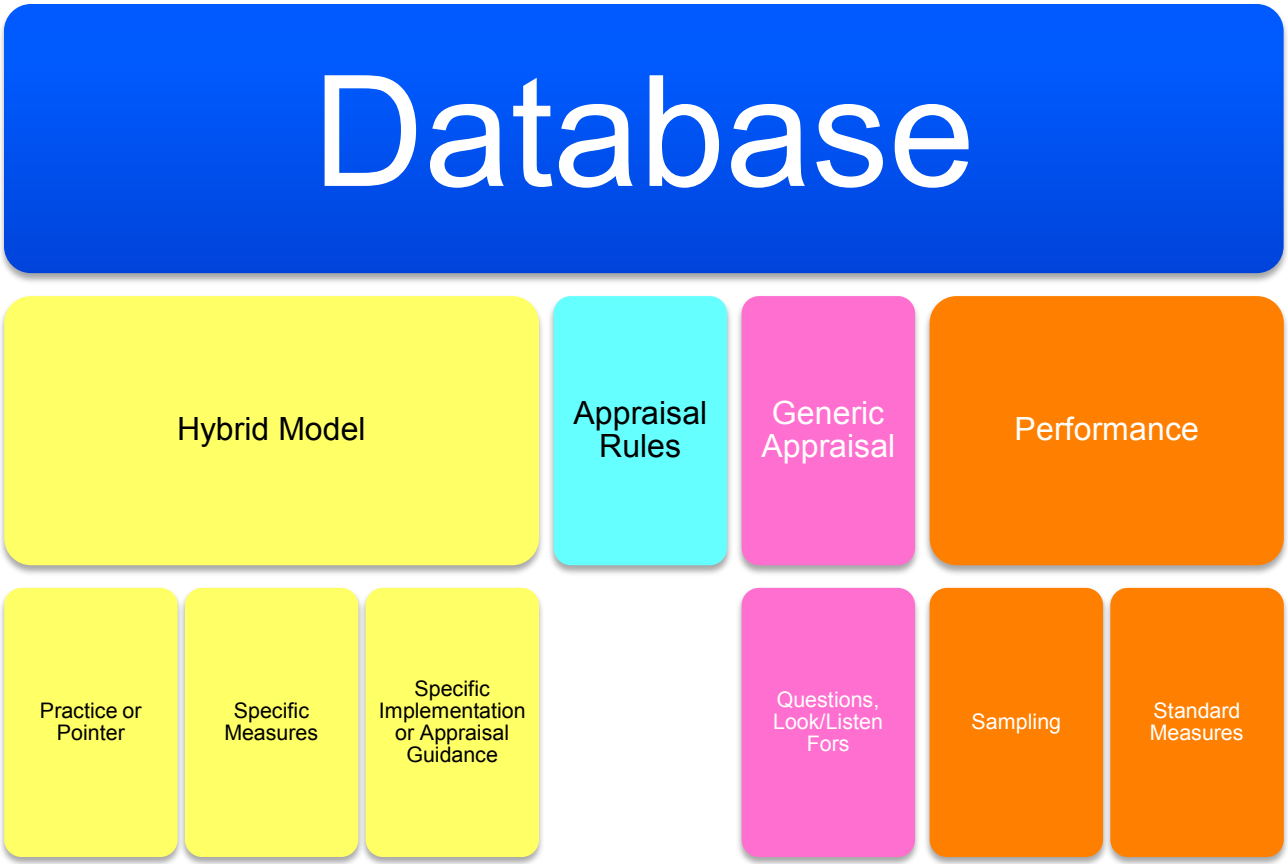
Concept - Models

Database

- Hybrid model
  - Tree structure
  - Model references
  - Interpretational/ implementation rules
- Performance
  - Work sampling
  - Standard set of measures
- Appraisal rules
  - Generic for whole model
  - Specific for individual practices

Generic appraisal

Implementation quick start

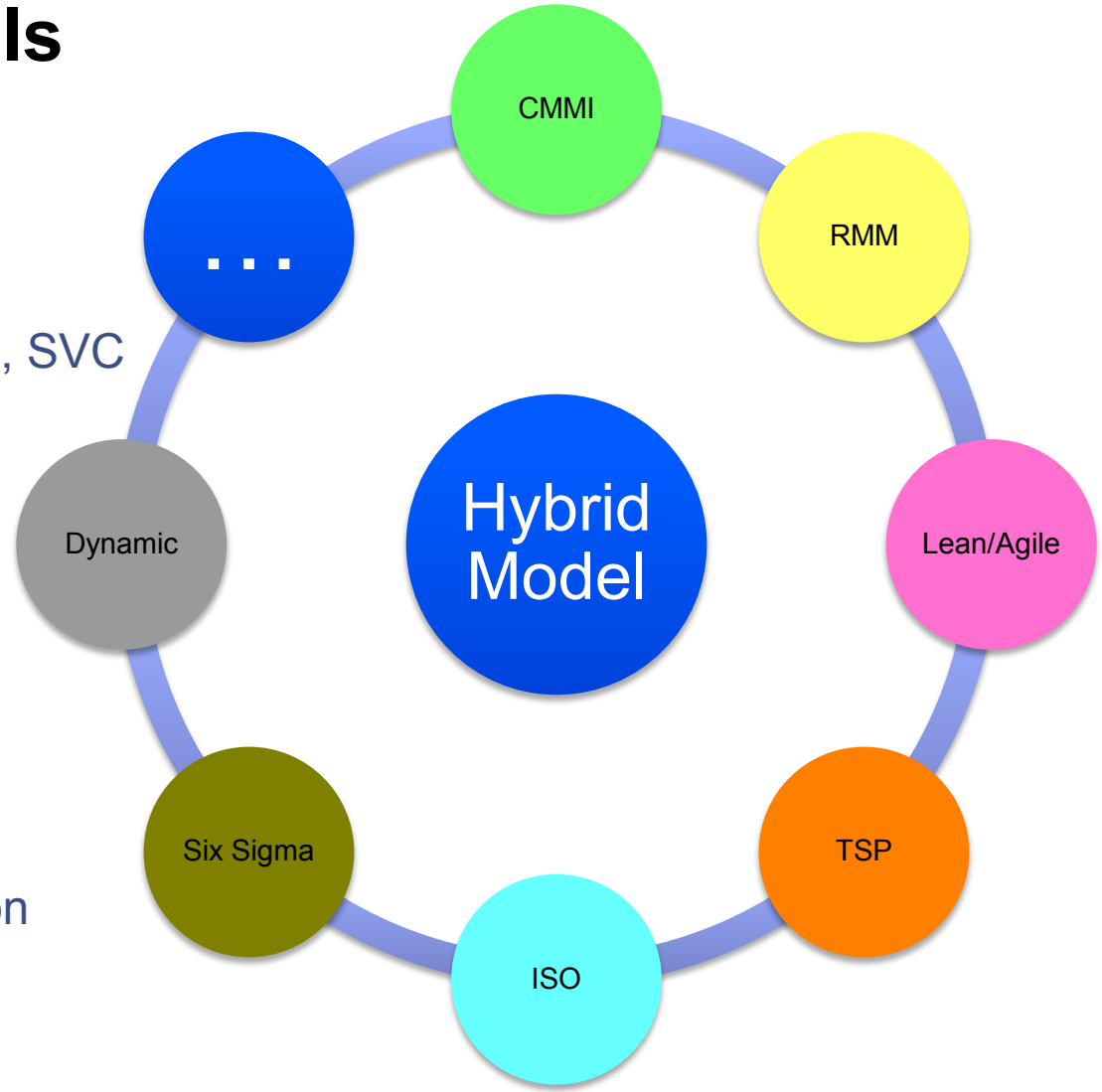


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Hybrid Models, Appraisal Rules & Generic Appraisals

Models, standards, methods, etc.

- Existing
  - CMMI – ACQ, DEV, SVC
  - RMM
  - SGMM
  - TSP
  - ISO NNN
  - Six Sigma
- Dynamic
  - From literature
  - Constructs based on existing systems or implementations
    - Agile



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For More Information

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CMMI® for Acquisition and CMMI® for Development: Potential Favorable Contributors to the Rapid Acquisition of IT Systems in Support of Public Law 111

11th Annual CMMI ® **Technology Conference and User Group**
National Defense Industrial Association
November 14-17, 2011

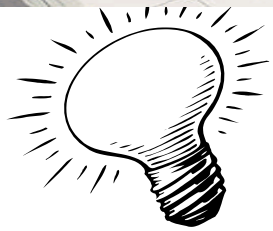
Dr. Kenneth E. Nidiffer
Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213
703-908-1117

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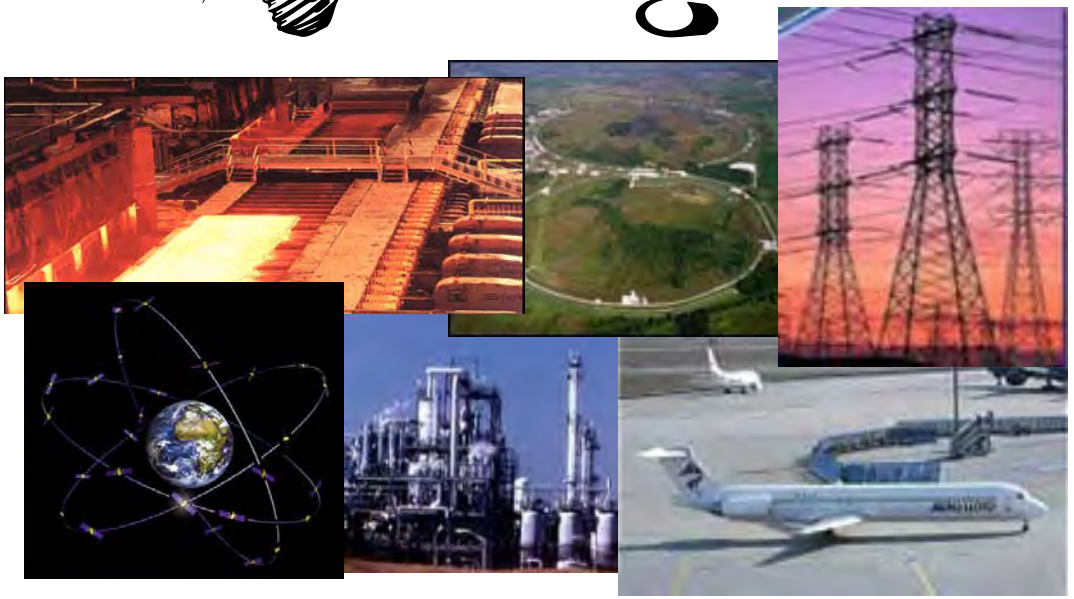
Overview

- Background
- Overview of Proposed Changes
- Challenges
- Summary









This presentation focuses on the *past, present,* and *future* of IT acquisitions

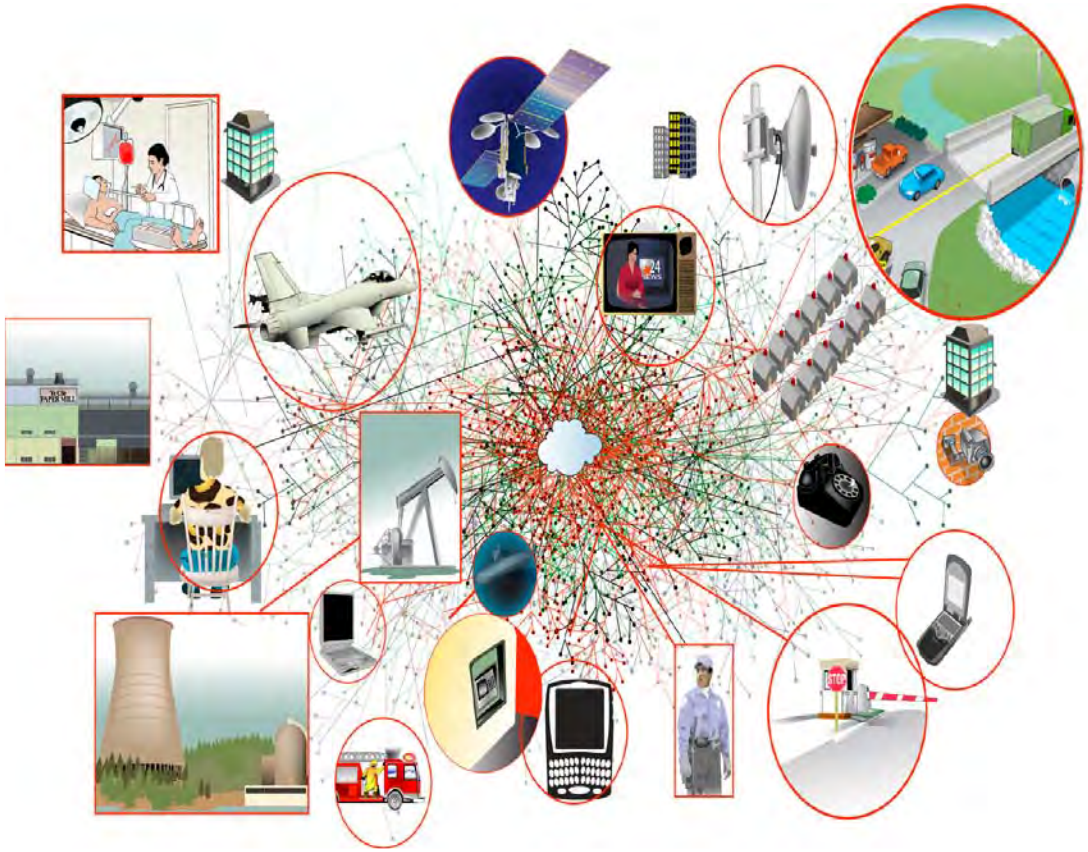
Source: SEI

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What is the Information Technology (IT) Environment?

Includes all

- System of Systems
- Architecture
- Services
- Networked Hardware/ Platforms
- People who digitally connect to cyberspace

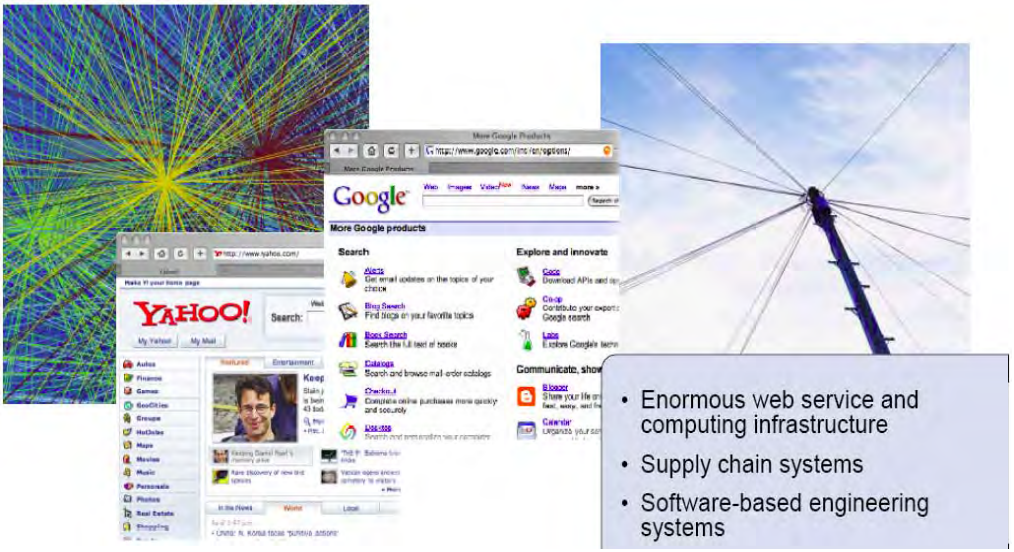


Often difficult to distinguish IT systems from other types of systems because they are networked systems!

Source: SEI

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Examples of Emerging Ultra-Large IT Systems



- Enormous web service and computing infrastructure
- Supply chain systems
- Software-based engineering systems

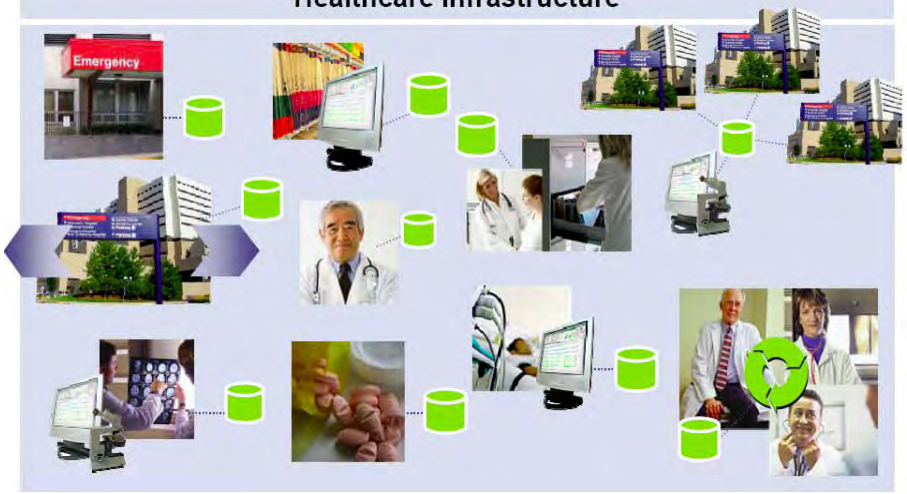
Networked Automobiles



Homeland Security



Healthcare Infrastructure



Source: www.sei.cmu.edu/uls

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Optimizing Information Technology*

- Adaptable IT Infrastructure Center on
  - Cloud Computing
  - Common Services
  - Network/Desktop Consolidation
- Streamlined IT Acquisition Processes 
- Robust Cyber Security Implementation
- Information Sharing Approaches
- Information Assurance
- Renewed Focus on Using Facilities on Reducing Overall Environment Consumption (e.g., power, space, cooling)

* Partial List

Sources: Department of Defense (DoD) Chief Information Officer (CIO) Campaign Plan Baseline (Oct, 2011) and SEI Discussions with CIOs (2010)

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Acquisition: IT Systems are Different from a Weapon System — and Critical to Enable a more Resilient Cyber Environment

Weapon Systems





- Weapon platform centric
- Military unique requirements
- Development of military-unique, breakthrough technologies
- Development cycle of decade or more
- Production decisions for unique hardware
- Service lives extending into decades

IT Systems





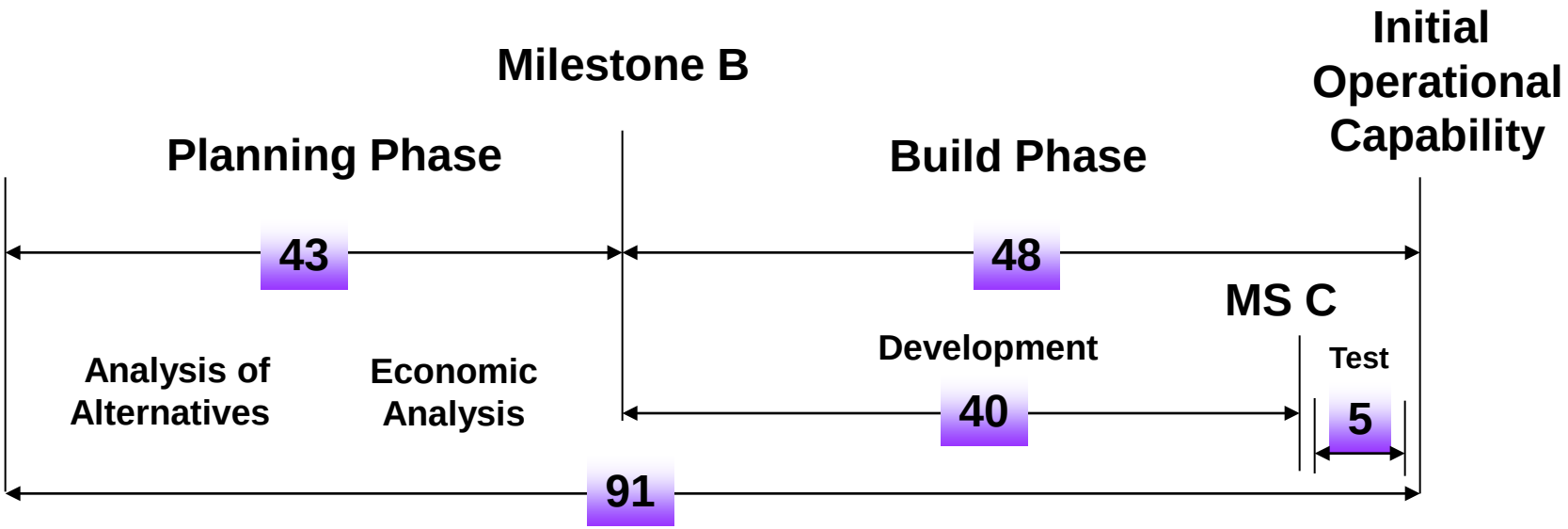
- Enterprise network centric
- Adapt commercial capabilities for military needs
- Leverage commercial technologies
- Technology cycle 12-18 months
- Procure commodity hardware
- Periodic technology refresh to avoid obsolescence

Demand Different Acquisition Life Cycles and Processes

Sources: IT Acquisition Reform Task Force/MITRE Corporation

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DoD IT Acquisition Cycle Time - 32 MAIS



Cycle Time Driven by Processes Developed to Counter a Cold War Adversary In Industrial Age Society

Source: Defense Science Board Report, March 2009

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The Opportunities

MAIS Program Avg = 91 Months

Adaptability

Speed

Agility



Previous DEPSECDEF Bill Lynn established a new goal: 18 months

Source: A New Approach for Delivering IT Capabilities in DoD, Report to Congress, November 2010

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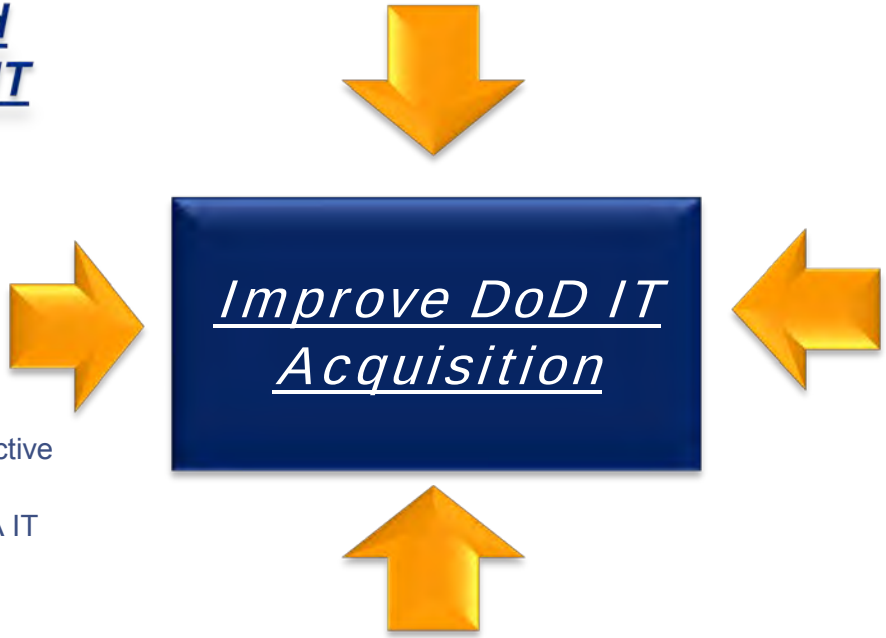
IT Acquisition Reform Imperative

Congress

- **Develop and Implement a new process for Acquiring IT (FY10 NDAA* Section 804)**
- **HASC** Panel on Defense Acquisition Reform Finding and Recommendations (23 March 2010)**

Widely documented Problems with DoD IT Acquisitions

- Defense Science Board
  - Jan 09 – Integrating COTS
  - Mar '09 – IT Acquisition
  - Apr '09 – Fix the Acq process
  - Jul '09 – Rapid Acquisition
- Industry Associations
  - AFEI, TechAmerica,
- National Academies - Achieving Effective Acq of IT in DoD 2010
- Business Leads – Aug '08 Joint DISA IT Review



Federal CIO

25-Pt Implementation Plan to Reform Federal IT Management

Vivek Kundra, U.S. CIO, December 9, 2010

DoD Senior Leadership Vision

"First step [for DoD to succeed in delivery of IT] is to acknowledge that simply tailoring the existing processes in not sufficient" **(National Research Council, DEC 2009)**

NDAA: National Defense Authorization Act ; HASC: House Armed Services Committee;
AFEI: Association for Enterprise Information; DISA: Defense Information Systems Agency

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Defense Science Board Report & Public Law 111 (Section 804) 2010 National Defense Authorization Act

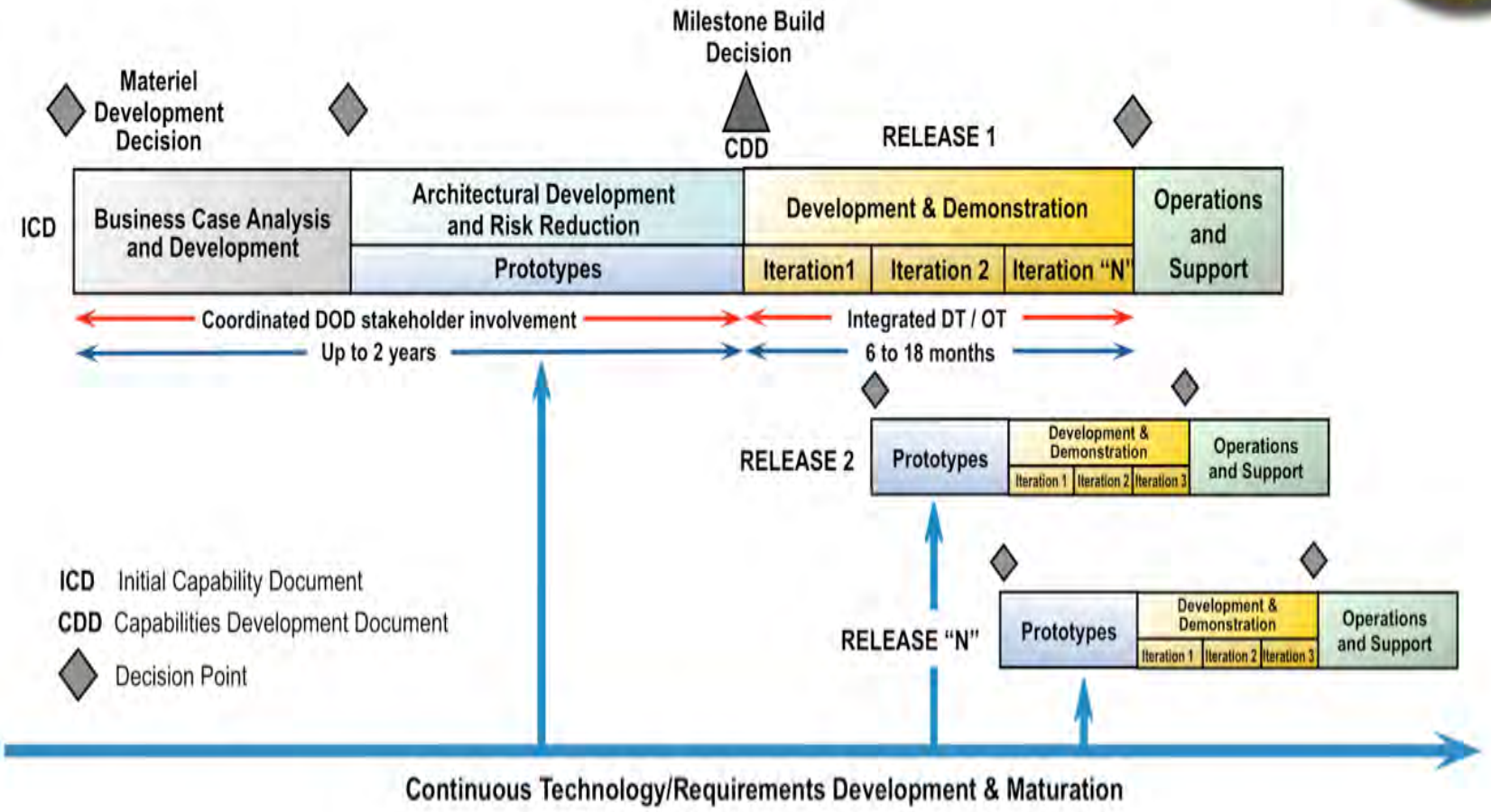
Selected Statements (paraphrased):

- NEW ACQUISITION PROCESS REQUIRED -The Secretary of Defense shall develop and implement a new acquisition process for information technology systems

- To the extent determined by the Secretary, be based on the recommendations in Chapter 6 of the March 2009 report of the DSB Task Force on DoD and Procedures for the Acquisition of Information Technology

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A New Acquisition Process for Information Technology



Source: Defense Science Board Report, March 2009

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Guiding Principles

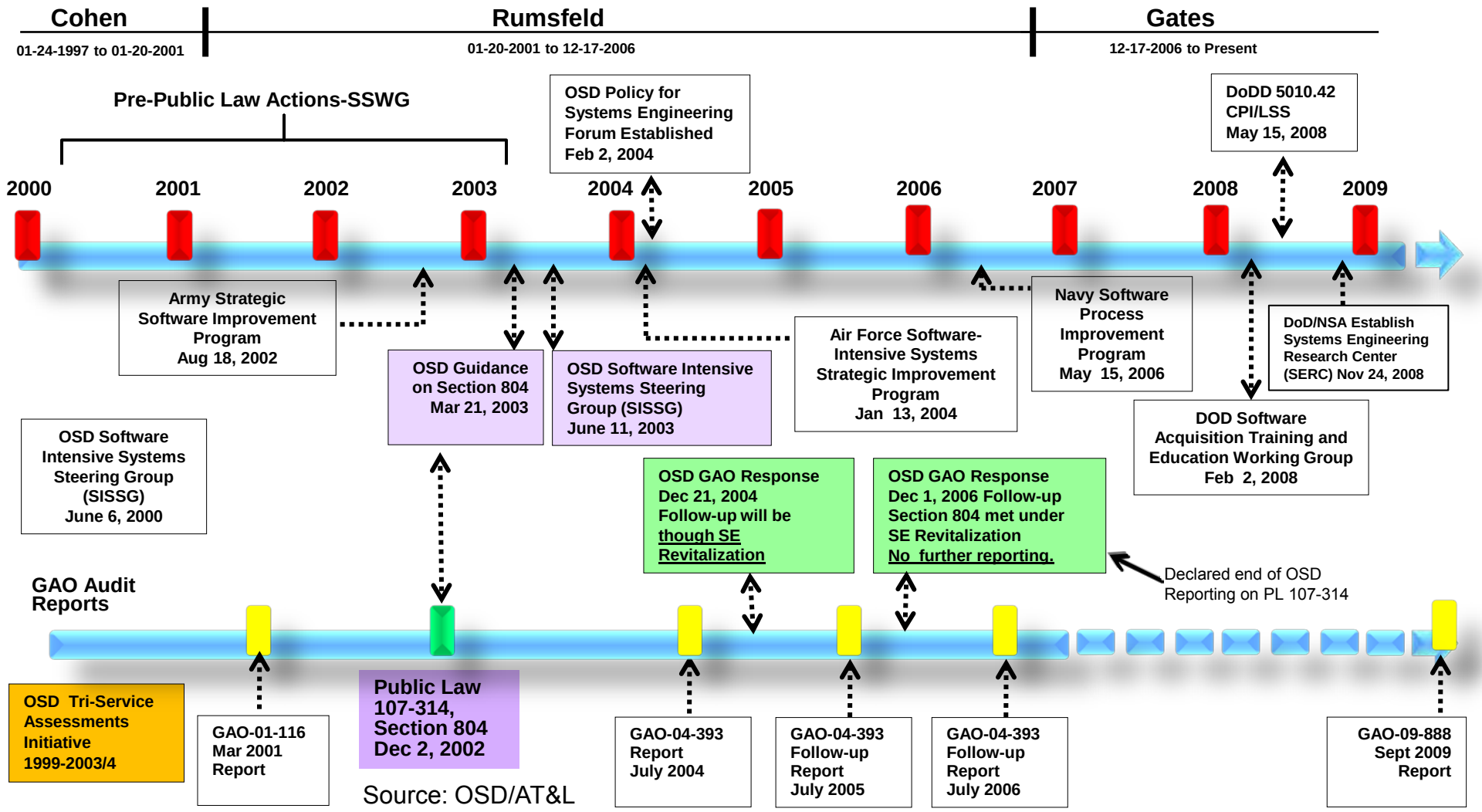


1. Deliver Early and Often
2. Incremental and Iterative Development and Testing
3. Rationalized Requirements
4. Flexible/Tailored Processes
5. Knowledgeable and Experienced IT Workforce

Sources: Defense Science Board Report, March 2009 and A New Approach for Delivering IT Capabilities in DoD, Report to Congress, November 2010

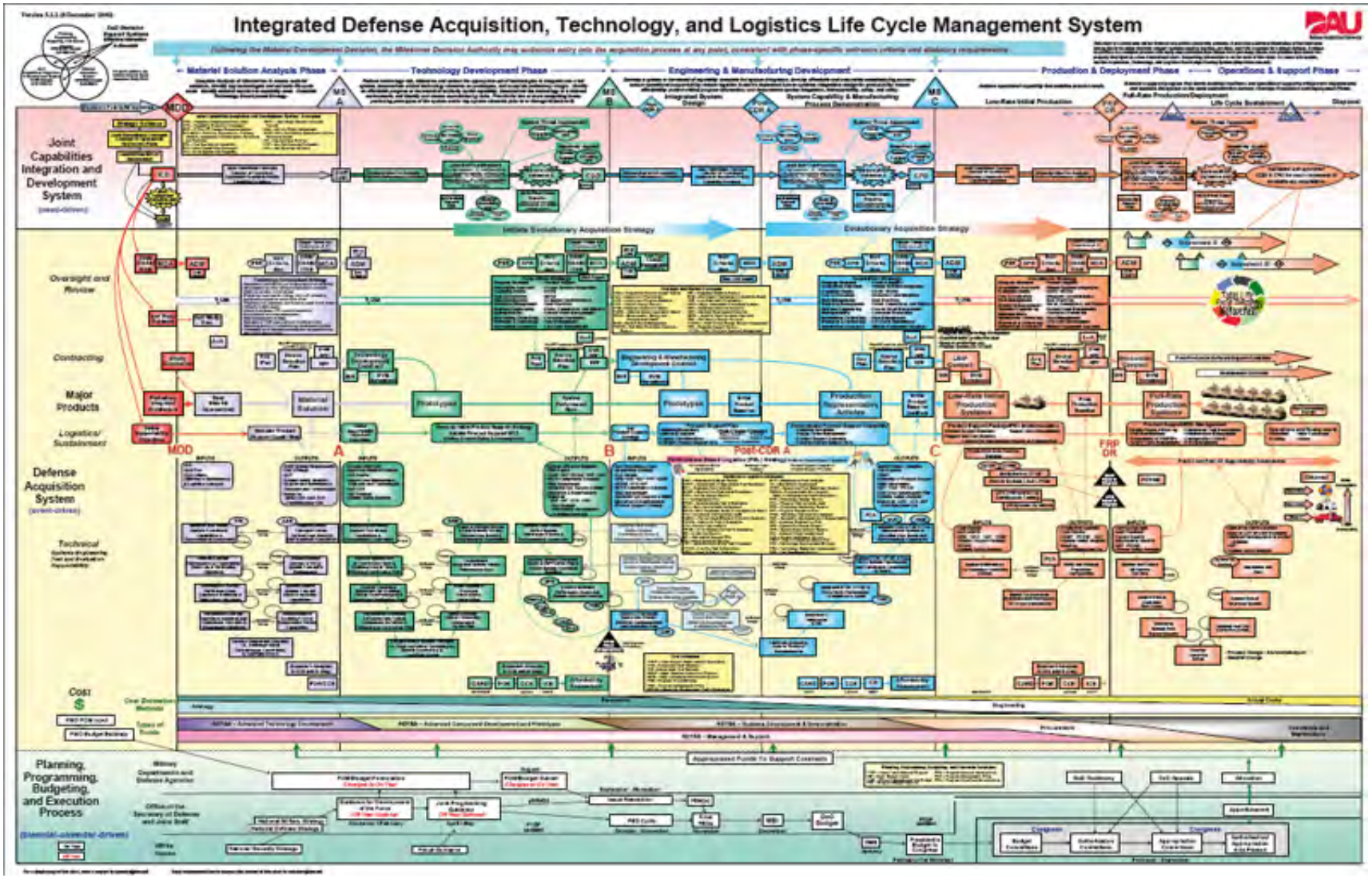
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DOD Software Acquisition Process Improvement Programs, DoD Major Events, and Leadership Rotation



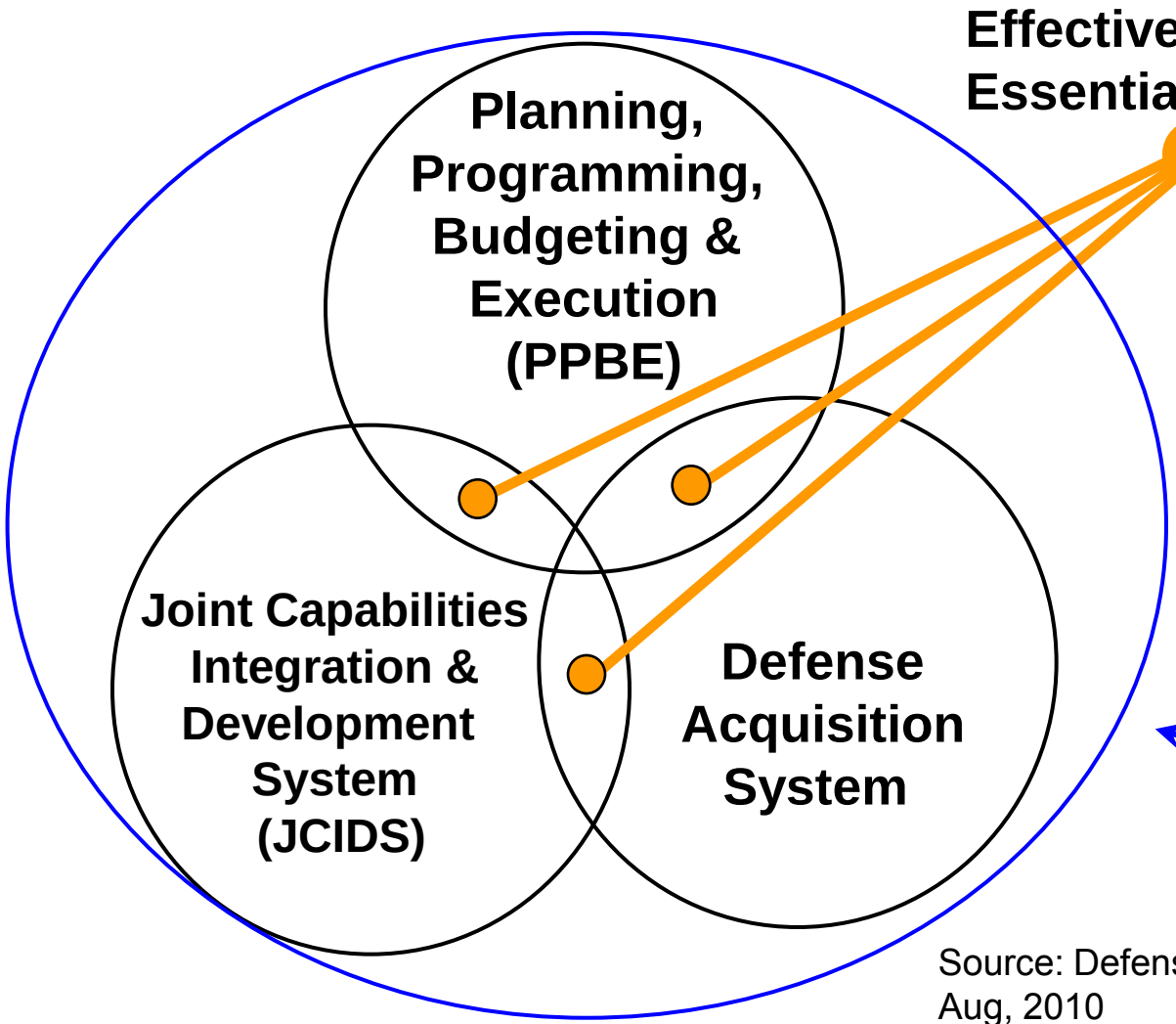
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An Effective Process for Major Defense Systems - but not very agile for IT Systems



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Better Alignment: Three Major DoD Decision Support Systems



Source: Defense Acquisition University Aug, 2010

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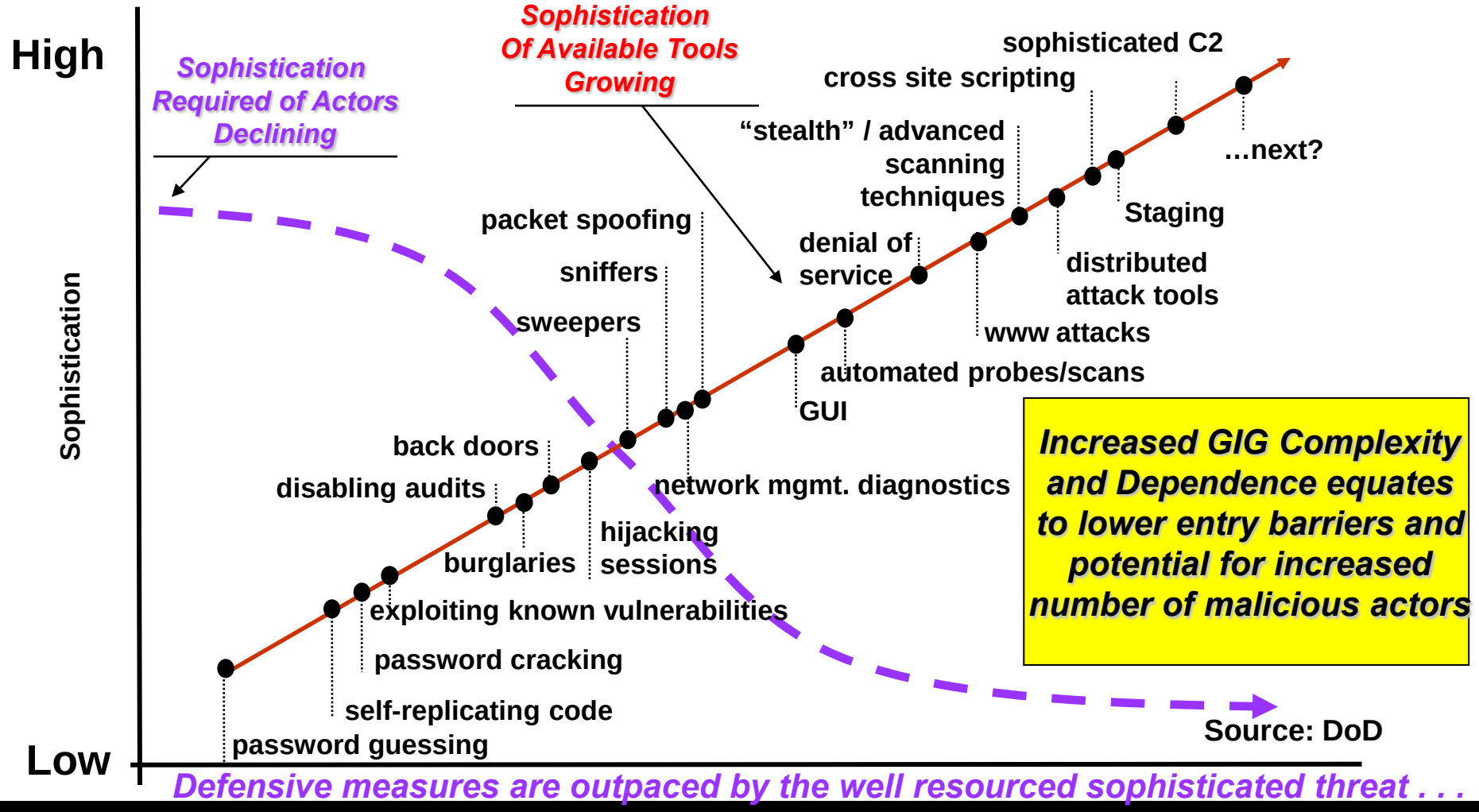
Challenges: Information Technology (IT) Environment



Source: www.sei.cmu.edu/uls

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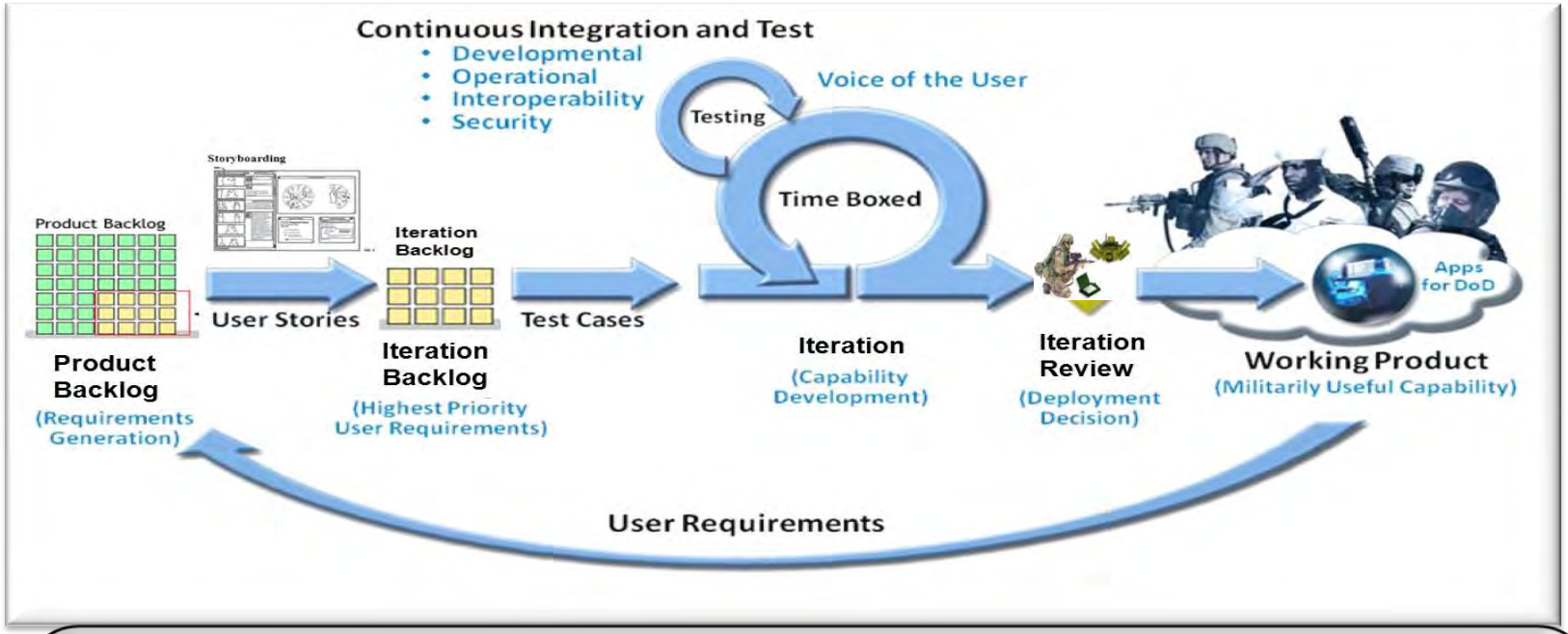
Rate of Adoption
The Cyber Domain is Hotly Contested



Defensive measures are outpaced by the well resourced sophisticated threat . . .

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Agile Development Process: A Building Block for Constructing Capabilities



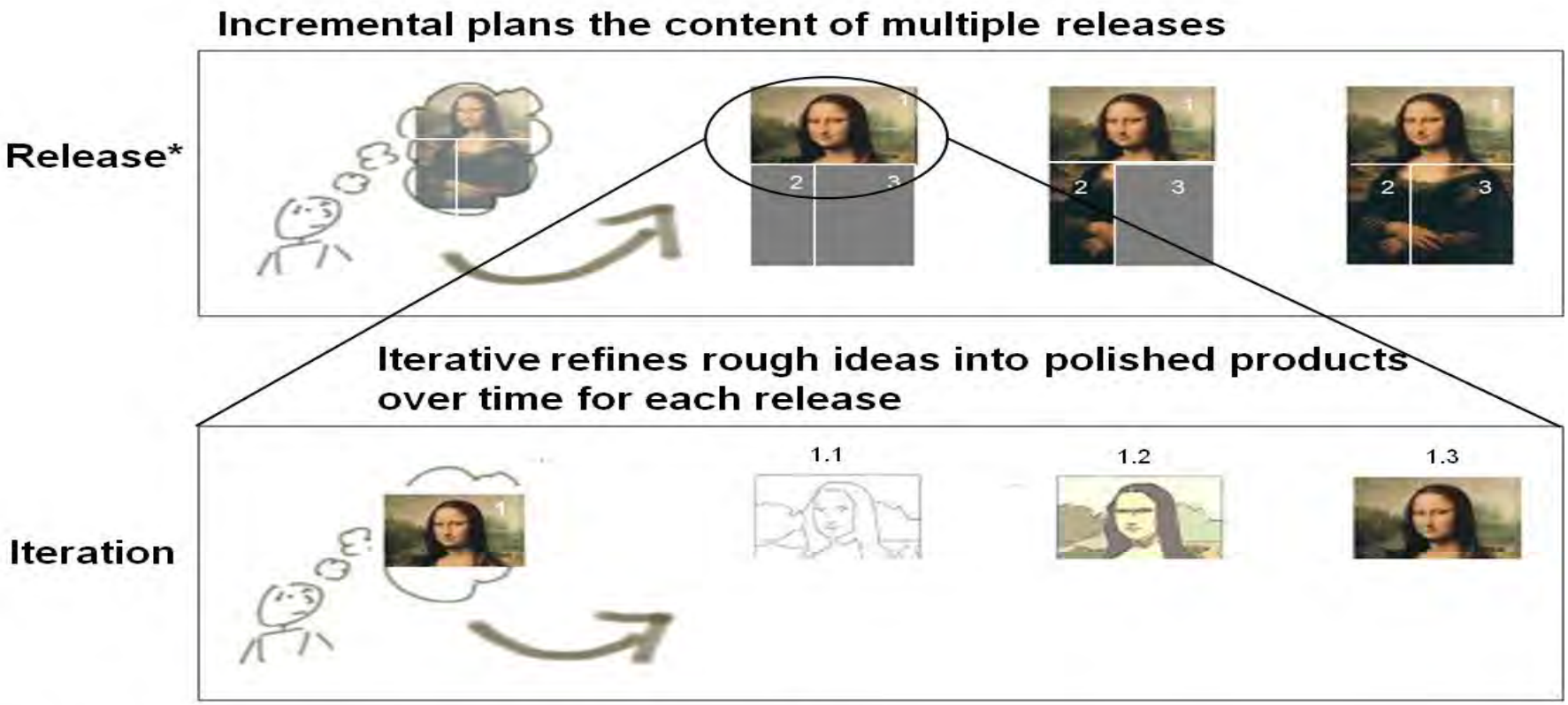
Agile methods emphasize early and continuous delivery of valuable products and services

- **User immersion in development for clarification and feedback**
- **Iterative development**
- **Testing occurs throughout (instead of at the end)**
- **Working product is the primary measure of progress**

Sources: IT Acquisition Reform Task Force/MITRE Corporation

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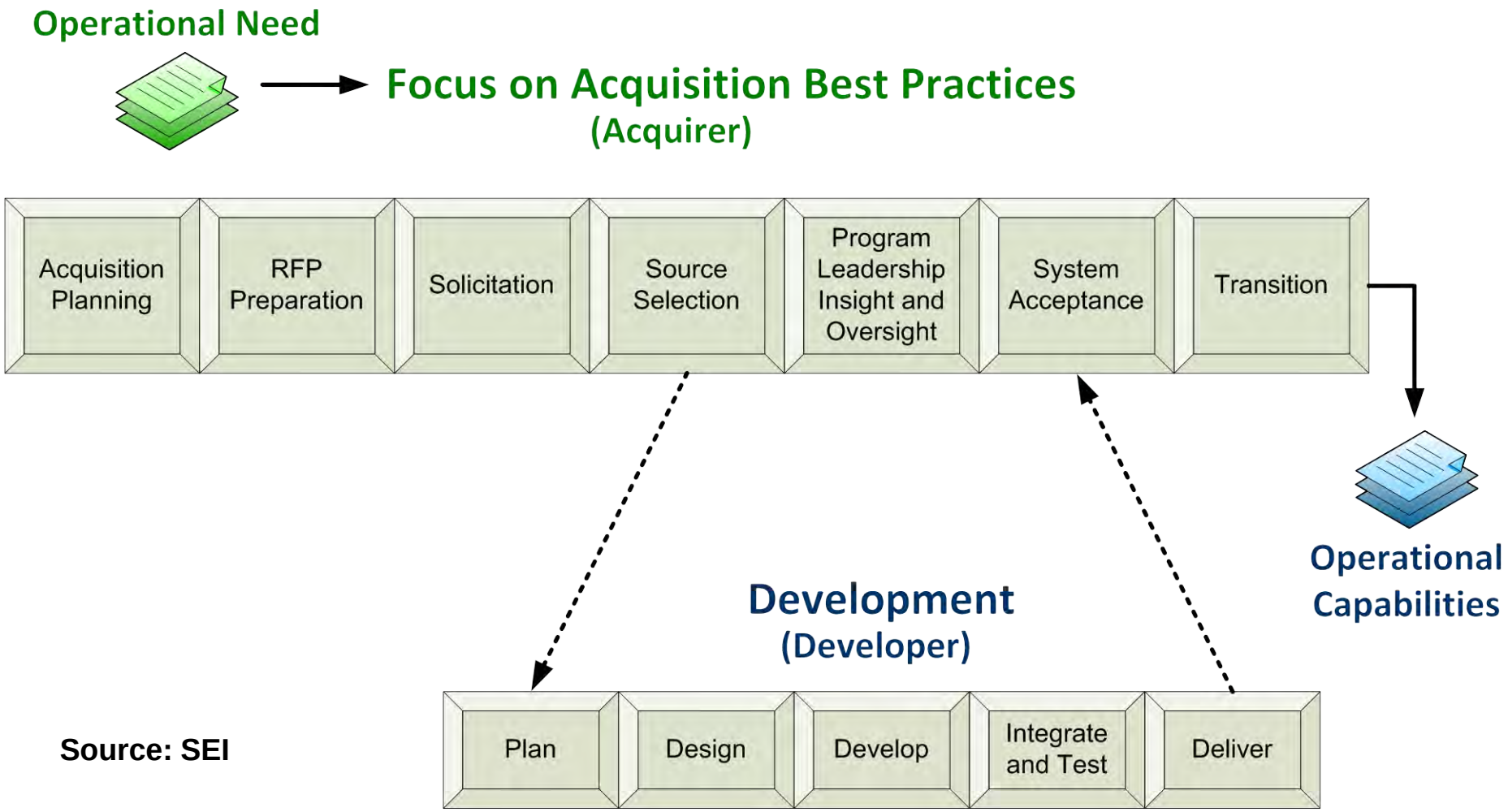
Agile is Not One-Size-Fits-All



Note: The diagram which was created by the MITRE Corporation team on the IT Acquisition Task Force Initiative is only for illustrative purposes and not necessarily representative of any specific agile approach

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Assessment Framework: *CMMI®-ACQ*



Source: SEI

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CMMI® -ACQ Categories and Process Areas

Category	Process Area
Acquisition	**Agreement Management (AM)** **Acquisition Requirements Development (ARD)** **Acquisition Technical Management (ATM)** **Acquisition Validation (AVAL)** **Acquisition Verification (AVER)** **Solicitation and Supplier Agreement Development (SSAD)**
Process Management	Organizational Innovation and Deployment (OID) **Organizational Process Definition (OPD)** Organizational Process Focus (OPF) Organizational Process Performance (OPP) **Organizational Training (OT)**
Project Management	**Integrated Project Management (IPM)** **Project Monitoring and Control (PMC)** **Project Planning (PP)** Quantitative Project Management (QPM) Requirements Management (REQM) Risk Management (RSKM)
Support	Causal Analysis and Resolution (CAR) Configuration Management (CM) Decision Analysis and Resolution (DAR) Measurement and Analysis (MA) Process and Product Quality Assurance (PPQA)

CMMI® -ACQ model was developed to codify best practices to help organizations improve acquisition processes

CMMI® reference models have gained significant traction across commercial and defense community and are widely used throughout world [CMMI Product Team 07]

Source: SEI

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CMMI ® -ACQ (V1.3) Project Planning – Comparison*

Project Planning		
PP	CMMI Pratice	Scrum Practice
SG 1	Estimates of project planning parameters are established and maintained	
SP 1.1	Establish and maintain the acquisition strategy	Concept of Operations or Scrum product vision
SP 1.2	Establish a top-level WBS to estimate the scope of the roject	The standard tasks used in a Scrum process combined with specific project tasks (Scrum Backlog)
SP 1.3	Establish and maintain estimates of the attributes of the work products and tasks	Story points, used to estimate the difficutly (or relative size) of a Story (requirement)
SP 1.4	Define the project lifecycle phases on which to scope the planning effort	The Scrum Process
SP 1.5	Estimate the project effort and cost for the work products and tasks based on estimation rationale	Scrum time estimate (similar to billable hours or Full Time Equivalents)
SG 2	A project plan is established and maintained as the basis for managing the project	
SP 2.1	Establish and maintain the project's budget and schedule	1. Scrum estimates; 2. Estimates of what work will be in each release; 3. Sprint Backlog; 4. Project Taskboard

Reference: N. Potter and M. Sakry, Implementing Scrum (Agile) and CMMI ® Together, March 2009

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IT Compared with Other Sciences

	PHYSICAL SCIENCE	BIOSCIENCE	IT- COMPUTER/SOFTWARE/CYBER SCIENCE
Origins/History	Begun in antiquity	Begun in antiquity	Mid-20th Century
Enduring Laws	Laws are foundational to furthering exploration in the science	Laws are foundational to furthering exploration in the science	Only mathematical laws have proven foundational to computation
Framework of Scientific Study	Four main areas: astronomy, physics, chemistry, and earth sciences	Science of dealing with health maintenance and disease prevention/treatment	• Several areas of study: computer science, software/ systems engineering, IT, HCI, social dynamics, AI • All nodes attached to/relying on netted system
R&D and Launch Cycle	10-20 years	10-20 years	Significantly **compressed**; solution time to market needs to happen very quickly

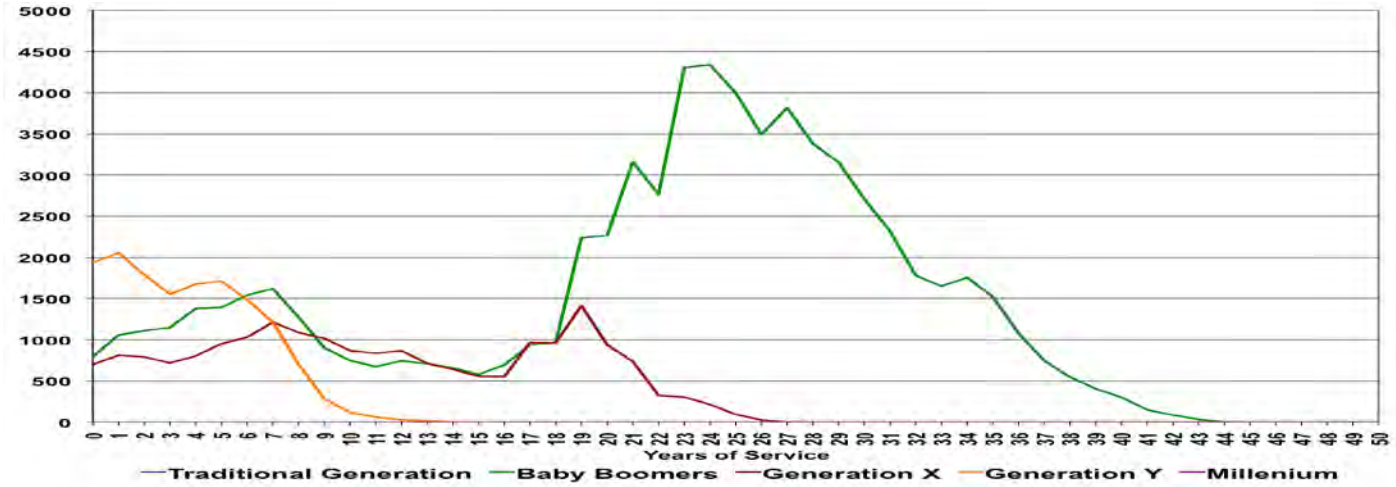
Source: SEI

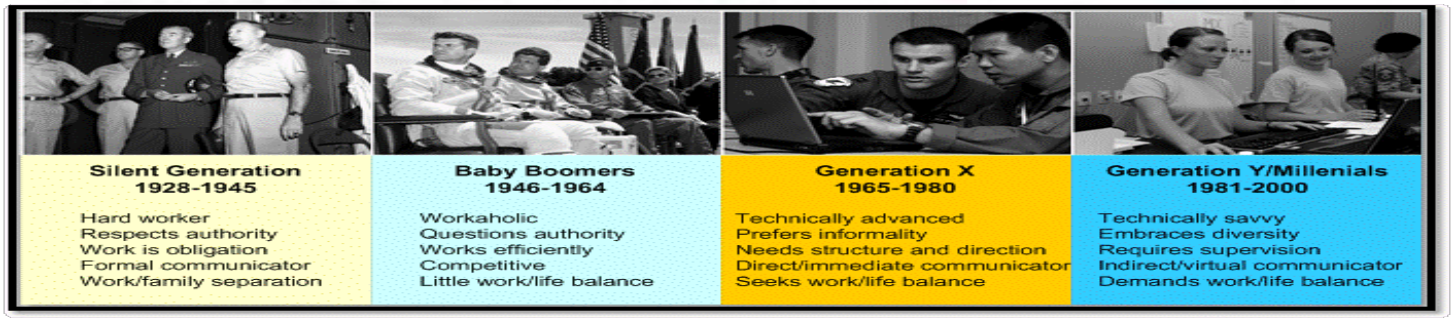
HCI: Human Computer Interaction; AI: Artificial intelligence

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Opportunity - 21st Century Acquisition Workforce

- Acquisition Guidance, and Training Programs Need to Be Updated to Support the 21st Century Acquisition Workforce





Sources: DoD (AT&L) and SEI

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Why are Software Intensive IT Projects Difficult?

According to Fred Brooks software projects are difficult because of accidental and essential difficulties

- Accidental difficulties are caused by the current state of our understanding
  - of methods, tools, and techniques
  - of the underlying technology base
- Essential difficulties are caused by the inherent nature of software
  - invisibility - lack of physical properties
  - conformity
  - changeability
  - complexity

Source: *The Mythical Man-Month* by Fred Brooks, Addison Wesley, 1995

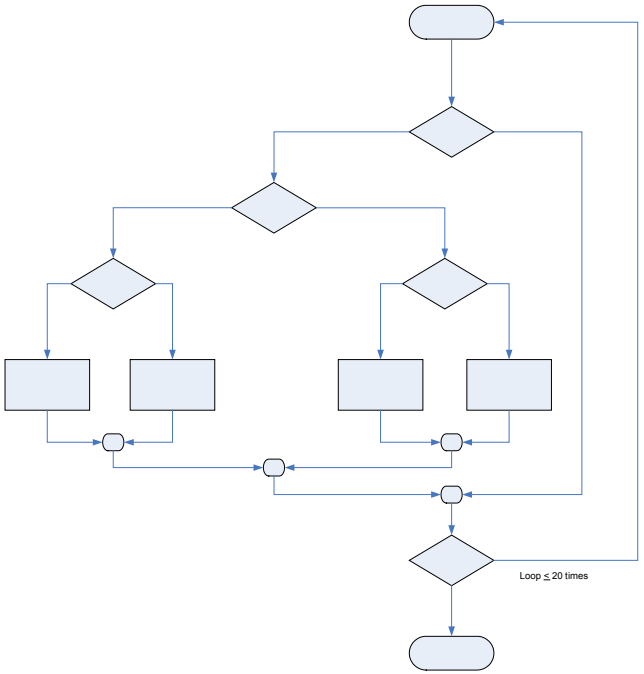
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Realities of Software Quality

The flowchart might correspond to a 100 LOC module with a single loop that may be executed no more than 20 times.

There are approximately 10^{14} possible paths that may be executed!

For any but the smallest programs, complete path coverage for defect detection is impractical.



Lehman Laws:

1. **The Law of Continuing Change – programs must change to be useful**
2. **The Law of Increasing Complexity – programs that change become more complex**

Source: Adapted from Pressman, R.S., *Software Engineering: A Practitioner's Approach, Third Edition*, McGraw Hill, 1992

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Software Evolution and Maintenance Cost Is Increasing

Year	Proportion of software maintenance costs	Definition	Reference
2000	>90%	Software cost devoted to system maintenance & evolution / total software costs	Erlikh (2000)
1993	75%	Software maintenance / information system budget (in Fortune 1000 companies)	Eastwood (1993)
1990	>90%	Software cost devoted to system maintenance & evolution / total software costs	Moad (1990)
1990	60-70%	Software maintenance / total management information systems (MIS) operating budgets	Huff (1990)
1988	60-70%	Software maintenance / total management information systems (MIS) operating budgets	Port (1988)
1984	65-75%	Effort spent on software maintenance / total available software engineering effort.	McKee (1984)
1981	>50%	Staff time spent on maintenance / total time (in 487 organizations)	Lientz & Swanson (1981)
1979	67%	Maintenance costs / total software costs	Zelkowitz *et al.* (1979)

Source: Jussi Koskinen, Department of Computer Science and Information Systems, University of Jyväskylä P.O. Box 35, 40014 Jyväskylä, Finland

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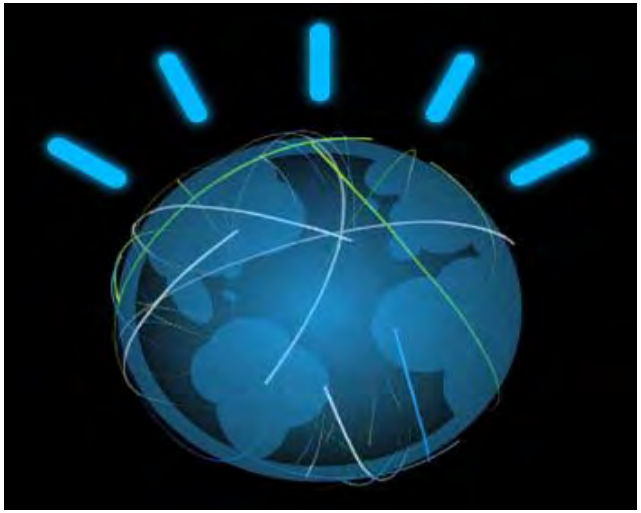
Federal IT Market Growth

"In the next five years, IT contractors will see the federal market for their services increase by a compound annual growth rate of 5.4 percent to a total of $111.9 billion by 2015."

-- Ben Bain
Federal Computer Week
April 8, 2010

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Proposed Changes: Think and Perform Differently



Watson's Avatar, Inspired by the IBM “Smarter Planet" Logo

CMMI® for Acquisition and CMMI® for Development Can Have a Potential Impact on the Rapid Acquisition of IT Systems

Source: Wikipedia - IBM Watson: The Face of Watson on You Tube

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Summary

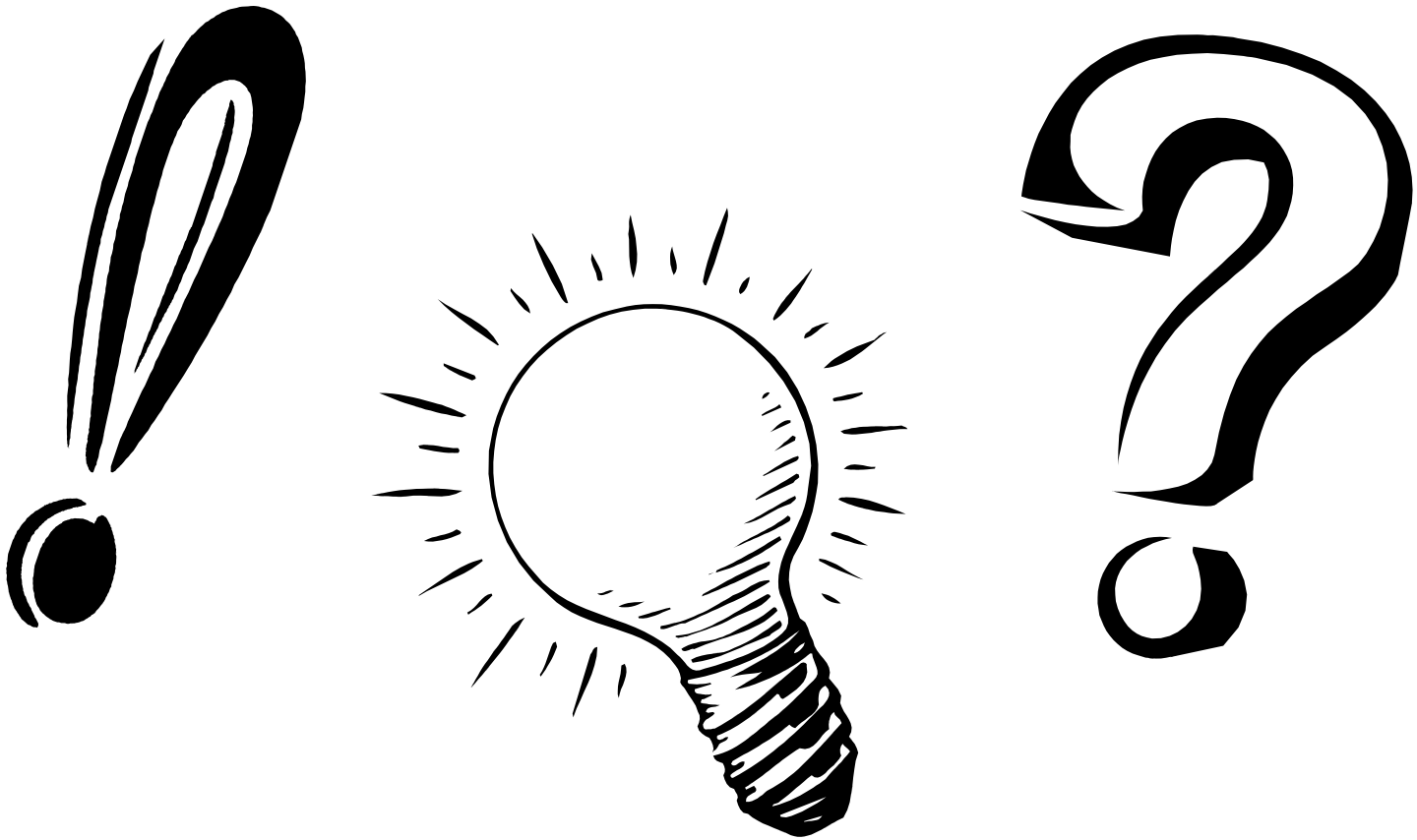


- The IT Acquisition Task Force Initiative concepts may have to be quite radical to meet the IT Acquisition Reform Guiding Principles (Section 804)*
  - Deliver Early and Often – *Be responsive to the users needs*
  - Incremental and Iterative Development and Testing
  - Rationalized Requirements – *Balance user needs with constraints*
  - Flexible/Tailored Processes – *Customize to IT category*
  - Knowledgeable and Experience IT Workforce – *Understands IT uniqueness*
- CMMI® for Acquisition and CMMI® for Development Can Have a Potential Impact on the Rapid Acquisition of IT Systems
- General acknowledgement that we can and must do better!

Source: A New Approach for Delivering IT Capabilities in the DoD, Report to Congress, November 2010

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Wrap Up



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SCAMPI Planning with Version 1.3

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LOCKHEED MARTIN

NDIA – November, 2011

Agenda

- Overview of Organization
- Getting Started
- Sampling Factors
- Sub-Groups
- Support Functions
- End Result – So Far
- Lessons Learned

Overview of Organization

- **Information Systems and Global Solutions (IS&GS) – Business Area within Lockheed Martin Corporation**
  - **IS&GS-Defense Product Line**
    - **Employs over 12,000 people at more than 200 sites worldwide**
    - **Principally engaged in the design, development, operation and sustainment of systems and solutions that help defense customers achieve their missions.**
    - **Performs on more than 400 programs for customers that include the U.S. military services, NASA and the National Oceanic and Atmospheric Administration.**
    - **Performs Software Development , Operations and Maintenance, Information Technology Services, Engineering Services and General Site services.**

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Getting Started

- Not an easy thing to get a list of programs
  - What is a program? (vs. contract, CLIN, project)
  - Who would have the most current list?
    - And what would it include?
- Business Area (IS&GS) Enterprise Dashboard
  - Centralized portal that provides weekly insight into IS&GS programmatic and financial performance across programs and provides a consistent consolidated view of performance status
  - Programs over a certain $ amount required to report weekly
    - Others at discretion of management
- Used Enterprise Dashboard to get baseline list of programs
  - Already provides a limiting factor ($ value)!
  - Initial list included 132 programs

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Sampling Factors

Sampling factors serve to identify meaningful differences in the conditions under which work is performed in the organizational unit. Based on a thorough understanding of the organization, the lead appraiser determines the sampling factors that define different clusters of process implementation for the organization unit. Tiers of the organization chart often provide an initial view of these potential groupings. The Method Definition Document section 1.1.4 contains a list of potential sampling factors which must be evaluated. In addition, the lead appraiser seeks information about other potential sampling factors.

Standard CMMI® Appraisal Method for Process Improvement (SCAMPISM) A, Version 1.3: Method Definition Document, Appendix F, Page 212

Sampling Factors

- What made sense as a differentiator – The organization's perspective:
  - All programs are required to follow a set of requirements, tailored for each program and documented in a compliance matrix
    - Regardless of Domain, Geography, Customer, Size or Life Cycle
    - Organizational tailoring was done for Program Type (e.g., development, services, operations/maintenance)
    - Requirements were specific for software, systems, hardware
  - Therefore, the organization felt that the following were process differentiators:
    - Discipline (i.e., software, systems, hardware)
    - Program Type (i.e., development, services, operations & maintenance – O&M)
    - Architecture Methodology (model-based or non-model based)
    - $ Value (default from program list obtained)
  - Provided this information to the Lead Appraiser for review / comment

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Sampling Factors (2)

- What made sense as a differentiator – The Lead Appraiser's perspective:
  - Additional information requested for:
    - % of contracts that were with Defense customers (92%)
    - Lines of Business within the organization (3 of the 5 with development or O&M effort included in scope)
  - Agreed the following were not differentiators
    - Domain, Geography, Customer and Life Cycle
    - Did not agree that size was not a differentiator
  - Lead Appraiser felt that the following were process differentiators:
    - Discipline (i.e., software, systems, hardware)
    - Program Type (i.e., development, services, O&M)
    - Architecture Methodology (model-based or non-model based)
    - Size (Full-Time Equivalents)

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Subgroups

Sampling factors are used to define subgroups in the organizational unit. Subgroups consist of sets of basic units which share the attributes identified by the sampling factors. Subgroups are defined by determining all potential combinations for each value of the sampling factors.

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Sub-Groups

- **First Pass:**
  - **19 Sub-groups defined based on Discipline, Program Type, and Architecture Methodology (called Project type)**

Subgroup	Relevant Sampling Factors
	Disciplines / Effort Types / Project Types
D1	H/W O&M
D2	Integration
D3	O&M Pass-thru, Production
D4	PM Only
D5	Production
D6	Research
D7	SW & HW O&M
D8	SE & SW / Development / non-model based
D9	SE & SW & HW / Development / model based
D10	SE & SW & HW / Development / non-model based
D11	SE & SW & HW / O&M
D12	Services
D13	SW & HW / Development / model based
D14	SW & SE / Development / model based
D15	SW & SE / O&M
D16	SW & SE/Dev - IDIQ
D17	SW / Development / model based
D18	SW / O&M
D19	T & M

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Sub-Groups (2)

- **Slice & Dice:**
  - **Select only those programs that were Development or O&M**
  - **12 Sub-Groups remaining**

Subgroup	Relevant Sampling Factors
	Disciplines / Effort Types / Project Types
D1	H/W O&M
D2	Integration
D3	O&M Pass-thru, Production
D4	PM Only
D5	Production
D6	Research
D7	SW & HW O&M
D8	SE & SW / Development / non-model based
D9	SE & SW & HW / Development / model based
D10	SE & SW & HW / Development / non-model based
D11	SE & SW & HW / O&M
D12	Services
D13	SW & HW / Development / model based
D14	SW & SE / Development / model based
D15	SW & SE / O&M
D16	SW & SE/Dev - IDIQ
D17	SW / Development / model based
D18	SW / O&M
D19	T & M

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Sub-Groups (3)

- **Slice & Dice:**
  - **Select only those programs that were multi-disciplined (with at least Systems Engineering for RD)**
  - **6 Sub-Groups remaining**

Subgroup	Relevant Sampling Factors
	Disciplines / Effort Types / Project Types
~~D1~~	~~H/W O&M~~
~~D2~~	~~Integration~~
~~D3~~	~~O&M Pass-thru, Production~~
~~D4~~	~~PM Only~~
~~D5~~	~~Production~~
~~D6~~	~~Research~~
~~D7~~	~~SW & HW O&M~~
D8	SE & SW / Development / non-model based
D9	SE & SW & HW / Development / model based
D10	SE & SW & HW / Development / non-model based
D11	SE & SW & HW / O&M
~~D12~~	~~Services~~
~~D13~~	~~SW & HW / Development / model based~~
D14	SW & SE / Development / model based
D15	SW & SE / O&M
~~D16~~	~~SW & SE/Dev - IDIQ~~
~~D17~~	~~SW / Development / model based~~ *
~~D18~~	~~SW / O&M~~
~~D19~~	~~T & M~~

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* Found out this wasn't a real "program" – no task orders

Sub-Groups (4)

- **Slice & Dice:**
  - **Select only those development programs that used model-based architecture design (keeping O&M)**
  - **4 Sub-Groups remaining**

Subgroup	Relevant Sampling Factors
	Disciplines / Effort Types / Project Types
D1	H/W O&M
D2	Integration
D3	O&M Pass-thru, Production
D4	PM Only
D5	Production
D6	Research
D7	SW & HW O&M
D8	SE & SW / Development / non-model based
D9	SE & SW & HW / Development / model based
D10	SE & SW & HW / Development / non-model based
D11	SE & SW & HW / O&M
D12	Services
D13	SW & HW / Development / model based
D14	SW & SE / Development / model based
D15	SW & SE / O&M
D16	SW & SE/Dev - IDIQ
D17	SW / Development / model based
D18	SW / O&M
D19	T & M

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Sub-Groups (5)

- Reviewed again by the Lead Appraiser:
  - This is when he determined that Size was also a factor!

- Start all over again?
- Not necessary – took the remaining sub-groups and created sub-sub-groups based on size:
  - < 50 Full Time Equivalents (FTEs)
  - 50 – 100 FTEs
  - > 100 FTEs
- BUT this resulted in 14 programs having to be sampled

Subgroup	Relevant Sampling Factors
	Disciplines / Effort Types / Project Types / ***Size***
D9	**SE & SW & HW / Development / model based**
D9.1	< 50 FTE
D9.2	50 - 100 FTE
D9.3	> 100 FTE
D11	**SE & SW & HW / O&M**
D11.1	< 50 FTE
D11.2	50 - 100 FTE
D11.3	> 100 FTE
D14	**SW & SE / Development / model based**
D14.1	< 50 FTE
D14.2	50 - 100 FTE
D14.3	> 100 FTE
D15	**SW & SE / O&M**
D15.1	< 50 FTE
D15.2	50 - 100 FTE
D15.3	> 100 FTE

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Sub-Groups (6)

- One more change in scope:
  - Programs with > 50 FTEs

- Some of the remaining sub-sub-groups did not have any programs that fit within that sub-sub-group

Subgroup	Relevant Sampling Factors
	Disciplines / Effort Types / Project Types / ***Size***
D9	**SE & SW & HW / Development / model based**
~~D9.1~~	~~< 50 FTE~~
D9.2	50 - 100 FTE
D9.3	> 100 FTE
D11	**SE & SW & HW / O&M**
~~D11.1~~	~~< 50 FTE~~
D11.2	50 - 100 FTE
D11.3	> 100 FTE
D14	**SW & SE / Development / model based**
~~D14.1~~	~~< 50 FTE~~
D14.2	50 - 100 FTE
D14.3	> 100 FTE
D15	**SW & SE / O&M**
~~D15.1~~	~~< 50 FTE~~
D15.2	50 - 100 FTE
D15.3	> 100 FTE

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Sub-Groups (7)

- **Results**

Subgroup	Relevant Sampling Factors	Size of Sub-sub-group	Size * # Sub-sub-groups	(Size * # Sub-sub-groups) / # Programs	# Sampled
	Disciplines / Effort Types / Project Types / *Size*				
D9	**SE & SW & HW / Development / model based**				
D9.3	> 100 FTE	4	20	1.67	2
D11	**SE & SW & HW / O&M**				
D11.3	> 100 FTE	3	15	1.25	1
D14	**SW & SE / Development / model based**				
D14.2	50 - 100 FTE	3	15	1.25	1
D14.3	> 100 FTE	1	5	0.42	1
D15	**SW & SE / O&M**				
D15.3	> 100 FTE	1	5	0.42	1
Total Number Programs		12			6
Number of Sub-sub-groups	5				

- **6 Programs to be Sampled**
- **Evolved Appraisal Scope:**
  - **Model based architecture development or O&M only, Multi-Disciplined with at least Systems Engineering included, for programs of 50 or more Full-Time-Equivalent people**

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Support Functions

Groups of people who perform work that enables or supports the work which is ultimately visible to the customers of the organization.

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Support Functions

- Looked across the organization's structure to see what could be defined as a "Support Function"
  - Quality – independent from the programs
  - Subcontracts – all follow Corporate guidelines and procedures
  - Organizational groups
- Received additional questions from the Lead Appraisers:
  - Provide information on reporting and reviews for Quality activities
  - What type of supplier agreements exist
- Worked with the organization to obtain additional information

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Support Functions (2)

- Quality was defined to be a Support Function
  - Different reporting structure from Program Management
  - Monthly Operating Review by Quality manager
    - Covers key accomplishments, disappointments, past 30 days activity, future 30 day activity, audits, corrective actions, prevention measures, etc.
  - Quality Plans had already been established on the programs
    - Quality manager participates in yearly program reviews, reviewing the Quality Plans to ensure they are up-to-date and are being followed
- Although this could have limited evidence collection, all the programs decided to provide PPQA evidence as part of their preparation for the SCAMPI A!

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Support Function (3)

- Subcontracts was not defined to be a Support Function
  - Corporate terms were not the same as model terms
    - Difficult to explain to participants
    - Difficult to explain to Lead Appraiser
  - Different levels and combinations of supplier activities
    - From standard COTS purchases to full subcontract management
- Could have pushed to make this a support function because of the consistency across the organization
  - But it was “too hard”!

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End Result – So Far

- Sampling Factors have been identified
  - Modified the original organizational scope
  - Several iterations with Lead Appraiser required
    - To understand model perspective
    - To understand organization
- Programs have been identified
  - 5 programs to provide full PIID evidence (except PPQA)
  - 2 programs to provide 2 or 3 PAs
  - Quality organization to provide PPQA evidence from one of the programs
- Data Coverage Plan completed
  - Team review of evidence completed

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End Result – So Far (2)

- Would it have been the same under V1.2?
  - It depends
  - In the past (under V1.1 and V1.2):
    - Identified minimum of 3 programs that provided 45 – 50% of sales and people
      - Typically, the biggest programs
    - In addition, would identify 5 – 10 programs that would prepare evidence to be "sampled" if the appraisal team wanted additional institutionalization evidence
    - 8 – 13 programs preparing full sets of evidence
  - Probably would have identified some of the same programs
    - But only 5 programs providing full sets of evidence and 2 more providing 2 – 3 process areas

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Lessons Learned

- SCAMPI V1.3 takes more effort in up-front planning
- SCAMPI V1.3 required earlier involvement by Lead Appraiser
  - Lead needs to really ***understand*** the organization
  - Lead needs to be responsive to questions / issues raised by organization so that the "slicing and dicing" proceeds quickly
  - Organization needs to be responsive to questions from the Lead
- This organization's programs are risk-averse
  - Even when they don't have to provide evidence, they do anyway
    - Just in case
    - So they won't have to do something at the last minute

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Questions??







CMMI® Level 5……. A Bargain!

11th Annual CMMI Technology Conference and User Group
November 14 – 17, 2011

Raytheon Integrated Defense Systems (IDS)
Mary Ellen Christopher
Jayne Perkins

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Raytheon

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Agenda

- IDS History
- Cost Effective SCAMPI's – a MUST
- Bargain Hunting
- Key Shopping Tips
- Summary

Raytheon

Is it possible to reduce SCAMPI costs?

- The considerable cost of preparing for and conducting a SCAMPI Class A appraisal can reduce the value of a CMMI initiative as well as diverting funds away from improvement activities.

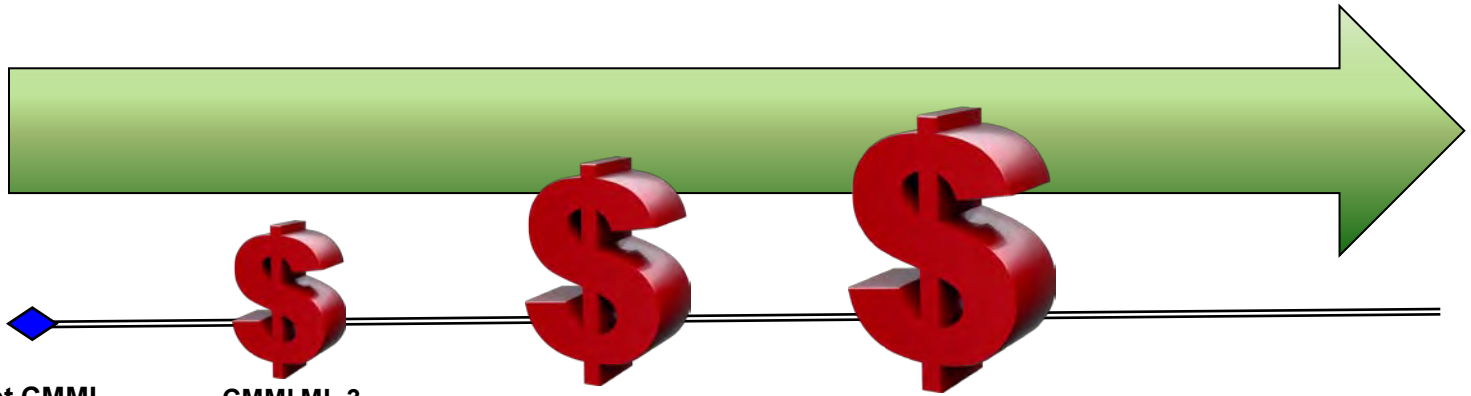
- This presentation will share how Raytheon Integrated Defense Systems (IDS) was able to significantly reduce cost and cycle time for preparing for and conducting a 2011 CMMI-DEV V1.3 Maturity Level 5 SCAMPI A as compared to the similar scope SCAMPI A conducted in 2008.

- The strategy used balanced results with an acceptable level of risk.

- We hope you can take some of our lessons learned and apply them to your organization.

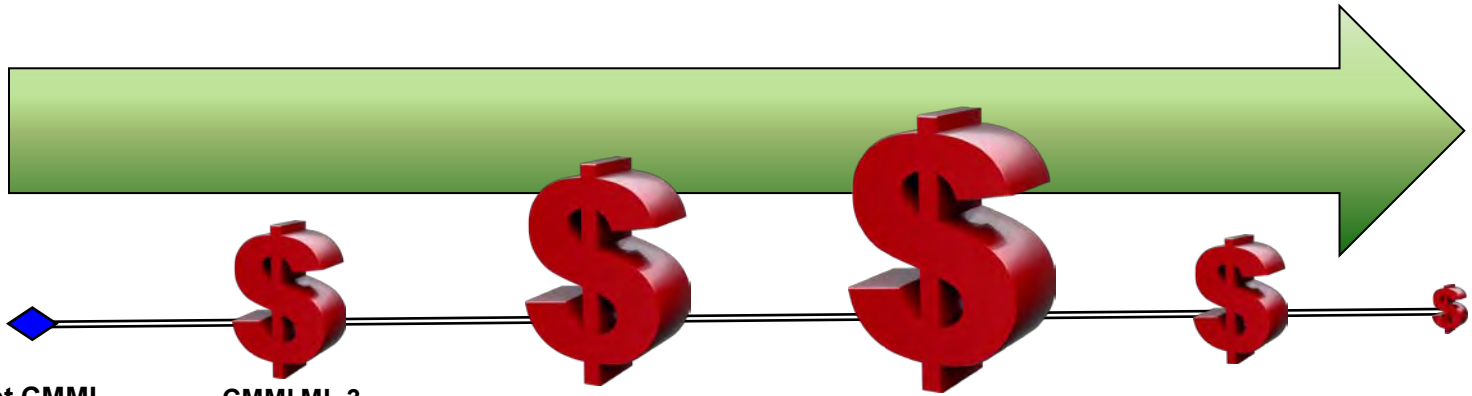
Raytheon

IDS CMMI Appraisal History



Raytheon

IDS CMMI Appraisal History





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Doesn't Everyone Want a Bargain?

A Bargain!

Bargain (noun): bɑː(r) gɪn (Macmillan Dictionary)

1. something you buy that costs much less than normal

You should be able to pick up a few good bargains.

a. a lower than usual price

Twenty pounds is a real bargain!



Raytheon

How do *YOU* Shop for a Bargain…

Raytheon

How do *YOU* Shop for a Bargain…

Special Tips for Getting the Best Bargains on Black Friday…



Raytheon

Tips for Bargain Hunting…



Comparison Shop





Shopping List

Exclusive Deal





Raytheon

#1 Shopping List

What do we have to get … It's all in Planning!

Problem: Evidence had been collected from multiple disciplines for every Process Area and was Evidence Collector Driven

Goal: To develop an Efficient Data Collection Strategy



- Established a Plan as to who would supply what evidence
  - Appraise at the program level vs. by individual disciplines
  - One Evidence Collector per Program
- Developed Precision PIID's - *"Operational Definitions"*
  - Example Evidence very detailed
  - Common Artifacts Identified
  - Identified Multi Purpose Evidence "Threads" for ease of collection and appraising
- Established Common File structure for Evidence Repository

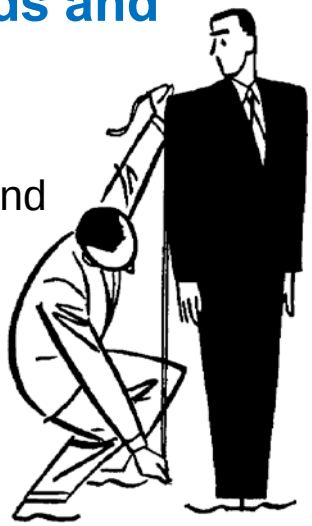
If you can't explain it simply, you don't understand it well enough.

Albert Einstein

Raytheon

#2 Exclusive Deals

What's unique … It's all in Understanding the Business Needs and Tailoring to suit!



Problem: Appraisals were considered a Major Event requiring many Meetings and Communications

Goal: To make Appraisals Less Invasive to Programs

- Eliminated Participant Briefing & Opening Briefing (3 Briefings merged to 1)
  - Used existing Project Briefing Sessions, combining duplicate information
- Eliminated two "Formal" Preliminary Findings Briefings
  - Performed alternative validation of Preliminary Findings - via E-mail with acknowledgement of Findings
- Eliminated the appraisal "*hype*"
  - Reduced Communications Costs - We did not want to "alert" the organization
  - An appraisal event should not be a stimulus to perform differently!
    - "This is the way we do business"
  - Stoplight status stayed within "Closed doors" *(vs. Fix that RED!)*

Breaking with Traditional Thinking

Raytheon

#3 Coupons

How much can we get for our money … It's all in spending $ wisely!

Problem: Too much Time and Money was spent on Polishing the Evidence and conducting Multiple Appraisal Events

Goal: Ensure Appraisals do not consume majority of Funding…Budget spread to Sustainment, Institutionalization and Improvements



- Focused on Sustainment Activities
  - Updated Quality Audits to find sustainment issues
  - Used a Maturity Index Tool to ensure no process regression
- Reduced Evidence review time Pre-Onsite and Onsite Activities
  - Common Artifacts and Threads told the same story
- Eliminated Class C and B appraisals - Were not looking for an appraisal with "No findings"
  - Address weaknesses after the SCAMPI^{SM} rather than between events
- External "seasoned" team members reviewed high risk evidence
- Level Set the Appraisal Team by phone a few weeks prior to the appraisal

More Bang for the Buck!

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#4 Buy 1 Get 1 Free

What can we get for free …. It's all in the Re-Use!

Problem: Multiple copies of the same evidence collected by various evidence collectors – too much evidence, too time consuming to review/interpret

Goal: To collect the Minimum amount evidence – for the Maximum amount of coverage



- Developed a list of "common" artifacts
  - 30/40 key documents provided 70% coverage …
  - Reduced Evidence Collection Rework
- Established a Common File Structure for Evidence
  - Ensured ease of evidence identification by collector *and* reviewer
- Created one PIID per Program being appraised (vs PIIDs by PA)
  - Facilitated the copy of common links rather than having to relink
- Identified One Evidence Collector per Program
  - Evidence collector knew what was already collected and could re-use across Process Areas

Read Once…. Write Many

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#5 Comparison Shop

Who has the best …It's all about Lessons Learned!

Problem: Preparing for and Conducting Appraisals the same as we always had because "that's how we do it"

Goal: Utilize Lessons Learned to get a Lean appraisal process while ensuring Appraisal Integrity and Accurate Appraisal findings.



- Write Once… Read Many for Evidence Collection
- Logistics
  - "Dry Run" in New Conference Area
  - Ensured two site coordinators were available and at least one was always present to assist the appraisal team
- Business Units typically staff 50% of their team members from outside
  - Enables sharing of best practices across the entire Raytheon - leverage across and take the best of the best
- Utilized local experienced appraisal team members for evidence review

Work Smarter, Not Harder

Raytheon

Impulse Purchase

Seeing something you can't live without… It's all about Best Practices!

- Raytheon shares among 6 Business Units (BU)
  - Engineering process Group (EPG) Workshop
  - Constantly look for improvements (Feeding ML 5)
- Hi – MAT
  - Worked with Programs in their own language – "not in CMMI terms" to determine actual process execution
    - Models that make sense – *"Model Hunting"*
    - Programs were performing "High Maturity"
- Maturity Index Tool
  - Adopted from another BU
    - Altered to fit our process structure
    - Modified to incorporate Services Model
- Appraisal Team Members
  - Participate on other BU Appraisals
  - Bring members from other BU's to participate on ours
- Lead Appraiser
  - Periodic Site Visits keeps Lead involved – no surprises



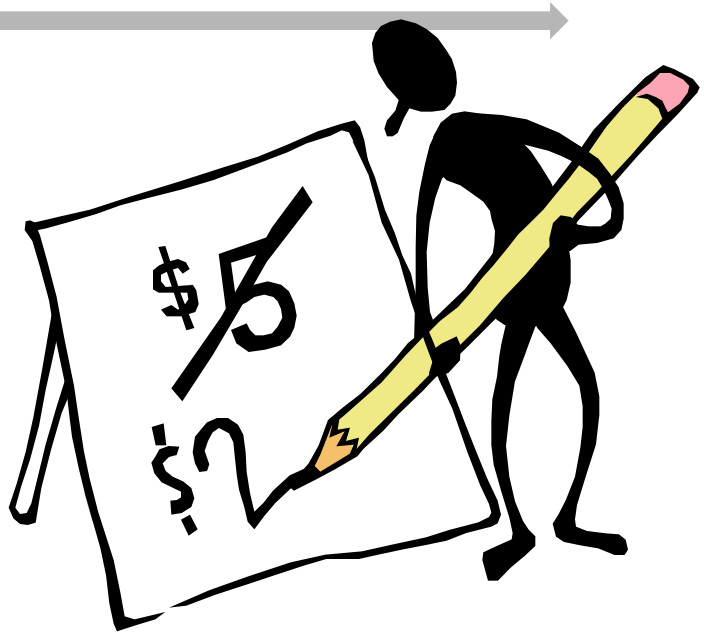
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Our ML5 Re-appraisal ….. a Bargain!



March 2011

CMMI® ML5
SCAMPI℠



-50% less overall cost (Prep & Conduct)
- 2.5 weeks on-site vs. 4 weeks
- 8 months ahead of schedule
- Minimal impact to programs – Already sustaining

Raytheon

Questions?



Raytheon

Contact Information





Raytheon

Appraisals and CMMI Gotchas

Lessons in CMMI Use and Appraisal Preparation

Neil Potter
The Process Group
help@processgroup.com

Referenced articles are at www.processgroup.com/newsletter.html

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Agenda - Part 1

- Introduction
- CMMI Premise
- Documentation
- Configuration Management
- Measurement and Analysis
- Project Planning
- Project Monitoring and Control

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Agenda - Part 2

- Integrated Project Management
- Training
- Equal-weighted Process Area practices?
- Appraisal Preparation - PIIDing
- Appraisal Interview Preparation

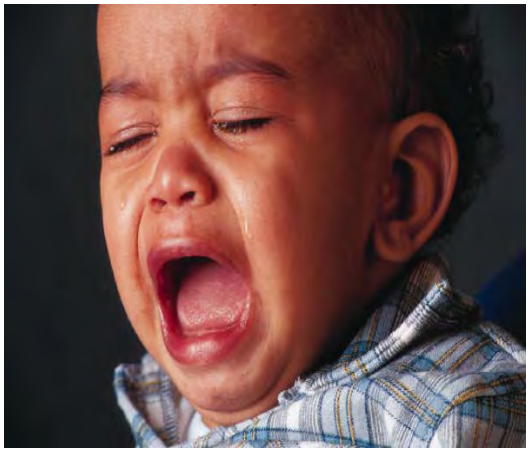
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CMMI HAZARDS!

Introduction

Using CMMI or preparing for an appraisal?

- Avoid the hazard of creating a **paper factory**, instead focus on organizational results
- Avoid putting the emphasis on the **less important** issues
  - » e.g., policy recital, training records, emails that say “We assigned this to Fred”
- Spend your time making things better, not on a rote exercise
- Know some **common blind spots**



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CMMI Premise

- **CMMI practices can:**
  - Reduce project risk
  - Reduce rework and costs
  - Improve output quality and predictability
  - Improve productivity through process improvement and process reuse
- **CMMI:**
  - Can be used to diagnose current state
  - Provides an example roadmap forward
    - » Management/project, engineering/organization, statistics/prediction, variation/mean

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Hazard: Drowning in Documentation

- **Easy to fall into the trap of the paper factory**
  - We are developers, so we develop!
  - What we really need is **guidance** for our jobs
    - » **Capture** best organization engineering and management practices
    - » Not necessarily **repeat** every book known to mankind!
- **What problem are we trying to solve?**
  - Make engineering easier, quicker, less hassle - NOT MORE



[Newsletter “documentation”]

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Configuration Management (CM)

Hazard: over-simplification

- **CM looks pretty straight forward, once people start to understand the discipline**
- **Don't avoid Configuration audits - make them useful [SP 3.2]**
  - Use physical audits to help ensure that products are released correctly, e.g.,
    - » Verify **differences** between source and release = change list
    - » Compare **checksum** value between source and release
- **What problem(s) are we trying to solve?**
  - Producing the right stuff and getting it to the customer
  - Keeping track of our stuff, protecting ourselves from loss

SP 3.2: Perform configuration audits to maintain integrity of the configuration baselines.

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Measurement and Analysis (MA)

Hazard: skip parts or overkill

- **Organizations often have metrics but entirely skip the first half of this Process Area:**
  - Defining: objectives, metrics, analysis, reporting, information storage
- **Or take the other extreme and overdo measurement and goal definitions**
  - 34 objectives, a procedure for documenting objectives, 82 core metrics
- **Need a good balance for:**
  - Spending enough time to arrive at **appropriate goals**
  - Specifying what **measures** are needed
  - Clarifying how they will be **analyzed and stored**
- **What problem are we trying to solve?**
  - Knowing why we are measuring in order to get the most value out of it and not waste time on useless metrics



[Newsletter “measurement”]

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GP 2.8/3.2 and Over-simplified MA

Hazard: I measured it because CMMI SAID I HAD TO!



- **MA comprises of only 7 PA measures, and GP 2.8 and 3.2 are academic**
  - What is it telling you?
- **What problem are we trying to solve?**
  - GP 2.8 (on each PA) – How's it going this time?
  - GP 3.2 (on each PA) - Are the PA related processes as implemented meeting our needs, getting better or worse?
  - MA should help you run your business, not just CMMI!

GP 2.8: Monitor and control the process against the plan for performing the process and take appropriate corrective action.

GP 3.2: Collect process-related experiences derived from planning and performing the process to support the future use and improvement of the organization's processes and process assets.

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Project Planning (PP)

Hazard: skimping on size estimation and risk management

- **Many people either skip size, or don't spend enough time finding a good use for size or attribute estimation [SP 1.2]**
  - "My project size is 2,000 hours"
  - "I estimate Lines of Code, but track effort"
- **Others underutilize risk at the project level [SP 2.2]**
  - Risks should come from the team, not just the manager
  - Risks should be more than boilerplate "We might not have resources"
  - Risks should be made very visible to customers + management
- **What problem are we trying to solve?**
  - Clarifying **how big the project is**
  - Understanding what can **really** go wrong
  - Thinking through potential issues ahead, while there is **time to react** / recover



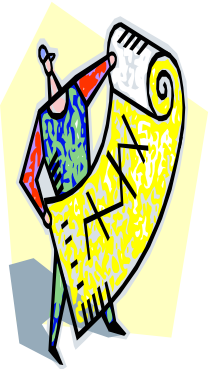
SP 1.2 Establish and maintain estimates of work product and task attributes.
SP 2.2 Identify and analyze project risks.

[Newsletter "attributes"]

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Project Monitoring and Control (PMC)

Hazard: missing valuable information that could save the day



- **No useful way to track actual work progress [SP 1.1], e.g.,**
  - Actual work effort (**labor**)
  - Actual amount of work accomplished (**size**)
- **What problem are we trying to solve?**
  - Use data to determine if current **resource** expenditure (hours or money) can be **sustained**
  - Know the **volume of work** and how much each project **actually costs**
    - » How much we lost this time, or how much future projects might cost
  - Proactively manage and identify re-planning points while there is time to recover
    - » **Identifying large changes in effort or size**

SP 1.1 Monitor actual values of project planning parameters against the project plan.

[Newsletter “attributes”]

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Integrated Project Management (IPM)

Hazard: not having proactive visibility

- **Not use thresholds to trigger corrective action [SP 1.5]**
  - At Level 3, corrective action and escalation are more objective ("We are 10% behind") than emotional ("I think things will speed up")
  - Organizational and project knowledge are used to establish thresholds
- **Process tailoring not based on organizational learning [SP 1.1]**
  - Level 3 is often interpreted as "**Processes are standardized** across all projects," rather than "**Standard processes are tailored** for each project"
- **What problem are we trying to solve?**
  - We have MEANINGFUL data, let's really use it!
  - Have organizational wisdom available and used

SP 1.5 Manage the project using the project plan, other plans that affect the project, and the project's defined process.

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Integrated Project Management (IPM) Without Historical Data?

Hazard: databases full of data are not enough!

- **Organizational Process Definition (OPD) and IPM not well understood**
  - OPD sets up a Process Asset Library and measurement repository for use by projects (IPM)
  - Not all Lead appraisers know or communicate this
- **What problem are we trying to solve?**
  - Run projects based on historical and current data



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Do Software Engineers Need Training?

Hazard: trivial training



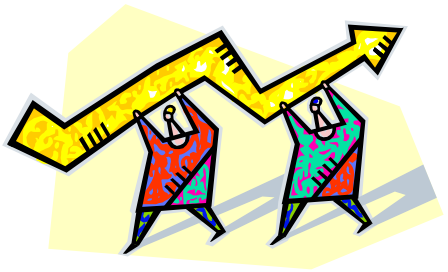
- **Project Planning (SP 2.5)**
  - Make sure you have the skills for THIS project
- **Organizational Training**
  - Make sure you have the skills for current work, and work to come
- **What problem are we trying to solve?**
  - Engineers and managers don't have the skills to perform their roles correctly (as per process definition) and/or efficiently
  - Prevent mistakes due to lack of skills

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Equal-weighted Process Area practices?

Hazard: each process area practice is treated as EQUAL

- **Each CMMI practice should not necessarily be equally weighted during implementation. Example:**
  - Policy vs. estimating effort or risk
  - Training records vs. performing validation
- **The correct weighting can be given when you:**
  - Focus on what you are trying to accomplish (real jobs)
  - Use the CMMI and its components to improve
  - Fix real problems



- **What problem are we trying to solve?**
  - Real world, day-to-day work gets better (easier, faster, higher quality, less stress, less busy-work, less rework, less risk)

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Appraisal Preparation - PIIDing*

Hazard: creating documents to please the appraiser

- **As an appraisal date approaches, people find themselves focused on providing required appraisal evidence:**
  - A lot of time can be **wasted chasing down documents**
  - When practices are **institutionalized** correctly, the evidence needed **already exists**
- **What problem are we trying to solve?**
  - Evidence should never be created to please an appraiser
  - Artifacts examined should be the **real work** of the organization
  - For example, evidence of responsibilities could be an organization chart or a schedule with assignments

*Practice Implementation Indicator

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Appraisal Interview Preparation

Hazard: wasting time rehearsing

- **Some people prepare using mock interviews**
  - Appraisals should be about how you DO YOUR **REAL** work
  - Interview practice might make folks feel more comfortable, but this can:
    - » Induce stress over remembering to say the right answers
    - » Focus your people on CMMI terms and rote answers
- **What problem are we trying to solve?**
  - Time to practice for an appraisal takes away from getting real work done
  - Participants should be able to answer the questions because the answers describe how they do their jobs



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Q & A

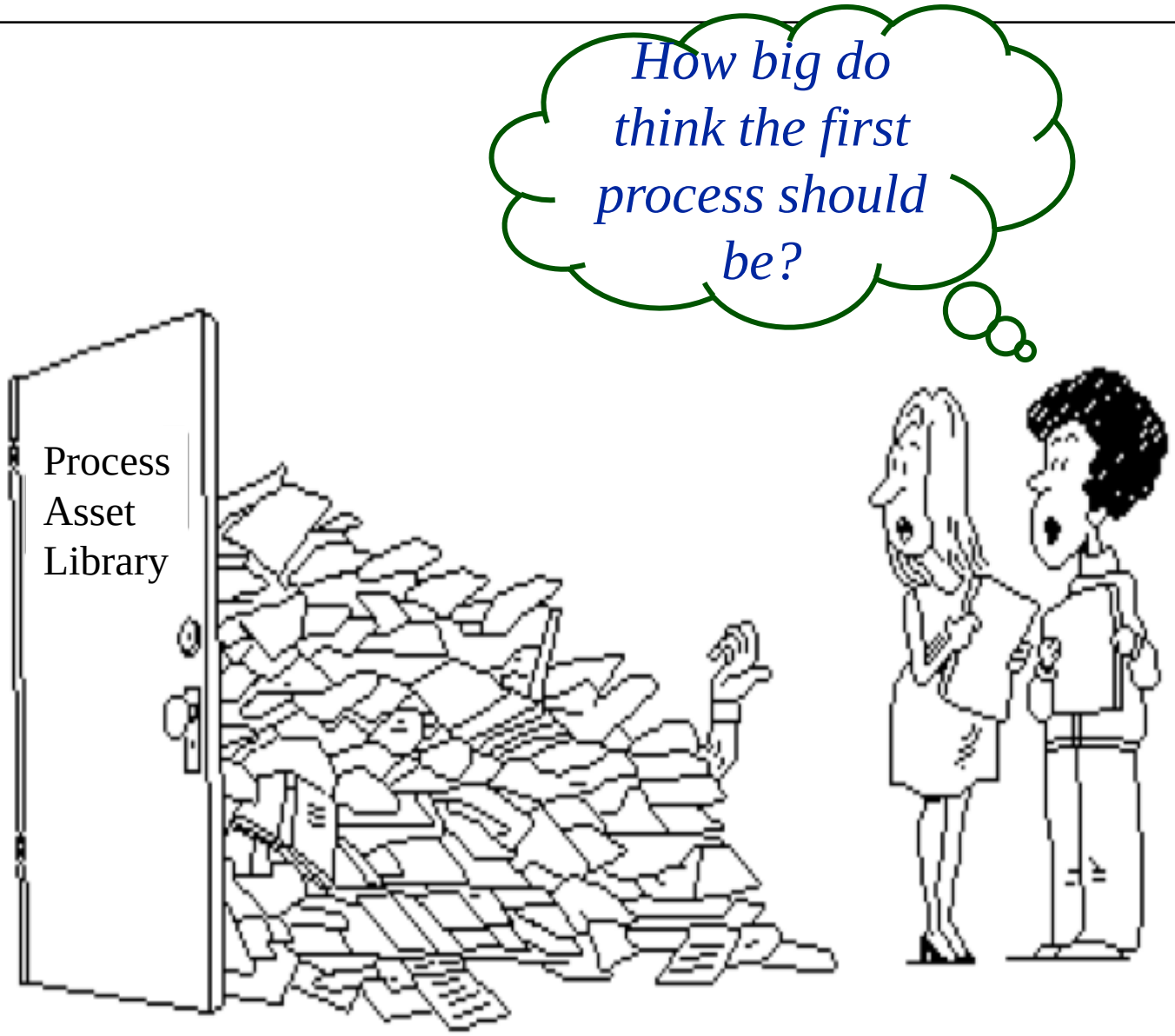
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Using Lessons Learned from Medical Checklists to Simplify CMMI Processes

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Neil Potter

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Agenda

1. Background
2. Matching Process Complexity with Need
3. Guidelines for Creating Checklists
4. Example Service Requirements Management (REQM) Process
5. A Checklist for Checklists
6. Summary



References

- http://www.processgroup.com/monthlytidbits.html#tidbit8
- http://www.processgroup.com/monthlytidbits.html#tidbit11

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Background



- World Health Organization Goal: Improve surgical procedures worldwide*.
- A medical checklist was created based on aviation checklists.



- Premise: a simple checklist can ensure that critical steps have not been overlooked, either due to haste, forgetfulness or inexperience.
- Measurements were collected from surgeries performed around the world, before and after the checklist. Results:
  - Major complications down by 36%
  - Infections down by ~50%
  - Patients returned to surgery because of problems down by 25%
  - Harm suffered from surgery (over 4,000 patients) down by 150
  - 27 fewer deaths (47% drop) caused from surgical complications



*Atul Gawande, associate professor of surgery at Harvard Medical School
Checklist Manifesto: How to Get Things Right

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Surgical Safety Checklist

World Health Organization | Patient Safety
A World Alliance for Safer Health Care

Before induction of anaesthesia

(with at least nurse and anaesthetist)

Has the patient confirmed his/her identity, site, procedure, and consent?
- ☐ Yes

Is the site marked?
- ☐ Yes
- ☐ Not applicable

Is the anaesthesia machine and medication check complete?
- ☐ Yes

Is the pulse oximeter on the patient and functioning?
- ☐ Yes

Does the patient have a:

Known allergy?
- ☐ No
- ☐ Yes

Difficult airway or aspiration risk?
- ☐ No
- ☐ Yes, and equipment/assistance available

Risk of >500ml blood loss (7ml/kg in children)?
- ☐ No
- ☐ Yes, and two IVs/central access and fluids planned

Before skin incision

(with nurse, anaesthetist and surgeon)

- ☐ **Confirm all team members have introduced themselves by name and role.**
- ☐ **Confirm the patient's name, procedure, and where the incision will be made.**

Has antibiotic prophylaxis been given within the last 60 minutes?
- ☐ Yes
- ☐ Not applicable

Anticipated Critical Events

To Surgeon:
- ☐ What are the critical or non-routine steps?
- ☐ How long will the case take?
- ☐ What is the anticipated blood loss?

To Anaesthetist:
- ☐ Are there any patient-specific concerns?

To Nursing Team:
- ☐ Has sterility (including indicator results) been confirmed?
- ☐ Are there equipment issues or any concerns?

Is essential imaging displayed?
- ☐ Yes
- ☐ Not applicable

Before patient leaves operating room

(with nurse, anaesthetist and surgeon)

Nurse Verbally Confirms:
- ☐ The name of the procedure
- ☐ Completion of instrument, sponge and needle counts
- ☐ Specimen labelling (read specimen labels aloud, including patient name)
- ☐ Whether there are any equipment problems to be addressed

To Surgeon, Anaesthetist and Nurse:
- ☐ What are the key concerns for recovery and management of this patient?

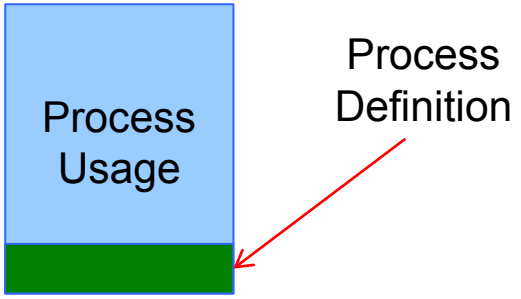
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Matching Process Complexity with Need

- **The time needed to write a process is usually a lot less than the time spent using it. E.g.,**
  - A project planning process of 1-2 pages may take a 2 days to develop and then be used numerous times.
  - A spreadsheet for risk management may take ½ day to develop and manage numerous risks over many years.
  - The benefit of using it outweighs the cost of developing it.

- **Places where a small process might be adequate:**
  - SVC: REQM, PP, PMC, CM, MA, OPF, OPD, OT.
  - DEV: OPF, OPD, PI (small DEV projects), OT
  - .... process includes all Generic Practices



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Guidelines for Creating Checklists -1

- Two main styles of checklists:
  - "Do-Confirm" – verify critical steps
  - "Read-Do" - perform given specific situations
- Select pause points in work flow where the completion of critical steps can be verified.
- Condense the checklist onto one page and use single bullet point sentences.
- Checklist items are critical (high-risk) and are not covered elsewhere.
- Run the checklist verbally with the team to ensure that anyone that has an issue can speak up.
- Revise the checklist numerous times until it is able to quickly detect serious problems.

Read-Do

CM Process

1. List Configuration Items

   x, y, z

2. Establish File Naming Convention

   File-x<n>.docx

3. Establish Baseline File Structure

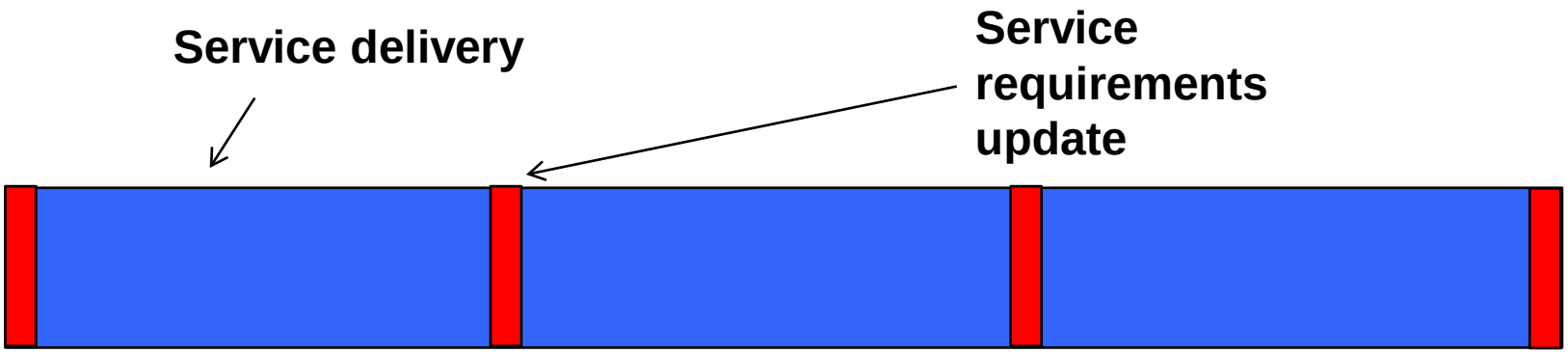
   ~~~~~~

4. ~~~~

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   ~~~~~~

Guidelines for Creating Checklists -2

- **Move implementation details as help text or training.**
- **Treat the process as "day-to-day usage," not beginner.**
  - This is where the majority of time will be spent.
- **Example scenario:**
  - Service requirements don't change much (or at all) over time.
  - REQM is used 1 day per year to manage the change.



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Example Service Requirements Management (REQM) Process – 1

Purpose: A checklist used to understand, confirm and manage changes to service requirements.

Policy: All service changes are managed using this checklist [gp2.1]

Do

- ❑ Plan the requirements definition/review event [gp2.2]:
  - Date: _____
  - Time / resources needed: (gp2.3) _____
  - Responsibility: [gp2.4] _____
  - Stakeholders [sp1.2, gp2.7]:
    - ❖ Role = Agree to services: <Name>. Commitment _____
    - ❖ Role = Provide expertise: <Name>. Commitment _____
    - ❖ Role = Team member 1: <Name>. Commitment _____
    - ❖ Role = Senior manager approval: [gp2.10] <Name>. Commitment _____

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Example Service Requirements Management Process – 2

- Discuss new and changed service requirements with stakeholders to clarify understanding: [sp1.1, 1.3, 1.5]
  - Review current service requirements
  - Review proposed changes to service requirements
  - Human resources needed to implement change: _____
  - New materials/consumables/computers needed to implement change:_____
  - Current commitments and deadlines impacted:_____
  - Added risks and mitigation actions: _____
  - Record stakeholder commitments next to name [sp1.2]
- Record major issues/actions
- Update traceability mapping [sp1.4]
  - Label service requirement 1 thru N
  - List impacted deliverables and documents for each requirement
  - State test method (e.g., peer review, test case, pilot) for each service requirement
- Save this document as service-roles-vN.doc on X drive with change history comments [gp2.6]

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Example Service Requirements Management Process – 3

Check

- ❑ Training has been provided to perform the steps above? [gp2.5]
  - If not, training date / time / who _____
- ❑ All process steps above have been performed? [gp2.8]
  - Corrective actions needed/taken? _____
- ❑ Objective/independent check done [gp2.9]:
  - Auditor name: _____
  - Audit date: _____
  - Pass / fail?: _____
  - If fail, corrective actions needed: _____
- ❑ Senior management aware of this service requirements event, results, issues? [gp2.10]
  - Comments: _____

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A CHECKLIST FOR CHECKLISTS

Development → Drafting → Validation

Development

- ❑ Do you have clear, concise objectives for your checklist?

Is each item:

- ❑ A critical safety step and in great danger of being missed?
- ❑ Not adequately checked by other mechanisms?
- ❑ Actionable, with a specific response required for each item?
- ❑ Designed to be read aloud as a verbal check?
- ❑ One that can be affected by the use of a checklist?

Have you considered:

- ❑ Adding items that will improve communication among team members?
- ❑ Involving all members of the team in the checklist creation process?

Drafting

Does the Checklist:

- ❑ Utilize natural breaks in workflow (pause points)?
- ❑ Use simple sentence structure and basic language?
- ❑ Have a title that reflects its objectives?
- ❑ Have a simple, uncluttered, and logical format?
- ❑ Fit on one page?
- ❑ Minimize the use of color?

Is the font:

- ❑ Sans serif?
- ❑ Upper and lower case text?
- ❑ Large enough to be read easily?
- ❑ Dark on a light background?

- ❑ Are there fewer than 10 items per pause point?
- ❑ Is the date of creation (or revision) clearly marked?

Validation

Have you:

- ❑ Trialed the checklist with front line users (either in a real or simulated situation)?
- ❑ Modified the checklist in response to repeated trials?

Does the checklist:

- ❑ Fit the flow of work?
- ❑ Detect errors at a time when they can still be corrected?

- ❑ Can the checklist be completed in a reasonably brief period of time?
- ❑ Have you made plans for future review and revision of the checklist?

Source: www.projectcheck.org

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Summary

- **Processes don't have to be voluminous to be "complete."**
- **A checklist is adequate for some Process Areas (and processes).**
- **Consider splitting processes into 2 parts:**
  - a) A checklist for essential steps – day-to-day usage.
  - b) Separate training/details/explanation.
- **Use "Do-Confirm," or "Read-Do" style.**
- **Refine checklist until:**
  - It achieves the desired result.
  - It is able to quickly detect serious problems.

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References

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   http://www.processgroup.com/monthlytidbits.html#tidbit8

2. Tidbit #11: ***Using Medical Checklists to Simplify CMMI Process Development - Keeping it Very Simple,*** Potter, N.

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   www.processgroup.com/tpgbook.html

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Acronyms

- **PP/WP:** Project / Work Planning
- **PMC/WMC:** Project / Work Monitoring & Control
- **CM:** Configuration Management
- **REQM:** Requirements Management
- **MA:** Measurement Analysis
- **OPF:** Organizational Process Focus
- **OPD:** Organizational Process Development
- **OT:** Organizational Training
- **PI:** Product Integration

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REQM Practice definition from CMMI

- SP 1.1 Develop an understanding with the requirements providers on the meaning of the requirements.
- SP 1.2 Obtain commitment to requirements from project participants.
- SP 1.3 Manage changes to requirements as they evolve during the project.
- SP 1.4 Maintain bidirectional traceability among requirements and work products.
- SP 1.5 Ensure that project plans and work products remain aligned with the requirements.
- GP 2.1 Establish and maintain an organizational policy for planning and performing the process.
- GP 2.2 Establish and maintain the plan for performing the process.
- GP 2.3 Provide adequate resources for performing the process, developing the work products, and providing the services of the process.
- GP 2.4 Assign responsibility and authority for performing the process, developing the work products, and providing the services of the process.
- GP 2.5 Train the people performing or supporting the process as needed.
- GP 2.6 Place selected work products of the process under appropriate levels of control.
- GP 2.7 Identify and involve the relevant stakeholders of the process as planned.
- GP 2.8 Monitor and control the process against the plan for performing the process and take appropriate corrective action.
- GP 2.9 Objectively evaluate adherence of the process and selected work products against the process description, standards, and procedures, and address noncompliance.
- GP 2.10 Review the activities, status, and results of the process with higher level management and resolve issues.

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ManTech
International Corporation ®

Leading the Convergence of National Security and Technology℠

Chutes and Ladders

ISO/CMMI Considerations

November 16, 2011

Intro

ManTech International Corporation

Since our company was ISO 9001 certified, we assumed we were all set for CMMI. However, much like the game of Chutes and Ladders, we learned when we performed our gap analysis that some of our ISO practices put us ahead for CMMI, while others meant we were behind where we needed to be!



Topics of Discussion

ManTech International Corporation

- Challenges faced
  - Become ISO 9001:2008 certified
  - Simultaneously implement CMMI Maturity Level 3
- The gap analysis “reveal”
  - “ladders” (areas where ISO procedures and practices gave us the inside edge)
  - “chutes” (areas which required improvement)
- The cultural shift required
  - How a group of creative, talented and opinionated employees worked together to adopt processes, procedures, and best practices
- The road less traveled
  - How ISO and CMMI learned to successfully co-habitat (or at least not kill each other)
  - Let’s save some time (or helpful hints)

Background

ManTech International Corporation

- The Customer
  - Defense Commissary Agency
- The SSESS Team
  - 34 employees
- The System
  - DeCA Interactive Business System (DIBS)



Background (continued)

ManTech International Corporation

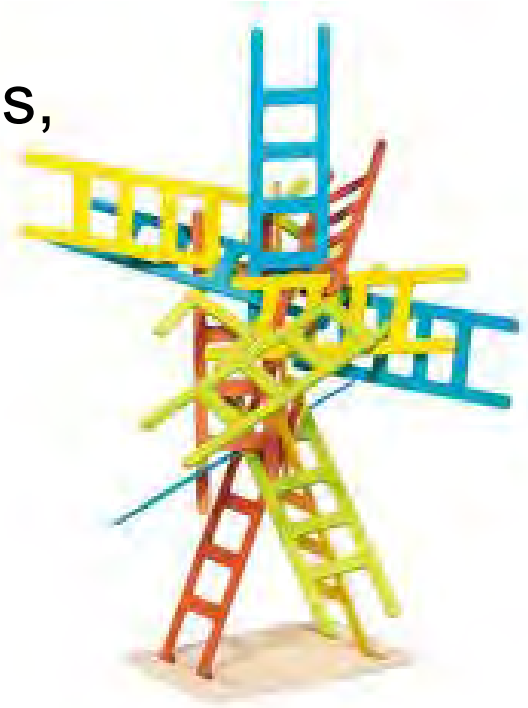
- The Contract
  - ISO 9001 OR CMMI DEV
- The Challenges
  - Documentation
  - Procedures
- THE SOLUTION
  - ISO 9001



The Implementation…

ManTech International Corporation

- In 2007, we started work on the SSESS contract.
- With scarcely documented procedures, we rolled up our sleeves and got to work!
- We had 34 people who were:
  - Overworked
  - Overwhelmed
  - Working like crazy
- How did we implement ISO 9001 during all this chaos?



First Things First

ManTech
International Corporation

- Top down or bottom up?
  - Without management's support, no one would listen
  - Without employee buy-in, no one would act
- Lesson learned:
  - Stakeholder engagement!!!



Stakeholder Engagement

ManTech International Corporation

- It's all about the message
  - Say it loud
  - Say it often
  - Say it again
  - *Repeat steps as needed*



Get Ahead of the Curve…and Stay There

ManTech International Corporation

- Our guidance
  - Prior to the first external audit, our appraiser recommended a shift from ISO 9001:2000 to 9001:2008.
- Lesson learned:
  - Whenever possible, become certified or appraised in the upcoming version of the standard. You will benefit by getting ahead of the curve.



Enter the CMMI…

ManTech International Corporation

- We're prepared…or are we?
  - As we entered the gap analysis: "We already have processes and procedures in place! This should be a piece of cake!"
  - During the SCAMPI C, our eyes were opened: "This is no piece of cake!



A Not So Simple Union

ManTech International Corporation

"England and America are two countries separated by a common language." George Bernard Shaw

- Matching the ISO standard with CMMI process areas is conceptually impossible
- Limited mapping between ISO 9001 and CMMI ML 3 with some similar terminology:
  - Configuration Management = Configuration Management (well, sort of)
  - Quality Assurance = Verification
  - Requirements = Requirements (RD/REQM)



It's A Model, Not a Process

ManTech International Corporation

- If I comply with ISO 9001:2008 7.3.1, do I conform with the TS SG 2?

ISO 9001L2008	CMMI-Dev 1.3
7.3.1- Design and Development Planning	Technical Solution SG2- Develop the Design

- What's an interface anyway?

ISO 9001L2008	CMMI-Dev 1.3
7.3.1- Manage Interfaces (Design and Development Planning)	Product Integration SP 2.2- Manage Interfaces

Ladder…

ManTech
International Corporation

- Processes were well documented and institutionalized on the project



Chute…

- Processes were institutionalized on the PROJECT!
- The Organization wants me to do what?
  - Change…again
  - Document…again
  - Train…again

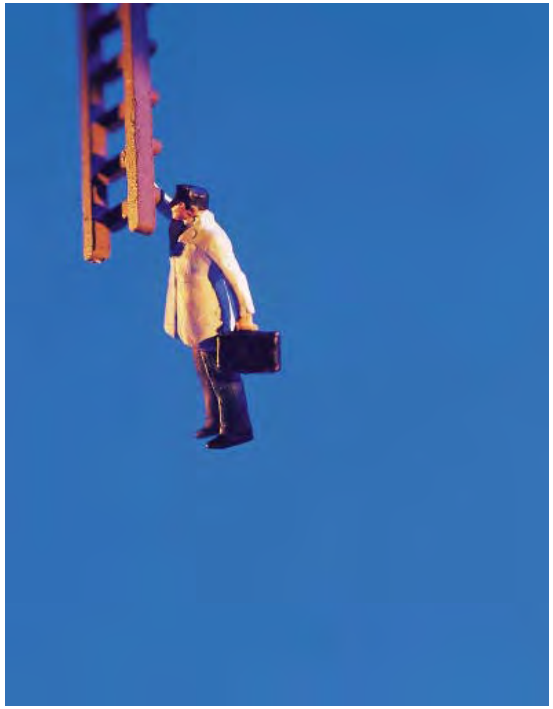
Hint: the miracle of Tailoring



Ladder…

ManTech International Corporation

- The SSESS customer required and supported quality standards for the project which means we already had their buy-in



Chute…

ManTech International Corporation

- CMMI does require the time and commitment of the project team
  - Project leadership had to ensure this didn't take away from deliverables and scheduled tasks
- Lesson Learned: If it doesn't get planned, it doesn't get done.



Ladder…

ManTech International Corporation

- Since SSESS already had process evangelists embedded on the team, it was easier to make CMMI disciples
- Lesson Learned: Form partnerships between the Organization's Quality Group and project Quality team members early. It takes a village to raise a process framework.



Chute…

ManTech International Corporation

- Cultural shift
  - "We already made it up the ISO mountain! Who needs CMMI?"
- Lost in translation
  - The SSESS quality team was often serving as the translators between the technical staff and the Organization's corporate quality team during the CMMI gap analysis
  - The distillation between CMMI and ISO often left our heads spinning
- The challenge of objectivity



Shoot…let's just do it!

ManTech International Corporation

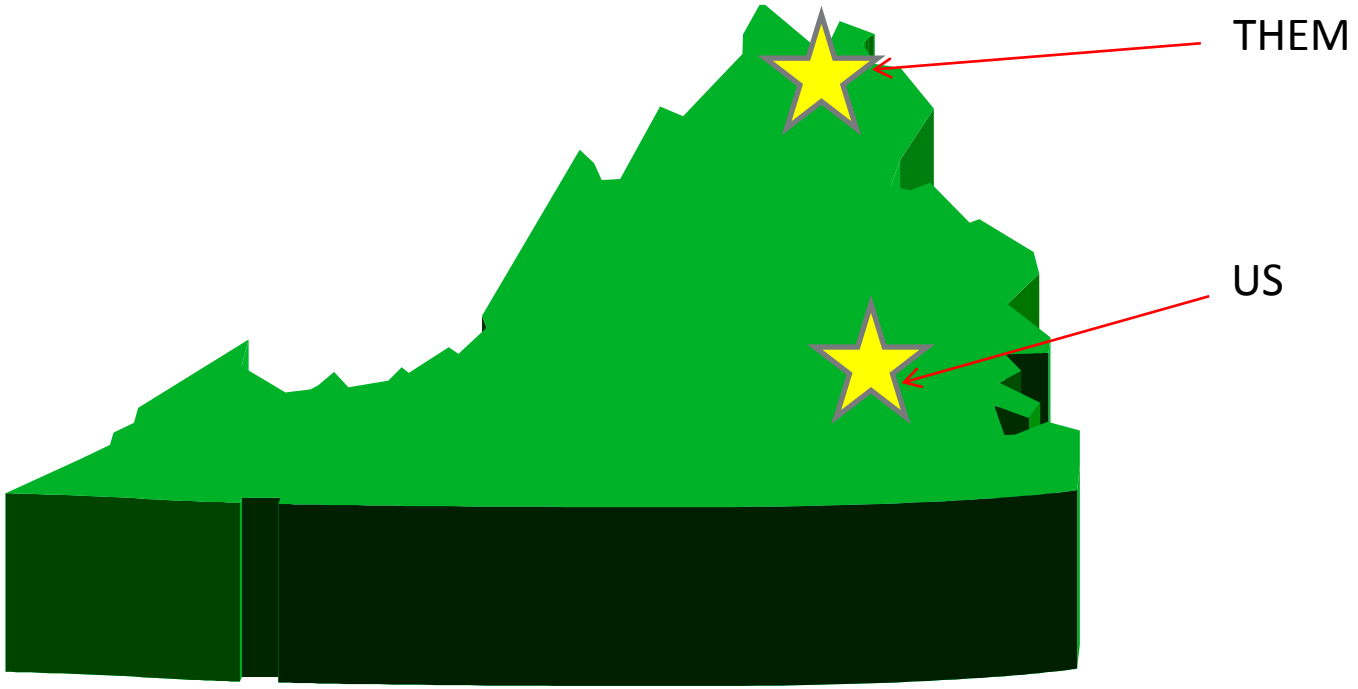
- What happens when you marry a standard and a model?
  - Continuous quality improvement, of course



Think Globally. Act Locally.

ManTech International Corporation

- We're in Prince George, they're in Northern Virginia…
- You want CMMI? That's nice…what's in it for me?



What Didn't Work…

ManTech International Corporation

- Trying to match up ISO and CMMI is like trying to herd cats…



What Didn't Work…

ManTech International Corporation

"Resistance is futile."

- Resisting conformance to organizational standards…



What Didn't Work…

ManTech International Corporation

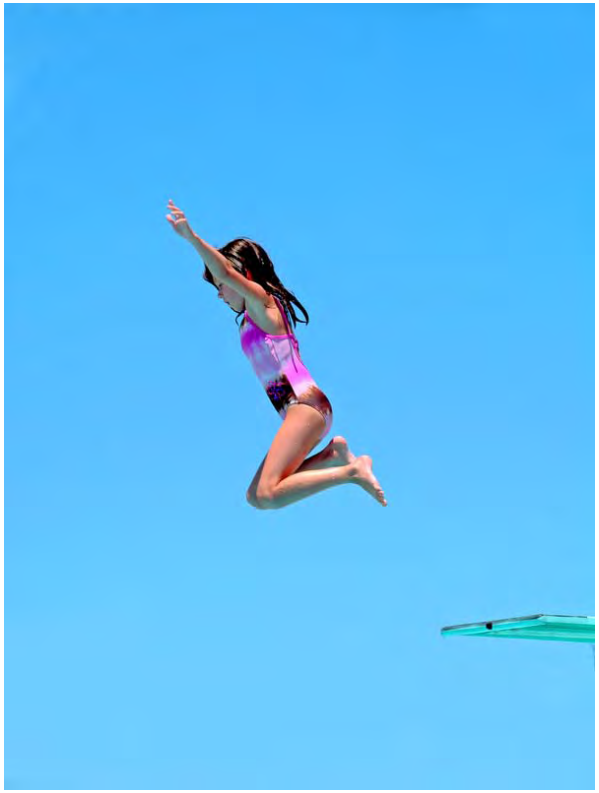
- Not planning for CMMI tasks, but expecting them to get done anyway…



What Didn't Work…

ManTech International Corporation

- Jumping into CMMI with minimal training…



What worked…

ManTech International Corporation

- Don’t lose buy-in: from the bottom up and the top down
  - Required weekly CMMI status reports to many levels of ManTech management with regular feedback
  - CMMI Day
  - Team engagement with Mission Assurance (not just the PM/DPM)
  - CMMI Training



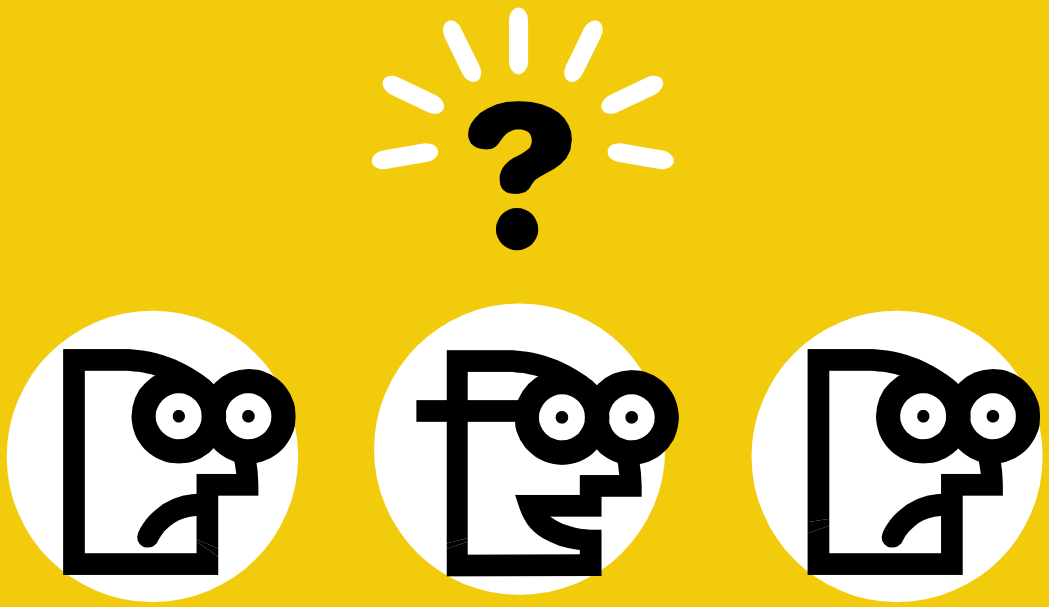
What worked…

ManTech International Corporation

- Continual reality checks
  - Why are we doing this?
  - Is it working?
  - What can we do better?



Questions or Comments



It's QUESTION TIME !!

CMMI® Surveillance Appraisals: A Modest Proposal

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NDIA CMMI® Working Group
NDIA Systems Engineering Division

2011 NDIA CMMI Technology Conference and User Group

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® CMMI is registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

Note

The CMMI Surveillance Appraisal method described in this presentation represents the thoughts and recommendations of the NDIA CMMI Working Group, with inputs from selected stakeholders. The method has not been approved or endorsed by the CMMI Program.

You feedback will help determine if this is a viable concept. Suggestions are welcome.



Agenda

Introduction

General Concepts

Operational Concept

Methodology

- Organizational Unit Change Constraints
- Organizational Scope and Sampling

Case Study Example

Characterization & Rating

Team Qualifications

Open Issues

Summary

Introduction

SCAMPI A appraisal costs have been problematic for many businesses seeking to use CMMI and SCAMPI A to benchmark their organizational processes.

- Appraisals are expensive and often perceived as a burden to CMMI adoption.

After a SCAMPI A is completed, an organization must then conduct additional SCAMPI A appraisals every 3 years to maintain the previously achieved rating.

- Diverts valuable process improvement funding to a benchmarking activity that may offer little value in return.

Goal: Develop a *CMMI Surveillance Appraisal*

- Remove the need for a full SCAMPI A appraisal every 3 years by defining a low cost surveillance appraisal method to extend the lifespan of a SCAMPI A rating without compromising rating integrity.
- Align with ISO 9001/AS9100, TL9000 surveillance benchmarking activities.

General Concepts *(1 of 2)*

A CMMI surveillance appraisal should be not be more than 25-30% of the cost of a SCAMPI A.

- This should be a design constraint on the method.

A CMMI surveillance appraisal must be rigorous enough to ensure full confidence in extending the results of a SCAMPI A appraisal.

A CMMI surveillance appraisal will provide an extension of SCAMPI A results for 2 years from the completion date of the surveillance appraisal.

Maximum time between SCAMPI A appraisals is 7 years.

- CMMI surveillance appraisals cannot extend SCAMPI A rating(s) beyond 7 years.
- Two CMMI surveillance appraisals could be conducted in that timeframe

CMMI surveillance appraisals can be used for all CMMI constellations and the People CMM. Both staged and continuous representations will be supported.

General Concepts *(2 of 2)*

Model scope cannot be greater than the SCAMPI A baseline model scope.

- Can't add PAs that weren't in baseline, including previously not applicable PAs.
- Can't increase maturity levels or capability levels using a CMMI surveillance appraisal.

Organizational unit change must be within CMMI surveillance appraisal method constraints.

If a CMMI surveillance appraisal identifies problems (e.g., goal failures) the SCAMPI A rating cannot be extended.

- The SCAMPI A rating would not be immediately revoked.
- Additional CMMI surveillance appraisals would not be permitted until after another SCAMPI A.

If a SCAMPI A rating (or successful surveillance appraisal extension) expires before a surveillance appraisal is successfully conducted, the rating cannot be restored via a surveillance appraisal.

Maximum duration of surveillance appraisal is 45 days.

CMMI surveillance appraisal ratings should be noted as such in PARS.

Example Appraisal Timelines



CMMI ML rating validity

Use 2 Surveillance Appraisals to extend rating 3 years

T+2: Conduct Surv. Appraisal

T+4: Conduct Surv. Appraisal

Extended CMMI ML rating validity | Extended CMMI ML rating validity

CMMI ML rating validity

Use 2 Surveillance Appraisals to extend rating 4 years

T+3: Conduct Surv. Appraisal

T+5: Conduct Surv. Appraisal

Extended CMMI ML rating validity | Extended CMMI ML rating validity

Surveillance Appraisals - Operational Concept

Time, coverage, confidence

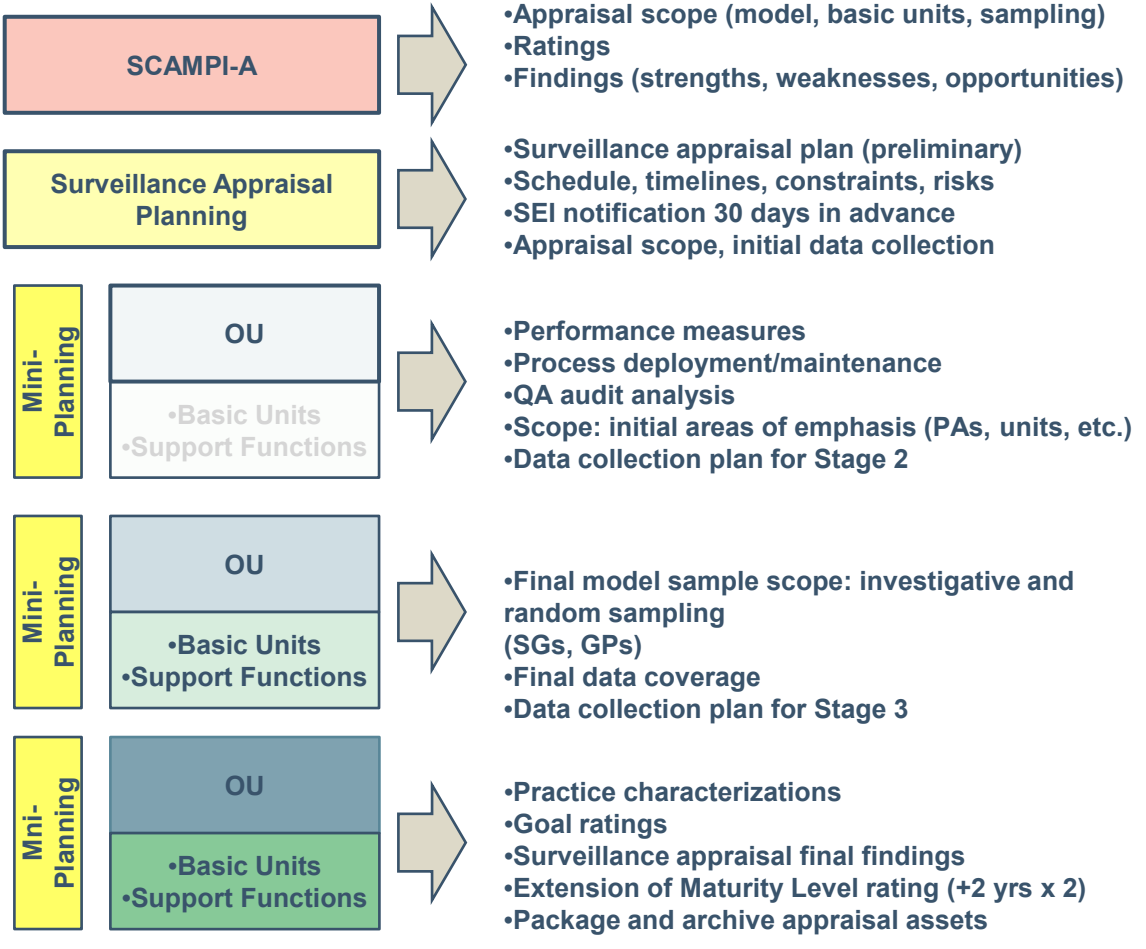
T-0:

Stage 1: Contextual Overview
- Business objectives, process plans
- Interviews (sponsor, EPG, QA leads)
- Performance measures
- Process deployment/maintenance
- QA audit analysis

Stage 2: High-Yield Artifacts
- Work products (basic units, support); high leverage artifacts
- Interviews (basic unit/support leads as needed)

Stage 3: Model Sampling
- Artifacts, affirmations (interviews)
- Sampling of model SGs, GPs

≤ T+3 yrs:



- Appraisal scope (model, basic units, sampling)
- Ratings
- Findings (strengths, weaknesses, opportunities)

- Surveillance appraisal plan (preliminary)
- Schedule, timelines, constraints, risks
- SEI notification 30 days in advance
- Appraisal scope, initial data collection

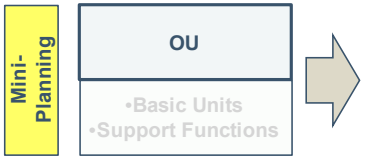
- Performance measures
- Process deployment/maintenance
- QA audit analysis
- Scope: initial areas of emphasis (PAs, units, etc.)
- Data collection plan for Stage 2

- Final model sample scope: investigative and random sampling (SGs, GPs)
- Final data coverage
- Data collection plan for Stage 3

- Practice characterizations
- Goal ratings
- Surveillance appraisal final findings
- Extension of Maturity Level rating (+2 yrs x 2)
- Package and archive appraisal assets

Operational Concept
Stage 1: Contextual Overview

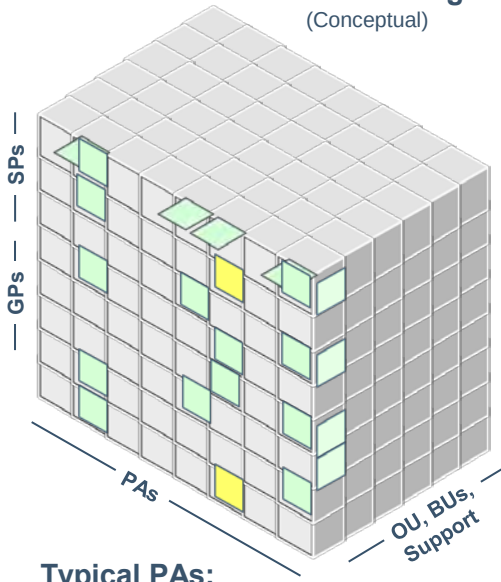
Stage 1: Contextual Overview
- Business objectives, process plans
- Interviews (sponsor, EPG, QA leads)
- Performance measures
- Process deployment/maintenance
- QA audit analysis



- Performance measures
- Process deployment/maintenance
- QA audit analysis
- Scope: initial areas of emphasis (PAs, units, etc.)
- Data collection plan for Stage 2

Goals:	Contextual understanding of the organization's process state, process deployment and maintenance status, possible noncompliance trends
Interviews:	Sponsor, EPG leads, Quality leads
Activities:	**Review performance measures from the organization** • *Business objectives, process performance objectives* • *Measurement and analysis related to achieving objectives* • *Corrective actions and process improvements*
	Review status of process deployment and maintenance • *Status of deployment to basic units, support functions* • *Results of process implementation/compliance monitoring* • *Status of improvement activities, appraisal findings*
	Review PPQA audit-type analysis • *Trend reports of audit non-compliances* • *Relate significant areas of concern to CMMI process areas*
Output:	Potential areas for further investigation in Stages 2 and 3

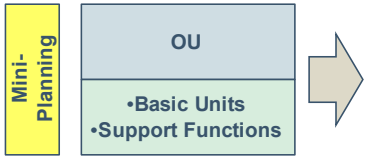
Model Coverage
(Conceptual)



Typical PAs:
- MA, PPQA
- OPF, OPD, OT, OPM, OPP
- Probe selected PAs based on data collected

Operational Concept
Stage 2: High Yield Artifacts

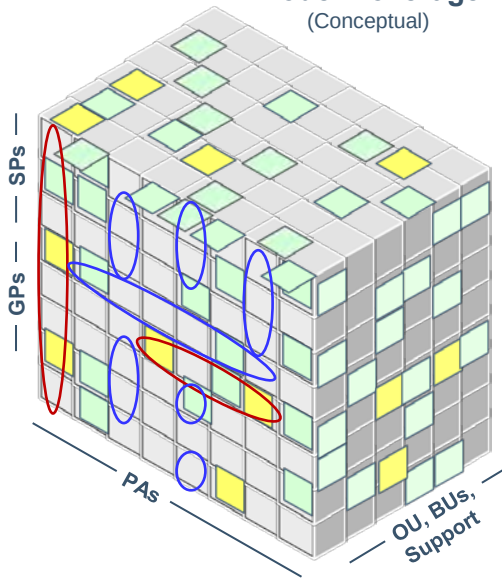
Stage 2: High-Yield Artifacts
- Work products (basic units, support); high leverage artifacts
- Interviews (basic unit/support leads as needed)



- Final model sample scope: investigative and random sampling (SGs, GPs)
- Final data coverage
- Data collection plan for Stage 3

Goals:	Determine Stage 3 model sample scope
Interviews:	Optional interviews with basic unit and support function leads as needed for high yield artifact analysis
Activities:	**Review example high yield artifacts** • *Plans, documents, reviews, financial reports, etc.* (MDD Table18) • *Collected from basic units and support functions in org scope* •*Identify areas of concern, initial Stage 3 model sample scope*
	Use random sampling to fill Stage 3 model sample scope • *Random sampling of SGs/GPs to supplement evidence review* • *Must meet method-defined minimum model sampling reqts* • *Status of improvement activities, addressing appraisal findings*
	"Finalize" Stage 3 model sample scope • *Appraisal team can identify additional SGs/GPs* • *Determine data coverage reqts based on model scope and applicable MDD coverage rules* • *Update Data Collection Plan for Stage 3*
Output:	Final Stage 3 model scope, updated data collection plan

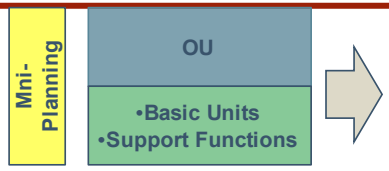
Model Coverage
(Conceptual)



- Map OE to model SPs, GPs
- Identify model sample scope for Stage 3 *(see sampling rules)*
  - -Targeted sampling (investigative)
  - -Random sampling (supplementary)

Operational Concept
Stage 3: Model Sampling

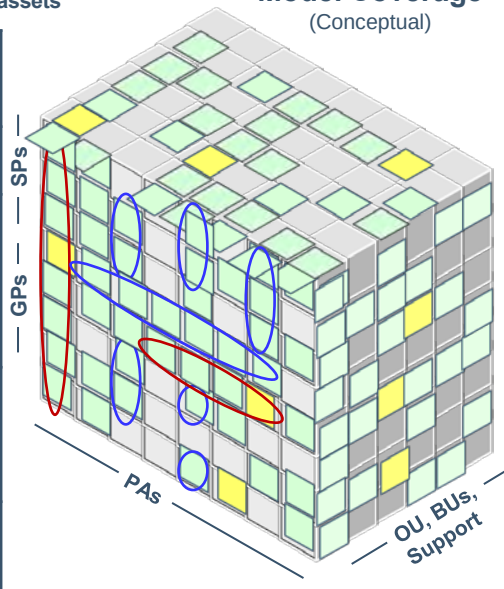
Stage 3: Model Sampling
- Artifacts, affirmations (interviews)
- Sampling of model SGs, GPs



- Practice characterizations
- Goal ratings
- Surveillance appraisal final findings
- Extension of Maturity Level rating (+2 yrs x 2)
- Package and archive appraisal assets

Goals:	Rate SGs and GGs included in model sample scope to determine if SCAMPI A rating can be extended
Interviews:	As needed for affirmations based on applicable MDD coverage rules
Activities:	**Verify objective evidence** • *Review data collected by OU based on model sample scope and MDD coverage rules* • *Conduct interviews for affirmations*
	Perform practice characterizations as described in MDD • *Characterize all SPs for SGs in model sample scope* • *Characterize GPs in model sample scope*
	Derive findings and rate goals • *Document preliminary findings (strengths and weaknesses)* • *Validate preliminary findings (optional)* • *Rate goals in model sample scope, determine ratings extension*
	Report results •*Deliver final findings. Package and archive appraisal assets.*
Output:	Final findings and ratings

Model Coverage
(Conceptual)



- Collect and verify OE for SPs and GPs in model sample scope
- See details for sampling and rating methods
- Follow MDD rules for practice characterization and aggregation

Organizational Unit Change Constraints

If the Organizational Unit has evolved since the previous SCAMPI A…

- The determinant on whether a surveillance appraisal is appropriate is the amount of change in the sampling factors used to scope the previous SCAMPI A.

Change in Sampling Factors/Values	Surveillance Appraisal Candidate*
No change.	Yes
# sampling factors/values has been reduced, with no new sampling factors/values added	Yes
# sampling factors/values have grown or sampling factors/values have changed	No
Internal reorganizations or external mergers/acquisitions	Maybe •Sampling factor/value changes? – see above •If no process implementation impact - Yes

* - The lead appraiser makes the final decision on whether a CMMI surveillance appraisal may be performed. Document rationale in plan/ADS.

Organizational Scope and Sampling *(1 of 2)*

Basic Unit and Support Function Sampling

- Organizational scope is determined using SCAMPI A V1.3 MDD rules.
  - Sampling factors beget subgroups which beget sample basic units and support functions.
  - Sampled basic units and support functions may or may not be the same as those sampled in baseline SCAMPI A.
  - All sampled basic units in each subgroup and support functions undergo Stage 2 high yield artifact review and Stage 3 sampling.
  - Stage 3 data coverage is based upon applicable SCAMPI A V1.3 MDD rules applied to Stage 3 model sample scope.
    - Coverage Rule 1 for Process Areas is not applicable by design of the CMMI surveillance appraisal method.
    - Process Area practice coverage is determined by SGs and GPs identified during Stages 1 and 2.

Organizational Scope and Sampling *(2 of 2)*

Model Sampling Methodology

- Specific Goals and Generic Practices are identified in Stage 1 and 2 for inclusion in Stage 3 sample scope (investigative sampling).
- A minimum of 33% of SGs and GPs in model scope must be included in Stage 3 sample scope.
  - Random sampling of SGs and GPs in model scope supplements investigative sampling performed in Stage1 and Stage 2.
  - At least two SGs must be selected for random sampling (even if Stage 1 and Stage 2 identified SGs are ≥ 33%.
  - At least one SG from each Process Area Category (within model scope) must be included in the Stage 3 sample.
  - GPs identified for Stage 3 sample are sampled for all Process Areas with SGs in Stage 3 sample scope.
- Appraisal team can always request additional evidence beyond original sample scope.

Case Study Example *(1 of 5)*

Reference MDD V1.3 Appendix F, Case Study 1 (expanded to Maturity Level 5). OU undergoes a CMMI Surveillance Appraisal 2 years after achieving Maturity Level 5.

- Stage 1
  - Team meets with Sponsor
    - Observes business objectives unchanged since last appraisal
  - Team meets with EPG Lead, Quality Leads
    - Observes some updated OSSP standards and quality issues with suppliers
- Stage 2
  - Team reviews OSSP, project plans, tailorings, status reporting packages
    - Observes QPPOs unchanged and some projects not meeting objectives without appearing to take action or use CAR
    - Observes supplier quality, cost, and schedule problems in status. Supplier stakeholder involvement questionable.
- Stage 3
  - Team identifies all SAM, OPP, QPM, CAR, OPM SGs, and IPM SG2 (11 SGs), and GP 2.2 and GP 2.7 for Stage 3 sample
  - For 33% SG coverage (16), randomly select 5 more SGs
  - For 33% GP coverage (4), randomly select 2 more GPs

Case Study Example *(2 of 5)*

SGs and GPs identified during Stages 1 and 2:

- All SGs in SAM, OPP, QPM, CAR, OPM, and also IPM SG2
- GPs: GP 2.2, GP 2.7

PA	SG	# SPs
SAM	SG 1	3
SAM	SG 2	3
IPM	SG 2	3
OPP	SG 1	5
QPM	SG 1	4
QPM	SG 2	3
CAR	SG 1	2
CAR	SG 2	3
OPM	SG 1	3
OPM	SG 2	4
OPM	SG 3	3

GPs
GP 2.2
GP 2.7

Case Study Example *(3 of 5)*

Use Random Number Generator to select 5 additional SGs and 2 additional GPs.

	PA	SG	# SPs
1	CM	SG 1	3
2	CM	SG 2	2
3	CM	SG 3	2
4	MA	SG 1	4
5	MA	SG 2	4
6	PPQA	SG 1	2
7	PPQA	SG 2	2
8	PMC	SG 1	7
9	PMC	SG 2	3
10	PP	SG 1	4
11	PP	SG 2	7
12	PP	SG 3	3
13	REQM	SG 1	5
14	DAR	SG 1	6
15	IPM	SG 1	7
16	OPD	SG 1	7
17	OPF	SG 1	3
18	OPF	SG 2	2
19	OPF	SG 3	4

	PA	SG	# SPs
20	OT	SG 1	4
21	OT	SG 2	3
22	PI	SG 1	3
23	PI	SG 2	2
24	PI	SG 3	4
25	RD	SG 1	2
26	RD	SG 2	3
27	RD	SG 3	5
28	RSKM	SG 1	3
29	RSKM	SG 2	2
30	RSKM	SG 3	2
31	TS	SG 1	2
32	TS	SG 2	4
33	TS	SG 3	2
34	VAL	SG 1	3
35	VAL	SG 2	2
36	VER	SG 1	3
37	VER	SG 2	3
38	VER	SG 3	2

	GPs
1	GP 2.1
2	GP 2.3
3	GP 2.4
4	GP 2.5
5	GP 2.6
6	GP 2.8
7	GP 2.9
8	GP 2.10
9	GP 3.1
10	GP 3.2

11 investigative sample SGs + 5 random sample SGs = 16 = 33% SG model scope.
2 investigative sample GPs + 2 random sample GPs = 4 = 33% GP model scope.

Case Study Example *(4 of 5)*

MDD Appendix F Case Study 1 Table 27 expanded to ML5 SCAMPI A Practice Instantiations

SCAMPI A SPs	627
SCAMPI A GPs	1008
Total	1635

		REQM		PP		PMC		MA		CM		PPQA		SAM		OPF		OPD		OT		RD	
Subgroups	**Sample**	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP
LA, Commercial, Large, Short	1	5	12	14	12	10	12	8	12	7	12	4	12	6	12							10	12
LA, Commercial, Small, Short	1	5	12	14	12	10	12	8	12	7	12			6	12							10	12
LA, DoD, Large, Long	1	5	12	14	12	10	12	8	12	7	12											10	12
LA, DoD, Small, Short	2	5	12					8	12	0	0											10	12
		5	12					0	0	0	0											0	0
Dayton, DoD, Large, Long	1	5	12					8	12	7	12	4	12									10	12
Dayton, DoD, Small, Long	2	5	12					8	12	0	0											10	12
		0	0					8	12	0	0											0	0
Enterprise Process Group																9	12	7	12	7	12		
		35	84	42	36	30	36	56	84	28	48	8	24	12	24	9	12	7	12	7	12	60	72

		TS		PI		VER		VAL		IPM		RSKM		DAR		OPP		QPM		CAR		OPM	
Subgroups	**Sample**	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP
LA, Commercial, Large, Short	1	8	12	9	12	8	12	5	12	10	12	7	12	6	12			7	12	5	12		
LA, Commercial, Small, Short	1	8	12	9	12	8	12	5	12	10	12	7	12	6	12			7	12	5	12		
LA, DoD, Large, Long	1	8	12	9	12	8	12	5	12					6	12					5	12		
LA, DoD, Small, Short	2	8	12	9	12	8	12	5	12					6	12					5	12		
		0	0	0	0	0	0	0	0	10	12	7	12	0	0			7	12	0	0		
Dayton, DoD, Large, Long	1	8	12	9	12	8	12	5	12					6	12					5	12		
Dayton, DoD, Small, Long	2	8	12	9	12	8	12	5	12					6	12					5	12		
		0	0	0	0	0	0	0	0					0	0					0	0		
Enterprise Process Group																5	12					10	12
		48	72	54	72	48	72	30	72	30	36	21	36	36	72	5	12	21	36	30	72	10	12

Case Study Example *(5 of 5)*

MDD Appendix F Case Study 1 Table 27 expanded to ML5 Surveillance Appraisal Practices

Total Stage 3 SPs Sampled	161
Total Stage 3 GPs Sampled	144
Total Stage 3 Sample	305

SP % of SCAMPI	26%
GP % of SCAMPI	14%
Total % of SCAMPI	19%

Proj. Mgt.: SAM, IPM, QPM
Proc. Mgt.: OPD, OPF, OPP, OPM
Eng.: PI
Support: MA, CM, CAR

		REQM		PP		PMC		MA SG1		CM SG2		PPQA		SAM		OPF SG2		OPD SG1		OT		RD	
Subgroups	**Sample**	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP
LA, Commercial, Large, Short	1	*	*	*	*	*	*	4	4	2	4			6	4							*	*
LA, Commercial, Small, Short	1	*	*	*	*	*	*	4	4	2	4	*	*	6	4							*	*
LA, DoD, Large, Long	1	*	*	*	*	*	*	4	4	2	4											*	*
LA, DoD, Small, Short	2	*	*	*	*	*	*	4	4	*	*											*	*
		*	*	*	*	*	*	*	*	*	*											*	*
Dayton, DoD, Large, Long	1	*	*	*	*	*	*	4	4	2	4											*	*
Dayton, DoD, Small, Long	2	*	*	*	*	*	*	4	4	*	*	*	*									*	*
		*	*	*	*	*	*	4	4	*	*											*	*
Enterprise Process Group																2	4	7	4	*	*		
		0	0	0	0	0	0	28	28	8	16	0	0	12	8	2	4	7	4	0	0	0	0

		TS		PI SG3		VER		VAL		IPM SG2		RSKM		DAR		OPP		QPM		CAR		OPM	
Subgroups	**Sample**	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP	SP	GP
LA, Commercial, Large, Short	1	*	*	4	4	*	*	*	*	3	4	*	*	*	*			7	4	5	4		
LA, Commercial, Small, Short	1	*	*	4	4	*	*	*	*	3	4	*	*	*	*			7	4	5	4		
LA, DoD, Large, Long	1	*	*	4	4	*	*	*	*					*	*					5	4		
LA, DoD, Small, Short	2	*	*	4	4	*	*	*	*					*	*					5	4		
		*	*	*	*	*	*	*	*	3	4	*	*	*	*			7	4	5	4		
Dayton, DoD, Large, Long	1	*	*	4	4	*	*	*	*					*	*					5	4		
Dayton, DoD, Small, Long	2	*	*	4	4	*	*	*	*					*	*					5	4		
		*	*	*	*	*	*	*	*					*	*					*	*		
Enterprise Process Group																5	4					10	4
		0	0	24	24	0	0	0	0	9	12	0	0	0	0	5	4	21	12	35	28	10	4

* - reviewed in Stage 1 and 2 only

Investigative Sample | Random Sample

Characterizations and Ratings

Characterizations are done on the Stage 3 sampled practices using SCAMPI A MDD characterization rules.

Goals that have Stage 3 sampled practices are rated based on the characterizations of the sampled practices and associated weaknesses (if any).

If all sampled goals are satisfied, the SCAMPI A rating can be extended.

If any sampled goals are not satisfied, the SCAMPI A rating cannot be extended.

Team Qualifications *(1 of 2)*

CMMI Surveillance Appraisal Team member qualifications are more stringent than SCAMPI A requirements

- Experienced team members able to reach accurate conclusions with less evidence

SCAMPI A	Surveillance Appraisal
Minimum team size is 4, including the lead appraiser	Minimum team size is 2, including the lead appraiser •Members of the appraised organization are allowed to be team members but the team must have a minimum of 2 team members external to the OU (including the lead appraiser).
Team members complete Introductory to model course	Team members must have previous experience as appraisal team members on at least two SCAMPI A appraisals
Average of 6 years field experience wrt reference model, aggregate of 10 yrs management experience, 1 team member with 6 yrs mgt. experience	Each team member must have minimum of 6 yrs field experience, (including experience performing practices from the process areas that the team member is reviewing)
Aggregate of 25 years field experience	N/A

Team Qualifications *(2 of 2)*

High Maturity

SCAMPI A	Surveillance Appraisal
Certified High Maturity Lead Appraiser (HMLA)	Certified High Maturity Lead Appraiser (HMLA)
All members of high maturity mini-team have high maturity experience	Team members reviewing high maturity process areas must have been on a previous SCAMPI A high maturity appraisal
HMLA or ATM with statistical analysis & other high maturity training assigned to high maturity mini-teams	At least one team member reviewing high maturity process areas must: • have been on a previous SCAMPI A high maturity appraisal as part of a high maturity mini-team or •be a certified HMLA who has been on a high maturity appraisal as lead or team member
Team as a whole has collective experience implementing high mat activities	N/A

Open Issues

V1.2 Model and Method Sunset issue

- **Should CMMI V1.2 model appraisals be candidates for surveillance appraisals?**
  - Under discussion
  - If no, there may be no surveillance appraisal market until 2013
  - If yes, outdated model ratings are being extended
- **Should surveillance appraisals be done with MDD V1.2?**
  - Recommendation – NO
  - The CMMI Surveillance Appraisal method requires use of the SCAMPI A V1.3 MDD methods.
    - Appraisal scoping, characterizations, ratings, etc. must be done in accordance with MDD V1.3
    - For example, an OU that used MDD V1.2 would have to convert critical factors to sampling factors, and apply the MDD V1.3 subgroup/sampling process, data coverage rules, etc.
    - The lead appraiser must ensure that the OU in the CMMI Surveillance Appraisal falls within the OU change constraints described earlier in this presentation, and document the rationale in the CMMI Surveillance Appraisal plan.

Summary

Goal: Define a *low cost CMMI* Surveillance Appraisal method to extend the lifespan of a SCAMPI A rating *without compromising rating integrity.*

Lower costs…	…without compromising integrity
Less evidence collection and review by the organizational unit and appraisal team	Organizational Unit has already undergone a recent baseline SCAMPI A appraisal
Fewer, but more experienced team members	Team member qualifications are more stringent than SCAMPI A V1.3 MDD team member qualifications
Fewer SCAMPI A appraisals performed just to maintain ratings	Combines investigative sampling and random sampling of specific goals and generic practices

For More Information….

NDIA CMMI Working Group

http://www.ndia.org/Divisions/Divisions/SystemsEngineering/Pages/CMMI_Working_Group.aspx

Jim Armstrong
Stevens Institute

Steve Austin
Lockheed Martin

Dan Blazer
SAIC

Michael Campo
Raytheon Company

Juliet Davis
The Boeing Company

Geoff Draper
Harris Corporation

Jeffrey L. Dutton
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BAE Systems

Wendell Mullison
General Dynamics, Land Systems

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Hewlett-Packard

Rick Welch
Northrop Grumman

Risk Managment



2011 NDIA CMMI Conference
Denver, Colorado

Presented by
Al Florence
The MITRE Corporation

This presenter's affiliation with the MITRE Corporation is provided for identification purposes only and is not intended to convey or imply MITRE's concurrence with or support for the positions, opinions or view points expressed by this presenter.

Agenda

- ***Introduction***
- Reasons for Risk Management
- Risk Management
- Questions/Discussion
- References
- Contact Information

Introduction

Definitions

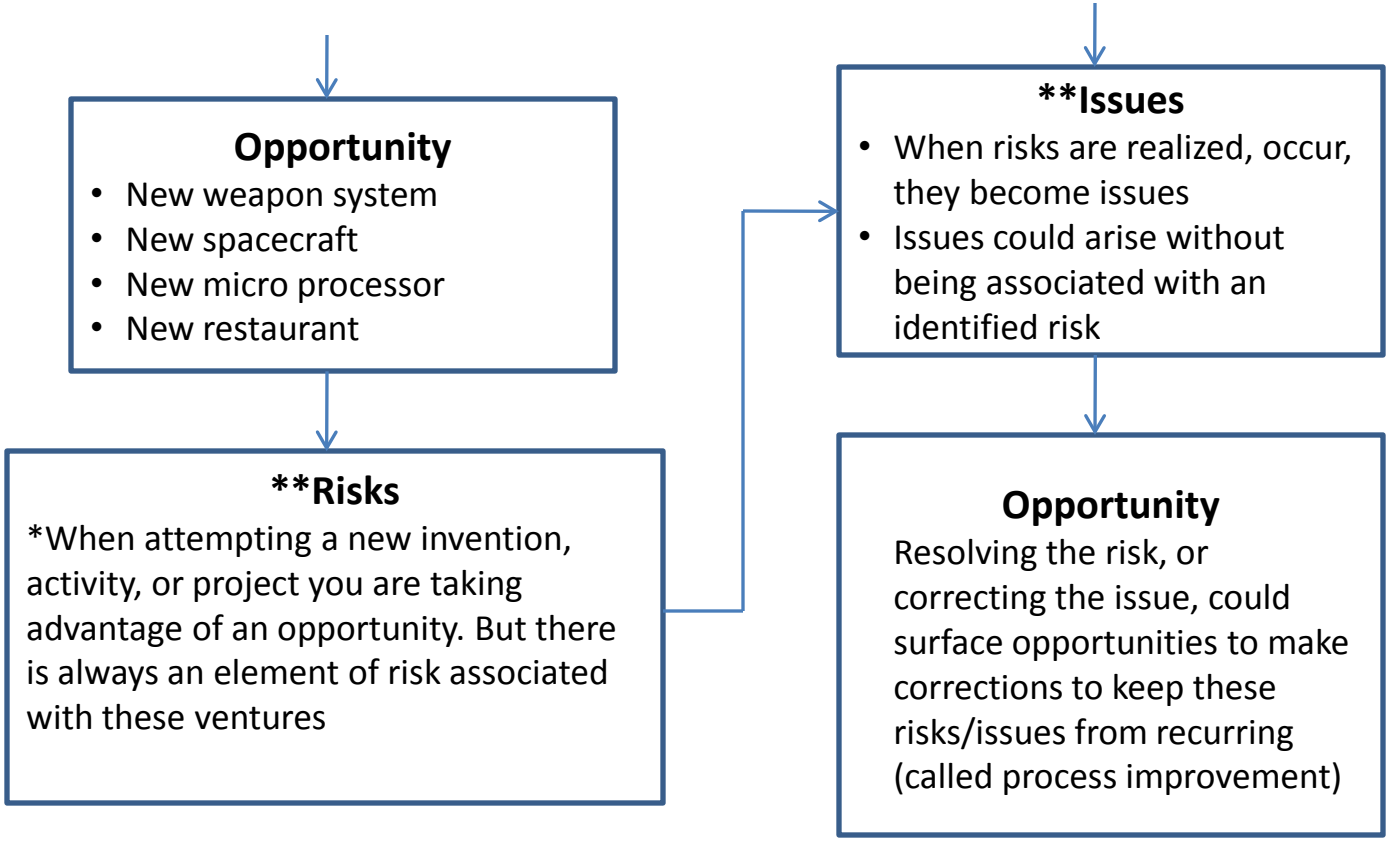
- Risks (IEEE Std 1540-2004; Standard for Software Life Cycle Processes)
  - Program and project risks are the likelihood of an event, hazard, threat, or situation occurring and its undesirable consequences
- Risk (Project Management Body of Knowledge PMBOK)
  - An uncertain even or condition that, if it occurs, has a positive or negative effect on project's objectives
- Issues (QATAR National Project Management)
  - An issue is something currently happening that is having a negative impact on the project and requires resolution for the project to proceed successful
- Issues
  - An issue can be associated with a risk if the risk is realized; has occurred
- Opportunity (The American Heritage Dictionary)
  - A favorable or advantageous combination of circumstances
  - A chance for progress or advancement
- Opportunity (PMBOK)
  - A condition or situation favorable to the project, a positive set of circumstances, a positive set of events, a risk that will have a positive impact on project objectives, or a possibility for positive chances

Introduction

Definitions

- Risk Response
  - The process of developing options and actions to enhance opportunities and reduce threats to project objectives PMBOK
  - Includes Mitigation and Contingencies
  - Includes acceptance of the risk or issue consequence
- Mitigation
  - Risk mitigation implies an elimination or reduction in the probability of risk occurrence PMBOK
- Contingency
  - Issue contingency implies an elimination or reduction of the impact of issues or alternative actions taken

Introduction



**Managing Risks, Methods for Software Systems Development; Dr. Elaine M. Hall, SEI Series in Software Engineering*
***Focus of this presentation*

Where Are We

- Introduction
- ***Reasons for Risk Management***
- Risk Management
- Questions/Discussion
- References
- Contact Information

Reasons for Risk Management

- When developing, delivering, and acquiring systems and products
  - developers and acquirers face many challenges
- Challenges can exist with many items and activities:
  - Cost
  - Schedule
  - Technical
  - Management
  - Programmatic
  - Process
  - Performance
  - Others?

Reasons for Risk/Issue Management

- Consequences may be numerous if challenges are not mitigated
  - Cost overruns
  - Late deliveries
  - Technically inadequate
  - Programmatic difficulties
  - Irate management
  - Irate customer
  - Canceled project
  - Loss of market share
  - Missed opportunities
  - Others?

Reasons for Risk/Issue Management

- There are solutions for an organization to help mitigate these challenges
  - Proper program/project management
  - Proper program/project planning
  - Program/project monitoring and control
  - Adequate budgets
  - Adequate schedules
  - Proper requirements development and management
  - Contract tracking and oversight
  - Product evaluation
  - Performance management
  - ***Risk management***
  - Quality assurance
  - Configuration management
  - Independent Verification and Validation (IV&V)
  - Others?

Compliance with CMMI®

- Software Engineering Institute (SEI) Capability Maturity Model Integration (CMMI)
  - CMMI for Development v1.3
  - CMMI for Acquisition v1.3
  - CMMI for Service v1.3

All have
Risk Management

In order for organizations to be compliant with CMMI they need to establish risk management capabilities

Where Are We

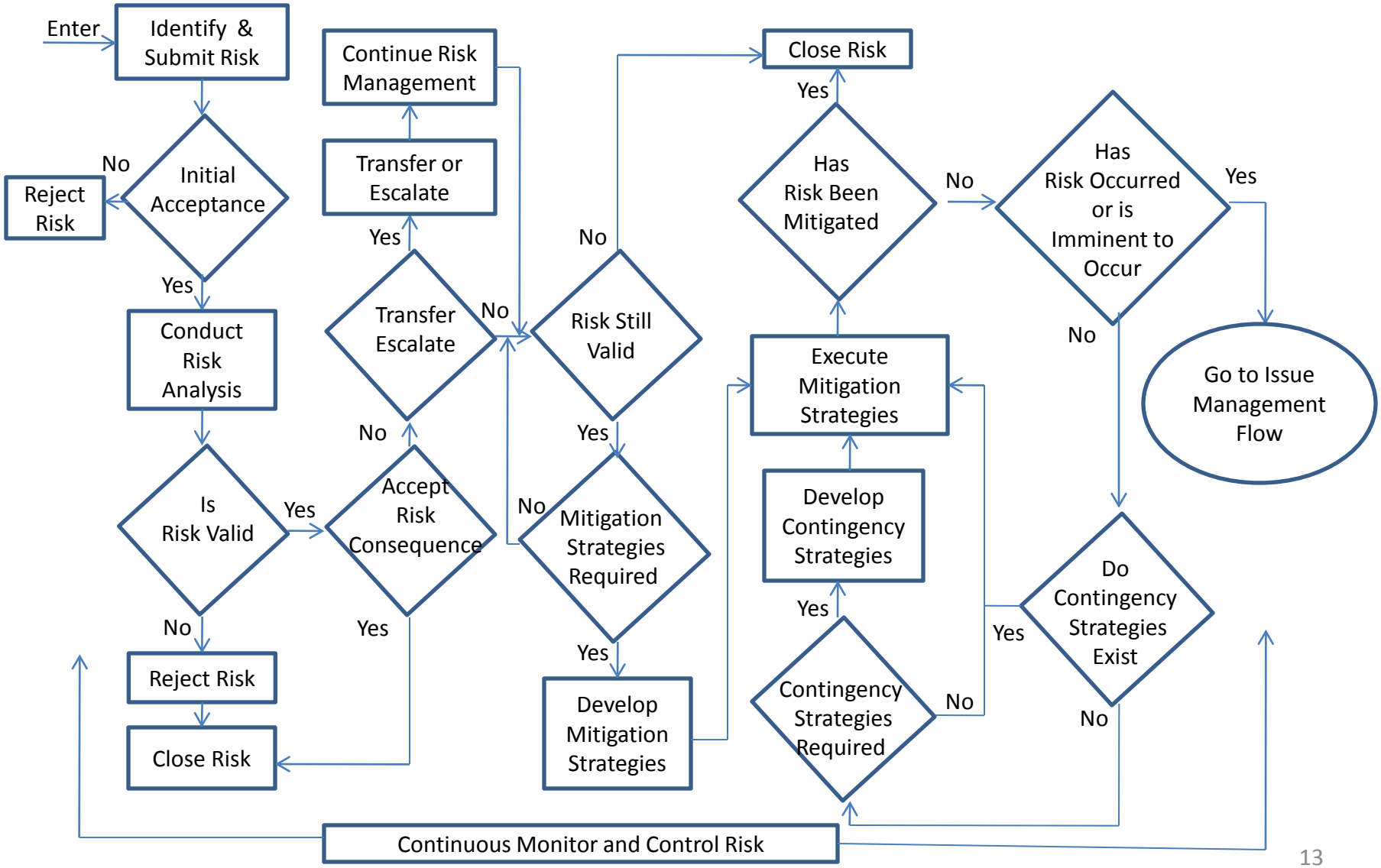
- Introduction
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Risk Management Process

- Risk Management is an overarching process that encompasses
  - Risk Planning
  - Risk Identification
  - Risk Analysis
  - Risk Response
  - Risk Monitoring and Control

  PMBOK

Risk Management Flow



Risk Management Planning

- Risk management planning is the process of deciding how to approach and conduct the risk management activities for a project
- Planning is important to
  - Ensure the level, type and visibility of risk management are commensurate with both the risk and importance of the project to the organization
  - Provide sufficient resources and time for risk management activities
  - Establish an agreed-upon basis for evaluating risks
- Risk planning should be completed early during project planning

PMBOK

Risk Management Team

- The Risk Managment planning activity may assign a Risk Management Team to administer the Risk Management Program
- A Risk Manager may be assigned to manage the Risk Management Team
- A Risk Management Board may be chartered to review, accept, decline, transfer and escalate risks
- Hierarchy Governance Boards may exist for escalation of risks based on thresholds
- Everyone on the program/project is responsible for managing risks

The level of this implementation depends on the size, scope, critically, safety, security, etc. of the application

Risk Management Plan

- Risk management planning needs to be part of project planning
- A risk management plan can be a stand alone plan or part of the project plan
- The risk management plan needs to be tailored to the scope of the application
- The concepts provided in this tutorial can be used to develop the plan

Risk Management Plan Outline

- Introduction
- Project Description
- Risks/Issue/Opportunity Descriptions
- Risk Identification
- Risk Analysis
- Risk Response
  - Risk Acceptance
  - Risk Avoidance
  - Risk Transfer
  - Risk Escalation
  - Risk Mitigation
- Risk Monitor and Control
- Risk Register
- Issue Management
- Issue Contingency
- Risk/Issue Training
- Glossary
- References

Risk Identification

- Risk Identification is the activity that:
  - Identifies potential and current risks
  - Examine elements of the program to identify associated potential root causes of risks
  - Risk identification begins as early as possible in successful programs and continues throughout the life of the program
- Risk can be associated with all aspects of a program; e.g.

Requirements	Design
Threat	Schedule
Security	Cost
Technology maturity	Performance
Supplier capability	Etc.

Risk Description

- A well-written risk statement contains three main components:
  - Cause – The negative conditions that currently exist relative to the risk
    - Identification of root cause(s) of the risk
    - This provides justification that a risk exists
  - Probability of Occurrence – The likelihood of the occurrence of the risk
    - Within a future time frame
    - Or a future event
  - Consequence – The effect(s), negative impact(s) to the program(s) in case the risk occurs
    - The consequence should be related to at least cost, schedule, scope and performance
    - Consequence could also result in opportunities that may surface in correcting the problems

Risk Description

- The risk is written in a chain of: Cause: IF; THEN

Example

An Interface Working Group has not been formed and a plan to form one does not exist.
IF key stakeholders cannot agree on interface protocol by 11/14/2011;
THEN the schedule for development and delivery will be delayed causing cost overruns.

NOTE: The cause includes assurance that the reason for the risk is valid. I.e., is there a compelling reasons(a root cause) to assume that stakeholders cannot agree on the interface protocol by 11/14/2011? *Not just pie in the sky.*

Risk Description

- Risks must be written in a clear, concise and unambiguous fashion
- Words and phrases that may have confusing and multiple interpretations must be avoided
  - Adequate
  - Ad hoc
  - All
  - Always
  - Appropriate
  - Clearly
  - Easy
  - Existing
  - Fast
  - Flexible
  - Future
  - If required
  - Immediately
  - Large
  - Light
  - Limited
  - Near real time
  - Periodic
  - Portable
  - Rapid
  - Several
  - Slow
  - Small
  - Sometimes
  - State of the art
  - Sufficient
  - Usable
  - User-friendly
  - Weight
  - When required

Also:
http://www.ppi-int.com/newsletter/SyEN-017.php#article

Risk Analysis

- The risk is submitted to the Risk Management Board
- The risk is accepted or declined by the Board
  - If declined rational is conveyed to the submitter
- If accepted the Risk Management Board assigns:
  - A Risk Analyst responsible for conducting risk analysis on assigned risks
    - Supported by Subject Matter Experts (SMEs)
  - A Risk Owner responsible for ensuring risks are properly managed throughout their life
  - Risk Analyst and Owner could be one in the same

Risk Analysis Components

- Risks have the following components:
  - A future root cause(s) (yet to happen) which
    - if eliminated or corrected, would prevent a potential consequence from occurring
  - A probability of occurrence (or likelihood)
    - assessed at the present time and updated when necessary of the future root cause occurring
  - The consequence (or effect/impact) of that future occurrence
  - The time horizon during which the consequences will occur if the risk is not mitigated
  - Risk Priorities
    - Mapping of probability of risk occurrence and risk consequence
  - Risk Triggers
    - Specific events or conditions that indicate when to develop and execute mitigation or contingency strategies

.

Risk Analysis

- **Qualitative Risk Analysis**
  - Relative measure of risk or asset value based on ranking or separation into descriptive categories such as low, medium, high; not important, important, very important; or on a scale from 1 to 10.

    BusinessDictionary.com
  - An examination and prioritization of the risks based on their probability of occurring and the impact on the project if they do occur. Qualitative risk analysis guides the risk reaction process.
    pmpbank.googlepages.com/glossary

- **Quantitative Risk Analysis**
  - Incorporates numerical estimates of frequency or probability and consequence. In practice, a sophisticated analysis of risk requires extensive data which are expensive to acquire or often unavailable. Fortunately, few decisions require sophisticated quantification of both frequency and consequences
  - Shortly spoken one might say that "quantitative risk analysis breaks down risks from a high medium low ranking to actual numerical values and probabilities of occurrence" for being able to compute the overall effects

    (comp. CROSSWIND7, p. 423)

Root Causes

- A future root cause is the most basic reason for the presence of a risk
- The cause of the risk has to be isolated and defined
  - Root causes should be initially identified when risks are identified
  - Once initial root cause are identified they may need to be analyzed further to determine the actual deep rooted causes of the risks
  - Root causes are documented and they support:
    - Establishing risk mitigation and contingency strategies
    - Improvement opportunities
- Root causes can also be referred as risk drivers

Root Cause Analysis. An analytical technique used to determine the basic underlying reason that causes a variance or a defect or a risk. A root cause may underlie more than one variance or defect or risk. ((PMBOK® Guide) -- Fourth Edition) Syn: root-cause analysis

Root Causes

- Typical root causes may be associated with:
  - Threat
  - Requirements
  - Technical Baseline
  - Test and Evaluation
  - Modeling and Simulation
  - Technology
  - Logistics
  - Management
  - Schedules
  - External Factors
  - Budget
  - Earned Value Management
  - Production
  - Industrial Capabilities
  - Cost
  - Others?

Root Causes

Background Information

- Threat - The sensitivity of the program to uncertainty in the threat description, the degree to which the program would have to change if the threat's parameters change
- Requirements - The sensitivity of the program to uncertainty in the system requirements
- Technical Baseline - The approved and fixed configuration of a technical item at a specific time in its lifecycle that serves as a reference point for change control
- Test and Evaluation - The adequacy and capability of the test and evaluation program to assess attainment of significant performance specifications and determine whether the system is operationally effective, operationally suitable, and interoperable with the system

Root Causes

Background Information

- Modeling and Simulation - The adequacy and capability of M&S to support all life-cycle phases of a program using verified, validated, and accredited models and simulations
- Technology - The degree to which the technology proposed for the program has demonstrated sufficient maturity to be realistically capable of meeting all of the program's objectives
- Logistics - The ability of the system configuration and associated documentation to achieve the program's logistics objectives based on the system design, maintenance concept, support system design, and availability of support data and resources

Root Causes

Background Information

- Management - The degree to which program plans and strategies exist and are realistic and consistent. The program support team should be qualified and sufficiently staffed to manage the program
- Schedule - The sufficiency of the time allocated for performing the defined tasks
- External Factors - The availability of resources external to the program that are required to support the program such as facilities, resources, personnel, government furnished equipment, etc.
- Budget - The sensitivity of the program to budget variations and reductions and the resultant program turbulence
- Earned Value Management (EVM) - The adequacy of the EVM process and the realism of the integrated baseline for managing the program

Root Causes

Background Information

- Production - The ability of the system configuration to achieve the program's production objectives based on the system design, manufacturing processes chosen, and availability of manufacturing resources
- Industrial Capabilities - The abilities, experience, resources, and knowledge of the contractors to design, develop, manufacture, and support the system
- Cost - The ability of the system to achieve the program's life-cycle cost objectives. This includes the effects of budget and affordability decisions and the effects of inherent errors in the cost

Probability of Occurrence

- Probability of occurrence assessed, at the present time, is the probability of a future root cause occurring
- The chance of a risk occurring is rated on a scale between >0 and 1
- When the probability of occurrence = 1; (100%)
  - The risk has occurred; it then becomes an issue and is managed as an issue
- For most risks, estimating the precise probability of occurrence may be difficult
  - Analysis by SMEs may be necessary, and often using Best Engineering Judgment

Probability Scores

- Probability of occurrence may begin with a qualitative description of probability, which will tie to a numeric range of probability.

Sample Risk Probability Scores

Probability Description	Probability % of Occurrence
Very High (Extremely likely)	≥81% and =100%
High (Probable)	61% – 80%
Medium (Possible)	41% – 60%
Low (Unlikely)	21% – 40%
Very Low (Highly improbable)	>I% – ≤20%

Consequence of Risk Occurrence (Impact)

- Risks are reviewed for the effect that they would have on the project's objectives and other elements of the program
- The level of impact, may be rated from very low (1) to very high (5), and is assessed against at least four categories:
  - Cost
  - Schedule
  - Scope
  - Performance

Consequence of Risk Occurrence

Program/Project Objective	**Very Low** Minor	**Low** Moderate	**Medium** Serious	**High** Critical	**Very High** Catastrophic
Cost	Insignificant increase	Increase < 2% of budget baseline	Increase 2–5% of budget baseline	Increase 6–10% of budget baseline	Increase > 10% of budget baseline
Schedule	Insignificant slippage	Slippage < 2% of project baseline schedule	Slippage 2–5% of project baseline schedule	Slippage 6–10% of project baseline schedule	Slippage > 10% of project baseline schedule — OR — Slippage past a milestone mandated by Congress
Scope	Scope decrease barely noticeable	Minor areas of scope affected	Major areas of scope affected	Scope reduction unacceptable to sponsor	Project outcome is effectively useless
Performance	Performance degradation barely noticeable	Performance degradation noticeable, but does not fail acceptance criteria	Performance reduction requires sponsor approval	Performance reduction unacceptable to sponsor	Project outcome is effectively useless

Risk Exposure

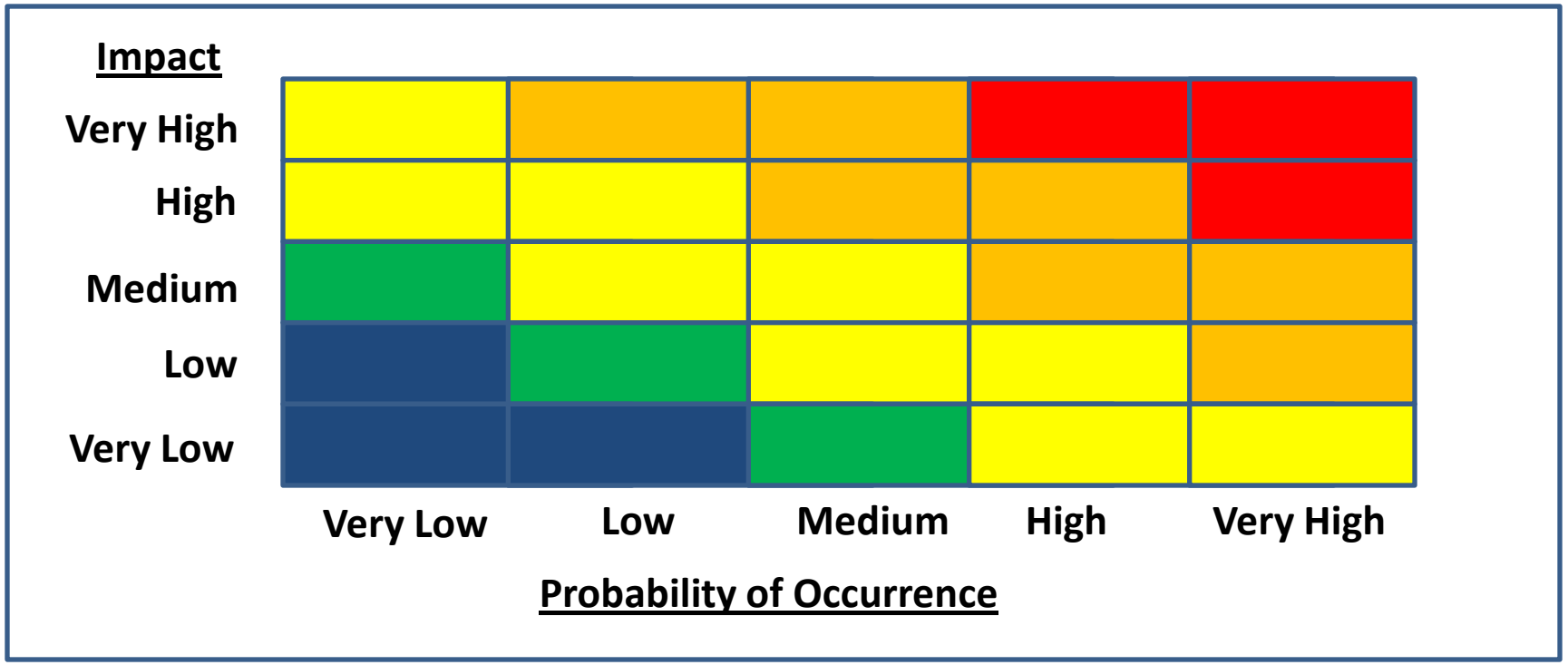
- Risk exposure. (ISO/IEC 16085:2006 Systems and software engineering--Life cycle processes--Risk management

  (1) the potential loss presented to an individual, project, or organization by a risk

  (2) a function of the likelihood that the risk will occur and the magnitude of the consequences of its occurrence

- Risk exposure can also be called **Risk Priority**
  - The priority of a risk helps to determine the amount of resources and time that should be dedicated to managing and monitoring the risk
  - Very Low, Low, Medium, High, and Very High priority is assessed by using probability and impact scores
  - The potential timing of a risk event may also be considered when determining risk management actions

Risk Priorities



Very Low Priority

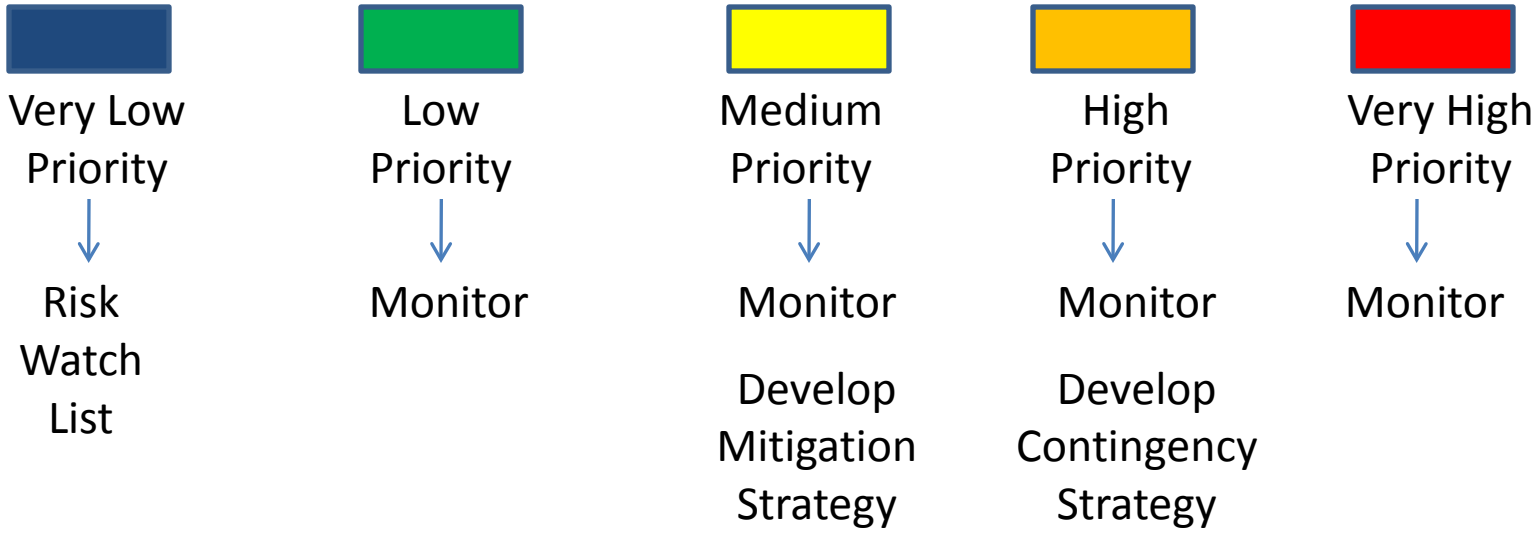
Low Priority

Medium Priority

High Priority

Very High Priority

Risk Priority vs. Mitigation/Contingency



Very Low Priority Risks are placed in a Risk Watch List which are periodically monitored.
Other Risks are monitored more aggressively.

Identifying Triggers

- Triggers are specific events or conditions that indicate when to execute mitigation or contingency strategies
- Unless a condition is immediate, a trigger should be defined
- Examples of triggers may include:
  - Cost performance
  - Schedule performance
  - Results of management reviews
  - Occurrence of the risk
    - as a trigger for execution of contingency strategies

Risk Response

- Risk response is the process of developing options and determining actions to enhance opportunities and reduce threats to the project's objectives
- Risk response must be
  - Appropriate to the significance of the risk
  - Cost effective in meeting the challenge
  - Timely and realistic within the project contend
  - Agreed to by all parties involved

PMBOK

Risk Response

- Risk Responses has at least five components
  - Acceptance
  - Avoidance
  - Transfer
  - Escalate
  - Mitigate *(contingencies – for issues)*
- Acceptance – Accept the consequences of the risk occurring
  - Other responses may not be possible
  - Cost to respond may be greater than the benefit
  - May not be possible to prevent the impact if the risk occurs
  - Impact may be negligible
  - Risk may be imminent and should be handled as an issue

Risk Avoidance/Transfer

- Avoidance
  - Eliminate the sources of high risk and replace them with a lower-risk alternative
  - Avoid risks with good management and engineering practices
- Transfer - Shift the responsibility of managing and resolving the risk to another party
  - May be better able to manage the risk
  - May be the proper owner of the risk
  - Transfer could be from one party to another within the same organization
  - Transfer could be to a completely different organization

Risk Escalation

- Escalation - Risks should be managed at the lowest practical level
  - But conditions may arise where a risk should be escalated to higher levels of management or beyond the program/project
  - The next higher organizational (Governance) entity may be able to better to handle the risk/issue
  - Thresholds may exist that determine escalation
    - Cost of impact
    - Schedule effect of Impact
    - Scope of impact
    - Performance effect of impact
    - Time critical
    - Cost critical

Risk Mitigation

- Taking early action to reduce the probability and/or impact of a risk occurring is often more effective that trying to repair the damage after the risk has occurred
- Adapting less complex processes, conducting more tests, or choosing a more stable supplier are examples of mitigation actions

PMBOK

Risk Mitigation

- The following are important guidelines for effective risk mitigation:
  - Prepare detailed mitigation strategies for all medium, high and very high risks
    - With sufficient detail about what is to be done, when, where, and by whom
  - Develop mitigation strategies as early as possible, allowing time to address risks needing special attention or action
    - Helps reduce the chance of having high-priority risks appear at the last moment on the critical path
  - Prepare contingency strategies for all high and very high priority risks and risks imminent to occur

Risk Mitigation

Background Information

- Adaptations of the following strategies can be applied to a range of risks. This list is intended merely as a starting point for thinking about risk mitigation
  - Multiple Development Efforts - Create competing systems in parallel that meet the same scope and performance requirements
  - Alternative Design - Create a backup design option that uses a less risky approach
  - Trade Studies – Conduct studies to arrive at the least risky solution
  - Early Prototyping - Build and test prototypes early in the system development
  - Incremental Development - Design with the intent of upgrading system parts in the future

Risk Mitigation

Background Information

- Technology Maturation Efforts - Normally, technology maturation is used when the desired technology will replace an existing technology that is available for use in the system
- Robust Design - This approach, while it could be more costly, uses advanced design and manufacturing techniques that promote quality through design
- Reviews, Walk-Throughs, and Inspections - These three actions can be used to reduce the probability/likelihood and potential consequences/impacts of risks through timely assessment of actual or planned events
- Design of Experiments - This engineering tool identifies critical design factors that are sensitive, and therefore potentially high-risk, to achieve a particular user requirement

Risk Mitigation

Background Information

- Open Systems - Carefully selected commercial specifications and standards, which can result in lower risks
- Use of Standard Items/Software Reuse - Use of existing and proven hardware and software, where applicable, can substantially reduce risks
- Use of Mock-Ups - The use of mock-ups, especially man-machine interface mock-ups, can be used to conduct early exploration of design options
- Modeling/Simulation - Modeling and simulation can be used to investigate various design options and system requirement levels
- Key Parameter Control Boards - The practice of establishing a control board for a parameter may be appropriate when a particular feature (such as system weight) is crucial to achieving the overall program requirements

Risk Monitoring and Control

- In order to effectively monitor and control risks a Risk Repository needs to be established
  - Also called a Risk Register
- There are many risk tools that provide repository capabilities:
  - Home developed tools
  - Commercial tools
  - Corporate/agency tools

Note: Risk register implementation may depend on project size. A month long project might just need a spread sheet table whereas a multi-year, geographically dispersed project may require an internet and SQL-based database tool.

Where Are We

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- ***References***
- ***Contact Information***



References

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- *Issue Management Plan Preparation Guidelines;* QATAR National Project Management

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- *IEEE Std 1540-2004, IEEE Standard for Software Life Cycle Processes—Risk Management;* IEEE
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- *The Black Swan: The Impact of the Highly Improbable*; Nazism Nicholas Tale ; The Random House Publishing Company
- http://pascal.computer.org/sev_display/index.action SEVOCAB: Software and Systems Engineering Vocabulary

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CMMI® Training – Avoiding Waste and Ineffectiveness

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November 17, 2011

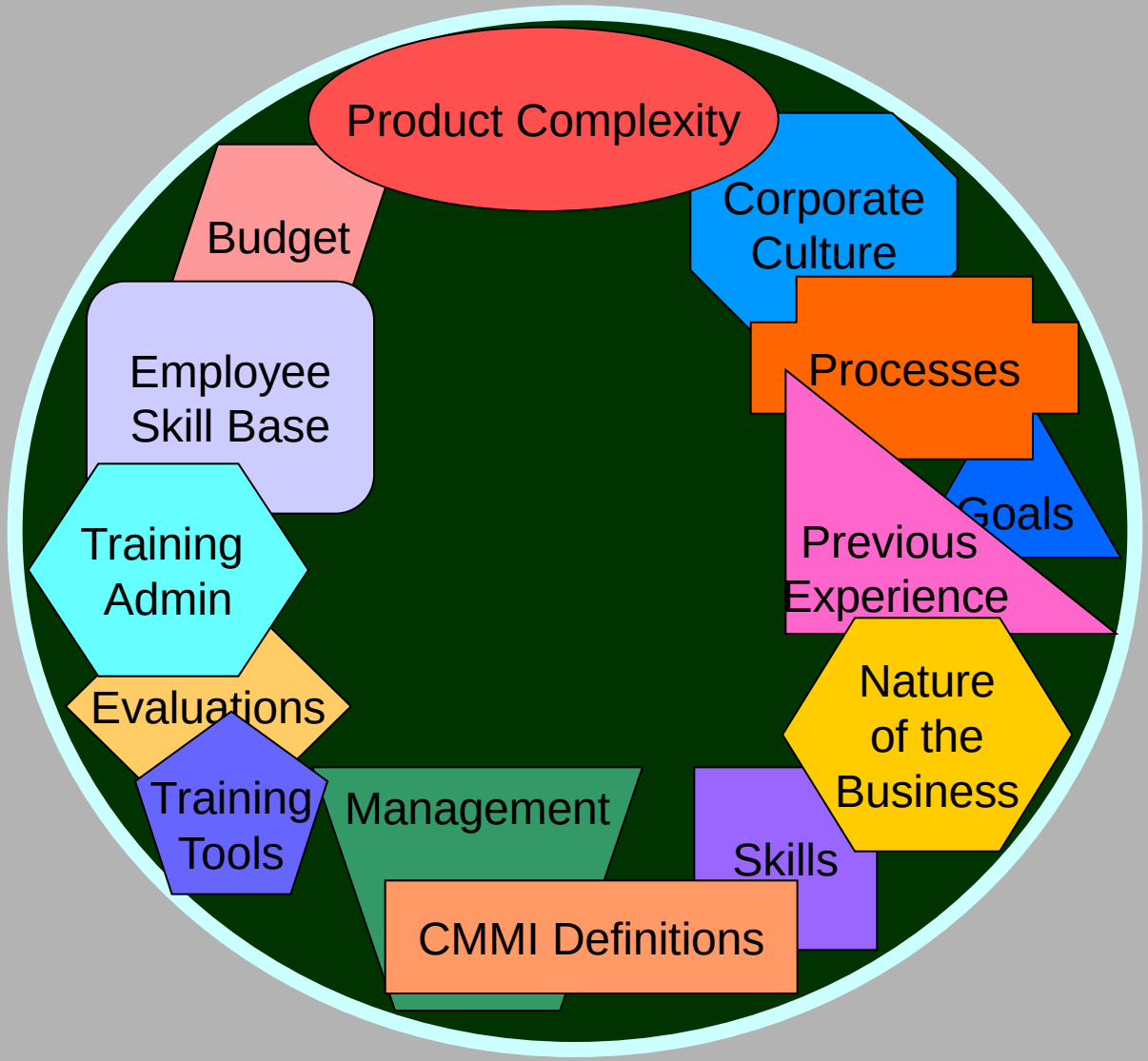
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CMMI® Training – Opportunities or Pitfalls?

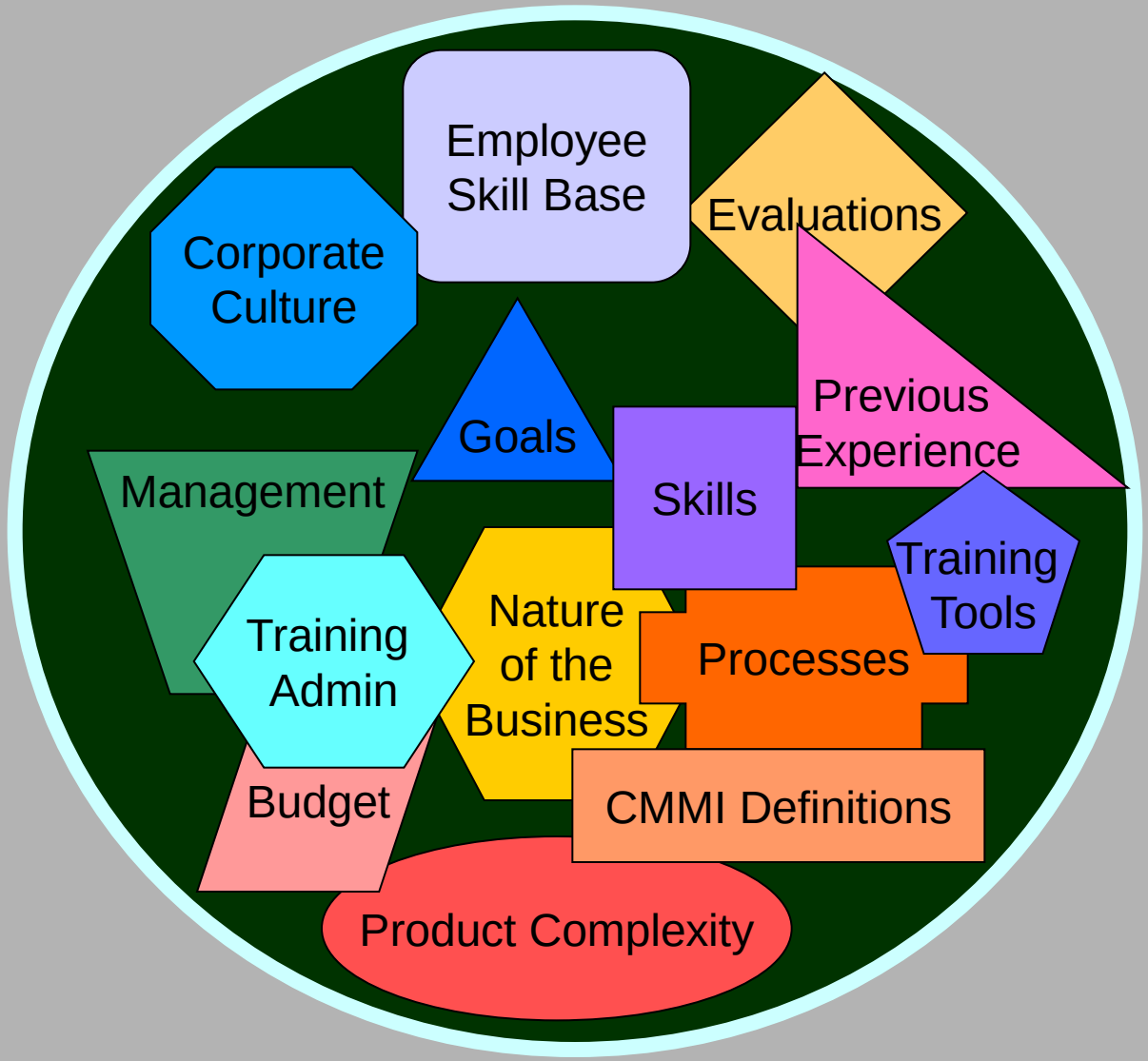
- Budget
- CMMI Definitions
- Corporate culture
- Evaluations
- Employee skill base
- Goals
- Management
- Nature of the business
- Previous experience
- Product complexity
- Processes
- Roles
- Skills
- Training Tools
- Training administration
- etc

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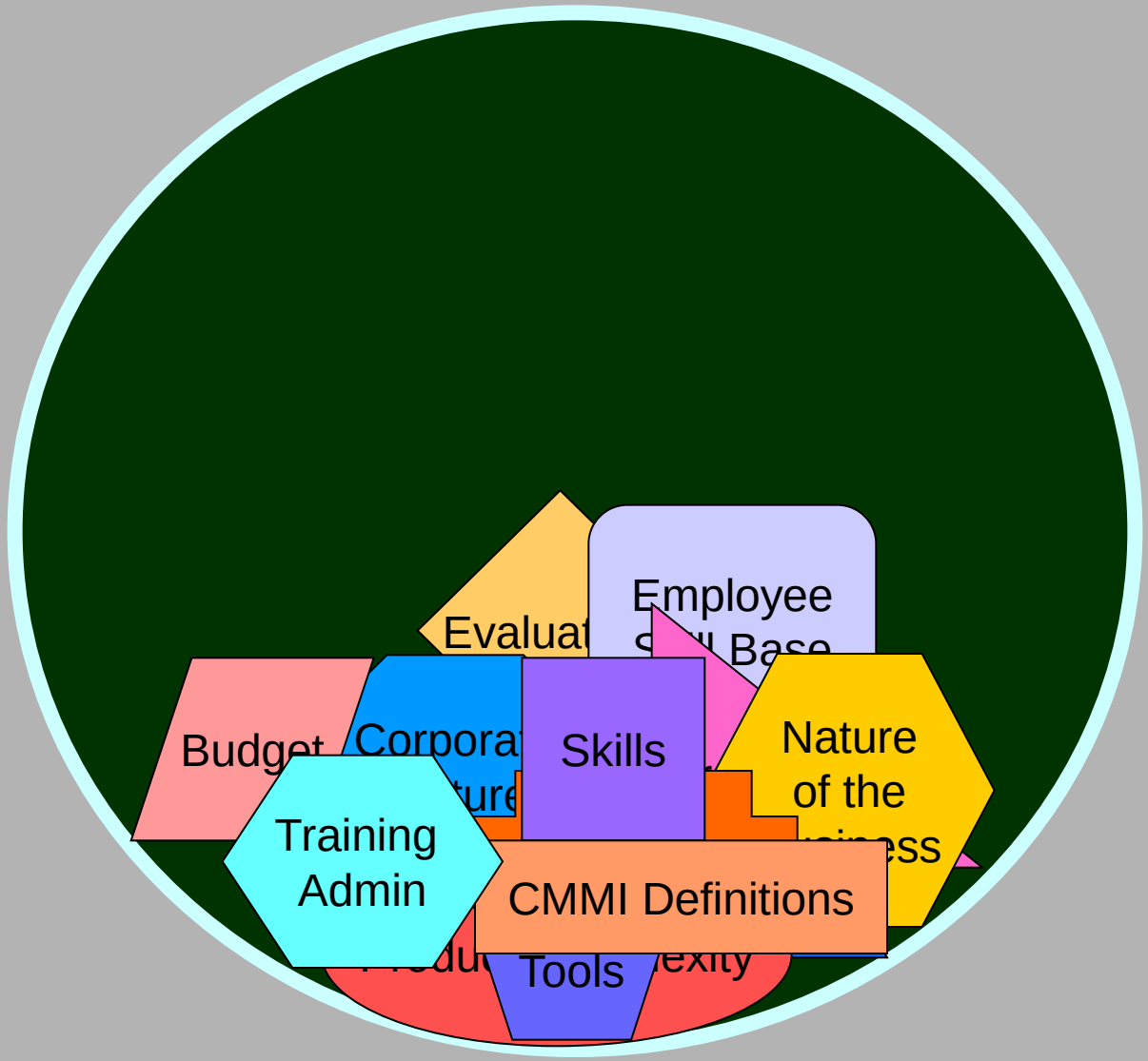
CMMI Training Kaleidoscope



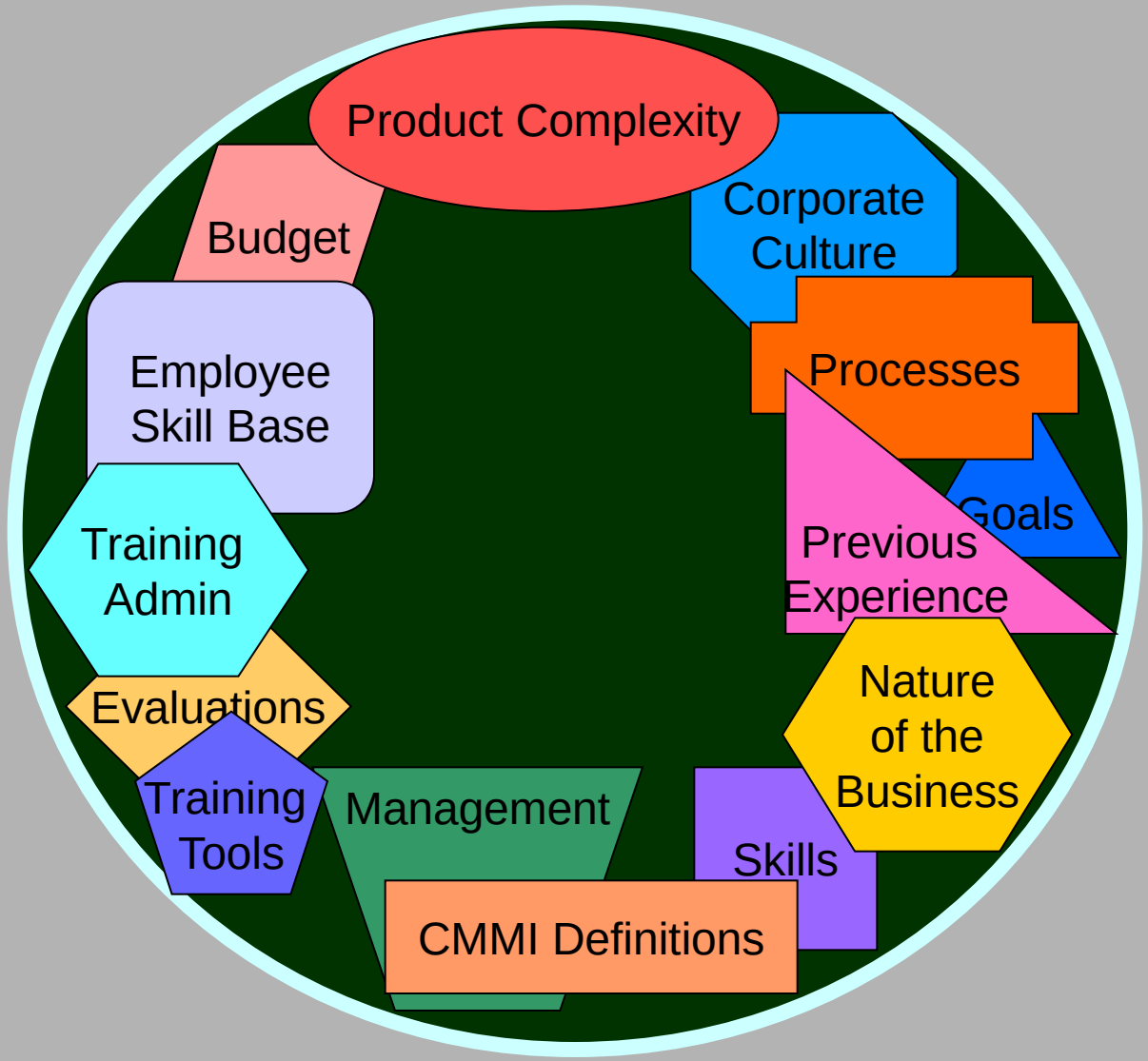
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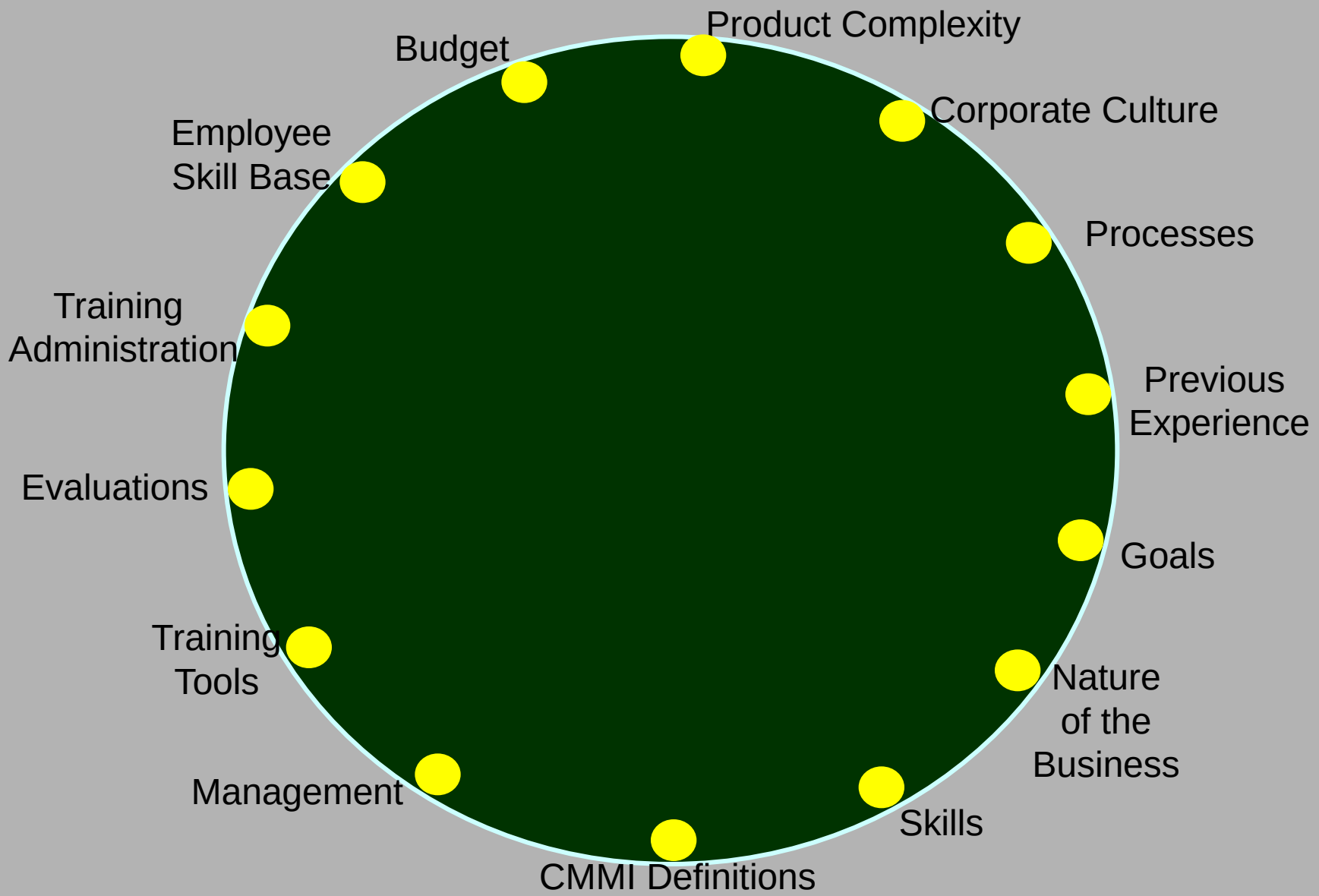
CMMI Training Kaleidoscope



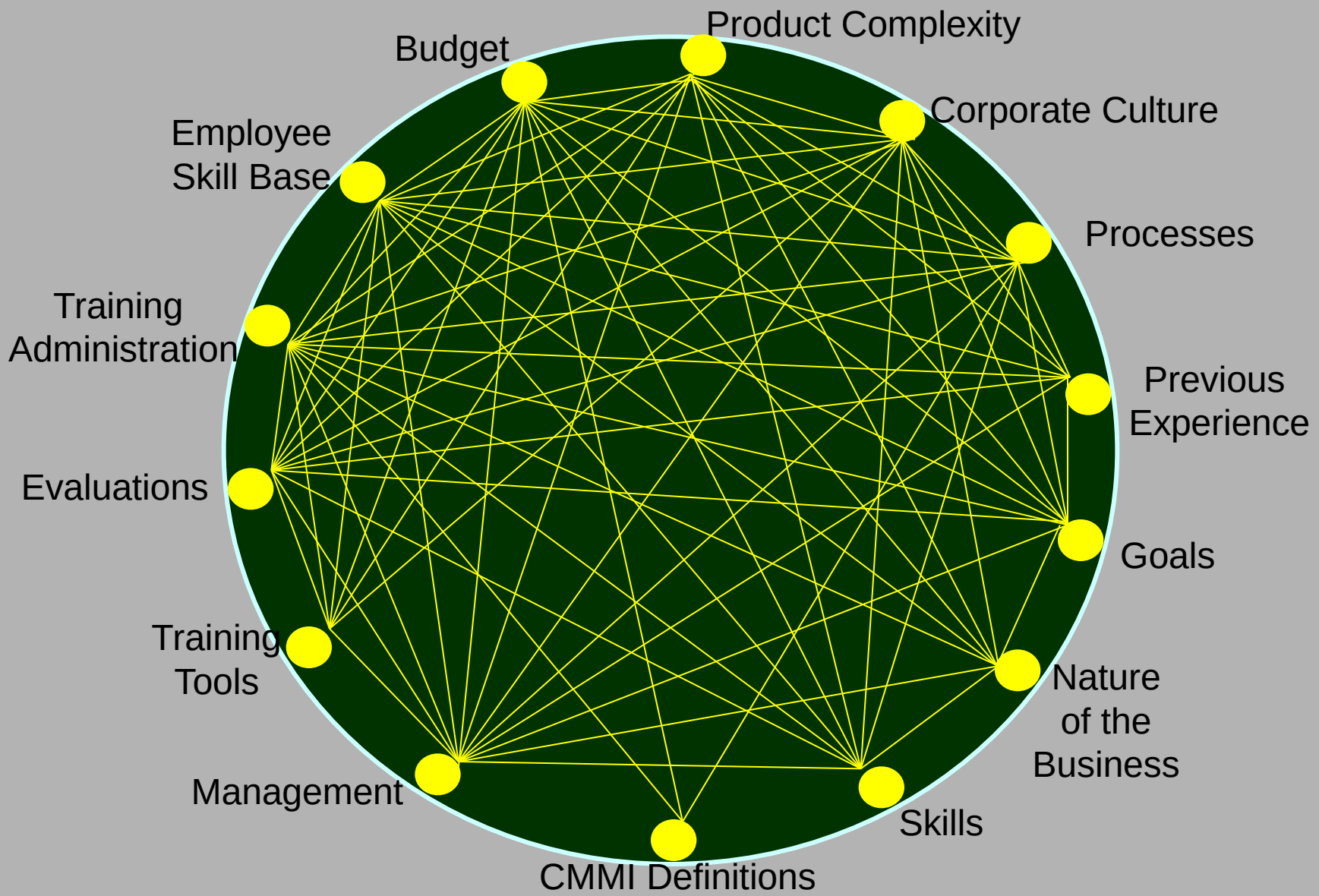
CMMI Training Kaleidoscope



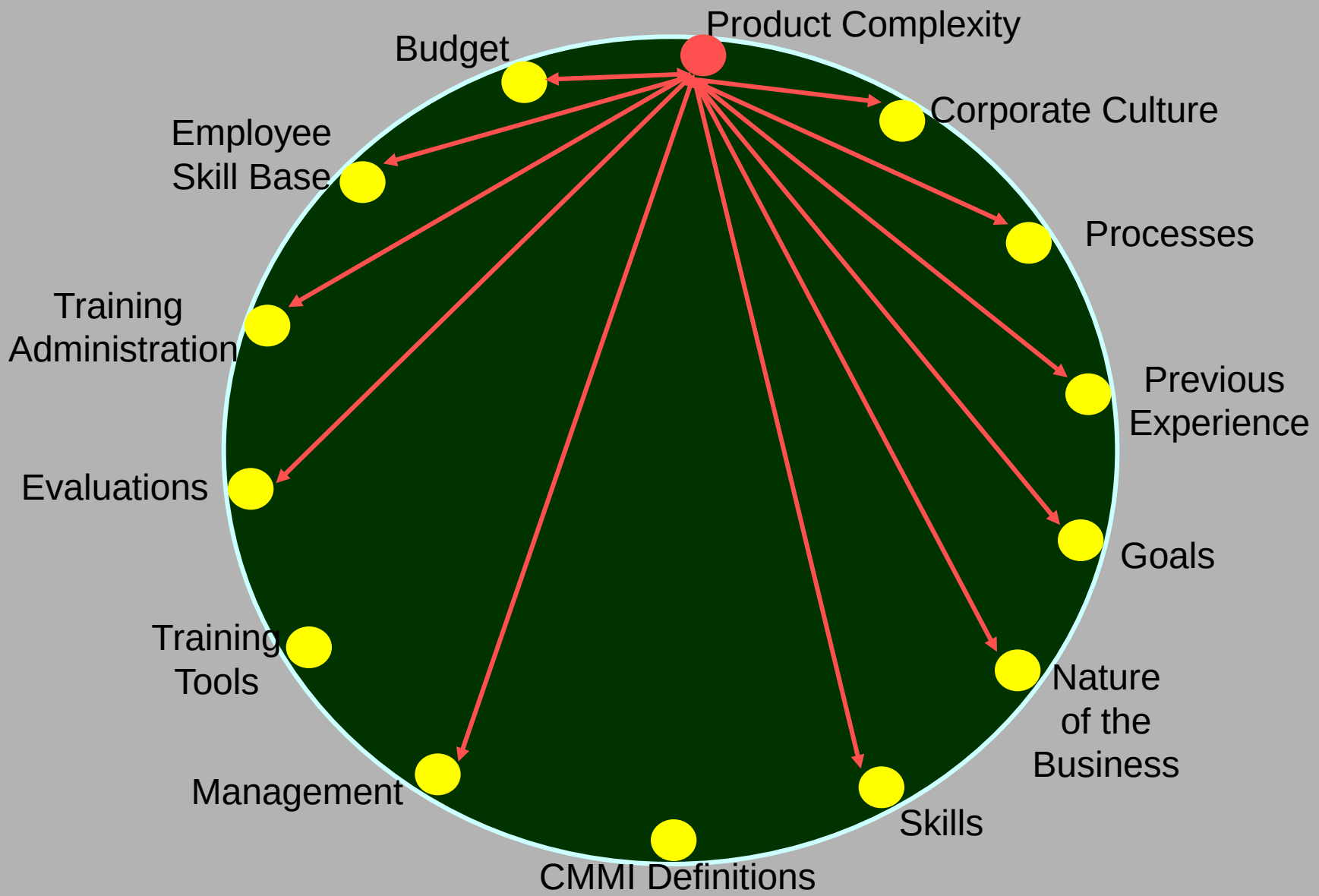
CMMI Training Inter-relationship Diagram



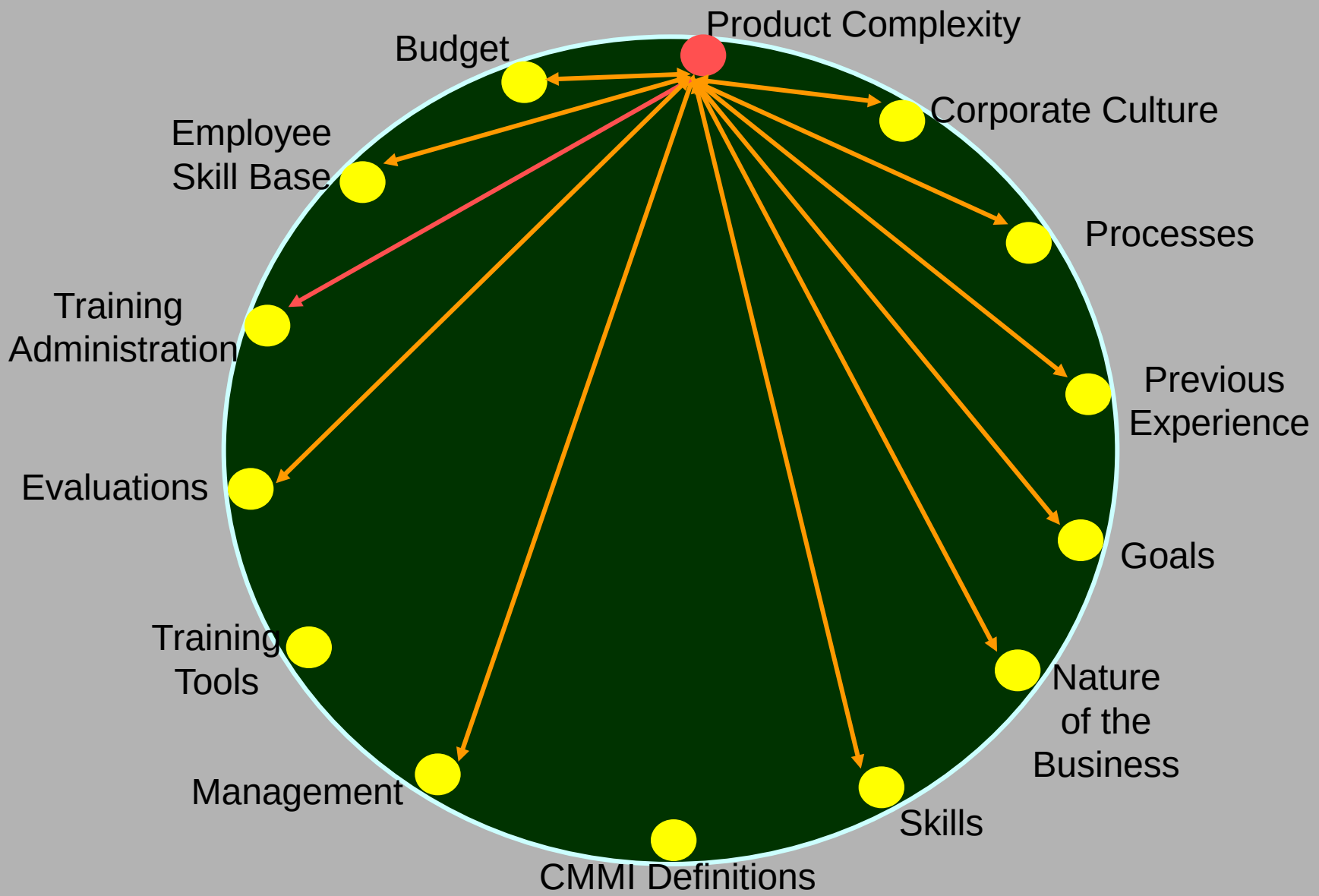
CMMI Training Inter-relationship Diagram



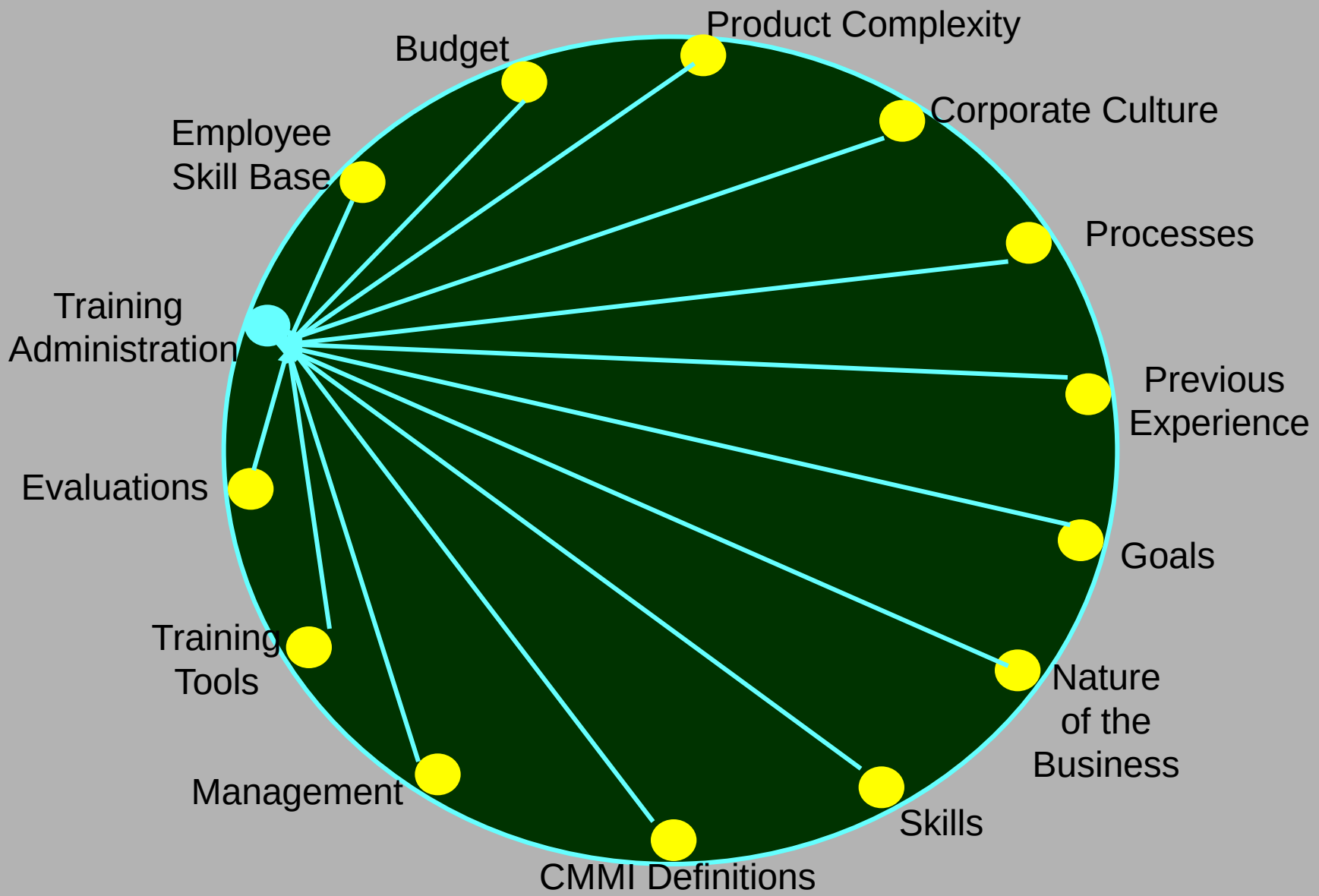
CMMI Training Inter-relationship Diagram



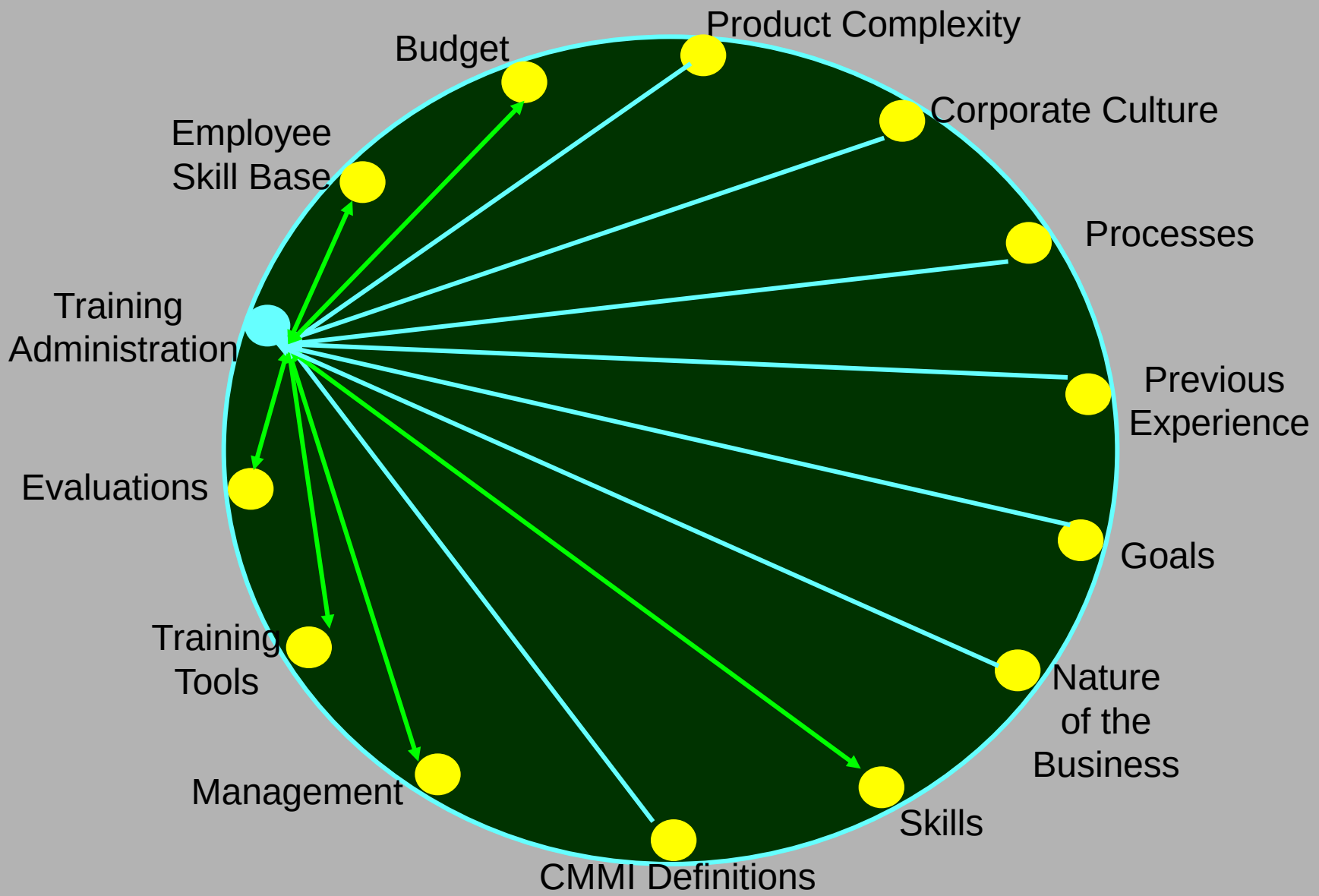
CMMI Training Inter-relationship Diagram



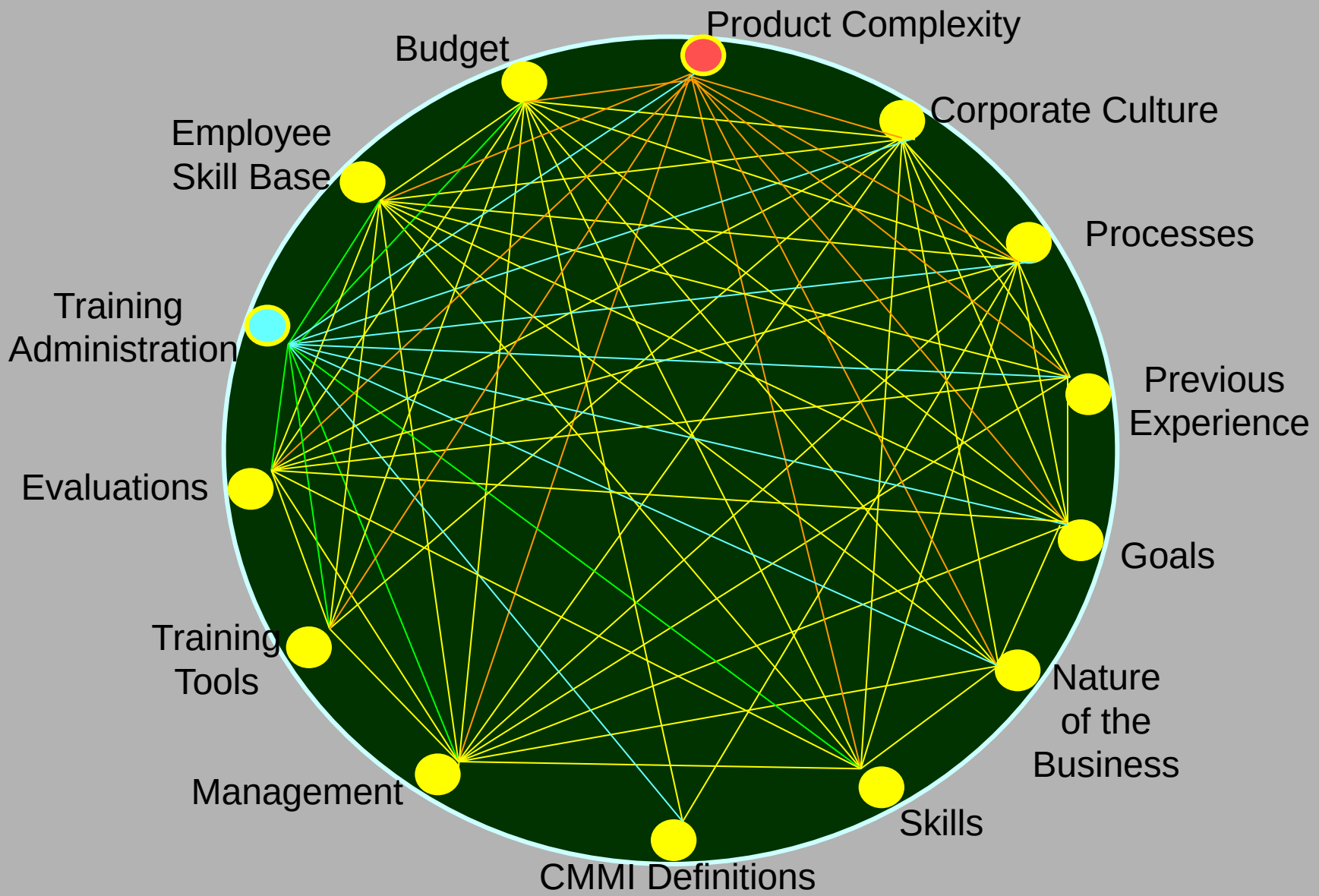
CMMI Training Inter-relationship Diagram



CMMI Training Inter-relationship Diagram

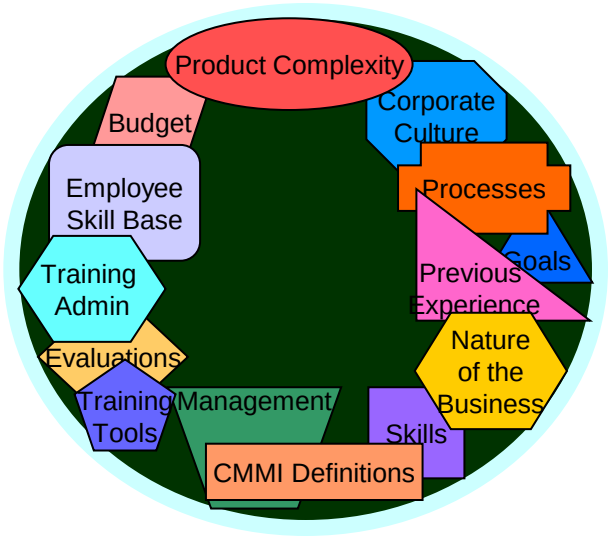


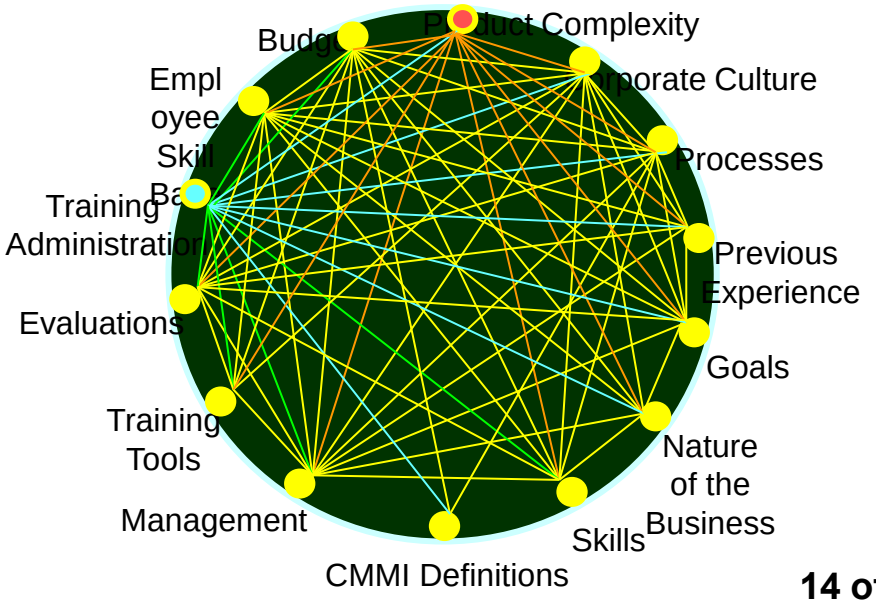
CMMI Training Inter-relationship Diagram



CMMI® Training – Navigating the Pitfalls

- **Who needs/provides training?**
- **What's the goal?**
- **Where/How is training provided?**
- **When is training needed?**
- **Why is training needed/not needed?**

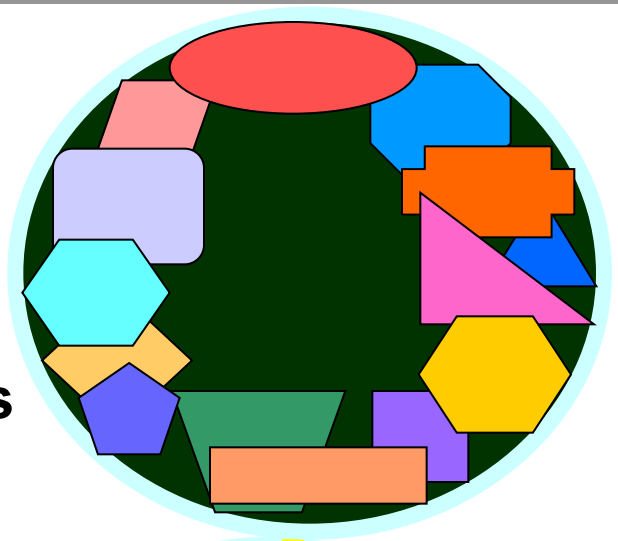


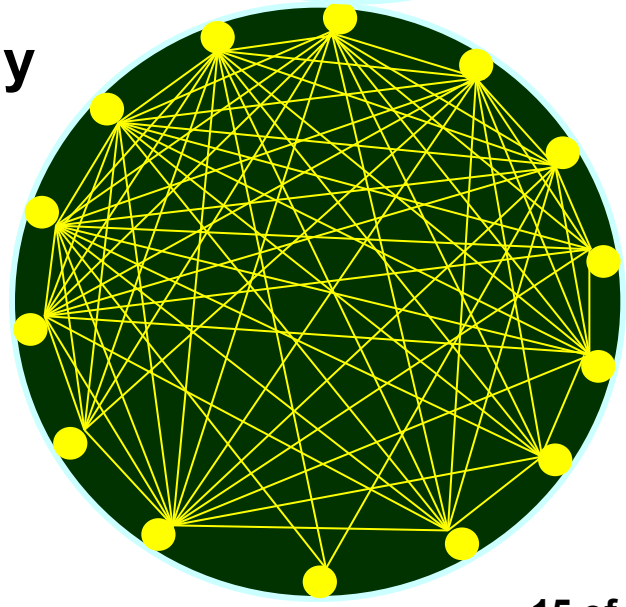


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CMMI® Training – Getting it Right

- **Factors in Getting It Right**
  - Complexity of the product
  - Nature of the business
  - Expected skill base of the employees
  - Corporate culture & organization
  - Importance of CMMI to the company
  - Laws & regulations

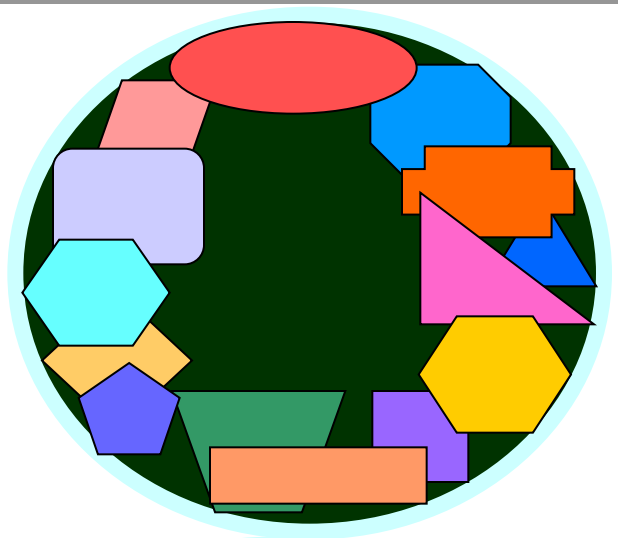


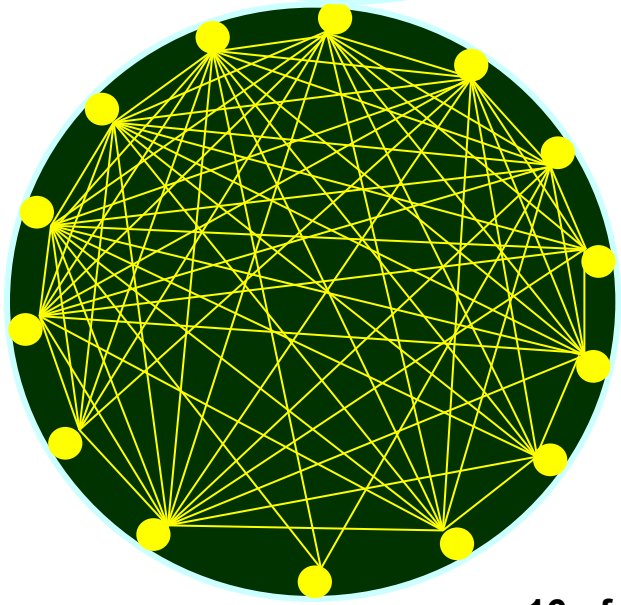


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CMMI® Training – Typical Training Issues

- Administration
- Budget
- Business Complexity
- Contracts
- Metrics
- Need Identification & Communication
- Process/Skill/Tool Training
- Process Architecture & Definition
- Process Format
- Physical Plant
- Role Definition
- Training Tools
- Updates & Training
- Waivers

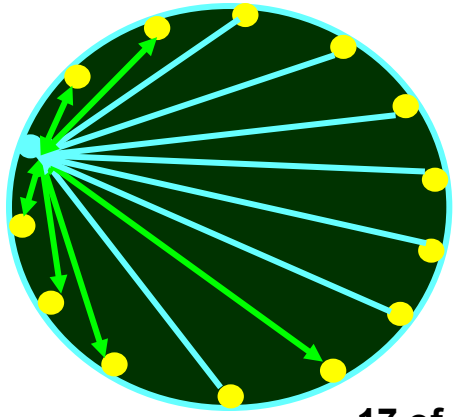




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Training Administration & the Other Training Issues

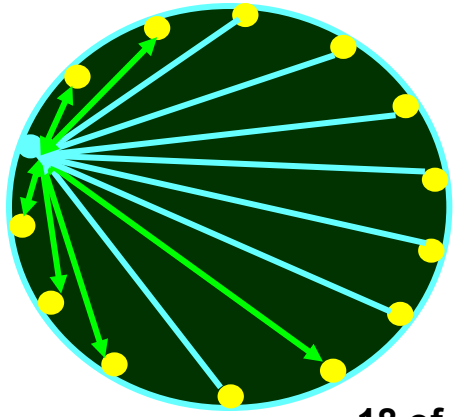
- **Training Administration and Budget**
  - **What is the baseline level of competency?**
  - **What is the expected level of competency?**
  - **Who pays for what?**
    - **process or skill training**
    - **process or tool training**
    - **process updates and training material updates**



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Training Administration & the Other Training Issues

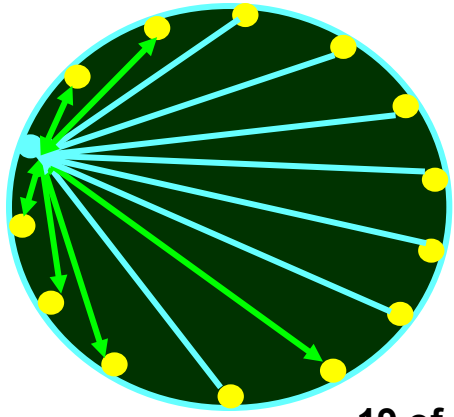
- **Training Administration and Business Complexity**
  - **Number of products**
  - **Contract requirements**
  - **Legal and regulatory requirements**
  - **Multiple levels of training requirements**
  - **Single or multiple sites**
  - **Size of the workforce**
  - **Diversity of the workforce**



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Training Administration & the Other Training Issues

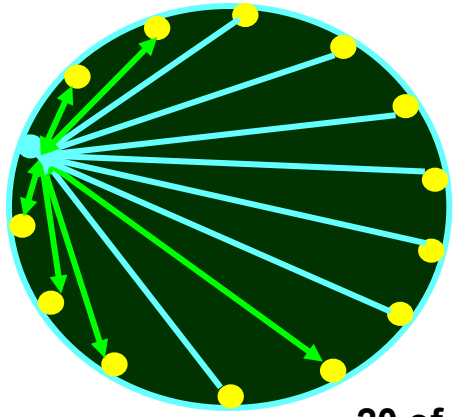
- **Training Administration and Contracts**
  - **Budget for upgrade training**
  - **Whose budget?**
  - **Scheduling of training**
  - **Cost factored into the proposal?**



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Training Administration & the Other Training Issues

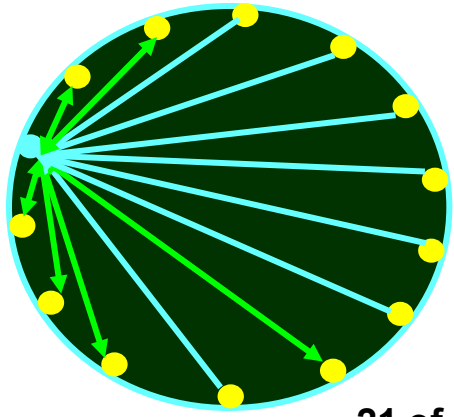
- **Training Administration and Delivery Methods**
  - **On the Job Training**
  - **Web**
  - **Instructor-led**
  - **Mixed delivery**
  - **In-house or external**
  - **Simulations**



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Training Administration & the Other Training Issues

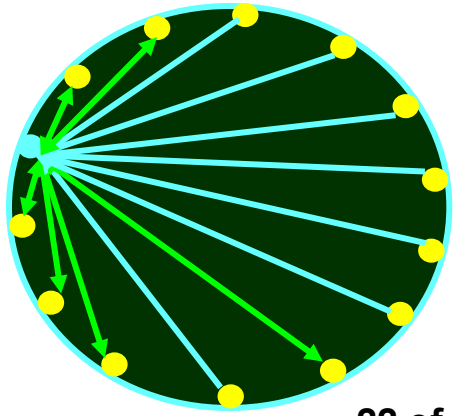
- Training Administration and Metrics
  - Format – individual, project, manager, roll-up
  - Whose budget?
  - What do the metrics tell about the training?
    - Quality
    - Quantity
    - Skill level
  - Who needs to know what, why, and when?
    - Course completions
    - Competency levels
    - Personally Identifiable Information
  - What are the success criteria?



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Training Administration & the Other Training Issues

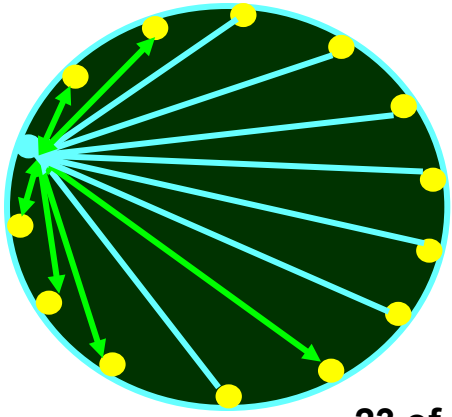
- **Training Administration & Need Identification**
  - **Identification of training needs**
  - **Communication of training needs**
  - **Need to maintain currency**



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Training Administration & the Other Training Issues

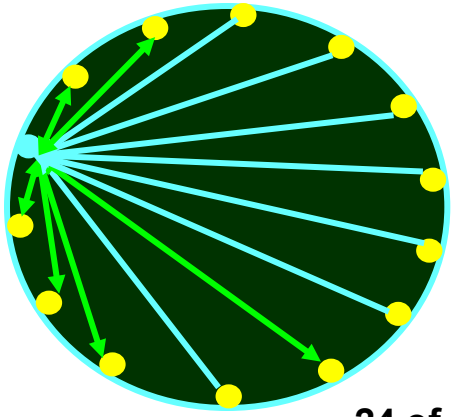
- **Training Administration & Processes**
  - **Definition of 'process'**
    - **Series of tasks to produce an output**
    - **Process or skill?**
    - **Tool instructions**
    - **Multiple sites**
  - **Process Hierarchy**
  - **Process Updates**
  - **Process Format**
  - **Process Inter-relationships**
  - **Process detail**



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Training Administration & the Other Training Issues

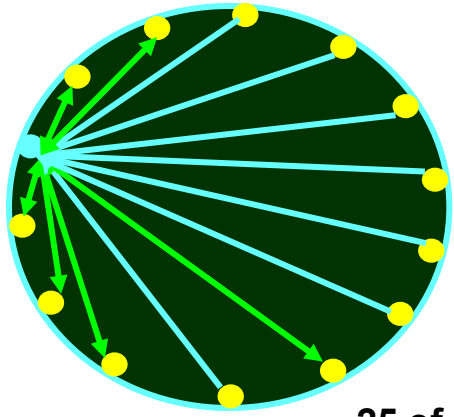
- **Training Administration and Skill/Tool Training**
  - **Definitions**
  - **Budget**



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Training Administration & the Other Training Issues

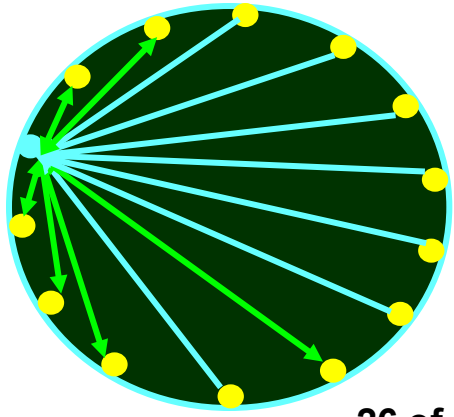
- **Training Administration and Role Definition**
  - **Consistent definition**
    - **programs**
    - **sites**
    - **processes**
    - **departments**
  - **Level of detail in the definition**
    - **budget**
    - **scheduling of training**



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Training Administration & the Other Training Issues

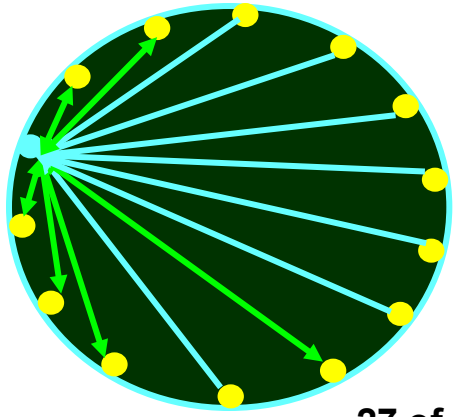
- **Training Administration and the Training Tool**
  - **Course equivalents**
  - **Course waivers**
  - **Course updates**
  - **Course Curricula**
  - **Number of courses**
  - **Number of people**
  - **Questionnaires**
  - **Scheduling**
  - **Cancellations**



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Training Administration & the Other Training Issues

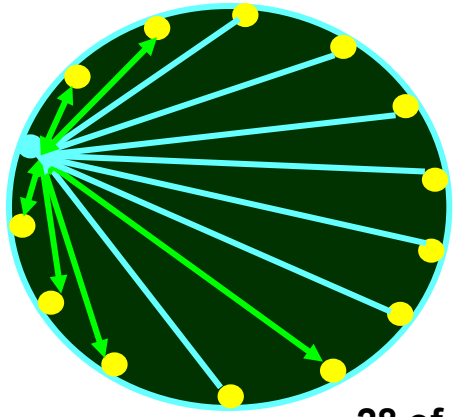
- **Training Administration and the Training Tool cont'd**
  - **Number of**
    - **courses**
    - **people**
    - **sites**
    - **roles**
    - **levels of competency**
    - **processes**
    - **skills**
    - **available instructors**
    - **available training venues**



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Training Administration & the Other Training Issues

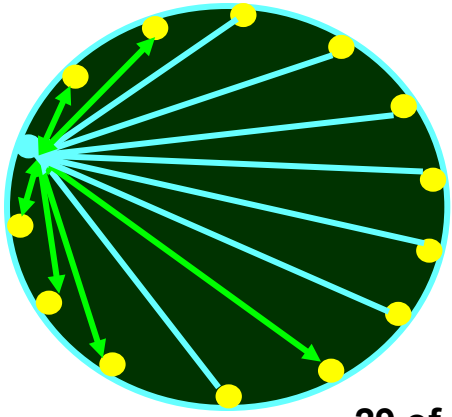
- **Training Administration and Training Tool**
  - **Multiple users**
  - **Multiple levels of access**
  - **Multiple levels of requirements**
    - **Federal, state, and local laws and regulations**
    - **Head office, division, sites, projects**
  - **Budget**
  - **Upgrades**
  - **Training on how to use the tool**
  - **COTS or DIY**



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Training Administration & the Other Training Issues

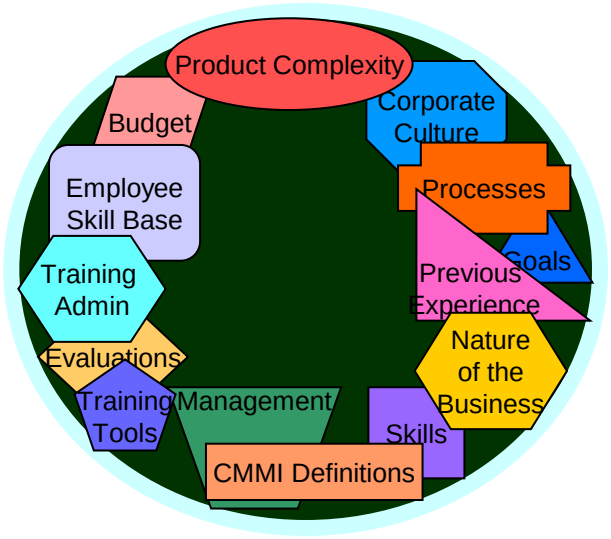
- **Training Administration and Updates**
  - **Training materials are part of the tool/process/skill level updates**
  - **Budget – whose?**
  - **Impact of out of date training materials**

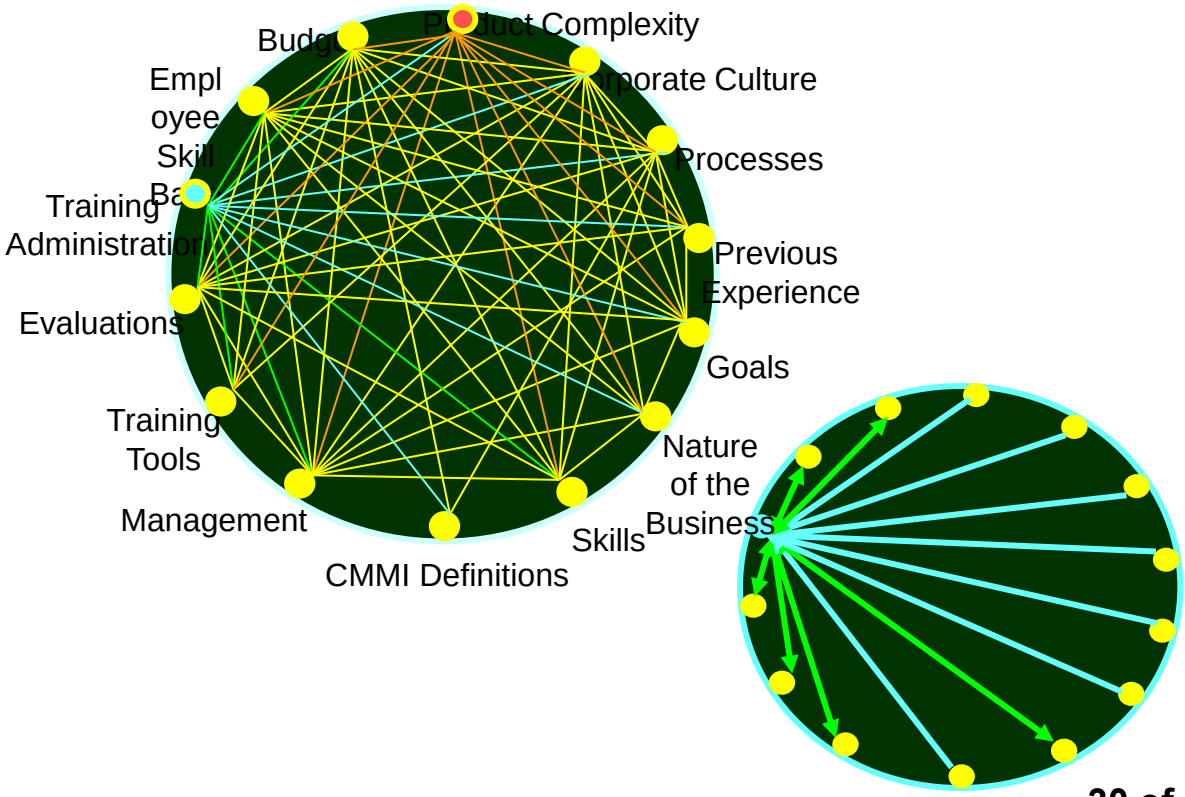


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Summary Training Administration and CMMI®

- **Training Administration**
  - **Is inter-related with multiple aspects of the business**
  - **Impacts all areas of training**

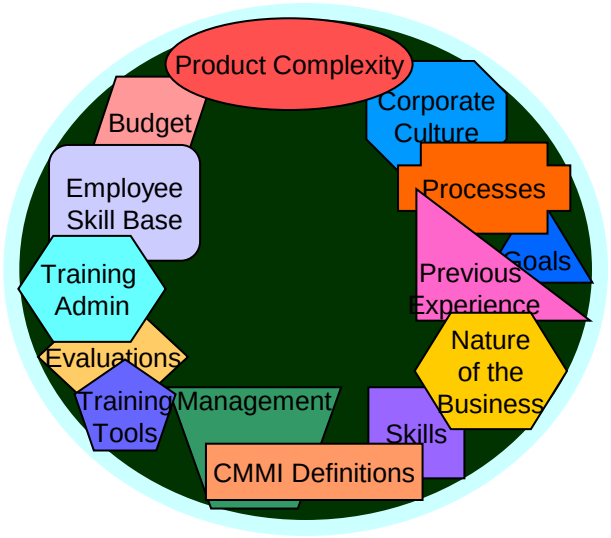


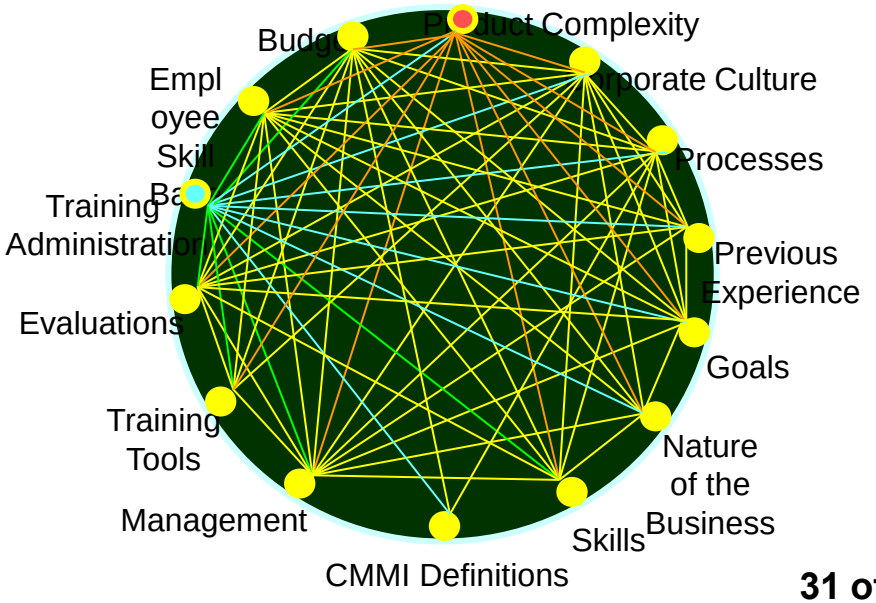


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Summary Training Administration and CMMI®

- **Training Administration**
  - **Does the discipline of CMMI assist the development and maintenance of the training program? In other words the administration of the training program?**
    - **How is that impact evaluated?**





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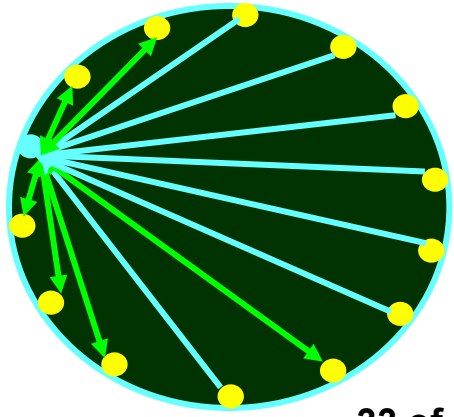
CMMI® Training – Avoiding Waste and Ineffectiveness

- If CMMI were no longer a business need, would you keep doing training the same way?
  - What would be dropped?
  - What would be retained?
  - What are the criteria for making these decisions?

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CMMI® Training – Avoiding Waste and Ineffectiveness

- **What is being done in the name of CMMI that is not necessary?**
  - **How do you know it's not necessary?**
  - **How do you know it is necessary?**



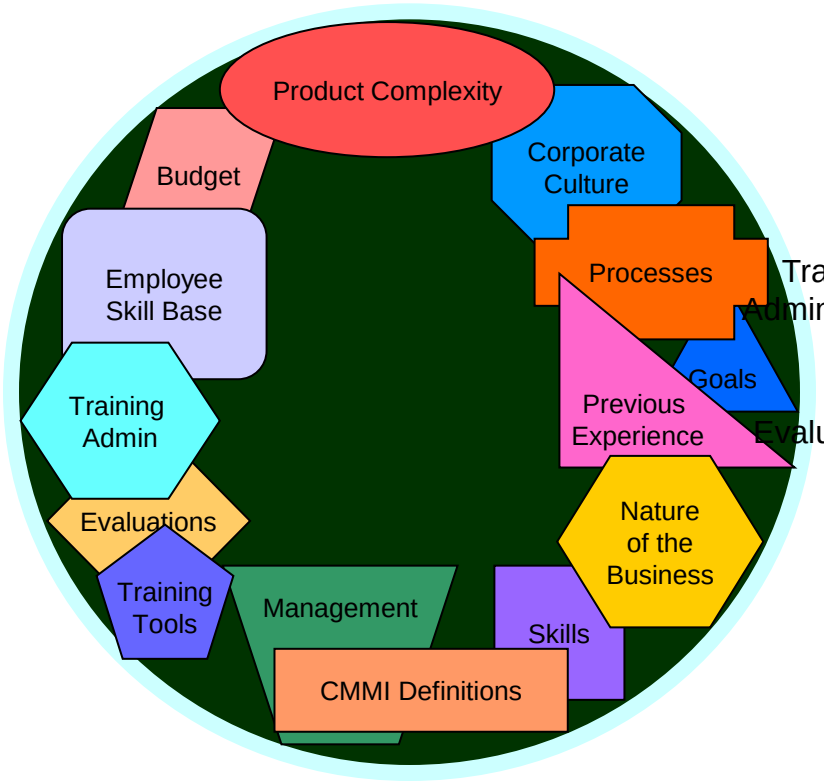
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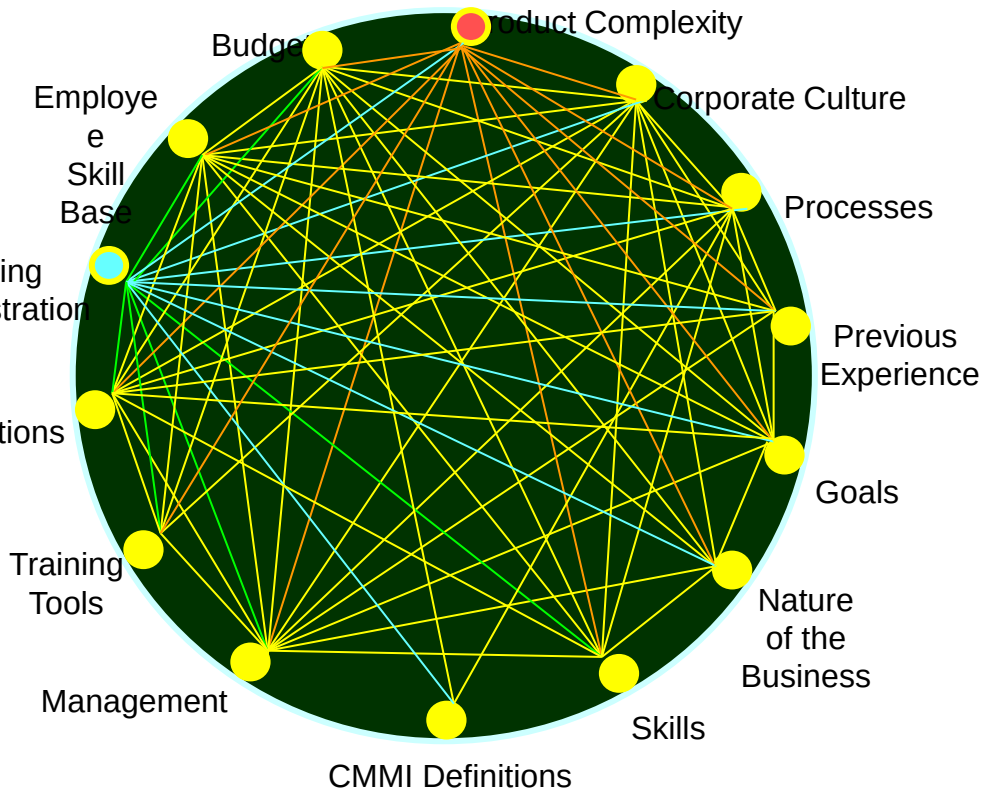
CMMI® Training – Avoiding Waste and Ineffectiveness

- **Is your CMMI implementation being done in the Leanest way possible?**
- **Is it being driven by your inefficiencies?**

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Any Questions?





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BOEING



Assured Communications™
Anytime. Anywhere.

Streamlining Process Deployment and Compliance

Gary Natwick
Harris Corporation
16 November 2011

NDIA CMMI® Conference and User Group

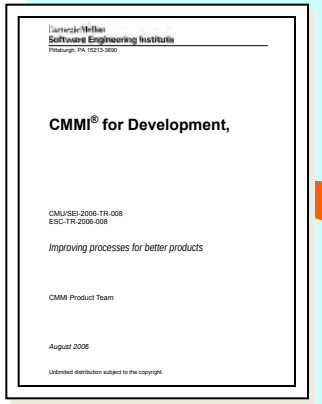
Agenda

- Foundation
- Approach and Challenges
- Streamlining:
  - Organizational Processes
  - Work Products
  - Appraisal Process
- Summary

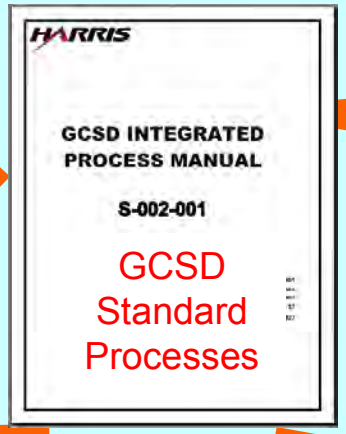
Integrated Compliance Approach

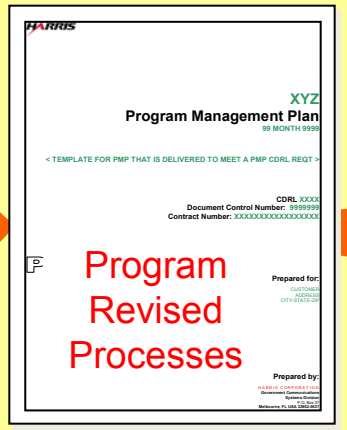
HARRIS

CMMI Model

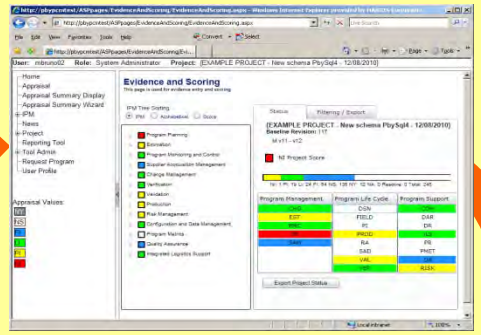


Division





Programs



Program's Process Baseline



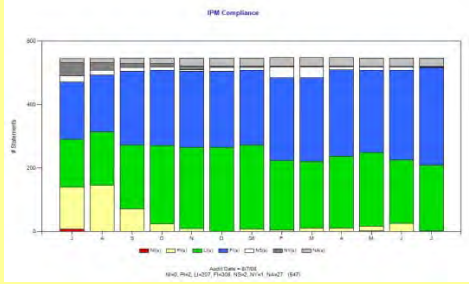
Command Media

Improve

Reuse

Submit

Historical Data
Best Practices
Example Assets
Improvement Requests



Program's Compliance Metric

Organizational Learning

Work Products for Compliance

Overview
A brief description of the process intent

Entry Criteria State, Prerequisites, Criteria	**Exit Criteria** State, Criteria
Inputs Needed work products, resources	**Outputs** Resulting work products

Required Activities
Mandatory tasks to implement the process

Measures
Process performance against plans

Organizational Improvement Information
Metrics, reusable work products

Verification
Process compliance oversight

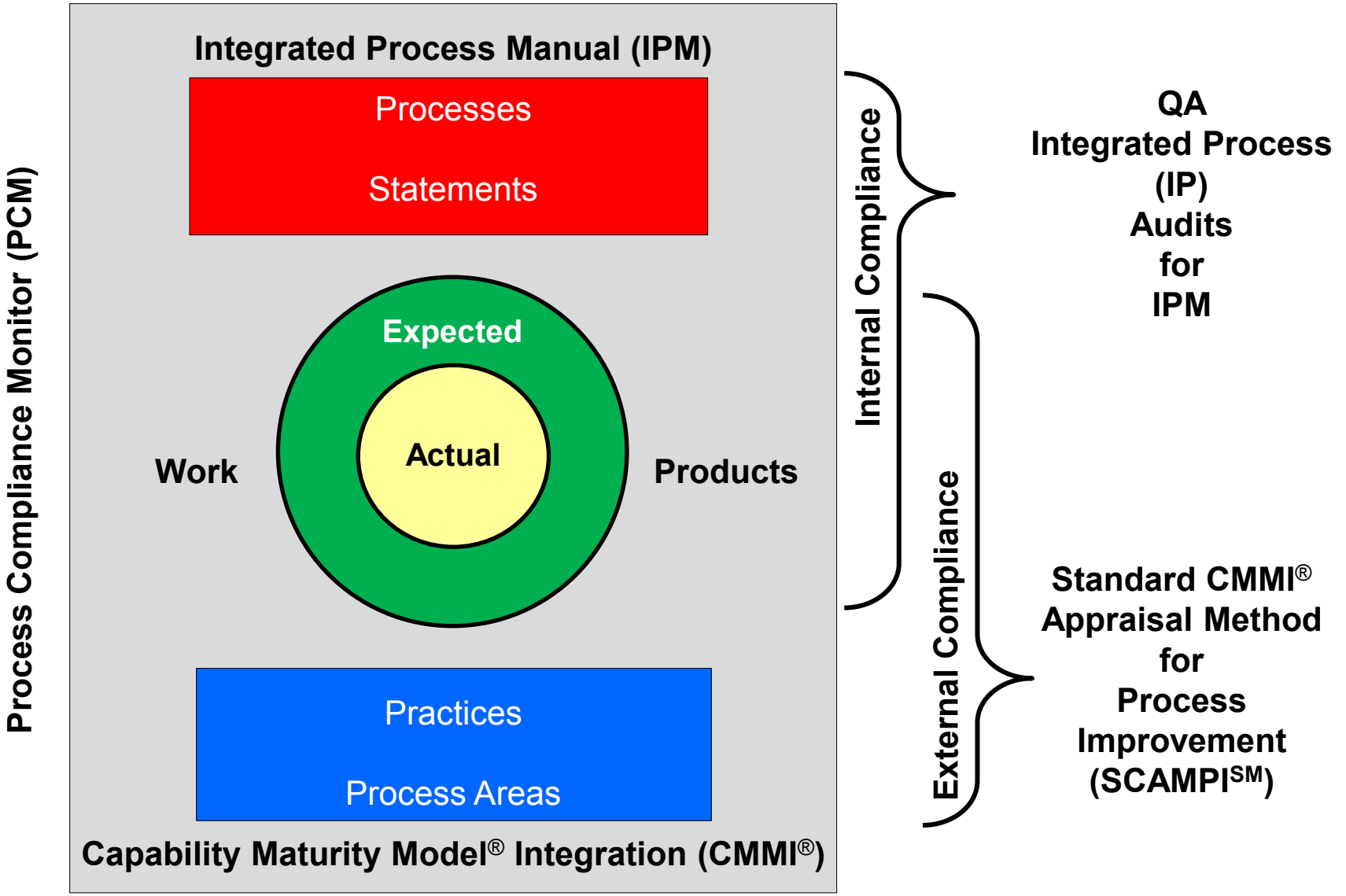
Tailoring
Approved tailoring, process specific

Implementation Guidance
Common implementation descriptions

Supporting Documentation and Assets
Applicable organizational references

Program work products needed to demonstrate IPM process compliance

Organizational Process Context

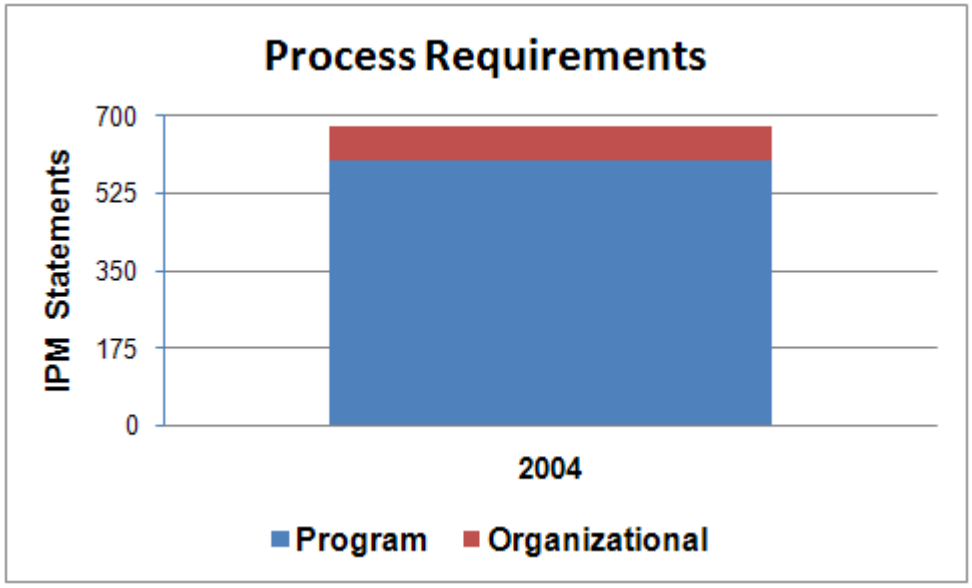


Approach and Challenges

- Streamline processes based upon systemic analysis of compliance and user feedback
- Balance of product-centric vs. process-centric
- Lean Six Sigma
- Continuous streamlining of organizational processes and appraisals in parallel while maintaining:
  - Compliance to organization internal requirements and external industry standards (e.g., CMMI®)
  - Minimal impact to organizational performance
- Validation
  - Internal assessments
  - SCAMPI℠

Streamline Process Requirements

- Common process tailoring across programs
- IPM statements with no CMMI relationship
- Consolidation, modification or deletion of IPM statements reducing the amount of work products without compromising the overall process requirements
- SCAMPI results to identify work products not required



Streamline Process Changes

- Entry/Exit Criteria and Verification sections removed from PCM tool in each process
  - Programs not required to tailor, provide work products, or audit
  - Remains in IPM as reference/guidance
- Deleted procedural detail
- Combined similar/related statements within a process
  - Examples
    - Establishing and maintaining plans, budgets, schedules, etc.
    - Identify and categorize risks
- Consolidated statements within a process that had similar/same expected work products resulting in fewer:
  - Statements for tailoring
  - Work products
  - Audits by QA

Streamlining Compliance

HARRIS

Overview
A brief description of the process intent

Entry Criteria	**Exit Criteria**
State, Prerequisites, Criteria	State, Criteria
Inputs	**Outputs**
Needed work products, resources	Resulting work products

Required Activities
Mandatory tasks to implement the process

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Process performance against plans

Organizational Improvement Information
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Verification
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Tailoring
Approved tailoring, process specific

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Supporting Documentation and Assets
Applicable organizational references

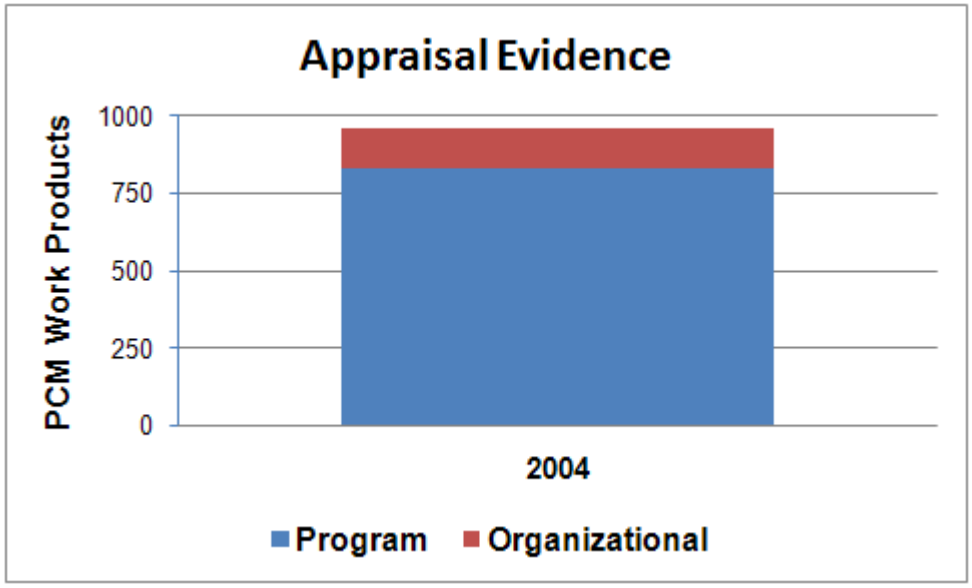


Program work products needed to demonstrate IPM process compliance

2009

Streamline Work Products

- Product-centric focus
- Reverse engineering to achieve simplification
- Reuse of unique work products
- Organization default work products and locations



Reverse Engineer Artifacts - 1

- Instead of looking from the process view – looked from a program work products view
- Basic guidelines:
  - Every CMMI® practice shall have a minimum set of adequate expected work products in PCM
  - Every IPM statement shall have a minimum set of adequate expected work products in PCM
  - Every PCM work product (existing or new) shall map to one or more IPM statements and CMMI® practices
  - Maximize the re-use of existing work products
    - PCM Startup Template
    - Standard Directory Structure

Reverse Engineer Artifacts - 2

HARRIS

- Mapped program work products to IPM statements and to relevant CMMI® practices
  - IPM mapping clearly documented in PCM tool
  - CMMI® mapping in PCM tool - transparent to the program
- Work product descriptions clarified to help the program understand relevance
  - Descriptions let the program know why this work product is important
  - IPM perspective
  - CMMI® perspective
- Provided name of typical project work product to be used
- Provided standard directory structure location where that work product should be maintained

Process-Centric: IPM → WP→ CMMI

IPM Tag	IPM Statement	Project Work Product	Expected Work Product Description	CMMI Tag
RA.RA.3	Work with stakeholders to capture needs, expectations, constraints, and interfaces for all phases of the system life-cycle.	Concept of Operations (CONOPS)	Approved Concept of Operations (CONOPS) that documents system mission, system operation, operational control, staffing, interfaces and operational environment - from an external perspective	RD.GP2.6 RD.SP1.1
		Customer requirements specification	Customer requirements specification (i.e., A-Spec)	RD.GP2.6 RD.SP1.1 RD.SP1.2
		Minutes from working groups	Records of requirements elicitation techniques utilized on the program (e.g., Prototypes, modeling, simulation, working groups, use cases)	RD.SP1.1

Product-Centric: WP→ IPM → CMMI

Project Work Product	IPM Tag	IPM Statement	CMMI Tag
Concept of Operations (CONOPS)	RA.RA.3	Work with stakeholders to capture needs, expectations, constraints, and interfaces for all phases of the system life-cycle.	RD.GP2.6 RD.SP1.1
	RA.RA.4.a	Ensure the stakeholder mission and operational needs are validated and documented in the Concept of Operations (CONOPS).	RD.SP3.1 RD.SP3.4
	SAD.RA.3.g	Define the system functional baseline.	RD.SP3.1 TS.SP1.2

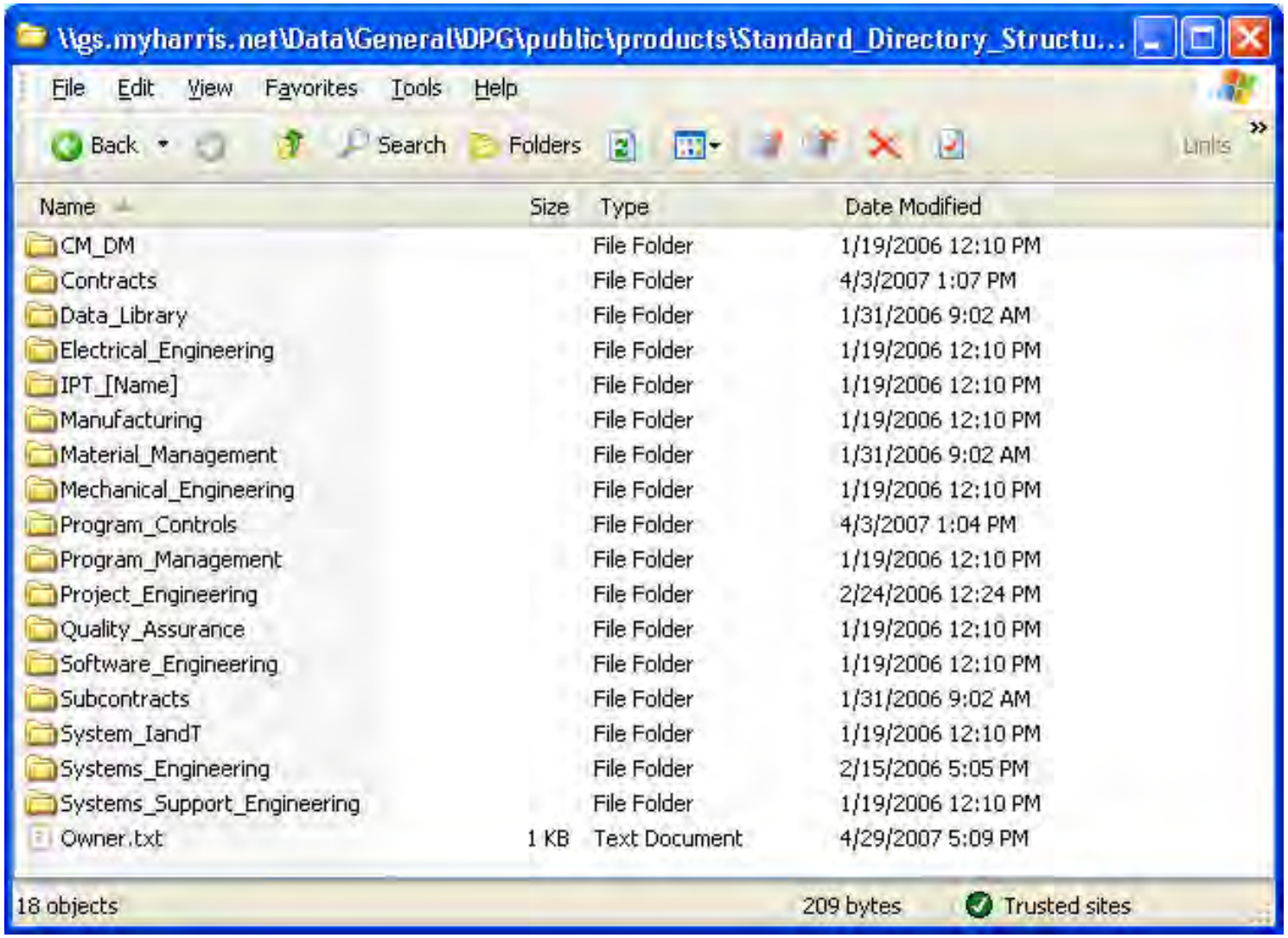
Product-Centric: WP→ CMMI → IPM

Project Work Product	CMMI Tag	CMMI Practice	IPM Tag
Concept of Operations (CONOPS)	RD.GP2.6	Place designated work products of the requirements development process under appropriate levels of contol.	RA.RA.3
	RD.SP1.1	Elicit stakeholder needs, expectations, constraints, and interfaces for all phases of the product life cycle.	RA.RA.3
	RD.SP3.1	Establish and maintain operational concepts and associated scenarios.	RA.RA.4.a
			SAD.RA.3.g
	RD.SP3.4	Analyze requirements to balance stakeholder needs and constraints.	RA.RA.4.a
	TS.SP1.2	Select the product component solutions that best satisfy the criteria established.	SAD.RA.3.g

Standard Directory Structure

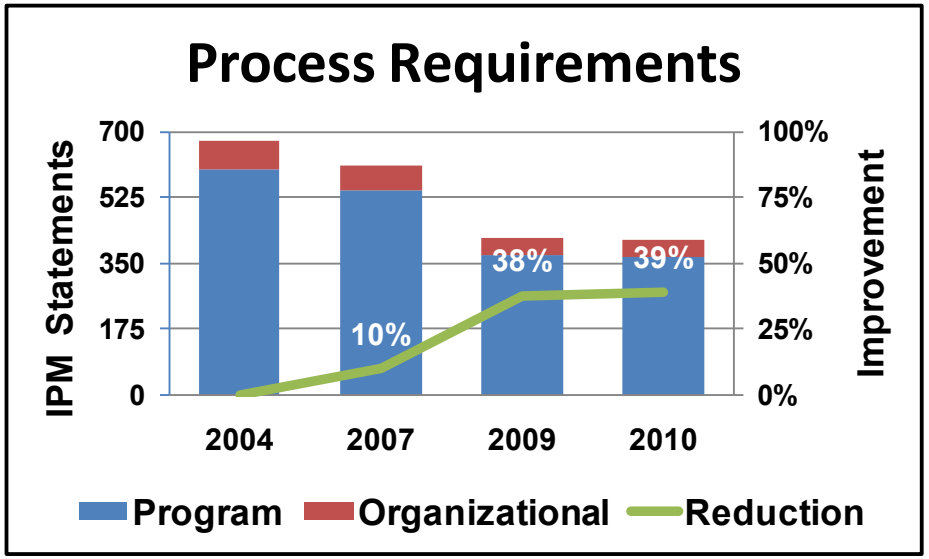
- Supports IPM Compliance with work products in a common structure across programs
- Top level directories are used as location for program work products
  - Avoids tying PCM work products to low level directories
  - Easy access by all program team members
  - Avoids confusion as to which is the latest version of a work product
  - Flexibility for custom directories which contain “work-in-progress”
- Pre-populated with latest forms, checklists and plan templates
  - Set up by IT group when program data server is assigned

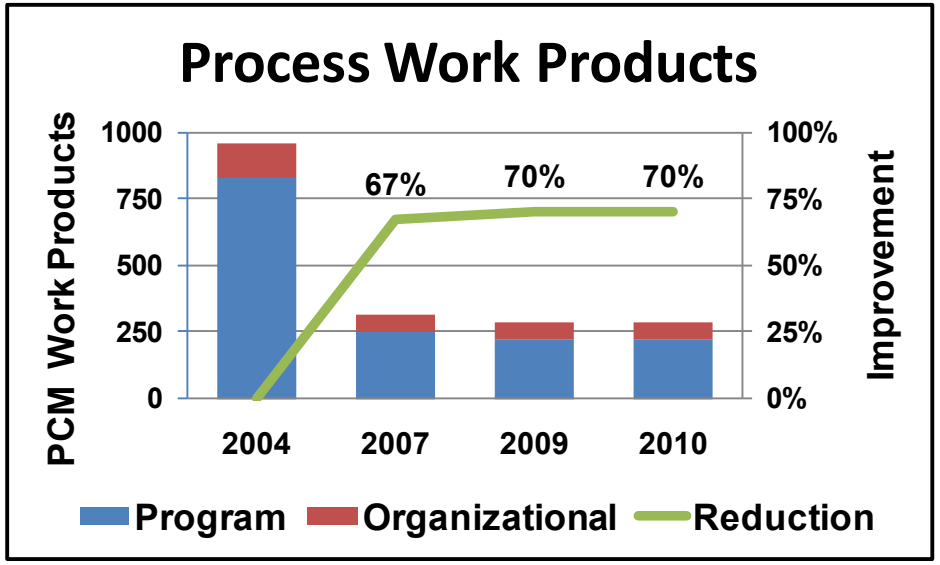
Standard Directory Structure



Streamlining Results

- Significant reduction in process requirements
- Maximized the re-use of appraisal evidence to minimize the number of unique work products
- Created a process-centric view to maintain program work products
- Reduced effort required by programs
- Maintained CMMI® compliance





Streamlining Appraisal

- Problem
  - Total cost of SCAMPI^{SM} for division is significant and increases every SCAMPI^{SM} cycle (3-years)
- Goals
  - Reduce SCAMPI^{SM} preparation effort using Lean method
- Measurement
  - SCAMPI^{SM} preparation effort
- Benefits
  - More efficient SCAMPI^{SM} preparation process with earlier feedback for corrective actions

Approach

- Objective
  - Reduce effort in conversion for work products from internal organizational requirements to CMMI® Practices
  - Establish a work product priority to focus on the number of CMMI® practices affected by each work product
  - Reduce the rework in discovering the correct work product
- Implementation
  - Automate the conversion process
  - Prioritized work product review
  - Utilize process experts to data mine for work products
  - Complete improvements prior to next SCAMPI^{SM}
  - Establish more detailed measurements of SCAMPI^{SM} activities for future improvements
- Validation
  - SCAMPI^{SM}

SIPOC

HARRIS

Define → Measure → Analyze → Improve → Control

Supplier
- SCAMPI Projects
- Organizational (HR, DPG)

Input
- SCAMPI Projects
- Program Work Products
- Organizational Work Products

Process
- **Characterize and reduce the frequency to review each work product**
- Work products into PCM
- **Export from PCM into Excel**
- **Compare deltas from last PCM export**
- **CMMI® conversion mapping macro**
- Review & identify corrective actions
- **Map corrective actions back to PCM**

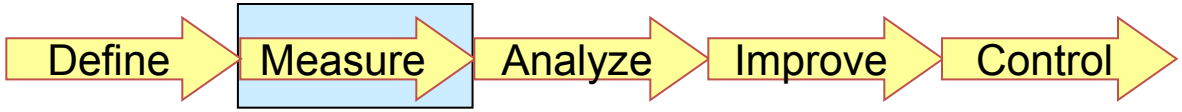
Output
- Corrective Actions
- CMMI® Progress Report

Customer
- Program Team
- Management
- Independent Appraiser

Export, conversion and mapping of work products is Non-Productive

Rework in discovering the correct work products is Non-Productive

Brainstorming



- Facilitated session with team resulting in 42 items
  - Identified 3 possible Lean applications
    - Reduce effort in PCM to CMMI® conversion for projects work products
    - Establish a work product priority to focus on the items that typically have issues and minimize the amount of effort appraising
    - Reduce the frequency of discovering correct work products
  - No detailed measurement breakdown available from previous SCAMPI℠ components or subparts
    - Planning
    - ✓Preparation
      - ✓ PCM to CMMI® conversion
      - ✓ Discovery of work products
      - ❑ Review work products for corrective action
      - ✓ CMMI® to PCM conversion
    - Conduct
    - Closeout

Limited Historical Data to Demonstrate Measureable Improvement

Improvement Basis

HARRIS

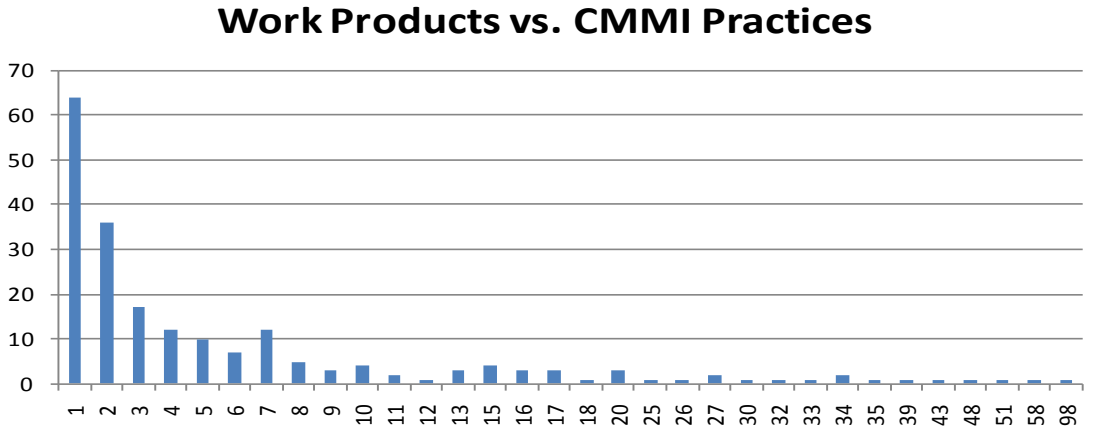
Define → Measure → Analyze → Improve → Control

PCM to CMMI Conversion

- Sampled 4 months of SCAMPI[SM] effort for 2 individuals involved in conversion and applied 50% to represent best estimate of time spent
  - Averaged 115 hours/month

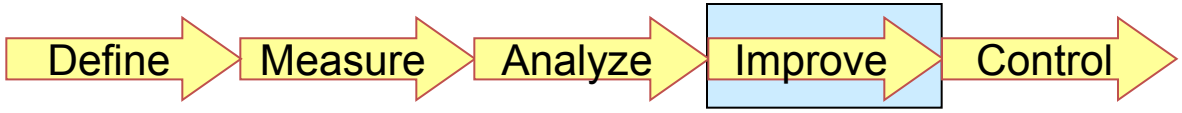
Work Product Priority

- Analyzed the number of CMMI® practices affected by PCM default work products to prioritize



Sample to Establish Measureable Improvement

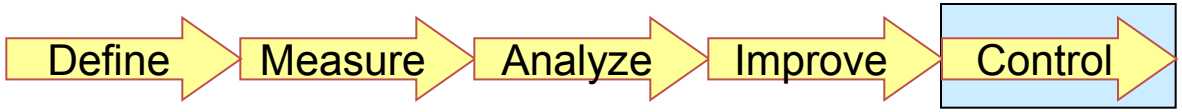
Improvement Approach



- PCM to CMMI® conversion for projects work products
  - Reduced to a one time event
  - Alternative communication used for corrective actions
- Establish a work product priority
  - Focus on the items that typically have issues and minimize the amount of effort appraising
- Find the correct work products the first time
  - Utilized process experts to data mining based upon standard organizational tools and standard program directory structure
  - Eliminated “bring me a rock”

Piloted on Next SCAMPI℠ Event

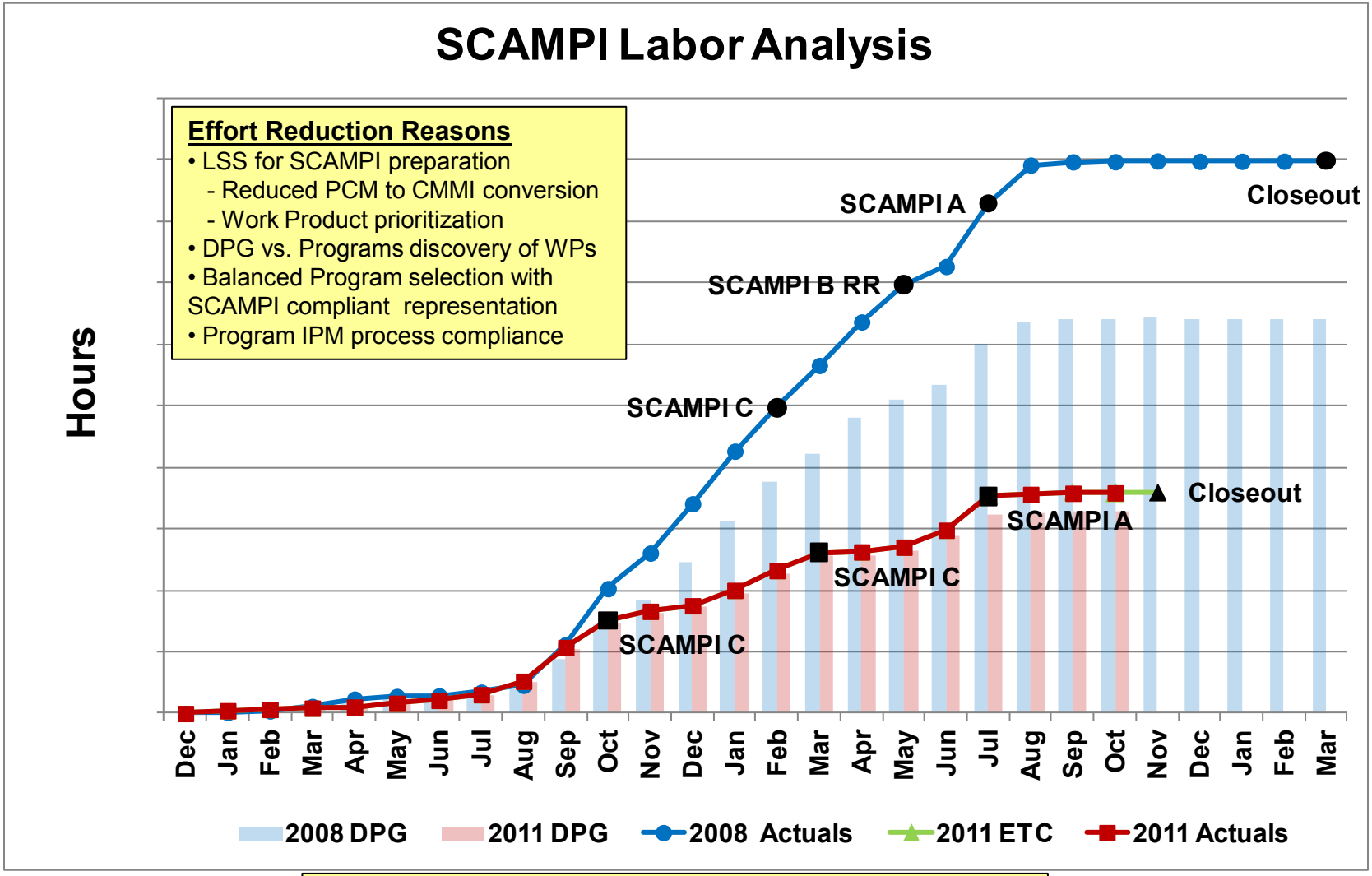
Implement Process Controls



- Let's Not Do This Again
  - One time event for PCM to CMMI® conversion of projects work products
  - Establish a work product priority
  - Utilized process experts to data mining
- Setup work codes to measure SCAMPI℠ activities for future improvements:
  - Planning
  - Preparation
  - Program Support
  - Reviews (Readiness & On-Site)
  - Closeout

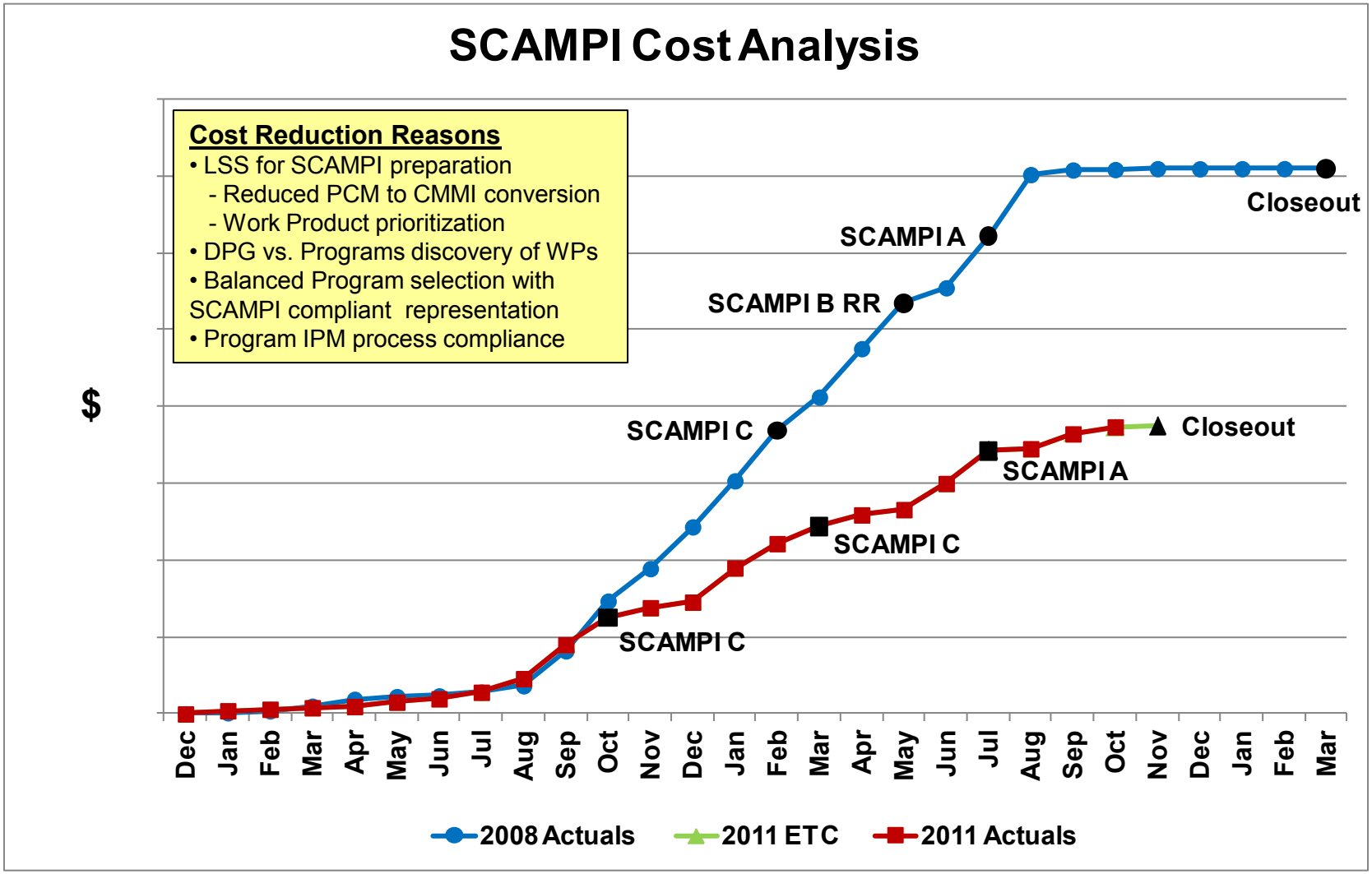
Continuous Process Improvement

SCAMPI Labor Savings



Labor Savings = 60%
Program Staff Hours = difference between Actuals and DPG.

SCAMPI Cost Savings



Cost Savings = 47%

Summary

- Streamlined the organizational processes resulting in reduced:
  - Number of process requirements
  - Amount of appraisal evidence
  - Effort required by programs
- Established a product-centric view to complement the existing process-centric view providing:
  - Efficient and focused project data collection
  - Improved support for projects and the organization
  - Integrity of the appraisal method and achievement of sponsor objectives
- Maximized the re-use of unique work products
- Minimized the impact of changes to the programs
- Simplified the preparation and conduct of appraisals
- Maintained the process compliance requirements:
  - Relevant and adequate evidence
  - Organizational processes
  - CMMI® processes

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- **SEI-Certified Introduction to CMMI® Instructor**
- **Harris SEI Partner Business & Technical Point of Contact**

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US ARMY RDECOM

U.S. Army Research, Development and Engineering Command



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Implementation of Process Improvement in a Multi-Model/Standard Government Environment

16 November 2011

Nathaniel Becker
US ARMY ARDEC
Armament Software Engineering Center (Armament SEC)

Our Mission

Provide RDECOM, Joint Munitions & Lethality Life Cycle Management Command, TACOM Life Cycle Management Command, resident PEO/PMs and other customers a Center of Excellence for Software Engineering and Software Acquisition support services for Army Weapon Systems, Trainers, and Combat Support Systems throughout the entire system life

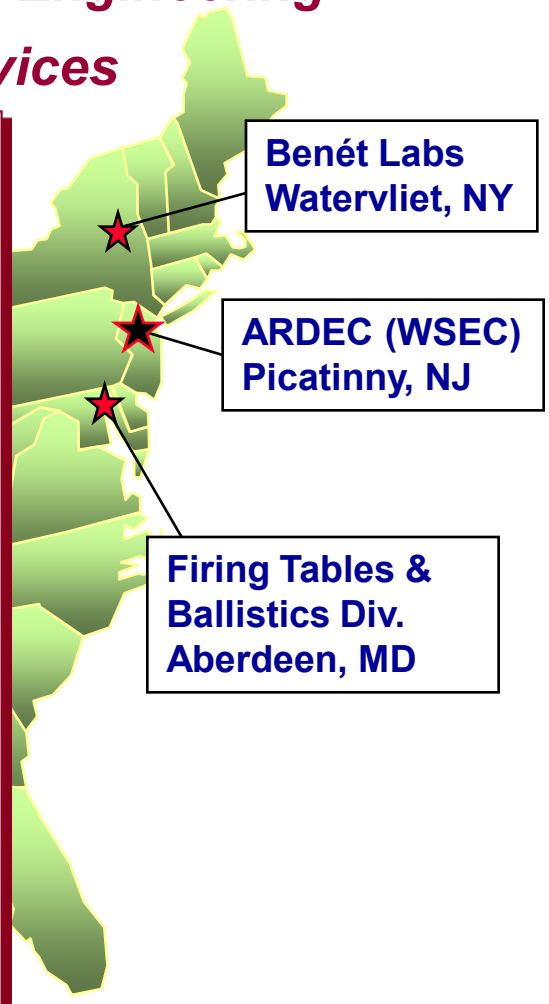
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TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Background

Serve as a Center of Excellence for Software Engineering & Software Acquisition Support Services

- ✓ AMC Chartered Life Cycle Software Engr Center
- ✓ Customer Focus – Exceptional Life Cycle Mission Execution; Flexible, Agile, Innovative Workforce
- ✓ Technology Innovation Leader – Winner 2004, 2006 & 2007 DoD Top 5 Program of the Year
- ✓ State-of-the-Art Facilities, Equipment, Tools
- ✓ CMMI Level 5 – 2006 First in DoD for SE, SW & SS
- ✓ CMMI Level 5 – 2010 Sole Gov Organization to achieve; only Gov Org to successfully re-appraise
- ✓ Resident, Agent of the Certification Authority (ACA)
- ✓ A 30+year legacy of developing & sustaining SW-intensive systems to our warfighters…



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Over 275 Organic Software Engineers ~ 50% with Advanced Degrees

Background (cont)

Is there anything beyond CMMI?



Growing & Sustaining a High Maturity Organization . . .

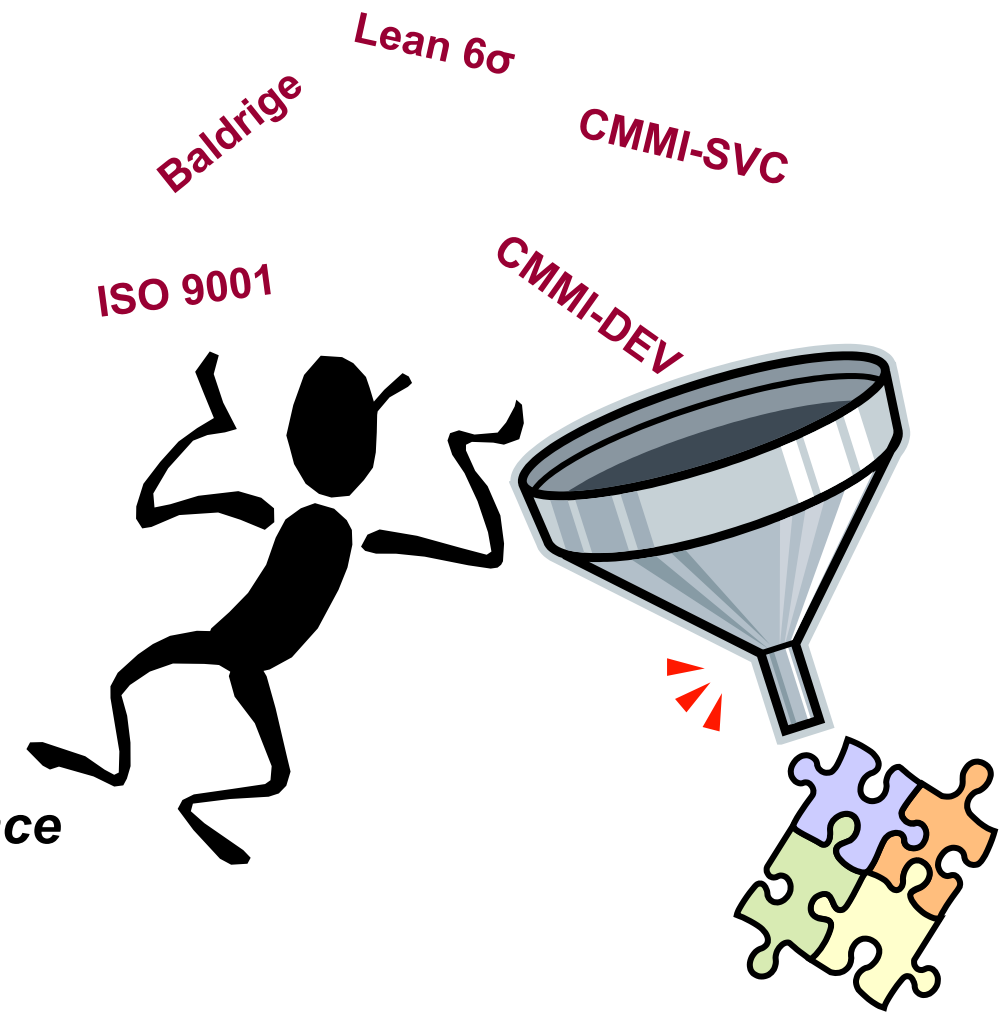
- ***Establish an Enterprise Performance Improvement Framework (PIF) that …***
  - ***Harmonizes operations in a multi-model environment***
  - ***Migrates to an organizational set of standard processes that leverages the successes of individual organizational achievements***
  - ***Facilitates sharing of best practices, organizational processes and process assets***
  - ***Reduces investment redundancies***
- ***Results-based and linked to improved program performance !***



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Background (cont)

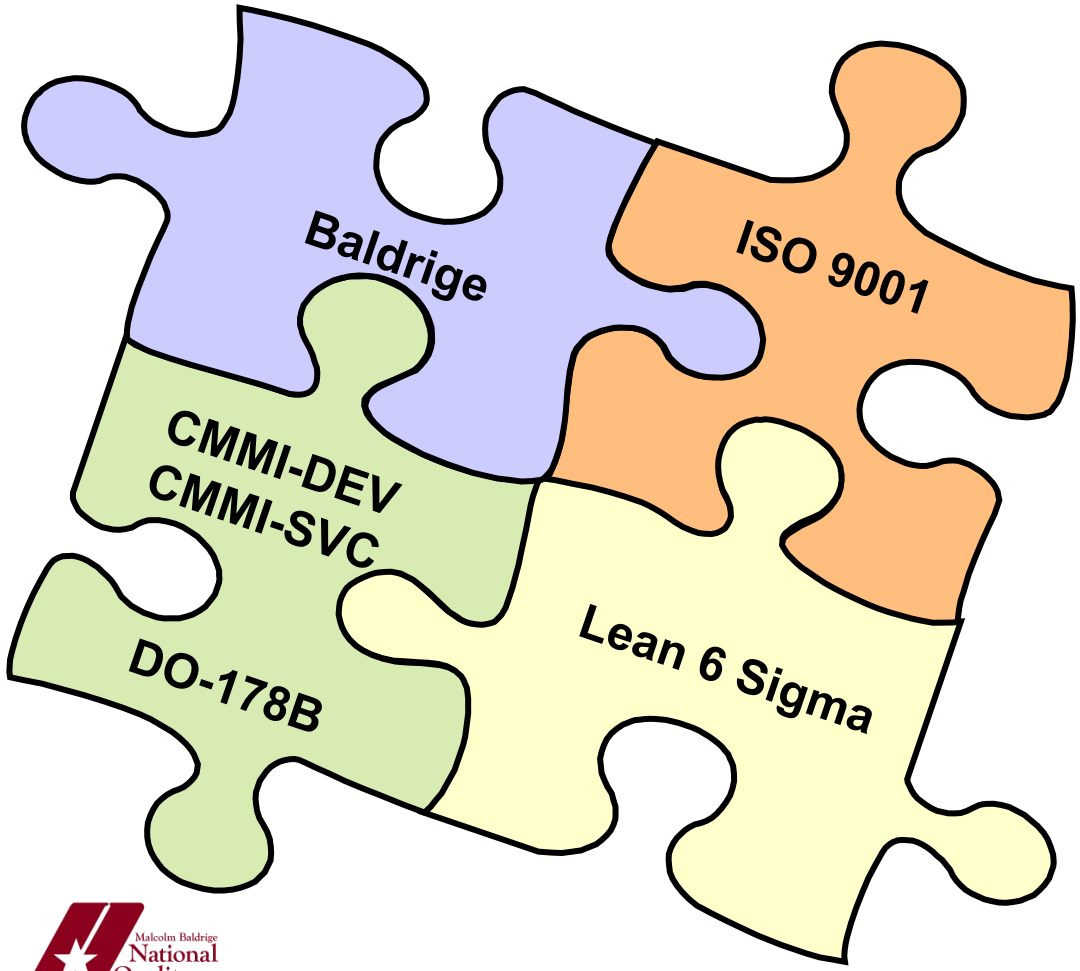
- **Currently pursuing:**
  - Baldrige
  - CMMI - DEV
  - CMMI - SVC
  - ISO 9001
  - Lean 6σ
  - DO - 178B
- **Under consideration:**
  - CMMI - ACQ
- **Audit & Appraisals:**
  - ISO 9001 Audit Compliance
  - SCAMPI CMMI - DEV



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Background (cont)

Performance Improvement Framework



Performance Objectives

- *Improve Predictability, Consistency & Quality of Service*
- *Increase Productivity & Reduce Cycle Time*
- *Maintain & Enhance our Core Competencies*
- *Improve Customer Satisfaction*
- *Retain & Improve our Competitive Advantage*

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What can a PIF do for you?

Business Objective	Process Improvement Objective
Reduce the redundancies in the processes deployed across organization	Increase efficiency and effectiveness of improvement program
Reduce rework and quality issues	Re enforce training and develop new skills and capabilities Reduce the number of costly “false-starts”
Enable achievement of growth	Targeted at facilitating high value activities: • key start-up decisions • appraisal program management • ongoing expert process improvement advice
Consolidate audits and process compliance reporting	Implement standard processes Increase portability of resources Transfer lessons learned Leverage best practices

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Strategy

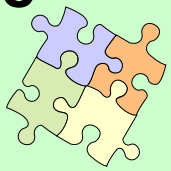
Enterprise Alignment Strategy

Strategic Intent

- Vision & Mission
  - Strategic considerations
  - Align mission needs
  - Align business goals
  - Select improvement tools & techniques

Enterprise Capstone Document

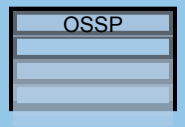
Architecture & Design



- Organizational Processes
  - Comprised of elements from underlying models, standards, quality frameworks
  - Dynamic process architecture
  - Robust organizational processes

Enterprise Performance Improvement Framework

Implementation



- Implementation
  - Efficient & effective performance improvement infrastructure
  - Process asset library & measurement repository
  - Benchmarking appraisals
  - Compliance audits

Enterprise Organizational Set of Standard Processes

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Performance Improvement Framework (Integrated)

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WSEC | RDECOM - ARDEC Armament S E C Picatinny Arsenal, NJ | Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ

ORG EXCELLENCE

BALDRIGE Organizational Excellence Benchmark

Baldrige Criteria

Organizational Excellence Measures

MODELS, STANDARDS, QUALITY

CMMI-DEV – V1.2/V1.3
CMMI-SVC – V1.2/V1.3
CMMI-ACQ – V1.2/V1.3
ISO 9001
People CMM

Domain Standards (e.g. DO-178B)

Enterprise PIF



Customer Unique

ARDEC Policy

Enterprise OSSP

OSSP

Tailoring

Learning Model

Defined Project Processes

IMPROVEMENT TOOLKIT

Lean Six Sigma

Statistical Process Control

APPLY
Lean Six Sigma (Investment Focus)

APPLY
Lean Six Sigma (Project Level Focus)

Benchmarks, Models, Standards, Toolsets

Resolve Investment Redundancies & Design Solutions to Bridge "Improvement Gaps"

Identify Redundancies & Design Solutions to Bridge "Project Process Gaps"

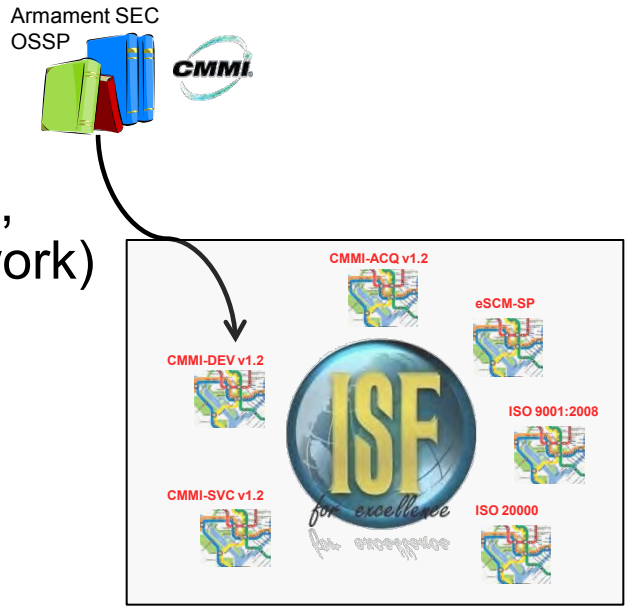
Sources

Best Practice

Tailored Implementation

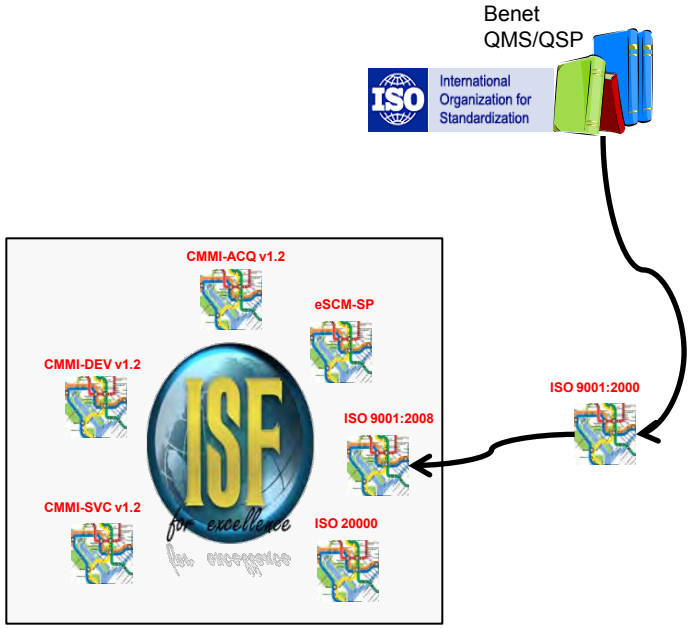
Model Steps Completed

- Created the Armament SEC OSP in Model Wizard (policies, project procedures and organization procedures)
- Built a model map between CMMI-DEV v1.2 and Armament SEC OSP
- Validated the above mapping CMMI-DEV v1.2 to Armament SEC mapping
- Created a model using the existing PA Audit Checklist
- Created an appraisal instance within the tool using the CMMI-DEV v1.2, Armament SEC OSP, ISO 9001-2000, ISF (Integrated System Framework)
- Established an approach to record audits using Appraisal Wizard with the above models and model maps



Model and Mapping Steps Completed

- Created the Benet Process model in Model Wizard using the Benet QMS
- Created a model map between the Benet QMS and ISO 9001-2000
- Using an appraisal instance with Armament SEC OSP, Benet Process model, CMMI-DEV v1.2, ISF and ISO 9001-2000 extrapolated a map between the Armament SEC OSP and Benet QMS
- Added the Benet QSPs into the Benet Process model

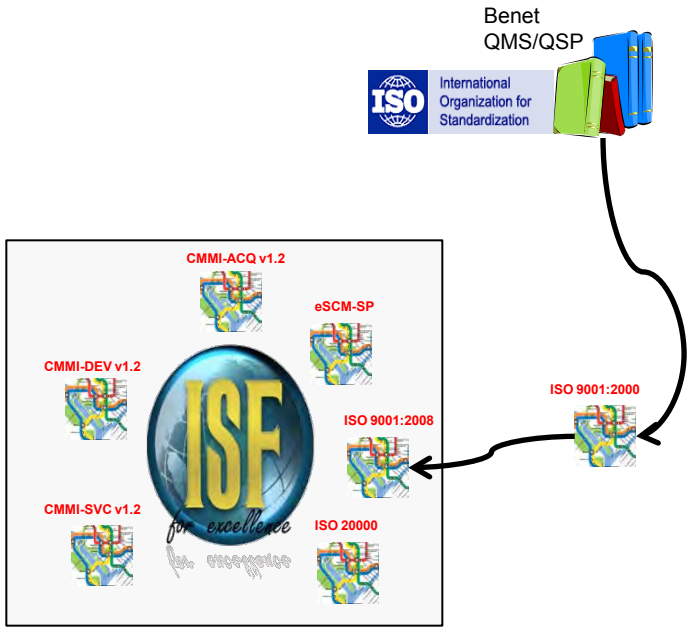


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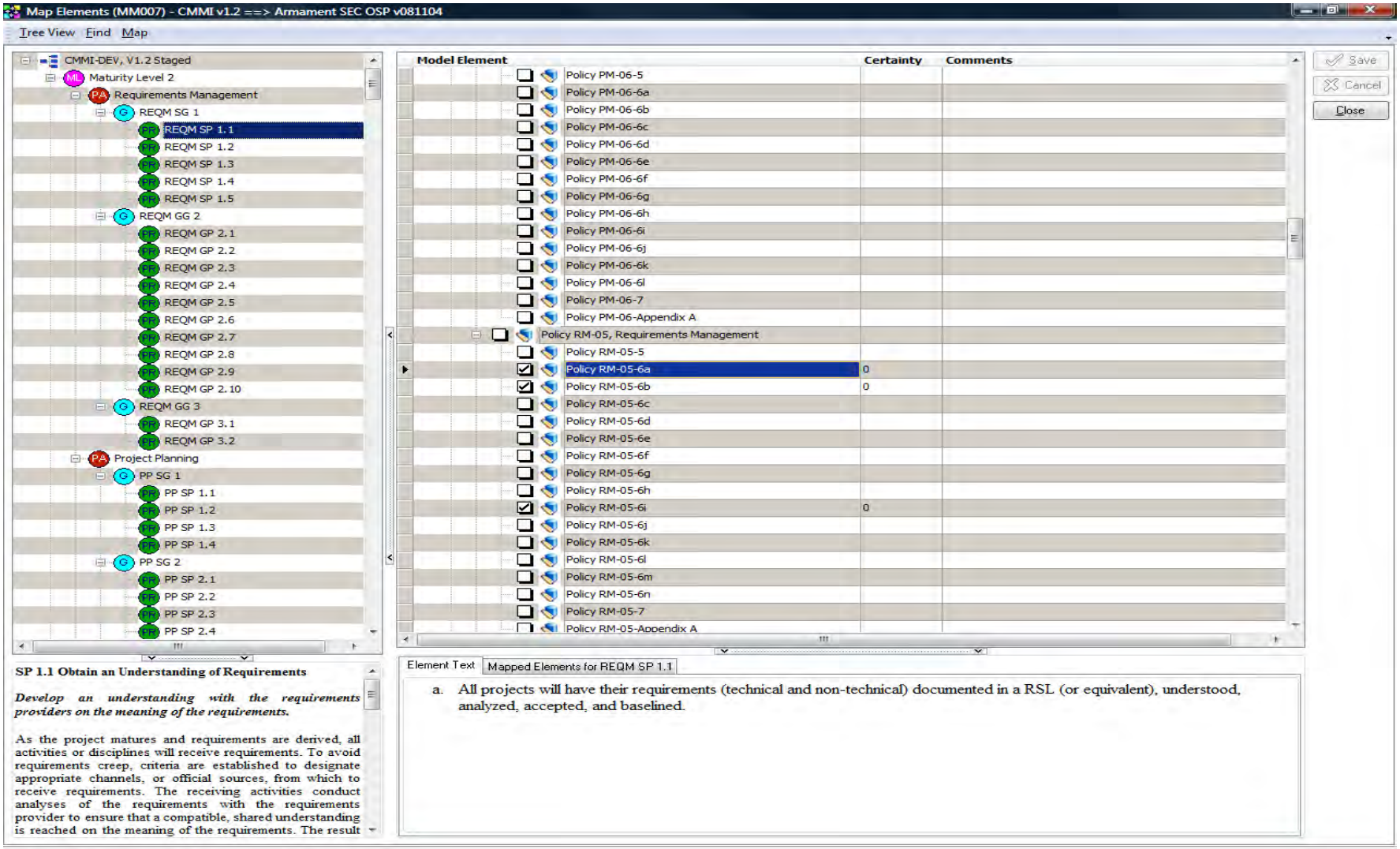
Model and Mapping Steps Completed (continued)

- Added the Quality System Procedures into the Quality Management System model in Model Wizard for Benet Labs implementation
  - Split up the Benet QSPs and entered them into MS Excel
  - Imported these into the existing QMS/QSP Model

- Included the QSPs in the existing ISO 9001-2000 map
  - Began mapping the relationships between the QSPs and ISO 9001:2000, focusing only on the strong relationships versus all relationships.
  - Need to validate this mapping with the Benet QSP author team.

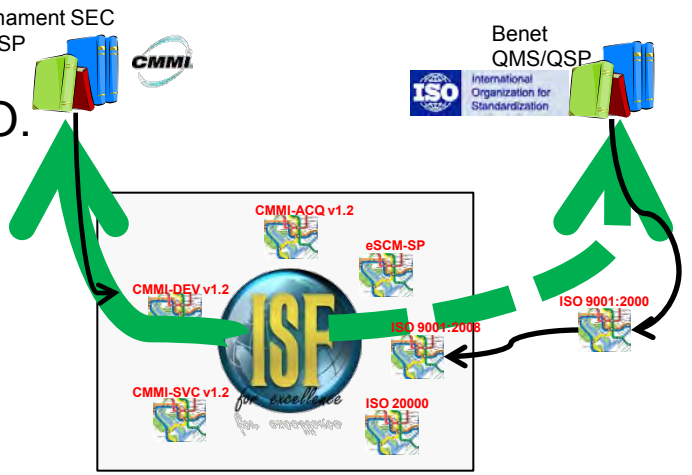


Model Mapping Tool



Reporting Steps Completed

- Built QMS to OSP report
  - Used the ISF as the mechanism to resolve how the QMS/QSP related to Armament SEC OSP.
  - Created the QMS/QSP to OSP map by extrapolating a map using ISF.
  - A report was completed from the set of maps we created using ISF as the connector between ISO and CMMI.
  - Initial observation gave an indication that we could potentially have problem with the CMMI generic practices due to the way they are accounted for within ISF.
  - We later discovered that if the specific practices are connected to the appropriate CPP objectives then the necessary connections will still be made between the CMMI and ISO.

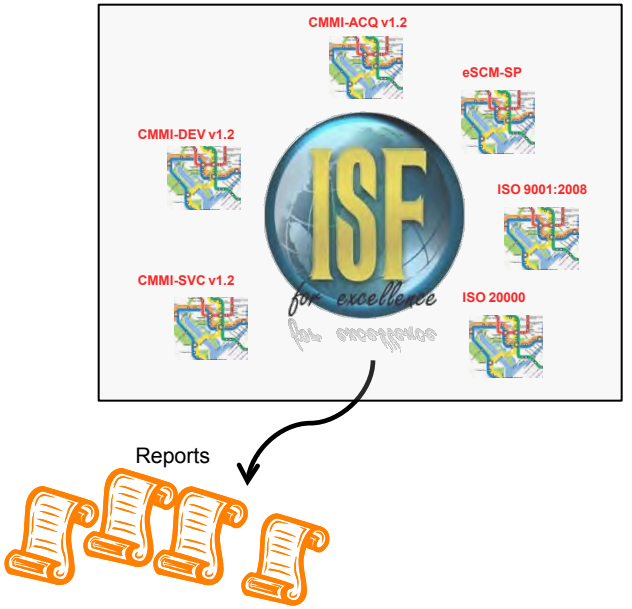


*CPP = Critical Process Performance

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Reporting Steps Completed (continued)

- Built OSP to QMS report
- Built OSP to ISO 9001-2000 report
- Built QMS/QSP to CMMI-DEV report



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Preliminary Conclusions

- Areas of the Armament SEC Organizational Standard Software Process not explicitly addressed or emphasized sufficiently in Benet Quality Management System or Quality System Procedures
  - CP002,CP003 – Specific aspects of peer review related to policy and process related work products
  - CP005 - Lessons Learned
  - CP006 – Identify and Obtain Project Specific Training
  - CP CM002 - Processing and Handling of PCRs
  - CP103 – Risk Management
  - CP108 – Formal decision making process (DAR)
  - CP110 – Requirements Development – operational concepts and scenarios, requirements baselines
  - CP114 – Document/assess/control interfaces
  - CP115 – Make/Buy/Reuse Specified Products
  - CP116 – Product Integration
  - CP118 – Capture of validation work products
  - CP119 – Transition and sustainment of products

Preliminary Conclusions (continued)

- Areas of the Benet Quality Management System or Quality System Procedures not explicitly addressed or emphasized sufficiently in Armament SEC Organizational Standard Software Process
  - QSP 4.2-1 – Preparation & Control of Quality Management System
  - QSP 4.2-2 – Control of External Documents and Data
  - QSP 4.2-3 – Control of Product Drawings
  - QSP 4.2-4 – Backup Restoration Procedure for Electronic Data Files
  - QSP 4.2-5 – Record Maintenance
  - QSP 4.2-6 – Quality Management System Manual Distribution & Amendment
  - QSP 6.2-1 – Competence Awareness & Training
  - QSP 7.1-1 – Product Realization Planning
  - QSP 7.2-1 – Review of Customer Requirements & Estimates Proposals
  - QSP 7.2-2 – Customer Communication & Satisfaction
  - QSP 7.5-1 – Process Control

Preliminary Conclusions (continued)

- Areas of the Benet Quality Management System or Quality System Procedures not explicitly addressed or emphasized sufficiently in Armament SEC Organizational Standard Software Process
  - QSP 7.5-2 – Preventive Maintenance
  - QSP 7.5-3 – Product Identification and Traceability
  - QSP 7.5-4 – Verification and Control of Customer Supplied Product
  - QSP 7.5-5 – Handling Storage Packaging Preservation Distribution and Delivery of Products and Materials
  - QSP 7.6-1 – Control of Monitoring and Measuring Devices

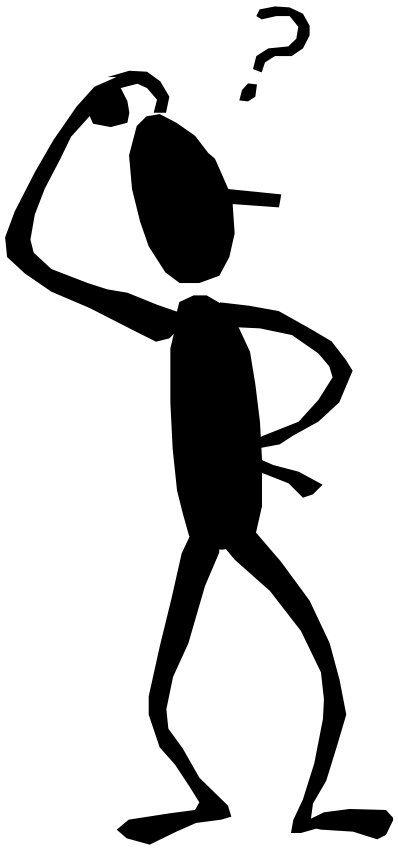
Preliminary Conclusions (continued)

- Looking at the following ISO and CMMI best practice implementations
  - QSP 8.1-1 – Measurement Analysis & Improvement
  - QSP 8.2-1 – Internal Audits
  - QSP 8.2-2 – Monitoring & Measurement of Product
  - QSP 8.3-1 – Nonconforming Product Review and Disposition
  - QSP 8.5-1 – Corrective Action
  - QSP 8.5-2 – Customer Complaint
  - QSP 8.5-3 – Preventive Action

Takeaways

- *Ensure management buy-in*
- *Potential for multi-model appraisals*
- *Incorporate strengths of multiple models and standards*
- *Continuous feedback and Lessons Learned to organization throughout steps*

Questions



Malcolm Baldrige National Quality Award 2007 Award Recipient

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Malcolm Baldrige National Quality Award 2007 Award Recipient

Project-Driven Process Improvement:

A Large-Scale Lean Six Sigma Deployment Across Small- and Medium-Sized Organisations





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11th Annual CMMI Technology Conference and User Group
14-17 November 2011 – Denver, CO

AGENDA

- **The Egyptian IT landscape**
  - Key Facts
  - The Role of ITIDA – SECC
- **The Lean Six Sigma Initiative for IT and Software**
  - Objectives
  - Participating Organisations - Companies profile
  - Types of Projects
  - Deployment approach
  - Preliminary Results
- **Challenges and Lessons Learned**
- **Q&A**

Objectives of the presentation

- **Share with you the experience of Three-Party setup for deploying a Lean Six Sigma Initiative in Egypt, in terms of:**
  - Implementation and delivery model
  - Organisations involved
  - Challenges
  - Commonalities and differences
  - Key lessons learned



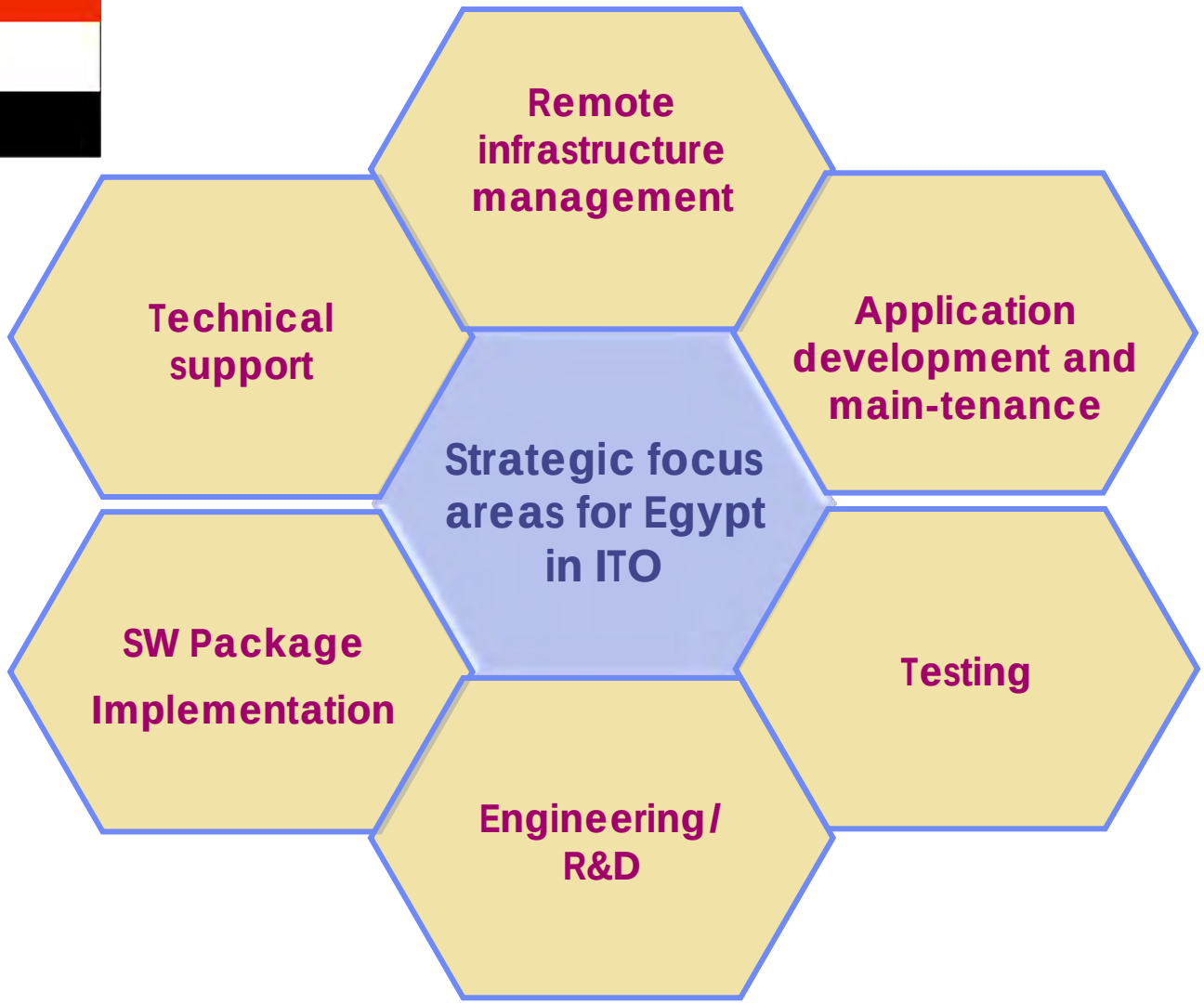


Egypt's strategic focus areas

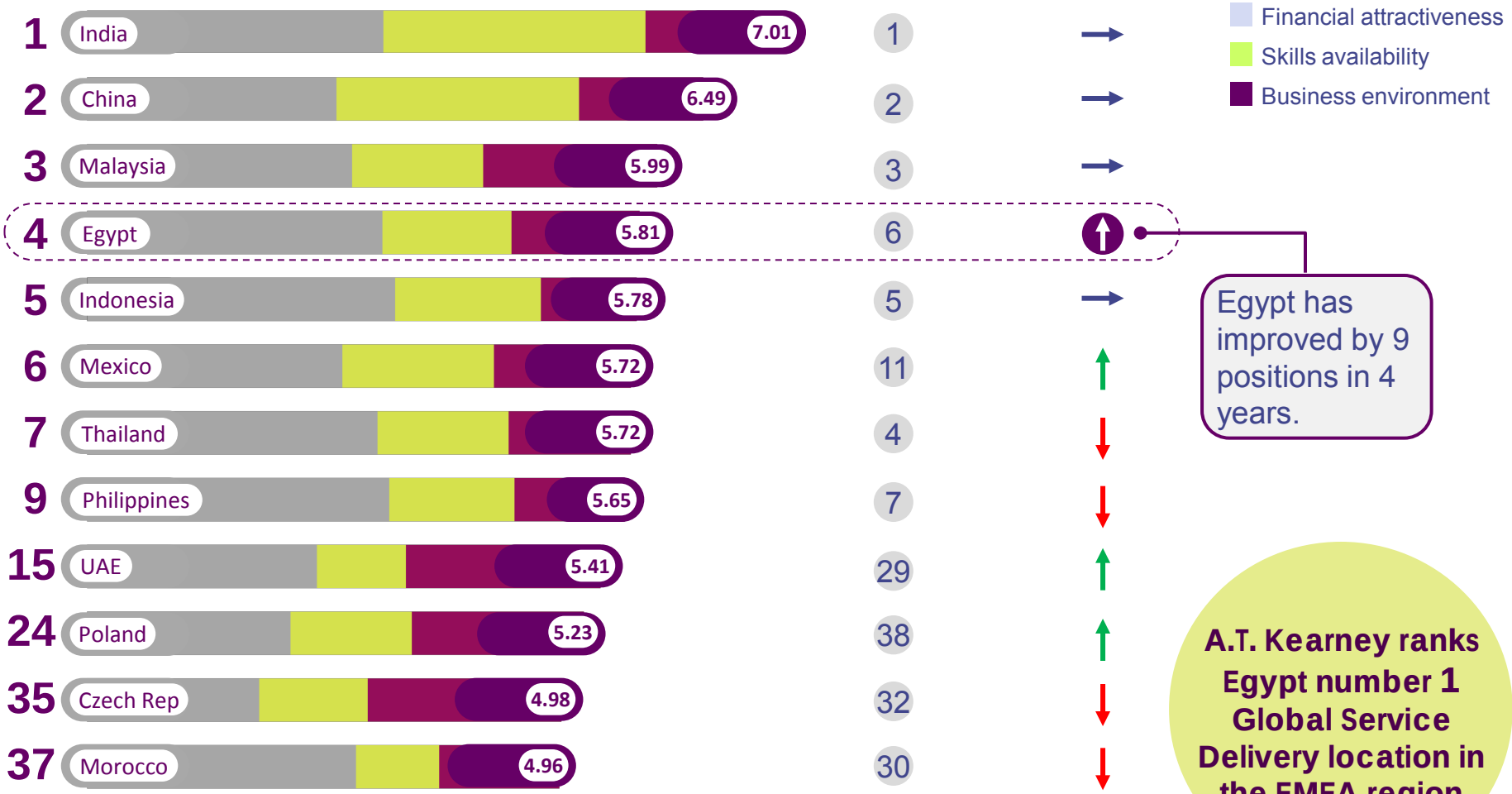


Ministry of Communication & Information Technology

itida Developing IT in Egypt



The Egyptian IT landscape



A.T. Kearney Global Services Location Index 2011

SECC Vision & Mission

- **Vision:**
  - To enhance the quality, efficiency and level of innovation of the ICT companies and improve their global competitiveness
- **Mission:**
  - Provide services improving technical competence and internal capabilities
- **Profile:**
  - Sole Certified Lead Appraisers for CMMI in the Middle East
  - Sole Examination Institute/Certification Body for the ISTQB® certificates in Egypt
  - Highest number of IT experts under one roof in the Middle East
  - Largest Sponsor of IT technical capacity building in Egypt
  - Large array of experiences with Multilanguage capabilities
  - Serving more than 450 customers
  - Offering a portfolio of 12 services
  - More than 8 international cooperation & alliances

SECC - Suite of Services

- Capability Maturity Model Integration for Development (CMMI-DEV)
- Software Process Improvement Guide (SPIG)
- Personal Software Process/Team Software Process (PSP/TSP)
- Embedded Software
- Software Reuse
- Software Testing
- Information Technology Infrastructure Library (ITIL)
- Capability Maturity Model Integration for Services (CMMI-SVC)
- Certification
- Training
- Agile
- Lean Six Sigma for IT and Software

Services are sponsored by ITIDA (through corporate tax revenues) and offered to Egyptian IT companies at substantially reduced cost

Systonomy Profile

Founded in 1999

- Headquarter in London
- Presence in Europe, US and ASIA

Dedicated to Quality Engineering

- **Lean Six Sigma** and **DFSS**
- Leadership Development
- Software Process Improvement (CMMI®, ITIL, PSP…)
- Strategic Consulting
- IT and Software Risk Management
- Training and Coaching
- Hands-on Project Implementation

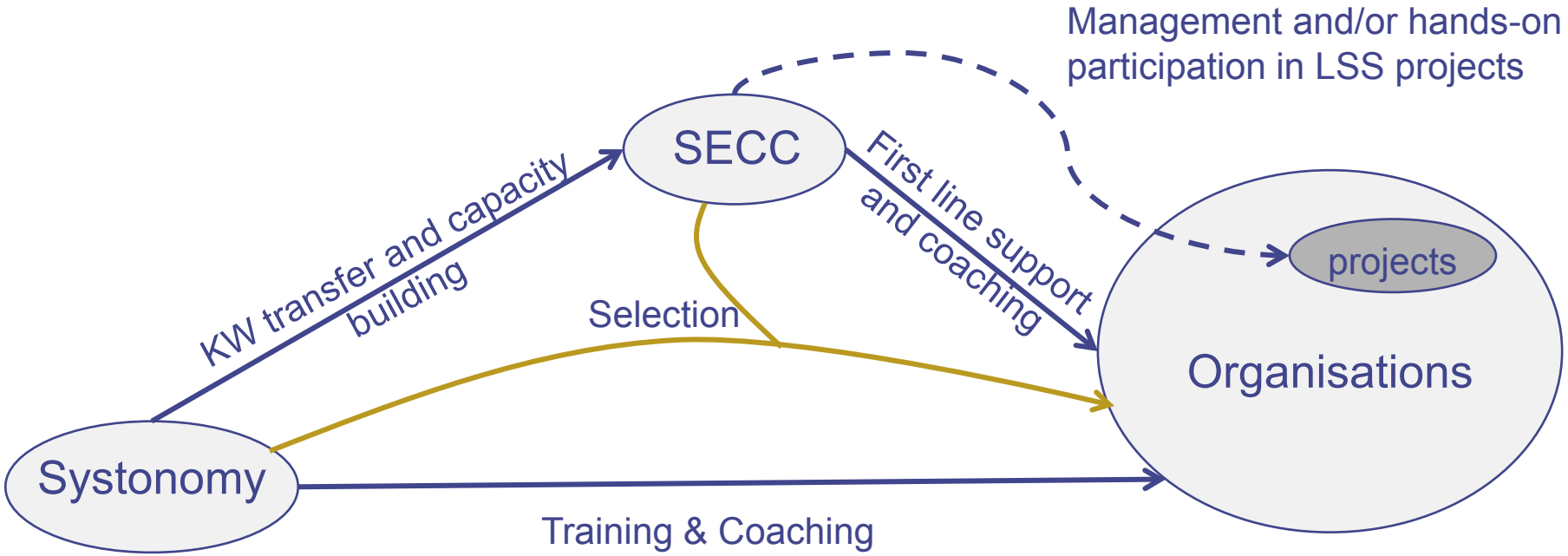
Our Mission

- **Our business is Software Quality Engineering and Lean Six Sigma for ICT and Software Development**
- **We work with any organisation where Software and IT is a critical part of the business**
- **We help our client to accelerate their investment in continuous improvement in:**
  - Software process performance
  - Software product quality
  - ICT services



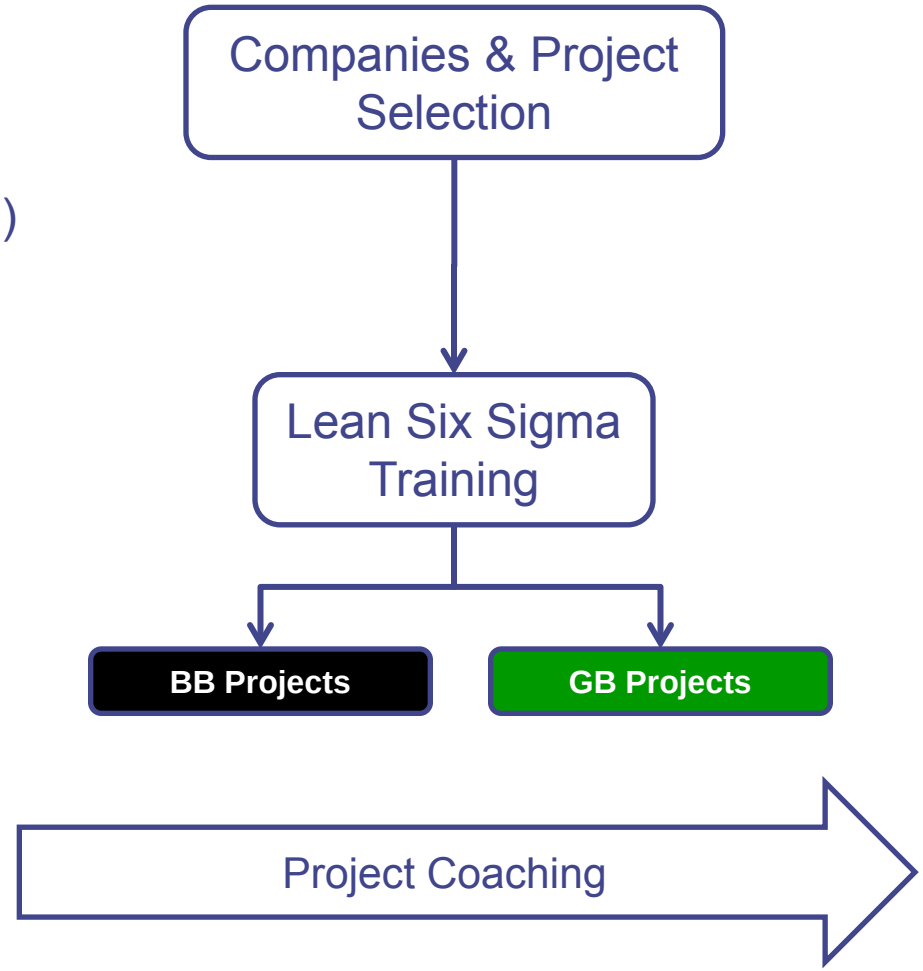
The programme set-up and roles

- **Three-party setup and work dynamics**
  - Knowledge transfer
  - Lean Six Sigma for IT and Software Training
  - Project Coaching
  - Companies Project implementations



Deployment approach

- **Entire initiative managed on a project by project basis:**
  - Companies selection (based on proposed Lean Six Sigma projects)
  - Training (aligned with projects calendar)
  - Coaching (hands-on project work)
  - Certification (based on project results and not only theoretical knowledge)



Organisations and Projects Selection

Questionnaire → Interview → Selection

(next slide)

- Company Profile
  - Industry
  - Market sector
  - Types of systems
- Motivations for joining the programme
  - Interest
  - Expected benefits
  - Previous improvement (CMMi, ITIL, ..)
  - Commitment
  - Sponsorship
  - Team
- Problem areas
  - Type of problems (pains)
  - Importance
  - Who is affected
  - Quantification
  - Visibility

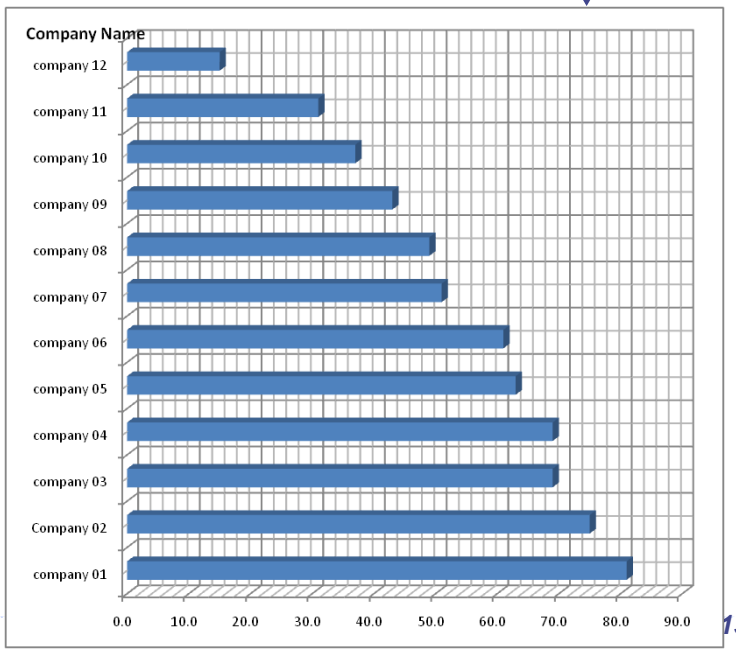
- Explanation of the programme
- Refinement of problem areas
- Refinement of potential projects
- Expected commitment
  - Training
  - Resource allocation
  - Profile
- Sponsorship
- Team composition
  - Individual
  - Leadership
- Certification
  - Training (2)
  - Project (1)
  - Exam (3)

Organisations and projects selection

Company fitness — Company Name

Criteria	Importance	company 01	Company 02	company 03	company 04	company 05	company 06	company 07	company 08	company 09	company 10	company 11	company 12	Total	%
Problem Awareness	1.0	H	H	H	M	H	H	M	M	M	H	L	L	68.0	11
Problem: Fitness for ITIDA/Pilot	1.0	H	H	H	H	M	H	M	H	L	M	M	L	68.0	11
Individual Commitement	1.0	H	H	H	H	H	H	H	H	H	H	M	M	96.0	15
Individual Availability	1.0	H	H	H	H	H	H	H	H	H	H	H	M	102.0	16
Individual Fit (as a Team)	1.0	H	H	H	H	H	H	M	H	M	M	M	M	78.0	12
Organisational Sponsorship	1.0	H	H	H	H	H	H	H	M	H	L	H	L	86.0	13
Long Term Sustainability	1.0	H	H	M	H	M	M	M	M	M	L	L	L	48.0	07
Track record - Improvement Initiatives	1.0	H	H	M	M	M	L	M	L	M	L	L	L	38.0	06
Relationship with SECC	1.0	H	M	H	H	H	M	H	M	M	L	L	L	60.0	09
Total		81.0	75.0	69.0	69.0	63.0	61.0	51.0	49.0	43.0	37.0	31.0	15.0		
%		13	12	11	11	10	09	08	08	07	06	05	02		

Criteria	Weight
Problem Awareness	W1
Problem: Fitness with SECC/Pilot	W2
Individual Commitement	W3
Individual Availability	W4
Team Fitness	W5
Organisational Sponsorship	W6
Long Term Sustainability	W7
Track record - Improvement Initiatives	W8
Relationship with SECC	W9



Lean Six Sigma Initiative - Participants

- **A broad and diverse group of organisations, reflecting the composition of the local market**
  - Software Development
  - IT Services
  - Business Process Outsourcing
  - Government Organisations



Selected Companies

- **The majority of selected companies are mid-sized or SME's companies**
  - Local and international presence

- **Engaged in Projects Improvement initiatives in the past:**
  - CMMI
  - PSP/TSP
  - ITIL
  - COPC

- **<u>Original</u> Lean Six Sigma motivations**
  - Process Excellence (attraction of international clients)
  - Individual motivation (Certification)
  - Trained on "classical" Six Sigma but don't know how to apply it to IT/Software
  - Measurement...estimation...
  - A mean to achieve high maturity levels

IT and software culture and challenges

IT Organisations

Culture & Challenges

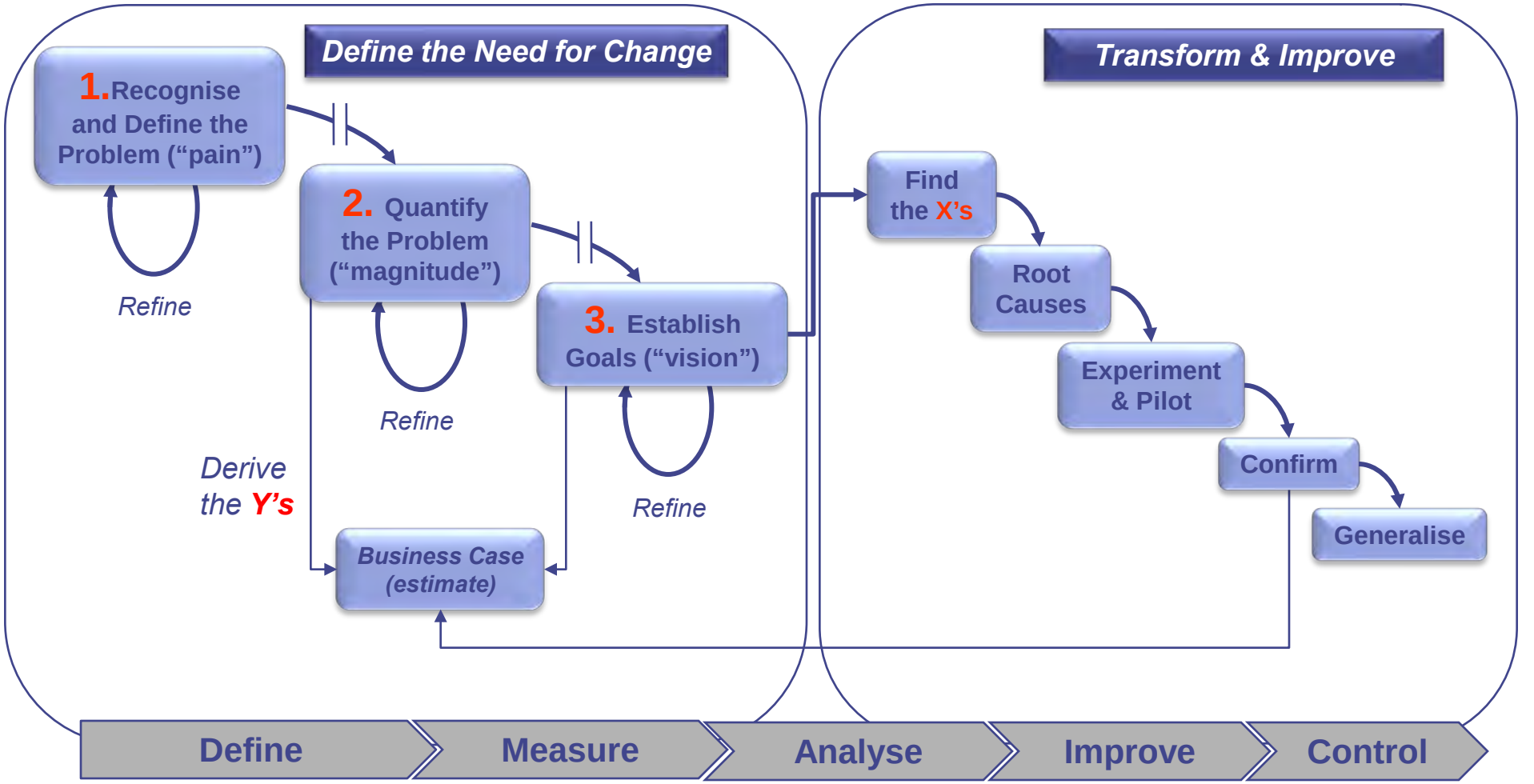
- ITIL Culture
- Closer to the customer
- More tangible benefits
- Straightforward improvement
- Have useful data or were able to generate data easily

Software Organisations

Culture & Challenges

- Tend to think through compliance to a maturity model
- Struggle with problem definition
- More technical than business oriented
- More complex
- Heavily rely on project development schedule
- More invasive and disruptive
- Protective attitude
- Various levels of maturity (CMMI L1 to L5)
- Some have huge volumes of data, but rarely useful

Problem Solving Methodology - A rigorous approach (Reminder)



Six Sigma Integrates Project & Change Management and rooted into Empirical and Experimental Software Engineering studies

Training delivery

- **Black Belt Training (4 weeks)**
  - 13 BB's from SECC and companies
- **Green Belt Training (2 weeks)**
  - 40 GB's from companies
- **Importance of Theory and Practice**
  - *No theory...No Learning* (Deming)
- **Each delegate must have a project**
  - No project... No training
- **Lean Six Sigma does not mean "Light" Six Sigma**
- **Six Sigma is NOT just about Statistics**

- **Key comments**
  - Participants surprised by the importance/emphasis put on problem formulation and "soft" skills...but recognised the value later
    - "The soft stuff is the hard stuff"
    - Some people want to jump on statistics
  - Some participants previously trained in "Classical" LSS realised the major differences with IT and Software
  - Teaching statistics remains a difficult task
    - Use of visual exploratory tools
    - "Unlearn" some misconceptions

Coaching activities

- **Coaching delivered through focused and intensive sessions**
  - Often 2 coaches, to get different views on the problem
  - Complement to training by enabling effective knowledge transfer
  - Practical knowledge in Software Engineering and Lean Six Sigma methods
    - People expect the coach to help solve the problem and be familiar with IT and Software
  - The coach should not do things instead of the team, but bring people to do it by themselves
    - Provocative and naive questioning



- **Minimum of 3-5 days coaching per phase**

- **Coach SECC consultants to become coaches**
  - Train-action[SM] (from French Formaction)

Projects and (initial) Problem areas identification

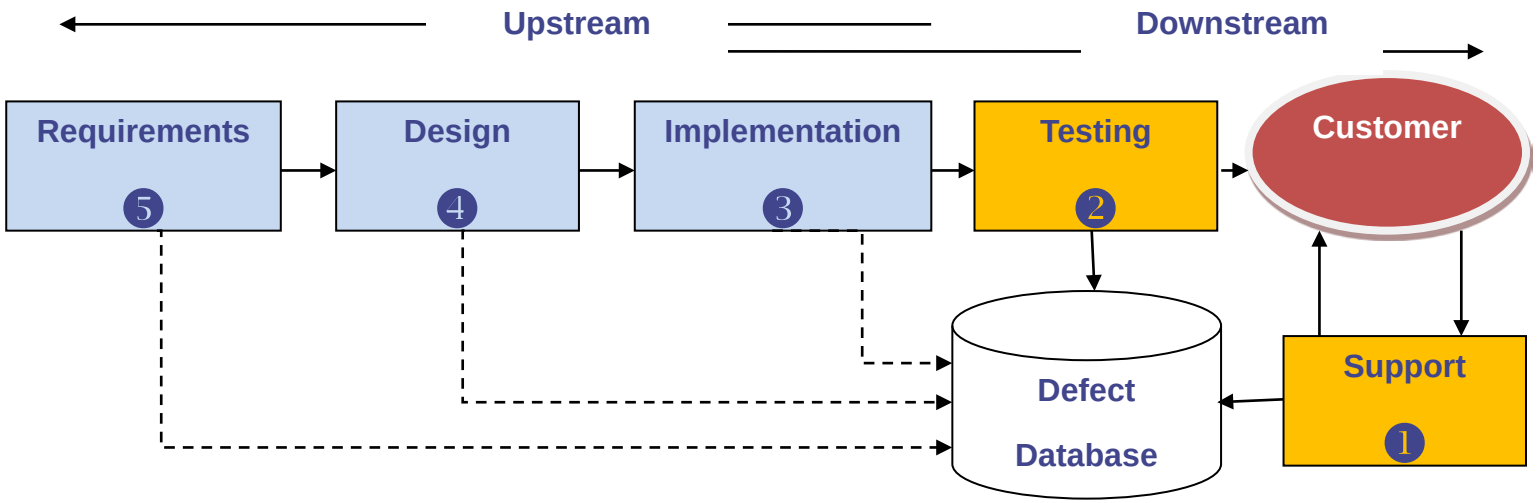
Selection Criteria

- Strategic Issues
- Type of Problems
- Expected Return on Investment
- Measurability
- Organisational Issues
- Project Issues

Pragmatism

- Start from the areas closer to the final customer
- Stop the bleeding first!

... Start Downstream



Lean Six Sigma can be applied at any level of maturity

IT and software project types

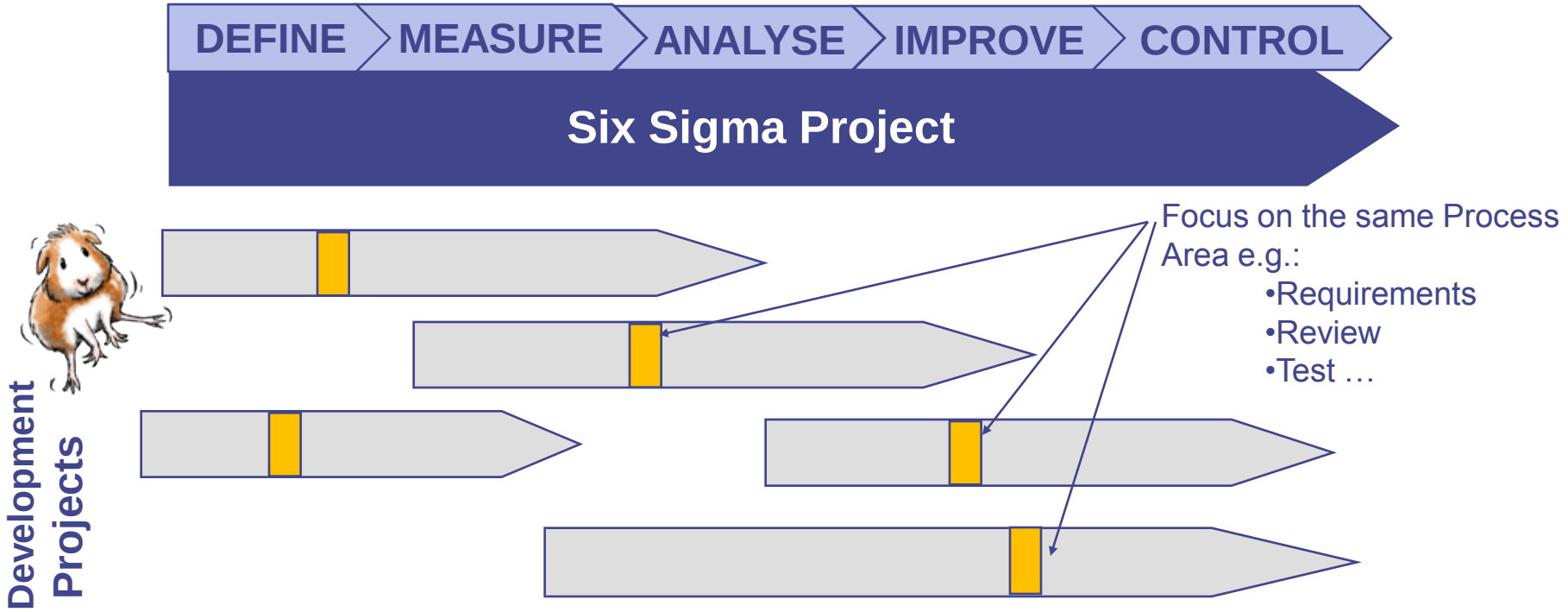
- **Projects have been selected and refined during the initial phase of the DMAIC Six Sigma roadmap**

SW Companies		IT Services Companies	
Project Type	**Nb**	**Project Type**	**Nb**
Test Effectiveness	2	Incident Management	2
Code defects containment	5	Capacity Planning	1
UI defects reduction	1	Delivery Cycle Time	1
Regression testing -False defects	1	Service Requirements effectiveness (Requirement Defects)	1
Project management overhead	1		
Acceptance test cycle time	1		

A common problem to many companies

Lean Six Sigma for SW Process improvements Experimental Projects

- Development projects are objects of studies and implementation for the Lean Six Sigma Projects.



Lean Six Sigma projects must be synchronised with development projects

Six Sigma SW Projects - findings

- **Initial problems often expressed as "Non compliance" or absence of process**
  - "CMMI excuse"

Why is this problem?
BTW: processes always exist...
Who tells you that if you follow that process you will perform better?



- **Shift the thinking towards "Pain" related to:**
  - Effectiveness first → Defects
    - Late phases first and go up the process
  - Efficiency second → High Effort, Waste
    - Again the CMMI excuse, CMMi asks for lot of overhead activities and/or documentation (some companies have over 35% management overhead)

Very difficult to admit for CMMI L2 and L3, that we have quality problems

- **Shift the thinking about Cost of Poor Quality**
  - Pain means cost

Business Case

Management:
... Now we are talking!

Define phase ranged from 6 to 15 weeks: paradigm shift from compliance oriented improvement to performance oriented improvement... Shock therapy

Lean Six Sigma SW Projects – findings 1/3

MEASURE

- **Most existing measures are not useful...**
  - Again "CMMI excuse"
  - *KPImania* syndrome
    - *KPI's are collected like Pokémons*
  - 3rd order measure vs 1st order
    - Complicated is Beautiful
  - Time reporting system
    - One of the most unreliable and distorted source of data

"So how this is related to our problem?"
"Anyway, what can I do (or get) from these measures?"
"Why do you collect them?"

- **"We do not have measures"**
  - You often have (or can easily get) more measures than you think!

- **Focus on First Order Measures → Defects**
  - Defect Categorisation
  - Cost of defect

It is not about collecting measures for compliance, but finding the key factors (X's) that influence our problem (Ys).
MEASURE PHASE ranged from 8 to 15 weeks.

Lean Six Sigma SW Projects – findings 2/3

- 9 Six Sigma projects analysed between 590 to 1070 defects (Code defect Containment, Testing, Regression test)
  - Analysis conducted as a workshop gathering people from multiple perspectives
- To the surprise of all it only took max 2 hours to analyse 100 defects → 2-3 days to analyse a large enough sample of defects!
- People do have a memory for defects!
- Defects analysed on multiple dimensions
  - Type of defects
  - Complexity - T-shirt sizing (XL, L, H, XH)
  - Effort to fix

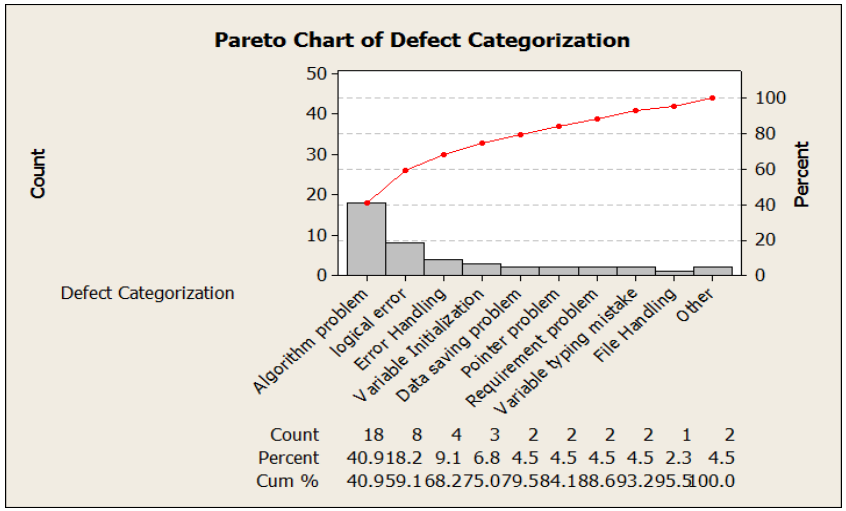
- Reliability and agreement on the defect assessment by design
- First Stage: Operational definitions provided
  - "Calibration" of the team
  - Adaptation and refinement of Operational definition
- Second stage: more reliable and quicker

Defects Characterisation
Provides the basis for the organisation measurement system

Lean Six Sigma SW Projects – findings 3/3

- **Typology of defects help refining the problem, will drive the projects and the solution**

- **Root cause Analysis depends on the type of defects**

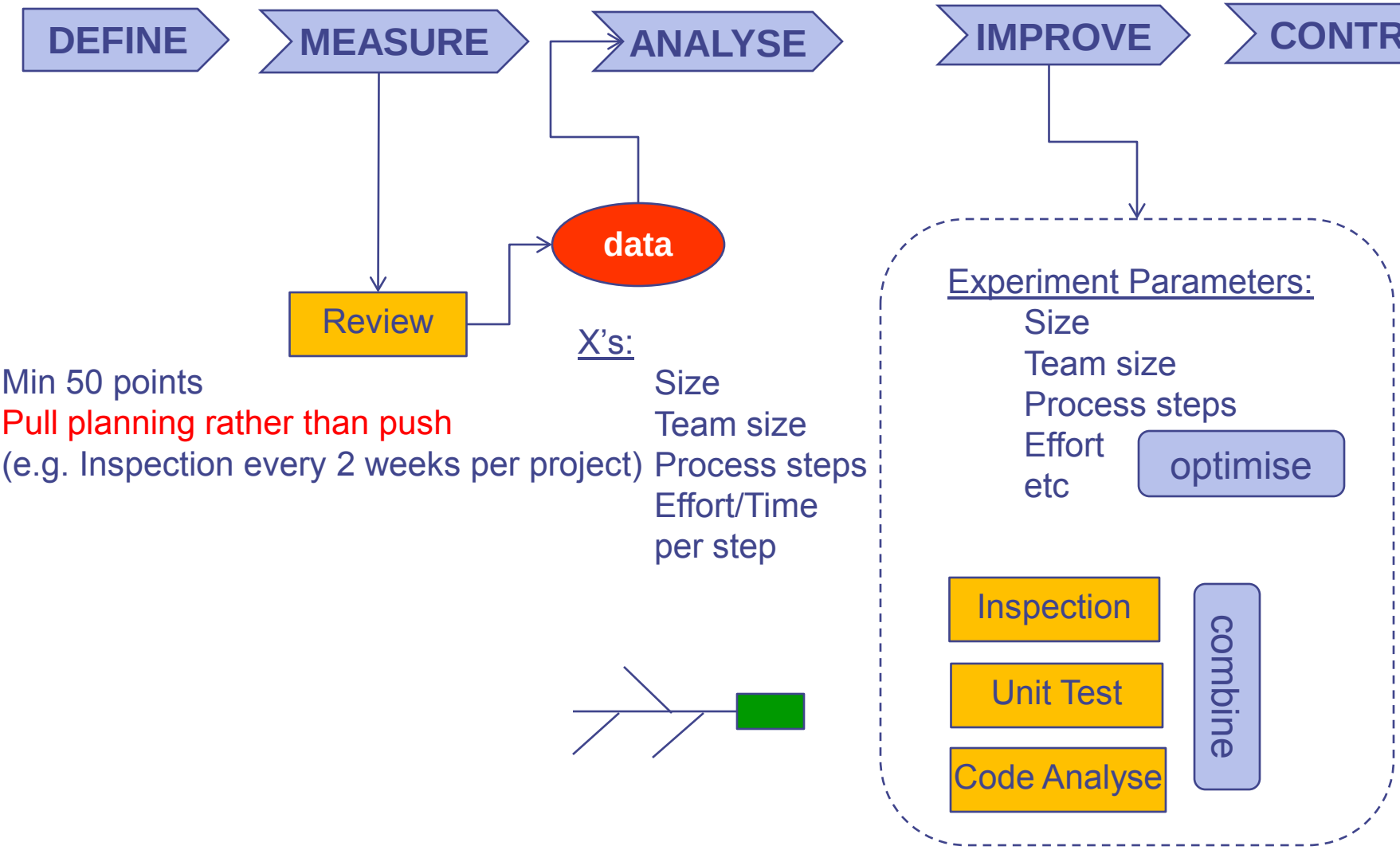


Looking for the Pareto effects

- **Analyse is not only about statistics**
  - People tend to jump on the statistical analysis tools
  - System and structural tools are as much important as the statistical tools → provides context to the data

ANALYSE PHASE ranged from 4 to 8 weeks.

Six Sigma SW Projects Example of experimentation

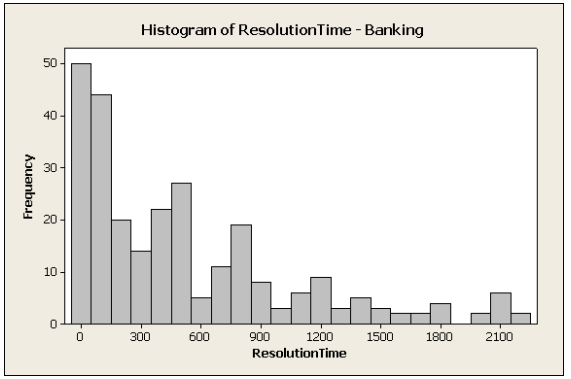


Six Sigma SW Projects – findings

- **Pilot projects**
  - Code Inspections
  - UI Defect Containment
  - Testing Cycles
- **Software Projects showing slower paced improvement**
  - More complex
  - Cultural barriers
  - **Economic slowdown due to recent events**
- **...but the initial analysis of the implemented improvements data shows potential for remarkable increases in Defect containment**
- **Financial Benefits so far: 2.5:1 to 10:1**
- **Cultural resistance is the key challenge, but cultural change is always possible (and the Egyptians know this very well...)**

Six Sigma IT projects – findings

- **Problem Space more straightforward**
  - Delays and Cycle time (Lean focus)



- **Highly visible to the Customer ("louder" VOC)**
  - *Shift from service denial to true a service provider*

- **Performance measures already available**
  - SLA adherence, response times, Non value added time
  - Tangible COPQ (rework, duplication, penalties..)

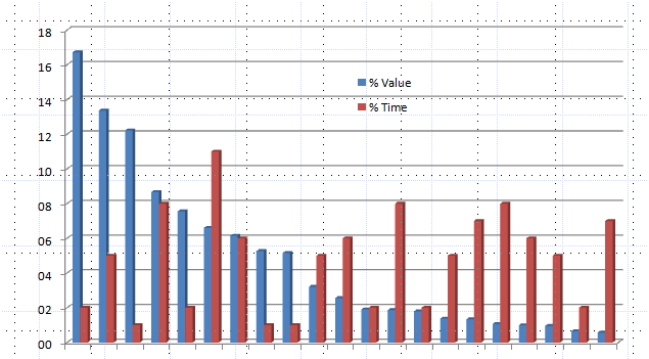
- **Process more directly observable**

- **"Continuous" flow of data (incidents)**

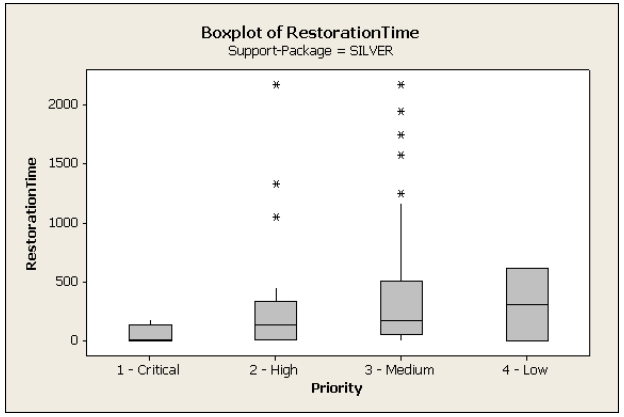
Compared to Software organisations, IT services company already have a culture of process excellence, commitment to customer and measurement

Six Sigma IT projects – Approach

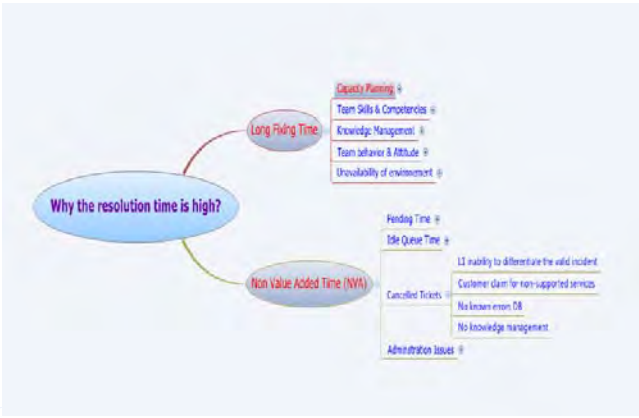
- **Process Value Analysis (Lean)**



- **Root Causes**
  - Incorrect incident classification / prioritisation
  - Non value added time
  - Capacity Planning



- **Importance of Process and Data view**
  - Huge volumes of data, require context and interpretation



Six Sigma IT Projects – findings

- **Pilot projects**
  - Incident Management
  - Capacity and resources planning
  - Delivery and procurement cycles
- **IT projects showing significant reductions in terms of cycle time, improved capacity planning and process governance**
  - Lean process improvement
  - Six Sigma for establishing ongoing monitoring and controls
  - Process harmonisation
  - Customer involvement, focus on delivering value
- **Straightforward improvement with quicker tangible benefits**
- **Huge Financial Benefits so far ROI: 7.4:1 to 17:1**

Change is possible...

From	To
(Managers) decisions are rarely questioned	Everything can and will be questioned openly
Decisions are based on experience, influence, power relations and gut-feelings	Decisions are based on in-depth knowledge of structural and quantitative characteristics of the system
Quality is viewed as compliance, controls, checklists and extra processes	Quality is seen as a business enabler and a way of working
Buzzwords and *tecchie jargon* are used extensively to justify improvement efforts	Clarity and Operational Definitions are used to build consensus and drive change initiatives
Solutions are often quick fixes	Problems are tackled at the level of the root causes
Improvement (if any) is “by the book”	Improvement is “by experiment “



tahrirsquare

SIXSIGMA

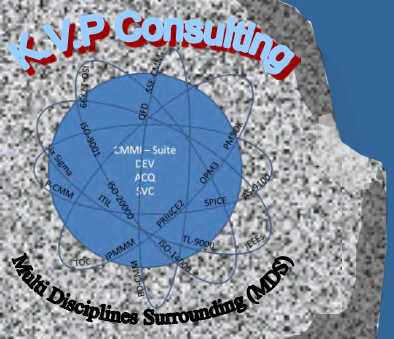
Lessons Learned

- **Large scale deployments can accelerate the investment in capacity building**
- **They do however present specific challenges**
  - Managing multiple projects in the same process area, but with different organisations
  - Synergies across projects, knowledge sharing across organisations
- **Cultural change and resistance**
  - Use projects to drive change (tangible results)
  - The exploratory part and problem definition play a major role in raising awareness and getting the "*questioning habit*"
- **Data is A-politycal... Data makes a difference**
  - But I don't believe your data... I might believe my own data!
  - First order Measurement come first (keep it simple)

Questions?



Thank You!

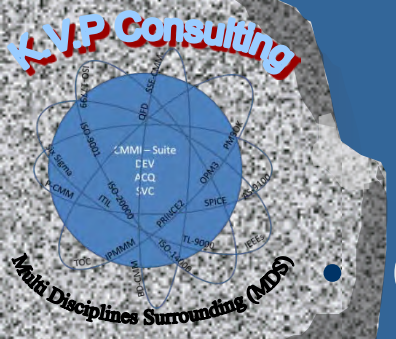


A Process Performance Models Case Study

Based on sample (from) 450 project feasibility checks

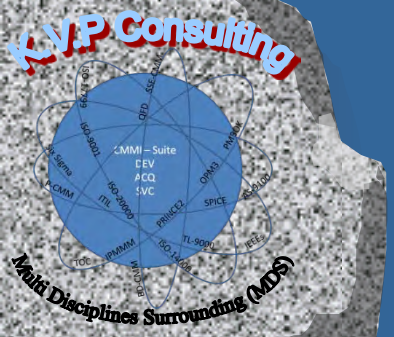
and

Presented with practical usage and implementation tips



Agenda and Topics

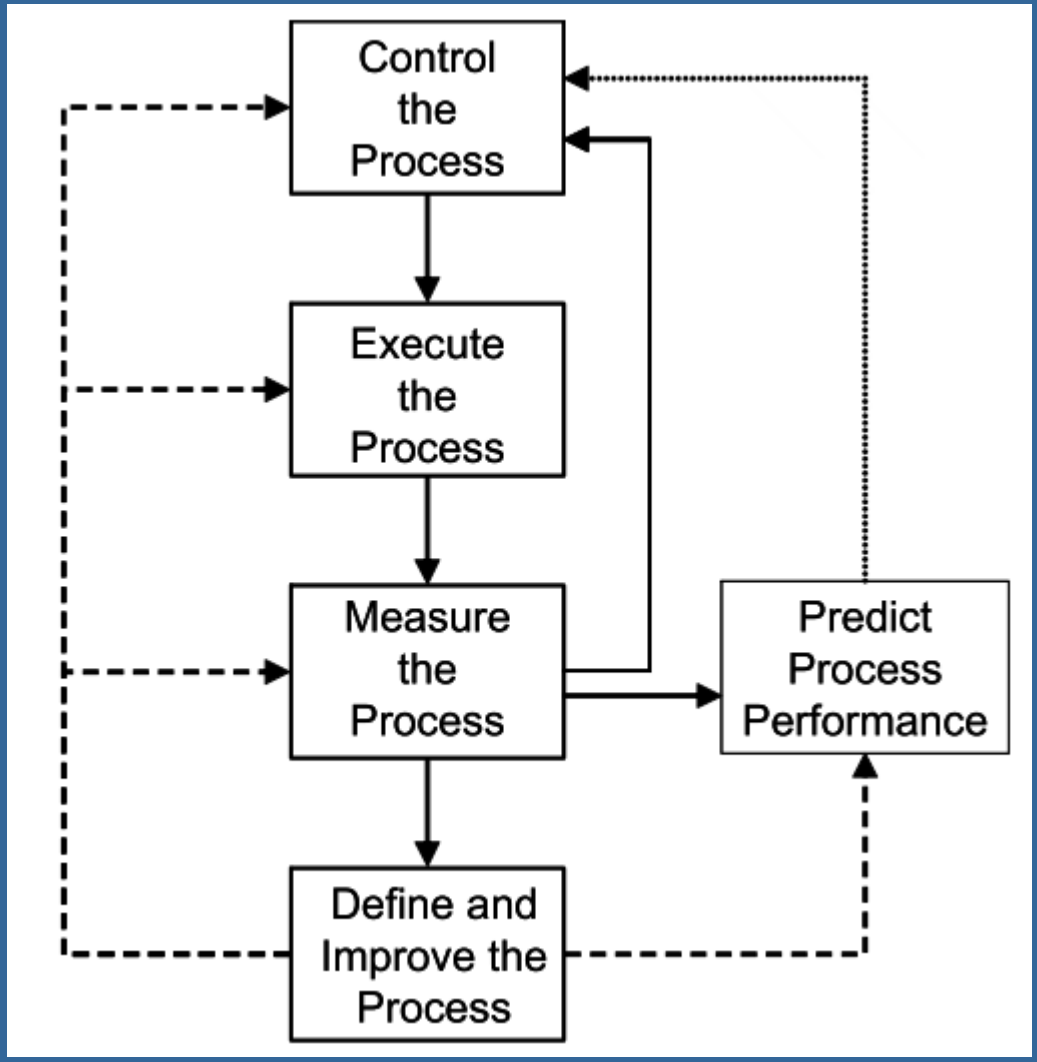
- Opening
- Organizational Background and Process ROI
  - Project Idea and Proposal Preposition Development
  - Quality Audits and Progress Check Calibration
  - Call and Incident Center Performance
- Case Studies and High Level Process
  - Project Idea and Proposal Preposition Development
  - Quality Audits and Progress Check Calibration
  - Call and Incident Center Performance
- Main Questions for High Maturity Process Improvement
- Pilot Lessoned Learned

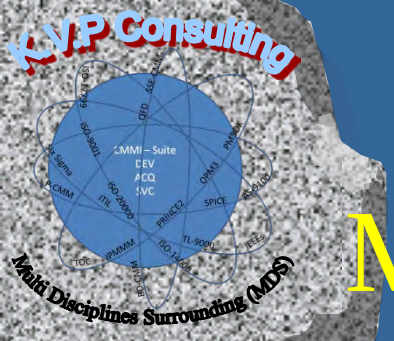


Definition of Process

- A set of interrelated activities, which transform inputs into outputs, to achieve a given purpose.

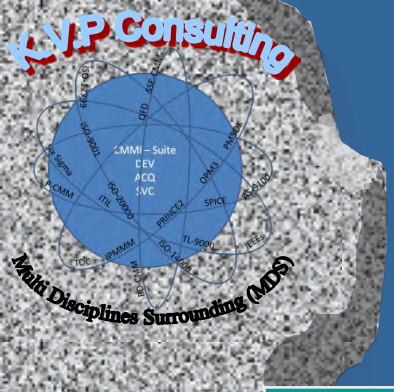
Process Control





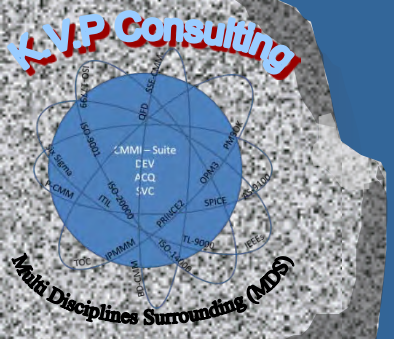
Measuring Process Performance

- Key Questions
  - What is the current performance?
  - Is this value "good"?
  - Is it changing?
  - How can I make the value “better”?
- Candidate Attributes
  - Definition (completeness, compatibility)
  - Usage (compliance, consistency)
  - Stability (repeatability, variability)
  - Effectiveness (capability)
  - Efficiency (productivity, affordability)
  - Predictive Ability (accuracy, effects of tailoring and improvements)



Some Examples

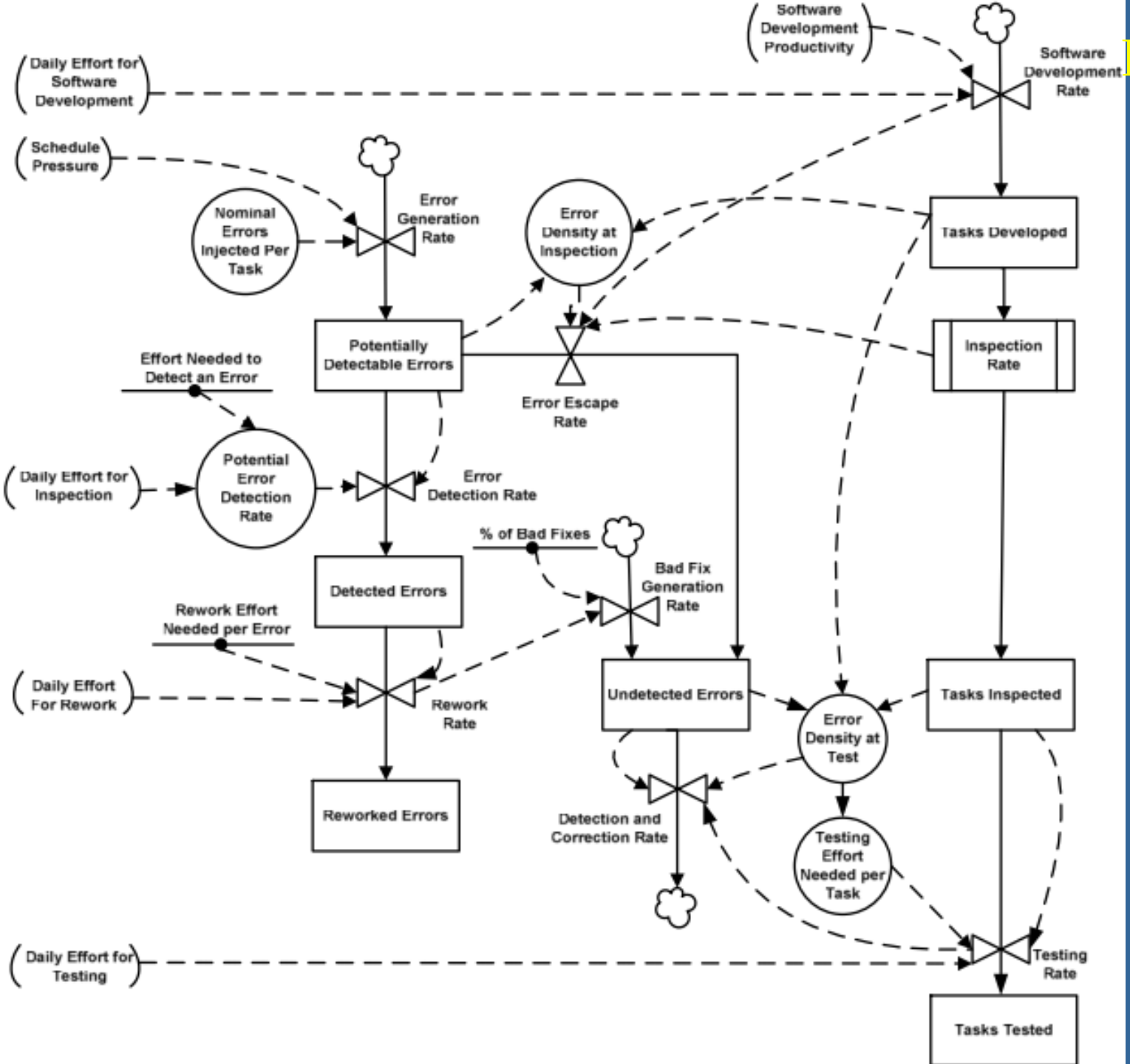
Goal	Measure
Completeness	The number of process elements added, changed, and deleted during tailoring.
Compliance	Number of discrepancy reports generated by Quality Assurance audits
Stability (volatility)	The number of process elements changed within a specified time interval.
Effectiveness	Product quality
Effectiveness	Defect leakage to subsequent phases
Efficiency	Productivity (or production coefficient)
Efficiency	Rework as a fraction of total effort
Predictability	Probability distribution for an estimated quantity or related population statistics

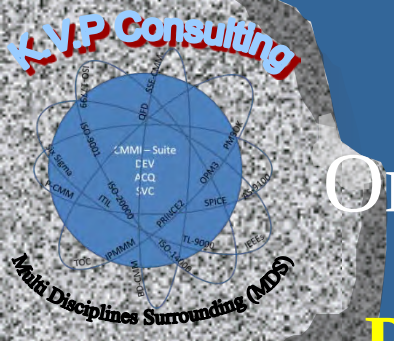


Opening

- Typically when one read the CMMI-SVC he may think on the classic service provider organization
- The model provides guidance for the application of CMMI best practices by the service provider organization.
- Best practices in the model focus on activities for providing quality services to the customer and end users.
- In this presentation the ‘services’ is a project feasibility checks provided by a dedicated group

Relationships for CoQ





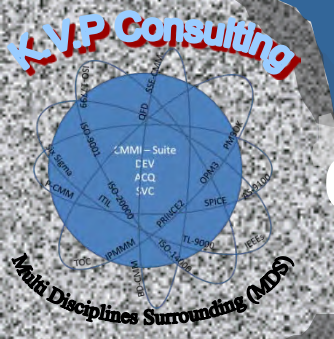
Organizational Background and Process ROI

Project Idea and Proposal Preposition Development

- If an average developer day cost is ~7000
- The total Program effort was 10220 day (100%)
- The testing phase was 1480 day (14.5%)
- Defect that are the result of documentation are 69% of all defects

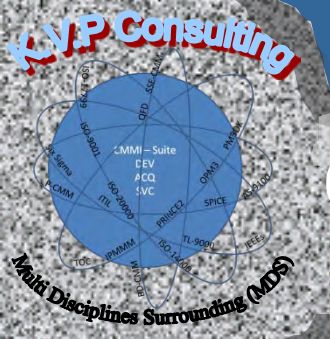
- If we will assume the to correct 69% of all defects will take around 40% of the testing duration; ☞ means that:
  - that will be 740 day
  - With the overall cost of 518000
- However to add 100 review days in the static tests and another 20 of code inspection will end with the cost of 2100000

- And still we have saved at least 3080000 (440 days)
- Means that we ware able to reduce 4.5% of the project time



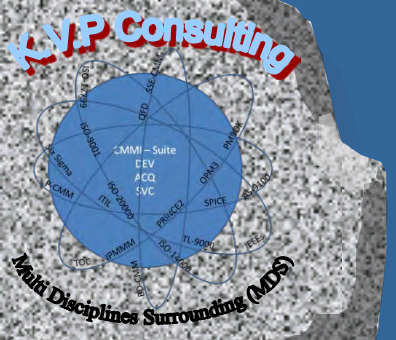
Organizational Background and Process ROI

- **Quality Audits and Progress Check Calibration**
  - As for today most of major industries which runs and mange large and complex programs need to comply with more than just one quality standards in many disciplines (e.g. HW, optics, software) use large groups of internal and external assessors that perform implementation checks, progress checks, readiness reviews and formal appraisals.
  - These communities are typically composed from groups of very experienced and professional individuals that have the best knowledge in their professional domain but not necessarily on how to conduct an efficient and effective appraisal which provide meaningful results
  - The combination of the effort and expected resources increase the risks on qualification of auditors, domain knowledge, and calibration of results and findings effectiveness



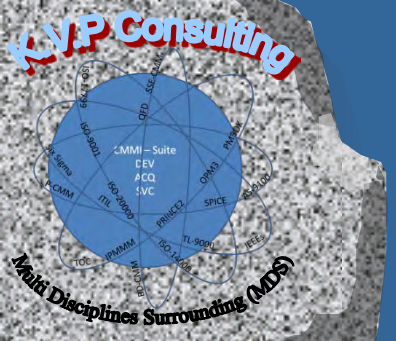
Organizational Background and Process ROI

- **Quality Audits and Progress Check Calibration**
  - By measuring the following attributes, we were able to increase usability of the progress checks by 47%, and quality of deliverables by 37%
    - Role based profile and criteria
    - Calibration mechanism and criteria
    - Evaluation mechanism and criteria
    - Leveling the different quality engineers and ‘auditors’
    - Flowing specific trainings (on different levels) as personal development and qualification criteria
    - Listing specific performances as indicators for leveling justifications
    - Structuring the different audits and reporting guidelines in a single mandatory to follow process,



Main Steps for High Maturity Process Improvement

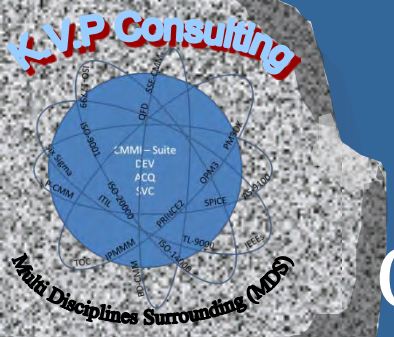
- During our analysis and planning, we were able to identify improvement targets in main lifecycle areas such as
  - operations,
  - information,
  - governance,
  - people
  - organizational structure,
  - portfolios,
  - project execution,
  - finance.
- And as in core process that are critical to the system success such as stakeholder management, technical interfaces and integration.



Main Steps for High Maturity Process Improvement

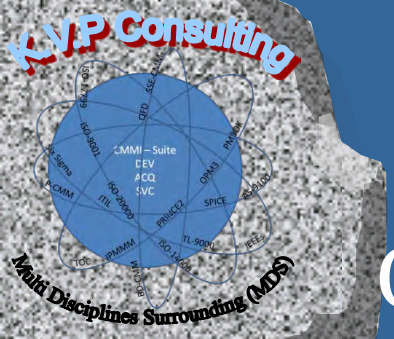
As the result of this observation we have built an action plan,

- Then in the second step we have built a services roadmap using the CMMI-SVC, that allow companies to begin the improvement journey, and manage the transformation to maturity by building on each successive step, and ultimately delivering the benefits expected:
  - service reuse,
  - improved perception
  - response time,
  - interoperability,
  - business agility.
- Service performance and its impact on the organization governance is a significant part of that journey



Organizational Background and Call and Incident Center Performance

- The service provider provides a large number of services to its customers, which are mainly departments from a sibling organization.
- To manage the communication with customers regarding those services, the department has implemented helpdesk management and problem management processes.
- The implementation of these processes has been based on the CMMI-SVC with elements of other CMMIs (for the organization maturity) and ITIL (for the individuals' education).

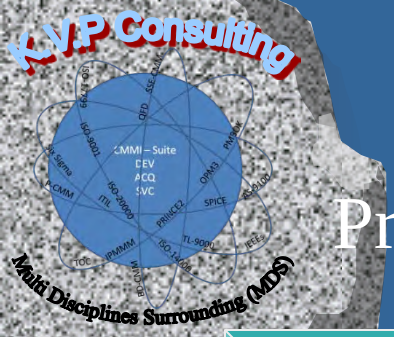


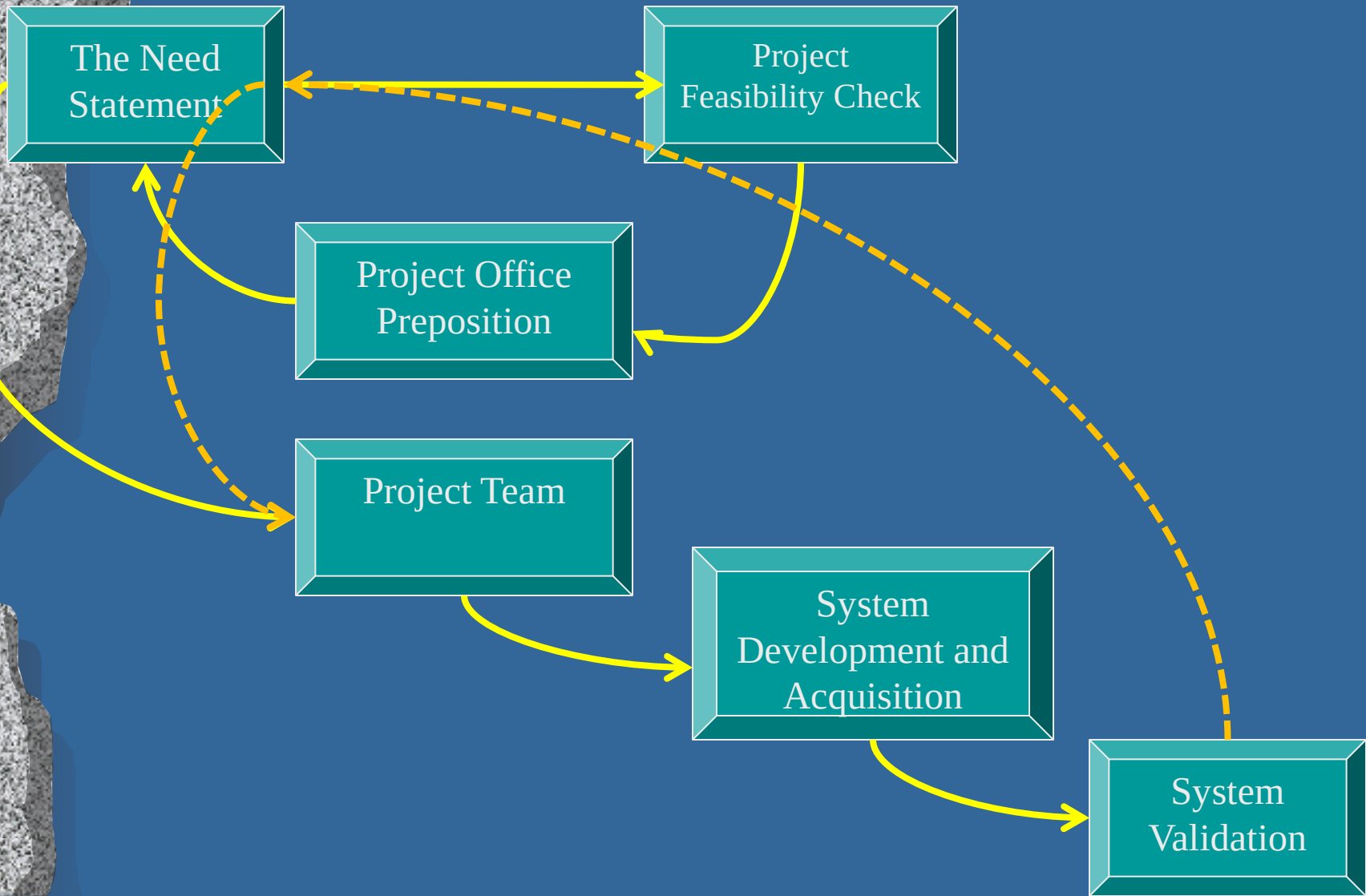
Organizational Background and Call and Incident Center Performance

- Program Management Office is used to guarantee the continuity of services, while Analysts Management Team is used to improve the level of service in the future. So, PMO deals with *requests*, whereas Requirements Management Team is concerned with solving the *challenges* that cause these requests.
- The goal of this case study was to assess the quality and performance of the feasibility checks Management process.

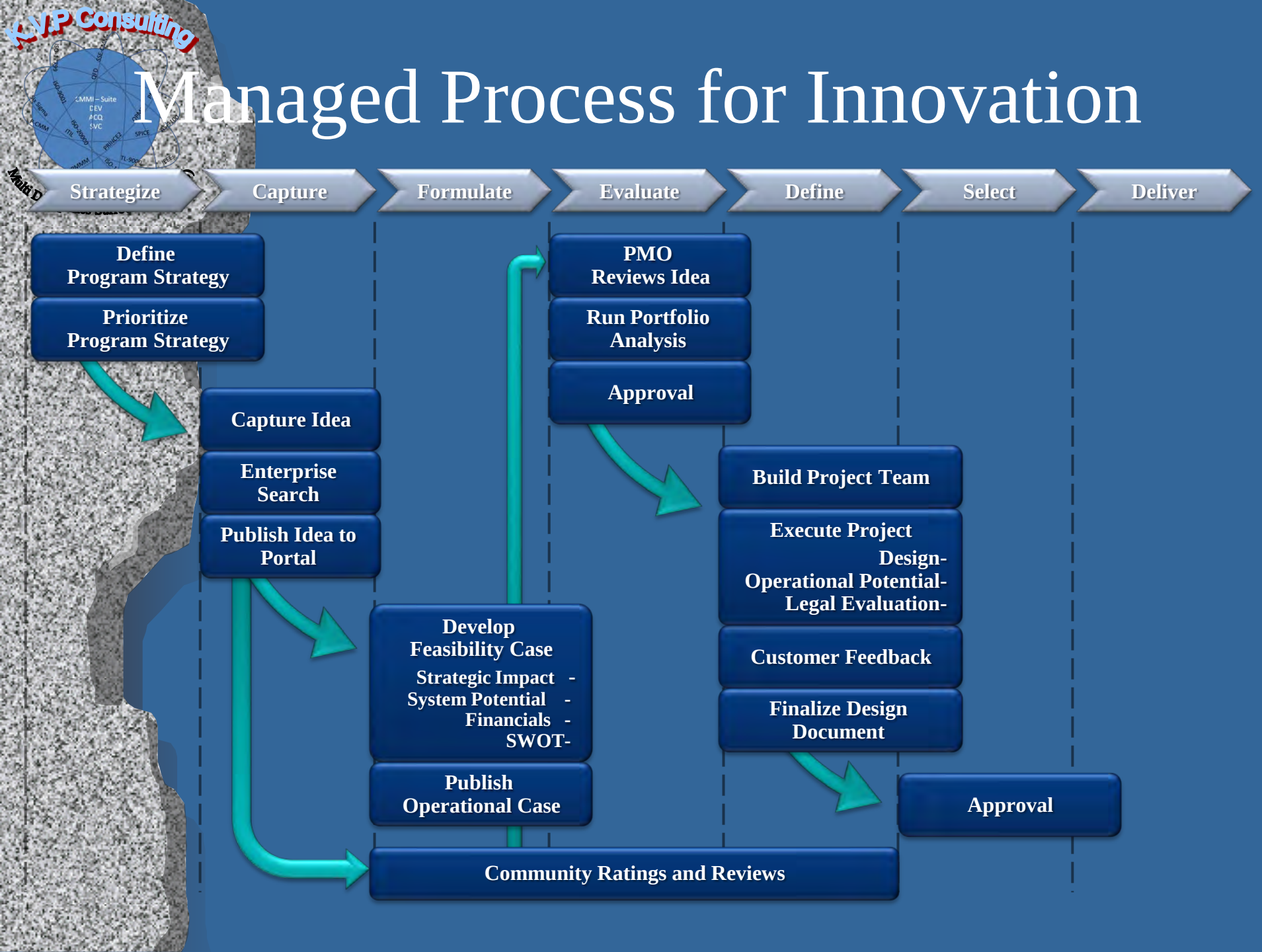
Process

Project Idea and Proposal Preposition Development

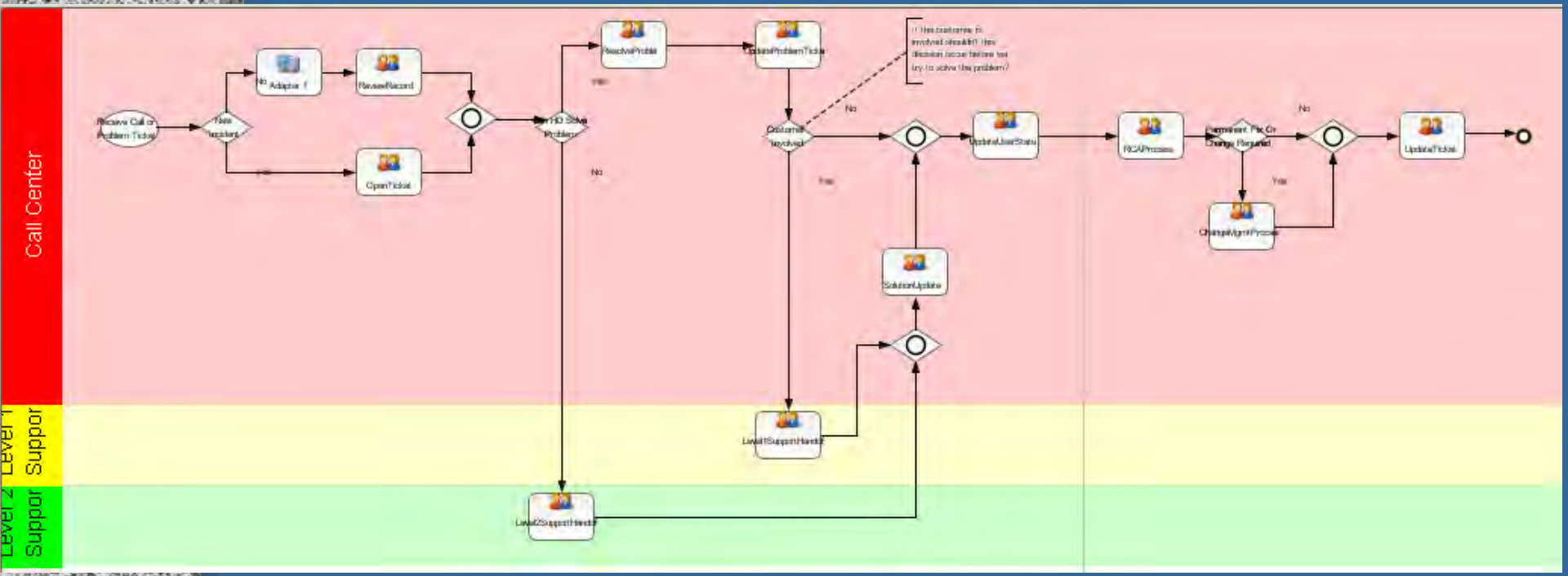




Managed Process for Innovation



Case Study


Call Center
Level 1 Suppor
Level 2 Suppor
Receive Call or Problem Ticket
New Incident
Adaptur 1
ReviewRecord
OpenTicket
HD Solve Problem
ReactivePrblm
UpdatedProblemTicke
Customer Involved
No
Yes
UpdateUserStatus
RCAProcess
Permanent Fix Or Change Required
ChangeMgmtProcess
UpdateTicket
SolutionUpdate
Level1SupportNeeded
Level2SupportNeeded

Case Study

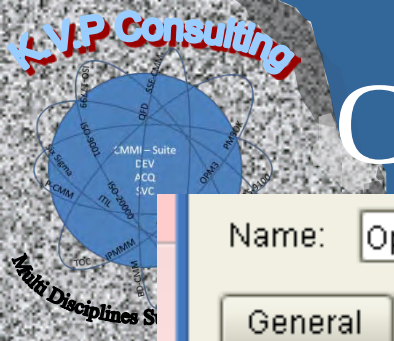
General | Fields | Simulation

Dataslot: AllDataslots

	Name	Type	Label	Editable	Required
✓	HDResolution	Boolean	H d resolution	✓	
	ScheduledDate	Date	Scheduled date	✓	
	Attachments	Document	Attachments	✓	
A	CustomerConta...	String	Customer conta...	✓	
A	CustomerName	String	Customer name	✓	
A	Description	String	Description	✓	
A	EstimatedDurat...	String	Estimated durat...	✓	
A	Installation	String	Installation	✓	
A	Skid	String	Skid	✓	
A	TicketPriority	String	Ticket priority	✓	

Dataslots

Case Study



Name: OpenTicket

General | Fields | Simulation

Scenario: (default)

Work Time: 2 hours ...

Randomize duration using: Normal Distribution (StDev=(none)) ...

Resources

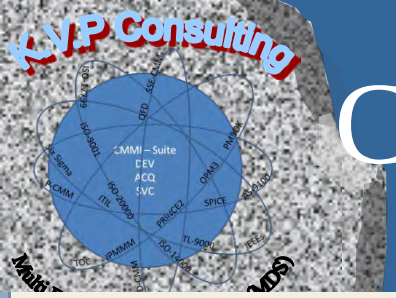
Name	Value	Unit	Cost per unit	Threshold

Modify...

Reset

OK | Cancel | Help

Case Study



General | Fields | Simulation

Scenario:

Work Time:

Randomize d

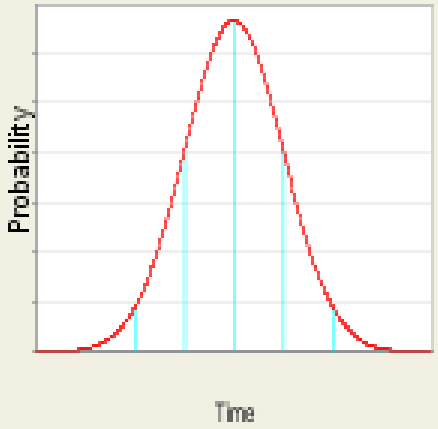
Resources

Name

Modify...

Reset

Distribution of Probability



Type: Normal

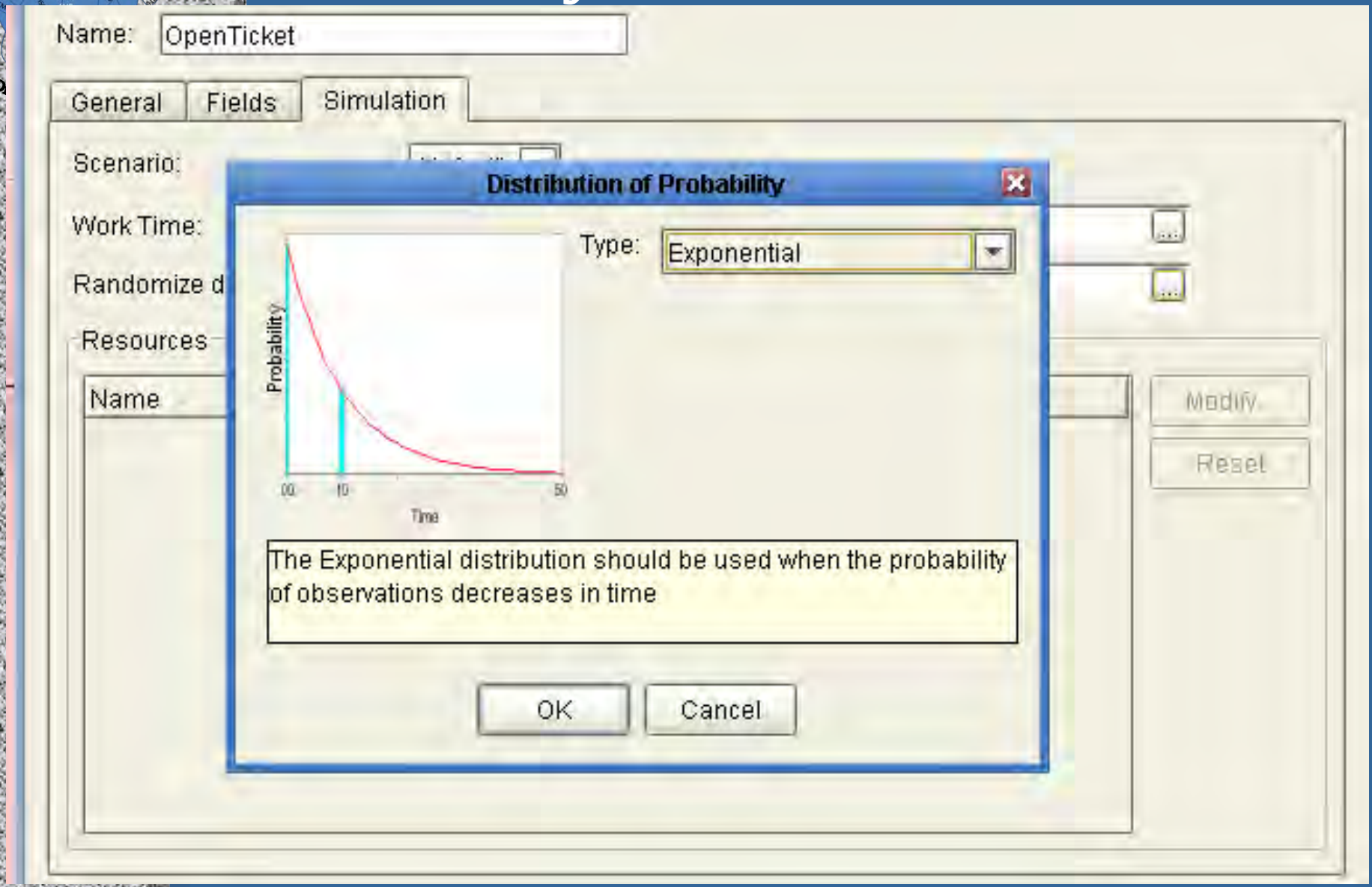
StDev:

- Constant
- Exponential
- Normal

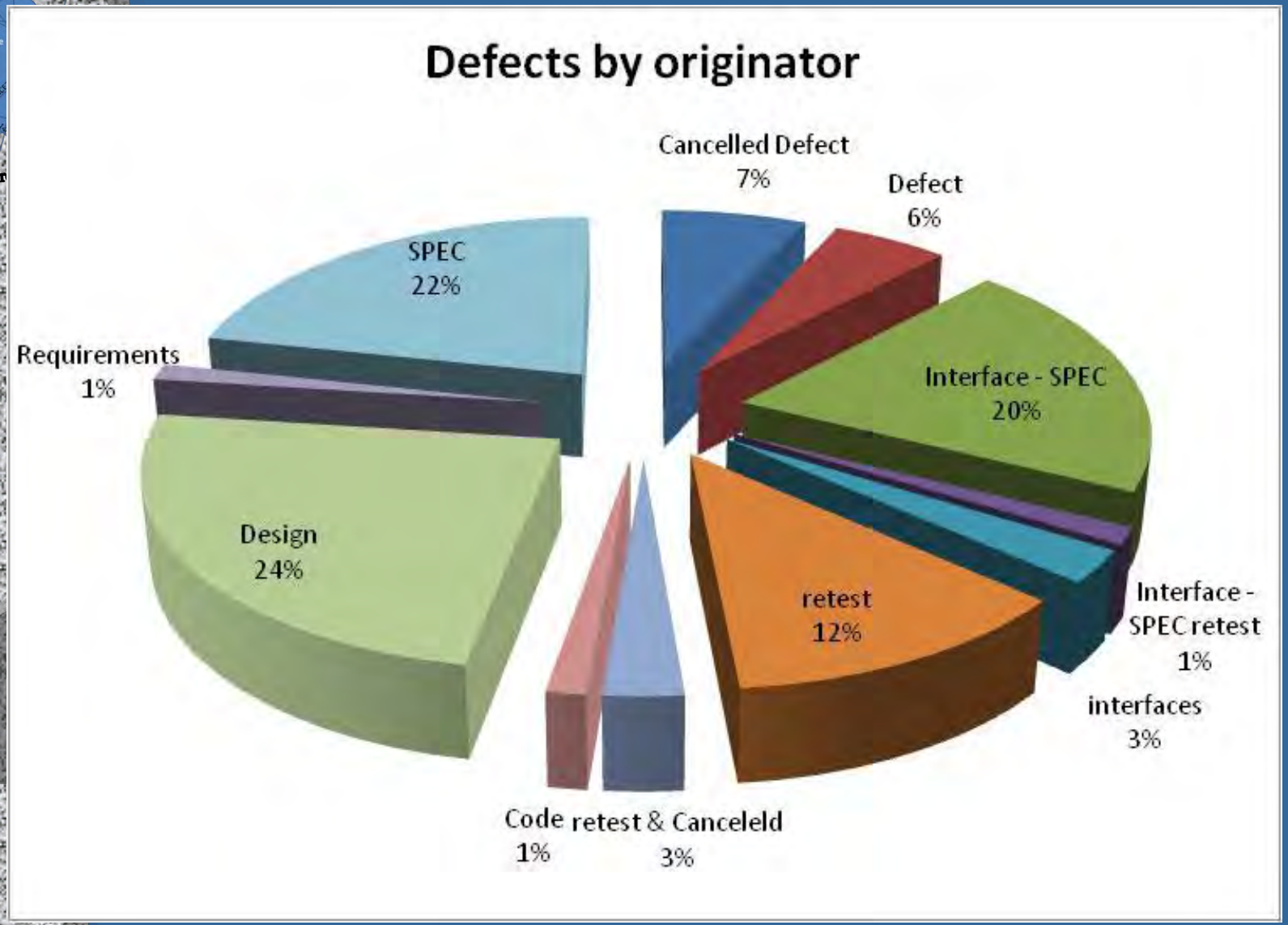
The Normal Distribution should be used when observations tend to accumulate around a particular value rather than spread evenly across a range of values

OK | Cancel

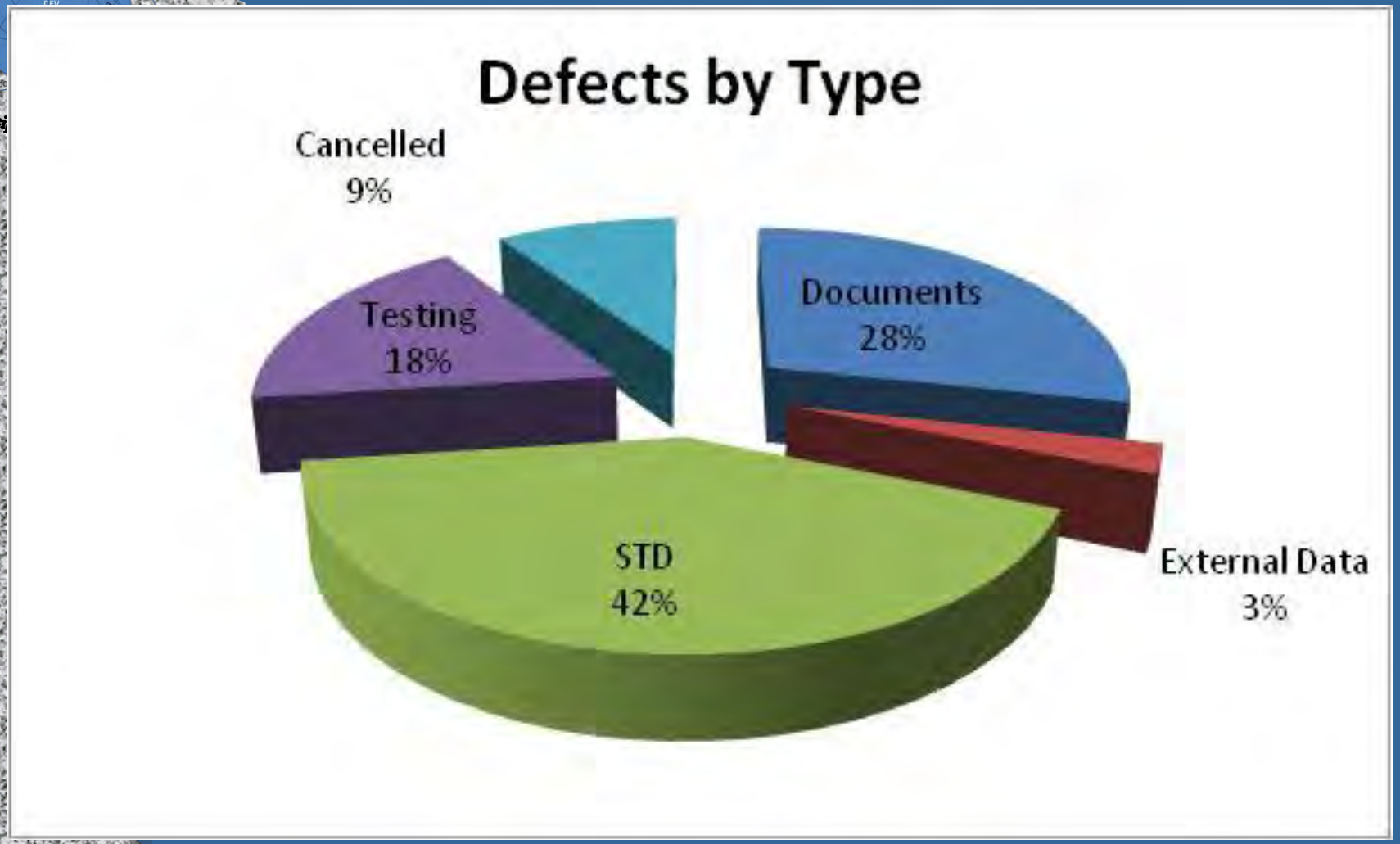
Case Study

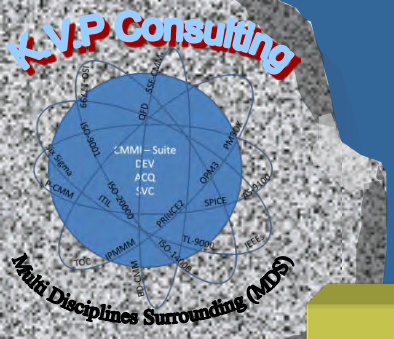

Name: OpenTicket
General
Fields
Simulation
Scenario:
Work Time:
Randomize d
Resources
Name
Modify
Reset
Distribution of Probability
Type: Exponential
Probability
00
10
50
Time
The Exponential distribution should be used when the probability of observations decreases in time
OK
Cancel

A.N.P Consulting
Multi Disciplines Sum



K.V.P Consulting





Process

Quality Audits and Progress Check Calibration

Plan Assessment

Prepare for Assessment

Gather Data

Consolidate Data
Organize and Combine Data

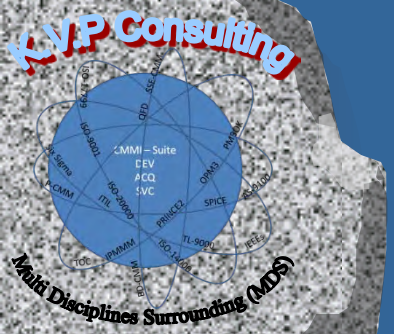
Determine Data Sufficiency

Review and Revise Data Gathering Plans

Make Rating Judgments

Report Results

Process
Quality Audits and Progress Check Calibration



Ratings

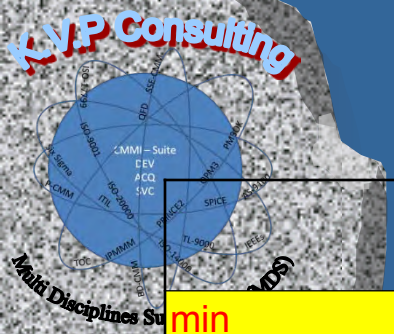
Findings

Observations

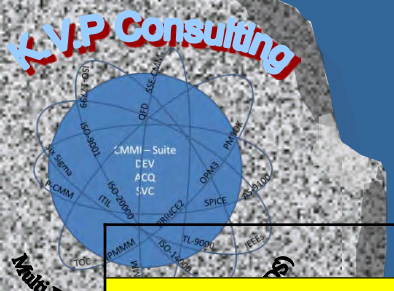
Notes

Interviews **Doc Review** **Instruments** **Presentations**

Data

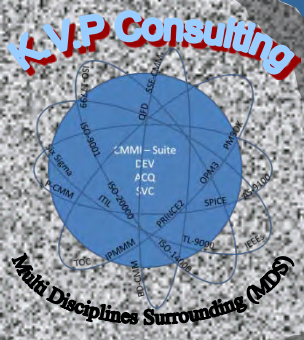


Center	
min	0%
max	100%
ave	50%
sample Projects	104
% From ORG	100.00%
Sample Practices	19629
% From Sample	100.00%
is 0	2649
% of is 0	13.50%
>4	9147
% of >4	46.60%
<4	7828
% of <4	39.88%
is 4	2654
% of is 4	13.52%
>6	4818
% of ≥6	24.55%
mean	#NUM!
median	4
mode	8
VAR	7.279

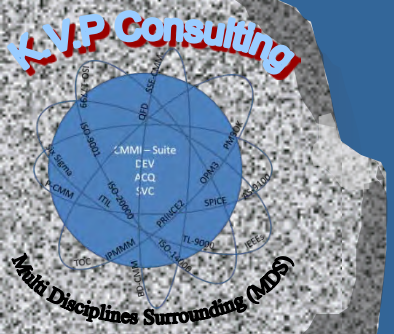


Areas

	A1	A2	A3	A4	A5	A6	A7
min	0%	0%	0%	0%	0%	0%	0%
max	100%	100%	100%	100%	100%	100%	100%
ave	50%	50%	37.5%	62.5%	50%	50%	75%
sample Projects	22	6	3	13	23	13	24
% From ORG	21.15%	5.77%	2.88%	12.50%	22.12%	12.50%	23.08%
Sample Practices	3733	957	647	2069	4961	2914	4348
% From Sample	19.02%	4.88%	3.30%	10.54%	25.27%	14.85%	22.15%
is 0	526	127	154	195	914	378	355
% of is 0	14.09%	13.27%	23.80%	9.42%	18.42%	12.97%	8.16%
>4	1575	476	213	1092	1850	1413	2528
% of >4	42.19%	49.74%	32.92%	52.78%	37.29%	48.49%	58.14%
<4	1626	347	322	705	2358	1165	1305
% of <4	43.56%	36.26%	49.77%	34.07%	47.53%	39.98%	30.01%
is 4	532	134	112	272	753	336	515
% of is 4	14.25%	14.00%	17.31%	13.15%	15.18%	11.53%	11.84%
>6	779	211	82	579	775	733	1659
% of >6	20.87%	22.05%	12.67%	27.98%	15.62%	25.15%	38.16%
mean	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
median	4	4	4	5	4	4	6
mode	2	6	0	6	0	6	8
VAR	7.058	6.898	6.750	6.853	6.654	7.142	7.265


S.V.P. Consulting
CMMI – Suite
DEV
ACQ
SVC
Multi Disciplines Surrounding (MDS)

Questions ?



Contact

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K.V.P Consulting

Kobi.Vider@hotmail.com

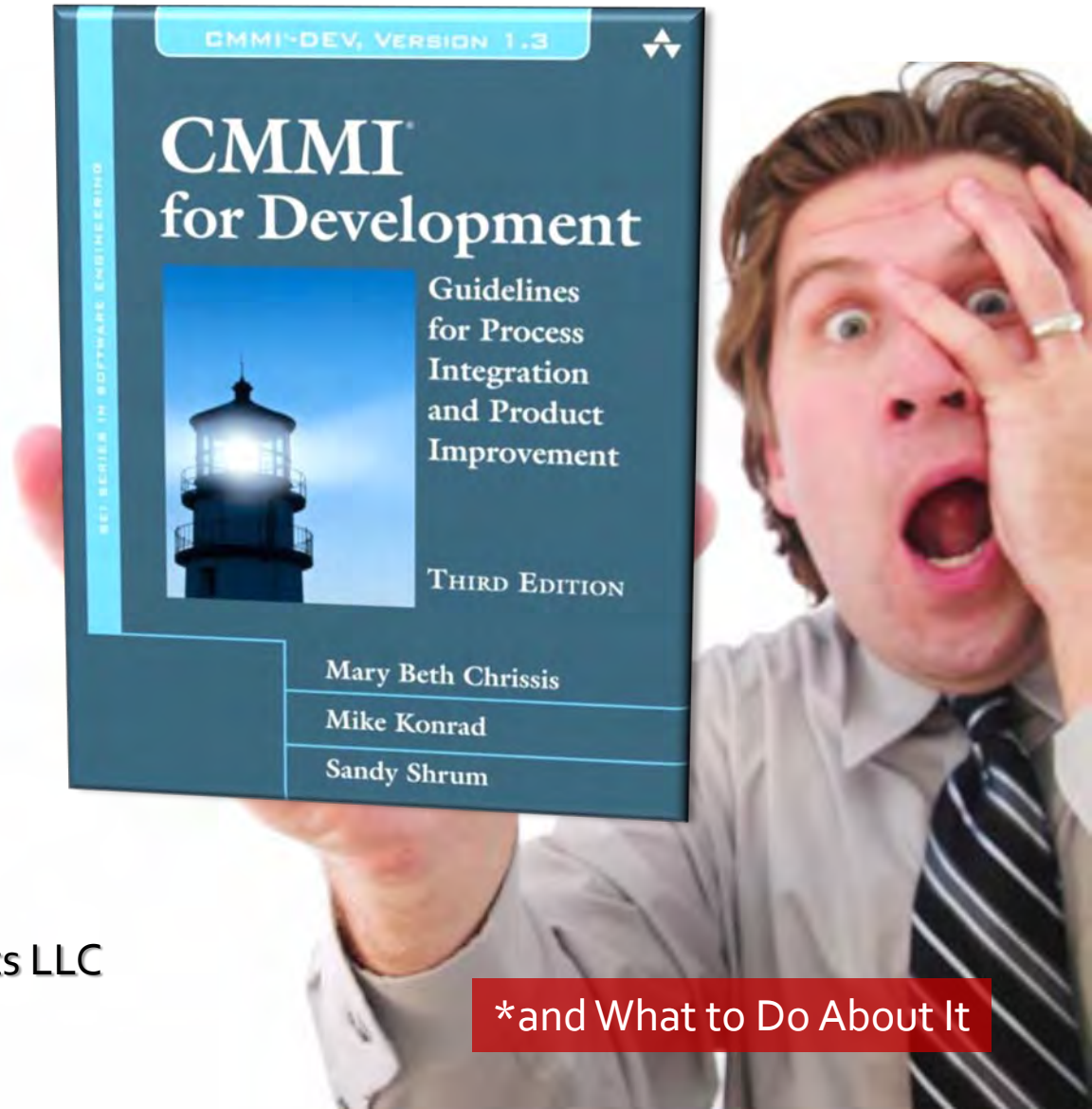
KobiVP@aol.com

Phone: +972522946676

Leading Edge PROCESS CONSULTANTS LLC

SEI Partner

Why Project Managers (Understandably) Hate the CMMI*



Bill Smith CEO
Leading Edge Process Consultants LLC
www.CmmiTraining.com

*and What to Do About It

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Let’s roll!

Ground rules



2:15 -
3:00



at the
end *



set to
stun

* better yet: **Garrity's** at 5:30

and **yes**
I have...

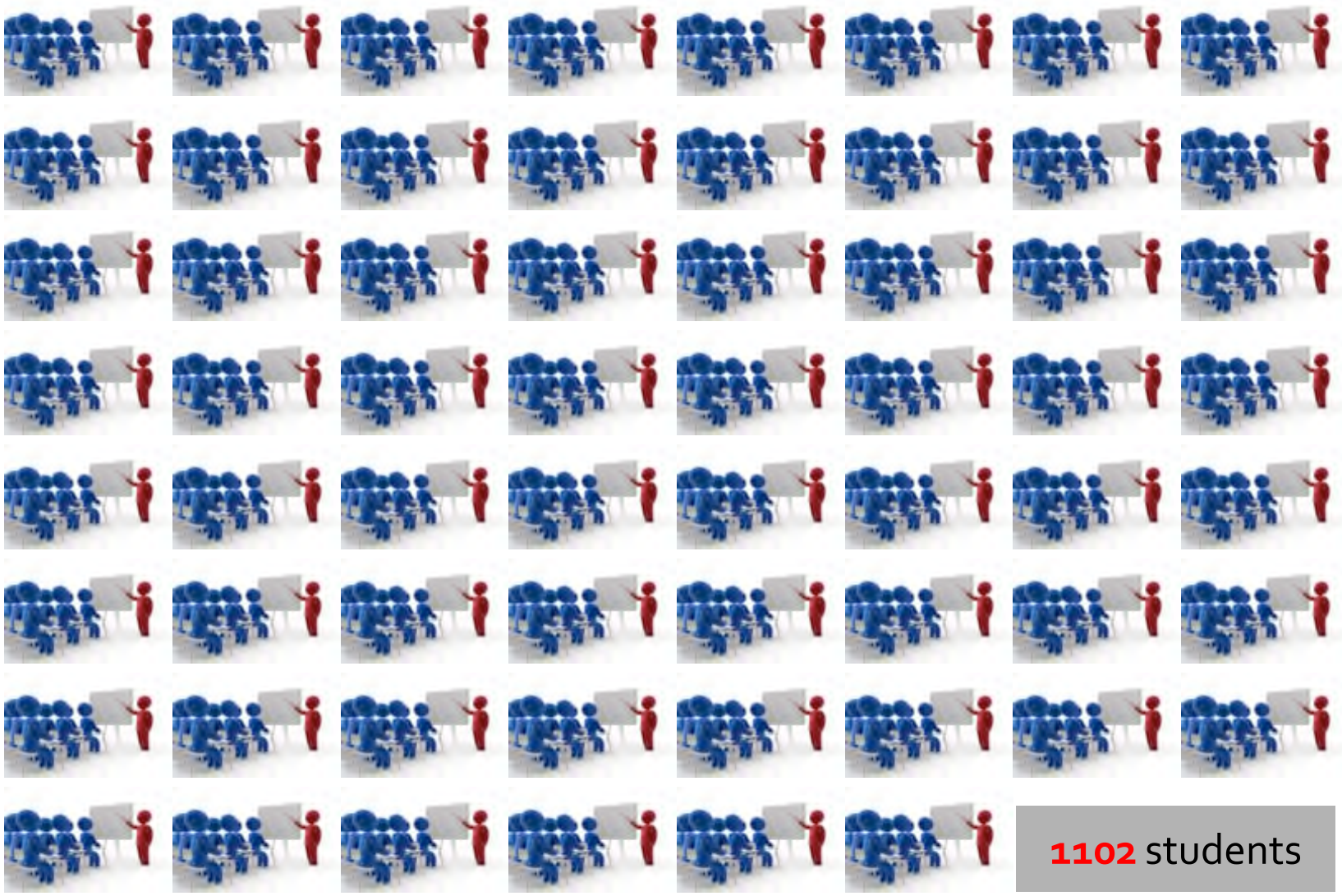

ing.com

So who am I?



I’m familiar with the **CMMI®** …

62 Intro to CMMI® classes taught



1102 students

but more
importantly I've…

Been there, done that



process analyst



project manager

Today's **story**
is all about…

Changing this…



+



=



...into this



+


CMMI
for Development
Guidelines
for Process
Integration
and Product
Improvement
Third Edition
Mary Beth Chrissis
Mike Konrad
Sandy Shrum

=


win

Meet Pam



Pam leads a small **team** of…



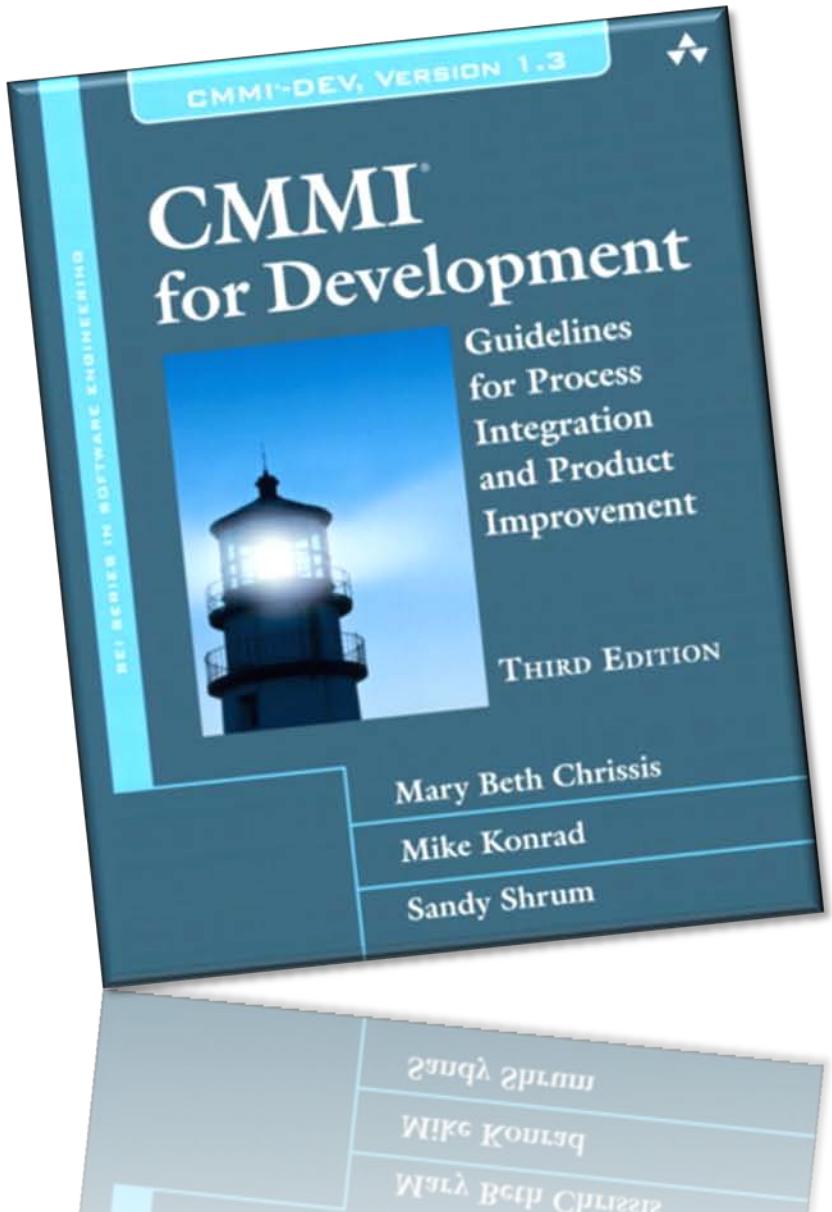
She **works** near…



and **kicks butt** at…

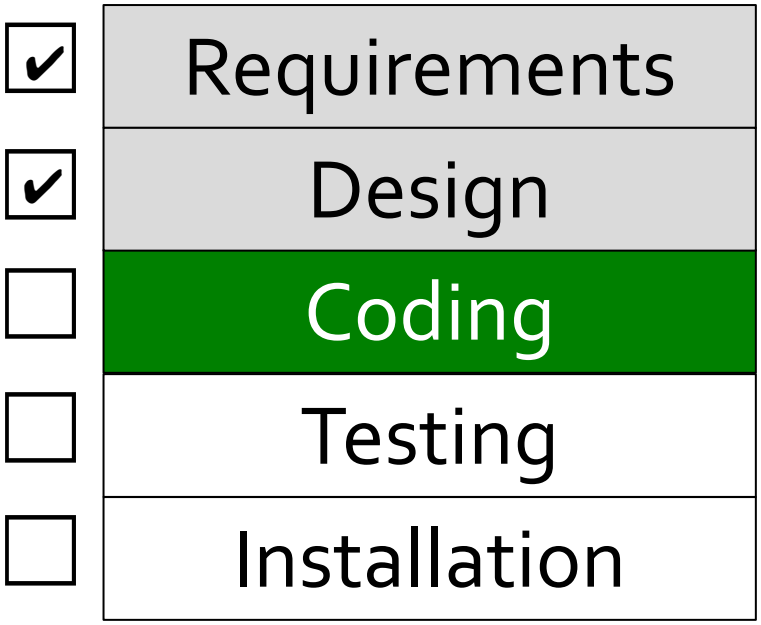

Management
managers
resources
business
organization
organizing
objectives
people
planning
controlling
policy
directing
Directors
corporations
enterprise
comprises
human
person
Resourcing
facilitating
innovation
goals
chief
implemented
natural
defined
act
often
leading
effort
large
activity
getting
one
discipline
achieve
money
firm's
materials
together
purpose
twofold
policy's
size
staffing
encompasses
range
responsibility
production
perform
accomplishing
interlocking
formulates
entities
board
accomplish
According
achievement
thousands
policies
small
officer
firms
functions
activities
goal
certain
marketing
manage
basic
hundreds
financial
clearly
refer
definitions
guru
make
group
also
manipulation
along
simply
power
included
corporate
machines
desired
manipulating
formulating
coordination
executive
technological
deployment
accordance
task
factor
companies
decisions
firm
multinational

but is **clueless**
about…


CMMI-DEV, VERSION 1.3
SEI SERIES IN SOFTWARE ENGINEERING
CMMI®
for Development
Guidelines
for Process
Integration
and Product
Improvement
THIRD EDITION
Mary Beth Chrissis
Mike Konrad
Sandy Shrum

except she's heard it **creates**…

Pam's team has started coding



Her project is rockin'!



on schedule!

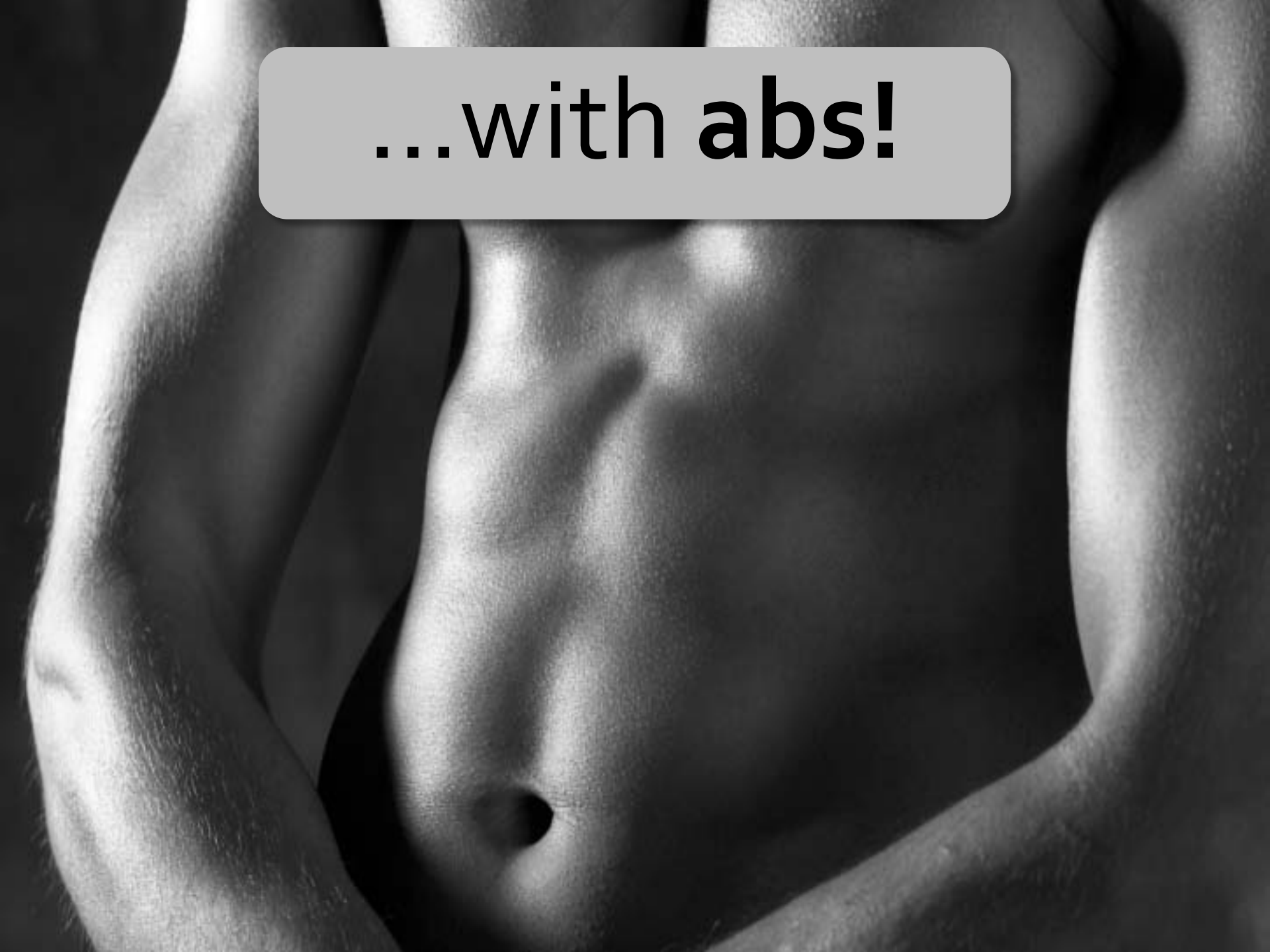


on budget!



happy customer!

She even has a new **boyfriend**…


…with **abs!**


Life is good
for Pam!

One day Pam gets an **e-mail**…

Uh-oh

Use our new *CMMI processes**

Blah blah blah **all projects must use our new CMMI processes** blah blah blah. Blah blah blah immediately blah blah blah. Blah blah blah under penalty of death blah blah blah.

Blah blah blah congratulate blah blah blah process group blah blah blah sweated blood blah blah blah.

Signed,

Blah

Mr. Blah Blah
VP of Blah Blah



*Of course we know there's no such thing

Deployment

=

Do this **(now)**

because

we said so!

Whatever.

I'll look at that stuff **when I have time**.





Pam's

CMMI®
Rock-O-Meter

5

Then one day
Pam has a…

...brainstorm!



Maybe

(just maybe)

this "CMMI® stuff"

can be **useful!**

Pam wants a…



She consults the PAL*



*process asset library

…and finds templates for systems like

this



…but her system is more like **this**

She's forced to develop a plan



on her own

Crap! I thought the CMMI® was supposed to **help** with stuff like this!





Pam's

CMMI®
Rock-O-Meter

3

QA pays
a visit...



Pam's project is audited

Y	N	
☐	☑	Blah blah blah **data management plan**.
☐	☑	Blah blah blah **stakeholder involvement plan**.
☐	☑	Blah blah blah blah blah blah.




FAIL

She talks with QA



But the project is **half over!**

You must **follow the process**.

I have **no time** for this!

You must **follow the process**.

It **doesn't help** my project!

You must **follow the process**.



The

rules were changed

on Pam

mid-stream!

She works
day…


...and night

Addressing "non-compliances"

instead of

-

But most “fixes” have no business value



So the CMMI® really is just about **paperwork**…

…and now I'm **behind schedule**!





Pam's

CMMI®
Rock-O-Meter

Pam discovers **appraisals**…


We need you to populate an **evidence matrix** for our…

SCAMPI*



*Standard CMMI® Appraisal Method for Process Improvement




Hey, we have a **template**! It even lists example **artifacts**!




Our VP says
you have to.





The project's new part-time job,

"populate evidence matrix"…


...takes **forever**

Evidence matrix review loop



Pam's team

good enough?



try again!



EPG*

*engineering process group

The project is now so

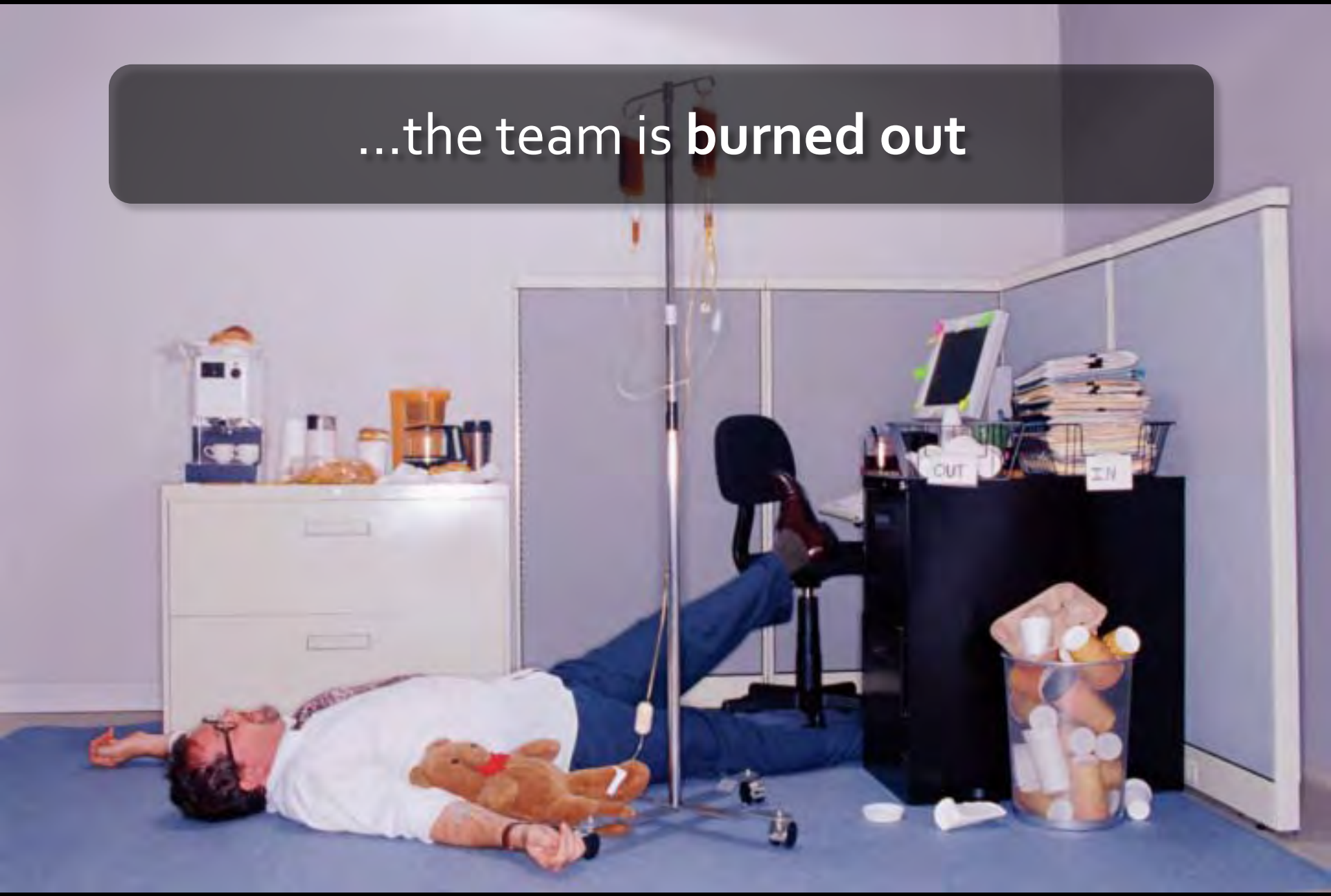
distracted

by CMMI®

"compliance"

that…


…it’s hopelessly **behind schedule**


...the team is **burned out**
OUT
IN



…the customer's **not smiling** anymore



…and Pam’s boyfriend **dumps** her!

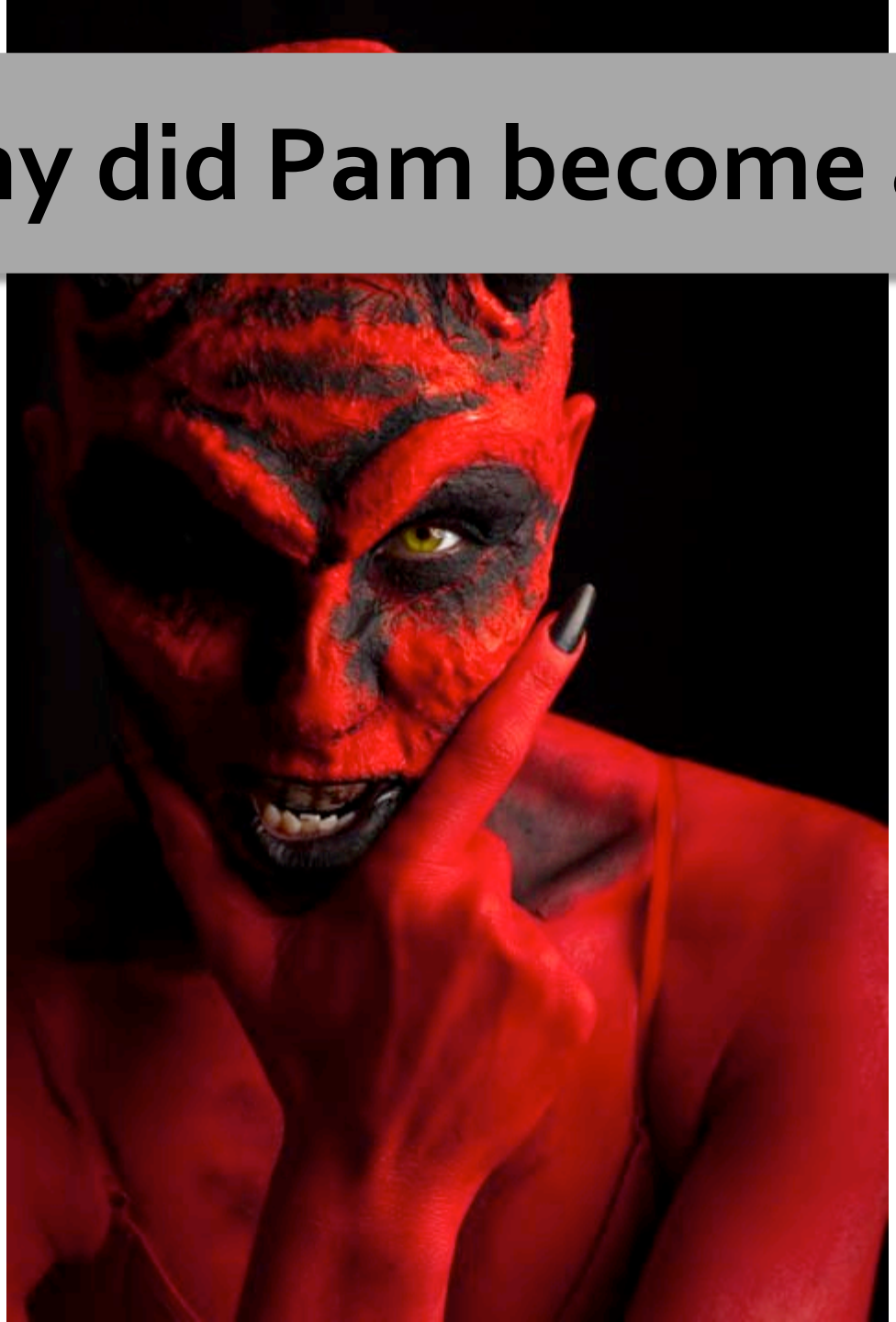
Meet the
new Pam…





Pam's CMMI® Rock-O-Meter

Why did Pam become a…



?

Why do project managers…



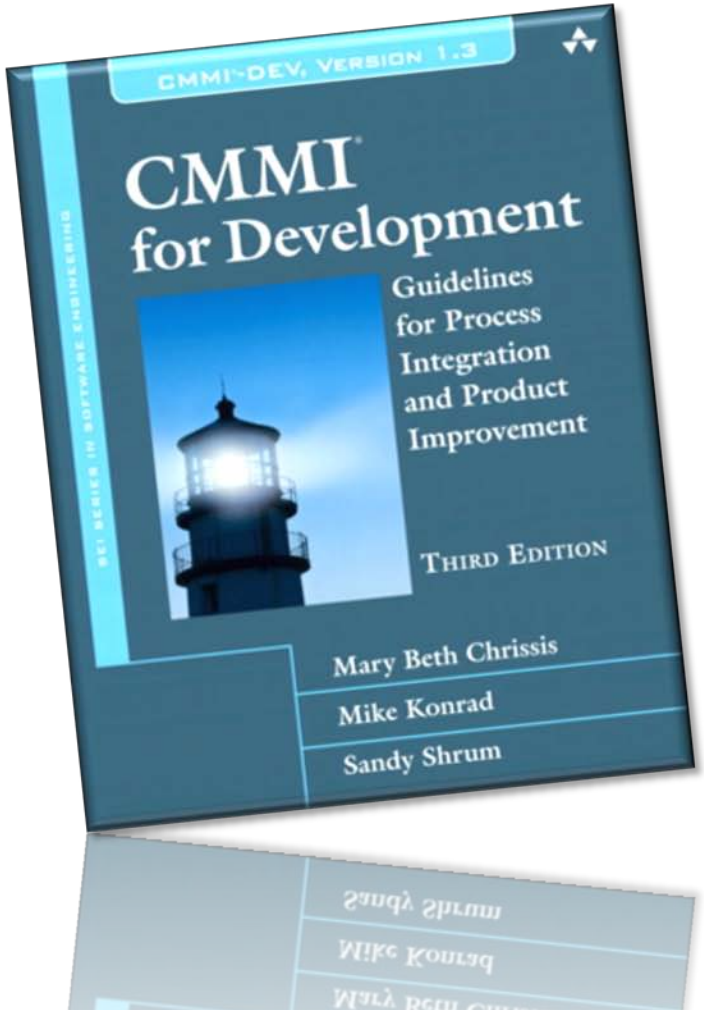

often...


hate...



…the CMMI®?

Not because of…



But because of problems with…

1. Process development
2. …and finds templates for systems like **this**



3. …but her system is more like this

She's forced to develop one



on her own

But because of problems with…



1. Process development
2. Process deployment
3.



But because of problems with…

The project's new part-time job,

"populate evidence matrix"…



1. Process development
2. Process deployment
3. Appraisals

But because of problems with…

1. Process development
2. Process deployment
3. Appraisals

We could go **on and on**
and on
and on
and on

about each of these…

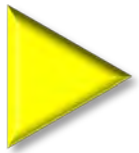
Instead let's focus on a few process improvement **best practices…**

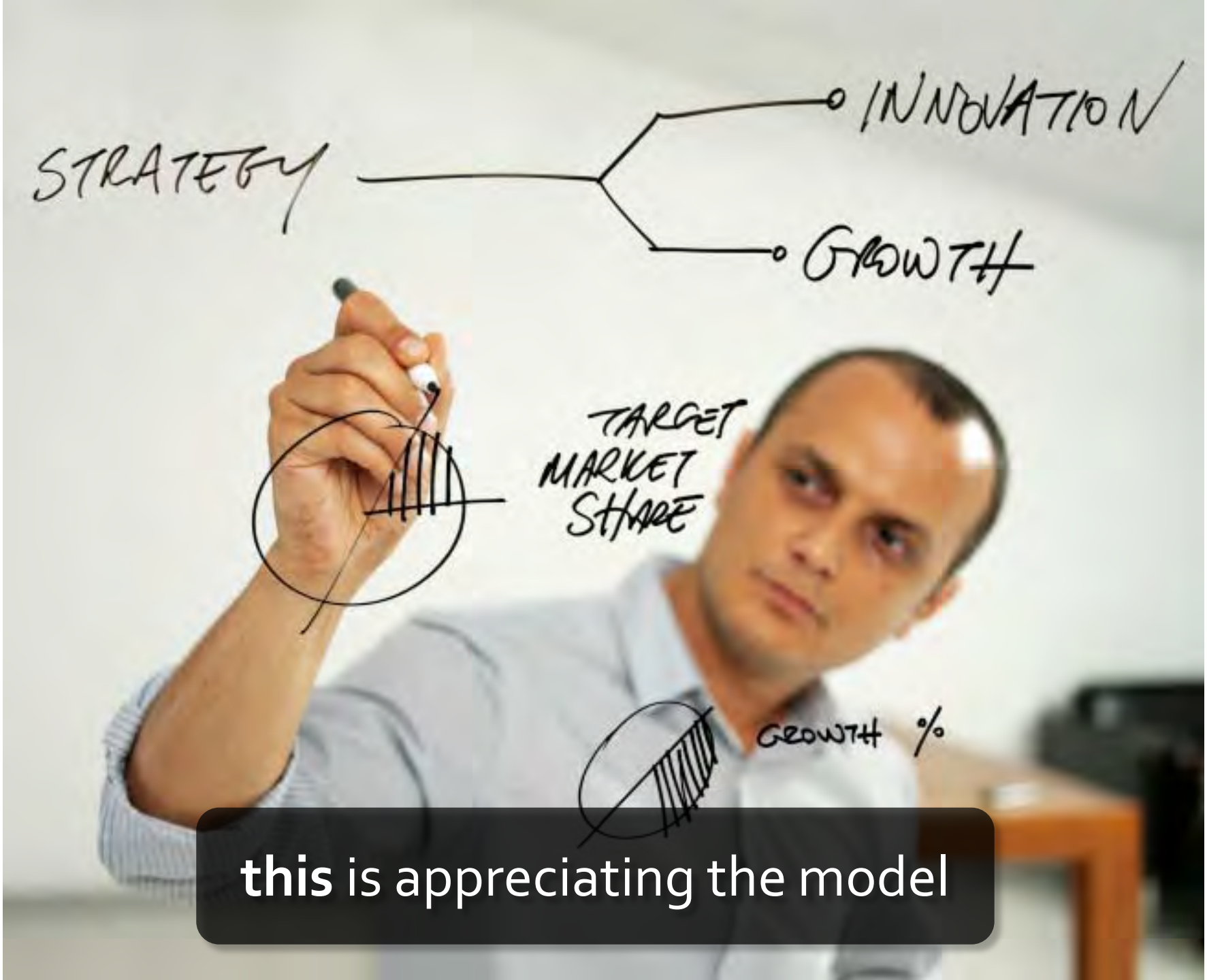


…that a **project manager** might value

Process development

Ensure that your process developers **appreciate** the model





this is appreciating the model

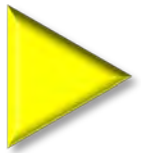

this is appreciating the model


this is appreciating the model

this is **not**



Involve people
that do
“real” work



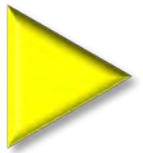
like **her**...




and **him**...


…but maybe **not him**

Use
project planning
to plan your
PI* project



*process improvement

Open the book

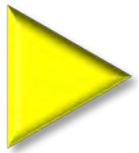
Specific Goal and Practice Summary

SG 1	Establish Estimates
SP 1.1	Estimate the Scope of the Project
SP 1.2	Establish Estimates of Work Product and Task Attributes
SP 1.3	Define Project Lifecycle Phases
SP 1.4	Estimate Effort and Cost
SG 2	Develop a Project Plan
SP 2.1	Establish the Budget and Schedule
SP 2.2	Identify Project Risks
SP 2.3	Plan Data Management
SP 2.4	Plan the Project's Resources
SP 2.5	Plan Needed Knowledge and Skills
SP 2.6	Plan Stakeholder Involvement
SP 2.7	Establish the Project Plan
SG 3	Obtain Commitment to the Plan
SP 3.1	Review Plans That Affect the Project
SP 3.2	Reconcile Work and Resource Levels
SP 3.3	Obtain Plan Commitment

...ices by Goal


Don’t estimate by pulling numbers out of…
…the air!

Develop **useful** tailoring guidance



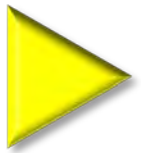

This seems **heavyweight** for my little project.
I'll create a plan from scratch.*
Project Plan Template
*and spend my time **figuring out how** to manage my project instead of **actually managing** it!


Perfect!
Large
Project
Plan
Template
> $100K
Small
Project
Plan
Template
< $100K



Process deployment

Don’t just
announce
the existence
of a **book**



Unless **this** is the reaction you want

Whatever.

I'll look at that stuff **when I have time**.





…is **not** a **deployment plan**

Try these things instead

Communicate

Train

Ensure Access

Learn

Schedule

Monitor

Guide

Pilot

Top 3 success factors
in an improvement initiative

1



senior leadership support

2



communication

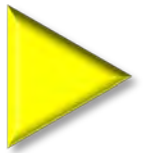
3



training
(of those impacted by the initiative)

Source: *The CMMI Success Factor Survey,* ACME Process Group, 2010

Caring
is better than
enforcing



This is not caring



But the project is **half over!**

You must follow the process.



This is caring



But the project is **half over!**

Okay, good point. Let's think about what would make sense here.

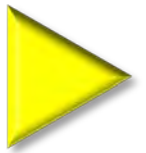




"Complying for compliance's sake **ravages** the operation and firmly entrenches **self-defeating** cycles of continued **mediocrity**."

Hillel Glazer,
High Performance Operations

Don't
change the rules
on a project that's
already been
planned



…unless you're willing to toss



OR



OR



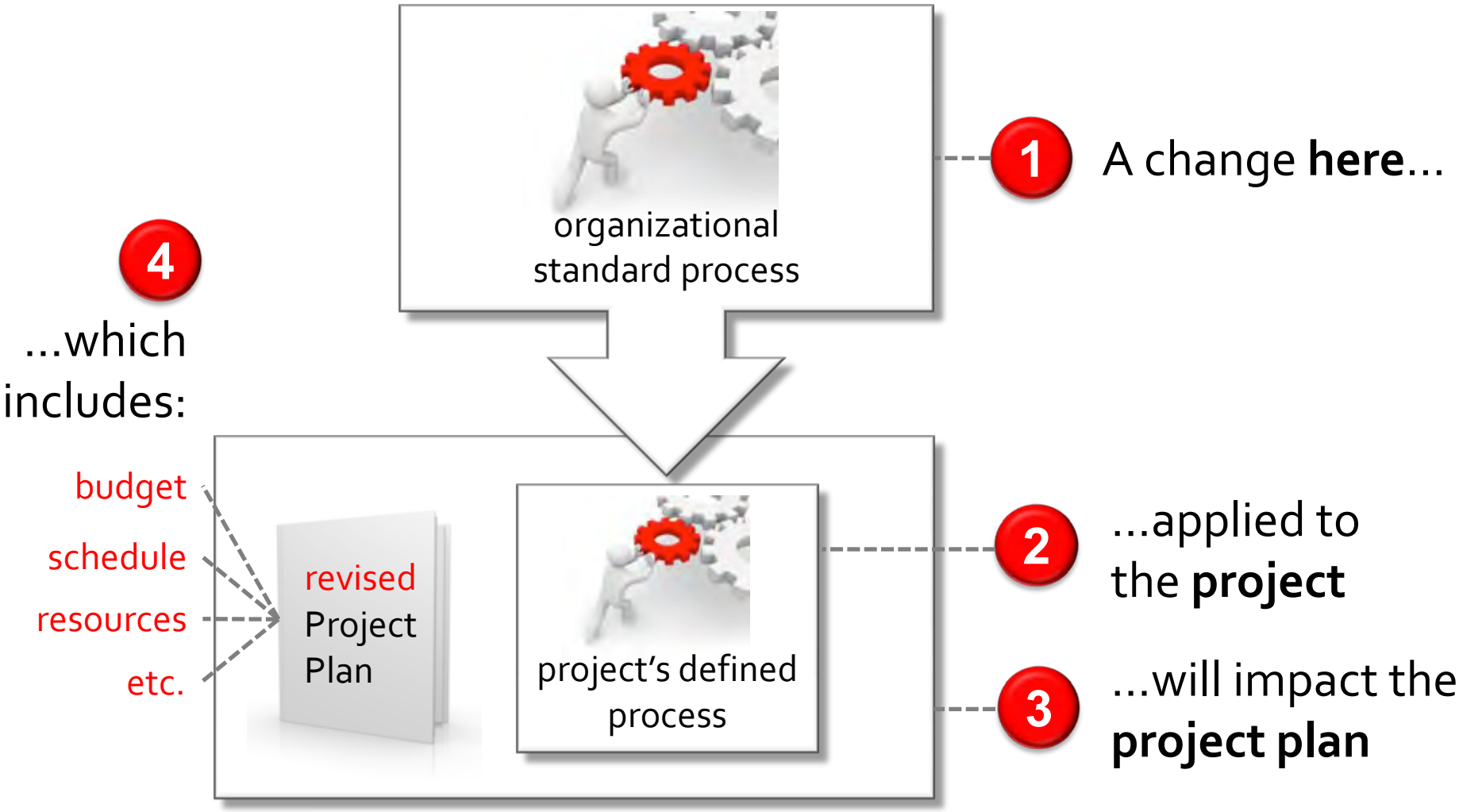
cost schedule quality

out the…



why?

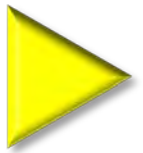
A process change = a plan change





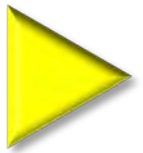
Appraisals

Hire an appraiser with a **business value** mindset




Again...
maybe **not him**

Don’t
under-estimate
the cost of
evidence collection



Average **total*** effort

2500-3000 hours

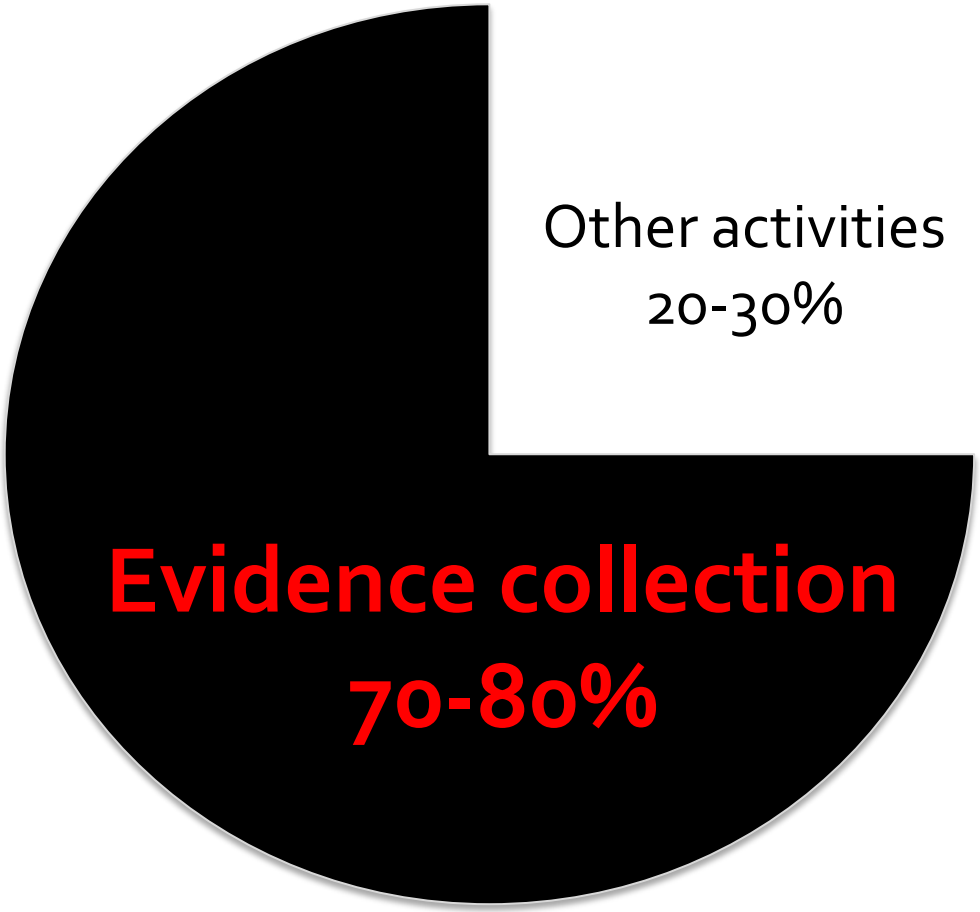
for **small**** ML 3 appraisals

*all appraisal activities, including but not limited to evidence collection

**2 projects, 6 team members + Lead, first appraisal at ML 3, CMMI SE/SW v1.1

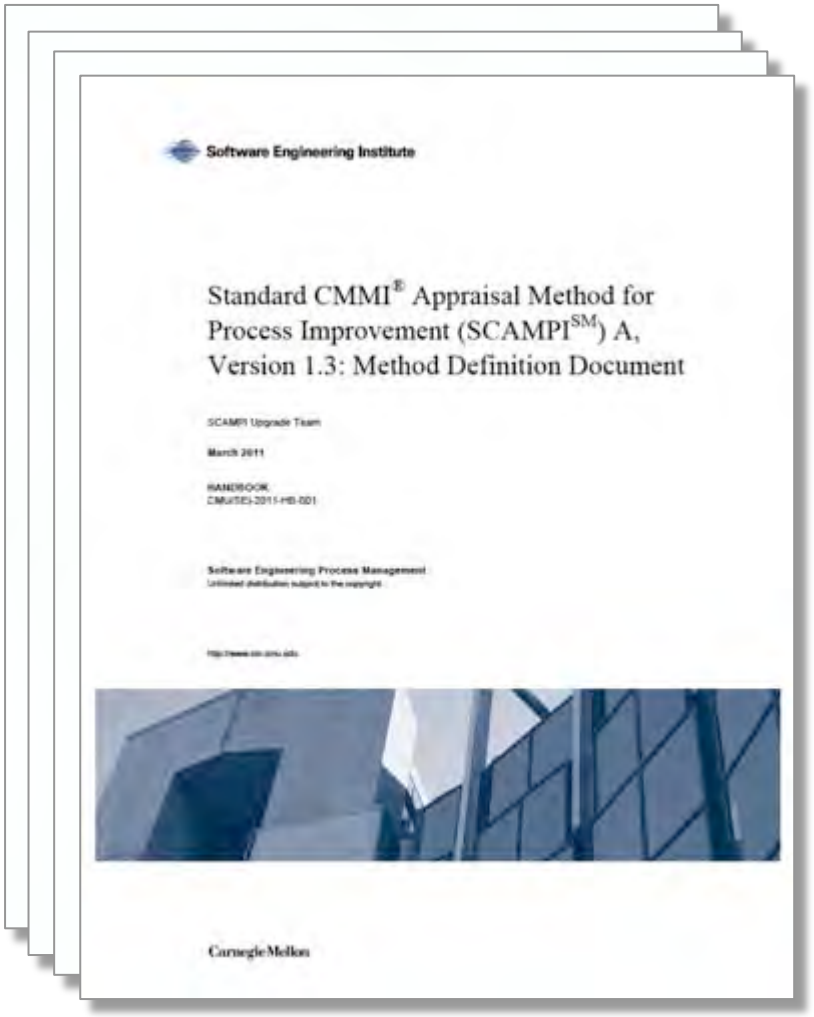
Source: *Value-Based CMMI Appraisal Techniques,* Systems and Software Consortium Inc., 2006

Total appraisal effort



Source: *Value-Based CMMI Appraisal Techniques*, Systems and Software Consortium, 2006

SCAMPI v1.3 may help with this a bit…



But you still need to clearly identify…





1 Process development

Ensure that your process developers **appreciate** the model

Involve people that do **"real" work**

Use **project planning** to plan your PI project

Develop **useful** tailoring guidance



2 Process deployment

Don't just announce the existence of a **book**

Caring is better than **enforcing**

Don't **change the rules** on a project that's already been **planned**



3 Appraisals

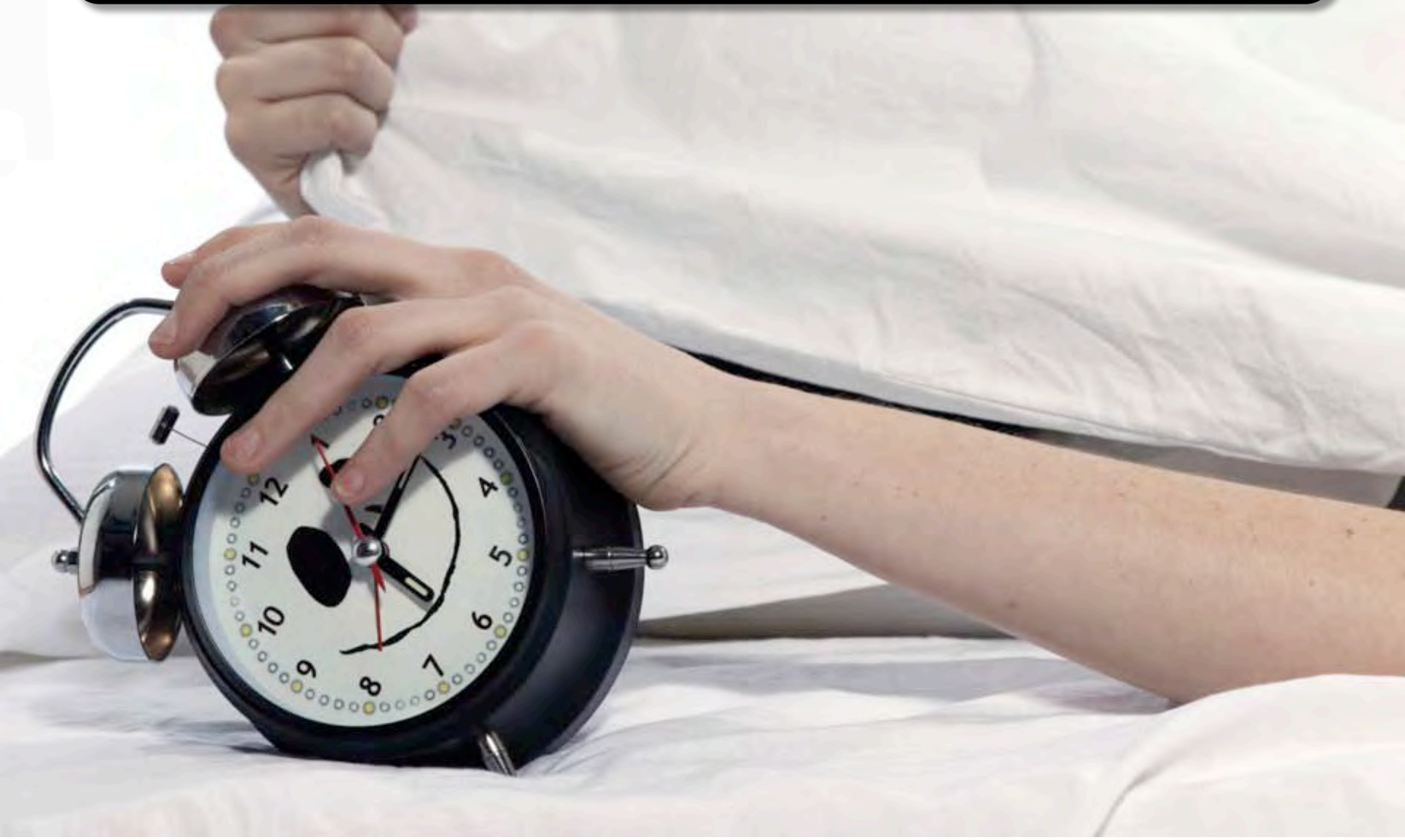
Hire an appraiser with a **business value** mindset

Don't under-estimate the cost of **evidence collection**

Super.

But whatever happened to Pam?

She wakes up one morning and…



realizes her CMMI® experience was all…

Just a bad dream!!



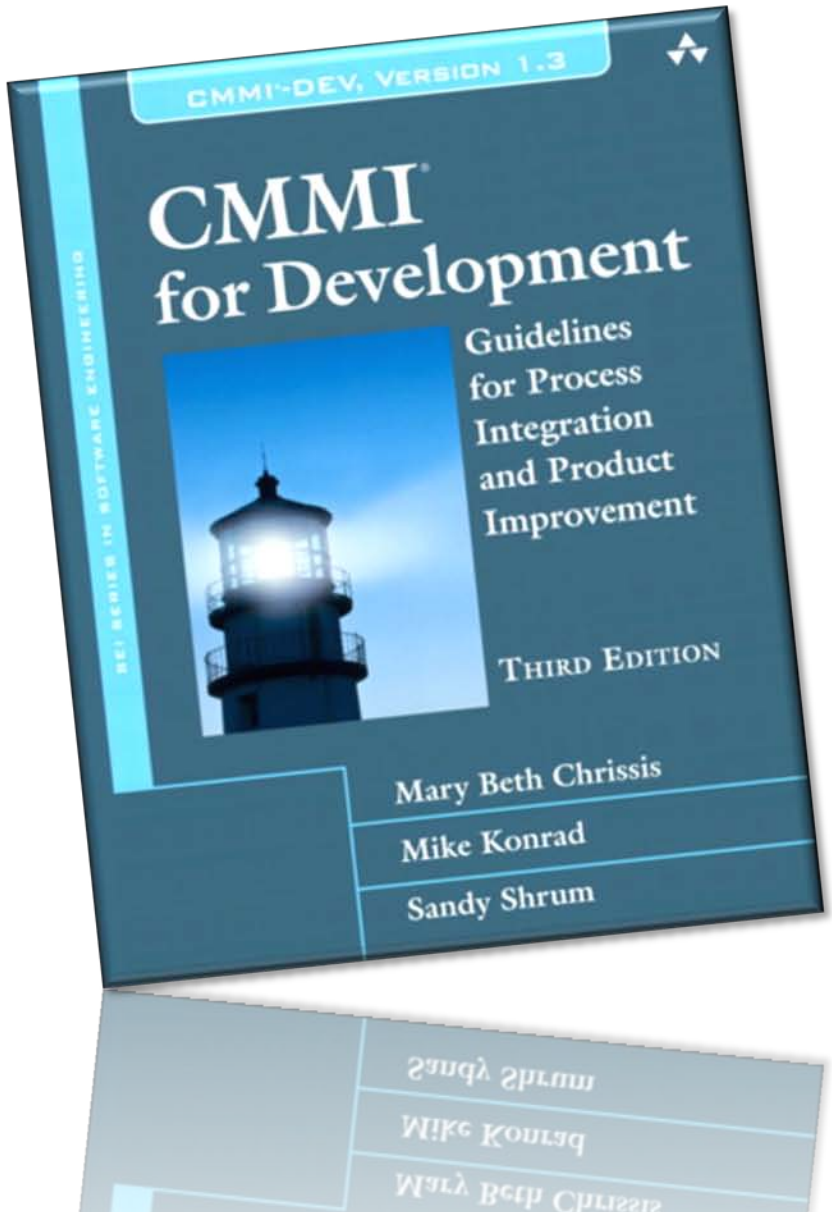
so she grabs some…



and heads
off to…



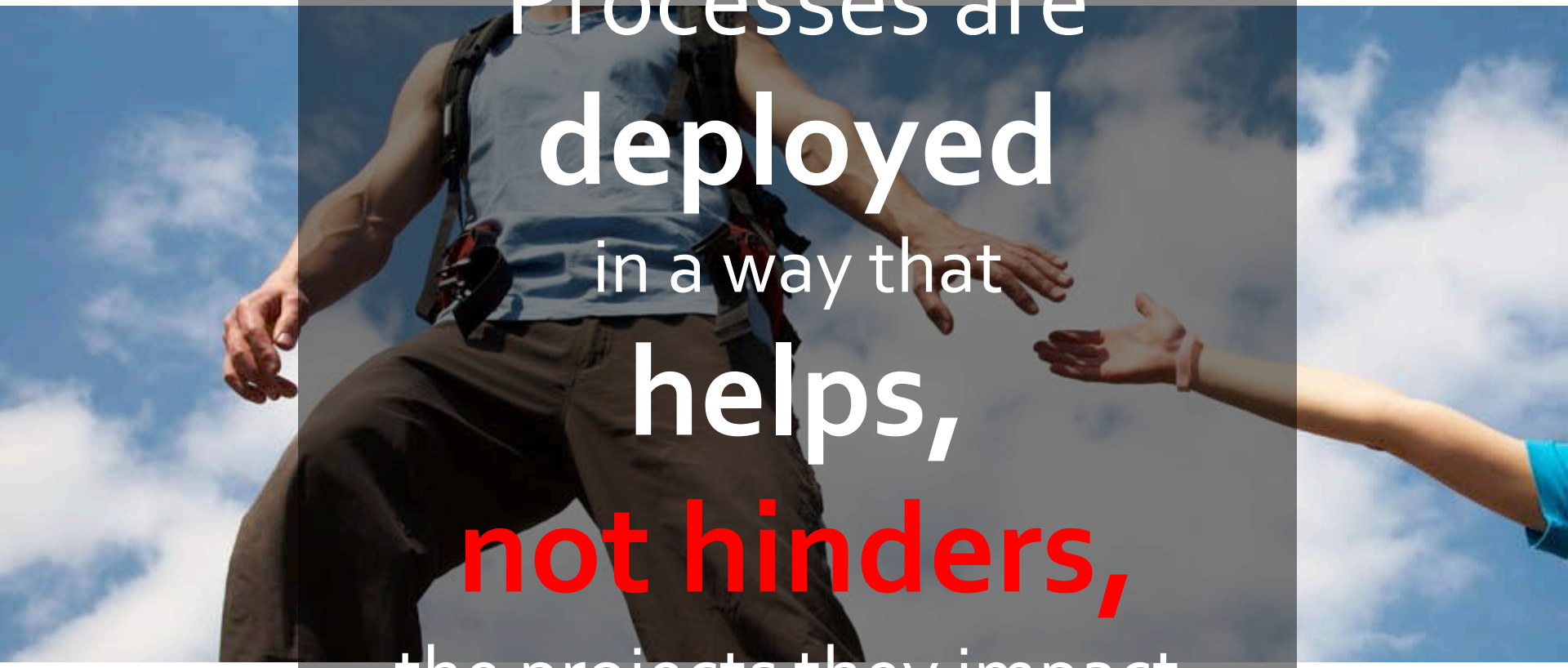
where...


CMMI-DEV, VERSION 1.3
SEI SERIES IN SOFTWARE ENGINEERING
CMMI®
for Development
Guidelines
for Process
Integration
and Product
Improvement
THIRD EDITION
Mary Beth Chrissis
Mike Konrad
Sandy Shrum

is used, but…

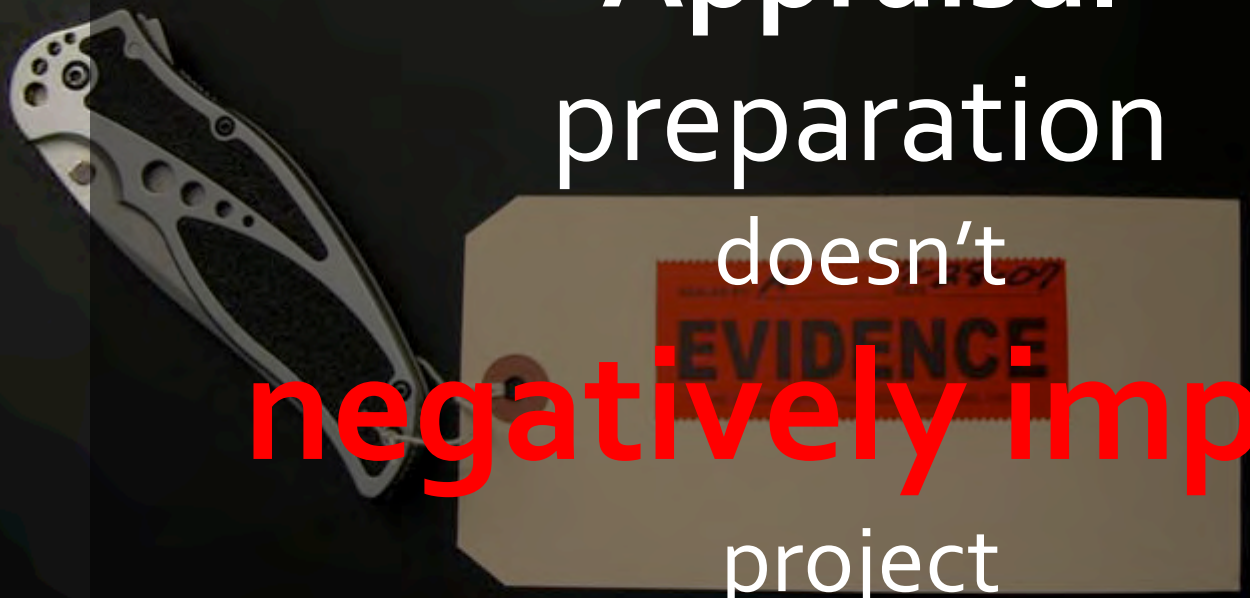

1
Compliance
doesn't
get in the way
of developing processes that
improve
operations.

2



Processes are
deployed
in a way that
helps,
not hinders,
the projects they impact.

3



Appraisal
preparation
doesn't
negatively impact
project
progress.

and much to
Pam's delight…


Her boyfriend still has abs!


Pam's
happy!

and all I ask
of you is to…


STOP

Please stop the

mindless bureaucracy

and instead use the CMMI® to

legitimately improve

your operations.

References

- ***The 2010 CMMI Success Factor Survey.*** Vienna VA: ACME Process Group, November 2010.
- Caldwell, Laura, Sam Fogle, and Gene Jorgensen. ***Value-Based CMMI Appraisal Techniques.*** Version 01.00. Herndon VA: Systems and Software Consortium, 2006.
- Chrissis, Mary Beth, Mike Konrad, and Sandy Shrum. ***CMMI for Development: Guidelines for Process Integration and Product Improvement.*** 3rd ed. Boston: Addison Wesley, 2011.
- Glazer, Hillel. ***High Performance Operations: Leverage Compliance to Lower Costs, Increase Profits, and Gain Competitive Advantage.*** 1st ed. Upper Saddle River NJ: FT Press, 2012:31.
- ***Standard CMMI Appraisal Method for Process Improvement (SCAMPI) A, Version 1.3: Method Description Document.*** Pittsburgh: Software Engineering Institute, March 2011.



Leading Edge PROCESS CONSULTANTS LLC

SEI Partner

Rock'n CMMI Training ...and Appraisals!



Bill Smith



Mary Segnit

More info?

bill@cmmitraining.com
www.CmmiTraining.com

Leading Edge PROCESS CONSULTANTS LLC

SEI Partner

Questions from the Trenches

What Over 1000 Students Want to Know Most About the CMMI®



Bill Smith CEO
Leading Edge Process Consultants LLC
www.CmmiTraining.com

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Ground rules



10:30 – 11:15



at the end

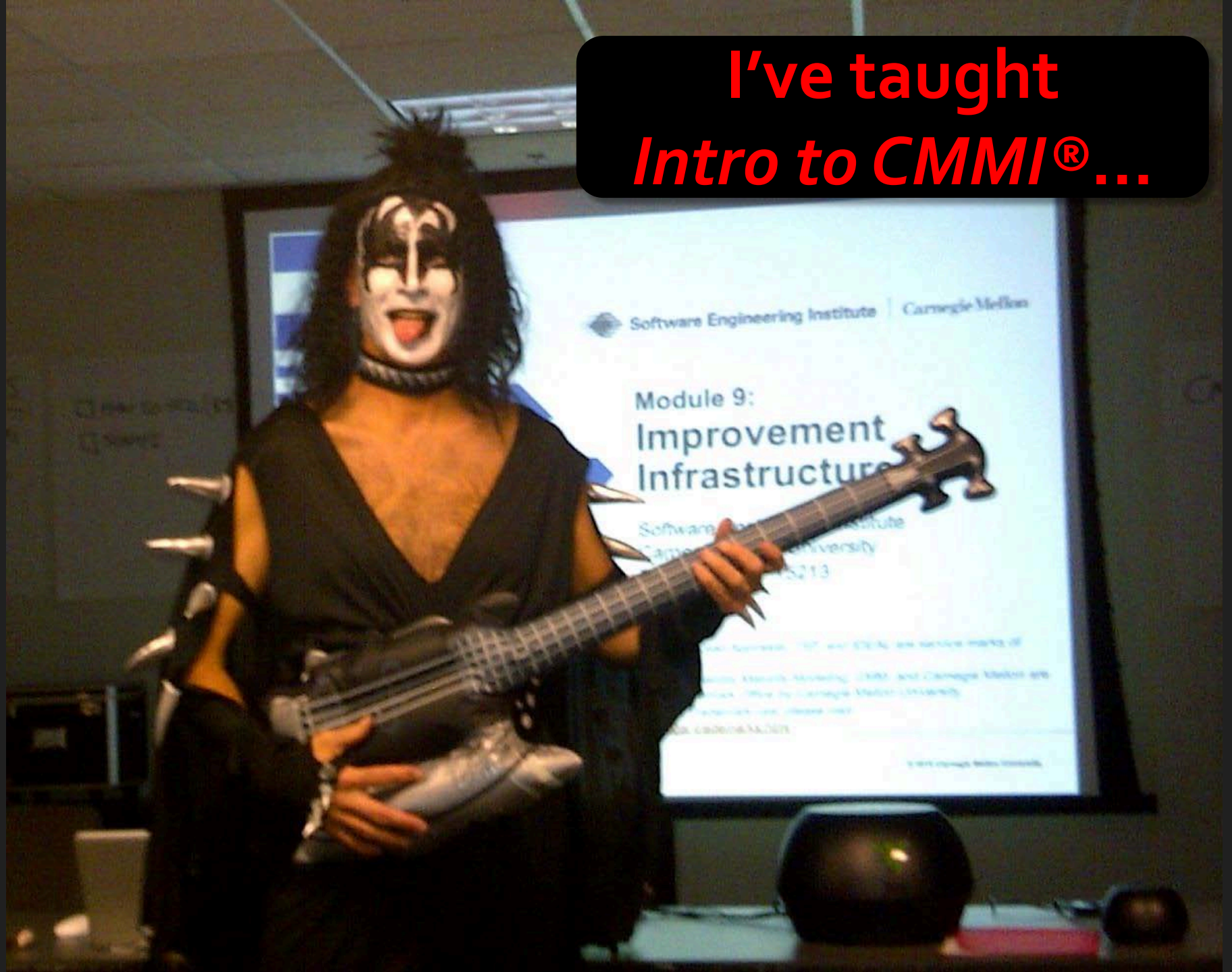


set to **stun**

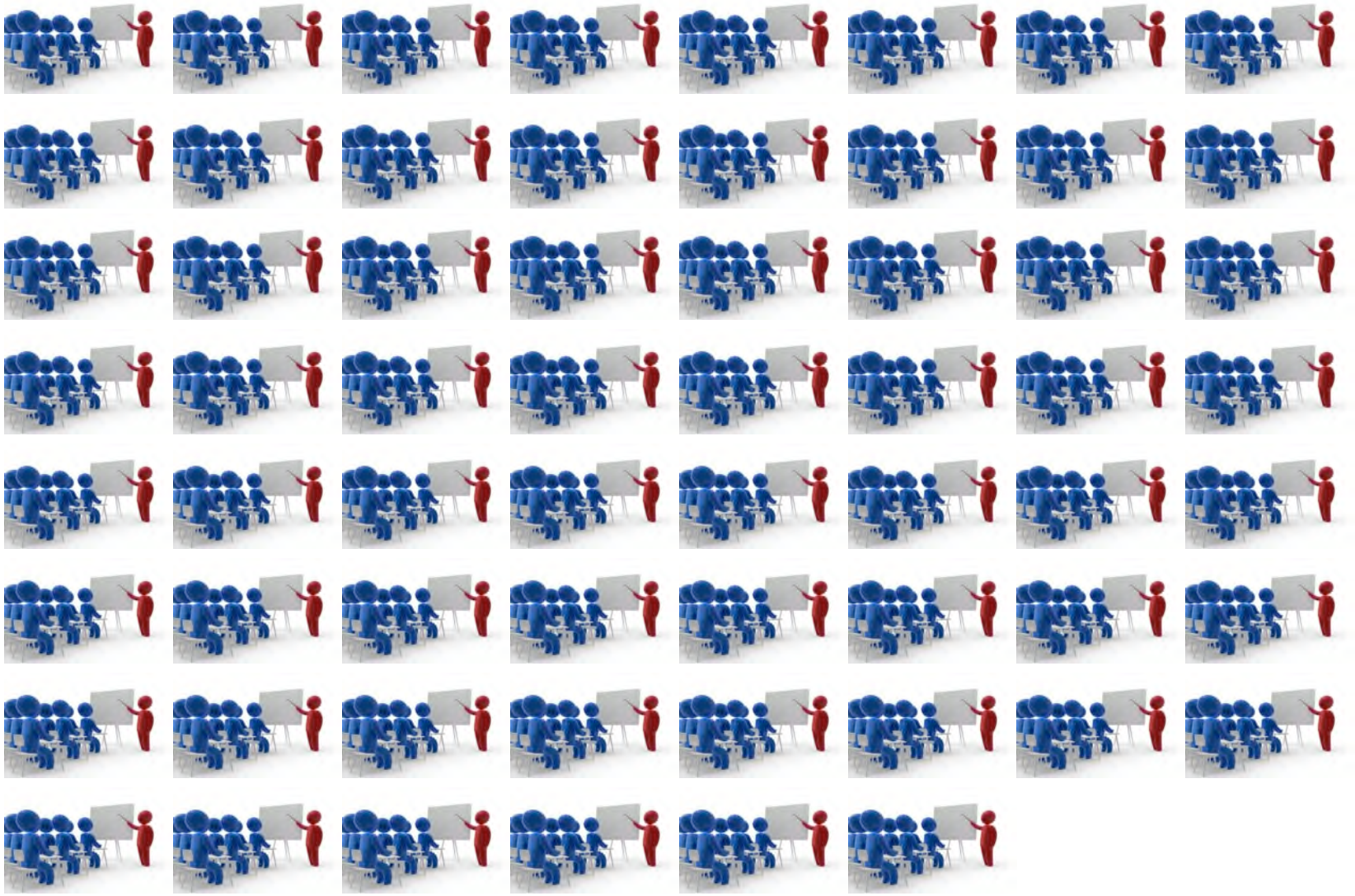
and **yes**
I have...


Flying Monkeys!
Matthew

Who am I?


I've taught
Intro to CMMI®...
Software Engineering Institute | Carnegie Mellon
Module 9:
Improvement
Infrastructure

62 times, to 1102 students



1102

>

The number
of hours
Lindsay Lohan
has spent
in court!



In class, I've been asked 100's of…



Some before class even starts…

Does your class have a **dress code**?



Obviously not.



I'll be presenting

a sampling of

those questions

with help from…

Some of my favorite students!

- **Vishal Agarwal**; Project Manager; REI Systems Inc.
- **Bill Altman**; Principal Engineer; SCRA/ATI
- **Dale Bingham**; Director of Quality Management; PSI Pax
- **Susan Carlson**; SVP & Chief Operating Officer; A+ Government Solutions
- **Matthew Carney**; IT Specialist; U.S. Department of Education
- **Judy Engle**, PHR; HR Manager; Tribalco, LLC
- **Gayle Giblin**; Industry Standards Lead; IBM
- **Tim Gollner**; Quality Manager, HES Director; G&B Solutions
- **Ned Gubbi**; Quality Manager, Sunhillo Corporation
- **Sharon Howington**; Technical Writer; SMS Data Product Group, Inc.
- **Sandra Kinsey**; PI/QA Engineer; Primus ASRC
- **Erika Kohnke**; Staff Tech, Inc.
- **David Kresheck**; Senior CMMI Specialist; CGI
- **Andy Lisko**; Mgr IT Processes, Quality & Compliance; United Illuminating
- **Mike Mezeul**; Sr. Director, Adva Optical Networking, Inc.
- **Shannon Quinn**; Quality Management Specialist; Delta Solutions and Technologies
- **Felicia Stuckey**; Principal Strategist; Visions Strategic Marketing
- **Will Swann**; Director; Technatomy Corporation
- **Lindsey Swanson**; Society for Human Resource Management
- **Bob Swenson**; Director of Quality; C-Far Services

From some very cool organizations

- **Vishal Agarwal**; Project Manager; **REI Systems**
- **Bill Altman**; Principal Engineer; **SCRA/ATI**
- **Dale Bingham**; Director of Quality Management; **PSI Pax**
- **Susan Carlson**; SVP & Chief Operating Officer; **A+ Government Solutions**
- **Matthew Carney**; IT Specialist; **U.S. Department of Education**
- **Judy Engle**, PHR; HR Manager; **Tribalco, LLC**
- **Gayle Giblin**; Industry Standards Lead; **IBM**
- **Tim Gollner**; Quality Manager, HES Director; **G&B Solutions**
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- **Will Swann**; Director; **Technatomy Corporation**
- **Lindsey Swanson**; **Society for Human Resource Management**
- **Bob Swenson**; Director of Quality; **C-Far Services**

who’ve given me…


Where Do Insects Live?

A mild disclaimer

In this presentation, I'll associate each student with a question that I've actually been asked in class. In most cases, **that specific student** did not ask **that specific question**…

except for Susan…


I have an **important meeting** on Thursday. Is it okay if I miss part of class?
Susan

No problem.

I'll just give you a

make-up

assignment


I have a brand new SUV…
APR
VIRGINIA
12
CMMI ROX
…that could really use a nice hand-waxing!

Let’s get started

Why do you think **requirements** are so hard to get right?



So many reasons!
Here's one: the English language…

...and write
"Happy Birthday"
on the sides.



Happy Birthday Orsides

If you can mess up
the requirements for
what to write on
a birthday cake
is it any wonder
we can have problems with



…harder things?

Speaking of requirements, why is **REQM at ML2**, when RD is at ML3?



I wasn’t at that meeting, but…

When considering the PAs that are at

ML2 vs. ML3

don't think

What comes first in the life cycle.

Think

Level of risk to a project.

Scope creep is a major risk.

Scope creep: a quick example

Can you take out the **trash**, hun?



Sure, no problem!

The next morning…

Did you take out the **recycling**?



Scope creep!

So, wouldn't the best **validation** environment always be the **operational** environment?



No.

Say you're developing **ruggedized equipment** that must…



survive high temperatures…



…and sandstorms

You could just…


find a convenient desert…

sit there...



and wait…



for days… weeks… months…

for your target temperature…



And when that

special day arrives

and it's

finally 130 degrees

and your equipment works

and you're ready to leave

and you

showered for the first time in 60 days,

you realize

you can't go home

because…


You still need
a freakin'
sandstorm!

Or you could just…

stick the equipment in an **oven**…





…and throw **sand** at it

(An oversimplification, of course. But you get the point.)

The

operational environment

may not provide you with all the

environmental characteristics

you want to test, in a

reasonable timeframe

at a

practical cost.

I'm a DJ. One of my buddies attended your class and said you applied DAR to **selecting music**. Really?



Glad you asked…

A jukebox for the basement!

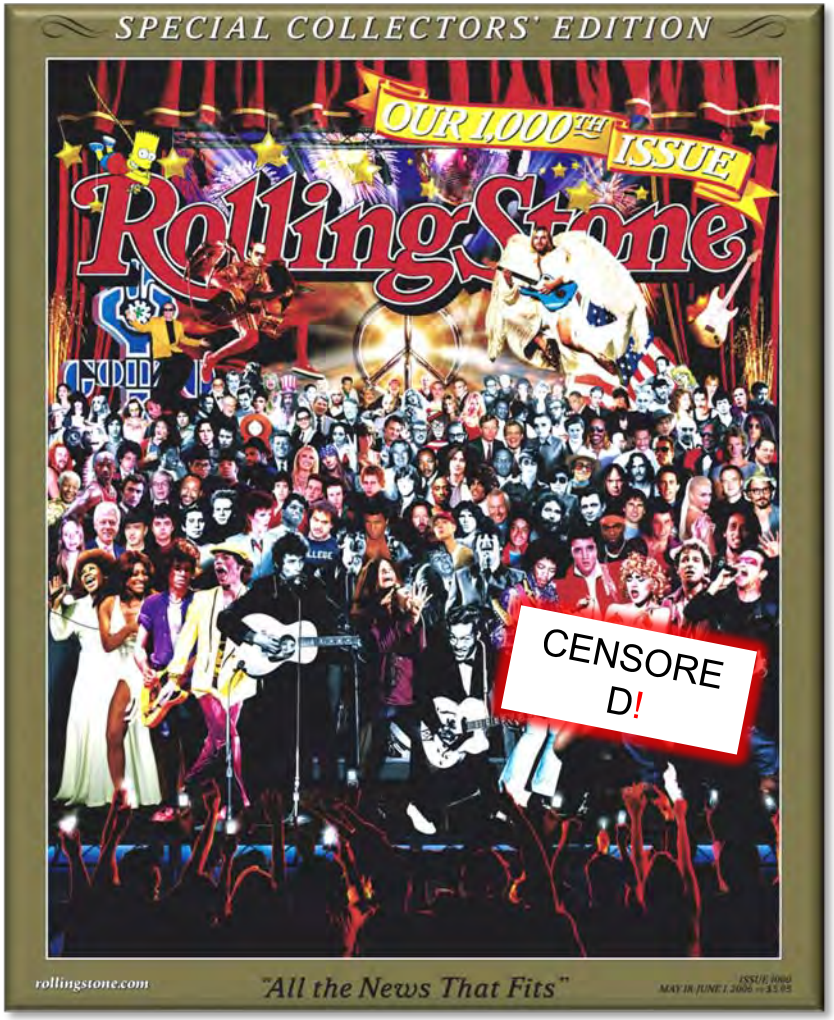
The situation:

- I targeted a retro-style, CD-playing **jukebox** for my basement
- The **capacity** is 100 CDs
- 50 CDs will be dedicated to **classic rock** artists – one CD of each artist's best songs

Which 50 artists should have a CD in my jukebox?



Identify candidate artists



I searched through lists for potential artists:

- Rock & Roll **Hall of Fame** inductees
- ***Rolling Stone*** Magazine
  - "100 Greatest Artists"
  - Cover of 1000th issue

DAR

SP 1.3

Identify Alternative Solutions

Determine the evaluation criteria

I decided:

*which **criteria** were important*

*how **important** each was*

*how I'd **measure** each*

Critical Acclaim	Popularity	My Taste
		
• *Rolling Stone* Magazine ranking • Rock & Roll HOF? • Cover of *Rolling Stone* #1000?	• *Billboard* magazine singles ranking • RIAA* album sales	• #of 5-star songs

DAR

SP 1.2

Establish Evaluation Criteria

Establish the evaluation method

DAR
SP 1.4
Select Evaluation Methods

I decided how to combine all this information…

Artist	Critical Acclaim 30%				Popularity 30%			My Taste 40%		Total (0 to 1)
	Rock and Roll Hall of Fame? (Thru 2006)	Cover of Rolling Stone Magazine #1000? (5/18/06)	Rolling Stone Magazine Ranking (4/15/04, 4/21/05)	**Points (0 to 1)**	Billboard Magazine Singles Ranking (Thru 12/27/03)	RIAA Album Sales (Millions, Thru 7/31/06)	**Points (0 to 1)**	Number of 5-Star Songs (My Ratings, 20 Max)	Points (0 to 1)	

…including the formulas that I'd use to derive each artist's final rating

Perform the evaluation



I ended up with a sorted list of over 200 artists.

Artist	Critical Acclaim 30%				Popularity 30%			My Taste 40%		Total (0 to 1)
	Rock and Roll Hall of Fame? (Thru 2006)	Cover of Rolling Stone Magazine #1000? (5/18/06)	Rolling Stone Magazine Ranking (4/15/04, 4/21/05)	Points (0 to 1)	Billboard Magazine Singles Ranking (Thru 12/27/03)	RIAA Album Sales (Millions, Thru 7/31/06)	Points (0 to 1)	Number of 5-Star Songs (My Ratings, 20 Max)	Points (0 to 1)	
The Beatles	•	•	1	1.00	2	169.5	1.00	20	1.00	1.00
Elvis Presley	•	•	3	.97	1	118.5	0.88	20	1.00	0.95
The Rolling Stones	•	•	4	.95	9	65.5	0.69	20	1.00	0.89
Led Zeppelin	•	•	14	.81		109.5	0.60	20	1.00	0.82
Bob Dylan	•	•	2	.98		36.0	0.35	20	1.00	0.80
The Beach Boys	•	•	12	.83	20	21.5	0.45	20	1.00	0.78
Stevie Wonder	•	•	15	.79	5	19.5	0.49	20	1.00	0.78
Michael Jackson	•	•	35	.55	6	60.5	0.68	20	1.00	0.77
Bruce Springsteen	•	•	23	.69	87	62.5	0.51	20	1.00	0.76
Prince	•	•	28	.63	21	39.5	0.54	20	1.00	0.75

Here are the Top 10.

My top 50 rock 'n roll artists

#	Artist	Pts.	#	Artist	Pts.	#	Artist	Pts.
1	The Beatles	1.00	18	Eric Clapton	0.64	35	CCR	0.51
2	Elvis Presley	0.95	19	Neil Young	0.64	36	Van Halen	0.50
3	The Rolling Stones	0.89	20	Aerosmith	0.64	37	Chuck Berry	0.49
4	Led Zeppelin	0.82	21	Rod Stewart	0.62	38	Bob Marley	0.49
5	Bob Dylan	0.80	22	Fleetwood Mac	0.60	39	Steely Dan	0.49
6	The Beach Boys	0.78	23	The Ramones	0.60	40	Simon & Garfunkel	0.48
7	Stevie Wonder	0.78	24	Jimi Hendrix	0.59	41	Sam Cooke	0.47
8	Michael Jackson	0.77	25	The Clash	0.58	42	The Temptations	0.46
9	Bruce Springsteen	0.76	26	Pink Floyd	0.58	43	Blondie	0.46
10	Prince	0.75	27	Marvin Gaye	0.57	44	Ray Charles	0.44
11	Elton John	0.74	28	The Police	0.57	45	AC/DC	0.43
12	Madonna	0.74	29	Bob Seger	0.56	46	The Supremes	0.43
13	U2	0.73	30	David Bowie	0.55	47	Queen	
14	The Who	0.66	31	Tom Petty	0.55	48	Eminem	
15	Billy Joel	0.66	32	The Doors	0.53	49	Boston	
16	The Eagles	0.66	33	John Mellencamp	0.52	50	Paul Simon	
17	Johnny Cash	0.66	34	Journey	0.52			



My top 50 rock 'n roll artists

#	Artist	Pts.	#	Artist	Pts.	#	Artist	Pts.
				Eric C				0.51
				Neil Y				0.50
				Aero				0.49
				Rod				0.49
				Flee				0.49
				The			nkel	0.48
				Jim				0.47
				Th			ns	0.46
				Pir				0.46
				M				0.44
								0.43
1							s	0.43
1								
1								
15								
16		0.66	33	J				
17	Johnny Cash	0.66	34	Journey	0.52			

CHANGE REQUEST

Originator
CMMI Student

Description of Proposed Change
Eminem!?
How about Metallica instead?

Rationale
Metallica rocks!

Disposition



CHANGE REQUEST

Originator
Mrs. K. Smith

Description of Proposed Change
Please add Barbra Streisand.

Rationale
It's *my* basement, too.

Disposition



Per 2001 agreement

DAR
SP 1.6
Select Solutions

Can you do a quick walkthrough of the **engineering PAs** again?



No problem, Tim.

The following slides use

graphics

I've adapted from

"How Projects Really Work"

available at

www.projectcartoon.com


What the customer
really needed
www.projectcartoon.com

RD

SP 1.1

Elicit Needs







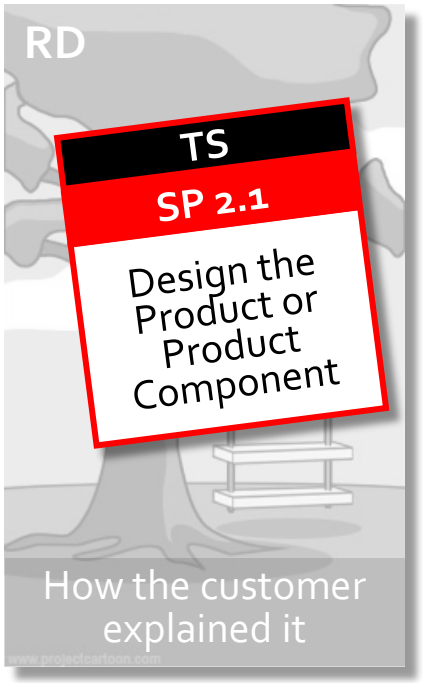


RD

SP 2.1

Establish Product and Product Component Requirements




RD
TS
SP 2.1
Design the Product or Product Component
How the customer explained it


RD


Technical Solution
How the analyst designed it

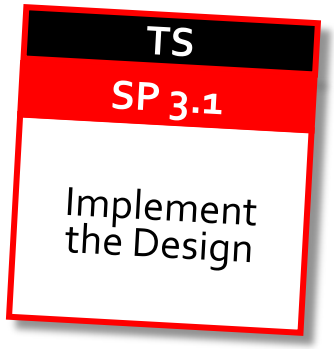

What the customer really needed


RD
How the customer explained it

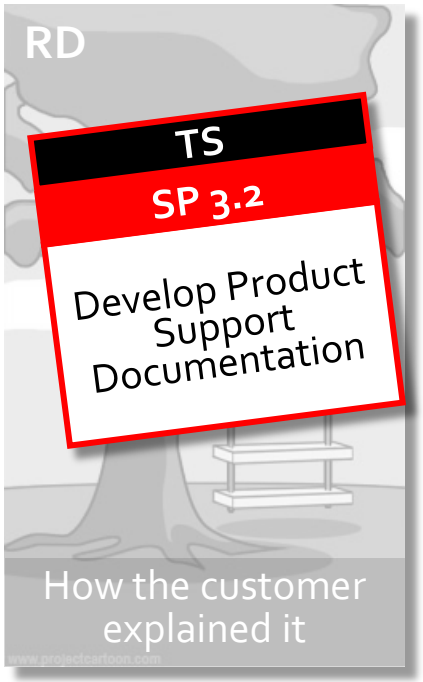

RD


TS

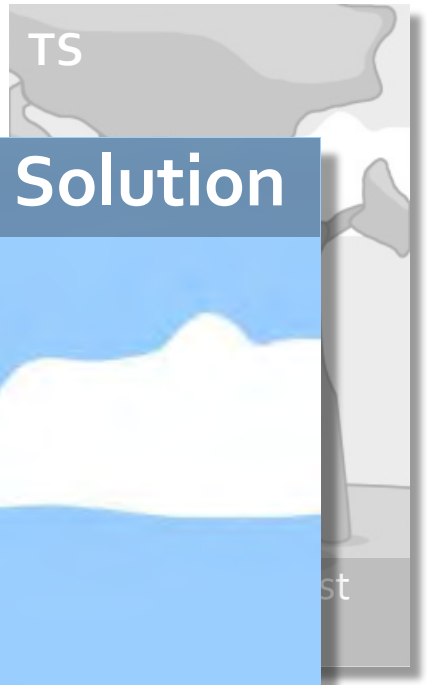

Technical Solution
How the programmer wrote it


TS
SP 3.1
Implement the Design

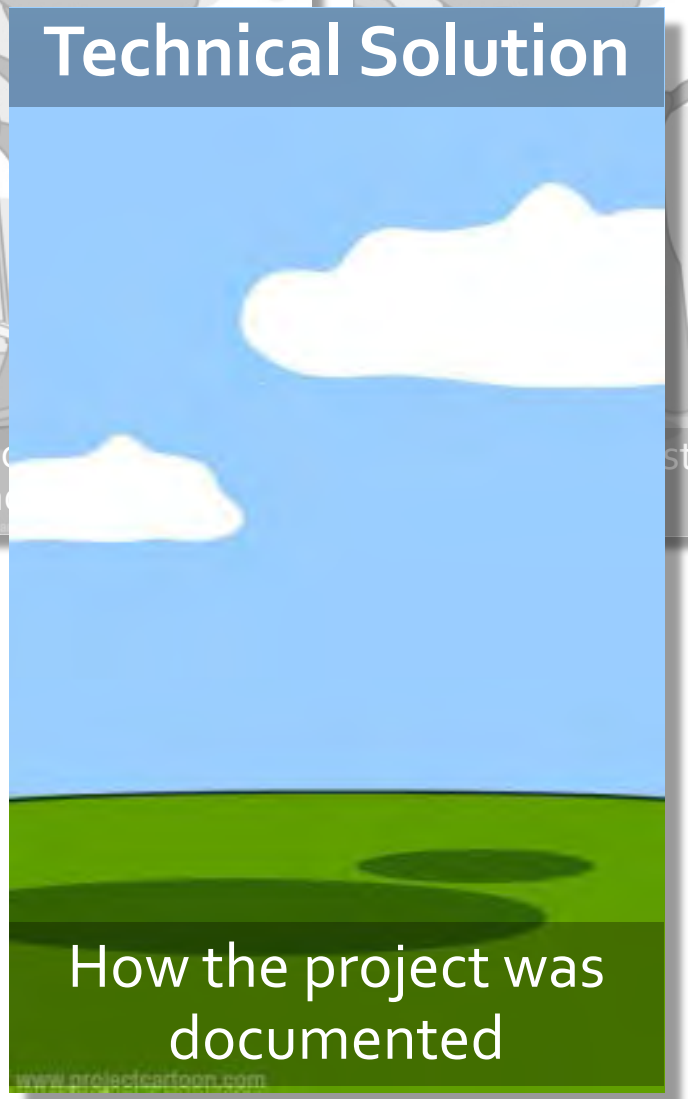

What the customer really needed


RD
TS
SP 3.2
Develop Product Support Documentation
How the customer explained it


RD


TS


TS
How the programmer wrote it


Technical Solution
How the project was documented


What the customer really needed

RD

How the customer explained it

RD

TS

TS

VAL

SP 2.1

Perform Validation

How the programmer wrote it

Validation



How it performed under stress

TS

How the project was documented

What the customer really needed

RD

PI

SP 3.4

Package and Deliver the Product or Product Component

How the customer explained it

RD

How

lea

TS

st

TS

How the programmer wrote it

Product Integration



What operations installed

TS

How the project was documented

VAL

How it performed under stress

What the customer really needed


RD
How the customer explained it


RD
How the project leader understood it


TS
How the analyst designed it

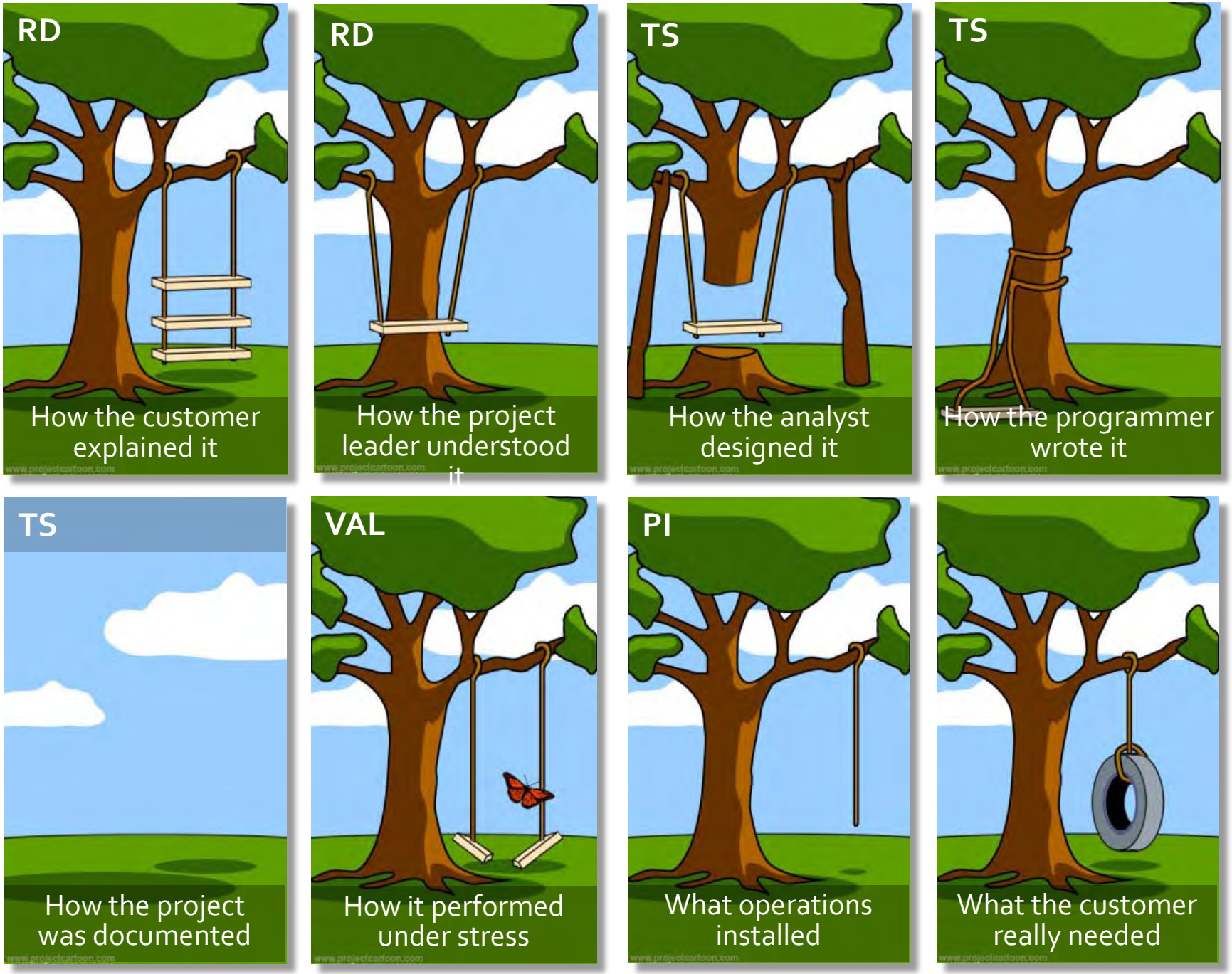

TS
How the programmer wrote it


TS
How the project was documented

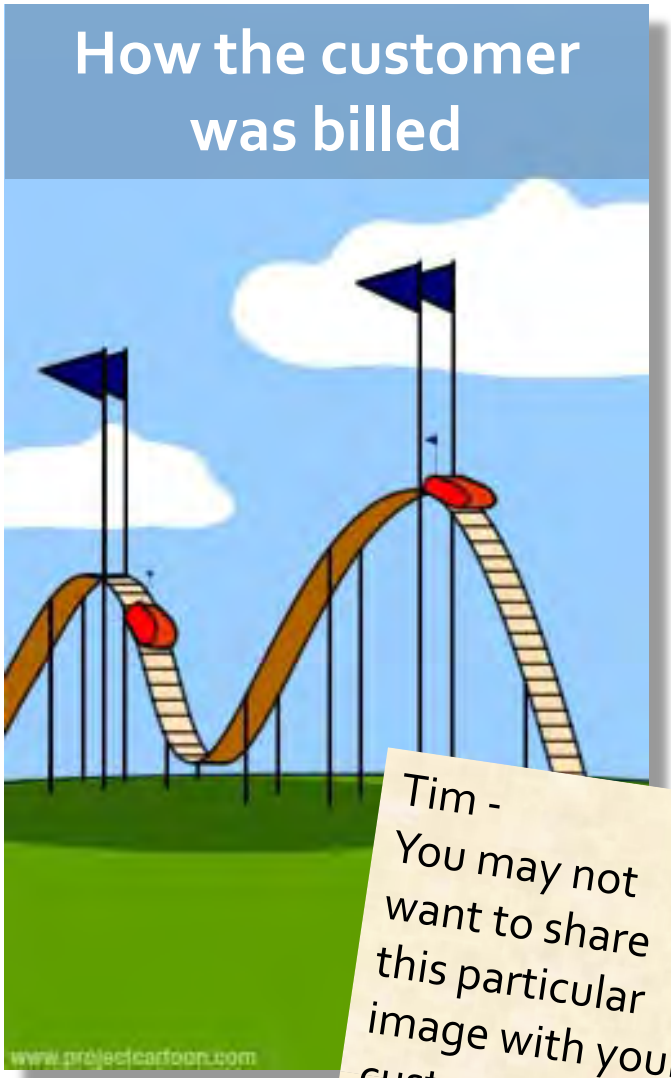

VAL
How it performed under stress


PI
What operations installed


What the customer really needed


RD
How the customer explained it
RD
How the project leader understood it
TS
How the analyst designed it
TS
How the programmer wrote it
TS
How the project was documented
VAL
How it performed under stress
PI
What operations installed
What the customer really needed





Tim -
You may not want to share this particular image with your customers.

- Bill

You said **institutionalization** is when you can say "that's the way we do things around here." Is that always *good*, though?



Excellent point, Lindsey!
Not always…

When you

institutionalize

processes,

they become

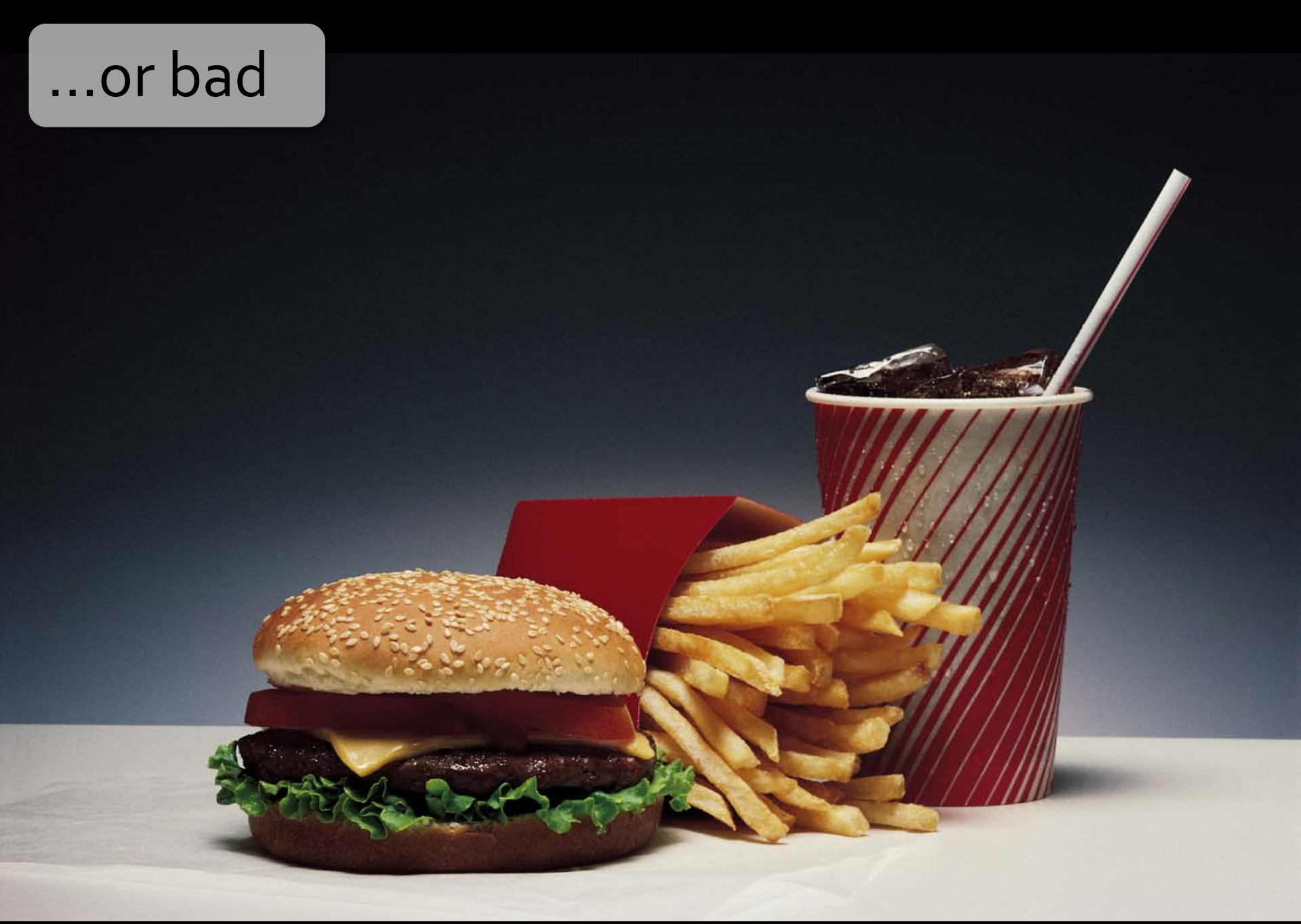
organizational

habits.

Habits can be good…



...or bad



You can
use the CMMI® to
create processes
that are
repeatably…


Stupid!

Just say no!

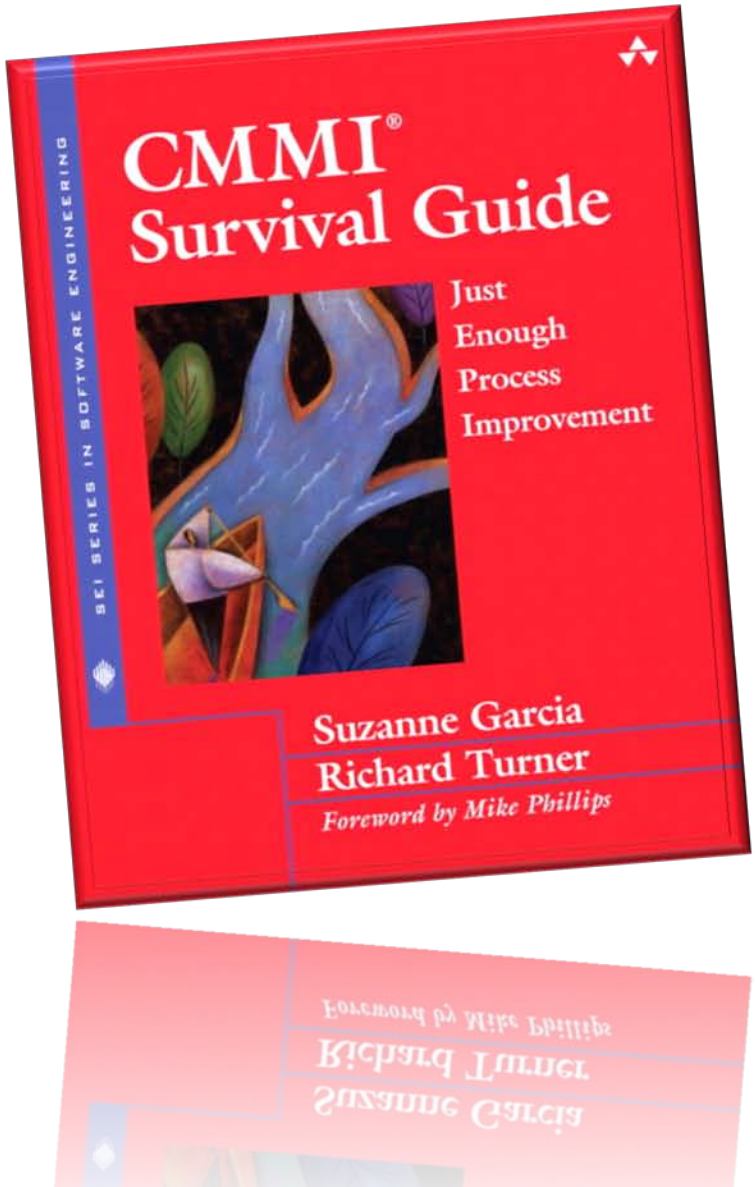
to bad processes

Check
out...

My 2010 NDIA CMMI® Conference Presentation



Or one of the many books written by…



…people much smarter than me!

Could you say a little more about the different types of **appraisals**?



This is not a class on appraisals, and I'm not a Lead Appraiser. But since we have a few extra minutes…

SCAMPI Fun


The next four slides are based on quotes from *CMMI SCAMPI Distilled: Appraisals for Process Improvement*. Ahern et al, Addison-Wesley, 2005.



Fat-Free SCAMPI

an appraisal in which the **objective evidence** presented to the team is **very thin**



All-You-Can-Eat SCAMPI

an
appraisal in
which the team
is swamped with
objective evidence for
every model subpractice

Chicken SCAMPI



an appraisal whose **lead appraiser** comes from within the **company being appraised**


Sushi SCAMPI
an appraisal whose results seem fishy

What are some characteristics of a **maturity level 1** organization?

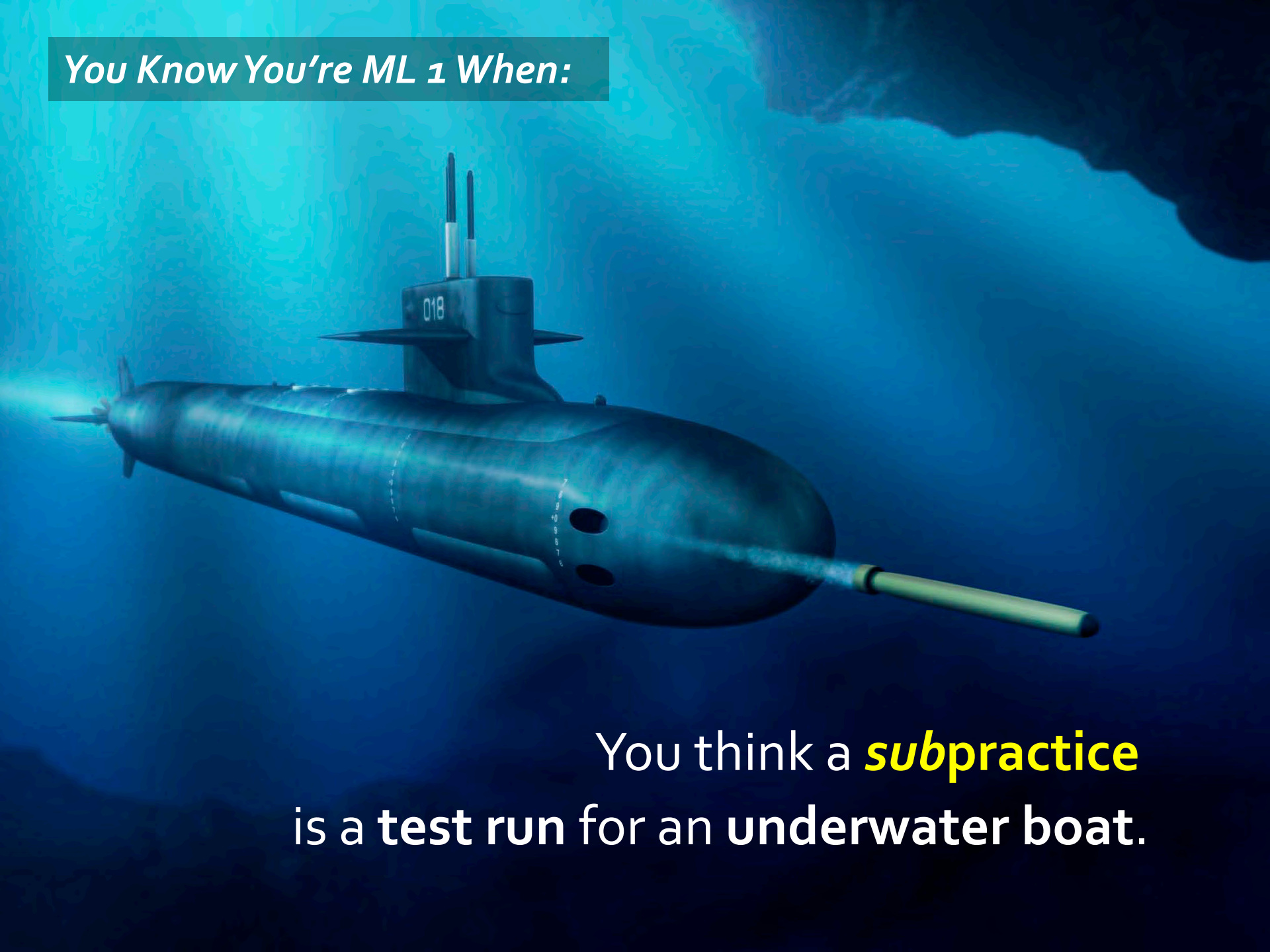


I thought you'd never ask.

Thanks, Dale,
for setting up…


The grand finale!

You Know You're ML 1 When:



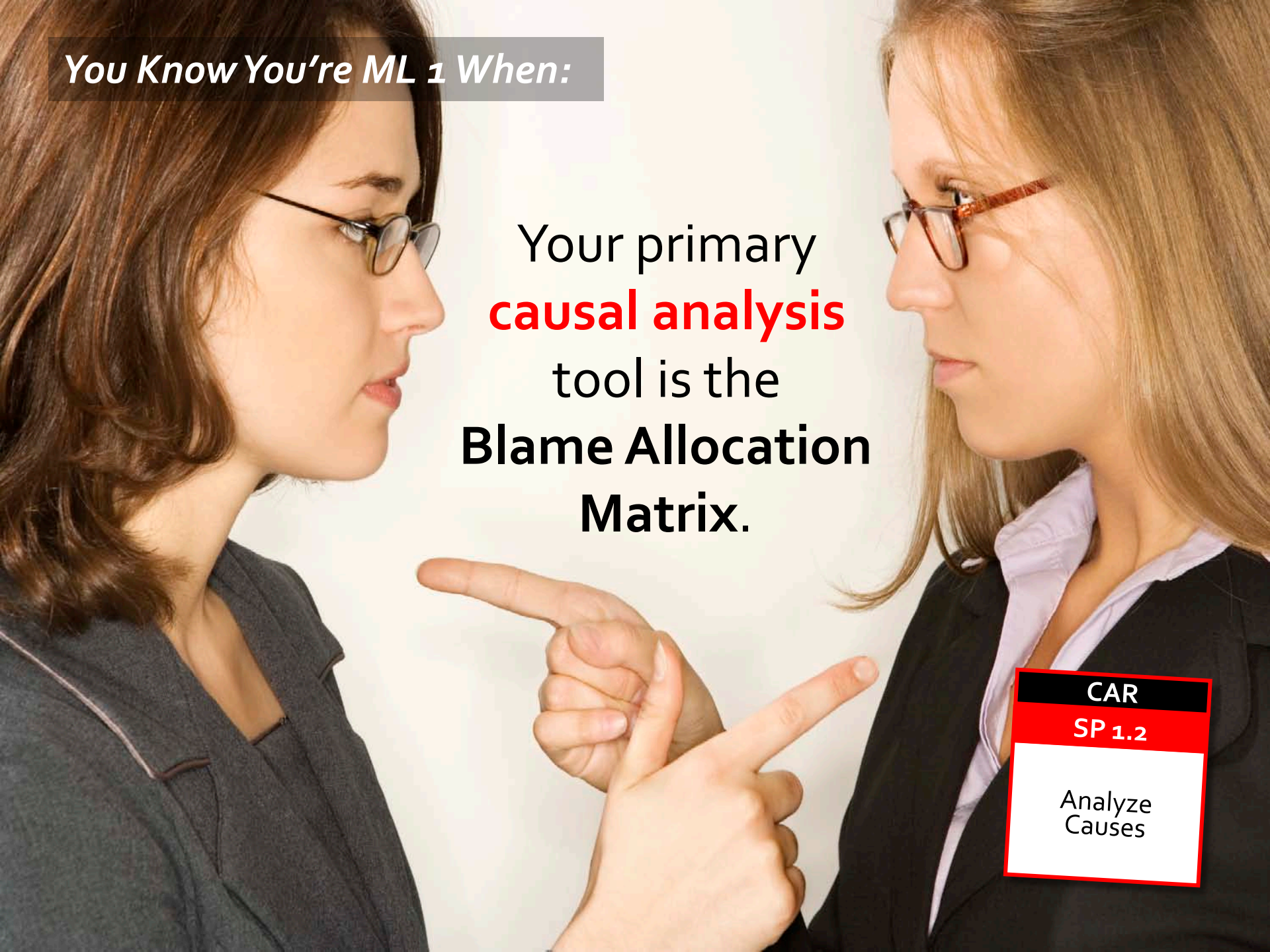
You think a ***sub*practice**
is a **test run** for an **underwater boat**.


You Know You're ML 1 When:
RD
SP 3.1
Establish Operational Concepts and Scenarios
You believe an operational scenario involves an ill-fitting gown that ties in the rear

You Know You're ML 1 When:

Your **integration procedures** use the phrase **"duct tape"** three or more times




You Know You're ML 1 When:
Your primary
causal analysis
tool is the
Blame Allocation
Matrix.
CAR
SP 1.2
Analyze
Causes

You Know You're ML 1 When:

DAR

SP 1.4

Select Evaluation Methods





Your formal **decision making** process typically involves a **chimpanzee**, a **dartboard**, and a six-pack of **beer**.

You Know You're ML 1 When:

You think a **maturity level** is something you attain when you're old enough to join the **AARP**



The End

(kinda)

Join me again *right here* at 2:15!



Leading Edge PROCESS CONSULTANTS LLC

SEI Partner

Rock'n CMMI Training …and Appraisals!



Bill Smith



Mary Segnit

More info?
bill@cmmitraining.com
www.CmmiTraining.com



or


Kate
Kim

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A Tale of Two Cultures

NDIA CMMI Conference – November 2011

Presenters:

Marie Johnson LOCKHEED MARTIN

Beth Layman LAYMAN & LAYMAN

Agenda

- Scope
- Two Cultures
- Architecture
- Appraisals
- Change Management
- Plan Forward

FDOC Overview

Mission Support Operations Contract

- Sustainment and Operations
  - Mission Control Center
  - Integrated Planning System
  - Houston Support Room – Moscow
  - Ground Systems Development Environment
  - Common Development Environment
- Operations Technology Facility Support

New

- Constellation Training Facility (CxTF)
- MCC and PAS for Cx

Space Program Operations Contract

- Shuttle System and Cargo Engineering and Integration
- Flight Element Processing
  - Orbiter
  - Solid Rocket Booster
  - Flight Software
  - External Tank
- Launch and Landing Operations
- Flight Operations
- Mission Control Center Automation System
- ISS MOD Avionics Reconfiguration System
- Day of Launch Initialization Load Update
- Shuttle Mission Training Facility
- User Application and Supporting Data Files
- Software Production Facility

FDOC Scope
- SPOC / IMOC

Two Cultures to One

Lockheed Martin

- One set of Established Processes
- Large development projects
- HW and SW Integration
- 12M Lines of code

United Space Alliance

- Four Processes
- Some work CMMI Level 3 compliant
- Majority of the work less than 3 month effort
- 60M lines of code

FDOC Goal

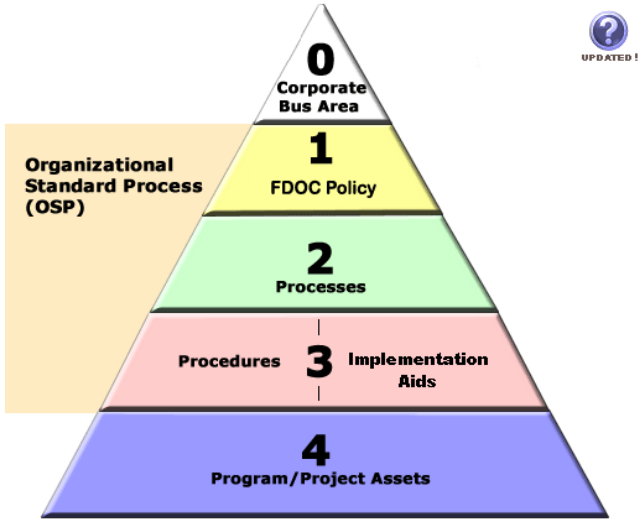
- One Process
- CMMI Level 3 for Development

Path to Consolidation

- **Conducted a series of LM21 events for consolidation of processes from two predecessor contracts**
  - 29 events in 2009 and 7 events in 2010
  - Didn't get to a steady state, continued evolving process
- **Considered USA Common Software Process (CSP) but found it too limited in scope (Small SW jobs only)**
  - Did not consider their lessons learned
- **Chose a Level 5 process set that did not meet our business model**
- **Result was that every employee had to learn something new**

Road to CMMI for Development

- **Early Successes**
  - Established the Process Asset Library
  - Established the Organizational Process Group
  - Use of myFDOC and collaboration tools
- **Struggles**
  - Created new processes vs. Document what you do
  - Developed action plans late
  - Internal audits late
  - Choice for not using CMMI for Services was based on lack of experience
- **Acknowledge that change is hard**



Appraisal's

- **Approach included the LM Continuous Assessment Method (CAM)**
  - Six phases to continuously assess compliance
- **SCAMPI B was done as a risk mitigation to identify any weaknesses in the model implementation**
  - Weaknesses were identified and the SCAMPI A was delayed
- **SCAMPI A successfully conducted after all weaknesses were corrected and reviewed by the Lead Appraiser**

PIID's

Phase I (CAM)

- 1 piece of evidence per project
- Engineers provided data

SCAMPI B

- Training from the LA (not followed)
- New projects selected
- Collected data by Process Area
- Data duplicated

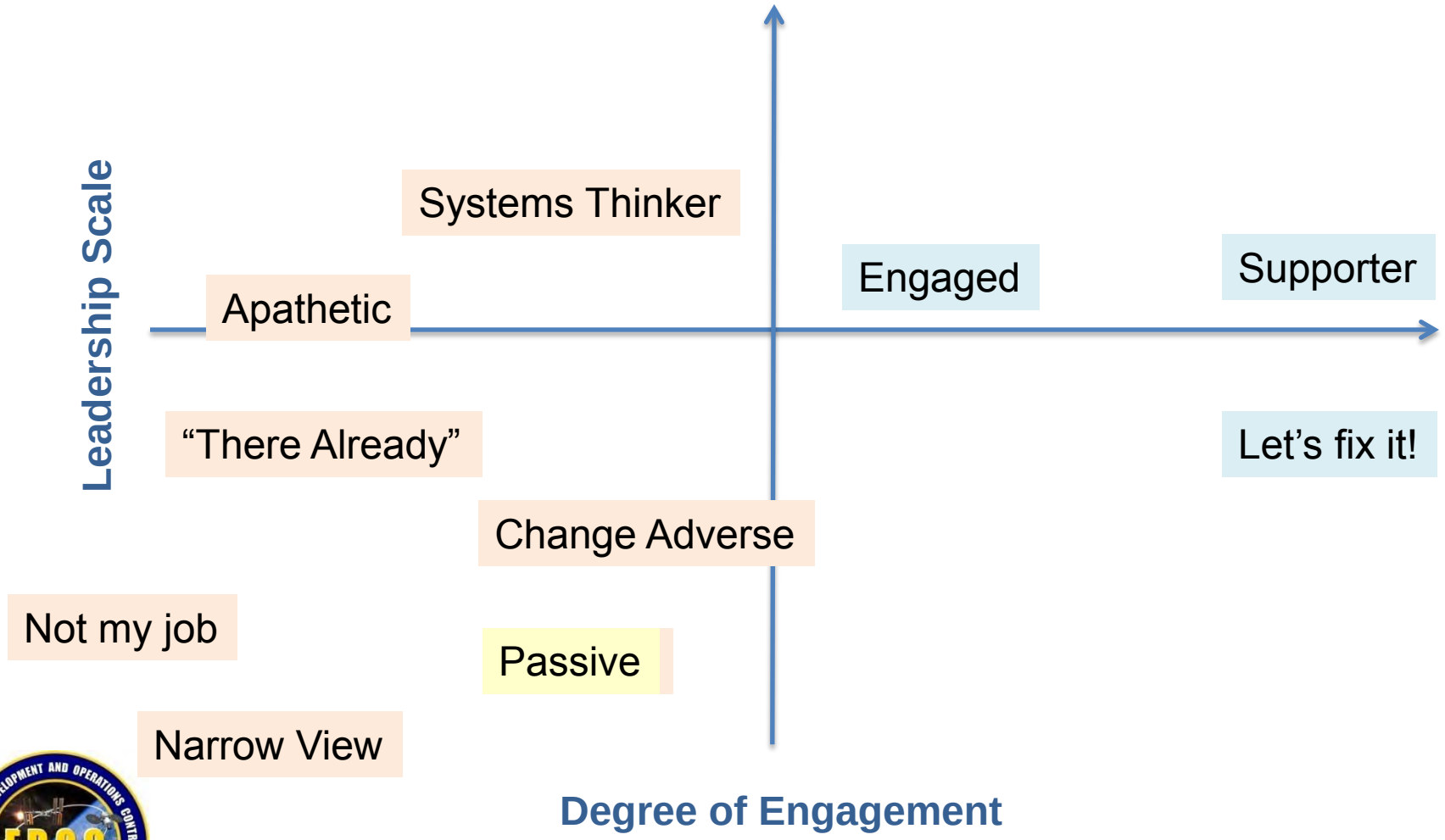
SCAMPI A

- Compliant with the training
- Additional projects selected
- Collected data by projects
- Small team

LA/Advisor Going In Perspective

- **People**
  - PI team - too focused on develop vs. implement
  - Lack of change *leadership*
- **Processes**
  - High Level/Generic/CMMI-speak
  - Text-based
  - Tailoring vision cloudy
- **Tools**
  - Great tooling; but disconnected from process
- **Other**
  - Measures focused solely on contract requirements
  - "Project" selection proved difficult

Management Positions



Change Management

What We Did	What We Should Have Done
• Drafted a Plan • Established a Baseline • Selected Framework • Identified Resources • Designed Solutions • Monitored Progress	• Share a Vision • Communicate Expectations • Be Honest About Changes • Handle Resistance • Reward Correct Behaviors

Communication

- Vision
- Roles and Responsibilities

Porcelain Press

What is CMMI?

- The acronym stands for: Capability Maturity Model Integration
- In a nutshell, this is what it means: CMMI is a set of process models that compare an organization's process capability (maturity) against industry standards.



What is SCAMPI?

- The acronym stands for: Standard CMMI Appraisal Method for Process Improvement
- What it is: Organizational appraisal using a CMMI model. Three SCAMPI methods of increasing level of rigor are defined (SCAMPI A, B, and C). Only the most rigorous method (SCAMPI A) can result in a rating.

FDOC's goal is CMMI Maturity Level 3 (Defined)

Let's Talk FDOC Organization Standard Process – CMMI Level 3

In July 2010, FDOC deployed its Organization Standard Process (OSP). In December, 2010 FDOC completed a CMMI SCAMPI B Appraisal on its OSP. Although FDOC has made huge improvements on institutionalization of the OSP some weaknesses were found. Listed below are some global weaknesses that all FDOC employees should be working to eliminate.



SCAMPI B –Global Weaknesses Awareness

- **Newly deployed processes – lack of adoption throughout the organization**
- **Audits were done prior to process awareness and no follow-up of findings**
- **Distributed project management and control of engineering led to confusion of roles and responsibilities**
- **Lack of project measures to all levels of work**
- **Practices not met: Analysis of peer review data and use of historical data for costing**
- **PIID's were disorganized with poor Configuration Management**

Why is CMMI important to me?

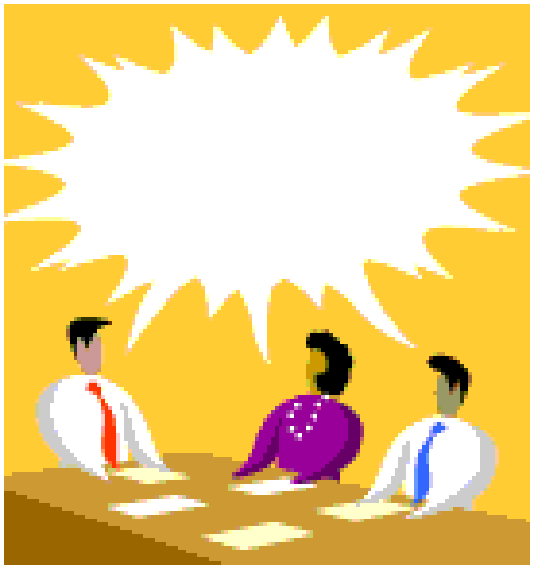
- Not only does CMMI provide a proven framework for program planning and execution, but it helps each of us become ***more competitive*** as a unit. This is critical in today's era of economic struggles.
- As a systems provider, we are required to be CMMI Level III (minimum) just to continue to have the ***opportunity to keep doing what we're doing***.
- Because CMMI methodology is performance-focused with measurable impacts on business effectiveness, this ***provides our customer with concrete evidence of our benefit*** to them.
- When CMMI practices are used properly, it ***facilitates teaming, process integration, and benchmarking*** which helps all of us to be more effective in our individual roles.
- CMMI helps us to ***recognize our process gaps and provides ways for correcting those gaps long before they become an issue*** for our customer.

Look forward to further CMMI communication that can lead to



Handling Resistance

Meetings with Managers to be champions



Lunch with Employees to understand concerns



Reward Correct Behaviors

Play CMMI Millionaire !





Play CMMI Crossword Puzzle!



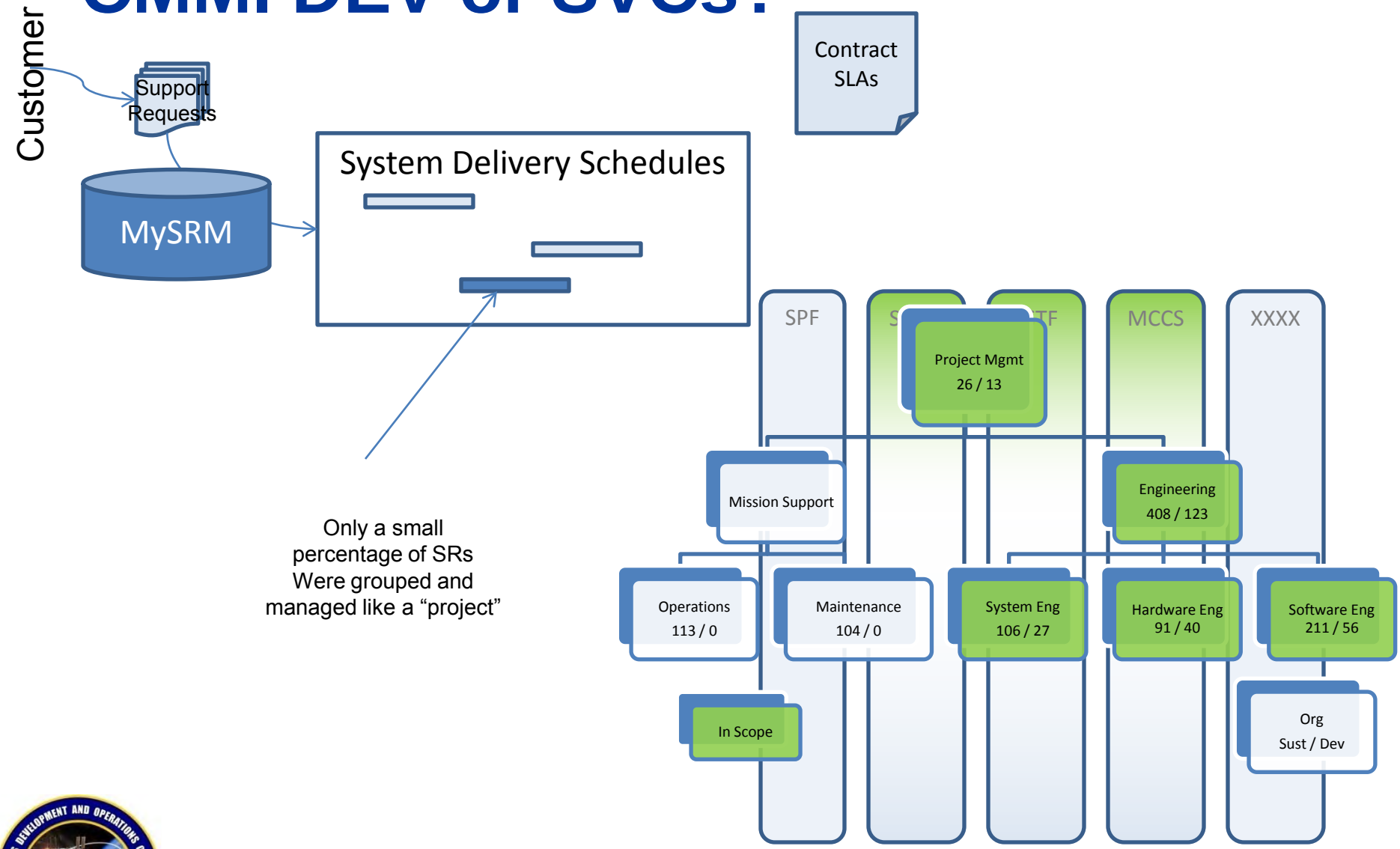
Plan Forward

- **Consolidation of ISO and CMMI Audit checklist**
  - Audit by role instead of by process area
- **Creation of a measurement working group**
  - Ensure the continuation of measurement collection and review
  - Ensure the measures are value add
- **Promote the use of best practices across FDOC**
- **Consolidation of Configuration Management systems**
  - Eliminate redundant data
- **Maintain the Organizational Process Assets**

LA/Advisor Post Mortem Perspective

- **CAM and LA not coordinated, aligned**
  - audit/test vs. intent
  - breadth and depth of practice implementation
- **FDOC Process Lead's tenacity essential**
- **Changes made between SCAMPI B and A brought processes closer to actual practice**
- **Ongoing activity post SCAMPI A is sure sign of true maturity**
- **CMMI for Services probably a better fit**

CMMI DEV or SVCs?



Questions?





Thank You!

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Creating an SQA Program at NREL

A DOE FFRDC Program based on the NDIA/DoD Sponsored CMMI



CMMI Conference 2011

Tim Kasse

16 November 2011

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

NREL

The National Renewable Energy Laboratory (NREL) , located in Golden, Colorado is the only Department of Energy (DOE) laboratory in the United States that is “solely” focused on renewable energy with focus on such research areas as:

- Solar
- Wind
- Bio-Mass
- Hydrogen

NREL - 2

Research Service Facility (RSF) buildings used for staffing are the most efficient in the world.

- Visitors from all over the world come to see and hear about how these energy efficient buildings were built and how they work
- Newest RSF building scheduled for occupancy starting in December will be zero-net energy.

NREL - 3

The past 30 years has seen NREL evolve as a renewable energy facility, non-profit, government-funded entity

Today, after doubling in size in the past 3 years, NREL finds itself being required to be more strictly focused on business with the ability to prove it is focused on continuous process improvement to satisfy both the DOE and its industry and academic partners

In addition, the importance of Software, together with Systems Engineering has risen to a visibility far beyond that of its past 30 years

- Along with that visibility goes software quality and the processes that product it

Software Quality Assurance versus Process Improvement

In the CMMI-based process improvement world, Process Improvement might be considered the overarching umbrella with Quality Assurance operating beneath it.

In the NREL-DOE world Quality Assurance / Software Quality Assurance serves as the overarching umbrella with process improvement operating beneath it.

SQA Program Approach

CMMI Continuous Representation

Incremental process improvement

Problem Solving Approach

- Integrated Models/Standards
- Lack of emphasis on the specific models, standards or techniques such as CMMI, Lean, Six Sigma, ITIL, PMI, Agile, etc.

"Slices of Process Areas for Improvement"

Just in Time Training

Hand-Holding Coaching

Progress Checks

Basic Measurement

SQA Program Approach - 2

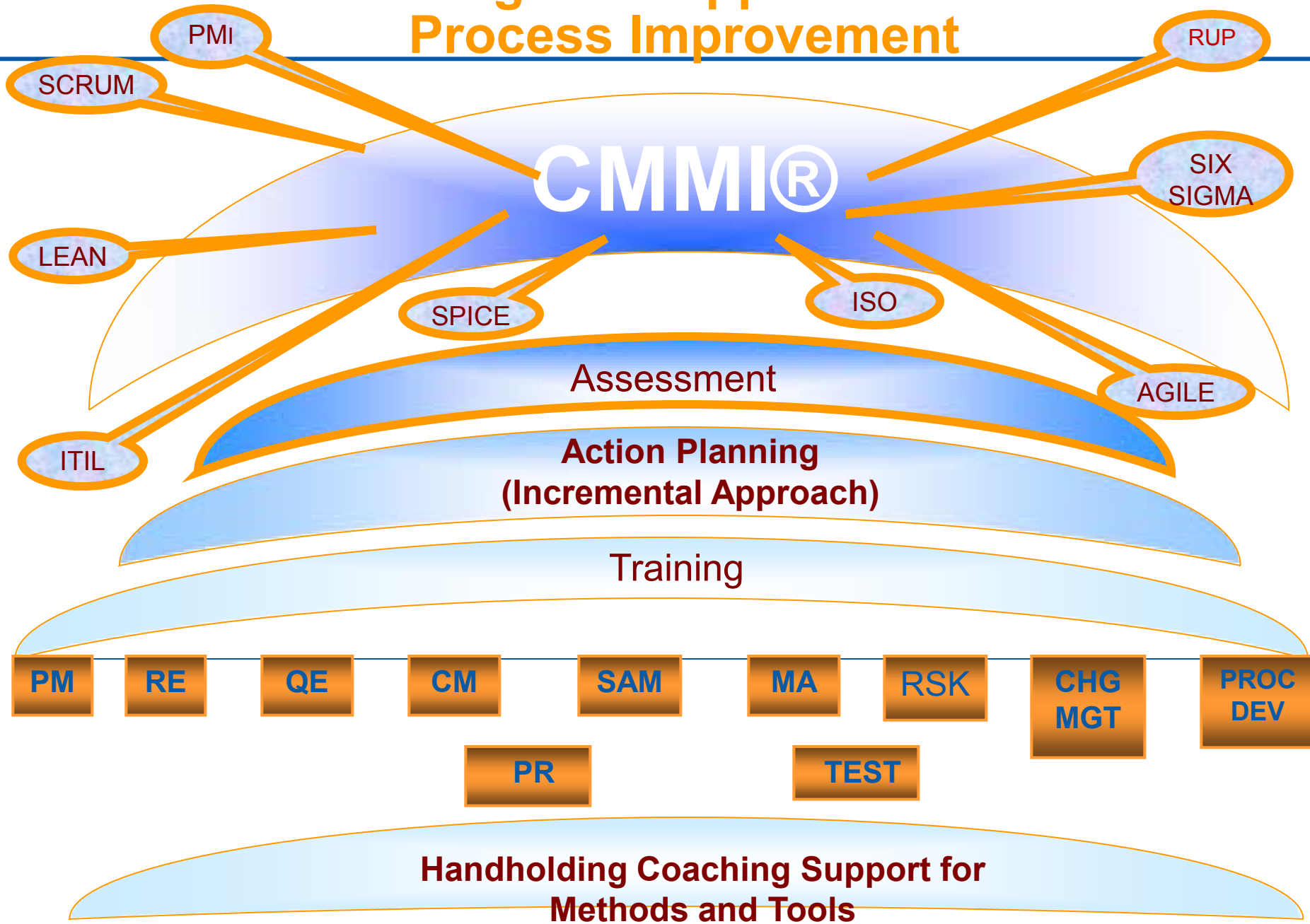
Identifying business objectives for projects, programs and departments

Providing definitions, descriptions, papers, references

Using Peter Block's Consulting Modes (Expert, Collaborative and Observer)

Borrowing Peer Review concept of "Kin Documents"

Integrated Approach to Process Improvement



Software Quality Management

Quality Control and Quality Assurance

- Quality Control evaluates the products
  - Checks the quality of the product(s)
    - Is the product within tolerance?
    - Is the product (or life-cycle work product) of an acceptable quality?
  - Tools and Techniques
    - Reviews
    - Tests
    - Inspections
    - Simulations
    - Observations
    - Demonstrations

Quality Control and Quality Assurance - 2

Quality Assurance evaluates the process

- Checks that the process is working
  - Is the process being followed?
  - Are the QC checks being applied?
  - Are the QC checks efficient?
  - Is the process causing quality problems?
  - Is the process working for the organization?
- Tools and Techniques
  - Audits / Objective Evaluations
  - Assessments / Appraisals / GAP Analysis

Software Quality Management Functions

Software Quality Management Functions include:

- Setting **Quality Goals** that support business objectives
- Establishing and enforcing a **Quality Policy**
- **Planning** for Quality (Organizational and Project level)
- Developing **Processes** (Organizational and Project level)
- Establishing the use of **Standards and Procedures**
- Performing multiple levels of **Testing**
- Conducting **Peer Reviews** throughout the product lifecycle
- Designing in **Quality Factors** (i.e., safety, security, maintainability, reliability)
- Conducting Quality Audits with respect to **product** quality
- Conducting Quality Audits with respect to **process** quality
- Providing visibility into the process and product quality for management through **Quality Reporting**
- Getting **non-compliance** issues resolved before the product is delivered to the customer (looking for trends)

Software Quality Management Functions - 2

Software Quality Management Functions also include:

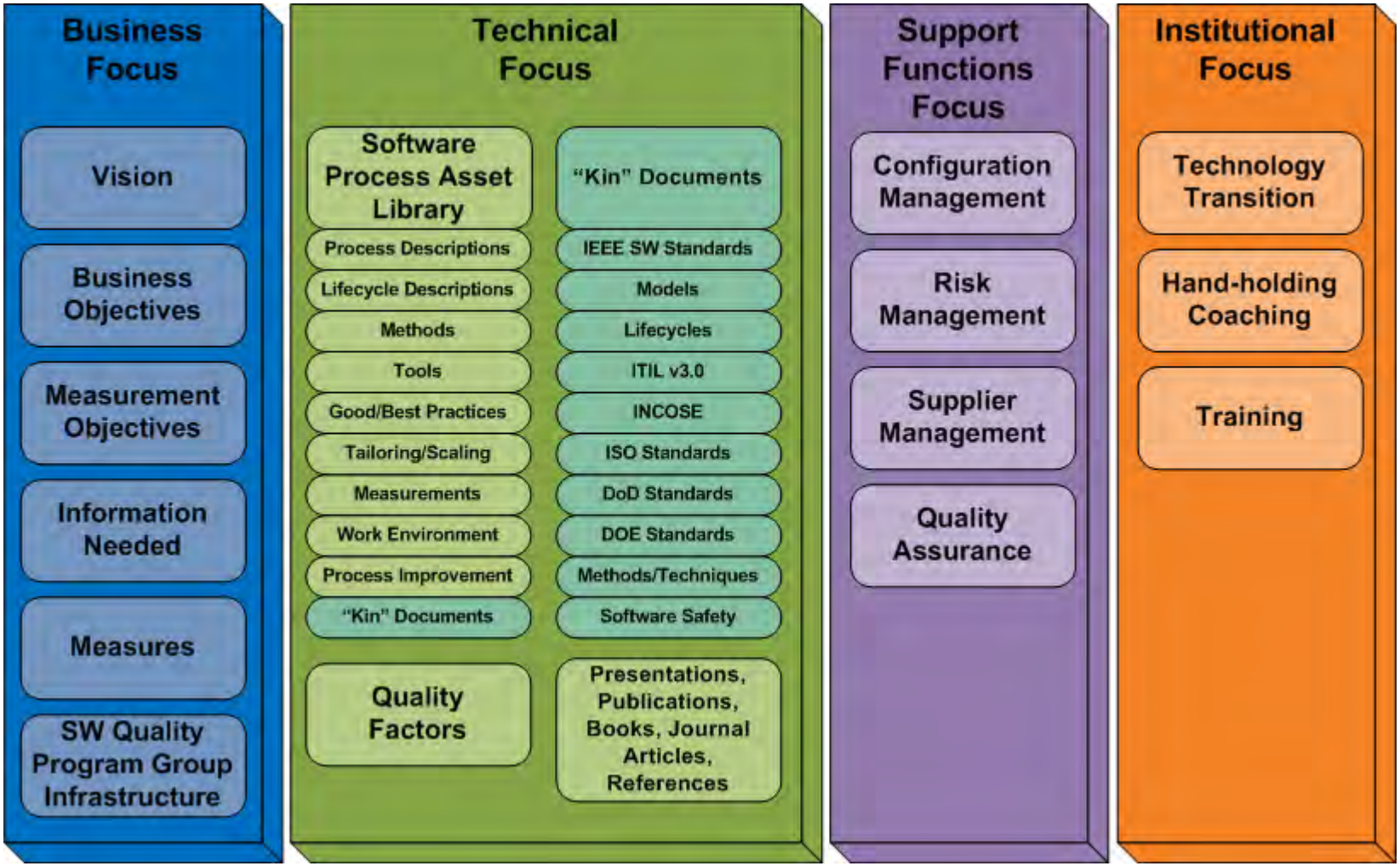
- Implementing complementary Configuration Management functions
- Identifying Measurements that support the information needs of the project and organization
- Conducting Performance Evaluations to ensure the system converges to established performance constraints
- Conducting appropriate Verification functions
- Conducting appropriate Validation functions

NREL Software Quality Assurance Program

Developed the Software Quality Assurance Program based on and linked to the existing Quality Assurance Program.

- Software Quality Assurance Program Architecture developed and placed on Share Point

Software Quality Program Architecture



Software Quality Assurance Program - 2

Emphasis of the SQA Program Architecture is broken into four major areas:

- **Business Focus** – (completely populated)
- **Technical Focus**
  - Software Process Asset Library defined to more detailed levels
  - Software Lifecycle Descriptions defined (Waterfall, V-Model, Waterfall)
  - Software Design Methods defined
  - Process Descriptions started and available for Requirements, Inspections and Risk Management
- **Support Functions Focus** – Executive Overview for Configuration Management, Risk Management, Supplier Management, and Quality Assurance
- **Institutional Focus** – Topics describe the QMS&A approach for technology transition of knowledge to Projects, software systems training that is available to support projects and Hand-holding coaching QMS&A is starting to provide

SW Process Asset Library

Process Descriptions
- Process Architecture
- Sets of Standard Processes
- Policies
- Procedures
- Standards
- Guidelines
- Templates
- Checklists
- Starter Kits

Lifecycle Descriptions
(With Examples)
- Waterfall
- Overlapping Waterfall
- V-Model
- Spiral
- Incremental
- Evolutionary
- Acquisition
- Agile

Methods
- Object Oriented
- Agile
- SCRUM
- SASD
- Top-Down
- Bottom-Up

Tools
- Project Mgmt
- CM
- QA
- Risk Mgmt
- Mind Maps
- Testing

Good & Best Practices
- Lessons Learned
- Good Examples

Tailoring Guidelines / Graded Approach / Scaling
- External and Internal to the Process Descriptions

Measurement Repository
- Actual Project Data
- Measurement Examples
- Guidance for Measures

"Kin" Documents
- IEEE Standards
- CMMI
- EIA-632
- ITIL
- ISO Standards

Work Environment Standards
- Development Environments
- Testing Environments
- Production Environments
- Web Applications

Process Improvement Approaches
- Big Bang
- Incremental based on Project Need
- Incremental based on Business Objectives
- "Constagedeous"

"Kin" Documents

IEEE Software Standards
- 730 – Std for SQA Plans
- 730.1 – Guide for SQA Planning
- 828 – Std for SW Configuration Management (SCM) Plans
- 1008 – Std for Unit Testing
- 1012 – Std for SW VER and VAL
- 1028 – Std for Software Reviews
- 1042 – Guide to SCM
- 1058 – Std for SW Proj Mgmt Plans
- 1059 – Guide for SW VER & VAL Plans
- 1219 – Std for SW Maintenance
- 1540 – SW Lifecycle Processes – Risk Management

INCOSE
- EIA – 731 SE CMM
- EIA – 632 Processes for Engineering a System

DoD Standards
- DoD-Std-2167a
- DoD-Std-2168b

Models
- CMMI-DEV v1.3
- CMMI-SVC v1.3
- CMMI-ACQ v1.3
- ISO 15504 (SPICE)

ITIL v3.0
- Executive Overview
- Service Strategy
- Service Design
- Service Transition
- Service Operation

Lifecycles
- ISO/EIA 12207 SW Lifecycle Processes
- ISO/EIA 15288 SE Lifecycle Processes

Quality
- ISO 9001:2008 – Quality Management Systems - Requirements
- ISO 9004:2009 – Managing for the Sustained Success of an Organization - A Quality Management Approach
- ISO/IEC – 9126 – Software Engineering – Product Quality
  - Quality Model
  - External Metrics
  - Internal Metrics
  - Quality in Use Metrics

"Kin" Documents - 2

ISO Standards
- AS 9100 – ISO 9000 for Aerospace
- TL 9000 – Telecommunications
- ISO 16949 – Automotive Engineering

Methods and Techniques
- Six Sigma
- PMI PMBOKv3
- OPM 3 – Proj Mgmt for the Organization
- Lean

Training

Classes / Workshops/ Tutorials / Presentations

- EXAMPLES:
  - Software Quality Engineering
  - Software Configuration Management
  - Requirements Engineering
  - Peer Reviews (Inspections)
  - CMMI-DEV v1.3 – SEI Introduction to CMMI-DEV v1.3 with KI Additional Value
  - CMMI-ACQ v1.3 – Kasse Initiatives
  - CMMI-SVC v1.3 – Kasse Initiatives
  - CMMI-based Assessments (SCAMPI)

Incremental Approach

QMS&A guides its NREL customers in developing an incremental approach to the process improvement needs it has identified and prioritized, being ever mindful of satisfying the business objectives as well as guidance provided by the CMMI and other standards and models

Increments of approximately 3 months in duration are designed based on the organization's business objectives.

- These increments are populated with improvement tasks that represent achievement of some aspect of planning, developing, testing, controlling, and managing software development

Hand-Holding Coaching

"Hand-holding" support is "roll-up-your-sleeves" support provided to help implement critical processes or "slices" of processes on projects. Projects can expect:

- Knowledge about the software process
- Assistance in developing process descriptions
- Assistance in creating a Project Quality Plan
- Assistance in choosing the right standards for the project's needs
- Assistance in applying the tailoring guidelines to the organization's process descriptions for practical use by the projects
- Performing quality and configuration audits
- Assistance in setting up Peer Reviews

Hand-Holding Coaching - 2

Currently being focused on:

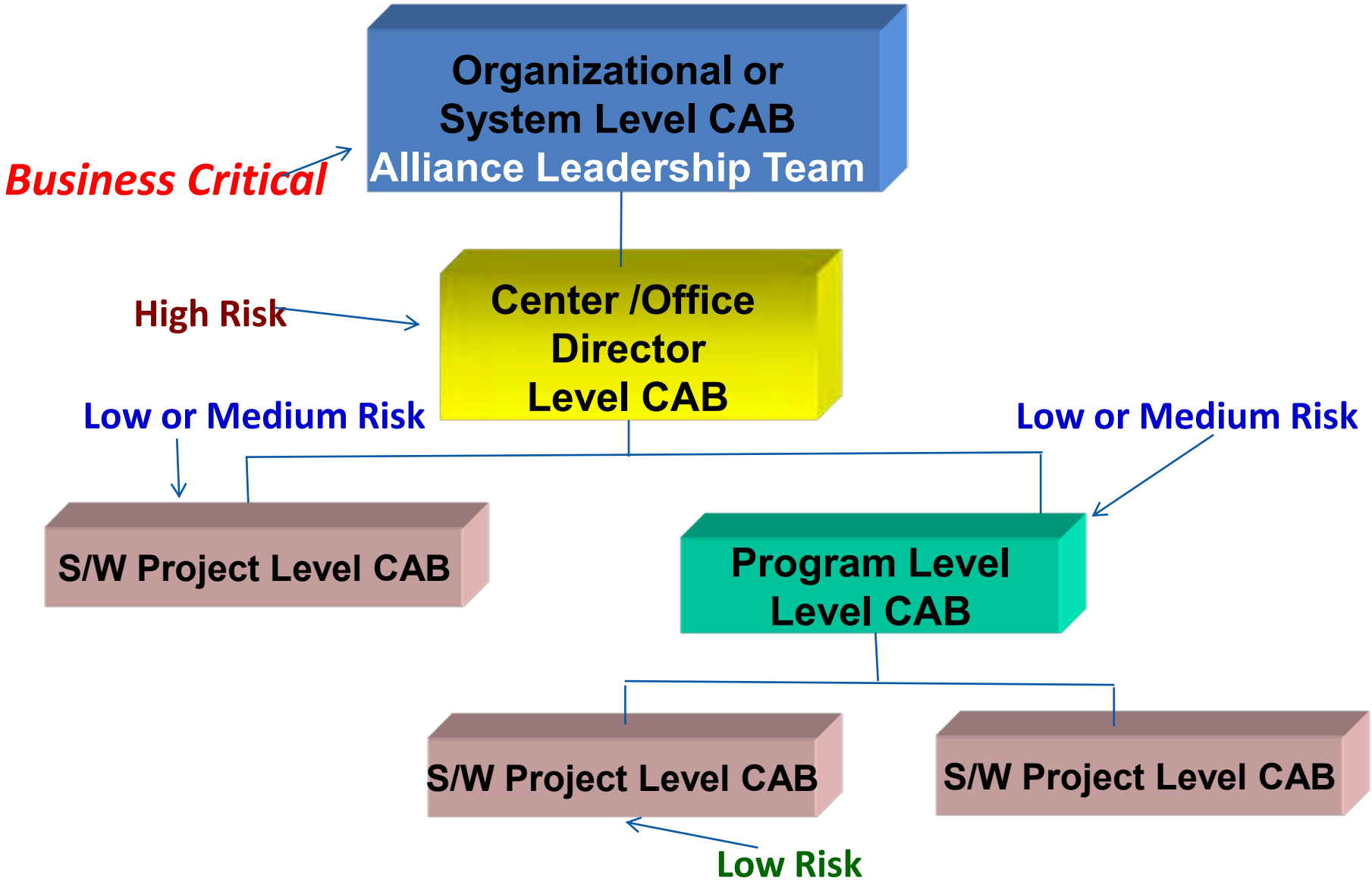
- Requirements Development and Requirements Management
- Risk Management
- Software Inspections
- Software Safety
- Web Applications Development
- Change Control Boards

Current Focus Areas

Configuration Management
(Serving Project Management and Quality)

- Identification
- Baselining
- Change Control
  - Change Advisory Boards
- Status Accounting
- Configuration Auditing
  - Functional Configuration Audits
  - Physical Configuration Audits

Hierarchies of CABs



Web Applications Development Process

The Web Applications Development Process is serving as the platform for improvement of the software applications development processes

- These improvements will assist the development of many classes of software and are some of the first steps in the development of the overall Software Quality Assurance (SQA) program

Draft Policy for the Web Applications Development Process has been developed

Web Applications Development Process has been drafted and reviewed by the Task Force

- Has been submitted to the NREL review process to be placed into the NREL Standard Policies and Procedures

CMMI Overview

Level	Process Characteristics	Process Areas
5 Optimizing	Focus is on quantitative continuous process improvement	Causal Analysis and Resolution Organizational Performance Management
4 Quantitatively Managed	Process is measured and controlled	Quantitative Project Management Organizational Process Performance
3 Defined	Process is characterized for the organization and is proactive	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organization Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis & Resolution
2 Managed	Process is characterized for projects and is often reactive	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Product and Process Quality Assurance Configuration Management Measurement and Analysis
1 Initial	Process is unpredictable, poorly controlled, and reactive	

CMMI-DEV v1.3 Training

Completed CMMI-DEV v1.3 4-Day Training Class for Enterprise Solutions and other specialists such as Internal Audit.

- The Capability Maturity Model Integration (CMMI) was developed by the Software Engineering Institute (an FFRDC) to focus on the Project Lifecycle from requirements elicitation to transfer to the Customers / End Users operational environment.
- The CMMI model is referenced in DOE O 414.1D as one of the international consensus models that may be used to enforce 414.1D requirements.
- The CMMI describes requirements for development activities that not only support the development lifecycle but dovetails into the Service Management activities described by the IT Infrastructure Library (ITIL v3) currently being taught and implemented in ISO.
- Other classes are being scheduled for 1st quarter of FY12 and beyond.

Requirements Engineering Training

Conducted two (2) Requirements Engineering Workshop for Enterprise Solutions with HR, and Business Systems Governance representation.

- The course was well received with one person stating that it was the best course she had received in 20 years on the topic
- Templates for developing Software Requirements Specification and Interface Requirements Specification have been developed and are being used
- Checklists supporting the SRS has been built and put in use
- One more RE Workshops is scheduled at the end of 1st Q FY12.

SQA Program Coaching

SQA Program coaching is starting to take place to support the institutionalization of the concepts being offered in the software quality training classes

- Requirements Engineering coaching for Enterprise Solutions
- Risk Management Coaching
- Software Safety Coaching

Software Safety

Developed Software Quality Assurance (QA) requirements specific to the development of safety-related software

Collected Software Safety research material from the Internet, the Software Engineering Institute, selected government standards on Software Safety and manuscripts written by Dr. Nancy Levinson of MIT.

Started the development of a Software Safety Guidebook based on research material and NREL software safety needs.

Developed a Software Safety Presentation based on the current state of the Software Safety Guidebook, software safety research material, CMMI, and the SQA program that satisfied a DOE compliance action item.

Software Safety - 2

Applied Software Safety concepts by working with the Process Automation software vendor developing the software for the SCADA system, part of Energy Systems Integrated Facility to ensure their software safety activities match the needs of any software safety critical components.

FY12 will see the evolution of the Software Safety Guidebook into a fully developed guide for all of NREL projects that involve safety and particularly software safety.

All Software Safety materials are available from the SQA Program Share Point site!

Summary

The Software Quality Assurance Program's foundation has been established, based on the concepts of the CMMI and its implementation along with continuous improvement is underway

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QMS&A

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Raytheon

Customer Success Is Our Mission



Experiences in the Application of MDD v1.3 Sampling Factors

Bradley Bittorf

Raytheon Missile Systems

Abstract #13485

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Topic Overview, Objectives

Raytheon Missile Systems

- Raytheon Missile Systems Organizational Unit overview
- About the v1.3 Method Definition Document (MDD) scoping and sampling provisions
- Case study: RMS' experience with applying scoping and sampling
- Experiences and Lessons
- Questions
- Biography

Raytheon Missile Systems CMMI® Background

Raytheon Missile Systems

- Raytheon Missile Systems
  - One business of Raytheon
    - Characterized by high-volume, complex systems--“Rocket Science”
    - A large organization
  - Appraised at Maturity Level 5 for CMMI® for Development version 1.2 +IPPD in 2009
  - Next appraisal in 2012
    - Selected CMMI-DEV v1.3 using v1.3 of the Method Definition Document (MDD)
    - To use MDD v1.3, we must satisfy the scoping and sampling provisions

Summary of v1.3 Sampling and Scoping

Raytheon Missile Systems

- MDD version 1.3 calls out scoping and sampling in section 1.1.4 (Implementation Guidance)

- How does this guidance affect my organization? (How bad is it?)
  - Sources of information
    - Software Engineering Institute (SEI) webinars
    - SEI staff and others at conferences
    - Lots of reading of the MDD and its appendices
    - Try things
    - Ask questions!

Applying MDD v1.3 Sampling Factors

Raytheon Missile Systems

- Sampled projects / basic units (always were) representative of the *Organizational Unit* (OU)

- Define and evaluate dimensions which cause behavior within OU to vary
  - Set of required (to be considered) *sampling factors* is described in MDD Appendix F
  - Select those sampling factors which make a difference in process execution in your OU
    - Use sampling factors to determine your *subgroups*
  - Determine whether *support functions* exist in your organization
  - Use selected sampling factors, subgroups and support functions to construct a representative sample of your OU
    - Document these in your appraisal plan and package
    - Might result in more, or fewer, instantiations than appraisals conducted under MDD v1.2

Note: Terms in italics can be found in MDD glossary

For instance, “Basic Unit,” “Sampled Basic Unit (SBU),” “Support function,” “[Sampled] Subgroup”

Tips for Applying the v1.3 Sampling and Scoping Provisions

Raytheon Missile Systems

- Become familiar with the case studies in MDD Appendix F
- Gather information about your OU
- Construct various scenarios related to your own organization
  - Remember to base appraisal objectives on your goals
  - Peer review
  - Have others ask questions
  - Iterate as necessary
- Vary parameters and OU dimensions to see how factors affect your appraisal
  - Constraining the OU is a useful tool
    - You may find that two appraisals is a better solution than one big appraisal
- Declare and use appropriate support functions to reduce instantiations
  - Effort is required to initially adjudge whether appropriate to declare a support function
  - Probable effort savings over the appraisal life cycle

- Don't give up!

Once Approach is Decided, Share with Stakeholders

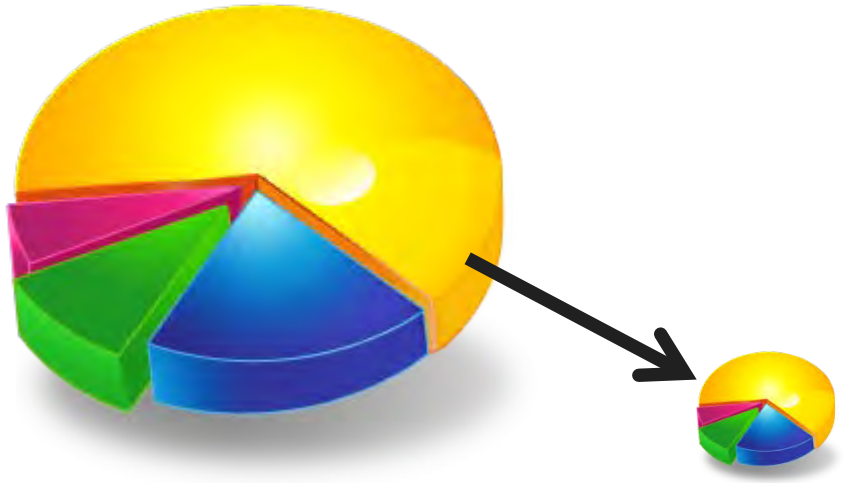
Raytheon Missile Systems

- Share approach with lead appraiser
  - Process will be iterative
  - Don't assume your lead appraiser has already applied all the provisions of sampling and scoping at other sites
    - Your OU is (probably) unique
- Share with appraisal team
  - Also iterative process
  - Start with internal team members
  - Use internal members to educate external team members
  - Involve all members of team
    - Including any who don't often lead
    - Ensure understanding and buy-in
- Share with other stakeholders
  - Appraisal team members can brief sponsors, managers, basic unit leaders

Sampling Factors to be Considered

Raytheon Missile Systems

- The MDD requires organizations to construct a representative sample of the organization. Sampling factors serve to identify meaningful differences in the conditions under which work is performed in the organization. The following sampling factors must be considered:
  - Location
  - Customer
  - Size
  - Organizational Structure
  - Type of work
  - [Others]



Case Study: RMS Application of SEI Sampling Factors

Raytheon Missile Systems

RMS appraisal team considered the potential influential contributors to variation in the conditions under which our work is performed.

Sampling Factor	Applicability to RMS
Location	**Single location, scope of appraisal is defined as "RMS, Tucson, Arizona."**
Customer	**Product lines account for different customers.**
Size	**Period of performance accounts for size.**
Organizational structure	**Product lines account for different organizational structure.**
Type of work	**Tiers account for the type of work.**

Case Study: RMS Factor Analysis Summary

Raytheon Missile Systems

- All criteria which are within scope are subsumed by RMS program tiers
  - RMS has defined “tiers” as categories of like programs based on their end use

- The RMS appraisal team mapped sampling factors and selected tiers as the critical factor used to attain the representative sample for RMS

Observations and Experiences

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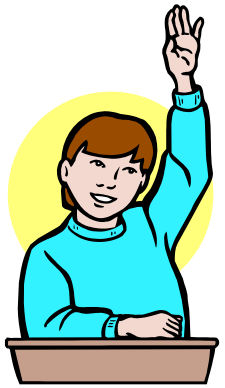
- Become familiar with the intent and details of the sampling algorithm
  - Examples and case studies helped us more than explanations
    - Some of our most applicable examples came from Services rather than Development
  - Always go back to the MDD explanations to understand what flexibility exists

- Version 1.3 will probably drive a change in your appraised set of instantiations
  - More diverse work and project / basic unit types can anticipate a more complex appraisal, or more separate appraisals
  - More consistent, homogenous organizations probably have a smaller appraisal burden using v1.3

- Support functions can reduce the appraisal burden
  - You must decide which support functions are appropriate to declare for your appraisal
    - Gain consensus with the appraisal team regarding the use of support functions in your appraisal
    - Invest early work to demonstrate support function appropriateness to save downstream work over the appraisal lifetime
  - You can still appraise support function disciplines the “traditional” way

Questions?





Presenter Biography

Raytheon Missile Systems

Bradley Bittorf

- Senior Principal Multi-discipline Engineer, Raytheon Missile Systems, Tucson, AZ
- bjbittorf@raytheon.com
- +1.520.545.9359

Recent roles

- Raytheon Missile Systems CMMI project team
- Raytheon Business Point of Contact to SEI
- Member of several CMMI appraisal teams

28 years engineering experience

- Functions: software, systems engineering, program management liaison, process improvements
- Industries: cell phones, industrial automation, missile systems
  - 3 patents – high-reliability systems, redundancy, inter-process communication

Personal

- Long-time science fair judge
- Officer of the International Lilac Society
- Together with his wife Debbie, is a rated geocacher in the desert southwest
- Cat rescue

CMMI Level 1 to 3 in 15 Months: AIM for a performance upgrade

David Martin (CGI)

Gene Miluk (SEI)

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

This work is sponsored by the U.S. Department of Defense

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Introductions

- David Martin

Gene Miluk

- Some questions for you
  - SEPG
  - Appraisers
  - Partners
  - Large Organizations
  - SME

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_experience the commitment ™

March 2011

AIM Implementation Pilot Projects

Presenter:
David Martin

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Accelerated Improvement Method (AIM)

Accelerated Improvement Method (AIM)

Integrates and leverages TSP+ to achieve high-maturity and high-performance with an agile, “right-weight” implementation.



CGI

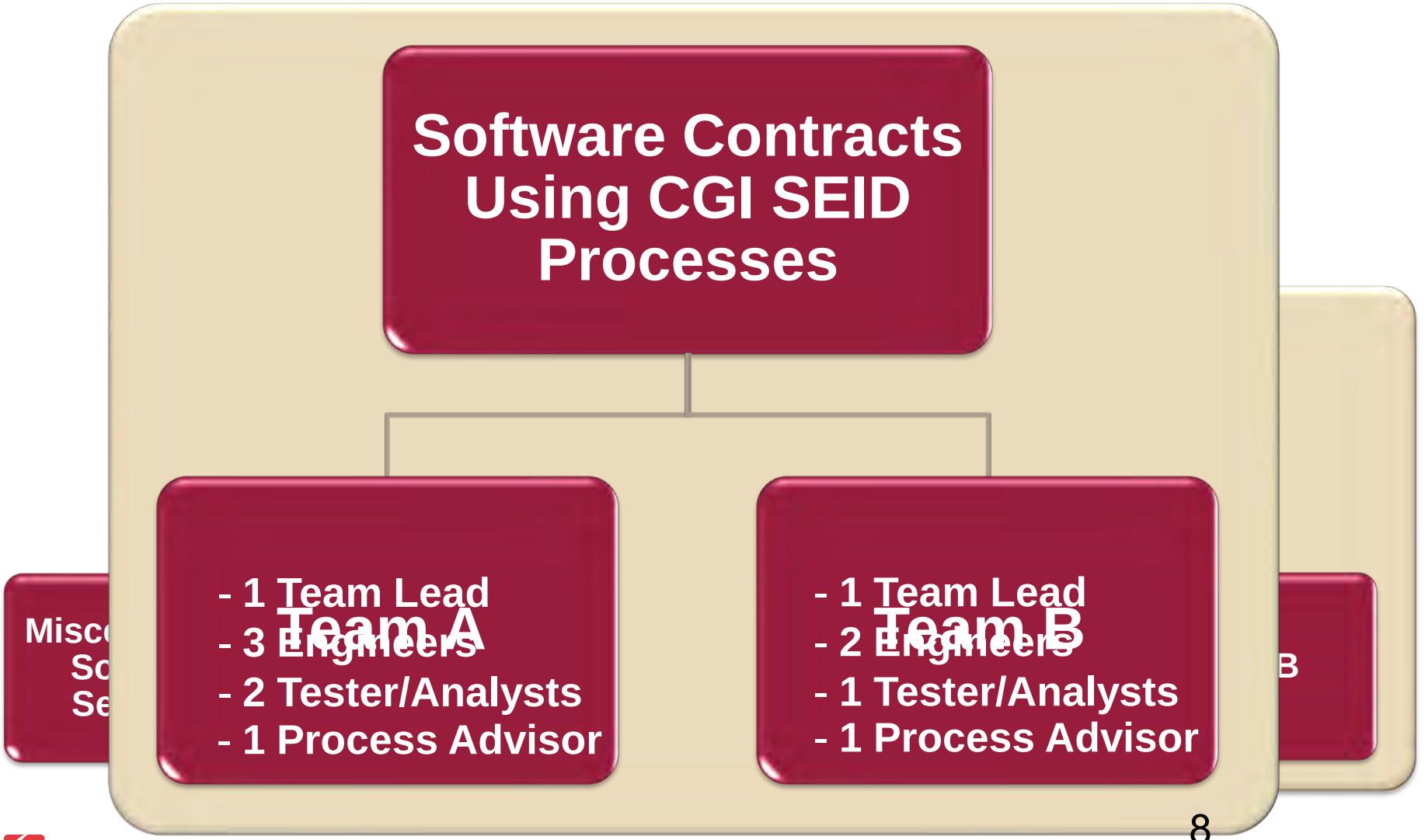
Who is CGI?

- A global leader in IT, business process, and professional services, CGI partners with federal agencies to provide end-to-end solutions for defense, civilian, and intelligence missions
- Acquired Stanley Associates, Inc. in August 2010
- This CGI Business Unit division has provided software services for our government customer at this site for over 30 years
- This CGI Business Unit division has participated with its government customer in process improvement since 1991.

Organizational goals

- Improve existing software development processes and software team performance
- Improve software quality
- Enhance process performance
  - Estimations
  - Consistency
  - Schedule
- Be prepared to conduct SCAMPI ML3 appraisal in 18 months or less

Organizational Scope and Team Composition

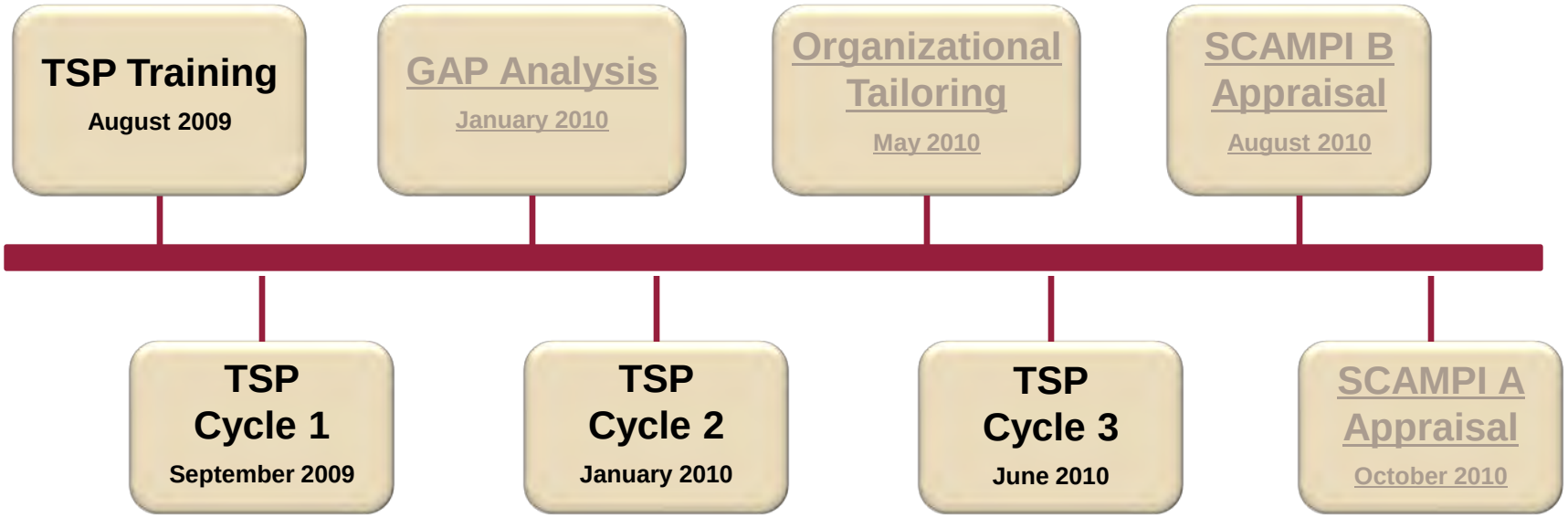


Appraisal Preparation

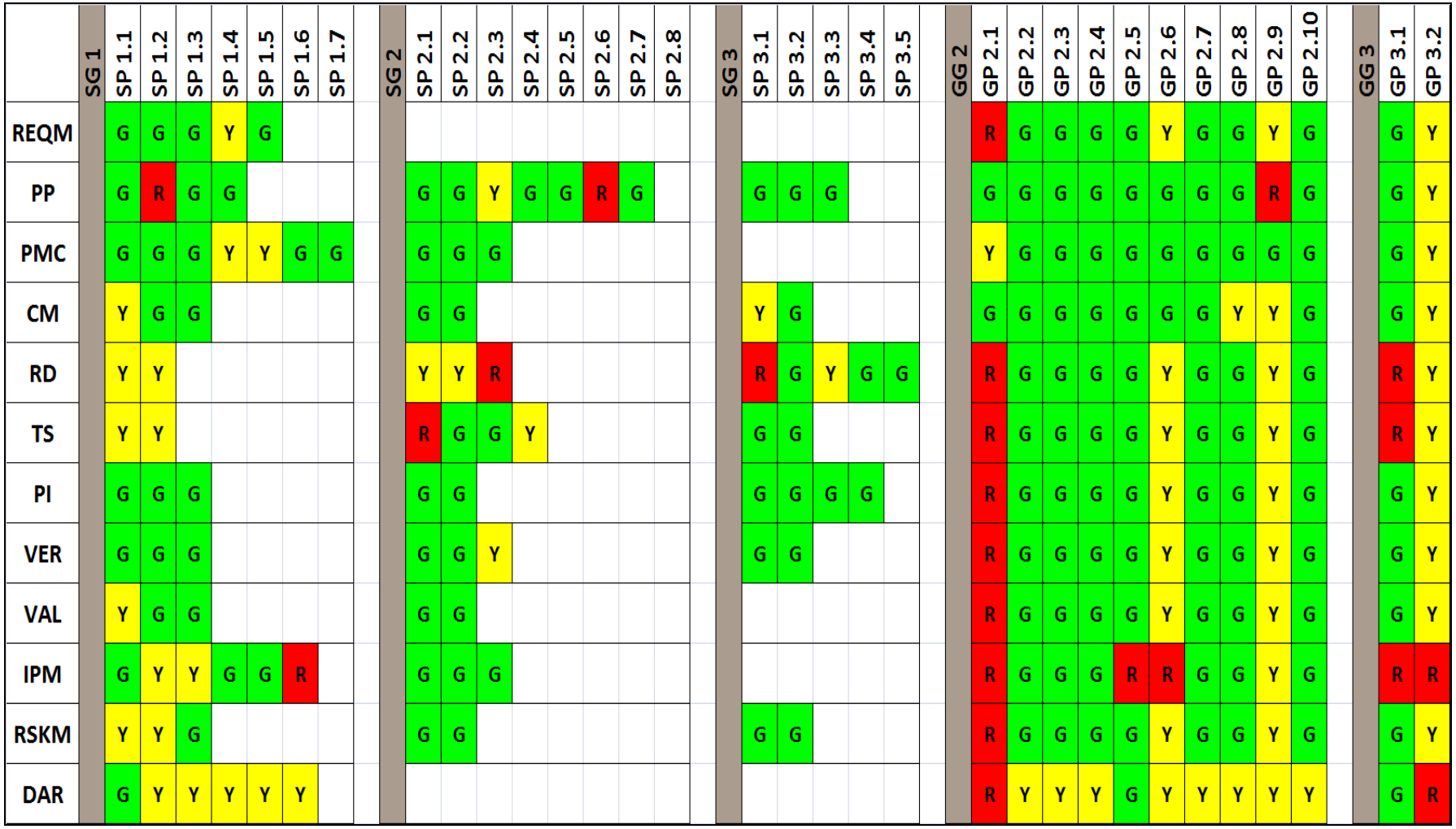
- Traditional Teams
  - Engineering Projects
  - Process Group
  - Management
  - PPQA
  - Org. Support Roles
  - Training
- Major impact to other functions within the division

- TSP Team
  - TSP Projects
  - Process Group
  - Management
  - Function Roles (filled by PG or TSP Project Members)
- Minimal Impact on other functions within the division

CGI Implementation Timeline



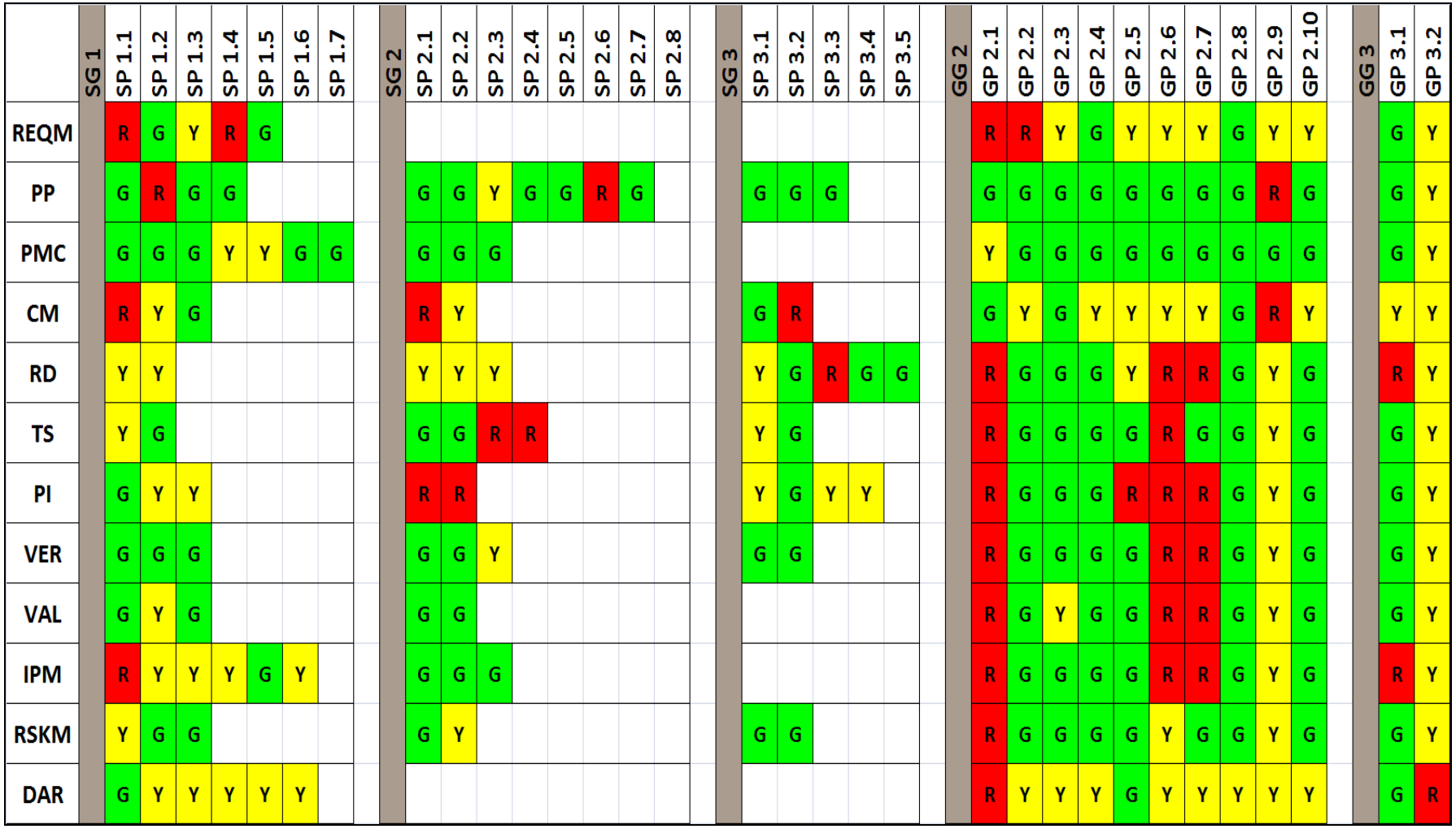
Team A – Gap Analysis Results



	SG 1	SP 1.1	SP 1.2	SP 1.3	SP 1.4	SP 1.5	SP 1.6	SP 1.7	SG 2	SP 2.1	SP 2.2	SP 2.3	SP 2.4	SP 2.5	SP 2.6	SP 2.7	SP 2.8	SG 3	SP 3.1	SP 3.2	SP 3.3	SP 3.4	SP 3.5	GG 2	GP 2.1	GP 2.2	GP 2.3	GP 2.4	GP 2.5	GP 2.6	GP 2.7	GP 2.8	GP 2.9	GP 2.10	GG 3	GP 3.1	GP 3.2
REQM		G	G	G	Y	G																			R	G	G	G	G	Y	G	G	Y	G		G	Y
PP		G	R	G	G					G	G	Y	G	G	R	G			G	G	G				G	G	G	G	G	G	G	G	R	G		G	Y
PMC		G	G	G	Y	Y	G	G		G	G	G													Y	G	G	G	G	G	G	G	G	G		G	Y
CM		Y	G	G						G	G								Y	G					G	G	G	G	G	G	G	Y	Y	G		G	Y
RD		Y	Y							Y	Y	R							R	G	Y	G	G		R	G	G	G	G	Y	G	G	Y	G		R	Y
TS		Y	Y							R	G	G	Y						G	G					R	G	G	G	G	Y	G	G	Y	G		R	Y
PI		G	G	G						G	G								G	G	G	G			R	G	G	G	G	Y	G	G	Y	G		G	Y
VER		G	G	G						G	G	Y							G	G					R	G	G	G	G	Y	G	G	Y	G		G	Y
VAL		Y	G	G						G	G														R	G	G	G	G	Y	G	G	Y	G		G	Y
IPM		G	Y	Y	G	G	R			G	G	G													R	G	G	G	R	R	G	G	Y	G		R	R
RSKM		Y	Y	G						G	G								G	G					R	G	G	G	G	Y	G	G	Y	G		G	Y
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CGI

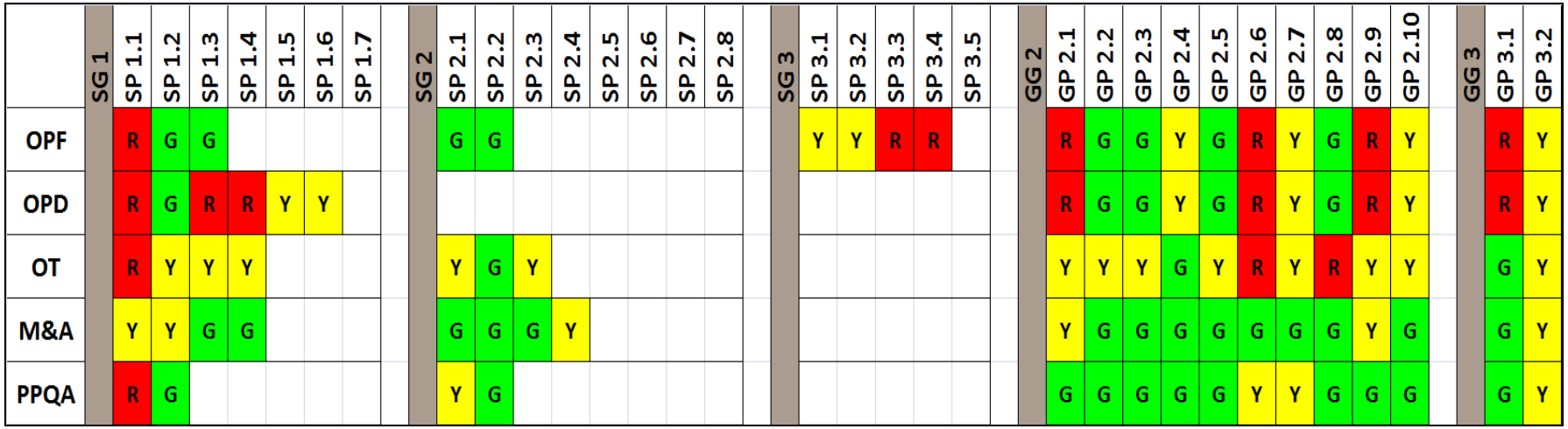
Team B – Gap Analysis Results



	SG 1	SP 1.1	SP 1.2	SP 1.3	SP 1.4	SP 1.5	SP 1.6	SP 1.7	SG 2	SP 2.1	SP 2.2	SP 2.3	SP 2.4	SP 2.5	SP 2.6	SP 2.7	SP 2.8	SG 3	SP 3.1	SP 3.2	SP 3.3	SP 3.4	SP 3.5	GG 2	GP 2.1	GP 2.2	GP 2.3	GP 2.4	GP 2.5	GP 2.6	GP 2.7	GP 2.8	GP 2.9	GP 2.10	GG 3	GP 3.1	GP 3.2
REQM		R	G	Y	R	G																			R	R	Y	G	Y	Y	Y	G	Y	Y		G	Y
PP		G	R	G	G					G	G	Y	G	G	R	G			G	G	G				G	G	G	G	G	G	G	G	R	G		G	Y
PMC		G	G	G	Y	Y	G	G		G	G	G													Y	G	G	G	G	G	G	G	G	G		G	Y
CM		R	Y	G						R	Y								G	R					G	Y	G	Y	Y	Y	Y	G	R	Y		Y	Y
RD		Y	Y							Y	Y	Y							Y	G	R	G	G		R	G	G	G	Y	R	R	G	Y	G		R	Y
TS		Y	G							G	G	R	R						Y	G					R	G	G	G	G	R	G	G	Y	G		G	Y
PI		G	Y	Y						R	R								Y	G	Y	Y			R	G	G	G	R	R	R	G	Y	G		G	Y
VER		G	G	G						G	G	Y							G	G					R	G	G	G	G	R	R	G	Y	G		G	Y
VAL		G	Y	G						G	G														R	G	Y	G	G	R	R	G	Y	G		G	Y
IPM		R	Y	Y	Y	G	Y			G	G	G													R	G	G	G	G	R	R	G	Y	G		R	Y
RSKM		Y	G	G						G	Y								G	G					R	G	G	G	G	Y	G	G	Y	G		G	Y
DAR		G	Y	Y	Y	Y	Y																		R	Y	Y	Y	G	Y	Y	Y	Y	Y		G	R

CGI

Organizational – Gap Analysis Results



	SG 1	SP 1.1	SP 1.2	SP 1.3	SP 1.4	SP 1.5	SP 1.6	SP 1.7	SG 2	SP 2.1	SP 2.2	SP 2.3	SP 2.4	SP 2.5	SP 2.6	SP 2.7	SP 2.8	SG 3	SP 3.1	SP 3.2	SP 3.3	SP 3.4	SP 3.5	GG 2	GP 2.1	GP 2.2	GP 2.3	GP 2.4	GP 2.5	GP 2.6	GP 2.7	GP 2.8	GP 2.9	GP 2.10	GG 3	GP 3.1	GP 3.2
OPF		R	G	G						G	G								Y	Y	R	R			R	G	G	Y	G	R	Y	G	R	Y		R	Y
OPD		R	G	R	R	Y	Y																		R	G	G	Y	G	R	Y	G	R	Y		R	Y
OT		R	Y	Y	Y					Y	G	Y													Y	Y	Y	G	Y	R	Y	R	Y	Y		G	Y
M&A		Y	Y	G	G					G	G	G	Y												Y	G	G	G	G	G	G	G	Y	G		G	Y
PPQA		R	G							Y	G														G	G	G	G	G	Y	Y	G	G	G		G	Y

- Summary
  - 326 Adequate Implementation of Mode Practice
  - 171 Partial Implementation of Model Practice
  - 81 Implementation Absent or Poorly Addressed

CGI

Gap Analysis Results

- Software Teams
  - Existing processes and toolsets such as TSP and version control systems added strength to team practices
  - Many tasks were being performed without generating artifacts necessary for CMMI
  - Organizational processes are weak
- Launch the Process Group as a TSP Team
  - Create New Organizational Processes
  - Track Appraisal Preparation Progress
  - Address Identified Weaknesses

Launching the Process Group

- Team Composition
  - Team Lead, 4 additional team members
  - All working on a part-time basis
- 252 corrective actions tracked as tasks by the PG

Organizational Tailoring

- Organizational processes were updated to allow for TSP to be used by software teams in addition to standard software practices
- TSP Documentation was updated to reflect CGI's processes as they are practiced

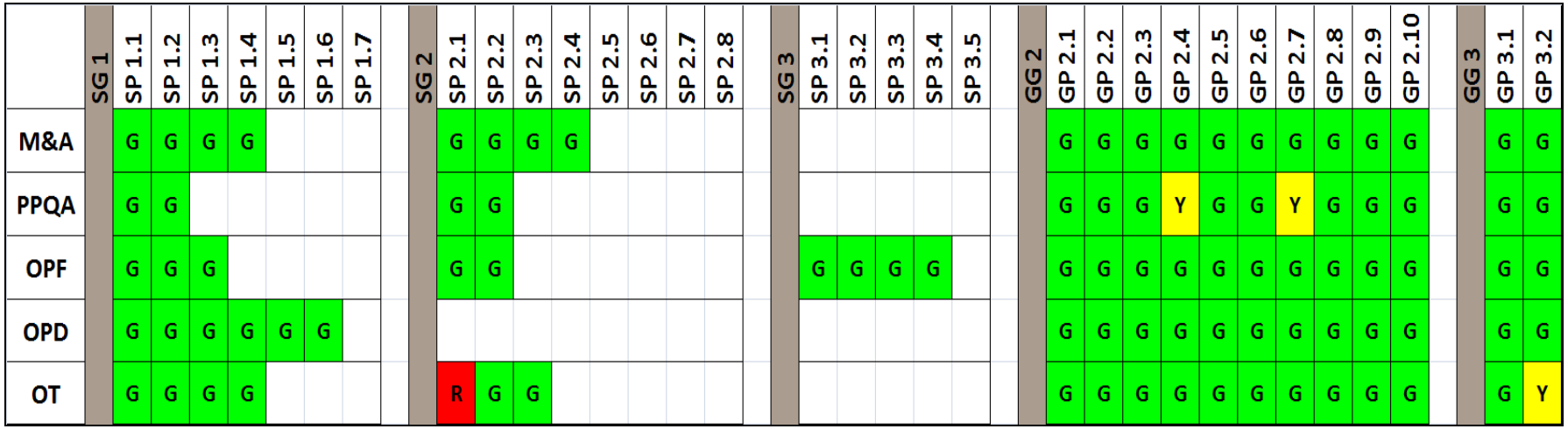
SCAMPI B Results



	SG1							SG2								SG3					GG2										GG3	
	SP 1.1	SP 1.2	SP 1.3	SP 1.4	SP 1.5	SP 1.6	SP 1.7	SP 2.1	SP 2.2	SP 2.3	SP 2.4	SP 2.5	SP 2.6	SP 2.7	SP 2.8	SP 3.1	SP 3.2	SP 3.3	SP 3.4	SP 3.5	GP 2.1	GP 2.2	GP 2.3	GP 2.4	GP 2.5	GP 2.6	GP 2.7	GP 2.8	GP 2.9	GP 2.10	GP 3.1	GP 3.2
REQM	G	G	G	G	G																G	G	G	G	G	G	G	G	G	G	G	G
PP	G	G	G	G				G	G	G	G	G	G	G		G	G	G			G	G	G	G	G	G	G	G	G	G	G	G
PMC	G	G	G	G	G	G	G	G	G	G											G	G	G	G	G	G	G	G	G	G	G	G
CM	G	G	G					G	G							G	G				G	G	G	G	G	G	G	G	G	G	G	G
RD	G	G						G	G	G						G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
TS	G	G	G					G	G	G	G					G	G				G	G	G	G	G	G	G	G	G	G	G	G
PI	G	G	G					G	G							G	G	G	G		G	G	G	G	G	G	G	G	G	G	G	G
VER	G	G	G					G	G	G						G	G				G	G	G	G	G	G	G	G	G	G	G	G
VAL	G	G	G					G	G												G	G	G	G	G	G	G	G	G	G	G	G
IPM	G	G	G	G	G	G		G	G	G											G	G	G	G	G	G	G	G	G	G	G	G
RSKM	G	G	G					G	G							G	G				G	G	G	G	R	G	G	G	G	G	G	G
DAR	G	G	G	G	G	G															G	G	G	G	G	G	G	G	G	G	G	G

	SG1							SG2								SG3					GG2										GG3	
	SP 1.1	SP 1.2	SP 1.3	SP 1.4	SP 1.5	SP 1.6	SP 1.7	SP 2.1	SP 2.2	SP 2.3	SP 2.4	SP 2.5	SP 2.6	SP 2.7	SP 2.8	SP 3.1	SP 3.2	SP 3.3	SP 3.4	SP 3.5	GP 2.1	GP 2.2	GP 2.3	GP 2.4	GP 2.5	GP 2.6	GP 2.7	GP 2.8	GP 2.9	GP 2.10	GP 3.1	GP 3.2
REQM	G	G	G	G	G																G	G	G	G	G	G	G	G	G	G	G	G
PP	G	G	G	G				G	G	G	G	G	G	G		G	G	G			G	G	G	G	G	G	G	G	G	G	G	G
PMC	G	G	G	G	G	G	G	G	G	G											G	G	G	G	G	G	G	G	G	G	G	G
CM	G	G	Y					G	G							G	G				G	G	G	G	G	G	G	G	G	G	G	G
RD	G	G						G	G	G						G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
TS	G	G	G					G	G	G	G					G	G				G	G	G	G	G	G	G	G	G	G	G	G
PI	G	G	G					G	G							G	G	G	G		G	G	G	G	G	G	G	G	G	G	G	G
VER	G	G	G					G	G	G						G	G				G	G	G	G	G	G	G	G	G	G	G	G
VAL	G	G	G					G	G												G	G	G	G	G	G	G	G	G	G	G	G
IPM	G	G	G	G	G	G		G	G	G											G	G	G	G	G	G	G	G	G	G	G	G
RSKM	G	G	G					G	G							G	G				G	G	G	G	G	G	G	G	G	G	G	G
DAR	G	G	G	G	G	G															G	G	G	G	G	G	G	G	G	G	G	G

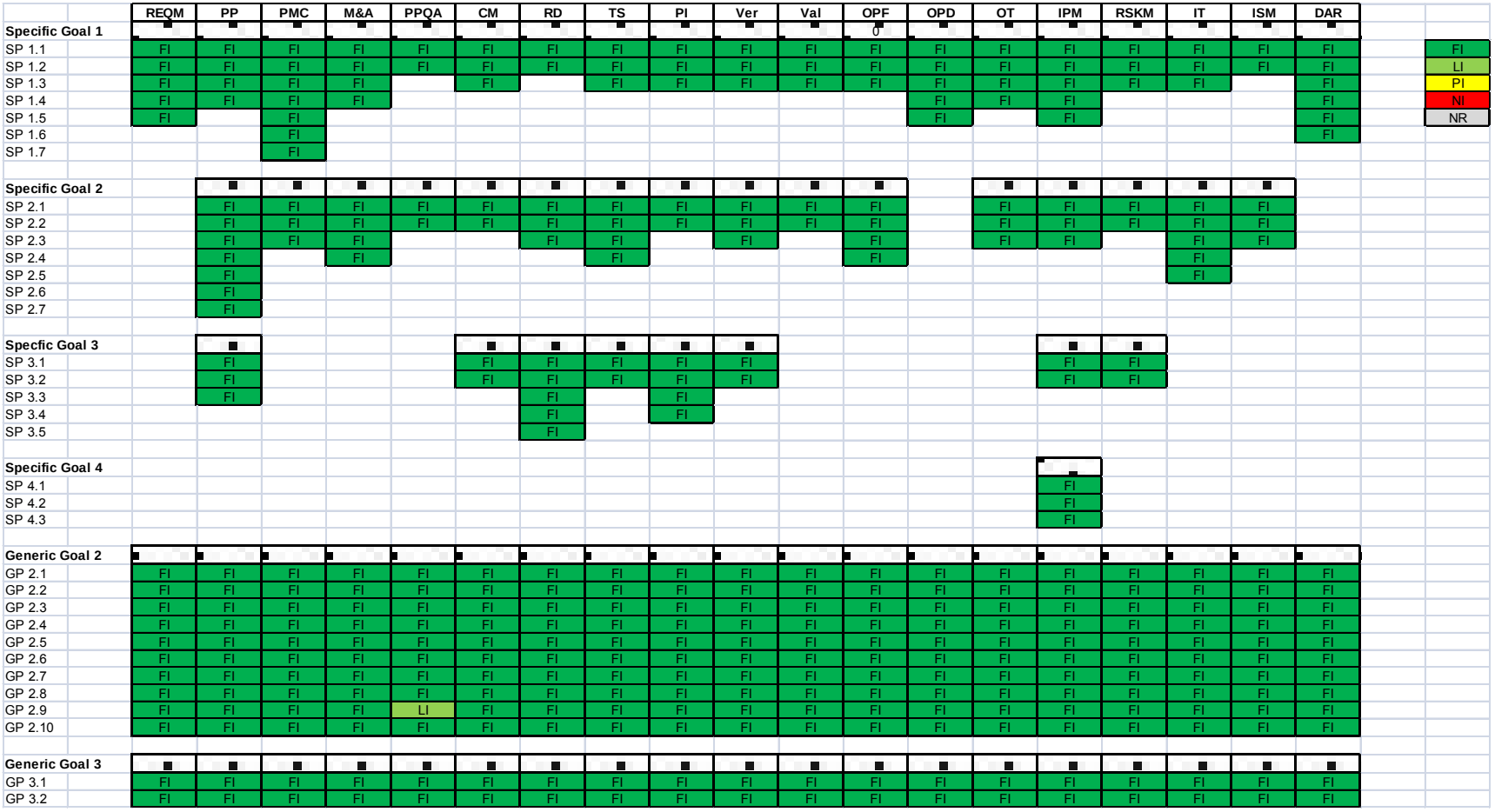
Organizational – SCAMPI B Results



	SG 1	SP 1.1	SP 1.2	SP 1.3	SP 1.4	SP 1.5	SP 1.6	SP 1.7	SG 2	SP 2.1	SP 2.2	SP 2.3	SP 2.4	SP 2.5	SP 2.6	SP 2.7	SP 2.8	SG 3	SP 3.1	SP 3.2	SP 3.3	SP 3.4	SP 3.5	GG 2	GP 2.1	GP 2.2	GP 2.3	GP 2.4	GP 2.5	GP 2.6	GP 2.7	GP 2.8	GP 2.9	GP 2.10	GG 3	GP 3.1	GP 3.2
M&A		G	G	G	G					G	G	G	G												G	G	G	G	G	G	G	G	G		G	G
PPQA		G	G							G	G														G	G	G	Y	G	G	Y	G	G	G		G	G
OPF		G	G	G						G	G								G	G	G	G			G	G	G	G	G	G	G	G	G	G		G	G
OPD		G	G	G	G	G	G																		G	G	G	G	G	G	G	G	G	G		G	G
OT		G	G	G	G					R	G	G													G	G	G	G	G	G	G	G	G	G		G	Y

- Summary
  - 574 Adequate Implementation of Mode Practice
  - 4 Partial Implementation of Model Practice
  - 2 Implementation Absent or Poorly Addressed

CGI SCAMPI A Practice Ratings

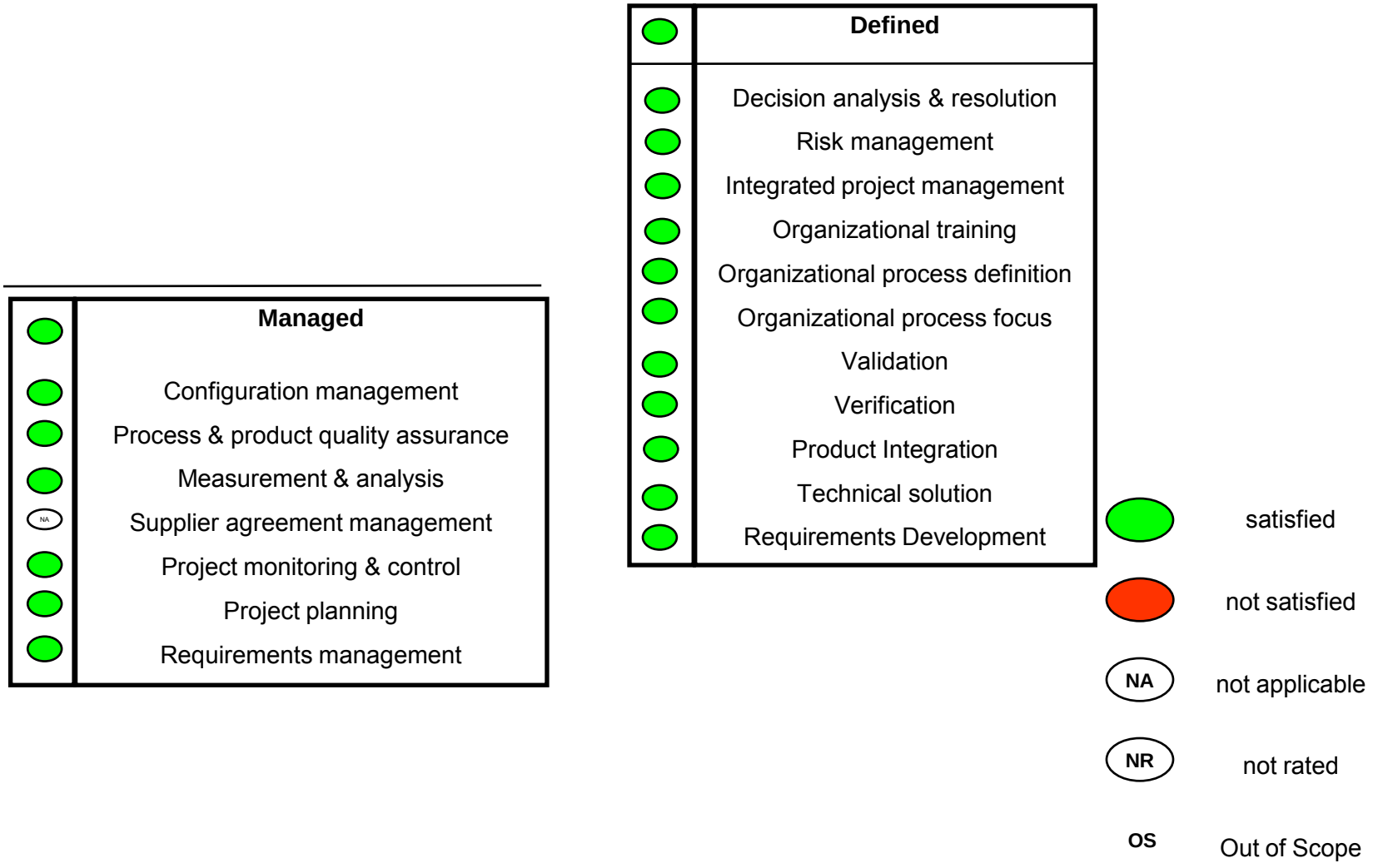


	REQM	PP	PMC	M&A	PPQA	CM	RD	TS	PI	Ver	Val	OPF	OPD	OT	IPM	RSKM	IT	ISM	DAR
Specific Goal 1																			
SP 1.1	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI
SP 1.2	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI
SP 1.3	FI	FI	FI	FI		FI		FI	FI	FI	FI	FI	FI	FI	FI	FI	FI		FI
SP 1.4	FI	FI	FI	FI									FI	FI	FI				FI
SP 1.5	FI		FI										FI		FI				FI
SP 1.6			FI																FI
SP 1.7			FI																
Specific Goal 2																			
SP 2.1		FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI		FI	FI	FI	FI	FI	
SP 2.2		FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI		FI	FI	FI	FI	FI	
SP 2.3		FI	FI	FI			FI	FI		FI		FI		FI	FI		FI	FI	
SP 2.4		FI		FI				FI				FI					FI		
SP 2.5		FI															FI		
SP 2.6		FI																	
SP 2.7		FI																	
Specfic Goal 3																			
SP 3.1		FI				FI	FI	FI	FI	FI					FI	FI			
SP 3.2		FI				FI	FI	FI	FI	FI					FI	FI			
SP 3.3		FI					FI		FI										
SP 3.4							FI		FI										
SP 3.5							FI												
Specific Goal 4																			
SP 4.1															FI				
SP 4.2															FI				
SP 4.3															FI				
Generic Goal 2																			
GP 2.1	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI
GP 2.2	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI
GP 2.3	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI
GP 2.4	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI
GP 2.5	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI
GP 2.6	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI
GP 2.7	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI
GP 2.8	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI
GP 2.9	FI	FI	FI	FI	LI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI
GP 2.10	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI
Generic Goal 3																			
GP 3.1	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI
GP 3.2	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI	FI

FI
LI
PI
NI
NR

CGI

Process Area Profile



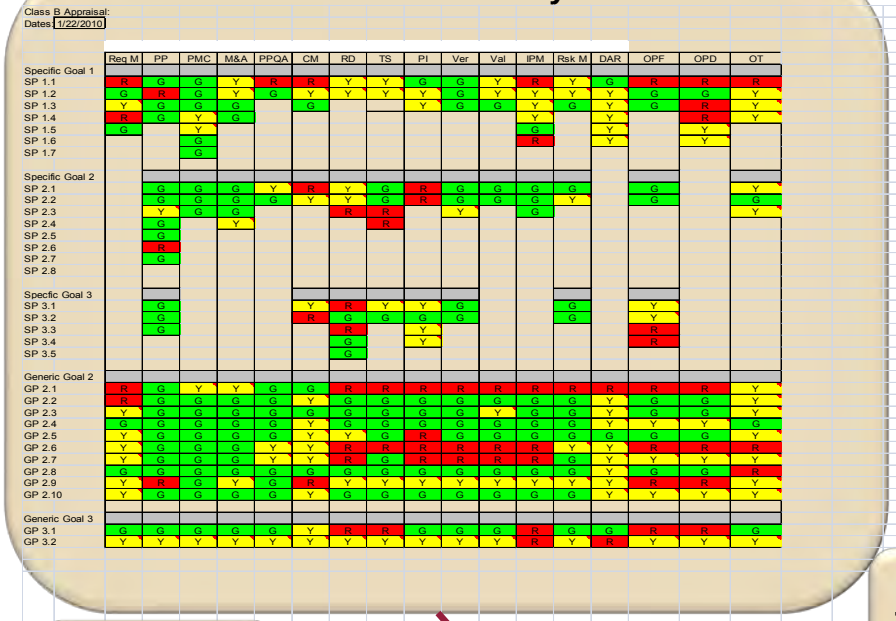
Accelerated Improvement Method (AIM) Implementation Timeline

CGI Federal, TPG, SEID

Project Performance Pilot vs Pre-TSP

- Productivity Increased by 35%
- Estimated Time on Task Variance Reduced from 18% to 7%
- Defects Found in Validation Testing Reduced by 50%
- Schedule Variance Reduced to Less than 10%

Initial GAP Analysis



August 2009 — TSP Training

September 2009 — TSP Cycle 1

January 2010 — TSP Cycle 2; EPG Launch

May 2010 — Organizational Tailoring of TSP Processes

June 2010 — TSP Cycle 3

August 2010 — SCAMPI B Appraisal

October 2010 — SCAMPI A Appraisal, ML 3 Rating

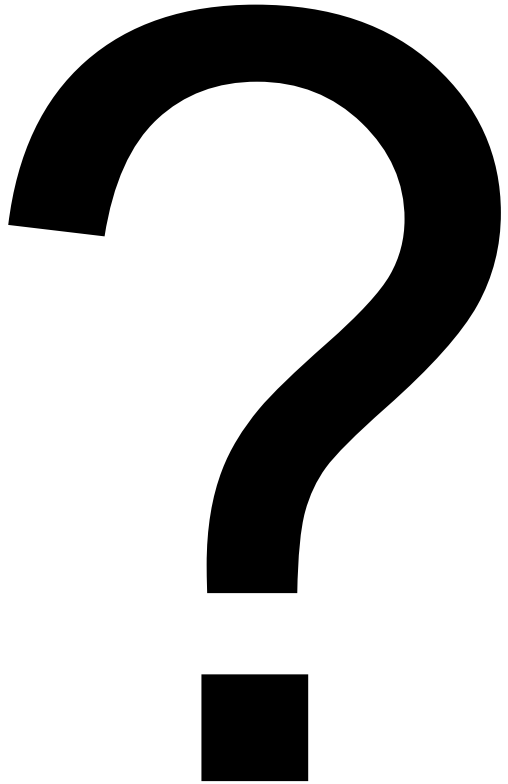
TSP Cycle 4

SEID Objectives:

- Improve Quality
- Improve Estimations
- Improve Productivity

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Questions/Comments



Agenda

- Introductions
- AIM Overview
- Experience/Insight
- Questions

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TSP[SM] and Architecture in the Real World

James McHale, SEI

(with thanks to Luis Carballo, Bursatec and Robert Nord, SEI)

NDIA CMMI Technology Conference 2011

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The Most Pervasive CMMI V1.3 Change?

Certainly the most publicized model changes are at the higher maturity levels.

But consider…

> *Requirements Development, Specific Practice 3.2 – Establish and maintain a definition of required functionality* ***and quality attributes.***

Quality attributes are mentioned dozens of times now throughout the informative material of the model.

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Quality Attributes and Architecture

From the Glossary:

> *quality attribute – A property of a product or service by which its quality will be judged by relevant stakeholders. Quality attributes are characterizable by some appropriate measure. Quality attributes are non-functional, such as timeliness, throughput, responsiveness, security, modifiability, reliability, and usability. They have a significant influence on architecture.*
>
> *architecture – The set of structures needed to reason about a product. These structures are comprised of elements, relations among them, and properties of both.*

In the most basic sense, quality attributes, whether expressed or implied, are what drive architectural decisions.

Put another way, architecture decisions express quality attributes, *whether they are stated or not*.

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An Opportunity for Architecture

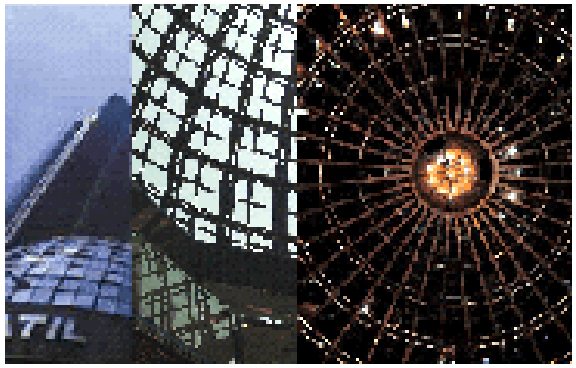
Background:

- Bolsa Mexicana de Valores (BMV) operates the Mexican financial markets under license from the federal government.
- Bursatec is the technology arm of the BMV.
- BMV desired a new trading engine to replace the existing stock market engine and integrate the options and futures markets.
- The BMV performed a build vs. buy analysis, and decided to replace their three existing trading engines with one in-house developed system.



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The Project -1



Bursatec committed to deliver a trading engine in 8-10 quarters:

- High performance (as fast or faster than anything out there)
- Reliable and of high quality (the market **cannot** go down)
- Scalable (able to handle both spikes and long-term growth in trading volume)

Bursatec approached the SEI for support during design & development.

SEI's role—provide methods, techniques, and guidance to improve Bursatec's software delivery capability:

- Training and coaching for the system architects
- Training and coaching for the development team

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The Project -2

Architecture Decisions (to satisfy quality attributes):

- Development in Java (lower TCO)
- Low Latency Communication Multicast Network
- In memory data storage during trading session.
- Hot-Hot High Availability configuration.
- Parallel processing in JVM
- Horizontal scalability

Functional Requirements:

- Order routing with FIX protocol.
- Interconnect to current legacy systems.
- Combined Cash and Derivatives markets with a single Control Workstation.
- Separate Market Data and Index calculation system.



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A Partial List of Potential Problems

Complicating factors:

- Pressure – managers replaced when commitments are not met
- Inexperience - available staff talented but young
- Large project - scope of the project beyond the organization's recent experience
  - # of person-months
  - # KLOC/function points
  - # of interconnecting platforms
  - # of individual projects
- Key implementation technologies never used together formally
- Constant stream of new requirements/changes to business rules

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Trading Engine Quality and Other Attributes

Quality Attributes

- Under 1ms processing latency
- Horizontal scalability
- Redundant HA system
- Warm DR system
- Automatic testing framework (one day turnaround attribute)
- Localize business rules changes in specific modules

Other Attributes

- Backward compatible with current systems
- Combined platform for both markets
- Run on Commodity hardware
- 86 order type/attribute combinations (30 in current system)
- Real time updates to status of system via Control Workstation.

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The Proposed Solution –
Integrates High-Value Architecture and Team Practices

Architecture-Centric Engineering

- Proven technology.
- Strongly addresses critical technical aspects of the early project lifecycle activities.
- Specific focus on architecting to meet business objectives.
- Key managers familiar with technology via training courses.

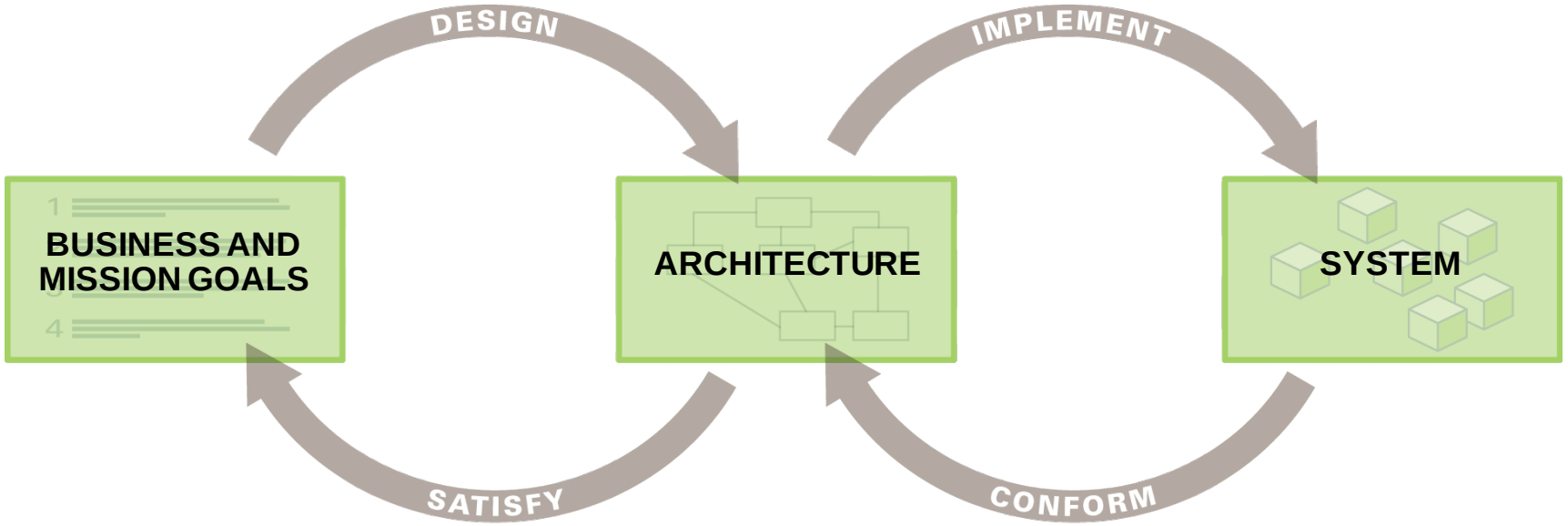
Team Software Process

- Proven technology.
- Strongly addresses management and measurement across the project lifecycle.
- Specific focus on building high-performance teams.
- Key managers familiar with technology only through word-of-mouth and literature.

TSP has a large "out-of-the-box" CMMI footprint. Architecure drove the work breakdown structure (WBS) and provided a robust framework for requirements management.

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Architecture Drives the Lifecycle



Two iterative processes based on the architecture of the system:

Design cycles (1, 2)
The goal is to design a system that ensures business success.

Implementation cycles (3, 5, 6)
The goal is to implement the system according to the design.

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QAW/BTW – Building Quality Attribute Scenarios

The Quality Attribute Workshop (QAW) and Business Thread Workshop (BTW)

- bring together important internal and external stakeholders
- develop and validate key quality attribute scenarios that ***quantitatively*** define the most important ***non-functional*** requirements
- QAW focuses on developing quality attribute scenarios
- BTW focuses on business context to validate scenarios

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Attribute-Driven Design (ADD) Method

ADD uses quality attribute scenarios to drive architectural design.

The process was time-boxed two ways.

- Six-week boxes to focus on
  - initial architectural (v1) while training architect team
  - refined architecture (v2) for early review or ATAM[1]
  - "complete" (not final) architecture (v3) for use by developers[2]
- Two-week boxes that focused on
  - developing the architecture
  - preparing for and performing ATAM-based peer-reviews with the "architecture coach"

1. ***Development team was launched at this point***
2. ***ATAM actually occurred at this point***

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Views and Beyond for Architecture Documentation

"View and Beyond is not a method, but a collection of techniques:

1. Find out what architecture information stakeholders need.
2. Provide that information to satisfy the needs.
3. Capture the information in views, plus beyond-view information.
4. Package the information in a useful form to its stakeholders.
5. Review the result to see if it satisfied stakeholders' needs."

From the SEI class *Documenting Software Architectures,*
http://www.sei.cmu.edu/training/p33.cfm.

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Active Review of Intermediate Designs (ARID)

An ARID was held in conjunction with a TSP relaunch.

The purpose of ARID is to

- put the architectural documents into the hands of developers
- ensure that the documents are fit for development use (right information recorded at sufficient level of detail)
- provide early “live” feedback to the architecture team

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Architecture Trade-off Analysis Method (ATAM)

ATAM

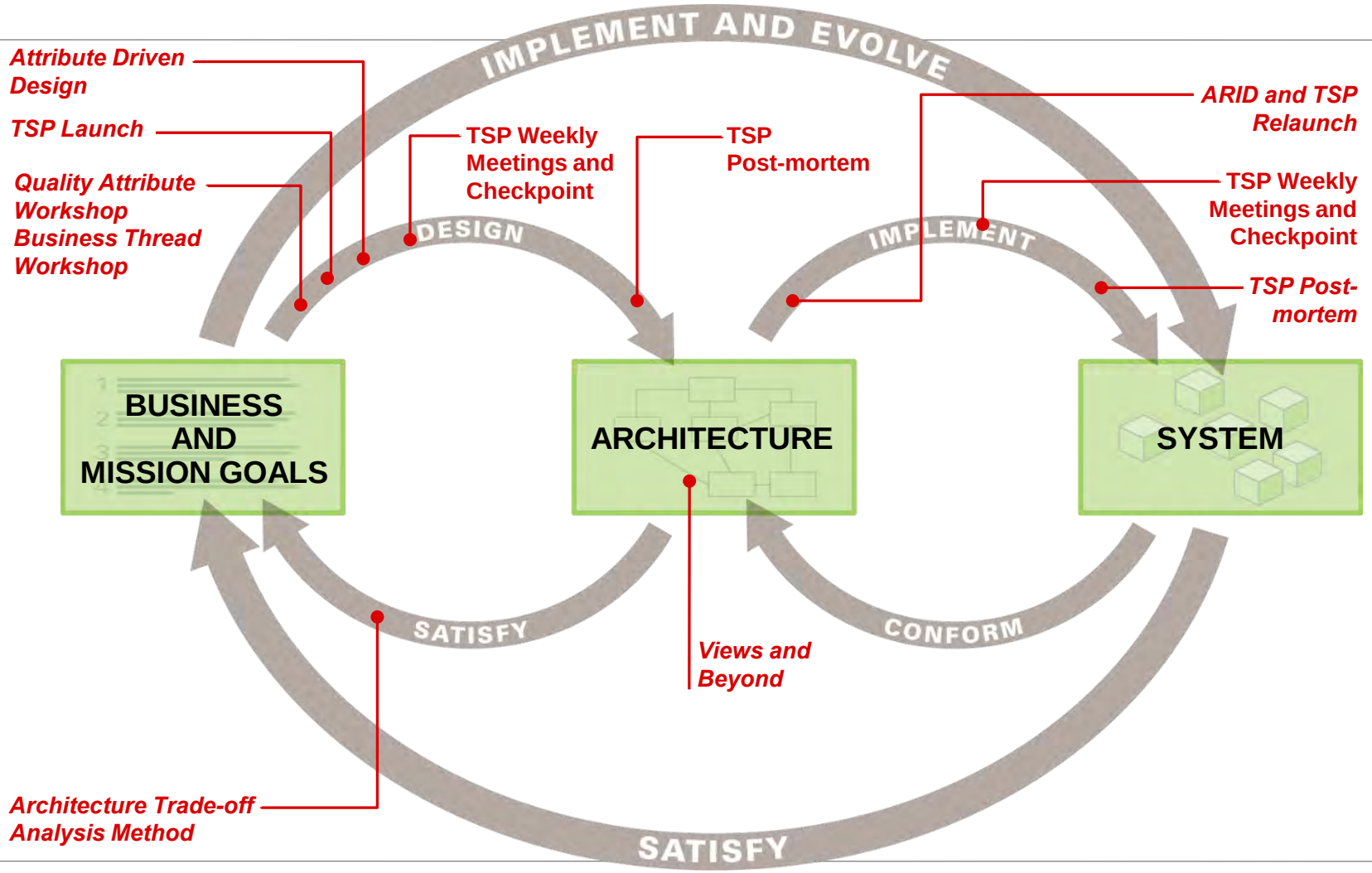
- brings together a system's stakeholders
- evaluates the existing architecture with respect to the quality attribute scenarios
- focuses on surfacing architectural risks
- promotes & requires adequate documentation of the architecture

As mentioned previously, two-day ATAM-based peer-reviews were used by the architecture coach during development.

- on-the-job training for architecture team
- forced adequate documentation from the start
- fewer risks surfaced at formal ATAM than expected for size/scope of project

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ACE / TSP Design, Analysis, and Implementation



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Trading Engine

Multicast Network

Horizontal Scalability

Legacy w/ Msg translation

HA

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Special TSP Roles for Architecture

TSP defines certain standard roles on a software development team.

- "Staff" roles - planning, quality, process, support
- "Line" roles – customer interface (requirements), design, implementation, test

Planning and performing these roles have a large CMMI footprint.

The team defined three special roles to address critical architecture issues.

- Lead architect – a coming "standard" role
- Performance manager – the #1 quality attribute scenarios
- Garbage collection manager – the #1 technical risk to performance

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Project History

Cycle 1 (Architecture) – Completed Jan. 2010 (on time), demonstrated architecture coaching for the first time, evaluation of comm. packages, built test framework

Cycle 2 (Infrastructure implementation) – Completed Apr. 2010 (on time), included successful ATAM in Mar. 2010 (documentation noticeably thorough, no significant new architectural risks discovered)

Cycle 3 (Basic functions and main performance loop) – Completed July 2010 (on time), good (not great) quality, performance exceeding requirements by more than a factor of 5

Cycle 4 (Non-TSP cycle, outside evaluation by world-class experts) – Completed Aug. 2010, JVM & high-speed redundant communications

Cycle 5 (Full normal operations, complete performance loop) – Completed Jan. 2011 (on time)

Cycle 6 (Full functionality incl. startup, shutdown, & maintenance modes) – Completed July 2011 (additional scope extended scheduled June finish)

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Current Project Status – cont.

Cycle 7 – System Test / Integration Test

- ***ALL QUALITY ATTRIBUTES HAVE BEEN DEMONSTRATED AT OR BETTER THAN SPECIFIED LEVELS.***
- On Time (expected Oct. 2011 finish)
- Integration Test with Legacy systems

Cycle 8 – Acceptance Test / Parallel Test

- Internal user testing / certification
- Scheduled to start in 4Q'2011

Cycle 9 – User Test / Deployment

- Brokerage firms testing , including functional, HA, throughput and DRP tests
- Scheduled to start late 2011

Go-Live Scheduled 2Q'2012

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Select Process Data

Measured size through cycle 7 (actual)

- ~208 eKLOC in 24 months

Effort distribution through cycle 6 (% of task hours)

Cycle 1	Cycle 2	Cycle 3	Cycle 5	Cycle 6
14.4	4.9	19.4	32.5	28.8

Effort distribution through cycle 6 (% by “block activities”)

Mgt	Req	Arch	DLD	Code	Test	Other
3.7	17.5	12.0	18.5	32.2	14.5	1.5

25.3% of all recorded task hours through cycle 6 were some form of review or inspection, 48% requirements or design.

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Current Project Status

- Very low defect count in System Test
- Defects encountered have not modified the Architecture
- Unit Test in place with high code coverage
- Testing Framework allowed a smooth continuous integration
- Regression tests done within the same day (except for multiday orders)
- Static analysis tools for Inspections and Architecture Integrity
- Latency and throughput metrics exceeded initial expectations

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Key Takeaways

Architecture and TSP were focused on core of the system (Matching Engine)

Other key components would have benefitted with TSP such as:

- Message Format translator
- Trading Terminal

Most of the issues encountered have been with the interaction with legacy systems: Reporting, Billing, Market monitoring due to legacy fields.

Requirements / Inspections could be done better (including DLD interfaces with legacy systems) to have a better defect yield.

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Future Potential for TSP & Architecture

This is not a complete set of possible TSP adaptations of architecture processes.

- Applying architecture methods to a large legacy system that requires significant enhancements demands different adaptations of the underlying principles.
- Applying SOA (service-oriented architecture) methods would be a related but different set of adaptations.

The presumption is that the appropriate combination of TSP and architecture methods meets the intent of the (new) CMMI practices.

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Questions?

?

See the SEI website for information on their architecture-related conference, *SATURN 2012.*

http://www.sei.cmu.edu/saturn/

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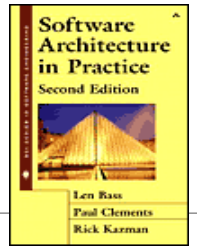
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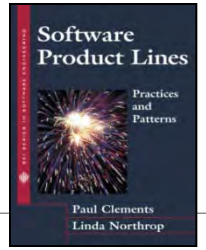
Backup Slides

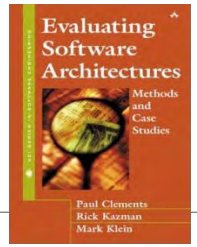
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ACE Training







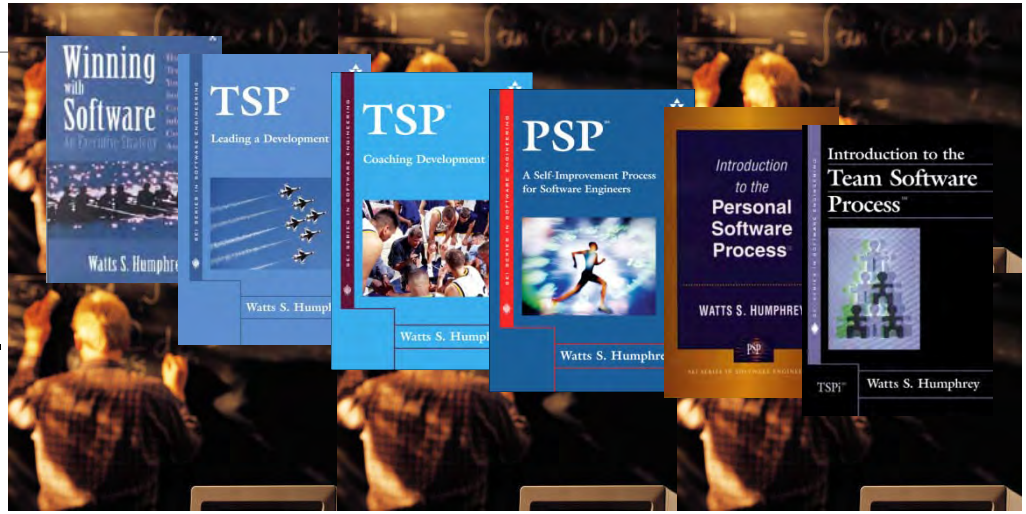


	CERTIFICATE PROGRAMS		CERTIFICATION
Requirements	**Software Architecture Professional**	**ATAM Evaluator**	**ATAM Leader**
Software Architecture: Principles and Practices course	●	●	●
Documenting Software Architectures course	●		●
Software Architecture Design and Analysis course	●		●
Software Product Lines course	●		
Software Architecture: Principles and Practices Exam	●	●	●
ATAM Evaluator Training course		●	●
ATAM Leader Training course			●
ATAM Observation			●

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PSP[SM] training

Personal Software Process (PSP[SM]) training is *essential* to successful TSP implementation.



- *TSP Executive Seminar* (1 day for top-level execs, middle managers)
- *TSP Team Leader Training* (3 days for team leads, affected managers)
- *PSP Fundamentals* (5 days for software developers)
- *TSP Team Member Training* (3 days for other disciplines)

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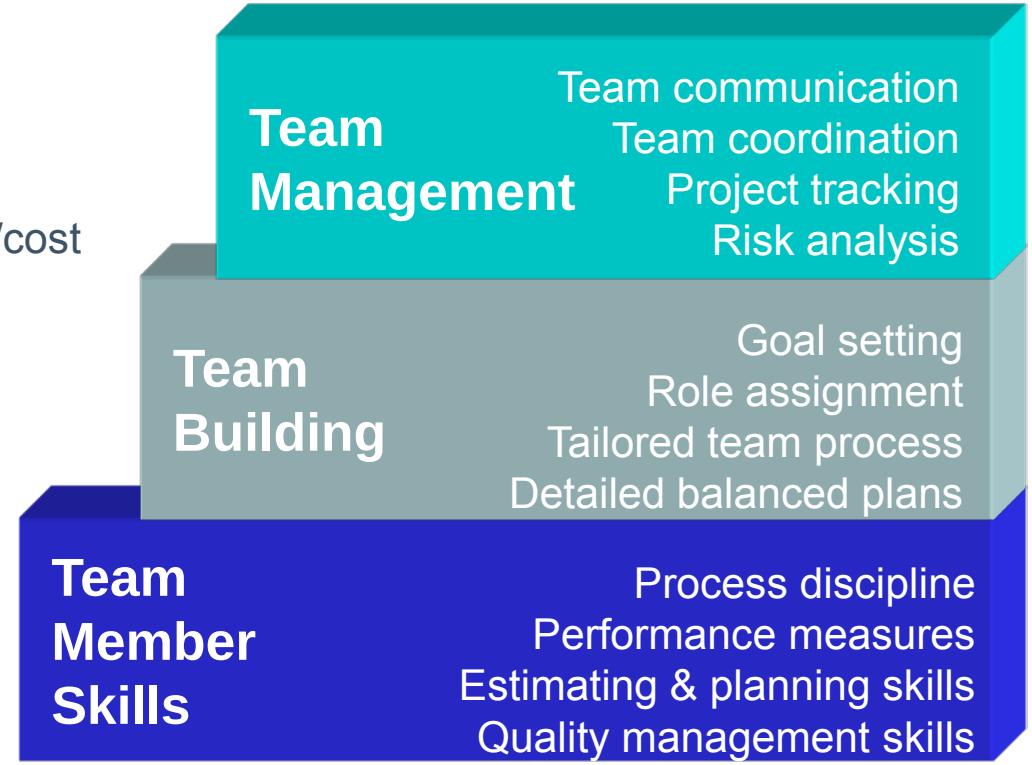
Building a High-Performance Engineering Team

The Team Software Process (TSP) is a development process for engineering teams

- Meet planned commitments
- Produce high-quality products
- Deliver working software on time/cost

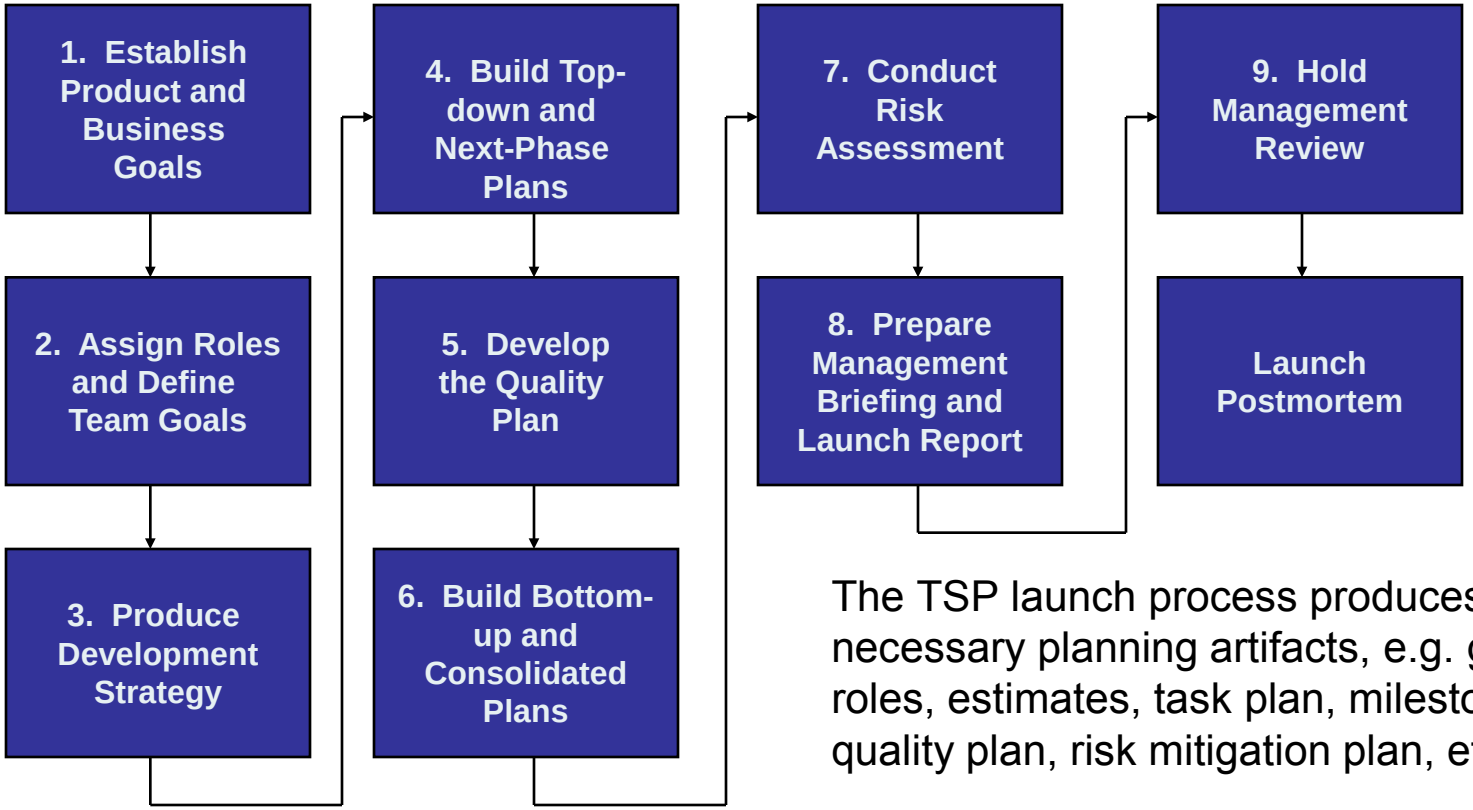
The TSP provides a disciplined, measured approach to engineering.

Focus on quality, cost, and schedule performance by improving the management and engineering of software at the team and individual level.



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The TSP Launch Process

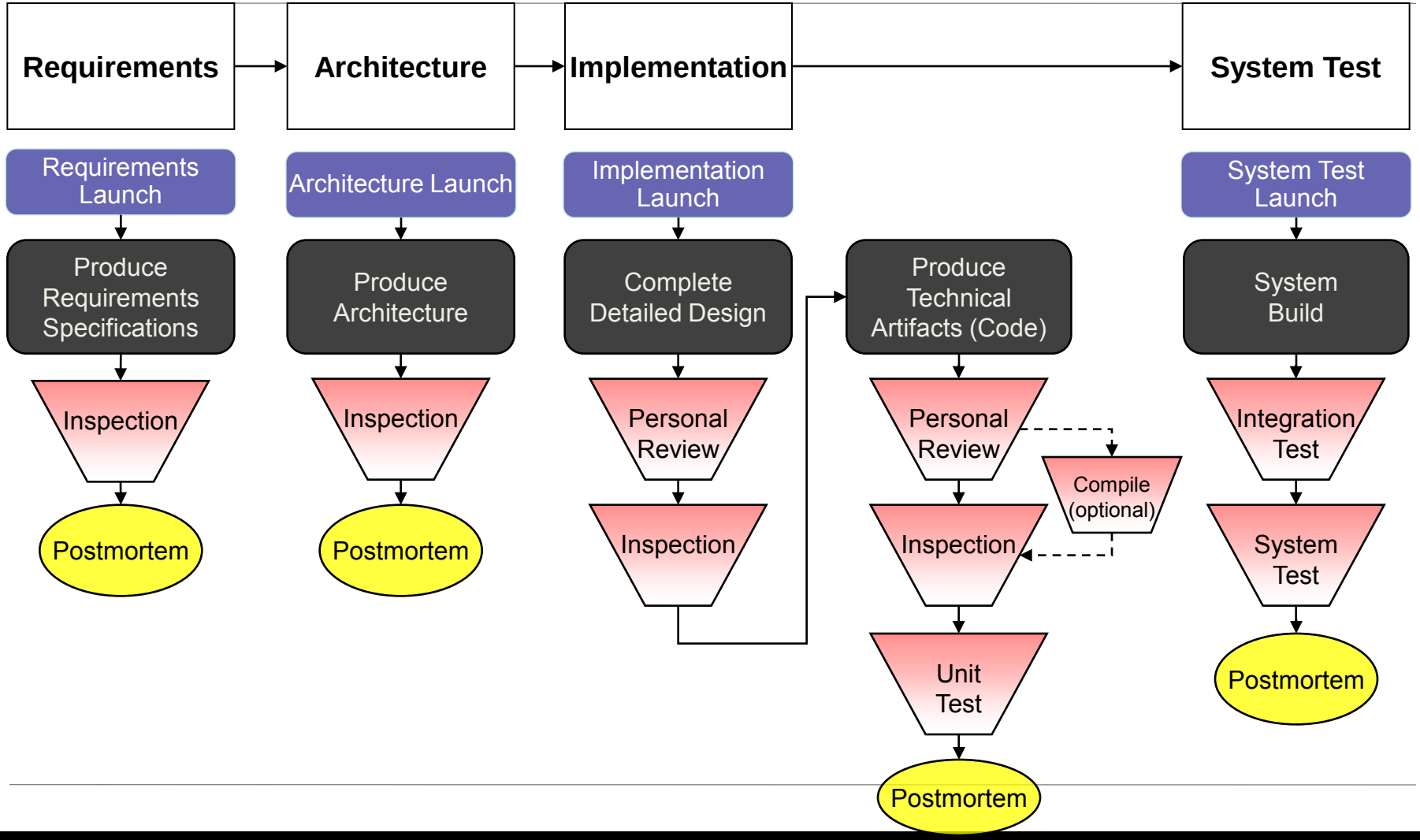


The TSP launch process produces necessary planning artifacts, e.g. goals, roles, estimates, task plan, milestones, quality plan, risk mitigation plan, etc.

The most important outcome is a committed team.

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TSP-ACE Development Process



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TSP Guidelines for Architecture Methods -1

Training (SEI courses – SAPP, DSA, SADA, ESA)

- *Software Architecture Principles & Practices (2 days or 11 hrs. online)*
- *Documenting Software Architectures (2 days – some concepts overlap with PSP design templates)*
- *Software Architecture Design and Analysis (2 days)*
- *Evaluating Software Architecture (2 days – can be replaced by an architecture coach; recommended for TSP coaches)*

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TSP Guidelines for Architecture Methods -2

For first projects:

- An architecture coach is essential for inexperienced teams, replacing ESA training.
- ESA may be sufficient for experienced teams, especially if there is architecture expertise elsewhere in the organization.
- Expertise in defining and capturing quality attributes (QAW) and evaluating architectures (ATAM) is worth the price.

Architectural Process Assets

- Views & Beyond (taught in DSA) informs design standards.
- ADD (a subject in SADA) is the basic architecture design process.
- Lead Architect is more than a design manager.

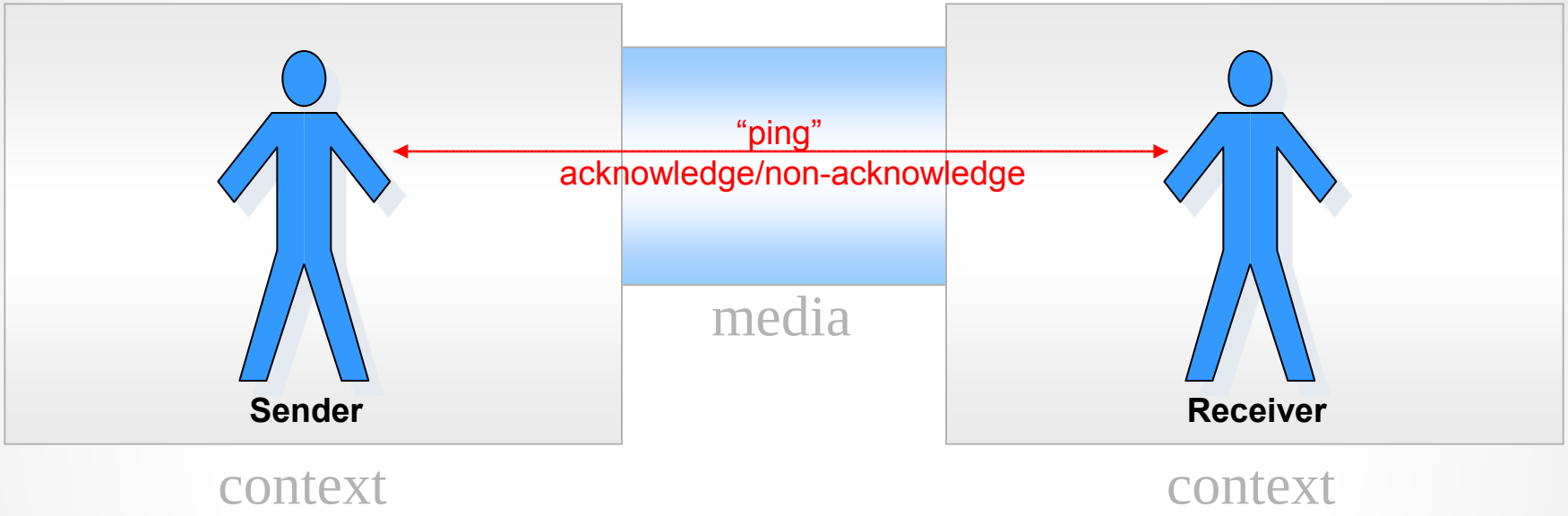
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Message Over Medium:

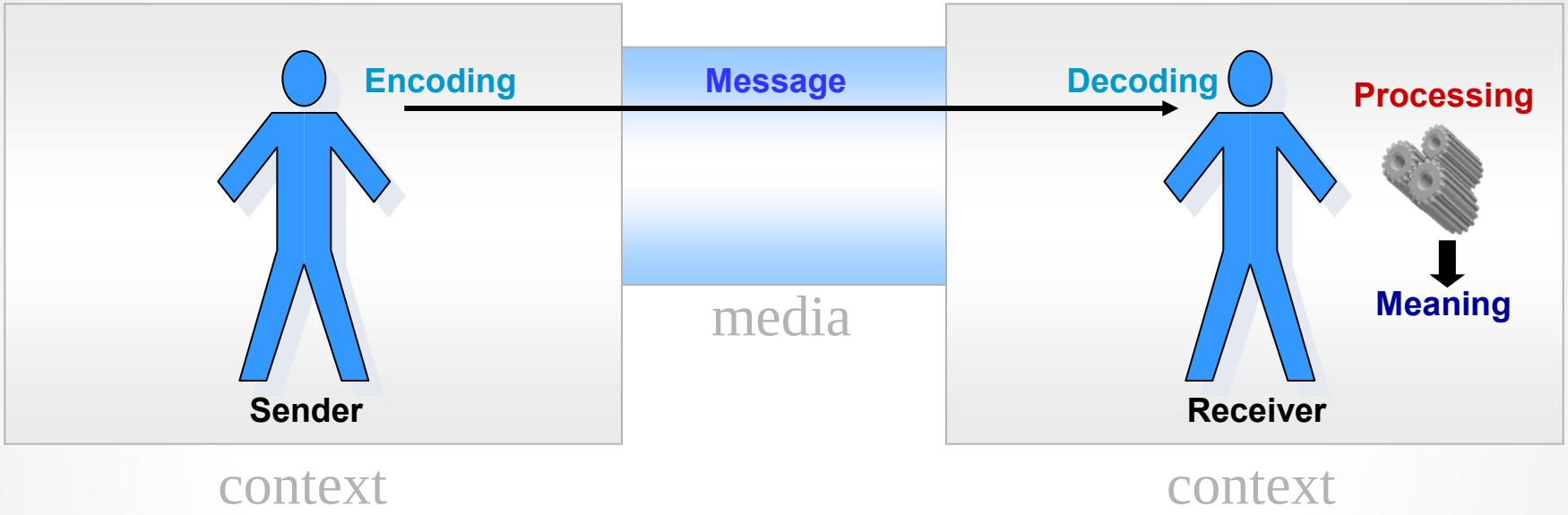
Communication Loops in the CMMI

Elements of Communication

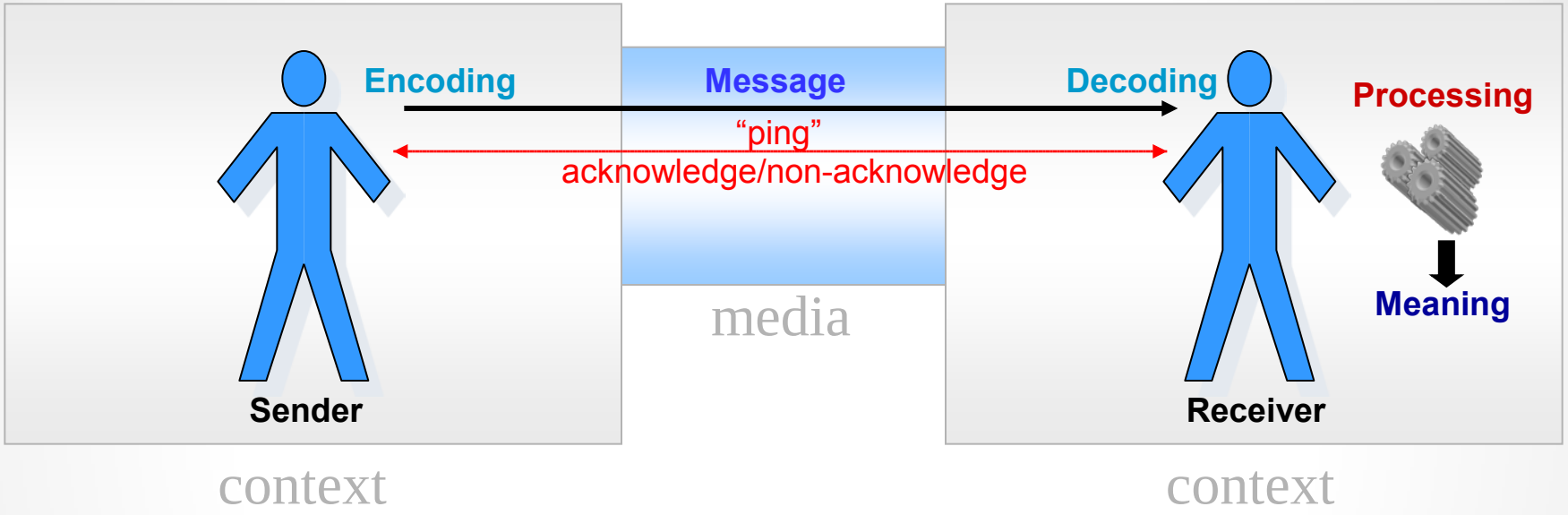
Elements of Communication



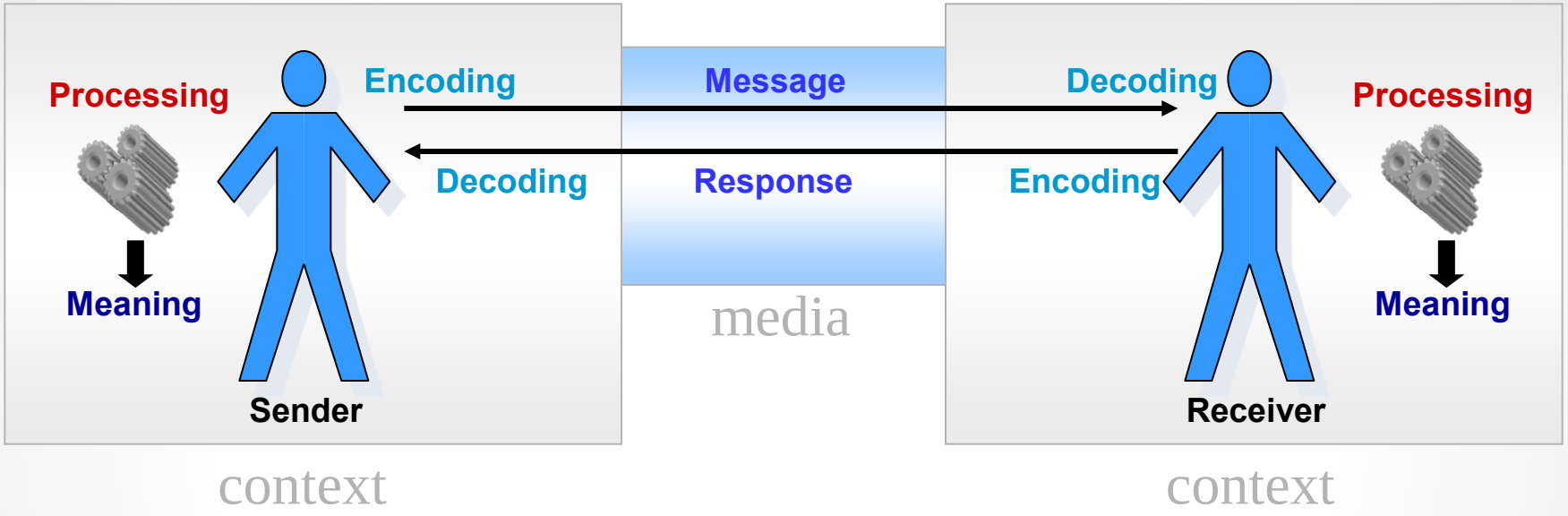
Elements of Communication



Elements of Communication



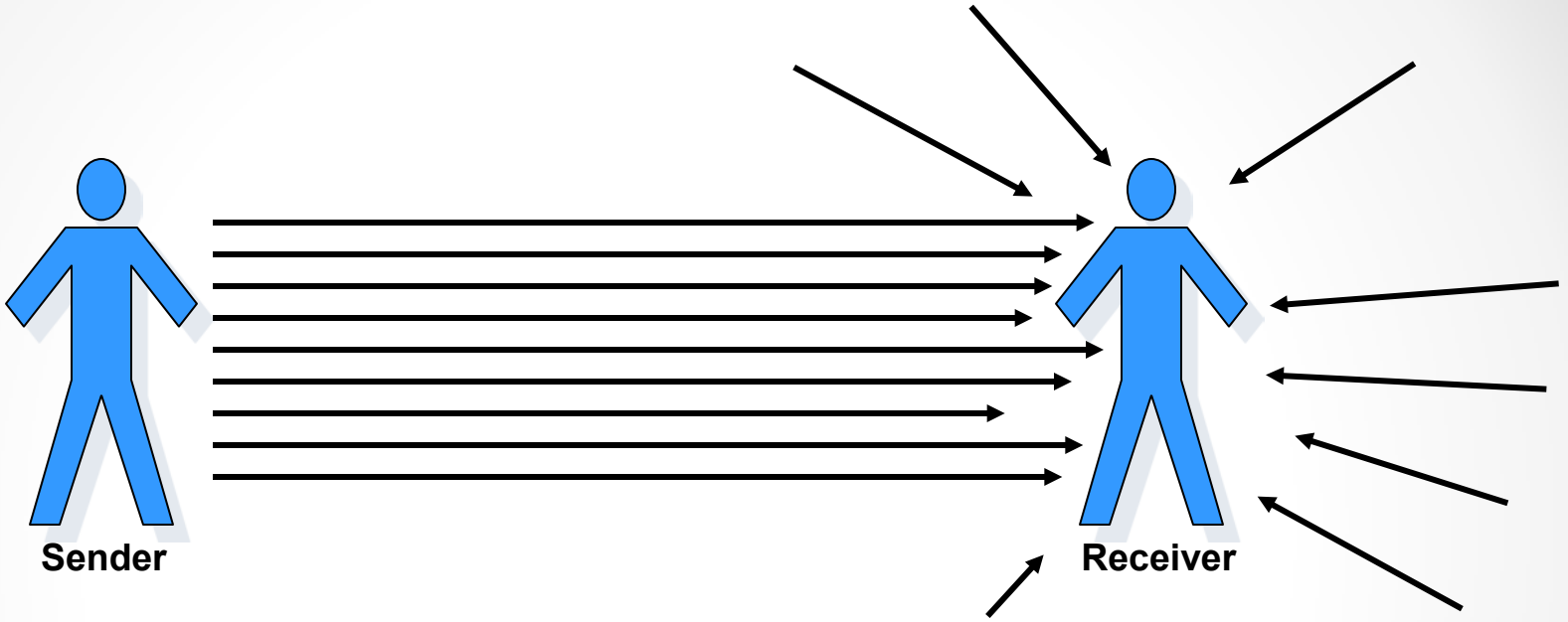
Elements of Communication



Elements Summary

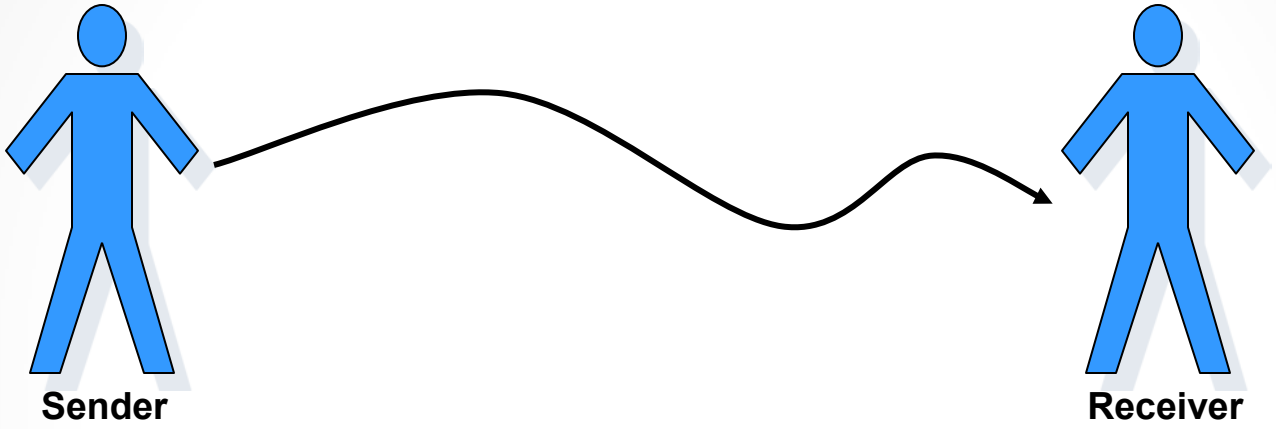
- Sender
- Receiver
- “Handshaking”
- Medium
- Message
- Contexts
- Meaning

Noise via Overload



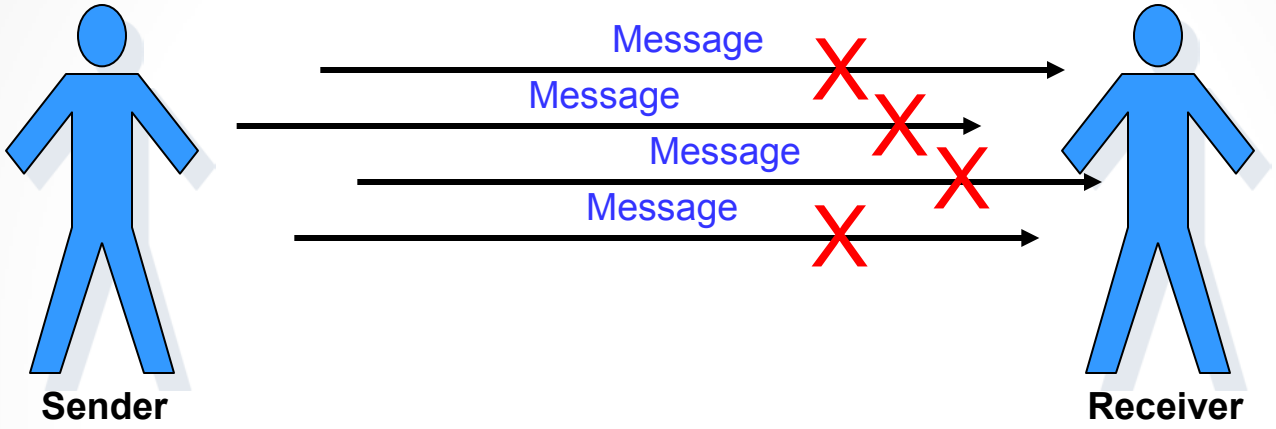
- Unfiltered communication
- Environmental factors
- Input Selection challenges

Noise via Distortion



- Medium unreliability distorts or redacts
- Faulty encoding/decoding
- Context mismatch
- Synchronization issues

Noise via Mixed Messages



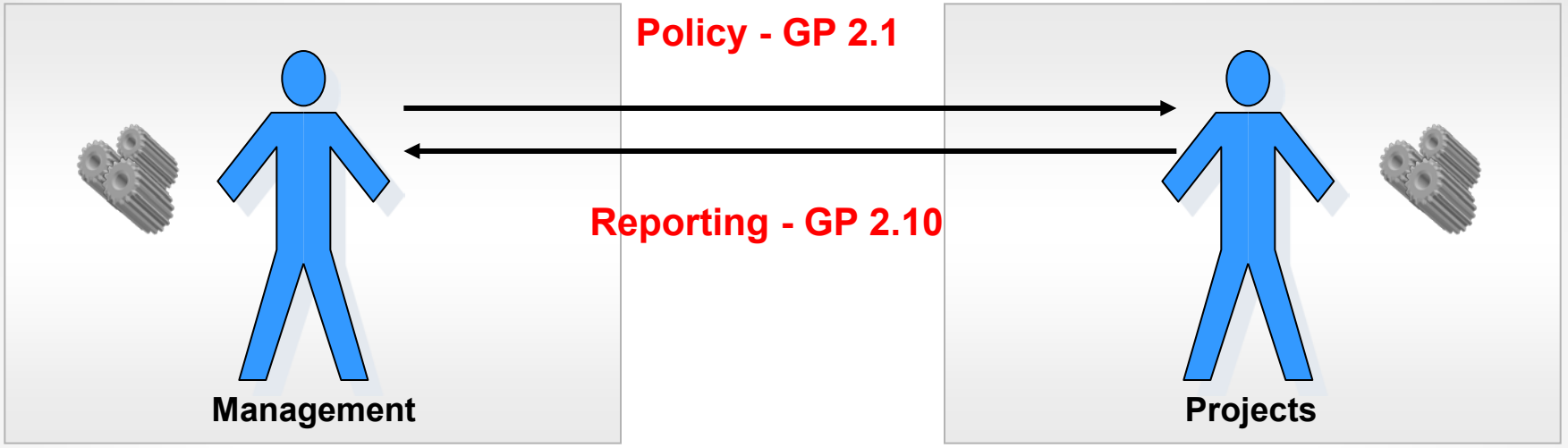
- Mixed Messages

Noise Summary

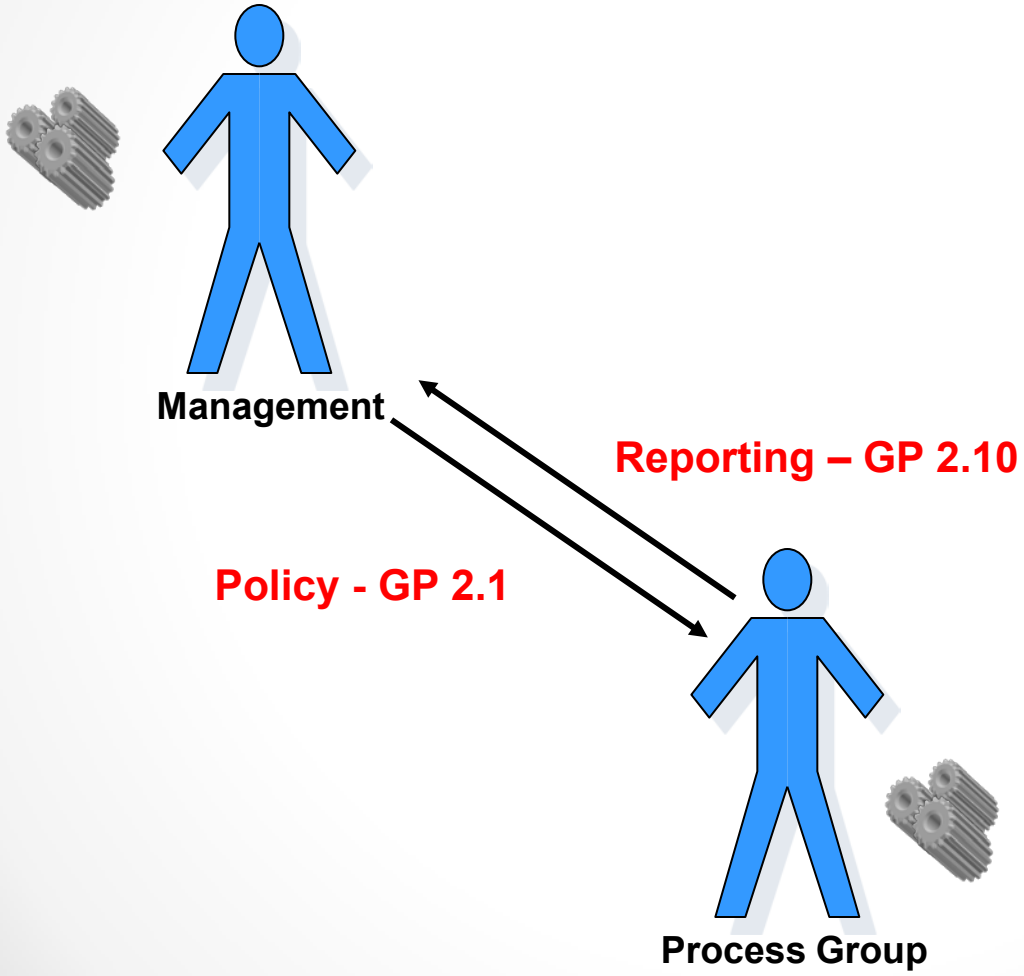
- Overload
- Distortion
  - Medium unreliability
  - Faulty encoding/decoding
  - Context mismatch
  - Synchronization issues
- Mixed Messages

Communication Loops in The Generic Practices

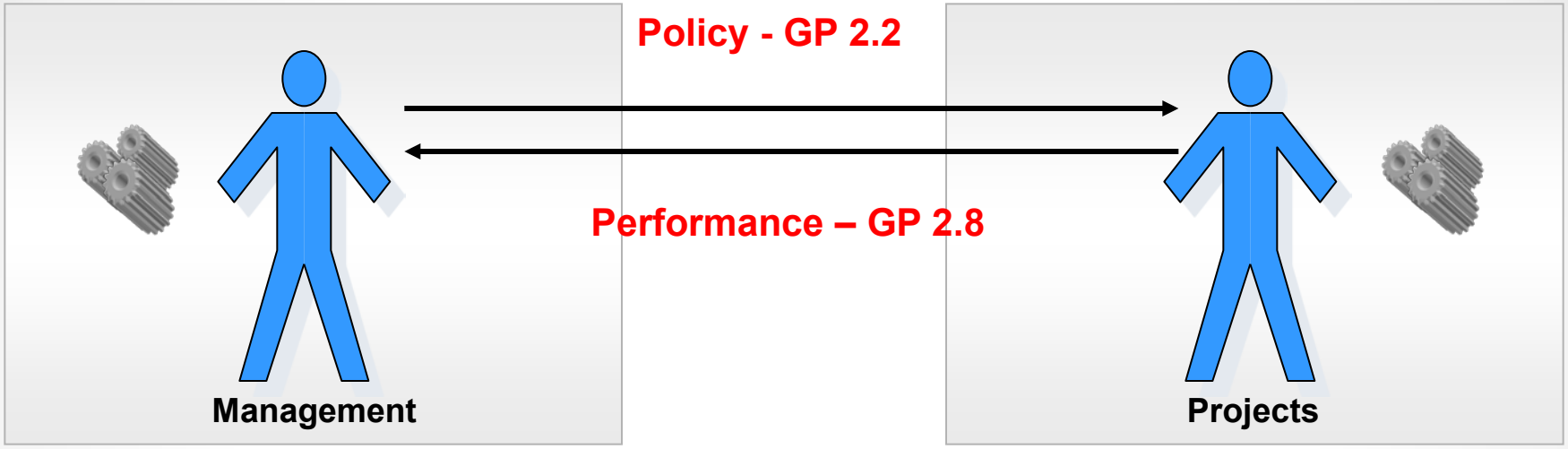
Loop – Policy and Reporting



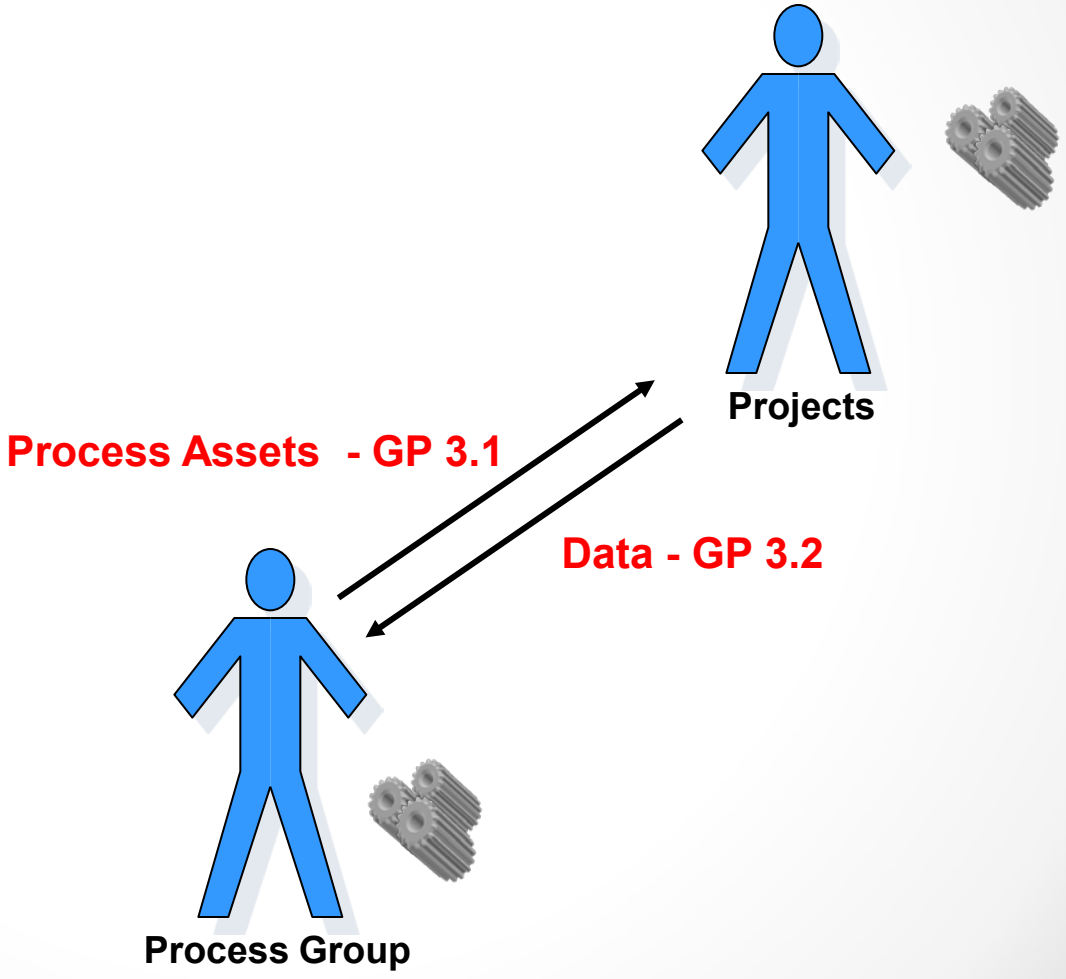
Policy and Reporting - SEPG



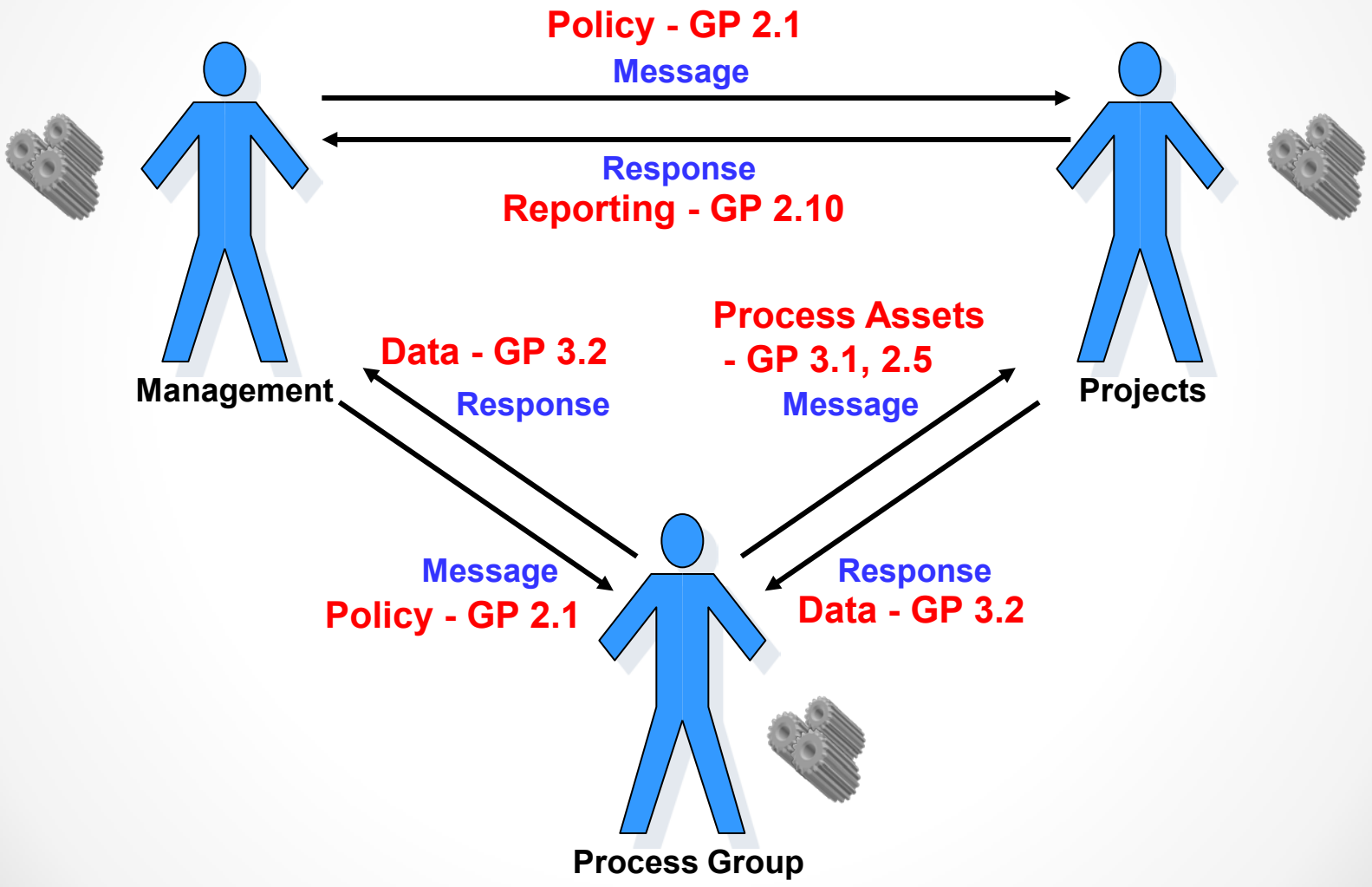
Loop – Planning and Performance



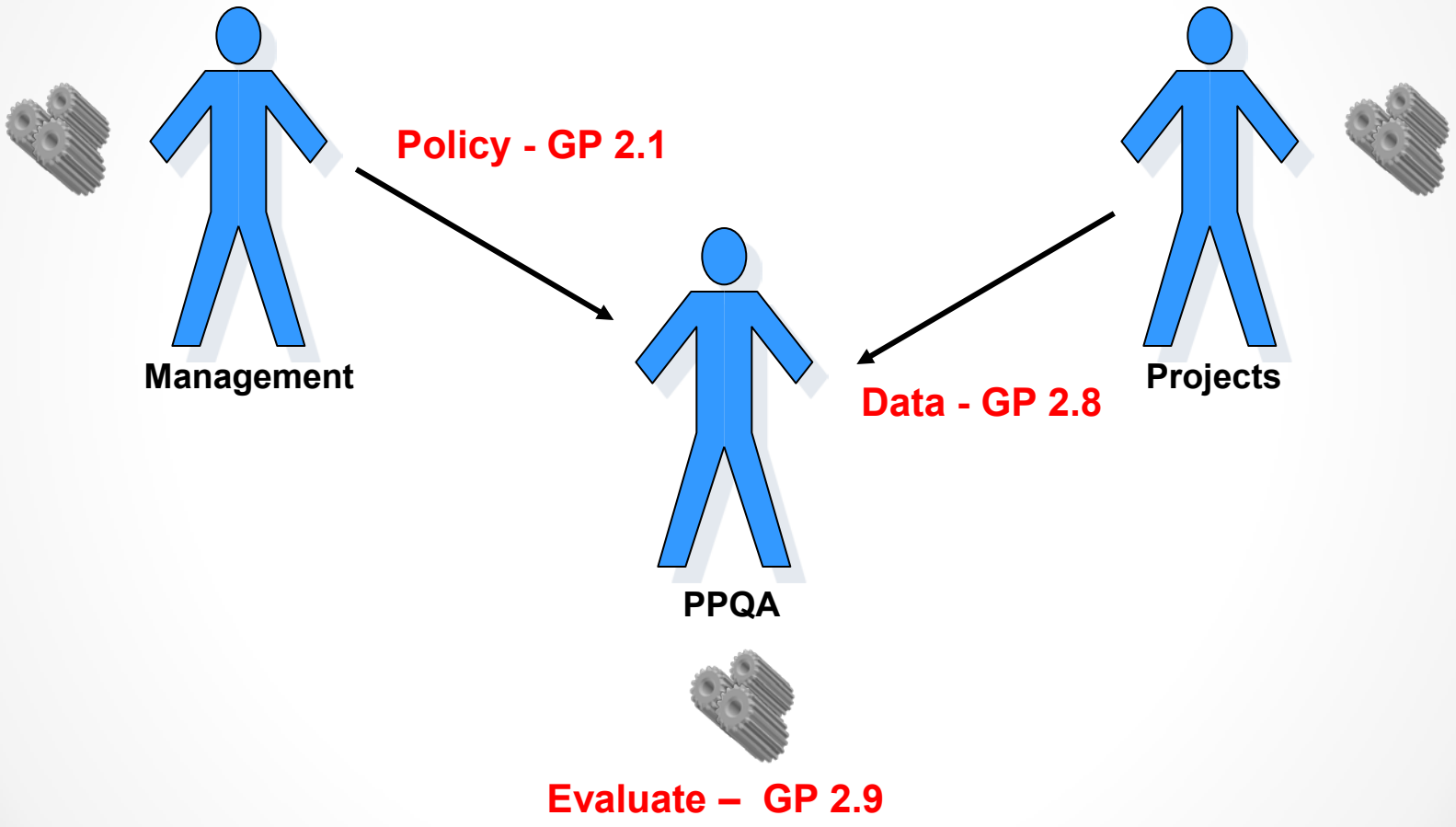
Process Communication



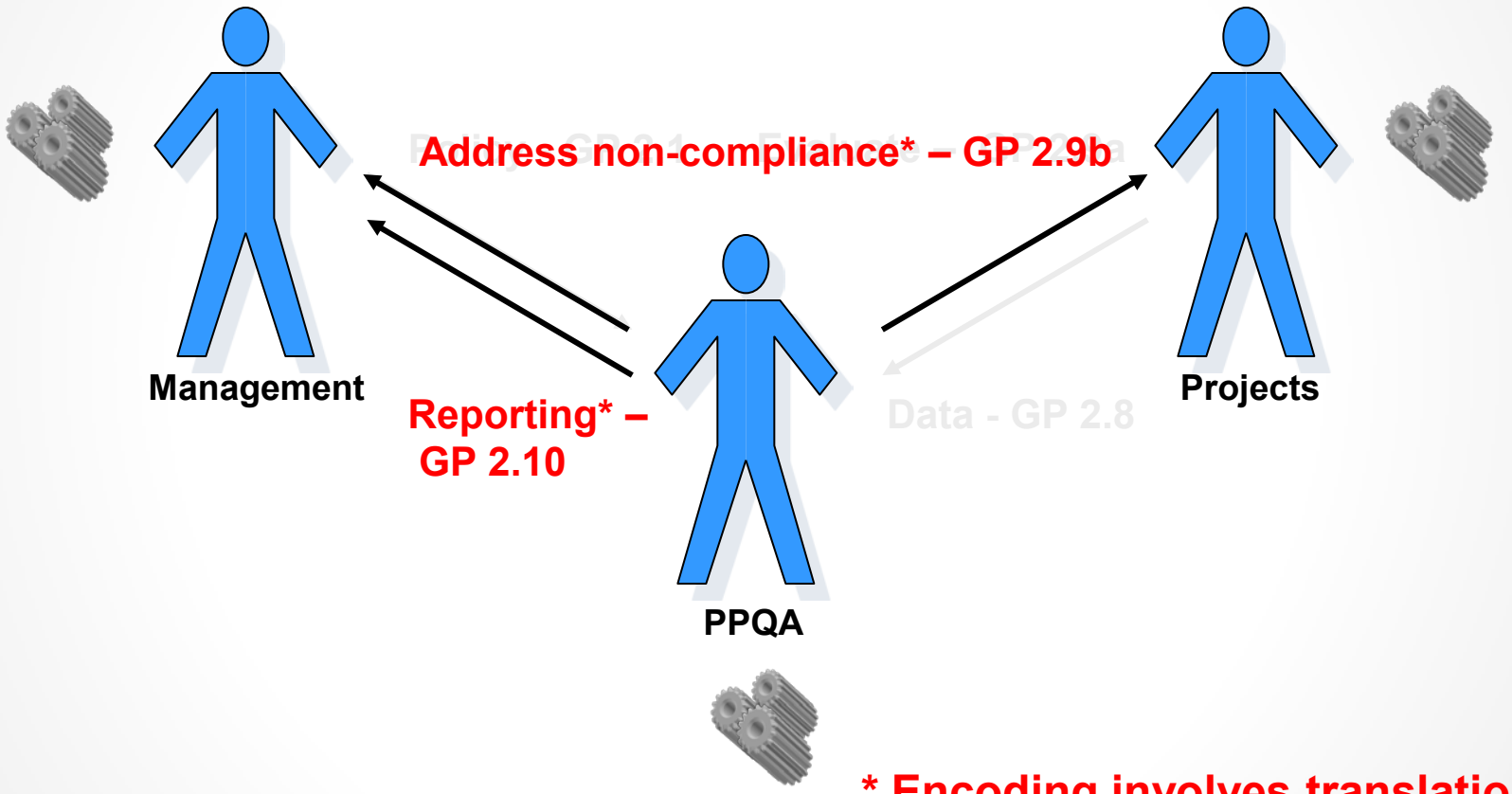
Multi-Level Communication



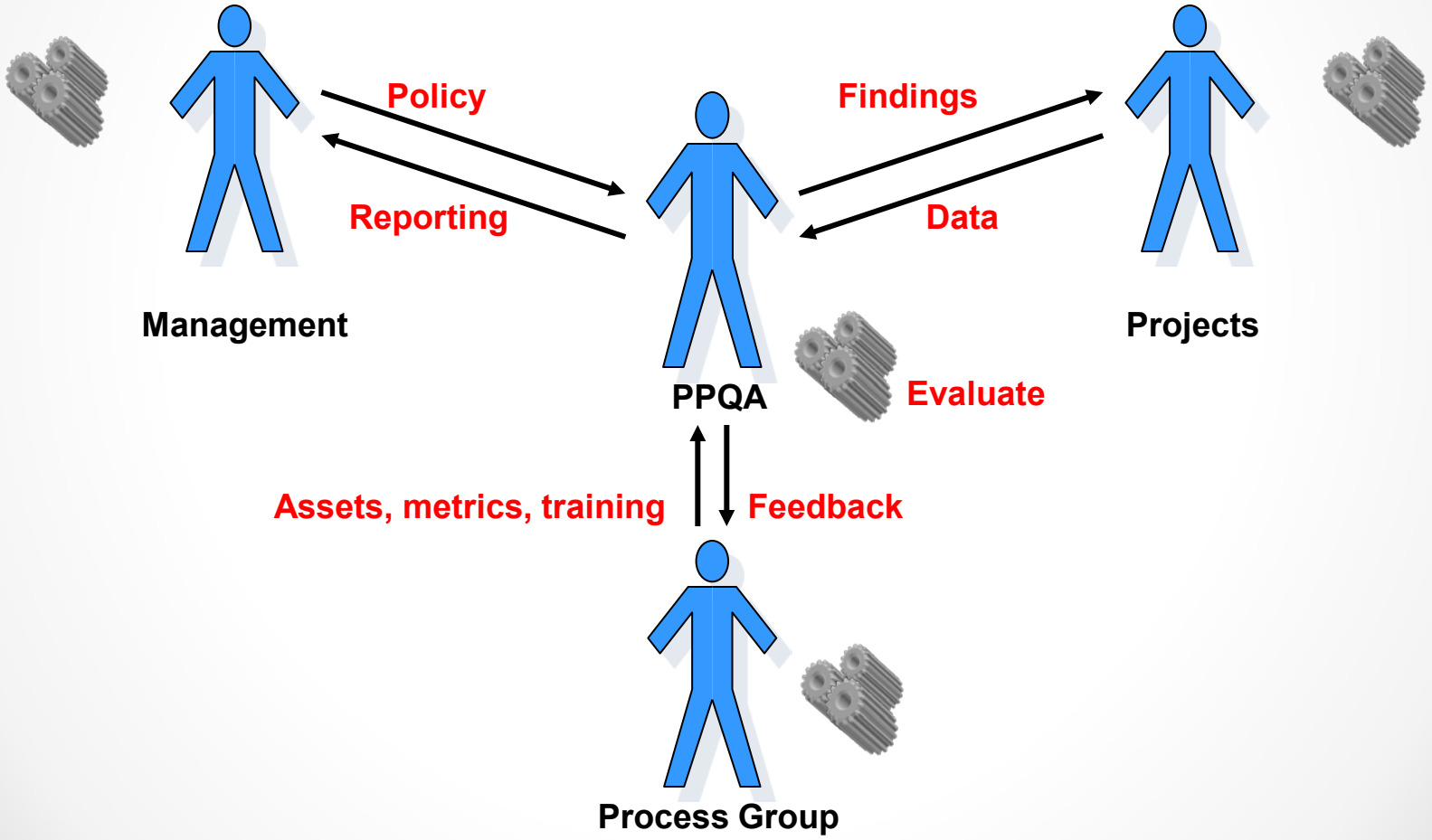
Objective Evaluation



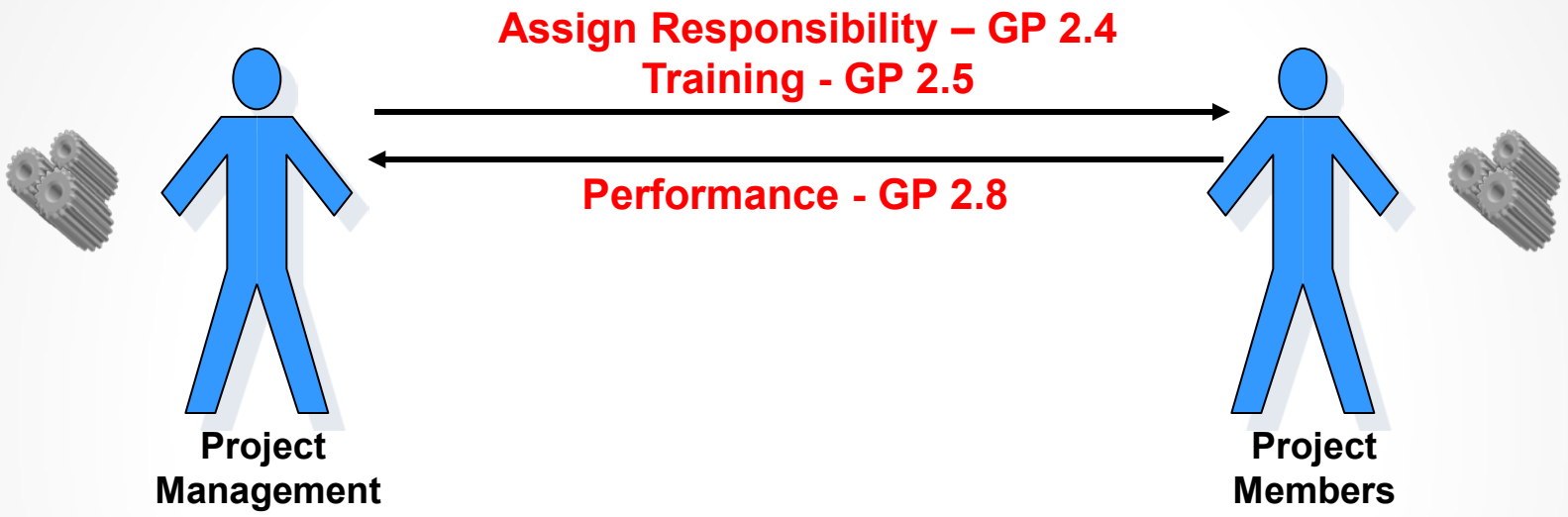
Adherence


Address non-compliance* – GP 2.9b
Management
Reporting* – GP 2.10
Data - GP 2.8
Projects
PPQA
* Encoding involves translation

Reporting

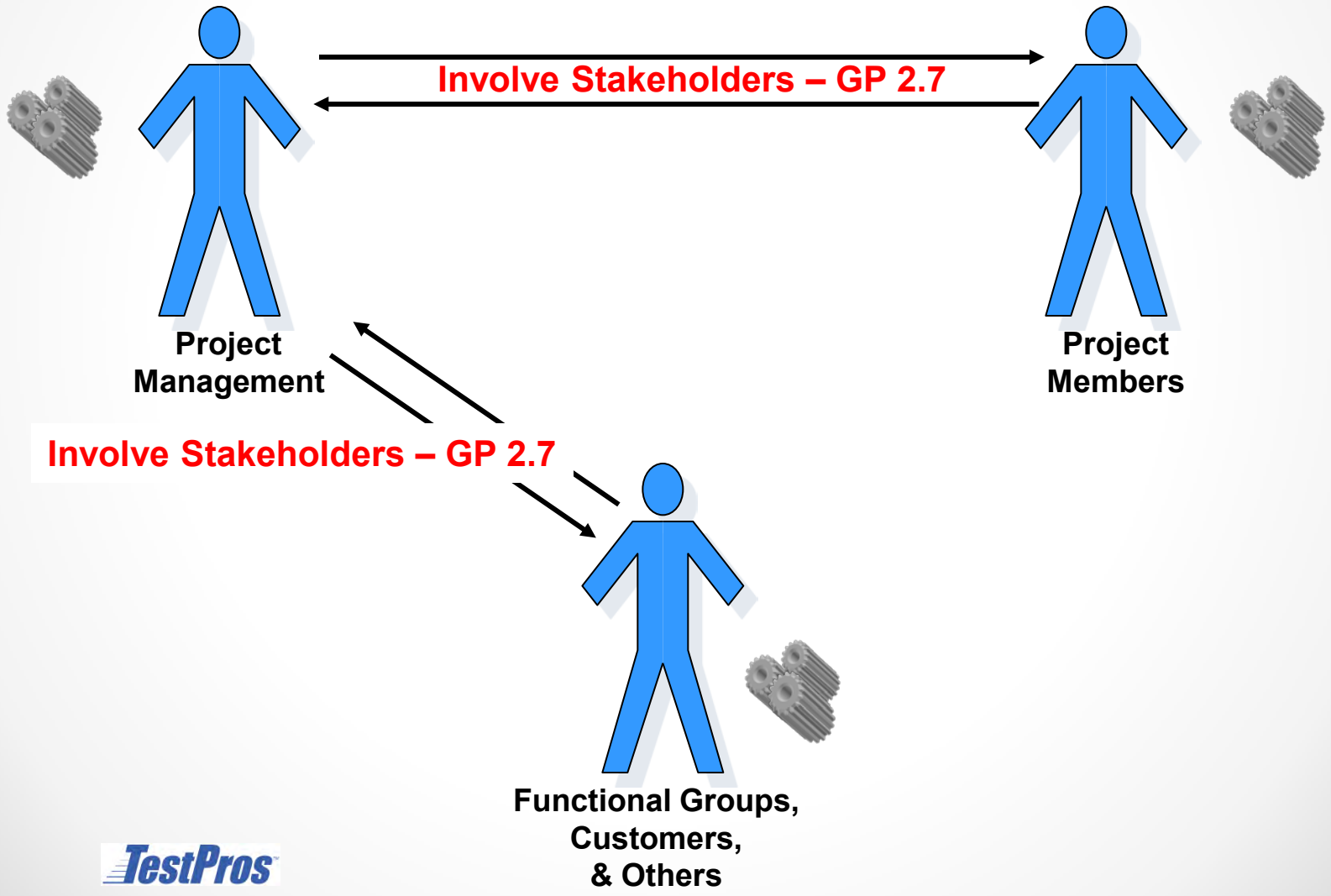

Policy
Reporting
Findings
Data
Management
PPQA
Projects
Evaluate
Assets, metrics, training
Feedback
Process Group

Skills and Responsibilities

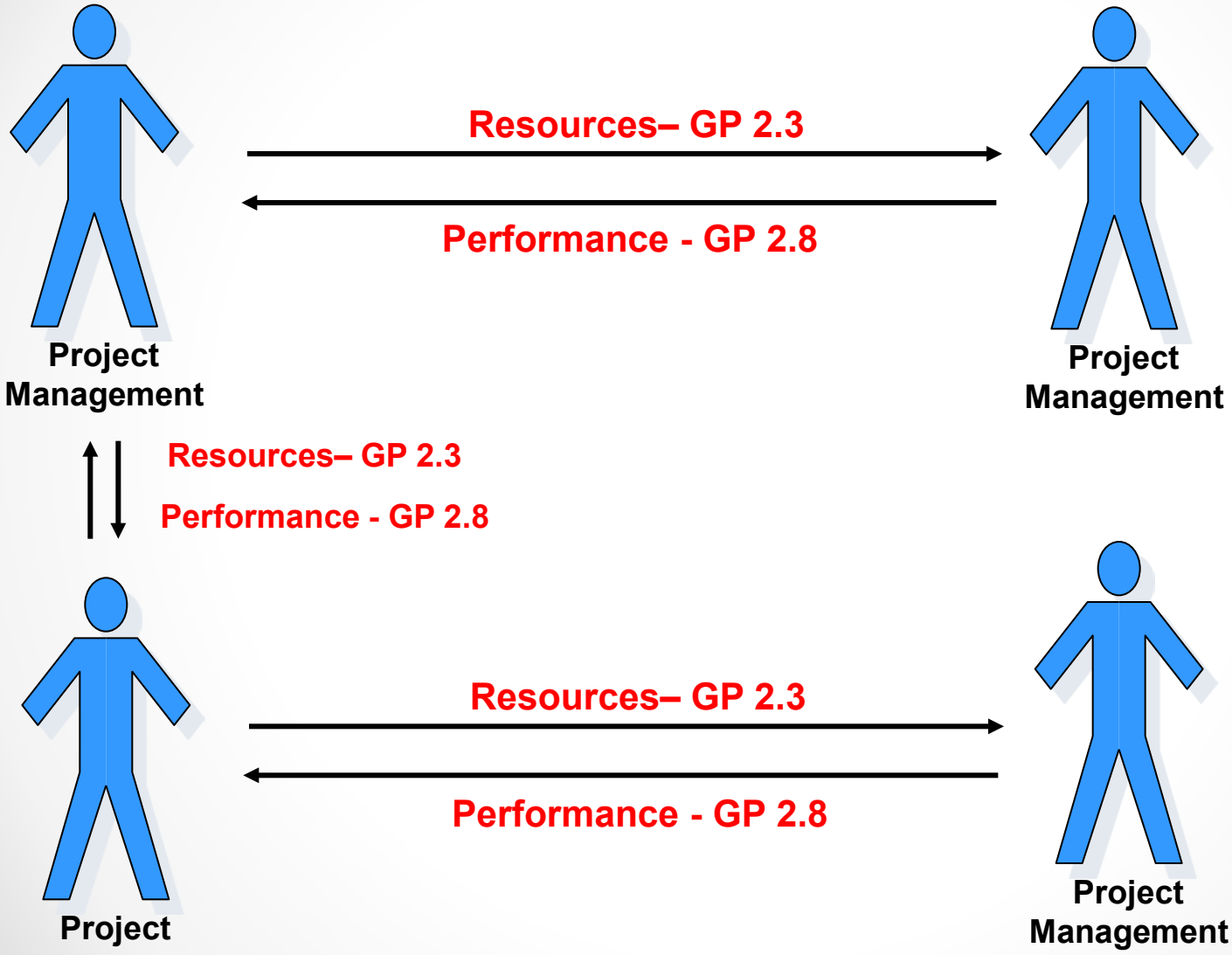


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Stakeholders



Tools and Resources



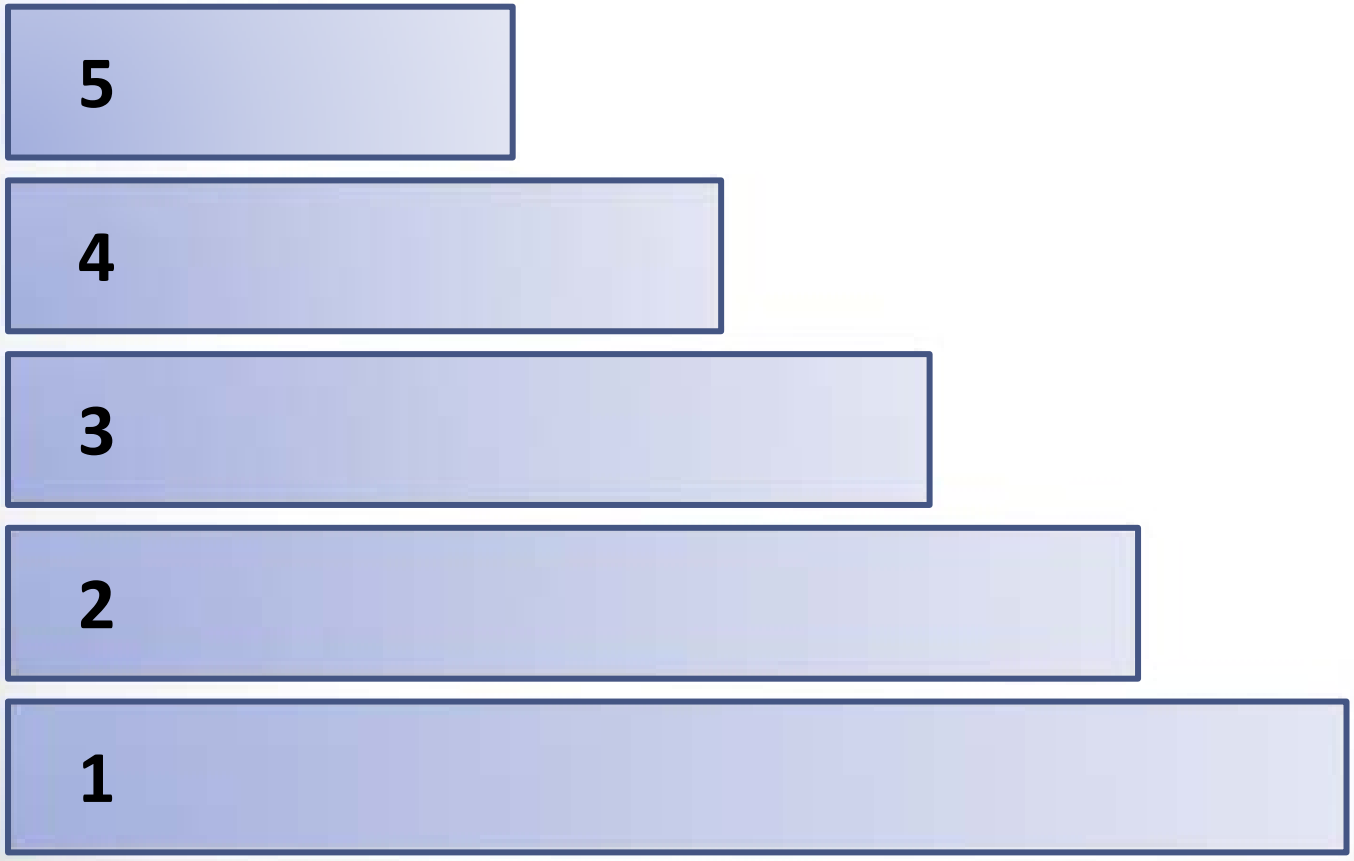
Specific Practices (Very Briefly)

Specific Practice Examples

- DAR.SP1.6 Select Solutions "Document and communicate to relevant stakeholders the results and rationale for the recommended solution."
- IPM.SP2.3 Resolve Coordination Issues "Communicate issues to relevant stakeholders."
- MA.SP1.4 Specify how measurement data are analyzed and communicated; SP2.4 Communicate Results
- OPF.SP3.1 "…deployment of process assets include…identifying how changes to organizational process assets are communicated."
- OPM.SP1.1 "quality and process performance objectives may need to be created or maintained and re-communicated."
- PMC.SP.3.1 Monitor Project Risks "Communicate the risk status to relevant stakeholders."
- PPQA.SP.2.1 Communicate and Resolve Noncompliance Issues
- RD.SP.3.2 Establish a Definition of Required Functionality and Quality Attributes "This functional description…communicates the manner in which the product will be used."

Insights and Issues

Communications and Maturity Levels



Issues with CMMI Application

- Typical Noisy Errors
  - Confusing the model with process
  - Neglecting the bottom line
  - Compartmentalization of improvement efforts
  - Maturity Level Mandates
- Common consequence: inability to measure and discuss impact of changes (empty communication)
- Usual Outcome: using the documentation (medium) as indicators of success

How Issues Arise

- Encoding, decoding, context issues often are intangible
- The medium is tangible and attracts attention
- The “medium over message” syndrome surfaces
- Focusing on the medium can aggravate noise issues, resulting in a vicious cycle

Solution: Focus on Communication

- The model implies all components of communication loops
- The model doesn't tell us specifically what we should say
- The model does indicate what we should be able to communicate about
  - Model as prescriptive method => noise
  - Model as diagnostic => real communication loops

Summary

- The CMMI describes communications, both explicitly and by implication
- Media is a critical element, but not the only one
- The media serves the messages in communication
- Improper focus on the media may distort or completely subvert the message
- Understanding complete communication loops and how the CMMI relates to them preserves the critical messages

Process Improvement via CMMI

Presented by: OST, Inc.

November 17th, 2011

OST®

CMMI LEVEL 5 | ISO 9001:2008

Agenda

- **Case Study I**: Use CAR to reduce the time taken to close critical defects
- **Case Study II**: Use QPM to dynamically manage our program to optimize expected project objectives
- Questions



Case Study - I

Using CAR to reduce the time taken to close critical defects

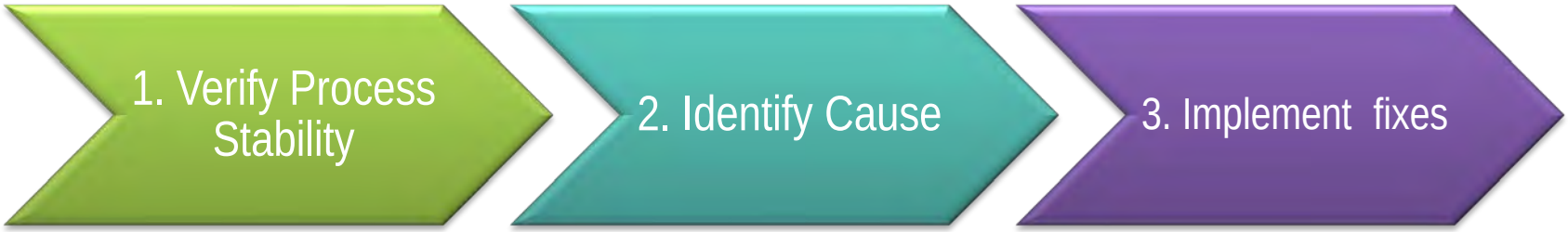
Background

- Mission critical project
- Major release involving complete re-write of 350,000 lines of code
- Process already in place for system testing and logging of defects
- Data Source – Mercury Quality Center
- Daily review of defects opened, fixed, tested and closed

GOAL: Why do a CAR

- Reduce the mean and standard deviation for the time taken to close critical defects
- Identify the root causes that contribute to high mean and variance to close critical defects

METHOD: Root Cause Analysis Steps



- Use I-MR charts to identify outliers and cause

- Repeat steps 2 & 3 for each identified phase for the process till all root causes are resolved

TOOLS: One-way ANOVA

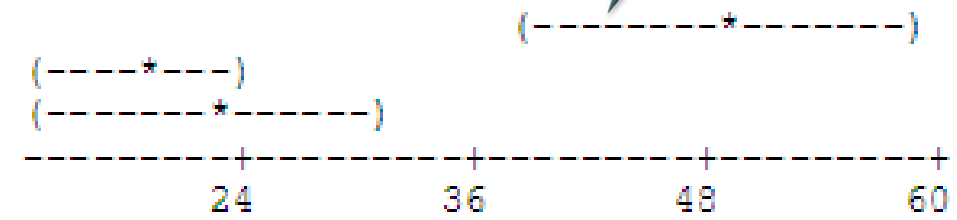
One-way ANOVA: Days to close versus Severity

Source	DF	SS	MS	F	P
Severity	2	14300	7150	14.01	0.000
Error	112	57156	510		
Total	114	71456			

S = 22.59 R-Sq = 20.01% R-Sq(adj) = 18.58%

Level	N	Mean	StDev
Critical	20	48.85	33.97
Major	72	18.79	16.22
Minor	23	22.39	27.43

Individual 95% CIs For Mean Based on Pooled StDev



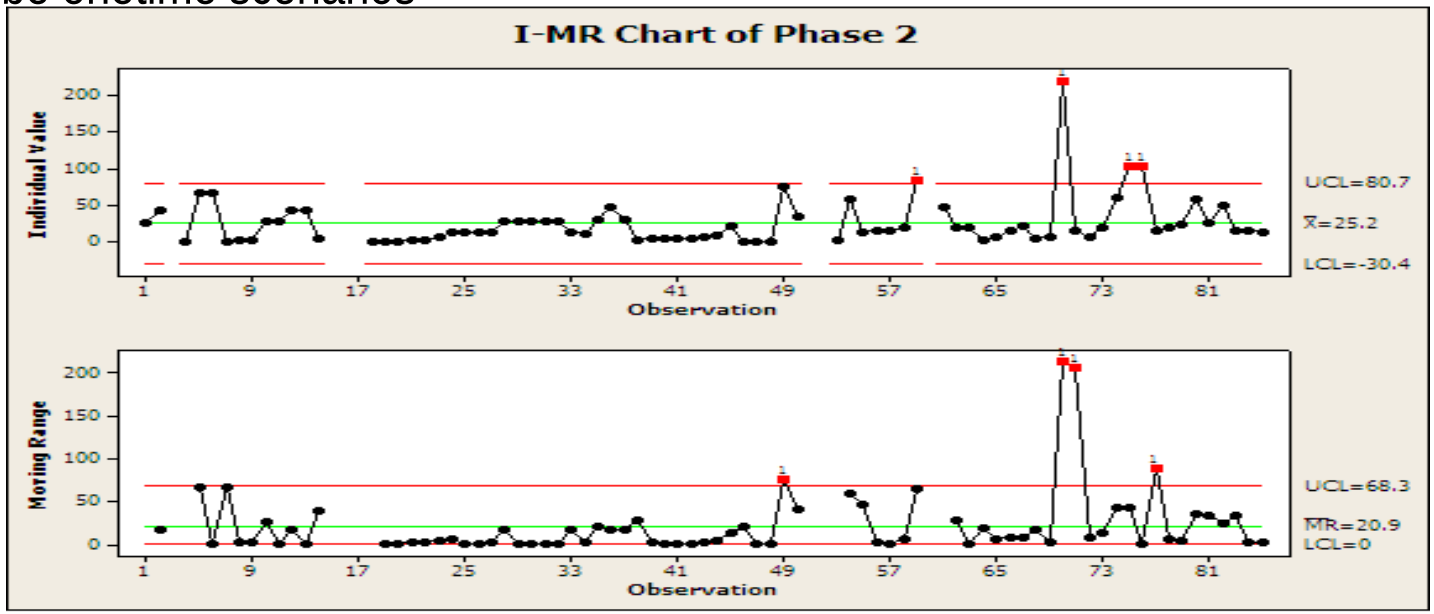
Pooled StDev = 22.59

ANOVA test showing significant & statistical difference for fix time for critical defects

* Representative data

TOOLS: I-MR Charts

- First - verify Process is stable: I-MR charts to identify outliers. Outliers turned out to be onetime scenarios



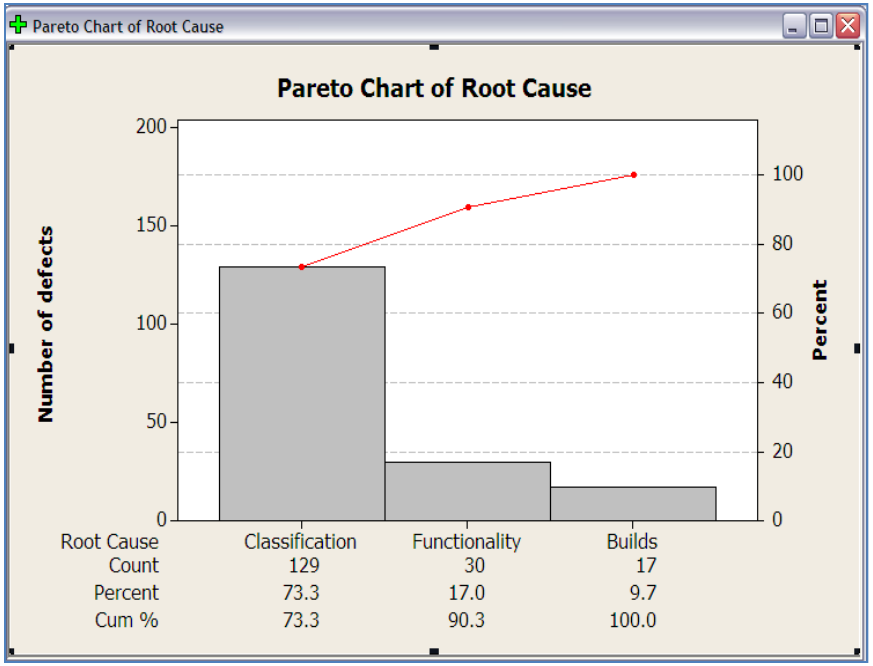
- Divided the analysis into phases to implement the correction for an identified cause, and statistically analyzed the results – iterative process
- Establish targets at every phase (Based on “Half Life metric” developed by Art Schneiderman - also referenced in The Balanced Scorecard by Kaplan and Norton)

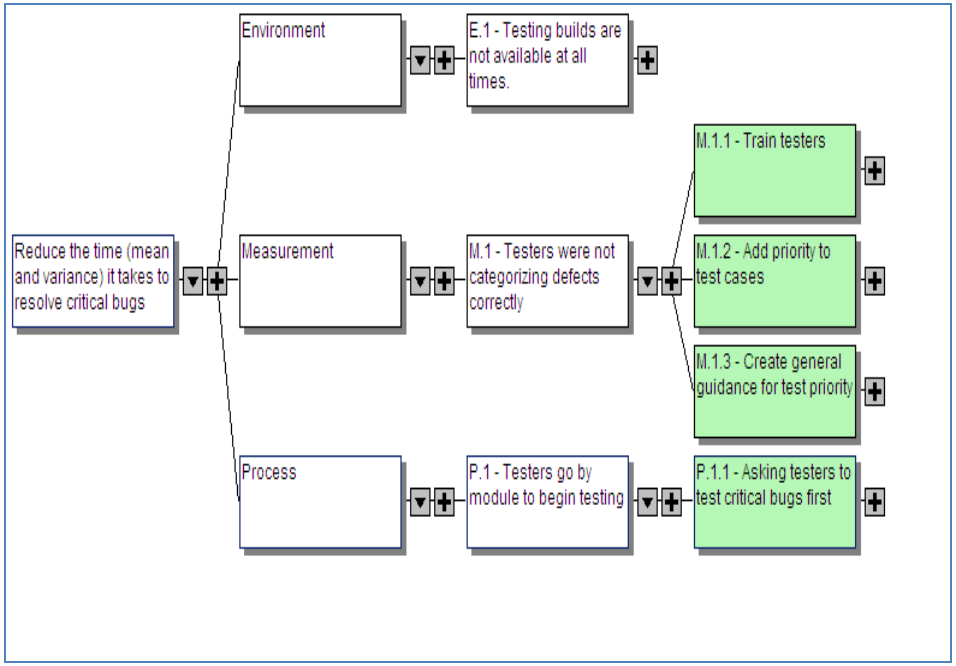
* Representative data

The CAR Process

Cause → **Analyze** → **Resolve**

- Brainstorming session
- Fishbone diagram
- Potential root causes identified





* Representative data

Analysis

Cause → **Analyze** → Resolve

- **Effort vs Impact** analysis to identify the priorities of the actions to implement

Effort \ Impact	High	Medium	Low
Low	1	2	3
Medium	2	3	4
High	3	4	5

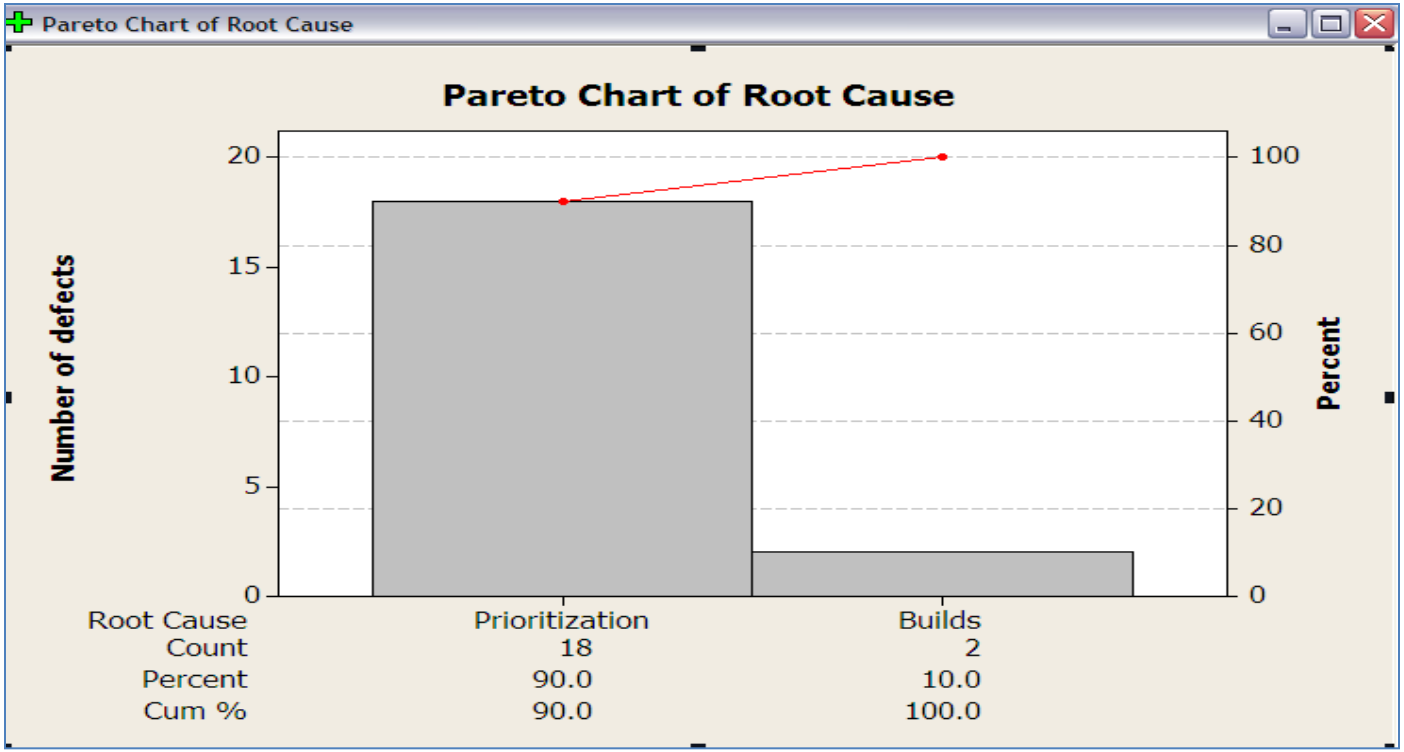
Action	Effort	Impact	Priority
E.1. Test builds are not ready at all times. There may be a delay.	Medium	Medium	3
M.1. Train Testers to classify defect severity correctly	Low	High	1
M.2. Add priority to test cases	High	Medium	3
M.3. Ask Testers to test according to priority in functionality	Medium	Medium	2
P.1. Add priority to test cases according to Severity (Identified in Phase 3)	Low	High	1

* Representative data

Analysis(contd.)

Cause | **Analyze** | Resolve

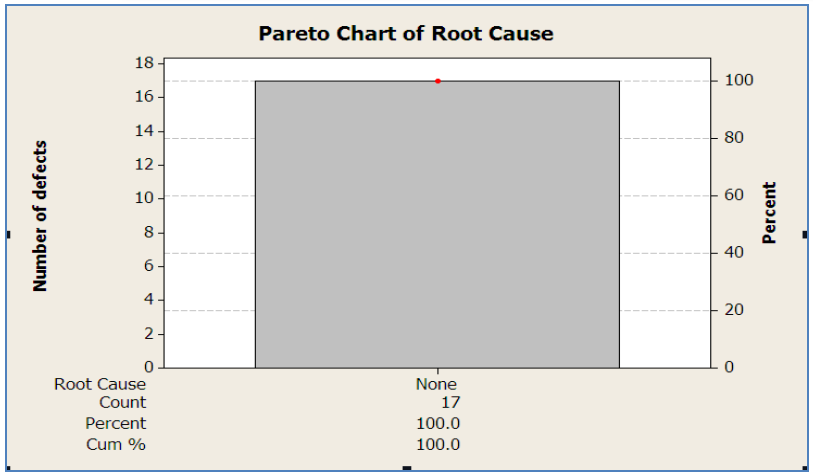
- Pareto Charts to determine the root causes of the problem (that were addressed), monitoring and recording of the data also helped bring about other issues that we were able to resolve quickly

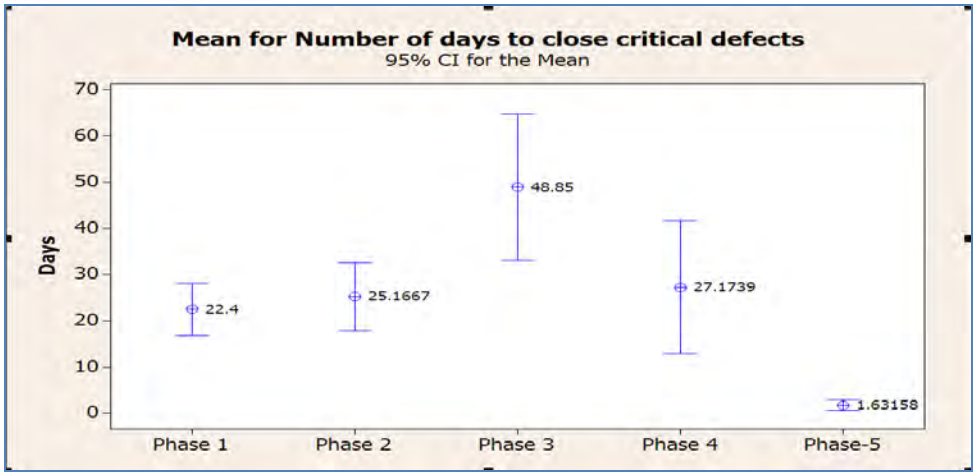


* Representative data

Results

Cause → Analyze → Resolve





Mann-Whitney Test and CI: Phase 2, Phase 5

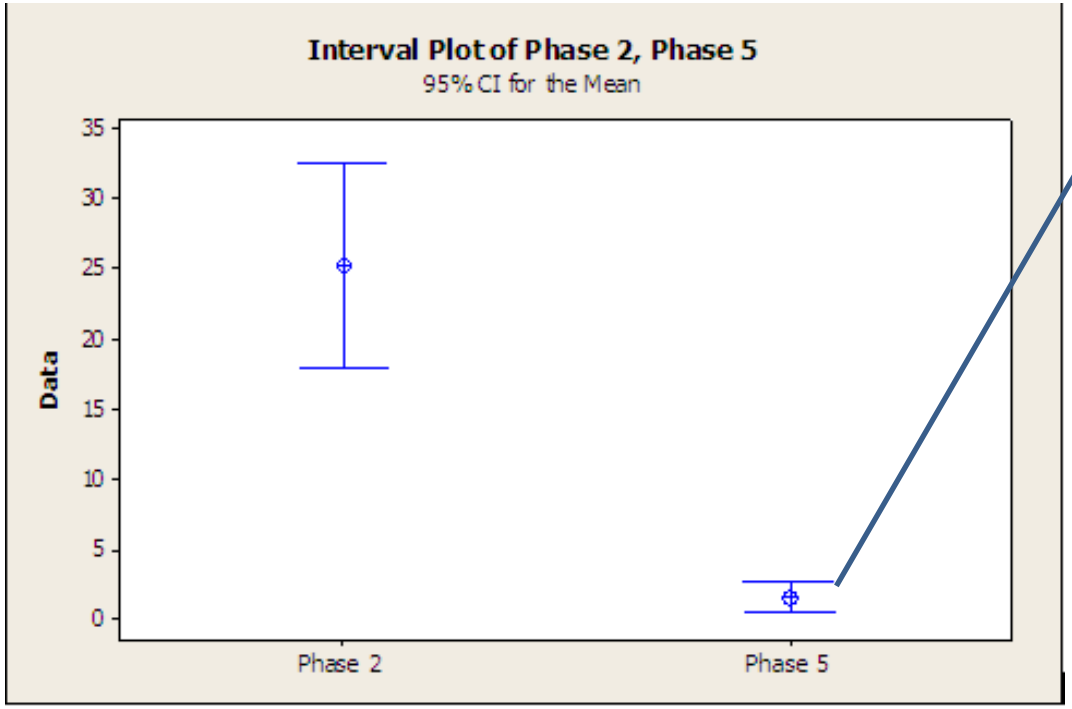
	N	Median
Phase 2	78	15.000
Phase 5	19	0.000

Point estimate for ETA1-ETA2 is 14.000
95.1 Percent CI for ETA1-ETA2 is (7.999,22.001)
W = 4394.5
Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.0000
The test is significant at 0.0000 (adjusted for ties)

The mean time to close critical defects is now at 1.6 days and the standard deviation is at 2.36 – from a mean of 25 days and standard deviation of 32

* Representative data

Conclusion



- Significant shift in the mean and standard deviation
- Assumptions may not always be true
- Statistical data and analysis = Quantified information
- Increased confidence in the process that was changed and standardized = improved team direction and common goals
- Faster delivery of a quality product = Improved customer satisfaction

Case Study - II

Using QPM to dynamically manage our program to optimize expected project objectives

Project Background

- Customer

  Government Agencies reconciling asset discrepancies between systems

- What triggered the Task

  Audit Finds needed to be addressed and resolved with a deadline

- Task I - Phase I Objective

  Analyze and Validate the existence of 3660 assets and provide a resolution

- Schedule

  Start Date: 01/29/2010 – End Date: 04/16/2010

- Team Size

  7 FTEs

Introduction

- What?
  - Model to predict quantity of assets processed
- Why?
  - Increase in project scope by 40%
- Who?
  - Developed by SEPG team and project team
- Who?
  - Project Management and Leadership team
- When?
  - Weekly

Business and Project Goals

- High Level Business Goal
  - Have all assets analyzed and reconciled in time for the external audit
  - Credibility of the client organization was riding on the success of this effort
  - Divide and conquer – divide the work amongst various teams
- Project Level Goal
  - Have all assets assigned to our team processed to meet an internal deadline
  - Leave enough time for the customer to review our analysis
- Need for the model
  - 40% increase in scope at the 50% schedule marker
  - Slight delay in receiving the assets

Risks in meeting business and Project Goals

RISKS / IMPACTS / MITIGATION

ID	Risk	Description	Business Impact	Mitigation	Likelihood	Impact Score	Risk Score
31	Delays from AFO to provide all work packages by 3/12/2010 may impact OST schedule to meet 4/30/2010 milestone	The work packages from the regional POCs will be provided to OST on 4/1/2010. Our initial understanding was that these work packages will be provided to us for review by 03/12/2010. All work packages will still have to be reviewed and field verification where required has to be completed by 4/15/2010. OST has 420 assets to process as of 3/18/2010 which will be likely be done by 3/24/2010 at which point OST resources will be waiting for work papers for about 4 days.	• **Schedule**: 4/15/10 milestone may not be met **Cost**: OST resources will not be working at full capacity which has a cost impact	• AFO Provide total assets remaining 1,496 at the rate of 100 per day (~4/2/10)	High	High	**High / Red**
33	AFO may escalate more than 2/3 of assets (1952) which will impact the schedule, the scope and the budget allocated for the tasks	Based on discussion with AFO, OST and AJW-21 we estimated that 2/3 of the assets not resolved by AFO will be processed and resolved by OST. If more than 2/3 of the assets are escalated to OST this may have an impact on the schedule and the budget of Task 1.	• **Cost**	See Next Slides	High	High	**High / Red**

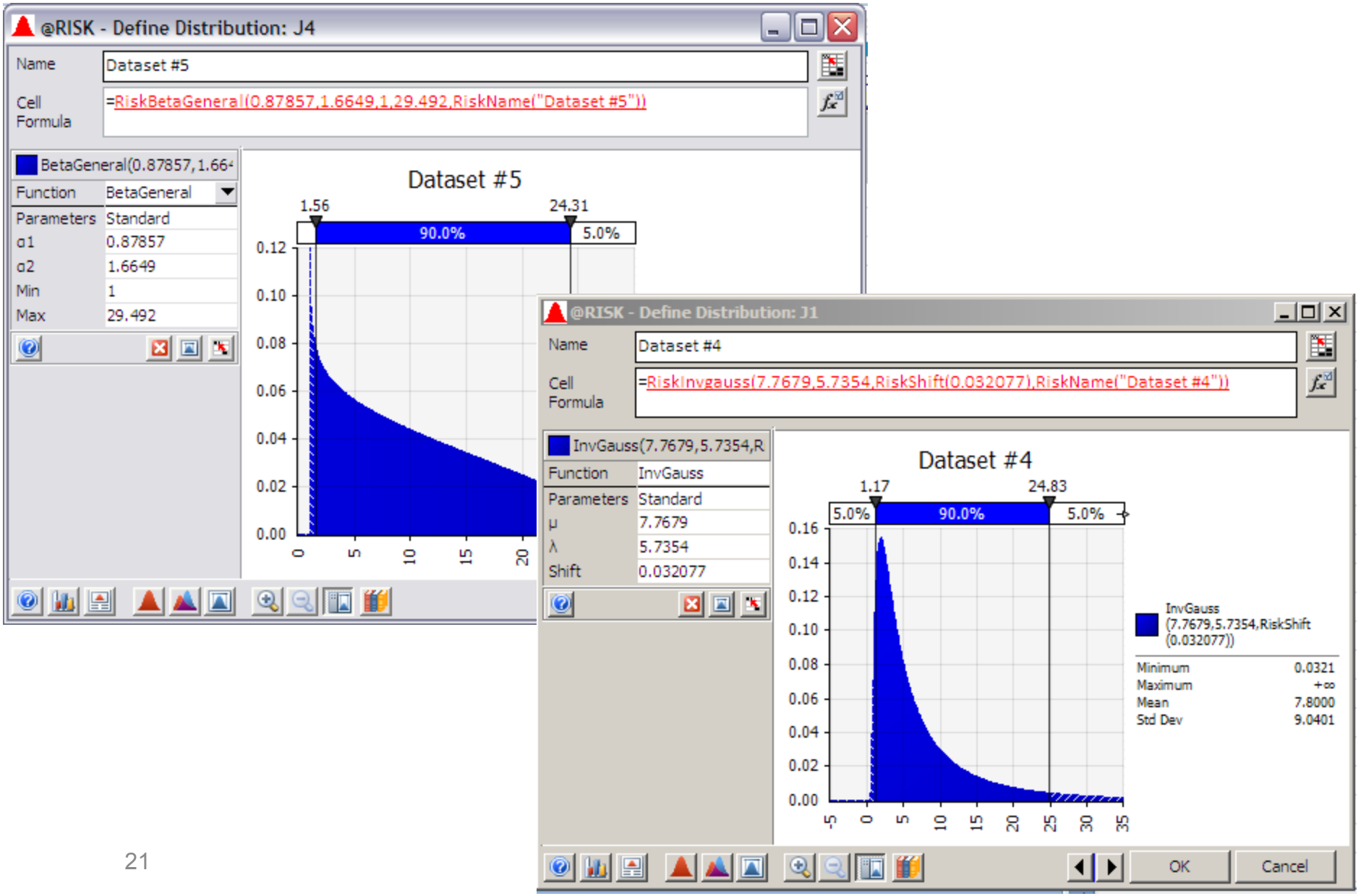
Outcome(s) Predicted and Stakeholder Audience

- Outcome predicted
  - Number of assets processed (with Confidence Interval and Prediction Interval)
  - Data type – Continuous
- Purpose of the output
  - Determining optimal number of resources needed that we could propose to the customer
- Stakeholders
  - Customer (Government Agency)
  - OST resources (Analysts)

Data Collection

- Data Collection:
  - 165 data points from Phase I analysis data
  - All data analyzed was recorded and stored using SQL Server
  - Analyzed data was grouped by resolution (Resolved, Retired, Needs Supporting Documentation, etc…)
  - Analyzed data was grouped by analyst
- Time period of data collection
  - Baseline is 2/18/2010 – 3/17/2010.

Distribution Fitting



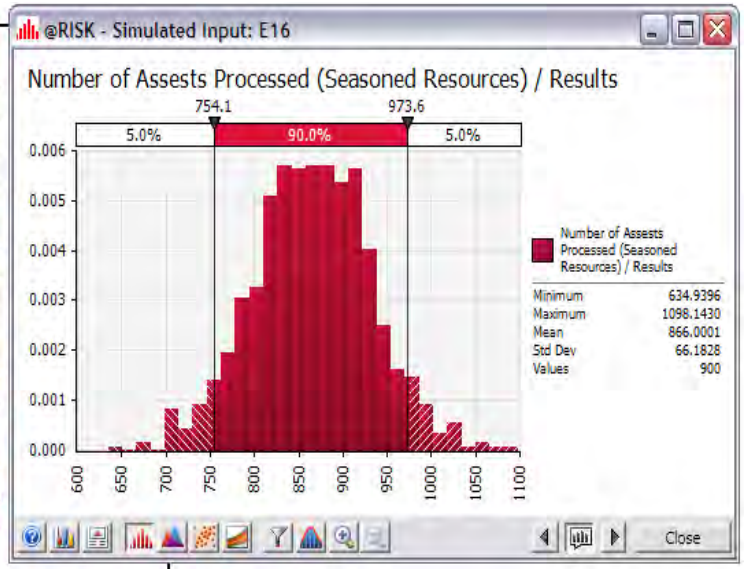
The Model

- Monte Carlo Simulation was used to predict the output (Response)
- @Risk simulation software was used.
- Output was calculated using the function containing input variables and baseline data

Model	Simulation
f_x =RiskCompound(E12,Baselines!J4)	

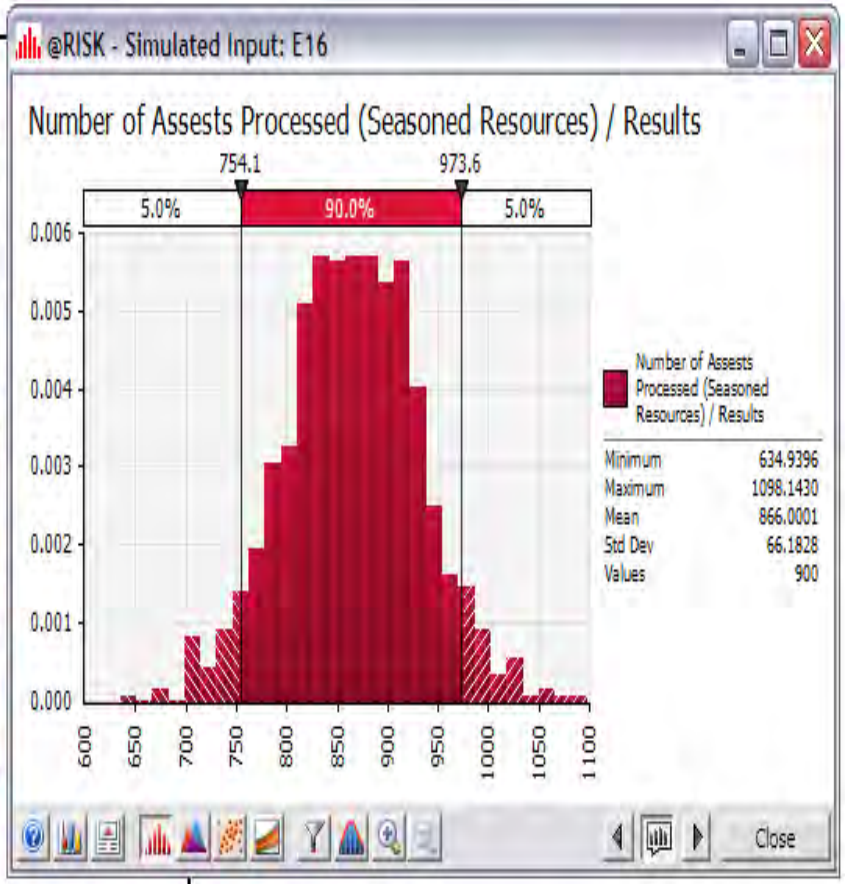
- Histogram for the output is produced after model is run using @Risk.

Net working Days	8
New Resources:	
#	0
Net New Resource Work Days	0
Seasoned Resources:	
#	10
Net Seasoned Resource Work Days	80
Results	
Number of Assests Processed (New Resources)	
Number of Assests Processed (Seasoned Resources)	867.3406469
Total Assets Processed	867.3406469



The Model

Net working Days	8
New Resources:	
#	0
Net New Resource Work Days	0
Seasoned Resources:	
#	10
Net Seasoned Resource Work Days	80
Results	
Number of Assests Processed (New Resources)	
Number of Assests Processed (Seasoned Resources)	867.3406469
Total Assets Processed	867.3406469



Risk Mitigation Scenarios presented to the customer

	Scenario 1	Scenario 2	Scenario 3
Description	Meet 4/16/2010 with increase Scope	Meet 4/30/2010 deadline with increase scope	Maintain status quo with increase scope
Assumptions	Receive all work papers by 4/2/2010 at rate of 100 / day starting 4/22/2010	Receive all work papers by 4/2/2010 at rate of 100 / day starting 4/22/2010	Receive all work papers by 4/2/2010 at rate of 100 / day starting 4/22/2010
Action Plan	• > 95% Confidence: Add 9 Team Members • 60 % Confidence: Add 8 Team Members • 6 % Confidence: Add 6 Team Members	•95% Confidence: Add 3 Team Members • 85% Confidence: Add 2 Team Members • 10% Confidence: Add 1 Team Member	Continue with current staffing level
Impact	Cost	Cost / Schedule (15 days – April 30th 2010)	Cost / Schedule (40 days – May 17th 2010)

Results and Benefits

- Results
  - Increase in staff was authorized
  - Contract value increased by 50%
  - Contract was changed from FFP to T&M
  - Critical customer deadline of 4/30 was met
- Benefits
  - The ability to make the case statistically provided analytical credibility
  - Increase in Client confidence and reputation
  - Client began advertising OST's modeling capability with the entire customer organization

What Worked Well

- Excitement about the potential of modeling
- Generating support for dedicated resources for modeling
- Customer Delight
- Using this as a success story to build 9 more models

Summary

- Increase in asset analysis scope
- Creating model using Montecarlo Simulations to provide confidence levels with different staffing numbers and days
- Multiple scenarios were provided to the customer to choose from
- OST met the critical customer deadline of 04/30/2011
- The ability to make the case statistically provided analytical credibility
- Increase in Client confidence and reputation
- Other models were created due to its success

Questions



Thank You





Increasing efficiency and saving costs with new SCAMPI approaches

Paul D. Byrnes
ISD Principal and CTO
Jeff McGarry
Mission Solutions Engineering (MSE) Process Director

Presented at
CMMI Conference
November 2011

CMM and CMMI are registered in the U.S. Patent and Trademark office. CMMI are service marks of Carnegie Mellon University
SCAMPI is a Service Mark of Carnegie Mellon University

Agenda

- Brief background of the MSE organization
- Perceived problems to jointly solve
- Targeted improvement areas
  - Planning
  - Organizational and data sampling
  - High maturity evidence approach
  - Team composition and events
  - Tooling

This presentation includes planning activities that pre-dated the official release of SCAMPI V1.3 – projected concepts were used that are totally in concert with the intent of the method as released.

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Mission Solutions Engineering (MSE) – Who We Are

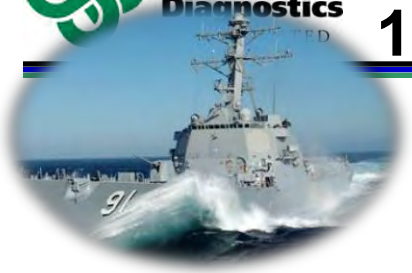
- MSE, LLC is headquartered in Arlington, VA with operations in Moorestown, NJ
- 600+ personnel / $90M+ annual revenue
- 40+ years of success in mission systems development
- Originally a division of CSC, MSE was acquired by ASRC Federal Holding Company in October 2010
- Domain and Functional Expertise – Real time combat system software development
  - Command and control (C2)
  - Weapons control
  - Display systems
  - Radar control

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10 Years of Outstanding Process Maturity

21 Baselines Evaluated at Level 5





2001
- 6P3
- 7P1
- F100
- CMM Level 5

2003
- 7P1, 7P1C
- 6P3D
- Norway
- CMM Level 5

2004
- 6.3.2
- 7P1, 7P1C
- Norway
- J5
- CMM Level 5

2006
- 7P1R
- BMD
- J5
- KDX
- CMMI Level 5

2008
- DDG 1000
- BMD 4.0.1
- J5
- CGM
- KDX
- CMMI Level 5

2011
- DDG1000
- BMD 4.0.1
- ACB-12
- F105
- AWD
- K1.1
- N1.4
- J5.4
- J3.4
- CMMI Level 5

MSE
MISSION SOLUTIONS ENGINEERING

CMMI Level 5 systems engineering processes mitigate program risk and ensure a culture of innovation.

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Proven Performance

- Delivered Results
  - Fielded systems in over 110 surface combatants
  - Delivered over 48 capability baselines
  - Developed and support over 95 million SLOCs
- 20% productivity increase since 2000
- 55% decrease in first pass test failures since 2001
- 100% increase in CPCR/STR productivity since 2000
- 50% decrease in defects for developed code since 2000
- 80% decrease in defects for delivered code since 2000
- 3% increase in SPI
  - 25% increase in SPI within 1% of 1 over all EVMS contracts



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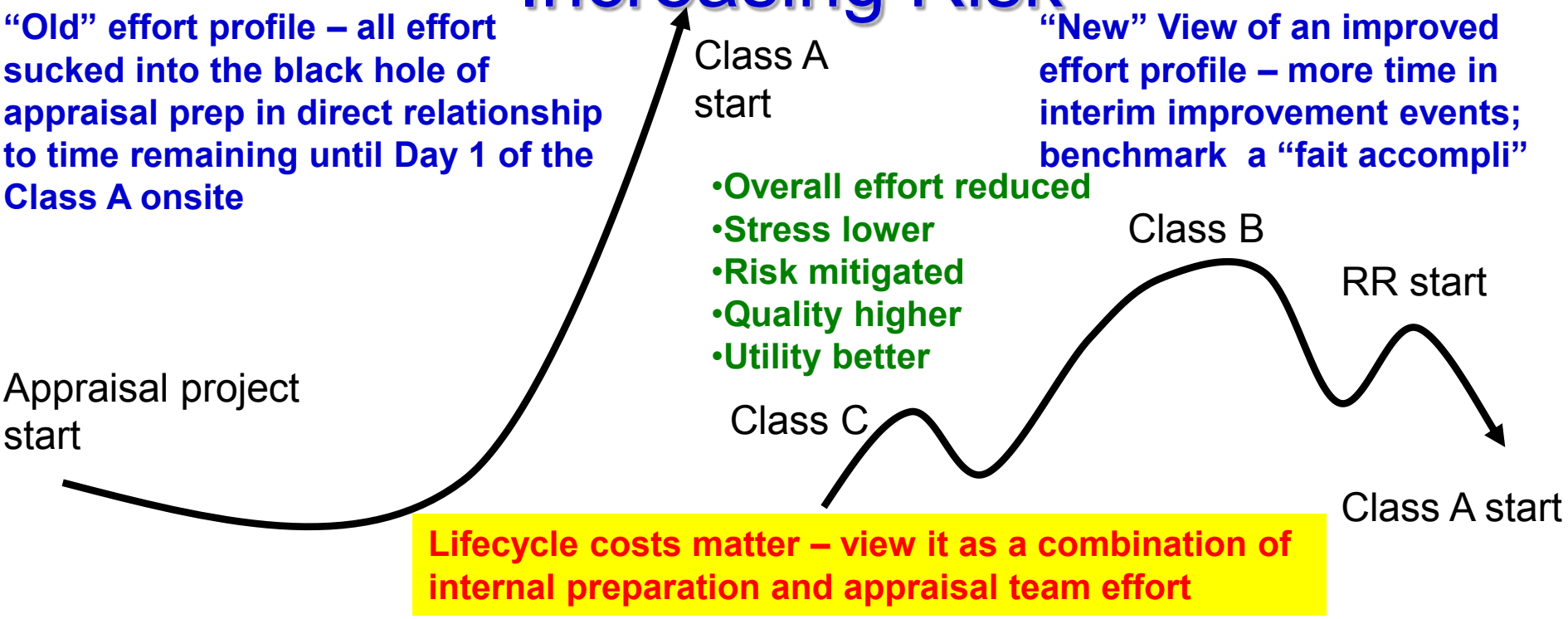
Problem Statement

MSE had a long history of performing successful SCAMPIs (and CBA IPIs and SCEs before that dating to the early „90s). The legacy:

- Inordinate amounts of effort and resources preparing for and conducting a SCAMPI A (via PIID generation and very large teams)
- Each appraisal was treated as an independent end item – a once every three years approach - "regenerating" data and "new" PIIDs
- Appraisal preparation and evidence collection was performed separately from team and Lead activities – not integrated
- "All or nothing" Class A rules motivated this organization to provide "the kitchen sink" evidence approach – way too much.
- Old V1.2 rules limited project participation, and…
- Practice based appraisals were not "natural" for a HM organization
  - PIIDs got in the way of seeing how work really gets done…
  - Practice by practice decomposition artificially fragmented a highly complex integrated set of activities.
  - Generic practices coupled with evidence rules vastly expanded the quantity of data required.

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The Goal: Transition to a More Cost Effective Effort Profile Without Increasing Risk



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An Alternative Solution Implemented

- Used a more expert driven, incremental, managed evolution of data collection and review tasks to make the outcomes **both** significantly more efficient **and** improved the quality and utility of the data. Summary approach and outcomes:
  - *New sampling rules allowed for much greater participation*
  - *Managed Discovery and Phased Data Collection –Incremental data evolution and reuse used through the appraisal lifecycle.*
  - *Easier to collect data for the organization, and easier to review, understand, and analyze for the team*
  - *Reduced emphasis on PIID preparation*
  - *A set of events was integrated into a single plan. Used interim events to manage risk and costs*
  - *Implemented a concept of "threads" to present the data. HM data primarily presented data by "topics," rather than "practices"*
  - *Ensured results and effort expended reflected event goals*

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"Real" Organization Sampling Example

Selected Sampling factors

Relative percentages

Selected Sampling Factor	Size	Customer Location	Work type	Lifecycle	Customer	Benchmarking period		Subgroup size	
Project	Large (>zzz), Medium (>yyyy<=zzz) Small (<=aaa)	Foreign or Domestic	Legacy or New	Devel or Maint	Customer (A, B, C, D)	July 2010 SM (Actual)	Feb 2011 SM (Projected)	ROM % in each subgroup	Notes
A	Large	D	New	Devel	Customer A	8.0x	5.0x	41%	All PAs
B	Large	F	New	Devel	Customer B	1.5x	1.5x	12%	All PAs
C	Medium	D	Legacy	Maint	Customer C	1.0x	.68x	21%	Levels 4-5 PAs
D	Medium	D	New	Devel	Customer A	0x	.67x		start fall 2010 end fall 2012
E	Medium	D	New	Devel	Customer D	.67x	.75x		Levels 2-3 PAs
F	Medium	D	New	Maint	Customer A	0x	0.5x		Ending fall 2010
G	Medium	F	Legacy	Maint	Customer B	.12x	1.0x	23%	
H	Medium	F	Legacy	Maint	Customer B	.075x	0.5x		
I	Medium	F	New	Maint	Customer B	1.0x	0.5x		Smattering of PAs
J	Medium	F	New	Maint	Customer B	0.3x	0.6x		
K	Medium	F	New	Maint	Customer B	0.5x	0.5x		
L	Small	D	New	Devel	Customer D	0.2x	0.15x		Too small. Not in scope
M	Small	D	New	Maint	Customer A	0x	0x		Too small. Not in scope
N	Small	F	Legacy	Maint	Customer B	0x	.25x		Too small. Not in scope
total						Large	Large		overall size roughly the same

Projects organized into Subgroups using the sampling factors

High level data plan

Company had defined rules for large, medium, and small projects
Company had defined policy for what CMMI based processes were applicable to
Company would be considered "large" by SEI Class A SAS reporting data
X in Staff Months (SM) above is normative to understand relative size.

Other factors considered but weren't relevant:
- Work Location
- Funding Source
- Contract type
- Application Domain
- Functional Area

Other sampling factors evaluated

This example is a sanitized real example that was completed prior to the formal SCAMPI V1.3 sampling rules being defined.

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“Real” Data Sampling Example

This is the data sampling plan for the fourth subgroup on the prior slide (the 4th and 5th color bands combined into one subgroup)

	Projects					Comments
Process Area Count	3	4	4	4	3	
Process Areas	A	B	C	D	E	
Organizational Process Focus - OPF	Org	Org	Org	Org	Org	
Organizational Process Definition - OPD	Org	Org	Org	Org	Org	
Organizational Training - OT	Org	Org	Org	Org	Org	
Organizational Process Performance - OPP	Org	Org	Org	Org	Org	Maintenance Model
Organizational Inovation and Deployment - OID	Org	Org	Org	Org	Org	
Project Planning - PP				X		
Project Monitoring and Control - PMC				X		
Supplier Agreement Management - SAM	Org	Org	Org	Org	Org	
Integrated Project Management- IPM		X				
Risk Management - RSKM		X				
Quantiative Project Management - QPM			X			Development SPC
Requirements Management - REQM				X		
Requirements Development - RD				X		
Technical Solution - TS	X					alternate practice?
Product Integration - PI		X				
Validation - VAL	X					
Verification - VER	X					
Configuration Management - CM					X	
Process and Product Quality Assurance - PPQA			X			
Measurement and Analysis - MA			X			
Decision Analysis and Resolution - DAR			X		X	
Causal Analysis and Resolution - CAR		X - B			X - A	
Legend	Subgroup: Medium, Foreign, Maintenance, Legacy					
Level 2						
Level 3						
Level 4						
Level 5						

This answers the question, “Now that we know the subgroups and the participating projects, who will provide what data?”

This sampling plan assumed that both artifacts and affirmations were collected from each basic unit or support function for their identified areas.

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Positive Sampling Outcomes

- Using sampling factors was in line with the way the organization did process tailoring so it “made sense.”
- Some factors originally thought to be important turned out not to be. The SCAMPI V1.3 process improved the overall organizational analysis.
- Small projects always got “costed out” of participating in V1.2 SCAMPIs. The new rules allowed other projects to participate – ***the Sponsors, Projects, and Process Group were all very pleased with this result***.
- Increased organizational coverage from:
  - 50% of **people** in 2008 to **81% in 2011**
  - 25% of **projects** in 2008 to **64% in 2011**

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Data Collection Approach

- Managed Discovery – Used through a set of incremental appraisals. Added additional, smaller events to the 2010-11 flow relative to the 2008 appraisal lifecycle.
  - Class C
  - Appraisal Consulting
  - Class B1
  - Class B2 (virtual) and B3 (virtual)
  - Readiness Review
  - Class A

- *The data collection plan was refined after each event, requiring less and less additional preparation effort and subsequent team effort.*

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Data Collection Plan Improvements

- The Data Collection Plan (DCP)
  - The DCP was a subsidiary plan to the Appraisal Plan.
  - The set of events noted on the prior page (the appraisal lifecycle events) were all documented in a single appraisal plan
  - The plan was initialized at the start of the flow, and added to and evolved over the duration.
  - The detailed plan data was maintained in an excel workbook to facilitate cohesion and easier maintenance.
  - Outputs from the appraisal tool (Appraisal Wizard®) were direct inputs into the plan, increasing synergy and reducing redundant effort.

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Changing scoping complexity, coverage rules, timing of tasks, and other method options requires commensurate updates in how teams are formed and trained.

Team Training and Qualification

- Training
  - Method training (refresher in this case) was performed as a just-in-time activity. A little bit before each event.
  - Team training sessions with all team members present were performed prior to each event (it didn‟t look and feel like “training)
  - Additional training in CMMI High Maturity practices was delivered.
  - Training in the designated appraisal tool (Appraisal Wizard®) was also performed and then refreshed at each event.

- Qualification
  - Team experience excluding the Lead Appraiser far exceeded method requirements (experience). The technical approach really needed this.
  - A qualifications table was added to the appraisal plan workbook to verify requirements were met

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These approaches were not really new, but rather a more rigorous approach than past events that facilitated being more efficient.

Team Composition

- Team membership changed slightly during each event. Team members (count) changed (reduced) after each event.
- Conflicts of Interest (COI) were explicitly addressed in the team qualification section of the appraisal plan workbook.
  - The Lead only performed training and appraisal related tasks, not internal consulting.
- Affiliation: members were selected to ensure at least half the team was totally external to the Organizational Unit.
  - Actually we exceeded this target.
  - We mixed people with past experience with this OU with people who were “new” to get fresh perspective
  - We matched up “external” people with “internal” people to minimize conflicts
  - We documented mini-team outputs in a way that supported adjusting the mini-teams over the set of events

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Recall that this is a ML5 scope. Team sizes relative to norms are significantly less than average across the industry.

Team Comp Table by Event

Class C	Class B	Class B2	Class B3	RR	Class A	Organization
Paul Byrnes	Paul Byrnes	Paul Byrnes	Paul Byrnes	Paul Byrnes	Paul Byrnes	ISD, SEI Certified HM Lead Appraiser, Team Lead
Jack Lawrence	Jack Lawrence			Jack Lawrence	Jack Lawrence	ISD, SEI Certified HM Lead Appraiser
	Barbara Spence			Barbara Spence	Barbara Spence	CSC NPS BPMO/PREMO
Joe Ryan	Joe Ryan	Joe Ryan	Joe Ryan	Joe Ryan	Joe Ryan	MSE
Patricia Brencher	Patricia Brencher	Patricia Brencher	Patricia Brencher	Patricia Brencher	Patricia Brencher	MSE
	Mel Wahlberg			Mel Wahlberg		CSC NPS BPMO (Class B and RR only). Certified Lead Appraiser.
	Bill Decker					CSC NPS BPMO/PREMO (Class B only)

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Team Qualifications Table

Name	Organization	Appraisal Role	Field Experience (Group Average 6; Group Total>=25)		
			Project Management (GT>=10; I >=6)	Engineering	Process Management
Paul Byrnes	ISD	Team Lead - HM	20	10	21
Jack Lawrence	ISD	Team Member - HM	12	20	15
Mel Wahlberg	CSC NPS	Team Member	28	37	25
Barbara Spence	CSC NPS	Team Member	17	27	15
Bill Decker	CSC NPS	Team Member - HM	2	33	15
Joe Ryan	MSE	Team Member - HM	22	31	15
Pat Brencher	MSE	Team Member	7	24	12
			112	182	118
			16.0	26.0	16.9

Note: Years can overlap between categories – do not add up to total years – we are not that old! (i.e., you could be doing project management and process at same time)

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Other Technical Approach Differences

- Documentation links were entered directly into the appraisal database (Appraisal Wizard®) and generally went to folders rather than specific documents.

- We made maximum use of the 90 day clock. Document review during the Readiness Review was done with a purpose to reuse data wherever possible.
  - Reviewed documents resulted in findings (gaps) and we generated preliminary practice characterizations
  - Guidelines for what could be reused, and how re-review of data was to be performed were documented in Team Norms
  - The technical approach implemented in effect started the main event during the Readiness Review.

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Evidence Threads

- Data (high maturity in particular) was presented as integrated “stories” spanning time rather than individual documents in separate practice buckets.
  - Much more “natural” and “integrated.”
  - Much easier for PIID maintenance.
  - Much easier to see both legacy and evolution.
  - Easier for the team to decide what and how much to review



Microsoft Word Document

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Sample CR Productivity Thread

Mapping matrix

Storyboard

Model Element	Thread Location
OPP SP 1.4	1
OPP SP 1.5	1, 2, 3, 4, 5, 6, 7,8 (new for A)
OPP GP 2.7	5
OPP GP 2.8	2, 3, 4, 5, 6, 7,8 (new for A)
OPP GP 2.10	5, 8 (new for A)
QPM SP 1.1	Summary Statement (new for A)
QPM SP 1.4	8, Summary Statement (new for A)
QPM SP 2.3	9, (new for A)

Evolution noted from subsequent events

Summary Statement:

New for SCAMPI A: The "CR Closure Rate (Dev)" and "CR Closure Rate (Maint)" metrics are defined in ORG Standard Process <xyz> with the performance objective "decrease cycle time". The objective is correlated to Strategic Plan Goal number 1 - <insert goal statement>. (QPM SP 1.1) The Quality Compliance yield SPC slides are presented to management as the means of monitoring the performance against the goal and assessing the QPPO. (QPM SP 1.4). One of the activities in the ORG Process Improvement Plan (PIP) is to expand beyond the set of models ORG currently uses and develop additional models. The Metrics Group created a CR Productivity Model. This model uses historical performance characteristics to predict the number of CRs that will be implemented per staff month for the CR work packages provided by the customer….Inputs into the CR Productivity Model are the predicted CRs from the Development and Maintenance Defect Models.

This thread covers CR Productivity models of both development and maintenance CRs….

Time line with direct links and mapping

Activity Details:

•Prior to November 2009 - CR Productivity rate of <#> CRs per staff month was used when bidding on contracts. (OPP SP 1.4, 1.

1.See Project X Cost Model <date>

•In order to improve CR Productivity rate the process was changed from random assignment of personnel to implement CRs to maintaining the same staff from baseline to baseline.

1.(Same staff charging CR implementation from one Project X release to the next.)

•Statistical Analysis performed on historical projects to determine the historical CR Productivity rate. (The time line was ordered based on the projects' period of performance.) (OPP SP 1.5, GP 2.8)

1.ORG CR Productivity Presentation (October 2009)

•Statistical Process Control (SPC) performed on current projects (Pjt X and Pjt Y) to determine the current CR Productivity rate as well as the stability and capability of the process for the specific projects. (OPP SP 1.5, GP 2.8)……

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Some Outcomes

- **Planning** started sooner (in this case, approximately 17 months in advance of the Class A on site start)
  - More time with the Lead reviewing organizational data to determine the most appropriate sample to meet sponsor objectives.
  - More time allocated to designing and "right sizing" each interim event – appropriate interview sessions (size, scope, type, etc.)
- **Team composition** changed – more external members, "reuse" of trained personnel, distributed team activity, specialized training.
- **Managed Discovery** shifted the balance of effort from site personnel back to the team, but not terribly so – the whole approach was done in a more joint, collaborative manner.
- **Automated tooling (Appraisal Wizard®)** was essential and extremely beneficial. It facilitated our ability to effectively pinpoint issue areas, data needs, maximize data reuse and collaboration.

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Evidence Review Outcomes

- Interim appraisals were used to *incrementally "build" the appraisal database.*



- Reused appraisal data. *Appraisal events and data were not treated as "one-time,"* but as an integrated set leading to the next.

- Characterization and rating – When are you "conducting" the appraisal? *It was on-going…*



- Appraisal Wizard® *enabled efficient application* of these approaches.

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Outcomes – Team Conduct

- Lead more of a **facilitator** rather than “all knowing” expert
- Mini-teams with “inside-outside” membership **maximized objectivity** while benefiting from “insider” knowledge and **minimizing conflicts**
- Much more targeted, **parallel effort** was implemented (interview sessions, remote review, more virtual activity, greater use of 90-day window).



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Outcomes – Effort and Cost

- Total cost of 2011 evaluation effort (including the SCAMPI B, Readiness Review, and SCAMPI A) was 9% less than the cost of the 2008 events (in normalized dollars.)

- Reduced total staff effort of conducting events by 25% between 2008 and 2011. This is the sum total of external (ISD and CSC) consultants and internal resources for all events (SCAMPI B & A in 2008 and SCAMPI B, A, and Readiness Review in 2011)

Event	Date	Evaluator Consultant Days	CSC Evaluator Consultant Days	MSE Staff Days	MSE Preparation Staff Months
2008 SCAMPI					
SCAMPI Class B	Feb-08	20	50	30	12
SCAMPI Class A	May-08	10	15	10	4
Totals		30	65	40	16
2011 SCAMPI - Actual					
SCAMPI Class B	Nov-10	10	15	10	9.5
SCAMPI RR	Mar-11	10	10	10	4.26
SCAMPI Class A	May-11	14	7	14	3
Totals		34	32	34	16.76

And this included additional events *and* additional external people!!

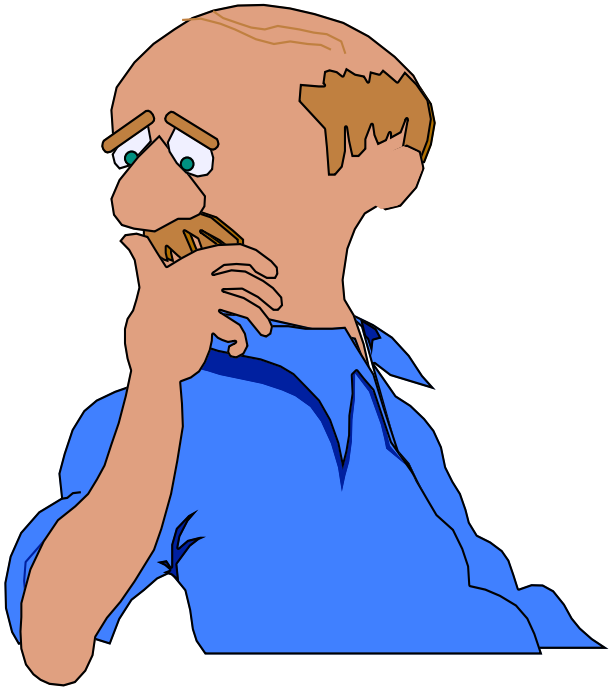
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Questions and Answers

Q

&

A



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Strategies for Retaining CMMI Maturity Level 5 in v1.3

CMMI Technology Conference and User Group
14-17 November 2011



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Factors Driving v1.3 Changes

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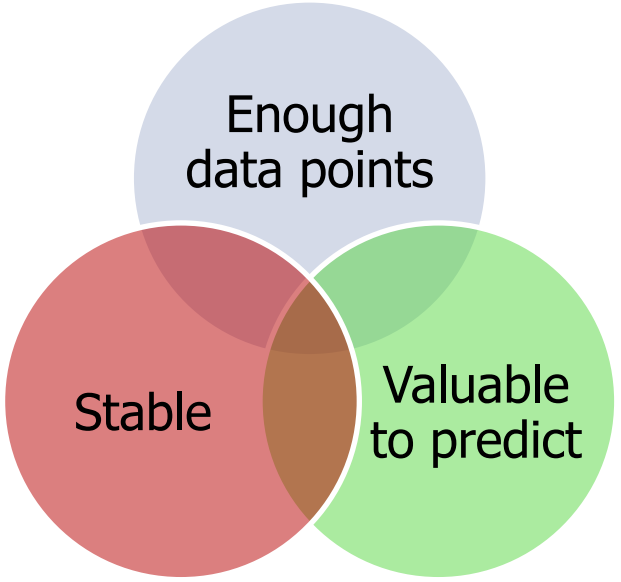
- **Bring constellations (-DEV, -SVC, -ACQ) into harmony**
- **Simplify the model architecture**
- **Reflect modern engineering approaches (Agile, Lean Six Sigma, quality attributes, architectural methods, etc.)**
- **Clarify high maturity and enhance its value**

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Why Didn't Customers See Value in ML5?

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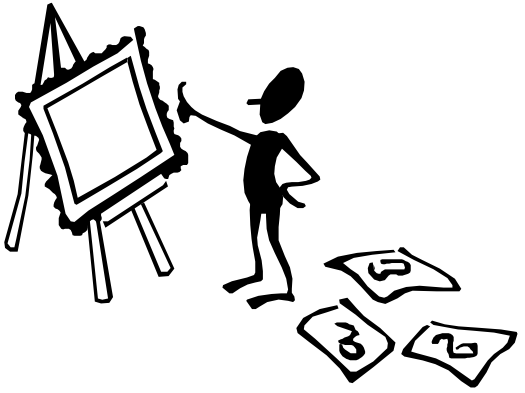
- **Some adopters viewed high maturity as "applying Statistical Process Control to something" (i.e., finding some stable subprocess with enough data points to be able to construct control charts)**



- **Some organizations constructed process performance baselines and models with little relationship to project performance**
- **Some projects selected subprocesses to quantitatively manage that did not contribute significantly to their customer's quality and process objectives**

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The Value of Level 4/5



- **The value of Level 4/5 is *insight***
  - Level 4/5 is 10-20% cheaper than Level 3 (even though more is being done
  - Quantitative management establishes expected ranges of process performance
  - Process are stable and predictable – unusual process behaviors can be quickly identified, so effective corrective action can be taken
- **To realize the value of Level 4/5**
  - Processes have to be stable (performed consistently)
  - Processes under statistical control must support business objectives
  - Data has to be useful and clean
  - Analysis has to lead to actions

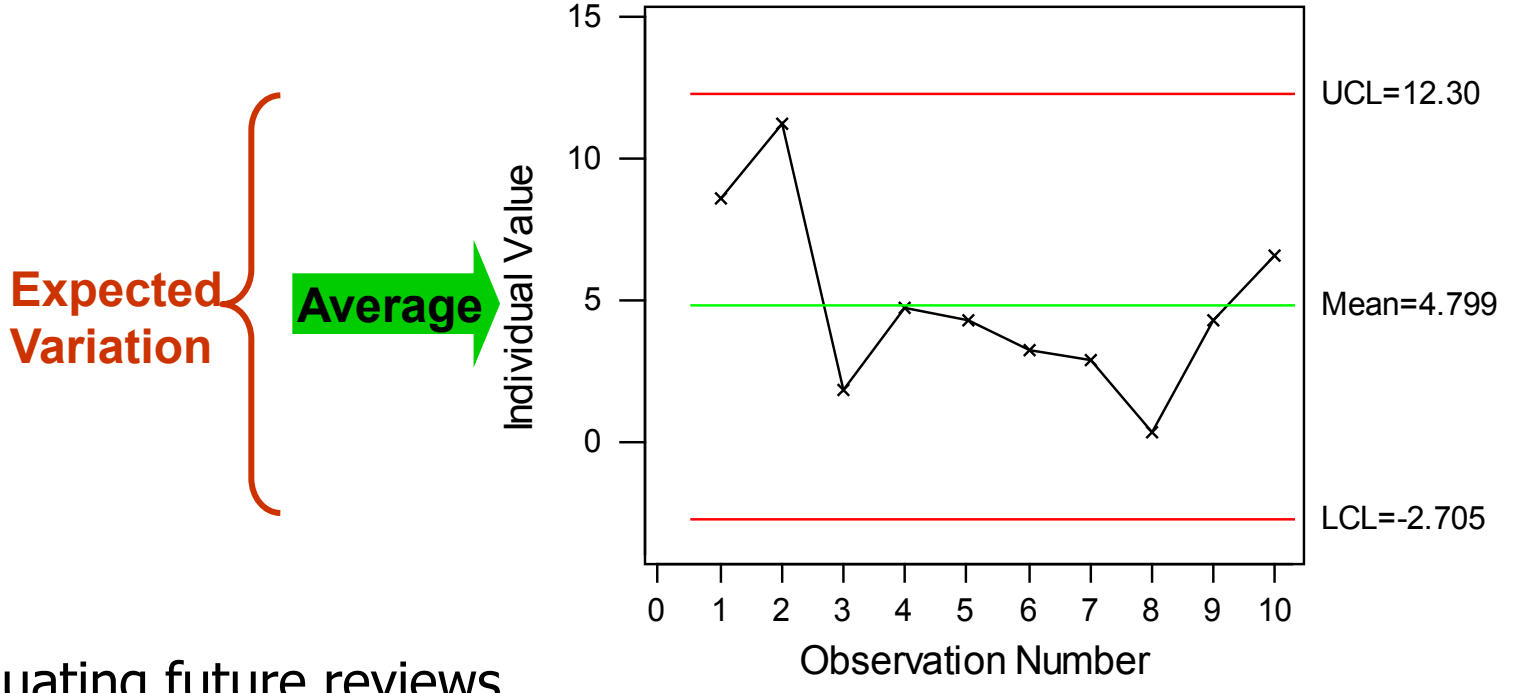
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Understanding the Process

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Managing by Variation

- How many errors are typically found in reviewing an interface specification?



- Useful in evaluating future reviews
  - Was the review effective?
  - Was the process different?
  - Is the work product different?

Corrective and preventative actions

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Quantitative Project Management

Restructured SPs, clarified quantitative management

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QPM V1.2

SG 1 Quantitatively Manage the Project

SP 1.1 Establish the Project's Objectives

SP 1.2 Compose the Defined Process

SP 1.3 Select the Subprocesses that Will Be Statistically Managed

SP 1.4 Manage Project Performance

SG 2 Statistically Manage Subprocess Performance

SP 2.1 Select Measures and Analytic Techniques

SP 2.2 Apply Statistical Methods to Understand Variation

SP 2.3 Monitor Performance of the Selected Subprocesses

SP 2.4 Record Statistical Management Data

QPM V1.3

SG 1 Prepare for Quantitative Management

SP 1.1 Establish the Project's Objectives

SP 1.2 Compose the Defined Process

SP 1.3 Select Subprocesses and Attributes

SP 1.4 Select Measures and Analytic Techniques

SG 2 Quantitatively Manage the Project

SP 2.1 Monitor the Performance of Selected Subprocesses

SP 2.2 Manage Project Performance

SP 2.3 Perform Root Cause Analysis

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Prepare for Quantitative Management

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SP 1.3 Select Subprocesses and Attributes

Select subprocesses and attributes critical to evaluating performance and that help to achieve the project's quality and process performance objectives.

Examples of criteria used to select subprocesses include the following:

- There is a strong correlation with performance results that are addressed in the project's objectives.
- Stable performance of the subprocess is important.
- Poor subprocess performance is associated with major risks to the project.
- One or more attributes of the subprocess serve as key inputs to process performance models used in the project.
- The subprocess will be executed frequently enough to provide sufficient data for analysis.

Examples of product and process attributes include the following:

- Effort consumed to perform the subprocess
- The rate at which the subprocess is performed
- Cycle time for process elements that make up the subprocess
- Resource or materials consumed as input to the subprocess
- Skill level of the staff member performing the subprocess
- Quality of the work environment used to perform the subprocess
- Volume of outputs of the subprocess (e.g., intermediate work products)
- Quality attributes of outputs of the subprocess (e.g., reliability, testability)

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Quantitatively Manage the Project

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SP 2.2 Manage Project Performance

~~Monitor~~Manage the project using statistical and other quantitative techniques to determine whether or not the project's objectives for quality and process performance will be satisfied~~, and identify corrective action as appropriate~~

1. Periodically review the performance of subprocesses.

Stability and capability data from monitoring selected subprocesses, as described in SP2.1, are a key input into understanding the project's overall ability to meet quality and process performance objectives.

4. Use process performance models calibrated with project data to assess progress toward achieving the project's quality and process performance objectives.

Process performance models are used to assess progress toward achieving objectives that cannot be measured until a future phase in the project lifecycle. Objectives can either be interim objectives or overall objectives.

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Quantitatively Manage the Project - 2

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SP 2.3 Perform Root Cause Analysis

Perform root cause analysis of selected issues to address deficiencies in achieving the project's quality and process performance objectives.

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Organizational Process Performance

Re-ordered SPs, projects can develop PPBs/PPMs

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OPP V1.2

SG 1 Establish Performance Baselines and Models

SP 1.1 Select Processes

SP 1.2 Establish Process-Performance Measures

SP 1.3 Establish Quality and Process-Performance Objectives

SP 1.4 Establish Process-Performance Baselines

SP 1.5 Establish Process-Performance Models

OPP V1.3

SG 1 Establish Performance Baselines and Models

SP 1.1 Establish Quality and Process Performance Objectives

SP 1.2 Select Processes

SP 1.3 Establish Process Performance Measures

SP 1.4 Analyze Process Performance and Establish Process Performance Baselines

SP 1.5 Establish Process Performance Models

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Establishing Process Performance Baselines

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SP 1.4 Analyze Process Performance and Establish Process Performance Baselines

~~Establish~~ Analyze the performance of the selected processes, and establish and maintain the ~~organization's~~ process~~-~~ performance baselines.

These baselines are used to determine the expected results of the process or subprocess when used on a project under a given set of circumstances.

Process performance baselines are compared to the organization's quality and process performance objectives to determine if the quality and process performance objectives are being achieved.

The process performance baselines are a measurement of performance for the organization's set of standard processes at various levels of detail:

- –Sequence of connected processes
- –Processes that cover the entire life of the project
- –Processes for developing individual work products

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Causal Analysis & Resolution

Outcomes can be positive

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CAR V1.2

SG 1 Determine Causes of Defects

SP 1.1 Select Defect Data for Analysis

SP 1.2 Analyze Causes

SG 2 Address Causes of Defects

SP 2.1 Implement the Action Proposals

SP 2.2 Evaluate the Effect of Changes

SP 2.3 Record Data

CAR V1.3

SG 1 Determine Causes of Selected Outcomes

SP 1.1 Select Outcomes for Analysis

SP 1.2 Analyze Causes

SG 2 Address Causes of Selected Outcomes

SP 2.1 Implement Action Proposals

SP 2.2 Evaluate the Effect of Implemented Actions

SP 2.3 Record Causal Analysis Data

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Selecting Outcomes for Analysis

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SP 1.1 Select Outcomes for Analysis

Select outcomes for analysis.

Examples of when to perform causal analysis include the following:

- When a stable subprocess does not meet its specified quality and process performance objectives, or when a subprocess needs to be stabilized
- During the task, if and when problems warrant a causal analysis meeting
- When a work product exhibits an unexpected deviation from its requirements
- When more defects than anticipated escape from earlier phases to the current phase
- When process performance exceeds expectations
- At the start of a new phase or task

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Organizational Performance Management

Added SG1, generalized piloting

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OPM V1.2

SG 1 Select Improvements

SP 1.1 Collect and Analyze Improvement Proposals

SP 1.2 Identify and Analyze Innovations

SP 1.3 Pilot Improvements

SP 1.4 Select Improvements for Deployment

SG 2 Deploy Improvements

SP 2.1 Plan the Deployment

SP 2.2 Manage the Deployment

SP 2.3 Measure Improvement Effects

OPM V1.3

SG 1 Manage Business Performance

SP 1.1 Maintain Business Objectives

SP 1.2 Analyze Process Performance Data

SP 1.3 Identify Potential Areas for Improvement

SG 2 Select Improvements

SP 2.1 Elicit Suggested Improvements

SP 2.2 Analyze Suggested Improvements

SP 2.3 Validate Improvements

SP 2.4 Select and Implement Improvements for Deployment

SG 3 Deploy Improvements

SP 3.1 Plan the Deployment

SP 3.2 Manage the Deployment

SP 3.3 Evaluate Improvement Effects

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SG1: Manage Business Performance

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SG 1 Manage Business Performance

The organization's business performance is managed using statistical and other quantitative techniques to understand process performance shortfalls, and to identify areas for process improvement.

SP 1.1 Maintain Business Objectives

Maintain business objectives based on an understanding of business strategies and actual performance results.

SP 1.2 Analyze Process Performance Data

Analyze process performance data to determine the organization's ability to meet identified business objectives.

SP 1.3 Identify Potential Areas for Improvement

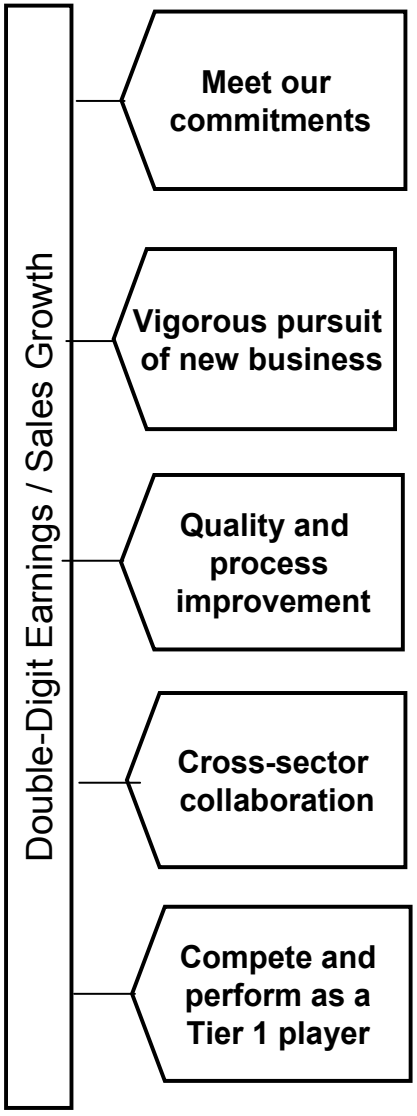
Identify potential areas for improvement that could contribute to meeting business objectives.

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NGC Business Goals and Performance Objectives

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Strategic Objectives



Quality & Process Performance Objectives

- Increase understanding of product quality across wider range of project processes and decrease variation
- Develop understanding of process performance across wider range of project processes and decrease variation

- Organizational strategic goals flow down annually
- Organizational staff develop proposed organizational quantitative quality and process performance objectives based on the strategic goals
- The proposed quantitative goals are reviewed with the Divisions and adjusted as needed

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OPM Validation

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SP 2.3 Validate Improvements

Validate selected improvements.

Examples of validation methods include the following:
- Discussions with stakeholders, perhaps in the context of a formal review
- Prototype demonstrations
- Pilots of suggested improvements
- Modeling and simulation

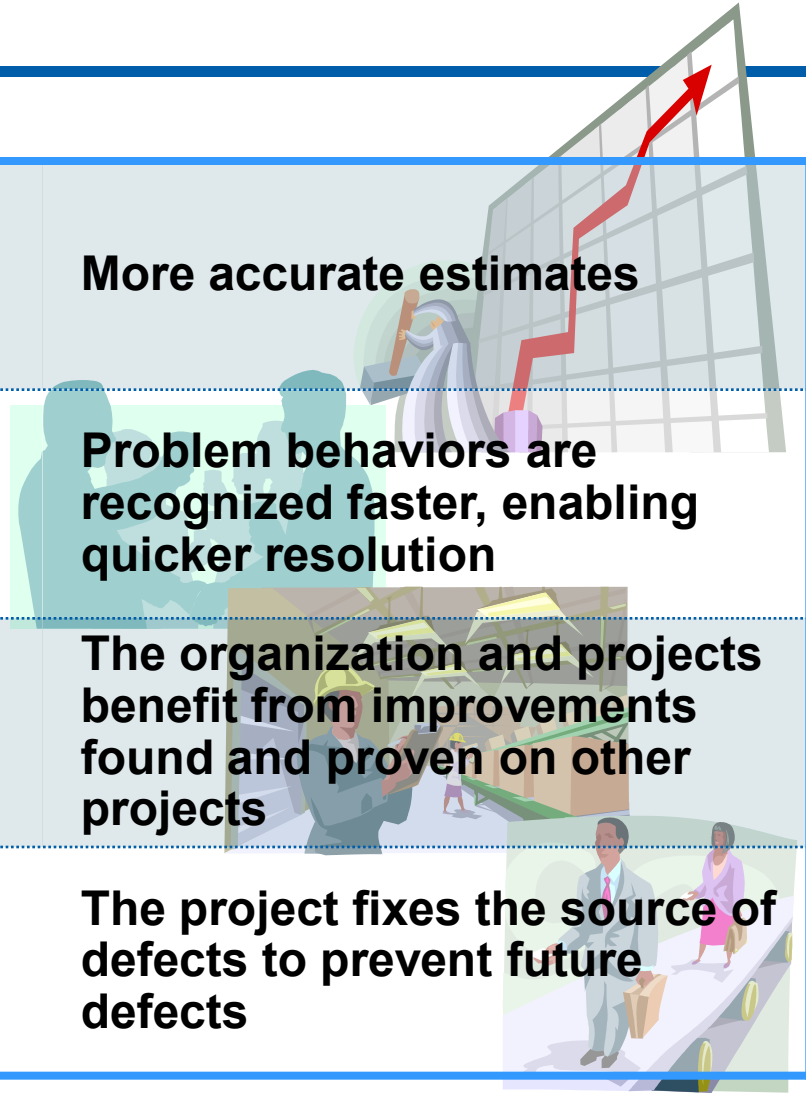
Pilots can be conducted to evaluate significant changes involving untried, high-risk, or innovative improvements before they are broadly deployed. Not all improvements need the rigor of a pilot.

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How Does Level 4 & 5 Benefit the Customer?

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Organizational Process Performance	**More accurate estimates**
Quantitative Project Management	**Problem behaviors are recognized faster, enabling quicker resolution**
Organizational Performance Management	**The organization and projects benefit from improvements found and proven on other projects**
Causal Analysis and Resolution	**The project fixes the source of defects to prevent future defects**



Better Products and Services Produced Faster And Cheaper

Adapted from "How Does High Maturity Benefit the Customer?", R. Hefner, Systems & Software Technology Conference, 2005

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Effective, CMMI-Compliant Project Plans (in Less Than 10 Pages)

CMMI Technology Conference and User Group
14-17 November 2011



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Background

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- Most CMMI adopters continue to write plans the traditional way -- hundreds of pages long, filled mostly with boilerplate
- This approach is not consistent with the CMMI model, and makes the plans difficult (and time-consuming) to create, use, and maintain
- This presentation will describe a simple, easy to use method for creating a short (less than 10 pages), effective, CMMI-compliant project plan

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Topics

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- CMMI planning practices (PP, IPM, GP 2.2)
- Policy, plans, process descriptions, procedures – what's the difference?
- A 10-page (or less) planning template
- Lessons learned

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CMMI Planning Practices

- Planning is mentioned both as a process area and as a generic practice in all process areas

		Requirements Management	Project Planning	Project Monitoring and Control	Supplier Agreement Management	Measurement and Analysis	Process and Product Quality Assurance	Configuration Management	Requirements Development	Technical Solution	Product Integration	Verification	Validation	Organization Process Focus	Organization process definition	Organizational Training	Integrated Project Management	Risk Management	Decision Analysis and Resolution	Organizational Process Performance	Quantitative Project Management	Organizational Performance Management	Causal Analysis and Resolution
GP 2.1	Establish an Organizational Policy																						
GP 2.2	Plan the Process																						
GP 2.3	Provide Resources																						
GP 2.4	Assign Responsibility																						
GP 2.5	Train People																						
GP 2.6	Control Work Products																						
GP 2.7	Identify and Involve Relevant Stakeholders																						
GP 2.8	Monitor and Control the Process																						
GP 2.9	Objectively Evaluate Adherence																						
GP 2.10	Review Status with Higher Level Management																						
GP 3.1	Establish a Defined Process																						
GP 3.2	Collect Process Related Experiences																						

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What Might Be Included in a Plan?

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GP 2.2 Plan the Process

Establish and maintain the plan for performing the process.

The plan for performing the process typically includes the following:

- Process description **GP 3.1**
- Standards and requirements for the work products and services of the process
- Specific objectives for the execution of the process and its results (e.g., quality, time scale, cycle time, use of resources)
- Dependencies among the activities, work products, and services of the process
- Resources (e.g., funding, people, tools) needed to perform the process **GP 2.3**
- Assignment of responsibility and authority **GP 2.4**
- Training needed for performing and supporting the process
- Work products to be controlled and the level of control to be applied
- Measurement requirements to provide insight into the execution of the process, its work products, and its services
- Involvement of relevant stakeholders
- Activities for monitoring and controlling the process
- Objective evaluation activities of the process
- Management review activities for the process and the work products

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CMMI Planning Process Areas

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Project Planning

SG 1 Establish Estimates
SP 1.1 Estimate the Scope of the Project
SP 1.2 Establish Estimates of Work Product and Task Attributes
SP 1.3 Define Project Lifecycle Phases
SP 1.4 Estimate Effort and Cost

SG 2 Develop a Project Plan
SP 2.1 Establish the Budget and Schedule
SP 2.2 Identify Project Risks
SP 2.3 Plan Data Management
SP 2.4 Plan for Project Resources
SP 2.5 Plan Needed Knowledge and Skills
SP 2.6 Plan Stakeholder Involvement
SP 2.7 Establish the Project Plan

SG 3 Obtain Commitment to the Plan
SP 3.1 Review Plans that Affect the Project
SP 3.2 Reconcile Work and Resource Levels
SP 3.3 Obtain Plan Commitment

Integrated Project Management

SG 1 Use the Project's Defined Process
SP 1.1 Establish the Project's Defined Process
SP 1.2 Use Organizational Process Assets for Planning Project Activities
SP 1.3 Establish the Project's Work Environment
SP 1.4 Integrate Plans
SP 1.5 Manage the Project Using Integrated Plans
SP 1.6 Establish Teams
SP 1.7 Contribute to Organizational Process Assets

SG 2 Coordinate and Collaborate with Relevant Stakeholders
SP 2.1 Manage Stakeholder Involvement
SP 2.2 Manage Dependencies
SP 2.3 Resolve Coordination Issues

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Other CMMI Planning Implications

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Words like “selected”, “identify”, in practices imply a choice to be made in planning

GP 2.6 Place selected work products of the process under appropriate levels of control.
GP 2.7 Identify and involve the relevant stakeholders of the process as planned.
PPQA SP 1.1 Objectively evaluate selected performed processes against the applicable process descriptions, standards, and procedures.

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How do Plans and Process Descriptions Differ?

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Plan

- Description of activities
- Resources (including funding, people, and tools) — GP 2.3
- Schedule
- Assignment of responsibility and authority — GP 2.4

At Level 2, plans describe what to do

At Level 3, the existence of a process description means plans become much shorter

- **Focus is on instantiating the process (e.g., how often a process executes)**

Process Description GP 3.1

- Process roles
- Applicable standards
- Applicable procedures, methods, tools, and resources
- Process performance objectives
- Entry criteria
- Inputs
- Verification points (e.g., peer reviews)
- Outputs
- Interfaces
- Exit criteria
- Product and process measures

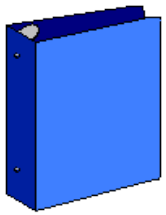
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A Top-Level Comparison

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Policy — **High-level "what" to do (organizational guidance)**



Process — **High-level "how" to do (organizational standard, tailored by projects)**



Procedure — **Low-level "how" to do (details needed to follow a strategy)**



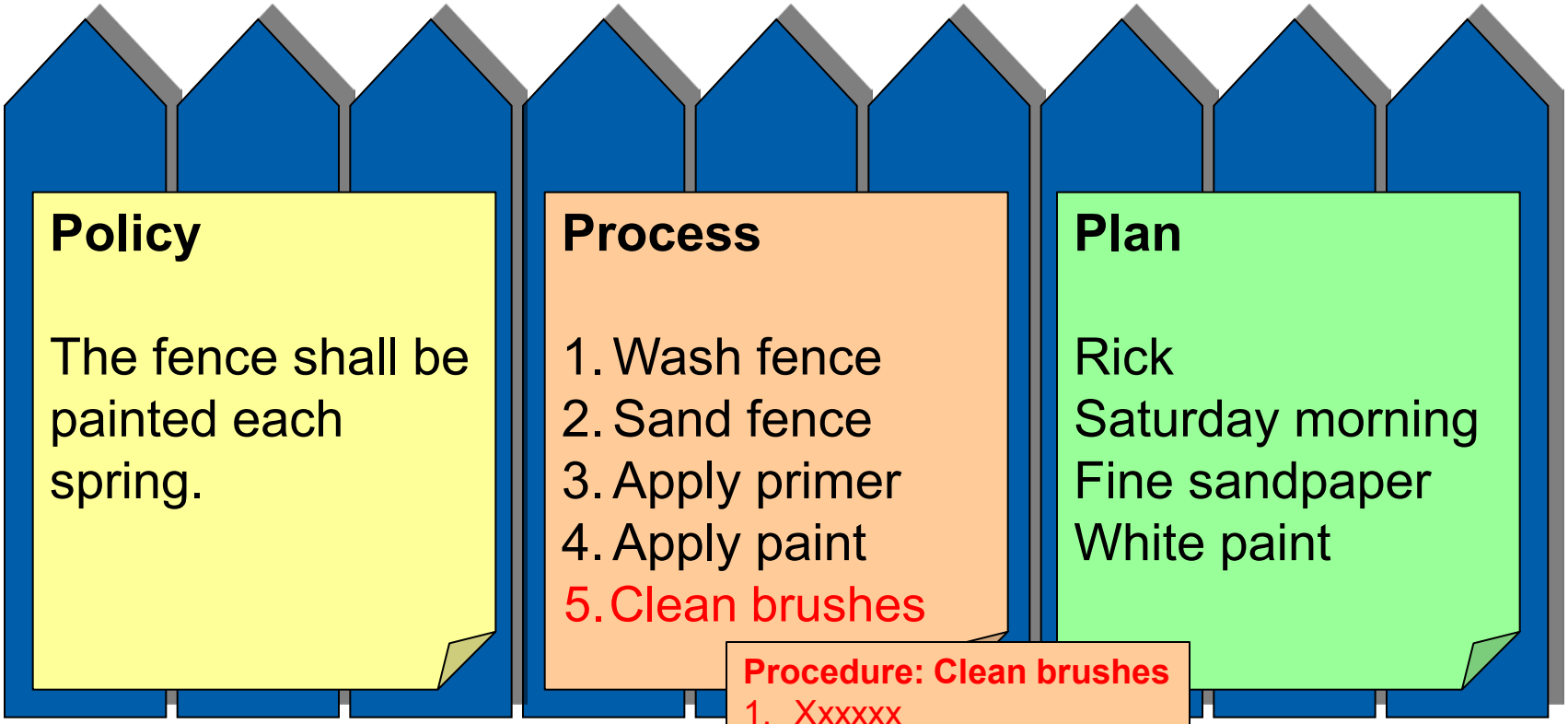
Plan — **Instantiation of the process (how often, when, etc.)**

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Documenting Choices in Plans

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- Policies identify what must happen
- Process descriptions and procedures describe the steps to be performed
- Plans describe how the process is instantiated



Bottom Line

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- For Maturity Level 3 and higher organizations, the existence of a process description means the typical "boilerplate" process descriptions included in a plan (e.g., DOD-STD-2167A) can be eliminated
- Plans simply describe the instantiation of the process
  - Who, how often, what resources
- Plans capture the decisions about how to best fit the process to the task at hand
  - By creating a short, table-based template, the decisions are highlighted

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Plan Template

The work products to be controlled for each project process, their level of control, and the control authority authorized to make changes to the work product are defined in Table 2.10. The levels of control are defined in Table 2.11

Table 2.10. Work Products, Documents, and Records

PROJECT PROCESS	WORK PRODUCT	LEVEL OF CONTROL	AUTHORITY
Project Planning	Project Management Plan	Project	Project Manager
	Engineering Change Proposals (CDRL A017)	Project	Project Manager
Project Monitor and Control	Work Breakdown Structure	Project	Project Manager
	Technology Control Plan (CDRL A001)	Project	Project Manager
	Contract/Funds Status Report (CDRL A003)	Project	Project Manager
	Cost-Schedule Status Report (CDRL A004)	Project	Project Manager

- All CMMI-required decisions are captured in the template
- The template can include either blanks to fill in, “typical” values to be reviewed/modified as needed, or mandatory values set by the organization

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Lessons Learned

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- The template has been a very useful tool for explaining CMMI concepts
- The table approach encourages Project Managers to be more conscientious in their process decisions
- Shorter plans are easier to create – helps CMMI buy-in
- Shorter plans are easier to read – no more shelfware

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How to Successfully and Cost-Effectively Conduct a Re-Appraisal

CMMI Technology Conference and User Group
14-17 November 2011



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Background

- **Once they've passed their first appraisal, many organizations have difficulty maintaining CMMI-compliant behavior**
  - Projects regress into old habits
  - Senior management turns their attention to other challenges
  - None of the investment pays off
  - When the time comes to re-appraise, you have to start all over

This presentation will examine:

- **How to sustain CMMI-compliant behavior across an organization**
  - Why projects and organizations fail to institutionalize CMMI practices, and ways to overcome theses problems
- **How evidence gathering differs in a re-appraisal**

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Agenda

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- **What institutionalization is – and how to spot it**
- **Why institutionalization fails**
  - Understanding your organization's culture
  - Why quality assurance is key (and why most QA efforts are focused on the wrong things)
  - Resources required to sustain maturity
  - Keeping senior management support
- **How evidence gathering differs for a re-appraisal**
  - What evidence needs to be "refreshed"
  - Common areas of recidivism

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What is Institutionalization?

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Institutionalization: The ingrained way of doing business that an organization follows routinely follows as part of its corporate culture.

- CMMI-DEV v1.3

When mentioned in the generic goal and generic practice descriptions, institutionalization implies that the process is ingrained in the way the work is performed and there is commitment and consistency to performing the process.

An institutionalized process is more likely to be retained during times of stress.

GG 2 Institutionalize a Managed Process

GP 2.1 Establish an Organizational Policy
GP 2.2 Plan the Process
GP 2.3 Provide Resources
GP 2.4 Assign Responsibility
GP 2.5 Train People
GP 2.6 Control Work Products
GP 2.7 Identify and Involve Relevant Stakeholders
GP 2.8 Monitor and Control the Process
GP 2.9 Objectively Evaluate Adherence
GP 2.10 Review Status with Higher Level Management

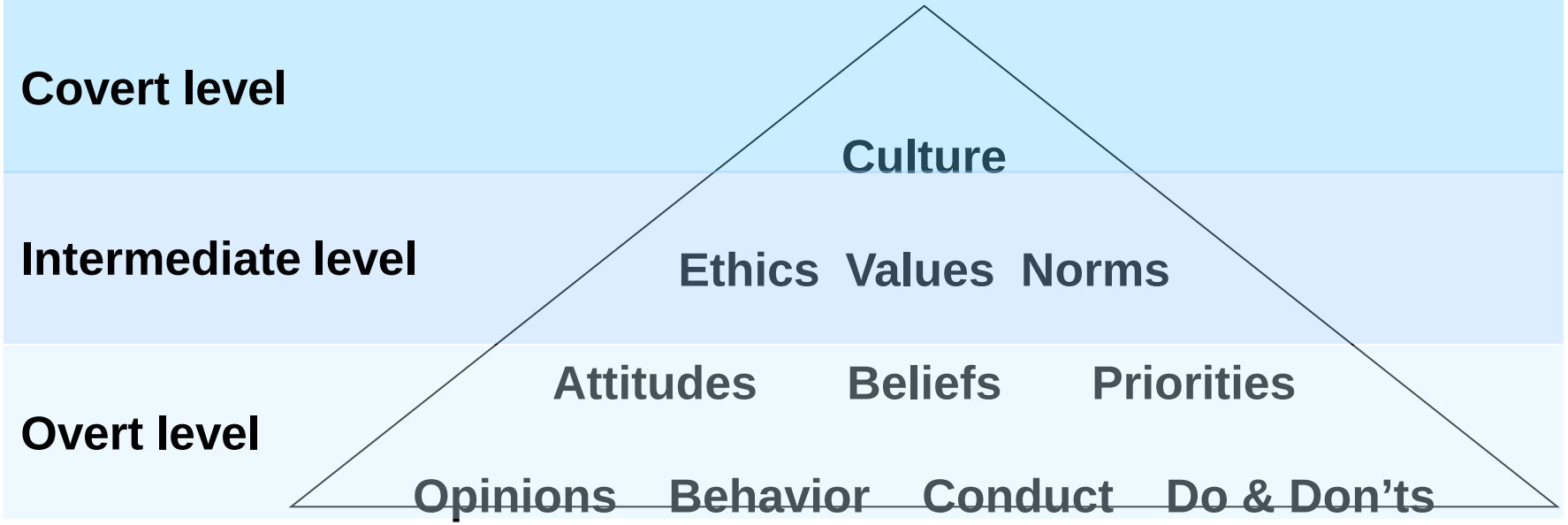
GG 3 Institutionalize a Defined Process

GP 3.1 Establish a Defined Process
GP 3.2 Collect Process Related Experiences

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Understanding Your Organization's Culture

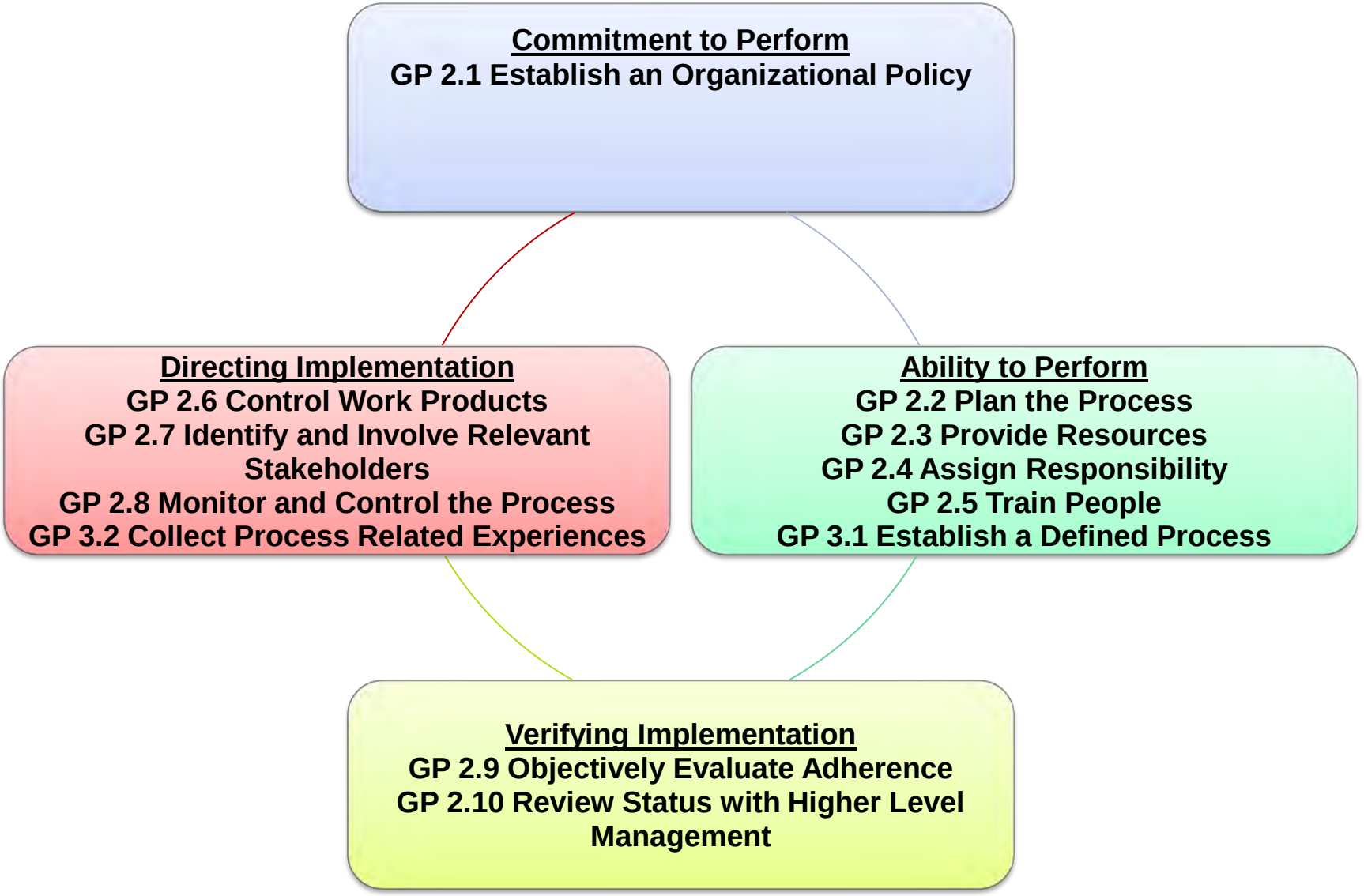
- **Few engineers or managers are trained in organizational psychology**
- **Improvement efforts implement the generic practices (i.e., change the artifacts) without understanding or addressing lower level contributors to culture**



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Common Features – A Lost Perspective in CMMI v1.2 and 3!

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Five Dimensions of Work

Reference: Richard Hackman & Greg Oldham, Work Redesign







- *Skill variety* - The degree to which the work requires you to exercise a variety of skills
- *Task identity* - The degree to which the work requires you to complete a whole, identifiable piece of work
- *Task significance* - The degree to which your work affects others and contributes to social welfare
- *Autonomy* - The degree to which you have control over the means and methods you use to perform your work
- *Job feedback* - The degree to which carrying out the work itself provides you with direct and clear information about how effective you are.



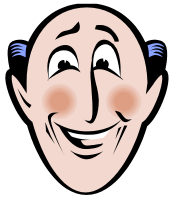




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Perceptions of the CMMI Common Features Based on Work Environment Preferences

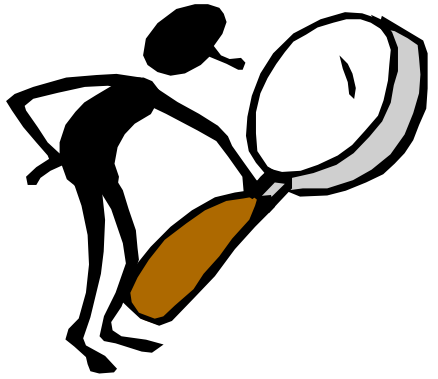
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	Skill Variety	*Task Identity*	*Task Significance*	*Autonomy*	*Job Feedback*
Commitment to Perform Establish an Org. Policy					
Ability to Perform Plan the Process Provide Resources Assign Responsibility Train People Establish a Defined Process					
Directing Implementation Control Work Products Identify/Involve Stakeholders Monitor/Control the Process Collect Process Experiences					
Verification Obj. Evaluate Adherence Review with Higher Mgmt					

"Aligning CMMI Strategies with Individual, Project, and Organizational Perspectives," Software Technology Conference, 2003

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Why QA is Key



- **Process and product audits provide tangible, objective measures of adoption/sustainment**
  - Policies, processes, and standards must reflect the desired behaviors
- **Appraisals evaluate the effectiveness of the audit program**
  - Standardized tools, approaches, and methods
  - Consistency of appraisers – if they understand the way we are structured and operate, there is less time required to understand what we are doing.
  - Pre-appraisal activities to prepare projects for the appraisal process
- **The frequency of audits and appraisals, and the sampling, must reflect the progress of the cultural change**
  - As the culture begins the change, more frequent and more in-depth audits/appraisals are required
  - Later, the amount of audits/appraisal may decrease, if the culture has truly changed

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The Problem with Traditional QA

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Traditional QA (DoD-STD-2168)

- Involved checking documents against DIDs (data item descriptions
- Some organizations performed process audits against plans
- Criteria were often subjective

CMMI Approach

- PPQA emphasizes both work product and process audits
  No DIDs means PMs must decide what work products need standards
- Process audits are performed against process descriptions and procedures
- Criteria are defined in the procedures and work product standard

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QA's Role Evolves

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Initially, effective QA enforces the new processes

- Conflict exists when QA is also in the process improvement role





Level	Focus	Process Areas
5 Optimizing	*Continuous process improvement*	Causal Analysis and Resolution Organizational Performance Management
4 Quantitatively Managed	*Quantitative management*	Quantitative Project Management Organizational Process Performance
3 Defined	*Process standardization*	Organizational Process Focus Organizational Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis and Resolution Requirements Development Technical Solution Product Integration Verification Validation
2 Managed	*Basic project management*	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management
1 Performed		

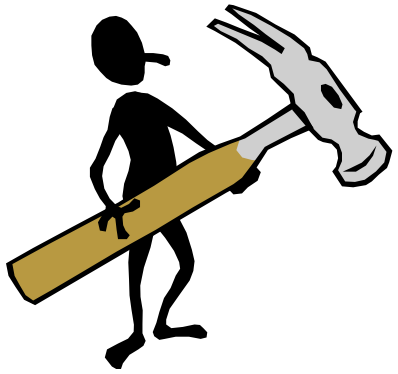
At higher maturity levels, the need for traditional QA often diminishes

- QA personnel measures effectiveness, may perform metrics/statistics collection and analysis

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Resources Needed: Management Commitment and Support

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Committed management:

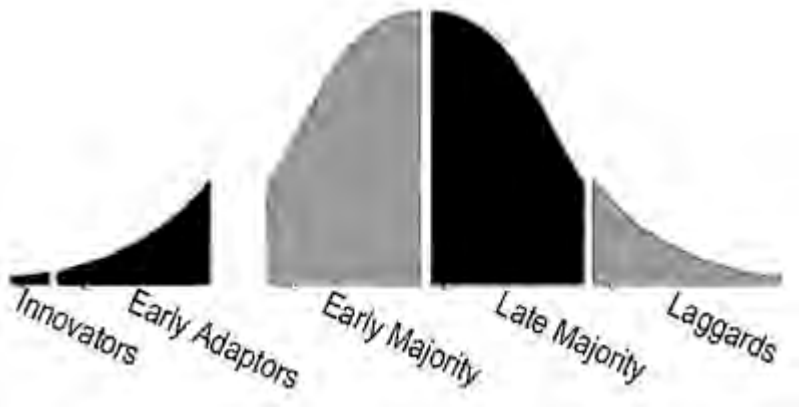
- **Understands the key messages**
- **Is willing to take actions to reinforce them**
- **Provides resources to support/sustain process improvement efforts**
- **Sets expectations that essential project functions will be funded and processes will be followed**
  - Project planning, estimation, tailoring, CM, QA, etc.
- **Supports process improvement and sustainment, rather than passing appraisals**
- **Rewards following the agreed-to processes rather than individual heroics**
  - "Tell me how you will reward me, and I'll tell how I will behave"

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Accountability

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- **Adopting and sustaining CMMI is about each practitioner learning and performing the new behaviors**
- **The role of management in cultural change is to hold people accountable for the new behaviors and conduct**
- **Change agents can enable management by:**
  - Helping them have a clear vision of the new culture
  - Identifying inappropriate behavior
  - Providing tangible, objective measures of adoption/sustainment



"Crossing The Chasm", Geoffrey Moore

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How Evidence Gathering Differs in a Re-appraisal

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- In a first appraisal, evidence gathering is typically performed as part of an initial gap assessment
  - CMMI awareness and buy-in, education, assessment

- In a re-appraisal, evidence gathering should focus on assessing the effectiveness of institutionalization
  - Are processes in place?
  - If not, why? What GPs are ineffective?

- New projects in a re-appraisal will have a similar focus to an initial appraisal
  - Provides an assessment of how effective your start-up processes are

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Re-appraising Continuing Projects

Can I use 3-year old evidence?

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Possibly good

- PP, GP 2.2, GP 3.1 (need to check whether plans, tailoring are being maintaining current with program scope)
- "Prepare for" Specific Goal 1's (confirm strategies have not changed)



Probably bad

- PMC, GP 2.8, GP 2.10, IPM, GP 2.7, RskM, QPM
- CM, GP 2.6, QA, GP 2.9, MA, DAR, CAR (use more recent application)
- RM, RD (unless no requirement changes)
- TS, PI, VER, VAL (all driven by requirement changes)
- OPF, OPD, OT, OPP, OPM, GP 2.1, GP 2.5, GP 3.2



It depends

- GP 2.3, GP 2.4

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Summary

- **The difficulty in passing a re-appraisal is directly related to how effectively practices have been institutionalized**
  - Depends on the strength of the Generic Practices (Common Features), the commitment of management, and the role of QA
- **Re-appraisal offer a mechanism to assess the effectiveness of the generic practices**
  - Focus should be preventing recidivism, not just correcting the evidence

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The Fundamental Value of Every Single CMMI Practice

CMMI Technology Conference and User Group
14-17 November 2011



Rick Hefner
Northrop Grumman Corporation
rick.hefner@ngc.com

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Background

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- Convincing someone to implement a CMMI practice is especially difficult when they don't believe the practice adds any value
- It is important that CMMI advocates be able to clearly explain the business value of each practice and its positive impact on project and organization performance
- This presentation will outline the potential benefits from adopting CMMI practices

® CMMI is registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

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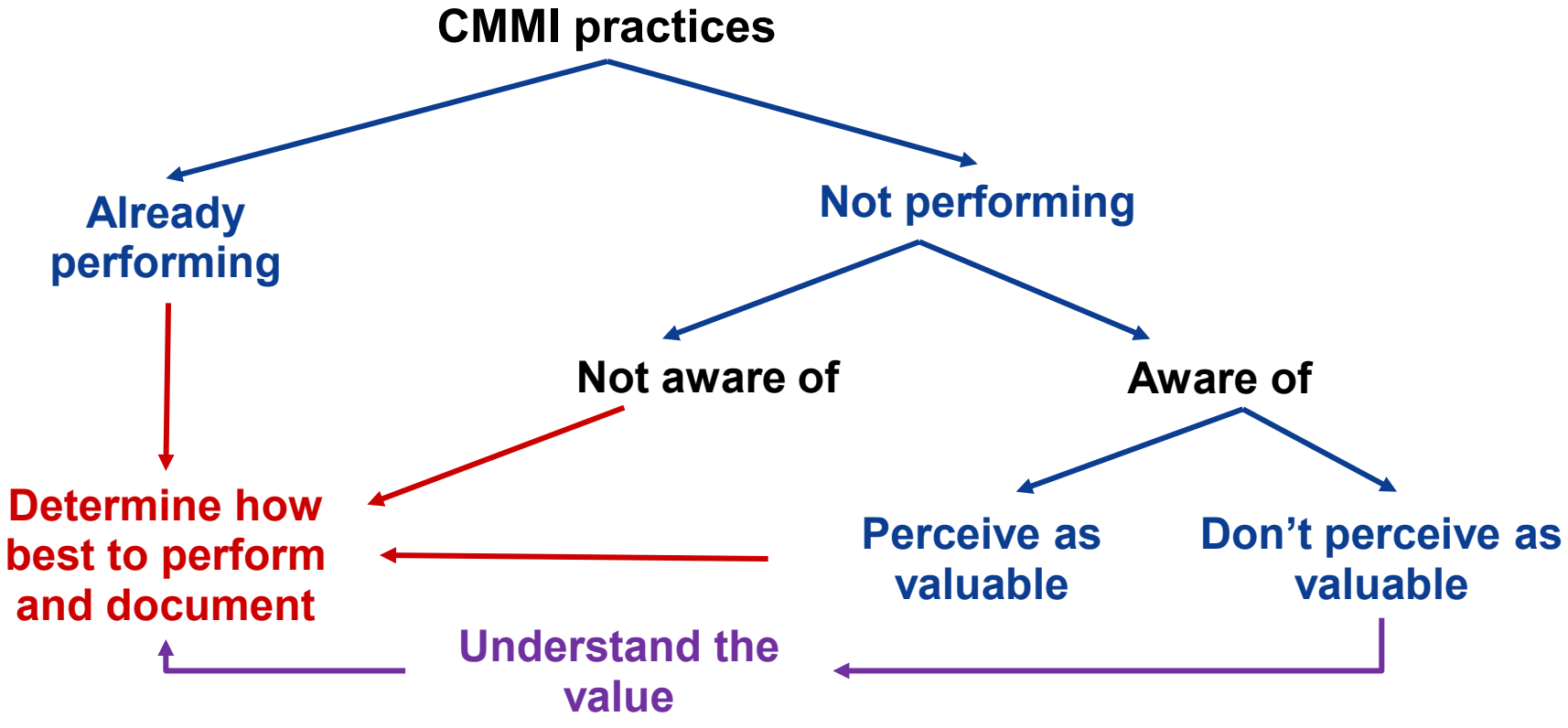
What is CMMI?

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- The CMMI is a model of industry best-practices for engineering products
- When an organization decides to adopt CMMI, they commit to performing these best-practices
  - Different than a customer-driven process, where you simply do what the customer asks you to do
- You are performing practices in what you understand to be the best way known in industry
  - “Best” implies predictably producing products of acceptable quality at the lowest possible cost and schedule

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Adopting the CMMI



Key enablers

Willingness to learn unfamiliar practices

Desire to extract value not "check the box"

Ability to interpret the CMMI in your context

Understanding the value of the CMMI practices

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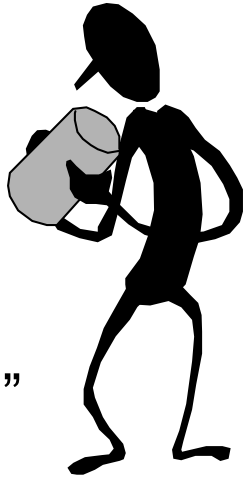
A Typical Interchange

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CMMI Change Agent



CMMI Change "Target"



"You're not doing practice X."

"You must do that practice to satisfy CMMI!"

"Practice X adds value"

"Well, it's in the CMMI, so it must be important."

"Well…, you have to do the practice or you'll fail the appraisal!"

"So."

"The customer didn't say we have to do practice X."

"How?

"Practice X doesn't make sense for us – we're special."

"$^&*&%!!!!!"

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Underlying Principles of CMMI

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- Process discipline leads to predictable project performance
  - Say what you do; do what you say
  - Document the plans/processes
  - Communicate them to the performers and stakeholders
  - Audit to ensure we are following them
- Conscious choices lead to better processes
  - E.g., identify relevant stakeholders and their involvement; identify work products to be controlled and the control method; define validation procedures and criteria, …
- Organizational learning improves project performance
  - Capture what works, and what doesn't
  - Make rules (policies) to guide projects
  - Define expected processes, and let projects tailor them to fit
  - Capture work products and measures, and learn from them

"Interpreting the CMMI: It Depends!", R, Hefner and S. Yellayi, 2005 CMMI Technology Conference and User Group

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How Do the CMMI Practices Add Value

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- Each practice provides value in 4 possible ways:
  - Performance – the practice directly reduces cost and or schedule through either increased efficiency, increased effectiveness, or lowered rework
  - Quality – the practice produces higher quality products, by either preventing or uncovering defects
  - Insight – the practice helps explain current process or project behaviors, enabling action
  - Communications – the practice helps everyone understand expected behavior, or provides insight leading to better decisions
- Many practices effect more than one dimension
- Some practices provide the potential for a positive impact or reduce the risk of a negative impact

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Some CMMI Areas Offer More Potential Value than Others

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- The activities which drive cost and schedule the most provide the most potential for productivity improvement
- For most large companies and large software projects, the most expensive and time consuming activities, in rank order are:
  - Defect removal
  - Producing documents
  - Meetings and communications
  - Coding
  - Project management

"The Schedules, Costs, and Value of Software Process Improvements," Caper Jones, 2007, used with permission

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Why Do People Resist Change?
Perceived Loss of Personal Power

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Here's the new practices you need to start implementing.



If these are essential industry best practices...

and I haven't been performing them....

then I've been wrong....

so they must not be essential industry best practices!

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Barriers to Seeing the Value

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"Sometimes you have to believe it to see it."

- Practitioners may not have worked in an environment where the practice was performed
- Practitioners may have worked in an environment where the practice was performed poorly or in a non-value-added manner
- The practice may run counter to a long-held belief
- Believing the practice is an improvement may require an action the practitioner is not willing to take
  - Awkwardness of doing something new
  - Admit they've been doing it wrong
  - Loss of personal power when perceived to be an expert in the current approach

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Some CMMI Areas Where the Value Isn't Obvious to Many Practitioners

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- PP SP 1.2 Establish Estimates of Work Product and Task Attributes
  - PMC SP 1.1 Monitor Project Planning Parameters
- Process and Product Quality Assurance
- Risk Management
- Decision Analysis & Resolution
- Supplier Agreement Management
- GP 2.6 Control Work Products
  - PMC SP 1.4 Monitor Data Management
- GP 2.7 Identify and Involve Relevant Stakeholders
  - PMC SP 1.5 Monitor Stakeholder Involvement
- Level 4/5

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Planning



- The value of planning is *communication*
  - Plans provide a structured way to investigate the best approach for satisfying given objectives
  - Practitioners know what is expected of them, so fewer mistakes are made, avoiding rework
  - Interdependences are identified and negotiated which causes fewer disconnects between groups, avoiding schedule delays and wasted resources
  - We monitor progress against plans, so that corrective actions can be taken more quickly and insightfully
- To realize the value of planning
  - The environment has to be predictable
  - Plans must be reasonable
  - Plans must be up-to-date
  - Plans must be communicated to those involved and followed
  - The process behind the plans must be communicated and followed

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Planning Example

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Project Planning - Specific Practice 1.2

Establish and maintain estimates of work products and task attributes.

Measures of size of complexity that contribute to determining effort and cost

- Frequently heard:
  - "It's not important to estimate or track code size, it changes anyway"
  - "We don't use attributes, we just know it's a X week effort"
- Explaining the value
  - Everyone uses attributes, perhaps subconsciously – we just want to make it conscious

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Risk Management



- The value of risk management is *performance*
  - By identifying potential risks and mitigating them, you prevent schedule delays caused by a problem
  - Without risk management, effectiveness is hindered because events outside your control un-do your careful planning and execution
  - Must accept that some mitigation actions will be "wasted" because the risk is never realized
- To realize the value of risk management
  - The culture must support an open discussion of risks
  - Must be effective at identifying ALL risks, ALL perspectives
  - Risk mitigations must offer a reasonable return on investment
  - Solid plans must be written so the risks (of not meeting the plans) can be determined

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Risk Management Example

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Risk Management - Specific Practice 1.1

Determine risk sources and categories.

What sources of risk should we consider in identifying risk?

How should we categorize the risks once they are identified?
- Urgency
- Assignee

- Frequently heard:
  - "The sources are the same as the categories"
  - "Anybody can identify a risk at any time"
  - "Risks are categorized by impact: cost, schedule, performance"

- Explaining the value
  - Setting expectations for the types of risk to consider helps ensure that ALL risks get identified
  - How the risks will be categorized helps ensure they are managed appropriately

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SEI Risk Taxonomy

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A. Product Engineering

1. Requirements
- a. Stability
- b. Completeness
- c. Clarity
- d. Validity
- e. Feasibility
- f. Precedent
- g. Scale

2. Design
- a. Functionality
- b. Difficulty
- c. Interfaces
- d. Performance
- e. Testability
- f. Hardware
- g. Non-Developmental SW

3. Code and Unit Test
- a. Feasibility
- b. Testing
- c. Coding/Implementation

4. Integration and Test
- a. Environment
- b. Product
- c. System

5. Engineering Specialties
- a. Maintainability
- b. Reliability
- c. Safety
- d. Security
- e. Human Factors
- f. Specifications

B. Development Environment

1. Development Process
- a. Formaility
- b. Suitability
- c. Process Control
- d. Familiarity
- e. Product Control

2. Development System
- a. Capacity
- b. Suitability
- c. Usability
- d. Familiarity
- e. Reliability
- f. System Support
- g. Deliverability

3. Management Process
- a. Planning
- b. Project Organization
- c. Management Experience
- d. Program Interfaces

4. Management Methods
- a. Monitoring
- b. Personnel Management
- c. Quality Assurance
- d. Configuration Mgmt

5. Work Environment
- a. Quality Attitude
- b. Cooperation
- c. Communication
- d. Morale

C. Program Constraints

1. Resources
- a. Schedule
- b. Staff
- c. Budget
- d. Facilities

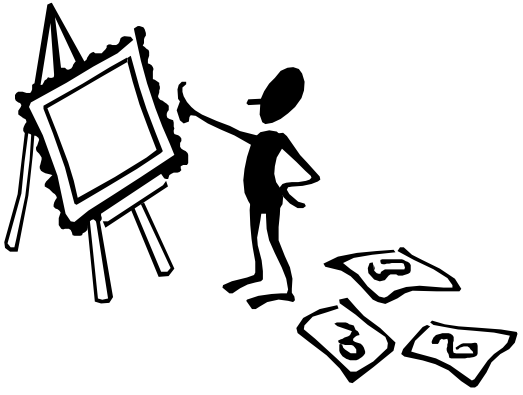
2. Contract
- a. Type of Contract
- b. Restrictions
- c. Dependencies

3. Program Interfaces
- a. Customer
- b. Associate Contractors
- c. Subcontractors
- d. Prime Contractor
- e. Corporate Management
- f. Vendors
- g. Politics

Taxonomy-Based Risk Identification," Marvin J. Carr, et al, Software Engineering Institute, CMU/SEI-93-TR-6, ESC-TR-93-183, June 1993.

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Level 4/5



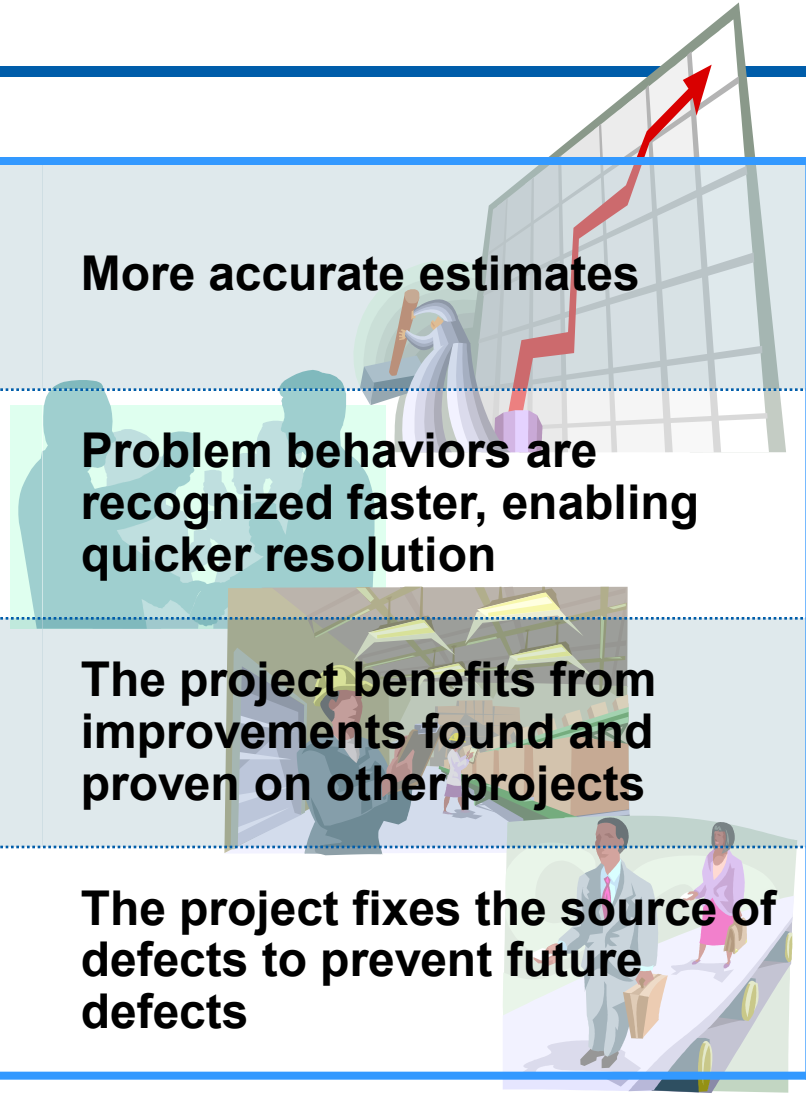
- The value of Level 4/5 is *insight*
  - Level 4/5 is 10-20% cheaper than Level 3 (even though more is being done
  - Quantitative management establishes expected ranges of process performance
  - Process are stable and predictable – unusual process behaviors can be quickly identified, so effective corrective action can be taken
- To realize the value of Level 4/5
  - Processes have to be stable (performed consistently)
  - Processes under statistical control must support business objectives
  - Data has to be useful and clean
  - Analysis has to lead to actions

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How Does Level 4 & 5 Benefit the Customer?

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Organizational Process Performance	**More accurate estimates**
Quantitative Project Management	**Problem behaviors are recognized faster, enabling quicker resolution**
Organizational Performance Management	**The project benefits from improvements found and proven on other projects**
Causal Analysis and Resolution	**The project fixes the source of defects to prevent future defects**



Better Products and Services Produced Faster And Cheaper

"How Does High Maturity Benefit the Customer?", R. Hefner, Systems & Software Technology Conference, 2005

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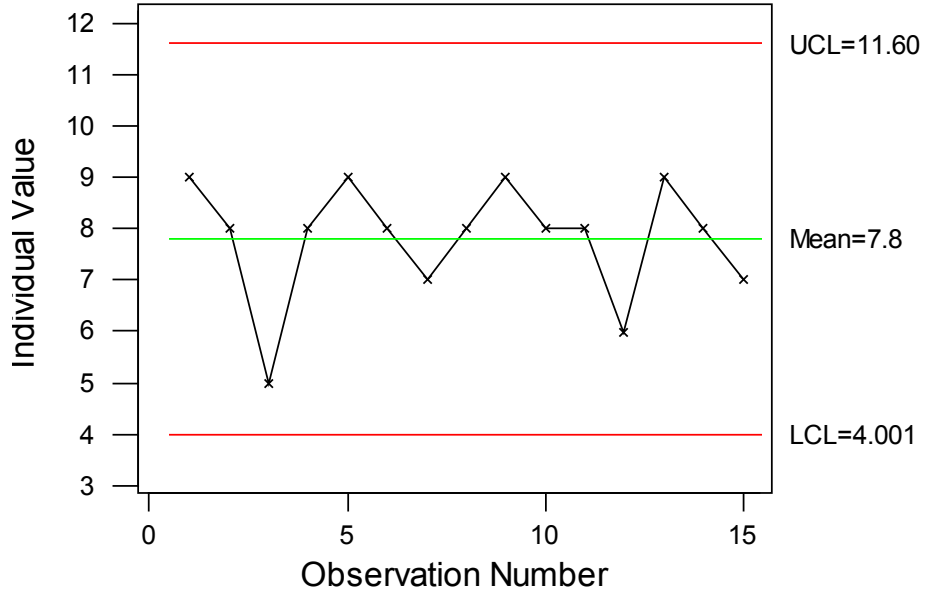
Quantitative Management Example

Suppose your project conducted several peer reviews of similar code, and analyzed the results

Mean = 7.8 defects/KSLOC

+3σ = 11.60 defects/KSLOC

-3σ = 4.001 defects/KSLOC



- What would you expect the next peer review to produce in terms of defects/ KSLOC?
- What would you think if a review resulted in 10 defects/KSLOC?
- 3 defects/KSLOC?

"A Practical Guide to Implementing Levels 4 and 5 (tutorial)," R. Hefner, 2006 CMMI Technology Conference and User Group

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Summary

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- Convincing someone to implement a CMMI practice is easier when you can explain how the CMMI practices add value
- Insight comes from observing practical, value-added implementations

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Resilient Service: CMMI –SVC and CERT-RMM

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

November 2011

Eileen Forrester, Richard Caralli

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What we will cover

- An alternate way to get some security coverage
- What is resilient service
- CMMI-SVC and RMM
- Quality and mission assurance
- An example resilient service using both models



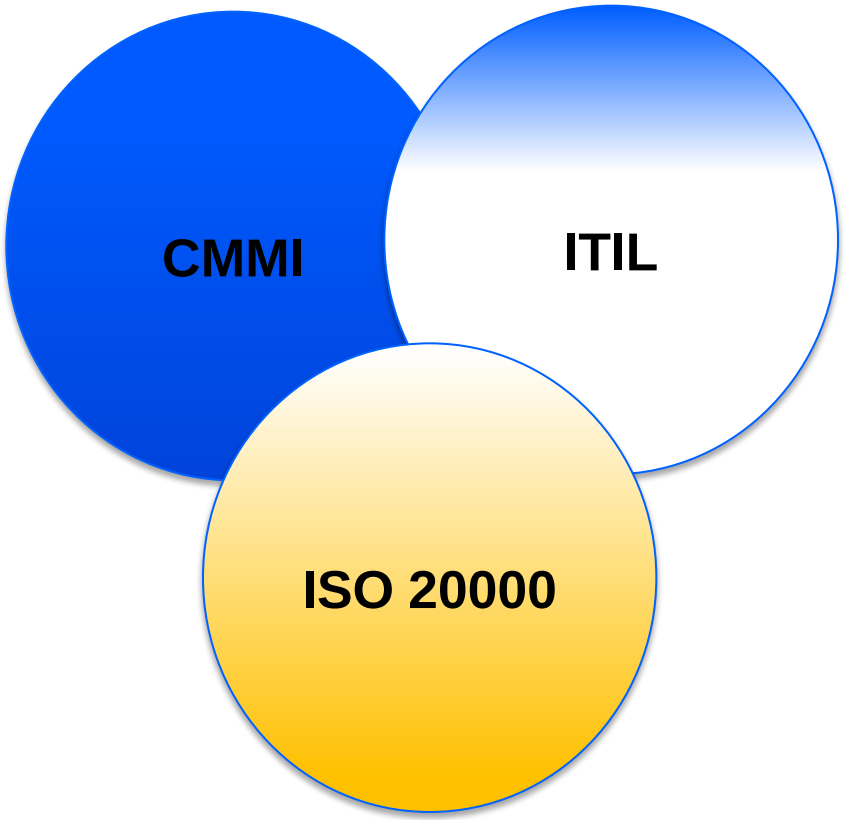
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Assembling a multi-model approach to improving service quality and ensuring service resilience in complex risk environments



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Improving Service Management



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Why Should We Fill the Gap?

Completeness of Improvement Journey

- Organizations have business problems to solve that cross model boundaries
- Framing these issues in a common language helps

Appraisal or Audit or Compliance Need

- Organizations with multiple accreditations are faced with frequent internal audit and appraisal issues
- One common framework cuts appraisal and audit costs & minimizes disruption to busy front line workers

Model Completeness

- Security issues are not “additional” to service delivery they are integral to it

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How To Fill The Gap?

RMM?

- Lots of great material
- High specification of how to solve security questions
- Probably interpreted in some people's minds as "An Extra Model to adopt!"

Services PA

- Services security content needs steward approval

CMMI-SVC "Pseudo PA" Material

- Quick
- Seed for further development
- Small scale addition to existing model

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Developing a “Bolt on” for CMMI

Requirements

- Needs to work with other CMMI process areas
- Needs to have fit CMMI architecture
  - Required Components
  - Expected Components
  - Informative Material
- Generic Practices
- Specific Material

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GP Relationship - Conclusions

ISO 27001 clauses are short statements of requirements

- Not much detail
- No “informative material” – example work products, etc.

ISO 27001 – Is less explicit on Stakeholder Management

Using CMMI GPs would

- Further help embed good practice
- Build upon existing material

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ISO 27001 – Establishing ISMS

Clause 4.2.1 - Establish the Information Security Management System

- Scope the security system
- Define an approach to identifying and evaluating security threats
- Define how to deal with them
- Obtain management approval for the plans and mechanisms defined

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ISO 27001 – Put the ISMS in Place

Clause 4.2.2 - Implement and Operate the Information Security Management System

- Instigate a plan to operate the security system
- Manage the level of threat.

Clause 4.2.3 - Monitor and Review the ISMS

- Use ISMS mechanisms to monitor threats
- Take action to address threats

Clause 4.2.4 - Maintain and Improve the ISMS

- Measuring and monitor the system
- Implement corrections or improvements

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Security Pseudo PA – Basic Structure

Examination of ISO 27001 provided a nice suggestion of initial content

- Establish and Maintain a Security Management System
- Use the Agreed Security Management System to Provide Required Security
- Note we dropped “information” in our version

Under these two strands we can construct statements that look and feel like practice statements

- Ideal for appraisal purposes
- Very valuable for improvement teams constructing an improvement plan
- One language style, one plan, potentially multiple models engaged

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Pseudo PA:
Security Management (SM)

ESG1 – Establish a Security Management System

- ESP1.1 Establish Security Objectives
- ESP1.2 Establish an Approach to Threat Assessment
- ESP1.3 Identify Security Threats
- ESP1.4 Evaluate and Prioritize Security Threats
- ESP1.5 Establish a Security Management Plan
- ESP1.6 Obtain Commitment to the Security Management Plan

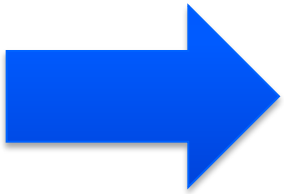
ESG2 – Provide Security

- ESP2.1 Operate the Security Management System
- ESP2.2 Monitor the Security Management System

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Framework For Building Upon

Basic Pseudo PA Architecture



Ability to Appraise

But ….

CMMI is used for more than appraisals, what about the implementation and improvement

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Informative Material

Informative Material provides:

- Subpractices
- Notes
- Examples
- Elaborations
- Example Work Products
- Etc.

All these help the implementation of good practice

This PA is quite general, so RMM is also a source for more detail and rigor.

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Example New Informative Material

ESP1.2 Establish an Approach to Threat Assessment

Establish and maintain an approach to assessing vulnerabilities and threats to essential assets.

Subpractices

1. Select methods for assessing security threats
2. Define criteria for evaluating and quantifying security threats.
3. Describe responsibility and resources for evaluating vulnerabilities and threats.

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Next Moves

Pseudo PA has been tested on a number of appraisals

Challenge to develop more “PA” like substructure

- Practices
- Subpractices
- Example work products
- GP Elaborations

We have made a start–but now would like to engage a wider audience to take the discussion forward

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Community Feedback and Input

Should this work be taken further?

Is the scope useful for improvement?

What could be done next to make it more credible?

We would like your comments.

- cmmi-comments@sei.cmu.edu.

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Some Useful Links

CMMI for Services Model

http://www.sei.cmu.edu/cmmi/tools/svc/index.cfm

CMMI for Services and Security Whitepaper

http://www.sei.cmu.edu/cmmi/tools/svc/upload/Security-and-CMMI-SVC.pdf

CMMI for Services Book

http://www.amazon.com/CMMI-Services-Guidelines-Superior-Engineering/dp/0321711521/ref=sr_1_1?ie=UTF8&qid=1304415568&sr=8-1

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Summary on the Pseudo PA

ISO20000, ITIL, & CMMI all work very well together

CMMI misses one component in common with the other approaches: security

ISO 27001 provided a starting point for developing a “pseudo” process area: SM

We are seeking community input to develop this pseudo process area further

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How Resilient Am I? - 1

When asked:

- How resilient am I?
- Am I resilient enough?
- How resilient do I need to be?

what does this mean?



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How Resilient Am I? - 2

- Do I need to worry about operational resilience?
- If services are disrupted, will it make the news? Will I end up in court? in jail? Will I be able to stay in business?
- Do I meet compliance requirements?
- How resilient am I compared to my competition?
- Do I need to spend more $$ on resilience? If so, on what?
- What am I getting for the $$ I've already spent?

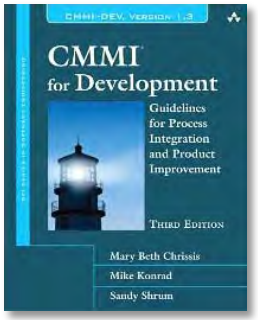


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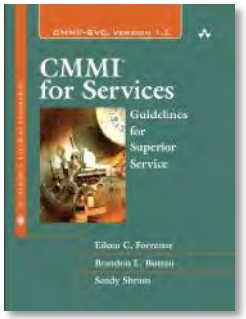
What is CMMI?

The Capability Maturity Model Integration (CMMI)

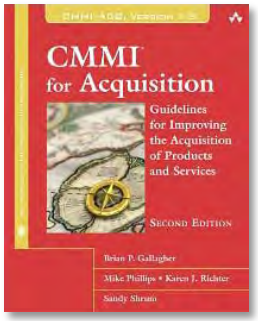
- is a framework for management practices
- provides organizations with the essential elements of effective processes that improve performance
- can be used as a benchmark, but is about quality improvement



CMMI for Development (CMMI-DEV)



CMMI for Services (CMMI-SVC)

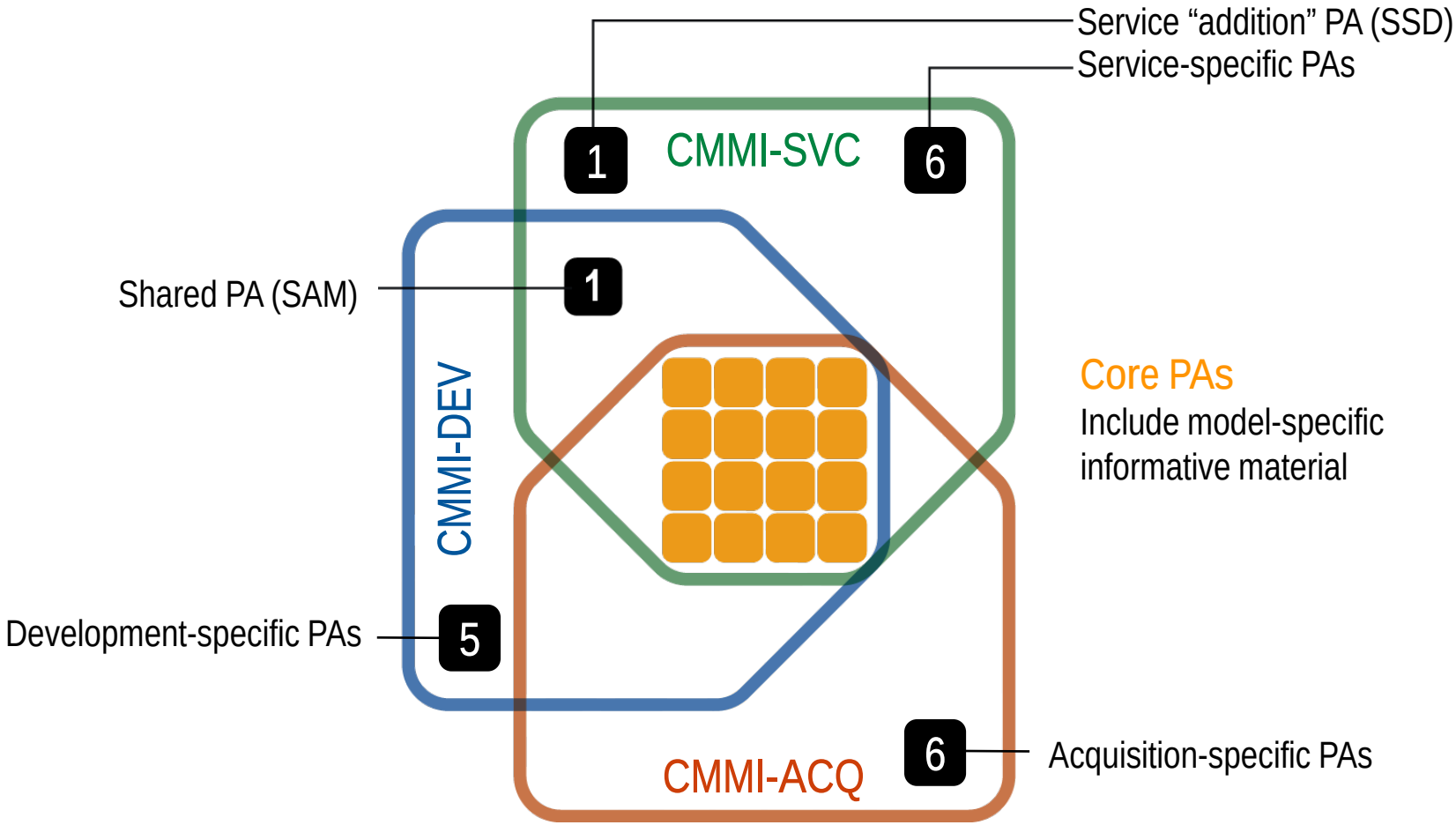


CMMI for Acquisition (CMMI-ACQ)

The CMMI Product Suite is a set of CMMI-related products that includes CMMI models, appraisal method, and CMMI training courses.

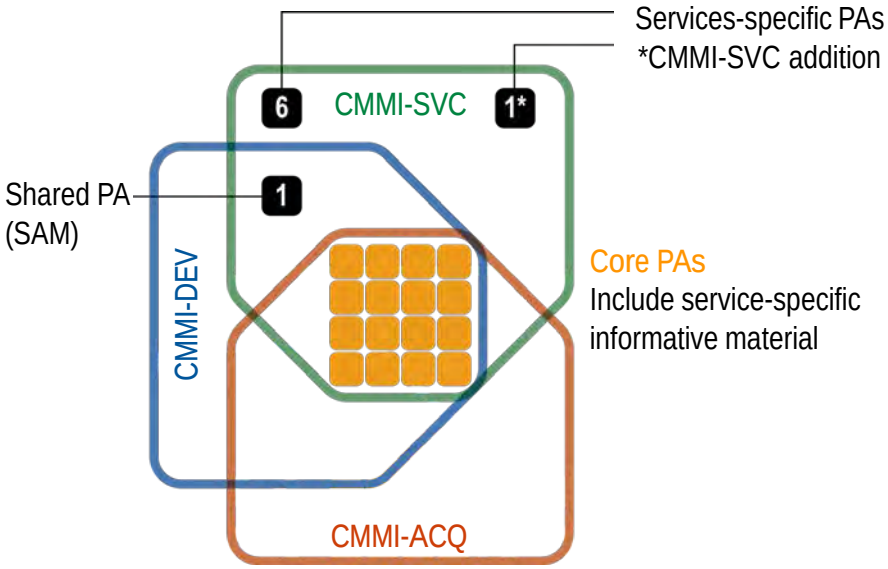
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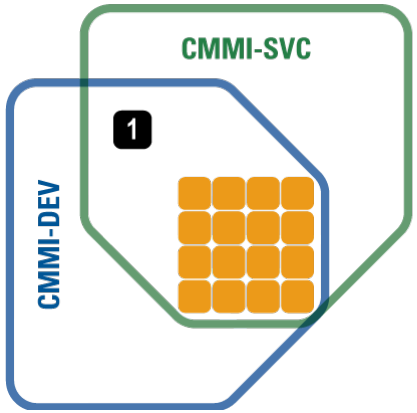
Relationships Among CMMI Models



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A Look at CMMI-SVC





CAM Capacity and Availability Management

IRP Incident Resolution & Prevention

SCON Service Continuity

SD Service Delivery

STSM Strategic Service Management

SST Service System Transition

SSD Service System Development

Define, and Establish, and Deliver Services

SD REQM WP SSD

Monitor and Control Service and Work Products

CAM WMC CM

Ensure Service Mission Success

IRP RSKM SCON SST

Make Work Explicit and Measurable

MA OPP QWM CAR OPM

Manage Decisions, Suppliers, and Standard Services

SAM DAR STSM

Create a Culture to Sustain Service Excellence

PPQA OPD IWM OT OPF

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What is CERT®-RMM?

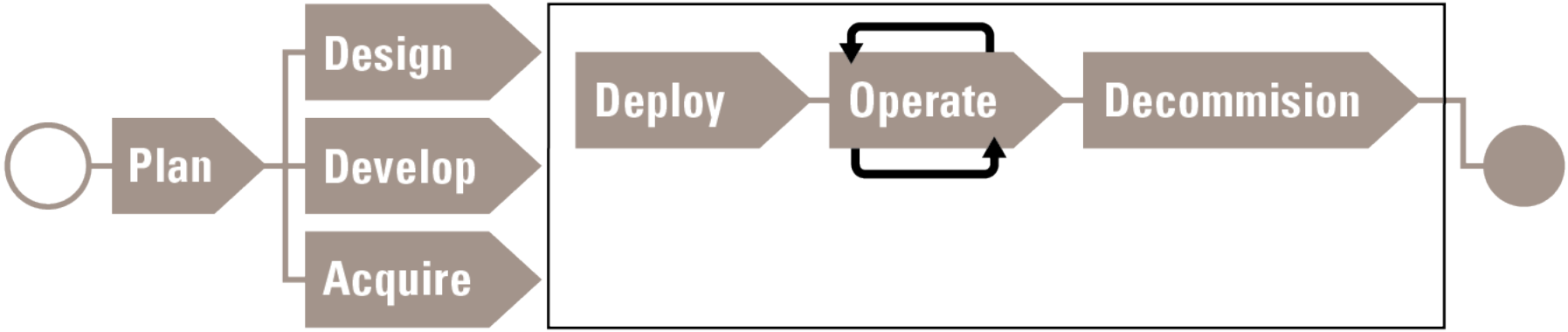
CERT-RMM is a capability model for managing and improving operational resilience.

- **Guides implementation and management of operational resilience activities**
- **Converges key operational risk management activities: security, BC/DR, and IT operations**
- **Defines maturity through capability levels *(like CMMI)***
- **Improves confidence in how an organization responds in times of operational stress**

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CERT-RMM in the life-cycle

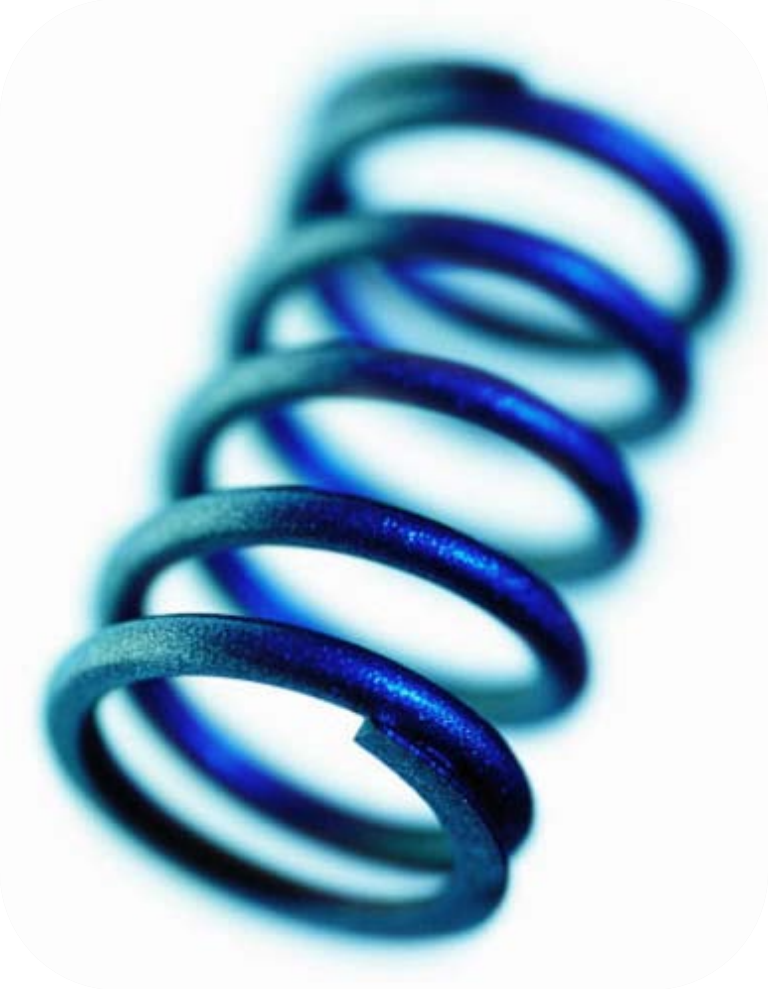
Operational resilience management focuses on the deploy, operate, and decommission phases, but reaches back to development phase of lifecycle to ensure consideration of security and continuity issues prior to placing assets in production.



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Operational resilience

Resilience: The physical property of a material when it can return to its original shape or position after deformation that does not exceed its elastic limit
[wordnet.princeton.edu]



Operational resilience: The *emergent* property of an *organization* that can *continue to carry out its mission* after *disruption* that *does not exceed* its *operational* limit

[CERT-RMM]

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Services in CERT-RMM

The resilience of **high-value services** ensures the resilience of the **mission.**

Service resilience is a factor of **asset resilience**—if an asset is disrupted or fails, the service may suffer.

Service resilience is the object of CERT-RMM processes.

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Assets

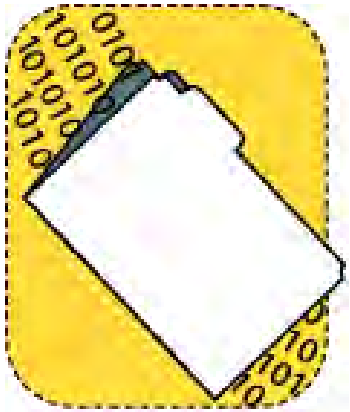
Something of value to the organization

Used by business processes and services

CERT-RMM focuses on four types:



People



Information



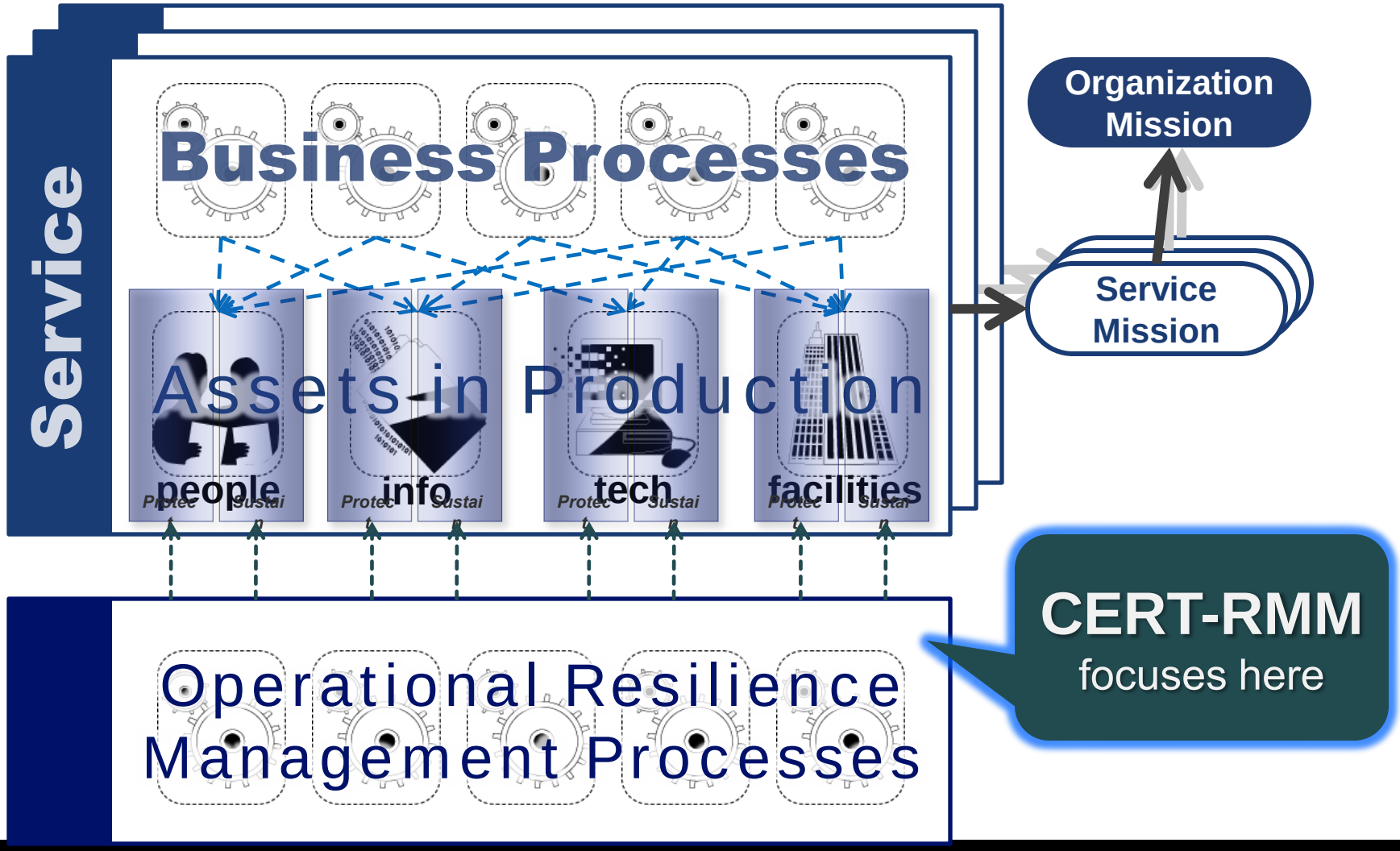
Technology



Facilities

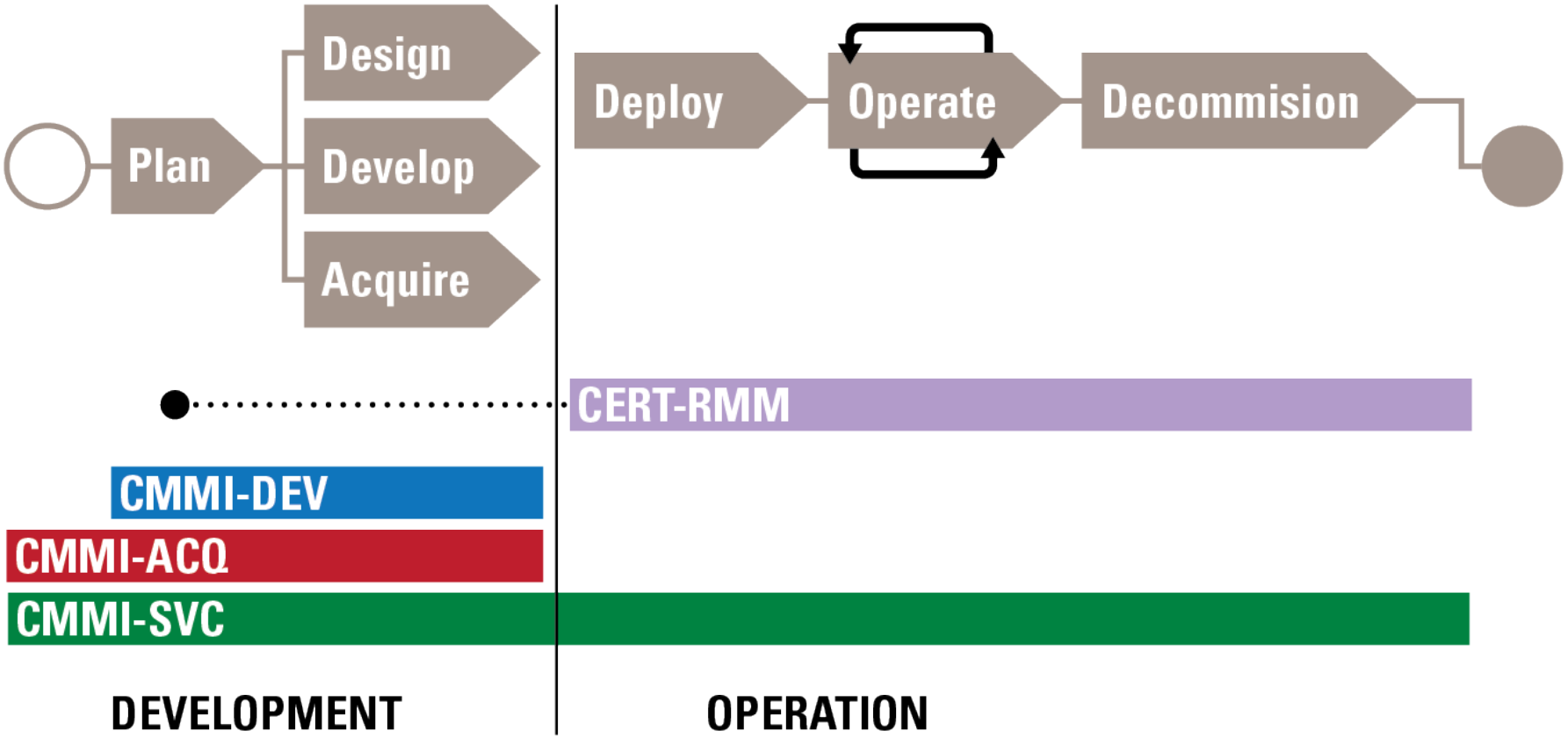
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Organizational Context



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CERT-RMM & CMMI in the life cycle



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CERT-RMM architectural elements

CERT-RMM uses proven architectural elements of CMMI and applies them in an operational context.



- 26 process areas
- Arranged in a continuous representation
- Goals, practices, sub-practices, and work products that *specifically* define each process area
- Goals, practices, and sub-practices that *generically* define increasing levels of capability
- Implementation and adoption examples
- An appraisal methodology to determine capability levels

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CERT-RMM at a glance

Engineering	
ADM	Asset Definition and Management
CTRL	Controls Management
RRD	Resilience Requirements Development
RRM	Resilience Requirements Management
RTSE	Resilient Technical Solution Engineering
SC	Service Continuity

Enterprise Management	
COMM	Communications
COMP	Compliance
EF	Enterprise Focus
FRM	Financial Resource Management
HRM	Human Resource Management
OTA	Organizational Training & Awareness
RISK	Risk Management

Operations Management	
AM	Access Management
EC	Environmental Control
EXD	External Dependencies
ID	Identity Management
IMC	Incident Management & Control
KIM	Knowledge & Information Management
PM	People Management
TM	Technology Management
VAR	Vulnerability Analysis & Resolution

Process Management	
MA	Measurement and Analysis
MON	Monitoring
OPD	Organizational Process Definition
OPF	Organizational Process Focus

26 Process Areas in 4 categories

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Enterprise management

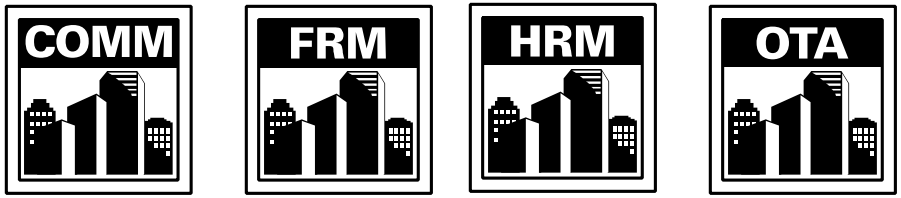
Seven process areas that support the resilience management process



Governance, Risk, & Compliance



Supporting Resilience



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Engineering

Six process areas for establishing resilience for organizational assets, business processes, and services



Asset Management

ADM

Requirements Management

RRD RRM

Establishing and Managing Resilience

CTRL RTSE SC

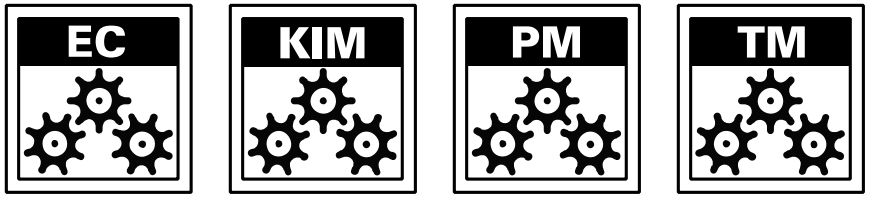
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Operations management

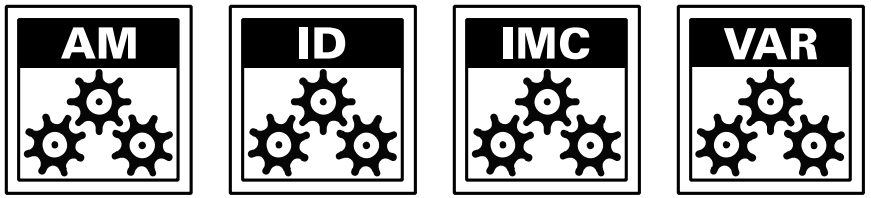
Nine process areas for managing the operational aspects of resilience



Asset Resilience Management



Threat, Incident, & Access Management



Supplier Management



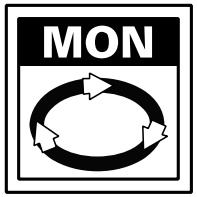
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Process management process areas

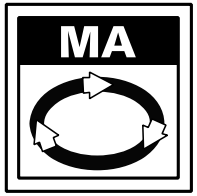
Four process areas for defining, planning, deploying, implementing, monitoring, controlling, appraising, measuring, and improving operational resilience management processes



Data Collection & Logging



Process Management

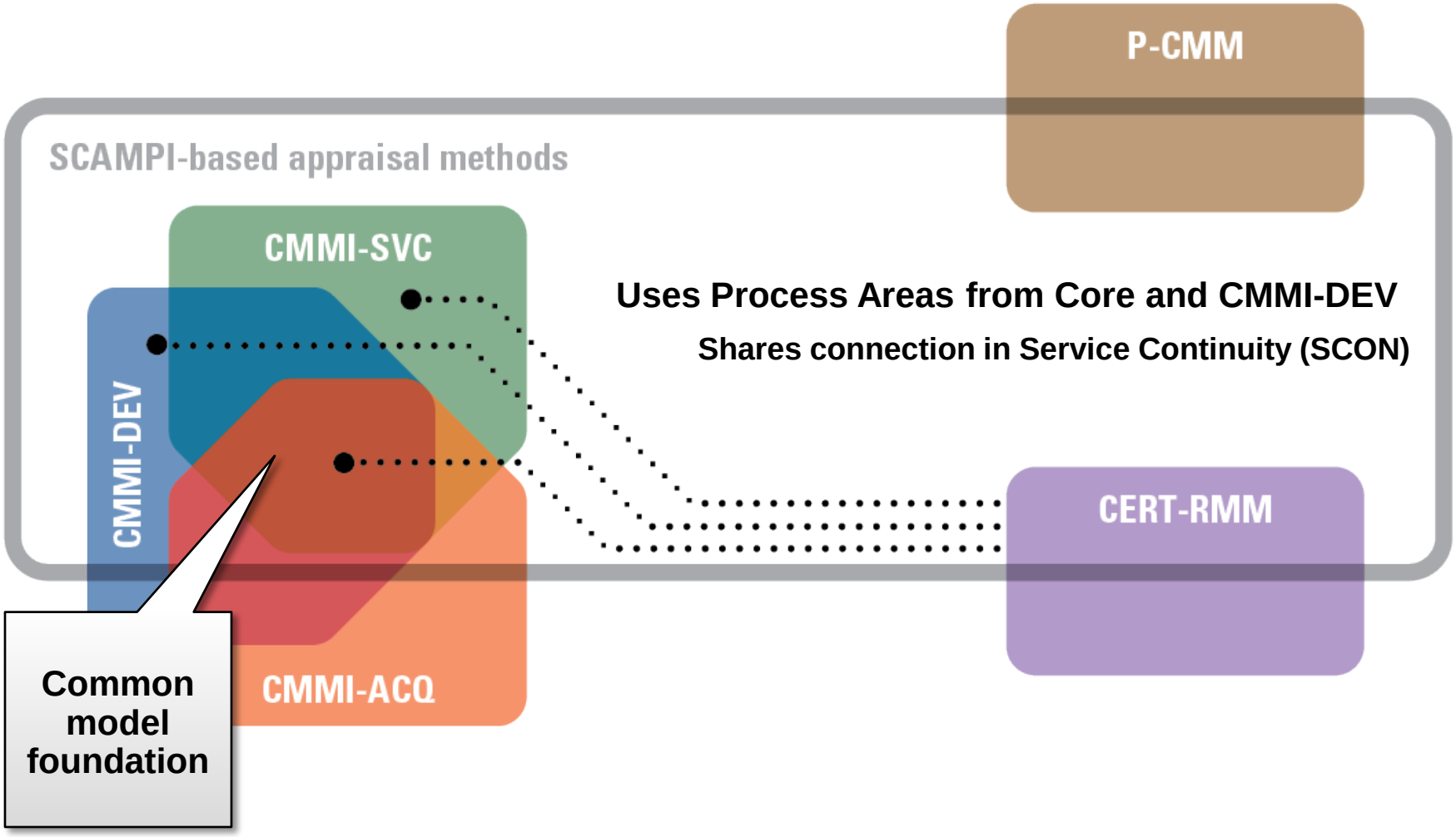






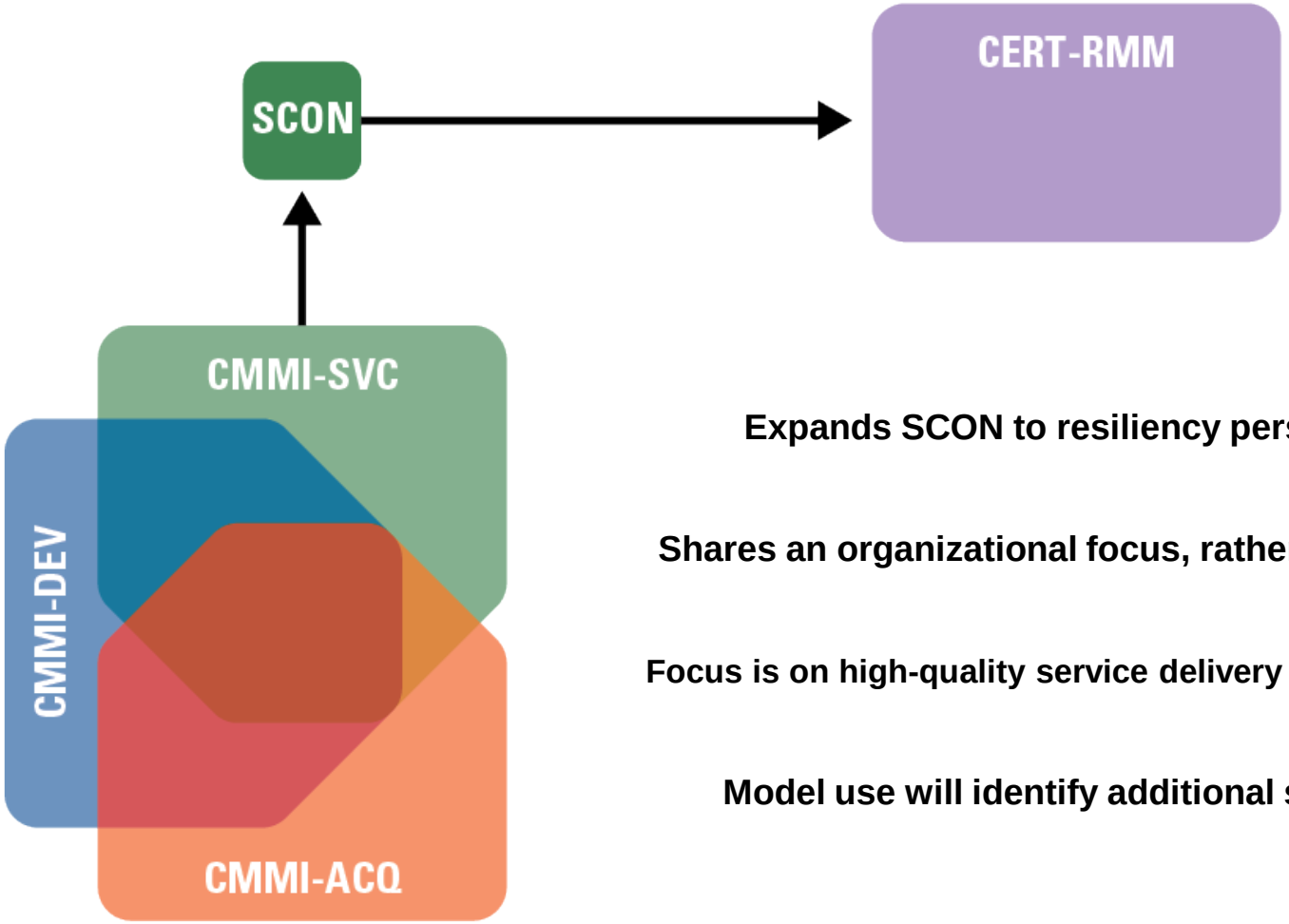
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Positioning CERT-RMM with CMMI



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CERT-RMM and CMMI-SVC



Expands SCON to resiliency perspective

Shares an organizational focus, rather than project

Focus is on high-quality service delivery that is resilient

Model use will identify additional synergies

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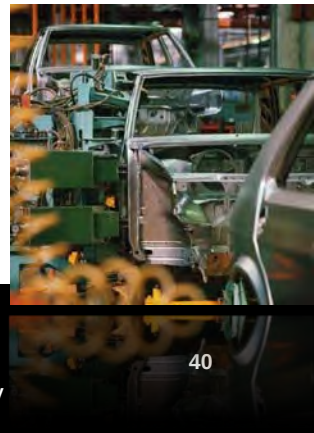
A service example: US auto insurance

Olive Vehicle Insurance (OVIG) provides car and light truck insurance.

Customer services include providing quotes, issuing policies, billing and processing premiums, processing claims, providing legal services, and providing vehicle repair.

They pride themselves on being easy to reach and quick to act when the customer needs them. They are facing an increasingly demanding regulatory environment in the US.

What does it mean for these services to be resilient? What assets must be resilient? What practices in RMM go beyond RSKM, IRP, and SCON?



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CMMI-SVC PAs that ensure mission success

Incident Resolution and Prevention (IRP):

- handling what goes wrong—and preventing it from going wrong ahead of time if you can

Risk Management (RSKM):

- supporting the success of your service mission by anticipating problems and how you will handle them—before they occur

Service Continuity Management (SCON):

- being ready to recover from a disaster and get back to delivering your service

Service System Transition (SST):

- getting new systems in place, changing existing systems, and retiring obsolete systems, all while making sure nothing goes terribly wrong with service

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CMMI-SVC PAs taken further with RMM PAs

Incident Resolution and Prevention (IRP):

- IMC is obvious, but also VAR in RMM goes further than goal 3 in IRP to actively watch and resolve vulnerabilities before they become incidents that disrupt insurance services

Risk Management (RSKM):

- KIM practices can be used to apply controls for confidentiality, integrity, and availability to critical data, such as customer information
- CTRL practices go further to applying controls to service processes such as paying claims, so that, for example, no claim is paid twice and that claim data is kept confidential and not accidentally modified

Service Continuity Management (SCON):

- SC in RMM explodes the goals and practices found in SCON with considerably more detail; for example, a data-intensive service like insurance can find more advice on managing effects on vital records; in addition, SC makes clear the distinctions among continuity, recovery, and restoration of service

Also consider:

EXD, which goes further than SAM to further resilience, more info on external dependencies and service agreements

MON, which goes beyond MA in SVC to have “feelers” out for data so that the organization knows how their data stands relative to threats and vulnerabilities

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Summary

GPs and Pseudo PA approach allows you to selectively borrow from additional models, even during appraisal.

RMM and CMMI-SVC combination:

- The goal of CMMI-SVC is equip organizations to improve processes and ensure high-quality service management and delivery at an affordable cost.
- The goal of CERT-RMM is to improve processes to ensure that essential organizational services meet their mission consistently in the face of shifting operational risk.
- They share common content, similar product suites to support use, and provide different detail and specificity that you can choose from to meet your precise needs.
- These two models are being combined in appraisal and implementation.
- In short, CMMI-SVC and CERT-RMM are synergistic and amenable to a continuous approach based on your business needs for resilient service.

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http://www.cert.org/resilience/

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Backup slides as needed

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Imperatives for building CERT-RMM



Tech reliance



Global economy



Open boundaries



Complexity



Cultural shifts

Increasingly complex operational environments; traditional approaches failing

Silo nature of operational risk activities; a lack of convergence

Lack of common language or taxonomy

Overreliance on technical approaches

Lack of means to measure organizational capability

Inability to confidently predict outcomes, behaviors, and performance under times of stress

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How Resilient Am I? - 3

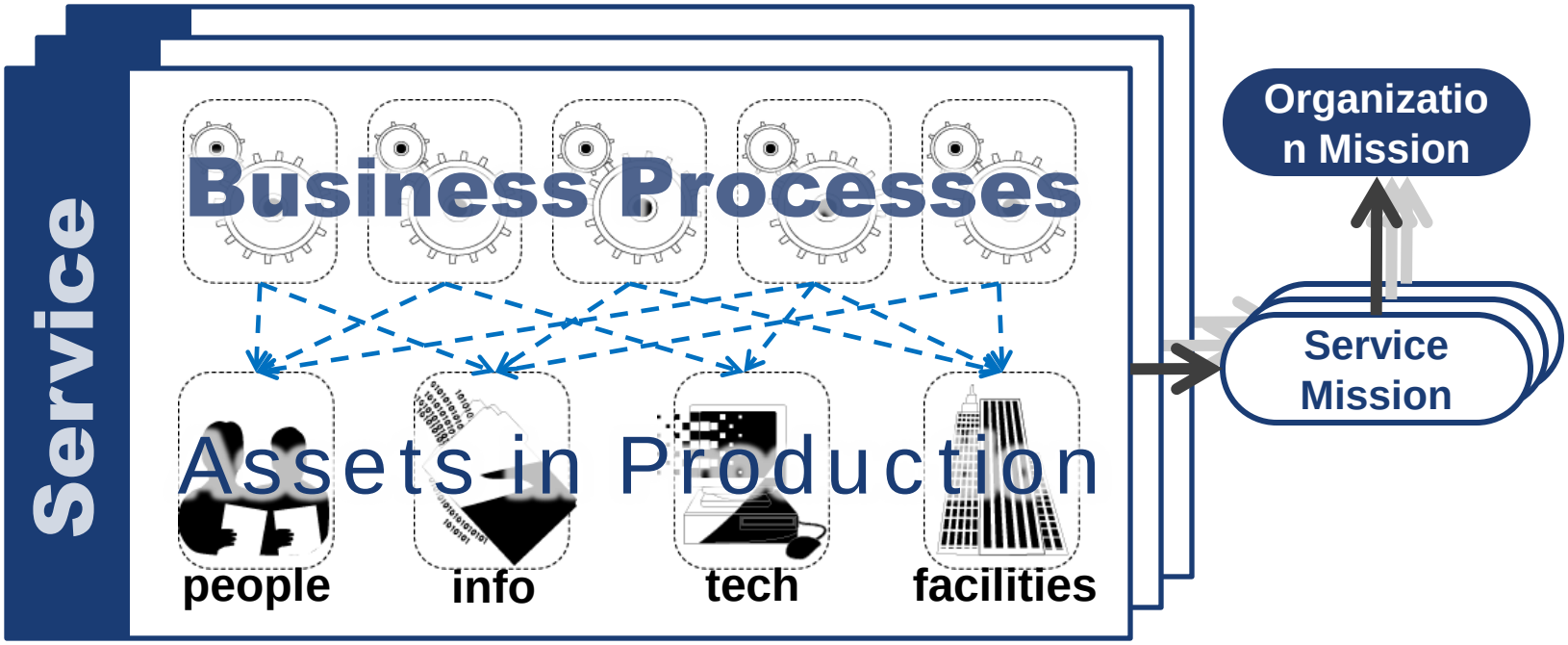


What should I be measuring to determine if I am meeting my performance objectives for resilience?

What is the business value of being more resilient?

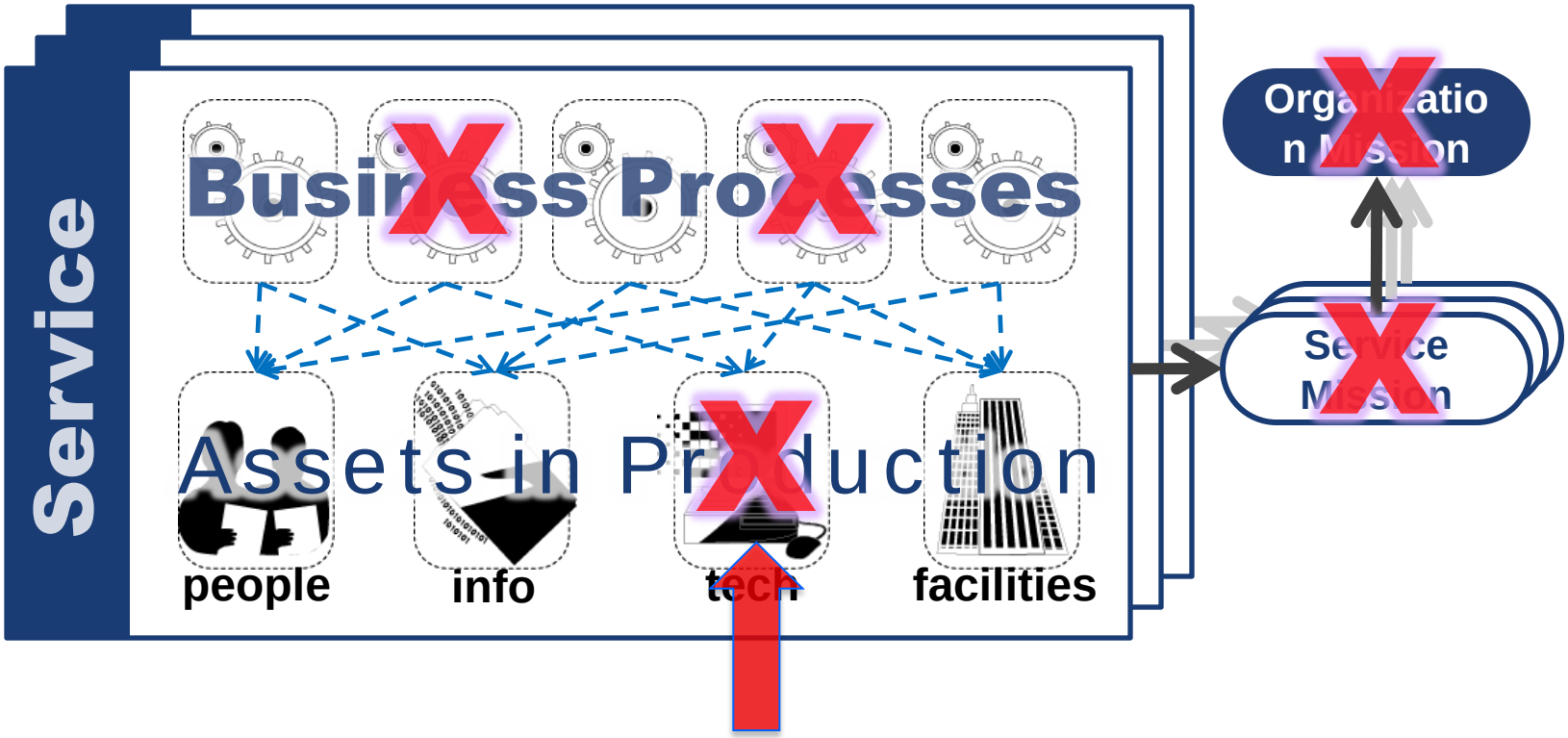
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Organizational context



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Organizational context - disruption

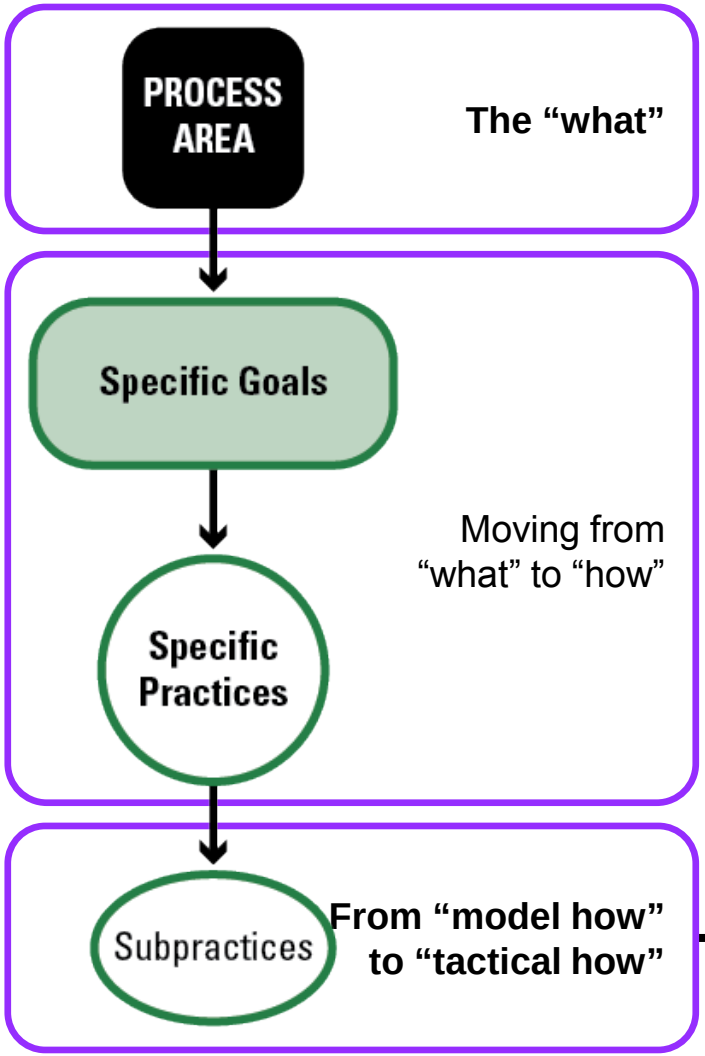


Operational risk can disrupt an asset

And lead to organizational disruption

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CERT-RMM links to codes of practice



Codes of Practice:

BS25999-1:2006

CMMI v1.2

CMMI for Services

CobiT 4.1

COSO ERM

DRII GAP

FFIEC Handbooks (Security, BCP)

ISO 20000-1:2005(E)

ISO 20000-2:2005(E)

ISO 24762:2008(E)

ISO 27001:2005

NFPA 1600 (2007)

PCI DSS v1.1

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How Resilient Am I? - 1

When asked:

- How resilient am I?
- Am I resilient enough?
- How resilient do I need to be?

what does this mean?



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How Resilient Am I? - 2

- Do I need to worry about operational resilience?
- If services are disrupted, will it make the news? Will I end up in court? in jail? Will I be able to stay in business?
- Do I meet compliance requirements?
- How resilient am I compared to my competition?
- Do I need to spend more $$ on resilience? If so, on what?
- What am I getting for the $$ I've already spent?



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