Presented To: NDIA 3rd Annual CMMI® Technology Conference and User Group

Applying the CMMI to Diverse Environments

November 19, 2003

Topics

- CMMI
- Diversity at CMSIS, Inc.
- Diversity Challenges
- Interpreting the CMMI for diverse domains
- Lessons learned
- Benefits

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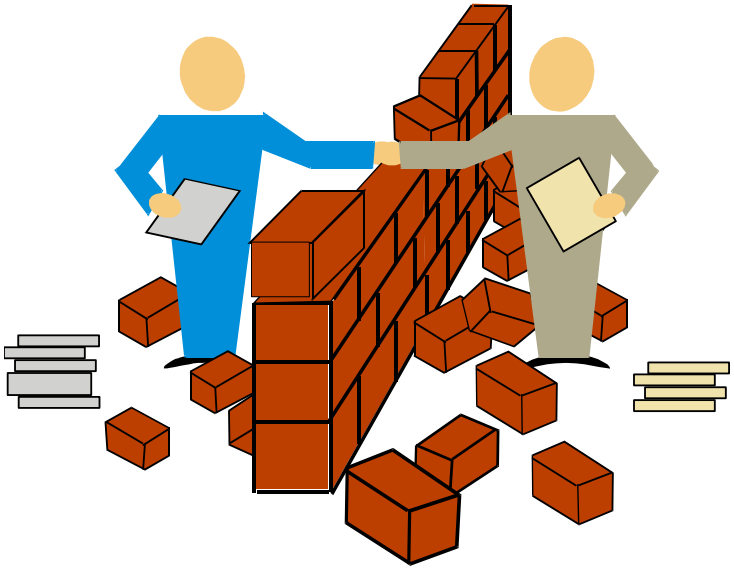
The Capability Maturity Model Integration

- Systems engineering-hardware engineering interface has matured over many years.
- The systems engineering-software engineering interface is not as mature as the hardware engineering interface.
- Dependency on the systems engineering-software engineering interface has increased faster than it has matured.

SEI Software Process Technology Briefing, ‘What is the CMMI?’, 1999

CMMI Vision

- Software and Systems engineering processes are integrated - and focus on the product.



SEI Software Process Technology Briefing, ‘What is the CMMI?’, 1999

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Scope of the CMMI

- Impetus came from organizations interested in the benefits of developing an integration framework to aid in enterprise-wide process improvement.
- The CMMI project team has been working to provide guidance that encourages process improvement in organizations of any structure.

CMMI Maturity Levels and Process Areas

Level	Focus	Process Areas
5 Optimizing	*Continuous process improvement*	Causal Analysis and Resolution Organizational Innovation and Deployment
4 Quantitatively Managed	*Quantitative management*	Quantitative Project Management Organizational Process Performance
3 Defined	*Process standardization*	Organizational Process Focus Organizational Process Definition Integrated Project Management Organizational Training 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 Measurement and Analysis Process and Product Quality Assurance Configuration Management Supplier Agreement Management
1 Initial		

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Diversity is Inherent

- Enterprise-wide process improvement
- Organizations of any structure

- *Why characterize the diversity?*
- *How to characterize that diversity?*

To Understand…

- What domains are addressed by current processes
- What the boundaries are for current processes
- When new processes may be required
- When different levels of process detail may be required

Diversity in terms of …

- Characteristics of:
  - Systems Engineering
  - Technical Skills
  - Application Complexity
- Diversity can be represented by a continuum from least to most of these characteristics

Diversity at CMS

- Projects representing these domains are involved in the process improvement effort:
  - Financial management software development
  - Technology infrastructure
  - System management
  - Document management
  - Proposal development

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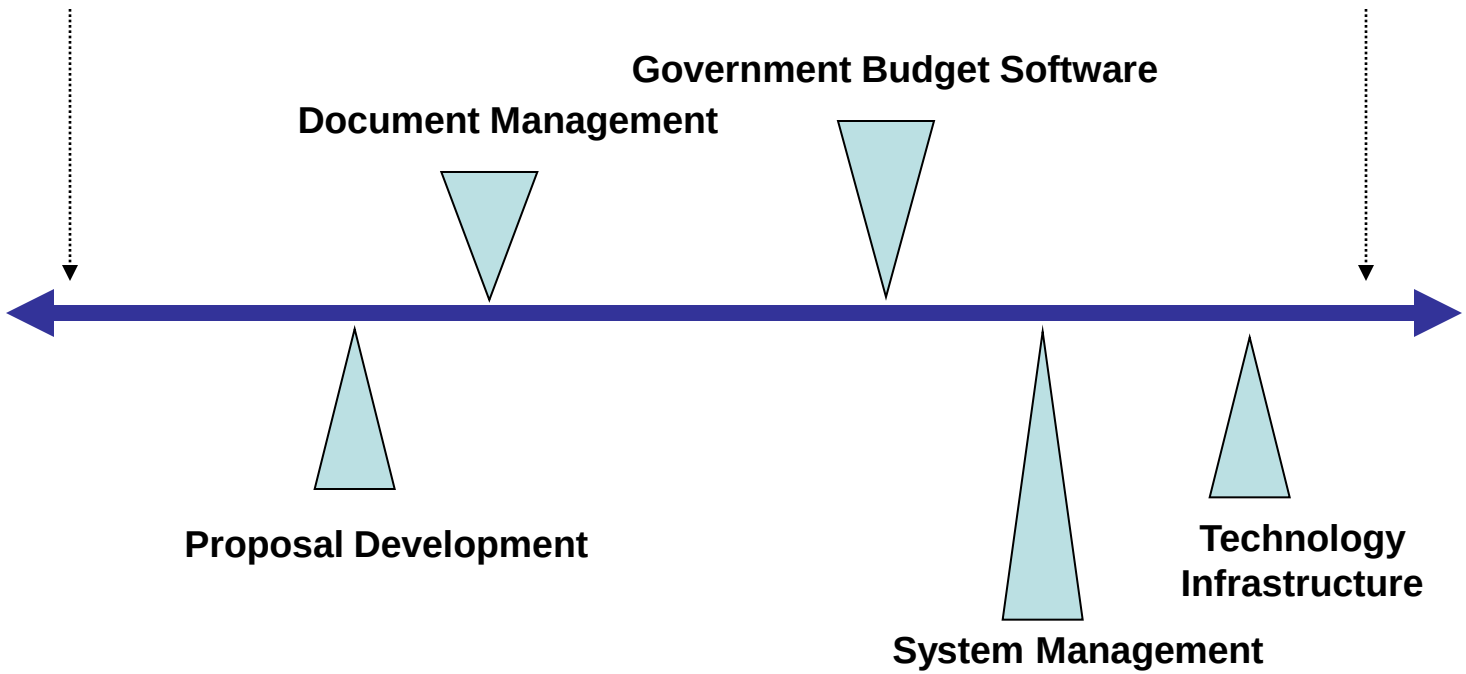
CMS Application Domain Continuum

- *Less Systems Engineering*
- *Fewer technical skills*
- *Less complex*

- *More Systems Engineering*
- *More technical skills required*
- *More complex*



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Challenges

- Staff with WIDELY differing backgrounds involved
- Different business objectives (profit vs non-profit)
- Different language, acronyms, terminology
- Processes had to accommodate all domains
- All needed to agree

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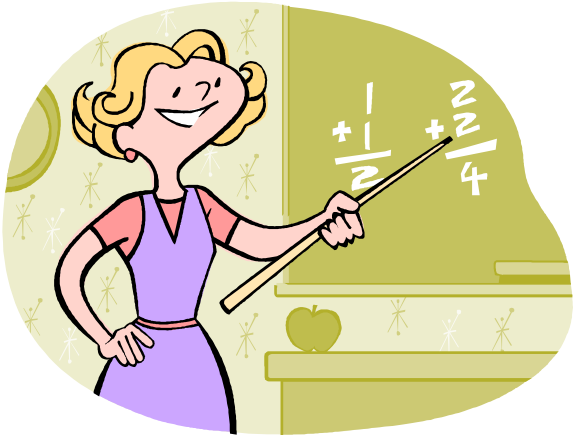
Traditional Approach

- Form process improvement infrastructure
- Define organizational level processes
- Train and deploy processes
- Revise, improve processes
- Identify projects for appraisal
- Prepare for and conduct appraisal



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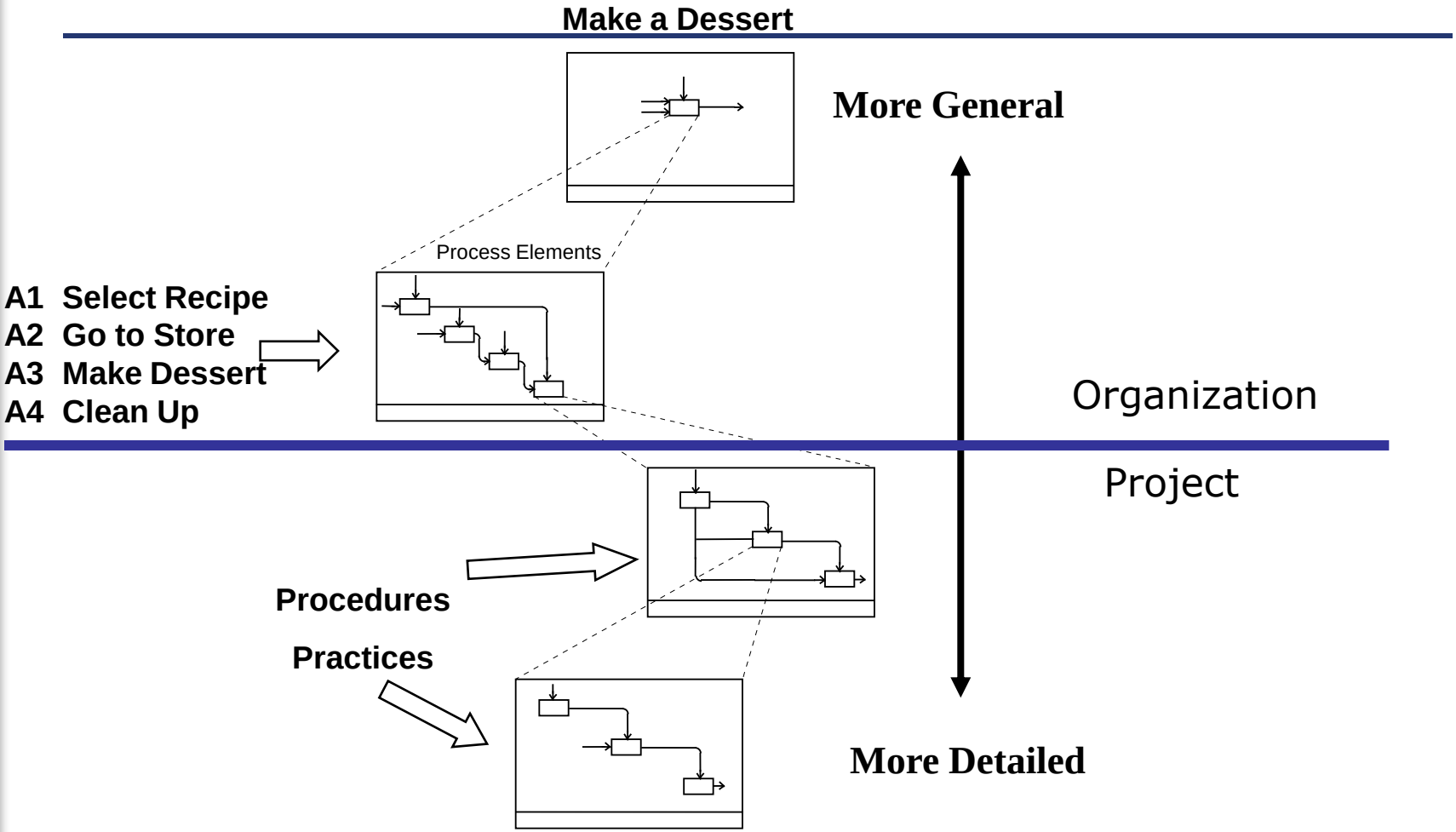
Process Action Teams

- Include members from each domain
- Processes accommodate all
- Find the ‘blue line’
- Details in the tailoring guidelines

Process Decomposition



Process Decomposition Into Elements

Modfified from a briefing developed by the Software Productivity Consortium NFP, Inc.

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Examples

- Measures
- Configuration Management
- Product Integration
- Training

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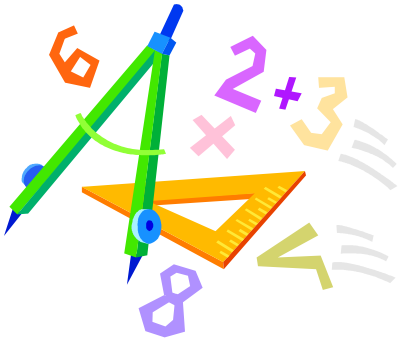
Measures Example

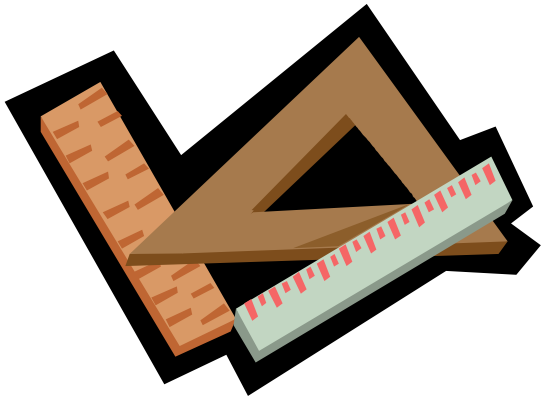
- Size



- Quality

Measures Guidance

- The CMS Project Management Process addresses measures in the following categories:
  - Cost
  - Schedule
  - Size
  - Quality



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Size and Quality

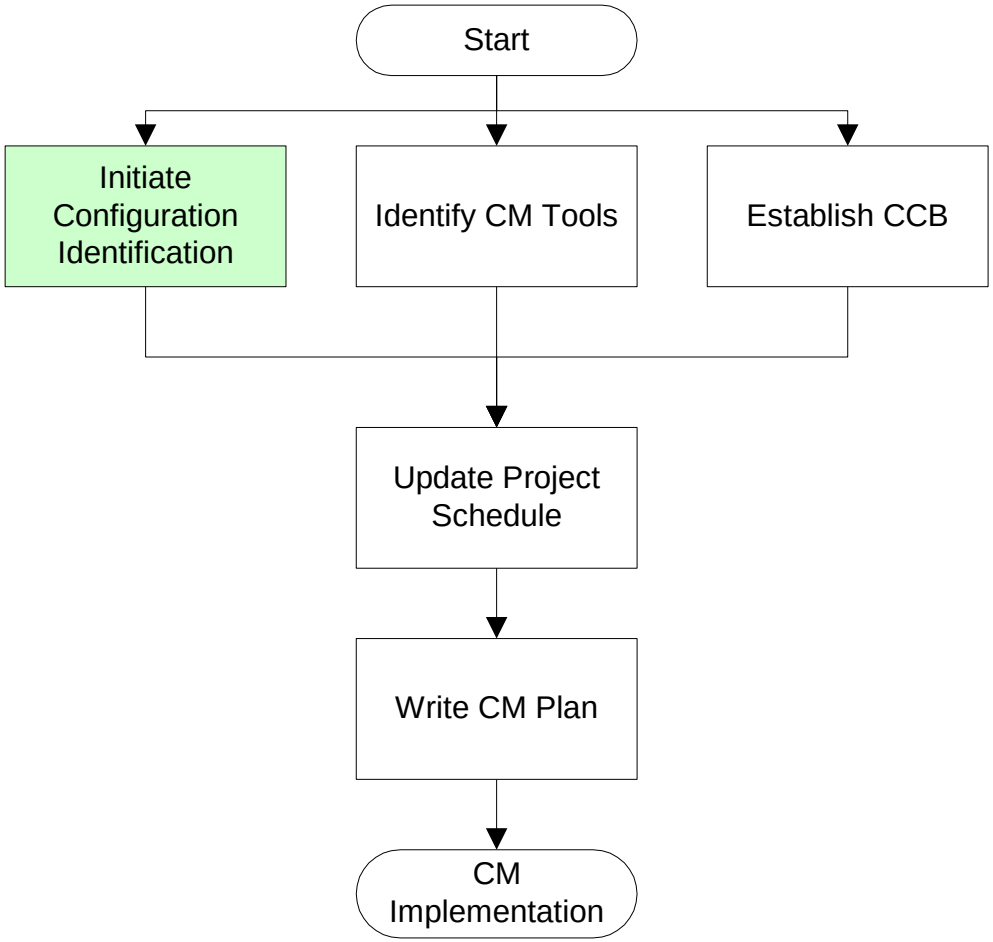
- Size of work product or service
  - Action cases, network locations, users, document pages, scan items, teaming agreements
- Errors/Defects
  - Requirements, Red Team comments, customer satisfaction, failed drops, scanning errors

Configuration Management

- Configuration items

- Baselines

CM Planning Process



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Initiate Configuration Identification

	Entry Criteria/Data	Task(s) to be performed	eXit Criteria/data	
Input(s):	• Work Approved	1. Review the contract/task order and/or available project documentation to identify known or required configuration items (CIs). 2. Identify the types/categories of CIs (documents, hardcopies, code, applications, hardware, etc.). 3. Develop a draft CI naming and numbering schema. Follow CMS guidelines where applicable. 4. Conduct interviews with Technical Leads to identify area-specific CIs. 5. Update the CI naming and numbering schema, if necessary. 6. Identify planned project baselines. Refer to the *CMS Baseline Identification Guideline*. 7. Allocate CIs to baselines. 8. Identify CI owner and update authority. 9. Prepare and baseline a project CI Index. At a minimum, include important CI characteristics such as name, ID, type/category, owner, update authority, allocated baseline(s), and applicable life cycle phase(s). Reference the *CMS CI Index* template.	• CI naming and numbering schema defined • CI Index baselined	**Output(s):**
• Contract or Task Order • Project Documentation • Interviews				• CI Index • Input to CM Plan Configuration Identification section

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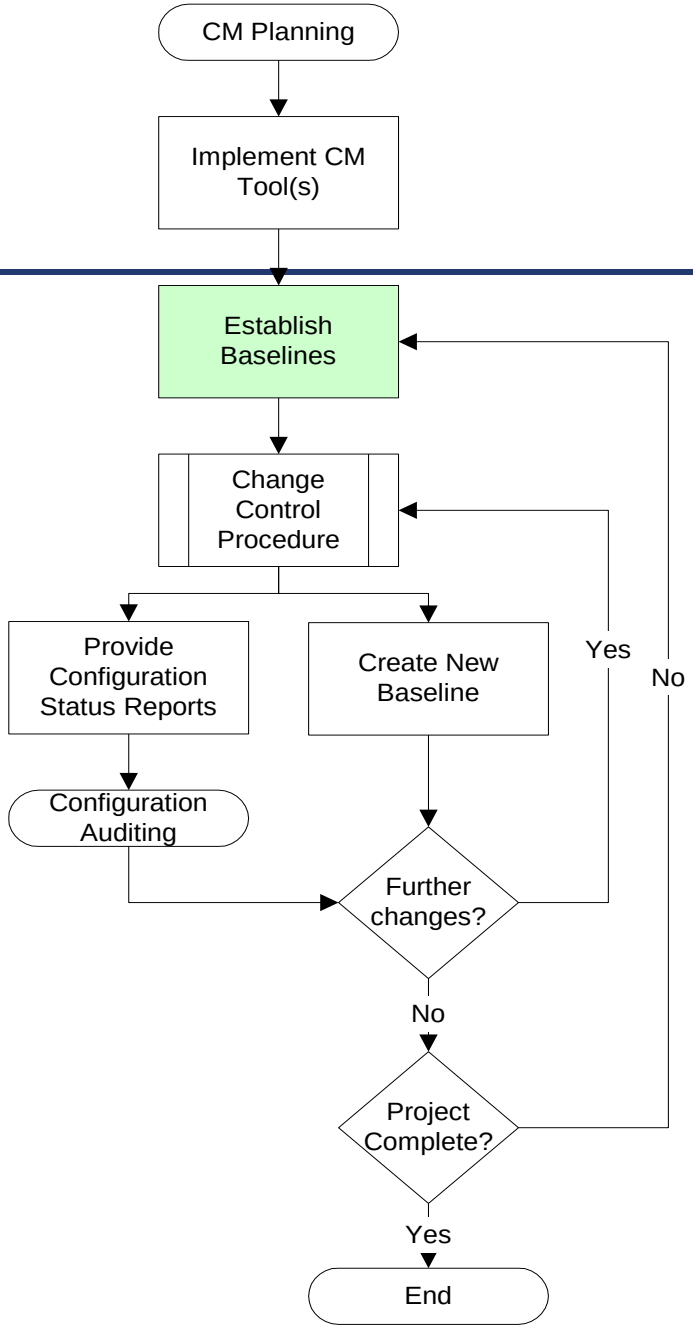
Configuration Items

- Financial management software
  - Project plan, action cases, objects, screen specifications, software components
- Technology infrastructure
  - Servers, Cisco switches, communications equipment, fiber optic cables, vertical wire managers, patch panels

Configuration Items

- System management
  - Software/hardware components
- Document management
  - Project Plan, Requirements Specification, User Guide, System Admin Guide, NDI software packages/tools (e.g., Adobe Acrobat), CD products
- Proposal Development
  - Lot 1 Enterprise Applications, Lot 2 Operations Support, Lot 3 Customer Support (sections of the proposal)

CM Implementation Process



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Establish Baselines

Input(s):	Entry Criteria/Data	Task(s) to be performed	eXit Criteria/data	Output(s):
• CM Plan • CI Index • CM Tools	• Planned project baselines have been identified	1. Review CM Plan for the list of planned baselines. 2. Identify which baselines require establishment per current project life cycle phase, status, and/or activities. 3. Review CI Index for CIs allocated to each baseline. 4. Identify the applicable version/revision of each CI. 5. Reference the CM Plan to determine baseline creation authority. 6. If required, obtain baseline creation approval. 7. Prepare required media, release notes, etc., from CM libraries. 8. Reference the CM Plan to determine baseline approval authority. 9. If required, obtain baseline approval. 10. Provide notification, media, and/or release notes to affected groups	• Baseline(s) established • Notification and/or distribution of related materials completed	• Baseline(s) • Media • Release Notes

Verification Steps
• CIs are labeled and archived in appropriate CM libraries

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Baselines

- Government budget software
  - Requirements, Design, Code
- Technology infrastructure
  - Requirements, Design, Network Equipment Configuration, Network Equipment Site Installation, Final Walkthrough, Product

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Baselines

- System management
  - COTS components, Test Plan,
- Document management
  - Requirements, Design, Planning, Database Schema, Custom Developed Interfaces, Document Management Software Modules, Acceptance Testing, Digitized Images
- Proposal Development
  - Blue, Pink, Red, Green, Product

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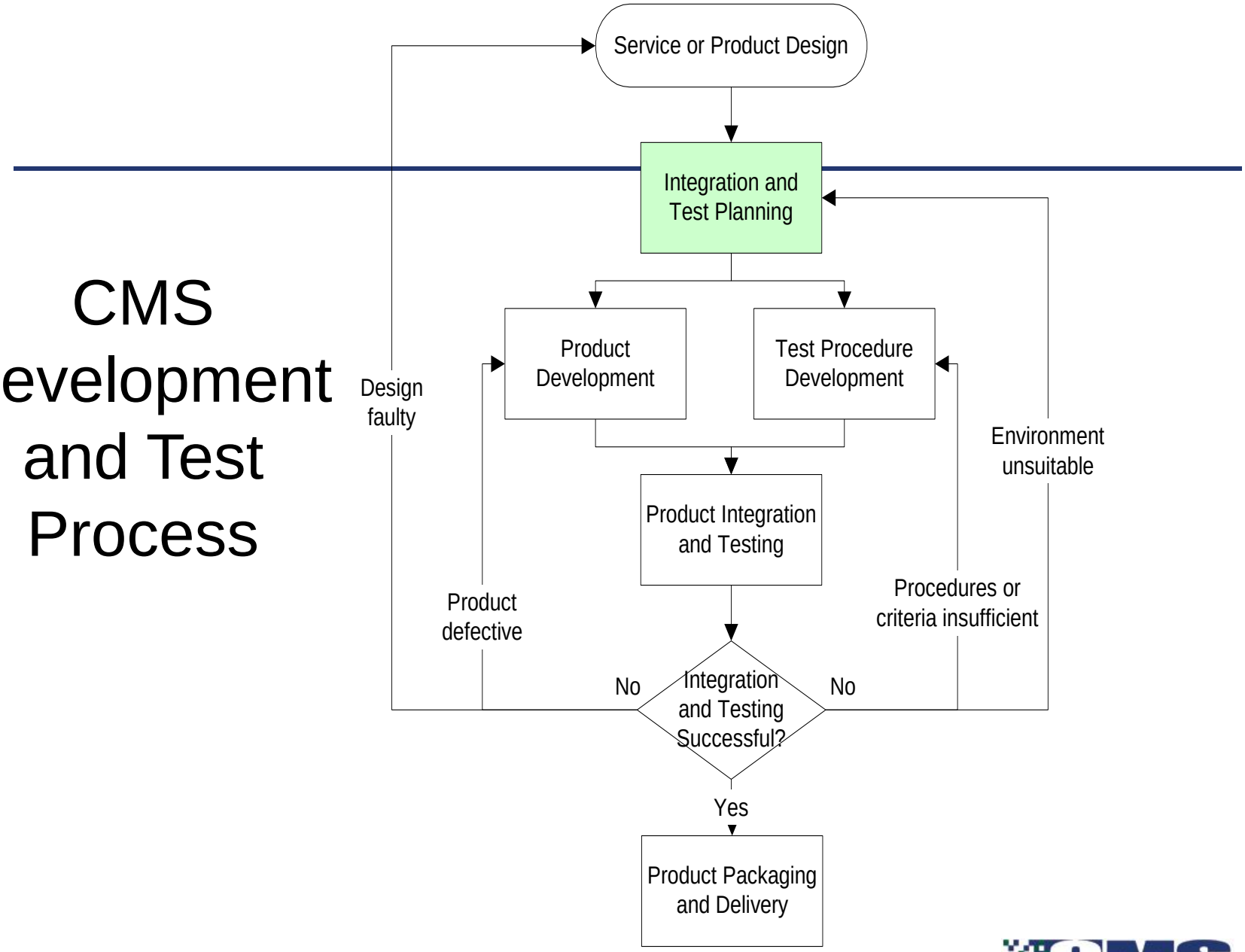
Product Integration

- Components

- Interfaces

CMS Development and Test Process



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Integration and Test Planning

Input(s):	Entry Criteria	Task(s) to be performed	eXit Criteria	Output(s):
• Requirements • Design Document(s)	• Project planning has commenced OR • Product design is ready for the implementation team • Product design approved	1. Identify project member(s) responsible for the management of the test environment or staging area for the duration of the project. Responsibilities should include preparation of procedures and checklists; maintenance of inventory (equipment and software); access control; acquisition, set up, and coordination of the repair, addition, or removal of items utilized in the test environment. 2. Review the project requirements, interface, and design documents to identify the product components requiring integration (incl. the product integration sequence) and/or testing, as well as interfaces that require verification. 3. If a product integration sequence has not been imposed or defined: For small projects and projects for which CMS posses expertise, define the product integration sequence based on prior experience, product knowledge, or vendor constraints. Document the rationale for the selection of the integration sequence. For large or complex projects, utilize the *CMS Decision Analysis Procedure* to identify alternate integration sequences and select the best sequence. Document the rationale for the selection of the integration sequence. 4. Identify and document the requirements for the test environment. Utilize existing resources if available. Reference the CMS *Supplier Management Agreement (SAM) Process* if procurement of resources to support the test environment is required. 5. Prepare a procedure or checklist for the setup and verification of the test environment. Label product component interfaces or connections to facilitate build or assembly. 6. Prepare a procedure or checklist to define the method for the delivery and validation of product components to the test environment. 7. Prepare a procedure or checklist to document product component integration/assembly instructions.	• Product integration sequence defined • Requirements for the integration environment defined	• Product integration sequence • Product integration environment requirements/set up and validation procedure/checklist • Product component delivery /integration procedure/checklist

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Product Components

- Government budget software
  - Software units and architectural groups
- Technology infrastructure
  - Servers, cables, switches

Product Components

- System management
  - Software versions, hardware upgrades
- Document management
  - Individual documents, individual compact disks
- Proposal Development
  - Proposal section/chapters, graphics/figures/tables, Microsoft Project schedules

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Product Interfaces

- Government budget software
  - Among software components and between versions
- Technology infrastructure
  - Among servers and between versions

Product Interfaces

- System management
  - Among product suites and between hardware and software versions
- Document management
  - Among document types and between documents and CDs
- Proposal Development
  - Among chapter sections, graphics and related support elements such as schedules and between versions

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Training Challenges

- Headquarters and six sites
- Staff training time constraints
- Customers not always supportive
- Training resource challenged

Response

- Developed one-hour modules
- Focus on CMS processes
- External sources for in-depth courses
- Train-the-trainer
- Group one-hour modules
- Site coordinators
- Coordinated with HR

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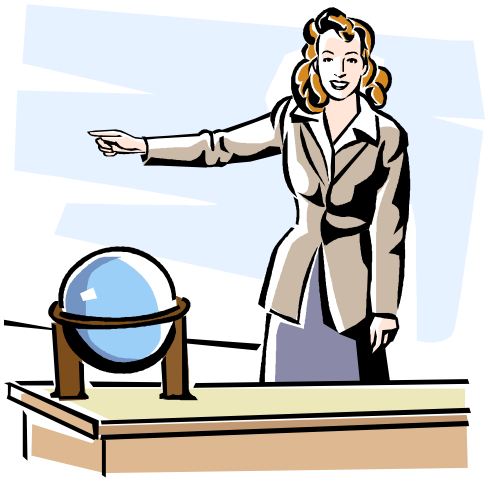
Automated Support for Training

- Master Training Schedule
- Course Catalog
- Training record database
- Post training surveys



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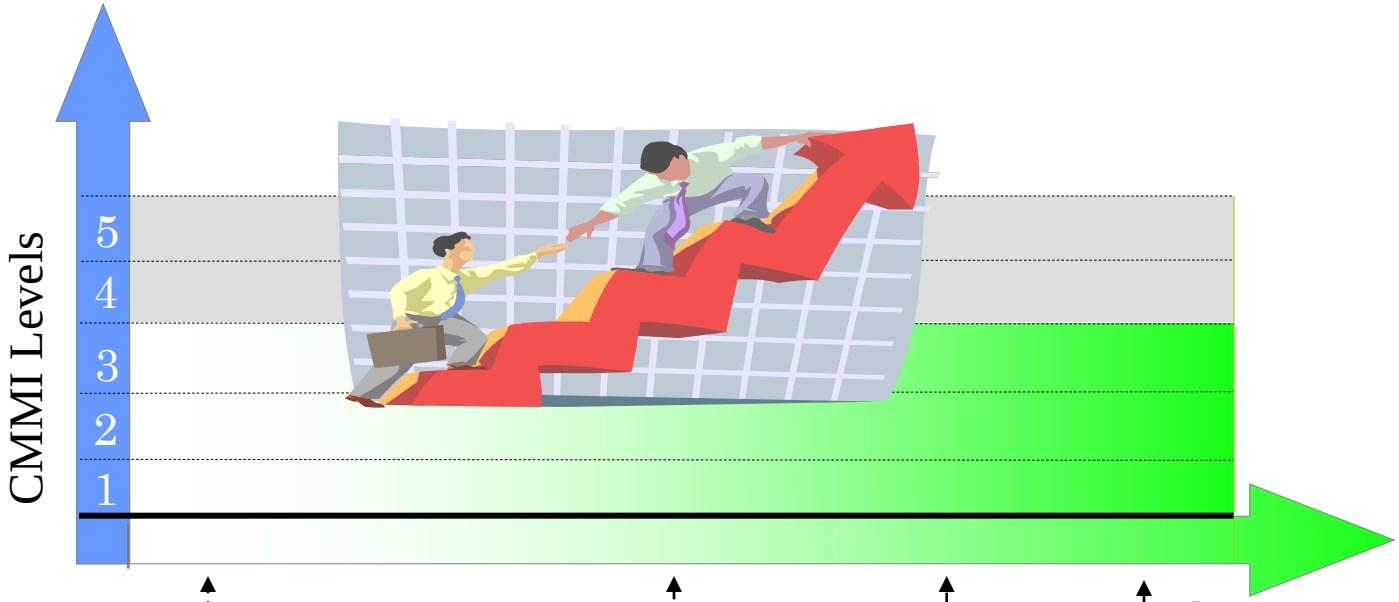
Appraisal Timeframe



Time

Class A Appraisal
April 03

Class A Readiness Review
March 03

Class B 11/02
88% Process Area Goals Graded '**Green**'
12% Process Area Goals Graded '**Yellow**'
0% Process Area Goals Graded '**Red**'

Class C Baseline 10/01

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Lessons Learned (1)

- Diversity impacted the process definition/implementation teams in numerous ways
  - Selection of leaders
  - Teamwork
- Diversity of team members made regular meetings to review status and work products very important

Lessons Learned (2)

- Spend more time up front on documentation technique
  - Format
  - Hierarchy
  - Templates
  - Examples for documenting the processes.

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Benefits

- The mix of domains brought different perspectives and expertise together.
- Improved cross-project communication
- Increased sense of community and information sharing

Questions?

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List of Acronyms

- CI – Configuration item
- COTS – Commercial Off-the-Shelf
- CM – Configuration Management
- CMMI – Capability Maturity Model Integration
- ESC – Executive Steering Committee
- EPG – Engineering Process Group
- ETVX – Entry, Task, Verification, eXit
- IT – Information technology
- NDI – Non-developmental item
- PAT – Process Action Team
- PI – Process improvement