

# SOFTWARE TECHNOLOGY FOR ADAPTABLE, RELIABLE SYSTEMS (STARS) PROGRAM

## Technical Papers: Defining Manually Enactable Processes Using the Process Definition Information Organizer Templates

Contract No. F19628-93-C-0129  
Task IV02 - Megaprogramming Transition Support

Prepared for:

Electronic Systems Center  
Air Force Materiel Command, USAF  
Hanscom AFB, MA 01731-2116



Prepared by:

Loral Federal Systems  
700 North Frederick Avenue  
Gaithersburg, MD 20879

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## Preface

This document was developed by the Loral Federal Systems - Gaithersburg, located at 700 North Frederick Avenue, Gaithersburg, MD 20879. Questions or comments should be directed to Mr. William H. Ett at 301-240-6337 (Internet: [ettb@lfs.loral.com](mailto:ettb@lfs.loral.com)).

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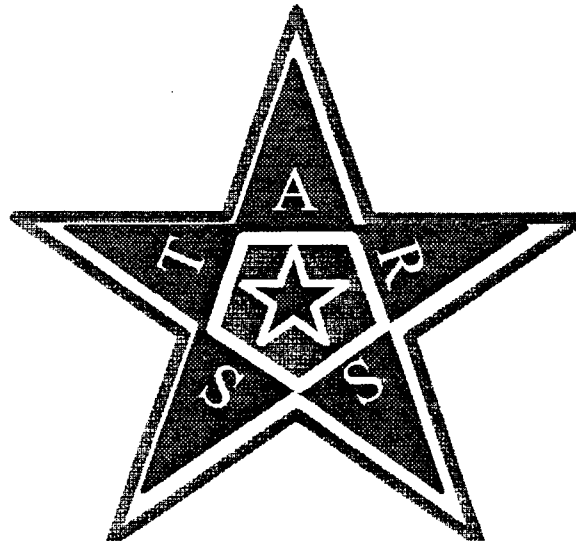
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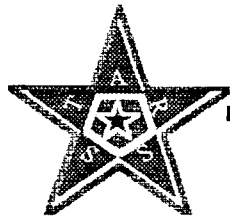
**1995 SEPG Conference**  
**Boston, Massachusetts**  
**May 22-25, 1995**

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**Tutorial:**  
**Defining Manually Enactable Processes**  
**Using the Process Definition**  
**Information Organizer Templates**



Prepared by:  
William H. Ett, Loral Federal Systems  
Dick Phillips, SEI  
Jim Over, SEI  
Marc Kellner, SEI



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Support for the preparation of materials for this tutorial was provided by the ARPA Software Technology for Adaptable, Reliable Systems (STARS) Program under the Loral STARS V02 Technology Transition task. Support was also provided by Dick Phillips, Jim Over and Marc Kellner of the SEI, through the collaboration of the SEI's Process Definition Project with the STARS prime contractors and the STARS service demonstration projects. The authors would like to express their appreciation to John Foreman, STARS Program Manager, for his support of this tutorial.



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# Defining Manually Enactable Processes Using the Process Definition Information Organizer Templates

William H. Ett  
Loral Federal Systems, STARS Program

Marc Kellner  
Software Engineering Institute

Richard W. Phillips  
Software Engineering Institute

Jim Over  
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## Tutorial Contents

- ★ 1 - Introduction
- 2 - Process Definition Concepts
- 3 - Planning the Project Process
  
- Definition*
- 4 - Process Context
- 5 - Process Layout Specification
- 6 - Process Design Specification
- 7 - Process Enactment Information Specification
  
- Evaluation*
- 8 - Evaluating Process Definition Results

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# Introduction

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## Who Should Be Here?

**Professionals that:**

- **Define and reuse processes that need to be both understandable and enactable (or executable)**
  - work, system, utility/service processes ...
- **Tailor organization processes to address the needs of their software development projects**
- **View processes as part of their transferrable knowledge base on how they expect to conduct business**

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## What Will We Cover?

### **Planning for the definition of a project's processes**

- Defining requirements for the project's process
- Defining the project's process architecture

### **An approach for defining manually enactable processes**

- Laying out the process
- Describing methods, resources, and artifacts
- Describing the work actions of every enactable process
- Packaging the enactable process

### **An approach for evaluating process definition results**

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## What Will You Walk Away With?

### **Techniques that can be applied to:**

- Plan your process definition efforts
- Define manually enactable processes
- Evaluate your process definitions

### **A copy of :**

- *"Instructions for Process Definition Information Organizer Templates"*
- Template skeleton

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## Agenda

- 08:00 AM Introduction**
- 08:10 AM Concepts and Process Definition Planning**
- 09:20 AM Process Context and Layout Specification**
- 10:30 AM Break**
- 10:40 AM Process Design & Enactment Specification**
- 11:40 AM Process Definition Evaluation**
- 11:55 AM Discussion**
- 12:00 PM Adjourn**

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## Contributors

### SEI Software Process Definition Project

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- Dr. Jerry R. Pixton, Unisys

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# Process Definition Concepts



## Process Definition Concepts

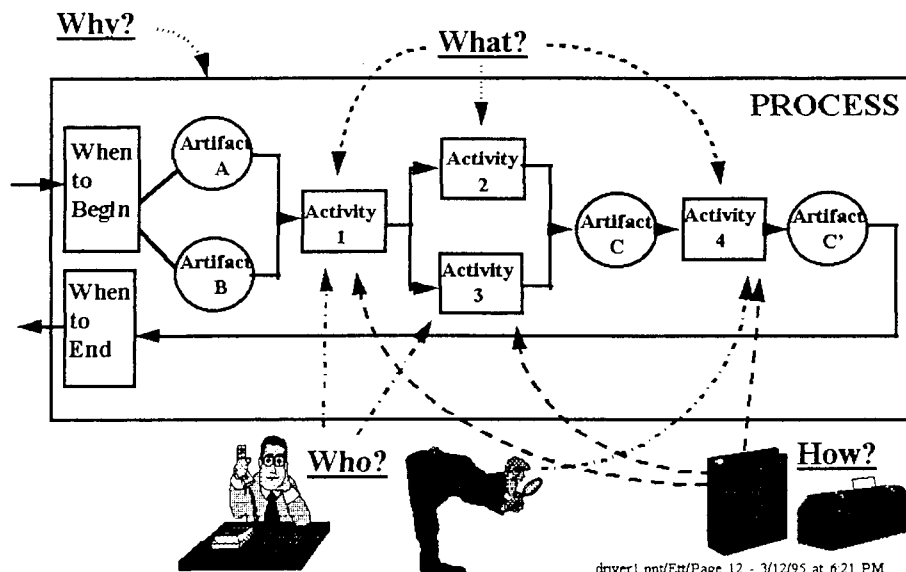
### Concepts

- **Process Definition Elements**
  - Activities, Artifacts, Agents
  - Methods and Entry/Exit Criteria
- **Two Life Cycles Model for Process Definition**
- **Process Definition Activities**
- **Process Definition Products**

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## Process Definition Elements



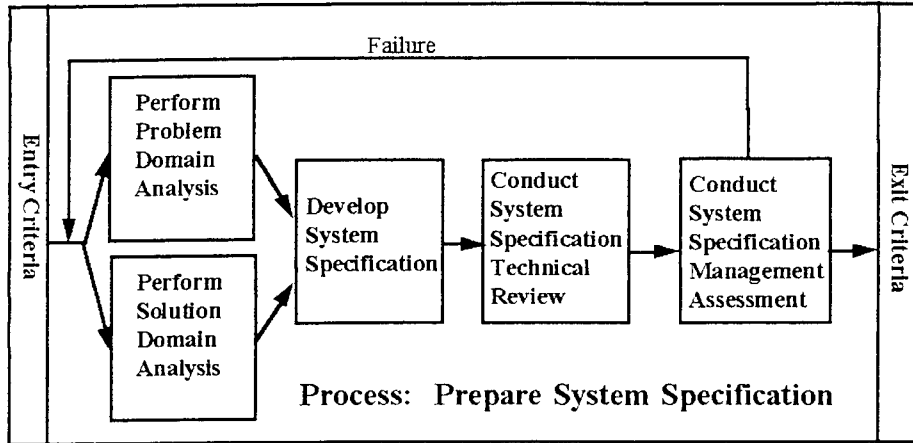


## Process Context

Why?

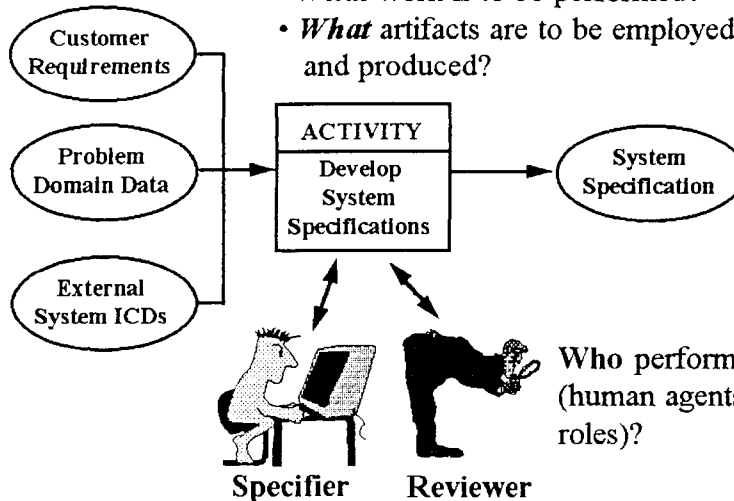
Why *this* process?

- *What* are the requirements for the process?
- *What* is the purpose of the process?



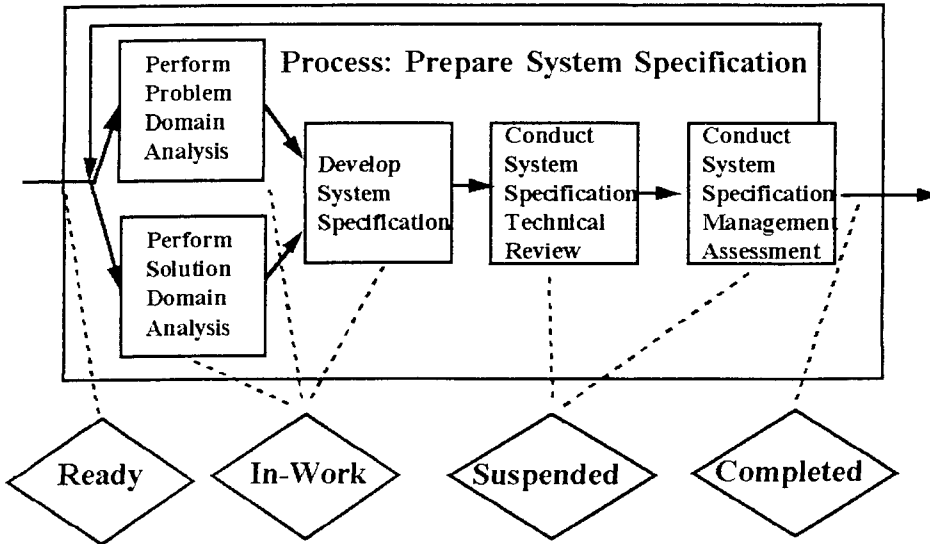
## Activities and Agents

- *What* work is to be performed?
- *What* artifacts are to be employed and produced?

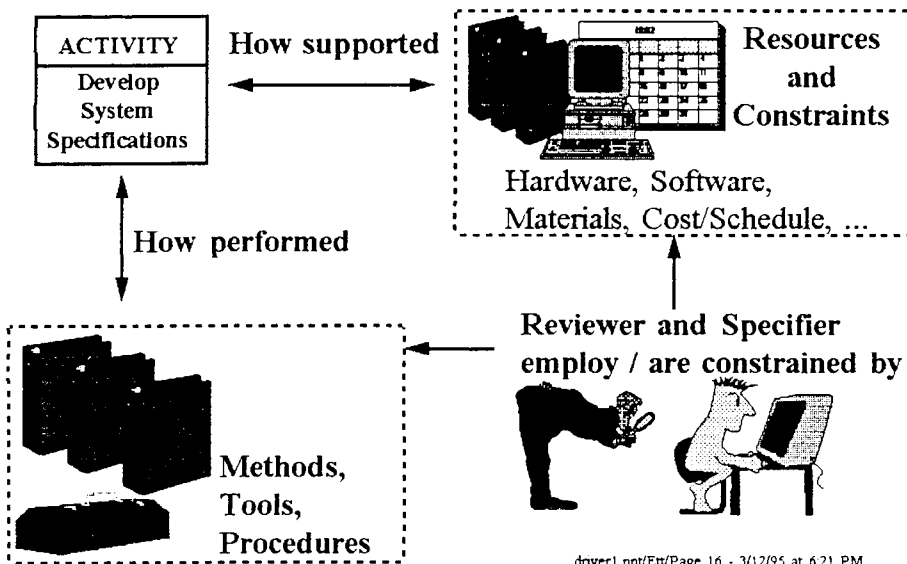




# Activity States



# Methods and Resources



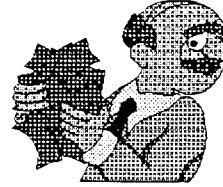


## Entry/Exit Criteria

Conditions under which an *activity*:

1) should begin:

- Artifact states
- Completion of predecessor activities
- Resource availability



2) may be declared "complete:"

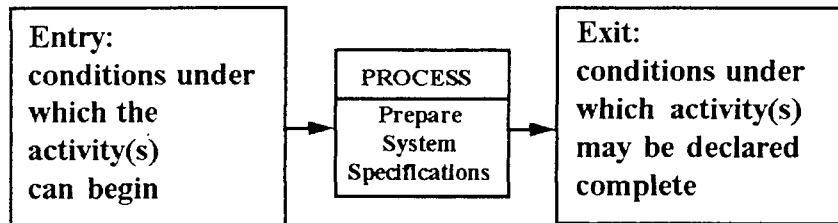
- Artifact states
- Completion of other related activities
- Returns from methods
- Checklist completion



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## When



If "Customer Requirements"  
and "External System ICDs"  
are available,  
Then  
begin "Prepare System  
Specifications"

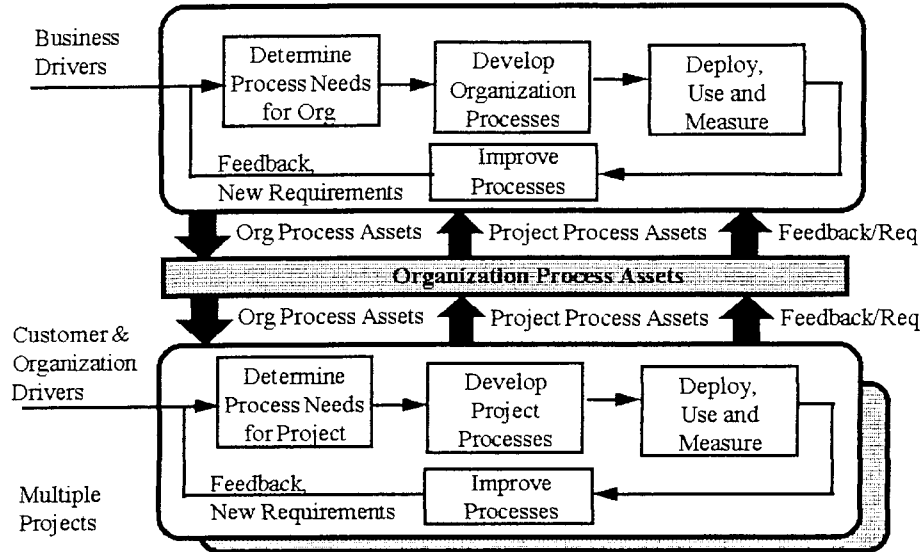
If "System Specifications"  
has state of "approved,"  
Then  
log "Prepare System  
Specifications"  
as "completed"

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## Two Life Cycle Concept for Process Definition



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## Why the Two Life Cycles for Process?

### Organization Focus

- Organization processes as "Product Line"
  - Standard Business processes
  - Standard technical, service and utility processes
  - Process analysis and improvement
- Processes defined to:
  - Support the organization's business requirements
  - Ensure consistency and quality of products / work results
  - Address process assurance criteria required by customer set

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## Why the Two Life Cycles for Process?

### Project Focus

- **Project process concerns - Customer / Developer**
  - Processes that demonstrate developers can deliver
  - Processes that address customer's requirements
  - Processes that address customer's quality concerns
  - Processes that also address organization requirements
  - Processes must reflect how work is to be performed
    - Different application domains
    - Different domain and technical maturity
    - Technology adoption and use

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## CMM V1.1 Mapping to Cleanroom

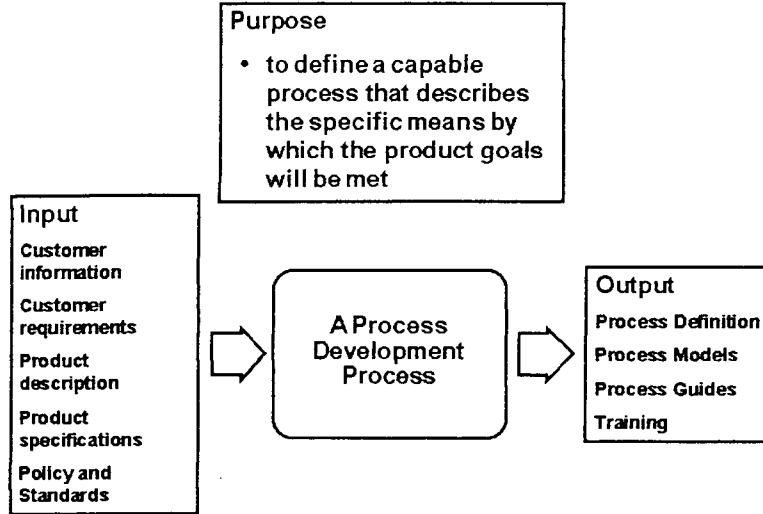
Exercise illustrated key differences of the "project process" and "organization processes"

- *Organization processes* developed to address process assurance criteria of the CMM
  - Software project management processes
  - Technical service processes
- *Cleanroom Process* - prepared specifically to support the *technical management* and development of software projects:
  - Life cycle specific way of doing business
    - Defect prevention
    - Statistical usage testing

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## A Process Development Process

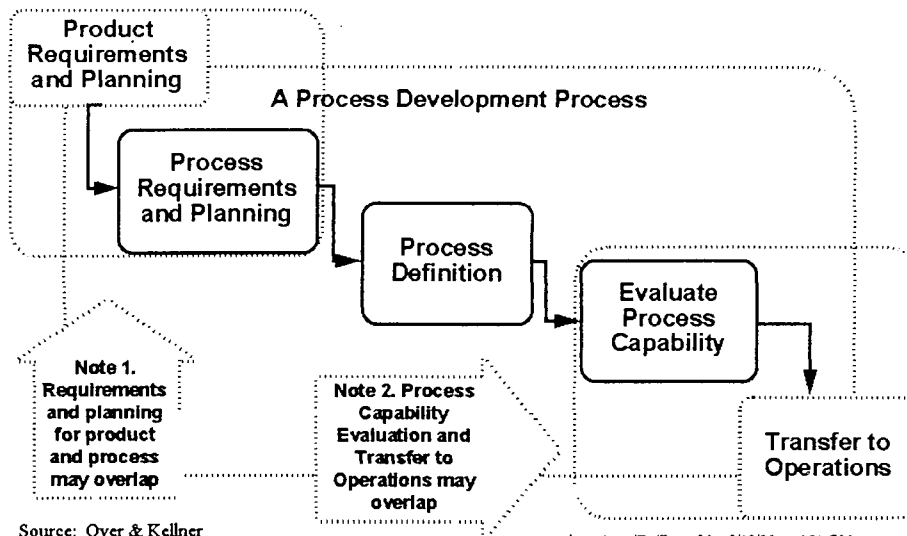


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## Process Development Activities

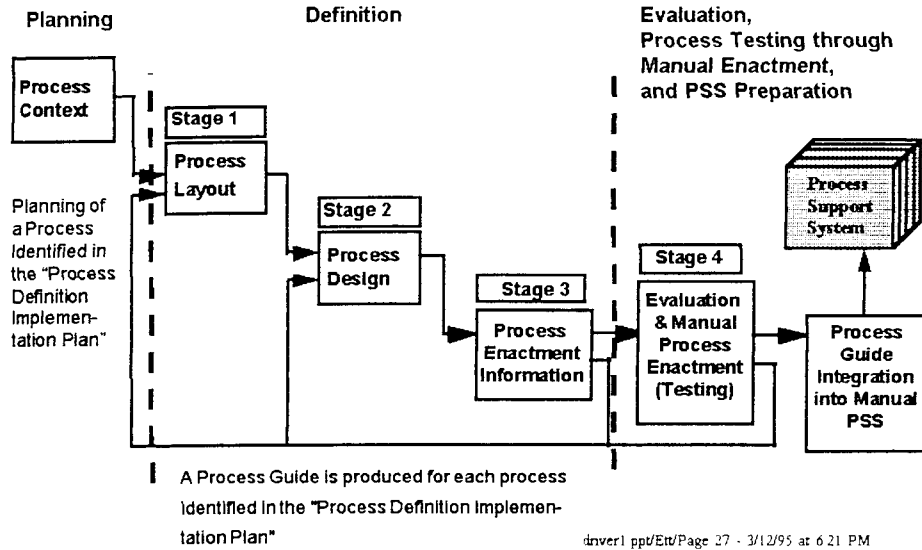


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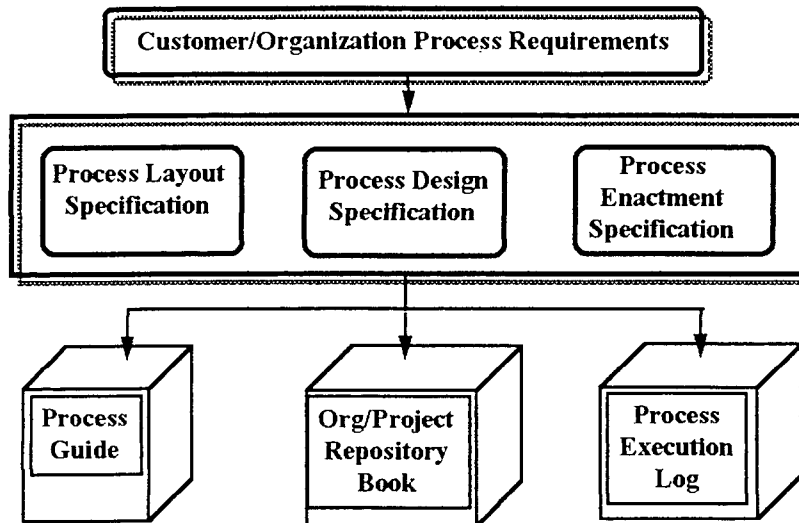
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# Process Definition, Evaluation & Use

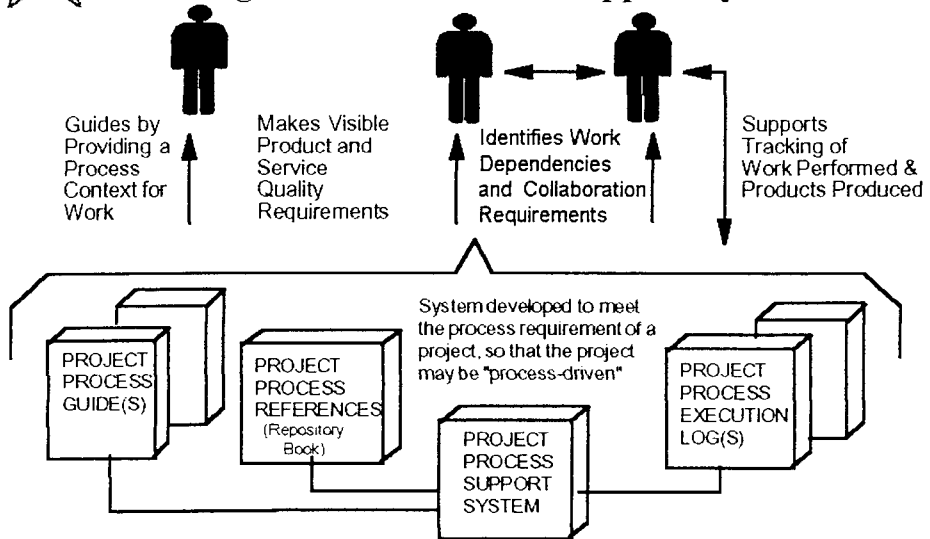


# Process Definition Products





## Defining a Manual Process Support System



Note: Figure Depicts a Manual Process Support System for a Project drver1 pp/Ett/Page 29 - 3/12/95 at 6:21 PM



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# Process Definition Planning



## Process Definition Planning

### Concepts

- Analyzing the Requirements for the Project Process
- Preparing the Project Process Architecture
  - SCAI Project Example
- Preparing the Phased Definition Plan
- Using the Process Architecture to Support Process-Driven Project Planning

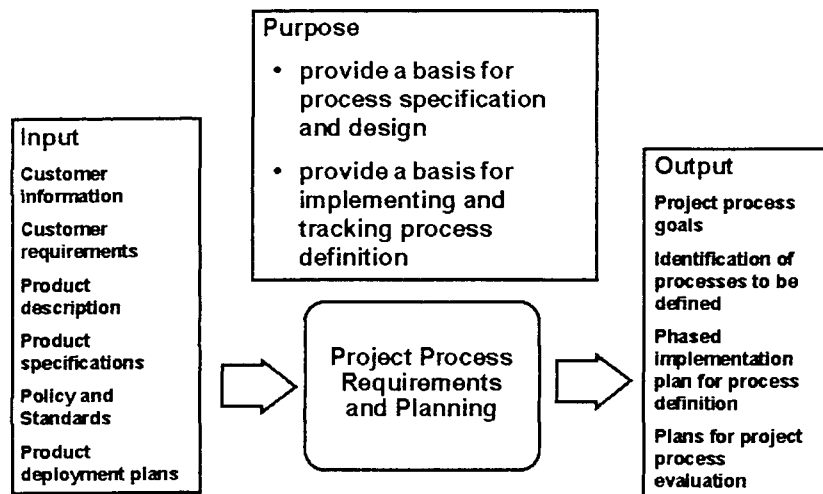
### Focus

- Project Process Definition
- Approach applied on the Air Force STARS Demonstration Project

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## Project Process Requirements & Planning



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## Process Definition as a Project Activity

Project process definition is a vital part of an engineering project and must be planned

- Process Definition efforts may be organized as a project within a project

Examples:

- process action teams
- business process re-engineering

Successful process definition efforts:

- are planned and tracked
- follow a defined process as the basis for planning
- are staffed, reviewed, approved, etc.

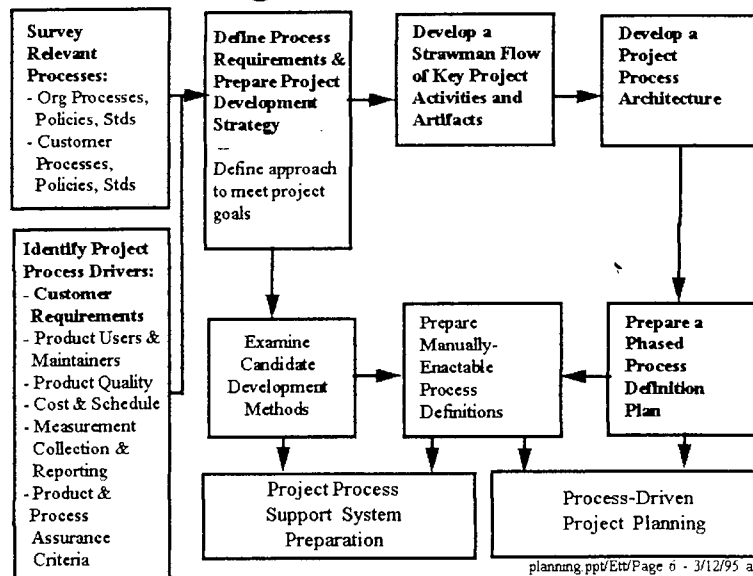
| Schedule | Process Development Project |  |  |  |
|----------|-----------------------------|--|--|--|
| Task     |                             |  |  |  |
| Task 1   |                             |  |  |  |
| Task 2   |                             |  |  |  |
| Task 3   |                             |  |  |  |
| Task 4   |                             |  |  |  |
| Task 5   |                             |  |  |  |
| Task 6   |                             |  |  |  |
| Task 7   |                             |  |  |  |
| Task 8   |                             |  |  |  |
| Task 9   |                             |  |  |  |
| Task 10  |                             |  |  |  |

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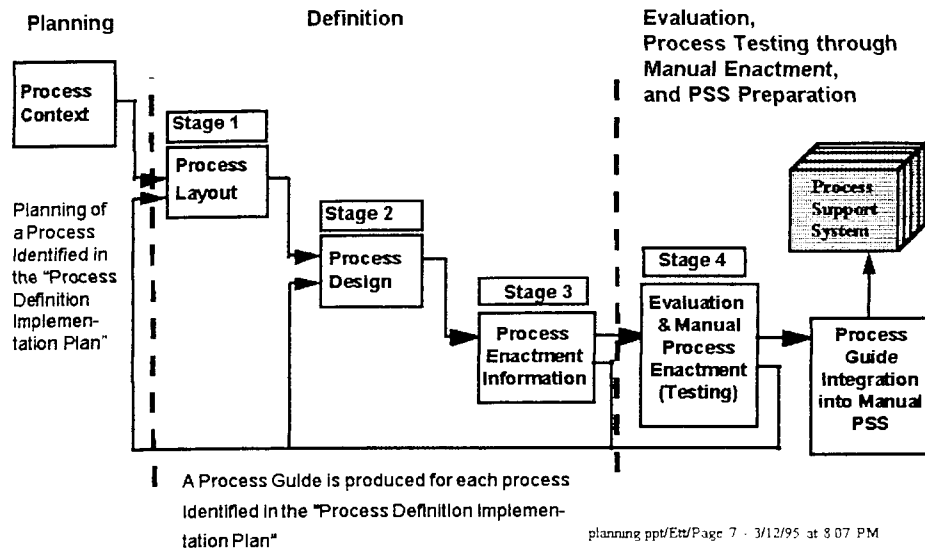
## Planning for Process Definition



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## Process Definition, Evaluation & Use



## Survey Relevant Processes

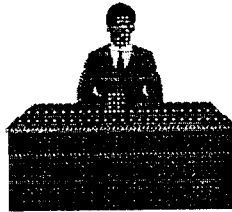
Project process definition teams must identify what processes have been defined

Potential Sources:

- Site SEPG
- SEI:
  - SEI Software Process Frameworks for levels 2 through 5 (ETVX description of each CMM V1.1 KPA)
- STARS *ASSET*:
  - Keeper of the SEI/STARS Process Assets
    - Cleanroom Process Guidebooks
    - Ada Process Model Guidebook
    - AT&T Quality Function Deployment Process
- Customer:
  - Standards and Product DIDs



## Identify Project Process Drivers



- Organization processes, policies, practices, standards, methods, etc

- Product/system requirements
- Cost
- Schedule
- Customer processes, policies, and development standards
- Customer's definition of product quality
- Developer Process Assurance

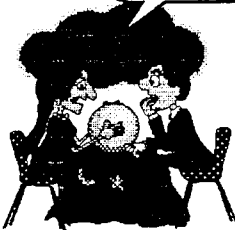


Do you see any problems with the requirements we got from the customer?



## Identify Project Process Drivers

I see a system deployed that is incredibly slow, and cannot be easily ported to your customer's other machines.



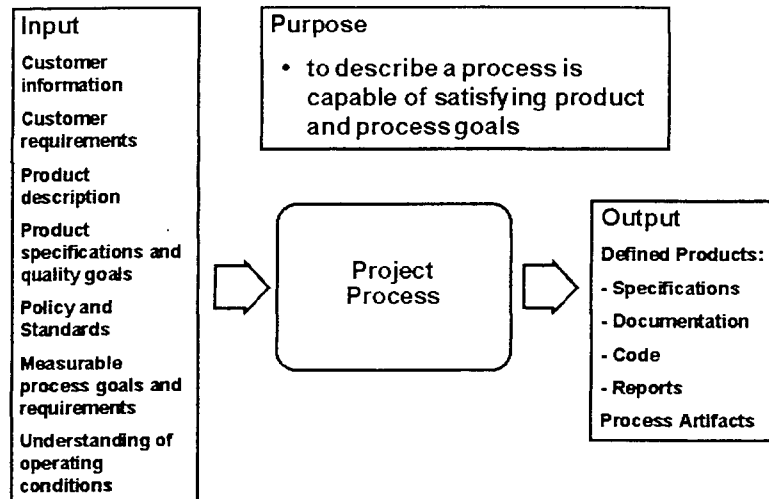
We forgot to tell the contractor **what?** Who's gonna want to use this new system ...



- Operating environments
- How and where the target system will be used
- How the target system will be maintained and by whom



## Defining Project Process Requirements



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## Defining Project Process Requirements

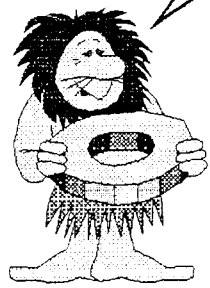
### Requirements for the Project Process:

- How will we *verify and validate* the specified work products?
  - Verification - Is our work *technically correct*?
  - Validation - Is the system we built *what the customer wanted*?
- How will customer and contractor management *assess* work progress?
- How and when will status be *reported* to support project control?
- What *measurements* must be taken and what *metrics* must be computed? How will they be reported and when?

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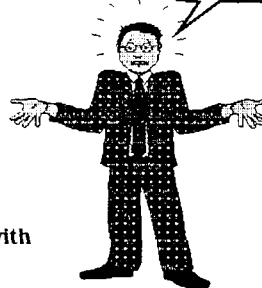


## Verification and Validation Requirements: A Project Process Concern



It meets all of your requirements! It's what you specified.

**Verification:**  
"Did I do it the thing right?"  
- technical correctness  
- compliance with specifications



It may be what I specified - but it isn't what I expected.

**Validation:**  
"Did I do the right thing"  
- producing what's needed  
- compliance with expectations

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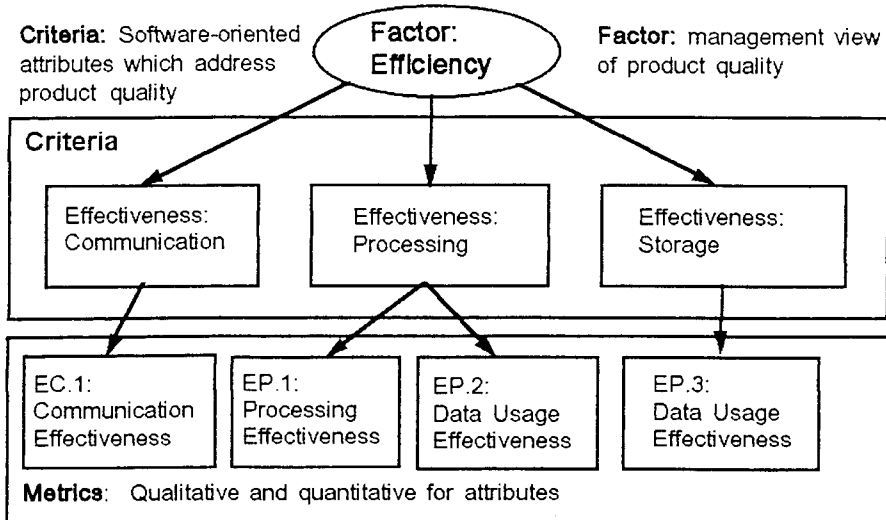


## RADC Quality Framework

| Criterion \ Factors  | Efficiency | Integrity | Reliability | Survivability | Usability |
|----------------------|------------|-----------|-------------|---------------|-----------|
| Accuracy             |            |           | X           |               |           |
| Anomaly Mgt          |            |           | X           | X             |           |
| Autonomy             |            |           |             | X             |           |
| Distributedness      |            |           |             | X             |           |
| Effectiveness: Comm. | X          |           |             |               |           |
| Effectiveness: Proc. | X          |           |             |               |           |
| Effectiveness: Stor. | X          |           |             |               |           |
| Operability          |            |           |             |               | X         |
| Reconfigurability    |            |           |             | X             |           |
| System Accessability |            | X         |             |               |           |
| Training             |            |           |             |               | X         |

This table illustrates a portion of the RADC quality framework factors and associated criteria. Factor/criteria pairing is used to identify data collection forms and associated metrics for use in process instrumentation.

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## Prepare Project Development Strategy

### Risk Factors:

- Problem domain understanding
- Technology maturity
- Precedence with respect to past systems
  - Unprecedented (first time out)
  - Precedented (instances have been built)

### Development Approaches Selected to Manage Risk:

- Spiral framework
  - Prototyping
  - Incremental development
- Waterfall framework



## Defining the Project Process Architecture

### What is a “Project Process Architecture”

A framework of the process components required to satisfy a project’s process requirements

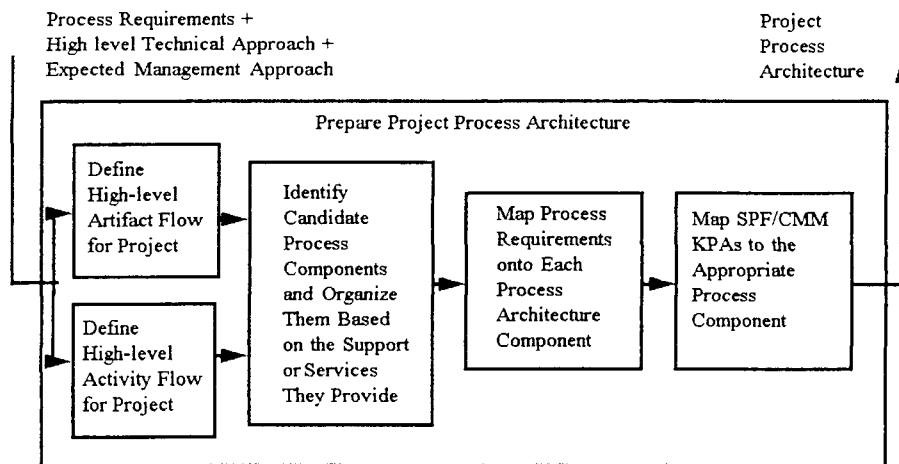
### The “Project Process Architecture” defines:

- The components of the project process and their relationships from a “black box” perspective:
  - Process components inputs and outputs
  - Process component black box behavior
- The interfaces between process components

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## Defining the Project Process Architecture



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## Defining the Project Process Architecture

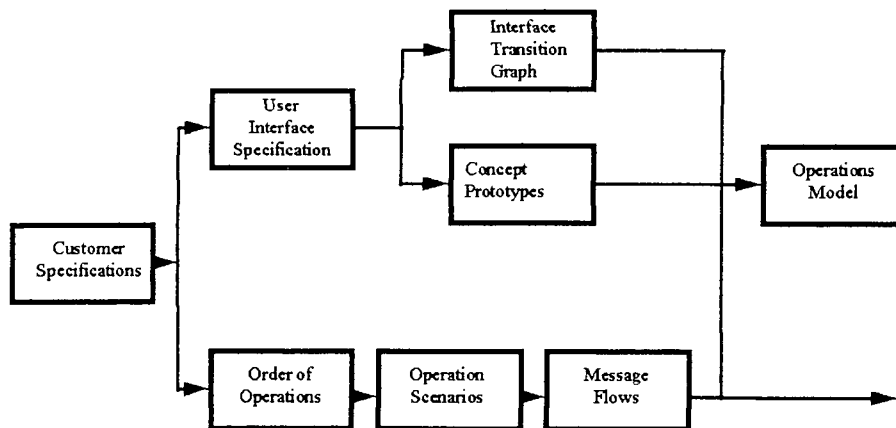
After the “Project Process Architecture” is defined, it becomes the basis for:

- **Process Definition Planning**
  - Understand what processes to reuse, tailor or develop
  - Basis for phasing the definition of project processes
  
- **Process Requirements Allocation**
  
- **Process Assurance Planning**
  - Understand which process components must address SEI CMM V1.1 or ISO-9000.2 criteria

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## Artifact flow for preparing an “Operations Model”

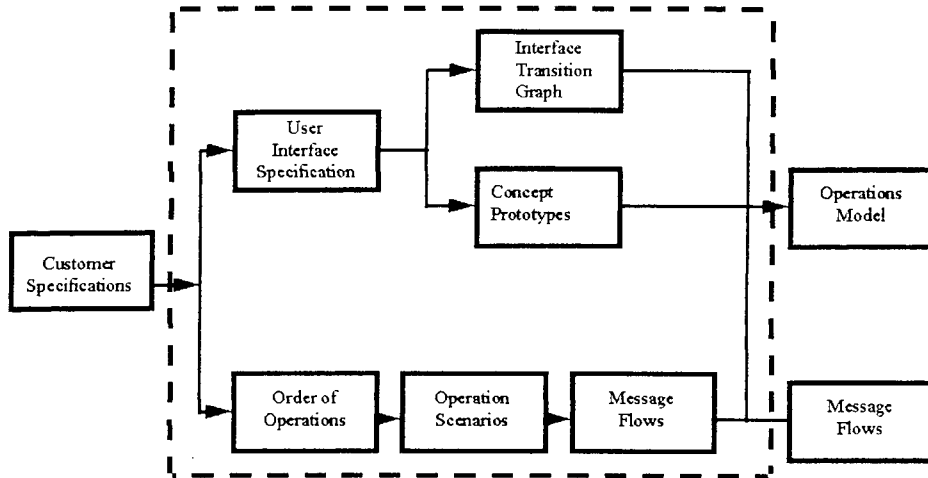


Example from “Developing with Ada: Life Cycle Methods” by Bruce E. Krell. Bantam Professional Books

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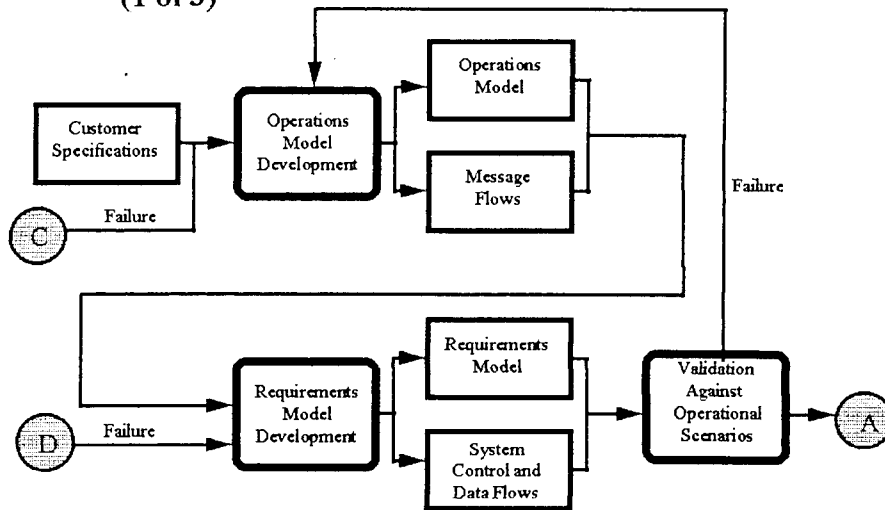
### Process Component: "Operations Model Development"



Example from "Developing with Ada: Life Cycle Methods" by Bruce E. Krell. Bantam Professional Books  
planning ppt/Err/ Page 21 - 3/12/95 at 3:07 PM



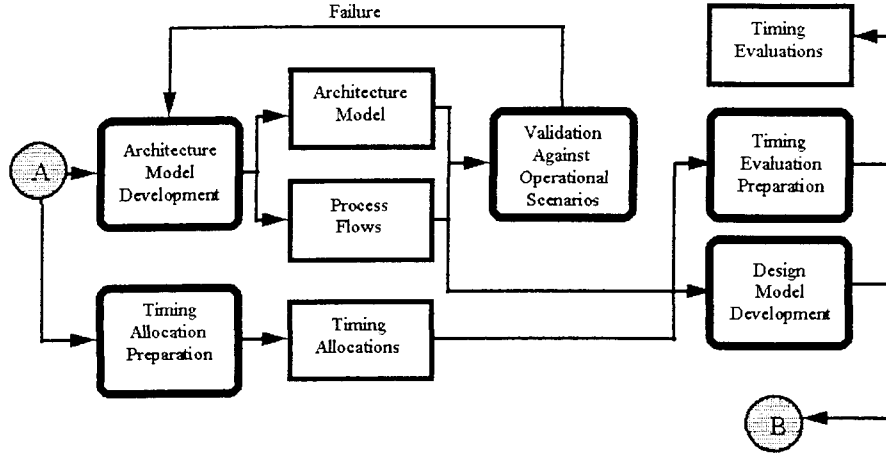
### Activity Flow: "Ada R/T Software Engineering Process" (1 of 3)



Example from "Developing with Ada: Life Cycle Methods" by Bruce E. Krell. Bantam Professional Books  
planning ppt/Err/ Page 22 - 3/12/95 at 3:07 PM



Activity Flow: "Ada R/T Software Engineering Process"  
(2 of 3)

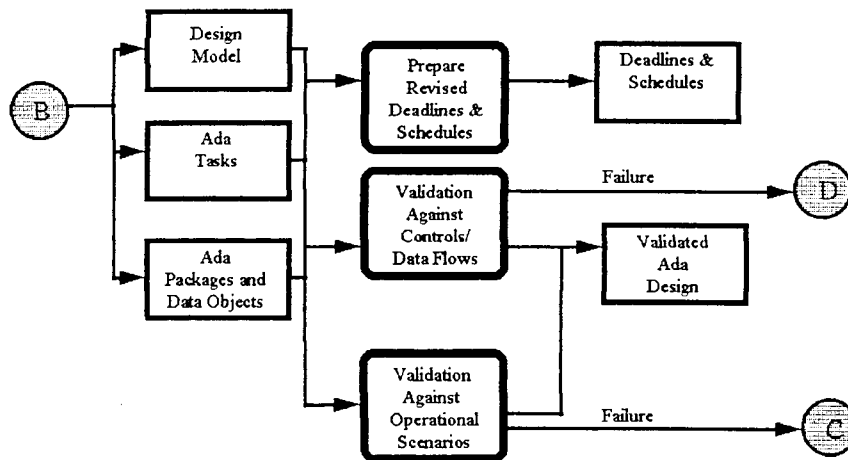


Example from "Developing with Ada: Life Cycle Methods" by Bruce E. Krell. Bantam Professional Books

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Activity Flow: "Ada R/T Software Engineering Process"  
(3 of 3)

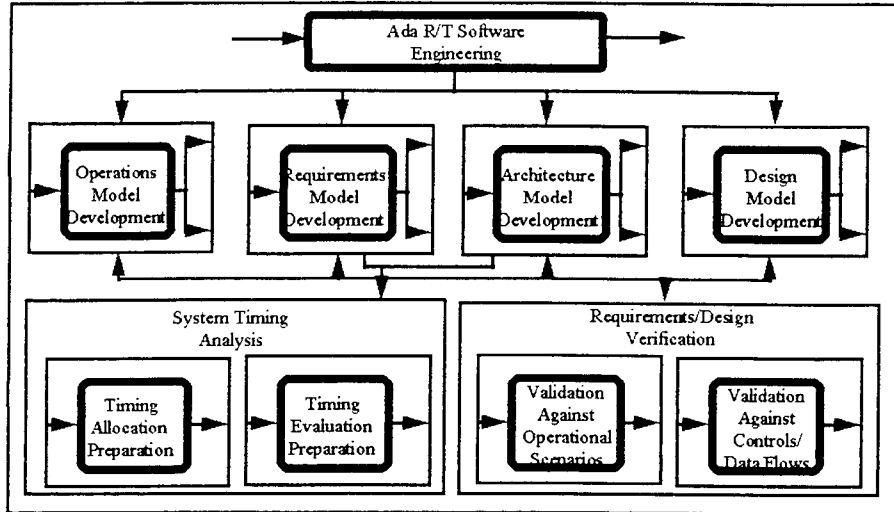


Example from "Developing with Ada: Life Cycle Methods" by Bruce E. Krell. Bantam Professional Books

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## Process Architecture

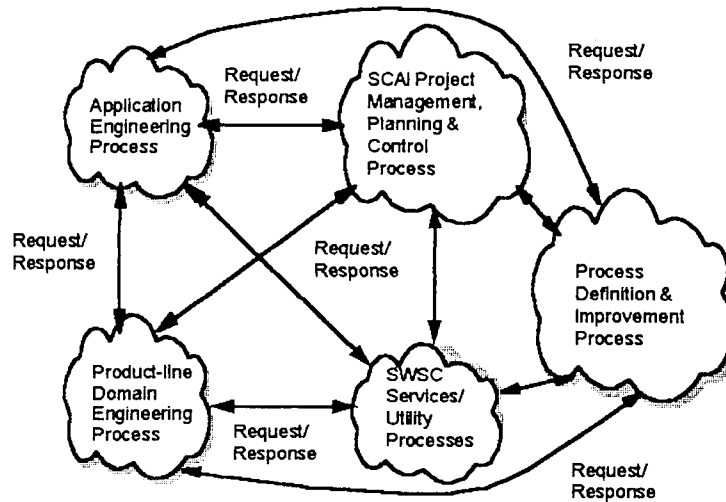


Example from "Developing with Ada: Life Cycle Methods" by Bruce E. Krell. Bantam Professional Books

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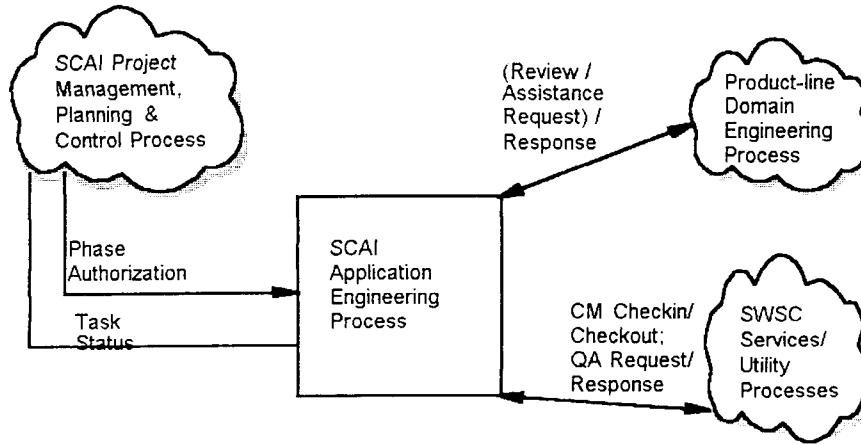
## SCAI Process Architecture Concept



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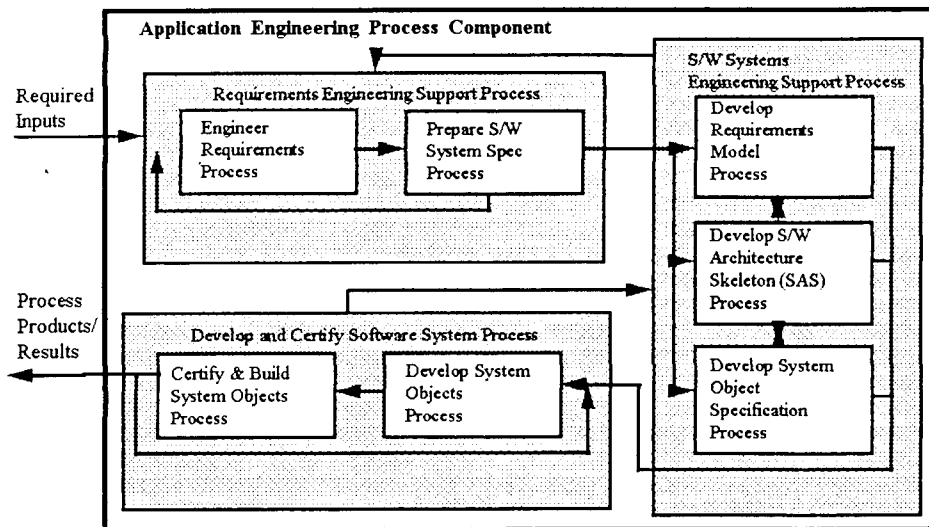
## SCAI AE Development Strategy



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## SCAI Application Engineering Process



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## Phased Process Definition Plan

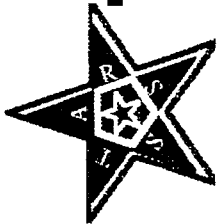
| Preparation Phase  | Processes Required to Support Work Increments   |
|--|---|
| SCAI Increment 1<br>(90 days prior to project start)               | <ul style="list-style-type: none"> <li>o Requirements Engineering Process (OBE)</li> <li>o System Specification Development Process</li> <li>o SAS Development Process</li> <li>o Requirements Model Development Process</li> </ul> |
| SCAI Increment 2<br>(120 days prior SCAI release 1 development)    | <ul style="list-style-type: none"> <li>o System Object Specification Development Process</li> <li>o System Object Development Process</li> <li>o System Object Certification Process</li> </ul>                                     |
| SCAI Increment 3<br>(120 days prior to SCAI release 2 development) | <ul style="list-style-type: none"> <li>o System Object Integration &amp; Build Process</li> <li>o System Certification Process (Outside of AEP)</li> <li>...</li> </ul>   |

Example from the SCAI Project "Phased Process Definition Plan " for Application Engineering



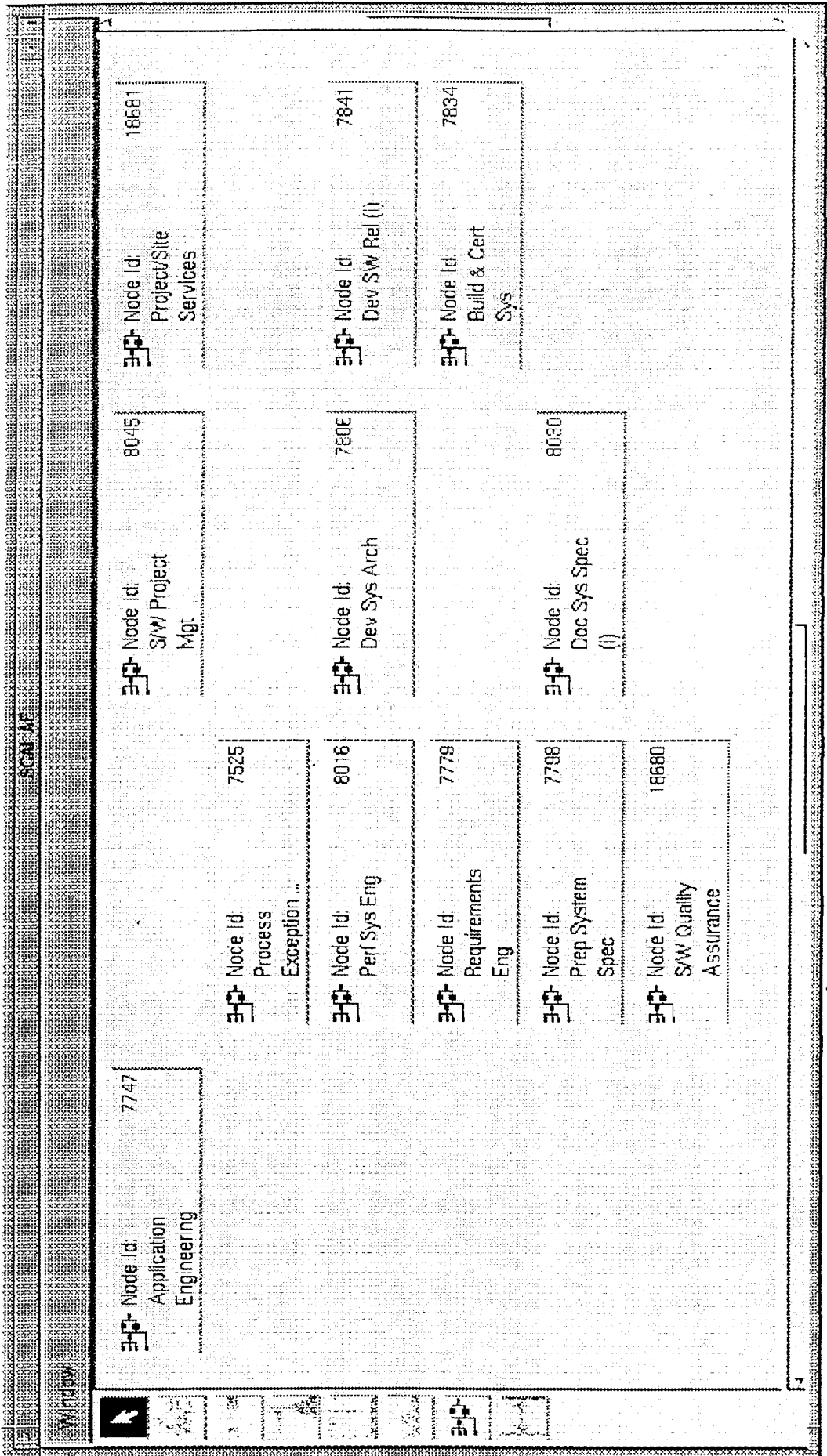
## Process Driven Project Planning (1)

|  |  |                                 |   |
|--|--|---------------------------------|---|
| Node Id: 7747<br>Application Engineering | Node Id: 7725<br>Process Exception     | Node Id: 6505<br>SW Project Mgt | Node Id: 19881<br>Project/Case Services |
| Node Id: 8078<br>Perf Sys Eng            | Node Id: 7778<br>Requirements Eng      | Node Id: 7818<br>Dist Sys Arch  | Node Id: 7841<br>Dev SW Int (I)         |
| Node Id: 7758<br>Prep System Spec        | Node Id: 1668<br>SIS Quality Assurance | Node Id: 6887<br>Dist Sys Spec  | Node Id: 7804<br>Build & Cert Sys       |



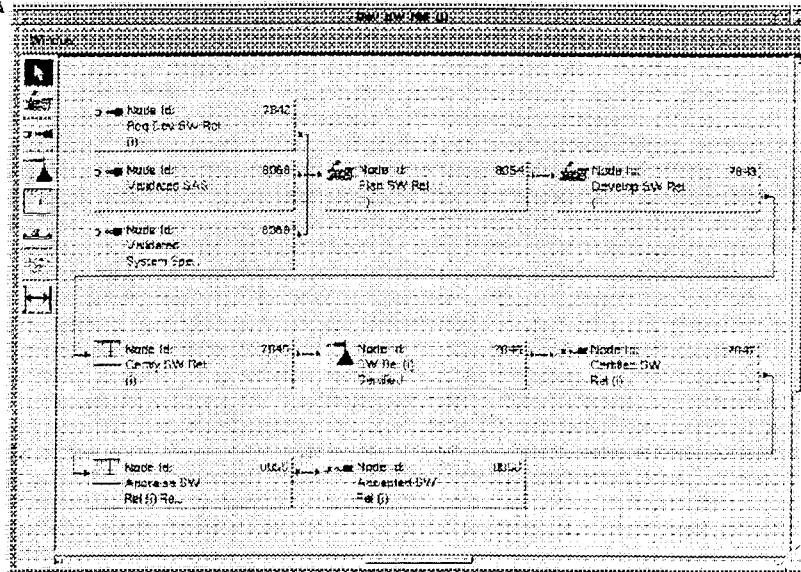
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# Process Driven Project Planning (1)





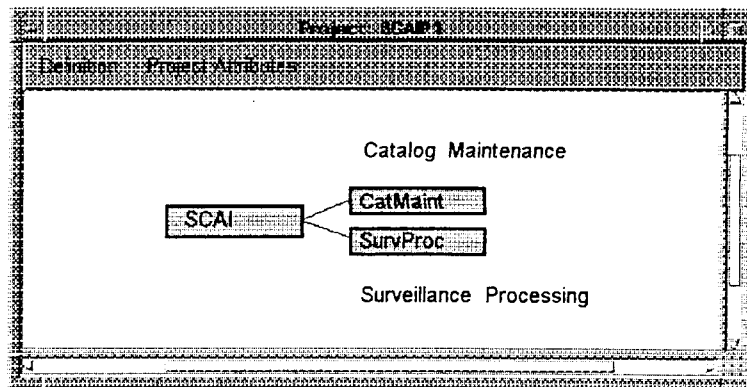
## Process Driven Project Planning (2)



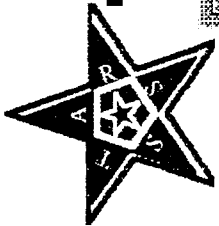
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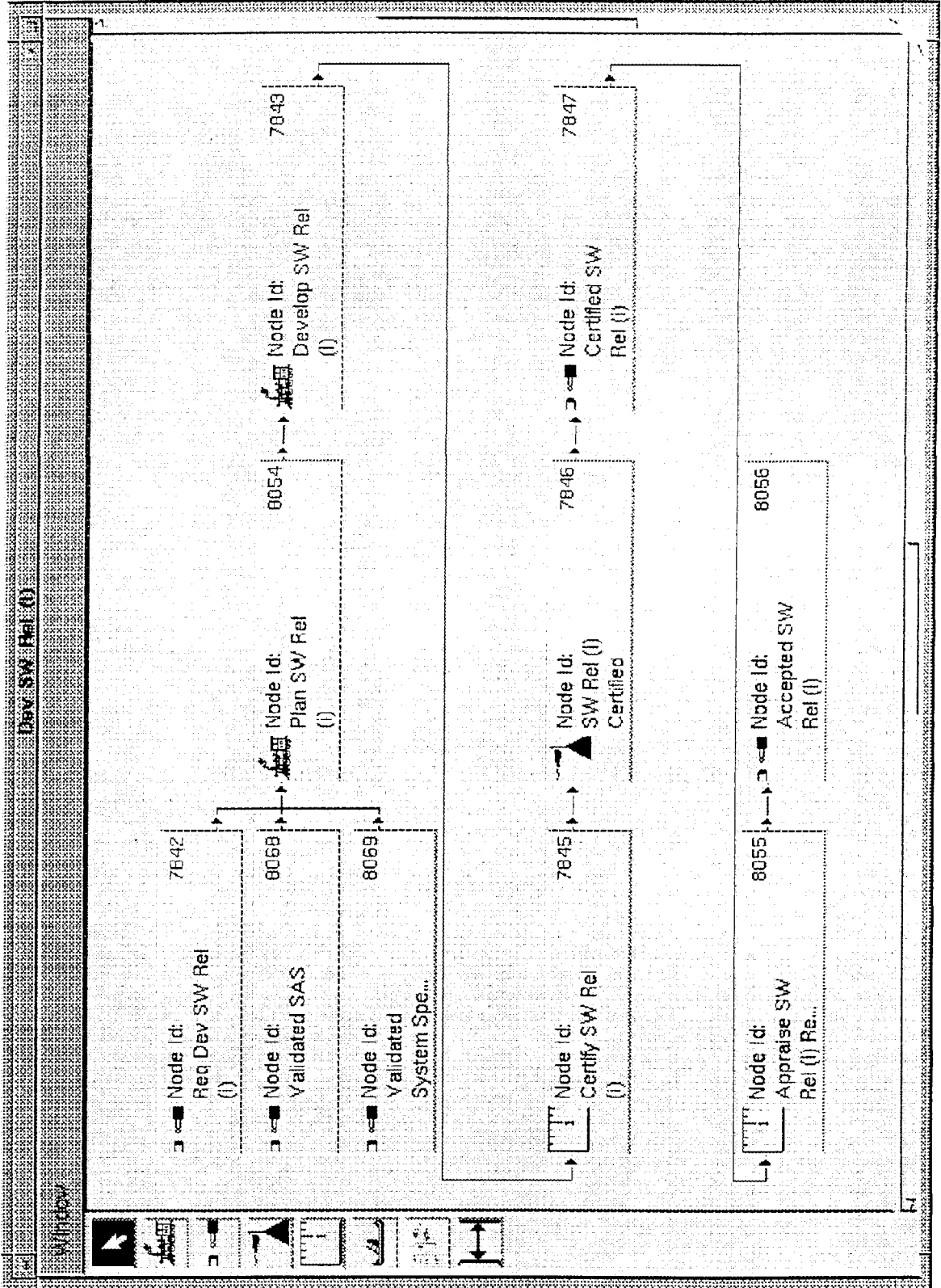
## Process Driven Project Planning (3)

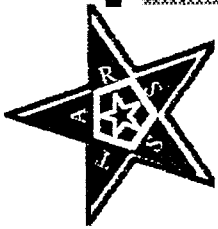


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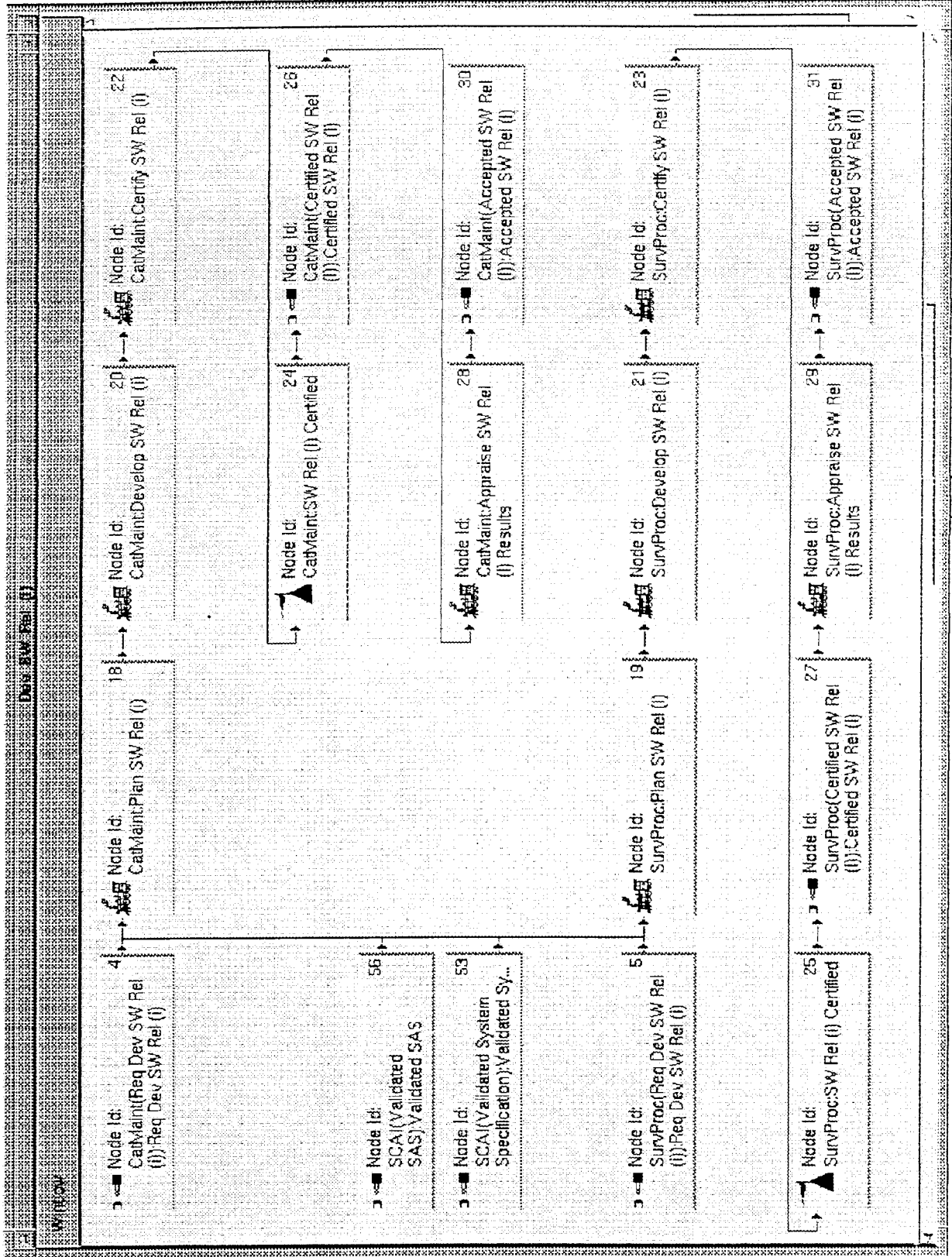


# Process Driven Project Planning (2)





# Process Driven Project Planning (4)





## Tutorial Contents

- 1 - Introduction
- 2 - Process Definition Concepts
- 3 - Planning the Project Process

### *Definition*

- ★ 4 - Process Context
- 5 - Process Layout Specification
- 6 - Process Design Specification
- 7 - Process Enactment Information Specification

### *Evaluation*

- 8 - Evaluating Process Definition Results

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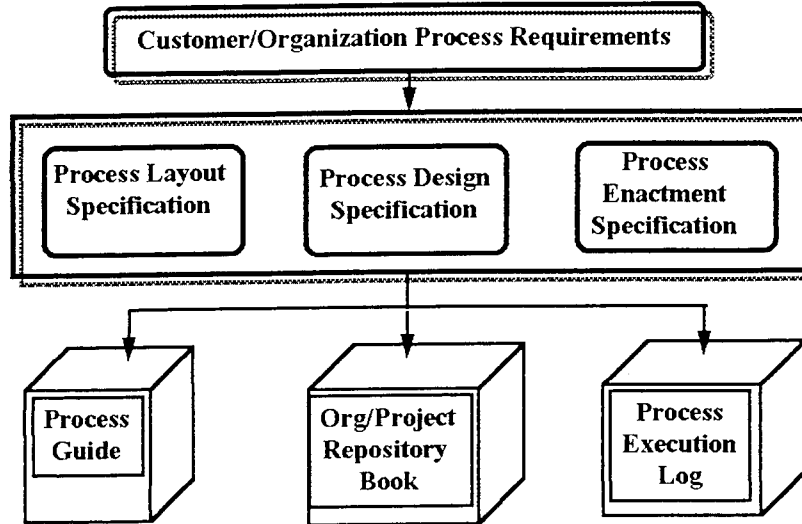


# Process Context

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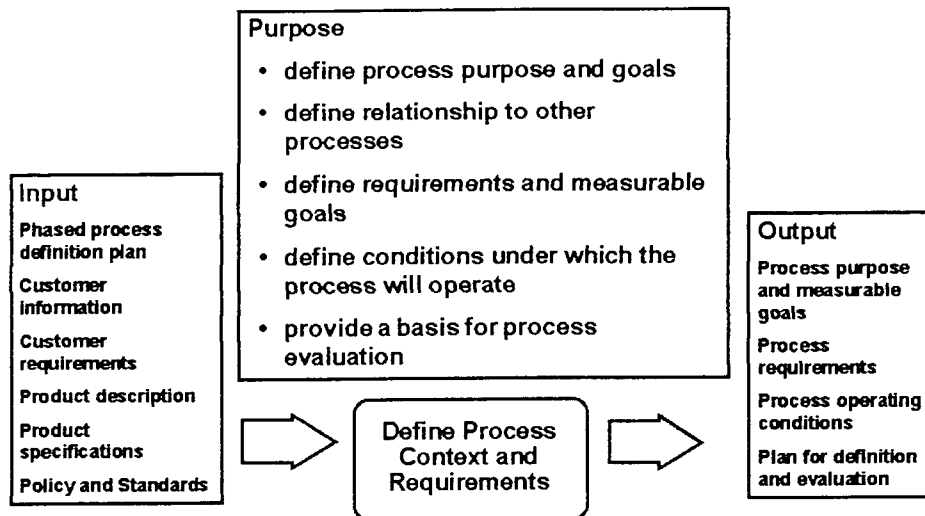
## Process Definition Products



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## Process Context & Requirements Definition



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## Process Context

|   |
|---|
| <b>Process Guide</b>  |
| <b>Process Context Section</b>  |
| <p><b>Overview:</b></p> <p><b>Process Purpose:</b></p> <ul style="list-style-type: none"><li>- What will following this process accomplish?</li><li>- Does following this process satisfy its intended purpose?</li></ul> <p><b>Process Goals:</b></p> <ul style="list-style-type: none"><li>- Goals this process addresses</li></ul> <p><b>Process Context:</b></p> <ul style="list-style-type: none"><li>- Relationship of this process with others</li></ul> |

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## Process Context

|   |
|---|
| <b>Process Guide</b>  |
| <b>Process Context Section (Continued)</b>  |
| <p><b>Process Requirements:</b></p> <p><b>Required Inputs (Artifacts, messages, controls, etc.)</b></p> <p><b>Process Work Results (Products and services)</b></p> <ul style="list-style-type: none"><li>- Quality attributes of each work product and service</li></ul> <p><b>Measurement requirements</b></p> <ul style="list-style-type: none"><li>- Process measurements and metrics</li><li>- Product measurements and metrics</li></ul> <p><b>Reporting Requirements</b></p> <ul style="list-style-type: none"><li>- Normal reporting and exception reporting</li></ul> |

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## Process Context: Artifact Quality Attributes

| Product                          | User Product Quality Factor | Product Quality Criteria                                   |
|----------------------------------|-----------------------------|--|
| Space Catalog Software Component | Reliability                 | Accuracy<br>Simplicity                                     |
|                                  | Usability                   | Operability<br>Training                                    |
|                                  | Correctness                 | Completeness<br>Consistency<br>Testability<br>Traceability |

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## Process Context

| Organization/Project Repository Book  |
|---|
| <b>Process Context Section (Continued)</b><br><br><b>Process Operating Environment:</b><br><br><b>Process Audience:</b> <ul style="list-style-type: none"><li>- Who (roles) are the intended users of this process?</li><li>- What are their current responsibilities?</li></ul> <b>Process Usage:</b> <ul style="list-style-type: none"><li>- How will each audience use this process definition?</li></ul> <b>Benefits:</b> <ul style="list-style-type: none"><li>- What benefits will users realize after using the process?</li></ul> |

Source: "Developing Useful Documents," American Institute for Research, 1990 layout ppt/Ett & Phillips/Page 8 - 3/12/95 at 8:55 PM



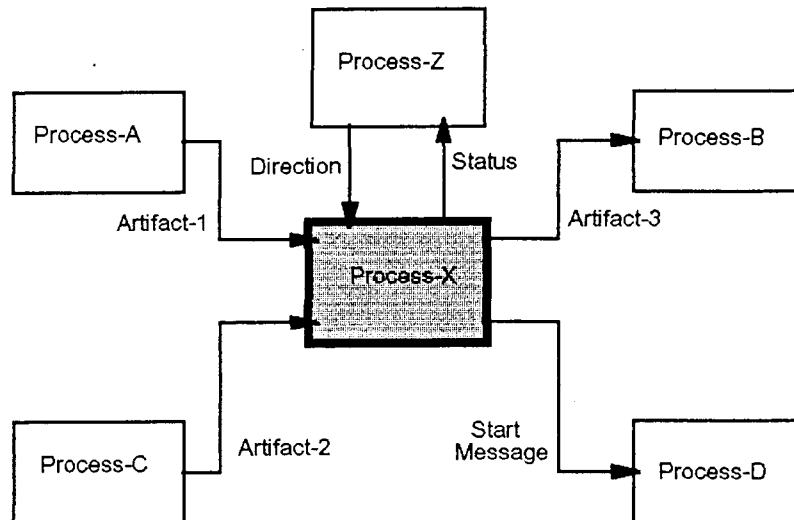
## Process Context

| Organization/Project Repository Book  |
|---|
| <b>Process Context Section (Continued)</b>  |
| <b>Process Audience and Experience:</b> <ul style="list-style-type: none"><li>- How new is what you are telling them?</li><li>- What vocabulary do they use?</li><li>- How do they think about this topic or the tasks involved?</li><li>- What do they need to know before using the process</li></ul> |
| <b>Process Audience Motivation:</b> <ul style="list-style-type: none"><li>- How much effort are they willing to put into learning understanding what the process definition requires of them?</li></ul>   |

Source: "Developing Useful Documents," American Institute for Research, 1990 layout ppt/Ett & Phillips/Page 9 - 3/12/95 at 8:55 PM



## Process Context



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## Next Step: Process Layout

- Complete process context for assigned process
- Identify and define artifacts
- Define agent roles
- Graphically depict process layout
- Verify that activity and artifact granularity is OK

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## Tutorial Contents

- 1 - Introduction
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### *Definition*

- 4 - Process Context
- ★ 5 - Process Layout Specification
- 6 - Process Design Specification
- 7 - Process Enactment Information Specification

### *Evaluation*

- 8 - Evaluating Process Definition Results

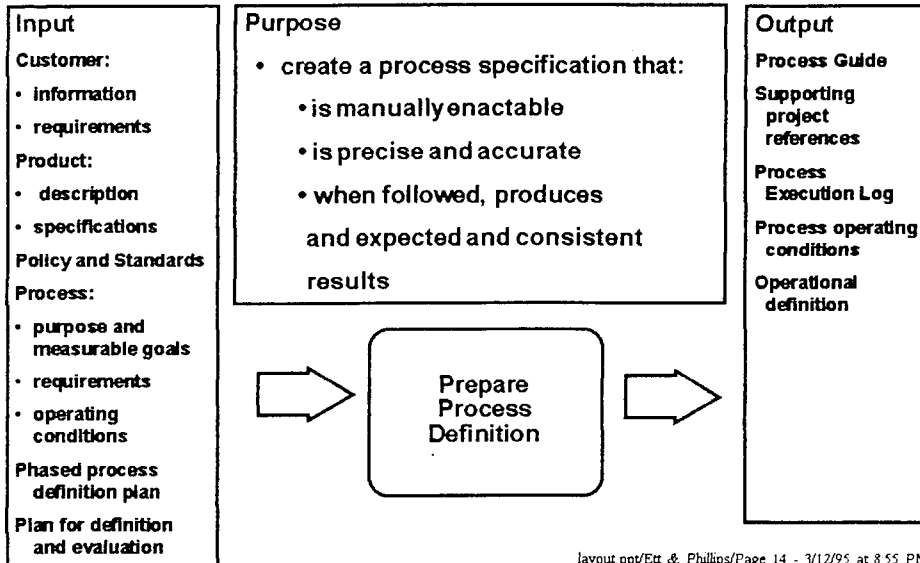
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# Process Layout Specification

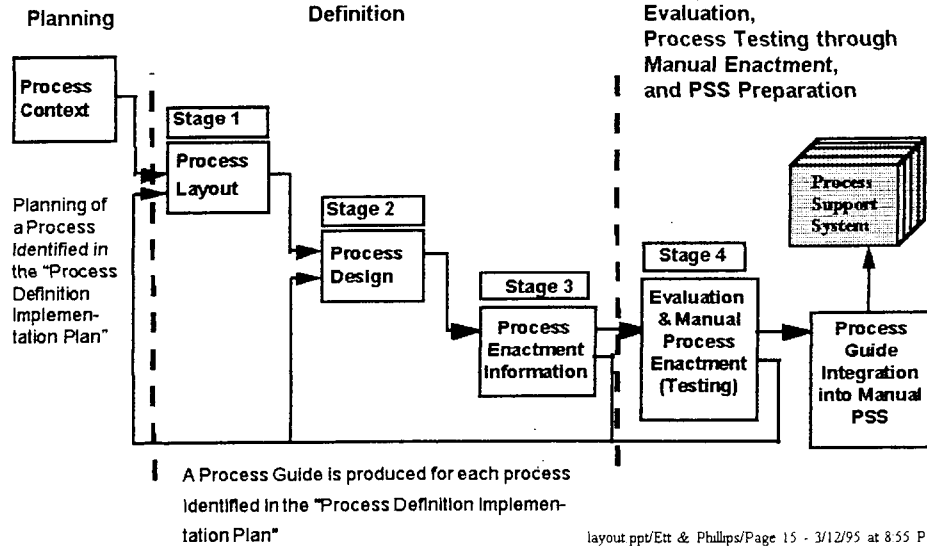


## Process Definition

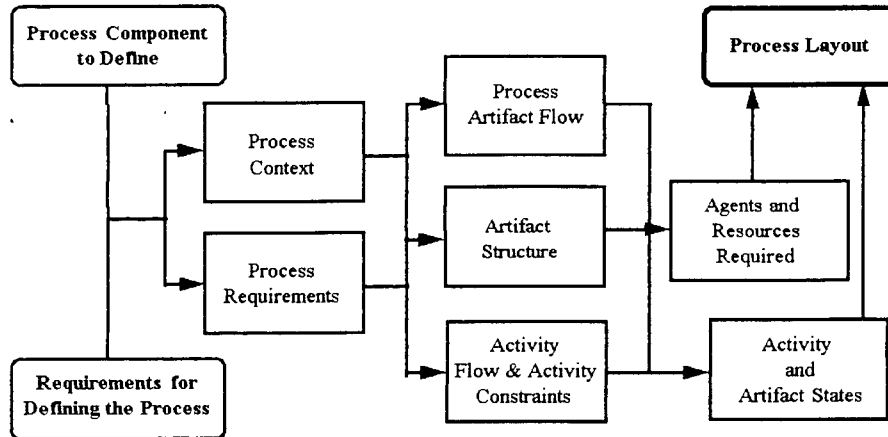




# Process Definition, Evaluation & Use

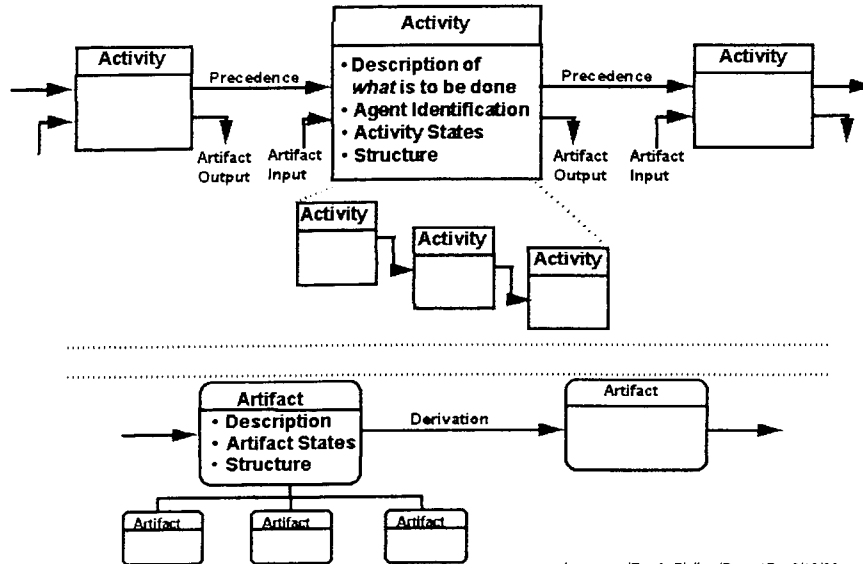


# Process Layout Objectives





## Process Layout Information



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## Describing the Artifacts of a Process

The important features of an artifact that should be described are:



| Relationships  | Behavior  | Attributes  |
|--|---|---|
| <ul style="list-style-type: none"> <li>• structure and content</li> <li>• derivation</li> <li>• used or produced by activity</li> <li>• used or produced by agent</li> </ul> | <ul style="list-style-type: none"> <li>• artifact state</li> <li>• allowable state transitions</li> </ul> | <ul style="list-style-type: none"> <li>• purpose</li> <li>• description</li> <li>• requirements, goals, and measures</li> <li>• applicable specifications or standards</li> </ul> |

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## Artifact Structure

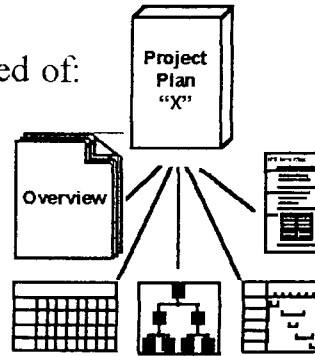
Describes the parts (components) of an artifact

- Artifact composition (part/subpart)

Artifact parts may themselves be artifacts

Example: Project Plan "X" is composed of:

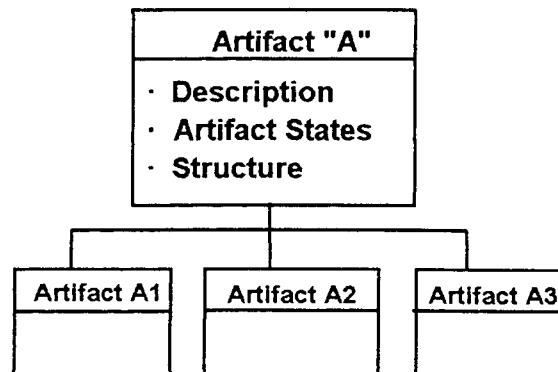
- Overview section
- Work breakdown structure
- Size, effort, and cost estimates
- GANNT chart
- Methods/procedures



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## Artifact Structure



Artifact "A" has subparts "A1," "A2," and "A3."

Artifact "A1" is a subpart of Artifact "A."

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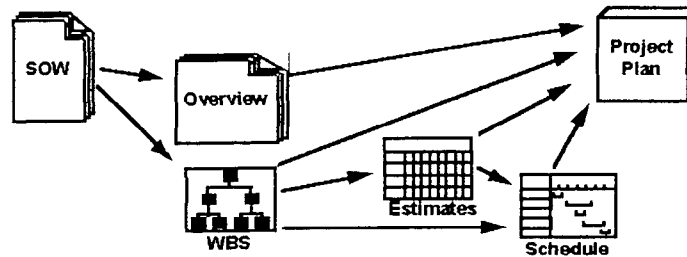


## Artifact Derivation

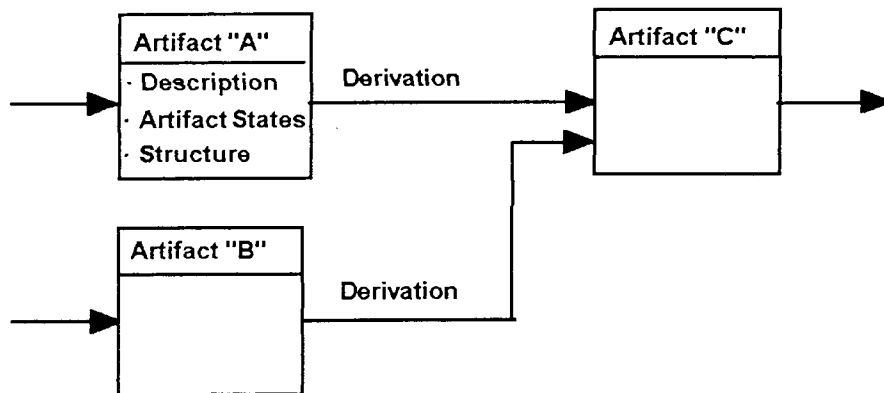
Describes precedence order based on the use of one artifact to derive another

For example:

- Project estimates are based on the WBS
- Project schedule is derived from the project effort estimates and the WBS



## Artifact Derivation



Artifact "C" is derived from Artifact "A" and "B"

Artifact "A" is used to derive Artifact "C"

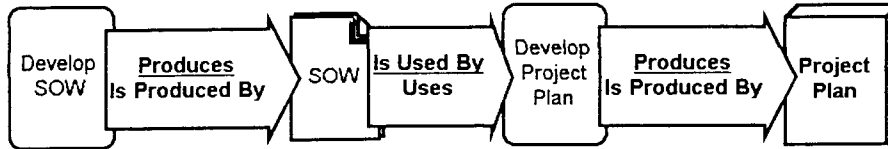


## Artifacts Used and Produced

Activities have *inputs* and produce *outputs*

Examples of this relationship:

- Activity Develop Project Plan uses artifact SOW
- Activity Develop Project Plan produces Project Plan
- Artifact SOW is used by Develop Project Plan
- Artifact Project Plan is produced by Develop Project Plan



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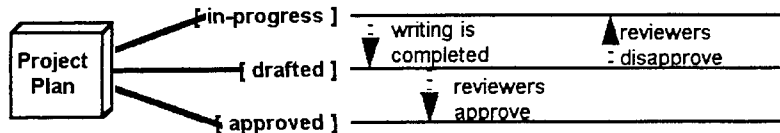


## Artifact State

- Describes the phases (or states) of an artifact
- Transitioning from artifact state to artifact state describes the evolution of the artifact in the process

Example:

A project plan evolves from *in-progress* to *drafted*, and then to either *approved* or *in-progress*



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## Describing the Activities of a Process

The important features of an activity that should be described are:



| Relationships  | Behavior  | Attributes   |
|--|---|--|
| <ul style="list-style-type: none"> <li>artifacts used and produced</li> <li>decomposition into sub-activities or procedures</li> <li>dependencies among activities</li> <li>activity control flow</li> <li>performing agent</li> </ul> | <ul style="list-style-type: none"> <li>activity state</li> <li>entry criteria</li> <li>exit criteria</li> </ul> | <ul style="list-style-type: none"> <li>purpose</li> <li>description</li> <li>goals and measures</li> <li>applicable polices</li> </ul> |



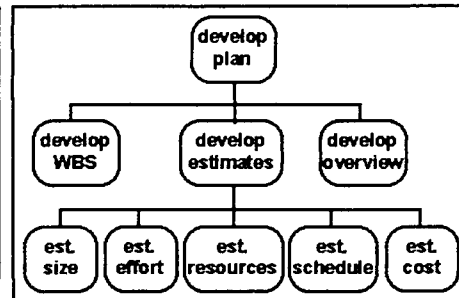
## Activity Decomposition

Activities are decomposed into steps that are:

- Lower level sub-activities (tasks)
- Methods or procedures

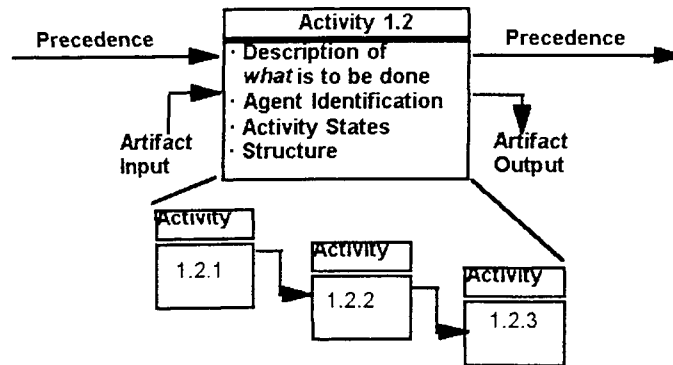
Example:

1. Develop plan
  - 1.1 Develop WBS
  - 1.2 Develop estimates
    - 1.2.1 Estimate size
    - 1.2.2 Estimate effort
    - 1.2.3 Estimate resources
    - 1.2.4 Estimate schedule
    - 1.2.5 Estimate cost
  - 1.3 Develop overview





## Activity Decomposition



Activity 1.2 has sub-activities 1.2.1, 1.2.2, and 1.2.3

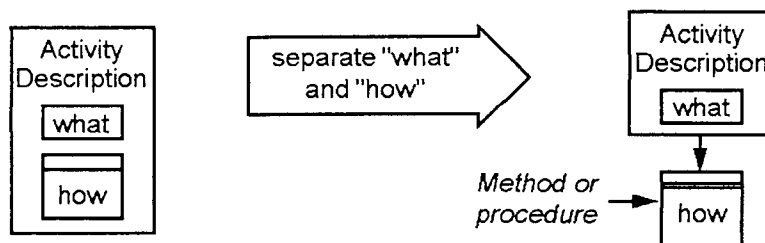
Activity 1.2.1 is a sub-activity of 1.2



## Separating "What" and "How"

An activity is described by specifying:

- "what" happens and "how" it is done
- The "how" component of an activity description should be defined in a method or procedure description separate from the activity description

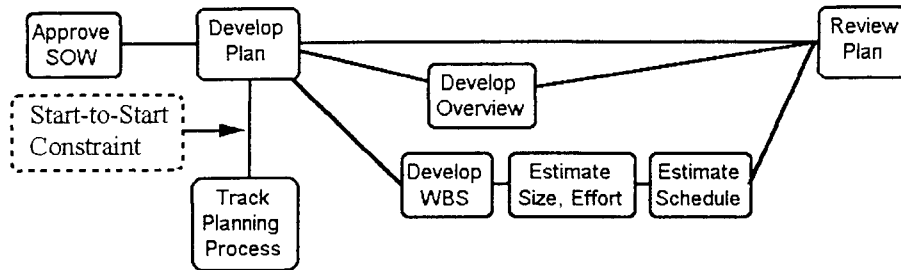




## Activity Dependencies

Activity dependencies arise from:

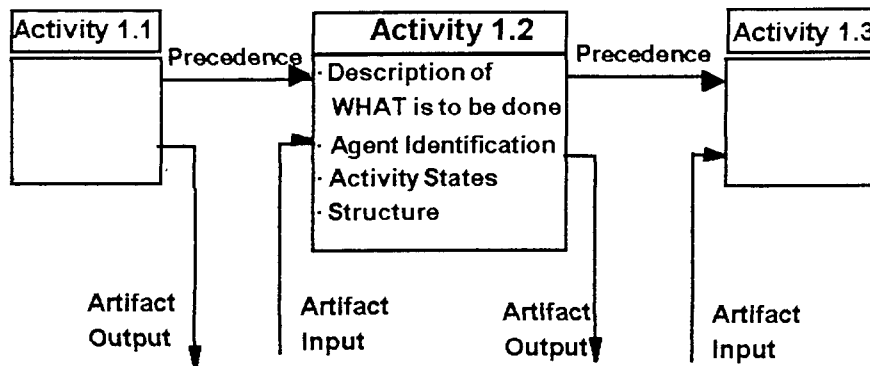
- Artifact state or use, as well as activity state
- Decomposition of activities
- Coupling of activities
- Activity constraint relationships



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## Activity Precedence



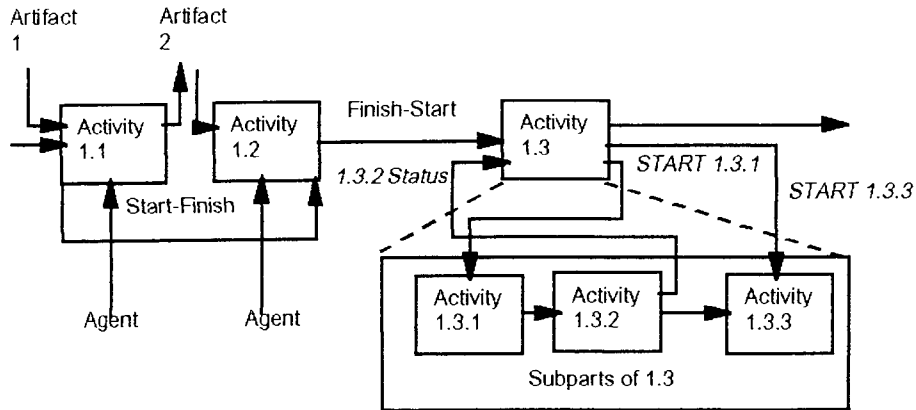
Activity 1.1 comes before Activity 1.2

Activity 1.2 comes after Activity 1.1

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## Activity Control



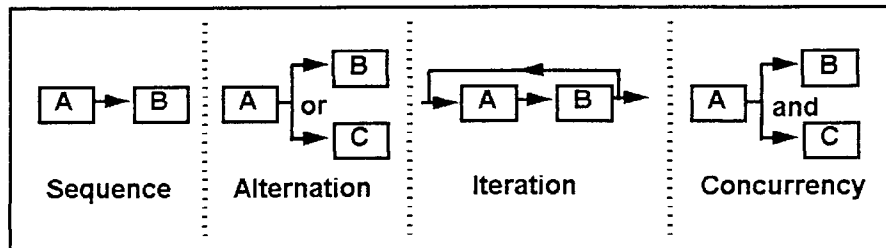
Activity 1.3 controls 1.3.1, 1.3.2 and 1.3.3.

Activity 1.3.1 is controlled by 1.3.



## Activity Flow Relationships

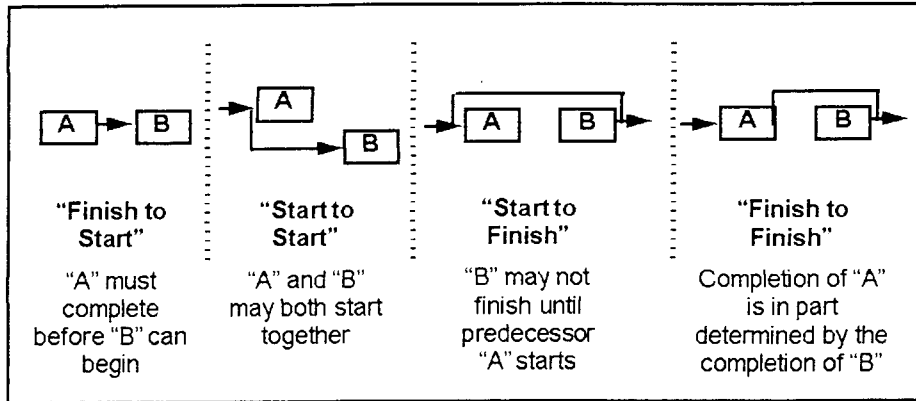
Activity flow describes the static order of Activities



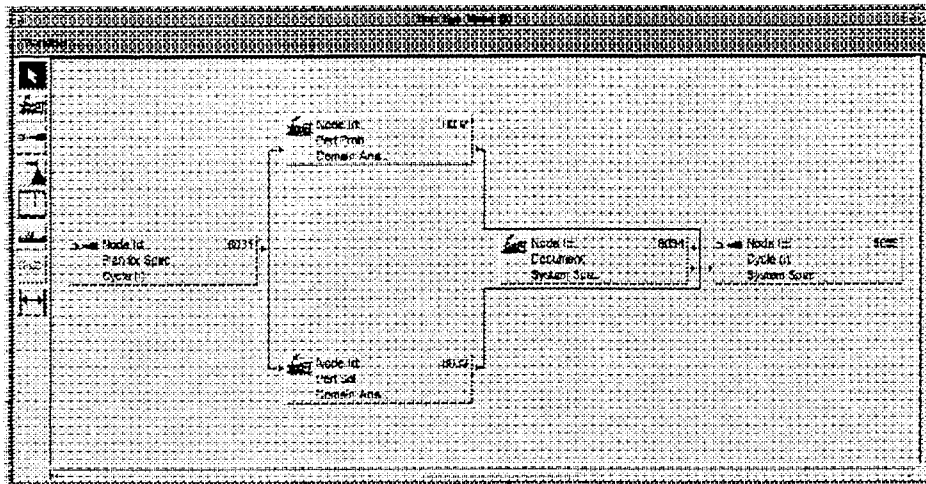


## Activity Flow Relationships

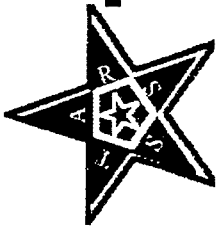
Activity flow also describes the relationships and constraints between activities



## Activity Flow Relationships

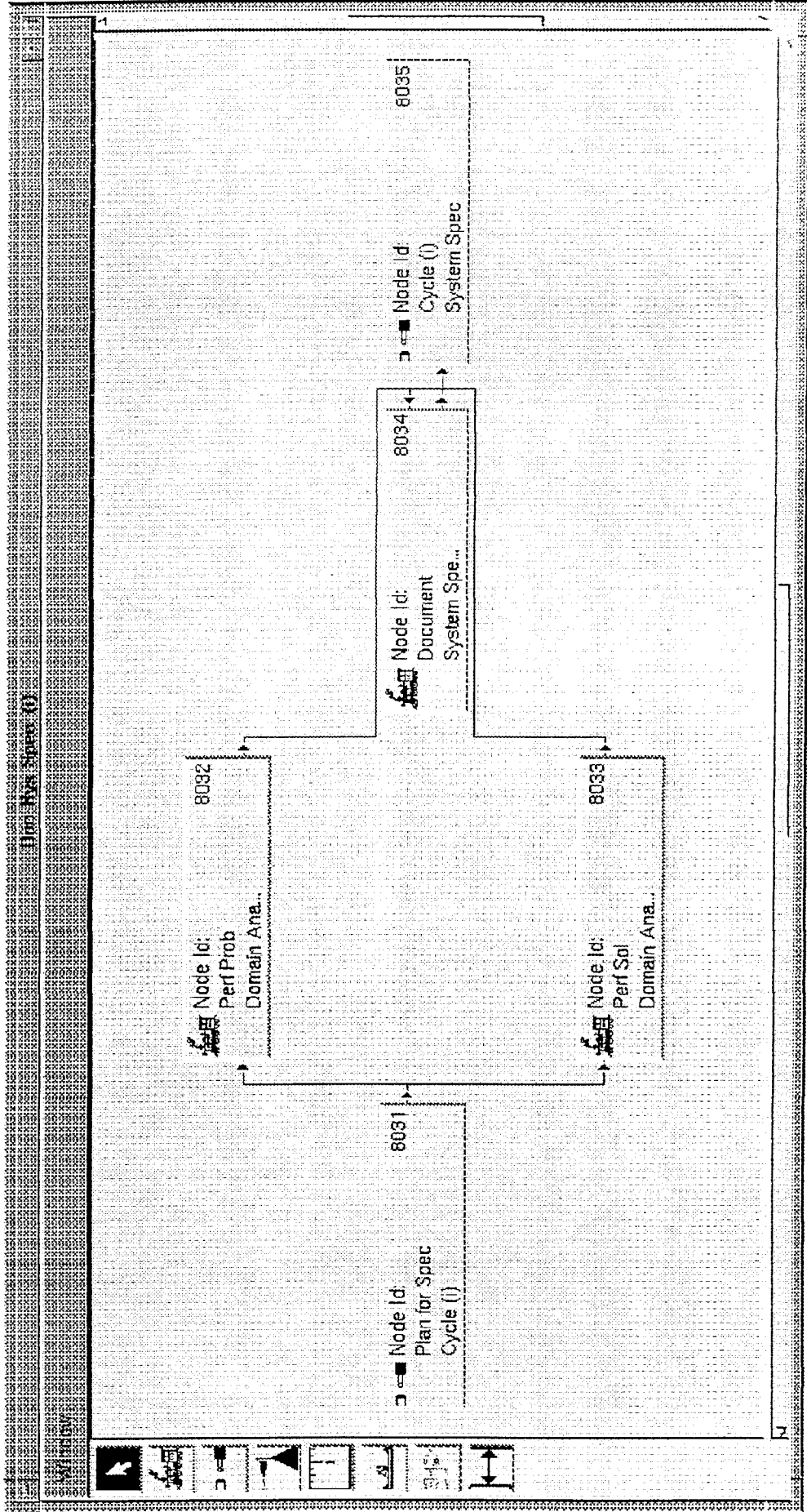


"Finish to Finish" Link Example



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# Activity Flow Relationships



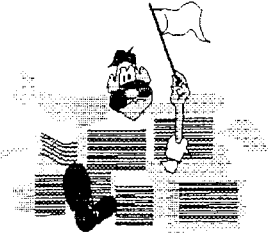
“Finish to Finish” Link Example



## Parallelism Considerations

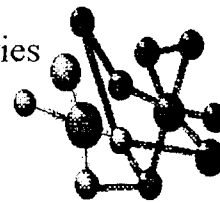
### Typical software developer's state:

- Many activities in progress
- Few activities completed
- Tendency toward activity completions  
"bunching up" at major checkpoints



### Process definer:

- Eliminate unnecessary serial dependencies
- Seek opportunities to enable multiple activities  
to be performed asynchronously
- Synchronize at milestones as necessary



## Layout Granularity Considerations

- Some granularity factors
  - **Single Agent**
  - **Method intricacy**
  - **Practitioner expertise**
  - **Availability of subprocesses/methods**
  - **Characteristics of subprocesses/methods**
  - **Goals/purpose**
  - **Process/product state change logging points**
  - **Communication/navigation decision points**
  - **Project planning support requirements**



## Process Layout

|   |  |
|---|--|
| <b>Process Guide</b>  |  |
| <b>Process Layout Section</b>   |  |
| <b>Graphic Representation</b>   |  |
| <ul style="list-style-type: none"><li>• Artifact Goal State Map (artifact derivation flow)<ul style="list-style-type: none"><li>• Artifact structure</li><li>• Artifact precedence</li></ul></li><li>• Activity Network<ul style="list-style-type: none"><li>• Activity hierarchy</li><li>• Activity precedence</li><li>• Activity relation to artifacts (inputs/outputs)</li></ul></li></ul> |  |

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## Process Layout

|   |  |
|---|--|
| <b>Process Guide</b>  |  |
| <b>Process Layout Section</b>   |  |
| <b>Textual Representation</b>   |  |
| <p>For each activity of the process:</p> <ul style="list-style-type: none"><li>• Activity description</li><li>• Identification of supporting methods and states they may change</li><li>• Identification of required resources</li><li>• Identification of agents (roles) to perform/support the activity</li></ul> |  |

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## Process Layout

| Organization/Project Repository Book   |  |
|--|--|
| Artifacts and Goal States Section  |  |
| Artifact Goal States   |  |
| For each artifact, identify:   |  |
| <ul style="list-style-type: none"><li>• Artifact state variables</li><li>• Allowable state transitions</li></ul> |  |

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## Layout Example

Refer to "*Process Definition Information Organizer Instructions*" Manual

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## Next Step: Process Design

For the assigned process:

- Verify that activity and artifact granularity is OK
- Completely describe all artifacts
- Completely describe all roles and their skill and experience requirements
- Define all required method descriptions



## Tutorial Contents

- 1 - Introduction
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### *Definition*

- 4 - Process Context
- 5 - Process Layout Specification
- ★ 6 - Process Design Specification
- 7 - Process Enactment Information Specification

### *Evaluation*

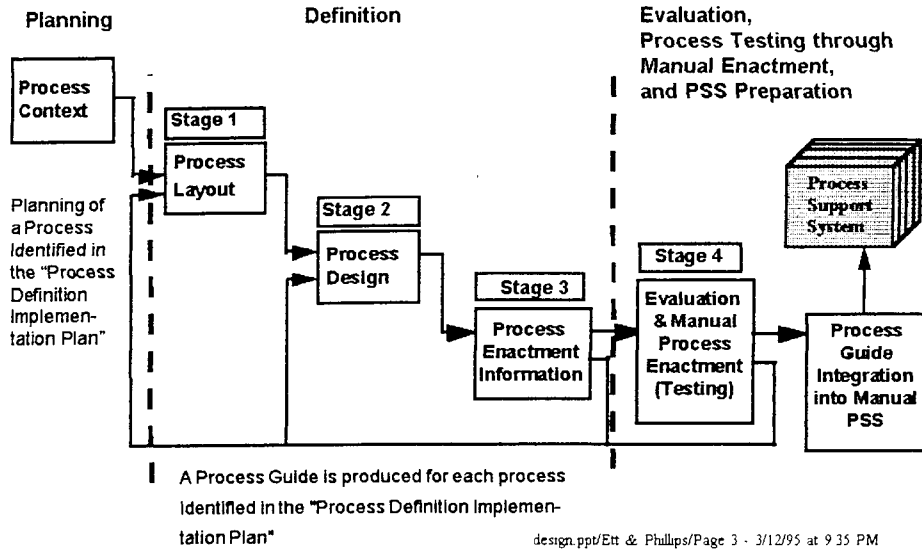
- 8 - Evaluating Process Definition Results



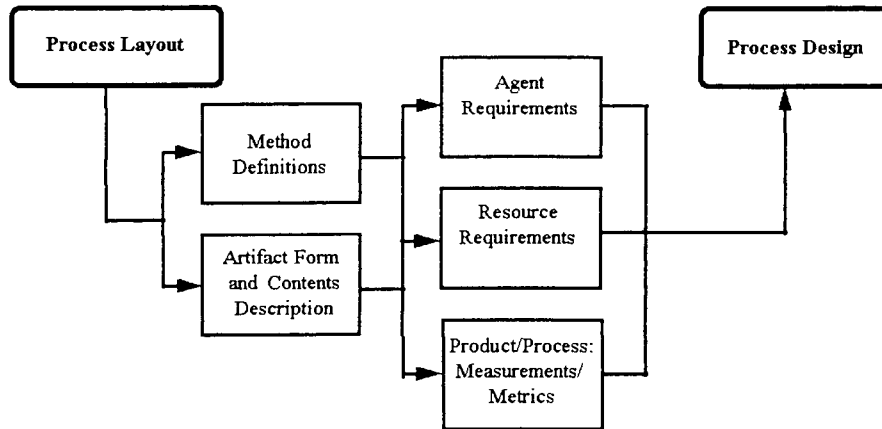
# Process Design Specification



## Process Definition, Evaluation & Use

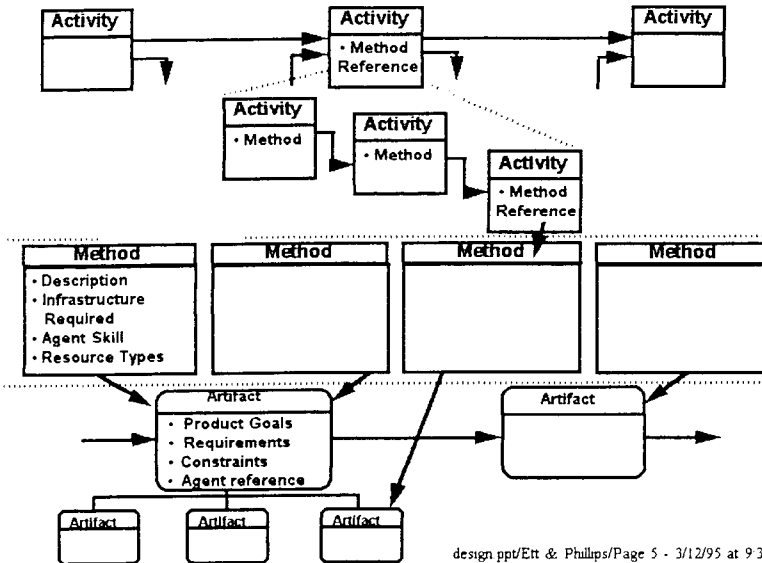


## Process Design Objectives





## Process Design Information



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## Describing the Agents of a Process

The important features of an agent that should be described are:



| Relationships   | Behavior   | Attributes   |
|---|--|--|
| <ul style="list-style-type: none"> <li>organizational structure</li> <li>activities performed</li> <li>artifacts used and produced</li> </ul> | <ul style="list-style-type: none"> <li>availability</li> </ul> | <ul style="list-style-type: none"> <li>role</li> <li>skills required</li> <li>training required</li> </ul> |

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## Roles

**Process definer:** lays out the process, defines it, and creates the Process Guide

**Practitioner:** follows or executes/enacts the process definition

– Executive, Manager, Team Leader, QA, Engineer, etc.

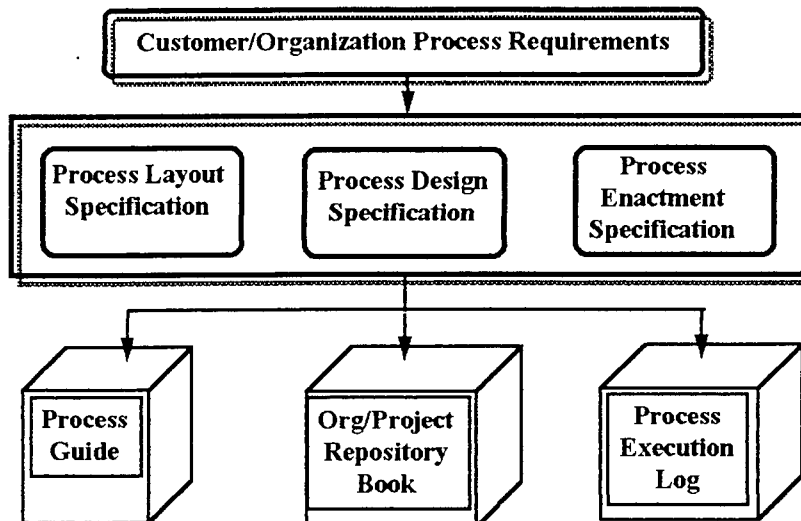
**Monitor:** tracks and evaluates status and progress, anticipates future state

– Executive, Manager, Team Leader, QA, Engineer, etc.

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## Process Definition Products



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## Process Design

### Organization/Project Repository Book

#### Artifacts and Goal States Section

##### Artifact Descriptive Information

- Artifact Purpose and scope
  - Artifact Goals
  - Artifact hierarchical structure (layout)
  - Reference to artifact specification (Artifact DID)
    - Artifact organization
    - Artifact contents
  - Artifact constraints
- Examples: Product standards, Drop dead dates, etc.

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## Process Design

### Organization/Project Repository Book

#### Artifacts and Goal States Section

##### Artifact Owner and Constraints

- Artifact Owner/Author (role identification)
- Artifact Reviewer and Approvers (role identification)
- Artifact access privileges and constraints
- Reference to artifact specification (Artifact DID)
  - Artifact organization
  - Artifact contents

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## Process Design

### Organization/Project Repository Book

#### Artifacts and Goal States Section

##### Artifact Owner and Constraints (Continued)

- Artifact constraints
  - Access permissions
  - How used/maintained
  - Who uses/maintains
- Artifact metrics to compute and collect



## Process Design

### Organization/Project Repository Book

#### Methods Section

##### Method Descriptive Information

- Method objectives
- Inputs used
- Outputs produced

##### Infrastructure Requirements

- Agent requirements (requisite skills, method training)
- Organizational and management support required
- Process system support functions required



## Process Design

### Organization/Project Repository Book

#### Methods Section (Continued)

##### Method Enactment Information

- How to achieve the objectives of the method
- How to report results

#### Agent Description Section

##### Agent role description

General experiences and skills required for the role  
Types of resources the role requires



## Design Example

Refer to Information Organizer Instructions



## **Next Step: Enactment Information Specification**

- Add enactment work paradigm steps
- Draft "Process Guide"
- Refine granularity
- Refine detailed methods
- Complete "Process Guide"



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### *Evaluation*

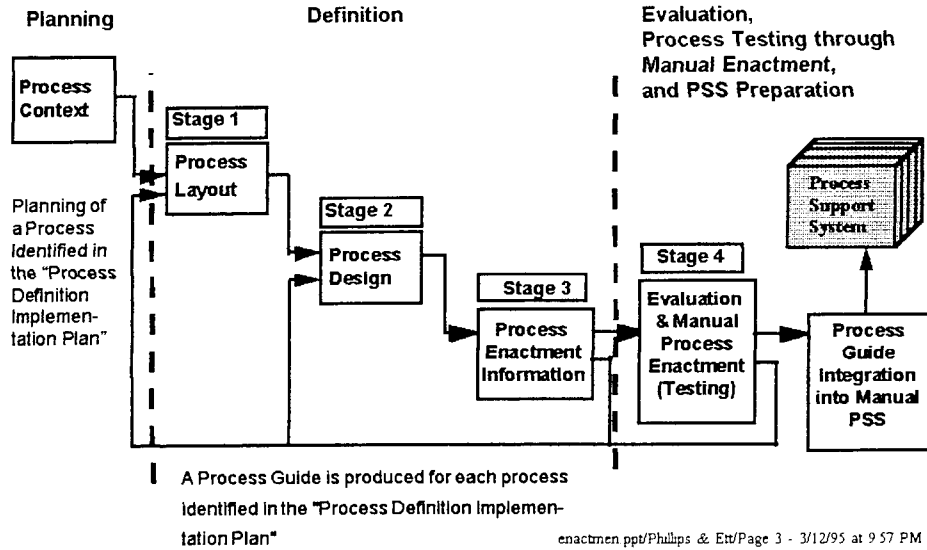
- 8 - Evaluating Process Definition Results



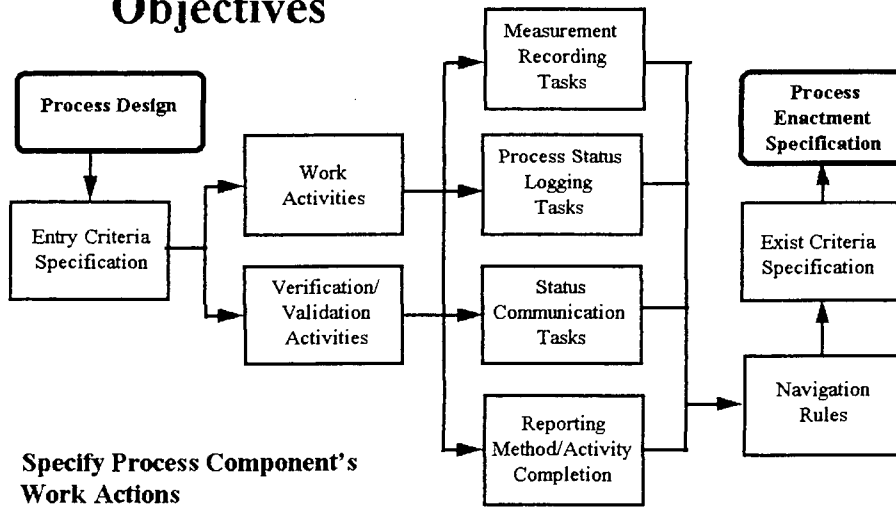
# Process Enactment Information Specification



# Process Definition, Evaluation & Use

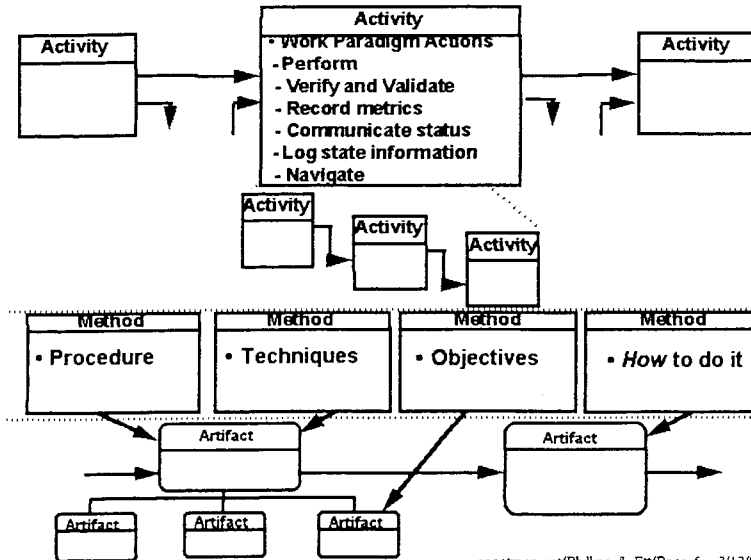


# Process Enactment Specification Objectives





## Process Enactment Information



## Concept of a Work Paradigm

### Work Paradigm

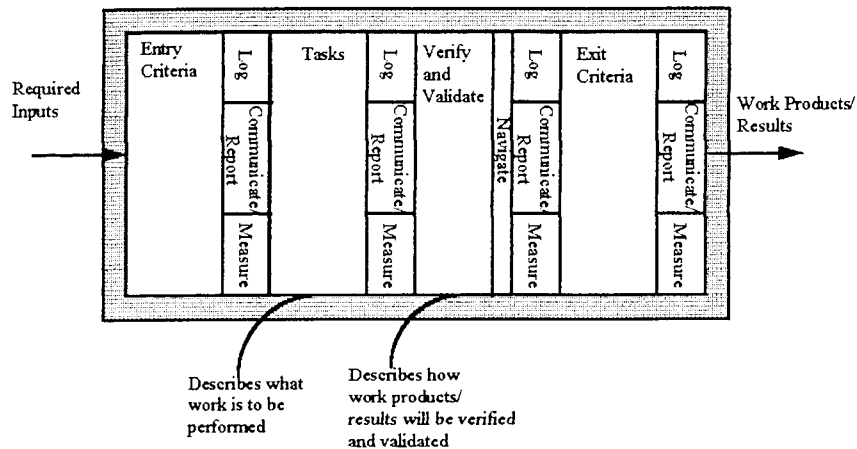
- Common set of actions to be performed within each activity
- General case across an organization or project

### Example: "ETVX" paradigm

- Test Entry criteria
- Perform Task
- Verify/validate results
- Test eXit criteria



## Extended ETVX Process Description



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## Example Work Paradigm Actions

Performing main task and logging Artifact state information for future navigation decisions

Verifying results against internal criteria

Validating results according to recipient needs

Recording process and product metrics for future improvement or contractual needs

Testing Exit Criteria and logging Activity status

Communicating status to/from dependent work

Navigating to next defined activity based on current process/product state

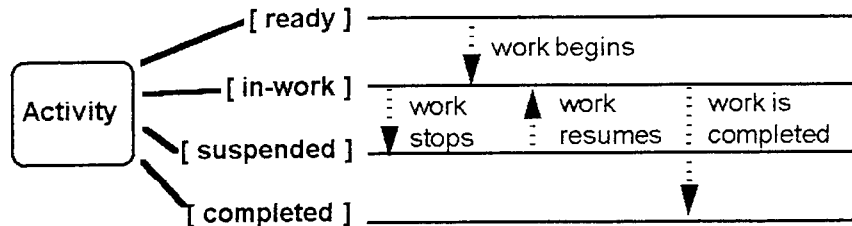
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## Activity State and Allowed Transitions

Activity state can generally be described with these four states and the transitions:

- Ready
- In-work
- Suspended
- Completed



## Activity Entry and Exit Criteria

Entry criteria define the conditions under which an activity is allowed to begin

Exit criteria define the conditions under which an activity can be declared complete, and are generally based on:

- Completion of an activity or output
- Availability of an input or agent
- Satisfaction of evaluation criteria
- State of an activity, artifact, or agent



## Concepts of Behavioral Adaptability

Exceptions to prescribed process definition stem from real-life events

Process definition must carry adequate information to accommodate these situations

Example of process navigation needs that require behavioral adaptability:

- Iteration
- Rework
- Workahead

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## Mixed Initiative Considerations

Typical developer situation from following *information-based, creative* processes such as software development or product engineering:

- Many activities in progress
- Few completed
- Parallelism the norm

To support "real life" process pragmatics:

- Support/encourage *workahead* by means of *permissive Entry Criteria*
- Enable *management control* through dependency network of *rigid Exit Criteria*

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## Optimal & Mandatory Entry Criteria

Entry criteria are either *optimal* or *mandatory*

Optimal entry criteria are those that should be met before the activity begins, but may be deferred to allow work-ahead

Mandatory entry criteria are those that must be met before the activity begins

Deferred entry criteria must be satisfied before the activity may be declared complete

**Note:** exit criteria should always be mandatory



## Process Enactment

### Process Guide

### Process Enactment Section

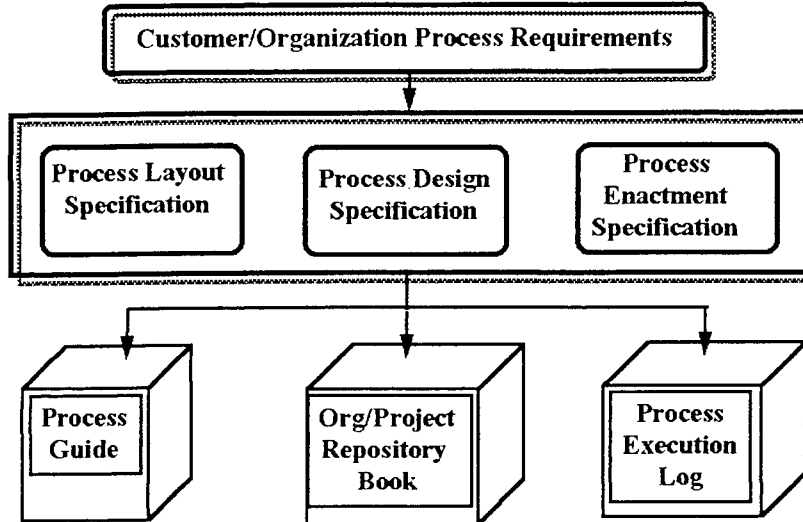
For each activity in the process, specify -

Activity Work Paradigm Actions:

- Test the entry criteria
- Perform the activity main task
- Verify main task results
- Validate main task results
- Record measurements and metrics
- Communicate process status
- Navigate to next activity



## Process Definition Products



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## Enactment Information Example

Refer to "*Process Definition Information Organizer Template*" Instructions Manual

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## Next Steps

- Complete enactment information
- Complete detailed methods
- Complete all artifact DIDs
- Complete Process Guides
- Prepare Project References and Execution Logs
- Review Process Guide, Organization/Repository Book entries, and Process Execution Log
  - Revise as appropriate
- Evaluate all process definition products

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### *Evaluation*

- ★ 8 - Evaluating Process Definition Results

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STARS Program  
LORAL Federal Systems

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# Evaluating Process Definition Results

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LORAL Federal Systems

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# Discussion

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