Disciplined Software Engineering
Lecture #14

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

Sponsored by the U.S. Department of Defense

Lecture # 14 Overview
Process terms

Why define a process

Process definition
• process elements
• process architecture
• process evolution

A process development process
Selected Process Terms - 1

Accuracy - the degree to which the process produces the intended result

Agent - the person or machine that enacts the process

Fidelity - the faithfulness with which the process is followed

Fitness - the degree to which the agents can faithfully follow the process

Selected Process Terms - 2

Precision - the degree to which the process-defined actions produce accurate results

Process architecture - a process design framework

Process definition - a process implementation

Process design - an embodiment of a process architecture
Selected Process Terms - 3

Process element - a component of a process

Process script - a process definition suitable for a human agent

Process step - an atomic process action with no visible external substructure

Process tailoring - the act of adopting a process design to support a particular purpose

Why Define a Process

The principal purpose of a defined process is to help agents to faithfully enact it.

To help to automate the process

To provide a framework for process measurement

To improve the process - if you don’t know what you are doing, you can’t improve it
Software Process Elements

Defined scripts for performing the tasks

A set of planning, tracking, and recording forms and templates

A set of standards and checklists

An improvement procedure, with process improvement proposal (PIP) forms and facilities

Process Formats

There are many possible process formats.

A convenient format is helpful but not critical.

The textbook follows the principles of information mapping.
Information Mapping

The principles of information mapping
• group information into manageable chunks
• place only like things together in chunks
• provide a label for each chunk
• be consistent with terms, organization, format
• use tables, illustrations, diagrams
• write at the most usable level of detail
• provide a clear hierarchy of chunks

Process Architecture - 1

Process architecture: a conceptual framework for consistently incorporating, relating, and tailoring process elements into enactable processes

An effective process architecture
• provides consistency among processes
• facilitates unit process development and reuse
• identifies missing process elements
• enables the use of consistent support tools
• provides a common measurement framework
Process Architecture - 2

Process architectures will ultimately be very helpful in guiding process development.

At present, no general process architectures have been developed and there are no guidelines for their development.

Until we have experience with developing multiple related processes, we will not likely be able to develop sound process architectural principles and guidelines.

Defining the Software Process

The steps in defining a software process are
• determine agent needs and priorities
• define process objectives, goals and quality criteria
• characterize the target process
• characterize the current process
• establish the development strategy
• define the initial process
• validate the initial process
• install and enhance the process
Agent Needs and Priorities - 1

The actions involved in determining agent needs and priorities are

* identify the potential process agents
* determine the nature of the products that the process is to produce
* identify the principal product attributes
* determine the relative priorities of these attributes
* determine the process features needed to produce these attributes

Agent Needs and Priorities - 2

Note the relationships among the product attributes and the process features

* strong
* medium
* weak

Categorize these process features into priorities

* HP - high priority
* P - priority
* N - needed
* NN - not needed
Objectives, Goals, Quality

To determine the process objectives, goals, and quality criteria define what a good process would look like to each using constituency.

• the product customer
• the agents
• project management
• organization management

Considering the agent’s needs, set composite product and process objectives.

PSP Example

Using the PSP as an example, define the using constituencies.

• the developers of the PSP
• agents using the PSP

Specify the nature of products to be produced.

• small experimental programs
• the PSP process
• process improvement data
Example Product Priorities - 1

Highest priority
• meet the program functional objectives
• minimize the number of defects

Example Product Priorities - 2

Priority
• meet the performance objectives
• minimize the development time
• maintain the development cost within 10% of plan
Example Product Priorities - 3

Needed
• an easy to use product
• a maintainable end product
• a reusable object asset library

Example Process Priorities - 1

Highest priority
• process improvement feedback
• comprehensive process measurements
• a fully planned and tracked process
Example Process Priorities - 2

Priority
- assure minimum latent product errors
- minimize test and rework cost
- maximize process predictability

Example Process Priorities - 3

Needed
- minimize cycle time
- minimize development resource
Example Goals and Criteria - 1

Goal 1: learn how to produce an effective PSP
• process improvement proposals (PIPs) are submitted
• a process development process is used to make process updates
• process development data are gathered and used

Example Goals and Criteria - 2

Goal 2: obtain comprehensive process data
• a final report is prepared on each project
• a database is maintained for all defect data
• a database is maintained for all plan and actual project data
Example Goals and Criteria - 3

Goal 3: process and product quality
  • overall inspection efficiency is above 80%
  • test defects are below 5/KLOC
  • compile time is below 2% of total development time

Example Goals and Criteria - 4

Goal 4: process predictability
  • the estimate to actual standard deviations are under 20%
The Target Process - 1

The target process is used to relate process objectives to the process design.

By setting a long-term direction, the target process guides process improvement priorities.

The Target Process - 2

Since a target process will likely be hard to define, some helpful initial steps are to

- examine other processes
- use available data on the current process
- define an early experimental version as a learning vehicle

At a minimum, the target process should contain

- a high-level listing of the principal steps
- key process measures
- the principal improvement goals
The Target Process - 3

Ask some questions about the target process
• which steps are currently performed?
• which steps are and are not well understood?
• which steps will be frequently repeated?
• which steps will likely use the most resources?
• where do you expect the most problems?

Use the answers to guide your prototype studies and improvement priorities.

The Current Process - 1

How well do you understand the current process?
• can you describe the principal steps?
• do you know how these steps relate?
• do you know the resource distribution among these steps?

Does each step have defined entry and exit criteria?

Does your current process have known serious deficiencies?
The Current Process - 2

Is the current process planned and tracked?

Is it well enough measured to permit quantitative improvement plans?

Is there a current quality baseline?
  • resource distribution
  • defect rates
  • schedule and cost performance

Process Development Strategy

Ask some questions about the steps in the current process.

Establish some initial priorities.

Define the initial process.

Test and adjust the initial process.
Current Process Questions

Which steps
- are and are not well understood?
- are frequently repeated?
- use the most resources?
- cause the most quality problems?
- have the most management problems?
- have the most technical problems?

Initial Priorities

Include the following items in an early process version
- an initial planning phase
- basic resource and product measures
- some initial quality measures
- documented estimates of all measured items
- planning and reporting forms for all measures
- a process completion report
- a postmortem phase for data gathering, data analysis, and reporting
Define, Test, and Adjust

Follow the abstraction paradigm
• first define the total process as a single step
• second define each subprocess step
• then continue until the process is appropriately refined
• use a standard format

Focus on process quality
• do a walkthrough with available data
• do an initial test with a small project
• encourage user feedback

Definition Level

A process captures knowledge; you must have knowledge to develop a good process.
• only generally define the steps you know well and that do not cause current problems
• study and measure the steps you do not understand before attempting to define them
• on steps you generally understand, define a little more than you know and revise the definition as your knowledge improves
Defining Process Steps

Use a standard step definition template to ensure you include all the necessary items.

- purpose
- responsibilities
- products produced
- inputs
- tasks
- methods, procedures, and standards
- entry criteria
- exit criteria
- next steps

Process Definition Guidelines

Start with your current process.

- make minimal initial enhancements
- only define things you know reasonably well how to do
- if you know a step well, focus elsewhere
- if a step is confusing, experiment or talk to someone who knows how to do it
- expect to get it wrong the first time
- plan to prototype and test
- plan for perpetual enhancement
- make improvements in small steps
Process Evolution

To evolve and improve your process
• it must be defined
• it must reasonably represent what you do

You must
• know where you want to go
• be willing to experiment
• observe and measure your own performance

Expect process evolution to take time.

The 4 Processes

what you do

what you think you do

what you are supposed to do

what you want to do
Start By Converging

what you do

what you are supposed to do

your initial process

what you think you do

what you want to do

Evolving Your Process - 1

Your first objective should be to converge what you do, what you think you do, and what you are supposed to do to a common process.

Convergence is an iterative process that lasts throughout process development and evolution.
Evolving Your Process - 2

Process convergence is critical because
• until converged, improvement actions will often not affect behavior
• convergence provides a deeper understanding of the current process
• convergence can result in substantial behavior modification

Process Development Process

Start with a simplified process definition

Plan and measure your work
• record development time per process category
• count the numbers of product items by category
• define productivity measures
• plan every process development
• keep a record of each process development
• produce a summary report for each process development
A Process Development Process

Lecture #14 Assignment

Complete the final report.

Update the process used to develop the midterm report and use it to develop the final report.

Turn in the updated process, the plan for the work, the actual data for the work, and the final report.

Consult the report specifications in Appendix D.
Messages to Remember from Lecture 14

1. Process development is an evolutionary process.

2. You must understand your process before you can properly define it.

3. Process development is a process that should also be defined, measured, and managed.