Domain-specific Engineering

Application Engineering
Domain-specific Engineering

- Business Objectives

  Domain Engineering

  Market and Project Needs

- Customer Needs

  Domain

  Application Engineering

  Application Product

  Application Uses
Responsibilities of AE

• Deliver a product to a customer
  – on schedule and within budget
  – meeting actual needs (fit for use)
  – able to be cost-effectively modified as needs change
• Comply with organizational and product line standards
• Make optimal use of DE-supplied capabilities
• Cooperate with DE to advance the product line business and achieve its long-term objectives for the market
What is Your Current AE Practice?

Product Specification

Requirements Analysis

Requirements Specification

Design

Architecture, Interface Specifications

Implementation

Code, tests, user documentation

Integration

Product
Opportunities for Improvement

• Eliminate redundant effort across projects: flexible reuse of all or parts of every work product
• Reuse and tailoring criteria applied consistently across all work products of the process
• Avoid multiple equally good solutions: standardize one “best” way to do everything and simplify tools and procedures
2 Alternative AE Process Models

• Augmented
  – Same activities and workflow as current practice
  – Explicit focus on best reuse opportunities per work product
  – Reuse is planned and managed
  – 50-100% productivity improvement target

• Streamlined
  – Automation is introduced to mechanize the process
  – Work products are derived views of a unified product
  – Product is represented in terms of product family variabilities (how is it different from all others?)
  – 2.5-10x productivity improvement target
An Augmented Application Engineering Process

- Requirements
- Design
- Implementation
- Domain Infrastructure

- Requirements Analysis
- Design
- Implementation

- Product Spec.
- Rqmts. Spec.
- Arch., Intfc. Specs.
- Code, etc.
A Typical Work Product Task

1. Analyze work product requirements
2. Survey available domain assets
3. Define the structure of the work product (outline/diagram of parts and relationships)
4. Select and retrieve assets for reuse
5. Tailor assets for better fit
6. Construct unmatched parts
7. Evaluate the work product against its requirements
8. Revise work product as needed to satisfy requirements

work product examples:
requirements specification, interface specification, code, user documentation
Augmented Process Properties

Benefits
- Leverage expertise of expert developers across projects
- Avoid repeated redevelopment of recurring similar parts, easy or hard
- Focus AE project effort on application-specific parts

Costs/Risks
- Less availability of expert developers for project work
- Loss of investment if assets do not suit future needs
- Loss of investment if assets are not reused
Streamlined Process Properties

Benefits

– Refocus projects on deriving whole-products by specification of key problem/solution attributes
– Standardize how the entire project works
– Standardize the form and content of products with a minimum of deviation accepted

Costs/Risks

– Less availability of expert developers for project work
– Loss of investment if assets do not suit future needs
– Loss of investment if assets are not reused
Streamlined Document Preparation

Wrong way:
– Provide a boilerplate filled document template
– Allow developers to add/modify “as needed”

Right way:
– Provide a “complete” document annotated with instructions on where and how to make any allowed addition, modification, or deletion
– Write instructions in terms of specific “decisions” that developers need to make to create the right document
– Base all documents on one set of decisions that are sufficient to describe different products
Project Management

Context: Customer needs

Needed Expertise:

– Project planning, monitoring, and control
– Coordination and control of staff and resources

Responsibilities:

– Organize and staff an application project
– Plan, monitor, and control project resources to deliver a product

Work Product: Project Plan
Project Management

Customer Needs

Evaluate Risks

Risk Analysis

Set product & risk objectives

Objectives

Issues

Monitor progress to schedule

Schedule

Allocate resources
Application Modeling

Context: Customer needs

Needed Expertise:
- Requirements analysis
- Validation and assessment techniques

Responsibilities:
- Analyze customer requirements to specify a corresponding Application Model
- Validate the Application Model to customer needs
- Assess alternative Application Models to resolve tradeoffs among needs

Work Product: Application Model
Application Modeling

Customer Needs

Problem Analysis & Specification

Solution Analysis & Validation

Application Model (Domain-specific notation)
Application Production

**Context:** Application Model

**Needed Expertise:**
- Work product generation mechanisms
- Product verification techniques

**Responsibilities:**
- Generate a standardized product and verify that it conforms to the Application Model
- Produce installation and training materials for product delivery

**Work Products:**
- Application Product
- Delivery Support
Application Production

Adaptable Components

Application Model (Domain-specific notation)

Product Generation

Verification

Delivery Support

Application Product (work products)
Delivery & Operation Support

**Context:** Application Product, Delivery Support

**Needed Expertise:**
- Training
- Customer service

**Responsibilities:**
- Install and verify the Application Product in the customer’s operational environment
- Train and support users in proper use of the Application Product and evaluate its effectiveness
- Analyze and document suggested enhancements, future needs, or problems in Product use or fit to customer needs