Models and RUP

- A model is a simplification of reality that helps us master a large, complex system that cannot be comprehended easily in its entirety.
- The model is not the reality, but the best models are the ones that stick very close to reality.
- A large part of RUP focuses on modeling.
- Multiple models are needed to address different concerns.

Architecture

- Software architecture is commonly defined in terms of components and connectors.
- Components are identified and assigned responsibilities that client components interact with through "contracted" interfaces.
- Component interconnections specify communication and control mechanisms, and support all component interactions needed to accomplish system behavior.

Alternative View -- Architecture

- Describe a system so designers, programmers, users, and managers (stake-holders) would be able to
  - Understand what the system does
  - Understand how the system works
  - Work on one piece of the system
  - Extend the system
  - Reuse part of the system to build another one

Alternative View -- Architecture

- Architecture is what remains when you cannot take away any more things and still understand the system and explain how it works.

Architecture Today

- For an organization to adopt an architecture focus, three things are required
  - An understanding of the purpose
  - An architectural representation
  - An architecture process
Users of an Architecture

• The system analyst, who uses it to organize and articulate the requirements and to understand the technological constraints and risks
• End users or customers, who use it to visualize at a high level what they are buying
• The software project manager, who uses it to organize the team and plan the development
• The designers, who use it to understand the underlying principles and locate the boundaries of their own designs
• Other development organizations (if the system is open), which use it to understand how to interact with it
• Subcontractors, who use it to understand the boundaries of their chunk of development
• Architects, who use it to reason about the evolution or reuses.

Multiple Views of an Architecture

• Similar to blueprints of a building
  – Floor plans
  – Elevations
  – Electrical cabling
  – Water pipes, central air-condition, and ventilation
  – The look of the building in its environment (in sketches)

Views in a Software Architecture

• The 4+1 View Model
  – The logical view
  – The implementation view
  – The process view
  – The deployment view
  – The user-case view

The 4+1 Views

Logical View
Implementation View
Use-Case View
Process View
Deployment View

The Logical View

• This view describes what the system does and addresses the functional requirements of the system
  – In an airline reservation system example
    • Flight database
    • Agent component
    • End-user component
    • Ticketing component
    • Billing component

The Implementation View

• This view describes the organization of static software modules and addresses the issue of ease of development, management, reuse and others.
  – In an airline reservation system example
    • Java package for database handling
    • Java classes for graphical user interface with end users and agents
    • Java library for scheduling (finding optimal route for a given request)
### The Process View

- This view describes the concurrent aspects of the system at run-time and addresses issues such as fault tolerance, deadlock, response time and throughput.
  - In an airline reservation system example
    - Which java module should start first
    - How multiple agents can access a shared database

### The Deployment View

- This view describes how the various executables and other run-time libraries are mapped to the underlying platforms and addresses issues such as installation, performance, and system requirements.
  - In an airline reservation system example
    - The agent reservation component is installed on every workstation
    - The database is a centralized one

### The Use-Case View

- Contains a few key scenarios or use cases
  - Initially these use cases are used to drive the discovery and design of the architecture
  - Later these use cases are used to validate the different views
    - In an airline reservation system example
      - Customer books a ticket
      - Customer makes change to the original ticket

### Architecturally Significant Elements

- Major classes, in particular the classes that model major business entities
- Architectural mechanisms that give behavior to these classes
- Patterns and frameworks
- Layers and subsystems
- Interfaces
- Major processes, or threads of control

### Architecture Is More Than Blueprint

- Primary objectives of the elaboration phase
  - Building the architecture
  - Validating it
  - Baselining it (prototype)
- Most important artifact associated with the architecture is an architectural prototype
  - A prototype that implements the most important design decisions
  - Validate the decisions (test and measure them)

### An Architecture-Centric Process

- RUP defines two primary artifacts related to architecture
  - The software architecture description (SAD)
  - The architectural prototype
- Three other artifacts rooted from the above two
  - Design guidelines
  - The product structure
  - The team structure
Software Architect

• Responsible for the architecture in elaboration phase
• Other team members are also involved
  – Designers focus on architecturally significant classes
  – Integrators integrate major software components
  – Testers test the architectural prototype for performance and robustness

Other Architectural Concepts

• Architectural style – may be defined by an architectural framework, set of patterns
  – Examples: pipe-and-filter, client-server, event-driven
• Architectural mechanism – a pattern that provides a common solution to a common problem
  – Examples: DBMS, an event broadcasting system, a transaction server