Development Methodologies

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SOFTWARE LIFE-CYCLE MODELS

Overview

- Build-and-fix model
- Waterfall model
- Rapid prototyping model
- Incremental model
- Extreme programming
- Synchronize-and-stabilize model
- Spiral model
- Object-oriented life-cycle models
- Comparison of life-cycle models

Software Life-Cycle Models

Life-cycle model (formerly, process model)

The steps through which the product progresses

- Requirements phase
- Specification phase
- Design phase
- Implementation phase
- Integration phase
- Maintenance phase
- Retirement

Build and Fix Model

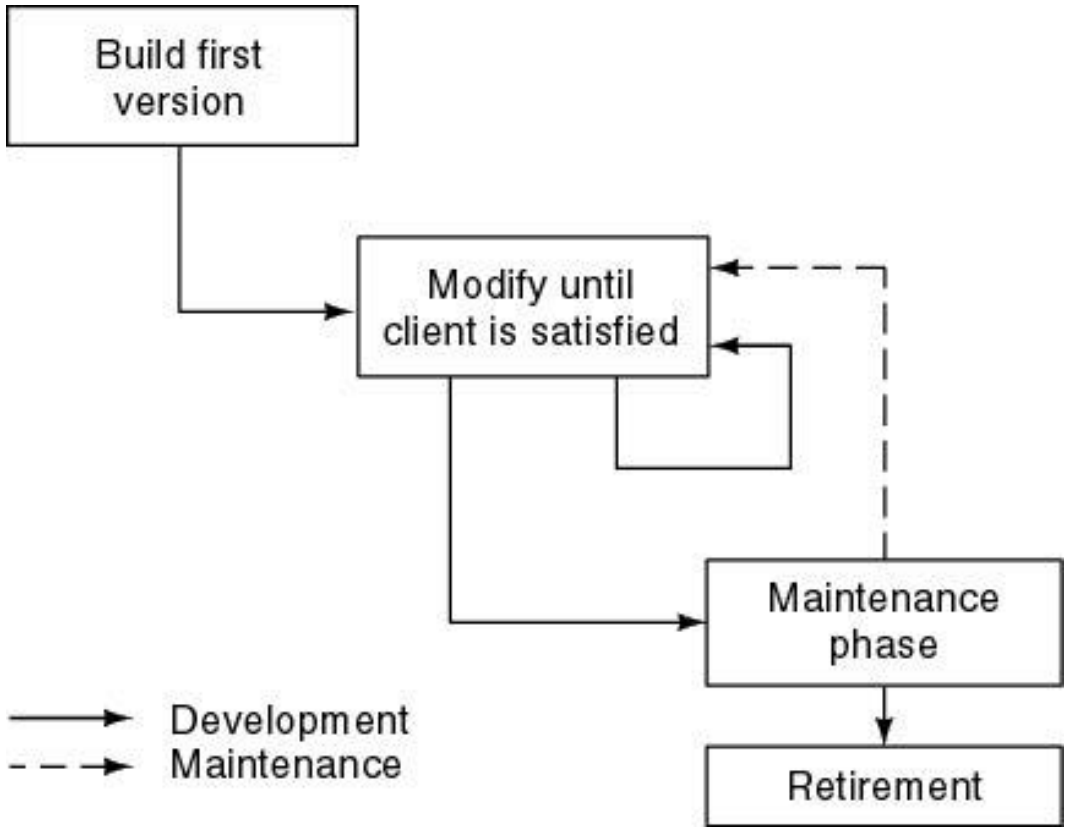
Problems

- No specifications
- No design

Totally unsatisfactory

Need life-cycle model

- “Game plan”
- Phases
- Milestones



Waterfall Model (contd)

Characterized by

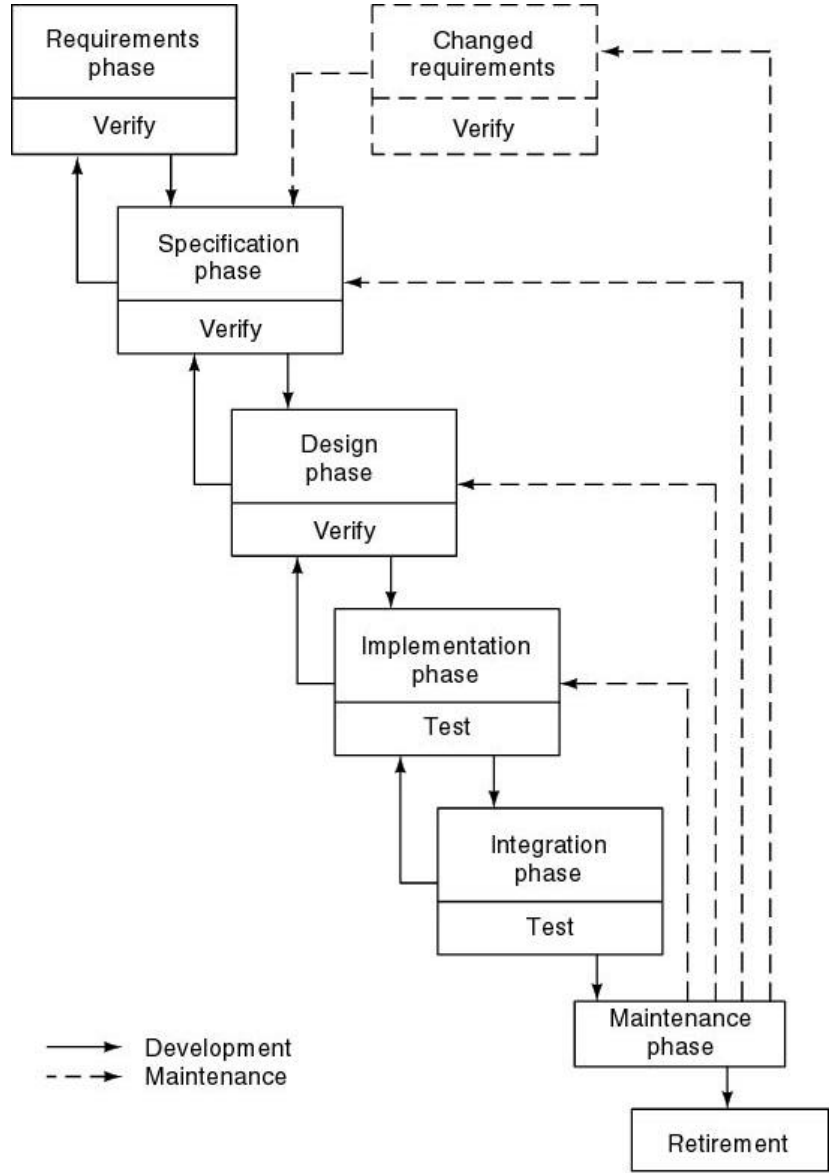
- Feedback loops
- Documentation-driven

Advantages

- Documentation
- Maintenance easier

Disadvantages

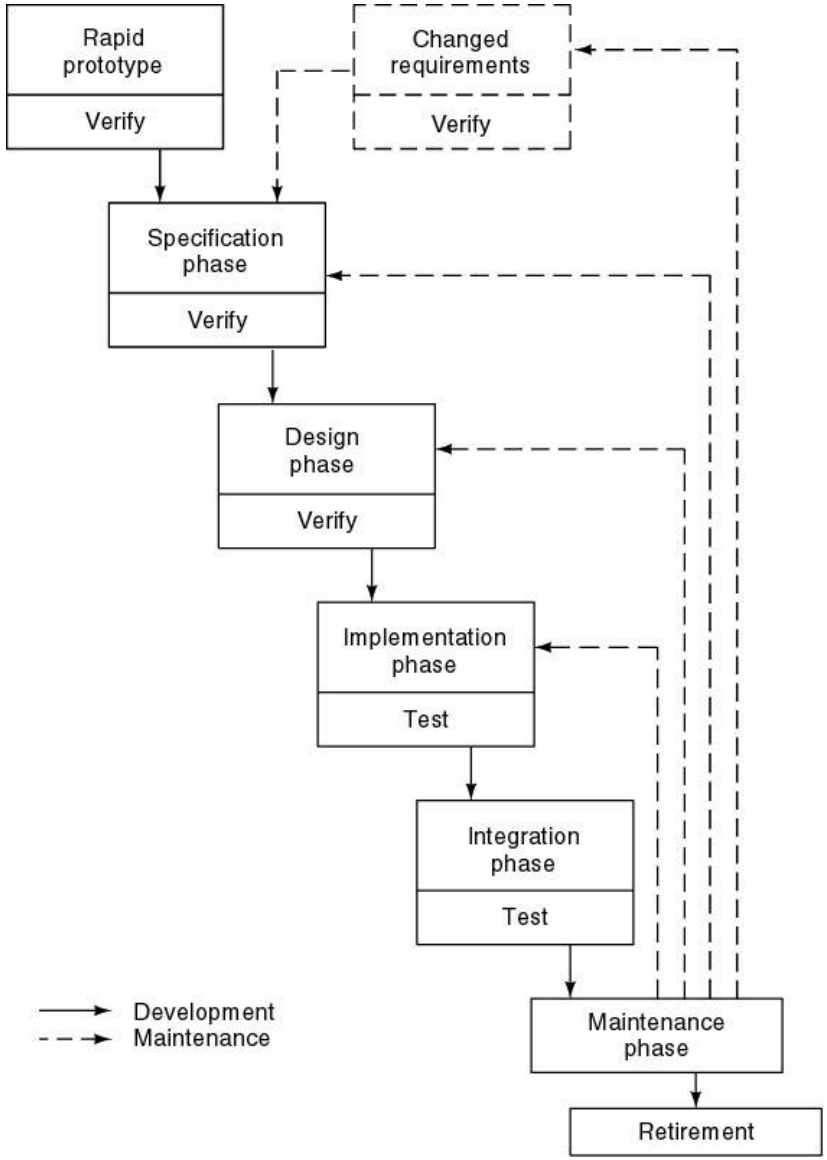
- Specifications
  - Joe and Jane Johnson
  - Mark Marberry



Rapid Prototyping Model

Linear model

“Rapid”



Three Key Points of Prototyping

Do not turn into product

Rapid prototyping may replace specification phase—*never* the design phase

Comparison:

- Waterfall model—try to get it right first time
- Rapid prototyping—frequent change, then discard

Waterfall and Rapid Prototyping Models

Waterfall model

- Many successes
- Client needs

Rapid prototyping model

- Not proved
- Has own problems

Solution

- Rapid prototyping for requirements phase
- Waterfall for rest of life cycle

Extreme Programming

Somewhat controversial new approach

- Stories (features client wants)
- Estimate duration and cost of each story
- Select stories for next build
- Each build is divided into tasks
- Test cases for task are drawn up first
- Pair programming
- Continuous integration of tasks

Unusual features

- Computers are put in center of large room lined with cubicles
- Client representative is always present
- Cannot work overtime for 2 successive weeks
- No specialization
- Refactoring (improve existing system : cost / benefit?)

Synchronize-and Stabilize Model

Microsoft's life-cycle model

- Requirements analysis—interview potential customers
- Draw up specifications
- Divide project into 3 or 4 builds
- Each build is carried out by small teams working in parallel
- At the end of the day—synchronize (test and debug)
- At the end of the build—stabilize (freeze build)
- Components always work together
- Get early insights into operation of product

Spiral Model

Simplified form

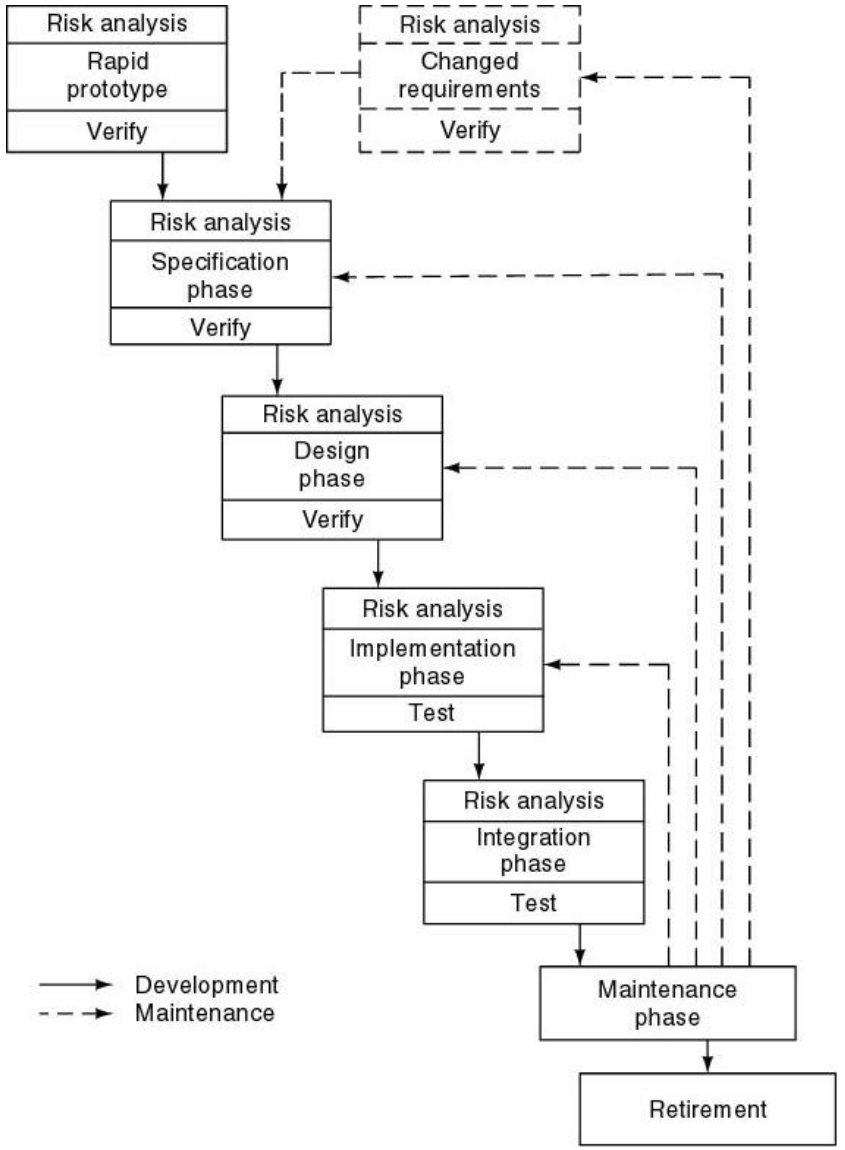
- Waterfall model plus risk analysis

Precede each phase by

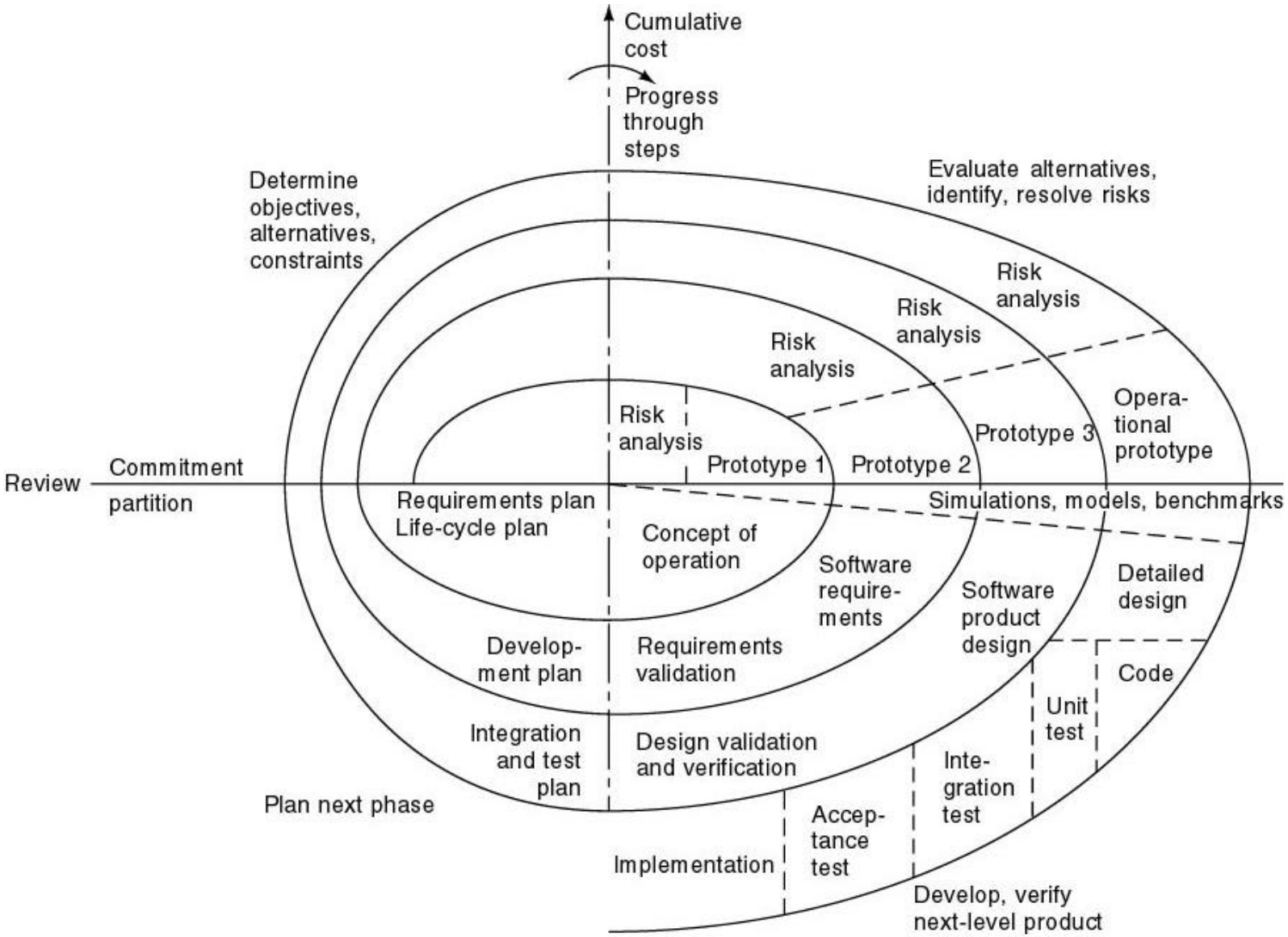
- Alternatives
- Risk analysis

Follow each phase by

- Evaluation
- Planning of next phase



Full Spiral Model (contd)



Analysis of Spiral Model

Strengths

- Easy to judge how much to test
- No distinction between development, maintenance

Weaknesses

- For large-scale software only
- For internal (in-house) software only

Object-Oriented Life-Cycle Models

Need for iteration within and between phases

- Fountain model
- Recursive/parallel life cycle
- Round-trip gestalt
- Unified software development process

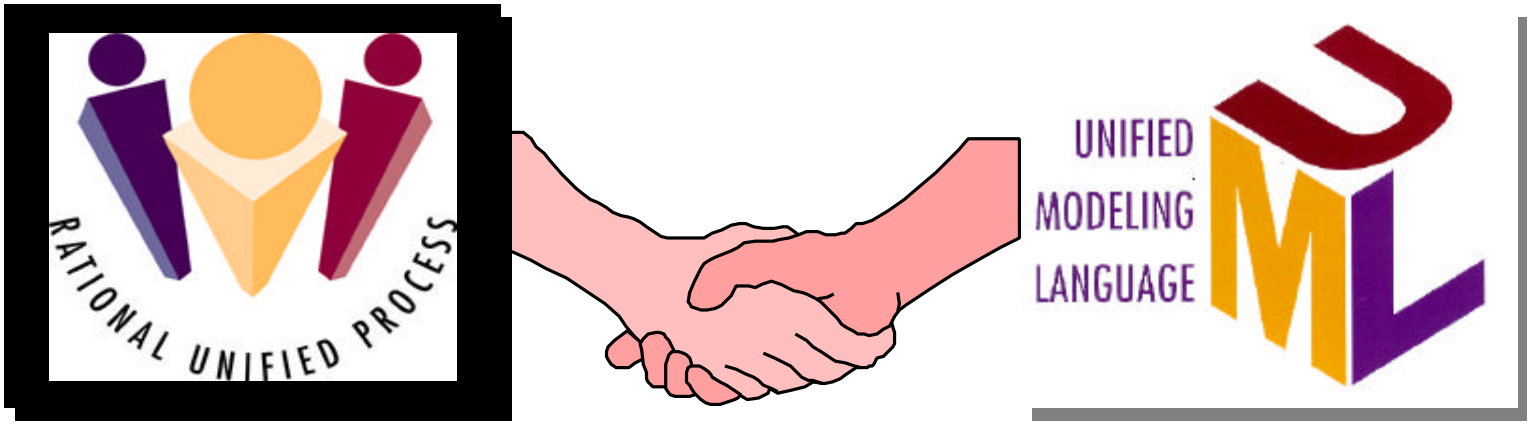
All incorporate some form of

- Iteration
- Parallelism
- Incremental development

Danger

- Infinite loop

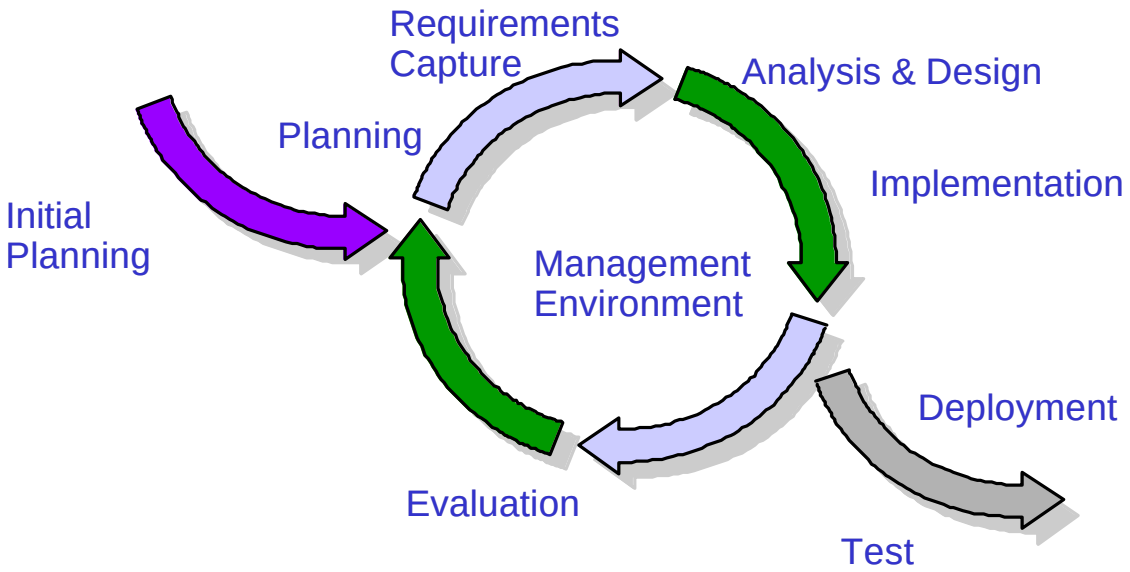
RUP – Rational Unified Process



- The Rational Unified Process and the UML — developed hand-in-hand — by Rational
- Contributions by major vendors
  - Microsoft
  - HP
  - IBM
  - Oracle
  - Texas Instruments
  - MCI SystemHouse
- Standard through OMG

1. Important Features of the Iterative Approach

- Attacks risks
- Continuous integration
- Frequent, executable releases
- Continuous end user involvement



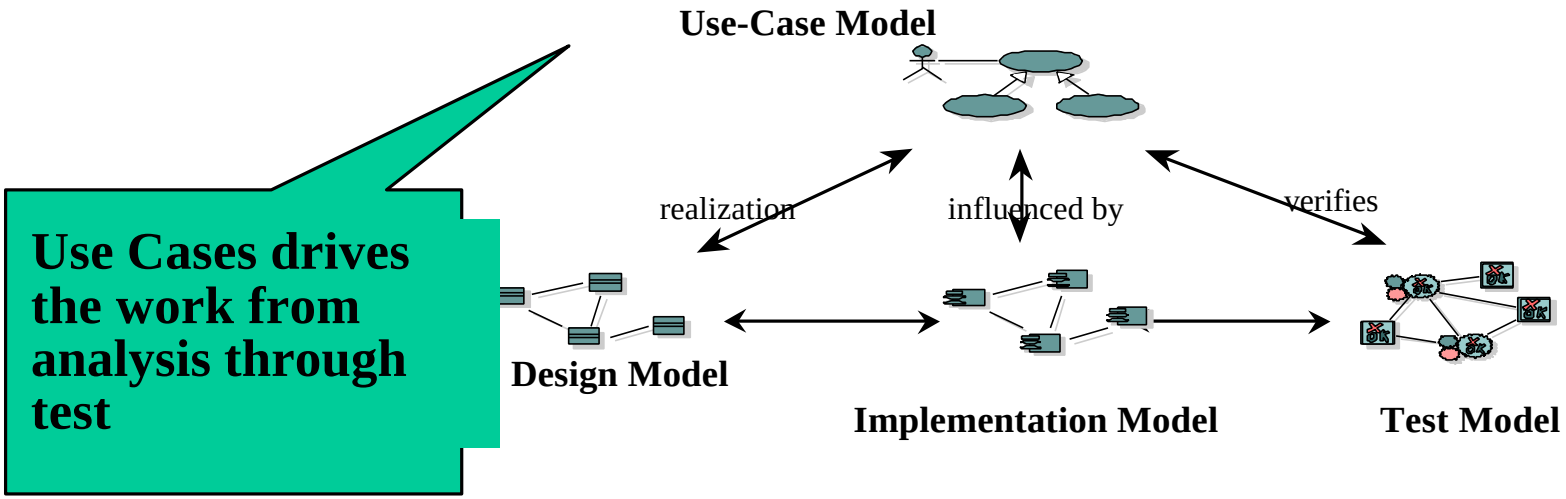
2. Manage Your Requirements

Elicit, organize, and document required functionality and constraints

Track and document tradeoffs and decisions

Business requirements are easily captured and communicated through use cases

Use cases are important planning instruments

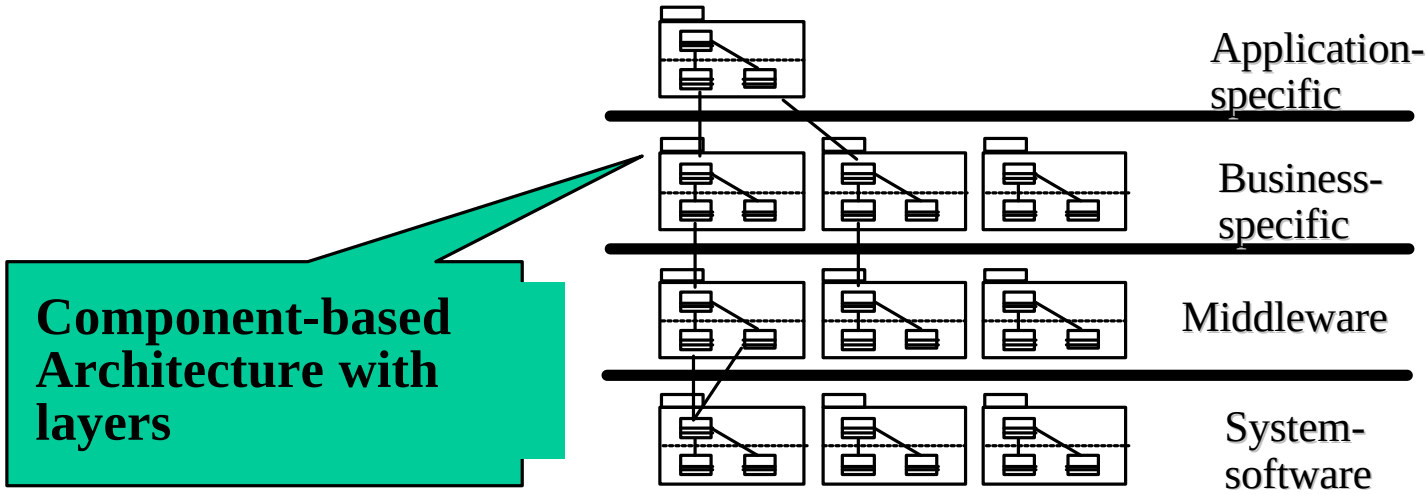


3. Employ Component-based Architecture

Design, implement and test your architecture up-front!

A systematic approach to define a “good” architecture

- resilient to change by using well-defined interfaces
- by using and reverse engineering components
- derived from top rank use cases
- intuitively understandable



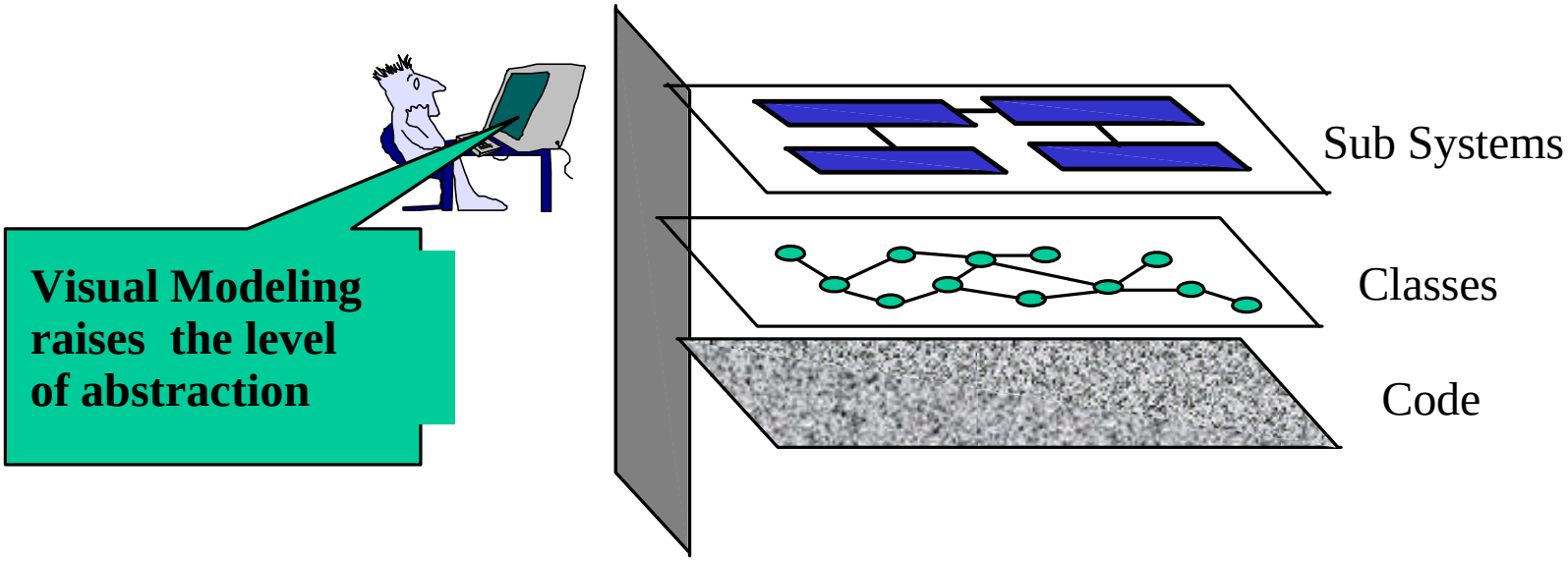
4. Model Software Visually

Capture the structure and behavior of architectures and components

Show how the elements of the system fit together

Maintain consistency between a design and its implementation

Promote unambiguous communication



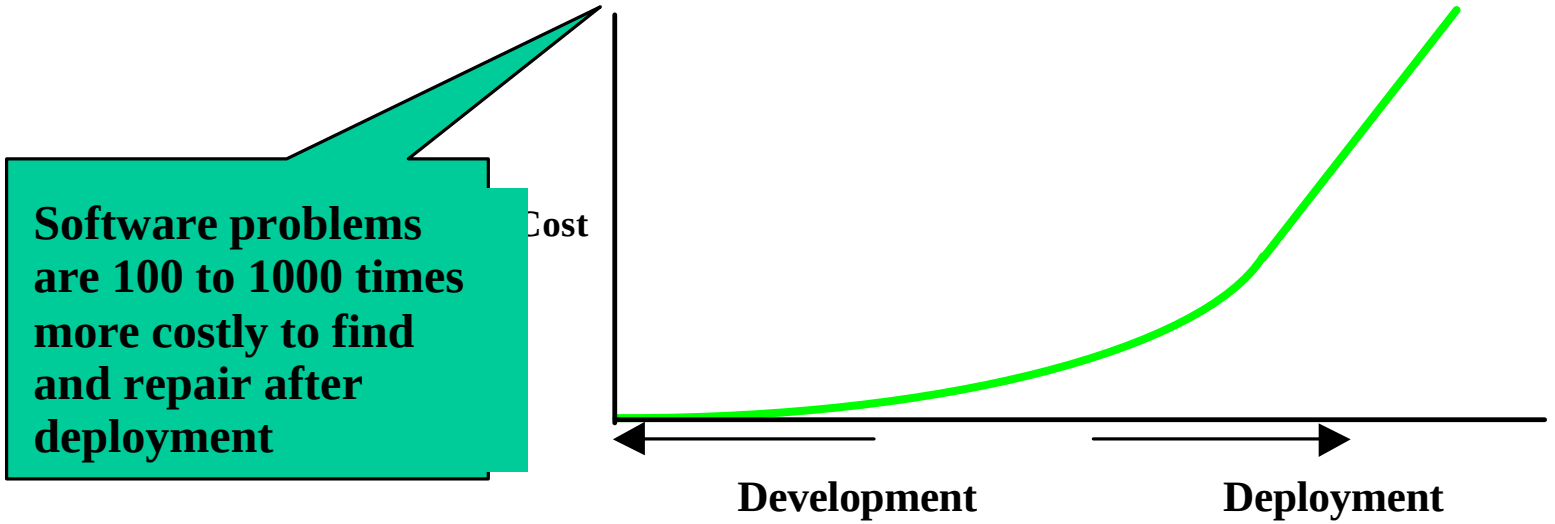
5. Verify Software Quality

Create tests for each key scenario to ensure that all requirements are properly implemented

Unacceptable application performance hurts as much as unacceptable reliability

Verify software reliability - memory leaks, bottle necks

Test every iteration - automate test!



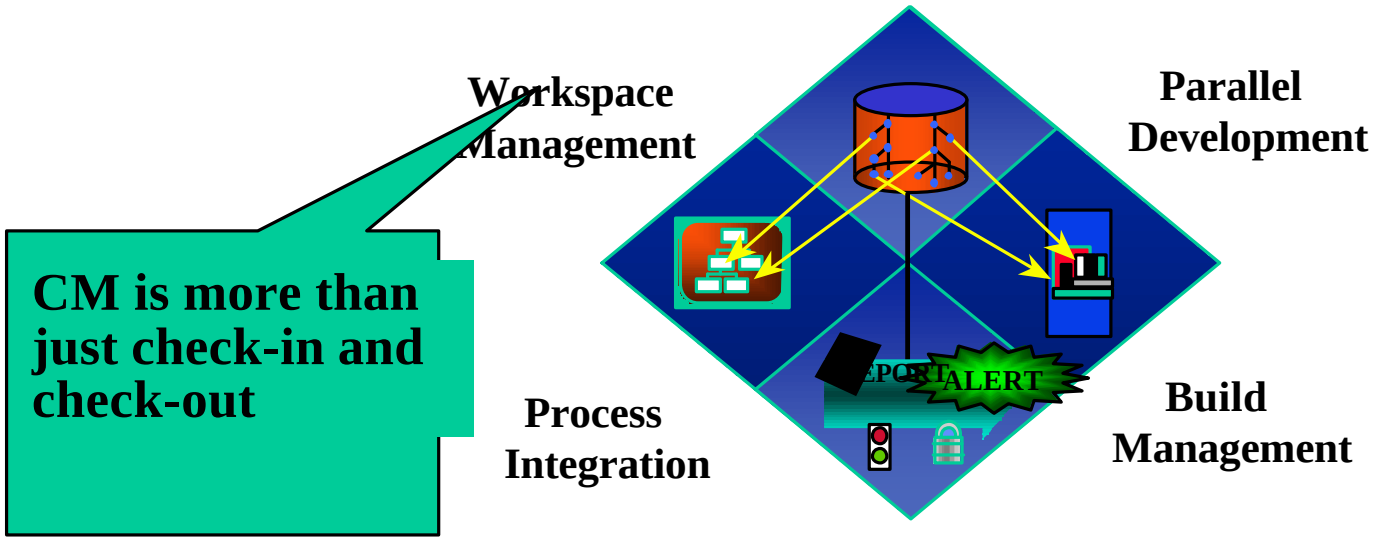
6. Control Changes to Software

Control, track and monitor changes to enable iterative development

Establish secure workspaces for each developer

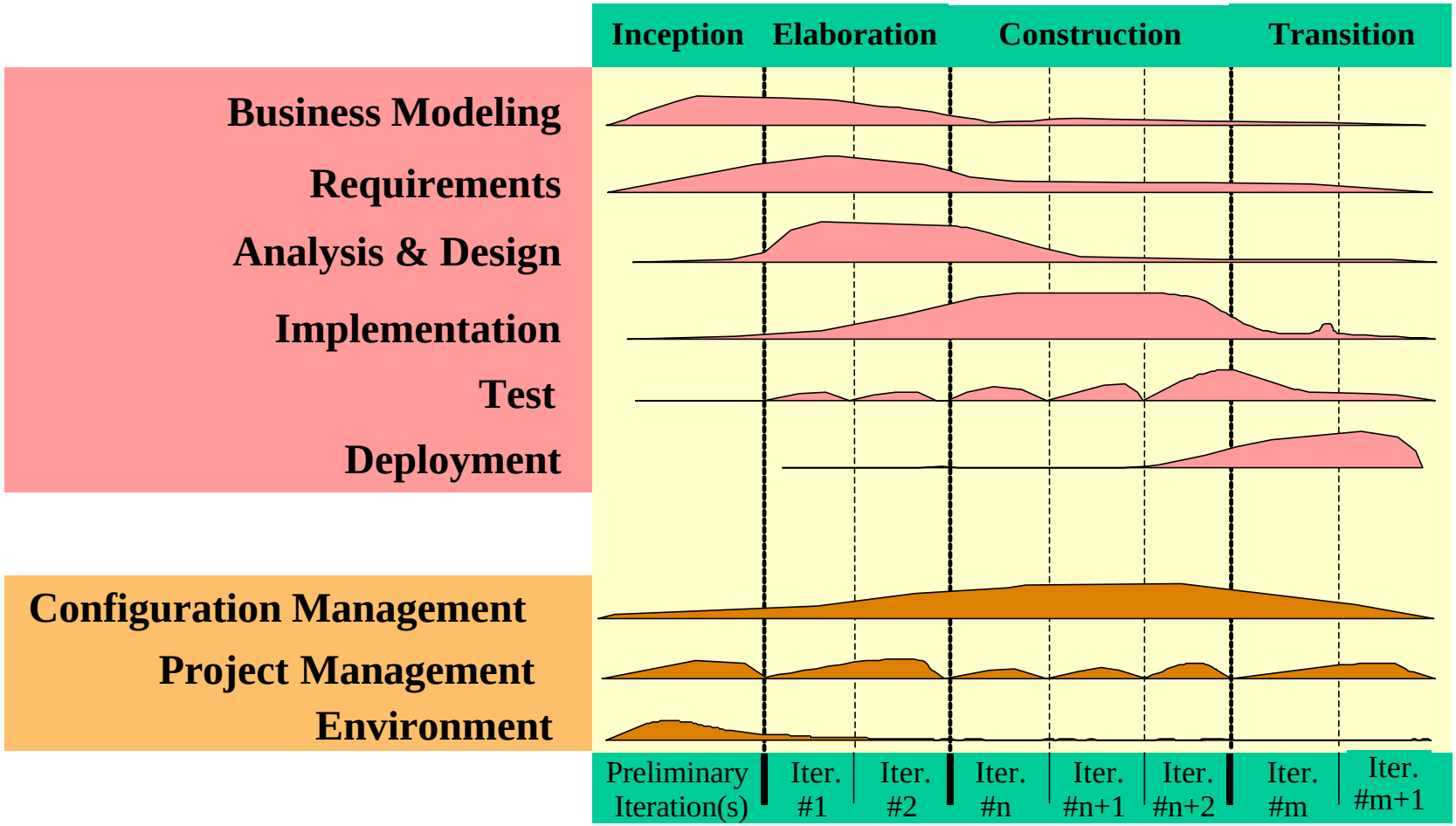
- Provide isolation from changes made in other workspaces
- Control all software artifacts - models, code, docs, etc.

Automate integration and build management

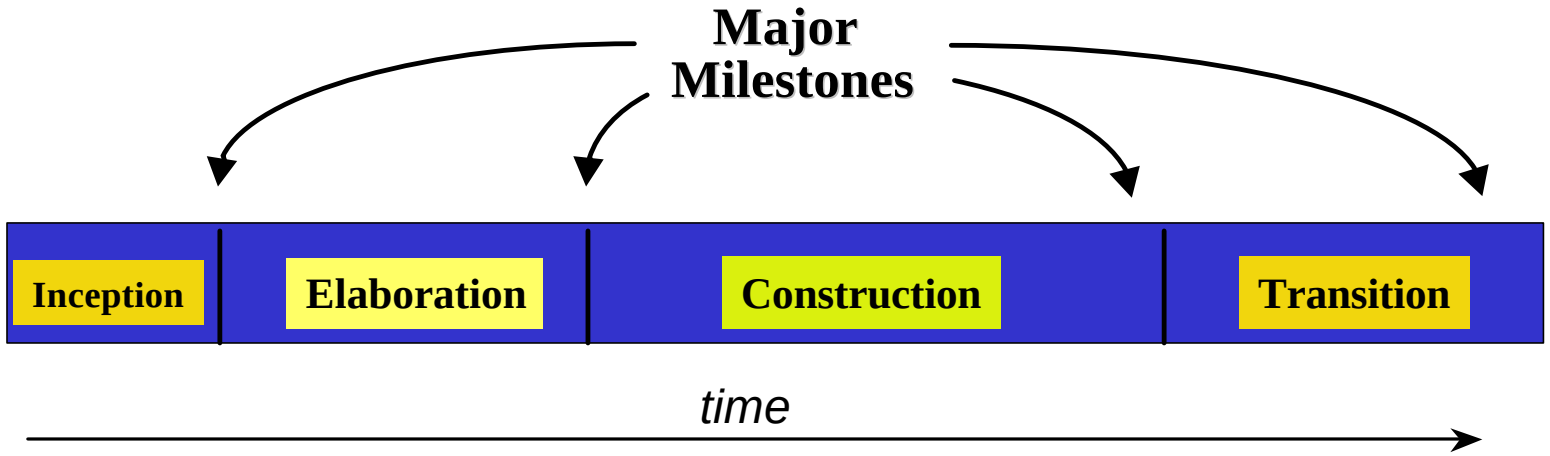


CM is more than just check-in and check-out

Process Overview



Phases in the Process

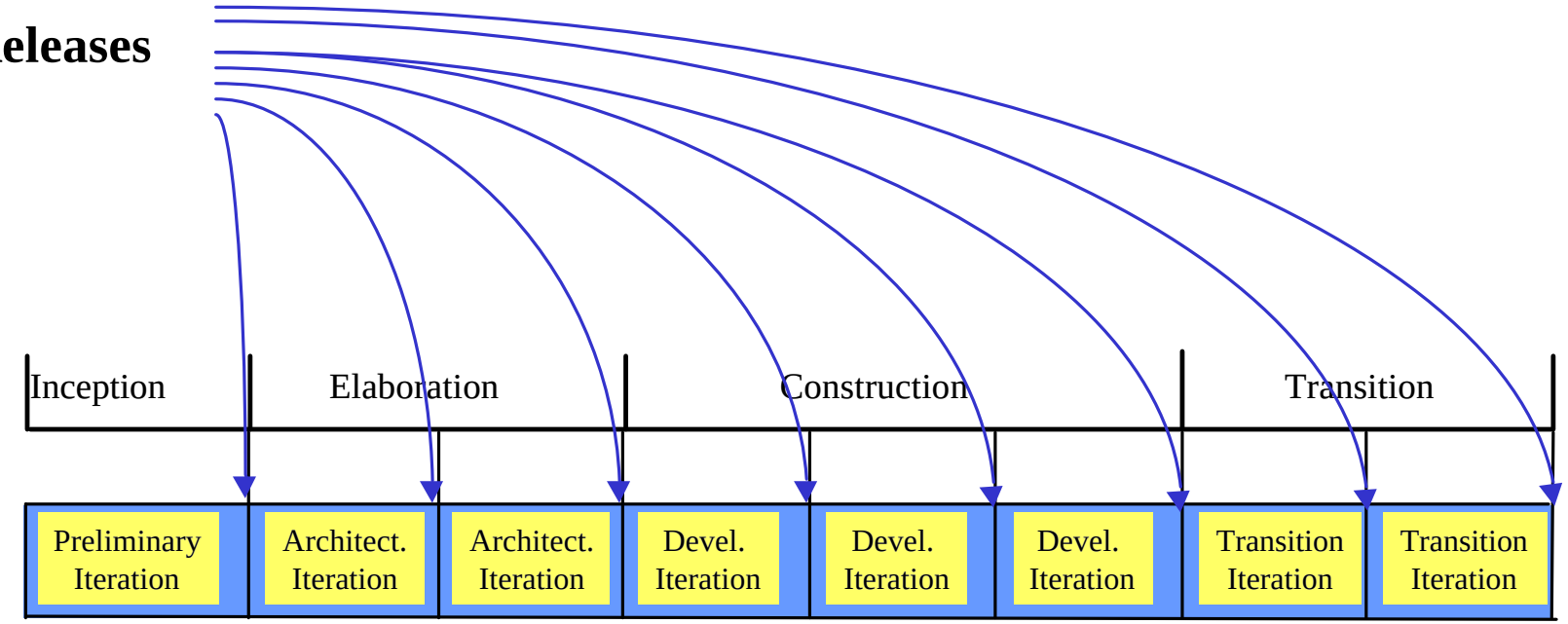


The Rational Unified Process has four phases:

- Inception - Define the scope of project
- Elaboration - Plan project, specify features, baseline architecture
- Construction - Build the product
- Transition - Transition the product into end user community

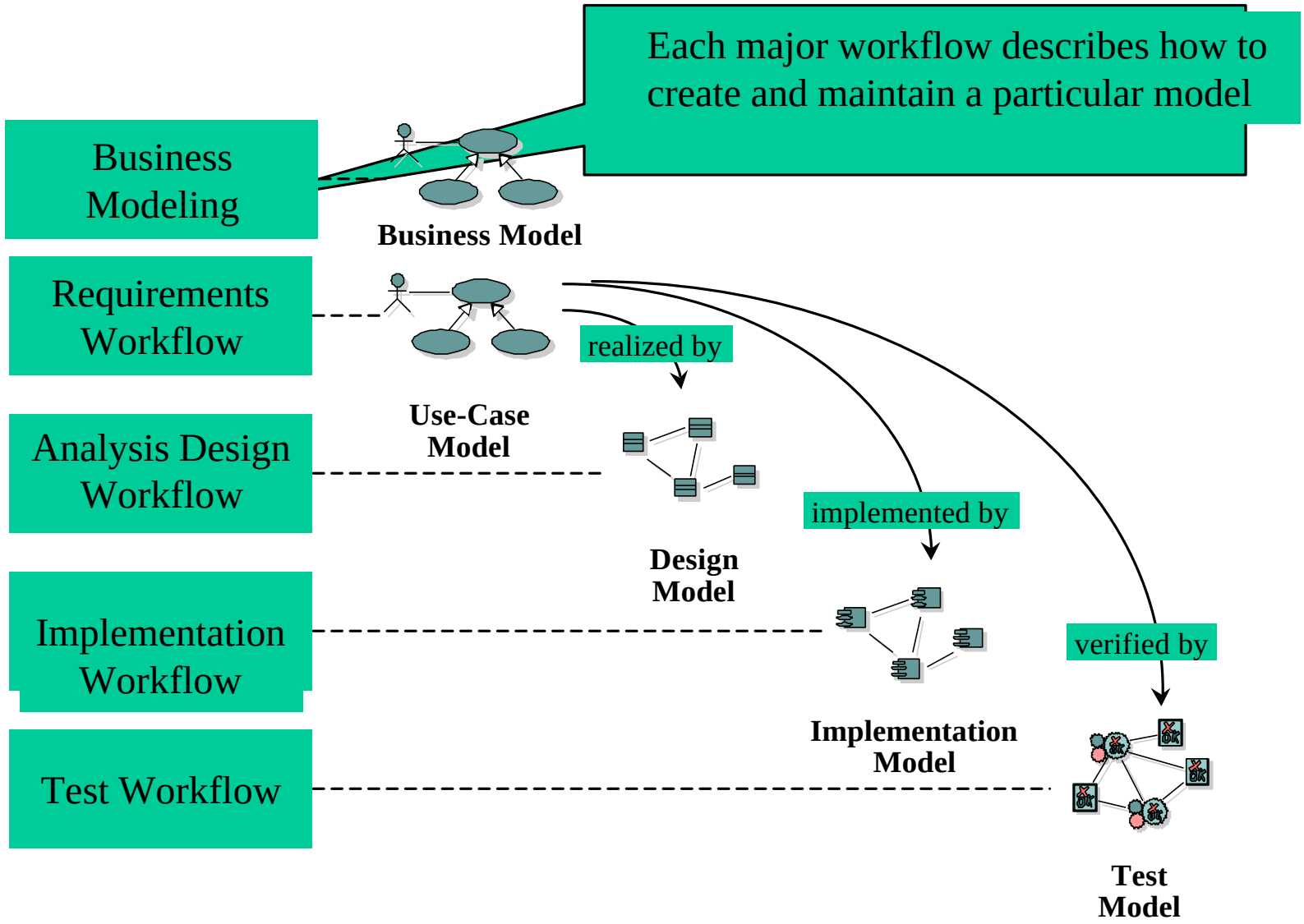
Iterations and Phases

Releases



An *iteration* is a distinct sequence of activities with an established plan and evaluation criteria, resulting in an executable release (internal or external).

Models and Workflows



HAAS & PARTNER
THE LEARNING SOLUTION COMPANY

Bringing It All Together...

In an iteration, you walk through all workflows

Phases

Process Workflows

Business Modeling

Requirements

Analysis & Design

Implementation

Test

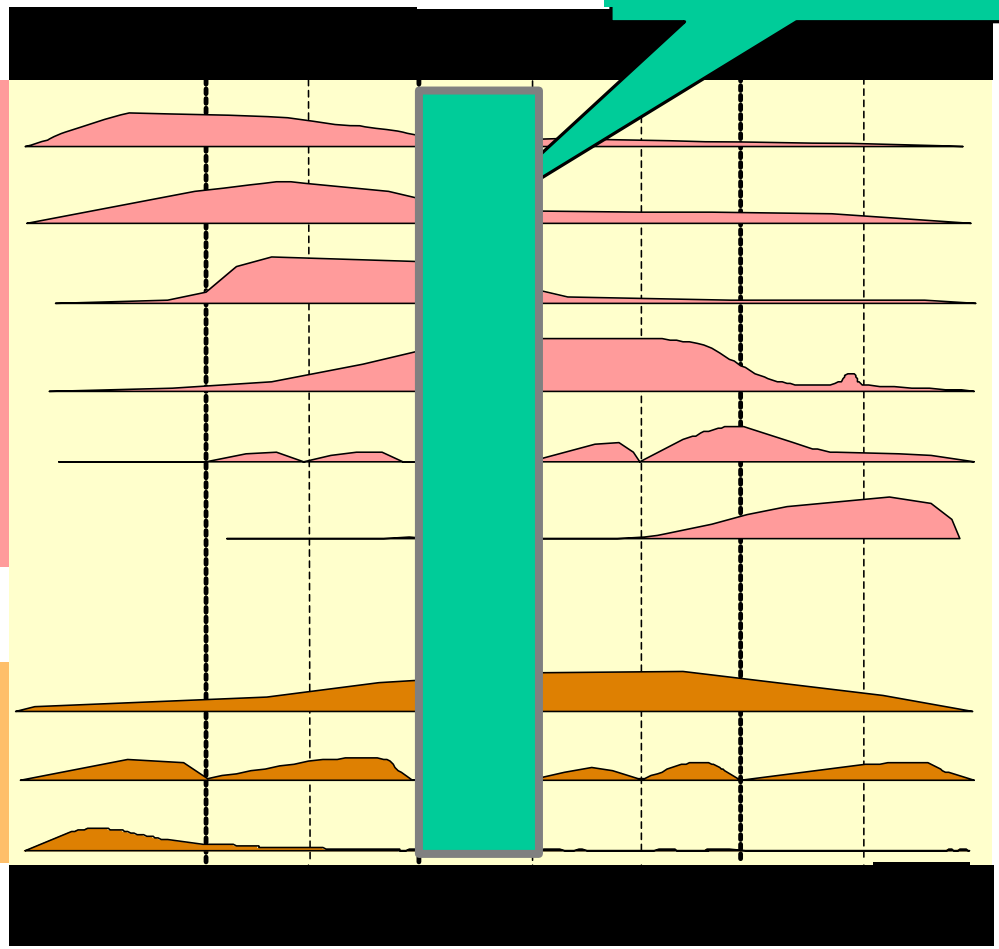
Deployment

Supporting Workflows

Configuration Mgmt

Management

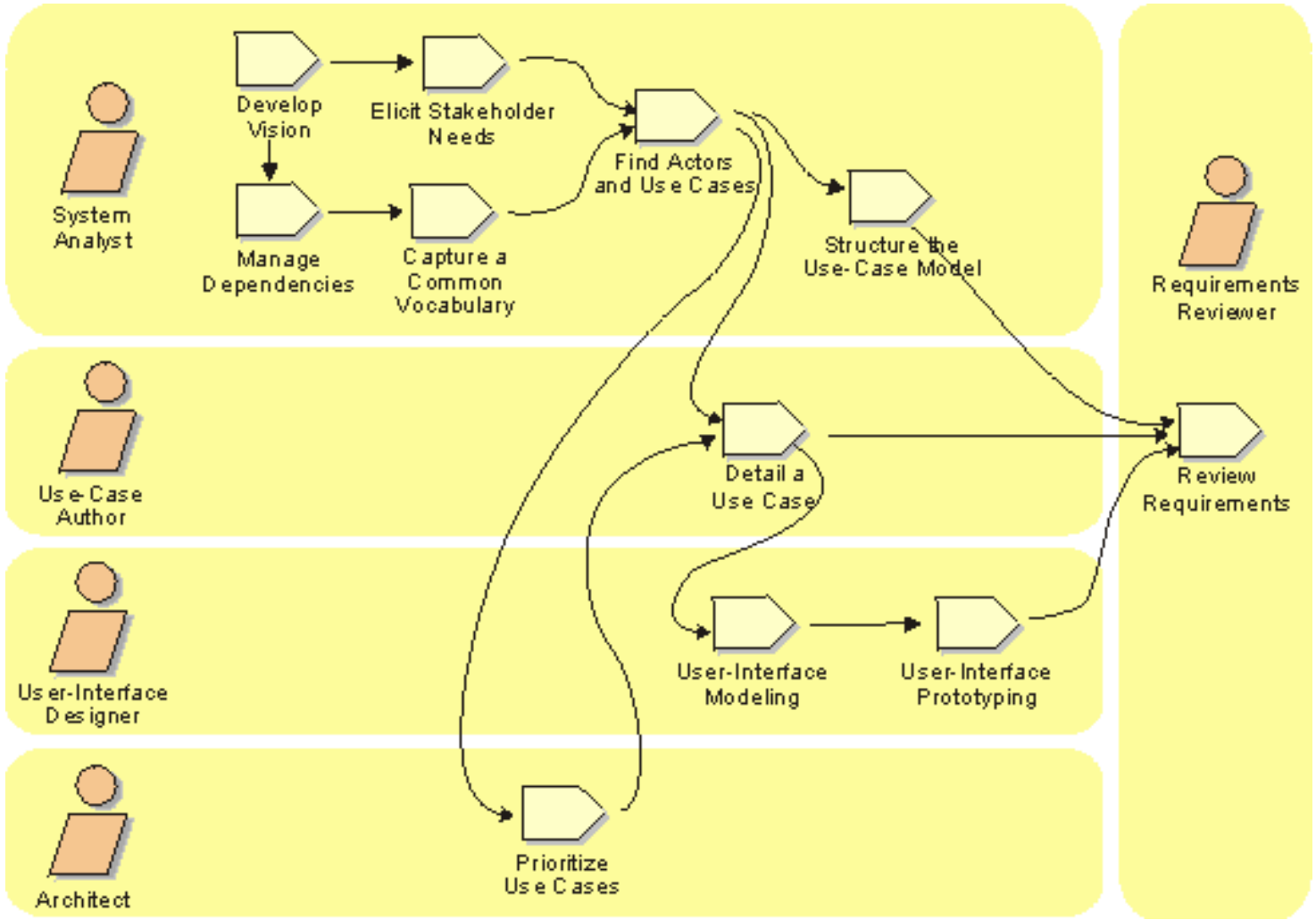
Environment



Workflows group activities logically

Iterations

Example of a Workflow



Rational Unified Process (RUP)

Trial

http://www.rational.com/products/rup/tryit/eval/gen_eval.jsp

- Username
  - jjoller@hsr.ch
- Password
  - KmiVF1wP

valid approx until end of April 2002!

Conclusions

Different life-cycle models

Each with own strengths

Each with own weaknesses

Criteria for deciding on a model include

- The organization
- Its management
- Skills of the employees
- The nature of the product

Best suggestion

- “Mix-and-match” life-cycle model