Object-Oriented Analysis and Design
Lecture 1: Best Practices of Software Engineering

Objectives

- Identify activities for understanding and solving software engineering problems.
- Explain the Six Best Practices.
- Present the Rational Unified Process (RUP) within the context of the Six Best Practices.

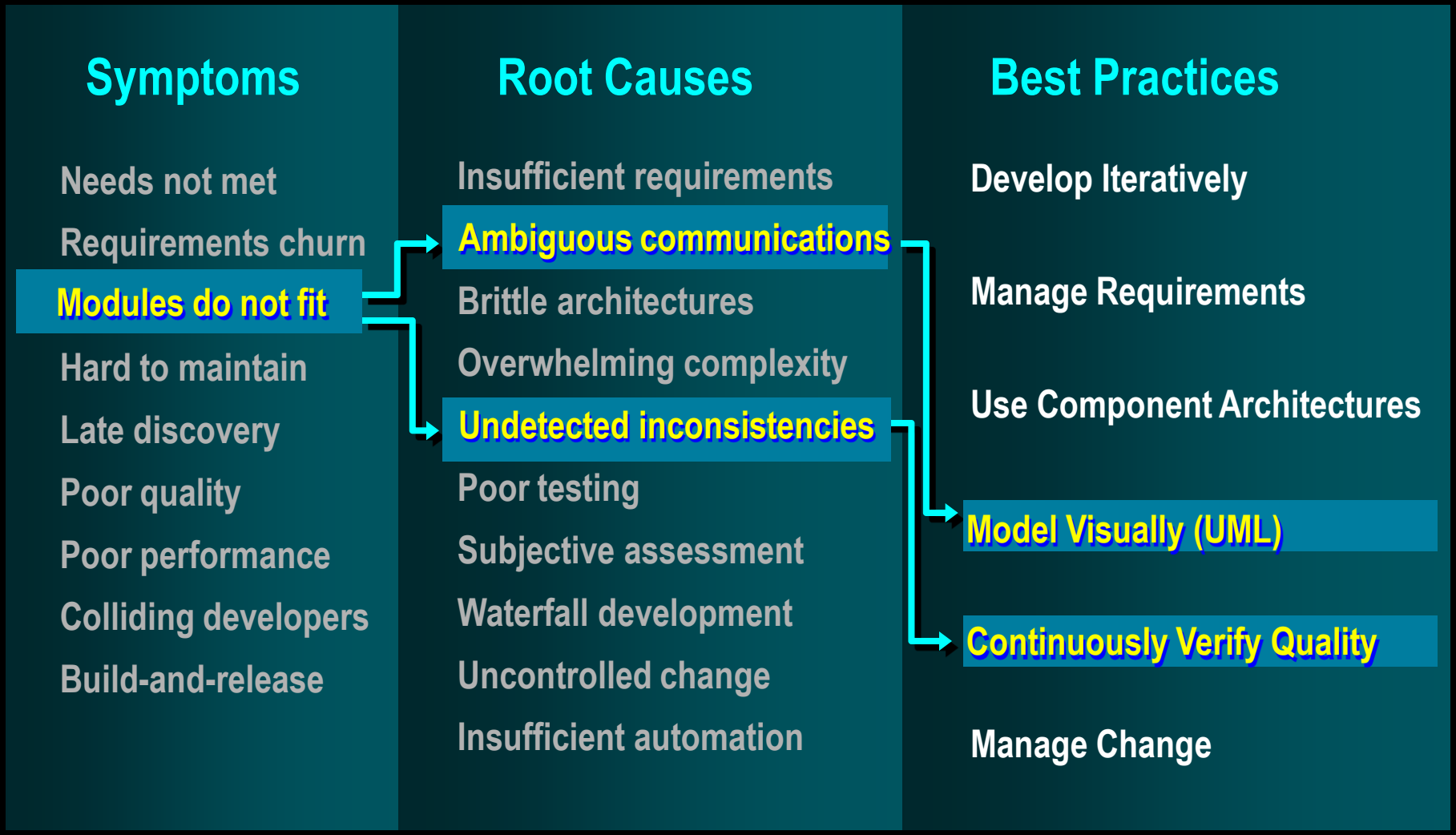
Content Outline

- ★ Software development problems
- The Six Best Practices
- RUP within the context of the Six Best Practices

Symptoms of Software Development Problems

- ✓ User or business needs not met
- ✓ Requirements not addressed
- ✓ Modules not integrating
- ✓ Difficulties with maintenance
- ✓ Late discovery of flaws
- ✓ Poor quality of end-user experience
- ✓ Poor performance under load
- ✓ No coordinated team effort
- ✓ Build-and-release issues

Trace Symptoms to Root Causes



Content Outline

- Software development problems
- ★ The Six Best Practices
- RUP within the context of the Six Best Practices

Practice 1: Develop Iteratively

Best Practices

Process Made Practical

Develop Iteratively

Manage Requirements

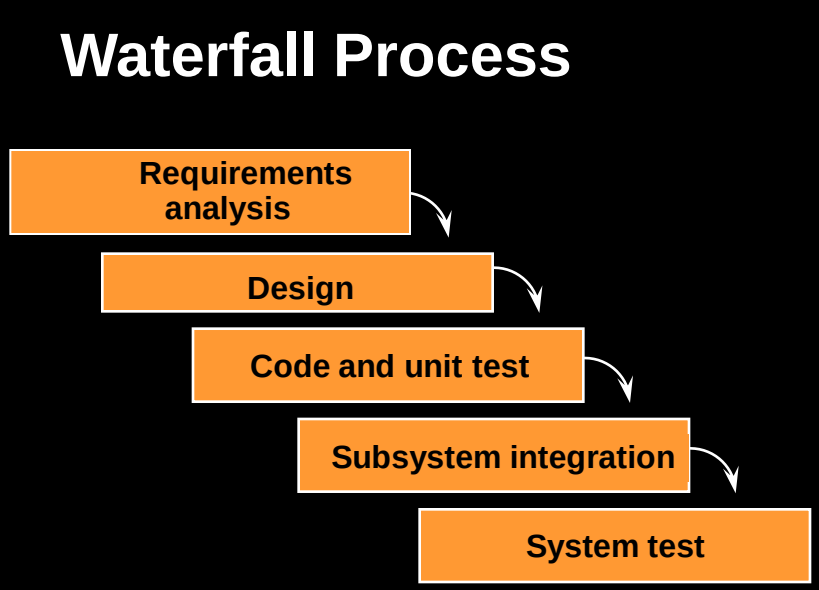
Use Component Architectures

Model Visually (UML)

Continuously Verify Quality

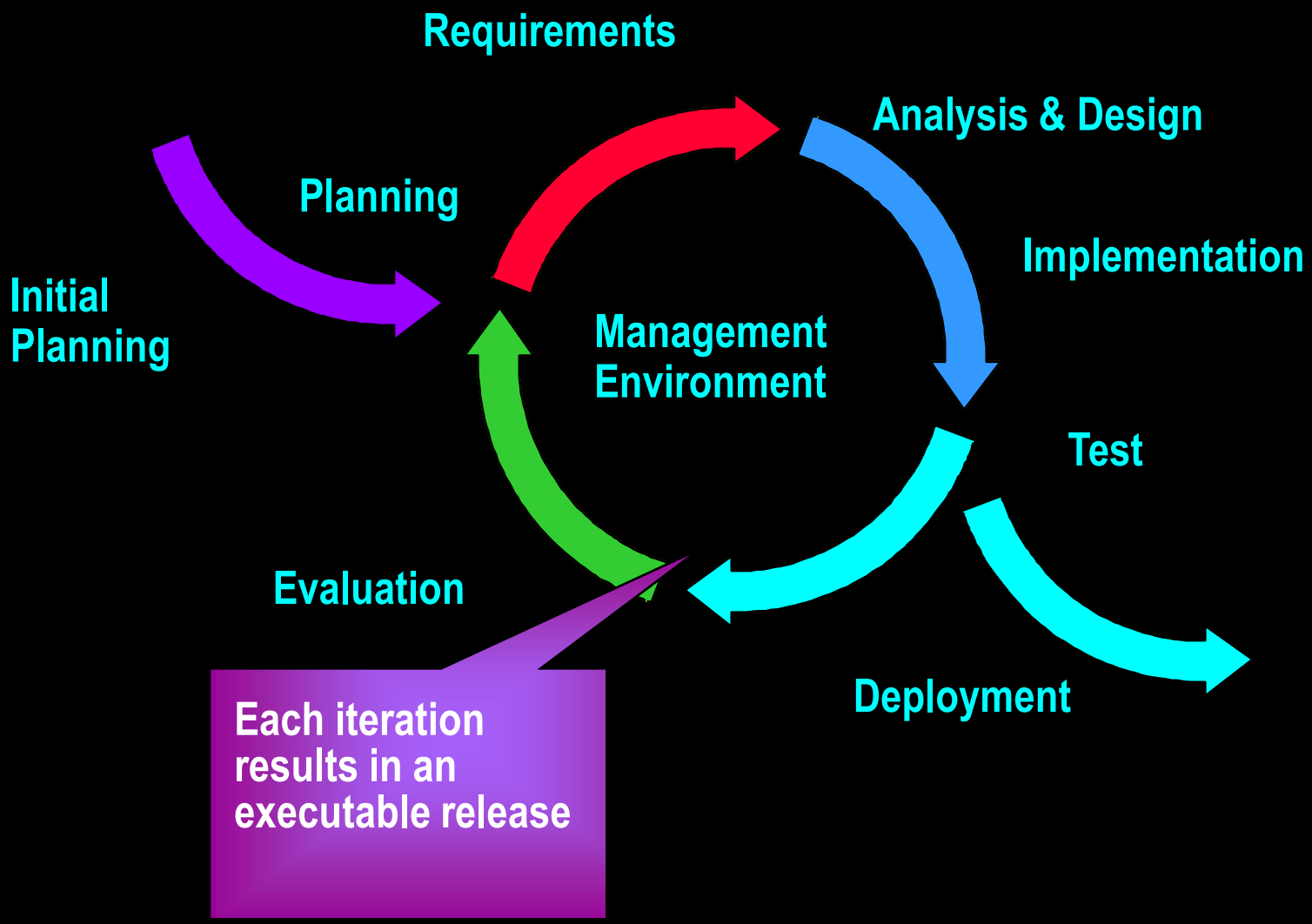
Manage Change

Waterfall Development Characteristics

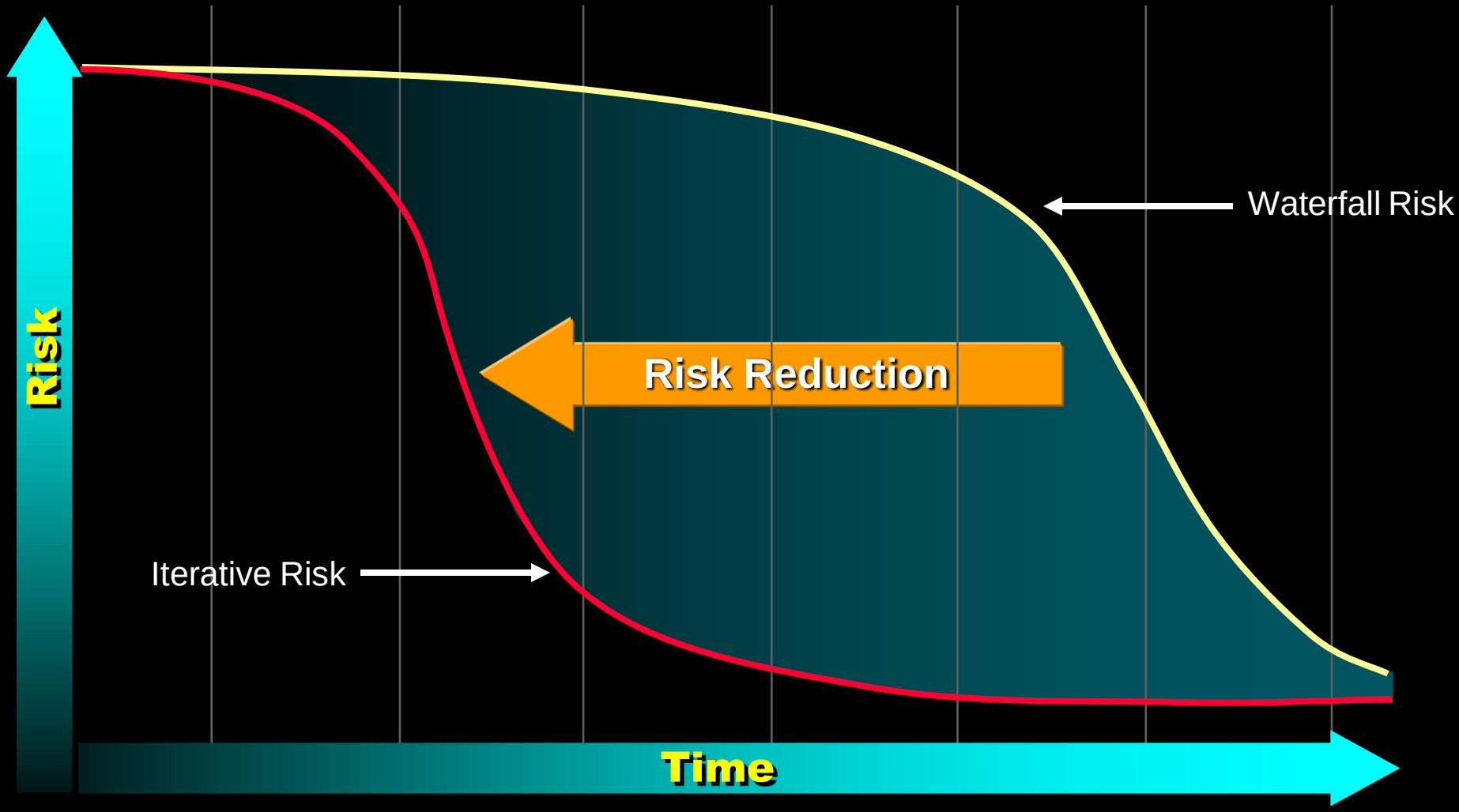


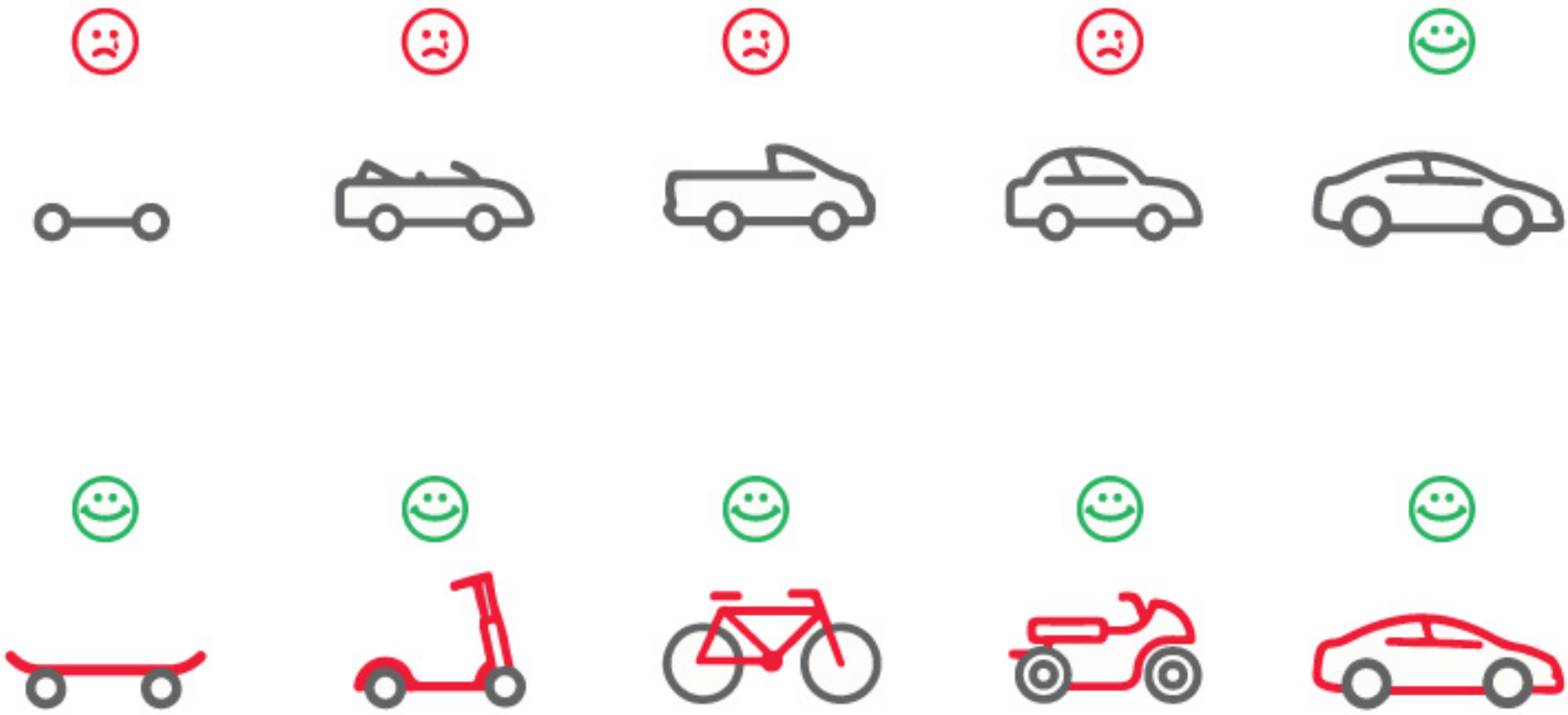
- Delays confirmation of critical risk resolution
- Measures progress by assessing work products that are poor predictors of time-to-completion
- Delays and aggregates integration and testing
- Precludes early deployment
- Frequently results in major unplanned iterations

Iterative Development Produces an Executable

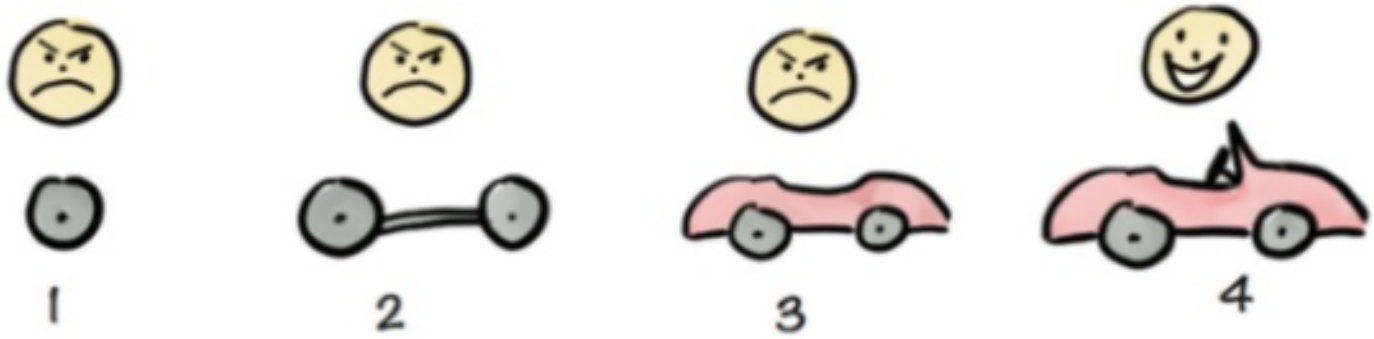


Risk Profiles

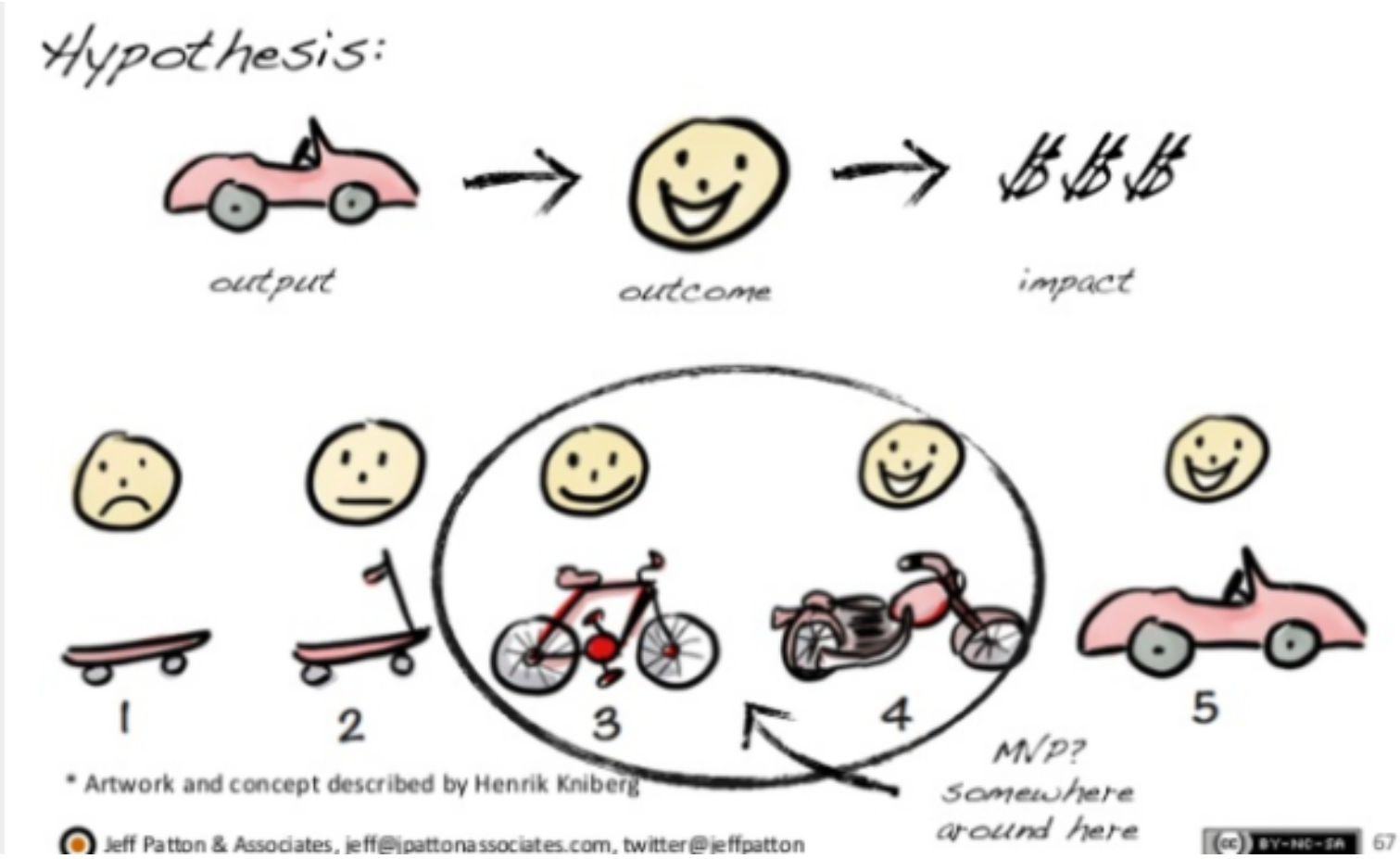




Hypothesis:



* Artwork and concept described by Henrik Kniberg


Hypothesis:
output
outcome
impact
1
2
3
4
5
MVP?
somewhere
around here
* Artwork and concept described by Henrik Kniberg
Jeff Patton & Associates, jeff@jpattonassociates.com, twitter@jeffpatton
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Practice 2: Manage Requirements

Best Practices

Process Made Practical

Develop Iteratively

Manage Requirements

Use Component Architectures

Model Visually (UML)

Continuously Verify Quality

Manage Change

Requirements Management

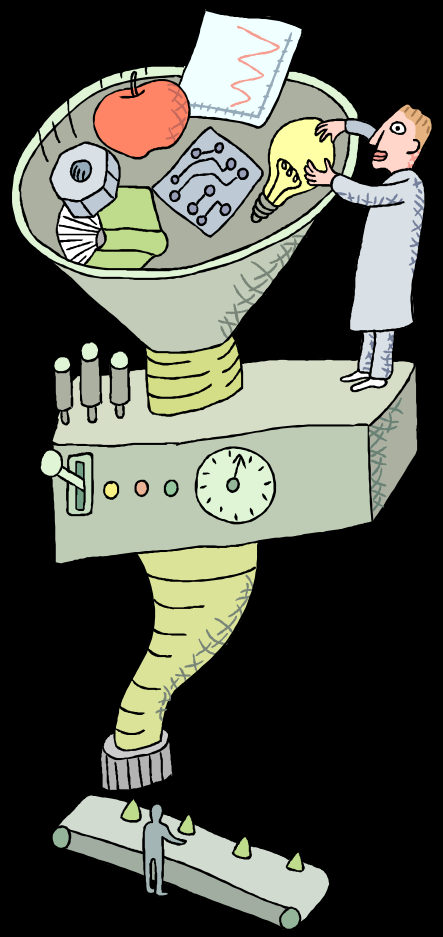
Making sure you

- solve the right problem
- build the right system

by taking a systematic approach to

- eliciting
- organizing
- documenting
- managing

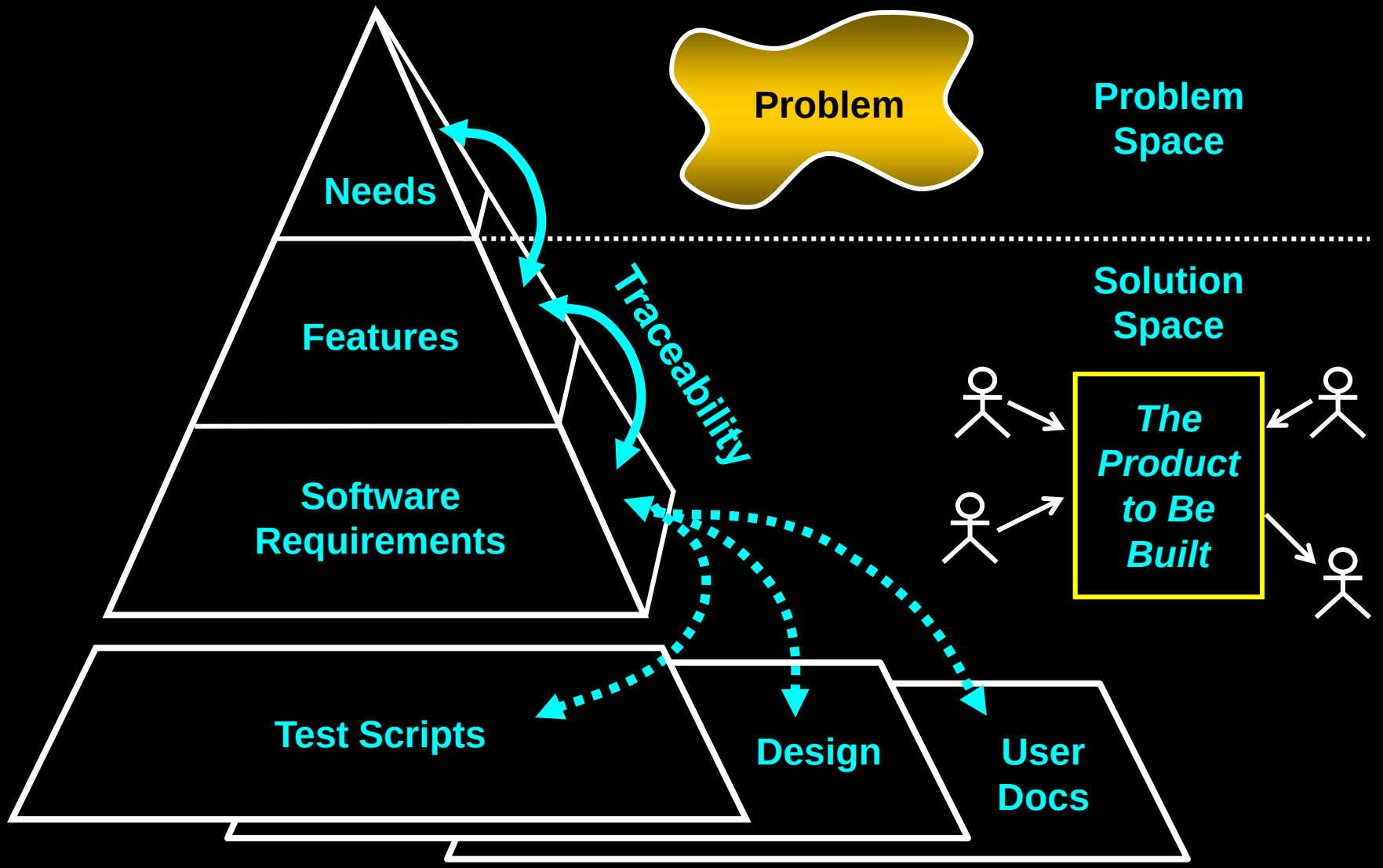
the changing requirements of a software application.



Aspects of Requirements Management

- Analyze the Problem
- Understand User Needs
- Define the System
- Manage Scope
- Refine the System Definition
- Manage Changing Requirements

Map of the Territory



Practice 3: Use Component Architectures

Best Practices

Process Made Practical

Develop Iteratively

Manage Requirements

Use Component Architectures

Model Visually (UML)

Continuously Verify Quality

Manage Change

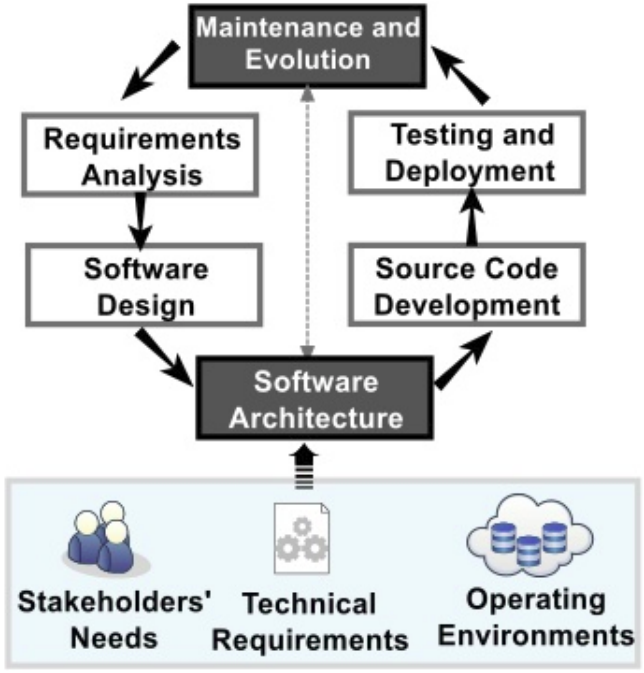
Architecture-Centric Software Evolution

- **Software Architecture** represents the blue-print of a software as topological configuration of computational components and connectors that enable component-level interconnections. [ISO/IEC/IEEE 42010 Standard]

- **Software Evolution** adapts a software to changing requirements and operating environment by means of addition, removal and modification of software artefacts. [ACM/IEEE Software Engineering Curriculum, 2004]

- Evolution @ Design-time

- Evolution @ Run-time

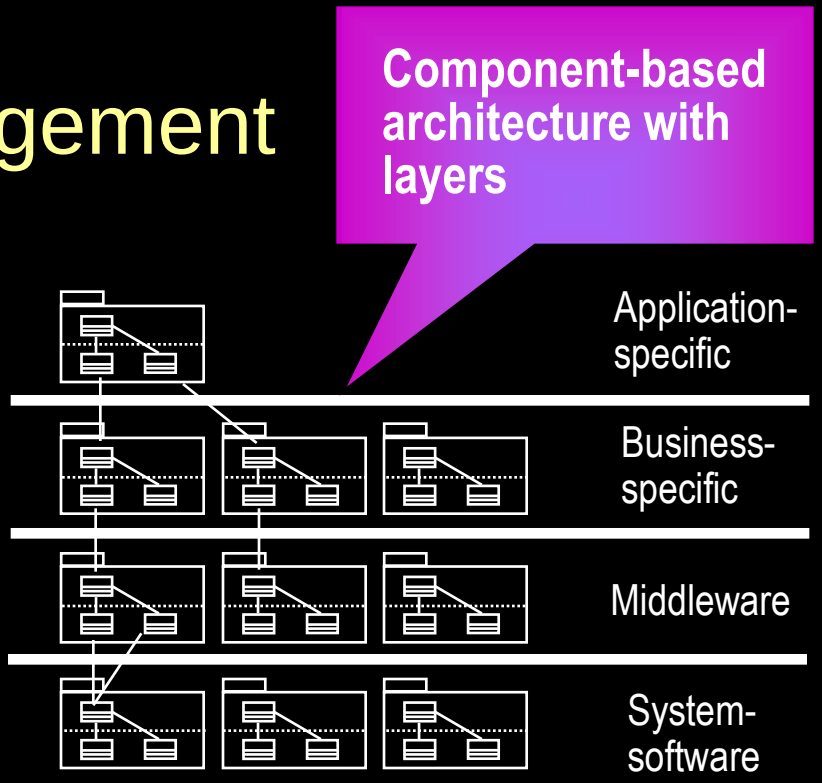


Resilient Component-Based Architectures

- Resilient
  - Meets current and future requirements
  - Improves extensibility
  - Enables reuse
  - Encapsulates system dependencies
- Component-based
  - Reuse or customize components
  - Select from commercially available components
  - Evolve existing software incrementally

Purpose of a Component-Based Architecture

- Basis for reuse
  - Component reuse
  - Architecture reuse
- Basis for project management
  - Planning
  - Staffing
  - Delivery
- Intellectual control
  - Manage complexity
  - Maintain integrity



Practice 4: Model Visually (UML)

Best Practices
Process Made Practical

Develop Iteratively

Manage Requirements

Use Component Architectures

Model Visually (UML)

Continuously Verify Quality

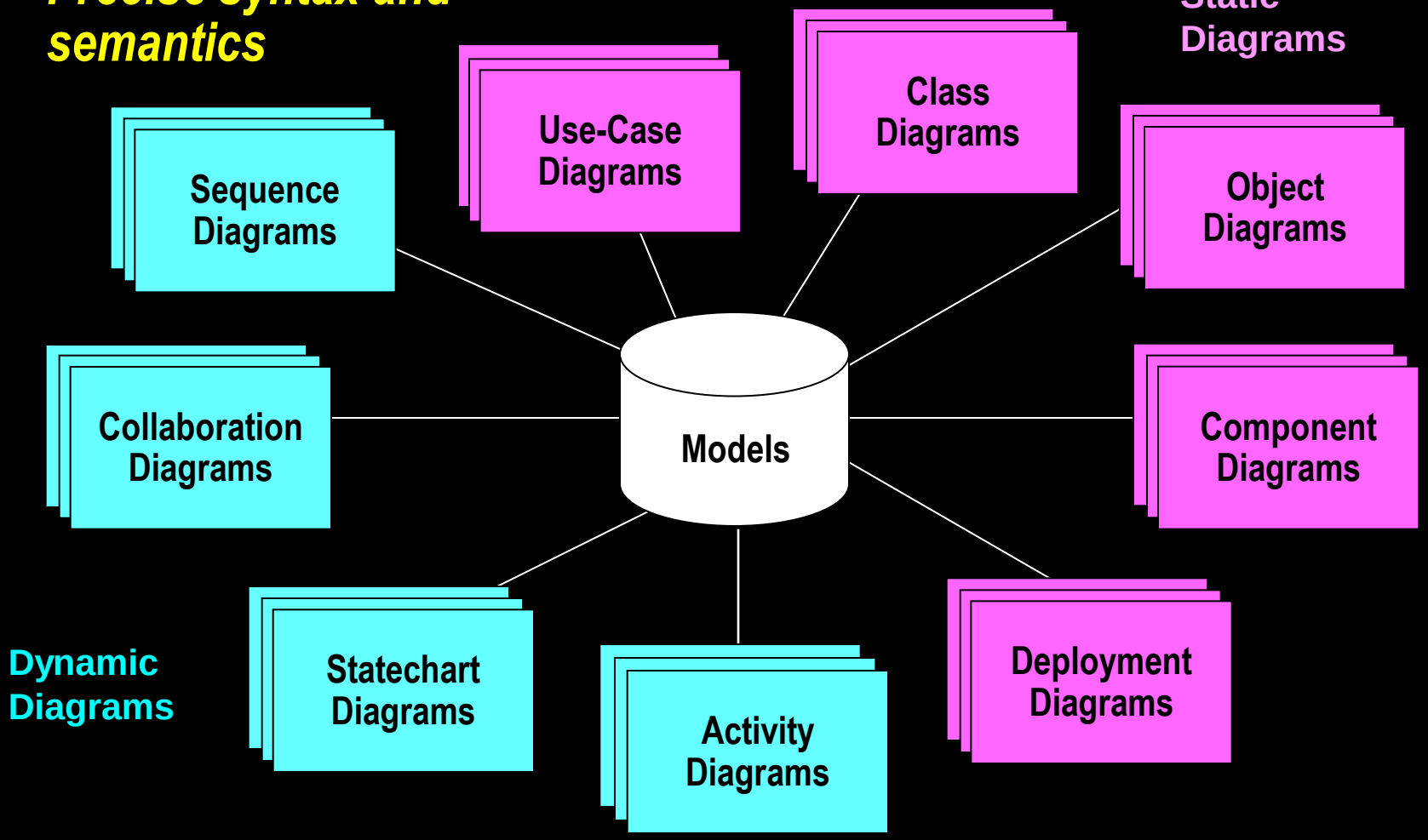
Manage Change

Why Model Visually?

- Captures structure and behavior
- Shows how system elements fit together
- Keeps design and implementation consistent
- Hides or exposes details as appropriate
- Promotes unambiguous communication
  - The UML provides one language for all practitioners

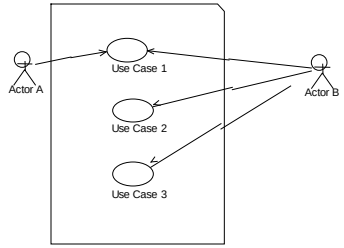
Visual Modeling With the Unified Modeling Language

- ***Multiple views***
- ***Precise syntax and semantics***

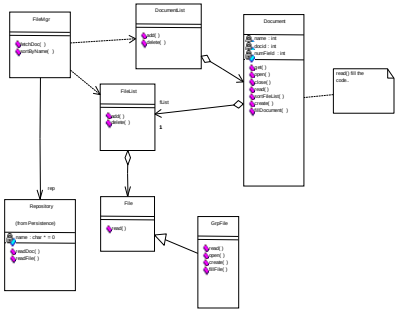


Visual Modeling Using UML Diagrams

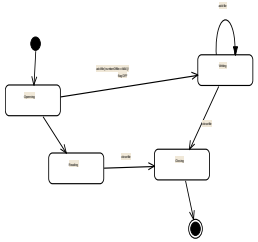
Use-Case Diagram



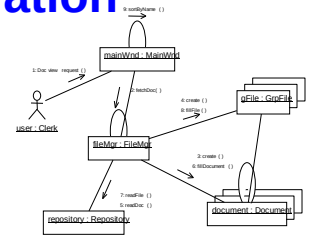
Class Diagram



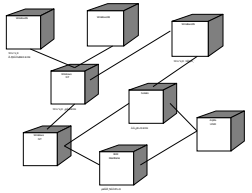
Statechart Diagram



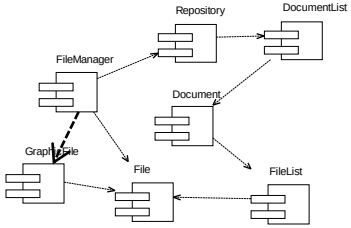
Collaboration Diagram



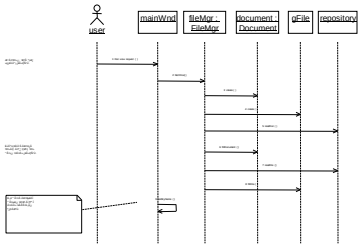
Deployment Diagram



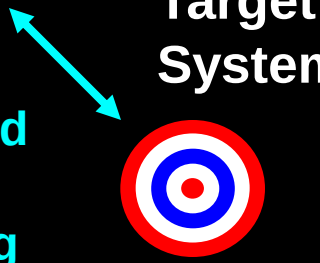
Component Diagram



Sequence Diagram



Forward and Reverse Engineering



Target System

Practice 5: Continuously Verify Quality

Best Practices

Process Made Practical

Develop Iteratively

Manage Requirements

Use Component Architectures

Model Visually (UML)

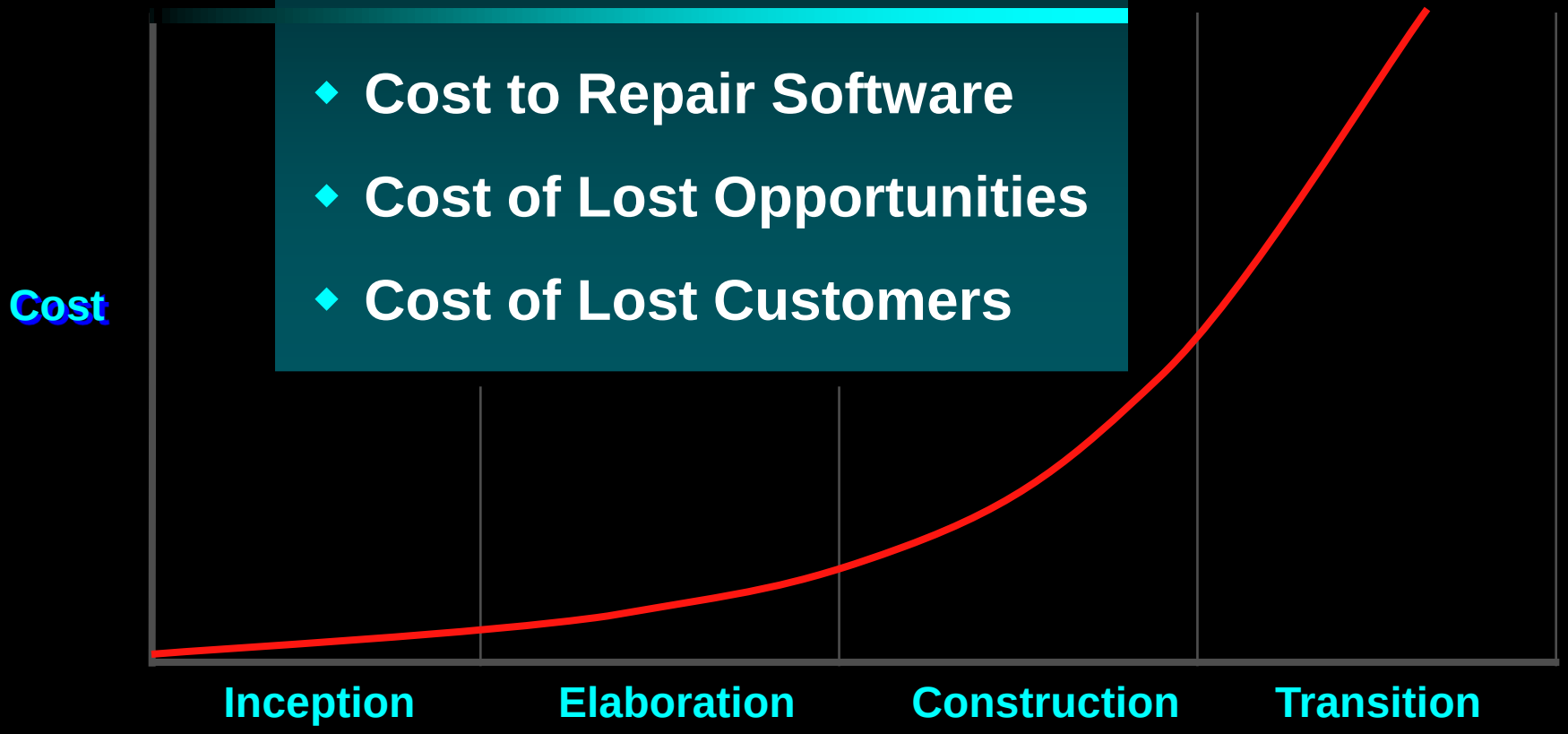
Continuously Verify Quality

Manage Change

Continuously Verify Your Software's Quality

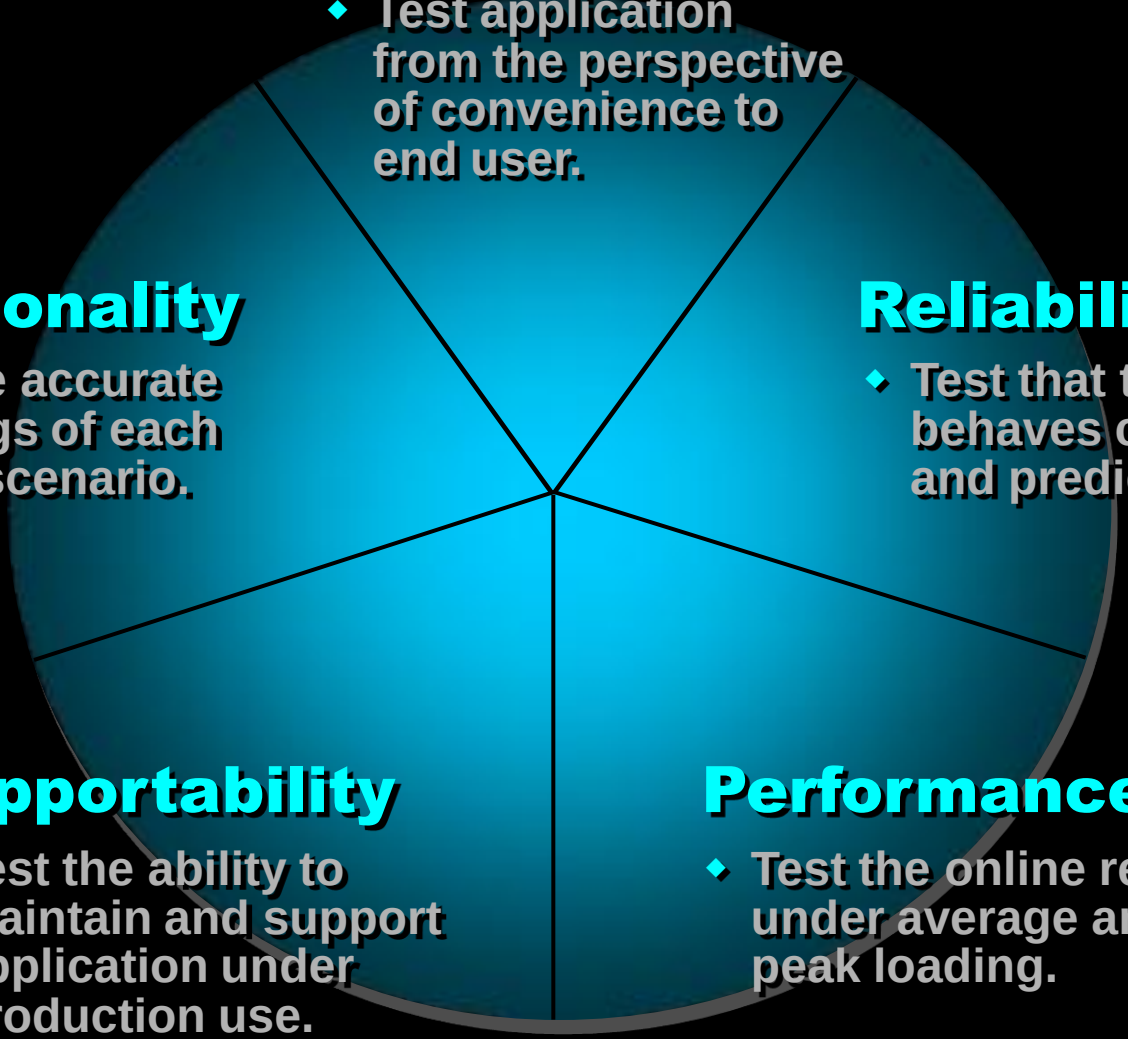
Software problems are 100 to 1000 times more costly to find and repair after deployment

- Cost to Repair Software
- Cost of Lost Opportunities
- Cost of Lost Customers




Software Quality Factors
Functionality
Are the required function available in the software?
Reliability
How reliable is the software?
Usability
Is the software easy to use?
Portability
How easy is to trasfer the software to another environment?
Maintainability
How easy is to modify the software?
Efficiency
How efficient is the software?

Testing Dimensions of Quality



Usability

- Test application from the perspective of convenience to end user.

Functionality

- Test the accurate workings of each usage scenario.

Reliability

- Test that the application behaves consistently and predictably.

Supportability

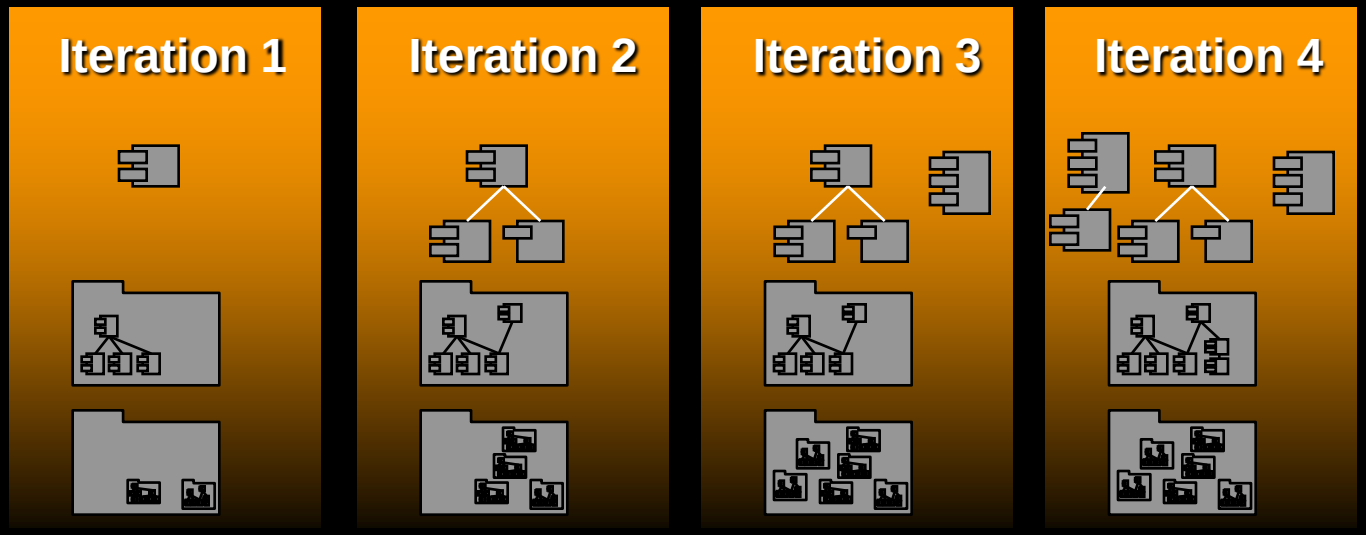
- Test the ability to maintain and support application under production use.

Performance

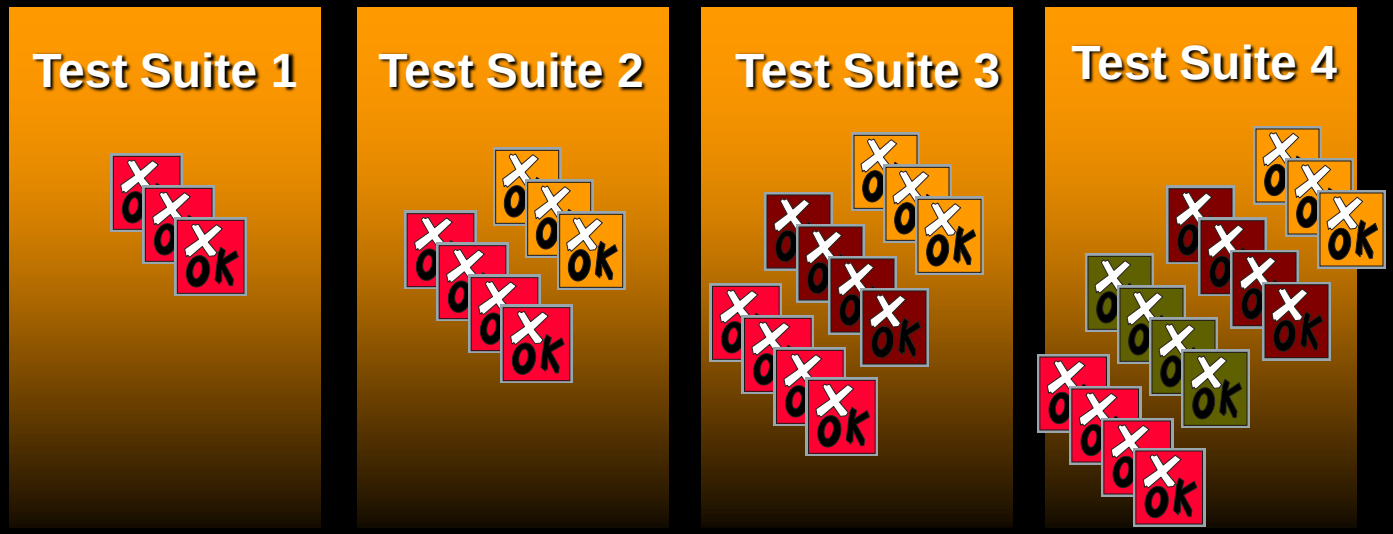
- Test the online response under average and peak loading.

Test Each Iteration

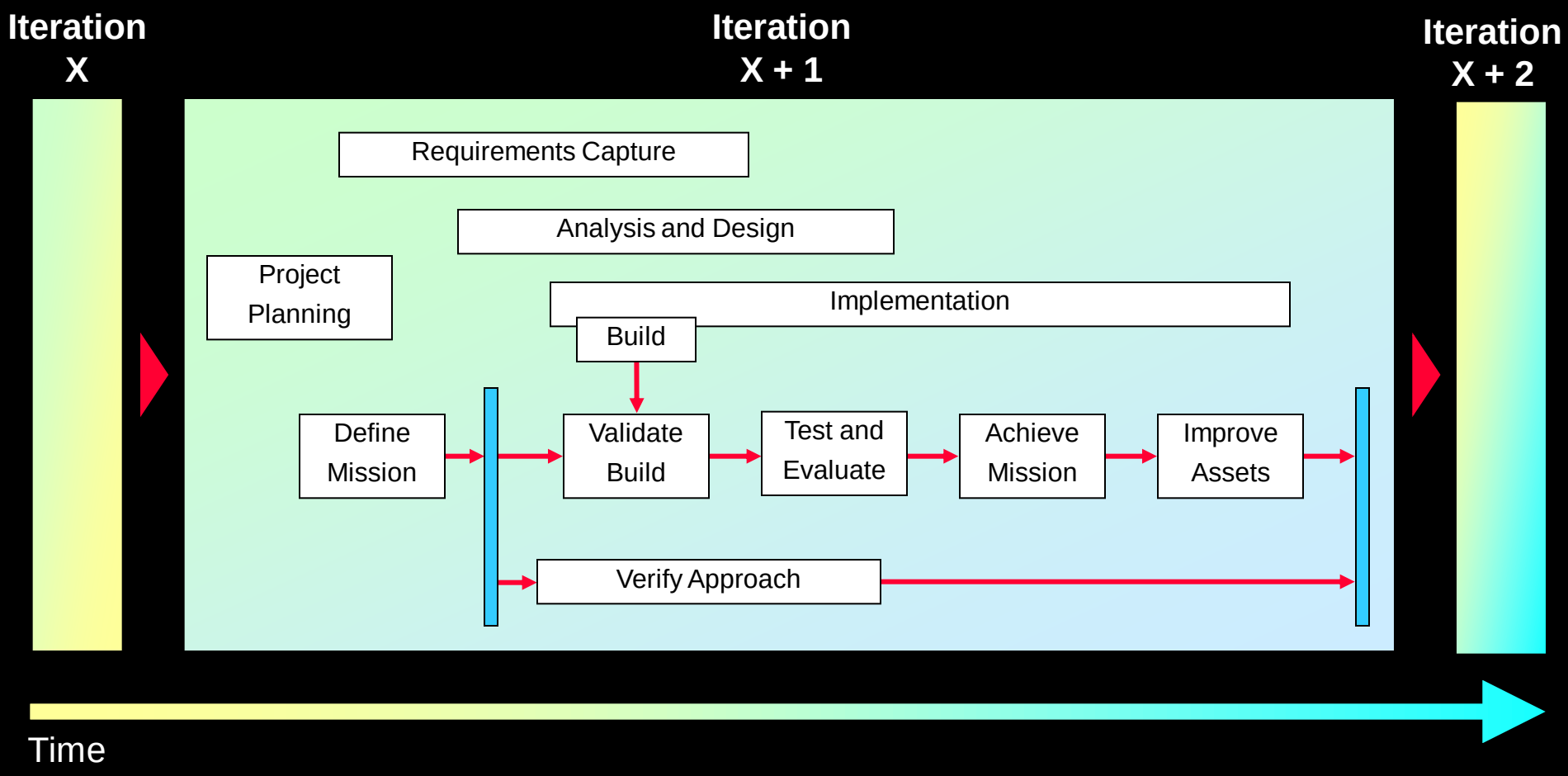
UML Model and Implementation



Tests



Test Within the Product Development Lifecycle



Practice 6: Manage Change

Best Practices
Process Made Practical

Develop Iteratively

Manage Requirements

Use Component Architectures

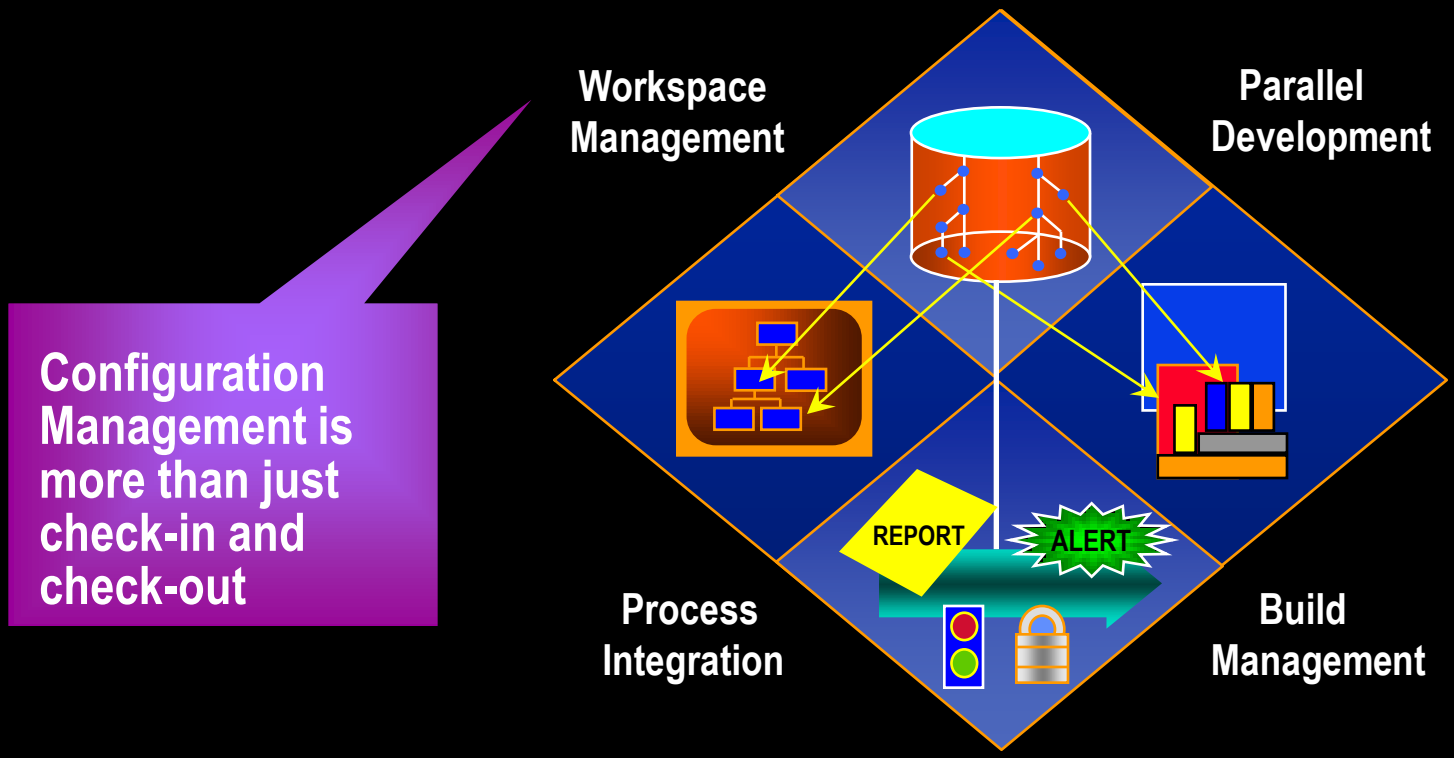
Model Visually (UML)

Continuously Verify Quality

Manage Change

What Do You Want to Control?

- Secure workspaces for each developer
- Automated integration/build management
- Parallel development



Aspects of a CM System

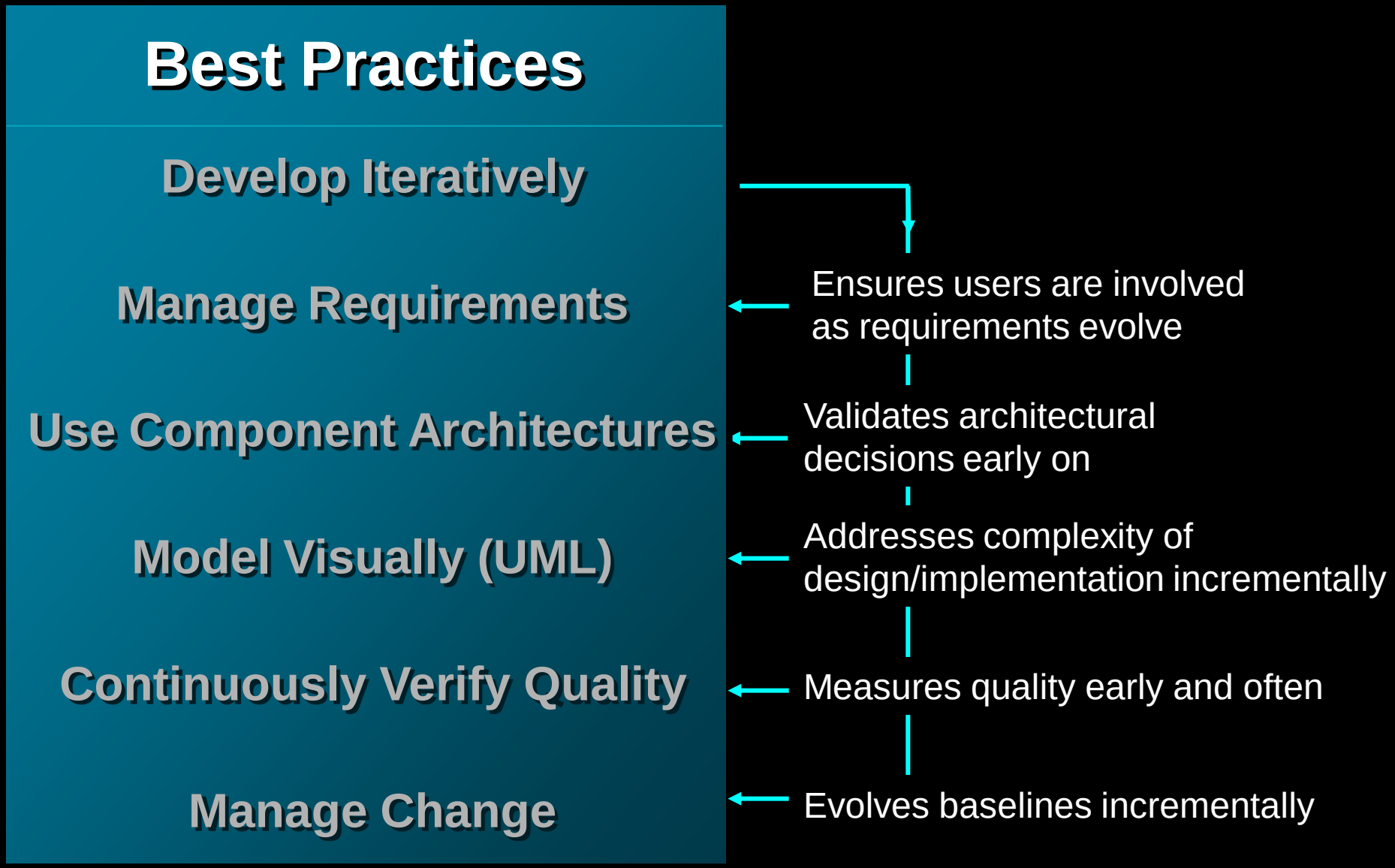
- Change Request Management (CRM)
- Configuration Status Reporting
- Configuration Management (CM)
- Change Tracking
- Version Selection
- Software Manufacture

Unified Change Management (UCM)

UCM involves:

- Management across the lifecycle
  - System
  - Project Management
- Activity-Based Management
  - Tasks
  - Defects
  - Enhancements
- Progress Tracking
  - Charts
  - Reports

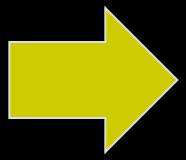
Best Practices Reinforce Each Other



Module 1 Content Outline

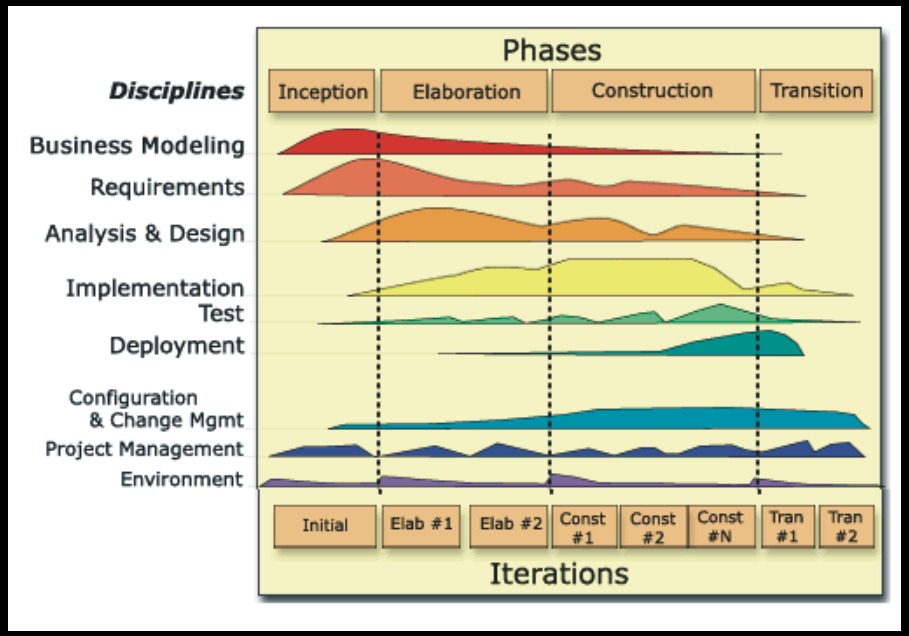
- Software development problems
- The Six Best Practices
- ★ RUP within the context of the Six Best Practices

Rational Unified Process Implements Best Practices



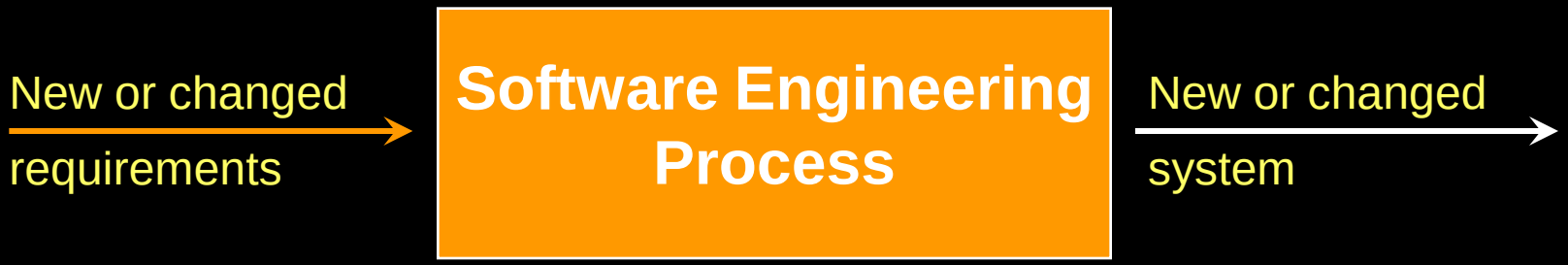
Achieving Best Practices

- Iterative approach
- Guidance for activities and artifacts
- Process focus on architecture
- Use cases that drive design and implementation
- Models that abstract the system



A Team-Based Definition of Process

A process defines **Who** is doing **What, When,** and **How**, in order to reach a certain goal.

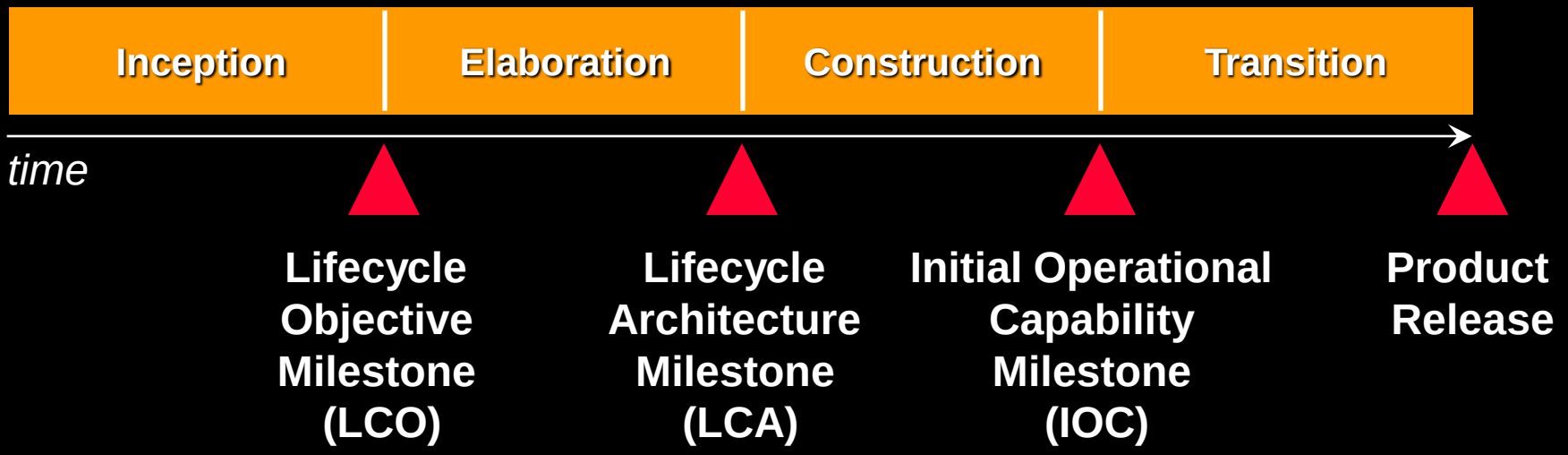


Process Structure - Lifecycle Phases

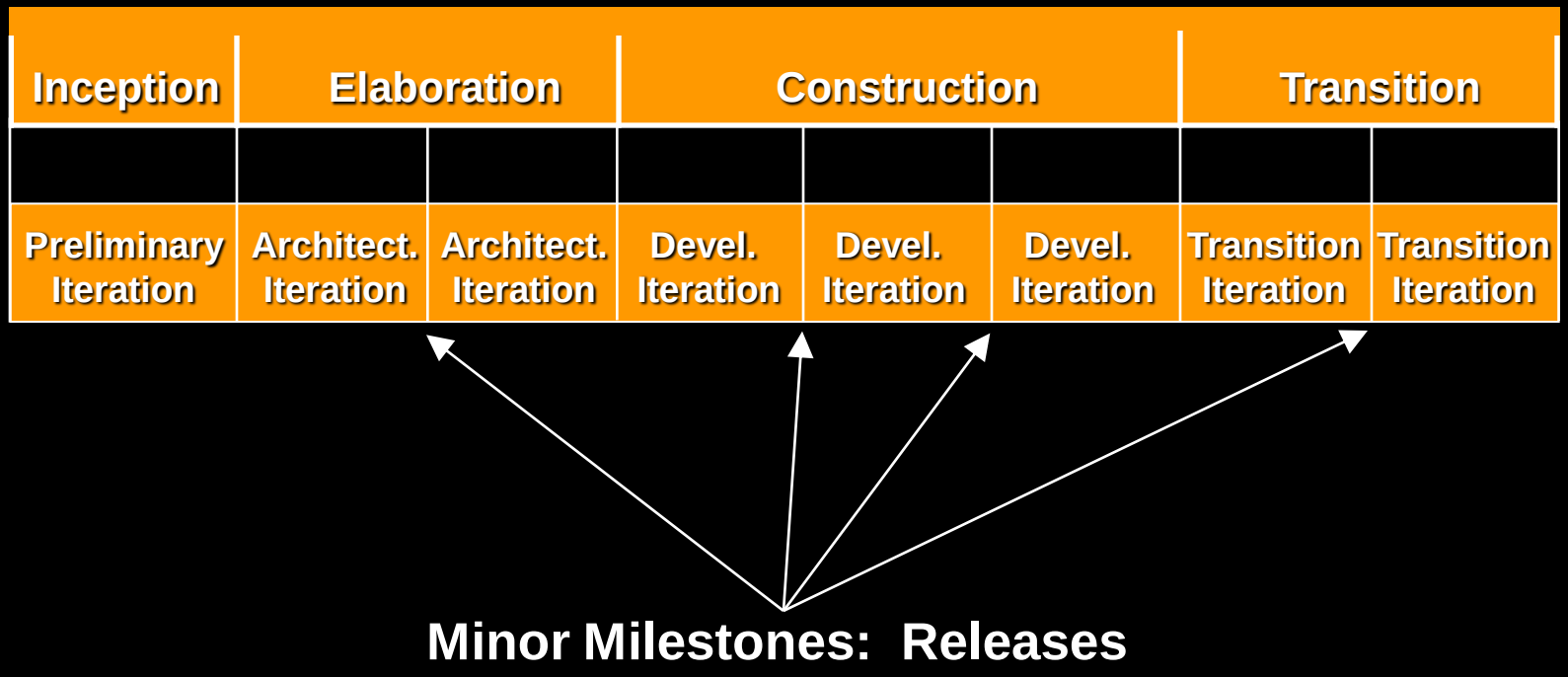
Rational Unified Process has four phases:

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

Phase Boundaries Mark Major Milestones



Iterations and Phases

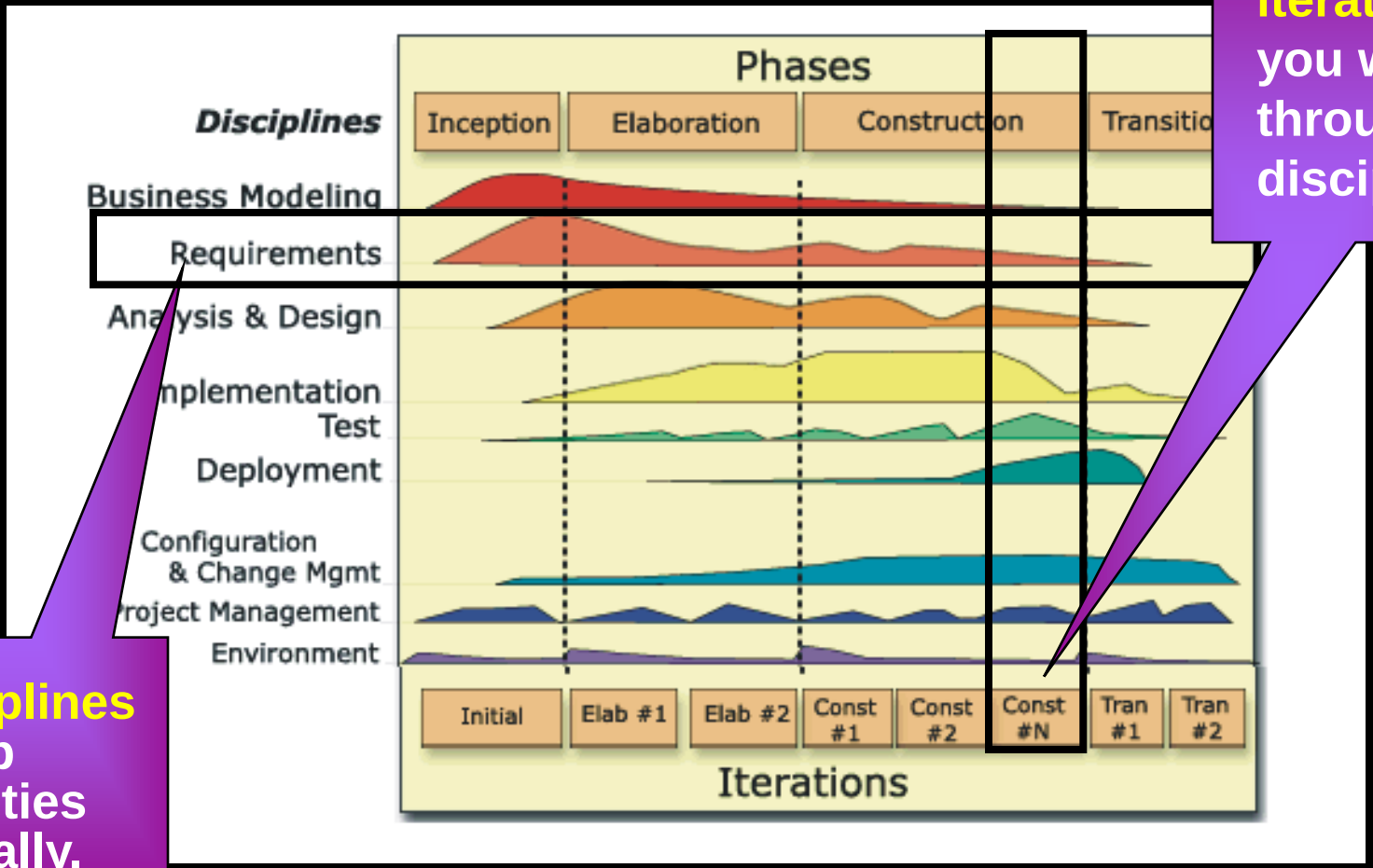


An **iteration** is a distinct sequence of activities based on an established plan and evaluation criteria, resulting in an executable release (internal or external).

Discipline	Artifact	Incep.	Elab.	Const.	Trans.
	Iteration⟶	I1	E1..En	C1..Cn	T1..T2
Business Modeling	Domain Model		s		
Requirements	Use Case Model (SSDs)	s	r		
	Supplementary Specification	s	r		
	Glossary	s	r		
Design	Design Model		s	r	
	SW Architecture Document		s		
	Data Model		s	r	

Table 18.1. Sample UP artifacts and timing. s - start; r - refine

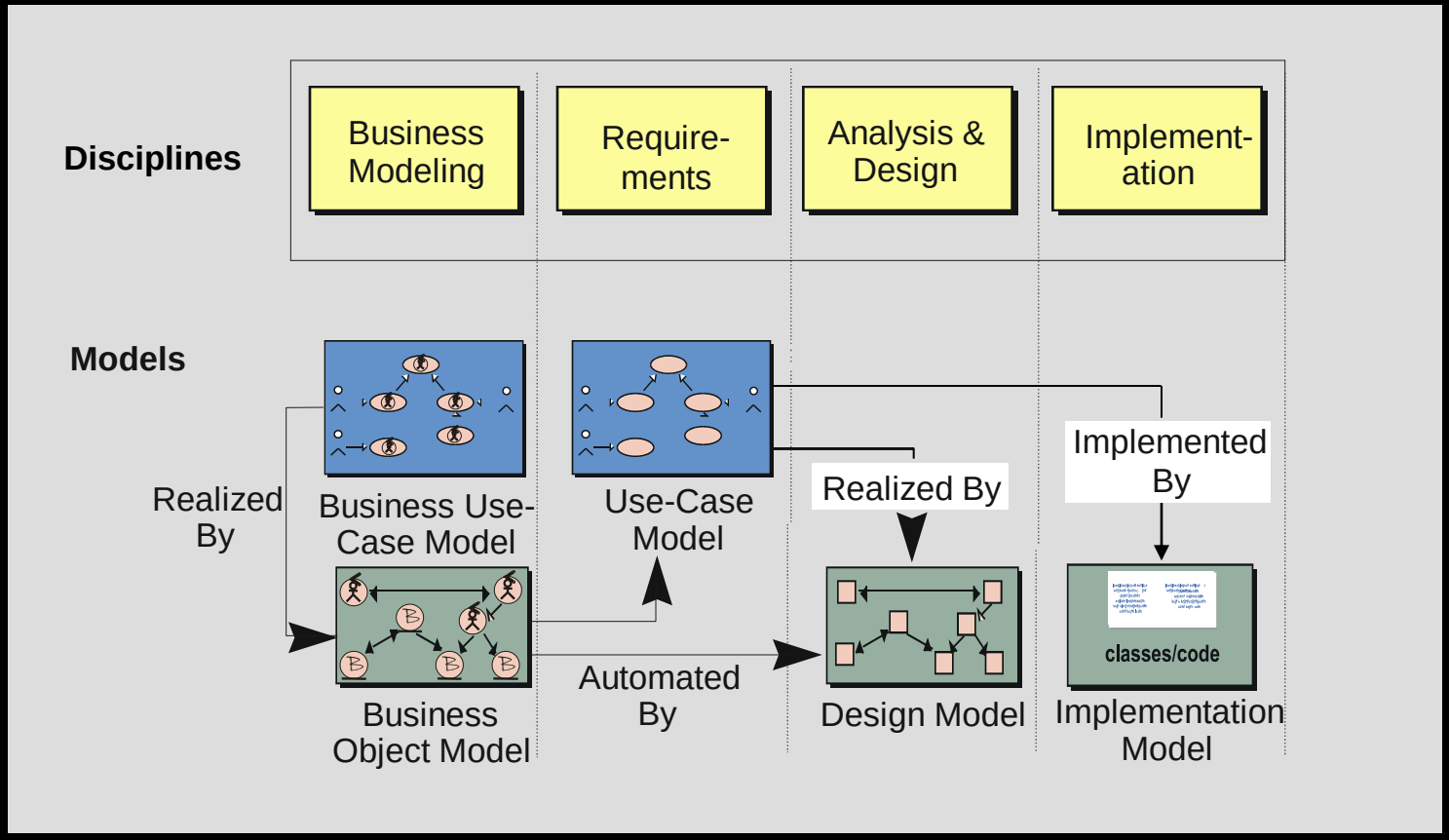
Bringing It All Together: The Iterative Approach



In an iteration, you walk through all disciplines.

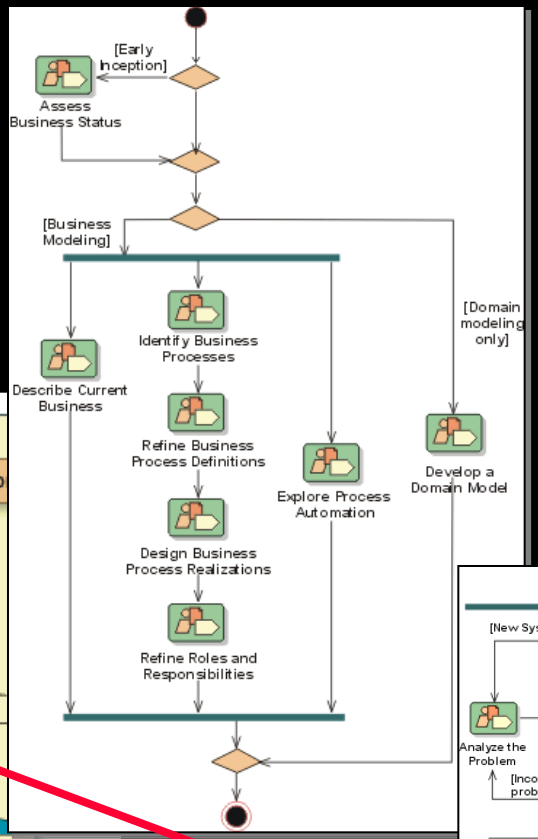
Disciplines group activities logically.

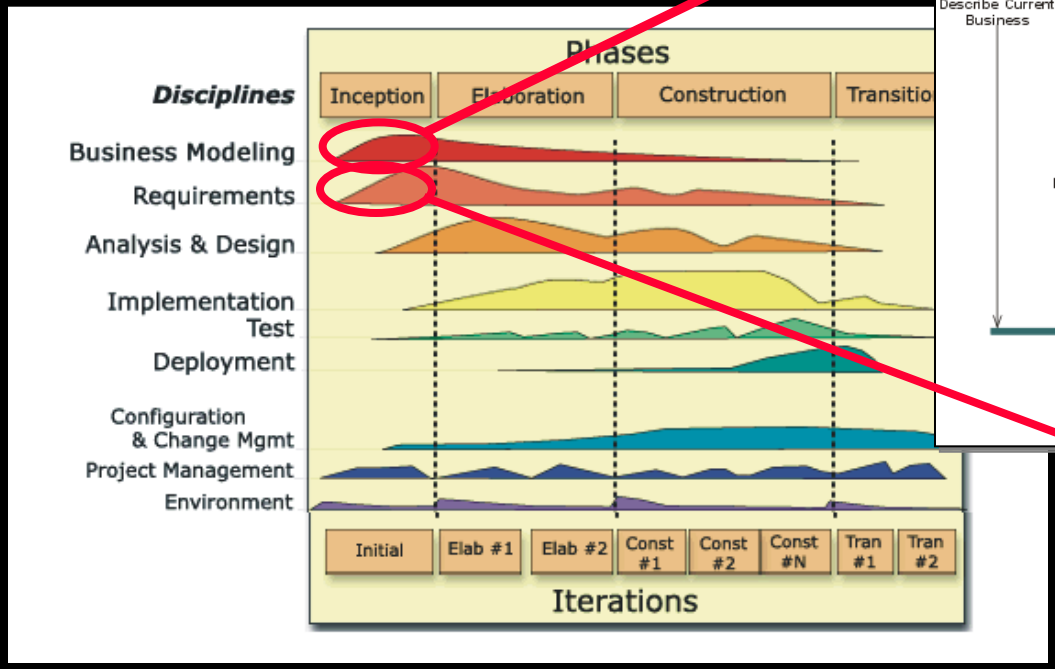
Disciplines Produce Models

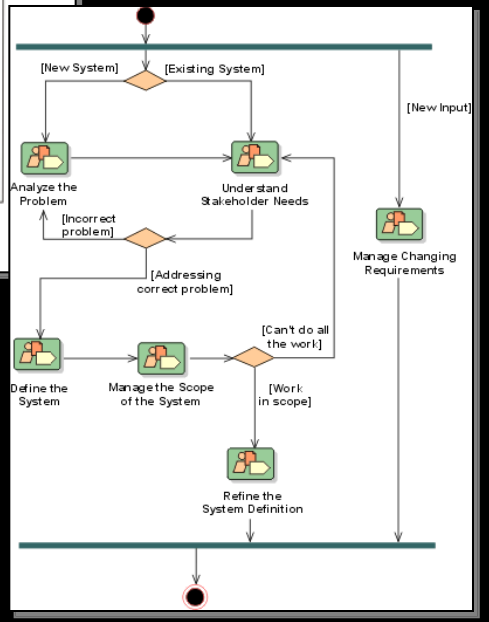


Disciplines Guide Iterative Development

Business Modeling: Workflow

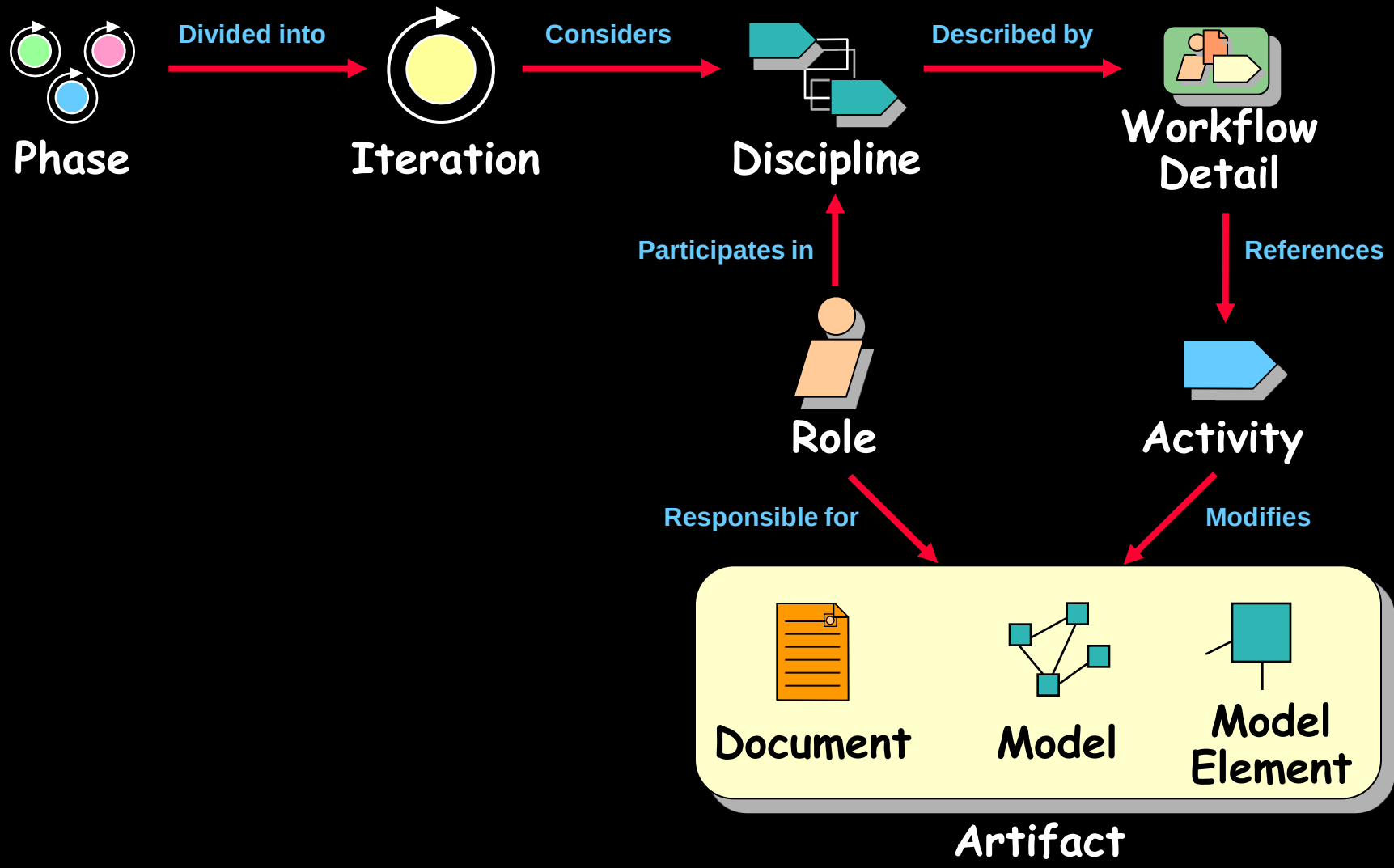






Requirements: Workflow

Overview of Rational Unified Process Concepts



Review

- Best Practices guide software engineering by addressing root causes.
- Best Practices reinforce each other.
- Process guides a team on who does what, when, and how.
- The Rational Unified Process is a means of achieving Best Practices.