Software Engineering Processes

Course Code: XB_0089

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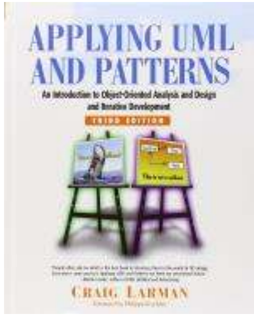
Bachelor in Computer Science, June 4th 2024

Part 1: Unified Process

Unified Process (UP)

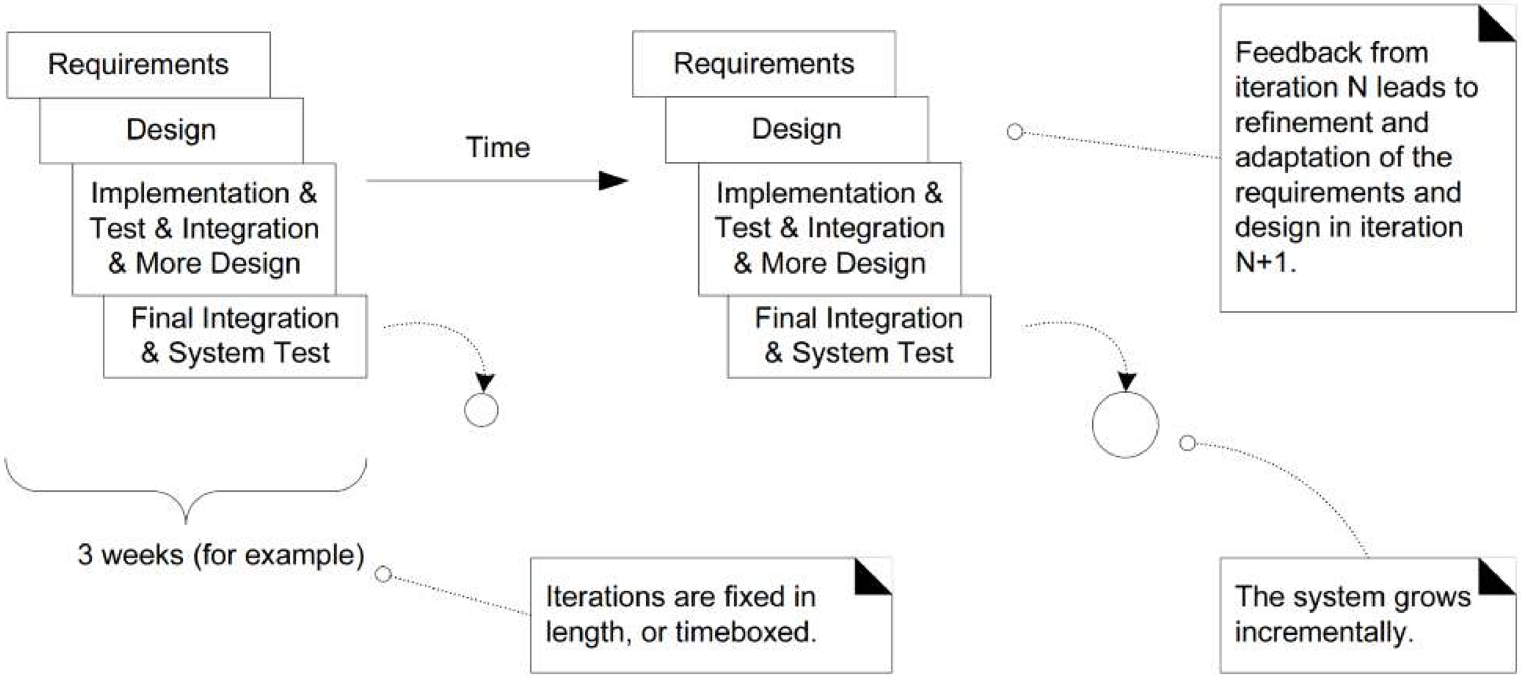
- An **iterative** software development process for building **object oriented** systems
- Uses OOA/D concepts
- Promotes the use of **UML** (Unified Modeling Language)
- **Very flexible** and **open**
- Uses practices from other agile methods:
  - From XP: test-driven development, refactoring, continuous integration, …
  - From Scrum: daily meetings, …

Unified Process (UP)


APPLYING UML AND PATTERNS
An Introduction to Object-Oriented Analysis and Design and Iterative Development
THIRD EDITION
CRAIG LARMAN

- Craig Larman says:
  - The **UP** combines commonly **accepted best practices**, such as an **iterative lifecycle** and **risk-driven development**, into a **cohesive** and **well-documented process** description.

Iterative, Incremental, Evolutionary Development



Requirements

Design

Implementation & Test & Integration & More Design

Final Integration & System Test

Time

Requirements

Design

Implementation & Test & Integration & More Design

Final Integration & System Test

3 weeks (for example)

Feedback from iteration N leads to refinement and adaptation of the requirements and design in iteration N+1.

Iterations are fixed in length, or timeboxed.

The system grows incrementally.

Iterations and Their Results

- The result of each iteration is an **executable but incomplete system**
- The result is **not ready to deliver into production**
- The system may not be eligible for production deployment until after many iterations e.g., 10 or 15 iterations or more ...
- The result of an iteration is **not an experimental or throw-away prototype**
- Iterative development is **not prototyping**
- The result is a production grade subset of the final system

Unified Process (UP) & Changes

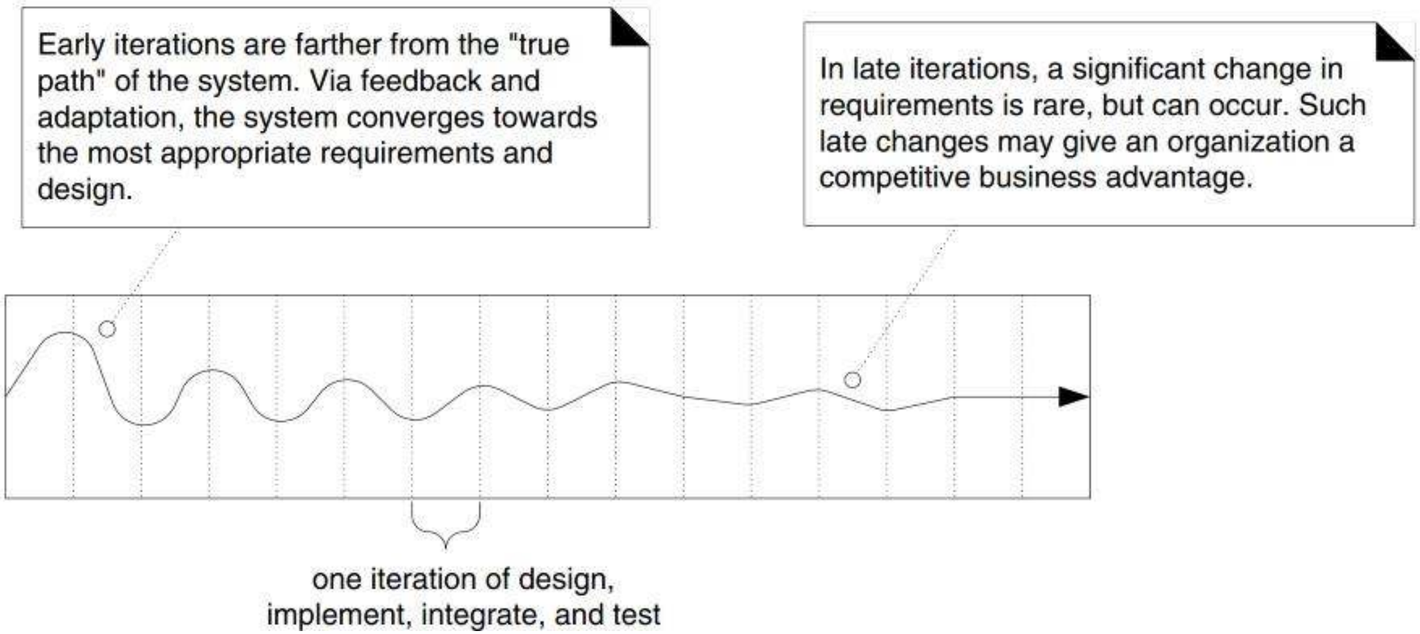
- Each iteration focusses on a **small subset of the requirements**, and **quickly designing, implementing, and testing**
- In early iterations the choice of requirements and design may not be exactly what is ultimately desired
- But taking a small step, before all requirements are finalized, or the entire design is speculatively defined, leads to rapid feedback from the users, developers, and tests

Unified Process (UP)

- Iterations may be considered a series of structured **build-feedback-adapt** cycles
- Main objectives:
  - Address changes
  - Minimize risks

Unified Process (UP)

- The design and requirements instability lowers over time

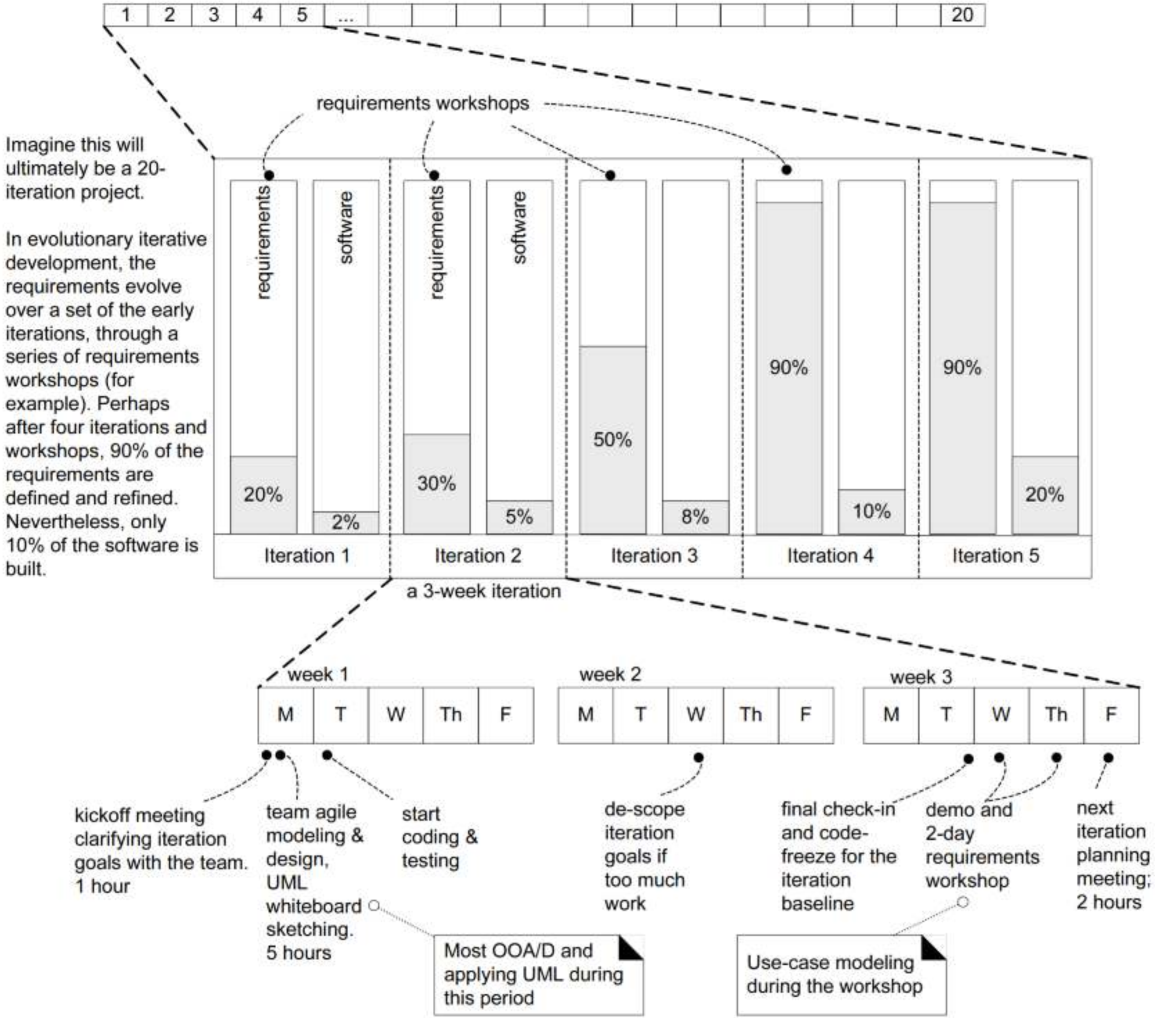


Early iterations are farther from the "true path" of the system. Via feedback and adaptation, the system converges towards the most appropriate requirements and design.

In late iterations, a significant change in requirements is rare, but can occur. Such late changes may give an organization a competitive business advantage.

one iteration of design, implement, integrate, and test

Iterative and Evolutionary Analysis and Design



Imagine this will ultimately be a 20-iteration project.

In evolutionary iterative development, the requirements evolve over a set of the early iterations, through a series of requirements workshops (for example). Perhaps after four iterations and workshops, 90% of the requirements are defined and refined. Nevertheless, only 10% of the software is built.

kickoff meeting clarifying iteration goals with the team. 1 hour

team agile modeling & design, UML whiteboard sketching. 5 hours

start coding & testing

de-scope iteration goals if too much work

final check-in and code-freeze for the iteration baseline

demo and 2-day requirements workshop

next iteration planning meeting; 2 hours

Most OOA/D and applying UML during this period

Use-case modeling during the workshop

Benefits of Unified Process (UP)

- Less project failure
- Better productivity
- Lower defect rates
- Early rather than late mitigation of high risks (technical, requirements, objectives, usability, …)
- Early visible progress

Benefits of Unified Process (UP)

- Early feedback, user engagement, and adaptation, leads to a refined system that meets the real needs of the stakeholders
- Managed complexity – development team is not overwhelmed by “analysis paralysis” or very long and complex steps
- The learning within an iteration can be methodically used to improve the development process itself, iteration by iteration

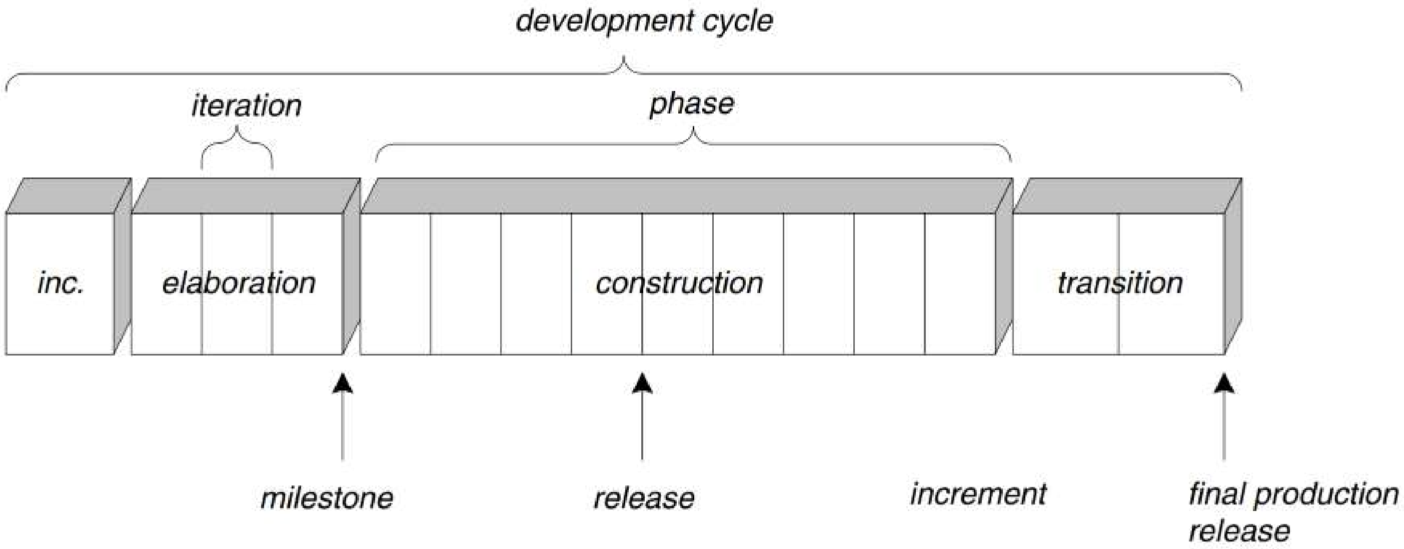
Agile UP

- Keywords: adaptability and lightness
- Examples:
  - Requirements and designs are not completed before implementation; they adaptively emerge through a series of iterations, based on feedback
  - UML applied with agile modeling practices
  - No detailed plan for the entire project
  - …

UP 4 Phases

- **Inception**: approximate vision, business case, scope, vague estimates
- **Elaboration**: refined vision, iterative implementation of the core architecture, resolution of high risks, identification of most requirements and scope, more realistic estimates
- **Construction**: iterative implementation of the remaining lower risk and easier elements, and preparation for deployment
- **Transition**: tests, deployment

UP Iterations and Phases



An iteration end-point when some significant decision or evaluation occurs.

A stable executable subset of the final product. The end of each iteration is a minor release.

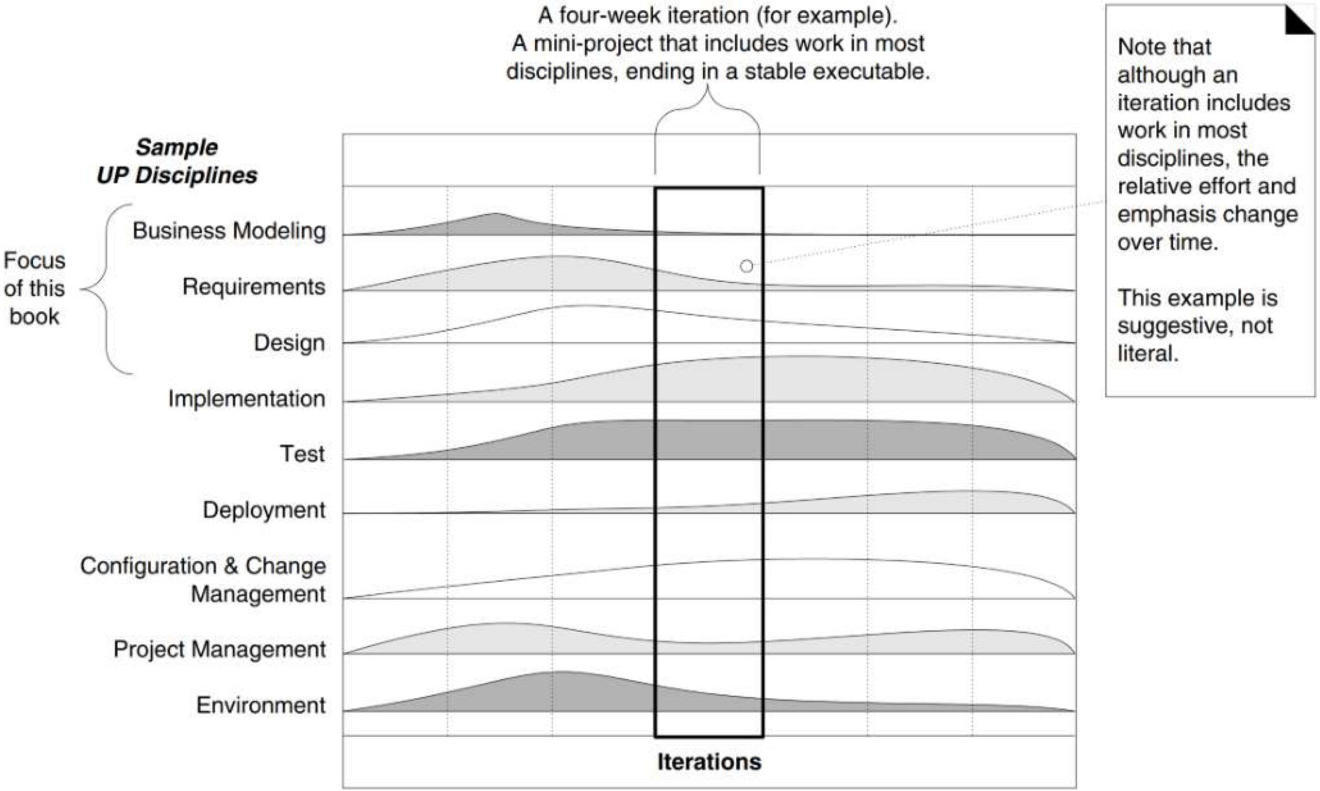
The difference (delta) between the releases of 2 subsequent iterations.

At this point, the system is released for production use.

UP Disciplines

- **Disciplines**: **a set of activities** (and related artifacts) in one subject **area** (e.g., activities within requirements analysis)
- In UP, an **artifact** is the general term for any **work product**: code, Web graphics, database schema, text documents, diagrams, models, …

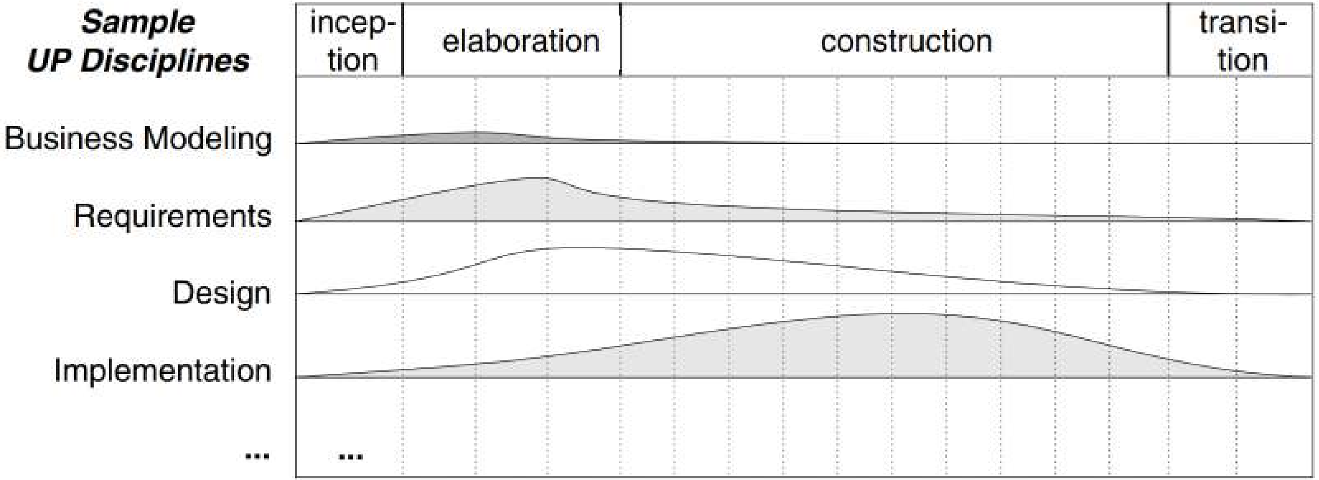
UP Disciplines


A four-week iteration (for example).
A mini-project that includes work in most disciplines, ending in a stable executable.
Sample UP Disciplines
Focus of this book
Business Modeling
Requirements
Design
Implementation
Test
Deployment
Configuration & Change Management
Project Management
Environment
Iterations
Note that although an iteration includes work in most disciplines, the relative effort and emphasis change over time.
This example is suggestive, not literal.

UP Disciplines and Phases

- During one iteration work goes on in most or all disciplines
- The relative effort across these disciplines changes over time
- Early iterations focus on requirements and design
- Later iterations, as the requirements and core design stabilize through a process of feedback and adaptation, focus on implementation and testing

UP Disciplines and Phases



The relative effort in disciplines shifts across the phases.

This example is suggestive, not literal.

Part 2: Rational Unified Process

Rational Unified Process (RUP)

- A detailed refinement of UP
- The result of each iteration is an executable but incomplete system; it is not ready to deliver into production.
- The system may not be eligible for production deployment until after many iterations; for example, 10 or 15 iterations
- UML based analysis and modeling

Part 3: Exercises

Incremental vs Iterative

- Similarities/Differences?
- Advantages/Limitations?

- A possible answer at:
  - https://www.plutora.com/blog/iterative-incremental-development-comparison

Examples of Software Systems – What SEP to Use?

- Example 1: **Software Design Project**
  - Teams of 3/4 students
  - Time: 2 months

- Example 2: **Air Traffic Management**
  - Teams of 100 software engineers distributed all over the world
  - Time: 2 years

- Example 3: **Web Application for a New University**
  - Teams of 20 software engineers
  - Time: 6 months

- Example 4: **Lego Store**
  - Teams of 50 software engineers distributed all over the world
  - Time: 1 year

To Do

Your TO DO List for the 2nd Lecture:

- ▣ Read the study material

Reading – For the 2nd Lecture

- Exam material:
  - Ian Sommerville, Software Engineering, 9th or 10th edition – Chapter 2.4
  - RUP: RationalUnifiedProcess.pdf

Takeaways?

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