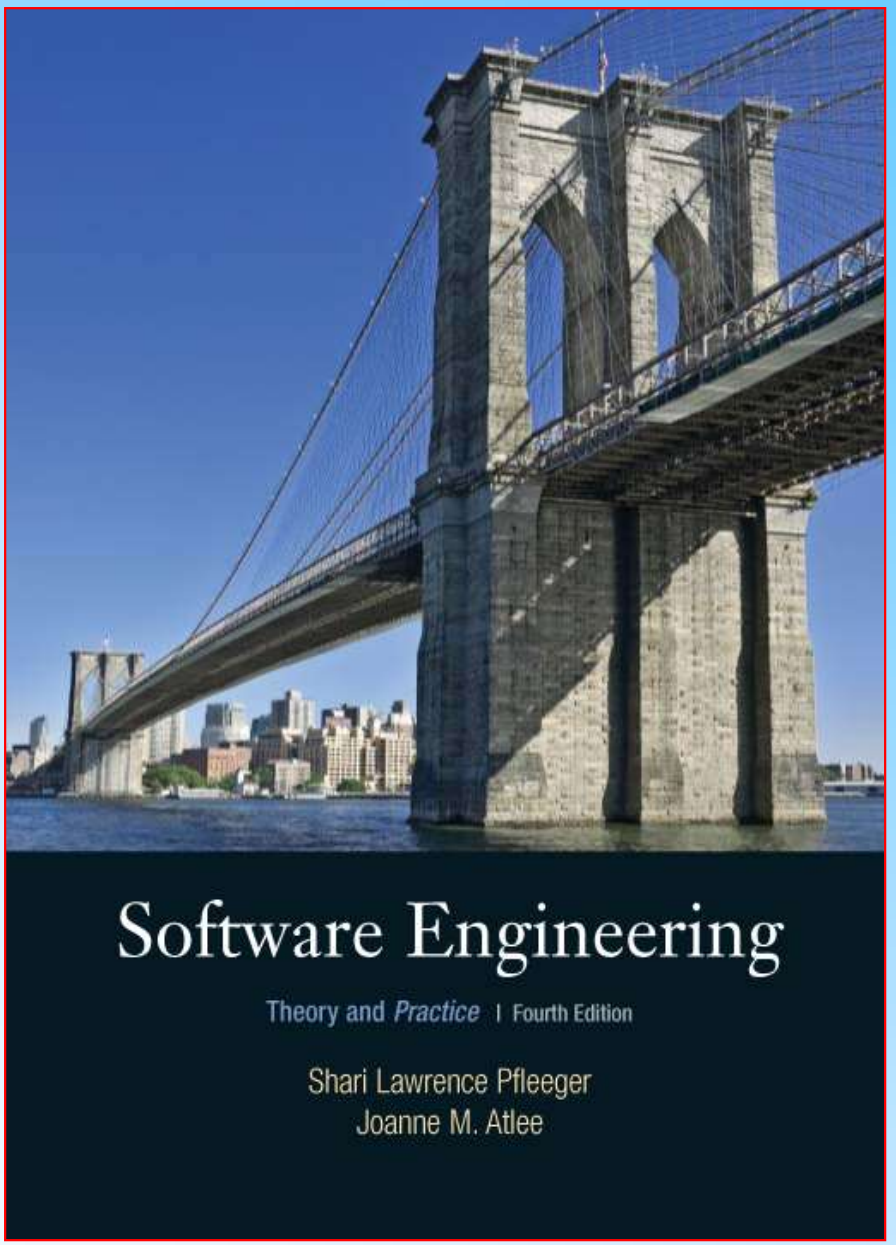
Chapter 2

Modelling the Process and Life Cycle



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2.2 Software Process Models
Reasons for Modeling a Process

- To form a common understanding
- To find inconsistencies, redundancies, omissions
- To find and evaluate appropriate activities for reaching process goals
- To tailor a general process for a particular situation in which it will be used

2.2 Software Process Models
Software Life Cycle

- When a process involves building a software, the process may be referred to as software life cycle
  - Requirements analysis and definition
  - System (architecture) design
  - Program (detailed/procedural) design
  - Writing programs (coding/implementation)
  - Testing: unit, integration, system
  - System delivery (deployment)
  - Maintenance

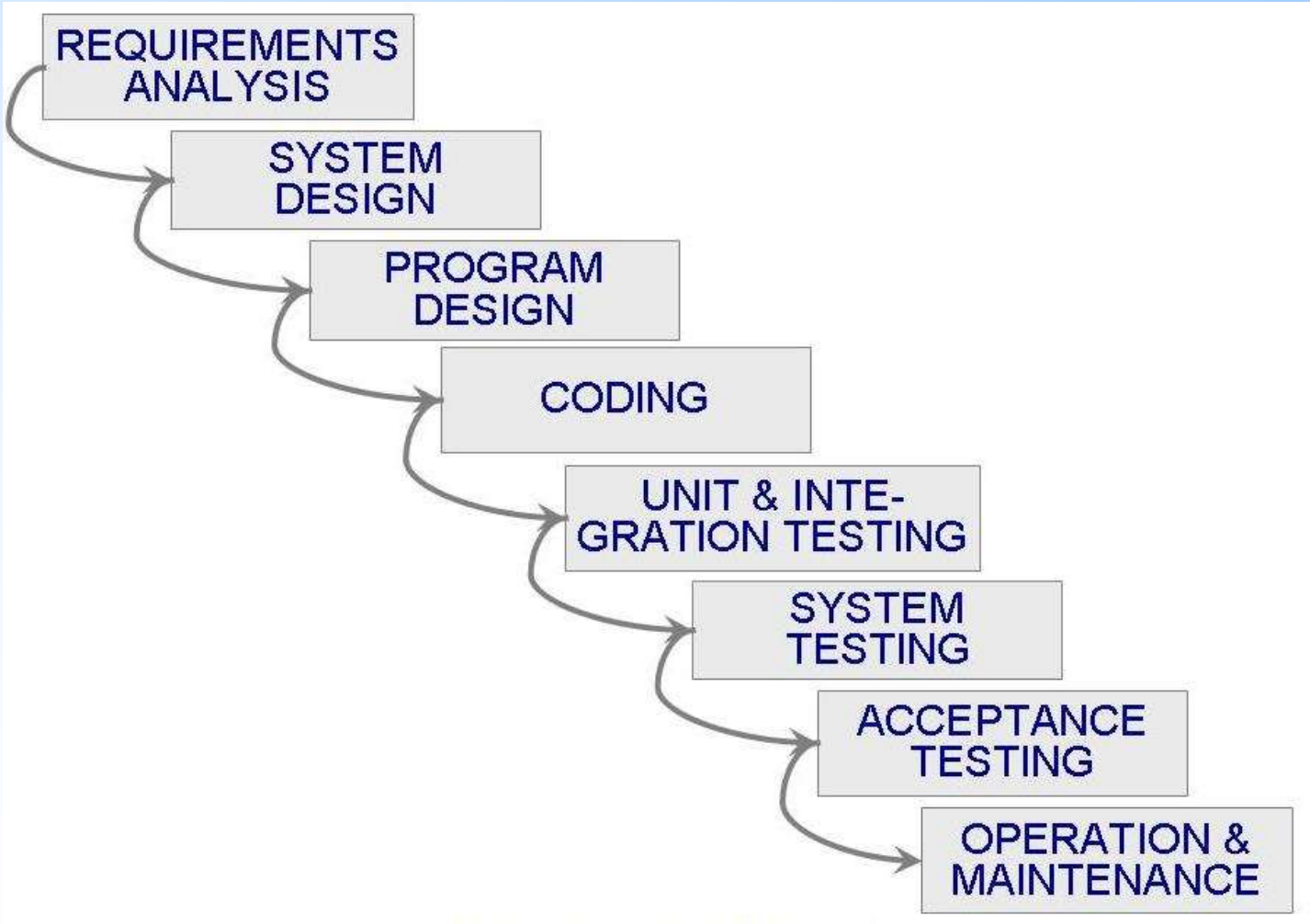
2.2 Software Process Models
Software Development Process Models

- Waterfall model
- V model
- Prototyping model
- Operational specification
- Transformational model
- Phased development: increments and iteration
- Spiral model
- Agile methods

2.2 Software Process Models
Waterfall Model

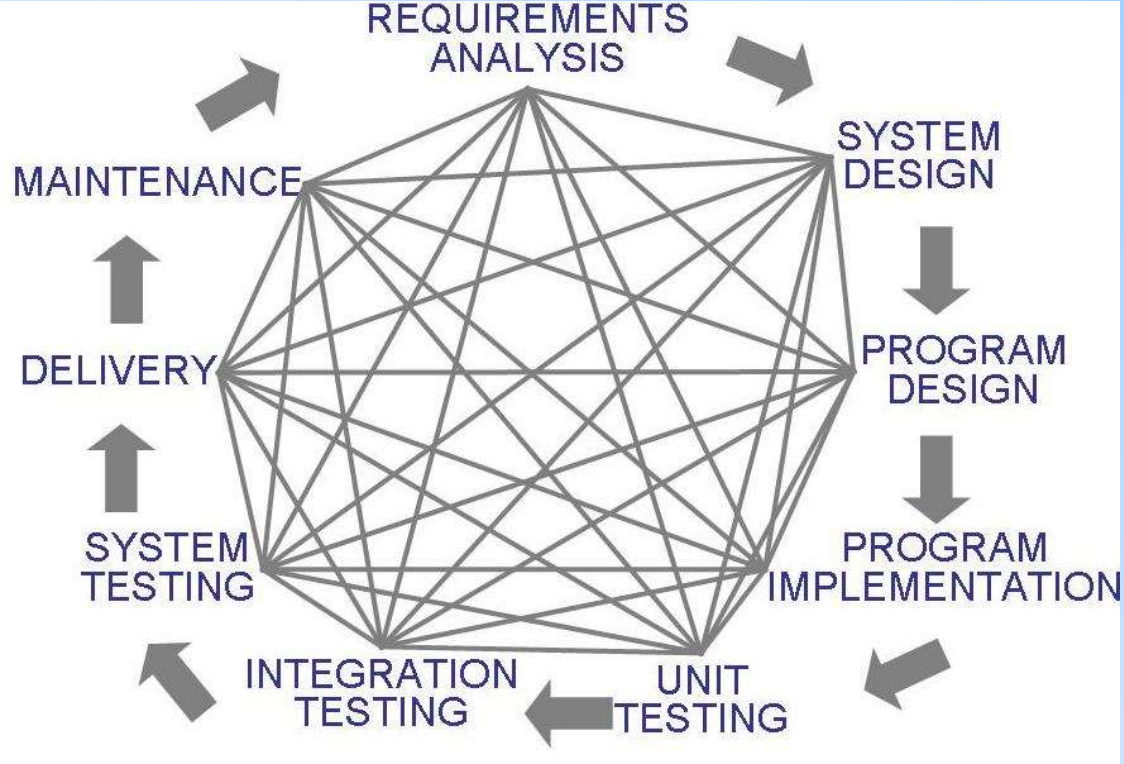
- One of the first process development models proposed
- Works for well understood problems with minimal or no changes in the requirements
- Simple and easy to explain to customers
- It presents
  - a very high-level view of the development process
  - sequence of process activities
- Each major phase is marked by milestones and deliverables (artifacts)

2.2 Software Process Models
Waterfall Model (continued)



2.2 Software Process Models
Waterfall Model (continued)

- There is no iteration in waterfall model
- Most software developments apply a great amount of iterations



2.2 Software Process Models
Sidebar 2.1 Drawbacks of The Waterfall Model

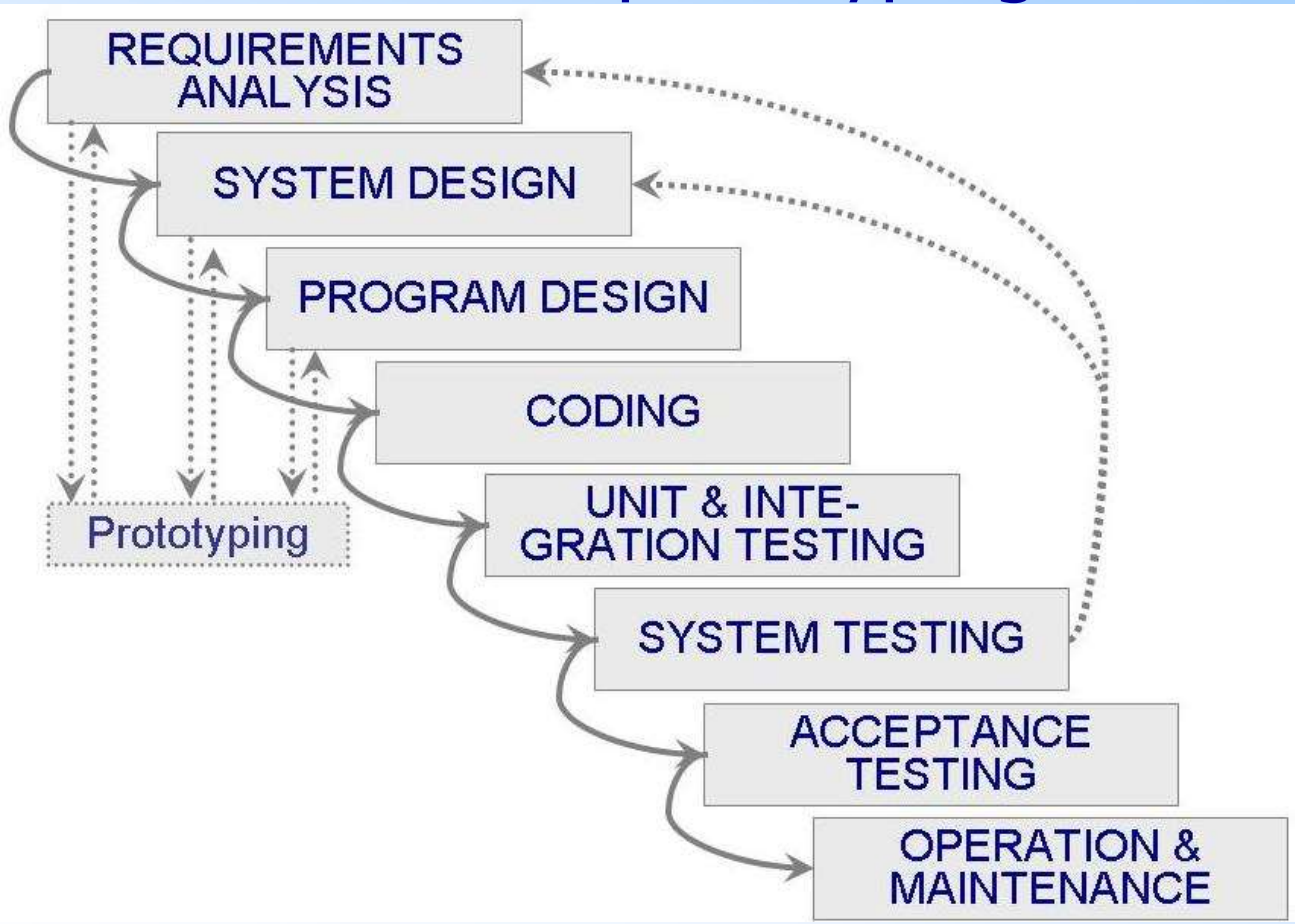
- Provides no guidance how to handle changes to products and activities during development
- Views software development as manufacturing process rather than as creative process
- There is no iterative activities (i.e. developing and evaluating prototypes) that lead to creating a final product
- Long wait before a final product

2.2 Software Process Models
Waterfall Model with Prototype

- A prototype is a partially developed product
- Prototyping helps
  - to determine whether it is feasible and practical
  - developers assess alternative design strategies (design prototype)
  - users understand what the system will be like (user interface prototype)
- Protopyping is useful for verification and validation

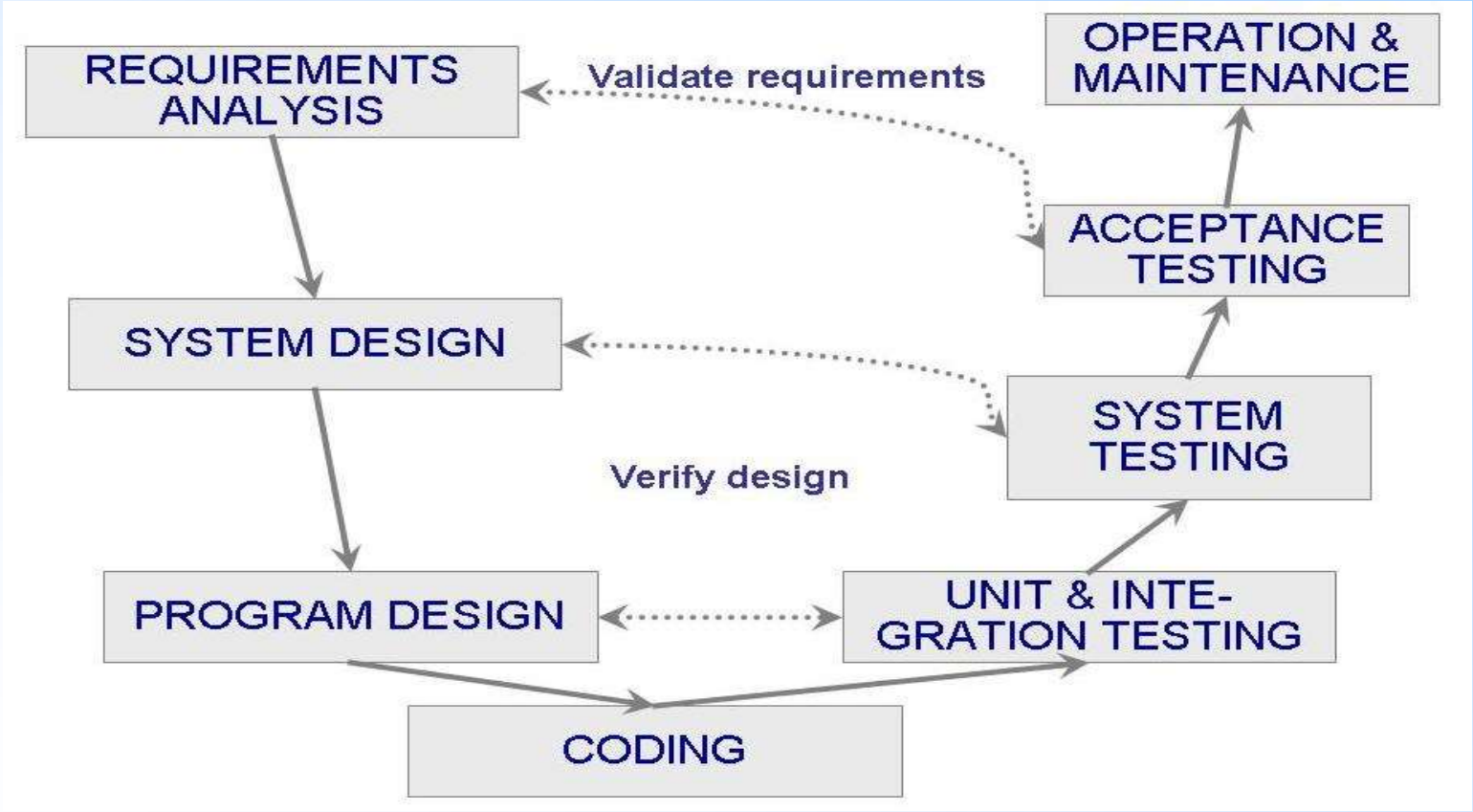
2.2 Software Process Models
Waterfall Model with Prototype (continued)

- Waterfall model with prototyping



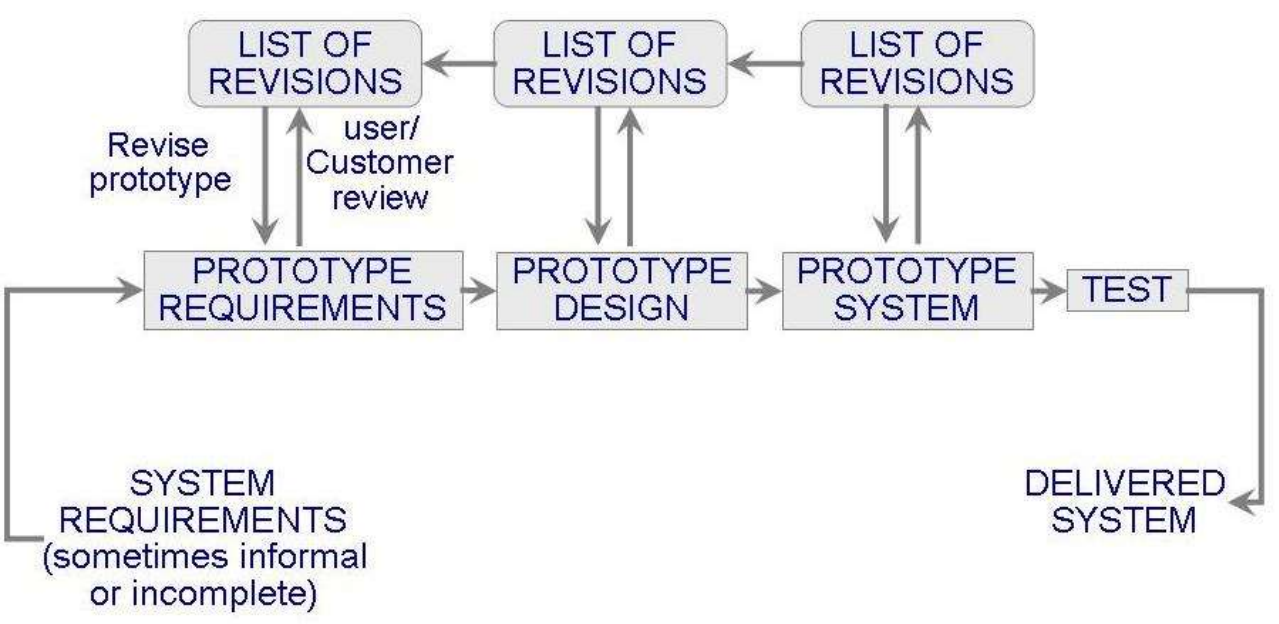
2.2 Software Process Models
V Model

- A variation of the waterfall model



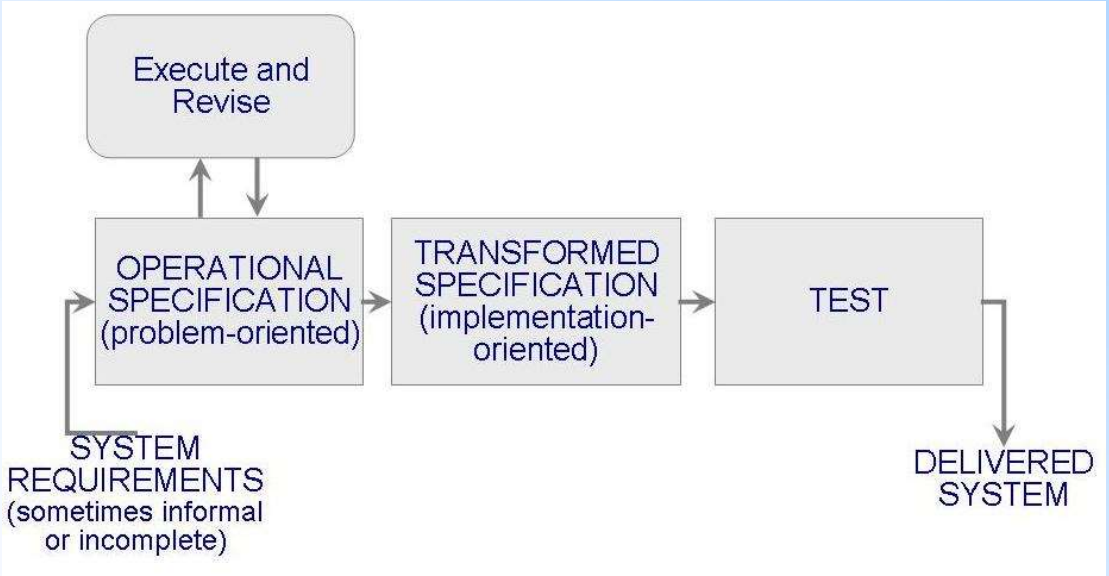
2.2 Software Process Models
Prototyping Model

- Allows repeated investigation of the requirements or design
- Reduces risk and uncertainty in the development



2.2 Software Process Models
Operational Specification Model

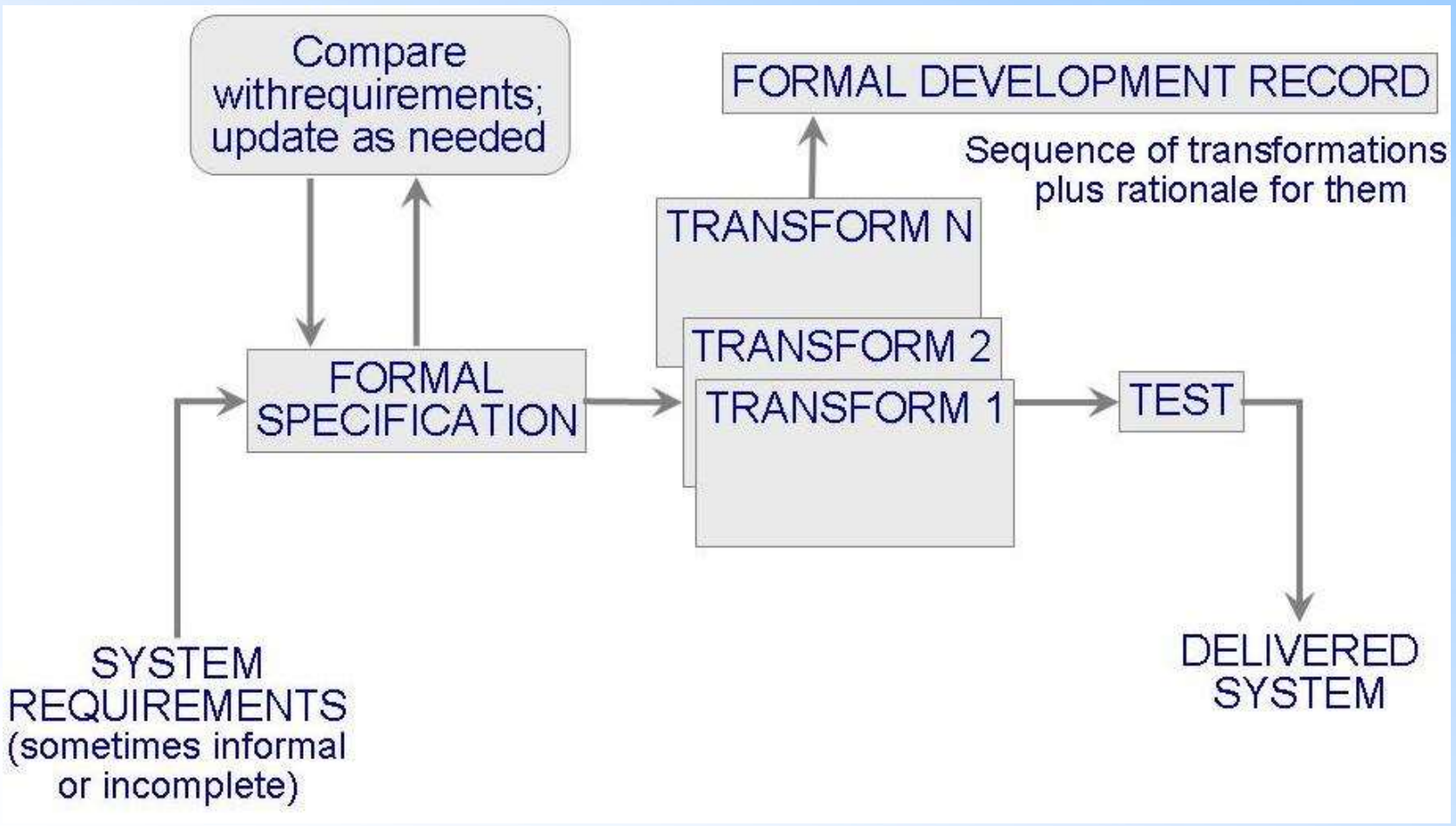
- Requirements are executed (examined) and their implication evaluated early in the development process
- Functionality and the design are allowed to be merged



2.2 Software Process Models
Transformational Model

- Fewer major development steps
- Applies a series of transformations to change a specification into a deliverable system (such as)
  - Change data representation
  - Select algorithms
  - Optimize
  - Compile
- Relies on formalism
- Requires formal specification to allow transformations

2.2 Software Process Models
Transformational Model (continued)

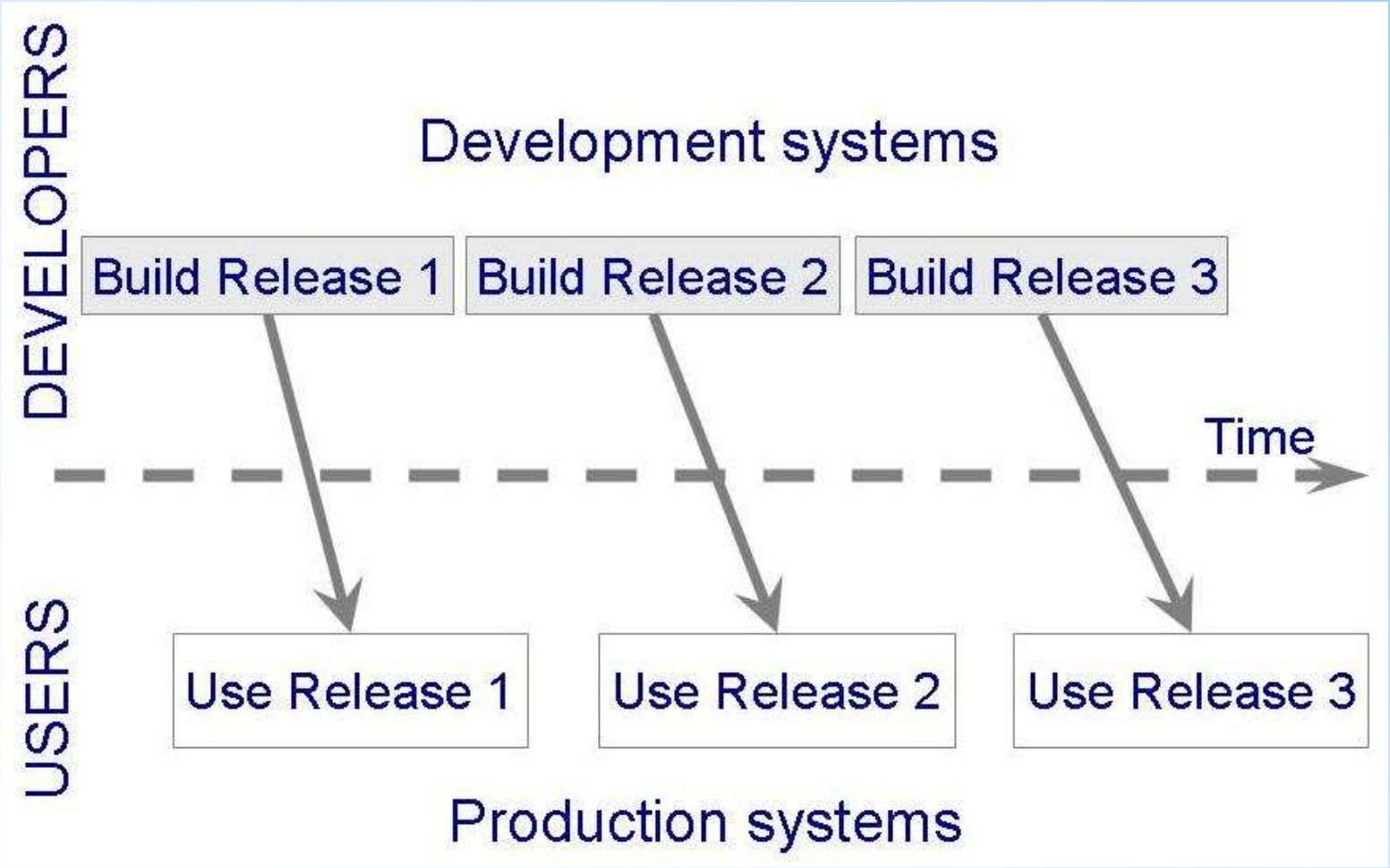


2.2 Software Process Models
Phased Development: Increments and Iterations

- Shorter cycle time
- System delivered in pieces
  - enables customers to have some functionality while the rest is being developed
- Allows two systems functioning in parallel
  - the production system (release *n*): currently being used
  - the development system (release *n+1*): the next version

2.2 Software Process Models

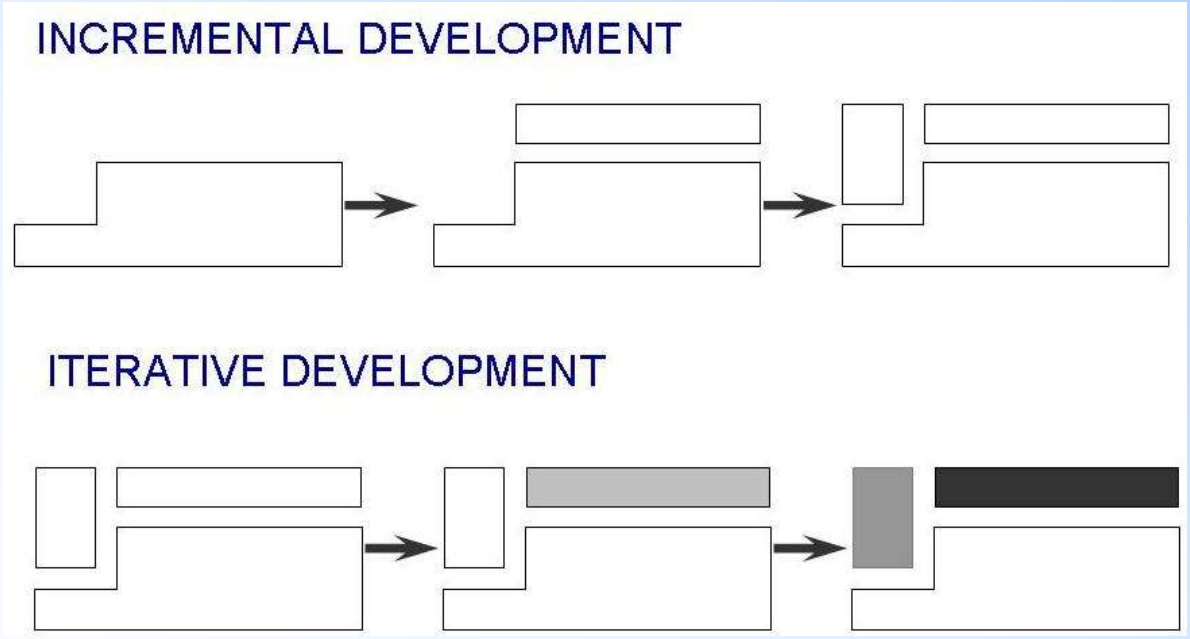
Phased Development: Increments and Iterations (continued)



2.2 Software Process Models

Phased Development: Increments and Iterations (continued)

- **Incremental development**: starts with small functional subsystem and adds functionality with each new release
- **Iterative development**: starts with full system, then changes functionality of each subsystem with each new release



2.2 Software Process Models

Phased Development: Increments and Iterations (continued)

- Phased development is desirable for several reasons
  - Training can begin early, even though some functions are missing
  - Markets can be created early for functionality that has never before been offered
  - Frequent releases allow developers to fix unanticipated problems globaly and quickly
  - The development team can focus on different areas of expertise with different releases

2.2 Software Process Models
Spiral Model

- Suggested by Boehm (1988)
- Combines development activities with risk management to minimize and control risks
- The model is presented as a spiral in which each iteration is represented by a circuit around four major activities
  - Plan
  - Determine goals, alternatives and constraints
  - Evaluate alternatives and risks
  - Develop and test

2.2 Software Process Models
Spiral Model (continued)

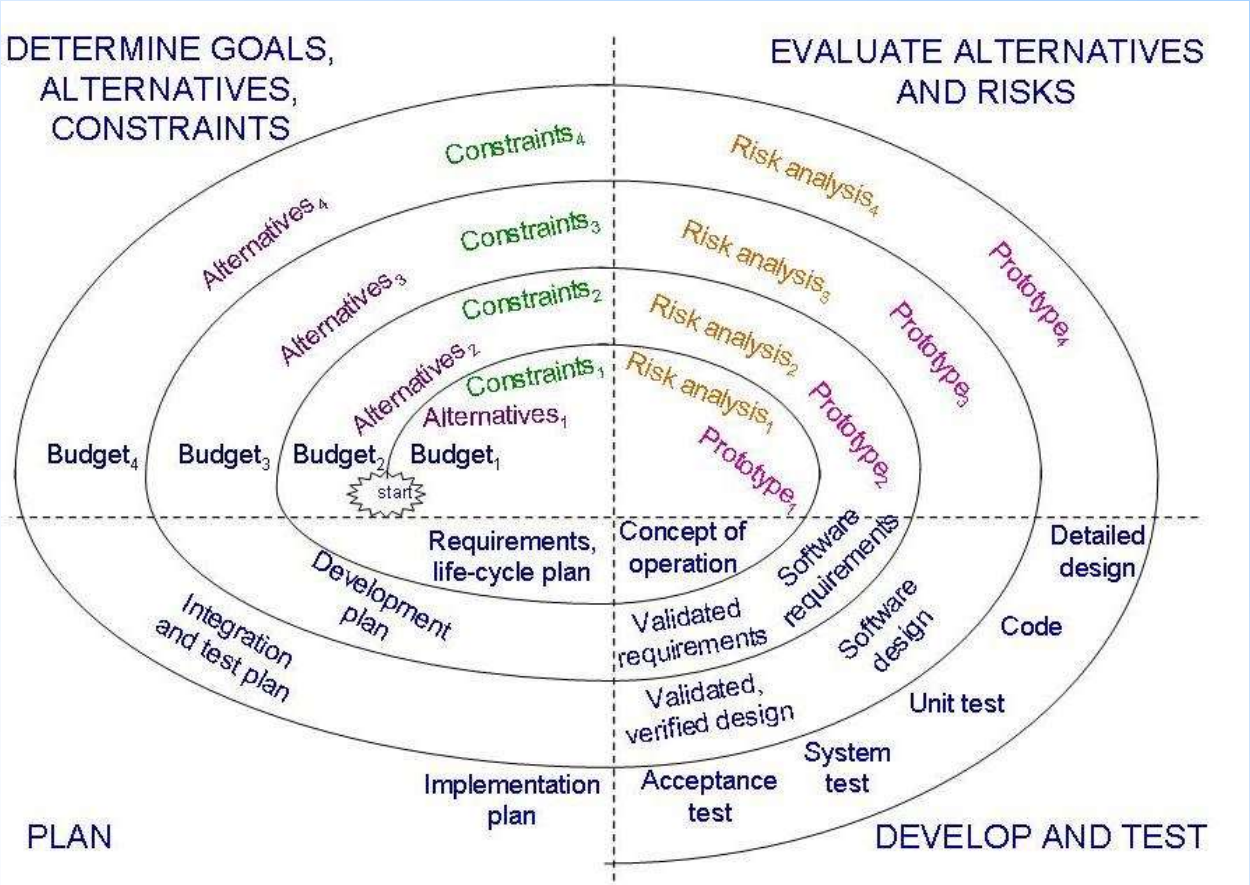


Figure 2.10 the spiral model.

2.2 Software Process Models
Agile Methods

- Emphasis on flexibility in producing software quickly and capably
- Agile manifesto
  - Value individuals and interactions over process and tools
  - Prefer to invest time in producing working software rather than in producing comprehensive documentation
  - Focus on customer collaboration rather than contract negotiation
  - Concentrate on responding to change rather than on creating a plan and then following it, since requirements change frequently.

2.2 Software Process Models
Agile Methods: Examples of Agile Process

- Extreme programming (XP)
- Crystal: a collection of approaches based on the notion that every project needs a unique set of policies and conventions
- Scrum: 30-day iterations; multiple self-organizing teams; daily “scrum” coordination

2.2 Software Process Models
Agile Methods: Extreme Programming

- Emphasis on four characteristics of agility
  - *Communication*: continual interchange between customers and developers
  - *Simplicity*: select the simplest design or implementation
  - *Courage*: commitment to delivering functionality early and often
  - *Feedback*: loops built into the various activitites during the development process

2.2 Software Process Models
Agile Methods: Twelve Facets of XP

- The planning game *(customer defines value)*
- Small release *(incremental or iterative cycles)*
- Metaphor *(development team agrees on common vision, common names)*
- Simple design
- Writing tests first *(functional and unit)*
- Refactoring *(revisiting the requirements)*
- Pair programming *(one keyboard two people)*
- Collective ownership *(any developer can change)*
- Continuous integration *(small increments)*
- Sustainable pace *(40 hours/week)*
- On-site customer
- Coding standard

2.2 Software Process Models
Sidebar 2.2 When Extreme is Too Extreme?

- Extreme programming's practices are interdependent
  - Uncomfortable with pair programming, many developers prefer to do some design documents before they write code.
- Requirements expressed as a set of test cases must be passed by the software
  - System passes the tests but is not what the customer is paying for (moving away from goals)
- Refactoring issue
  - Difficult to rework a system without degrading its architecture