Software Processes

CMPT 276
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Based on slides from Software Engineering 9th ed, Sommerville ch2

Topics

1) What activities are part of software development

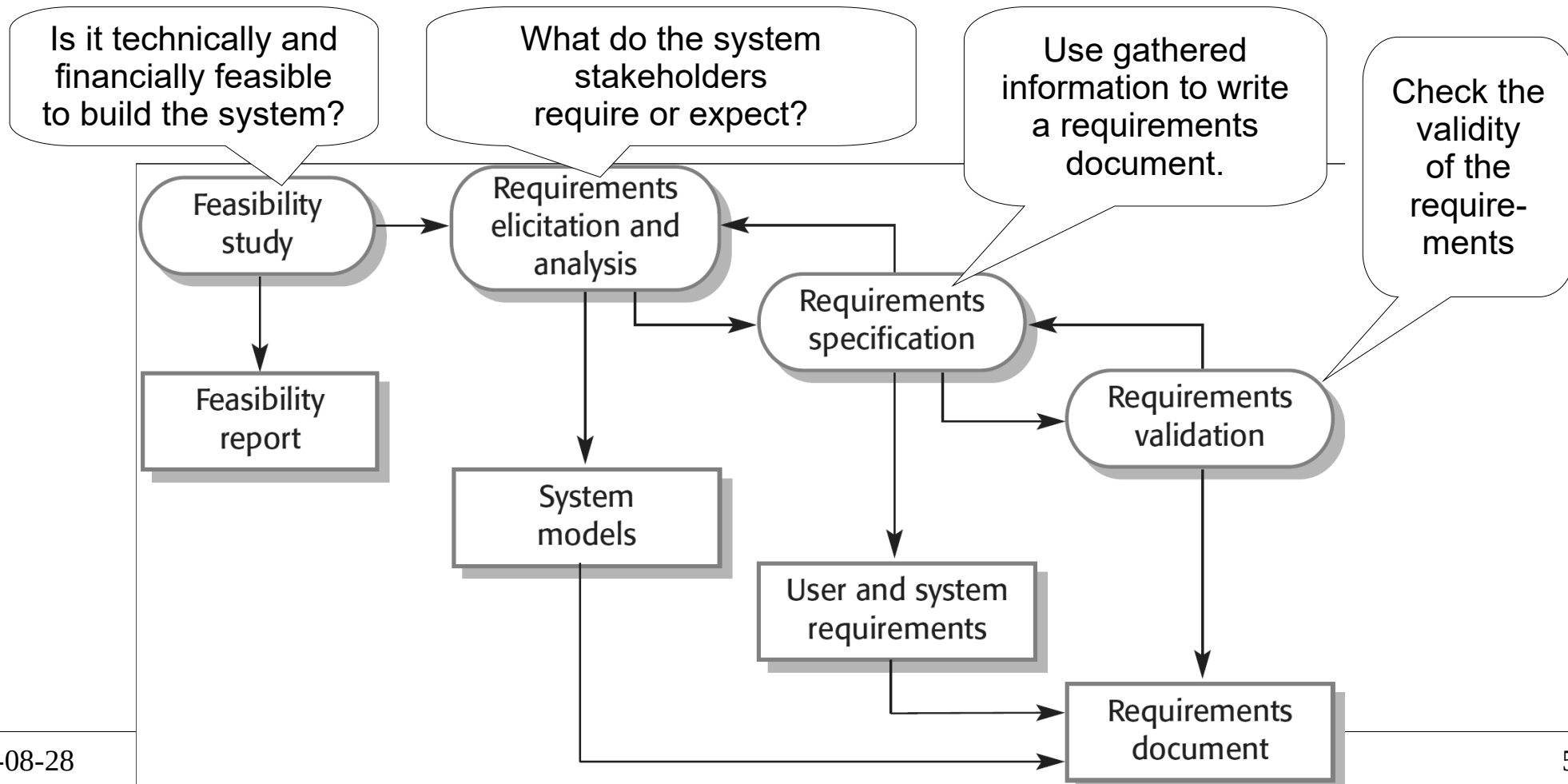2) What are software process models?

Process Activities

The software process

- Software Process:
  -

- All software processes involve:
  - Specification – what will the system do?
  - Design & implementation – how will it do this? ..

  - Validation – does it do what the customer wants?
  - Evolution – change system to meet
                        customer's changing needs.
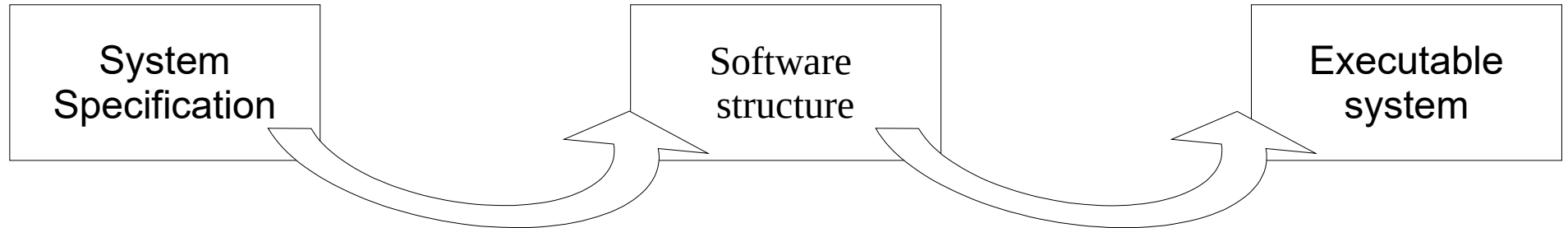- A software process model is..

Software Specification

Software specification: establishing what services are required and..

Is it technically and financially feasible to build the system?

What do the system stakeholders require or expect?

Use gathered information to write a requirements document.

Check the validity of the require-ments

Feasibility study

Requirements elicitation and analysis

Requirements specification

Requirements validation

Feasibility report

System models

User and system requirements

Requirements document

Software design and implementation

- Process to convert system specification into an executable system.

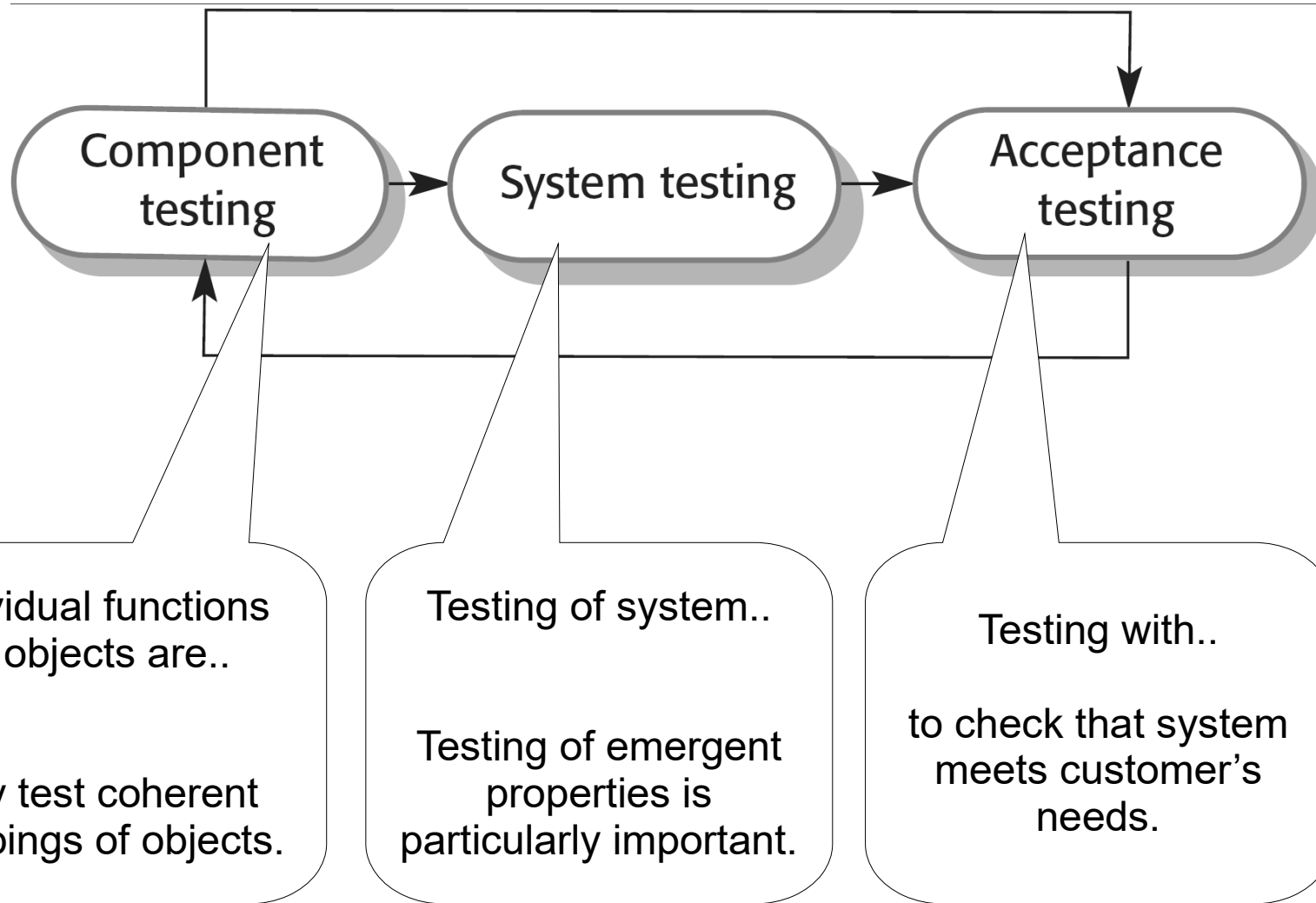| System Specification	Software structure	Executable system

- Design and implementation are closely related and..

Design Activity	Description
Architectural Design	Identify overall structure of the system & principle components:..
UI design	Layout initial ideas for user interface (UI).
Component design	Design each system component
Database design	Design the system's data structures and database

Software validation

- Validation
  - checks the system conforms to its..

- Involves testing
  - Create test cases which ensure system behaves correctly for some component/feature.
  - Best if using real-world data

- Can Involve Formal Verification
  - ..
  - Hard in practice; often restricted to critical components of life-critical components.

Testing Stages

Component testing → System testing → Acceptance testing

Individual functions or objects are..

May test coherent groupings of objects.

Testing of system..

Testing of emergent properties is particularly important.

Testing with..

to check that system meets customer's needs.

Software evolution

- Software is inherently flexible and can change.
- Software must change to meet new business needs
  - Most of a project's time and cost associated with...

- Programming stereotype is:
  - development is creative and interesting, but
  - maintenance is dull.

  - This is increasingly irrelevant as most..

  - Line between old and new is blurring.

So, what's the process to develop software?
Software Processes

Software processes

- Describe each process by:
  - such as designing how data is stored, or the user interface, etc
  -

- All processes involve the four basic activities
  - specification, development, validation and evolution.

- 2 Big Questions
  - Done up front? Or as you go?
  - Done at the end?
    Or multiple times?

(Planning) Paradigms

- Plan-driven processes:
  -
  -
  - Also called Big Design Up Front (BDUF).
- Agile processes:
  -
  - Easier to change the process to reflect changing customer requirements.
- Most practical processes include elements of both plan-driven and agile approaches.
  -

Delivery

- Single Delivery (at end)
  - Software only delivered to customer..

- Incremental Delivery
  - Customer is given..
    of the software throughout development.

Single
Delivery

Time during development...

Incremental
Delivery

High-level View of Software Processes

..

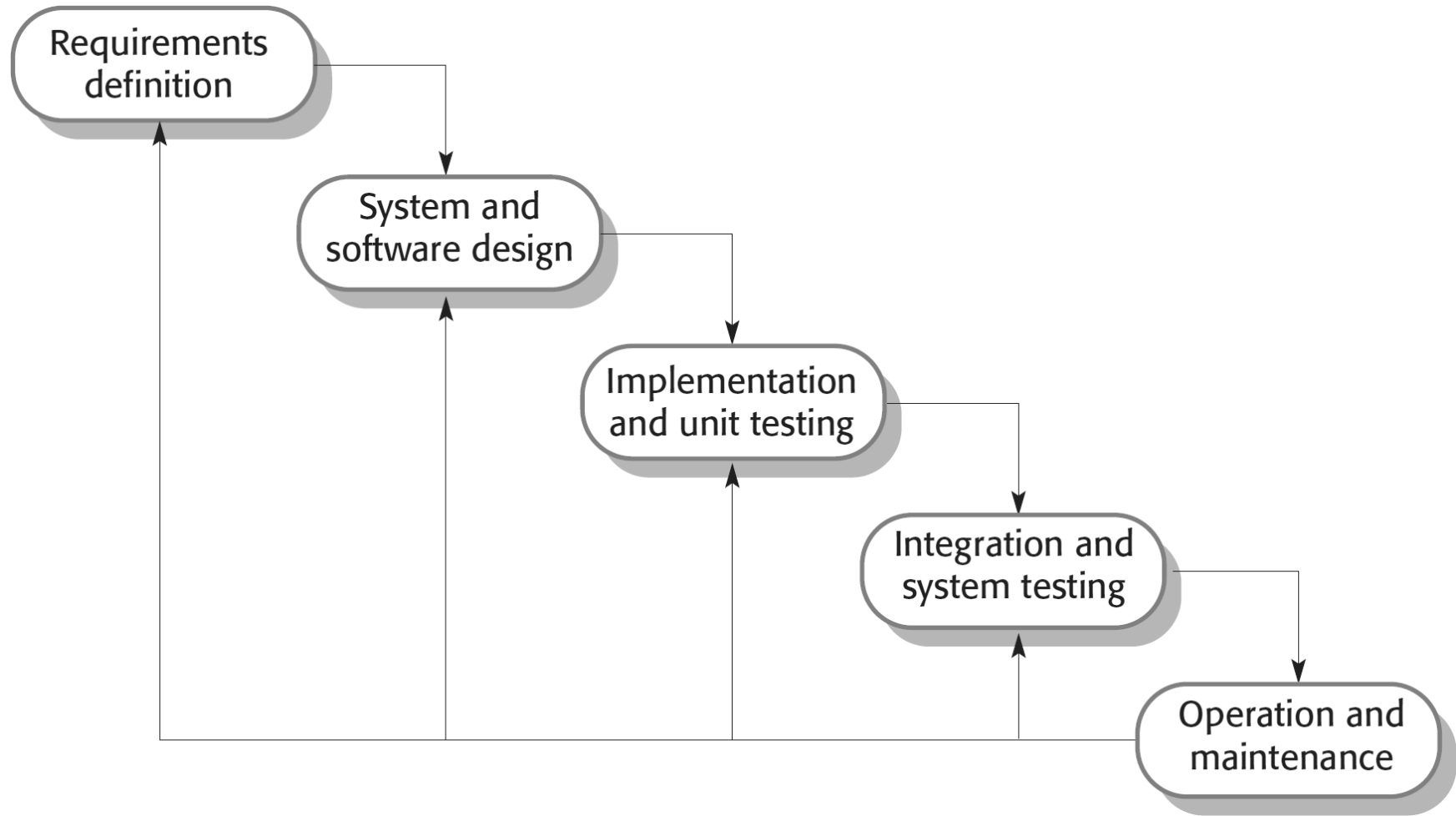|	Single Delivery	Incremental Delivery
Plan Driven (BDUF)		Plan Driven Incremental Model, Spiral Model
Evolutionary Planning		

..

Describe what a course assignment would look like for each of these 4 possibilities.

Software process models

- The waterfall model
  - Plan-driven model – Separate and distinct phases of specification and development.

- Incremental development
  - Specification, development and validation are..

- Agile
  - Lightweight process to adapt to changing requirements.

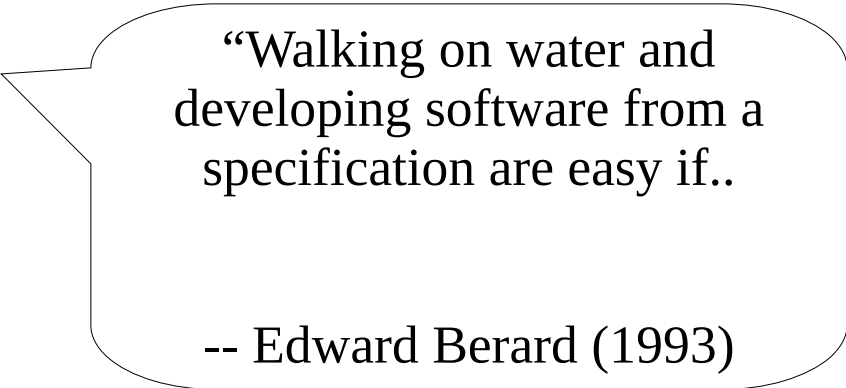- Most large systems developed using a process that incorporates elements from multiple models.

Waterfall model phases

Requirements definition → System and software design → Implementation and unit testing → Integration and system testing → Operation and maintenance

●

Waterfall model problems

- Must complete phase N before starting phase N+1.

- Waterfall-ish model is (somewhat) appropriate when..

    – Few business systems
       have stable requirements.

"Walking on water and developing software from a specification are easy if..

-- Edward Berard (1993)

- Plan-driven nature of the waterfall model helps..

    – However waterfall is so rigid it is
       virtually never used as a full methodology.

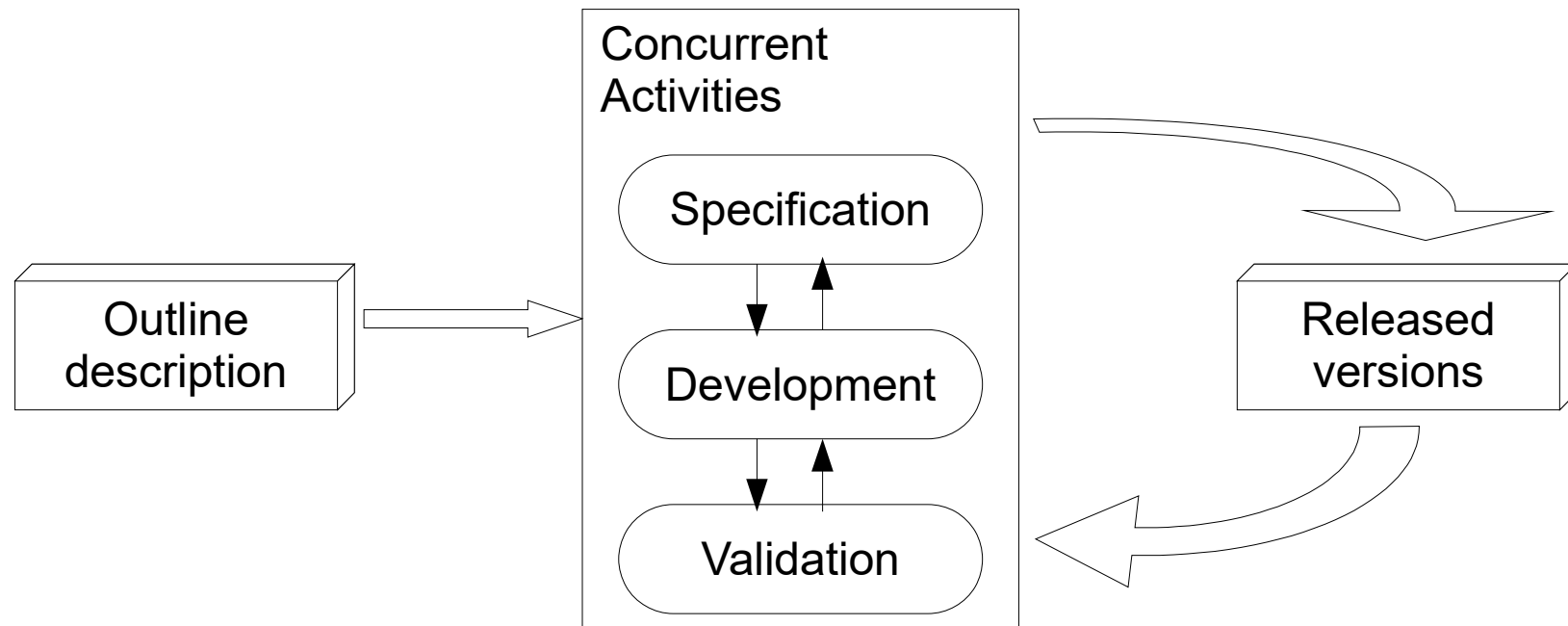# Incremental development

- Waterfall model delivers full system to user..

- Incremental development delivers..

Incremental and its benefits

- Incremental development usable by either paradigm
  - Plan Driven Models:
    Functionality of increments are..
  - Agile Models:
    Functionality of early increments are planned,
    later increments driven by...

- Reduced cost from changing customer requirements:
  - Not as much..

- Quick delivery of useful software.
  - Easier to get customer feedback on
    working software rather than paper designs.
  - Customer uses and gains value from the software
    earlier than with a single end delivery process.

Incremental development problems

- Code Rot:
  -
    Incorporating code changes becomes increasingly difficult and costly.
  - Time and money must be spent refactoring to improve the software.

Refactoring

- Refactoring
  -

- Refactoring Examples
  - rename a poorly named variable
  - split huge function into smaller ones,
  - improve OOD (object oriented design)
  - fixing parts of the code which have..

Agile

- Agile methodologies are lightweight:
  they try to..
  - Ex: Only as much documentation and planning as needed.

- Develop application in short iterations
  - ~1-3 weeks long

  - .. at start of each iteration.

  - .. at end of each iteration.

- Very common in industry
  - Whole slide-deck on it soon!

Summary

- Software processes are the activities involved in producing a software system.
    - Requirements engineering: develop the specification.
    - Design and implementation: transform requirements specification into an executable software system.
    - Software validation: check the system conforms to its specification and meets the needs of its users.
    - Software evolution: change existing software systems to meet new requirements.

- Process models describe a sequence of activities: 'waterfall' model, incremental development, and agile development.