Software Processes

Chapter 2

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

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.
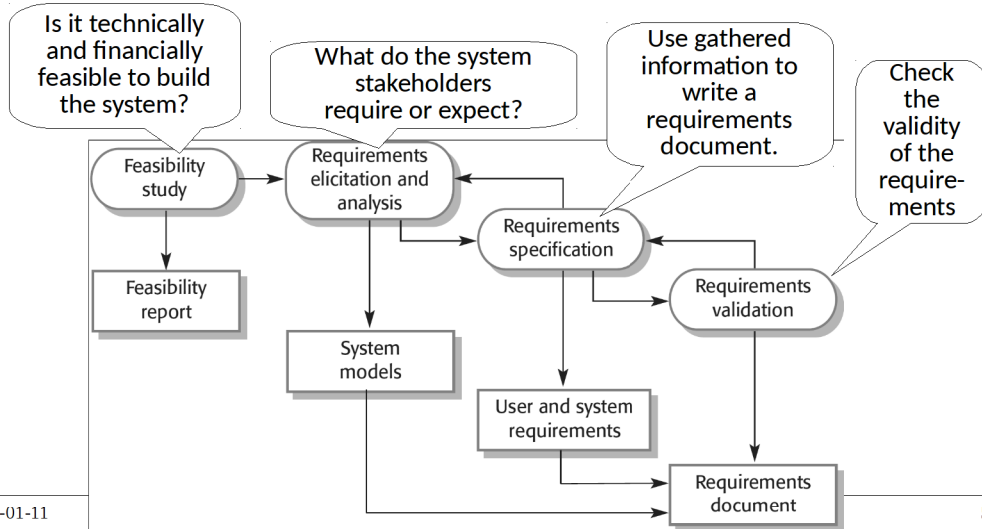- A software process model is..

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 requirements

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
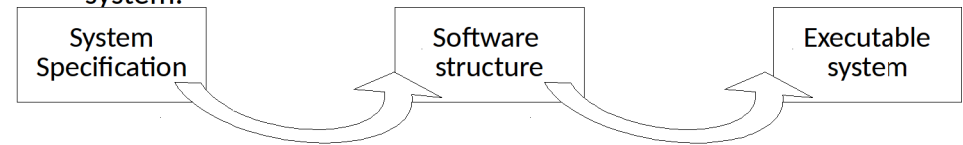
- Design and implementation are closely related and..

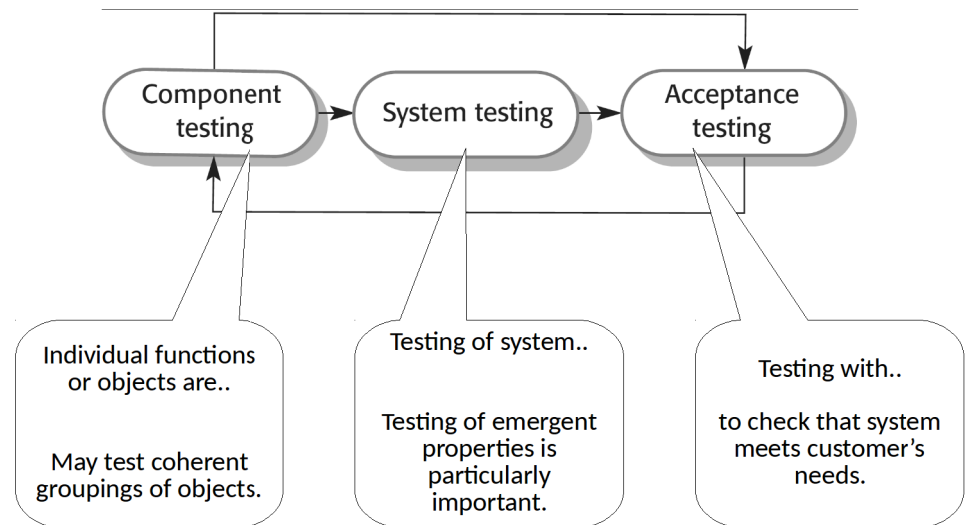| Design Activity	Description
Architectural Design	Identify overall structure of the system & principle components:..
Interface design	Define interfaces between system components
Component design	Design each system component
Database design	Design the system's data structures and database

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Software validation

- Verification and validation (V & V)
  - checks the system conforms to its..

- Involves system testing
  - Executing the system with test cases derived from real data to be processed by the system.
  - Testing is the most commonly used V & V activity.

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 specifying a data model, designing a 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.
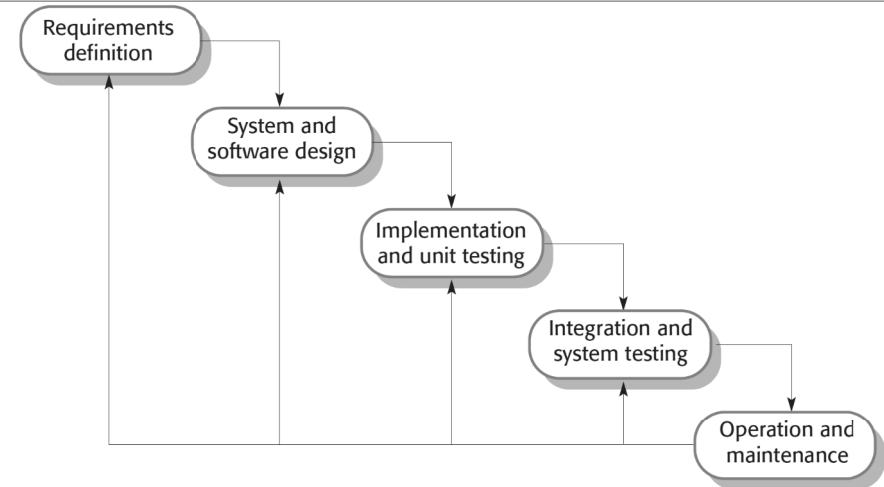
Software process models

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

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

- Reuse-oriented software engineering
  - System is assembled from existing components. May be plan-driven or agile.

- Most large systems developed using a process that incorporates elements from all of these 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.
- Therefore, waterfall model is appropriate when..

  – Few business systems have stable requirements.

- Waterfall model mostly used for large systems being developed at several sites.
  – Plan-driven nature of the waterfall model helps...

Incremental development

- Waterfall model delivers full system to user..

- Incremental development delivers..
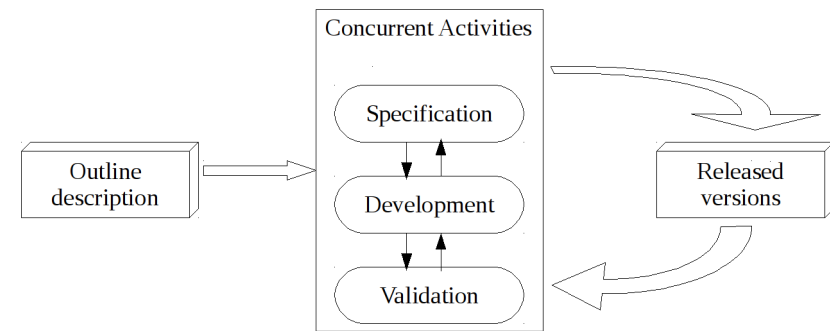
Incremental and its benefits

- 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 waterfall process.

Incremental development problems

- The process is not visible:
  – Managers need...
    to measure progress.

- Code Rot:
  –
    Incorporating code changes becomes increasingly difficult and costly.

  – Time and money must be spent refactoring to improve the software.
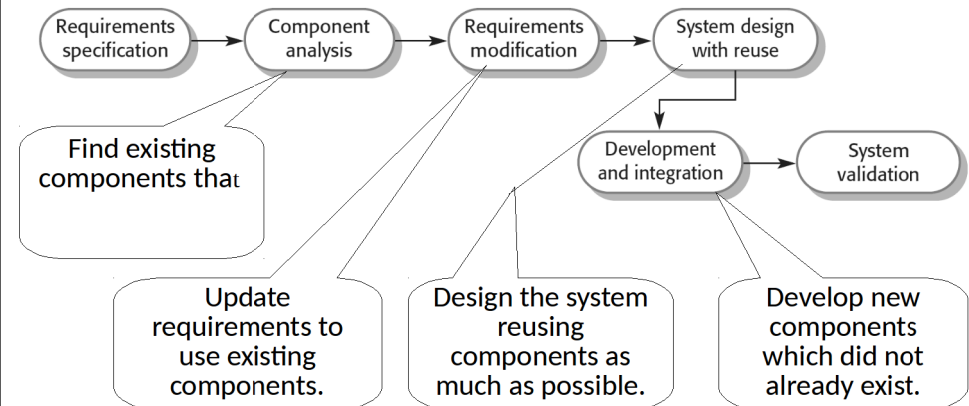
Refactoring

- Refactoring
  -

- Refactoring Examples
  - split a huge function into smaller ones,
  - improve class design,
  - fixing parts of the code which have..

Reuse-oriented software engineering

- Systems constructed by...
  or COTS (Commercial-off-the-shelf) systems.
- Reuse is now the standard approach for business system

Software component reuse examples

1) Web services: service available for remote invocation.

2) Packages of objects designed for a component framework such as .NET or J2EE.

3) Stand-alone software systems (COTS) configured for use in a particular environment.
   - Ex: Using Word as part of your system to display/edit invoices.

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 reuse-oriented development.