Introduction — CS-397/8: Software Systems Development

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References

- **Course Webpage:** All material in this syllabus plus supplemental lecture material can be found at the following URL: http://web.mst.edu/~marouanek/classes/cs397
- **References:**
  - Pressman Roger S, Software Engineering: A Practitioner's Approach, 7th Edition, McGraw-Hill, 2010. ISBN-13: 978-0071267823
  - Ivar Jacobson, Grady Booch, James Rumbaugh, The Unified Software Development Process, Addison-Wesley, 1999. ISBN-13: 978-0201571691

- **Course Prerequisites:** Comp Sci 206.

- **Grade Scale:**
  - **A: 100-90**,
  - B: 89-80,
  - C: 79-70,
  - D: 69-60,
  - F: 59-0.

Assignments and Project(s):

- *Presentations: 20% (graded individually)*
  - *Mid-semester : 10%*
  - *End of semester: 10%*
- *Monthly reports: 15% (graded individually)- 3 reports (5% each)*
- *Project (for each group): 65%*
  - *CV (resume) : 5% (graded individually)*
  - *Project proposal : 10%*
  - *Requirements analysis : 15%*
  - *Planning : 5%*
  - *Project design: 15%*
  - *Coding and testing : 15%*

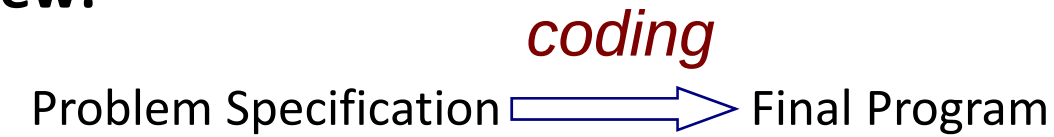
Date	Lecture Topics	Assignment/Project
08/23/2012;	Software engineering overview	CV and CL(up-to 4 pages) Due date : 08/30/2012
08/30/2012; 09/06/2012 09/13/2012;	UML: use cases, sequence diagram, planning, class diagrams, etc.	Project proposal Due date : 09/06/2012
09/20/2012	Meetings/discussions about software requirements	Requirements analysis Monthly report Due date : 09/27/2012
09/27/2012	No lecture	
10/04/2012	Meetings/discussions about projects planning	Project planning Due date : 10/11/2012
10/11/2012; 10/18/2012;	Meetings/discussions about projects design	Project design Mid-semester presentations Monthly report Due date : 10/25/2012
10/25/2012;	Mid-semester presentations	Project coding and testing Monthly report Final presentations Due date : 11/29/2012
11/01/2012;	No lecture	
11/08/2012	Meetings/discussions about projects coding and testing	
11/15/2012	No lecture	
11/22/2012	Meetings/discussions about projects coding and testing	
11/29/2012	Final presentations	
12/06/2012	Final presentations	

Roadmap

- Course Overview
- What is Software Engineering?
- The Iterative Development Lifecycle
- Software Development Activities

Why Software Engineering?

A naive view:



But ...

- Where did the *specification* come from?
- How do you know the specification corresponds to the *user's needs*?
- How did you decide how to *structure* your program?
- How do you know the program actually *meets the specification*?
- How do you know your program will always *work correctly*?
- What do you do if the users' *needs change*?
- How do you *divide tasks up* if you have more than a one-person team?

What is Software Engineering? (I)

Some Definitions and Issues

"state of the art of developing quality software on time and within budget"

- Trade-off between perfection and physical constraints
  - SE has to deal with real-world issues
- State of the art!
  - Community decides on "best practice" + life-long education

What is Software Engineering? (II)

"multi-person construction of multi-version software"

— Parnas

- Team-work
  - Scale issue ("program well" is not enough) + Communication Issue
- Successful software systems must evolve or perish
  - Change is the norm, not the exception

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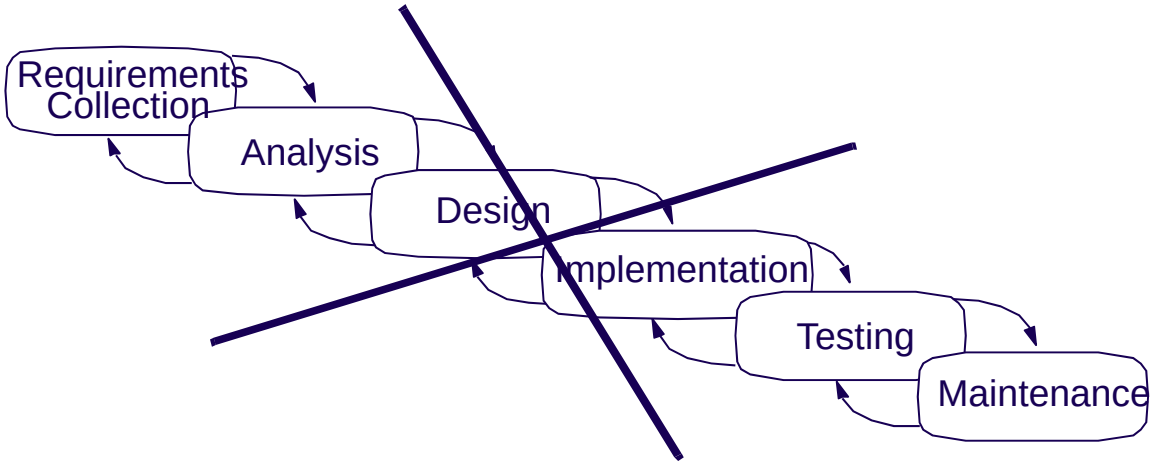
Software Development Activities

Requirements Collection	Establish customer's needs
Analysis	Model and specify the requirements ("what")
Design	Model and specify a solution ("how")
Implementation	Construct a solution in software
Testing	Validate the solution against the requirements
Maintenance	Repair defects and adapt the solution to new requirements

NB: these are ongoing activities, not sequential phases!

The Classical Software Lifecycle

The classical software lifecycle models the software development as a step-by-step "waterfall" between the various development phases.

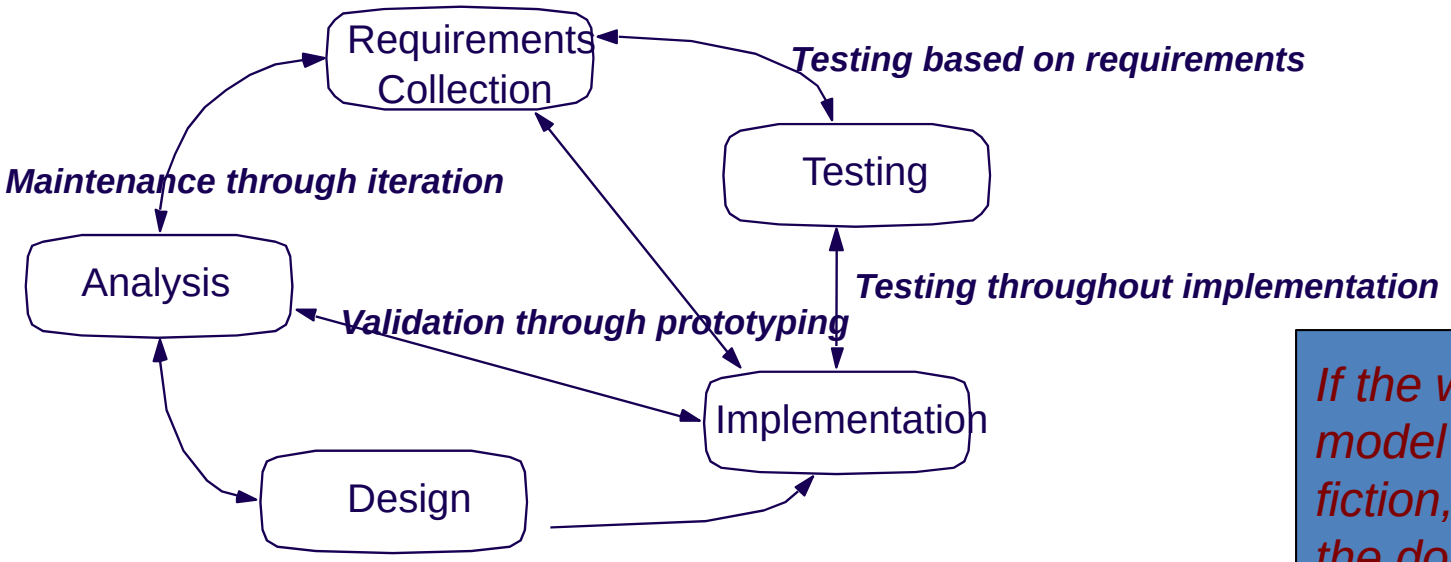


The waterfall model is unrealistic for many reasons:

- requirements must be *frozen too early* in the life-cycle
- requirements are *validated too late*

Iterative Development

In practice, development is always iterative, and *all* activities progress in parallel.



If the waterfall model is pure fiction, why is it still the dominant software process?

Iterative Development

Plan to *iterate* your analysis, design and implementation.

- You won't get it right the first time, so *integrate*, *validate* and *test* as frequently as possible.

  "You should use iterative development only on projects that you want to succeed."

  – Martin Fowler, UML Distilled

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Requirements Collection

User requirements are often expressed *informally*:

- features
- usage scenarios

Although requirements may be documented in written form, they may be *incomplete*, *ambiguous*, or even *incorrect*.

Changing requirements

Requirements *will* change!

- *inadequately captured* or expressed in the first place
- user and business *needs may change* during the project

Validation is needed *throughout* the software lifecycle, not only when the "final system" is delivered!

- build constant *feedback* into your project plan
- plan for *change*
- early *prototyping* [e.g., UI] can help clarify requirements

Requirements Analysis and Specification

Analysis is the process of specifying *what* a system will do.

- The intention is to provide a clear understanding of what the system is about and what its underlying concepts are.

The result of analysis is a *specification document*.

Does the requirements specification correspond to the users' actual needs?

Design

Design is the process of specifying *how* the specified system behaviour will be realized from software components. The results are *architecture* and *detailed design documents*.

Object-oriented design delivers models that describe:

- how system operations are implemented by *interacting objects*
- how classes refer to one another and how they are related by *inheritance*
- *attributes* and *operations* associated to classes

Design is an iterative process, proceeding in parallel with implementation!

Implementation and Testing

Implementation is the activity of *constructing* a software solution to the customer's requirements.

Testing is the process of *validating* that the solution meets the requirements.

- The result of implementation and testing is a *fully documented* and *validated* solution.

Maintenance

Maintenance is the process of changing a system after it has been deployed.

- *Corrective maintenance*: identifying and repairing *defects*
- *Adaptive maintenance*: *adapting* the existing solution to new platforms
- *Perfective maintenance*: implementing *new requirements*

In a spiral lifecycle, everything after the delivery and deployment of the first prototype can be considered "maintenance"!

Maintenance activities

"Maintenance" entails:

- configuration and version management
- reengineering (redesigning and refactoring)
- updating all analysis, design and user documentation

Repeatable, automated tests enable evolution and refactoring

Maintenance costs

"Maintenance" typically accounts for *70% of software costs!*

Means: most project costs concern continued development *after* deployment