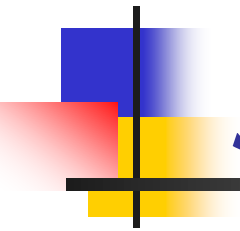


COMP 354: Introduction to Software Engineering

Software Development and Software Engineering

Based on Chapter 1 of the textbook

Programming vs. Software Development

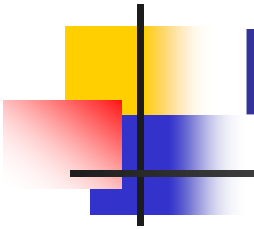
Programming:

- Requirements are given/fixed.
- Select data structures and algorithms.
- Program to implement
- Test the program.

Software Development:

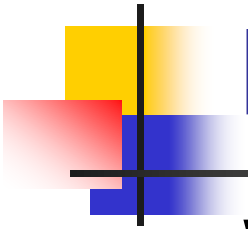
- Find/fix the requirements.
- Design/discuss the architecture and code.
- Implement the design.
- Test the software.
- Maintain the software.

Nature of Software: Defining Software



Software is:

1) Instructions (computer programs) that when executed provide desired features, function, and performance;
2) Data structures that enable the programs to adequately manipulate information.
3) Documentation that describes the operation and use of the programs.

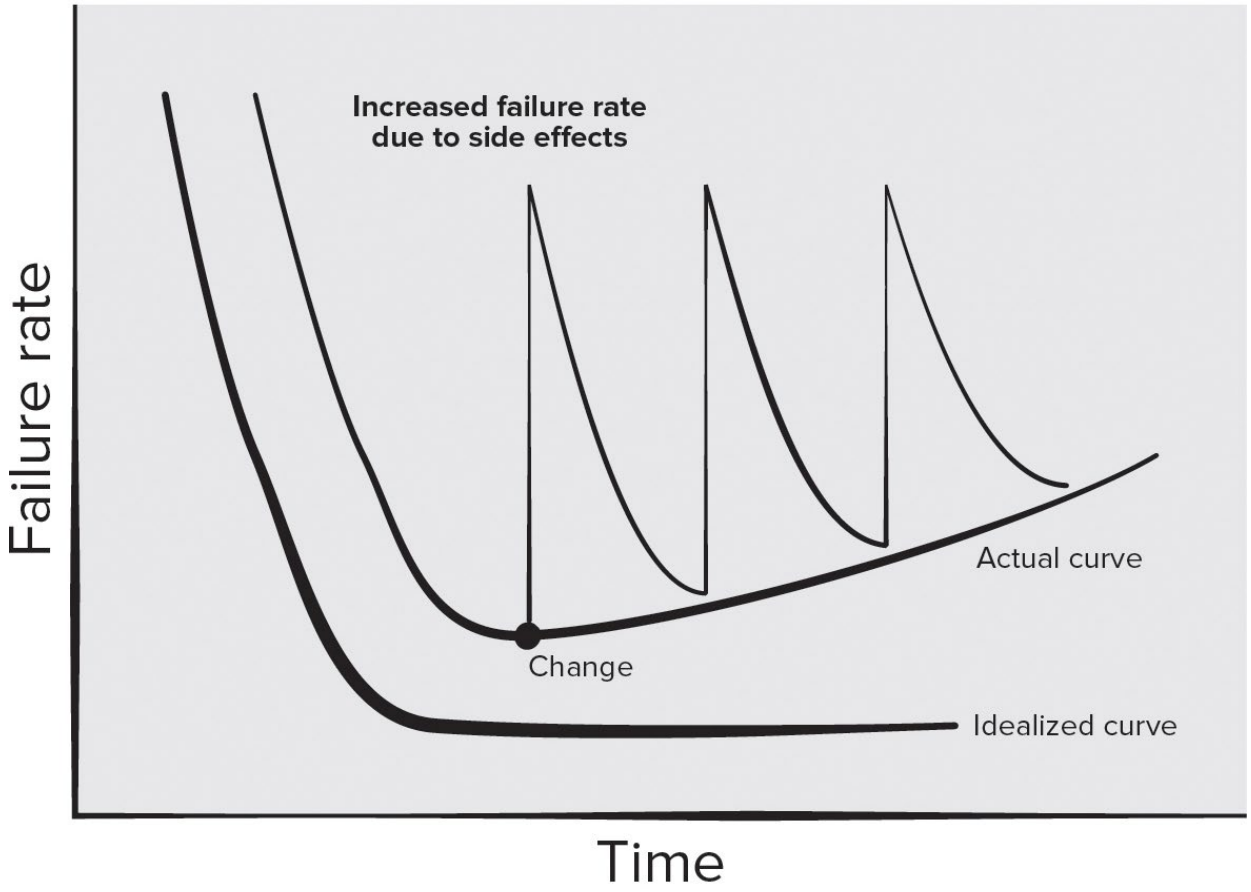


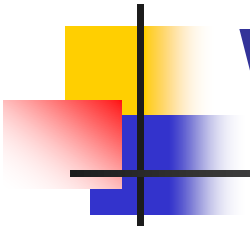
Legacy Software

Why must software change?

- Software must be adapted to meet the needs of new computing environments or technology.
- Software must be enhanced to implement new business requirements.
- Software must be extended to make it interoperable with other more modern systems or databases.
- Software must be re-architected to make it viable within a network environment.

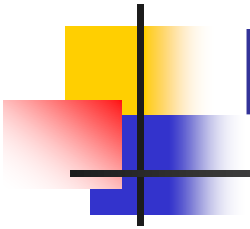
Wear versus Deterioration





What is Software?

- Software is developed or engineered it is not manufactured in the classical sense.
- Software doesn't "wear out" but is does deteriorate.
- Although the industry is moving toward component-based construction, most software continues to be custom-built.

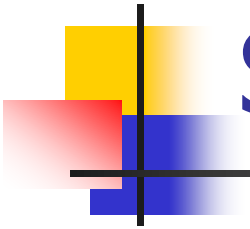


How it all Starts

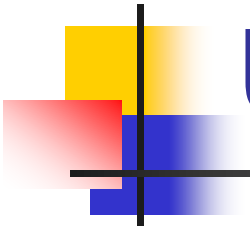
Every software project is precipitated by some business need

- The need to correct a defect in an existing application
- The need to adapt a 'legacy system' to a changing business environment
- The need to extend the functions and features of an existing application, or
- The need to create a new product, service, or system.

Essence of Software Engineering Practice

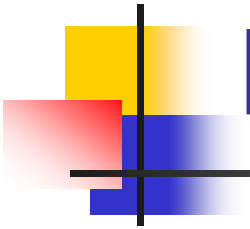


1. Understand the problem (communication and analysis).
2. Plan a solution (modeling and software design).
3. Carry out the plan (code generation).
4. Examine result for accuracy (testing & quality assurance).



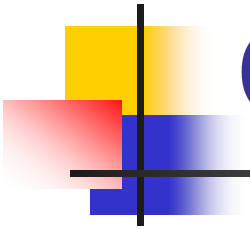
Understand the Problem

- Who has a stake in the solution to the problem?
  - That is, who are the stakeholders?
- What are the unknowns?
  - What data, functions, and features are required to properly solve the problem?
- Can the problem be compartmentalized?
  - Is it possible to represent smaller problems that may be easier to understand?
- Can the problem be represented graphically?
  - Can an analysis model be created?



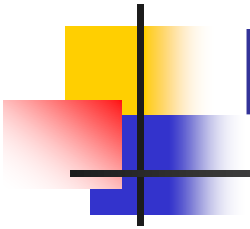
Plan a Solution

- Have you seen similar problems before?
  - Are there patterns that are recognizable in a potential solution? Is there existing software that implements the data, functions, and features that are required?
- Has a similar problem been solved?
  - If so, are elements of the solution reusable?
- Can subproblems be defined?
  - If so, are solutions readily apparent for the subproblems?
- Can you represent a solution in a manner that leads to effective implementation?
  - Can a design model be created?



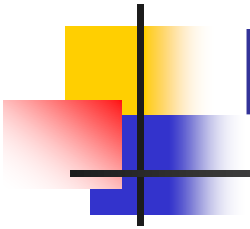
Carryout the Plan

- Does the solution conform to the plan?
  - Is source code traceable to the design model?
- Is each component part of the solution provably correct?
  - Has the design and code been reviewed, or better, have correctness proofs been applied to algorithm?



Examine the Result

- Is it possible to test each component part of the solution?
  - Has a reasonable testing strategy been implemented?
- Does the solution produce results, that conform to the data, functions, and features that are required?
  - Has the software been validated against all stakeholder requirements?



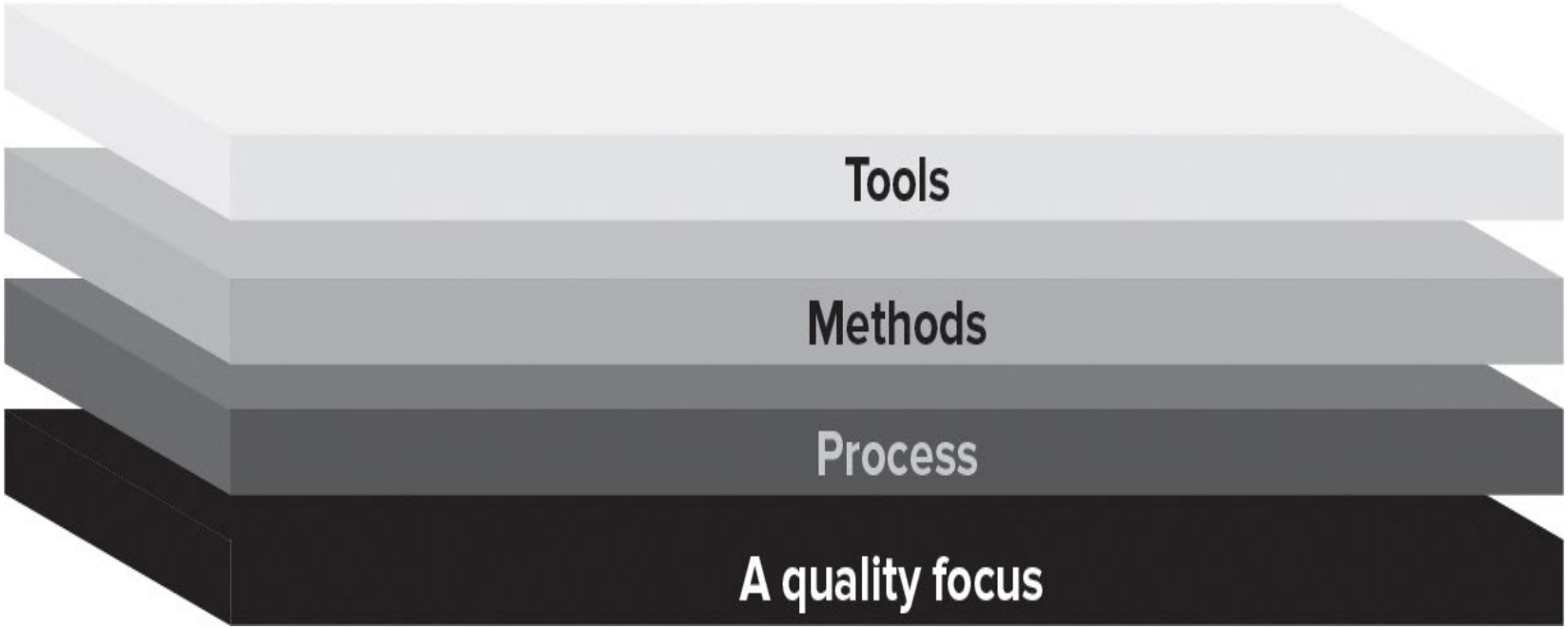
Defining the Discipline

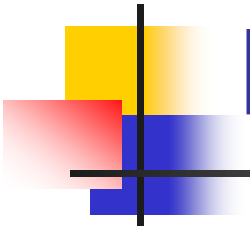
The IEEE definition:

Software Engineering:

1. The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software.
2. The study of approaches as in (1).

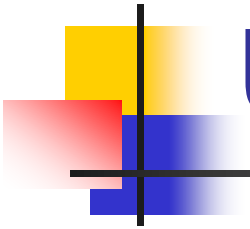
Software Engineering Layers





Process Framework Activities

- Communication
  - Planning
  - Modeling
  - Analysis of requirements
  - Design
- Construction
  - Code generation
  - Testing
- Deployment

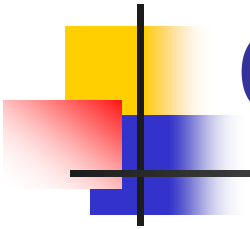


Umbrella Activities

- Software project tracking and control.
- Risk management.
- Software quality assurance.
- Technical reviews.
- Measurement.
- Software configuration management.
- Reusability management.
- Work product preparation and production.

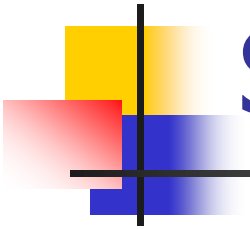
Process Difference Requiring Adaptation

- Overall flow of activities, actions, and tasks and the interdependencies among them.
- Degree to which actions and tasks are defined within each framework activity.
- Degree to which work products are identified and required.
- Manner in which quality assurance activities are applied.
- Manner in which project tracking and control activities are applied.
- Overall degree of detail and rigor with which the process is described.
- Degree to which the customer and other stakeholders are involved with the project.
- Level of autonomy given to the software team.
- Degree to which team organization and roles are prescribed.



General Principles

1. The Reason It All Exists – provide value to users.
2. KISS (Keep It Simple, Stupid!) – design simple as it can be.
3. Maintain the Vision – clear vision is essential.
4. What You Produce, Others Will Consume.
5. Be Open to the Future - do not design yourself into a corner.
6. Plan Ahead for Reuse – reduces cost and increases value.
7. Think! – placing thought before action produce results.



Software Application Domains

- System software.
- Application software.
- Engineering/Scientific software.
- Embedded software.
- Product-line software.
- Web/Mobile applications.
- AI software (robotics, neural nets, game playing).