16.35

Aerospace Software Engineering

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Introduction

- Getting started with software engineering
- 16.35 information
- Software processes

Reading suggestions for today's lecture: van Vliet pp 1-31

"I think there is a world market for maybe five computers."
 -- Thomas Watson, chairman of IBM, 1943

"I traveled the length and breadth of this country and talked with the best people, and I can assure you that data processing is a fad that won't last out the year."
--The editor in charge of business books for Prentice Hall, 1957

"There is no reason anyone would want a computer in their home."
-- Ken Olson, president, chairman and founder of Digital Equipment Corp., 1977

Software Engineering

- Notion of software engineering was first proposed in 1968 as an answer to the software crisis

- More and more systems are software controlled

- Software is abstract and intangible

- New techniques and methods were needed to control the complexity inherent in large software systems

    - Software engineering is concerned with theories, methods and tools for professional software development

- The economies of all developed nations are dependent on software

The Ariane 5 Launcher Failure

Software Costs

- Software costs often dominates system costs. The costs of software on a PC are often greater than the hardware cost

- Software costs more to maintain than it does to develop. For systems with a long life, maintenance costs may be several times development costs

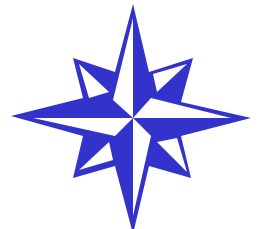- Software engineering is concerned with cost-effective software development and sustenance

FAQs About Software Engineering

- [What is software](#)?
- [What is software engineering](#)?
- [What is the difference between software engineering and computer science](#)?
- [What is the difference between software engineering and system engineering](#)?
- [What is a software process](#)?
- [What is a software process model](#)?
- [What are the costs of software engineering](#)?
- [What is CASE](#)?
- [What are the attributes of good software](#)?
- [What are the key challenges facing software engineering](#)?

What is Software?

- Computer programs and associated documentation
- Software products may be developed for a particular customer or may be developed for a general market
- Software products may be
    - Generic – developed to be sold to a range of different customers
    - Bespoke (custom) – developed for a single customer according to their specification
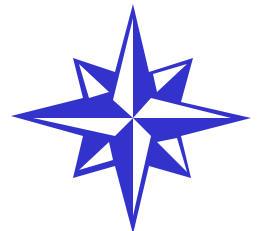
What is Software Engineering?

- Software engineering is an engineering dicipline which is concerned with all aspects of software production

- Software engineers should adopt a systematic and organised approach to their work and use appropriate tools and techniques depending on the problem to be solved, the development constraints and the resources available
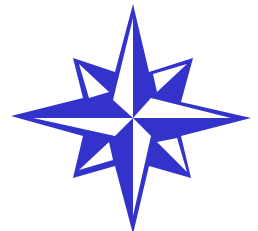
What is the Difference Between Software Engineering and Computer Science?

- Computer science is concerned with theory and fundamentals; software engineering is concerned with the practicalities of developing and delivering useful software

- Computer science theories are currently insufficient to act as a complete underpinning for software engineering

What is the Difference Between Software Engineering and System Engineering?

- System engineering is concerned with all aspects of computer-based systems development including hardware, software and process engineering. Software engineering is part of this process

- System engineers are involved in system specification, architectural design, integration and deployment
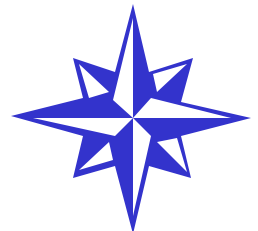
What is a Software Process?

- A set of activities whose goal is the development or evolution of software
- Generic activities in all software processes are:
  - **Specification** – what the system should do and its development constraints
  - **Development** – production of the software system
  - **Validation** – checking that the software is what the customer wants
 - **Evolution** – changing the software in response to changing demands
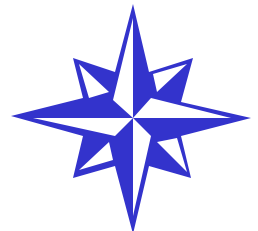
What is a Software Process Model?

- A simplified representation of a software process, presented from a specific perspective

- Examples of process perspectives are
  - *Workflow* perspectives – sequence of activities
  - *Data-flow* perspective – information flow
  - *Role/action* perspective – who does what

- Generic process models
  - Waterfall
  - Evolutionary development
  - Formal transformation
 - Integration from reusable components
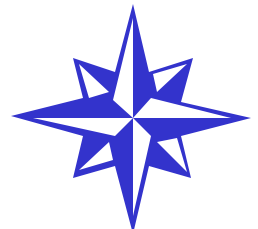
What is the Cost of Software Engineering?

- Roughly 60% of costs are development costs, 40% are testing costs. For custom software, evolution costs often exceed development costs.

- Costs vary depending on the type of system being developed and the requirements of system attributes such as performance and system reliability

- Distribution of costs depends on the development model that is used
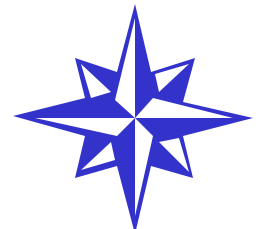
What is CASE?

- Software systems which are intended to provide automated support for software process activities. CASE (Computer-Aided Software Engineering) systems are often used for method support

- Upper-CASE
  - Tools to support the early process activities of requirements and design

- Lower-CASE
  - Tools to support later activities such as programming, debugging and testing
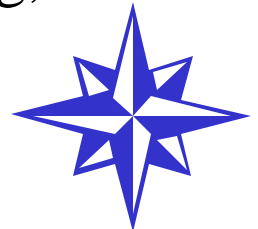
What are the Attributes of Good Software?

- The software should deliver the required functionality and performance to the user and should be maintainable, dependable and usable

- Maintainability
  - Software must evolve to meet changing needs

- Dependability
  - Software must be trustworthy

- Efficiency
  - Software should not make wasteful use of system resources

- Usability
  - Software must be usable by the users for which it was designed
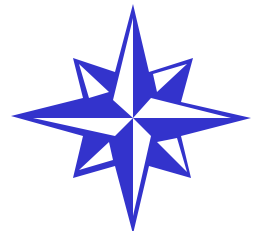
What are the Key Challenges Facing Software Engineering?

- Legacy systems
  - Old, valuable systems must be maintained and updated

- Heterogeneity
  - Systems are distributed and include a mix of hardware and software

- Delivery
  - There is increasing pressure for faster delivery of software
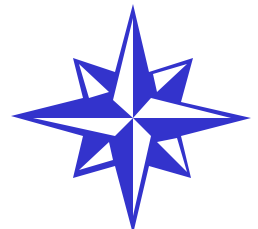
Key Points

- Software engineering is an engineering discipline which is concerned with all aspects of software production.

- Software products consists of developed programs and associated documentation. Essential product attributes are maintainability, dependability, efficiency and usability.

- The software process consists of activities which are involved in developing software products. Basic activities are software specification, development, validation, and evolution.

- Methods are organized ways of producing software. They include suggestions for the process to be followed, the notations to be used, rules governing the system descriptions which are produced and design guidelines.

Key Points

- CASE tools are software systems which are designed to support routine activities in the software process such as editing design diagrams, checking diagram consistency and keeping track of program tests which have been run.

16.35 Information

- http://web.mit.edu/16.35/www
- "What to do and what not to do"
    - Group project: the team is assessed as a whole and individual contribution is evaluated. This constitutes 40% of your grade.
    - Individual Assignments: Turn them in on time, they constitute 10% of your grade.