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Lecture 1: Introduction to Software Engineering

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What is Software Engineering?

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- **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 and

  (3) Documentation that describes the operation and use of the programs.

- **Software is considered to be a collection of executable programming code, associated libraries and documentations.**

What is Software Engineering?

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- **Engineering:**
  - **An engineering branch associated with the development of software product using well-defined scientific principles, methods and procedures.**
- **IEEE defines software engineering as:**
  - The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software (the application of engineering to software).
  - **The outcome of software engineering is an efficient and reliable software product**

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Software Types

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- **Generic** - developed to be sold to a range of different customers,
  - e.g. PC software such as Word or Excel

- **Custom** - developed for a single customer according to their specification

- **Cooperative Solutions**
  - Starting with generic system and customizing it to the needs of a particular customer. For example, Resource Planning (ERP) system

Software Crisis: Late 1960's

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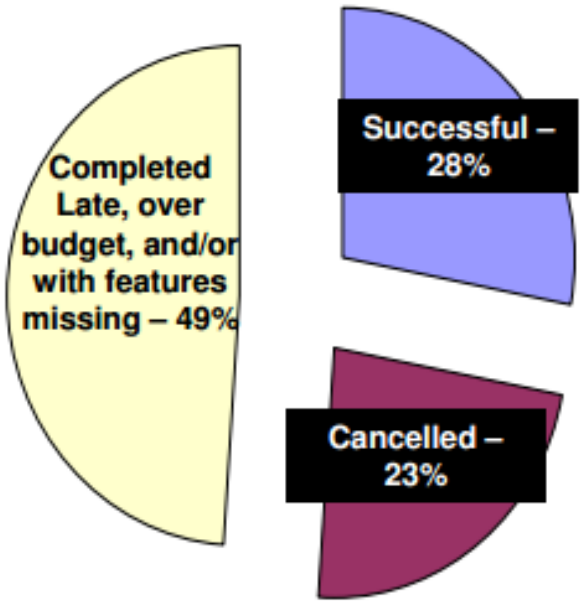
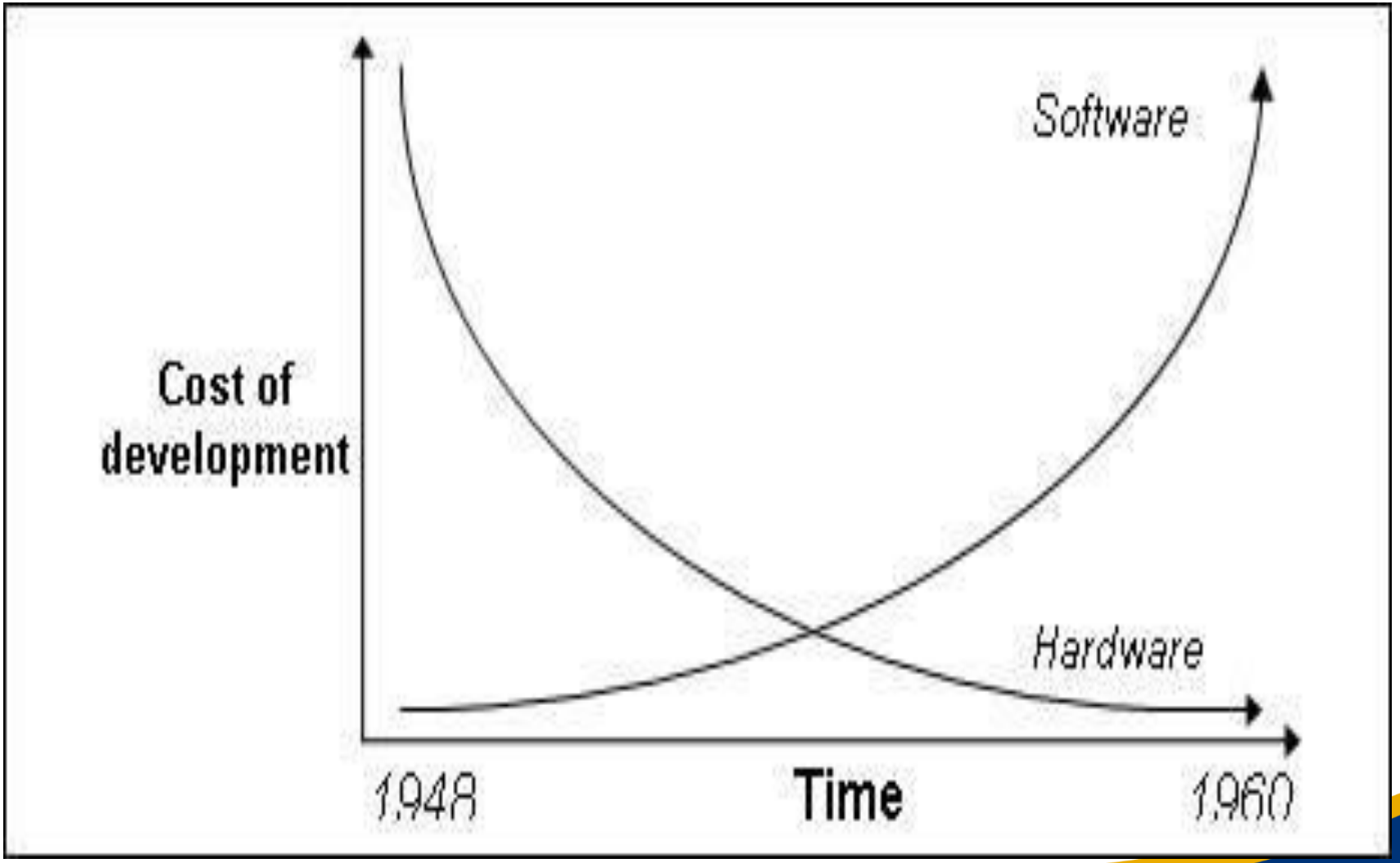


- **Characterized by:**
  - **Late delivery; over budget - Inaccurate schedule and costs**
  - **Product does not meet specified requirements**
  - **Inadequate documentation**
  - **Complexities of software increased**
  - **Demand became greater than ability to generate new software**

Summary: Software Crisis



History of Software Testing

SOFTWARE CRISIS - WHY

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- Poor data collection process with no historical data
- Poor communication between customer and developer
- Software Myths (3 types)
  - Managers (use of standards, state or art tools or if project is late, add more programmers)
  - Developers (job done on delivery of code, success = quality of program)
  - Customers (easy to accommodate change, a general statement sufficient to start coding)
- Existing Software can be difficult to maintain
- Poor software management - "*any manager can manage any project*".
- Lack of or little formal training in the new techniques
- Resistance to change

Class Discussion questions

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1. **Why does it take so long to get software finished?**

2. **Why are development costs so high?**

3. **Why can't we find all errors before we give the software to our customers?**

4. **Why do we spend much time and effort in maintaining existing programs?**

Need for Software Engineering

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- **Arises because of higher rate of change in user requirements and environment on which the software works.**

1. **Large software: as the size of software grows, there is need for a scientific process**
2. **Scalability: Enhancing existing software**
3. **Cost: Software is expensive as compared to hardware**
4. **Dynamic Nature**
5. **Quality Management: better process of software development, better quality.**

Attributes of Quality Software

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a) **Maintainability** - Change is inevitable thus Software must evolve to meet changing needs;

b) **Dependability** - Software must be trustworthy; e.g. reliability, security, safety.

c) **Efficiency** -Software should not make wasteful use of system resources (memory and processor cycle)

d) **Usability** - Software must accepted by the users for what it was designed i.e. appropriate user interface & adequate documentation.

Challenges of Software Engineering

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- Increased Diversity
  - Inherent heterogeneity
  - Distributed systems, networks, different computers and software
  - Integration with legacy systems
- Reduced delivery times
  - Traditional software engineering techniques are time consuming
- Developing trustworthy systems
  - Users can trust the system
  - More so for remote software systems accessed through a web page

Software engineering process activities

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1. Software specification:
   - customers & engineers identify the functionality of the software that is to be produced and the constraints on its operation.
2. Software development:
   - the software is designed and programmed.
3. Software validation:
   - the software is checked to ensure that it is what the customer requires/needs.
4. Software evolution:
   - the software is modified to reflect changing customer and market requirements.

Key Student Reflection Points

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1. Software is a complex engineering product.
2. Approaches which work for constructing small programs for personal use do not scale-up to the challenges of real software construction.
3. A disciplined engineering process and associated management disciplined is needed.