



UNIVERSITY OF SCIENCE
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FUNDAMENTAL QUESTIONS IN SOFTWARE ENGINEERING

Adapted from the Slides of Software
Engineering, 9th Ed. by Ian Sommerville

FAQs about software engineering

- Why 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?

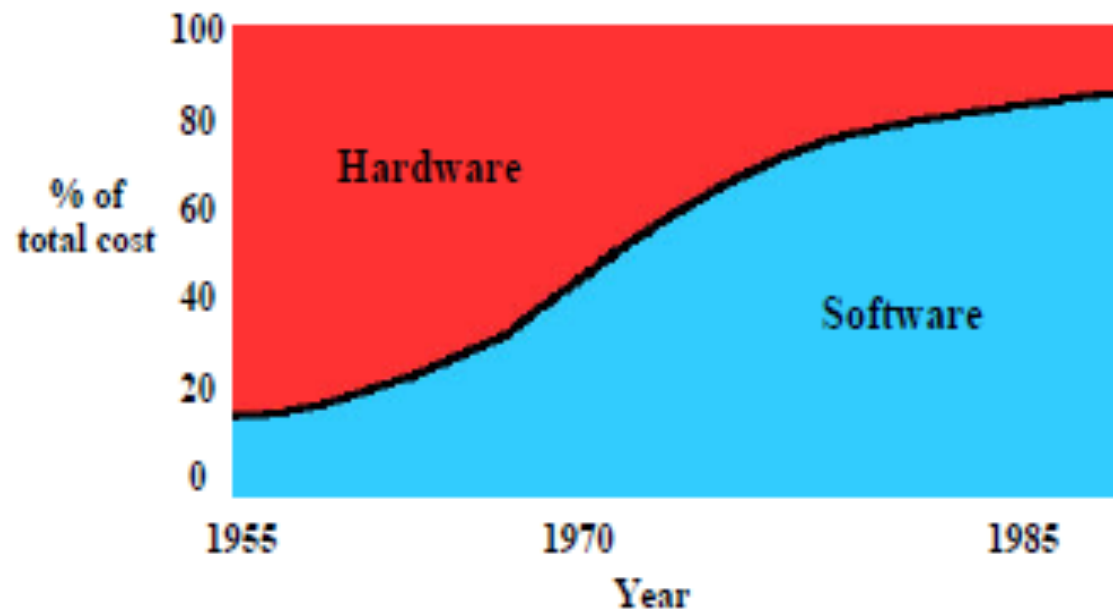
FAQs about software engineering

- What are the costs of software engineering?
- What are software engineering methods?
- What is CASE (Computer-Aided Software Engineering)
- What are the attributes of good software?
- What are the key challenges facing software engineering?

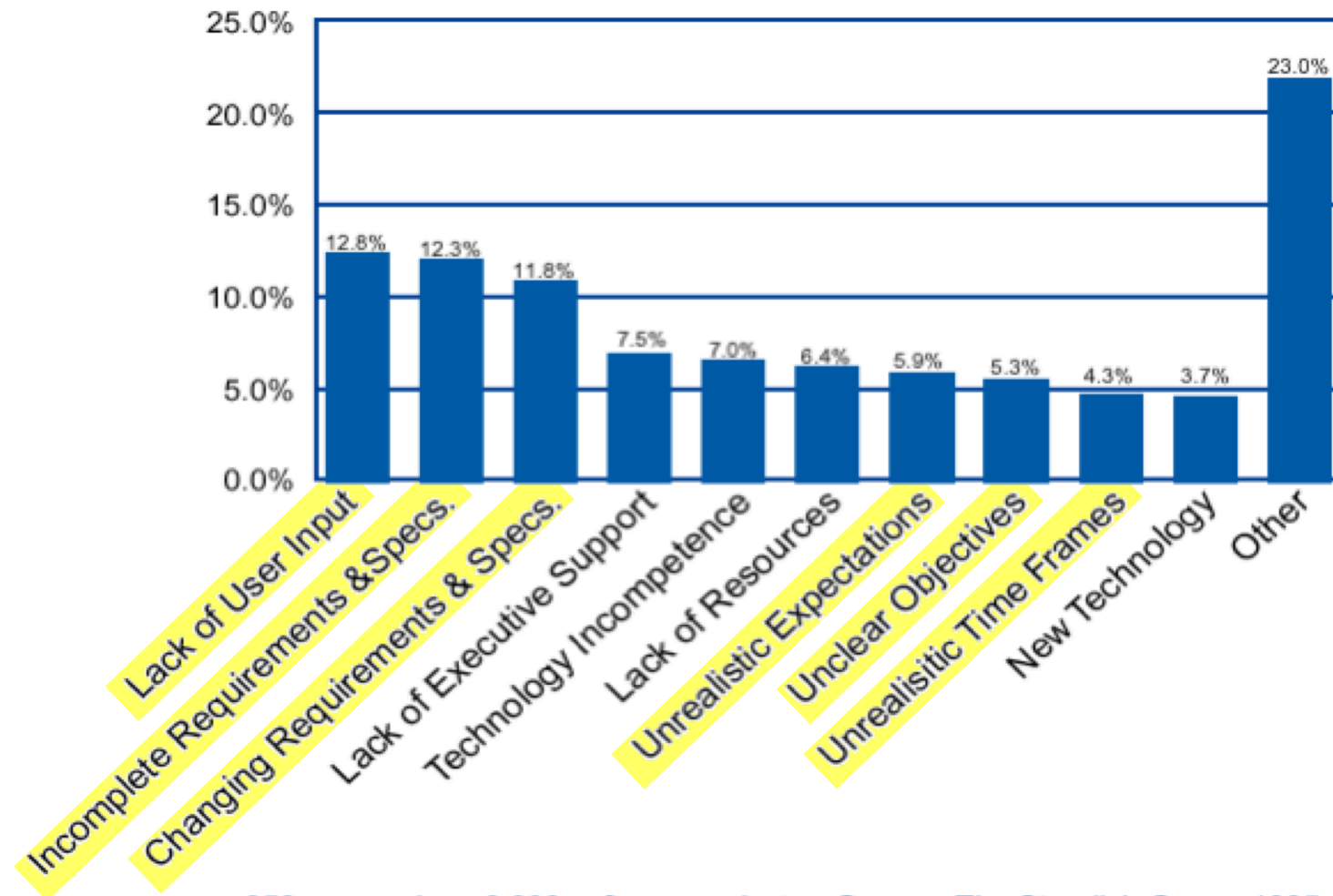
Software engineering

- Economies of ALL developed nations are dependent on software
- More and more systems are software controlled
- **Software engineering** is concerned with theories, methods and tools for professional software development

Software costs (Boehm, '81)



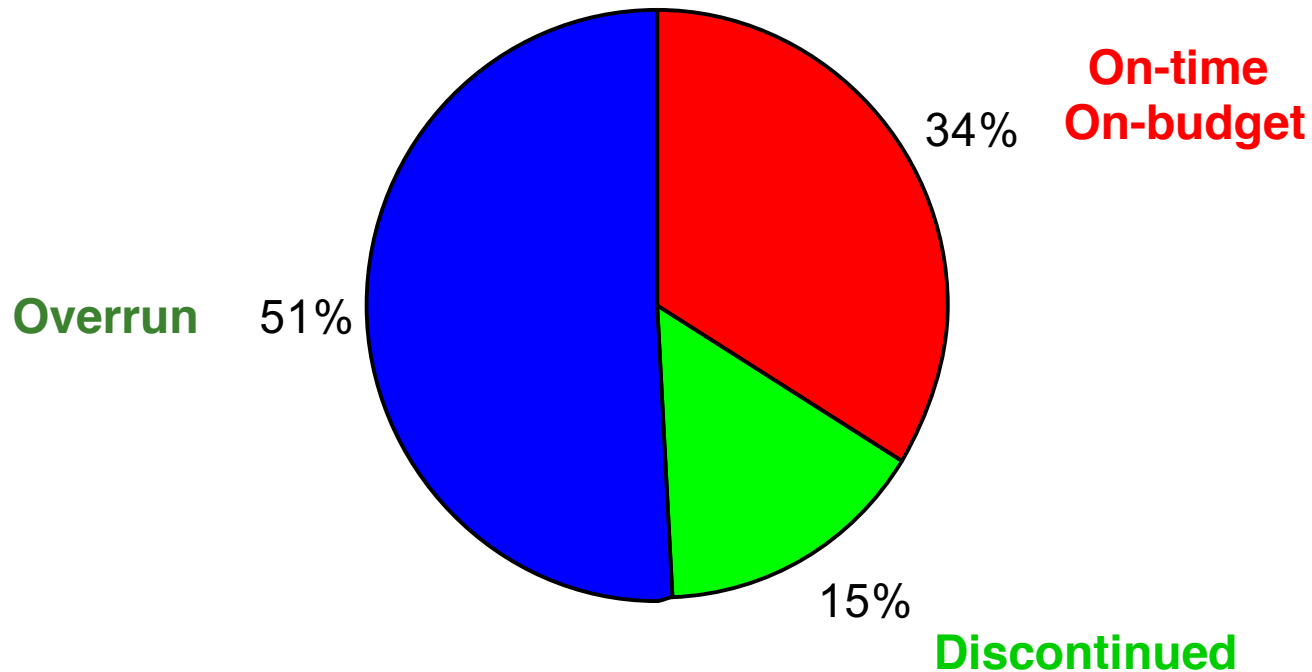
Why Software Projects Fail



352 companies - 8,000 software projects. Source: *The Standish Group, 1995*

Software Engineering Is Not Well-Practiced Today

-Standish Group CHAOS Report 2003



Software costs (cont'd)

- Software costs often dominate computer system costs
- Costs of software on a PC are often greater than the hardware cost
- Software costs more to maintain than it does to develop
- Key objective of software engineering: **cost-effective software development**

What is software?

- Computer programs and associated documentation such as requirements, design models and user manuals.
- Software products may be
 - ❑ Generic - developed to be sold to a range of different customers e.g. PC software such as Excel or Word.
 - ❑ Custom (bespoke) - developed for a single customer according to their specification.
- Software can be created by
 - ❑ by developing new programs
 - ❑ configuring generic software systems
 - ❑ reusing existing software.

What is software engineering?

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

- Goals
 - ❑ Cost effective (within budget)
 - ❑ On time
 - ❑ High quality
 - ❑ Satisfying customer's needs

Software engineering vs. Computer science?

- Computer science
 - concerned with theory and fundamentals
- Software engineering
 - concerned with the practicalities of developing and delivering useful software
- Computer science theories are still insufficient to produce successful software

Software engineering vs. System engineering?

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

What is a software process?

- A set of activities whose goal is the development or evolution of software

- Generic activities in software processes
 - ❑ 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 perspective - sequence of activities
 - ❑ Data-flow perspective - information flow
 - ❑ Role/action perspective - who does what
- Generic process models
 - ❑ Waterfall
 - ❑ Iterative development
 - ❑ Component-based software engineering

What are the costs 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 many factors
 - Requirements, complexity, personnel, etc.

What are software engineering methods?

- Structured approaches to software development, including
 - system models, notations, rules, design advice and process guidance.
- Model descriptions
 - Descriptions of graphical models which should be produced;
- Rules
 - Constraints applied to system models;
- Recommendations
 - Advice on good design practice;
- Process guidance
 - What activities to follow.

What is CASE?

- CASE = Computer-Aided Software Engineering
 - Software systems that are intended to provide automated support for software process activities.
- CASE 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?

- Software should deliver the required functionality to the user
- It should be maintainable, dependable and acceptable
- Maintainability
 - Software must evolve to meet changing needs;
- Dependability
 - Software must be trustworthy;
- Efficiency
 - Software should not make wasteful use of system resources;
- Acceptability
 - Software must accepted by the users for which it was designed.
 - It must be understandable, usable and compatible with other systems.
 - -ilities

What are the key challenges facing software engineering?

- Many, here are some:
 - Heterogeneity, delivery and trust.
 - Heterogeneity
 - Developing techniques for building software that can cope with heterogeneous platforms and execution environments;
 - Delivery
 - Developing techniques that lead to faster delivery of software;
 - Trust
 - Developing techniques that demonstrate that software can be trusted by its users.