

An Introduction to Software Engineering

Software engineering

- The 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.
- Expenditure on software represents a significant fraction of GNP in all developed countries.

Software costs

- Software costs often dominate computer 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.

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?

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?

What is software?

- Computer programs and associated documentation such as requirements, design models and user manuals.
- 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 e.g. PC software such as Excel or Word.
 - Bespoke (custom) - developed for a single customer according to their specification.
- New software can be created by developing new programs, configuring generic software systems or reusing existing software.

What is software engineering?

- Software engineering is an engineering discipline that 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 still insufficient to act as a complete underpinning for software engineering (unlike e.g. physics and electrical 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 concerned with developing the software infrastructure, control, applications and databases in the system.
- System engineers are involved in system specification, architectural design, integration and deployment.

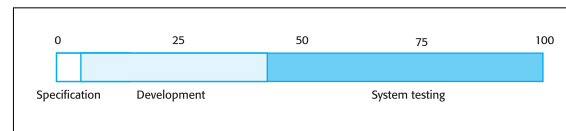
What is a software process?

- 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 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.

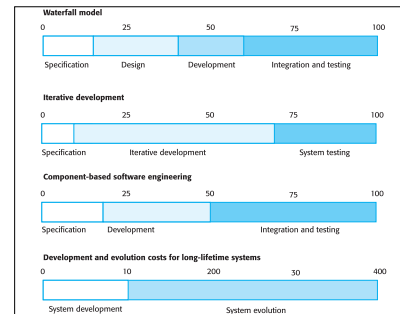
Product development costs



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 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.

Activity cost distribution



What are software engineering methods?

- Structured approaches to software development which include 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 (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?

- The software should deliver the required functionality and performance to the user and 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 be accepted by the users for which it was designed. This means it must be understandable, usable and compatible with other systems.

What are the key challenges facing software engineering?

- 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.