
An Introduction to Software Engineering

What is software?

- Computer programs and associated documentation (e.g. 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.
 - 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?

- An engineering discipline that is concerned with **all aspects of software production**.
- Soft. 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 and cost-effective software.

What is the difference between software engineering and system engineering?

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

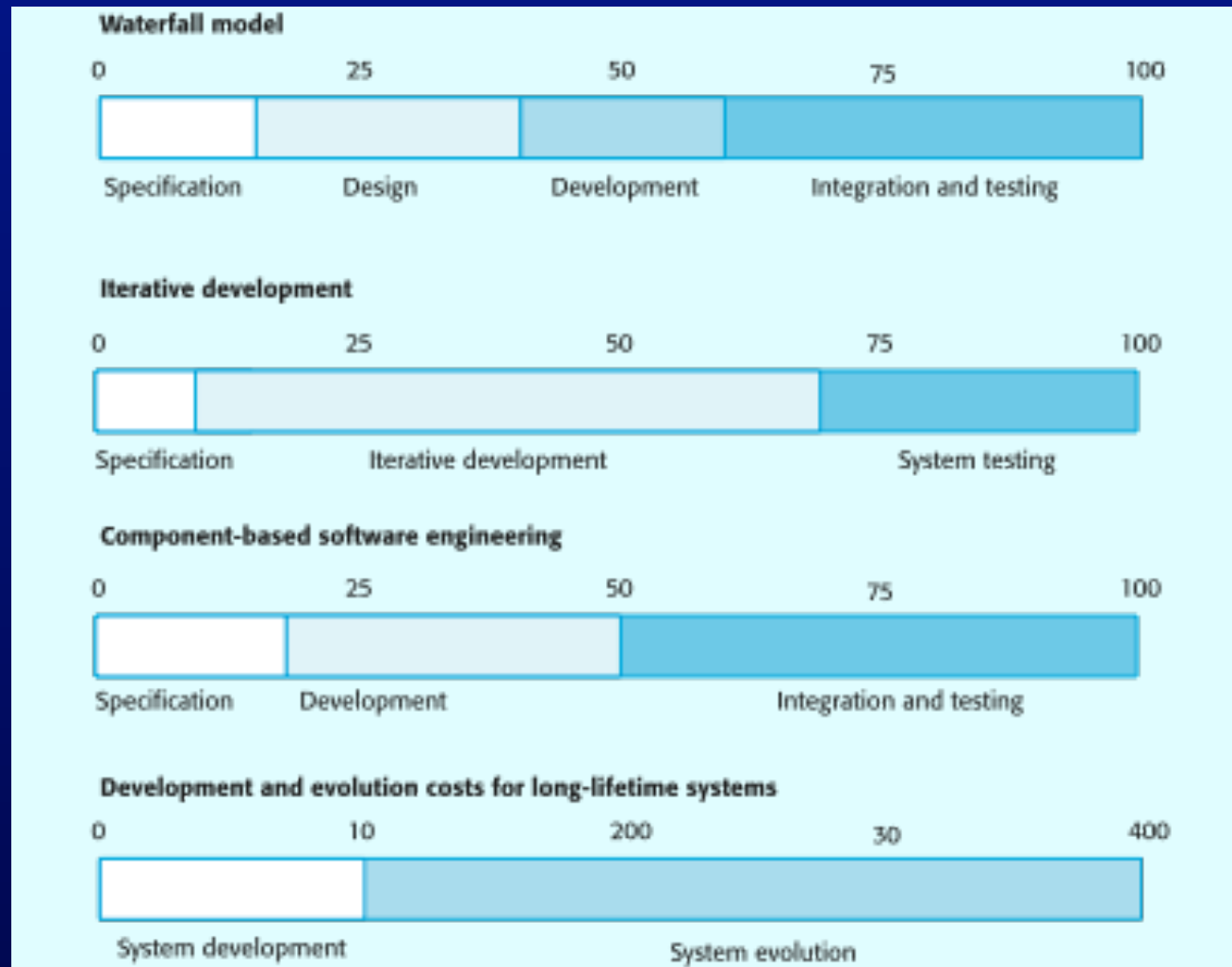
What is a software process model?

- 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.

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
 - 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**
 - Model descriptions and Notations
 - 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
 - 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.

Professional and ethical responsibility

- Soft. Enginnering is more than the application of technical skills.
- Engineers must behave in an honest and ethically responsible way
- Ethical behaviour is more than simply upholding the law.

Issues of professional responsibility

- Confidentiality
 - Engineers should normally respect the confidentiality of their employers or clients irrespective of whether or not a formal confidentiality agreement has been signed.
- Competence
 - Engineers should not misrepresent their level of competence. They should not knowingly accept work which is **outwith their competence**.

Issues of professional responsibility

- Intellectual property rights
 - be aware of local laws about intellectual property such as patents, copyright, etc.
 - be careful to ensure that the intellectual property of employers and clients is protected.
- Computer misuse
 - Eng. should not use their technical skills to misuse other people's computers.
 - From game playing on an employer's machine,
 - To extremely serious (dissemination of viruses).

ACM/IEEE Code of Ethics

- The professional societies in the US have cooperated to produce a code of ethical practice.
- The Code contains eight Principles related to
 - The behaviour
 - The decisions
- ...including practitioners, educators, managers, supervisors and policy makers, as well as trainees and students of the profession.

Ethical dilemmas

- Disagreement in principle with the policies of senior management.
- Your employer acts in an unethical way and releases a safety-critical system without finishing the testing of the system.
- Participation in the development of military weapons systems or nuclear systems.

Ordine degli Ingegneri

- Regolamentazione e Controllo della Professione
- Codice Deontologico
- ...
- Tariffazione
- anche gli informatici possono iscriversi!
 - Settore: Ingegneria dell'Informazione
- ... valutate bene!!!!