Lecture 1 Introduction

Sommerville

Software Engineering 10th edition

- The current situation.
- What is software engineering ?
- What is a software ?

Software Engineering

- The economies of ALL developed nations are dependent on software.
- More and more systems are software controlled.
- Expenditure on software represents a significant fraction of GNP in all developed countries.

History

- First computers were built in the mid 1940s.
- 1960s realisation programming techniques had lagged behind developments in software both in size and complexity. Programming was an art not a craft, programmers had learned by doing. They had not been formally educated.
- Result software was delivered late, programs behaved unexpectedly and were difficult to change, many errors were detected after delivery – "the software crisis"
- 1968/69 NATO conferences: introduction of the term Software Engineering
  - Idea: software development is not an art, or a bag of tricks
  - Build software like we build bridges starting from a sound theoretical basis using proven design and construction techniques.

What is Software Engineering?

- Engineering discipline
  - Using appropriate theories and methods to solve problems bearing in mind organizational and financial constraints.
- All aspects of software production
  - Not just technical process of development. Also project management and the development of tools, methods etc. to support software production.
- Software engineering is concerned with theories, methods and tools for professional software development

The Problem

- Technology, you can't live with it, you can't live without it. Unfortunately, millions of users around the world have come to realise the latter over recent years due to a series of spectacular, and thoroughly unwelcomed, failures.
- As long as humans write code there will be human errors in the code.

Software Failures

The quality of the systems we develop increasingly determines the quality of our existence.

"For a short period last Tuesday, the United States brought their atomic bombers and nuclear missiles to an increased state of alarm when, because of a computer error, a false alarm indicated that the Soviet Union had started a missile attack." – ***6 June 1980.***

The engines of the planes of the strategic air force were started three days later due to the same error.

April 2008 *Aer Lingus website mistakenly sold €1,775 business class tickets to the US for €5.*

July 2012 *Ulster Bank*

Software Failures

August 2017 *a software error in the National Integrated Medical Imaging System (Nimis) meant potentially thousands of patient records from MRIs, X-rays, CT scans and ultrasounds were recorded incorrectly and may have led to patients' undergoing unnecessary treatment.*

January 2018 the citizens of Hawaii were notified to take immediate cover in the face of an inbound ballistic missile strike. It turned out to be a false alarm, although it took over 30 minutes (and, presumably, several thousand heart attacks) before the alert was retracted. Investigations found that while the problem was largely due to human error, there were "troubling" design flaws in the Hawaii Emergency Management Agency's alert origination software.

Software defects have been blamed for Boeing 737-MAX 8 crashes in **October** and **March 2019**, which killed 346 people.

September 2022 *Aer Lingus boarding software crashed causing the cancellation of 51 flights. Problems with the app meant passengers could not check in or book flights.*

More Recently

Security experts have said CrowdStrike's routine update of its widely used cybersecurity software, which caused clients' computer systems to crash globally, apparently **did not undergo adequate quality checks before it was deployed.**

The latest version of its Falcon Sensor software was meant to make CrowdStrike clients' systems more secure against hacking by updating the threats it defends against.

However, **faulty code** in the update files resulted in one of the most widespread tech outages in recent years for companies using Microsoft's Windows operating system.

Global banks, airlines, hospitals and government offices were disrupted.

https://www.rte.ie/news/world/2024/0720/1460920-it-outage-checks/

Characteristics of Software Engineering

- Concerns the development of large programs – multi-person jobs that span more than six months.
- Complexity is an issue – the problem cannot be surveyed in its entirety but must be broken down into smaller more manageable parts.
- Software evolves- with associated costs.
- Software must be developed efficiently.
- Many people are working together.
- The software must effectively support users.
- Is a field in which members of one culture create artefacts on behalf of members of another.

Importance of Software Engineering

- More and more, individuals and society rely on advanced software systems. We need to be able to produce reliable and trustworthy systems economically and quickly.
- It is usually cheaper, in the long run, to use software engineering methods and techniques for software systems rather than just write the programs as if it was a personal programming project. For most types of system, the majority of costs are the costs of changing the software after it has gone into use.

What is Software?

- Software is a set of items or objects that form a "configuration" that includes
  - programs
  - documents
  - data ...
- Software products may be developed for a particular customer or may be developed for a general market

Software products

- Generic products
  - Stand-alone systems that are marketed and sold to any customer who wishes to buy them.
  - Examples – Apps for mobile devices, PC software such as databases, word processors, drawing packages and project management tools; software for specific markets such as appointments systems for dentists.
- Customised products
  - Software that is commissioned by a specific customer to meet their own needs.
  - Examples – embedded control systems, air traffic control software, traffic monitoring systems.

Product specification

- Generic products
  - The specification of what the software should do is owned by the software developer and decisions on software change are made by the developer.
- Customized products
  - The specification of what the software should do is owned by the customer for the software and they make decisions on software changes that are required.

Software Diversity

- There are many different types of software system and there is no universal set of software techniques that is applicable to all of these.
- The software engineering methods and tools used depend on the type of application being developed, the requirements of the customer and the background of the development team.

Software Process

- Is a framework for carrying out the activities of a project in an organised and disciplined manner.
- It imposes structure and helps guide the many people and activities in a coherent manner. Expresses the interrelationships among the phases by defining their order and frequency, as well as deliverables.
- Different types of systems need different development processes

Software Engineering

- In the early days the field was seen as an art and in a counter movement the term "software engineering" was coined.
- In the 1990s the pendulum swung back and the art aspect was emphasised anew in the agile movement.
- The goal of software engineering is the creation of software systems that meet the needs of customers and are reliable, efficient and maintainable.