

Software Engineering: Theory and Practice

Introduction

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Topics

Welcome!

You have just started a software company:

New Mind Applications

and now you should think about

- Software
- Engineering

Engineering

What are the major ingredients and concerns of engineering?

Make your own list.

Compare with your neighbor and discuss.

Engineering: The World Is Not Ideal

- Design and produce products/artifacts (incl. tools) for others.
Resources needed: materials, energy, labor, intellect
- Apply scientific knowledge and scientific method (incl. math).
Use theories, models to predict, analyse, compare.
Do experiments, prototyping, problems solving (not: exercises).
Also inspires new science.
- Ethical aspects (society, environment, life, death)
- Economical aspects (limited resources: time, effort, cost)
- Human limits: productivity, memory, accuracy, communication

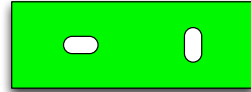
Engineering: The World Is Not Ideal

- Variability, risks (stochastic aspects)

Account for variability in drill hole location when fixing a plate:



No freedom after drilling in wall



Two degrees of freedom

- Quality (satisfy expectations: not black & white)
- Intellectual Property (IP) rights, patents

Software

In what ways does software differ from hardware?

Make your own list.

Compare with your neighbor and discuss.

Software: Its Special Character

- Immaterial, intangible (like holes in a punchcard)
- Malleable (reshapable, flexible, "soft": is also a danger)
- Intellectually intensive
- Incomplete product (requires hardware to run)
- Easy/cheap to reproduce
- Stable, no wear
- Easy to create unmaintainable products

Software

What kinds of software can you distinguish?

Make your own list.

Compare with your neighbor and discuss.

Software: Its Diversity

- Consumer software for “standard” computer (word processor)
- Consumer software for “special” hardware (video games)
- Embedded software in consumer products (phone, TV, shaver)
- Embedded software in industrial systems (baggage handling)
- Administrative/information systems (library, tax department)
- Scientific computing software (weather forecast)
- Software tools (to develop software, or hardware)
- Operating systems (to extend capabilities of hardware)

Software

In what markets is software relevant?

Make your own list.

Compare with your neighbor and discuss.

Software: Its Omnipresence

Where not?

- Science, engineering
- Industry, business
- Medical
- Government, education
- Transportation (air, road, water, space)
- Consumer products

Software Engineering: IEEE Definition

The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software

Also: the scientific study of such approaches

IEEE = Institute of Electrical and Electronics Engineers

The IEEE develops and maintains numerous internationally-accepted standards for Software Engineering.

History

Evolution from

- Customer, developer, and user of software are the same amateur to
- Software products developed by professionals for external non-expert customers and used by yet other non-experts

Goals and Challenges of Software Engineering

Make **quality** software products, **on time**, **within budget** that

- are (part of) large and complex systems,
- are built by teams,
- are requested and used by non-experts,
- exist in many revisions and variants,
- last for many years, and
- undergo frequent changes.

Welcome to **New Mind Applications** and the world of software!

References



Association for
Computing Machinery
Advancing Computing as a Science & Profession

- *Software Engineering Code of Ethics and Professional Practice*
Copy at IEEE Computer Society
Copy at ACM
- *SWEBOK – Software Engineering Body of Knowledge*