Software Engineering: Theory and Practice

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Lecture 1

Tom Verhoeff

Technische Universiteit Eindhoven
Department of Mathematics & Computer Science
Software Engineering & Technology

Feedback to `T.Verhoeff@TUE.NL`

Topics

Welcome!

You have just started a software company:

N*ew* **M***ind* **A***pplications*

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)

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 (TV, shaver)
- Embedded software in industrial systems (baggage handling)
- Administrational/information systems (library, tax department)
- 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 **N***ew* **M***ind* **A***pplications* and the world of software!

References

- IEEE IEEE computer society
- acm 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*