SOFTWARE ENGINEERING

CO3001

CHAPTER 1 - INTRODUCTION

Anh Nguyen-Duc
Tho Quan-Thanh

Adapted from https://iansommerville.com/software-engineering-book/slides/

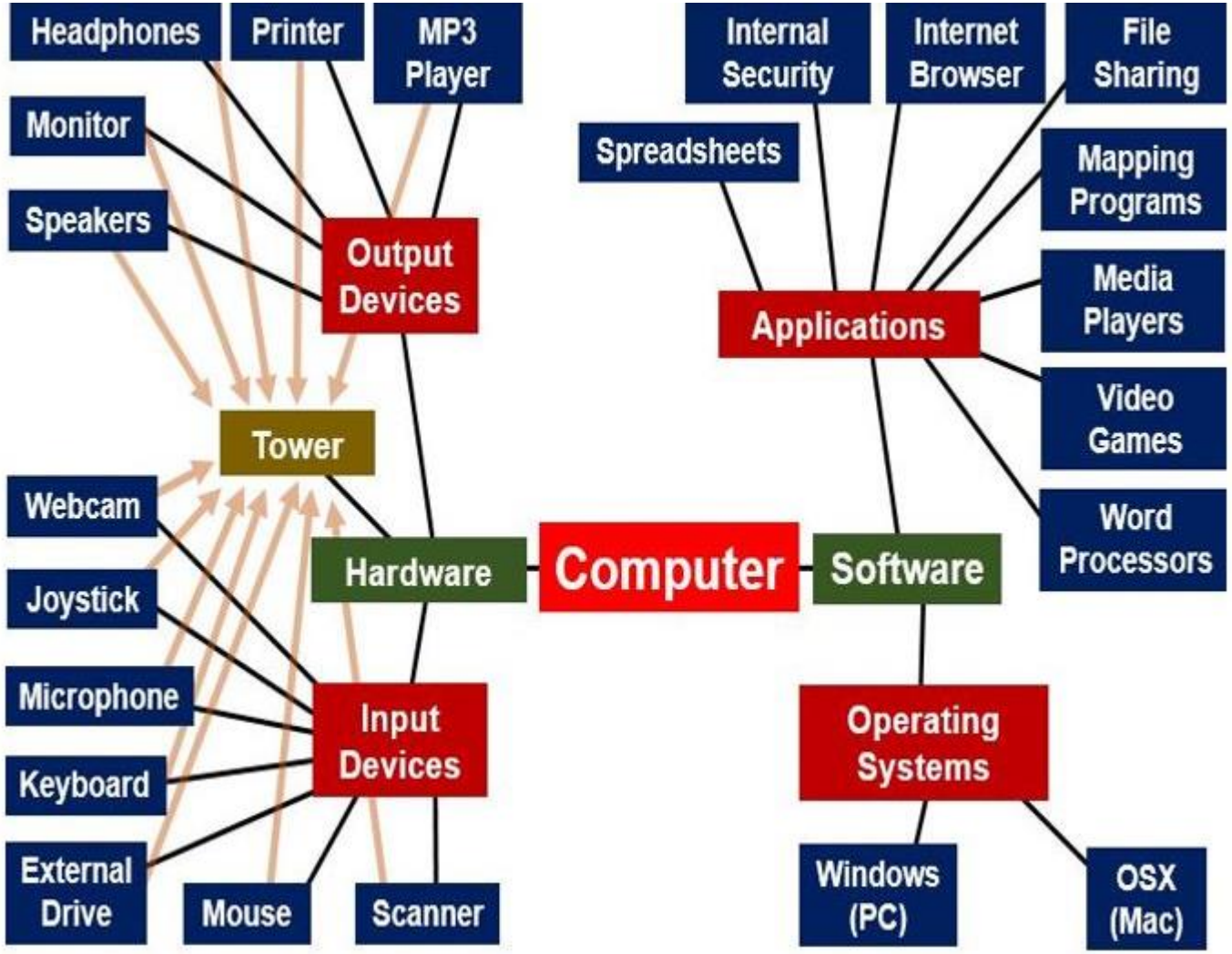
WEEK 1

TOPICS COVERED

- ✓ Professional software development
  - What is meant by software engineering.
- ✓ Ethical & sustainable software engineering
  - A brief introduction to ethical issues that affect software engineering.

WHAT IS SOFTWARE?

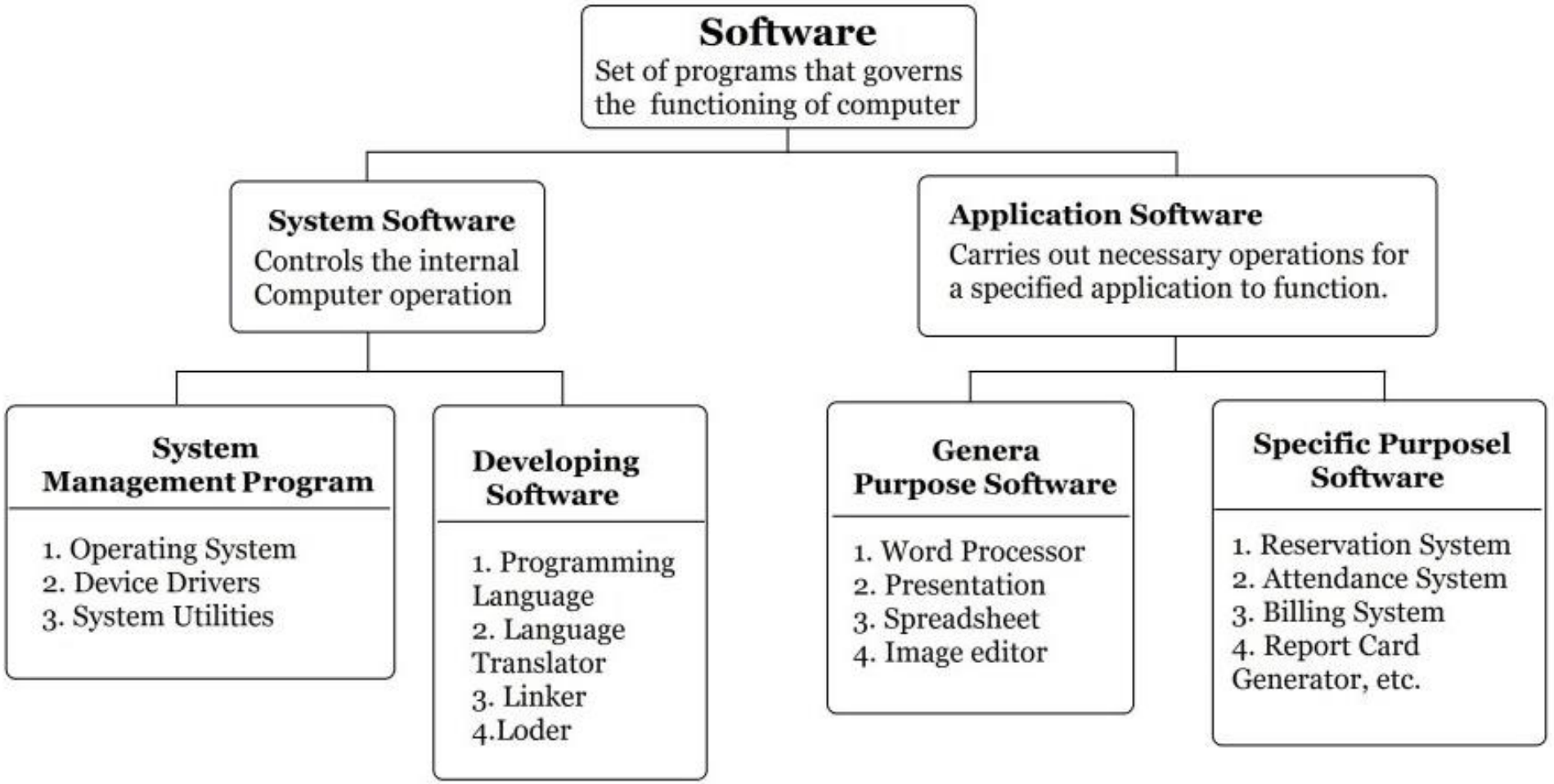
- ✓ Software = Computer program(s) + associated documentation
- ✓ Software products may be developed for
  - a particular customer (bespoken)
  - or a general market (market driven)



SOFTWARE IS COMPLEX

- ✓ Complex ≠ complicated
- ✓ Complex = composed of many simple parts related to one another
- ✓ Complicated = not well understood, or explained

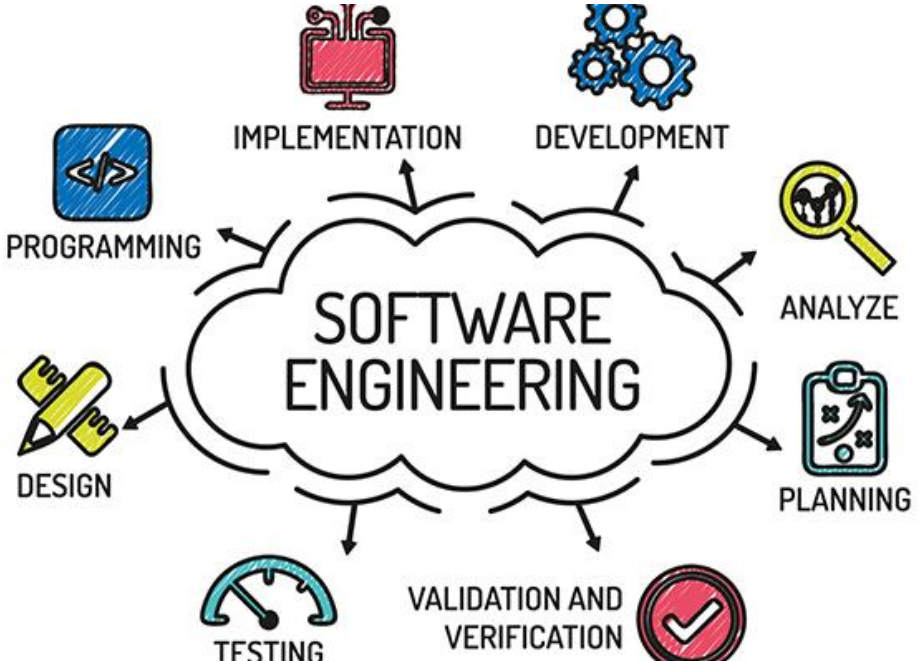
TYPE OF SOFTWARE



SOFTWARE ENGINEERING

using appropriate theories and methods to **solve** problems bearing in mind organizational and financial constraints.

Software engineering is an **engineering** discipline that is concerned with **all aspects** of software production



technical process of development, project management , the development of tools, methods etc.

WHO IS IN CHARGE FOR THE SPECIFICATION?

- ✓ Product specification at initial stage and the changes later
- ✓ Generic products
  - The software engineering team
- ✓ Customized products
  - The customer

> Agile value. Working software over Comprehensive document

GOOD SOFTWARE?

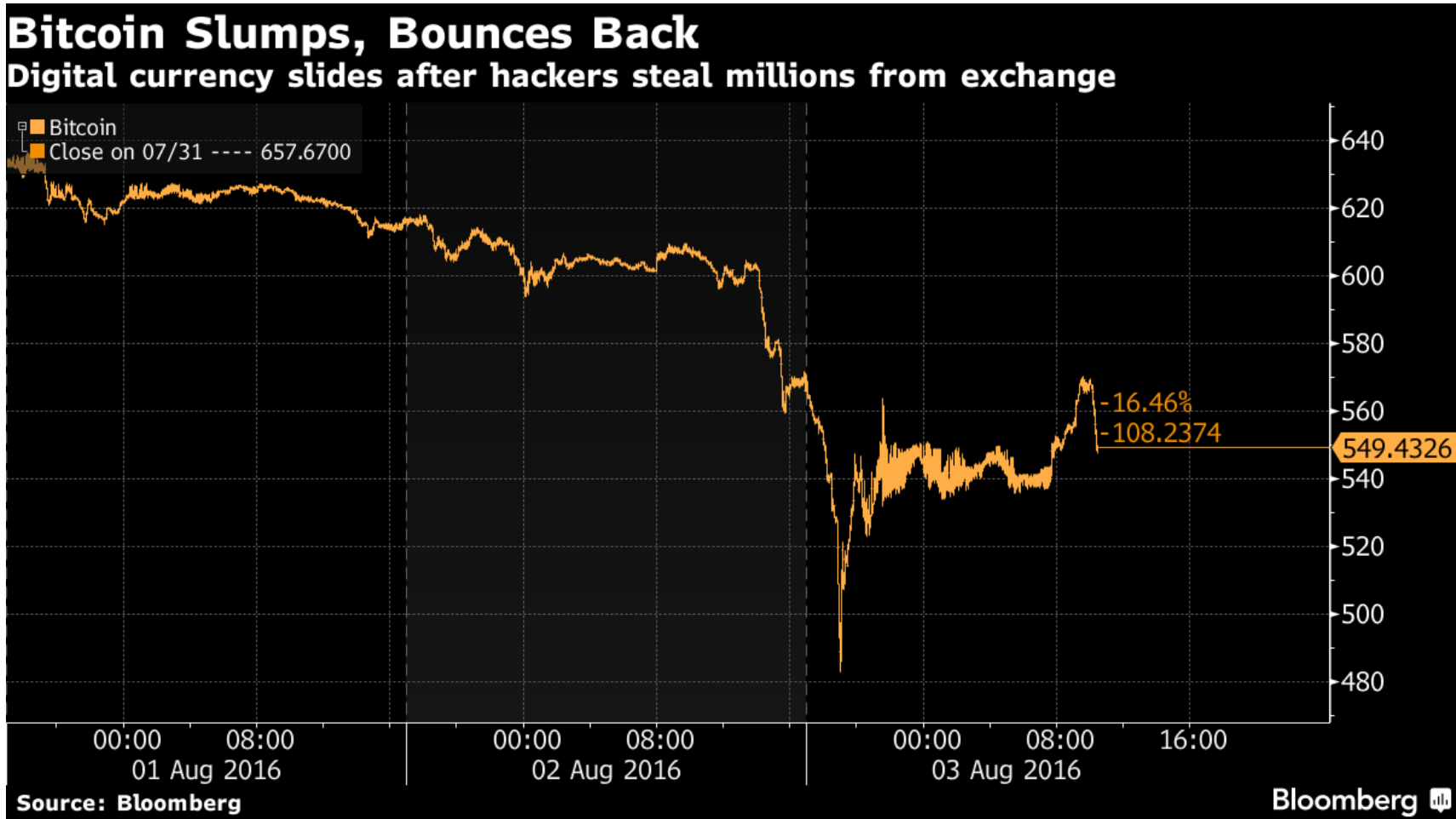
- ✓ "Good" is a general attribute:
  - of a high quality or level
  - to be desired or approved of
- ✓ Break-down "good" quality into required quality attributes:
  - performance
  - maintainable
  - dependable
  - usable

IMPORTANCE OF SOFTWARE ENGINEERING

- ✓ Quality can mean the difference between excellence and disaster
  - Airbus A400M Atlas crash in 2015, 4 killed

IMPORTANCE OF SOFTWARE ENGINEERING

- ✓ 8/2016: Security breach with Bitcoin cost 72 mil. Usd lost in market



SOFTWARE COSTS

- ✓ Software costs ~ computer system costs
- ✓ Costs to maintain > to develop

- ✓ Software engineering is concerned with cost-effective software development.

SOME FAQS ABOUT SOFTWARE ENGINEERING

Question	Answer
What is the difference between software engineering and computer science?	Computer science focuses on theory and fundamentals; software engineering is concerned with the practicalities of developing and delivering useful software.
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 more general process.

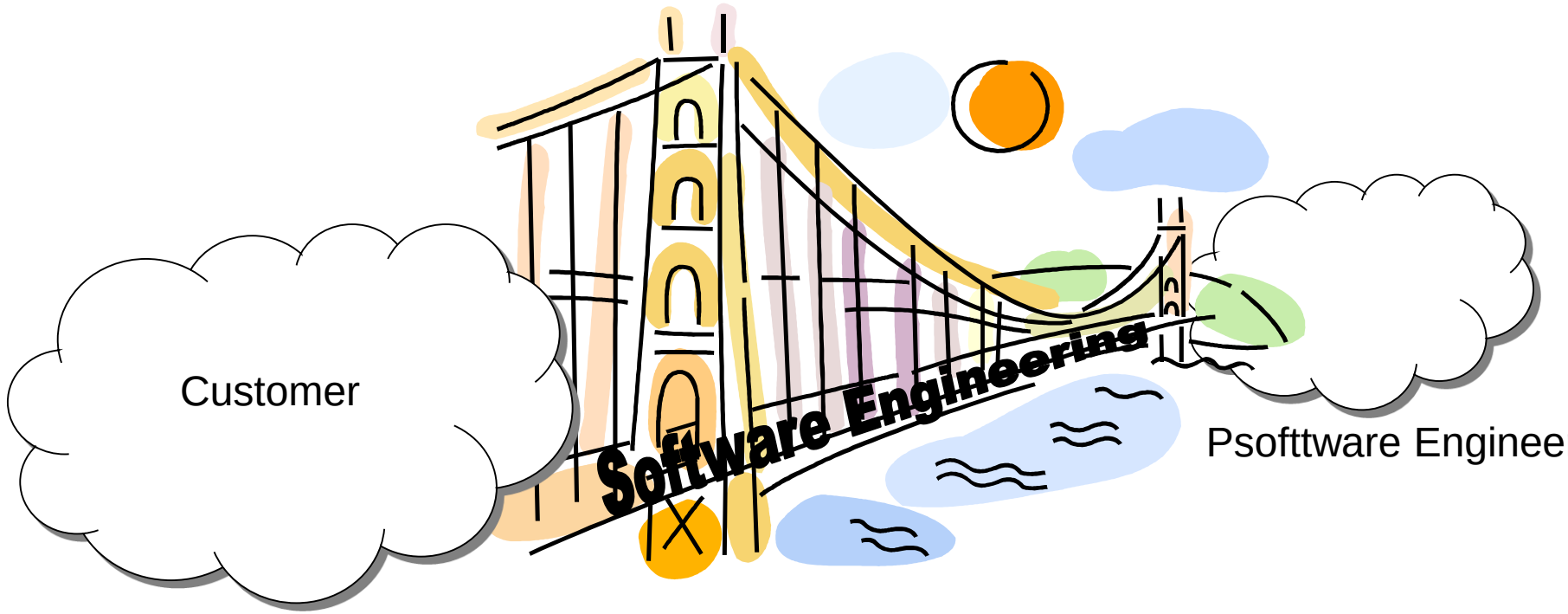
IMPORTANCE OF SOFTWARE ENGINEERING

- ✓ We need:
  - Reliability & trustworthy products
  - Delivering on time
  - Reusable
  - Cost effective in changing/evolution

  - More?

IMPORTANCE OF SOFTWARE ENGINEERING

A bridge from customer needs to programming implementation

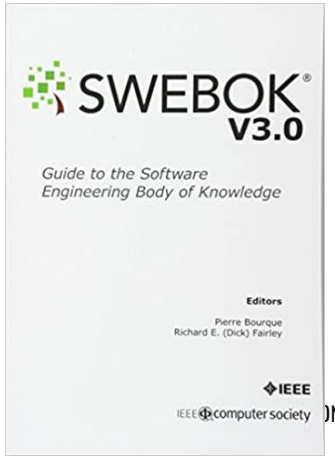


First law of software engineering

Software engineer is willing to learn the problem domain
(problem cannot be solved without understanding it first)

FUNDAMENTAL SOFTWARE ENGINEERING ACTIVITIES

1. Software Requirements
2. Software Design
3. Software Construction
4. Software Test
5. Software Maintenance
6. Software Configuration Management
7. Software Engineering Management
8. Software Engineering Process
9. Software Engineering Tools and Methods
10. Software Quality



GENERAL ISSUES THAT AFFECT MOST SOFTWARE

- ✓ Heterogeneity
  - Increasingly, systems are required to operate as distributed systems across networks that include different types of computer and mobile devices.
- ✓ Business and social change
  - Business and society are changing incredibly quickly as emerging economies develop and new technologies become available. They need to be able to change their existing software and to rapidly develop new software.
- ✓ Security and trust
  - As software is intertwined with all aspects of our lives, it is essential that we can trust that software.

SOFTWARE DIVERSITY

- ✓ Many different types of software system
  - Stand-alone
  - Transaction-based
  - Embedded system
  - Batch processing
  - Entertainment
  - Modeling and simulation
  - System of systems
- ✓ Software development is context-specific
  - Large companies
  - SME
  - Startups
  - In-house
  - Outsourcing

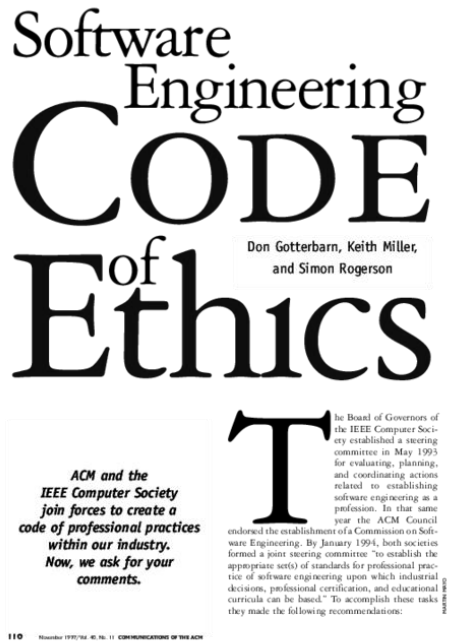
➔ no universal set of software techniques applicable to all!

SOFTWARE ENGINEERING FUNDAMENTALS

- ✓ Some fundamental principles apply to all types of software system:
  - Use a managed and understood development process
  - Consider dependability and performance
  - Understand and manage the software specification and requirements
  - Try reuse software

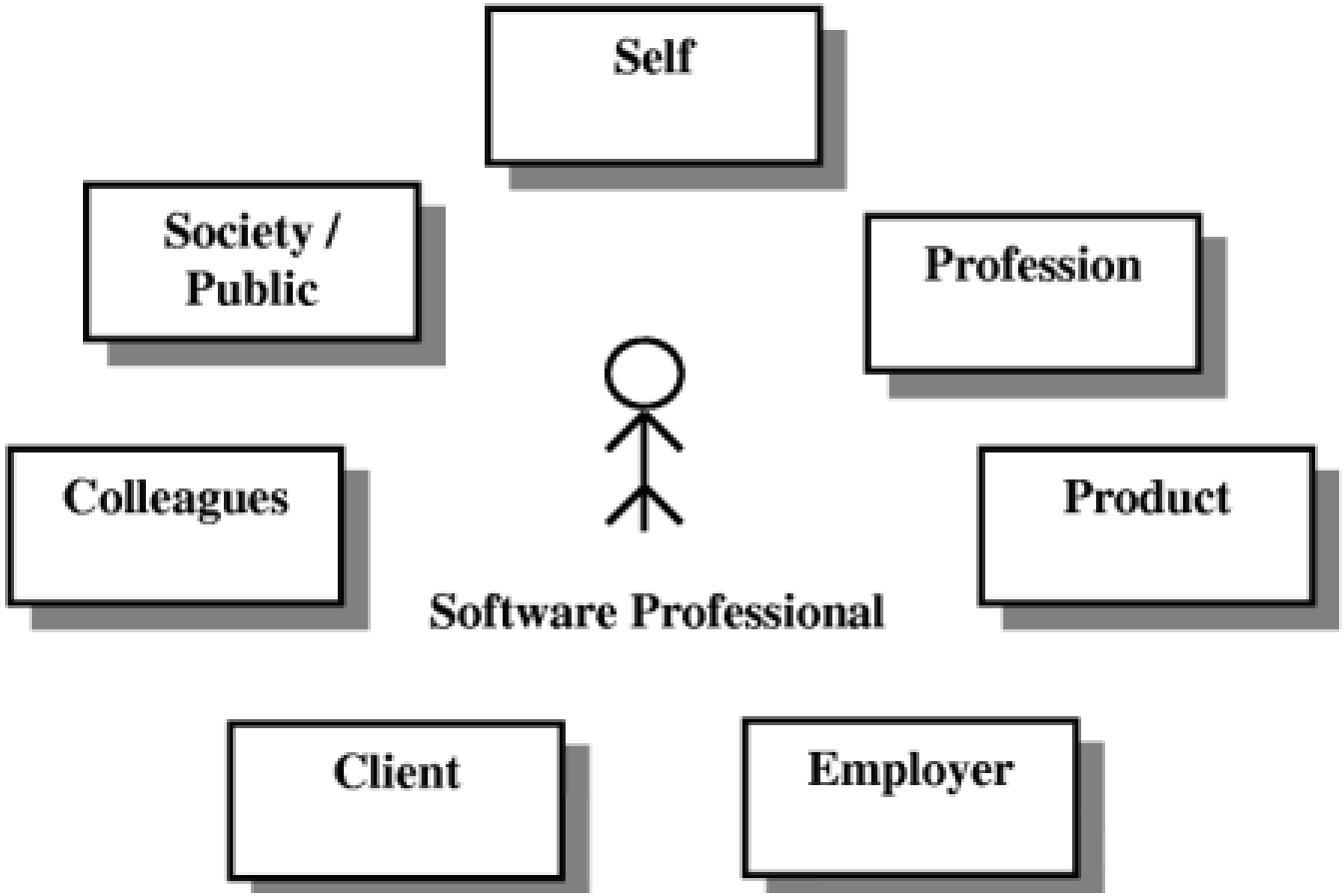
SOFTWARE ENGINEERING ETHICS

- ✓ Ethics?
  - (Oxford dictionary) Moral principles that govern a person's behaviour or the conducting of an activity.


Software Engineering
CODE of Ethics
Don Gotterbarn, Keith Miller, and Simon Rogerson
ACM and the IEEE Computer Society join forces to create a code of professional practices within our industry. Now, we ask for your comments.
The Board of Governors of the IEEE Computer Society established a steering committee in May 1993 for evaluating, planning, and coordinating actions related to establishing software engineering as a profession. In that same year the ACM Council endorsed the establishment of a Commission on Software Engineering. By January 1994, both societies formed a joint steering committee "to establish the appropriate set(s) of standards for professional practice of software engineering upon which industrial decisions, professional certification, and educational curricula can be based." To accomplish these tasks they made the following recommendations:

- ✓ Fundamental Software engineering ethics
  - Software engineering involves **wider responsibilities** than simply the application of technical skills.
  - Software engineers must behave in an honest and ethically responsible way if they are to be respected as professionals.
  - Ethical behaviour is more than simply upholding the law but involves following a set of principles that are morally correct.

SOFTWARE ENGINEERING ETHICS



ACM CODE OF ETHICS AND PROFESSIONAL CONDUCT

- ✓ 1.1 Contribute to society and human well-being.
- ✓ 1.2 Avoid harm to others.
- ✓ 1.3 Be honest and trustworthy.
- ✓ 1.4 Be fair and take action not to discriminate.
- ✓ 1.5 Honor property rights including copyrights and patent.
- ✓ 1.6 Give proper credit for intellectual property.
- ✓ 1.7 Respect the privacy of others.
- ✓ 1.8 Honor confidentiality.

SOFTWARE ENGINEERING AND SUSTAINABILITY

SOFTWARE ENGINEERING AND SUSTAINABILITY - EXAMPLE

- ✓ **Green Software Engineering** is an emerging discipline at the intersection of climate science, software practices and architecture, electricity markets, hardware and data centre design.
- ✓ **Green Software Engineering** concerns the design, development and operation of software-intensive products in a way that reduces pollution, promotes sustainability, and minimizes risk to human health and the environment without sacrificing economic viability and efficiency

https://principles.green/

SOFTWARE ENGINEERING AND SUSTAINABILITY - EXAMPLE

- ✓ Carbon: Build applications that are carbon efficient.
- ✓ Electricity: Build applications that are energy efficient.
- ✓ Carbon Intensity: Consume electricity with the lowest carbon intensity.
- ✓ Embodied Carbon: Build applications that are hardware efficient.
- ✓ Energy Proportionality: Maximize the energy efficiency of hardware.
- ✓ Networking: Reduce the amount of data and distance it must travel across the network.
- ✓ Demand Shaping: Build carbon-aware applications.
- ✓ Measurement & Optimization: Focus on step-by-step optimizations that increase the overall carbon efficiency.

https://principles.green/

SUMMARY

- ✓ Software engineering is an engineering discipline that is concerned with all aspects of software production.
- ✓ Essential software product attributes are maintainability, dependability and security, efficiency and acceptability.
- ✓ The high-level activities of specification, development, validation and evolution are part of all software processes.
- ✓ The fundamental notions of software engineering are universally applicable to all types of system development.

SUMMARY (CONT.)

- ✓ There are many different types of system and each requires appropriate software engineering tools and techniques for their development.
- ✓ The fundamental ideas of software engineering are applicable to all types of software system.
- ✓ Software engineers have responsibilities to the engineering profession and society. They should not simply be concerned with technical issues.
- ✓ Sustainability is an emerging concern in all engineering discipline, including software development and operation.