



CS5030

Software Engineering

Learning outcomes

- On completing this lecture and associated reading, you should be able to
 - Explain what software engineering is and why it is important
 - Understand that the development of different types of software systems may require different software engineering methodologies and techniques

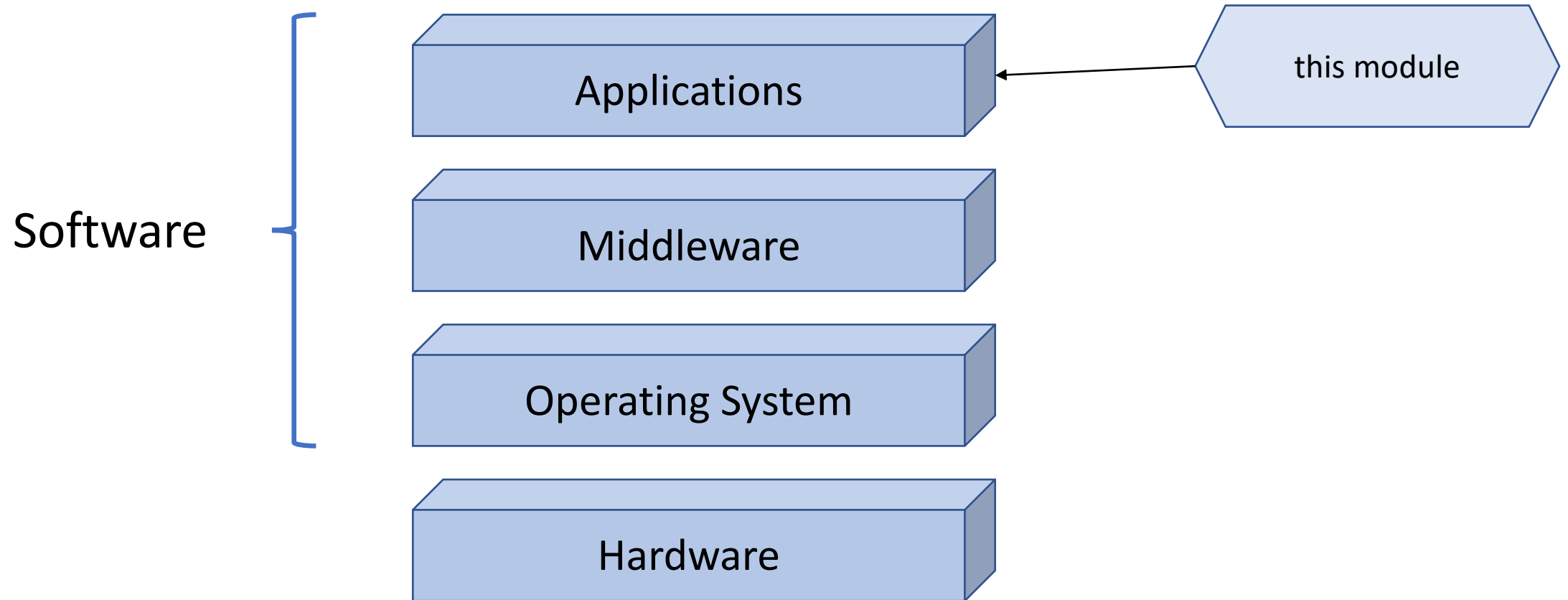
What is software?

- OED
 - The collection of programs essential to the operation of a particular computer system, typically (in early use) being provided by the manufacturer
 - System software
 - Programs designed to enable a computer to perform a particular task or series of tasks
 - Application software

What is software?

- IEEE / ISO standard definitions
 - Computer programs, procedures and possibly associated documentation and data pertaining to the operation of a computer system
 - All or part of the programs, procedures, rules, and associated documentation of an information processing system
 - Program or set of programs used to run a computer

Where is software?



Who creates software?

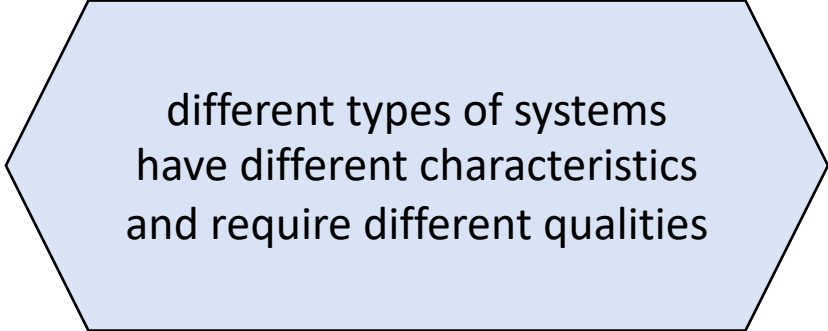
- Software companies – large and small
- Public and private organisations with software divisions
- Academic / research groups
 - Including research software engineers
- Individual developers
- End users
- . . .
- Professional software development
 - Not for personal use, interest or enjoyment

Who is software for?

- Software could be for
 - Specific customers
 - Organisations or individuals
 - General market
- This typically decides who controls the specification
 - Customer or
 - Developing organisation / team / person

Different types of applications

- Stand-alone
- Interactive, transaction-based
- Embedded control
- Batch processing
- Entertainment
- Modelling and simulation
- Data collection and analysis
- Systems of systems



different types of systems
have different characteristics
and require different qualities

What are the attributes of good software?

- It delivers required functionality and performance
- It is maintainable, dependable and usable
- Anything else?

Goal of software development

- Production of software
 - of good quality
 - on time
 - within budget
 - satisfying customer requirements

Challenges of software development

- Increasing diversity and complexity of systems
 - ‘Traditional’ CS knowledge and skills +
 - Understanding of scale, uncertainty, mobility, dynamism, ... +
 - Understanding of domain, ethical concerns, legal aspects, ...
- Demand for faster delivery times and other business pressures

More on challenges

- Heterogeneity
 - Application domains, devices, paradigms and languages
- Business and social change
 - Technologies, market forces, changing development practices
- Security and trust
 - Access over networks, data collection and storage
- Scale
 - Size of applications, demand, resource constraints

Software Engineering (SE)

1. systematic application of scientific and technological knowledge, methods, and experience to the design, implementation, testing and documentation of software
[ISO/IEC 2382:2015]
2. application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software
[ISO/IEC TR 19759:2016]

IEEE Standard 24765

Software Engineering

- An engineering discipline that is concerned with all aspects of software production from initial conception to operation and maintenance

[Sommerville, 2016]

What SE isn't

- Software engineering \neq coding
- Good quality code \neq successful software project

What SE isn't

- Software engineering doesn't refer to a single
 - Technique
 - Methodology
 - Language
 - Set of tools
 - ...
- A systematic and organised approach

SE activities

- Software specification
- Software development
- Software validation
- Software evolution

Techniques and methods in SE

- Choices based on
 - types of systems
 - business, organisational and regulatory constraints

Software engineering costs

- Roughly
 - 60% development
 - 40% testing
- Costs of maintenance and evolution often outstrip development costs

Standish Group CHAOS Report (2015)

MODERN RESOLUTION FOR ALL PROJECTS

	2011	2012	2013	2014	2015
SUCCESSFUL	29%	27%	31%	28%	29%
CHALLENGED	49%	56%	50%	55%	52%
FAILED	22%	17%	19%	17%	19%

The Modern Resolution (OnTime, OnBudget, with a satisfactory result) of all software projects from FY2011–2015 within the new CHAOS database. Please note that for the rest of this report CHAOS Resolution will refer to the Modern Resolution definition not the Traditional Resolution definition.

From: https://www.standishgroup.com/sample_research_files/CHAOSReport2015-Final.pdf

Key points

- Software engineering is an engineering discipline that is concerned with all aspects of software production
- There are many different types of software system
 - Each requires appropriate software engineering tools and techniques for its development
- The fundamental ideas of software engineering are applicable to all types of software system
- Software engineering continues to face many challenges