

Introduction

PA017 SW Engineering II → Aspects of SW Development Management

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Course Organization

- Lectures are not mandatory
- Final exam will be in IS
 - multiple-choice question
 - at least one correct answer
 - more correct answers possible
 - "test" questions will be published throughout semester

What is Software...?

Software

Software consists of a total sum of computer programs, procedures, rules, documentation, and data that are relevant to the operation of a computer system.

A software product is a commodity to be handed-over to the client.

Software Properties

- It is designed and developed using engineering techniques, it is not produced or manufactured in a traditional meaning of these concepts
- It does not degrade or wear-down physically
- It is usually tailor-made, a minority of products is composed from already existing components

Software Properties II

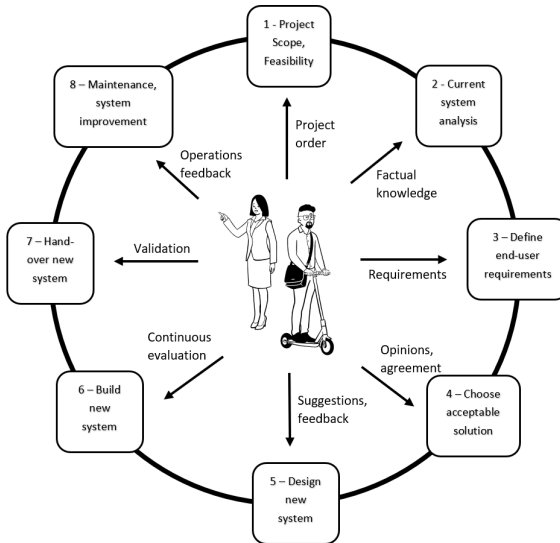
Generic products

- Standalone systems created by the manufacturing organization and sold on free market to any customer who wishes to buy it
- Specification of such system is defined internally by manufacturing organization, usually by sales department

Contractual Products

- Systems ordered by a particular customer. Software is being developed by Contractor bind by a Contract
- Specification is an essential part of the contract between Customer and Contractor. Any future changes must be approved and impact on price will be calculated

Interaction with Users



Software Properties III

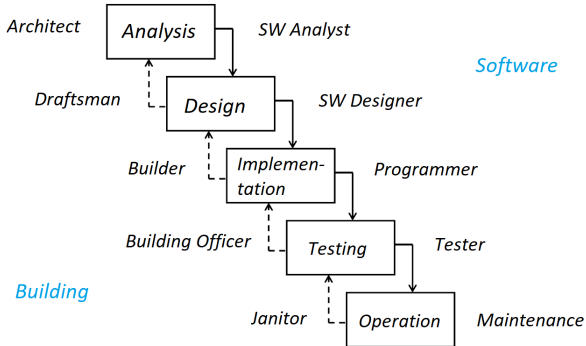
- Maintenance problems
 - Increased support after handover
 - Developmental requests
 - Change in law
- High costs of programs
- Programmers' productivity
 - Extreme individual deviations (1:28)
 - How to estimate prices, man-hours...?
- Programming language impact
 - Application complexity has greater impact on a productivity than programming language selection
- Debugging cost
 - Differs per lifecycle phase

Similarity to other Engineering Domains



Well-designed software is like well-designed building.
It is an engineering endeavour.

Waterfall Model - SW or Building?



Software Engineering

Software Engineering

is a standalone engineering domain which applies systematic approach to development, operation, maintenance and replacement of software

- Acknowledged as certified field in 1997 (USA)
- Lack of unified theory, basic terminology differs
- Practitioners use collection of techniques which seem to be functional

Well-delivered Software

- **Maintainability:** it should be possible to maintain and enhance SW according to changing Customer needs
- **Reliability:** failure-free operation, data protection, security. In case of failure, no physical or economic damage shall be caused
- **Efficiency:** SW should not waste HW resources (memory, CPU usage, etc.)
- **Usability:** SW should have reasonable user-friendly GUI and appropriate documentation

Critical Factors of SW Productivity

- **Complexity:** may be defined indirectly by selected visible attributes of a program (architecture, number of variables...)
- **Size:** programming-in-the-large vs. programming-in-the-small
- **Communication:** individual, small team, large team
- **Time, Work plan**
- **SW "Invisibility"**

Programming-in-the-small

- Verified techniques
- Top-down approach, structured coding, step-wise refinement
- Inspection of logic and code
- Tools - compilers, debuggers

Programming-in-the-large

- Planning mechanisms - division of labor, scheduling, resources
- Documented specification
- Structured teams
- Formalized test files and test cases
- Formalized inspections

SW Development Process

SW development is a process in which:

user needs

↓ are transformed into

SW requirements

↓ are transformed into

design

↓ is implemented as

code

↓ is tested, documented, and certified for

operational use

Basic Activities during SW Development

■ Specification

It is necessary to define SW functionality and operational restrictions

■ Development

It is necessary to create SW which fulfills requirements defined in specification

■ Validation

SW must be validated (inspected) in order to make sure that it provides exactly the functionality that is required

■ Evolution

SW must be further developed to fulfill changing requirements of a Customer

Visible SW Development Outputs

■ Artifacts

- Program printouts
- Documentation
- Data
- Source code

■ Processes

- Work procedures
- Rules-of-thumb
- Team member interaction

SW Development Process Properties

- **Comprehensiveness**

Is the process explicitly defined and is it easy to understand process definition?

- **Visibility**

Does the process activities lead to identifiable results such that the output is apparent externally?

- **Reliability**

Is the process designed such that it eliminates errors, or that it is possible to identify errors before they result in faults in SW?

- **Acceptability**

Is the process acceptable and usable by engineers responsible for production?

SW Development Process Properties

■ Robustness

Can the process continue even when unexpected events have occurred?

■ Maintainability

Can the process evolve such that it will reflect changing organizational demands or identified improvements?

■ Speed

How fast is the development process from specification to system hand-over?

■ Supportability

To which extent can the process be supported by CASE tools?

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