

SOFTWARE ENGINEERING

Fundamentals

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What is Software?

- Often equated with *computer programs*
- More than just software (source code)
 - Associated documentation
 - Configuration data
 - Needed for correct program operation

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A **software system** consists of:

- One or more application programs
- Configuration files
- System documentation (System structure)
- User documentation (how to use system)
- Peripheral devices
- Users ?

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A **software engineer** is a person concerned with developing software products to be sold to customers

Software Products

- Generic/Commercial Off the Shelf (COTS)
- Customised (bespoke)

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Generic Products

- Stand-alone systems
- Sold on open market
- Bought by anyone who can pay!
- S/W for PCs: WP/DB/CAD
 - MS Office
 - SAGE/Big Red Book
 - SmartDraw , AutoCAD
- Software specification controlled by the developer

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Customised Products

- Commissioned by a customer
- Developed by software contractor
 - Air traffic control system
 - Control system for electronic devices
 - Online banking / Paddy Power/ Ryanair
- Software specification controlled by the customer

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What is Software Engineering?

1. An engineering discipline

- Aim is 'to make things work'
- Application of methodologies/tools
Work within a framework
- Work within organisational and financial constraints

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2. Concerned with all aspects of S/W production

- Analysis
- Design
- Technical processes (code/test/data storage)
- Project management
- Development of tools/methodologies

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Software Engineers adopt a systematic approach to the development, operation and maintenance of software (a framework)

Framework is applied throughout all phases from system specification → system maintenance

Very effective in the production of high-quality software

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Software V System Engineering ?

System Engineering:

- Development and evolution of complex systems
- Hardware development
- Policy and process design
- Software engineering
- System specification
- System deployment

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What is a Software Process?

“A set of activities and associated results that produce a software product”. (Sommerville, 2007)

There are four fundamental process activities:

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

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Software Specification

- Involves engineers and customers
- Defines the software to be produced in terms of :
 - *user requirements*
 - *system requirements*
- Defines operational constraints, if any

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Software Development

- Software is designed (program specification)
- Code is written
- Code is tested
- Code is verified/Validated

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Software Validation

- Software is checked against the user requirements
- Does the S/W do what it was intended to do?
- Have all user requirements been provided?
- Does the S/W meet it's operational constraints?

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Software Evolution

- Software changes over time
 - Fix 'bugs'
 - New customer requirements
 - Enhance with new features (functionality)
 - New market requirements
 - Government / legislative requirements

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- Different types of systems require different approaches to software development i.e. Use different development processes
- Real-time S/W in an aircraft requires specification to be complete **before** development begins (critical systems)
- e-commerce systems specification and development can be performed together (incremental development)

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If an appropriate process model is **not** used:

- Reduced product quality
- Increased production costs
- Reduced profits

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What is a Software Process Model?

- A simplified description of a SW process that presents one view of the process
- Process models may include:
 - Activities (tasks) of the SW process
 - Software products/tools
 - Roles of people involved in SW engineering

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Examples of Process Models

Workflow model

Shows the sequence of activities in the process with inputs, outputs and dependencies.

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A Dataflow or Activity model

- Represents the process as a set of activities
- Each activity performs data transformation
- Shows how input to the process is transformed to an output
e.g. specification → design
- Transformations are made by people and/or computers.

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A Role/Action Model

- Roles of the people involved in the SW process
- Responsibilities of these people

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Most process models are based on one of three general models:

- The Waterfall approach
- Iterative Development
- Component-based software engineering (CBSE)

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Other models:

- Prototype Model
- Object Oriented Model
- Dynamic Systems Development Model

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