

ICT 2402 Software Engineering

An Overview of Software Engineering

Objectives

- After completing this lesson you should be able to,
 - describe different categories of software
 - describe the scope of software engineering including its objectives
 - describe software process
 - Describe ethics in software engineering

Topics Covered

- This course
- Define the terms 'software' and 'software engineering'
- History of software engineering
- Software Process and Process Models
- Software engineering as a discipline
- Professional and ethical responsibility
- Software Attributes
- Challenges Facing Software Engineering

Course content

- **Course Contents**
- **Scope of Software Engineering**
- **Software Process Models**
- **Non-functional Requirements**
- **Functional Requirements**
- **Requirement Specification**
- **Design Techniques and software architectures**
- **Software Implementation**
- **Testing**
- **Software Quality**
- **Current topics**

What is Software

Computer programs , associated documentation and configuration data

-Sommerville

Generic software vs. bespoke software

- **Generic software:** stand-alone software products that are sold to the open market
 - e.g. spreadsheet applications, database systems, text editors etc.
- **Bespoke software:** software developed for a specific customer
 - e.g. business process automations, embedded systems software, air traffic control systems etc

System software vs application software

- **System software:** low-level software required to manage computer resources and support the production or execution of application programs
- **Application software:** software that performs a specific function directly for the end user

- Find out the about the Sri Lankan software development community.
- How many companies are there? How many people are working on SD? Are they developing generic or bespoke software?

System software

- Operating systems
 - Client operating systems
 - Network operating systems
- Database management systems
- Network software
 - Network management software
 - Server software
 - Security and encryption software
 - Middleware
- Development tools and programming language software
 - Software development tools
 - Testing tools

Application software

- General business productivity applications
 - Word processors
 - Spreadsheets
 - Simple databases
 - Graphics applications
 - Project management software
- Home use applications
 - Games
 - Media players
- Cross-industry application software
 - Professional accounting software
 - Human resource management
 - Customer relations management software
 - Geographic Information System software

Cont...

- Vertical market application software
 - Software for a specific industry (manufacturing, health care, telecom, etc)
- Utilities software
 - Anti virus
 - Compression programs
 - Search engines
 - Font
 - Voice recognition software

Software crisis and the history of software engineering

- The notion of 'software engineering' was first proposed in 1968 at a conference held to discuss what was then called the 'software crisis' (Naur and Randell, 1969).-wikipedia.
- So "software engineering" was the answer to "software crisis".
- Software crisis
 - Computer hardware technology advanced rapidly
 - As a result, more complex software were possible to create
 - However, there were no standard methods and practices developed to tackle complex software development
 - As a result, software projects were running over budget and over schedule
 - Software was of low quality
 - Software often did not meet requirements
 - Projects were unmanageable and code difficult to maintain
 - Some projects were never delivered at all

Creating New Software:

- Develop new software programs
- Configure generic software to suit an organization
- Re-use existing software

Software Engineering

An **Engineering Discipline** which is concerned with **All Aspects of Software Production** from system specification to maintenance.

- Sommerville

Engineering Discipline:

- Selectively apply theories, methods and tools.
- But,
- Some systems need creative, informal approaches.

Aspects of Software Production:

- Technical processes
+ Software Project Management

Computer Science vs Software Engineering

- Theory and Fundamentals

- Practically produces software using
Computer Science
+ ad hoc approaches

System Engineering vs. Software Engineering

- Development and Evolution of **All System Components**
 - Software, Hardware development
 - Policy and process design
 - System deployment
- Focused on software development to a greater depth
- Software Engineering is **part of** System Engineering

Software Process

- Software Specification
 - Analysis
 - Specification
- Software Development
 - Design
 - Implementation
 - Documentation
- Software Validation
 - Testing
 - Debugging
- Software Evolution
 - Maintenance

Objectives of software engineering

- Maintainability
- Correctness
- Reusability
- Testability
- Reliability
- Portability
- Adaptability
 - <http://courses.cs.vt.edu/~cs4704/slideso.pdf>

Software development life cycle

- Software development life cycle is a series of steps/stages/phases in which software is produced. Almost all life cycles share these steps/stages/phases:
 - Requirements
 - Design
 - Implementation
 - Testing
 - Maintenance
 - <http://www.cs.washington.edu/education/courses/cse403/11sp/lectures/lecture02-lifecycle.pdf>

Contd...

- Goals of each step/stage/phase:
 - mark out a clear set of steps to perform
 - produce a tangible item
 - allow for review of work
 - specify actions to perform in the next phase
- Some life cycle models:
 - Waterfall
 - spiral

Software Process Model

- A simplified representation (or **abstraction**) of a software process.
- **Software Development Models / Paradigms:**
 - **Waterfall model**
 - Represent process activities as separate phases
 - **Iterative development**
 - "cycles" through the development phases, from gathering requirements to delivering functionality
 - **Component-based software engineering**
 - Software is developed by integrating existing software components

Software engineering methods

- Structured approaches to develop high quality software in a cost-effective way
- Methods consist of system models, notations, rules, design, advice and process guidance
- Most popular software engineering methods are,
 - Structured analysis
 - Structure software systems into a set of functional components
 - Object oriented methods
 - Attempts to model real world processes as a set of interrelated objects

CASE – Computer Aided Software Engineering

Support software process activities

- Upper-CASE tools
 - Support early phases: analysis and design
- Lower-CASE tools
 - Support later phases: implementation and testing

Software Attributes

- Maintainability:
ability to evolve
- Dependability:
be reliable, safe and secure and not cause damage when
system fails
- Efficiency
not waste system resources
- Usability
ability to use software without hassle

Challenges Facing Software Engineering

- Legacy Challenge:
maintaining systems developed long ago
- Heterogeneity Challenge:
maintaining systems distributed across networks
- Delivery Challenge:
delivering systems quickly

Professional ethics for software engineers

- Software engineers have responsibilities to the engineering profession as well as society.
- IEEE-CS/ACM task force have developed a software engineering code of ethics
- Code contains 8 guiding principles
 - Public
 - Software engineers shall act consistently with the public Interest
 - Software engineers shall act in a manner that is in the best interest of their client and employer, consistent with the public interest.
 - Product
 - Software engineers shall ensure that their products and related modifications meet the highest professional standards possible

Cont...

- Profession
 - Software engineers shall advance the integrity and reputation of the profession consistent with the public interest
- Peers and self
 - Software engineers shall maintain integrity and independence in their professional judgment
 - Software engineering managers and leaders shall subscribe to and promote an ethical approach to the management of software development and maintenance
 - Software engineers shall be fair to and supportive of their colleagues
 - Software engineers shall participate in lifelong learning regarding the practice of their profession and shall promote an ethical approach to the practice of the profession

Key Points

- Software Engineering:
engineering discipline concerned with all aspects of software production
- Software:
programs + documentation + configuration data
- Software Process:
specification, development, validation & evolution
- Software Attributes:
maintainability, dependability, efficiency and usability

References

- Chapter 1
Software Engineering – 9th Edition
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