Slide 01: Software Engineering

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Software

Software is a set of instructions, data, and documentation that enables a computer to perform specific functions or solve problems.

Engineering

Engineering is the application of scientific principles to build products systematically.

Software Engineering

Software Engineering is defined as the application of a systematic, disciplined, quantifiable approach to the development, operation and maintenance of software.

Need for Software Engineering

- ***Large software –*** As the size of software become large, complexity and difficulty levels of the programs increases exponentially. So, engineering has to step-up to give it a scientific process.
- ***Scalability –*** Well-engineered software can be extended and reused, avoiding the need to rebuild from scratch.
- ***Cost*** – Without proper engineering practices, software development becomes expensive and inefficient.
- ***Dynamic Nature*** – As user needs and environments evolve, software must be updated frequently and engineering ensures smooth adaptability.
- ***Quality Management –*** A systematic development process leads to higher-quality, reliable software products.

Techniques to reduce complexity of a software

Software Engineering principle use two important techniques to reduce complexity:

1. ***Abstraction***

Abstraction simplifies a problem by focusing only on the relevant details and ignoring the irrelevant ones. It allows us to solve a simpler version of the problem first. Then the omitted details can be taken into consideration to solve the next lower level abstraction. This approach is a powerful way to manage and reduce complexity.

2. ***Decomposition***

   Decomposition breaks a complex problem into smaller, manageable parts that can be solved individually. However, simply dividing a problem randomly won't help. Each part should be designed to work independently, so their solutions can later be combined into a complete solution. Good decomposition reduces interaction between components—if the parts are too interdependent, complexity remains high and solving them separately becomes difficult.

Characteristics of Good Software

A good software product must satisfy on the following grounds:

Operational	***Transitional***	***Maintenance***
This tells us how well software works in operation. 1. Budget 2. Usability 3. Efficiency 4. Correctness 5. Functionality 6. Dependability 7. Security	This aspect is important when the software is moved from one platform to another. 1. Portability 2. Interoperability 3. Re-usability 4. Adaptability	This aspect briefs about how well a software has the capabilities to maintain itself in ever-changing environment. 1. Modularity 2. Maintainability 3. Flexibility 4. Scalability

Characteristics of Good Software

Good software should exhibit several key qualities to ensure it is effective, efficient, and user-friendly.

1. ***Functionality*** — Software must meet all the specified requirements and perform as expected in its intended environment.
2. ***Usability*** — The software is easy to use and understand, offering a smooth and positive experience to users.

3. ***Reliability*** — The software is free of defects and performs consistently across various conditions and scenarios.
4. ***Performance*** — How efficiently the software runs, especially when handling large amounts of data or user traffic.
5. ***Security*** — The software must safeguard data and functions against unauthorized access and malicious attacks.
6. ***Maintainability*** — Maintainability is the ease with which the software can be updated, modified, or supported by good documentation that helps other developers understand it.
7. ***Re-usability*** — Allows components of the software to be used in other projects, promoting efficient development.
8. ***Scalability*** — Ensures that the software can handle increasing workloads and adapt to growing requirements.
9. ***Testability*** — The software is designed in a way that makes it easy to test and validate, with sufficient test coverage to ensure quality.