

# Review of Software Engineering

- The Software Crisis
- Software Engineering
- Goals of software engineering
- Principles of software engineering
- Methods
- Process Models

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# The Software Crisis

- Symptoms:
  - Unmanageable.
  - Over budget.
  - Late.
  - Poor quality.
- Causes:
  - One word: Complexity.

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## Software Engineering (1of2)

- Definition: The establishment and use of sound engineering principles in order to obtain economically software that is reliable and works efficiently on real machines. (Fritz Bauer, at the First NATO Conference on Software Engineering, 1969)

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## Software Engineering (2of2)

- History:
  - Advances in hardware capability have enabled increasingly complex software.
  - Our ability to intellectually manage this complexity has always lagged the advances in software complexity.
  - We continually require better tools.
    - CASE (Computer-Assisted Software Engineering) tools.
    - Intellectual tools -- Software engineering techniques.

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## Goals of Software Engineering

- Maintainability - the ability to easily make changes, enhancements, or improvements.
- Dependability - the ability to rely on the software to function properly when needed.
- Efficiency - the ability for software to use computing resources effectively (mainly space and time).
- Usability - the ability for the end user to easily and effectively put the software to proper use.

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## Principles of Software Engineering

- Modularity - divide and conquer.
- Encapsulation - hide the implementation.
- Localization - collect similar things together.
- Abstraction - provide an illusion.
- Uniformity - make everything look similar.
- Completeness - do everything required.
- Confirmability - be able to prove that the software works properly.

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## Methods

- Modeling – producing abstractions of things.
- Data-driven methods – base the structure of the solution on the structure of the data.
- Function-driven methods – base the structure of the solution on the required functionality.
- Object-oriented methods – base the structure of the solution on objects (combinations of data and functions).

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## Process Models

- Waterfall.
  - Strict sequence of activities.
  - One pass.
- Incremental.
  - Multiple passes through sequence.
  - Start with skeletal system.
  - Add functionality in pre-planned increments.
- Iterative.
  - Multiple passes.
  - Each pass starts with planning step.
  - Each pass ends with an evaluation step.

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