

# Chapter 2

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## ■ Software Engineering

*Slide Set to accompany*

*Software Engineering: A Practitioner's Approach, 8/e*

**by Roger S. Pressman and Bruce R. Maxim**

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# Software Engineering

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- Some realities:

- *a concerted effort should be made to understand the problem before a software solution is developed*
- *design becomes a pivotal activity*
- *software should exhibit high quality*
- *software should be maintainable*

- The seminal definition:

- *[Software engineering is] the establishment and use of **sound engineering principles** in order to obtain **economically** software that is **reliable and works efficiently** on **real machines**.*

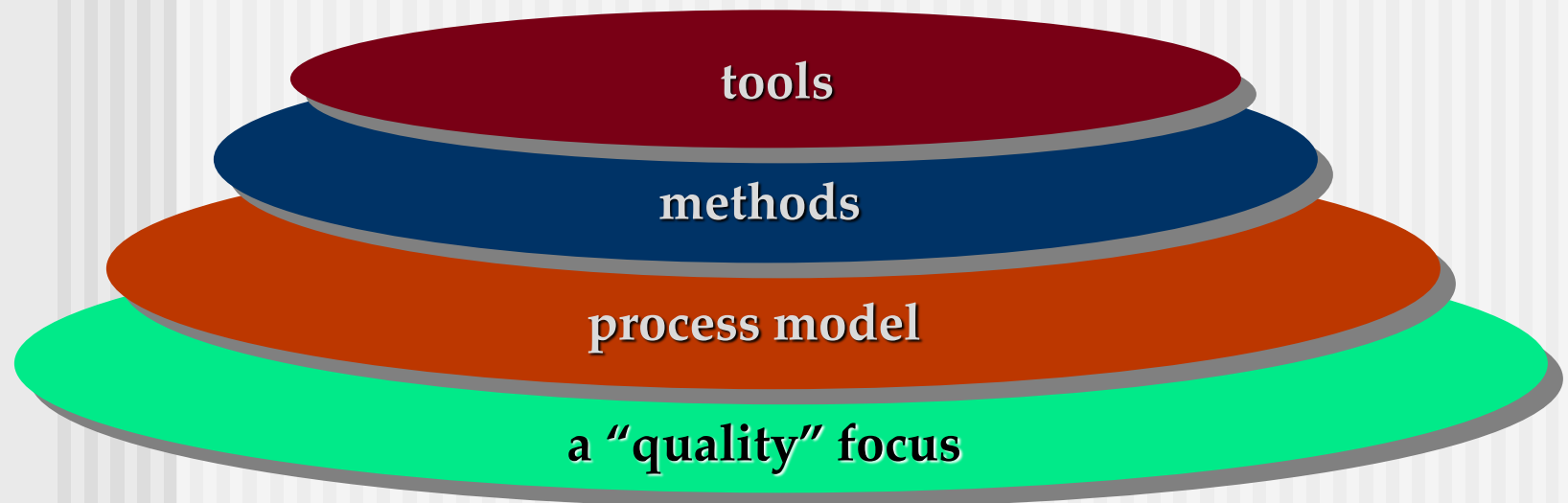
# Software Engineering

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- The IEEE definition:
  - *Software Engineering:*
  - (1) *The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software.*
  - (2) *The study of approaches as in (1).*

# A Layered Technology

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*Software Engineering*

# A Process Framework

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**Process framework**

**Framework activities**

work tasks

work products

milestones & deliverables

QA checkpoints

**Umbrella Activities**

# Framework Activities

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- Communication
- Planning
- Modeling
  - Analysis of requirements
  - Design
- Construction
  - Code generation
  - Testing
- Deployment

# Umbrella Activities

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- Software project tracking and control
- Risk management
- Software quality assurance
- Technical reviews
- Measurement
- Software configuration management
- Reusability management
- Work product preparation and production

# Adapting a Process Model

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- the overall flow of activities, actions, and tasks and the interdependencies among them
- the degree to which actions and tasks are defined within each framework activity
- the degree to which work products are identified and required
- the manner which quality assurance activities are applied
- the manner in which project tracking and control activities are applied
- the overall degree of detail and rigor with which the process is described
- the degree to which the customer and other stakeholders are involved with the project
- the level of autonomy given to the software team
- the degree to which team organization and roles are prescribed



# The Essence of Practice

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- Polya suggests:

1. *Understand the problem* (communication and analysis).
2. *Plan a solution* (modeling and software design).
3. *Carry out the plan* (code generation).
4. *Examine the result for accuracy* (testing and quality assurance).

# Understand the Problem

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- *Who has a stake in the solution to the problem?* That is, who are the stakeholders?
- *What are the unknowns?* What data, functions, and features are required to properly solve the problem?
- *Can the problem be compartmentalized?* Is it possible to represent smaller problems that may be easier to understand?
- *Can the problem be represented graphically?* Can an analysis model be created?

# Plan the Solution

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- *Have you seen similar problems before?* Are there patterns that are recognizable in a potential solution? Is there existing software that implements the data, functions, and features that are required?
- *Has a similar problem been solved?* If so, are elements of the solution reusable?
- *Can subproblems be defined?* If so, are solutions readily apparent for the subproblems?
- *Can you represent a solution in a manner that leads to effective implementation?* Can a design model be created?

# Carry Out the Plan

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- *Does the solution conform to the plan?* Is source code traceable to the design model?
- *Is each component part of the solution provably correct?* Has the design and code been reviewed, or better, have correctness proofs been applied to algorithm?

# Examine the Result

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- *Is it possible to test each component part of the solution?* Has a reasonable testing strategy been implemented?
- *Does the solution produce results that conform to the data, functions, and features that are required?* Has the software been validated against all stakeholder requirements?

# Hooker's General Principles

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- 1: *The Reason It All Exists*
- 2: *KISS (Keep It Simple, Stupid!)*
- 3: *Maintain the Vision*
- 4: *What You Produce, Others Will Consume*
- 5: *Be Open to the Future*
- 6: *Plan Ahead for Reuse*
- 7: *Think!*

# Software Myths

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- Affect managers, customers (and other non-technical stakeholders) and practitioners
- Are believable because they often have elements of truth,  
*but ...*
- Invariably lead to bad decisions,  
*therefore ...*
- Insist on reality as you navigate your way through software engineering

# How It all Starts

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## ■ *SafeHome:*

- Every software project is precipitated by some business need—
  - the need to correct a defect in an existing application;
  - the need to the need to adapt a 'legacy system' to a changing business environment;
  - the need to extend the functions and features of an existing application, or
  - the need to create a new product, service, or system.