

Chapter 4

■ Principles that Guide Practice

Slide Set to accompany

Software Engineering: A Practitioner's Approach, 7/e
by Roger S. Pressman

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Software Engineering Knowledge

- *You often hear people say that software development knowledge has a 3-year half-life: half of what you need to know today will be obsolete within 3 years. In the domain of technology-related knowledge, that's probably about right. But there is another kind of software development knowledge—a kind that I think of as "**software engineering principles**"—that does not have a three-year half-life. These software engineering principles are likely to serve a professional programmer throughout his or her career.*

Steve McConnell

Principles that Guide Process - I

- **Principle #1. *Be agile.*** Whether the process model you choose is prescriptive or agile, the basic tenets of agile development should govern your approach.
- **Principle #2. *Focus on quality at every step.*** The exit condition for every process activity, action, and task should focus on the quality of the work product that has been produced.
- **Principle #3. *Be ready to adapt.*** Process is not a religious experience and dogma has no place in it. When necessary, adapt your approach to constraints imposed by the problem, the people, and the project itself.
- **Principle #4. *Build an effective team.*** Software engineering process and practice are important, but the bottom line is people. Build a self-organizing team that has mutual trust and respect.

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Principles that Guide Process - II

- **Principle #5. *Establish mechanisms for communication and coordination.*** Projects fail because important information falls into the cracks and/or stakeholders fail to coordinate their efforts to create a successful end product.
- **Principle #6. *Manage change.*** The approach may be either formal or informal, but mechanisms must be established to manage the way changes are requested, assessed, approved and implemented.
- **Principle #7. *Assess risk.*** Lots of things can go wrong as software is being developed. It's essential that you establish contingency plans.
- **Principle #8. *Create work products that provide value for others.*** Create only those work products that provide value for other process activities, actions or tasks.

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Principles that Guide Practice

- **Principle #1. *Divide and conquer.*** Stated in a more technical manner, analysis and design should always emphasize *separation of concerns* (SoC).
- **Principle #2. *Understand the use of abstraction.*** At its core, an abstraction is a simplification of some complex element of a system used to communicate meaning in a single phrase.
- **Principle #3. *Strive for consistency.*** A familiar context makes software easier to use.
- **Principle #4. *Focus on the transfer of information.*** Pay special attention to the analysis, design, construction, and testing of interfaces.

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Principles that Guide Practice

- **Principle #5. *Build software that exhibits effective modularity.*** Separation of concerns (Principle #1) establishes a philosophy for software. *Modularity* provides a mechanism for realizing the philosophy.
- **Principle #6. *Look for patterns.*** Brad Appleton [App00] suggests that: "The goal of patterns within the software community is to create a body of literature to help software developers resolve recurring problems encountered throughout all of software development.
- **Principle #7. *When possible, represent the problem and its solution from a number of different perspectives.***
- **Principle #8. *Remember that someone will maintain the software.***

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Communication Principles

- **Principle #1. Listen.** Try to focus on the speaker's words, rather than formulating your response to those words.
- **Principle # 2. Prepare before you communicate.** Spend the time to understand the problem before you meet with others.
- **Principle # 3. Someone should facilitate the activity.** Every communication meeting should have a leader (a facilitator) to keep the conversation moving in a productive direction; (2) to mediate any conflict that does occur, and (3) to ensure that other principles are followed.
- **Principle #4. Face-to-face communication is best.** But it usually works better when some other representation of the relevant information is present.

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Communication Principles

- **Principle # 5. Take notes and document decisions.** Someone participating in the communication should serve as a "recorder" and write down all important points and decisions.
- **Principle # 6. Strive for collaboration.** Collaboration and consensus occur when the collective knowledge of members of the team is combined ...
- **Principle # 7. Stay focused, modularize your discussion.** The more people involved in any communication, the more likely that discussion will bounce from one topic to the next.
- **Principle # 8. If something is unclear, draw a picture.**
- **Principle # 9. (a) Once you agree to something, move on; (b) If you can't agree to something, move on; (c) If a feature or function is unclear and cannot be clarified at the moment, move on.**
- **Principle # 10. Negotiation is not a contest or a game. It works best when both parties win.**

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Planning Principles

- **Principle #1. Understand the scope of the project.** It's impossible to use a roadmap if you don't know where you're going. Scope provides the software team with a destination.
- **Principle #2. Involve the customer in the planning activity.** The customer defines priorities and establishes project constraints.
- **Principle #3. Recognize that planning is iterative.** A project plan is never engraved in stone. As work begins, it's very likely that things will change.
- **Principle #4. Estimate based on what you know.** The intent of estimation is to provide an indication of effort, cost, and task duration, based on the team's current understanding of the work to be done.

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Planning Principles

- **Principle #5. Consider risk as you define the plan.** If you have identified risks that have high impact and high probability, contingency planning is necessary.
- **Principle #6. Be realistic.** People don't work 100 percent of every day.
- **Principle #7. Adjust granularity as you define the plan.** *Granularity* refers to the level of detail that is introduced as a project plan is developed.
- **Principle #8. Define how you intend to ensure quality.** The plan should identify how the software team intends to ensure quality.
- **Principle #9. Describe how you intend to accommodate change.** Even the best planning can be obviated by uncontrolled change.
- **Principle #10. Track the plan frequently and make adjustments as required.** Software projects fall behind schedule one day at a time.

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Modeling Principles

- In software engineering work, two classes of models can be created:
 - *Requirements models (also called analysis models)* represent the customer requirements by depicting the software in three different domains: the information domain, the functional domain, and the behavioral domain.
 - *Design models* represent characteristics of the software that help practitioners to construct it effectively: the architecture, the user interface, and component-level detail.

Requirements Modeling Principles

- **Principle #1.** *The information domain of a problem must be represented and understood.*
- **Principle #2.** *The functions that the software performs must be defined.*
- **Principle #3.** *The behavior of the software (as a consequence of external events) must be represented.*
- **Principle #4.** *The models that depict information, function, and behavior must be partitioned in a manner that uncovers detail in a layered (or hierarchical) fashion.*
- **Principle #5.** *The analysis task should move from essential information toward implementation detail.*

Design Modeling Principles

- **Principle #1.** *Design should be traceable to the requirements model.*
- **Principle #2.** *Always consider the architecture of the system to be built.*
- **Principle #3.** *Design of data is as important as design of processing functions.*
- **Principle #5.** *User interface design should be tuned to the needs of the end-user. However, in every case, it should stress ease of use.*
- **Principle #6.** *Component-level design should be functionally independent.*
- **Principle #7.** *Components should be loosely coupled to one another and to the external environment.*
- **Principle #8.** *Design representations (models) should be easily understandable.*
- **Principle #9.** *The design should be developed iteratively. With each iteration, the designer should strive for greater simplicity.*

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Agile Modeling Principles

- **Principle #1.** *The primary goal of the software team is to build software, not create models.*
- **Principle #2.** *Travel light—don't create more models than you need.*
- **Principle #3.** *Strive to produce the simplest model that will describe the problem or the software.*
- **Principle #4.** *Build models in a way that makes them amenable to change.*
- **Principle #5.** *Be able to state an explicit purpose for each model that is created.*
- **Principle #6.** *Adapt the models you develop to the system at hand.*
- **Principle #7.** *Try to build useful models, but forget about building perfect models.*
- **Principle #8.** *Don't become dogmatic about the syntax of the model. If it communicates content successfully, representation is secondary.*
- **Principle #9.** *If your instincts tell you a model isn't right even though it seems okay on paper, you probably have reason to be concerned.*
- **Principle #10.** *Get feedback as soon as you can.*

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Construction Principles

- The construction activity encompasses a set of coding and testing tasks that lead to operational software that is ready for delivery to the customer or end-user.
- **Coding principles and concepts** are closely aligned programming style, programming languages, and programming methods.
- **Testing principles and concepts** lead to the design of tests that systematically uncover different classes of errors and to do so with a minimum amount of time and effort.

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Preparation Principles

- ***Before you write one line of code, be sure you:***
 - Understand of the problem you're trying to solve.
 - Understand basic design principles and concepts.
 - Pick a programming language that meets the needs of the software to be built and the environment in which it will operate.
 - Select a programming environment that provides tools that will make your work easier.
 - Create a set of unit tests that will be applied once the component you code is completed.

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Coding Principles

- ***As you begin writing code, be sure you:***

- Constrain your algorithms by following structured programming [Boh00] practice.
- Consider the use of pair programming
- Select data structures that will meet the needs of the design.
- Understand the software architecture and create interfaces that are consistent with it.
- Keep conditional logic as simple as possible.
- Create nested loops in a way that makes them easily testable.
- Select meaningful variable names and follow other local coding standards.
- Write code that is self-documenting.
- Create a visual layout (e.g., indentation and blank lines) that aids understanding.

Validation Principles

- ***After you've completed your first coding pass, be sure you:***

- Conduct a code walkthrough when appropriate.
- Perform unit tests and correct errors you've uncovered.
- Refactor the code.

Testing Principles

- Al Davis [Dav95] suggests the following:
 - **Principle #1. All tests should be traceable to customer requirements.**
 - **Principle #2. Tests should be planned long before testing begins.**
 - **Principle #3. The Pareto principle applies to software testing.**
 - **Principle #4. Testing should begin “in the small” and progress toward testing “in the large.”**
 - **Principle #5. Exhaustive testing is not possible.**

Deployment Principles

- **Principle #1. Customer expectations for the software must be managed.** Too often, the customer expects more than the team has promised to deliver, and disappointment occurs immediately.
- **Principle #2. A complete delivery package should be assembled and tested.**
- **Principle #3. A support regime must be established before the software is delivered.** An end-user expects responsiveness and accurate information when a question or problem arises.
- **Principle #4. Appropriate instructional materials must be provided to end-users.**
- **Principle #5. Buggy software should be fixed first, delivered later.**