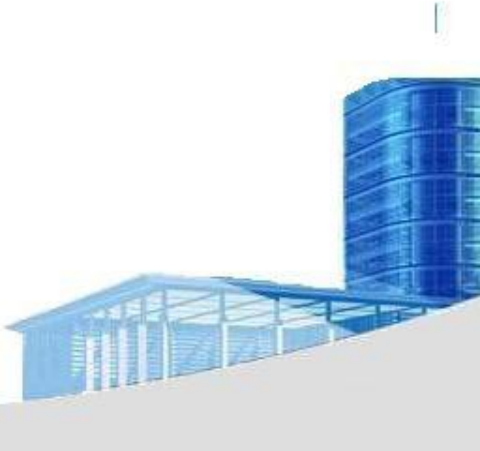
Ch.7 Principles that Guide Practice



- **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.

- **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. Focus on quality at every step.* 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.

- **Principles that Guide Practice - I**

  - *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 it core, an abstraction is a simplification of some complex element of a system used to communication 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.

- **Principles that Guide Practice - II**

  - *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.*

- **Communication Principles - I**

  - *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 than 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.

- **Communication Principles - II**
  - *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.*

- **Planning Principles - I**
  - *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 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.

- **Planning Principles - II**
  - *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.

- **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.

- **Agile Modeling Principles - I**

  - 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 makies them amenable to change.
  - Principle #5. Be able to state an explicit purpose for each model that is created.

- **Agile Modeling Principles - II**

  - Principle #6. Adapt the models you create to the system at hand.
  - Principle #7. Try to build useful models, forget abut building perfect models.
  - Principle #8. Don’t become dogmatic about model syntax. Successful communication is key.
  - Principle #9. If your instincts tell you a paper model isn’t right you may have a reason to be concerned.
  - Principle #10. Get feedback as soon as you can.

- **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 - I**
  - 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 #4. Interfaces (both internal and external) must be designed with care.
  - Principle #5. User interface design should be tuned to the needs of the end-user. Stress ease of use.

- **Design Modeling Principles - II**

  - Principle #6. Component-level design should be functionally independent.
  - Principle #7. Components should be loosely coupled to each other than the environment.
  - Principle #8. Design representations (models) should be easily understandable.
  - Principle #9. The design should be developed iteratively.
  - Principle #10. Creation of a design model does not preclude using an agile approach.

Living Modeling Principles - I

- Principle #1. Stakeholder-centric models should target specific stakeholders and their tasks.
- Principle #2. Models and code should be closely coupled.
- Principle #3. Bidirectional information flow should be established between models and code.
- Principle #4. A common system view should be created.

- **Living Modeling Principles - II**

  - Principle #5. Model information should be persistent to allow tracking system changes.

  - Principle #6. Information consistency across all model levels must be verified.

  - Principle #7. Each model element has assigned stakeholder rights and responsibilities.

  - Principle #8. The states of various model elements should be represented.

- **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.

- **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.

- **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 - I**
  - *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.”

- **Testing Principles - II**
  - *Al Davis [Dav95] suggests the following:*
    - Principle #5. Exhaustive testing is not possible.
    - Principle #6. Testing effort for each system module commensurate to expected fault density.
    - Principle #7. Static testing can yield high results.
    - Principle #8. Track defects and look for patterns in defects uncovered by testing.
    - Principle #9. Include test cases that demonstrate software is behaving correctly.

- **Deployment Principles**
  - Principle #1. Customer expectations for the software must be managed.
  - Principle #2. A complete delivery package should be assembled and tested.
  - Principle #3. A support regime must be established before the software is delivered.
  - Principle #4. Appropriate instructional materials must be provided to end-users.
  - Principle #5. Buggy software should be fixed first, delivered later.