Software Engineering

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Chapter 6
Principles that guide Practices

In chapter 5, we have learned

- ✓ Characteristics of software engineer.
- ✓ Behavioral Model for Software Engineering.
- ✓ Organization and Team Structures.
- ✓ Effective Software Team Attributes.
- ✓ How to establish Team?
- ✓ Agile Team.
- ✓ Factors Affecting Global Software Development Team.

Chapter 6

Principles that guide Practices

In this chapter, we will discuss

- ✓ Software Engineering Knowledge.
- ✓ Core principles of SE.
- ✓ Principles that guide each framework activity.

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Software Engineering Knowledge

- *You often hear people say that software development knowledge has a 3-year half-life(半衰期): 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

General Principles

- 1: The Reason It All Exists.(存在价值)
- 2: KISS (Keep It Simple, Stupid! 保持简洁).
- 3: Maintain the Vision.(保持愿景)
- 4: What You Produce, Others Will Consume.(关注使用者)
- 5: Be Open to the Future.(面向未来)
- 6: Plan Ahead for Reuse.(提前计划复用)
- 7: Think! (思考)

From Chapter 2, by Hooker

Core Principles - Guide Process

- **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.

Core Principles - Guide Process

- **Principle #3. *Be ready to adapt.*** Process is not a religious experience and dogma(教条) 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.

Core Principles - Guide Process

- ***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.

Core Principles - Guide Process

- ***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.

Core Principles - 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 it core, an abstraction is a simplification of some complex element of a system used to communication meaning in a single phrase.

  But at last, all segments should be synthesized.

Core Principles - Guide Practice

- **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.

Core Principles - 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.

Modularity must be effective. That is, each module should focus exclusively on one well-constrained aspect of the system.

Additionally, modules should be interconnected in a relatively simple manner to other modules, to data sources, and to other environ-mental aspects.

Core Principles - Guide Practice

- **Principle #6. *Look for patterns.***

Using patterns as a means of cataloging and reusing solutions to problems they have encountered in the past. The use of these design patterns can be applied to wider systems engineering and systems integration problems, by allowing components in complex systems to evolve independently.

Core Principles - Guide Practice

- **Principle #7. *Several different perspectives***

  When possible, represent the problem and its solution from a number of different perspectives.

- **Principle #8**. ***Someone will maintain the software***

  Over the lifecycle, software will be corrected as defects are uncovered, adapted as its environment changes, and enhanced as stakeholders request more capabilities. These maintenance activities can be facilitated if solid software engineering practice is applied throughout the software process.

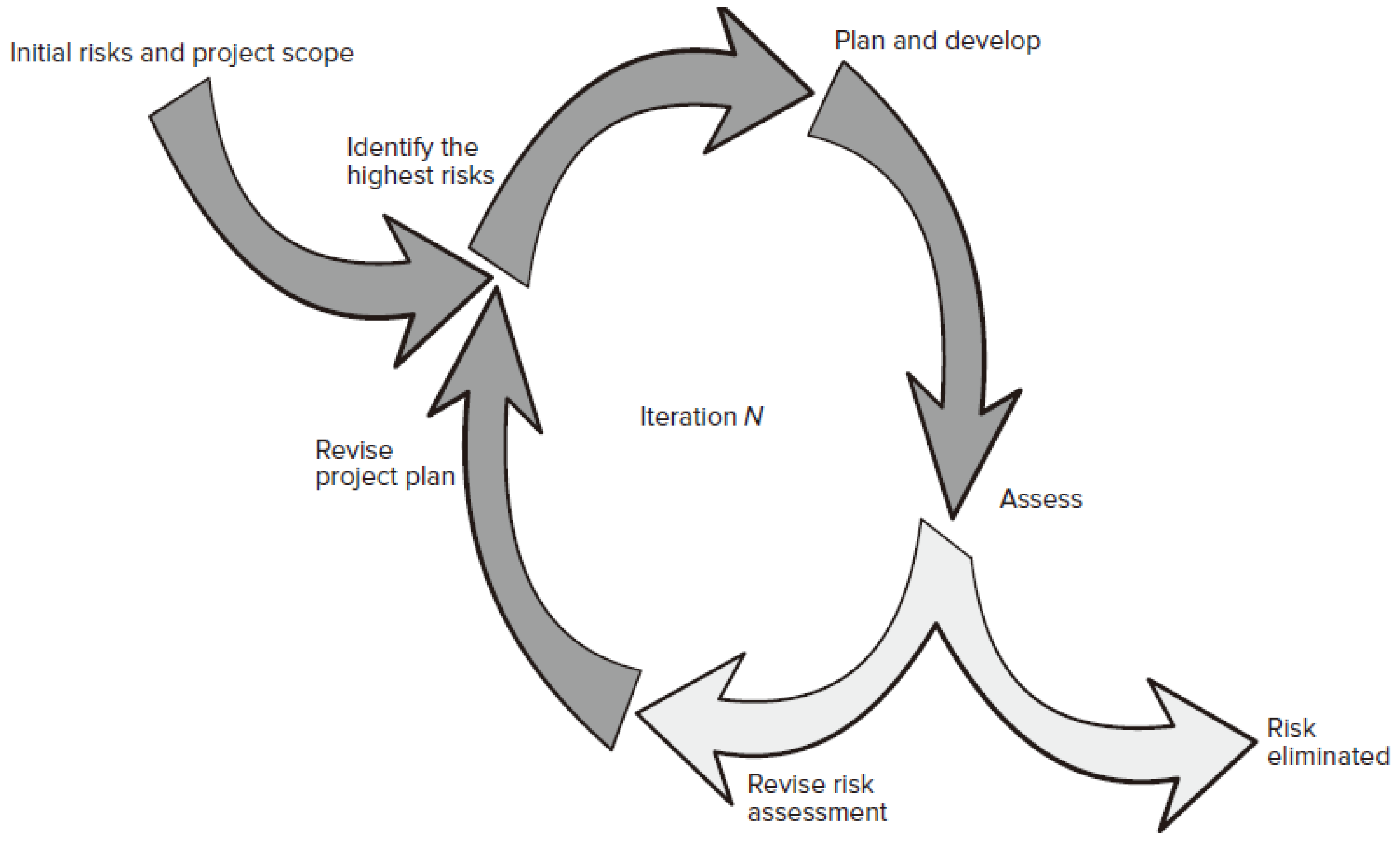
Communication Principles

- **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 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

- **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



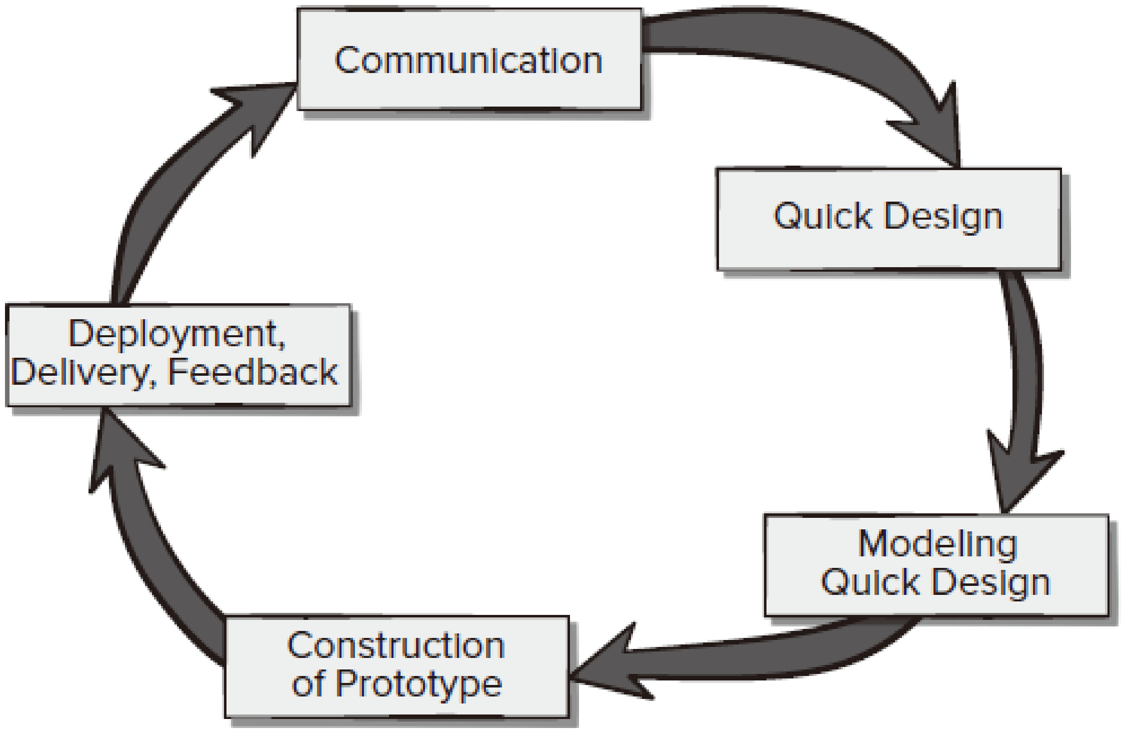
Planning Principles

- **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 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

- **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(粒度) 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



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
    - 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

- 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.

Agile Modeling Principles

- 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.

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.

Construction Principles

- In modern software engineering work, coding may be:

  (1) the direct creation of programming language source code.

  (2) the automatic generation of source code using an intermediate design like representation of the component to be built.

  (3) the automatic generation of executable code using a fourth-generation programming language.

Construction Principles

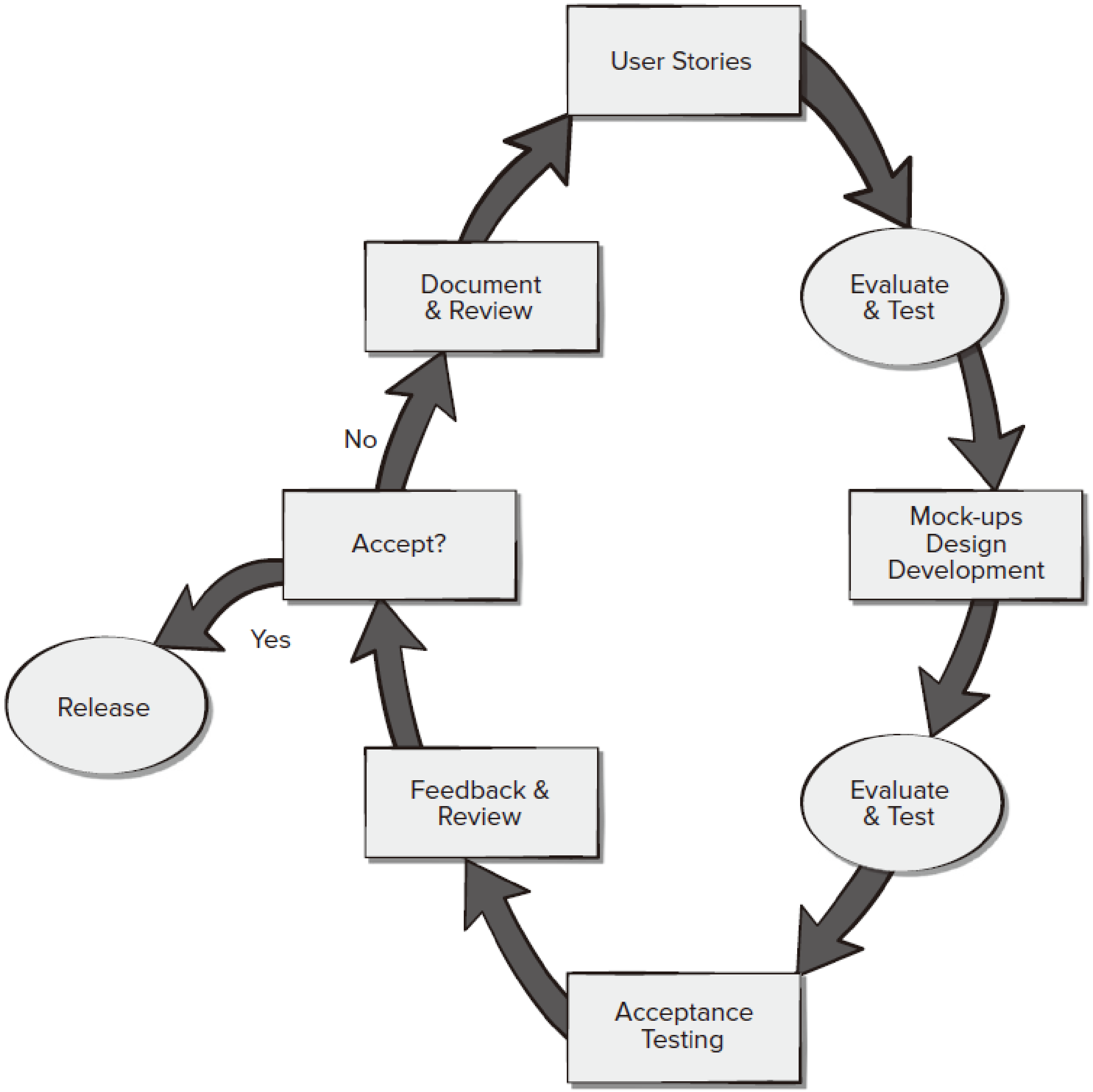
- The initial focus of testing is at the component level, often called unit testing. Other levels of testing include:

(1) integration testing (conducted as the system is con-structed).

(2) validation testing that assesses whether requirements have been met for the complete system (or software increment).

(3) acceptance testing that is conducted by the customer in an effort to exercise all required features and functions.

Construction Principles



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

- ***Glen Myers [Mye79] states a number of rules that can serve well as testing objectives:***

1. Testing is a process of executing a program with the intent of finding an error.
2. A good test case is one that has a high probability of finding an as-yet- undiscovered error.
3. A successful test is one that uncovers an as-yet- undiscovered error.”

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.”

Testing Principles

- 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.

Summary

- This chapter describes professional practice as the concepts, principles, and methods used by software engineers and managers to plan and develop software.
- Software engineers must be concerned both with the technical details of doing things and the things that are needed to build high-quality computer software.
- Software process provides the project stakeholders with a roadmap to build quality products. Professional practice provides software engineers with the detail needed to travel the road.
- Software practice encompasses the technical activities needed to produce the work products defined by the software process model chosen for a project.

Assignment

- Problem to ponder

  6.3 Describe the concept of *separation of concerns* in your own words.

- Preview

  《Software Engineering》 (8th Edition) by R.S.Pressman

  Chapter 8 Understanding Requirements