Chapter 6

Principles that Guide Practice

Slide Set to accompany
Software Engineering: A Practitioner's Approach
by Roger S. Pressman and Bruce R. Maxim

For non-profit educational use only

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.***

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

- **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.***

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.

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.***

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

- **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 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 SE 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
    - 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 about 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

- **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

- **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 appraoch.**

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 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 your code is completed.

Coding Principles

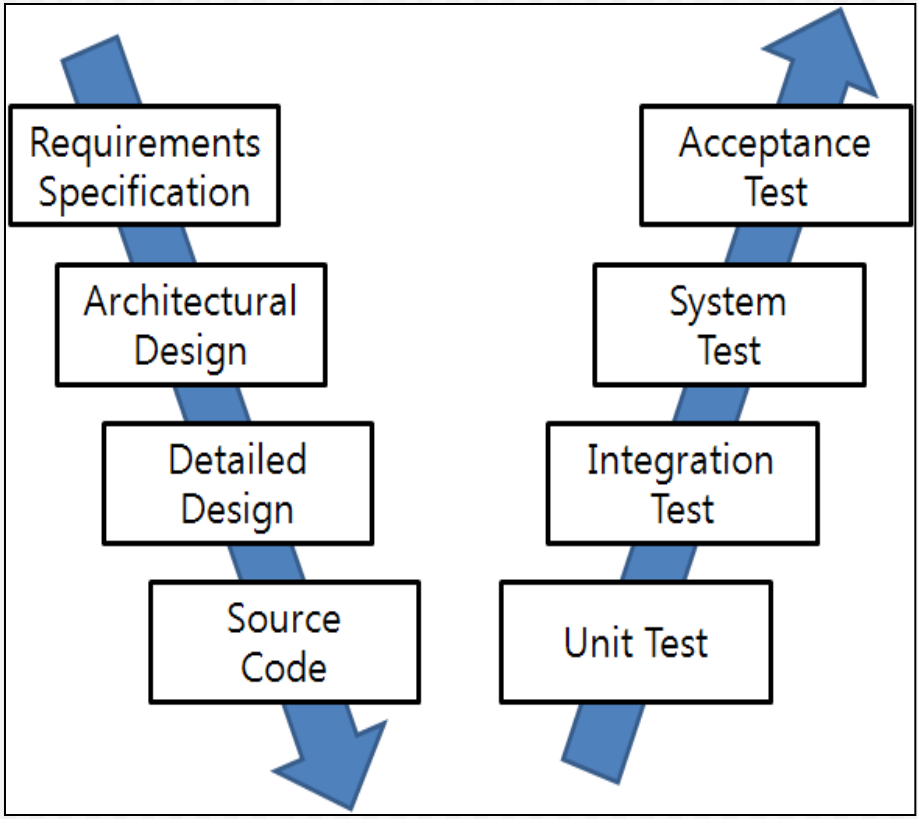
- ***As you begin writing code, be sure you:***
  - Constrain your algorithms by following structured programming [Boh00] practice.
  - Consider the use of pair programming
  - Select data structures that will meet the needs of the design.
  - Understand the software architecture and create interfaces 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

- 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."***



V model of SW development

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 (i.e. document review) 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.***

Communication Mistakes (pg 90)

- **The scene:**
  - SE team workspace
- **The players:**
  - Jamie Lazar, software team member;
  - Vinod Raman, software team member;
  - Ed Robbins, software team member;

The conversation:

Ed: What have you heard about this SafeHome project?

Vinod: The kick-off meeting is scheduled for next week.

Jamie: I've alreadyd done a little bit of investigation, but it didn't go well.

Ed: What do you mean?

Jamie: Well, I gave Lisa Perez a call. She's the marketing honcho on this thing

Vinod: And …?

Jamie: I wanted her to tell me about SafeHome features and functions… that sort of thing. Instead, she began asking me questions about security systems, surveillance systems… I'm not an expert

Vinod: What does that tell you?

(Jami shrugs)

Vinod: That marking will need us to act as consultants and that we'd better do some homework on this product are before our kick-off meeting. Doug said that he wanted us to "collaborate" with our customer, so we'd better lean how to do that

Ed: Probably would have been netter to stop by her office. Phone calls just don't work as well for this sort of thing.

Jamie: You're both right. We've got to get our act together or our early communications will be a struggle.

Vinod: I saw Doug reading a book on "requirements engineering". I'll bet that lists some principles of good communication. I'm going to borrow it from him

Jami; Good idea… then you can teach us

Vinod (smiling): Yeah, right.

- **Facilitator:** Does that also add some constraints?
- **Jamie:** It does, both technical and legal.
- **Production rep:** Meaning?
- **Jamie:** We better make sure an outsider can't hack into the system, disarm it, and rob the place or worse. Heavy liability on our part.
- **Doug:** Very true.
- **Marketing:** But we still need Internet connectivity. Just be sure to stop an outsider from getting in.
- **Ed:** That's easier said than done and....
- **Facilitator (interrupting):** I don't want to debate this issue now. Let's note it as an action item and proceed. (Doug, serving as the recorder for the meeting, makes an appropriate note.)
- **Facilitator:** I have a feeling there's still more to consider here.
- (The group spends the next 45 minutes refining and expanding the details of the home security function.)