

# Chapter 6

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## ■ Principles that Guide Practice

*Slide Set to accompany*

*Software Engineering: A Practitioner's Approach*

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# Software Engineering Knowledge

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- 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

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- **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

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- **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

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- **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

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- **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

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- **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

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- **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

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- **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

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- **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

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- 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

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- **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

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- **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

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- **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

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- **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

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- 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.

# Construction Principles

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- 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

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- *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

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- *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.

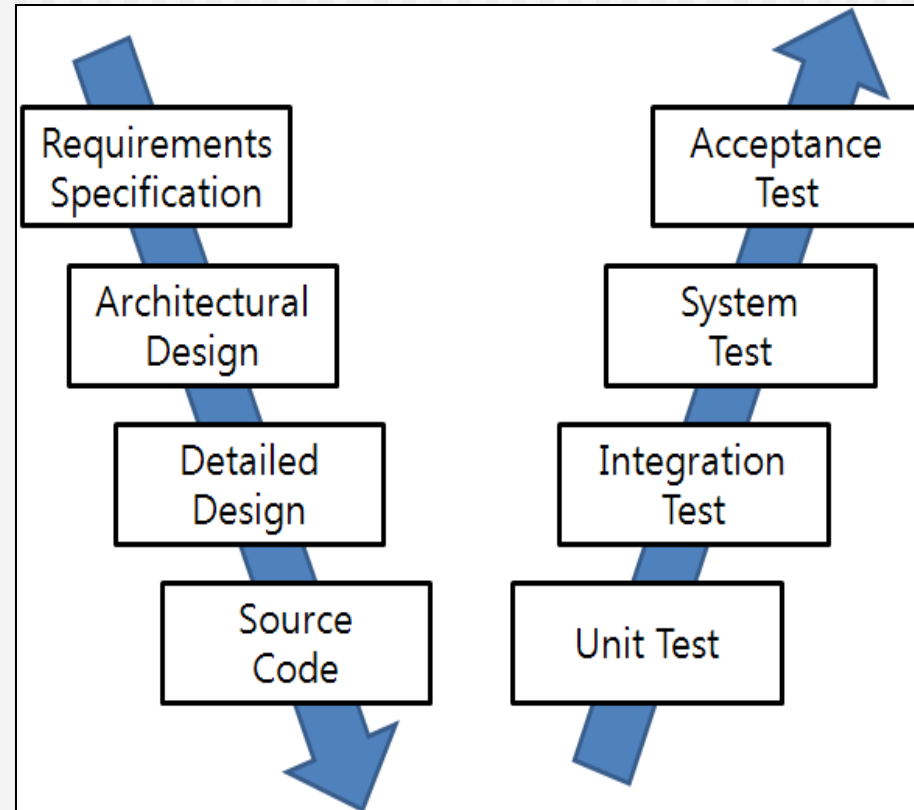
# Validation Principles

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- *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<sup>22</sup>

# Testing Principles

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- **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

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- **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 already 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 learn 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.)