COMP 354: Introduction to Software Engineering

Software Engineering Principles

Based on Chapter 6 of the textbook

Principles that Guide Process

- **Principle #1**. Be agile. Regards of your process model, let the basic tenets of agile development 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 produced.
- **Principle #3**. Be ready to adapt. Dogma has no place in software development. 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.

Principles that Guide Process

- **Principle #5**. Establish mechanisms for communication and coordination. Projects fail because information falls into the cracks and/or stakeholders fail to coordinate their efforts.
- **Principle #6**. Manage change. Approach may formal or informal. You need mechanisms to manage how changes are requested, assessed, approved and implemented.
- **Principle #7**. Assess risk. Lots of things can go wrong as software is being developed, 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.

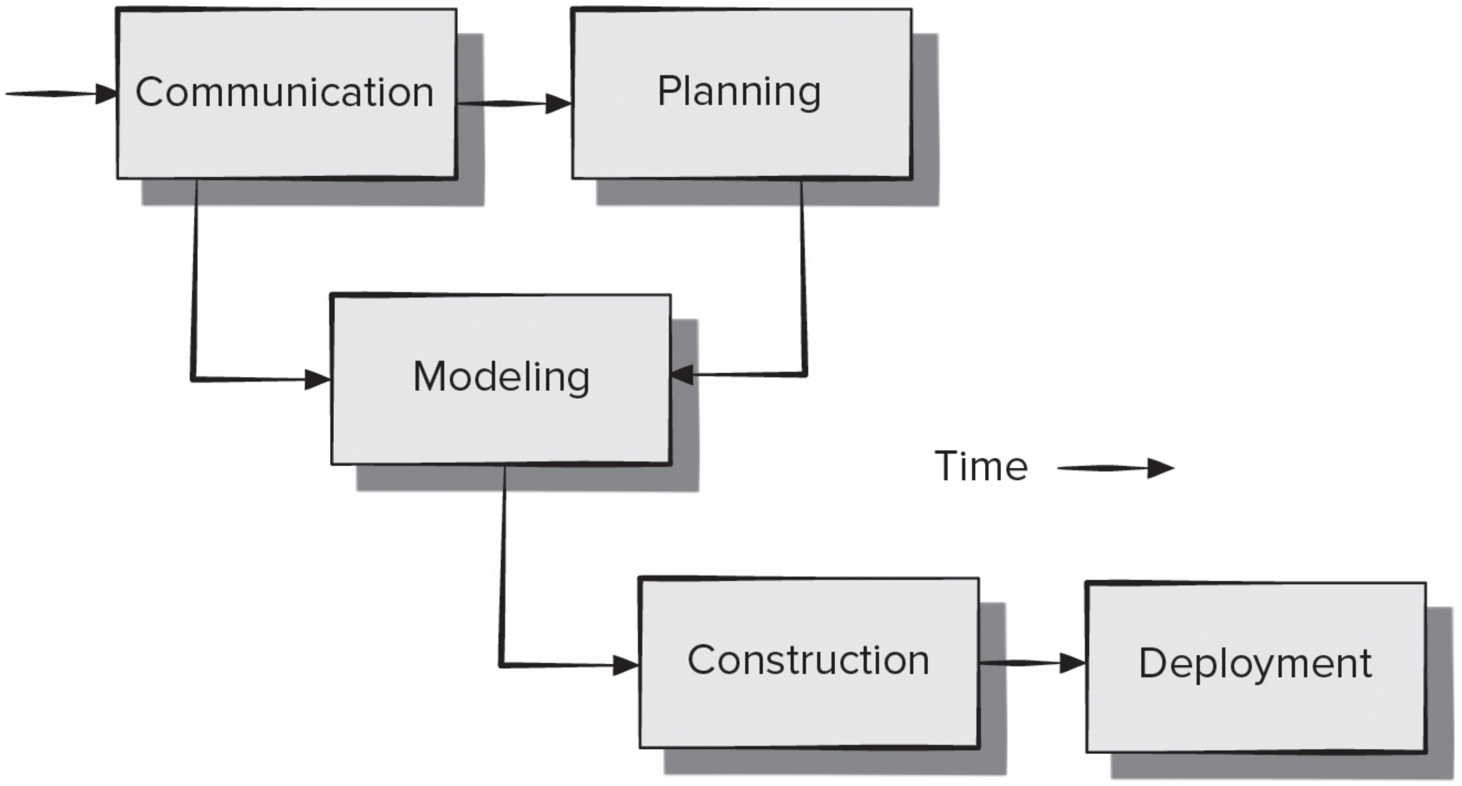
Principles that Guide Practice

- **Principle #1**. Divide and conquer. Analysis and design should always emphasize separation of concerns (SoC).
- **Principle #2**. Understand the use of abstraction. Abstraction is a simplification of a complex system element used to communication meaning simply.
- **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. Provides a mechanism for realizing the philosophy of Separation of concerns .
- **Principle #6**. Look for patterns. The goal of patterns is to create a body of literature to help developers resolve recurring problems encountered in software development.
- **Principle #7**. Use multiple viewpoints. Represent the problem and solution from different perspectives.
- **Principle #8**. Some consumes your work products. Remember that someone will maintain the software.

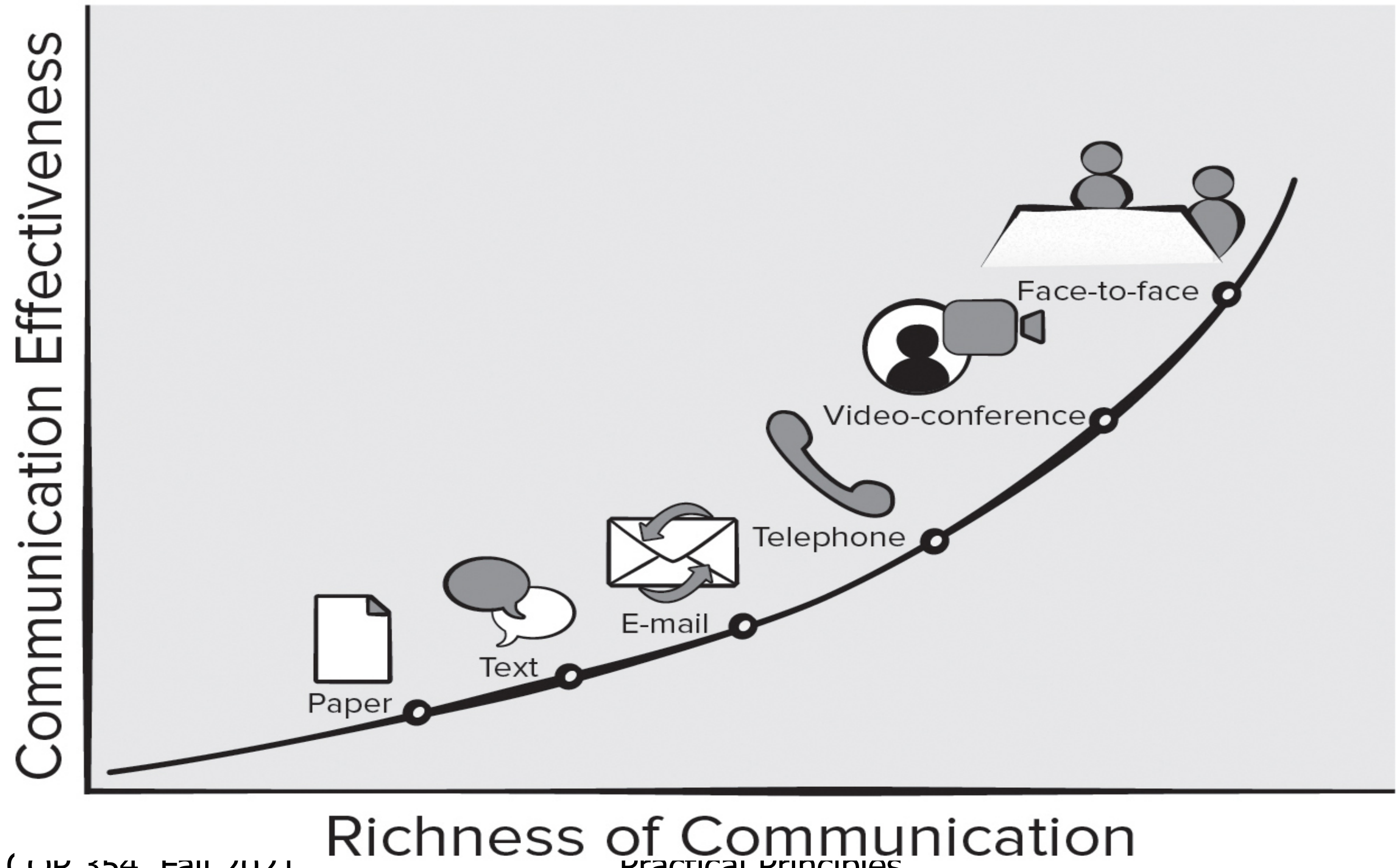
Simplified Process Framework



Communications Principles

- **Principle #1**. Listen. Try to focus on the speaker's words, not formulating your response to those words.
- **Principle # 2**. Prepare before you communicate. Understand a problem before meeting with others.
- **Principle # 3**. Someone should facilitate the activity. Every communication meeting should have a leader to keep the conversation moving in a productive direction.
- **Principle #4**. Face-to-face communication is best. Visual representations of information can be helpful.
- **Principle # 5**. Take notes and document decisions. Someone should serve as a "recorder" and write down all important points and decisions.

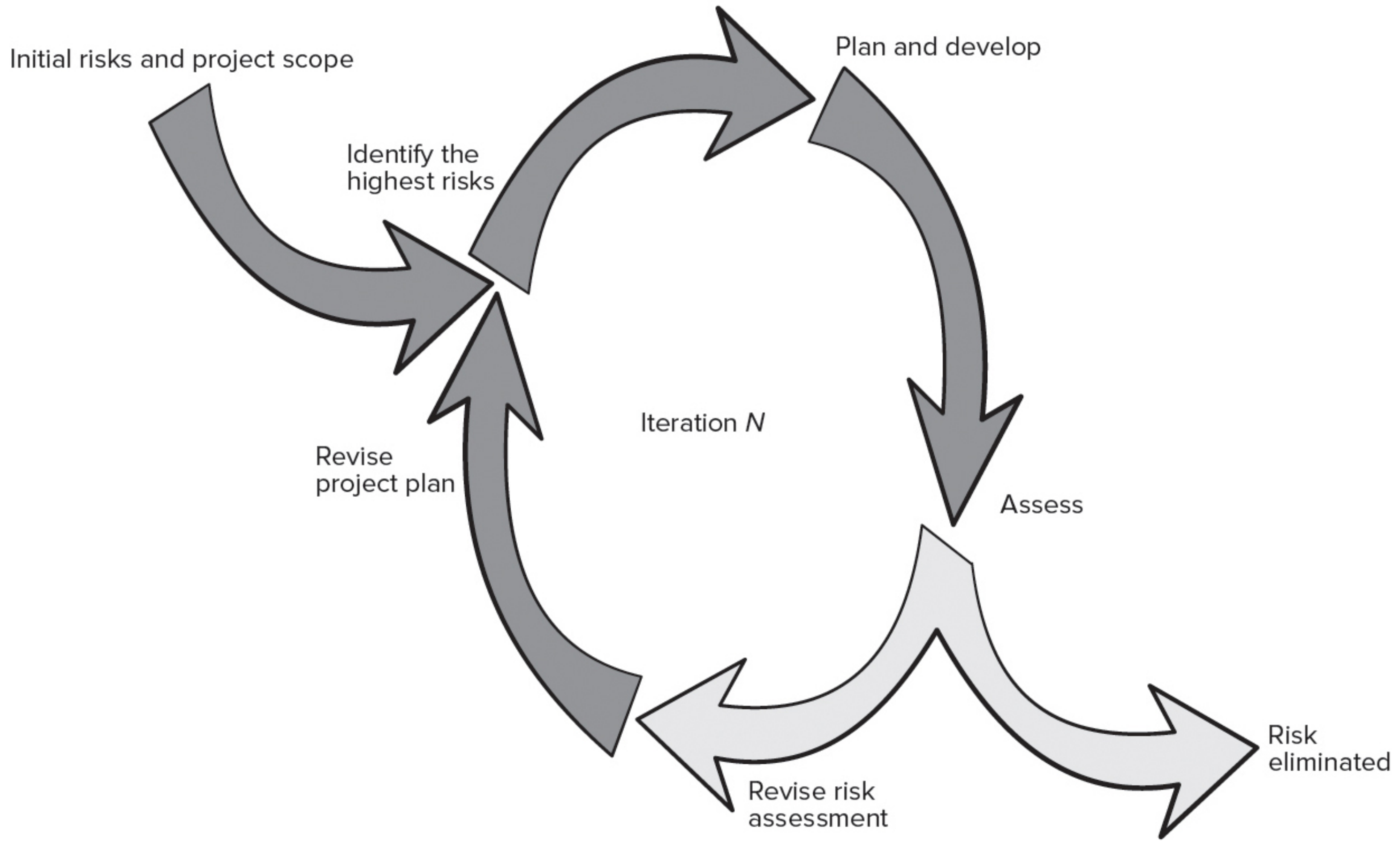
Communications Mode Effectiveness



Communications Principles

- **Principle # 6**. Strive for collaboration. Consensus occurs when collective team knowledge is combined.
- **Principle # 7**. Stay focused, modularize your discussion. The more people involved in communication the more likely discussion will bounce between topics.
- **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.

Iterative Planning Process



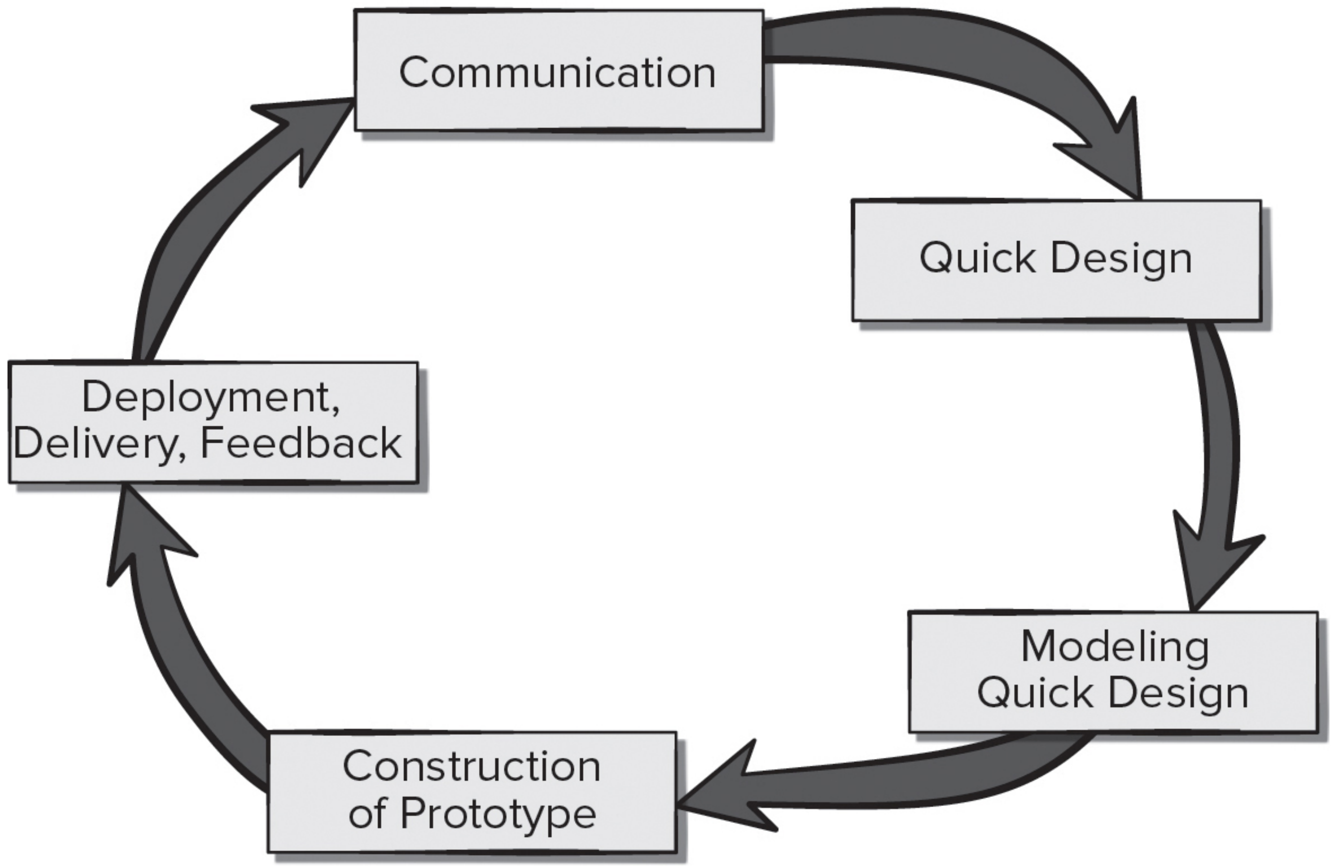
Planning Principles

- **Principle #1**. Understand the scope of the project. Scope provides the software team with a destination as the roadmap is created.
- **Principle #2**. Involve the customer in the planning activity. They define priorities and project constraints.
- **Principle #3**. Recognize that planning is iterative. A project plan is likely to change as work begins.
- **Principle #4**. Estimate based on what you know. Estimation provides an indication of effort, cost, and task duration, based on team's current understanding of work.
- **Principle #5**. Consider risk as you define the plan. Contingency planning is needed for identified high impact and high probability risks.

Planning Principles

- **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. Your 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.

Software Modeling



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 working you may have a reason to be concerned.
- **Principle #10**. Get feedback as soon as you can.

Construction Principles - Coding

Preparation Principles: Before you write one line of code, be sure you:

- **Principle 1**. Understand the problem to be solved.
- **Principle 2**. Understand basic design principles and concepts.
- **Principle 3**. Pick a programming language that meets the needs of the software to be built.
- **Principle 4**. Select a programming environment that provides tools that will make your work easier.
- **Principle 5**. Create a set of unit tests that will be applied once the component you code is completed.

Construction Principles - Coding

Coding Principles: As you begin writing code, be sure you:

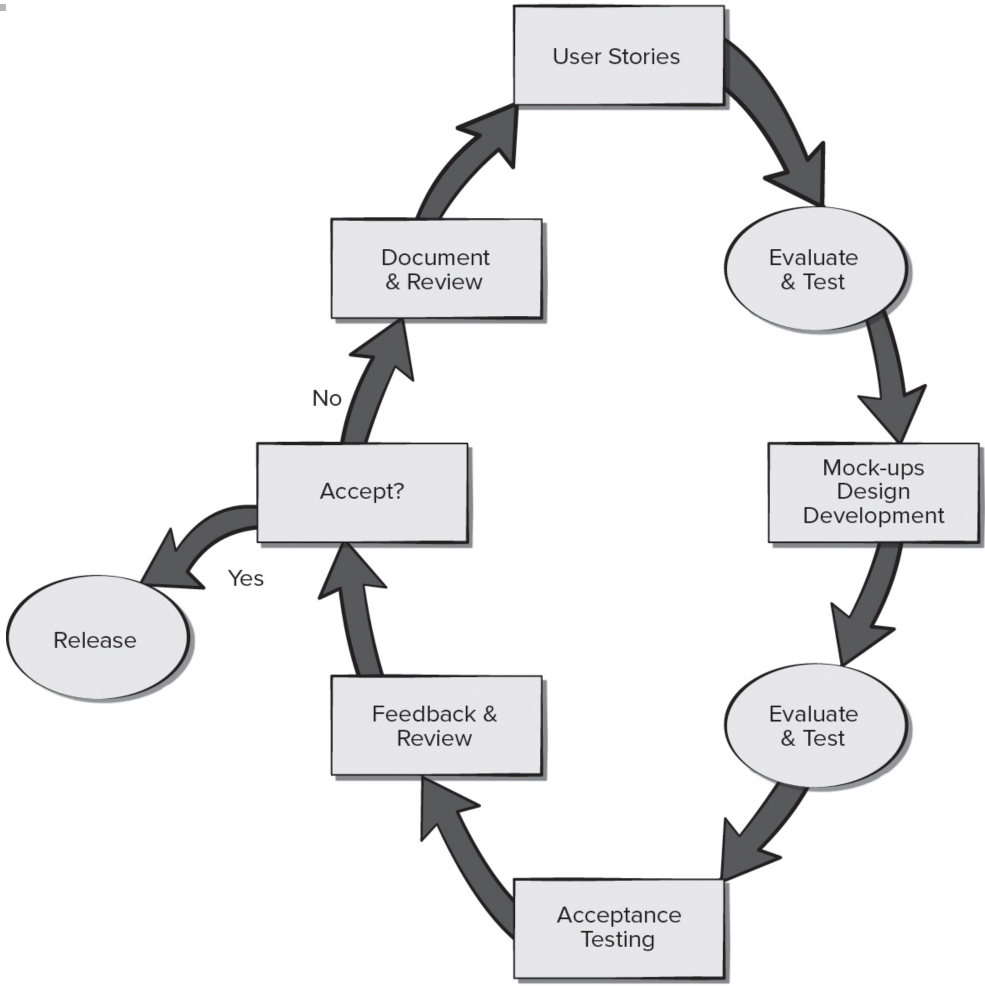
- **Principle 6**. Constrain your algorithms by following structured programming practice.
- **Principle 7**. Consider the use of pair programming.
- **Principle 8**. Select data structures that will meet the needs of the design.
- **Principle 9**. Understand the software architecture and create interfaces that are consistent with it.

Construction Principles - Coding

Validation Principles: After you've completed your first coding pass, be sure you:

- **Principle 10**. Conduct a code walkthrough when appropriate.
- **Principle 11**. Perform unit tests and correct errors you've uncovered.
- **Principle 12**. Refactor the code to improve its quality.

Agile Testing



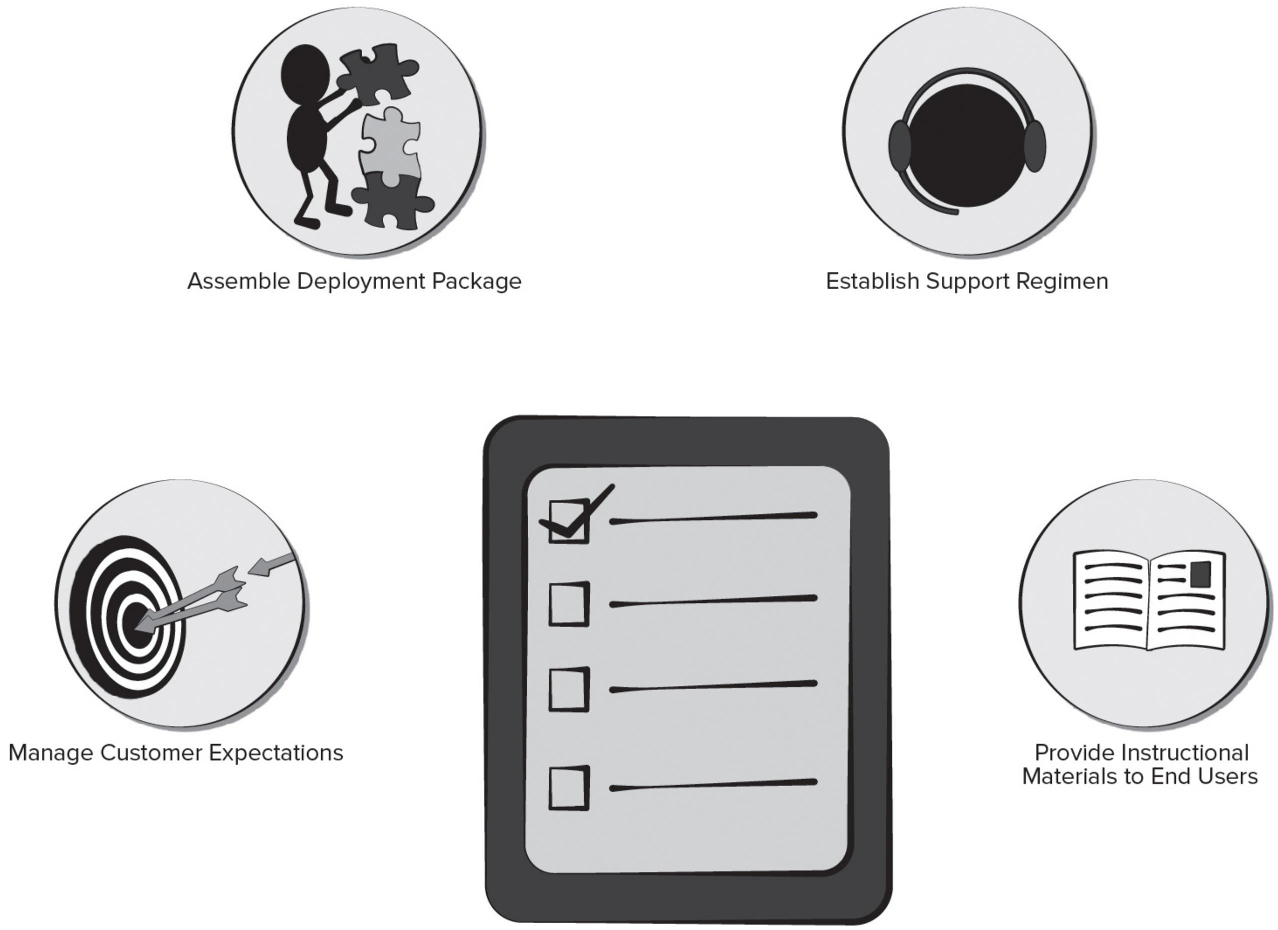
Testing Principles

- **Principle #1**. All tests should be traceable to customer requirements.
- **Principle #2**. Tests should be planned long before testing begins.
  - Testing is a process of executing a program with intent of finding an error,
  - A good test case is one that has a high probability of finding an as-yet-undiscovered error.
  - A successful test is one that uncovers an as-yet-undiscovered error.
- **Principle #3**. The Pareto principle applies to software testing.

Testing Principles

- **Principle #4**. Testing should begin “in the small” and progress toward testing “in the large.”
- **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.

Software Deployment Actions


Assemble Deployment Package
Establish Support Regimen
Manage Customer Expectations
Provide Instructional Materials to End Users

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.

Traits of Successful Software Engineers

- Sense of individual responsibility.
- Acutely aware of the needs of team members and stakeholders.
- Brutally honest about design flaws and offers constructive criticism.
- Resilient under pressure.
- Heightened sense of fairness.
- Attention to detail.
- Pragmatic adapting software engineering practices based on the circumstances at hand.