Chapter 8

Understanding Requirements

Slide Set to accompany

Software Engineering: A Practitioner's Approach, 8/e

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Requirements Engineering-I

- Inception—ask a set of questions that establish …
  - basic understanding of the problem
  - the people who want a solution
  - the nature of the solution that is desired, and
  - the effectiveness of preliminary communication and collaboration between the customer and the developer
- Elicitation—elicit requirements from all stakeholders
- Elaboration—create an analysis model that identifies data, function and behavioral requirements
- Negotiation—agree on a deliverable system that is realistic for developers and customers

Requirements Engineering-II

- Specification—can be any one (or more) of the following:
  - A written document
  - A set of models
  - A formal mathematical
  - A collection of user scenarios (use-cases)
  - A prototype
- Validation—a review mechanism that looks for
  - errors in content or interpretation
  - areas where clarification may be required
  - missing information
  - inconsistencies (a major problem when large products or systems are engineered)
  - conflicting or unrealistic (unachievable) requirements.
- Requirements management

Inception

- Identify stakeholders
  - “who else do you think I should talk to?”
- Recognize multiple points of view
- Work toward collaboration
- The first questions
  - Who is behind the request for this work?
  - Who will use the solution?
  - What will be the economic benefit of a successful solution
  - Is there another source for the solution that you need?

Eliciting Requirements

- meetings are conducted and attended by both software engineers and customers
- rules for preparation and participation are established
- an agenda is suggested
- a "facilitator" (can be a customer, a developer, or an outsider) controls the meeting
- a "definition mechanism" (can be work sheets, flip charts, or wall stickers or an electronic bulletin board, chat room or virtual forum) is used
- the goal is
  - to identify the problem
  - propose elements of the solution
  - negotiate different approaches, and
  - specify a preliminary set of solution requirements

Elicitation Work Products

- a statement of need and feasibility.
- a bounded statement of scope for the system or product.
- a list of customers, users, and other stakeholders who participated in requirements elicitation
- a description of the system's technical environment.
- a list of requirements (preferably organized by function) and the domain constraints that apply to each.
- a set of usage scenarios that provide insight into the use of the system or product under different operating conditions.
- any prototypes developed to better define requirements.

Quality Function Deployment

- Function deployment determines the "value" (as perceived by the customer) of each function required of the system
- Information deployment identifies data objects and events
- Task deployment examines the behavior of the system
- Value analysis determines the relative priority of requirements

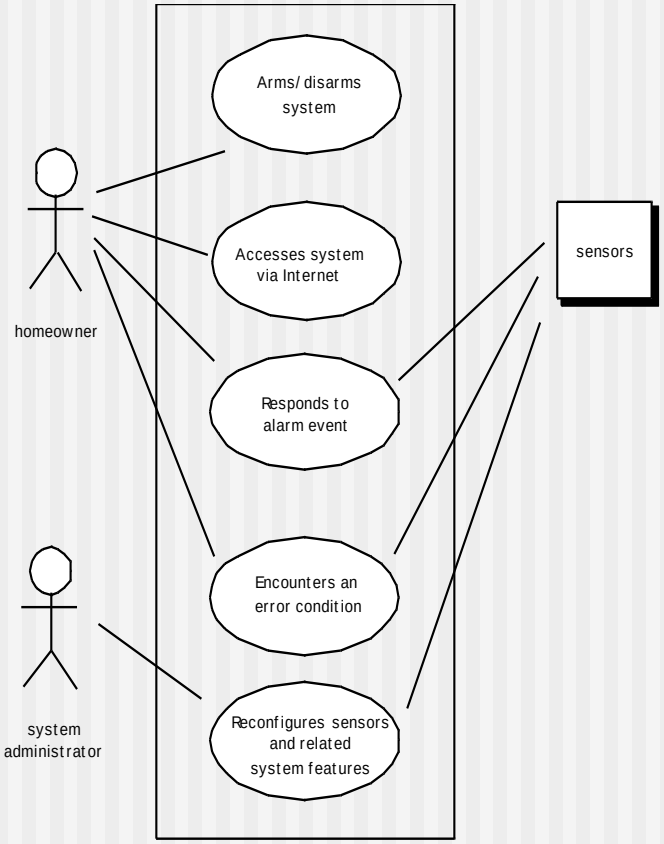
Non-Functional Requirements

- Non-Functional Requirment (NFR) – quality attribute, performance attribute, security attribute, or general system constraint. A two phase process is used to determine which NFR's are compatible:
  - The first phase is to create a matrix using each NFR as a column heading and the system SE guidelines a row labels
  - The second phase is for the team to prioritize each NFR using a set of decision rules to decide which to implement by classifying each NFR and guideline pair as complementary, overlapping, conflicting, or independent

Use-Cases

- A collection of user scenarios that describe the thread of usage of a system
- Each scenario is described from the point-of-view of an “actor”—a person or device that interacts with the software in some way
- Each scenario answers the following questions:
  - Who is the primary actor, the secondary actor (s)?
  - What are the actor’s goals?
  - What preconditions should exist before the story begins?
  - What main tasks or functions are performed by the actor?
  - What extensions might be considered as the story is described?
  - What variations in the actor’s interaction are possible?
  - What system information will the actor acquire, produce, or change?
  - Will the actor have to inform the system about changes in the external environment?
  - What information does the actor desire from the system?
  - Does the actor wish to be informed about unexpected changes?

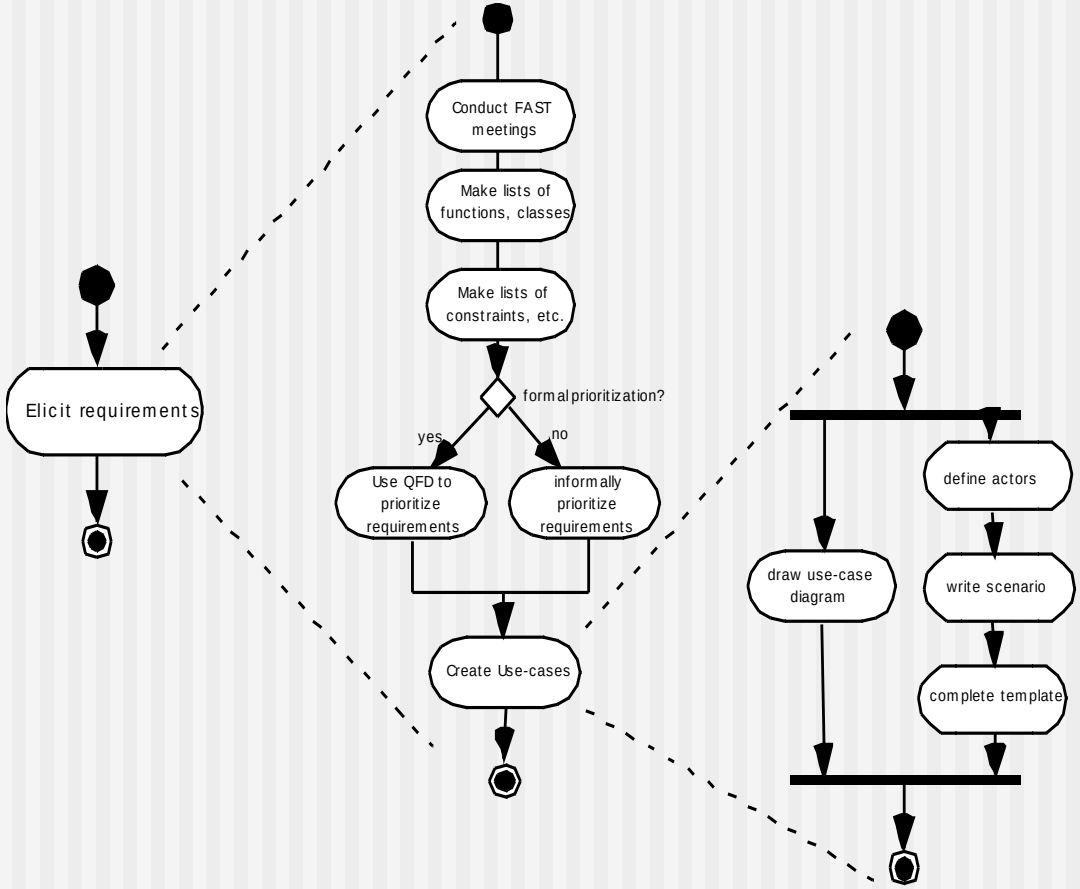
Use-Case Diagram



Building the Analysis Model

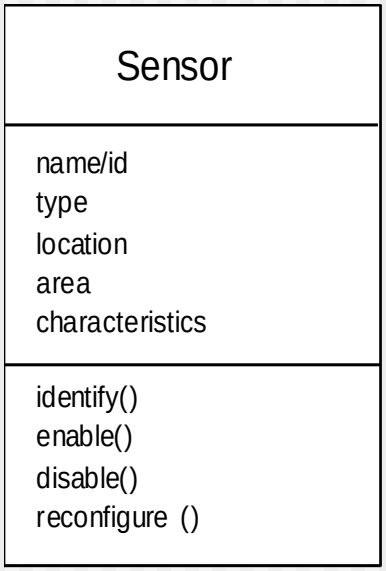
- Elements of the analysis model
  - Scenario-based elements
    - Functional—processing narratives for software functions
    - Use-case—descriptions of the interaction between an "actor" and the system
  - Class-based elements
    - Implied by scenarios
  - Behavioral elements
    - State diagram
  - Flow-oriented elements
    - Data flow diagram

Eliciting Requirements

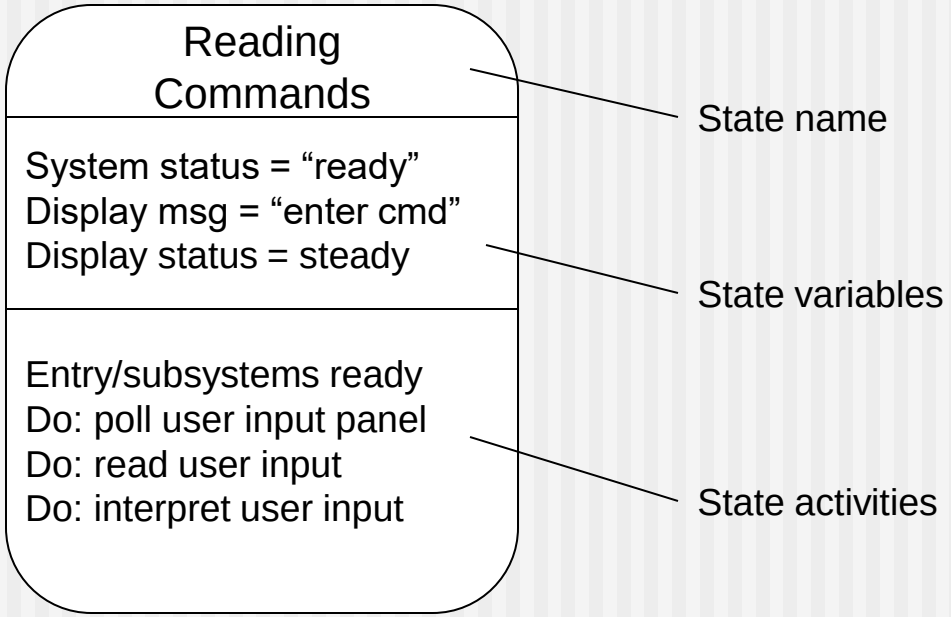


Class Diagram

From the *SafeHome* system …



State Diagram



Analysis Patterns

Pattern name: A descriptor that captures the essence of the pattern.

Intent: Describes what the pattern accomplishes or represents

Motivation: A scenario that illustrates how the pattern can be used to address the problem.

Forces and context: A description of external issues (forces) that can affect how the pattern is used and also the external issues that will be resolved when the pattern is applied.

Solution: A description of how the pattern is applied to solve the problem with an emphasis on structural and behavioral issues.

Consequences: Addresses what happens when the pattern is applied and what trade-offs exist during its application.

Design: Discusses how the analysis pattern can be achieved through the use of known design patterns.

Known uses: Examples of uses within actual systems.

Related patterns: On e or more analysis patterns that are related to the named pattern because (1) it is commonly used with the named pattern; (2) it is structurally similar to the named pattern; (3) it is a variation of the named pattern.

Negotiating Requirements

- Identify the key stakeholders
  - These are the people who will be involved in the negotiation
- Determine each of the stakeholders “win conditions”
  - Win conditions are not always obvious
- Negotiate
  - Work toward a set of requirements that lead to “win-win”

Requirements Monitoring

Especially needes in incremental development

- *Distributed debugging* – uncovers errors and determines their cause.
- *Run-time verification* – determines whether software matches its specification.
- *Run-time validation* – assesses whether evolving software meets user goals.
- *Business activity monitoring* – evaluates whether a system satisfies business goals.
- *Evolution and codesign* – provides information to stakeholders as the system evolves.

Validating Requirements - I

- Is each requirement consistent with the overall objective for the system/product?
- Have all requirements been specified at the proper level of abstraction? That is, do some requirements provide a level of technical detail that is inappropriate at this stage?
- Is the requirement really necessary or does it represent an add-on feature that may not be essential to the objective of the system?
- Is each requirement bounded and unambiguous?
- Does each requirement have attribution? That is, is a source (generally, a specific individual) noted for each requirement?
- Do any requirements conflict with other requirements?

Validating Requirements - II

- Is each requirement achievable in the technical environment that will house the system or product?
- Is each requirement testable, once implemented?
- Does the requirements model properly reflect the information, function and behavior of the system to be built.
- Has the requirements model been “partitioned” in a way that exposes progressively more detailed information about the system.
- Have requirements patterns been used to simplify the requirements model. Have all patterns been properly validated? Are all patterns consistent with customer requirements?