بـــخش د و م

Requirements Engineering

1. Requirements Engineering-I

فرایندی که ما در مهندسی نیازمندی داریم از ۷ بخش تشکیل شده است
)الان ما در قسمت Communication یعنی اول کار هستیم و چیزی نداریم

The requirements engineering process can be described in seven distinct steps:

1. **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
2. **Elicitation**—elicit requirements from all stakeholders
3. **Elaboration**—create an analysis model that identifies data, function and behavioral requirements
4. **Negotiation**—agree on a deliverable system that is realistic for developers and customers

1. Requirements Engineering-II

5. **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
6. **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.
7. **Requirements management**

2.ESTABLISHING THE GROUNDWORK
A. 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?

3. 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

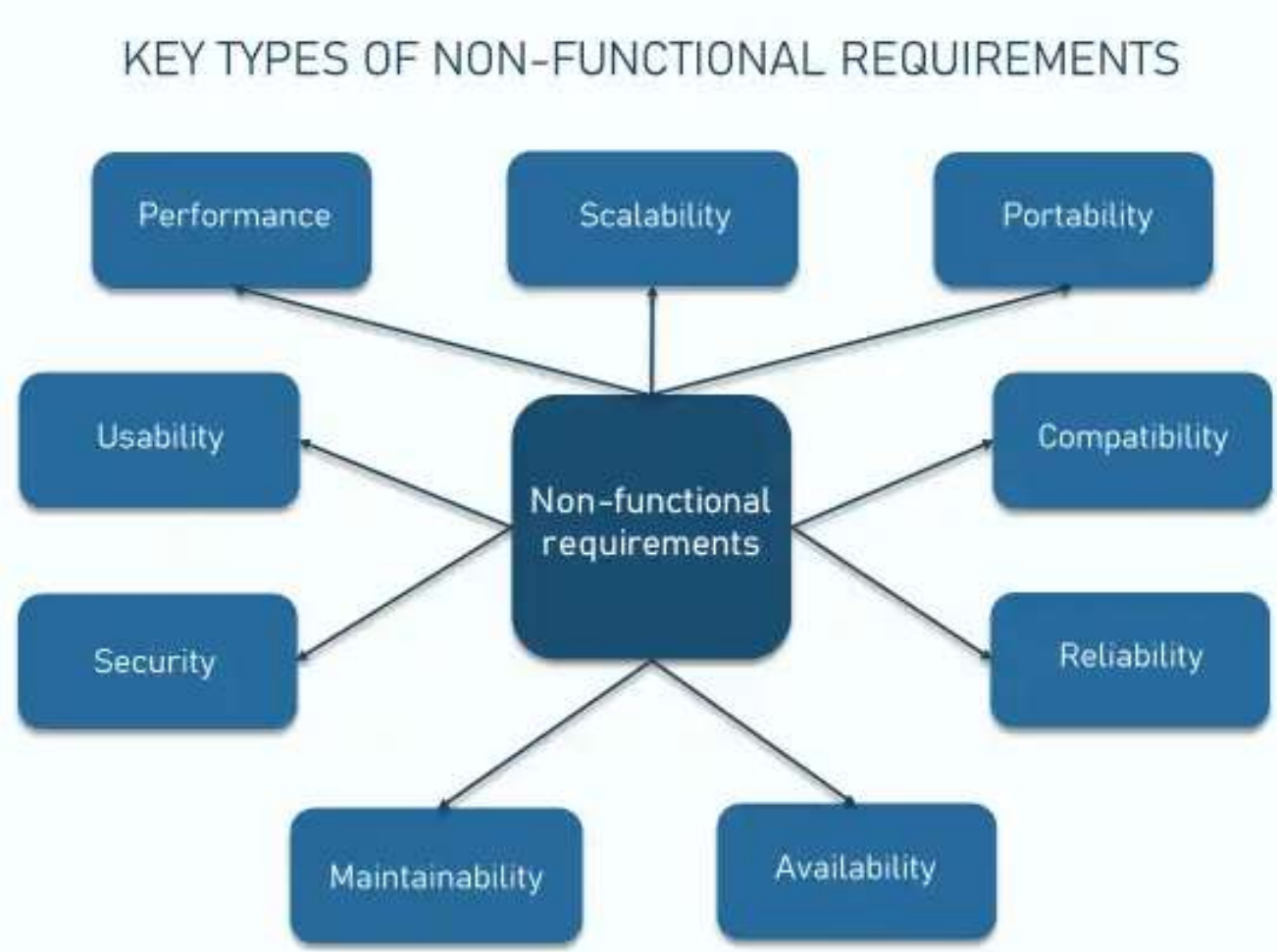
QFD is a quality management technique that translate the needs of the customer into technical requirements for software

- 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

b. 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

b. Non-Functional Requirements



b. Non-Functional Requirements

Performance. How fast does the system return results?

Scalability. How much will performance change with higher workloads?

Portability. Which hardware, operating systems, and browsers, along with their versions, does the software run on?

Compatibility. Does the system conflict with other applications and processes?

Reliability. How often does the system experience critical failures?

Maintainability. How much time does it take to fix the issue when it arises?

Availability. How long is the average system downtime?

Security. How well are the system and its data protected against attacks?

Usability. How easy is it to use the system?

Let's now take a closer look at each type of NFRs one by one, with examples and tips on how to approach them.

4. Use-Cases

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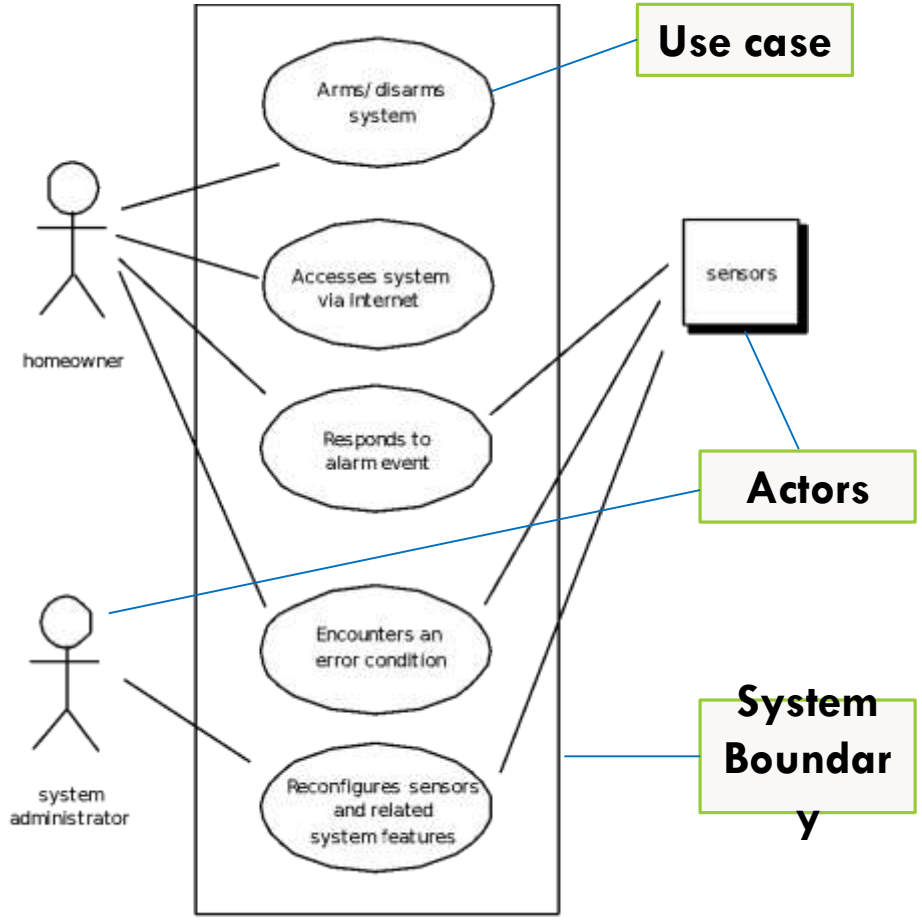
A Use case represents the functionality of the system.

- 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?

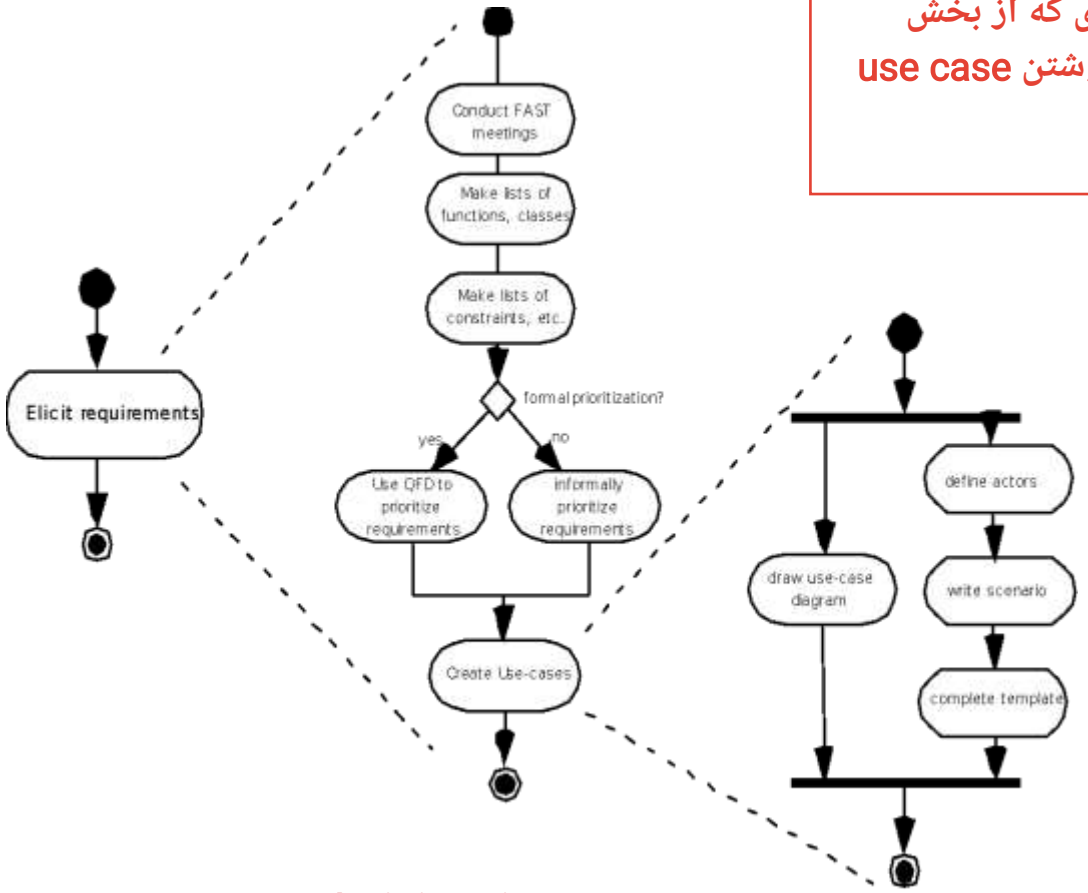
Use-Case Diagram



UML use case diagram for SafeHome home security function

Eliciting Requirements

خلاصه ان جیزی که از بخش Eliciting تا نوشتن use case انجام میدهیم

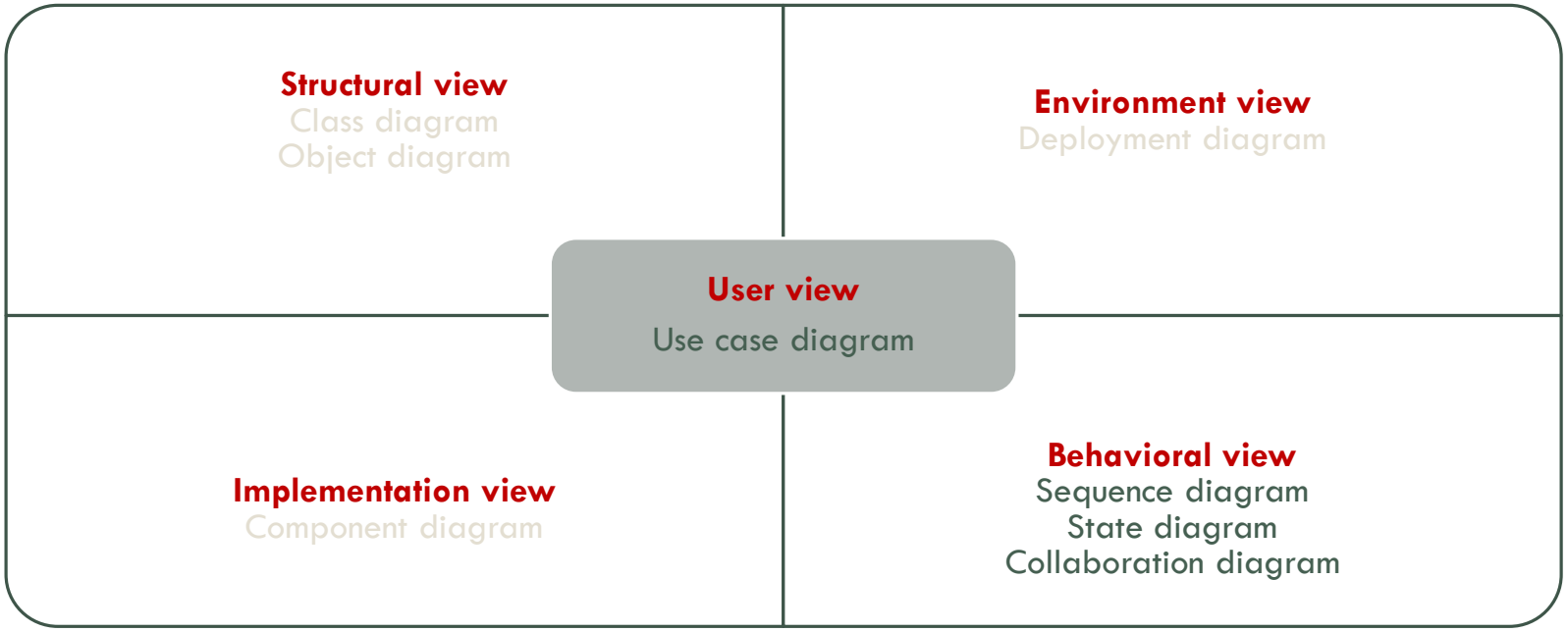


Activity Diagram

5. Building the Analysis Model

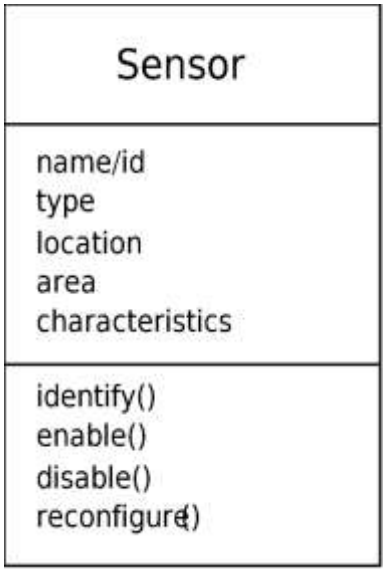
- Elements of the analysis model
  - Scenario-based elements
    - Functional—processing narratives for software functions
    - Use-case—descriptions of the interaction between an “actor” and the system
  - Class-based elements
    - Implied by scenarios
  - Behavioral elements
    - State diagram
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

DIFFERENT MODE OF REPRESENTATION

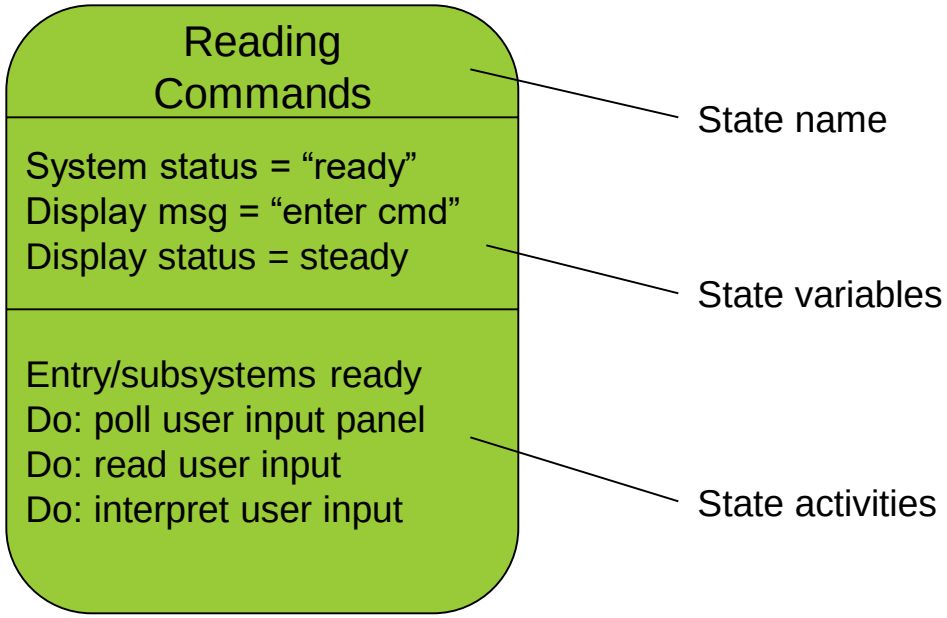


Class Diagram

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.

6. 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”

7. 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.

8. 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?