Requirement Engineering

Non-Functional Requirements

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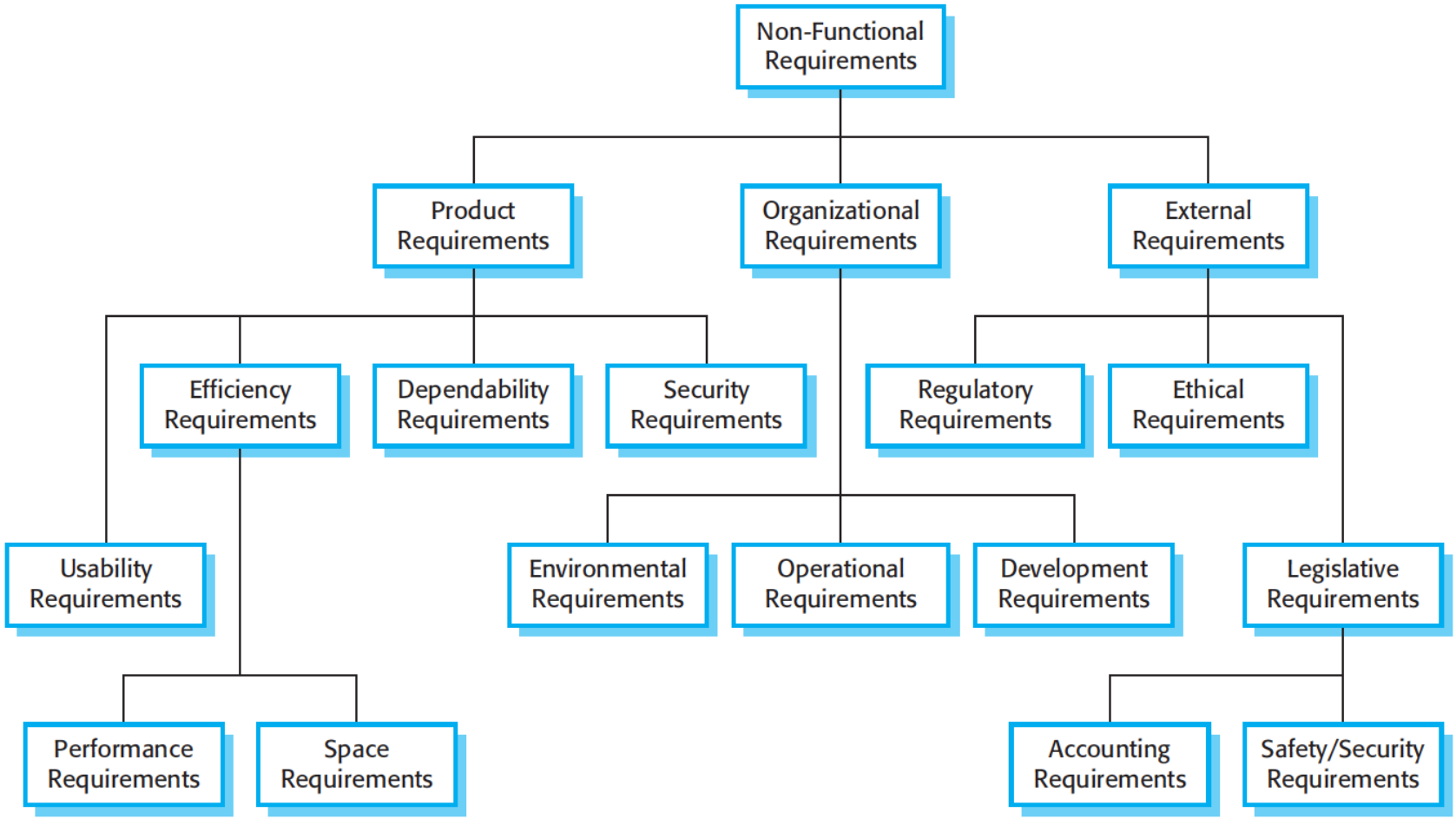
Non-Functional Requirements

- Not directly concerned with the specific services delivered by the system to its users
- Relate to emergent system properties such as
  - Reliability
  - Response Time
  - Performance
  - Security
- May affect the overall architecture of the system rather than individual components
- May generate a number of related functional requirements, such as functionalities to ensure security

Examples of Non-Functional Requirements

- If an aircraft system does not meet its reliability requirements, it will not be certified as safe for operation
- If an embedded control system fails to meet its performance requirements, the control functions will not operate correctly

Types of Non-Functional Requirements



Non-testable and Testable Non-Functional Requirements

- **Non-testable**
  The system should be easy to use by medical staff and should be organized in such a way that user errors are minimized

- **Testable**
  Medical staff shall be able to use all the system functions after four hours of training. After this training, the average number of errors made by experienced users shall not exceed two per hour of system use

Measurable Non-Functional Properties

Property	Measure
Speed	Processed transactions/second User/event response time Screen refresh time
Size	Mbytes Number of ROM chips
Ease of use	Training time Number of help frames
Reliability	Mean time to failure Probability of unavailability Rate of failure occurrence Availability
Robustness	Time to restart after failure Percentage of events causing failure Probability of data corruption on failure
Portability	Percentage of target dependent statements Number of target systems

Challenges in Specifying Non-Functional Requirements

- Customers for a system often find it difficult to translate their goals into measurable requirements
  - For some goals, such as maintainability, there are no metrics that can be used
- Customers may not be able to relate their needs to these specifications
  - What does some number defining the required reliability (say) mean in terms of their everyday experience with computer systems?
- The cost of objectively verifying measurable, non-functional requirements can be very high and the customers paying for the system may not think these costs are justified

Dependability Properties

- **Safety.** The safety of a system is a judgment of how likely it is that the system will cause damage to people or its environment
- **Security.** The security of a system is a judgment of how likely it is that the system can resist accidental or deliberate intrusions

Examples of Safety Properties

Autonomous Vehicles

- The vehicle will not collide with another vehicle or pedestrian
- The vehicle will not violate traffic signs and signals

Insulin Pump

- It must never deliver a dangerous dose of insulin

Security Properties

- **Confidentiality:** The system must not disclose information to people or programs that are not authorized to have access to that information
- **Integrity:** The software and its data should never be damaged or corrupted
- **Availability:** The software and its data should never be restricted for authorized users

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