Software Requirements Engineering (SE2001)

Dr. Syed Muazzam Ali Shah

HEC Approved Ph.D. Supervisor

(Assistant Professor)

Department of Software Engineering

NUCES-FAST Karachi

Contact#: (021) 111-128-128 Ext. 130

Website: sites.google.com/view/muazzam-kazmi/home

Official page: https://khi.nu.edu.pk/personnel/dr-syed-muazzam-ali-shah-2/

Google Scholar: https://scholar.google.com.tw/citations?hl=en&user=0vcfR-IAAAAJ

Kinds of Requirements

- Functional requirements
- Non-functional requirements
- Domain requirements
- Inverse requirements
- Design and implementation constraints

Functional Requirements

- Statements describing what the system does.
- Functionality of the system.

Functional Requirements

- Requirements form the basis of all software engineering projects.
- Functional requirements capture the **behavioral aspects/functions** of the proposed automated system.
- Functional requirements are the **backbone** of all software products.

Functional Requirements

- Statements of services the system should provide:
  - Reaction to particular inputs.
  - Behavior in particular situations.

Functional Requirements

- Abnormal behavior is also documented as functional requirements in the form of exception handling.

Functional Requirements

- Functional requirements should be **complete** and **consistent**.
- Customers and developers usually **focus all their attention** on functional requirements.

Functional Requirements Examples

- The system shall solve a quadratic equation using the following formula:

$$x = (-b \pm sqrt(b^2 - 4*a*c))/2*a$$

- The user shall be able to search either the entire database of patients or select a subset from it (admitted patients, or patients with asthma, etc.).

Functional Requirements Examples

- The system shall provide appropriate viewers for the user to read documents in the document store.
- Every order shall be allocated a unique identifier (ORDER_ID) which the user shall use to access that order.

Functional Requirements Examples

- The system shall allow customers to return non-perishable items within fifteen days of the purchase. A customer must present the original sale receipt to return an item.

Comments on Examples

- Notice the level of detail in different requirements described above. Some are very detailed compared to others.
- Notice the ambiguity in the requirement, which uses the term ‘appropriate viewers’.
- This requirement does not mention the formats of documents and types of viewers, which can be used.

Comments on Examples

- Notice the ambiguity in the requirement for solving the quadratic equation. The requirement does not speak about the possibility when the value of ‘a’ is zero.

$$x = (-b \pm sqrt(b^2 - 4*a*c))/2*a$$

Non-Functional Requirements

- Most non-functional requirements relate to the system as a whole.
- They include constraints on:
  - Timing
  - Performance
  - Reliability
  - Security
  - Maintainability
  - Accuracy
  - The development process
  - Standards, etc.

Non-Functional Requirements

- They are often more critical than individual functional requirements.
- Capture the **emergent behavior** of the system.
  - That is they relate to system as a whole.

Non-Functional Requirements

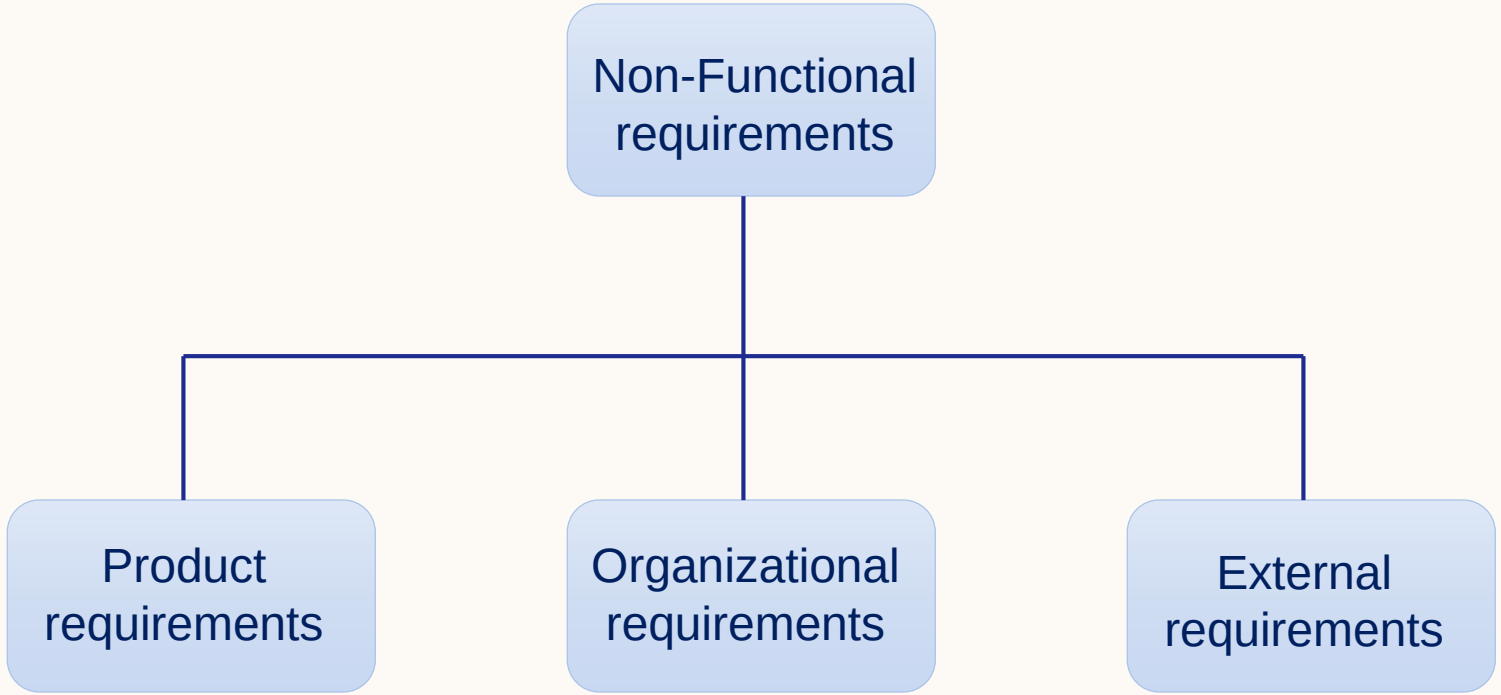
- Must be built into the framework of the software product.
- Failure to meet a non-functional system requirement may make the whole system unusable.

Non-Functional Requirements

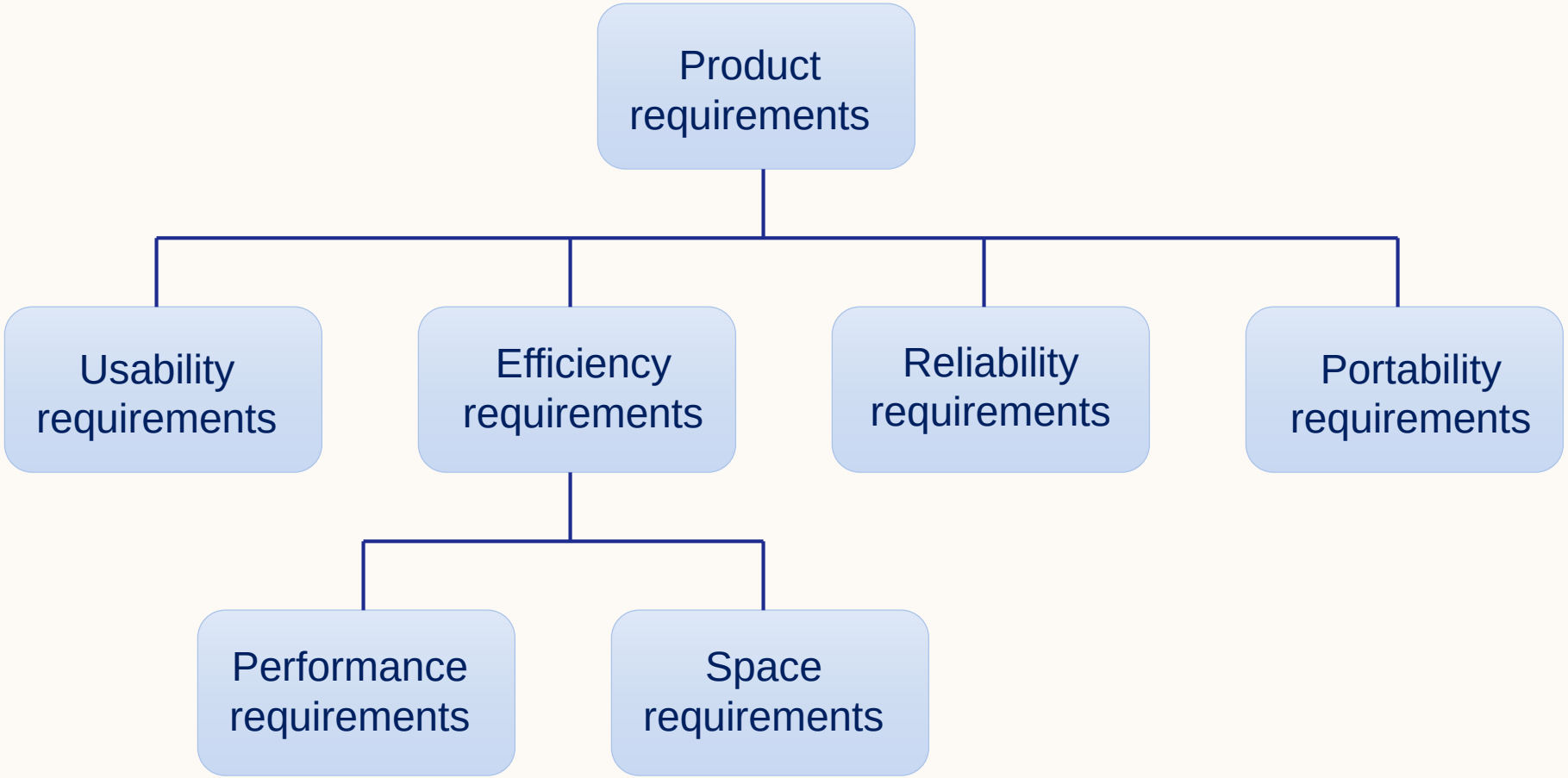
For example:

- If an aircraft system does not meet reliability requirements, it will not be certified as ‘safe’.
- If a real-time control system fails to meet its performance requirements, the control functions will not operate correctly.

Non-Functional Requirements



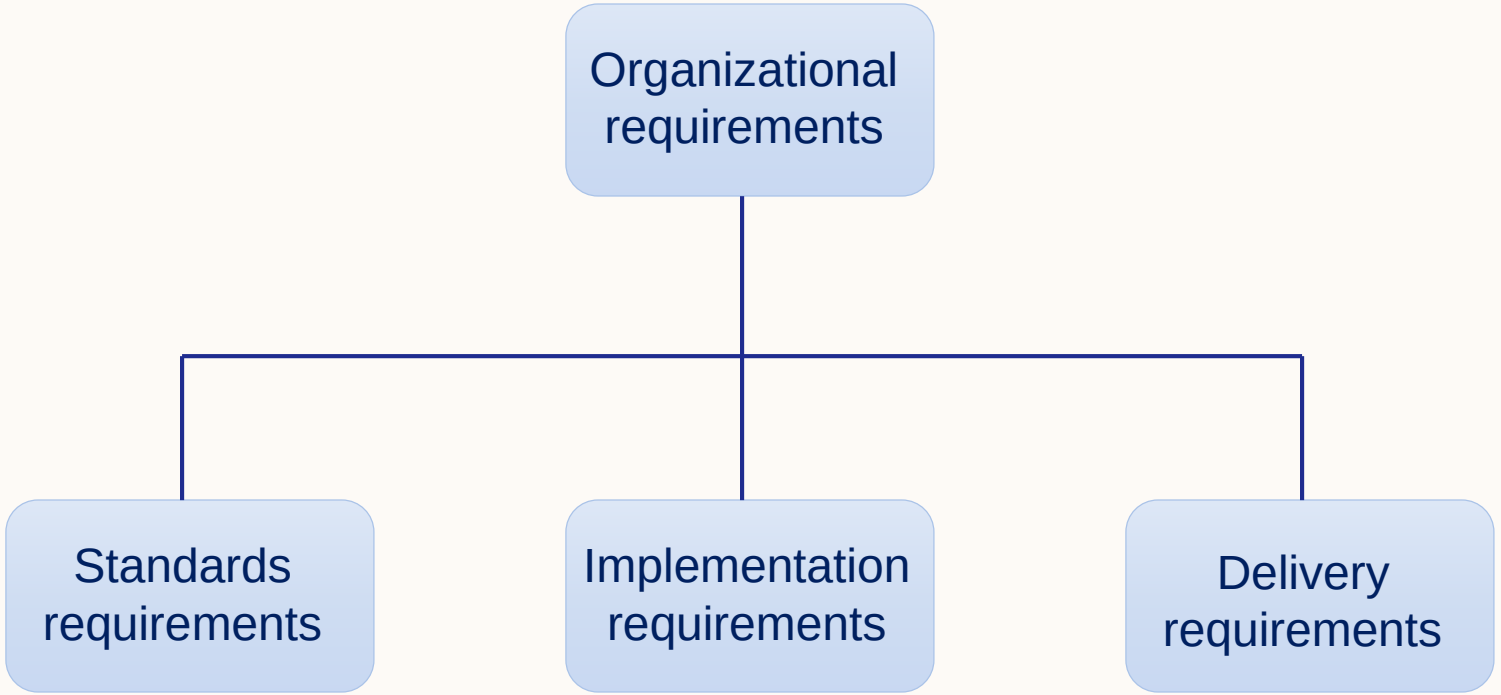
Product Requirements



Product Requirements Examples

- The system shall allow one hundred thousand hits per minute on the website.
- The system shall not have down time of more than one second for continuous execution of one thousand hours.

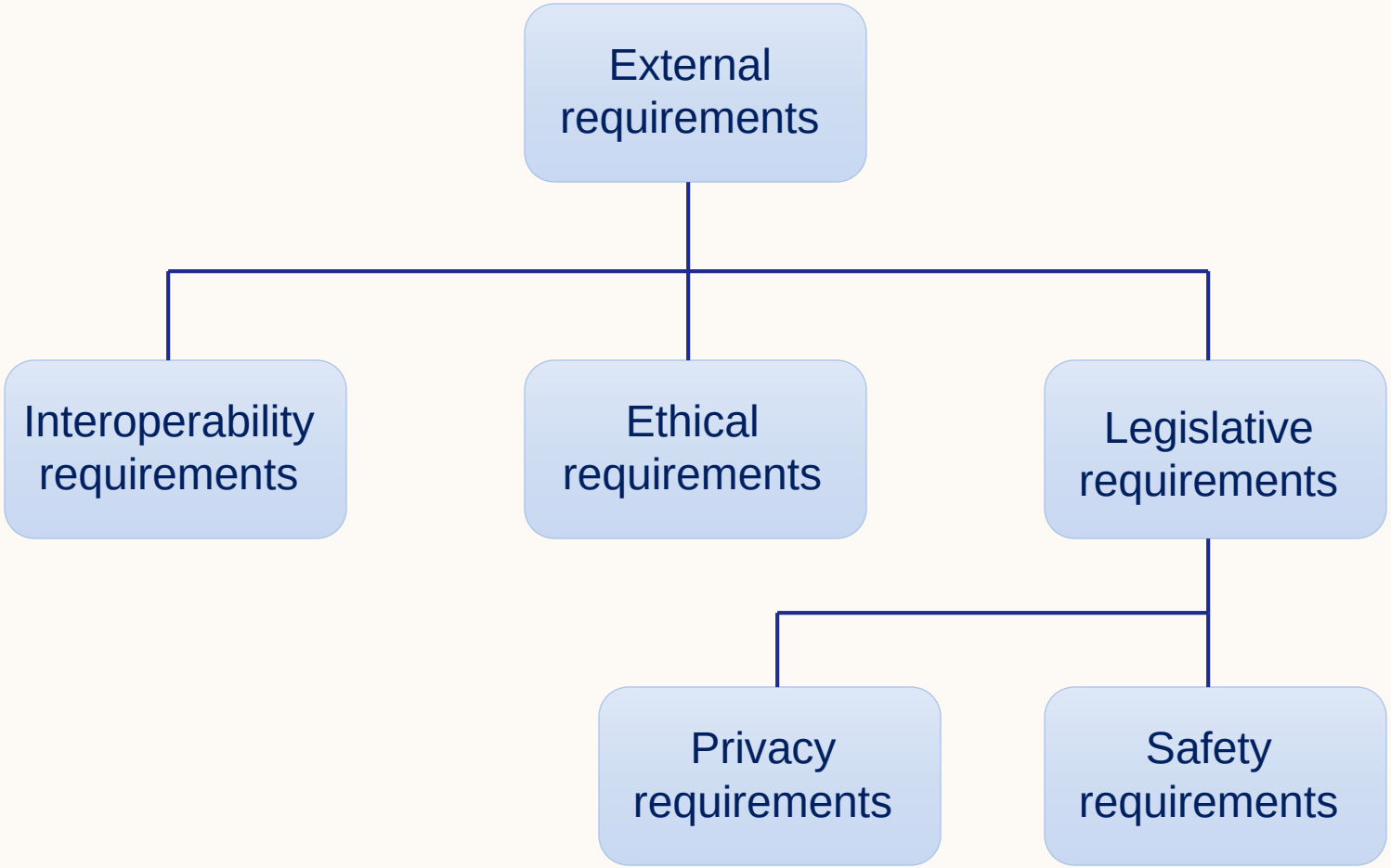
Organizational Requirements



Organizational Requirements

- The system development process and deliverable documents shall conform to the MIL-STD-2167A.
- Any development work sub-contracted by the development organization shall be carried out in accordance with Capability Maturity Model.

External Requirements



External Requirements

- The system shall not disclose any personal information about members of the library system to other members except system administrators.
- The system shall comply with the local and national laws regarding the use of software tools.

Observations on Non-Functional Requirements

- Non-functional requirements can be written to reflect general goals for the system. Examples include:
  - **Ease of use.**
  - **Recovery from failure.**
  - **Rapid user response.**

Observations on Non-Functional Requirements

- Goals are open to misinterpretation.
- Objective verification is difficult.
- Distinction between functional and non-functional is not always very clear.

Observations on Non-Functional Requirements

Non-functional requirements should be written in a quantitative manner as much as possible, which is not always easy for customers.

Observations on Non-Functional Requirements

Goal (unverifiable)

- The system should be easy to use by experienced controllers and should be organized in such a way that user errors are minimized.

Non-functional requirement (verifiable)

- Experienced controllers shall be able to use all the system functions after a total of two hours' training. After this training, the average number of errors made by experienced users shall not exceed two per day.

Observations on Non-Functional Requirements

- Chances of conflicts within non-functional requirements are fairly high, because information is coming from different stakeholders.
  - For example, different stakeholders can give different response times or failure tolerance levels, etc.

Observations on Non-Functional Requirements

- Some negotiations must be done among different stakeholders, to achieve an agreement in these situations.

Observations on Non-Functional Requirements

- Non-functional requirements should be highlighted in the requirements document, so that they can be used to build the architecture of the software product.

THANK YOU

Dr. Syed Muazzam Ali Shah
muazzam.ali@nu.edu.pk