

Requirements Engineering I

Chapter 10

Requirements Management



Chapter roadmap



10.1

Organizing requirements
Storing, retrieving and metadata

10.2

Prioritizing requirements
Not all requirements are
equally important

10.3

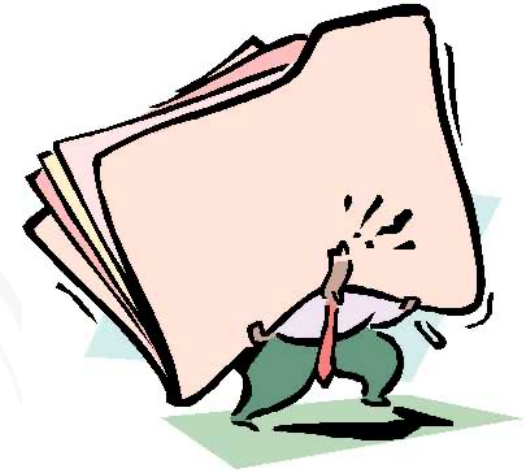
Traceability
Keeping track of origins and
destinations

10.4

Requirements evolution
Keeping up with the evolution
of the problem

Tasks of requirements management

- Organize
 - Store and retrieve
 - Record metadata (author, status,...)
- Prioritize
- Keep track: dependencies, traceability
- Manage change



10.1 Organizing requirements

Every requirement needs

- a **unique identifier** as a reference in acceptance tests, review findings, change requests, traces to other artifacts, etc.
- some **metadata**, e.g.
 - Author
 - Date created
 - Date last modified
 - Source (stakeholder(s), document, minutes, observation...)
 - Status (created, ready, released, rejected, postponed...)
 - Necessity (critical, major, minor)

Storing, retrieving and querying

Storage

- Paper and folders
- Files and electronic folders
- A requirements management tool

Retrieving support

- Keywords
- Cross referencing
- Using search machine technology or GenAI

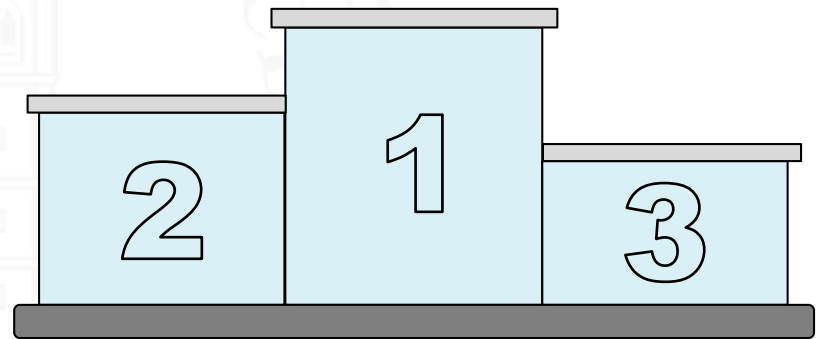
Querying

- Selective views (all requirements matching the query)
- Condensed views (for example, statistics)

10.2 Prioritizing requirements

DEFINITION. **Prioritization** – The process of assigning priorities to a set of items.

- Requirements may be **prioritized** with respect to various criteria, for example
 - Necessity
 - Cost or time to implement
 - Risk
 - Volatility
- Prioritization is done by the **stakeholders**
- Only a **subset** of all requirements may be prioritized
- Requirements to be prioritized should be on the **same level of abstraction**



Simple prioritization (by necessity)

Ranks all requirements in three categories with respect to **necessity**, i.e., their **importance for the success** of the system

- **Critical** (also called essential, or mandatory)
The system will **not be accepted** if such a requirement is not met
- **Major** (also called conditional, desirable, important, or optional)
The system **should meet** these requirements, but not meeting them is **no showstopper**
- **Minor** (also called nice-to-have, or optional)
Implementing these requirements is **nice**, but **not needed**

Single criterion prioritization techniques

Prioritization is done according to a **single criterion**, e.g., necessity or cost

- **Simple ranking**

Stakeholders rank a set of requirements according to a given criterion

- **Assigning points**

Stakeholders receive a total of n points that they distribute among m requirements

- Prioritization by multiple stakeholders may be **consolidated** using weighted averages (with stakeholders' weights chosen according to their importance)

Multiple criteria prioritization techniques

[Wiegiers 1999]

Wiegiers' matrix

- Prioritization based on **value**, **cost**, and **risk** of requirements
- Process:
 - Requirements to estimate form the rows of a matrix
 - Estimate relative **value** (in terms of benefit & detriment), **cost**, and **risk** for each requirement (columns of the matrix)
 - Calculate **percentages** of **total** value, cost and risk
 - Calculate a **weighted priority**:
$$\text{priority} = \text{value \%} / (\text{cost \%} + \text{risk \%})$$
 - Rank according to calculated priorities

Multiple criteria prioritization techniques – 2

[Saaty 1980]

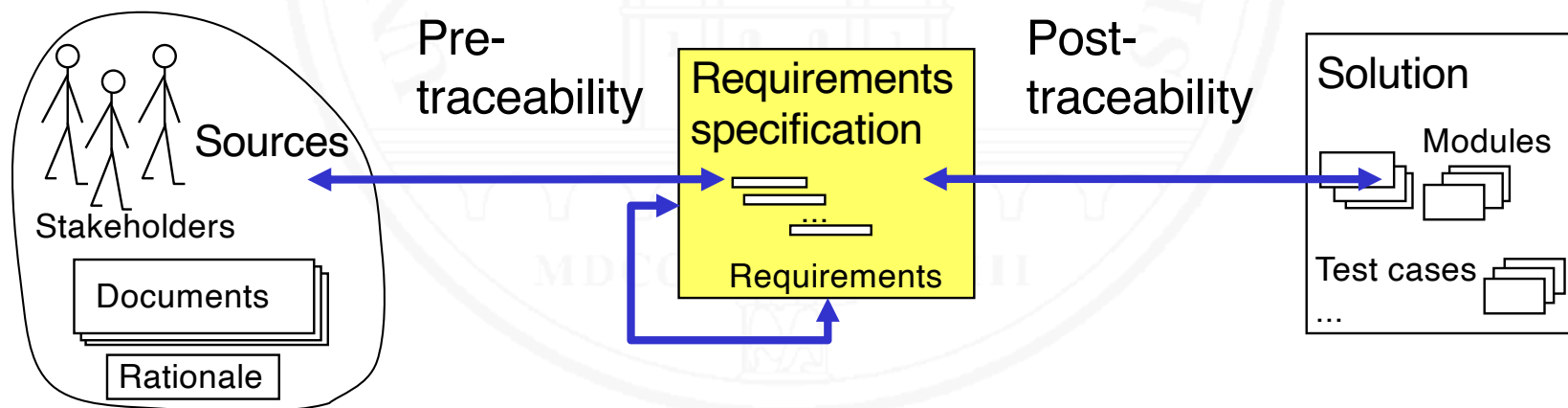
AHP (Analytic Hierarchy Process)

- Algorithmic process for any set of prioritization criteria
 - Based on pairwise comparison
 - Process:
 - Select prioritization criteria
 - Stakeholders determine the importance of the criteria by pairwise comparison of all criteria
 - For each criterion, stakeholders do a pairwise comparison of all requirements and assess their relative difference of importance
 - From these values, an algorithm calculates the overall weighted priority for every requirement
- Process is expensive and time-consuming

10.3 Traceability

[Gotel and Finkelstein 1994]

DEFINITION. **Traceability** – The ability to trace a requirement
(1) back to its origins,
(2) forward to its implementation in design and code,
(3) to requirements it depends on (and vice-versa).
Origins may be stakeholders, documents, rationale, etc.



Establishing and maintaining traces

○ Manually

- Requirements engineers explicitly create traces when creating artifacts to be traced
- Tool support required for maintaining and exploring traces
- Every requirements change requires updating the traces
- High manual effort; cost and benefit need to be balanced

○ Automatic

- Automatically create candidate trace links between two artifacts (for example, a requirements specification and a set of acceptance test cases)
- Uses information retrieval technology or GenAI
- Requires manual post processing of candidate links

10.4 Requirements evolution

The **problem** (see Principle 7 in Chapter 2):
Keeping requirements **stable**...
... while permitting requirements to **change**

Potential **solutions**

- Agile / iterative development with short development cycles (1-6 weeks)
- Explicit requirements change management

Every solution to this problem further needs **requirements configuration management**

Requirements configuration management

Keeping track of changed requirements

- **Versioning** of requirements
- Ability to create requirements **configurations, baselines and releases**
- **Tracing** the reasons for a change, for example
 - Stakeholder demand
 - Bug reports / improvement suggestions
 - Market demand
 - Changed regulations

Classic requirements change management

Adhering to a strict **change process**

- (1) Submit change request
- (2) Triage. Result: [OK | NO | Later (add to backlog)]
- (3) If OK: Perform impact analysis
- (4) Submit result and recommendation to Change Control Board
- (5) Decision by Change Control Board
- (6) If positive: make the change, create new baseline/release,
(maybe) adapt the contract between client and supplier

Change control board – A committee of **customer** and **supplier** representatives that **decides** on **change requests**.

Requirements change in agile development

In agile and iterative development processes, a **requirements change request** ...

- ... **never affects the current sprint / iteration**, thus ensuring **stability**
- ... is added to the **product backlog**

Decisions about change requests are made when prioritizing and selecting the requirements for the subsequent sprints / iterations

Mini-Exercise

Discuss the importance of requirements management

(a) In comparison to requirements elicitation and validation

(b) As an element of the RE process:

- Can an RE process without requirements management be successful?
- How could missing requirements management lead to failure?