



Software Engineering 2

Structure of a RASD document

RASD assignment



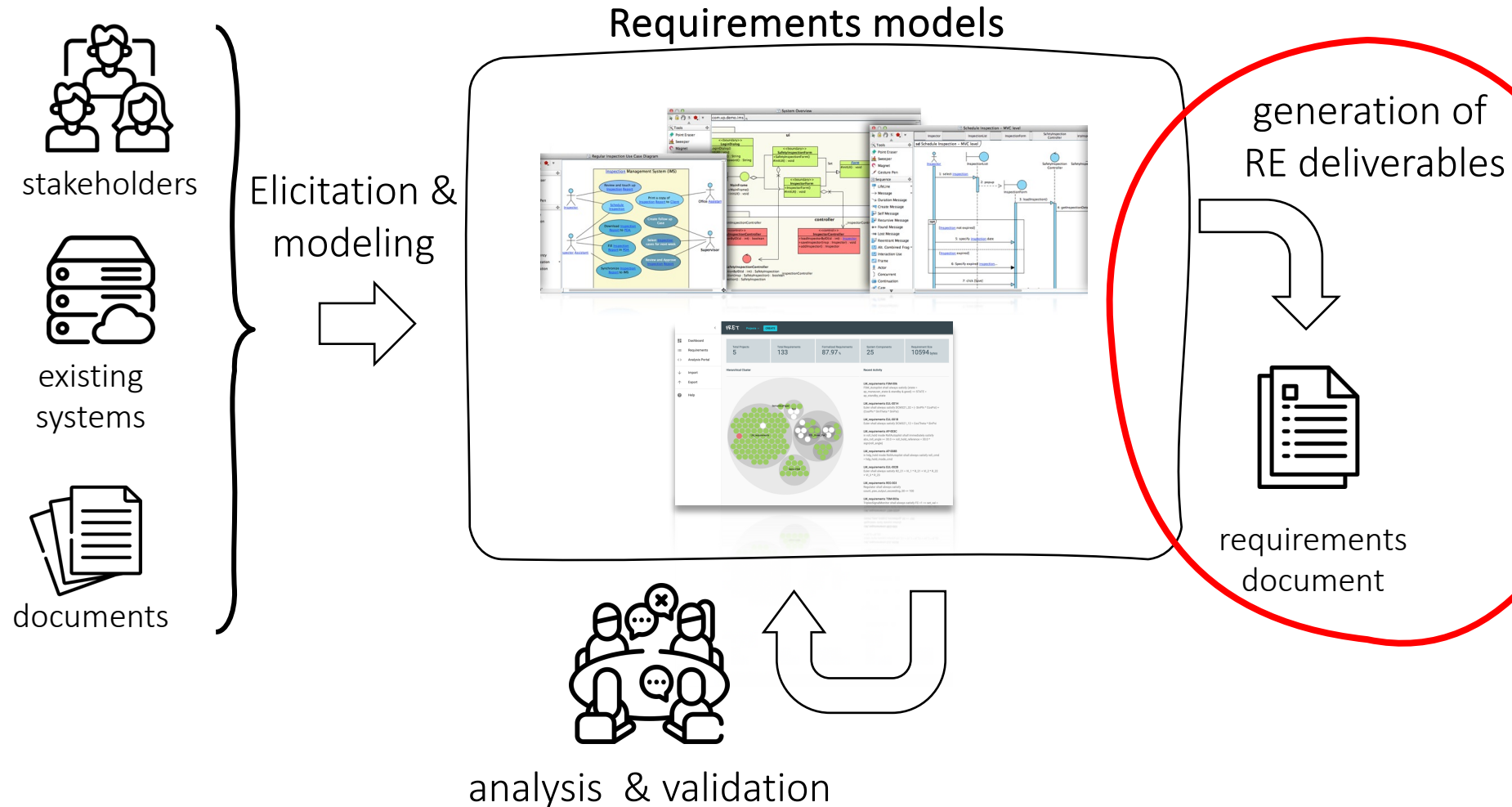
Requirements Engineering (RE)

Requirements Analysis and Specification Document (RASD)

RASD



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Purposes of the RASD

- **Communicates** an understanding of the requirements
 - explains both the application domain and the system to be developed
- **Contractual**
 - may be legally binding!
- **Baseline** for other activities
 - **Project planning** and estimation (size, cost, schedule)
 - **Software V&V**
 - supports system testing, verification and validation activities
 - should contain enough information to verify whether the delivered system meets requirements
 - **Change control**
 - requirements change, software evolves

Audience of the RASD

- **Customers & Users**
 - most interested in validating system goals and high-level description of functions
 - not generally interested in detailed software requirements
- **Systems Analysts, Requirements Analysts**
 - write various specifications of other systems that inter-relate
- **Developers, Programmers**
 - Eventually implement the requirements
- **Quality Assurance teams**
 - determine that the requirements have been met
- **Project Managers**
 - measure and control the analysis and development processes

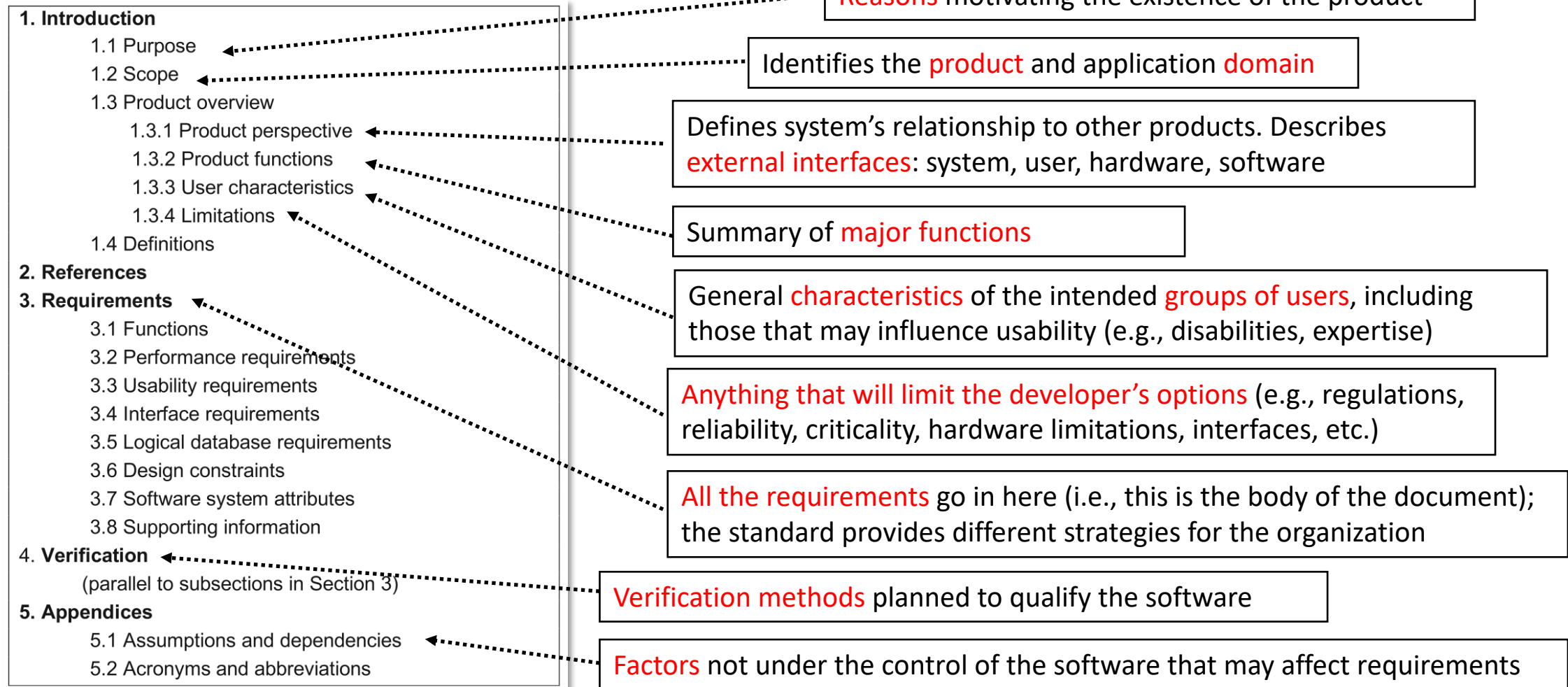
IEEE Standard for RASD – example of possible structure



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Source: ISO/IEC/IEEE 29148 (Nov 2018)

<https://doi.org/10.1109/IEEESTD.2018.8559686>



Section 3 — Requirements

Adapted from ISO/IEC/IEEE 29148 (Nov 2018)

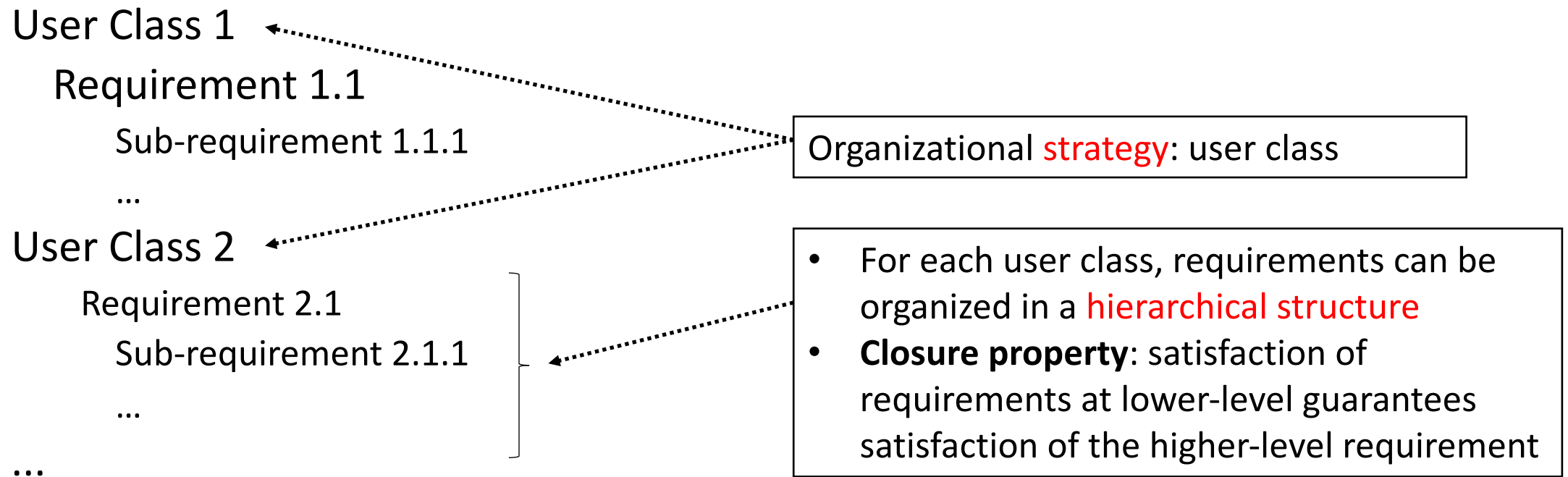
3.1 Functions (functional requirements)

- Fundamental actions that must occur in the software in accepting/processing the inputs and in generating the outputs
 - Validity checks
 - Sequence of operations
 - Responses to abnormal situations (e.g., overflow, failures, error handling)
 - Effect of configuration parameters
 - Input/output relationships
- Functional requirements can be **organized by** mode, user class, feature, etc.
- Functional requirements can be **hierarchical** (partition into sub-requirements)

Section 3 — Requirements

Adapted from ISO/IEC/IEEE 29148 (Nov 2018)

3.1 Functions (example)



Section 3 — Requirements

Adapted from ISO/IEC/IEEE 29148 (Nov 2018)

3.2 Performance requirements

3.3 Usability requirements

... etc.

Essentially, all NFR we consider high priority for our system, grouped by type

Section 3 — Requirements

Adapted from ISO/IEC/IEEE 29148 (Nov 2018)

3.6 Design constraints

- Constraints on design decisions imposed by:
 - Domain-specific standards, regulatory documents
 - Other project limitations (as specified in Sec. 2)

3.7 Software system attributes

- Includes the required quality attributes of the product (system-level):
 - Reliability — required reliability level at the time of delivery
 - Availability — required availability level at the time of delivery
 - ... etc.

Section 3 — Requirements

Adapted from ISO/IEC/IEEE 29148 (Nov 2018)

3.9 Supporting information

- Additional supporting information to be considered includes:
 - Sample input/output formats
 - Background information that can help the readers
 - Description of the problem(s) to be solved

Target qualities for a RASD (1)

- **Completeness**

- **w.r.t. goals:** the requirements are sufficient to satisfy the goals under given domain assumptions

Req and Dom \models Goals

- all Goals have been correctly identified, including all relevant quality goals
- Dom represent valid assumptions; incidental and malicious behaviours have been anticipated
- **w.r.t. inputs:** the required behavior is specified for all possible types of inputs
- **w.r.t. structure:** document does not contain TBDs

Target qualities for a RASD (2)

- **Precision**

- Requirements should have a level of detail sufficient for software design, development, and verification of the software release

- **Pertinence**

- each requirement or domain assumption is needed for the satisfaction of some goal
- each goal is truly needed by the stakeholders
- the RASD does not contain items that are unrelated to the definition of requirements (e.g., design or implementation decisions)

- **Consistency**

- no contradiction in formulation of goals, requirements, and assumptions

Target qualities for a RASD (3)

- **Unambiguity**

- unambiguous **vocabulary**: every term is defined and used consistently
- unambiguous **assertions**: goals, requirements and assumptions must be stated clearly in a way that precludes different interpretations
- unambiguous **responsibilities**: the split of responsibilities between the software-to-be and its environment must be clearly indicated
- **verifiability**: a process exists to test satisfaction of each requirement

Target qualities for a RASD (4)

- **Feasibility**
 - the goals and requirements must be technically realizable within the assigned budget and schedules
- **Comprehensibility**
 - must be comprehensible by all in the target audience
- **Good Structuring**
 - e.g., highlights links between goals, requirements and assumptions
 - every item must be defined before it is used
- **Modifiability**
 - must be easy to adapt, extend or contract through local modifications
 - impact of modifying an item should be easy to assess



Target qualities for a RASD (5)

- **Traceability**

- must indicate sources of goals, requirements and assumptions
- must link requirements and assumptions to underlying goals
- facilitates referencing of requirements in future documentation (design, test cases, etc.)

IEEE structure vs our RASD template

1. Introduction

- 1.1 Purpose
- 1.2 Scope
- 1.3 Product overview
 - 1.3.1 Product perspective
 - 1.3.2 Product functions
 - 1.3.3 User characteristics
 - 1.3.4 Limitations
- 1.4 Definitions

2. References

3. Requirements

- 3.1 Functions
- 3.2 Performance requirements
- 3.3 Usability requirements
- 3.4 Interface requirements
- 3.5 Logical database requirements
- 3.6 Design constraints
- 3.7 Software system attributes
- 3.8 Supporting information

4. Verification

(parallel to subsections in Section 3)

5. Appendices

- 5.1 Assumptions and dependencies
- 5.2 Acronyms and abbreviations

1. INTRODUCTION

- A. *Purpose*
- B. *Scope*
- C. *Definitions, Acronyms, Abbreviations*
- D. *Revision history*
- E. *Reference Documents*
- F. *Document Structure*

2. OVERALL DESCRIPTION

- A. *Product perspective*
- B. *Product functions*
- C. *User characteristics*
- D. *Assumptions, dependencies and constraints*

3. SPECIFIC REQUIREMENTS:

- A. *External Interface Requirements*
- B. *Functional Requirements*
- C. *Performance Requirements*
- D. *Design Constraints*
- E. *Software System Attributes*

4. FORMAL ANALYSIS USING ALLOY

5. EFFORT SPENT

6. REFERENCES

In which sections do we include all we have learnt about requirements?



1. INTRODUCTION

- A. **Purpose:** here we include the **goals** of the project
- B. **Scope:** here we include an analysis of **the world and of the shared phenomena**
- C. **Definitions, Acronyms, Abbreviations**
- D. **Revision history**
- E. **Reference Documents**
- F. **Document Structure**

In which sections do we include all we have learnt about requirements?



2. OVERALL DESCRIPTION

- A. Product perspective:** here we include **scenarios** and further details on the shared phenomena and a domain model, possibly expressed through **class diagrams** and **state diagrams**
- B. Product functions:** here we include the **most important requirements/categories of use cases**
- C. User characteristics:** here we include anything that is relevant to clarify their needs
- D. Assumptions, dependencies and constraints:** here we include **domain assumptions**

In which sections do we include all we have learnt about requirements?

3. SPECIFIC REQUIREMENTS: Here we include more details on all aspects in Section 2 if they can be useful for the development team.

A. External Interface Requirements

A.1 User Interfaces

A.2 Hardware Interfaces

A.3 Software Interfaces

A.4 Communication Interfaces

B. Functional Requirements: use case diagrams, use cases and related sequence and activity diagrams, and mapping on requirements

C. Performance Requirements

In which sections do we include all we have learnt about requirements?



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D. Design Constraints

- D.1 Standards compliance
- D.2 Hardware limitations
- D.3 Any other constraint

E. Software System Attributes

- E.1 Reliability
- E.2 Availability
- E.3 Security
- E.4 Maintainability
- E.5 Portability

In which sections do we include all we have learnt about requirements?

4. FORMAL ANALYSIS USING ALLOY:

- Brief presentation of the **main objectives** driving the formal modeling activity
- the **model itself**
- **what can be verified** with it, **why what is verified is important** given the problem at hand
- To show the soundness and correctness of the model, this section can show some worlds obtained by running it, and/or the results of the checks performed on meaningful assertions

5. EFFORT SPENT: In this section you will include information about the number of hours each group member has worked for this document

6. REFERENCES

A note on traceability

- Use cases are related to some requirements
- Keep track of this relationship through proper identifiers
 - E.g., RE.3 is associated with UC.3.1 and UC.3.2
- We may also have use cases that refer to multiple requirements
 - E.g., UC.3.1 may refer also to RE.2
 - ...even though the main relationship is with RE.3
 - Make this explicit in the presentation
 - E.g., you could build a traceability matrix

Traceability matrix

Raw ID	Goal ID	Req ID	Use Case ID	Comments
r1	G.1	RE.3	UC.3.1	
r2	G.1	RE.2	UC.3.1	

- This may grow during the development process, example:

Raw ID	Goal ID	Req ID	Use Case ID	Test case ID	Comments
r1	G.1	RE.3	UC.3.1	TC.3.1.1	
r2	G.1	RE.2	UC.3.1		

Homework

- Review the RASD available on Webeep, direct link
 - https://webeep.polimi.it/pluginfile.php/1116082/mod_folder/content/0/ProjectToBeReviewed/RASD.pdf
 - It refers to the assignment described in this document:
https://webeep.polimi.it/pluginfile.php/1116082/mod_folder/content/0/ProjectToBeReviewed/Assignment_2022-2023.pdf
- Answer to the questionnaire here (one set of answers per group)
 - <https://forms.office.com/e/LKU0uDnnDf>
 - if you are doing the R&DD project , keep the **same groups as for R&DD** projects
 - If you are not doing the R&DD project, you can create a new group (even cross-class), but you will have to keep the same group also for the DD homework
 - We will assign up to 1 point to clear and convincing answers
- **Deadline: October 25th at 23.59 (Rome time)**
- Answers will be used as basis for discussion during the lab of October 26th



Homework — important note

- Focus more on content rather than structure
- Your critical review should identify weaknesses and strengths especially considering our “target qualities for a RASD”