UNIVERSITÄT DUISBURG ESSEN

Offen im Denken

Requirements Engineering & Management

Core Activities – Documentation I

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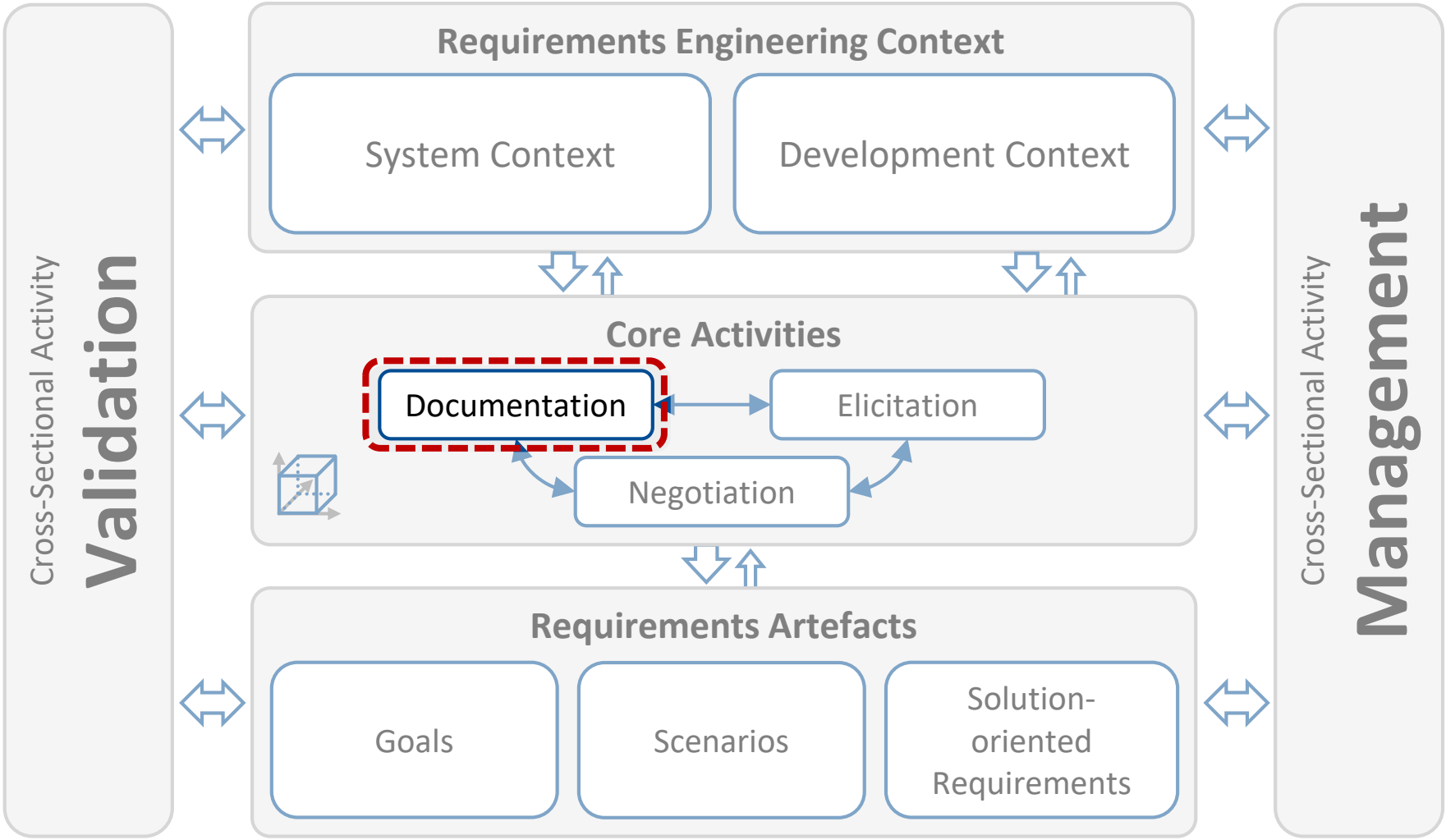
The Ruhr Institute for Software Technology

Requirements Engineering Framework



Agenda

1. Introduction
2. Definition and Characteristics
3. Documentation of Additional Information
4. Documentation of Requirements
5. Documentation Guidelines
6. Requirements Documentation vs. Specification

1. Introduction

Importance of Documentation (1)

- **Persistence**
  - **A lot of different kinds of information** is elicited/developed
  - Without documenting (part of) this information, it would be lost **(forgotten by stakeholders)**

- **Common reference**
  - Documenting (relevant) information establishes a common reference for the stakeholders

- **Promotes communication**
  - Documented information **supports communication** and promotes **discussions**

- **Promotes objectivity**
  - Documented information (compared to verbal information exchange) is more objective and (partially) **avoids subjective interpretation and subjective bias**

All icons from [1].

Importance of Documentation (2)

- **Supports integration of new stakeholders**
  - New stakeholders can:
    - **Selectively access information** (e.g., required for performing a specific task)
    - Get an overall **overview** of the system

- **Preserves expert knowledge**
  - Typically, not all stakeholders know all relevant information (e.g., about technologies or relevant context aspects)
  - Documentation makes expert **knowledge available to all stakeholders**
  - **Reduces** the **dependence** on individual experts

- **Supports problem reflection**
  - When documenting information, the author is **forced to structure the information**
  - The author has to **reflect on the information** → identification of **gaps** and **inconsistencies**
  - **Readers** of documents also **reflect** on the documented information

All icons from [1].

What should be Documented?

Requirements Engineering Context:

- System context information
- Development context information

Core Activities:

- Activity execution (outputs/ inputs)
- Minutes, e.g., of meetings/interviews
- Decisions taken
- Stakeholders involved
- …

Validation:

- Validation results and decisions
- Stakeholders involved
- …

Management:

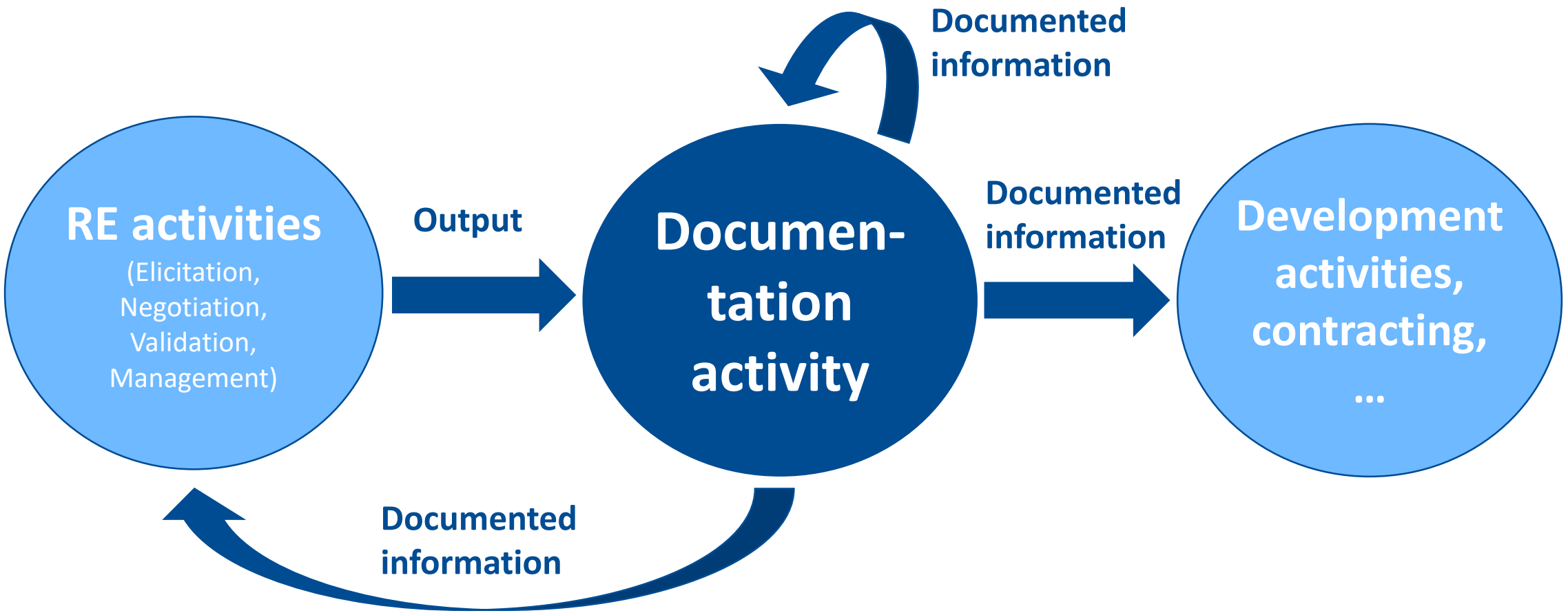
- Change requests
- Change decisions
- Prioritizations
- …

Requirements Artefacts:

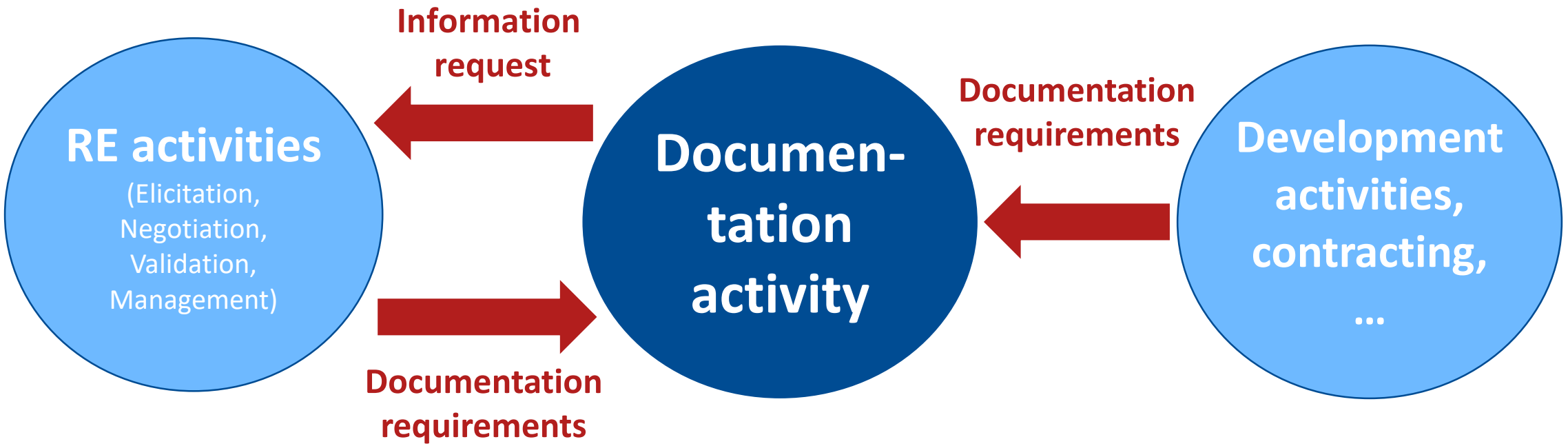
- Goals
- Scenarios
- Solution-oriented requirements
- Quality requirements
- Constraints
- …

Documentation Activity (1)

Documentation Activity (2)



Documentation Activity (3)



Documentation Activity (4)

Documentation requirements:

- Purpose of the produced document
- Required content, i.e. the information the document should contain
- Required quality
- Required documentation format(s)
- …

Information request:

- Request for clarification
- Request for more detailed information
- Resolution of a conflict
- Prioritisation
- Information about requirements realisation
- …

2. Definition and Characteristics

Definition

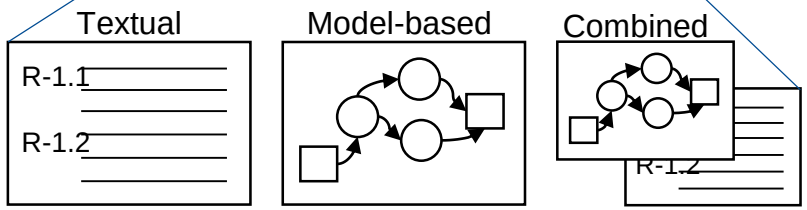
D **Documentation** serves a **specific purpose**. Depending on the purpose, **documentation differs in terms of content, format and quality**.

Three key documentation characteristics in requirements engineering:

Content
- Level of detail
- Level of abstraction
- Structure of document

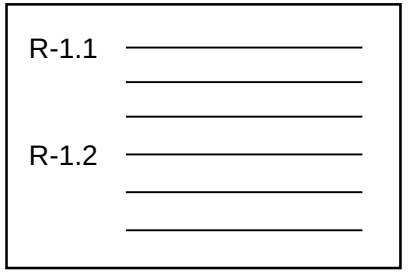
Format
- Textual
- Model-Based
- Combined

Quality
- Quality properties



Representation Formats

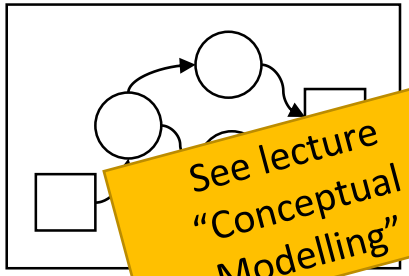
Textual



- Natural language text
- Structured text
- Templates

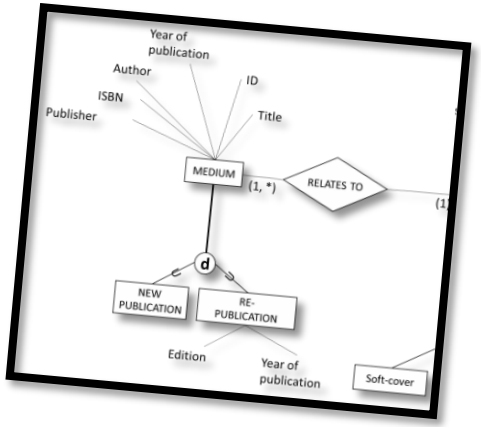
Identifier	R-S-33-8
Name	Recommendation for rental car after booking
Author	Matthias Gerdes
Version	V3
Sources	Ms. Reisig, Ms. Meier, TBD (incomplete)
Short description	After booking a journey the system recommends a rental car provided by InterCars.
Requirement	After booking a flight or holiday package the booking system shall display a selection of available rental cars provided by InterCars. The rental cars shown shall be available at the destination point and during the time of the journey booked. Each rental car shall be described by displaying category, type, price per day and picture.

Model-based

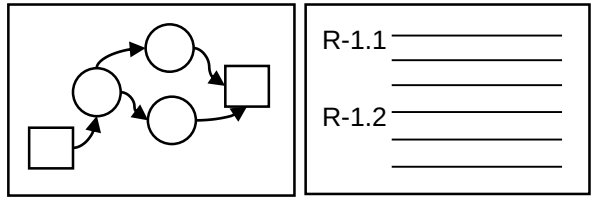


See lecture "Conceptual Modelling"

- Data perspective
- Behaviour perspective
- Functional perspective



Combined



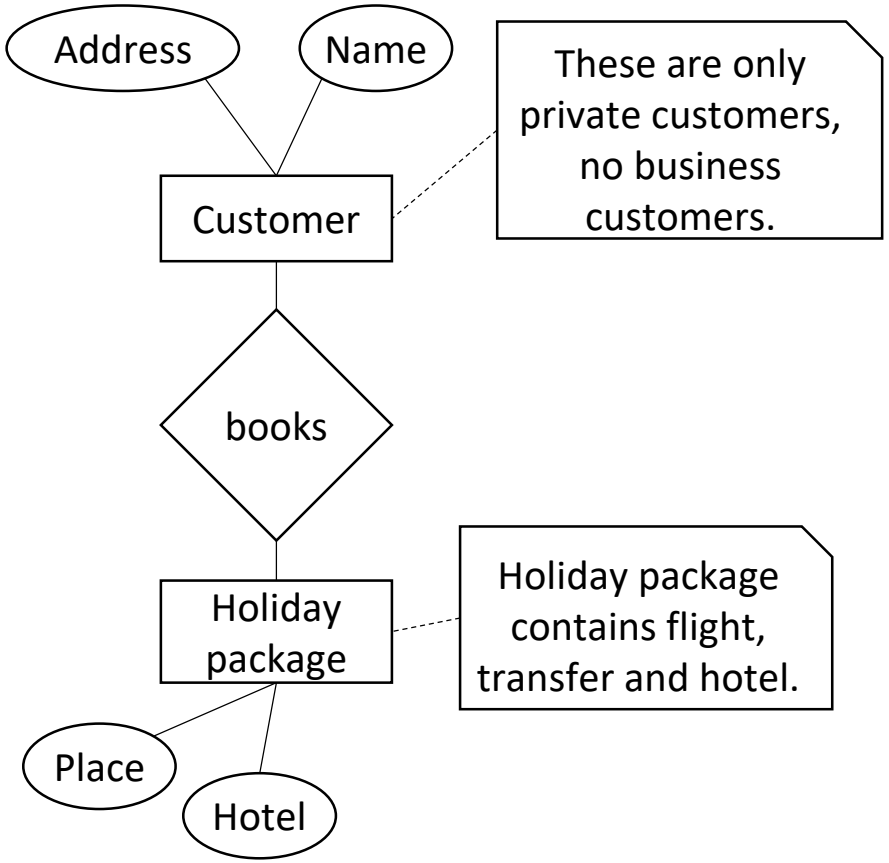
- Conceptual models with annotations
- Text with models

Examples see next slide

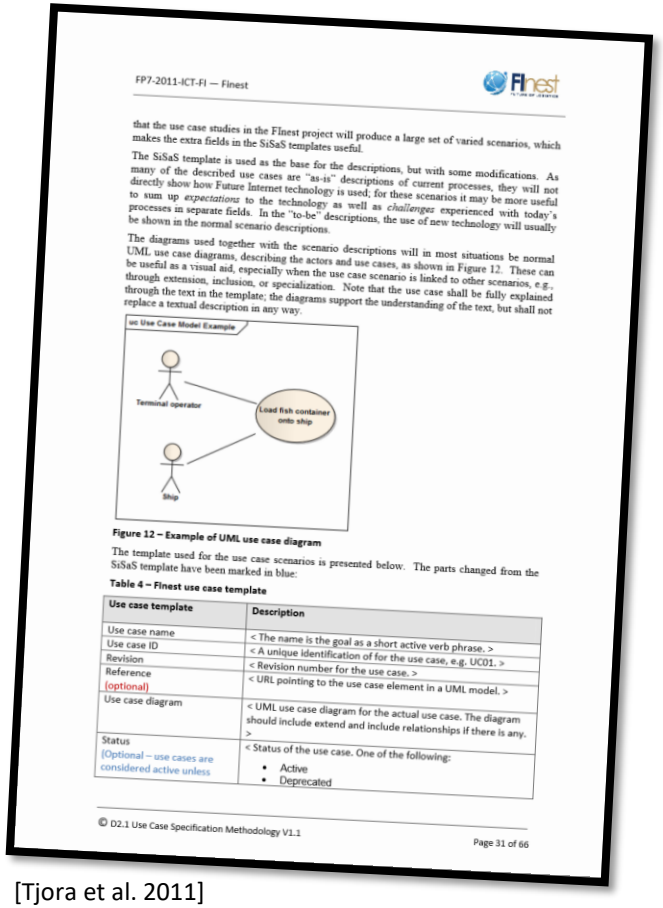
Combination of Representation Formats

E

Conceptual models with textual annotations



Text including conceptual models



FP7-2011-ICT-FI — Finest

that the use case studies in the FInest project will produce a large set of varied scenarios, which makes the extra fields in the SiSaS templates useful.

The SiSaS template is used as the base for the descriptions, but with some modifications. As many of the described use cases are "as-is" descriptions of current processes, they will not directly show how Future Internet technology is used; for these scenarios it may be more useful to sum up *expectations* to the technology as well as *challenges* experienced with today's processes in separate fields. In the "to-be" descriptions, the use of new technology will usually be shown in the normal scenario descriptions.

The diagrams used together with the scenario descriptions will in most situations be normal UML use case diagrams, describing the actors and use cases, as shown in Figure 12. These can be useful as a visual aid, especially when the use case scenario is linked to other scenarios, e.g., through extension, inclusion, or specialization. Note that the use case shall be fully explained through the text in the template; the diagrams support the understanding of the text, but shall not replace a textual description in any way.

uc Use Case Model Example
Terminal operator
Load fish container onto ship
Ship

Figure 12 – Example of UML use case diagram

The template used for the use case scenarios is presented below. The parts changed from the SiSaS template have been marked in blue:

Table 4 – FInest use case template

Use case template	Description
Use case name	< The name is the goal as a short active verb phrase. >
Use case ID	< A unique identification of for the use case, e.g. UC01. >
Revision	< Revision number for the use case. >
Reference (optional)	< URL pointing to the use case element in a UML model. >
Use case diagram	< UML use case diagram for the actual use case. The diagram should include extend and include relationships if there is any. >
Status (Optional – use cases are considered active unless	< Status of the use case. One of the following: • Active • Deprecated

© D2.1 Use Case Specification Methodology V1.1 Page 31 of 66

[Tjora et al. 2011]

Purpose of Documentation

The **purpose of documentation** during requirements engineering **varies**:

Elicitation:
- Support **creativity workshop**
- **Questionnaire-based** elicitation, e.g. in interviews

Negotiation:
- **Support** agreement with structured argumentation/alternatives
- **Support** the **comparison** of conflicting viewpoints

Management:
- **Support team communication** by recording **meeting minutes**
- **Report** progress to **management**

Validation/Verification:
- Assure **quality**
- **Reference** for verification activities
- **Proof** of safety features
- **Illustration** (e.g., based on scenarios) for **validation** by stakeholders

For non-RE activities:
- Specifying requirements as **input for successive system development activities**
- **Bidding** and **contracting**
- Supporting the **derivation of test** cases

What Influences the Creation of a Documentation?

- **How documentation is executed, depends on:**
  - the **purpose** for documentation
  - the skills and needs of **stakeholders**
  - the **consuming activities**
  - the **current status** of requirements process
  - contractual and process constraints
  - resources available
  - …
- All above has impact on the
  - **content** documented
  - the **representation formats** chosen
  - the **quality properties** to be fulfilled

E Requirements should be validated with domain experts. To fulfil this purpose, among others, the requirements should be documented in a representation format the domain experts are familiar with.

Documentation of Management Meeting (1)

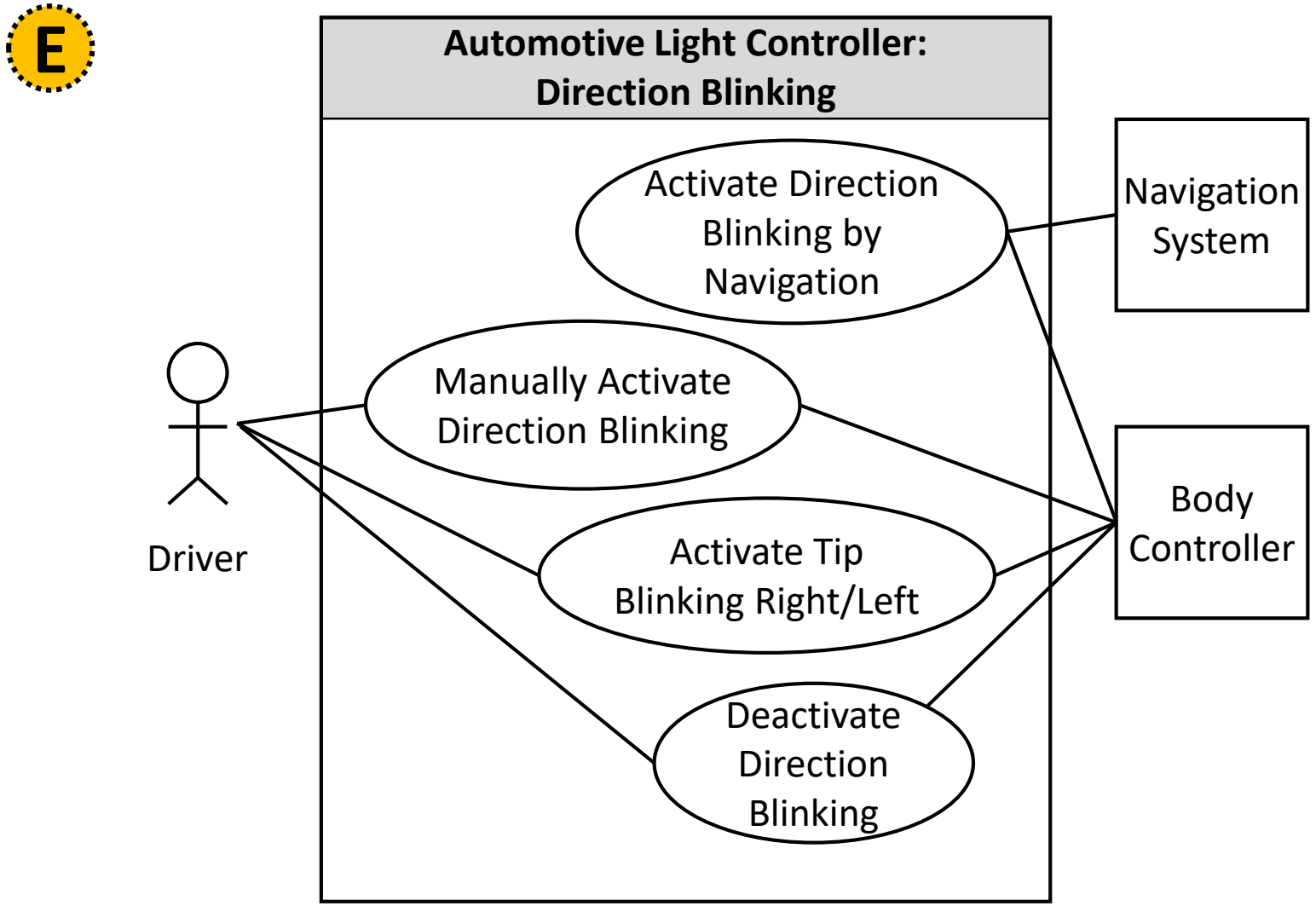
Purpose: Validation and selection of system functionality by management

Documentation should support the validation of the desired functions and use cases by management. Management should decide about alternative functions. Therefore alternative functions (if available) should be documented as well.

For this purpose, the documented properties should include:

Content	Format	Quality (for content & format)
• System viewed as a black box • Overview of end-user functionality • Alternatives to be decided about	• Easy to understand modelling language • English language	• Correct defined functions • Complete alternatives • No formal consistency required • Contradictions are allowed

Documentation of Management Meeting (2)



All icons from [1].

Documents - Management Meeting (3)

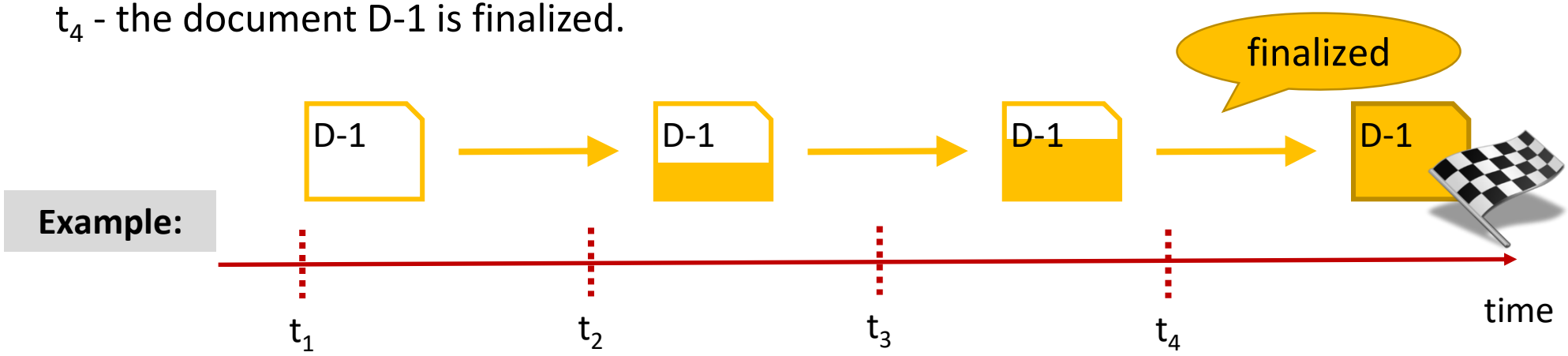
The documentation fulfil the purpose by:

	Content	Format	Quality
Overview of functions in use case diagrams	X	X	
Documentation of system as black box using use cases	X		
Representation formats are easy to comprehend (management is familiar with the use case notations)		X	
Alternatives are documented (direction blinking: manually vs. by navigation)	X		

Degree of Finalisation

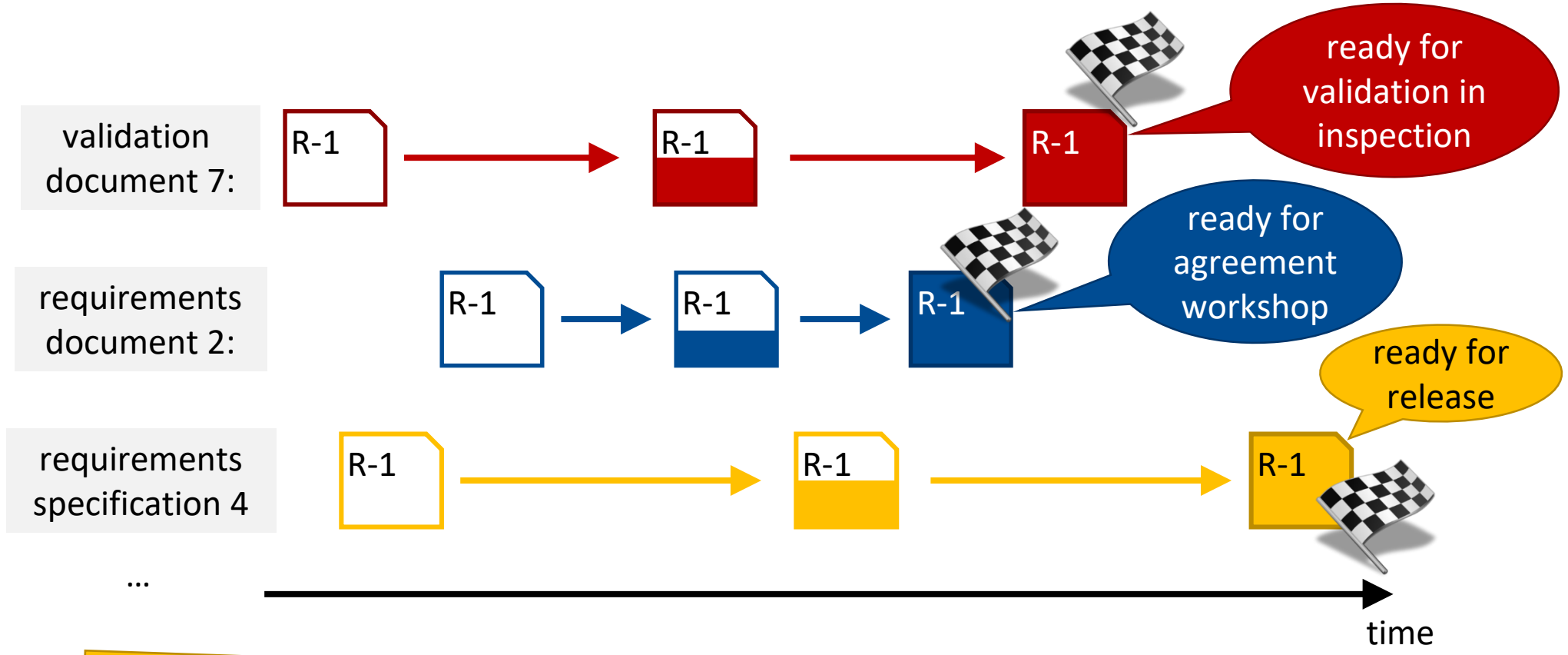
- **Degree of finalisation of a documentation** improves over time (in terms of **content, format and quality**)
- The degree of finalization can either be assessed
  - for the **whole document**
    (mix-calculation of finalization degree of content, format, quality), or
  - **separately** for the **content**, the **format** and the **quality**.

For example, at
t_1 - the documentation process started to prepare document D-1,
t_2 - the document D-1 is about 40% ready (in terms of content, format and quality),
t_4 - the document D-1 is finalized.



All icons from [1].

Co-Existence of Documentations in Requirements Eng.

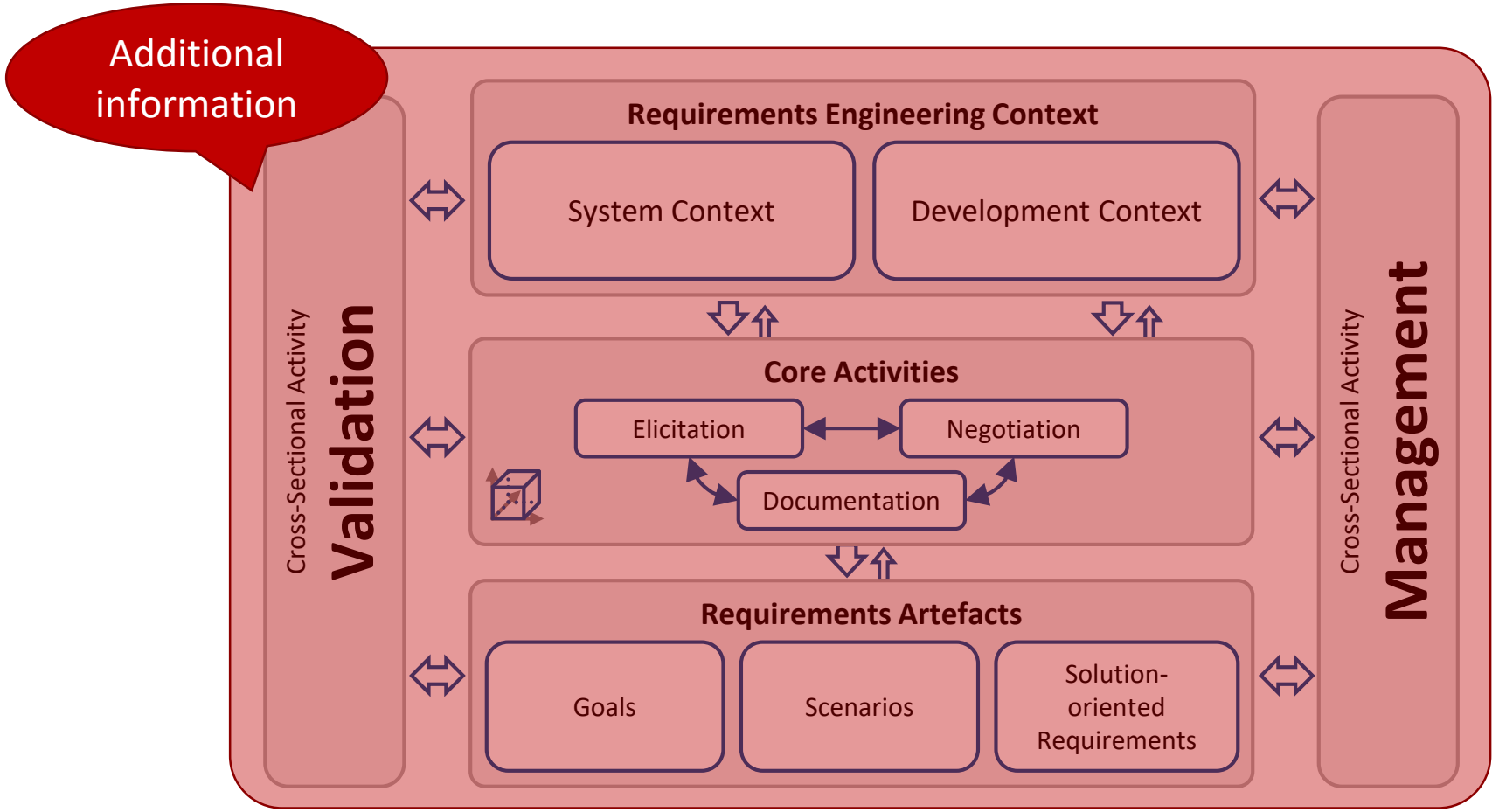


A requirement might be documented differently. Each documentation can vary in terms of level of detail, abstraction, structure, formats used and quality.

All icons from [1].

3. Documentation of Additional Information

Types of Additional Information



Additional Information for Core Activities (1)

Elicitation

Typical information:

- Interview minutes
- Requirements sources
- Brainstorming results
- Exploratory scenarios

Example for Information:

The interview minutes document the result of an interview with a manager. The requirements engineers can uses the minutes (later in the process) to search for requirements, specific opinions, alternative suggestions or even decisions about requirements made by the manager.

Negotiation

Typical information:

- Conflicts detected
- Argumentations
- Conflict resolutions
- Decisions

Example for Information:

Different members of the management board have conflicting opinions about a requirement. Domain experts facilitate the establishing of an agreement by comprehensively explaining the alternatives. The agreement achieved and the key arguments are documented as support further activities.

Additional Information for Core Activities (2)

Documentation

Typical information:

- Who has created the documentation, when, for which purpose
- Related different documentations (of the same information)
- Document versions
- …

Example for Information:

For documenting requirements, a domain-specific modelling language is customised for the project. The customisation has to be documented for stakeholders to be able to understand the modelling language.

Additional Information for Cross-Sectional Activities

Validation

Typical information:

- Potential defects
- Vague documentation
- Interpretation difficulties
- Stakeholders involved

Example for Information:

During the inspection the inspector documents the potential defects detected in the requirements. Those potential defects are input for other activities, e.g. negotiation (if a conflict was detected), elicitation (if details about a requirements were missing).

Management

Typical information:

- Project plan
- Trace information
- Change requests
- Resource consumption
- Prioritization

Example for Information:

During requirements engineering, the legal departments passes on the new law for tax calculation. The consideration of the new law is documented as change request.

Additional Information About Context and Artefacts

Context

Typical information:

- Context objects
- Stakeholders
- Identified sources of information
- Physical constraints

Example for Information:

By analysing the system context, stakeholders identify physical constraints affecting the system in operation. Among others, the physical constraint that the system will be operated in geographical areas with a temperature range from -10° to 40° Celsius is documented.

Req. Artefacts

Typical information:

- Date of creation
- Author(s)
- Versions
- Volatility

Example for Information:

An initial scenario together with the date of creation and the author is documented. The volatility of the scenario is documented as “volatile” – the scenario has not yet been discussed by all stakeholders and thus might be revised.

Minutes of an Interview

Identifier	INT-23
Date	05.07.2015
Goal	Elicitation of requirements for the booking process
Interviewer	Matthias Gerdes
Interviewee(s)	Julia Reisig (Account Manager, Far-Away-Travel Ltd.)
Minutes	• … • Provide dedicated functions for booking holiday packages, flights and hotels. • To increase sales and customer satisfaction the system shall provide as many recommendations as possible we can offer to the customer. • … • The booking of rental car (at least support for it via third-party services) should be included in the system. Many customers ask for it. Currently, this is not possible. • …

Card Sort: Output of Creativity Workshop

Documented Decisions

Management Meeting

Introduction

Project	Travel Agency Booking Portal
Date	April 24th 2015
Participants	• Ms. Meier • Mr. Smith • Ms. Reisig • Mr. Johnson • Ms. William • Ms. Brown

Decisions

D-1.1 Support for Holiday Packages

Identifier	**Issue**			**Decision**
D-1.2	Should the booking system support holiday packages?			Yes
#All	**#Yes**	**#No**	**%Yes**	**%No**
6	4	2	33%	66%

Decisions per Participant

Stakeholder	**Decision**	**Stakeholder**	**Decision**
Ms. Meier	Yes	Mr. Johnson	Yes
Mr. Smith	No	Ms. Williams	No
Ms. Reisig	Yes	Ms. Brown	Yes

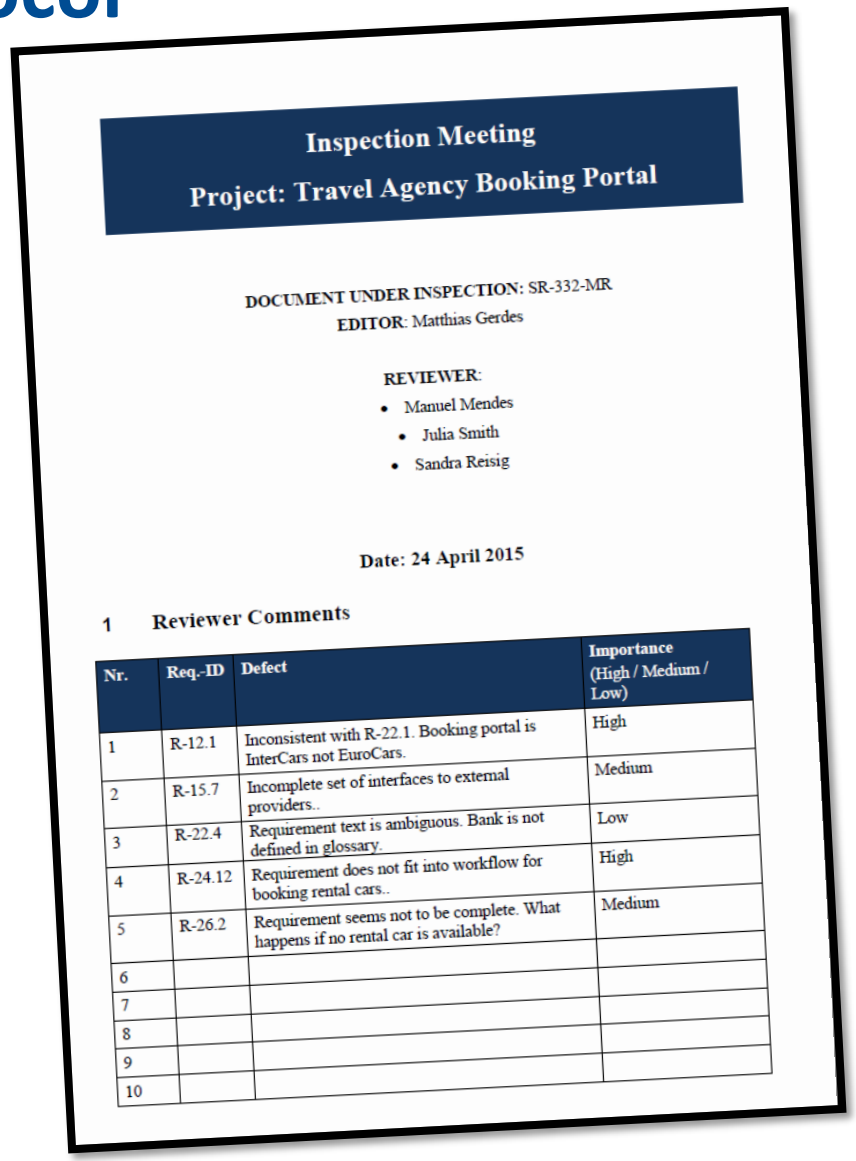
Choosen Position: support for holiday packages

Pro/Contra	**Argument**
Pro	Bestselling product
Pro	Complex booking process causes high manual effort
Pro	Booking system can reduce effort signicantly
Contra	Relatively high implementation effort
Contra	Causes delay in development.

Declining Position: no support for holiday packages

Pro/Contra	**Argument**
Pro	Less implementation effort
Pro	No delay in development
Contra	Less competitiveness caused by higher process time and more failures in process.

Inspection Protocol



Inspection Meeting

Project: Travel Agency Booking Portal

DOCUMENT UNDER INSPECTION: SR-332-MR
EDITOR: Matthias Gerdes

REVIEWER:
- Manuel Mendes
- Julia Smith
- Sandra Reisig

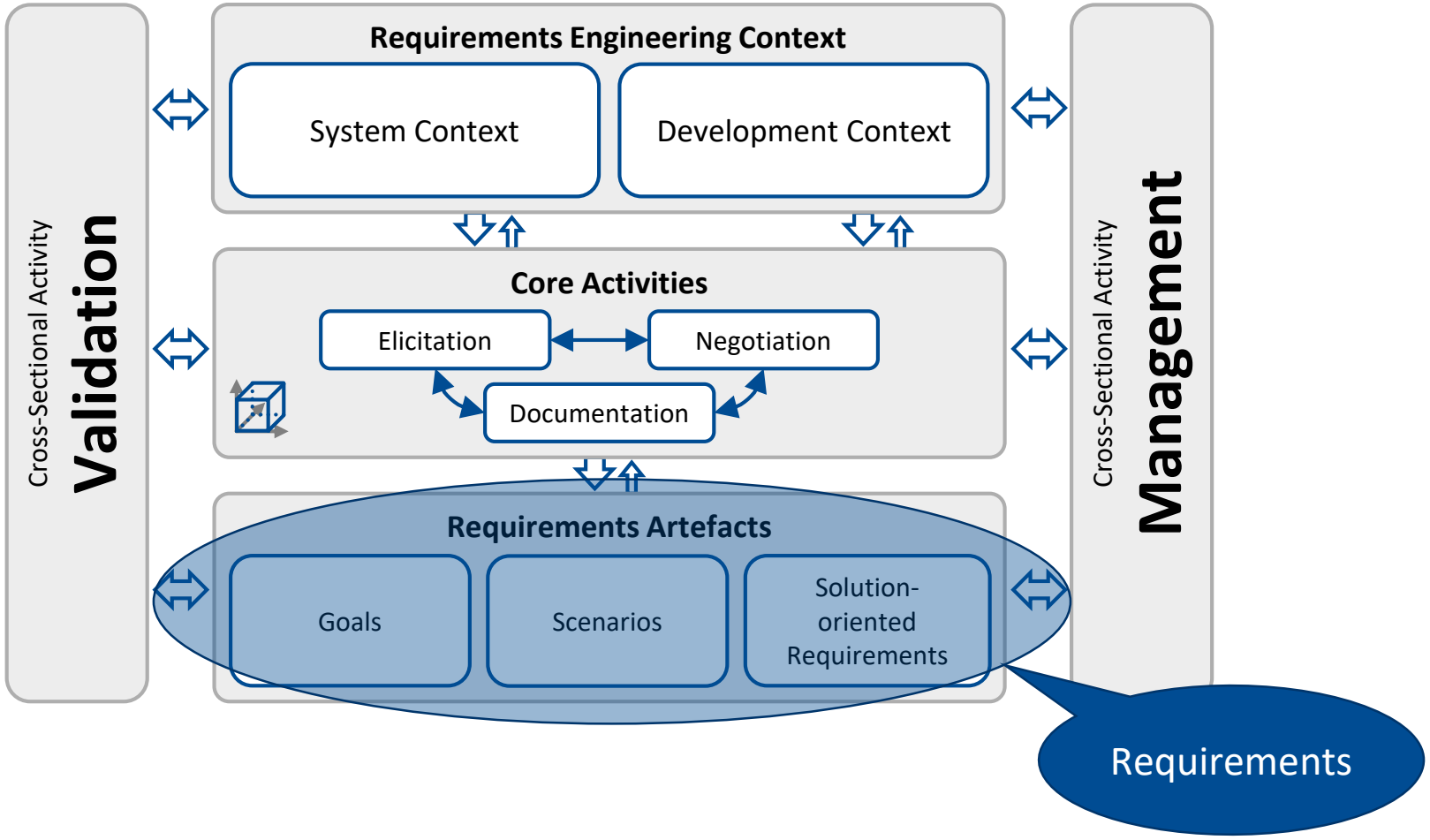
Date: 24 April 2015

1 Reviewer Comments

Nr.	Req.-ID	Defect	Importance (High / Medium / Low)
1	R-12.1	Inconsistent with R-22.1. Booking portal is InterCars not EuroCars.	High
2	R-15.7	Incomplete set of interfaces to external providers..	Medium
3	R-22.4	Requirement text is ambiguous. Bank is not defined in glossary.	Low
4	R-24.12	Requirement does not fit into workflow for booking rental cars..	High
5	R-26.2	Requirement seems not to be complete. What happens if no rental car is available?	Medium
6			
7			
8			
9			
10			

4. Documentation of Requirements

Requirements Artefacts



Documented Requirement (1)

D A **documented requirements** is an explicitly **recorded requirements artefact**.

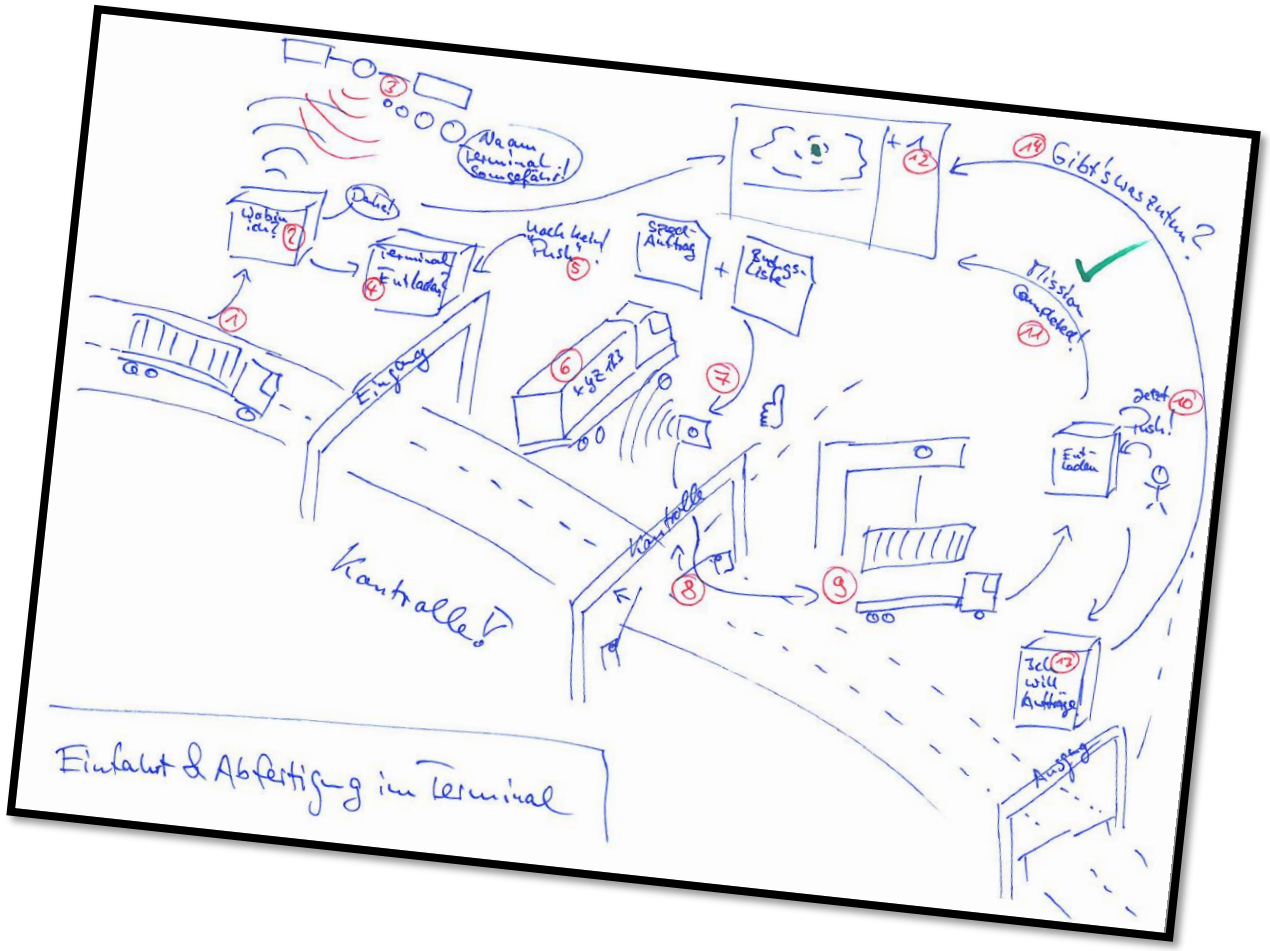
- A requirements artefact can be recorded
  - using **any kind of representation format** including sketches, drawings, natural language, formal models.
  - at **any level of detail (content)** and in **any kind of structure**.
  - in **any kind of quality**, e.g., the documented requirement may be consistent or not, completely documented or not.
- A requirement is **documented for a given purpose** and is typically **part of a document**. The documentation of the requirement should thus be supported by **documentation guidelines** defined for the document or the requirement itself (if such guidelines exist).

Documented Requirement (2)

E

Scenario sketch

of a creativity session



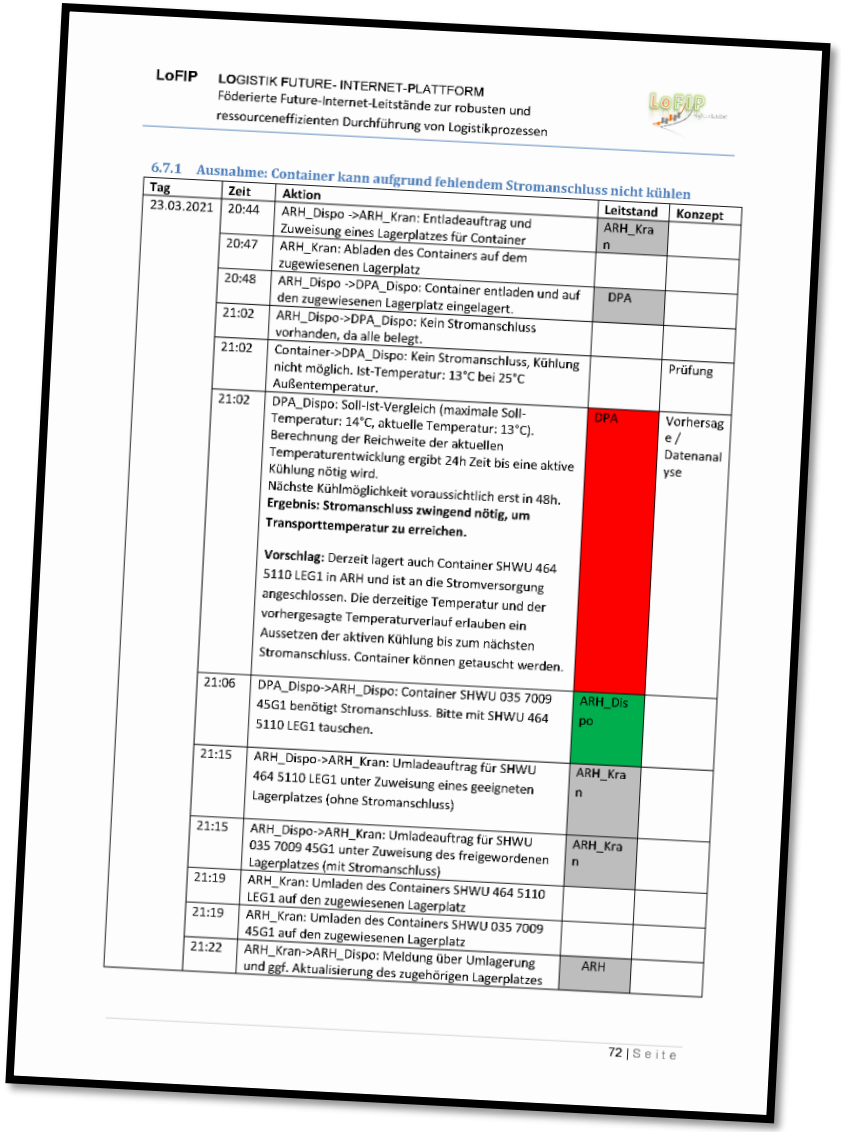
Documented Requirement (3)

Textual solution-oriented requirement for structured documentation of interview results

Identifier	R-S-33-8
Name	Recommendation for rental car after booking
Author	Matthias Gerdes
Version	V3
Sources	Ms. Reisig, Mr. Meier, TBD (incomplete)
Short description	Recommendation of rental cars provided by InterCars.
Requirement	After booking a flight or holiday package the booking system shall display a selection of available rental cars provided by InterCars. The rental cars shown shall be available at the destination point during the whole time of the travel. Each rental car shall be described by displaying category, type, price per day . Additionally a picture of a car in the car category should be shown.

Documented Requirement (4)

Textual interaction scenario for communication between team members



LoFIP LOGISTIK FUTURE- INTERNET-PLATTFORM
Föderierte Future-Internet-Leitstände zur robusten und ressourceneffizienten Durchführung von Logistikprozessen

6.7.1 Ausnahme: Container kann aufgrund fehlendem Stromanschluss nicht kühlen

Tag	Zeit	Aktion	Leitstand	Konzept
23.03.2021	20:44	ARH_Dispo ->ARH_Kran: Entladeauftrag und Zuweisung eines Lagerplatzes für Container	ARH_Kran	
	20:47	ARH_Kran: Abladen des Containers auf dem zugewiesenen Lagerplatz		
	20:48	ARH_Dispo ->DPA_Dispo: Container entladen und auf den zugewiesenen Lagerplatz eingelagert.	DPA	
	21:02	ARH_Dispo->DPA_Dispo: Kein Stromanschluss vorhanden, da alle belegt.		
	21:02	Container->DPA_Dispo: Kein Stromanschluss, Kühlung nicht möglich. Ist-Temperatur: 13°C bei 25°C Außentemperatur.		Prüfung
	21:02	DPA_Dispo: Soll-Ist-Vergleich (maximale Soll-Temperatur: 14°C, aktuelle Temperatur: 13°C). Berechnung der Reichweite der aktuellen Temperaturentwicklung ergibt 24h Zeit bis eine aktive Kühlung nötig wird. Nächste Kühlmöglichkeit voraussichtlich erst in 48h. **Ergebnis: Stromanschluss zwingend nötig, um Transporttemperatur zu erreichen.** **Vorschlag:** Derzeit lagert auch Container SHWU 464 5110 LEG1 in ARH und ist an die Stromversorgung angeschlossen. Die derzeitige Temperatur und der vorhergesagte Temperaturverlauf erlauben ein Aussetzen der aktiven Kühlung bis zum nächsten Stromanschluss. Container können getauscht werden.	DPA	Vorhersage / Datenanalyse
	21:06	DPA_Dispo->ARH_Dispo: Container SHWU 035 7009 45G1 benötigt Stromanschluss. Bitte mit SHWU 464 5110 LEG1 tauschen.	ARH_Dispo	
	21:15	ARH_Dispo->ARH_Kran: Umladeauftrag für SHWU 464 5110 LEG1 unter Zuweisung eines geeigneten Lagerplatzes (ohne Stromanschluss)	ARH_Kran	
	21:15	ARH_Dispo->ARH_Kran: Umladeauftrag für SHWU 035 7009 45G1 unter Zuweisung des freigewordenen Lagerplatzes (mit Stromanschluss)	ARH_Kran	
	21:19	ARH_Kran: Umladen des Containers SHWU 464 5110 LEG1 auf den zugewiesenen Lagerplatz		
	21:19	ARH_Kran: Umladen des Containers SHWU 035 7009 45G1 auf den zugewiesenen Lagerplatz		
	21:22	ARH_Kran->ARH_Dispo: Meldung über Umlagerung und ggf. Aktualisierung des zugehörigen Lagerplatzes	ARH	

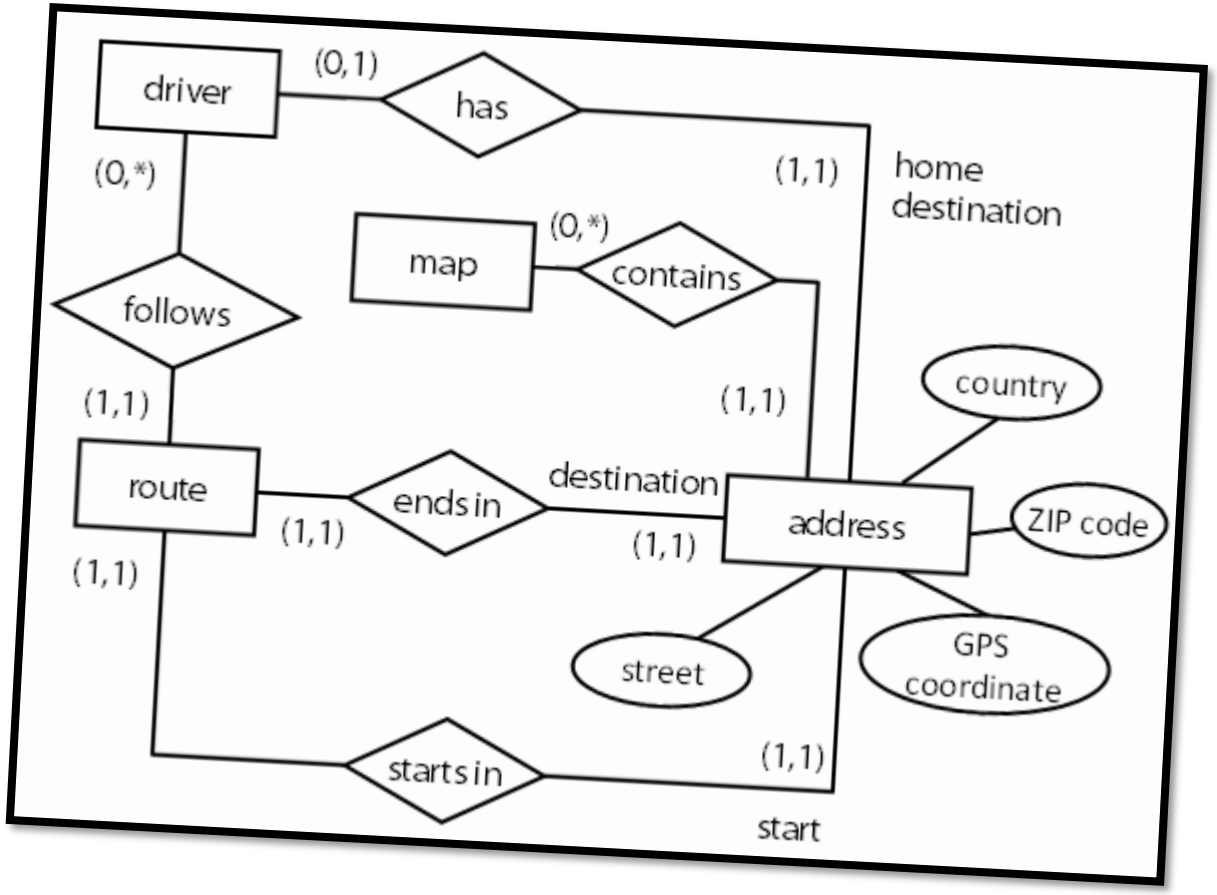
72 | Seite

[Schmidt 2013]

Documented Requirement (5)

E

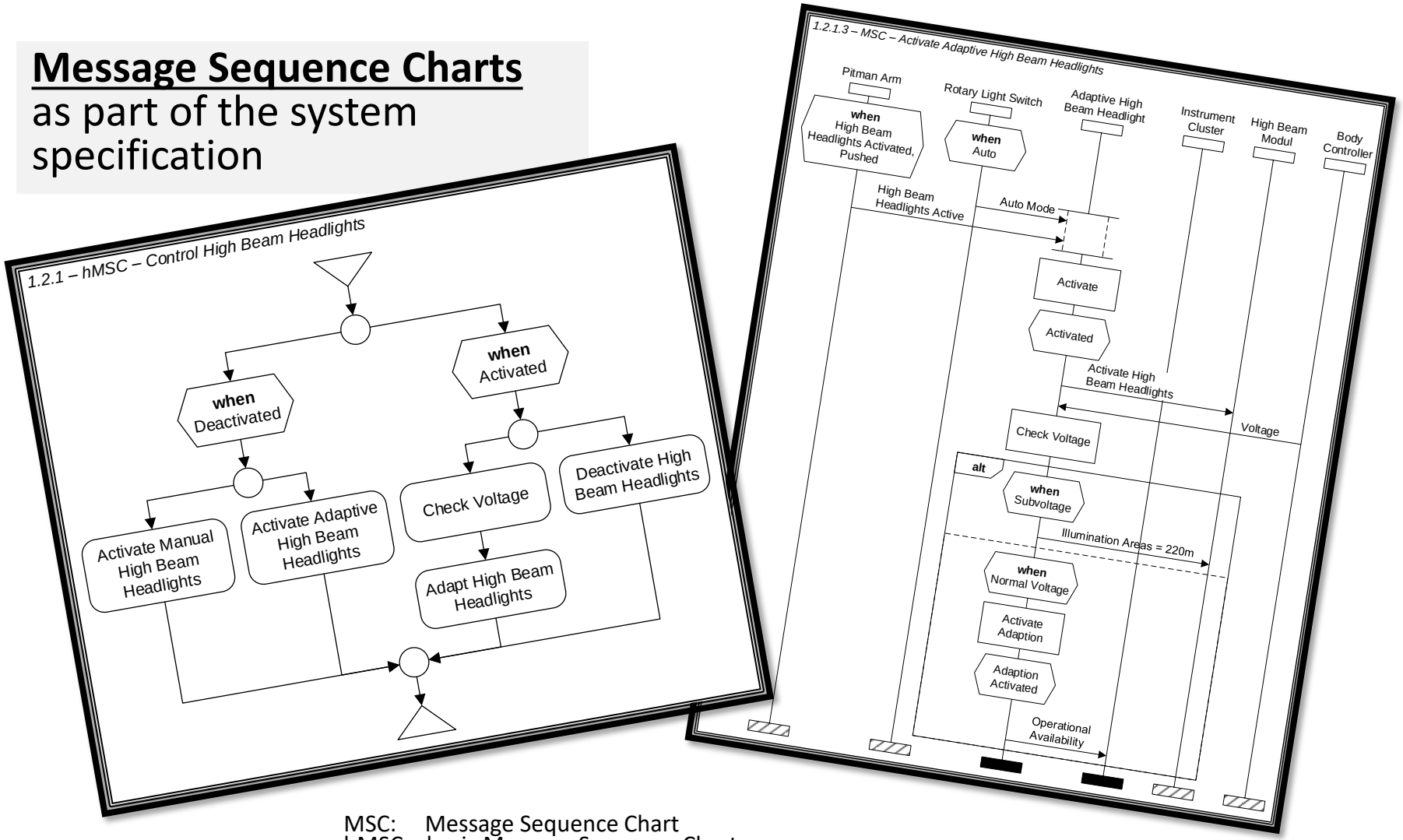
Entity Relationship diagram specifying data types and their relationships



Documented Requirement (6)

E

Message Sequence Charts
as part of the system specification



MSC: Message Sequence Chart
bMSC: basic Message Sequence Chart
hMSC: high-level Message Sequence Chart

[Föcker et al. 2015]

5. Documentation Guidelines

Definition

D Documentation guidelines **support** the **creation of a documents and/or the documentation of a specific information** in terms of:

1. documenting the **required content** in the **desired structure**.
2. **use** of appropriate **representation formats**.
3. **fulfilling** the **quality criteria**.

Documentation guidelines

- are **document specific**.
- are defined based on the **content**, **format** and **quality** required for a given purpose.
- should be **easy to understand** and **easy to apply**.
- shall be **known at least by all requirements engineers**.

Scope of Documentation Guidelines

Documentation guidelines can be defined **for**

- a **whole document**, e.g. a requirements specification.
- a **specific information** to be documented, e.g. decision, requirement, stakeholder opinions.

Documentation of textual requirements for validation

Guidelines for whole document:

- Document all requirements marked as to be included in the next system release (to achieve completeness for the release).
- Pre-check for contradictions between the requirements (to achieve consistency).

Guidelines for specific information:

- Use template no. 245-A to document each individual requirement (to ensure you don't forget to document important attributes/information).
- If an attribute is not known yet, mark it clearly as TBD (to make the gaps clearly visible).

Documentation Templates (1)

- Templates facilitate **structured documentation** of information based on predefined slots (attribute types) and predefined values for the attribute types (attributes).
- Templates are typically organized in **tabular format**.
- Templates can be define for specific types of information including requirements types.
- Templates can obviously **differ in the content** (in terms of attributes types and predefined attribute values for the attribute types).
- **Advantages of using templates**:
  - Definition which information has to be recorded
  - Structured documentation of information
  - Documentation gaps are easy to detect (empty slots)
  - Same type of information is documented at the same place
  - Supports comparison of information
  - Differentiation between mandatory and optional information

Attribution see lecture "Documentation II"

Documentation Templates (2)

Excerpt of a Requirements Template

Identifier	SR-L-<number>
Name	<name of the requirement>
Author(s)	<name of Author(s)>
Version	<number of version>
Change history	<version>, <date>: <change description>
Source(s)	<name of source> (<source's function>)
Responsible person	<name of person> (<person's function>)
System release	<version>, <date>
Validation status	unchecked | under examination | partially checked | checked | in revision | released
Stability	stable | probably stable | volatile
Priority	high | medium | low
Short description	<short text>
Requirement	<text for requirement>
Quality requirements	<identifier> <category>
Additional trace links	<identifier> <name>, <relationship>

Documentation Guidelines for Content

- Guidelines for content determine the **content required** for documenting a specific information and **the structure** of this content.
- **Guidelines concerning** the **structure** support the organization of the information in, e.g. terms of:
  - Chapters
  - Sections
  - Order of content
- **Guidelines concerning** the **content** support the documentation of the information in terms of, e.g.:
  - Level of detail
  - Abstraction layers
  - System perspective

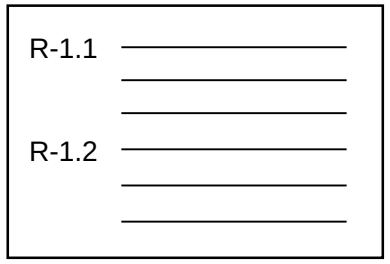
Documentation Guidelines for Content

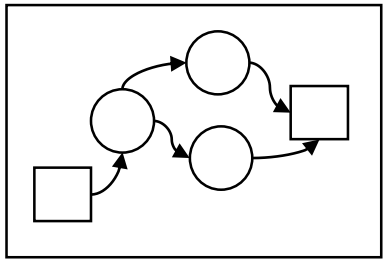
Guidelines for	Purpose: Input for management review	Purpose: Specification
Single information	For each requirement of the next release marked with low or medium criticality only document the identifier, name, author, sources and requirements text. (provide the minimum necessary information for validation)	Document each requirement with all attributes defined in document ATTR-1255. (do not miss any important information)
Whole document	Describe the content on not more than 4 pages. (ensure all information can be processed at the meeting)	Document the system according to the hierarchies defined in document D-H-334. (ensure all required details are documented)

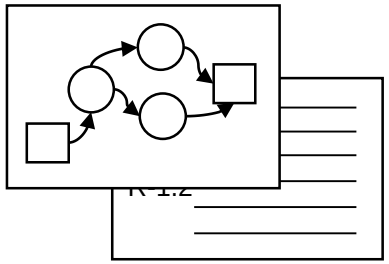
Documentation Guidelines for Format

- Define the **representation format** to be used to document information
- Are chosen based on the purpose of the documentation, e.g., the stakeholders, validation, contracting, etc.

Textual, e.g.:	**Model-based**	**Combined**
• Natural language text • Structured text • Templates	• Data-perspective e.g. EER diagrams • Behaviour-perspective e.g. UML 2.0 Statecharts • Functional-perspective e.g. DFDs	• Conceptual models with annotations • Text with models







Documentation Guidelines for Format

Guidelines for	Purpose: Input for management review	Purpose: Specification
Single information	For each functional requirement define a narrative scenario describing the intended way of achieving the goals associated with the function. (support comprehension of functions by management)	Document each scenario using Message Sequence Charts (MSC) notation. (use formal documentation formats to facilitate automation and verifications in succeeding development activities)
Whole document	Use English language in active voice. (understandability by a multi-national management team)	Annotate the model with decisions and rationales in English. (support design decisions by providing key arguments about important requirements decisions).

Documentation Guidelines for Quality

(1) Guidelines for the **quality of the content**, e.g.
- completeness,
- consistency and
- correctness of the documented information.

(2) Guidelines for the **quality** of the **representation formats**.
- correct usage of the modelling syntax.
- usage of syntactical patterns.

…

Documentation Guidelines for Quality

Guidelines for	Purpose: Input for management review	Purpose: Specification
Single information	If you are unsure if there is a dis-agreement about a requirement, tag the requirement as “potential disagreement”. (indicate to management potential conflicts)	Check the documentation of each requirement for consistency. (ensure consistency for each requirement)
Whole document	Check the correct use of the syntax of the use case diagram. (ensure the management is not distracted by syntactical errors)	Use the XYZ-modelling tool to ensure syntactical correctness. In addition, formally check the correctness of the modelled requirements. (provide software designers with consistent requirements models)

Template for Documenting Interviews

Extract of a template for documenting interview minutes

Purpose: Input for documentation of requirements

Content

- Document interview minutes using the predefined template (see right). Mark unfilled slots with “TBD” (to be defined) or “not applicable” to clearly indicate documentation gaps
  (ensure all important information of an interview is captured).

Format

- The interview minutes shall be documented in English (project-wide use of a common language).

Quality

- Interviewee shall approve the interview minutes (ensure stakeholders agree to the documented information).

Identifier	INT-<number>
Date	<date>
Goal of the interview	<goal in one sentence>
Inter-viewer	<name of the interviewer>
Inter-viewee(s)	<name of the interviewee> (<function>, <organization>)
Notes	Notes in bullet points

6. Requirements Documentation vs. Specification

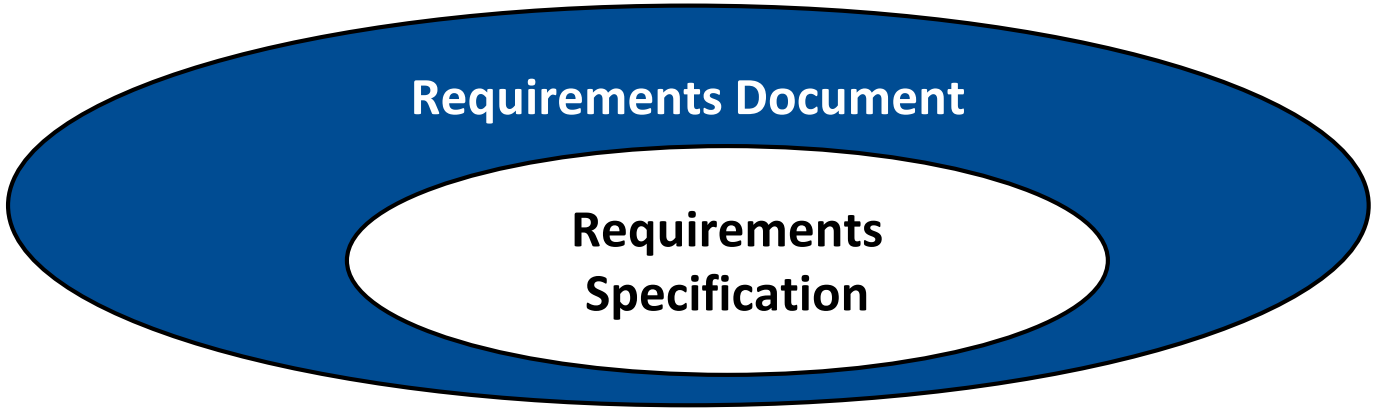
Requirements Document

D A **requirements document** contains a set of **documented requirements** and **additional information** defined for a specific system.

Requirements documents can **vary** in terms of **content, format and quality** to **serve different purposes**.

Requirements Specification

D A **requirements specification** is a specific kind of requirements document which **supports later development activities** and/or is used for **contracts**. It **contains specified requirements** and **additional information**.



Every requirements specification is a requirements document.

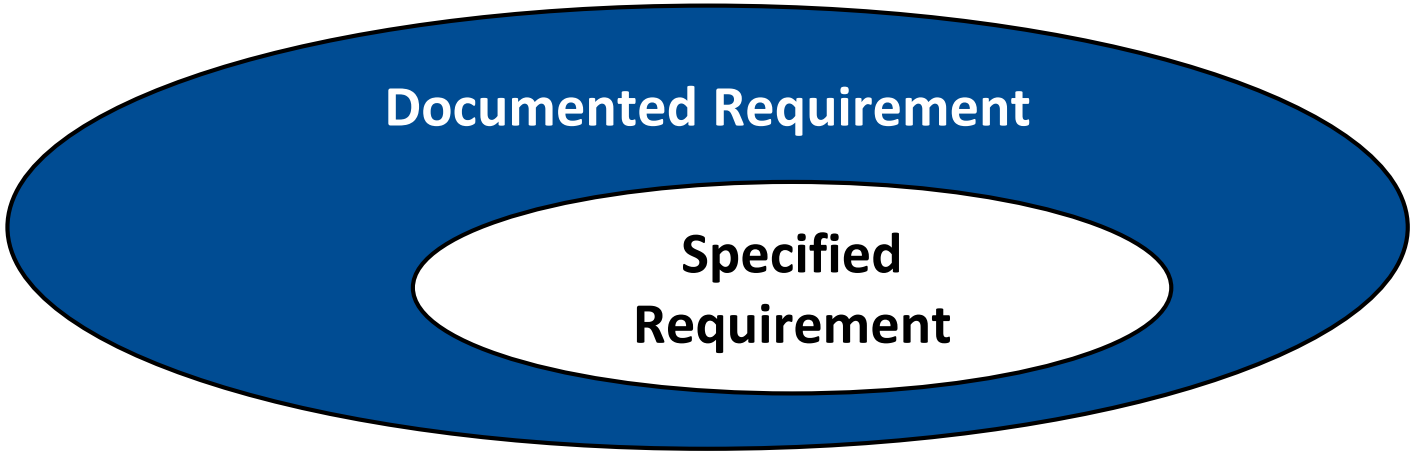
Requirements Documents vs. Requirements Specification (Documents)

- A **requirements specification document** typically requires **more strict documentation** of requirements as well as of additional information (compared with other documents used in RE).
- Typically, a specification document demands:
  - **Content**:
    - Only **requirements selected for the system** (release) are included.
    - The requirements are documented in **sufficient detail** (more detail than in most other documents).
    - Each requirement should be **fully specified**, i.e. **no information should be missing**.
  - **Format**:
    - Typically, more **formal representation** formats are used to facilitate (partial) automation and tool support in later development stages.
  - **Quality**:
    - More **rigorous quality** of both, the **overall document** and the **documented requirements**.

See lecture "Documentation II"

Specified Requirement

D A specified requirement is a requirement **specified (documented) according to the specification guidelines**.



Every specified requirement is a documented requirement.

Specification Guidelines

- Specification guidelines are **defined** similar to documentation guidelines:
  - **Content**, **format** and **quality**
  - For a **specific requirement** or a whole **requirements specification document**
  - Based on a given **purpose**
- Specification guidelines are typically
  - **more specific and strict** than documentation guidelines in terms of content, format and quality.
  - aligned with documentation guidelines.
- A requirement is typically **first documented** and **then specified**.
- Documentation guidelines and specification guidelines should thus be aligned. If possible they should not contradict each other.

Requirements Specification Documents (1)

Purpose: Specification for System Design

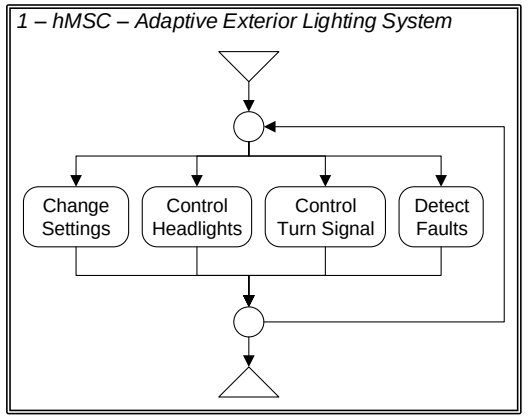
The document should serve as input for software design. It should describe interactions of desired system components as basis for developing the components. The requirements included in the document should be complete, sufficiently agreed and well specified.

For this purpose, the document should, among others, include:

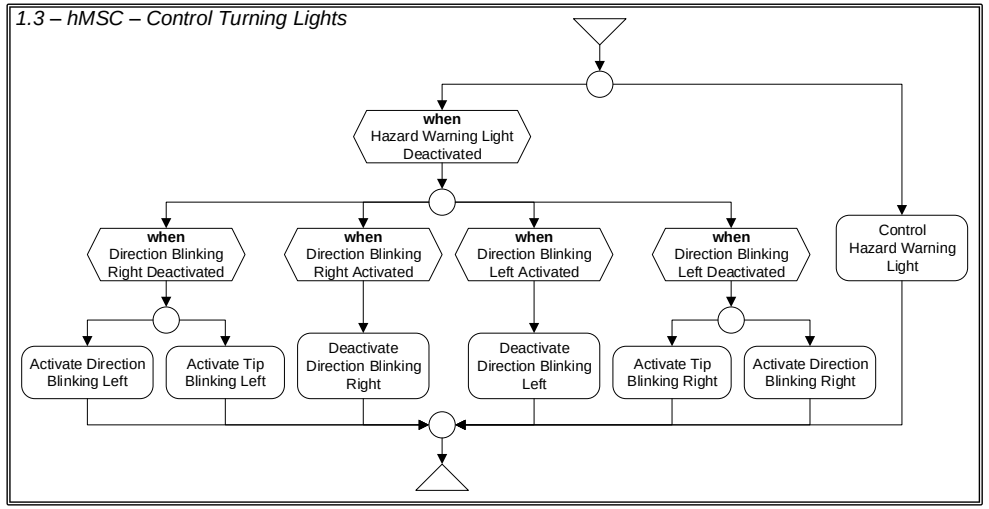
Content	Format	Quality (for content & format)
• System as white box • Detailed interactions • Different abstraction layers • …	• Formally defined modelling language • Scenarios (MSCs) • …	• Consistency • Completeness • …

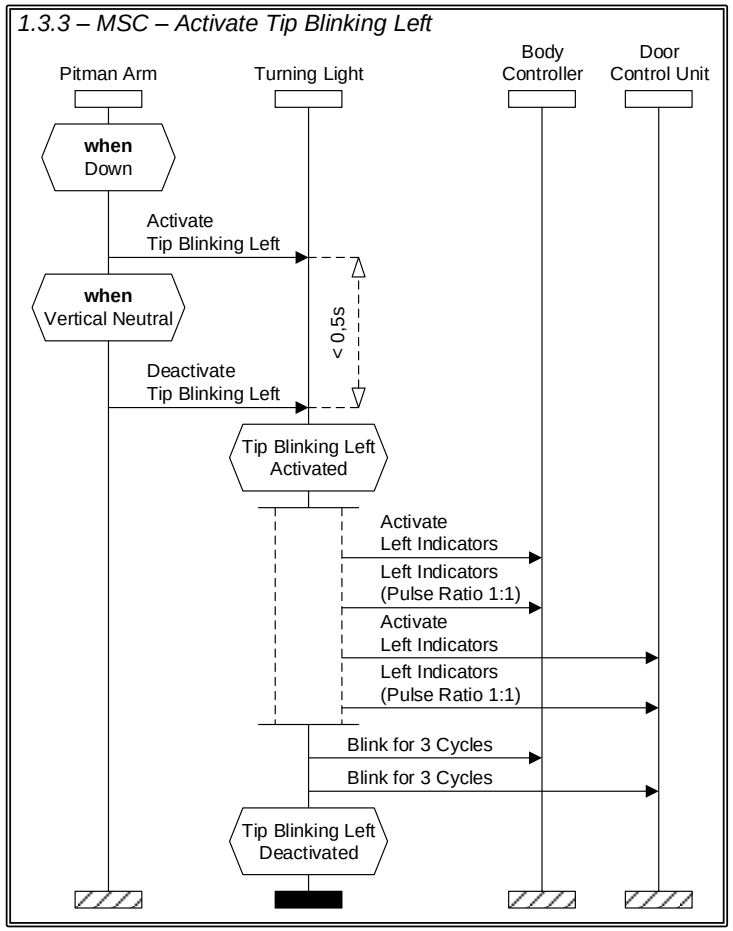
Requirements Specification Documents (2)

Automotive Light Controller: Direction Blinking (excerpt)



Message Sequence Charts are part of lecture "Scenarios III"





MSC: Message Sequence Chart
bMSC: basic Message Sequence Chart
hMSC: high-level Message Sequence Chart

All icons from [1]. [Föcker et al. 2015]

Requirements Specification Documents (3)

E

Document properties fulfil the desired purpose by:

	Content	Format	Quality
bMSCs describe system as white box.	X		
MSC notation facilitate the specification of detailed interactions between components.	X		
MSC notation supports abstraction using bMSCs and hMSCs.	X		
MSCs are formally defined.		X	
Document describes scenarios.		X	
Document is consistent and complete.			X

MSC: Message Sequence Chart
bMSC: basic Message Sequence Chart
hMSC: high-level Message Sequence Chart

Summary

- Documenting in requirements engineering is crucial, e.g. for making information persistent and laying the foundation for subsequent development.
- We differentiate between the documentation of requirements and additional information.
- Documents always serve a specific purpose. Therefore they differ in content, format and quality.
- Documented information are typically required as input for other development activities as well as other RE activities.
- Documentation guidelines and templates:
  - support documenting the required content, using the defined representation format in the required quality.
  - are typically project and/or system specific.
- A requirement specification is a specific requirements document. It is documented according to stricter specification guidelines and has the purpose to support succeeding development activities and/or contractual agreements.

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Literature for Further Reading

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Image References

[1] Licensed by http://www.iconshock.com/

[2] Provided by Microsoft Office

Legend

Definition

Example

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Vielen Dank für Ihre Aufmerksamkeit

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