UNIVERSITÄT DUISBURG ESSEN

Offen im Denken

Requirements Engineering & Management

Framework for Requirements Engineering

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Agenda

1. Motivation, Goals & Overview
2. Requirements Engineering Context
3. Core Activities
4. Requirements Artefacts
5. Cross-Sectional Activities

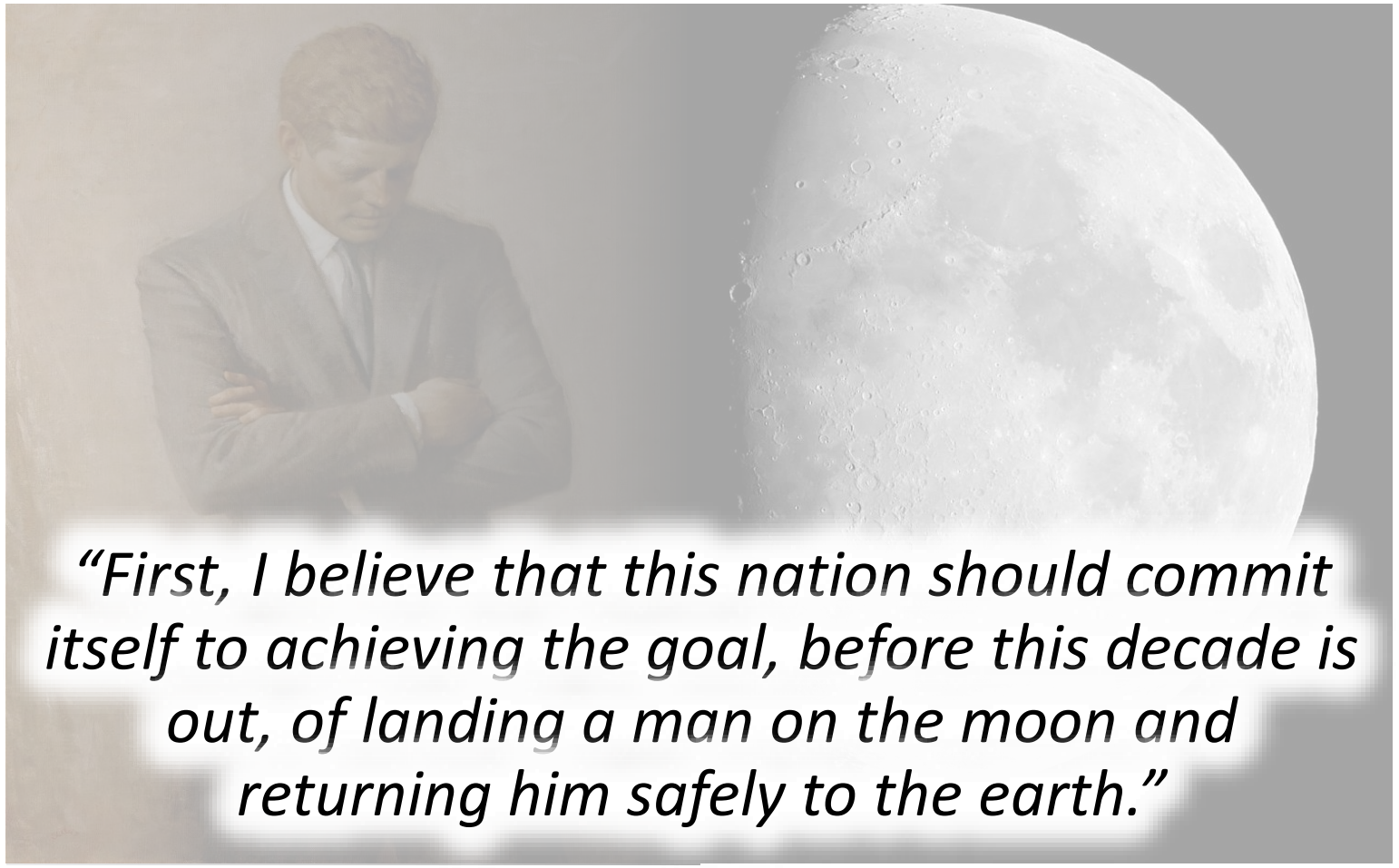
1. Motivation, Goals & Overview

The “Vision”

Idea/wish to **change** the current reality!

Icons from [1]

The “Vision” - Example



Vision of J.F. Kennedy in 1961

[Dudley 2000]

Pictures from [2, 3]

Example of a (System-)Vision

"First, I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon ~~and returning him safely to the earth~~."

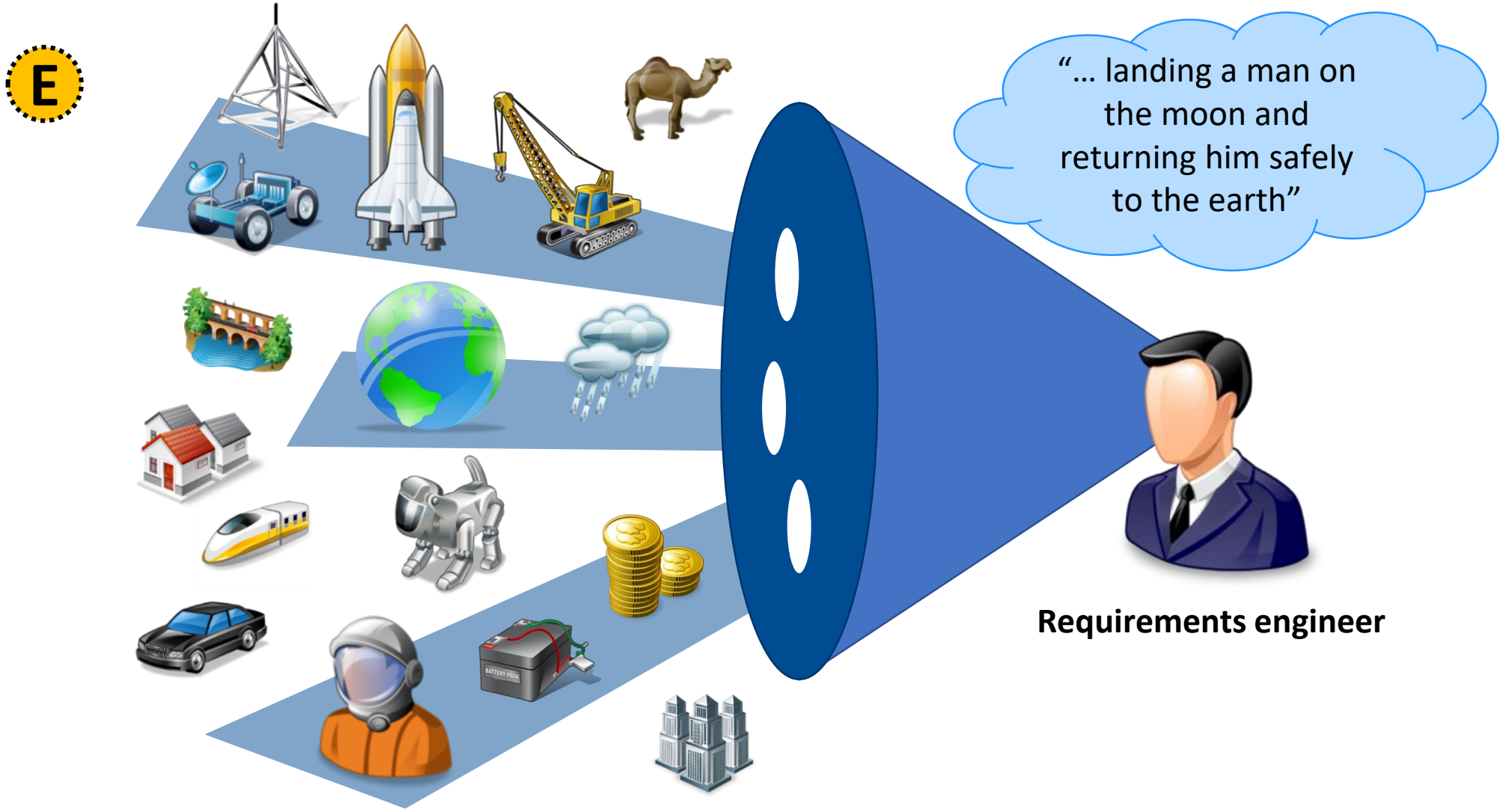
Small changes to the vision might have huge impact on the requirements and the way the system is being build!

Vision of J.F. Kennedy in 1961 [Dudley 2000]

Vision

- Defines an intended (small or large) **change** to a current reality.
- Is typically **brief and precise**.
- Guides the **definition of requirements**.
- Guides the **development of the system**.
- States a goal (**“What?”**),
  not how to achieve it (**“How?”**).
- Is the basis for making **decisions**.
- Justifies **expenses**.

Vision as Focus



All icons from [1]

Establishing a Vision in Context (1)

- Each **system is embedded** in a specific context.
- The **requirements sources** to be considered, depend on the context
- The context strongly **influences the definition and refinement** of requirements.
- **Adequate consideration** of the context **is** thus **essential** for requirements engineering and system development.
- The context is (typically) **not fully known/understood**.

Establishing a Vision in Context (2)

E

Vision: "The system shall stop from a speed of 50 km/h within 10 meters."



The **realization** of this "vision" **differs largely** in each of the above **contexts**.

In some contexts the vision can hardly be realised, e.g., for trains or ships.

All icons from [1]

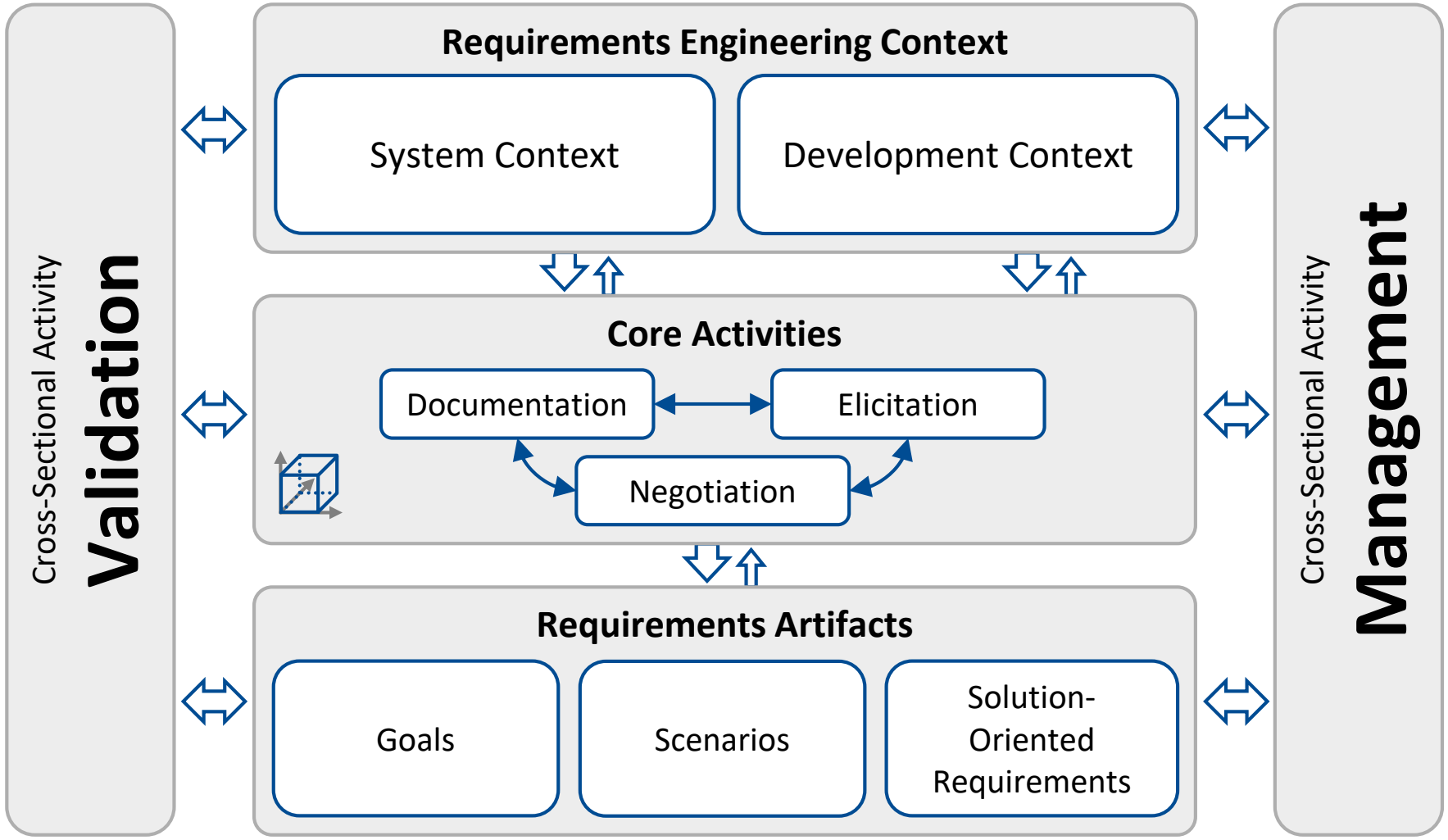
Motivation for the Framework

- Structuring requirements engineering by defining a set of **core activities and concepts** relevant for **every requirements engineering process**.
- **Reference** structure for **teaching** requirements engineering.
- **Reference** structure for industry
  - **Training** of managers, requirements engineers and developers.
  - **Analysis of strength and weaknesses** of RE processes.

...

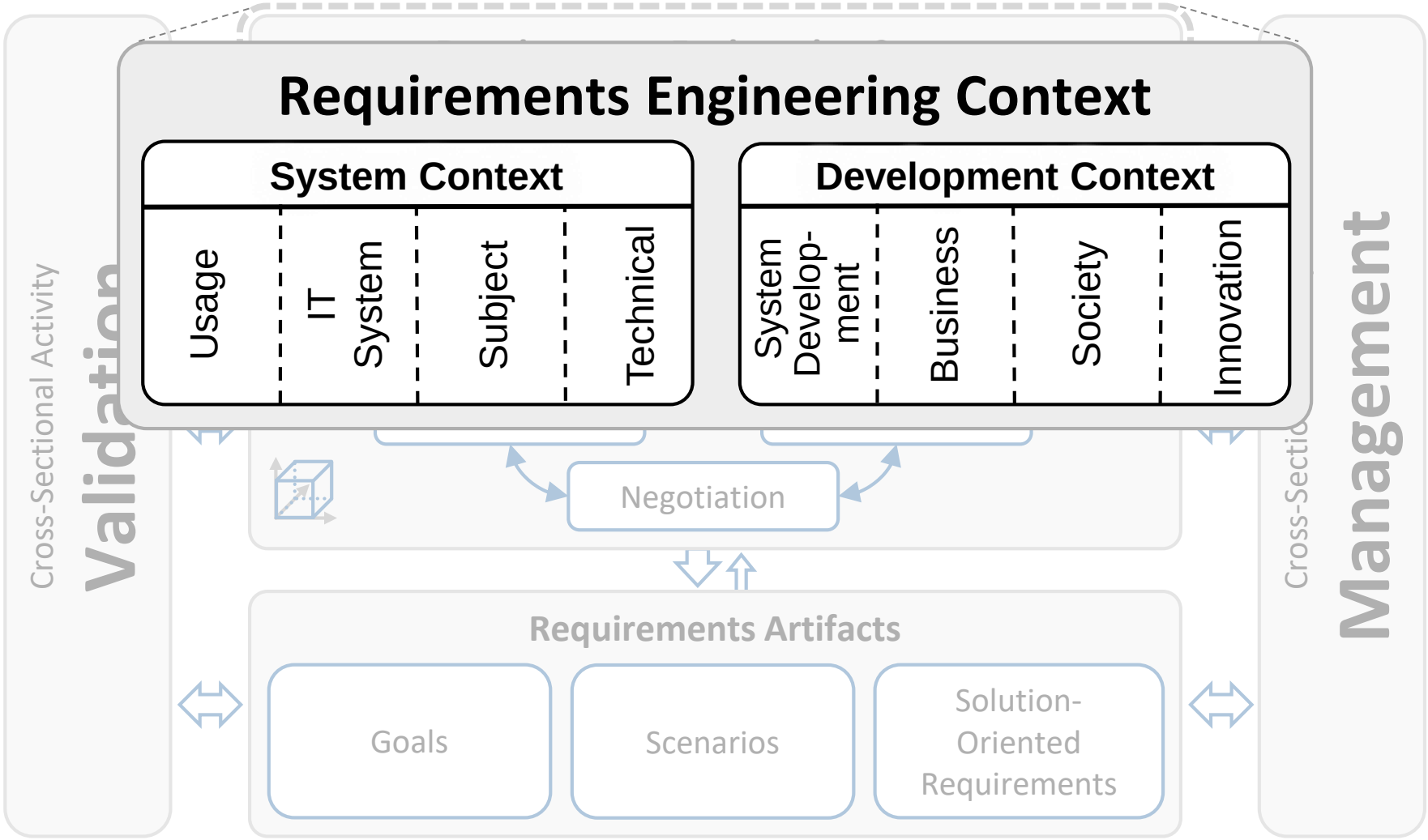
Used by many companies, organisation and universities

Framework for Requirements Engineering



2. Requirements Engineering Context

Framework for Requirements Engineering



Structure of the Requirements Engineering Context

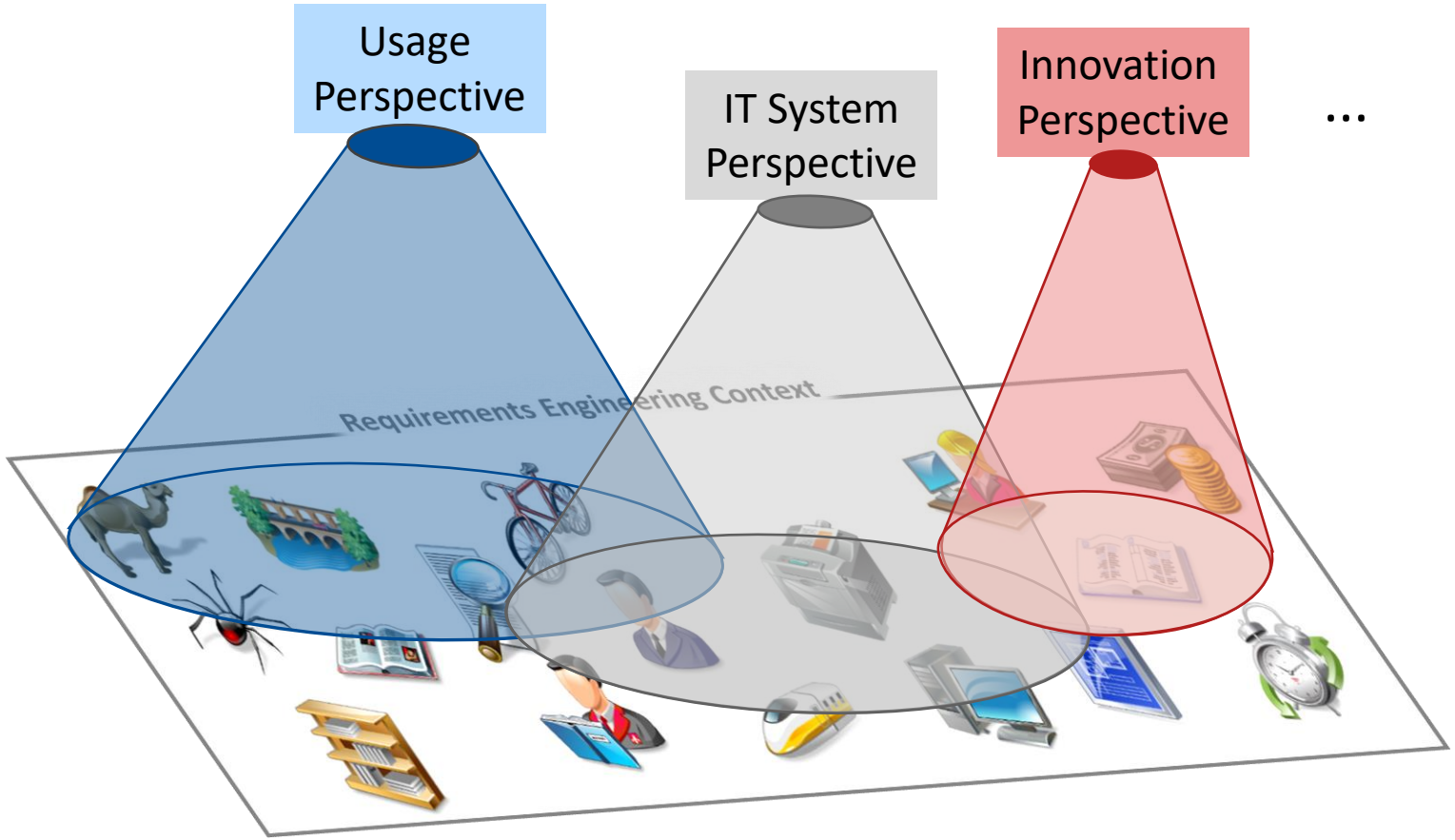
The requirements engineering context consists of:

(1) **The system context:**
Subsumes the part of the context in which the system will be operating/embedded.

(2) **The development context**:
Subsumes all the part of the context in which the system is being developed.

Context Perspectives (1)

- There are **different, relevant perspectives** for the System Context and Development Context



All icons from [1]

Context Perspectives (2)

Perspectives of the system context:

- **Subject** perspective
- **Usage** perspective
- **IT system** perspective
- **Technical** perspective

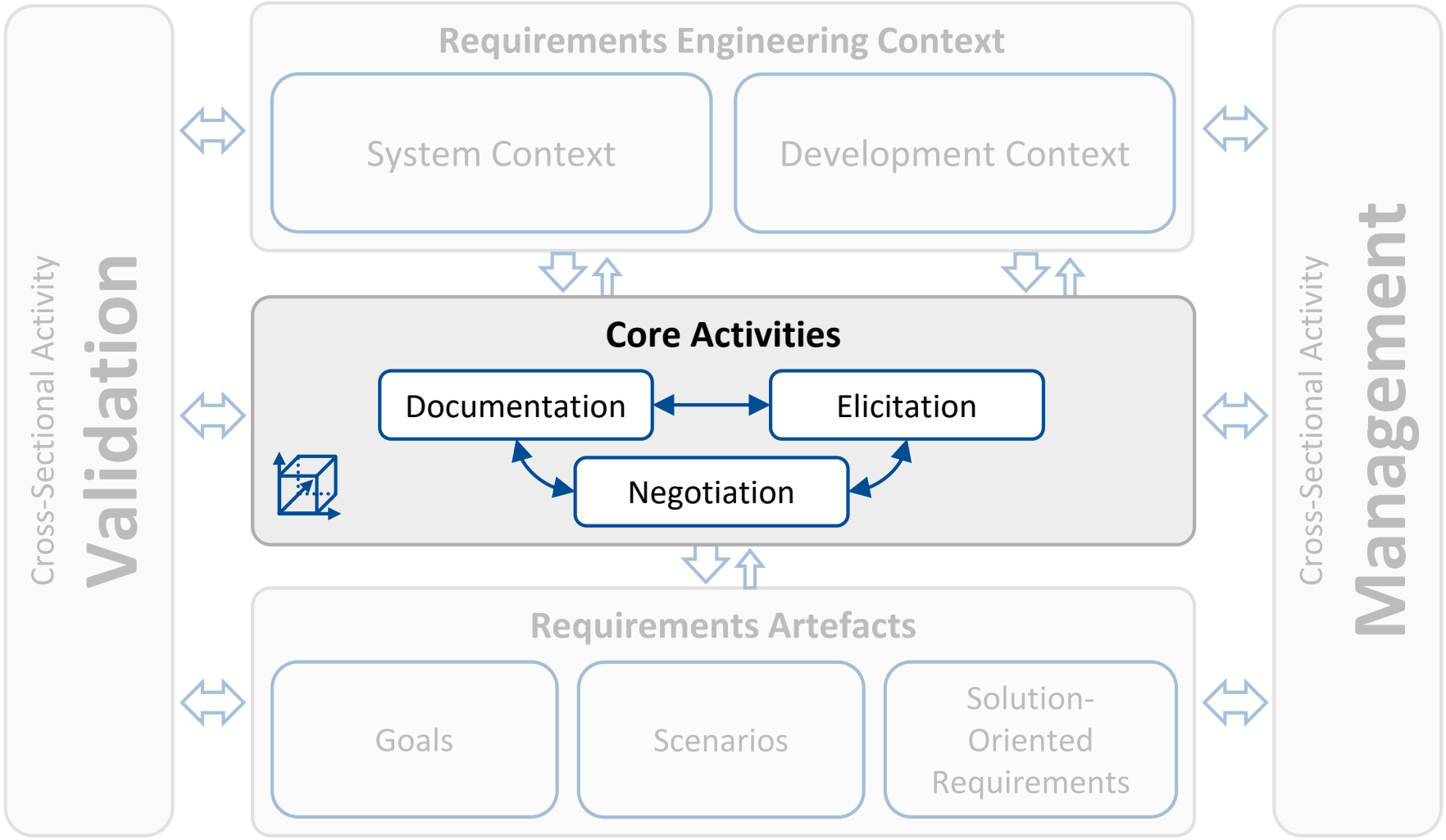
Perspectives of the development context:

- **System development** perspective
- **Business** perspective
- **Society** perspective
- **Innovation** perspective

More details in lectures on Context!

3. Core Activities

Framework for Requirements Engineering



Elicitation

D The goal of the elicitation activity is to:

(1) **Identify** relevant **requirements sources**.

(2) Elicit **existing requirements** from the identified sources.

(3) Develop **new and innovative requirements**.

- Requirements sources are **typically not known** at the beginning of the requirements engineering process!
- Requirements sources are **context objects** and have to be identified through systematic **context consideration**.

Progress in content dimension!

Negotiation

D The goal of the negotiation activity is to:

(1) **Identify conflicts**.
(2) **Analyse** the cause of each conflict.
(3) **Resolve** the conflicts by means of appropriate strategies.
(4) **Document** conflict resolution and their rationale.

- **Wishes and needs** of the stakeholders, as well as their **understanding of the context** typically **differ** and **can be in conflict**.
- **Conflicts** should be **identified** and be **resolved.**

Progress in agreement dimension!

Documentation

D The goal of the documentation activity is to:

(1) **Document** relevant **requirements and context information** according to the defined documentation guidelines.

(2) **Specify requirements** according to the defined specification guidelines.

(3) Choose **documentation formats** and notations, according to the indented use of the document and the **stakeholder needs**.

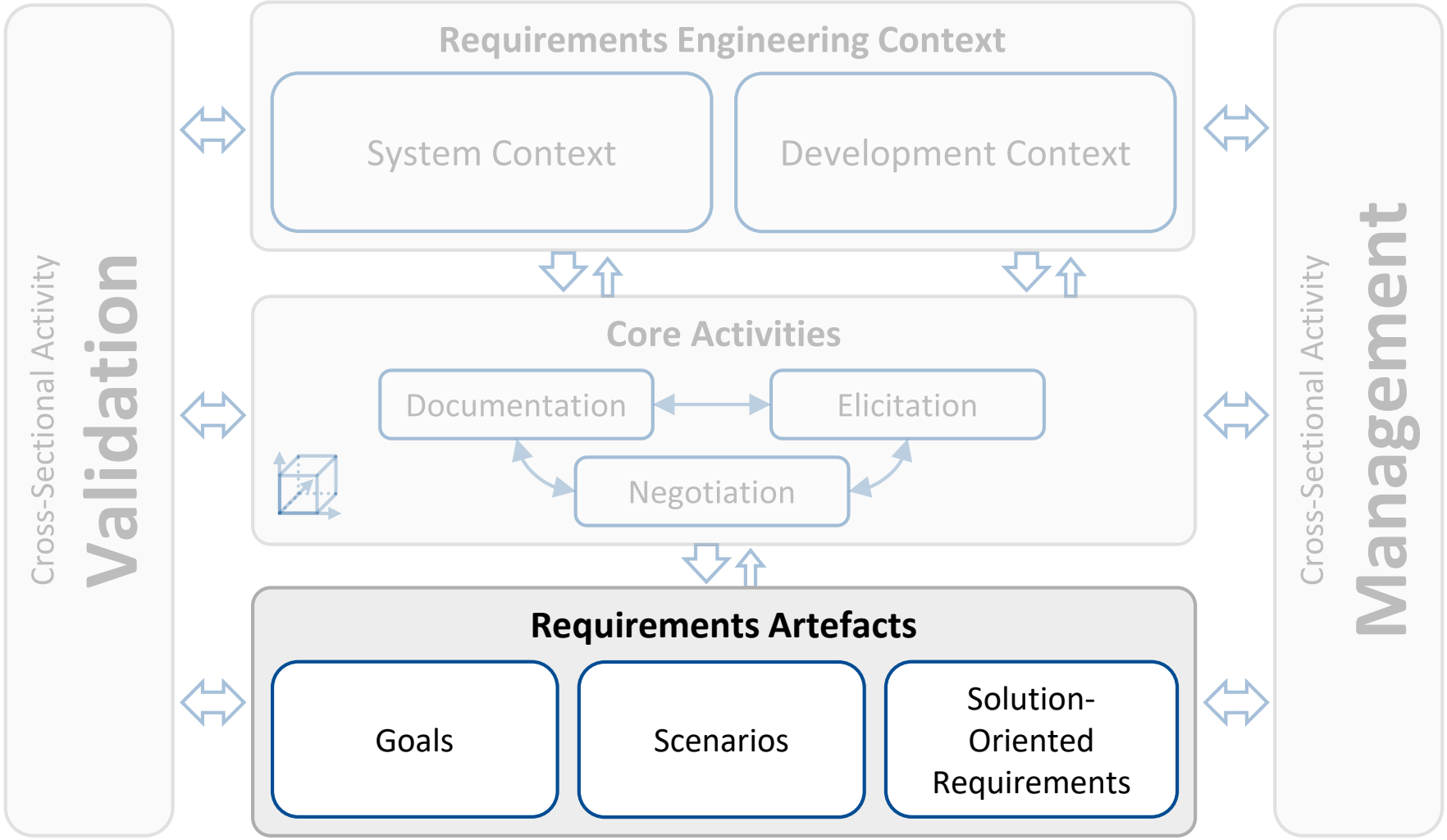
(4) Ensure **consistency between different documentations** used.

- Requirements as well as **information about the context** should be documented.
- Early in requirements engineering, information is often **unstructured** and documented **informally**, i.e. **not compliant** with the documentation and specification **guidelines/rules**.

Progress in documentation dimension!

4. Requirements Artefacts

Framework for Requirements Engineering



Goals (1)

D A goal describes a **high level objective** of one or more stakeholders **about a property** of the **system to be developed** or the **development project**.

Characteristics of a goal:

- Expresses **stakeholders' intentions**
- **Refines the system vision** into more detailed objectives to be fulfilled by the system.
- Should be **solution free**

Goals (2)

Scenarios (1)

D A scenario describes a **concrete example** of system usage (satisfying or failing to satisfy a goal/set of goals).

Characteristics of a scenario:

- Documents a concrete **example of system usage**.
- Increases the **comprehensibility** of **goals**.
- Puts **requirements into their context**.
- Typically defines a **sequence of interaction steps** executed to satisfy (or not satisfy) a goal/set of goals.

Scenarios (2)

Entry of destination

1. Driver selects the navigation to a desired destination by touching the touch display of the board computer.
2. Navigation system asks for the address of the destination.
3. Driver speaks the address.
4. Navigation system recognises the speech and extracts the address.
5. Navigation looks up the entered address in the road map.
6. If the entered address is found, the navigation system starts routing.

Three Types of Solution-oriented Requirements (1)

Solution-oriented requirements:

- **Specify** requirements at a level of detail **sufficient for supporting later development activities** such as design and test.
- Often imply a **conceptual/logical solution**.
- Should be **conflict-free**.
- Should be **agreed** on by all (relevant) stakeholders.
- Should be as **complete** as possible

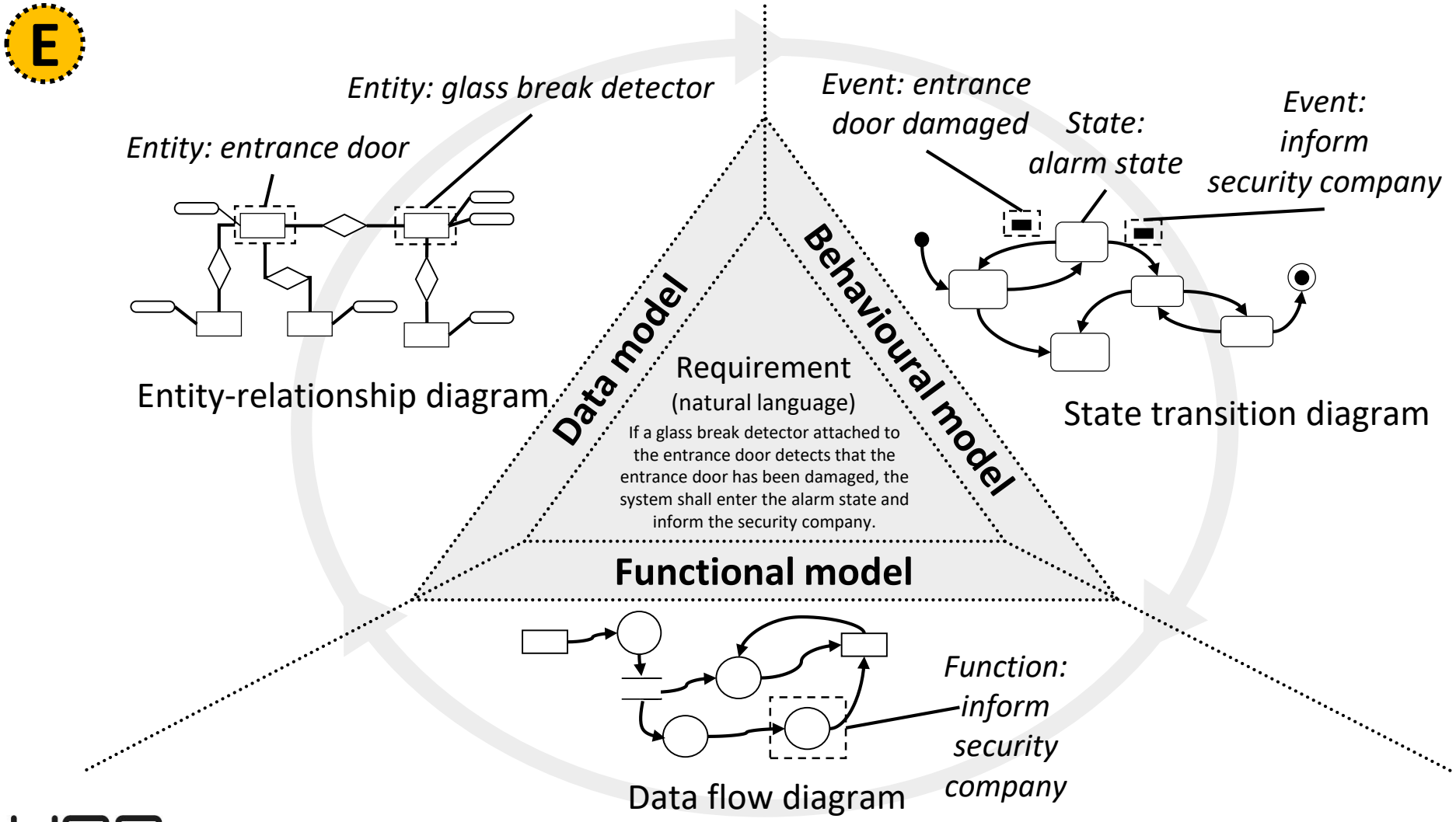
Three Types of Solution-oriented Requirements (2)

(1) **Data model**: Definition of the static data structures, including data types, attributes and relationships

(2) **Functional model**: Definition of the systems functions, including the data processing and transformation of system inputs into system outputs

(3) **Behavioural model**: Definition of the system behaviour, including reactions to external stimuli in form of permitted states, transitions and outputs

Three Types of Solution-oriented Requirements (3)



Goals, Scenarios & Solution-oriented Requirements

Goals, Scenarios and solution-oriented requirements are **used complementarily** during requirements engineering.

Interrelations:

- Developing **goals and scenarios** prior to or along with solution-oriented requirements leads to a **significant improvement of the quality** of the requirements.
- **Scenarios put requirements into context** and thus provide a basis for deriving and developing solution-oriented requirements.
- **Goals and scenarios support mutal understanding and learning!**

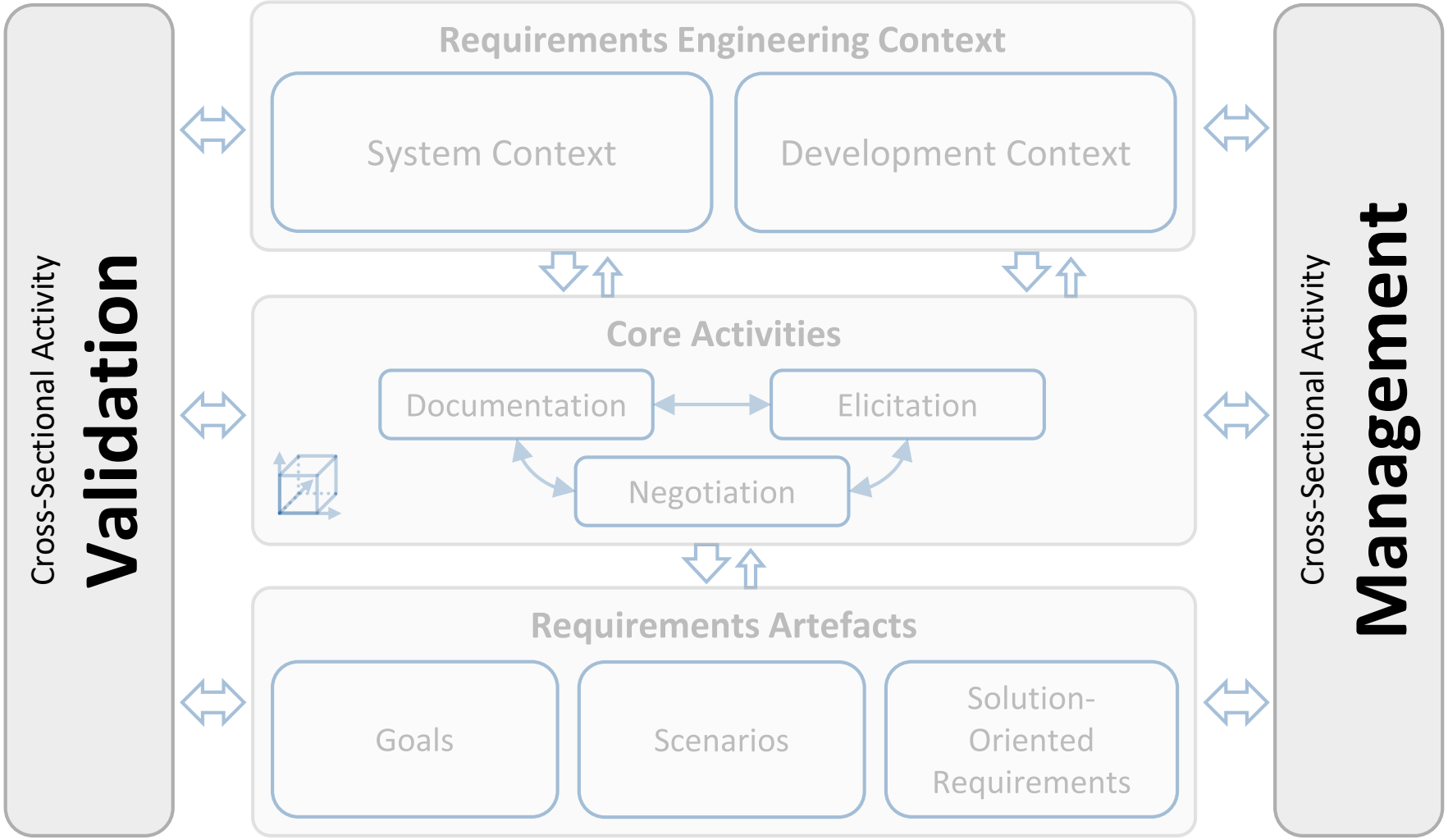
Two Categorisations

Types of requirements	Requirements artifacts
• Functional requirements • Quality requirements • Constraints	• Goals • Scenarios • Solution-oriented requirements

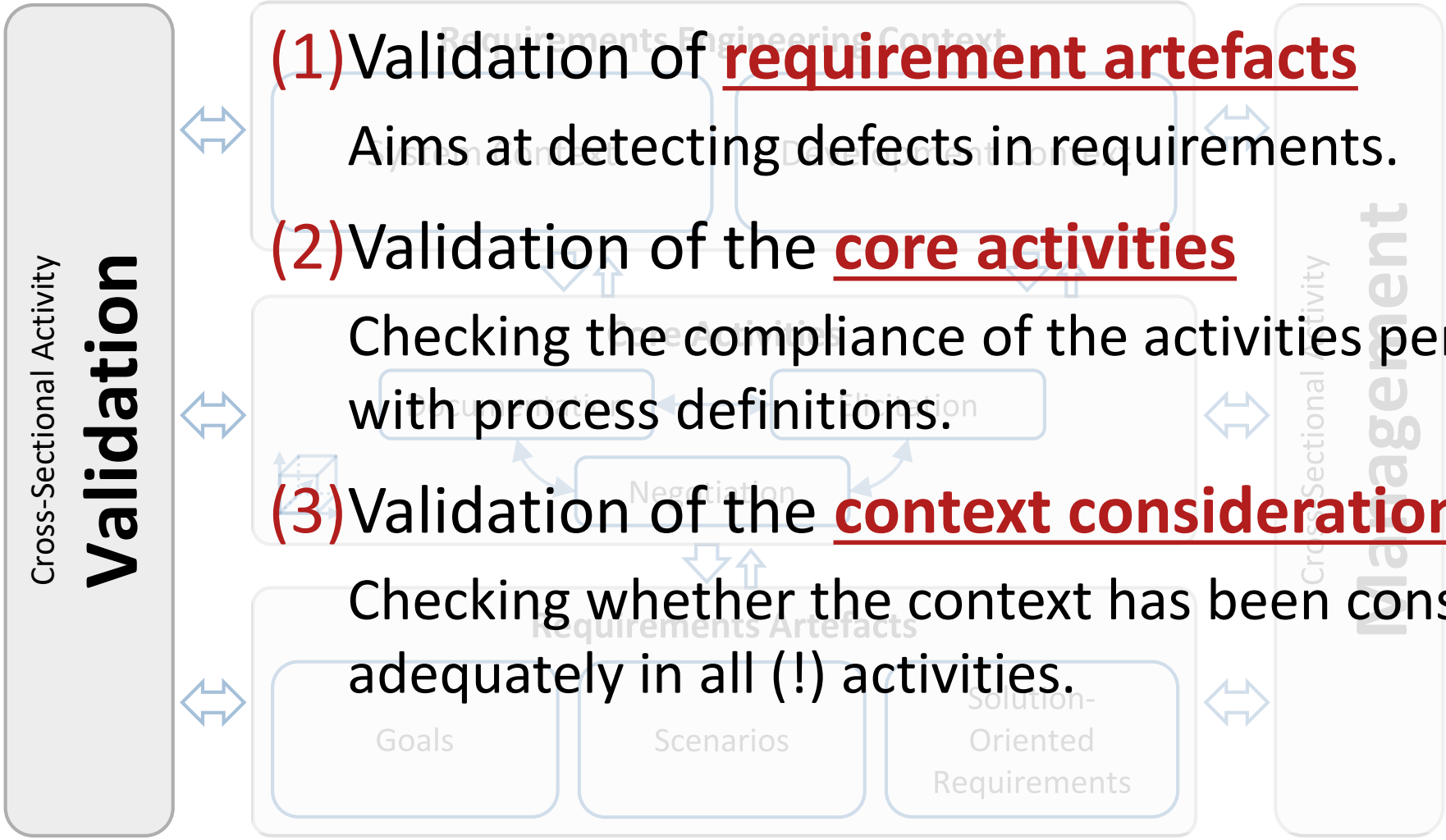
All requirements artefacts (goals, scenarios and solution-oriented requirements) can be used to define functional and quality requirements as well as constraints.

5. Cross-Sectional Activities

Framework for Requirements Engineering



Three Validation Goals



(1) Validation of **requirement artefacts**

Aims at detecting defects in requirements.

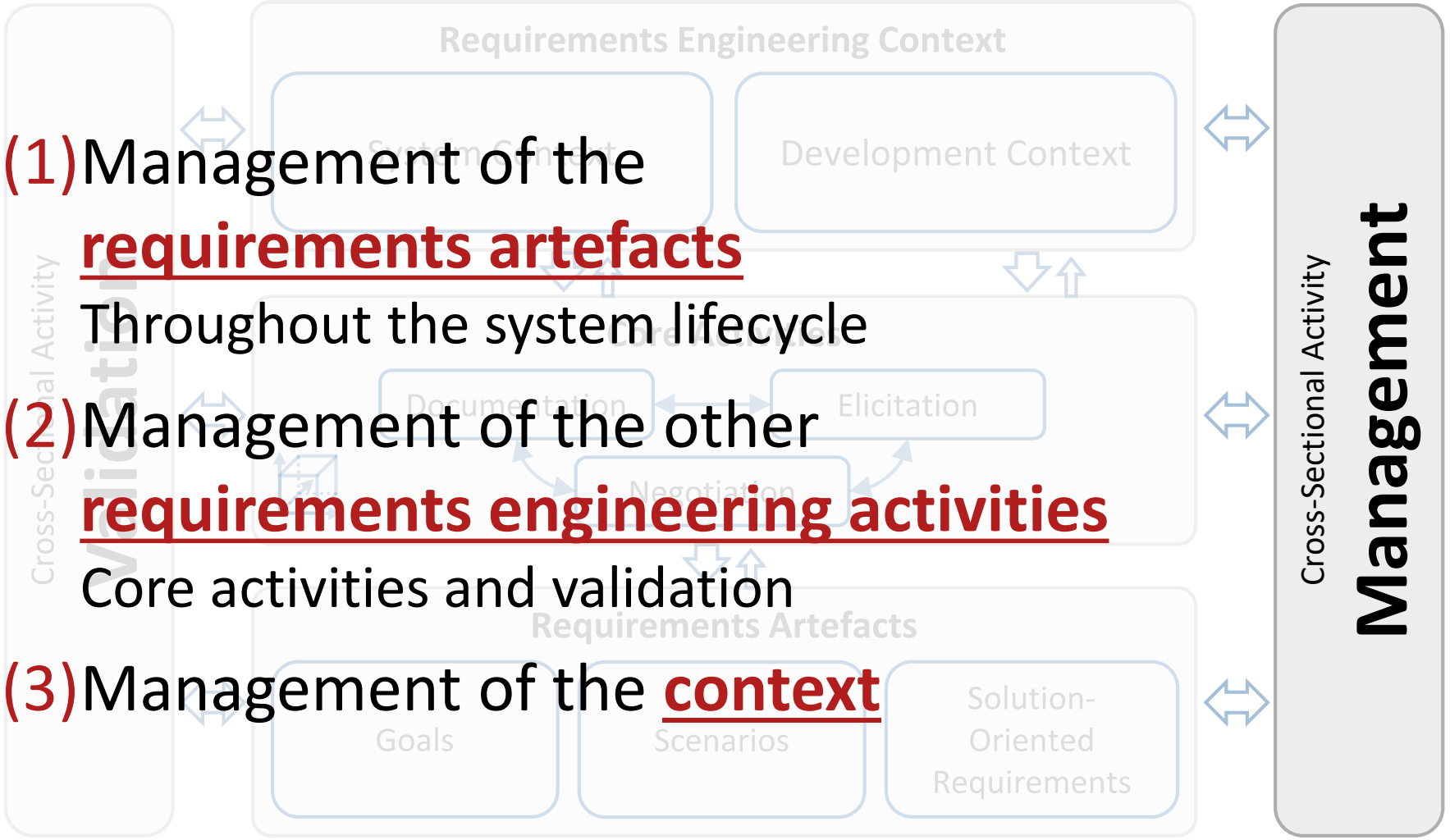
(2) Validation of the **core activities**

Checking the compliance of the activities performed with process definitions.

(3) Validation of the **context consideration**

Checking whether the context has been considered adequately in all (!) activities.

Three Management Goals



(1) Management of the **requirements artefacts**
Throughout the system lifecycle

(2) Management of the other **requirements engineering activities**
Core activities and validation

(3) Management of the **context**

Summary

Requirements Engineering: **Establishing a vision in context**

- Small **changes in the vision** might lead to huge changes in the requirements and the way the system is developed.
- Requirements always depend on their **context**.

Framework for Requirements Engineering with four building blocks:

(1) **Requirements Engineering Context**: structured into system context and development context

(2) **Three Core Activities**: documentation, elicitation and negotiation

(3) **Three types of Requirements Artefacts**: Goals, scenarios and solution-oriented requirements

(4) **Two Cross-Sectional Activities**: Validation and management

Literature

[Dudley 2000] B. Dudley (Ed.): The Greatest Speeches of President John F. Kennedy. Titan, West Vancouver, 2000.

[Pohl and Ulfat-Bunyadi 2013] K. Pohl, N. Ulfat-Bunyadi: The Three Dimensions of Requirements Engineering: 20 Years Later. In J. Bubenko et al., eds. *Seminal Contributions to Information Systems Engineering*. Springer Berlin Heidelberg, pp. 81–87, 2013.

Image References

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Legend

Definition

Example

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Vielen Dank für Ihre Aufmerksamkeit

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