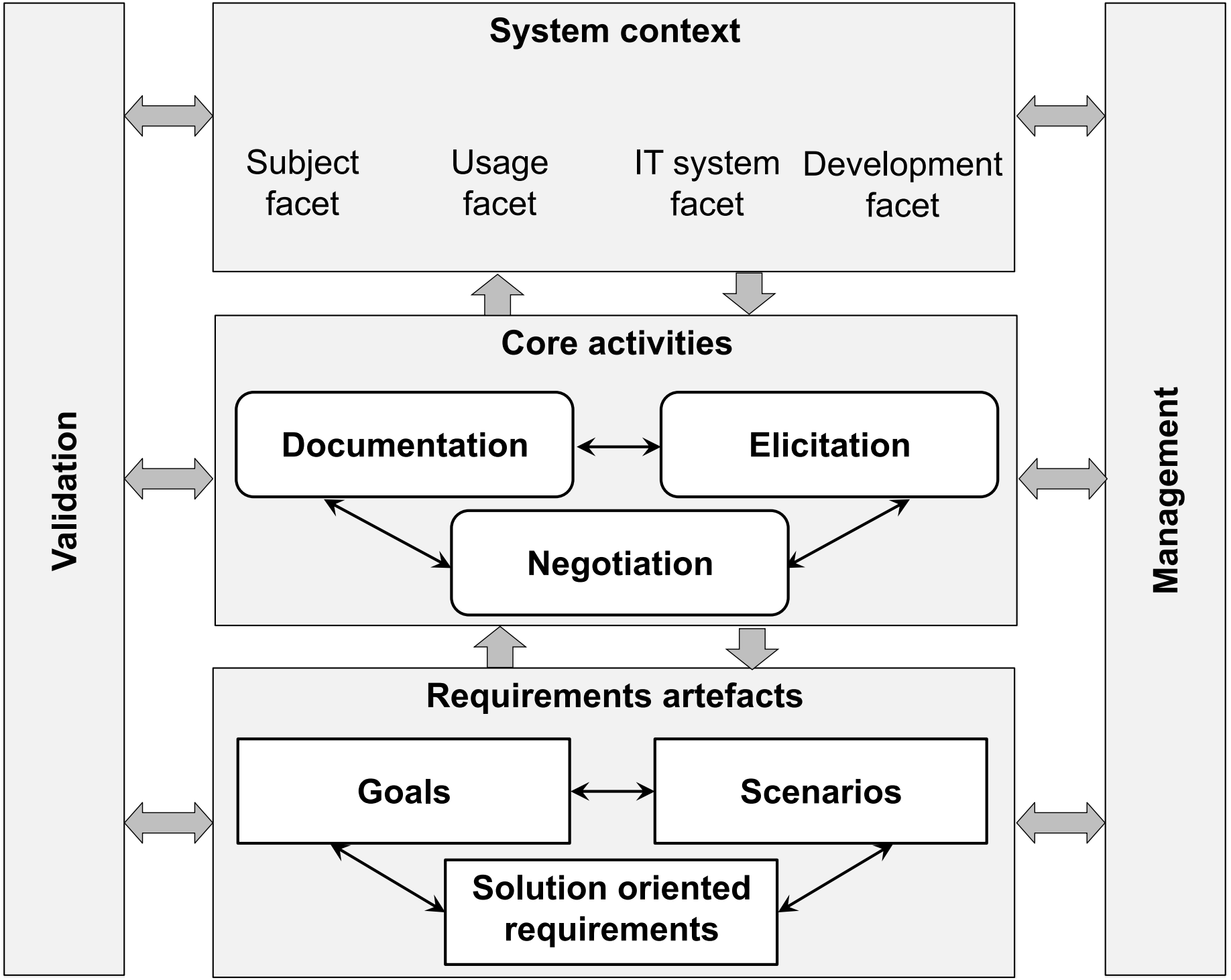
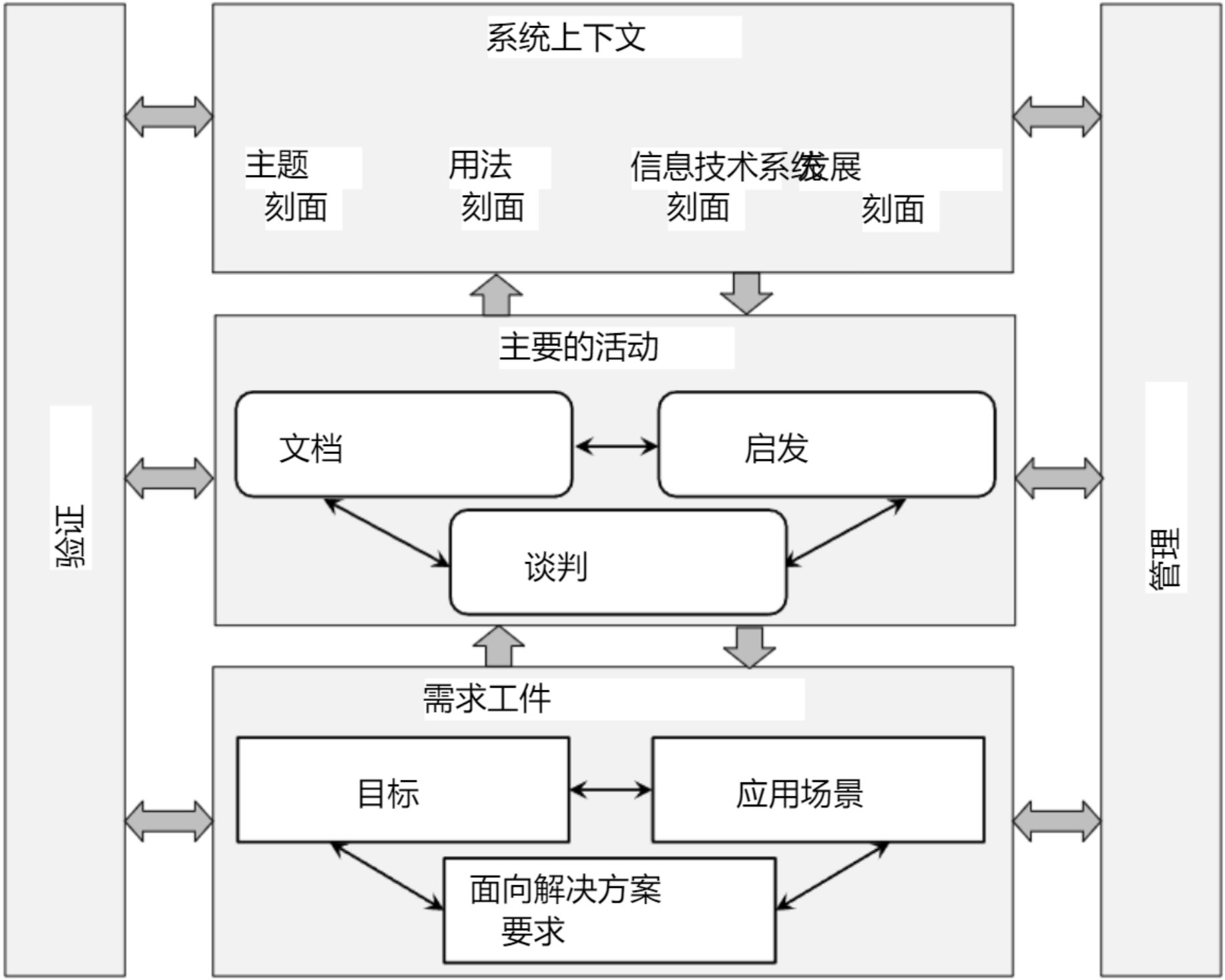
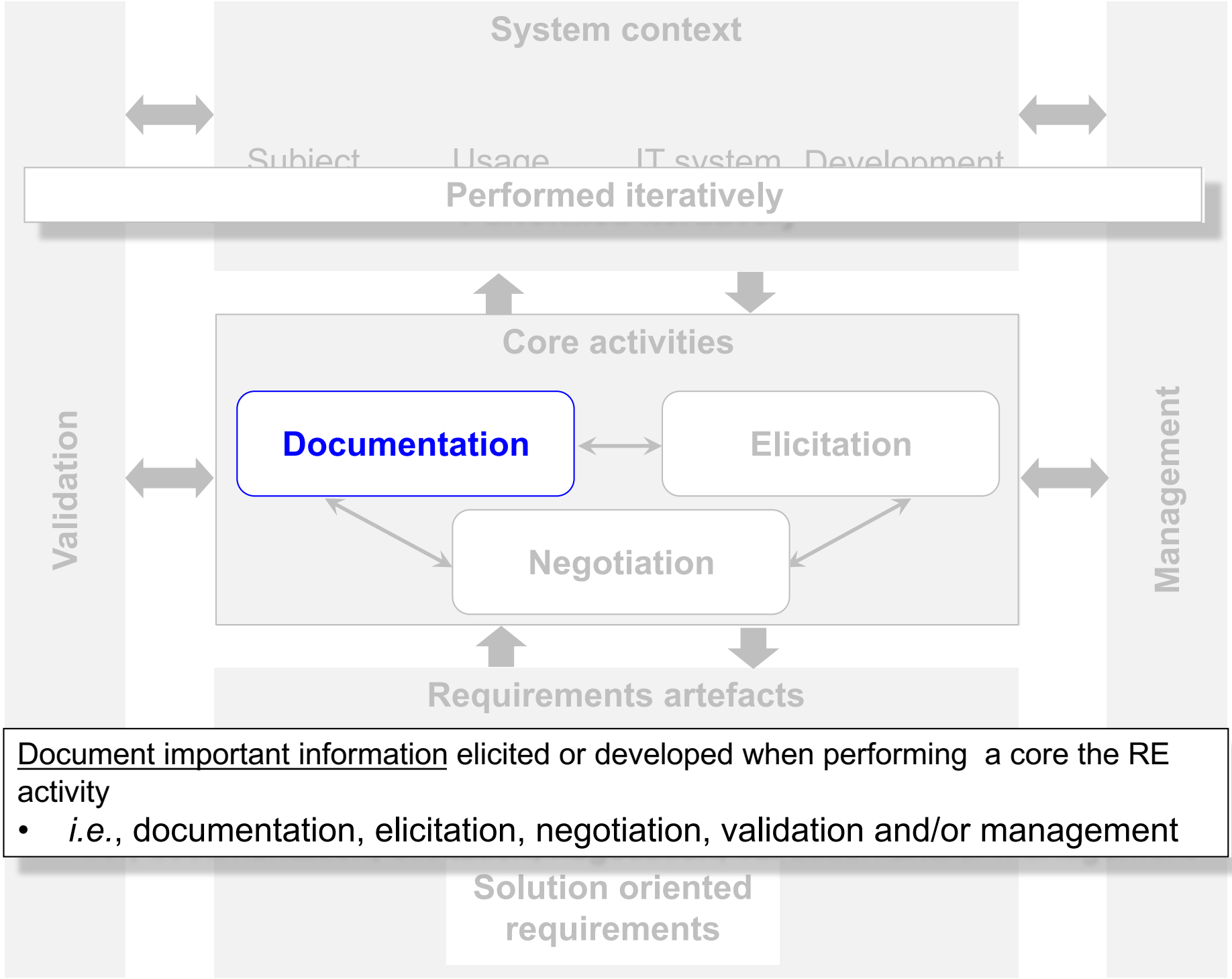
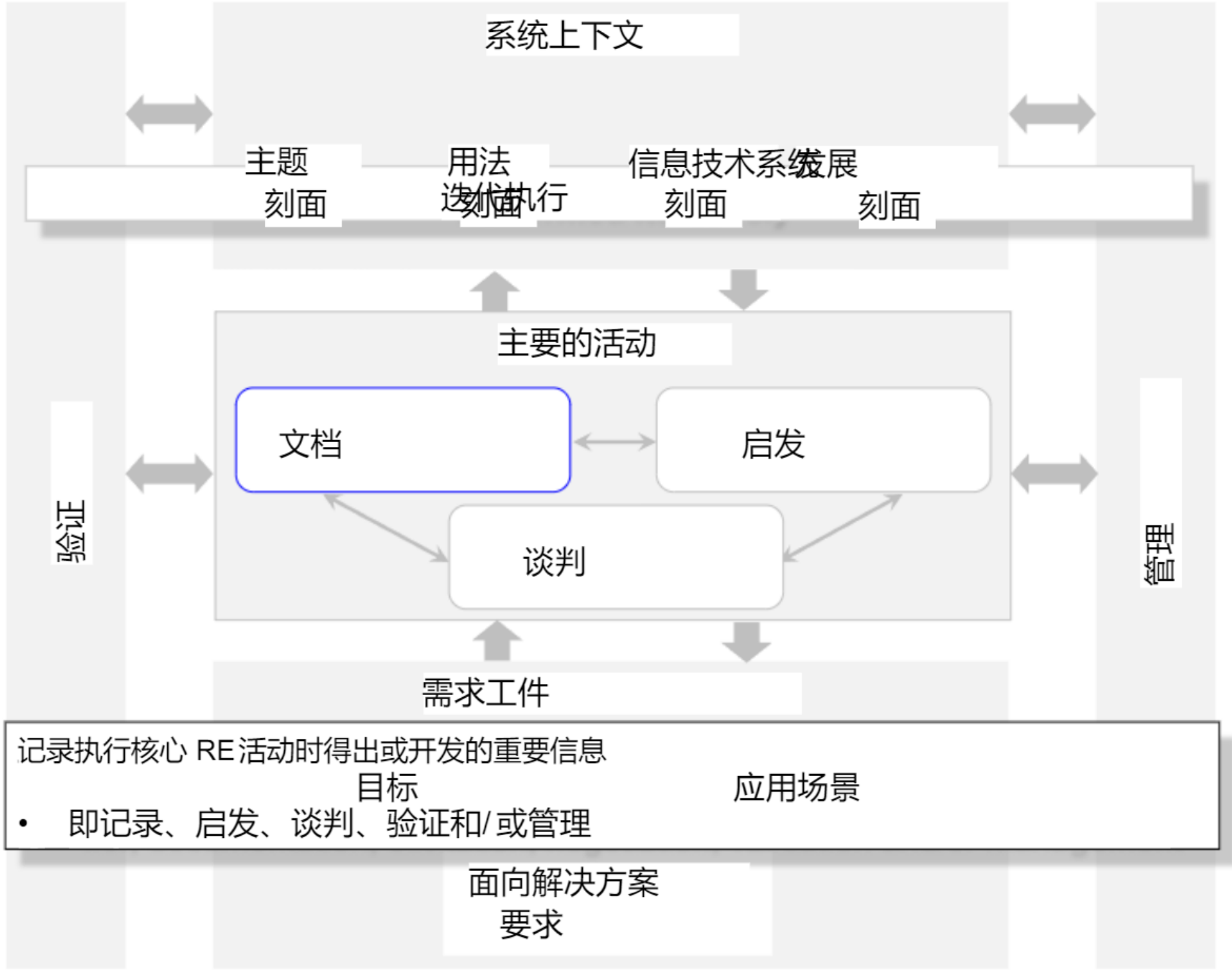

System context
Subject facet
Usage facet
IT system facet
Development facet
Core activities
Documentation
Elicitation
Negotiation
Requirements artefacts
Goals
Scenarios
Solution oriented requirements
Validation
Management


系统上下文
主题
刻面
用法
刻面
信息技术系统
刻面
发展
刻面
主要的活动
文档
启发
谈判
需求工件
目标
应用场景
面向解决方案
要求
验证
管理



Document important information elicited or developed when performing a core the RE activity

- *i.e.*, documentation, elicitation, negotiation, validation and/or management


系统上下文
主题
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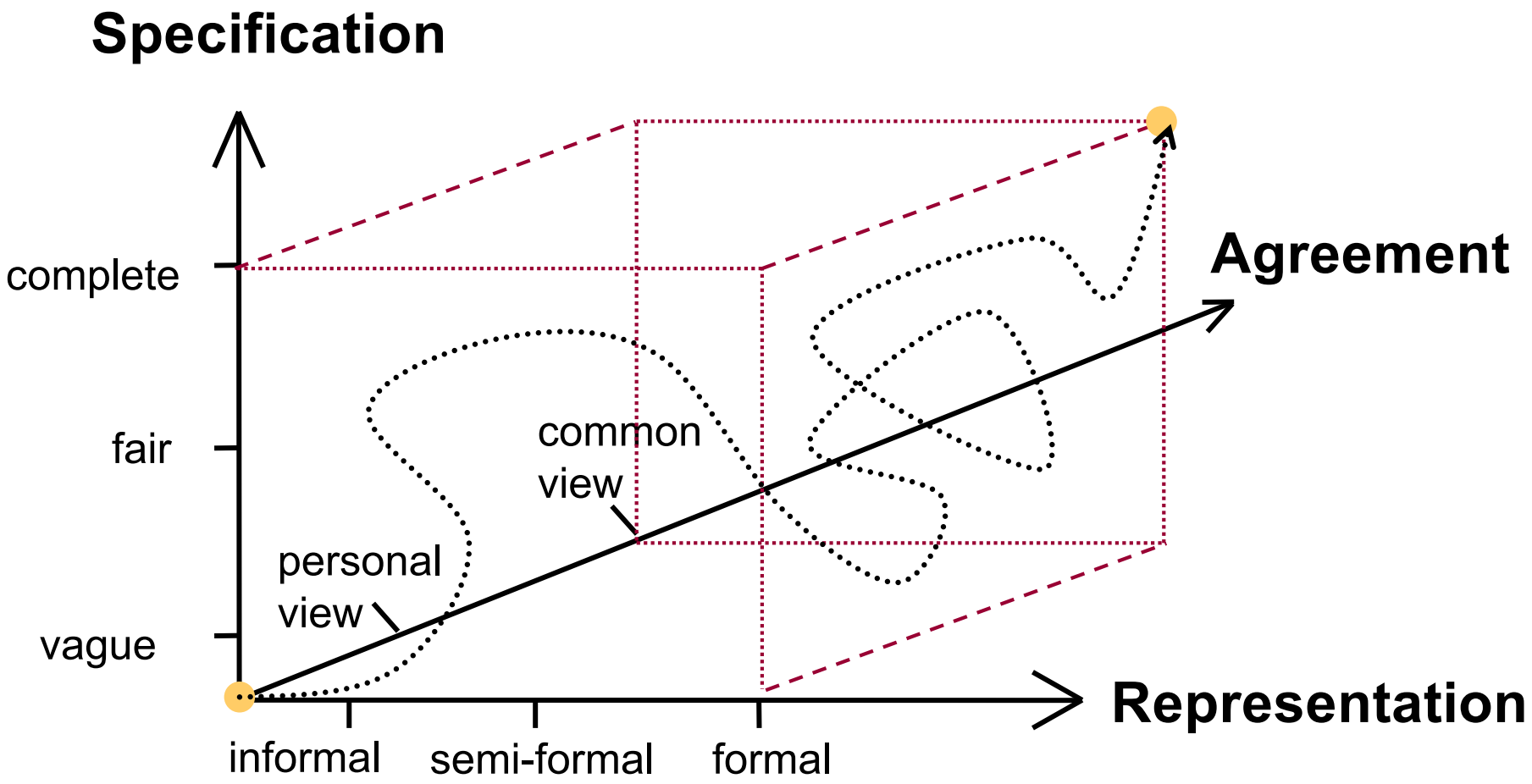
用法
刻面
信息技术系统
刻面
发展
刻面
主要的活动
文档
启发
谈判
验证
管理
需求工件
记录执行核心 RE 活动时得出或开发的重要信息
目标
• 即记录、启发、谈判、验证和/或管理
应用场景
面向解决方案
要求

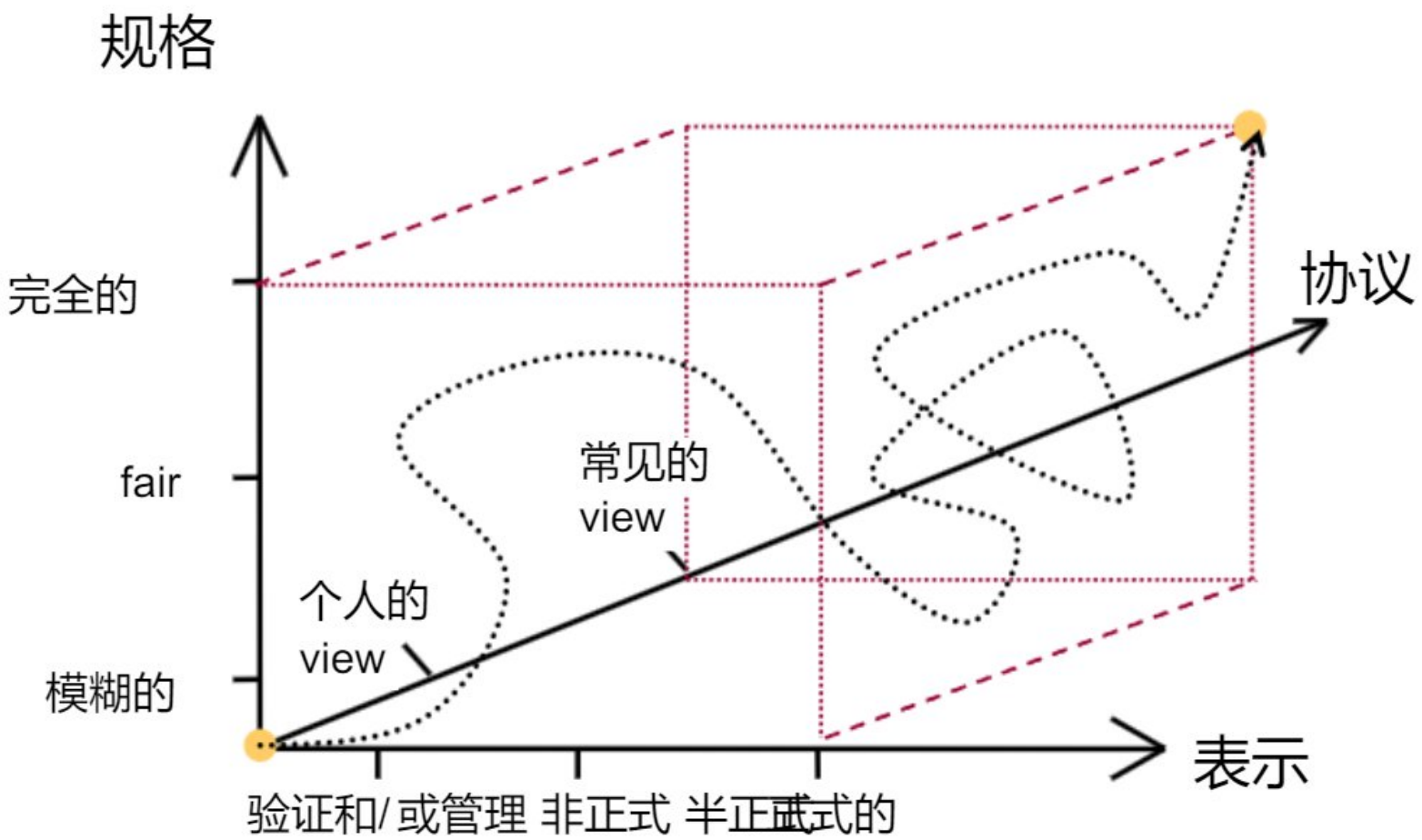
“Requirements Lifecycle”

Source: *Adapted from Pohl, CAISE 1993*



“需求生命周期”

资料来源：改编自 *Pohl , CAISE 1993*



Requirements Specification

- **What is Requirements Specification?**

要求规范

- 什么是需求规格说明书?

Requirements Specification

→ How do we communicate the Requirements to others ?

- It is common practice to capture them in a specification
  - But an specification does not need to be a single paper document...

→ Purpose

- **Communication**
  - explains the application domain and the system to be developed
- **Contractual**
  - May be legally binding!
  - Expresses agreement and a commitment
- **Baseline for evaluating the software**
  - supports testing, V&V
  - "enough information to verify whether delivered system meets requirements"
- **Baseline for change control**

→ Audience

- **Customers & Users**
  - interested in system requirements…
  - …but not detailed software requirements
- **Systems (Requirements) Analysts**
  - Write other specifications that inter-relate
- **Developers, Programmers**
  - Have to implement the requirements
- **Testers**
  - Have to check that the requirements have been met
- **Project Managers**
  - Have to measure and control the project

要求规范

➜ 我们如何向其他人传达这些要求?

常见的做法是在规范中捕获它们

Ø 但规范不一定是单一的纸质文档.....

➜ 目的

Ø 沟通

Ø 解释应用领域和要开发的系统

Ø 契约式

Ø 可能具有法律约束力!

Ø 表示同意并承诺

评估基线

软件

Ø 支持测试、V& V Ø " 有足够的信息来验证交付的系统是否满足要求"

变化控制基线

➜ 观众

Ø 客户和用户

Ø 对系统要求感兴趣... Ø ...但不了解详细的软件要求

系统（需求）分析师

Ø 编写其他相互关联的规范

Ø 开发人员、程序员

Ø 必须落实要求

Ø 测试人员

Ø 必须检查是否满足要求

Ø 项目经理

Ø 必须测量和控制项目

Appropriate Specification

A) Tiny project, 1 programmer, 2 months work

programmer talks to customer, then writes up a 2-page memo

	Project A
Purpose of spec?	Crystalizes programmer's understanding; feedback to customer
Management view?	Spec is irrelevant; have already allocated resources
Readers?	**Primary**: Spec author; **Secondary**: Customer

适当的规格

A) 小项目，**1**个程序员，**2**个月的工作

程序员与客户交谈，然后写下 2 页的备忘录

B) 大型项目，50 名程序员，工作 2 年

分析师团队对需求进行建模，然后将其记录在 500 页的文档中

	项目*A*	项目**B**
规范的目的?	明确程序员的理解;反馈给客户	按文档构建；必须包含足够的细节所有的程序员将使用规范估计资源需求并规划发展
管理看法?	规格无关紧要；有已分配资源	
读者?	主要：规范作者；第二：客户	主要：程序员、测试人员、管理人员；第二：客户

Appropriate Specification

B) Large project, 50 programmers, 2 years work

team of analysts model the requirements, then document them in a 500-page document

	Project B
Purpose of spec?	Build-to document; must contain enough detail for all the programmers
Management view?	Will use the spec to estimate resource needs and plan the development
Readers?	**Primary**: programmers, testers, managers; **Secondary**: customers

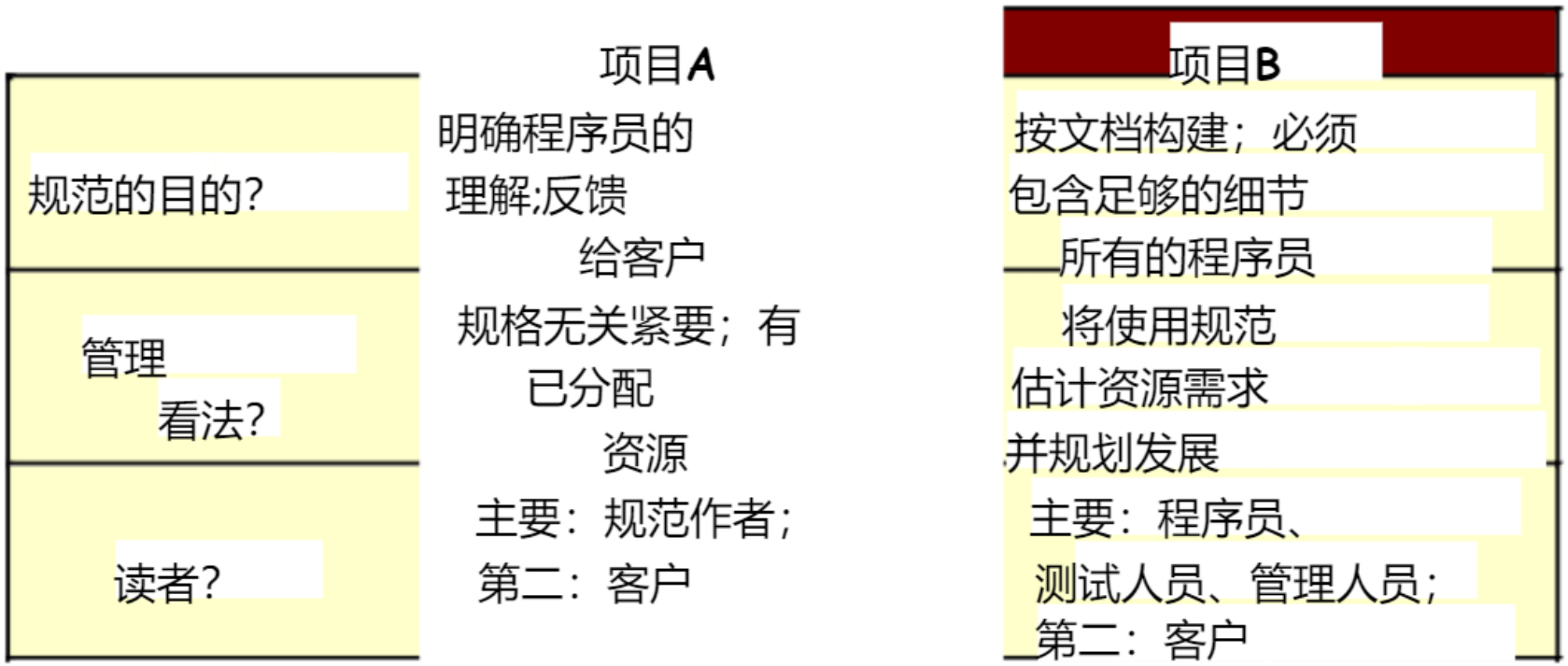
适当的规格

A) 小项目，1个程序员，2个月的工作

程序员与客户交谈，然后写下 2 页的备忘录

B) 大型项目，**50** 名程序员，工作 **2** 年

分析师团队对需求进行建模，然后将其记录在 500 页的文档中



Procurement

- A requirements specification may be written by…
  - …**the procurer**:
    - specification is really a call for proposals
    - Must be general enough to yield a good selection of bids…
    - …and specific enough to exclude unreasonable bids
  - …**the bidders**:
    - specification is a proposal to implement a system to meet the CfP
    - must be specific enough to demonstrate feasibility and technical competence
    - …and general enough to avoid over-commitment
  - …**the selected developer**:
    - reflects the developer's understanding of the customer's needs
    - forms the basis for evaluation of contractual performance
  - **…or by an independent RE contractor**!
- Choice over what point to compete the contract
  - **Early (conceptual stage)**
    - can only evaluate bids on apparent competence & ability
  - **Late (detailed specification stage)**
    - more work for procurer; appropriate RE expertise may not be available in-house

采购

➜ 需求规范可以由……编写

ä...采购人：

Ø 规范实际上是征求建议书 Ø 必须足够通用，以便产生良好的投标选择... Ø ...并且足够具体，以排除不合理的投标

……投标人：

Ø 规范是实施一个系统以满足 CfP 的建议 Ø 必须足够具体以证明可行性和技术能力

Ø ..并且足够通用以避免过度承诺

ä ..选定的开发商：

Ø 反映开发商对客户需求的理解 Ø 构成评估合同履行情况的基础

ä ..或由独立的可再生能源承包商！

➜ 选择什么点来竞争合同

早期（概念阶段）

Ø 只能根据明显的能力和能力来评估投标

Ø 后期（详细规范阶段）

Ø 采购员的工作量增加；内部可能不具备适当的可再生能源专业知识

Specification Contents

➜Specification should address:

- **Functionality**
  - What is the software supposed to do?
- **External interfaces**
  - How does the software interact with people, the system's hardware, other hardware, and other software?
  - What assumptions can be made about these external entities?
- **Performance**
  - What is the speed, availability, response time, recovery time of various software functions, and so on?
- **Attributes**
  - What are the portability, correctness, maintainability, security, and other considerations?
- **Design constraints imposed on an implementation**
  - Are there any required standards in effect, implementation language, policies for database integrity, resource limits, operating environment(s) and so on?

规格内容

➜规范应解决：

ä功能性

Ø 软件的用途是什么？

外部接口

Ø 软件如何与人、系统硬件、其他硬件、其他软件交互？ Ø 对于这些外部实体可以做出哪些假设？

一场表演

Ø 各种软件功能的速度、可用性、响应时间、恢复时间等如何？

ä属性

Ø 可移植性、正确性、可维护性、安全性等考虑因素有哪些？

设计对实施施加的限制

Ø 是否有任何有效的必要标准、实现语言、数据库完整性策略、资源限制、操作环境等？

Specification should not include…

- **Project development plans**
  - E.g. cost, staffing, schedules, methods, tools, etc
    - Lifetime of SRS is until the software is made obsolete
    - Lifetime of development plans is much shorter
- **Product assurance plans**
    - V&V, test, QA, etc
  - Different audiences
  - Different lifetimes
- **Designs**
  - Requirements and designs have different audiences
  - Analysis and design are different areas of expertise
    - I.e. requirements analysts shouldn't do design!

规格不应包括...

➜ 项目开发计划

例如成本、人员配置、时间表、方法、工具等

Ø SRS的生命周期是直到软件过时为止 Ø 开发计划的生命周期要短得多

➜ 产品保证计划

Ø V& V、测试、QA等

不同的受众

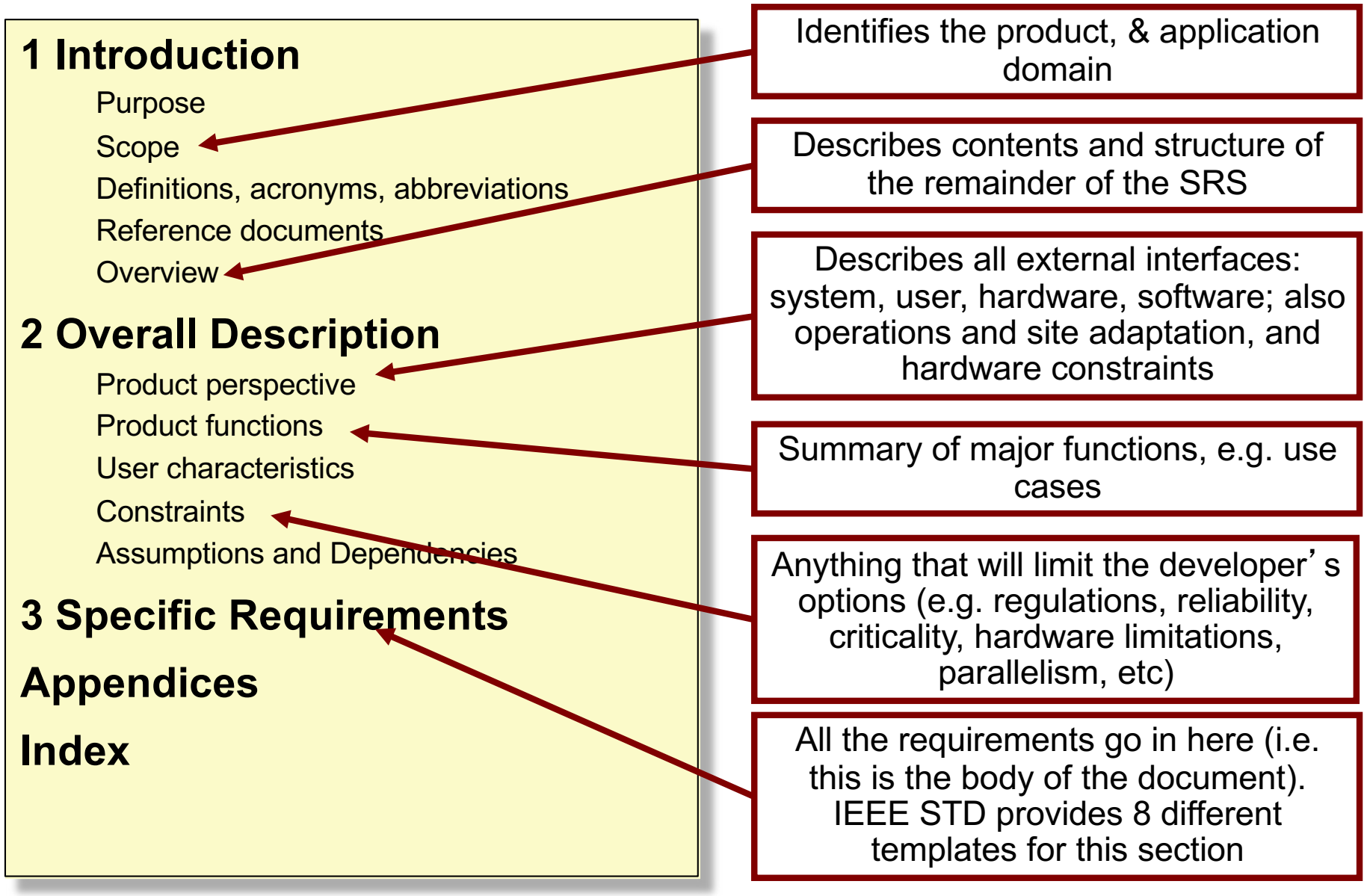
Ø 不同的生命周期

➜ 设计

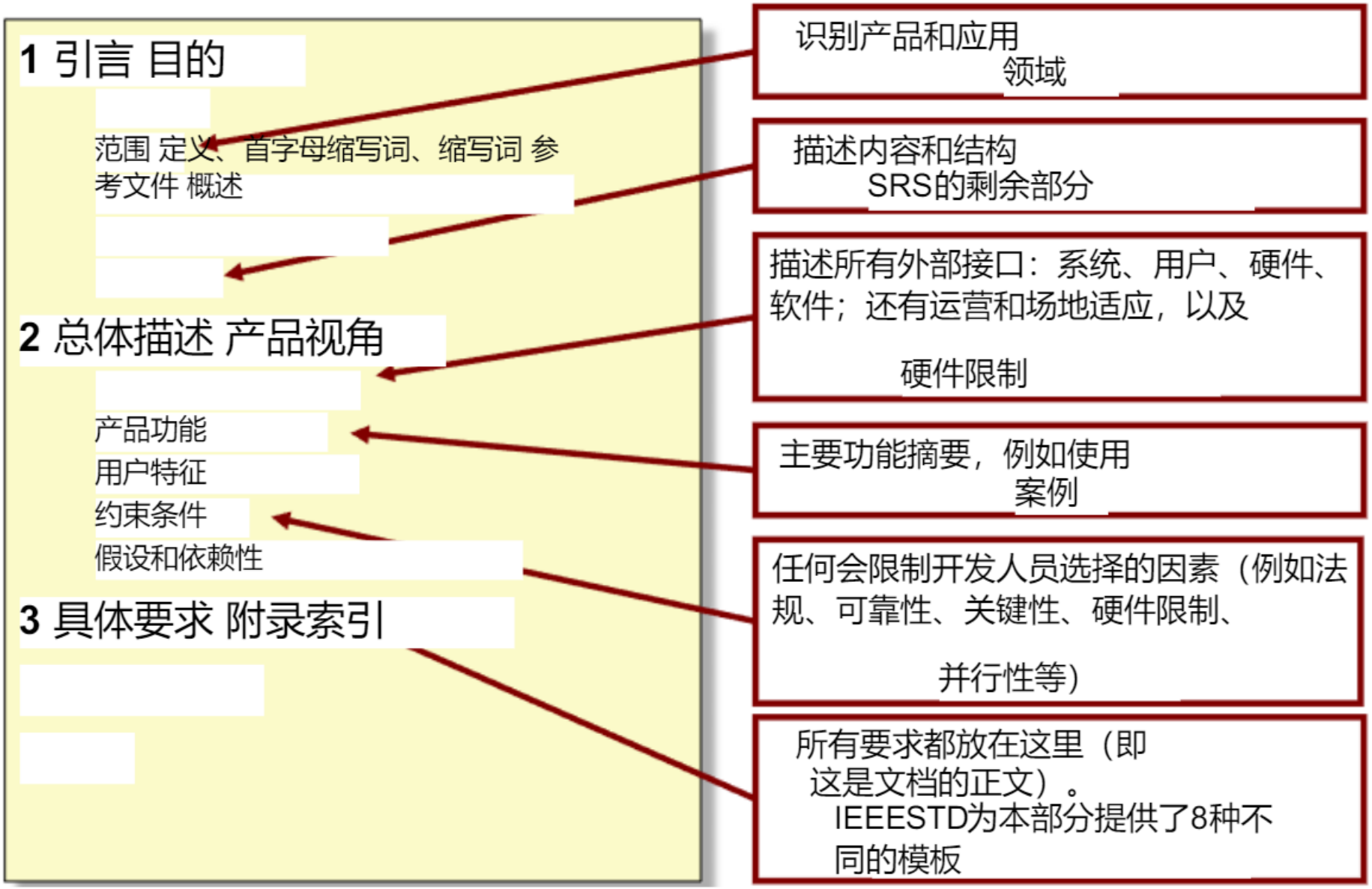
需求和设计有不同的受众分析和设计是不同的专业领域

Ø 即需求分析师不应该做设计!

IEEE Standard for Requirements Specification



IEEE需求规范标准


1 引言 目的
范围 定义、首字母缩写词、缩写词 参考文件 概述
2 总体描述 产品视角
产品功能
用户特征
约束条件
假设和依赖性
3 具体要求 附录索引
识别产品和应用 领域
描述内容和结构 SRS的剩余部分
描述所有外部接口：系统、用户、硬件、软件；还有运营和场地适应，以及 硬件限制
主要功能摘要，例如使用 案例
任何会限制开发人员选择的因素（例如法规、可靠性、关键性、硬件限制、 并行性等）
所有要求都放在这里（即 这是文档的正文）。 IEEESTD为本部分提供了8种不同的模板

IEEE STD Section 3 (example)

3.1 External Interface Requirements

3.1.1 User Interfaces

3.1.2 Hardware Interfaces

3.1.3 Software Interfaces

3.1.4 Communication Interfaces

3.2 Functional Requirements

this section organised by mode, user class, feature, etc. For example:

3.2.1 Mode 1

3.2.1.1 Functional Requirement 1.1

…

3.2.2 Mode 2

3.2.1.1 Functional Requirement 1.1

…

3.2.2 Mode n

...

3.3 Performance Requirements

Remember to state this in **measurable** *terms!*

3.4 Design Constraints

3.4.1 Standards compliance

3.4.2 Hardware limitations

etc.

3.5 Software System Attributes

3.5.1 Reliability

3.5.2 Availability

3.5.3 Security

3.5.4 Maintainability

3.5.5 Portability

3.6 Other Requirements

IEEESTD 第 3 节（示例）

3.1 外部接口要求

3.1.1 用户界面
3.1.2 硬件接口
3.1.3 软件接口
3.1.4 通讯接口

3.2 功能要求 本节按模式、用户类别、

功能等。例如:

3.2.1 模式*1 3.2.1.1* 功能要求*1.1*

…

3.2.2 模式*2 3.2.1.1* 功能要求*1.1*

…

3.2.2 模式n

. . .

3.3 性能要求 请记住以可测量的形式说明这一点

条款!

3.4 设计约束 *3.4.1* 标准符合性

3.4.2 硬件限制

etc.

3.5 软件系统属性

3.5.1 可靠性
3.5.2 可用性
3.5.3 安全
3.5.4 可维护性
3.5.5 便携性

3.6 其他要求

Organizing the Requirements

- Example Structures - organize by…
  - …**External stimulus or external situation**
    - e.g., for an aircraft landing system, each different type of landing situation: wind gusts, no fuel, short runway, etc
  - …**System feature**
    - e.g., for a telephone system: call forwarding, call blocking, conference call, etc
  - …**System response**
    - e.g., for a payroll system: generate pay-cheques, report costs, print tax info;
  - …**External object**
    - e.g. for a library information system, organize by book type
  - …**User type**
    - e.g. for a project support system: manager, technical staff, administrator, etc.
  - …**Mode**
    - e.g. for word processor: page layout mode, outline mode, text editing mode, etc
  - …**Subsystem**
    - e.g. for spacecraft: command&control, data handling, comms, instruments, etc.
- Requirements documents templates

https://www.volere.org/templates/volere-requirements-specification-template/

组织需求

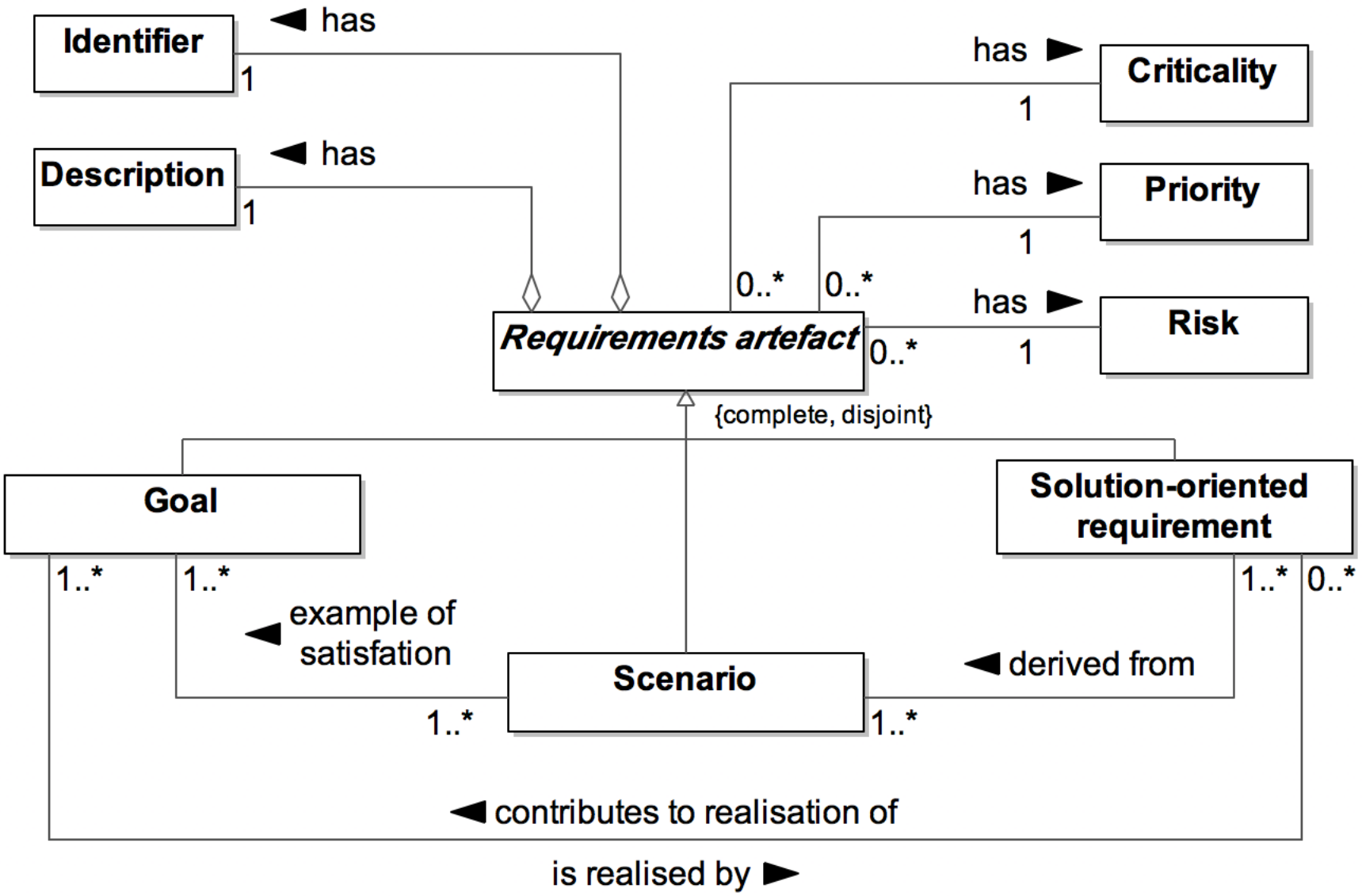
➜ 示例结构 - 组织方式...

- ä ..外部刺激或外部情况
  - Ø 例如，对于飞机着陆系统，每种不同类型的着陆情况：阵风、无燃料、跑道短等
- ä ..系统功能
  - Ø 例如，对于电话系统：呼叫转移、呼叫阻止、电话会议等
- ä ..系统响应
  - Ø 例如，对于工资系统：生成工资支票、报告成本、打印税务信息；
- ä ..外部对象
  - Ø 例如对于图书馆信息系统，按图书类型组织
- ä ..用户类型
  - Ø 例如对于项目支持系统：经理、技术人员、管理员等。
- ä..时尚
  - Ø 例如对于文字处理器：页面布局模式、大纲模式、文本编辑模式等
- ä ..子系统
  - Ø 例如对于航天器：命令与控制、数据处理、通信、仪器等。

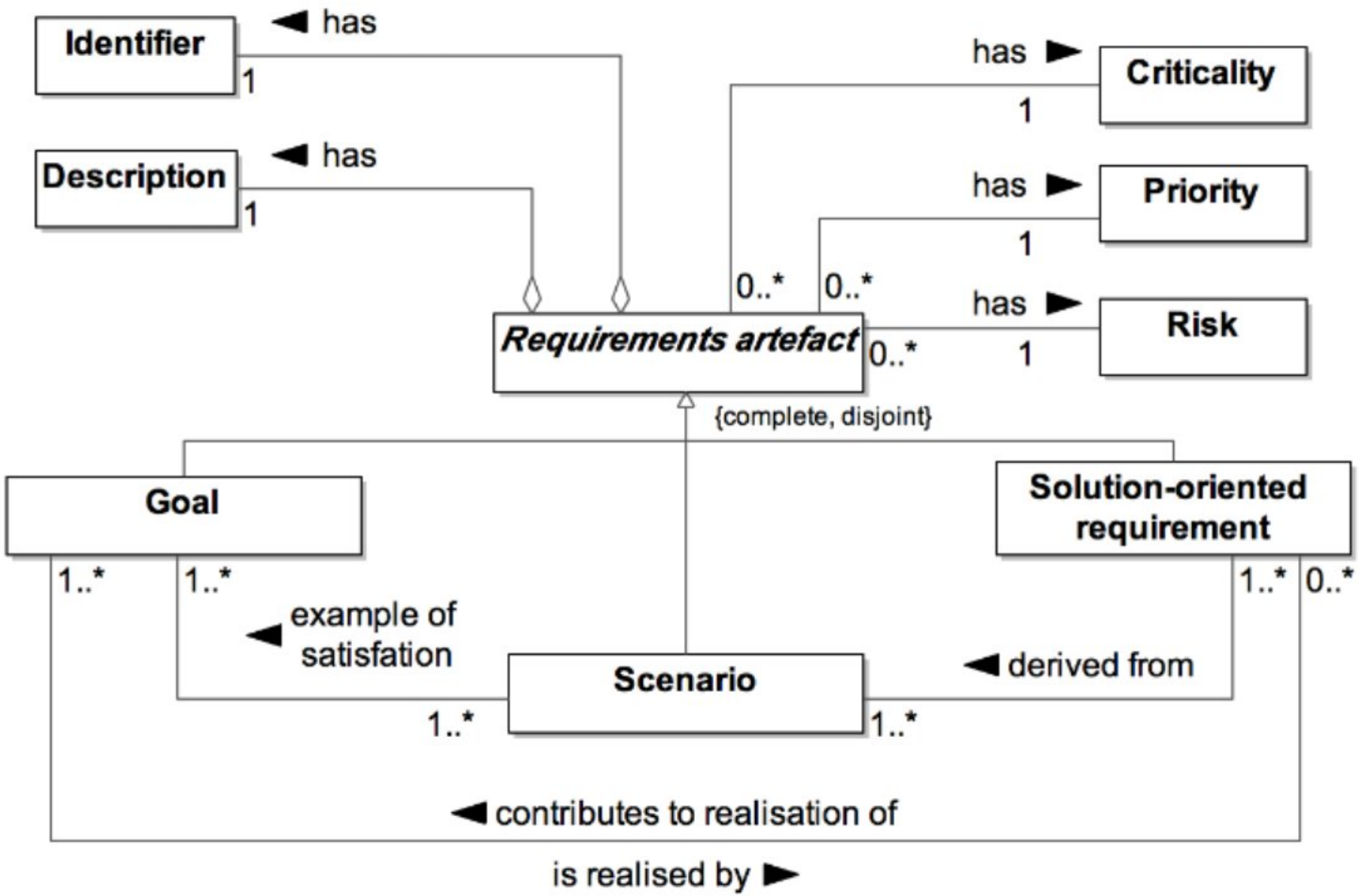
➜ 需求文档模板

https ://www .volere .org /templates /volere -requirements -specification -template /

Documenting requirements artefacts

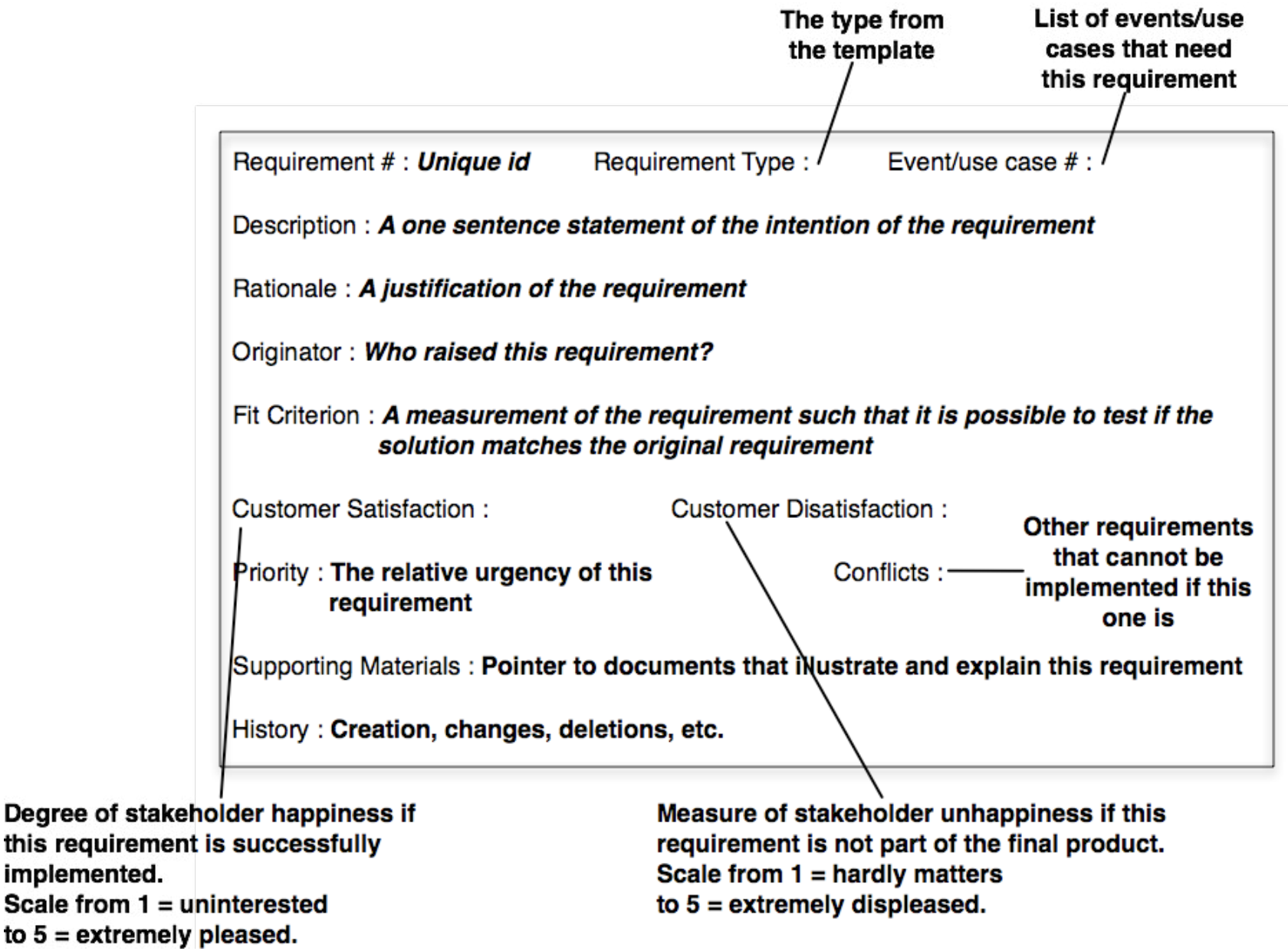


记录需求工件


Identifier
has
1
Description
has
1
has
Criticality
1
has
Priority
1
has
Risk
1
0..*
0..*
0..*
Requirements artefact
{complete, disjoint}
Goal
Solution-oriented requirement
1..*
1..*
example of satisfation
1..*
0..*
Scenario
derived from
1..*
1..*
contributes to realisation of
is realised by

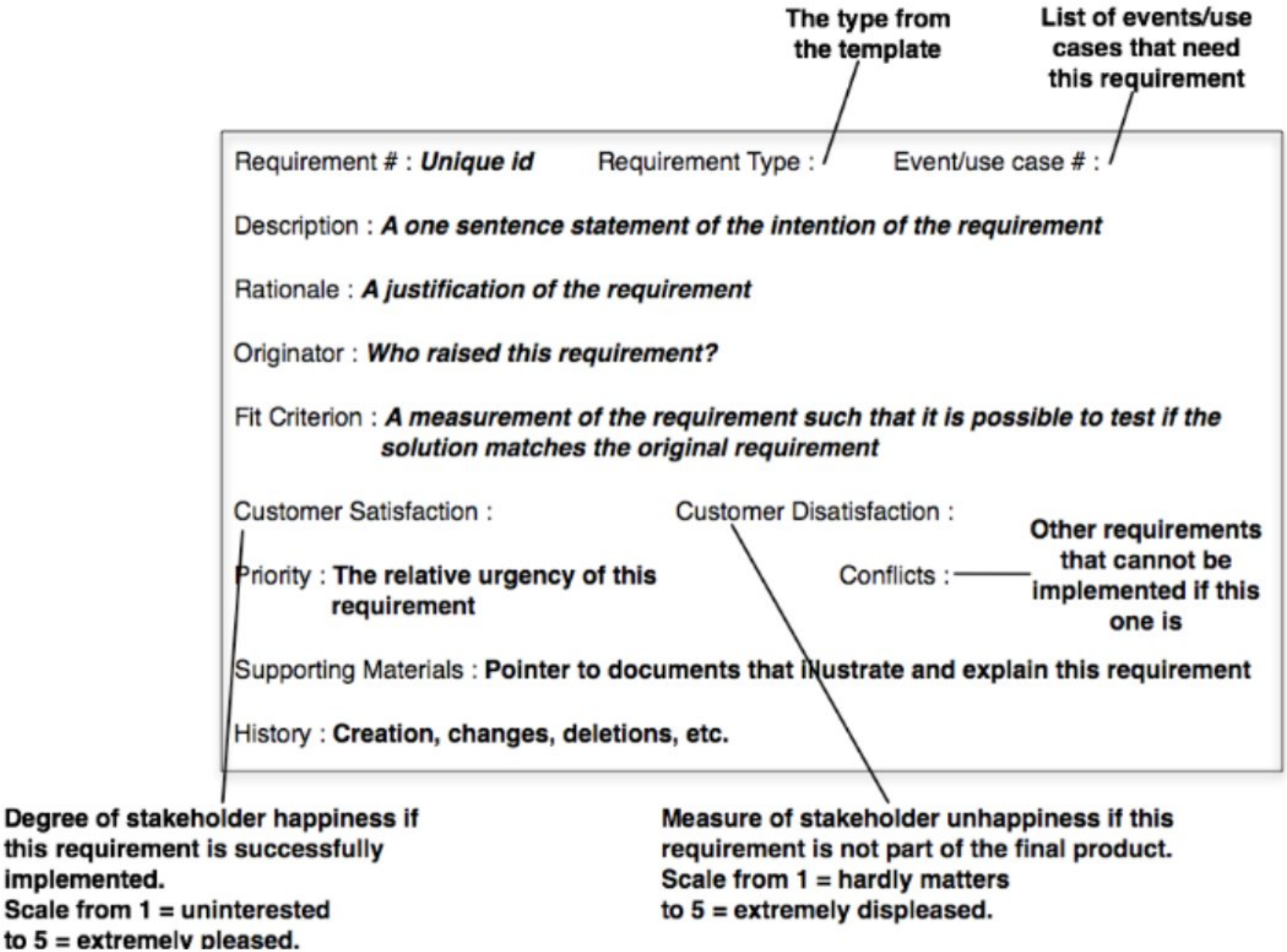
Requirement Shell

Volere template, 2010



需求外壳

想要模板，2010



Things to Take Home

- Requirements specification
- Criteria for good requirements

带回家的东西

- 要求规范
- 良好要求的标准