Service Requirements. Knowing and managing the whole end-to-end service lifecycle

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Service requirements – Knowing and Managing the whole end-to-end- service lifecycle

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Abstract: There is an ongoing pressure on IT service prices based on efficient and effective processes and IT infrastructure on the market. The client demands more (web-based) services that are available on-demand from an optimised, and highly scalable, service provider. For example cloud services especially are not only a technical challenge. They capture the attention of the business and they are the source of growth for the business. Clients and suppliers are searching for the right In-/ Outsourcing level to fulfil these demands. In focus are the business processes and the supporting IT services along the whole supply chain. IT services have also an end-to-end lifecycle with interfaces and different layers (organisation, processes, IT/infrastructure, legal, finance).
Existing requirements engineering and management models concentrate only on parts of the IT service requirement lifecycle. There is a need for an end-to-end lifecycle model and the practical management of the IT services. The article regards the definition of service requirements and develops a model for the end-to-end lifecycle management of service requirements and their different layers. The main focus is set on service requirement engineering also as basis of Continual Service Improvement and Knowledge Management. Other parts are topic of the current investigation.

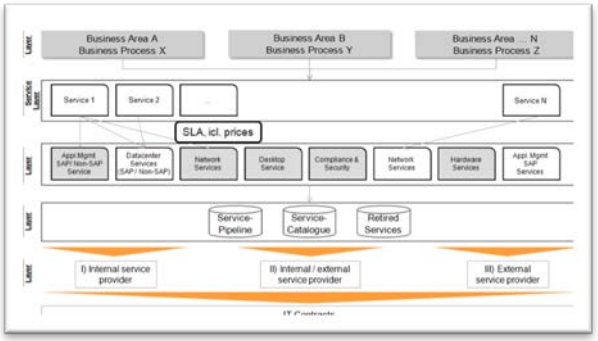
1. DEFINITION OF SERVICE REQUIREMENTS – WHAT DIFFERENCE DOES IT MAKE?

Therefore IT services and service processes need an own lifecycle to plan, implement, operate and change IT services.

The client describes his business service requirements on the process and business service layer (e.g. in a business service catalogue). It contains also the SLAs and the prices. The IT delivers the required service on the application and the IT services layer. The IT services are described in an IT service catalogue with future planed services (service pipeline), the available services (service catalogue) and retired services. The provider level contains the information which supplier delivers the service and which contract is valid.

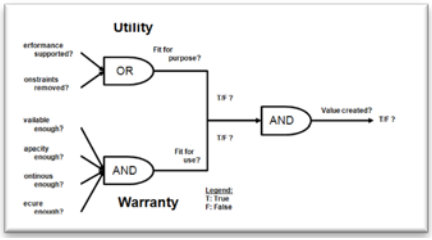
The following figure displays the service design on different layers.

Figure 1: Service Composition



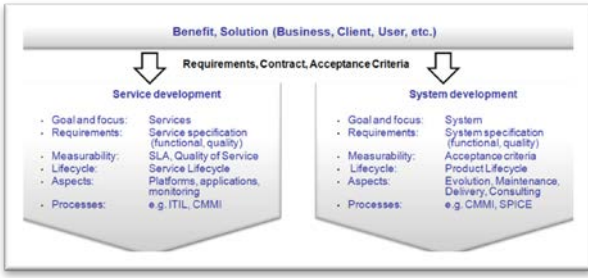
The IT service requirements focus on the services. In sense of ITIL V3 they create value if they are fit for purpose (Utility) and fit for use (Warranty).

Figure 2: ITIL V3 Utility and Warranty of IT services



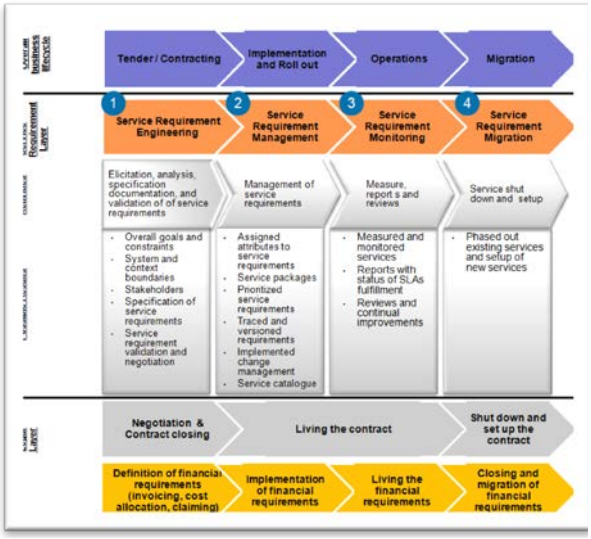
As IT services support the client business processes they need an own end-to-end lifecycle. Existing requirement engineering methods and lifecycles can be used as a basis. But there is a difference between service and system requirements.

Figure 3: Difference between system and service requirements



The following subchapters describe lifecycle and method approaches for IT services. Mainly on the IT service engineering as other parts are subject of future investigations.

Figure 1: End-to-end Service requirement lifecycle



2. FOCUS ON REQUIREMENTS ELICITATION

Although the subject of requirements elicitation has received some degree of attention in the research literature to date, there still remains a justified need for new approaches and tools that can be easily utilised by the majority of practitioners in typical service projects. In this research service project we investigated both the state of the art and the state of practice in order to develop and evaluate both an approach and a tool to support the elicitation of requirements for services in a workshop environment. The principle focus of this work is on the early stages of service requirements elicitation, and not the other RE activities related to analysis and design such as modelling and specification. Furthermore, we concentrated on the fact-finding and information-gathering tasks, and not other tasks often associated with requirements elicitation such as prioritization and negotiation. It is during this initial phase that an appropriate level of structure and rigor would be the most beneficial, given that the requirements are in their most raw form, and the process is at its most fluid.

We have also concentrated on directly addressing the needs of novice analysts working on service projects without a defined requirements elicitation methodology. This area has been specifically targeted because of its potential to have the most impact, since novices by definition have a low level of expertise with the requirements elicitation, and would therefore benefit from additional process support in the absence of a prescribed methodology. We believe that by addressing the combination of novice analysts, and service projects without a detailed and mature requirements elicitation methodology, the research also has a wide coverage in terms of service projects, and a large audience in terms of practitioners. Furthermore, we are of the opinion that this subset of service projects in practice would benefit the most from the adoption of a new and improved approach and tool for service requirements elicitation, and especially one that was both collaborative (i.e. enables multiple stakeholders to work together with each other and the analyst) and combinational (i.e. uses multiple and different requirements elicitation techniques where complementary)

Research Assumptions

The research described in this thesis is based on a number of important underlying assumptions, most

importantly being that effective requirements elicitation leads to good quality requirements, which in turn leads to high quality services and more successful projects. However, this assumption is supported by conventional wisdom, often articulated in the available literature (e.g. (Davis, A. M. 1990; Kotonya & Sommerville 1998; Lauesen 2002; Robertson, S. & Robertson 1999). We also presume that the objective of a service requirements elicitation process is to elicit all the relevant information from the sources in the most efficient and effective way. Other assumptions made initially, and later supported by the results of our literature review and survey of practice, are that novice analysts actually need more support during requirements elicitation, and to a lesser extent, that approaches and tools are an appropriate way to help narrow the gaps between research and practice, and experts and novices.

3. SERVICE REQUIREMENT ENGINEERING

3.1 Introduction – State of the Art Investigation

Before we investigate Requirements Engineering, and subsequently requirements elicitation, it is prudent to first define the word that is common in both of these terms, and what it means within the context of software engineering. The IEEE (IEEE 1990) defines a requirement as "(1) A condition or capability needed by a user to solve a problem or achieve an objective, (2) A condition or capability that must be met or possessed by a system or system component to satisfy a contract, standard, specification, or other formally imposed documents, or (3) A documented representation of a condition or capability as in 1 or 2". Put another way, a requirement is a statement of a customer need or objective, or of a condition or capability that a product must possess to satisfy such a need or objective, or a property that a product must have to provide value to a stakeholder (Wiegers 2007). .

Requirements are not only used as the basis for other downstream activities in the software development lifecycle such as design, testing, and system acceptance, but also in the planning phase to estimate the development cost and schedule for the system, as well to determine the feasibility and value of the project. Along these lines Maiden and Rugg (Maiden, N. A. M. & Rugg 1996) state that requirements are used for three basic purposes being "(1) to provide a specification for the design and implementation of a system, (2) to act as criteria for the selection of a system package, and (3) to form the basis of procurement agreements such as legal contracts between suppliers and customers". Consequently, requirements play a pivotal role in both system acquisition and system development types of projects.

3.2 Introduction to Service Requirement Engineering

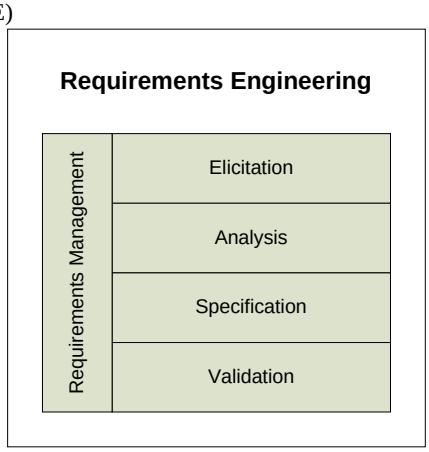
With its origins in Requirements Engineering and in particular service analysis, RE was presented as the fundamental first step of any service development project. As a result RE was positioned as being primarily important for both feasibility studies, system and service specification processes. Much like the phases of Requiremetns Engineering itself, the individual tasks and activities within the RE process are commonly divided into a number of phases. Once again there are a number of ways to group these activities together, and several different definitions for each of these resultant phases. However a typical RE process includes the phases of Elicitation, Analysis, Specification, Validation, and Management (Kotonya & Sommerville 1998). The service requirement RE process does not differ from this process but set the focus on different points.

- Requirements **Elicitation** (which is the core topic of our research, and described in detail in the next subsection) is concerned with the collection, capture, discovery, and development of requirements from a variety of sources including human stakeholders, contract partners, and governmental boundaries.
- Requirements **Analysis** focuses on examining, understanding, and modeling the elicited requirements, and checking them for quality in terms of correctness, completeness, clarity, and consistency. Analysis also includes the financial and the legal requirements as the requirements are part of the contract between the client and the supplier.
- Requirements **Specification** is the act of recording and documenting the requirements in a way that can be used by the stakeholders, and especially the developers who will design and construct the system. The requirement specification can be part of t he contract between client and supplier.
- Requirements **Validation** is the process of confirming the quality of the requirements,

and ensuring that they actually represent the wants and needs of the stakeholders.

- Requirements **Management** is performed throughout RE process and includes activities such as change control, version control, requirements status tracking, and requirements tracing.

Figure 5: The phases of Requirements Engineering (RE)



Several variations exist to this set of phases, such as those proposed by (Thayer & Dorfman 1987) and (Sommerville & Sawyer 1997). Others have included the addition phases of negotiation and prioritisation, while Hickey and Davis (Hickey & Davis 2003c) introduced a phase known as Requirements Triage, where the subset of all the requirements elicited that will actually be used is decided. In other breakdowns these additional phases may be included as activities in either the elicitation or analysis phases. In reality the phases of RE are intertwined and performed in an interleaved manner, often in parallel rather than as individual and sequential phases (Hickey & Davis 2003c). Phase 1: Service Requirement Engineering METHODOLOGY

The following section provides a basic example of how an existing 'ready-made' method could be implemented and enacted in a real-world project as a basis for a novice analyst, within the context of the general requirements elicitation approach presented in this chapter. This instructional generic example aims only to illustrate how the basic principles of the approach can be applied to the fundamental areas of a requirements elicitation project, and was based on the results from Literature and Survey of Practice.in addition to various industry standards and a selection of project artefacts.

Step 1: Service Characterisation

- **Definition Type**
  - The Definition Type, i.e. the definition of the type of elicitation project being conducted, is **Custom Service Development**. This represents a project where an IT service catalogue is built to order services according to the specifications of a particular customer or client (e.g. E-Mail Service as part of a cloud service).
- **Domain Type**
  - The Domain Type, i.e. the general service domain of the envisaged service, is service packages. This means an IT service that supports the business processes and operations of a specific organisation. It also includes information about the service type (core, extends, enhanced, special service).
- **Deliverable Type**
  - The Deliverable Type, i.e. the required IT service related output from the project. For example a serive catalogue, service SLA fact sheet, a contract, a service specification, ,.

Step 2: Method Construction

The following subsections detail the Info Types, Tasks, Sources and Techniques recommended for the 3Ds combination mentioned above in the project characterization step by this example presented. All of these info types, tasks, sources, and techniques have been identified from the available literature and project documentation, as being both relevant and appropriate for the elicitation of requirements, for the above mentioned combination of the 3Ds.

After the Sources for the elicitation of the Info Types have been identified, and assigned to the corresponding selected Tasks, the analyst is now required to choose which techniques are to be used within the workshop environment. As we have seen previously, the choice of elicitation technique can depend on a large number of factors, and not only the specific type of information that needs to be elicited. For the example ready-made method presented here however, the proposed Techniques can be seen in the table below.

The following table contains the whole approach with the different steps.

Table 1: Info Types, Tasks, Sources and Techniques

Name	Info Type	Tasks	Sources	Tech-niques
Service Identification	Service number	Define Service number		
Service Infor-mation	Benefit for the customer and scope of the service	Define and describe benefit, need, and/or idea behind the service and what is considered	CU, SP, PM	Interviews, Brainstorming, Document Analysis
Deliver-able Infor-mation	Desired result(s)	Define the intended deliverables and audience for the output of the service	CU, SP, PM	Interviews, Brainstorming
Landscape Infor-mation	Background, perspective, context, and scope	Describe the background and perspective of the services with reference to other services	CU, AT, PM	Interviews, Brainstorming,
Assumptions	Underlying assumptions upon which the service is based on	Identify all assumptions and related assumptions that may affect the service and describe in detail the assumptions previously elicited	CU, BA, PM	Interviews
Supported Business Processes	Detailed work process which the service should support	Identify key business work processes to be supported e.g.: • Universal business services (e.g. Email Services) • Business processes (e.g. Order	Existing Processes, System Manuals PM, BA, DE	Interviews, Docs, Analysis, Application Analysis, Domain Analysis, Task Analysis, Use Cases, Scenarios
Functional Aspects	Features and functional requirements which should be provided	Identify and describe the key functional aspects, key features and capabilities of the service	Existing Processes, System Manuals Forms & Reports	Interviews, Document Analysis, Application Analysis, Goals,
Non-functional Aspects	Non-functional conditions and requirements which should be provided by the service.	Identify the key non-functional aspects of the service (warranty and utility) such as Overall information • Service organization (1st, 2nd, 3rd level)	Existing Process, System Manuals PM, BA, DE	Interviews, Document Analysis, Application Analysis, Goals, Questionnaires
Implementation and Roll Out Details	Details relating to the implementation of target system	Identify the important details related to the implementation and roll out of the system	PM, BA, DE	Interviews, Brainstorming

Legend: CU Customer, PM Project Manager, BA Business Analyst, SP Sponsor, DE Domain Expert, AT Architect

Step 3: Method Execution

In the Method Construction step described above, 39 tasks were suggested by the example ready-made method as necessary to elicit the required information types. Since each method component is based on an individual task, this means that there are a minimum of 39 core method components in the pre-selected, pre-assembled, and

pre-constructed method for the identified 3Ds combination

The Scoping Phase

Upper Management of the same organisation, and key members of the project team such as the Project Manager. Furthermore, any and all available external documentation sources relevant to the project should be studied, such as the marketing material and website of the target organisation. As the service requirements can be part of a contract, the legals also should be integrated in the process. In addition, the participating analyst should carefully review and be familiar with the method components and sequence for the Scoping Performance stage, as well as gathering as much preliminary but relevant information as possible through informal discussions and observations.

The High-level Phase

In addition to studying all of the available high-level internal documentation sources relevant to the project, such as organisation charts and departmental reports, the Preparation stage of the High-level phase also requires the participating analyst to observe and take summary notes on the existing work processes and system operations relevant to the target system and the established scope.

The Performance of the High-level workshop (15 method components as can be seen in Table 4.5.6 below) involves firstly the tasks of reviewing and refining the information elicited from the Scoping workshop. In addition to the project team, High-level workshops also typically include Domain Experts, Middle Management, and Key User Representatives as sources.

Table 2: Scoping Performance Stage Method Components

Task	Info Type	Source	Techniques
Business Context			
26. Refine service information	Service Information	Project Managers Business Analysts Domain Experts	Interviews
27. Refine deliverable information	Deliverable Information		
Application Setting			
28. Refine service information	Service Information	Project Managers Business Analysts Domain Experts	Interviews Questionnaires
29. Refine goals	Goals		
30. Describe assumptions	Assumptions		
Work Processes			
38. Describe supported Business processes	Work Processes		
Functional Aspects			
39. Describe features and capabilities	Functional Aspects		
Non-functional Aspects			
40. Describe non-functional aspects	Non-functional Aspects		

Like the previous phase, the High-level Presentation stage consists of documenting the results of the workshop sessions, quality checking, and then distribution and review, except this time in the format of a Concept of Operations (ConOps) document (IEEE 1998b). Approval of the High-Level document, as with the Scoping and Detailed documents, may require several iterations of reviews and updates before approval is attained, depending on the effectiveness of the workshops, commitment of the stakeholders, and the complexity of the project.

The Detailed Phase

Techniques such as Goal decomposition and Viewpoint definition for example.

Table 3: The Detailed Phase

Task	Info Type	Source	Technique
Business Context			
41. Review service information	Service Information	Exiting Processes System Manual Project Managers Business Analysts Domain Experts Supervisors Key Users	Interviews Brainstorming
42. Review deliverable information	Deliverable Information		
Service Setting			
43. Review information	Service Information	Exiting Processes System Manual	Interviews Brain-storming Questionnair
44. Review goals	Goals		

Task	Info Type	Source	Technique
45. Review assumptions	Assumptions	Project Managers Business Analysts Domain Experts Supervisors	es
46. Review constraints	Environmental Details		
47. Refine environment	Opportunities		
48. Refine opportunities			

The same process is followed once again for the Presentation stage of the Detailed phase, however the format is that of a full System Requirements Specification document (IEEE 1998a). Given that this document is substantially more comprehensive than the previous documents, and involves most of the participating stakeholders, finalization of this document and its subsequent approval can often take considerably more iterations and time. This is particularly the case when the document is to be used as part of a contractual agreement between a customer and supplier.

4. SUMMARY AND OUTLOOK

. Required IT services will be successful if they fulfill the following criteria:

- A. Market compliance
  - IT Service delivers benefit within a market accepted price and quality range
- B. Fulfills clients requirements
  - IT Service supports clients business and fulfills clients needs
  - IT Services are aligned to business along the supply and value chain
- C. IT Service is professional managed
  - Covers all aspects of with an end-to-end service lifecycle

If these criteria are fulfilled, service will deliver value and will be beneficial.

This article is focused on the criteria B. and C. where existing requirement end-to-end lifecycles and methods were used as a basis. As system requirements differ from service requirements there is a need to develop a special service requirement approach. The article represents the current status of investigation for a service requirement approach and provides a ready-made method. The method could be implemented and enacted in a real-world project to manage the whole end-to-end service lifecycle.

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