Toward a Service Management Quality Model

Gil Regev[1, 2], Olivier Hayard[2], Donald C. Gause[3], and Alain Wegmann[1]

[1] Ecole Polytechnique Fédérale de Lausanne (EPFL),
School of Computer and Communication Sciences
CH-1015 Lausanne, Switzerland
{gil.regev,alain.wegmann}@epfl.ch
[2] Itecor, Av. Paul Cérésole 24, cp 568, CH-1800 Vevey 1, Switzerland
{o.hayard,g.regev}@itecor.com
[3] State University of New York at Binghamton and Savile Row, LLC, U.S.A
dgause@stny.rr.com

Abstract. **[Context and motivation]** Service Management has been steadily gaining in importance in many organizations and is becoming a major force of change in IT departments. ITIL, one of the main service management frameworks, defines the value of a service for its customers as the sum of the service utilities and service warranties but provides no specific rules for defining them. **[Question/problem]** Companies, IT departments and their consultants face difficulties defining utilities and warranties, as well as identifying their value for customers. **[Principal ideas/results]** We propose a general framework for understanding service requirements and for analyzing the quality of a service. The framework is based on General Systems Thinking. We define service utilities as norms created by the service for a given stakeholder. Service warranties then protect the stakeholder from variations of these norms as a result of threats. Value is created when the norms are maintained within the tolerance range of the stakeholder. Risk is defined as the possibility of detrimental consequences for a stakeholder if the norm is pushed outside its tolerance range. **[Contribution]** We believe that this work has the potential to advance theory and practice of service management in both academia and industry, and to reduce the risk of overlooking important service properties when defining service requirements.

Keywords: Service Utilities, Service Warranties, Norms, Tolerances.

1 Introduction

Service Management has been steadily gaining in importance in industry. As many IT departments are struggling with the changing business environment they are encouraged or sometimes forced to specify the services they provide to their customers, to define the value of these services, how they will be developed, provided, monitored and maintained.

Two of the main frameworks driving these changes are the IT Infrastructure Library (ITIL) and the Control Objectives for IT (COBIT). These frameworks have, in recent years, elevated the awareness of many organizations to the necessity of enhancing the

M. Glinz and P. Heymans (Eds.): REFSQ 2009, LNCS 5512, pp. 16–21, 2009.

strategic importance of IT departments for their parent organization by delivering services with customer value rather than applications and computing power.

The IT Infrastructure Library (ITIL) [9] is one of the main service oriented frameworks. It is a major industry driver that is drawing the attention of IT department managers to the service they provide and its value for their customers.

The concept of service[1] is defined in ITIL as [9] "a means of delivering value to customers by facilitating outcomes customers want to achieve without the ownership of specific costs and risks." Value is defined in ITIL as the sum of two deliverables, Utility and Warranty. Utility and warranty can be seen at a first glance as corresponding to Functional Requirements (FR) and Non-Functional Requirements (NFR), respectively, in Requirements Engineering (RE). Warranties are defined in Service Level Requirements (SLR), which, once signed by provider and beneficiary, become Service Level Agreements (SLA).

In ITIL Utility is defined as fitness for purpose whereas Warranty is defined as fitness for use. These two concepts are themselves defined as follows [9], "Fitness for purpose comes from the attributes of the service that have a positive effect on the performance of activities, objects, and tasks associated with desired outcomes. Removal or relaxation of constraints on performance is also perceived as a positive effect. Fitness for use comes from the positive effect being available when needed, in sufficient capacity or magnitude, and dependably in terms of continuity and security."

In everyday language [7] utility evokes both fitness for purpose and fitness for use, and relation between warranty and fitness for use is not directly apparent. The blurry nature of the definitions of ITIL results in confusion about the categorization of the properties of a service into utility or warranty. This confusion is one of the difficulties in specifying an SLR.

In this paper we attempt to clarify the crucial concepts of service level requirements, i.e. value, utility, warranty, and risk. We propose a conceptual framework based on General Systems Thinking (GST) [12], in which we consider a service as a system that maintains stable states (norms) for its stakeholders. We use the very simple example of an email service offered by an IT department to its company users. Due to space constraints, we only consider the availability warranty.

In Section 2 we present a very short introduction to GST. In Section 3 we discuss the view of a service as a system. In Section 4 we describe our conceptual framework. In Section 5 we review some of the related work before concluding in Section 6.

2 Viewing a Service as a System

One way of exploring the quality of a service is to model the service as a system, i.e. "a set of elements standing in interrelations" [11]. As demonstrated by Weinberg [12], some person, usually referred to as an observer in General Systems Thinking (GST), must define what the system is, its elements and their relationships, or else there is no system. A system is therefore a model (Weinberg calls it a viewpoint) that the

[1] We refer to business service in this paper as opposed to web services as they are considered in Service Oriented Architecture (SOA) and Service Oriented Computing (SOC).

observer creates in order to understand some object in his or her reality. From this philosophical point of view, the quality of a system is a relationship between an observer and the object itself. Quality is therefore neither an absolute property, nor an intrinsic property, of an object. It depends on the observer as much as it depends on the object.

In Systems Theory [11] a system draws energy, information and matter from the systems with which it has relationships in order to maintain its internal order. The concept of open systems implies that systems must accept input from other systems in order to survive. In doing so, a system becomes dependent on the stability of the input it receives from the other systems' output. In GST, outputs and inputs are traditionally specified in terms of states. More specifically, according to Klir [6], "the set of instantaneous values of all the quantities of the system (external as well as internal) is usually denoted as the *state* of the system. Similarly, the set of instantaneous values of all the internal quantities of the system will be called the *internal state* of the system." The system exists in states and the inputs may alter the system states. This causes the system to emit outputs. If we model the inputs, outputs, and system as another super system, then the inputs, system, and outputs can be described in terms of a more encompassing state space. We refer to the stable state of a system as its norm [10], whether it applies to its input, output or internal state.

In RE the observers of a system (or in our case of a service) are its stakeholders. A stakeholder of a service derives its norms from the stable input he or she receives from the service. This input is the service's output. The stakeholder then becomes sensitive to the variations in the service's output.

3 Defining Utilities, Warranties, Value, Risk and Quality

In the example of the email service, a user we call Alice provides input to the service in the form of requests to connect to the service, to send messages and to receive messages. The service outputs can be: connection confirmation, delivering sent messages to their destination and displaying received messages. As Alice takes the habit of using the service it becomes dependent on it for his or her everyday work. This everyday work is the output expected by the company from Alice. If the service's output is not stable, e.g. if Alice cannot connect to it of if the service doesn't display Alice's messages, or doesn't deliver the messages she sends, Alice will not be able to ensure the stability of her work.

From Alice's point of view, the utility of the email service is the outputs it maintains, connection, displaying received messages and delivering sent messages. Alice expects the service to deliver these outputs wherever and whenever she needs them. This can be anytime, anyplace (in the office, at home or during business travels) or restricted to certain hours in the office. The corresponding service warranty for Alice is that the service will be available when and where she needs it. Hence availability is not only a question of time (as described by ITIL, see definition of warranty in the introduction) but also a question of place.

The value for Alice is her ability to perform her daily work reliably. The risk for Alice is the probability that the email service, by not displaying or delivering messages will prevent her from performing her work. By accepting to use the email

service, Alice and her employer benefit from the advantage of electronic communication and shape their work accordingly but become potential victims if it is unreliable.

To understand the other stakeholders' viewpoints we use Gause and Lawrence's classification of stakeholders. Gause and Lawrence [3] propose to categorize users[2] (or rather stakeholders) as: clients, designers, direct users, secondary stakeholders, tertiary stakeholders, frivolous stakeholders. Clients are defined by Gause and Lawrence as [3], "responsible for economic matters, which include the ultimate financial success of the product." A similar definition can be found in ITIL [9]. Direct users are those who enter into contact with the service.

The advantage of this classification for a service is that it includes the designers as stakeholders. Extending this list from product stakeholders to service stakeholders, we have to include the service provider as well. The designers may or may not be part of the service provider. If the service provider is an IT department, the designers of the utilities are often the developers. The designers of the warranties and the service providers are the IT operations people. Secondary or tertiary stakeholders include regulators (market and legal), competitors, business process owners within organizations, as well as the partners of direct users and clients. In the case of the email service, it is probably on an off the shelf application designed by a software development firm. To turn it into a service, the application is hosted by the IT operations who must define its availability considering a set of threats that may limit this availability.

Gause and Lawrence provide a further subdivision of stakeholders. *Favored stakeholders* are those for which the service is designed and provided, in our example, Alice. *Disfavored stakeholders* are those for which the service is designed to create inconveniences and difficulties. Disfavored stakeholders are those who create the threats that push the norm outside of the tolerance range of favored stakeholders. Making the service impractical for them to use is one way of protecting the interests of favored stakeholders. Disfavored stakeholders include people who are not authorized to use the service and people who can create damage whether authorized to use the service or not. We can think of many such stakeholders for the email service, spammers, hackers, and even maintenance people can bring the service down. *Ignored stakeholders* are those for which the service is not designed at all, in our example, people outside the company with whom Alice never exchanges emails.

Favored stakeholders are those for which the service warranties maintain a norm within their tolerance range. Conversely, we want the warranties to be outside the tolerance range for disfavored stakeholders.

Based on this stakeholder classification, we propose the following definitions:

- A service utility is a norm that the service must maintain in order to satisfy favored stakeholders.
- The service warranty is the commitment by the service provider that the variation of the utility will be kept within favored stakeholders' tolerances and outside of disfavored stakeholders' tolerances.

[2] Gause and Lawrence's definition of a user as "any individual who is affected by or who may affect your product" corresponds to what is referred to as stakeholder in the current RE literature. We therefore take the liberty to refer to their concept of user as stakeholder.

- Value is the effect on a favored stakeholder when the utility is delivered within the warranty
- Risk is the possibility that a favored stakeholder will suffer the consequences of a service utility moving beyond their tolerance as a result of the system experiencing a given set of threats.

Favored stakeholders derive a value from the relationship they have with the service because it helps them to maintain their norms but at the same time they take the risk that if the service cannot maintain stability in its output, they may not be able to maintain stability in their own norms either. Hence, value and risk are inseparable.

In order to maintain the service's value to its favored stakeholders and to reduce the risk they are taking in using it, the service designer must design mechanisms that guarantee that the output remains within the tolerances of its favored stakeholders in the face of variations in the input. Limiting the variations of the input includes limitations to both favored stakeholders and disfavored stakeholders requests.

In our example, it is critical to understand Alice's tolerances for a lack of availability of the email service. These depend on the nature of Alice's work and on her personal preferences. If Alice depends on email for a mission critical work, her tolerances for a lack of availability will be very low. The service warranties will have to be very stringent. If, however, Alice uses her email for sending and receiving non urgent messages, the service can be down for maintenance every now and then and she may not even notice it. The IT department must therefore understand these norms and tolerances in order to define the SLR for the service provided to Alice.

When the variations in the utility become unacceptable to a stakeholder, he or she will define the service as being of poor quality. Conversely, when the states expected by a stakeholder are maintained despite perturbations, he or she is likely to declare that the service has high quality.

We can therefore define the quality of a service for a given stakeholder as the adequacy between its utilities and the needs of the stakeholder and adequacy of the warranties with the stakeholder's tolerances to variations in the utilities.

4 Related Work

Our definition of quality can be seen as an extension of the definition of service quality defined in [13], "the extent of discrepancy between customers' expectations or desires and their perceptions." Indeed, each stakeholder has his or her own idea of the quality of a service. We have also sharpened the question of expectations and perceptions.

Value-based Requirements Engineering [1, 5] is a stream of RE research based on the analysis of value exchanges within a network of actors. Value is considered in financial terms as the exchange of goods for money.

The research presented in [2] and [8] is an attempt to define business service properties by abstracting from the domain of software services. The result is much more technical and less general than our proposal.

The dichotomy between utilities and warranties in ITIL is similar to the well known dichotomy between Functional and Non Function Requirements in RE. Studies such as [4] can help in clarifying this dichotomy and therefore establish a better understanding of utilities and warranties.

5 Conclusions

Utilities and warranties as presented in ITIL are as important to service management as the concepts of Functional and Non Functional Requirements are to Requirements Engineering. We have found the definitions of utilities and warranties to be somewhat confusing. In this paper we propose to clarify these notions by resorting to the fundamental principles provided by General Systems Thinking, As a result we define utilities and warranties as relating to stakeholders' norms and tolerances. We believe that this clarification will be a stepping stone for further research in service science as well as a more pragmatic approach to service level requirements in industry. No doubt, more research is needed to refine the model we proposed. For example, we have not dealt with the issues of service support and service innovation. We have encouraging initial experience using this model in organizations, but more experience is needed.

References

1. Aurum, A., Wohlin, C.: A Value-Based Approach in Requirements Engineering: Explaining Some of the Fundamental Concepts. In: Sawyer, P., Paech, B., Heymans, P. (eds.) Proc. 13th International Working Conference on Requirements Engineering: Foundation for Software Quality, Trondheim, Norway, June 11-12, 2007, pp. 109–115 (2007)
2. Ferrario, R., Guarino, N.: Towards an Ontological Foundation for Services Science. In: Proc. of Future Internet Symposium, Vienna, Austria, September 28–30 (2008)
3. Gause, D.C., Lawrence, B.: User-Driven Design: Incorporating users into the requirements and design phase. Software Testing & Quality Engineering (January/February 1999)
4. Glinz, M.: On Non-Functional Requirements. In: Proc. 15th IEEE International Requirements Engineering Conference, New Delhi, India (October 2007)
5. Gordijn, J., Akkermans, J.M.: Value-based requirements engineering: exploring innovative e-commerce ideas. Requirement Engineering Journal, 114–134 (July 2003)
6. Klir, G.: An Approach to general Systems Theory. Van Nostrand Rheinhold, New York (1969)
7. Merriam-Webster online dictionary, http://www.merriam-webster.com (accessed, November 2008)
8. Nayak, N., Nigam, A., Sanz, J., Marston, D., Flaxer, D.: Concepts for Service-Oriented Business Thinking. In: Proc. IEEE International Conference On Services Computing, Chicago, Illinois, September 18–22 (2006)
9. Office of Government Commerce, ITIL Service Strategy, TSO, London (2007)
10. Regev, G., Wegmann, A.: Where do Goals Come From: the Underlying Principles of Goal-Oriented Requirements Engineering. In: Proc. 13th IEEE International Requirements Engineering Conference (RE 2005), Paris (September 2005)
11. von Bertalanffy, L.: General System Theory. George Braziller, New York (1968)
12. Weinberg, G.M.: An Introduction to General Systems Thinking. Wiley & Sons, New York (1975)
13. Zeithaml, V.A., Parasuraman, A., Berry, L.L.: Delivering Quality Service: Balancing Customer Perceptions and Expectations. Free Press, NY (1990)