Specifying Customers’ Expectations using DEMO-based SLAs

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Abstract. Currently, there are several organizations that are migrating their business models from a vision of selling products to a vision of service delivery. Thus, it became important to increase and ensure the quality of services provided to customers. However, these services are affected by gaps that decrease their quality level and, consequently, reduce the customers’ satisfaction regarding these services. One of the gaps that decrease service quality is the difference between customers’ expectations of a service and the providers’ perception of those expectations. To solve that gap, we propose a service quality approach based on the Enterprise Ontology (EO) and its methodology Design & Engineering Methodology for Organizations (DEMO). This dissertation presents a proposal of DEMO-based Service Level Agreement (SLA) to model the expectations of customers. The research methodology used to conduct this dissertation was the Design Science Research Methodology (DSRM) and the evaluation of our proposal was performed in a city council, a primary healthcare center and a cloud services provider. We conclude that our proposal of DEMO-based SLA can model customers’ expectations and thus contribute to a better perception of those expectations in order to close one of the gaps that affect service quality.

KeyWords. Enterprise Ontology, DEMO, Service Quality, Service Level Agreement

1. Introduction

Currently, the world has seen a growth in the service sector in industrialized economies (Cali, Ellis, & Velde, 2008). Not only there are many countries changing their focus from manufacturing sector to services sector as we are seeing a migration of human resources to providing services such as call centers and back office functions. Furthermore, the current Fortune 500 list contains more companies related to the services sector and less manufacturing companies than in the previous decades (Vandermerwe & Rada, 1988).

This growth of the service sector has increased the importance of issues such as the quality of services provided to the customers (Vandermerwe & Rada, 1988). To this end, various solutions are on the market and solutions based on ITIL or CMMI are among the most used worldwide (Hochstein, Zarkekow, & Brenner, 2005). The problem is that these solutions have a lack of theoretical foundation which leads to several inconsistencies between their implementations. This lack contributes to increase the gaps present in the gaps models (Parasuraman, Zeithaml, & Berry, 1985) and leads to a reduction in the quality perceived by the customer.

We propose a solution based on Enterprise Ontology (Dietz, 2006), and respective methodology DEMO, that intends to reduce the gap between customers’ expectations and the perception of them by the service provider (Parasuraman, Zeithaml, & Berry, 1985). We propose to close this gap by formally specifying the customers’ expectations into Services and Service Level Agreements. Several experiments have been performed (Mendes, Almeida, Salvador, & Mira da Silva, 2012) (Mendes & Mira da Silva, 2012) (Mendes, Ferreira, & Mira da Silva, 2012) which allowed us to mature the proposal. In this document we present the extended version of our proposal that contains a new definition of a Service Level Agreement (SLA) and a new structure of attributes for the SLAs.

Design & Engineering Methodology for Organizations (DEMO) is a methodology for modeling, (re)designing and (re)engineering organizations and networks of organizations. This methodology is based on the Enterprise Ontology (EO) theory. DEMO models are independent of their implementation which helps to build generic models that can be applicable to any kind of services (Dietz, 2006). At first glance it is not very clear the link between EO and the concept of service but recent studies (Albani, Terlouw, & Hardjosumarto, 2009) specified a service definition in accordance with EO and also a framework for specifying services (Terkouw & Albani, An Enterprise Ontology-Based Approach to Service Specification, 2011) that served as basis for our proposal.

In order to evaluate our proposal we applied in three real world field studies: a City Council, a Primary Healthcare Center and a Cloud Services provider. On the other hand, an evaluation of the artifact empirically was performed in parallel with the first demonstration through several interviews with service management experts.
The research method used in this dissertation was the Design Science Research Methodology (DSRM) which aims at the creation and subsequent evaluation of IT artifacts used to solve identified organizational problems (Mendes, Ferreira, & Mira da Silva, 2012).

This document is structured as follows. We specify the research problem that we address in this document in Section 2. In Section 3, we present a brief overview of the literature on the research problem area. Next, we introduce the theoretical background of this research, the Enterprise Ontology (Section 4). Afterward we present our proposal, namely the SLA definition using EO terms and our DEMO-based proposal to specify the services quality (Section 5). In Section 6 we present experiments where we applied our proposal, followed in Section 7 by an evaluation of these results. Finally, in Section 8 we show our conclusions.

2. Problem Statement

This section corresponds to the problem identification and motivation phase of DSRM. We will focus this research on the gaps (Parasuraman, Zeithaml, & Berry, 1985) that influence the quality of services and represent the main causes of reduced quality of services. This model of the five gaps states that the major difference between the perception of service quality and expected quality (Gap 5) is caused by the four other gaps (Figure 1):

- **Gap 1** - The expected service as perceived by the service provider differs from what is expected by the customer. The gap is caused by inadequate market research orientation, lack of upward communication and insufficient relationship focus;
- **Gap 2** - The service specification as used by the service provider differs from the expected service as perceived by the service provider due to the absence of customer driven standards, inadequate leadership and poor service design;
- **Gap 3** - The actual service delivery differs from the specified services by deficiencies of human resource policies, failure to match supply and demand, and customers not fulfilling roles;
- **Gap 4** - Communication about the service does not match the actual service delivery due to the ineffective management of customer expectations and inadequate horizontal communications;

Gap 5 is the difference between the actual service performance and the customers’ expectations. Judgments of high and low service quality depend on how consumers perceive the actual service performance in the context of what they expect. This gap is caused by the four preceding gaps. Hence, service quality can be increased by closing the first four gaps and, as a result, align the perceived service with the expected one.

![Figure 1 - The gaps model of Service Quality, based on (Parasuraman, Zeithaml, & Berry, 1985)](image)

Although the situation to achieve maximum utopian quality of service would have to close all of these gaps, **this research is only intended to reduce the gap 1**, as evidenced in Figure 1. We will try to close the difference between customers’ expectations about a service and the perception of those expectations by the service provider. This misalignment is caused by several factors, among them inadequate market research, lack of communication between contact employees and management, and insufficient relationship focus.

3. Related Work

This section presents the concept of service and we show some of the solutions currently used to specify services quality and we explain why they do not solve our problem.
Over time, service has always been defined as a set of one time consumable and perishable benefits that is delivered from the service provider to a service customer (Zeithmal, Parasuraman, & Berry, 1985). In most studies, the definition of service is evidenced by characteristics such as intangibility, perishability, inseparability and heterogeneity (Bitner, Fisk, & Brown, 1993).

Recent studies involving EO specified the concept of service based on the similarity with the pattern of the transaction proposed in the Dietz’s Enterprise Ontology (Dietz, 2006). The concept introduced focuses mainly on the part of the executor of the transaction and not on the part of the initiator. Therefore, a service is defined as a part of the transaction and not the transaction as a whole: A service is a universal pattern of coordination and production acts, performed by the executor of a transaction for the benefit of its initiator, in the order as stated in the standard of a transaction. When implemented it the service provider has the ability to know the coordination facts produced by the initiator and to make available to the initiator the coordination facts produced by itself (Albani, Terlouw, & Hardjosumarto, 2009).

We use this definition in this research, because this definition is the only one that, as our research, uses DEMO as a conceptual foundation. There are some solutions used to specify service quality that are widely used. We now present two of them: Service Level Management and Web Services based Solutions.

### 3.1 Service Level Management

Service Level Management is one of the key processes by which organizations manage their services, because it acts as the interface between the customer and the provider. At its most basic level, Service Level Management is involved in the following activities: define, agree, record and manage levels of service. There are a number of key elements required to ensure that services are fit for purpose and use, and remain so throughout their lifetime: service level requirements, targets and agreements (Office of Government Commerce, 2007).

Basically, to understand the Service Level Requirements (SLR) means that the customers’ needs and wants are understood, i.e. an SLR is a customer requirement for an aspect of a service. SLRs are based on business objectives and are used to negotiate Service Level Targets (SLT) which are commitments documented in Service Level Agreements (SLAs). SLTs are based on SLRs and are needed to ensure that the service is fit for purpose. SLTs should be SMART: specific, measurable, attainable, realistic and timely. Finally, SLA is an agreement between a provider and a customer that describes the service; it documents the SLTs and specifies the responsibilities of the provider and customer. Over the years it has also been the chosen concept to specify services quality (Office of Government Commerce, 2007).

Regarding Service Level Management solutions, current approaches have two main flaws. First, they lack a strong conceptual foundation because they were derived from best practices of several years of implementations - not from a well-founded theory. Consequently, the inexistence of a theory may cause incoherencies among those solutions (second flaw). Service Level Management solutions are process-driven and not service-driven. These solutions are designed to work individually as processes but the interactions between these processes (such as Request Fulfillment, Service Level Management and Incident Management) are usually unclear. For instance, the connection between an incident and an SLA is neither clearly explained in ITIL nor in CMMI.

### 3.2 Web Services based solutions

There are some solutions to specify service quality that originated in the web services community. In (Sahai, Durante, & Machiraju, 2002) the authors show how to use Web Service Description Language (WSDL) and Web Service Flow Language (WSFL) to specify SLAs. However, this work suffers from the web vision tunnel as it is focused on the web services and does not try to specify business services. For instance, the specifications do not include penalties or prices. The researches in (Tosic, Patel, & Pagurek, 2002), (Dobson, 2004) and (Frolund & Koistinen, 1998) have the same bottleneck. Despite this trend in the web service community, there are some recent researches that try to overcome the mentioned web service tunnel vision.

In (Keller & Ludwig, 2003) a novel framework for specifying and monitoring SLAs for Web Services is introduced: the Web Service Level Agreement (WSLA) framework. This framework is applicable to any inter-domain management scenario such as business process and service management or the management of networks, systems and applications in general. In (Andrieux, et al., 2007) and (Liu, Ngu, & Zeng, 2004) business criteria is also included in SLAs. These three solutions represent a new movement in the web service community; however, none is based on a strong conceptual foundation.

### 4. Theoretical Foundation

This section briefly describes the Enterprise Ontology theory (the theory that supports our proposal).

Enterprise Ontology (Dietz, 2006) is based on four axioms – operation, transaction, composition and distinction – and the organization theorem. The operation axiom states that the operation of an enterprise is constituted by the activities of actor roles that are elementary chunks of authority and responsibility, fulfilled by subjects. In doing so,
these subjects perform two kinds of acts: **production acts** and **coordination acts**. These acts have definite results: production facts and coordination facts, respectively. By performing production acts (P-acts) the subjects contribute to bringing about the goods and/or services that are delivered to the environment of the enterprise. By performing coordination acts (C-acts) subjects enter into, and comply with, commitments towards each other regarding the performance of production acts.

The transaction axiom states that coordination acts are performed as steps in universal patterns. These patterns, also called transactions, always involve two actor roles (initiator and executer) and are aimed at achieving a particular result. A transaction develops in three phases: the order phase (O-phase), the execution phase (E-phase), and the result phase (R-phase). In the O-phase the two actors agree on the expected result of the transaction; in the E-phase the executer executes the production act needed to create the expected result; and in the R-phase the two actors discuss if the transaction result is equal to the expected result.

The composition axiom establishes the relationships between transactions. This axiom states that every transaction is either a) enclosed in another transaction, b) is a customer transaction of another transaction, or c) is a self-activation transaction. The latter case refers to transactions that give rise to further transactions of the same type.

The distinction axiom states that there are three distinct human abilities playing a role in the operation of actors, called **performa**, **informa**, and **forma**. An ontological act (performa) is an act in which new original things are brought about. Deciding and judging are typical ontological production acts. Regarding the coordination between people, typical ontological acts are requesting and promising. An infological production act is an act in which one is not concerned about the form but, instead, about the content of the information. Typical infological acts are inquiring, calculating, and reasoning. Regarding the coordination between people, formulating thoughts (in written or spoken sentences) and interpreting perceived (through listening or reading) sentences are typical infological coordination acts. Acts like copying, storing, and transmitting data are typical datalogical acts, while speaking, listening, writing, and reading are typical datalogical coordination acts.

### 5. Proposal

This section corresponds to the design and development step of DSRM. In order to solve the problem of the difference between customers’ expectations and the perception of those by the service provider, we propose **DEMO-based Service Level Agreements to specify customers’ expectations**.

Our proposal for modelling customers’ expectations is composed by three steps (Mendes, Almeida, & Mira da Silva, 2012). The **first step** is to identify the services of the provider, using for that purpose a process based on the Enterprise Ontology methodology (Dietz, 2006). The **second step** of the proposal is to apply part of the GSSF. Our proposal includes the first three areas of GSSF’s attributes: service executor, service production and service coordination. For each identified service, one should specify the list of associated SLAs using our SLA definition (**step three**).

We have reached the following **definition of SLA**: Service Level Agreement (SLA) is a contract between two actors, initiator and executer, in the Order-Phase of any ontological transaction. This contract consists of the proposition detailed by informative acts that want to unify the service expectations of the initiator with the perception of those expectations by the executer.

We propose that an SLA is the same proposition detailed with various attributes that will make explicit the expectations that the customer has for the service. By specifying these expectations, the problem known as Gap 1 is reduced or even eliminated because the service provider will be acquainted with all the customer’s expectations.

Our proposal for a SLA structure consists of three areas of concern in each of these areas has its specific attributes. This structure, as illustrated in Figure 2, consists of three areas: SLA Basic Information, SLA Responsibility Information and SLA Specific Information.
The **SLA Basic Information** area contains the generic information expected by anyone when listing all SLAs or searching for a particular SLA. In this area the following attributes are specified:

- **Name** – This attribute defines the name of the Service Level Agreement that will be known to the world outside this contact;
- **Description** – This attribute contains a short description of the purpose of the SLA. This description, together with the SLA Name attribute, helps answer the question “What”;
- **Owner** and **Owner Contact Information** – These two attributes specify the name of the actor who owns the SLA and possible ways of being contacted by the customer or by another entity related to the SLA: The first attribute can be taken from the ATD while the second one is supplied by the Owner. These two attributes answer to the question ‘Who is responsible for fulfilling the SLA?’;
- **Service** – This attribute defines the service itself (on which this SLA is drawn) and makes the connection between our proposal and the Generic Service Specification Framework (Terkouw & Albani, 2011).

The **SLA Responsibility Information** area contains the information related to the duties and obligation of actors (customer and provider) when implementing the SLA. This area defines what is expected to be performed by each of the entities involved in this contract, in order to avoid misunderstandings or breaches of contract. In this area the following attributes are specified:

- **Customer Responsibilities** – This attribute lists the actions that the customer has to perform in compliance with this SLA. This information can be found in the Process Model and the Information Used Table (IUT) of DEMO;
- **Provider Responsibilities** – This attribute is similar to that mentioned above but with respect to the service provider.

The last area in the SLA, **SLA Specific Information**, contains the unique information for each SLA that defines the metrics and parameters that must be respected by the service provider to match the needs of the customer. This section answers questions such as “What are the targets?” and “What penalties can be applied if the targets are not met?”. The area is composed by a set of different combinations of targets and actions for each type of SLA. For each SLA type, the following attributes are specified:

- **Type** – This attribute has the same role as the SLA Name in the SLA Basic Information area but in this case the purpose is to identify a specific combination of targets and actions for the SLA. For each type will be specified the service configuration, the targets and the consequences for fulfillment (or not) of the targets, and assigned a price;
- **Service Configuration** – This attribute relates to the specific features of the service that this type of SLA includes. This information is specified by the Service Provider and it has no direct representation in the DEMO models and diagrams, as it is implementation dependent;
• **Targets** – This attribute is composed by six other attributes that relate to six specific metric of SLA and a seventh attribute that allows some flexibility to add other targets. The six targets types that we propose are: performance, availability, reliability, security, usability and financial. These targets may be partially obtained from the State Model, because this model specifies the state space of the P-world. According to (LaBounty, 1995), a contract between a provider of service and a consumer of service must set targets to measure compliance;

• **Penalties and Bonuses** – these two attributes specify the actions to be taken if the targets are not met (Penalties) or possible bonuses if the targets are met (Bonuses). This information is induced from the Action Model of the EO because this model defines the operational business rules of an enterprise;

• **Price** – This attribute assigns a price to the SLA and has no direct representation in the DEMO models and diagrams, as it is implementation dependent.

With these attributes we intend to capture the customers’ expectations, easing the task of service providers on perceiving those expectations and thus contributing to solve one of the main gaps in services exchange.

### 6. Demonstration

In this section we detailed three field studies where we applied our proposal. The first experiment was conducted in the Pombal City Council, the second was made in a Primary Healthcare and, finally, the last one was in a Cloud Services Provider. In these field studies we performed an organizational modeling using DEMO models, then we identified and specified the services using our proposal. The last step was the definition of SLAs for those services using our proposal.

#### 6.1 City Council

The demonstration occurred in a Portuguese city council named Pombal (CMP). Pombal is located in Leiria District and is composed of 17 parishes. It has a total area of 626.1 km² and a total population of 58,617 inhabitants. The population of the city of Pombal is about 18,000 inhabitants. CMP employs a total of 389 people with 203 men and 189 women and has five major departments divided into divisions, units and sections. In 2010 CMP spent a total of 20 553 200 € from which 7 542 250 € in human resources (Pombal City Council, 2011).

After completing the 17 individual interviews with employees from several departments and units of CMP and with the documentation provided by the employees, we specified all transactions of the City Council. Following the service definition based on DEMO (Albani, Terlouw, & Hardjosumarto, 2009) we identified 173 transaction of which 145 are ontological, 17 are infological and 11 are datalogical. These transactions correspond to all services provided by the five major departments that constitute the City Council. Due to the high number of transactions and services identified, we have chosen the transactions of the IT Division in the City Council.

The IT division operates and maintains the computer equipment, develops new tools, supports their applications, and conducts courses to enhance learning of the new features. We identified 13 services provided by this division: Network Configuration (T26), Hardware Installation (T28), Hardware Uninstallation (T29), Hardware Substitution (T30), Application Development (T30), Incident Resolution (T31), Database Management (T32), Software Installation (T35), Software Uninstallation (T36), Backup Realization (T40), Handbook Definition (T41), Training (T42) and Business Intelligence Study Realization (T43).

We applied the Generic Service Specification Framework (GSSF) to specify the ITD services (second step of the proposal). An example of this specification is the service called Application Development and is carried out by a Developer whose contact is available in the Service Executor section. In the Service Production area, it is specified that a new application is produced, which makes this an ontological service and, based on the ITD State Model, we found the information classes used in this service: Application, Handbook, Employee and Course. The ontological coexistence rules between these classes are the following: an Application may have a Handbook, several Courses and Employees using it. Additionally, a Course concerns an Application and it is taught in a certain period to a number of Employees.

Before this service execution, a precondition must be guaranteed, since the application development must be preceded by the hardware installation (T28). Regarding the post conditions there are none associated with the Application Development service. Concerning the Coordination area, the coordination acts involved in this service are illustrated by the Process Structure Diagram (PSD). In this diagram we see that the employee makes a request for a new application or feature and this request is handled by the developer that, when the development of the new application ends, starts two new transactions: write the user manual (Handbook Definition – T41) and schedule a training on this new application (Training – T42). In addition, in the Coordination area the procedure or protocol to successfully contact the service provider is specified as well as the location of the service that, in this case, is by email or phone.

In the third step of the proposal we specified the SLAs associated to the CMP services using our SLA proposal. The SLA concerns the development of an application named WebDoc2.0 and the SLA Owner is the IT Division Chief.
Multiple contacts of the IT Division Chief are specified in order to be contacted by the service customer at any time. This SLA was made on the first day of January of 2011, was valid until 31 of November of 2011 and was changed in July 15. To fulfill this SLA, the service provider needs to complete all the points specified in the SLA Provider Responsibilities (completion of ERP integration, improvement of communication between citizens and putting into production all features developed). This SLA has three types that depend on the date of completion of the development. Penalties and bonuses are translated into career points that influence the career development.

On the one hand, in case of SLA Type “Overcome goal”, the SLA Owner wins five career points and can evolve in his career. On the other hand, if the service provider does not meet the deadline the SLA Type “Non Fulfillment Goal” applies and the SLA Owner only wins one career point and can be fired with probable cause. Note that this SLA has no price defined because this is an internal service to the CMP and no chargeback is made among the CMP departments.

6.2 Primary Healthcare Center

The demonstration occurred in a Portuguese Primary healthcare center called ACES Oeiras that operates in a single county covering a population of 175,000 residents. ACES Oeiras employs 100 specialist doctors, 96 nurses, 68 health technicians and approximately 50 administrative staff. The mission of this Primary healthcare center is to secure for all patients of that geographical area gradual improvement of quality in health promotion and disease prevention, provision of care in sickness and linkage to other services for continuity of care and ensure efficient accessibility.

In order to identify all the services provided by the Primary healthcare center, we conducted an extensive interview with the three important employees in the organization: executive director, IT director and clinical director. Through this interview and with the help of a secretarial manual provided to us by the executive director, we have accomplished the first step of the proposal, getting the Actor Transaction Diagram that would later be used to identify improvements.

We have identified 12 main services provided by ACES Oeiras. We applied the Generic Service Specification Framework (GSSF) to specify the service of Scheduled Consultation. The service carried out by an actor role Patient Problem Handler, whose contact is available in the Service Executor section. In the Service Production area, it is specified that a new scheduled consultation is performed, which makes this an ontological service and, based on the ACES State Model, we found the information classes used in this service: Patient, Register, Physician and Consultation.

The ontological coexistence rules between these classes are the following: a Patient may have a Register that is used in the Consultations. Additionally, a Consultation is performed by a Physician which evaluates the state of the Patient. Regarding the pre-conditions there are one associated with the Scheduled Consultation service that is Registering Patient. Concerning the Coordination area, the coordination acts involved in this service are illustrated by the Process Structure Diagram (PSD). In this diagram we see that the Patient makes a request for a new scheduled consultation and this request is handled by the Patient Problem Handler that waits for the conclusion of the transactions T6, T8 or T10 to terminate the transaction referring to the Scheduled Consultation. In addition, in the Coordination area the procedure or protocol to successfully realize the consultation is specified as well as the location of the service that, in this case, is personal.

In the third step of the proposal we specified the SLAs associated to the ACES Oeiras services using our SLA proposal. This SLA concerns the performance of a scheduled consultation to a pregnant woman and the SLA Owner is the Physician. A phone contact of the Physician Office is specified in order to be contacted by the service customer at any time. This SLA was made on the 14th day of January of 2011 at 15pm, was valid until the end of the day. To fulfill this SLA, the customer and the service provider needs to complete all the points specified in the SLA Customer Responsibilities and the SLA Provider Responsibilities, respectively.

This SLA has two different types that depend on the time for completion of the consultation counting the waiting time of the Patient. In case of SLA Type “Satisfactory Service”, the SLA Owner wins two points in a possible scorecard with influence in his career and the price associated with this SLA correspond to the price of the consultation. On the other hand, if the service provider does not meet the 30 minutes target the SLA Type “Unsatisfactory Service” applies and the customer only have to pay three quarters of the price of the consultation.

6.3 Cloud Services Provider

The demonstration occurred in one of the main Portuguese operators of telecommunications providing a combined offer of Voice, Data, Internet and Service components aimed at corporate market. For confidentially problems, we will call CSP to this organization. CSP employs around 250 people and in 2010 had revenues more than 100,000,000€. Over two thirds of these revenues were derived from complex data and communications services. Recently, CSP aim to redesign their cloud services in order to be more customer oriented and aligned with costumers’ expectations. Therefore, this demonstration is focused on a specific area of the CSP services, the cloud services offering.

In order to identify the services (step one of our proposal) we interviewed four CSP employees individually. The participants were asked to describe the activities performed by CSP. The interviews were recorded and transcribed as
well as checked and discussed by two interviewers. The interviews allowed us to develop an enterprise description of CSP that was used as input for the service identification step.

We have identified 15 main services provided by CSP. We applied the GSSF to specify the service Server Access Start that implements the T02 transaction. This service is executed by the actor role Server Access Starter (A02) that is fulfilled by a CSP employee. An email and a phone number are provided to the customers.

In the service production area, a description of the action performed by the service provider is given (production act attribute), the categories used in this act are listed (production information used) and the resulting production fact is described (Customer C access to Server S has been started). As this production fact is an original one (this fact cannot be derived from previous facts), then the service can be defined as ontological. Before the service Server Access Start is executed, the provider must first configure the server, i.e. execute T03, T04, T05, T06, T07 and T08 (preconditions attribute). After the service execution, the customer must pay for it, i.e. execute T11 (postconditions attribute).

In the third step of the proposal we specified the SLAs associated to the CSP services using our SLA proposal. As stated before, our SLA proposal is composed by three areas: Generic SLA Information, Responsibility Information and Specific SLA Information. In the first one, we defined the name of the SLA (Virtual Private Server Configuration), the SLA description (SLA concerning the configuration of a Virtual Private Server), the SLA owner (Server Access Starter - A01), the SLA owner contacts, and the service (Server Access Start - T01). In the Responsibility Information area we defined both the customers' and the provider’s responsibilities.

Finally, in the third area, we specified the quality options of the service that correspond to the six SLAs types: Configuration 1 – Standard, Configuration 1 – Enterprise, Configuration 2 – Standard, Configuration 2 – Enterprise, Configuration 3 – Standard, and Configuration 3 – Enterprise. When requesting access to a server (T02), the customers can only choose one of these SLAs types. These six SLAs types represent different combinations of Operating Systems, number of processor cores, RAM capacity, and storage capacity that CSP has available for the service Server Access Start (T02) (the last three attributes were specified using variables n, x and z due to confidentiality purposes).

Every combination is described in the Service Configuration attribute and each one is associated to a different monthly price (from 62.50€ to 242.50€). All the SLA types have a common target regarding the service availability, since the server made accessible in T02 should be available 99.95% of the time. If not, the penalty applies and the customer receives a discount of 2% in the price (penalty attribute). In this service there are no bonuses.

7. Evaluation

The evaluation phase of our work was performed using several tools: Moody & Shanks Framework to evaluate the obtained models; the framework of the DSRM Strategies (section Error! Reference source not found.) to identify the type of assessment strategy that would be used for each field study, and the Memorandum of Information Systems for evaluate our artifact according to the four principles specified (abstraction, originality, justification and benefit). To evaluate our artifact we also collected feedback from experts via personal interviewers. We only present here the major conclusions of each evaluation.

7.1 Artifact

We conducted seven interviews with experts in the service management area in order to collect their feedback about our proposal. These experts hold high positions in international organizations active in providing services and gathering requirements, and have over 10 years of experience in this industry.

For the purpose of the interviews, a few days before we sent them a presentation of our proposal with an explanation of the different attributes and an example of our proposal applied in practice. The interviews were brief, 15 to 20 minutes, and each person was asked to comment the areas that constitute the SLA proposal and respective attributes. They were also asked to suggest new attributes to our proposal, explaining why, and if they agreed that our proposal could be used in a day-to-day business environment.

One of the main conclusions drawn from these interviews and from the contributions via email and LinkedIn was the need to add to our proposal an attribute that allows some flexibility to the writing of targets that do not fit those six types. We chose to add a seventh attribute to the Targets named Other Targets to tackle this gap. Another conclusion that was crafted in writing this document was a poor explanation of each attribute, sometimes not realizing the difference between attributes which led us to analyze and develop a better description of all attributes of the proposal. Overall, our proposal was assessed by the seven experts and all showed interest in putting this idea into production.

7.2 City Council

We collected feedback from 23 CMP employees and 7 CMP customers, and we validated the service catalogue from the IT Division with the IT chief. The IT chief agreed with all 13 identified services. The 23 CMP employees and 7 CMP
customers were arbitrarily chosen and were asked to classify the attributes of the SLA proposal from 1 to 10 according to the importance (being 1 irrelevant and 10 essential).

The first 14 attributes had high average scores (from 7.60 to 8.40) and the remaining two (Bonuses and Price) had lower classifications (5.90 and 6.85). These results indicate that the majority of the proposed attributes (14 in 16) were classified as important since they scored a minimum of 7.60 in 10 possible points. The remaining two attributes (Bonuses and Price) scored 5.90 and 6.85 revealing that they were classified as less important when comparing to the first 14. These results can be explained by the fact that there are no chargeback among the departments of the 30 inquired persons. Therefore, they value more the attributes that describe the service quality than the ones that capture the price.

7.3 Primary Healthcare Center

After the demonstration we collected feedback from practitioners interviewed previously that shown the approval by the practitioners of the service and service level (SLA) specified.

Another feedback given by practitioners and similar to the previous experience regards to the attributes present in our solution. It was the opinion of the three that our solution contains the attributes necessary for a good specification of the services of that organization, which showed the maturity of our solution. They were of the opinion that this SLA structure could be adopted in health to define the contracts between service providers and customers.

7.4 Cloud Services Provider

We collected feedback from four CSP employees. They were arbitrarily chosen and asked to freely comment on the proposal. The feedback was positive and they identified that the artefact provides a structured working approach for specifying customers' expectations. Additionally, the interviewees recognized the value of our proposal in the specification of their services, since it allowed the service provider to specify some attributes of the service that has not been initially designed (for example, the SLA Bonus attribute).

8. Conclusion

The services are booming in the world. This exponential expansion raises an important question concerning the quality services. This quality is affected by 5 gaps demonstrated in the gaps model (Parasuraman, Zeithaml, & Berry, 1985). Over the years, various solutions have emerged to align the customers' expectations and the perception of those expectations by the service provider, but none solved the problem completely.

In this dissertation we summarized proposals based on web services and the Generic Service Specification Framework. Web Services, in addition to being focused on processes rather than services, have a lack of strong conceptual foundation. The GSSF lacks detail, leading to different notions of quality by customers and service providers.

In order to solve the gap between customers’ expectations and perception of them by suppliers (gap 1), this dissertation proposes a definition of Service Level Agreement based on DEMO. Apart from the SLA definition, our proposal specifies a structure for the SLAs with three sections as well as attributes for each of these sections.

To prove the applicability and usability of our proposal based on DEMO, we held three field studies, the first one in a city council, the second in a Primary healthcare center, and the last one in a Cloud Services Provider. Then, to evaluate the obtained results, we used the Moody & Shanks Framework, collected feedback through interviews and questionnaires regarding the services obtained and the specified SLAs, and we analyze the results. In parallel, we conducted seven interviews with experts in order to collect feedback regarding our proposal.

After demonstrating how our DEMO-based Service Level Agreement can be applied in real situations to solve real problems and according to the results obtained after applying our evaluation methodology, we can claim that DEMO can be used to specify Service Level Agreements in order to model the expectations of the customers. Through this definition of SLA, there is a greater alignment between customers' expectations and the perceptions of these expectations by the service provider. Consequently, such reduction of gap 1 contributes to a sharp reduction in the gap 5 which relates to the difference between the Perceived Service and the Expected Service and the which corresponds to the sum of the four gaps.

The last step of DSRM, communication, is being achieved through scientific publications (one accepted and two waiting for the approval) aimed at the practitioners and researchers within the service science area.

For future work we propose some resolution of the other 3 gaps which will lead to a reduction of the gap 5. With this reduction, there is a higher services quality provided to customers which consequently increase the satisfaction of customers.
9. References


