EVALUATING THE SERVICE LEVEL AGREEMENTS OF NDT UNDER WS-AGREEMENT
An Empirical Analysis

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Abstract: Service-Level Agreements (SLA) is one of the well-known mechanisms to manage the services offered by a provider. In software engineering, it is usually taken as the starting point to define the collaboration between the development team and clients. More concretely, an SLA is a part of a service contract where the level of service is formally defined. In this document, both providers and clients purchase commitments that rule the working guidelines in a software project. However, despite its relevance, sometimes it is difficult or too subjective to assure that providers and clients are following SLA. This paper proposes a research approach based on the standard WS-Agreement and model-based paradigms that offers a mechanism for SLA testing and presents an initial evaluation of this approach in a Web methodology named NDT (Navigational Development Techniques). The paper refers to some practical experiences so as to evaluate the quality of the results, as well as introduces a new research line as a future work.

1 INTRODUCTION

In the scope of software engineering, a Service Level Agreement (SLA) is a contract or technical document signed by both the service provider and the user. Basically, this document states all the conditions to be fulfilled regarding the provision of the services. Furthermore, the SLA can also specify the set of actions (penalties or rewards) that must be applied if the guaranteed conditions are not satisfied.

In order to make a decision about the fulfilment of the SLA conditions, it is necessary to gather information about the service provision. This task may be performed by means of a set of monitors in charge of obtaining relevant information according to the SLA terms. However, the evaluation of SLAs is not a trivial task and may result very difficult or too subjective to be carried out. One of the main reasons is that SLAs are not always defined following a systematic and standard specification but they are usually elaborated in an unstructured format or even through natural language.

This paper presents a research approach that allows specifying SLAs in a systematic way using model-based paradigms. The approach is aligned with the application of a Web methodology named NDT (Navigational Development Techniques) that is currently used in a large number of companies in Spain. In this work we compare NDT solution with the standard WS-Agreement with the aim at identifying their common characteristics and differences. The approach is assessed by means of two empirical examples extracted from real projects developed by the Regional Cultural Ministry in Andalusia, Spain.

The paper is organized as follows. Section 2 outlines the basic concepts about WS-Agreement and a general vision of NDT methodology. Section 3 describes the NDT solution to manage SLAs by analyzing empirical examples in comparison with WS-Agreement. Finally, conclusions and future work are presented in Section 4.

2 BACKGROUND

This section introduces the basic concepts about WS-Agreement language as well as a general vision of NDT methodology.

2.1 WS-Agreement

WS-Agreement is a recommendation of the Open Grid Forum (OGF), which offers an XML-based structure to define SLA documents. The specification of an SLA in WS-Agreement is composed of the following elements: name, context and Terms. Although there are different types of terms, Guarantee Terms are the most important elements of the SLA and they list the obligations that have to be fulfilled by a specific obligated party (service provider or service consumer). A guarantee term includes a list of services the term applies to (Service Scope), a Qualifying Condition (QC) which is an assertion under which the term is applied, a Service Level Objective (SLO) which is the condition that has to be guaranteed and, finally, a Business Value List (BVL) which specifies a set of business values related to the agreement description (i.e., penalties, rewards, importance).

2.2 NDT – Navigational Development Techniques

NDT (Navigational Development Techniques) is a methodological approach based on the model-driven paradigm. NDT begins defining requirements phase formal metamodels and a set of transformations to generate analysis phase models. Requirements engineering phase begins with the definition of the objectives of the system. In this context, NDT can be understood as an objective-guided methodology.

Once the objectives are defined, NDT proposes the capture and definition of all the requirements in the system. In the analysis phase, NDT works in a similar manner, representing a content model, a navigation model and an abstract interface model. All of them are also defined in a set of metamodels.

After analyzing both the requirements metamodel and the analysis metamodel, this approach establishes a series of relationships among all the artefacts from the different models.

In recent years the initial approach of the NDT methodology (Escalona and Aragon, 2008) has evolved and nowadays it offers full support for the entire life cycle. It covers the stages of viability study, requirements, analysis, design, construction and implementation, as well as maintenance and testing phases during software development. Thus, NDT is compatible with a set of processes such as project management or safety and quality assurance. Currently, a large number of companies in Spain are working with NDT in software development due to a set of free tools grouped in NDT-Suite (NDTQ-

Framework 2011).

3 EVALUATION OF SLA OF NDT

In the maintenance phase, NDT supports SLAs in its lifecycle. In this Section, we present the solution offered by NDT and we compare this solution with the standard WS-Agreement.

3.1 SLA in NDT

The current solution of NDT to support SLAs is offered in two ways to the development team. The first one, more classical, is a word pattern that has to be completed by the development team and accepted by the client. The index of this NDT SLA Template is organized in the following sections (Figure 1).
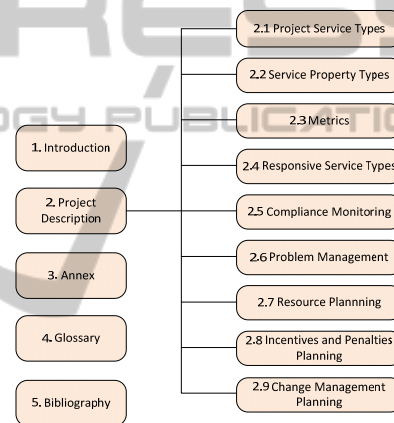
Figure 1: NDT SLA Template Index.

1. **Introduction**: defines business objectives, scope of services, details of the organizational structure and relationships between the organization and service providers.
2. **Project description**: includes information about the technical infrastructure and architecture, obligations, terms of license or responsibilities among others.
3, 4 and 5: **Annex, Glossary** and **Bibliography**.

This model means a good solution for development teams although it poses limitations (difficulty to be tested and maintained). Regarding this pattern and the fields defined in the model, a metamodel to include SLA in NDT was developed. Thus, by means of elements of UML, a development team can develop an integrated SLA in the rest of the system.

3.2 Empirical Examples

With the aim at comparing NDT approach with WS-

Agreement standard, we assessed two empirical examples of SLAs obtained from two real projects carried out by the Culture Government in Andalusia.

The first example is named Archiva and consists in a report to the Steering Committee on the proposed maintenance of the application. It analyzes the current status of the project and the incidents response time, studying the reasons that increase these times and setting the necessary measures to correct them. Then, the project indicators will be graphically represented according to open and close incidents. The report must be based on SLA indicators so as to obtain the list of incidents that do not fulfil such indicator and the reasons. Another indicator is the impact analysis, which allows us to be informed of the state of the system, showing the set of indicators that have improved and those that must be improved. Finally, an analysis of the whole project must be done, showing a matrix with the current problems of the project and identifying in each case the impact of the lack of resolution as well as the necessary actions to solve it.

The second example involves the project for the evolution of Mosaico, which describes the operational, management and relationships models as well as the quality parameters from the catalogue governing during the full life of the project. This plan should help to increase efficiency in the information systems life cycle management and to facilitate continuous improvement of the quality of the TIC services provided. The description of the project presents the services, the operating model which describes the details of the service requests and the information that must be provided at each stage when processing a request for service. Once the volume of service and required effort have been decided, the indicators that determines whether it is necessary to establish specific actions to stabilize the situation or start the modification process should be set. Finally, operational tools are listed and the metrics and indicators per service are established. It will also establish periodicity for SLAs measurement with SLA indicators and the basic documents that must be enclosed for the committees.

3.3 SLA vs WS-Agreement

This section studies the traceability between the SLA template provided in NDT and WS-Agreement. The objective is twofold: identify the common characteristics of both specifications and describe a reasonable mapping between the elements of each template. In Table 1 the elements of the NDT SLA Template are listed in rows while WS-Agreement

elements are represented in columns. We use (▤) in a cell to show that these characteristics represent the same information in both specifications. We use (⇧) to indicate that the information within the NDT SLA Template is not explicitly specified in WS-Agreement, but should be reasonably included in the corresponding WS-Agreement element. In the same way, we use (⇦) to highlight that the information specified in the WS-Agreement element can be mapped to the section of NDT SLA Template represented in that row. We use (⇔) if the information contained in WS-Agreement and NDT SLA Template is not the same, but it can be bidirectionally mapped from both elements. Finally, the cross-lined cells points out the elements of both specifications that do not have similar information, so they could not be directly mapped.

Both specifications share identical information in different parts of their structure. Firstly, the whole definition of the services is described in the Project Service Types section of NDT SLA Template and also in the SDTs of WS-Agreement through a specific DSL. Furthermore, both specifications allow identifying the set of measurable properties with their corresponding metrics.

Probably, the most important part of the SLA comprises the specified conditions to be fulfilled by the stakeholders signing the agreement. This information is stated in the Service Guarantee of the NDT SLA Template and the GTs section of WS-Agreement. Such sections indicate who is responsible for satisfying the conditions and the thresholds that have to be honoured.

The fulfilment or violation of the SLA terms may lead stakeholders to further consequences. Hence, a specific policy must be agreed, depending whether the objectives have been met or not. This information may appear both in the Penalties and Rewards Planning of NDT SLA Template and in the BVL of a GT in WS-Agreement.

Generally, each agreement lasts a specific period of time. However, WS-Agreement only includes the expiry date of the SLA, whereas the NDT SLA Template indicates both the initial and final dates of validity of the SLA.

In addition to the specific guarantees of the agreement, different information about the business objectives, stakeholder's organization or the relationship between service providers and consumers, among others, may be specified in the Introduction section of NDT SLA Template and the Context section of WS-Agreement. Furthermore, a description of the project or system can be given both in the Project Service Types of NDT SLA

Table 1: Traceability between NDT SLA Template and WS-Agreement specification.

		Context								Terms — Service Description Terms				Service References			Service Properties					Guarantee Terms				QC/SLO			BVL				
		Agreement ID	Name	AgreementInitiator	AgreementResponder	Provider	Expiration Date	TemplateID & Name	Any Attribute	Term Compositors	Name	Service Name	Full Description	Name	Service Name	Representation	Name	Service Name	Variable Name	Metric	Location	Name	Obligated	Service Name	Condition	Name	Target	Custom Value	Importance	Penalty	Reward	Preference	Custom Business Value
Introduction		⇐	⇐	⇔	⇔	⇔		⇔	⇑																								
Project Description									⇑				⇔																				
Project Service Types											▤	▤	▤	⇐	⇐	⇐																	
Service Properties Types																	▤	▤															
Metrics																			▤	▤	▤												
Respons. Service Types	Responsibility																					▤	▤	▤	⇐								
Respons. Service Types	QoS Thresholds																					▤		▤	⇐	▤	▤	▤					
Compliance Monitoring	Reports																																
Compliance Monitoring	Format																																
Compliance Monitoring	Addressee																																
Compliance Monitoring	Planning																																
Problems Managem.	Procedures																																
Problems Managem.	Scalability																																
Problems Managem.	Severity Levels																												⇔			⇔	
Resource Planning																																	
Incent. and Penalt. Plan																														▤	▤		
Changes Manag. Planning	Validity Period						▤																										
Changes Manag. Planning	Review Proc.																																
Changes Manag. Planning	Improvement Procedures																																
Annex, Glossary and Ref.																																	

Template and the Service Description Terms of WS-Agreements, here again through a specific DSL.

4 CONCLUSIONS

This paper presents an approach that allows specifying SLAs in a systematic way through a model-based paradigm. The solution is applied in the context of a Web methodology named NDT, which is currently in use in several companies in Spain. The evaluation of the solution is performed by two empirical examples of SLAs extracted from real projects developed by the Culture Government in Andalusia. This evaluation has allowed us to identify similarities and differences between both specifications helping to address our future work.

With the aim at improving the profile of NDT, it should be integrated with the types of problems and tests, the business objectives and the scope of the contracted services as well as the organizational structure and its relationships. This would follow the standard and improve the traceability of the system.

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