Project no. FP7- 216556
Instrument: Integrated Project (IP)
Objective ICT-2007.1.2: Service and Software Architectures, Infrastructures and Engineering

Deliverable D.A2a
Business SLA Management

Keywords:
Service Level Agreement, Service-Oriented Infrastructure

Due date of deliverable: [31st May 2009]
Actual submission to EC date: [12th June 2009]

Start date of project: 1st Jun 2008
Duration: 36 months

Lead contractor for this deliverable: TID
Revision: V.1.0 (3rd June 2009)

Project co-funded by the European Commission within the Seventh Framework Programme (2007-2013)

<table>
<thead>
<tr>
<th>Dissemination level</th>
<th>Public</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>PU</td>
<td>Public</td>
<td>Yes</td>
</tr>
</tbody>
</table>
This work is licensed under a Creative Commons Attribution 3.0 License.

Document Status

<table>
<thead>
<tr>
<th>Deliverable Lead</th>
<th>Juan Lambea, TID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reviewer 1</td>
<td>Francesco Torelli, ENG</td>
</tr>
<tr>
<td>Reviewer 2</td>
<td>Luciano Baresi, PMI</td>
</tr>
<tr>
<td>PMT Reviewer</td>
<td>Ramin Yahyapour, UDO</td>
</tr>
<tr>
<td>Complete version submitted to reviewers</td>
<td>24 April, 2009</td>
</tr>
<tr>
<td>Comments of reviewer 1 received</td>
<td>4 May, 2009</td>
</tr>
<tr>
<td>Comments of reviewer 2 received</td>
<td>10 May, 2009</td>
</tr>
<tr>
<td>Revised deliverable submitted to PMT</td>
<td>26 May, 2009</td>
</tr>
<tr>
<td>PMT Approval</td>
<td>03 June, 2009</td>
</tr>
</tbody>
</table>

Contributors

<table>
<thead>
<tr>
<th>Partner</th>
<th>Contributors</th>
</tr>
</thead>
<tbody>
<tr>
<td>TID</td>
<td>Juan Lambea, Beatriz Fuentes, Alfonso Castro, Oscar Dueñas</td>
</tr>
</tbody>
</table>

Notices

The information in this document is provided "as is", and no guarantee or warranty is given that the information is fit for any particular purpose. The above referenced consortium members shall have no liability for damages of any kind including without limitation direct, special, indirect, or consequential damages that may result from the use of these materials subject to any liability which is mandatory due to applicable law. Copyright 2009 by the SLA@SOI consortium.

There are some diagrams and basic information model that are exposed in this document that are based in SID (Shared Information Data) model from Tele Management Forum. Copyright 2009 by TM Forum.

Document History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Author</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>07th April 09</td>
<td>Juan Lambea</td>
<td>Template</td>
</tr>
<tr>
<td>0.2</td>
<td>16th April 09</td>
<td>Juan Lambea</td>
<td>Adaptation to the new delivered template and updated sections 3 4.3 and 4.4.</td>
</tr>
<tr>
<td>0.3</td>
<td>20th April 09</td>
<td>Beatriz Fuentes, Alfonso Castro</td>
<td>Introduction, State of the Art</td>
</tr>
<tr>
<td>0.4</td>
<td>23th April 09</td>
<td>Oscar Dueñas</td>
<td>eTom/SID information added</td>
</tr>
<tr>
<td>0.5</td>
<td>24th April 09</td>
<td>Juan Lambea</td>
<td>Implementations details</td>
</tr>
<tr>
<td>0.6</td>
<td>21th May 09</td>
<td>Juan Lambea, Oscar Dueñas</td>
<td>Updated with reviewer recommendations</td>
</tr>
<tr>
<td>0.7</td>
<td>25th May 09</td>
<td>Beatriz Fuentes, Alfonso Castro</td>
<td>Updated with reviewer recommendations</td>
</tr>
<tr>
<td>0.8</td>
<td>1st June 09</td>
<td>Beatriz Fuentes, Alfonso Castro</td>
<td>PMT updated recommendations</td>
</tr>
<tr>
<td>0.9</td>
<td>2nd June 09</td>
<td>Juan Lambea</td>
<td>PMT updated recommendations</td>
</tr>
</tbody>
</table>
Executive Summary

The main concept of SLA@SOI project is a systematic grounding of SLAs from the business level down to the physical infrastructure. At the business level, the project entails an automated e-contracting lifecycle that covers the whole interaction between service providers and customers. This starts from the commercial product definition to the negotiation and sales process. Finally, the management of the post-sales relationship including SLA monitoring and customer behaviour analysis is included.

Service providers require the management of service level agreement (SLA) contracts in business terms, e.g. for minimizing financial penalties for service-level violations or maximizing service-level measurement based customer satisfaction metrics. A considerable number of languages (i.e. WSLA, WSAgreement, WS-Policy) have been developed that are used for specifying SLAs between service providers and consumers. These languages are focused on the specification of functional and quality properties of web services. However, they do not provide support for specifying information that would be necessary in a business context. Early initiatives have been launched for developing an information model to represent business concepts such as SID (Shared Information/Data).

SID is the information model of the Tele Management Forum’s New Generation Operations Systems and Software (NGOSS) program. It is a set of comprehensive standardized information definitions aiming to be the common language for building easy to integrate OSS (Operational Support System) and BSS (Business Support System) solutions.

In this document the Business SLA Model based on WS-Agreement is introduced, aiming to improve the quality perceived by customers and their satisfaction. Upon this model a basic Business SLA Framework has been implemented covering the whole commercial lifecycle.

Furthermore, a deep study of the SID has been done in order to determine the mapping of the main concepts in the business SLA@SOI model, and identifying the modules or classes that need to be further extended.

Finally, the Business SLA Model is used to construct an ontology, where the main concepts, properties and their relationships are represented.
Table of Contents

1 Introduction .................................................................................................................. 7
2 Summary of State of Art ............................................................................................ 9
  2.1 TeleManagement Forum’s (TMF) Shared Information and Data Model (SID) .... 9
  2.2 Web Services Agreement (WS-Agreement) ....................................................... 9
  2.3 Web TM Forum SLA Management Handbook ................................................. 10
  2.4 TMForum Service Delivery Framework (SDF) Catalyst Project ...................... 10
  2.5 Web Service Level Agreement (WSLA) .......................................................... 11
3 Business SLA Model ................................................................................................. 12
  3.1 Service Level Agreements ................................................................................. 12
     3.1.1 Service Agreement .................................................................................. 13
  3.2 Service BusinessValue ..................................................................................... 14
  3.3 Service Level Objective (SLO) ........................................................................ 14
  3.4 SLA Templates & Service Descriptions ............................................................ 14
     3.4.1 Class Descriptions .................................................................................. 15
        ServiceDescription ...................................................................................... 15
        ServiceOfferDescription .......................................................................... 15
  3.5 Monitoring ........................................................................................................... 15
     3.5.1 Class Descriptions .................................................................................. 16
        KPI ............................................................................................................... 16
        Metric ......................................................................................................... 17
        MeasurementDirective ............................................................................... 17
        Function ..................................................................................................... 17
        MonitoringPolicy ....................................................................................... 17
        MonitoringReportsPolicy .......................................................................... 17
  3.6 Billing ..................................................................................................................... 18
     3.6.1 Class Descriptions .................................................................................. 18
        BillDescription .......................................................................................... 18
        BillFormat .................................................................................................. 18
        BillAlteration .............................................................................................. 18
        Customer ..................................................................................................... 19
        PaymentMethod .......................................................................................... 19
4 Business SLA basic Framework ................................................................................... 20
  4.1 Overview .............................................................................................................. 20
  4.2 High-Level design goals ...................................................................................... 20
  4.3 Requirements ....................................................................................................... 20
     4.3.1 Requirements codification ...................................................................... 21
     4.3.2 Generic Business Framework .................................................................. 21
     4.3.3 Commercial creation .............................................................................. 21
     4.3.4 Negotiation, assessment & post-sale management .................................... 22
  4.4 Architecture ......................................................................................................... 22
     4.4.1 Physical architecture ............................................................................... 22
     4.4.2 Overall software architecture .................................................................. 23
     4.4.3 eContracting software architecture ...................................................... 23
        eContracting Module Architecture Diagram .............................................. 23
        Business web tools Architecture Diagram ............................................... 27
     4.4.4 eContracting requirements and components matrix ............................... 28
     4.4.5 Data Model .............................................................................................. 29
  4.5 Business SLA interfaces ....................................................................................... 33
     4.5.1 Provided interfaces .................................................................................. 33
     4 QueryCatalogue interface .............................................................................. 33
ProposeAgreement interface ................................................................. 33
QuerySLAStatus interface ................................................................. 34
EContractingSchema_1-0.xsd ............................................................. 34
BusinessViolationEvent interface ...................................................... 35
4.5.2 Consumed interfaces ............................................................... 35
CreateAgreement interface & operation .............................................. 35
GetTemplates interface & operation .................................................... 35
StoreTemplates interface & operation .................................................. 36
GetSLAS & operation ........................................................................ 36
StoreSLAS & operation ..................................................................... 36
NotifyDeliveryStatus interface ............................................................ 36
4.6 Business SLA implementation ...................................................... 36
4.6.1 Business SLA Templates .......................................................... 36
Service Description Term section .......................................................... 37
Creation Constraints section ............................................................... 38
4.6.2 Business SLAs .......................................................................... 38
5 Business Web Tool ........................................................................... 39
5.1 Product .......................................................................................... 39
5.1.1 Publish .................................................................................. 39
5.1.2 Find ...................................................................................... 40
5.1.3 Customers ............................................................................... 41
5.2 Business SLAT ............................................................................. 43
5.2.1 Publish .................................................................................. 43
5.2.2 Find ...................................................................................... 48
5.3 Policies .......................................................................................... 49
5.3.1 Publish .................................................................................. 49
5.3.2 Find ...................................................................................... 51
6 Business and Information Framework for supporting Business SLA Model ... 52
6.1 Relationship between Business SLA Model and eTOM ...................... 52
6.2 Relationship between Business SLA Model and SID ....................... 55
6.2.1 Agreement SID Class Descriptions ............................................ 59
Relationship with Business SLA Model .......................................................... 61
6.2.2 Service Level Specification SID Class Descriptions .................. 61
Relationship with Business SLA Model .......................................................... 63
6.2.3 Billing SID Class Description .................................................. 63
Relationship with Business SLA Model .......................................................... 65
6.2.4 Specification SID Class Description ....................................... 65
Relationship with Business SLA Model .......................................................... 67
6.2.5 Performance SID Class Description ....................................... 67
Relationship with Business SLA Model .......................................................... 68
6.3 Business SLA Model aspects not included in SID model .................. 68
7 Business SLA Ontology ..................................................................... 70
7.1 Offered and provisioning service description .................................. 71
7.2 SLA description .......................................................................... 71
7.3 Monitoring description ................................................................. 72
7.4 Billing description ........................................................................ 73
8 Conclusions .................................................................................... 75
8.1 Summary ..................................................................................... 75
8.2 Next steps ................................................................................... 75
9 References ....................................................................................... 76
# Table of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Schematic representation of the structure of this section</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>SLA classes</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>SLA Templates &amp; Service Descriptions</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Monitoring model</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>Billing concepts</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>Overall architecture diagram</td>
<td>23</td>
</tr>
<tr>
<td>7</td>
<td>eContracting architecture diagram</td>
<td>24</td>
</tr>
<tr>
<td>8</td>
<td>Business Schema</td>
<td>25</td>
</tr>
<tr>
<td>9</td>
<td>Business Web Tools architecture diagram</td>
<td>28</td>
</tr>
<tr>
<td>10</td>
<td>Business Data Model</td>
<td>30</td>
</tr>
<tr>
<td>11</td>
<td>Monitoring Event</td>
<td>32</td>
</tr>
<tr>
<td>12</td>
<td>eTOM processes level 0 and 1</td>
<td>53</td>
</tr>
<tr>
<td>13</td>
<td>Relationship with Level 2 Operations Processes</td>
<td>54</td>
</tr>
<tr>
<td>14</td>
<td>Relationship with level 2 SI&amp;P Processes</td>
<td>55</td>
</tr>
<tr>
<td>15</td>
<td>SID Domains</td>
<td>56</td>
</tr>
<tr>
<td>16</td>
<td>Business View Domains and eTOM level 1 mapping</td>
<td>57</td>
</tr>
<tr>
<td>17</td>
<td>SID and Business SLA Model mapping</td>
<td>58</td>
</tr>
<tr>
<td>18</td>
<td>Agreement SID classes</td>
<td>59</td>
</tr>
<tr>
<td>19</td>
<td>Service Level Specification SID classes</td>
<td>62</td>
</tr>
<tr>
<td>20</td>
<td>Billing SID classes</td>
<td>64</td>
</tr>
<tr>
<td>21</td>
<td>Specification SID classes</td>
<td>66</td>
</tr>
<tr>
<td>22</td>
<td>Performance SID classes</td>
<td>67</td>
</tr>
<tr>
<td>23</td>
<td>Schematic representation of provisioning service ontology</td>
<td>71</td>
</tr>
<tr>
<td>24</td>
<td>Schematic representation of SLA ontology</td>
<td>72</td>
</tr>
<tr>
<td>25</td>
<td>Schematic representation of monitoring semantic description</td>
<td>73</td>
</tr>
<tr>
<td>26</td>
<td>Schematic representation of SLA billing ontology</td>
<td>74</td>
</tr>
</tbody>
</table>
1 Introduction

This deliverable describes the architecture, design and implementation of the business SLA management framework which has been created within the first year of the European research project SLA@SOI. This includes a specification of a standardized model for Business Service Level Agreements (SLAs) characterization, including domains as Market/Sales, Product, Customer, Service, Partner and Common Business. Also, it includes the implementation of relevant components.

A motivating business scenario highlighting the idea behind this project is the service provider who is enabled to offer services with differentiated, dependable and adjustable SLAs and can negotiate concrete SLAs with (individual or groups of) customers in an automated fashion. This business goal imposes requirements on software providers (to provide components with predictable non-functional behaviour) and infrastructure providers (to support an SLA aware management of resources). Of course, complete business value chains can be easily composed on top of this infrastructure.

This document starts with a review of the state of the art. Then, the Business SLA Model is introduced, and then, Section 4 describes the basic Business SLA Framework that has been implemented for the initial phase of the project. The goal of this conceptual model is to identify key entities at the business level, and to explicate the relationships between them. The model is built based on the Web-Services Agreement Specification (see reference [9]) and the Web Service Description Language (WSDL), [10], and extends the SLA Model in [11] specified as part of the A5 Work Package. Also, the document contains the part of the SID model used to enrich the SLA Model with business issues.

Once the Business SLA Model has been established, a business SLA basic framework is build.

Secondly, an analysis is made in order to determine how its concepts and principles map to the TM Forum Information Framework (SID, Shared Information Data).

Finally, the Business SLA Model is used to construct an ontology, where the main concepts, properties and their relationships are represented.

The Figure 1: Schematic representation of the structure of this section represents the structure of this deliverable:
Figure 1: Schematic representation of the structure of this section

The document is organized in the following sections:

i) Section 2: presents the state of the art about business SLA management

ii) Section 3: builds a Business SLA Model, first identifying the Business SLA Parameters and then including them into the SLA Model Definition already specified by work package A5 (see document [11]).

iii) Section 4: describes the business SLA basic framework

iv) Section 5: describes the relationship of the Business SLA Model built in Section 3 and the SID.

v) Section 7: builds an ontology based on the Business SLA Model described in Section 3.

This document serves as formal deliverable D.2a for reporting the work progress of work package A2 at project month 12.
2 Summary of State of Art

In this section a summary of the state of the art regarding business SLA Models is presented. A more detailed analysis has been included in deliverable D.B5a [1].

2.1 TeleManagement Forum’s (TMF) Shared Information and Data Model (SID)

Shared Information Data (SID) model [2][3] is the information model of the Tele Management Forum’s New Generation Operations Systems and Software (NGOSS) program.

SID is a set of comprehensive standardized information definitions aiming to be the common language for building easy to integrate OSS (Operational Support System) and BSS (Business Support System) solutions.

The SID model focuses on what are called “business entity” definitions and associated attribute definitions. A business entity is a thing of interest to the business such as customer, product, service, or network, while its attributes are facts that further describe the entity. Together, the definitions provide a business-oriented perspective of the information and data that is needed to run in an organization.

The adoption of the SID as the industry’s standard information model is growing rapidly, with many service providers, system vendors, equipment vendors and systems integrators using the SID as the basis for their development and integration. And the influence is widening as the principles are adopted by other industry forums through the TMF industry liaison program.

2.2 Web Services Agreement (WS-Agreement)

WS-Agreement [4][5] is a Web Services protocol for establishing agreement between two parties, such as between a service provider and consumer, using an extensible XML language for specifying the nature of the agreement, and agreement templates to facilitate discovery of compatible agreement parties.

The specification consists of three parts which may be used in a composable manner: a schema for specifying an agreement, a schema for specifying an agreement template, and a set of port types and operations for managing agreement life-cycle, including creation, expiration, and monitoring of agreement states.

There are two topics that are directly relevant to the A2 Work package: the SLA lifecycle management and the Price Offer Specification. While the first one is
already covered in the current definition, the Price Offer Specification will have to be included by means of an extension of the WS-Agreement, adding service description terms and constraints to fulfill the price-related functionality.

2.3 **Web TM Forum SLA Management Handbook**

SLA Management Handbook series [6] is a handbook to assist two parties in developing a Service Level Agreement (SLA) by providing a practical view of the fundamental issues. The parties may be an "end" Customer, i.e., an Enterprise, and a Service Provider (SP) or two Service Providers. In the latter case one Service Provider acts as a Customer buying services from the other Service Provider. For example, one provider may supply network operations services to the provider that supplies leased line services to its customers. These relationships are described as the Customer-SP interface and the SP-SP interface.

The perspective of the SLA Management Handbook series is that the end Customer, i.e., an Enterprise, develops its telecommunication service requirements based on its Business Applications. These requirements are presented to a Service Provider and the two parties begin negotiating the specific set of SLA parameters and parameter values that best serves both parties. For the SP, the agreed-upon SLA requirements flow down through its organization and become the basis for its internal management and control of its Quality of Service (QoS) processes. For the Enterprise Customers, the SLA requirements serve as a foundation or a component of its internal network services or business services. The SLA requirements define and limits the offer and the consumption of the service for the both parts that are joined. It means that affect to the consumption of the customer and the offer, service level and support of the service by the service provider.

2.4 **TMForum Service Delivery Framework (SDF) Catalyst Project**

The Syndicated Services Catalyst Project [7][8] tries to demonstrate a new concept that standardizes the product lifecycle management, service provisioning, event generation, and subscription across Service Provider domains to facilitate service syndication and end-to-end management of the services.

A Syndicated Service is a self-contained service that has been created and established in a hosted environment by a Service Provider and is ready to be used (or "on-boarded") by another Service Provider. From these syndicated services, it is possible to create commercial agreements or SLAs associated with the syndicated services.

The Service Provider who can syndicate services must expose service access, usage, assurance, and billing capabilities. The Service Provider on-boarding the service will use these capabilities to unify and extend to syndication partners its own product management process including updates to fulfillment, assurance, and billing processes.

The Catalyst project presents new concepts used in the new environment of contracting services. It tries to demonstrate the profits of the syndication of the services in order to be used by other service provider or the events generation in order to improve the quality and the management of services. This is one of the
topics of interest in SLA@SOI, which aims to provide an end-to-end management of the service lifecycle, from the creation to the monitoring of the services.

2.5 Web Service Level Agreement (WSLA)

Web Service Level Agreement (WSLA) [9] is a novel framework for specifying and monitoring Service Level Agreements (SLA) for Web Services. SLA monitoring and enforcement become increasingly important in a Web Service environment where enterprises rely on services that may be subscribed dynamically and on demand.

Although WSLA has been designed for a Web Services environment, it is applicable as well to any inter-domain management scenario such as business process and service management or the management of networks, systems and applications in general. The WSLA framework consists of a flexible and extensible language based on XML Schema and a run-time architecture comprising several SLA monitoring services, which may be outsourced to third parties to ensure a maximum of objectivity. WSLA enables service customers and providers to unambiguously define a wide variety of SLAs, to specify the SLA parameters and the way how they are measured, and to relate them to manage resource instrumentations. Upon receipt of an SLA specification, the WSLA monitoring services are automatically configured to enforce the SLA.

This specification is directly relevant to the Work package A2, since it includes definitions for the various parties, the SLA parameters and how they are computed, as well as the definitions for the parties’ obligations, such as Service Level Objectives (SLOs) and Guarantees.
3 Business SLA Model

This section presents the Business SLA Model as a series of inter-related UML Class Diagrams. The starting point was the identification of the main concepts of the SLA model from the business point of view. The result was a collection of Business SLA Parameters, summarized in Appendix A: Business SLA Parameters. Based on these identified parameters, a Business SLA Model is built, extending the SLA Model specified as part of the A5 work package (reference [11]).

Since the SLA Model defined in the Work Package A5 is a conceptual framework covering all the levels in the SLA context, we have selected only those categories and UML diagrams of DA5a deliverable that are directly related to the business level. This involves mainly the Service Level Agreements and SLA Templates sections. In order to avoid confusion, this chapter is splitted into sections that share the name with those SLA Model sections. At the end of the chapter, new sections with Billing and Monitoring models from the Business point of view are presented.

In each section, the corresponding UML Diagram taken from [11]is shown, followed by a description of the main concepts. If needed, new attributes are attached to the already defined classes. When new classes become necessary to accommodate the complete set of business parameters, a new UML diagram is depicted. Salmon-pink colour will be used to clearly identify the new components.

3.1 Service Level Agreements

The following figure, taken from [11], represents the main classes related to SLAs:

![Figure 2: SLA classes](image)

(Salmon-pink colour used to clearly identify new components.)
In the following paragraphs, a brief description of the main classes is presented.

Class Descriptions

3.1.1 ServiceAgreement

ServiceAgreement is defined in [11] as an “agreement” between a Customer and Service Provider. The “agreement” exists when both parties “agree”. ServiceAgreements are codified by SLAs. SLA

The class SLA denotes a (written) Service Level Agreement between a Customer and a Provider concerning the delivery of a Service.

D.A5a. [11] describes some of the aspects that each SLA must specify:

i) the specific parties involved in the Agreement – e.g. minimally the Customer & Provider, but also any third-parties such as the Consumer (if different from Customer), Observer & Verifier (cf. monitoring).

ii) Start and end-times specifying the period during which the Agreement is effectively delivered.

iii) a (non-empty) set of GuaranteeTerms, and optionally; one or more BusinessValues and/or MonitoringPolicies.

At the business level, the following parameters of SLAs have been identified:

Change Procedures: methods to specify changes in service’s requirements and how to carry them out. For example, a customer subscribed to a service which provides reports wants a new or a more detailed report. The process description should clarify how to ask for it, and the steps of the negotiation process.

i) Update Procedures: specification of the upgrade expectations (once a year, 6 months…), the distribution media (e-mail, CD…), the procedures for releasing and installing patches, and what to do if upgrade fails.

ii) SLA update procedures: specification of the interaction process between the Service Provider and the Customer concerning the updating of the SLA itself or of the information contained in the SLA (i.e. ServiceDescription, QoS).

iii) Backup & Recovery Mechanisms: specification of the mechanisms the ServiceProvider will use to insure service continuity during and following the occurrence of a disaster and the Customer support required to assist with disaster recovery. This kind of information could be more interesting for customers who are intermediate Providers and want to ensure a good availability level of the service to their end customers.

iv) Support Information, including:

a. Contact points: one for technical aspects and a different one for administrative issues. It includes a complete description: names, phone and facsimile numbers, postal and email addresses, etc.

b. Assigned resources: description of the support capabilities including the scope of the offered services, the periods when supporting service is accessible, the means of contact, etc.
c. Support process: ProcessDescription objects specifying for example the mechanisms to notify problem resolution state to the customer.

v) Termination information: specifies the conditions and the process to terminate an agreement. The termination process could be launched following a bilateral or an unilateral decision. In any case, the SLA should specify the foreseen reasons to end an agreement, and the methods and periods to send the corresponding notification, as well as possible fees or expenses due to services being delivered up to the effective date of termination.

vi) Tariffs and Billing. The SLA should specify the price at which the Service is delivered to the customer, as well as the billing mechanisms. This part of the model will be explained in detail in section 3.6.

### 3.2 Service BusinessValue

The class BusinessValue denotes the value (or ‘worth’) of Obligations to the ‘obligated’ party (Customer or Provider). In the A5 model 2 kinds of BusinessValue are considered— namely;

i) Cost – which comes in 2 flavors:
   a. Penalty, denoting a punitive measure on the obligated party in the case the Obligation is not fulfilled,
   b. Reward, denoting (potential) benefits for the obligated party in the case the Obligation is fulfilled.

ii) A Priority level – defines the importance of the associated Service Level Objective (SLO). It is intended to aid in the resolution of conflicts between Obligations, i.e., in the case of two events that affect different functionalities of a service happen, this value could be used to specify which one is attended first.

### 3.3 Service Level Objective (SLO)

The class SLO (Service Level Objective) serves to specify the ‘Quality of Service’ (QoS) properties of a Service, and is expressed as a target for a Key Performance Indicator (KPI) such as average response time, completion time, availability, etc. See Section 3.5 for more details.

### 3.4 SLA Templates & Service Descriptions

The following figure, taken from [11], represents the main classes related to SLAs and Services:
3.4.1 Class Descriptions

ServiceDescription

DA5.1a defines a ServiceDescription as a representational artefact that completely describes a Service.

ServiceOfferDescription

The class ServiceOfferDescription is the symbolic correlate of a ServiceOffer – i.e. it denotes the concrete description of the offer. The ServiceOfferDescription defines the functionality that will be delivered under an agreement:

i) A ServiceDescription describing the offered Service.

ii) Technical information, i.e. redundancy level, routing alternatives, transport restrictions. This kind of information is necessary when the Customer is a ServiceProvider that needs technical details in order to assess if the offered service is valid to build his own service.

iii) Equipment: description of the Service Provider equipment to be located on customer premises and its requirements of space, power and environment, as well as how SP staff can access it.

3.5 Monitoring

This section outlines the main concepts involved in the monitoring process at the business layer. Most of the parameters and measurements used to assess the QoS are usually provided by the service and infrastructure levels (WPA3 & WPA4). At business level all such indicators are combined in order to calculate the global QoS of the offered service. This involves different activities:

i) Select data meaningful to Customer taking into account that very technical indicators are useless for customers.

ii) Detect the most important aspects of the service and then the relevant indicators. For example, a periodical polling could indicate to the provider...
that his customers find images more important than sounds in a specific service.

iii) Combine parameters to get one that assess the quality of the service being offered. Following the former example, the service quality indicator (QI) can be equal to 90% image QI plus 60% sound QI.

iv) Assign values to quality indicators for different service offers. In our example, Gold service QI = 90% image QI + 80% sound QI, common service QI = 80% image QI + 60% sound QI.

In general, business service quality indicators are a combination of one or more service and infrastructure quality indicators according to business policies. There are other kinds of quality measures which can be considered as business level quality measurements, as those of support, billing and any other facility provided by Service Provider with the service itself.

The following UML class diagram represents the most important conceptual object types and their relationships:

![UML class diagram](image)

**Figure 4: Monitoring model**

### 3.5.1 Class Descriptions

**KPI**

A **KPI** (Key Performance Indicator) is used to define measurable and exposed properties associated with a service, such as response time and throughput. The properties are used to express service level objectives. A **ServiceDescription** can have one or more KPIs.

A compound service will have KPIs derived from the KPIs of the atomic services, but it may also have new parameters. For instance, an audiovisual service composed out of an image service and an independent audio service: it will
inherit parameters like quality of the sound or quality of the image, but it will have a new KPI to indicate if the audio and the video are synchronized.

**Metric**

A *Metric* is a definition of values of parameters that are measured from a service providing system (*MeasurementDirective*) or computed from other metrics and constants (*Function*). Metrics are the key instruments to define exactly what a KPI means by specifying how to measure or how to compute it.

A *Metric* definition includes data collection and monitoring intervals.

**Example**

A metric measures an invocation counter of an application server for a particular operation. How to access the counter is defined in a measurement directive. A composite metric “average number of invocations in a minute interval” is defined by a function specifying a time series of readings of the resource metric and computing the averages from this time series.

**MeasurementDirective**

Measurement directives define how parameter values are to be measured by the organization that makes a metric's value available. How the measurement is conducted and which information is needed for this purpose depends strongly on the particular system to which measurement is applied. Some systems expose standard management interfaces such as SNMP, but other types of measurement require probing, which requires an interface to the probing system.

**Function**

A *Function* specifies how to compute a metric's value from the values of other metrics and constants. Functions are central for describing exactly how KPIs are computed from measurements.

**MonitoringPolicy**

The *MonitoringPolicy* describes the monitoring activities: parameters to be collected and measures to be made, data collection and measurement intervals, and aggregation intervals.

**MonitoringReportsPolicy**

The SLA should include a description of the monitoring reporting activities. This includes:

i) **Reports**: content and format of performance reports, frequency of report production and delivery, delivery mechanism and associated distribution list.

ii) **Changes in reports**: specifies how the customer can perform changes in the report content, format, frequency etc, including a description of the notification procedures for changes made by the Service Provider.
3.6 Billing

This section is intended to specify a conceptual model dealing with the billing part of the project. The following figure shows an overview of the main billing domain business entities:

![Billing Concepts Diagram]

**Figure 5: Billing concepts**

### 3.6.1 Class Descriptions

**BillDescription**

A *BillDescription* describes the detailed structure of the customer's bill. It indicates when to initiate the bill creation, as well as the frequency of the billing. It also specifies the billing mechanisms, detailing how the billing is built (for instance, specifying a time criterion like minutes or seconds or events subject to billing).

**BillFormat**

A *BillFormat* represents the presentation format of the bill. This bill may be sent to the customer through various media (for example, email, post mail ...).

**BillAlteration**

This class represents a deduction that can be applied to the billing charge. The type attribute indicates the nature of the discount, i.e. a promotion, a reduction due to a violation of the signed SLA, or even an increase derived from a penalty applied to the Customer.
Customer

This class encapsulates all the customer data needed to contact him, i.e. name, address, e-mail, phone number.

PaymentMethod

This class represents the method used for payment. As an example, two subclasses have been included in the figure:

- *BankTransfer*, which includes the name of the financial institution and the account number where the bill will be charged.
- *CreditCard*, defined by the card number and the expiration date.

Other payment methods can be added by extending the *PaymentMethod* class.
4 Business SLA basic Framework

4.1 Overview

The business SLA basic framework is the result of the study of SID model and definition of the data model, the study of WS-Agreement standard and the definition of the basic interaction of the eContracting module (that implements the previous features).

The focus has been put in these basic points:
- Commercial creation (in terms of products and offers).
- Business SLA template creation.
- SLA negotiation & creation.
- Notification of business violations & querying SLA status.

4.2 High-Level design goals

We can describe high-level design goals of basic business SLA framework:
- Study in depth which business terms are necessaries to take care of.
- Define how it is possible to express the business terms in an agreement and its template.
- Study eTOM and SID model in order to define a consistent business model adapted to SLA@SOI.
- Study WS-Agreement in order to define an extension of it, oriented to include the business model of the project.

4.3 Requirements

The requirements that are described in this section are mainly provided for the work in A2 work package and the others work packages that have a strong relationship with A2, like A1 and A5. Also we have considered some requirements from B1 and B5.

It is possible to summarize the requirements that have been implemented in the Business SLA Framework for year 1 in SLA@SOI as follows:
- A simple tool that allows create, view and store basic business information for the high level elements:
  - Products
  - Offers
  - Policies
  - Business SLA templates
- A module to be integrated in the SLA framework, that allows establish a business SLA and launch the negotiation and provision in the other SLA levels (software & infrastructure).
- The module has to be capable of applying policies that give an increase or discount in the price, depending of the parameters filled by the customer in the business SLA offer. Also, it is possible define some kind of rewards based on some SLO aspects (expressed like a discount).
• Also the module has to receive the violations from the framework and store and resent it to the customers (ADHOC).

The following sections describe deeply these requirements.

### 4.3.1 Requirements codification

In order to summarize the requirements, we define a codification for tagging each requisite.

We have the first letters corresponding to:

- **EC**: EContracting (Mayor module name)

We have a second level with other letter related to:

- **G**: Generic Business Framework Requirements
- **C**: Commercial creation
- **N**: Negotiation
- **A**: Assessment
- **P**: Post sale management

And finally we have a 3 digit number, that it is numerated sequentially.

Example:

EC.G.1 Creation product tool

### 4.3.2 Generic Business Framework

**EC.G.1 Retrieving Business SLA Templates**

It is necessary to obtain the Business SLA templates for a specific product.

**EC.G.2 Establish an Business SLA offer for a Customer**

It must be possible for a customer to submit a Business SLA offer to contract a an offered product (and the IT services that are included inside the it).

**EC.G.3 Business Violation Information for a Customer**

It must be possible to send Business Violation information to a Customer that established a Business SLA before.

### 4.3.3 Commercial creation

**EC.C.1 Product Creation**

It is necessary have a tool for the creation of the products information and overall information regarding to the commercial creation. The information of a product creation are: name, description, brand ...

**EC.C.2 Offering and Prices Creation**

It is necessary have a tool for defining the offers and prices for the products. We can have different offers with different economic features and prices.

**EC.C.3 Get Price for services**
It is necessary to obtain price items from the services in order to include these business terms in the prices creation of a product.

EC.C.4 Bundle Creation
It must be possible associate some services in a service bundle.

EC.C.5 Datamodel definition
It must be possible to store information about the business terms, products, offers, etc.

### 4.3.4 Negotiation, assessment & post-sale management

EC.N.1 Simple negotiation step
It has to have the possibility to have no negotiation process to accept an agreement. This should be the simplest way to make an agreement.

EC.N.2 Obtaining the SLA
The result of the negotiation process has to be the SLA.

EC.A.1 SLA personalization
The SLA must be changed in terms of personalization of prices supported by customer requirements about the changes of these values in the templates for him. For instance we can have an special reward for a customer or a discount because we have a more flexible guarantee term.

EC.A.2 Policies definition
It must be possible to define policies. These policies can be associated to discounts, rewards or recharges.

EC.A.3 Policies detection
The change of a parameter in the template should be detected and matched with the defined policies. For instance if a customer modify a guarantee term parameter of the service, it is necessary to increase/decrease the price.

EC.P.1 Evaluation of penalties
It is necessary to evaluate the violations of terms, and who breaks the guarantee and calculate their penalties.

EC.P.2 Communication of Violations
It is necessary communicate to the customer all the violations that have been produced on business SLAs.

### 4.4 Architecture

#### 4.4.1 Physical architecture

The work developed in the Work Package A2 has been compacted into the eContracting module in the SLA@SOI framework, described in Deliverable D.A1a [17].
4.4.2 Overall software architecture

This section presents the relationship between the eContracting and other modules of the SLA@SOI framework for the ad-hoc demonstrator. Figure 6, taken from [17], reproduce the technical architecture of the project.

eContracting realizes the business-level management of customer requests and the interaction between a service provider and his customers. In order to do that, it offers interfaces for the customer (adhoc) to retrieve SLA templates of offered services.

The eContracting module will also be informed of any violation of SLA that affects the business layer (i.e. when a customer has unfulfilled his obligations, or when a penalty or reward should be applied). This information can be forwarded to the customer.

![Figure 6: Overall architecture diagram](image)

4.4.3 eContracting software architecture

eContracting Module Architecture Diagram

In the eContracting module we have the following components:
The objective of eContracting module is to be the component that interacts with ADHOC and Negotiation, Provision and Adjustment modules (as a part of the SLA Framework). Then eContracting exports some interfaces to ADHOC and consume others as you can see in the diagram.

**Business Terms**

This module is in charge of describing all the business terms related with a Business SLA template. It is based on a complete business schema focused in business issues that are not contemplated in WSA. This is a metamodel that has its own entity in SLASOI. Also these items were expressed in coremodel terms. Then Business schema uses coremodel expressions inside.
Figure 8: Business Schema
The package that has the functionality is org.slaatsoi.business.schema.

Common
This module contains the following basic components:
- Constants
- Configuration
- Datamodel for data persistence (beans and daos)
- Other general framework classes and objects

The detail of data model is widely explained in section 3.

The package is org.slasoi.eContracting.common.

Business WebServices
This module is in charge of manages the web services for eContracting (server and client part). The interfaces and operations supported are the following:

QueryCatalogue interface
- queryProductCatalog operation
- queryCatalog operation

ProposeAgreement interface
- proposeAgreement operation

QuerySLAStatus interface
- QuerySLAStatus operation

NotifyDeliveryStatus interface
- NotifyDeliveryStatus operation

More detail in next sections.
The package is org.slasoi.eContracting.common.WS.

Product Discovery
This module offers the functionality needed by a Customer (or in some cases a Service Provider) to access information about the available Products for purchase. Basically this entails two different tasks:
1) Maintaining and managing the Service Registry for each Service Provider in which the details about the different Services / Products are stored and
2) Expose this information to end Customers as a result of their queries.

The package is org.slasoi.eContracting.productDiscovery.

Product Lifecycle Management
A Product will need to go through different stages during its lifecycle (such as creation, negotiation, provisioning, initiation, termination, etc.) This module is in charge of managing the transitions between these stages indicating to the appropriate modules when they have to perform specific operations.
This module will, for instance, make use of the functionalities described in the Provisioning interface to indicate when a new Product has to be provisioned and initiated following the successful end of the negotiation process.

The package is org.slasoi.eContracting.productLifeCycle.

**Business Negotiation**

The module is in charge of relations between end Customer and the Service Provider, according to a predefined signaling protocol and a term nomenclature that both parties can understand. During this process the Business Rules will have to be applied to get to the final agreed SLA.

The Business Rules are specific constraints related to commercial or business characteristics of the services offered by the service provider and that have implications (i.e. they have to be followed) in negotiation processes. The business rules have been applied in an automatic way in the negotiation process. For instance, they can provoke that the negotiation is refused or finish...

The package is org.slasoi.eContracting.businessNegotiation.

**Events Monitoring**

The actual monitoring is performed in lower layers below the business level but there are some types of events that have a direct relationship with the eContracting module and are needed for the proper working of the module in real time.

For that, this module receives the events of violations, and decides what component is in charge of manages these events. The datatype used by this module, is named BusinessViolationEvent and it is received from adjustment module. For example, eContracting can receive an event related with the break of the guarantee term X (service S).

The package is org.slasoi.eContracting.eventsMonitoring.

**Penalties Engine**

This module is in charge of evaluating the received SLA violations and calculates and applies the actions to take (such as notifying the Billing module of it or indicating the Lifecycle management module that the service has to be interrupted for instance).

The package is org.slasoi.eContracting.penaltiesEngine.

**Business web tools Architecture Diagram**

Also we have other separate component that uses some parts of eContracting module. This component is in charge of manages eContracting module. The business tools are the web module prepared to be the graphical user interface for managing eContracting
Grayed packages are not used in Business Web Tools component.

The main goal of this component is to be the business view of eContracting module. It is in charge of creates businesses data. Also, all these information is query able with the web tool.

In the first year we don’t deliver any code about this module, but in year 2 we split it in a free part for the project and other private for Telefónica.

The mainly functionality included is:
- Product creation (service selection)
- Offers and prices definition
- Discounts and rewards
- Business SLA templates definition
- Policies definition
- ...

4.4.4 eContracting requirements and components matrix
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EC.G.1</td>
<td>Retrieving Business SLA Templates</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>EC.G.2</td>
<td>Establish an Business SLA offer</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>EC.G.3</td>
<td>Business Violation Information</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>EC.C.1</td>
<td>Product Creation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>EC.C.2</td>
<td>Offering and Prices Creation</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>EC.C.3</td>
<td>Get Price for services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>EC.C.4</td>
<td>Bundle Creation</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>EC.C.5</td>
<td>Data model definition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>EC.N.1</td>
<td>Simple negotiation step</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>EC.N.2</td>
<td>Obtaining the SLA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>EC.A.1</td>
<td>SLA personalization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>EC.A.2</td>
<td>Policies definition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>EC.A.3</td>
<td>Policies detection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>EC.P.1</td>
<td>Evaluation of penalties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>EC.P.2</td>
<td>Communication of Violations</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

### 4.4.5 Data Model

#### 4.4.5.1.1 Business Data Model
Figure 10: Business Data Model
4.4.5.1.2 Agreements Data Model

All the templates of SLAs and the proper SLAs are based on WSAG wrapper library from Work Package 5. Also, this wrapper it is based on WS-Agreement standard. More detail in the documents provide by Work Package A5.

4.4.5.1.3 Violations Data Model

The information stored is relative to the business SLA violation, and all the information about the event that provokes this violation at business level.

Details of monitoring events include other structures used by other components in SLASOI, but if you want more detail about that it is necessary we refer to these work packages: WP A5 (negotiation, provision, adjustment), WP A4 (infrastructure management) and WP A6 (prediction).

The monitoring event structure is the following:
Figure 11: Monitoring Event
4.5 Business SLA interfaces

4.5.1 Provided interfaces

These interfaces are consumed for other modules that consume them. eContracting is the server that offers the operations. In the final demo release of SLA@SOI we don’t use web services but the operations are defined as here appears. In year 1 release we use spring integration in order to do this effort in an easy way.

QueryCatalogue interface

This interface is provided for eContracting to Adhoc Demonstrator in order to interact for finding products, templates, and services. This interface uses EContractingSchema-1.0.xsd. eContracting is the server that offers the operations.

queryProductCatalogue operation

This operation is in charge of recover the product information from eContracting products Catalogue. It will be implemented in Year 2.

queryCatalog operation

This operation is in charge of retrieves available SLATs for the product identification given.

ProposeAgreement interface

This interface is provided for eContracting to Adhoc Demonstrator in order to interact for create an agreement with a customer. This interface allows operate with business agreements (establish, revoke, query,...). This interface uses EContractingSchema-1.0.xsd. eContracting is the server that offers the operations.
proposeAgreement operation

The customer proposes an SLA offer to be compute in the framework. As a result, the customer will receive the complete SLA. This operation initiates all the agreement processing with the SLA offer of the customer. Concrete SLA is returned to the customer when the framework negotiates and provision the required resources.

QuerySLAStatus interface

This interface is provided for eContracting to Adhoc Demonstrator in order to interact for get information about an SLA. This interface contains all the operations that give the detailed status of an SLA to a customer. eContracting is the server that offers the operations.

QuerySLAStatus operation

In year 1, this operation only retrieves the violations stored of a business SLA. This operation will be enriched in year 2, with information relative to the status of the SLAs included in the business SLA and other useful information.

EContractingSchema_1-0.xsd

This schema defines all the datatypes used by propose agreement and query catalogue interfaces. It is based on WS Agreement Standard Schemas.
**BusinessViolationEvent interface**

This interface is provided for eContracting to Adjustment module in order to receive the violations event from adjustment.

The data send from adjustment is defined by the section of the document 4.4.5.1.3

**4.5.2 Consumed interfaces**

These interfaces are provided by other modules, and they are consumed for eContracting. In this case, eContracting is the client that access to the external operations. More detail of these interfaces can be found in the corresponding modules documentation: Work package A5 (Negotiation) and B2 (ADHOC).

**CreateAgreement interface & operation**

This interface is provided by Negotiation module, and it is consumed by eContracting. The operation allows establishing an agreement with the software and infrastructure levels.

**GetTemplates interface & operation**

This interface and operation are provided by Negotiation module, and it is consumed by eContracting. The operation allows retrieve concrete business, software and infrastructure SLA templates that are stored in the Templates Registry. This interface is not implemented in Year 1.
StoreTemplates interface & operation
This interface and operation are provided by Negotiation module, and it is consumed by eContracting. The operation allows store business, software and infrastructure SLA templates in the Templates Registry.

GetSLAS & operation
This interface and operation are provided by Provisioning module, and it is consumed by eContracting. The operation allows retrieve concrete business, software and infrastructure SLAs that are stored in the SLA Registry.

StoreSLAS & operation
This interface and operation are provided by Provisioning module, and it is consumed by eContracting. The operation allows store business, software and infrastructure SLA in the SLA Registry.

NotifyDeliveryStatus interface
This interface and operation are provided by ADHOC demonstrator to eContracting in order to send the violations of the SLAs of the framework. This interface is in charge of delivery to the customers also other kind of information. eContracting is the client that connects to the server allocated in ADHOC demonstrator, and eContracting send the violations in case that they appears in the framework.

NotifyDeliveryStatus operation
This operation allows eContracting to send violations to the customers.

4.6 Business SLA implementation

4.6.1 Business SLA Templates
The business SLA templates are based in WS-Agreement standard. The business templates defined, use the business schema defined and coremodel expressions.

In WS-Agreement we can find the following sections in SLA template:
- Context
- Service Description Terms
- Guarantee terms
- Creation Constraints

The business items necessary to add to the templates are:
- Business terms
- Product Information
- Offering and prices information

**Service Description Term section**

All the business items are defined in the section Service Description Term using as a base the business schema.

We can see the following example business terms section:

```xml
<wsag:ServiceDescriptionTerm wsag:Name="ContactPoint" wsag:ServiceName="IntermediateService">
        <ContactPoint>
            <Name>Contact Point Name</Name>
            <Email>Contact Point Email</Email>
            <PhoneNumber>+34606352187</PhoneNumber>
            <Fax>+34606352187</Fax>
            <Address>Contact Point Address</Address>
        </ContactPoint>
    </BusinessSchema:BusinessSchema>
</wsag:ServiceDescriptionTerm>
```

Other example relative to product and offering section:

```xml
<wsag:ServiceDescriptionTerm wsag:Name="IntermediateService_OfferPrice" wsag:ServiceName="IntermediateService">
        <ProductOfferingPrices>
            <ProductOfferingPrice>
                <Name>Gold</Name>
                <Description>Maximum quality</Description>
                <BillingFrequency>Per month</BillingFrequency>
                <ValidFrom>01/01/2009</ValidFrom>
                <ValidFrom>31/12/2009</ValidFrom>
                <ComponentProdOfferingPrice>
                    <PriceType>One Time Charge</PriceType>
                    <Price type="coremodel:Price">
                        <Unit>EURO</Unit>
                        <Value>20</Value>
                    </Price>
                    <Quantity>1</Quantity>
                </ComponentProdOfferingPrice>
            </ProductOfferingPrice>
        </ProductOfferingPrices>
    </business:BusinessTerm>
</wsag:ServiceDescriptionTerm>
```
<!--One Time Charge, tariff usage plain tariff, per month, -->
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:coremodel="http://www.slaatsoi.org/coremodel"
xmlns:terms="http://www.slaatsoi.org/commonTerms">
  <Unit>EURO</Unit>
  <Value>10</Value>
</ProductOfferingPrice>
</ProductOfferingPrices>
</business:BusinessTerm>
</wsag:ServiceDescriptionTerm>

Creation Constraints section

Also, we can define some bounds about the prices in Creation Constraints section.

<wsag:CreationConstraints>
  <wsag:Item wsag:Name="IntermediateService_PriceRestrictions">
    <wsag:Location>
      //ProductOfferingPrice/ComponentProdOfferingPrices/ComponentProdOfferingPrice/
      //child::PriceType='One Time Charge'][1]:Value
    </wsag:Location>
    <wsag:ItemConstraint>
      <xsd:restriction base="xsd:positiveInteger">
        <xsd:maxInclusive value="10"/>
      </xsd:restriction>
    </wsag:ItemConstraint>
  </wsag:Item>
</wsag:CreationConstraints>

4.6.2 Business SLAs

The business SLAs are based in WS-Agreement standard. The business templates defined, uses the business schema and coremodel expressions like the templates.

In WS-Agreement we can find the following sections in a SLA:

- Context
- Service Description Terms
- Service Properties
- Guarantee terms

The business items necessary to add to the SLAs are the same as a template:

- Business terms
- Product Information
- Offering and prices information

The information related to business SLAs is the same that the last section 4.6.1 but without Creation Constraints section. This section doesn’t exist in the SLAs, then it has no sense to include it.

All the information related to business items are the same of the last section.
5 Business Web Tool

The current chapter shows the screens of this tool and explains the basic operation of it.

The tool has a main menu at the left of the screen. These options are divided in three aspects: Product, Business SLAT, and Policies.

5.1 Product

5.1.1 Publish

This option allows the user to create and publish a product. It is necessary to introduce the fields required about the product. We can divide this information in different parts:

- General information about the identification and features of the product
- Commercial information like offer dates and other features like the price
- Services selection

In year 1, the selection of the services is limited to Payment & Inventory services.
5.1.2 Find

The user can find products filling some fields of the filter on the screen or without filling any filter (and recover all).

If the user clicks on the magnifying glass of a product, he can recover all the information stored of it like you can see in the following screen.
5.1.3 Customers

We have the possibility to find the customers that use a product.

1. The first step is to select the product which we want to know its customers. At the following screen you can see the list of the products with summarized information of each. And we can see a list with a radio button in the left of each register. The user has to select one radio button of one product.
2. Using the scrollbar we can see in the bottom of the screen the customers that are associated with this product and their business SLA and other information.
5.2 Business SLAT

5.2.1 Publish

This option allows the user to create and publish a Business SLA template. It is necessary to select the product related to this template and to introduce the fields required about the business terms. We can find all the A2 defined terms and their fields. Also, we can introduce the concrete data about the guarantee terms and other information of the template. In the screen, we can find the following options:

- **Product**
- **Business Sla Template**
- **Business Sla Terms**
- **Guarantee Terms**
- **Constraints**

The icon allows to extend the fields required to be filled, and with the icon, you can retract the section.

1. **Selection of the product**
   
The first step is to select the product in order to create a business SLAT. In this screen, the user recovers the full list of the existent products, and select one of it.
2. Business Terms creation in the business SLA template. The first information that the user has to fulfil is the data associated to the template like identification id, name, service provider and expiration date. At this section, the user can fill the business term he wants. In this screen you can find how the contact information has to be filled.
In this screen you can find how the support business term has to be filled.

3. Guarantee Terms
In this section, the user has to fill all the information about each guarantee term. With the icon and , the user can add or delete more guarantee terms.

Each guarantee term used is named with a number in order to identify it. In each guarantee term, it is necessary to fulfill the information associated like name, KPI, Qualify Conditions, and Penalties (with more additional fields).
4. Creation Constraints
The last section is the creation constraint section of the template. Here also, the user can use the following icons: + for adding or , for deleting each constraint defined.
5.2.2 Find

The user can find business templates filling some fields of the filter on the screen or without filling any filter (and recover all).

If the user wants to show the complete xml file of the template, he can click in the icon below the text “View XML”. The appearance of the XML showed for this option is like the following screen:
5.3 Policies

5.3.1 Publish

This option allows the user to create and publish a policy. It is necessary to select some items like the product, the offer, the service, the service level specification and introduce the parameter and price variation. Both parameters have to be filled like a percentage. The first step is the selection of the product, the screen shows the list of available products. The user mark the checkbox control on the left side of the register and selects the product.
Also, the information required to fulfil is the kind of modification of the price and thinks like that.
5.3.2 Find

The user can find policies stored, filling some fields of the filter on the screen or without filling any filter (and recover all).

When the user recover the policies filtered, can review the information about the product that applies, clicking in the magnifying glass of the register. The screen that shows the information of the product is the same of the section 5.1 (product details).
6 Business and Information Framework for supporting Business SLA Model

Once we have identified the Business SLA Model components in section 3.1, we can establish the relations with business and information frameworks. It is important, because with this, we obtain an overall view of the business processes that support the Business SLA Model, and then, we can define the Information Model that it will be used.

For establishing the relation with frameworks, we are going to use the TMForum initiatives and specifically the eTOM (enhanced Telecom Operation Map) and SID (Shared Information Data Model) initiatives. These initiatives have been detailed in State of the Art documents, and now in this section we are going to identify the areas involved (in next subsections).

- **eTOM**: For establishing alignment with business process framework, and the specific processes that support the Business SLA Model.
- **SID**: For establishing alignment with Information Data Model Framework, and the specific entities that support the Business SLA Model.
- The last section presents a summary of aspects included in the business SLA model that are not presented in SID.

6.1 Relationship between Business SLA Model and eTOM

In this section, first we are going to present the main concepts of eTOM (Enhanced Telecom Operations Map), and then, we will establish the relationships with Business SLA Model.

**eTOM** is the ongoing TMForum initiative to deliver a business process model or framework for use by service providers and others within the telecommunications and related sectors of industry.

The eTOM describes all the enterprise processes required by a service provider and analyzes them to different levels of detail according to their significance and priority for the business.

The processes structure in eTOM uses hierarchical decomposition, so that the business processes of the enterprise are successively decomposed in a series of levels. Process descriptions, inputs and outputs, as well as other key elements are defined.

The Framework also includes views of functionality as they span horizontally across an enterprise's internal organizations.

In the following Figure, it is identified the eTOM processes of Level 0 and 1.
Now, we are going to identify the eTOM processes that support the Business SLA Model, establishing the relationship between the Business SLA Model and eTOM Processes.

The Business SLA Model elements will be:

- Service level Agreement
- SLA Templates & Service Descriptions
- Monitoring
- Billing

And the alignment it will be defined over the eTOM level 0 Processes:

- Operations, and,
- Strategy, Infrastructure & Product

These two level 0 processes represent the core of the business, for this reason, we have not included the other eTOM level 0 process: Enterprise Management.

**Relationship between Business SLA Model and eTOM Operations processes**

In the following Figure, it is established the relationship and the eTOM processes that support the Business SLA Model, taking into account the decomposition of Operations processes at levels 0, 1 and 2.

Figure 12: eTOM processes level 0 and 1
The eTOM Operations processes that support mainly the Business SLA Model are:

- Customer Relationship Management Processes (horizontal grouping of level 1),
- Assurance Processes (vertical grouping of level 1),
- Customer Qos/SLA Management (Level 2 Process),
- Service Quality Management (Level 2 process)

**Relationship between Business SLA Model and eTOM Strategy, Infrastructure & Product**

In the following Figure, it is established the relationship and the eTOM processes that support the Business SLA Model, taking into account the decomposition of Strategy, Infrastructure & Product processes at levels 0, 1 and 2.
The eTOM SI&P processes that support mainly the Business SLA Model are:

We have identified relations mainly in:

- Product Lifecycle Management (vertical grouping of level 1), and,
- Product & Offer Development & Retirement (Level 2 Process),

### 6.2 Relationship between Business SLA Model and SID

In this section, we will establish the relationship between SID and Business SLA Model. In the following figure, it is presented the domains and the level 1 of ABES of the SID Business Model.
Figure 15: SID Domains

With the eTOM, the SID model provides enterprises with not only a process view of their business but also an entity view. That is to say, the SID provides the definition of the ‘things’ that are to be affected by the business processes defined in the eTOM. The SID and eTOM in combination offer a way to explain ‘how’ things are intended to fit together to meet a given business need.

In the following Figure, it is defined the high level alignment between eTOM Process Framework and SID Model.
The SID model also defines attributes for Business entities and relationships between them and is represented using an UML model that provides an architecturally oriented business view of business entities, their attributes, and relationships to other business entities.

Now, taking into account the relationships identified before between eTOM and Business SLA Model, we are going to analyse which aspects of the Business SLA Model are contained in the SID Model and the possibility to include those not considered.

In the following Figure, it is defined the overall relationship between SID Model and Business SLA Model, for this, it has been identified the next SID Classes:

- Agreement
- Service Level Specification
- Billing
- Specification
- Performance

(Each SID Class identified, it will be explained in the next paragraphs).
SID model has a common entity specific for agreements called Agreement. An agreement is a contract or arrangement, either written or verbal and sometimes enforceable by law, which involves a number of other business entities, such as Services, and/or Resources.

SLA is a type of agreement represented in the SID model by the ServiceLevelAgreement entity. Both entities – Agreement and ServiceLevelAgreement – consist of items which make the link between the SLA and the Product/Service/Resource it applies to.

For this purpose, SID ServiceLevelAgreementItem entity establishes relations with entities in different domains.

The following sections describe the SID classes directly or indirectly related with Agreement entity and the Business SLA Model. Each section finishes with the point, named Relationship with Business SLA model, where the mapping between SID and SLA business model is presented.
6.2.1 Agreement SID Class Descriptions

The following figure shows the main SID entities and relationships involved in agreement definition:

![Agreement SID classes](image)

**Figure 18: Agreement SID classes**

**Agreement**

It is a type of commitment that represents a contract or arrangement, either written or verbal and sometimes enforceable by law.

**AgreementItem**

The purpose for an Agreement expressed in terms of a Product, Service, Resource, and/or their respective specifications.

**AgreementApproval**

AgreementApproval represents the acceptance of the agreement by the owners of the Agreement. During the negotiation of the Agreement, there could be several iterations of approvals.

**AgreementTermOrCondition**

Aspects of the Agreement not formally specified elsewhere in the Agreement and that cannot be captured elsewhere in a formal notation or automatically monitored, but require a more human level of management.

**ServiceLevelAgreement**

A ServiceLevelAgreement (SLA) is a type of Agreement that represents a formal negotiated agreement between two parties designed to create a common understanding about Products, Services, priorities, responsibilities, and so forth, in order to achieve and maintain specified Quality of Service.

**ServiceLevelAgreementItem**

The purpose for a ServiceLevelAgreement expressed in terms of a Product, Service, Resource, and/or their respective specifications, and in terms of ServiceLevelSpecification(s).

**ServiceLevelSpecification**

This is a pre-defined or negotiated set of Service Level Objectives, and consequences that occur, if the objectives are not met.

Quality of services/Products is measured by service level specifications, then this entity provides the link between Agreement and Quality of Service.

**ProductOfferingPrice**

An amount, usually of money, that is asked for when a ProductOffering is bought, rented, or leased. The price is valid for a defined period of time and may not represent the actual price paid by a customer.

A ProductOfferingPrice entity can aggregate several ProductPrice entities. The structure of ProductPrice subclasses resembles the structure of ProductOfferingPrice subclasses and in most of the cases the relationships established for one group are also valid for the other.

Price is one of the bases for billing, and ProductOfferingPrice/ProductPrice provides the link between Agreement and Billing.

**Product Specification**

A detailed description of a tangible or intangible object made available externally in the form of a ProductOffering to Customers or other parties.

This entity provides the link between Agreement and description of Product/Services/Resources.
**Relationship with Business SLA Model**

An attribute of the Agreement entity is the time period during which the agreement is valid. This attribute is inherited by ServiceLevelAgreement and corresponds to "Availability dates" SLA Business parameter.

In addition, the following parameters from the business model can be included in the AgreementTermOrCondition entity:

- Change Procedures
- Update Procedures
- Backup & Recovery Mechanisms.
- Changes in reports
- Priorities.
- Support Information: The contact points and resources assigned.
- Termination clauses.

### 6.2.2 Service Level Specification SID Class Descriptions

Service Level Agreements are expressed in terms of Service Level Specifications. Service Level Specification represents a predefined or negotiated set of Service Level Objectives. In addition, certain consequences are associated with not meeting the Service Level Objectives.

Regarding negotiation process there can be consider two types of Service Level Specification, the Template during the process and the Negotiated when the process is finished.

The following figure shows the most relevant SID entities associated with ServiceLevelSpecification entity.
**Figure 19: Service Level Specification SID classes**

**ServiceLevelObjective**

Quality goal for a ServiceLevelSpecification defined in terms of parameters and metrics, thresholds, and tolerances associated with the parameters.

**ServiceLevelSpecParameter**

A parameter whose value is used to determine compliance with a ServiceLevelObjective. SID model considers two types of parameters:

- Key Performance Indicator: A measure of a specific aspect of the performance of a ServiceResource or a group of ServiceResources of the same type.
• Key Quality Indicator: A measure of a specific aspect of the performance of a product or a service. A KQI draws its data from a number of sources, including KPIs.

**ServiceLevelConsequence**

An action that takes place in the event that a ServiceLevelObjective is not met.

**ServiceLevelApplicability**

The time of day or days during which a ServiceLevelSpecification, ServiceLevelObjective, or ServiceLevelSpecConsequence is relevant or not.

**Relationship with Business SLA Model**

ServiceLevelObjective and associated ServiceLevelSpecParameter entities cover the Level and Quality of service parameters included in Business SLA.

ServiceLevelConsequence includes the concept of Penalty as “prescribedAction” attribute, but in case this penalty implies any type of alteration in the bill it will be considered in billing entities.

**6.2.3 Billing SID Class Description**

This paragraph describes the most relevant business entities and ABE utilized by rating and billing processes in particular the Applied Customer Billing Rate ABE and the Customer Bill ABE.

Products are rated at different prices depending on ProductOfferingPrices and additional terms & conditions that are determined by the CustomerAccount.

Rating process takes ProductUsages on input and applies rates to them. The Billing process applies additional charges (for example, one time charges, recurring charges), allowances, discounts and taxes, to Products, then aggregates applied rates into bills and sends them to customers.

The following figure shows the most relevant SID entities associated with Billing.
CustomerAccount
An arrangement that a Customer has with an enterprise that provides Products to the Customer.

CustomerBill

Figure 20: Billing SID classes
A total amount due to a Provider by a CustomerAccount for all products during the billing period.

Other entities associated with this are:
- CustomerBillFormat. A detailed description of the way in which a customer's bill is presented.
- CustomerBillPresentationMedia. A means of communicating a CustomerBill, supported by the associated bill format. For example, post mail, email, web page.

**AppliedCustomerBillingRate**

A charge or a credit assigned to the customer's account in the course or for the purpose of the billing process. Each applied billing rate can be atomic or composed.

There are different types of billing rates (charges, discount, taxes...) represented in the figure by a group of AppliedCustomerBilling... entities (AppliedCustomerBillingProductCharge, AppliedCustomerBillingDiscount...).

**Relationship with Business SLA Model**

CustomerAccount entity inherits form Customer ABE the customer data necessary for the bill in Business SLA model.

CustomerBill and the group of entities for bill specification cover the billing parameters in the Business SLA model: Description of the bill, billing frequency and billing mechanism.

AppliedCustomerBillingRate entity and its subclasses link the bill with prices and monetary penalties.

**6.2.4 Specification SID Class Description**

In the SID Model the specification is spread across Product, Service and Resource domains.

Business entities in the Product domain have a close relationship with business entities in the Service and Resource domains. While Product business entities represent what the market sees of a provider’s offerings, Service and Resource business entities represent the realization of the offerings from a provider’s perspective.

The following figure shows the most relevant SID entities associated with specification.
**ProductSpecification**

A detailed description of a tangible or intangible object made available externally in the form of a ProductOffering to Customer. A ProductSpecification may consist of other ProductSpecifications supplied together as a collection.

**ServiceSpecification**

A ServiceSpecification defines the invariant characteristics of a Service. It can be conceptually thought of as a template that different Service instances can be instantiated from. Each of these Service instances will have the same invariant characteristics. However, the other characteristics of the instantiated Service will be specific to each instance.

This entity has two subentities:

- **CustomerFacingServiceSpec.** An abstraction that defines the invariant characteristics and behaviour of a particular service as seen by the Customer.
- **ResourceFacingServiceSpec.** An abstraction that defines the invariant characteristics and behaviour of a particular service that is not directly seen or purchased by the Customer.

**ResourceSpecification**

A ResourceSpecification defines the common attributes and relationships of a set of related Resources, while Resource defines a specific instance that is based on a particular ResourceSpecification.
### Relationship with Business SLA Model

ProductSpecification entity covers Design Information at business level with its “description” attribute and gives access to a more detailed description through Service and Resource Specification entities.

Entities for Service and Resource specification does not have any attribute defined so it is necessary to include the equipment on customer premises as a parameter.

#### 6.2.5 Performance SID Class Description

SID Model has developed a common ABE call Performance that comprises two entities: PerformanceSpecification and Performance.

PerformanceSpecification and its related specification entities provide the definition of the performance attributes, such as KPIs, dimensions, and performance objectives. The Performance entity and its related entities provide the values associated with the manner in which a service or resource is performing or has performed.

These entities have been specialised for Service and Resource domains and should be extended to Product domain which can be considered nearer to business level.

The following figure shows the most relevant common SID performance entities related with monitoring.

![Figure 22: Performance SID classes](image)

**PerformanceSpecification**

The invariant characteristics of a measure of the manner in which a Service and/or Resource is functioning. Each related Performance instance will have the same invariant characteristics. However, the values associated with other
characteristics of the instantiated Performance entity are specific to each instance.

**Performance**
A measure of the manner in which a Service and/or Resource is functioning. It is an instance of PerformanceSpecification.

**CharacteristicSpecification**
A quality or distinctive feature that defines an entity. The characteristic can be take on a discrete value, can take on a range of values, or can be derived from a formula which description is included in the attributes of the entity.

**PerformanceCharacteristicValue**
A value of a CharacteristicSpecification provided for Performance that further defines what the Performance is.

**CharacteristicSpecValue**
A number or text that can be assigned to a CharacteristicSpecification.

**PerformanceIndicatorSpecification**
A measure of a specific aspect of the performance of an entity that may trigger the creation of a PerformanceConsequence.
This entity includes as attributes a textual description of the indicator and how to calculate it.

**PerformanceIndicator**
A numerical value or text determined for a PerformanceIndicatorSpecification.

**Relationship with Business SLA Model**
Performance entities provide the description of parameters to be collected and measures to be made, algorithms and methods used to calculate, measurement intervals, and aggregation intervals.
However, they do not include anything about the specification of the content of performance reports, their format, the frequency of report production and delivery, the delivery mechanism and associated distribution list.

### 6.3 Business SLA Model aspects not included in SID model

SID Model does not include some aspects considered in Business SLA Model.

**Payment**
Billing entities omits the payment concept, nothing about methods used by customers to pay is included and this is information that should be in the SLA.

**Support**

SID Model does not include any information about the support process, for example, response and resolution times, mechanisms to assign severity levels to incidences or notify problem resolution state to customer.
7 Business SLA Ontology

In this section, an ontology model that defines the business SLA will be introduced. This ontology could be used in future works.

Ontology definition is a very fuzzy concept in the artificial intelligence field because of the fact that experts have not found a universal one. A widely quoted definition of an ontology is Gruber's [14] "A specification of a conceptualization".

In the context of computer and information sciences, an ontology defines a set of representational primitives with which to model a domain of knowledge or discourse. The representational primitives are typically classes (or sets), attributes (or properties), and relationships (or relations among class members). The definitions of the representational primitives include information about their meaning and constraints on their logically consistent application. In the context of database systems, ontology can be viewed as a level of abstraction of data models, analogous to hierarchical and relational models, but intended for modeling knowledge about individuals, their attributes, and their relationships to other individuals.

Ontologies are typically specified in languages that allow abstraction away from data structures and implementation strategies; in practice, the languages of ontologies are closer in expressive power to first-order logic than languages used to model databases. For this reason, ontologies are said to be at the "semantic" level, whereas database schema are models of data at the "logical" or "physical" level. Due to their independence from lower level data models, ontologies are used for integrating heterogeneous databases, enabling interoperability among disparate systems, and specifying interfaces to independent, knowledge-based services.

It could be said that an ontology is composed by a set of concepts, its taxonomy, interrelation and the rules that govern such concepts.

The use of an ontology description to define the business SLA provides interoperability and the use of machine reasoning in order to infer knowledge. Other advantage is that the business SLA ontology would be able to include the definitions of behaviour rules for business information.

The ontology definition language will be OWL (Ontology Web Language) [15] which is defined by the Semantic web. This language includes all the necessary blocks to semantically describe the business SLA definitions, classes and properties using hierarchies. SWRL (Semantic Web Rule Language) [16] extends the set of OWL axioms to include conditional rules (Horn clauses) as "if .. then".

This ontology has been designed based on UML business SLA model developed in the section 3 Business SLA Model.

In order to clarify and facilitate its reusability and extensibility, the ontology model has been divided in several parts: Offered and provisioning service description

- SLA description
- Monitoring description

In the following sections presents each ontology part showing the main concepts and the relationships between them.
### 7.1 Offered and provisioning service description

This section shows the relationships between the entities that take part in the service offering and provisioning.

The next figure shows the ontology schema associated with ServiceOffer and ProvisioningServiceOffer.

![Schematic representation of provisioning service ontology](image)

#### Figure 23: Schematic representation of provisioning service ontology

A ServiceOffer (Product) has a description in business terms and is provided by a service provider.

Each ServiceOffer has its SLAT (SLA Template). An SLA template is a document used by the agreement responder to advertise the types of offers it is willing to accept.

When the negotiation of a ServiceOffer between a provider and a customer finishes it is necessary to generate a SLA, based on the SLAT, customized for the customer in order to initiate the ServiceOffer provisioning.

### 7.2 SLA description

This section shows the SLA description since its generation by the provider in the provisioning service offer. Due to the fact that the creation process must be dynamic, a semantic description is necessary in order to compose and monitor the SLA.

The next figure shows the ontology schema:
Once the service has been provisioning the SLA is associated with it. SLA is defined by the SLAT composed by a set of KPI (Key Performance Indicators). KPIs are defined in the service offer description.

On the other hand each SLA has a guarantee terms composed by SLO (Service Level Objectives). SLOs have associated a value and a threshold. Each threshold has associated its KPI and with that the loop is closed.

### 7.3 Monitoring description

Business SLA has a runtime state that can be monitored. The objective of the monitoring is to observe agreement compliance at runtime.

The next figure shows the ontology schema:
SLO is monitored by an actor which could be customer, provider or third party, in the role of MeasurementPartner.

MeasurementPartner uses the MonitoringPolicy (set of rules) in order to determinate the set of KPI that will be monitor (monitoredKPI)

Metric concepts from the ontology are associated with metric class from the model

A compound service will have KPIs derived from the KPIs of the atomic services, but it may also have new parameters. These parameters could be compose from ComplexMetric resulted to apply different Operation.

7.4 Billing description

Billing is the process of sending accounts to customers for goods or services. The process calculates additional charges (for example, one time charges, recurring charges), allowances, discounts and taxes, then aggregates applied rates into bills and sends them to customers

The next figure shows the ontology schema
Each SLA has associated a BillDescription, which includes information like the initial data to initiate the billing, frequency or format of the bill.

The actual Billing values could change when a violation of the parameters specified in the GuaranteeManagementInfo is detected. Then a BillAlteration is generated. This alteration could be a reward (a reduction in the bill when the Provider doesn’t fulfil its Obligations) or a penalty (an increase in the price) applied to the Customer.

In addition, each BillDescription has associated a PaymentMethod for each customer, i.e. bank transfer or credit card.
8 Conclusions

8.1 Summary

In this document we have studied many aspects at business level, from the first year of the European research project SLA@SOI. This includes: business process, business data models, and business terms definitions inside WS-Agreement. Also we have defined eContracting module, which is fitted inside overall framework architecture, oriented to make automatically agreements between customers and providers.

The design of the business framework has been based on the models defined in TMForum. Those are well known and used by Telco operators and IT industries (eTOM/SID). The work done has permitted feed the actual standard models with innovative SLA@SOI requirements.

The basic business framework is consistent and well defined, and was successful implemented in eContracting module. This is the first step with a basic business model, prepared to enrich it with features scheduled in next project years.

As we commented before, the business framework is fed by some requirements defined by line A and B. Then the idea is to have a module that provides business layer support for the rest of architecture in SLA@SOI.

8.2 Next steps

The main objectives for the next steps in the business framework will be to study in depth some aspects relatives to business layer like:

- **commercial creation process,**
  threshold and ranges definition for made possible some kind of negotiation
- **negotiation,**
  extend the actual negotiation process, in a two steps roundtrip
  extend the actual negotiation model with stop and extend operations
- **assessment,**
  personalization interface definition, in order to retrieve segmentation information of the customers
  customer personalization based in specific conditions and customer segmentation
- **Post sale management.**
  Arbitration & penalty management mechanism
  Definition of links between penalties and service providers and communication in order to establish a procedure to advice and substitution

We have to automate all the business processes that we can, in order to have an added value system. It is necessary to study in depth the business rules associated to some aspects that have to be covered in SLA@SOI framework and also define the rules associate to the more pure business layer interaction.
9 References

[1] Deliverable D.B5a Scientific Evaluation Report. SLA@SOI.
# Appendix A: Business SLA Parameters

In this section we present the collection of the Business SLA Parameters that have been identified as relevant for the Work package A2 of SLA@SOI (Columns 1-3).

Column 3 explains how the business parameters fit into the model introduced in section 3 Business SLA Model of this document.

<table>
<thead>
<tr>
<th>Types</th>
<th>Description</th>
<th>Mapping into SLA@SOI Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability dates</td>
<td>Ready for service date and contract duration.</td>
<td>Attribute of SLA class</td>
</tr>
<tr>
<td>Design Information</td>
<td>Necessary when the Customer is also a SP who needs technical details in order to assess if the service offered is valid to build his own service. Information about redundancy level, routing alternatives, transport restrictions and others, can be included. In any case, if the Customer can modify some technical details, SLA shall include what type of changes he can make and under what conditions, as well as the procedure to access to the technical information he needs.</td>
<td>Attribute of ServiceOfferDescription class.</td>
</tr>
<tr>
<td>Change Procedures</td>
<td>Changes are required by one party and must be agreed by both parties. A change can affect the service provided to a customer, a group of customers or all of them. Changes can be distributed within an upgrade or separately. SLA shall contain the method to specify changes in service’s requirements and the procedure to carry out them.</td>
<td>Included in SLA</td>
</tr>
<tr>
<td>Update Procedures</td>
<td>Specification of the upgrade expectations (once a year, 6 months...), the distribution media (e-mail, CD...), the procedures for releasing and installing patches, and what to do if upgrade fails.</td>
<td>Included in SLA</td>
</tr>
<tr>
<td>Types</td>
<td>Description</td>
<td>Mapping into SLA@SOI Model</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td><strong>Backup &amp; Recovery Mechanisms</strong></td>
<td>It may be advisable to include in the SLA a specification of the mechanisms the SP will use to insure service continuity during and following the occurrence of a disaster and the Customer support required to assist with disaster recovery. This kind of information could be more interesting for customers who are intermediate SPs and want to ensure a good availability level of the service to their end customers.</td>
<td>Included in SLA</td>
</tr>
<tr>
<td><strong>Priorities</strong></td>
<td>Sometimes, it is needed to specify the priorities of tasks or priorities in the execution of functionality of the service. In the other hand, when a problem happens, may be It's needed to explain how the support is applied, under which priorities or criterions.</td>
<td>Included in BusinessValue</td>
</tr>
<tr>
<td><strong>Support</strong></td>
<td>It is useful to specify a single point of contact for technical aspects and a different one for administrative issues. Points of contact should be specified for both parties and include a complete description: names, phone and facsimile numbers, postal and email addresses, etc.</td>
<td>Included in SLA class</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td>If necessary, SLA must include a description of the Service Provider equipment to be located on customer premises and its requirements of space, power and environment. As well as how SP staff can access it.</td>
<td>Included in SLA class</td>
</tr>
<tr>
<td><strong>Resources assigned</strong></td>
<td>Description of the support capabilities including the scope of services offered, the periods when supporting service is accessible, the means of contact, etc.</td>
<td>Included in SLA class</td>
</tr>
<tr>
<td><strong>Support process</strong></td>
<td>Information about the support process should also be included.</td>
<td>Included in SLA class</td>
</tr>
</tbody>
</table>

**Monitoring and Reporting**

<p>| <strong>Monitoring</strong>                  | Description of parameters to be collected and measures to be made, data collection and measurement intervals, and aggregation intervals. | MonitoringPolicy class. |
| <strong>Reporting</strong>                   | Specification of the content of performance reports, their format, the frequency of report production and delivery, the delivery mechanism and associated distribution list. Specification of ad hoc reporting support should be included. | MonitoringReportsPolicy   |</p>
<table>
<thead>
<tr>
<th>Types</th>
<th>Description</th>
<th>Mapping into SLA@SOI Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes in Reports</td>
<td>SLA shall include how the customer can perform changes in the report content, format, frequency, means of delivery, etc, if proceed. A description of the notification procedures for changes made by SP should also be included.</td>
<td>MonitoringReportsPolicy</td>
</tr>
<tr>
<td>Tariffs and Billing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description of the Bill</td>
<td>Description of the content of the bill: Customer data: name, address. Method used for payment Service data: all the details needed to identify uniquely the service. Date and period Amount to be paid and details: how many unities and unit cost, discounts or promotions applied.</td>
<td>BillDescription, BillFormat and CustomerData classes</td>
</tr>
<tr>
<td>Billing frequency</td>
<td>Specifies how the billing is done. At this point it can be specified for instance time criterion like minutes or seconds or events subject to billing.</td>
<td>BillDescription attribute</td>
</tr>
<tr>
<td>Billing mechanisms</td>
<td></td>
<td>Included in BillDescription</td>
</tr>
<tr>
<td>Price</td>
<td></td>
<td>Included in SLA</td>
</tr>
<tr>
<td>Penalties</td>
<td>Description of the penalties in case the service doesn't reach the level agreed: discounts, bonuses, ... Description of claiming procedures.</td>
<td>Included in BusinessValue</td>
</tr>
<tr>
<td>Termination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payments</td>
<td>In the event of termination of an Agreement for any cause, it is possible to specify any fees or expenses due for services delivered up to the effective date of termination.</td>
<td>Included in SLA</td>
</tr>
<tr>
<td>Termination for convenience clauses</td>
<td></td>
<td>Included in SLA</td>
</tr>
<tr>
<td>Process for unilateral termination</td>
<td></td>
<td>Included in SLA</td>
</tr>
</tbody>
</table>

Table 1: Business SLA Parameters
Appendix B: Glossary

The following list shows the most important entries of the SLA@SOI glossary.

Abstract Service
Any service not yet instantiated (service instance) is called an abstract service.

Active Data Source*
A data source that is emitting events in an autonomic manner.

Agreement Initiator
An agreement initiator is a party to a service level agreement. The initiator creates and manages an agreement on the availability of a service on behalf of either the service customer or service provider, depending on the domain-specific signalling requirements.

Agreement Offer
An offer is the description of the agreement relationship that is sent from agreement initiator to agreement responder during agreement creation, indicating the relationship which the initiator would like to form.

Agreement Responder
The agreement responder is a party to a service level agreement. The responder implements and exposes an agreement on behalf of either the service provider or service customer, depending on the domain-specific signalling requirements.

Agreement Template
An agreement template is an XML document used by the agreement responder to advertise the types of offers it is willing to accept.

Agreement Term
Agreement terms define the content of a service level agreement.

Business Service
A business service is exposed/invoked via at least some non IT elements.

External Service
External services are exposed across the boundaries of an organization, i.e. across at least two administrative domains.

Guarantee Term
Guarantee terms define the assurance on service quality associated with the service described by the service definition terms. They refer to the service description that is the subject of the agreement and define service level objectives, qualifying conditions and business value expressing the importance of the service level objectives.

Infrastructure Provider
A specific kind of service provider who focuses on the provisioning of infrastructure services.

Infrastructure Service
An infrastructure service is a specific IT service which exposes resource/hardware-centric capabilities.

Internal Service
Internal services are exposed within the boundaries of an organization, i.e. within one administrative domain.

IT Service
An IT service is exposed/invoked by means of information technology. Specific classes of IT services may be software services, infrastructure services or media services.

Offered Service
An abstract service which is offered by a specific Service Provider to its Service Customers. Product is the synonym in this deliverable.
Passive Data Source*  
A data source which is passive in the sense that all data elements have to be explicitly written or read to the source.

Service  
A means of delivering value to Customers by facilitating Outcomes Customers want to achieve without the ownership of specific Costs and Risks. See also service interface type, service stage, service exposure

Service Stage  
The stage a service reaches over time from fully abstract to actually instantiated. See also abstract service, offered service, service instance

Service Consumer  
Person(s) who actually consume/use the provided services. Typically they belong to the service customer.

Service Customer  
Someone (person or group) who orders/buys services and defines and agrees the service level targets.

Service Description Term  
Service Description Terms describe the functionality that will be delivered under the service level agreement. The agreement description may include also other non-functional items referring to the service description terms.

Service Exposure  
Services can be exposed either internally (within the same administrative domain) or externally. See also internal service, external service

Service Instance  
A concrete implementation of an offered service which is ready for consumption by service users.

Service Interface Type  
Describes the nature of an actually exposed service, i.e. about the nature of his invocation interface. See also business service, IT service, composed service

Service Level Consequence  
An action that takes place in the event that a service level objective is not met.

Service Level Agreement  
An agreement defines a dynamically-established and dynamically managed relationship between parties. The object of this relationship is the delivery of a service by one of the parties within the context of the agreement. The management of this delivery is achieved by agreeing on the respective roles, rights and obligations of the parties. The agreement may specify not only functional properties for identification or creation of the service, but also non-functional properties of the service such as performance or availability. Entities can dynamically establish and manage agreements via Web service interfaces.

Service Level Objective  
Service Level Objective represents the quality of service aspect of the agreement. Syntactically, it is an assertion over the agreement terms of the agreement as well as such qualities as date and time.

Service Provider  
An organization supplying services to one or more internal customers or external customers.

Software Provider  
An organization producing software components which might be used by a service provider to assemble actual services.

Software Service  
A software service is a specific IT service which is exposed/invoked by means of software entities such as
Web services, user interfaces, or software-based business processes.

**Software Component**  
Software components are the entities produced at design-time by a *software provider*.

**T-shirt sizes**  
A term to denote predefined system templates for different capacity requirements along well known t-shirt sizes such as S, M, L, XL.
Appendix C: Abbreviations

ABE  Aggregated Business Entities
BSS  Business Support System
eTOM Enhanced Telecom Operations Map
KPI  Key Performance Indicator
KQI  Key Quality Indicator
NfP  Non-functional property
NGOSS New Generation Operations Systems and Software program
ORC  Open Reference Case
OSS  Operational Support System
OWL  Ontology Web Language
QI  Quality Indicator
QoS  Quality of Service
SAP  Service Access Points
SID  Shared Information and Data Model
SLA  Service Level Agreement
SLAT SLA Template
SLO  Service Level Objective
SNMP Simple Network Management Protocol
SOA Service Oriented Architecture
SP  Service Provider
SWRL Semantic Web Rule Language
TMF  Tele Management Forum
TNA Technology Neutral Architecture
UML Unified Modelling Language
URL Unified Resource Locator
WP  Work Package
WS  Web Services
WSLA Web Service Level Agreement
XML eXtensible Mark-up Language