

Modeling Service Level Agreement with Ontology

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Abstract— the Negotiation and management of service level agreements between the customer and the service provider plays a very important role in the proper functioning of the network. SLA [1] defined between the various stakeholders (customer, provider, signing authority...) allows specifying the possible levels of service, compliance with this specification provides a guaranteed quality of service that the customer is seeking to meet her needs.

From this first definition, we understand that the main goal of SLA is to manage the customer-provider relationship. However, the existing approaches to provide these definitions, demonstrate some difficulty. The use of simple variables, the restriction of these variables on a number of clauses previously managed by the provider, that are suggested as well to customers to make their choices. These factors are the major defects that we tried to improve in our approach.

Our solution is based on a semantic meaning for the drawing up of SLA agreements. For this reason, we established two models at the beginning, an intentional model for the customer need and a semantic presentation of the providers offers in order to get afterwards an ontology that defines these settlements.

Keywords: SLA, Quality of Service, Ontology, WSLA, and OWL.

I. INTRODUCTION

Since the creation of the World Wide Web, new multimedia flows have come into existence as well as the appearance of a big amount of diversified customer requests. This evolution of information is associated with another: the evolution of used equipment, starting by the heavy machines and computers, on the shift towards materials that are lighter and mobile as well.

This artificial intelligence has required a more sophisticated information management that is the origin of an approach to exercise general management, and supervision which cover all these criteria (variety of equipment, multimedia flows, complex system, mobility to the user, terminal mobility ...). The network administrators (operators, service providers) have realized that a good management means the mastering of all the software and hardware resources of the network, hence the possibility to guarantee quality of service for each range of

customers, which subsequently results in more agreement maintain and customer's attraction.

The purpose of our presentation is the development of a first study for all the suggested models, and solutions to manage the customers, and provider's contracts in terms of service quality, as well as the respect of the agreements and requirements. This study has allowed us to develop a new approach that is more semantic, in order to manage the SLA agreements (Service Level Agreement) or the service contract. This latter is based on a generic ontology while benefiting from intentional models between customers and providers that we have developed as semantic model of input. The first model represents the need of a customer according to a simple and comprehensive language and a second model that represents the provider offers.

This presentation of the quality service patterns between among the various players, aims primarily to facilitate the presentation of information. This interpretation allows on one hand an understandable human reading, on the other hand, it permits possible treatments by machines.

After the development of these two input models, we will deduct our ontology that will permit the description of SLA agreements, these agreements aim at ensuring a certain quality of services to meet the customer's needs.

All of our work is based on open standards such as OWL [2] and SWRL [3], the models that permit the interpretation of the obligations of each contract, and to control each violation or overrun. As a first step, we are seeking through each section of this article to give definitions, and an overview of each used element contributed in the completion of our approach, the definition of SLA and its dependencies, an overview of existing approaches that treat SLA agreements.

II. SLA DEFINITION

We can define SLA (Service Level Agreement) by a contract that represents all the clauses and rules that the provider shall comply with and apply for a specific customer. This contract allows as well defining the penalties of the provider in the case of the non-compliance with one the contract rules.

The provider commitment of this special treatment of flows, and customer’s data with a certain quality of service is measured by some defined parameters, like the response time or the service duration. These criteria are applicable on the two key players that are client and provider.

The SLA is not a concept that is reserved to a specific filed or a given product, the establishment of this type of contract deals with a manual signature in most cases. However, the implementation of these agreements of quality service generally follows a certain language such as WSLA [4], WSOL [5], WS-Agreement [6].

Eventually, we will represent an overview of the different existing models and working activities for the modeling of SLA, in which each model presents a certain semantic description.

III. EXISTING WORK OF THE SERVICE AGREEMENT LEVEL MANAGEMENT

The life cycle of an SLA runs mainly through 5 phases: Development of an SLA model, Negotiation, implementation, execution and termination, we notice here that the SLA model gets an important place to ensure a proper management of customer quality of service.

For these reasons, many models gave been started, amongst these we mention the QoSOnt [7] model defined by OWL [2] language to describe the attributes and generic concepts relied on the quality of service due to a variety of layers. These metrics use XML language, a form of presenting which proves a considerable restraint for a semantic interpretation.

WS-QoS [8] model is another model based on ontology, it allows to set up the QoS parameters, however it has a major drawback which is the loss of its capacities on offer by the OWL language. FIPA QoS [9] offers a rich vocabulary in the method for QoS by using ontology, for interrogations and the information retrieval, but this model remains specific to the lowest layers of OSI[10] standard.

SL-Ontology [11] is another semantic presentation that defines in its structure: providers offers, customer requests as well as the interveners agreements. This solution as set out above includes the supply and demand in the same form, which limits the customer self-expression.

All the models that we have developed before and others offer the advantages and prove these limitations. Some use XML for

the definition of the methods, and the parameters of quality service to establish SLA agreements, this form of presentation is inappropriate for the semantic management of this agreements. The other models have a limited work stream over specific layers (for example FIBA), or do not include the logic definitions for the quality service.

We see that a semantic definition of operator offers and another that represents the customers’ demands separately and in a more practical way, even optimal for the elaboration of output ontology for SLA agreements; each of the interveners will have the possibility to describe his or her objectives according to his or her proper terms and understandable language for each. The ontology of these agreements offers an automation to facilitate the analysis of information.

IV. INTENTIONAL MODEL OF THE CUSTOMER

We will present in this part of the article a formal modeling of customer’s intentions according to an understandable model. These intentions describe the attitude of the customer demands. For this, we have modified and significantly enriched the intentional model of H.Kanso [12], while respecting pretty simple and interpretable vision.

This model takes into consideration the concept of service quality (QoS), and the management of “customer-provider” contract as well as the responsibility of handling the penalties in case of violating the contracts set.

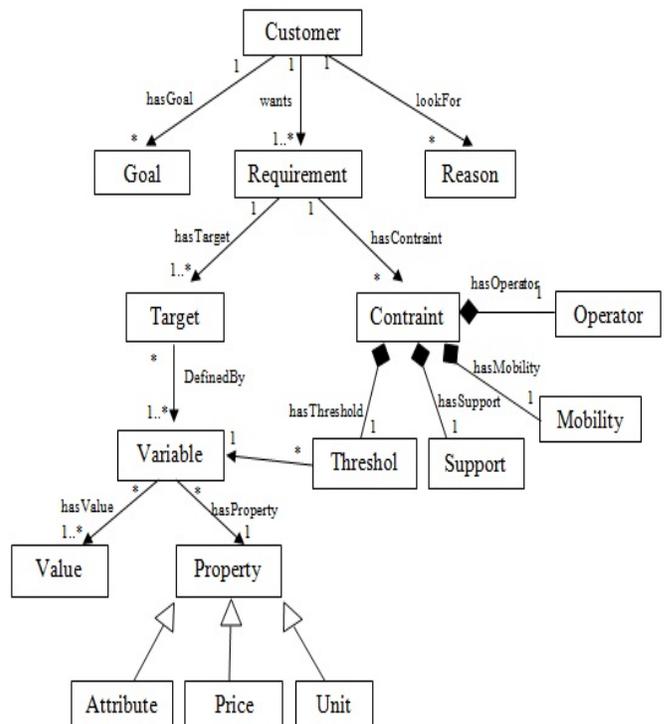


Figure 1 : Customer Ontology DemandeOnto

The Figure 1 represents the class diagram of our proper intentional model, which constitutes the customer requirement according to an easy and understandable structure for each range of customers. We notice three main axes, which offer an exposure of the customer's states of mind.

Each customer seeks to satisfy some needs (customer intent) that aim the following: product, service, and action that we have represented by the target concept. All these resources (software or hardware) are variables, hence each target one or many variables, and each of those is characterized by some properties (attribute, unit, and price) that undertake a certain instance and specific value. The unit of measure given to this value is recoverable from the ownership.

The customer requirements undergo many constraints, each customer can tolerate functions and show compliance with its limits. We identified some constraints related to the mobility of the terminal or the user. The coverage areas of the provider as well as the triggering concept represent a specific limitation that is necessary to satisfy a customer request. For example, while performing a customer file transfer the target will be a whole range of data to download. The customer requires a limited duration due to the use of the threshold, which will define in that situation, the response to enquiries to respect for ensuring the best service quality required by the customer.

DemandeOnto ontology is different compared with existing models, thanks to their simplicity that make it possible to offer to each customer, the chance to express his or her needs by a simple language without giving any consideration to some business models.

V. PROVIDER ONTOLOGY

For the specification of the SLA provider, and the managing of Quality of Service (QoS) agreements, an important number of models and ontology have existed. We distinguish among them: WSOL, SLAng or WS-Agreement.

Most of these models suggest a language that is based on XML. This form of description does not offer a possible retrieval of information, because of its fine-grained and it pretty difficult presentation. As a result, we have suggested **OffreOnto** ontology that represents a semantic description of provider's offers, as well as a set of functions and operations allowing the management of vendor and customer arrangements.

We will demonstrate in Figure 2 the ontology provider that will permit the description of possible offers. Each provider is distinguished in comparison to others thanks to the provider concept. Each provider adopts his own suggestions that are modeled in our ontology by the concept of Offer. This enables

to represent either a product that a provider has the ability to providing it, or a service to meet.

Each provider offer suffers from a set of constraints, for example, right to access constraints that define the validity of an offer to a range of customers, or penalties during the violation of an engagement between the customer and provider for a product or a service. But also another concept called «Measuring Operation» that influences directly each offer. With this operation, it will be possible to measure the variables that intervene. This concept can give the possibility to calculate the level of service for these variables of periodic manner, something that is important for the respect of the provider undertaking towards a customer, more specifically the meet of the quality service.

We then distinguish two possible proposals, a product or a service. The first is characterized by the property concept, which forms the grouping of entities relating to a product, the product price, scope and technical or functional characteristic. This product can be complex and may contain several variables or a single variable, each of these variables to a specific value and defines a unit. We note that the provider product is limited by some requirement reformulate with the concept Contraint. We find then, the threshold value of a variable, the availability of a product in a specific time interval, warranty, and portability in a change in another area of coverage.

The concept Service it allows to define the set of operations that the provider offers a contract already established (update, consultation, parameter change ...) or an action to perform each of these operations has a or more variables as parameters.

VI. SEMANTIC DESCRIPTION OF THE SERVICE CONTRACT

After the development of the two input model, the intentional customer models (DemandeOnto) and ontology provider (OffreOnto), we have established a output model AccordOnto which is based on the combination of these two models, while maintaining our primary objective which is compliance with agreements of QoS. This proposal offers different properties and functions for the design of a contract respecting the customer requirements.

AccordOnto is based on the semantic definition offered by WSLA, the concept "Parties" defines participating in a service contract. provider and customer is the signatory parties, while the third part includes responsible monitoring and measurement of service quality in SLA, guarantee the reliability of this Agreement may be sponsored by one or two members of the contract (provider and customer). all two classes inherit from the Party class that includes a common set of components for each participant in the SLA.

A key concept necessary for the control of service contracts is Control, this is an essential class that has a vision of all obligations, and the Policy concept that contains all predicate, and rules that govern the agreement. Control entity uses the result of the operation Measuring class that returns values in a catalog of predefined functions and operations, it can return control of these agreements more dynamic.

We find that the Obligation part represents the set of constraints to respect to have a quality of service agreement, the contract established between the parties requires the respect of some obligations (threshold, mobility, price, warranty ...), the concept threshold represents a limitation on providing a setting, suddenly, and the provider must give these resources to respect this threshold. Price f concept describes a very important component in each contract with or without QoS between the customer and the provider.

The concept guarantee describes the commitment of the service provider against the customer's request. In the case of abuse or non-compliance, with any of the terms established in the contract, a penalty is defined by the concept Penalty. service may be movable relative to a user or device, in this case, it is the report Mobility concept.

Each contract is based on an agreement on a set of SLAparameter, the latter concept includes the parameters that the customer and the provider are expected to comply, it is associated with a product, a service or a metric, the first product is negotiated between customer and provider, it may combine one or more variables, each variable has a value defined by a specific unit (byte, second, number, percentage ...).

the concept Service defines the entity through the feature set of operations that the customer can request, the function concept includes a catalog operation that the provider can offer in settlement of contract, or possible amendment after agreement, these operations are clean each provider according to the offers he can guarantee.

Metric concept with MesurementDirectives includes the mathematical function, and the call applied on a set of variable, for OutputResult as a usable result to establish this agreement.

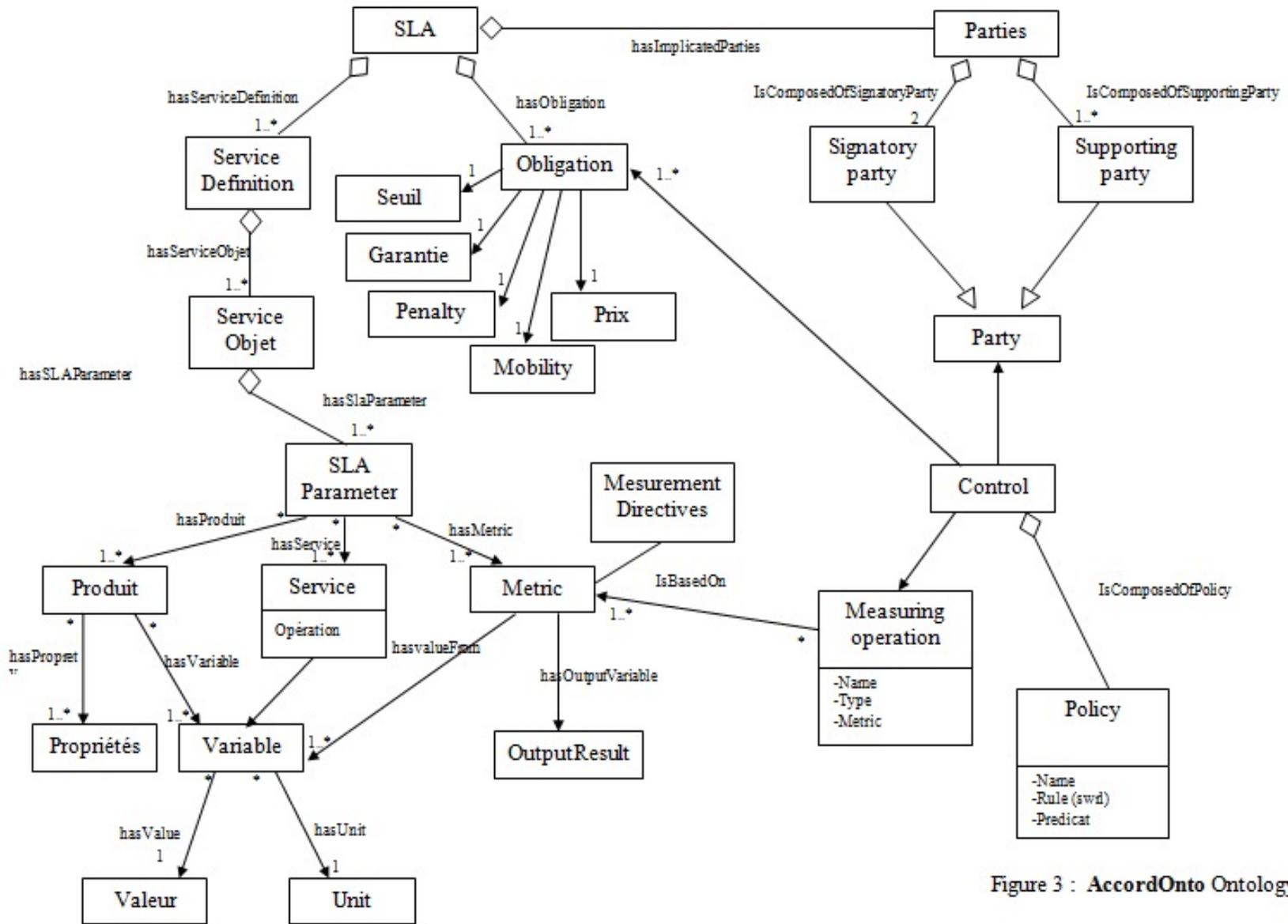


Figure 3 : AccordOnto Ontology

VII. ACKNOWLEDGMENT (HEADING 5)

The study of existing models for the generation of agreements, or more precisely the SLA between the customer and provider reflects clearly a remarkable failure, the lack of a complete approach for the specification of quality of service, and managing of violation. competition between operators opens the door to the evolution of their offerings, and management of quality of service and can give the distinction in this market, hence the need for a more concrete semantics management and integral to the customer need, Our approach comes in this purpose, we have established a global ontology allow more precise management for QoS, and integrate different concepts to better understand customer needs.

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