# Service Level Agreement Modeling

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### Abstract

Service Level Agreements have been used since late 1980s by fixed line telecom operators as part of their contracts with their corporate customers.Internal departments (such as IT, HR, and Real Estate) in larger organizations have adopted the idea of using service-level agreements with their "internal" customers in other departments within the same organization.

This Paper will contribute the Service Level Agreement Model and the interaction system between the user and service provider to minimize the time and the cost of service delivery.

**Keywords:** SLA, SOA, REM, UML.

## Introduction

One benefit of SLAs can be to enable the quality of service to be benchmarked with that agreed to across multiple locations or between different business units. This internal benchmarking can also be used to market test and provide a value comparison between an in-house department and an external service provider (Kertesz, Kecskemeti and Brandic 2008, p31). A service level agreement (SLA) is a negotiated agreement between two parties where one is the customer and the other is the service provider. This can be a legally binding formal or informal "contract". Contracts between the service provider and other third parties are often (incorrectly) called SLAs-as the level of service has been set by the (principal) customer, there can be no "agreement" between third parties (these agreements are simply a "contract") (Wetzstein,

Karastoyanova and Leymann 2008).

The SLA records a common understanding about services, responsibilities, activities, and decisions. Each area of service scope should have the "level of service" defined. The SLA may specify the levels of availability, serviceability, performance, operation, or other attributes of the service, such as billing. The "level of service" can also be specified as "target" and "minimum, " which allows customers to be informed what to expect (the minimum), whilst providing a measurable (average) target value that shows the level of organization performance. In some contracts, penalties may be agreed upon in the case of non-compliance of the SLA (but see "internal" customers below). It is important to note that the "agreement" relates to the services the customer receives, and not how the service provider delivers that service (Zhang and Aragna 2004, p179).

Service-level agreements are, by their nature, "output" based. The result of the service as received by the customer is the subject of the "agreement." The (expert) service provider can demonstrate their value by organizing themselves with ingenuity, capability, and knowledge to deliver the service required, perhaps in an innovative way. Organizations can also specify the way the service is to be delivered, through a specification (a service-level specification) and using subordinate "objectives" other than those related to the level of service. This type of agreement is known as an "input" SLA where the requirements are becoming obsolete as organizations become more demanding and shift the delivery methodology risk on to the service provider.

The cooperation between services and service oriented architectures need to interact between them, generally service level agreements expressed in ambiguous ways and this implies that they need to evaluate both in a mutual agreement to qualify a service and in monitoring process (Chris 2005).

## SLA Overview

Service level agreement model represent both measurable and immeasurable parts; it presents the operation of the SLA model. The implementation of SLA model will be faced some of limitations in its implantation. The developing system of SLA will mention with the restrictions.

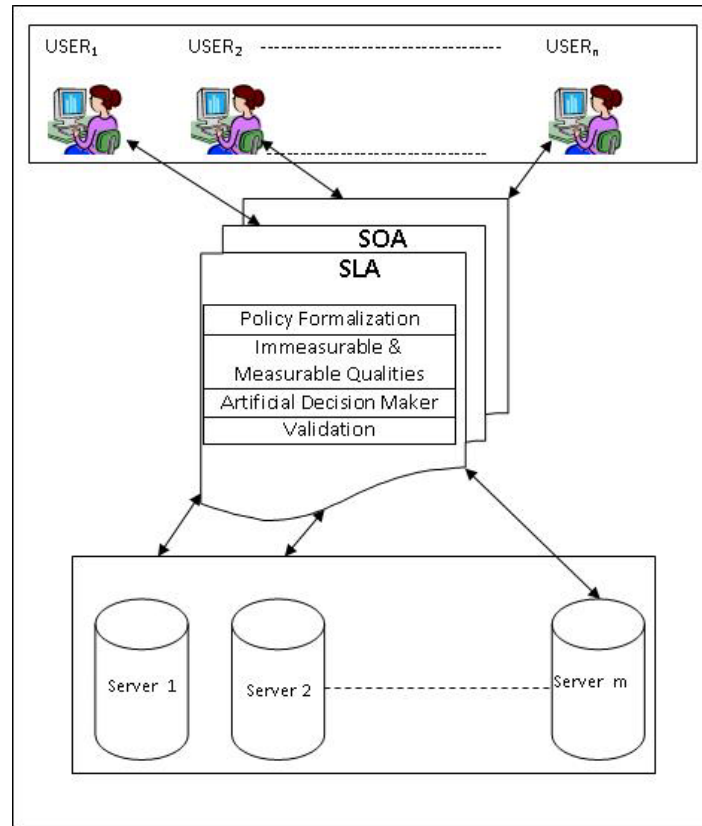The general architecture of the proposed framework is shown in Figure 1.

Figure 1 Proposed Framework of SLA

The core of proposed SLA model is the decision maker which builds by either by mathematical technique or artificial technique like neural network or genetic algorithm for measurable and immeasurable parts, it can take a decision when the actual proposed output values when applying the measurable and immeasurable data sets. The validation layer considers as assessment layer to evaluate the extracted output by evaluate it with actual extracted outputs.

## System Architecture

Service Level Agreement manages the roles of the users/service providers' contract, it collects the setting of measurable and immeasurable qualities for various users and helps the developers to extract and select suitable agreements. SLA is part of QoS of SOA, it defined briefly as policy formalization, the measurable and immeasurable qualities matrices, the artificial decision maker, and the last layer is validation layer.

Having formalized and expressed SLAs by a different type of quality policies for different users and service providers, The model needs an

evaluation methodology to unify these qualities and decide either to execute the new service or not for the user.

The proposed SLA system is composed from the following components:

- Policy formalization: A formalized policy instance expresses in a rigorous way, who, how and where security SLAs will be applied. The way in which we formalize a policy is strongly dependent on the technique we intend to adopt (Chakravarti and Varma 2008); at this aim, the adopted formalization will be presented with the technique.
- The policy formalization based on defining the measurable and immeasurable qualities matrices.
- Evaluation technique: The aim of this proposal is to define and develop the SLA model to provide the optimal services to the End-User in Client-Server environments. The proposed model can be used to test the service layer agreement by selecting suitable policies formalization for each end user.
- The evaluation technique is used in the client side to decide if the service query must send to the current server or it needs to change the server. The general structure of the SLA Model is as follow:
- The inputs to SLA are qualities of each client, where the outputs are requested, wait, or change server of the current service. To design the service level agreement (SLA), matrices technique are used by defining different qualities in different measurable and immeasurable qualities then it will find the trace for each matrix by maximum value of the matrices, so that it can select the optimum policy formula. As we know that neural network lies in the fact that they can be used to infer a function from observations and also to use it. This is particularly useful in applications where the complexity of the data or task makes the design of such a function by conventional technique impractical. Application areas include system identification and control (process control), and decision making. In service level agreement we select different patterns of policy formalization, so that it can select the optimum policy formula, this formula represent the best formula to test the service behavior in SOA. Brien, P. and Gray, J.

    Figure 2 shows UML sequence diagram of how each component of SLA model interacts with each others.
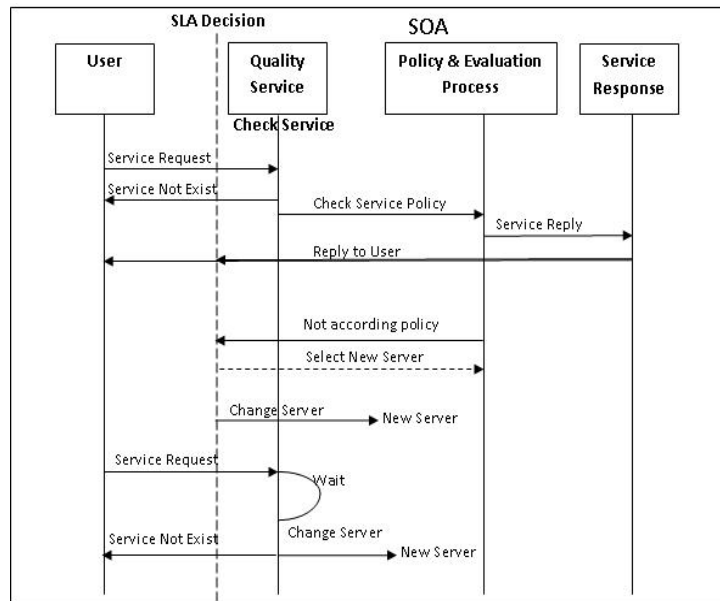
Figure 2 SLA System Interactions

In Figure 2, messages are indicated on UML sequence diagrams as labeled arrows, when the source and target of a message is an object or class the label is the signature of the method invoked in response to the message. However, if either the source or target is human actor, then the message is labeled with brief text describing the information being communicated. For example, the user object sends the message Service request to the Quality Service. It's clear that the state include both the method's name and the name of the parameters. The user provides information to the SLA Decision object via the messages labeled, its user interactions.

Return values are optionally indicated using a dashed arrow with a label indicating the return value. For example, the return value Service Not Exist is indicated coming back from the class Quality Service as the result of invoking a message, whereas no return value is indicated as the result of sending the message Check Service Policy to Policy & Evaluation Process. The style is not to indicate the return values when it's obvious what is being returned, so the sequence diagrams is complicated fairly quickly. It is very important notes are basically free-form text that can be placed on any UML diagram, to provide a header for the diagram, indicating its title and identifier (It should give unique identifiers to all classes). Although the Figure models the logic of the basic action for the SLA use case. The easiest way to do so is to create a single sequence diagram for each alternate course, this diagram models only the logic of the SLA, it can tell the numbering of the steps, and the header note for the diagram indicates the actions. The diagram notices the classes' header, the interaction messages, the actions, the state, and the location of classes.

The model is composed of the following components:
- The User who initiates the service request, it represents the service consumer. The user represents the developer for the system.
- The SLA Decision represents the decision maker for the user.
- The quality service registers the service request and checking if it is available or not, it chooses the server who can provide the requesting service.
- When the request is available then it will forwarded to policy and evaluation process state, in this state the qualities will formalize into certain forms and then it will evaluate by the suggested SLA model.
- After the qualities, evaluation, and the decision is taken; the service reply will be activated to the user.

The SLA system model is suggested according to the following:
- Collect the measurable and immeasurable qualities which are defined in SLA contract between the users and service providers.
- The measurable and immeasurable qualities will formalize into two separate matrices.
- The measurable and immeasurable matrices will apply as inputs to evaluation technique, by data sets of measurable and immeasurable matrices.
- Running the evaluation technique with applied data sets to extract the activated output/outputs. The evaluation technique will work as a Decision maker.
- The extraction outputs can decide the operation work flow as following:
- Server provides the requesting service to the user.
- The server busy then the user will wait by activating a timer with defined and certain time.
- The system can change the server to provide the request service.

Figure 3 shows SLA system architecture, the user request a service then the qualities will be formulated into two measurable and immeasurable matrices, these matrices will apply to Decision maker to extract the outputs.
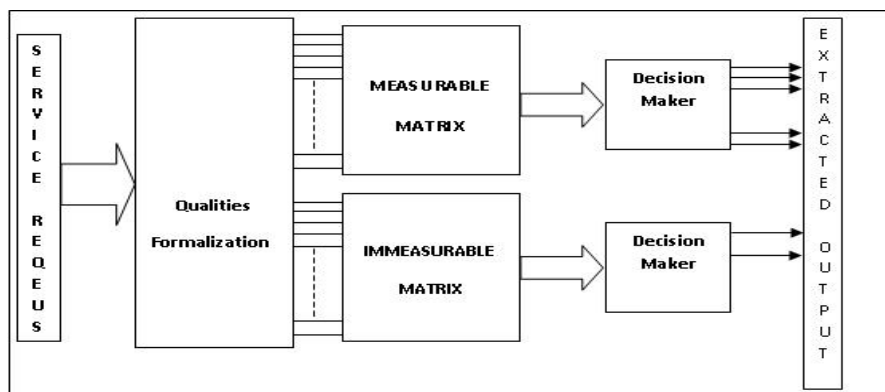


Figure 3 SLA System Architecture

## Conclusions

In this paper we have introduced a theoretical model to evaluate Service Level Agreement in SOA. The model is based on two fundamental features; the first one is the SLA formalization through the use of standard policy while the second one is the formalization of "qualifiable service levels" against which we could measure the SLA.

In particular, we have adopted a Reference Evaluation Model, developed for different methodology, to evaluate and compare different policies and quantifying their levels. The application of the methodology in different samples of measurable and immeasurable qualities and we adopted it in the integration of mathematical model and artificial model to guarantee the same perceived service level to the end-user.

SLAs have been applied in service organizations in general, including IT organizations, to formalize the level of service between a service provider and service user. While SLAs are well understood in these domains, they are less understood for services in the SOA context.

SOA enables the integration of automated services from multiple organizations. External providers may offer services that were not initially implemented to meet the quality attribute requirements of the service consumer organization. Defining an SLA and establishing SLA management mechanisms are important factors when clarifying the quality requirements for achieving the business and mission goals of SOA systems.

Standardized SLAs are going to be an important element for organizations moving to automation, SLA systems characterized by the dynamic discovery, composition, and invocation of services based on QoS and other contextual information.

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