



Service Level Agreement: A Basic Approach for Understanding SLA

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Abstract— *Service Level Agreement (SLA) is a type of agreement or set of statements among user and service provider. All the information regarding services and their performance capability or quality is defines in this agreement. The terms mentioned in an SLA defines different levels that the service can meet when delivers to users, these levels of service are presented in terms of parameters and performance metrics which include penalties, priorities, compensation, punishments etc, that is to be enforced by an authority on the violator party. Most commonly parameters of SLA defines QoS (Quality of Service) of the service, included delay, response time, execution time, availability, access time, throughput, network bandwidth, latency, uptime, downtime etc. If quality of these services does not reach at user side according to SLA than provider have to pay some penalties. In this paper, we will cover the basic understanding of service level agreement, components, types and life cycle.*

Keywords— *SLA, SLO, KPI, SOA, QoS*

I. INTRODUCTION

The SLA [1] specifies the quality of service (QoS) between a service provider and service consumer, and usually includes the service price and the level of QoS adjusted by the price of the service. For instance cloud provider can charge a higher price to a consumer who requires a high level of quality of service (QoS). From the performance perspective, flexible and reliable management of SLA agreements is of vital importance for both consumer and Cloud providers. Also, prevention of SLA violations avoids penalties that providers have to pay and on the other hand, by considering flexible and timely actions to possible SLA violations, enables Cloud computing to take roots as a flexible and reliable form of on-demand computing [2].

II. SERVICE LEVEL AGREEMENT

A Service Level Agreement (SLA) is a contractor agreement between a network service provider and a customer or user that determines, generally in measurable terms, what type of services the network service provider will furnish. Many Internet service providers (ISPs) provide their customers with an SLA [3]. The agreement is expressed in a simple language so that it can be clearly understood by the users. The agreement may also include more technical terms for defining the service [4]. In other words, Service Level Agreement is a record which defines a set amount of time for a task to reach a specific condition. If the task does not reach the condition by a set amount of time, it is viewed or marked as breached. SLAs are used to ensure that a task reaches end conditions within a certain amount of time, like ensuring that an incident is closed or resolved within a few business days [5].

The Service Level Agreement is often part of a wider service contract or agreement. A Service Level Agreement can either be an informal contract between parties or a legally binding contract. The SLA may address several areas including the availability of the service, reliability, the performance of the service, how it will operate and priorities, responsibilities of involved parties or groups, guarantees and warranties. As well as defining specific areas, the Service Level Agreement may also contain a level of service, decided targets and a minimum level that can be reached. Some of the common uses for a Service Level Agreement would be for Internet Service Providers (ISP), telecom companies, multinational companies IT service providers, and outsourcing [4].

A. Types of SLA

There are many types of SLAs present for provider and user, some are discusses below:

- 1) *Customer SLA*: Customer service level agreement is an agreement with an individual customer [6]. This agreement can be with individual customer group with all the services they use in a time of agreement. For example, an SLA between a provider like IT service provider, or network provider and a department of a large co-operate company or organization for the services such as software, finance system, checking system, payroll system, controlling system, billing system, server system, procurement/purchase system, etc. This agreement covering all SLM issues relevant to the particular customer group or parties, regardless of the services being used.
- 2) *Service SLA*: This service agreement is for every customer making use of the services being provided; it may be for group of customer which is using service according to service SLA. This agreement is for all customers using the services being delivered by the service provider. For example: A car service station offers a routine service to all the customers and offers certain maintenance as a part of offer with the charging. A mobile service provider offers a routine service to all the customers and offers certain maintenance as a part of offer with the

universal charging.

- 3) Multi-level SLA: Multi level SLA is a combination of levels like according to the privileges or priorities of some group of customers, with which SLA addressing multiple sets of customers.
- 4) Corporate SLA: Corporate SLA covers all Service Level Management (SLM) issues. Covering all the generic service level management (often abbreviated as SLM) issues appropriate to every customer throughout the organization. These issues are to be less volatile and so updates (SLA reviews) are less frequently required.

III. COMPONENTS OF SLA

An SLA can comprise a few short pages up to a few hundred pages. The basic parts of agreement are a statement of the parties intent, a layout of the responsibilities of each party (including acceptable performance parameters with appropriate metrics), a statement on the expected duration of the agreement, a detail description of the applications and services covered by the agreement, processes for monitoring the service levels, a schedule for unauthorized access of outages and associated penalties, and problem-resolution procedures [7].

A. Service Level Objective (SLO)

A service level objective (SLO) is a key element of a service level agreement (SLA) between a service provider and a customer. SLO's are agreed as a means of measuring the performance of the service provider and are outlined as a way of avoiding disputes between the two parties based on misunderstanding. There is always confusion in the use of SLA and SLO. Also combination of both SLA and SLO they are become Service Level Objective & Agreement (SLO&A) which removes the blur between the two in a certain view. SLO's are specific measurable characteristics of the SLA such as availability, reliability, throughput, response time, frequency or quality. The SLA agreement that specifies what service is to be provided to the users, how it is supported, times, locations, costs, performance metrics and responsibilities of the parties involved [8]. For different types of models of cloud computing, there is different services, service levels and operation. Some are discusses as follows according in [9].

1) Infrastructure as a Service(IaaS):

- Service Provided: A wide range of computing components like CPU, memory, network, storage etc, generally with the basic operating systems or softwares.
- Service Level: Environment provisioning time, Environment availability, Environment performance.
- Service Operation: Generally users create, change and backup the computing environment through a service portal.

2) Platform as a Service (PaaS):

- Service Provided: Environments for program development, testing and production run. It may include Web server, database server and application server.
- Service Level: Service levels stated for IaaS are applicable. Under PaaS, it is a service provider to take care of the underlying infrastructure, such as patch update and version upgrade. Thus, service level may be used to govern a service provider to announce the infrastructure change ahead of time and provision a patched or upgraded environment for testing out application compatibility and performance.
- Service Operation: Regarding infrastructure maintenance and update, the service operation should be transparent to users. However, when such operations affect availability, users should be well and duly informed of the schedule and impact. Since the application and business process are developed by users, they need to take care of the corresponding operations, such as backup of database containing business data.

3) Software as a Service (SaaS):

- Service Provided: Application
- Service Level: Application availability, such as application uptime, Application performance, such as application response time. Under SaaS, from infrastructure to application all are taken care by a service provider. Users should be duly informed of the changes and be given the related environment for testing.
- Service Operation: Under SaaS, users interact with application only. The operations of a service provider are transparent to users, unless it affects availability and performance.

B. Key Performance Indicators (KPI)

Key Performance Indicators (KPIs) are metrics used to quantify the performance of the supplier and monitor Service Level Agreement. When KPIs are set correctly, they give an early indication of when the supplier is struggling to reach the agreed level of service.

On the other hand Key Performance Indicators (KPIs) are metrics that target service provider's organization objectives both tactical and strategic. These metrics are used to measure:

- Quality and effectiveness of a service
- Service operation status.

It should be noted that not all metrics automatically become Key Performance Indicators. According to the organization or service goals KPIs must be bound and drive continuous improvement and efficiency [10].

In Service Level Agreements applications, key performance indicators are managed by the associated service level agreement. Key performance indicators are performance metrics that keeps track critical performance variables over time. In many cases, a person can track the performance of a service desk organization and its compliance with service level agreements. Key performance indicators are created in the Key Performance Manager application. For key performance indicators, some actions can perform as following:

- Define the value to be calculated (response time, throughput, resolution time, and so on)
- Select a calculation type (percentage or decimal)
- Define the time you want calculated (day, week, month, and so on)
- Define the thresholds that define the high and low limits on the key performance indicator display
- Define the degree to which users can get high performance of application and services through the key performance indicator to get more information, such as response time by department.

Some Example of key performance indicator

A service level agreement with a group of user or customer states that meet the following criteria:

- Respond to all incident tickets within two hour and resolve the incidents within five hours.
- Maintain a monthly average of a half-hour response time, or pay financial penalties.

To ensure that supplier aware of average response time for all incident tickets for this customer, create a key performance indicator for this service level agreement, and create the key performance indicator accessible to the appropriate managers. Using the key performance indicator, supplier can take necessary proactive measures to avoid the financial penalties associated with noncompliance [11].

Key performance indicators identify and measure the key metrics for business. KPIs for a restaurant would include number of customers, tables filled, number of customers, income per night, food costs, labor costs and advertising budget. KPIs for an online store would include response time, income per category, costs for bandwidth, advertising and shipping. KPIs help business succeed by keeping up-do-date on the "vital signs" of the company [12].

C. Operational Level Agreement (OLA):

An operational level agreement (OLA) is a contract that defines how various IT groups within a company plan to deliver a service or set of applications. OLAs are designed to address and solve the problem of IT silos by setting forth a specific set of criteria and defining the specific set of IT services that each department is responsible for. It should be recognized that the term Service Level Agreement (SLA) is used in many companies when discussing agreements between two internal groups or organizations, but according to the Information Technology Infrastructure Library (ITIL) framework for best practices, this type of internal agreement should be called an Operational Level Agreement [13].

Operational Level Agreement is an agreement between the internal support groups of an institution that supports SLA. According to the OLA, each internal support group has certain responsibilities to the other group. The OLA clearly mentioned the performance and relationship of the internal service groups. The main goal of OLA is to ensure that all the support groups provide the intended Service Level Agreement [14].

IV. STRUCTURE OF SLA

SLAs have been the subject of substantial standardization effort within the Grid community. The WS-Agreement specification is one such example; it defines a mechanism for automated SLA creation between two parties[15].The objective of WS-Agreement is to define a language and protocol for establishing agreements between two parties, advertising the capabilities and requirements of service consumers and providers, creating agreements based on creation offers and monitoring the agreement compliance at runtime[16].

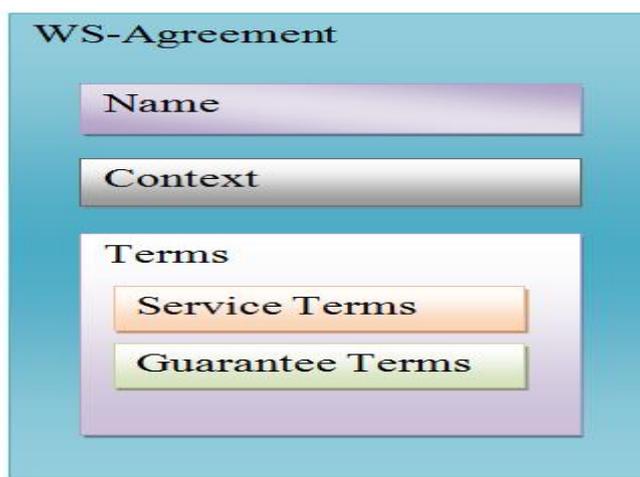


Fig.1 WS-Agreement specification [19]

WS-Agreement is one of the most widely used SLA specifications. Benefits of WS-Agreement over other agreement models is that it allows one to depict conditional and optional term sets inside an agreement document and statements which are commonly found features in real-world agreements [17]. The Service Terms and Guarantee Terms contain detail information; both are recursively defined with a Term Compositor construction. The Service Terms describe the service sufficiently well, e.g. by including or linking to a WSDL document or parts of it. In addition they can define variables of the service that can be monitored. Most important are the Guarantee Terms. Again, a Term Compositor structure allows for a logical combination of several Guarantee Terms via AND, NOT and XOR operators, and thus for constructing a logical formula. Each Guarantee Term contains a Service Level Objective (SLO) which is a predicate over

variables defined in the Service Terms part of the WS- Agreement document. Based on the observed values of these variables during operation of the service, the Service Level Objective is evaluated; it can be fulfilled or violated [18].

V. SERVICE LEVEL AGREEMENT LIFE CYCLE

Service level agreement has several phases, but mostly six phases discusses by different authors. In [20], define these six phases as:

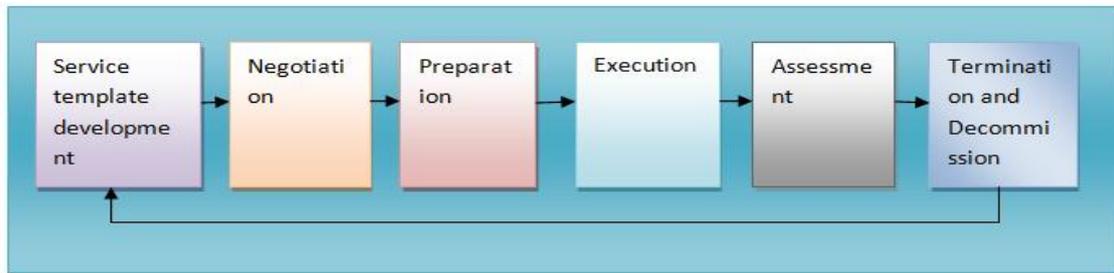


Fig.2 Service Level Agreement Life Cycle

A. Service and SLA Template Development

Service and SLA Template Development phase involves identifying the service consumer needs, the identification of appropriate service characteristics and parameters that can be offered given the service execution environment, and the preparation of standard SLA templates.

B. Negotiation

Negotiation phase negotiates the specific values for the defined service parameters, the costs for the service consumer, the costs for the service provider when the SLA is violated, and the definition and periodicity of reports to be provided to the service consumer.

C. Preparation

The service (or a specific instance of it) is prepared for consumption by the service consumer. Reconfiguration of the resources that support service execution in order to meet SLA parameters is required in the preparation phase.

D. Execution

This phase is the actual operation of the service. It includes service execution and monitoring, service quality validation, real-time reporting, and real-time SLA violation processing.

E. Assessment

This phase has two parts:

First is the assessment of the SLA and the QoS that is provided to an individual consumer. QoS, consumer satisfaction, potential improvements, and changing requirements are reviewed periodically for each SLA. Second is the assessment of the overall service. This assessment can be attached to an internal business review. Components to be covered in this review are the QoS provided to all consumers, the need for the rearranging of service goals and operations, the identification of service support problems, and the identification of the need for different service levels.

F. Termination and Decommission

This step deals with termination of the service for reasons such as contract expiration or violation of contract, as well as the decommission of discontinued services [20].

In 2011[22] brings a new idea of public SLA life cycle template in [22]. The formalized public SLA template life cycle, which consists of five steps, is shown in Figure. An initial template is created in the beginning of the life cycle. Afterward, consumers perform SLA mappings to their private SLA templates (step 2). Based on their needs, inferred from these mappings (step 3), and the predefined adaptation method, the public SLA template is adapted (step 4). Assuming that the demand of market participants does not change, a final template is generated (step 5). If the demand has changed during a fixed time period (i.e., new tasks has to be executed or new users joined the marketplace), the process continues with step 2. In practice, the time between two iterations could correspond to a time period of one week, e.g., but can be set to any value depending on the volatility of the market. During that time new SLA mappings are solicited from users (i.e., consumers and providers).

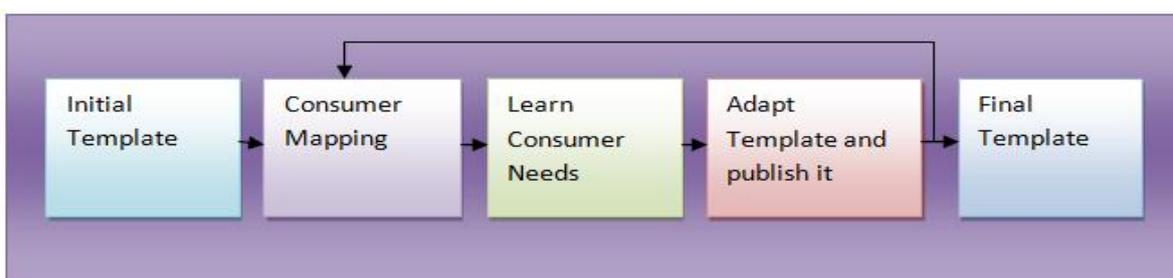


Fig.3 Public SLA template life cycle

VI. SERVICE LEVEL PARAMETERS

Service level agreements have many service performance metrics according to service level objective. Breaches or violation of SLAs are measured by these parameters by their performance measurements, like if performance of services is not up to the mark or any jitter or delay occur, then consumers can ask for the penalties to be fulfilled by supplier. Some parameters are considered in [21], for matching algorithm include; Virtual Machine (VM), Storage Capability, Memory Capability, Ethernet port, Availability, Processor Speed, Response Time, Server Reboot Time, Service Credit. In [23], Considers six aspects of (Quality of Service) QoS, performance, availability, accessibility, integrity, reliability and security [23]. Some common metrics like uptime, downtime, throughput, execution time also parameters of service level agreement. Most valuable parameters are decided by user and supplier, user select those parameters which they need more specifically. If performance of those parameters degrade due to some circumstances or because of any obstacle of network, or by overload etc, then supplier have to pay some compensation or some penalties to user or consumer. It may be by cash or service free for some extent of time as according to agreement signed by user and supplier.

VII. CONCLUSION

Service Level Agreements define expectations between two or more groups or parties regarding service quantity, quality, accessibility, priorities, and responsibilities. Traditionally SLAs have been a contract between a Service Provider or service supplier and customer or user. Today, partnership of two or more groups or companies established with the terms and conditions of Service level agreement. Generally, SLAs contain segments to address; performance measurement, a definition of services, problem management, warranties, customer duties, disaster recovery, termination of agreement etc. For ensuring that SLAs are consistently meet their terms and conditions, these agreements are often designed with specific lines and groups or the parties involved are necessary to meet regularly to create a open conversation on it. Contract statements like compensation or penalties should be rigidly deployed. If user uses services of any service provider, than its a responsibility of user to understand and for provider to clearly mention all the service related terms in service level agreement. A SLA demonstrates that how services will provided to user, and all the privileges and priorities, and how the user will use those services.

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