Analysis of Performance and Quality Parameters for Service Level Agreement in Long Distance Calls Service

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***Abstract*—SLA (Service level agreement) is a formal negotiated contract between service providers and customers. Nowadays the quality of telecommunication services is the key parameter in the success or failure of business enterprises. If there is no SLA between two parties, the customers can not track their rights. With SLA, expectations and responsibilities of parties will be defined. In this manner, the service providers can present different levels of services with different prices. Consequently, the revenue of companies will increase. With creating more competitive market, the performance quality of services will increment and the customers can fine service providers if they fail to deliver as promised.**

In this work, we design SLA for telecommunication infrastructure company's services in Iran and the quality of service's evaluation is provided. For this, all kinds of services, measurement equipments and management resources in telecommunication Infrastructure Company are determined. Finally SLA is written for all services of this company such as leased line, Long Distance Calls, Intelligent Network, video conference, transit and etc. this paper contains a case study about defining quality parameters of Long Distance Calls service for designing SLA.

***Index Terms*—service level agreement, key performance indicator, key quality indicator, service availability**

I. Introduction

In the modern business world, e-business has direct impact on all business enterprises. More and more companies are increasingly dependent on telecommunication services. The quality of telecommunication services is therefore rapidly becoming an important factor in the success or failure of businesses, particularly with regard to availability and reliability. It is the Service Level Agreement (SLA) that defines the availability, reliability and performance quality of delivered telecommunication services and networks to ensure the right information gets to the right person, safely and securely. The rapid evolution of the telecommunications market is leading to the introduction of new services and new networking technologies. SLAs are tools that help support and encourage Customers to use these new technologies and services as they provide a commitment from service providers for specified performance levels.

As described in the SLA Management Handbook [1], an SLA is a formal negotiated agreement between two parties regarding provided Service Level. Sometimes called a Service Level Guarantee, it is a contract (or part of one) that exists between two parties that is designed to create a common understanding about services, priorities, responsibilities, etc.

SLA is an important tool because it can answer to the following questions:

- What is the provider promising?
- How will the provider deliver on those promises?
- Who will measure delivery, and how?
- What happens if the provider fails to deliver as promised?
- How will the SLA change over time?

This paper is organized as follows: the second section gives a brief introduction of service life cycle, in third section end to end service delivery is described and then we introduce key quality indicators (KQIs) and key performance indicators (KPIs) in section 4, the next section contents the availability parameter followed by the SLA for long distance call service. Finally, the conclusion is presented.

II. Service life cycle

A service and its associated SLA are divided into six Life Cycle Stages to clarify the roles of the Customer and the Service Provider. Each life cycle stage addresses specific operations processes in the enhanced Telecom Operations Map (eTOM). These six phases that are needed for SLA Management are:

- Product/Service Development
- Negotiation and Sales
- Implementation
- Execution
- Assessment
- Decommission

These Six Phases are shown in Fig. 1.

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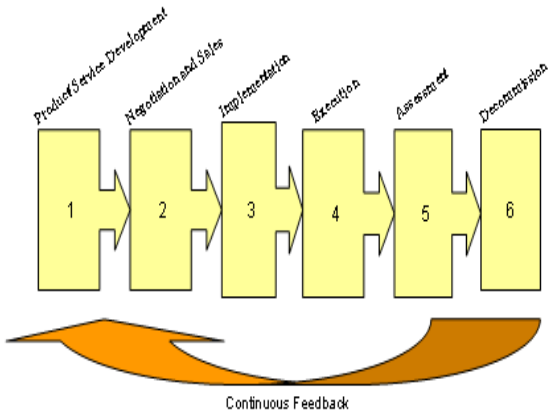

Fig1. Service and Associated SLA Life Cycle

SLA management requires interaction between many of the eTOM processes. Therefore analyzing these interactions, various lifecycle stages or phases must be considered separately. Note that a continuous feedback process is assumed to be used to among all parties.

III. End to End Service Delivery

For delivering an end to end service it's may that there are more than one service provider for example in Fig 2 there are two providers.

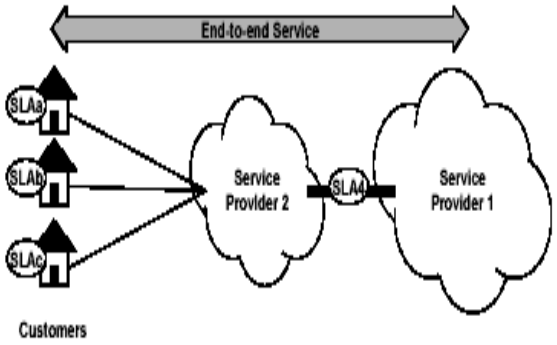

Fig2. Multiple Domain SLA Relationships

The service provider for delivering a special service to the customer may need to different SLAs with other service providers [2]. Customer should just sign one SLA with main service provider.

IV. Service's Performance and Quality Indicators

Service Level Specification parameters can be one of two types: KQIs and KPIs. At the highest level, a KQI or group of KQIs are required to monitor the quality of the product offered to the end-user. These KQIs will often form part of the contractual SLA between the provider and the customer. A KQI provides a measurement of a specific aspect of the performance of a Product or a Service [4]. A KQI draws its data from a number of sources, including KPIs.

Service Providers have historically reported the performance of their networks against a set of business focused KPIs. These KPIs were inherently network-based and provided little direct indication of the end to end service delivery that the network supports. Nevertheless KPIs are an important measurement for network operations and will continue to be so for the foreseeable future.

KPIs provide a measurement of a specific aspect of the performance of a service resource (network or non-network) or group of service resources of the same type. A KPI is restricted to a specific resource type [3]. Fig. 3 illustrates the key indicator hierarchy.

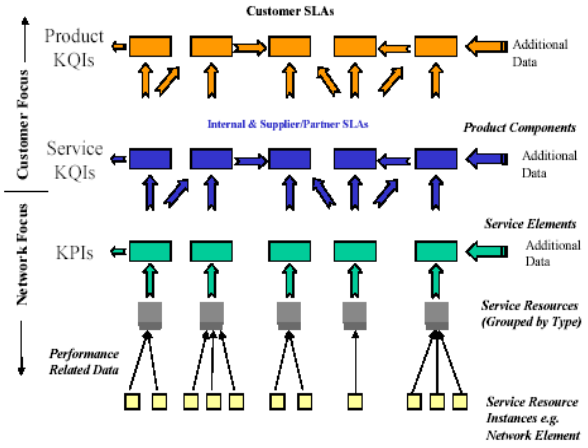

Fig3. Key Indicator Hierarchy

V. Availability

Experience shows that "Service Availability" is the key parameter of interest to Customers. ITU-T Recommendation E.800 [4] defines availability as the ability of a service to be obtained, when requested by the user and continue to be provided without significant failure for certain duration.

There is a methodology to measure the service availability. Service Availability (SA) is expressed as a percentage (SA%).

The unavailability of a service at the SAP is defined as an outage. The duration of this specific event is the outage interval. These concepts are used in the Service Unavailability percentage (SUA%) and Service Availability percentage (SA%) that is calculated according to (1).

$$SA\% = 100\% - SUA\% \tag{1}$$

Where Service Unavailability SUA% is defined as (2).

$$SUA\% \equiv \frac{\sum Outage\,\text{int}\,erval \times SDF}{Activity time} \times 100\% \quad 0 \le SDF \le 1 \tag{2}$$

SDF is Service Degradation Factor that show a complete service outage (service completely unusable i.e. SDF=1) or a partial service outage (service degraded, but still usable). A Service Degradation Factor (SDF) is used in the SUA calculation.

A. End-to-End Unavailability

For the purposes of end-to-end calculations, it is more convenient to use the unavailability ratio [5].The following notations are used in this section:

ur_{im}: mean unavailability ratio of a PE1.
ur_{iw}: worst-case unavailability ratio of a PE.
UR_M: mean unavailability of a path.
UR_W: worst-case unavailability of a path.

A path may be built using a linear topology or redundant topology. In linear topology, there is just one path between source and destination but in redundant topology, there are protection links in which two independent links are used end-to-end through all transit countries and terminating countries.

1) Linear topology

If a path is made of N path elements used in series, then the (3) and (4) can be used for small values of unavailability ratios:

$$UR_M = \sum_i \left(ur_{im}\right) \tag{3}$$

$$UR_W = UR_M + \left\{\sum_i \left(ur_{iw} - ur_{im}\right)^2\right\}^{1/2} \tag{4}$$

Equation (4) assumes that the unavailability ratios of the different PEs follow normal distributions.

2) Redundant topology

In a redundant configuration using two parallel paths and a protection switch at one end (for each direction of transmission), the availability of the protected path between points A and B is according to (5):

$$UR_{AB} \approx UR_1 \times UR_2 + UR_S \tag{5}$$

Where UR_1, UR_2 are the unavailability ratios of the parallel paths and URS is the unavailability of the protection switch (for one direction).

- Mean values

Replacing UR_1 and UR_2 in (5) by their mean values, calculated according to Formula (3), leads to the mean value of UR_{AB} as (6):

$$UR_{M(AB)} = UR_{1M} \times UR_{2M} + UR_S \tag{6}$$

- Worst-case values

Replacing UR_1 and UR_2 in (5) by their worst-case values, calculated according to (4), leads to an upper bound of the worst-case value of UR_{AB} as (7):

$$UR_{W(AB)} \le UR_{1W} \times UR_{2W} + UR_S \tag{7}$$

[1] Path Element

VI. SLA FOR LONG DISTANCE CALLS SERVICE

In this paper, the SLA is designed for telecommunication Infrastructure Company's long distance call service. Long distance call service is used for voice traffic transmission between different points.

In the result of vast research and evaluation of different standards in this field [5]-[7] and gathering statistics information of switching network, finally we set KPIs and KQIs for SLA. It is so important that use parameters, which is measurable by customers. In this paper, the costumers are not end users, but also they are themselves providers that transmit voice traffic to end users. There is an interconnection relationship between Infrastructure Company and these providers. We use the following parameters in SLA:

- Seizures:

A seizure is a bid (test call) that obtains a B-channel assignment notification under the assumption that the destination number, selected automatically by the test call device, is correctly provided.

- ASR[2]:

ASR gives the relationship between the number of seizures that result in an answer signal and the total number of seizures. This is a direct measure of the effectiveness of the service being offered and is usually expressed as a percentage as (8):

$$ASR = \frac{Seizures\ resulting\ in\ answer\ signal}{Total\ Seizures} \times 100 \tag{8}$$

Seizures that result in an answer signals includes:

- Total number of answered calls by subscribers
- Total number of calls to busy subscribers
- Total number of unanswered calls

- ACT[3]

This parameter is average conversation time that is important in estimation of network efficiency. This parameter should be set to a certain threshold and service provider should take a policy in order to customer do not exceed from this value. For example if the customer's channel is so busy, then he/she should buy other services.

On the other hand, the ACT should not be so low. The low ACT can show the failure in the network that cause disconnecting in calls. The low ACT also can show that customers do not answer to their calls or they put short announcement on telephone.

The above discussion shows if the ACT violates from normal value, that network congestion will be increased and network efficiency will be decreased and finally, the revenue of company will be reduced.

Switching Network management center of Infrastructure Company in Iran has suitable systems for monitoring and measuring the performance parameters at scheduling intervals. According to parameters that have been described

[2] Answer to Seizures Ratio
[3] Average Conversation Time

above and by analyzing the statistics information, the Fig. 4 presents availability rate and ASR. These graphs are related to three months. As an instance in Fig. 4, average availability rate is 99.57357% and average ASR is 49.41286%.

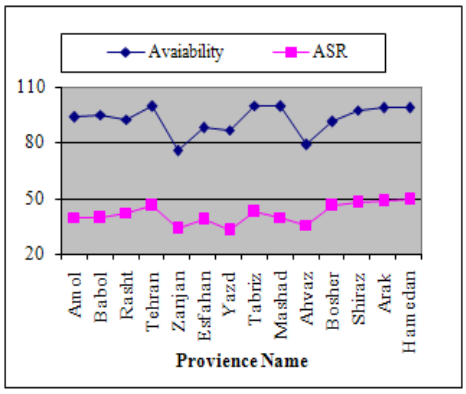

Fig4. Quality Parameters for Long Distance Calls Service

VII. Conclusion

In this paper, we designed service level agreement for long distance call service for the most important telecommunication company in Iran. A service level agreement is a formal agreement between two parties established through a negotiation process. It is a commitment that exists between the service provider and the customer. With reading the related standards and gathering related statistics information from infrastructure Telecommunication Company and analyzing this information, we finally define necessary quality parameters for SLA. It is important to note that just the parameters, which can be measured by service providers, should be considered in SLA and the KQIs and KPIs for each service are the minimal set required for that service. Note that the more KQI and KPI use in SLA, we meet the more complexity in parties' commitments. The future work of this paper is determining of end-to-end service prices and defining necessary penalties.

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