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Review article

SERVICE LEVEL AGREEMENT FOR CLOUD COMPUTING AND USABILITY IN PUBLIC AND PRIVATE ENTERPRISES IN NORTH MACEDONIA

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Abstract

A Service Level Agreement (SLA) is a contract between a cloud service provider and a client that guarantees a certain level of performance. Most Service Level Agreements are now standardized until a client becomes a significant consumer of cloud services, thanks to the emergence of huge utility-like cloud computing providers. In any case, if a cloud provider issuer fails to satisfy the said objectives of minimums then the issuer has to pay the penalty to the cloud provider customer as according to the agreement. So, Service Level Agreements are like coverage rules wherein the enterprise has to pay as according to the agreements if any casualty occurs. We have created a questionnaire for public and private enterprises in North Macedonia to see if they use SLAs when selling or buying between two companies. The aim of paper was to make a questionnaire to see if enterprises in North Macedonia are using SLA during agreement between companies.

Keywords: architecture, service, cloud, software, computing, SLA.

1. Introduction

Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services. The services themselves have long been referred to as Software as a Service, so we use that term. The datacenter hardware and software are what we will call a Cloud [1]. SLA for cloud is the legal agreement between two parties' first one which will provide cloud service and another one which will receive the cloud service [2]. Services such as Software as a Service, Platform as a Service and Infrastructure as a Service are provided worldwide over the Internet through the new computing paradigm which is called cloud computing [3][4]. In the cloud computing system, there are many players: cloud service provider, cloud customer, network service provider and end customer. Cloud service provider offers services to the high tier cloud customer [5]. Service Level Agreements are one of the most common approaches for specifying some form of mutual understanding about business transactions between a Cloud provider and a Cloud consumer in the software and telecommunications domain. An SLA is a representation of all features a consumer should expect to receive by a service [6]. An SLA represents functional and non-functional properties of services and serves as a way for controlling and managing these properties. Typically, an SLA is a bilateral binding statement signed between a service provider and a service consumer, over the agreed terms and conditions of the given service [7]. SLA is not a one-size-fits-all agreement that is announced once in a while for all services, but rather a dynamic agreement that is declared before the service is delivered and maintained throughout the service time in the form of a SLA life cycle.

The SLA has no widely accepted life cycle. SLA outlines the relationship between parties to understand each other's needs, preferences and expectations. It should include how to perform future service delivery including QoS levels required, performance-tracking techniques, performance reports, managing problems and conflicts, security and termination. During service delivery, SLA requires real-time verification. If violation occurs, appropriate action (e.g., penalty, conflict resolution) should be taken. SLA life cycle in three high level phases:

the creation phase, operation phase and removal phase. Sun Microsystems Internet Data Center Group defined a more detailed SLA life cycle in six steps (as shown in Fig ure 1): l. Discover service providers: where service providers are located according to consumers requirements. 2. Define SLA: includes definition of services, parties, penalty policies and QoS parameters. In this step it is possible for parties to negotiate to reach an agreement. 3. Establish agreement: an SLA template is established and filled in by specific agreement, and parties are starting to commit to the agreement. 4. Monitor SLA violation: the provider's delivery performance is measured against to the contract. 5. Terminate SLA: SLA terminates due to timeout or any party's violation. 6. Enforce penalties for SLA violation: if there are any parties violating contract terms, the corresponding penalty clauses are invoked and executed [8].

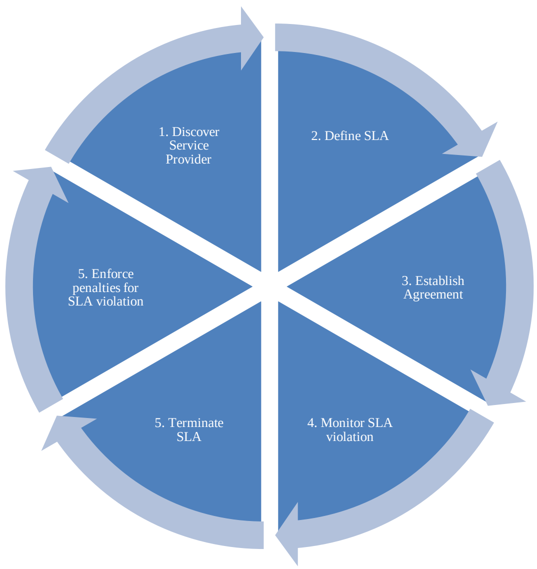

Fig 1: Service Level Agreement lifecycle

2. SLA Characteristics and Objectives

In this section SLA characteristics and a key element named Service Level Objective (SLO) are explained. SLOs are specific and measurable characteristics of SLAs [9]. The characteristics of SLAs can be identified as foundation, change and governance characteristics. Foundation Characteristics (FC) of SLA includes provisions which specify the key agreements and principles among actors, the SP and their responsibilities and roles, and the expected service performance levels [10]. The aim behind the SLA agreements under FC is to publicize the normal convictions shared by the two associations with the goal that their Information and Communication Technology (ICT) outsourcing relationship could construct shared objectives and a general responsibility toward the outsourcing relationship [11]. By characterizing the goals and aim of the relationship, the objectives that at first drove the development of the relation can be at least understood partially and shared by a group of decision-makers and also individual employees who a reliable, safe and QoE-aware computer networking requires a set of services that goes beyond pure networking services. Therefore, in the paper this broader set of services will be taken into account and for each SLO the related services domains will be indicated. There is often times confusion in the use of SLO and SLA. SLOs are particular and measurable characteristics of the SLA like throughput, response time, availability, or quality [12]. Apart of SLO application domain, we can categories the objectives in four categories, namely: i) performance service level objectives; ii) security service level objectives; iii) data management service level objectives; iv) personal data protection service level objectives [13][14].

3. SLA Negotiation Procedures

Five specific open challenges are identified for the SLA negotiation protocols and processes. First and foremost, SLA negotiation processes and protocols diversity constrain the negotiation for establishing new SLAs as it was initially proposed by. Moreover, as the SLA is the pre-set agreement among the actors, the implemented SLA modification, and SLA negotiation between separated administrative domains are not an easy process and most likely it is impossible [15][16][17]. Often SLAs are technical documents regarding to terminology and concepts which may only be understood by a minor class of technology-oriented specialists. Therefore, evaluation and improvement do not take place on a regular basis. Such "dead-end" documents have a very restricted meaning for EUs and their management as it was initially proposed by. On the other hand, unclear service specifications can be considered as an open challenge and yet there is a need of protocol to develop a comprehensive SLA. For instance, agreements on "the availability of a network" are generally determined using a metric called the percentage of availability. It is extremely tough to specify what the accurate meaning of such a metric is in the context of a specific business location [18].

4. Implementation and Deployment

There are both practical and theoretical constraints to SD-SLA (Software-Defined SLA). Beyond the cost and physical limitations that are always system-level parameters that need to be managed, poorly designed SD-SLAs may not be able to be implemented on software-defined networks to support provided services such as cloud services. As an instance, if essential operations are serialized, afterwards, they cannot be programmatically scaled out and up to satisfy an SD-SLA. By developing and implementing appropriate SD-SLAs, there are chances to step into a continuous model for many significant background-processes, that are previously required to be scheduled due to the limitations of fixed resources [19][20][21][22][23]. Furthermore, yet there are further opportunities to develop a programmatic SD-SLA validation through automated test analytic and infrastructure [24]. The performance forecast management enables the recommendation for performance improvement and optimization; therefore, it can be considered as an open question in utility computing environments. Moreover, dynamic management of resource allocation has to be considered in the implementation of SLAs, because it addresses which resource is the best and appropriate for a current admitted request from the point of view of both actors [15][16].

5. SLA Monitoring

SLA monitoring measures an SLA compliance and monitors true uptime for provided services which is essential for better service delivery and network monitoring is utilized to ensure the hosts and nodes connections with the specified bandwidth as well as monitoring the proper packet delivery. The SLA should be established between providers and end-users from a different end-to-end point of view. As an instance, if the service of system has been outsourced, not only from SP to an EU but also from one SP to another SP, there must be an SLA agreement between them and this requires a dynamic SLA monitoring solution as well to help in managing the network and to maintain the SLA requirements [25][26].

6. SLA Security

This section presents the necessity to address the security issues of SLA contexts for cloud computing domains. Also, the phases of the SLA lifecycle for managing the need to define the level of services, which is required by the consumer, are presented also. Furthermore, presents the related works to security SLA for the cloud computing context and comparative analysis between the SLA lifecycle and the related works [27]. Despite the security issues of cloud computing are considered similar to the ones presented in ICT domains [28][29], the need to address security in SLA for cloud context was proposed only recently [30]. Through the survey, the following challenges in cloud security SLA were identified: the architecture for managing security SLAs [31], defining quantitative security metrics and not just qualitative metrics [32], security SLA representation and security service disclosure [33][34].

7. Results and Discussion

In this section we will reveal the results from the questionnaire we did about public and private enterprises whether they use SLA. 50 companies participated in the questionnaire, where they answered our questions. Below we will display the results in pie chart:

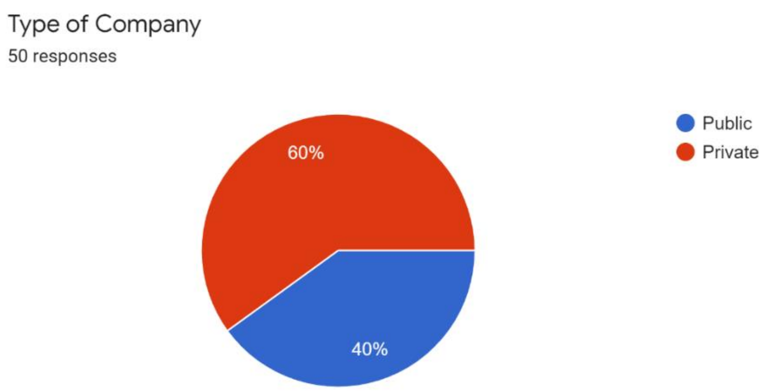

Fig 2. Type of Company

From all the enterprises participating in the research, we find that 60% are private enterprises and 40% are public enterprises.

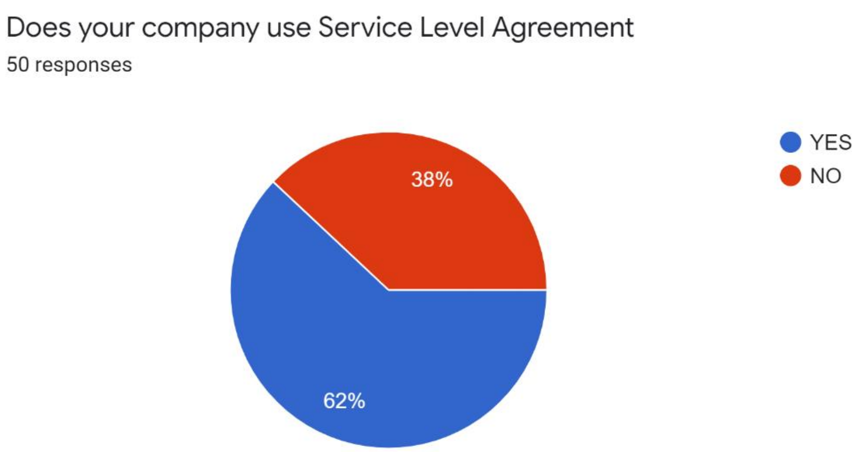

Fig 3. Usability of SLA

To the next question of our questionnaire, “Does your company use Service Level Agreement” the participants answered 62% yes and 38% no.

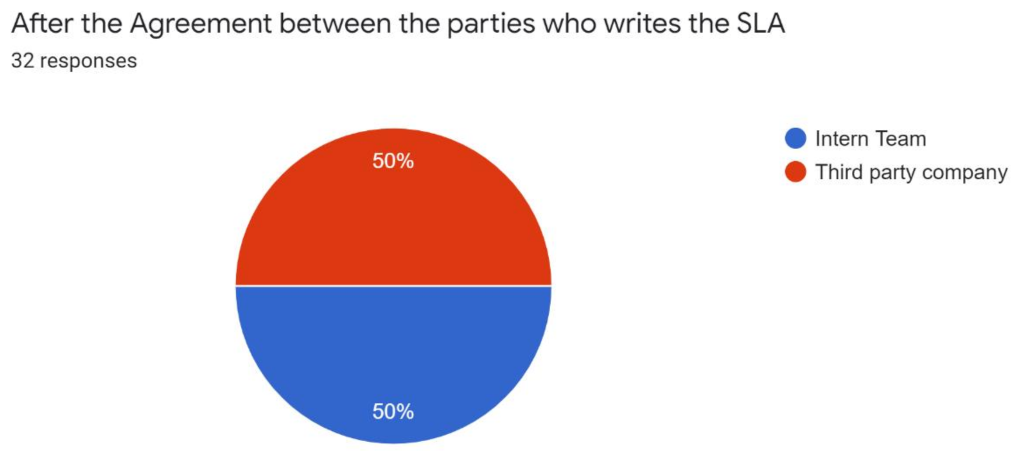

Fig 4. Who writes the SLA

In the last question we asked who wrote the SLA after the agreement, out of 32 answers 50% answered Intern Team, and 50% answered Third-Party Company.

From this questionnaire, we can say that SLA is being used during the agreements, from the answers we have received SLA is being used more in private enterprises than in public enterprises.

Although the service level agreement is defined according to the needs of the parties, but the Ministry of Information Society and Administration has the model which should be used between the parties.[35]

8. Conclusions

In this paper, we took a comprehensive review on SLA in cloud service provisions and consumptions. On paper we showed all steps for SLA, starting from defining of SLA, Characteristics, Negotiation Procedures, Implementation, Monitoring and Security. Also, in this paper we have made questionnaire, if enterprises use SLA during agreement. On questionnaire 50 public and private enterprises participated where they answered our questions.

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