

A review of SLA framework for Cloud Computing

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ABSTRACT

This paper presents a comprehensive review of Service Level Agreement (SLA) frameworks for cloud computing. SLAs have become an essential tool for ensuring the quality and reliability of cloud based services and applications. In this review, we examine the different types of SLAs and their key components and features including performance metrics, service level objectives and penalty mechanisms. We provide a comparative analysis of major provider centric and customer centric SLA frameworks highlighting their strengths and limitations. We also discuss the challenges of SLA management and enforcement including monitoring reporting and penalties. Furthermore, we explore emerging trends and developments in SLA frameworks such as the use of machine learning and artificial intelligence. Our review emphasizes the importance of SLA frameworks in supporting cloud service provider and users, underscores the need for standardized and interoperable SLA frameworks. We conclude with recommendations for future research and practice in this field including the need for comprehensive SLA frameworks that take into account the full range of cloud services and applications.

Keywords: Cloud Computing, Service Level Agreement, Negotiation

INTRODUCTION

Cloud computing has become an increasingly popular method for providing computing resources and services over the internet. As cloud computing continues to grow, the need for services level agreements(SLAs) has become more critical ensuring of quality of services(QoS) provided by cloud service provider(CSPs) to their customers. In the literature review, we examine the SLA frameworks that have been proposed for cloud computing by analyzing and synthesizing existing research papers, reports and industry standards.

SLA frameworks for cloud computing several research paper and industry reports have proposed SLA frameworks for cloud computing. These frameworks can be classified into three categories: CSP centric and customer centric and hybrid frameworks.

CSP centric frameworks are primarily focused on the resources and services provided by the CSP and they typically include metrics such as availability, resource time and resource allocation. CSP-centric frameworks include the Amazon Web Services(AWS)SLA and Microsoft Azure SLA. Mohindru et al.(2016)proposes a CSP centric SLA framework that uses an ontology based approach to model the monitor cloud resources and services.Winkler et al.(2016) proposes a framework that uses machine learning algorithms to predict and prevent SLA violations based on historical data.

Customer centric frameworks are focused on the customers perspective and they are typically include metrics such as application performance, user experience and service availability .Customer –centric frameworks include the Google

Cloud Platform(GCP)SLA and IBM Cloud SLA. Wu et al.(2014) proposes a customer centric SLA framework that uses a fuzzy logic approach to model and optimize QoS for cloud services. Chen et al.(2015) proposes the framework that uses a game theoretic approach to negotiate and enforce customer centric SLAs.

Hybrid frameworks aim to provide a balance between CSP and customer centric approaches and they include a mix of metrics from both perspectives. Hybrid frameworks include the Service Level Specification Language(SLSL) and Open Cloud Computing Interface(OCCI) SLA. Gao et al.(2017) proposes a hybrid SLA framework that uses a hierarchical approach to model and enforce QoS for cloud services.

The paper is organized as follows: section 2 provides an overview of the concept of SLA and its life cycle of SLA cloud computing. Section 3 describes the methodology used in the systematic review including the search strategy inclusion and exclusion criteria and data extraction process. Section 4 presents the results of the review including the characteristics of the SLA frameworks and their strength and weaknesses. Section 5 discusses the future research directions in SLA frameworks for cloud computing. Finally section 6 concludes the paper and highlights its contributions to the field of cloud computing.

Service Level Agreement (SLA)

SLA stands for service level agreement. It is a contractual agreement between a service provider and its customers that specifies the quality and level of service that the provider will deliver.SLA are commonly used in the context of cloud computing where cloud service providers offer various services to their customers such as Infrastructure as a service(IaaS),Platform as a service(PaaS)and Software as a service.(SaaS)

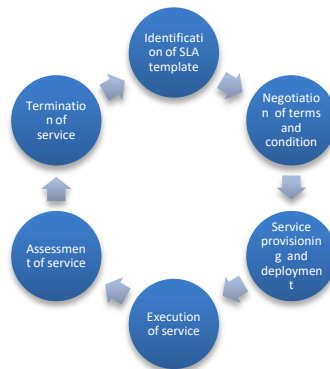
An SLA typically include several key components such as:

- 1.Service description: A description of the service that the provider will deliver including the scope , features and functionality of the service.
2. Performance metrics: A set of measurable performance metrics that provide must meet such as availability, uptime, response time and throughput.
3. Service levels: A set of service levels that that provider must meet such as minimum and maximum values for performance metrics.
4. Remedies and Penalties: A set of remedies and penalties that will applied if the provider fails to meet the service levels such as refunds service credits or termination of the agreement

The terms of service and the quality of service that the provider must deliver , SLA help to ensure that both the provider and the customer have a clear understanding of their responsibilities and obligations. They also provide a framework for monitoring and measuring the providers performance and for resolving disputes and issues that may arise during the course of the agreement.

SLA life Cycle

SLA consists of six main stages to complete its life cycle. These six stages are as follows: contact using SLA template, Negotiation term and condition, service provisioning and deployment, execution of service and assessment of service, termination of service.



Six stages of SLA Life Cycle

2.1 Identification of SLA template

In this stage identification of cloud customer requirement and identification of service parameters of standard SLA template.

2.2 Negotiation of terms and condition

This stage includes SLA parameter and its violation between cloud service provider and cloud consumer based on quality of service. Negotiation of SLA direct compromising between the clouds parties depend on QoS.

2.3 Service provisioning and deployment

In this stage prepare the service resources consumption and enabled specific service requirement and establish the service network and its service activation parameters.

2.4 Execution of Service

Actually, in this stage monitoring of service execution and duration of execution any violation created.

2.5 Assessment of service

SLA assessment major activities to service goals, modification of operation and problem of service. Its include cloud customer satisfaction that depend on quality of services.

2.6 Termination of service

If any issue arises in service of SLA contact, violation and expiration in that case SLA terminate the service of cloud provider.

RESEARCH METHODOLOGY

This review is based on a systematic literature review (SLR) methodology. The main goal of this review is to analyze the existing literature on the SLA frameworks for cloud computing and provide a comprehensive overview of the different approaches used in the field.

The following steps were taken to conduct the systematic literature review:

- 1. Research Questions:** The research questions were formulated based on the scope and objectives of the study. The primary research question for this study is “What is the current state of SLA frameworks for cloud computing and what are the limitations and gaps in the existing framework?”
- 2. Search Strategy:** A comprehensive search strategy was developed to identify relevant literature. The search was conducted using electronic databases such as ACM Digital Library, IEEE Xplore , Science Direct and Springer Link .The search was also extended to other relevant sources such as Google Scholar and Conference proceedings.
- 3. Literature screening:** The abstracts of the identified and keywords of the identified literature will be reviewed to determine their relevance to the research question. Studies that do not meet the inclusion criteria will be excluded.
- 4. Data Extraction:** The full text of the selected literature will be reach and relevant data will be extracted using a standardized data extraction form. The data will include information on the research question. The methodology used in the study, the findings and any limitations or gaps identified in the SLA frameworks.
- 5. Data Synthesis:** The extracted data will be synthesized and analyzed to identify common themes or patterns. The data will be used to answer the research question and identify any limitations or gaps in the existing SLA frameworks.
- 6. Reporting:** The findings of the study will be reported in a review paper that summarizes the current state of SLA frameworks for cloud computing and identifies any limitations or gaps in the existing frameworks. The paper will also provide recommendations for future research to address the identified limitations or gaps.
- 7. Conclusions:** The study will conclude by summarizing the main findings and implications for the field of cloud computing. It will also provide suggestions for future research in this area.

RESULTS

We found that SLAs are essential tools for ensuring the quality and reliability of cloud based services and applications. They provide a mechanism for cloud service and applications. They provide a mechanism for cloud service providers and users to define and agree upon service level objectives, performance metrics and penalty.

We identified three main types of SLA frameworks: Provider centric , customer centric and hybrid centric. Provider centric frameworks are used by cloud service providers to define and enforce SLAs with their customers while customer centric frame used by cloud service users to monitor and verify the performance of their providers. Hybrid framework used for balance between provider centric and customer centric.

We analyzed several major SLA frameworks including AWS Service Level Agreement, Microsoft Azure SLA and Google Cloud Platform SLA and Open Stack SLA. We found that these frameworks vary in their features and functionalities with some being more comprehensive and flexible than others. The choice of SLA framework depends on the requirements and priorities of both the CSP and the customer. The provider centric approach is suitable for scenarios where the CSP has limited resources or where the customer is less concerned about the performance of the service. The customer centric approach is suitable for scenarios where the customer has a critical or high priority application running on the cloud service and hybrid centric approach is suitable for scenarios where both the CSP and customer have critical \requirements and need to collaborate to achieve the desire performance levels.

DISCUSSION

Future research directions in SLA framework for cloud computing may include standardization of SLA templates and metrics although there are several existing SLA frameworks for cloud computing there is a lack of standardization in the SLA templates and metrics used by different providers. Future research could focus on developing standardized SLA templates and metrics that can be used across different cloud service providers which would make it easier for customers to compare different services and for providers to demonstrate their compliance with industry standards.

Automation of SLA monitoring and enforcement can be time consuming and resource intensive, especially for large scale cloud environments. Future research could explore the use of automation technologies such as machine learning and artificial intelligence to automate the SLA monitoring and enforcement processes I? subject to various regulatory requirements such as data protection and privacy laws. Future research could investigate ways to integrate SLA requirements with regulatory compliance frameworks which help to ensure that cloud service providers are meeting their legal obligations as well as their contractual obligations to customers.

Development of SLA framework for emerging cloud technologies Cloud computing is evolving rapidly. With new technologies and service emerging all the time such as edge computing, serverless computing and containerization. Future research could focus on developing SLA Frameworks that are tailored to these emerging technologies which would help to ensure that SLAs remain relevant and effective in the fast changing cloud computing landscape.

CONCLUSION

SLA frameworks are crucial for ensuring the QoS provided by CSPs in cloud computing. Each SLA framework has its own unique features and characteristic and choosing the right framework depends on the needs and requirements of the CSP and the customer. By understanding the strengths and limitations of different SLA frameworks, organizations can make more informed decisions when selecting a cloud provider and ensure that their QoS requirements are met. Further research is needed to evaluate the effectiveness and scalability of different SLA frameworks in real world cloud computing environments.

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