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# A Review of SLA Constraints and Scheduling Methods and Behaviour

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*Abstract— A cloud system environment is considered as the framework to provide resource and service distribution to the users. These different environment forms are accessed by different users under the service specification. The constraints at different levels are negotiated between the providers and the users. The paper has defined the different cloud services relative to the SLA behavior. The paper also identified the benefits of scheduling method for resource utilization and effective service distribution in cloud environment. The categorization of available scheduling methods is also provided along with feature exploration.*

*Keywords: Cloud Services, SLA, Scheduling, Virtual Machine*

## I. INTRODUCTION

Cloud computing is the distribution of resources and services in public and private environment. It is a layered or the architectural framework with integration of various technological and service driven aspects. The service driven aspects and the user centric access is required to apply the resource specific analysis. The responsibilities of cloud framework include the service provisioning, QoS optimization, user satisfaction etc. The framework also suffers number of associated challenges including the flexibility, scalability, security, access confliction etc. The cloud environment requires managing the resource integration with computational variation to achieve the resource sharing in critical cloud environment. The functionality of the cloud system is also classified under different platforms and methods. These cloud functionalities includes SaaS (Software as a Service), IaaS (Infrastructure as a Service) and PaaS (Platform as a Service). The effective use of cloud system is to provide service specific distribution and utilization. The service distribution and service integration is here divided in number of integrated aspects. These common aspects are shown in figure 1.

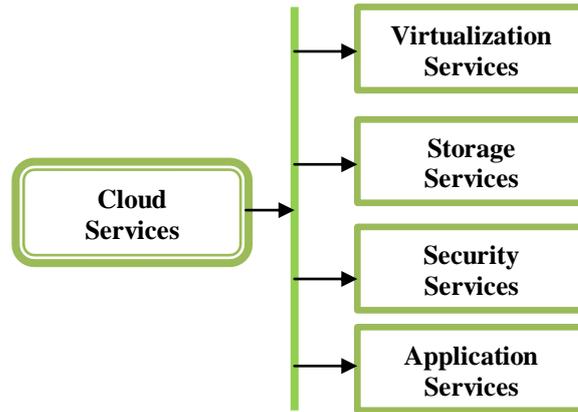


Figure 1 : Cloud Services

The foremost services of cloud system environment are virtualization services. It basically divides the single cloud server in multiple virtual machines so that the distributed processing will be applied. Each of the virtual machine is defined with specific individual configuration and the constraints. The process level mapping, role, load and capabilities of each virtual machine can be different. This virtual division is available to the real time user as the physical feature aspect so that the service can be available to the user based on the requirement specification. The second effective use of cloud system is the storage space utilization. The available storage space in cloud system can be divided in multiple data clusters. The storage space can be distributed according to the type of service, type of user and user role. The secure data access and encrypted data storage is also provided by the cloud server. The storage space environment is here defined for effective data storage and access. The data driven services are defined for effective storage utilization in cloud system environment.

Another critical aspect relative to the cloud environment is security. As the data is provided in the public environment, it is required to prevent it from unauthorized data access. The cloud system provides the user level, application level and process level security. The storage level and communication level security is also provided by the cloud system as a service constraint. Cloud system also provide as the security provider to other applications and services so that the effective and reliable communication will be performed. The fourth major service constraint of cloud system is application services. A cloud system is a larger pool of different kind of services. These services are divided in different categories. These services include network services, business services, data management services etc. These all services can be processed in an integrated form and to provide it there is the requirement to setup of Service level agreement (SLA). This SLA for cloud system is shown in figure 2.

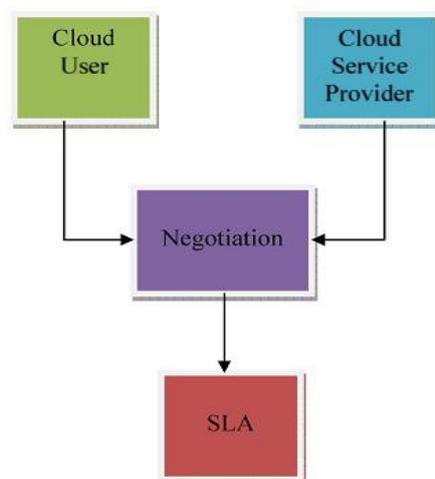


Figure 2 : Service Level Agreement

This agreement is established between the cloud user and the service provider. The SLA is a document form that defines the constraint or the rules based on the service feature requirement and the availability. The delivery service features are also defined along with service type, source, organization etc.

After setting up this agreement, the next work is to avail the required service to the cloud users. But as the number of cloud users for a server increases, there is the requirement to set a sequence of service allocation. This process of setting up the service allocation sequence is called scheduling. Scheduling provides the effective service allocation so that the server load will be reduced and the effective utilization of available resources will be done.

In this paper, a study on the service allocation behavior is discussed for the cloud system. The paper discussed different scheduling constraints, and types. In this section, different kind of cloud services along with requirements is discussed. The section also discussed the service level agreement for effective service distribution. In section II, the work defined by earlier researchers is discussed. In section III, different kind of services and the service constraints are discussed. In section IV, the conclusion of the work is presented.

## II. RELATED WORK

Scheduling in cloud system is required to provide effective resource allocation and utilization. Different researchers provided work on public and private cloud for effective service allocation. Some of the work defined by earlier researchers on different cloud form and by addressing different allocation criticalities. Mittal et. al.[1] has provided a comparative analytical observation on some of existing computational and heuristic methods for solving the scheduling problem for different cloud environments. A feature level characterization of cloud is defined with different scheduling types. The dynamic and workflow based analysis is observed in real time environment. The integrated optimization criteria is also observed for different scheduling methods. Another study based work on cloud scheduling method and objectives was provided by Kessaci et. al.[3]. Author observed the requirement of improvement at three levels called service level, task level and machine level. The comparative feature driven analysis is provided for different scheduling methods. The criteria driven analysis was provided under real time constraints by the author. Different scheduling models and classification methods are discussed by the author. Xin et. al.[15] also provided the study work on workflow scheduling for cloud system. Author provided the information access and trend observation for cloud environment. A constraint specific analysis is provided with challenge observation in the critical cloud environment. The resource specific challenge observation was provided in dynamic load environment to achieve better pricing and cost effectiveness. The interactive priority measure is also provided a study on pattern specific flow control for cloud environment.

Some of the researchers provided the configuration level and resource level changes on cloud servers or at intermediate layers to achieve the scheduling process optimization. Karthick et. al.[2] has provided a work on global scheduler to achieve the situation driven cloud utilization. The clustering method is integrated to provide the event and burst time specific service utilization. The problem reduction and issue tracking is here provided for improving the service utilization in economic and load balanced way. According to the cluster, the resource specification and configuration are suggested in this work. Xian Wu et. al.[6] provided the QoS criteria driven scheduling to improve the service access for cloud storage. Author defined the analysis on static load method with trust and resource constraint processing under scalability vector. A global load analysis method with effective service allocation and migration observation was provided by the author. A strategy based global utility method is provided to improve the service allocation fairness. Another work on cloud service configuration and memory adjustment was provided by Stanislas et. al.[7]. Author analyzed the queue level configuration under size and tier depth parameters. A feature factor utilization model under virtualization method is provided for improving the allocation to the cloud environment. Author provided the provisioning to the performance and resource utilization to achieve effective response time to satisfy customer requirements. A cost specific featured observation was provided by Thiago et. al.[8]. Author analyzed the behavior and configuration of cloud with pricing relation in public and private environment. The cost specific resource utilization is observed by the author to gain better resource utilization. Author applied the price relation integration to the cloud server to achieve better computation while performing the workflow analysis. Panda et. al.[10] has provided a work on scheduling method for multi-cloud environment. An algorithmic behavior in extensive environment was proposed using Min-Min and Max-Min algorithms. The synthetic data processing for heterogeneous environment is provided here for task scheduling algorithm. The performance metrics shows that the method has provided effective cloud service utilization.

Major contribution of some of the authors was in terms of algorithmic method and models for improving the trust in allocation aspects. Danial et. al.[4] provided a new work on service request based analysis to improve the trust for service allocation on cloud server. Author provided the resource driven service aspect observation model for issue tracking at different level. Author discussed the security issue and provided a service level agreement for resource allocation and criteria driven inclusion. Author applied the penalties based analysis on scheduling process for improving the service performance and resource utilization.

Udomkasemsub et. al.[5] has provided a workflow based scheduling framework for cloud scheduling to improve data analytics. Author combined the ABC (Artificial Bee Colony) optimization to achieve the constraint specific feature map to reduce the confliction and to provide the better feature map with cloud scheduling. Author provided the better service allocation and task specific processing so that the optimization to the process will be achieved. The task decomposition and computation cost reduction is provided in this work. Nivodhini et. al.[13] has provided a work on decision driven scheduling method to achieve better attention and sensitive allocation to cloud system. The resource specific mapping is provided to reduce the suspended processes and to avoid the starvation situations. An immediate user based processing method is here provided for hybrid cloud environment for lease specific processing. The slot driven method has reduced the processing efforts and improved the performance gain.

Some of the researchers also applied the scheduling in different cloud environment under certain objectives. One such scheduling method to achieve data privacy was provided by Abrishami et. al.[9] in hybrid cloud environment. Author provided the risk level observation and secure data protection in workflow analysis. The data maintenance and the risk analysis on data breach was provided for public and private cloud environment. The comparative analysis on workflow and cost is provided along with data security in this scheduling method. Another application driven work using multi-objective constraints and for meta heuristic environment was provided by Frincu et. al.[11]. Author achieved the higher availability and fault tolerant processing and resource utilization in round robin method. The criteria specific optimization method is here defined using genetic approach. The structure specific relocation and cost optimization is provided by the author. Another evolutionary process with big-data analytics was provided by Zhang et. al.[12] under elastic cloud processing. Author provided the performance level observation in dynamic work load environment. The allocation computation with promising scheduling was provided by the author. The comparative observation shows that the method is more appropriate for the real time big data applications. Christina et. al.[14] has combined the security measure with mining approach to optimize the scheduling behavior of cloud system. The interference analysis and the application driven observation is provided to improve the performance for targeted contention. A security threat observation for real time environment is provided by the author to achieve the effective interference scheduling in real time environment.

### III. SCHEDULING APPROACHES

Cloud scheduling is one of the effective way to provide effective service allocation and resource utilization in distributed environment. Relative to the application, requirement and the cloud environment, different constraints and configuration setup is required to optimize the scheduling process. To optimize the scheduling, there is the requirement to apply the process level, constraint level or feature level mapping at client side, server side or at the intermediate layer. In more effective form, the hybrid formed scheduling can be applied to achieve more effective and adaptive results. Different kinds of scheduling in different environment are categorized as shown in figure 3.

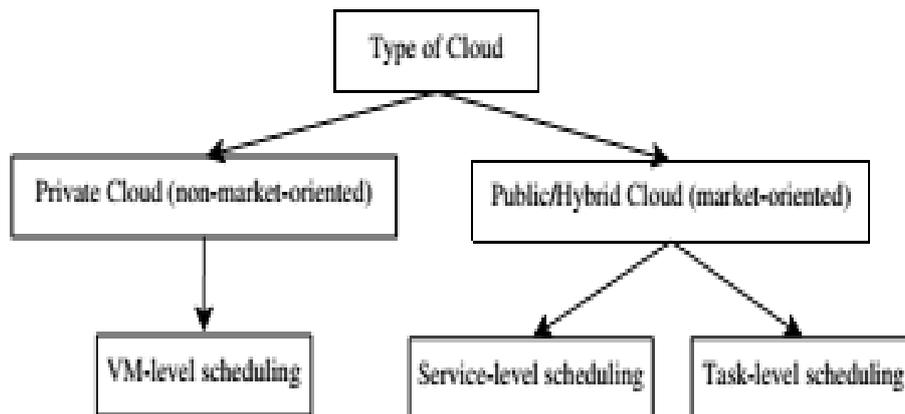


Figure 3 : Types of Scheduling[3]

As shown in the figure, the scheduling can be divided in three main categories at lower level. The task based, service based and VM based scheduling are applied by many of the public, private and hybrid environments. The scheduling the robust and wide environment can be applied to improve the allocation behavior and resource utilization. Different scheduling forms are described in this section

### A) Service Level Scheduling

This scheduling form is basically defined for effective resource management and utilization. The objective of the method is to provide the service allocation to coarse grained requests. The architecture level observation and the composition of the service is here defined in the global environment. The workflow observation and the specification of service distribution is the major concern of this scheduling method. The scheduler also uses the meta information so that the functional parameters will be observed. The request process is done based on the service constraints and provides a responsible best fit analysis to provide the service distribution in hybrid environment. The ser level estimation and the service estimation is also provided to achieve the guaranteed service processing to achieve effective QoS for requested customers. The functional scheduler is based on multiple aspect parameters with specification of requirement specific allocation. The signed parameters with static observation can be applied to generate the resource allocation. The dynamic scheduling is generally preferred in this scheduling form.

### B) Task Based Scheduling

This scheduling form is process oriented and provides the lesser resource management. The behavior of the cloud system and integrated changes is adapted by this scheduling form. The task to VM allocation is optimized by applying the effective configuration and the constraint setup. The resource level agreement and the price and time cost estimation is also provided by the cloud server. The matching process with task optimization is also defined. For better allocation, an intermediate broker is also defined. The task constraint observation and the relative service allocation is provided. The workload observation and task handling is applied for effective task allocation. The task driven scheduling is also applied dynamically based on the resource requirement observation. The provider level analysis with dynamic constraint map is defined. The VM instance change is also observed to provide effective scheduling to optimize the response time and cost.

### C) VM Level Scheduling

VM scheduling is the lowest level of scheduling provide to optimize the cloud system at server end. The running machines, configuration and the work specifications are managed to achieve effective service execution and management. The physical and virtual features of the VM are adjusted and observe to obtain the scheduling. The VM replacement, the capability specification, restrictions and the reference execution are suggested to improve the scheduling behavior. The scheduling behavior and the constraint specific feature map is here provided to achieve the higher profit. The energy specific VM is also common to reduce the resource consumption. The overload condition can be managed by configuring the systems. The staic and dynamic measures can be applied collectively to achieve higher scheduling aspects.

## IV. CONCLUSION

Cloud system optimization is required at service level and it is required to achieve better service management, allocation and resource allocation. For this, there is the requirement of effective service level agreement as well as constraint specific scheduling. This scheduling behavior can be applied at different levels to provide effective process execution. The paper has explored the constraints that affect the service allocation in different cloud environments. The optimization at user level and system level can be improved by improving the scheduling behavior at different levels.

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