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**RESEARCH ARTICLE**

# AN EVALUATION ON CLOUD RESOURCE PROVISIONING TECHNIQUES BASED ON PARAMETRIC PATTERNS OF QUALITY OF SERVICE (QoS)

**Dr. Ananthi Sheshasaayee and *Swetha Margaret T. A.**

Department of Computer Science, Quaid-E-Millath Government College for Women (Autonomous), Chennai, India

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**ABSTRACT**

Cloud computing assures to offer subscription-oriented and quality computing to the users of cloud worldwide. With the improved demand for delivering services to a large number of users, cloud providers need to offer segregated services to users and meet their quality anticipations. Resource Provisioning means the selection, deployment, and run-time management of software (e.g., DB server management systems, load balancers) and Hardware resources (e.g., CPU, storage, and network) for ensuring assured performance for applications. Resource Provisioning is an important aspect and challenging problem in the large-scale distributed systems such as Cloud computing environments. Resource provisioning and cloud negotiation techniques are most important drivers of all the happenings in the world of cloud computing. Cloud offers voluminous resource provisioning techniques, which is of static and dynamic each one having its own advantages and challenges. All these resource provisioning techniques mentioned and used must meet Quality of Service (QoS) parameters like obtain ability, throughput, response time, security and reliability. This paper focuses on various types of resource provisioning techniques available for cloud and comparison among various techniques.



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## INTRODUCTION

Service is very important task in daily life for all the organizations that are providing services in general. Cloud computing is one of the most important service provider in the Internet (Juve *et al.,* 2008). These services allow individuals and organizations to use software and hardware that are operated by third parties at remote locations. The word service in cloud computing is the concept of being able to use reusable, components across a third party server. Without using hardware and software the third party servers providing services according to the client requirement .Cloud Computing is the common buzzword in today's Information Technology (Juve *et al.,* 2008). Cloud computing platforms are rapidly emerging as the preferred option for hosting applications in many business contexts. An important feature of the cloud that differentiates it from traditional services is its apparently infinite amount of resource capacity (e.g. CPU, storage, Network) offered at a competitive rate.

***Corresponding author: Swetha Margaret T.A.,***
Department of Computer Science, Quaid-E-Millath Government College for Women, (Autonomous), Chennai, India.

Cloud Computing enables users to acquire resources dynamically and elastically. A major challenge in resource provisioning technique is to determine the right amount of resources required for the execution of work in order to minimize the financial cost from the perspective of users and to maximize the resource utilization from the perspective of service providers. So, Cloud computing is one of the preferred options in today's enterprise. The cloud computing environment provides a different platform by creating a virtual machine that assists users in accomplishing their jobs within a reasonable time and cost effectively without sacrificing the quality of the services. The huge growth in virtualization and cloud computing technologies reflect the increasing number of jobs that require the services of the virtual machine. Various types of scheduling algorithms have been applied on various data workloads and measured with different performance metrics to evaluate the performance. In cloud computing, resource provisioning is an important issue as it dictates how resources may be allotted to an cloud application such that service level agreements (SLAs) of applications are met (Kim *et al.* 2009). Negotiation activities are needed for establishing contracts and resolving difference between consumer and provider in resource allocation. In negotiation mechanism, an

agent make contract between provider and consumer for a fixed time interval. Negotiation evaluation is conducted on simulation test-bed. The organization of the paper is as follows. Section II discusses about Cloud resources. Section III discusses about resource provisioning in ephemeral. Section IV discusses various Resource Provisioning strategies. Section IV compares different resource provisioning techniques. Section V gives conclusion & future research directions (Kim *et al.* 2009).

increase hardware resources only when there is an increase in their needs.

- The ability to pay for use of computing resources on a short-term basis as needed (e.g., processors by the hour and storage by the day) and release them as needed, thereby rewarding conservation by letting machines and storage go when they are no longer useful.

| S .No | Resource Provisioning Techniques | Merits | Challenges |
|---|---|---|---|
| 1 | Deadline-driven provisioning of resources for scientific applications in hybrid clouds with Aneka | Application execution time can be reduced resourcefully from different sources | Not preferred for HPC-data which cadres on intensive application |
| 2 | Dynamic provisioning in multi-tenant service clouds | Serves to be best in terms of tenant functionalities with client requirements. | Does not work in terms of testing on real-life cloud–based system and across several domains |
| 3 | Elastic Application Container: A Lightweight Approach for Cloud Resource Provisioning (Buyya *et al.* 2011) | Outperforms in terms of flexibility and resource efficiency. | Not best for web applications and supports only single type of programming language, (Java). |
| 4 | Hybrid Cloud Resource Provisioning Policy in the Presence of Resource Failures (Calheiros *et al.,* 2011) | Able to adopt user the workload model to provide flexibility in the choice of strategy based on the desired level of QoS, the needed performance, and the available budget. | Not suitable to run real experiments. |
| 5 | Provisioning of Requests for Virtual Machine Sets with Placement Constraints in IaaS Clouds | Runtime efficient & can provide an effective means of online VM-to-PM mapping and also Maximizes revenue | Not practical for medium to large problems. |
| 6 | Resource provisioning for hybrid Cloud infrastructure | Able to improve the users' QoS about 32% in terms of deadline violation rate and 57% in terms of slowdown with a limited cost on a public cloud. | Not able to run real experiments and also not able to move VMs between public and private clouds to deal with resource failures in the local infrastructures. |
| 7 | VM Provisioning Method to Improve the Profit and SLA Violation of Cloud Service Providers (Calheiros *et al.,* 2011) | Reduces SLA violations and Improves Profit. | Increases the problem of resource allocation and load balancing among the Data centers. |
| 8 | Risk Aware Provisioning and Resource Aggregation based Consolidation of Virtual Machines | Significant amount of reduction in the numbers required to host 1000 VMs and enables to turn off unnecessary servers. | Takes into account only CPU requirements of VMs. |
| 9 | Semantic based Resource Provisioning and Scheduling in Inter-cloud Environment | Enables the fulfilment of customer requirements to the maximum by providing additional resources to the cloud system participating in a federated cloud circle. | QoS parameters like response time and throughput has to be achieved for interactive applications (Lee *et al.,* 2013) |
| 10 | Swarm intelligence is used | Efficient VM placement and significant reduction in power. | Not suitable for conserving power in modern data centers. |

**Cloud Resource**

Cloud is environmental friendly and promotes telecommuting techniques. Cloud provides a platform where three elements such as Infrastructure as a service (IaaS), Platform as a Service (PaaS) and Software as a service (SaaS) to provide the requirements of the customer in most efficient manner (Kim *et al.* 2009). According to NIST states "Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction". Three aspects are new in cloud computing paradigm are (Dillon *et al.,* 2010):

- The illusion of infinite computing resources available on demand, thereby eliminating the need for cloud computing users to plan far ahead for provisioning (Dillon *et al.,* 2010).
- The elimination of an up-front commitment by Cloud users, thereby allowing companies to start small and

Software, Platform, and Infrastructure as a Service are the three main service delivery models for cloud computing. In cloud shared resources, software, and information are provided to computers as a metered service. IaaS providers give a virtual server to start, stop, and access and configure an online storage. This allow a company to pay only as much capacity as needed. PaaS providers host a set of software and product development tools as online infrastructure, to allow the developers the ability to create applications on platform. SaaS provides no investment in servers or software licensing (Dillon *et al.,* 2010). Elasticity means that platform can handle sudden, unanticipated and extraordinary loads. Scalability is a planned level of capacity with ability to scale in a quick and easy manner when need more or less resources. Data integrity is a property that ensures that the data is of high quality, correct, consistent and accessible. Reliability is the ability to perform and maintain its function in routine as well as unexpected circumstances (Dillon *et al.,* 2010). Resource allocation is very important for virtualization platform. Resource allocation can be done based on the information from different domains. It depends on bandwidth and time. In the method of weighted allocation, all the domains are of same weight. It provides a

better scheduling and performance. Resource allocation considers the factors such as resource cost, resource reliability, execution time and bandwidth. Different type allocation algorithms are used in cloud for allocating resources (Zhang *et al.,* 2010).

### *Challenges and Benefits in Cloud*

The existing computing paradigms viz. distributed computing, SOA, networking etc. are building blocks of cloud computing. There are numerous issues associated with these computing paradigms and some new challenges emerged from cloud computing are required to be addressed properly in order to realize the cloud to its full extent (Sheshasaayee *et al.,* 2015). These challenges can be organized into several different categories varying from Dynamic Scalability to Disaster recovery as listed below (Dillon *et al.,* 2010):

- Dynamic Scalability
- Interoperability and Movability
- Consistent Service Allocation
- Scalable Querying and Secure Access
- Dependability and fault tolerance
- Data Location
- Disaster Recovery

These challenges in cloud are definitely accompanied by cloud benefits as well. Cloud computing is driven by tangible and powerful benefits which triggers cloud database. Cloud computing environment requires platform which supports the key design principles of the cloud architecture (Dillon *et al.,* 2010). In a traditional IT model, each development effort needs expertise on staff. But Cloud computing model enables development to be staffed by experts and these services are accessed by large number of users. The following are the features of cloud environment:

- Computing power is elastic only if workload is parallelizable.
- Data is stored at an untrusted host
- Data is replicated across large geographic distances.
- Hard to maintain ACID while data is replicated over large geographic distances (Zhang *et al.,* 2010).

### Resource Provisioning in Ephemeral

Resource provisioning is a procedure of supplying resources to the Cloud consumers for processing their jobs and storing the information. Cloud Service Provider (CSP) can supply two types of resource provisioning plans, namely On-demand and reservation plan (Vijayalakshmi and Muthusamy, 2014). In the reservation plan, under provisioning problem can occur when the reserved resources are unable to match the actual need. This under provisioning problem can be solved by provisioning more resources by on-demand plan to suit the extra demand, even though the price of demand plan is eminent than the reservation plan. The over provisioning problem can occur if the reserved resources are more than the actual demand requirement. It is necessary to minimize the total provisioning cost by reducing the on-demand cost and oversubscribed cost of under provisioning and over provisioning (Zhang *et al.,* 2010). To meet the increasing demand for computing resources, the size and complexity of today's data centers are growing rapidly. At the same time, cloud computing infrastructures are becoming popular. An immediate question is how the resources in a cloud computing infrastructure may be managed in a cost-effective manner. Static resource allocation based on peak demand is not cost-effective because of poor resource utilization during off-peak periods. In contrast, autonomic resource management could lead to efficient resource utilization and fast response in the presence changing workloads (Sriram *et al.,* 2010; Buyya *et al.,* 2011).

### *Resource Provisioning Types and Parameters*

Cloud computing and Software as a Service are ubiquitous words these days in IT world (Sriram *et al.,* 2010; Buyya *et al.,* 2011). And resource availability in cloud is copious and it certainly requires provisioning mechanisms or strategies with parameter that can provide better services to the users. So the ultimate goal of the cloud user is to minimize cost by renting the resources and from the cloud service provider's perspective to maximize profit by efficiently allocating the resources (Chaisiri *et al.,* 2010). In order to achieve the goal the cloud user has to request cloud service provider to make a provision for the resources either statically or dynamically so that the cloud service provider will know how many instances of the resources and what resources are required for a particular application. By provisioning the resources, the QoS parameters like availability, throughput, security, response time, reliability, performance etc must be achieved without violating Service Level Agreement (SLA) (Sriram *et al.,* 2010; Buyya *et al.,* 2011).

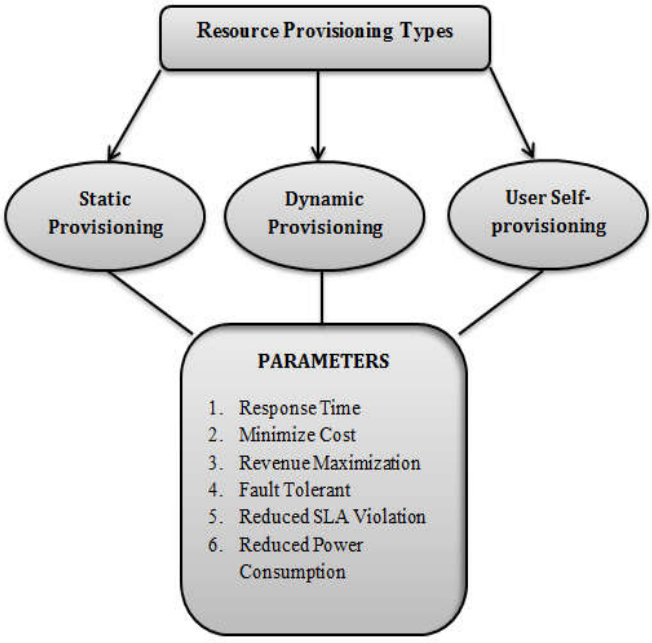


**Figure 1. Resource Provisioning Types and Parameters**

Figure 1 explains and illustrates the various types of cloud resource provisioning and the parameter that is involved in cloud provisioning Many challenges are influenced to adopt

the cloud computing technology such as security, resources allocation, resources provisioning and others. In provisioning resource for cloud computing environment the major challenge is to determine the right amount of resources required for the execution of work in order to minimize the financial cost from the perspective of users and to maximize the resource utilization from the perspective of service providers (Sriram *et al.,* 2010; Buyya *et al.,* 2011).

***Comparison on Resource Provisioning Techniques***

This comparison table illustrates a clear understanding on various kinds of cloud provisioning techniques and its challenges. Taking into consideration parameters that are available for resource provisioning as well (Girase *et al.,* 2013). The comparison states the challenges and the merits on various resource provisioning techniques that is practised on cloud.

**Conclusion and future work**

Resource provisioning is one of the key issues in the management of application execution in cloud environment. In Cloud Computing, Resource provisioning means the selection, deployment, and run-time management of software (e.g., database servers, load balancers etc.) and hardware resources (e.g., CPU, storage, network etc.) for ensuring guaranteed performance for applications. These techniques are used to improve response time, performance, save energy, QoS, SLA. The ultimate goal of resource provisioning is to maximize profit from the Cloud Service Provider's Perspective and from the Cloud User's Perspective to reduce cost. Mechanisms have to be proposed to efficiently make of cloud resources so that QoS is met and SLA violation in minimized in hybrid clouds when dynamically provisioned. The review shows that the challenges in here is for applications hosted in the cloud need to be elastic in order to achieve economy of scale while preserving the application specific. Service Level Agreements (SLA) with time constraints such as, response time, and throughput etc. The usage prediction and dynamic provisioning of resources is one of the fundamental research challenges, because a balanced trade-off between the business-specific SLAs and other constraints such as maximum utilization of resources, cost effectiveness, etc. will need to be achieve. Hence, Improvement heuristic will provide efficient resource provisioning to the multiple cloud users. Furthermost with this resource provisioning technique and as a part of extension, response time (reduced) and penalty cost on the hired resource can be reduced. This will increase the CSL on resource leased.

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