

Exploring and Understanding The Cloud Environment with Resource Allocation Techniques

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Abstract: People strongly believe that Cloud computing will redesign the entire Information and Communication Technology industry as a revolution. In this paper, we aim to explore the cloud environment in various aspects. First we try to make understanding about the cloud environment with service architecture and the deployment models. Next we try to bring out the importance of resource allocation in the cloud environment and few issues which arise when the resource allocated to the user request. Finally few formal resource allocation techniques which make to understand in what basis, the resources are allocated in cloud environment.

Keywords: Cloud Computing, Iaas, Paas, SaaS, Resources, Resource Allocation Techniques

I. Introduction

Cloud Computing is an on-demand delivery of database, compute power, storage, applications and other IT resources through cloud services platform over the internet on the pay-as-you-go basis. It is called cloud computing because the information that is to be accessed is found in "the cloud" and it does not require a user to be in particular region to get access to it.

Cloud services provider enables users to store applications and files on remote servers and data can be accessed over the internet. Everyone makes use of cloud services even though they don't realize it. The basic activities of your daily routine such as listening music, watching TV, editing documents, sending emails, playing games, storing and accessing data make the significant use of cloud computing.

It has merely been a decade when first cloud computing service came into existence. But now, a considerable number of organizations, whether big or small, non-profit or government agency, are making use of cloud technology for different purposes. Let's have a look at the things you can do with cloud computing:

- Developing new applications and services
- Hosting blogs and websites
- Storage, back up, and recovery of data
- Delivery of software on demand
- Streaming videos and audios as well
- Analysis of data for predictions

II. Characteristics of Cloud Computing

The following are few of the characteristics of the cloud computing:

- a. **Resource Pooling:** The service provider to share the physical services, storage, networking facility, can create the pool of resources. In which, multiple users can access their resources when they need it and can release when they no need of it[1]. The user is no aware of the physical location of his resource, except when the consumer requests to limit the physical location of his data to meet legal requirement.

- b. Rapid Elasticity:** The cloud users can use the resources needed per time. If any demand arises for more resources to complete the task, it should be provided immediately. Also, if there is no need of resources which are already availed, immediately it should be able to release. So that it can be allocated for other users who are waiting for this resource. [2]
- c. On-demand self-service:** Providing resources to cloud computing users is done through automated process. i.e., without human interaction. It may reduce the personal overhead of the cloud provider, cutting cost and reduce the price at which the service are offered [3]
- d. Reliability:** Cloud provider should be able to provide customer reliability service, committing to uptimes of their service.
- e. Shared Infrastructure:** Uses a virtualized software model, enabling the sharing of physical services, storage, and networking capabilities. The cloud infrastructure, regardless of deployment model, seeks to make the most of the available infrastructure across a number of users.
- f. Network Access:** Needs to be accessed across the internet from a broad range of devices such as PCs, laptops, and mobile devices, using standards-based APIs (for example, ones based on HTTP). Deployments of services in the cloud include everything from using business applications to the latest application on the newest smartphones.

III. Service Architecture

The services offered in Cloud computing[4], can be classified into the following three ways:

- a. Infrastructure as a Service (IaaS):** It provides the infrastructures as the service. ex: data centers, storage for servers, virtual machines.
- b. Platform as a Service (PaaS):** it provides the computing platform for design and development and also testing applications. Ex: Web Servers, Database, development tools.
- c. Software as a Service (SaaS):** it provides the application software's as a service on a pay as you go basis. Ex: Email, Games, etc.,

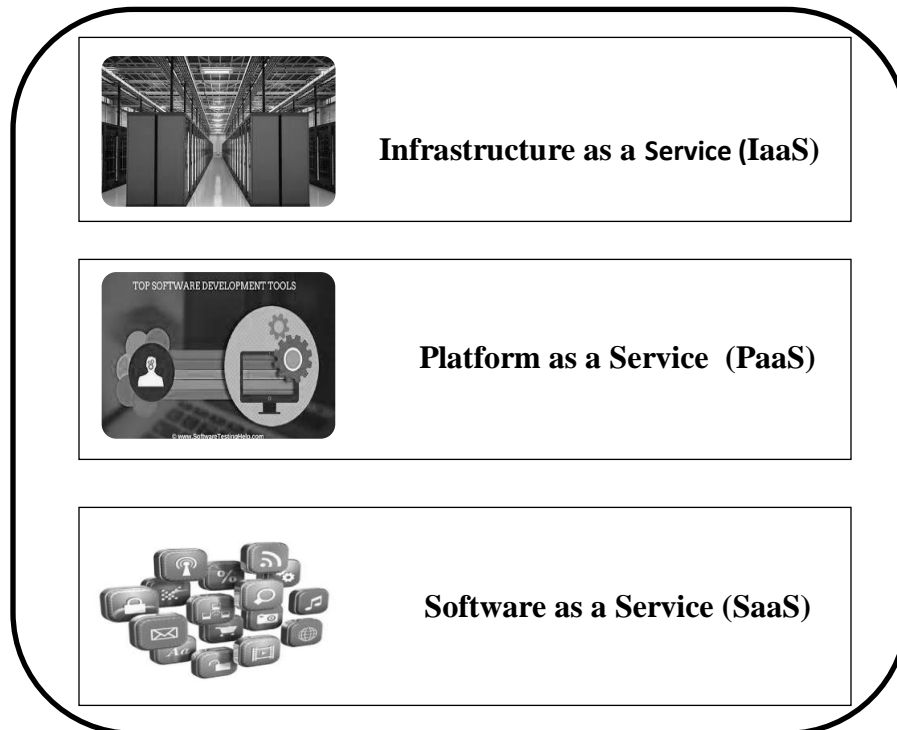


Figure 1. Cloud Service Architecture

IV. Service Deployment Models

The cloud computing service may be deployed in the following four methods:

- a. **Private Cloud:**The Cloud Services are used by the single organization for their multiple of users.it can be managed by the organization itself or by the third party.
- b. **Public Cloud:**A public cloud can be accessible to anybody. A public cloud has less security. [5] [2].
- c. **Hybrid Cloud:** this is a concatenation of two or more distinct cloud service deployment models.
- d. **Community Cloud:** this is deployed to serve several organizations that have a common theme and share a common concern. It may be owned, organized, and functioned by one or more of the organizations in the community. For example, this kind of cloud shared by two or more entities such as schools, colleges, universities etc..

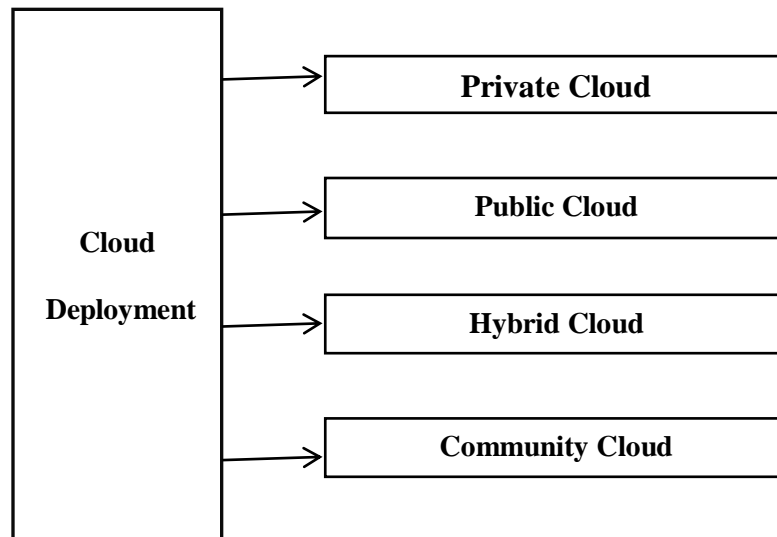


Figure 2. Cloud Deployment Model

V. Resource Allocation

Resource allocation is the process of assigning available resources to complete cloud services optimally in an economic way. It could also be seen as any mechanism that aims to guarantee that the applications' requirements as stated in the SLA are attended to correctly by the provider's infrastructure.

Resource allocation is defined as the process of integrating cloud provider activities for utilizing and allocation scarce resources, which may seem unlimited to users, within the limit of cloud environment so as to meet the needs of the cloud application in an elastic and transparent manner [6]. Resource allocation strategies help the two major players (users and service providers) in cloud computing to achieve their goals. Because of the Service-oriented nature of Cloud computing, users are concerned with quality and reliability, hence users may wish to estimate the resource demands to complete a job before the estimated time. This however could lead to the situation described as over-provisioning. On the other hand, providers wish to maximize their profit by using fewer resources per user in order to accommodate more users and make more profit. This will lead to under provisioning. However, it is difficult to allocate resources in a mutually optimal way due to the lack of information sharing between them.

VI. Major Issues In Resource Allocation

Resource allocation strategy must evade the following scenarios as opined by [4].

- a. **Resource conflict:** it may arise if two or more applications try to access the same resource at the same time.
- b. **Lack of resources:** It will occur if there are limited resources.

c. Resource Separation: It will occur when the resources are separated. There will be enough resources but not able to allocate to the needed application.

d. Extra- provisioning: It will arise when the application gets more resources than the demanded.

e. Less-provisioning: This situation will arise when the application is assigned with less number of resources than the requested.

VII. Resource Allocation Techniques

The number of techniques can be used for allocating the resources in the cloud environment to users. Every day experts of this technology people are inventing the new techniques based on the requirements and situations. Even we expect new technologies every day, few techniques are unavoidable and their contributions are very important. Here we discuss the few techniques such that.

a. Resource Allocation – Based on Cost

In the paper [7], the author discussed the reservation plan and on demand plans. The reservation plan price should be low when compare with on demand plan price. Because the user paying the price in advance. But it does not discuss about user future demand price since the uncertainty associated with provider resource price .another algorithm is proposed to solve this problem which includes the long term plan [8]. This author introduced cooperative cloud market to allocate resource. The aim is to minimize the cost while allocating the resource to the user. This paper suggests an algorithm to improve the cost. The basic idea is of the market-oriented cloud was discussed in [9].

b. Resource Allocation – Based on SLA

This technique involves with the Service Level Agreement with the user. The SLA should satisfy all the requirements of the user. In [4], SLA-Based Resource Allocation framework is presented. They considered multiple cloud providers. This approach uses Nash equilibrium concept of game theory to allocate resources to the users. Resource allocation problem among multiple cloud service provider forms a game. Each CSP has its own servers and each request is sent to appropriate servers.

The authors in [10] discussed reallocation of resources. The authors proposed architecture of resource reallocation. The architecture is divided into two parts one part includes Customer and data center which handles the SLA contract and resource scheduling and in the next part, the control chart is presented to detect SLA violation for host performance. A utility function is used in the evaluation mechanism.

c. Resource Allocation – Based on Priority

In [11], this author provides a method to execute job with a high priority.in addition, an idea to reuse VM is presented. New Virtual Machines are not created to run a newly arrived job. The proposed algorithm is able to run a high priority task or job by suspending a low priority job. The suspended job is resumed in a VM if that VM completely executed one job. DilipKumar.Met.al[12] has proposed a model for resource allocation. They considered peer to peer cloud. The request for a large amount of CPU is taken as higher priority job. K-means algorithm is used to classify the tasks into high, medium and low priority sets and the task is sorted in the task list based on priority. In the proposed approach, the price is calculated based on the current demand for a resource and its availability. In high contention across the network, resources are discovered from peer clouds.

d. Resource Allocation - Agent Oriented

Aarti Singh et.al[13] has presented a method for optimizing the resource allocation cost. This framework connects different agents with each other.

To minimize the cost, an algorithm is proposed in [11], The Agent is used to connect the different various cloud providers with the cloud users. The user's needs are considered. Cloud users and cloud providers represents the agent. Each cloud provider has several datacenters, each datacenter is composed of a large number of physical servers, and multiple virtual machines are created on the physical servers. Each layer has its own functions. The agent coordinator will find the right selection that satisfies the user request. For achieving this, the method uses multidimensional al comparison of each resource requested by the user and the available resources of the provider.

e. Resource Allocation – Based on Action

In [13],The author of the paper is using the method to allocate resources in the market-oriented cloud called “auction method” The Action Method is the method for resources buying and selling with the user requirements or choices. Optimal price detection and finding the winner of the auction are the main activities of this method. Paddy Field Algorithm (PFA) is used to find the best consumer and provider. This paper focused on participant's preference in the auction for selling and buying resources with the satisfied price of chosen resources. The auction method used here is a combinatorial auction (both consumers and providers are participating). The identifiers can find a best consumer and producer from the auction and eliminate dishonest participants from the auction. The society can approach the system when the system participants are trusted. The system is responsible for the

provision of high-quality computing resources. An algorithm has been developed for finding the winner of the auction Auction Based Dynamic Resource Allocation in Cloud has proposed in [14] by E. Iniyanehr. Combinatorial auction is used to allocate a set of resources. When there is resource contention, the cloud manager will call for the auction of resources among the users. Users then start to send bids for the resources. Users with the highest bid will be the winner. Resources are allocated on the basis of winners sorted list.

f. Resource Allocation – Based on Energy Consumption

Consuming the energy is a major anxiety in the mobile cloud. There are many research works carried out on this problem [15]. The research in [15], the proposed framework is to reduce the energy loss in cloud datacentres. The proposed framework does the following

- i) Calculate the amount of resources, and the number of virtual machine requests
- ii) To satisfy the user requests, the number of physical machines (PMs) is estimated
- iii) Improves energy consumption of cloud datacentres.

This framework consists of data classification, workload prediction module, and power management module. In [16], the author presented an approach to allocate resources by reducing the energy consumption. A method for Optimizing the Virtual Machine Migration has been presented here. The authors have used time series based forecasting method for prediction of CPU utilization and virtual machine migration. In [17], the research is based on IaaS cloud. They have considered IaaS cloud. They have proposed two models, server power model to optimize the power and resource wastage model to reduce resource wastage of server in IaaS cloud. In resource wastage model, VM request from different users of different resource specification has been taken and in server power model, energy consumption is considered.

VIII. Conclusion

This paper will explore the cloud computing environment in detail which anyone can understand the cloud and its types with its characteristics, services. Also it discusses about issues in the resource allocation to the user's task in detail and about few resource allocation techniques as solution. But it's a technology which expanding its boundary everyday with new ideas and new technologies based on the situation and demand from the user. Resource allocation is a very challenging work and it should be done immediately when request comes from the any user at any time. If any cloud provider able to allocate the resources to the user with maximal profit and also satisfy the user need under various circumstances, they will be a leader in this field. It lies in understanding the request issues and selecting the suitable resource allocation strategy in time.

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