

A Recapitulation on Load Balancing, Energy Productiveness of Cloud Architectonics

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Abstract— Cloud computing is one of the growing technologies, these days. Cloud computing is a paradigm that is surrounded by multiple resources, which helps in resource utilization. Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) are named as services of cloud computing. In the IaaS models, users can rent infrastructure of the data center as a service. Some of the examples of IAAS are Google Compute Engine (GCE) and Amazon Web Service (AWS). In the PaaS models, users can take services like operating system and database. Some of the examples of PAAS are Microsoft Azure and Google App Engine. In the SaaS models, users can access and install application software and databases via Internet. Examples of SAAS are Citrix GoToMeeting and Google Docs. In this paper, a novel model for load balancing and energy efficiency of cloud across with migrating the resources from server to server has been proposed. The objective of optimization of energy consumption on cloud has also been discussed in the paper. Along with the optimization techniques, the detailed literature review and various cloud services, issues and characteristics have been presented. To achieve the proposed work, CloudSim simulators and standard programming languages will be used. And, the performance of the proposed work will be analyzed by using the various performance parameters such as response time, energy efficiency and execution time.

Keywords—Cloud Computing, VMs, SLA, Migrations, Load balancing, , IAAS, PAAS, SAAS

I. INTRODUCTION

These days, many of the organizations, big business enterprises, are getting the benefits of various services of cloud and deploying their data and applications on the cloud. This deployment model results in much more effectiveness and efficiency in developing and deploying and also help in reducing the burden of maintenance and purchasing of the infrastructure.

One of the widely used definition of cloud is NIST as “Cloud computing is a one of the technique which allows convenient resources, according to the requirement of the user providing

network access to computing resources like applications, services, networks, servers and storage which can be allocated and released rapidly with minimum management work [1]. The cloud model consists of five characteristics, three services and four deployment models.”

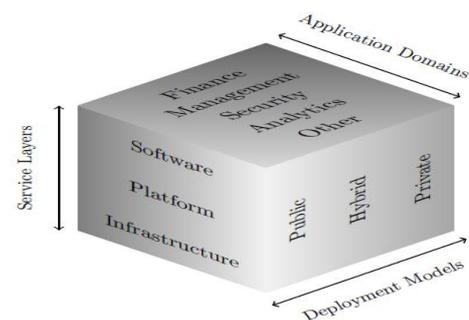


Fig. 1: cloud computing and its services[5]

Cloud computing security is always a major concern from user’s point of view. Some of the security issues are discussed in this paper. This paper consists of various parts that include the understanding of cloud computing, its applications, services, deployment models, its issues and literature review.

I. METHODOLOGIES

A. Characteristics

- On-demand self service: Recourses provided by the cloud providers, provide the resources to the user on demand whenever user demands for them. Through internet users can easily access these recourses.
- A broad network: Resources that are demanded by the user are accessible on the web and can be accessed through a standard mechanism which means users can access resources easily through laptops or workstation.
- Pooling of resources: Multiple buyers use multi-tenant model which is having various resources that can be real and unreal, which can be dynamically allocated and de-allocated according to the needs of users.
- Elasticity: Services provided by the cloud provider can be flexibly allocated and released, according to the needs

of the user.

- **Measured Service:** Cloud provider monitors the provision of services which may include various reasons like billing, effectiveness of resources, overall predicate planning etc.

B. Cloud Services

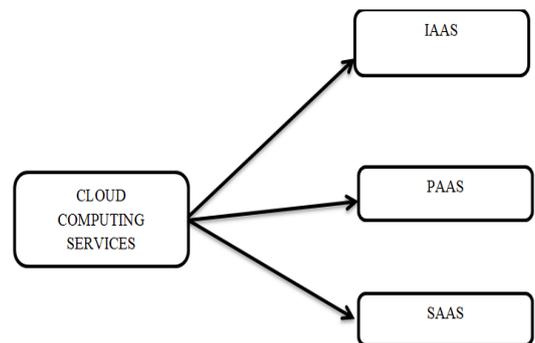
TABLE 1 consists of three types of cloud service provider with their use and their example.

TABLE I: Cloud Services

| Type | Comments | Examples | service content |
|-------------|--|---------------|---|
| IaaS | It is the bottom layer of cloud computing system. It helps in providing the resources like storage, computation and communication according to the users demand. | Amazon | Load balancing, data storage, Computer servers. |
| PaaS | This service helps in providing the user with the environment on which they can deploy or create their applications and user do not need to worry about how or many processors and memory is used for that application. Various programming models and | Google engine | Programming languages |

| | | | |
|-------------|---|---------------|---------------------------|
| | services such as data access, authentications are also provided to carry out new applications. | | |
| SaaS | First layer of cloud computing system is SaaS. Through web portals users can access all the services provided by this layer. These days user can choose online software services rather than using locally installed computer programs. | Saleforce.com | Web pages, office suites. |

In this Fig. three cloud services have been shown. First one is providing infrastructure to the users, second one is offering platform to run the applications of the users and the third one is providing software to the users.



C. Deployment Models

There are four deployment models used in cloud computing, which are discussed in the TABLE 2 given below.

TABLE II: Deployment

| Model | Comment | Security issue | Control issue |
|----------------------|---|----------------|---------------|
| Public Cloud | Cloud which is accessible for all the users anytime or anywhere with the help of internet. Users don't have to pay for the services in advance. Just how much service used has used only for that user will be charged. | Least secure | Least control |
| Private Cloud | A private cloud is only accessible by enterprise holder or other organization for their own purpose. It is not open for general public. | Most secure | Most control |
| Hybrid cloud | This type of cloud is used when computing capacity of both public and private cloud is being used together. | Moderate | Moderate |

| | | | |
|------------------------|--|-------------|--------------|
| Community cloud | This type of cloud is used by various associations and helps an individual community that includes mission, security requirements, strategy, and concurrence considerations. | Less secure | Less control |
|------------------------|--|-------------|--------------|

D. Issues in Cloud Computing

Cloud computing also has countless issues, in spite of having innumerable asset. Businesses, need to be alter for such perspectives before adopting for this technology. The main flyers involved in cloud computing are:

- **Technical Issues:** The information and data saved on the cloud can be achieved any time and from everywhere, but there are several occasions when the system can have some unhumorous affairs. The end user should be conscious that this technology is always prone to drain of their data and some other technical issues. Even the best providers of cloud have to undergo this kind of distress.
- **Cost:** In the beginning utilization of cloud computing may resemble much more moderate than a distinct software solution installed. The companies have to certify's that the cloud operations have all the attributes that are needed by software and if not, it has to analyze which of them are missing features essential to them.
- **Inflexibility:** Making a choice about which cloud dealer frequently means locking the business into using their applications or formats. For instance, possibility to insert a document created in another format into a Google Docs spreadsheet is not possible. The company must be adequate in adding and/or subtracting cloud users as significantly as its business amplify or compact.
- **Load balancing:** In cloud computing [10] another main issue these days is load balancing. It is an execution that allots the workload constantly to all the nodes in the cloud to divert a stage like some nodes are densely loaded with work and others are jobless or doing little work. It helps achieving high resource utilization ratio and user satisfaction, therefore improving the overall performance and resource utilization of the system.

- **Security:** Before using this technology, the user ought to know that they will hand over all their company's sensitive information to a third-party i.e to the providers of cloud. This could enforce a great danger to the company. Hence, businesses ought to be sure that they are appointing the faithful service providers, who will retain their information securely.
- **Prone to attack:** In the cloud, accumulation of our data and information causes companies exposed to intrusion and threats. So there are maximum chances of robbing of our sensitive data.

II. LITERATURE REVIEW

The authors have surveyed about various fields of cloud computing and presented a literature review in the form of a TABLE which is given below:

TABLE III: Literature

| Author's Name | Description |
|-----------------------------|---|
| Zhang Q et al. in [6] | The authors have presented that cloud is a new model which help in offering various resources to the users with the help of internet. This technique has helped enterprise like landholders for getting the benefits out of it as it helps in reducing the needs for users to begin from the small and increase resources only when there is demand for that thing. |
| Ramachandran et al. in [12] | The author has stated that cloud model allows users for appropriate and effective services like various applications and servers etc. All such services are accessible to users through internet. These services can be called or revealed any time when asked for and with minimum efforts. A user does not need any knowledge for maintaining the infrastructure of clouds. All the work is done by the cloud service provider. |
| Vaquero et al. in [17] | The author has given with 22 definitions of cloud computing and has done more comprehensive analysis on all its |

| | |
|-------------------------|---|
| | features. The cloud consists of pool of resources that can be used and accessed easily. Some of the features of cloud are user friendliness, variety of resources, Internet centric, resource optimization, automatic adaptation, pay as per usage, Service-Level Agreements (SLA), scalability and virtualization. |
| Armbrust et al. in [15] | The authors have described that cloud computing is a delusion of limitless computing services accessible according to users need. Cloud computing offers users with the facility in which user can pay for the resources that they wanted for a temporary basis and direct contracts are eliminated by the cloud users. |
| Plummer et al. in [16] | The authors have introduced that cloud computing is one of the paradigm in which hugely extended facilities for resources are offered to the users through the internet. |
| Staten et al. in [8] | The authors have stated that cloud computing is a bank of hugely supervised and extendable infrastructure which help in providing the applications to the various users and bill depends on the usage of resource done by the user. |
| Mell et al. in [2] | The authors have presented up cloud computing as a paradigm which help in providing suiTABLE and payable access like networks, applications, storage and services to users with the help of internet that can be easily attained and freed up with minimum management attempts. |

III. LOAD BALANCING

Load balancing is a leading technique these days that help

in distributing dynamic load among various systems to make sure that no single system is overloaded. Load balancing helps in better utilization of various resources and helps in improving the execution of the system. The main goal of load balancing is to minimize the consumption of resource that further help in minimizing the carbon emission rate and energy consumption rate. It also halts a situation in a cloud computing, where some systems are free or have no burden in work while other systems are heavily loaded with work. Higher ease of consumer and resource usage rate is attained using load balancing, so performance and resource utilization both overall has improved the system.

A. Need of Load Balancing

Load balancing is a technique that helps in providing all the nodes with various dynamic local workloads. A high consumer ease and resources usage rate can be achieved [15] with the help of load balancing, just be assures that all nodes which are participating are balanced and maintaining the total execution of the system. Load balancing also useful in allowing scalability, decreasing response time, declining bottlenecks, performing failover and over provisioning etc.

B. Load Balancing Approaches

There are different load balancing environments that are discussed below.

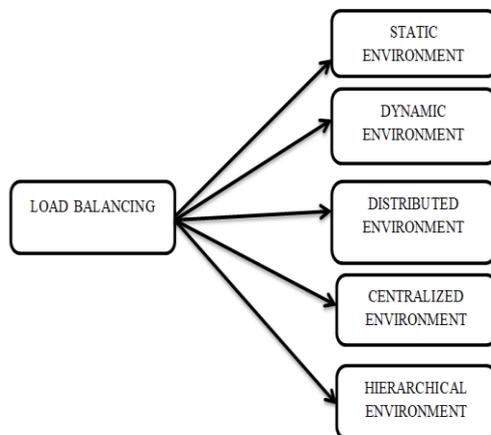


Fig. 3: Approaches of load balancing

1. **Static Environment:** This environment is appropriate for similar and non-dynamic systems. In this type of approach, the algorithm remains constant with determined designed time. Thus, in this scenario, there is no reconfiguration. The algorithm help in providing the jobs to the nodes only based on the older defined skill of the node to handle new demands [10].

2. **Dynamic environment:** The current parameters help in providing the job to a node in this approach. It is more suited in cloud environments. Such algorithm is difficult to handle as the provider has to regularly keep watch on each node, task method and then only can take the decision [10].

3. **Distributed Environment:** This approach is mostly used for resource allocating and for task Scheduling decision. Multiple domains monitor the network instead of single

domain for monitoring the cloud network in a distributed environment.

4. **Centralized Environment:** In this approach all the scheduling conclusions and allotments are made by a single node. This node is responsible for storing knowledge database of cloud network wholly and also help in providing static or dynamic approach.

5. **Hierarchical Environment:** This type of approach takes out different levels of cloud. This technique works on a master slave manner [18]. For its implementation tree data structure is used in which all branches are sTABLED below which directs to the parent node.

IV. SIMULATOR USED

Buyya et al. [12, 13] helps in delivering a simulator known as CloudSim which users all the infrastructure and applications which are present in a cloud. When any type of approach is invented, it is very necessary to check the feasibility of that approach. For checking the feasibility of an approach, it is run on a simulator. Cloudsim has been used to simulate the proposed approach and it help in checking the feasibility of an approach. Cloud computing applications, service brokers, infrastructures, allocation policies etc. are simulated by the Cloudsim. To start a simulation, Cloudsim project goes with a few important steps.

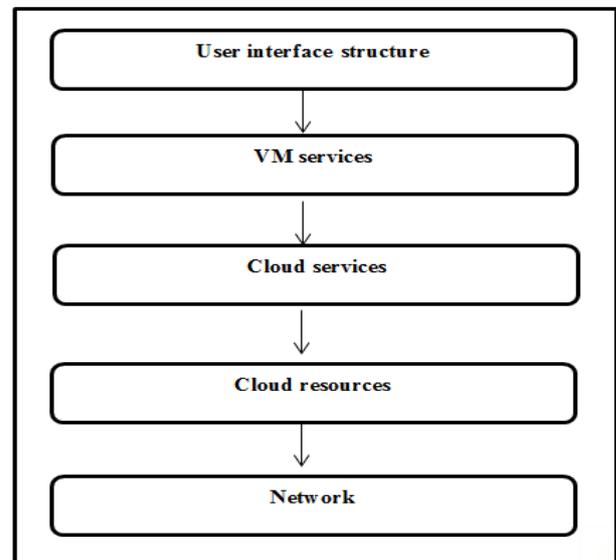


Fig. 4: Cloudsim components

It is important for the user to know about all these steps which are used for the working of Cloudsim [8]. There are steps that are followed, which are specified as follows:

- Select the number of brokers that are proportional to the users.
- Initializing the variables that are common.
- Make CIS which stands for Cloudsim information service.
- Creating cloudlets: Cloudlet(s) are created with characteristics like Number of cloudlets i.e. jobs or task,

there output size, there No of PE's required for execution of job/task, there length and there file size.

- Creation of the data center. Datacenter consists of storage size, RAM size, MIPS, Bandwidth, and No. of processing elements etc.
- Creation of Broker instance, which is further responsible for the communication among datacenter, Vm and cloudlets.
- Creation of virtual Machines which includes storage size, RAM size, MIPS, Bandwidth, No. of processing elements etc.
- After the creation of VM, Virtual Machine is submitted to the broker.
- Cloudlets are further submitted to the broker.
- Start Simulation.
- Stop Simulation, when execution is completed.

V. ENERGY EFFICIENT TECHNIQUES USED IN CLOUD FOR OPTIMIZATION

With the advancement of mobile technologies, these days in both hardware and software, mobile devices have become a one of the part of human life. Further, mobile devices are trained to perform different types of applications. The energy challenge of mobile devices along with their limited computation power acts as barriers in front of this expectation of this technology. To overcome this deficiency, mobile cloud computing has been presented in such computation intensive tasks which are offloaded to the resources of cloud, so that there will be reduction of the energy and time spent in executing the application. The efficiency of the proposed solution using both simulation and tested experiments are evaluated. The evaluation study proposed the proposal which can be better than existing optimal and near-optimal counterparts in terms of energy consumption, weighted execution cost and execution time [3].

The rapid increase in the growth of mobile computing is seriously challenging the resource constrained of mobile devices. Therefore, the mobile computing growth has been enhanced by blending mobile computing into cloud computing, and hence a new technique of computing is emerging which is known as mobile cloud computing [4].

Various optimization techniques that are useful in energy efficiency are discussed below:

A Ant colony optimization (ACO)

ACO algorithm is one of the random search algorithms [4]. The algorithm gives a positive feedback mechanism and help in imitating the behavior of real ant colonies in nature of searching for food and to communicate to each other by pheromone laid on paths travelled. Many researchers used ACO to solve NP-hard problems such as graph coloring problem, travelling salesman problem, scheduling problem and vehicle routing problem [5, 8].

B FA

Fireflies are the small insects that giving off light in the dark, hard wing which a light from luminescent chemicals in their stomach-related organs [5]. This algorithm draws an inspiration from this natural process of fireflies like common attraction behavior among insects, light emission and light absorption. Xin-She Yang in 2007 proposed this algorithm. It focuses on the following things.

- Fireflies are unisex it means they will attract others in spite of the gender.
- More the brightness, more will be the attractiveness among the fireflies. Firefly which are having low brightness will communicate with the firefly has brighter light.
- To get the optimum result solution the illumination of a firefly is controlled by the objective function.

C GSA

GSA was introduced by Rashedi in 2009. This algorithm obeys the rule of gravity and interaction of mass. The algorithm includes a collection of searcher agents that communicate with others via the weight force. The agents are denoted as things and their operation is measured by their masses. The gravity force causes a complete united attempt to get something done where all things move towards other things with greater weight masses. The slow attempt of greater weight masses gives good results [14].

D PSO

Particle swarm optimization, genetic algorithm, simulated annealing algorithm and ant colony optimization are optimization techniques which help in drawing the results and factors. The factors such as response time, makespan and schedule creating time are included. The performance of PSO is better than other algorithms.

There are also many other techniques such as Glowworm, Firefly opti.Cat Swarm, Lion Optimization and Bat Optimization which can be useful in energy efficiency.

VI. CONCLUSION

In the last few years existence of cloud computing has replaced the landscape of Information technology. It has been envisioned that cloud computing will be provided as 5th utility that will contribute the fundamental computing services. Cloud computing provides a collection of resources that can access anywhere by using internet. Cloud Computing has Major Characteristics like elasticity, on-demand self-service, etc that play important role in provisioning and releasing the services. It offers numerous service models and deployment models. In this paper various Cloud Computing platforms are also discussed. Though some difficulties exist in Cloud computing and to handle load balancing is one of them. A Technique that distributes the huge dynamic local workload across all the Nodes is called as load balancing. In this paper some current approaches and conflicts of load balancing are also discussed. In future work Proposed Hybrid Energy efficient model will be implemented and Cloudsim simulator

for cloud computing will be used to show all the results of the proposed technique.

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