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A Comparative Study on Job Scheduling Algorithm in Cloud

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ABSTRACT: Cloud Computing is an emergent area in the field of Information Technology having the Internet as its base and provides various services as utility and follows pay-as you-go model. Load balancing is a critical issue in cloud computing which is a technique that uses multiple nodes and distributes dynamic workload among them so that no single node is overloaded and ensures none of the system collapse as a victim of overloading. Load balancing includes optimal utilization of resources which increases the performance of the system and thereby the minimization of the load of competent resources. This paper makes a survey that helps in analyzing the issues of existing load balancing algorithms and gives a comparison among these algorithms on the basis of different qualitative metrics like throughput, reliability, performance, resource utilization etc.

KEYWORDS : Cloud computing; infrastructure load balancing; pay as you go; platform; software

I. INTRODUCTION

A. What is cloud computing model?

The NIST organization has described the Cloud computing

as , “Cloud computing is a model for enabling pervasive, convenient, on demand access to a shared pool of computing resources(like networks, storage, servers, applications)” which are allocated to the client and de-allocated rapidly with least management effort or any interaction.[2]. Cloud computing model is commonly known as “pay as you go” paradigm which means users rent applications/hardware/services and they pay for the services that they have used. This model provides a flexible and elastic approach to manage thousands of distributed nodes along with high performance computing environment for users. It has been successfully applied in different areas such as business, scientific research and industries, education. NIST has defined several features of cloud computing [1]:-

1. User On demand self-service:-Different users requests different services whenever they need and they pay for what they have used. Payment is based on the respective policies of the service providers.

2. Broad Network Access: - Resources are made available from a wide range of locations over the network and served according to a standard mechanism.

3. Fast elasticity: - The term Elasticity is similar with the term scalability that means to scale up or scale down the number of re-sources as per the requirement.

4. Measured Service :- Different services provided by cloud computing model must be automatically be controlled ,reported ,enhanced at different levels for the resources of providers and users.

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5. Auditability and Certifiability:- It is essential for services to prepare trails to make it possible to evaluate the degree to which rule and regulations are applied.[2]

6. Multi Tenacity:- this characteristic was defined by Cloud Security Alliance. Meaning of multi tenacity is that it is es-sential to have models for policy driven enforcement, seg-mentation, governance, and charge back /billing for different consumers.[2]

B. Cloud Computing Service Models

1. Software as a Service (SaaS):- SaaS provide those services where consumers can access software applications over the internet. The various providers like Facebook, flicker, Twitter and Google are some of the SaaS. It is variable service that has got various upgrades available on demand. We can access the different services/applications with the help of internet enabled devices across the globe. Applications/services are accessible from different locations at any time.

2. Platform as a Service (PaaS):- The cloud service provider provides both software and hardware tools and technologies that are needed by the user's application. The complete infrastructure is provided by the cloud provider. No need of implementing the in-house hardware and software applications. It allows its users to frequently change or up-grade operating system features.

3. Infrastructure as a Service (IaaS):- This cloud model provides various computer oriented entities like network, storage and other computing resources. There is no need of managing the cloud infrastructure but they can fully control the storage, operating system and selected networking components.

C. Deployment model of cloud computing

1) Public cloud- This deployment model is available to everyone and can be accessible in the cloud environment. Public services are provided on the internet based on predefined policies. Google, Amazon, yahoo, Microsoft are providing public services through their private cloud.

SAAS
PAAS
IAAS

Fig. 1. Service models of cloud computing model

2) Private Cloud- Unlike public cloud, private cloud model is used by a one/single organization. Private cloud solves the security issues because the private set up is implemented safely within the firewall. The private cloud model is available only to single user or the organization. This organization can completely manage the cloud to satisfy their requirements.

3) Community Cloud - Based on the requirements, different companies collaborate with each other and share cloud computing to provide applications/services to theirs community users. Low cost and division of expenses between community members along with high security are the main advantages of community cloud.

4) Hybrid Cloud - Hybrid cloud computing model is fusion of any two models out of the three explained. Hybrid cloud is useful in case of dynamic workload.

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II. VIRTUALIZATION

Virtualization is the most important context in cloud computing model, working of cloud computing is completely based on virtualization. Virtual means “not real”, so virtualization is defined as “something which does not exist in reality”. It is of two types.

Full virtualization – When one system is completely in-stalled on other system is said to be full virtualization. Hence all the software those are present on the actual server plus on virtual system.

Para Virtualization- In this type of virtualization, different types of soft wares / applications are allowed to execute on a standalone pc by making use of different types of bandwidth, processor, and architecture.

III. LOAD SCHEDULING IN CLOUD COMPUTING MODEL

In simple words Load balancing in cloud computing means to optimize the re-source use, to increase the throughput, to minimize the re-sponse time, and avoid overloading of a single resource. In cloud computing, balancing of load means to efficiently assign the tasks to the resources in order to achieve their complete utilization along with reducing the user’s response time and enhancing the throughput. The efficiency of the cost is also considered. For load distribution there are so many algorithms of balancing the load which are defined below:

Algorithms of Load balancing are classified in two aspects: [1]

a) System load

b) System Model/Topology

Categorization According to the Cloud Datacenter Load

i) Centralized approach: Using this approach, a particular sin-gle node/entity has the control to manage all the another nodes in the system.

ii) Distributed approach: In this approach, all systems in the network are capable of building their own load vectors by fetching the information of all the another systems in the network. The decisions of the system are made using local load vector schemes.

iii) Mixed approach: An integration of the two above approaches to take benefits of each approach.

Categorization According to the System Topology

Based on system topology load algorithms are divided in two categories. a) Static algorithms b) Dynamic algorithms

a) Static Algorithm

In Static load balancing algorithms, the task of the user is assigned to node on the basis of its ability to process the user’s request. In static algorithm tasks are defined equal-ly to servers. But performance decreases with the increase of traffic.

b) Dynamic Algorithm

Dynamic algorithms consider current position/ state of the system to balance the load. These algorithms change the

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status of the system by dynamically altering the parameters. Tasks are assigned dynamically to the server.

Load balancing algorithms

Following are some expected goals of load balancing algo-rithm [1]:

a) Cost efficiency: Main aim of balancing is to reduce the overall cost of the user by providing all the required services.

b) Scalability and flexibility: The system may change its services/size according to the user's requirement. So our algorithm must be capable of providing the scalability and flexibility so that all the changes can be handled easily and properly.

c) Priority: The algorithm should prioritize the tasks before executing them so that better services can be provided to the clients.

There exist different static and dynamic load algorithms. We have surveyed and compared different load balancing algorithms.

1) Round robin algorithm

This algorithm is used in load balancing and is a static algorithm for balancing the load. Using round robin order, all the processes are assigned to all processors. The process allocation order is prepared on a local server and is independent of the allocations from re-mote processors. Load distribution is same among the pro-cesses but the processing time is not equal. Time quantum is very important in this algorithm ,if the required time by the processes is same then this algorithm works same as that of FCFS, and if not ,then it is said to be the processor sharing algorithm. Drawback of this algorithm is the capacity of processors is not taken into account so therefore sometimes one machine is either overloaded or remain idle.

2) Honey Bee foraging

This algorithm is a dynamic algorithm for balancing the load in cloud architecture. Foraging behavior of honey-bees is used in this algorithm. This algorithm is defined on the analysis of the behav-ior of honey bees in order to search food. In case of load balancing, jobs from overloaded machines are considered as honey bees. The removed jobs from overloaded machines have to find out the under loaded machine to be allocated. Based on QoS criteria job finds the best machine, the machine with less number of tasks is chosen[4]. If a job is unable to find the suitable machine it will go for delay in allocation and listen to the updated information from another machine. capacity of machines is considered but with the increase of system size throughput is not increased.[3]

3) Min-Min Algorithm

The Min-Min algorithm for load balancing calculates the minimum execution time of all the users tasks that have been entered into the system. After that it chooses the work with the minimum processing time from all the given cloudlets/work. Then the Min-Min algorithm assigns the work/cloudlet to that virtual machine which provides the least finishing time. The same steps are repeated for all the given tasks. The only disadvantage of this algorithm is that it allocates the task with lesser instructions/smaller task first. The results given this algorithm is not so optimized in certain cases.

4) Max-Min Algorithm

This algorithm works on the principle of assigning the work with maximum finishing time is chosen and is allocated

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to the pc with least finishing time. Disadvantage of Max-Min algorithm is that cloudlets with min completion time has maximum waiting time. [6]

5) Opportunistic Load Balancing (OLB)

OLB load balancing algorithm is a load balancing algorithm which is static in nature. This algorithm keeps every virtual machine in the system busy and it never considers the current workload/tasks assigned to each and every virtual machine. It achieves proper load balancing but only limitation in this OLB algorithm is that it never uses the expected processing time of the task. Therefore, overall result of the algorithm is not optimized.

6) Biased Random Sampling

In this algorithm of biased random sampling, a virtual graph of virtual machines is developed that shows the load on the datacenter/host. The tasks are added and removed on the basis of random sampling scheme. The algorithm starts working on any node chosen randomly and last node in the complete graph is chosen for allotting the load.

It increases the overall efficiency of the system.

7) Ant Colony Optimization

ACO is a heuristic approach that do efficient local search of combinatorial problems. This algorithm is based on the behavior of real ant colonies in order to search their food. In this scheme tasks are assumed as ants and these tasks (ants) are sent to find the suitable machines. Ants traverse each node, update their information for future decision making and after completion of task ants commit suicide.[7]

8) The two phase scheduling load balancing algorithm

The combination of OLB and load balancing min-min algorithm is discussed in this algorithm. It maintains the proper load in the system and provide better results. It keeps each and every virtual machine in the system busy by dividing the load equally among each virtual machine. Hence it enhances the resource utilization and also increases overall efficiency of the system.

IV. CONCLUSION

In this paper cloud computing technology is explained which is the most trending technology these days, cloud computing model provides different services to the remote users, and services can be software or any platform or any infrastructure. Working of cloud computing is based on virtualization The fundamental goal of cloud computing model is balancing of load which means allocating the tasks efficiently to the machines in order to achieve minimum response time and maximum throughput along with efficient cost. Different load balancing algorithm are reviewed and compared in this paper.

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