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A Novel Method for Load Balancing In Cloud Computing: Round Robin with Floyd-Warshall Algorithm

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Abstract: ***Cloud Computing is the bundle of services provided to a user through the internet on the pay-as-use policy. As much as any service used by the user, a user will pay for it on the hourly, weekly, monthly & yearly basis etc. As the number of users increases, the load is also increased and it is the biggest challenge in the cloud computing environment to balance this continuously increasing load. There are many existing load balancing algorithms are in use. In this paper, I discussed my proposed algorithm, which depends on the distance between the Datacenter and the host . CloudSim simulator is used for simulation, to check the authentication of the proposed algorithm.***

Keywords: Load Balancing, Cloud Computing, Host, Virtual Machines (VMs), CloudSim Simulator

1. Introduction

This is the era of cloud computing and IOT, the main base behind both services is the Internet. Cloud computing is a computing paradigm that provides application and services over the internet on the basis of pay-as-use or on-demand internet services. The main motto of cloud computing is customer satisfaction Cloud Computing provides its services IAAS, PAAS and SAAS through deployment models (Public, Private, Hybrid)and Community Model). Virtualization and load balancing are the two most important pillar of cloud computing .load balancing is the process of balance the load among many resources to get maximum throughput, maximum utilization of resources. There are a lot of customers using services provided by cloud computing through a chain of points, these points in a sequence are User->Datacenter->Service Broker-> Host->VMs. The user sends his requests to Datacenter through Internet, then the request reached to service broker .then the distribution of requests take place among hosts, then in the final step the request is reached to VMs and task done by VMs. So as soon as the request reached to VMs and processed by it, load balancing algorithm plays an Important role in Cloud Computing. The greatest benefit of cloud computing is its eases of installation, low maintenance, and scalability .this way it grows with our need.

These are a real-world example of cloud computing:

- **Cloud Computing in Education:** SlideRocket's, Ratatype, Amazon Web Services
- **Cloud Computing in Healthcare:** ClearData, Dell's Secure Healthcare Cloud, IBM Cloud
- **Cloud Computing in Government Sector:** IT Consolidation, Shared services, Citizen services

2. Cloud Computing Characteristics

Cloud computing characteristics are as following:

1) On-demand self-service - cloud computing resources and services are available to the user on demand. it provides services and resources to the user, without requiring interaction with the cloud service provider.
2) Resources pooling – multiple users can use the same physical hardware with the multi-tenant aspect of the cloud computing, in which users are assigned virtual resources that work on the top of the physical resources .here the concept of virtualization will work.
3) Rapid Elasticity – cloud resources can be scaled up and down based on the demand of that resource .here two types of scaling exist:
   a) Horizontal Scaling(scaling out)
   b) Vertical Scaling(scaling up)
4) Measured services or Pay per use – in cloud computing some specific metrics are used to charge the user. The metrics are how much CPU cycles are used, how much storage space is used, a number of networks I/O requests, etc.
5) Broad network access.

3. Components of Cloud Computing

A typical Cloud computing system consists of four major components such as Datacenter & Datacenter Broker, Host, Virtual machines and Cloudlet. A brief discussion of the specific role and purpose of each component is presented in the following [7]:

Datacenter
A Datacenter is a set of hosts. Datacenter contains all pieces of information about Virtual Machines(VM) as the capacity of VM, Image Size, Memory of VM, No of PEs etc.

Datacenter Broker
This class represents the broker acting on the place of a user. It modifies a couple of mechanisms: one mechanism for submitting VM provisioning requests to Datacenters and mechanism with regard to submitting tasks to VMs.

Host
The actions regarding to management of VMs (e.g., creation along with the destruction) and update task processing to be able to VMs are executed by Hosts. A good host possesses the defined policy to provide memory, processing elements(pes), and also bandwidth (BW) to virtual machines. Only a host is a physical entity among all cloud elements.

VM
Virtual Machine represents the software implementation of a machine that executes applications, which functions as a physical machine. Creation of Virtual Machine is based on Virtualization.

Cloudlet
The Cloudlet work as a small datacenter for the mobile devices as the tablet, Watch Timer etc. it is built for a small area of users and work on LAN services.

4. Types of Cloud Computing System

The types of cloud computing system depend on two perspectives: Capability and Accessibility[6]

a) Based on Types of capability also known as Service Models – Cloud System provides three different types of service model as follows:

Software-as-a-Service (SaaS):
SaaS provides the users a complete software application or the user interface to the application itself. Network, Operating System, storage and application software, all these underlying infrastructure information are managed by cloud service provider .the user is unaware of all these things. Applications are provided to the user through a thin client interface (as the browser).

Platform-as-a-Service (PaaS):
Cloud provides the platform to the user in form of software libraries, Application Programming Interfaces(APIs) and development tools etc. A user can develop and deploy an application in the cloud.

Infrastructure-as-a-Service (IaaS):
In these type of services, the infrastructure is provided by the cloud, and the user can implement their own operating system and application according to their requirement. This service mainly depends on Virtual Resources. Virtual Resources are provided to the user as a virtual .machine instance. Based on Types of accessibility also known as Deployment Models – Cloud System provides three different types of deployment model as follows:

Public Cloud:
In the public cloud deployment model, cloud services can be easily accessible to everyone. The cloud services are used by a different individual user, large organization, smart and medium enterprises, and government sectors. These type of services are provided by a service provider. Data created and submitted by users are stored on the servers of the third-party provider user can enhance their use on demand.

Example of public cloud services: Google Cloud Engine, Salesforce.com, Amazon AWS, Microsoft Office 365

Private Cloud:
These types of services, which are provided by the cloud to a particular organization. The private cloud provides scalability, agility, and efficiency of the public cloud, but provide a higher level of security and control, making it perfect for larger companies or those with strict data, regulation, and governance obligation. Private clouds are best suited for the organizations, for those data security is very important.

Hybrid Cloud:
The hybrid cloud deployment model is the combination of many services of multiple clouds(Private and public cloud). It is used by the big organization, wherein which services data security is very important they use private cloud services and for the services, where secure data is not important but its cost also affect the budget of the organizations, they use a public cloud. Public cloud services are very cheap in comparison to private cloud services.

Community Cloud:
In the community cloud deployment model, the cloud services are shared by several organizations that have the same policy and compliance consideration. Community clouds are best suited for organizations that want access to the same applications and data and want the cloud costs to be shared with the larger group.

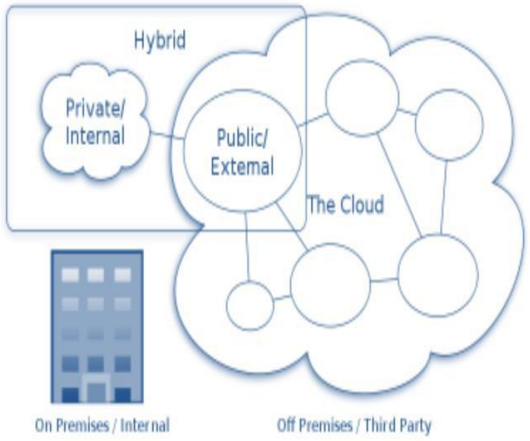

Figure 1: Cloud Computing Models

5. Cloud Computing Concept and Technologies

The key concept behind Cloud Computing[6] are as follows:
1) Virtualization
2) Load Balancing
3) Scalability & Elasticity

5.1 Virtualization

In the context of Cloud Computing, Virtualization is a technology which refers to the partitioning the resources of a physical system(such as Processor, Disk, Memory, and Network) into multiple virtual resources. Virtualization is something that does not exist in the real world but supplies all working that is existing in the real world. A multi-tenant

aspect of cloud computing allows multiple users to be served by the same physical hardware[6]. A user is assigned virtual resources that run on the top of the physical resources. The Virtualization layer partitions the physical resources into multiple virtual machines.

Hypervisor
The Virtualization layer consists of a hypervisor or a virtual machine monitor(VMM). The hypervisor presents a virtual operating platform to a guest operating system.

Guest OS
The operating system that installed in the virtual machine is known as guest OS. The guest OS may differ from host OS.

Two types of Virtualization approaches are:
Full Virtualization: In full virtualization, there is a separation made by the Virtualization layer between the guest OS and the underlying hardware. There is no modification take place in the guest OS and unaware of the fact that it is being virtualized.
Para-virtualization: In para-virtualization to improve efficiency and performance of the system, guest OS is modified according to the virtual machine monitor(VMM) or hypervisor.

5.2 Load Balancing

Load balancing is a very important concept of cloud computing after virtualization[1].In cloud computing, the numbers of users or end users are continuously increasing ,so in the same ratio load on the data centres are increasing .load balancing is a concept in which load at the Datacenter distributed to different host by load balancer to maximize the resources utilization[2].when the load at any resources reached to maximum tolerable limit then the load is shift to another resource of a node to respective resource on the another node . To balance the load between various hosts of the cloud system become major challenges in cloud computing.

Major goals of load balancing are:
- Increasing resources utilization
- Minimize the job waiting time in queue
- Increasing the throughput
- To increase user satisfaction

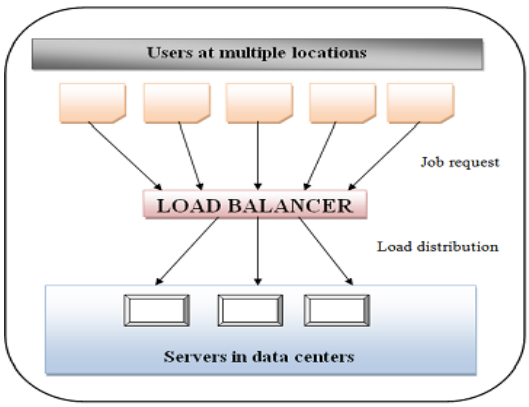

Figure 2: Load Balancing

Load balancing algorithms are mainly divided into two parts:
Static Load Balancing Algorithms, Dynamic Load Balancing Algorithms.

Static Load Balancing Algorithms
The Static load balancing Algorithms do not consider the current states of the system but it requires [8] knowledge about the application and resources of the system..All the nodes and their properties are known in advance. The algorithm works based on this previous information. While distributing the load a static algorithm does not use the system information and is less complex. These algorithms work properly in a system with a low variation of load .these types of Algorithms are less flexible and suitable for homogeneous system .Static algorithms divide the traffic uniformly among the servers. By this approach, the traffic on the servers will be handled easily and subsequently, it will make the circumstance better.

Dynamic Load Balancing Algorithms:
Dynamic load balancing algorithms are more flexible than static load balancing algorithms and do not rely on prior knowledge of the system but depend on the current state of the system[8]. A dynamic algorithm search through the whole network and selects the appropriate weights on a server and it prefers the lightest server to balance the traffic, But selecting suitable server needs a valid and continuous communication within networks that lead to extra traffic being added on a system. These algorithms work properly in a system with high or mix variation of load .these types of Algorithms are more flexible and suitable for the homogeneous and heterogeneous system.

6. Review of Various Existing Load Balancing Algorithms

1) Round-Robin Algorithm
This is a static load balancing algorithm. Round-Robin Algorithm is very simple scheduling algorithm that based on the principle of specific quantum. The task is allocated to the node(VM) in a round manner[9]. Every node has to finish its task within the quantum.

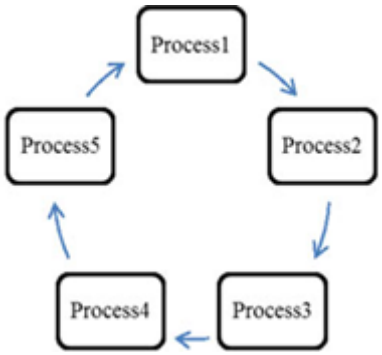

Figure 3: Round Robin Process

Result: This method is very slow processes because VM on the host has to share the same processors time with other VM on the host instead of finishing the tasks quickly.

Problem:

a) If the quantum is too longs it can cause poor response time, and work as First-Come-First-Serve scheduling.
b) There is no priority given to the host only based on time quantum.

1) Min–Min Algorithm:

- In Min-Min algorithms, small tasks are executed first, which makes a very long delay for bigger tasks[4].
- Result: Processor execute a smaller task, so they finish very fast.
- Problem: Starvation(infinite or very long waiting time) for longer tasks.

2) Max-Min Algorithms:

- In Max-Min algorithms, large tasks are executed first, which makes delay for bigger tasks for a smaller period of time.
- Result: Processor execute the large task, so they finish very fast.
- Problem: Starvation(infinite or very long waiting time) for smaller tasks.

3) Opportunistic Load Balancing:

- In this algorithm, the node gets the task randomly, no dependency on tasks size or quantum value. The main attraction of this algorithm is to keep each and every node busy [5].
- Result: It handles unexecuted tasks easily.
- Problem: no better result for load balancing.

4) Throttled Load Balancing Algorithm

The load balancer maintains an index table for a virtual machine and also update the record of the states of a virtual machine as VM is busy or available. When any user places any request to the datacenter, data canter ask the load balancer for the suitable VM for that request. then load balancer check its index table and if the VM is available ,load balancer respond to the datacenter with corresponding ID of that VM [1].then datacenter allot that request to VM .load balancer update his index table and change the state of that VM from available to busy .if suitable VM is not found, the load balancer returns a -1 value to datacenter means that VM is not free.

The steps of Throttled Load Balancing Algorithm phase are-

- The formation of VM is taken place in the first phase.
- The queue of the request for the virtual machine is prepared in the second phase. Once the queue is prepared, the processing on the VM start.
- Deletion of virtual machine done in the third phase.
- Then in the last phase, the throughput of the VM is calculated for a time slot.
- Result: maximum resources utilization but some tasks have to wait a lot till the suitable VM is busy.

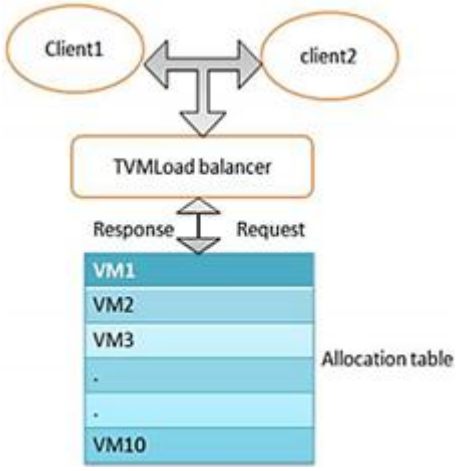

Figure 4: Throttled Load Balancing

5) Load Balancing Algorithm based on Ant Colony Optimization Method

This Algorithm is based on the food searching method of the ants. If any ant gets her food anywhere[1].And came back to their starting point and put some marker on their way. and inform other ants about that food point, and other ants go to that point and then opt the shortest path to reach that point and the rest all ant fallow the same route. In the same way, when any request came to a node, it goes to the nearest resource point, the one that is under loaded when that resource is overloaded, then request go to other resources, the main attraction of this Algorithm is the maximum utilization of the resources.

6) Honeybee inspired load Balancing Algorithm:

This is also a nature-based Algorithm for self-organization. as the Ant colony optimization, but it is somewhat different from that. The concept behind this algorithm is based on the behaviour of honey bees for discovering and drawing food. On the changing demands of the user, the servers demand is increase or decrease, the services are allotted dynamically .every server has their own virtual machine's queue, and when any server get maximum utilization of any VM, it is same as the quality that honey bee shows in their waggle dance[3].

Result: Maximizing the throughput and minimum waiting time.

Problem: Higher priority task is executed early so the lower priority task will remain in the queue.

7. Proposed Load Balancing Algorithm

In all the existing algorithms, everyone focuses on the search of host with VMs having free resources and Allocate the task to that VM, but my proposed algorithm is based on distance of the host from the Datacenter and from the individual host, we will use Round Robin algorithm to balance the load among the hosts , and if the host is overloaded, then the task transferred to other host [1] . We are using Warshall's algorithm to find the shortest path from the datacenter to any host for any task. When a request comes at the datacenter ,then datacenter first of all check the host ,whose turn to serve that request according to Round Robin task scheduling ,but that one is not free ,then the datacenter forward the request to the nearest host with free VM[4]. Every host has a hash map of all attached VM,

which contains the VM's ID, its status means VM is available or busy. We will implement our algorithm on CloudSim simulator as it is a very tough job to implement in the real world directly[14]. We are using Java language for coding. In the last phase of the work, we will compare our simulation result with the simulation result of some exiting load balancing algorithm and will prove the efficiency of our proposed algorithm over the existing algorithms [15].

8. Cloudsim Architecture

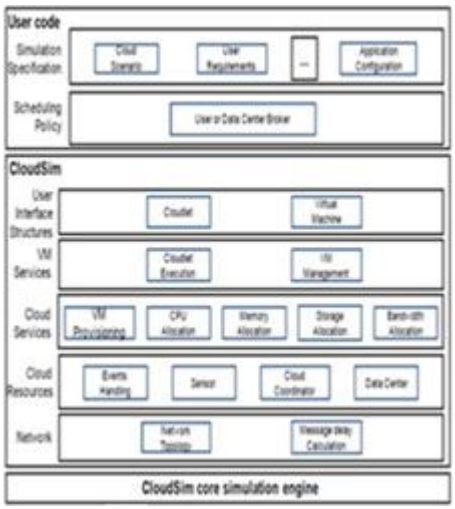

Figure 5: CloudSim Architecture

CloudSim: an extensible simulation toolkit [14] that enables modelling and simulation of Cloud computing systems and application provisioning environments. The CloudSim toolkit supports both system and behaviour modelling of Cloud system components such as datacenters [14], virtual machines (VMs) and resource provisioning policies. Multi-layered structure of CloudSim software framework and its architectural components are described in figure 3. Initial releases of CloudSim used SimJava as the discrete event simulation engine that supports several core functionalities, such as queuing and processing of events, the creation of Cloud system entities (services, host, datacenter, broker, VMs), communication between components, and management of the simulation clock. However, in the latest release, the SimJava layer has been disappeared, in order to allow some advanced operations that are not supported by SimJava.The fundamental issues, such as provisioning of hosts to VMs, managing application execution, and monitoring dynamic system state, are handled by this layer. By extending the datacenter entity of CloudSim, the Infrastructure-as-a-Service can be simulated. The data canter entity of the cloud is responsible for the host entity of the cloud. The VM allocation policy described that how many VMs are allocated to a host. A host is only a CloudSim component that is present as a physical computing server in a cloud. A host has a pre-configured processing capabilities memory, storage and a provisioning policy for allocating processing core to VMs[14]. Real World implementation of any new software is very cost effective and time-consuming work. To test any application at an initial level, the cloud provides, CloudSim toolkit, once we test our work using Cloud Simulator, and don't get the proper result, we can do change and can test it again and again till the result of our expectations[15].

9. Literature Review

This paper [1], is a very useful paper to get the whole knowledge about the fundamentals of Cloud computing under these headings as Cloud Computing Characteristics, Services of Cloud Computing, Cloud Deployment Models. Then they describe a very Important pillar technology of Cloud Computing, which is Virtualization, Types, and benefits of virtualization. Then the Core concept of the paper came that is Load Balancing and types and benefits of Load Balancing. The author reviewed many Load balancing algorithms with their pros & cons. The Load Balancing Algorithms explained by the authors are Round-Robin Algorithm, Min-Min algorithm, Max-Min algorithm, Opportunistic Load Balancing algorithm, Throttled Load Balancing (OLB) algorithm, Ant Colony Optimization based Load Balancing Algorithm, Weighted Scheduling and the last one is Genetic algorithm. Through this paper, we got very deep knowledge of load balancing algorithms and came to know the importance of load balancing in cloud computing.

In this paper [2] Authors first gave a very good fundamental knowledge of Cloud Computing. The second good feature of the paper is the description of various static and dynamic load balancing algorithms and the last the authors presented point-by-point merits and demerits of pre-described algorithms. The essence of the paper is the deep study of various static and dynamic load balancing algorithms.

A very good paper [3] to understand the basic concept of cloud computing, Architecture of cloud computing. A very simple language is used to explain the formation and working of Virtual Machine and through which we understand the depth concept of load balancing. Then put some light on performance matrices that affect load balancing concept. And then guided us about the approaches use for load balancing .fourth part of the paper based on the classification of load balancing algorithms in Static and Dynamic scenario and detail description of various load balancing algorithm. Through detail explanation of various load balancing algorithm by authors, we came to know deeply about their working. The author presented some simulation result to analyze the performance of a few scheduling algorithms. The experiments were performed using CloudSim-3.0.3 simulator.

In paper [4] they proposed a new Dynamic Round Robin algorithm, In which they studied the effect of Round robin technique with a dynamic approach by varying the vital parameters of host bandwidth, cloudlet length, cloudlet file Size, cloudlet output Size, image size and bandwidth of VM. A load has optimized by setting dynamic round robin by respective variation in all these parameters. Simulator CloudSim has been used for this implementation and discovered a working approach. Paper is started with the introduction of Cloud Computing and it's classification based on service models and deployment models. In the second part of the paper, authors showed Literature Survey the third part of the paper, authors described the structure of the algorithm they proposed and techniques used by them to bring the concept into existence. They used packages like

CloudSim and CloudSim based tool kit to implement their algorithm. Then they explained the Layered Architecture of CloudSim along with they informed about the components(Datacenter, Cloudlet, Host and Virtual Machines) of the cloud system and their relationship. The nub of the paper is the average response time varies with the variation in cloudlet length and host bandwidth for optimized load, getting from Dynamic approach of Round robin method.

In the given paper[5], first of all, authors discussed in short about the basic fundamental of cloud computing as what is cloud computing, types of services provided by cloud computing .than briefly explained about their proposed Algorithm. The proposed Algorithm is a combination of Dynamic Round Robin load balancing algorithm and Machine Learning. This, information related to the VM as VM id, capacity, current load on particular VM, CPU utilization etc. With the help of the Machine Learning, a queue of VMs will be prepared based on their properties, and allocated the desired VMs to the requests and again update the queue and replace the old queue with the new one. For the implementation of their proposed algorithm they used AWS EC2.AWS EC2 having its own load balancer which works on Round Robin load balancing technique. Round Robin load balancing with Machine Learning, a very effective load balancing algorithm from many aspects but somewhat slower than existence load balancing algorithms due to updation and replacement of queries.

In this paper [6], the authors explained very important features of cloud computing, Server Affinity. Server Affinity shows the capability of a load balancer to send a user's request to the same server where their session was started. They use the same concept to discover their new load balancing technique (Round Robin with Server Affinity).In the starting of the paper, the authors wrote a very short note on the basic concept of cloud computing. Then the remaining paper is based on their proposed load balancing algorithm .under problem statement and motivation topic they pointed a shortcoming of existing load balancing algorithm, As in the existing VM load balancing methods, an algorithm has to be run every time a new request for VM allocation is received from the User base. This happens because the existing VM load balancing techniques do not save the previous allocation state of a VM or the history of the VM related to a request from a given Userbase. However, in case of the proposed load balancing techniques, a hash map is used to store the entries for the last VM allocated to a request from a given Userbase. Thus, when a request is received from a Userbase, if an entry for the given Userbase exists in the hash map and if the particular VM is available, then there is no need to run the VM allocation algorithm again, as a result, it saves a significant amount of time. Then they explained their proposed algorithm related study, they used CloudAnalyst to study and analyze the proposed algorithm. CloudAnalyst is a cloud simulation tool that supports visual modeling and the simulation of large-scale applications that are deployed on Cloud Infrastructure. CloudAnalyst is built on CloudSim. after that they presented the pseudo code for their proposed algorithm. The second last part of the paper is the full description of the experimental setup to implement and run the existing algorithm(Round Robin algorithm) and the proposed algorithm.In the last section of the paper, authors compare both results and compared the results to prove the efficiency of their proposed algorithm over existing algorithm. By the simulation result, we get that, the proposed algorithm decrease the response time and processing time for the distributed Datacenters.

Paper[7], a very good paper to understand the fundamentals of load balancing and working of Virtual machines. Virtual Machines(VMs)is an execution unit that acts as a foundation for Cloud Computing Technology They proposed their new algorithm, Improved Weighted Round Robin method, As the title of the paper() indicating the focus of the authors are on non-preemptive task. Non-preemptive scheduling is a type of scheduling discipline in which a running process cannot be interrupted by any other process. In this paper the author has the main field of interest is Round robin and weighted round robin algorithm because these algorithms are using the concept of non-preemptive scheduling .but these two algorithms have their drawbacks as in Round-Robin algorithm every task gets a pre-defined time quantum ,and task has to finish within that time quantum or to wait for remaining all task to finish in that time quantum, till its turn come again, regardless of the facts as length of the task ,resource capability, resource's priority .last two drawbacks of the Round Robin are removed by Weighted Round Robin but it has its own drawbacks, it failed to consider the length of the tasks to select the appropriate VM . Whereas in the proposed algorithm, the authors are considering the length of the task to select the appropriate VM by the help of some mathematical formula and a detailed Algorithm.

In the second part of the paper, the authors presented the related work as the review of various paper to bring out their thoughts to a working algorithm.

The third part of the paper is focused on the description of load balancing concept and mathematical formulas to achieve it .then they explained about round robin and weighted round-round algorithms to find out their shortcomings. On the basis of those shortcomings, they proposed their algorithm. After that authors presented the model of their proposed algorithm. Then the Experimental results and Performance Analysis of the proposed algorithm done, which is used to show the efficiency of the proposed algorithm over round robin and weighted round robin algorithm. The heart and soul of the paper is response time, which is taken as the QoS parameter, achieved by improved weighted round robin technique proposed by authors.

In this paper[8], In this paper [1], authors, first of all, described the cloud computing system and their component. They gave brief information of load balancing algorithms. The main attraction of the paper is the proposed load balancing algorithm, based on the traditional Round Robin algorithm. Authors proposed their algorithms with a new concept of assigning a different time slot to individual process based on their priorities This load balancing algorithms increase the throughput, maximum resource utilization.

Paper[9] based on the Round Robin Scheduling policy. To understand the proper working of the Round-Robin(RR) scheduling technique for VM, basic knowledge of the scheduling Algorithm is very important. The performance of a scheduling algorithm depends upon the scheduling criteria, Turnaround time, Waiting Time, Response Time, CPU utilization and throughput. A good Scheduling algorithm is which provides maximum CPU utilization & throughput, Minimum response time and waiting Time and Turnaround Time. In this paper authors proposed a new scheduling Algorithm Dynamic Average Burst Round Robin(DABRR), Their work is based on the average burst time taken as the time quantum. When some process is completed, then the remaining burst time of the uncompleted task is calculated and then calculate the average burst time, which is again used as the time quantum. The drawback of the proposed algorithm is that the process, whose burst time is less than the average burst time have to wait unnecessarily for their turn.

Paper[10], In this paper authors, provided a comprehensive overview of interactive load balancing algorithms in the cloud computing environment. Authors discussed in detail about most of the Static and dynamic load balancing algorithms. Round-Robin, Opportunistic Load Balancing(OLB)+ Load Balancing Min-Max(LBMM), Max-Min algorithm are the example of Static Load Balancing Strategy. In Dynamic Load Balancing, through this paper, we came to know about Honey bee Algorithm, Ant Colony Algorithm, Carton etc. The pros and cons of the aforementioned algorithm are point wise explained by the authors. Fairness, performance, overhead, throughput, fault tolerance, resources utilization, speed, complexity and response time are the main factors to compare the efficiency of the algorithms. And through these comparisons we reached this result, that static algorithm is good for load distribution means the load is equally distributed to all available resources but they are not faulted tolerant. The min-min algorithm has a fast response time, high throughput and less complexity but not fair to load balance .honey Bee has high throughput , fast speed, high resources utilization but not suitable for equal load distribution. Ant Colony has high throughput, high resource utilization, no complexity but high Response Time is its drawback.

Paper[11], In this paper the author present a survey of the current load balancing algorithms developed specifically to suit the cloud computing environment They provide an introduction to those aforementioned algorithms and their properties. The main Attraction of the paper is the challenges faced by load balancing algorithms. Those are:

Spatial Distribution of the cloud Nodes:
Most of the Algorithm is work on the closely located nodes or nodes which are located to very near to each other with minimum communication delays. This is a challenge to develop a load balancing algorithm that works successfully on the spatially distributed nodes.

Storage/Replica problem:
The second challenge is the storage problem. In the case of full replication all the nodes have a replica of the data, so the more storage space is required. So it is a challenge to develop a load balancing algorithm which maintains both replica limits and storage capacity.

Algorithm Complexity:
As much as low the complexity of an algorithm, it is easy to understand it and use it. But it is very tough to get a very low complexity algorithm at the cost of high performance .when we reduce the complexity by changing any factor, due to change in the other depending factor again the complexity increased.

Point of Failure:
In the centralized system, if the central controller is failed, then the whole working of the system is stopped, This is known as Single point of failure. Any Load balancing algorithm must be designed in order to overcome this Single point of failure challenge. Distributed load balancing algorithms seem to provide a better approach, yet distributed load balancing algorithms are much more complex than centralize algorithms and require more coordination for communication.

Then in the third part of the paper authors reviewed the static and dynamic load balancing algorithm by a literature review of the reference papers .and in the next part they presented the pros & cons and comparison of the predefined load balancing Algorithm. The main attraction of the paper is the proposed load balancing algorithm, which is a load balancing algorithm based on dual direction downloading algorithm from FTP servers (DD FTP).In this algorithm a file of n size is divided in to two parts n/2 and is allocated to two servers, and the first server starts downloading the file from 0 blocks to an incremental way and the other server start downloading the file from n block to decremented order .in this way both servers do their work independent manner and give the response to the clients in as soon as possible. when both the server reached at two consecutive blocks, the work is assumed to finish .and a new task is allocated to the servers .this technique is very time efficient and gave better performance to the client.

After the comparisons between all reviewed algorithms, the author reached the result is that DD FTP algorithm is best in all manners. Paper[12], The first part of the paper is a wide introduction of cloud concept with the subheading Cloud Computing Architecture, Cloud Computing Deployment Model & Services Model(IaaS, PaaS, SaaS).Then they come to the concept of Load Balancing. There are many types of Load Balancing as memory load, CPU load, Network Load, Delay load and many more. The main attraction of the paper is that the authors described very deeply the key challenges and issues that affect the performance of load Balancing techniques. These are those Challenges and Issues.

- Virtual machine migration
- Energy Management
- Stored Data Management
- Spatial Distribution of the Cloud nodes.
- The emergence of a small different DataCenter for cloud computing
- Storage and Replication
- Algorithm Complexity
- Point of Failure Controlling

In this paper[13], Authors first of all introduced CloudSim then they discussed about cloud system's components as Datacenter, cloudlet , host, VM and CloudSim Simulator .then they described about the load balancing Algorithms as Round Robin and Throttled ,and then they wrote about their proposed load Balancing Algorithm which is somewhat different from the existing two above mentioned algorithms .in the existing algorithms, if any request comes to the datacenter ,then datacenter assigned the new request to the free host and if there is no free host, then the request forward towards another Datacenter, but in proposed algorithm when any datacenter assigned any request to host and were not any free host, then instead of forwarding the request to another datacenter, they check any host with maximum processor and once it free, request is assigned to it. The proposed algorithm is implemented in the Java language with CloudSim simulator and its result is compared with the existing Round Robin load balancing algorithm. The results proved the efficiency of the proposed algorithm.

This paper[14] is the milestone paper to understand the importance and working of CloudSim. The authors of the paper are also the developer of the CloudSim toolkit. In this paper, the author gave basic knowledge of cloud computing and then tell us the reason due to which the concept of cloud computing came into existence. Before some time the only scientist has the capability to develop cloud-related services and test them to check their performance of that service again and again, as we know the area of the cloud is very wide but what about the beginners, who has no such big infrastructure and platform to build and test new invented Algorithms. With the help of CloudSim toolkit, we can easily develop and check our new algorithm and software. These are the main advantages of the CloudSim:

1) Flexibility and applicability
2) Time Effectiveness

After a brief discussion about the cloud, computing author gave the background details of the cloud computing as the service model, deployment model with the help of the layered aspect of cloud computing architecture. The authors describe the federation of cloud or cloud federation. Cloud federation is the practice of interconnecting the cloud computing environments of two or more service provider for the purpose to reduce the load balancing traffic. Then the authors discuss the key component of the federation architecture, cloud coordinator and its responsibilities They also give some idea about the content delivery network(CDN). After the background study of the cloud, the author comes on the Grid Computing .and compare CloudSim over grid based Simulator, grids , SimGrid, OptorSim, and GrandSim. Although the aforementioned Grid Simulator is a very good simulator, none of them are able to clearly isolate the multi-layer service abstraction. They also informed us about open Cirrus, a global Cloud Computing test bed offered by Yahoo and HP .then the core concept of cloud computing came in light .in the third section of the paper, here the authors described the layered CloudSim architecture. The CloudSim simulation layer describes the modelling and simulation of virtualized cloud-based datacenter environment including dedicated management interfaces for VMs, memory, storage, and bandwidth. The main working of this layer based on provisioning of the host to VMs, application execution management and keep eyes on dynamic system state. Part 3 of the paper fully described CloudSim under these subheadings.

Modelling the cloud:

how a cloud is built with the help of the datacenter host, virtual machine and many more Here, the VM policy stands for the operations control policies related to VM life cycle such as provisioning of a host to a VM, VM creation, VM destruction, a VM migration. Similarly, one or more application services.VM allocation (provisioning) [7] is the process of creating VM instances on hosts that match the typical characteristics (storage, memory), configurations techniques (software environment), and requirements of the SaaS provider.

Modelling the network behaviour:

The quality of services provided by the cloud is affected by the network topologies to connect the simulated these cloud entities host, storage and end-user.

The fourth section of this paper is based on the Design and implementation of CloudSim, In this part, Authors described Cloudlet, Datacenter, host, VMs. Datacenter Characteristics, Host, Network Topology, Ram Provisions, SAN Storage, Sensor, VM, VMs Allocation Policy, VM Scheduler. This part is the soul of the paper through which we came to know about designing and implementation of CloudSim.

In the last part of the paper, they did some experiment on CloudSim and showed the result based on some features and mathematical formulas. The core aspect of the paper is the development and utilization of CloudSim toolkit.

[15]. With the help of the paper [14], we came to know about the CloudSim and its working, but this paper is also a very useful paper from the aspect of my proposed algorithm, In this paper, Authors have proposed the code for simulation. The hardware and software setup for their experiment is as follows: To evaluate the performance of Cloud, results were simulated in Window 7 basic (64-bit), i3 Processor, 370 M Processor, 2.40 GHz of speed with the memory of 3 GB and the language used is Java. The first code of Simulation is tested on one DataCenter with one Host and run on one Cloudlet. The main Steps of the Coding are:

1) Initialize the CloudSim Package
2) Initialize the CloudSim Library
3) Create DataCenter
4) Create Broker
5) Create Virtual Machine(VM)
6) Virtual Machine Description
7) Add the VM to the VmList
8) Submit VmList to the broker
9) Creation of Cloudlets
10) Cloudlet properties
11) Add the cloudlet list to the Broker
12) Start Simulation
13) Final Step: Print the result when Simulation is over.

With the help of the above discussed coding Steps, I got the guidance for my Proposed algorithm.

10. Conclusion

With the help of Cloud Computing, it is easy to build software or use of software with the minimal effort and at a reduced cost because cloud computing provides services at each level in the form of service models. Virtualization And Load balancing are the core concept of cloud computing. Virtualization is used to serve unlimited users in the parallel way to fulfil their requirements in the form of VMs and Load balancing is used to maximize the utilization of VM's resources .users satisfaction is the main aim of Cloud computing. There are many existing load balancing algorithms are in cloud computing environment but every algorithm has their pros & cons. My proposed Algorithm is based on two main points the first one is the distance between the datacenter to host and the second one is the time quantum for the round-robin algorithm among the VMs. I will use CloudSim simulator to prove the efficiency of my proposed algorithm over some aforementioned existing algorithms.

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