Round Robin Approach for VM Load Balancing Algorithm in Cloud Computing Environment

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Abstract:- Cloud computing is a new emerging trend in computer technology that has influenced every other entity in the entire industry, whether it is in the public sector or private sector with the advance feature of the cloud there are new possibility opening up how application can be built and how different servic es can be offered to the end user through Virtualization, on the internet. Considering the growing importance of cloud finding new way to improve cloud services is an area of concern and research focus. In available Virtual Machine Load Balancing policies limitation of cloud is that they don't save the state of the previous allocation of virtual machine to a request from the user and the VM Load Balancing algorithm require execution each time a new request for VM allocation received from user. This problem can be resolve by developing an efficient VM load balancing algorithm for using Round Robin approach.

Keywords- Virtual Machine, CloudSim, Datacentre, VM Load Balancer, Round Robin Virtual Machine Load Balancing Algorithms.

I. INTRODUCTION

The virtualization forms the foundation of cloud technology where virtualization is an emerging technology that separate computing function and technology implementation from physical hardware. Cloud computing is the virtualization of computer program through the internet connection rather than installing application on everywhere. Using virtualization user can access server or storage without knowing specific oe storage detail. Virtualization can be applied to many types of computer resources: Infrastructure such as storage, network, computer (as CPU, memory), platform (such as Linux, windows OS), and software as a services.
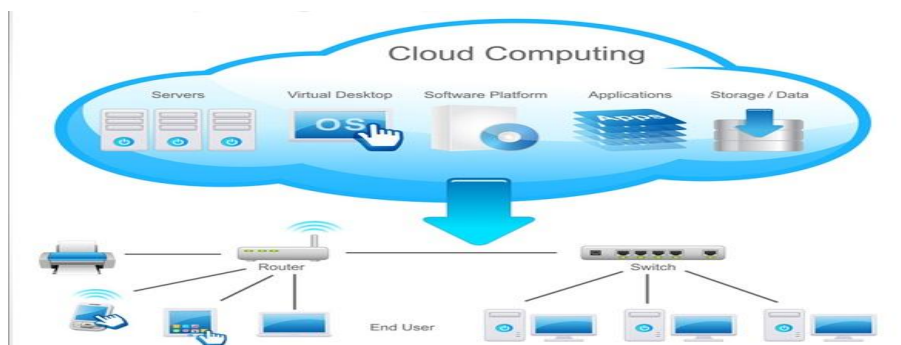

Fig 1: Virtualization of Cloud Computing

Cloud computing is the most recent emerging epitome to turn the vision of "computing utilities" into a real world. Cloud computing is an emerging technology with advance feature that focuses on the way in which we design computing system, develop application and building software with advancement. It is based on dynamic provisioning concepts, which is applied on the services, also to compute capability, storage, networking & Information Technology (IT) infrastructure. In cloud computing resources are made available through the Internet and offered on a pay-per-use basis in anywhere from Cloud computing service broker.

II. Cloud Computing Environment

Cloud computing provides their offers according to several models:

- Infrastructure as a Service (IaaS),
- Platform as a Services (PaaS),
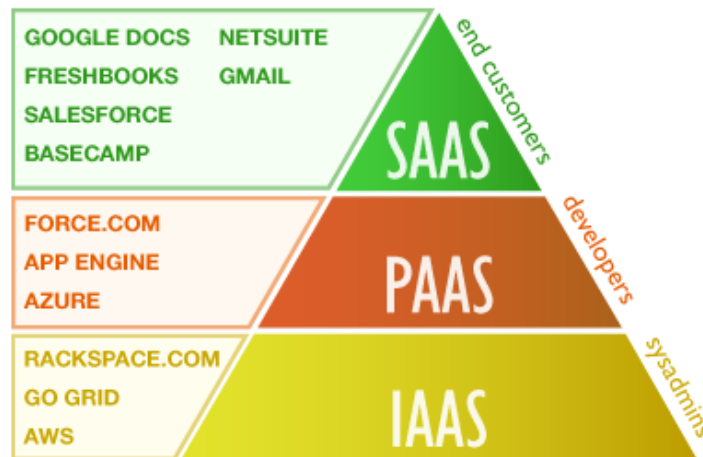- Software as a Services (SaaS)

Fig 2: Cloud Computing Environment

    a.   <u>Infrastructure as a services (IaaS). In IaaS grids clusters</u>, virtualized server, its computational resources- CPU's, memory, network, storage and system software are delivered as a services. Perhaps the best known example is Amazon's Elastic Computer Cloud (EC2) and Simple Storage Service's (S3) which provides (managed and scalable) resources as services to the user.

    b.   <u>Platform as a Services (PaaS)</u> typically makes use of dedicated API's to control the behaviour of a server hosting engine which executes and replicates the execution according to user request eg. force.com, Google App Engine.

    c.   <u>Software as a Services (SaaS)</u> standard application software functionality is offered within a cloud. Eg. Google Docs, SAP Bossiness by design Load Balancing is one of prerequisites to utilize the full resource of parallel and distributed systems.

In IaaS, the physical resources can be split into a number of logical slices called Virtual Machine (VM's). All VM Load Balancing methods are designed to determine which Virtual Machine is assigned to the next cloudlet task units. These VM are modelled using different tools Cloudsim- Simulation framework for its allocation to the application.

III.   CloudSim- A Simulation Toolkit

Cloudsim is a framework which enables modelling and simulation and experimenting on designing Cloud computing infrastructure. Cloudsim toolkit is developed in the GRIDS laboratory at the University of Melbourne. Cloudsim is a self-contained platform which can be used to model data centres, hosts, service brokers, scheduling and allocation policies of a large scaled cloud platform. CloudSim framework is built on the top of layer in GridSim framework. Hence CloudSim is used to model datacentres, hosts, VM's for experimenting in simulated cloud environment. In this paper we introduced a new VM Load balancing algorithm: "Round Robin Load Balancing Algorithm" to handle service request from user base.

IV.   Load Balancing

Load Balancing is a method to distribute workload on the multiple computers or a computer cluster through network links to achieve optimal resource utilization for maximizing throughput and minimizing overall response time. Load Balancing is used for avoiding too much overload on the resources and dividing the traffic between servers and data. Data can be sent and received without maximum delay. Load Balancing is used for minimizing the total waiting time of the resources. In cloud computing load balancing are uses for balancing the load on virtual machine and cloud resources.
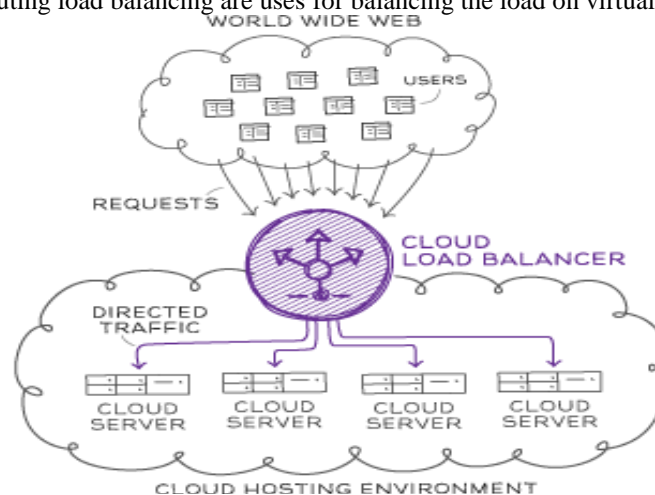

Fig 3: Cloud load balancer

V.   Modelling the VM Allocation

Cloud computing infrastructure is the massive deployment of virtualization tools and techniques as it has an extra layer i.e. virtualization layer which acts as execution, creation, management, and hosting for application services. The modelled VM's in the above virtual machine environment are contextually isolated but still they need to share computing resources-processing cores, system but etc. Hence, the amount of hardware resources available to each VM is constrained by the total processing power. Central processing unit, memory, storage and system bandwidth available within the host, that is optimal for an application.

CloudSim supports Virtual machine allocation at two levels

- Host level- in this level it specifies that how much overall processing power of each core will be assigned to each VM, known as VM allocation policy.
- VM level- the VM assign a fixed amount of the available processing power to the individual application service (task unit) that are hosted within its execution engine, known as VM Scheduling.

Note that at each level CloudSim implements the time shared and space shared provisioning policies. In this paper, we have proposed the Round Robin VM Load Balancing at the VM level where individuals application services is assigned varying amount of the available processing power of virtual machine.

VI.   Existing Scheduling Algorithm in Cloud Computing

Virtual machine enables the abstraction of an OS and Application running on it from hardware. The interior hardware infrastructure services interrelated to the Clouds is modelled in the Cloudsim simulator by a Datacentres element for handling service requests. These request are application element within VM's which need to be allocated a share of processing power on Datacentre's hosts, components. Datacentres object manages the data centre management activities such as VM creation and destruction and does the routing of user request received from user base to the VM's. The data centre controller uses a VmLoadBalancer to determine which virtual machine should be assigned to the next request of VM for processing. There are three types of VmLoadBalancer that is Round Robin, Throttled and active monitoring load balancing algorithms.

- a. **Round Robin Load Balancer-** It is one of the simplest scheduling technique that utilize the principle of time slices. Here the time is divided into multiple slices and each node is given a particular time slice or time interval i.e. it utilizes the principle of time scheduling. Each node is given a quantum and its operation. The resources of the service provider are provided to the requesting client on the basis of time slice.
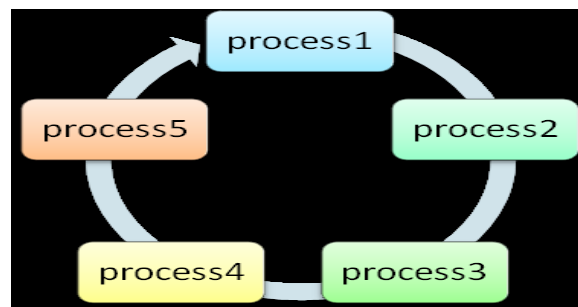

Fig 4: Round Robin Load Balancer

- b. **Throttled Load Balancer (TLB)-** This algorithm ensure that pre-defined number of cloudlets are allocated to a single VM at any given time. If there are more request groups are present than the number of available VM's at data centre allocate incoming request in queue basis until the next VM becomes available.
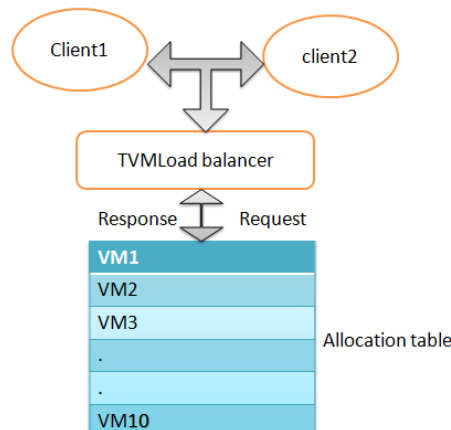- c.

Fig 5: Throttled Load Balancer

d. **Active Monitoring Load Balancer (AMLB)-** The Active Monitoring Load Balancer maintains information about each VM's and the number of request currently allocated to which VM when a request is allocate a new VM arrives. If there are more than one VM, the first identified is selected AMLB returns the VM id to the data centres controller. The data centres controller send the request to the VM identified by that id. The data centre controller notifies the AMLB to new allocation and cloudlets is sent to it.
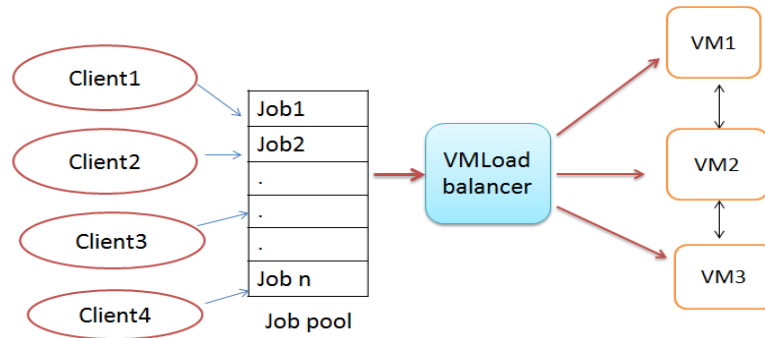

Fig 6: Active Monitoring Load Balancer

VII.   The Proposed Algorithm- Round Robin VM Load Balancing.

The proposed algorithm is an improvement over the Round Robin VM Load Balancing algorithm. The Round Robin algorithm does not save the state of previous allocation of a VM to a request from a given user base while the same state is saved in RR VM load balancer.

The Round Robin VM Load balancer maintain two data structure which is discussed below.

- Hash Map- in which it stores the entry for the last VM allocated to a request from a given user base.
- VM State List- this stores the allocation status (i.e. busy available) of each VM.

ALGORITHM is-

```
Round_Robin_Load_Balancing ()
{
Initialize all the VM allocation status to AVAILABLE in the VM state list;
Initialize hash map with no entries;
While(new request are recived by the Data Centre Controller)
Do {
    Data Center Controller queue the requests;
    Data Centre Controller removes a request from the beginning of the queue;
    If(hash map contain any entry of a VM corresponding to the current requesting user base
&& VM allocation status == AVAILABLE)
    {
     The VM is reallocated to the user base request;
    }
    Else
    {
     Allocate a VM to the user base request using Round Robin Algorithm;
     Update the entry of the user base and the VM in the hash map and the VM state list;
    }
  }
}
```

VIII.   Experimental Setup

Proposed algorithm is implemented with the help of simulation package like Cloudsim and cloudsim based tool. Java language is used for implementing VM load balancing algorithm.

We assume that the cloudsim toolkit has been deployed in one data centre having 5 virtual machines (with 1024 Mb of memory in each VM running on physical host with 1000 MIPS) where the parameter values are as under.

Table 1- Parameter Values

Parameter	Values
VM image size	10,000
VM memory	512 MB
VM bandwidth	1000
Data Centre- Architecture	X86
Data Centre- OS	Linux

Data Centre- VMM	Xen
Data Centre- No of machines	5
Data Centre- memory per machines	2048 Mb
Data Centre- storage per machines	10,000 Mb
Data Centre- available BW per machines	1000
Data Centre- no. of processor per machines	5
Data Centre- VM policy	Time Shared
Service Broker Policy	Optimise Response Time

IX.   Result Analysis

The proposed algorithm (i.e. the Round Robin Load Balancer Algorithm) implemented for simulation. Java language is used for implementing VM load balancing algorithm. Table 3 shows the result based on Round Robin VM Load Balancing algorithm for overall response time of the cloud. In this min(ms) time, max (ms) time to different number of virtual machines are analysed. Table 4 shows the result based on Round Robin VM Load Balancing algorithm for Data Centre processing time of the cloud. In this min (ms) time, max(ms) time to different number of virtual machines are analysed.

Table 3- For overall response time for Round Robin Load Balancing

No. of VM's	Avg(ms)	Min (ms)	Max (ms)
5	300.06	237.06	369.12
10	300.4	237.06	369.12
15	300.5	237.06	369.12
20	300.7	237.4	370.02
25	300.9	237.4	370.02

Table 4- For Data Centre processing time for Round Robin Load Balancing

No. of VM's	Avg (ms)	Min (ms)	Max (ms)
5	0.34	0.02	0.61
10	0.51	0.02	1.51
15	0.85	0.02	1.51
20	1.04	0.06	1.51
25	1.21	0.11	1.51

Analysed result shows that Round Robin Load Balancing consumes less time for overall response time and data centre processing time over Round Robin method. When number of virtual machine are increases then it takes more time for over all response time and data centre processing time. It decrease the problem of deadlock and server overflow in cloud environment by the new service broker policy in virtual machine that is Round Robin VM load balancing algorithm.
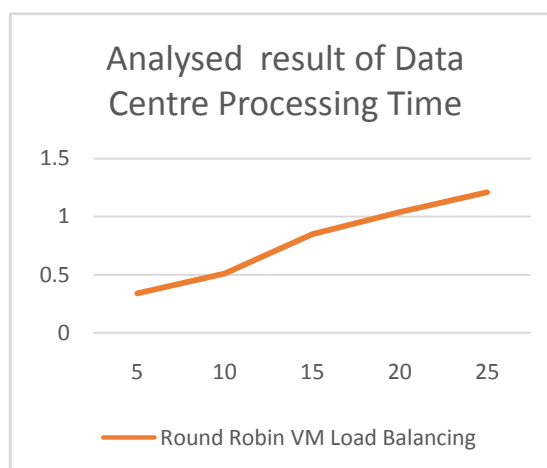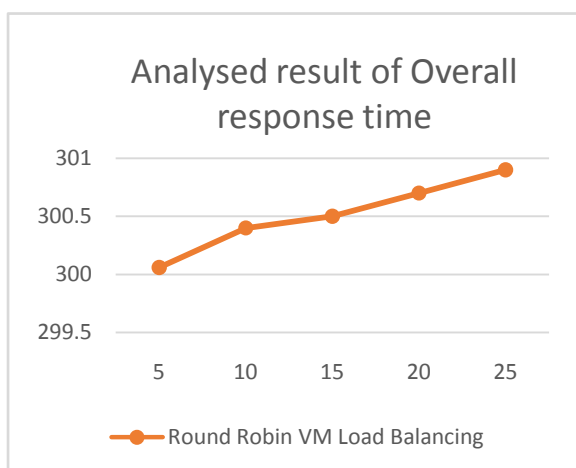
X.   Conclusion

A virtual machine is a virtual form of computer hardware within software. Virtual machine is a software implementation that executes programs as if they were actual physical machines. We also gives the detailed review on existing scheduling algorithm. The proposed Round Robin VM Load Balancing and existing Round Robin algorithm implemented Java language for implementing VM scheduling algorithm in CloudSim toolkit. Assuming the application is deployed in one data centres having virtual machine (with 2048 Mb of memory in each VM running on physical

processor capable of speed of 1000 MIPS). These experimental results shows that Round Robin VM Load Balancing method improves the performance by consuming less time for scheduling virtual machine.

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