# A novel approach for task scheduling in cloud

R. Vijayalakshmi, Mrs. Soma Prathibha
Department of Information Technology
Sri Sairam Engineering College
Chennai, India
vijayalakshmi289@gmail.com, somaprathi25@gmail.com

***Abstract*—Cloud computing is a popular computing paradigm which enables delivery of on-demand services over the internet. A cloud environment consists of multiple customers requesting for the available resources. Cloud vendors who offer Infrastructure as a Service should enable efficient management of the available resources. Proper scheduling in cloud enables the selection of best suitable resources for task execution. In the present scenario, allocating the resources efficiently is a challenging job. Service providers need to ensure that their resources are utilized properly. A new scheduling algorithm is proposed to address the challenge of task scheduling in cloud. The user tasks are prioritized. Based on the priority, the tasks are assigned to the Virtual Machines. The task with highest priority is assigned to a Virtual Machine with highest processing power. The proposed model is simulated using the CloudSim toolkit. The experimental results reveal that the proposed model results in lower execution time as the resources are allocated more efficiently.**

***Keywords— Task scheduling, Virtual Machines, priority, CloudSim, execution time.***

## I. INTRODUCTION

In the current scenario, cloud computing[1] has grabbed the attention of the IT industry. Cloud is an environment where a large number of systems are connected through a network, to provide dynamically scalable infrastructure for application, data and file storage. Today, more number of organizations benefit from cloud computing to host their applications. It eliminates the need to invest in new IT infrastructure[2] that includes network, computers, software and database administrators. It expels the need to create new Datacenters and manage them, thereby saving a huge amount of cost. It improves accessibility since any user can access the services from anywhere. The customers of cloud computing need not have to own the infrastructure and hence need not care about their maintenance. Cloud computing uses a pay-as-you-use scheme in which resources are provided on-demand by cloud vendors[3]. Some cloud vendors include Amazon, Microsoft, IBM and so on. The various services provided by the cloud vendors can be broadly classified as Infrastructure as a Service, Platform as a Service and Software as a Service. Some of the characteristics that a cloud vendor must consider while providing services are shown in Fig.1.

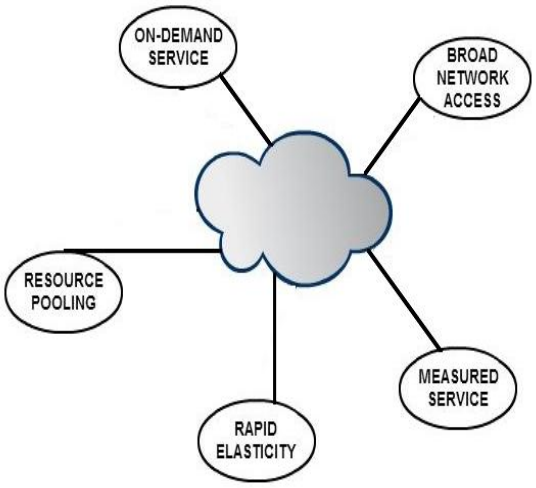


Fig. 1. Characteristics of cloud

## II. SCHEDULING IN CLOUD

Scheduling of resources[4][5] is considered very much essential in cloud computing. In general, task scheduling is the process of mapping the tasks to available resources in cloud, based on their characteristics. Appropriate scheduling results in efficient utilization of the available resources. Scheduling in cloud can be categorized into the following stages:

### *A. Resource discovering and filtering*

The Datacenter Broker discovers all the resources present in the network system and collects the status information related to them.

### *B. Resource selection*

The target resource is selected based on certain parameters of the task and the resource.

### *C. Task submission*

The task is submitted to the resource that is selected.

## III. CLOUDSIM

CloudSim[6] is a simulation toolkit that provides support for modeling and simulation of virtualized cloud-based Datacenter environments, including management of memory, virtual machines, bandwidth, storage etc. It has a virtualization engine that helps in the creation and management of independent, multiple virtualized services. It supports dynamic creation of different kinds of entities. Infrastructure as a Service(IaaS)[7][8][9] can be simulated by extending the Datacenter entity of CloudSim. The Datacenter manages large number of Hosts. The Hosts are assigned one or more Virtual Machines(VMs) based on VMAllocation policy. Cloudlets are allocated to VMs based on scheduling policies defined by the Cloudlet Scheduler.

### A. Features

- CloudSim supports modeling and simulation of large-scale cloud computing environment, including Datacenters, Hosts etc.
- It also supports modeling and simulation of user-defined allocation policies.
- It also supports simulation of network connections using network topology.

Using CloudSim, industry-based developers and researches can focus on specific system design issues[10] that they want to investigate, rather than considering the lower level details about the cloud-based services and infrastructure.

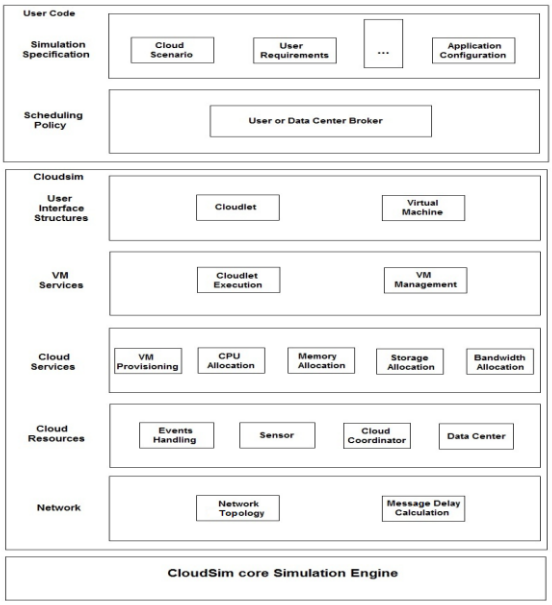


Fig. 2. CloudSim Architecture

The following classes of the CloudSim architecture, shown in Fig. 2, are mainly used in our proposed work.

### B. Major classes used

*1) Cloudlet:* This class models the cloud-based application services such as business workflow, social networking and so on. Cloudlets may also be referred to as tasks.

*2) CloudletScheduler:* This class implements different allocation policies that determine the sharing of processing power among cloudlets in a virtual machine.

*3) Host:* This class models a physical resource such as a computer or storage server. It encapsulates information such as amount of memory and storage, processing cores, policies for allocation of memory and bandwidth to virtual machines.

*4) Virtual Machines:* This class models a virtual machine. This virtual machine is created on a cloud Host component.

*5) VMAllocationpolicy:* This class determines the policy for allocating VMs to Hosts based on various criteria. The main functionality of this class is to select a Host in the Datacenter that meets the requirements for deployment of the virtual machine.

*6) Datacenter:* This class models the core infrastructure level services offered by the cloud service providers. It encapsulates a set of Hosts that can either be homogeneous or heterogeneous.

*7) DatacenterBroker:* This class is responsible for mediating between cloud service providers and users. It identifies the suitable service providers and allocates the resources in such a way that the users QoS requirements are met.

### C. Modeling the allocation of cloudlet to VM

The key aspect of cloud computing infrastructure is the deployment of various virtualization technologies and tools. Cloudlets can be allocated to VMs[11] using the following steps:

- Cloud users submit Cloudlets and request for VMs.
- The Cloudlet list and the VM request list are passed on to the Datacenter Broker.
- The DatacenterBroker uses the CloudletScheduler for scheduling the Cloudlets and the VMAllocationpolicy is used for allocation of VMs to hosts.

Fig. 3 shows how Cloudlets are allocated to VMs in cloud.

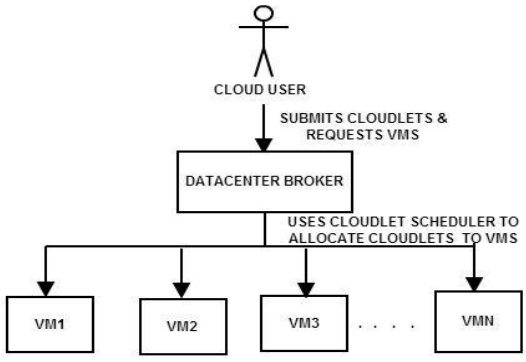


Fig. 3. Allocation of Cloudlets to VM

## IV. EXISTING MODEL

The existing algorithm for allocation of Cloudlets to VMs is FCFS(First Come First Served)[12]. The tasks are allocated to the virtual machines in the order in which they arrive.

FCFS Virtual Machine allocation policy works as follows:

- Cloud users submit Cloudlets and request for Virtual machines.
- The Cloudlet list and the VM request list are passed on to the Datacenter Broker.
- The DatacenterBroker uses CloudletScheduler to schedule Cloudlets.
- If this VM is free, Cloudlet will be sent to this VM.
- If not, Cloudlet will be sent to the next free VM.
- The VM list is then passed on to the VMAllocationPolicy for placement of VM on the Host.
- The Hosts will be created on Datacenters.

Fig. 4 shows the flowchart for allocation of cloudlets to VMs using First Come First Served algorithm.

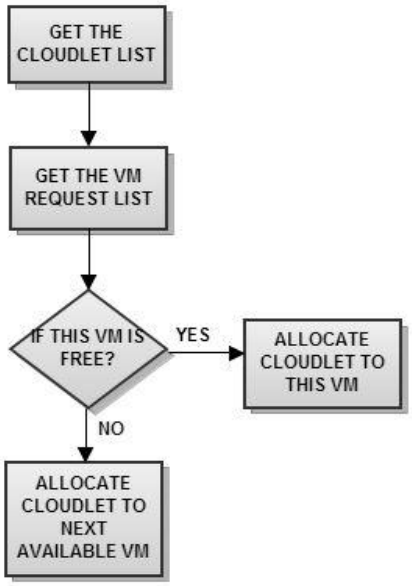


Fig. 4. Flowchart describing allocation of cloudlets to VMs using First Come First served algorithm

The main drawback of the existing model is that the Cloudlets are assigned to the VMs[13] as and when they arrive. This increases the completion time of the jobs. The user cannot prioritize the tasks for execution in the Virtual machines. These drawbacks can be overcome by the proposed model.

## V. PROPOSED MODEL

In the proposed model, Cloudlets are assigned to VMs based on priority. Some work have already been done for scheduling virtual machines to Hosts[14] based on priority in cloud. Our work focuses on scheduling tasks to the virtual machines based on priority. When the cloud user submits the tasks, the tasks are prioritized. Based on the priority, the tasks are allocated to the virtual machines. The task with highest priority is assigned to the virtual machine with largest processing power. The steps are as follows:

- Cloud users submit Cloudlets, along with priority and request for Virtual machines.
- The Cloudlet list and the VM request list are passed on to the DatacenterBroker.
- The Cloudlet list is sorted such that the Cloudlet of highest priority appears first.
- The VM request list is sorted in decreasing order of the processing power.
- The DatacenterBroker uses CloudletScheduler to schedule Cloudlets.
- The cloudlets are allocated to the VMs based on priority.
- The Cloudlet with highest priority is assigned to the VM with largest processing power.
- The VM list is then passed to VMAllocationPolicy for the placement of VM on the Host.
- The Hosts will be created on Datacenters.

Fig. 5 shows the flowchart for allocation of cloudlets to VMs using the proposed algorithm.

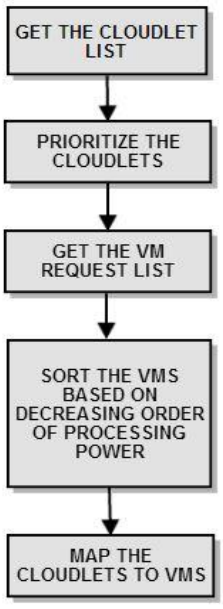


Fig. 5. Flowchart describing allocation of cloudlets to VMs using proposed algorithm

### A. *Algorithm for allocating Cloudlets to VMs using the proposed model*

*Input:* Cloudlet list and VM request list
*Output:* Cloudlets mapped to VMs.

*Get* the cloudlets along with priority.

```
for each cloudlet in the cloudletlist do
  begin
    if this.cloudletpriority<next.cloudletpriority then
          store this.cloudletpriority in a temporary variable
          swap  cloudletpriority
    end
    if this.propower<next.propower then
          store this.propower in a temporary variable
          swap propower
    end
  end
```

Map the cloudlets to corresponding VMs.

## VI. SIMULATION RESULTS

The proposed model is simulated in CloudSim using java programming language. The major benefit of simulation-based approach is that it allows cloud developers to test the performance of various scheduling policies in a controllable environment, before these policies are actually deployed in real cloud. This enables the developers to rectify their faults at an earlier stage. The existing and the proposed algorithms are tested for their efficiency by creating fifteen Virtual Machines which run on six Hosts. Each VM and Host is given specific characteristics like processing capability, storage, bandwidth and so on. The Hosts run on two Datacenters. The algorithms are tested by varying the number of Cloudlets. In the proposed algorithm, each cloudlet is given a specific priority. Based on the priority, the cloudlet will be allocated to the virtual machines. The execution time of the Cloudlets is found using the existing model and the proposed model. The results are tabulated in Table I.

TABLE I. EXECUTION TIME OF CLOUDLETS

| **Number of Cloudlets** | **Execution Time (seconds)** | |
|---|---|---|
| | ***Existing model*** | ***Proposed model*** |
| 25 | 14.12 | 11.2 |
| 50 | 19.31 | 14.67 |
| 75 | 26.17 | 17.61 |
| 100 | 32.77 | 20.68 |

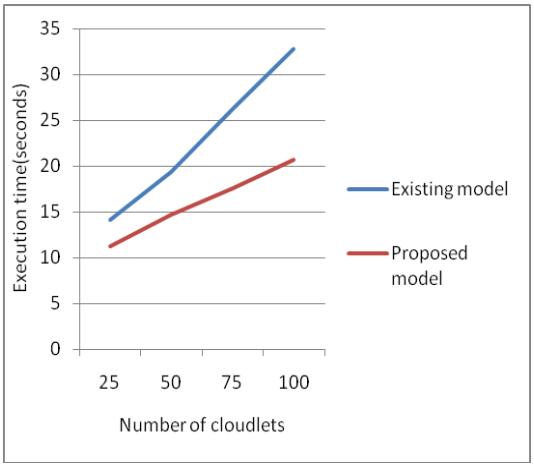


Fig. 6. Comparison of execution time of cloudlets using existing and proposed models

Fig. 6 shows the comparison of execution time of cloudlets using existing and proposed models. It is seen that if the Cloudlets are assigned to VMs using the proposed model, the execution time is very less.

## VII. CONCLUSION AND FUTURE WORK

Cloud is a collection of interconnected and virtualized computer resources that are dynamically provided, based on service level agreements, established by negotiation between service providers and customers. It allows workloads to be deployed by the creation of virtual machines on Hosts(physical machines) which are located at remote places. Allocation of available resources[15] to user tasks is an important issue. In this paper, the problem of scheduling of tasks[16] to virtual machines has been addressed. The cloud user prioritizes the tasks. The tasks are sent to the VMs based on priority. The simulation results show that by using the proposed system, there is a decrease in the execution time. This decrease in execution time would in turn benefit the cloud users. In future, we plan to implement this algorithm in a real-time cloud environment so that the cloud users would benefit from decreased execution time. We also plan to implement new scheduling policies for efficient allocation of Hosts to Datacenters.

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