Priority Based Resource Scheduling Algorithhm in CloudSim

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Abstract: ***With the continuous development of internet, the individuals and big organizations are finding new ways to reduce the cost of implementation, storage or communication. Cloud computing is a technology which provides secured and efficient services. Cloud Computing is a service which provides everything as a service to the consumer. It is "pay as per use" service. Cloud Computing provides services such as Software as a Service (SaaS), Platform as a service (PaaS) and Infrastructure as a service(IaaS). Infrastructure as a Service (IaaS) is one of the service delivery model in which storage or computational resources, network and database resources to the consumers or users. To host an application in cloud environment requires complex composition and deployment, and to evaluate the implemented model in repeated manner is very tedious and costly process. So simulation tools like CloudSim are used to model cloud computing systems and application environment. In this paper a new scheduling algorithm is proposed so that the virtual to real deployment would be easier and accurate.***

Keywords: Cloud Sim, Cloud Computing, Middleware, Resource Monitoring, Application scheduling.

1. Introduction

Cloud computing is a web service which provides everything to the user as a service. Cloud computing provides three types of service delivery models, these are- Software as a service(SaaS), platform as a service(PaaS) and Infrastructure as a service(IaaS).

The order in which work is performed in the computer system is called scheduling. Cloud computing is a parallel and distributed environment so the job scheduling is a very difficult task. In the cloud computing job may be distributed among more than one virtual machine so it is difficult to determine the job completion time. Virtual processing units are assigned to each virtual machine. The virtual processing units can share the queue from physical CPU or a separate queue can be used for each physical CPU. The CPU schedulers are usually classified as true-share Schedulers and Proportional schedulers [1].

In Proportional scheduler the CPU is allocated in a proportion manner to the virtual machines. It cannot be called as fair scheduler. A fare scheduler is a scheduler that allocates the available resources to the virtual machines in time divided form based on actual usage, which can be measured by eyeing on scheduling for a long time. If the CPU is shared between two clients in equal manner then based on weight of the active client, CPU will be allocated by proportional scheduling. One client can't interfere the other and can't ask for its resources even if it is not using it. But in the true-share scheduling if one client is inactive then we can utilize the free resources for the other clients.

Simulators like CloudSim are better alternative for development of cloud environment. These tools enable a developer to implement his proposed architecture in a controlled manner without setting up the whole physical environment which is very costly. It provides lots of benefits to IT companies or an individual who wants to deploy his services through cloud. CloudSim has the following important properties [2]:

1) It helps to model and simulate the data center, Cloud computing environments.
2) It provides a self-contained platform for modeling Clouds, service brokers, provisioning, and allocation policies.
3) It provides support for simulation of network connections among the simulated system resources.
4) It provides facility for simulation of federated Cloud environment that inter-networks resources.

These features show that CloudSim aids to develop the cloud environments and it uses sequential algorithms [1] like FCFS to allocate the resources. This sequential way may not match with the real world requirements because there are different types of requirement in the real world that must be categorized and allocation should be done based on different categories. So there is need to refine the algorithm and architecture of CloudSim so that every experiment using this simulator can be compared directly to the physical set up of cloud environment. By doing this the cost and time of cloud implementation can be reduced.

2. Related History

To develop high performance computing system for scientific applications Grids are developed as infrastructure. Many Grid simulators like GridSim [3], GangSim[4], SimGrid [5] etc. are developed to support the experimental works for the Grid environment. GridSim is a toolkit for development virtual resources and organizations which are Grid based. GridSim is based also on event driven technique and it is helpful for resources which are heterogeneous. It gives support to model the users, network, machines and other grid related tasks and resources.

As described above there are many toolkits are available for modeling and simulating Grid applications and environment. But no one of the Grid simulator is able to model the service delivery models (SaaS, PaaS, IaaS) in the cloud computing because of the multi-level abstraction. We can say that in the existing Grid simulators there is no support for modeling resource and entities that are based on virtualization. In the

cloud computing services are delivered in the form of pay as per usage service for any delivery model. So the cloud based simulator should have proper mechanism to evaluate economic entities, these are called cloud brokers. This helps to visualize real time values during the physical implementation of cloud environment.

As cloud computing technology is still immature and under development, a large number of experiments and modifications are needed to make it mature and establish. There are already some architecture are developed for CloudSim but some changes in architecture will help in modeling of cloud environment more effectively.

3. Existing Framework

CloudSim is one of the simulation toolkit for modeling the cloud resources and environment in an effective manner so that simulation can be deployed very easily in the real world. CloudSim is multi-layered advance architecture. Other simulators for modeling cloud environment are iCanCloud [9], SimProject [10], CloudReports etc. but we are concentrating on CloudSim.

The simulation layer of CloudSim provides help for modeling the data centers which are virtualized and cloud based. Along with this it provides interface for bandwidth, Virtual Machines and storage. The basic tasks like allocating hosts to virtual machines, monitoring the execution of application and managing the dynamic state of the system are taken care by this layer [2]. An individual who wants to make his own allocating schemes and wants to monitor all the scheduling policies, have to monitor this layer only. By extending the root strategies of VM allocation, this type of implementation can be done. A set of VMs can be allocated parallel by the cloud provider in order to execute application based on standards of SaaS provider. The study of the performance and monitoring workload can also be done an application developer using this tool. The first layer in this tool is User Syntax which shows the basic entities like machines, functionality, tasks, specification, requirements, users, type of application and the scheduling policy of the brokers. A number of activities can be performed by a cloud developer by extending the basic units of this layer. The activities are:

1) The request of distribution of workload and configuration of an application can be generated and mixed.
2) Based on the different properties many test can be performed and availability of the cloud can be modeled.
3) Customized application monitoring functions can be implemented for clouds.

There is need of standard tools, applications and methods that can model the cloud environment efficiently because cloud computing is still under development. So based on increasing need, in the near future many studies and research will be done to strengthen the techniques, algorithms and standards.

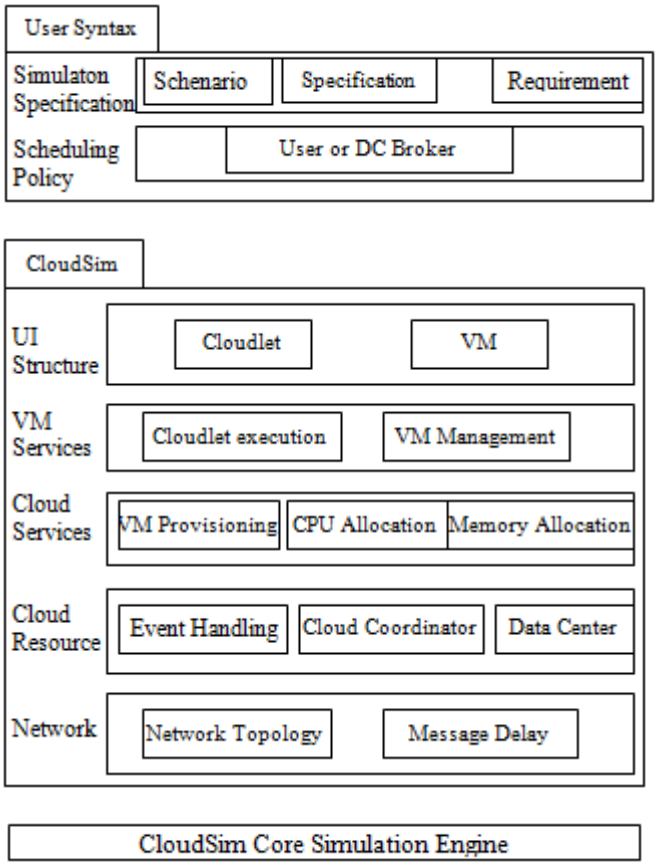

Figure 1: CloudSim Architecture

Figure 1 describes the overall architecture of CloudSim. It is divided into two major parts- user syntax and CloudSim. In the CloudSim layer, user interface, VM services, Cloud services, Cloud resource and network are defined as different modules. Using the data center in the CloudSim IaaS can be implemented. A number of hosts are managed by data center. The hosts are allocated to the VMs according to the scheduling policies of the service provider [7].

Virtual machines are creates using VM allocation policy and it is configured based on the requirements (storage, memory, environment etc.) that are needed by a host. A custom application service model can be developed by using CloudSim that can be implemented on VM and main Cloudlet entities are extended to deploy the application service. There is no limitation on any service model by the CloudSim if any user wants to create its own policy. The developed services are allocated to VMs based on the allocation or scheduling rules developed or defined by the cloud provider. In the data center allocation of VMs to the application based on its requirement is done by VM allocation policy. Based on new requirements in current generation and near future this part can be modified by researchers and scholars to produce an optimal result. This is the part of architecture which can be modified to get required results. VM allocation policy uses direct First Come First Serve (FCFS) to allocate the hosts to the VMs. Several hardware features like amount of memory, CPU cores etc. are taken into consideration while allocating the resources.

4. Proposed Framework

Cloud computing is a "pay as per usage" service. It is not easy to deploy the simulated work directly to the real world because cloud services are layered services and it takes additional scenarios also into consideration. For example when we are providing a service as cloud, we have several tasks that have higher priorities and needed to be finish first and there will be some other tasks which are defined earlier and needed to be performed according to the scheduled time. These are the scenarios that differs the simulated work with the real world.

In the CloudSim simulation toolkit, the VMs are created and allocated in FCFS manner based on the requirement of the hosts. The proposed architecture is given as figure 2.

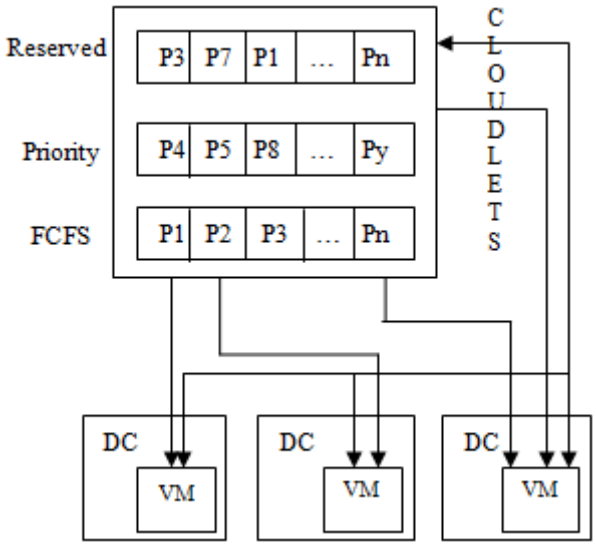

Figure 2: CloudLets Division

To map the simulation in real world more effectively first divide the cloudlets into different types of jobs. Based on that assign the VMs to the hosts and for this assignment we need to use priority scheduling rather than FCFS scheduling in data center's scheduling algorithm [8]. There are some entities that are needed to take care while making changes in scheduling algorithm. The algorithm is to be change in three parts of the data center code that is given as a pseudo code here-

Pseudo Code for resource scheduling

1. If (cloudlet_list == empty)
2. New cloudlet_list = cloudlet(id, name, length, file size, priority) ;
3. If (priority == 0)
4. {
5. Q_fcfs[] = Cloudlet$_i$;
6. }
7. Elseif (priority == 1)
8. {
9. Q_priority[] = Cloudlet$_i$;
10. }
11. Else {Q_reserve = Cloudlet$_i$;}
12. DataCenterScheduler = get_cloudlet_List();
13. If ((cloudlet_property <= VM_property) &&(priority== high))
14. {
15. bindcloudletToVm(cloudlet_id, vm_id);
16. }
17. Else {wait || create new vm || suspend_current_proc;} //if possible
18. If (cloudlet_work== over && vm == free)
19. {
20. Destroy_vm(id);
21. }
22. Repeat step 1 to 20 till all requests completed.
23. endif.

In this way priority scheduling helps in deployment of cloud environment as hypotheses during experiment or simulation and thus helps to save large amount of money and time for the organizations and researchers [6].

5. Conclusion

Recently many efforts have been done to develop cloud technology and many techniques have been presented to make it more efficient. CloudSim has been developed to help the researcher and organization to evaluate their experimental model before deployment in the real world. If the deployment is different from what we hypotheses then it causes heavy cost and implementation time. So in this paper simulation strategy is defined in real world manner so that the experiment what is being executed using CloudSim can be deployed directly in the cloud environment. If the simulation and actual cloud environment will be similar approximately then it will save lots of money and time of researchers and organizations. As the cloud development has increased rapidly it is came out of several results that data centers are taking very heavy energy (electric consumption) to operate, so further research is needed to add power consumption value in the simulators like CloudSim so that during simulation we would be able to guess the power and expense load.

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