On Demand VM Modeling using Cloud Computing

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Abstract: Cloud Computing paradigm is most popular because of its exist ability for provisioning resources quickly and efficiently. In cloud computing the resource requests are served by creating virtual machines of the requested specification on the underlying physical infrastructure. If the placement of virtual machines to the underlying physical machines will take long time or if all the accepted virtual machine requests can't be served then some exist ability will lost. In on demand access to cloud computing services the requested resources are served on the available infrastructure for short span of time. In on-demand access the number of resource requests in a particular time interval can not be predicted unlike in case of spot-market access. As a virtual machine instance will run on a single physical machine at a time, hence to serve more requests in case of on-demand access we have to use the available resource optimally considering the allocation cost and SLA violation. In this work we tried to improve the resource utilization by considering single dimensional best _t strategy, which not only reduce the cost by utilizing minimum number of resources but also minimize the SLA violation which may arise due to failure in allocating all the requested virtual machine. We have developed a framework that optimizes the use of physical infrastructure by effectively allocating the requested virtual machines and also reduces the allocation time. The proposed allocation policy is compared with three other existing policies named Greedy First Fit, Ranking and Round-Robin, by simulating all policies using CloudSim toolkit and the performance is evaluated by considering various parameters.

Keywords: **Cloud Computing, Virtual Machine Placement, Resource Allocation, Resource Utilization, Virtual Machine scheduling, Minimizing Resource Usages, Minimizing SLA Violation, On-demand Access.**

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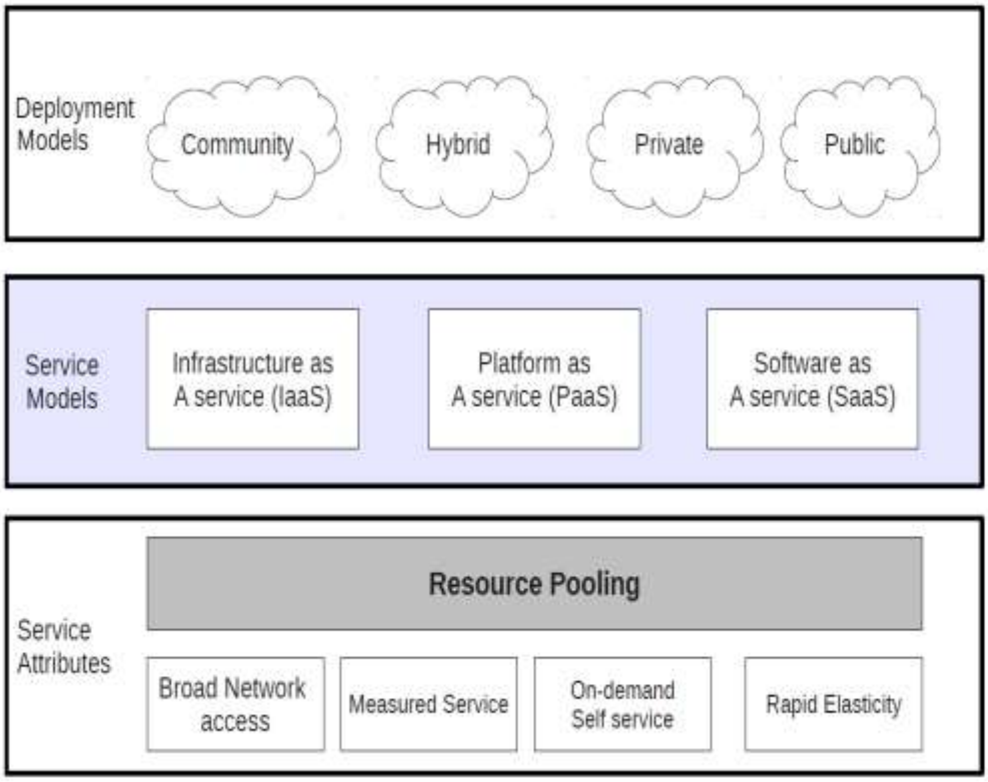
1. Introduction

There is plenty of dialogue of what cloud computing is. The US National Institute of Standards and Technologies (NIST) has place a shot in process cloud computing. According to NIST [5] Cloud computing is a model for convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. The above definition is often explained brief as, network access in on-demand basic and in a very convenient manner along with less effort from management and less service provider's interaction explains quick and straight forward access for potential resources. With resources in a shared pool, illustrates the supply of computing resources from a cloud service provider are combined in a one massive assortment, for serving all users. The frequent provisioning of resources is employed for quickly matching the active resources, once a necessities comes for those resources. This frequent and quick provisioning prevents a scarcity of computing power once the requirement will increase.

Cloud computing takes the technology, services, and applications that are almost like those on the Internet and turns them into a self-service utility. The use of the word cloud makes relevancy to two essential ideas:

1. **Abstraction**: Cloud computing abstracts the complexity of system implementation from developers and users. Applications run on physical systems that aren't nominative, data is hold on in locations that are unknown, administration of system is outsourced to others, and access by users is present.

2. **Virtualization**: Cloud computing virtualizes system by pooling and sharing resources. Systems and storage may be provisioned as required from centralized infrastructure, multi-tenancy is enabled, prices are assessed on metered basis, and resources are ascendible with lissomeness.



The NIST model of cloud computing

2. Categorization of VM placement algorithms

The placement algorithms may be loosely classified into 2 classes on the basis of their placement goal.

- Power primarily based approach
- Application QOS primarily based approach

2.1 Power primarily based approach

The necessity of power management has become progressively evident in computing environments. The necessity for power management is driven by 2 factors:

1. The increasing demands on power by each computing and cooling resources during operation of a data center.
2. The rising price of power.

The main aim of those approaches is to map virtual machines to physical machines in such the way, in order that the servers may be utilized to their most potency, and therefore the different servers may be either hibernated or clean up looking on load conditions.

2.2 Application QOS primarily based approach

These algorithms manage the mapping of virtual machines onto physical hosts with the aim of maximizing the standard of service (QOS) delivered. By endlessly observance virtual machine activity and using advanced policies for dynamic workload placement, such algorithms will cause higher utilization of resources eventually resulting in savings in price.

Greedy First Fit Algorithm For placement of a virtual machine on the underlying host Eucalyptus and Nimbus uses Greedy First fit algorithm [27]. In First fit Greedy strategy whichever node that can run the virtual machine found first is selected as the host for virtual machine placement [28]. This algorithms takes virtual machine request and requirement as input and produce the resource number in which to place the resource as output. The detail steps for Greedy first fit placement policy is delineated in Algorithm 2 .

Algorithm Greedy First Fit Algorithm

1: Procedure Allocate VM(VM_{List})
2: i←1;
3: while $VM_{List} \neq \phi$ do
4: HostId ←GreedyAlgo($Host_{List}$, Requirement);
5: $Host_{HostId}$←VM_i;
6: i←i+1;
7: end while
8: end procedure

1: procedure GreedyAlgo (HostList , Requirement)
2: for i = 1 to n do □ **n is the number of physical host**
3: if $Host_i$ Satisfies the Requirements then;
4: Return $Host_i$;
5: else
6: Continue;
7: end if
8: end for
9: end procedure

Experiment-1:

Table 5.1: Experiment-1 Host memory specification

Host	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10
Memory In (MB)	2048	1024	2048	512	1024	1024	512	2048	1024	512

Table 5.2: Experiment-1 VM request memory specification

VM	VM1	VM2	VM3	VM4	VM5	VM6	VM7	VM8	VM9	VM10
Memory In (MB)	256	2048	1024	512	1024	256	512	1024	512	1024

Results:

Table 5.3 shows the host machines in which the virtual machines of requested specification is created, by each placement policy.

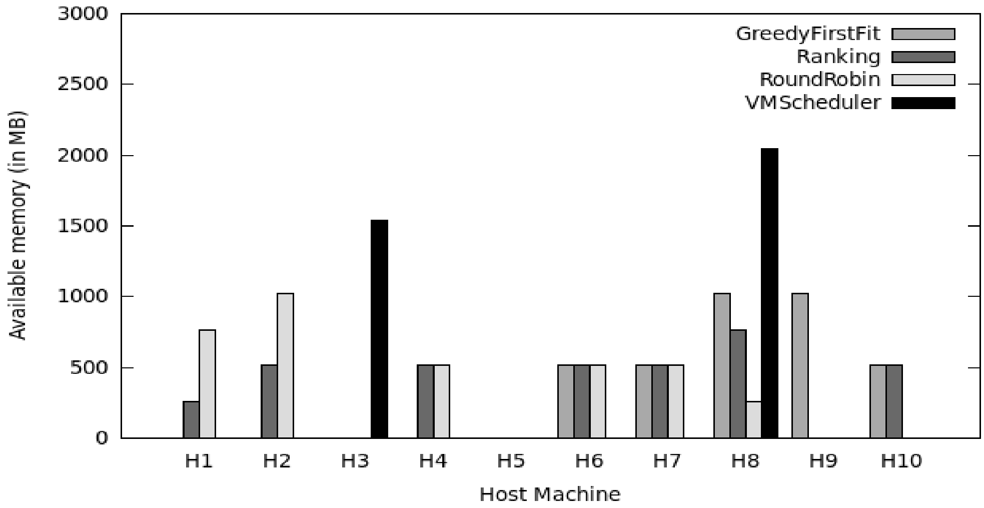


Figure 5.1: Experiment:1 Available Memory vs. Host Machine

	Greedy First Fit	Ranking	Round Robin	VM scheduler
VM1	H1	H1	H1	H3
VM2	H3	H3	H3	H1
VM3	H1	H8	H5	H2
VM4	H1	H1	H6	H4
VM5	H2	H1	H8	H5
VM6	H1	H8	H8	H3
VM7	H4	H2	H8	H7
VM8	H5	H5	H9	H6
VM9	H6	H6	H10	H10
VM10	H8	H9	H1	H9

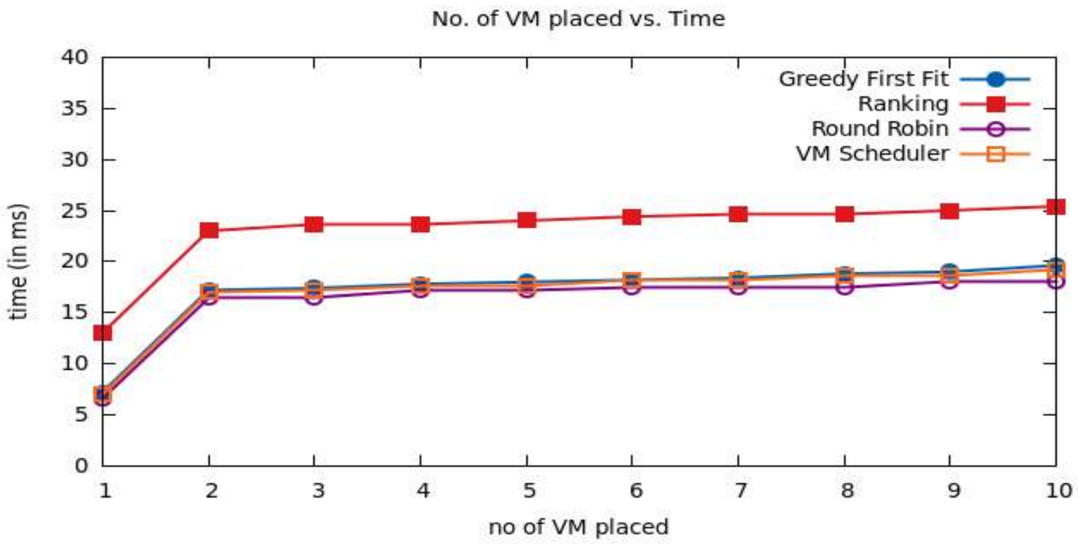


Figure 5.2: Experiment:1 Time vs. No. of VM placed

The graph in figure 5.1 shows that after allocation of all virtual machine requests, there are many small chunks of memory in different host machines in case of Greedy First Fit, Ranking and Round-Robin algorithm. But VM Scheduler utilizes all the host machines efficiently hence H3 and H8 is having two big chunks of memory which can be used to allocate two higher specification VM requests. The graph in figure 5.2 shows that when number of VM request is not large in number,Greedy First Fit, Round-Robin and VM scheduler have almost same time versus number of virtual machine placed graph, But Ranking algorithm is takes more time than the other three algorithm.

Conclusion

Virtual machine placement is an important issue in cloud computing, it is because all the requests that arrive for any infrastructure have to be served by creating virtual machines of the requested specification on the underlying physical machines. In case of On-Demand access the virtual machine requests have to served quickly for a small interval of time. In this paradigm to serve more requests at a particular time-frame, the physical machines should be used effectively i.e., the virtual machine placement policy should be good enough to minimize the number of physical machine used, considering the cost and SLA. In this thesis we discussed some virtual machine placement policies adopted by various open-source cloud computing solutions. We discussed our proposed framework for efficiently solve this problem, in which we described our proposed policy named VM Scheduler for virtual machine placement. From the results obtained it is clear that the proposed VM Scheduler is performing much better than other discussed placement policies in terms of minimizing cost, minimizing allocation time and minimizing SLA violations.

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