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On Demand VM Placement Using Cloud Infrastructure

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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 cannot 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.**

Introduction

Cloud computing is the utility computing that has unlimited virtualized resource to create a custom-built infrastructure or platform to run applications or full part services as pay-as-you-use basis. Cloud computing has modified the paradigm of system deployment [2]. The advanced system implementation are abstracted from the end user by the help of the virtualization techniques, resources are virtualized that offers an illusion of infinitely scalable and universally available system [1] [2].With the assistance of pay-as-you-use model, infinitely scalable and universally available systems, cloud computing makes the long command dream of utility computing possible. Developers having initiative concepts for providing new Internet services do not need massive expenditure to setup the hardware and software necessities. Cloud computing refers to each application that are provided as a service over the Internet and therefore the underlying hardware infrastructure and the platform over that those applications are developed. The underlying hardware infrastructure is technically called data-center, having massive vary of physical devices starting from personal computers to cluster computers to high end server machines. [3].

Cloud computing refers to a computing platform that is able to dynamically provide, configure, and reconfigure servers to address a wide range of needs, ranging from scientific research to e-commerce. While cloud computing is expanding rapidly as service used by a great many individuals and organizations internationally, policy issues related to cloud computing are not being widely discussed or considered. As this paper will demonstrate, there are a wide range of policy issues related to cloud computing that merit considerable attention as cloud computing develops into a widely used commercial enterprise; yet there has thus far been a lack of policymaking or court cases related to cloud computing. The objective of this paper is to introduce the policy concerns, research areas, and potential solutions related to cloud computing that will likely be the focus of discussion and deliberation in coming years. If these problems are considered during the developmental stages of cloud computing, perhaps they can be addressed before the consequences of non action are too significant.

Typically, the cloud computing infrastructure resides in a large data center and is managed by a third party, who provides computing resources as if it were a utility such as electricity accessible by anyone, anywhere with an Internet connection. For the “cloud provider,” this consolidation of computing resources yields many benefits deriving from centralized management and economies of scale; for the "cloud user,"1 the ability to gain rapid access to computing capacity not only reduces overall cost, but also lowers the barrier to entry for many processing-intensive activities, since it eliminates the need for upfront capital investment and the necessity of maintaining dedicated infrastructure. Through cloud computing, users transfer the burden of system management and data protection (e.g., in event of system crash or physical theft) over to the cloud provider. In addition, cloud computing provides a potential avenue by which users of handheld devices could have access to computing services.

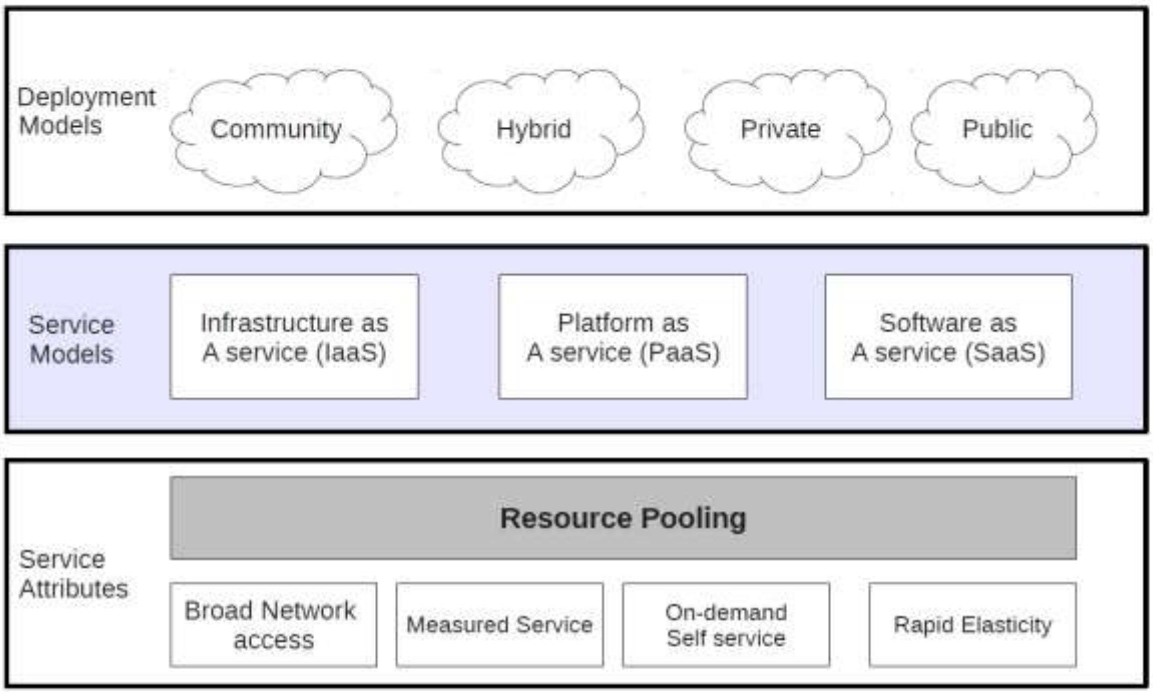

Figure 1: The NIST model of cloud computing

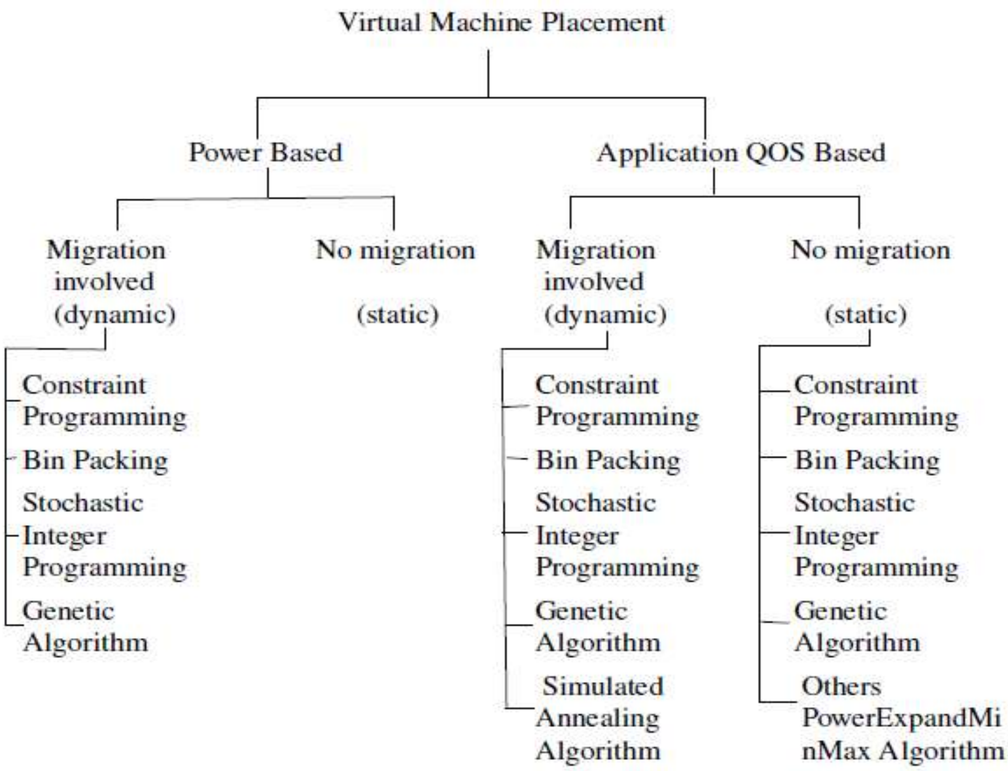

Fig. 2: Classification of VM Placement Algorithms

Round-Robin Algorithm

For placement of a virtual machine on the underlying host Eucalyptus and Nimbus also use Round-Robin algorithm [13]. Round robin records the last position of the scheduler visited. And also the scheduler starts from the last visited position next time new request(s) come(s) meantime the resources are thought of as a circular linked list [14]. 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 Round-Robin placement policy is delineated in Algorithm 3. In the above scheduling approaches, Greedy and round robin that provided by Eucalyptus and Nimbus is a random technique to pick adaptive physical resources for the VM requests that not considering maximum usage of physical resource.

Algorithm:

Procedure Allocate VM(VM_{List})
i←1;
pos←1;
while $VM_{List} \neq \Phi$ do
HostId ←RoundRobinAlgo($Host_{List}, Requirement_i, pos$);
$Host_{HostId} \leftarrow VM_i$;
i←i+1;
end while
end procedure

procedure ROUNDROBINALGO($Host_{List}$, Requirement, pos)
end ← pos;
limit← n+1;
if pos>n then
pos←1;
end if
for i=pos to limit do
if i<= n & $Host_i$ satisfies the requirements then;
Return $Host_i$;
else
if I >n then
pos ←1;
limit ←end;
else
continue;
end if
end if
end for
end procedure.

Experiment

Table 1: Experiment: Host memory specification

Host	H_{1-5}	H_{6-10}	H_{11-15}	H_{16-20}	H_{21-25}	H_{26-30}
Memory In(MB)	4096	2048	1024	4096	1024	2048

Table 2: Experiment: VM request memory specification

Host	VM_{1-10}	VM_{11-20}	VM_{21-30}	VM_{31-35}	VM_{36-40}	VM_{41-50}	VM_{51-55}
Memory In(MB)	2048	512	1024	512	1024	512	4096

The SLA violation percentage can be calculated as [100 - ($\frac{\text{deliveredservice}}{\text{requestedservice}}$ ×100)%] The graph in the figure 3 shows that even with increase in the number of requests the SLA violation with respect to single dimensional request is zero in case of VM Scheduler. And graph in figure 4 shows that with increase in number of VM requests the running time of the VM Scheduler is less than that of other three.

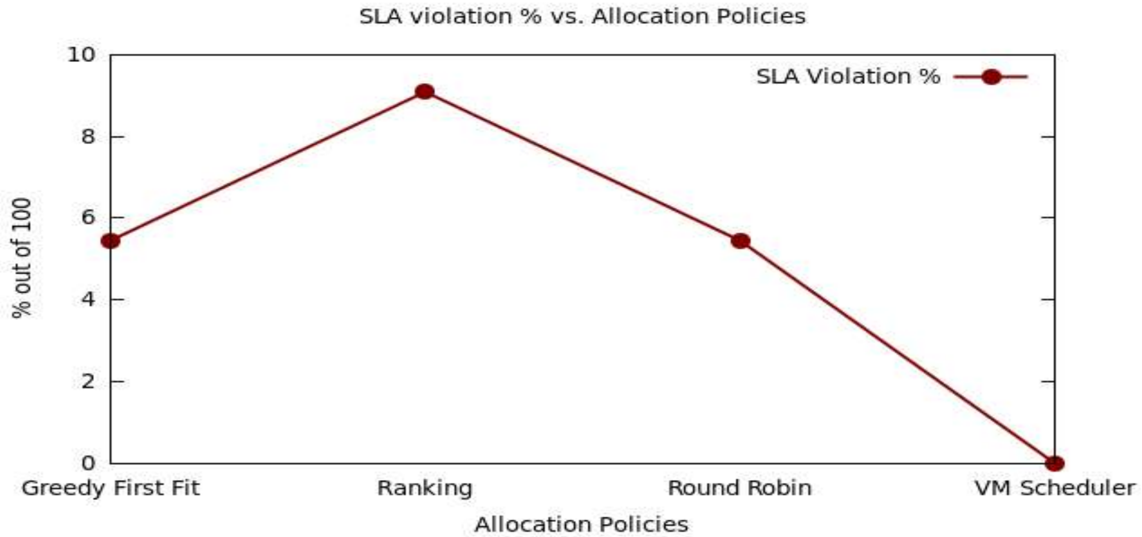

Figure 3 : SLA violation % vs. Allocation Policies

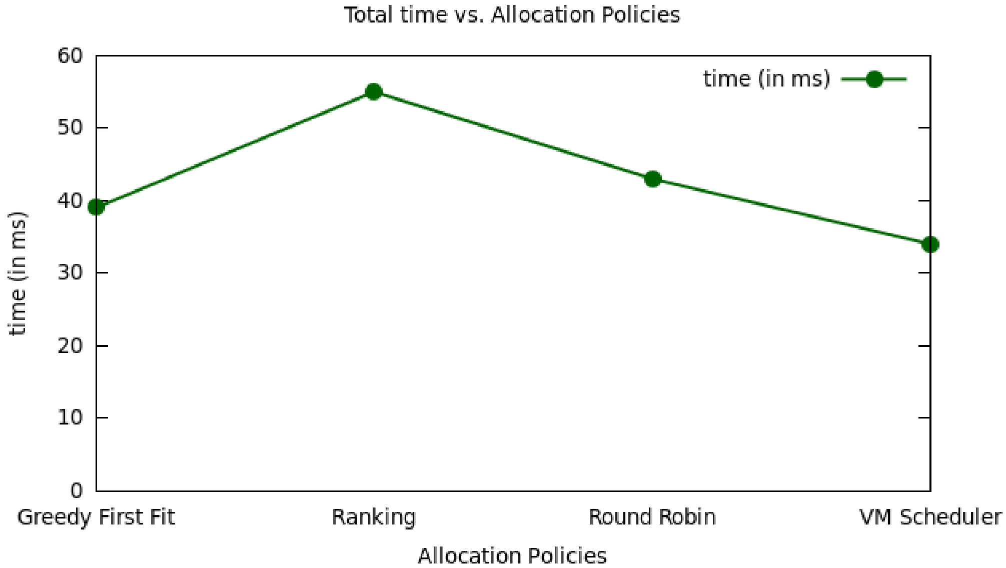

Figure 4: Experiment: Total time taken vs. Allocation Policies

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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