Virtual Machines Placement Algorithms Impacts on Targeted VMs Co-Location in the Cloud

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Introduction

In order to achieve maximum utilization of their physical infrastructure, Infrastructure as a Service (IaaS) cloud providers use virtualization to allow multiple users (tenants) to share a single physical server, ending with many tenants running their own virtual machines (VMs) and sharing the same underlying physical infrastructure, and this is called Multi-tenancy. This VMs Co-location/Co-Residency may introduce multiple threats to the cloud users [1]. In this Experiment, we propose an objective method by simulating cloud infrastructure settings and compare different VMs placement algorithms used in some of the open source public and private cloud platforms (i.e., Nimbus, OpenNebula, Eucalyptus and OpenStack) in order to understand each placement algorithm’s effects on the probability of achieving targeted VM co-location through targeted VMs co-location techniques.

Experiment Questions

- What are the effects of different VMs placement algorithms on the Co-locatability time window of each VM in the cloud? (Co-locatability window means the time in minutes in which a VM can be co-located by a new VM)
- What is the best VMs placement algorithm to minimize the possibility of achieving targeted VMs co-location?
- Do number of cloud users, number of clusters and hosts effect achieving targeted VMs co-location?

Results and Discussion

- Different VM placement algorithms have different effects on the Co-locatability window of VMs in the cloud.
- Zero Percent Co-locatable VMs forms nearly about the third of all VMs when using First Fit algorithm (Figure 3)
- The Co-locatable VMs using First Fit algorithm are the minimum when compared to Random and Next Fit policies.
- This can be the result of the (Maximum-Utilization) nature of the First Fit, which aims to use the minimum number of resources. While Random and Next Fit policies tend to distribute the load on the whole resources which adds extra rooms for new VMs to Co-locate in each server.

Method

- Design and implement a discrete-event cloud simulator, which aims to apply different settings and VM placement algorithms [2] of some of the widely used open source cloud to model and test the VM placement algorithms used in these cloud platforms and assess their effects on the probability of achieving successful targeted VMs co-location.

Conclusion

- While the number of cloud users, number of clusters and hosts have a noticeable impact on VM Co-location, VM placement algorithms that aim to maximize resource utilization (e.g. First Fit) decrease the possibility of successful VM Co-location by at least 77% compared to load-distribution algorithms (e.g. Next Fit and Random).

References