

Network management in virtual machine infrastructures

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January 10, 2010

1 Introduction

With the popularity of cloud computing on the rise there have been a number of companies that started to offer computing resources on demand. This is done using virtualized machines on physical hardware with automatic creation and destroying of the virtual machines, based on the computing needs of the customer. Currently resources like the cpu and memory are virtualized quite well, while the networking part is an aspect that hasn't got much attention.

2 Research question

The goal of this project is to get an insight in the network management and performance of present virtualization infrastructures like the Amazon EC2. Based on the data gathered and the analysis of that data suggestions will be made on how network management and quality of service can be improved using available networking technologies. The following questions paint a more specific picture of what we are trying to find out:

- Are the virtual machines logically separated from a networking point of view? Does data leak between virtual machines residing on the same local network? This would have serious security implications.
- What is the level of performance in terms of network bandwidth and latency between virtual machine instances ? Do we get best-effort performance and if yes how good or bad is the QoS?
- What is the level of performance compared to hardware based solutions?
- Is the network performance consistent over a number of instantiations of two virtual machines in the same datacenter or is it influenced by network usage by other virtual machines and the location where the virtual machines get created?
- Does the network topology change for each new pair of virtual machine instances?

3 Experimental tests

In order to find out the answer to the above research questions a suite of tests will be created that try to measure performance in an objective way and produce results that are comparable from one virtualization infrastructure to another. The first series of series of tests will be run on the Amazon EC2. The tests consist of running two virtual machine instances at a time doing the following measurements:

- response time between two VM instances
- response time between a VM instance and a server outside the virtualization infrastructure
- network throughput between two VM instances
- network throughput between a VM instance and a server outside the virtualization infrastructure
- traceroute between the two VM instances
- traceroute between a VM instance and a server outside the virtualization infrastructure
- packetloss between two VM instances
- local network scan on each VM instance to determine the level of network isolation

The measurements will be taken and recorded on a pair of instances at a time after which the two instances will be deleted. The test will be run multiple times(20 or more) and each time a new pair of instances will be created. The goal behind this is to increase the randomness of the location where the VM instances will be created which in turn will influence the following two factors:

- *distance* between the two VM instances, meaning the hop count and/or the round-trip time
- usage level of the hardware that host both VM instances

4 Approach

The first step in the project will be to make a set of tests that are formal and clearly defined. The tests should be generic in such a way that the results produced by them can be comparable from one virtual infrastructure to another, independent on the virtualization technology used.

Once the test framework is complete the tests will first run on the Amazon EC2 infrastructure, all the resulted data will be gathered and stored on the OS3 experimental server. If time allows the tests will also be done on the small Xen

infrastructure built by me at the OS3 laboratory.

In the next phase all recorded data will be analyzed and related to each other to get a clear picture on how the network performs. Finally a conclusion will be drawn and possible solutions to the problems that were found, if any, will be discussed.