Virtual Machines and Cloud Cluster

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Overview

- Installed two operating systems on one computer
- Installed two virtual machines on each operating system
- Wrote and used benchmark routines to test the performance of CPU, memory, hard drive
- Built a cloud cluster from bare metal on the Thunder supercomputer and installed virtual machines on it

Virtual Machine

- A virtual machine (VM) is a software implementation of a machine that executes a program like a physical machine.

Oracle VM VirtualBox

- It installs many different operating systems on an existing operating system such as:
  - Windows and Linux on Mac
  - Windows Server 2008 on Linux server
  - Linux on Windows PC

Why is virtualization useful?

- Operating system support
- Testing and disaster recovery
- Infrastructure consolidation
- Easier software installation

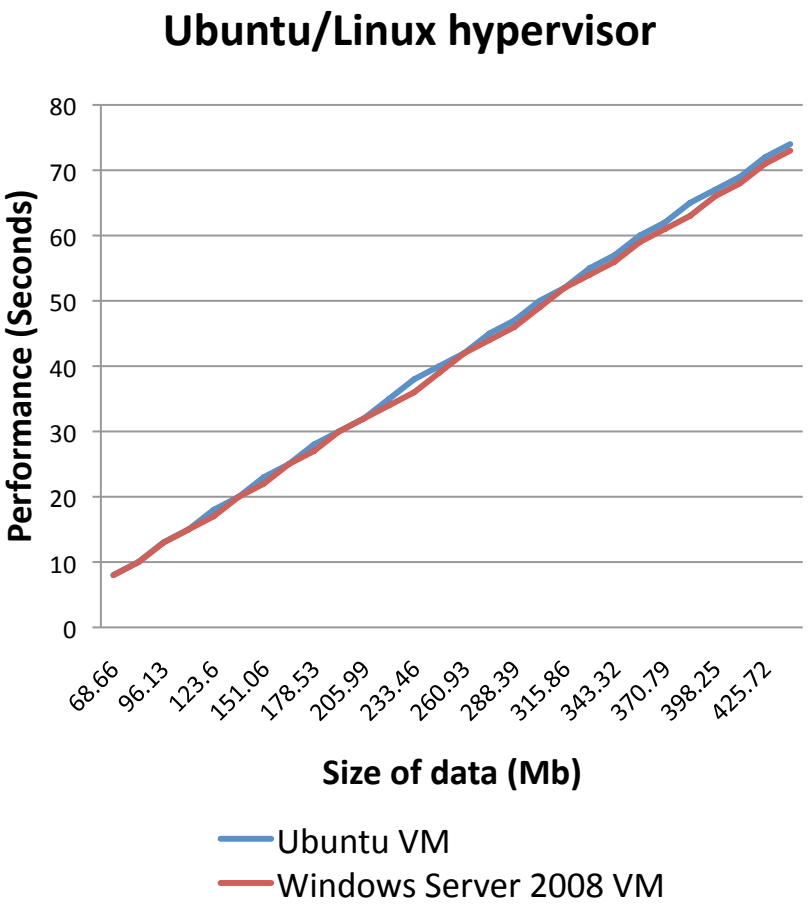
Benchmarks

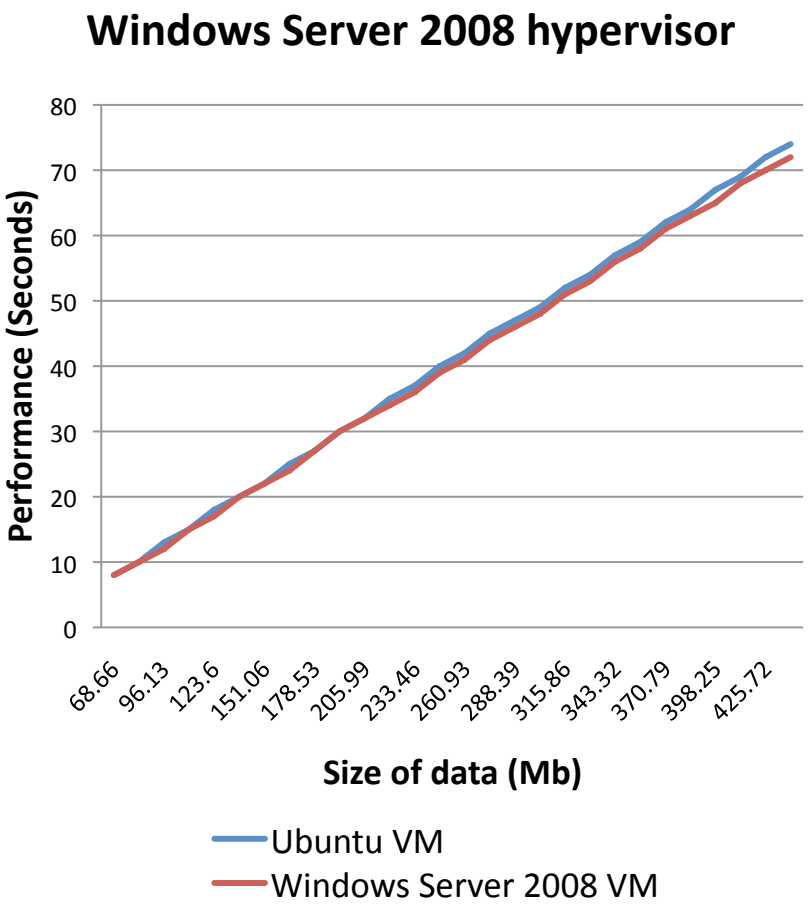
- Benchmark routines are used to measure a certain aspect of performance
  - CPU performance
  - Memory performance
  - Hard drive performance
  - Network performance

CPU Benchmark

- Test CPU performance
- The same test was used to benchmark CPU performance on both systems

CPU Performance

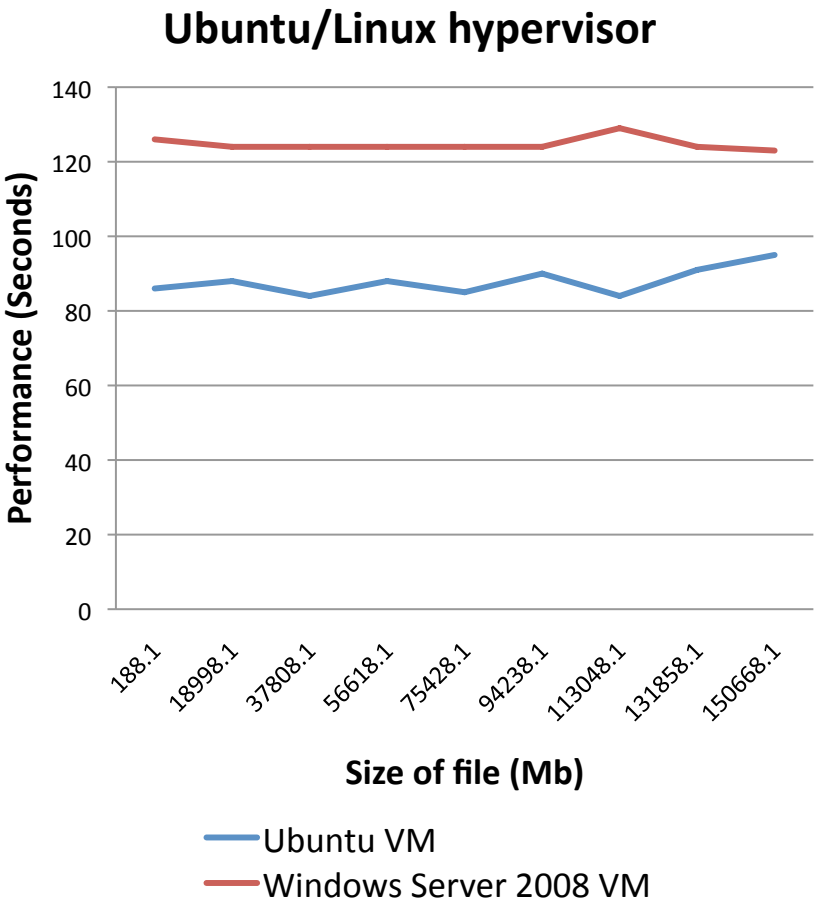


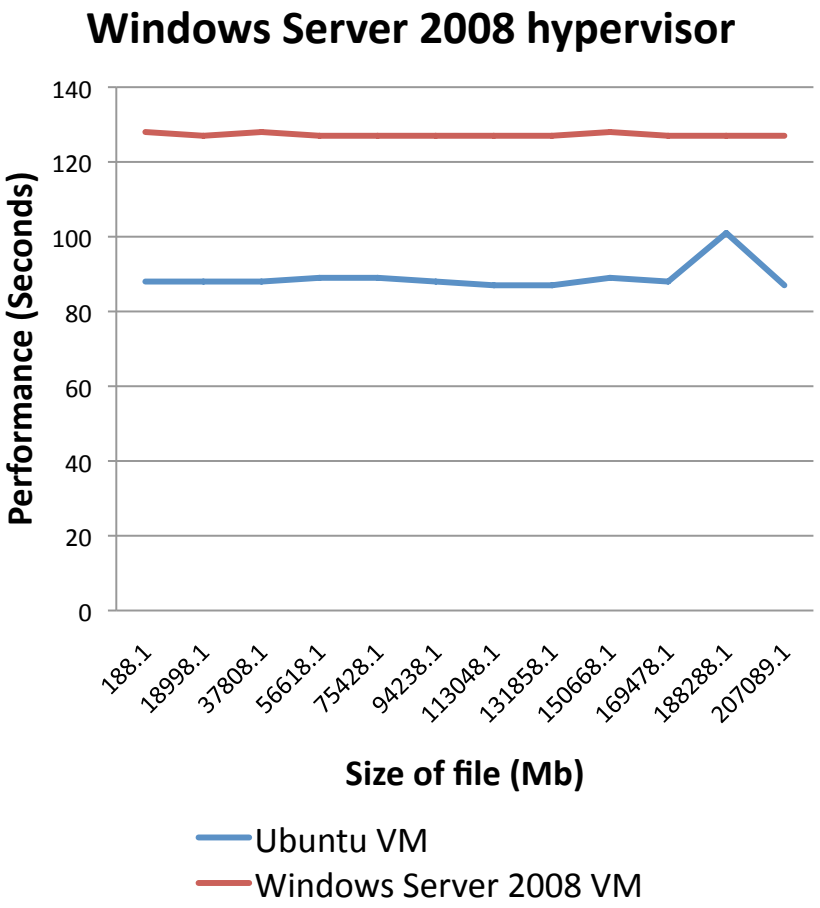


Hard Drive Benchmark

- Test hard drive performance
- The same test was used to benchmark hard drive performance on both systems

Hard Drive Performance

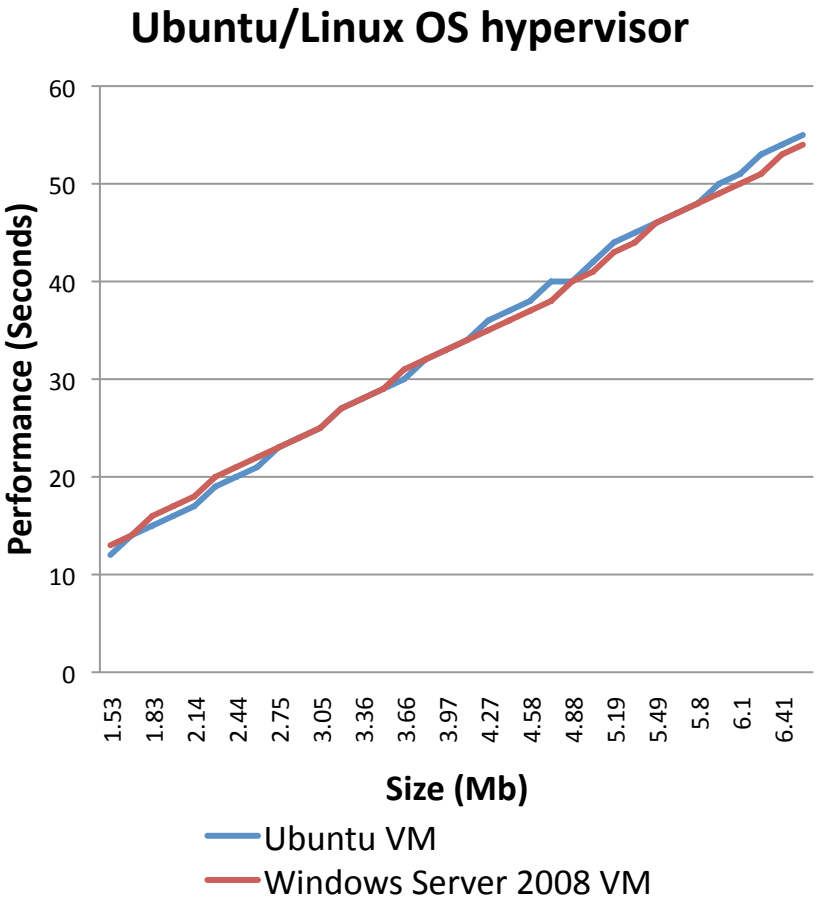


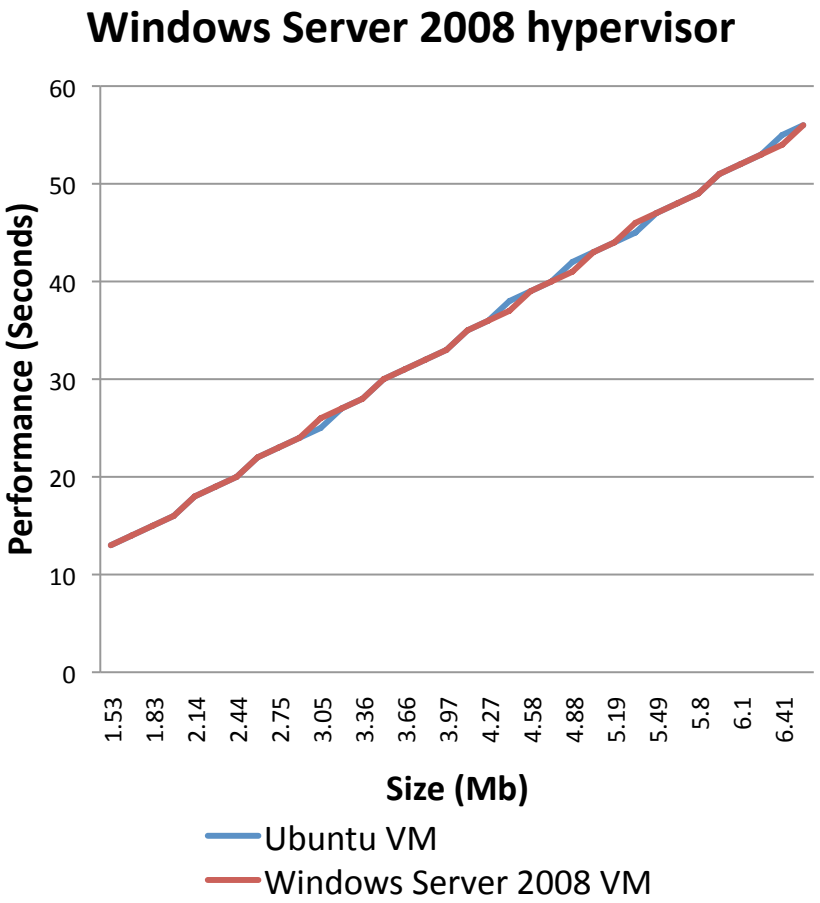


Memory Benchmark

- Test memory performance
- The same test was used to benchmark memory performance on both systems

Memory Performance

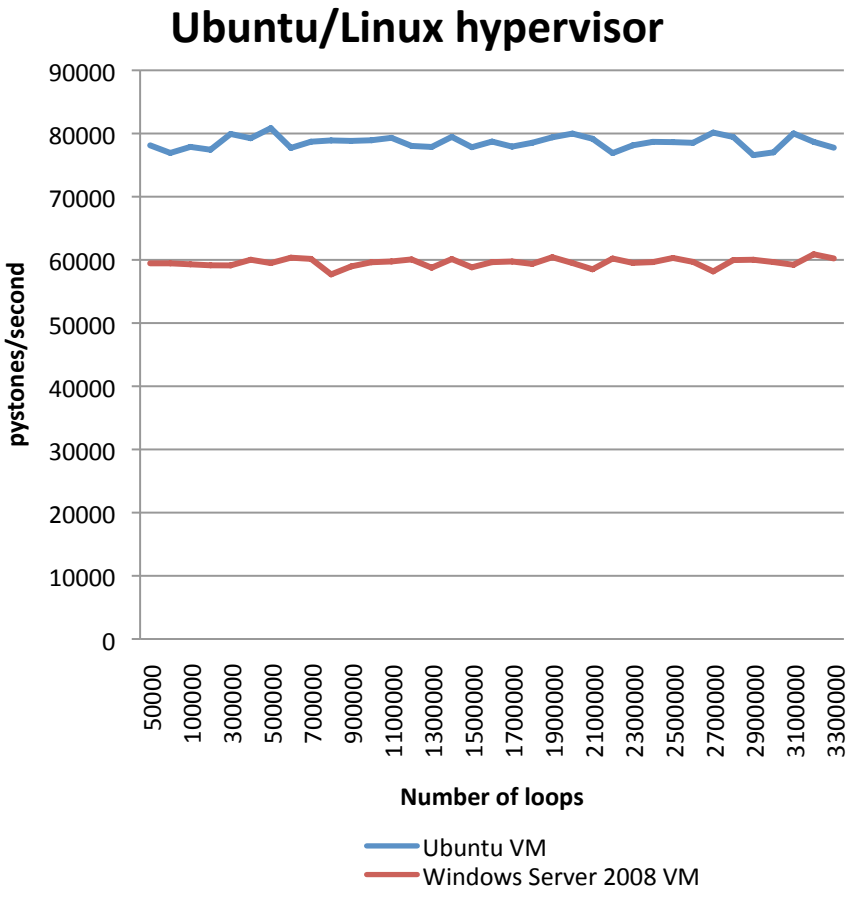


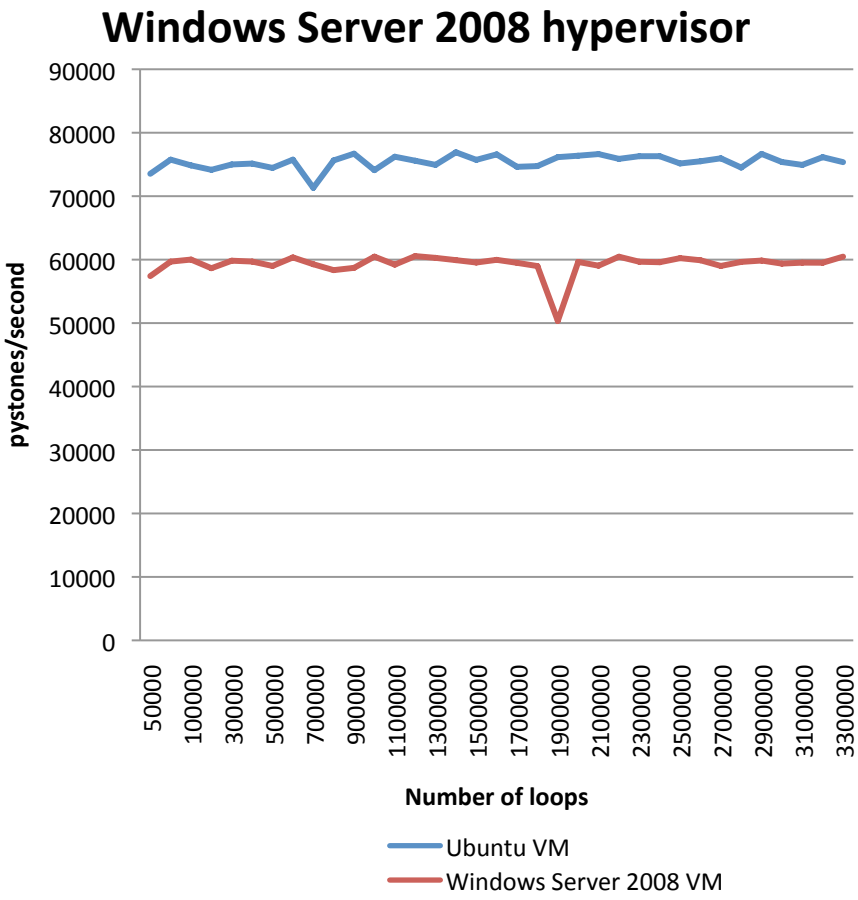


Pystone Benchmark

- Test CPU and memory performance
- The same test was used to benchmark CPU and memory performance on both systems

Pystone Benchmark

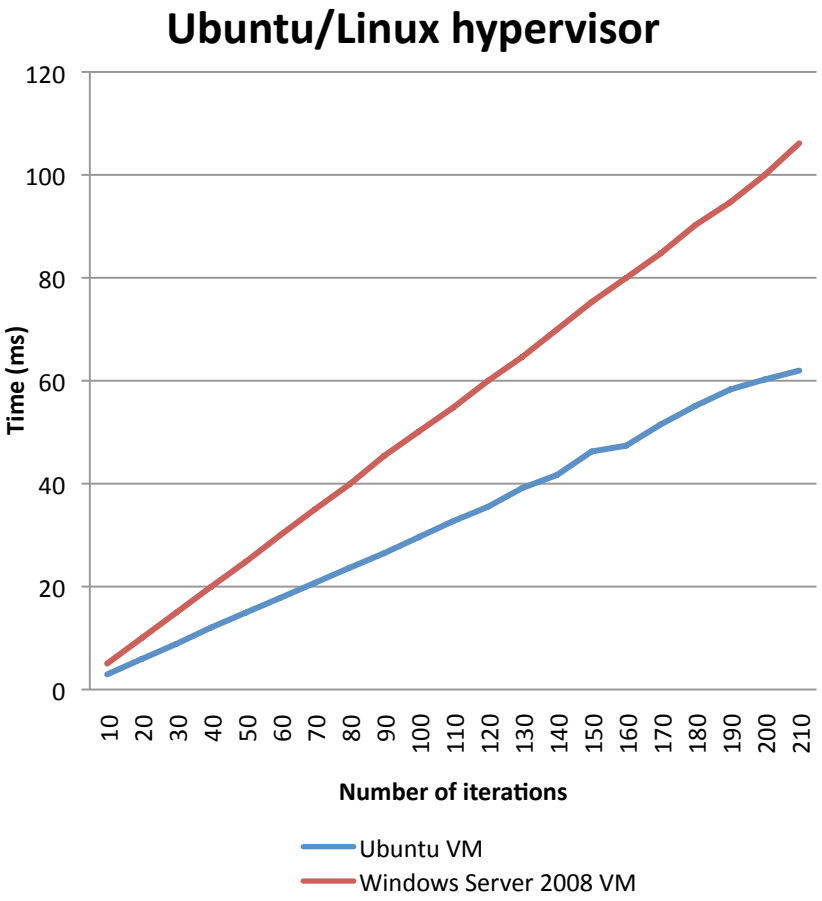


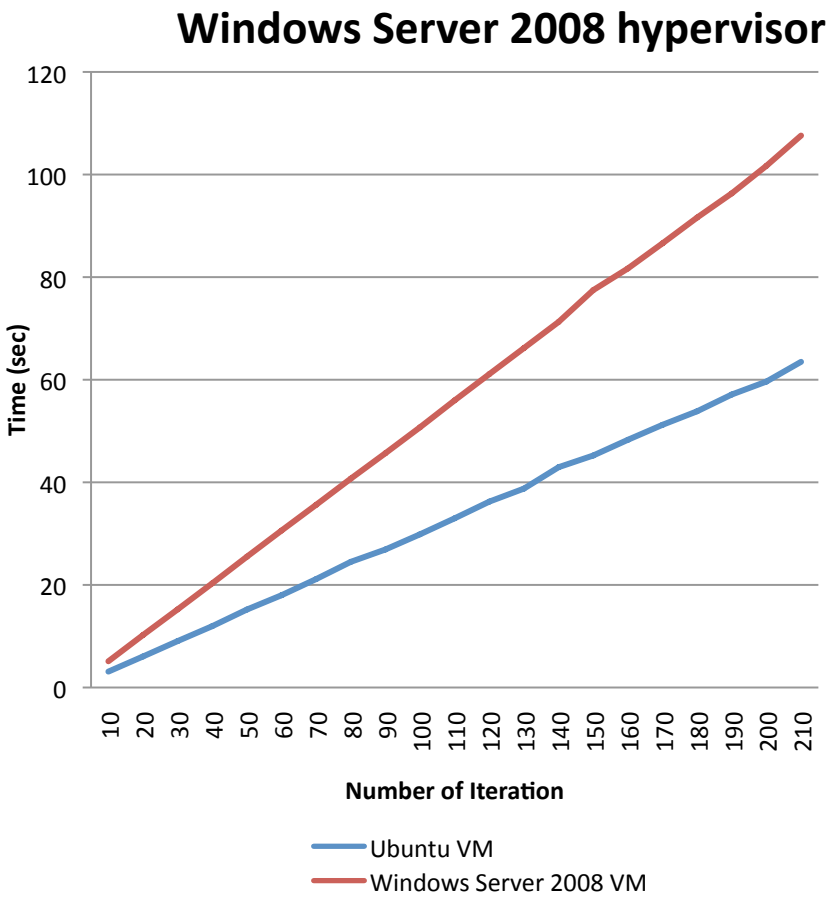


Richard Benchmark

- Test CPU and memory performance
- The same test was used to benchmark CPU and memory performance on both systems

Richards Benchmark

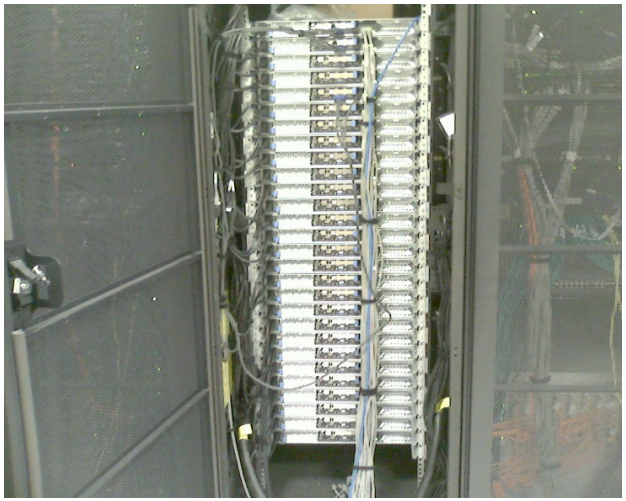




Review Analysis

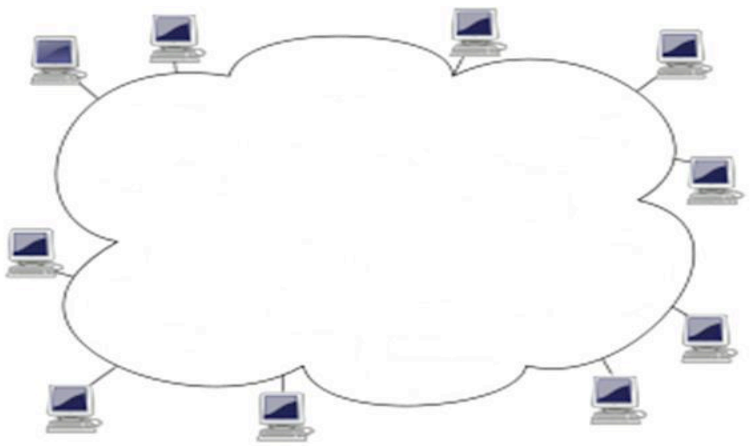
- Ubuntu performed better than Windows
  - Under hard drive the amount of time to read significantly less
  - Improved results in CPU & Memory tests
    - Computation of Pystone/seconds greater than Windows
    - Richards benchmark computed in less time per iterations

Relevant Use Case



- Given an opportunity to build a cloud cluster
- Provided with hardware to assemble cluster

Cloud Computing



- Deliver hosted services over the Internet
- A cloud service has three distinct characteristics that differentiate it from traditional hosting
  - Sold on demand
  - elastic
  - fully managed by the provider
- There are 2 kinds of cloud computing:
  - Public
  - Private

Creating Thunder – HPC Cloud

- Deploy master node
- Deploy cluster nodes
- Deploy virtual machines

Master Node

- Use System Rescue boot disk to boot the master node
- Configure the network
- Download and extract the install script then run the install script to install the node
- Generate rsa and dsa keys
- Reboot
- Connect to master node via ssh
- Restore the installation Repo

Cluster Nodes

- The cluster is split up into two tiers
- Update all the settings
- Install the first tier
- Reboot all the nodes in the first tier
- Check that all the nodes are up by connecting to all the nodes
- Install the second tier
- Reboot all the nodes in the second tier
- Check that all the nodes are up

Deploy Virtual Machines

- Download a list of VMs
- Push VMs to assigned servers
- Connect to each node and check if VMs were installed correctly
  - ssh to each node

Sources

- "Oracle VM VirtualBox" *Oracle Corporation*
  http://www.virtualbox.org/manual/UserManual.html
- "Specialized HPC Clusters in the Cloud" *Jason Stowe*
  http://www.sys-con.com/node/1447223
- "Cloud Computing"
  http://en.wikipedia.org/wiki/Cloud_computing
  http://searchcloudcomputing.techtarget.com
- "Pegasus Xen Cluster" *Nathan Rini* – NCAR
- "Virtualization" *Nathan Rini* - NCAR

Questions?