Virtualization: More Than Just a Buzzword

CSE 501
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Agenda

- What is Virtualization?
- Practical Uses
- What can be virtualized
- Popular virtualization products
- Demo
- Question, answer, discussion
What is Virtualization?

Can mean many things:
- Application virtualization
- Desktop (client) Virtualization
- Memory virtualization (beginnings of cloud computing)
- Operating system-level virtualization

Software simulation of hardware resources.
Such simulated resources can execute operating systems and programs like real physical machines.
Software run on virtual machines is isolated from the underlying hardware resources.
The software or firmware that creates a virtual machine is called a Hypervisor or Virtual Machine Monitor.

Hypervisors can provide different levels of virtualization:

- **Full** - Almost complete simulation of the actual hardware
- **Partial** - Some of the target environment is simulated
- **Para** - hardware environment is not simulated; guest software is executed in own isolated domains

Guest software needs to be specifically modified or “virtual machine aware” to run in a para-virtualization environment.
The term “virtualization” has quickly become an industry buzz word.

Important to cover facts versus fiction along with advantages and disadvantages.

Desktop hypervisor packages coupled with better CPUs now allow students to virtualize straight from their laptops.

CIS and literacy programs can now dabble in open source operating systems.

Lab assignments no longer need to be hindered by security restrictions.

Mac users can be given the same access to software as Windows users.
Practical Classroom and Lab Uses

Educating on operating systems other than Windows or MacOS
Lab exercises that can focus on system level administration, debugging and troubleshooting.
How to Teach About Virtualization?

Start with the basics. Talk conceptually about what virtualization does and why it may be useful.
Cover the pros and cons:

Pros of virtualization
- Cost of deployment
- Development and testing of systems
- “Risky” tasks can be isolated in a virtual machine
- More granular control of hardware resources
- Ability to “Snapshot” known good configurations

Cons of virtualization
- Hardware-assisted virtualization requires explicit support in the host CPU, which is not available on all x86/x86_64 processors
- A guest operating system will run faster on the “bare CPU” (depending on the level of para-virtualization)
- More expensive hardware is needed (in some cases)
Why not simply duo-boot?

Duo booting requires more of a change to the hard disk. Resizing of volumes and partitioning can sometimes cause problems that result in data loss.

Sometimes files are not shared between the OSs (although this seems to be getting better).

Virtual disk images expand on demand and make more efficient use of drive space.

Ultimately one OS goes unused more often, which means more time goes by until patches and anti virus definitions can be applied.

Virtualization gives more flexibility on 2\textsuperscript{nd}, 3\textsuperscript{rd}, N\textsuperscript{th} operating system setups.
What is needed hardware-wise?

- At least some type of duo core CPU with some type of virtualization extension support. Available for both Intel and AMD.
  - Intel virtualization (VT-x)
  - AMD virtualization (AMD-V)
- Support for this may need to be enabled in the BIOS.
- At least 2-4 gigabytes of RAM
- If you want to virtualize a 64 bit OS you will need a 64 bit CPU.
When is it not advantageous to virtualize a machine?

- When applications running require a lot of CPU or memory resources such as a compute server
- When applications generate a lot of disk I/O
- When some type of service is already performing a virtualization task
  - Ex: Citrix or Sunray Services
- When there is a high network link utilization that cannot be bound to a particular NIC
What Can Be Virtualized?

Windows

- All versions of XP and Windows 7.
- Microsoft’s VirtualPC only supports Home Premium, Enterprise, Business and Ultimate Editions
- Be careful with licensing

MacOS

- Only Mac OS Snow Leopard Server is licensed to run virtually
- Snow Leopard VMs can only run on Mac OSX host operating systems
- This information is buried in the EULA

Most, if not all, Linux distributions can be run virtually
Popular Virtualization Products

Parallels
Offers a number of virtualization products for MacOS, Windows and Linux
http://www.parallels.com/

Vmware
Offers a number of virtualization products for MacOS, Windows and Linux
http://www.vmware.com/

Virtual Box
OpenSource FREE hypervisor for MacOS, Windows and Linux
http://www.virtualbox.org/
Popular Virtualization Products

Windows Virtual PC

- Windows Hypervisor which can run on Windows host systems (and virtualize Windows Guest OSs)

Windows Hyper-V

- Available on Windows Server 2008. Can support a variety of Windows and Linux guest operating systems

Xen

- OpenSource FREE hypervisor available on most linux-ish and Free BSD distributions. This is a para-virtualized hypervisor which requires guest Oss to be modifies.
Demo

VirtualBox