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INFO-6003

O/S & Application Security

Week 01

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Agenda

- Contact Information
  - Professor S.J. Freymond
- Basic Concepts of Virtualization
  - Bare-Metal Hypervisor
  - Host-Based Virtualization
  - VMWare Workstation
- Setting up a folder structure that works well with virtual machines in a multi-class environment

Contact Information

- Email
  - Use my FOL email address
    - sfreymond@fanshaweonline.ca
  - Email sent Monday to Friday
    - You can expect a turnaround of 48 hours or less
  - Email sent on the Weekend
    - I usually check my email Sunday evening or first thing Monday morning

Contact Information

- Email Tips
  - Use a relevant Subject
  - Keep it brief and to the point
  - Don’t be afraid to use point form
  - Try not to wait until the last minute to send your email

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Course Information

- This course will provide an overview of, and concentrate on, the essential concepts of information security, specifically:
  - Vulnerabilities of Windows and Linux Operating Systems
  - Upgrading and Patching
- This course is a prerequisite for:
  - INFO6009 – Network Monitoring & Penetration Testing
  - INFO6065 – Ethical Hacking & Exploits

Course Information Sheet

- Learning Outcomes
  - What you are expected to be able to demonstrate that you have learned
  - Questions on tests will reflect these items
    - Lecture and Lab Content
- Detailed Content
  - What you should expect to be taught each week
  - Content, tests, labs
- Course Textbook
  - Suggested and Required textbook
- Methods of Evaluation

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How to Succeed in This Course

- Reading the Slides and listening to lectures will most likely get you a F in this course.
- Additionally, doing the labs in class every week may get you to a D - 50%
- Additionally, taking Notes in the lectures may boost you to a C - 60%

How to Succeed in This Course

- Additionally, spending at least 4 hours every week studying the above material and doing the assigned readings may earn you a B - 70%
- If you want to get an A or higher:
  - Doing all of the previous, then going above and beyond:
    - Research
    - Study groups and quiz groups
    - Making your own questions to study from
    - Redoing labs
    - Flash cards
    - Listening to MP3 versions of your notes/course lectures

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Course Information

- This course is delivered to both students in class and online: through interactive web sessions
- Online students will be able to ask questions via interactive text chat
  - I will check the chat periodically throughout the lecture/lab
- Each lesson will be recorded and available through the Virtual Classroom link in FOL

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Course Information

- The course is assigned 4 hours per week
- 2 hour lecture followed by a 2 hour lab
- The labs will develop essential skills and reinforce the lecture content

Method of Evaluation

- Tests and Exams: (65%)
  - Details can be found on the Course Information Sheet
- Labs (35%)
  - Labs are delivered weekly and need to be completed during the lab period for in class students
    - Online students have until the night before the next lab to complete the lab
  - Lab Marking Details can be found in the Additional Course Information Section

Lab Expectations

- Deduction for late arrival
  - I put a sign in sheet out when I arrive in the classroom
  - You have the opportunity to sign in while I am setting up
  - Once I start the lab I remove the sign in sheet and you are considered late
    - 25% deduction for late arrival

Lab Expectations

- Submission Times
  - To be eligible for full marks you need to submit your lab during the lab period (in class students)
  - Marks will be deducted for mistakes
  - The lab period ends ten minutes before the hour
    - 1 minute late, is late
  - If you submit the lab late it will be marked out of 50%
  - You have until midnight, on the day of the lab to submit it late
- The official rules can be found in the Additional Course Information section on FOL.

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What is Virtualization?

- A technology that provides an abstraction of the resources used by some software which runs in a simulated environment called a virtual machine (VM)
- Benefits include better efficiency in the use of the physical system resources
- Provides support for multiple distinct operating systems and associated applications on one physical system
- Raises additional security concerns

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Types of Virtualization

- Type1
  - Also known as a Bare Metal Hypervisor
  - The hypervisor is installed directly onto the hardware
  - The hypervisor has more direct access to the hardware
    - More Efficient, but More Expensive
- Type 2
  - Referred to as Hosted, Host based, or OS based
  - The hypervisor is running on top of another operating system: Windows, Linux, OSX
  - The OS is sitting between the hypervisor and the hardware
    - Less Efficient, but Less Expensive

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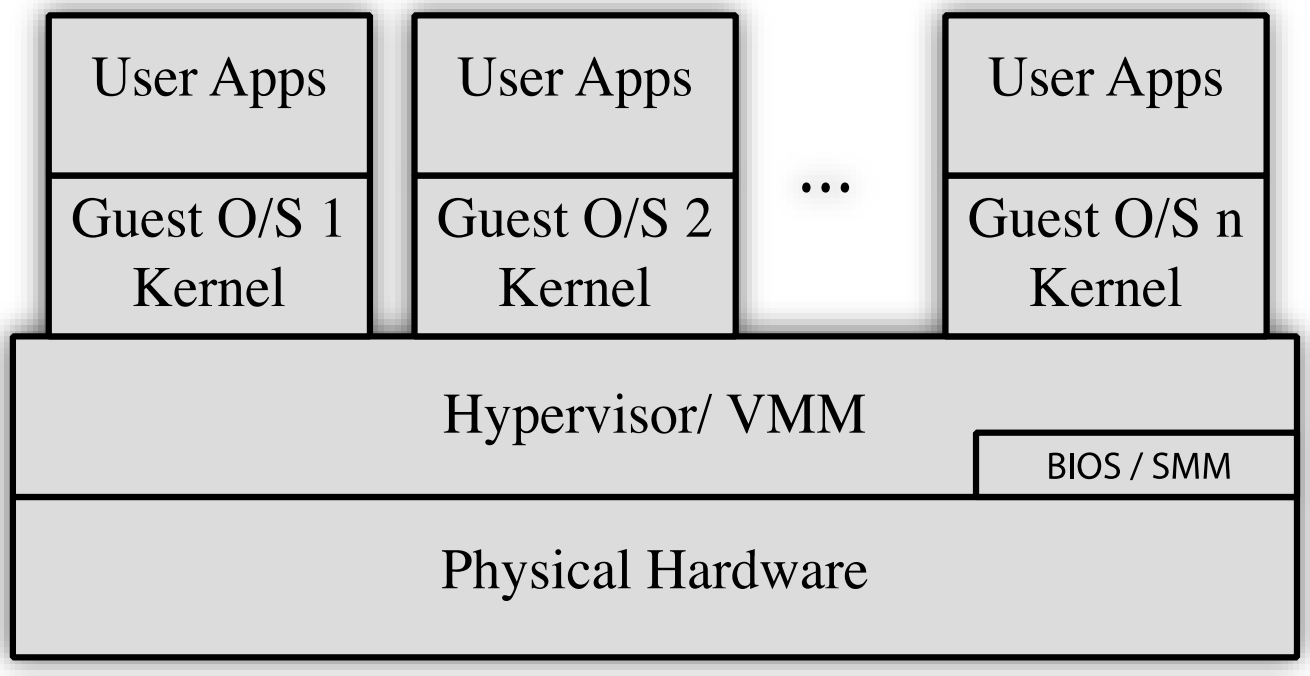
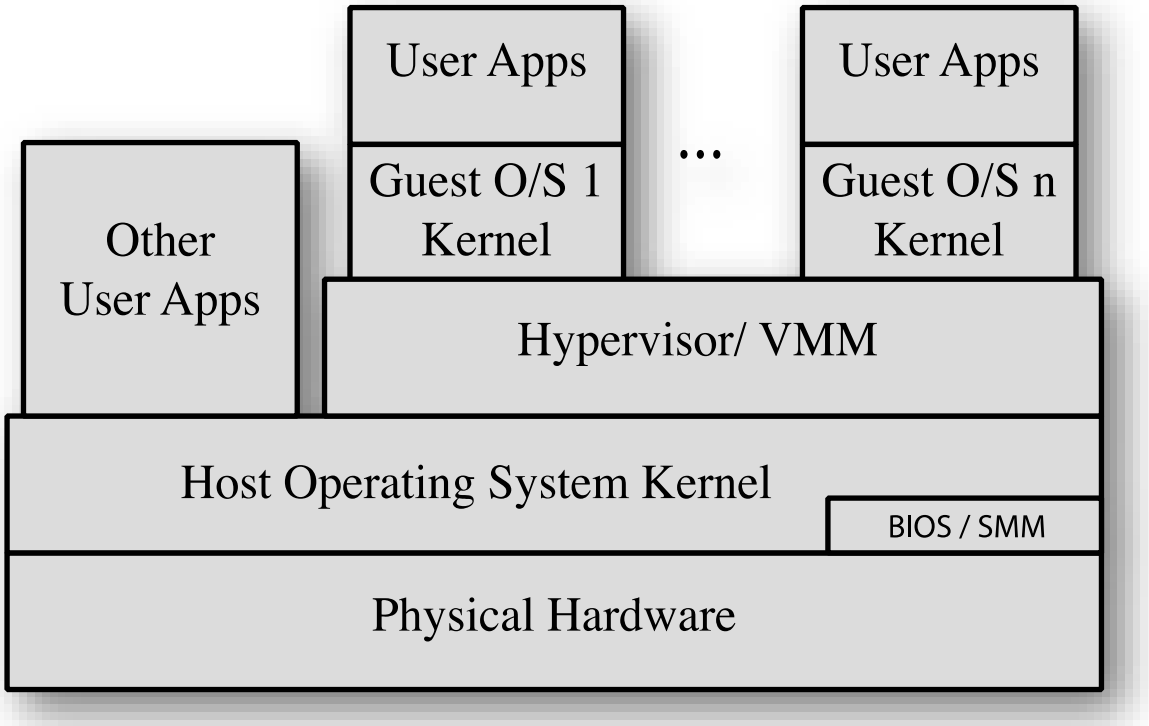
Type 1 - Bare-Metal Hypervisor



- A Bare-Metal Hypervisor system does not require another operating system

Type 2 - Host-Based Virtualization



- Host OS
  - Windows, Linux, OSX
- Hypervisor
  - VMware Workstation, VMware Fusion

Benefits of Virtualization

- Helps utilize the full capability of a server
  - Vendors may not want other applications running on the same physical server as their software as it may cause performance degradation
- Reduces management/support time, power consumption, etc.
- Can be easier to copy VMs and move them to other physical machines (more portable)

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Benefits of Virtualization

- Assists with return on investment (ROI)
  - You can fit numerous virtual servers on one physical machine and only expand when overall physical computing power needs to be upgraded
- Reduces costs of the environment
  - Less rack space required
  - Less maintenance contracts
  - Improves disaster recovery

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Hardware Resources & Virtualization

- Available hardware resources must be appropriately shared between the various guest Oss
  - CPU
  - Memory
  - Disk Space
  - Network Cards / Configuration
  - Any other attached devices

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VMWare Workstation Terminology

Host – The physical computer you install VMware Workstation on is called the host computer, and its operating system is the host operating system.

Guest – The operating system running inside a virtual machine is called the guest operating system.

Note: During labs make sure you are aware of whether you are doing something on the host or guest OS.

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Preserving VM States

- There are a variety of ways to preserve your guest operating system's state, providing you with a recovery path
- Snapshots
  - Taking an image of the VM at a specific point in time
    - After_Lab-01, After_Lab-02, etc.
- Suspend / Resume
  - Kind of like pause and play
- Cloning
  - Creating an entirely new VM

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VM Encapsulation

- The ability to preserve the state of VMs is made possible because of the concept of VM Encapsulation
- VMs exist on the host machine as a set of files
- When you are taking a snapshot, or cloning a VM, you are preserving the current state of the files that describe the VM

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Snapshots

- Snapshots preserve the VM state so that you can return to the same state repeatedly
  - Very useful when testing the effects of malware and viruses
  - Can also be useful if you want to do a lab again when you are studying
- Information captured in a snapshot
  - Memory State: Contents of the virtual machine memory
  - Settings State: Virtual machine settings
  - Disk State: State of all the virtual disks

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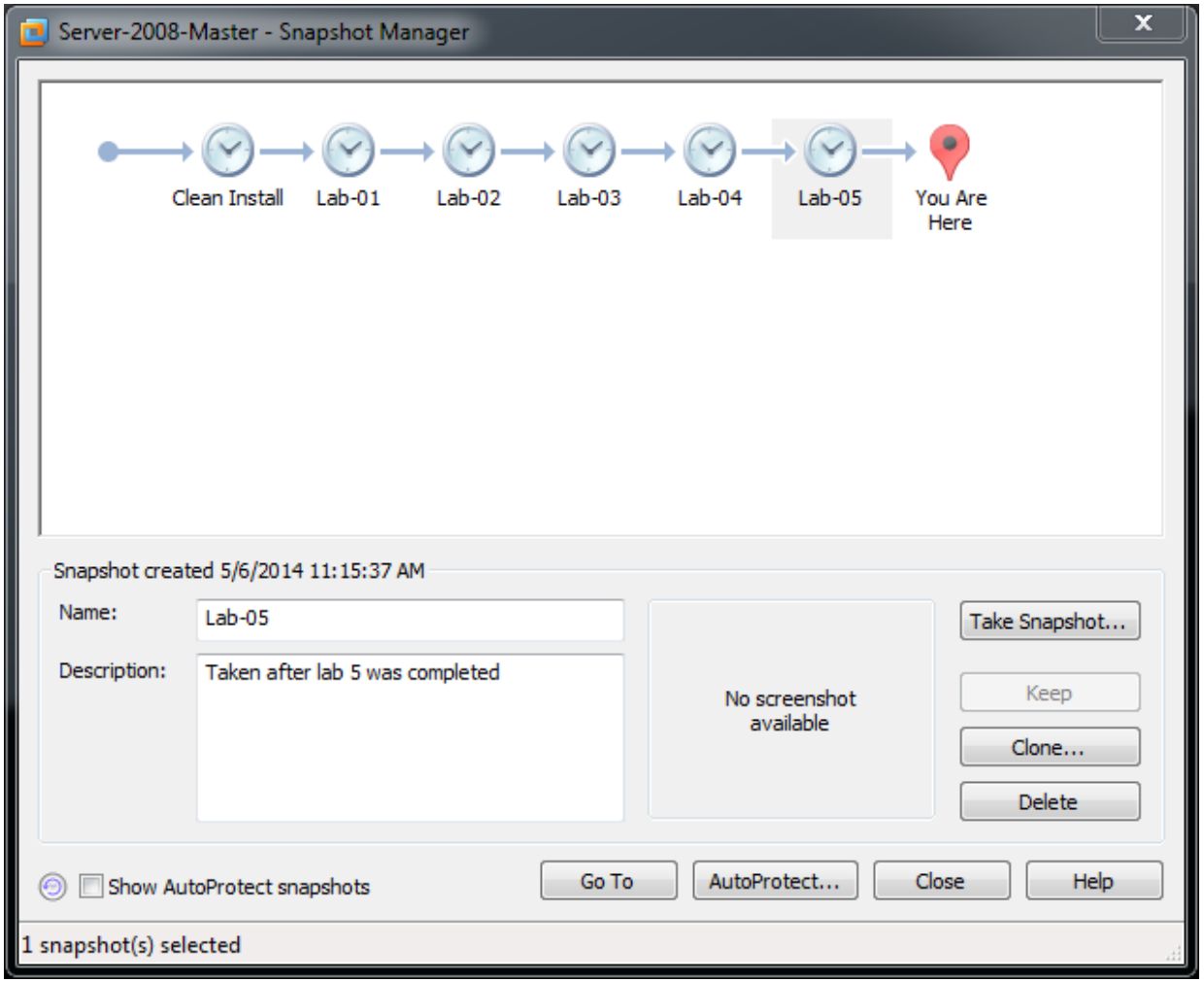
Types of Snapshots

- Snapshots are taken in two ways:
- Linear
  - Take a snapshot and continue to use the VM from that point
  - Can restore to any point along the line
  - Supports over 100 snapshots
- Process Tree
  - Multiple Nested snapshots
  - Supports over 100 snapshots per branch
  - This is the model used when you are using snapshots to do your labs again when studying

Linear Snapshots



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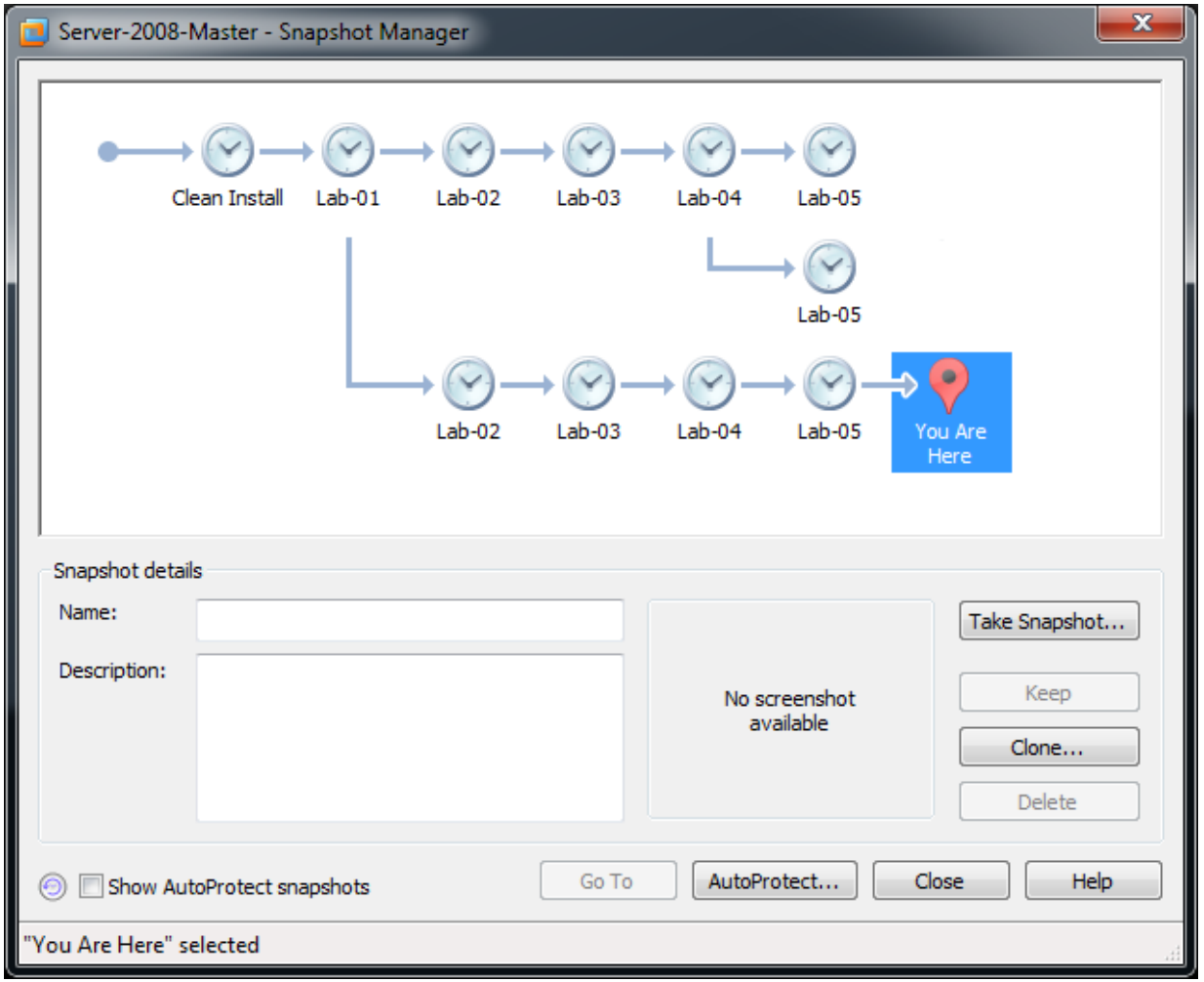
Process Tree Snapshots



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VMWare Tools

- There is a lot of Host to Guest OS integration available when you are using Workstation
  - Copy/Paste
  - Drag/Drop
  - Shared Folders from the Host Machine
- VMware tools must be installed to use these features
- Every version of Workstation comes with a specific version of VMware Tools
- To ensure your VMs work properly you need to make sure you are using the correct version of VMware Workstation and Tools

Virtual Network Interface Cards (NIC)

- Several alternatives exist for providing network access
  - The guest OS may have direct access to distinct network interface cards on the system
  - The hypervisor may mediate access to shared interfaces
  - The hypervisor may implement virtual network interface cards for each guest, routing traffic between guests as required
- This last approach is quite common, and arguably the most efficient since traffic between guests does not need to be relayed via external network links

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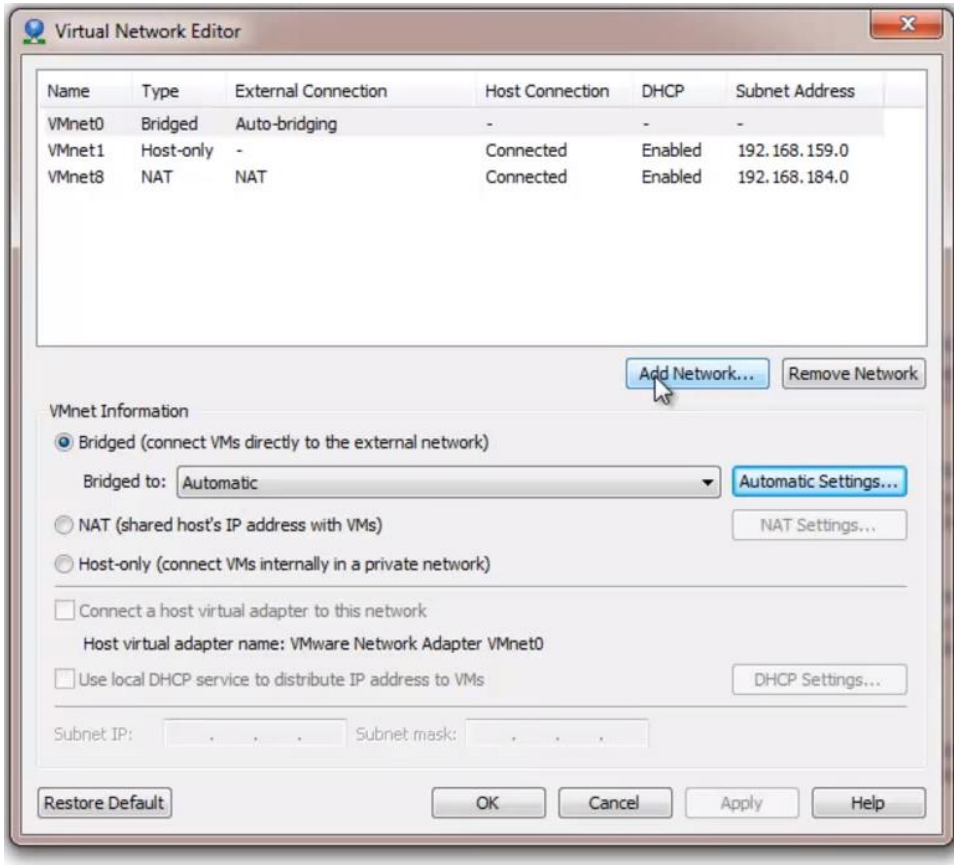
Virtual Switches

Network Type	Switch Name	DHCP
Bridged	VMnet0	No
NAT	VMnet8	Yes
Host-only	VMnet1	Yes

- Can be viewed through the Virtual Network Editor
- By Default there are three network types
  - Bridged
  - NAT
  - Host-Only

Default Network Types

- Clean Installation of VMWare Workstation



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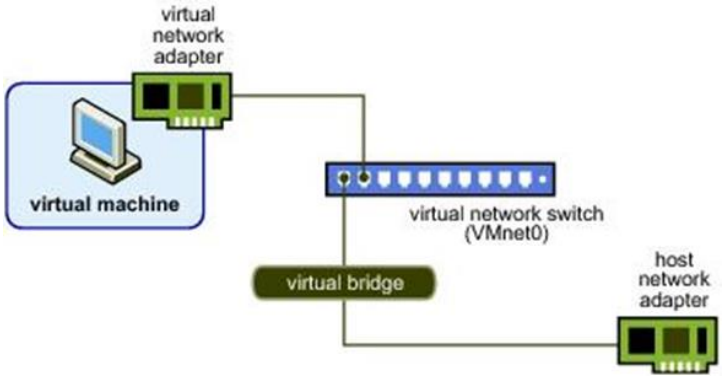
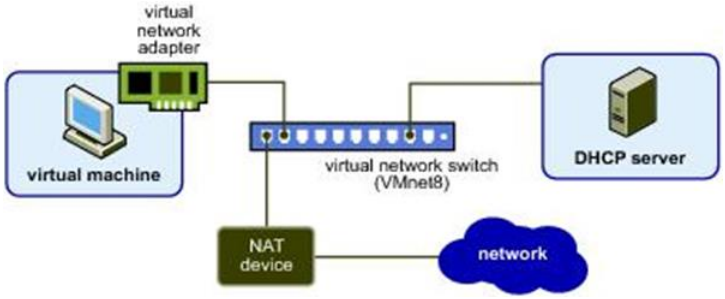
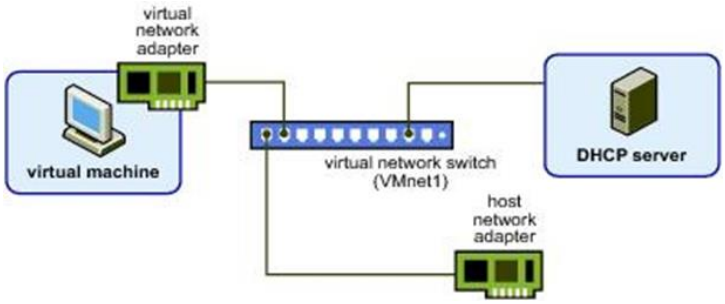
Adding Network Types

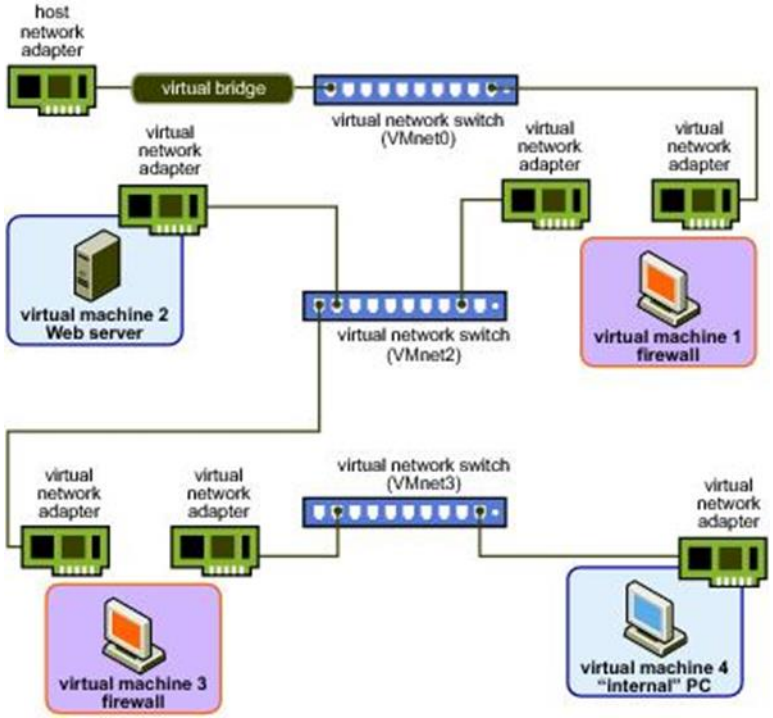
- In addition to the default network types on VMWare Workstation, you can add custom network types
- This is done in the Virtual Network Editor
- You will be creating these throughout the different courses in ISM
- Different Virtual Networks can communicate through virtual routers or multi-homed systems that utilize multiple NICs

Virtual Network Switches



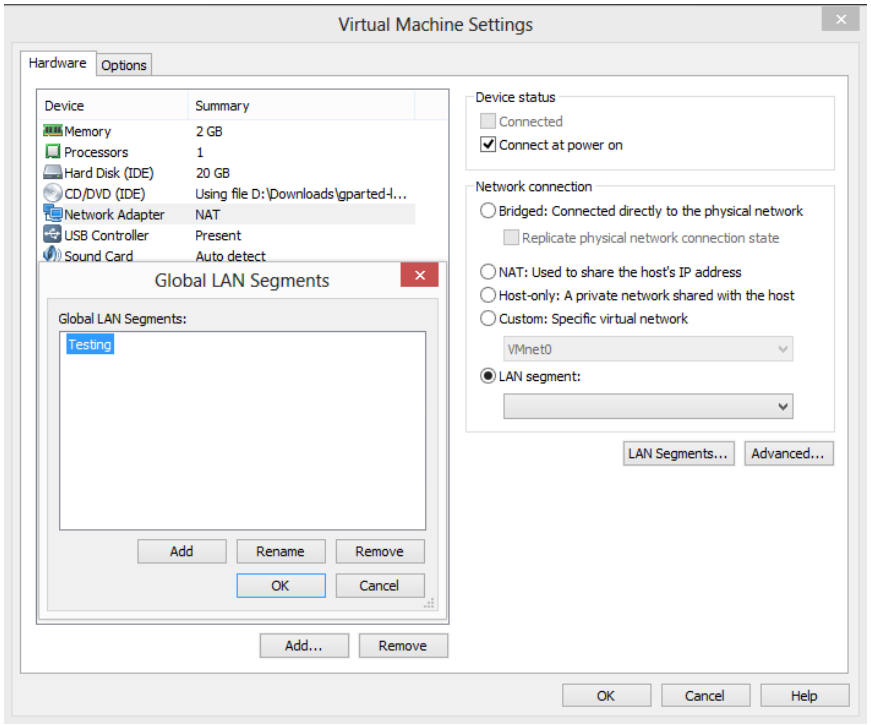






LAN Segments

- Provide complete isolation of VMs from host
- Inaccessible/Undetectable from other networks



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LAN Segments

- Very good for testing environments
- Can be used to test the behavior of various types of Malware
- Sandbox environment ensures that contact to the outside (internet) is blocked
- May assist with determining what was compromised during an attack

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LAN Segments

- Can also be a great way to test software updates for the O/S or other Applications prior to releasing them onto the production environment
- Allows for simulating a production environment in a lab setting with multiple machines on the same network
- Works with other virtualized test environments such as GNS3

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Virtual Network Details

- Bridged
  - Connected to your laptops physical NIC
  - No isolation
  - VMware doesn’t provide DHCP
- Host Only
  - Connected to virtual NIC on laptop
  - Isolated from the Internet
  - VMware provides DHCP
  - VMs on network can talk to each other and host computer

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Virtual Network Details

- Custom vmnet (most similar to host-only)
  - Connected to virtual NIC on laptop
    - Created when you create the custom vmnet
  - Isolated from the Internet
  - VMware provides DHCP
  - VMs on network can talk to each other and host computer
- LAN Segment
  - No virtual NIC on laptop
  - Completed isolated from laptop
  - VMware doesn’t provide DHCP

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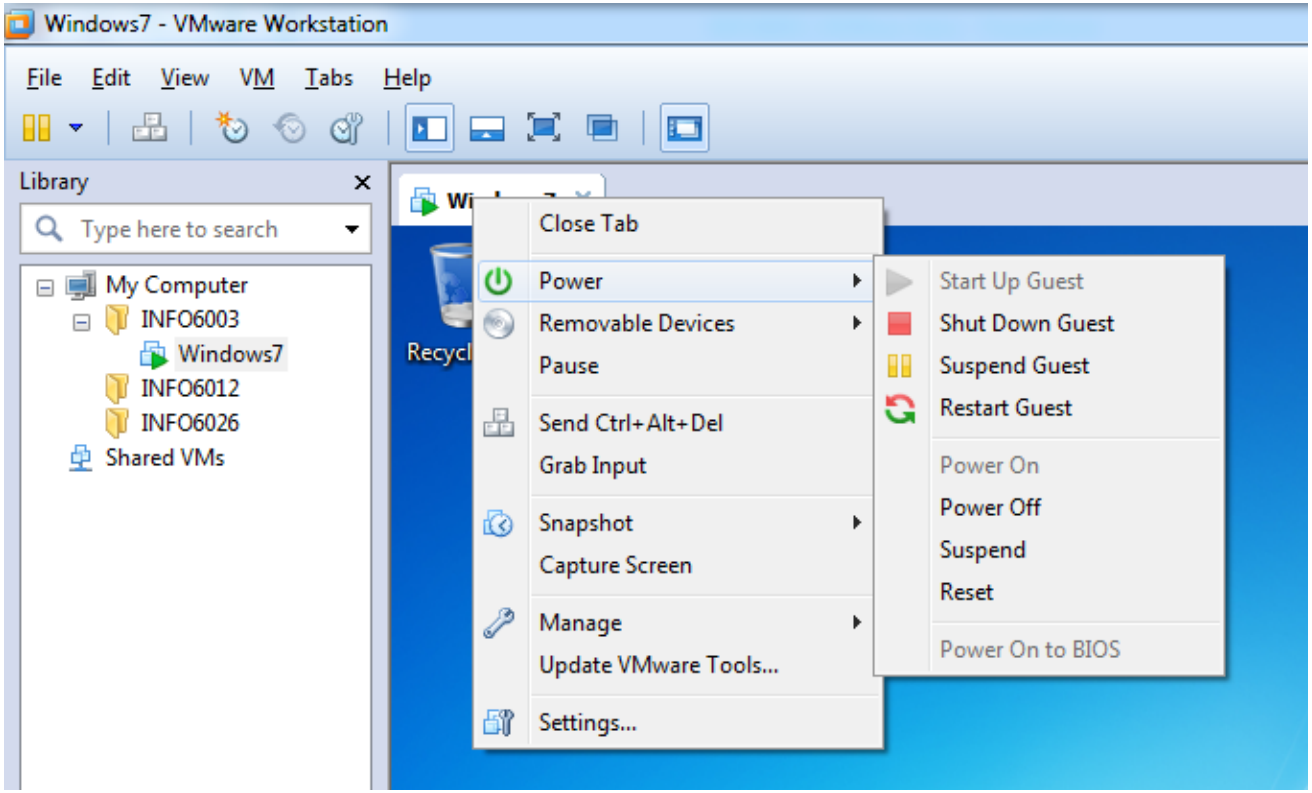
Virtual Network Details

- NAT
  - Connected to a virtual NIC on laptop
  - Internet connectivity
  - VMware provides DHCP
  - VMs on network can talk to each other, host computer and the Internet

Important Concept

- Powering Off is not the same as Shutting Down
- Always choose to shut your VMs down



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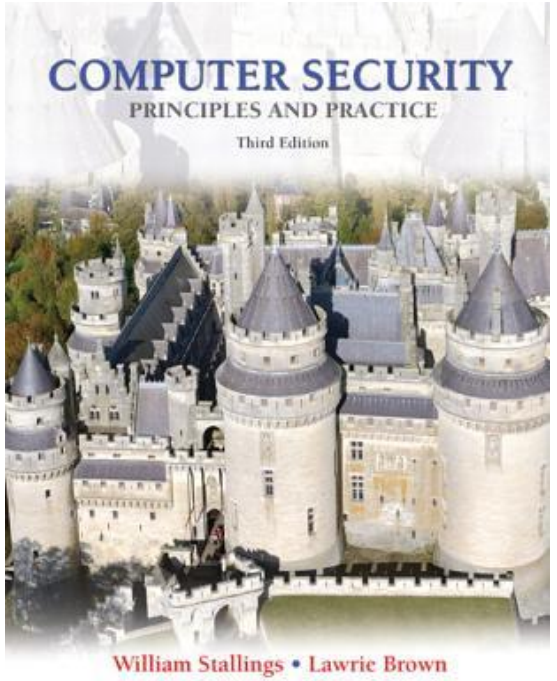
Matching Directory Structures

- You will all create an ISM folder within which you will store your VM and Lab related files:
  - Zipped VM images
  - Extracted VMs
    - A specific folder for each class
  - Install files
  - Screen Captures
- Keeping your files in this directory structure saves time later
  - You will have many copies of the same VM for different courses

Homework

- Read Chapter 1 for a general overview
  - Set Book: 3rd Ed. Computer Security - Principals and Practice by Stallings.
  - ISBN: 10:0133773922
  - ISBN: 13:9780133773927



Lab 00 - Setup

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Initial Lab Setup

- Setup folder structure on your hard drives
- Install VMware Workstation 15
- Setup logical folder structure in Vmware that matches physical folder structure on hard drive
- Install 7Zip, all VMs were compressed with 7Zip
- Download and extract three zipped VMs from the College's FTP server
- Confirm functionality