THE PERFECT VSPHERE 5 HOMELAB

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So why a home lab?

- A home lab has the following benefits:

    - Test new beta software whenever you want.
    - Study for various certification exams.
    - Power down any old server hardware that you might have running.
        - Save on your energy bill
        - Your significant other and non IT friends will stop asking about that 42U rack in the basement.
    - Try vSphere 5 features that you typically don't use at work.

    - **Remember, in NO WAY is this officially supported by VMware!**
    - **Always check the official HCL and this is not meant to replace production servers!**

Licensing

- VMware products are available for evaluation and lab use.
  - https://my.vmware.com/group/vmware/downloads

- Most products have a 60-day evaluation that entitles you to use every feature available in the product set.

- If you are a current VMware vExpert, you can obtain NFR licenses for a longer period of time.

You've got two options.

- When building a vSphere home lab, you've got to choose between either virtualizing a lab or building a physical lab.

- Physical Lab:
  - A physical lab will allow you to build more VMs!
  - More overall power.

- Virtual Lab:
  - Building a lab inside VMware workstation is cheaper but not quite as "real life" as a physical lab.

PHYSICAL

Base System 1

- The base system that we will use for the lab will be based on the Shuttle XPC platform. Small, powerful and doesn't use much power.

  - Shuttle XPC SH67H3
    - Supports i5 and i7 processors.
    - Supports up to 32GB of DDR3.
    - Realtek 8111E NIC Integrated

- Ideally 2 should be used.
- Flash BIOS to latest revision.

Processor

- You can save some money going with an i5 over an i7.
- You priority should not necessarily be CPU.

- I built mine with an i7 when building mine.

- *Your Choice:*

  - Intel Core i7 2600 Sandy Bridge Processor
  - Intel Core i5 2500 Processor

  - The newest revision also supports Ivy Bridge.

Memory

- You have the most choices here. Be careful to not get too little memory.

- In my lab, I used 16GB in each host, but now wish I did 32GB. You almost always run out of memory first!

- *Your Choice:*

    - 8GB Corsair DDR3 (2 x 4GB) 1600 MHz
    - 16GB Corsair DDR3 (2 x 8GB) 1600 MHz
    - 32GB Corsair DDR3 (4 x 8GB) 1600 MHz

Additional NIC Adapter

- The base system only has a single network adapter and it's not realistic to run all traffic across a single adapter.

- We will use an additional dual NIC adapter.

  - Intel PRO/1000 Dual Port Server Adapter
    - Works in the spare slot that the SH67H3 has.
    - No modifications or hacks to oem.tgz needed.

Internal Disk

- We're going to talk internal disk now and focus on shared storage later.

- ESXi 5.1 can be installed to USB sticks/SD cards.
  - An 8GB USB stick is recommended to allow for scratch space.

  - The one I've had good luck with:
  - [Kingston Digital 8 GB USB 2.0 Flash Drive](#)

Once Installed

- 1 CPU socket
- 8 logical processors
- 3 fully functional NICs

Network Adapters

Device	Speed	Configured	Switch
Intel Corporation 82571EB Gigabit Ethernet Controller			
vmnic1	1000 Full	Negotiate	vSwitch1
vmnic0	1000 Full	Negotiate	vSwitch0
Realtek Realtek 8168 Gigabit Ethernet			
vmnic2	1000 Full	Negotiate	vSwitch0

General

Manufacturer:	Shuttle
Model:	SH67H3
CPU Cores:	4 CPUs x 3.392 GHz
Processor Type:	Intel(R) Core(TM) i7-2600 CPU @ 3.40GHz
License:	VMware vSphere 5 Enterprise Plus - Licensed for 1 physic…
Processor Sockets:	1
Cores per Socket:	4
Logical Processors:	8
Hyperthreading:	Active
Number of NICs:	3
State:	Connected
Virtual Machines and Templates:	9
vMotion Enabled:	Yes
VMware EVC Mode:	Intel® "Sandy Bridge" Generation
vSphere HA State	Running (Master)
Host Configured for FT:	Yes
Active Tasks:	
Host Profile:	
Image Profile:	(Updated) ESXi-5.0.0-4695…
Profile Compliance:	N/A
DirectPath I/O:	Supported

Estimated Overall Costs (Shuttle)

- We will outline the physical costs below.

Component	Cost
SHUTTLE SH67H3	$238.98
Intel PRO/1000 Dual Port Adapter	$79.01
Intel i5-2500 Quad-Core 3.3 GHz	$209.99
Corsair 16GB (2x 8GB) DDR3	$114.91
8GB USB Flash Drive	$6.98
Total	**$649.87 /host**

Storage: Part 1

- You have several choices when it comes to storage. Local vs. Shared.

- The cheapest option: Find an old computer and install [openfiler](#) or [FreeNAS](#) on it and share it out.

- This is the cheapest option, but may not perform great depending on the box/disk/network etc.

Storage: Part 2

- No old computer to re-purpose? Then pick up a [Seagate Barracuda 7200 1 TB 7200RPM SATA 6 Gb/s](#)

- I've used these before but you can buy any simple and cheap SATA drive and install it inside of the Shuttle standalone host.

- Build a large virtual machine on the host and share out the storage over iSCSI/NFS to the host(s).

- Remember you are using memory/CPU on the hosts to do this.

Storage: Part 3

- Buy a small NAS unit, or build a dedicated NAS device.

- Synology has created some great little units to use. It seems like people in the "whitebox/homelab" community like Synology.

- Synology DS411 NAS
  - Definitely not the cheapest solution but the performance will be better than using internal storage that is shared out.

Networking

- In order to simulate a real world networking environment, you'll need to use multiple networks. The easiest way to do this is interVLANs.

- dd-wrt is probably the simplest way to accomplish this.
  - You need to find a compatible gigabit router that works.
  - Try to find one that supports 802.1Q, there are several at different price points.
  - http://www.dd-wrt.com/site/support/router-database

The HP ProLiant MicroServer Gen8

- The original MicroServer came with a AMD Athlon II NEO N36L 1.3 Ghz dual-core processor which was pretty weak to use with virtualization. (old one on right)

  - [HP ProLiant MicroServer Gen8](#)
  - The two new processor options are:
    - Intel [Celeron G1610T](#) (2.3Hz/2-core/2MB/35W) Processor
    - Intel [Pentium G2020T](#) (2.5GHz/2-core/3MB/35W) Processor

- Neither processor supports hyper-threading!
- This can be a basic all in one box for ~$500!
- Not as powerful as the Shuttle machine.

An "Unofficial" Whitebox HCL

- This past year, I created a new community driven HCL.
  - Most sites like ultimatewhitebox are out of date and not easy to submit new data.

- You can check out current submissions at ryanbirk.com

An "Unofficial" Whitebox HCL

- The HCL is split into three categories:
  - Complete Systems (all hardware is known to work out of the box)
  - Motherboard (a motherboard that all components work with ESXi)
  - NIC (a listing of various NICs that work.)

- You can easily submit new data via a Google Doc!

Motherboard HCL Submission : Motherboard Submissions

Manufacturer	Model	100% Compatibility?	VMware Version Tested	Additional Notes	Intel or AMD	CPU Type
ASRock	Z77 EXTREME4-M	Yes	5.1, 5.0		Intel	Intel Core i7 / i5 / i3
ASRock	Z68 Pro3-M	Yes	5.1, 5.0	Installed to USB stick. NIC comes up as a Realtek RTL8111E. 32GB RAM Max.	Intel	Intel Core i7 / i5 / i3
ASUS	E35M1-M PRO	Yes	5.1, 5.0	NIC works with ESXi 5, but not earlier versions. (Realtek 8111E)	AMD	AMD APU (FM2 Socket)
Gigabyte	GA-970A-D3	Yes	5.1, 5.0	Onboard raid is not supported.	AMD	AMD AM3 / AM3+
Gigabyte	GA-990FXA-UD3	Yes	5.1, 5.0	DirectPath I/O works out of box, NICs as well. Very stable over the last 3 months.	Intel	Intel Core i7 / i5 / i3
Intel	BOXDP43TF	Yes	5.1, 5.0, 4.1, 4.0		Intel	Intel Core 2 Quad / Core 2 Duo
Intel	BOXDQ67SWB3	Yes	5.1, 5.0		Intel	Intel Core i7 / i5 / i3
TYAN	S5510GM3NR	Yes	5	All NICs work out of the box.	Intel	Intel Core i7 / i5 / i3
Supermicro	X9SCM-F	Yes	4.1, 4.0	Maximum 32GB of memory. Supports DirectPath I/O and has remote mgmt.	Intel	Intel Core i7 / i5 / i3
Biostar	TH67B MicroATX	Yes	5.1, 5.0		Intel	
ASUS	m5a99x EVO	Yes	5.1, 5.0		AMD	AMD FX / Phenom II / Athlon II / Sempron 100 Series
ASUS	p8z77	Yes	5.1, 5.0		Intel	Intel Core i7 / i5 / i3
Intel	S5520HC	Yes	5.1, 5.0		Intel	Intel Xeon
Intel	S5520SC	Yes	5.1, 5.0		Intel	Intel Xeon

Complete System HCL Submission : Complete System

Manufacturer	Model	100% Compatibility?	VMware Version Tested	Additional Notes	DirectPath I/O Support
Foxconn	SFF R30-A1	Yes	5.1, 5.0	System does not come with memory! Installed to USB stick and it worked great.	Unknown
HP	N40L	Yes	5.1, 5.0, 4.1	Limited to 2 cores and 8GB of memory. Hardware RAID is not supported on vSphere 5.	Unknown
HP	ML110 G7	Yes	5.1, 5.0	Works out of box.	Yes
Shuttle	SH67H3	Yes	5.0, 5.1	Works out of the box with vanilla installer. It has been confirmed to work on both v1 and v2 motherboards that Shuttle has released.	Yes
Shuttle	SH55-J2-BK-V1	Yes	4.1		Unknown
HP	N36L	No	5	Integrated RAID controller does not work. I installed ESXi to a USB stick and it appears to work.	Unknown

VIRTUAL

Base System – Virtual Lab

- The base system in a virtual lab will be a bit less complicated than building and also cheaper.

- Essentially, we'll virtualize ESXi inside VMware Workstation 8. **VT inside the BIOS = required.**

- However, depending on your hardware you might not be able to run very many nested VMs.

- You will want a CPU with at least 4 cores + hyper threading. Intel Core i7 is a good choice. I have also used and currently use an AMD 6-core as well.

Virtual Lab - Memory

- Memory in your virtual lab is even more crucial as you will need to have enough to run an operating system + VMware Workstation + VMs.

- I have played with many systems and 12-16GB of memory typically is a good number to start with if you plan to do this on your current desktop PC.

- ESXi 5 requires a 2GB memory minimum so each host will need 2GB to start with.

Virtual Lab - Networking

- We will use internal switches and private "VMnet" options to separate the traffic.

- You'll want to be sure that you manually create DNS entries somewhere on your network for the hosts and servers.

Workstation 8 Steps – 1

- We will use the "Custom" option to build our VM.
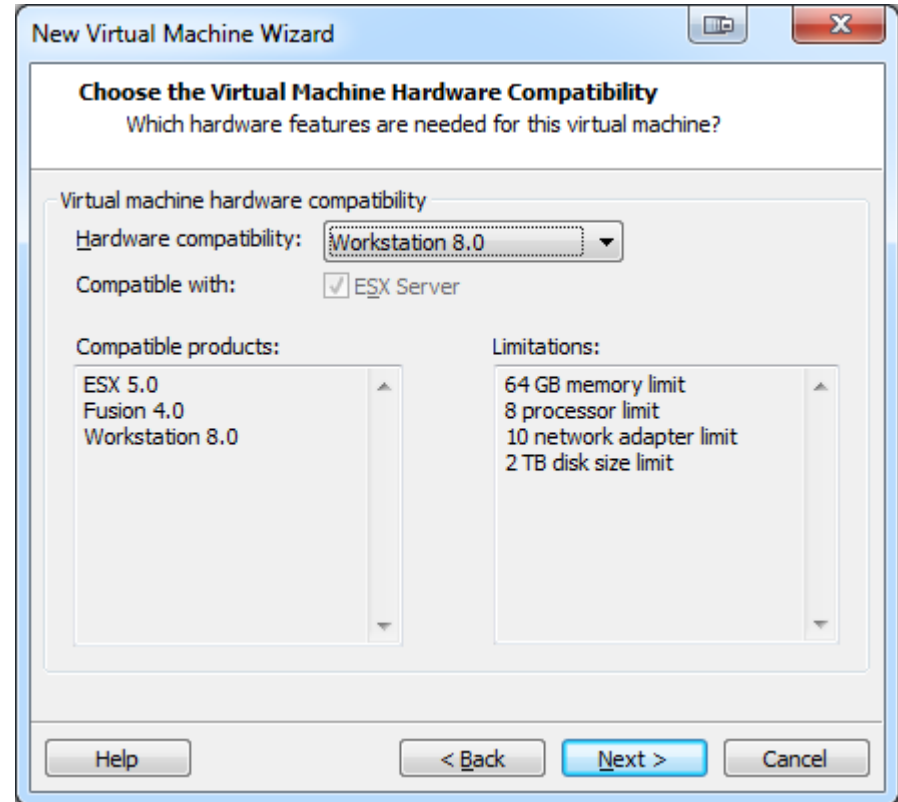
Workstation 8 Steps - 2

- Point the installer to your ESXi 5.0 iso.
  - Download the .iso from VMware.com
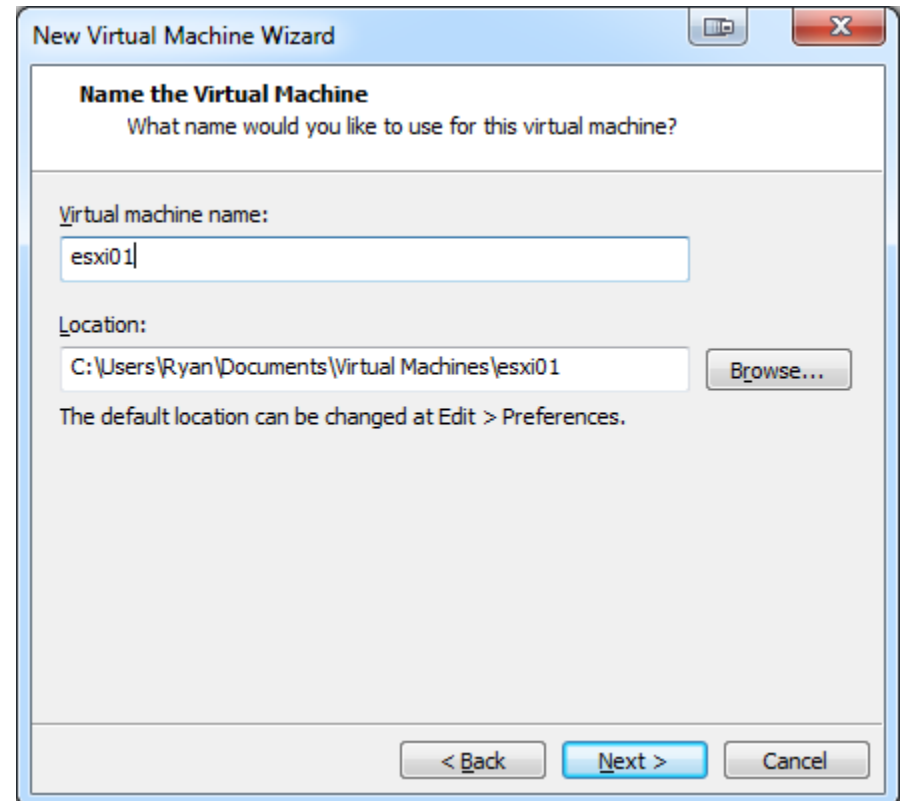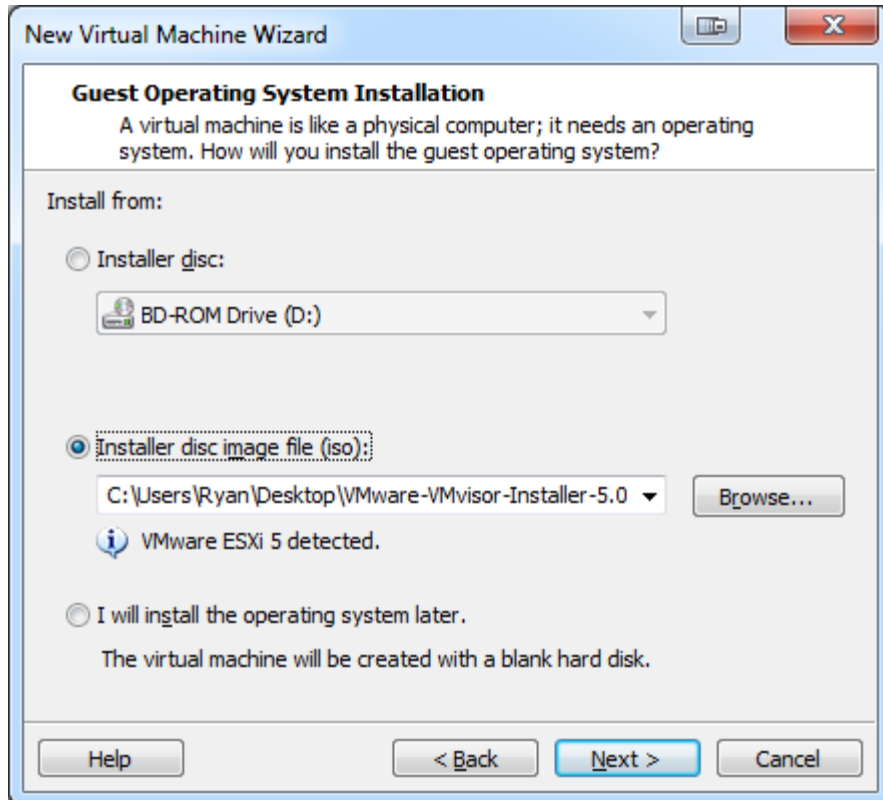
Workstation 8 Steps - 3

- Change the number of processors to 2 & use 2GB RAM.
  - 2 processors or cores are required for installation.
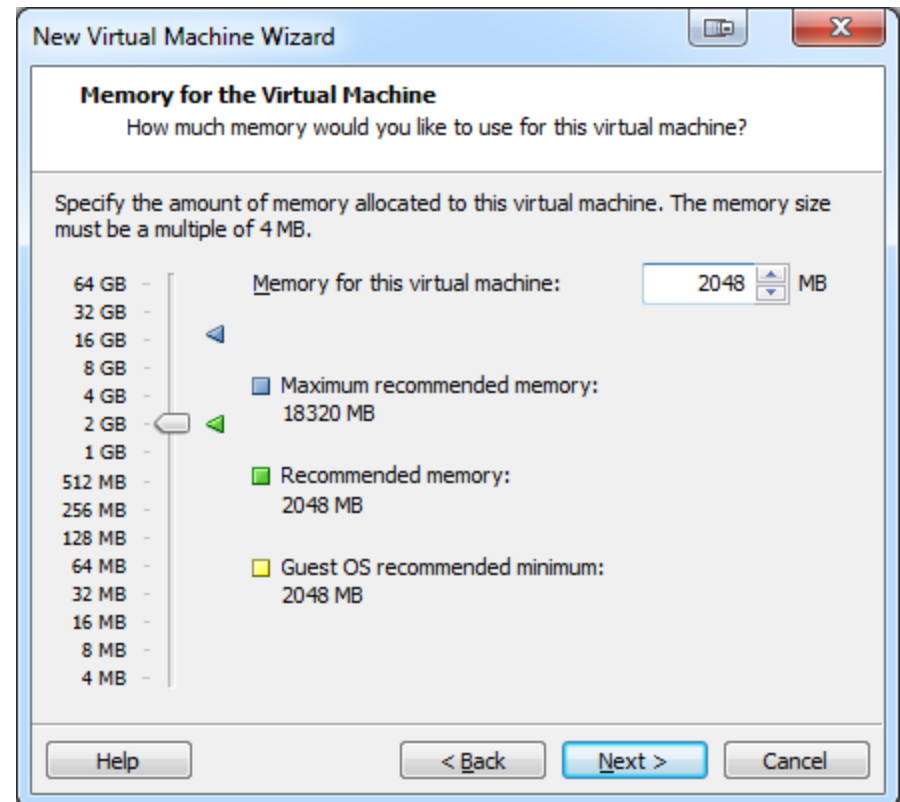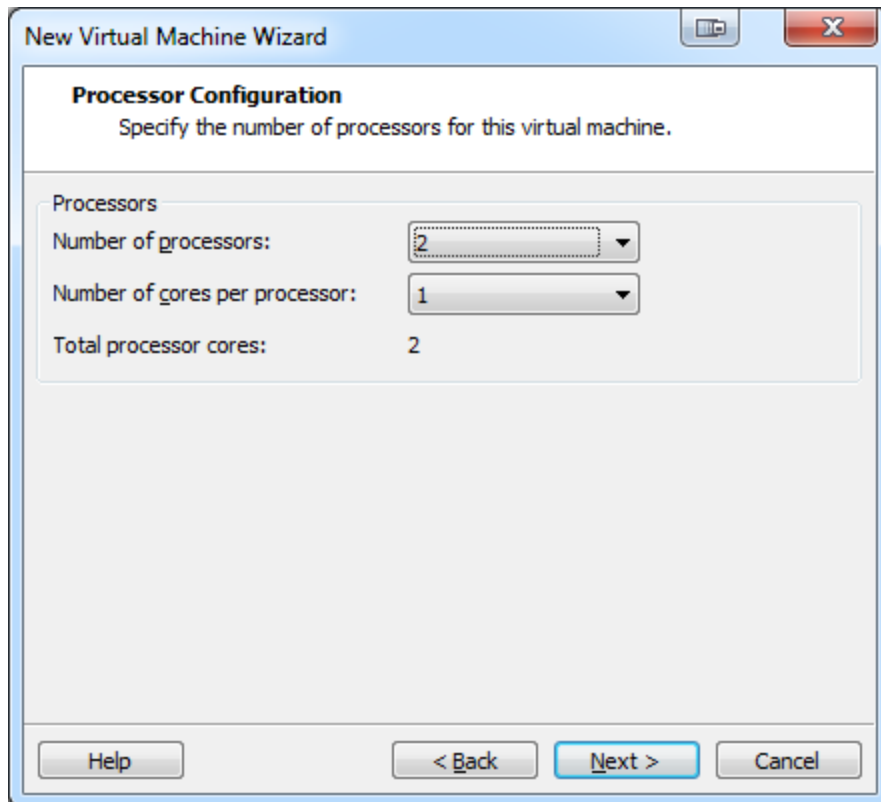
Workstation 8 Steps - 4

• Set the network to bridged. It's entirely up to you, but I like to put my management on the same network my other machines reside on.
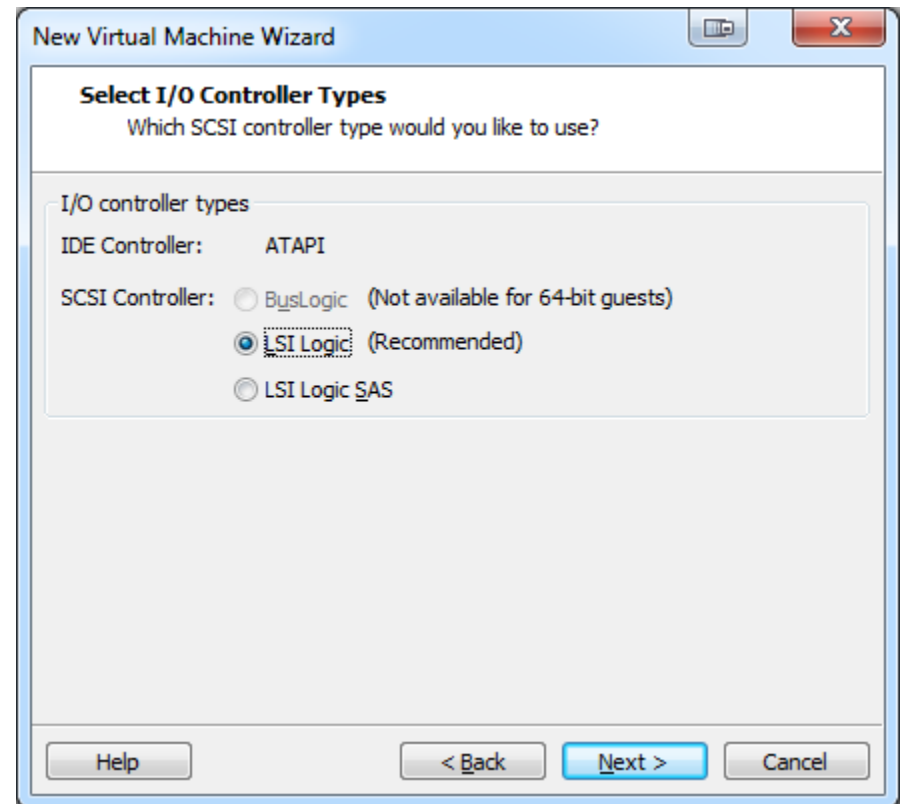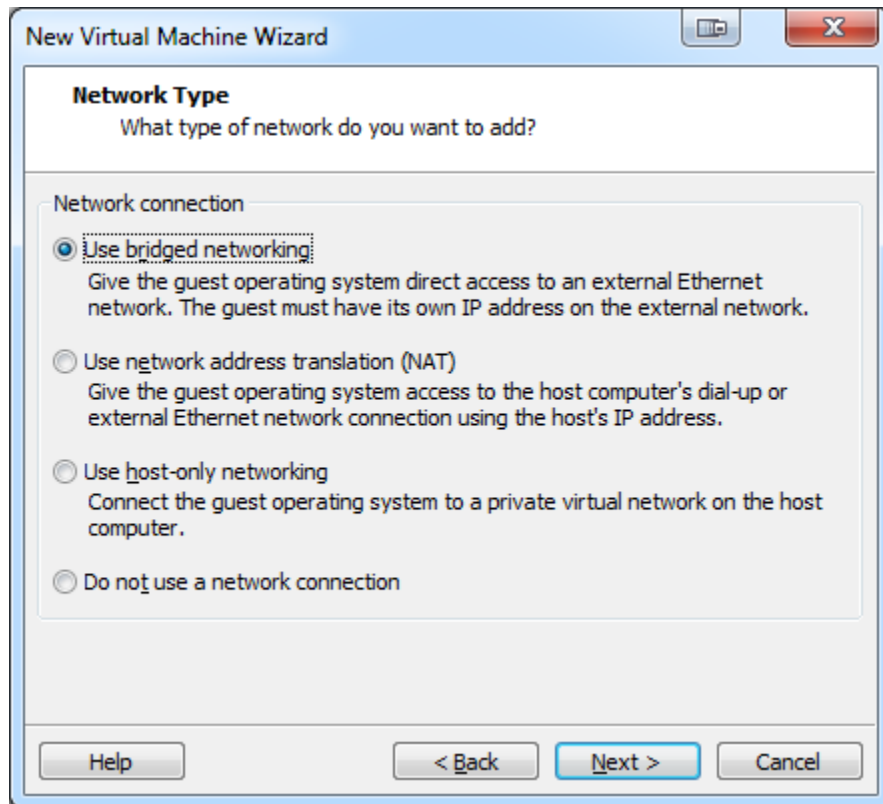
Workstation 8 Steps - 5

- At the end of the wizard, select customize hardware.
 - Under processors, select "Virtualize Intel VT-x/EPT or AMD-V/RVI."
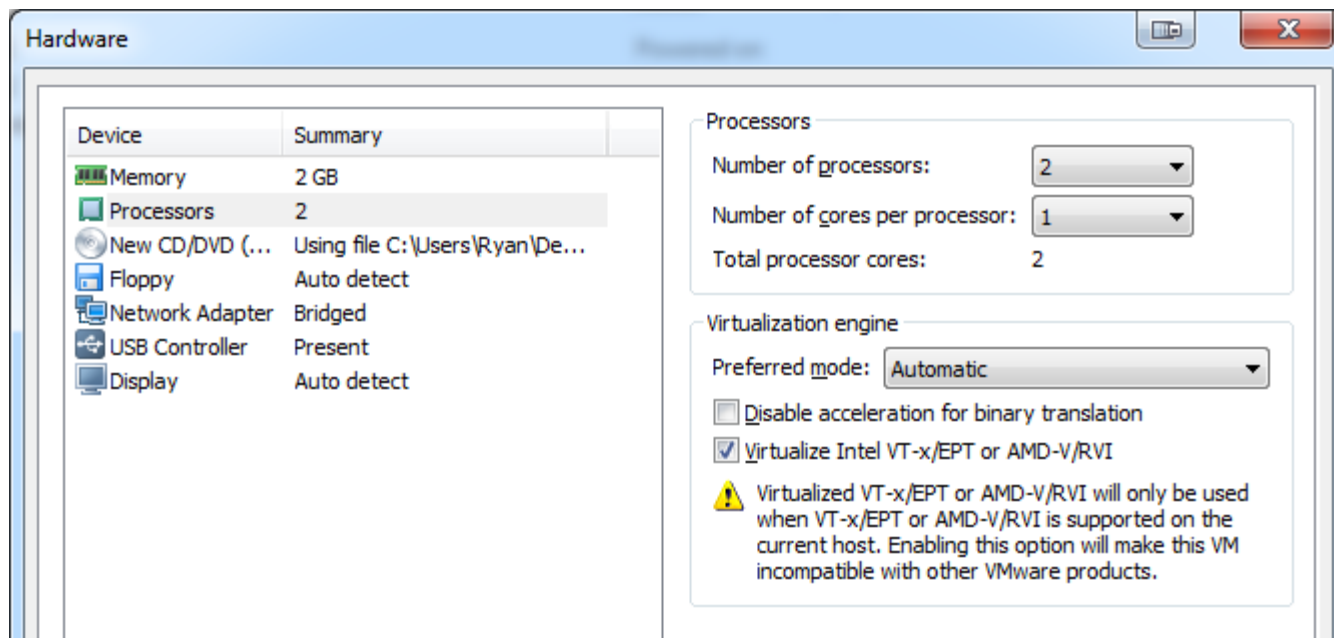
Workstation 8 Steps - 6

- Add additional network adapters.
    - One will be bridged for management, etc.
    - The other two should be connected to VMnet2 and VMnet3.
    - VMnet2 will be used for a private vMotion network.
    - VMnet3 will be used for a private Storage network.
    - Optionally, you could add another bridged adapter to connect VM traffic to.

Device	Summary
Memory	2 GB
Processors	2
Hard Disk (SCSI)	4 GB
CD/DVD (IDE)	Auto detect
Floppy	Auto detect
Network Adapter	Bridged
Network Adapt...	Custom (VMnet2)
Network Adapt...	Custom (VMnet3)
USB Controller	Present
Display	Auto detect

In the end…

- We will have a lab that looks something like this:
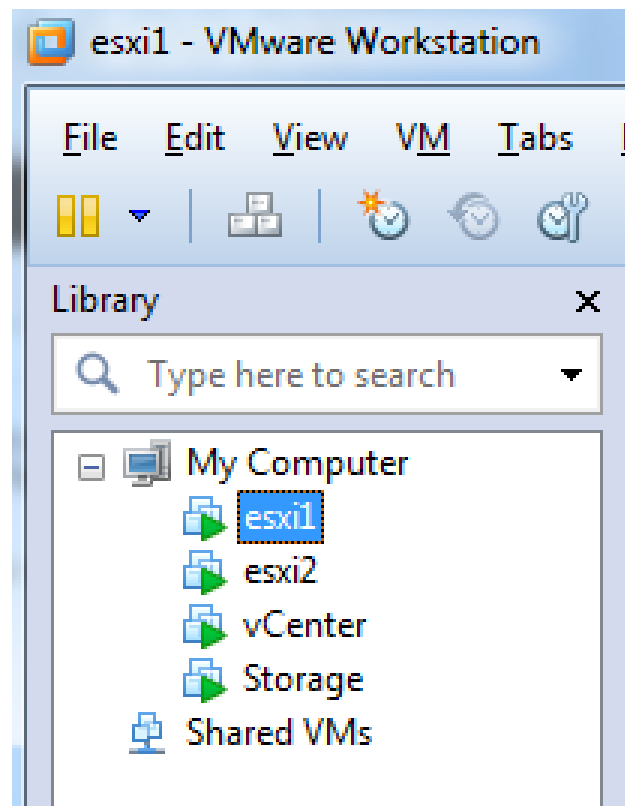
Questions?

Comments?

- What are YOU running in your home lab?

Suggestions?