November 14th 2023
Cincinnati VMUG User Conference

Automating the build of a vSphere 8 / vSAN 8 Sandbox Lab on Unsupported Hardware

Automation Strategies and Walkthrough / Demonstration

Home lab strategies

Who am I?

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Based in Hudson, WI

Systems Engineer for the Minnesota State Colleges and Universities system

VMware Engineer since 2006

Minneapolis VMUG Leader since 2015

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Agenda

- Why Automate?
- Why vSAN / vSphere 8?
- Components List for the Sandbox
- Coming up with a task list
- Taking things to the next level – slowly
- Walkthrough / Demo

Why Automate? -- vSphere 8 / vSAN 8 Sandbox Lab

- Infrastructure-as-Code
- Spend less time on the foundation of your lab
- It’s fun!

Lab Types -- vSphere 8 / vSAN 8 Sandbox Lab

Sandbox Labs vs Primary Labs

- Primary Lab
  - Critical Lab Infrastructure (DNS, Authentication Services, DHCP, File Services, VDI, logging, backups)
- Sandbox Lab
  - Isn’t always powered on
  - Loved ones shouldn’t care if you yank the power on it
  - Automate it as much as possible for repurposing

Getting a home lab

Alternatives:

- Single desktop with a type-2 hypervisor such as VMware Workstation!
  - Advantages
    - Cost effective – VMUG Advantage really helps!
    - Allows you to dual purpose your primary desktop as a lab
    - Able to run ESXi as a VM
    - Low power consumption
  - Disadvantages
    - CPU is usually a bottleneck – most PC's have one socket
    - Disk I/O can be a bottleneck, SSD is necessary and large capacity SSD disks can be expensive
    - Memory capacity is a limitation depending on what you want to test

Getting a home lab

Alternatives:

- Supermicro Super Servers – Paul Braren from www.tinkertry.com is a great resource for these!
  - Advantages
    - Brand new technology and great performing
    - Good RAM expansion and come in dual socket configurations
    - Low power consumption
    - Single system can leverage nested ESXi
    - Quiet!
  - Disadvantages
    - A bit more expensive… for a single system many are between $2000 and $4000
    - Nested ESXi doesn't match how you run your infrastructure (hopefully!)

Getting a home lab

Alternatives:

- Mini PC's running ESXi (example: Intel NUC)
  - Advantages
    - Brand new technology and great performing
    - RAM expansion is improving compared to the past
    - Semi-Low power consumption
    - Quiet!
    - USB NIC's can give you added flexibility
  - Disadvantages
    - Moderately expensive… for a single system many are between $500 and $1000

Getting a home lab

Alternatives:

- Used or Lease-Return Systems
  - Advantages
    - Same systems you probably use at your organization
    - Many have a good amount of HCL life left
    - Great expandability options
  - Disadvantages
    - Some use a moderate amount of power
    - Take up a bit more space
    - May be notified of CPU’s going out of support in a future release

Why vSphere 8 / vSAN 8 -- vSphere 8 / vSAN 8 Sandbox Lab

- Widely adopted technologies
- 60 Day Evaluation for anyone
- 365 Day Evaluation for EvalExperience / VMUG Advantage users
- Provides the foundation for other services
  - Horizon, Aria (vRealize) Automation/Operations, K8S / Tanzu
- Doesn’t require external storage

Hardware Components -- vSphere 8 / vSAN 8 Sandbox Lab

- HP Proliant DL360 Gen8p
  - 2x Intel Xeon CPU – E5-2640 @ 2.5GHz
  - 192GB RAM
  - 3x 128GB SSD (RAID5)
  - 5x 600GB HDD (RAID5)
  - 4x 1Gb Network

Software Components -- vSphere 8 / vSAN 8 Sandbox Lab

- vSphere
  - vSphere 6.5 on Physical Host (HPE custom ISO)
  - Or vSphere 8.0 on Physical Host (VMware ISO)
  - vSphere 8.0 on Virtual Machines (nested)
    - 4 Virtual Machines
    - 4 vCPU, 40GB RAM, 4 virtual NIC’s
    - Disks: 12GB (HDD), 50GB (SSD), 400GB (HDD)
    - One vSAN Disk Group / Host (Hybrid w 50GB cache/400GB capacity)

Coming up with a task list -- vSphere 8 / vSAN 8 Sandbox Lab

- Go through the installation manually and familiarize yourself
  - Physical Host
    - Create two RAID5 arrays (3x 120GB SSD, 5x 600GB HDD)
    - Deploy ESXi 6.5 Update 2 (final HP image for DL360 Gen8) https://my.vmware.com/web/vmware/details?downloadGroup=OEM-ESXI65U2-HPE&productId=614
    - Update to most current ESXi 6.5 build
    - Create two internal datastores, one for SSD virtual disks, one for HDD virtual disks
    - Choose a CPU Scheduler Modification to prevent CPU vulnerabilities https://blogs.vmware.com/vsphere/2019/05/which-vsphere-cpu-scheduler-to-choose.html Only the Side-Channel Aware Scheduler version 1 is supported with vSphere 6.5.
    - Nested Networking – Allow Promiscuous Mode, Forged Transmits, MAC address changes

Coming up with a task list -- vSphere 8 / vSAN 8 Sandbox Lab

- Next Steps
  - Configure port groups on physical host set for all VLAN's (VLAN 4095)
  - Create four virtual machines with specs from earlier
  - Log in to ESXi nested VM's and configure virtual machine, VMotion and vSAN networking
  - Install vCenter Server using the bootstrap to one host method
  - Add remaining hosts to vCenter
  - Add new vSAN disk groups to remaining hosts

Automation -- vSphere 8 / vSAN 8 Sandbox Lab

- Take previous steps and decide what to automate first
  - Configure port groups on physical host set for all VLAN's (VLAN 4095)
    - Add all vmnics to vSwitch0
    - Create 4 port groups with one vmnic active and three unused – passing all VLAN tags through to VM's
    - Allow MAC changes and Promiscuous Mode on port groups
  - Create four virtual machines with specs from earlier
    - Create new VM with aforementioned compute and boot disk, call out HW version, primary network adapter, a CD, and right guest ID
    - Add vSAN disks to VM, and three network adapters to the VM
    - Mount the ESXi 8.0 ISO to the CD
    - Allow nested virtualization on the VM
    - Power on the VM

Automation -- vSphere 8 / vSAN 8 Sandbox Lab

- **Install ESXi and configure the host**
  - Install Linux VM to allow you to repackage the ISO with custom kickstart script
  - Download installation ISO from VMware and extract files to a folder on your Linux server
  - Edit /efi/boot/boot.cfg to point to a custom kickstart file
  - Create a custom kickstart file to configure your nested ESXi hosts for your network
  - Mount nested ESXi VM's to each ISO and install

Create an installer ISO image with a custom installation or upgrade script
https://docs.vmware.com/en/VMware-vSphere/7.0/com.vmware.esxi.install.doc/GUID-C03EADEA-A192-4AB4-9B71-9256A9CB1F9C.html

ks.cfg options
https://kb.vmware.com/s/article/2004582

Automation -- vSphere 8 / vSAN 8 Sandbox Lab

- **Log in to ESXi nested VM's and configure virtual machine, VMotion and vSAN networking**
  - Create a loop to check for the status of your nested ESXi VM's after the build begins
  - Once it can connect to the host via HTTPS, add vmnic1,2,3 to vSwitch0
  - Create Virtual Machine Port Groups with uplinks 0,1
  - Create Dual-NIC Vmotion Port Groups and VMKernel Ports with uplinks 0,1 and 1,0
  - Create vSAN Port Group and VMKernel Port with uplinks 2,3
  - Create two iSCSI Port Groups with uplinks 2,3 (optional)

Automation -- vSphere 8 / vSAN 8 Sandbox Lab

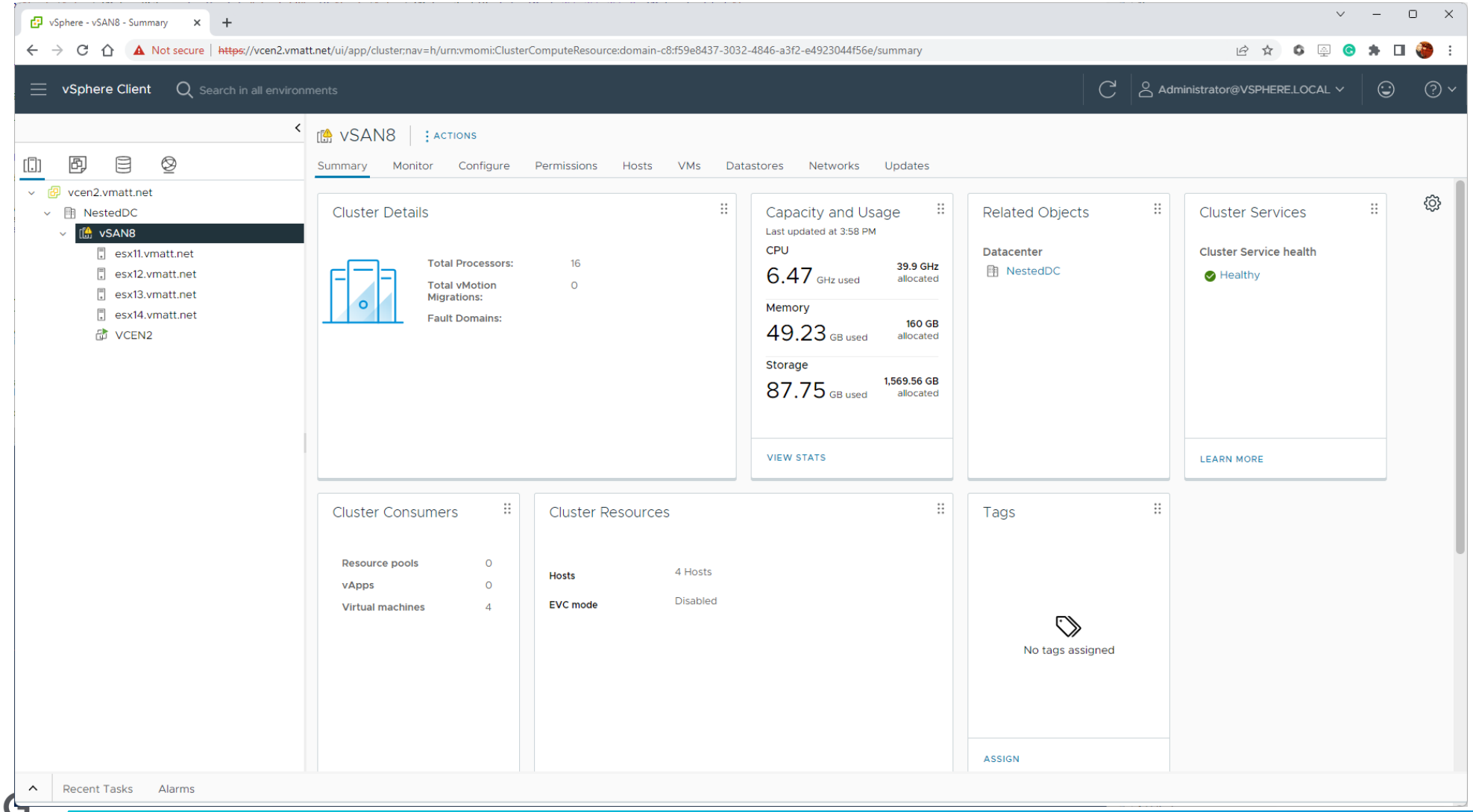
- **Install vCenter Server using the bootstrap to one host method**
  - Download vCenter Server 8 and mount it to CD drive
  - Copy the CD contents to a folder
  - Edit the file ISO:\\vcsa-cli-installer\templates\install\vCSA_with_cluster_on_ESXi.json
    Set this option if you have a capacity disk of 600GB or less "thin_disk_mode": true,
    Set this option if you have limited host memory resources "deployment_option": "tiny",
  - Launch the CLI installer with these switches:

```
.\vcsa-deploy.exe install --accept-eula --acknowledge-ceip --no-esx-ssl-verify PathTo\vCSA_with_cluster_on_ESXi.json
```

Automation -- vSphere 8 / vSAN 8 Sandbox Lab

- **Add remaining hosts to vCenter**
  - Use loop to test HTTPS connections to vCenter and proceed when it is available
  - Add hosts 2, 3 and 4 to the vSAN cluster that was created on host 1
  - Create new vSAN disk groups on each host comprised of your cache and capacity devices
  - Verify that the new disk groups on each host were added to your vSAN Datastore and communication is functioning
  - Enable DRS and HA on the vSAN cluster
  - Place original vSAN node in maintenance mode to test vSAN maintenance operations and VMotion

Completed Deployment - vSphere 8 / vSAN 8 Sandbox Lab



VMUG VMware User Group

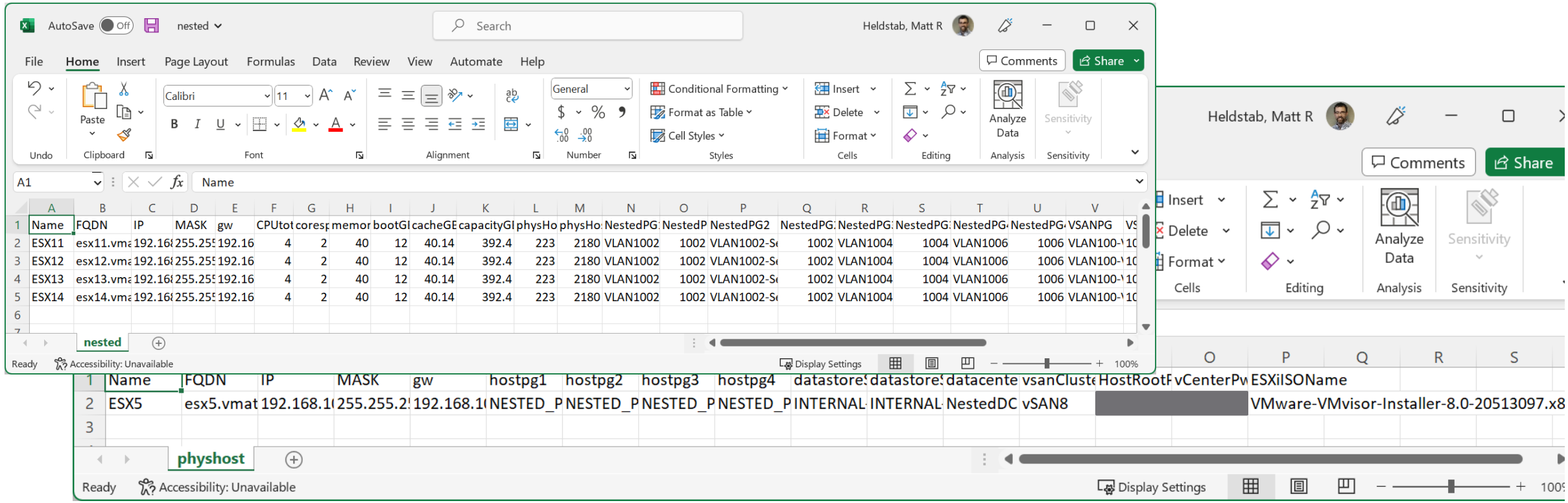
Data Input with Arrays -- vSphere 8 / vSAN 8 Sandbox Lab

Instead of entering the specs manually:

```
new-vm -Name ESX11 -Datastore INTERNAL-SAS-DATASTORE1 -GuestId "vmkernel65Guest"
-NumCPU 4 -CoresPerSocket 4 -MemoryGB 40 -HardwareVersion vmx-13 -DiskGB 12 -CD

new-vm -Name ESX12 -Datastore INTERNAL-SAS-DATASTORE1 -GuestId "vmkernel65Guest"
-NumCPU 4 -CoresPerSocket 4 -MemoryGB 40 -HardwareVersion vmx-13 -DiskGB 12 -CD

new-vm -Name ESX13 -Datastore INTERNAL-SAS-DATASTORE1 -GuestId "vmkernel65Guest"
-NumCPU 4 -CoresPerSocket 4 -MemoryGB 40 -HardwareVersion vmx-13 -DiskGB 12 -CD

new-vm -Name ESX14 -Datastore INTERNAL-SAS-DATASTORE1 -GuestId "vmkernel65Guest"
-NumCPU 4 -CoresPerSocket 4 -MemoryGB 40 -HardwareVersion vmx-13 -DiskGB 12 -CD
```

Data Input with Arrays -- vSphere 8 / vSAN 8 Sandbox Lab

- **Create arrays to house your host data**
  - Create two arrays, one for your nested ESXi hosts and one for your physical ESXi host



Data Input with Arrays -- vSphere 8 / vSAN 8 Sandbox Lab

- **Create arrays to house your host data**
  - Create two arrays, one for your nested ESXi hosts and one for your physical ESXi host
  - Save them as CSV files and import them in your PowerCLI script
  - Instead of calling out a resource by name, use the array

    $hosts[0].Name is the same as ESX11
  - Use Foreach loops to loop through the array index instead of calling it out by line

```
$hosts = import-csv -path h:\scripts\nestedESXi80\nested.csv

PS H:\scripts\nestedESXi80\VCSA\vcsa-cli-installer\win32> $hosts[0]

Name                    : ESX11
FQDN                    : esx11.vmatt.net
IP                      : 192.168.100.21
MASK                    : 255.255.255.224
gw                      : 192.168.100.30
CPUtotal                : 4
corespersocket          : 2
memory                  : 40
bootGB                  : 12
cacheGB                 : 40.14
capacityGB              : 392.4
physHostTotalCacheGB    : 223
physHostTotalCapacityGB : 2180
NestedPG1               : VLAN1002-Servers1-EPH
NestedPG1VLAN           : 1002
NestedPG2               : VLAN1002-Servers1
NestedPG2VLAN           : 1002
NestedPG3               : VLAN1004-Servers2
NestedPG3VLAN           : 1004
NestedPG4               : VLAN1006-Servers3
NestedPG4VLAN           : 1006
VSANPG                  : VLAN100-VSAN
VSANvmkIP               : 10.10.10.21
VSANVLAN                : 100
VMotionPG1              : VLAN0002-VMotionA
```

Data Input with Arrays -- vSphere 8 / vSAN 8 Sandbox Lab

```
$physHost = @()
$physHost = import-csv -path h:\scripts\nestedESXi80\physhost.csv
$hosts = @()
$hosts = import-csv -path h:\scripts\nestedESXi80\nested.csv
```

```
foreach ($i in $hosts){
write-Host "Building new"($i.Name)"VM" -ForegroundColor $cc
write-Host ($i.Name)"VM being configured with"($i.CPUtotal)"vCPU,"($i.memoryGB)"GB Memory" -ForegroundColor $cc
new-vm -VMHost $physHost[0].FQDN -Name $i.Name -Location $i.datacenter -Datastore $i.bootDatastore -GuestId "vmkernel65Guest" -NumCPU $i.CPUtotal -Co
get-vm $i.Name | get-NetworkAdapter | Set-NetworkAdapter -NetworkName NESTED_PORT1_ALLVLANS -confirm:$false
New-HardDisk -VM $i.Name -CapacityGB $i.SSD1GB -Datastore $i.SSD1Datastore -StorageFormat Thick
New-HardDisk -VM $i.Name -CapacityGB $i.SSD2GB -Datastore $i.SSD2Datastore -StorageFormat Thick
New-NetworkAdapter -VM $i.Name -NetworkName $physHost[0].hostpg2 -Type Vmxnet3 -StartConnected
New-NetworkAdapter -VM $i.Name -NetworkName $physHost[0].hostpg3 -Type Vmxnet3 -StartConnected

$vm = get-vm $i.Name
$vmsp = get-vmstartpolicy $vm
set-vmstartpolicy $vmsp -StartAction PowerOn -StartOrder $i.VMstartOrder -confirm:$false
###

write-Host "Mounting Custom ESXi installer on $($i.FQDN) VM" -ForegroundColor $cc
get-vm $i.Name | get-cddrive | set-cddrive -isopath "[$ISOdatastore] ISO/$($i.ESXiISOName)" -StartConnected $true -confirm:$false
$vm = Get-VM -Name $i.Name
write-Host "Configuring $($i.FQDN) for nested virtualization" -ForegroundColor $cc
$vm.ExtensionData.ReconfigVM($spec1)
write-Host "Powering on $($i.FQDN) VM" -ForegroundColor $cc
start-vm $i.Name
start-sleep -seconds 15
}
```

Making it user-friendly

- **If an error is possible, set a flag instead of being satisfied with a transient error**

```
#Delete VM Network Port Group if it exists
$Exists = get-virtualportgroup -name "VM Network" -ErrorAction SilentlyContinue
If ($Exists){
  get-virtualportgroup -Name "VM Network" | remove-virtualportgroup -Confirm:$false
}
```

- **Give the script user feedback by using “Write-Host” and changing the font color**

```
write-host "Installing vCenter Server on vcen2.vmatt.net" -ForegroundColor $cc
.\vcsa-deploy.exe install --accept-eula --acknowledge-ceip --no-esx-ssl-verify H
```

The script user will see:

```
Installing vCenter Server on vcen2.vmatt.net
Run the installer with "-v" or "--verbose" to l
Not executing pre-check-only.
Updating log file location, copying 'C:\Users\u
Consuming the installer build:20518555
Workflow log-dir
C:\Users\uo5221ns\AppData\Local\Temp\vcsaCliInst
```

The back-out script!

- **At times, you might make it through a script that fails, leaving a BIG MESS**
- **Instead of manually cleaning up, have a cleanup / back-out script**

```
$workingcsvfolder = "C:\Users\uo5221ps.VMATT\OneDrive - MNSCU\Documents\scripts\nestedESXi80"
$physHost = @()
$physHost = import-csv -path $workingcsvfolder\physhost-nuc2.csv
$hosts = @()
$hosts = import-csv -path $workingcsvfolder\nested-nuc2.csv

disconnect-viserver * -confirm:$false
connect-viserver $physHost[0].FQDN -user root -password $physHost[0].HostRootPwd

foreach ($i in $hosts){

get-vm $i.Name | Stop-VM -confirm:$false
get-vm $i.Name | Remove-VM -DeleteFromDisk -confirm:$false

}

disconnect-viserver * -confirm:$false
Remove-Variable * -ErrorAction SilentlyContinue
```

Performance Statistics
Standard Switch Port Group with MTU of 9000 on the Standard Switches

The network performance test is designed to assess the network bandwidth of the vSAN vmknic on the hosts. The result can be used as a reference to troubleshoot potential netw issues. For details, please refer to VMware Docs. Learn more

RUN TEST Last run: 02/08/2023, 8:24:12 AM, Warning

From Host	To Host	Health Status	Received Bandwidth (Mb/s)
esx14.vmatt.net	esx12.vmatt.net	Warning	307.83
esx12.vmatt.net	esx11.vmatt.net	Warning	262.06
esx11.vmatt.net	esx13.vmatt.net	Warning	223.97
esx13.vmatt.net	esx14.vmatt.net	Warning	316.28

HP ProLiant DL360 Gen8 Server 2x Intel Xeon E5-2690 2.90GHz 256GB P420i No HDD

Condition: Used

Price: US $353.29

No Interest if paid in full in 6 mo on $99+*

Buy It Now

Add to cart

Best Offer:

Make offer

♡ Add to Watchlist

Additional service available

☐ 1-year protection plan from Allstate - $39.99

For HP 651687-001 2.5" SFF HDD Tray Caddy G8 Gen8 G9 DL380p 651699 DL360p New

Be the first to write a review.

Condition: New

Quantity: 1 More than 10 available / 2,430 sold

See feedback

Price: **US $7.48**

Buy It Now

Add to cart

♡ Add to Watchlist

Free returns	28 watchers	2,430 sold

Shipping: US $1.98 Standard Shipping | See details
Located in: Monroe Township, New Jersey, United States

Delivery: Estimated between Sat, Feb 11 and Tue, Feb 14 to 54022

Returns: 30 day returns | Seller pays for return shipping | See details

Click to enlarge

Kingston 240 GB HyperX 3K 2.5" (6.35 cm) Solid State Drive - SKU#1516582

★★★★★ 5 product ratings

Condition: Used

Price: **US $39.00**

Buy It Now

Add to cart

Best Offer:

Make offer

♡ Add to Watchlist

Additional service available

☐ 1-year protection plan from Allstate - **$4.99**

Free shipping and returns | Ships from United States

LOT OF 5 46X5427 Seagate 46X5428 600GB SAS 10K 6Gb 2.5" Hard Drive 108-00221+A0

Condition: **Used**

"30 Day Warranty _ Fully Wiped _ Buyers will receive 5 Hard Drives"

1 lot available (5 items per lot)

Price: **US $55.90**

Buy It Now

Add to cart

Best Offer:

Make offer

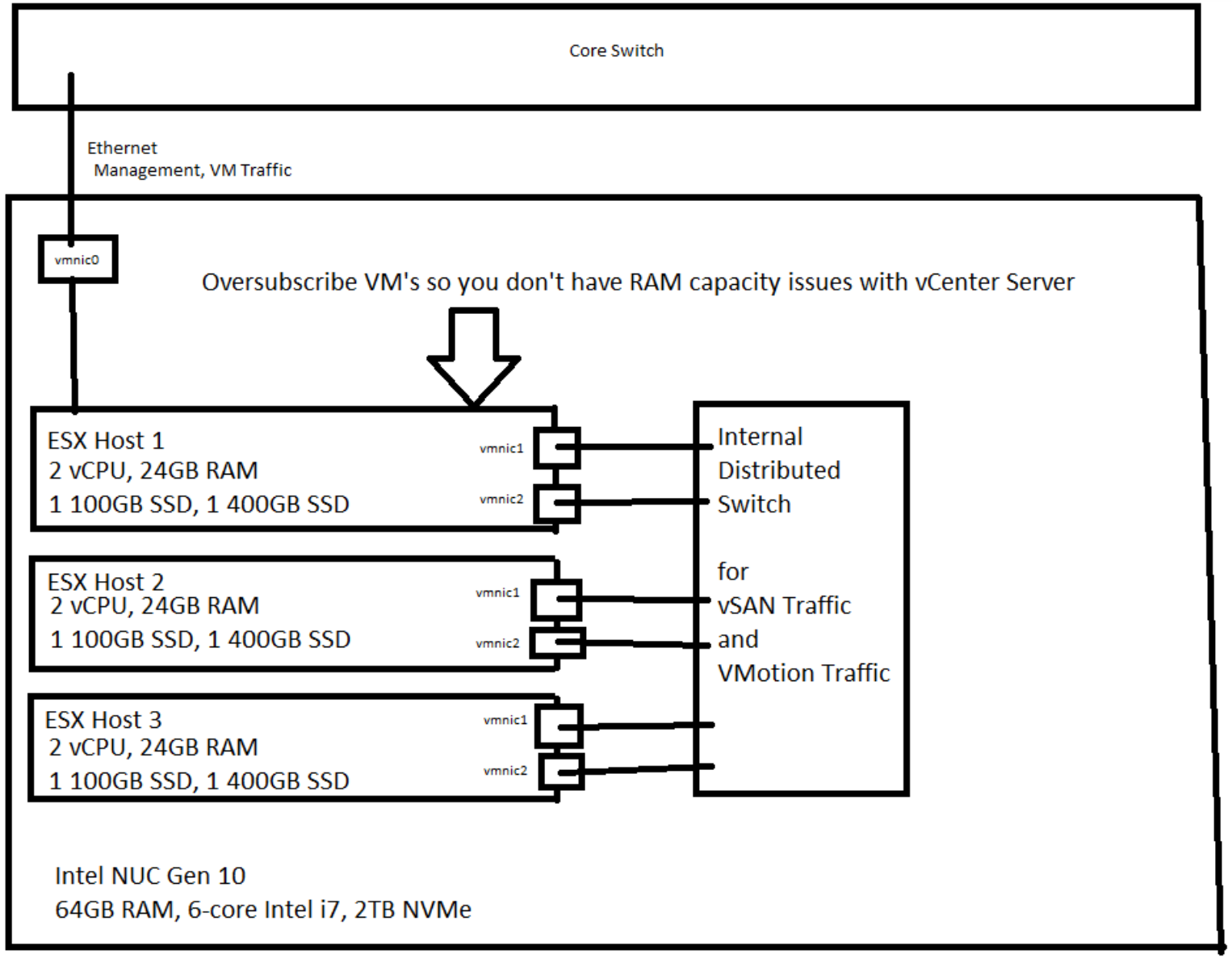
♡ Add to Watchlist

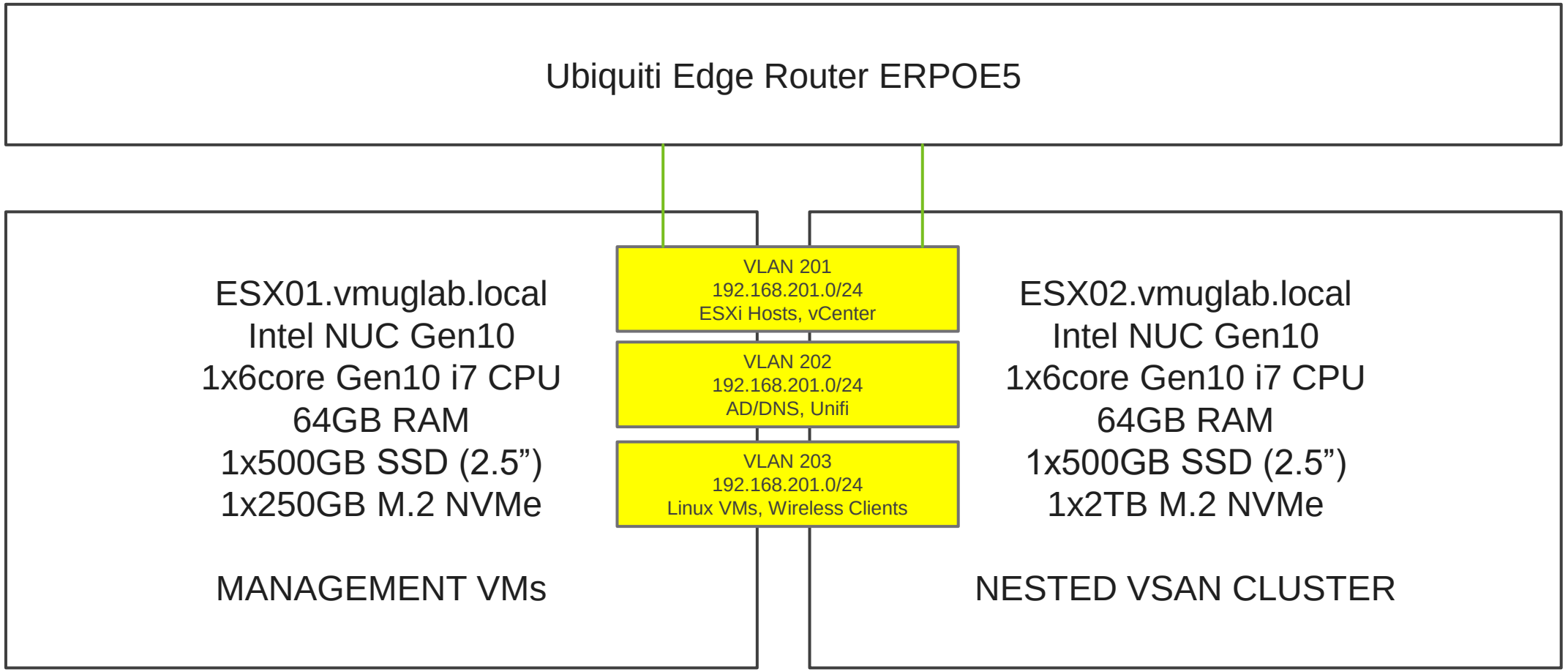
Additional service available

☐ 1-year protection plan from Allstate - **$10.99**

Total for HP Proliant DL360 Gen8 with 256GB RAM and Dual Xeon

Server -	~$350	$350
Drive Caddy	~$10 x 8	$ 80
SSD Drives	~$40 x 3	$120
HDD Drives	~$60 for 5	$ 60
Total		~$610





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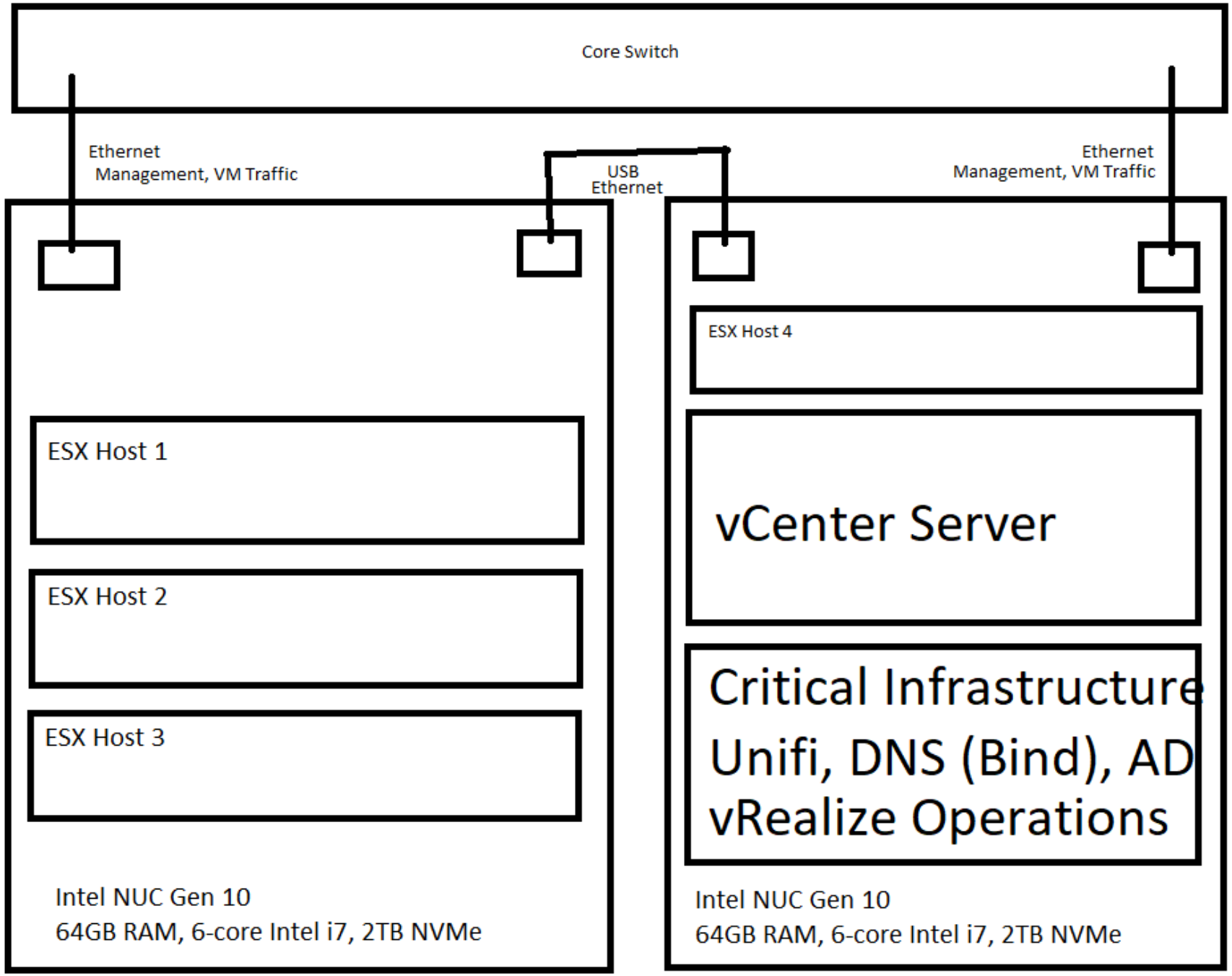
Core Switch
Ethernet
Management, VM Traffic
USB
Ethernet
Ethernet
Management, VM Traffic
ESX Host 1
ESX Host 2
ESX Host 3
Intel NUC Gen 10
64GB RAM, 6-core Intel i7, 2TB NVMe
ESX Host 4
vCenter Server
Critical Infrastructure
Unifi, DNS (Bind), AD
vRealize Operations
Intel NUC Gen 10
64GB RAM, 6-core Intel i7, 2TB NVMe

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20-35% off Training Discounts		✓
365-day Evaluation Licenses		✓
Exclusive VMware Explore Discount		✓
TestDrive by VMware		✓
Price	Free	$200.00USD/year

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VMware vSphere with VMware Tanzu Basic

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VMware Horizon® Advanced Edition 7

VMware Horizon® Advanced Edition 8

VMware vRealize Operations for Horizon®

Personal Desktop

VMware Fusion 13 Pro

VMware Workstation 17 Pro

DEMO TIME

Be Kind

Please do not

DDoS

Connect to Wireless SSID

vmuglab

!!!!!vmuglab!!!!!

vCenter Server

https://vcen1.vmuglab.local/ui

Take a username/password snippet

113 Seaboard Lane, Suite C-250, Franklin, TN 37067