

Citrix Virtual Apps and Desktops Machine Creation Service (MCS) Deployment on Oracle Cloud Infrastructure (OCI) Bare Metal Instances with Microsoft Hyper-V in Windows Server 2016 Data Center Edition

Deployment Guide

This paper highlights an approximately 764 (191 seats per one Hyper-V) knowledge based desktop VDI architecture or approximately 1316 non-persistent knowledge-type (329 users per one Hyper-V) hosted applications accesses using Citrix Virtual Apps and Desktops (formerly XenApp and XenDesktop) utilizing Citrix Machine Creation Services (MCS).

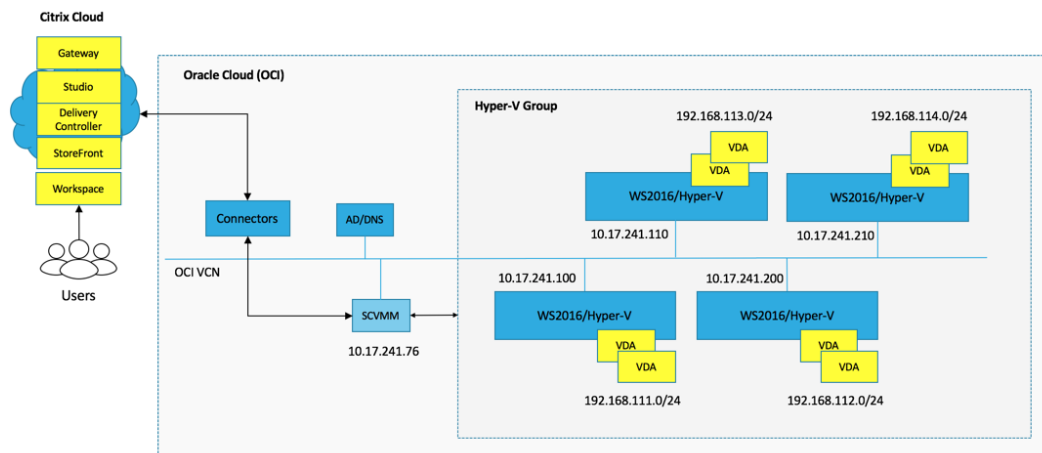
The presented desktop VDI solution along with non-persistent applications with OCI Bare Metal retains the end-user productivity with customized desktops while providing high performance, scalability, and minimized desktop administration overheads in a cost-effective way.

1. Deployment Topology (Multiple Hyper-Vs use case)

a. Citrix Virtual Apps and Desktops service and Citrix cloud services

Citrix cloud services deliver an integrated, secure digital workspace by unifying multiple Citrix services in a single cloud platform which simplifies and accelerates the deployment of services for the end-users. The Citrix cloud platform provides underlying services for operations, service administration, resource management, upgrades, user experience and system monitoring with smart analytics. The portfolio of Citrix cloud services includes, among others: Citrix Workspace, Citrix Virtual Apps and Desktops, Content Collaboration, Citrix Gateway, and Citrix Analytics. In this testing environment, the Citrix Apps and Desktops service has been tested and validated.

b. Testing environment



2. Components

The compute instances on OCI are available in two main groups: virtual machines (VMs) and bare metal machines (BMs). Both groups have a DenseIO option for high performance local NVMe SSD storage. In this testing architecture, both Standard and Dense IO bare metal instance were tested.

a. Compute Shapes used (Bare Metal and Virtual Machine Instances)

Shape	Processor	OCPU	Memory (GB)	Storage
BM.DenseIO2.52	2.0 GHZ Platinum 8167M	52	768	51.2 TB of local NVMe SSD Up to 512 TB Block volume
VM.Standard1.2	2.3 GHZ E5-2699	2	14	Up to 512 TB Block volume
VM.Standard1.4	2.3 GHZ E5-2699	4	28	Up to 512 TB Block volume
VM.Standard1.16	2.3 GHZ E5-2699	16	250	Up to 512 TB Block volume

b. Instances (on OCI VCN)

Host	Shape	Function	Operating Systems
DCX7-01	BM.DenseIO2.52	Hyper-V Host	Window Server 2016 Data Center Edition
DCX7-02	BM.DenseIO2.52	Hyper-V Host	Window Server 2016 Data Center Edition
DCX7-03	BM.DenseIO2.52	Hyper-V Host	Window Server 2016 Data Center Edition
DCX7-04	BM.DenseIO2.52	Hyper-V Host	Window Server 2016 Data Center Edition
AD	VM.Standard1.4	Active Directory, DNS	Window Server 2012 R2
SCVMM	VM.Stnadard1.16	Microsoft SCVMM for Hyper-V management	Window Server 2016 Standard Edition
CC1	VM.Standard1.2	Citrix Cloud Connector	Window Server 2012 R2
CC2	VM.Standard1.2	Citrix Cloud Connector	Window Server 2012 R2

c. Software

Software	Vendor	Function
Windows Server 2016 Data Center Edition	Microsoft	Hyper-V Host
Windows Server 2016 Standard Edition	Microsoft	SCVMM
Windows 10 build 1709	Microsoft	VDA

System Center 2016 Virtual Machine Manager (SCVMM)	Microsoft	Hyper-V management
Active Directory, DNS	Microsoft	
Citrix Cloud XenApp and XenDesktop Service	Citrix	XenApp and XenDesktop orchestration in cloud service
Citrix Cloud Connector	Citrix	

c. Network

VCN	Network	Region
Application network	10.17.241.0/24	US-ASHBURN-AD-1

3. Test Methodology

All validation testing was conducted in the Oracle Cloud Infrastructure in Ashburn, Virginia region with collaborated support from Oracle and Citrix. While XenApp and XenDesktop support both seamless application delivery as well as hosted shared desktops, validation and testing focused on application delivery workload with XenApp and virtual desktop (VDI) workload in XenDesktop.

Performance metrics were evaluated during the entire workload lifecycle—XenApp and XenDesktop virtual machine boot-up, user logon and virtual desktop acquisition (ramp-up,) user workload execution (steady state), and user logoff. Test metrics were analyzed from the hypervisor, virtual desktop, storage, and load generation software to assess the overall success of an individual test cycle. Each test cycle was not considered passing unless all of the planned test users completed the ramp-up and steady state phases and unless all metrics were within permissible thresholds.

3.1 Login VSI 4.1.32

Within the test environment, load generators were used to put demand on the system, simulating multiple users accessing the XenApp and XenDesktop service environment and executing a typical end-user workflow. To generate load, Login VSI 4.1.32 was used to generate the end user connection to the Citrix Cloud XenApp and XenDesktop service environment, provide unique user credentials to the StoreFront via Gateway, initiate the workload, and evaluate the end-user experience.

Login VSI measures in-session response time, providing an objective way to validate the expected user experience, even during periods of peak resource demand such as a login storm. Login VSI calculates an index (known as Login VSI_{max}) based on the number of simultaneous sessions that can be run on a single machine before performance degrades beyond an acceptable level. Additional information is available at <http://www.loginvsi.com>.

Parameter	Setting
Users for total four OCI BM nodes (Hyper-V)	
Host desktops	764 for total OCI BM nodes (191 per OCI BM node)
Host applications	1316 for total OCI BM nodes (329 per OCI BM node)

MCS Catalogs deployed	
Host desktops	2x MCS-deployed catalog (1x Delivery group) w/ 382 Windows 10 VMs
Hosted applications	2x MCS-deployed catalog (1x Delivery group) w/ 8x Windows Server 2016 VMs

MCS Catalog configuration	
Host desktops	Random, user data not saved
Host applications	Random, user data not saved

3.2 Results

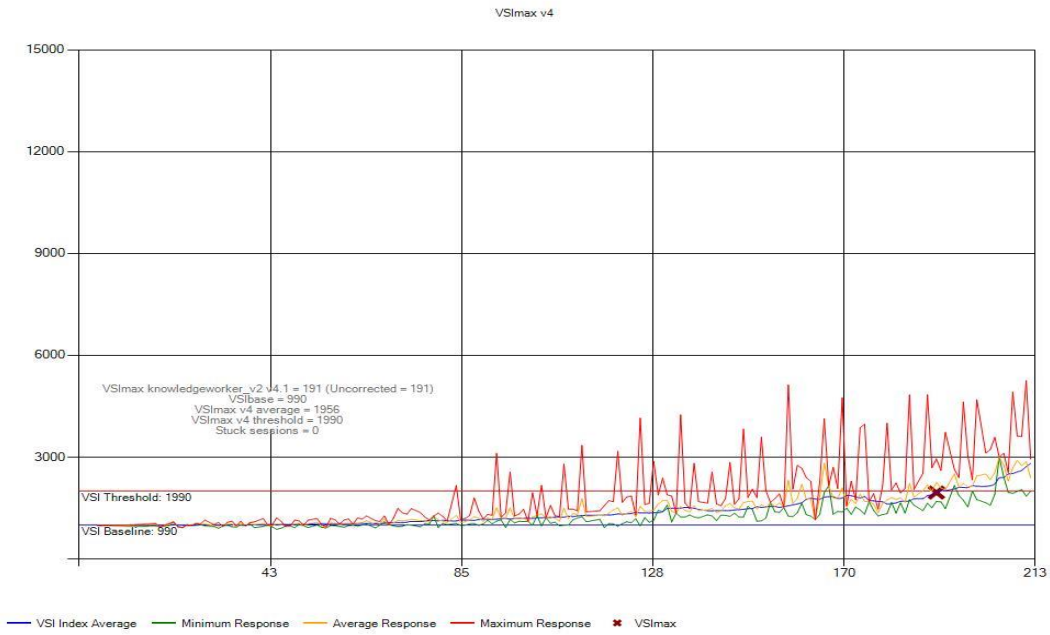


Figure 1. XenDesktop and Hyper-V on OCI bare metal instance – Login VSI VSImax overview

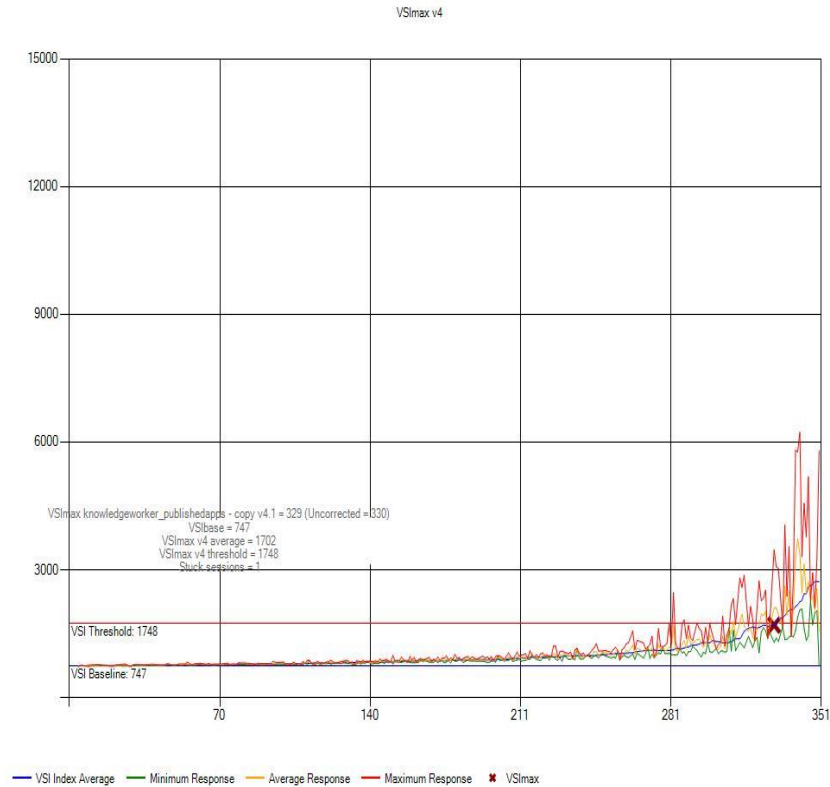


Figure 2. XenApp and Hyper-V on OCI bare metal instance – Login VSI VSI max overview

VSI max represents the maximum number of users the environment can handle before serious degradation of the end user experience occurs. It requires the systems under test to be stressed past the point of normal operating parameters. VSI max is calculated based on the response times of individual users as recorded during the workload execution. If VSI max is reached, that indicates the point at which the user experience has significantly degraded. The response time is generally an indicator of the host CPU resources, but this specific method of analyzing the user experience provides an objective method of comparison that can be aligned to host CPU performance.

In this testing, VSI max shows 191 (shown in figure 1) in XenDesktop desktop session with knowledge workers which is defined by Login VSI workload and 329 (in figure 2) in XenApp published application sessions with knowledge workers respectively. Please refer to following for Login VSI workload types. https://www.loginvsi.com/documentation/index.php?title=Login_VSI_Workloads

3.3 Conclusion

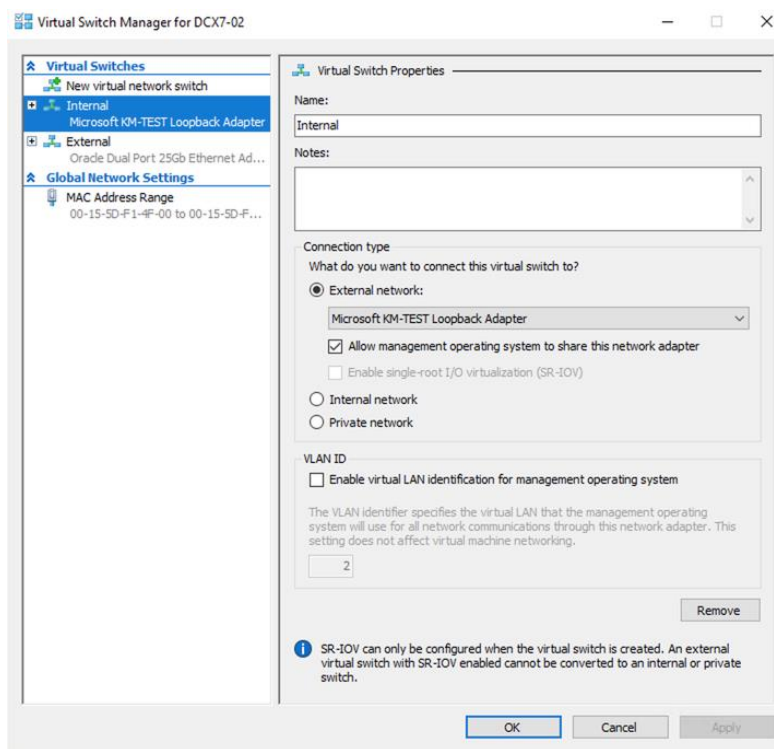
This reference architecture provides a simple, low-cost, fault tolerant Oracle OCI-managed infrastructure for deploying a 764 (191 sessions*4 Hyper-Vs) to 1316 (329 sessions*4 Hyper-Vs) seats configuration for virtual desktops or hosted streamed applications. The combination of Citrix Cloud XenApp and XenDesktop service and the Oracle OCI platform makes it easy to provision XenApp streamed applications and XenDesktop Hosted Shared Desktops.

Desktop virtualization provides significant advantages: it empowers user mobility, centralizes and protects corporate data and

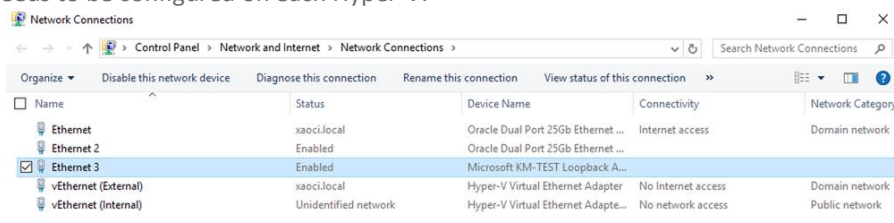
intellectual property, and simplifies management while reducing IT costs. Citrix Cloud XenApp and XenDesktop service delivers a high-definition user access experience for mission-critical Windows applications, data, and desktops centralized in the datacenter or installed on a local PC. XenApp built on HDX technologies enables high-definition real-time video and interactive collaboration even when accessed from hundreds of miles away, making it easy for remote and branch workers to have the same experience and resources as employees at headquarters.

4. Assumptions and known limitations

Oracle-provided Hyper-V internal routing needs to be configured on each Hyper-V to create a segregated (private) network.



- a. Oracle-provide Hyper-V network configuration to switch Hyper-V external switch to internal type by adding a loopback adapter needs to be configured on each Hyper-V.



- a. Each Hyper-V carries own private network (i.e., 192.168.11[1-4].0/24) along with internal DNS and DHCP (windows server), NAT and Router Hyper-V VMs

Virtual Machines					
Name	State	CPU Usage	Assigned Memory	Uptime	Status
hvnat04	Running	0 %	4196 MB	2.15:32:02	
hvrouter04	Running	0 %	700 MB	2.15:32:03	

- Multiple Citrix Cloud network resources under Host connection required
 - Multiple Citrix Cloud Machine Catalogs for each Host connection required
 - Multiple Citrix Cloud Golden Images (one per a Host network resource) required
- b. Machines to be created on each isolated Hyper-V network resource based on its own Golden Images

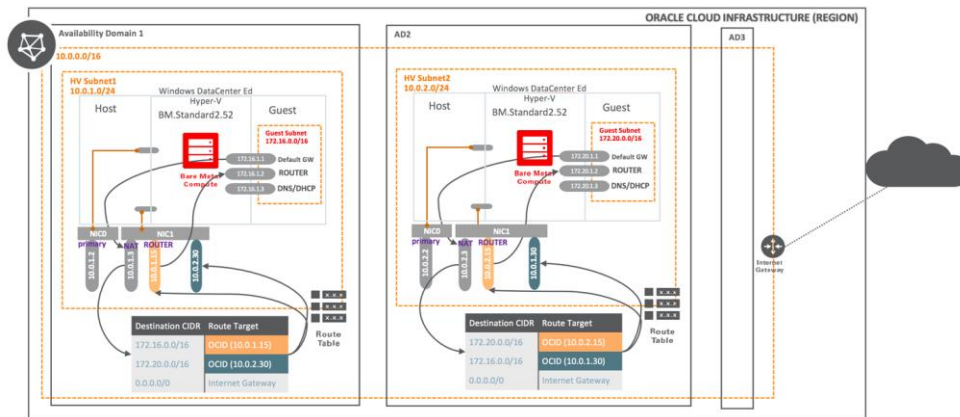
5. Configurations

c. Active Directory and DNS

Set up an active directory domain and DNS server.

Active Directory	Promote Active Directory Domain (\$AD_DOMAIN)
DNS	Set DNS server (\$DNS_IP)

d. Windows Server 2016 Data Center and Hyper-V on Oracle Cloud Infrastructure



Set up windows server 2016 data center edition and enable Hyper-V role. Due to OCI network configuration, Hyper-V NAT and route (External and Internal Hyper-V virtual switches) are needed to be configured according to Oracle OCI guideline. In addition, due to incompatibility with Microsoft SCVMM, a loopback adapter for Hyper-V host internal virtual switch needs to be configured so SCVMM can detect the loopback adapter as an additional external network interface.

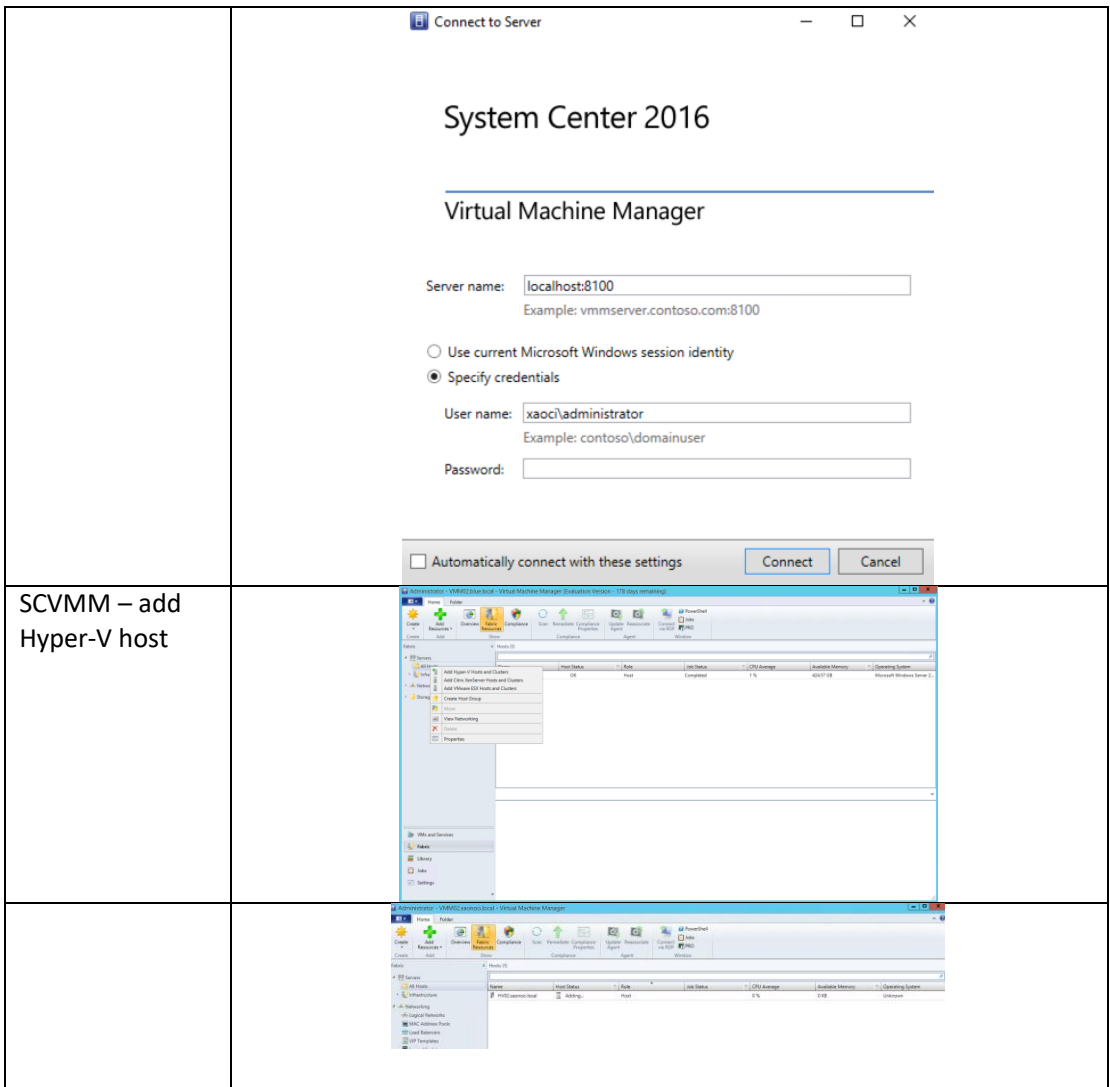
Set DNS server	# netsh interface ip set dns "Ethernet" static \$DNS_IP
Join AD Domain	# rename-computer \$NAME # restart-computer

	# add-computer –domainname \$AD_DOMAIN # restart-computer
Enable Hyper-V role, setup Hyper-V virtual switch and network configuration	<i>Please refer to Oracle Windows Server 2016 and Hyper-V virtual switch configuration guide. (in Appendix1)</i>

e. System Center 2016 Virtual Machine Manager (SCVMM) on OCI VCN

Set up a windows server 2016 standard edition to install Microsoft System Center 2016 Virtual Machine Manager (SCVMM).

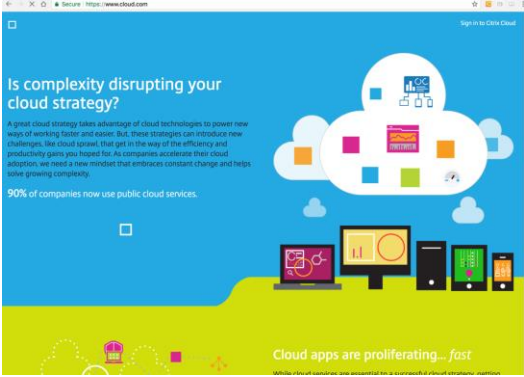
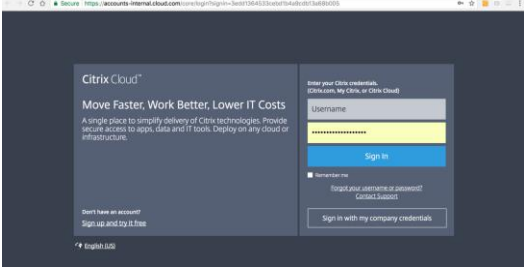
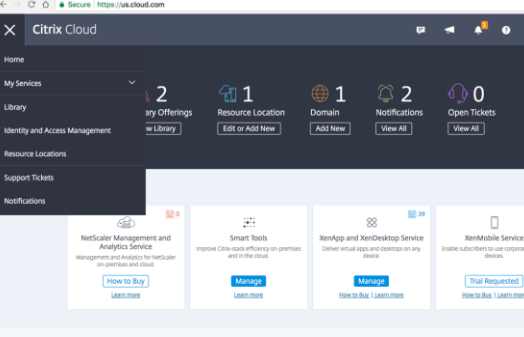
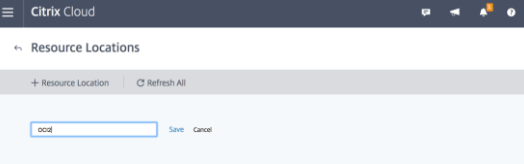
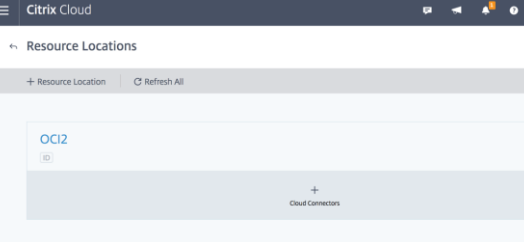
OCI VM instance creation	16-core (recommended), 16 GB RAM (recommended), 200 GB storage (recommended): VM.Standard2.16 or VM.DenseIO2.16																				
Set DNS server	# netsh interface ip set dns "Ethernet" static \$DNS_IP																				
Join AD Domain	# rename-computer \$NAME # restart-computer # add-computer –domainname \$AD_DOMAIN # restart-computer																				
SCVMM installation – Prep (requirements)	<table border="1"> <tr> <td></td> <td>adksetup</td> <td>12/17/2017 3:24 PM</td> <td>Application</td> <td>1,403 KB</td> </tr> <tr> <td></td> <td>SqlCmdLnUtils</td> <td>12/17/2017 5:57 AM</td> <td>Windows Installer ...</td> <td>2,364 KB</td> </tr> <tr> <td></td> <td>sqlncli</td> <td>12/17/2017 5:57 AM</td> <td>Windows Installer ...</td> <td>4,956 KB</td> </tr> <tr> <td></td> <td>SQLServer2016-SSEI-Eval</td> <td>12/17/2017 5:54 AM</td> <td>Application</td> <td>4,888 KB</td> </tr> </table>		adksetup	12/17/2017 3:24 PM	Application	1,403 KB		SqlCmdLnUtils	12/17/2017 5:57 AM	Windows Installer ...	2,364 KB		sqlncli	12/17/2017 5:57 AM	Windows Installer ...	4,956 KB		SQLServer2016-SSEI-Eval	12/17/2017 5:54 AM	Application	4,888 KB
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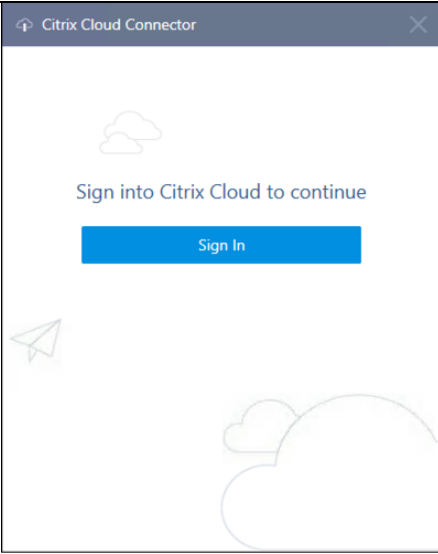
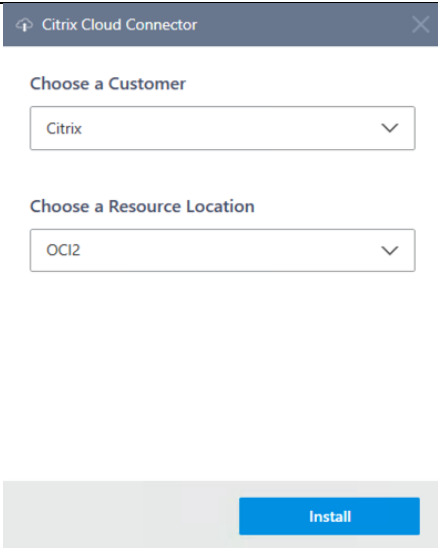


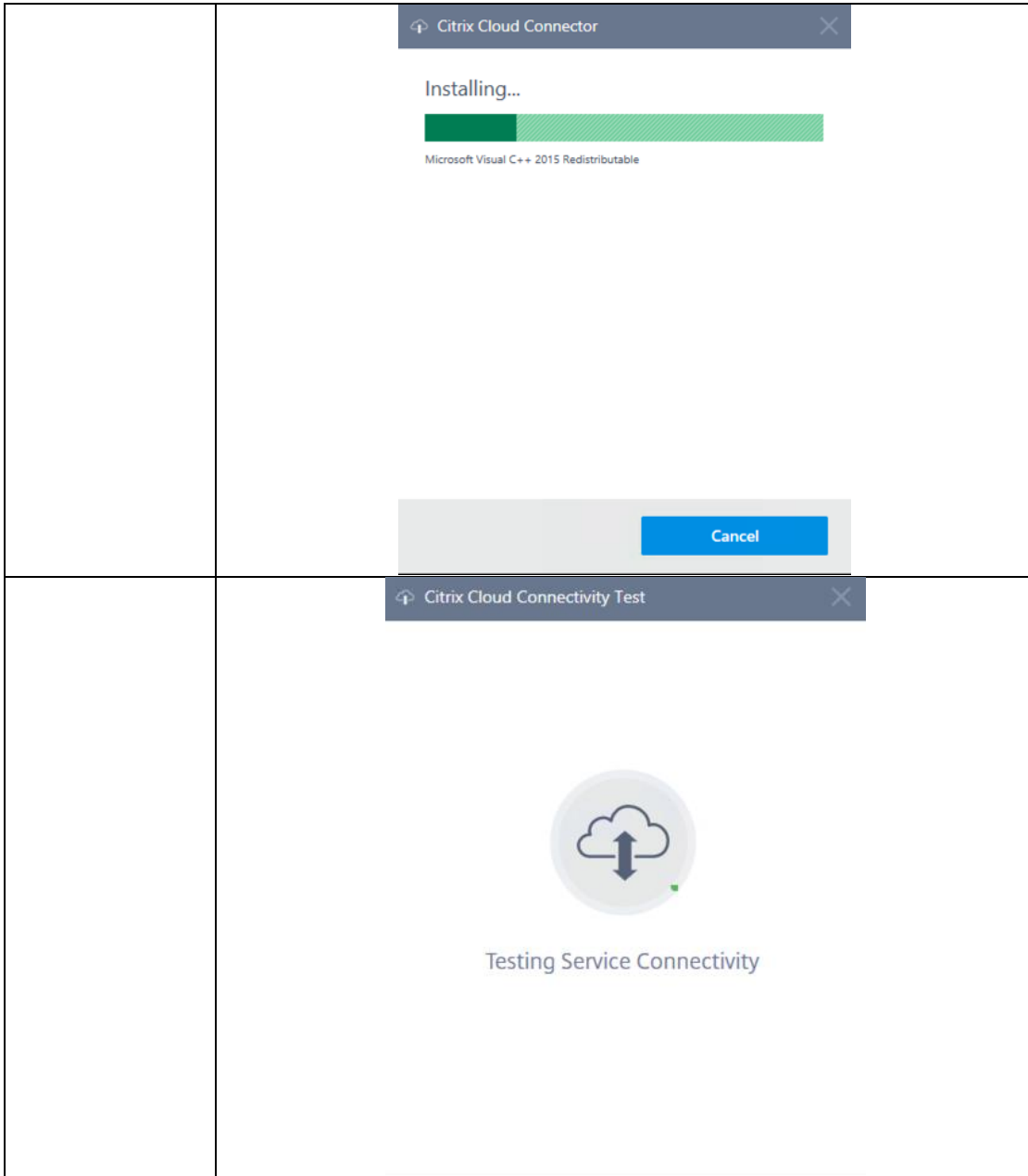
f. Citrix Cloud Connectors on OCI VCN

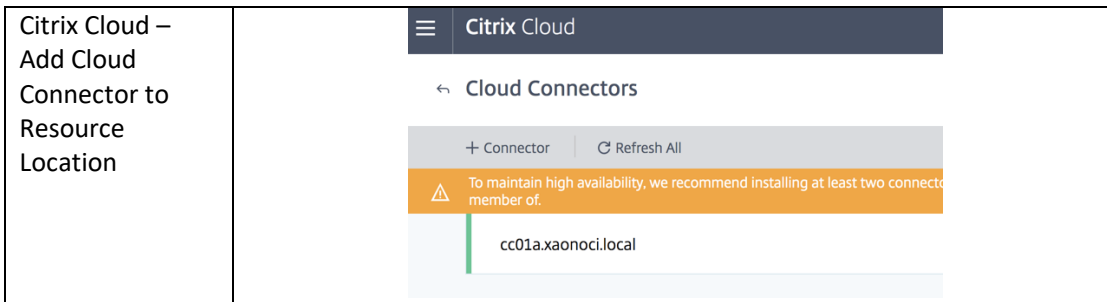
Install two window server 2012R2 or windows server 2016 and install Citrix Cloud Connectors.

<p>VM under OCI VCN</p>	
<p>Join AD domain</p>	<pre># rename-computer \$NAME # restart-computer # add-computer -domainname \$AD_DOMAIN # restart-computer</pre>
<p>Install SCVMM console</p>	
<p>Install SCVMM console only (cont.)</p>	
<p>Install SCVMM console (cont.)</p>	

<p>Citrix Cloud – initial configuration @ cloud.com</p>	 <p>The image shows the Citrix Cloud landing page. It features a blue header with the text "Is complexity disrupting your cloud strategy?" and a graphic of a cloud containing various application icons. Below the header, there is a paragraph about cloud strategy and a statistic: "90% of companies now use public cloud services." At the bottom, it says "Cloud apps are proliferating... fast".</p>
	 <p>The image shows the Citrix Cloud sign-in page. It has a dark background with the text "Move Faster, Work Better, Lower IT Costs". There is a form for entering Citrix credentials (username and password) and a "Sign In" button. There are also links for "Forgot your username or password?" and "Sign in with my company credentials".</p>
	 <p>The image shows the Citrix Cloud dashboard. It features a navigation menu on the left with options like "Home", "My Services", "Library", "Identity and Access Management", "Resource Locations", "Support Tickets", and "Notifications". The main area displays several metrics: "2 any Offerings", "1 Resource Location", "1 Domain", "2 Notifications", and "0 Open Tickets". There are also several service cards for "NetScaler Management and Analytics Service", "Smart Tools", "XenApp and XenDesktop Service", and "XenMobile Service".</p>
<p>Citrix Cloud – <u>Resource Location</u></p>	 <p>The image shows the "Resource Locations" form in Citrix Cloud. It has a header "Resource Locations" and a sub-header "+ Resource Location Refresh All". There is a text input field containing "ocid" and "Save Cancel" buttons.</p>
	 <p>The image shows the "Resource Locations" list in Citrix Cloud. It has a header "Resource Locations" and a sub-header "+ Resource Location Refresh All". There is a list item with the text "OCID" and a plus sign icon. Below the list, there is a "+ Cloud Connectors" button.</p>

<p>Install Citrix Cloud Connector @ Hyper- VM</p>	 <p>The screenshot shows a window titled 'Citrix Cloud Connector'. It features a cloud icon at the top, followed by the text 'Sign into Citrix Cloud to continue'. Below this text is a blue button labeled 'Sign In'. There are also decorative cloud icons at the bottom of the window.</p>
<p>Install Citrix Cloud Connector – Join a <u>customer</u> and <u>resource location</u></p>	 <p>The screenshot shows a window titled 'Citrix Cloud Connector'. It contains two dropdown menus. The first is labeled 'Choose a Customer' and has 'Citrix' selected. The second is labeled 'Choose a Resource Location' and has 'OCI2' selected. At the bottom of the window, there is a blue button labeled 'Install'.</p>

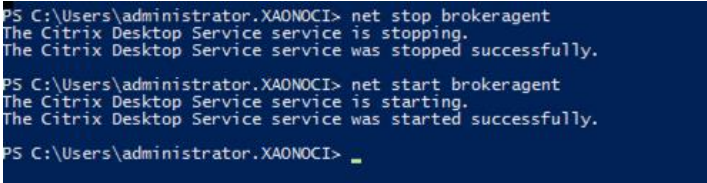
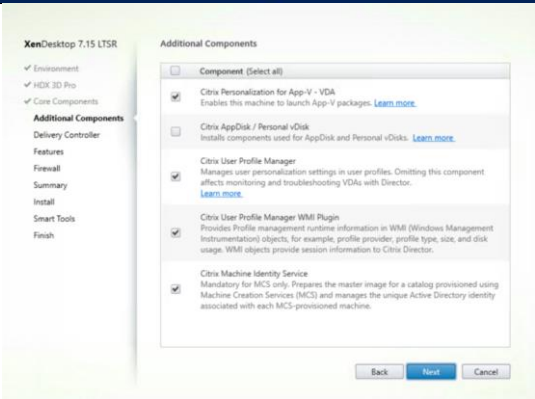




g. XenApp and XenDesktop – create a Master (Golden) Image on SCVMM

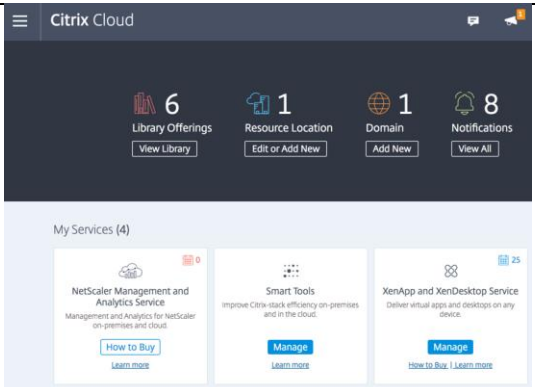
Create a master image of workloads (i.e., windows 10 clients or windows server 2016) to install Citrix VDA. Due to Personal vDisk deprecated for windows 10 (1709 or higher), please uncheck Citrix AppDisk/Personal vDisk during VDA installation.

	<p>Processor: Intel(R) Xeon(R) Platinum 8167M CPU @ 2.00GHz 2.00 GHz</p> <p>Installed memory (RAM): 4.00 GB</p> <p>System type: 64-bit Operating System, x64-based processor</p> <p>Pen and Touch: No Pen or Touch Input is available for this Display</p>
<p>Create a VM on SCVMM to be a master golden image</p>	
<p>Add to AD Domain</p>	<pre># rename-computer \$NAME # restart-computer # add-computer –domainname \$AD_DOMAIN # restart-computer</pre>
<p>Citrix VDA installation</p>	<pre># ./XenDesktopVDASetup.exe /quiet /masterimage # regedit \HKEY_LOCAL_MACHINE\SOFTWARE\Citrix\VirtualDektopAgent\ListOfDDCs to \$AB001.domain (from Catalog)</pre>

	<pre># net stop brokeragent # net start brokeragent</pre> 
<p>For Windows 10 only. Uncheck <i>Citrix AppDisk / Personal vDisk</i></p>	
<p>Publish applications</p>	<p>Install applications</p>

h. XenApp and XenDesktop – Machine Catalog and Delivery Group on Citrix Cloud

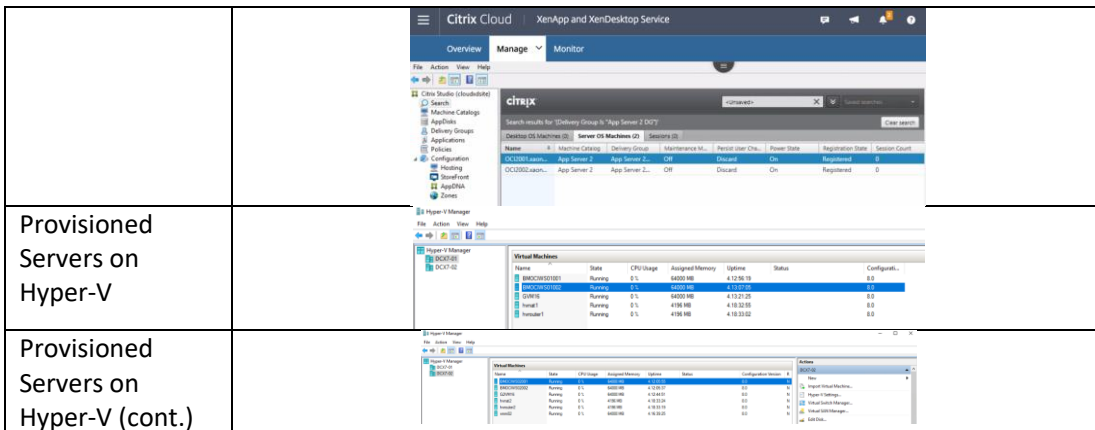
Log in Citrix Cloud (www.cloud.com) to access XenApp and XenDesktop service packages and create server catalog and delivery group to provision multiple VDA clients onto OCI.

<p>XenApp and XenDesktop Service from cloud.com</p>	
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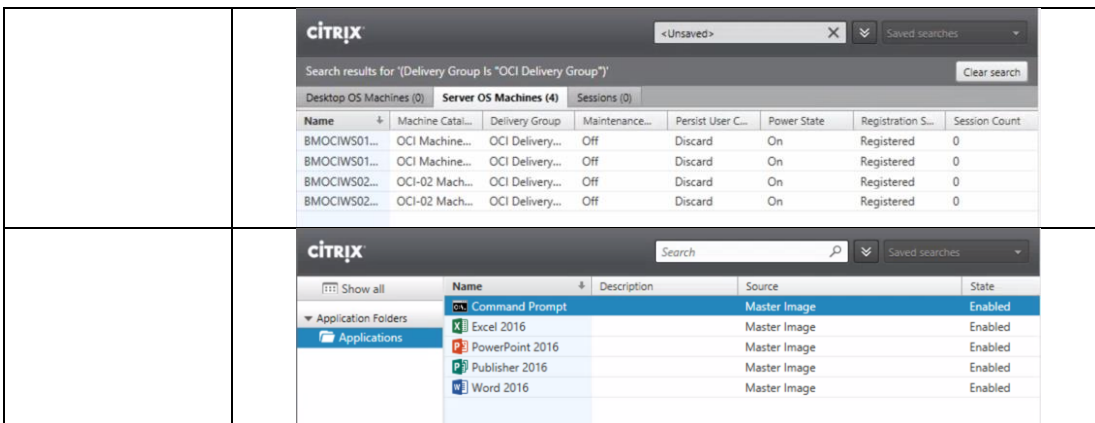
<p>Hosting connection based Cloud Connectors resources and SCVMM</p>	
<p>Add Hyper-V and networks to Hosting connections</p>	
<p>Create network resources for the Hosting connections</p>	

<p>Confirm <u>Storage</u> and <u>Network</u> resources for the Hosting connection</p>			
<p>Create <u>Machine Catalog</u>: using <u>Citrix Machine Creation Services (MCS)</u> with Resources created above</p>			

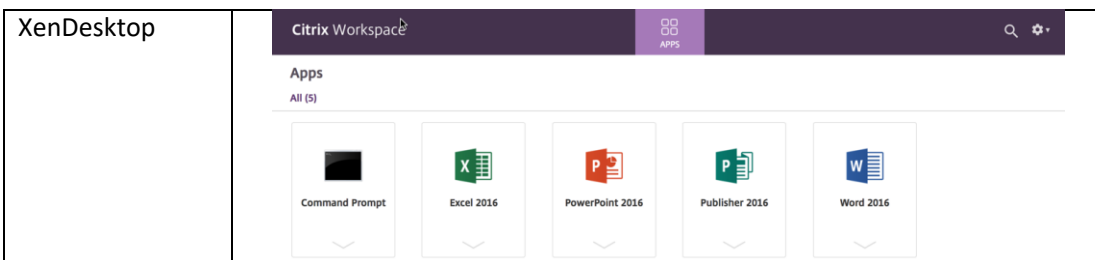
<p>Create <u>Delivery Group</u></p>																																									
<p>Provisioned Servers on Citrix Cloud Delivery Group under <u>View Machines</u></p>	<table border="1"> <thead> <tr> <th>Name</th> <th>Machine Catalog</th> <th>Delivery Group</th> <th>Membership</th> <th>Power State</th> <th>Power State</th> <th>Registration Status</th> <th>Session Count</th> </tr> </thead> <tbody> <tr> <td>BMC003021</td> <td>OCI Machine...</td> <td>OCI Delivery...</td> <td>Off</td> <td>Discard</td> <td>On</td> <td>Registered</td> <td>0</td> </tr> <tr> <td>BMC003022</td> <td>OCI Machine...</td> <td>OCI Delivery...</td> <td>Off</td> <td>Discard</td> <td>On</td> <td>Registered</td> <td>0</td> </tr> <tr> <td>BMC003023</td> <td>OCI-62 Mach...</td> <td>OCI Delivery...</td> <td>Off</td> <td>Discard</td> <td>On</td> <td>Registered</td> <td>0</td> </tr> <tr> <td>BMC003024</td> <td>OCI-62 Mach...</td> <td>OCI Delivery...</td> <td>Off</td> <td>Discard</td> <td>On</td> <td>Registered</td> <td>0</td> </tr> </tbody> </table>	Name	Machine Catalog	Delivery Group	Membership	Power State	Power State	Registration Status	Session Count	BMC003021	OCI Machine...	OCI Delivery...	Off	Discard	On	Registered	0	BMC003022	OCI Machine...	OCI Delivery...	Off	Discard	On	Registered	0	BMC003023	OCI-62 Mach...	OCI Delivery...	Off	Discard	On	Registered	0	BMC003024	OCI-62 Mach...	OCI Delivery...	Off	Discard	On	Registered	0
Name	Machine Catalog	Delivery Group	Membership	Power State	Power State	Registration Status	Session Count																																		
BMC003021	OCI Machine...	OCI Delivery...	Off	Discard	On	Registered	0																																		
BMC003022	OCI Machine...	OCI Delivery...	Off	Discard	On	Registered	0																																		
BMC003023	OCI-62 Mach...	OCI Delivery...	Off	Discard	On	Registered	0																																		
BMC003024	OCI-62 Mach...	OCI Delivery...	Off	Discard	On	Registered	0																																		

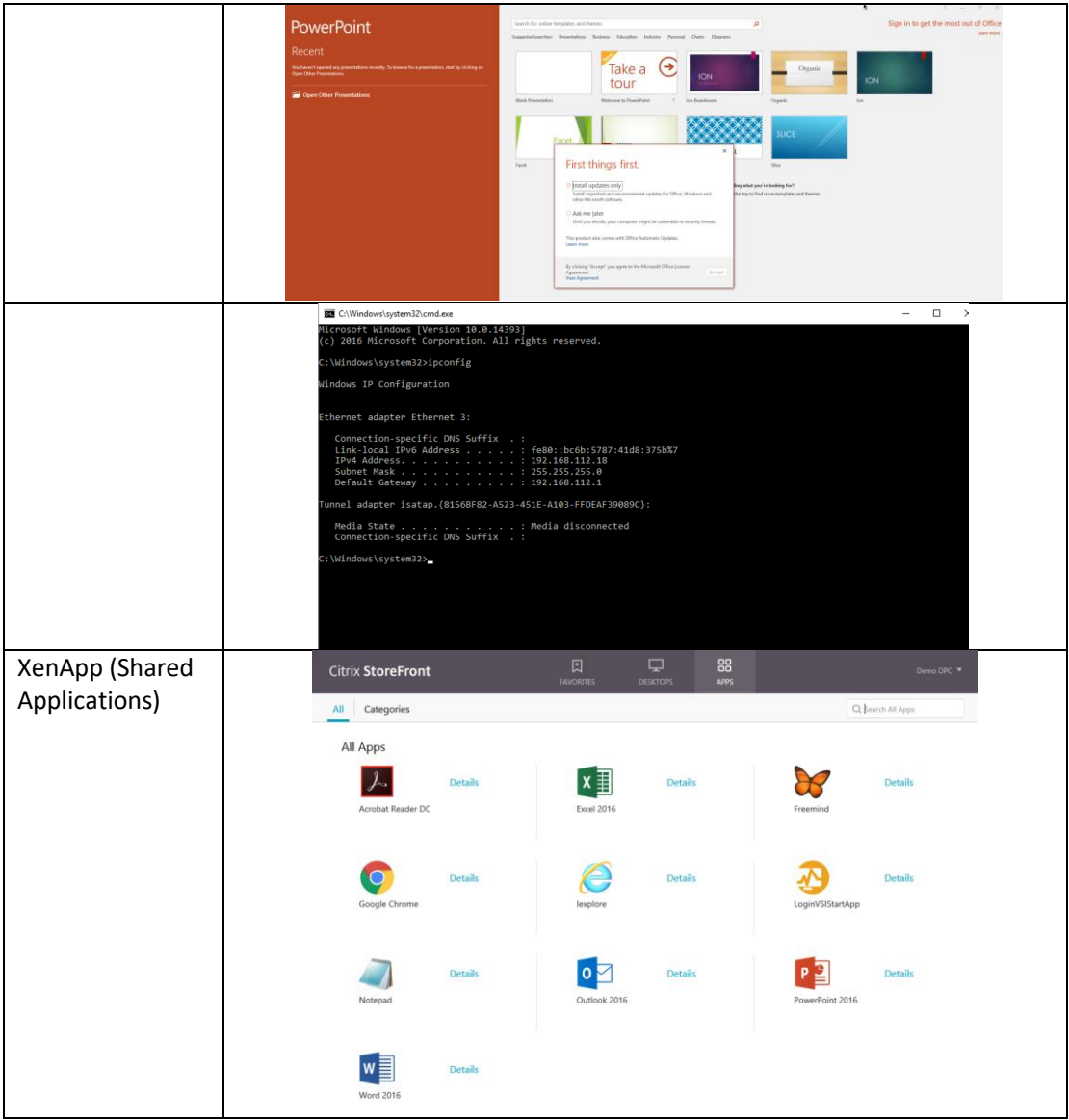


6. Administrator Experience



7. End-User Experience





8. Next Steps

	Hyper-V Cluster in SCVMM
	Bare metal Power Management

9. Resources

PvD Deprecated for Windows 10 1511 or higher -
<https://support.citrix.com/article/CTX232883>

VDA Command Line Helper Tool -
<https://www.citrix.com/blogs/2018/01/08/citrix-vda-commandline-helper-tool/>

SCVMM 2016 system requirements
<https://docs.microsoft.com/en-us/system-center/vmm/system-reqs?view=sc-vmm-2016>

Deploying Hyper-V with Routing (in OCI BM) -
<https://cloud.oracle.com/opc/iaas/whitepapers/deploy-hyper-v-with-routing.pdf>

Oracle Cloud Infrastructure Compute Instances -
https://cloud.oracle.com/en_US/infrastructure/compute/bare-metal/features

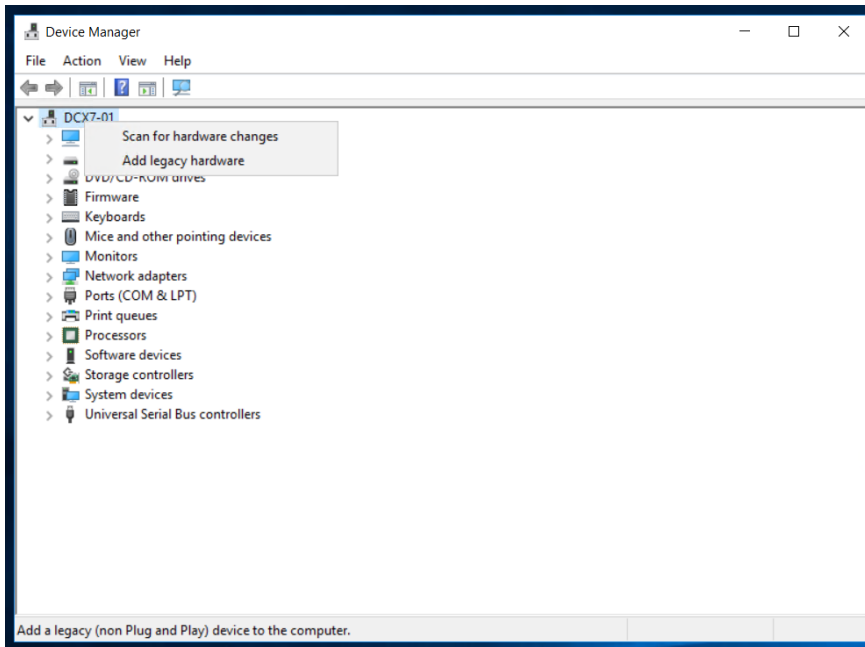
Citrix Scalability
<https://www.citrix.com/blogs/2017/03/20/citrix-scalability-the-rule-of-5-and-10/>

Login VSI Workloads
https://www.loginvsi.com/documentation/index.php?title=Login_VSI_Workloads

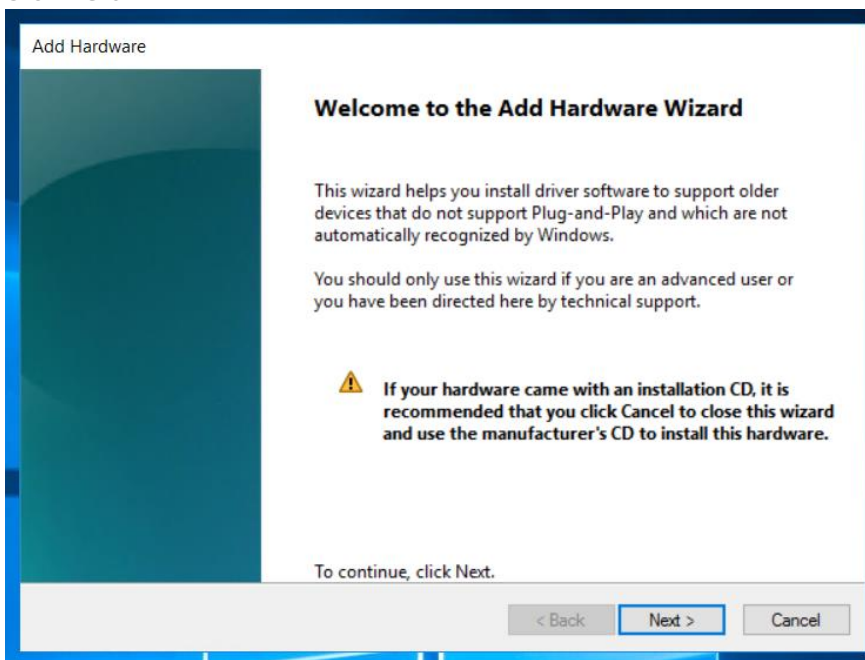
Appendix 1. Hyper-V: Switching to External Network for SCVMM

Step 1: Add a new NIC

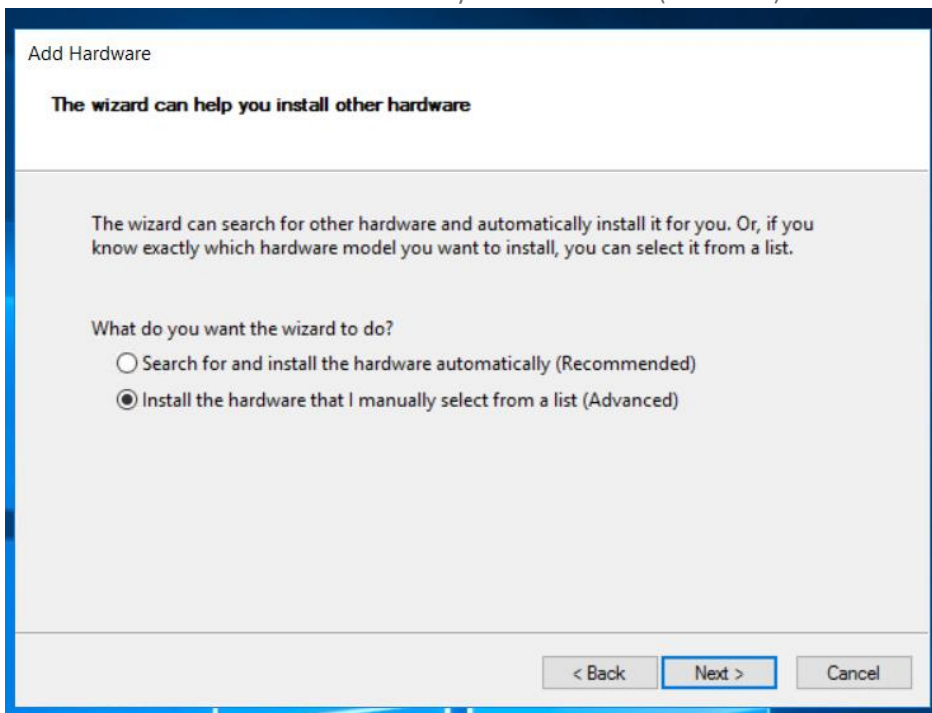
- Open Device Manager
- Right click on machine name and click 'Add legacy hardware'



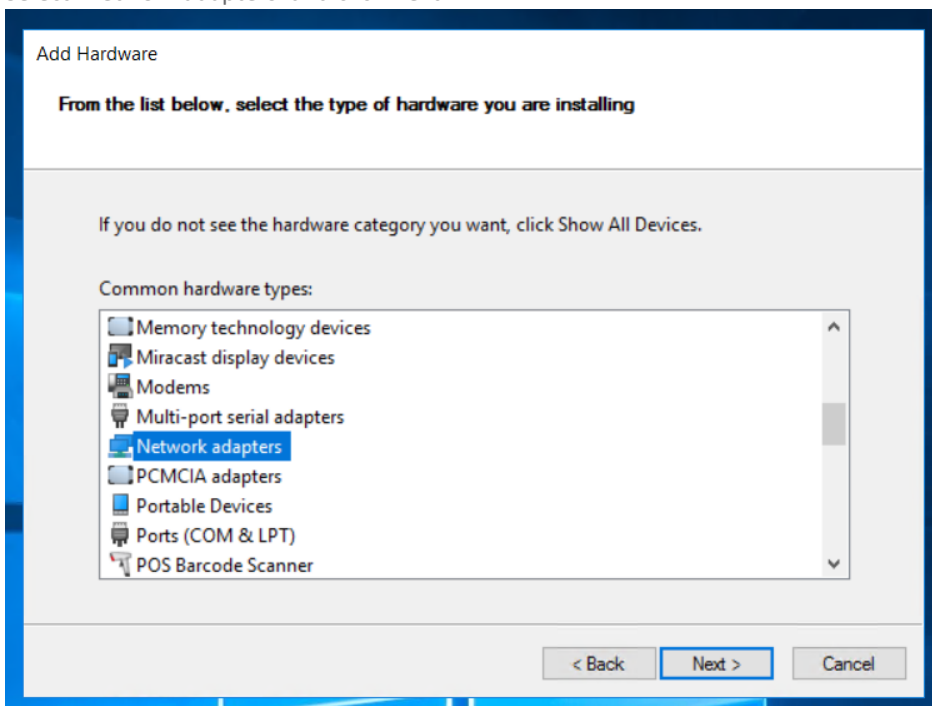
- Click 'Next'



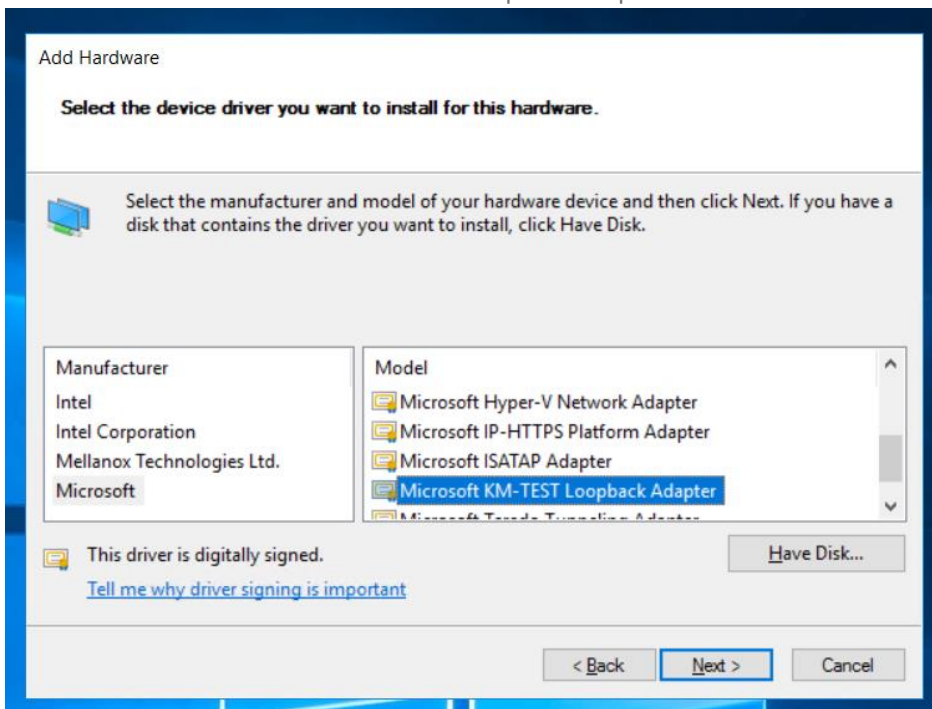
- Select 'Install the hardware that I manually select from a list (Advanced)' and click Next



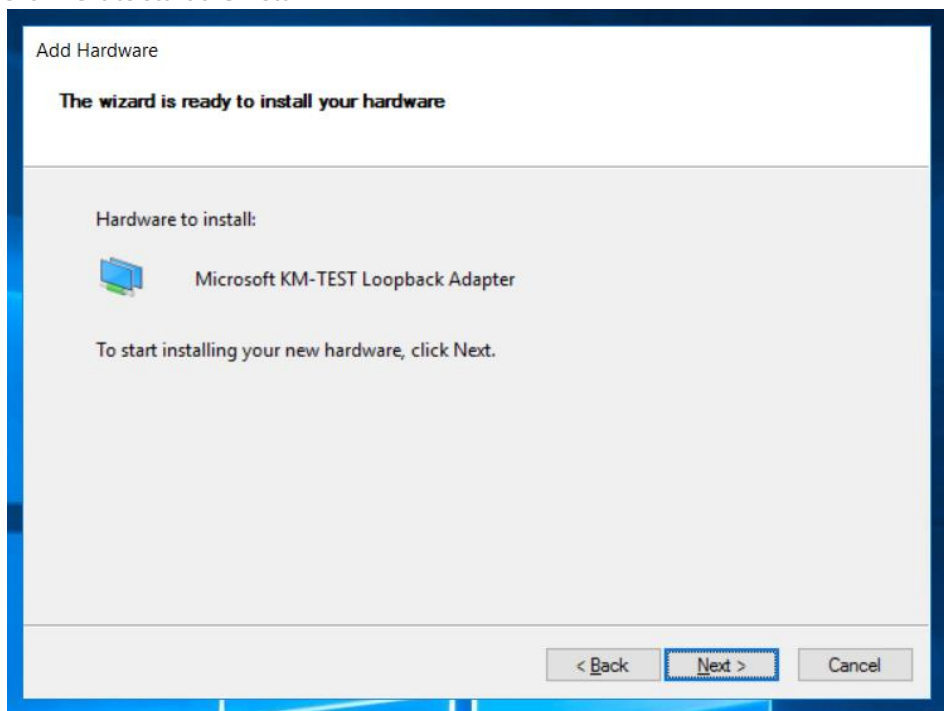
- Select 'Network adapters' and click Next



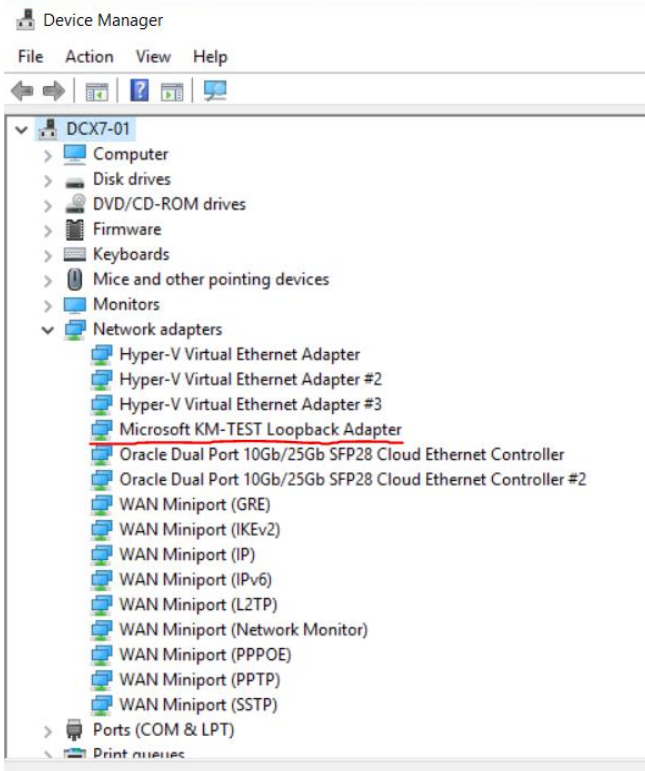
- Select 'Microsoft' and 'Microsoft KM-TEST Loopback Adapter' and then click Next



- Click Next to start the install



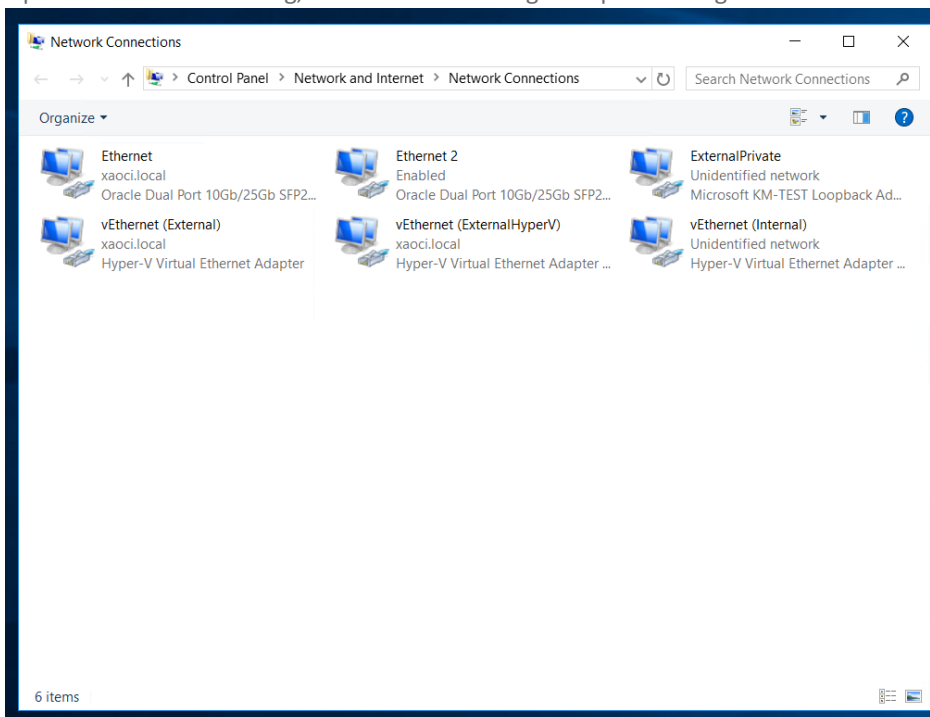
The device should now show up in device manager under Network adapters:



Step 2: Configure Virtual Switch

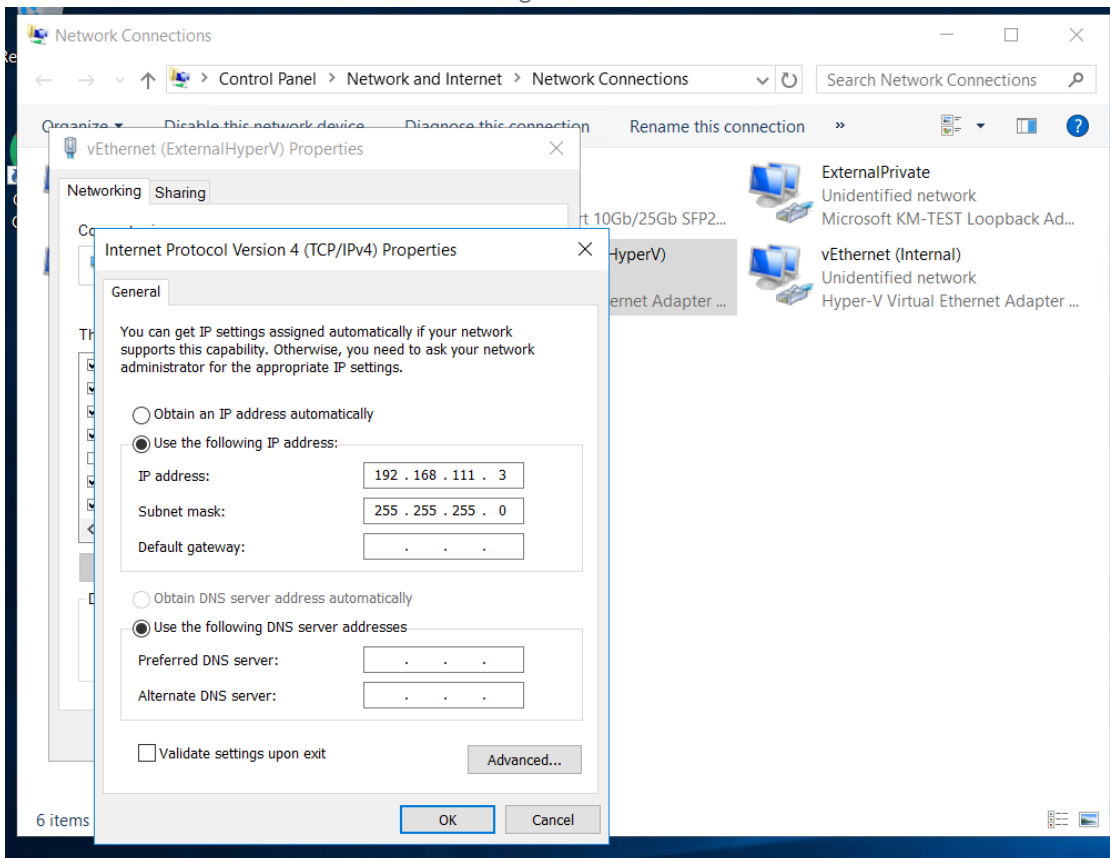
- In Hyper-V, create a new external switch on the Loopback Adapter. Keep all default settings.

- Open Network and Sharing, and then click 'Change Adapter Settings'



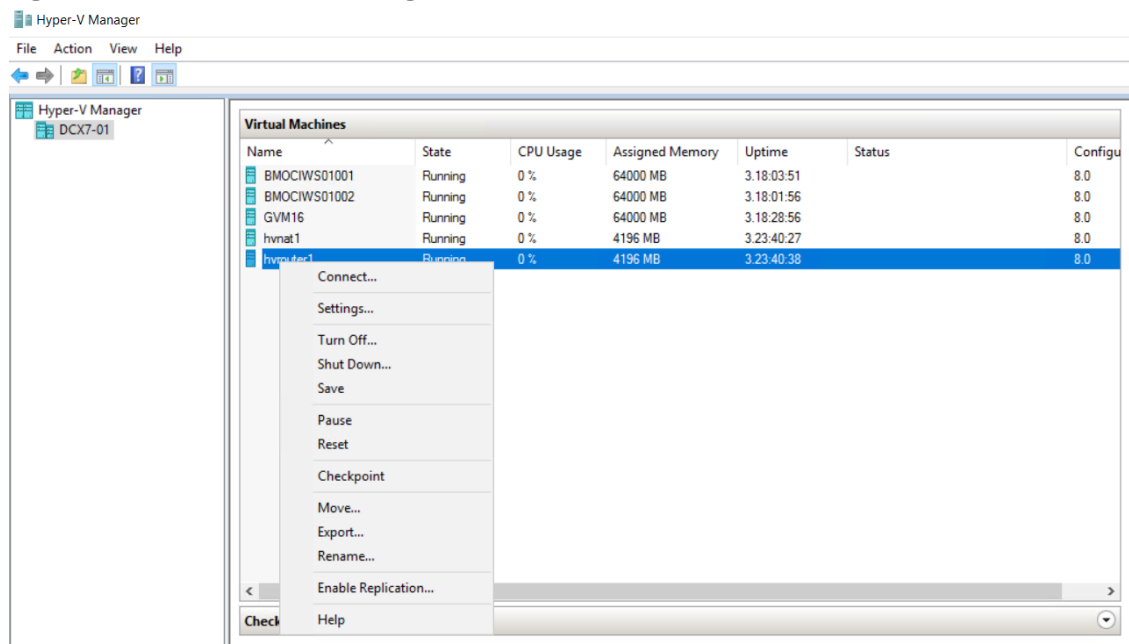
- Open the IPv4 settings for the internal switch. Record the current IP address, as we will need that for the new switch, then disable the internal switch.

- Open the IPv4 settings for the new external switch. Set the IP address to the address used by the internal switch, and the network mask to 255.255.255.0. Save the configuration

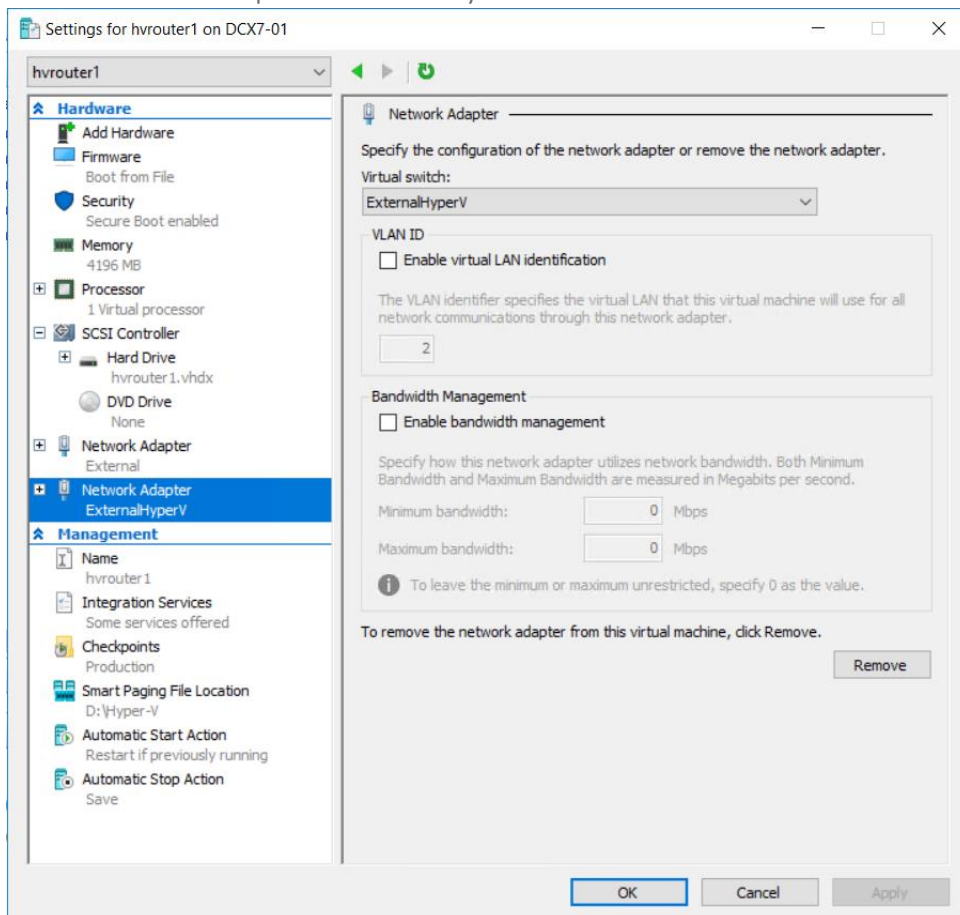


Step 3: Change networks

- In Hyper-V, shut down all running VMs.
- For each VM:
 - Right click VM name and click 'Settings...'



- Select the network adapter that is currently set to Internal and switch it to the new External



- Apply changes and close the window.

Step 4: Test!

- Power on the VMs.
- For guest VMs other than hvnat and hvrouter, you may need to renew the IP addresses. In a PowerShell window, type `ipconfig /renew`
- All connections should remain intact, but the NIC is now external



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