Secure Systems & Network Engineering

Large Installation Administration

Lab 1 Hypervisor setup

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Task 0 - Preparation

- Host machines: Windows Server 2016
- Hypervisor: Hyper-V
- The number of nodes: 4
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Task 1 - Set up hypervisor

Hyper-V is used in Microsoft Windows Server products as a hypervisor. To install hypervisor to the Microsoft Windows Server it is required to add role Hyper-V and restart the operating system. In our lab, we used Windows Server 2016 as the operating system. (Figure 1)

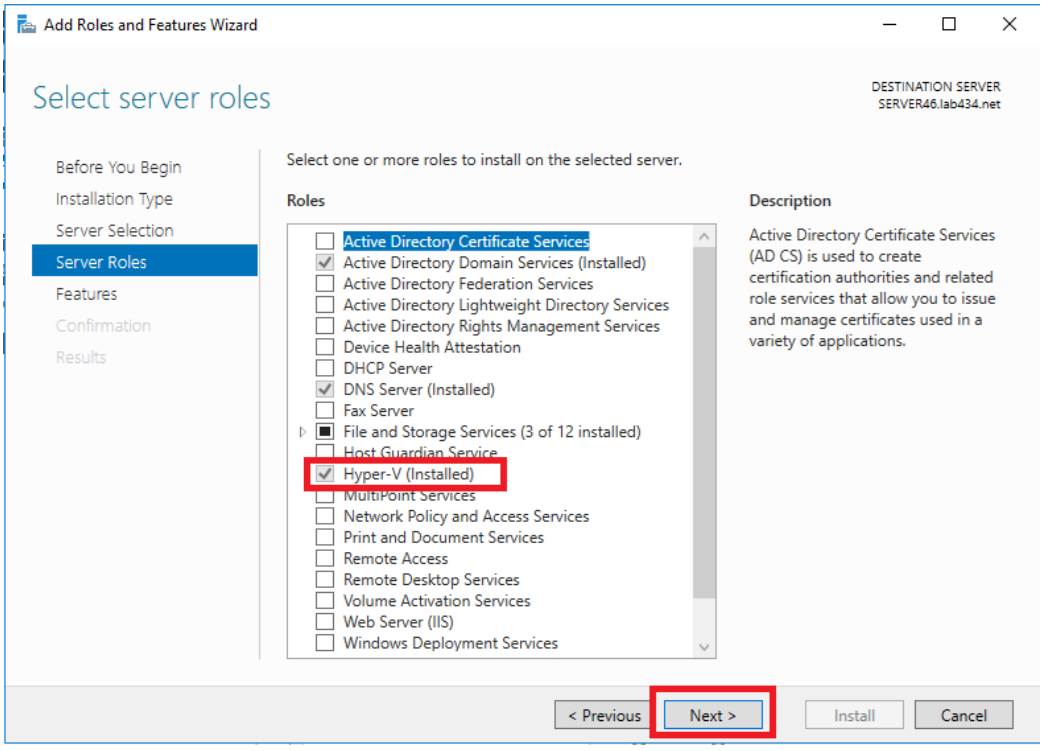

Figure 1: Adding the Hyper-V role

To remotely manage Windows Server it is required to deploy a single Remote Access server that can be used for remote management of DirectAccess clients through Remote Access Management Console.

Active Directory uses Lightweight Directory Access Protocol (LDAP) versions 2 and 3, Microsoft's version of Kerberos, and DNS. To set up Active Direcotry it is required install two roles - Active Directory Domain Services and DNS. Once installation completes, the next step is promoting this server to a domain controller. We used *lab434.net* as a root domain name. It is recommended to deploy at least two domain controller for fault tolerance, so we deployed two replicated domain controllers (Sergey and Saif). All other machines were connected to our domain controller. There was created a privileged user **Admin** in Active Directory Users and Computers for managing of server stations.

To store templates of virtual machines it was deployed File Storage server. When a privileged user connects to our domain, a network drive with saved templates and clones is automatically installed.(Figure 2, 4, and 3).

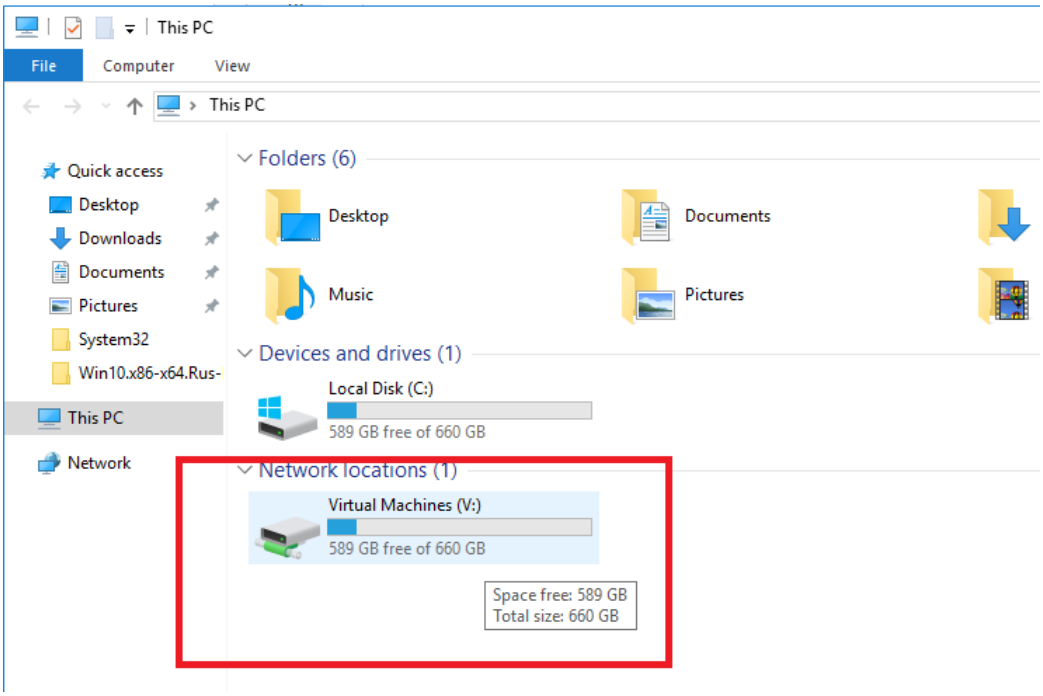

Figure 2: Network storage drive

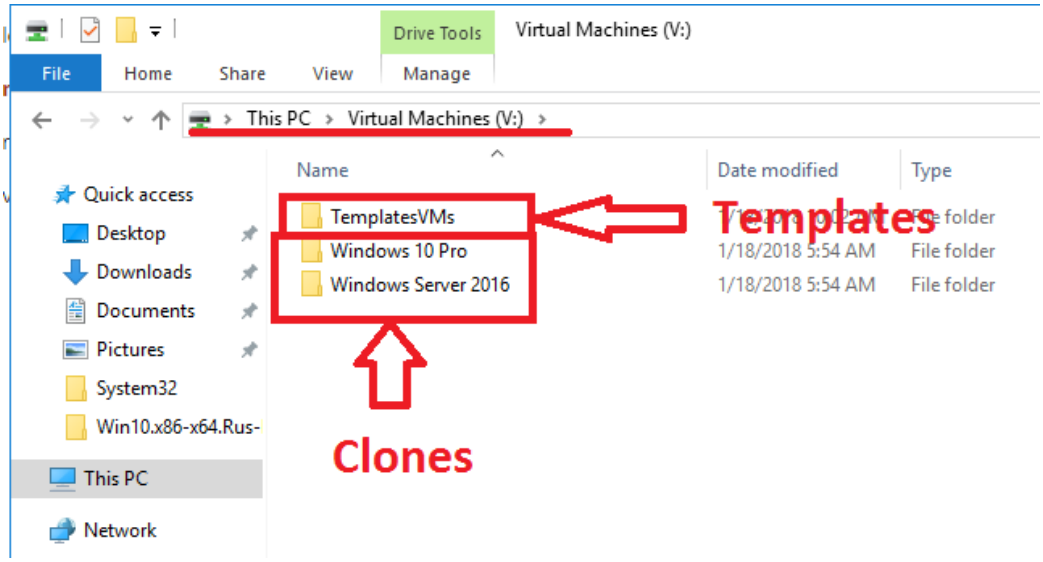

Figure 3: Templates and clones

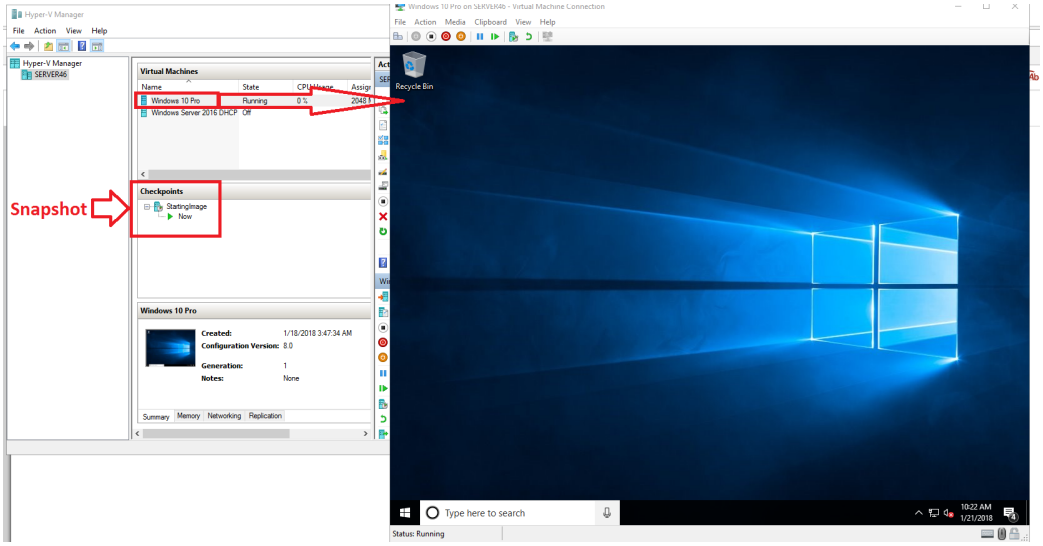

Figure 4: Guest virtual machine

Task 2 - Configure isolated networks

To create an isolated network between two guest machines it is required to setup virtual switches between these ones. It is preferred to use VLAN's

on the Hyper-V virtual switches so that our network was really isolated. (Figure 5)

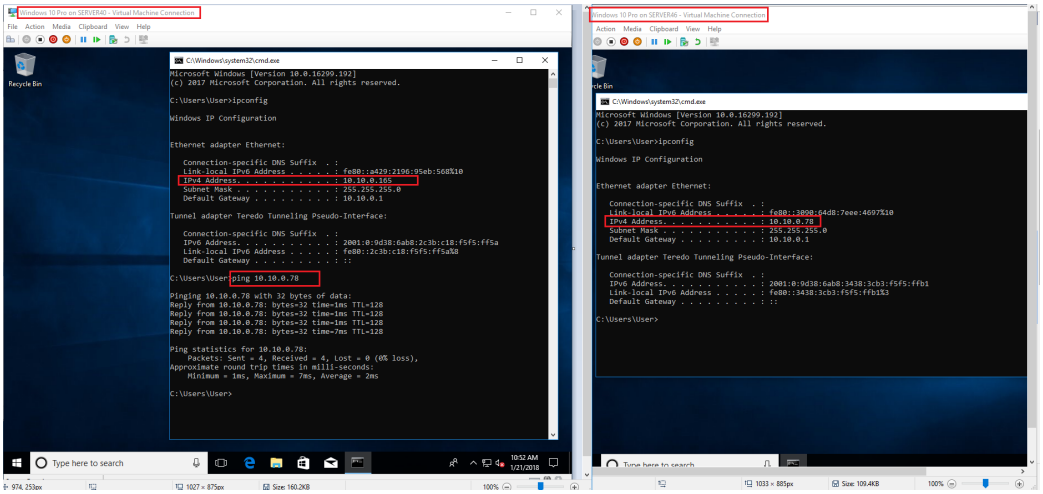

Figure 5: Isolated network between two guest hosts

Task 3 - Theoretical part

Question 1

Briefly explain what you think is the main difference between a 32-bit and a 64-bit operating system.

Answer

The difference is the maximum amount of memory (RAM) that is supported. In 32bit OS the size of address bus is only 32bit, so the OS can access up to 2^{32} address and each address can store only one byte, so the max memory size is 4GB. A computer with a 32-bit processor cannot have a 64-bit version of an operating system installed. While in 64bit OS the address bus size is 64bit, So the OS can access up to 2^{64} address, So the max memory size is 2^34 GB. Of course the more RAM you have, the better the performance of your computer.

Another main difference is the number of calculations per second they can perform.

Question 2

What kind of hardware is virtualized in your set up, what hardware you can pass through the host to the VM.

Answer

The hypervisor virtualized the following hardware:

- Memory. It is allowed to allocate the necessary amount of memory.
- Processor. It is allowed to assign the necessary amount of CPUs.
- IDE Controllers (Hard Drives or DVD Drives). To work with virtual machines it is required to use virtual hard disks.
- Network adapter using virtual switch.
- And others that do not often use (COM, Diskette Drive, SCSI Controller).

You can pass any hardware that is attached to the host using different ports (USB, FireWire, SATA, IDE, Serial-port, and others)

Question 3

How do you think that the virtual machine communicates with the outside network in your setup? Draw a simple network diagram showing at least the network cards, the bridges and any routers that might be present. Dont forget to label everything with IP addresses and names.

Answer Yes it can and there are 2 methods

1- using external type switch: in that case we need give the VM an IP in the same network that the physical machine is located on.

For example if the physical machine is located on 10.10.10.0/24 and has the ip address of 10.10.10.25, Then the VM should be on external type switch and has an ip address in the range of 10.10.10.0/24 (e.g. 10.10.10.30)

2-using internet connection sharing and internal type switch: in that case we need to create an internal type switch and share the internet connection from the physical interface to the internal switch as shown in Figure 6.

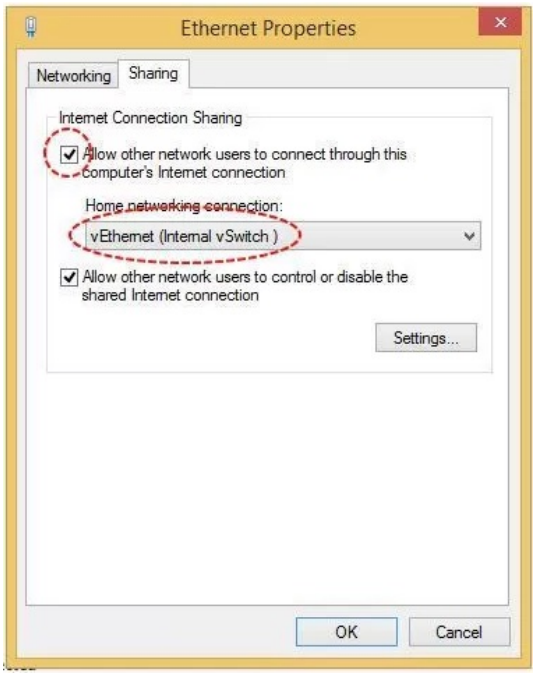

Figure 6: Sharing internet connection with the internal type switch

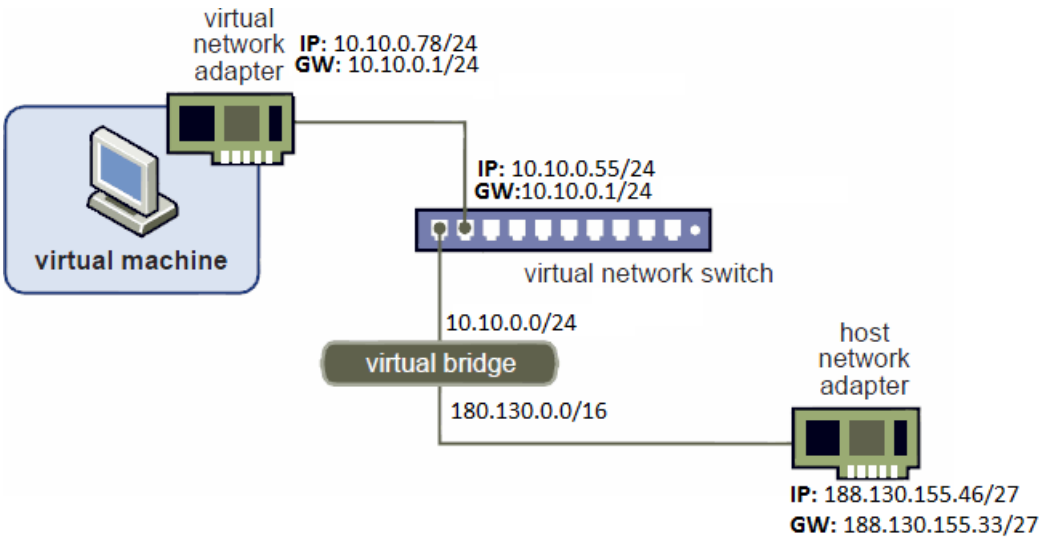

Figure 7: Network diagram

Question 4

Look to the MAC addresses assigned to the VMs, can you use the same MAC on the cloned VMs? Why MAC on the VMs has the same prefix?

Answer

It is not recommended to use the same MAC addresses on the VMs that is in the network since the switch will not know what to do with that traffic. As soon as both machines were live and claiming to have the same MAC address, they would have a situation that cause packet loss and other problems.

The prefix (first three octets) identify the organization that issued the identifier and are known as the organizationally unique identifier (OUI). The Hyper-V uses the Organizationally Unique Identifier (OUI) 00:15:5D. (Figure 8)

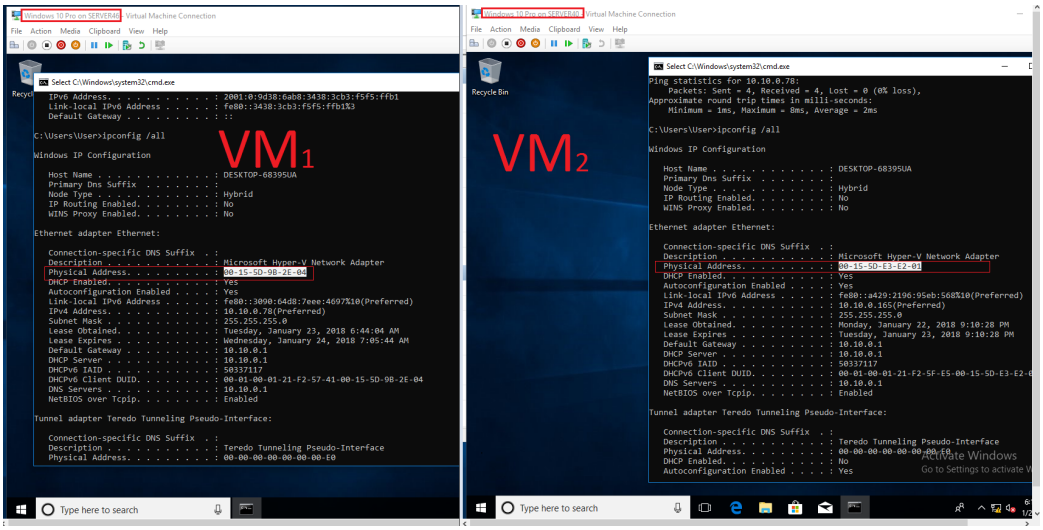

Figure 8: MAC addresses assigned to the different VMs

Question 5

What kind Virtualization does your Hypervisor support?

Answer

Hyper-V refers to Type 1 hypervisors, that is considered a bare-metal hypervisor and runs directly on top of hardware, to which the operating system accesses through a hypervisor. So it supports hardware-assisted virtualization. Also Windows Server supports network virtualization and Nested virtualization (WS 2016).

Question 6

What kind storages your Hypervisor support? Which one your prefer to use in production environment, explain why?

Answer

- **Physical Disks**

  There are three kinds of physical disks that can be attached to a virtual machine in Windows Server 2012 Hyper-V: Passthrough disks, iSCSI disks, or Fibre Channel disks.

- **Pass-through Disks**

  The pass-through disk is a LUN that is connected directly to the controller of a virtual machine, located in the settings of that virtual machines virtual hardware.

- **Virtual Hard Disks**

  Virtual hard disks can perform at almost the same speed as the physical storage that they reside on. In fact, virtual hard disks are the backbone of the Microsoft data center strategy and are probably the most used type in cloud computing.

There are some situations where using physical storage can be useful, but these are exceptions rather than the rule. Physical storage disables many of the benefits of virtualization. Virtual storage particularly the new VHDX format of virtual hard disk offers performance, scalability, and stability with support for all of the features of Hyper-V.

Question 7

User Mode Linux (Dike [2001]) is another approach to virtualization. Write a short paragraph highlighting at least two differences and two similarities between Xen and UML.

Answer

- **UML**

  It is possible to launch network services in UML, including honeypots. UML can be used to test and debug programs without affecting the underlying OS, as well as for training and research.

In the UML system, the kernel versions of the main and guest systems are not compatible. UML can be used to debug cores on one computer.

Sometimes given a web hosting based on UML.

- **Xen**

  Xen is a virtual machine monitor from XenSource. This is very similar to User-Mode-Linux, as well as privileged operating systems (in Domain 0 or Dom0) that allow access to equipment directly, pseudo-block devices and pseudo-network devices that will then be distributed in un-dominated domains (DomU).

  Unlike UML, Xen allows the launch of adapted non-linux guest operating systems in conjunction with the main OS. It is also possible to access specific PCI devices directly from DomU, thus eliminating additional system waste. (Access to the equipment is not currently included in Xen 3.0.