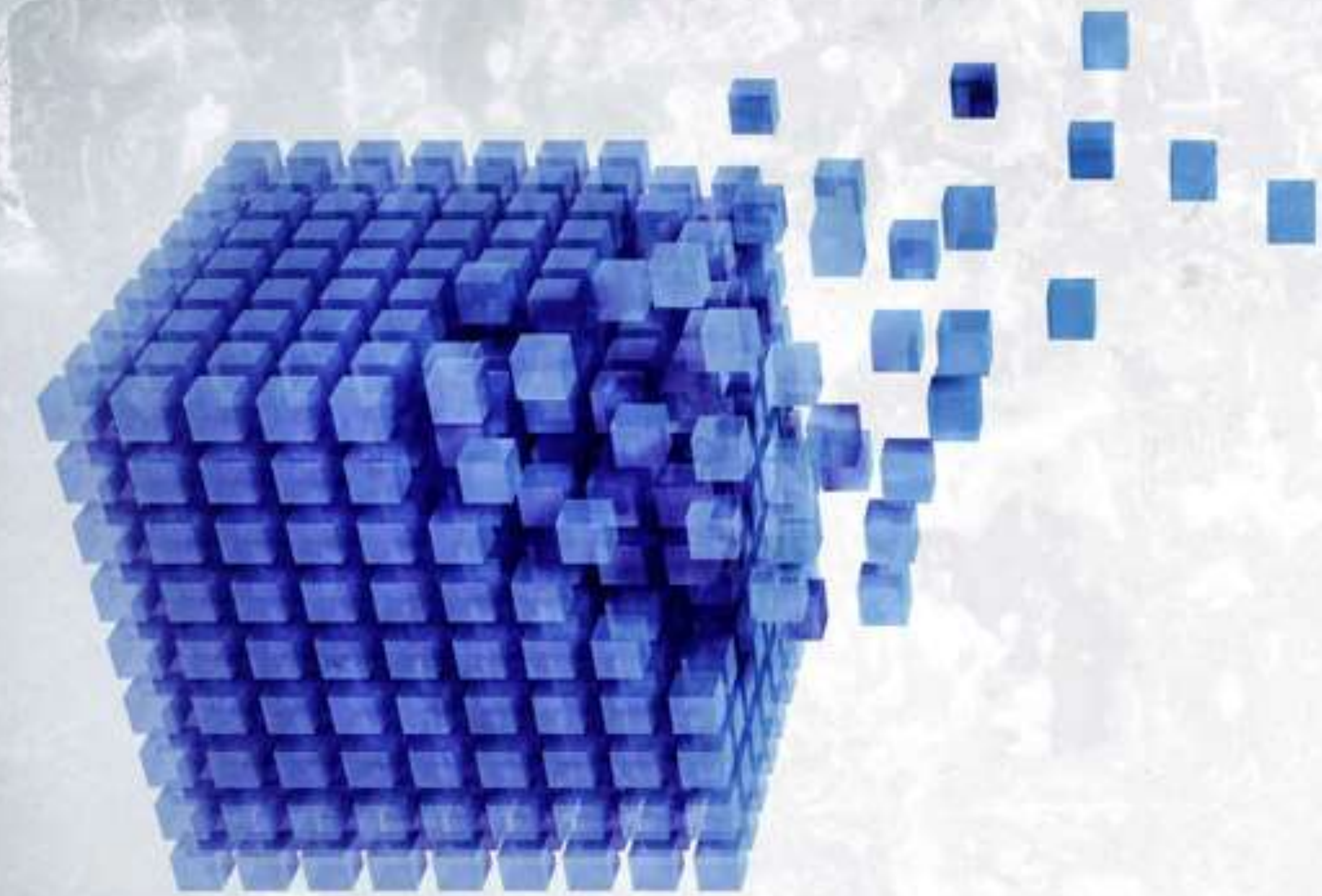
VIRTUALIZATION 2.0



tutorialspoint

SIMPLY EASY LEARNING

www.tutorialspoint.com

https://www.facebook.com/tutorialspointindia

https://twitter.com/tutorialspoint

About the Tutorial

Virtualization 2.0 is a technology that helps users to install different Operating Systems on a hardware. They are completely separated and independent from each other. Virtualization hides the physical characteristics of computing resources from their users, their applications, or end users.

This is an introductory tutorial, which covers the basics of Virtualization 2.0 and explains how to deal with its various components and sub-components.

Audience

This tutorial is created for IT Managers and System Administrators, who want to learn how to install different OS on a hardware. It provides simple, easy to understand explanations with useful working examples. We will go through most of the important modules of Virtualization 2.0, so you can also use this as a reference for your future projects.

This tutorial is intended to make you comfortable in getting started with Virtualization 2.0 and its various functions.

Prerequisites

Since Virtualization 2.0 is all about operating systems and hardware, you will need to have a basic knowledge about the various OS and their elements.

Additionally, it will be helpful if you are familiar with various components such as a server, an application and various storage devices, if you want to understand all the information provided.

Copyright and Disclaimer

All the content and graphics published in this e-book are the property of Tutorials Point (I) Pvt. Ltd. The user of this e-book is prohibited to reuse, retain, copy, distribute or republish any contents or a part of contents of this e-book in any manner without written consent of the publisher.

We strive to update the contents of our website and tutorials as timely and as precisely as possible, however, the contents may contain inaccuracies or errors. Tutorials Point (I) Pvt. Ltd. provides no guarantee regarding the accuracy, timeliness or completeness of our website or its contents including this tutorial. If you discover any errors on our website or in this tutorial, please notify us at contact@tutorialspoint.com

Table of Contents

1. Virtualization – Overview

Virtualization is a technology that helps us to install different Operating Systems on a hardware. They are completely separated and independent from each other. In Wikipedia, you can find the definition as – "In computing, virtualization is a broad term that refers to the abstraction of computer resources.

Virtualization hides the physical characteristics of computing resources from their users, their applications or end users. This includes making a single physical resource (such as a server, an operating system, an application or a storage device) appear to function as multiple virtual resources. It can also include making multiple physical resources (such as storage devices or servers) appear as a single virtual resource..."

Virtualization is often:

- The creation of many virtual resources from one physical resource.
- The creation of one virtual resource from one or more physical resource

Types of Virtualization

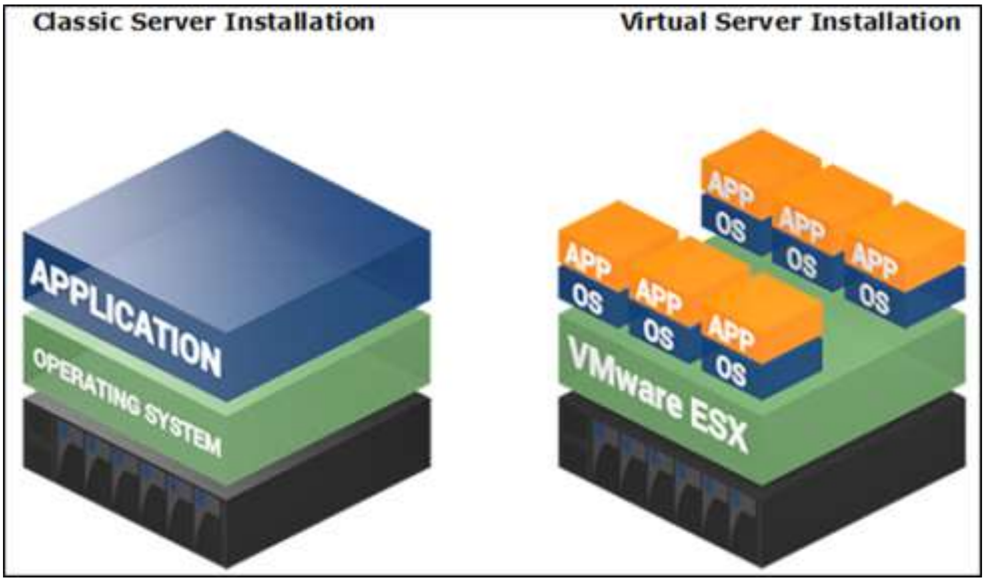
Today the term virtualization is widely applied to a number of concepts, some of which are described below:

- Server Virtualization
- Client & Desktop Virtualization
- Services and Applications Virtualization
- Network Virtualization
- Storage Virtualization

Let us now discuss each of these in detail.

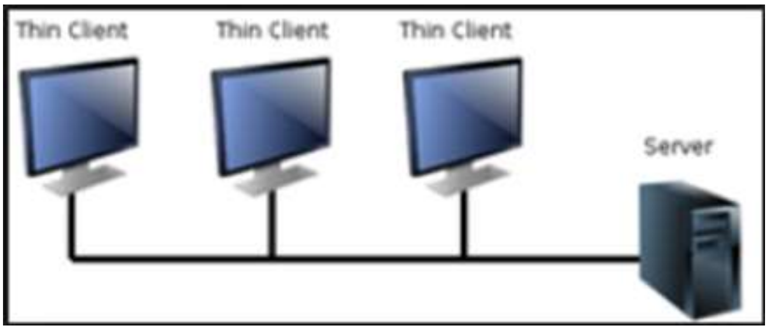
Server Virtualization

It is virtualizing your server infrastructure where you do not have to use any more physical servers for different purposes.



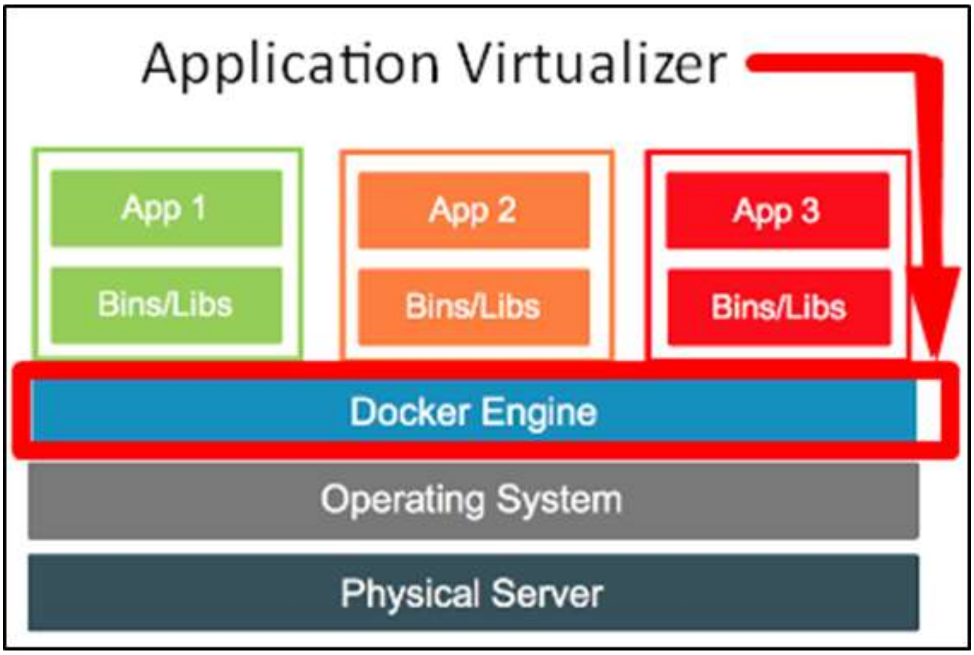
Client & Desktop Virtualization

This is similar to server virtualization, but this time is on the user's site where you virtualize their desktops. We change their desktops with thin clients and by utilizing the datacenter resources.



Services and Applications Virtualization

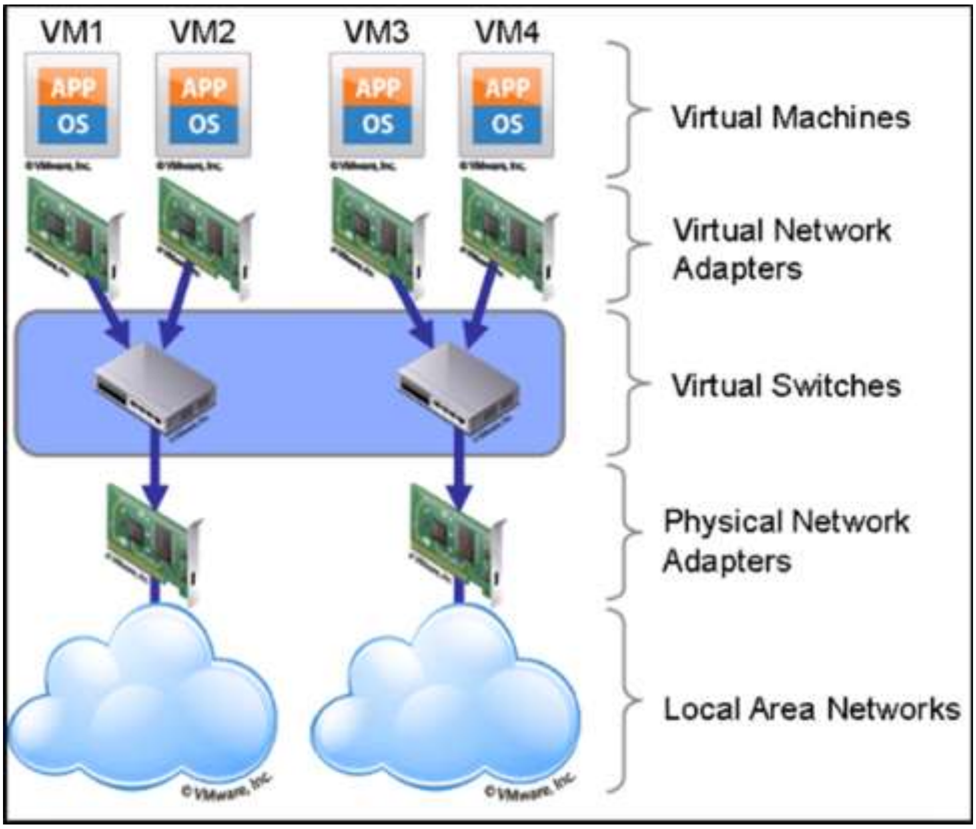
The virtualization technology isolates applications from the underlying operating system and from other applications, in order to increase compatibility and manageability. For example – Docker can be used for that purpose.



Network Virtualization

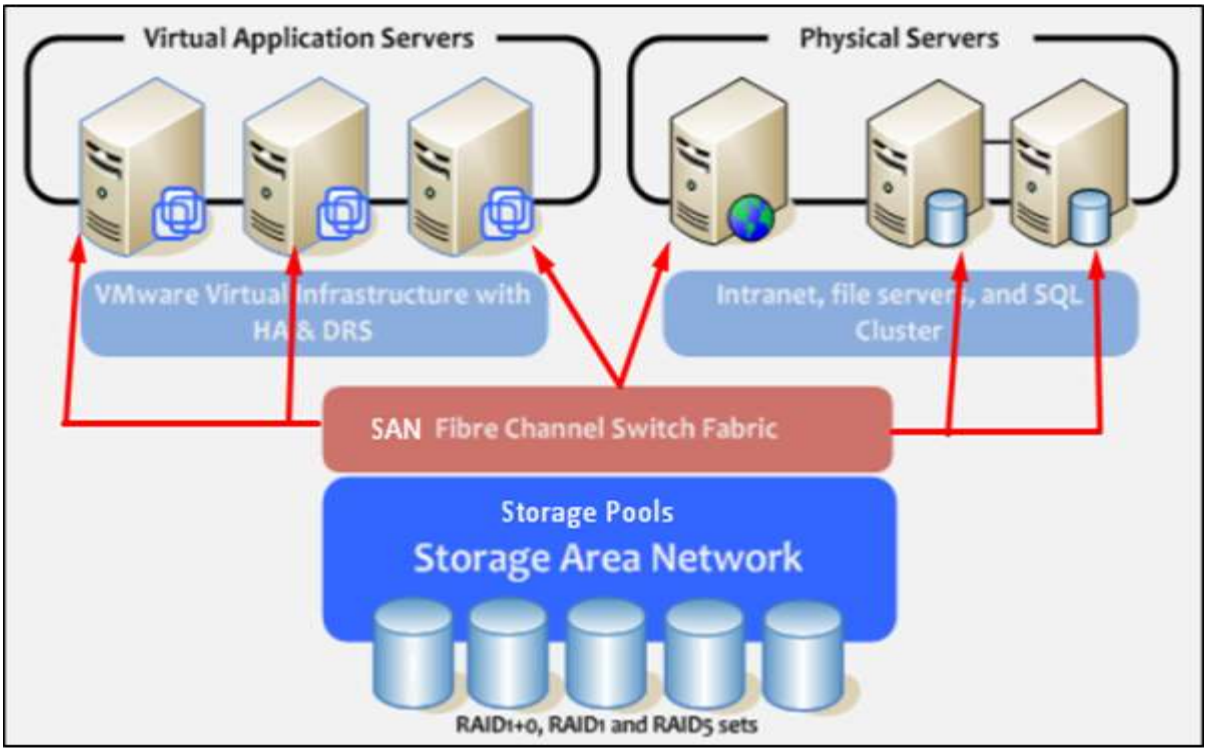
It is a part of virtualization infrastructure, which is used especially if you are going to visualize your servers. It helps you in creating multiple switching, Vlans, NAT-ing, etc.

The following illustration shows the VMware schema:



Storage Virtualization

This is widely used in datacenters where you have a big storage and it helps you to create, delete, allocated storage to different hardware. This allocation is done through network connection. The leader on storage is SAN. A schematic illustration is given below:


Virtual Application Servers
Physical Servers
VMware Virtual Infrastructure with HA & DRS
Intranet, file servers, and SQL Cluster
SAN Fibre Channel Switch Fabric
Storage Pools
Storage Area Network
RAID1+0, RAID1 and RAID5 sets

Understanding Different Types of Hypervisors

A hypervisor is a thin software layer that intercepts operating system calls to the hardware. It is also called as the **Virtual Machine Monitor** (VMM). It creates a virtual platform on the host computer, on top of which multiple guest operating systems are executed and monitored.

Hypervisors are two types:

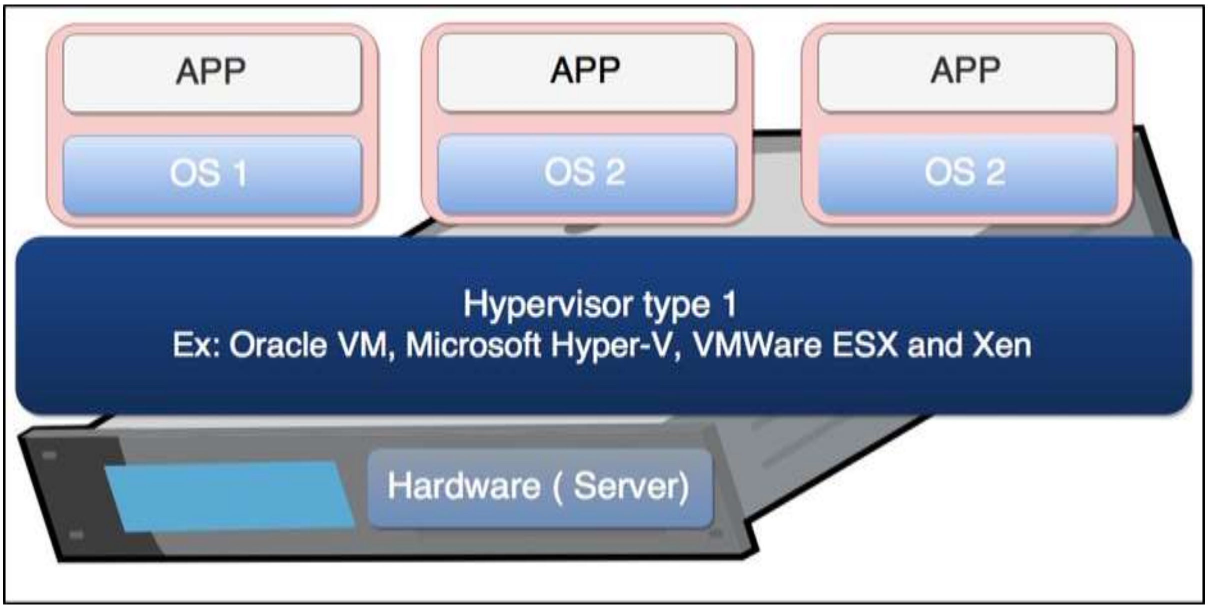
- Native of Bare Metal Hypervisor and
- Hosted Hypervisor

Let us now discuss both of these in detail.

Native or Bare Metal Hypervisor

Native hypervisors are software systems that run directly on the host's hardware to control the hardware and to monitor the **Guest Operating Systems**. The guest operating system runs on a separate level above the hypervisor. All of them have a Virtual Machine Manager.

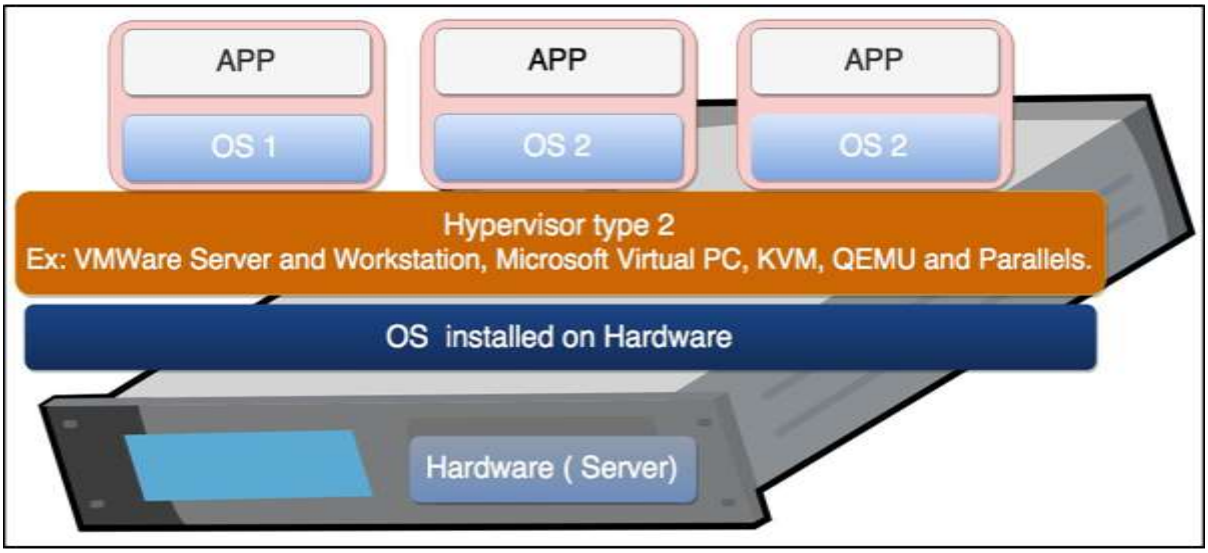
Examples of this virtual machine architecture are **Oracle VM**, **Microsoft Hyper-V**, **VMWare ESX** and **Xen**.



Hosted Hypervisor

Hosted hypervisors are designed to run within a traditional operating system. In other words, a hosted hypervisor adds a distinct software layer on top of the host operating system. While, the guest operating system becomes a third software level above the hardware.

A well-known example of a hosted hypervisor is **Oracle VM VirtualBox**. Others include **VMWare Server and Workstation**, **Microsoft Virtual PC**, **KVM**, **QEMU** and **Parallels**.


APP
APP
APP
OS 1
OS 2
OS 2
Hypervisor type 2
Ex: VMWare Server and Workstation, Microsoft Virtual PC, KVM, QEMU and Parallels.
OS installed on Hardware
Hardware (Server)

Understanding Local Virtualization and Cloud

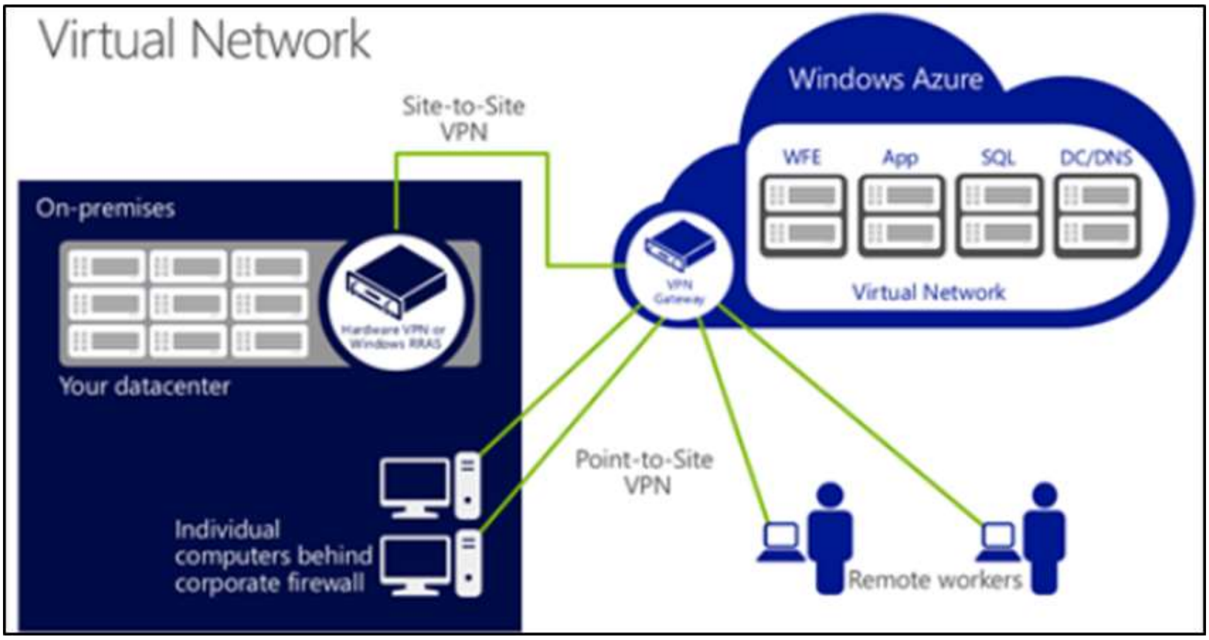
Virtualization is one of the fundamental technologies that makes cloud-computing work. However, virtualization is not cloud computing. Cloud computing is a service that different providers offer to you based on some costs.

In enterprise networks, virtualization and cloud computing are often used together to build a public or private cloud infrastructure. In small businesses, each technology will be deployed separately to gain measurable benefits. In different ways, virtualization and cloud computing can help you keep your equipment spending to a minimum and get the best possible use from the equipment you already have.

As mentioned before, virtualization software allows one physical server to run several individual computing environments. In practice, it is like getting multiple servers for each physical server you buy. This technology is fundamental to cloud computing. Cloud providers have large data centers full of servers to power their cloud offerings, but they are not able to devote a single server to each customer. Thus, they virtually partition the data on the server, enabling each client to work with a separate "virtual" instance (which can be a private network, servers farm, etc.) of the same software.

Small businesses are most likely to adopt cloud computing by subscribing to a cloud-based service. The largest providers of cloud computing are **Microsoft with Azure** and **Amazon**.

The following illustration is provided by Microsoft where you can understand how utilizing extra infrastructure for your business without the need to spend extra money helps. You can have the on-premises base infrastructure, while on cloud you can have all your services, which are based on Virtualized technology.



2. Virtualization – Pros and Cons

In this chapter, we will discuss some of the most common advantages and disadvantages of Virtualization.

Advantages of Virtualization

Following are some of the most recognized advantages of Virtualization, which are explained in detail.

Using Virtualization for Efficient Hardware Utilization

Virtualization decreases costs by reducing the need for physical hardware systems. Virtual machines use efficient hardware, which lowers the quantities of hardware, associated maintenance costs and reduces the power along with cooling the demand. You can allocate memory, space and CPU in just a second, making you more self-independent from hardware vendors.

Using Virtualization to Increase Availability

Virtualization platforms offer a number of advanced features that are not found on physical servers, which increase uptime and availability. Although the vendor feature names may be different, they usually offer capabilities such as live migration, storage migration, fault tolerance, high availability and distributed resource scheduling. These technologies keep virtual machines chugging along or give them the ability to recover from unplanned outages.

The ability to move a virtual machine from one server to another is perhaps one of the greatest single benefits of virtualization with far reaching uses. As the technology continues to mature to the point where it can do long-distance migrations, such as being able to move a virtual machine from one data center to another no matter the network latency involved.

Disaster Recovery

Disaster recovery is very easy when your servers are virtualized. With up-to-date snapshots of your virtual machines, you can quickly get back up and running. An organization can more easily create an affordable replication site. If a disaster strikes in the data center or server room itself, you can always move those virtual machines elsewhere into a cloud provider. Having that level of flexibility means your disaster recovery plan will be easier to enact and will have a 99% success rate.

Save Energy

Moving physical servers to virtual machines and consolidating them onto far fewer physical servers' means lowering monthly power and cooling costs in the data center. It reduces carbon footprint and helps to clean up the air we breathe. Consumers want to see companies reducing their output of pollution and taking responsibility.

Deploying Servers too fast

You can quickly clone an image, master template or existing virtual machine to get a server up and running within minutes. You do not have to fill out purchase orders, wait for shipping and receiving and then rack, stack, and cable a physical machine only to spend additional hours waiting for the operating system and applications to complete their installations. With virtual backup tools like Veeam, redeploying images will be so fast that your end users will hardly notice there was an issue.

Save Space in your Server Room or Datacenter

Imagine a simple example: you have two racks with 30 physical servers and 4 switches. By virtualizing your servers, it will help you to reduce half the space used by the physical servers. The result can be two physical servers in a rack with one switch, where each physical server holds 15 virtualized servers.

Testing and setting up Lab Environment

While you are testing or installing something on your servers and it crashes, do not panic, as there is no data loss. Just revert to a previous snapshot and you can move forward as if the mistake did not even happen. You can also isolate these testing environments from end users while still keeping them online. When you have completely done your work, deploy it in live.

Shifting all your Local Infrastructure to Cloud in a day

If you decide to shift your entire virtualized infrastructure into a cloud provider, you can do it in a day. All the hypervisors offer you tools to export your virtual servers.

Possibility to Divide Services

If you have a single server, holding different applications this can increase the possibility of the services to crash with each other and increasing the fail rate of the server. If you virtualize this server, you can put applications in separated environments from each other as we have discussed previously.

Disadvantages of Virtualization

Although you cannot find many disadvantages for virtualization, we will discuss a few prominent ones as follows:

Extra Costs

Maybe you have to invest in the virtualization software and possibly additional hardware might be required to make the virtualization possible. This depends on your existing network. Many businesses have sufficient capacity to accommodate the virtualization without requiring much cash. If you have an infrastructure that is more than five years old, you have to consider an initial renewal budget.

Software Licensing

This is becoming less of a problem as more software vendors adapt to the increased adoption of virtualization. However, it is important to check with your vendors to understand how they view software use in a virtualized environment.

Learn the new Infrastructure

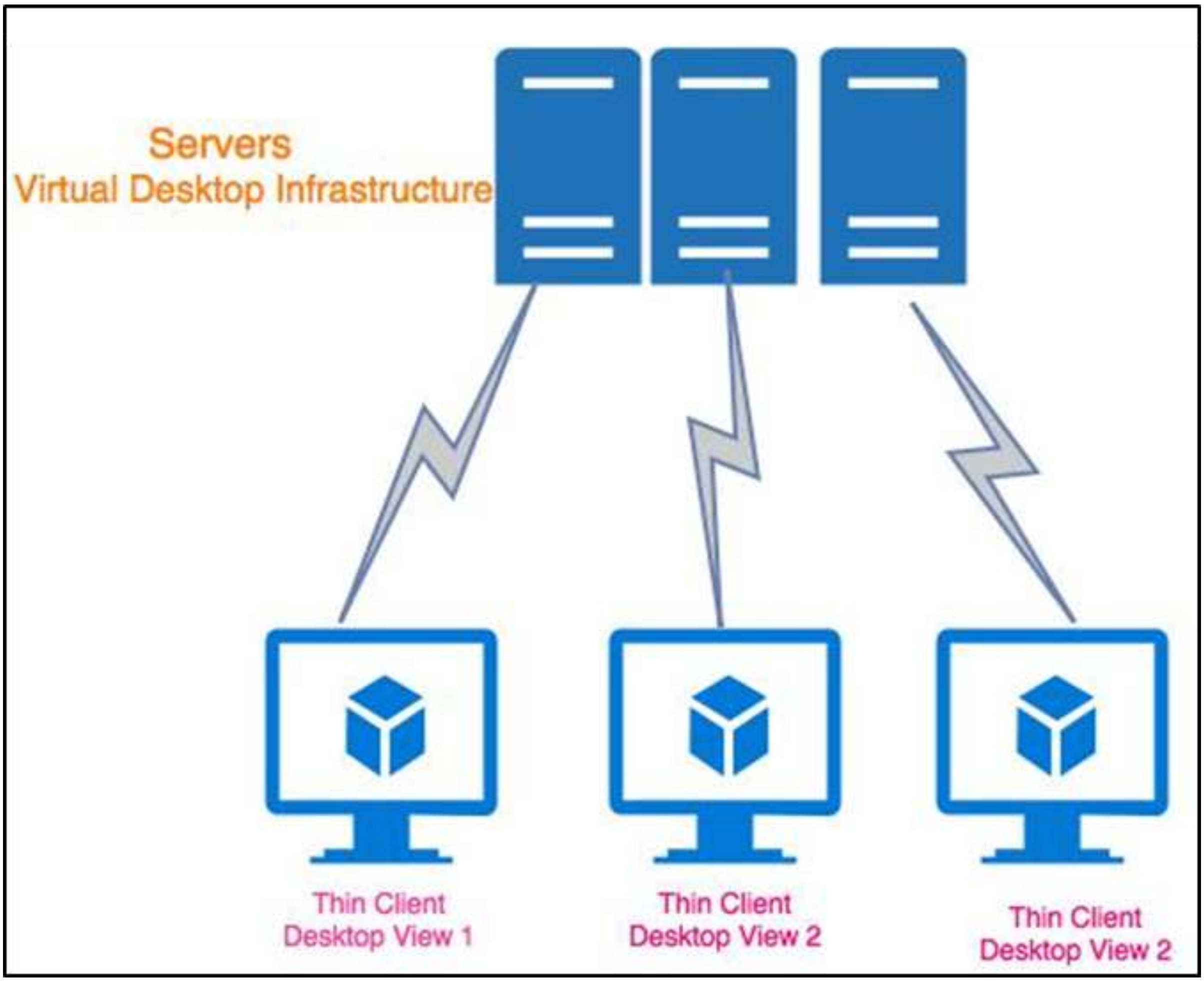
Implementing and managing a virtualized environment will require IT staff with expertise in virtualization. On the user side, a typical virtual environment will operate similarly to the non-virtual environment. There are some applications that do not adapt well to the virtualized environment.

3. Virtualization – Common Uses

There are several types of uses in virtualization, but the most commonly used are **Server Virtualization** and **Client Desktops Virtualization**. We have already discussed their advantages in the previous chapter and why are they used widely.

Virtualizing Desktop Computers

Client virtualization also called as VDI runs the entire desktop environment within a centralized server. All processing is done within the server. Client devices are typically thin clients that serve as an end node to connect I/O peripherals such as keyboard, mouse, a display, audio connectors and even USB ports over the LAN.



As discussed earlier, a thin client hardware is a computer terminal, which provides I/O for a keyboard, mouse, monitor, jacks for sound peripherals, and open ports for USB devices.

For example – Printer, Flash Drive, Web Cam, Card Reader, Smartphone, etc. Some thin clients include legacy serial and/or parallel ports to support older devices such as Receipt Printers, Scales, Time Clocks, etc. Thin client software typically consists of a GUI (graphical user interface), Cloud Access Agents (for e.g. RDP, ICA, PCoIP), a local web browser, terminal emulations (in some cases) and a basic set of local utilities.

The largest producers of thin clients are HP, Dell and IBM.

Running a Specific Program Solution

One of the best software known for Desktop Virtualization is XenApp & XenDesktop. Deliver Windows, Linux, Web and SaaS applications or full virtual desktops to workers on any device and anywhere.

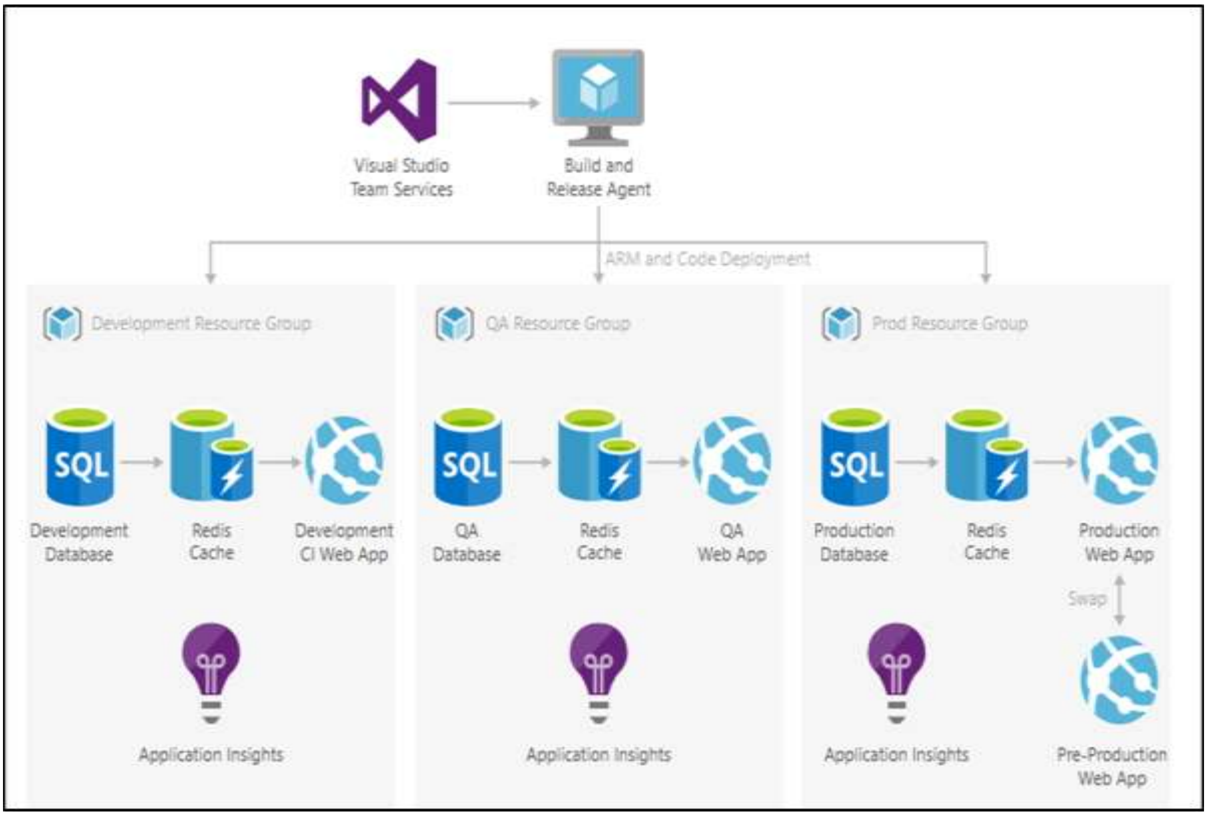
More information can be found on https://www.citrix.com/products/xenapp-xendesktop/.

Another major provider is VMware with its platform called **VMware Horizon 7**. To purchase and understand all their features and specifications, click on the following link – http://www.vmware.com/products/horizon.html.

Microsoft is another provider with a combination of Remote desktop services along with **Hyper-V**. For any further Information on this, click on the following link – https://technet.microsoft.com/en-us/windowsserver/ee236407.aspx.

Setting up Test and Development Environments

One of the most powerful features of a virtualized environment is the possibility to create labs for different approaches in a minute, especially in software development and then to import the same infrastructure in production.



Regarding the test environment, it brings cross-platform functionality to your dev-test environment and uses your preferred coding language to build natively. It tests your applications on the devices and platforms you use today: from Linux, Windows to iOS and Android.

All the features mentioned in the above can be done through private cloud or public cloud. It depends on what we would like to use as per the requirement. You should take into consideration the human resources with which you have to manage this cloud and the budget that you want to spend.

4. Virtualization – Hardware

In this chapter, we will discuss various components of hardware such as CPU, Memory, Storage and Networking.

Understanding Virtual CPU

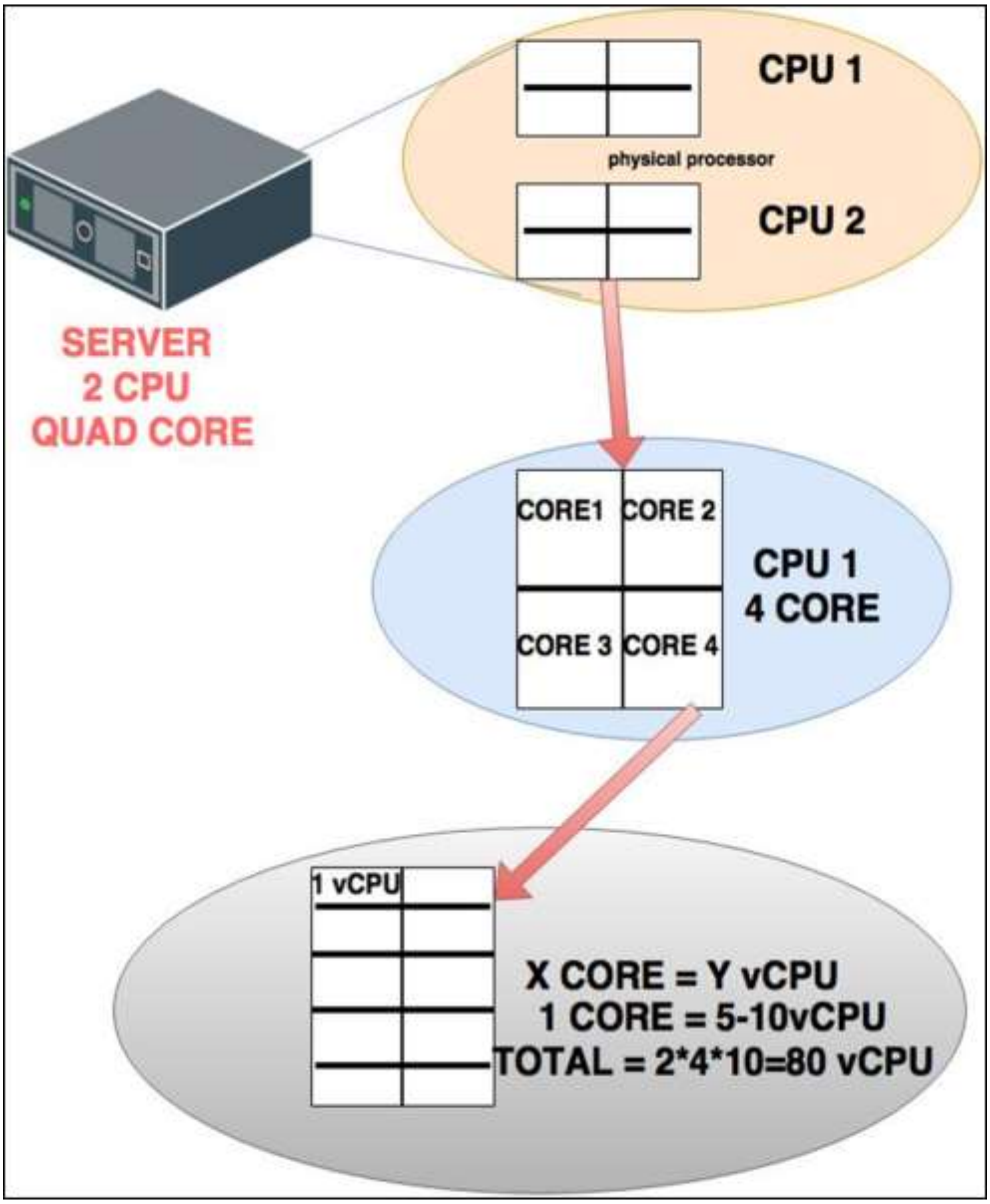
When we install a hypervisor, each physical CPU is abstracted into virtual CPUs. This divides the available CPU cycles for each core and allows multiple VMs to "time share" a given physical processor core. Generally talking, the hypervisor typically assigns one workload per vCPU (per core). If the workloads on a server need more CPU cycles, it is better to deploy fewer VMs on a particular virtual CPU.

Let us consider the following example to understand the logic of virtual CPU.

I have a physical server with two processors (CPU 1 and CPU 2) and each of them has four physical cores. In total, we have 2*4 = 8 physical cores.

Based on some calculations our hypervisor provided for each physical core, we can get 5-10 vCPUs.

In total, we will have [8 physical cores * (5 to 10 vCPUs)] 40-80 vCPUs, which means that we can assign a maximum of 80 vCPUs to virtual machines.



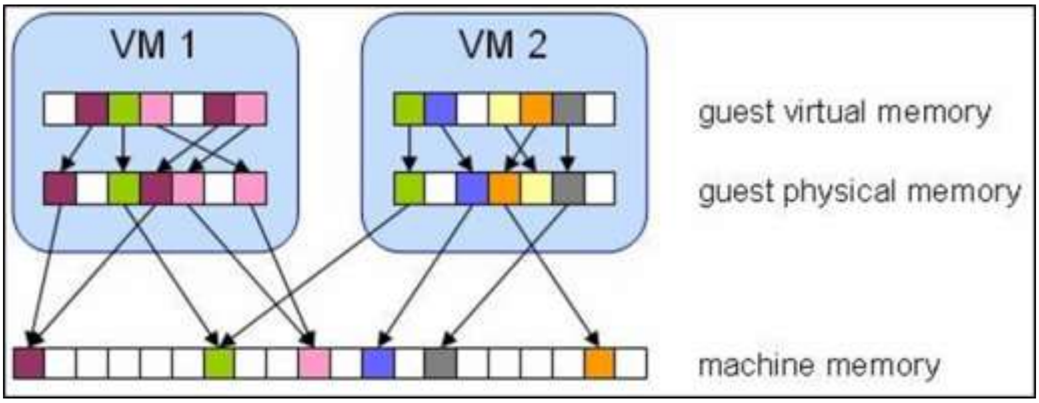
Understanding Virtual Memory

Virtual Memory in simple words is the RAM of the machine. The memory resource settings for a virtual machine determines how much of the host's memory is allocated to the virtual machine. The virtual hardware memory size determines how much memory is available to applications that run in the virtual machine.

A virtual machine cannot benefit from more memory resources than its configured virtual hardware memory size. The **ESXi hosts** limit the memory resource use to the maximum amount useful for the virtual machine, so that you can accept the default of unlimited memory resources.

You can add, change, and configure virtual machine memory resources or options to enhance virtual machine performance. You can set most of the memory parameters while creating the virtual machine or it can also be done after the **Guest Operating System** is installed. Most of the hypervisors require to power off the virtual machine before changing the settings.

In the following schematic illustration, you can see that the total physical memory is divided between two virtual machines.

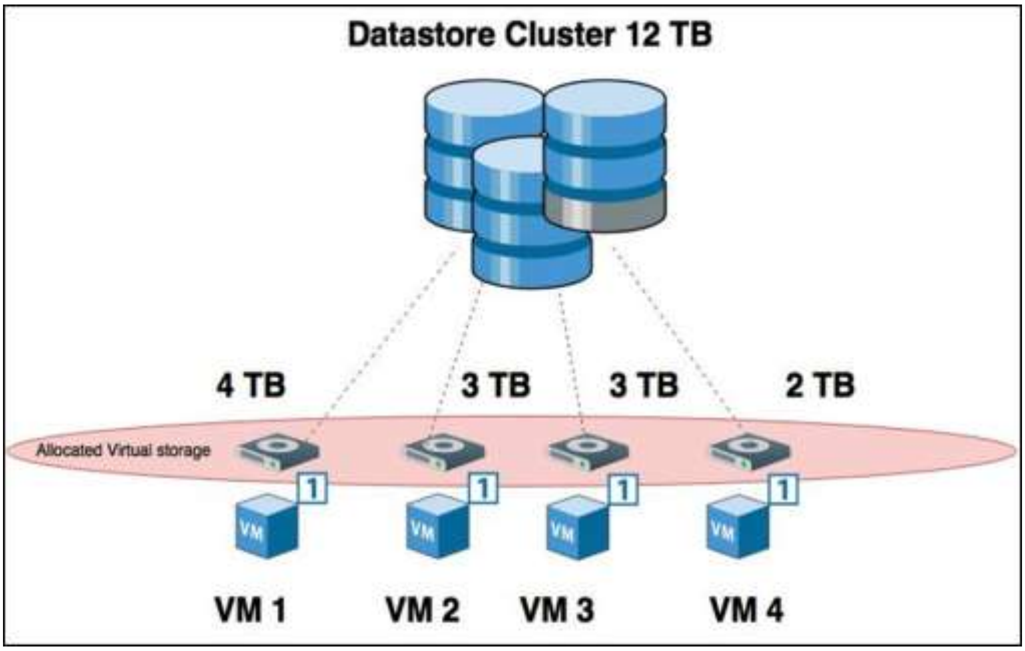


Understanding Virtual Storage

Storage virtualization is the pooling of physical storage (Data cluster) from multiple network storage devices into what appears to be a single storage device that is managed from a central console. We cannot assign more storage to virtual machines that data cluster offers physically.

You will see these extensions on the end of a file. Of all the files used as part of a virtual machine, different hypervisors like to use different file types. Some of the more common are **VDI**, **VHDX**, **VMDK** and **HDD**.

In the following example, we have a data cluster of 12 TB in total and four virtual machines to which we have allocated storage to each of them. In total, the maximum storage allocated to them is 12 TB.



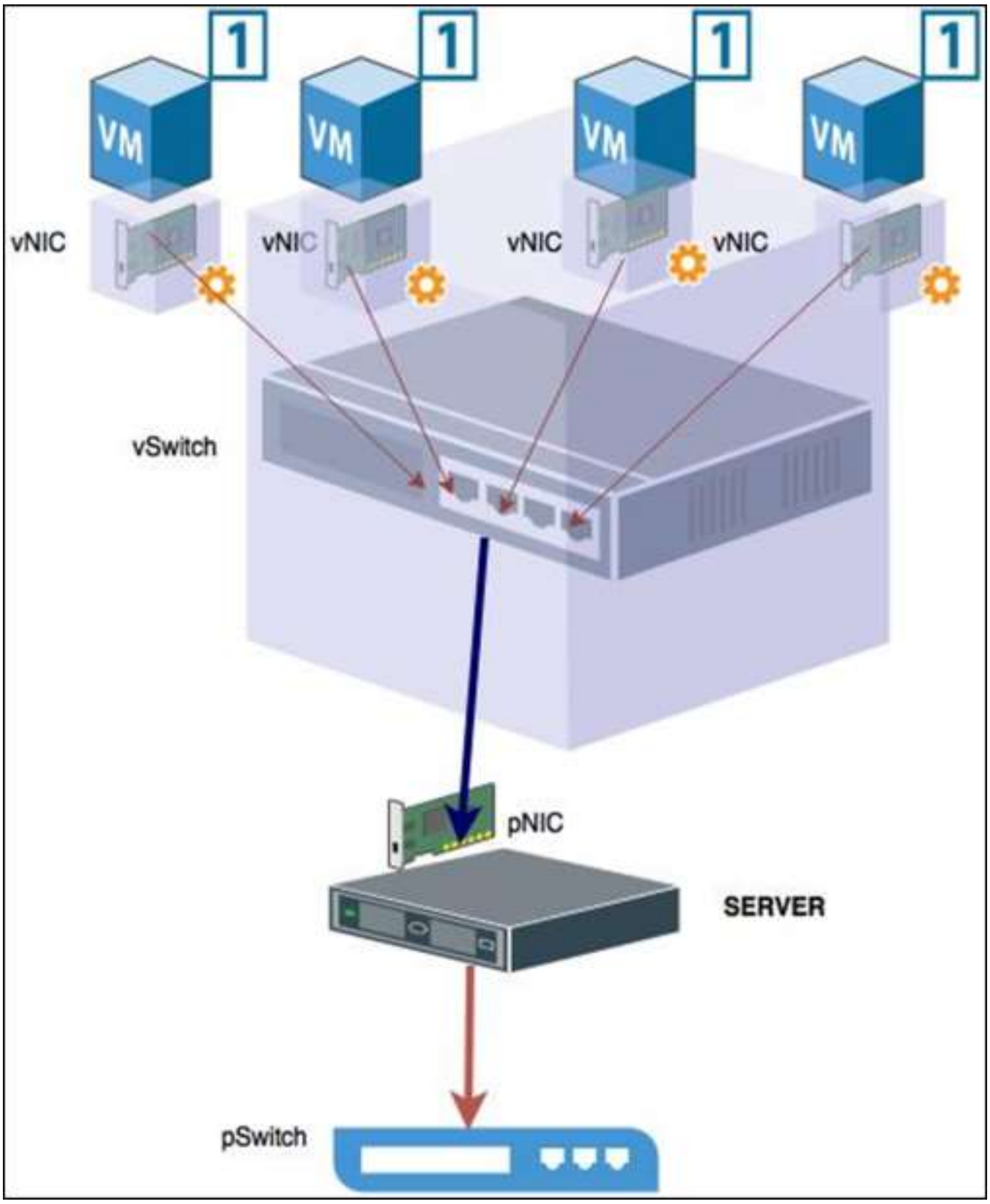
Understanding Virtual Networking

We will discuss this with a simple example as to how virtual networking done.

We have Virtual Machine 1, 2, 3 and 4 running on the same host. They would like to send the network traffic back and forth. This is done by virtual networking cards as shown in the following illustration (vNIC), which connects virtually with a virtual switch (vSwitch) that is created by the hypervisor.

This virtual switch communicates with a physical card of the server (pNIC), which is connected with a physical switch (pSwitch) and then communicates with the rest of the network equipment.

Please see the following schematically done up scenario.



5. Virtualization – Microsoft Hyper-V

In this chapter, we will discuss Microsoft Hyper-V along with its various modules.

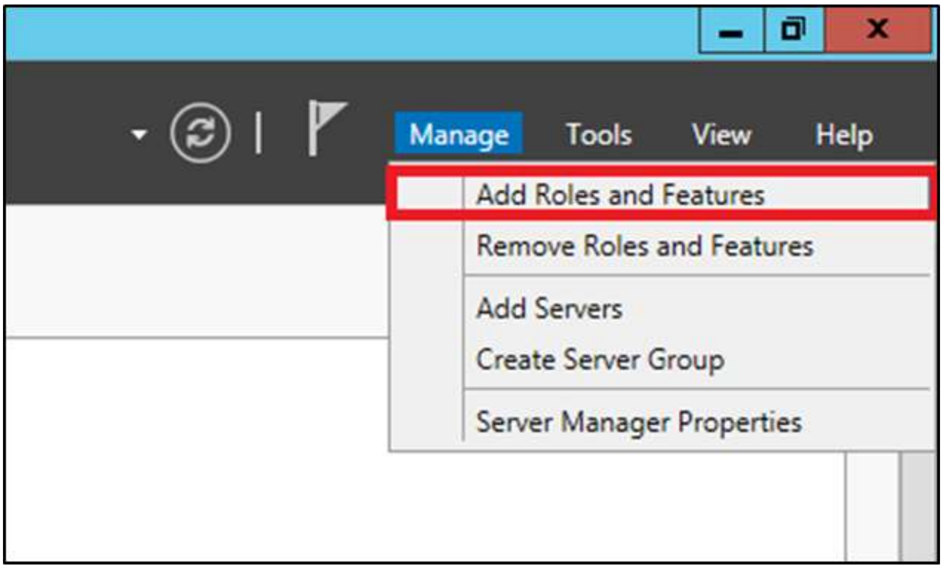
Installing Hyper-V in Windows Server 2012

Microsoft Hyper-V, known as Windows Server Virtualization, is a native (bare) hypervisor. It can create virtual machines on x86-64 systems running Windows OS, starting with Windows 8. Hyper-V supersedes **Windows Virtual PC** as the hardware virtualization component of the client editions of Windows NT. A server computer running Hyper-V can be configured to expose individual virtual machines to one or more networks.

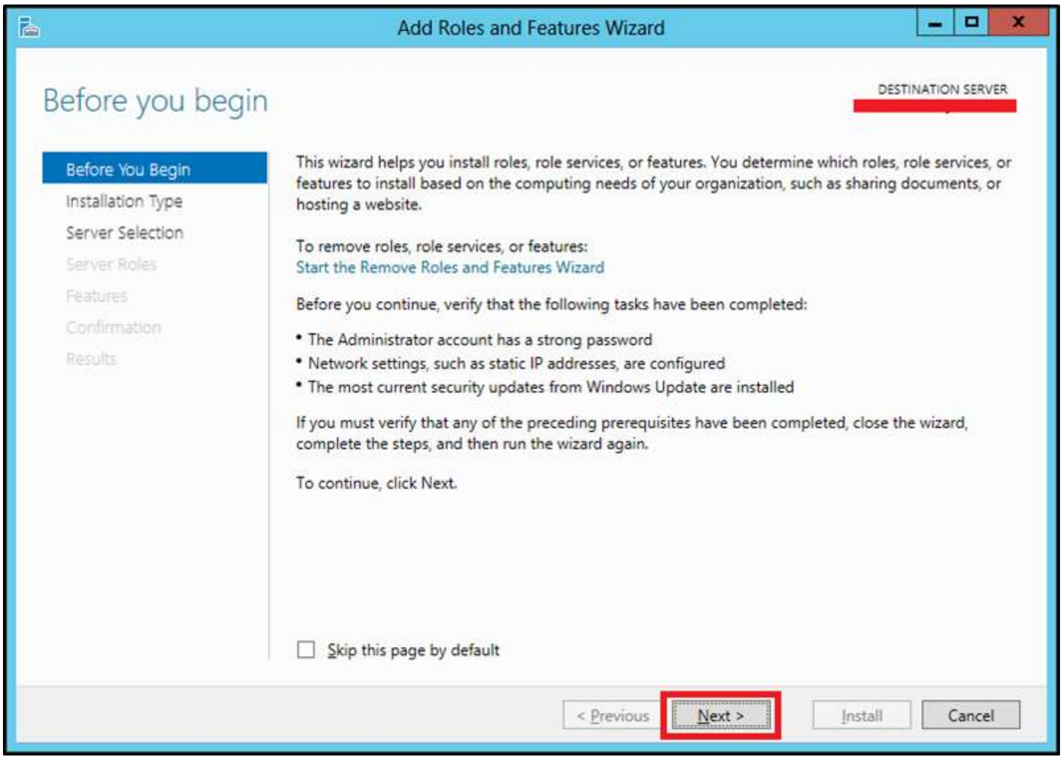
Hyper-V was first released alongside Windows Server 2008 and Windows 7 and has been available without charge for all the Windows Server versions and some client operating systems since that time.

Let us see how to install a Hyper-V role in a Windows Server 2012 by following the steps given below.

Step 1: To Install Hyper-V role go to "Server Manager" → Manage → Add Roles and Features.



Step 2: Click on “Next”.



This wizard helps you install roles, role services, or features. You determine which roles, role services, or features to install based on the computing needs of your organization, such as sharing documents, or hosting a website.

To remove roles, role services, or features:
Start the Remove Roles and Features Wizard

Before you continue, verify that the following tasks have been completed:

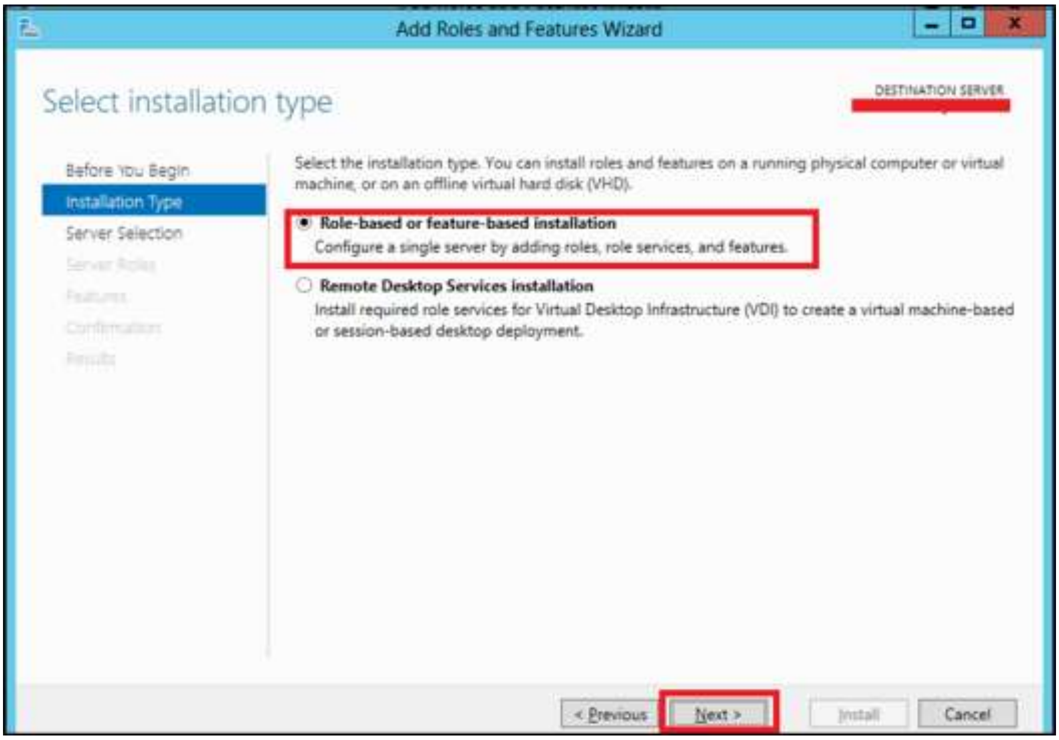
- The Administrator account has a strong password
- Network settings, such as static IP addresses, are configured
- The most current security updates from Windows Update are installed

If you must verify that any of the preceding prerequisites have been completed, close the wizard, complete the steps, and then run the wizard again.

To continue, click Next.

□ Skip this page by default

Step 3: Select “Role-based or feature-based installation” option → click on “Next”.

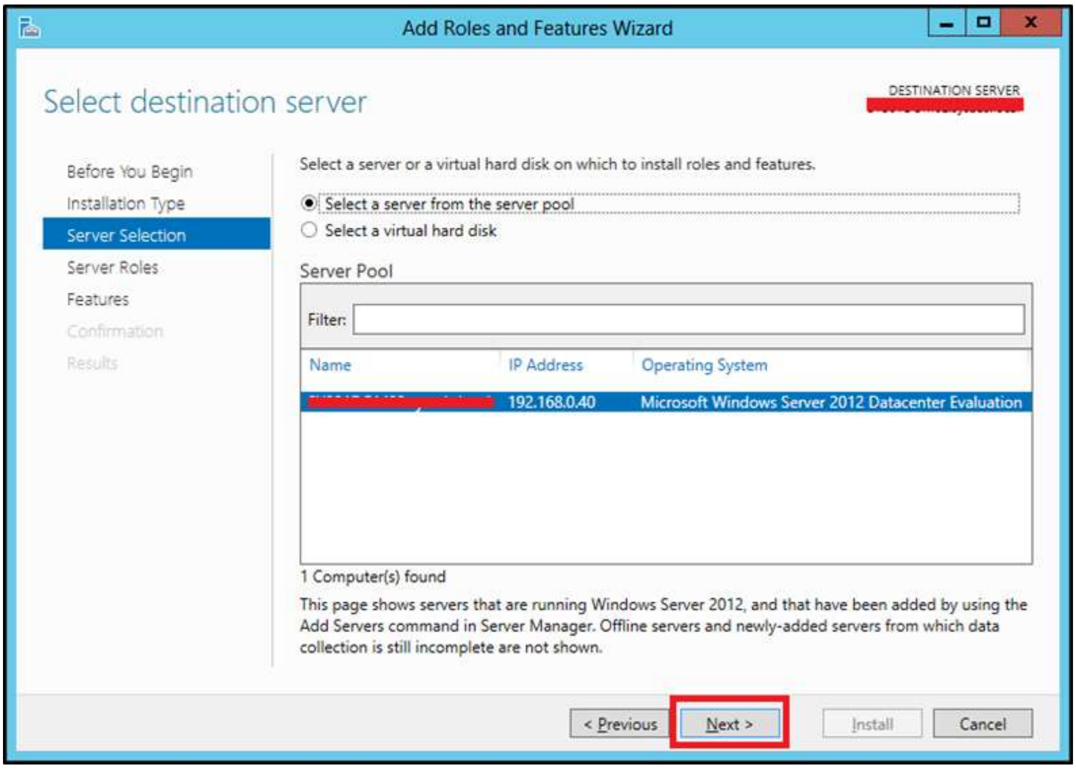


Select the installation type. You can install roles and features on a running physical computer or virtual machine, or on an offline virtual hard disk (VHD).

● **Role-based or feature-based installation**
Configure a single server by adding roles, role services, and features.

○ **Remote Desktop Services installation**
Install required role services for Virtual Desktop Infrastructure (VDI) to create a virtual machine-based or session-based desktop deployment.

Step 4: We will locally install the Hyper-V role as such "Select a server from the server pool" → click "Next".



Select destination server

DESTINATION SERVER
[redacted]

Select a server or a virtual hard disk on which to install roles and features.

● Select a server from the server pool

○ Select a virtual hard disk

Server Pool

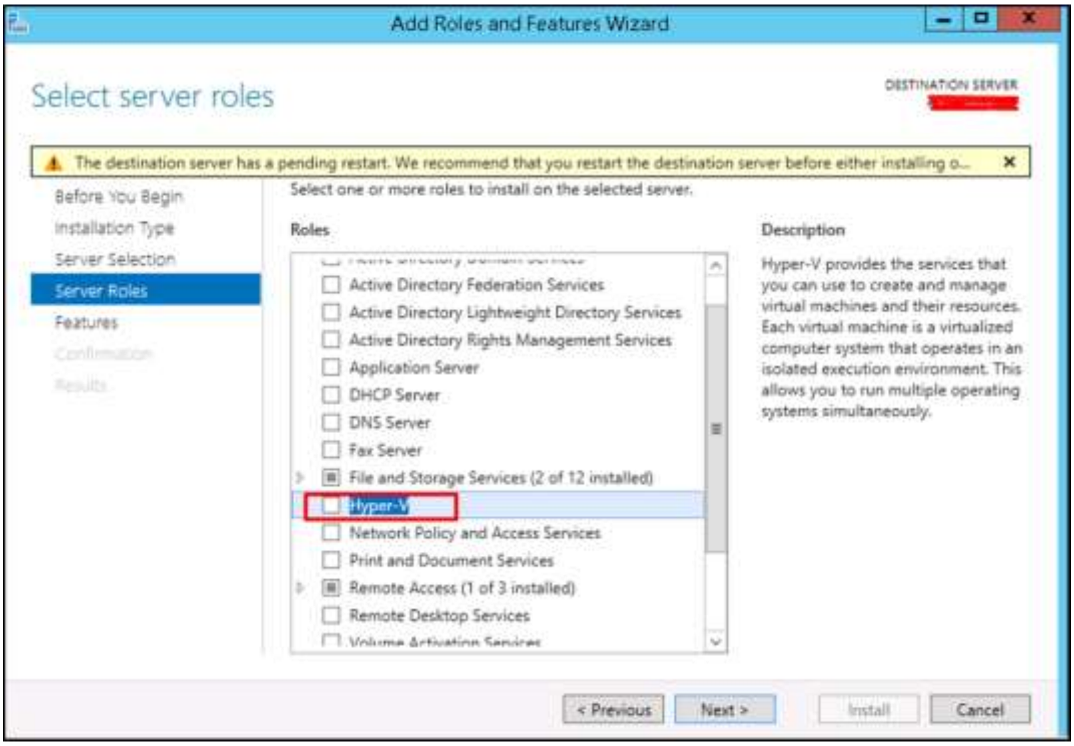
Filter:

Name	IP Address	Operating System
[redacted]	192.168.0.40	Microsoft Windows Server 2012 Datacenter Evaluation

1 Computer(s) found

This page shows servers that are running Windows Server 2012, and that have been added by using the Add Servers command in Server Manager. Offline servers and newly-added servers from which data collection is still incomplete are not shown.

Step 5: From the Roles lists, check the "Hyper-V" Server role → click on Add Features on the popup window → click "Next".



Select server roles

DESTINATION SERVER
[redacted]

⚠ The destination server has a pending restart. We recommend that you restart the destination server before either installing o... ✕

Select one or more roles to install on the selected server.

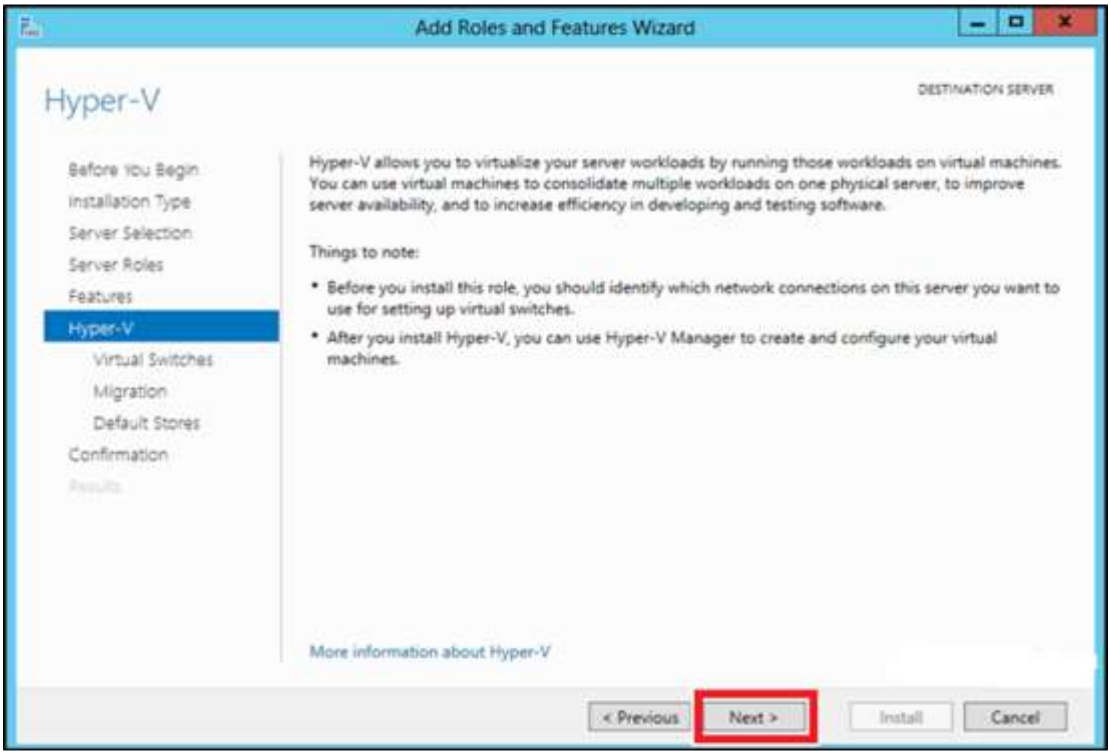
Roles

☐ Active Directory Federation Services
☐ Active Directory Lightweight Directory Services
☐ Active Directory Rights Management Services
☐ Application Server
☐ DHCP Server
☐ DNS Server
☐ Fax Server
▣ File and Storage Services (2 of 12 installed)
☐ Hyper-V
☐ Network Policy and Access Services
☐ Print and Document Services
▣ Remote Access (1 of 3 installed)
☐ Remote Desktop Services
☐ Volume Activation Services

Description

Hyper-V provides the services that you can use to create and manage virtual machines and their resources. Each virtual machine is a virtualized computer system that operates in an isolated execution environment. This allows you to run multiple operating systems simultaneously.

Step 6: Click “Next”.



Hyper-V

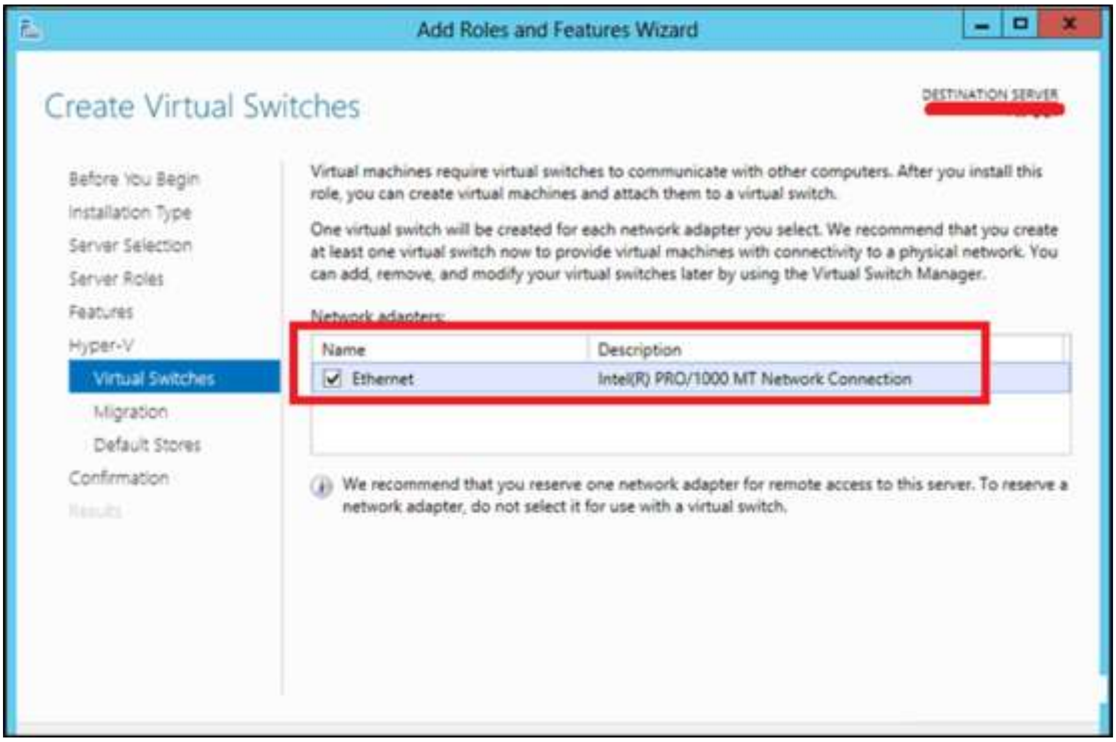
Hyper-V allows you to virtualize your server workloads by running those workloads on virtual machines. You can use virtual machines to consolidate multiple workloads on one physical server, to improve server availability, and to increase efficiency in developing and testing software.

Things to note:

- Before you install this role, you should identify which network connections on this server you want to use for setting up virtual switches.
- After you install Hyper-V, you can use Hyper-V Manager to create and configure your virtual machines.

More information about Hyper-V

Step 7: Choose your server’s physical network adapters that will take part in the virtualization and responsible for network switching → click on “Next”



Create Virtual Switches

Virtual machines require virtual switches to communicate with other computers. After you install this role, you can create virtual machines and attach them to a virtual switch.

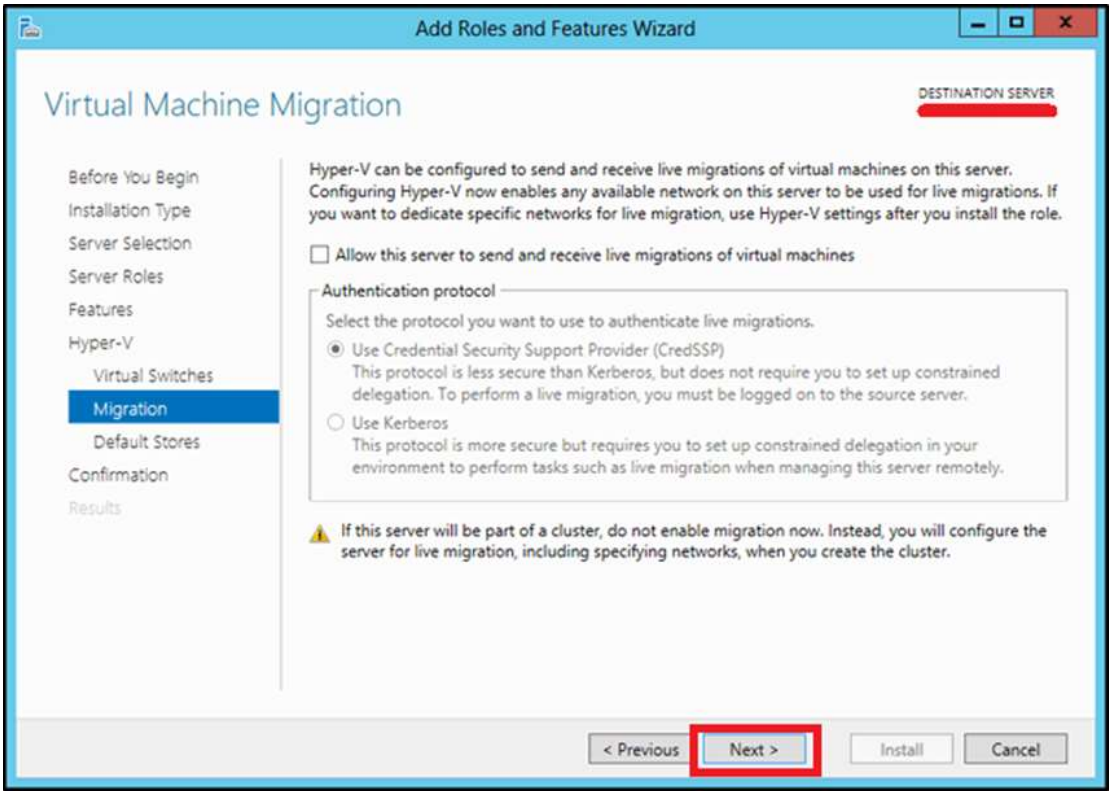
One virtual switch will be created for each network adapter you select. We recommend that you create at least one virtual switch now to provide virtual machines with connectivity to a physical network. You can add, remove, and modify your virtual switches later by using the Virtual Switch Manager.

Network adapters:

Name	Description
☑ Ethernet	Intel(R) PRO/1000 MT Network Connection

We recommend that you reserve one network adapter for remote access to this server. To reserve a network adapter, do not select it for use with a virtual switch.

Step 8: Under Migration, leave the default settings → click on "Next**".**



Virtual Machine Migration

Hyper-V can be configured to send and receive live migrations of virtual machines on this server. Configuring Hyper-V now enables any available network on this server to be used for live migrations. If you want to dedicate specific networks for live migration, use Hyper-V settings after you install the role.

□ Allow this server to send and receive live migrations of virtual machines

Authentication protocol

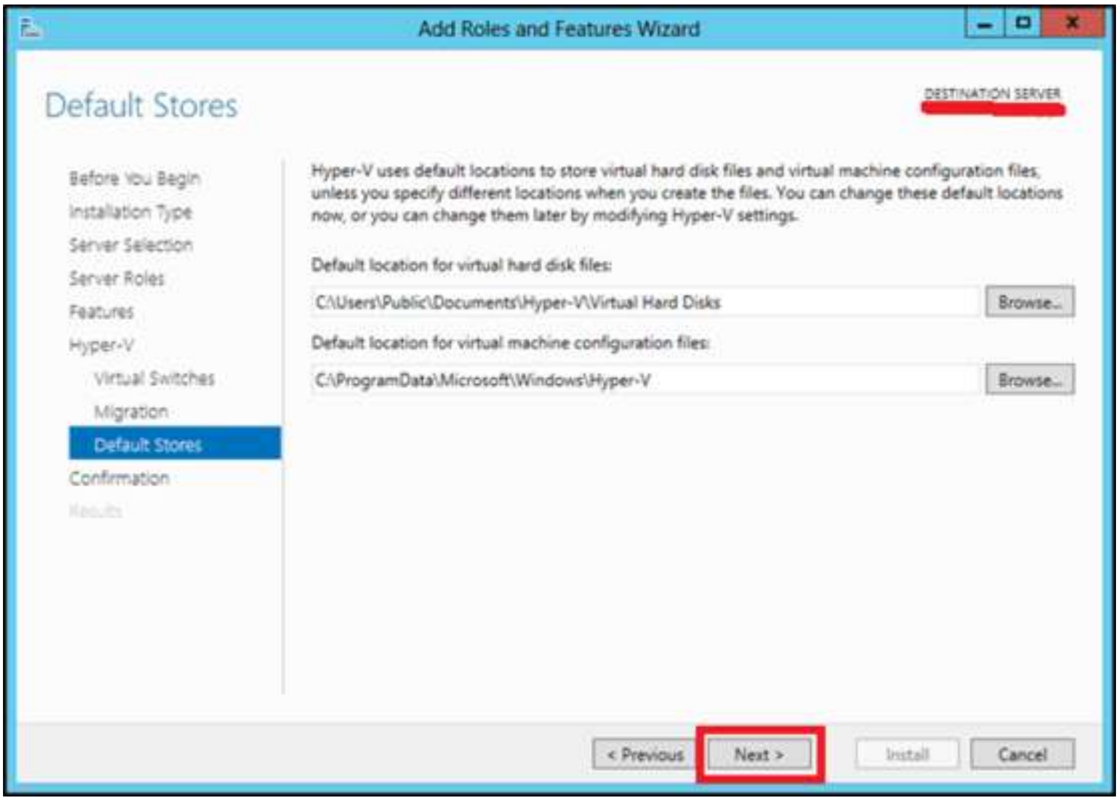
Select the protocol you want to use to authenticate live migrations.

● Use Credential Security Support Provider (CredSSP)
This protocol is less secure than Kerberos, but does not require you to set up constrained delegation. To perform a live migration, you must be logged on to the source server.

○ Use Kerberos
This protocol is more secure but requires you to set up constrained delegation in your environment to perform tasks such as live migration when managing this server remotely.

⚠ If this server will be part of a cluster, do not enable migration now. Instead, you will configure the server for live migration, including specifying networks, when you create the cluster.

Step 9: Choose the path where you want to save the file → click on "Next".



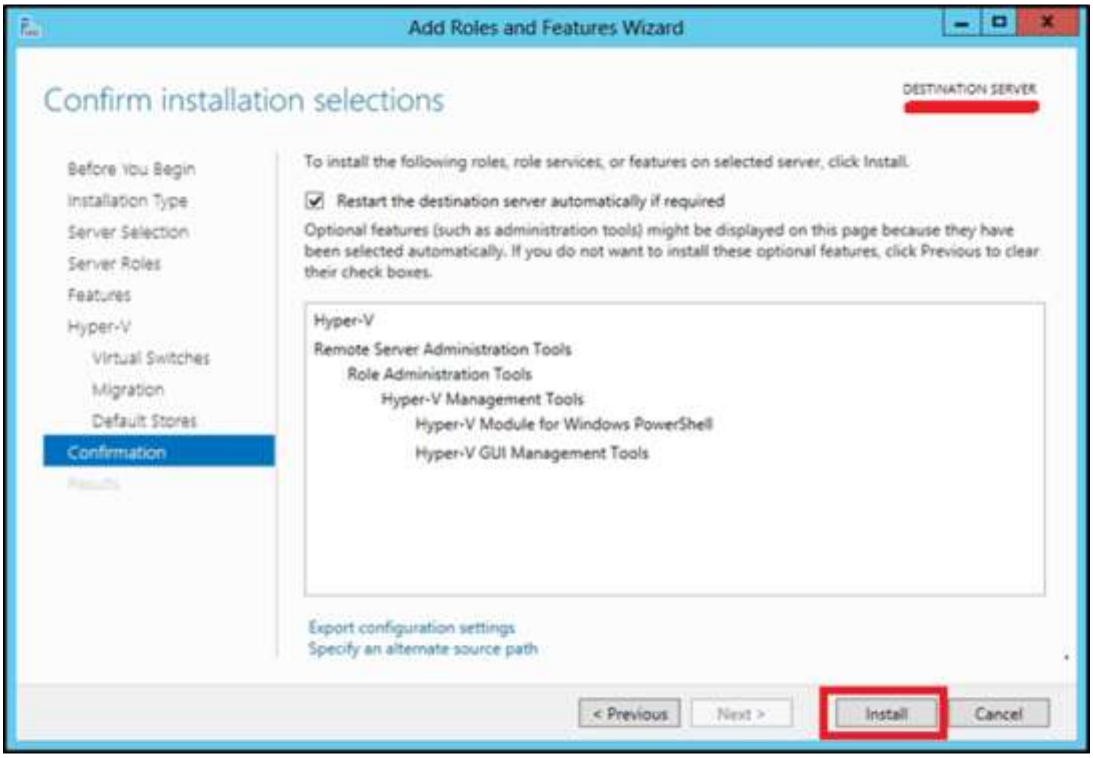
Default Stores

Hyper-V uses default locations to store virtual hard disk files and virtual machine configuration files, unless you specify different locations when you create the files. You can change these default locations now, or you can change them later by modifying Hyper-V settings.

Default location for virtual hard disk files:
C:\Users\Public\Documents\Hyper-V\Virtual Hard Disks

Default location for virtual machine configuration files:
C:\ProgramData\Microsoft\Windows\Hyper-V

Step 10: Click "Install" and wait for the installation bar to finish.



Confirm installation selections

To install the following roles, role services, or features on selected server, click Install.

☑ Restart the destination server automatically if required

Optional features (such as administration tools) might be displayed on this page because they have been selected automatically. If you do not want to install these optional features, click Previous to clear their check boxes.

Hyper-V
Remote Server Administration Tools
Role Administration Tools
Hyper-V Management Tools
Hyper-V Module for Windows PowerShell
Hyper-V GUI Management Tools

Installing Hyper-V in a windows 10 workstation

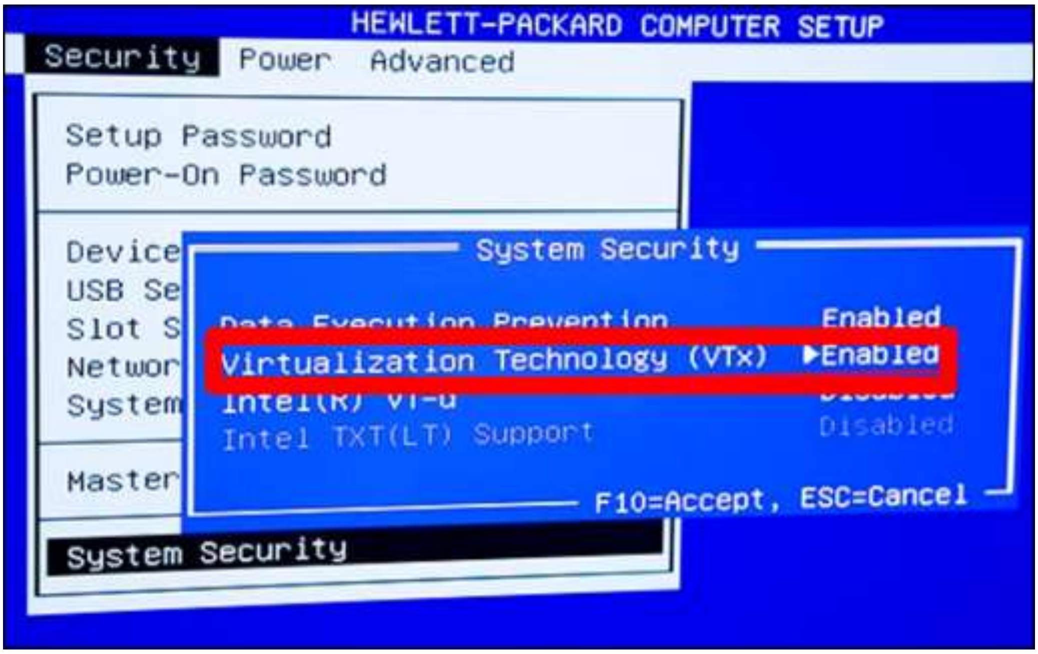
To install it in Windows 7, 8, 10 versions, you have to check if your computer supports virtualization. Following are the basic requirements:

- Windows 10 Pro or Enterprise 64-bit Operating System.
- A 64-bit processor with Second Level Address Translation (SLAT).
- 4GB system RAM at minimum.
- BIOS-level Hardware Virtualization support.

In my case, we have a laptop **HP Probook 450 G3**, which supports it.

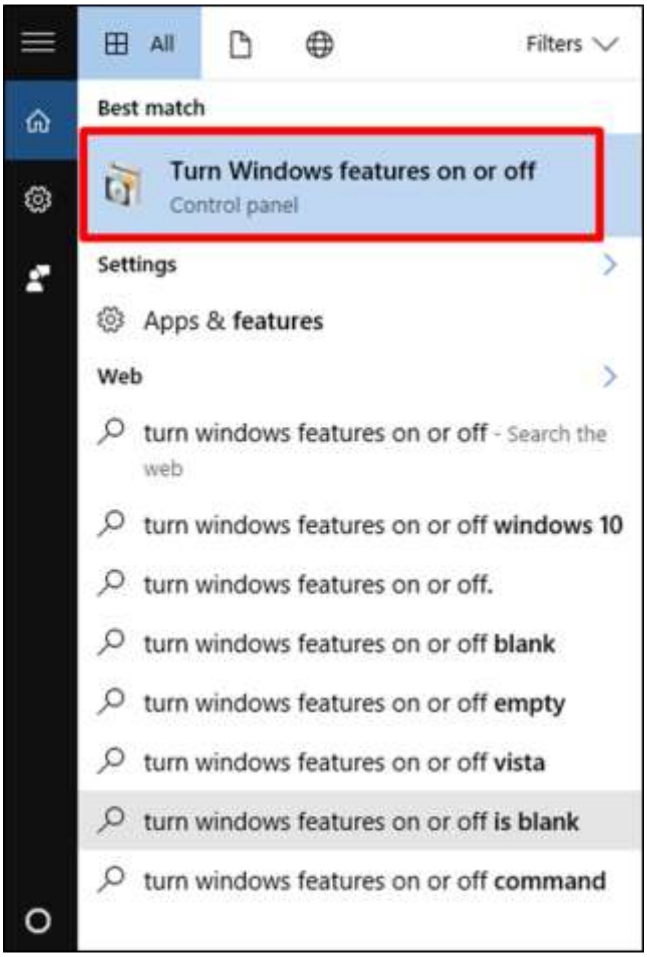
Before continuing with the installation, follow the steps given below.

Step 1: Ensure that hardware virtualization support is turned on in the BIOS settings as shown below:



Data Execution Prevention Enabled
Virtualization Technology (VTx) ▶Enabled
Intel(R) VT-d Disabled
Intel TXT(LT) Support Disabled

Step 2: Type in the search bar "**turn windows features on or off**" and click on that feature as shown below.



Turn Windows features on or off
Control panel

Apps & features

turn windows features on or off - Search the web

turn windows features on or off windows 10

turn windows features on or off.

turn windows features on or off blank

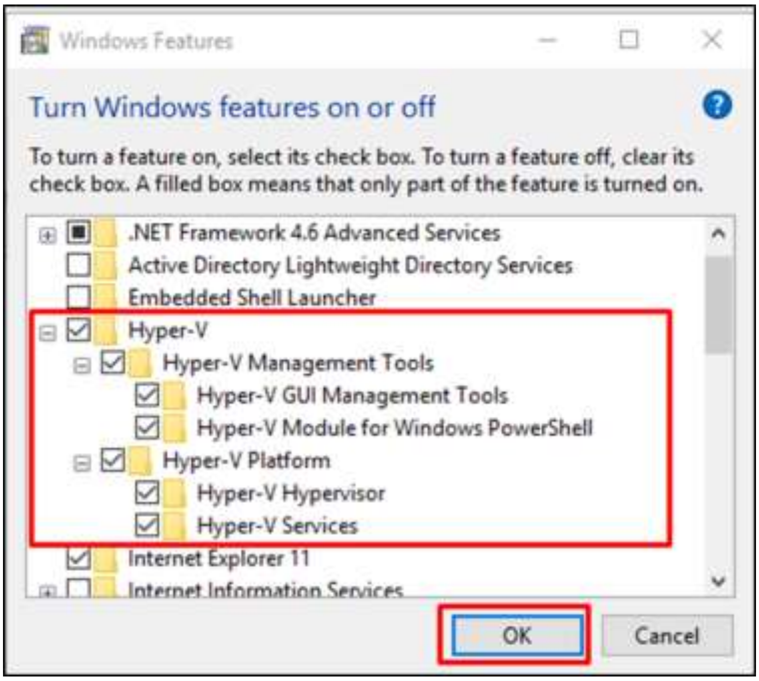
turn windows features on or off empty

turn windows features on or off vista

turn windows features on or off is blank

turn windows features on or off command

Step 3: Select and enable Hyper-V.



Turn Windows features on or off

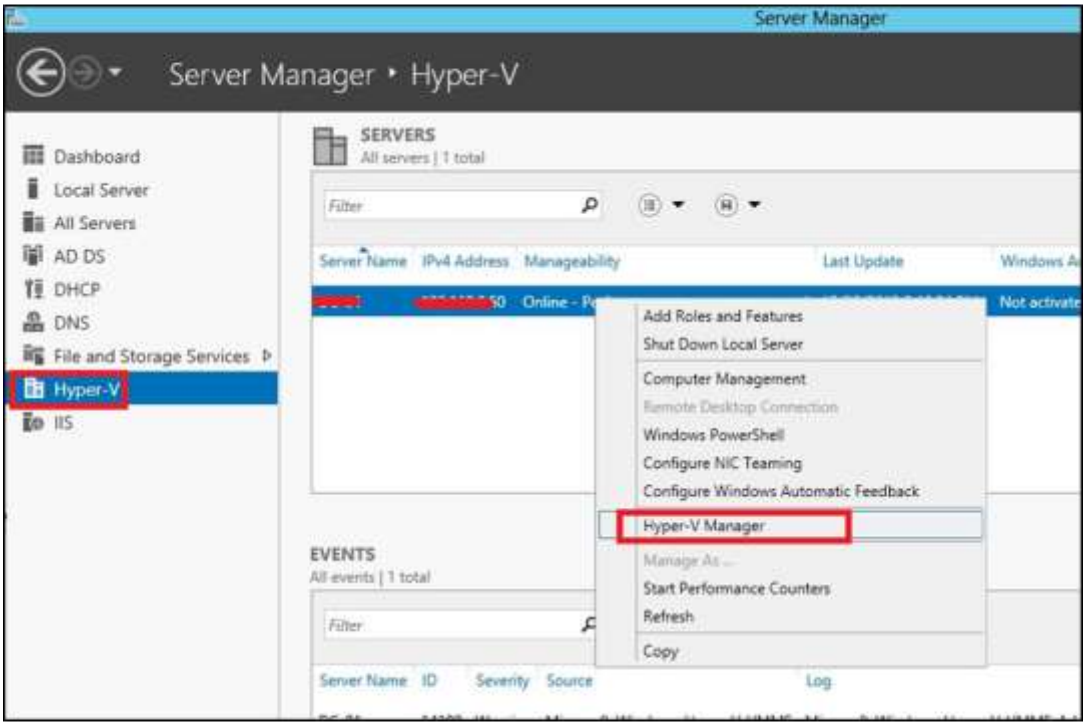
To turn a feature on, select its check box. To turn a feature off, clear its check box. A filled box means that only part of the feature is turned on.

- ■ .NET Framework 4.6 Advanced Services
- □ Active Directory Lightweight Directory Services
- □ Embedded Shell Launcher
- ☑ Hyper-V
  - ☑ Hyper-V Management Tools
    - ☑ Hyper-V GUI Management Tools
    - ☑ Hyper-V Module for Windows PowerShell
  - ☑ Hyper-V Platform
    - ☑ Hyper-V Hypervisor
    - ☑ Hyper-V Services
- ☑ Internet Explorer 11
- □ Internet Information Services

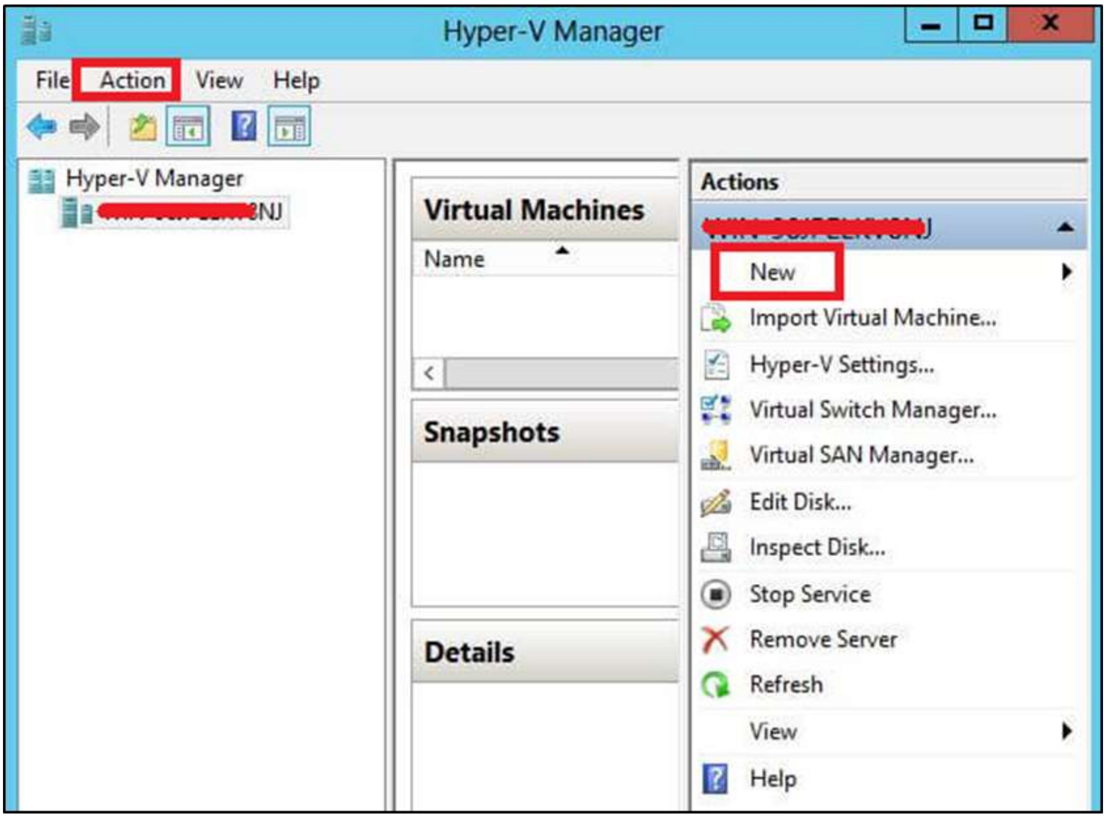
Creating a Virtual Machine with Hyper-V

In this section, we will learn how to create a virtual machine. To begin with, we have to open the Hyper-V manager and then follow the steps given below.

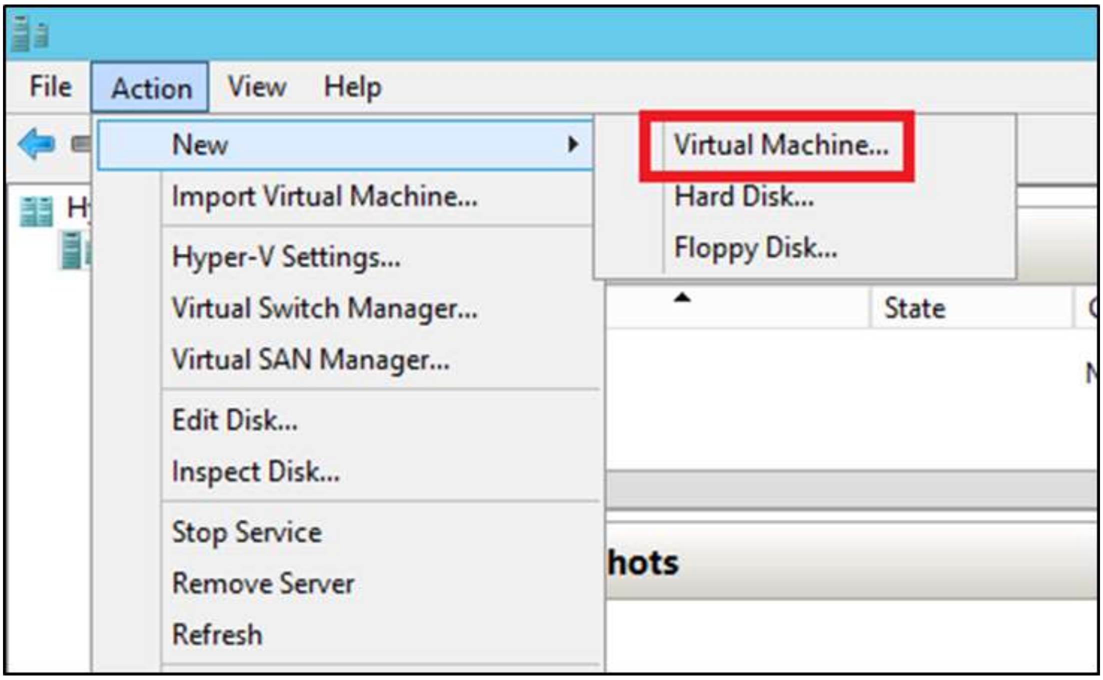
Step 1: Go to "Server Manager" → Click on "Hyper-V Manager".



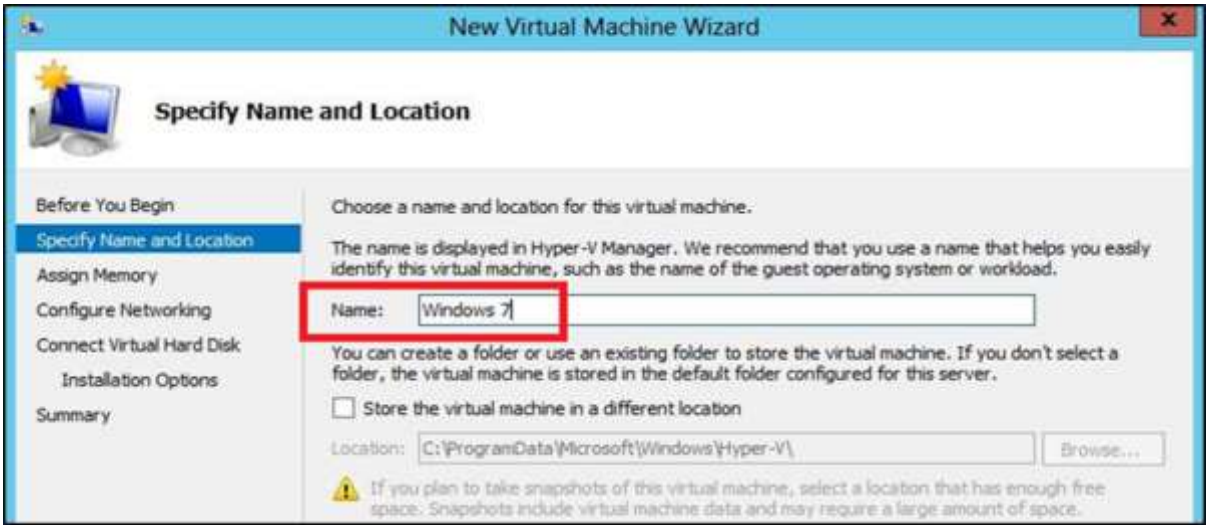
Step 2: Click "New" on the left Panel or on the "Actions" button.



Step 3: Double-click on "Virtual Machine…"



Step 4: A new table will open → Type Name of your new machine → click “Next”.


New Virtual Machine Wizard
Specify Name and Location
Before You Begin
Specify Name and Location
Assign Memory
Configure Networking
Connect Virtual Hard Disk
Installation Options
Summary
Browse...

Choose a name and location for this virtual machine.

The name is displayed in Hyper-V Manager. We recommend that you use a name that helps you easily identify this virtual machine, such as the name of the guest operating system or workload.

Name: Windows 7

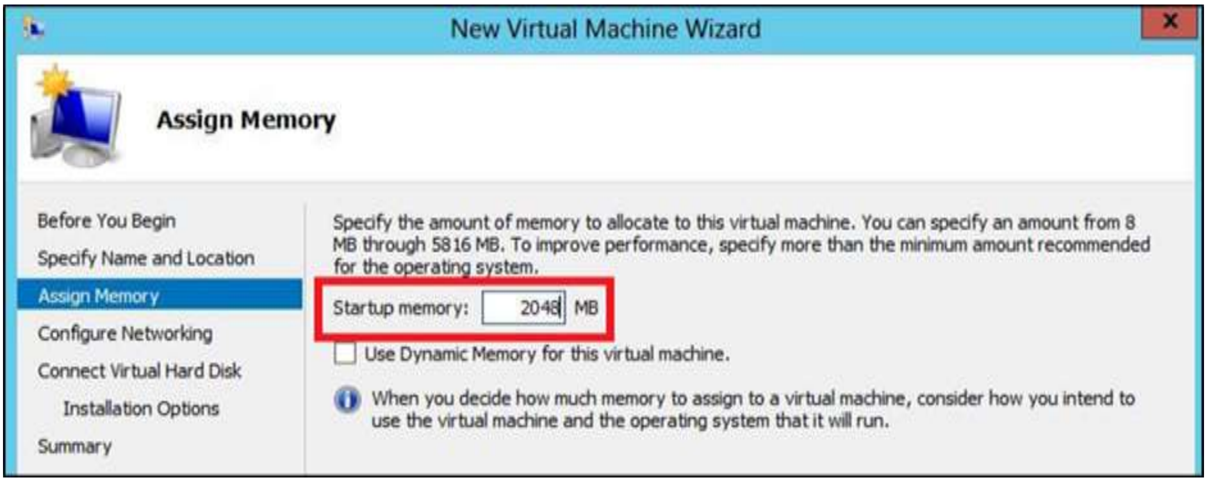
You can create a folder or use an existing folder to store the virtual machine. If you don't select a folder, the virtual machine is stored in the default folder configured for this server.

☐ Store the virtual machine in a different location

Location: C:\ProgramData\Microsoft\Windows\Hyper-V\

If you plan to take snapshots of this virtual machine, select a location that has enough free space. Snapshots include virtual machine data and may require a large amount of space.

Step 5: A new table will be opened where you have to allocate the memory. Keep in mind you cannot choose more memory than you have physically.



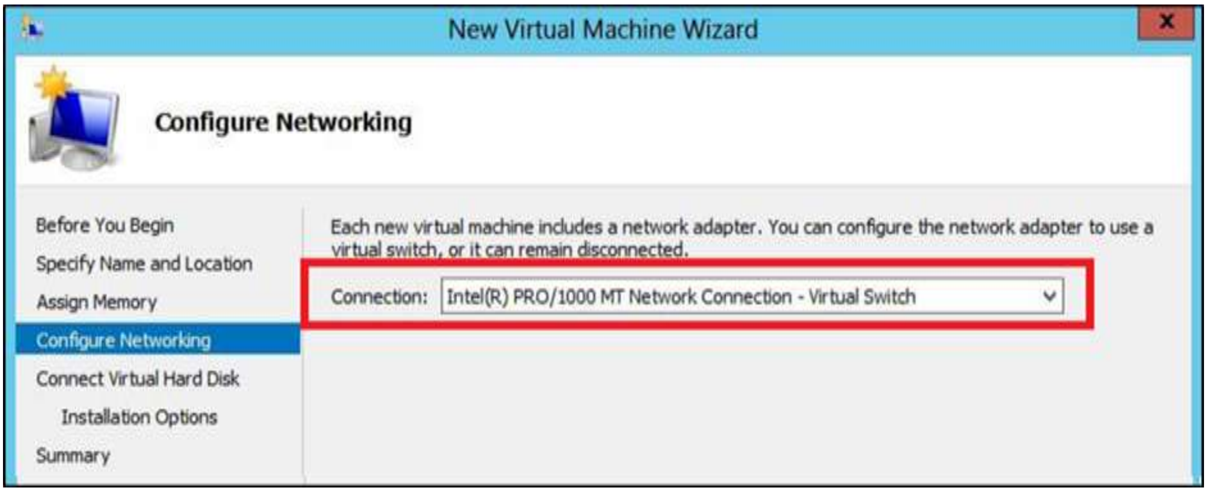
Specify the amount of memory to allocate to this virtual machine. You can specify an amount from 8 MB through 5816 MB. To improve performance, specify more than the minimum amount recommended for the operating system.

Startup memory: 2048 MB

☐ Use Dynamic Memory for this virtual machine.

When you decide how much memory to assign to a virtual machine, consider how you intend to use the virtual machine and the operating system that it will run.

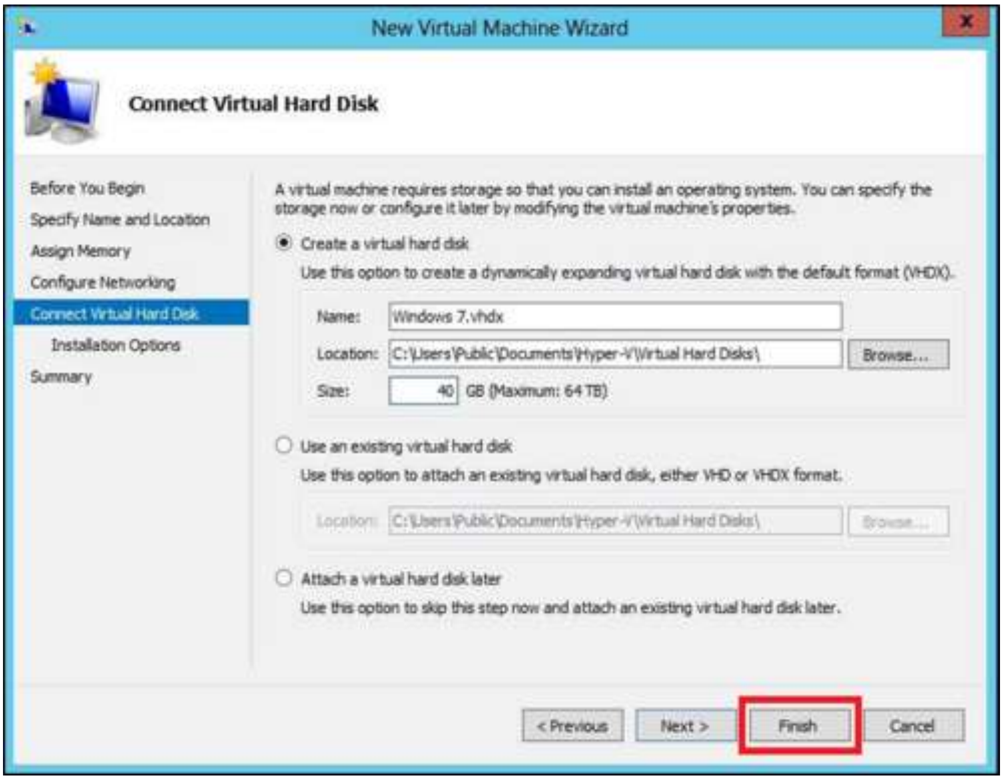
Step 6: In the “Connection” drop down box, choose your physical network adaptor → click on “Next”.



Each new virtual machine includes a network adapter. You can configure the network adapter to use a virtual switch, or it can remain disconnected.

Connection: Intel(R) PRO/1000 MT Network Connection - Virtual Switch

Step 7: Now it is time to create a Virtual Hard disk, if you already have one, choose the second option.



Connect Virtual Hard Disk

A virtual machine requires storage so that you can install an operating system. You can specify the storage now or configure it later by modifying the virtual machine's properties.

● Create a virtual hard disk

Use this option to create a dynamically expanding virtual hard disk with the default format (VHDX).

Name: Windows 7.vhdx

Location: C:\Users\Public\Documents\Hyper-V\Virtual Hard Disks\

Size: 40 GB (Maximum: 64 TB)

○ Use an existing virtual hard disk

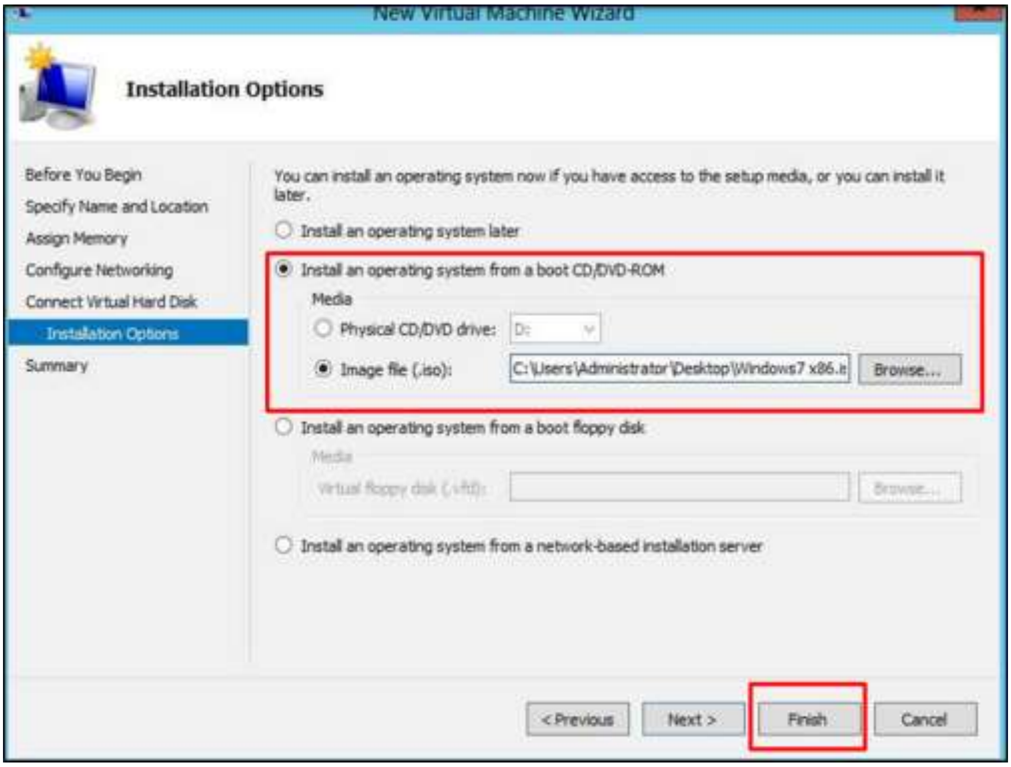
Use this option to attach an existing virtual hard disk, either VHD or VHDX format.

Location: C:\Users\Public\Documents\Hyper-V\Virtual Hard Disks\

○ Attach a virtual hard disk later

Use this option to skip this step now and attach an existing virtual hard disk later.

Step 8: Select the Image of ISO that has to be installed → click on "Finish".



Installation Options

You can install an operating system now if you have access to the setup media, or you can install it later.

○ Install an operating system later

● Install an operating system from a boot CD/DVD-ROM

Media

○ Physical CD/DVD drive: D:

● Image file (.iso): C:\Users\Administrator\Desktop\Windows7 x86.i

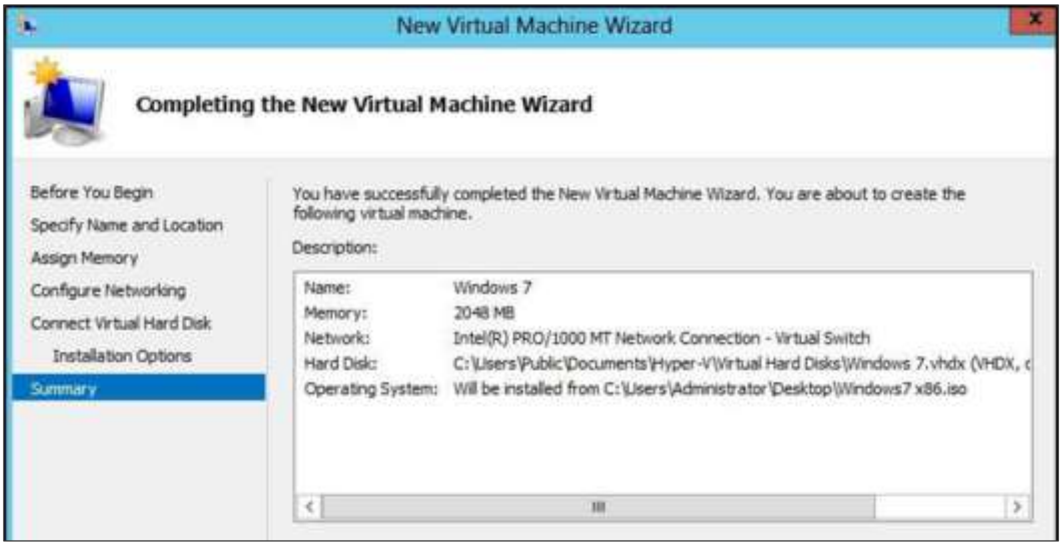
○ Install an operating system from a boot floppy disk

Media

Virtual floppy disk (.vfd):

○ Install an operating system from a network-based installation server

Step 9: After clicking on finish, you would get the following message as shown in the screenshot below.

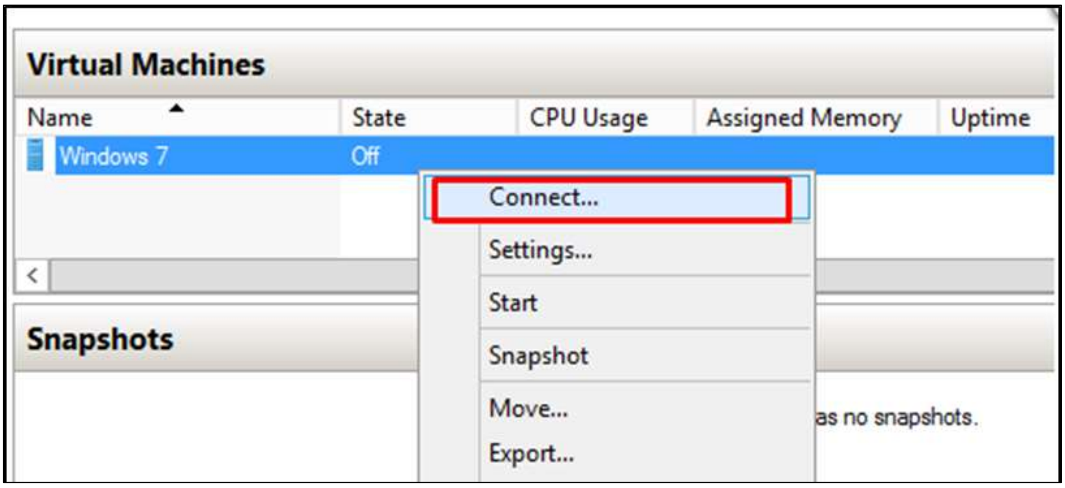

New Virtual Machine Wizard
Completing the New Virtual Machine Wizard
Before You Begin
Specify Name and Location
Assign Memory
Configure Networking
Connect Virtual Hard Disk
Installation Options
Summary

You have successfully completed the New Virtual Machine Wizard. You are about to create the following virtual machine.

Description:

Name:	Windows 7
Memory:	2048 MB
Network:	Intel(R) PRO/1000 MT Network Connection - Virtual Switch
Hard Disk:	C:\Users\Public\Documents\Hyper-V\Virtual Hard Disks\Windows 7.vhdx (VHDX, c
Operating System:	Will be installed from C:\Users\Administrator\Desktop\Windows7 x86.iso

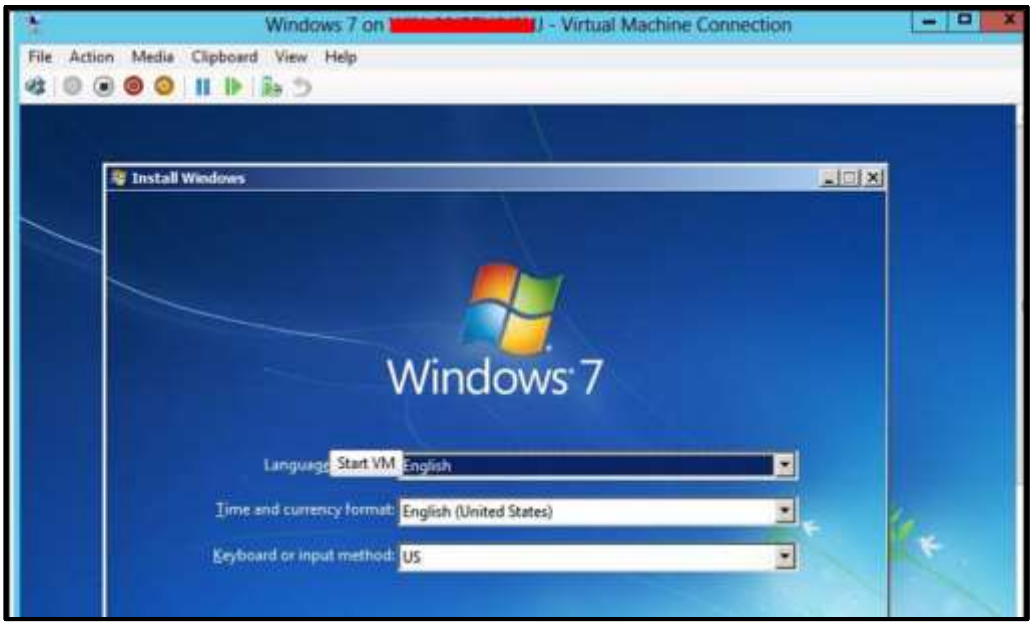
Step 10: To connect to the Virtual machine, Right Click on the created machine → click on "Connect…"



Virtual Machines

Name	State	CPU Usage	Assigned Memory	Uptime
Windows 7	Off			

Step 11: After that, installation of your ISO will continue.


Windows 7 on [redacted] - Virtual Machine Connection
File Action Media Clipboard View Help
Install Windows
Windows 7
Start VM

Language: English

Time and currency format: English (United States)

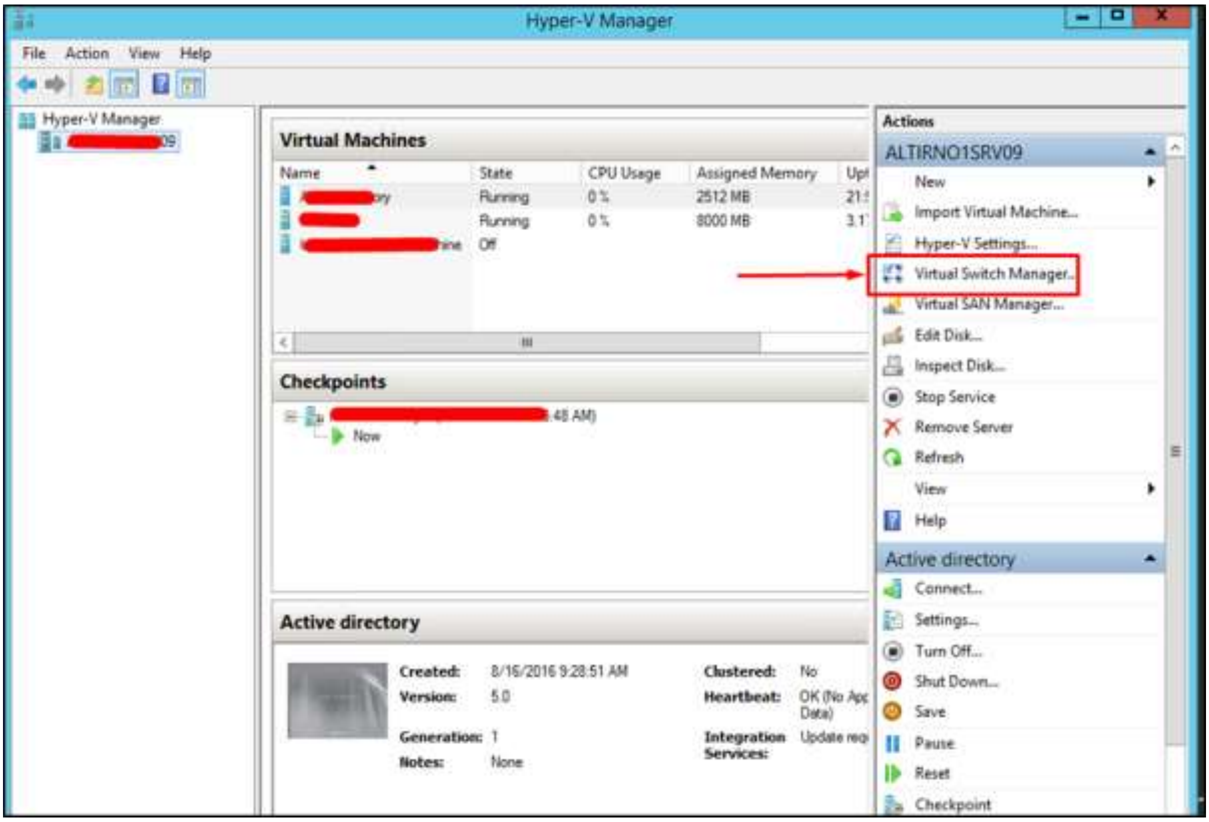
Keyboard or input method: US

Setting up Networking with Hyper-V

The Hyper-V vSwitch is a software, layer-2 Ethernet network-traffic switch. It allows administrators to connect VMs to either physical or virtual networks. It is available by default within the Hyper-V Manager installation and contains extended capabilities for security and resource tracking.

If you attempt to create a VM right after the set-up process, you will not be able to connect it to a network.

To set up a network environment, you will need to select the **Virtual Switch Manager** in the right hand side panel of Hyper-V Manager as shown in the screenshot below.



Virtual Machines

Name	State	CPU Usage	Assigned Memory	Upt
[redacted]	Running	0 %	2512 MB	21:
[redacted]	Running	0 %	8000 MB	3.1
[redacted]	Off			

Checkpoints

[redacted]

Now

Active directory

Created: 8/16/2016 9:28:51 AM
Version: 5.0
Generation: 1
Notes: None
Clustered: No
Heartbeat: OK (No App Data)
Integration Services: Update req

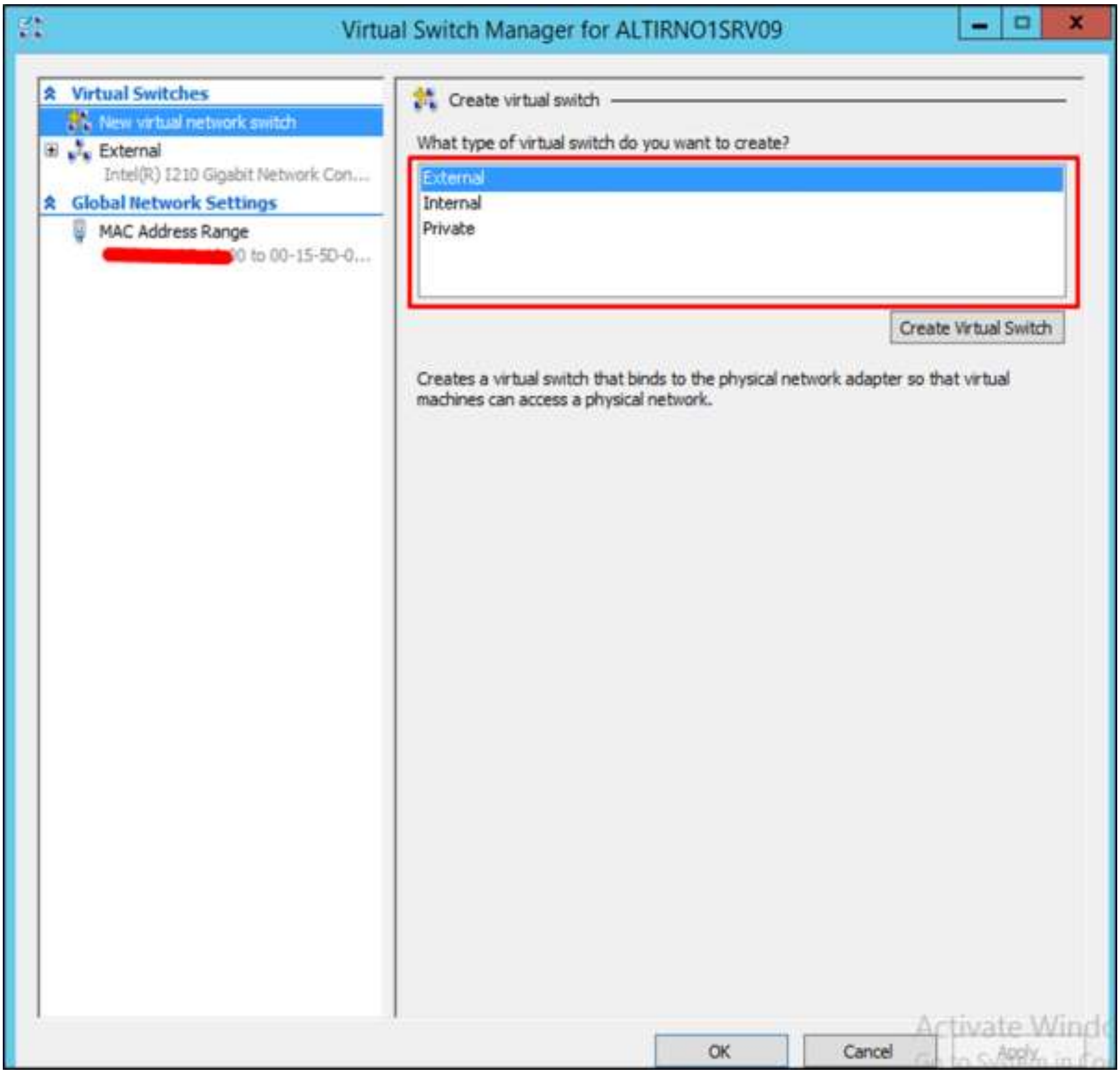
The Virtual Switch Manager helps configure the vSwitch and the Global Network Settings, which simply lets you change the default 'MAC Address Range', if you see any reason for that.

Creation of the virtual switch is easy and there are three vSwitch types available, which are described below:

- **External vSwitch** will link a physical NIC of the Hyper-V host with a virtual one and then give your VMs access outside of the host. This means that your physical network and internet (if your physical network is connected to internet).

- **Internal vSwitch** should be used for building an independent virtual network, when you need to connect VMs to each other and to a hypervisor as well.

- **Private vSwitch** will create a virtual network where all connected VMs will see each other, but not the Hyper-V host. This will completely isolate the VMs in that sandbox.


Virtual Switch Manager for ALTIRNO1SRV09
Virtual Switches
New virtual network switch
External
Intel(R) I210 Gigabit Network Con...
Global Network Settings
MAC Address Range
[redacted]0 to 00-15-5D-0...
Create virtual switch
Create Virtual Switch
OK
Cancel
Apply

What type of virtual switch do you want to create?

- External
- Internal
- Private

Creates a virtual switch that binds to the physical network adapter so that virtual machines can access a physical network.

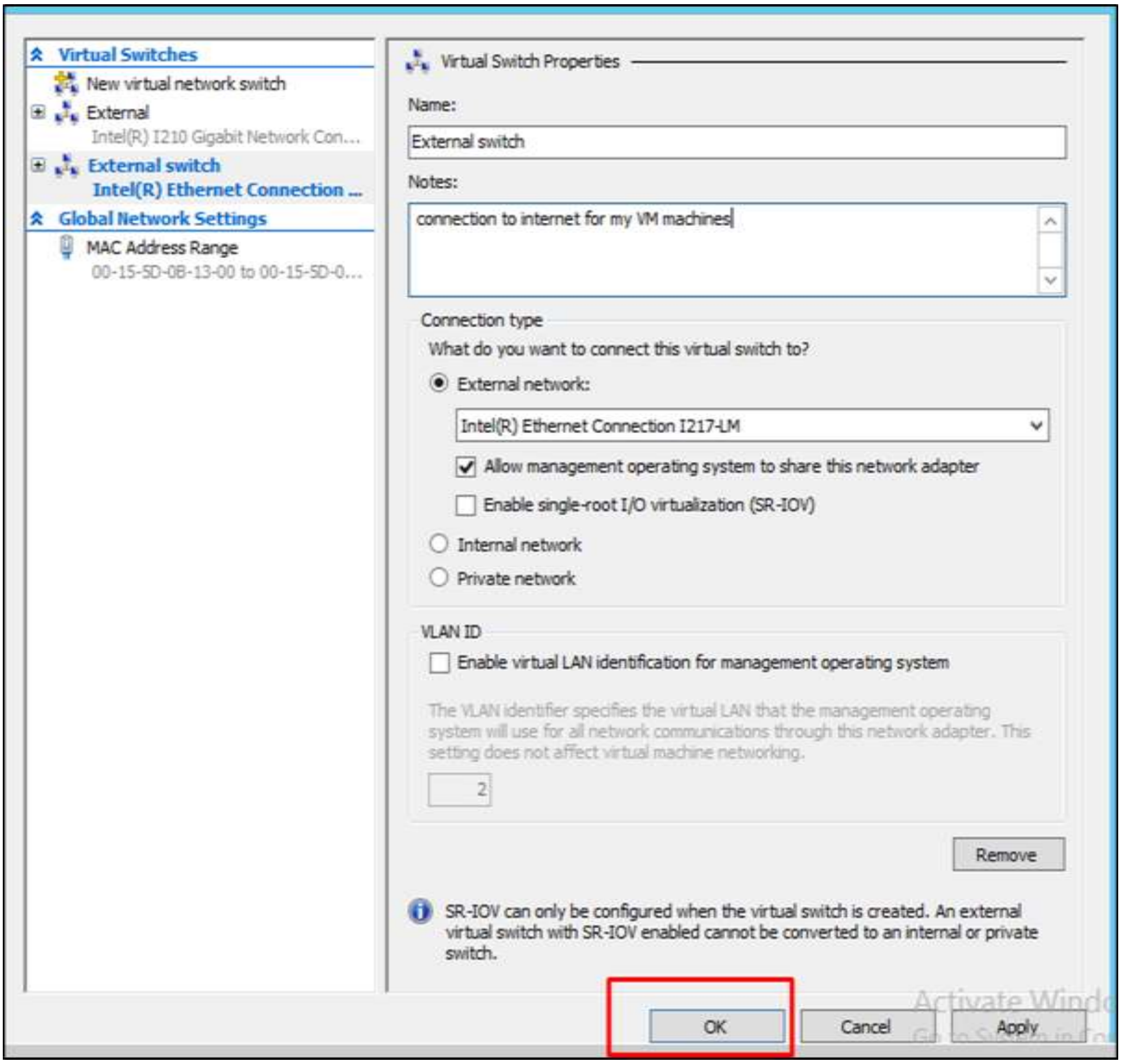
Here, we have selected “External” and then “Create Virtual Switch”. The table with the setting of the vSwitch will be open where we will fill the fields as shown below:

- **Name:** is the name that we will put to identify the vSwitch.

- **Notes:** is the description for us, generally, we put friendly descriptions to be understood.

- **Connection Type:** is external as explained earlier and selects a physical network card on my server.

Once all this is entered, Click on “OK”.



Virtual Switches
New virtual network switch
External
Intel(R) I210 Gigabit Network Con...
External switch
Intel(R) Ethernet Connection ...
Global Network Settings
MAC Address Range
00-15-5D-0B-13-00 to 00-15-5D-0...

Virtual Switch Properties

Name: External switch

Notes: connection to internet for my VM machines

Connection type

What do you want to connect this virtual switch to?

● External network: Intel(R) Ethernet Connection I217-LM

☑ Allow management operating system to share this network adapter

□ Enable single-root I/O virtualization (SR-IOV)

○ Internal network

○ Private network

VLAN ID

□ Enable virtual LAN identification for management operating system

The VLAN identifier specifies the virtual LAN that the management operating system will use for all network communications through this network adapter. This setting does not affect virtual machine networking.

2

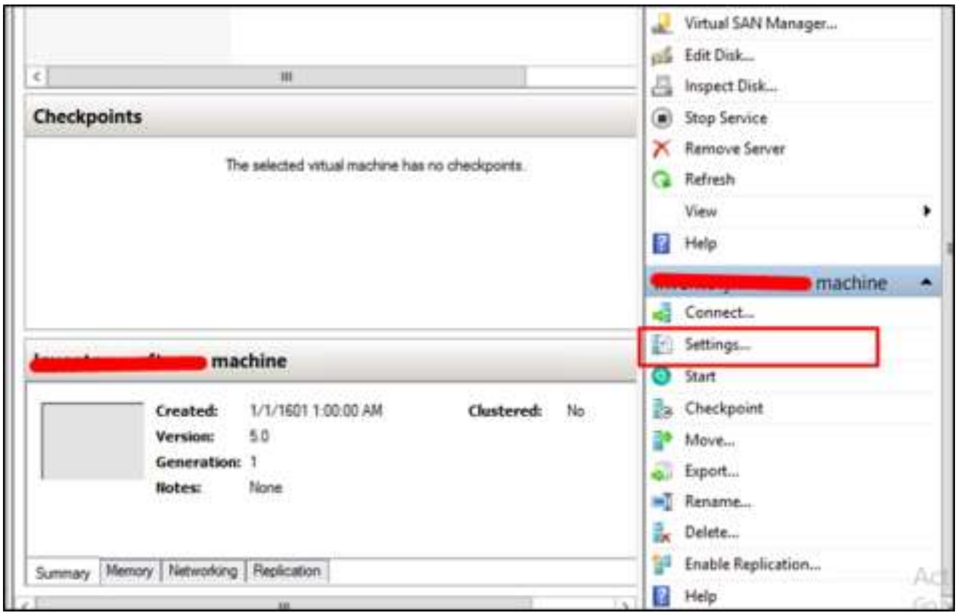
SR-IOV can only be configured when the virtual switch is created. An external virtual switch with SR-IOV enabled cannot be converted to an internal or private switch.

Allocating Processors & Memory to a VM using Hyper-V

In this section, we will see the task of allocating CPU, Memory and Disk Resources to the virtual machines that are running on a server. The key to allocating CPU or any other type of resource in Hyper-V is to remember that everything is relative.

For example, Microsoft has released some guidelines for Virtualizing Exchange Server. One of the things that was listed was that the overall system requirements for Exchange Server are identical whether Exchange is being run on a virtual machine or on a dedicated server.

To allocate one of the features mentioned above, we need to click on the "Settings…" tab in the right hand side panel.



Checkpoints

The selected virtual machine has no checkpoints.

[redacted] machine

Created: 1/1/1601 1:00:00 AM

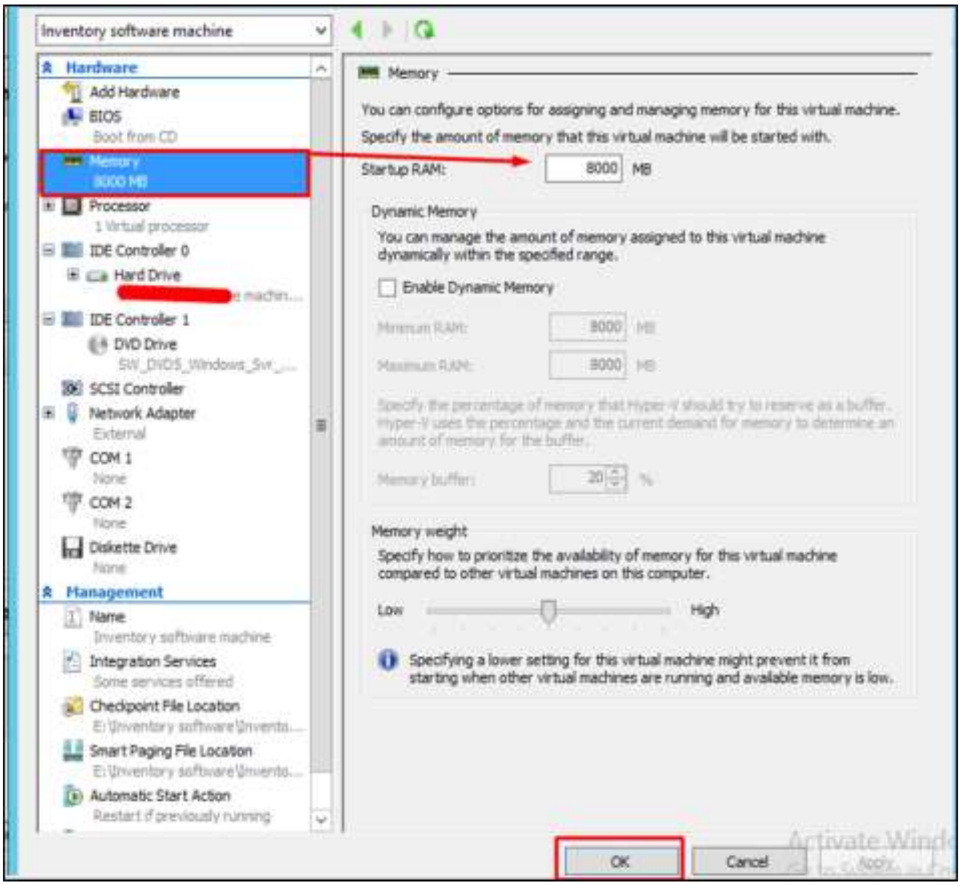
Clustered: No

Version: 5.0

Generation: 1

Notes: None

To allocate more memory to the selected virtual machine, click on the "Memory" tab on the left hand side of the screen. You will also have "Startup RAM", where you can allocate as much ram as you have physically to a VM machine → Click on "Ok".



Inventory software machine

Memory

You can configure options for assigning and managing memory for this virtual machine.

Specify the amount of memory that this virtual machine will be started with.

Startup RAM: 8000 MB

Dynamic Memory

You can manage the amount of memory assigned to this virtual machine dynamically within the specified range.

☐ Enable Dynamic Memory

Minimum RAM: 8000 MB

Maximum RAM: 8000 MB

Specify the percentage of memory that Hyper-V should try to reserve as a buffer. Hyper-V uses the percentage and the current demand for memory to determine an amount of memory for the buffer.

Memory buffer: 20 %

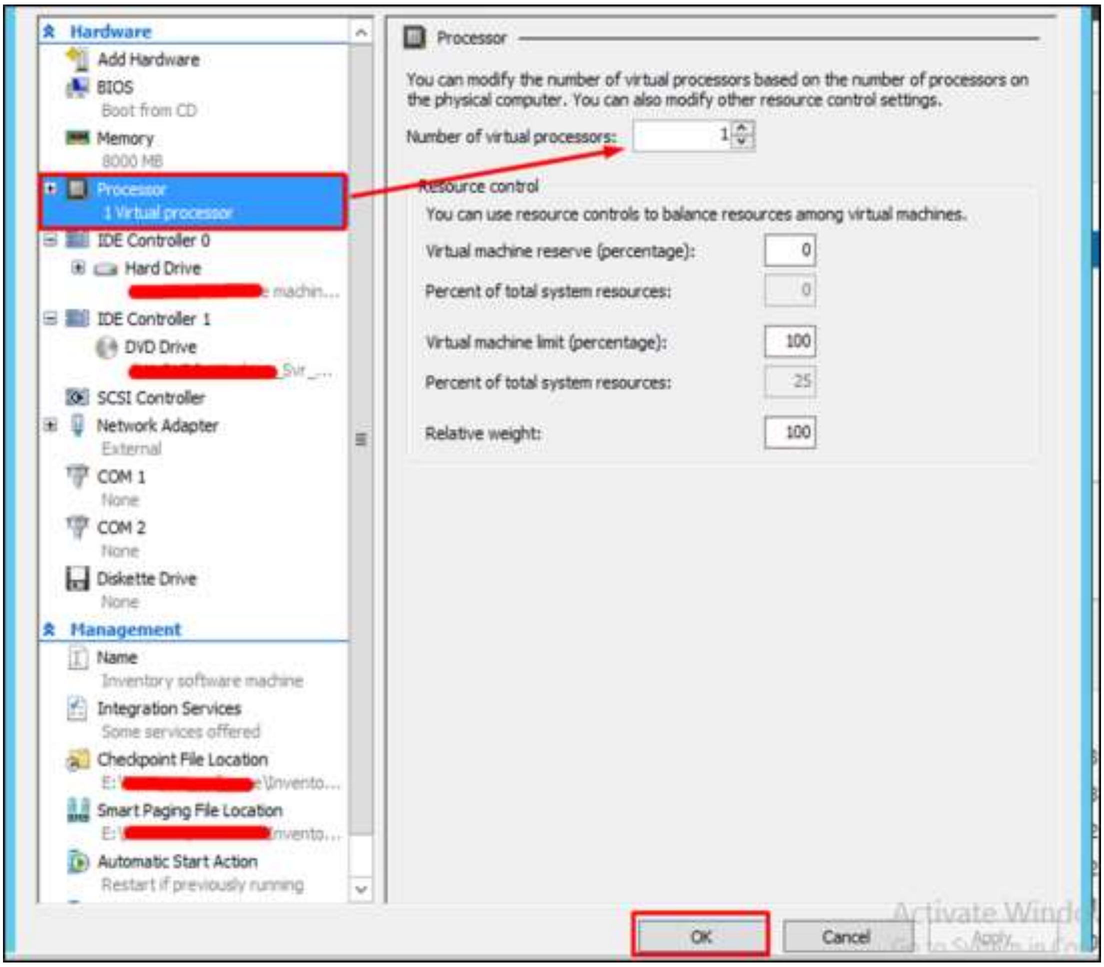
Memory weight

Specify how to prioritize the availability of memory for this virtual machine compared to other virtual machines on this computer.

Low — High

Specifying a lower setting for this virtual machine might prevent it from starting when other virtual machines are running and available memory is low.

To allocate more processors, click on the "Processor" tab on the left hand side of the panel. Then you can enter the number of virtual processors for your machine.



Hardware

- Add Hardware
- BIOS: Boot from CD
- Memory: 8000 MB
- Processor: 1 Virtual processor
- IDE Controller 0
  - Hard Drive: [redacted] e machin...
- IDE Controller 1
  - DVD Drive: [redacted] Svr_...
- SCSI Controller
- Network Adapter: External
- COM 1: None
- COM 2: None
- Diskette Drive: None

Management

- Name: Inventory software machine
- Integration Services: Some services offered
- Checkpoint File Location: E:\[redacted]e\Invento...
- Smart Paging File Location: E:\[redacted]nvento...
- Automatic Start Action: Restart if previously running

Processor

You can modify the number of virtual processors based on the number of processors on the physical computer. You can also modify other resource control settings.

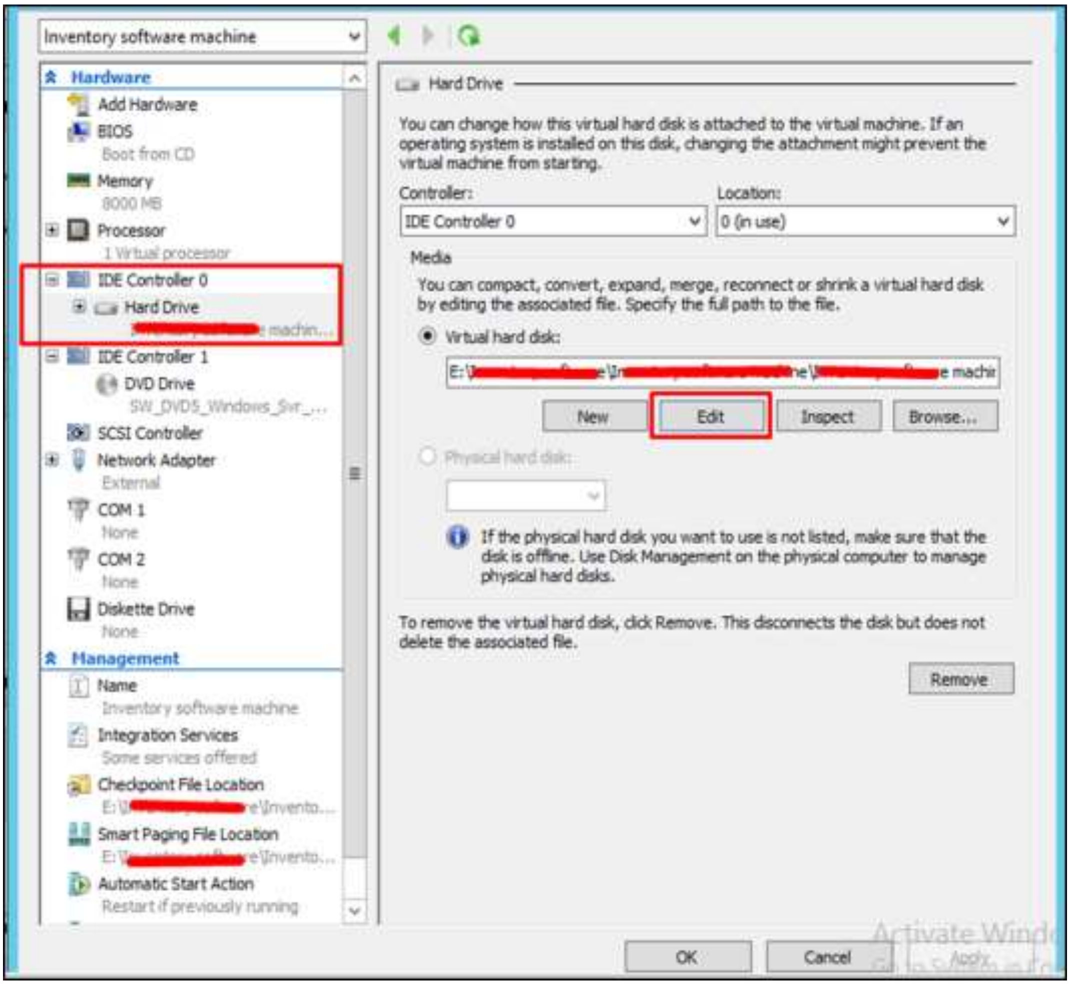
Number of virtual processors: 1

Resource control

You can use resource controls to balance resources among virtual machines.

Virtual machine reserve (percentage):	0
Percent of total system resources:	0
Virtual machine limit (percentage):	100
Percent of total system resources:	25
Relative weight:	100

If you need to expand, compress the capacity of the virtual hard disk. Click on the "IDE controller 0" on the left hand side panel → click on "Edit".



Inventory software machine

Hardware

- Add Hardware
- BIOS
  Boot from CD
- Memory
  8000 MB
- Processor
  1 Virtual processor
- IDE Controller 0
  - Hard Drive
    [redacted] machin...
- IDE Controller 1
  - DVD Drive
    SW_DVD5_Windows_Svr_...
- SCSI Controller
- Network Adapter
  External
- COM 1
  None
- COM 2
  None
- Diskette Drive
  None

Management

- Name
  Inventory software machine
- Integration Services
  Some services offered
- Checkpoint File Location
  E:\[redacted]e\Invento...
- Smart Paging File Location
  E:\[redacted]e\Invento...
- Automatic Start Action
  Restart if previously running

Hard Drive

You can change how this virtual hard disk is attached to the virtual machine. If an operating system is installed on this disk, changing the attachment might prevent the virtual machine from starting.

Controller: IDE Controller 0

Location: 0 (in use)

Media

You can compact, convert, expand, merge, reconnect or shrink a virtual hard disk by editing the associated file. Specify the full path to the file.

● Virtual hard disk:

E:\[redacted]e\In[redacted]ne\[redacted]e machi

New | Edit | Inspect | Browse...

○ Physical hard disk:

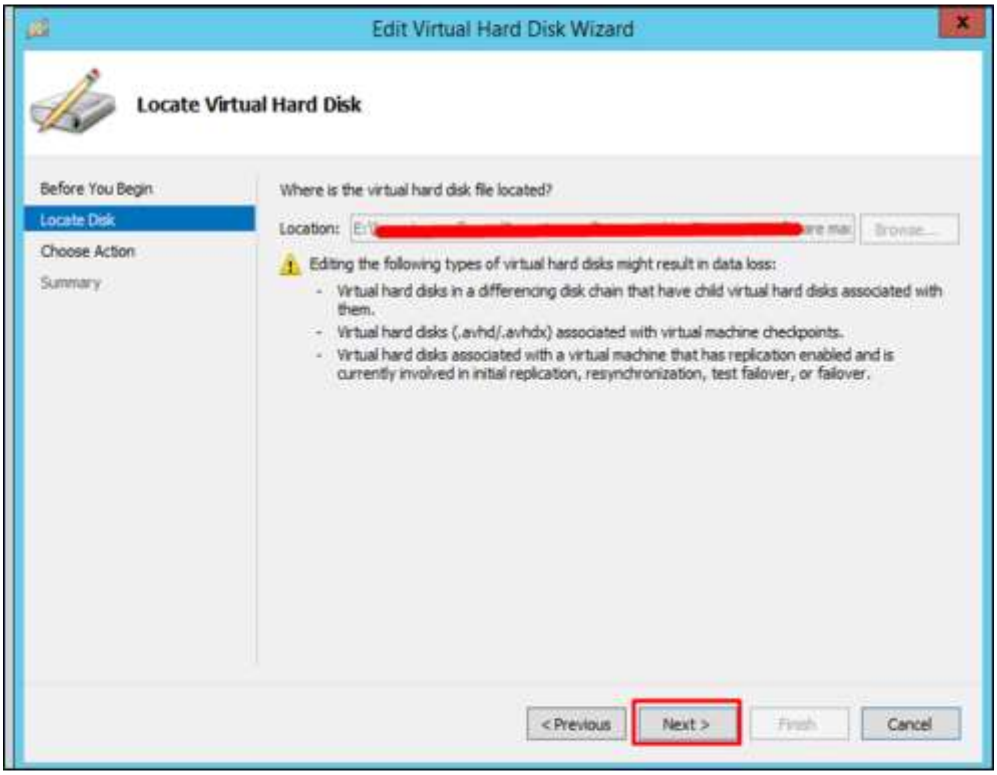
If the physical hard disk you want to use is not listed, make sure that the disk is offline. Use Disk Management on the physical computer to manage physical hard disks.

To remove the virtual hard disk, click Remove. This disconnects the disk but does not delete the associated file.

Remove

OK | Cancel | Apply

Once all the above changes are done, Click on "Next"



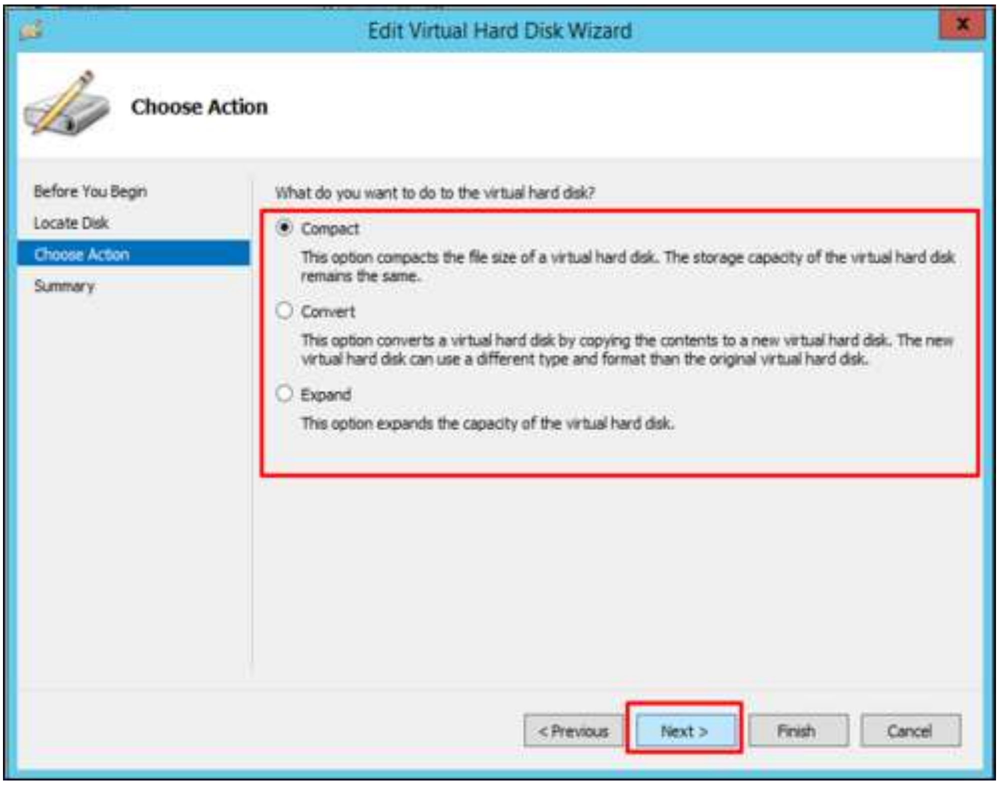
Where is the virtual hard disk file located?

Location: E:\[redacted]

Editing the following types of virtual hard disks might result in data loss:

- Virtual hard disks in a differencing disk chain that have child virtual hard disks associated with them.
- Virtual hard disks (.avhd/.avhdx) associated with virtual machine checkpoints.
- Virtual hard disks associated with a virtual machine that has replication enabled and is currently involved in initial replication, resynchronization, test failover, or failover.

Select one of the options based on your need (all of them have their respective descriptions) and then click on "Next".



What do you want to do to the virtual hard disk?

● Compact

This option compacts the file size of a virtual hard disk. The storage capacity of the virtual hard disk remains the same.

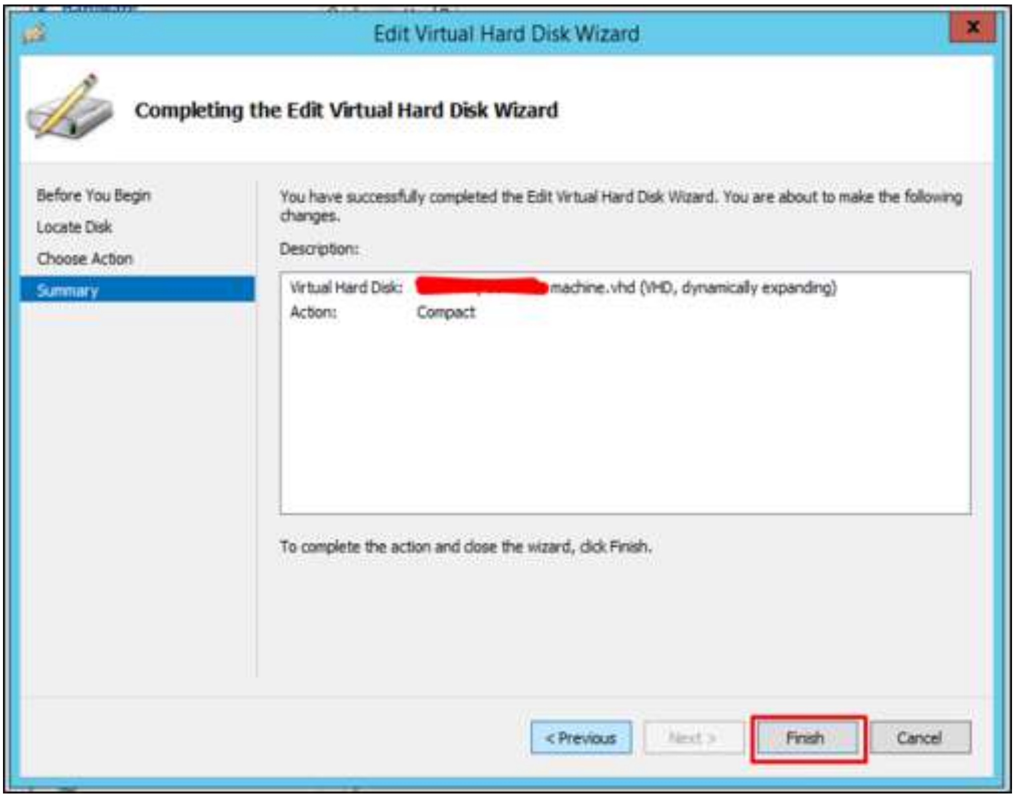
○ Convert

This option converts a virtual hard disk by copying the contents to a new virtual hard disk. The new virtual hard disk can use a different type and format than the original virtual hard disk.

○ Expand

This option expands the capacity of the virtual hard disk.

Click on "Finish" and wait for the process to finish.



Edit Virtual Hard Disk Wizard

Completing the Edit Virtual Hard Disk Wizard

You have successfully completed the Edit Virtual Hard Disk Wizard. You are about to make the following changes.

Description:

Virtual Hard Disk: [redacted]machine.vhd (VHD, dynamically expanding)
Action: Compact

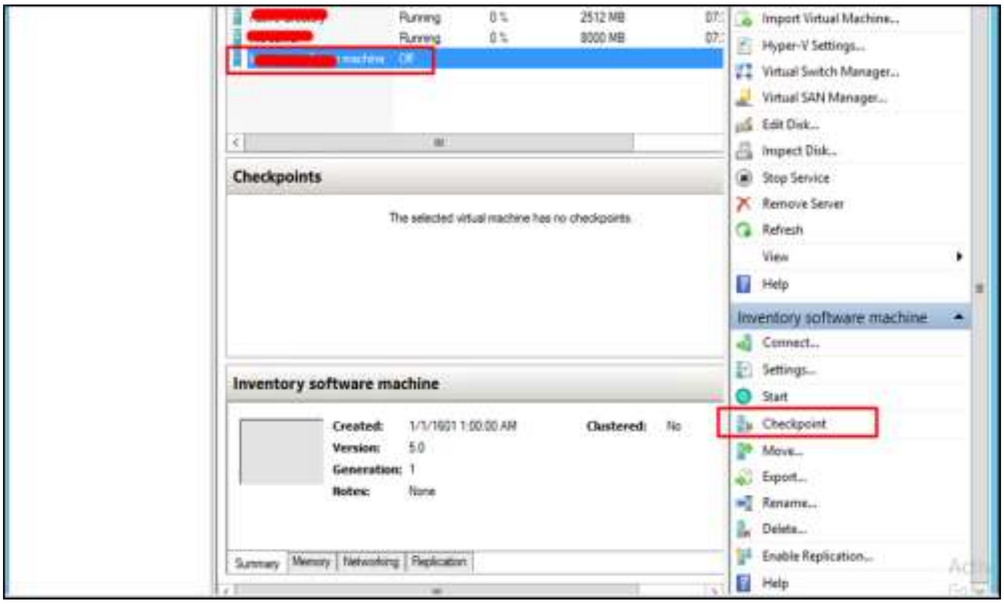
To complete the action and close the wizard, click Finish.

Using Checkpoints in Hyper-V

Checkpoints in Hyper-V are called snapshots and they help us to revert the machine in a desired state that we had in the past.

To create a checkpoint we should follow the steps given below.

Step 1: Select the VM by clicking on it. On the left hand side panel, click on "Checkpoint".



[redacted] Running 0 % 2512 MB 07:
[redacted] Running 0 % 8000 MB 07:
[redacted] machine Off

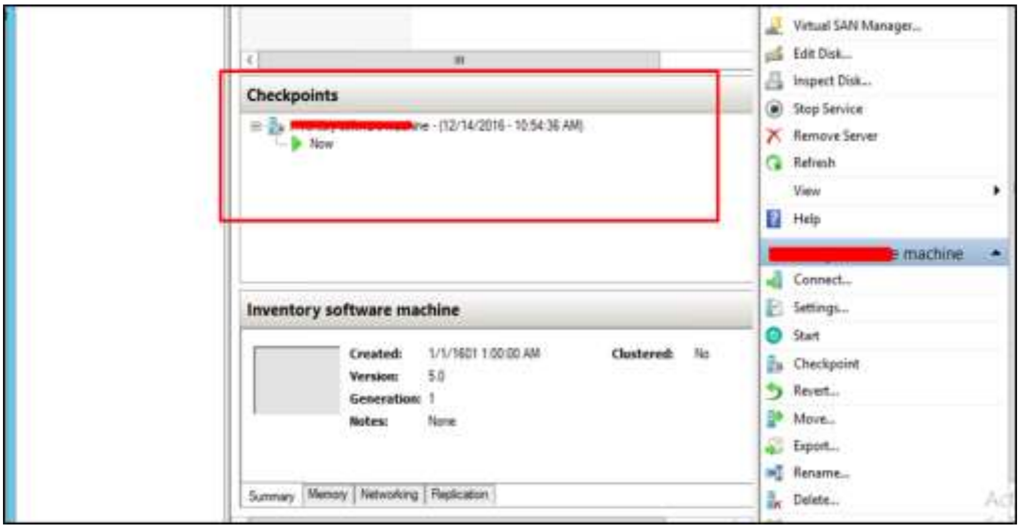
Checkpoints

The selected virtual machine has no checkpoints.

Inventory software machine

Created: 1/1/1601 1:00:00 AM
Clustered: No
Version: 5.0
Generation: 1
Notes: None

Step 2: The following checkpoint will be created with the respective date and time in the main Hyper-V manager console.



Checkpoints

[redacted]ne - (12/14/2016 - 10:54:36 AM)

Now

Inventory software machine

Created: 1/1/1601 1:00:00 AM

Clustered: No

Version: 5.0

Generation: 1

Notes: None

[redacted]e machine

6. Virtualization – VMware Workstation Player

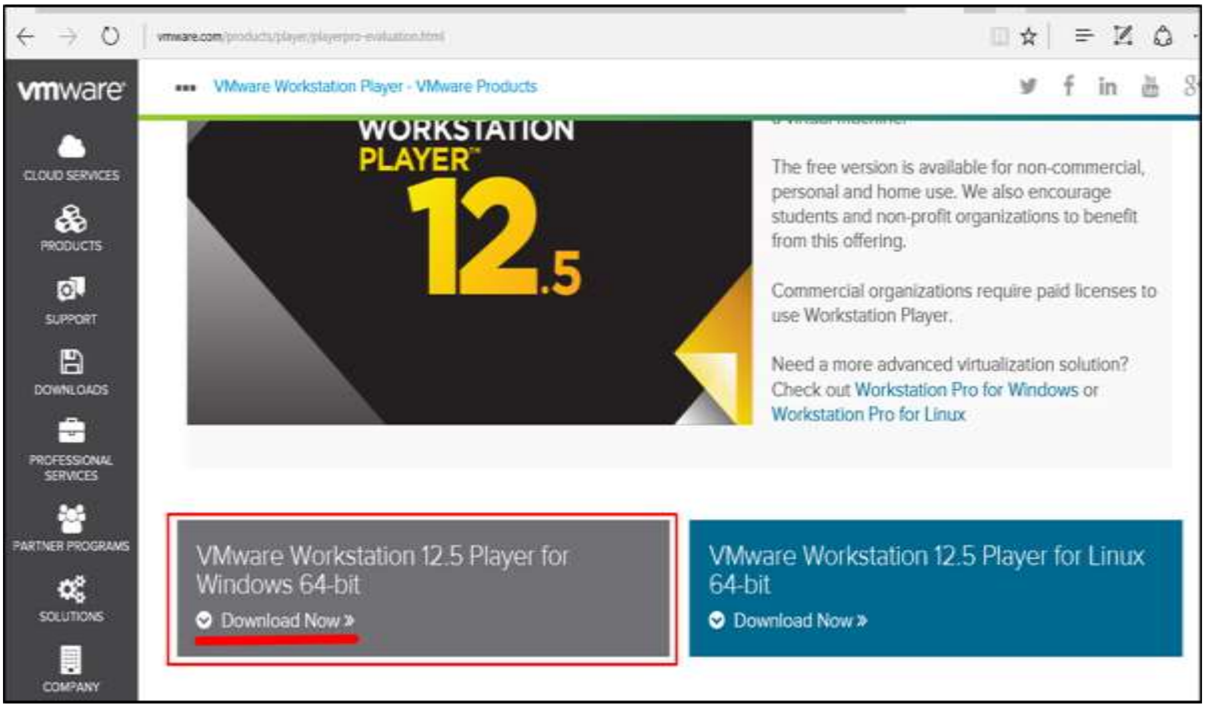
In this chapter, we will understand how to install the VMware Workstation Player and its usages.

Installing VMware Workstation Player

VMware workstation player is a "hosted hypervisor", so you have to have a pre-installed OS before continuing to install it.

VMware workstation player is free version and available for non-commercial, personal and home use. They also encourage students and non-profit organizations to benefit from this offering. To download the VMware workstation player, you can click on the following link – http://www.vmware.com/products/player/playerpro-evaluation.html. To install the VMware workstation player, follow the steps given below.

Step 1: Click on "Download Now" as shown in the screenshot below.



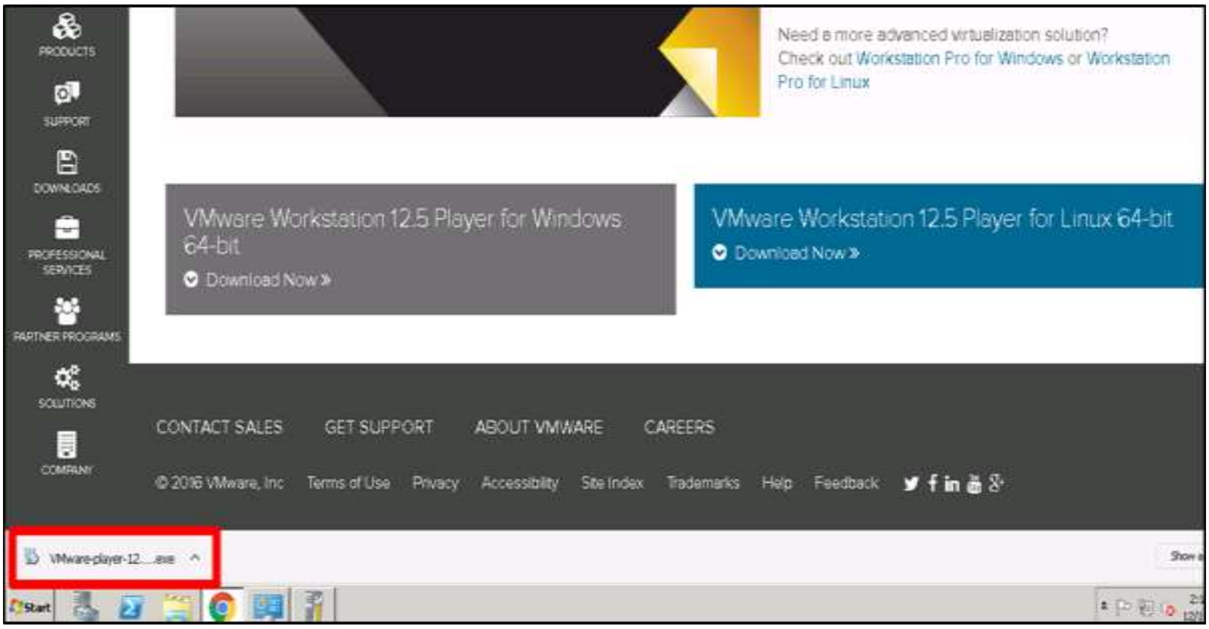
The free version is available for non-commercial, personal and home use. We also encourage students and non-profit organizations to benefit from this offering.

Commercial organizations require paid licenses to use Workstation Player.

Need a more advanced virtualization solution? Check out Workstation Pro for Windows or Workstation Pro for Linux

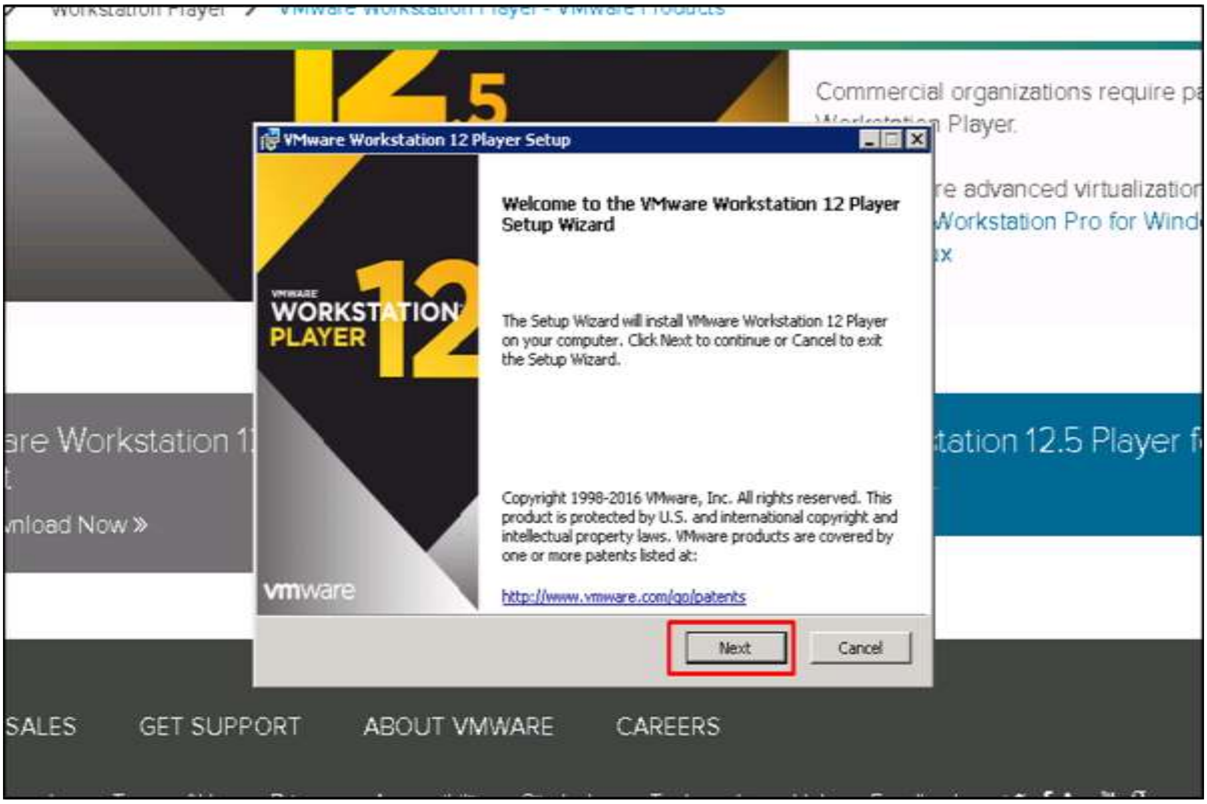
vmware.com/products/player/playerpro-evaluation.html
vmware
VMware Workstation Player - VMware Products
CLOUD SERVICES
PRODUCTS
SUPPORT
DOWNLOADS
PROFESSIONAL SERVICES
PARTNER PROGRAMS
SOLUTIONS
COMPANY
WORKSTATION PLAYER™ 12.5
VMware Workstation 12.5 Player for Windows 64-bit
Download Now »
VMware Workstation 12.5 Player for Linux 64-bit
Download Now »

Step 2: You will see that a file has been downloaded → double click on it.



Need a more advanced virtualization solution? Check out Workstation Pro for Windows or Workstation Pro for Linux

Step 3: A Table will pop-up initializing the installation of VMware -> Click "Next"



VMware Workstation 12 Player Setup

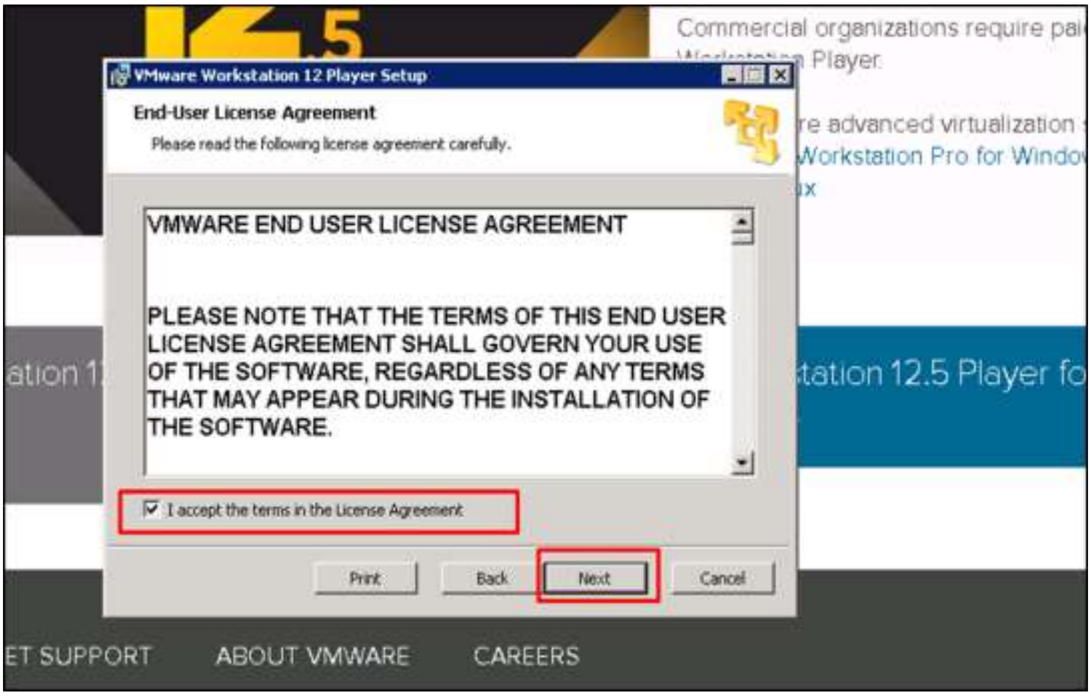
Welcome to the VMware Workstation 12 Player Setup Wizard

The Setup Wizard will install VMware Workstation 12 Player on your computer. Click Next to continue or Cancel to exit the Setup Wizard.

Copyright 1998-2016 VMware, Inc. All rights reserved. This product is protected by U.S. and international copyright and intellectual property laws. VMware products are covered by one or more patents listed at:

http://www.vmware.com/go/patents

Step 4: Check the box "I accept the terms in the license agreement" → Click on "Next".



VMware Workstation 12 Player Setup

End-User License Agreement

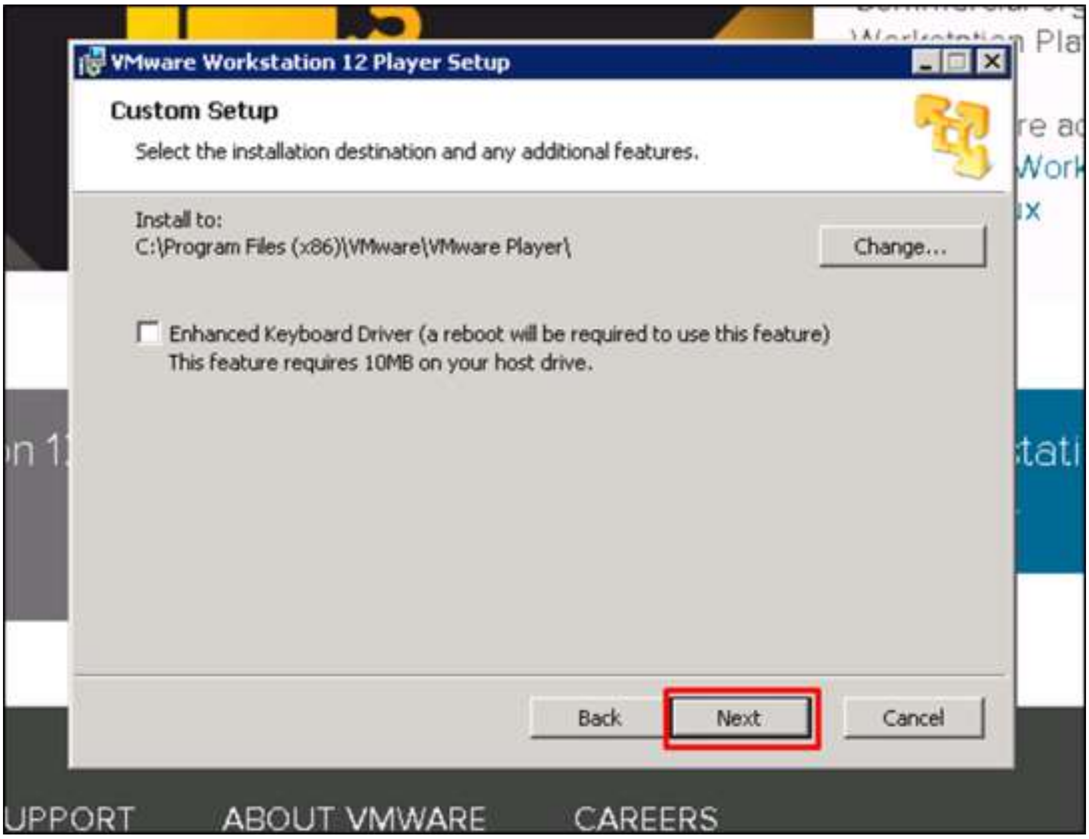
Please read the following license agreement carefully.

VMWARE END USER LICENSE AGREEMENT

PLEASE NOTE THAT THE TERMS OF THIS END USER LICENSE AGREEMENT SHALL GOVERN YOUR USE OF THE SOFTWARE, REGARDLESS OF ANY TERMS THAT MAY APPEAR DURING THE INSTALLATION OF THE SOFTWARE.

☑ I accept the terms in the License Agreement

Step 5: Once again, click on the "Next" button.



VMware Workstation 12 Player Setup

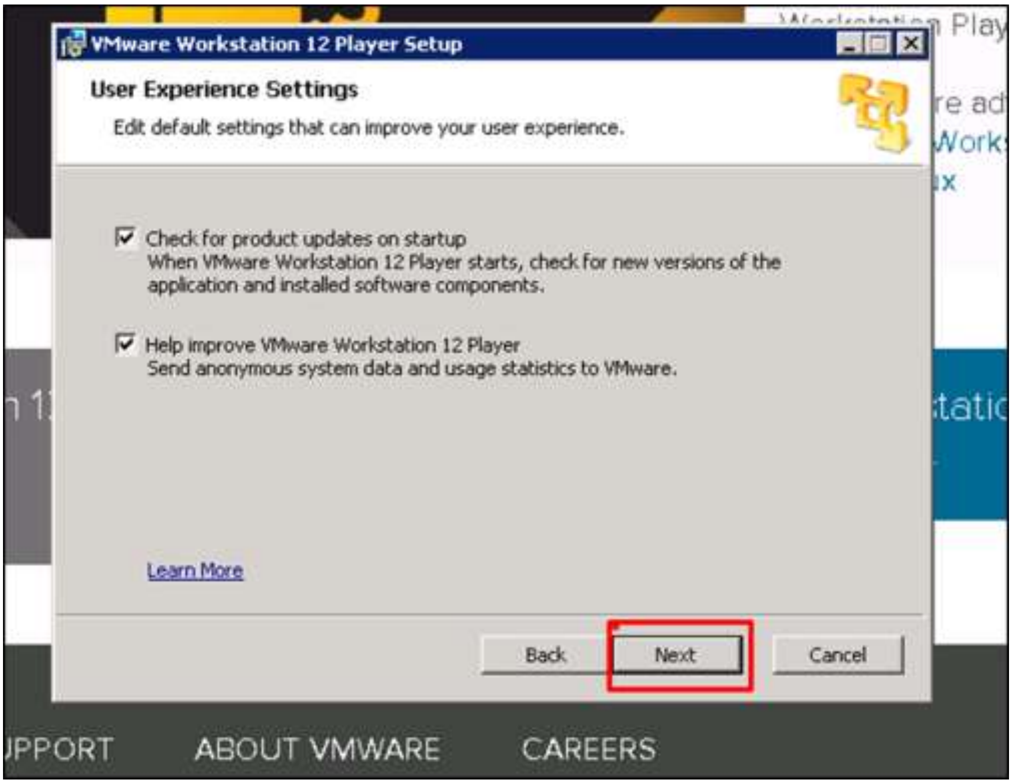
Custom Setup

Select the installation destination and any additional features.

Install to:
C:\Program Files (x86)\VMware\VMware Player\

□ Enhanced Keyboard Driver (a reboot will be required to use this feature)
This feature requires 10MB on your host drive.

Step 6: Leave the default values and click on "Next".



VMware Workstation 12 Player Setup

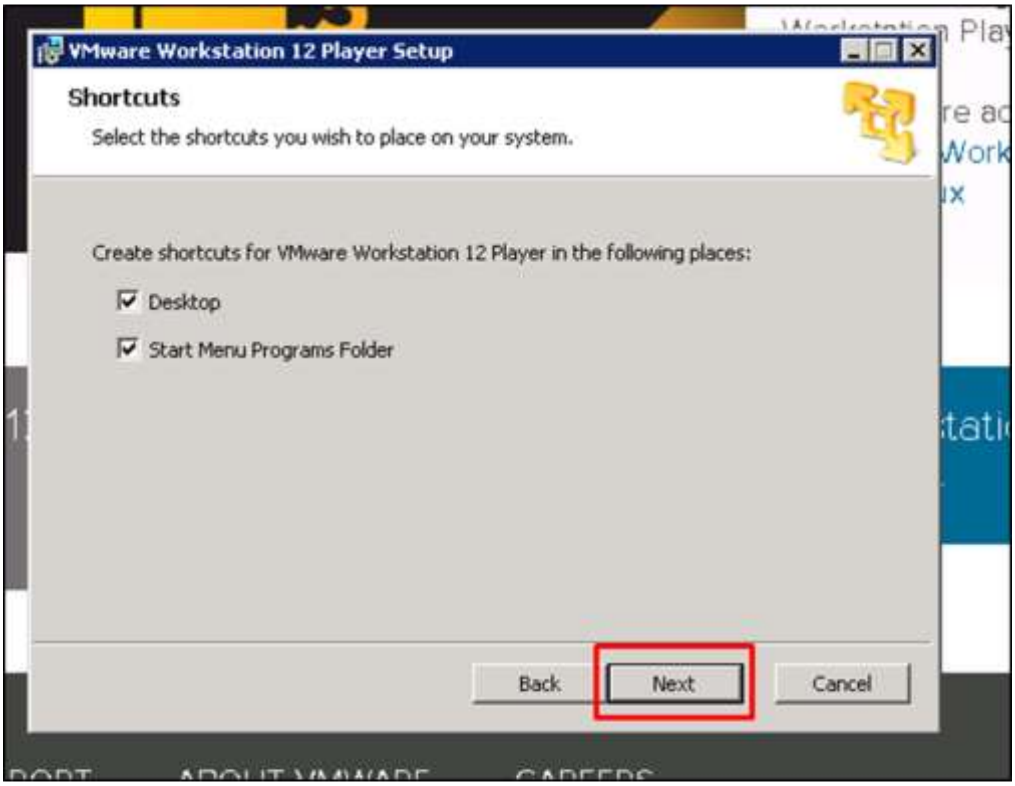
User Experience Settings

Edit default settings that can improve your user experience.

☑ Check for product updates on startup
When VMware Workstation 12 Player starts, check for new versions of the application and installed software components.

☑ Help improve VMware Workstation 12 Player
Send anonymous system data and usage statistics to VMware.

Step 7: Once again, click on "Next".



VMware Workstation 12 Player Setup

Shortcuts

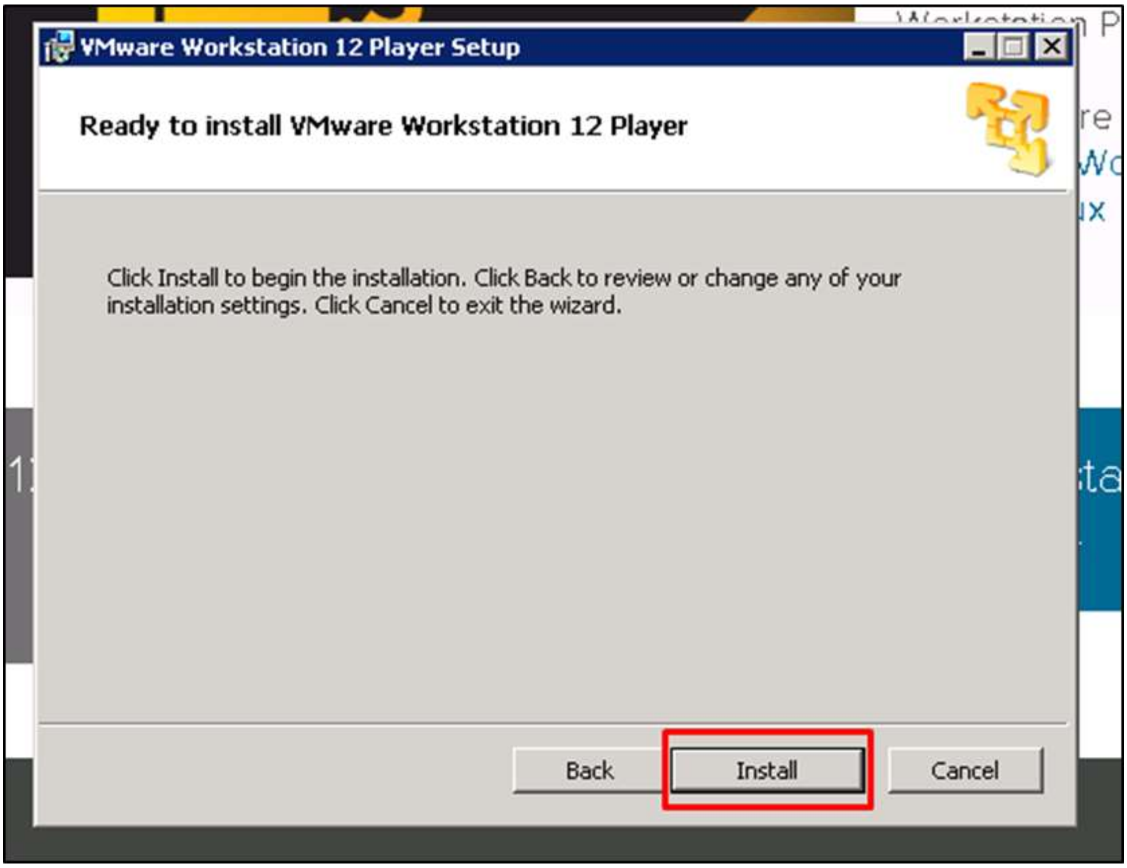
Select the shortcuts you wish to place on your system.

Create shortcuts for VMware Workstation 12 Player in the following places:

☑ Desktop

☑ Start Menu Programs Folder

Step 8: Click on "Install".

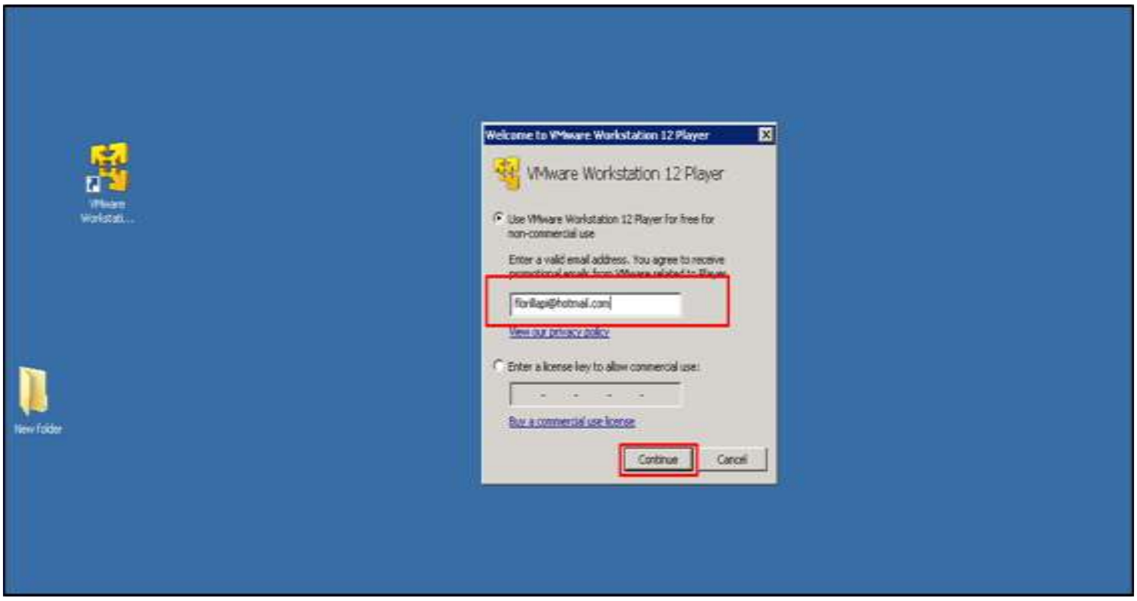


VMware Workstation 12 Player Setup

Ready to install VMware Workstation 12 Player

Click Install to begin the installation. Click Back to review or change any of your installation settings. Click Cancel to exit the wizard.

Step 9: An icon will be created on the desktop. Click on it and a table will pop–up, where you have two possibilities: If you want to use it as a non-commercial version, just enter your email address. If you want to use it as a commercial version, check the second option and enter your serial key.



Welcome to VMware Workstation 12 Player

VMware Workstation 12 Player

● Use VMware Workstation 12 Player for free for non-commercial use

Enter a valid email address. You agree to receive promotional emails from VMware related to Player.

fiorilapi@hotmail.com

View our privacy policy

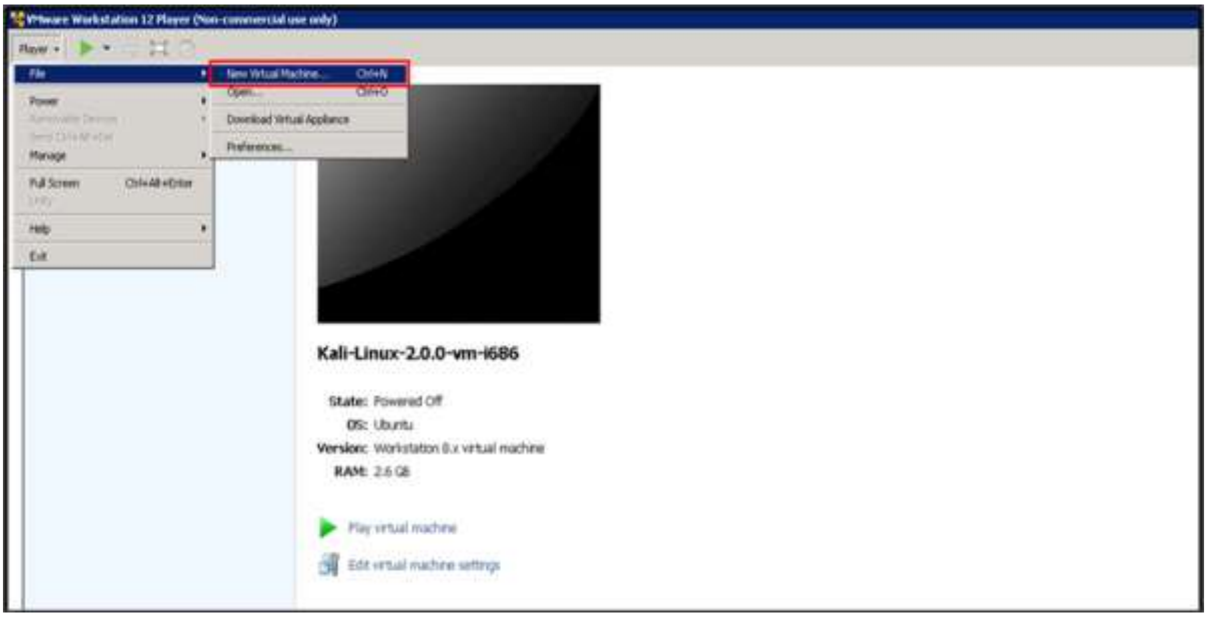
○ Enter a license key to allow commercial use:

Buy a commercial use license

Creating a VM with VMware Workstation

To create a virtual machine, we have to follow the steps given below.

Step 1: Click on “Player” → File → New Virtual Machine.



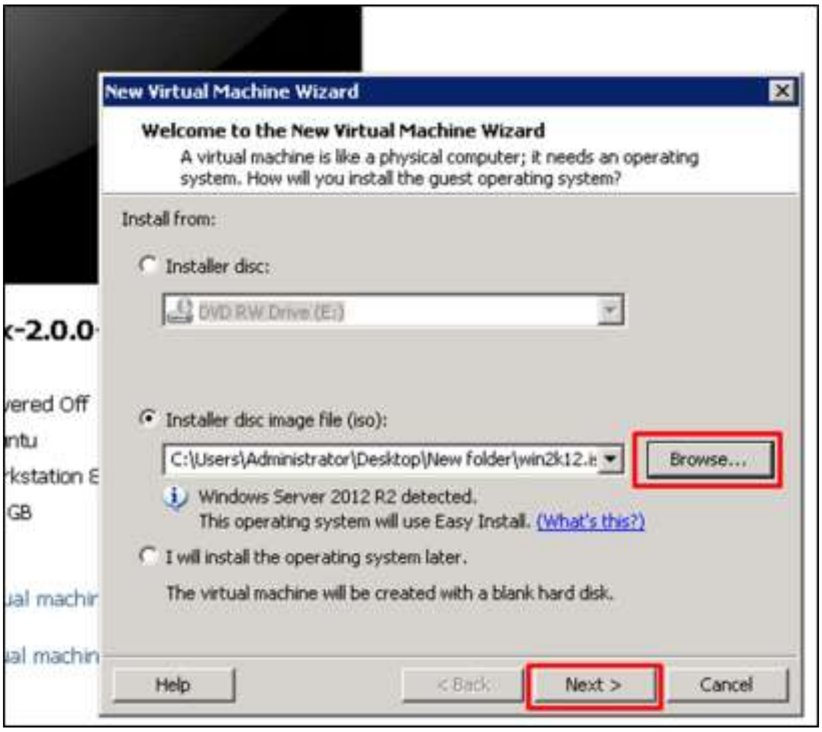
VMware Workstation 12 Player (Non-commercial use only)
Player
File
Power
Removable Devices
Send Ctrl+Alt+Del
Manage
Full Screen Ctrl+Alt+Enter
Unity
Help
Exit
New Virtual Machine... Ctrl+N
Open... Ctrl+O
Download Virtual Appliance
Preferences...
Play virtual machine
Edit virtual machine settings

Kali-Linux-2.0.0-vm-i686

State: Powered Off
OS: Ubuntu
Version: Workstation 8.x virtual machine
RAM: 2.6 GB

Step 2: A table will pop-up requesting you to find a “Boot disk”, “Boot Image” or to install OS at a later stage.

We will choose the second option and click on “Browse”. Then we have to click on the ISO image, which we want to install. Once all this is done, click on “Next”.



Welcome to the New Virtual Machine Wizard

A virtual machine is like a physical computer; it needs an operating system. How will you install the guest operating system?

Install from:

○ Installer disc:

● Installer disc image file (iso):

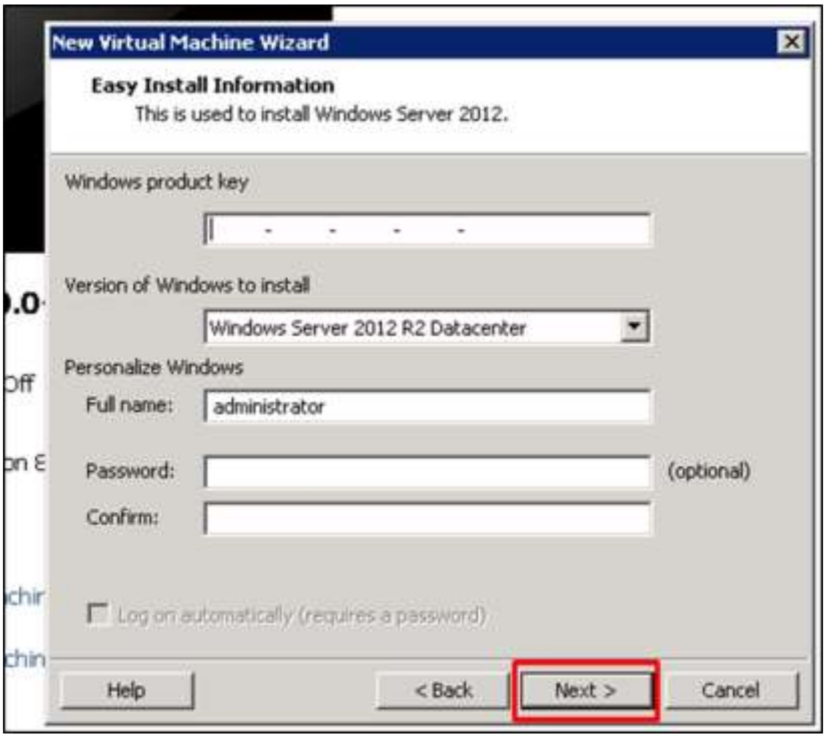
C:\Users\Administrator\Desktop\New folder\win2k12.is

Windows Server 2012 R2 detected.
This operating system will use Easy Install.

○ I will install the operating system later.

The virtual machine will be created with a blank hard disk.

Step 3: As I am installing windows server 2012, it will pop-up a table requesting to enter the serial key → click directly on "Next", if you want to activate the non-commercial version for Windows.



New Virtual Machine Wizard

Easy Install Information

This is used to install Windows Server 2012.

Windows product key: - - - -

Version of Windows to install: Windows Server 2012 R2 Datacenter

Personalize Windows

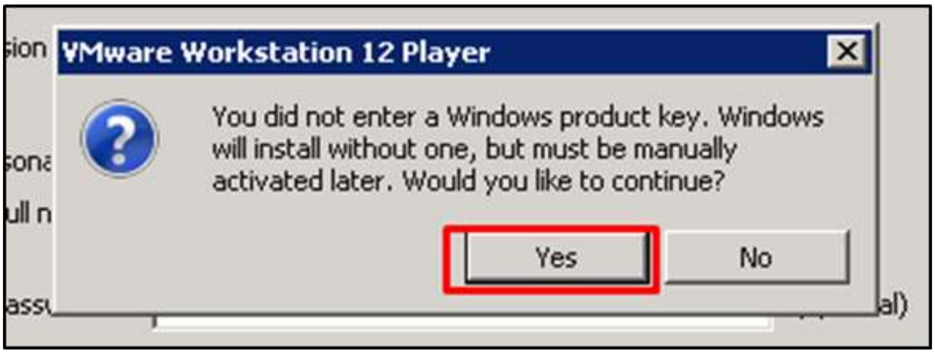
Full name: administrator

Password: (optional)

Confirm:

□ Log on automatically (requires a password)

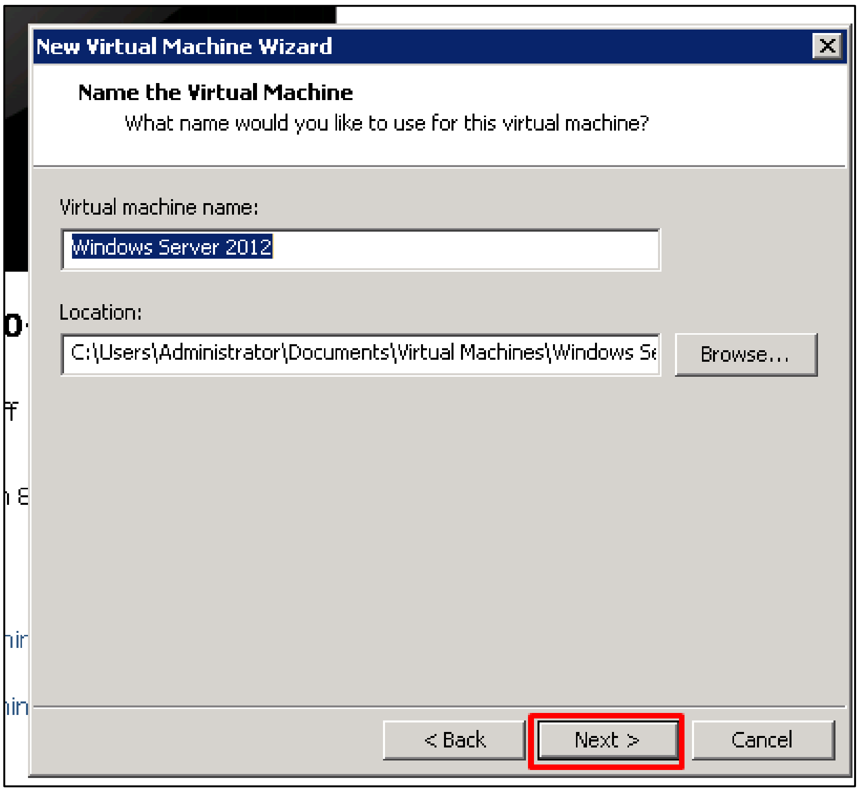
Step 4: After the above step is complete, a dialogue box opens. Click "Yes".



VMware Workstation 12 Player

You did not enter a Windows product key. Windows will install without one, but must be manually activated later. Would you like to continue?

Step 5: Click “Next”.



New Virtual Machine Wizard

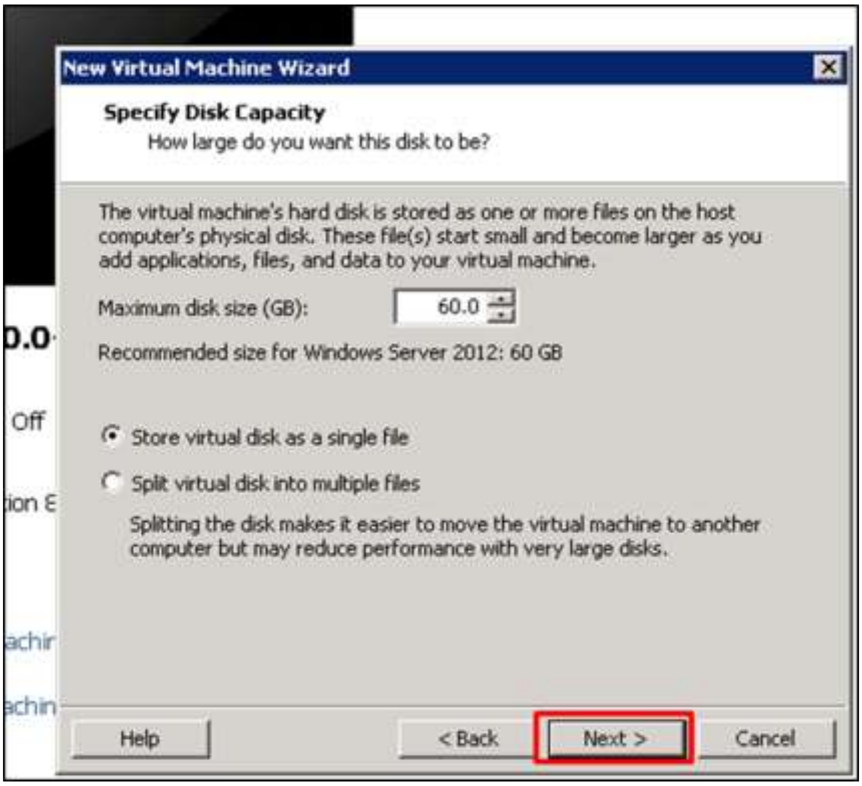
Name the Virtual Machine

What name would you like to use for this virtual machine?

Virtual machine name: Windows Server 2012

Location: C:\Users\Administrator\Documents\Virtual Machines\Windows Se

Step 6: In the “Maximum size disk” box, enter the value of your virtual Hard disk, which in our case is 60GB. Then click on “Next”.



New Virtual Machine Wizard

Specify Disk Capacity

How large do you want this disk to be?

The virtual machine's hard disk is stored as one or more files on the host computer's physical disk. These file(s) start small and become larger as you add applications, files, and data to your virtual machine.

Maximum disk size (GB): 60.0

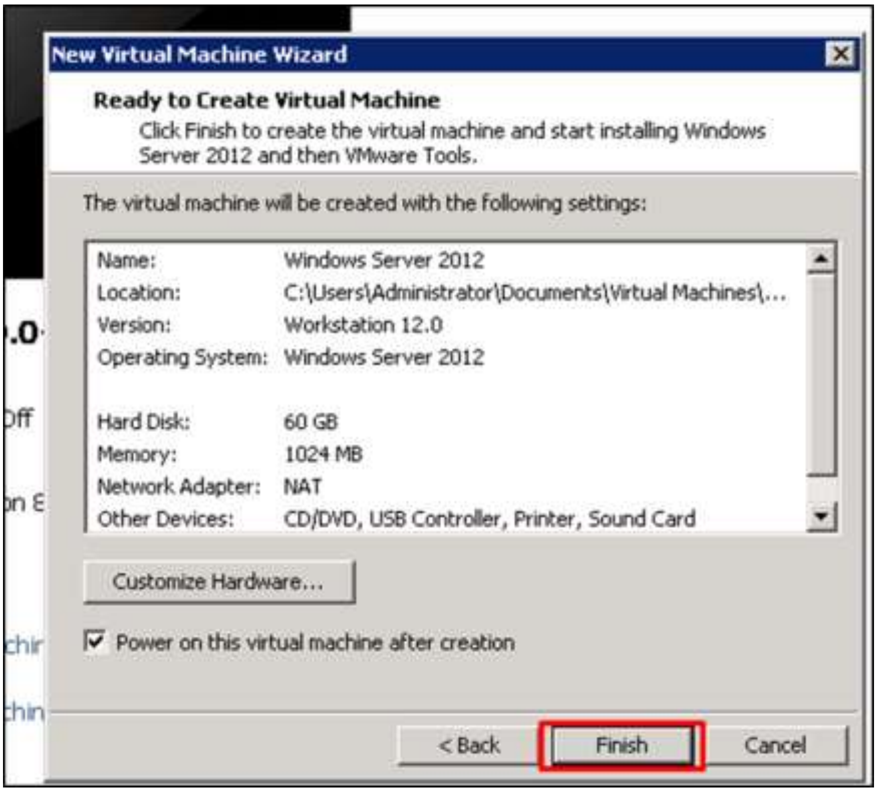
Recommended size for Windows Server 2012: 60 GB

● Store virtual disk as a single file

○ Split virtual disk into multiple files

Splitting the disk makes it easier to move the virtual machine to another computer but may reduce performance with very large disks.

Step 7: Click on "Finish".



New Virtual Machine Wizard

Ready to Create Virtual Machine

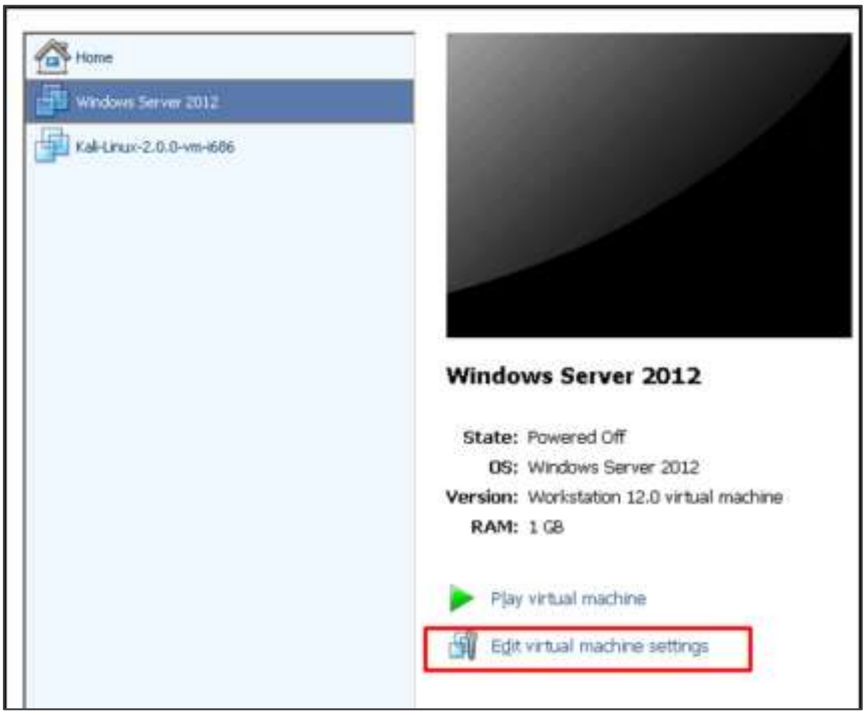
Click Finish to create the virtual machine and start installing Windows Server 2012 and then VMware Tools.

The virtual machine will be created with the following settings:

Name:	Windows Server 2012
Location:	C:\Users\Administrator\Documents\Virtual Machines\...
Version:	Workstation 12.0
Operating System:	Windows Server 2012
Hard Disk:	60 GB
Memory:	1024 MB
Network Adapter:	NAT
Other Devices:	CD/DVD, USB Controller, Printer, Sound Card

Setting up Networking with VMware Workstation

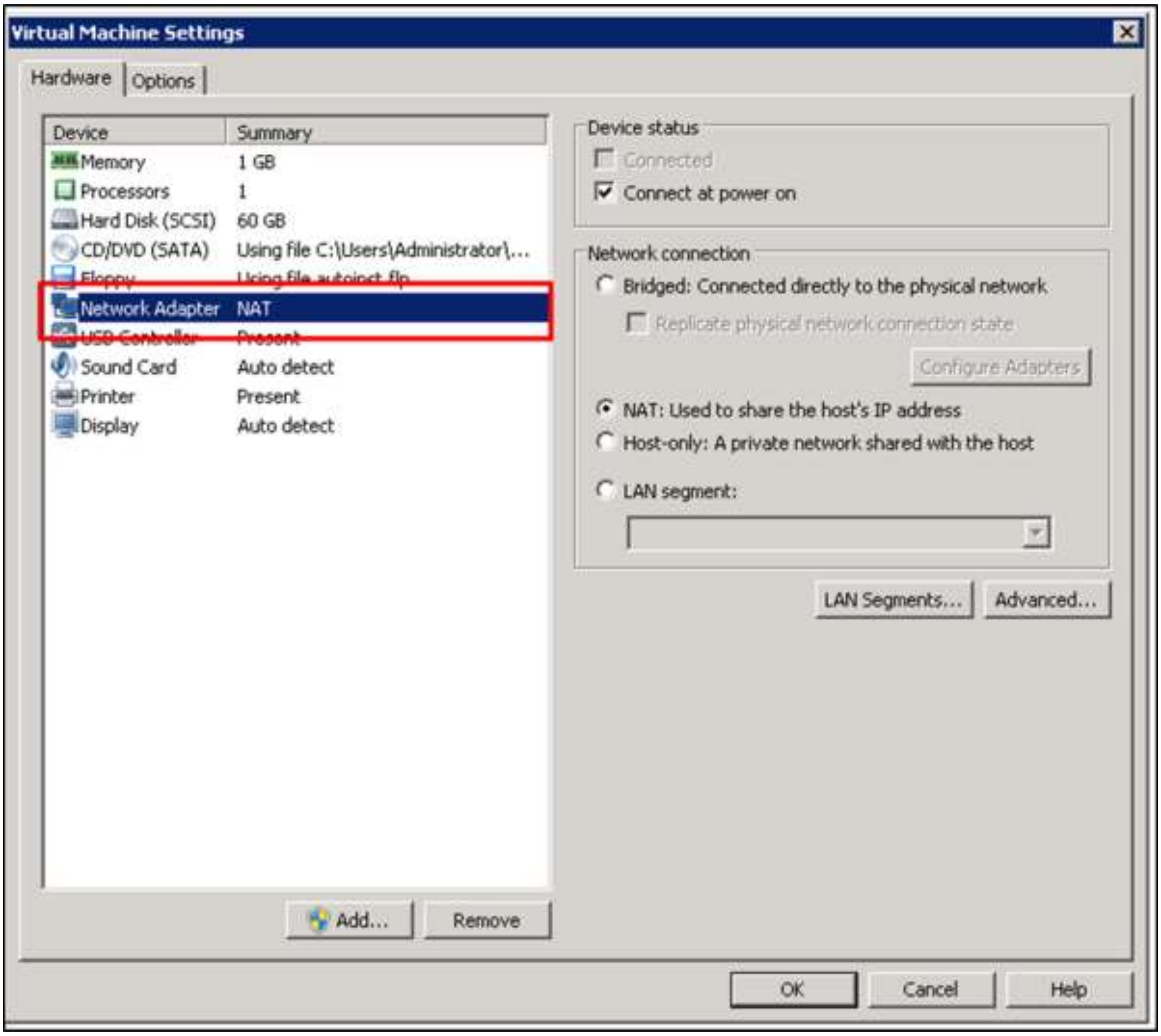
To set up the networking modes of a virtual machine in a VMware Workstation, we have to click on the "Edit virtual machine settings".



Windows Server 2012

State: Powered Off
OS: Windows Server 2012
Version: Workstation 12.0 virtual machine
RAM: 1 GB

A table will be opened with the settings of networking and on the left hand side panel of this table click on "Network Adaptor".



Device	Summary
Memory	1 GB
Processors	1
Hard Disk (SCSI)	60 GB
CD/DVD (SATA)	Using file C:\Users\Administrator\...
Floppy	Using file autoinst.flp
Network Adapter	NAT
USB Controller	Present
Sound Card	Auto detect
Printer	Present
Display	Auto detect

Device status

☐ Connected

☑ Connect at power on

Network connection

○ Bridged: Connected directly to the physical network

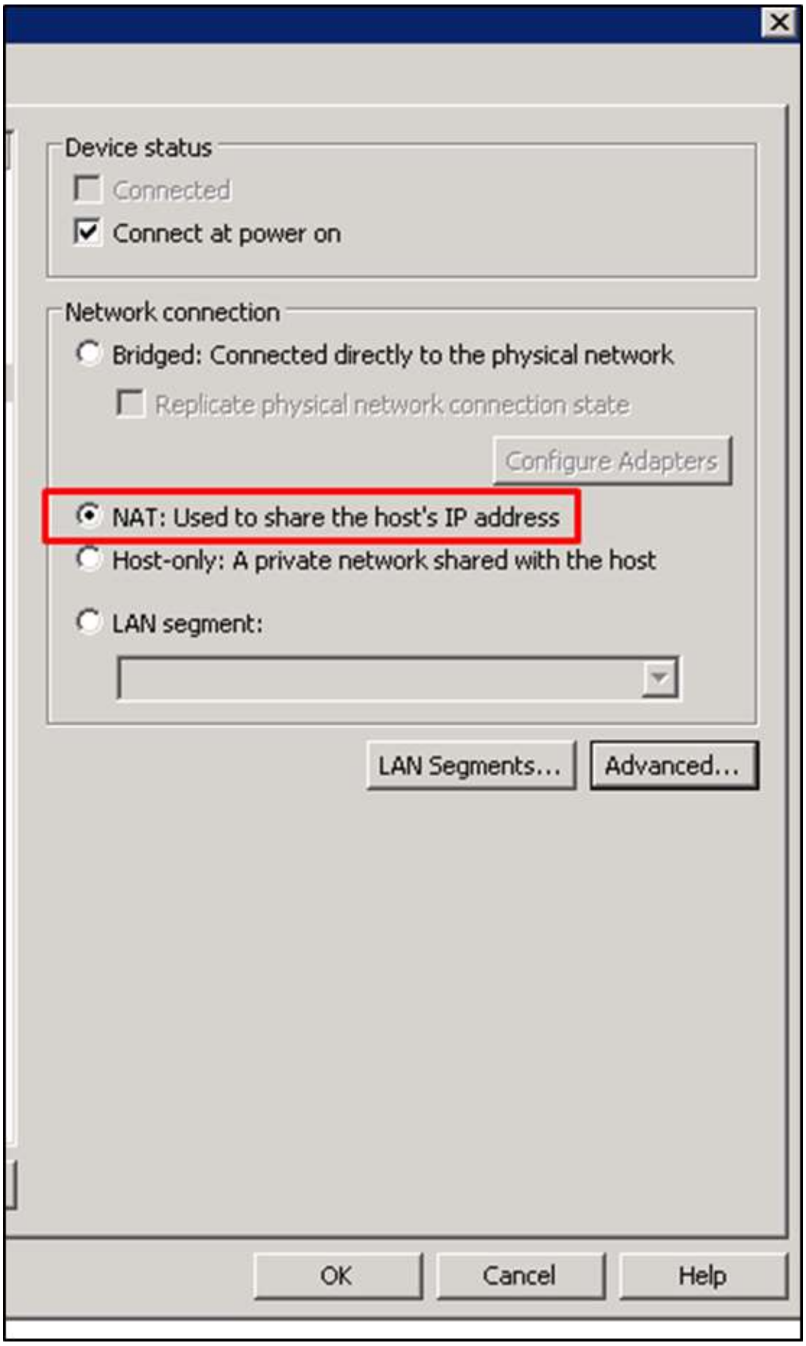
☐ Replicate physical network connection state

● NAT: Used to share the host's IP address

○ Host-only: A private network shared with the host

○ LAN segment:

On the left of this table, you can see the networking modes as shown in the following screenshots.



Device status

☐ Connected

☑ Connect at power on

Network connection

○ Bridged: Connected directly to the physical network

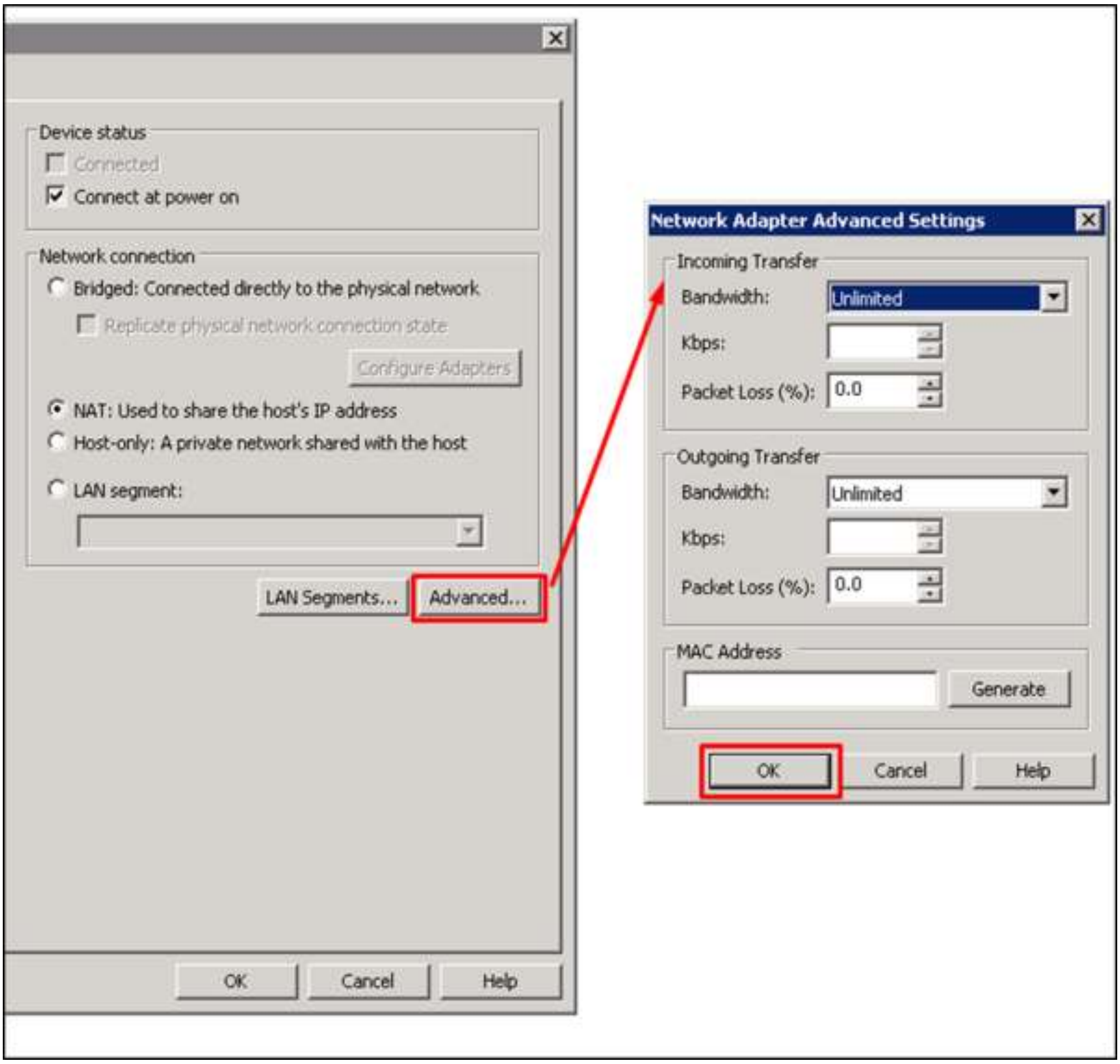
☐ Replicate physical network connection state

● NAT: Used to share the host's IP address

○ Host-only: A private network shared with the host

○ LAN segment:

If we want to limit the bandwidth usage of a virtual machine, click on "Advance" and set the incoming and outgoing bandwidths.



Device status

□ Connected

☑ Connect at power on

Network connection

○ Bridged: Connected directly to the physical network

□ Replicate physical network connection state

● NAT: Used to share the host's IP address

○ Host-only: A private network shared with the host

○ LAN segment:

Network Adapter Advanced Settings

Incoming Transfer

Bandwidth: Unlimited

Kbps:

Packet Loss (%): 0.0

Outgoing Transfer

Bandwidth: Unlimited

Kbps:

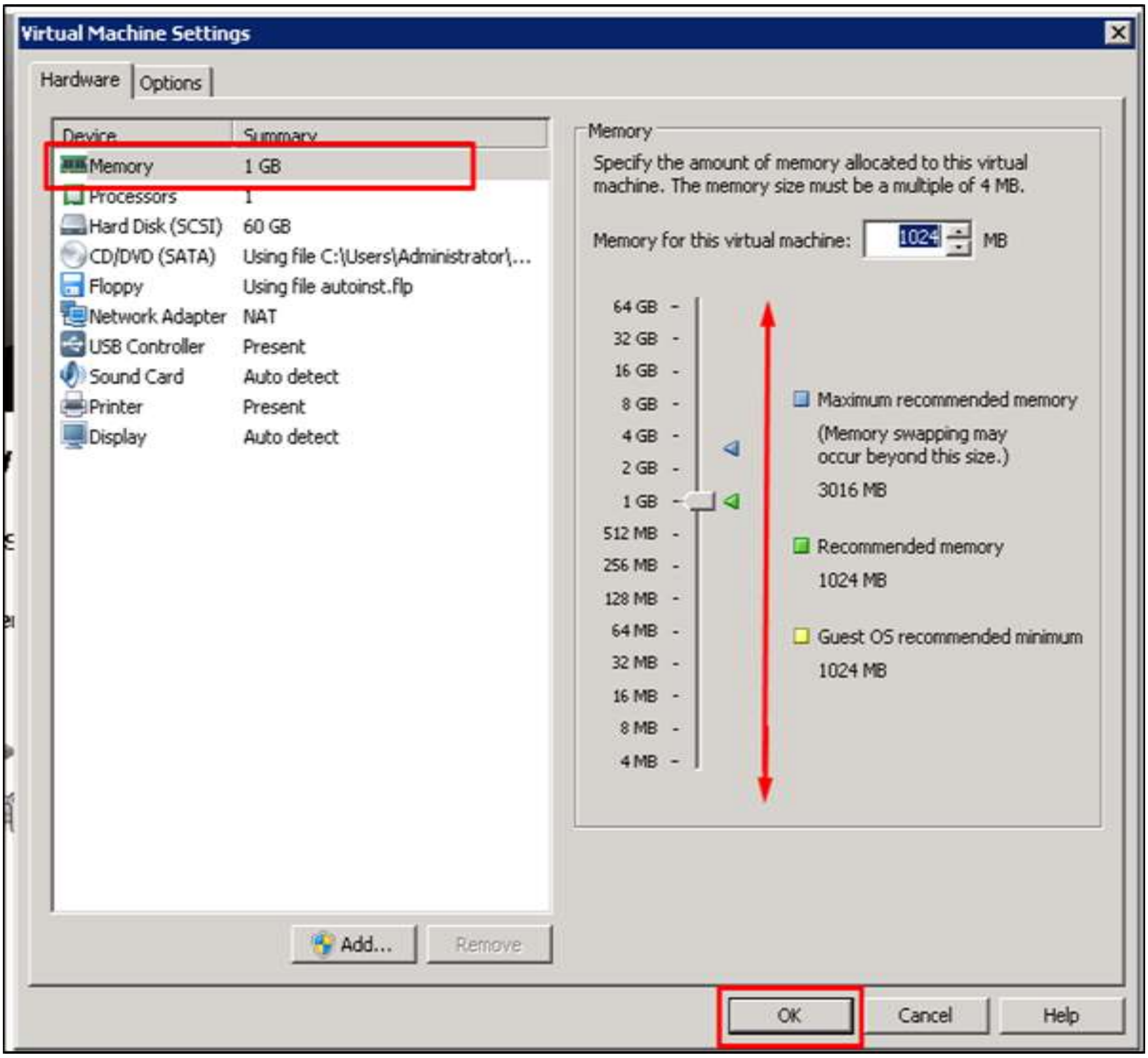
Packet Loss (%): 0.0

MAC Address

Allocating Processors & Memory to a VM using VMware Workstation

To allocate memory to a virtual machine in a VMware Workstation, we have to click on "Edit virtual machine settings". A table will be opened and we will have to click on "Memory".

On the left hand side panel, we have to enter the amount of memory manually or by moving the arrow up and down as shown in the following screenshot.



Virtual Machine Settings

Hardware | Options

Device	Summary
Memory	1 GB
Processors	1
Hard Disk (SCSI)	60 GB
CD/DVD (SATA)	Using file C:\Users\Administrator\...
Floppy	Using file autoinst.flp
Network Adapter	NAT
USB Controller	Present
Sound Card	Auto detect
Printer	Present
Display	Auto detect

Memory

Specify the amount of memory allocated to this virtual machine. The memory size must be a multiple of 4 MB.

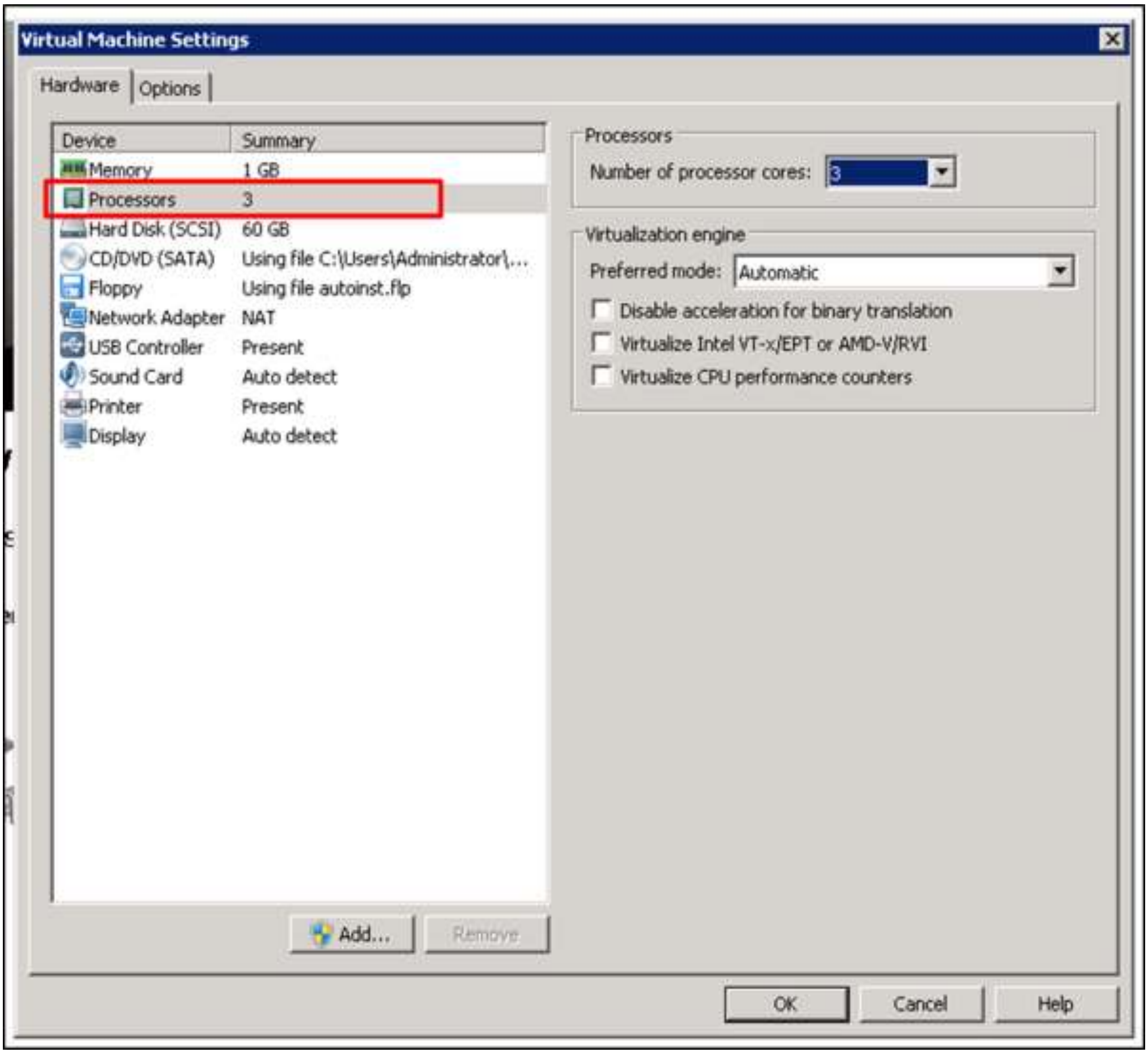
Memory for this virtual machine: 1024 MB

🟦 Maximum recommended memory
(Memory swapping may occur beyond this size.)
3016 MB

🟩 Recommended memory
1024 MB

🟨 Guest OS recommended minimum
1024 MB

If you click on "Processors". On the left hand side panel, we have to enter the amount of vCPU as shown in the screenshot below.



Virtual Machine Settings

Device	Summary
Memory	1 GB
Processors	3
Hard Disk (SCSI)	60 GB
CD/DVD (SATA)	Using file C:\Users\Administrator\...
Floppy	Using file autoinst.flp
Network Adapter	NAT
USB Controller	Present
Sound Card	Auto detect
Printer	Present
Display	Auto detect

Processors

Number of processor cores: 3

Virtualization engine

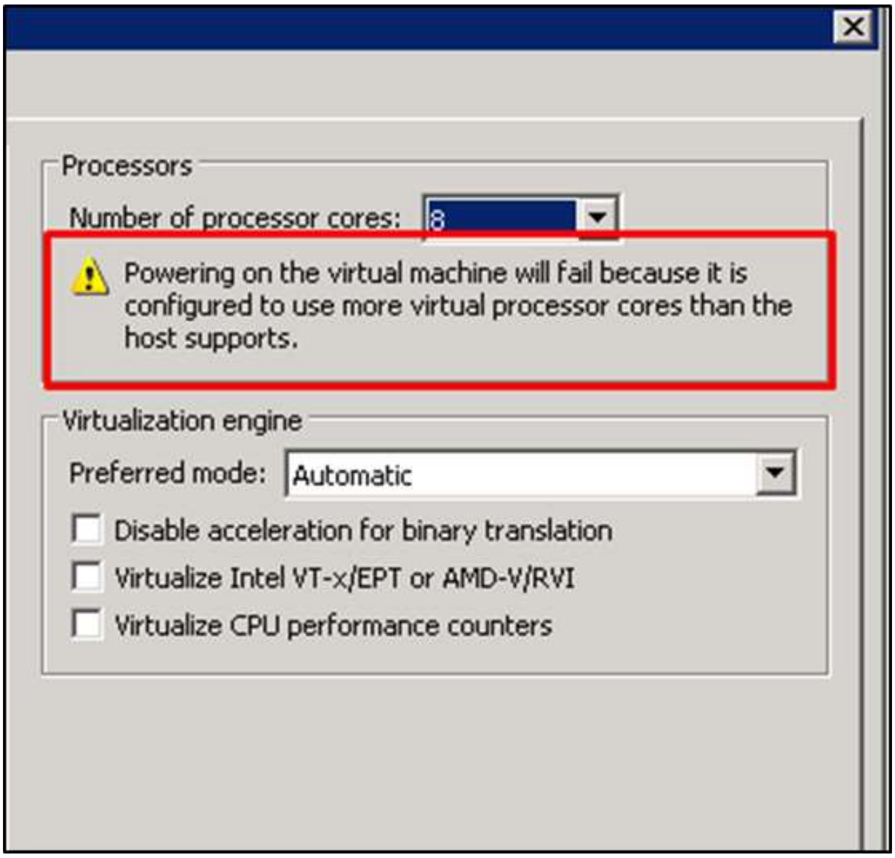
Preferred mode: Automatic

□ Disable acceleration for binary translation

□ Virtualize Intel VT-x/EPT or AMD-V/RVI

□ Virtualize CPU performance counters

Note: If you put more vCPU-s than what the host supports, it will fail to power on the VM.



Processors

Number of processor cores: 8

⚠ Powering on the virtual machine will fail because it is configured to use more virtual processor cores than the host supports.

Virtualization engine

Preferred mode: Automatic

□ Disable acceleration for binary translation

□ Virtualize Intel VT-x/EPT or AMD-V/RVI

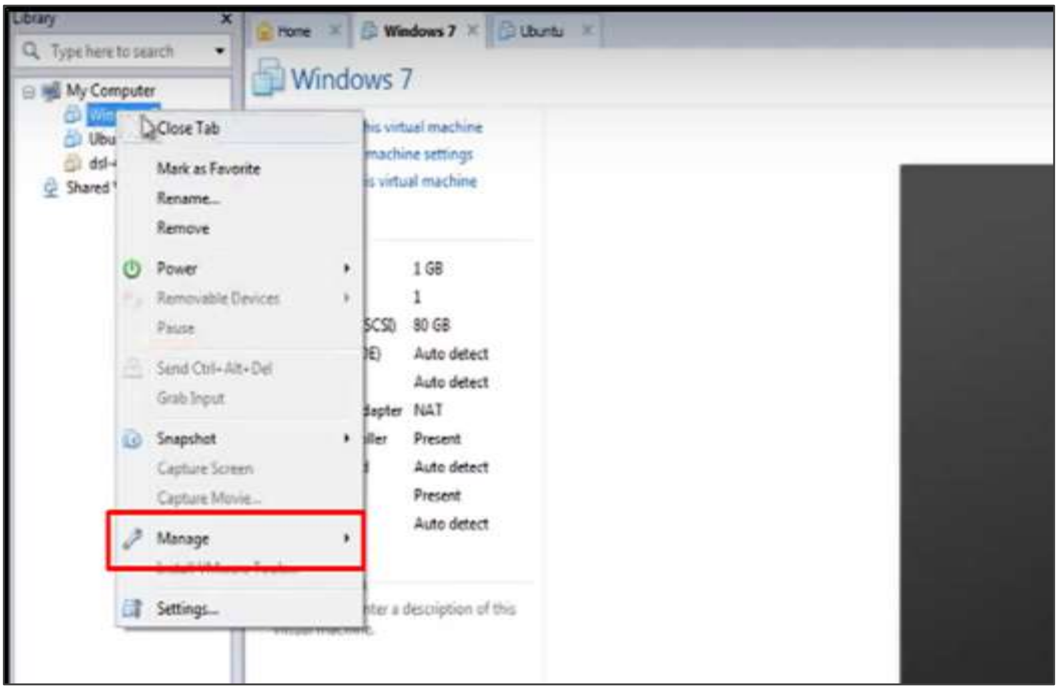
□ Virtualize CPU performance counters

Duplicating a VM Using VMware Workstation

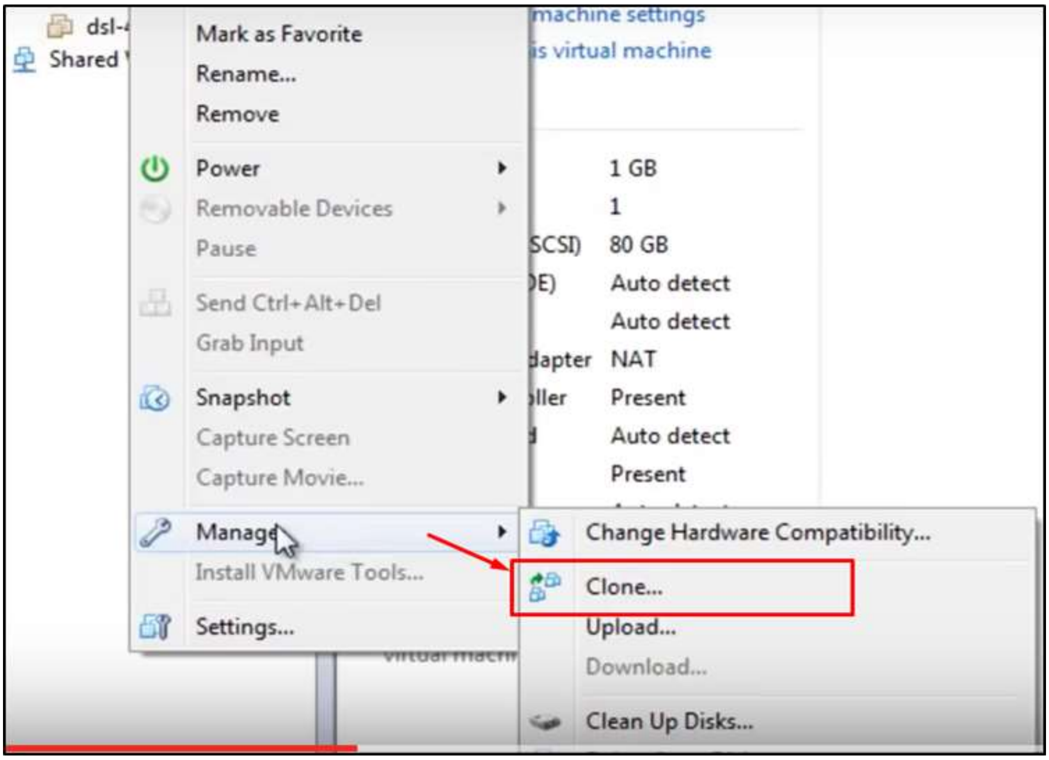
To create duplicates of VM machines, we have to use the VMware Workstation Commercial Version.

Let us see how to do it in practice by following the steps given below.

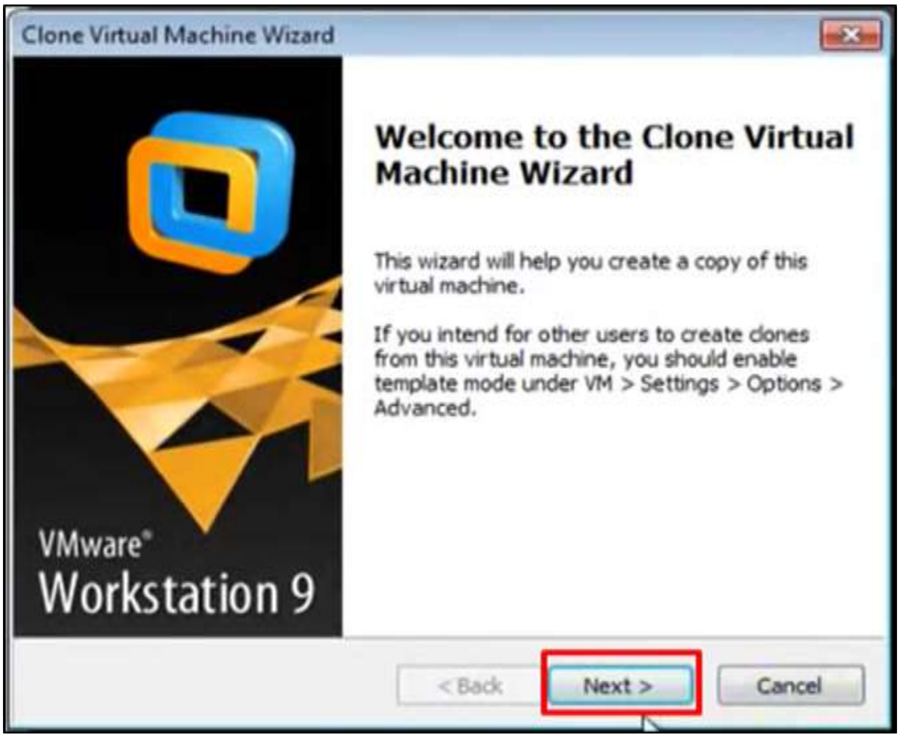
Step 1: Open the VMware managing console and right click on a VM that you want to duplicate. Click on "Manage".



Step 2: Click on "Clone..." and a wizard will be open.



Step 3: Click on "Next".



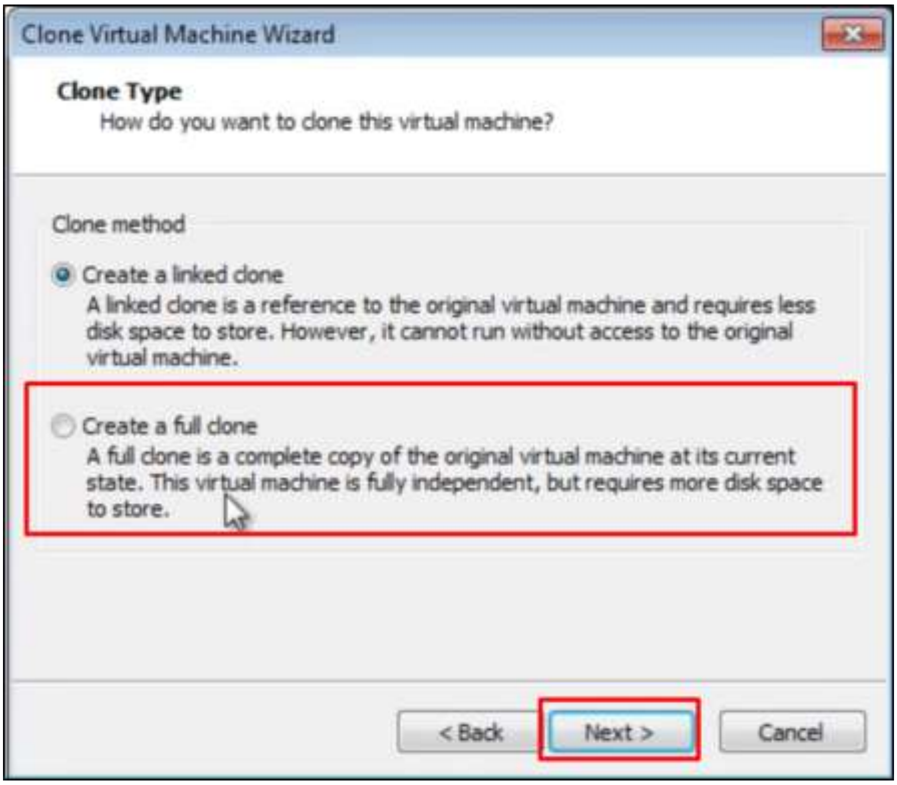
Clone Virtual Machine Wizard

Welcome to the Clone Virtual Machine Wizard

This wizard will help you create a copy of this virtual machine.

If you intend for other users to create clones from this virtual machine, you should enable template mode under VM > Settings > Options > Advanced.

Step 4: Click on "Create a Full Clone" and "Next".



Clone Virtual Machine Wizard

Clone Type

How do you want to clone this virtual machine?

Clone method

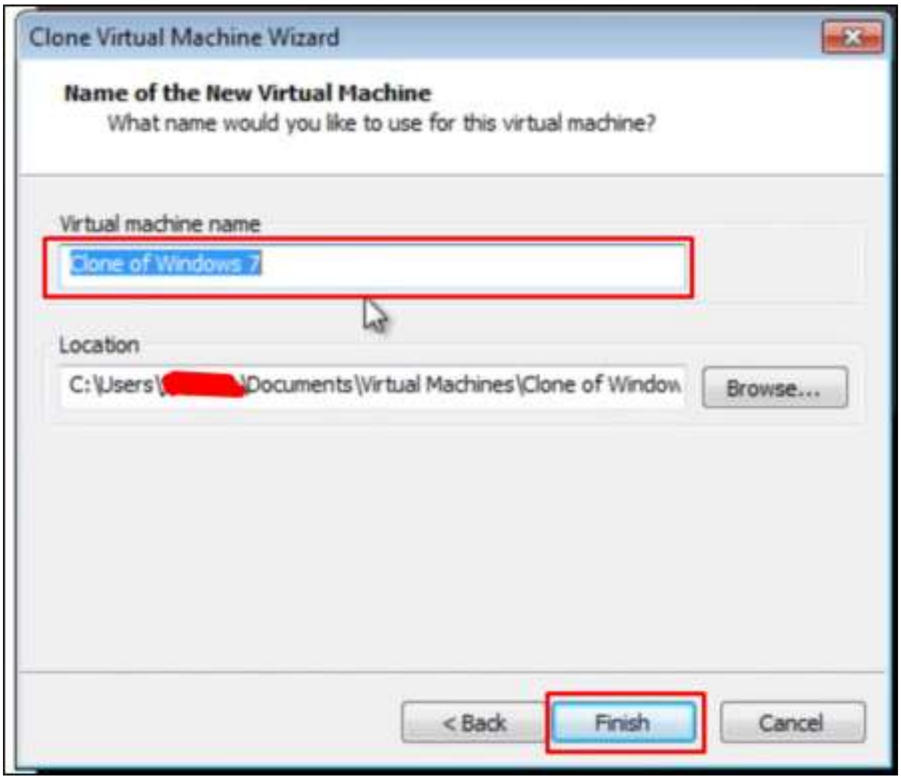
● Create a linked clone

A linked clone is a reference to the original virtual machine and requires less disk space to store. However, it cannot run without access to the original virtual machine.

○ Create a full clone

A full clone is a complete copy of the original virtual machine at its current state. This virtual machine is fully independent, but requires more disk space to store.

Step 5: Put a name for the clone that will be created and "Finish".



Clone Virtual Machine Wizard

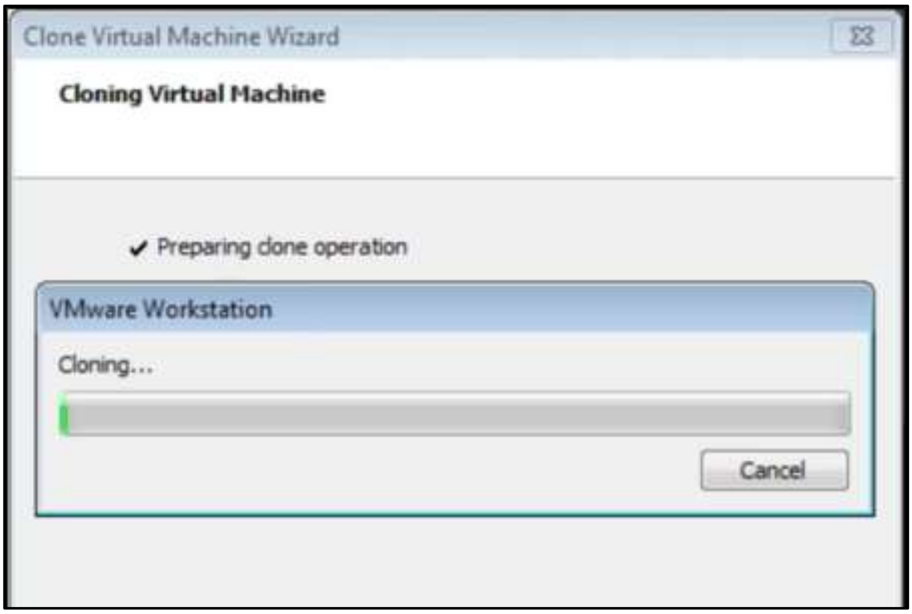
Name of the New Virtual Machine

What name would you like to use for this virtual machine?

Virtual machine name: Clone of Windows 7

Location: C:\Users\[redacted]\Documents\Virtual Machines\Clone of Window

The following screenshots describe the process of cloning.



Clone Virtual Machine Wizard

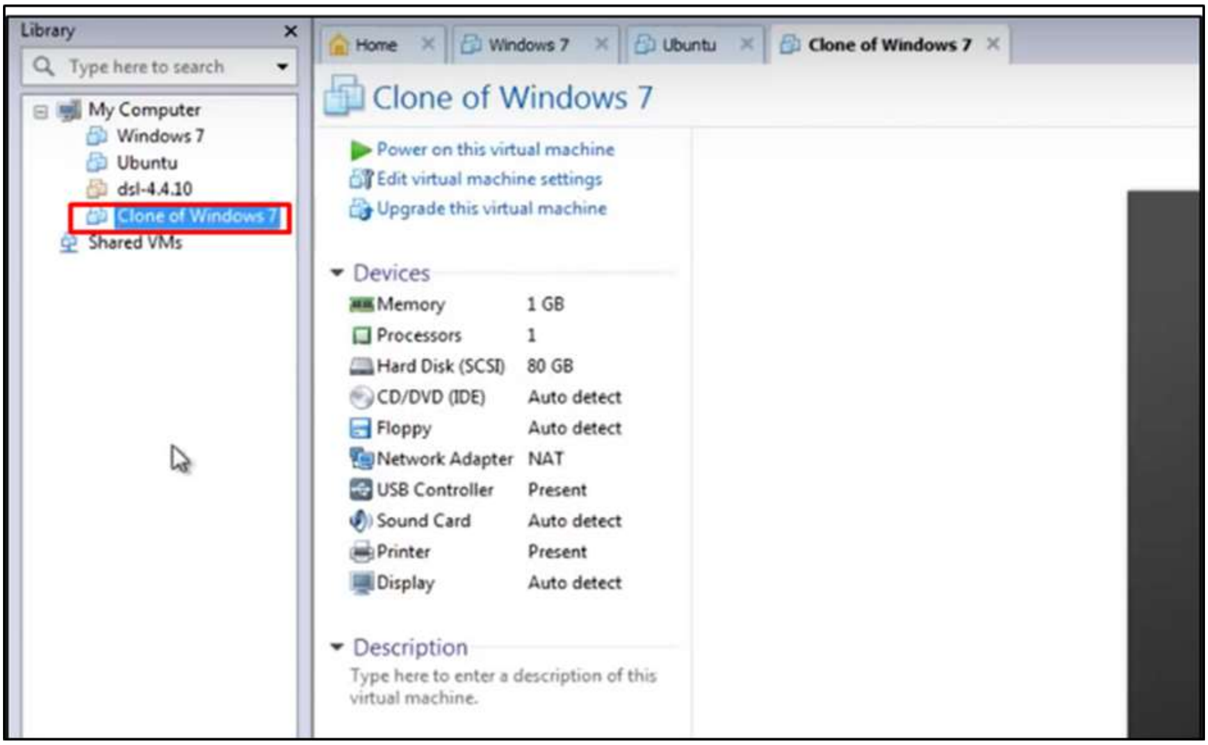
Cloning Virtual Machine

✓ Preparing clone operation

VMware Workstation

Cloning...

Once the cloning process is complete, the following window will open.



Clone of Windows 7

Devices

Memory	1 GB
Processors	1
Hard Disk (SCSI)	80 GB
CD/DVD (IDE)	Auto detect
Floppy	Auto detect
Network Adapter	NAT
USB Controller	Present
Sound Card	Auto detect
Printer	Present
Display	Auto detect

Description

Type here to enter a description of this virtual machine.

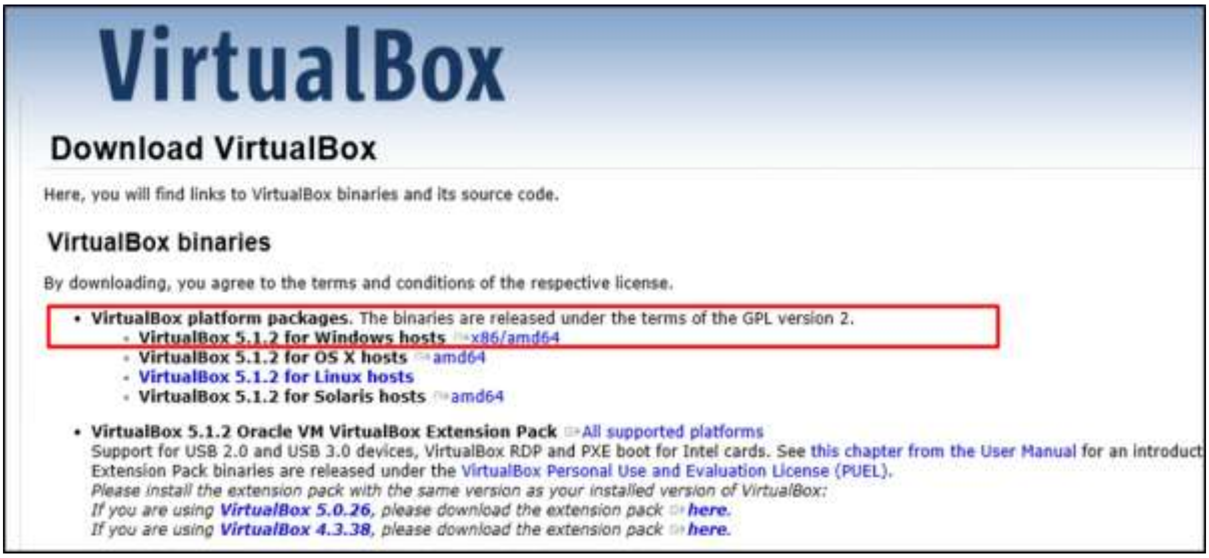
7. Virtualization – VirtualBox

In this chapter, we will understand what a VirtualBox is and discuss in detail the various components it has.

Installing VirtualBox

To start with, we will download VirtualBox and install it. We should follow the steps given below for the installation.

Step 1: To download VirtualBox, click on the following link – https://www.virtualbox.org/wiki/Downloads. Now, depending on your OS, select which version to install. In our case, it will be the first one (Windows host).



VirtualBox

Download VirtualBox

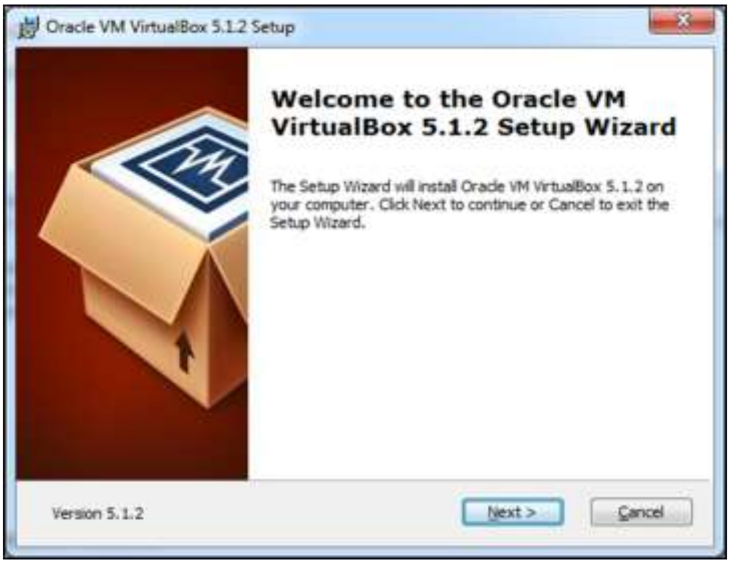
Here, you will find links to VirtualBox binaries and its source code.

VirtualBox binaries

By downloading, you agree to the terms and conditions of the respective license.

- **VirtualBox platform packages.** The binaries are released under the terms of the GPL version 2.
  - **VirtualBox 5.1.2 for Windows hosts** ⇒x86/amd64
  - **VirtualBox 5.1.2 for OS X hosts** ⇒amd64
  - **VirtualBox 5.1.2 for Linux hosts**
  - **VirtualBox 5.1.2 for Solaris hosts** ⇒amd64
- **VirtualBox 5.1.2 Oracle VM VirtualBox Extension Pack** ⇒All supported platforms
  Support for USB 2.0 and USB 3.0 devices, VirtualBox RDP and PXE boot for Intel cards. See this chapter from the User Manual for an introduct
  Extension Pack binaries are released under the VirtualBox Personal Use and Evaluation License (PUEL).
  Please install the extension pack with the same version as your installed version of VirtualBox:
  *If you are using **VirtualBox 5.0.26**, please download the extension pack ⇒**here**.*
  *If you are using **VirtualBox 4.3.38**, please download the extension pack ⇒**here**.*

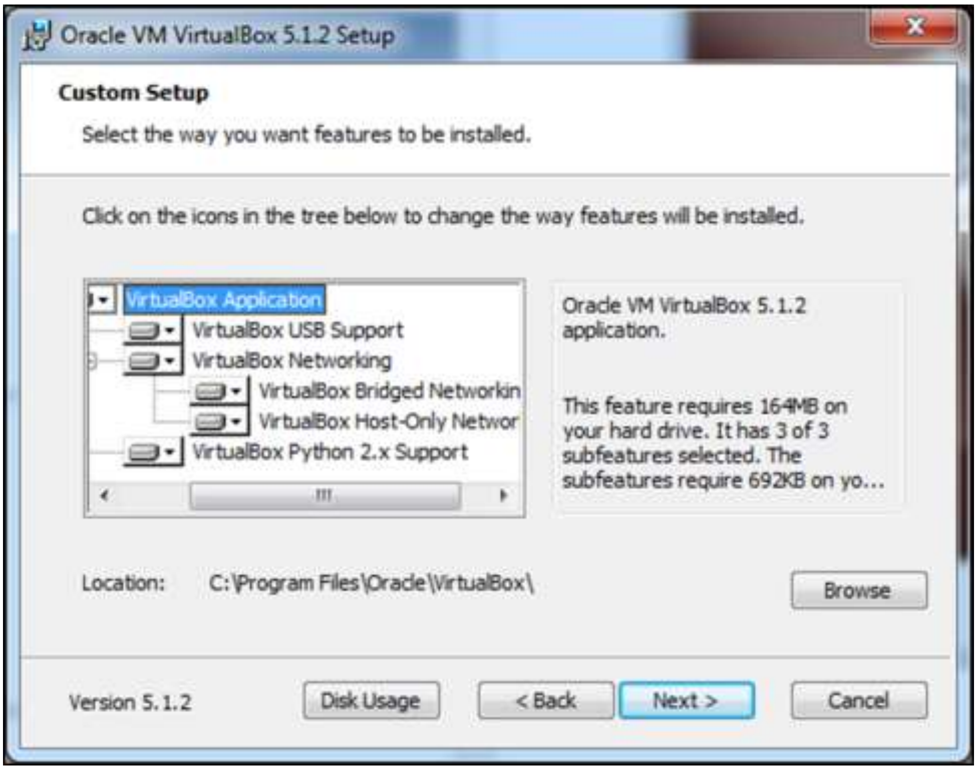
Step 2: Once the option is selected, click on "Next".



Welcome to the Oracle VM VirtualBox 5.1.2 Setup Wizard

The Setup Wizard will install Oracle VM VirtualBox 5.1.2 on your computer. Click Next to continue or Cancel to exit the Setup Wizard.

Step 3: You have the option asking where to install the application. We can leave it as default and click on "Next".


Oracle VM VirtualBox 5.1.2 Setup

Custom Setup

Select the way you want features to be installed.

Click on the icons in the tree below to change the way features will be installed.

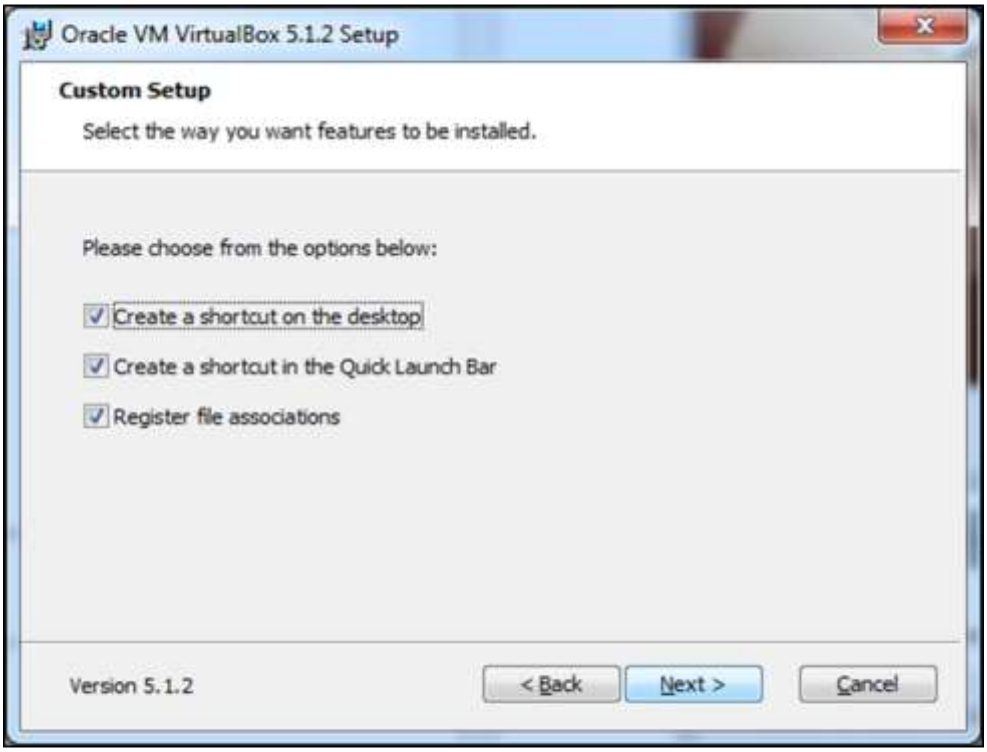
VirtualBox Application
VirtualBox USB Support
VirtualBox Networking
VirtualBox Bridged Networkin
VirtualBox Host-Only Networ
VirtualBox Python 2.x Support

Oracle VM VirtualBox 5.1.2 application.

This feature requires 164MB on your hard drive. It has 3 of 3 subfeatures selected. The subfeatures require 692KB on yo...

Location: C:\Program Files\Oracle\VirtualBox\

Step 4: Once the options are selected as shown in the following screenshot, click on Next.


Oracle VM VirtualBox 5.1.2 Setup

Custom Setup

Select the way you want features to be installed.

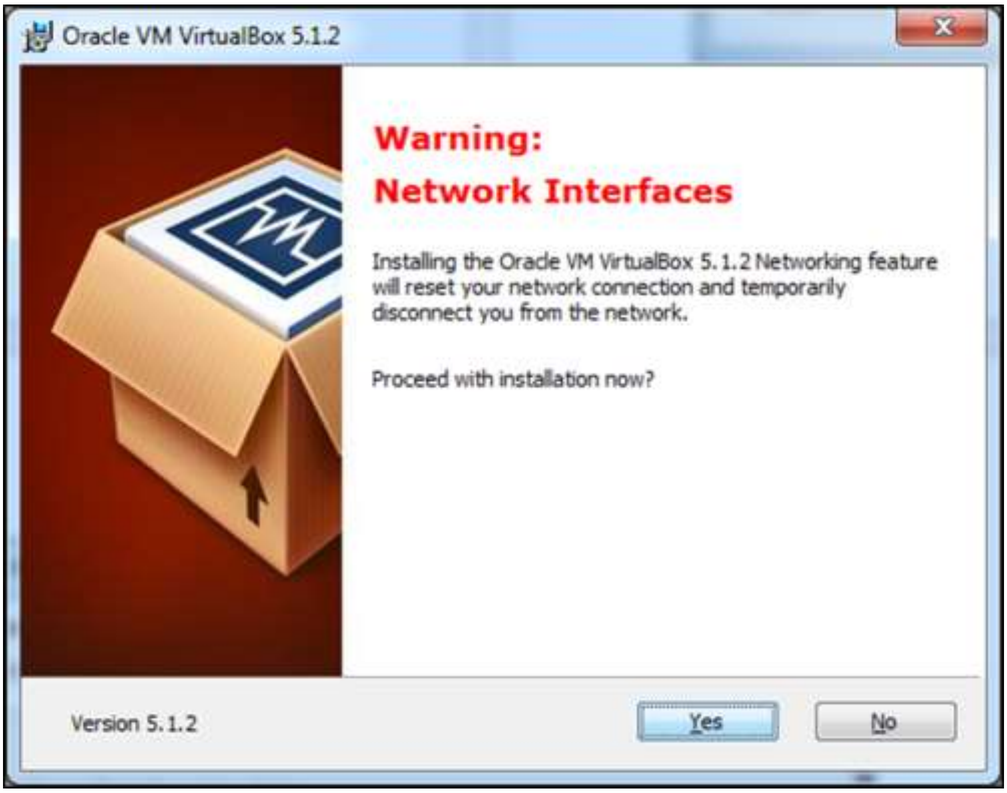
Please choose from the options below:

☑ Create a shortcut on the desktop

☑ Create a shortcut in the Quick Launch Bar

☑ Register file associations

Step 5: A dialog box will come up asking whether to proceed with the installation. Click "Yes".

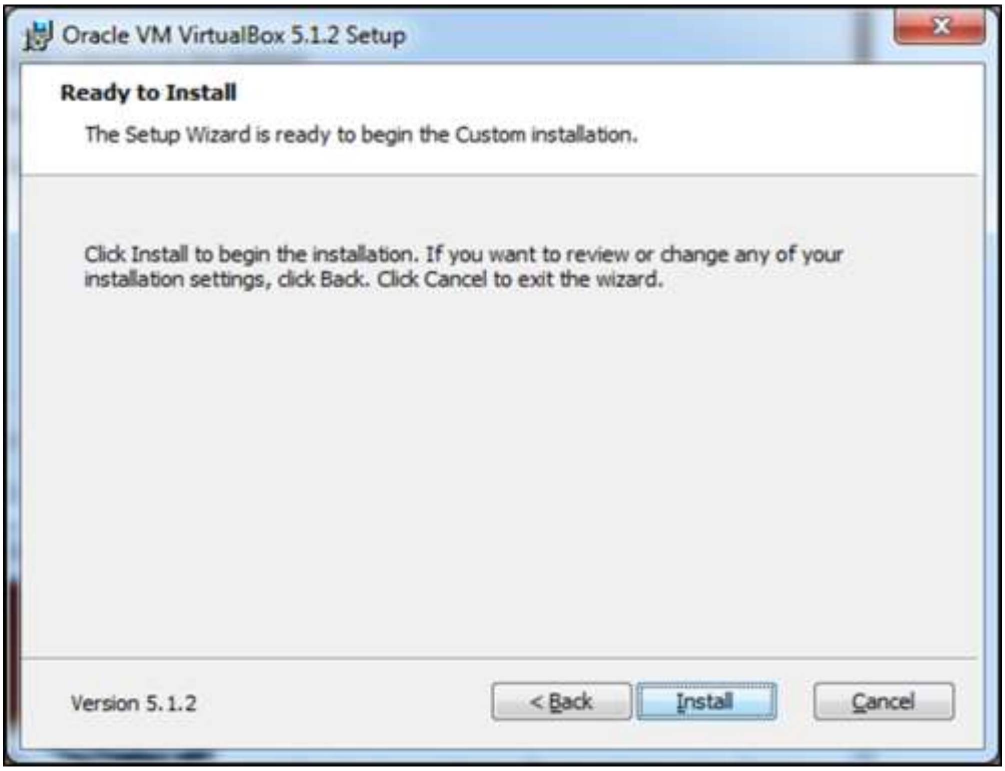


Warning:
Network Interfaces

Installing the Oracle VM VirtualBox 5.1.2 Networking feature will reset your network connection and temporarily disconnect you from the network.

Proceed with installation now?

Step 6: In the next step, click on "Install".

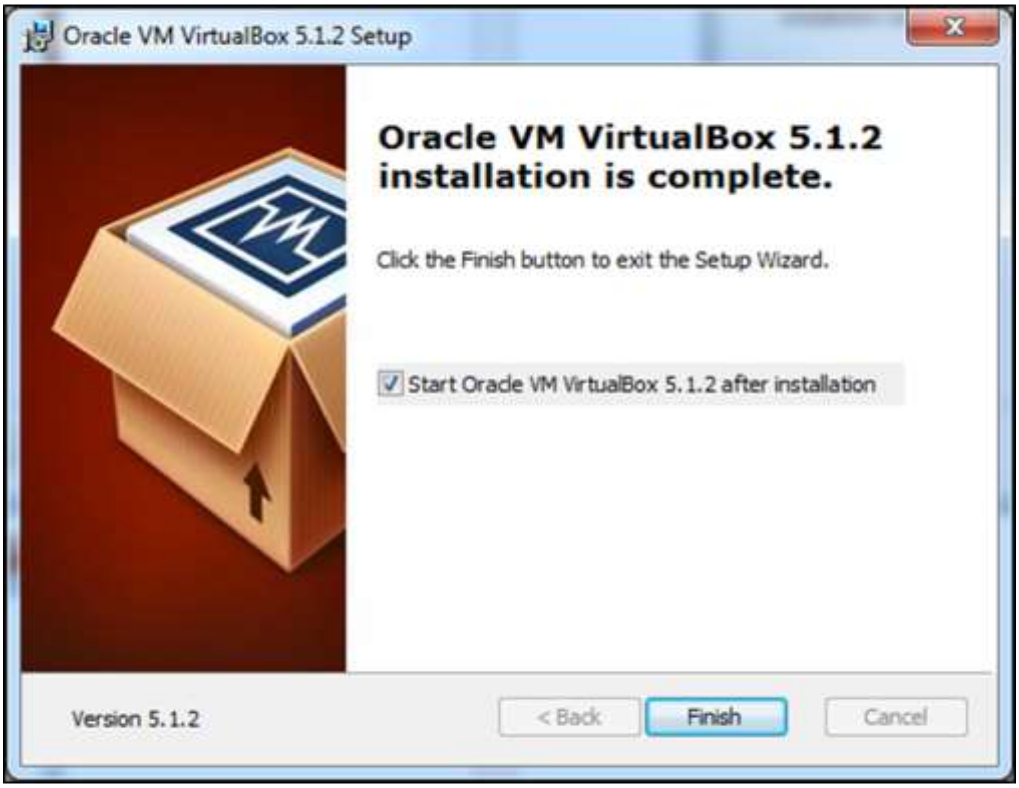


Ready to Install

The Setup Wizard is ready to begin the Custom installation.

Click Install to begin the installation. If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.

Step 7: Tick the start VirtualBox check box and click on “Finish”.



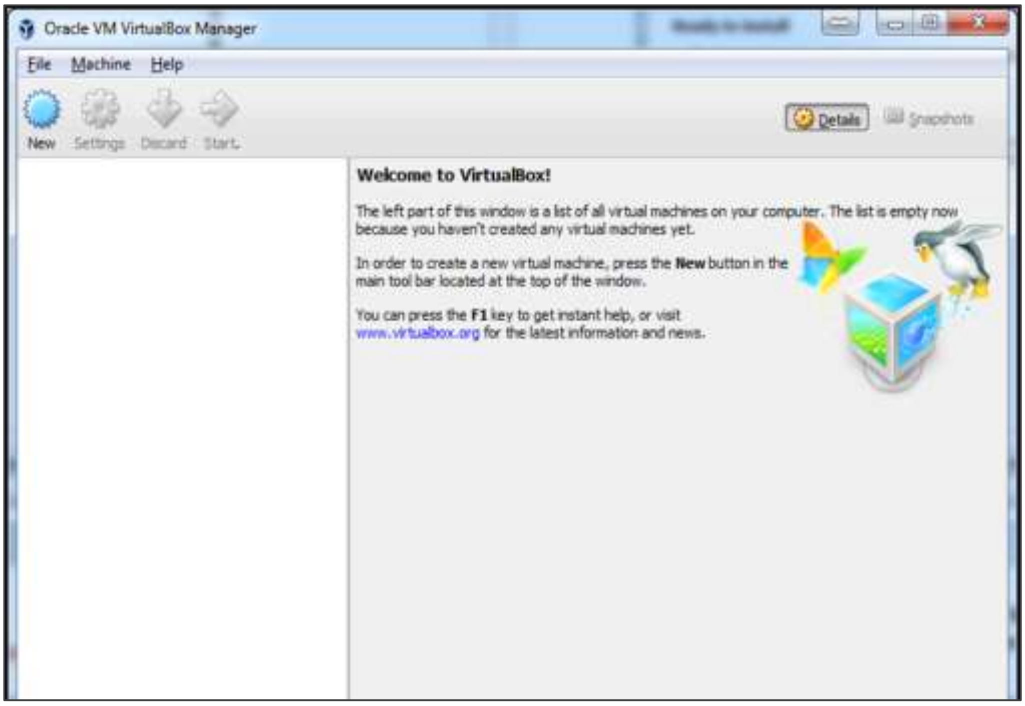
Oracle VM VirtualBox 5.1.2 installation is complete.

Click the Finish button to exit the Setup Wizard.

☑ Start Oracle VM VirtualBox 5.1.2 after installation

Version 5.1.2

Step 8: VirtualBox application will now open as shown in the following screenshot. Now, we are ready to install the virtual machines.



Welcome to VirtualBox!

The left part of this window is a list of all virtual machines on your computer. The list is empty now because you haven't created any virtual machines yet.

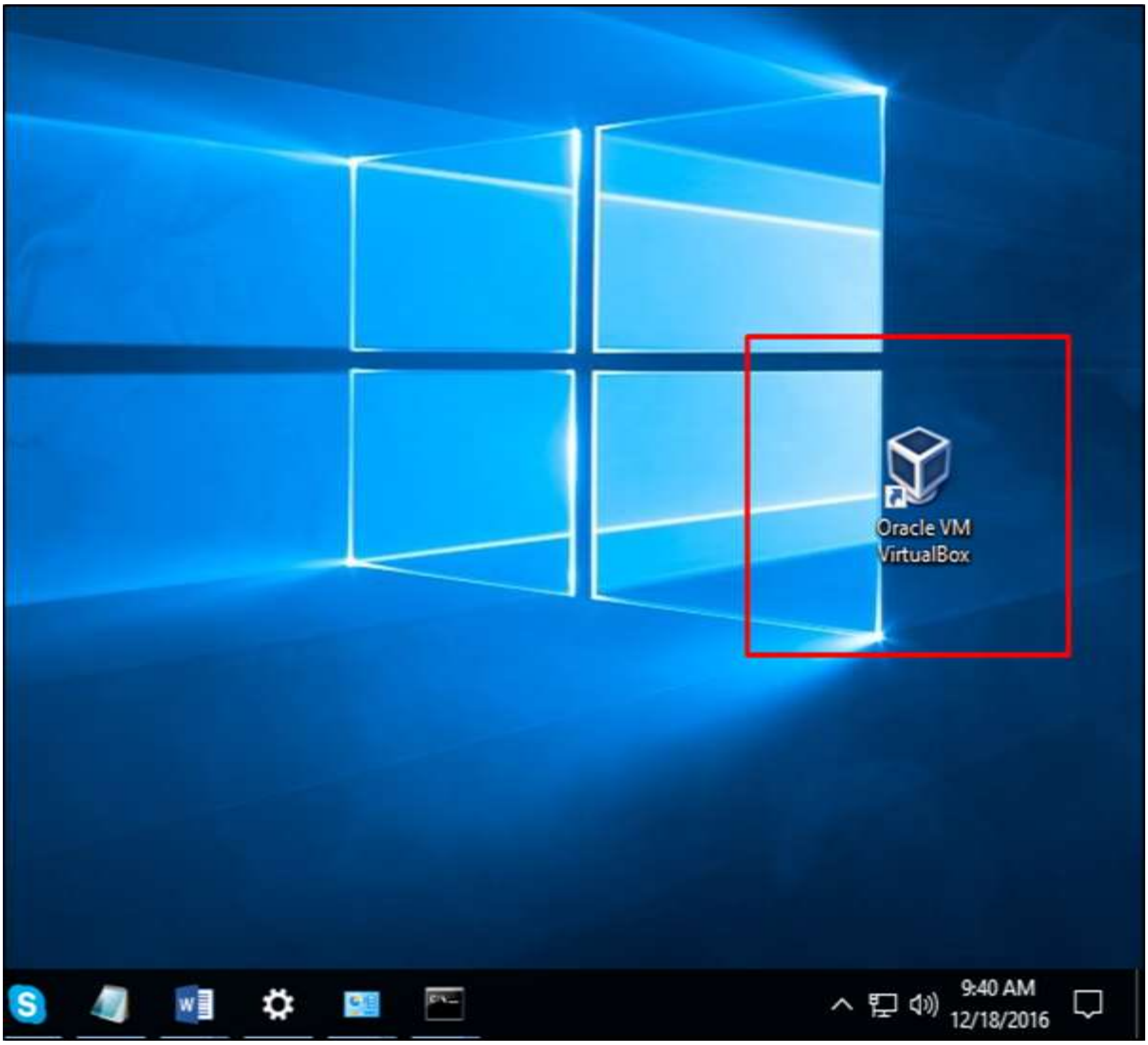
In order to create a new virtual machine, press the **New** button in the main tool bar located at the top of the window.

You can press the **F1** key to get instant help, or visit www.virtualbox.org for the latest information and news.

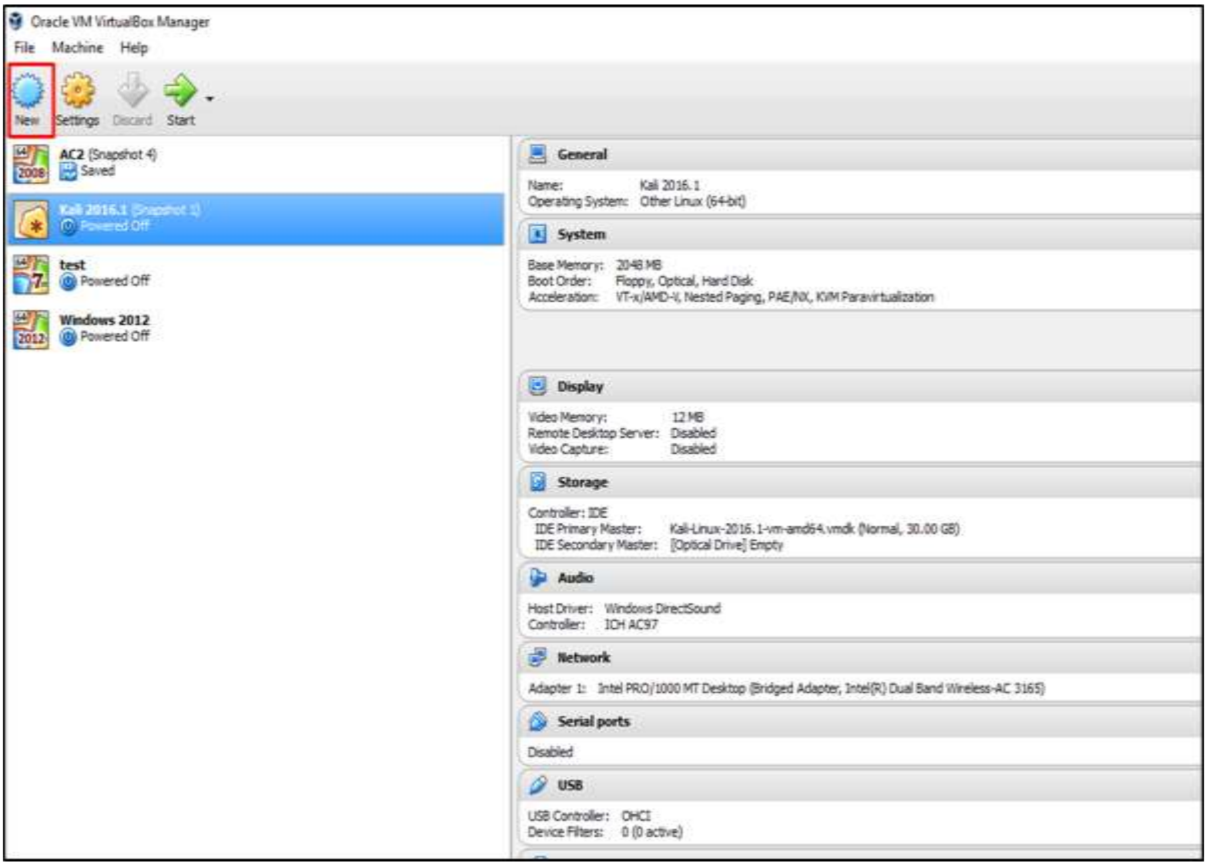
Creating a VM with VirtualBox

To create a virtual machine with Oracle VirtualBox, we should follow the steps given below.

Step 1: To begin with, click on the "Oracle VM VirtualBox" icon on the desktop as shown in the screenshot below.



Step 2: The next step is to click on "New" button, which is in the top left hand side of the screen.



General

Name: Kali 2016.1
Operating System: Other Linux (64-bit)

System

Base Memory: 2048 MB
Boot Order: Floppy, Optical, Hard Disk
Acceleration: VT-x/AMD-V, Nested Paging, PAE/NX, KVM Paravirtualization

Display

Video Memory: 12 MB
Remote Desktop Server: Disabled
Video Capture: Disabled

Storage

Controller: IDE
IDE Primary Master: Kali-Linux-2016.1-vm-amd64.vmdk (Normal, 30.00 GB)
IDE Secondary Master: [Optical Drive] Empty

Audio

Host Driver: Windows DirectSound
Controller: ICH AC97

Network

Adapter 1: Intel PRO/1000 MT Desktop (Bridged Adapter, Intel(R) Dual Band Wireless-AC 3165)

Serial ports

Disabled

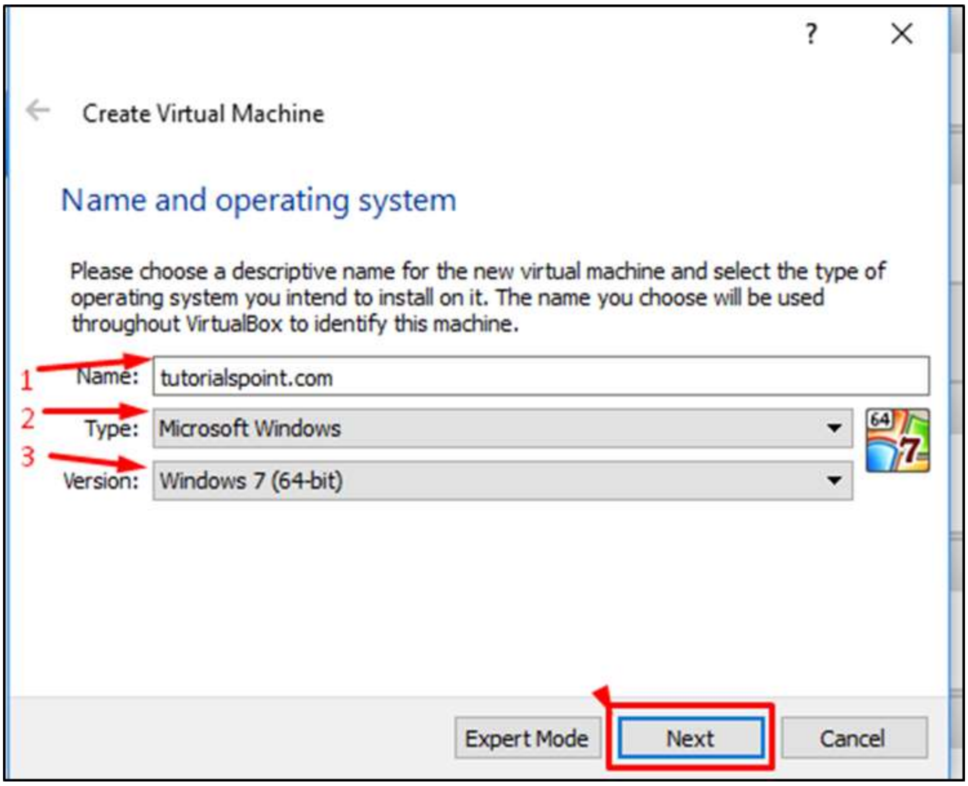
USB

USB Controller: OHCI
Device Filters: 0 (0 active)

Step 3: A table will pop-up requesting you the parameters for the virtual machine. These will be –

- **Name:** We have to put a friendly name for this Virtual Machine.
- **Type:** Enter the OS that is going to be installed on it.
- **Version:** Enter the specific version for that OS, which we have selected earlier.

Once all the above parameters are filled, click on “Next”.



Create Virtual Machine

Name and operating system

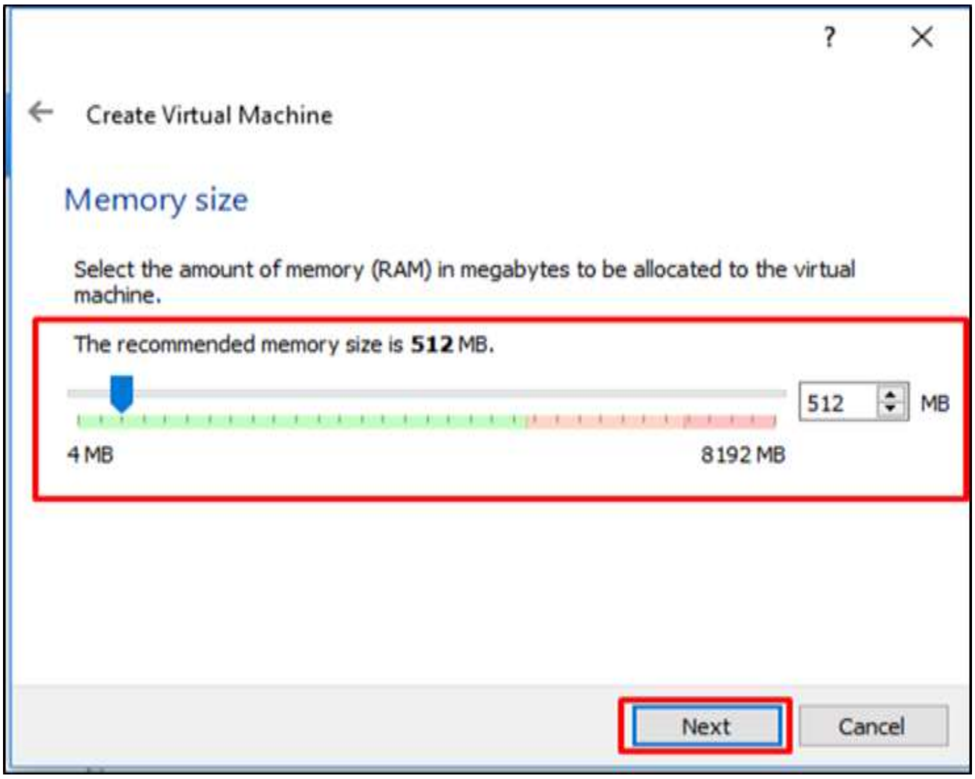
Please choose a descriptive name for the new virtual machine and select the type of operating system you intend to install on it. The name you choose will be used throughout VirtualBox to identify this machine.

1 Name: tutorialspoint.com

2 Type: Microsoft Windows

3 Version: Windows 7 (64-bit)

Step 4: Select the amount of memory that you need to allocate in this VM → Click on “Next”.



Create Virtual Machine

Memory size

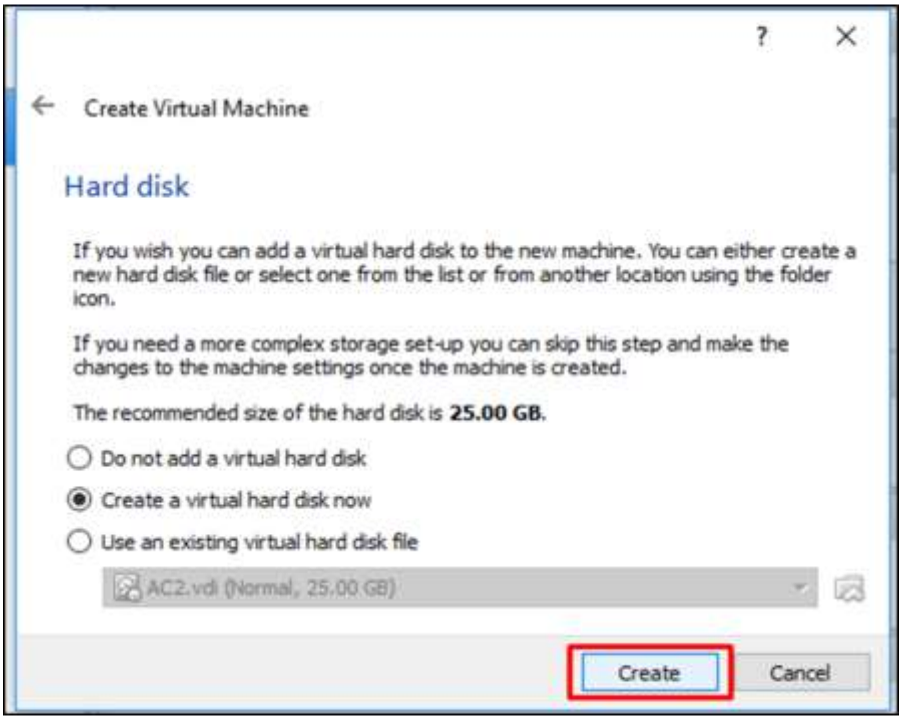
Select the amount of memory (RAM) in megabytes to be allocated to the virtual machine.

The recommended memory size is **512** MB.

512 MB

4 MB 8192 MB

Step 5: Check one of the three options for the HDD and click on "Create".



Create Virtual Machine

Hard disk

If you wish you can add a virtual hard disk to the new machine. You can either create a new hard disk file or select one from the list or from another location using the folder icon.

If you need a more complex storage set-up you can skip this step and make the changes to the machine settings once the machine is created.

The recommended size of the hard disk is **25.00 GB**.

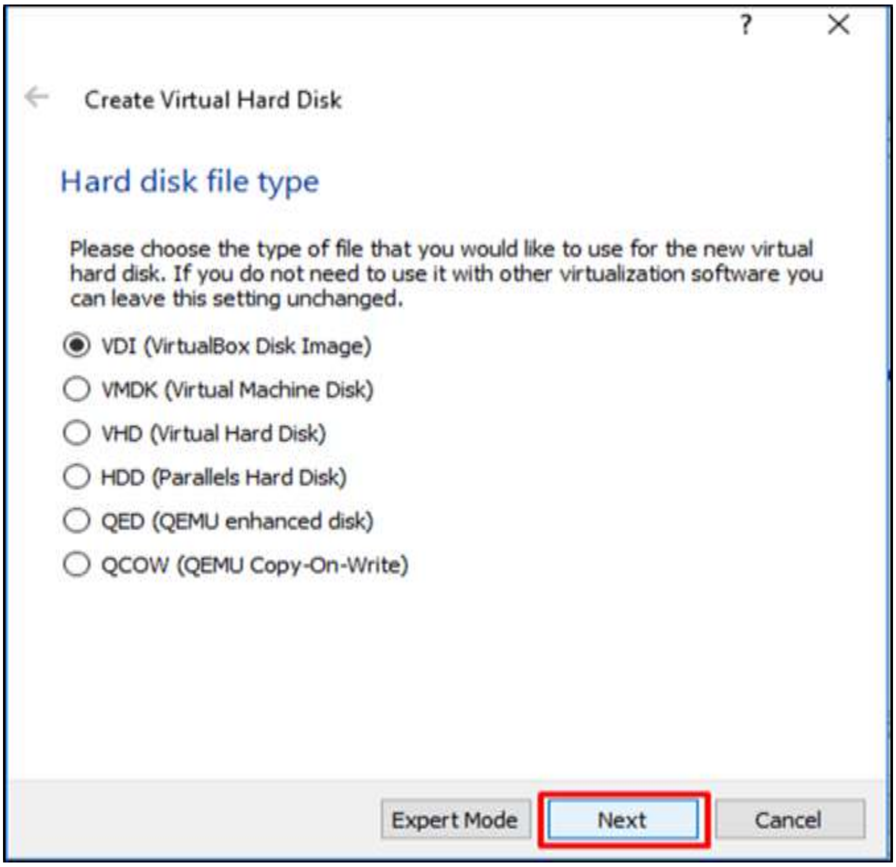
○ Do not add a virtual hard disk

● Create a virtual hard disk now

○ Use an existing virtual hard disk file

AC2.vdi (Normal, 25.00 GB)

Step 6: Select a file extension for your virtual HDD (It is recommended to use a common file extension that most of the hypervisors use like VHD) →click on "Next".



Create Virtual Hard Disk

Hard disk file type

Please choose the type of file that you would like to use for the new virtual hard disk. If you do not need to use it with other virtualization software you can leave this setting unchanged.

● VDI (VirtualBox Disk Image)

○ VMDK (Virtual Machine Disk)

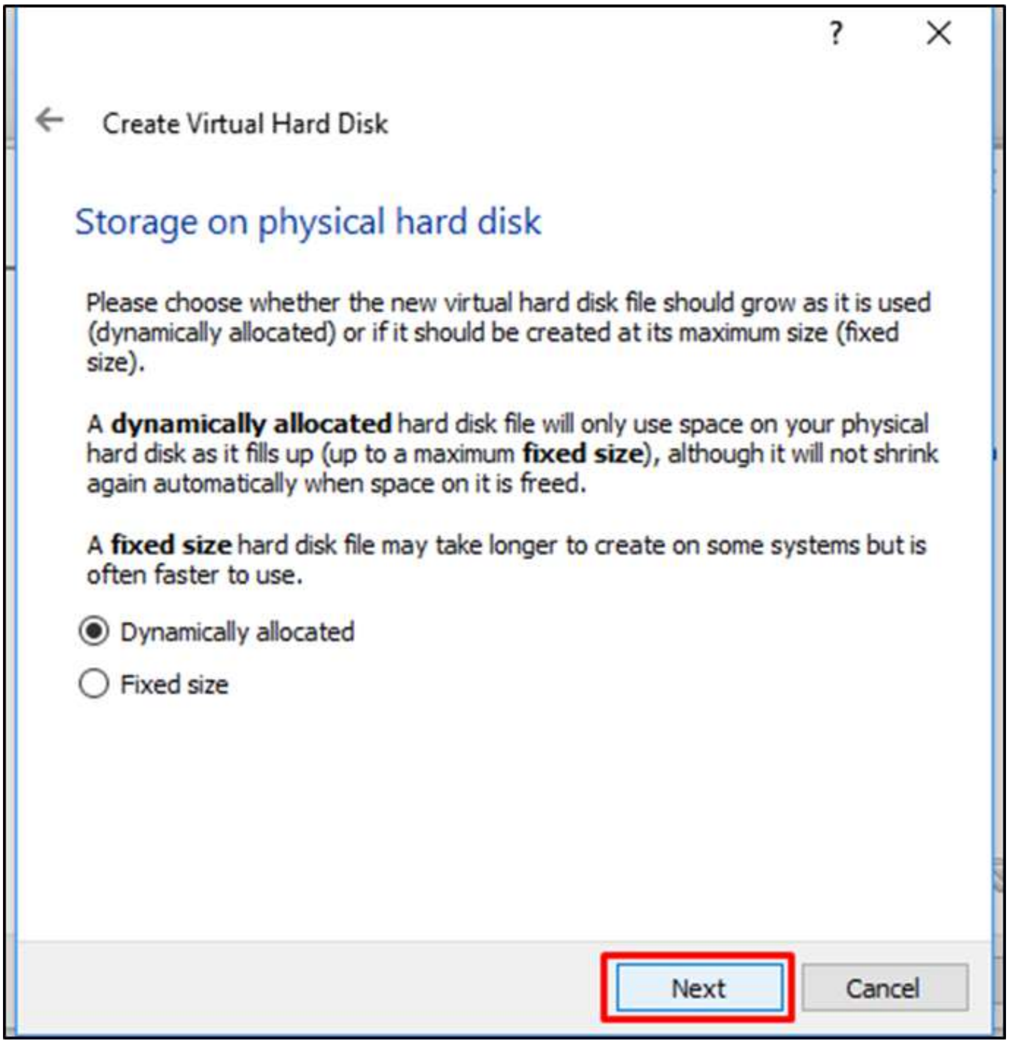
○ VHD (Virtual Hard Disk)

○ HDD (Parallels Hard Disk)

○ QED (QEMU enhanced disk)

○ QCOW (QEMU Copy-On-Write)

Step 7: Choose whether you want the Virtual HDD as dynamic or fixed. This is based on your needs → Click on "Next".



Create Virtual Hard Disk

Storage on physical hard disk

Please choose whether the new virtual hard disk file should grow as it is used (dynamically allocated) or if it should be created at its maximum size (fixed size).

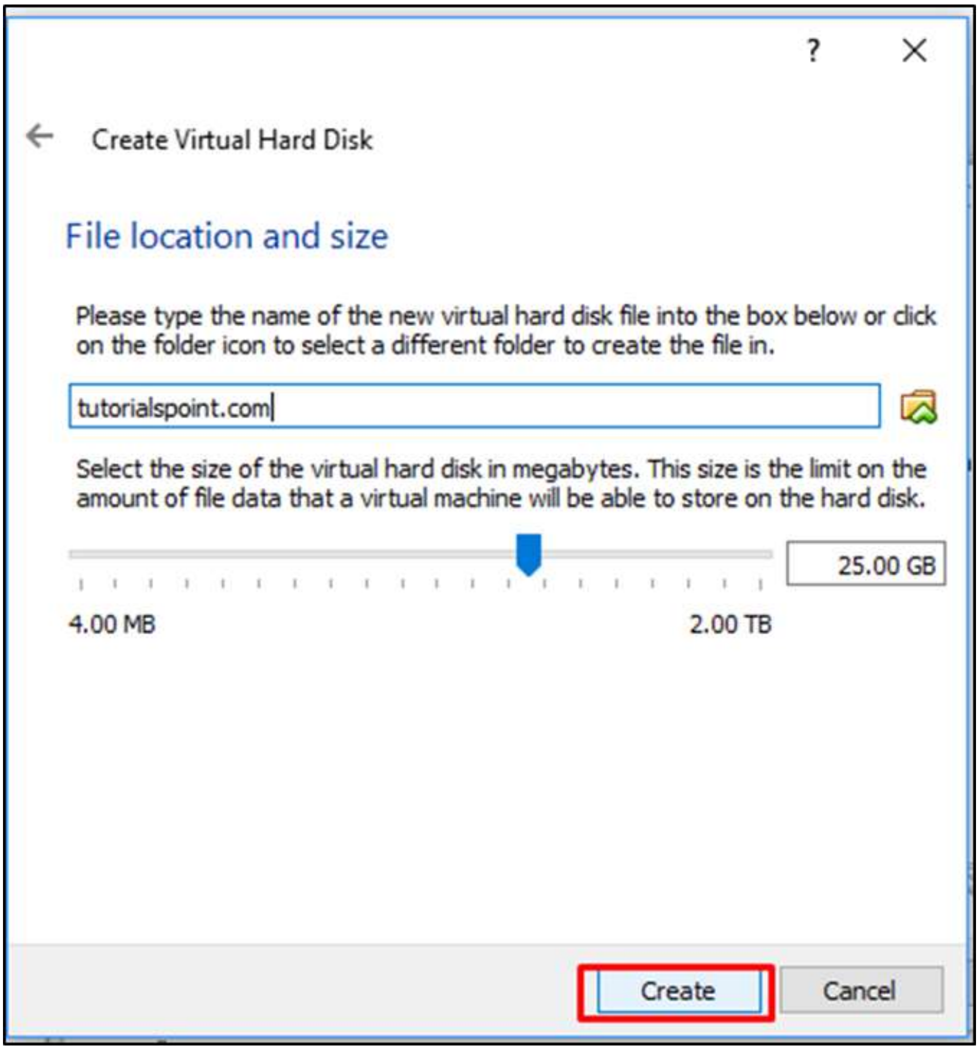
A **dynamically allocated** hard disk file will only use space on your physical hard disk as it fills up (up to a maximum **fixed size**), although it will not shrink again automatically when space on it is freed.

A **fixed size** hard disk file may take longer to create on some systems but is often faster to use.

● Dynamically allocated

○ Fixed size

Step 8: Put a name for your virtual HDD file and select the disk size for your VM → Click on "Create".



File location and size

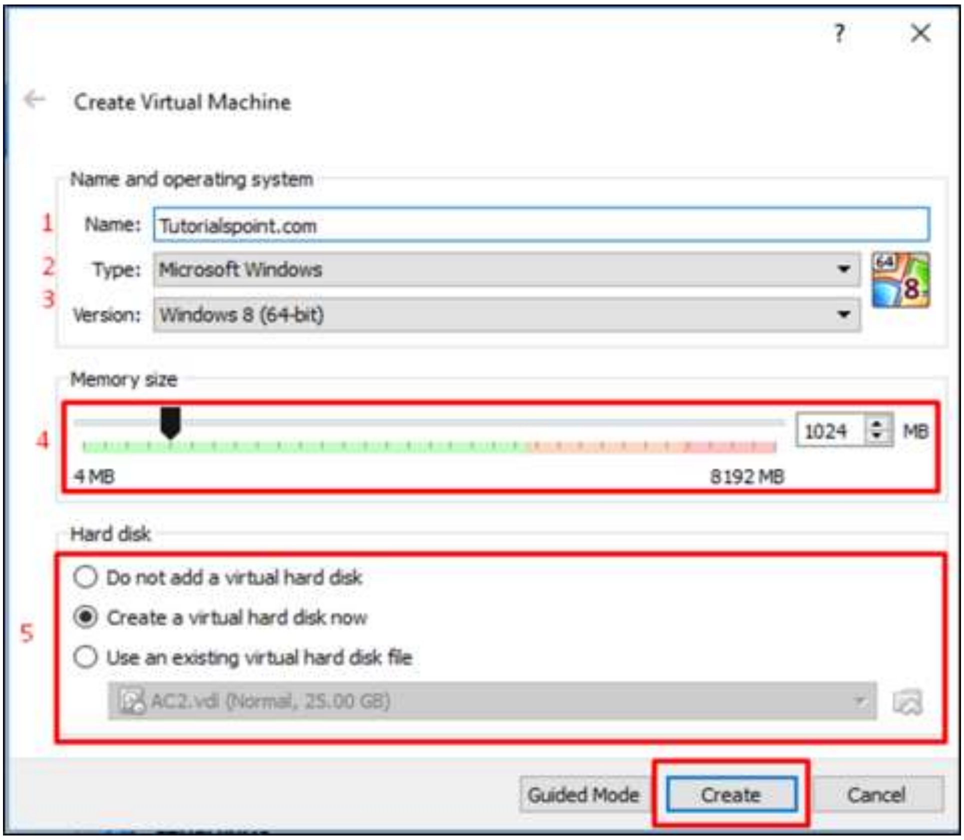
Please type the name of the new virtual hard disk file into the box below or click on the folder icon to select a different folder to create the file in.

tutorialspoint.com

Select the size of the virtual hard disk in megabytes. This size is the limit on the amount of file data that a virtual machine will be able to store on the hard disk.

25.00 GB

All the above steps can be done in one shot by selecting the “Expert mode”.



Create Virtual Machine

Name and operating system

1 Name: Tutorialspoint.com

2 Type: Microsoft Windows

3 Version: Windows 8 (64-bit)

Memory size

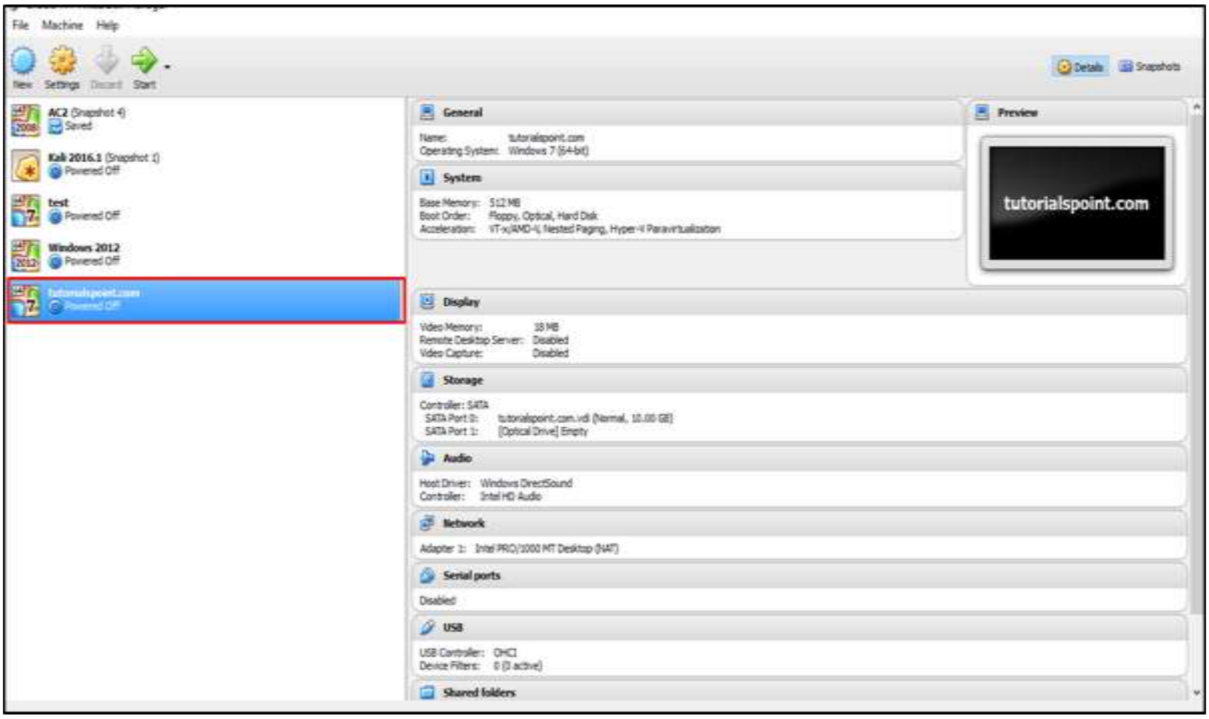
4 4 MB — 8192 MB: 1024 MB

Hard disk

5
- ○ Do not add a virtual hard disk
- ● Create a virtual hard disk now
- ○ Use an existing virtual hard disk file

AC2.vdi (Normal, 25.00 GB)

The virtual machine created will be as shown in the screenshot below.



AC2 (Snapshot 4) — Saved

Kali 2016.1 (Snapshot 1) — Powered Off

test — Powered Off

Windows 2012 — Powered Off

tutorialspoint.com — Powered Off

General

Name: tutorialspoint.com
Operating System: Windows 7 (64-bit)

System

Base Memory: 512 MB
Boot Order: Floppy, Optical, Hard Disk
Acceleration: VT-x/AMD-V, Nested Paging, Hyper-V Paravirtualization

Preview

tutorialspoint.com

Display

Video Memory: 18 MB
Remote Desktop Server: Disabled
Video Capture: Disabled

Storage

Controller: SATA
SATA Port 0: tutorialspoint.com.vdi (Normal, 10.00 GB)
SATA Port 1: [Optical Drive] Empty

Audio

Host Driver: Windows DirectSound
Controller: Intel HD Audio

Network

Adapter 1: Intel PRO/1000 MT Desktop (NAT)

Serial ports

Disabled

USB

USB Controller: OHCI
Device Filters: 0 (0 active)

Shared folders

Setting up Networking with VirtualBox

There are two types of networking modes in VirtualBox, which are –

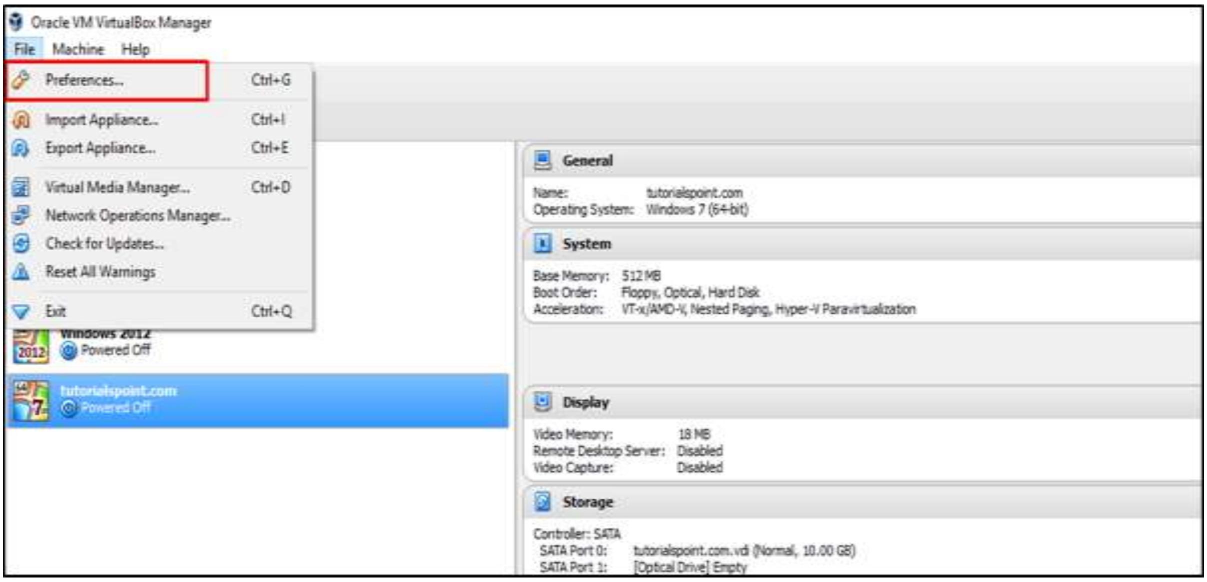
- Nat Networks and
- Host-only Networks.

Both of these are explained in detail below.

Nat Networks

For setting up Nat Networks, we should follow the steps given below.

Step 1: Go to Oracle VM VirtualBox Manager → Click on "Preferences…"



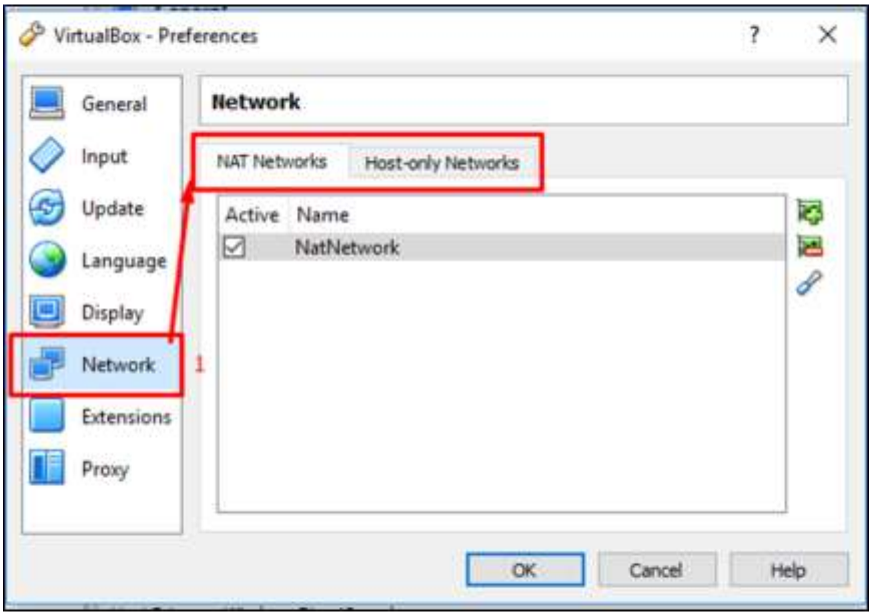
Name: tutorialspoint.com
Operating System: Windows 7 (64-bit)

Base Memory: 512 MB
Boot Order: Floppy, Optical, Hard Disk
Acceleration: VT-x/AMD-V, Nested Paging, Hyper-V Paravirtualization

Video Memory: 18 MB
Remote Desktop Server: Disabled
Video Capture: Disabled

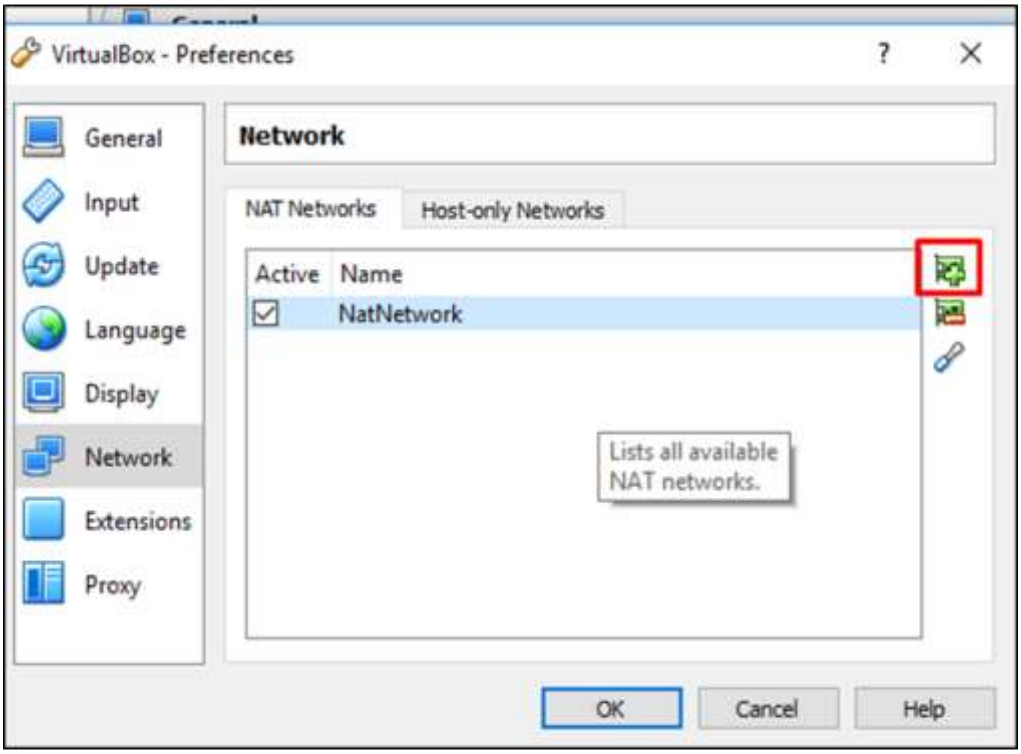
Controller: SATA
SATA Port 0: tutorialspoint.com.vdi (Normal, 10.00 GB)
SATA Port 1: [Optical Drive] Empty

Step 2: Click on "Network" and then on the left panel click on the "NAT Networks" tab.

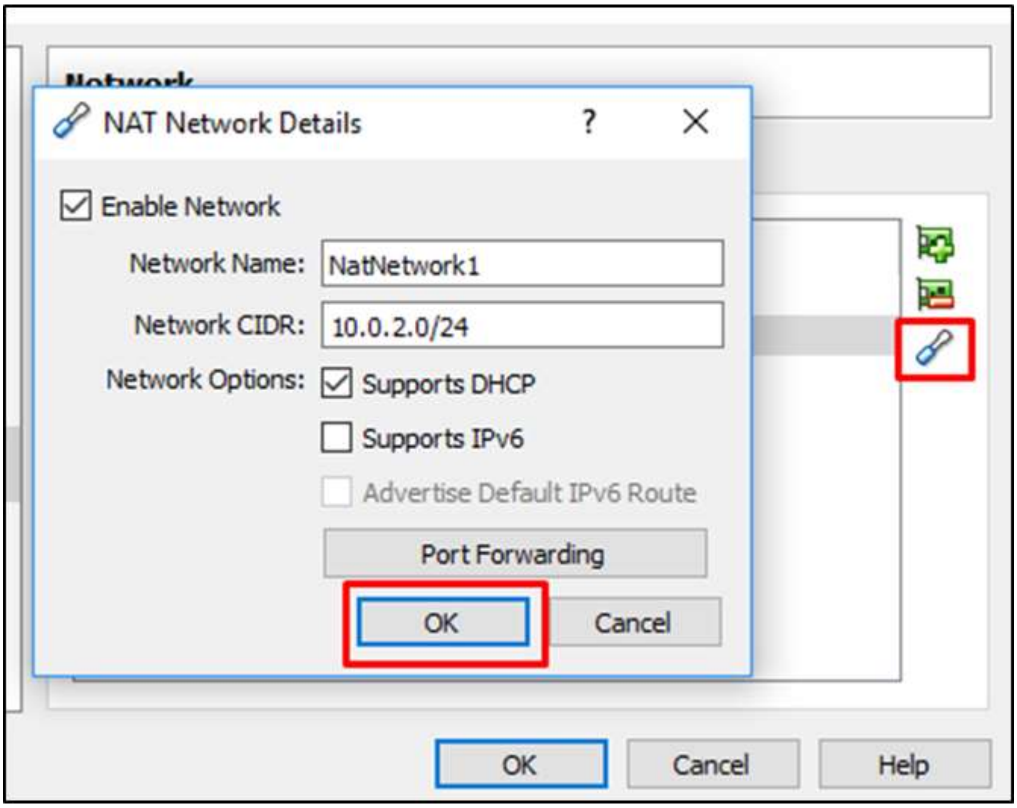


Active	Name
☑	NatNetwork

Step 3: Click on the "+" button, which is highlighted in the screenshot below.



Step 4: Here, we have to put the "Network Name" and the IP range for this network that will be NAT-ed, in order to have access to internet and to other networks.



NAT Network Details

☑ Enable Network

Network Name: NatNetwork1

Network CIDR: 10.0.2.0/24

Network Options: ☑ Supports DHCP

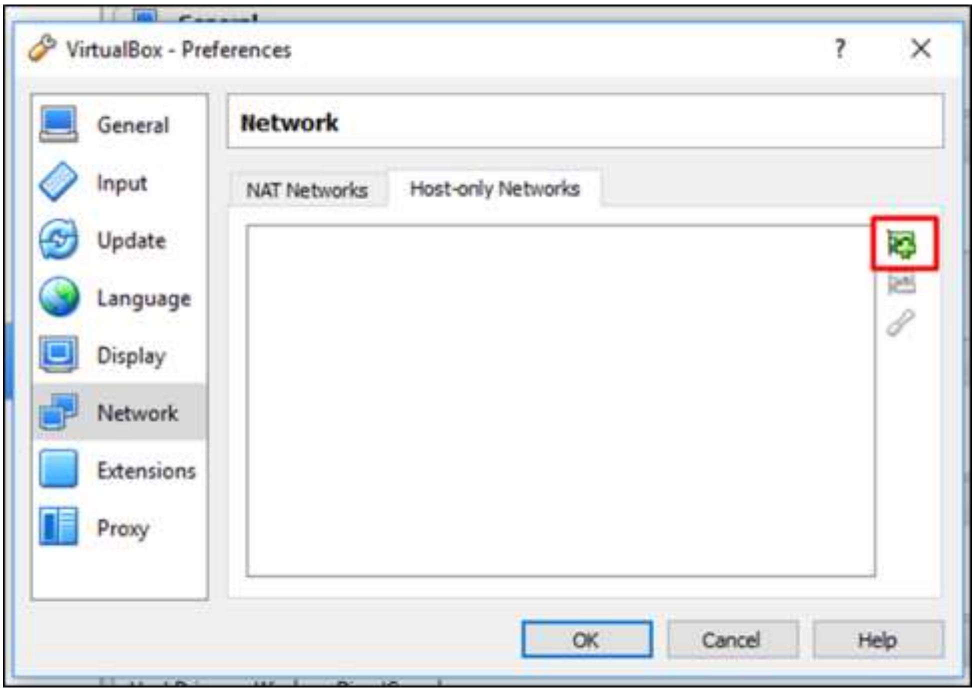
☐ Supports IPv6

☐ Advertise Default IPv6 Route

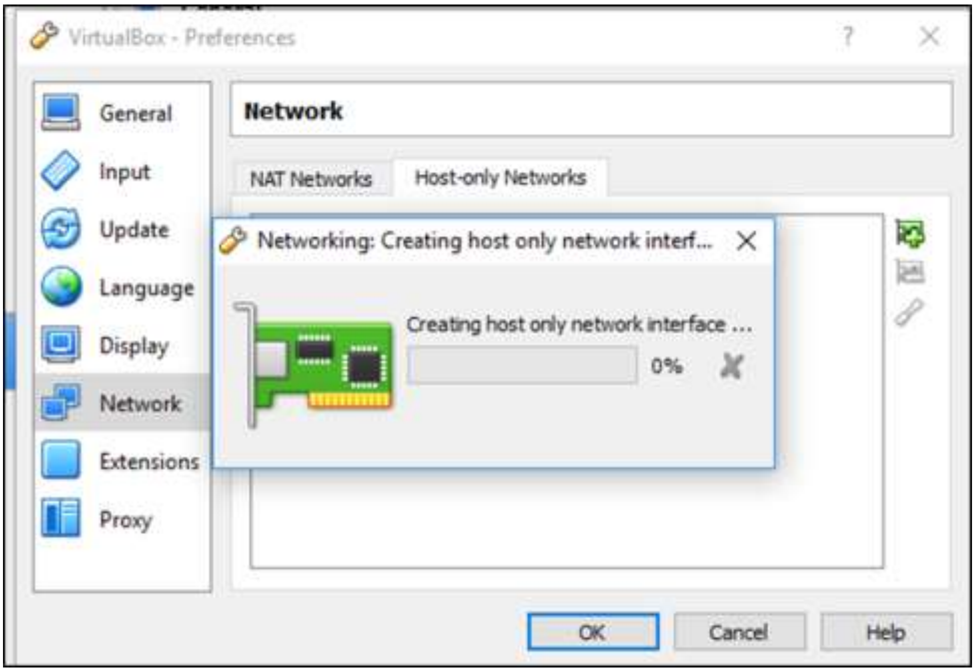
Host-only Networks

For setting up Host-only Networks, we should follow the steps given below.

Step 1: If you click on the "Host-only Networks" tab, you can create networks that are isolated from the other networks. However, VM hosts communicate with each other and the Hypervisor machine. Click on the "+" sign.



Step 2: The host interface will continue to be created as shown in the screenshot below.

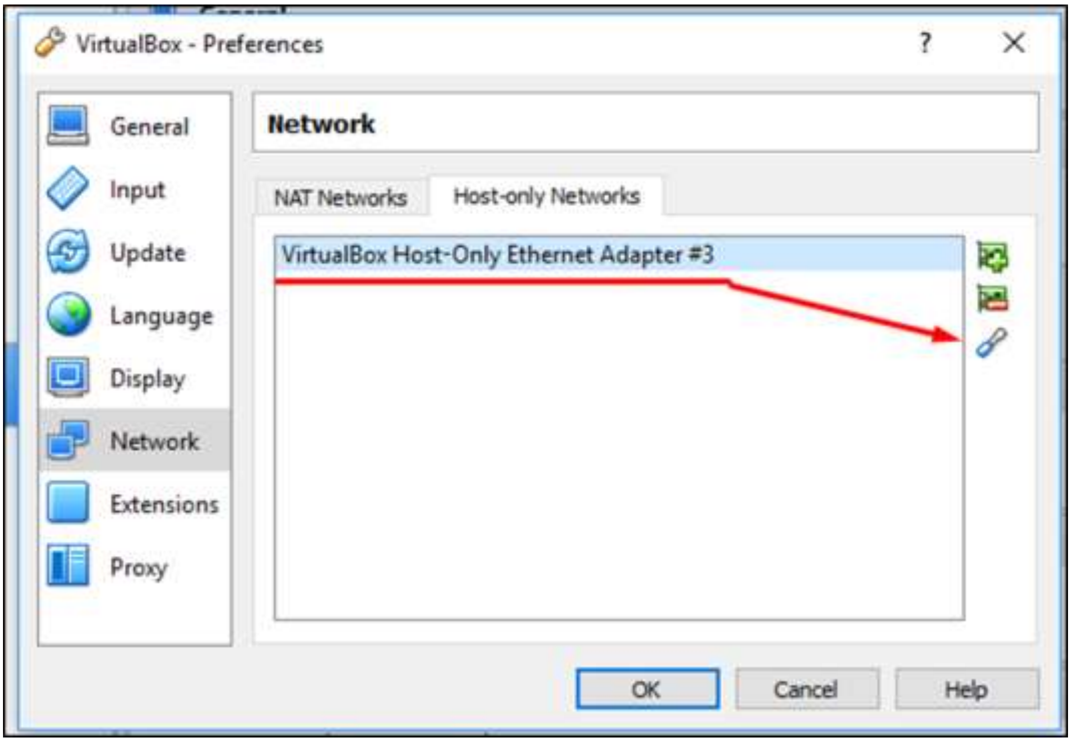


Networking: Creating host only network interf...

Creating host only network interface ...

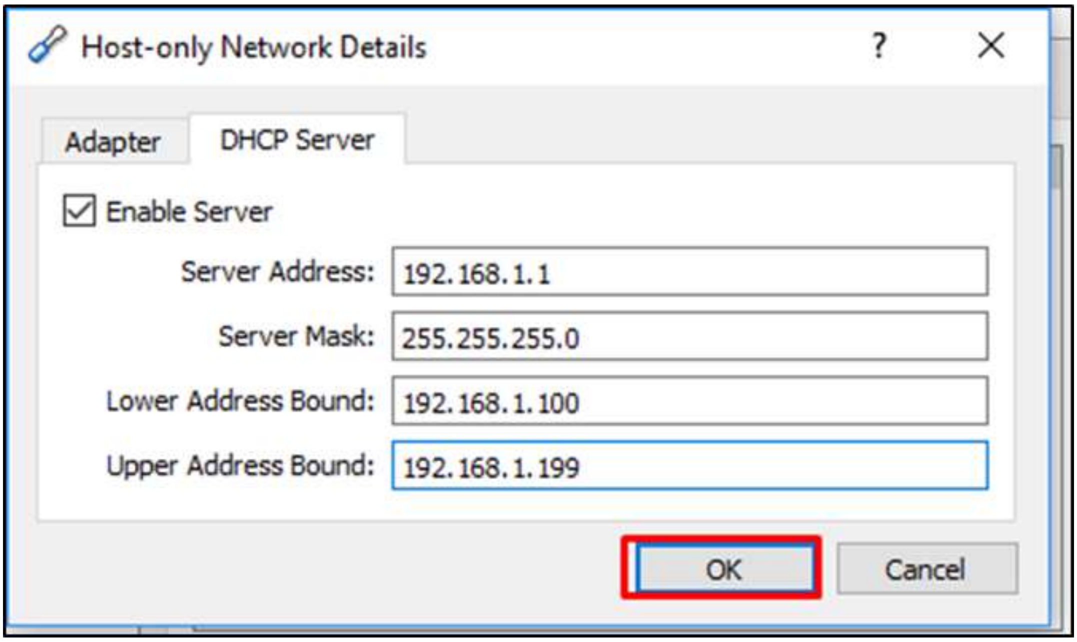
0%

Step 3: If you click on 🔧 button, you can edit the settings.



VirtualBox Host-Only Ethernet Adapter #3

Step 4: If you want your host machines to take "DHCP IP", click on the "DHCP Server" tab and check the box "Enable Server" → Click "OK".



☑ Enable Server

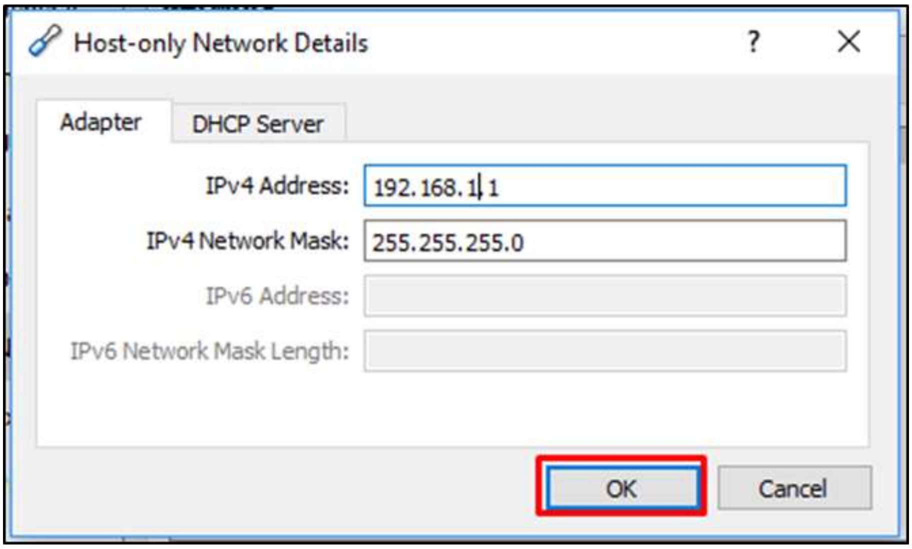
Server Address: 192.168.1.1

Server Mask: 255.255.255.0

Lower Address Bound: 192.168.1.100

Upper Address Bound: 192.168.1.199

Step 5: In the "Adapter" tab, put the IP of the hypervisor.



IPv4 Address: 192.168.1.1

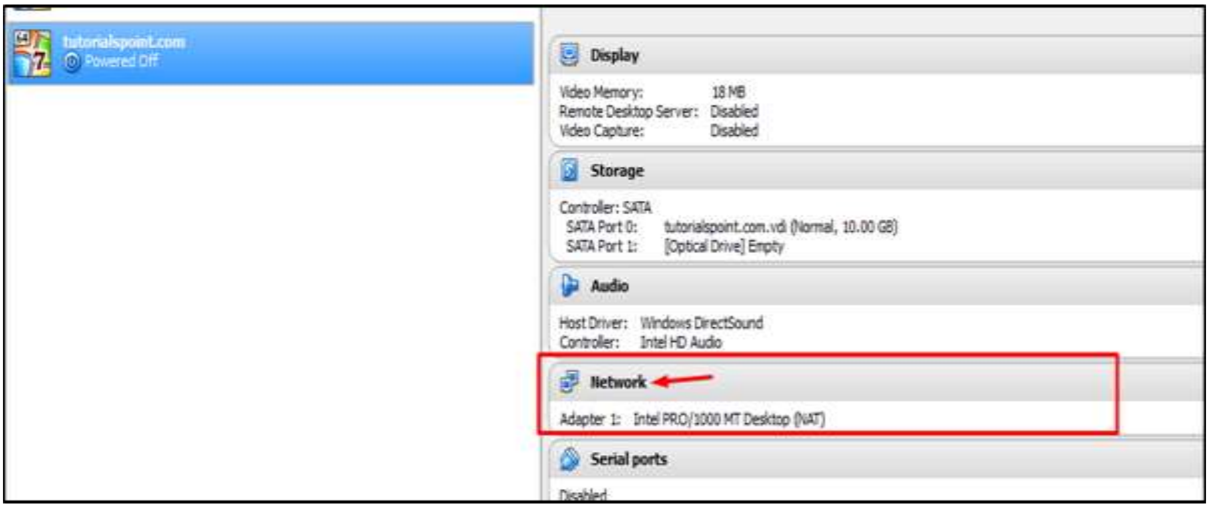
IPv4 Network Mask: 255.255.255.0

IPv6 Address:

IPv6 Network Mask Length:

After all these preparations for setting up the network modes is complete. It is now time to assign a network to our VMs.

To do this, Click on the VMs on the left side of the panel, then right click on the "Network" option and a table will be open.



Video Memory: 18 MB
Remote Desktop Server: Disabled
Video Capture: Disabled

Controller: SATA
SATA Port 0: tutorialspoint.com.vdi (Normal, 10.00 GB)
SATA Port 1: [Optical Drive] Empty

Host Driver: Windows DirectSound
Controller: Intel HD Audio

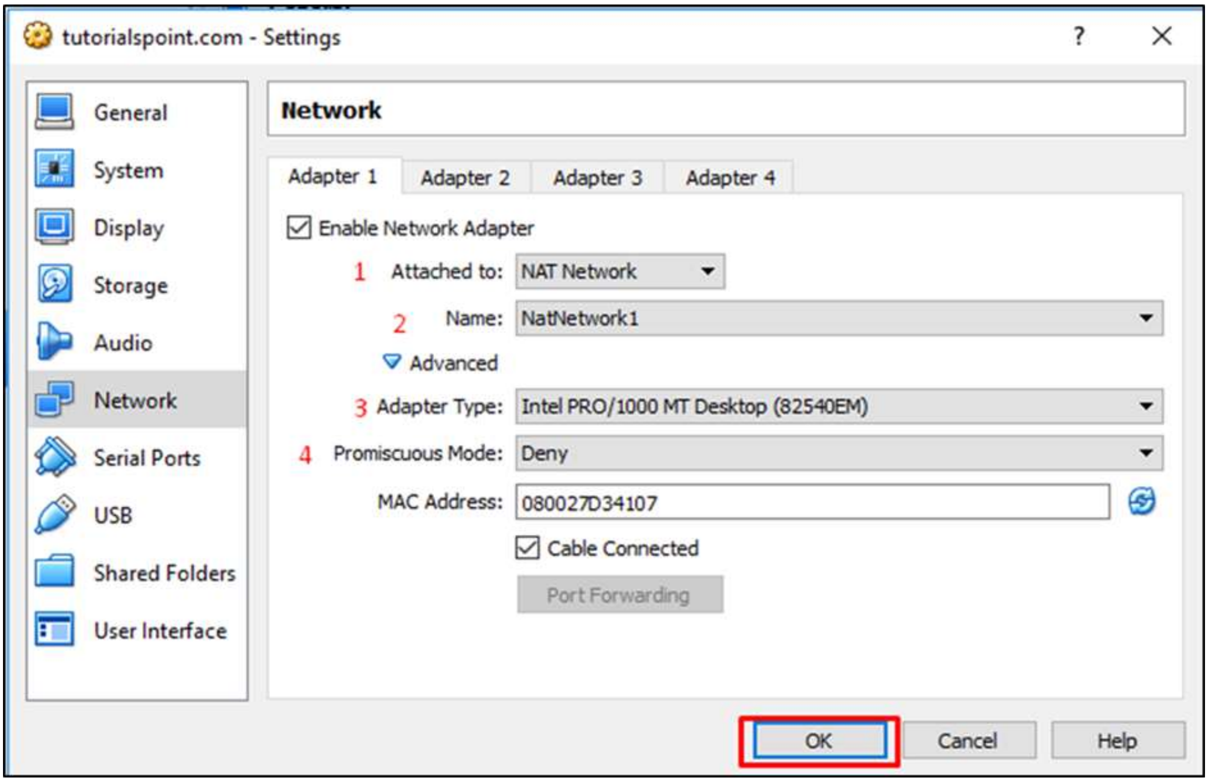
Adapter 1: Intel PRO/1000 MT Desktop (NAT)

Disabled

You can have up to four Ethernet adaptors per machine. The following image has four sections highlighted, which are explained below.

1. Check the box "Enable Network Adapter" to enable the vNIC on the VM and attach it to one network.
2. You can have many networks created, so we have to select one of them in the "Name" dropdown box.
3. In the adapter type dropdown-box, we have to select a physical NIC that the hypervisor has.
4. Promiscuous Mode: Here, we can select "Deny", if we do not want the VMs to communicate with each other.

Once all the above parameters are completed. Click on "OK".



Network

☑ Enable Network Adapter

Attached to: NAT Network

Name: NatNetwork1

Advanced

Adapter Type: Intel PRO/1000 MT Desktop (82540EM)

Promiscuous Mode: Deny

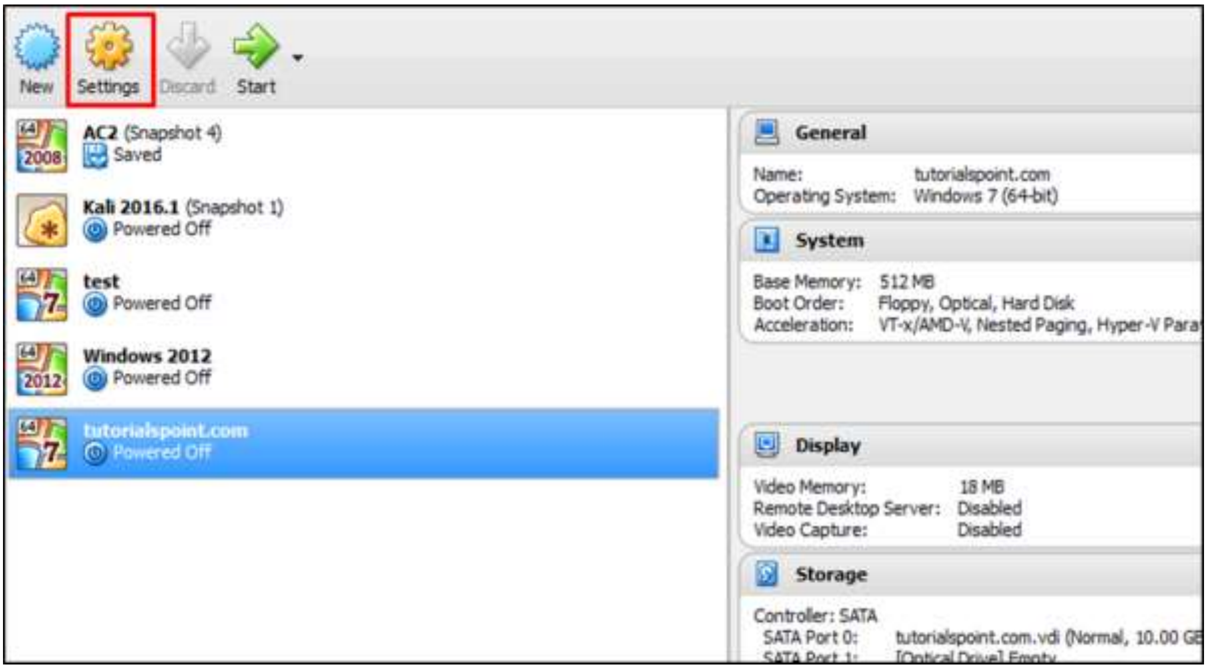
MAC Address: 080027D34107

☑ Cable Connected

Allocating Processors & Memory to a VM

To allocate processors and memory to a virtual machine using VirtualBox, we should follow the steps given below.

Step 1: To allocate a processor and memory, you have to click on "Settings" after you have selected the VM.



AC2 (Snapshot 4)
Saved

Kali 2016.1 (Snapshot 1)
Powered Off

test
Powered Off

Windows 2012
Powered Off

tutorialspoint.com
Powered Off

General

Name: tutorialspoint.com
Operating System: Windows 7 (64-bit)

System

Base Memory: 512 MB
Boot Order: Floppy, Optical, Hard Disk
Acceleration: VT-x/AMD-V, Nested Paging, Hyper-V Para

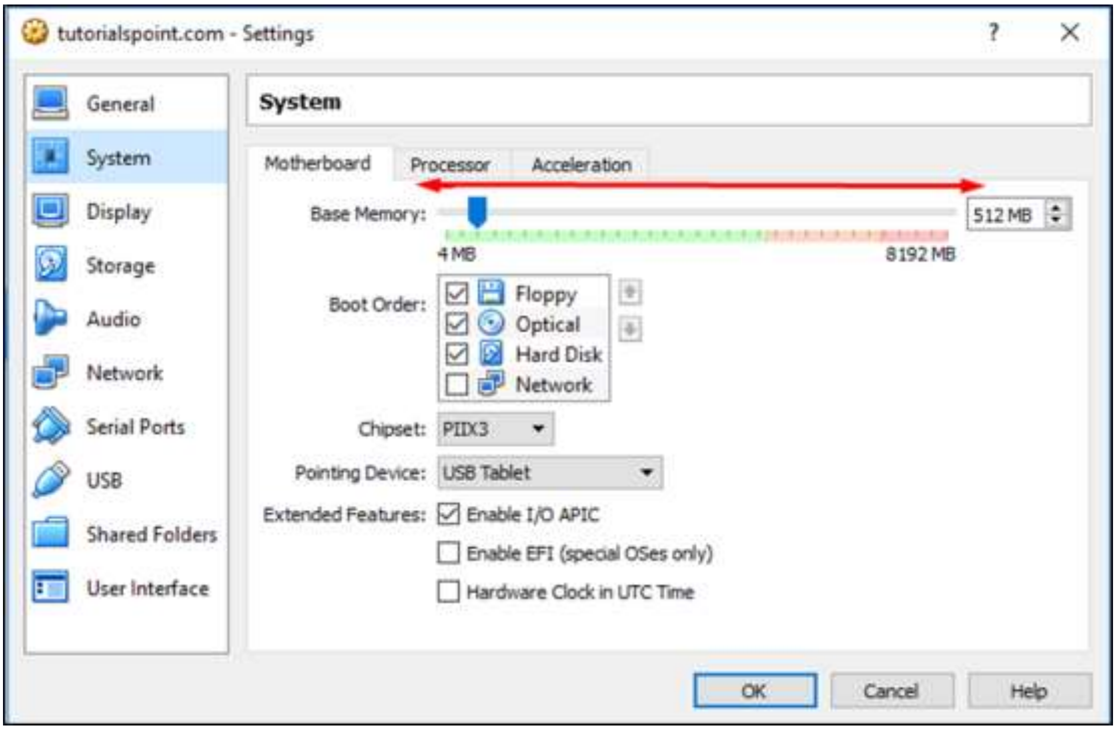
Display

Video Memory: 18 MB
Remote Desktop Server: Disabled
Video Capture: Disabled

Storage

Controller: SATA
SATA Port 0: tutorialspoint.com.vdi (Normal, 10.00 GB
SATA Port 1: [Optical Drive] Empty

Step 2: Click on "System" on the left side tab, then click on the "Motherboard" tab. Move the arrow left or right to allocate the memory as shown in the screenshot below.



tutorialspoint.com - Settings

System

Base Memory: 512 MB (4 MB – 8192 MB)

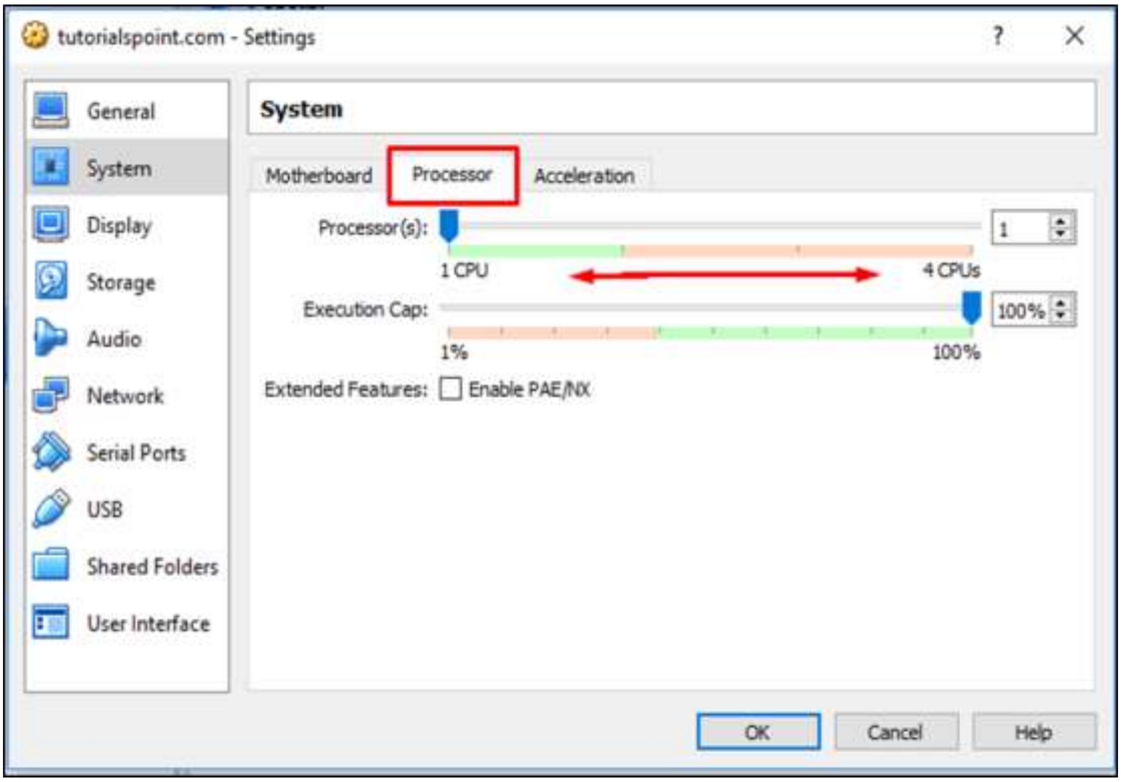
Boot Order:
☑ Floppy
☑ Optical
☑ Hard Disk
□ Network

Chipset: PIIX3

Pointing Device: USB Tablet

Extended Features:
☑ Enable I/O APIC
□ Enable EFI (special OSes only)
□ Hardware Clock in UTC Time

Step 3: To allocate processors, click on the "Processor" tab. Move the arrow left or right to allocate the number of processors as shown in the screenshot below.



tutorialspoint.com - Settings

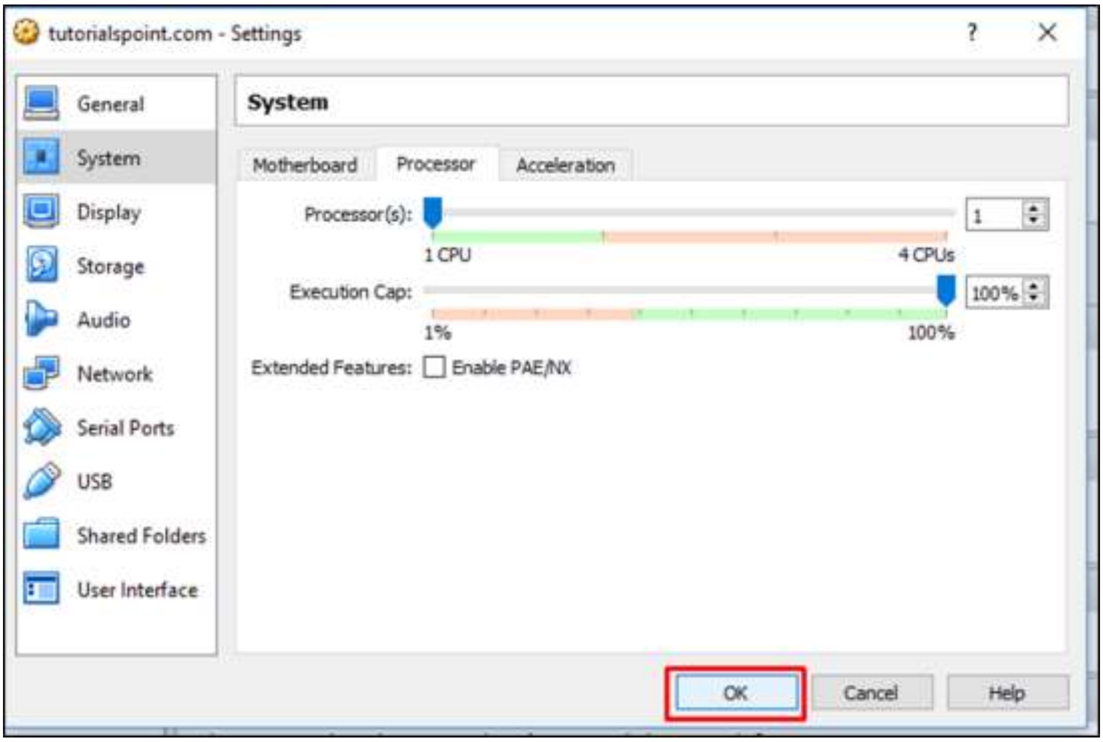
System

Processor(s): 1 (1 CPU – 4 CPUs)

Execution Cap: 100% (1% – 100%)

Extended Features: □ Enable PAE/NX

Step 4: After all those changes are done → click on "OK".



Processor(s): 1

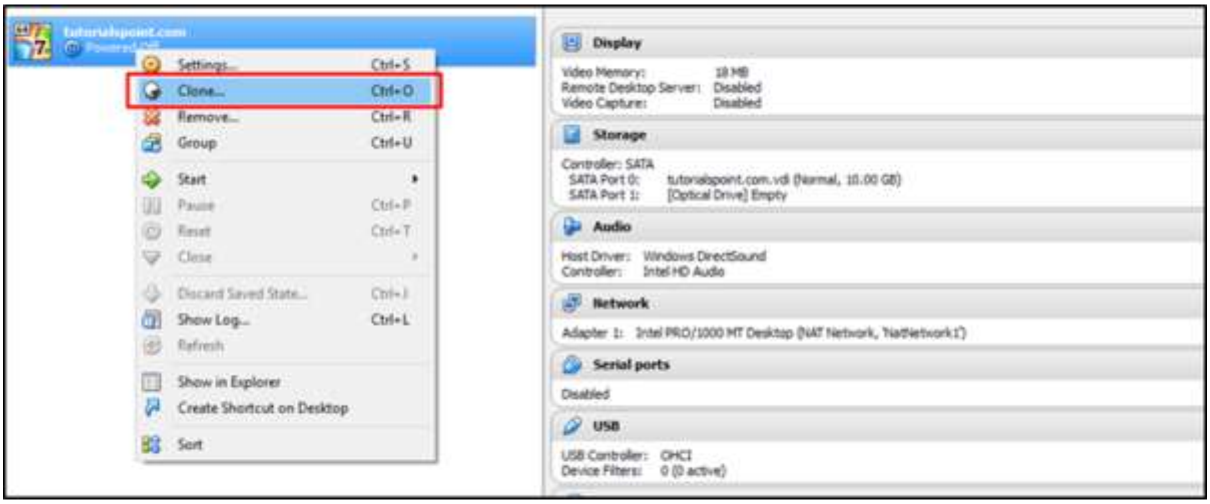
Execution Cap: 100%

Extended Features: □ Enable PAE/NX

Duplicating a VM Using VirtualBox

To duplicate a virtual machine using VirtualBox, we should follow the steps given below.

Step 1: To duplicate a VM that we created before, right click on the VM and select "Clone". A wizard will open.



Video Memory: 18 MB
Remote Desktop Server: Disabled
Video Capture: Disabled

Controller: SATA
SATA Port 0: tutorialspoint.com.vdi (Normal, 10.00 GB)
SATA Port 1: [Optical Drive] Empty

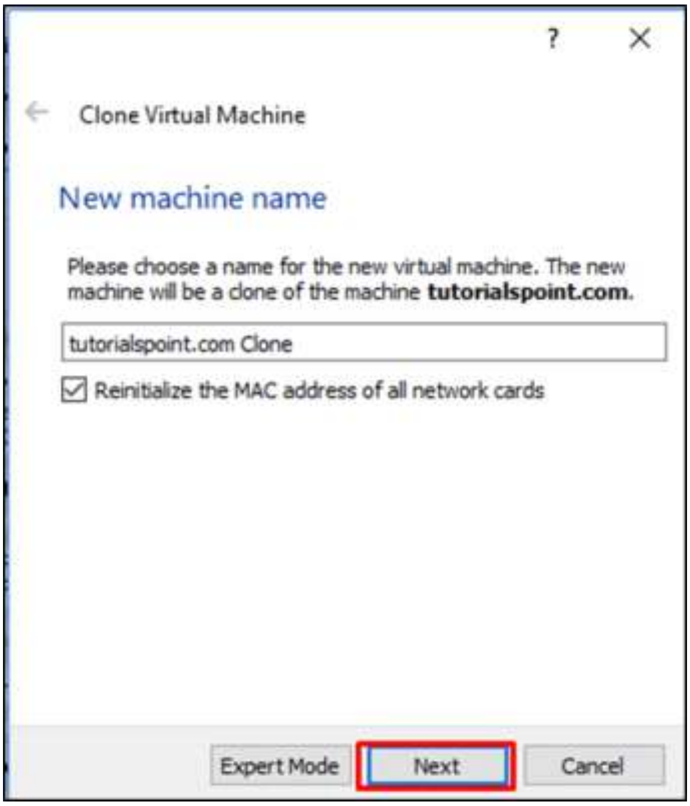
Host Driver: Windows DirectSound
Controller: Intel HD Audio

Adapter 1: Intel PRO/1000 MT Desktop (NAT Network, 'NatNetwork1')

Disabled

USB Controller: OHCI
Device Filters: 0 (0 active)

Step 2: Write the name of the cloning machine and click on "Next".



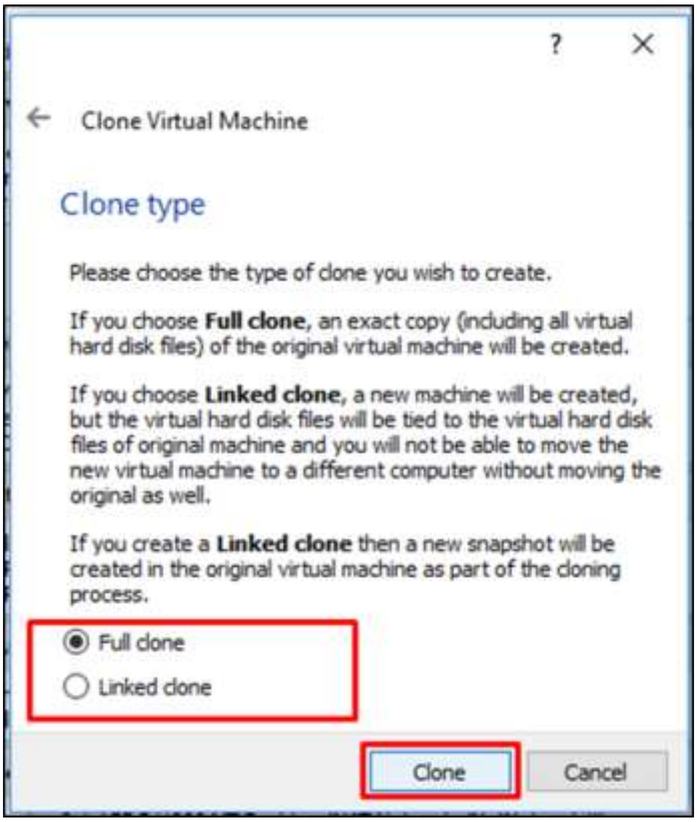
New machine name

Please choose a name for the new virtual machine. The new machine will be a clone of the machine **tutorialspoint.com**.

tutorialspoint.com Clone

☑ Reinitialize the MAC address of all network cards

Step 3: Select one of the options and Click on "Clone".



Clone type

Please choose the type of clone you wish to create.

If you choose **Full clone**, an exact copy (including all virtual hard disk files) of the original virtual machine will be created.

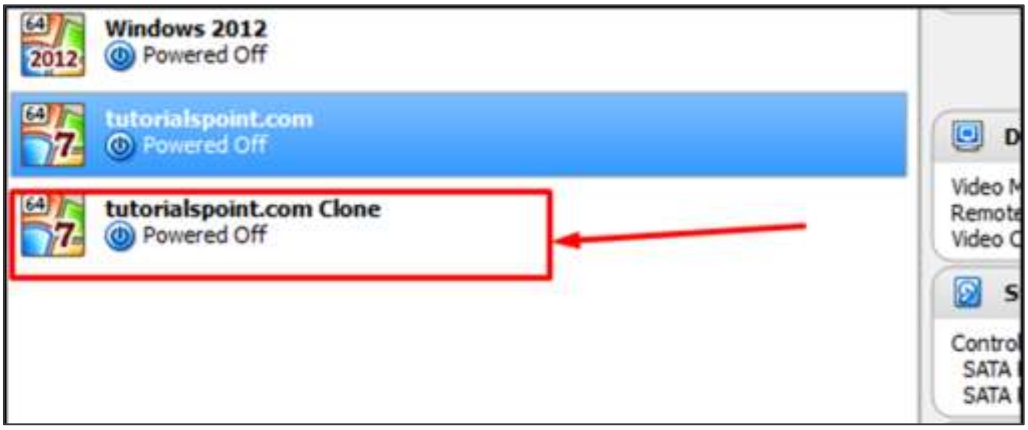
If you choose **Linked clone**, a new machine will be created, but the virtual hard disk files will be tied to the virtual hard disk files of original machine and you will not be able to move the new virtual machine to a different computer without moving the original as well.

If you create a **Linked clone** then a new snapshot will be created in the original virtual machine as part of the cloning process.

● Full clone

○ Linked clone

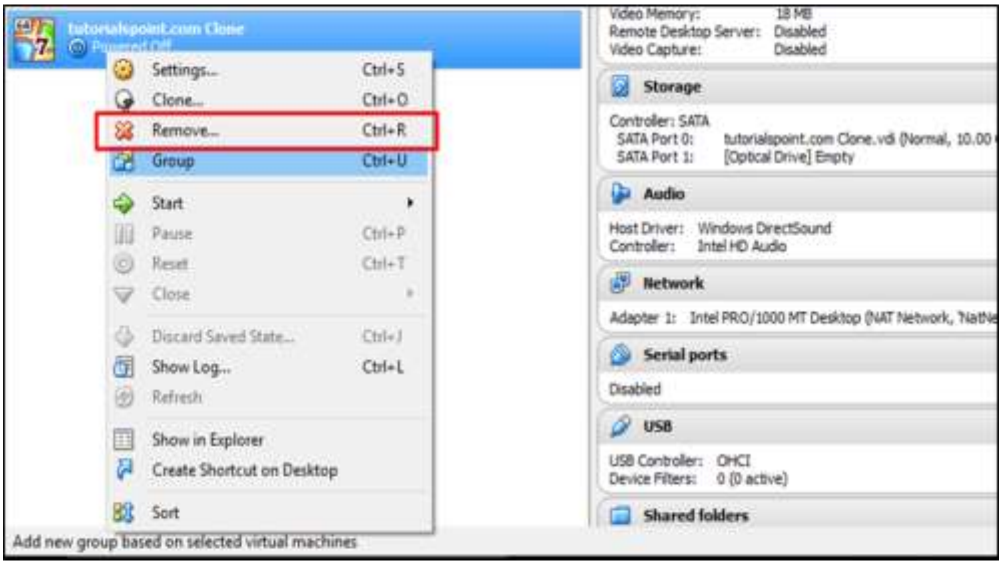
Step 4: The newly created VM will be as shown in the following screenshot.



Deleting a VM on VirtualBox

To delete a virtual machine on VirtualBox, we should follow the steps given below.

Step 1: To start with, we have to right click on the VM that we want to delete and then click on "Remove".



Video Memory: 18 MB
Remote Desktop Server: Disabled
Video Capture: Disabled

Controller: SATA
SATA Port 0: tutorialspoint.com Clone.vdi (Normal, 10.00
SATA Port 1: [Optical Drive] Empty

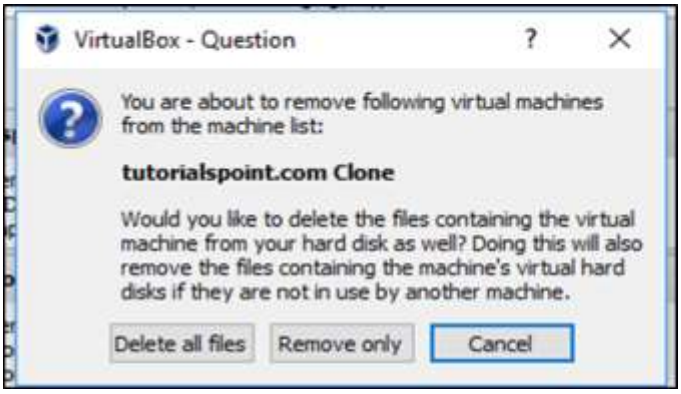
Host Driver: Windows DirectSound
Controller: Intel HD Audio

Adapter 1: Intel PRO/1000 MT Desktop (NAT Network, 'NatNe

Disabled

USB Controller: OHCI
Device Filters: 0 (0 active)

Step 2: To delete a virtual machine completely, select "Delete all files".



You are about to remove following virtual machines from the machine list:

tutorialspoint.com Clone

Would you like to delete the files containing the virtual machine from your hard disk as well? Doing this will also remove the files containing the machine's virtual hard disks if they are not in use by another machine.

8. Virtualization – Openstack

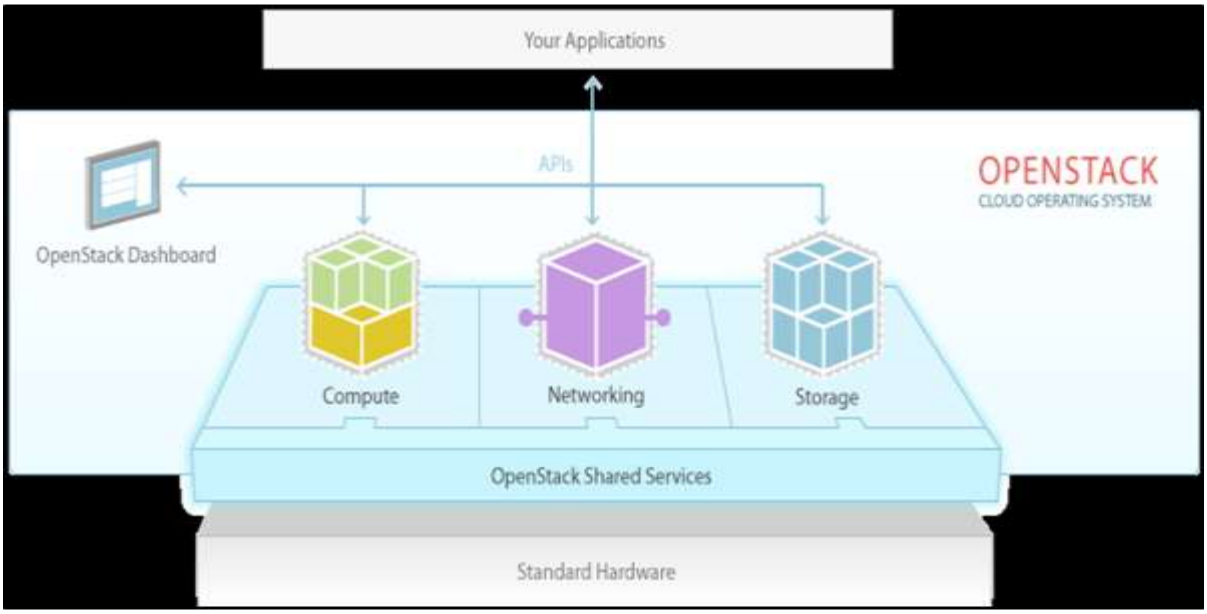
In this chapter, we will discuss regarding Openstack and its role in Virtualization.

Understanding Openstack

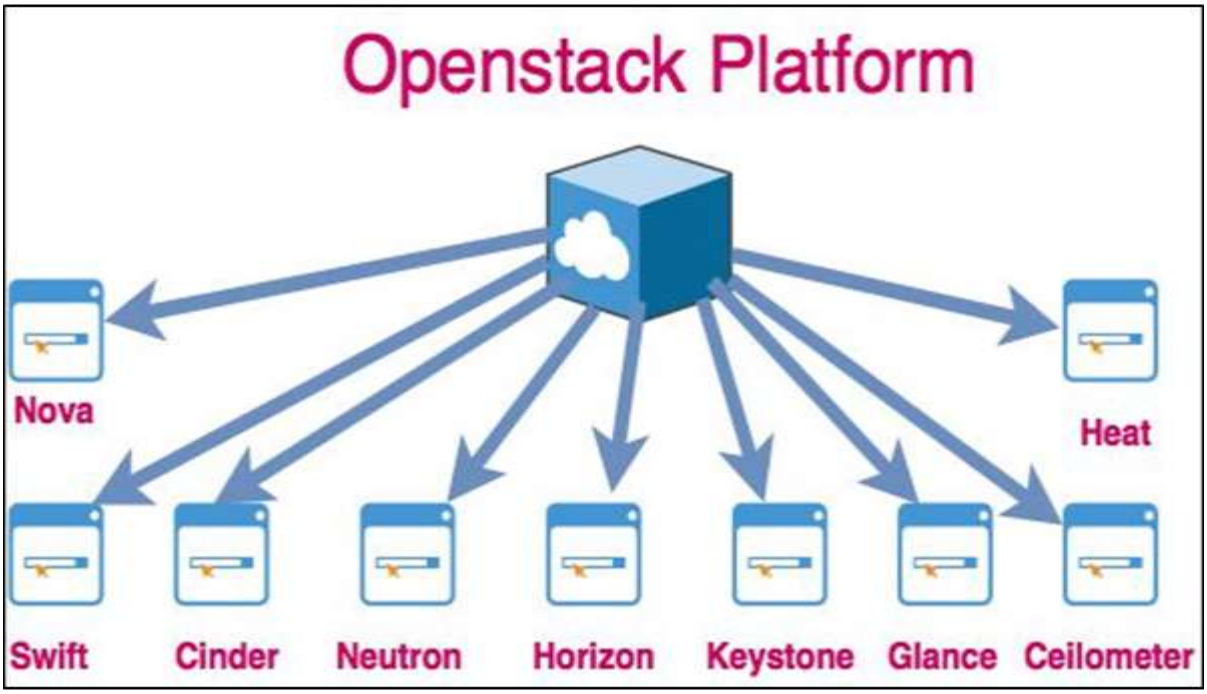
OpenStack is a software for building and managing cloud-computing platforms for public and private clouds. Openstack has one of the biggest communities. It is managed by the OpenStack Foundation, a non-profit organization that oversees both development and community building. Its official webpage is – https://www.openstack.org/.

OpenStack is used to deploy virtual machines and other instances that handle different tasks for managing a cloud environment. OpenStack is considered as – Infrastructure as a Service (IaaS). Based on Openstack, please see the following schematic illustration, which describes how it is managed.

Source: https://www.openstack.org/



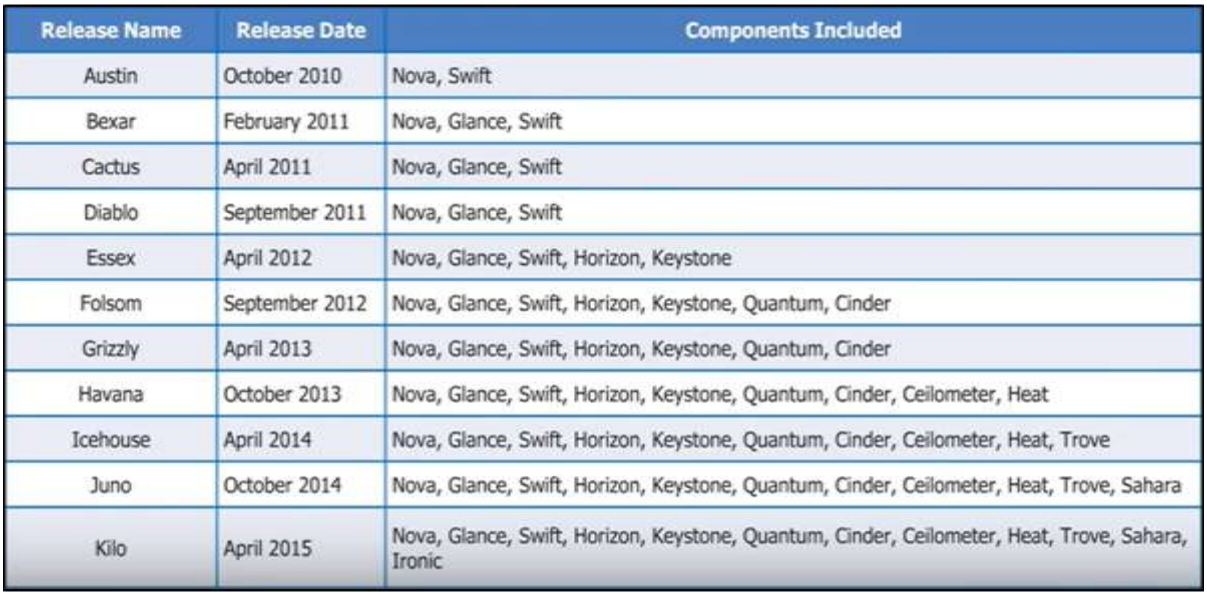
Openstack platform is managed by a web UI dashboard. It comprises of nine Core key components.



These key concepts are described in detail as follows:

- **Nova** is a computing engine. It is used for deploying and managing large numbers of virtual machines.
- **Swift** is a storage system for objects and files.
- **Cinder** is a block storage component. It accesses specific locations on a disk drive.
- **Neutron** provides the networking capability.
- **Horizon** is the dashboard of Openstack. It is the only graphical interface (WEB UI).
- **Keystone** provides identity services. It is essentially a central list of all the users.
- **Glance** provides image services to OpenStack. In this case, "images" refers to images (or virtual copies) of hard disks.
- **Ceilometer** provides telemetry services, which allow the cloud to provide billing services to individual users of the cloud.
- **Heat** allows developers to store the requirements of a cloud application in a file that defines what resources are necessary for that application.

The release versions of Openstack are explained in the following illustration.

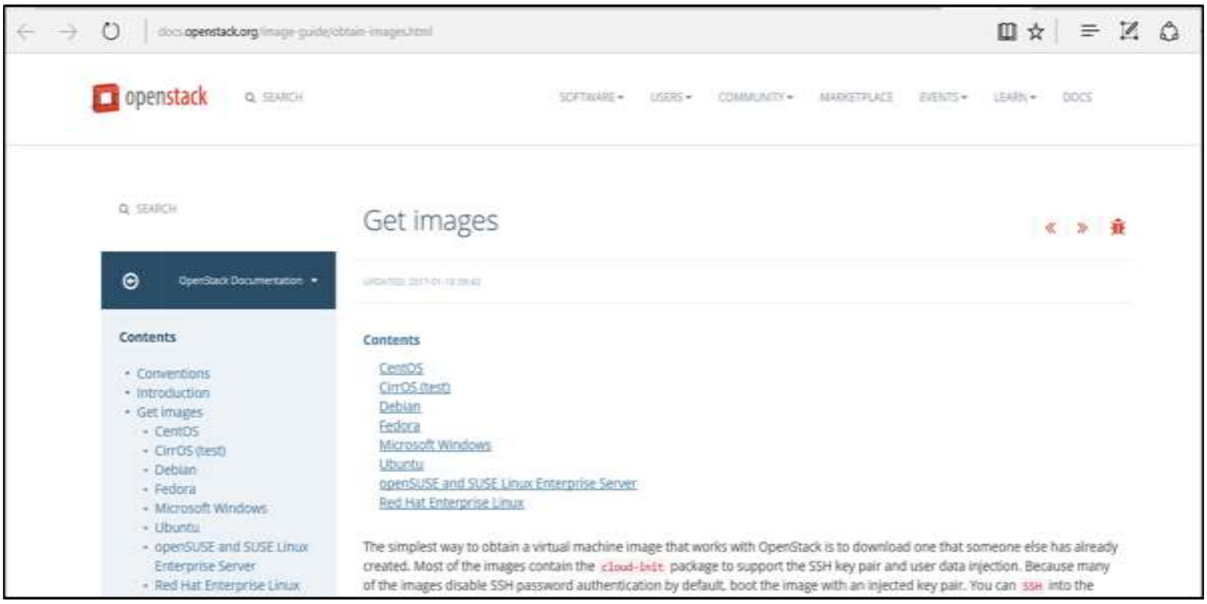


Release Name	Release Date	Components Included
Austin	October 2010	Nova, Swift
Bexar	February 2011	Nova, Glance, Swift
Cactus	April 2011	Nova, Glance, Swift
Diablo	September 2011	Nova, Glance, Swift
Essex	April 2012	Nova, Glance, Swift, Horizon, Keystone
Folsom	September 2012	Nova, Glance, Swift, Horizon, Keystone, Quantum, Cinder
Grizzly	April 2013	Nova, Glance, Swift, Horizon, Keystone, Quantum, Cinder
Havana	October 2013	Nova, Glance, Swift, Horizon, Keystone, Quantum, Cinder, Ceilometer, Heat
Icehouse	April 2014	Nova, Glance, Swift, Horizon, Keystone, Quantum, Cinder, Ceilometer, Heat, Trove
Juno	October 2014	Nova, Glance, Swift, Horizon, Keystone, Quantum, Cinder, Ceilometer, Heat, Trove, Sahara
Kilo	April 2015	Nova, Glance, Swift, Horizon, Keystone, Quantum, Cinder, Ceilometer, Heat, Trove, Sahara, Ironic

Installing Openstack

As Openstack is an open source platform, there are many ways to install and deploy it through different software distributions. Each one of them adds their own value to the cloud operating system.

For a new system administrator, who wants to play with Openstack will get pre-installed ISO images of the Openstack platform. They can be downloaded from the following link – http://docs.openstack.org/image-guide/obtain-images.html



Get images

Contents

- Conventions
- Introduction
- Get images
  - CentOS
  - CirrOS (test)
  - Debian
  - Fedora
  - Microsoft Windows
  - Ubuntu
  - openSUSE and SUSE Linux Enterprise Server
  - Red Hat Enterprise Linux

Contents

CentOS
CirrOS (test)
Debian
Fedora
Microsoft Windows
Ubuntu
openSUSE and SUSE Linux Enterprise Server
Red Hat Enterprise Linux

The simplest way to obtain a virtual machine image that works with OpenStack is to download one that someone else has already created. Most of the images contain the `cloud-init` package to support the SSH key pair and user data injection. Because many of the images disable SSH password authentication by default, boot the image with an injected key pair. You can `ssh` into the

To install them manually, the main distributors are:

- **Ubuntu:** https://www.ubuntu.com/cloud/openstack
- **Red Hat:** https://www.rdoproject.org
- **Suse**: https://www.suse.com/products/suse-openstack-cloud/

We must understand that Openstack is for enterprise environment and to install it we should have the following hardware requirements.

Installation Requirements

The installation requirements for Openstack are as follows:

- A minimum of 5 machines with the following roles:
    - 1 machine for the MAAS server.
    - 1 machine for the Autopilot.
    - 3 or more machines for the cloud:
        - At least one must have 2 NICs.
        - At least 3 must have 2 disks.
- A dedicated switch to create a private cloud LAN.
- Internet access through a router on that LAN.

For this laboratory, we have a virtual machine and we will install **Devstack**. It is designed for installation on a single laptop, PC or VM. It includes the raw upstream code for development evaluation. It is supported on –

- Ubuntu 14.04/16.04
- Fedora 23/24
- CentOS/RHEL 7
- Debian and
- OpenSUSE.

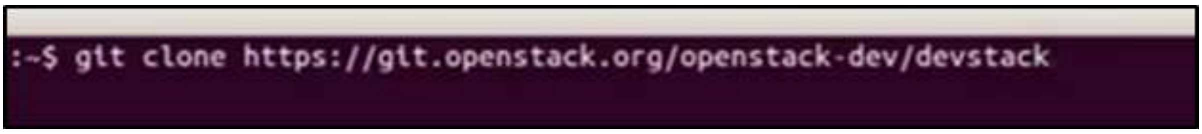
The link for this version is – http://docs.openstack.org/developer/devstack/#install-linux

Installing Openstack on Ubuntu 14.04

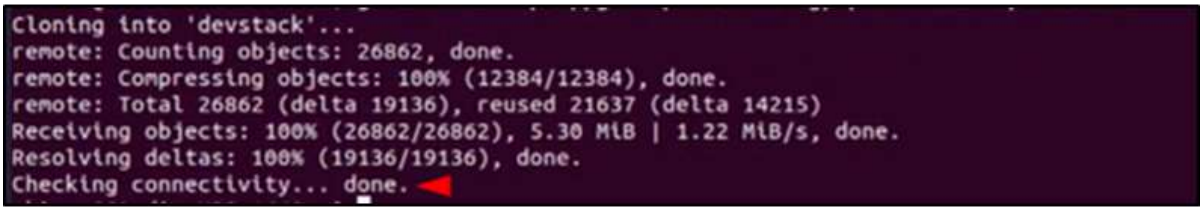
For installing Openstack on Ubuntu 14.04, we should follow the steps given below.

Step 1: Download the installation script from the following link – https://git.openstack.org/cgit/openstack-dev/devstack.

Use this command – ***git clone https://git.openstack.org/openstack-dev/devstack***

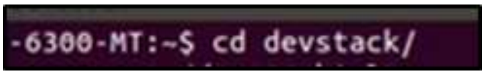


```
:~$ git clone https://git.openstack.org/openstack-dev/devstack
```



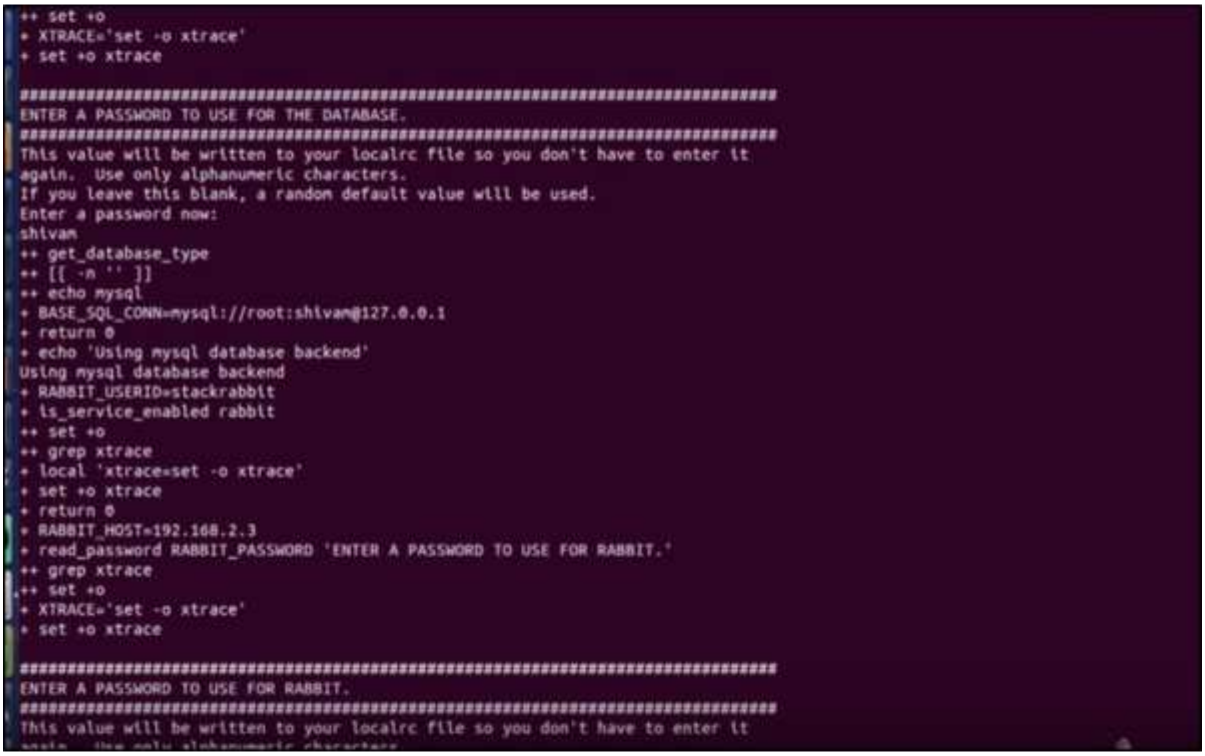
```
Cloning into 'devstack'...
remote: Counting objects: 26862, done.
remote: Compressing objects: 100% (12384/12384), done.
remote: Total 26862 (delta 19136), reused 21637 (delta 14215)
Receiving objects: 100% (26862/26862), 5.30 MiB | 1.22 MiB/s, done.
Resolving deltas: 100% (19136/19136), done.
Checking connectivity... done.
```

Step 2: Browse the folder Devstack by keying in the following command – **$ cddevstack**.



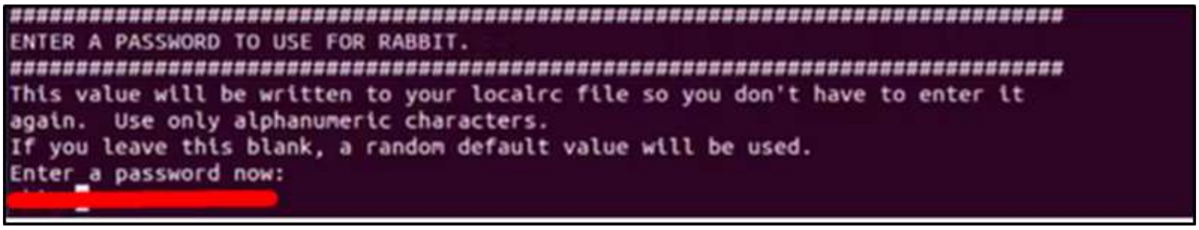
```
-6300-MT:~$ cd devstack/
```

Step 3: Execute the file **stack.sh** with the following command **./stack.sh** and installation process will continue as shown below:



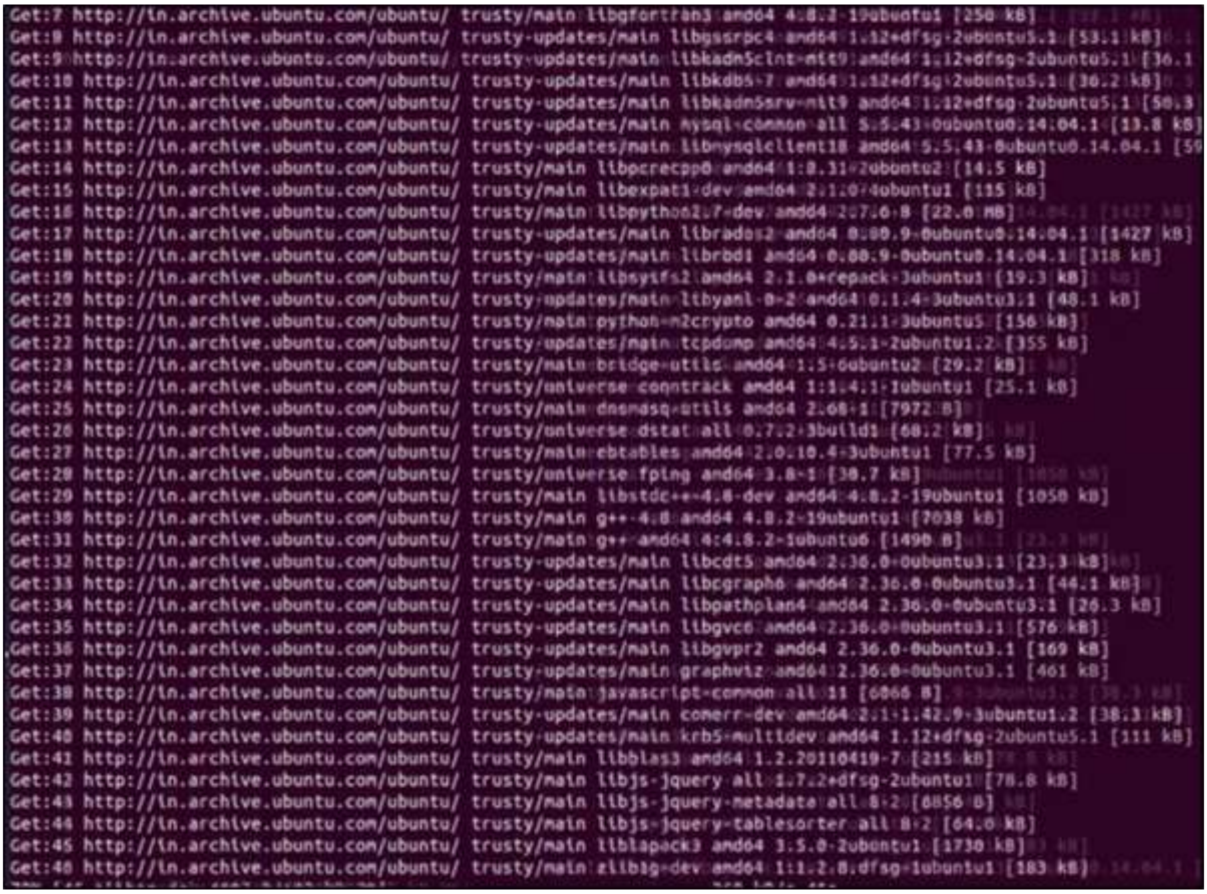
```
++ set +o
+ XTRACE='set -o xtrace'
+ set +o xtrace

#####################################################################################
ENTER A PASSWORD TO USE FOR THE DATABASE.
#####################################################################################
This value will be written to your localrc file so you don't have to enter it
again.  Use only alphanumeric characters.
If you leave this blank, a random default value will be used.
Enter a password now:
shivam
++ get_database_type
++ [[ -n '' ]]
++ echo mysql
+ BASE_SQL_CONN=mysql://root:shivam@127.0.0.1
+ return 0
+ echo 'Using mysql database backend'
Using mysql database backend
+ RABBIT_USERID=stackrabbit
+ is_service_enabled rabbit
++ set +o
++ grep xtrace
+ local 'xtrace=set -o xtrace'
+ set +o xtrace
+ return 0
+ RABBIT_HOST=192.168.2.3
+ read_password RABBIT_PASSWORD 'ENTER A PASSWORD TO USE FOR RABBIT.'
++ grep xtrace
++ set +o
+ XTRACE='set -o xtrace'
+ set +o xtrace

#####################################################################################
ENTER A PASSWORD TO USE FOR RABBIT.
#####################################################################################
This value will be written to your localrc file so you don't have to enter it
again.  Use only alphanumeric characters.
```

Step 4: Enter your password.



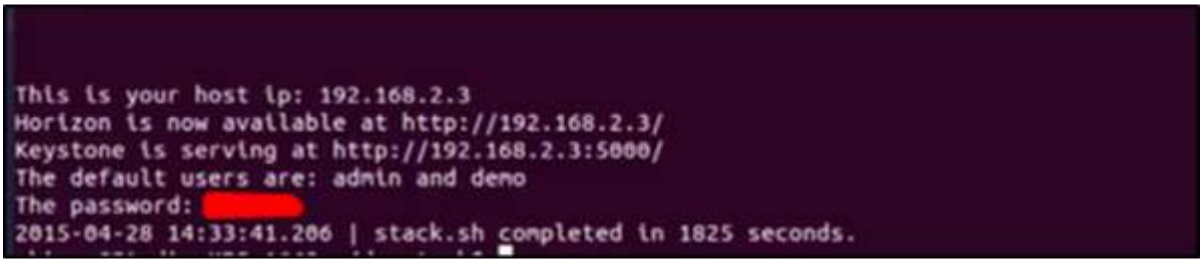
```
#####################################################################################
ENTER A PASSWORD TO USE FOR RABBIT.
#####################################################################################
This value will be written to your localrc file so you don't have to enter it
again.  Use only alphanumeric characters.
If you leave this blank, a random default value will be used.
Enter a password now:
[redacted]
```

Step 5: Now it will take about 15-20 minutes to finish the installation process, while it downloads and installs all the libraries.



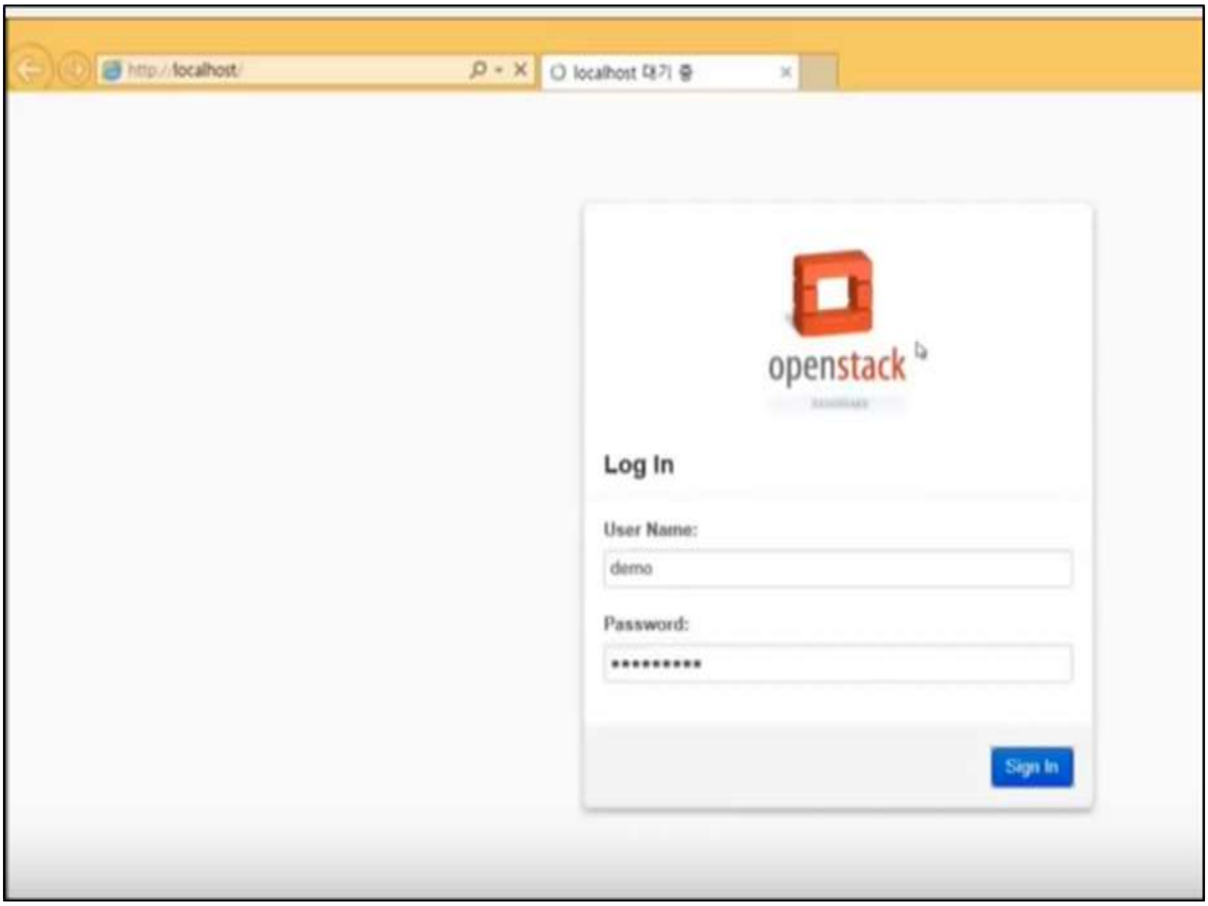
```
Get:7 http://in.archive.ubuntu.com/ubuntu/ trusty/main libgfortran3 amd64 4.8.2-19ubuntu1 [250 kB]
Get:8 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main libgssrpc4 amd64 1.12+dfsg-2ubuntu5.1 [53.1 kB]
Get:9 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main libkadm5clnt-mit9 amd64 1.12+dfsg-2ubuntu5.1 [36.1
Get:10 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main libkdb5-7 amd64 1.12+dfsg-2ubuntu5.1 [36.2 kB]
Get:11 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main libkadm5srv-mit9 amd64 1.12+dfsg-2ubuntu5.1 [50.3
Get:12 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main mysql-common all 5.5.43-0ubuntu0.14.04.1 [13.8 kB]
Get:13 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main libmysqlclient18 amd64 5.5.43-0ubuntu0.14.04.1 [59
Get:14 http://in.archive.ubuntu.com/ubuntu/ trusty/main libpcrecpp0 amd64 1:8.31-2ubuntu2 [14.5 kB]
Get:15 http://in.archive.ubuntu.com/ubuntu/ trusty/main libexpat1-dev amd64 2.1.0-4ubuntu1 [115 kB]
Get:16 http://in.archive.ubuntu.com/ubuntu/ trusty/main libpython2.7-dev amd64 2.7.6-8 [22.0 MB]
Get:17 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main librados2 amd64 0.80.9-0ubuntu0.14.04.1 [1427 kB]
Get:18 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main librbd1 amd64 0.80.9-0ubuntu0.14.04.1 [318 kB]
Get:19 http://in.archive.ubuntu.com/ubuntu/ trusty/main libsysfs2 amd64 2.1.0+repack-3ubuntu1 [19.3 kB]
Get:20 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main libyaml-0-2 amd64 0.1.4-3ubuntu3.1 [48.1 kB]
Get:21 http://in.archive.ubuntu.com/ubuntu/ trusty/main python-m2crypto amd64 0.21.1-3ubuntu5 [156 kB]
Get:22 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main tcpdump amd64 4.5.1-2ubuntu1.2 [355 kB]
Get:23 http://in.archive.ubuntu.com/ubuntu/ trusty/main bridge-utils amd64 1.5-6ubuntu2 [29.2 kB]
Get:24 http://in.archive.ubuntu.com/ubuntu/ trusty/universe conntrack amd64 1:1.4.1-1ubuntu1 [25.1 kB]
Get:25 http://in.archive.ubuntu.com/ubuntu/ trusty/main dnsmasq-utils amd64 2.68-1 [7972 B]
Get:26 http://in.archive.ubuntu.com/ubuntu/ trusty/universe dstat all 0.7.2-3build1 [68.2 kB]
Get:27 http://in.archive.ubuntu.com/ubuntu/ trusty/main ebtables amd64 2.0.10.4-3ubuntu1 [77.5 kB]
Get:28 http://in.archive.ubuntu.com/ubuntu/ trusty/universe fping amd64 3.8-1 [38.7 kB]
Get:29 http://in.archive.ubuntu.com/ubuntu/ trusty/main libstdc++-4.8-dev amd64 4.8.2-19ubuntu1 [1050 kB]
Get:30 http://in.archive.ubuntu.com/ubuntu/ trusty/main g++-4.8 amd64 4.8.2-19ubuntu1 [7038 kB]
Get:31 http://in.archive.ubuntu.com/ubuntu/ trusty/main g++ amd64 4:4.8.2-1ubuntu6 [1490 B]
Get:32 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main libcdt5 amd64 2.36.0-0ubuntu3.1 [23.3 kB]
Get:33 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main libcgraph6 amd64 2.36.0-0ubuntu3.1 [44.1 kB]
Get:34 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main libpathplan4 amd64 2.36.0-0ubuntu3.1 [26.3 kB]
Get:35 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main libgvc6 amd64 2.36.0-0ubuntu3.1 [576 kB]
Get:36 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main libgvpr2 amd64 2.36.0-0ubuntu3.1 [169 kB]
Get:37 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main graphviz amd64 2.36.0-0ubuntu3.1 [461 kB]
Get:38 http://in.archive.ubuntu.com/ubuntu/ trusty/main javascript-common all 11 [6066 B]
Get:39 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main comerr-dev amd64 2.1-1.42.9-3ubuntu1.2 [38.3 kB]
Get:40 http://in.archive.ubuntu.com/ubuntu/ trusty-updates/main krb5-multidev amd64 1.12+dfsg-2ubuntu5.1 [111 kB]
Get:41 http://in.archive.ubuntu.com/ubuntu/ trusty/main libblas3 amd64 1.2.20110419-7 [215 kB]
Get:42 http://in.archive.ubuntu.com/ubuntu/ trusty/main libjs-jquery all 1.7.2+dfsg-2ubuntu1 [78.8 kB]
Get:43 http://in.archive.ubuntu.com/ubuntu/ trusty/main libjs-jquery-metadata all 8-2 [6856 B]
Get:44 http://in.archive.ubuntu.com/ubuntu/ trusty/main libjs-jquery-tablesorter all 8-2 [64.0 kB]
Get:45 http://in.archive.ubuntu.com/ubuntu/ trusty/main liblapack3 amd64 3.5.0-2ubuntu1 [1730 kB]
Get:46 http://in.archive.ubuntu.com/ubuntu/ trusty/main zlib1g-dev amd64 1:1.2.8.dfsg-1ubuntu1 [183 kB]
```

Step 6: At the end of the installation, we will see the IP of the host, URL for managing it, username and password to administrate it.



```
This is your host ip: 192.168.2.3
Horizon is now available at http://192.168.2.3/
Keystone is serving at http://192.168.2.3:5000/
The default users are: admin and demo
The password: [redacted]
2015-04-28 14:33:41.206 | stack.sh completed in 1825 seconds.
```

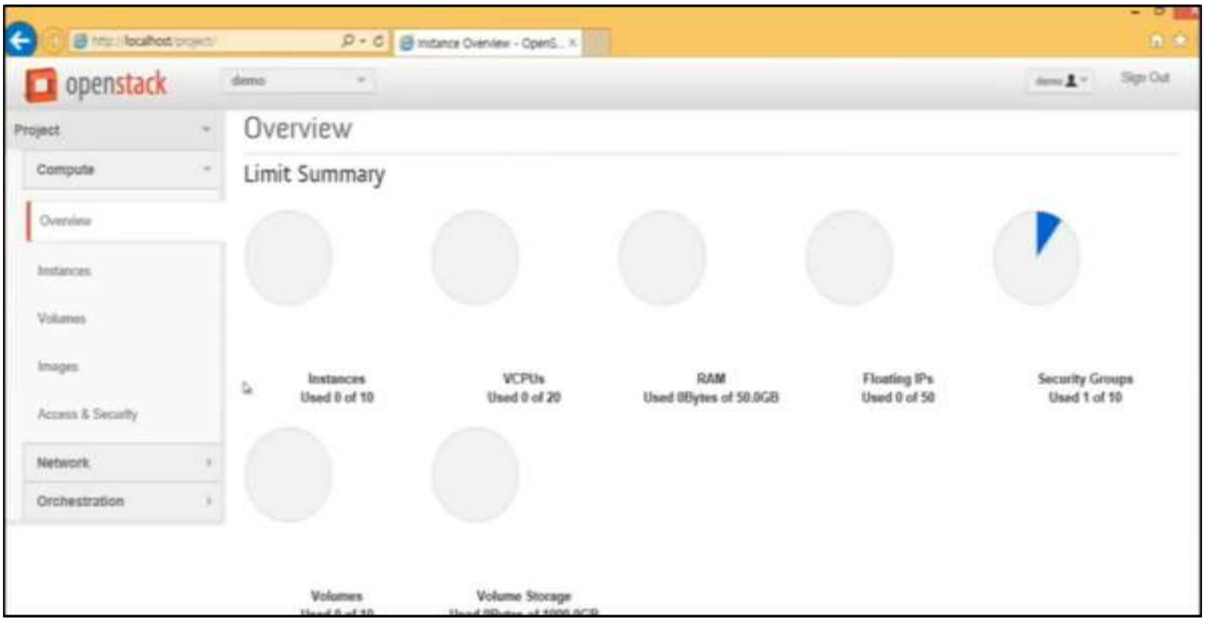
Step 7: To sign in, you have to type in the browser: Host IP, username and password that we entered during the installation.



User Name: demo

Password: **********

Step 8: In the main dashboard, you will see "Instances" overview.



Instances Used 0 of 10

VCPUs Used 0 of 20

RAM Used 0Bytes of 50.0GB

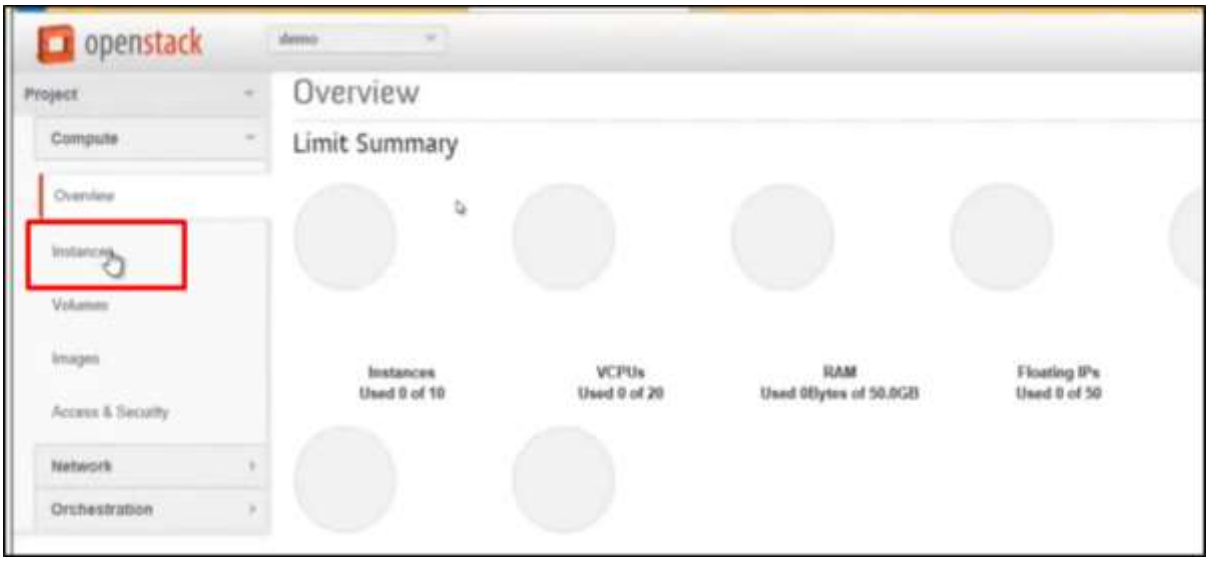
Floating IPs Used 0 of 50

Security Groups Used 1 of 10

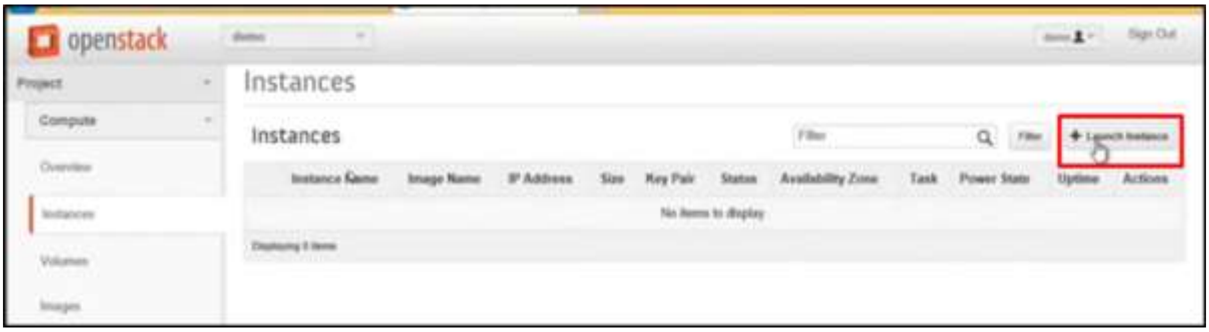
Volumes

Volume Storage

Step 9: To create new instances or in simple words to create Virtual machines click on "Instances".



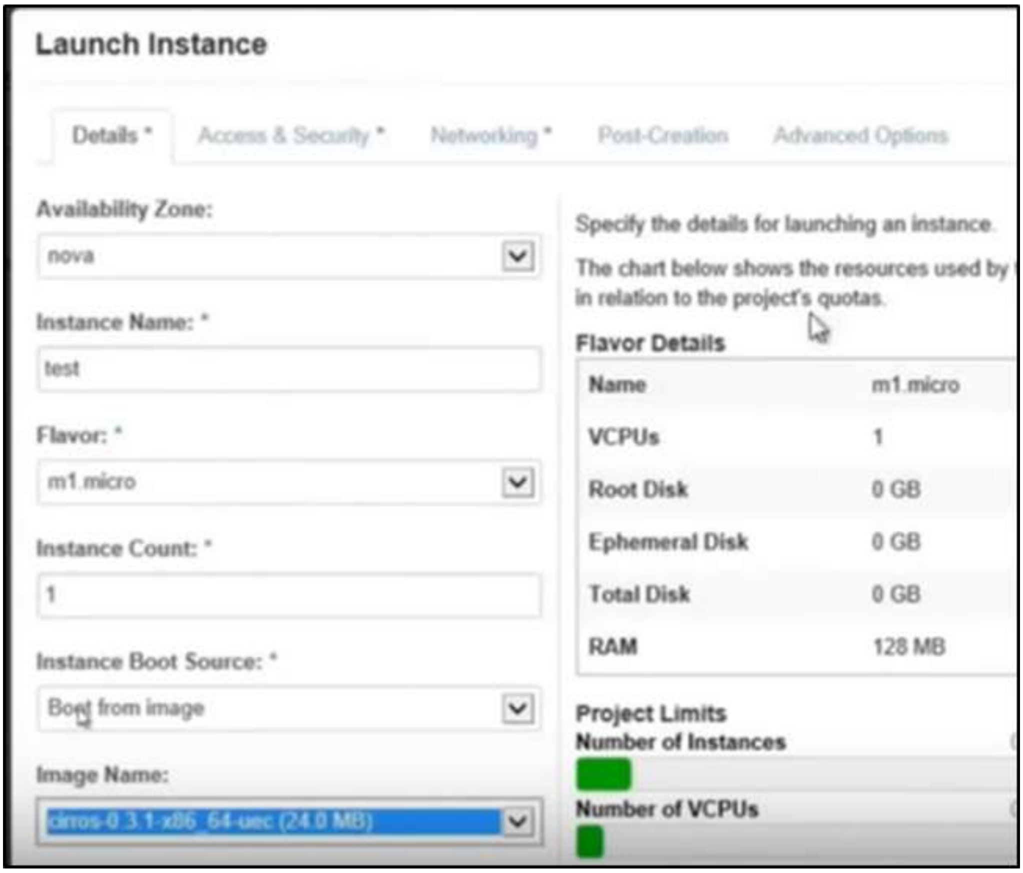
Step 10. Click on "Launch Instances".



Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Uptime	Actions
No items to display										

Displaying 0 items

Step 11: Fill in all the fields as shown below.



Launch Instance

Availability Zone: nova

Instance Name: * test

Flavor: * m1.micro

Instance Count: * 1

Instance Boot Source: * Boot from image

Image Name: cirros-0.3.1-x86_64-uec (24.0 MB)

Specify the details for launching an instance.

The chart below shows the resources used by in relation to the project's quotas.

Flavor Details

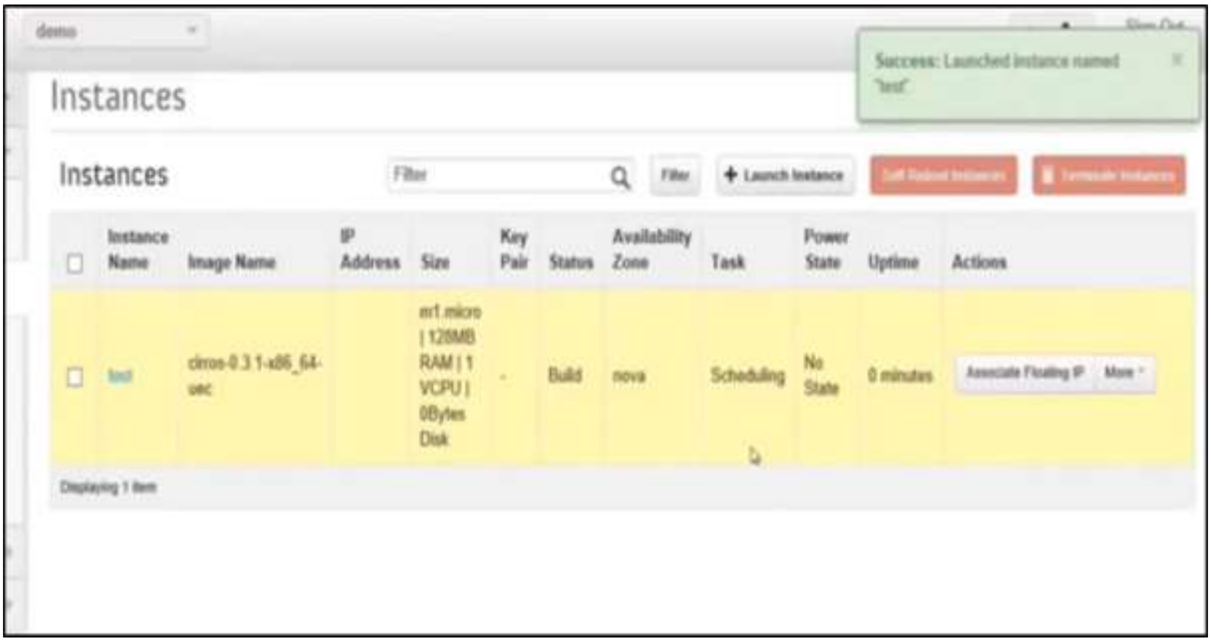
Name	m1.micro
VCPUs	1
Root Disk	0 GB
Ephemeral Disk	0 GB
Total Disk	0 GB
RAM	128 MB

Project Limits

Number of Instances

Number of VCPUs

Step 12: We will see the instance created as shown in the following screenshot.



Success: Launched instance named "test"

Instances

Instances

□	Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Uptime	Actions
□	test	cirros-0.3.1-x86_64-uec		m1.micro | 128MB RAM | 1 VCPU | 0Bytes Disk	-	Build	nova	Scheduling	No State	0 minutes	Associate Floating IP More

Displaying 1 item

9. Virtualization – Preparing the Infrastructure

Virtualization, at least at the server level, has been in use for some time. Since, the concept has expanded to the User, Application, Network, Security, Storage, and of course to Desktop Virtualization (VDI) as well. Therefore, to roll out in all these concepts, we have to prepare an infrastructure before, which is divided in some key components.

The First one is **Hypervisor** and we have discussed it in the earlier chapters. Some important specifications needed for this job are – Processors, Memory and Networking Modes, etc.

Networking - LAN and WAN Optimization

VDI can be very resource intensive – this includes traffic over the wire. Having a good **core-switching infrastructure** will help alleviate this pain by allowing the administrators to create certain rules and policies revolving around traffic flow.

Setting up **QoS metrics** for VDI-specific traffic can help remove congestion and ensure that the right traffic has the proper amount of priority. As for the traffic that is leaving the data center, knowing where the user is located and optimizing their experience based on certain criteria, becomes very important.

Another significant aspect is storage. Large organizations will have numerous storage controllers. At the same time, some smaller organizations will be using only one. Regardless of the amount of storage controllers available, they need to be sized properly for VDI.

To prevent boot and processing storms, organizations must look at IOPS requirements for their images. To alleviate processing pains, administrators can look at **Flash Technologies** (**NetApp**, **Fusion-IO**, **XtremIO**) or **SSD Technologies** (**Violin**, **Nimbus**) to help offload that kind of workload. Furthermore, intermediary platforms like **Atlantis ILIO** run on top of a virtual machine that utilizes massive amounts of RAM as the key storage repository.

Understanding Different File Systems

File systems are varied depending on their functions. Some of the most common ones are listed below:

- Virtual Machine File System- VMFS
- Network File System- NFS
- New Technology File System- NTFS
- Raw Device Mapping- RDM

Let us discuss each of these in detail.

Virtual Machine File System

VMFS is a file system proprietary to VMware. It is a clustered file system and it can be mounted on multiple servers simultaneously. This helps every host to connect to the any file system at the same time, which is expected from a proprietary system preferred by

VMware. Most of the VMware hypervisors will work with other file systems, but the default choice and the preferred choice is VMFS.

Network File System

NFS is a system that was originally developed by Sun, but is now an Open Standard system. Used commonly in the UNIX and Linux world. It is a distributed file system. It can be mounted on one server and the network will be used to share information to multiple machines.

New Technology File System

NTFS is the standard file structure for the Windows NT operating system. It is used for retrieving and storing files on the hard disk.

Raw Device Mapping

RDM helps any file in a virtual machine file system to act as a proxy for any raw device. It allows a VM to access as well as use the storage device.

Choosing Between Different Types of Storage

All the storage devices are divided into three categories, which are –

- Direct-Attached Storage
- Network-Attached Storage
- Storage-Area Network

Let us understand each of these in detail.

Direct-Attached Storage

DAS is your local hard drive. We can have one or more local hard drives in every machine. It is mostly used for small-virtualized systems. This solution is appropriate for a small amount of guest machines. It is the cheapest and the easiest method of storage. You can connect an external hard drive too with this method, load any guest machines onto that external hard drive, and that is just a quick and easy way to get rolling.

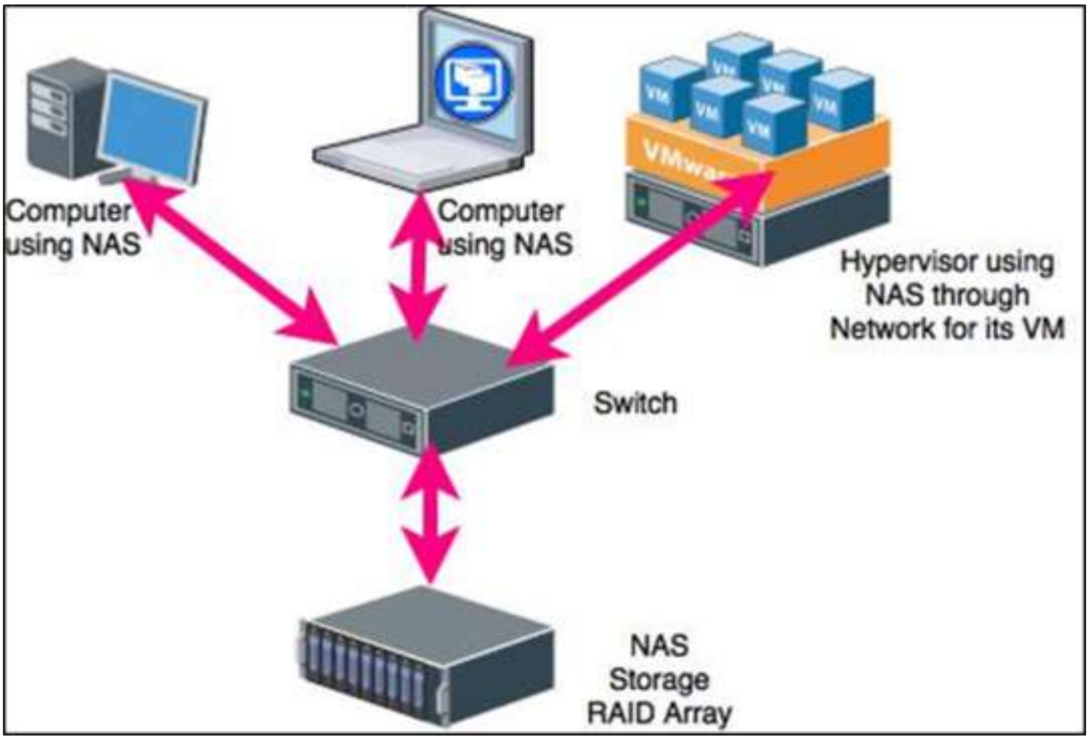
For example – A server that has local hard discs on it. That type of hypervisor can hold not more that 10-20 VM machines. A sample device can be a HP Server with eight local hard discs as shown in the following illustration.

Network-attached Storage

NAS is "Any server that shares its own storage with others on the network and acts as a file server in the simplest form". Network Attached Storage shares files over the network. Some of the most significant protocols used are **SMB**, **NFS**, **CIFS**, and **TCP/IP**. When you access files on a file server on your windows system, it is NAS.

NAS will be using an Ethernet connection for sharing files over the network. The NAS device will have an IP address and then will be accessible over the network through that IP address. Biggest providers of NAS are **QNAP** and **Lenovo**.

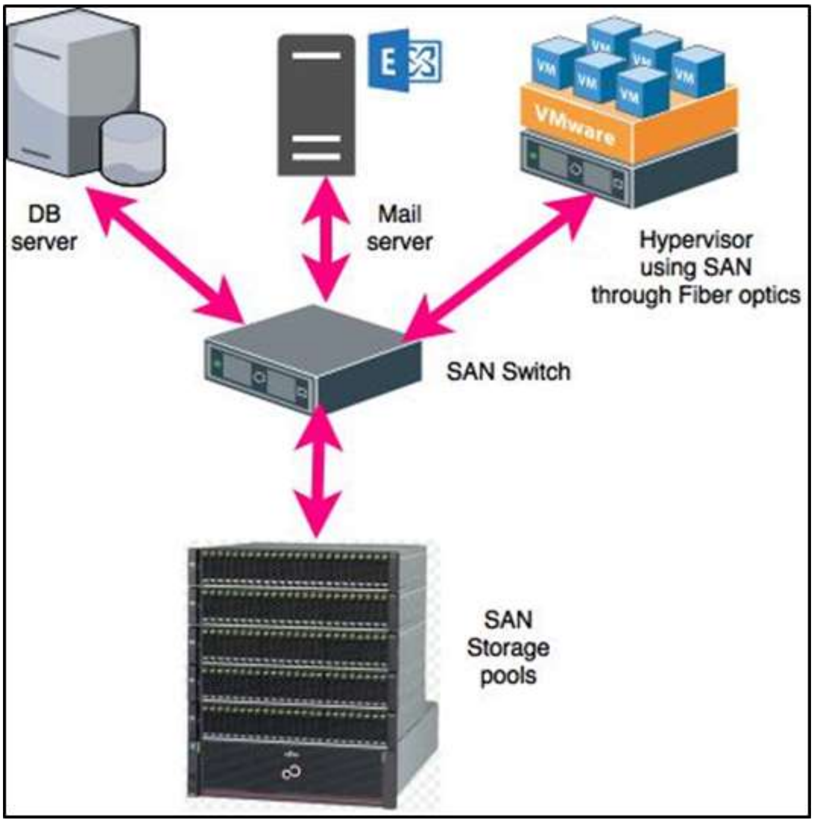
The following illustration shows how NAS works.



Storage-area Network

SANs allow multiple servers to share a pool of storage; making it appear to the server as if it were local or directly attached storage. A dedicated networking standard, **Fibre Channel**, has been developed to allow blocks to be moved between servers and storage at high speed. It uses dedicated switches and a fiber-based cabling system, which separates it from the day-to-day traffic traversing the busy enterprise network. While the well-established SCSI protocol enables communication between the servers' host bus adaptors and the disk system.

The following illustration shows how a SAN switch operates.



10. Virtualization – Troubleshooting

In this chapter, we will discuss troubleshooting for network communication and for slow performance.

Troubleshooting Network Communication

In a virtual environment, to troubleshoot a network connectivity, we should follow some steps in order to find a resolution.

Network Communication Indications

Some of the symptoms that we have are as follows:

- You cannot connect to the Internet.
- There is no network connectivity to or from a single virtual machine.
- Virtual machines fail to connect to the network.
- Cannot get an IP.
- A TCP/IP connection fails to and from a single virtual machine.

Network Communication Errors

You can get the following errors as well:

- Destination Host Unreachable
- Network error
- Connection Refused
- Network cable is unplugged
- Ping request could not find host
- Please check the name and try again
- Unable to resolve target system name, etc.

Network Communication Resolutions

The resolutions for the above symptoms and errors are as follows –

- Make sure that the **Port Group Name** is associated with the virtual machine's network adapter, which exists in the switch or in the Virtual Distributed Switch. Also, ensure that it is spelt correctly.

- Make sure that there are enough **storage capacities** in your virtual machine sometimes it affects the connectivity.

- Verify that the **virtual network adapter** is present and connected.

- Verify that the networking within the virtual machine's **guest operating system** is correct.

- Verify that the **TCP/IP stack** is functioning correctly.

- If this virtual machine was converted from a physical system, verify that there are no **hidden network adapters** present. Because it can have hidden static routes.

- Verify that the **vSwitch** has enough ports for the virtual machine.

- Verify that the virtual machine is configured with two **vNICs** to eliminate a NIC or a physical configuration issue.

- Confirm that your virtual machine's **firewall** is not blocking the Internet access.

- Confirm that your virtual machine's **anti-virus program** is not blocking the Internet access.

- Ensure that the **network adapter** is enabled.

- Shut down the virtual machine and then restart your **Host Machine**.

- Removing and re-adding **virtual network card adaptor**.

Troubleshooting Slow Performance

Check if your CPU load is high. You can click on "CPU". This will show you the amount of CPU the VM is consuming. If it is very high, you may consider adding some more vCPUs. This should be done after ensuring that the physical host has more cores available than what you are going to configure inside the VM. We should also consider whether the applications inside the VM are actually able to utilize multiple vCPUs or not.

Check the Memory

Memory could be a serious limit on VM performance as well. If you do not configure enough memory, the VM will usually respond by starting to swap its memory pages to disk .If your virtual machine is using more than 2/3rd of the memory and then we should allocate more.

See Disk Alignment

For any pre-Windows 7, pre-Windows 2008 Server or older Linux based systems, your disks may be misaligned. Misalignment may cause quite a performance hit, especially when your storage underneath does not have many IOPS to spare.

It is important to format the virtual disks to a specific format or block size according to the application needs. For example – The database of a Microsoft SQL 2005 server is generally put on an NTFS that has a block size of 64KB.

If the virtual machine has a performance issue at some point in time, you need to check the virus scanner. Not only on the impacted virtual machine, but also on the other virtual machines as well.

If you do a P2V – a virtual machine (meaning you convert a physical machine to a VM) and you do not "clean up" afterwards, there may be a lot of unused drivers and even applications.

11. Virtualization – Backing Up, Restoring & Migrating VM

In this chapter, we will discuss how to back up, restore and migrate a virtual machine.

Duplicating a VM

To duplicate or clone a machine means making an exact copy of it. Most of the hypervisors support this feature. By duplicating a machine, we copy down every detail, including the name of the machine and the different network addresses attached to the machine.

Duplicating a machine and putting it in to function is not always the best option because a duplicate name or IP in network can be a problem. We make duplication generally for backup purposes.

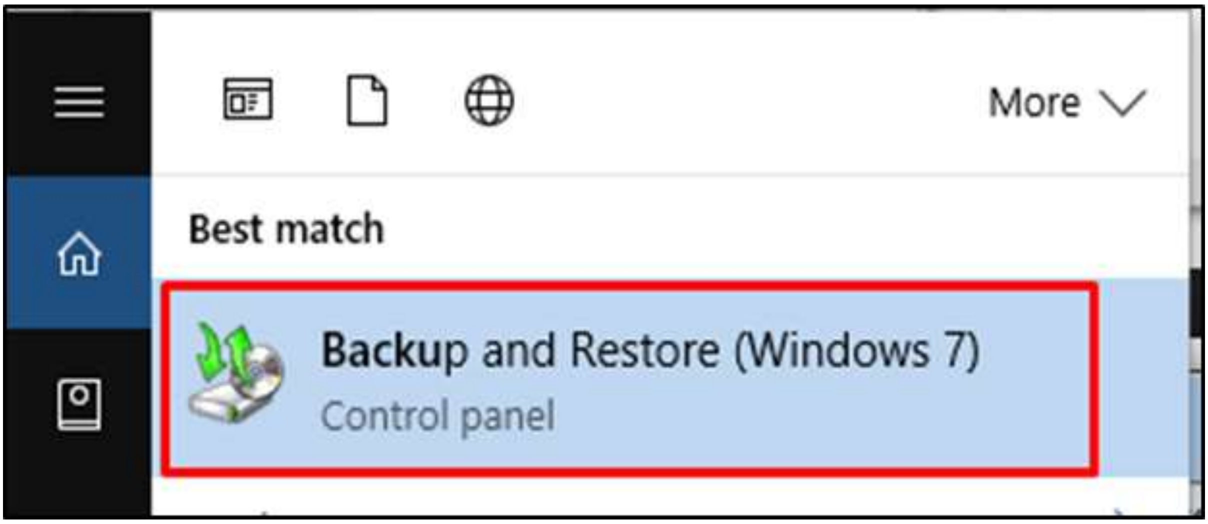
Most hypervisors can clone while the machine is turned off. If the hypervisor accepts to clone while it is on, it is recommend to turn it off, because the process can crash the machine. In practice, we have discussed "How cloning is done in VMware Workstation", please refer to the previous chapters.

Backing Up and Recovering a VM

There are three methods for backing up virtual machines.

Method 1

The most common one is to install traditional backup software on the guest VM. If Windows OS is used on our VM, we can use "Backup and restore" to back up the machine, which is found in the "Control Panel".

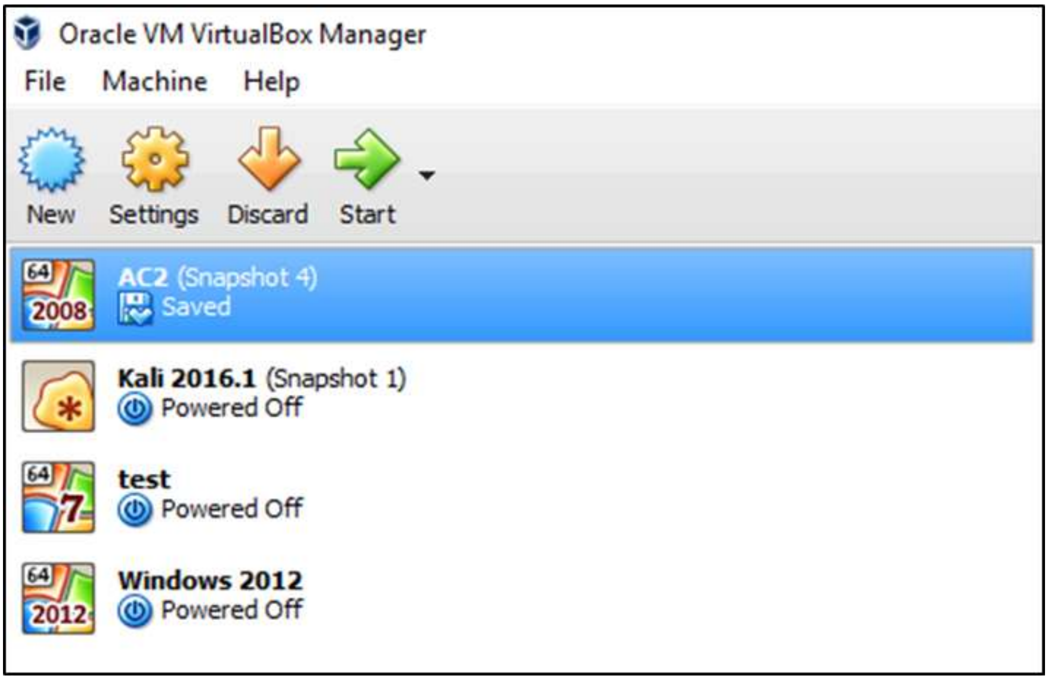


For Linux OS, we can use many open source tools depending on our needs, like "Bacula", "rsync", etc.

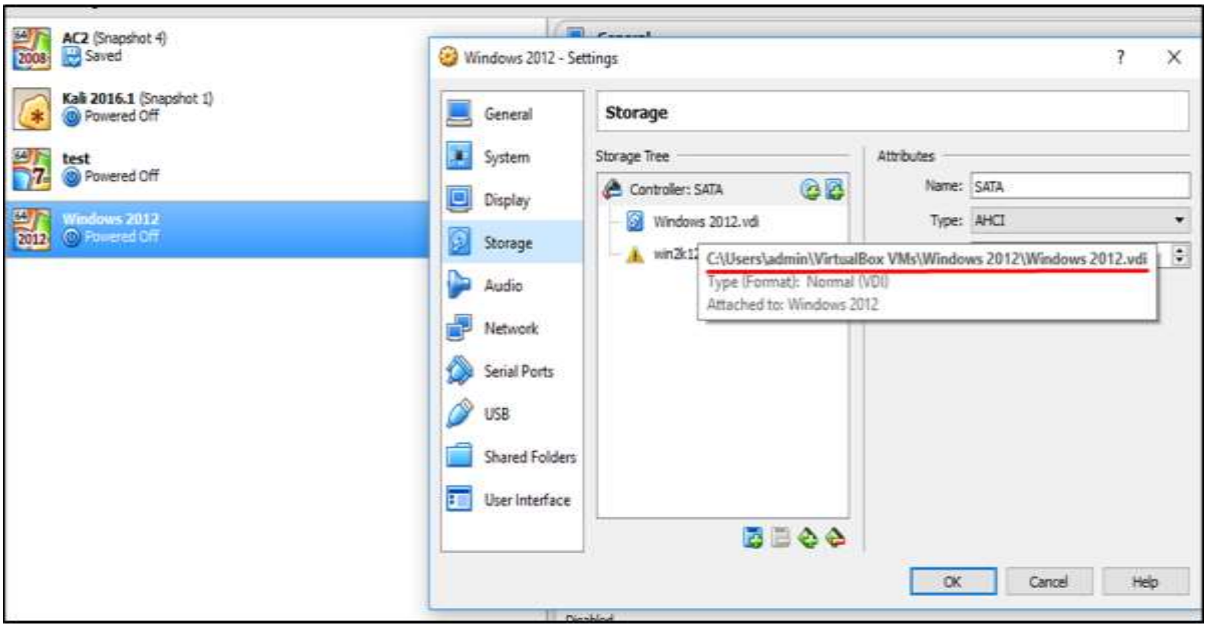
Method 2

Another strategy or method is to copy all of the files that define a VM. Therefore, we will have to go out and find all of the individual files that define our virtual machine and copy them to an alternate location. Some of these files are going to be large.

Example: Here, we have created several VM machines with VirtualBox as shown in the following illustration. Their names are – "AC2", "Kali2016.1", "test", "Windows 2012".



To find the files that we have to copy or to backup, we have to right click on the VM machine. Go to "Storage" then move your mouse over the virtual HDD and it will show the full path where the VDI files are found.



Storage

Controller: SATA

Windows 2012.vdi

win2k12

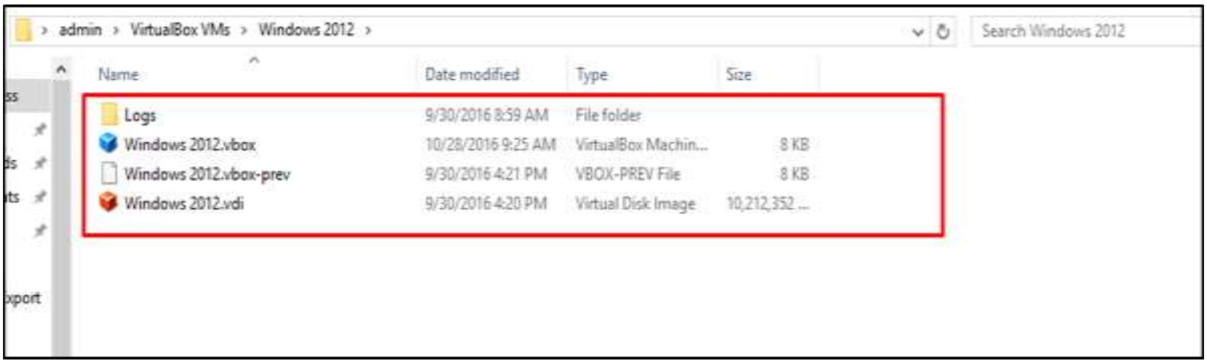
Name: SATA

Type: AHCI

C:\Users\admin\VirtualBox VMs\Windows 2012\Windows 2012.vdi

Type (Format): Normal (VDI)

Attached to: Windows 2012



admin › VirtualBox VMs › Windows 2012 ›

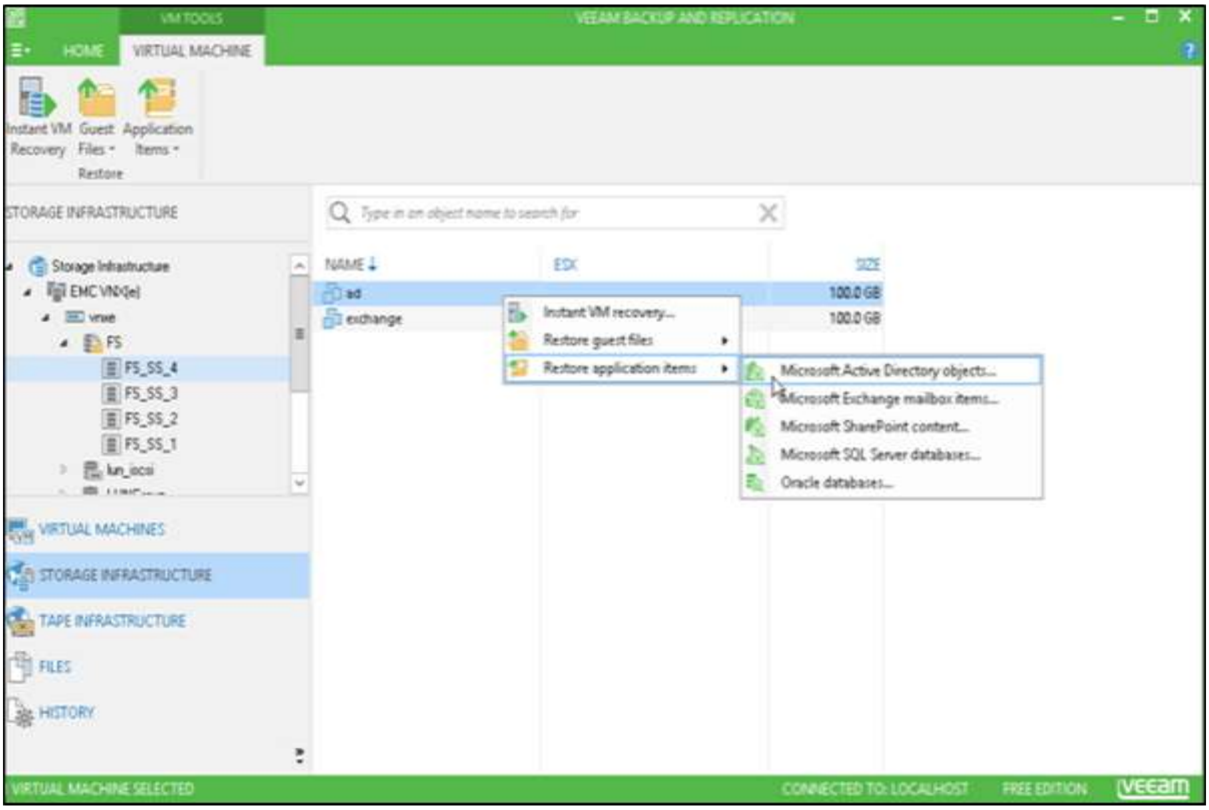
Search Windows 2012

Name	Date modified	Type	Size
Logs	9/30/2016 8:59 AM	File folder	
Windows 2012.vbox	10/28/2016 9:25 AM	VirtualBox Machin...	8 KB
Windows 2012.vbox-prev	9/30/2016 4:21 PM	VBOX-PREV File	8 KB
Windows 2012.vdi	9/30/2016 4:20 PM	Virtual Disk Image	10,212,352 ...

We will save all these files to another location.

Method 3

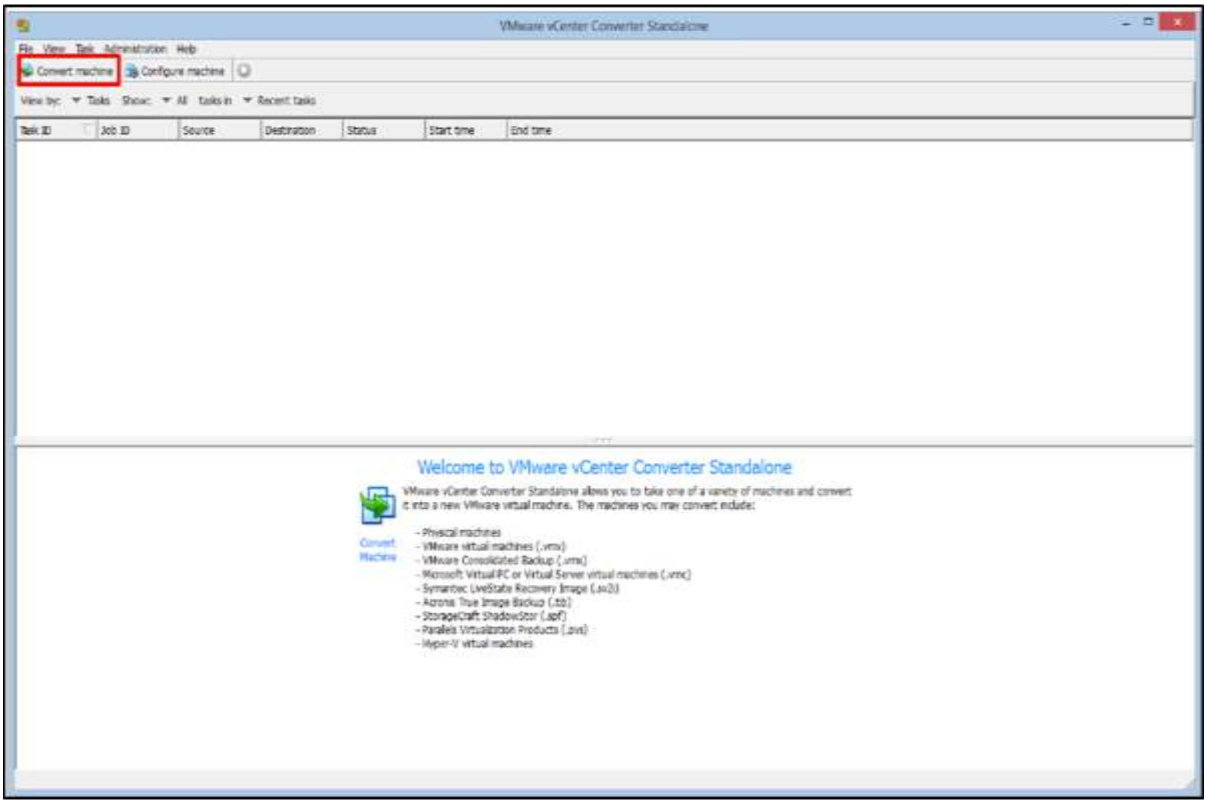
The third option to backup and restore VM machines is to use third party software. One of the best is **VEEAM**, which can be found on the following URL – https://www.veeam.com/



Converting a Physical Server into a Virtual Server

In this section, we will see how to convert a physical machine into a virtual machine. This is often called as **P2V** in many literatures.

VMware puts out a product that is called **vCenter Converter**, which will convert from a physical machine specifically into a VMware virtual machine. The software can be downloaded from – http://www.vmware.com/products/converter.html


VMware vCenter Converter Standalone
File View Task Administration Help
Convert machine
Configure machine
View by: Tasks Show: All tasks in Recent tasks
Task ID
Job ID
Source
Destination
Status
Start time
End time
Convert Machine

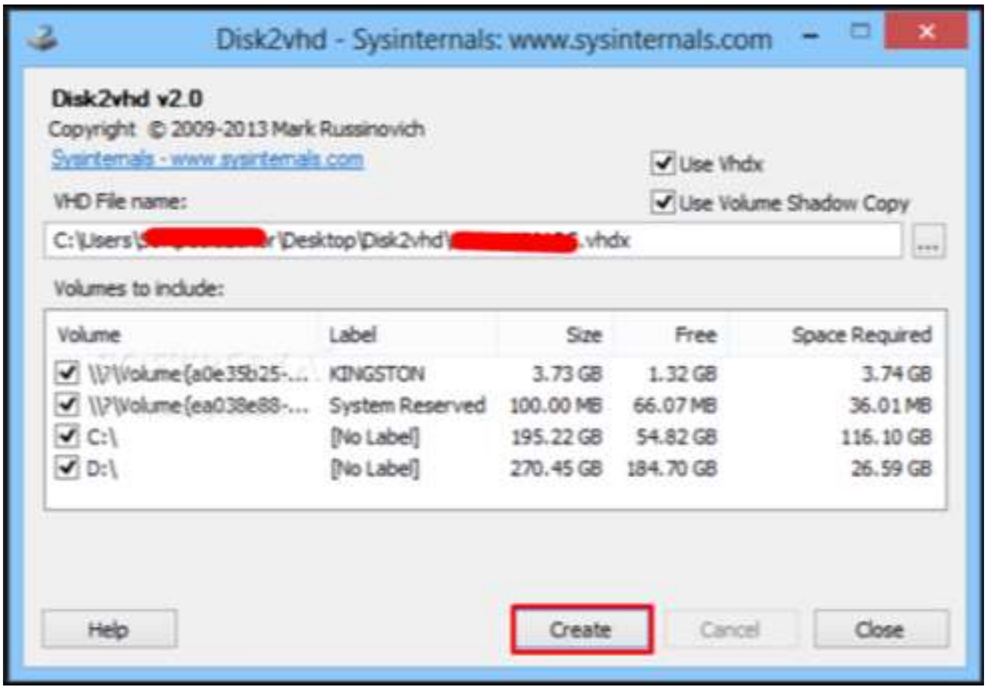
Welcome to VMware vCenter Converter Standalone

VMware vCenter Converter Standalone allows you to take one of a variety of machines and convert it into a new VMware virtual machine. The machines you may convert include:

- Physical machines
- VMware virtual machines (.vmx)
- VMware Consolidated Backup (.vmx)
- Microsoft Virtual PC or Virtual Server virtual machines (.vmc)
- Symantec LiveState Recovery Image (.sv2i)
- Acronis True Image Backup (.tib)
- StorageCraft ShadowStor (.spf)
- Parallels Virtualization Products (.pvs)
- Hyper-V virtual machines

Microsoft has a product called **Disk2vhd**, which will convert a physical hard drive into a VHD formatted virtual hard drive. It can be downloaded from the following link – https://technet.microsoft.com/en-us/sysinternals/ee656415.aspx

We just have to install the software on the physical server and click "Create" as shown in the screenshot below. A VHDX file will be created which could be imported in a Hypervisor.



Disk2vhd v2.0
Copyright © 2009-2013 Mark Russinovich
Sysinternals - www.sysinternals.com

☑ Use Vhdx
☑ Use Volume Shadow Copy

VHD File name:
C:\Users\[redacted]\Desktop\Disk2vhd\[redacted].vhdx

Volumes to include:

Volume	Label	Size	Free	Space Required
☑ \\?\Volume{a0e35b25-...	KINGSTON	3.73 GB	1.32 GB	3.74 GB
☑ \\?\Volume{ea038e88-...	System Reserved	100.00 MB	66.07 MB	36.01 MB
☑ C:\	[No Label]	195.22 GB	54.82 GB	116.10 GB
☑ D:\	[No Label]	270.45 GB	184.70 GB	26.59 GB

Both of these products will convert machines, while the server is running and is free. All the vendors of hypervisors have some P2V tool and they are typically free. From the vendor’s point of view, they would very much like you to convert your physical machines into virtual machines that are optimized for their hypervisor.

Converting a Virtual Server into a Physical Server

To convert a virtual server to a physical server also commonly called as V2P is certainly less common than a P2V conversion. However sometimes, it is needed in development-based environments. It does happen where a product needs to be tested in the virtual server than to a physical server, or to clone a production machine and move it to test.

Hypervisor vendors do not offer such a tool. However, you have to request the hardware vendor, if they could offer such tools.