# Unit 2
Virtualization Technology terms & techniques

- What is VDI
- Benefits of VDI
- Introduction to virtual machine
- various components of virtual machine to be considered while creating a virtual machine
- Virtual hard disk and its usage in different virtualized environment.
- Hypervisor management application(Refer unit-1 notes)

Traditional Desktop Deployment
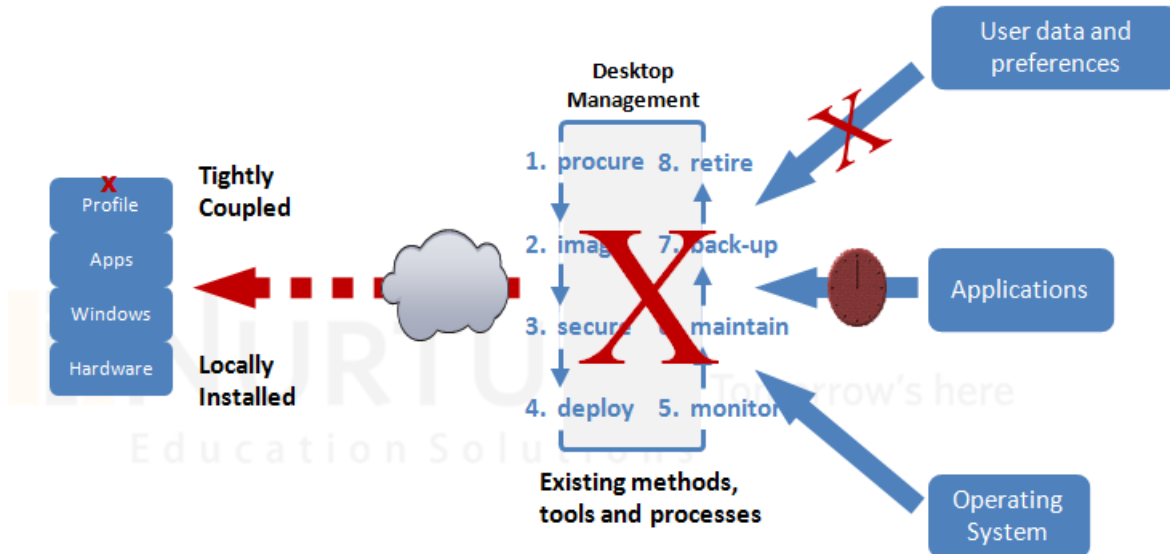
- Tight binding between layers
- The components are linked together in ways that are difficult to support and maintain
- A problem at one layer often causes a chain reaction
- May destroy the whole stack
- Makes recovery difficult
- Threatens any locally stored user data and settings
- Most organisations just replace or re-image the whole PC

Why VDI?

- Traditional desktop infrastructure challenges have led to use of virtual desktop infrastructure

Difficult to manage

- Variety of PC hardware and users' need
- Broadly distributed PC hardware

Inefficient resource utilization

- The distributed nature of PCs

High total cost of ownership

- High cost of PC management and support
- Lack of standardisation and the need for support personnel to troubleshoot issues

**Difficult to protect and secure data**

- Data back-up and data restored when PCs are failed or files are lost
- The risk of PC theft threatens the security of important data

Virtual desktop infrastructure

Virtual desktop infrastructure (VDI) is defined as the hosting of desktop environments on a central server. It is a form of desktop virtualization, as the specific desktop images run within virtual machines (VMs) and are delivered to end clients over a network. Those endpoints may be PCs or other devices, like tablets or thin client terminals.

Virtual Desktop Infrastructure (VDI) is a *computing model* that adds a layer of virtualization between the server and the desktop PCs.
Virtual desktop infrastructure (VDI) is a virtualization technology that hosts a desktop operating system on a centralised server in a data centre. VDI is a variation on the client-server computing model, sometimes referred to as server-based computing. The term was coined by VMware.
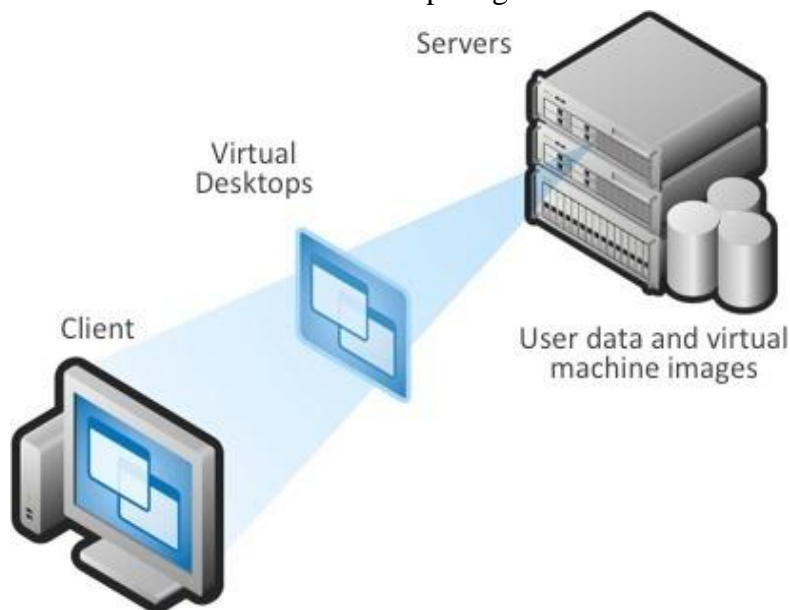

VDI is a desktop-centric service
Host users desktop environments on remote servers and/or blades, which are accessed over a network using a remote display protocol (RDP).

VM: Virtual Machine
VMM: Virtual Machine Monitor
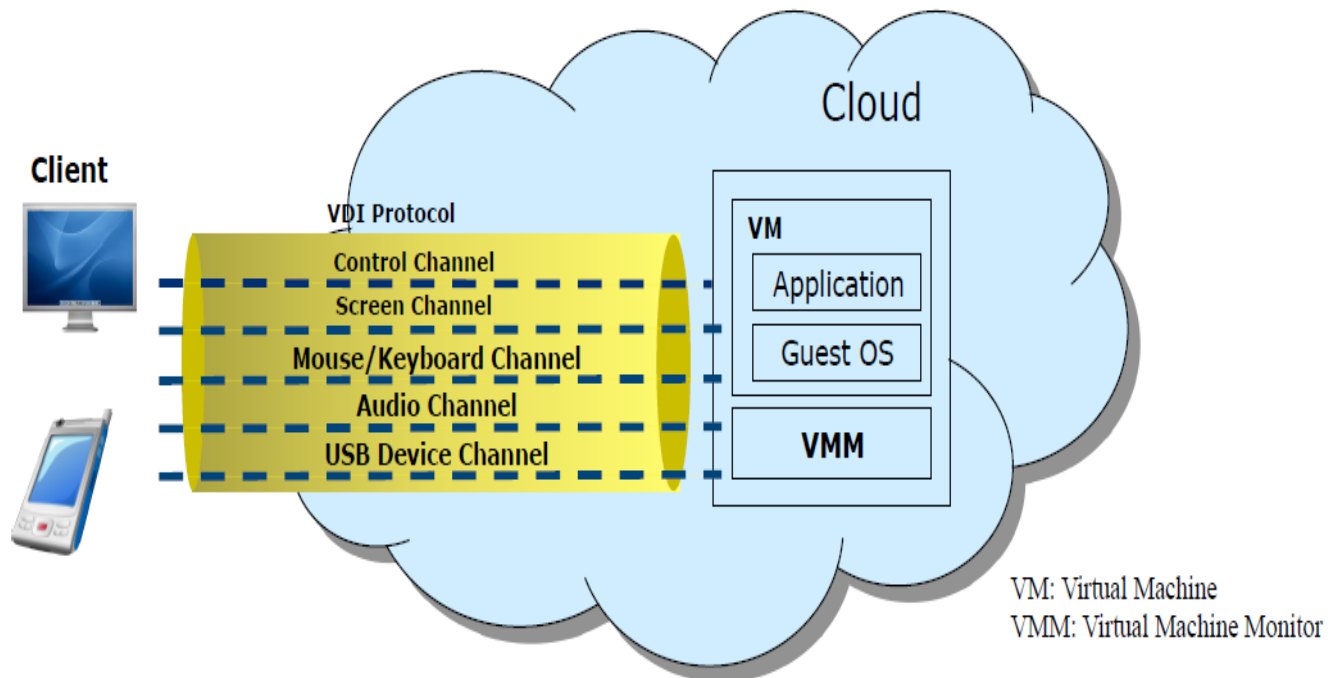
Generic View of VDI
- VDI Client: The converged end user device
- VDI Server: Delivers a desktop from a server operating system for a single user
  - Virtual Desktop Agent: The control software resides in a virtual machine hosted in a data center
  - VDI Protocol: Connect client and server, transport the necessary control commands and I/O data
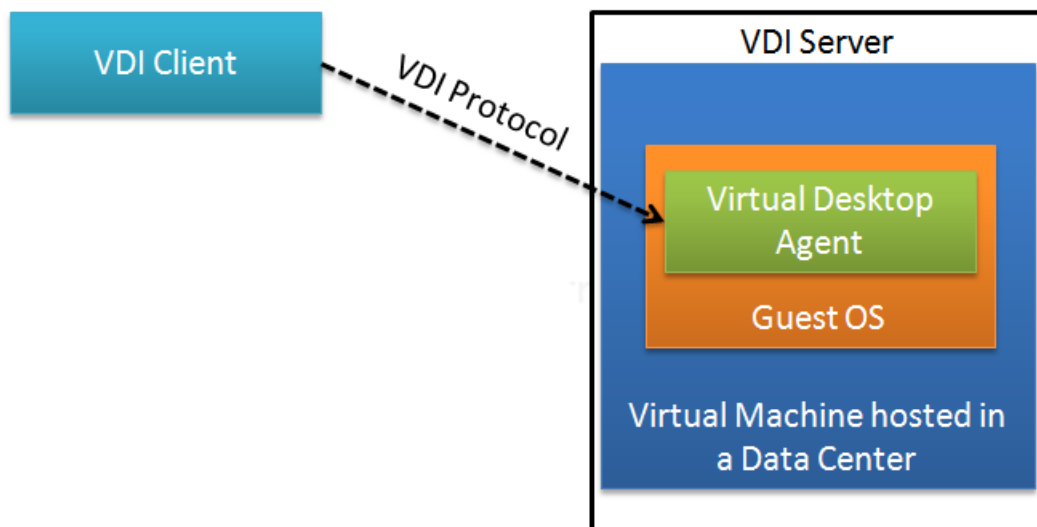
VDI Components
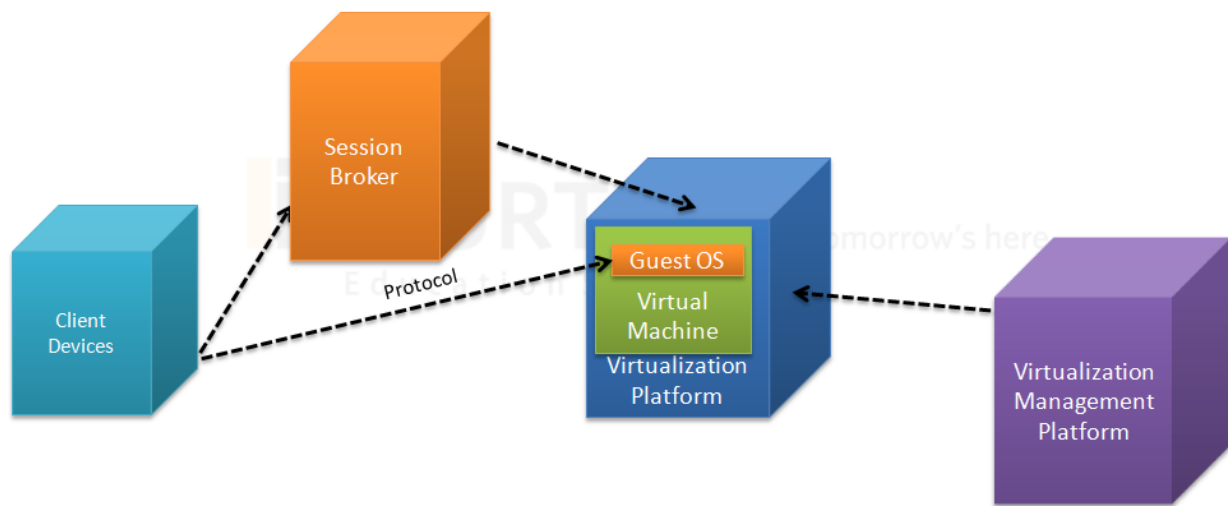
Client Devices

Client devices are access points.

It could be

- Thin Client: A thin client is a lightweight computer built to connect to a server from a remote location. The server does most of the work, which can include crunching numbers and storing information for the thin client.

- Clients running software on OS

  - ✓ Such as, Windows, Linux or others supported by the VDI solution

Session Broker

The session broker is responsible for:

- Distributing sessions from clients to VMs

- Redirecting disconnected sessions of users back to their original VMs

Example: Windows Server 2008 R2, XenDesktop (for Microsoft VDI) and VMware View Manager
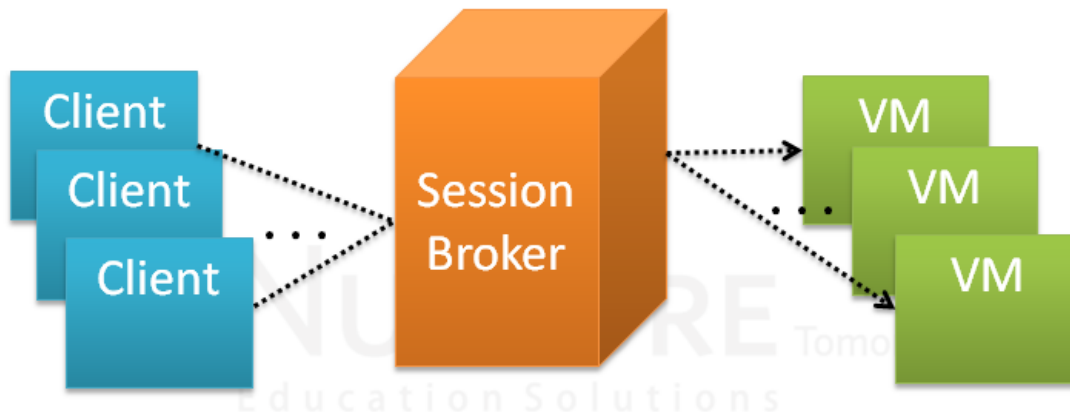
Virtualization Platform

- A platform hosts VMs with the client operating systems

- This platform must have the capacity to host enough VMs for all concurrently connected users
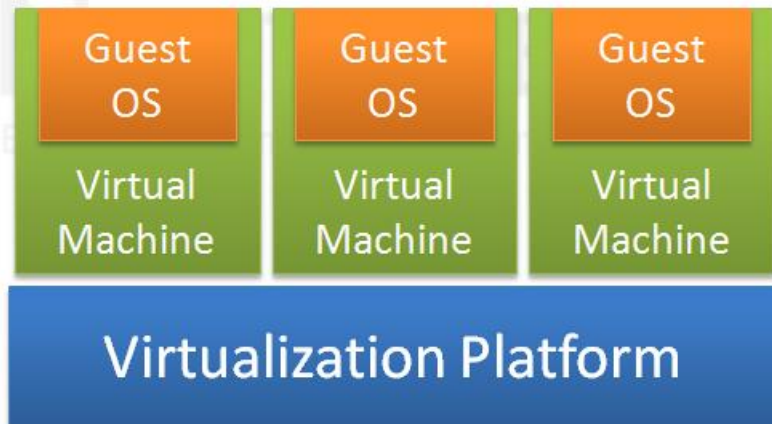
Virtualization Management Platform

Virtual management platform is a platform that

- Manages the servers

- Provisions VMs quickly and efficiently

- Uses templates and libraries of disk images to provision the client OS in VMs

- It ensures there is always a pool of VMs available for new connections.

Benefits of VDI

As more organisations are moving to the cloud environment. Following are some of the benefits of the VDI:

- Usage of Less Bandwidth

- Reduce IT Costs up to 30 Percent

- Access Workstations Anywhere

- Data is More Secure

- Assign Information Access according to an Employee's Security Clearance

- Use VDI to Access Very Large Files

- Backup Data Just Once

- Save Power

Players of VDI

Virtual Machine

A virtual machine is a software that creates a virtual environment of physical computing and emulates just as a real machine that allows a user to install operating system or programs to run virtually. This process is also referred as virtualization. Virtual machine runs on your current

operating system which is called as "host" operating system and operating system installed on Virtual Machine referred as "guest" operating system. The guest operating system will run on your host operating system just like any other program on your computer.
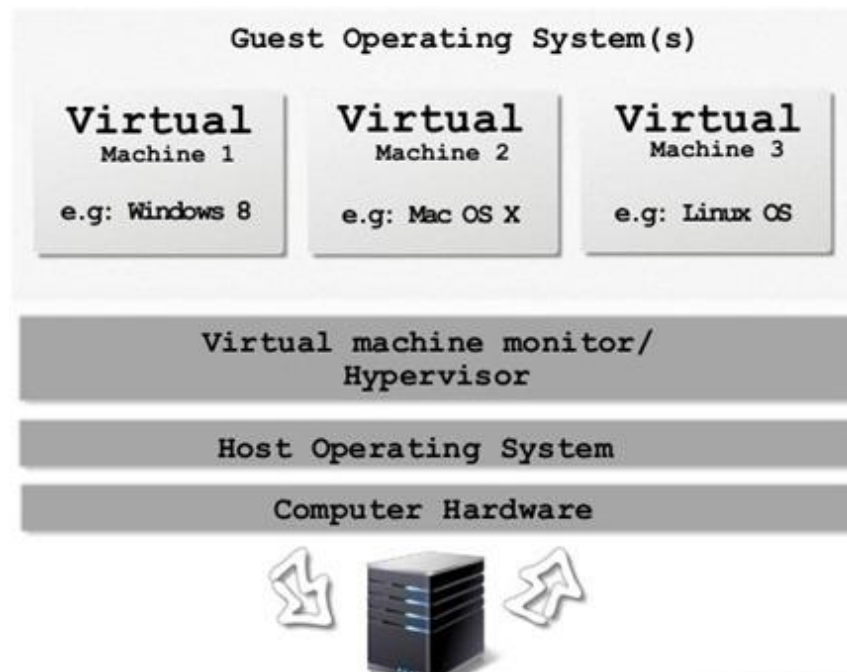
Key Benefits of Virtual Machines

- Partitioning: Run multiple operating systems on one physical machine and divide system resources between virtual machines.

- Isolation: Provide fault and security isolation at the hardware level and preserve performance with advanced resource controls.

- Encapsulation: Save the entire state of a virtual machine to files. Move and copy virtual machines as easily as moving and copying files.

- Hardware Independence: Provision or migrate any virtual machine to any physical server.

List of Popular Virtual Machine Software that Runs on a Desktop OS

- VMware Player

- Oracle VM VirtualBox

- VMware Workstation

- Parallels

- VMware Fusion

List of Popular Virtual Machine Software that Runs on a Server Hardware

- Microsoft Hyper-V,

- XenServer

- KVM (Kernel-based Virtual Machine)

- VMware ESXi (formerly ESX)

Components of Virtual Machines-Files

- Configuration File

- Hard Disk File (s)

- Virtual Machine State File

- In-memory File
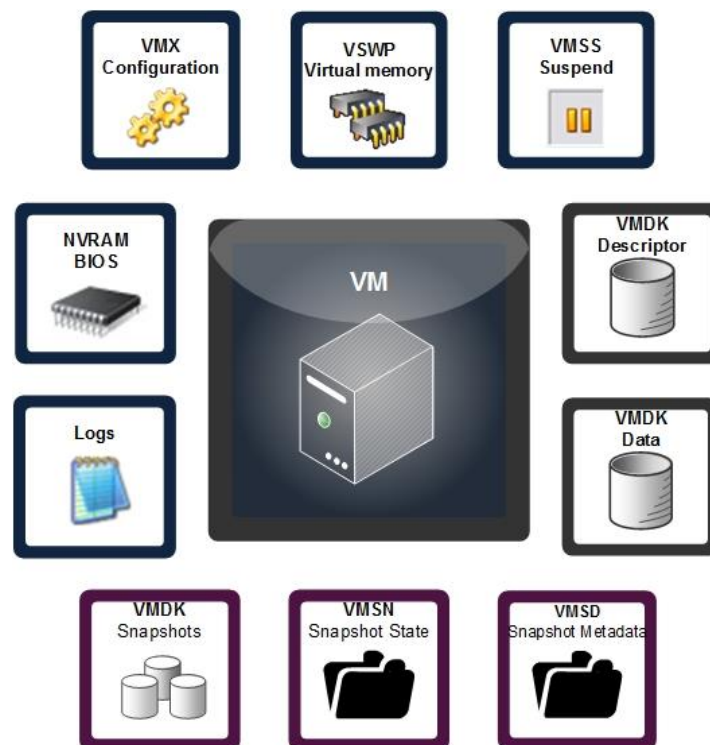
VMware Workstation

VMware Workstation is a hosted hypervisor that runs on x64 versions of Windows and Linux operating systems (an x86version of earlier releases was available); it enables users to set up virtual machines (VMs) on a single physical machine and use them simultaneously along with the actual machine. Each virtual machine can execute its own operating system, including

versions of Microsoft Windows, Linux, BSD and MS-DOS. VMware Workstation is developed and sold by VMware, Inc., a division of Dell Technologies.

Creating Virtual Machine using Oracle's VirtualBox

Oracle VM VirtualBox is a free and open-source hypervisor for x86 computers currently being developed by Oracle Corporation.

A VirtualBox is a software virtualization package that installs on an operating system as an application. VirtualBox allows additional operating systems to be installed on it, as a Guest OS and run in a virtual environment.

Components of VMware vSphere Virtual Machine

- A virtual machine is a software representation of a physical computer and its components.

- The virtualization software converts the physical machine and its components into files.

- Virtual machines typically have an operating system, VMware Tools, and virtual resources and hardware that can be managed in much the same way as it is managed in physical computer.

- A user installs a guest operating system on a virtual machine the same way as installing an operating system on a physical computer. A user must have a CD/DVD-ROM or ISO image containing the installation files from an operating system vendor.

- VMware Tools is a suite of utilities that enhances the performance of the virtual machine's guest operating system and improves management of the virtual machine. With VMware Tools, you have more control over the virtual machine interface.

- In the vSphere Web Client, user assigns each virtual machine to a compatible ESXi host version, cluster, or datacentre by applying a compatibility setting. The compatibility setting determines which ESXi host versions the virtual machine can run on and the hardware features available to the virtual machine.

What is VHD?

A virtual hard disk provides storage for a virtual machine. Within a virtual machine, the virtual hard disk is represented as a physical disk and is used by the virtual machine as if it were a physical disk.

Technically, the virtual hard disk is a file that resides on a physical disk that the host operating system can access. On the physical disk, the virtual hard disk file is stored as a *.vhd* file. As a general rule, you can store a *.vhd* file on any type of storage device as long as the host operating system can access the storage device.
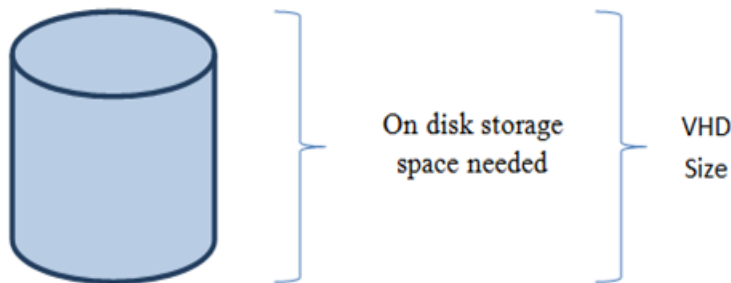
Virtual hard disks are of two types:

- Fixed size

- Dynamically expanding

Fixed Size Virtual Hard Disk

- A fixed sized VHD uses a file in which the space to store the file is *allocated on the physical storage* when the virtual hard disk is created.

- The file size is the same as the size specified for the virtual hard disk. As their name implies, fixed sized VHDs occupy the same space on the underlying physical storage device as their specified size. However, once a fixed sized VHD is created, the size can be increased when the disk is offline by editing the disk to expand it.

- Reducing the size is not supported. Because the physical storage required for a fixed size VHD is allocated when the VHD is created, there is a better chance at optimal placement and organisation on-disk which yields the best performance.

- The disadvantage is that the space is committed even if it is not used.

Fixed Sized Virtual Hard Disk

Dynamically Expanding Virtual Hard Disk

- A dynamically expanding VHD is a file that at any given time is as large as the actual data written to it plus the size of on-disk meta-data. Dynamically expanding disks are useful because they do not require all the storage needed to contain the maximum size of the disk to be reserved up front.

- The VHD file starts quite small (for example, 42KB is a typical physical size of an empty 20GB disk) and grows as new blocks in the disk are used.

- There are a number of optimizations around dynamically expanding disks that improve performance; however, in general their read/write performance is slower than fixed disks.

- One optimization is the selection of data block size which can be either *512KB or 2MB*; another is skipping *allocation of all-zero blocks*.
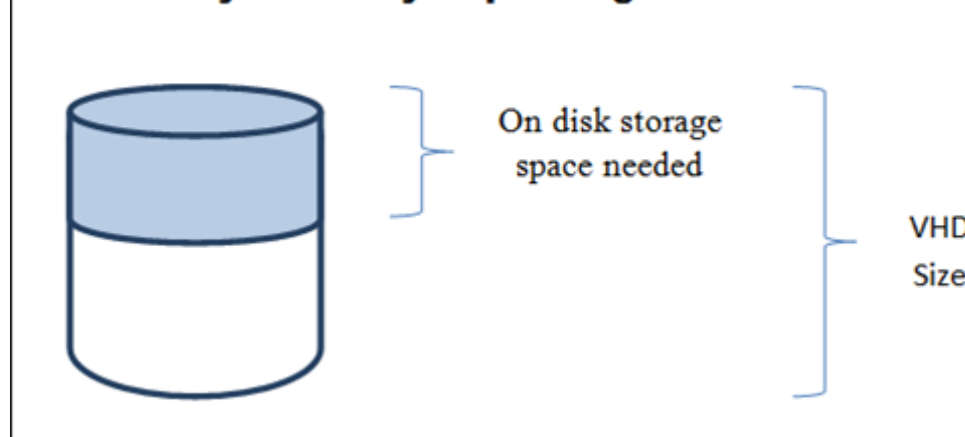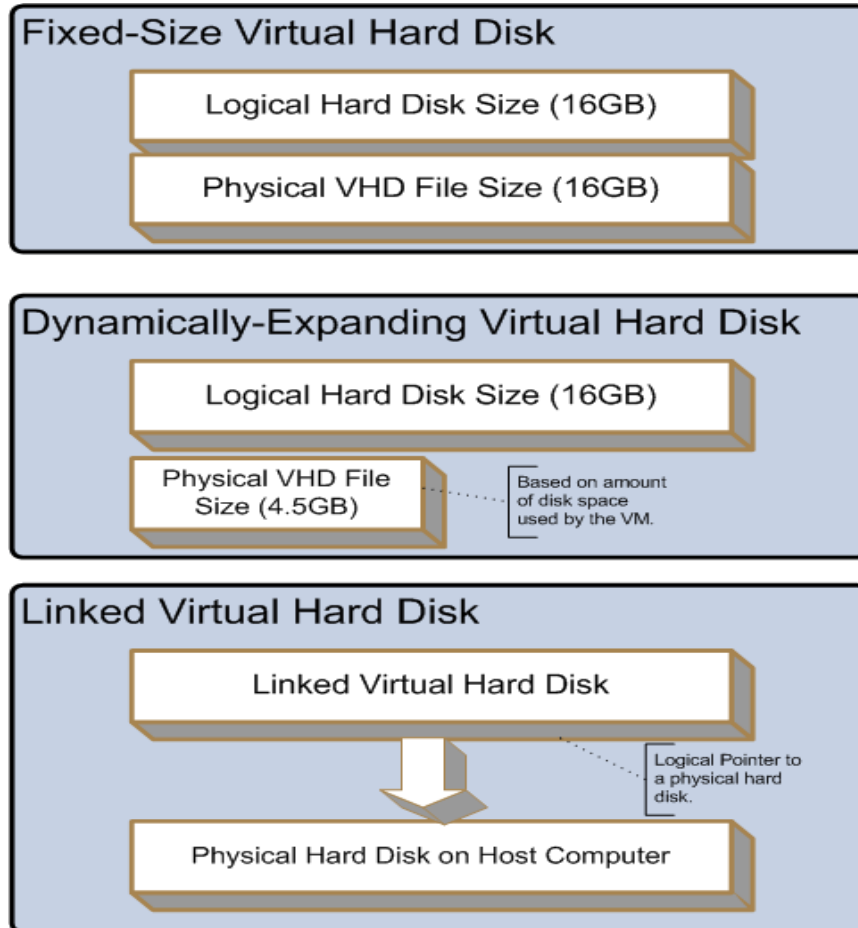

Linked Hard Disk

Linked hard disks map to a single physical hard disk on the host computer. This type of hard disk is created primarily for converting a physical hard disk into a VHD. First, you create the

linked VHD and then you convert it to a fixed-size or dynamically expanding VHD. Beware that if you make a linked hard disk accessible to a virtual machine, the VM can change data stored on the host's physical hard disk. The figure shows the comparison of three different types of VHDs.

Fixed-Size Virtual Hard Disk

Logical Hard Disk Size (16GB)

Physical VHD File Size (16GB)

Dynamically-Expanding Virtual Hard Disk

Logical Hard Disk Size (16GB)

Physical VHD File Size (4.5GB)

Based on amount of disk space used by the VM.

Linked Virtual Hard Disk

Linked Virtual Hard Disk

Logical Pointer to a physical hard disk.

Physical Hard Disk on Host Computer

Differencing Virtual Hard Disk

- A differencing VHD is a file representing the current state of the virtual hard disk as a set of modified blocks in comparison to a parent virtual hard disk. Differencing VHDs can be associated with either a fixed sized or dynamically expanding VHD.

- Differencing VHDs can also be associated with another differencing VHD but they cannot be associated with a physical disk. Differencing VHDs are used to prevent changes from being made in their parent VHD to which they are applied and are used to implement a number of additional features.

- In Hyper-V, differencing VHDs are also created automatically whenever snapshots are taken of a virtual machine. Note that differencing VHDs used for snapshot purpose are

named with an AVHD file extension to help users easily distinguish them from regular differencing VHDs. Differencing VHDs may also be used to deploy a "golden" or "master" image, because one can associate multiple differencing VHDs to one parent VHD.

- Some disadvantages of differencing VHDs are increased caching needs and the inability to grow or shrink the VHD size. You can however compact differencing VHDs to reclaim physical space usage.
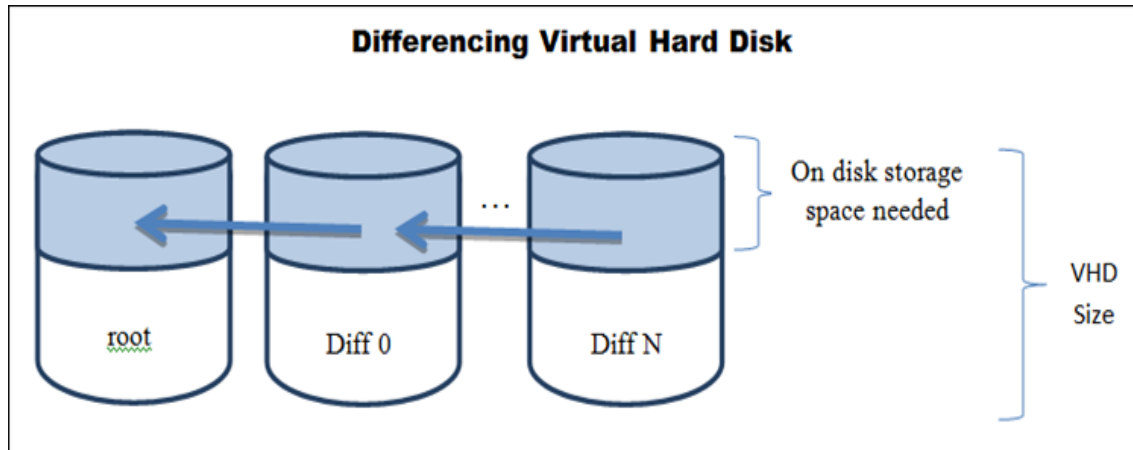
Features of VHD

There are following smart features, which are provided by virtual hard disks to make life simple and easy for enterprise computer users :

Ease in Sharing Files on Virtual Machine:

With help of the server, users can easily share or distribute their file over a network, which will allow everyone to access that file within a network.

Ease in Storing Backup File and its Recovery: Users can create a backup file of their system and then save it on a virtual machine. This will enable users to safely keep the replica of their files on local machine itself.

VHD Architecture in Virtualized Environment

- A virtual hard disk (VHD) is a file that encapsulates a hard disk image. VHDs can be used in new and interesting ways. VHDs first were created to be the storage media for virtual machines (VMs). Today, VHDs are used to ship trial versions of software, used in backup solutions, used for bug triage (for example, customers can convert a physical disk

to virtual and share it) and even used to store multiple boot environments. VHDs are very flexible storage containers and are not tied to any single file system format.

- Microsoft began using VHD technology in Microsoft Virtual PC around 2003, and then continued its use in Microsoft Virtual Server release in 2005. The next major release happened as part of Hyper-V in Windows Server 2008. Currently VHD support is made *as part of* Windows Server 2008 R2 .

- VHDs were limited to use by virtual machines running in Virtual PC/Virtual Server/Hyper-V and loopback mounting of VHDs in the parent partition sometimes referred to as the management operating system. The integration of VHD support into the operating system was drastically improved in Windows Server 2008 R2 which added native support.

- There are three VHD formats each with different performance characteristics. The three formats of VHD are fixed, dynamic and differencing.