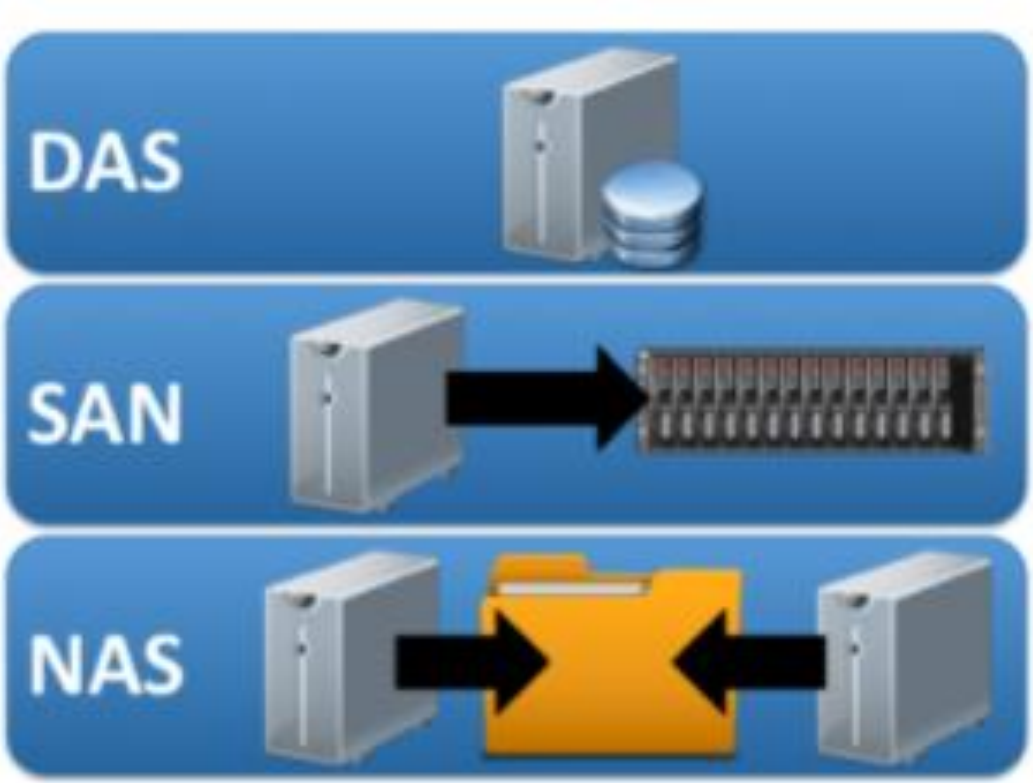
Storage Virtualization

Physical Storage

At the root of all storage is some set of physical storage protocols.



Direct Attached Storage (DAS)

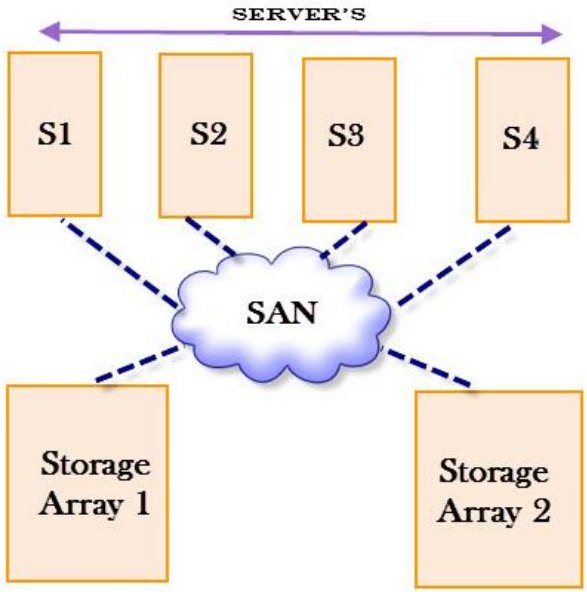
- Simplest storage model
- laptops, phones, and desktop computers
- Physically impossible to remove the storage from the compute
- But even in the case of servers, where it is theoretically possible to pull disk drives, once a drive is separated from the server, it is generally wiped before reuse.
- Small Computer System Interface (SCSI) is examples of DAS protocols.

Storage Area Network (SAN)

- Eventually the storage industry recognized the utility of separating storage from the compute.
- Rather than attaching disks to each individual computer, we placed all the disks on a single cluster of servers and accessed the disk over the network.
- Shared storage, since multiple computers will use a single pool of storage.
- client and server over the network using the same (or very similar) block protocols that were used to communicate with locally attached disk drives.

SAN

- Own network of storage devices that are generally not accessible through the local area network by other devices.
- Fibre Channel and Internet Small Computer Systems Interface (iSCSI) are examples of SAN protocols.
- Administrator will group a set of disks (or a portion of a set of disks) into a LUN (logical unit), which then behaves like a single disk drive to outside computers.
- The LUN is the fundamental unit used to manage SAN storage.
- Block level data storage



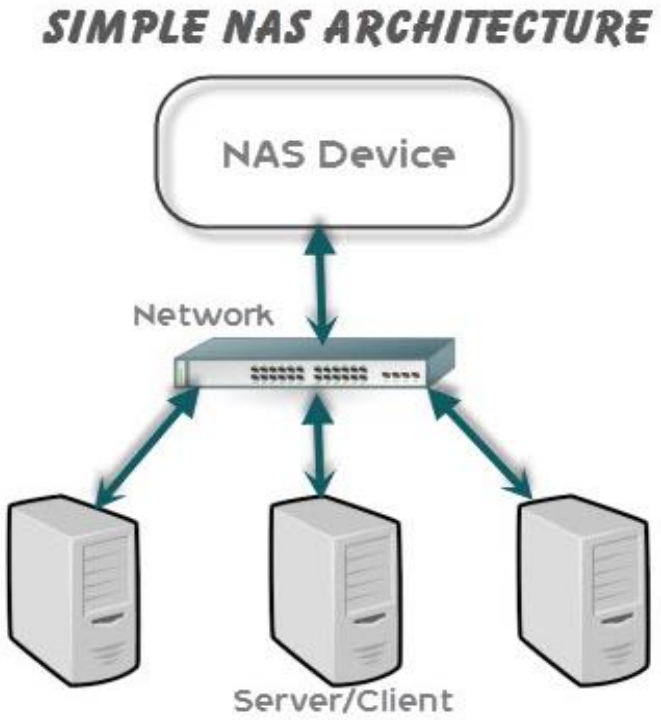
Storage Area Network (SAN) Implementation

Network Attached Storage (NAS)

- Communicate with the storage using file system protocols, which closely resemble the file systems run on local computers.
- The file system abstraction allows multiple servers to access the same data at the same time.
- Multiple servers can read the same file at the same time, and multiple servers can place new files into the file system at the same time.
- Thus, NAS is a very convenient model for shared user or application data.
- NFS and SMB are examples of NAS protocols.

NAS

NAS: IP-based file sharing device which is attached to a local area network (LAN). Storage device which is connec to a network and clients or use are accessing it.



Types of Storage Virtualization

Virtualization on block level means that storage capacity is made available to the operating system or the applications in the form of virtual disks

The task of the virtualization entity is to map these virtual blocks to the physical blocks of the real storage devices

Virtualization on file level means that the virtualization entity provides virtual storage in the form of files and directories

The applications work with files instead of blocks and the conversion of the files to virtual blocks is performed by the virtualization entity

The physical blocks are presented in the form of a virtual file system and not in the form of virtual blocks

Storage Virtualization

Storage virtualization

It is the process of masking the underlying complexity of physical storage resources and presenting the logical view of these resources to compute systems.

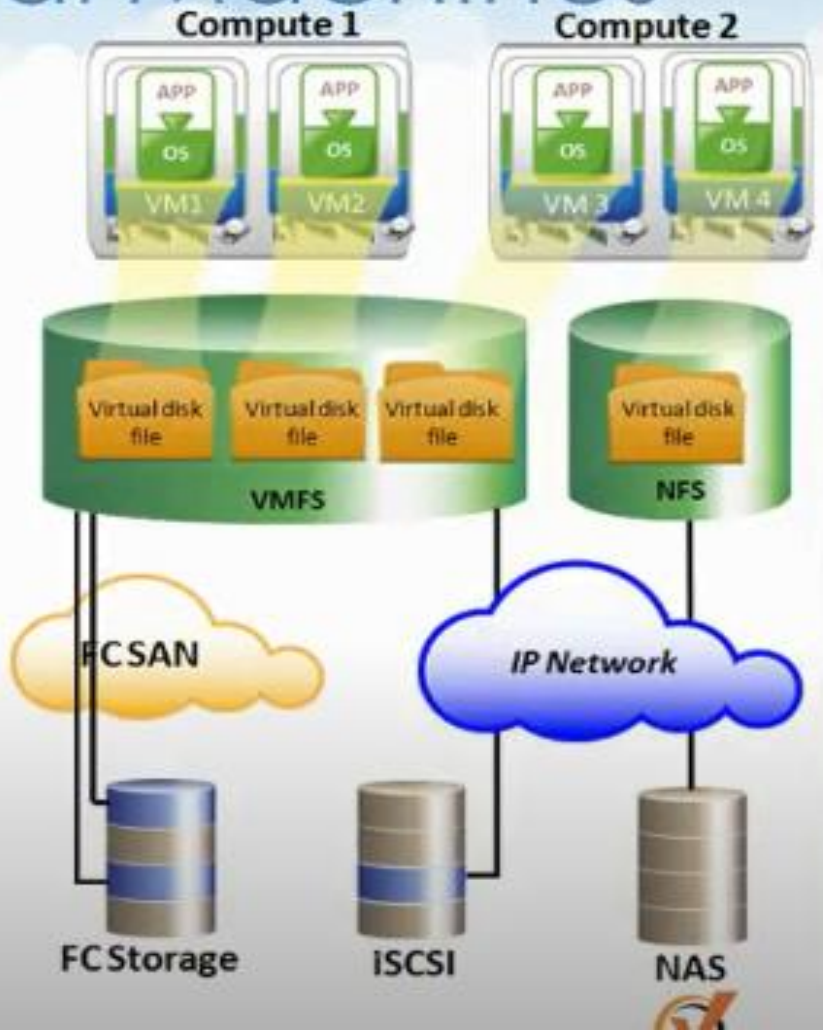
- Logical to physical storage mapping is performed by virtualization layer
- Virtualization layer abstracts the identity of physical storage devices
  - Creates a storage pool from multiple, heterogeneous storage arrays
- Virtual volumes are created from the storage pools and are assigned to the compute system

Storage Virtualization at Different Layers

Layers	Examples
Compute	• Storage provisioning for VMs
Network	• Block-level virtualization • File-level virtualization
Storage	• Virtual Provisioning • Automated Storage Tiering

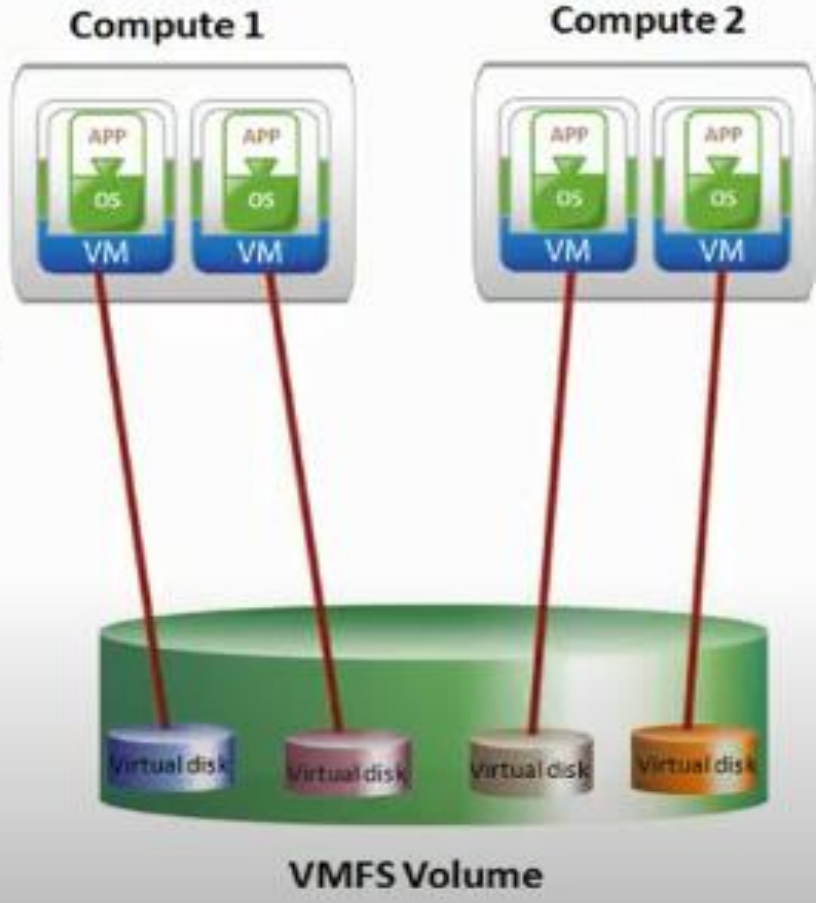
Storage for Virtual Machines

- VMs are stored as set of files on storage space available to hypervisor
- 'Virtual disk file' represents a virtual disk used by a VM to store its data
- Size of virtual disk file represents storage space allocated to virtual disk
- VMs remain unaware of
  - Total space available to the hypervisor
  - Underlying storage technologies



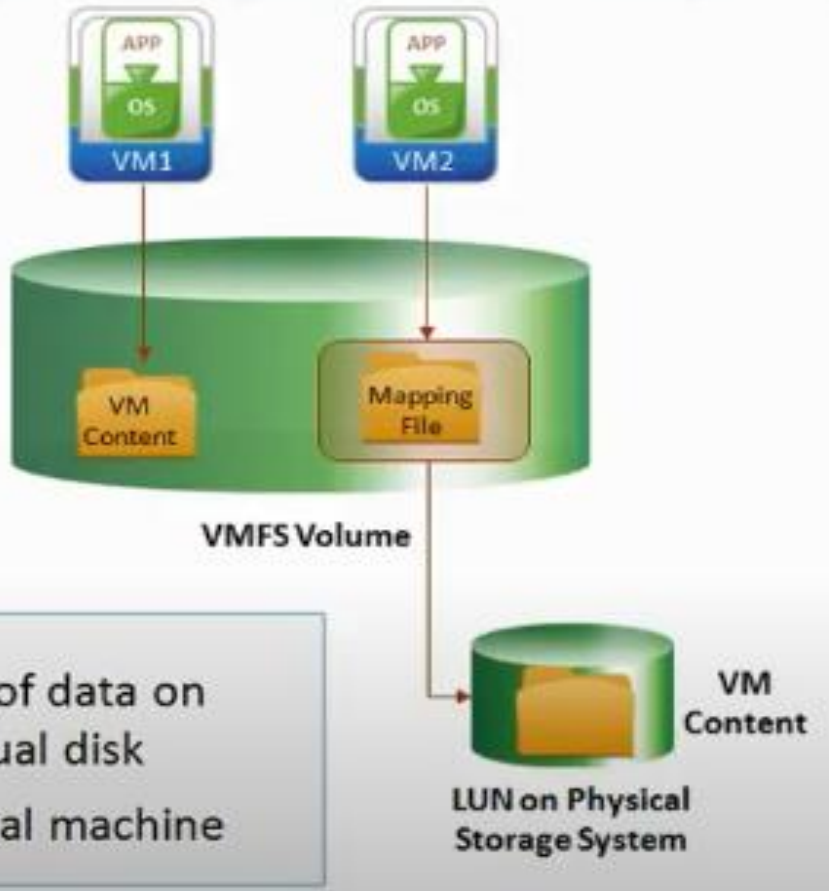
Virtual Machine File System (VMFS)

- Hypervisor's native file system to manage VM files
- Cluster File System
  - Can be accessed by multiple compute systems simultaneously
  - Provides on-disk locking
- Uses a VMFS volume to store VM files



Raw Device Mapping

- Enables VM to directly access LUNs in a storage system
- Contains a symbolic link on VMFS volume to the LUN
  - Acts as a proxy that allows direct access to a LUN

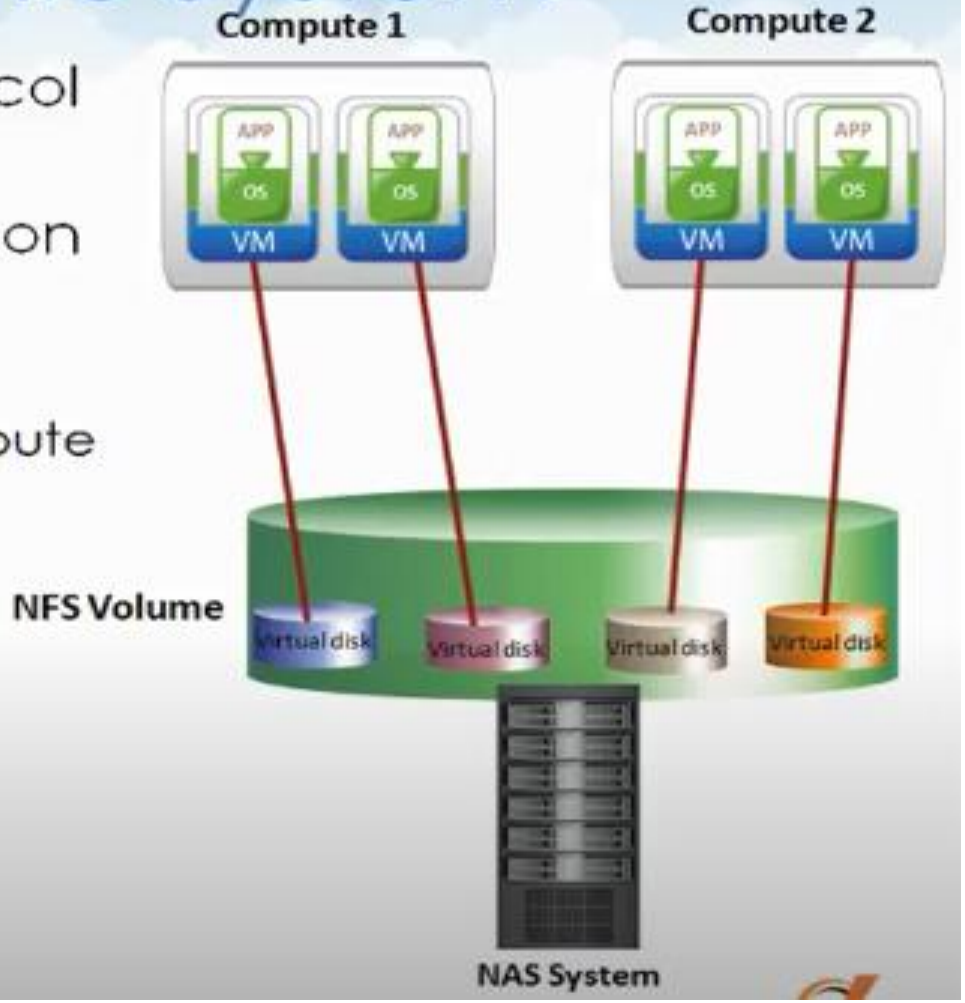


Benefits

- Provides solution when huge volume of data on LUN is not practical to move onto virtual disk
- Enables clustering the VM with physical machine

Network File System

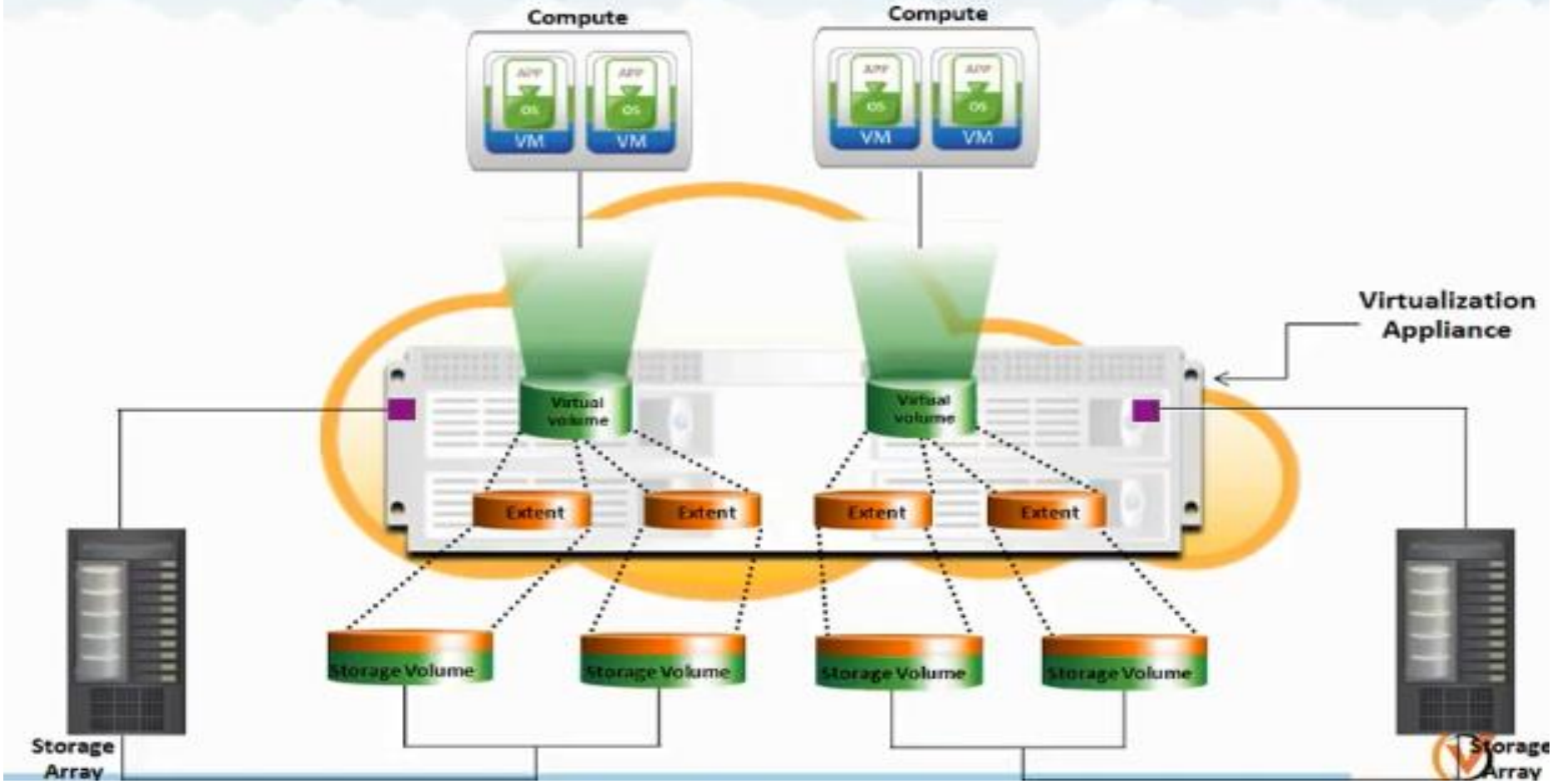
- Hypervisor uses NFS protocol to access NAS file system
- NFS volumes are created on NAS device
  - Provide storage to VM
  - Accessed by multiple compute systems simultaneously



Block-level and File-level Virtualization – Overview

- Network-based virtualization embeds storage virtualization intelligence at the network layer
- Provides ability to
  - Pool heterogeneous storage resources
  - Perform non-disruptive data migration
  - Manage a pool of storage resources from a single managemen interface
- Network-based storage virtualization is applied at
  - Block-level (SAN)
  - File-level (NAS)

Physical to Virtual Volume Mapping



Benefits of Storage Virtualization

- Adds or removes storage without any downtime
- Increases storage utilization thereby reducing TCO
- Provides non-disruptive data migration between storage devices
- Supports heterogeneous, multi-vendor storage platforms
- Simplifies storage management

References

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