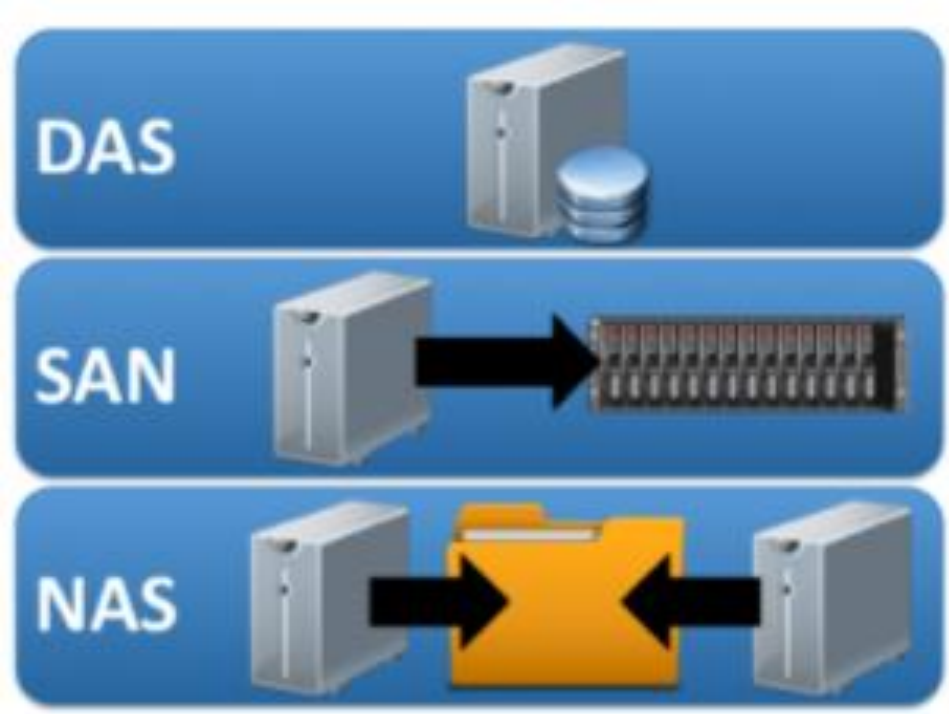
Storage Virtualization

Storage virtualization

- A grouping is done of physical storage which is from multiple networked storage devices.
- This is done so it looks like a single storage device.
- It is a sharing of the physical storage from multiple storage devices.

Physical Storage

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



Direct Attached Storage

Storage Area Network

Network Attached Storage

Direct Attached Storage (DAS)

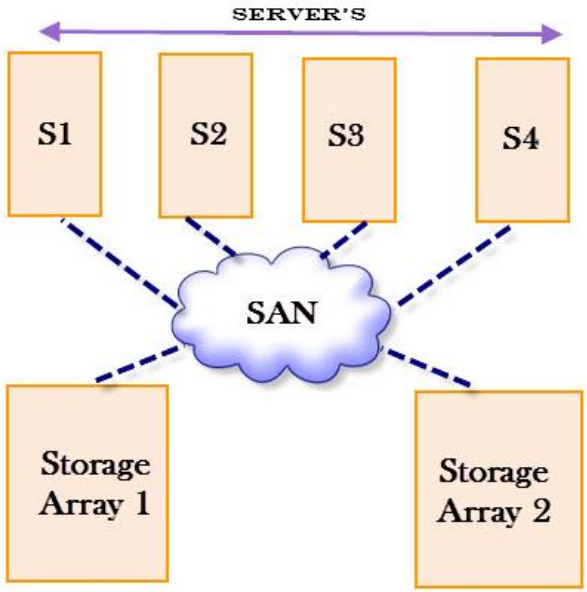
- Simplest storage model
- laptops, phones, and desktop computers
- Physically impossible to remove the storage from the compute
- But even in the case of servers, where it is theoretically possible to pull disk drives, once a drive is separated from the server, it is generally wiped before reuse.
-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

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

- Network of storage devices, Fibre Channel
- 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



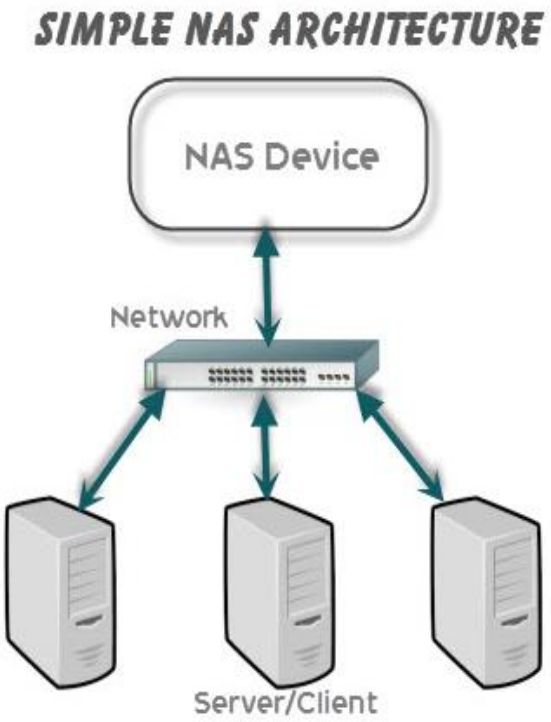
Storage Area Network (SAN) Implementation

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.
- Server Message Block (SMB) and Network File system (NFS) are examples of NAS protocols.

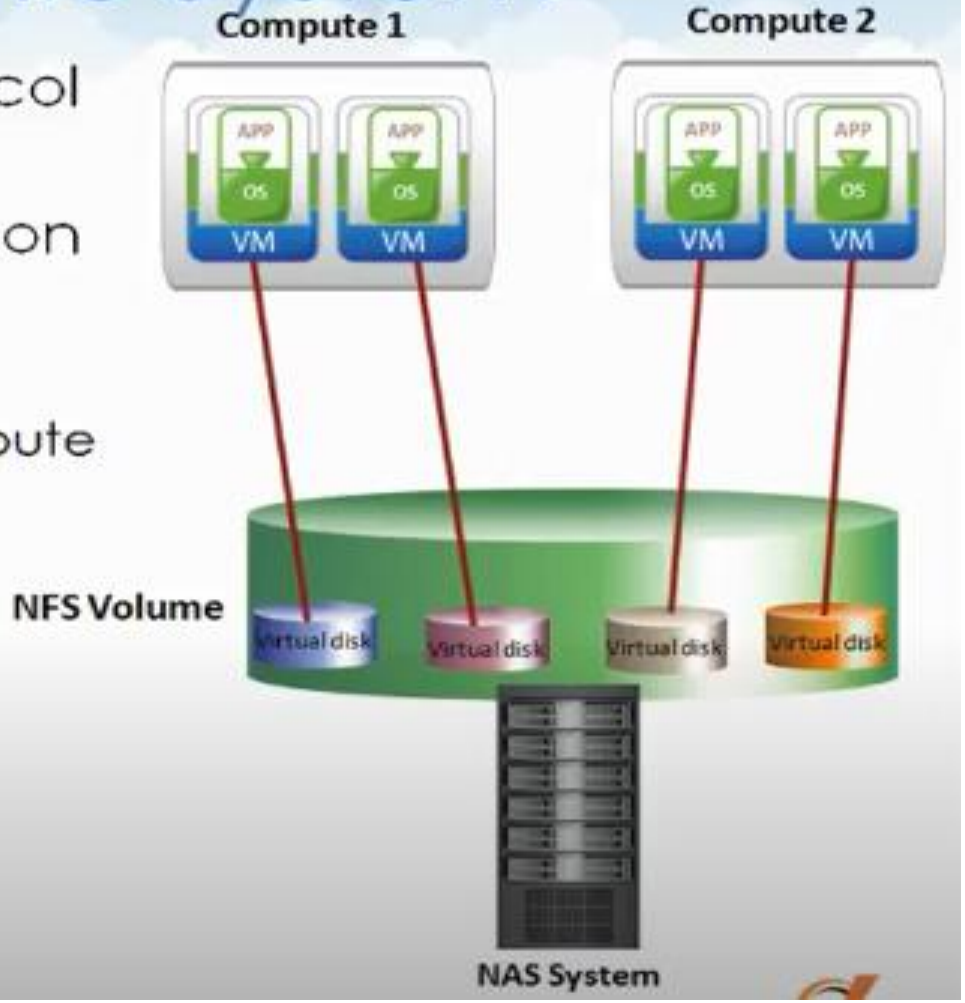
NAS

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



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



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

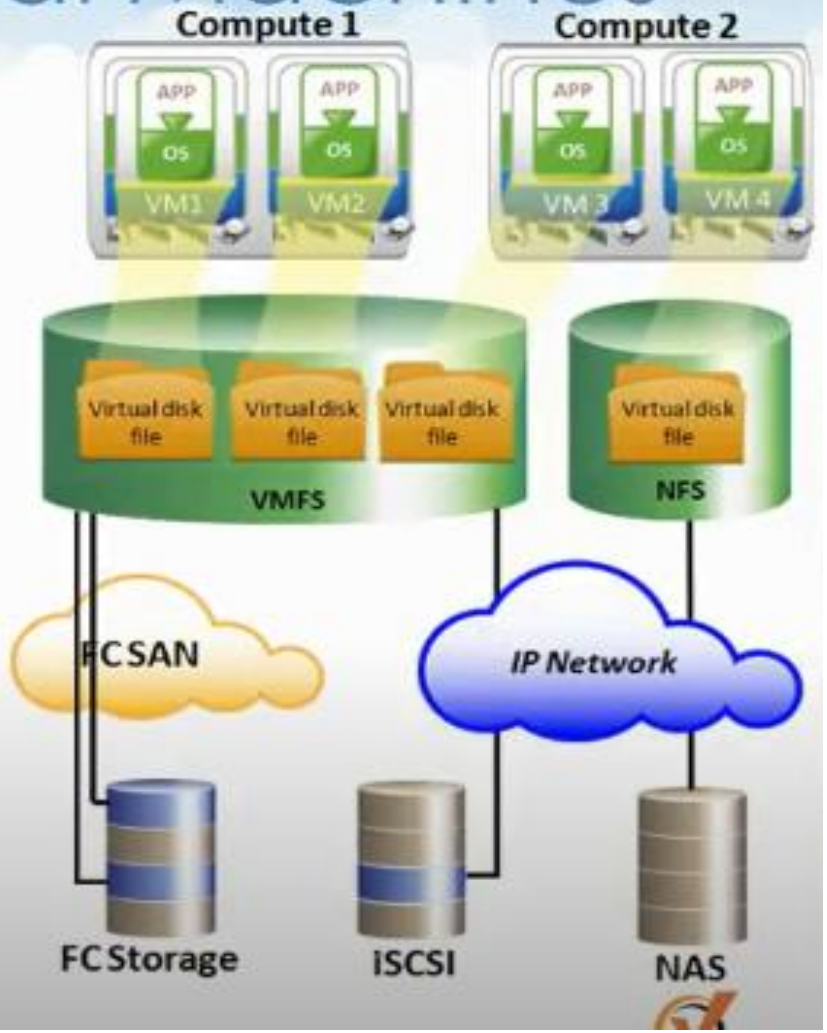
Storage virtualization

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 for Virtual Machines

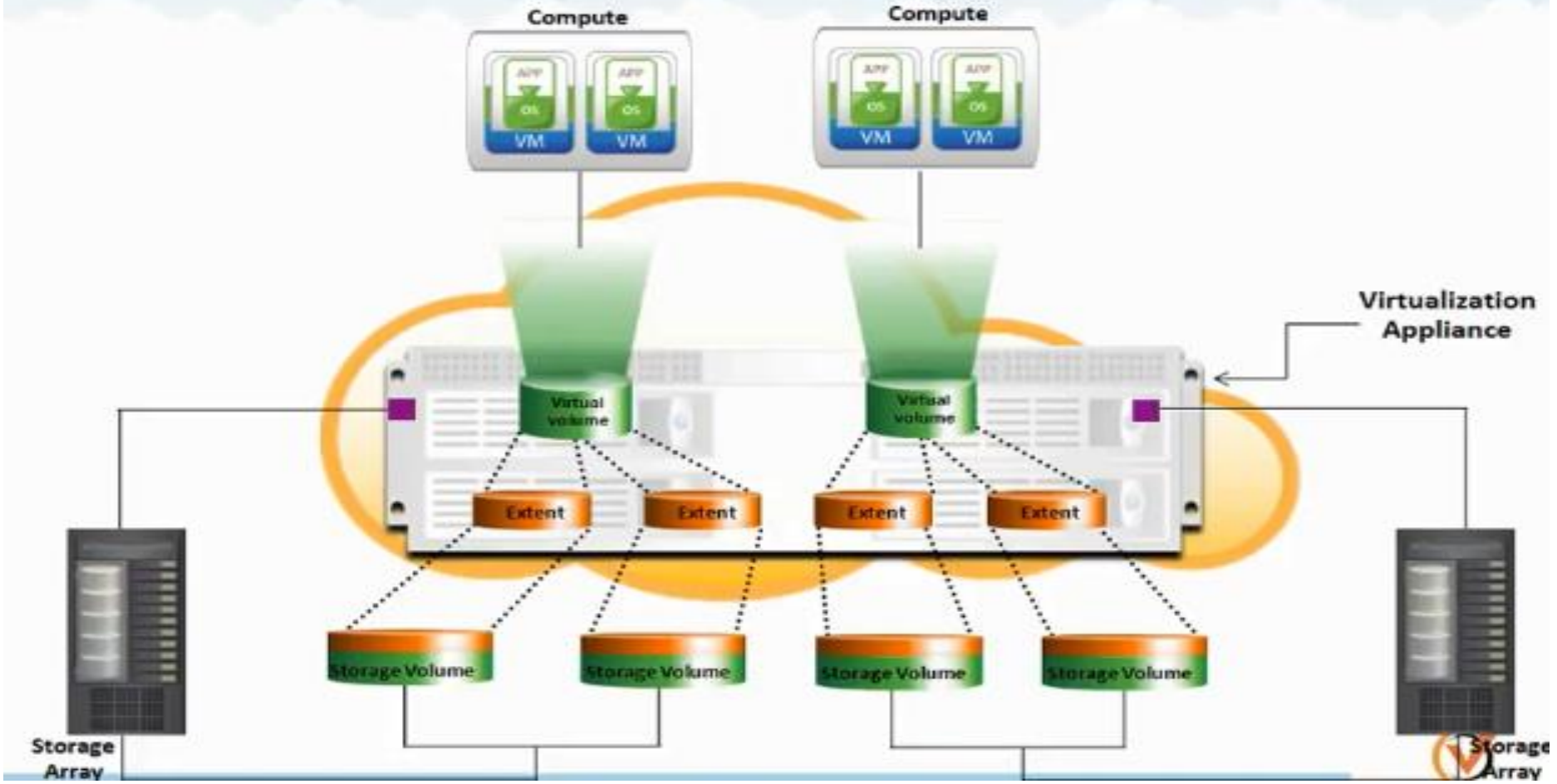
- VMs are stored as set of files on storage space available to hypervisor
- 'Virtual disk file' represents a virtual disk used by a VM to store its data
- Size of virtual disk file represents storage space allocated to virtual disk
- VMs remain unaware of
  - Total space available to the hypervisor
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



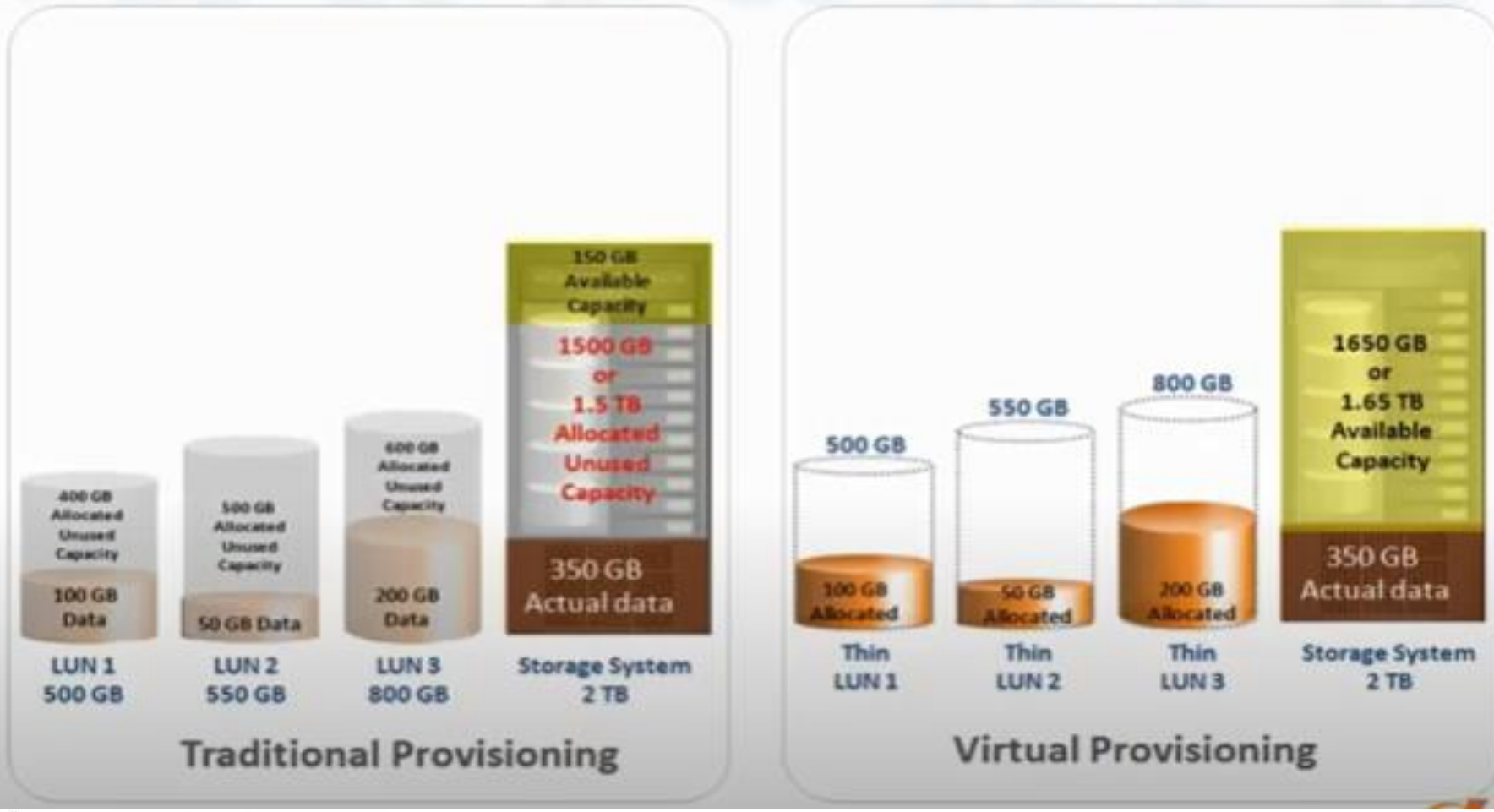
Block-level and File-level Virtualization – Overview

- 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



Traditional Provisioning vs. Virtual Provisioning



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

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