Cloud Computing NETW1009

Lecture 3

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Lecture 3: Cloud Data Centers II

Lecture Outline

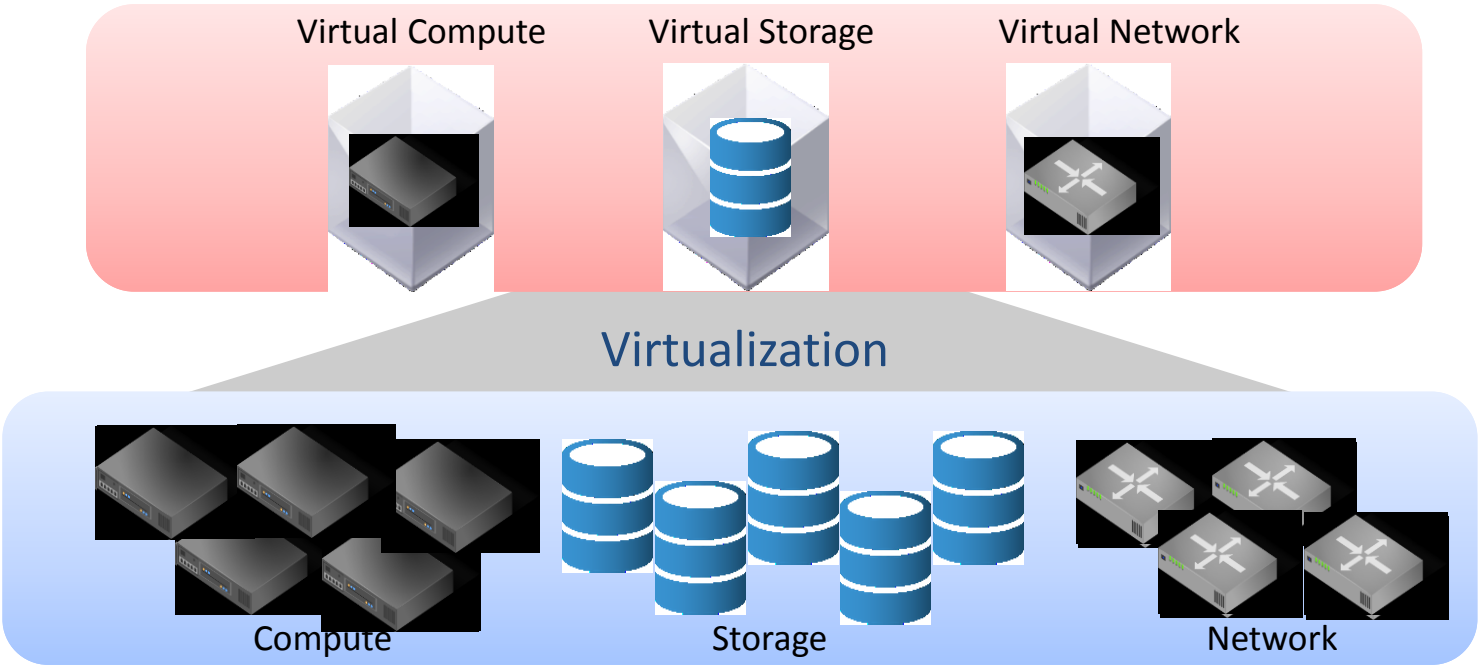
- Virtualization
- Hypervisor
- Virtual Machine
- Compute Systems Virtualization
- Application Virtualization
- Desktop Virtualization

- Now that you understand what is Cloud Computing and what is a Cloud Data Center..
- Time to learn about the key technology behind Cloud Computing!

What is Virtualization?

Virtualization

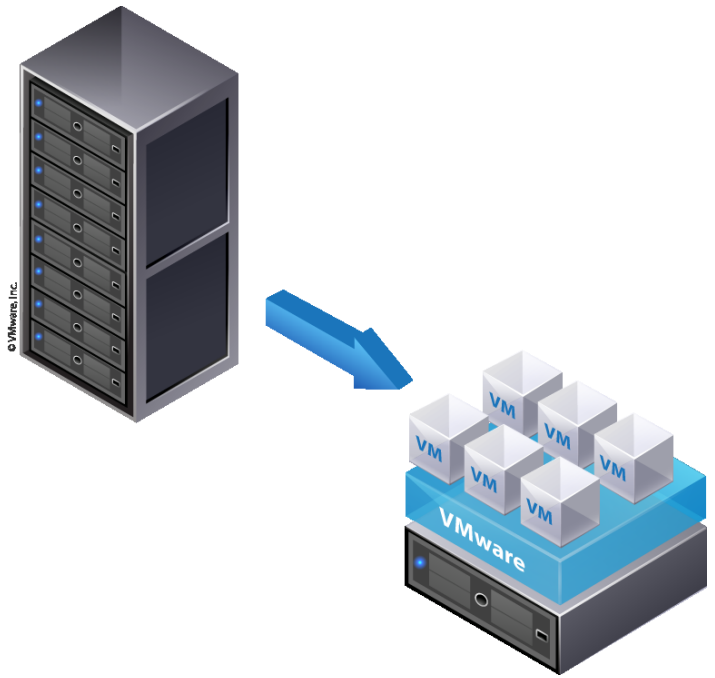
The process of abstracting physical resources such as compute, storage, and network, and making them appear as logical resources.



Why Virtualization?

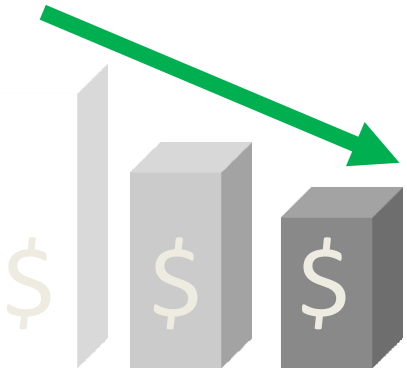
Virtualization provides a powerful tool to help systems designers and administrators optimize their environments:

- Multiple separate servers can be consolidated as virtual machines on a single physical computer
- Converts hardware to software
- It is very simple to modify a virtual machine configuration
- Moving virtual machines between physical systems is quick and easy



Virtualization Benefits

Improves Re



Reduces Cost

Increases Management Efficiency

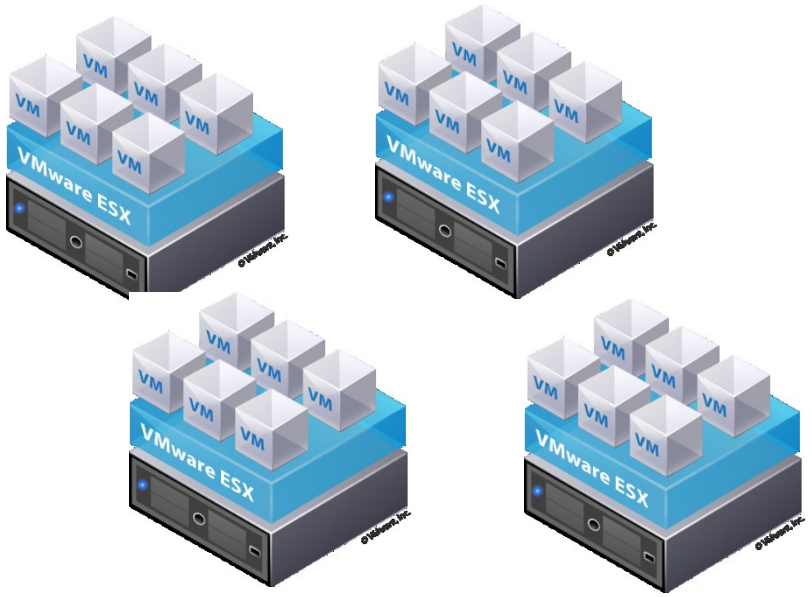
Provisioning

Increase Flexibility

Challenges of Virtualization

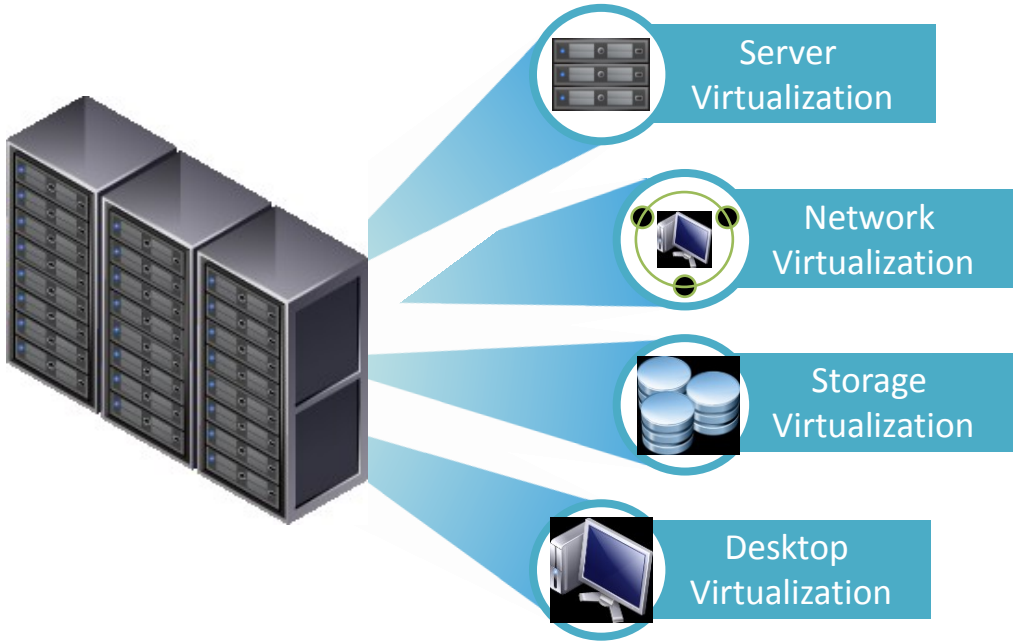
There are a number of challenges and downsides to virtualization:

- Initial lack of software vendors support.
- Physical failures can affect multiple virtual machines.
- High consolidation ratios can result in more complex physical servers.
- Performance management becomes critical as virtual machine performance issues can affect other virtual machines.
- Storage management can be challenging.



Core Virtualization Technologies

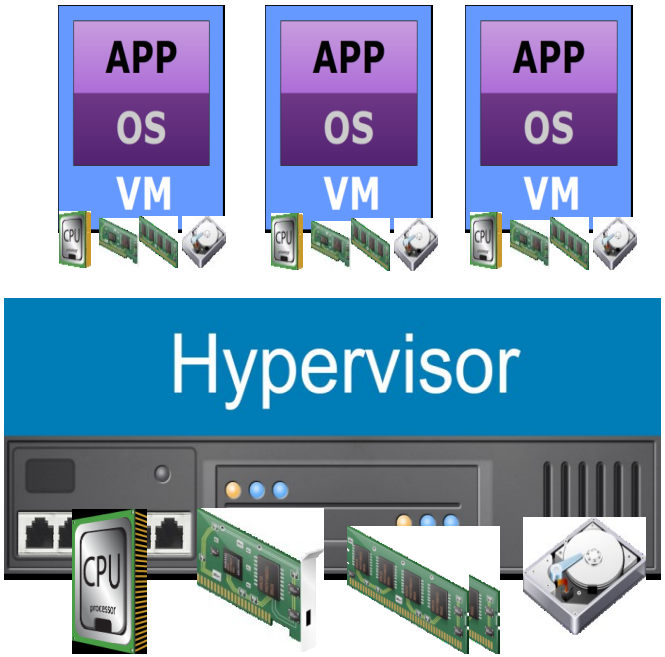
Effective virtualization requires the effective ability to manage Compute, Storage and Network resources



Compute Virtualization

Compute Virtualization

The technique of abstracting the physical compute hardware from the operating system and applications enabling multiple operating systems to run concurrently on a single or clustered physical compute systems.



Physical Compute Components

Compute Virtualization

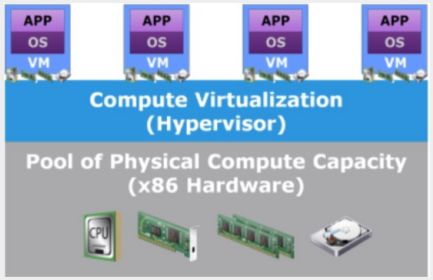
Need for Compute Virtualization

Before Virtualization

- IT silos and underutilized resources
- Inflexible and expensive
- Management inefficiencies
- Risk of downtime

After Virtualization

- Server consolidation and improved resource utilization
- Flexible infrastructure at lower costs
- Increased management efficiency
- Increased availability and improved business continuity

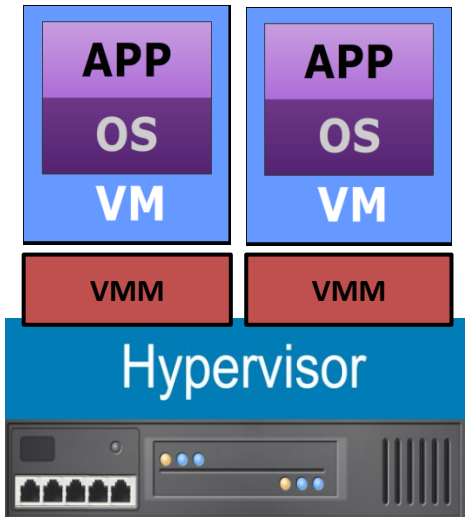


Compute Virtualization Components: Hypervisor

Hypervisor

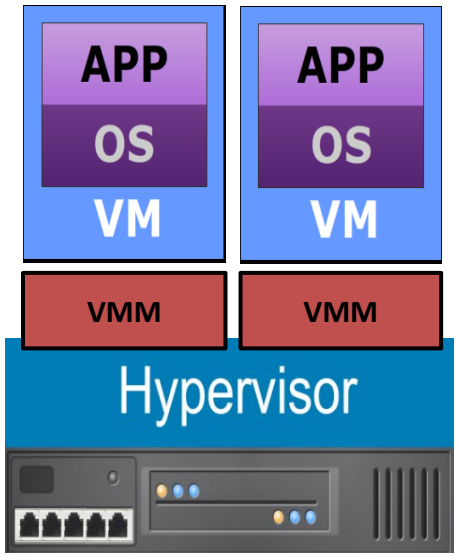
Software that provides a virtualization layer for abstracting compute system hardware, and enables the creation of multiple virtual machines.

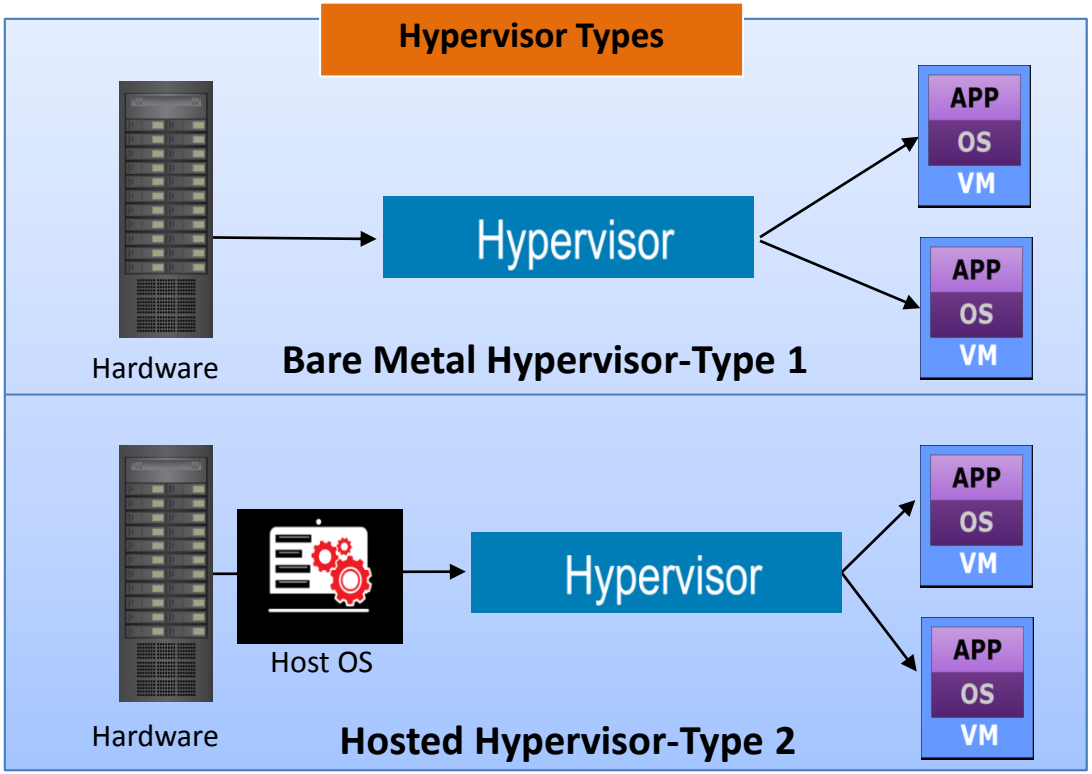
- Two key components:
  - Hypervisor Kernel
    - Provides functionality similar to an OS kernel
  - Virtual Machine Manager (VMM)
    - Each VM is assigned a VMM
    - Abstracts physical hardware and presents it to VM
- Two types of Hypervisors: Bare-metal & Hosted



Compute Virtualization Components: Hypervisor

- Types of Hypervisors: Bare-metal & Hosted

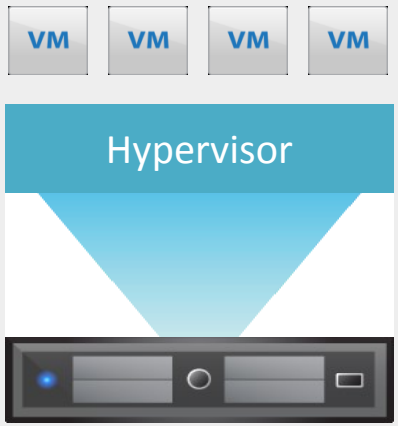




Compute Virtualization Components: Hypervisor Types

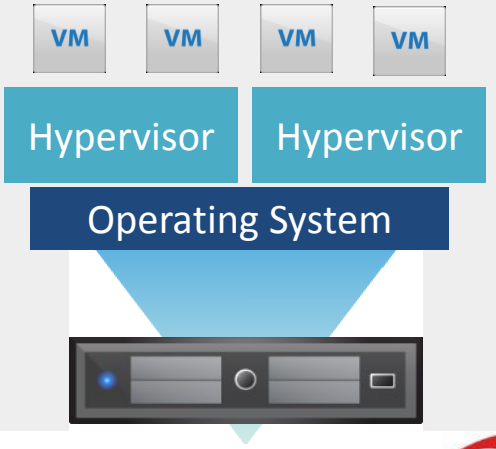
Bare Metal Hypervisor

- Runs directly on the hardware
- Completely replaces the operating system on the physical machine
- Most efficient to manage server hardware
- Example: VMware ESX & ESXi, vSphere



Hosted Hypervisor

- Runs inside another operating system
- Has an overhead & performance penalty
- Not ideal for server solutions
- Example: VMware Workstation, VMware Server, Microsoft's Virtual PC



Compute Virtualization Components: Virtual Machine

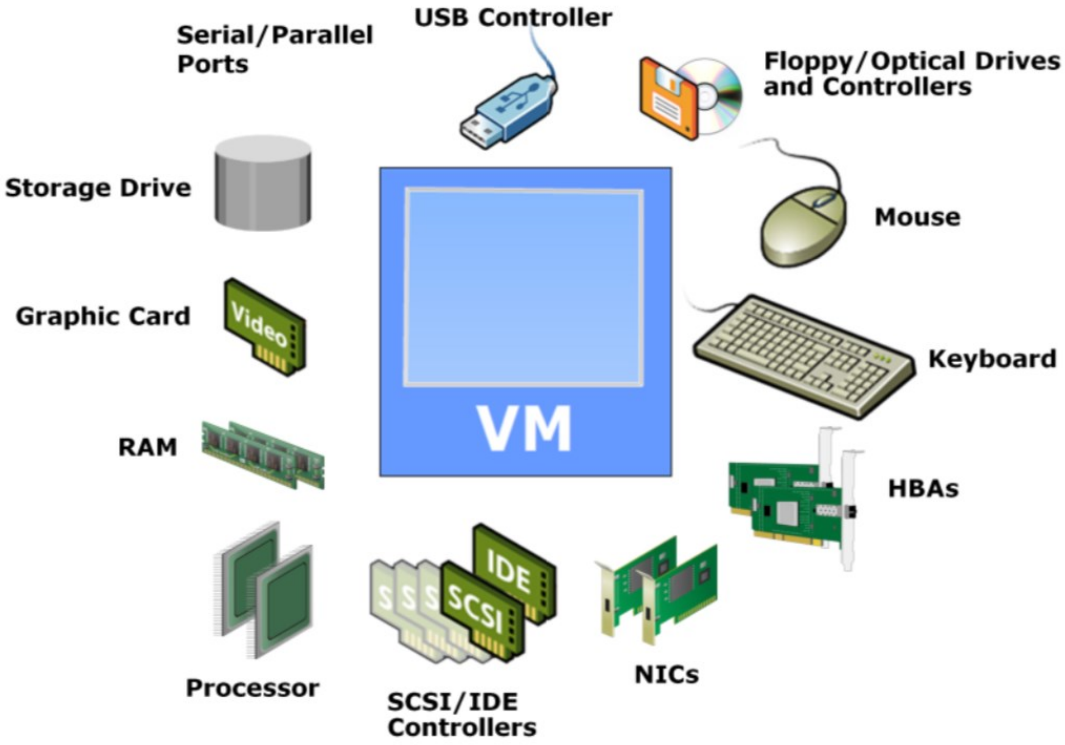
Virtual Machine (VM)

A logical compute system with virtual hardware on which a supported guest OS and its applications run.

- Hypervisor creates a VM
- Comprises virtual hardware, such as virtual processor, memory, storage, and network resources
  - Appears as a physical compute system to the guest OS
  - Hypervisor maps the virtual hardware to the physical hardware
- Provider provisions VMs to consumers for deploying applications
  - VMs on the same compute system or cluster run in isolation

Compute Virtualization Components: Virtual Machine

VM can virtually be allocated all hardware components



Compute Virtualization Components: Virtual Machine

From a hypervisor's perspective, a VM is a discrete set of files such as:

Configuration File	• Stores information, such as VM name, BIOS information, guest OS type, memory size
Virtual Disk File	• Stores the contents of the VM's disk drive
Memory State File	• Stores the memory contents of a VM in a suspended state
Snapshot File	• Stores the VM settings and virtual disk of a VM
Log File	• Keeps a log of the VM's activity and is used in troubleshooting

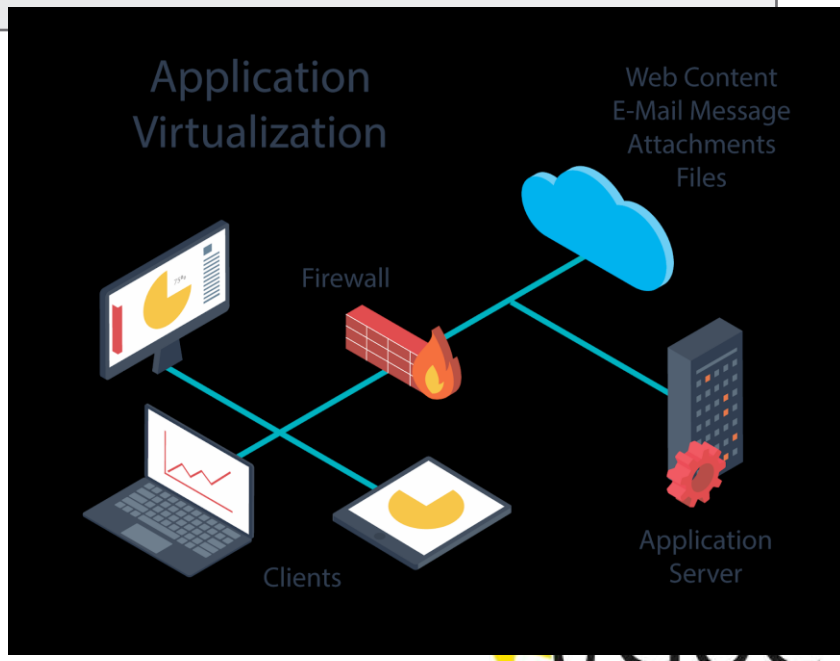
More Compute Virtualization

Application Virtualization

Application Virtualization

The technique of decoupling an application from the underlying computing platform (OS and hardware) to enable the application to be used on a compute system without installation

- Application is either delivered from a remote compute system, or encapsulated in a virtualized container
- Application Virtualization Benefits:
  - Simplified application deployment and management
  - Eliminate OS modifications
  - Resolve application conflicts and compatibility issues
  - Flexibility of application access



More Compute Virtualization

Application Virtualization Techniques

Application Encapsulation

- Application is converted into a standalone, self-contained executable package
- Application packages may run directly from local drive, USB, or optical disk

Application Presentation

- Application is hosted and executes remotely, and the application's UI data is transmitted to client
- Locally-installed agent on the client manages the exchange of Ui information with users' remote application session

Application Streaming

- Application-specific data is transmitted in portions to clients for local execution
- Requires locally-installed agent, client software, or web browser plugin

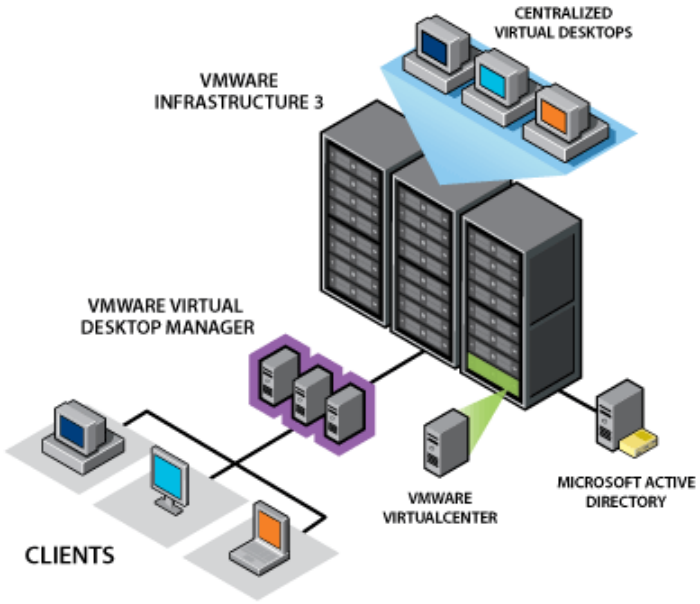
More Compute Virtualization

Desktop Virtualization

Desktop Virtualization

Technology that decouples the OS, applications, and user state from a physical compute system to create a virtual desktop environment that can be accessed from any client device

- Desktops are hosted and managed centrally
- Desktop virtualization benefits:
  - Simplified desktop infrastructure management
  - Improved data protection and compliance
  - Flexibility of access

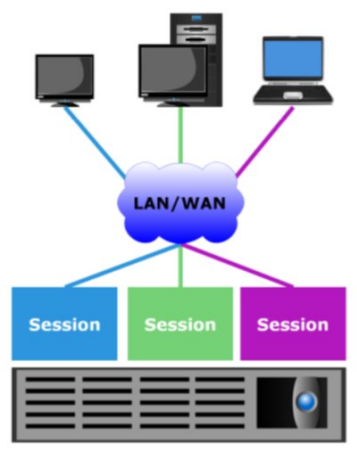


More Compute Virtualization

Desktop Virtualization Techniques

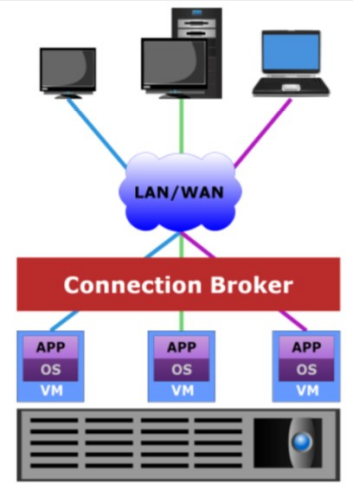
Remote Desktop Services

OS and applications are hosted on a remote compute system (Terminal Server) and are shared by multiple users



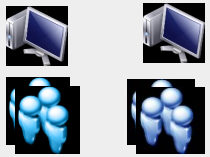
Virtual Desktop Infrastructure

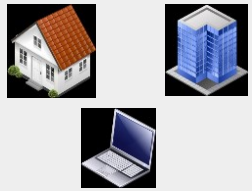
OS and applications are hosted on virtual machines running on a remote compute system



Desktop Virtualization Benefits

Low cost Terminals & Deployment	• Using thin/zero clients, the need for desk-side technical support is reduced • Limited configuration steps
Protection for Shared Desktops	• Eliminates risks associated with storing user data locally at shared computers • All user data is stored centrally in a protected environment
True Remote Solutions	• Minimal dependency on users' mobile computer • Replacing lost/stolen/broken machines doesn't require extensive restoration of apps & data • Improved security in case of loss/theft
Simplified Management	• Simplified rollout of security patches & applications • Availability of operating system migration options • Simpler legal compliance auditing & enforcement
Security Benefits	• Eliminate threats from rogue devices connecting to the network • Tight control & monitoring of network traffic

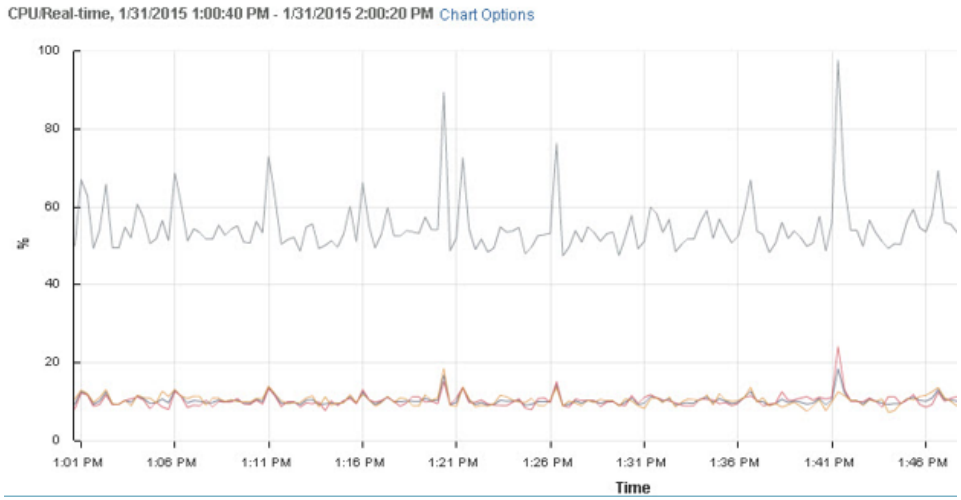




Desktop Virtualization Challenges

Virtual desktops present their own challenges:

- Network connectivity is critical.
- Load patterns follow regular user behaviours and can cause performance demand spikes.
- Scheduled IT activities that are not carefully planned, like an urgent security patch, might cause a rapid spike in performance demand.
- Storage design for large virtual desktop deployments can be difficult and expensive.



Use Cases for Application & Desktop Virtualization

Cloud Application Streaming	• Streaming applications from the cloud to diverse client devices • Applications flexibly scale to meet growth in processing and storage needs • Applications can be delivered to devices on which they may run natively
Desktop as a Service (DaaS)	• Cloud service in which a VDI is hosted by a cloud service provider • Provider manages VDI and OS updates • Facilitates CAPEX and OPEX savings

References

- “Cloud Infrastructures and Services - CIS” Course by Dell Technologies
- “Information Storage and Management – ISM” Course by Dell Technologies
- “IT Solutions for Digital Businesses - Virtualization and the Journey to the Modern Digital Workspace” Course by Vmware

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