Unit 3 - Virtualization

Introduction

- Virtualization is the Key component of Cloud Computing

- It is the enabling technology allowing the creation of an intelligent abstraction layer which hides the complexity of underlying hardware or software

- Virtualization is the ability to run "Virtual machines' on top of a "hypervisor"

- A hypervisor provides a uniform abstraction of the underlying physical machine

What Virtual Machines provide

- Hardware Independence
  - ➢ VM sees the same hardware regardless of the host hardware

- Isolation
  - ➢ VM's operating system is isolated from the host operating system

- Encapsulation
  - ➢ Entire VM encapsulated into a single file

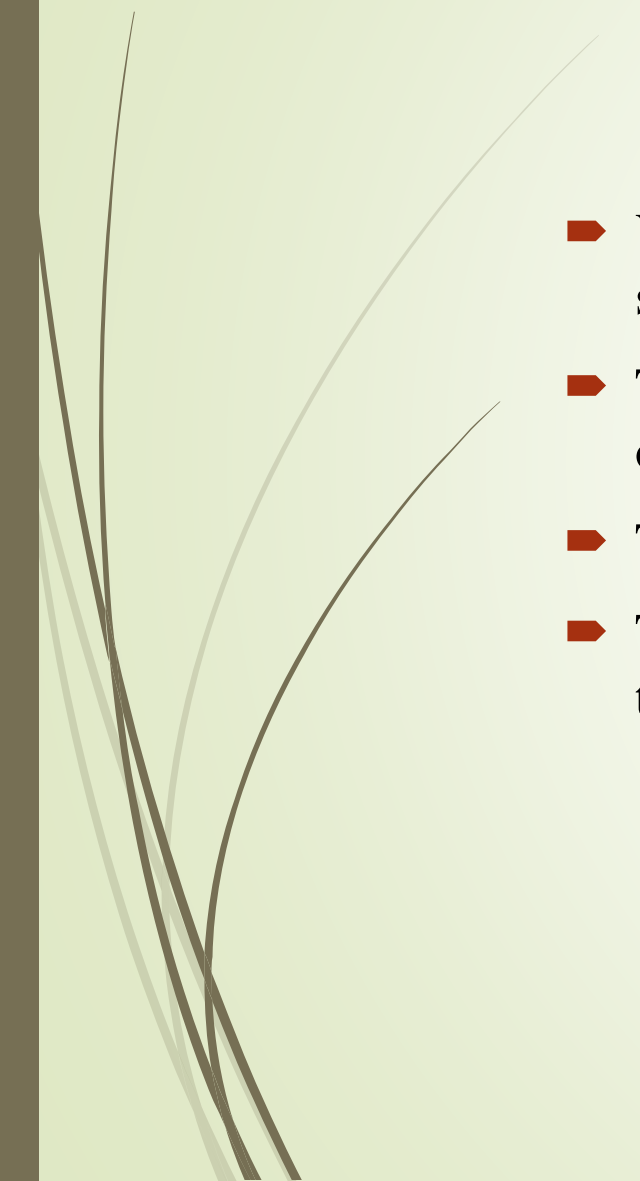# Virtual Machines Classification

➡ Process Virtual Machine

  ➢ Designed to run a single program, which means that it supports a single process

  ➢ Eg. JVM, Dalvik.

➡ System Virtual machine

  ➢ Provides a complete system platform which supports the execution of a complete operating system (OS)

  ➢ Eg. VirtualBox, Parallels Workstations, Vmware, Xen etc.

Virtualization

- Virtualization is a technology that allows multiple operating systems to run on the same physical hardware

- This is done by creating a layer of abstraction between the hardware and the operating systems

- This layer is called a hypervisor

- The hypervisor manages the resources of the physical hardware and allocates them to the virtual machines.
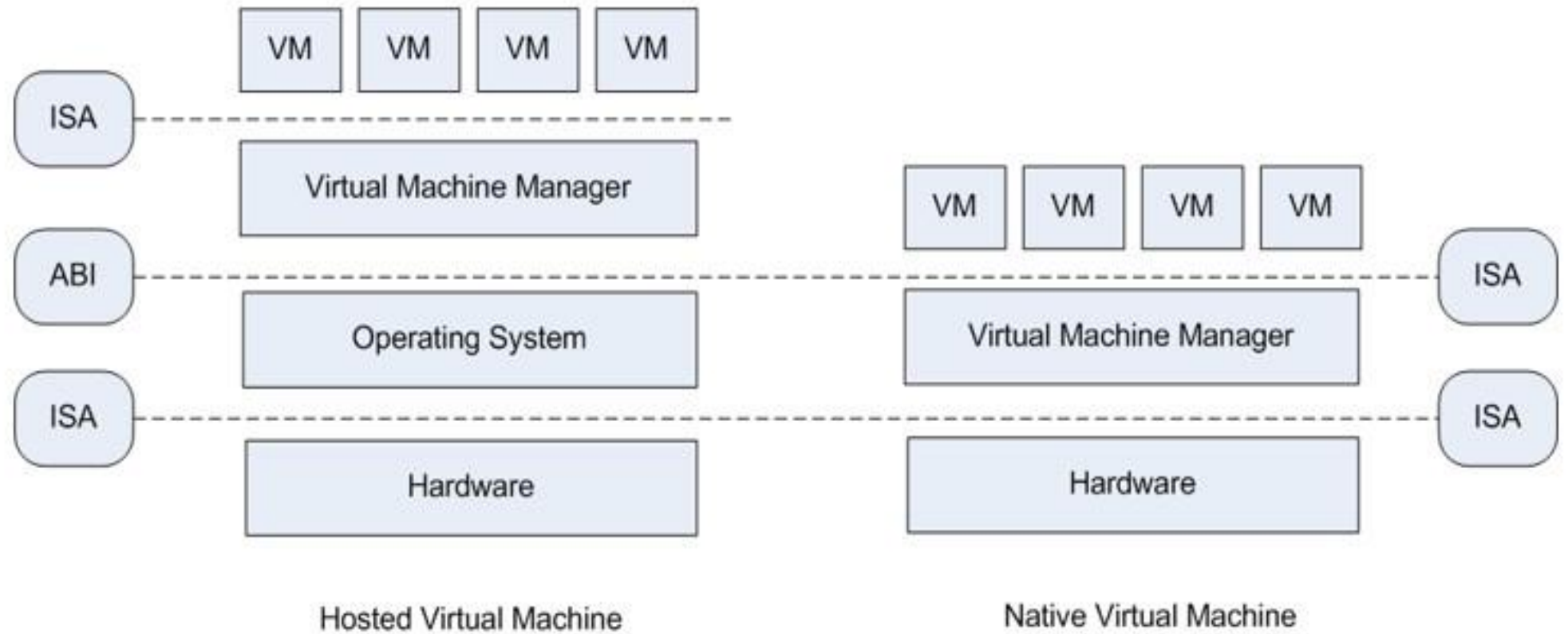
Type I and Type II Hypervisors

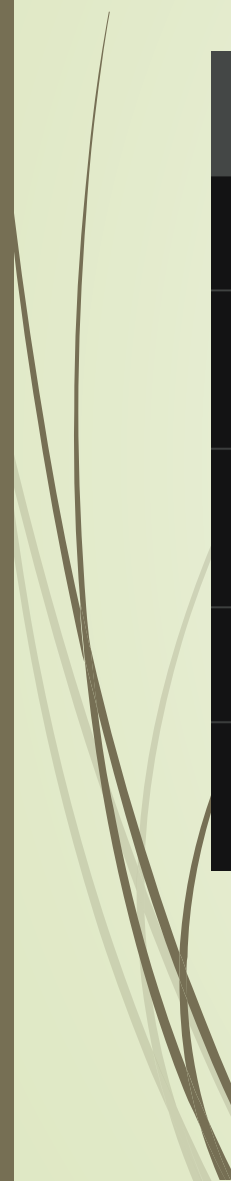Figure- Type I and Type II Hypervisors

Types of Virtualization

- General Types:
  - Network Virtualization
  - Storage Virtualization
  - Desktop Virtualization
  - Application Virtualization
  - Data Virtualization

- Primary Types:
  - Full – Virtualization
  - Para – Virtualization
  - OS – Virtualization
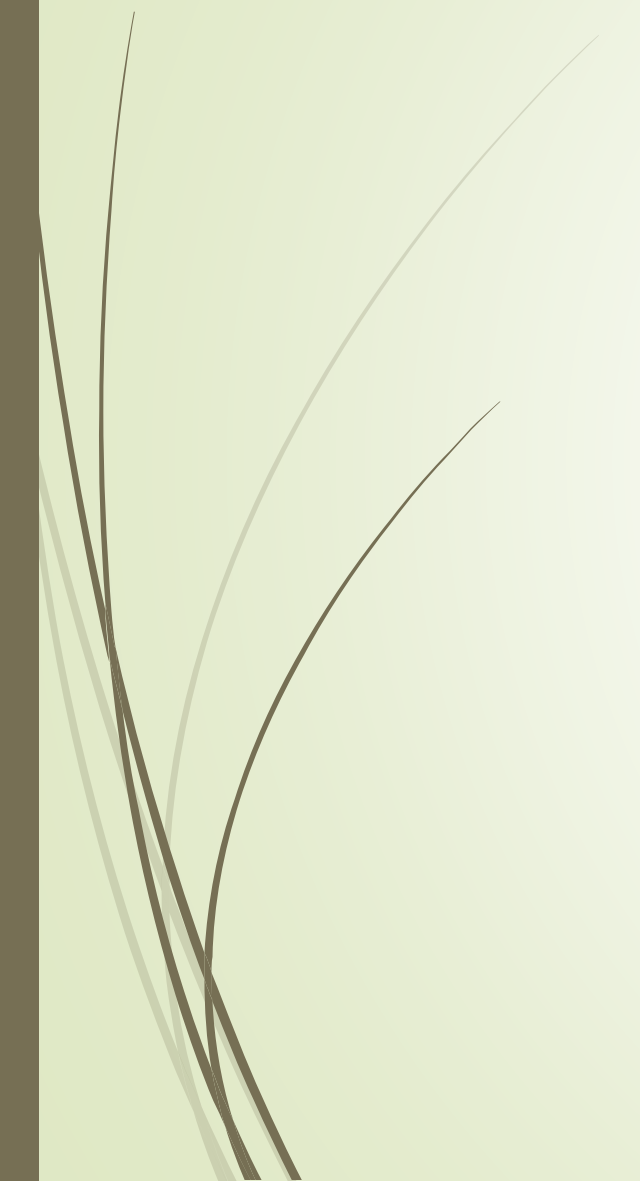
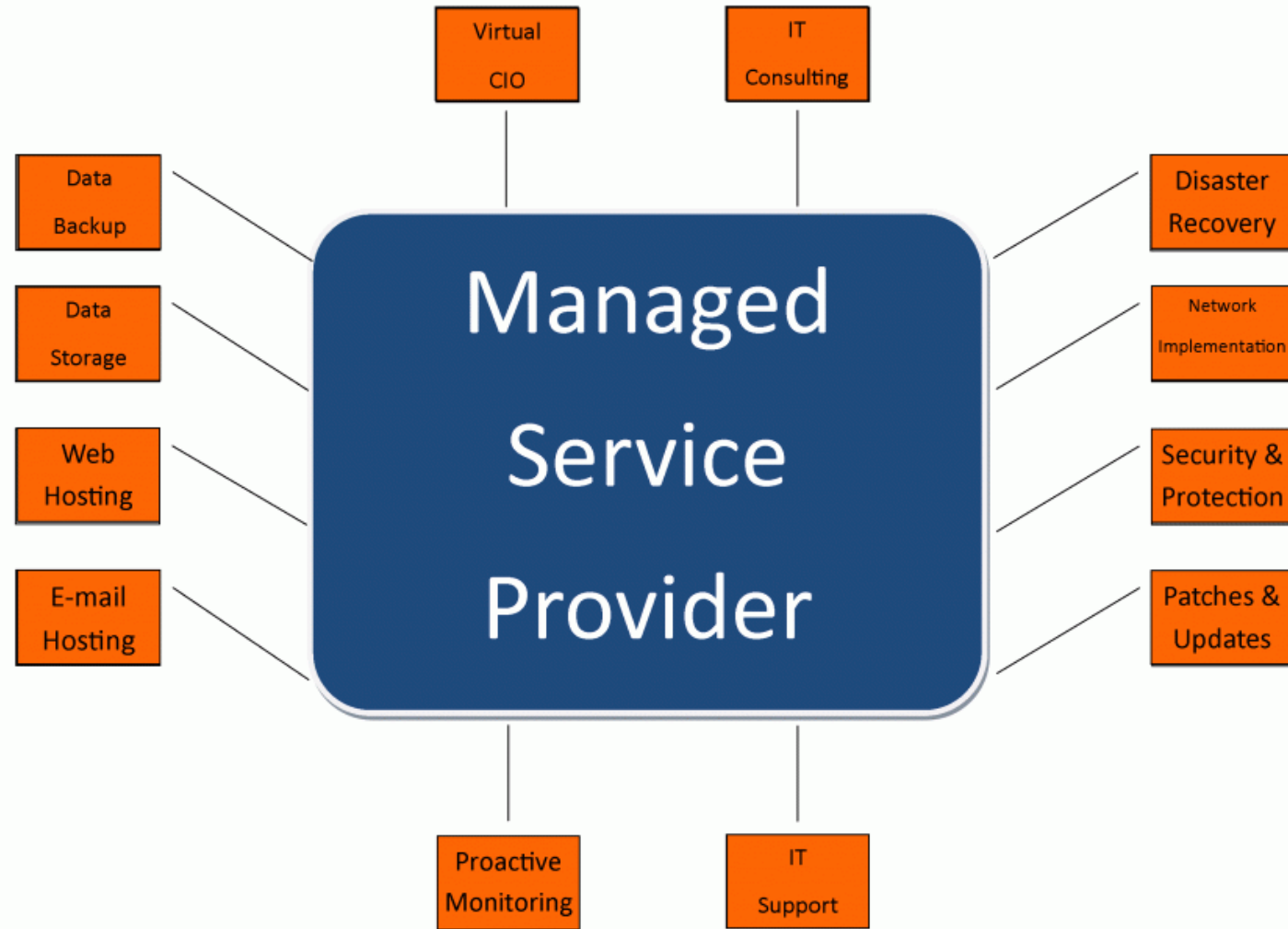| Feature	Full virtualization	Paravirtualization	OS virtualization
Flexibility	Most flexible	Least flexible	Least flexible
Efficiency	Least efficient	More efficient than full virtualization	Most efficient
Modifications to operating systems	No modifications required	Modifications required	No modifications required
Isolation	Not isolated	Partially isolated	Isolated
Best use case	Running a variety of operating systems on the same physical hardware	Improving the performance of operating systems	Creating isolated environments for different users or applications

Managed Service Provider (MSP)

- A managed service provider (MSP) is an outsourced third- party company that manages and assumes the responsibility of a defined set of day-to-day management services to its customers(server, network, specialized applications etc.)

- It is a strategic method of improving operations that is commonplace among large corporations as well as small and medium-size businesses, non-profit organizations, and governments.

MSP (contd.)

- Managed service providers tend to be Web hosting or application service providers that allow users to outsource their network and application resource procedures under a delivery agreement.

- In most cases, MSPs own the entire physical back-end infrastructure and provide resources to end users remotely over the Internet on a self-service, on-demand basis.

  - Eg: Sirius Computer Solutions, Inc. ,PCM Inc, Softchoice Corporation

Evolution of MSP to CC

➡ The evolution of MSP started around the 1990s with the emergence of application service providers (ASPs) who helped pave the way for remote support for IT infrastructure

➡ From the initial focus of remote monitoring and management of servers and networks, the scope of an MSP's services expanded to include mobile device management, managed security, remote firewall administration

➡ The advance of cloud computing has added another complex blend of challenge and opportunity into the mix.

➡ The biggest challenge is around finding ways to manage new hybrid environments, which combine the traditional on- premise world with new cloud-based infrastructures.

Evolution of MSP to CC (contd…)

- Cloud Computing enables organizations to consume compute resources as a utility, rather than having to build and maintain computing infrastructures in-house

- In both Managed Services and Cloud Computing – regardless of whether it is Private or Public, there is a third-party entity that is providing a service to the consuming business entity.

- This then leads to thoughts where organizations ponder if Managed Services is even relevant in the context of Cloud Computing.

- As the cloud evolves, so will managed solutions in the cloud. It's inevitable, as there are many positives to cloud computing, the bond between managed services and cloud computing will only strengthen in the years to come.

Evolution of MSP to CC (contd…)

Pre-Cloud Landscape

Managed Services Provider
+
Enterprise IT
➡ Enterprise IT Consumer

Current Landscape

Managed Services Provider
+
Cloud Provider
+
Enterprise IT
➡ Enterprise IT Consumer

From Single Purpose architectures to multi-purpose architectures

- In the early days of MSPs, the providers would actually go onto customer sites and perform their services on customer-owned premises

- Over time, these MSPs specialized in implementation of infrastructure and quickly figured out ways to build out data centers and sell those capabilities off in small chunks commonly known as monthly recurring services, in addition to the basic fees charged for ping, power, and pipe (PPP)

  - Ping refers to the ability to have a live Internet connection

  - Power is obvious enough, and

  - Pipe refers to the amount of data throughput that a customer is willing to pay for.
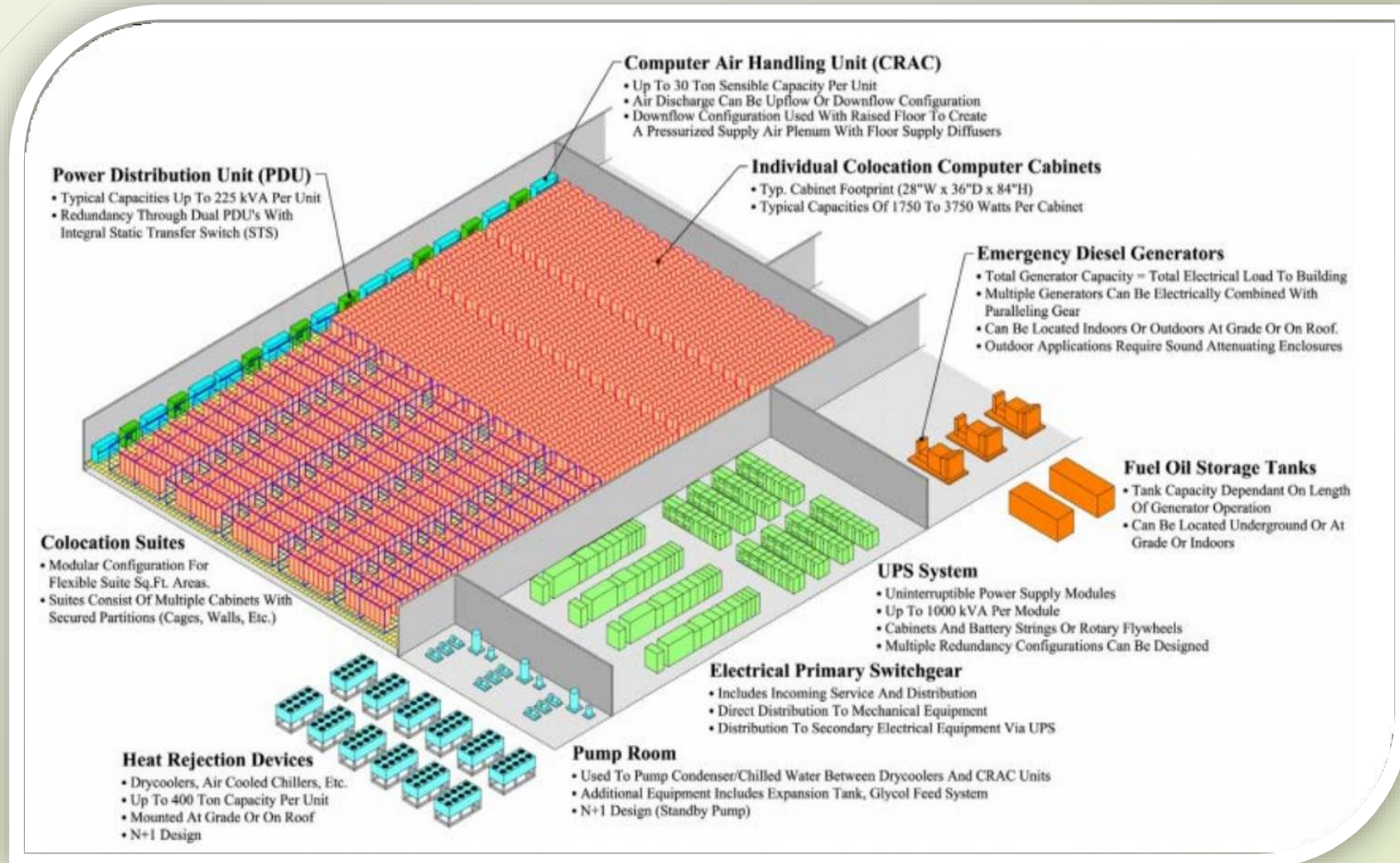
contd…

- An advantage for customers using an MSP is that by purchasing a defined set of services, MSPs bill a flat or near-fixed monthly fee

- Step forward to today and we find that many MSPs now provide their services remotely over the Internet rather than having to sell data center space and services or perform on- site client visits (which is time-consuming and expensive).

Data Centers

Data Center Virtualization

- Data center virtualization is the process of designing, developing and deploying a data center on virtualization and cloud computing technologies

- It primarily enables virtualizing physical servers in a data center facility along with storage, networking and other infrastructure devices and equipment

- Data center virtualization usually produces a virtualized, cloud and collocated virtual/cloud data center. Virtual Sever resides on top of hypervisor also known as virtual Machine Manager(VMM)
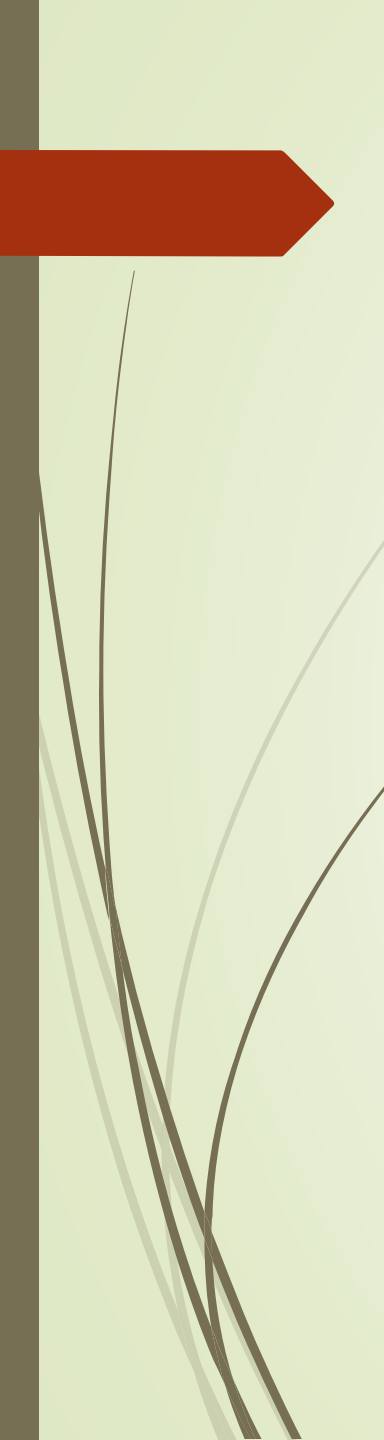
Benefits

➡ Enables the consolidation of physical servers, slashing the costs of operating a data center. This includes reducing the costs of server upgrades, management, power, space, and storage

➡ Reduction in data center space and in data center equipment such as PDUs, air conditioning units, etc

➡ Reduction in the number of network, HBAs and SAN switches

➡ Provides true high-availability for all servers without requiring duplicate hardware and clustering software

➡ Facilitates true disaster recovery for all servers

➡ Eliminates the need for maintenance windows for physical server troubleshooting or upgrades and enables faster server provisioning

➡ Enhances security and provides regulatory compliance benefits

Cloud Data Center

➡ A cloud data center has three distinct characteristics that differentiate it from traditional DC

➡ It is sold on demand, typically by the minute or the hour

➡ It is elastic - a user can have as much or as little of a service as they want at any given time

➡ The service is fully managed by the provider (the consumer needs nothing but a personal computer and Internet access)

➡ The multiplier effect of Internet data, trends of enterprises information transformation and tremendous load bring forth traditional DC huge challenges: how to reduce operation and maintenance cost, how to meet demand of high capacity, high security and high efficiency

Traditional Corporate Data Center	Cloud Data Center
Thousands of different applications	Few applications (maybe even just one)
Mixed hardware environment	Homogeneous hardware environment
Multiple management tools	Standardized management tools
Frequent application patching and updating	Minimal application patching and updating
Complex workloads	Simple workloads
Multiple software architectures	Single standard software architecture

Virtualization Software

- Vmware vSphere
- Microsoft Hyper-V
- Citrix- XenServer
- Oracle VM
- Virtualbox
- Vmware Workstation and many more…

Load Balancing

- Load balancing is the process of distributing network or application traffic across multiple servers

- This can help to improve performance and reliability

- There are two main types of load balancing

  - **Hardware load balancers** are dedicated devices that are used to distribute traffic. They are typically faster and more scalable than software load balancers

  - **Software load balancers** are software applications that are installed on a server. They are typically less expensive than hardware load balancers, but they may not be as scalable.

Infrastructure Requirement for Virtualization

- Physical Servers

- Hypervisor

- Storage

- Network

- Operating Systems

- Applications

- Virtualization management tools