

Virtual Systems & Services

by

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Week #1

Virtualization

Why learn virtualization?

- Modern computing is more efficient due to virtualization.
- Virtualization can be used for mobile, personal and cloud computing.
- You can also use virtualization in your personal life

Virtualization Benefits

- Have you ever wished you could clone yourself?
- If you could, would you be more efficient? Would you do more?
- Virtualization enables computers to be more efficient in a similar fashion.
- Computers that use virtualization optimize the available compute resources.

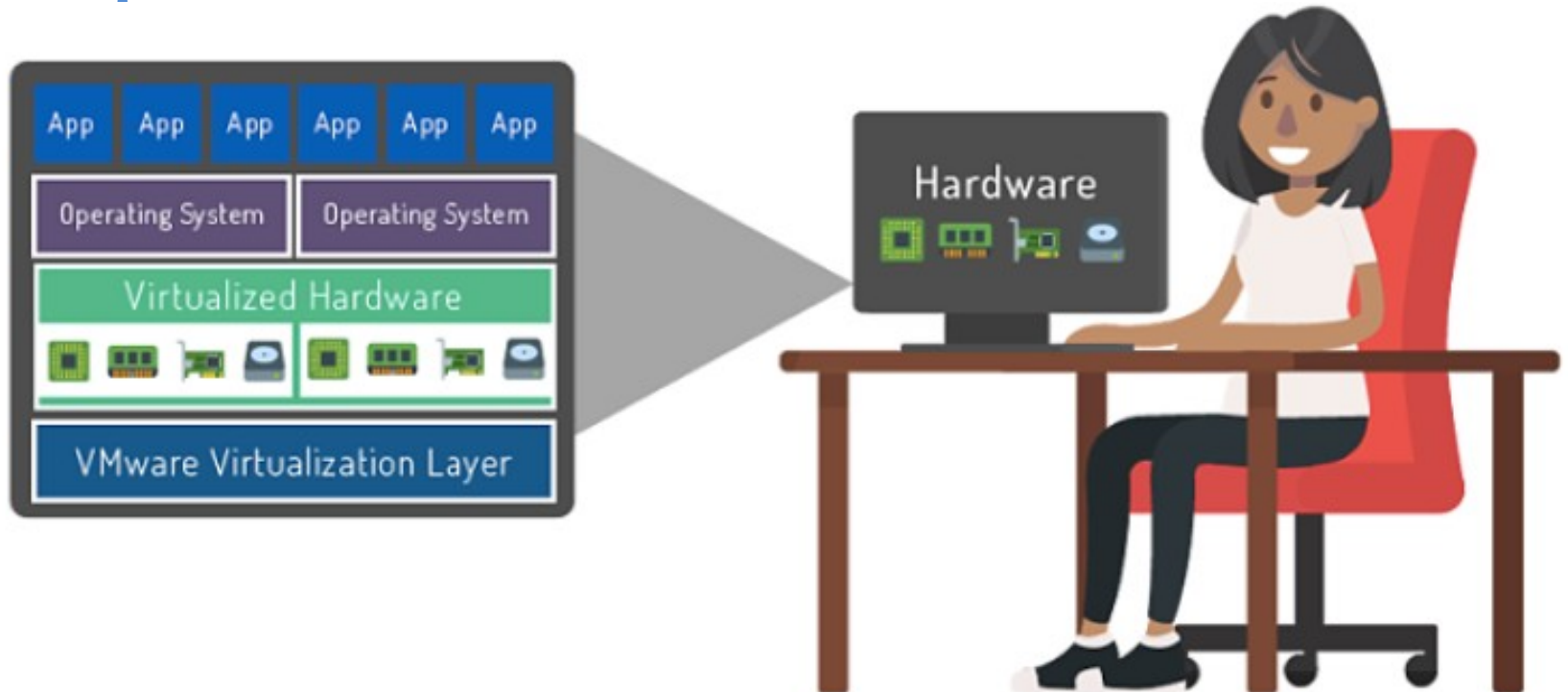
Real



Clones

How Virtualization Works?

- Virtualization is the “layer” of technology that goes between the physical hardware of a device and the operating system to create one or more copies of the device.



What is a VM?

- Virtualization creates virtual hardware by cloning physical hardware.
- The hypervisor uses virtual hardware to create a virtual machine (VM)
- A VM is a set of files.
- With a hypervisor and VMs, one computer can run multiple OS simultaneously

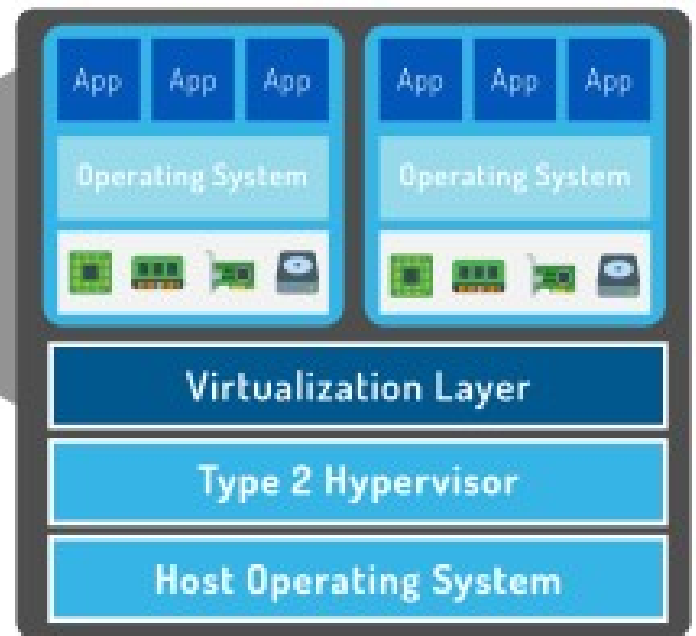


What is a Hypervisor?

- Software installed on top of hardware that created virtualization layer.
- Hosts VMs
- Type 1 Hypervisor – Bare metal hypervisor (VMware ESXi)
- Type 2 Hypervisor – Hosted hypervisor (VMware Workstation)



Virtual Machines



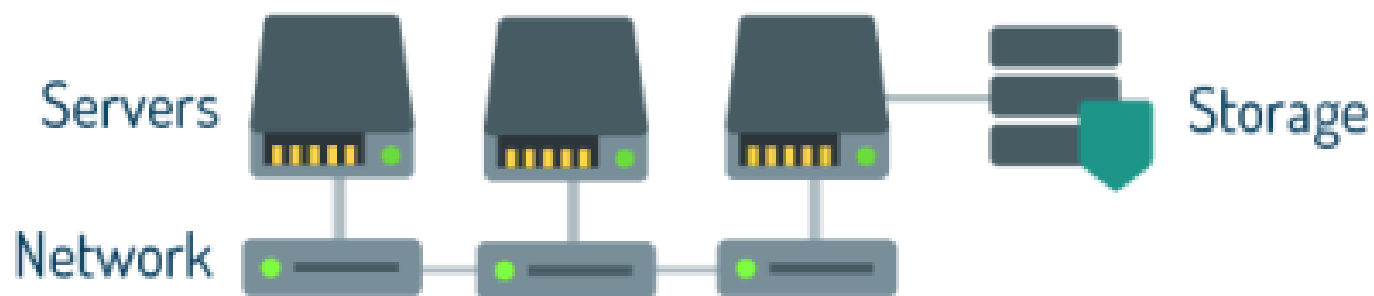
Virtual Machine Files

- VMs can be exported and moved to other hosts
- Files are created by the hypervisor and stored in a directory.
- Example VM files:

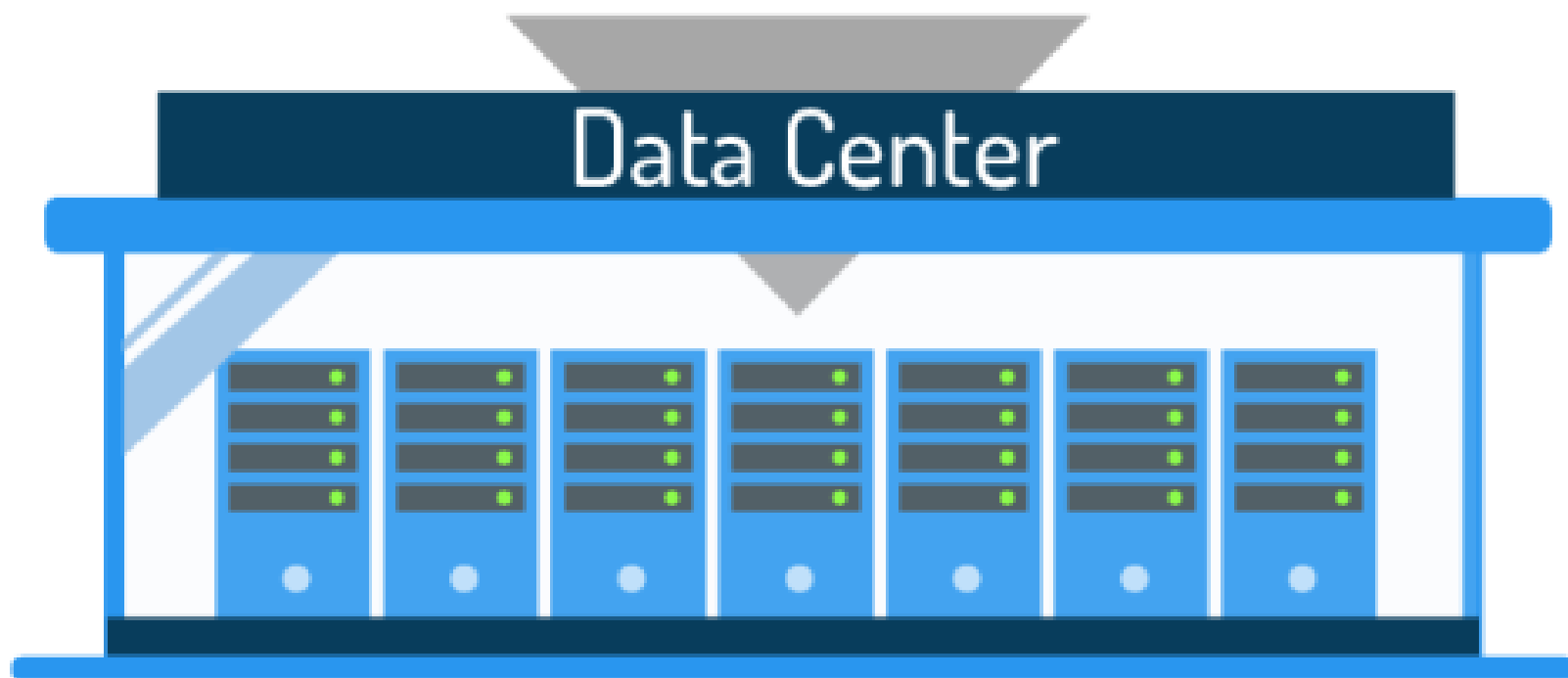
File Type	File Name	Description
Log File	<vmname>.log	Keeps a log of VM activity
Disk File	<vmname>.vmdk	Stores content of VM's disk drive
Snapshot Files	<vmname>.vmsd and <vmname>.vmsn	Stores information about VM snapshots (saved VM state)
Configuration File	<vmname>.vmx	Stores information about VM name, BIOS, guest OS, and memory

What is a Data Center?

- **Hardware infrastructure that supports virtualization.**
- **Focus is on processing large amounts of data.**
- **What are the three main components?**
 - **Compute**
 - **Storage**
 - **Networks**



Data Center



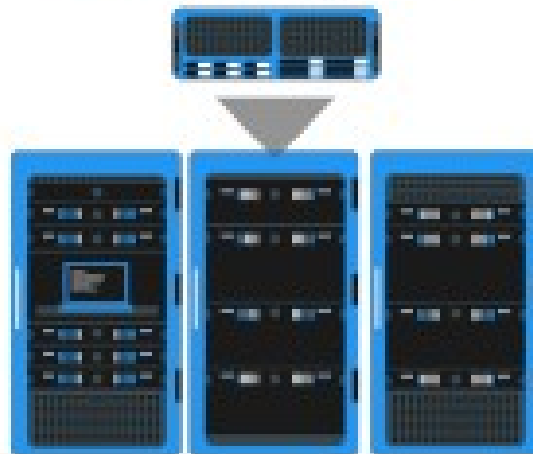
Compute Systems

- **Hardware and operating system software that runs applications.**
- **Difference between a PC and a server**
 - **PCs have user-friendly interface while servers focus on running programs.**
- **Types of servers:**
 - **Tower**
 - **Rack-mounted server**
 - **Blade server**

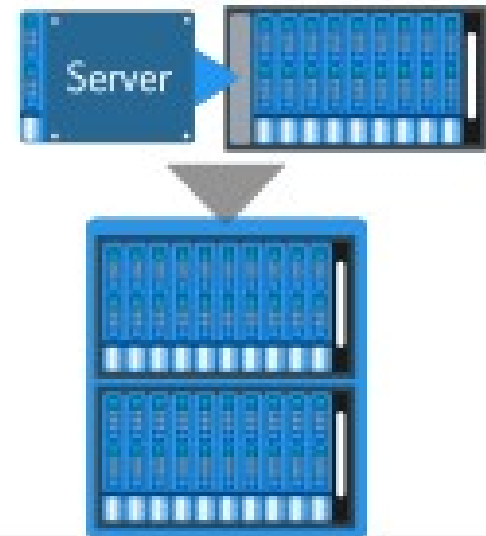
Tower
Compute



Rack-Mounted
Compute System

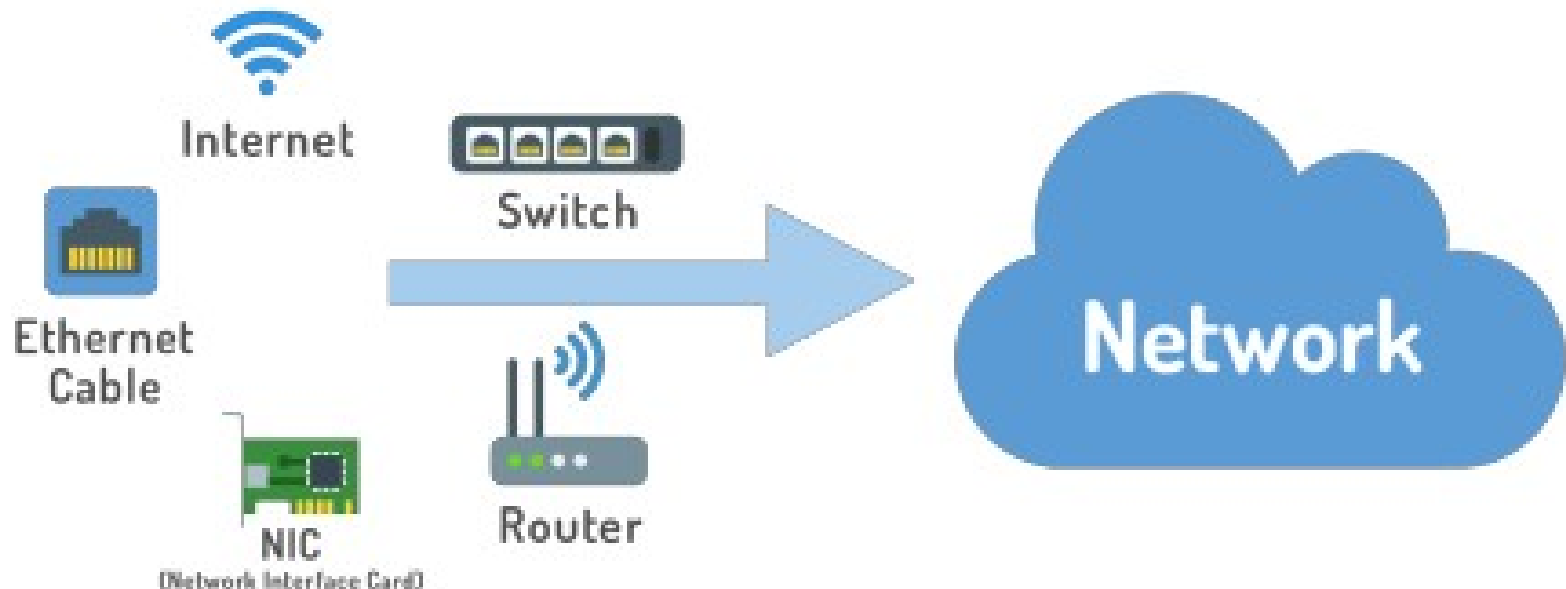


Blade Compute System



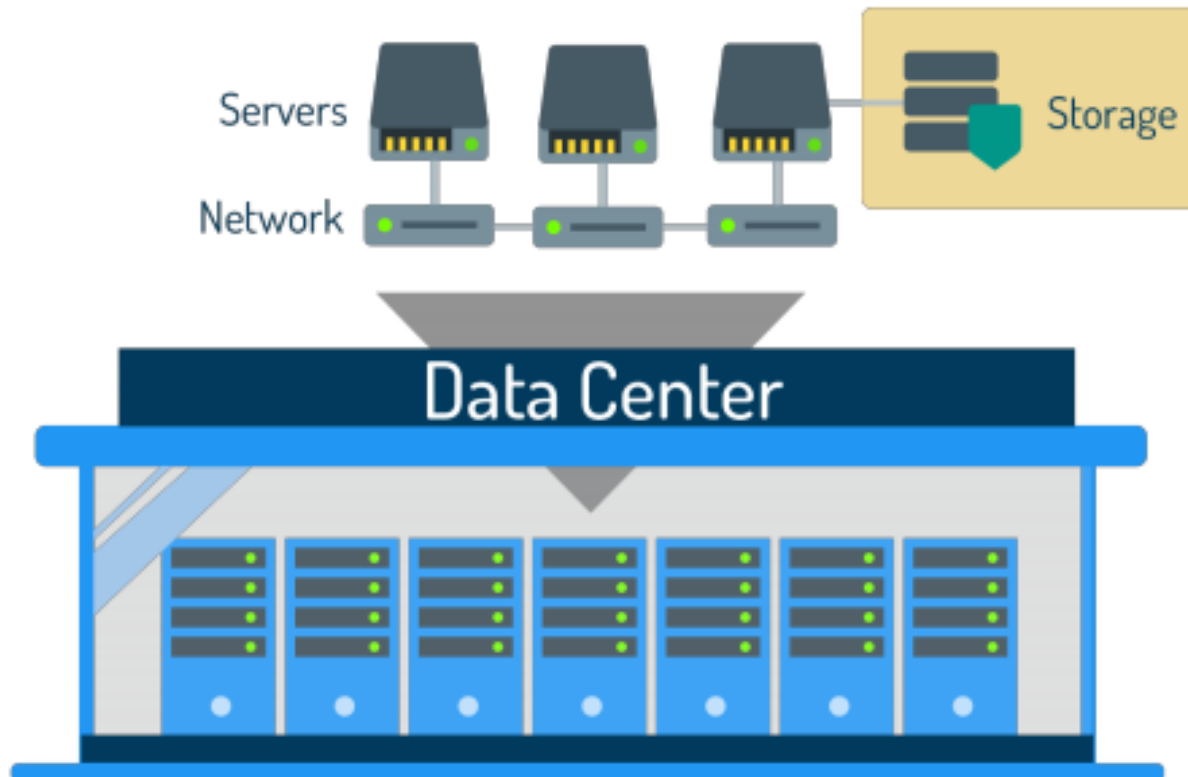
Networks

- Transfer data across the data center so devices can communicate.
- What type of hardware is used for networking?



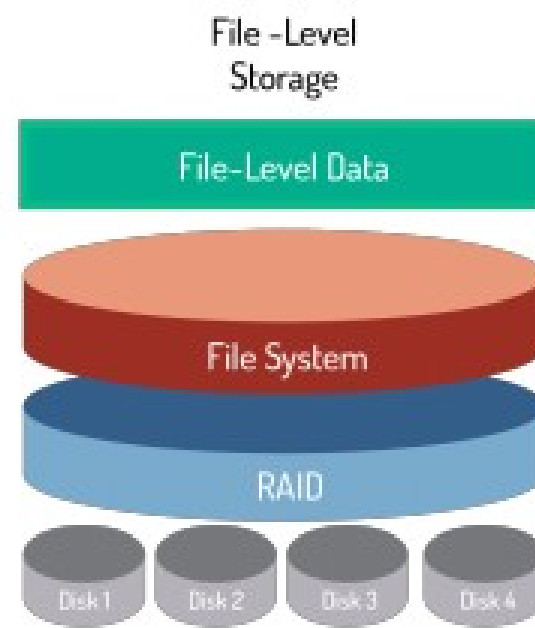
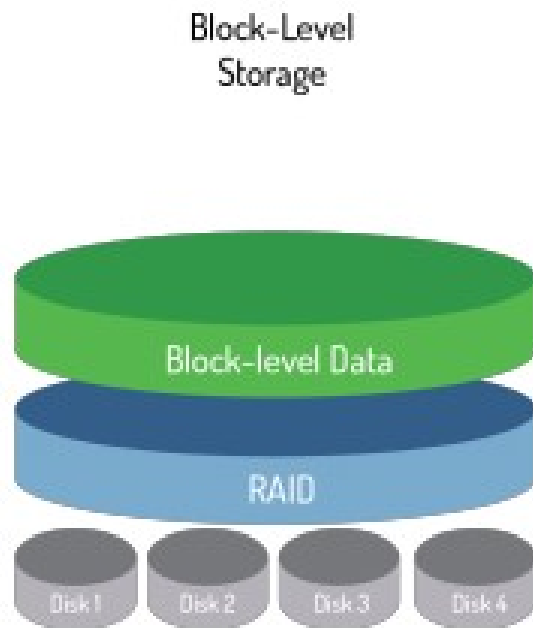
Storage

- Data center storage should have two features:
 - Availability
 - Redundancy



Block vs. File Level

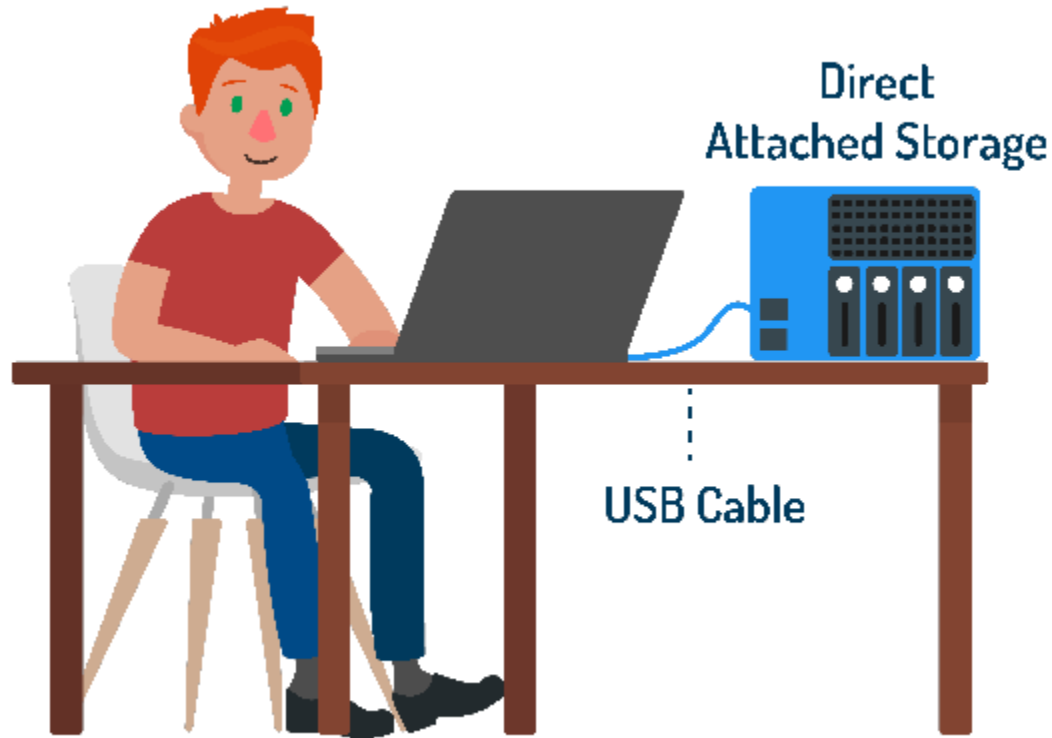
- **Block-Level Storage** – Data is written to and accessed from storage volumes (blocks).
- **File-Level Storage** – Data is written to disks but accessed from default file system.



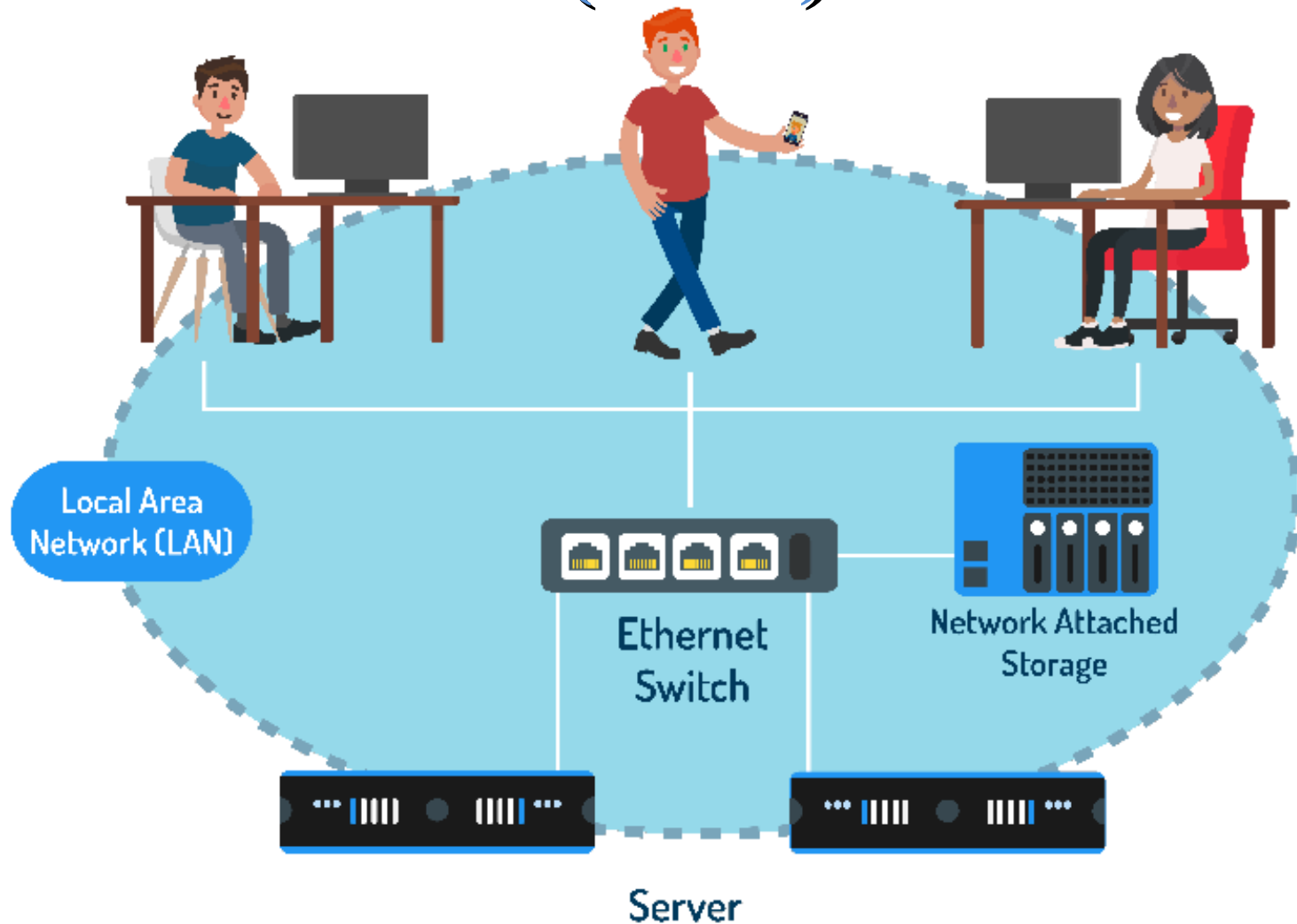
Types of Data Center Storage

- **Direct Attached Storage (DAS)** – Storage device is directly attached to a server (block-level).
- **Network Attached Storage (NAS)** – Storage device is attached to a network, servers on the network can access device (file-level).
- **Storage Area Network (SAN)** – Clustered storage devices on their own network that servers can connect to (block-level).

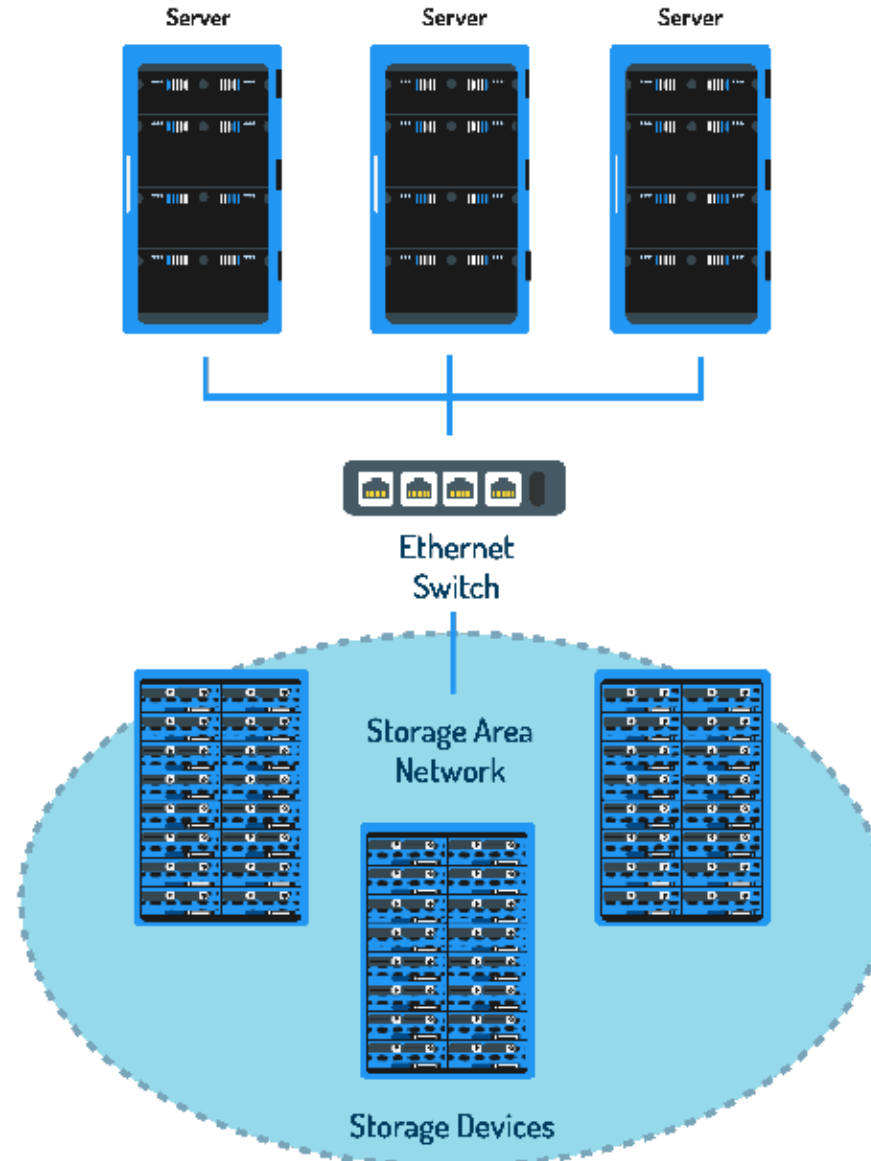
Direct Attached Storage (DAS)



Network Attached Storage (NAS)

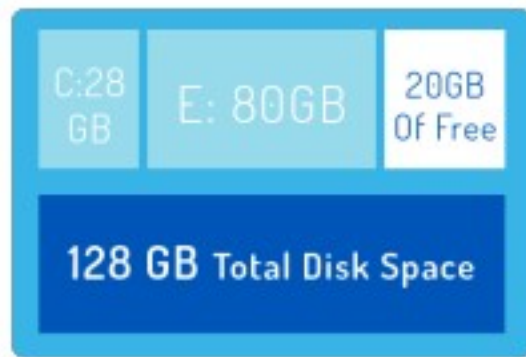


Storage Area Network (SAN)



Storage Provisioning

- **Thick provisioning:** Disk space is strategically pre-allocated to a server, or a VM.
- This means that the logical space provided by partitioning is equal to the amount of actual physical space set aside on the physical disk.



Benefits of a Virtual Data Center

Data centers use a lot of hardware and virtualization makes hardware more efficient.

- Increased computing resources results in higher availability of applications**
- Less labor needed to monitor data center (administrator can monitor from desk using a program).**
- Software-defined data center (SDDC): Hypervisor pools physical data center resources into a virtual data center.**

Cloud Computing

- Cloud Computing provides us a means by which we can access the applications as utilities, over the Internet.
- It allows us to create, configure, and customize applications online.
- With Cloud Computing users can access database resources via the internet from anywhere for as long as they need without worrying about any maintenance or management of actual resources.

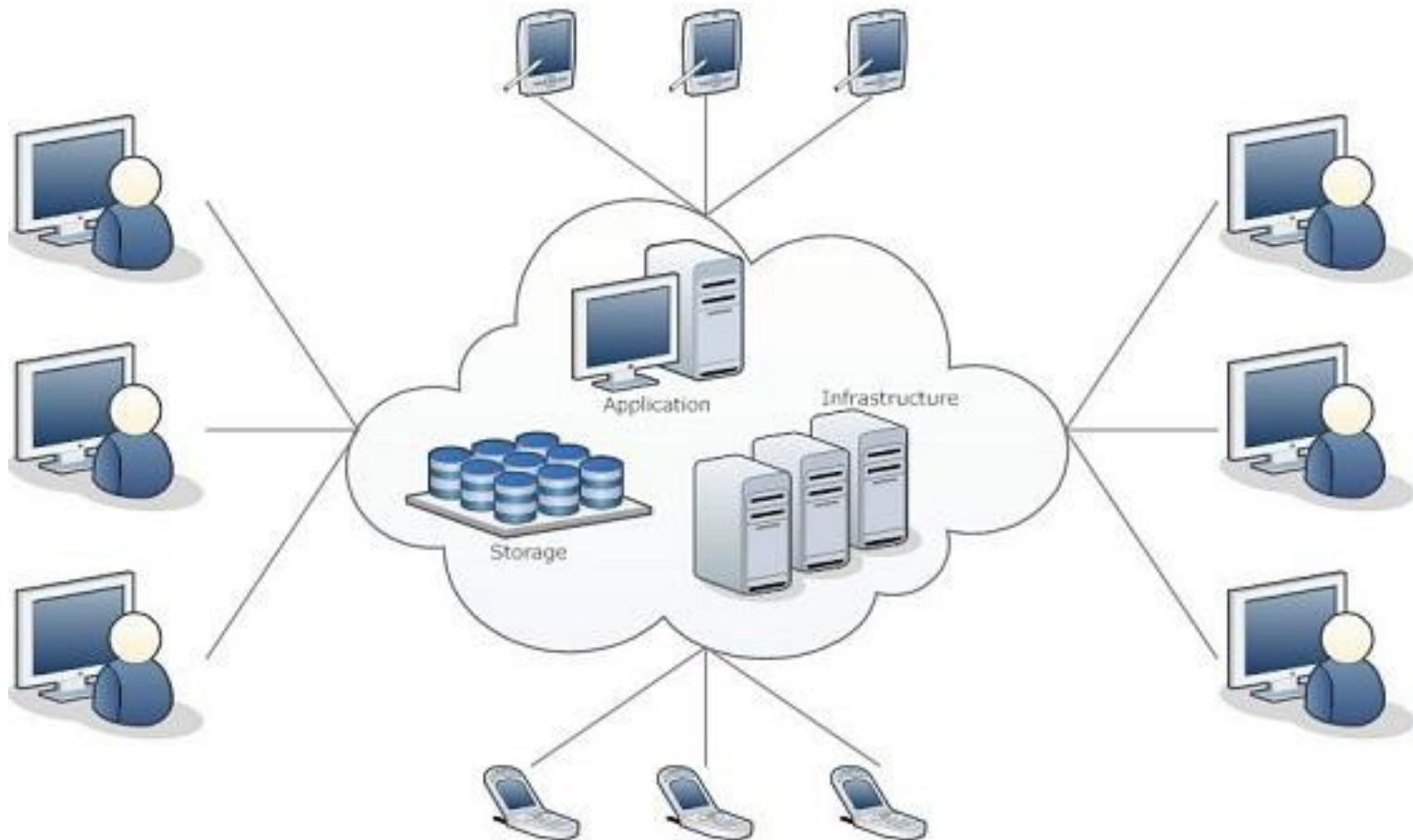
What is Cloud?

- The term Cloud refers to a Network or Internet.
- In other words, we can say that Cloud is something, which is present at remote location.
- Cloud can provide services over network, i.e., on public networks or on private networks, i.e., WAN, LAN or VPN.
- Applications such as e-mail, web conferencing, customer relationship management (CRM), all run in cloud.

What is Cloud Computing?

- **Cloud Computing refers to manipulating, configuring, and accessing the applications online.**
- **It offers online data storage, infrastructure and application.**
- **Cloud Computing is both a combination of software and hardware based computing resources delivered as a network service.**

Cloud Computing Architecture



Basic Concepts

There are certain services and models working behind the scene making the cloud computing feasible and accessible to end users. Following are the working models for cloud computing:

1. Deployment Models

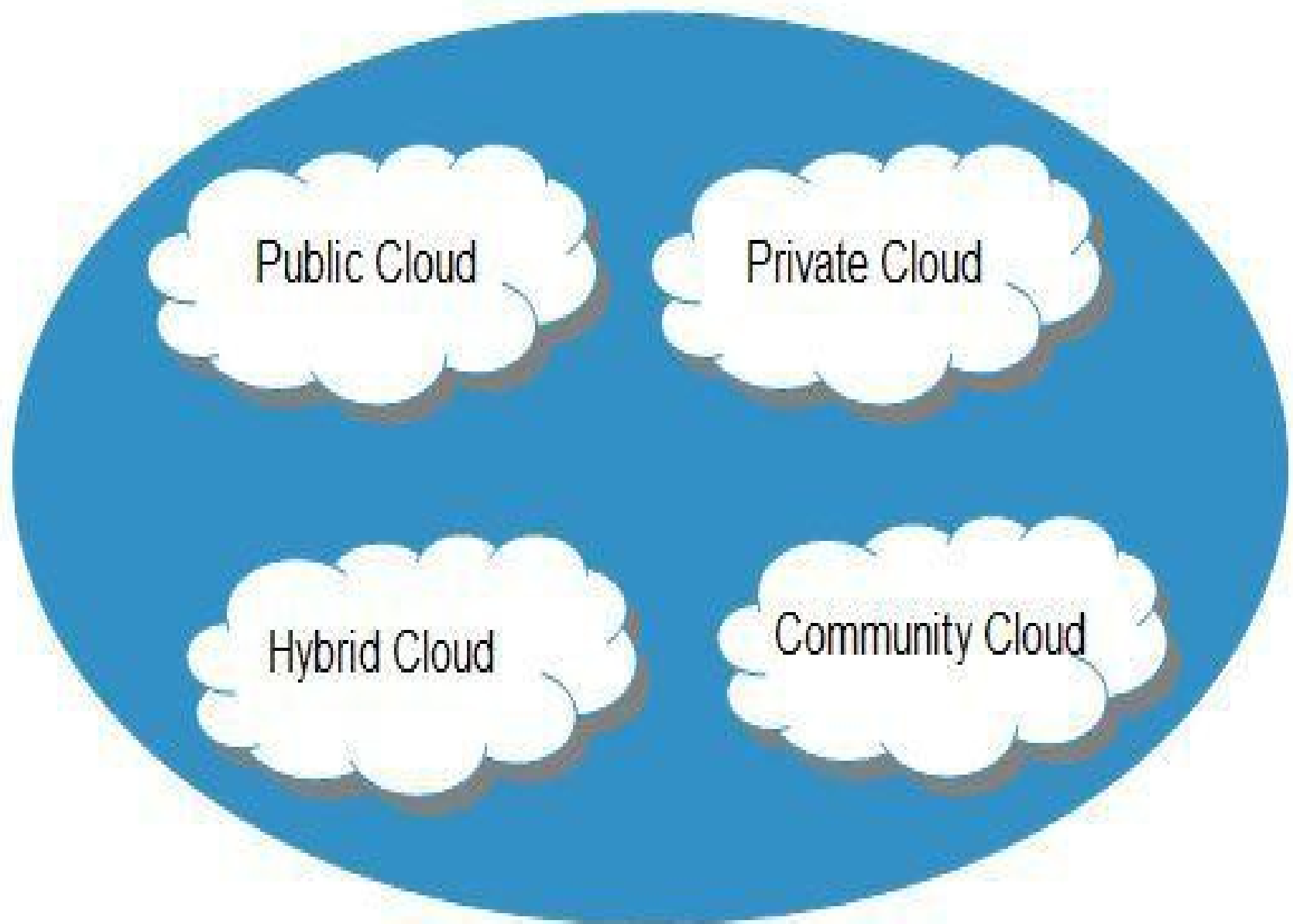
2. Service Models

Deployment Models

Deployment models define the type of access to the cloud, i.e., how the cloud is located?

- Cloud can have any of the four types of access:

- Public,
- Private,
- Hybrid
- Community.



PUBLIC CLOUD : The Public Cloud allows systems and services to be easily accessible to the general public. Public cloud may be less secure because of its openness, e.g., e-mail.

PRIVATE CLOUD : The Private Cloud allows systems and services to be accessible within an organization. It offers increased security because of its private nature.

COMMUNITY CLOUD : The Community Cloud allows systems and services to be accessible by group of organizations.

HYBRID CLOUD :

The cloud infrastructure is a composition of two or more clouds (private, community, or public)

However, the **critical activities** are performed using private cloud while the **non-critical activities** are performed using public cloud.

Two private cloud scenarios exist, as follows:

On-site Private Cloud

Applies to private clouds implemented at a customer's premises.

Outsourced Private Cloud

Applies to private clouds where the server side is outsourced to a hosting company.

Examples of Private Cloud:

- **Eucalyptus**
- **Ubuntu Enterprise Cloud - UEC (powered by Eucalyptus)**
- **Amazon VPC (Virtual Private Cloud)**
- **VMware Cloud Infrastructure Suite**
- **Microsoft ECI data center.**

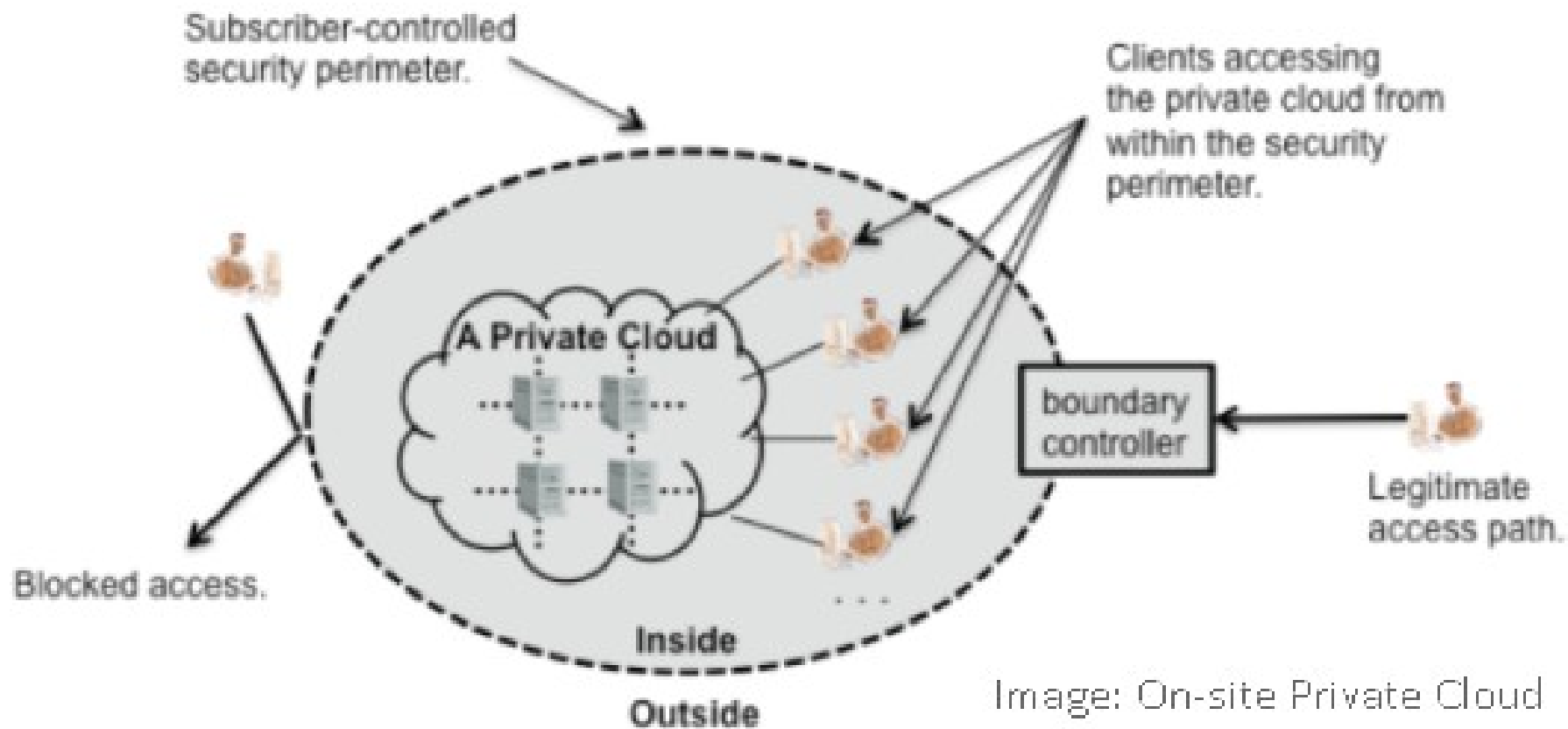
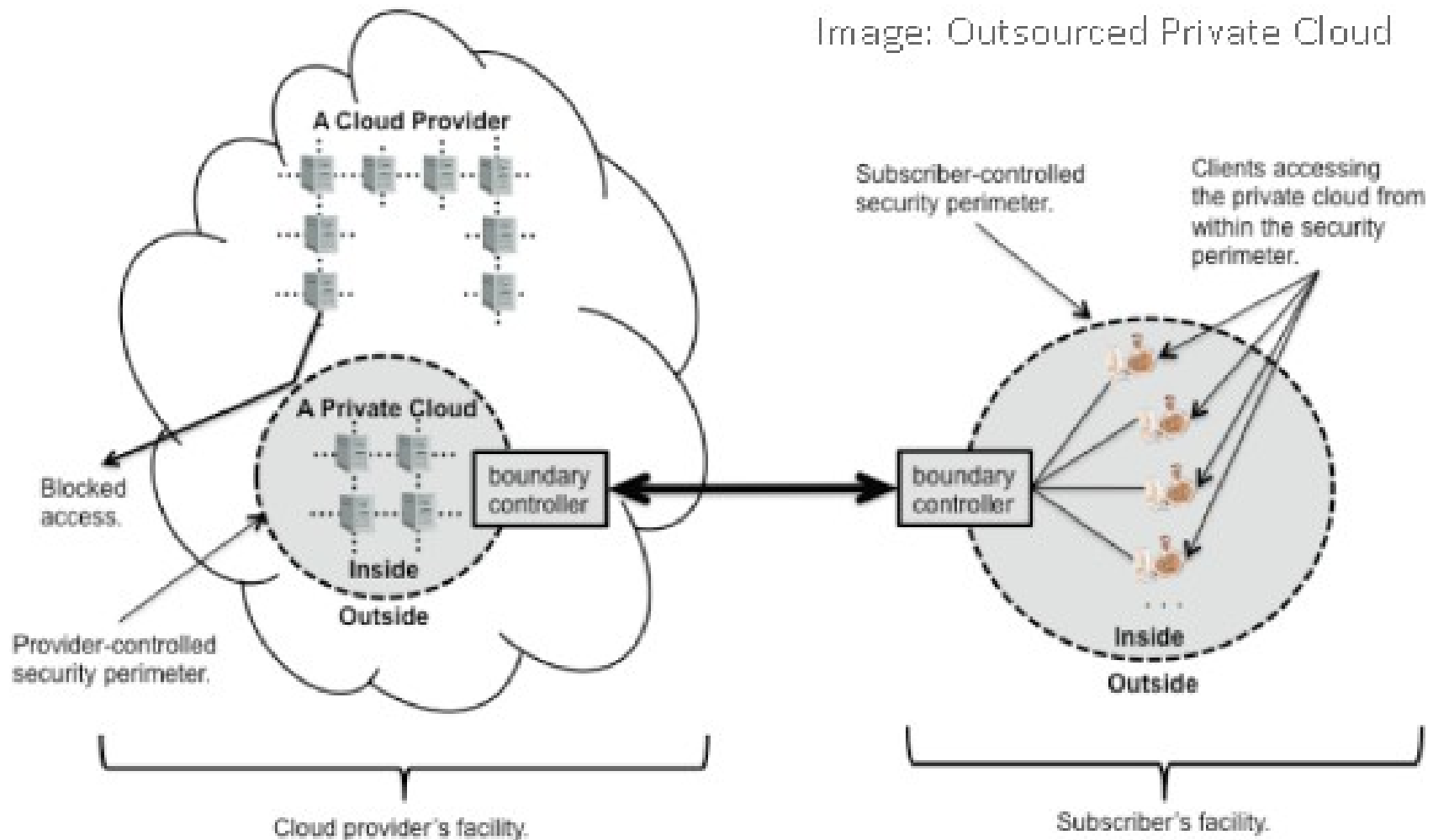


Image: On-site Private Cloud

Image: Outsourced Private Cloud



Community cloud also has two possible scenarios:

- **On-site Community Cloud Scenario:**

Applies to community clouds implemented on the premises of the customers composing a community cloud.

- **Outsourced Community Cloud:**

Applies to community clouds where the server side is outsourced to a hosting company.

Examples of Community Cloud:

- **Google Apps for Government**

- **Microsoft Government Community Cloud**

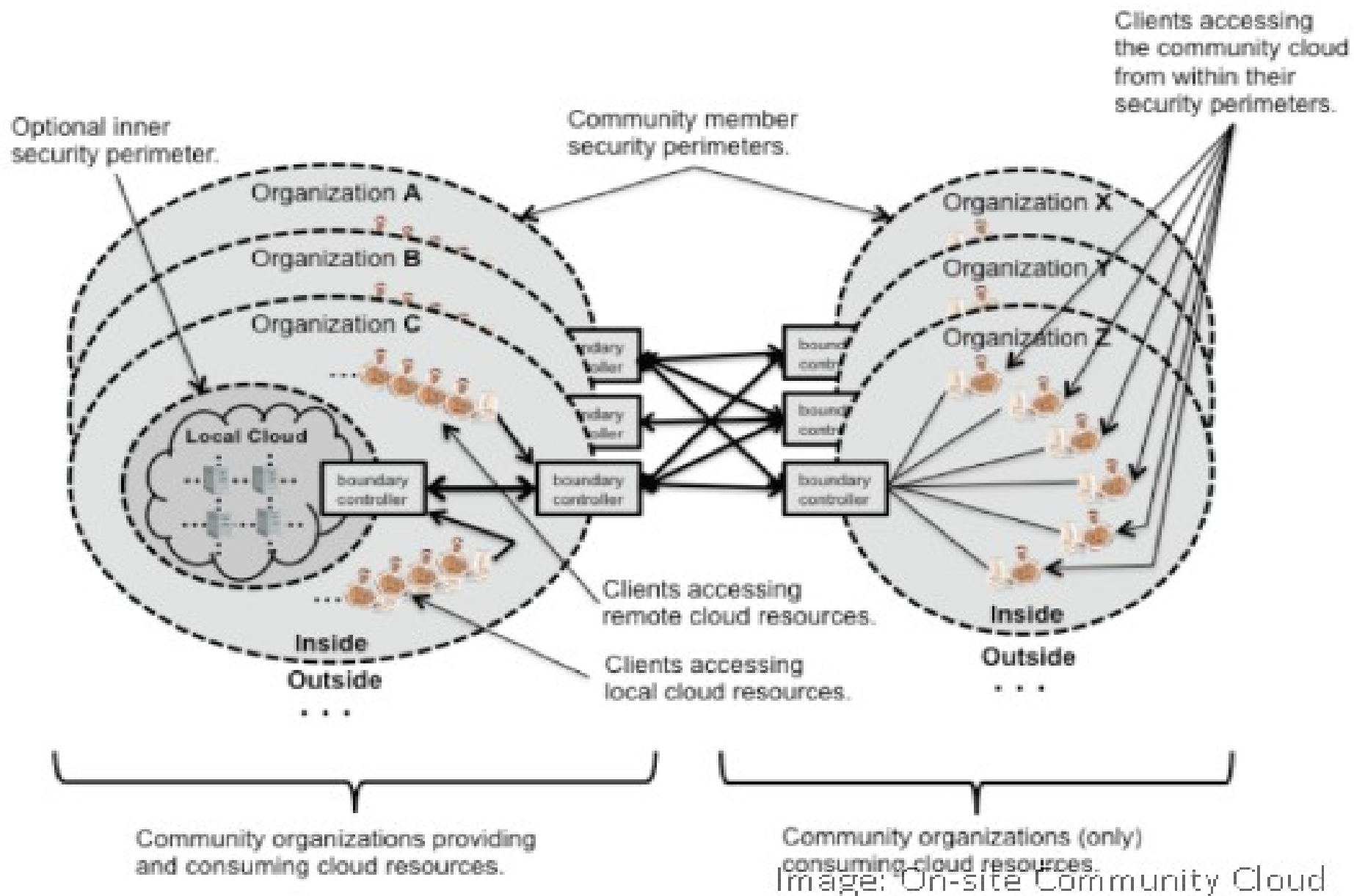
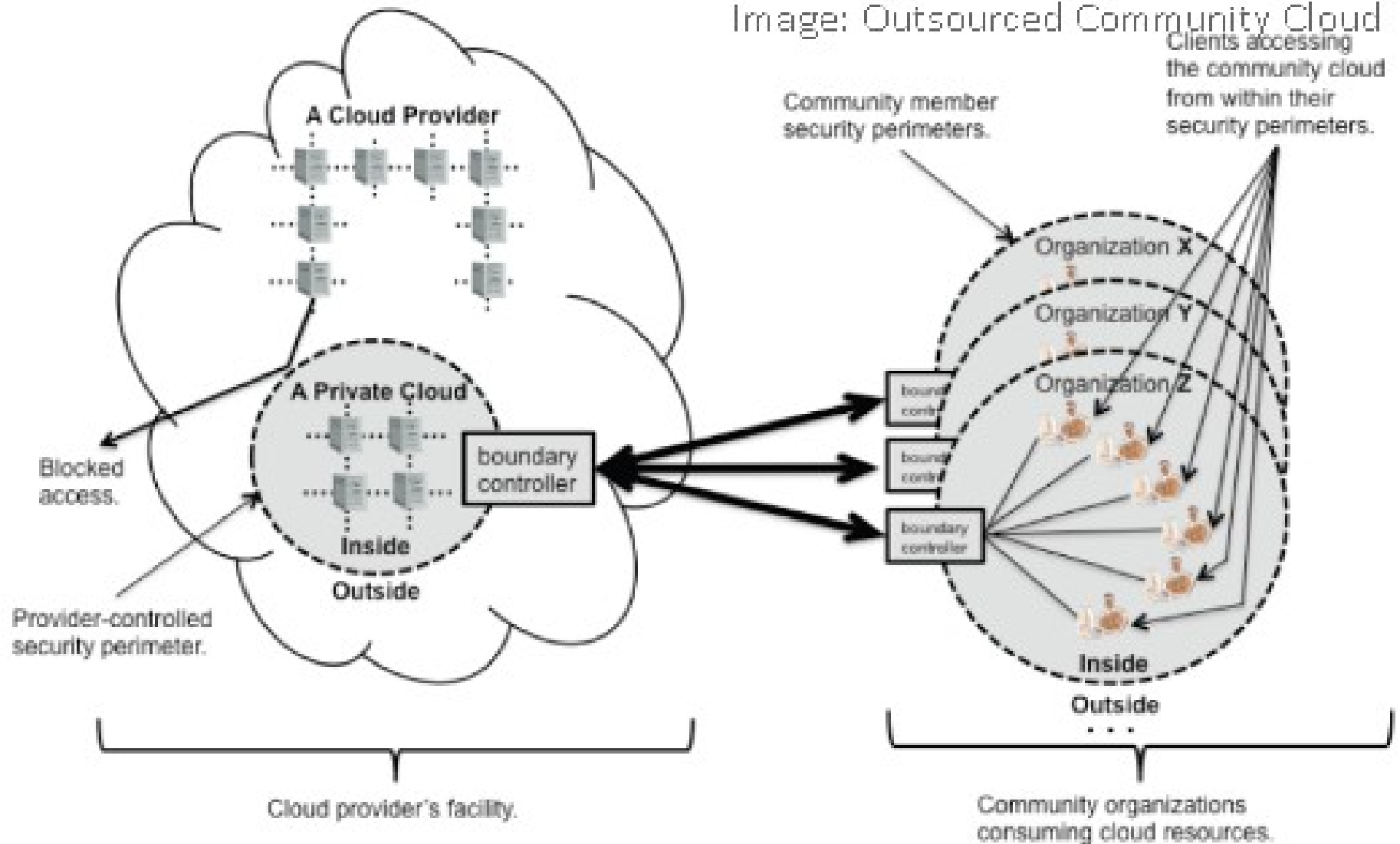


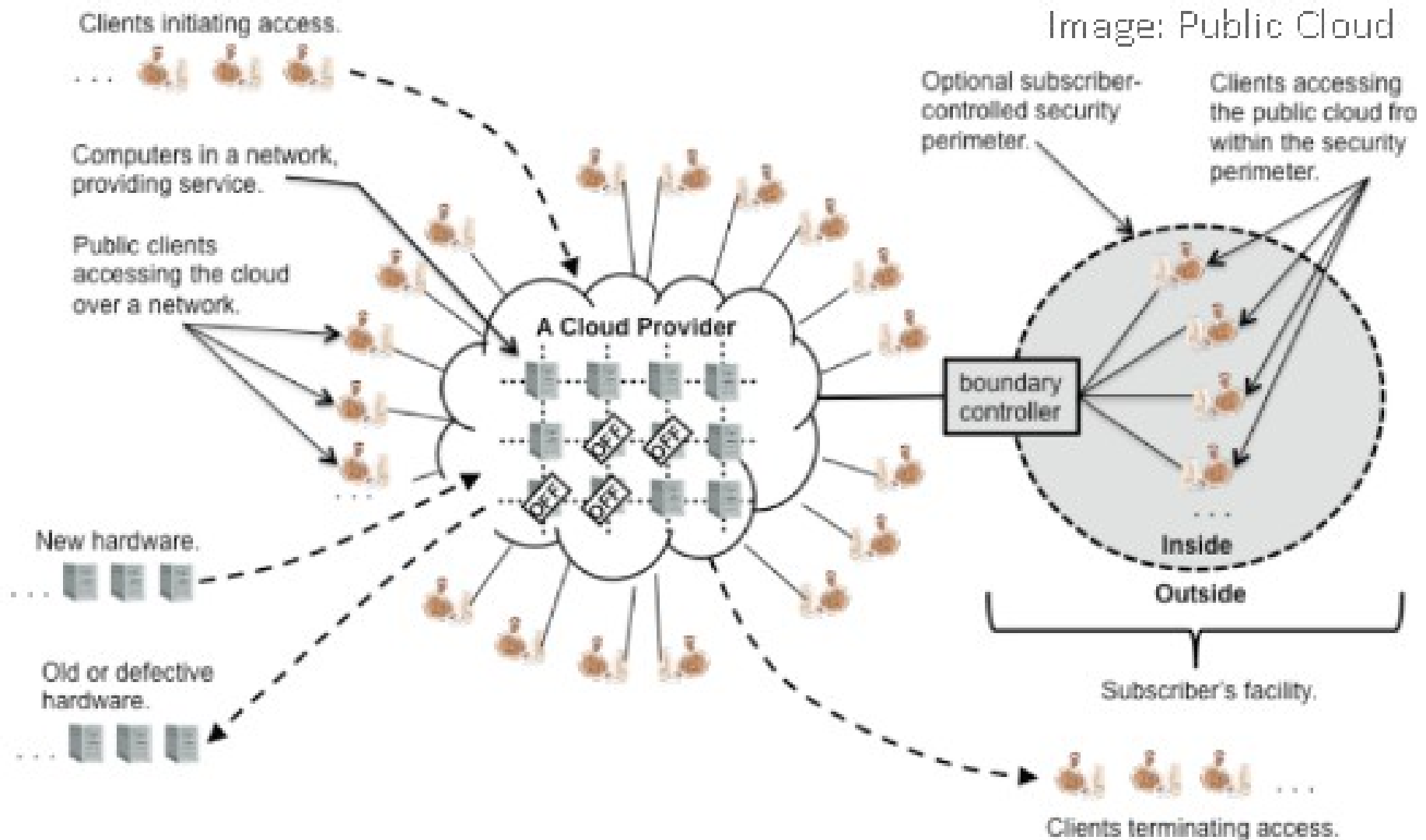
Image: Outsourced Community Cloud



Examples of Public Cloud:

- **Google App Engine**
- **Microsoft Windows Azure**
- **IBM Smart Cloud**
- **Amazon EC2**

Image: Public Cloud



Examples of Hybrid Cloud:

Windows Azure (capable of Hybrid Cloud)

VMware vCloud (Hybrid Cloud Services)

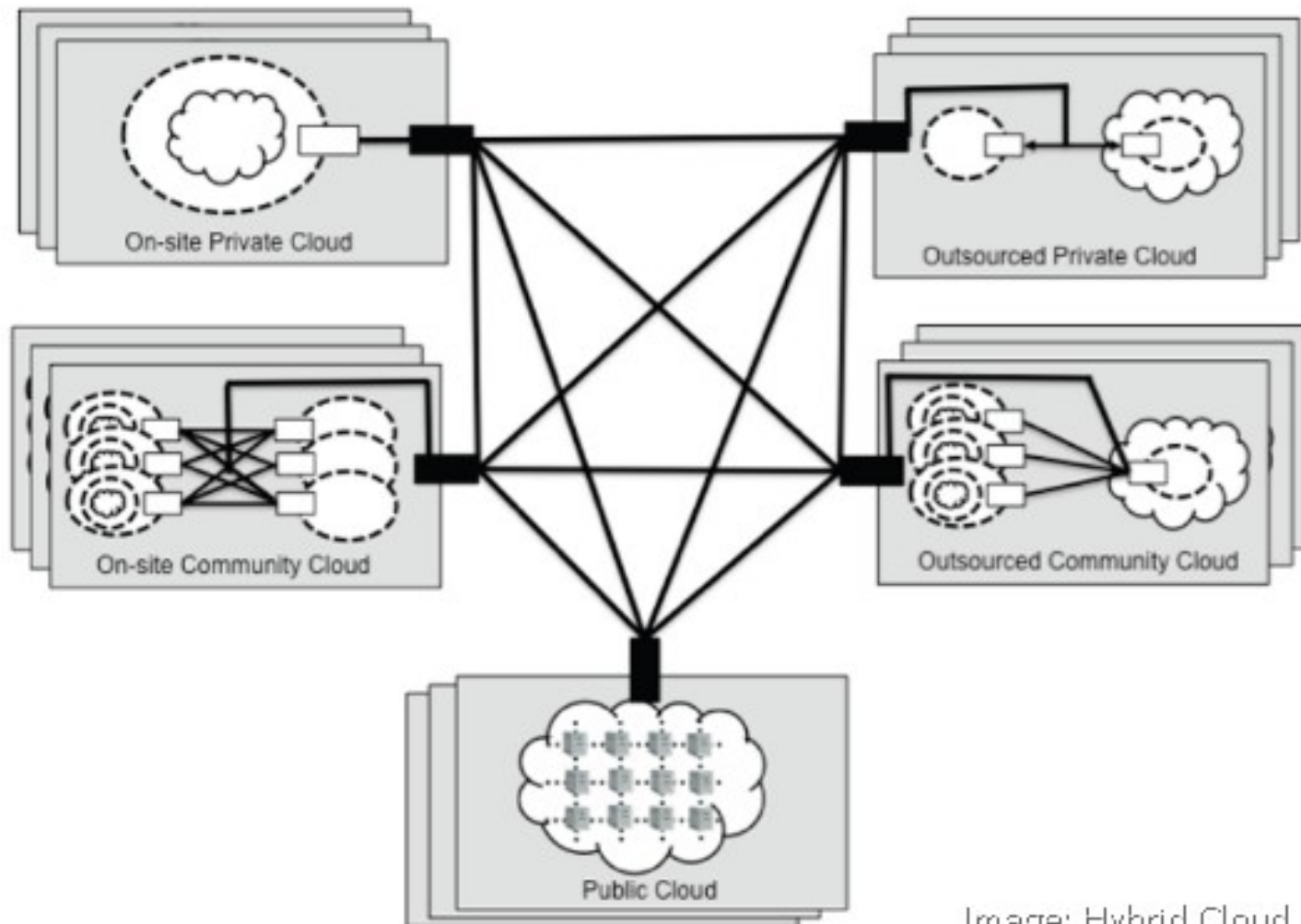


Image: Hybrid Cloud

Service Models

Service Models are the reference models on which the Cloud Computing is based. These can be categorized into three basic service models as listed below:

1. Infrastructure as a Service (IaaS)

2. Platform as a Service (PaaS)

3. Software as a Service (SaaS)

Infrastructure as a Service (IaaS)

IaaS is the delivery of technology infrastructure as an on demand scalable service.

IaaS provides access to fundamental resources such as physical machines, virtual machines, virtual storage, etc.

- Usually billed based on usage**
- Usually multi tenant virtualized environment**
- Can be coupled with Managed Services for OS and application support**

IaaS Examples



Platform as a Service (PaaS)

PaaS provides the runtime environment for applications, development & deployment tools, etc.

PaaS provides all of the facilities required to support the complete life cycle of building and delivering web applications and services entirely from the Internet.

Typically applications must be developed with a particular platform in mind:

- Multi tenant environments
- Highly scalable multi tier architecture

PaaS Examples



Software as a Service (SaaS)

SaaS model allows to use software applications as a service to end users.

SaaS is a software delivery methodology that provides licensed multi-tenant access to software and its functions remotely as a Web-based service.

- Usually billed based on usage**
- Usually multi tenant environment**
- Highly scalable architecture**

SaaS Examples



Microsoft Online Services: Business Productivity Online Suite

Microsoft
SharePoint Online

Microsoft
Office Communications Online

Microsoft
Exchange Online

Microsoft
Office Live Meeting

facebook

Do you Use the Cloud?



Advantages

- **Lower computer costs**
- **Improved performance:**
- **Reduced software costs**
- **Instant software updates**
- **Improved document format compatibility**
- **Unlimited storage capacity**
- **Increased data reliability**
- **Universal document access**
- **Latest version availability**
- **Easier group collaboration**
- **Device independence**

Disadvantages

- **Requires a constant Internet connection**
- **Does not work well with low-speed connections.**
- **Features might be limited**
- **Can be slow**
- **Stored data can be lost**
- **Stored data might not be secure**

Cloud Storage

The logo for Box.com, featuring the word "box" in a blue, lowercase, sans-serif font.The logo for SkyDrive, featuring a blue cloud icon with a yellow and orange swoosh, and the text "SkyDrive" in a black, sans-serif font.The logo for Dropbox, featuring a blue, isometric cube icon and the word "Dropbox" in a bold, black, sans-serif font.The logo for Amazon Cloud Drive, featuring the Amazon logo (a curved arrow) and the text "amazon cloud drive" in a blue, sans-serif font.

- **Create an Account**
User name and password.
- **Content lives with the account in the cloud.**
- **Log onto any computer with Wi-Fi to find your content**

Download For Storage

- Download a cloud based app to on your computer.
- The app lives on your Computer.
- Save files to the app.
- When connected to the Internet it will sync with the cloud.
- The Cloud can be accessed from any Internet connection.

