IT
Infrastructure

Agenda – IT Infra Services

- **Overview** of IT Infrastructure Services

- Importance in **Business Continuity and Growth**

- **Servers**: Physical, Virtual, and Cloud

- **Networking**: Switches, Routers, Firewalls

- **Storage** Solutions: SAN, NAS, and Cloud Storage

- **Monitoring** and **Troubleshooting** Tools

- **Virtualization** Basics

- **Hypervisor** & it's types

Agenda – Cloud (Azure)

- Introduction to **Cloud** Platforms

- Cloud Vs On-Premise

- Cloud Concepts - Principles of cloud computing & Create an Azure account

- Core Cloud Services
  - Introduction to Azure
  - Azure architecture and service guarantees
  - Azure compute options
  - Azure data storage options
  - Azure networking options

- Security, responsibility, and trust in Azure

- Apply and monitor infrastructure standards with Azure Policy

- Control and organize Azure resources with Azure Resource Manager

- Predict costs and optimize spending for Azure

Overview of IT Infrastructure Services

- IT infrastructure services refer to the wide-ranging activities involved in managing and supporting an organization's technology foundation.

- Infrastructure includes **Networking** equipment, **Servers** and **Storage** due to the important function they provide within specific business environments.

- Infrastructure services include communication services, networking, data processing and storage, platforms through which businesses can share content and media, knowledge management, systems, applications, IoT, user devices, resilience.

What if businesses do not have an IT infra?

- Without IT infrastructure, businesses struggle with operational inefficiencies, manual processes, and slow communication.

- Data management becomes troublesome, increasing the risk of data loss.

- Security vulnerabilities arise, making businesses susceptible to cyber threats and compliance issues.

- Customer service suffers, leading to frustration and loss of trust.

- Competitively, businesses fall behind, unable to innovate or adopt new technologies.

- Financially, higher operational costs and potential revenue loss from downtime and poor service impact growth.

Servers

- Servers play a crucial role in IT infrastructure services, serving as the backbone for various applications and services.

- Some of the key uses of servers are:

  - File servers

  - Database servers

  - Web & Application servers

  - E-Mail server

  - Domain Controller

  - Backup servers

  - Firewall & monitoring servers

Servers

- **Physical Servers**

  - Physical servers are dedicated hardware devices that provide computing resources and services to other computers or devices on a network.

- **Virtual Servers**

  - Virtual servers are created using virtualization software (**hypervisor**), which allows multiple virtual machines (VMs) to run on a single physical server.

- **Cloud Servers**

  - Cloud servers are virtual servers hosted on cloud computing platforms like Amazon Web Services (AWS), Microsoft Azure, and Google Cloud.

Networking - Switches

- Switches are networking devices that **connect multiple devices** within a Local Area Network (LAN).

- Switches are essential devices in a network that **connect multiple devices**, like computers, printers, and servers, allowing them to communicate with each other.

- Switches operate at the **Data Link Layer (Layer 2)** or sometimes the Network Layer (Layer 3 switch) of the OSI model.

- Switches direct data to the correct destination by identifying unique addresses (***MAC addresses***)

- Unlike Hub, Switches are considered as **intelligent-device.**

Networking - Routers

- Routers are devices that **connect different networks** and direct data packets between them.

- Routers operate at the **network layer** (Layer 3) of the OSI model and use IP addresses to determine the best path for data transmission.

- Routers are devices that connect different networks and ensure data travels to the **correct destination**.

- It decides the **best route** for data to travel based on its destination address.

- Translate **private IP addresses to public IP addresses**, enabling devices within a LAN to access external networks.

Networking - Firewalls

- Firewalls are security devices that **monitor, and control** incoming and outgoing network traffic based on predetermined security rules.

- They operate at **various layers** of the OSI model, typically the network and transport layers (Layers 3 and 4), and sometimes the application layer (Layer 7).

- In an IT infrastructure, switches, routers, and firewalls work together to ensure **seamless connectivity**, efficient data routing, and robust security.

- There are various types of firewalls:

  - Hardware

  - Software

  - Next-Generation Firewalls (NGFWs)

Storage

- **Storage** refers to the solutions used to save and manage data.

- Efficient storage is essential for ensuring data integrity, accessibility, and security.

- Types of storage:

  - **Primary storage** – RAM, SSDs

  - **Secondary storage** – HDDS, Optical storage

  - **Offsite storage** – Tape drives, External drives

  - **Network storage** – DAS, NAS, SAN

 - **Cloud storage** – Public cloud storage, Private cloud storage

Storage – DAS

- **Direct Attached Storage** is a storage system that is directly connected to a computer or server without using a network.

- It provides a dedicated storage solution for a specific server or workstation, making it a simple and cost-effective option for data storage needs.
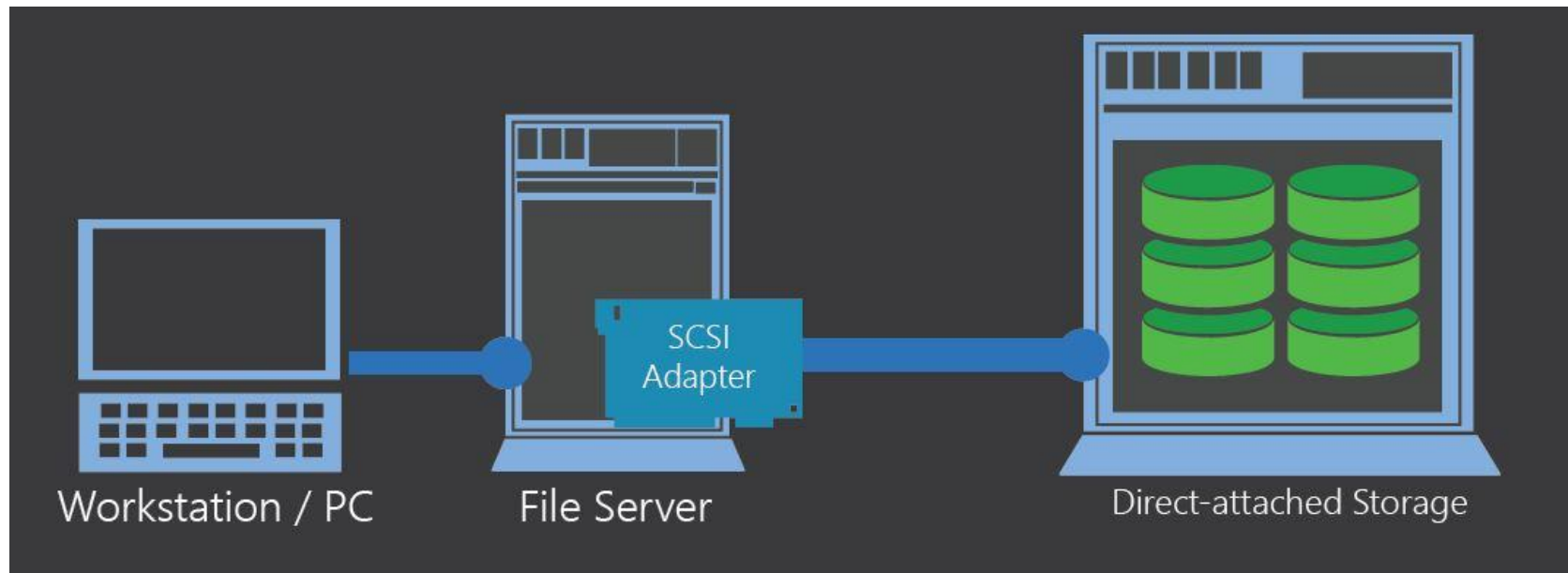
Storage – NAS

- **Network Attached Storage** (NAS) is a data storage device connected to a local network that allows multiple users or devices to access and share files stored on it.

- It provides centralized, scalable storage that can be accessed remotely over a network, making it convenient for home or small office data backup and file sharing.

Network Attached Storage
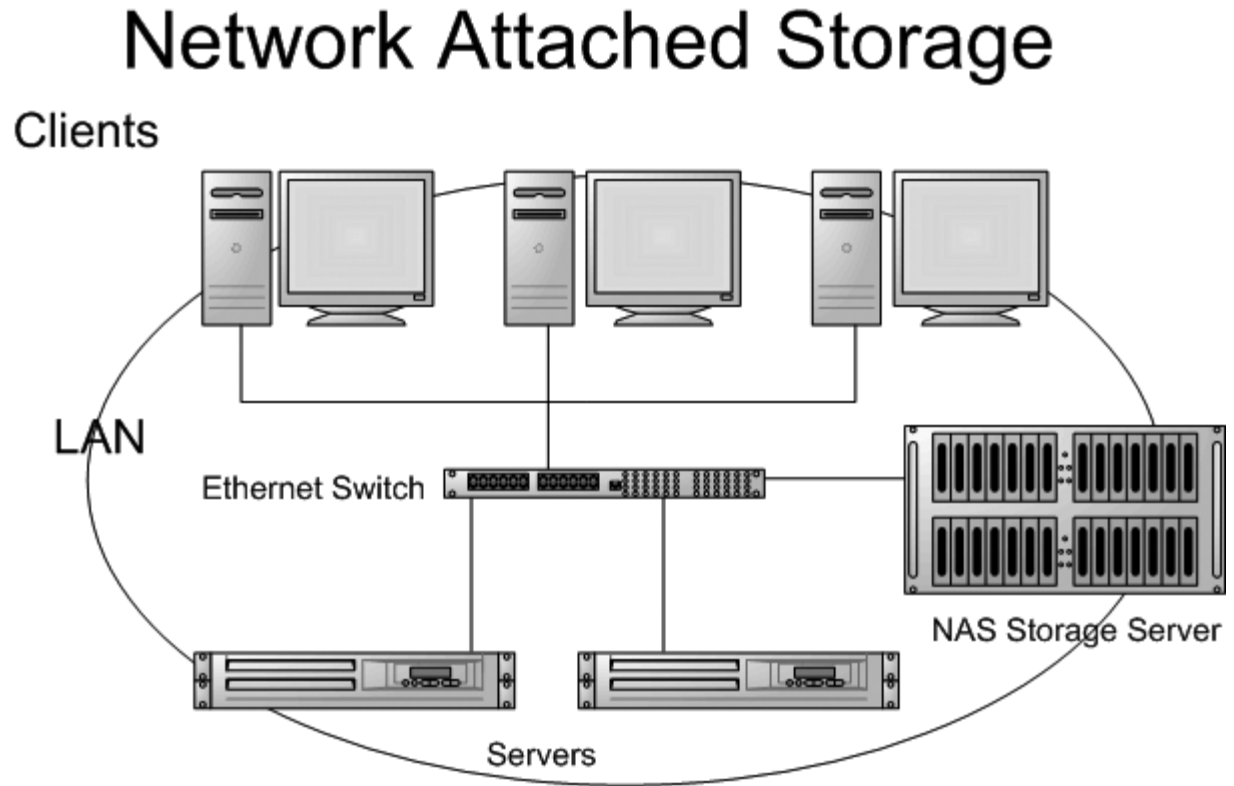
Storage – SAN

- A **Storage Area Network** (SAN) is a dedicated high-speed network that provides access to consolidated, block-level data storage.

- It allows multiple servers to access shared storage devices, such as disk arrays and tape libraries, as if they were locally attached.

- This enables efficient data management, backup, and disaster recovery across an organization's storage infrastructure.
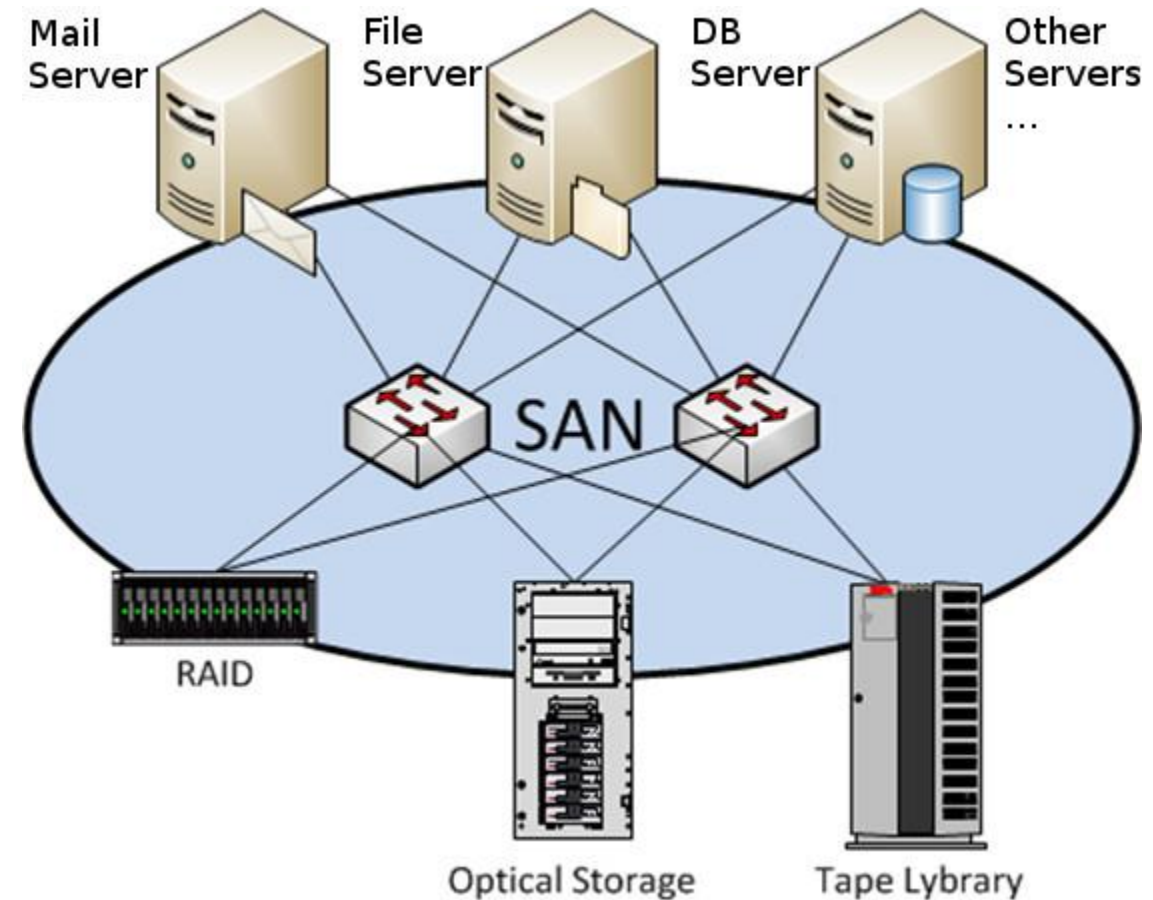
Monitoring Tools

- Monitoring tools are designed to continuously observe the performance and health of IT systems, networks, and applications.

- Key features for monitoring tools:
  - Performance monitoring
  - Alerting
  - Logging
  - Visualization

- Examples of Monitoring tools:
  - Nagios
  - Prometheus
  - Splunk

Troubleshooting tools

- These tools assist IT teams in diagnosing and resolving issues.

- They help identify root causes & provide solutions.

- Key Features:
  - Diagnostics Utilities & System Recovery
  - Log & Network Analysis

- Examples of Troubleshooting Tools
  - Wireshark
  - Ping
  - Traceroute (Linux) / Tracert (Windows)

Virtualization Basics

- Virtualization is a technology that allows the creation of multiple virtual instances of hardware or software resources on a single physical machine.

- It decouples the hardware from the software, enabling more efficient use of physical resources and providing greater flexibility in IT infrastructure management.

- Key Concepts of Virtualization

    - Virtual Machine (VMs)

    - Hypervisor

    - Hypervisor types

    - Virtualization Types

Virtualization - VMs

- Virtual machines are software-based emulations of physical computers.

- They run their own operating system and applications, just like a physical computer.

- Each VM has its own virtual

  - CPU,

  - Memory,

  - Storage, and

  - Network interfaces.

- VMs are isolated from each other, ensuring that issues in one VM do not affect others.

Virtualization - Hypervisor

- A hypervisor, also known as a Virtual Machine Monitor (VMM), is software that creates and manages virtual machines.

- It allows multiple VMs to run on a single physical host.

  - **Type 1 (Bare-metal):** Runs directly on the physical hardware (e.g., VMware ESXi, Microsoft Hyper-V).

  - **Type 2 (Hosted):** Runs on top of an existing operating system (e.g., VMware Workstation, Oracle VirtualBox).

Virtualization Types

- **Server Virtualization**

  - Multiple virtual servers run on a single physical server.

- **Desktop Virtualization**

  - Virtual desktops are provided to users, allowing them to access their work environment from any device.

- **Network Virtualization**

  - Abstracts physical network resources to create virtual networks, improving network management and flexibility.

- **Storage Virtualization**

  - Pools physical storage resources into a virtual storage environment, simplifying storage management.

Introduction to Cloud

- Cloud computing can be called a technology through which things like software, processing, and data storage are outsourced.

- There is only a need for an internet connection, an updated web browser and a compatible device for using a cloud computing service.

- Cloud computing makes computer system resources, especially storage and computing power, available on demand without direct active management by the user. [By Wikipedia]

Cloud Computing

- Central data center for providing services.

- On-demand, scalable, unlimited computation & storage.

- It's basically a data center.

- 4 characteristics of a Cloud:

  - Everything is a Service (backup, firewall, network…)

  - Elasticity in nature

  - HA – 99.99% SLA

  - Unlimited computation power.

- Any Data Centre that provides above 4 characteristics is a cloud.

High availability

Availability %	Downtime per year[note 1]	Downtime per quarter	Downtime per month	Downtime per week	Downtime per day (24 hours)
90% ("one nine")	36.53 days	9.13 days	73.05 hours	16.80 hours	2.40 hours
95% ("one nine five")	18.26 days	4.56 days	36.53 hours	8.40 hours	1.20 hours
97% ("one nine seven")	10.96 days	2.74 days	21.92 hours	5.04 hours	43.20 minutes
98% ("one nine eight")	7.31 days	43.86 hours	14.61 hours	3.36 hours	28.80 minutes
99% ("two nines")	3.65 days	21.9 hours	7.31 hours	1.68 hours	14.40 minutes
99.5% ("two nines five")	1.83 days	10.98 hours	3.65 hours	50.40 minutes	7.20 minutes
99.8% ("two nines eight")	17.53 hours	4.38 hours	87.66 minutes	20.16 minutes	2.88 minutes
99.9% ("three nines")	8.77 hours	2.19 hours	43.83 minutes	10.08 minutes	1.44 minutes
99.95% ("three nines five")	4.38 hours	65.7 minutes	21.92 minutes	5.04 minutes	43.20 seconds
99.99% ("four nines")	52.60 minutes	13.15 minutes	4.38 minutes	1.01 minutes	8.64 seconds
99.995% ("four nines five")	26.30 minutes	6.57 minutes	2.19 minutes	30.24 seconds	4.32 seconds
99.999% ("five nines")	5.26 minutes	1.31 minutes	26.30 seconds	6.05 seconds	864.00 milliseconds
99.9999% ("six nines")	31.56 seconds	7.89 seconds	2.63 seconds	604.80 milliseconds	86.40 milliseconds
99.99999% ("seven nines")	3.16 seconds	0.79 seconds	262.98 milliseconds	60.48 milliseconds	8.64 milliseconds
99.999999% ("eight nines")	315.58 milliseconds	78.89 milliseconds	26.30 milliseconds	6.05 milliseconds	864.00 microseconds
99.9999999% ("nine nines")	31.56 milliseconds	7.89 milliseconds	2.63 milliseconds	604.80 microseconds	86.40 microseconds
99.99999999% ("ten nines")	3.16 milliseconds	788.40 microseconds	262.80 microseconds	60.48 microseconds	8.64 microseconds
99.999999999% ("eleven nines")	315.58 microseconds	78.84 microseconds	26.28 microseconds	6.05 microseconds	864.00 nanoseconds
99.9999999999% ("twelve nines")	31.56 microseconds	7.88 microseconds	2.63 microseconds	604.81 nanoseconds	86.40 nanoseconds

Link: https://en.wikipedia.org/wiki/High_availability

What you have to manage on On-Premises?

- Power supply

- Network devices

- Storage devices

- Server racks

- Space

- Scalable options

 - Administrators for Servers, Networks, etc..

Virtualized Data Center

- Achieved using tool called "Hypervisor".

- Advantages of using virtualization:
  - No maximum limit for a VM.
  - Centralized monitoring.
  - Software defined.

- Different types of Virtualization"
  - Hardware virtualization
  - Network virtualization
  - Desktop virtualization
  - Storage virtualization
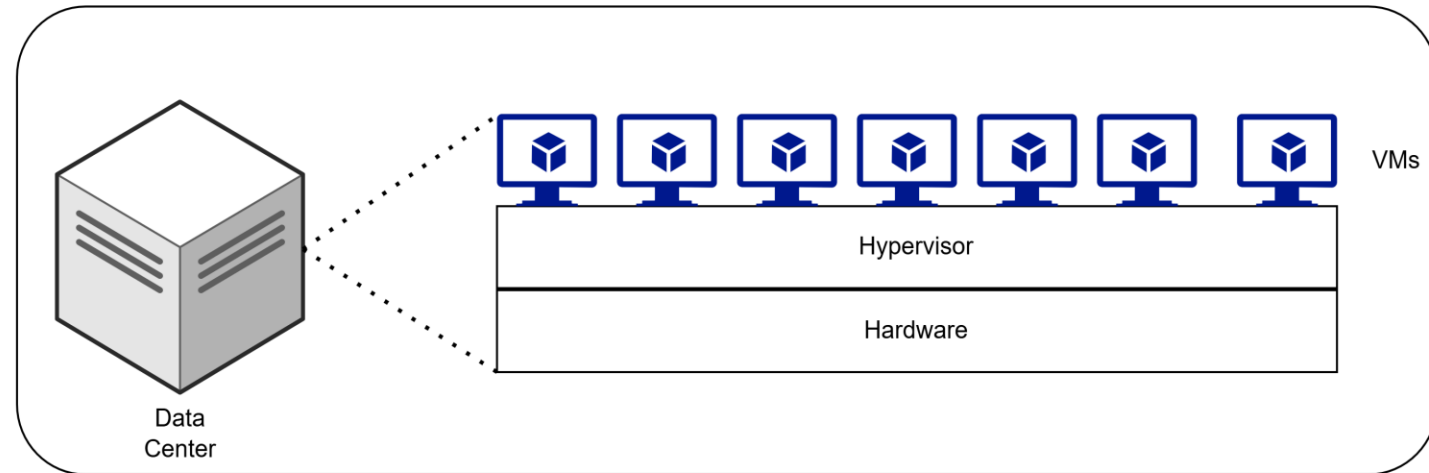
Virtualized Data Center to Cloud
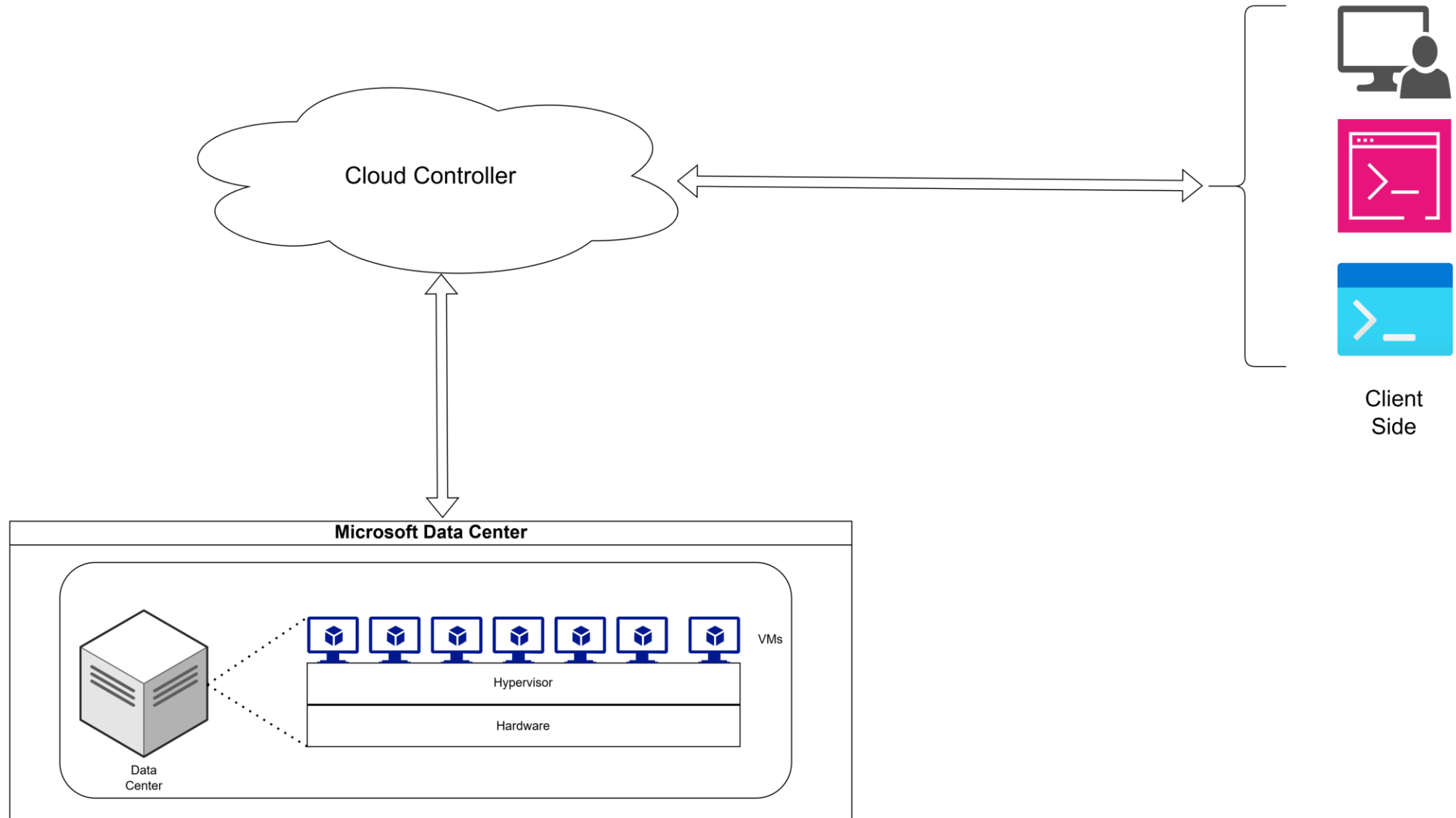
Why cloud computing is a better option?

- Highly scalable and flexible

- Low-cost solution

- Faster and secure

- Global Access

- Productive

- Hybrid

- Intelligent

Essential Characteristics of Cloud
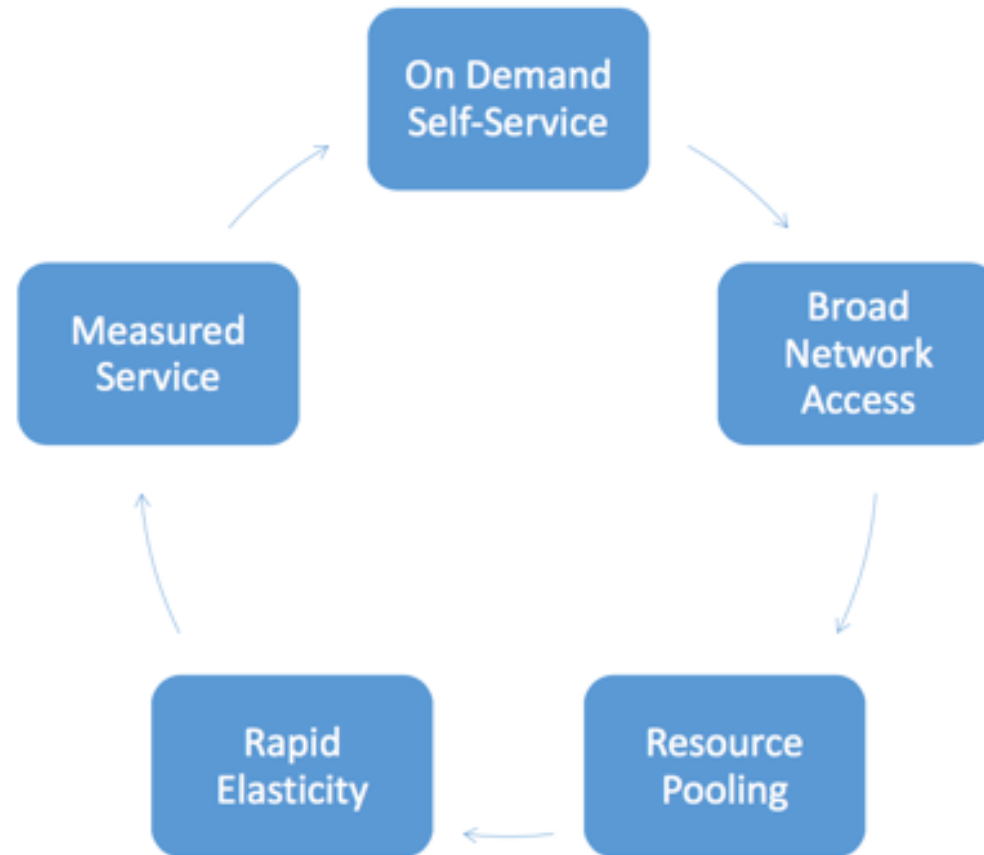
Essential Characteristics of Cloud

- **On-demand self-service**
  - Resources are instantly available when needed.

- **Broad network access**
  - Access anytime or anywhere a connection to the Internet exists.

- **Resource pooling**
  - Data center resources are pooled together optimizing quality of service.

- **Rapid elasticity**
  - The ability to add or remove computing resources based on need.

- **Measured service**
  - The ability to measure resource usage and charge customers.

Services provided
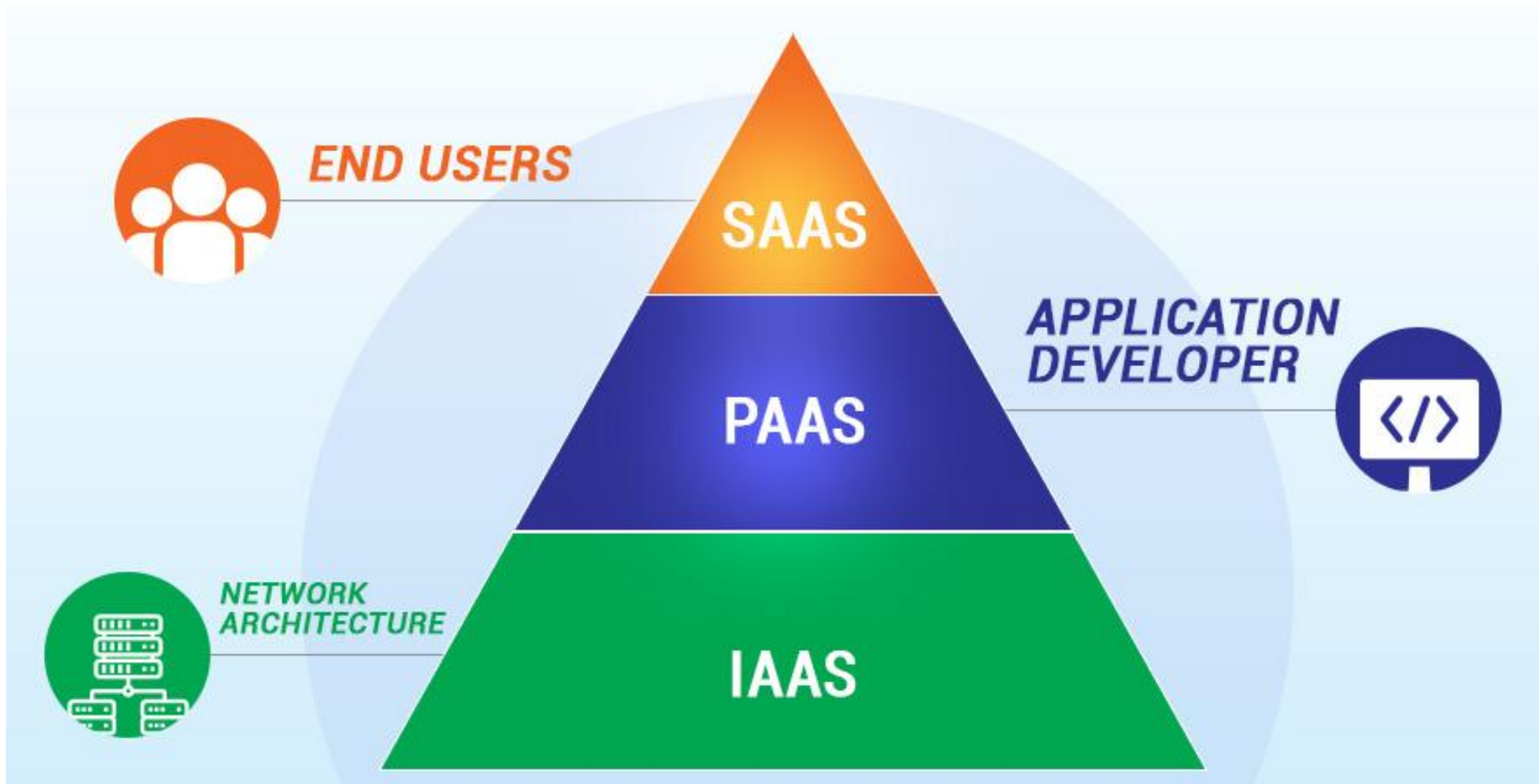
Infrastructure as a Service (IaaS)

- IaaS is a fully self-service model that delivers infrastructure resources via virtualization technologies.

- IaaS comprises scalable computing, storage, and security capabilities accessed on an API or dashboard.

- Examples of IaaS

  - Amazon Web Services (AWS)

  - HP Cloud Services

  - Microsoft Windows Azure

  - Rackspace Cloud

  - IBM Smart Cloud

  - VMware

  - GoGrid

Platform as a Service (PaaS)

- PAAS provides a framework for developers to create their own applications.

- Essential, PaaS gives developers an online platform to create and manage software without worrying about maintaining everything else.

- Examples of PaaS
  - Amazon Web Services (AWS)
  - Microsoft Windows Azure
  - Google App
  - IBM SmartCloud Application services
  - Force.com

Software as a Service (SaaS)

- SAAS is the most common cloud deployment model. SaaS refers to applications delivered over the Internet that a third party manages.

- SaaS applications are typically accessed and ran via a Web browser, eliminating the need to download software onto a user's machines.

- Examples of SaaS
  - Salesforce CRM
  - Basecamp
  - Intuit QuickBooks
  - Constant Contact
  - NetSuite
  - Google Docs

Pizza as a Service

Traditional On-Premises (On Prem)	Infrastructure as a Service (IaaS)	Platform as a Service (PaaS)	Software as a Service (SaaS)
Dining Table	Dining Table	Dining Table	Dining Table
Soda	Soda	Soda	Soda
Electric / Gas	Electric / Gas	Electric / Gas	Electric / Gas
Oven	Oven	Oven	Oven
Fire	Fire	Fire	Fire
Pizza Dough	Pizza Dough	Pizza Dough	Pizza Dough
Tomato Sauce	Tomato Sauce	Tomato Sauce	Tomato Sauce
Toppings	Toppings	Toppings	Toppings
Cheese	Cheese	Cheese	Cheese
Made at home	**Take & Bake**	**Pizza Delivered**	**Dined Out**

You Manage   Vendor Manages

Business manages everything (no cloud computing)	IAAS	PAAS	SAAS
Applications	Applications	Applications	Applications
Data	Data	Data	Data
Runtime	Runtime	Runtime	Runtime
Middleware	Middleware	Middleware	Middleware
Operating System	Operating System	Operating System	Operating System
Virtualization	Virtualization	Virtualization	Virtualization
Servers	Servers	Servers	Servers
Storage	Storage	Storage	Storage
Networking	Networking	Networking	Networking

Key:

You manage

Vendor manages

Deployment Models
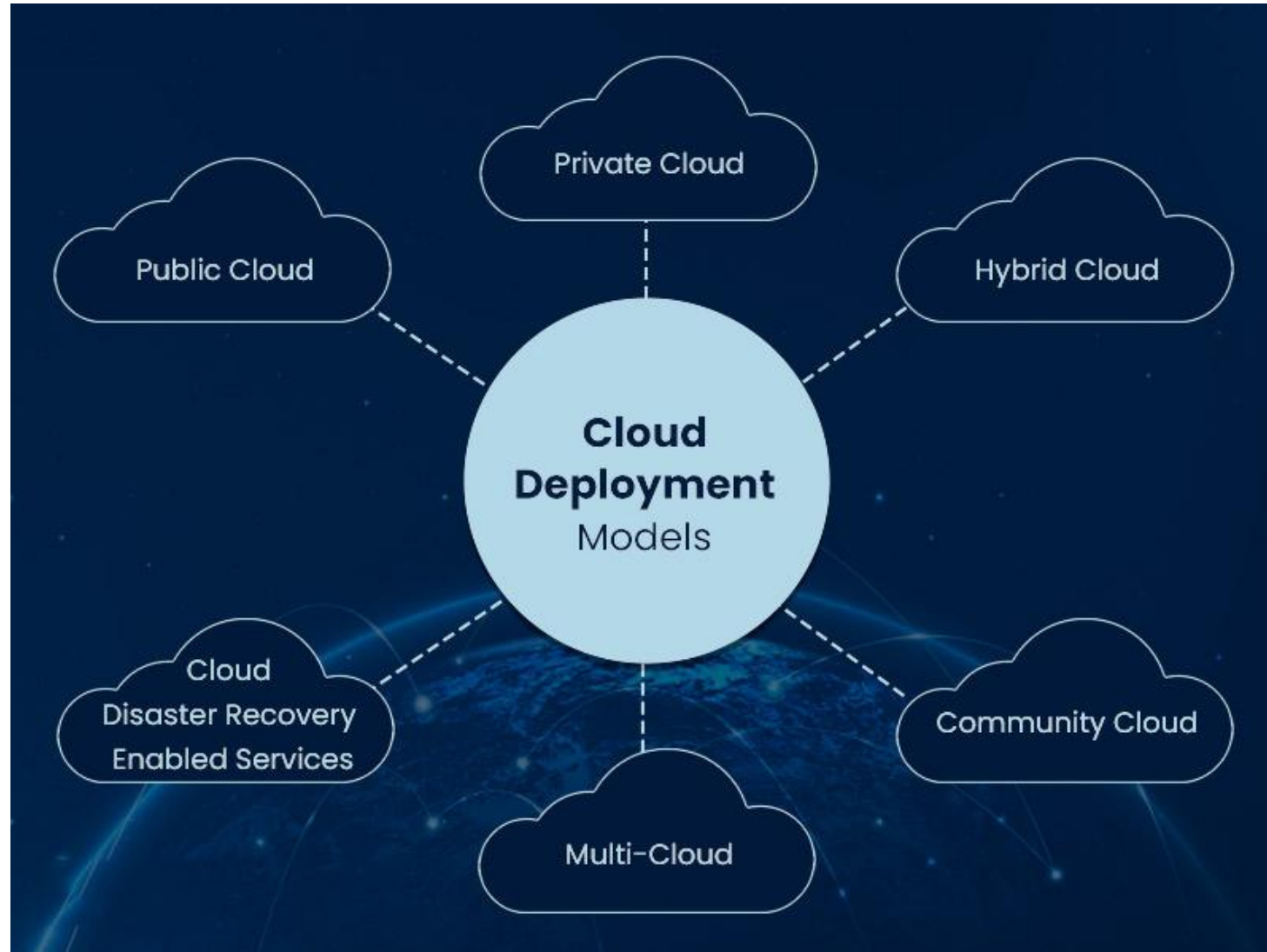
Deployment Models – Public Cloud
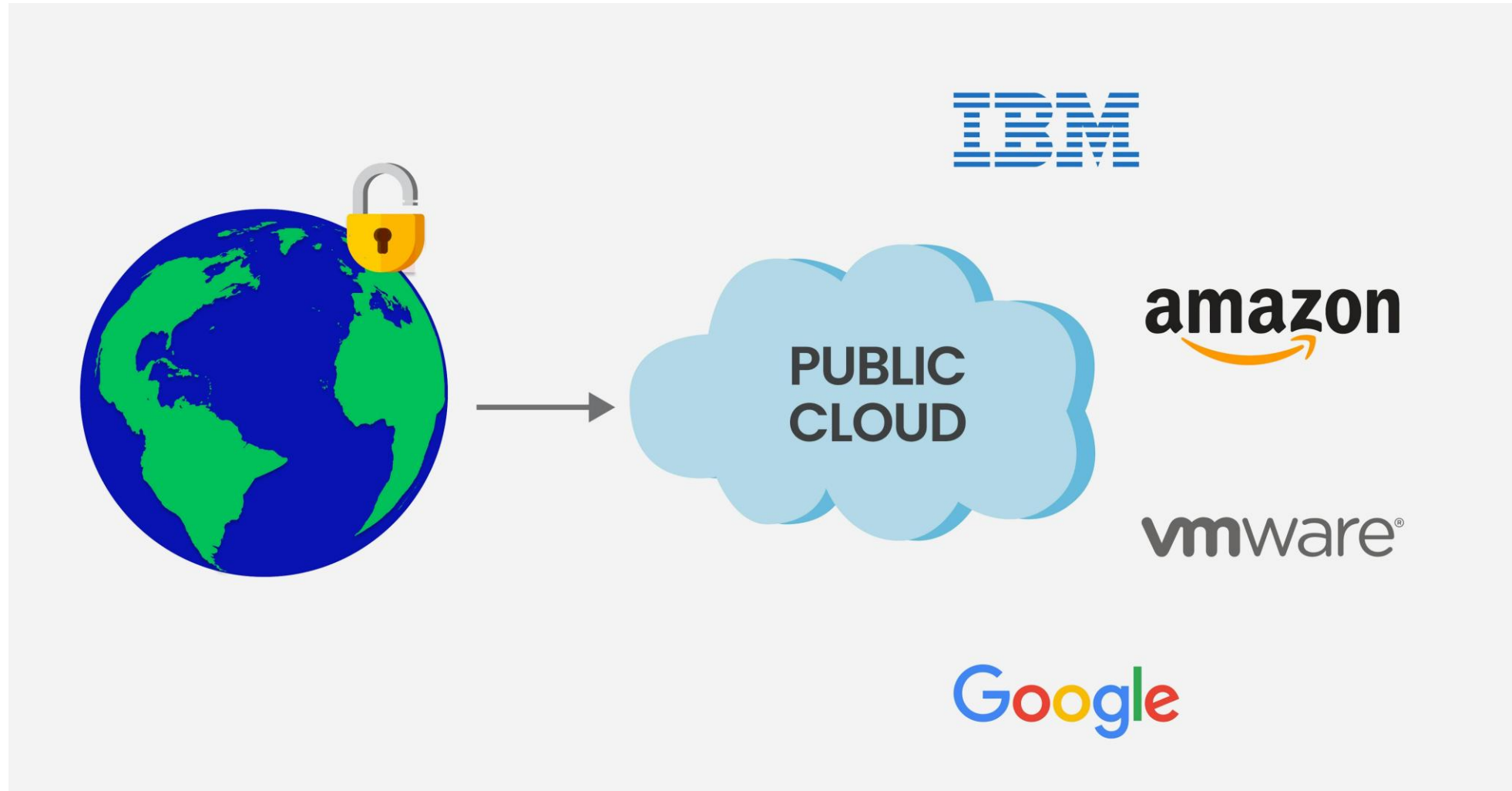
Deployment Models – Private Cloud
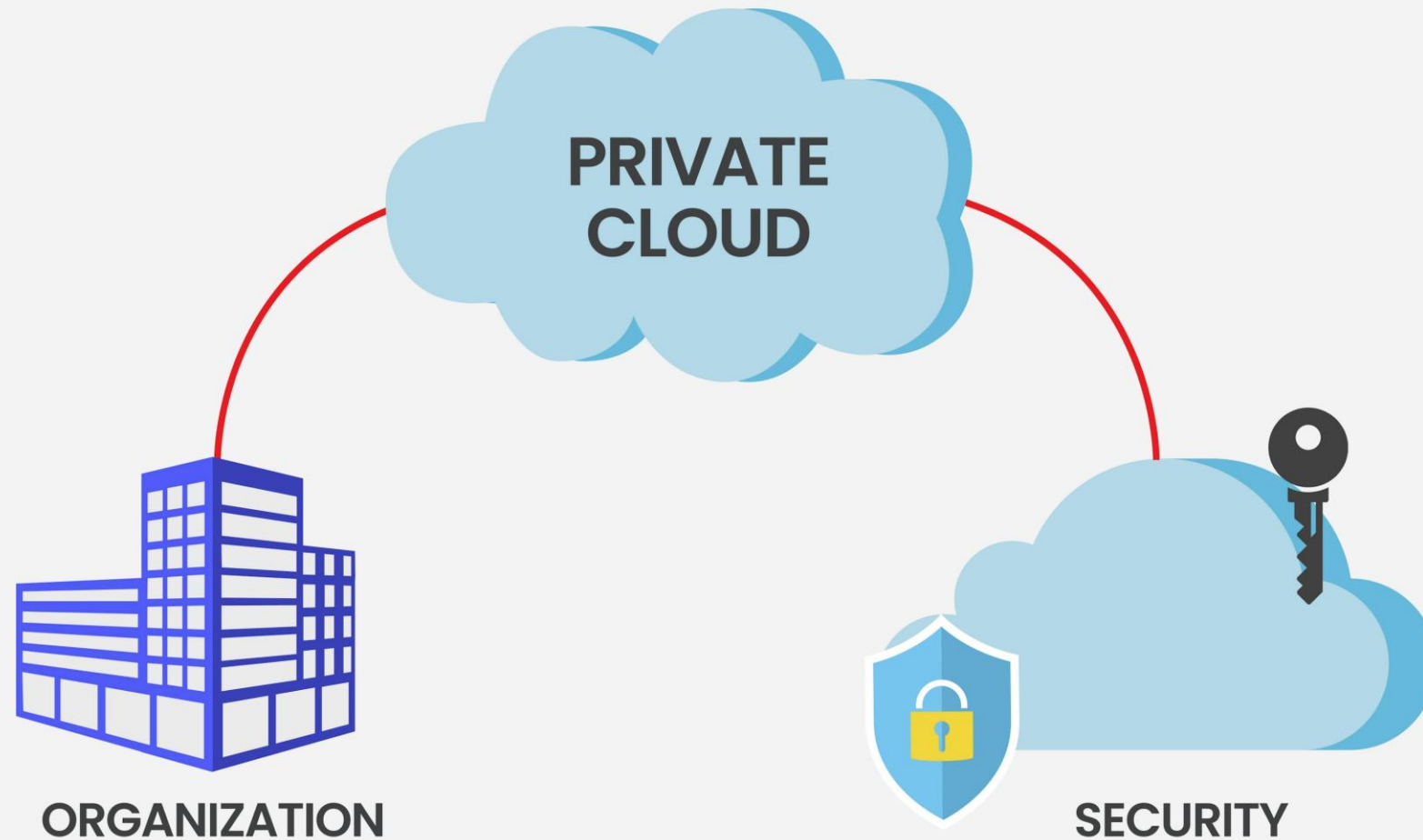
Deployment Models – Hybrid Cloud
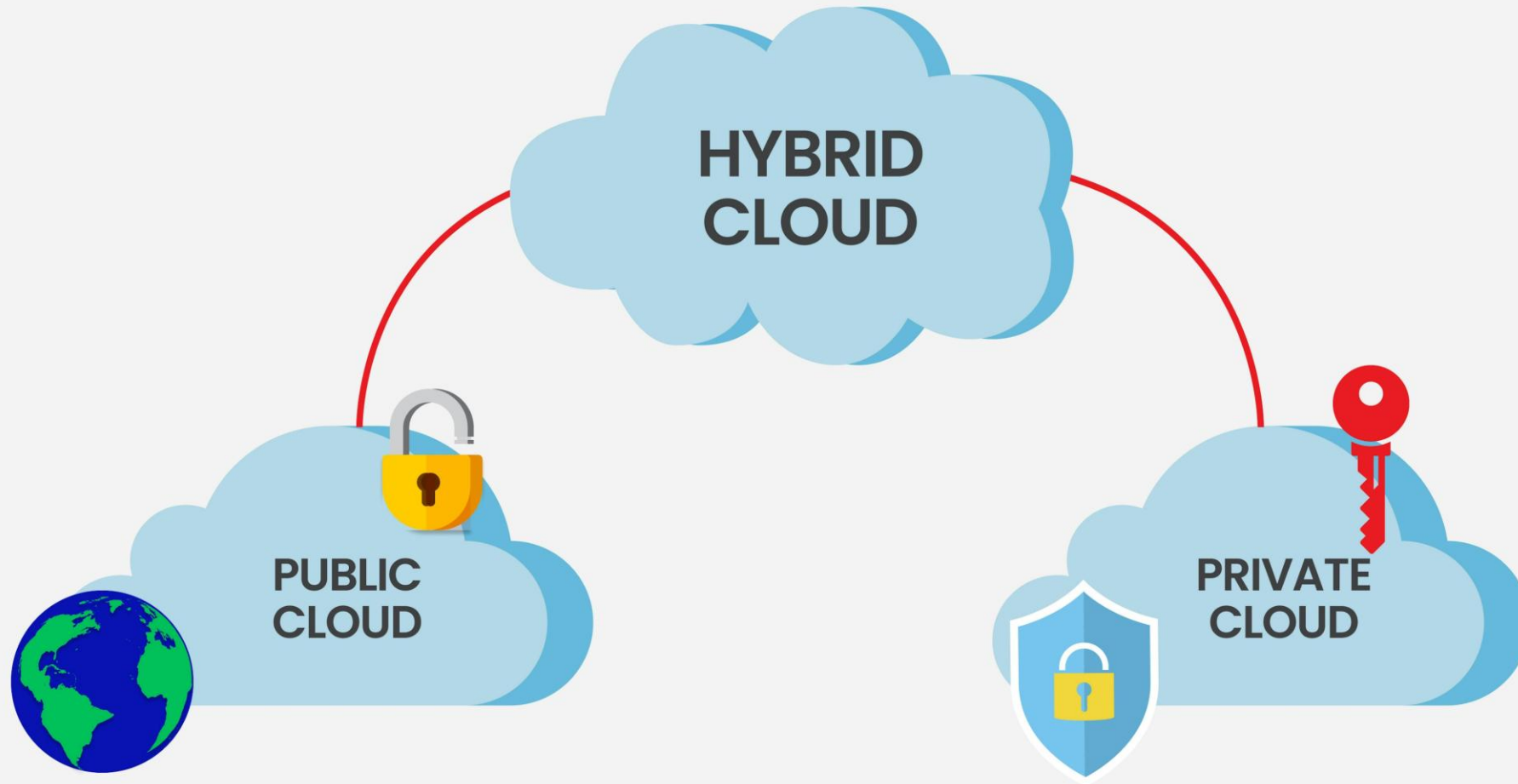
Deployment Models – Community cloud

Benefits of Cloud computing

- **Cost**

  - No h/w, s/w, on-prem data centers

- **Global scale**

  - Elastic in nature (any time scale-in/out).

- **Performance**

  - Reduced n/w latency.

- **Speed**

  - Self-service, on-demand, flexibility.

- **Productivity**

  - No racks & stacks, no h/w setup, no s/w patching.

- **Reliability**

  - Data backup, easy & cheap DR, redundant.

Cloud vendors in market

- AWS

- Azure

- Google Cloud

- Alibaba

- IBM

- VMWare

- Rackspace

- Adobe
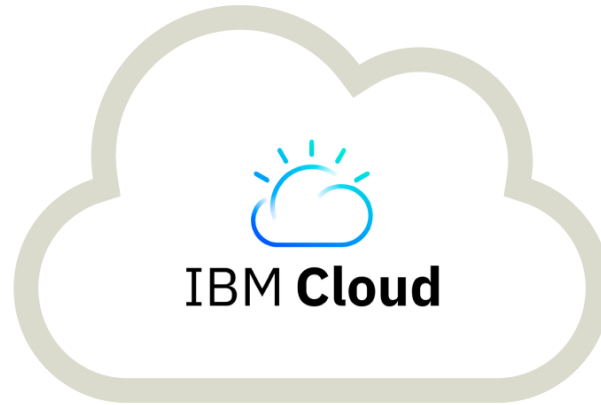
What is Microsoft Azure?

▪ Microsoft Azure is an ever-expanding set of cloud services to help your organization meet your business challenges.

▪ It's the freedom to build, manage, and deploy applications on a massive, global network using your favorite tools and frameworks.

▪ Microsoft Azure (formerly Windows Azure) is a cloud computing service created by Microsoft for building, testing, deploying, and managing applications and services through Microsoft-managed data centers.

Global footprint - Azure regions
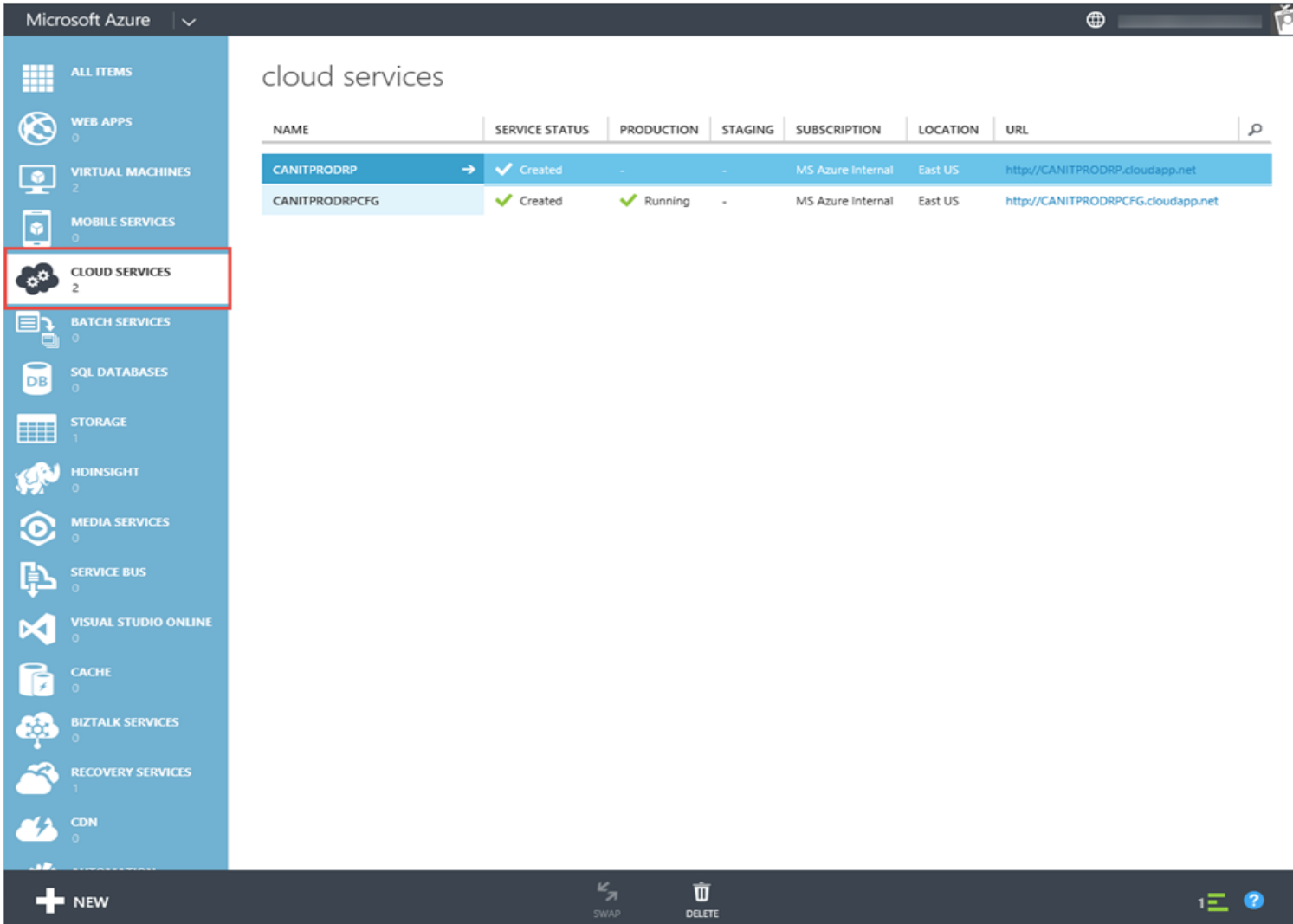
Accessing Azure

- GUI – New (ARM)

- GUI – Old (ASM)

- PowerShell

- Azure cloud shell

- REST API

Azure Service Manager (ASM)

- a.k.a **Classic portal**

- Now **deprecated**.

- No **Resource Groups**.

- No **parallel execution** of tasks.

- The API set used by ASM is **XML** driven REST API.
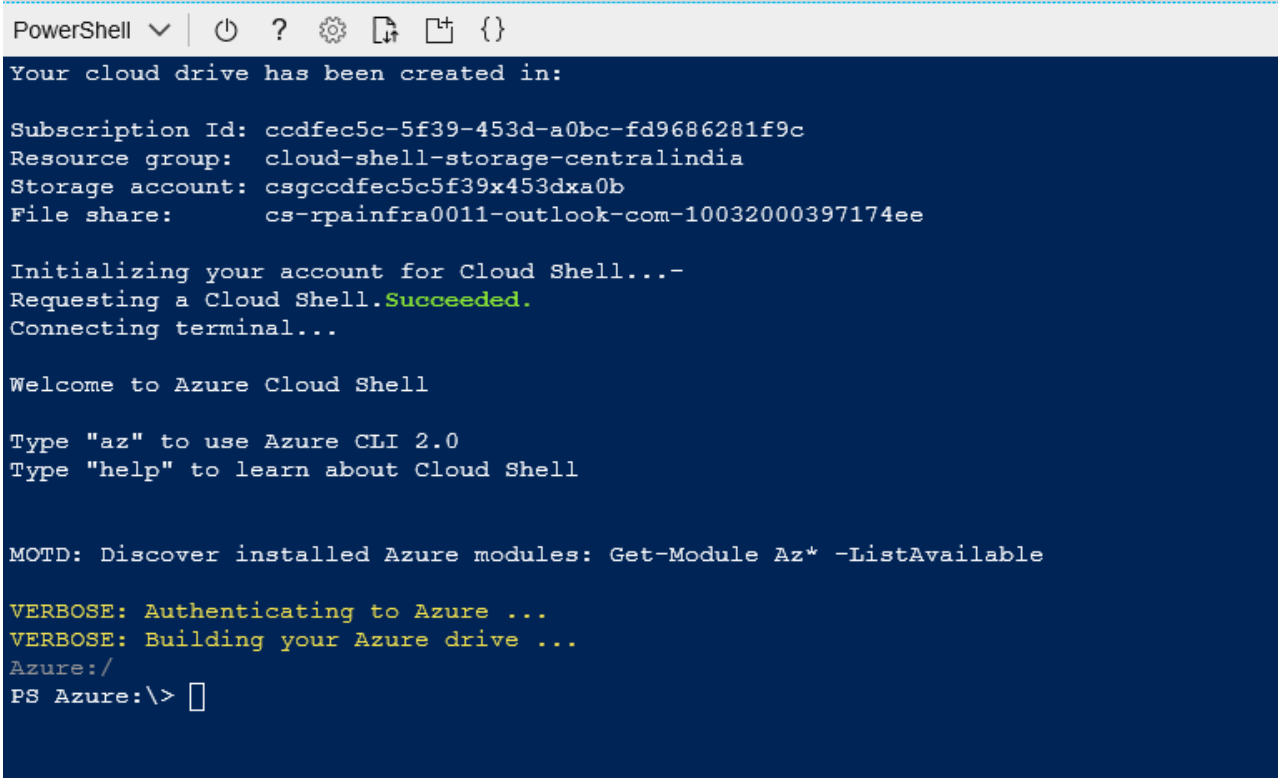
- No **RBAC** support.

Azure Resource Manager (ARM)
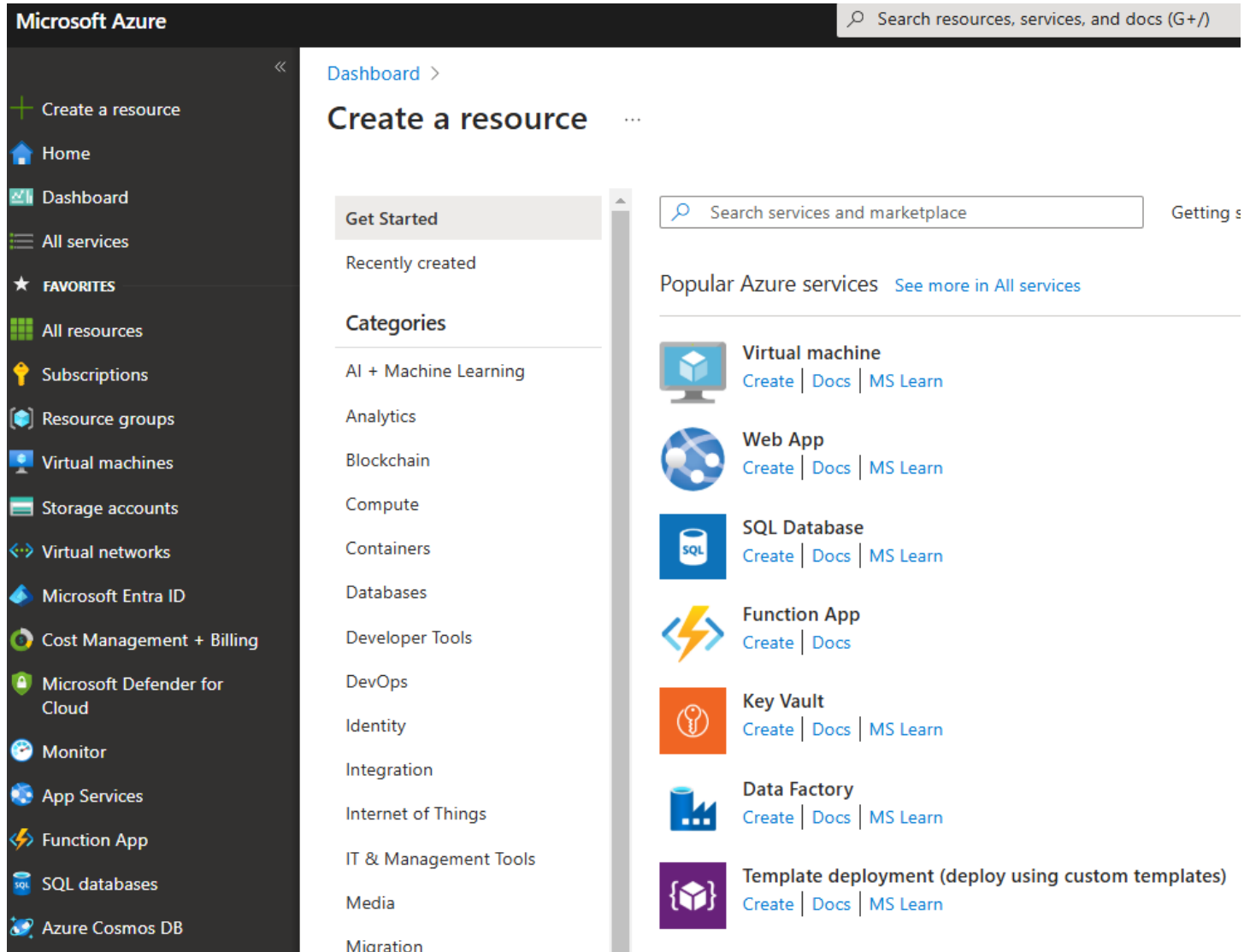
- a.k.a **Modern deployment Model**

- Supports **IaC and ARM Templates.**

- Fine-grained **RBAC** with built-in roles and custom role definitions.

- Resources are deployed within specific **Resource Groups**.

Azure Cloud Shell

- Azure Cloud Shell is an **interactive**, **browser-based** shell provided by Microsoft that allows users to **manage and automate Azure resources** directly from the Azure portal.

- It provides a pre-configured environment with a wide range of tools and utilities for managing Azure services.

Azure PowerShell

```
PS C:\scripts> Get-AzSubscription | fl

Id                          :
Name                        : MSDN Platforms
State                       : Enabled
SubscriptionId              :
TenantId                    :
CurrentStorageAccountName   :
ExtendedProperties          : {[Account, jeetu.singh5591@hotmail.com], [Tenants,              ],
                              [Environment, AzureCloud]}
CurrentStorageAccount       :
```

- To get this, you need to install Azure modules (**AZ**) using PowerShell (run as admin).

- After installation, you will be able to run cmdlets & scripts on to Azure portal to automate the job(s).

Azure free services (for 12 months)

▪ Linux Virtual Machines (750Hrs)	▪ Windows Virtual Machines (750Hrs)
▪ Managed Disks (64 GB x 2)	▪ Blob Storage (5 GB)
▪ File Storage (5 GB)	▪ SQL Database (250 GB)
▪ Azure Cosmos DB (5 GB)	▪ Bandwidth (Data Transfer) (15 GB)
▪ Computer Vision (AI + MACHINE LEARNING/5,000 transactions)	▪ Personalizer (AI + MACHINE LEARNING / 50,000 transactions)
▪ Translator Text (AI + MACHINE LEARNING / 2,000,000 characters)	▪ Anomaly Detector (AI + MACHINE LEARNING / 20,000 transactions)
▪ Form Recognizer (AI + MACHINE LEARNING / 500 pages)	▪ QnA Maker (AI + MACHINE LEARNING / 3 days)

Azure Subscriptions

- Azure Free Account

- Trial Subscriptions

- Pay-As-You-Go (PAYG)

- Azure Dev/Test Pay-As-You-Go

- Enterprise Agreement (EA)

- Microsoft Customer Agreement (MCA)

- Microsoft Partner Agreement (MPA)

- Sponsorship

- Azure for Students

- Microsoft Imagine

- Azure Reserved Instances

- Azure Consumption Commitment

- Cloud Solution Provider (CSP)

- Azure Marketplace Plans

Azure calculator

Virtual Machines

REGION:
West US

OPERATING SYSTEM:
Windows

TYPE:
(OS Only)

TIER:
Standard

INSTANCE:
D2 v3: 2 vCPU(s), 8 GB RAM, 50 GB Temporary storage, US$ 0.21/hour

Billing Option

Save up to 72% on pay-as-you-go prices with 1-year or 3-year Reserved Virtual Machine Instances. Reserved Instances are great for applications with steady-state usage and applications that require reserved capacity. Learn more about Reserved VM Instances pricing.

◉ Pay as you go

○ 1 year reserved (~18% savings)

○ 3 year reserved (~32% savings)

Azure Updates

Apply filters

| Products ⌄ | Status ⌄ | Update type ⌄ | New or updated ⌄ |

■☐☐ In development (123) ⓘ   ■■☐ In preview (2607) ⓘ   ■■■ Launched (4175) ⓘ

Generally Available: Changes to instance size flexibility ratios for Azure Reserved Virtual Machine Instances for M-series

Virtual Machines

■■■ LAUNCHED

GENERAL AVAILABILITY
December 2024

+

Retirement: Resources interacting with Azure Automation using TLS 1.0/1.1 protocol will be blocked from March 1, 2025

Automation

RETIREMENT
March 2025

+

Azure Status

Updated 53 seconds ago | Refresh every [2 minutes ▾]   ✓ Good   ⓘ Information   ⚠ Warning   ⊗ Critical   -- N/A

| | Current Impact | Americas | Europe | **Asia Pacific** | Middle East and Africa | Azure Government | Azure China | Jio§ |

Products And Services	*Non-Regional ⓘ	Southeast Asia	East Asia	Australia East	Australia Southeast	Australia Central	Australia Central 2	Central India	West India	South India	Japan East	Japan West	Korea Central	Korea South	New Zealand North
COMPUTE															
Azure VMware Solution	--	✓	✓	✓	✓	--	--	✓	--	--	✓	✓	--	--	--
Azure VMware Solution by CloudSimple	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Batch	--	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	--
Azure Center for SAP solutions	--	--	✓	✓	--	--	--	✓	--	--	✓	--	✓	--	--
Cloud Services	--	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	--
Azure Functions	--	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	--
Azure VM Image Builder	--	✓	✓	✓	--	--	--	✓	--	--	✓	--	✓	--	--
Azure Quantum	--	--	--	--	--	--	--	--	--	--	✓	✓	--	--	--
Azure Service Fabric	--	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	--