Cloud Computing Lecture #3

Workshop Contents – Day 3

- Details of PaaS and SaaS
- Concepts of Virtualization
- Use of Virtualization in Cloud Computing
    - Storage Virtualization, Application virtualization, Server virtualization, Network virtualization
- Microsoft Windows Azure architecture
- Services offered by Microsoft Azure
- Demo:
    1) Creating a virtual Machine
    2) Microsoft Windows Azure
        - Creating an account on the cloud
        - Starting a server instance
        - Allocating storage and other resources

Renting an abstract machine

PLATFORM AS A SERVICE

Concept

A complete development and deployment environment in the cloud, with resources that enable you to deliver everything for cloud-based apps

Advantages of PaaS

Additional features—middleware, development tools and other business tools

Cut coding time.

PaaS development tools can cut the time it takes to code new apps with pre-coded application components built into the platform, such as workflow, directory services, security features, search and so on..

Develop for multiple platforms

—including mobile—more easily. Some service providers give you development options for multiple platforms, such as computers, mobile devices and browsers making cross-platform apps quicker and easier to develop.

Common PaaS Scenarios

- **Development framework.**
  - provides a framework that developers can build upon to develop or customise cloud-based applications.
  - Cloud features such as scalability, high-availability and multi-tenant capability are included, reducing the amount of coding that developers must do.
- **Analytics or business intelligence.**
  - Tools provided as a service with PaaS allow organisations to analyse and mine their data, finding insights and patterns and predicting outcomes to improve forecasting, product design decisions, investment returns and other business decisions.
- **Additional services.**
  - Offer other services that enhance applications, such as workflow, directory, security and scheduling.

Advantages of PaaS

- **Use sophisticated tools affordably.** A pay-as-you-go model makes it possible for individuals or organisations to use sophisticated development software and business intelligence and analytics tools that they could not afford to purchase outright.
- **Support geographically distributed development teams.** Because the development environment is accessed over the Internet, development teams can work together on projects even when team members are in remote locations.
- **Efficiently manage the application lifecycle:** building, testing, deploying, managing and updating within the same integrated environment.

Windows Azure Platform

- Microsoft Azure is a cloud computing service created by Microsoft for building, testing, deploying, and managing applications and services through Microsoft-managed data centers.
- **Developed by:** Microsoft Corporation
- **License:** Closed source for platform
- **Initial release date:** February 1, 2010
- **Operating system:** Linux, Microsoft Windows

- **Azure** is a public cloud computing platform—
  - with solutions including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)
  - can be **used for** services such as analytics, virtual computing, storage, networking,

Microsoft Azure - Pricing

AZURE SERVICE	PRICE MATCH	STARTING FROM
Linux virtual machines (VMs)	AWS EC2*	Starting from ₹0.260 per hour
Functions	AWS Lambda*	Starting from ₹13.220 per million executions
Block Blob storage (ZRS HOT)	Amazon S3 Standard*	Starting from ₹1.488 per GB per month
Block Blob storage (ZRS COOL)	Amazon S3 Standard-Infrequent Access*	Starting from ₹0.827 per GB per month

Microsoft Azure - Pricing

	DEVELOPER	STANDARD	PROFESSIONAL DIRECT	PREMIER
Best for:	Trial and non-production environments	Production workload environments	Business-critical dependence	Substantial dependence across multiple products
Initial response time	<8 hours	<2 hours	<1 hour	<15 minutes (with Azure Rapid Response or Azure Event Management) (with Azure Rapid Response) or <1 hour (without Azure Rapid Response)
Monthly costs	₹1,916.792/mo	₹6,609.625/mo	₹66,096.25/mo	Contact us

GAE Pricing

Google App Engine is a Platform as a Service and cloud computing platform for developing and hosting web applications in Google-managed data centers

- **Google App Engine** (often referred to as **GAE** or simply **App Engine**) is a Platform as a Service and cloud computing platform for developing and hosting web applications in Google-managed data centers.
- Google App Engine primarily supports Go, PHP, Java, Python, Node.js, .NET, and Ruby applications, although it can also support other languages via "custom runtimes".
- The service is free up to a certain level of consumed resources and only in standard environment but not in flexible environment. Fees are charged for additional storage, bandwidth, or instance hours required by the application.
- App Engine automatically allocates more resources for the web application to handle the additional demand

GAE Pricing

Google App Engine is a Platform as a Service and cloud computing platform for developing and hosting web applications in Google-managed data centers

	Free	Paid	Premier
Platform fee	Free	$9/app/month	$500/account /month
Dynamic scaling	✔	✔	✔
Java Runtime	✔	✔	✔
Python Runtime	✔	✔	✔
Usage based pricing		✔	✔
Infinitely scalable		✔	✔
SLA		✔	✔
Operational support			✔

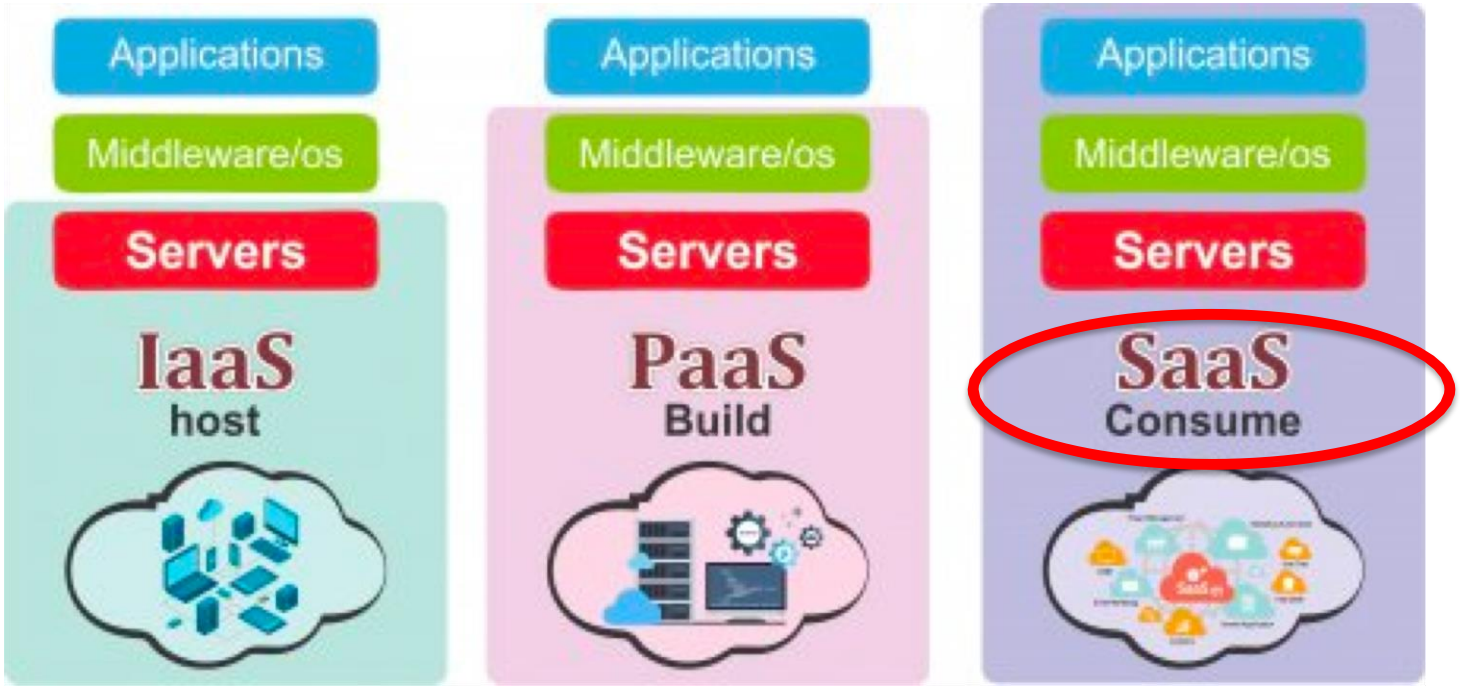
Renting software

SOFTWARE AS A SERVICE

Concept

- With a SaaS offering you do not have to think about how the service is maintained or how the underlying infrastructure is managed;
- a cloud computing model in which a **third-party provider delivers hardware and software tools -- usually those needed for application development** -- to users over the internet.
- you only need to think about how you will use that particular piece software.
- A common example of a SaaS application is web-based email where you can send and receive email without having to manage feature additions to the email product or maintaining the servers and operating systems that the email program is running on.

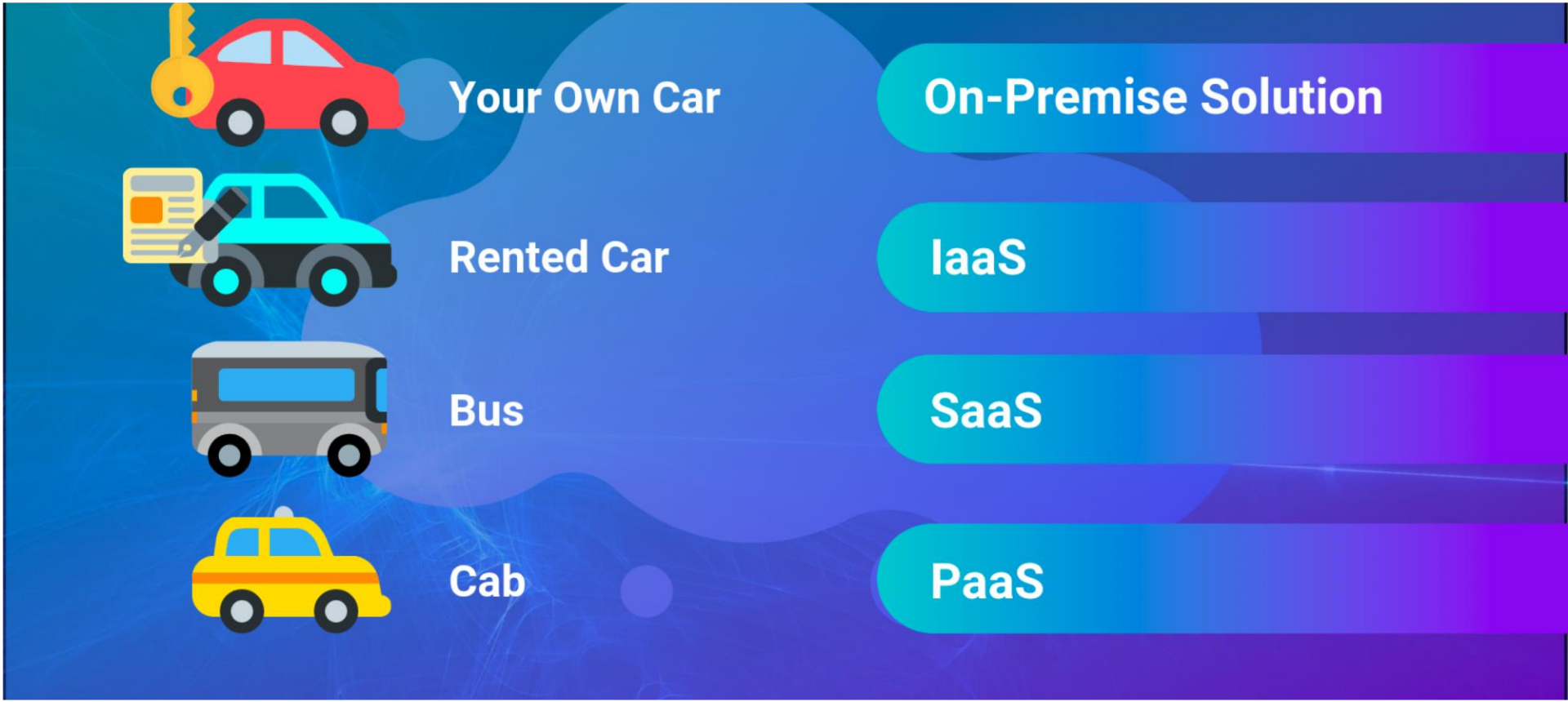
Concept


Applications
Middleware/os
Servers
IaaS
host
Applications
Middleware/os
Servers
PaaS
Build
Applications
Middleware/os
Servers
SaaS
Consume

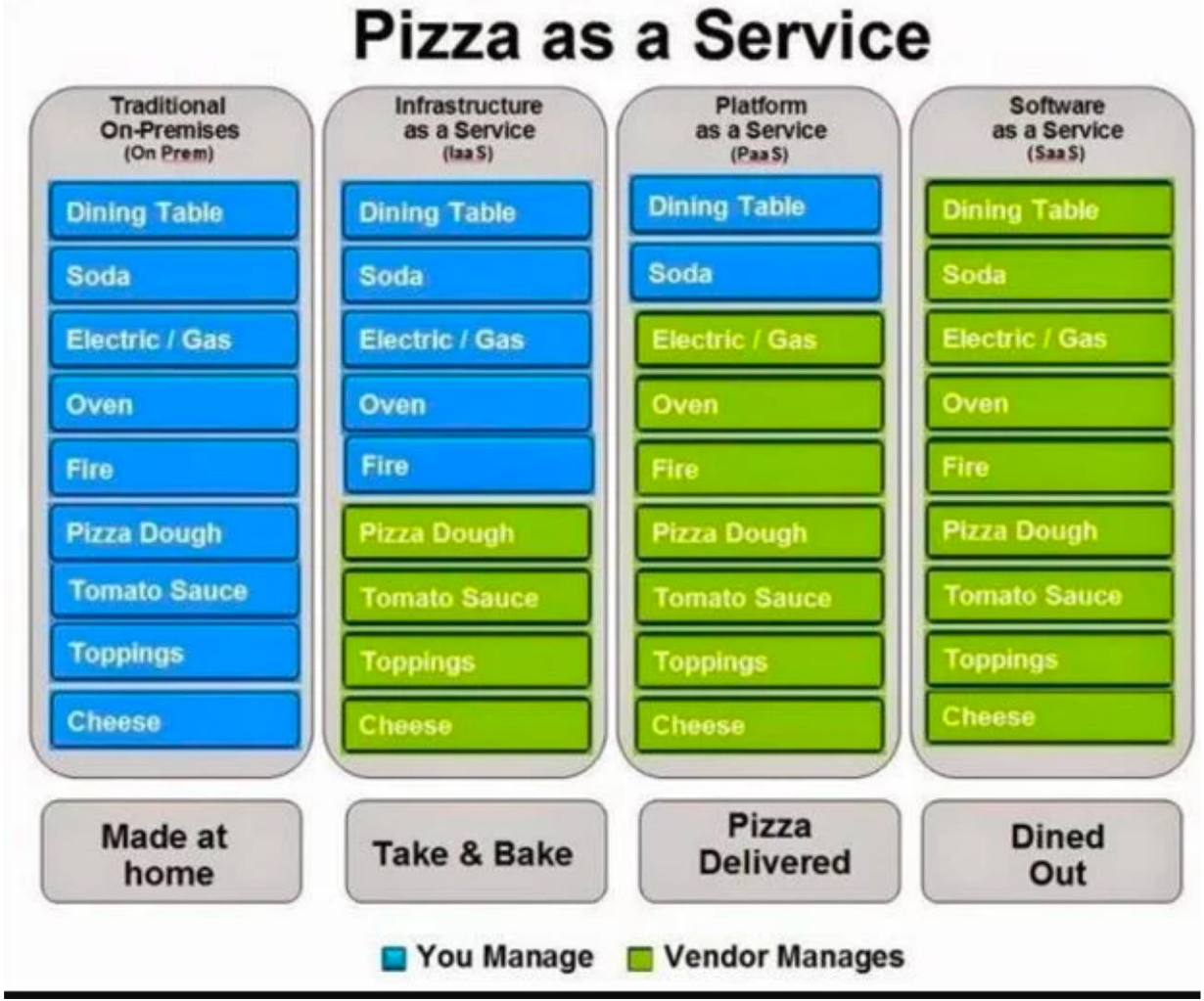
Concept

- Simply renting an application instead of setting it up on your own server
- Examples:
  - Exchange hosting ($10/user/month)
  - Wordpress hosting ($20-$150 / month)
  - Web hosting ($90 / year)
  - Salesforce ($125/user/month)
  - World of Warcraft ($20/month)
- These are all cloud apps (computing as a utility)

Final Summary



Final Summary




VIRTUALIZATION IN
CLOUD COMPUTING

Key Technology: Virtualization

the "creation of a virtual (rather than actual) version of something, such as a server, a desktop, a storage device, an operating system or network resources"

Virtualization in Cloud Computing

Cloud computing takes virtualization one step further:

- You don’t need to own the hardware
- Resources are rented as needed from a cloud
- Various providers allow creating virtual servers:
    - Choose the OS and software each instance will have
    - The chosen OS will run on a large server farm
    - Can instantiate more virtual servers or shut down existing ones within minutes
- You get billed only for what you used

Virtualization in Cloud Computing

- Virtualization is the ability to run multiple operating systems on a single physical system and share the underlying hardware resources*
- It is the process by which one computer hosts the appearance of many computers.
- Virtualization is used to improve IT throughput and costs by using physical resources as a pool from which virtual resources can be allocated.

Illustration of Virtualization in CC

You have a Desktop
Specifications:
CPU: Intel Core i7
Graphics: Radeon RX Vega M GL – GH
RAM: 4GB – 64GB Storage: 128GB – 2TB SSD

You use it for 4 hours in a day
Implies:16% utilization

Lets replace this Desktop with a Server

Illustration of Virtualization in CC

- CPU: Intel Xeon processor 3 GHz or greater
- RAM: 8 GB or greater
- 100 Mbps or faster network interface
- 100 GB for primary partition 1 – Operating System,
- 1 TB or more for secondary partition1 – Data
- 500 GB for database 2
- 500 GB for case files and video2

Now we install a Software on it to create multiple desktops called Virtual machines
This Software is called Hypervisor

Illustration of Virtualization in CC

- Now one server can replace several desktop PCs
- Instead of buying several desktops, we buy one server
- Now it is a Central Management
- Lower Cost
- Lower Operational Cost

Now we install a Software on it to create multiple desktops called Virtual machines
This Software is called Hypervisor

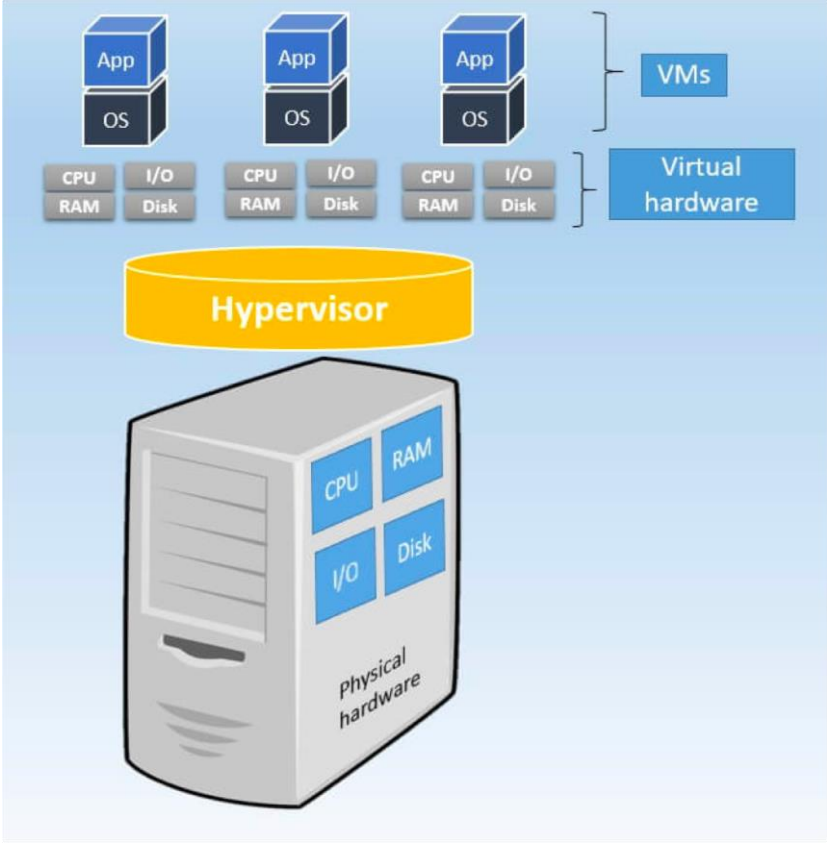
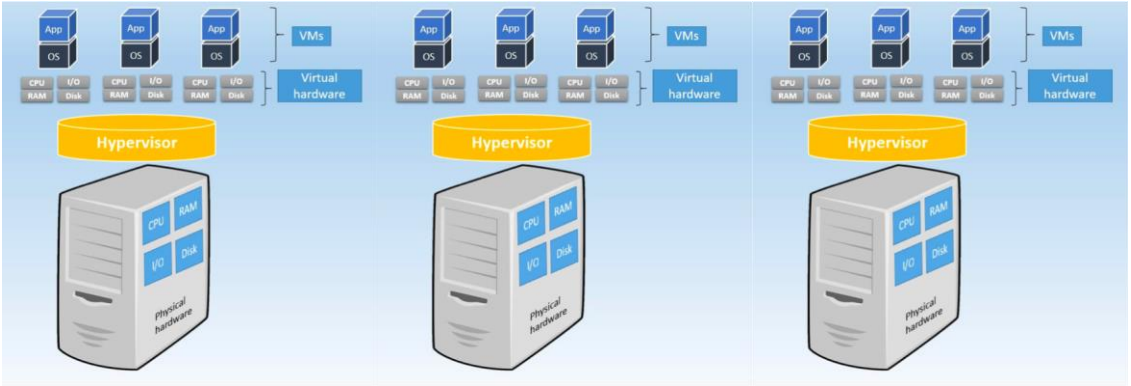
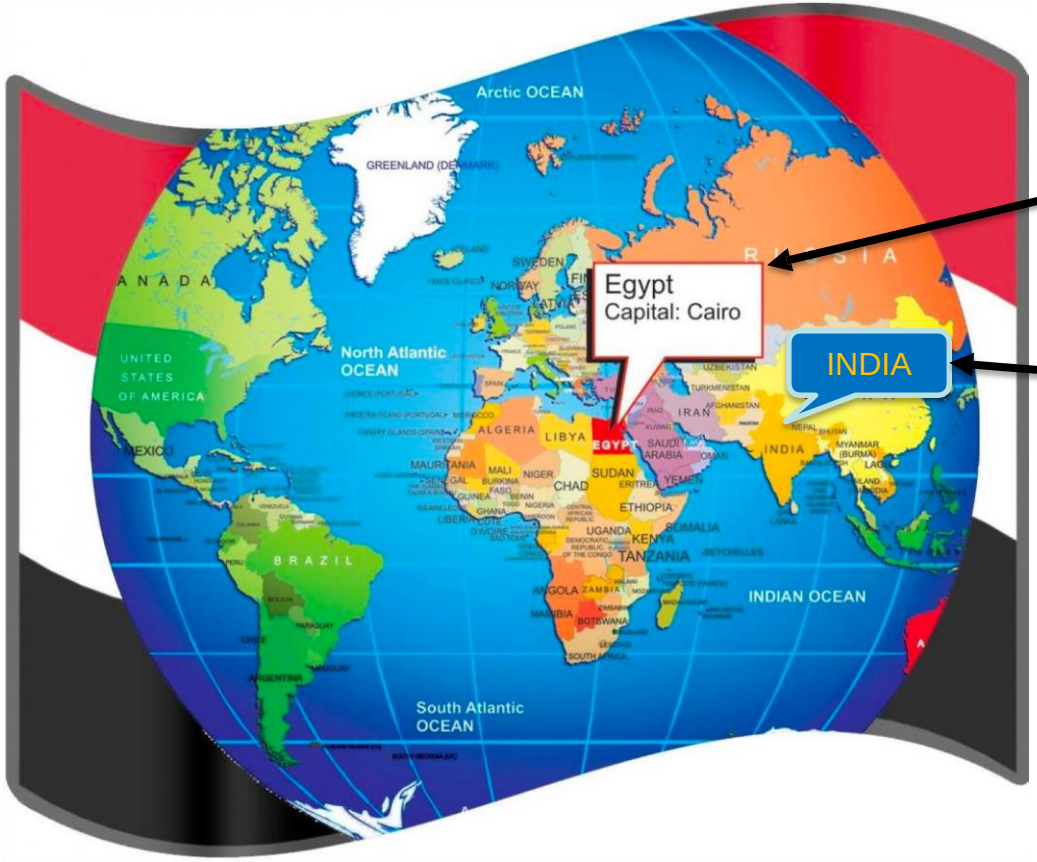


Illustration of Virtualization in CC



- Now we add several servers and make a Data Centre
- With this Data Centre we can create several Virtual servers as well as Several Virtual Desktops

Illustration of Virtualization in CC



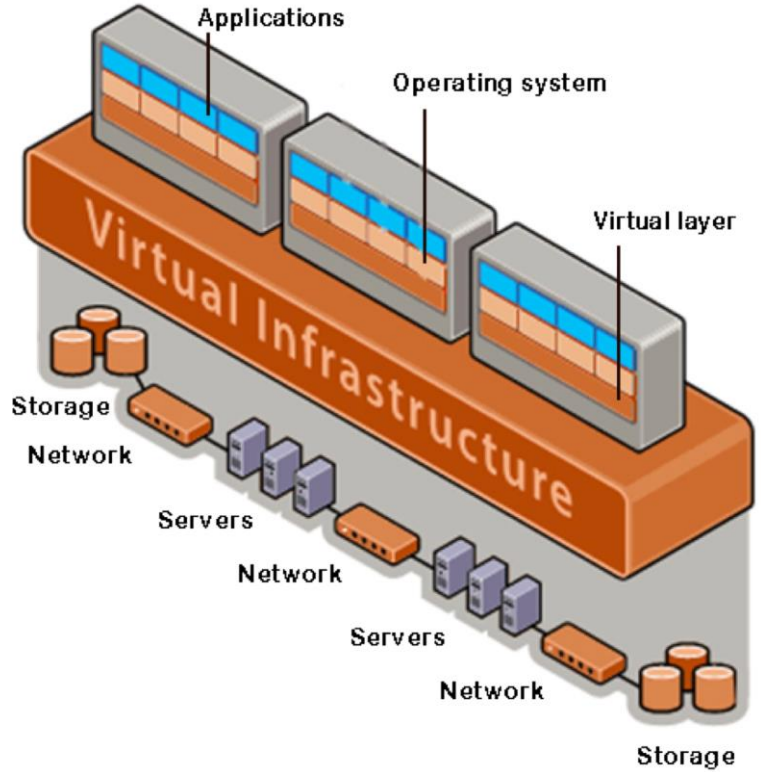
You are here and buy IaaS from the Data Centre on Cloud

Data Centre is here and managed as Cloud Server

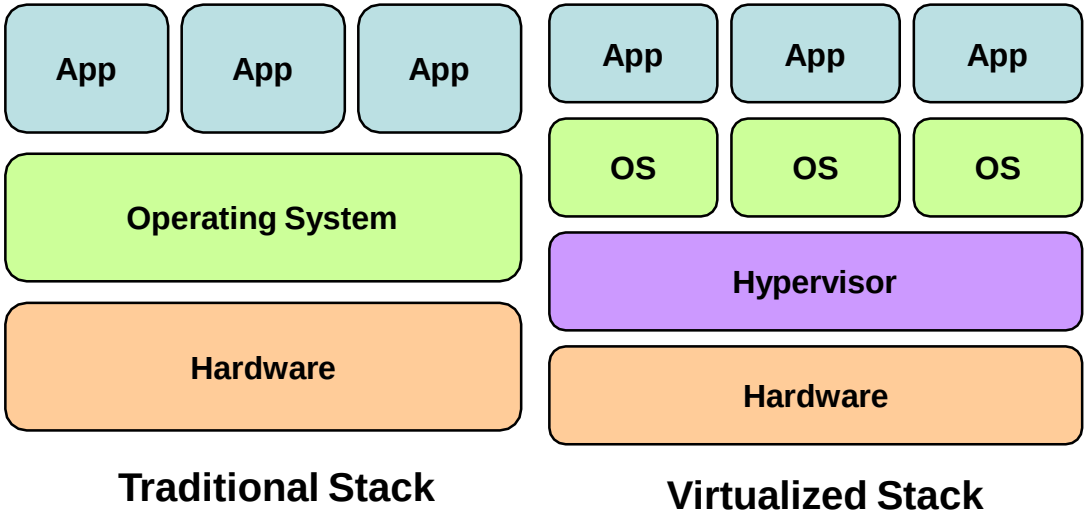
Other users are also distributed across the world and accessing the data centre. Each user buys a Virtual Machine with different specifications and installs different OS

Virtualization Architecture

- A Virtual machine (VM) is an isolated runtime environment (guest OS and applications)
- Multiple virtual systems (VMs) can run on a single physical system



Traditional Computing vs Virtualization

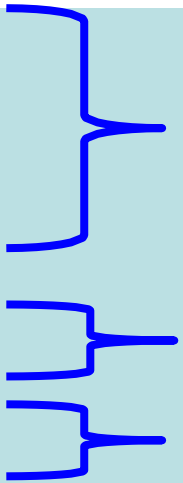


Hypervisor

- A virtual machine manager/monitor (VMM), or virtualization manager,
- It is a program that allows multiple operating systems to share a single hardware host.
- Each guest operating system appears to have the host's processor, memory, and other resources all to itself.
- However, the hypervisor is actually controlling the host processor and resources, allocating what is needed to each operating system in turn and making sure that the guest operating systems (called virtual machines) cannot disrupt each other.

Roles of the Hypervisor

- Isolating/Emulating resources
  - CPU: Scheduling virtual machines
  - Memory: Managing memory
  - I/O: Emulating I/O devices
- Networking
- Managing virtual machines



Push to HW / Pre-allocation

Remove

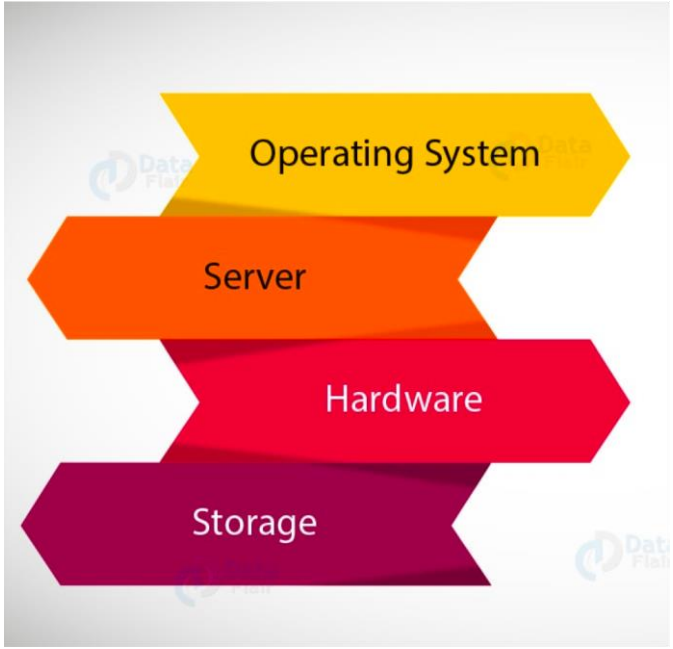
Push to side

Benefits of Virtualization

- Sharing of resources helps cost reduction
- Isolation: Virtual machines are isolated from each other as if they are physically separated
- Encapsulation: Virtual machines encapsulate a complete computing environment
- Hardware Independence: Virtual machines run independently of underlying hardware
- Portability: Virtual machines can be migrated between different hosts.

Types of Virtualization in Cloud Computing

- Operating System Virtualization
- Hardware Virtualization
- Server Virtualization
- Storage Virtualization



Thank you