
CLOUD COMPUTING

What is cloud computing

- In cloud computing, the word "cloud" is used as a metaphor for "*the Internet*," so the phrase *cloud computing* means "a type of Internet-based computing," where different services such as servers, storage and applications are delivered to an organization's computers and devices through the Internet.

INTRODUCTION

- Computing is being transformed into a model consisting of services that are **commoditized and delivered** in a manner similar to utilities such as water, electricity, gas, and telephony

- Users access services based on their requirements, **regardless of where the services are hosted**

- Technological advancement that focuses on the way we **design computing systems, develop applications, and leverage existing services** for building software

https://www.youtube.com/watch?v=4OO77HFcCUs&t=151s

A Brief history

- 1960 – John McCarthy (Software engineer) opined that "computation may someday organized as a public utility".
- Early 1990s – The term cloud comes to commercial use referring to large networks and the advancement of the Internet.
- 2001 – IBM details the Saas concept in their "Autonomic Computing Manifesto"
- 2005 - Amazon provides access to their web.

CLOUD COMPUTING

- Concept of dynamic provisioning, which is applied not only to services but also to compute **capability, storage, networking, and information technology** (IT) infrastructure

- Resources are made available through the Internet and offered on a **pay-per-use basis** from cloud computing vendors.

- Today, anyone with a **credit card can subscribe to cloud services** and deploy and configure servers for an application in hours

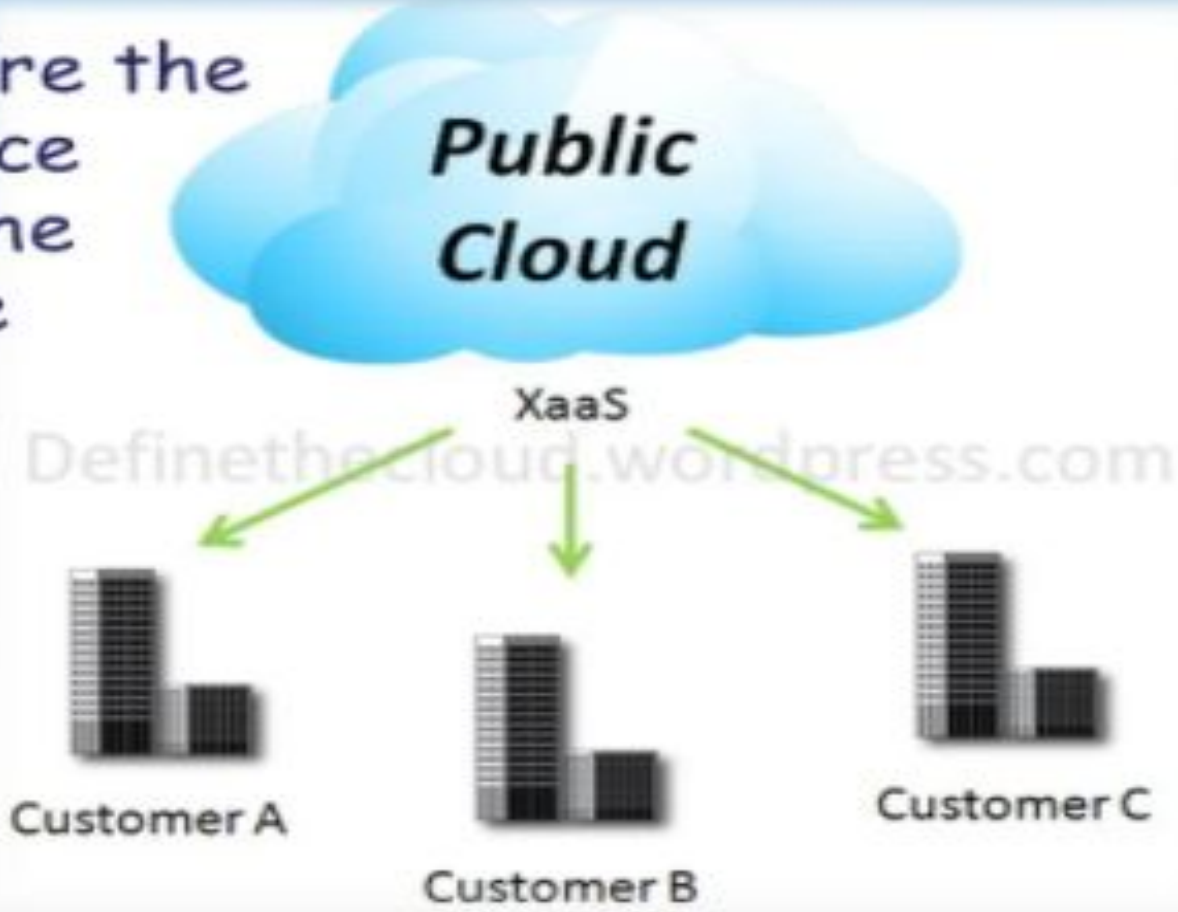
- **Growing and shrinking the infrastructure** according to the demand, and paying only for the time these resources have been used.

Types of Cloud Computing

- Public cloud
- Private cloud
- Hybrid cloud

Public cloud (External cloud):

- A form of cloud storage where the enterprise and storage service provider are separate, and the data is stored outside of the enterprise's data center.

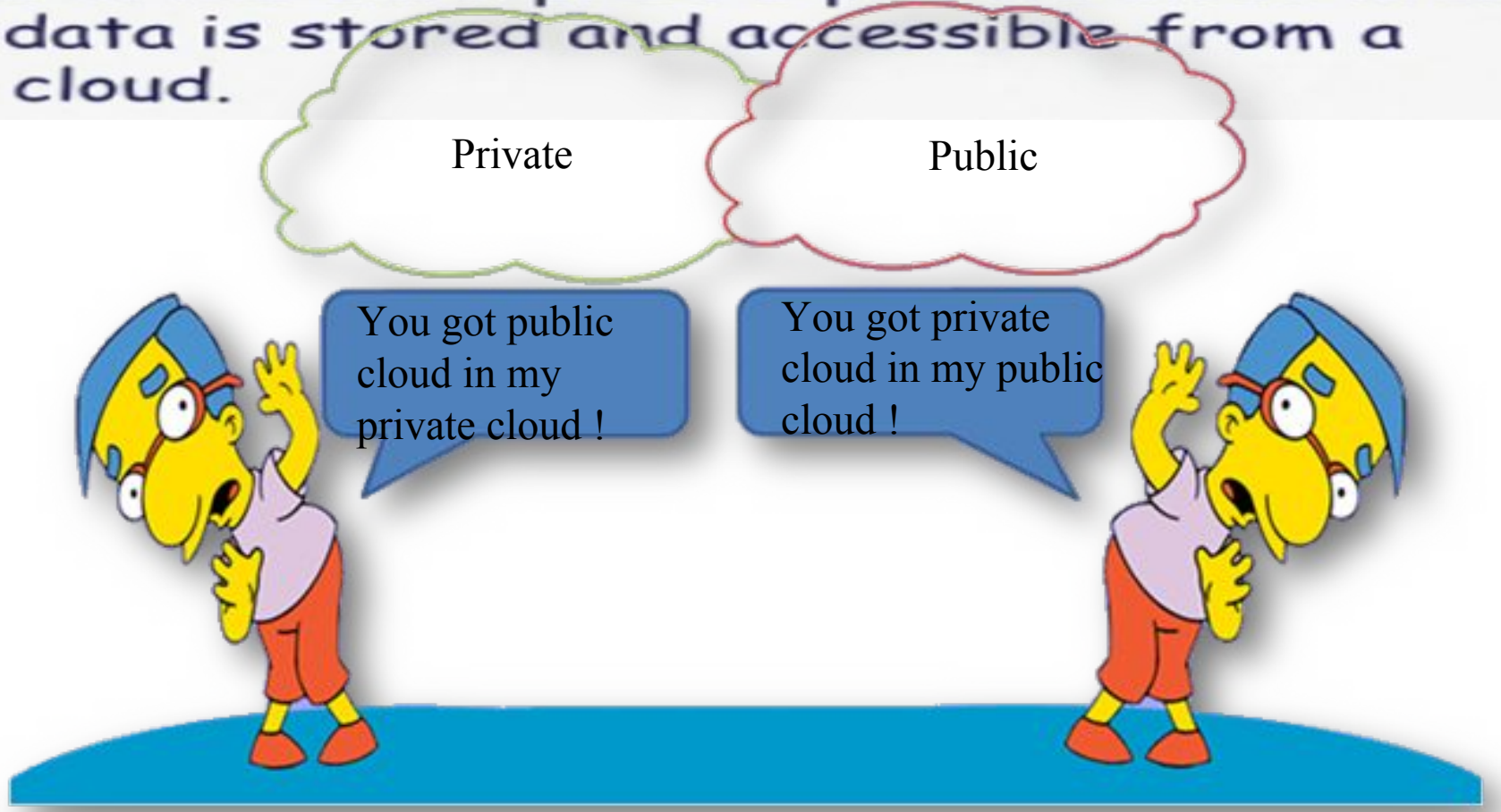


Private Cloud (Internal cloud):

A private cloud is designed to offer the same features and benefits of public cloud systems, but removes a number of objections to the cloud computing model Which includes control over enterprise and customer data, worries about security, and issues connected to regulatory compliance.

Hybrid cloud

- A combination of public cloud storage and private cloud storage where some critical data resides in the enterprise's private cloud while other data is stored and accessible from a public 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

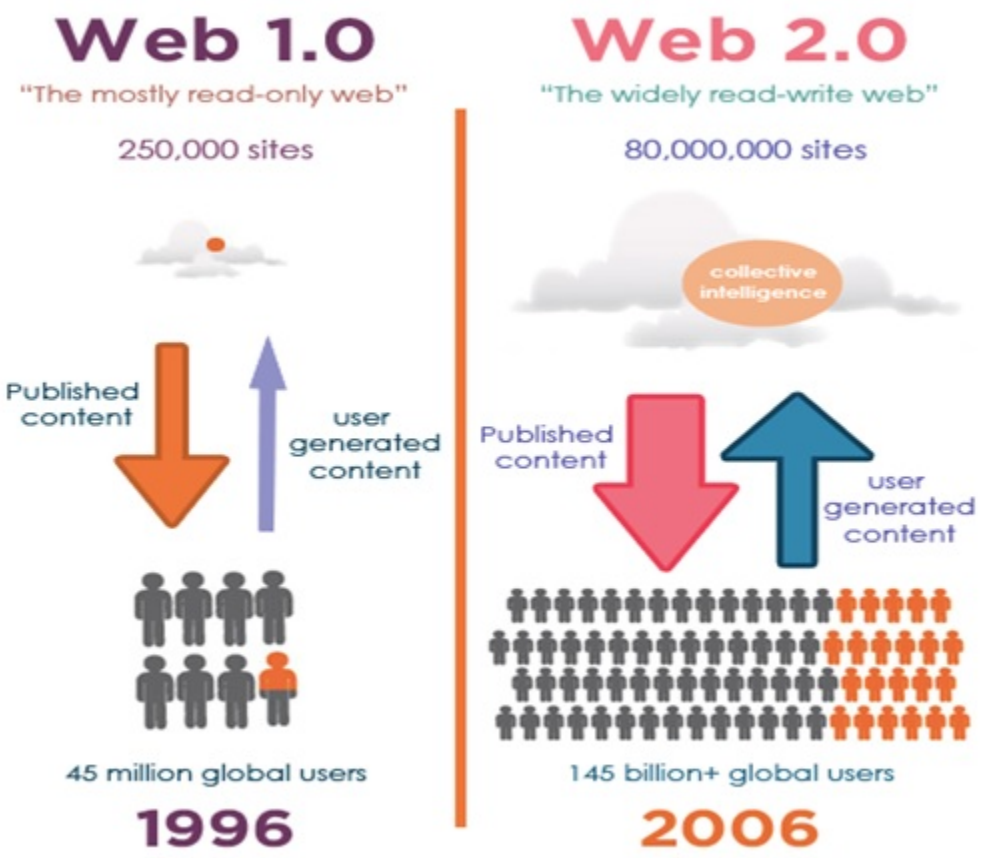
FROM USER'S VIEW

I don't care
where my servers are,
who manages them,
where my documents are stored, or
where my applications are hosted

I just want them
always available and
access them from any device
connected through Internet

And I am willing to pay for this service for as a long as I need it

ROLE OF WEB 2.0



- ✔ Plays a central role in making cloud computing **an attractive opportunity for building computing systems**
- ✔**Transformed the Internet into a rich application** and service delivery platform
- ✔Mature enough to serve **complex needs**
- ✔**Service orientation** allows cloud computing to deliver its capabilities with familiar abstractions
- ✔Virtualization confers on cloud computing the necessary degree of **customization, control, and flexibility** for building production and enterprise systems.

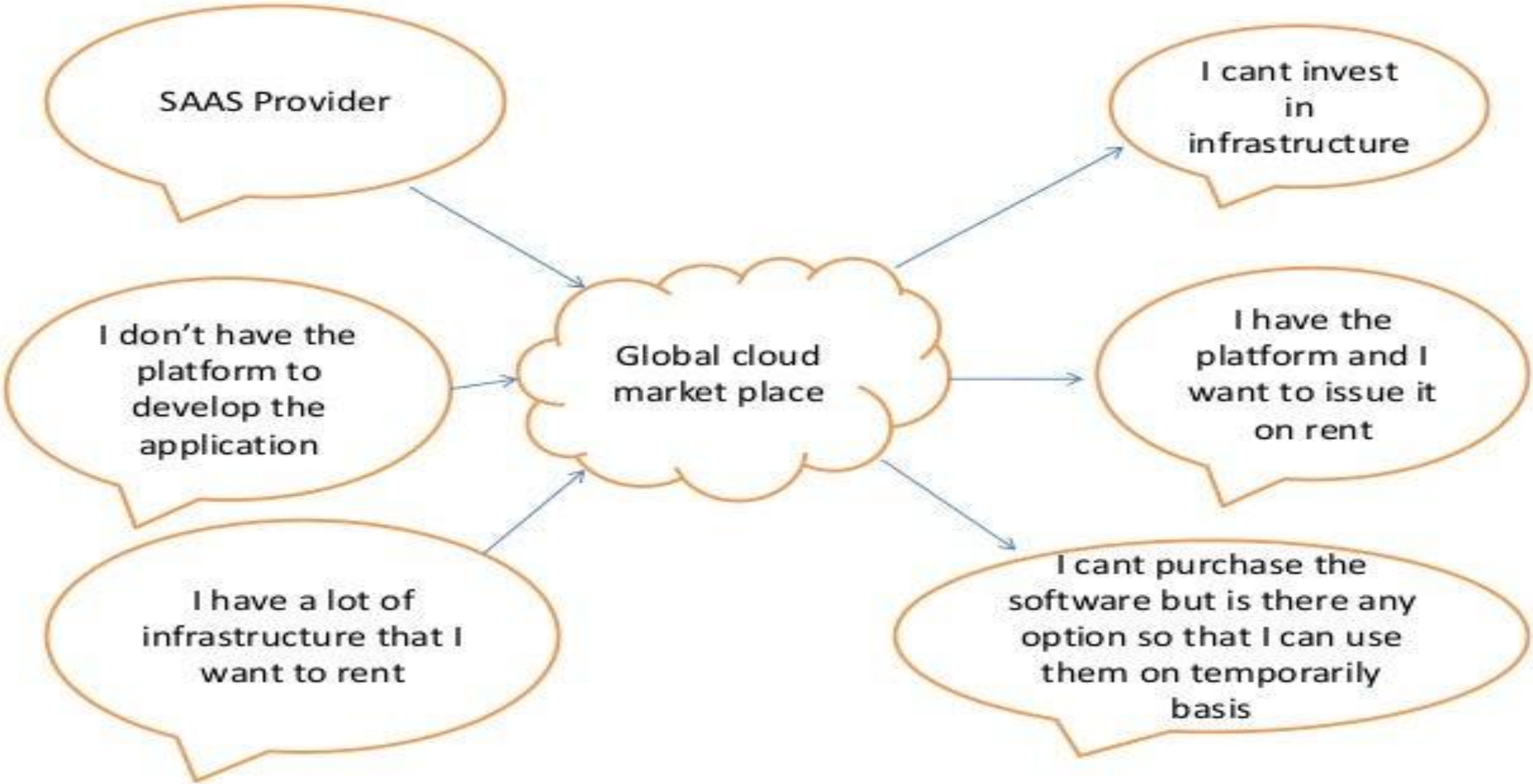
Cloud Computing

- It allows renting infrastructure , runtime environment , and services on a pay-per-use basis.
- It is an effective composition of several technologies
  - **Web 2.0** :-
    - brings ***interactivity*** and ***flexibility*** into web pages.
    - Web-based ***access to all the functions*** that are normally found in ***desktop applications***.
  - **Service Orientation Computing** :-
    - ***Service as a main building blocks*** of application and system development.
  - **Virtualization** :-
    - Abstraction of some of the fundamental ***elements for computing such as h/w , storage etc***.

https://aws.amazon.com/what-is-cloud-computing

Cloud computing Vision

Vision of Cloud Computing



→ Cloud computing provides the facility to provision virtual hardware, runtime environment and services to a person having money.

→ These all things can be used as long as they are needed by the user, there is no requirement for the upfront commitment.

→ The whole collection of computing system is transformed into a collection of utilities, which can be provisioned and composed together to deploy systems in hours rather than days, with no maintenance costs.

→ The long term vision of a cloud computing is that IT services are traded as utilities in an open market without technological and legal barriers.

Vision of Cloud Computing

→ In the near future we can imagine that it will be possible to find the solution that matches with our requirements by simply entering our request in a global digital market that trades with cloud computing services.

→ The existence of such market will enable the automation of the discovery process and its integration into its existing software systems.

→ Due to the existence of a global platform for trading cloud services will also help service providers to potentially increase their revenue.

→ A cloud provider can also become a consumer of a competitor service in order to fulfill its promises to customers.


No capital investments
Cloudbursting
SaaS
Quality of Service
Pay as you go
Internet
PaaS
Green computing
IaaS
Billing
Utility computing
Elasticity
IT outsourcing
Service Level Agreement
Virtual Datacenters
Scalability
IT outsourcing
Privacy & Trust
Provisioning on demand
Security
Virtualization
Cloud Computing?

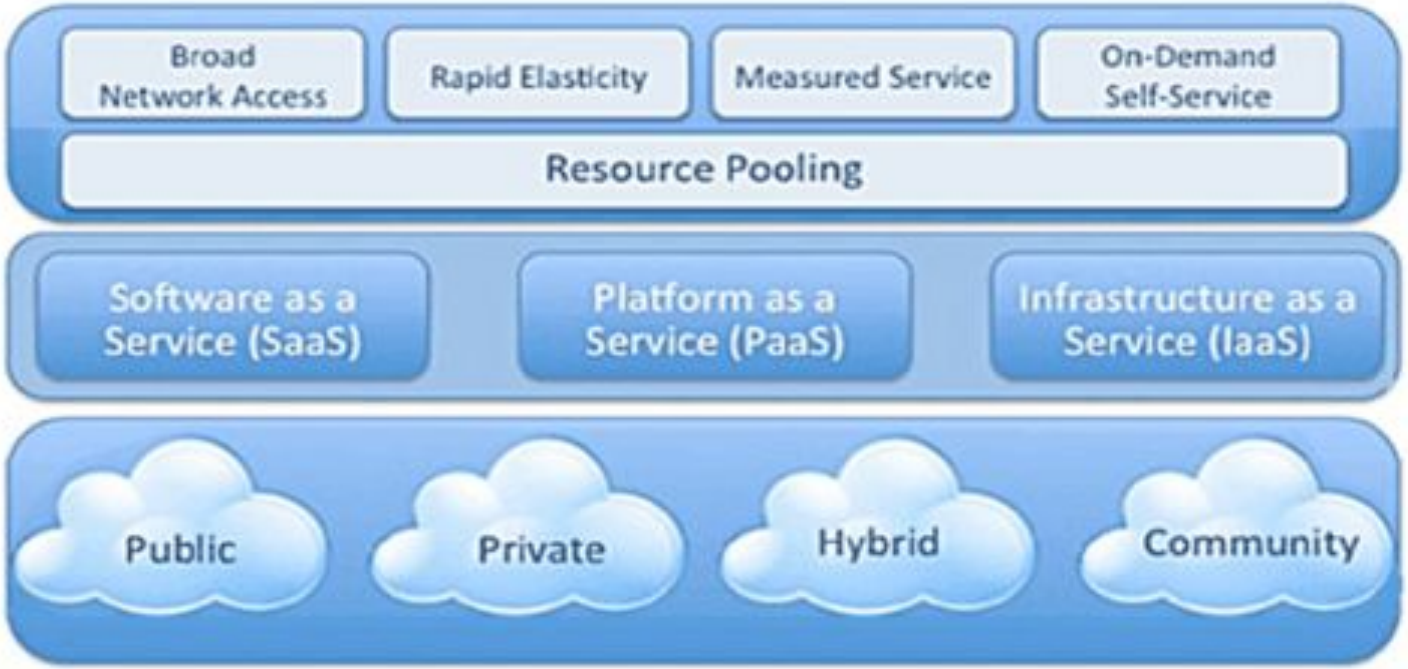
Define Cloud

- Cloud is used as an abstraction of network/internet in system diagrams.
- Cloud computing is an internet-centric way of computing.
- Internet is represent either ***the medium*** or ***the platform*** through which cloud computing services are delivered and made accessible.
- Define by Armbrust
  - *Cloud computing refers to both the application delivered as services over the Internet and the hardware and system in the datacenters that provide those services.*

What is Cloud Computing ?

NIST
National Institute of Standards and Technology

"Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction"



Essential Characteristics

Service Models

Deployment Models

FEATURES

- online storage
- use development platforms
- rent virtual hardware

- Operations can be performed and billed simply by entering the credit card details and accessing the exposed services through a Web browser
- This helps us provide a different and more practical characterization of cloud computing

THREE CRITERIA

1. The service is accessible via a Web browser (nonproprietary) or a Web services application programming interface (API).
2. Zero capital expenditure is necessary to get started.
3. You pay only for what you use as you use it.

SERVICE-LEVEL AGREEMENT

Even though many cloud computing services are freely available for single users, enterprise class services are delivered according a specific pricing scheme.

In this case users subscribe to the service and establish with the service provider a **service-level agreement (SLA)** defining the **quality-of-service parameters** under which the service is delivered

Cloud Definitions

- Definition from ***Buyya***
  - A Cloud is a type of parallel and distributed system consisting of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements established through negotiation between the service provider and consumers.

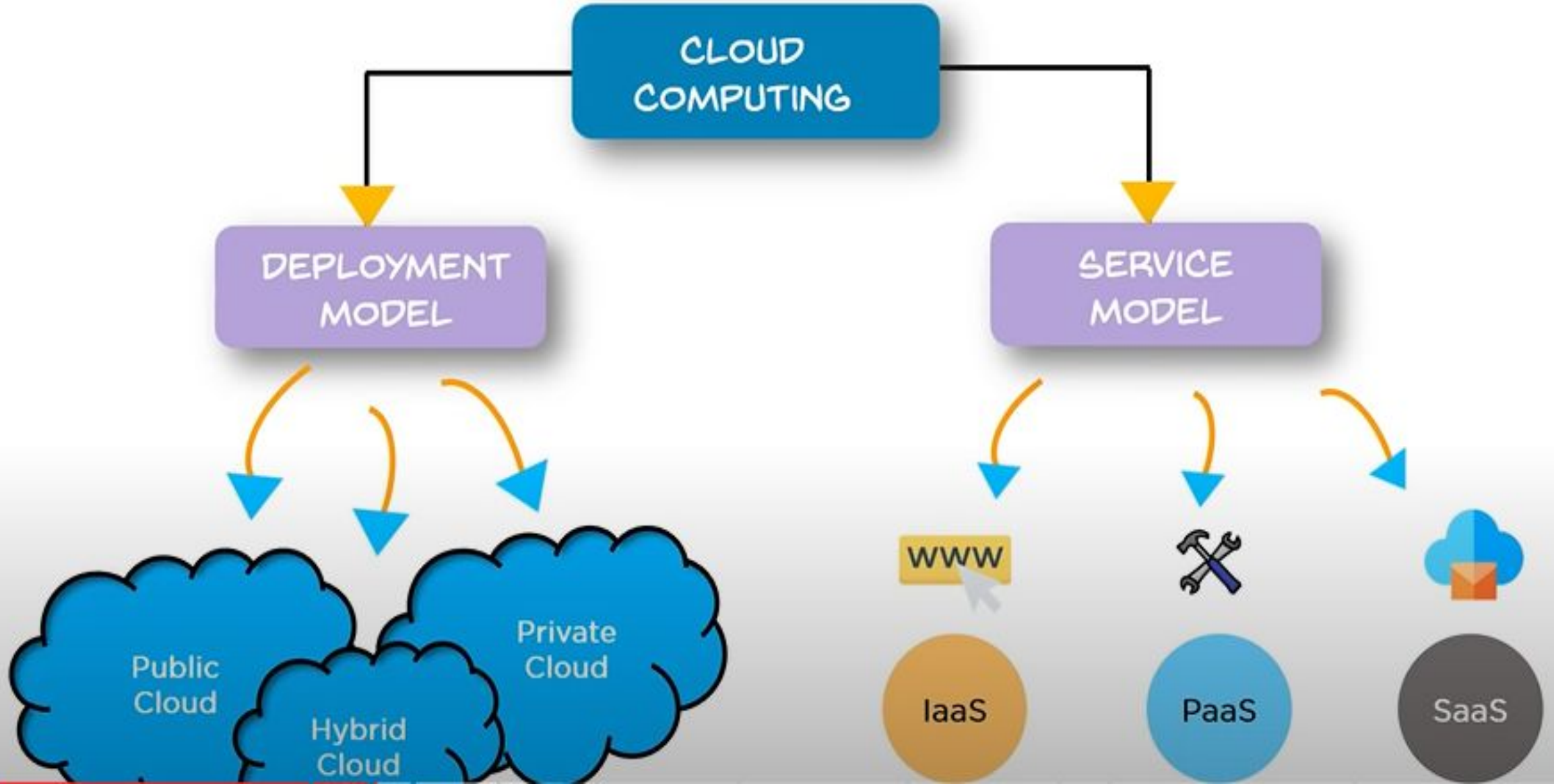
Basic Concepts

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:

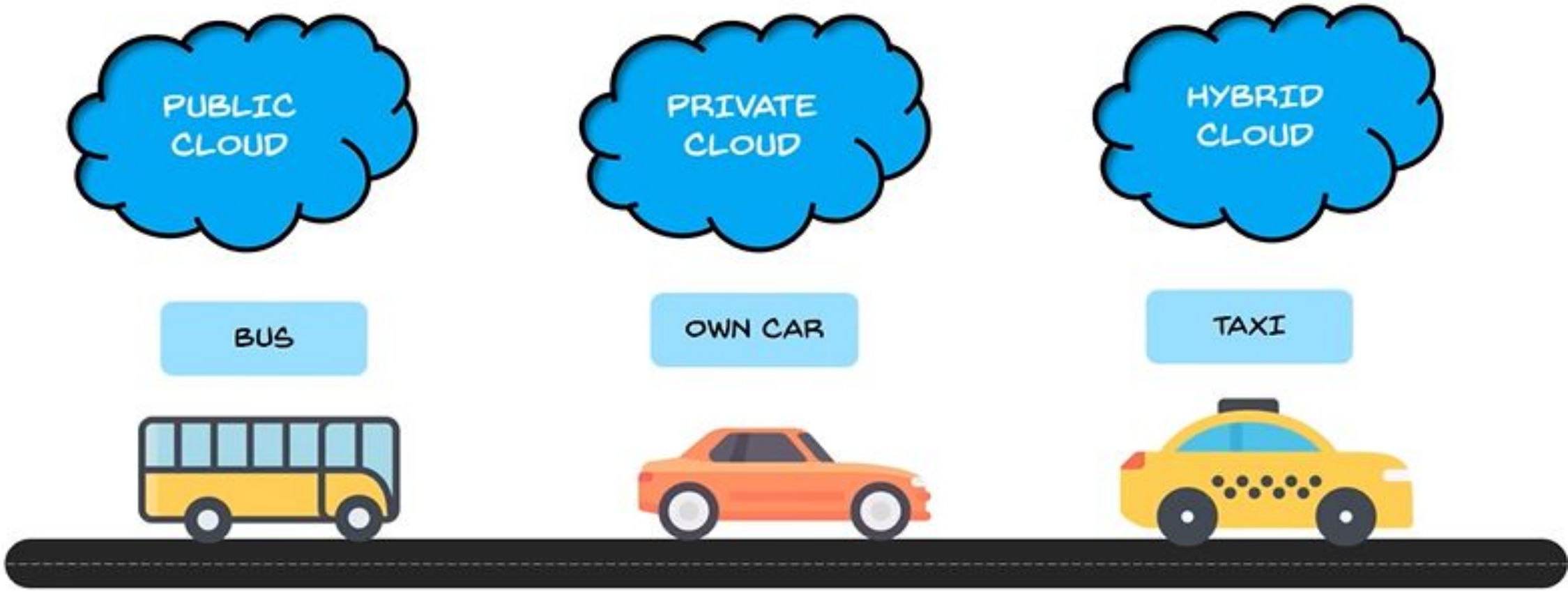
1. Deployment Models

2. Service Models

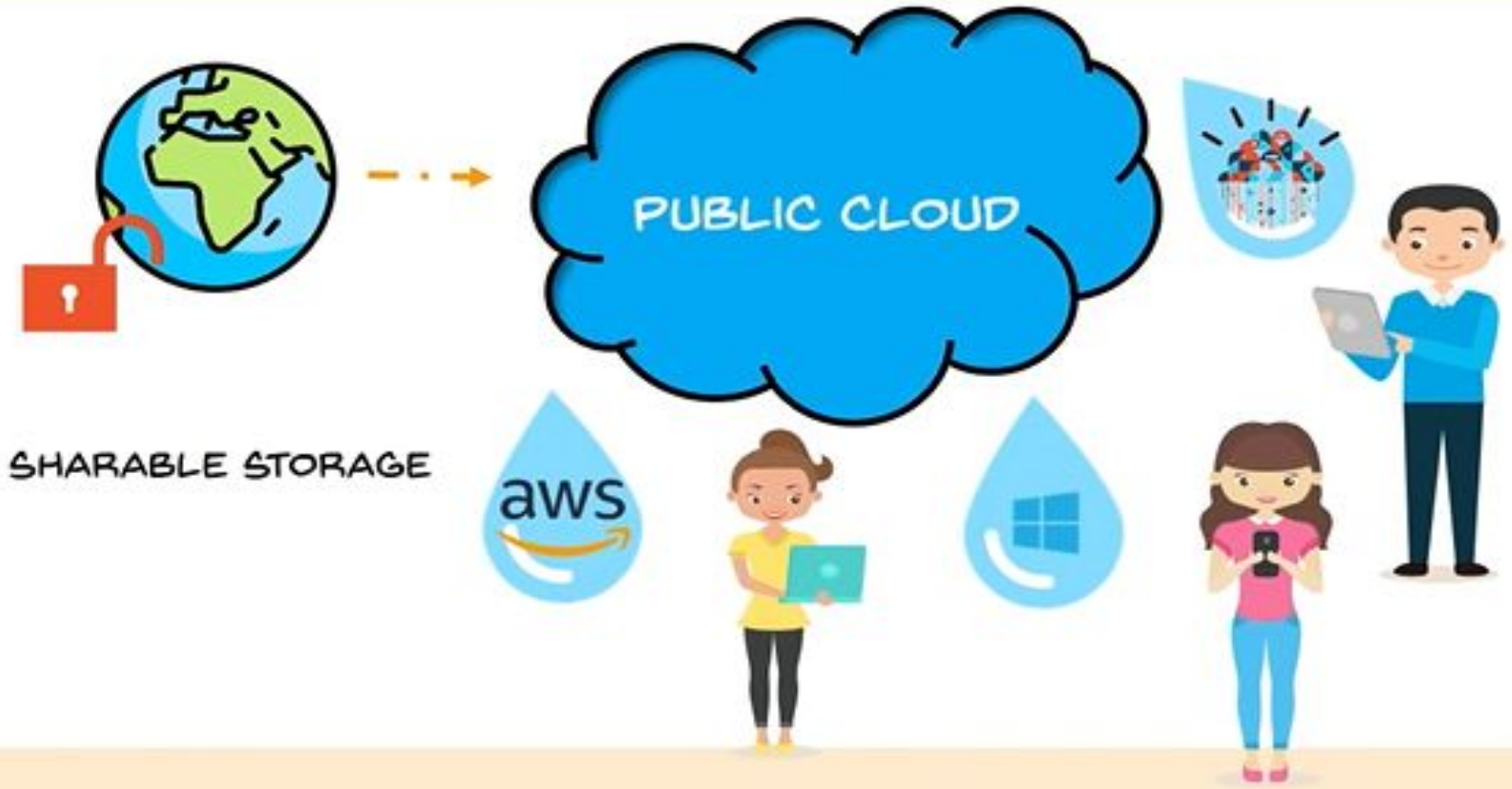
Types of Cloud Computing



Types of Deployment Models



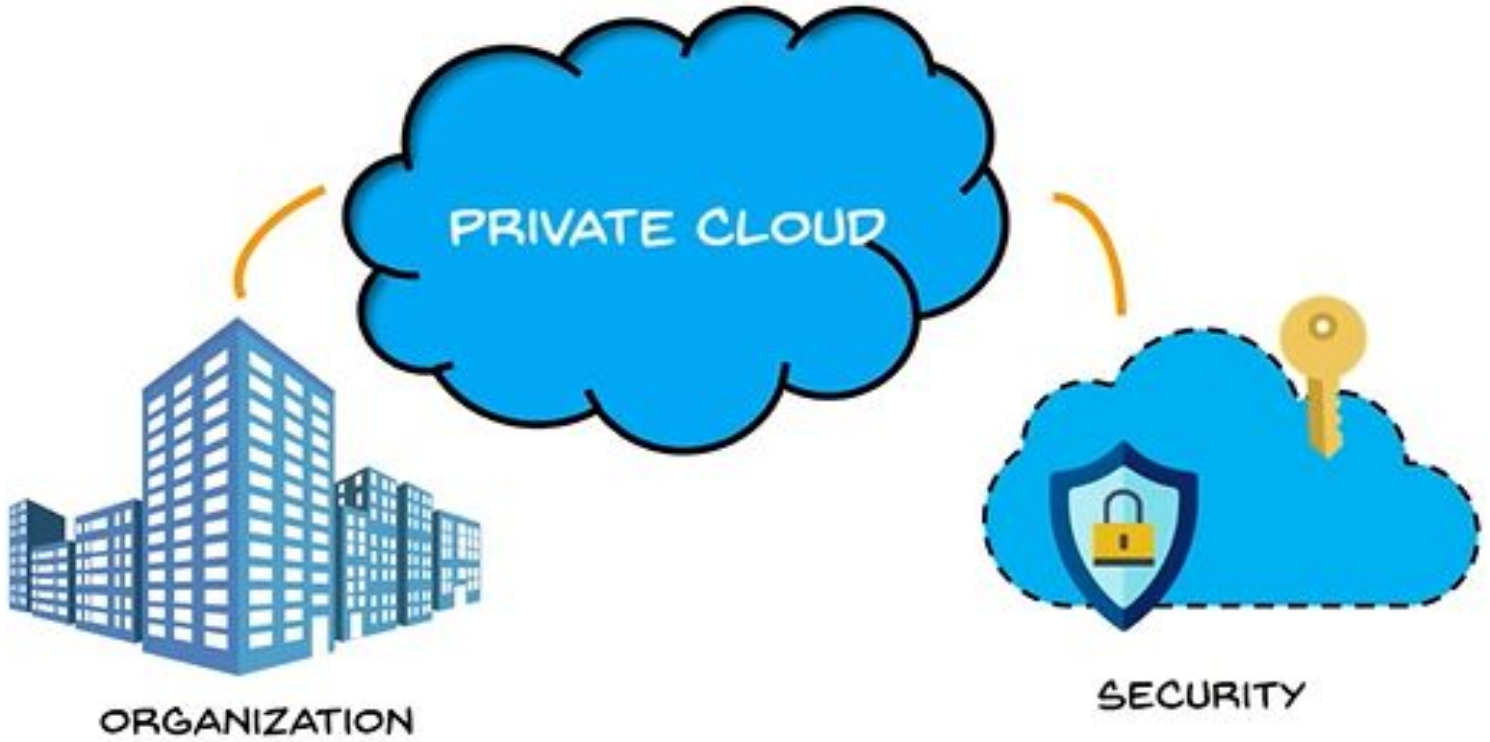
Public Cloud



The cloud infrastructure is made available to the general public over the internet and is owned by a cloud provider

Example: AWS, Microsoft Azure, IBM's Blue Cloud and Sun Cloud

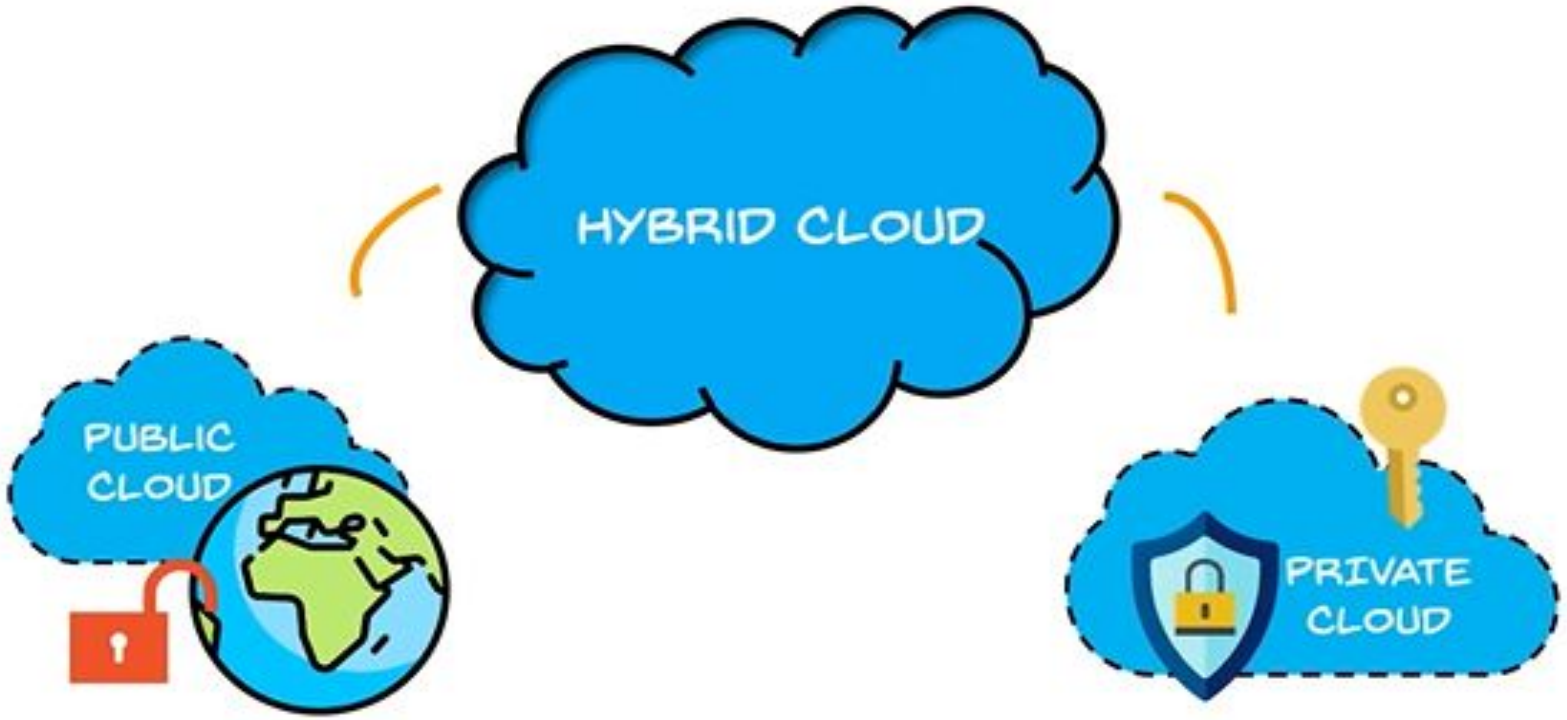
Private Cloud



The cloud infrastructure is exclusively operated by a single organization. It can be managed by the organization or a third party and may exist on-premise or off-premise

Example: AWS, VMware

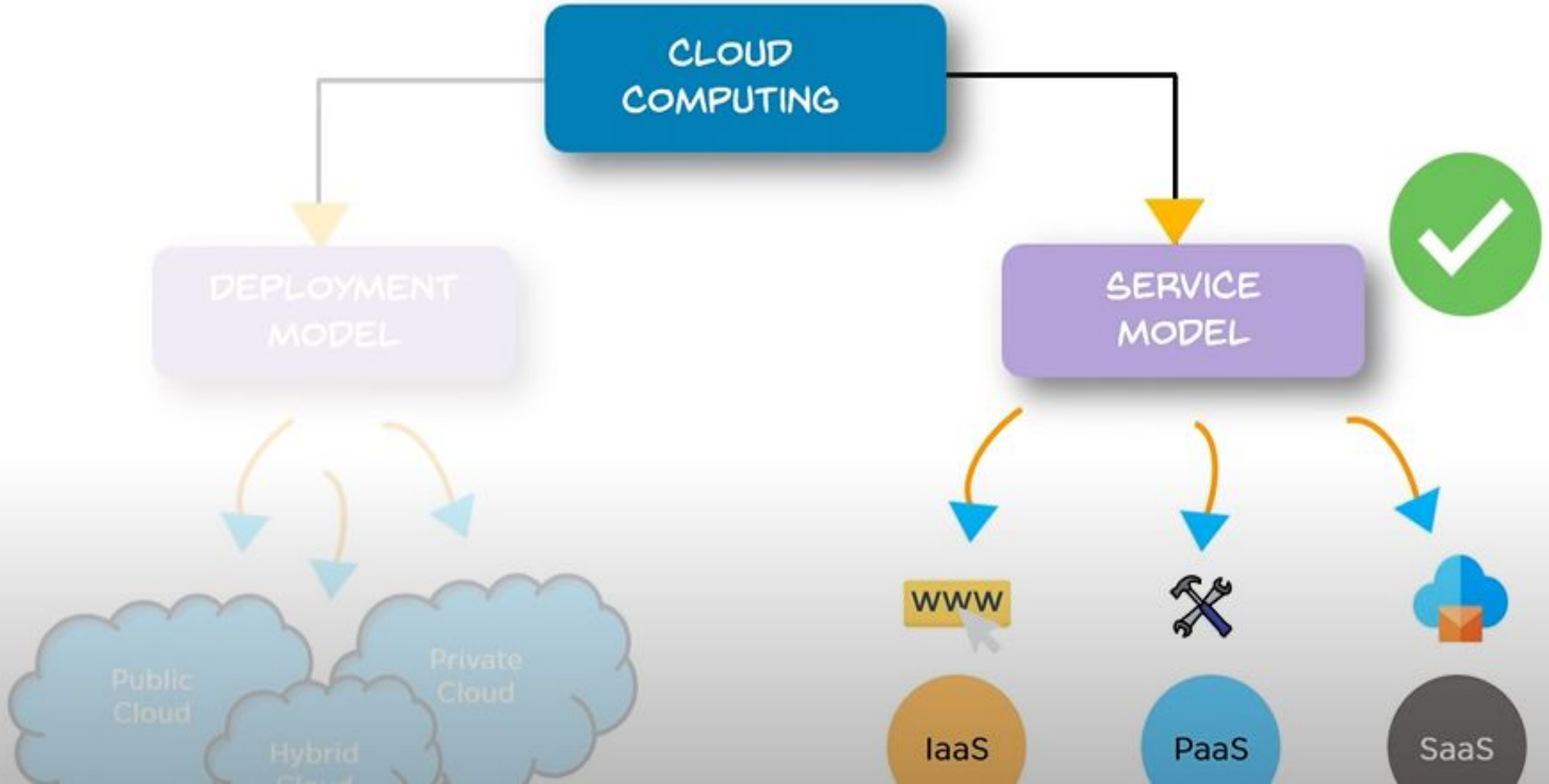
Hybrid Cloud



It consists the functionalities of both public and private cloud

For example:
Federal agencies opt for private clouds when sensitive information is involved
Also, they use the public cloud to share datasets with general public or other government departments

Types of Service Models



Types of Service Models

Which cloud service is suitable for you?

IAAS

If your business needs a virtual machine, opt for Infrastructure as a Service

PAAS

If your company requires a platform for building software products, pick Platform as a Service

SAAS

If your business doesn't want to maintain any IT equipment, then choose Software as a Service

IaaS

- In the most basic cloud-service model, providers of IaaS offer computers physical or virtual machines and other resources.

- IaaS clouds often offer additional resources such as a virtual-machine disk image library, raw (block) and file-based storage.

IaaS

- IaaS is a cloud service that provides basic computing infrastructure
- Services are available on PAY-FOR-WHAT-YOU-USE model
- IaaS providers include Amazon Web Services, Microsoft Azure and Google Compute Engine
- Users: IT Administrators

IAAS PRODUCTS AND SERVICES

PaaS

In the PaaS model, cloud providers deliver a computing platform typically including operating system, programming language execution environment, database, and web server.

Application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers.

Some examples include:

- Cloud Foundry,
- Force.com,
- EngineYard,
- Mendix,
- OpenShift,
- Google App Engine,
- Windows Azure Cloud Services
- OrangeScape

PaaS: Platform as a Service

Windows Azure

heroku

Google

force.com

Google Apps

PaaS

- PaaS provides cloud platforms and runtime environments for developing, testing, and managing applications
- It allows software developers to deploy applications without requiring all the related infrastructure
- Users: Software Developers

SaaS

- In the SaaS model, cloud users do not manage the cloud infrastructure and platform where the application runs. This eliminates the need to install and run the application on the cloud user's own computers , which simplifies maintenance and support.

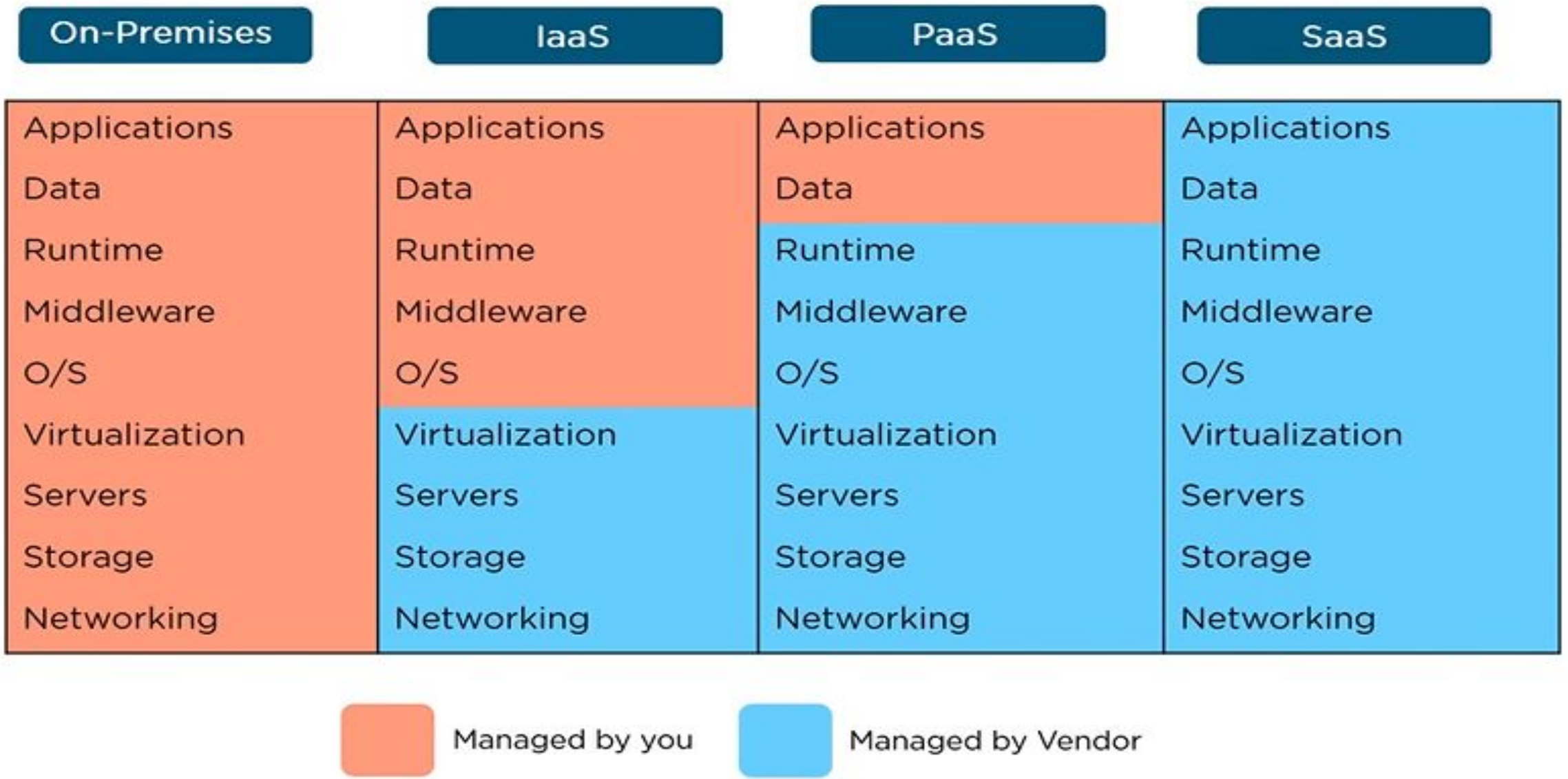
SaaS

- In SaaS, cloud providers host and manage the software application on a pay-as-you-go pricing model
- All software and hardware are provided and managed by a vendor so you don't have to maintain anything
- Users: End Customers

Examples of SaaS include:

- Google Apps,
- Microsoft Office 365,
- Onlive,
- GT Nexus,
- Marketo,
- TradeCard.

Differences between IaaS, PaaS and SaaS



SaaS

Software as a Service

- Email
- CRM
- Collaborative
- ERP

CONSUME

PaaS

Platform as a Service

- Application Development
- Decision Support
- Web
- Streaming

BUILD ON IT

IaaS

Infrastructure as a Service

- Caching
- Legacy
- File
- Networking
- Technical
- Security
- System Mgmt

MIGRATE TO IT

Differences between IaaS, PaaS and SaaS

Example:

Consider a task where you are planning to bake a cake

Differences between IaaS, PaaS and SaaS

On-Premises

Made at Home

Dinning table

Water

Electricity

Oven

Cake Pan

Flour

Sugar

Butter

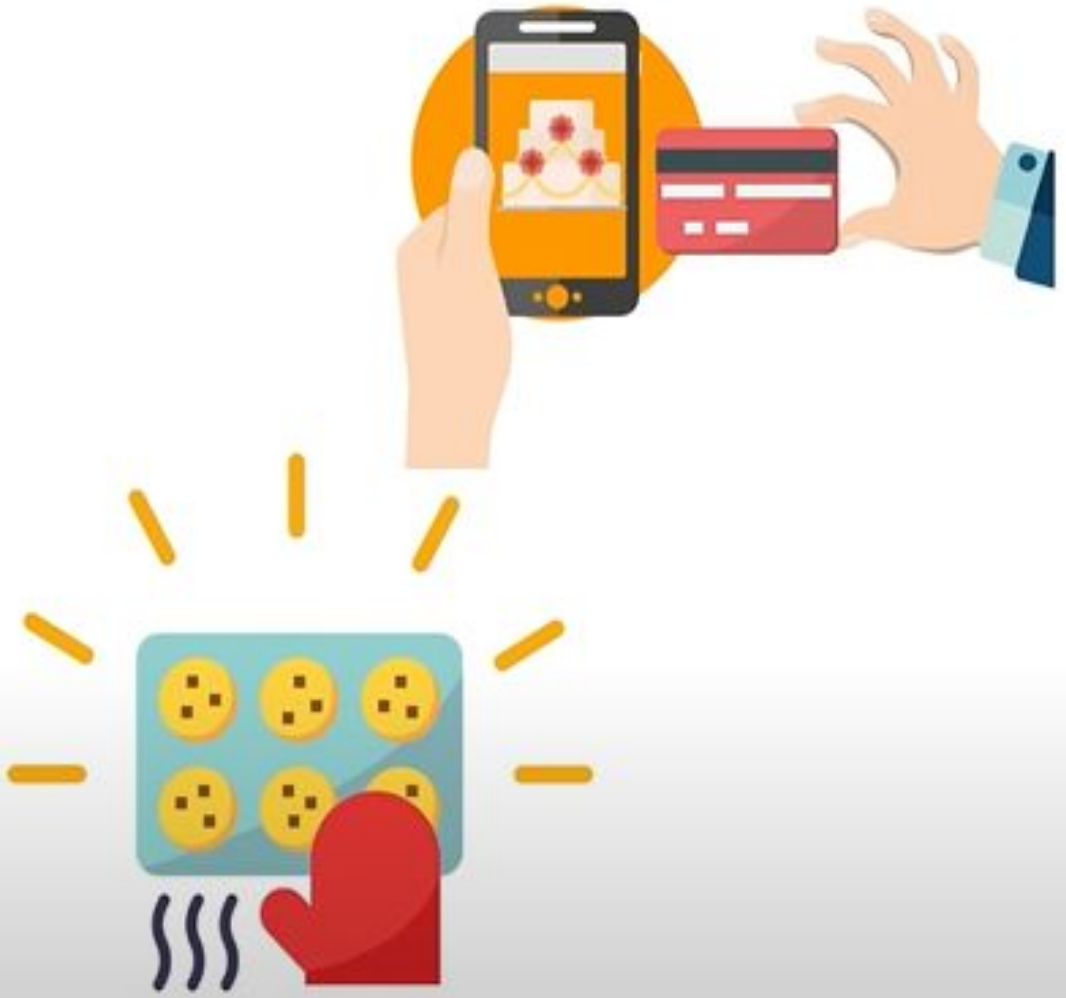
Eggs

Managed by you

Managed by Vendor

Differences between IaaS, PaaS and SaaS

On-Premises	IaaS
Made at Home	Buy & bake
Dinning table	Dinning table
Water	Water
Electricity	Electricity
Oven	Oven
Cake Pan	Cake Pan
Flour	Flour
Sugar	Sugar
Butter	Butter
Eggs	Eggs

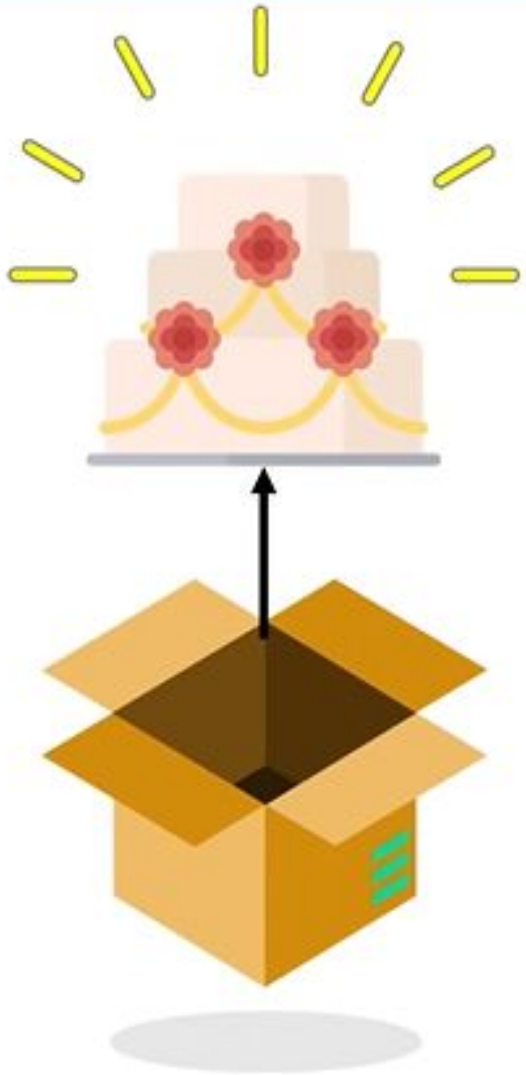


Differences between IaaS, PaaS and SaaS

On-Premises	IaaS	PaaS
Made at Home	Buy & bake	Cake delivery
Dinning table	Dinning table	Dinning table
Water	Water	Water
Electricity	Electricity	Electricity
Oven	Oven	Oven
Cake Pan	Cake Pan	Cake Pan
Flour	Flour	Flour
Sugar	Sugar	Sugar
Butter	Butter	Butter
Eggs	Eggs	Eggs

Managed by you

Managed by Vendor



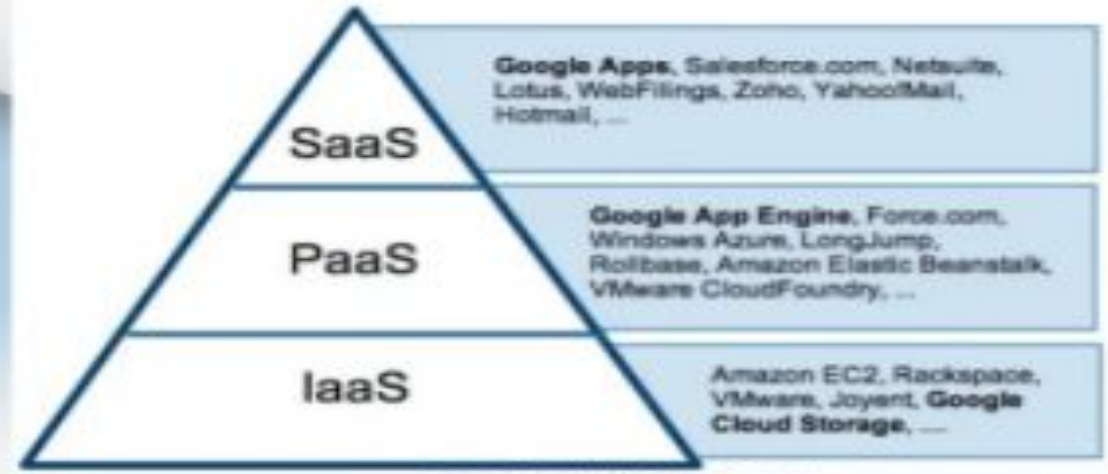
Differences between IaaS, PaaS and SaaS

On-Premises	IaaS	PaaS	SaaS
Made at Home	Buy & bake	Cake delivery	Dine out
Dinning table	Dinning table	Dinning table	Dinning table
Water	Water	Water	Water
Electricity	Electricity	Electricity	Electricity
Oven	Oven	Oven	Oven
Cake Pan	Cake Pan	Cake Pan	Cake Pan
Flour	Flour	Flour	Flour
Sugar	Sugar	Sugar	Sugar
Butter	Butter	Butter	Butter
Eggs	Eggs	Eggs	Eggs

Managed by you

Managed by Vendor

Cloud Computing as Gartner Sees It



Source: Gartner AADI Summit Dec 2009

Cloud Providers

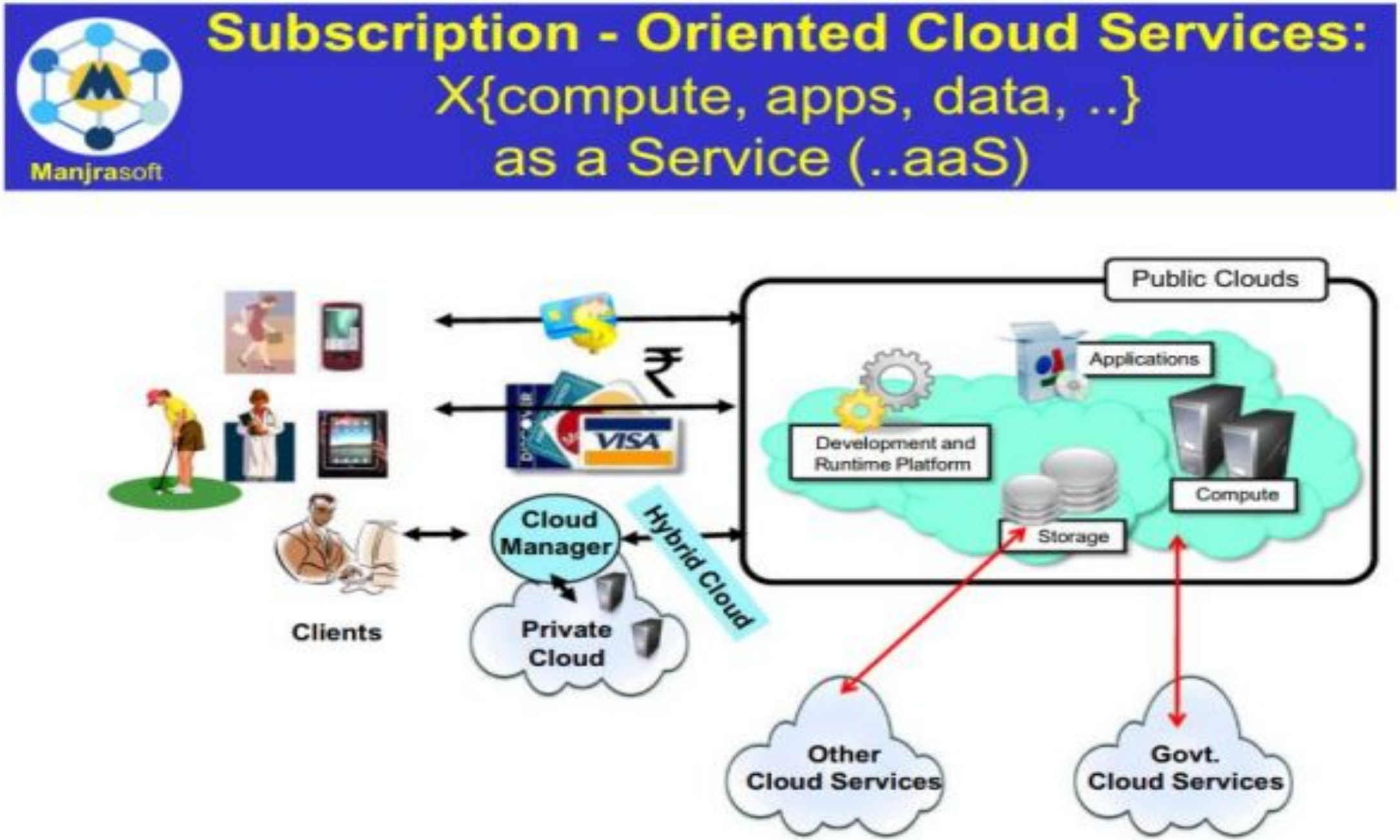
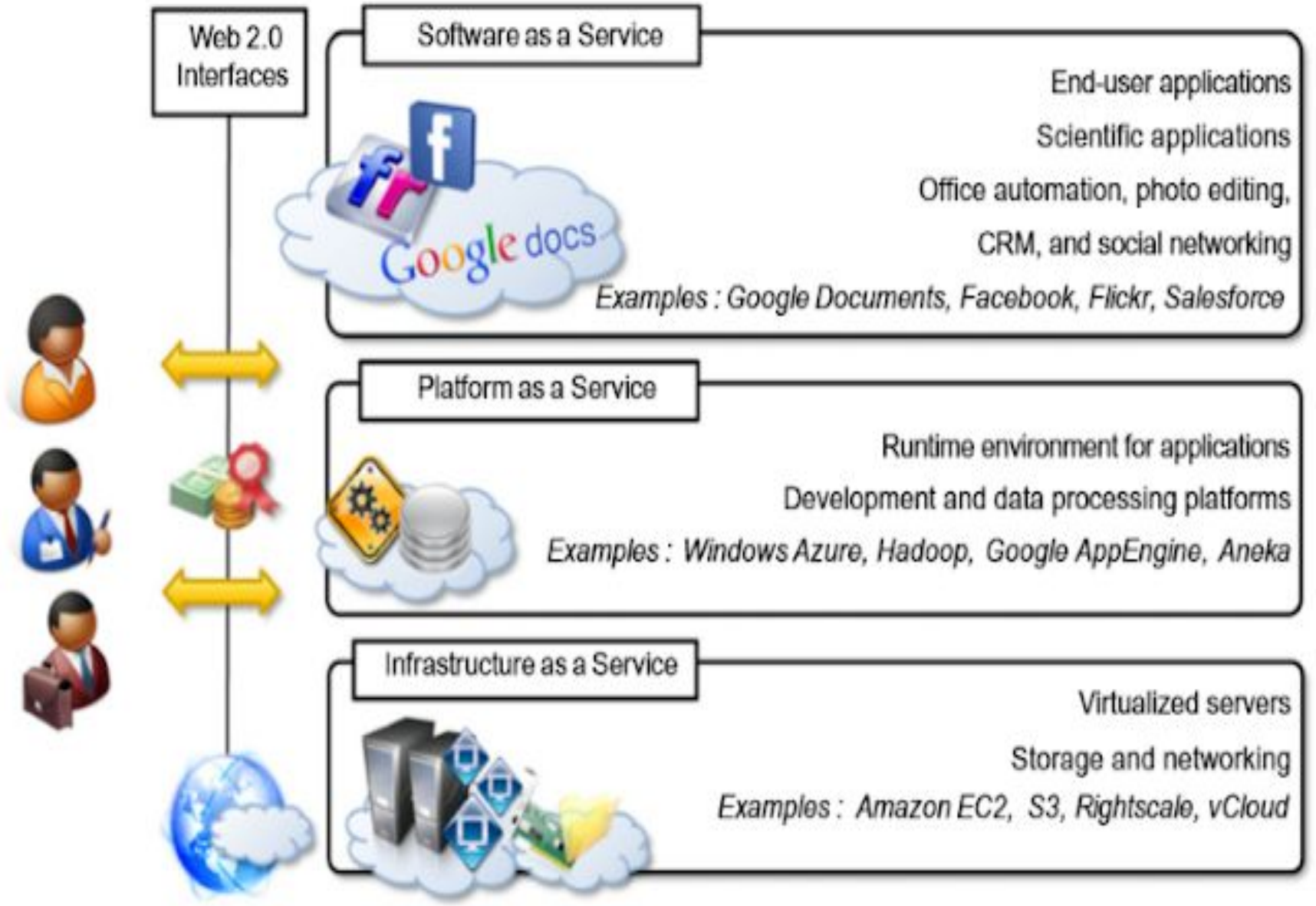


FIGURE 1.4 A bird's-eye view of cloud computing

CLOUD COMPUTING REFERENCE MODEL



CHARACTERISTICS AND BENEFITS

Cloud computing has some interesting characteristics that bring benefits to both cloud service consumers (CSCs) and cloud service providers (CSPs). These characteristics are:

- No up-front commitments
- On-demand access
- Nice pricing
- Simplified application acceleration and scalability
- Efficient resource allocation
- Energy efficiency
- Seamless creation and use of third-party services

CHALLENGES AHEAD

- Automated service provisioning
- Virtual machine migration
- Server consolidation
- Energy management
- Traffic management and analysis
- Data security
- Software frameworks
- Storage technologies and data management
- Novel cloud architectures