Session-2

Cloud Computing

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Cloud computing is the on-demand delivery of IT resources over the Internet with pay-as-you-go pricing. Instead of buying, owning, and maintaining physical data centers and servers, you can access technology services, such as computing power, storage, and databases, on an as-needed basis from a cloud provider like Amazon Web Services (AWS). – **AMAZON**

Cloud computing is on-demand access, via the internet, to computing resources—applications, servers (physical servers and virtual servers), data storage, development tools, networking capabilities, and more—hosted at a remote data center managed by a cloud services provider (or CSP). The CSP makes these resources available for a monthly subscription fee or bills them according to usage. – **IBM**

Simply put, cloud computing is the delivery of computing services—including servers, storage, databases, networking, software, analytics, and intelligence—over the Internet ("the cloud") to offer faster innovation, flexible resources, and economies of scale. You typically pay only for cloud services you use, helping you lower your operating costs, run your infrastructure more efficiently, and scale as your business needs change. – **MICROSOFT**

Cloud computing is the act of running workloads within clouds—which are IT environments that abstract, pool, and share scalable resources across a network. Neither cloud computing nor clouds are technologies unto themselves.

Cloud computing is an act—the function of running a workload in a cloud.

Clouds are environments—places where applications run.

Technologies are things—software and hardware used to build and use clouds. **- REDHAT**

Cloud Computing: Definition

The US National Institute of Standards (NIST) defines cloud computing as follows:
Cloud computing is a model for enabling ubiquitous, 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.

3-4-5 rule of Cloud Computing

NIST specifies 3-4-5 rule of Cloud Computing

3 cloud service models or service types for any cloud platform

4 deployment models

5 essential characteristics of cloud computing infrastructure

Characteristics of Cloud Computing

5 Essential Characteristics of Cloud Computing

Ref: The NIST Definition of Cloud Computing
http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf

- On demand self-service
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured service

On-demand self-service

Ubiquitous network access

Location transparent resource pooling

Rapid elasticity

Measured service with pay per use

Source: http://aka.ms/532

4 Deployment Models

1. Public Cloud
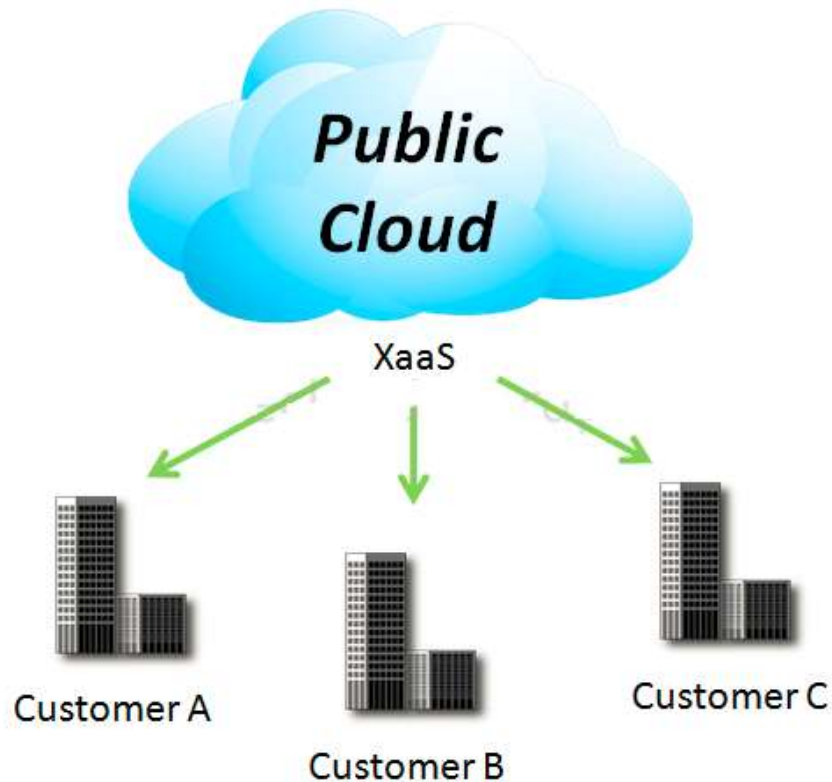
Mega-scale cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.

Public Cloud

Key characteristics of the public cloud:

- Scalability
- Cost effectiveness
- Reliability
- Flexibility
- Location Independence
- On demand computing
- Pay per use pricing
- broad network access
- Resource pooling

Examples:
- AWS
- Microsoft Azure
- Google Cloud Platform (GCP)
- Alibaba

Public Cloud

Advantage of public cloud:

- It helps organizations to have less investment and maintenance costs
- User demands can be easily met with scalability
- less resource wastage
- High reliability

Disadvantages of public cloud:

- As the cloud infrastructure is actually owned and controlled by others, the controls for the user are limited.
- It is difficult to deploy regulations like HIPAA and PCI DSS in a public cloud and often demands a hybrid solution.
- There may be data privacy issues
- Limited control on the infrastructure configurations

4 Deployment Models

2. Private Cloud

XaaS

Private Cloud

Company A
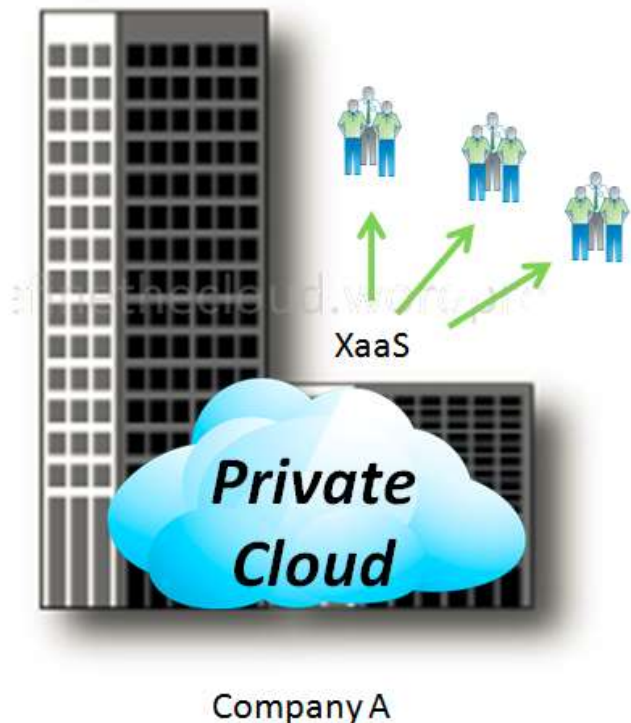
The cloud infrastructure is operated solely for an organization. It may be managed by the organization or a third party and may exist on premise or off premise.

Private Cloud

Key characteristics/Benefits of Private Cloud:

- Predictable server usage
- Improved resource utilization
- Reduced costs
- Increased security
- Regulatory compliance
- Flexibility

Drawback: Cost and accountability of managing the private cloud - Company's IT department

Need the same staffing, management, and maintenance expenses as traditional datacenter ownership

4 Deployment Models

3. Hybrid Cloud
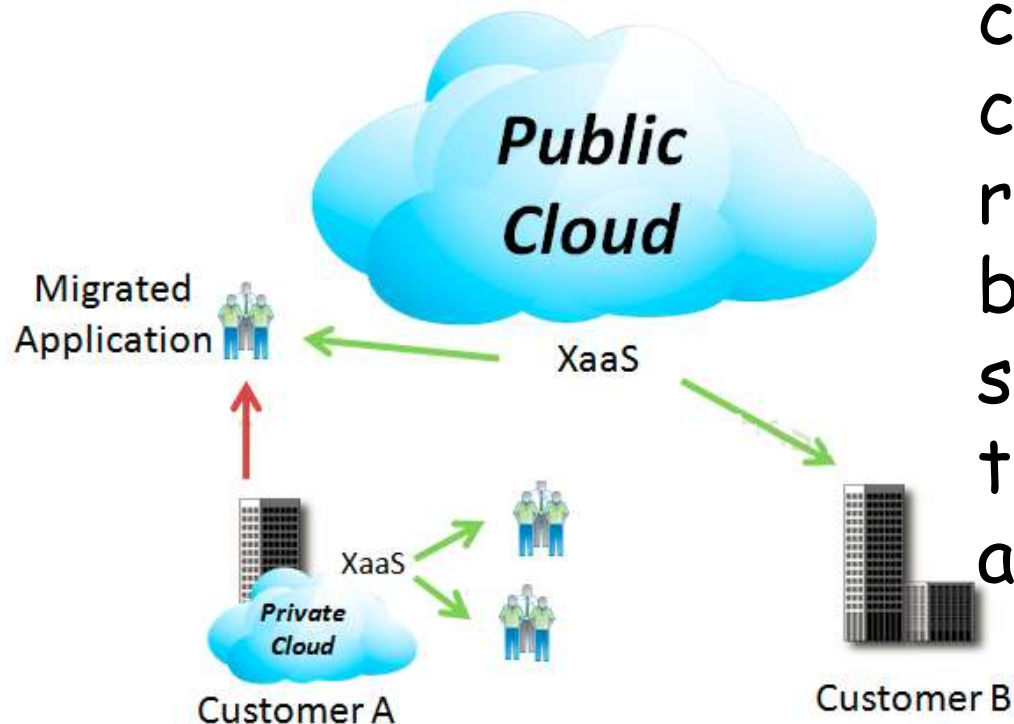
The cloud infrastructure is a composition of two or more clouds (private or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability

4 Deployment Models

4. Community Cloud
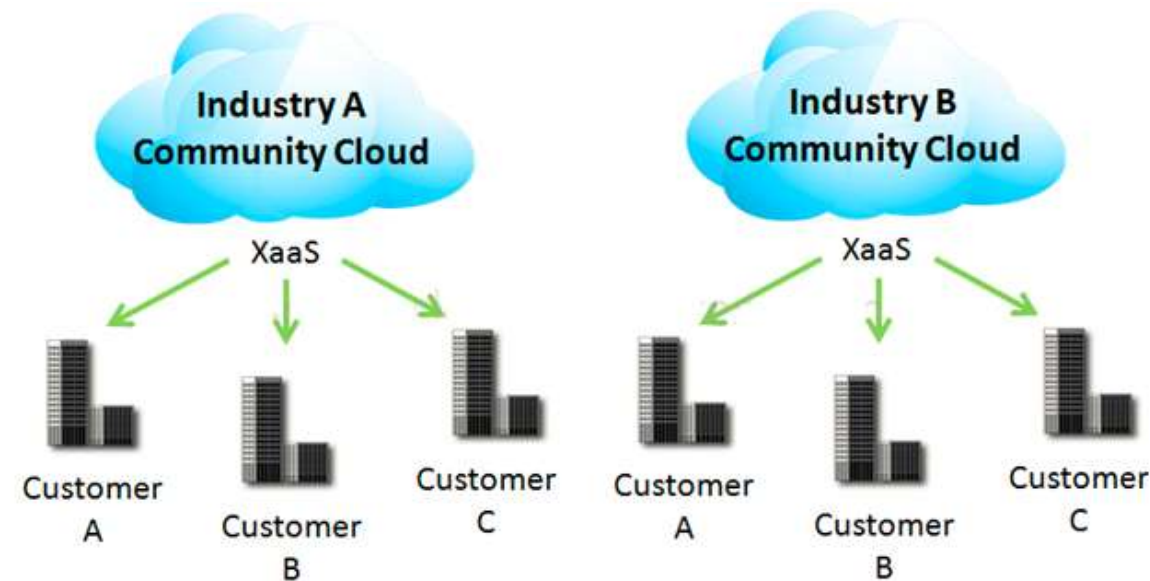
- Community Clouds are when an 'infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations).
- It may be managed by the organizations or a third party and may exist on premise or off premise' according to NIST.

3 Cloud Service Models

Software as a Service (SaaS)

Platform as a Service (PaaS)

Infrastructure as a Service (IaaS)

SalesForce CRM
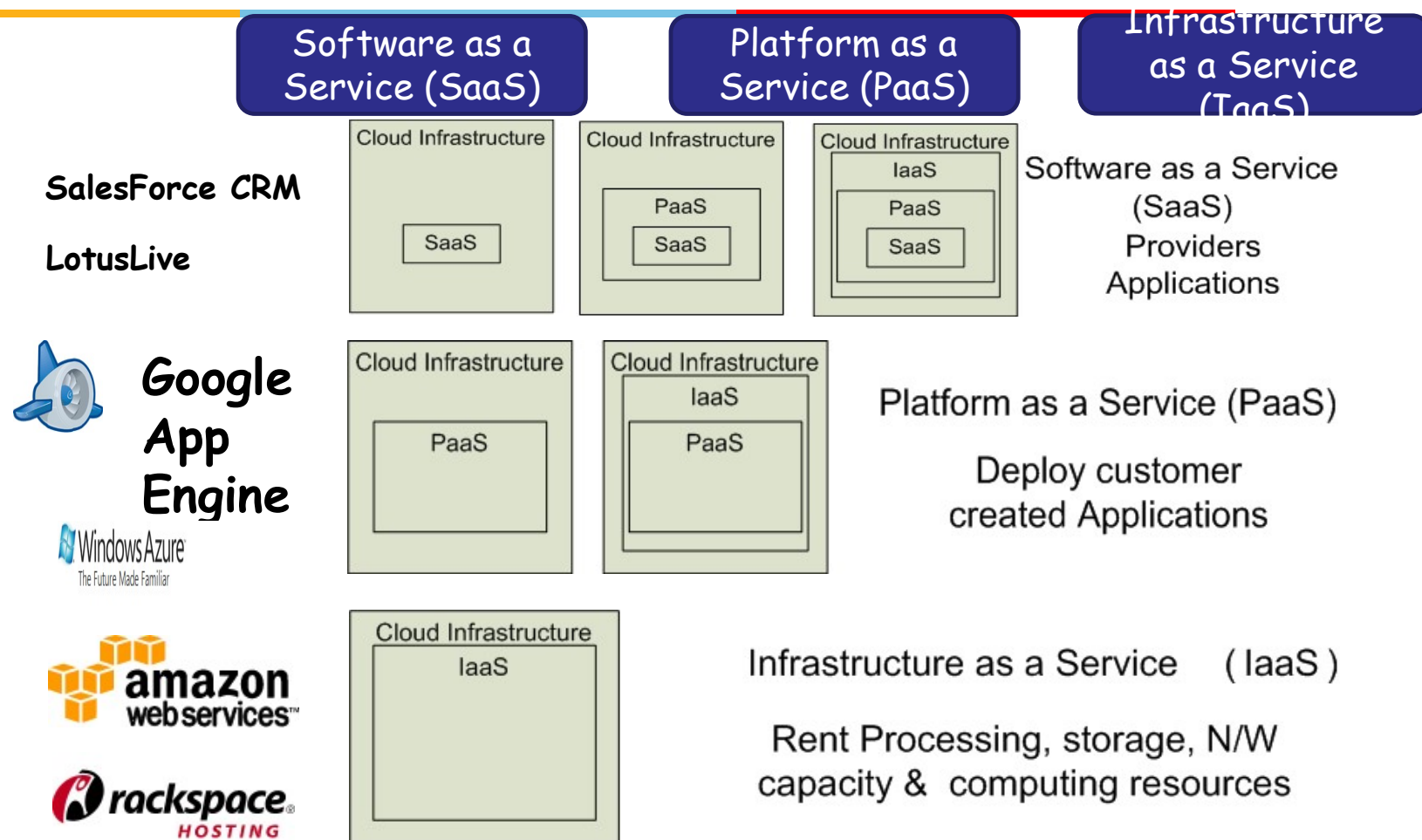
LotusLive

Google App Engine

Windows Azure
The Future Made Familiar

amazon
web services

rackspace
HOSTING

Cloud Infrastructure
SaaS

Cloud Infrastructure
PaaS
SaaS

Cloud Infrastructure
IaaS
PaaS
SaaS

Software as a Service (SaaS)
Providers
Applications

Cloud Infrastructure
PaaS

Cloud Infrastructure
IaaS
PaaS

Platform as a Service (PaaS)

Deploy customer
created Applications

Cloud Infrastructure
IaaS

Infrastructure as a Service   (IaaS)

Rent Processing, storage, N/W
capacity & computing resources

Software as a Service (SaaS)

Software as a service features a complete application offered as a service on demand.
A single instance of the software runs on the cloud and services multiple end users or client organizations.
E.g. salesforce.com , Google Apps

On-site	IaaS	PaaS	SaaS
Applications	Applications	Applications	Applications
Data	Data	Data	Data
Runtime	Runtime	Runtime	Runtime
Middleware	Middleware	Middleware	Middleware
O/S	O/S	O/S	O/S
Virtualization	Virtualization	Virtualization	Virtualization
Servers	Servers	Servers	Servers
Storage	Storage	Storage	Storage
Networking	Networking	Networking	Networking

You manage
Service provider manages

Platform as a Service

Platform as a service encapsulates a layer of software and provides it as a service that can be used to build higher-level services.

2 Perspectives for PaaS :-

Producer:- Someone producing PaaS might produce a platform by integrating an OS, middleware, application software, and even a development environment that is then provided to a customer as a service.

Consumer:-Someone using PaaS would see an encapsulated service that is presented to them through an API. The customer interacts with the platform through the API, and the platform does what is necessary to manage and scale itself to provide a given level of service.
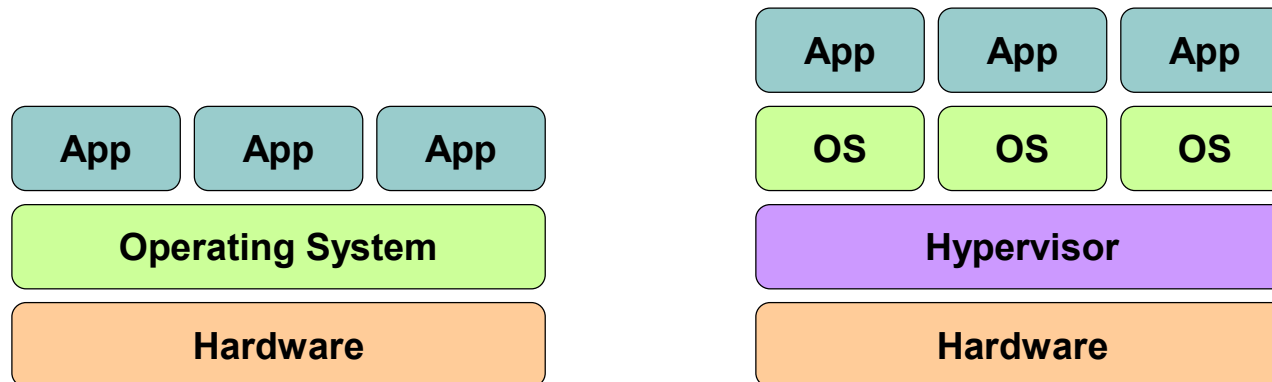
Infrastructure as a Service

Infrastructure as a service delivers basic storage and computing capabilities as standardized services over the network. Servers, storage systems, switches, routers , and other systems are pooled and made available to handle workloads that range from application components to high-performance computing applications.

On-site	IaaS	PaaS	SaaS
Applications	Applications	Applications	Applications
Data	Data	Data	Data
Runtime	Runtime	Runtime	Runtime
Middleware	Middleware	Middleware	Middleware
O/S	O/S	O/S	O/S
Virtualization	Virtualization	Virtualization	Virtualization
Servers	Servers	Servers	Servers
Storage	Storage	Storage	Storage
Networking	Networking	Networking	Networking

■ You manage
■ Service provider manages

Cloud Infrastructures

Key Technology is Virtualization

	App	App	App
App	App	App	OS	OS	OS
Operating System	Hypervisor
Hardware	Hardware

Virtualization plays an important role as an enabling technology for datacentre implementation by abstracting compute, network, and storage service platforms from the underlying physical hardware

Cloud Providers Characteristics

- Provide on-demand provisioning of computational resources
- Use virtualization technologies to lease these resources
- Provide public and simple remote interfaces to manage those resources
- Use a pay-as-you-go cost model, typically charging by the hour
- Operate data centers large enough to provide a seemingly unlimited amount of resources to their clients

Management of Virtualized Resources

- Distributed Management of Virtual Machines

- Reservation-Based Provisioning of Virtualized Resources

- Provisioning to Meet SLA Commitments

The Cloud OS
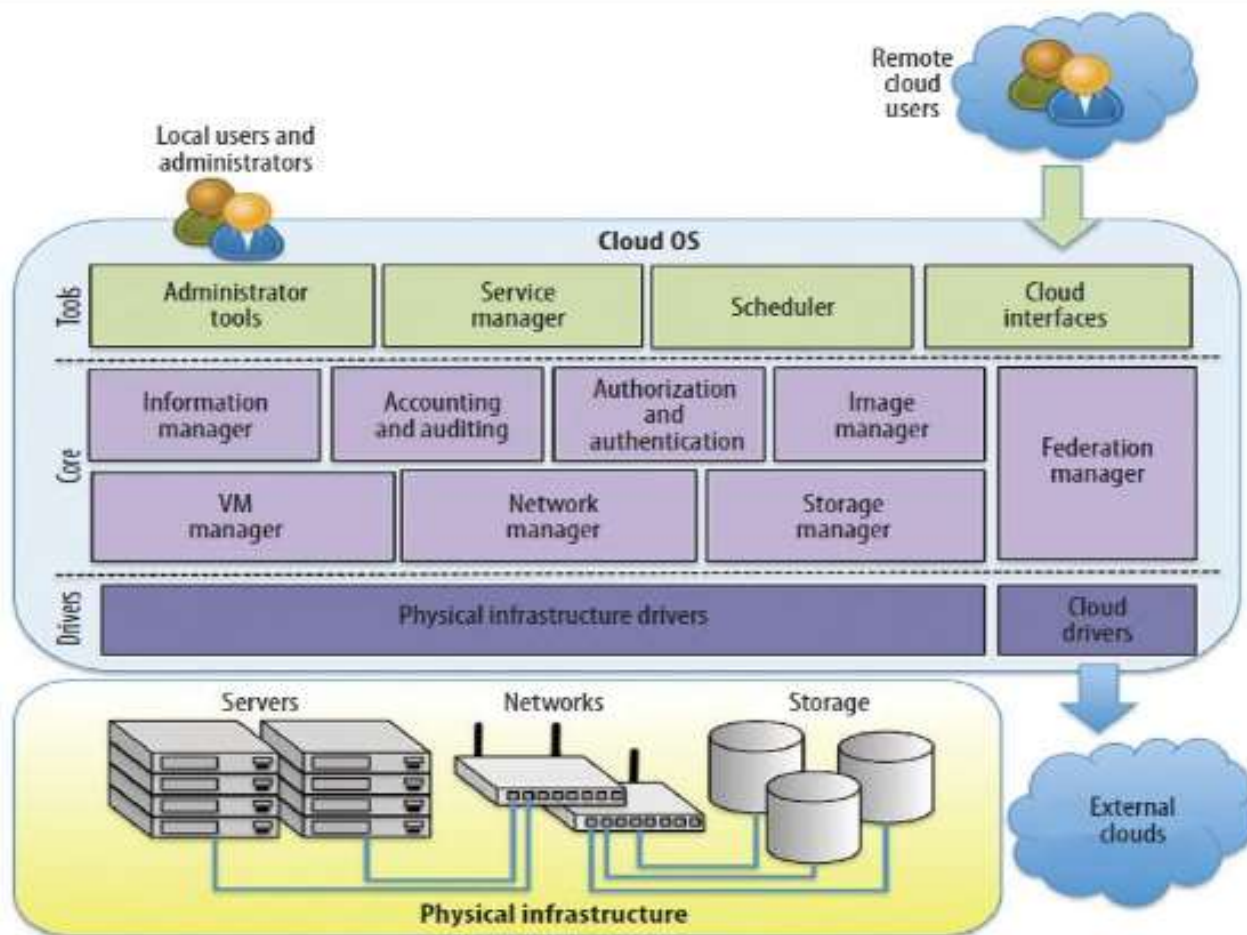
The cloud OS, the main component of an IaaS cloud architecture, is organized in three layers: drivers, core components, and high-level tools.

The cloud operating system is responsible for:
1. managing the physical and virtual infrastructure,
2. orchestrating and commanding service provisioning and deployment
3. providing federation capabilities for accessing and deploying virtual resources in remote cloud infrastructures

Value of Cloud

Value Delivered	From Traditional	From Cloud
Design and Release Application	Months	Weeks/Days
Test Provisioning	Weeks	20 Minutes
Change Management	Months	Days or Hours
Install Database	1 Day	12 Minutes
Install Operating System	1 Day	30 Seconds
Service Provisioning	Weeks/Days	Hours/Minutes

Thank You.