

SESSION 1

COMPUTING PARADIGM AND INTRODUCTION TO CLOUD COMPUTING

OBJECTIVES

- Computing Paradigms
- Cloud computing definition
- Cloud computing essential characteristics
- Cloud computing deployment models
- Cloud computing service models

PREAMBLE

- The term paradigm conveys that there is a set of practices to be followed to accomplish a task
- In the domain of computing, there are many different standard practices being followed based on inventions and technological advancements.

CLIENT/SERVER MODEL

- In the client/server model, all end systems are divided into clients and servers each designed for specific purposes
- Clients have an active role and initiate a communication session by sending requests to servers
 - Clients must have knowledge of the available servers and the services they provide
 - Clients can communicate with servers only; they cannot see each other
- Servers have a passive role and respond to their clients by acting on each request and returning results

CLIENT/SERVER MODEL (CONT'D)



CLIENT/SERVER MODEL (CONT'D)

➤ Software roles

- TCP/IP uses different pieces of software for many protocols to implement "client" and "server" roles
- Client software is usually found on client hardware and server software on server hardware, but not always
- Some devices may run both client and server software

➤ Web clients:

- Mozilla Firefox, Internet Explorer, Google Chrome, ...

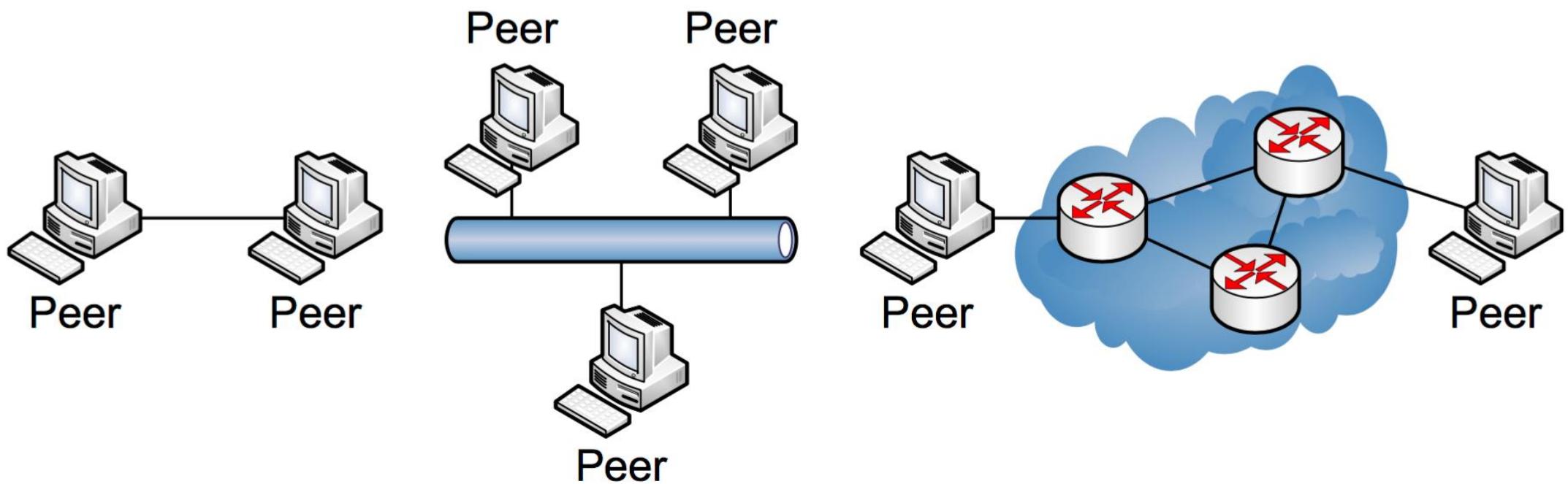
➤ Web servers:

- Apache, Microsoft IIS, GWS, ...

P2P MODEL

- In the P2P model, all end systems have equivalent capabilities and responsibilities and either party can initiate a communication session
- The participants share a part of their own hardware resources
- Thus, the participants are both resource providers and resource requestors and use similar networking programs to connect with each other

P2P MODEL (CONT'D)



P2P MODEL (CONT'D)

- Benefits of P2P:
 - No need for dedicated application and database servers
 - Improved scalability and reliability (no single point of failure)
- Shortcomings of P2P:
 - Poor security
 - Lack of centralized control
 - Computers with shared resources may suffer from sluggish performance
- P2P networking allows easily to share and download copyrighted files
 - Is it a benefit or a shortcoming? :-)

HIGH-PERFORMANCE COMPUTING

- In high-performance computing systems, a pool of processors (processor machines or central processing units [CPUs]) connected (networked) with other resources like memory, storage, and input and output devices, and the deployed software is enabled to run in the entire system of connected components.
- The processor machines can be of homogeneous or heterogeneous type.
- HPC systems are normally found in those applications where it is required to use or solve scientific problems.

PARALLEL COMPUTING

- Parallel computing is also one of the facets of HPC
- It is run using multiple processors (multiple CPUs)
- A problem is broken down into discrete parts that can be solved concurrently
- Each part is further broken down into a series of instructions
- Instructions from each part are executed simultaneously on different processors
- An overall control/coordination mechanism is employed

DISTRIBUTED COMPUTING

- Distributed computing is also a computing system that consists of multiple computers or processor machines connected through a network, which can be homogeneous or heterogeneous, but run as a single system
- The goal of distributed computing is to make such a network work as a single computer
- There is a support for the following characteristic features
 - Scalability: It is the ability of the system to be easily expanded by adding more machines as needed, and vice versa, without affecting the existing setup
 - Redundancy or replication: Here, several machines can provide the same services, so that even if one is unavailable (or failed), work does not stop because other similar computing supports will be available.

CLUSTER COMPUTING

- A cluster computing system consists of a set of the same or similar type of processor machines connected using a dedicated network infrastructure.
- This is also a kind of HPC category.
- The individual nodes can work together to solve a problem larger than any computer can easily solve

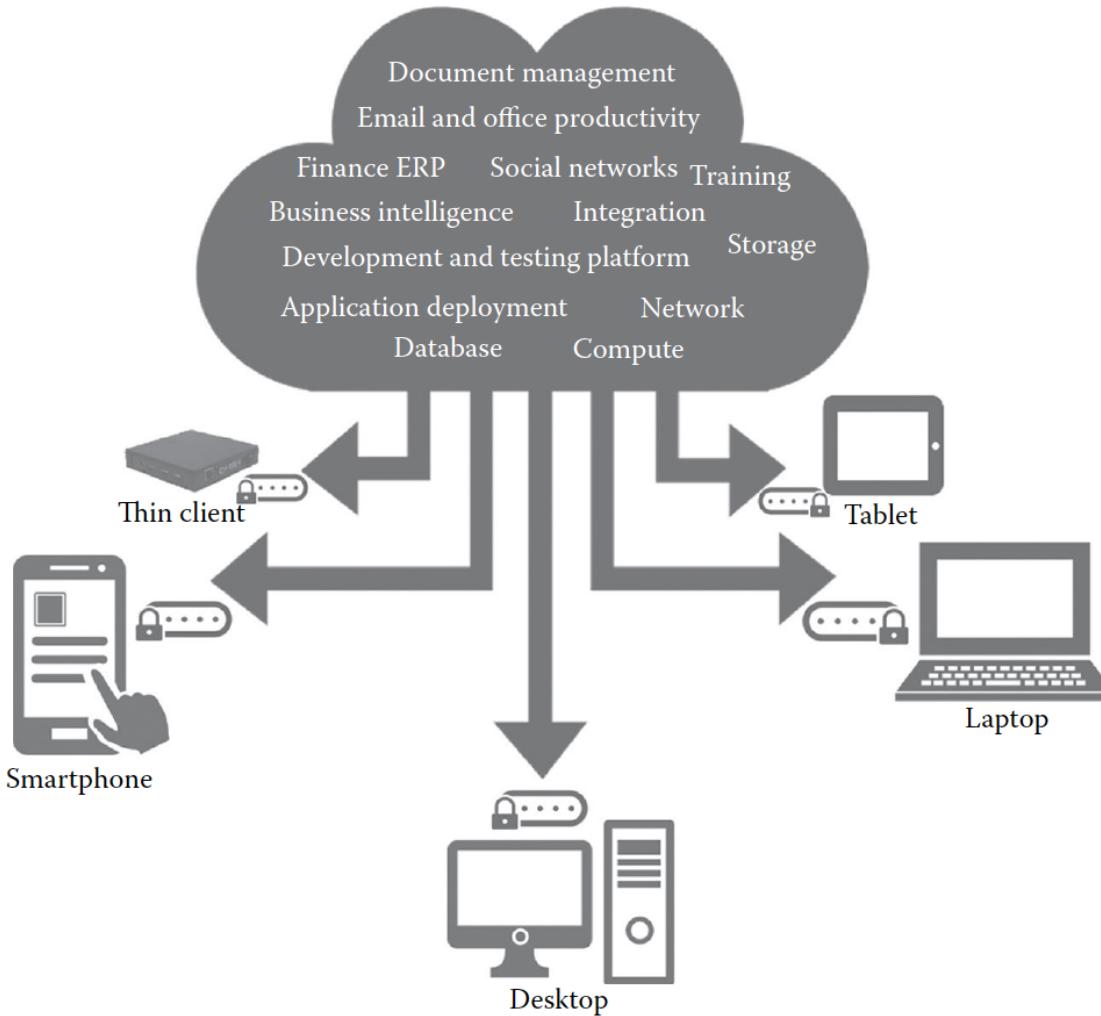
GRID COMPUTING

- Grid computing is a network of computing or processor machines managed with a kind of software such as middleware, in order to access and use the resources remotely.
- The managing activity of grid resources through the middleware is called *grid services*
- Grid services provide access control, security, access to data including digital libraries and databases, and access to large-scale interactive and long-term storage facilities

CLOUD COMPUTING

- In the simplest terms, cloud computing means storing and accessing data and programs over the Internet from a remote location or computer instead of our computer's hard drive.
- The cloud is just a metaphor for the Internet
- With an online connection, cloud computing can be done anywhere, anytime, and by any device.

CLOUD COMPUTING (CONTINUED)



FIVE ESSENTIAL CHARACTERISTICS

- *On-demand self-service*: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.
- *Broad network access*: Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms
- *Elastic resource pooling*: The provider's computing resources are pooled to serve multiple consumers using a multitenant model

FIVE ESSENTIAL CHARACTERISTICS

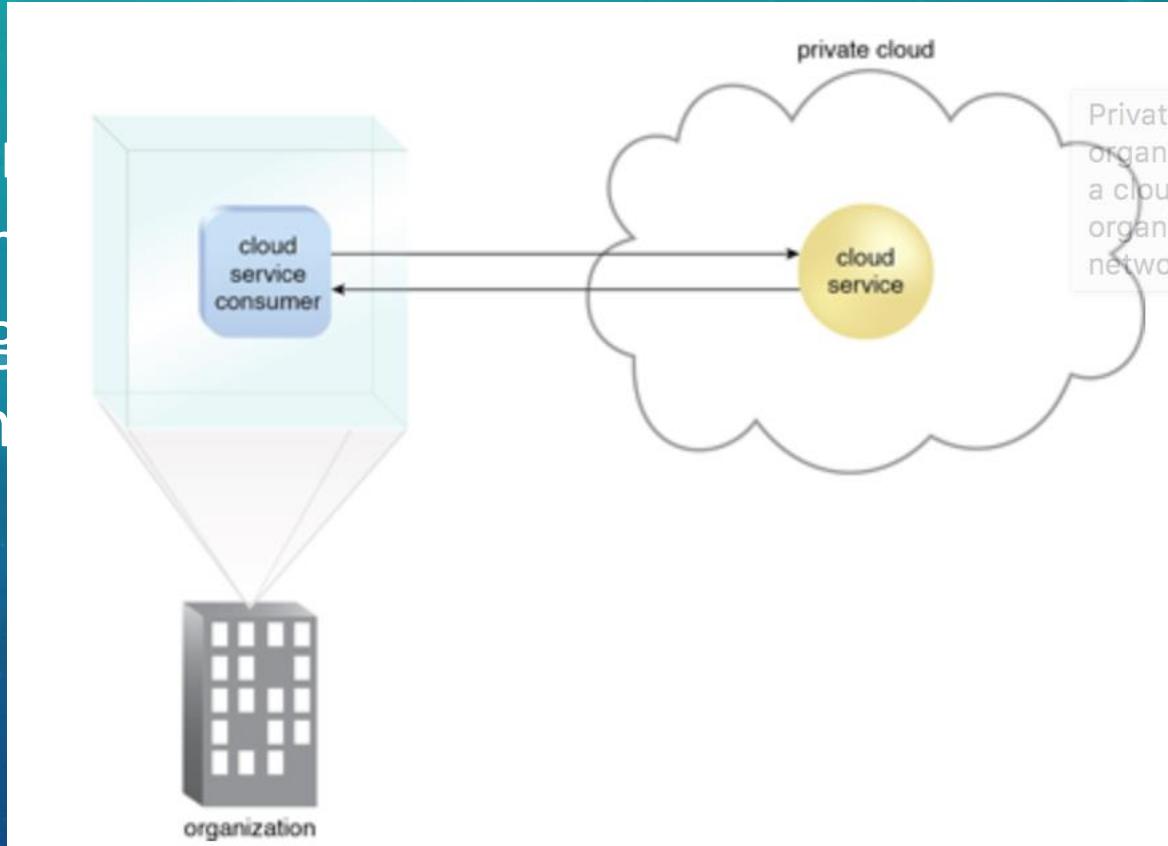
- *Rapid elasticity*: Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in
- *Measured service*: Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service

FOUR CLOUD DEPLOYMENT MODELS

- Deployment models describe the ways with which the cloud services can be deployed or made available to its customers, depending on the organization structure and the provisioning location.
- Four deployment models are usually distinguished, namely, **public**, **private**, **community**, and **hybrid** cloud service usage

PRIVATE CLOUD

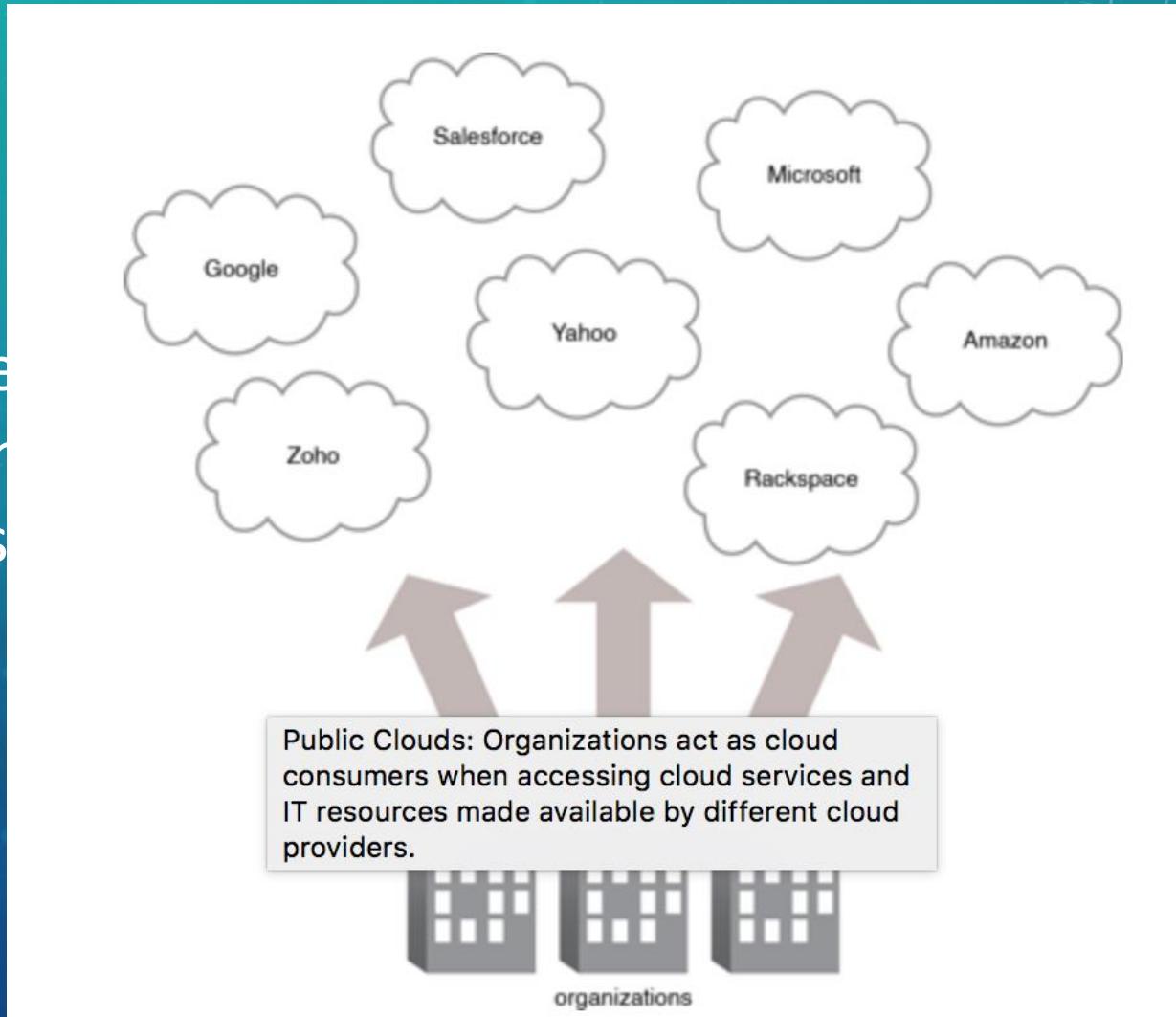
- The cloud infrastructure and organization comprising the private cloud may be owned, managed by one party, or some combination of parties.



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PUBLIC CLOUD

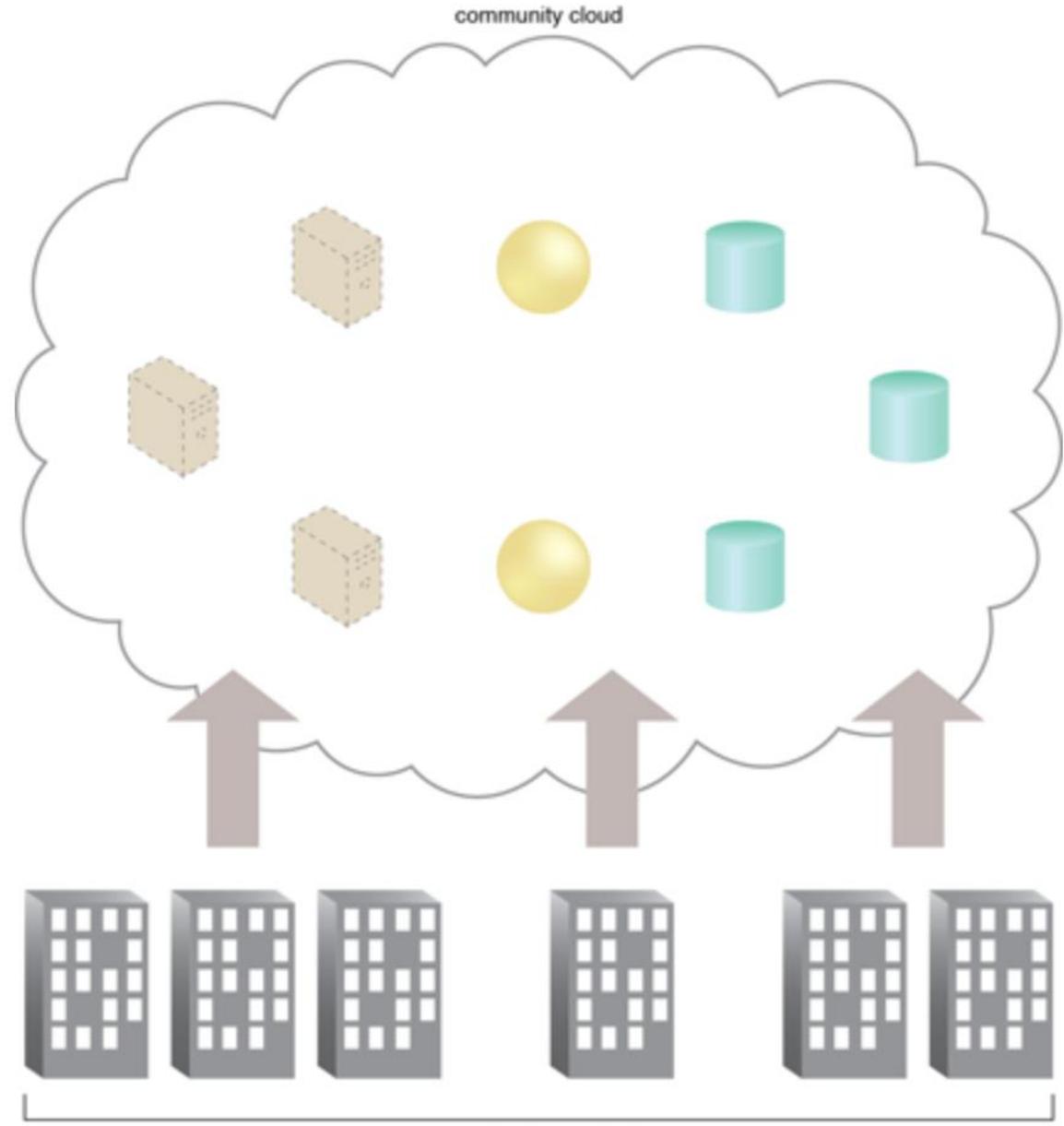
- *Public cloud:* The cloud is available to the general public. It may be used by commercial, academic, or government organizations. It exists on the premises of the provider.



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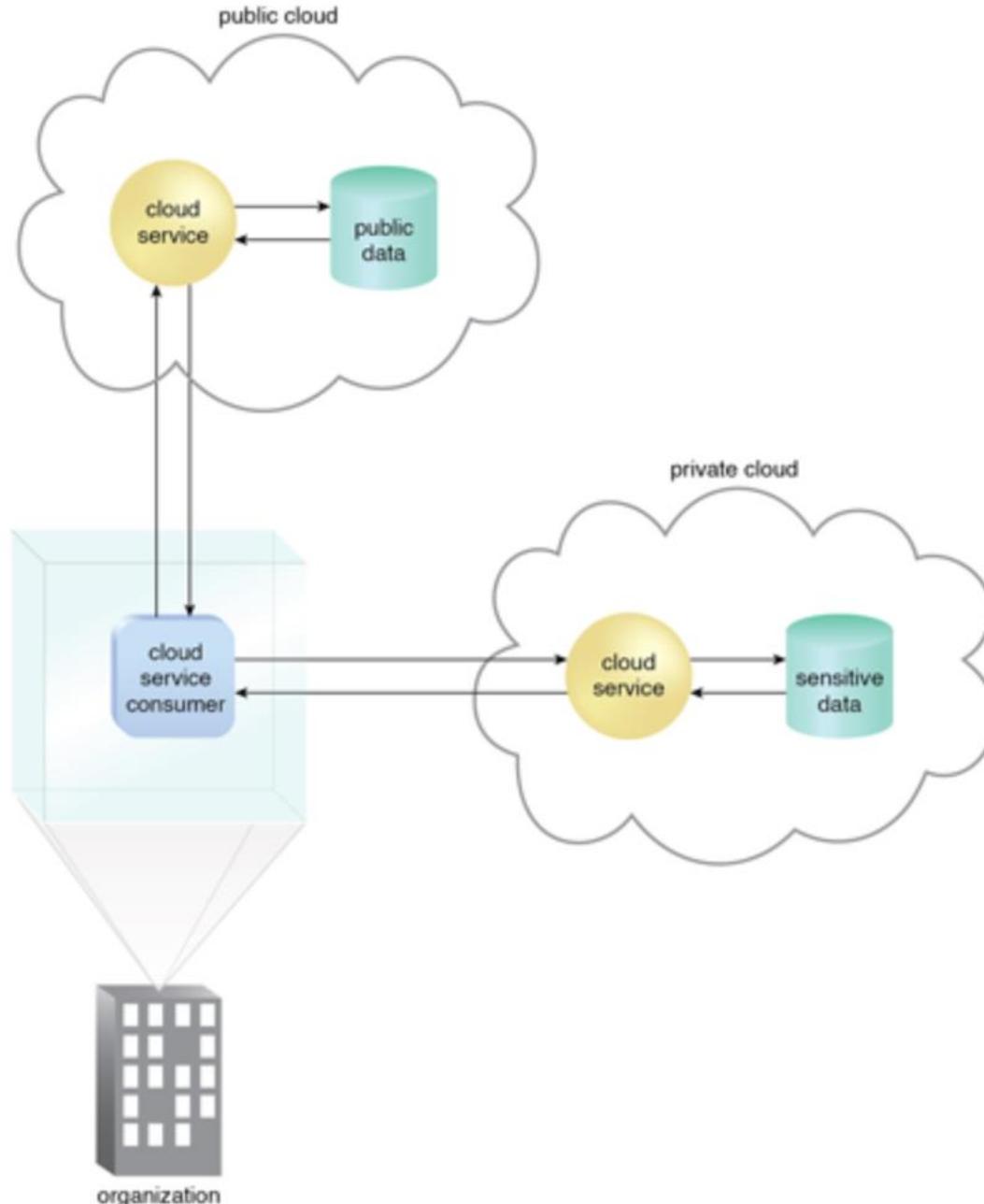
COMMUNITY CLOUD

- *Community cloud:* The cloud is owned by multiple organizations and supports their specific concerns. It may be managed centrally or independently. It may exist on premise or off-premise.



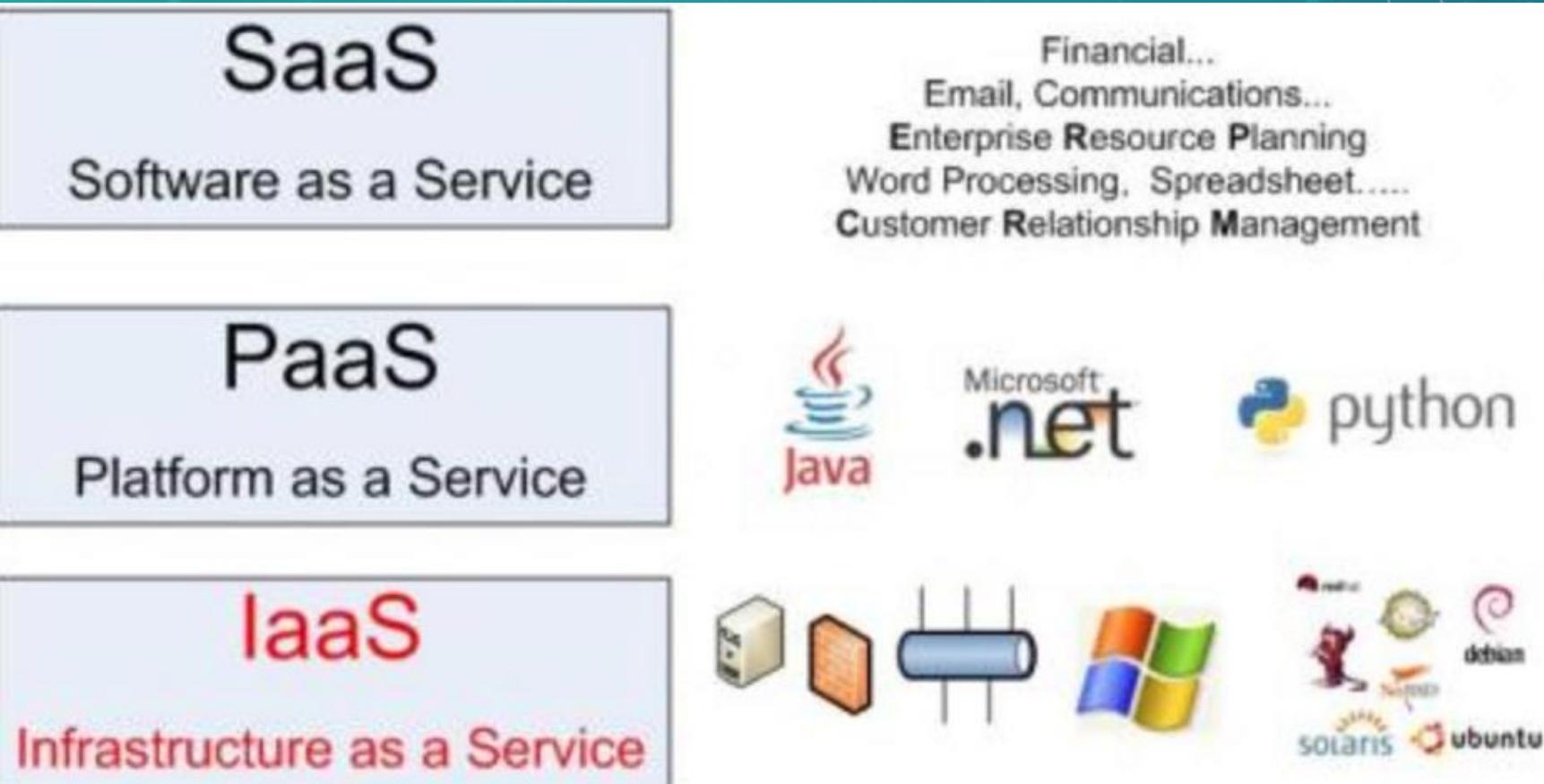
HYBRID CLOUD

- The cloud infrastructure consists of two or more cloud infrastructures (private, community, public or hybrid) that are bound together by a common management interface that enables data and application portability between them.



THREE SERVICE OFFERING MODELS

- The three key resources are:
 - Software
 - Platform
 - Infrastructure



CLOUD SAAS

Examples of cloud based software:

- The cloud based software applications serve specific capabilities.
- Typically used by managers.

- Financial Accounting Software



- Sales Software



- HR & Payroll Software



- Storage Software



- Email Software



- Instant Messaging



CLOUD PaaS

- *Cloud PaaS:* The cloud infrastructure created using products supported by the cloud provider.



CLOUD IAAS

- *Cloud IaaS*: The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources on a pay-per-use basis where he or she is able to deploy and run arbitrary software, which can include operating systems and applications.
- The consumer does not manage or control the underlying cloud infrastructure but has control over the operating systems, storage, and deployed applications and possibly limited control of select networking components

RECAPS

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REFERENCES

- Client/server and peer-to-peer models: basic concepts (Dmitri Moltchanov September 04, 2013)