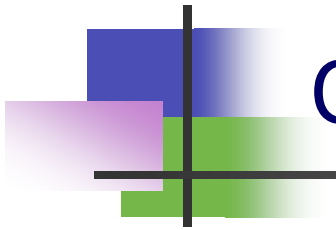
Cloud Computing

Cloud Computing – Lecture 2

Edited/Reviewed By: **Dr. Manar Elkady**
Email: m.elkady@fci-cu.edu.eg



Outline

- Intended Audience
- US NIST Definition of Cloud Computing
- Essential Cloud Characteristics
- Cloud Service Model
- Other cloud service model
- The cloud software stack
- Cloud Deployment model

Intended Audience

- Students
  - Courses, Assignments, Projects, etc…
- Researchers & Professors
  - Masters, PhD thesis topics
- Cloud Service Providers
  - Large organization
  - Small organization acting as a cloud broker
- Cloud Service Consumers
  - System planner, designer, etc…
  - IT manager, IT specialist, etc…
  - Cloud software developer/user

NIST

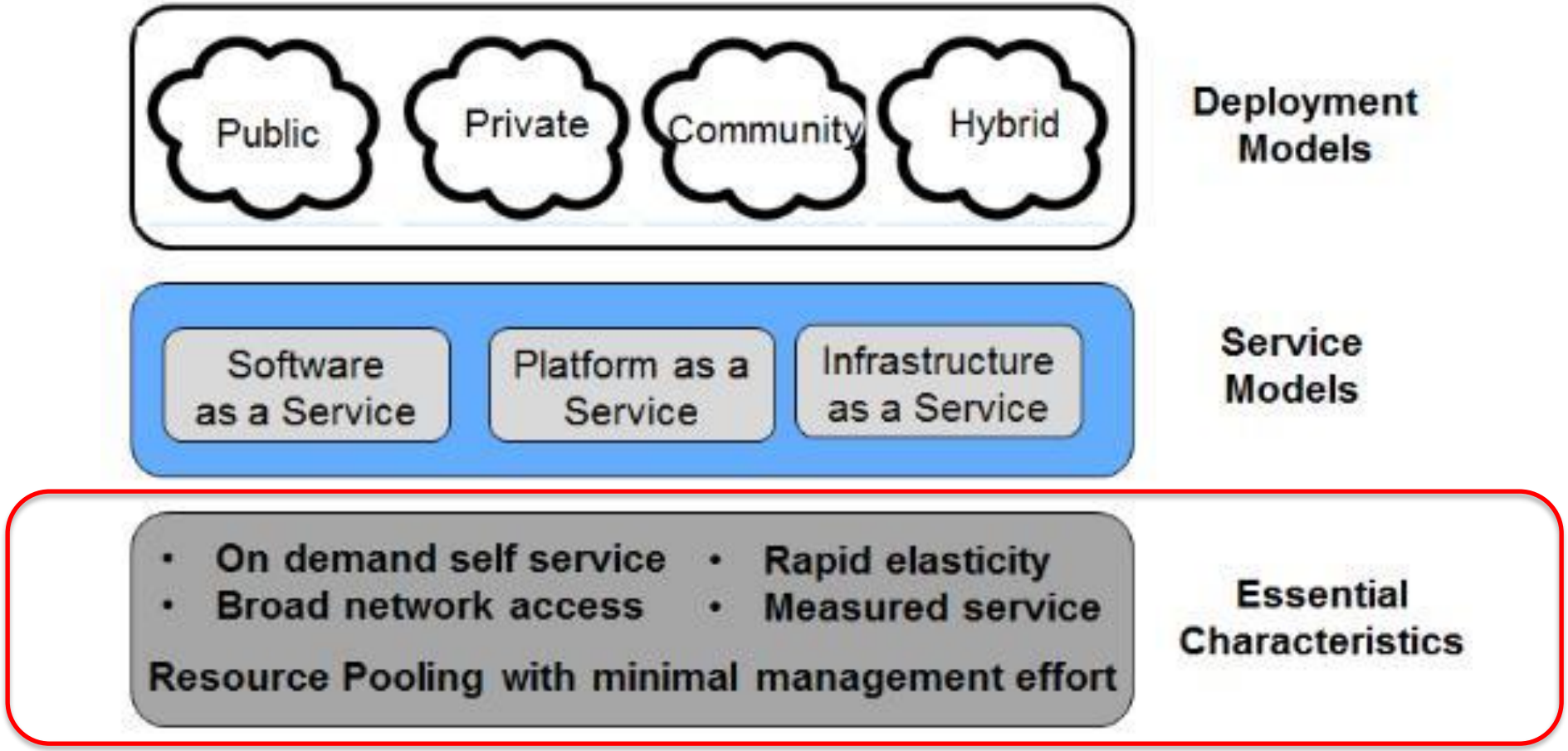
- National Institute of Standards & Technology (NIST)
  - United States Department of Commerce
  - Information Technology Laboratory (ITL)
  - NIST cloud computing program launched in November 2010
- NIST Cloud Computing Working groups:
  - Cloud Computing Target Business Use Cases
  - **Cloud Computing Reference Architecture and Taxonomy**
  - Cloud Computing Standards Roadmap
  - Cloud Computing SAJACC Working Group
  - Cloud Computing Security Working Group

NIST Definition of Cloud Computing

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

Reference - "**A NIST definition of cloud computing**", NIST Special Publication 800-145 by Peter Mell and Timothy Grance, 2011.

NIST Definition of Cloud Computing

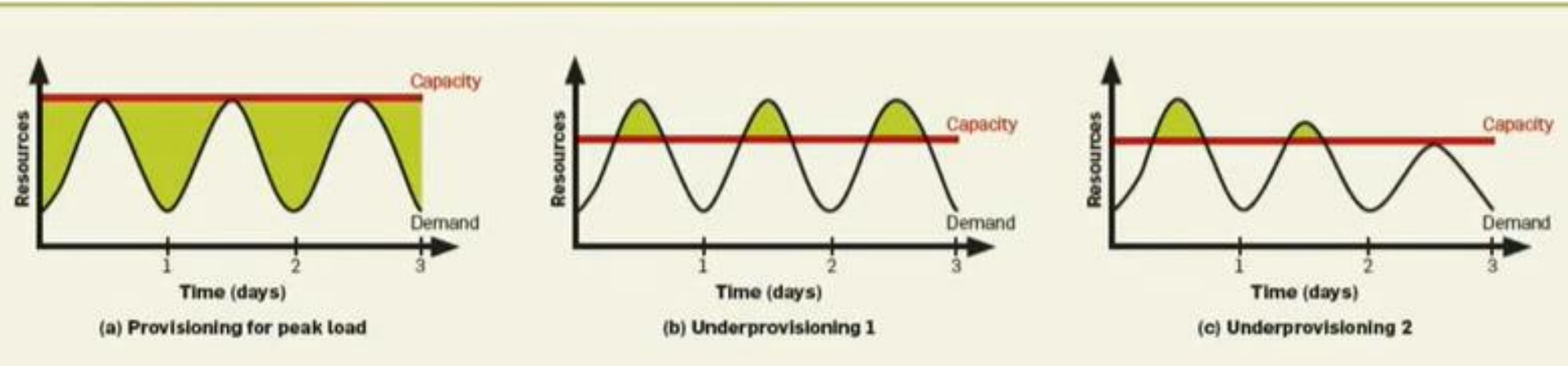


Five Cloud Computing Characteristics

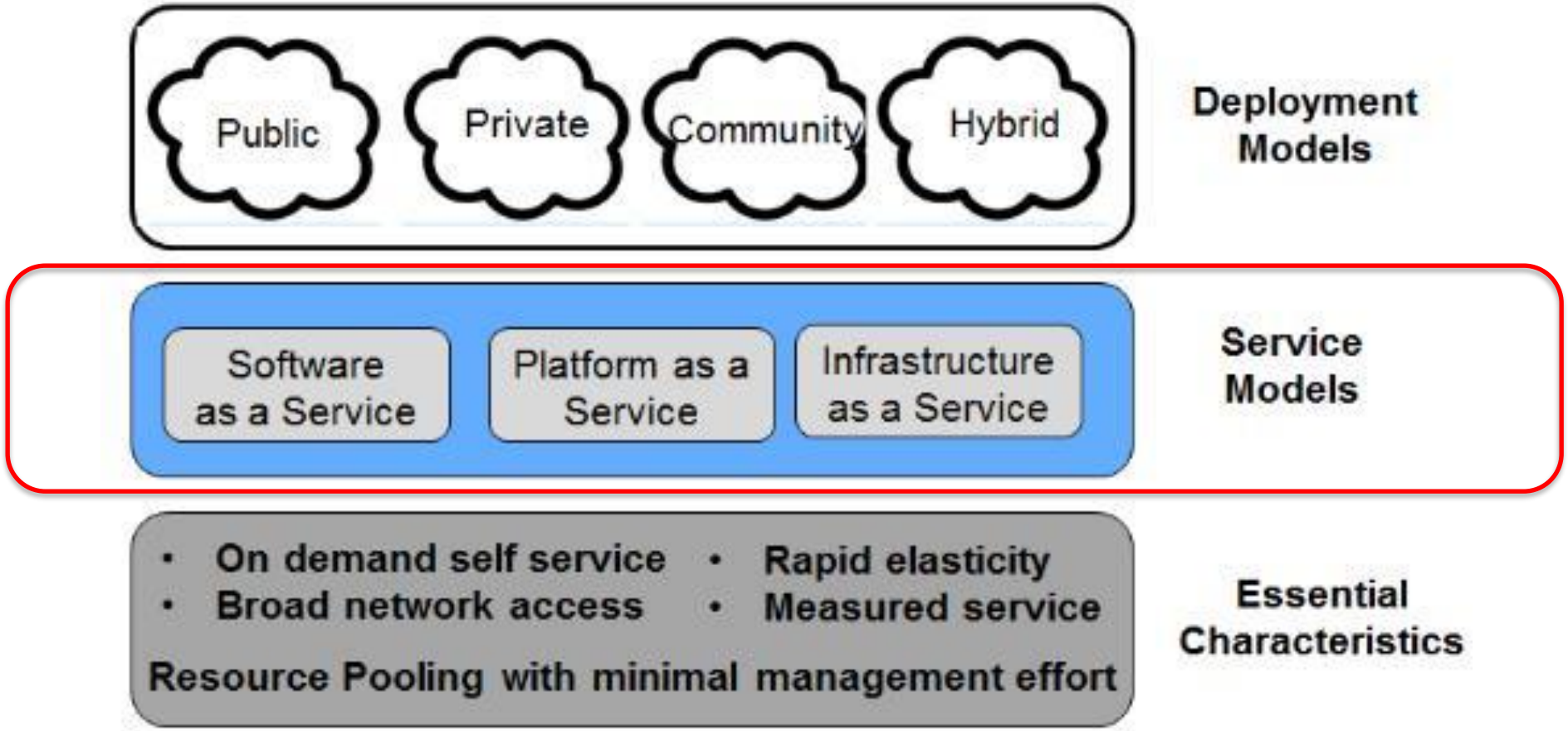
- On-Demand Self-Service
  - A consumer can provision computing resources as needed automatically without requiring service provider interaction
- Broad Network Access
  - Resources are available over the network and accessed through client platforms (e.g., mobile phones, tablets, laptops, etc…)
- Resource Pooling
  - Resources are pooled to serve multiple consumers using a multi-tenant model

Five Cloud Computing Characteristics

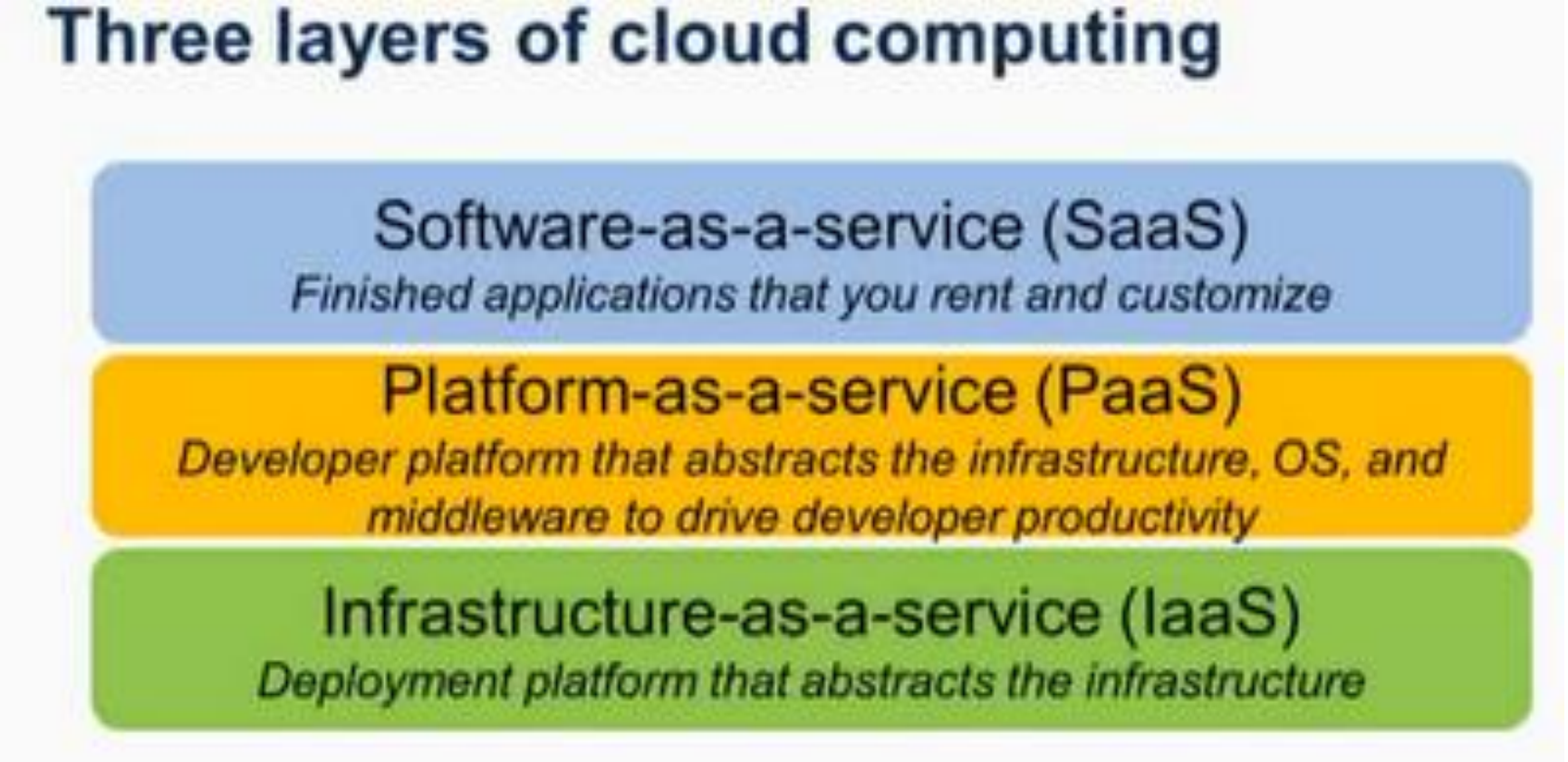
- Rapid Elasticity
  - Resources can be elastically provisioned and released to scale rapidly with demand
- Measured Service
  - Controlling resource usage by leveraging a metering capability at some level of abstraction appropriate to the type of service or resource
  - e.g. per hour processing, per day storage, active user accounts



NIST Definition of Cloud Computing



Three Cloud Service Models



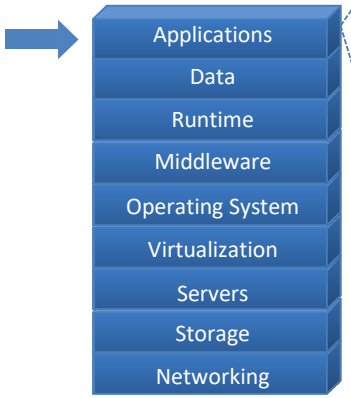
Other Service Models

- Database-as-a-Service
- Sensing-as-a-Service
- XaaS
  - “X” as a Service

The Cloud Software Stack

The Cloud Software Stack

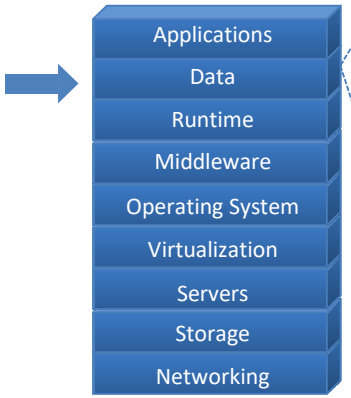
Applications



- Cloud applications can range from Web applications to scientific computational jobs

The Cloud Software Stack

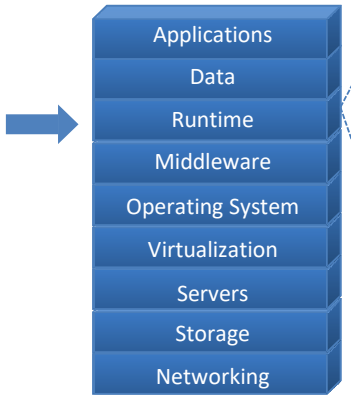
Data



- Data Management
- New generation cloud-specific databases and management systems
- E.g., Hbase, Cassandra, Hive, Pig etc.

The Cloud Software Stack

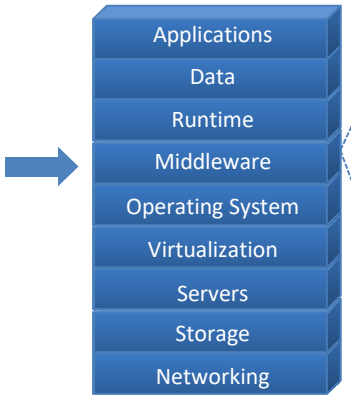
Runtime Environment



- Runtime platforms to support cloud programming models
- E.g., MPI, MapReduce, Pregel etc.

The Cloud Software Stack

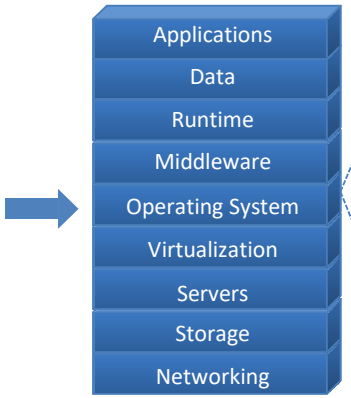
Middleware for Clouds



- Management platforms that enable:
  - Resource Management
  - Monitoring
  - Provisioning
  - Identity Management and Security

The Cloud Software Stack

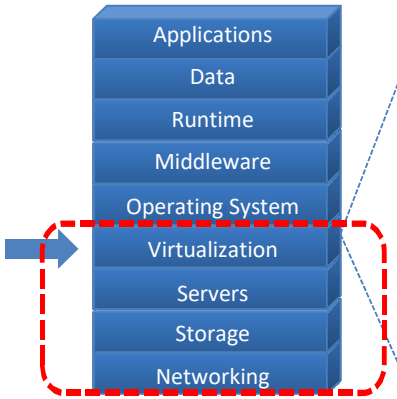
Operating Systems



- Standard Operating Systems used in Personal Computing
- Packaged with libraries and software for quick deployment and provisioning
- E.g., Amazon Machine Images (AMI) contain OS as well as required software packages as a “snapshot” for instant deployment

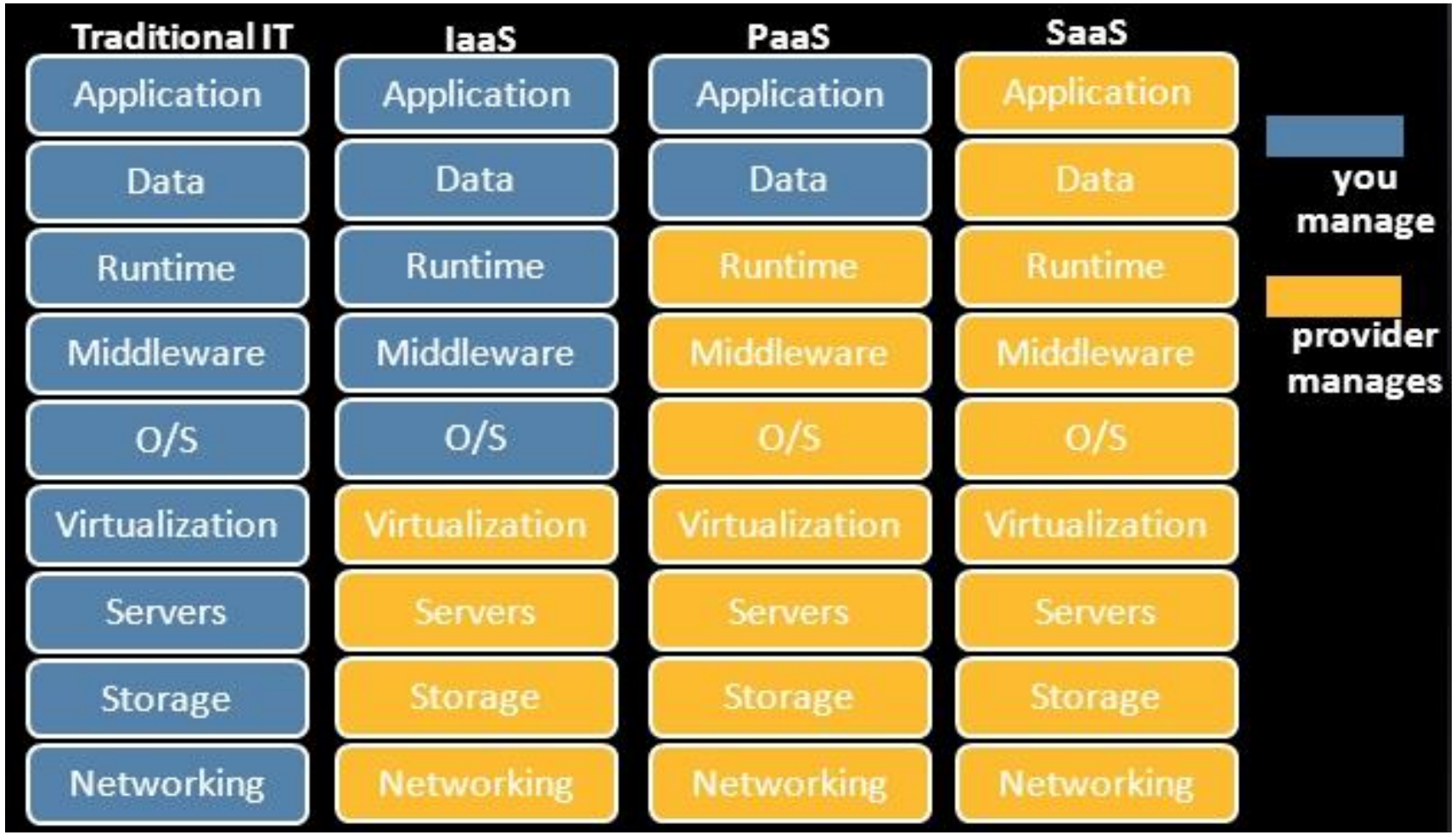
The Cloud Software Stack

Virtualization



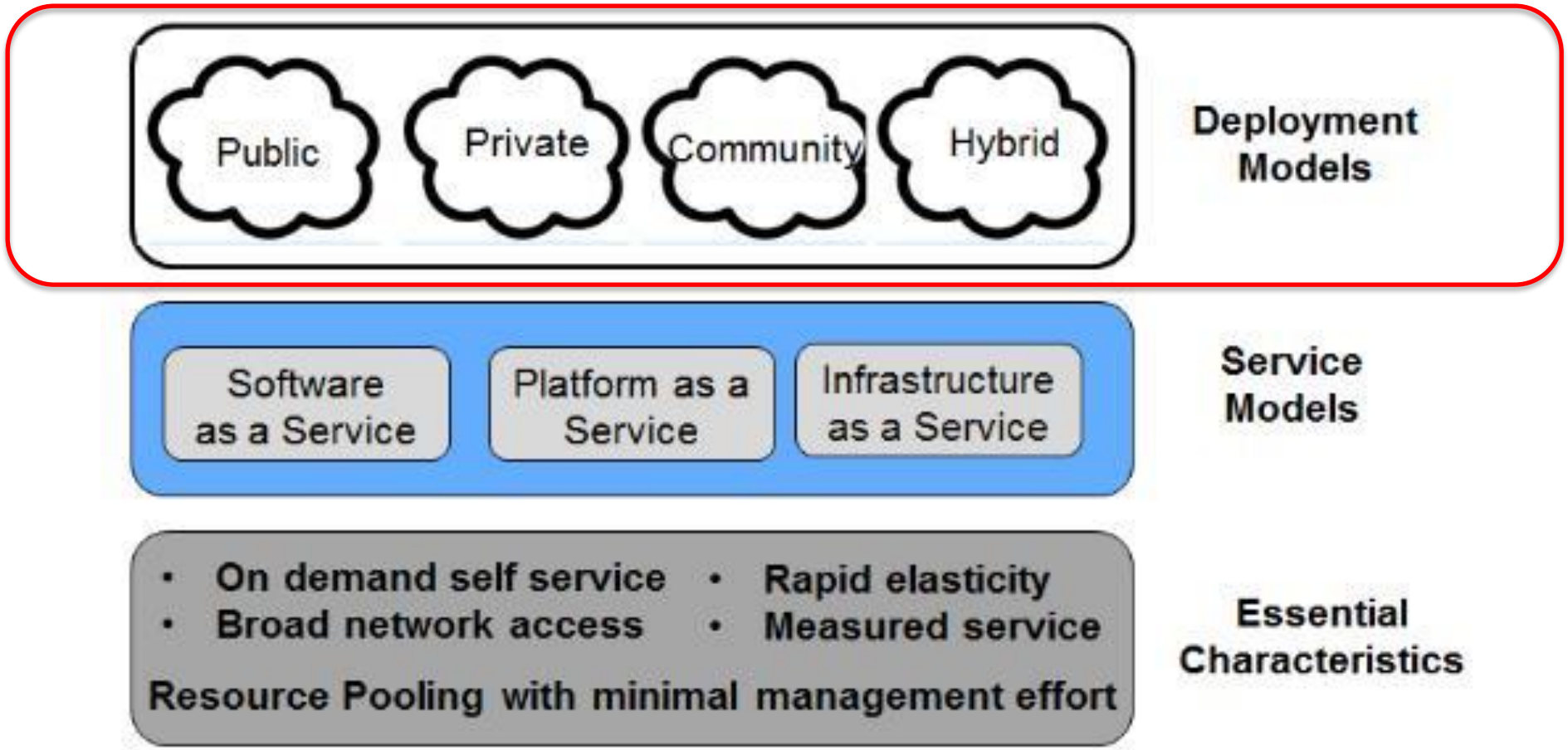
- Key Component
- Resource Virtualization
- Amazon EC2 is based on the Xen virtualization platform

Three Cloud Service Models



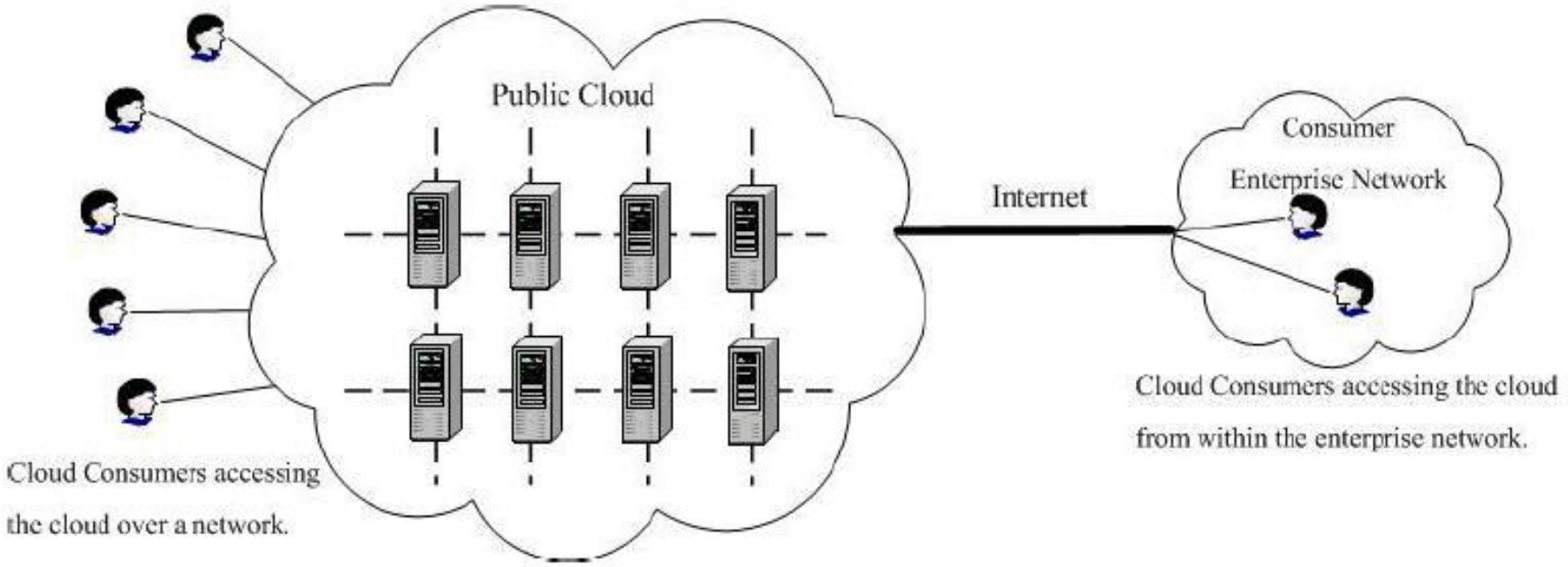
Three Cloud Service Models

NIST Definition of Cloud Computing



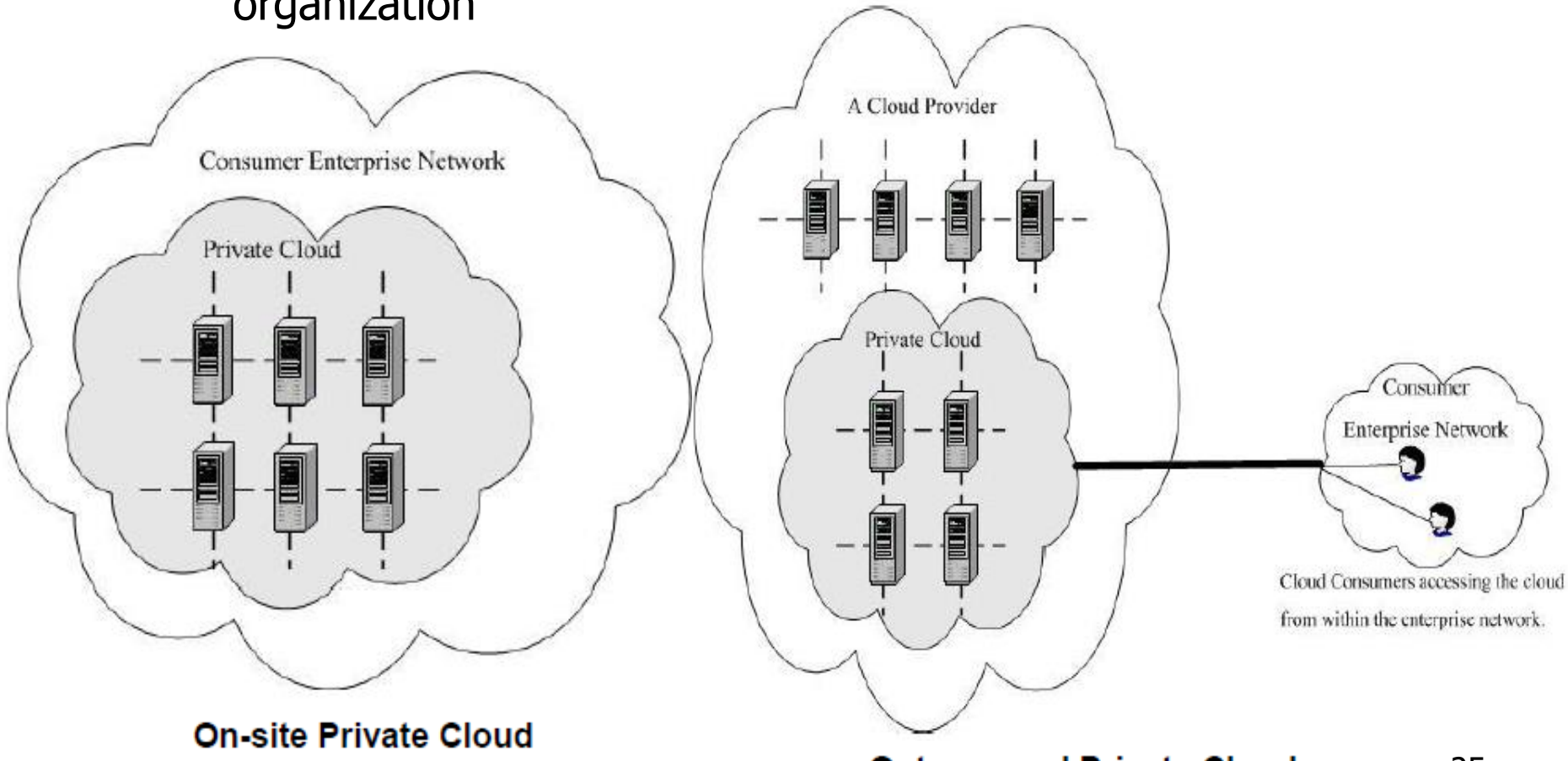
Four Cloud Deployment Models

- Public Cloud
  - Infrastructure is provisioned for open use by general public



Four Cloud Deployment Models

- Private Cloud
  - Infrastructure is provisioned for exclusive use by a single organization

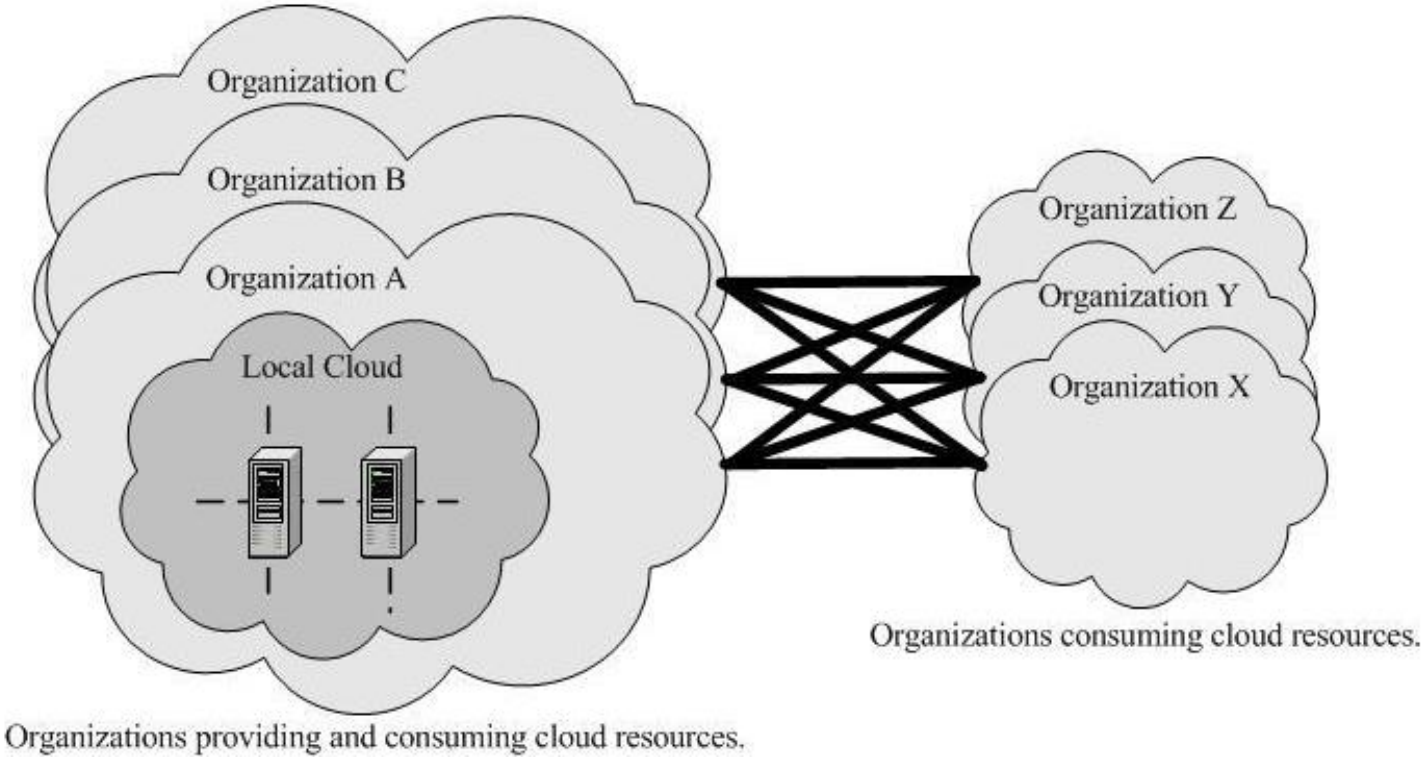


On-site Private Cloud

Out-sourced Private Cloud

Four Cloud Deployment Models

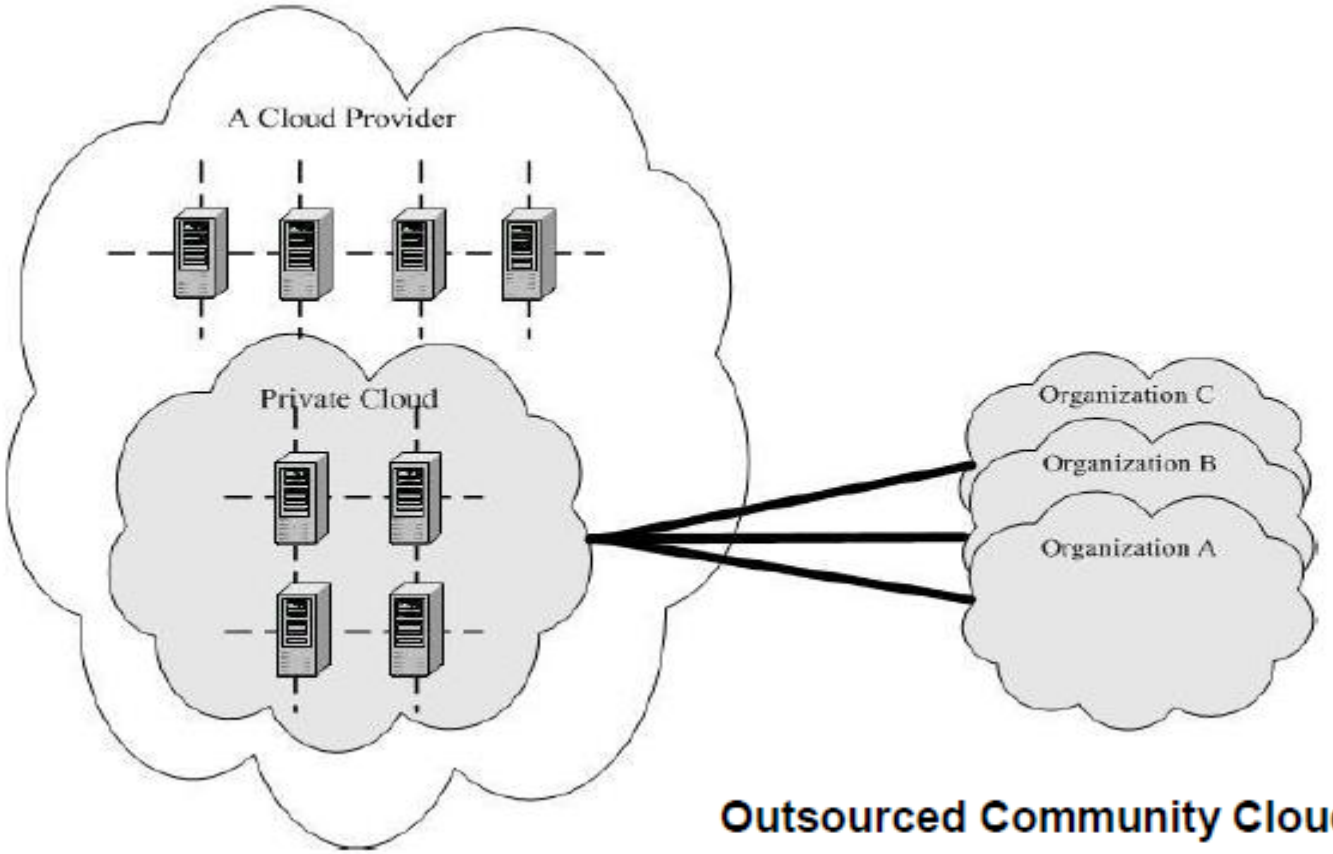
- Community Cloud
  - Infrastructure is provisioned for exclusive use by a specific community of organizations that have shared concerns



On-site Community Cloud

Four Cloud Deployment Models

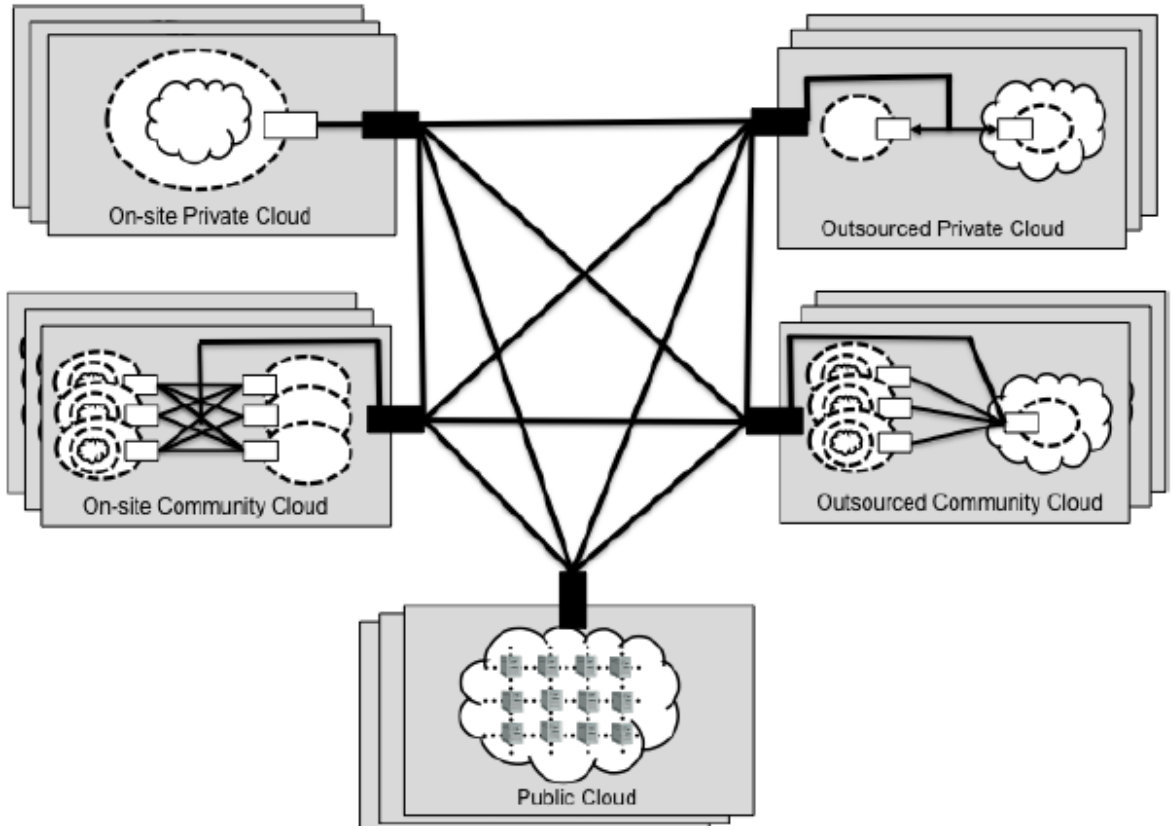
- Community Cloud
  - Infrastructure is provisioned for exclusive use by a specific community of organizations that have shared concerns



Outsourced Community Cloud

Four Cloud Deployment Models

- Hybrid Cloud
  - Distinct cloud infrastructures remain unique entities, bound together by standardized or proprietary technology for data and application portability



Blackboard Enrollment

212201.FCI.SCS473	Cloud Computing