KHOA CÔNG NGHỆ THÔNG TIN-ĐHKHTN
CSC11004 - MẠNG MÁY TÍNH NÂNG CAO

CLOUD COMPUTING

Lê Ngọc Sơn

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KHOA CÔNG NGHỆ THÔNG TIN
TRƯỜNG ĐẠI HỌC KHOA HỌC TỰ NHIÊN

fit@hcmus

The Cloud Computing Phenomenon

- Adoption of cloud computing is significantly rising in organizations
- Cloud computing is seen as a leading "disruptive" technology in the coming decade
- Cloud is driving optimization and innovation of business models in organizations
- Trends like mobility, Big Data, and social media are also influencing cloud adoption

What is Cloud Computing?

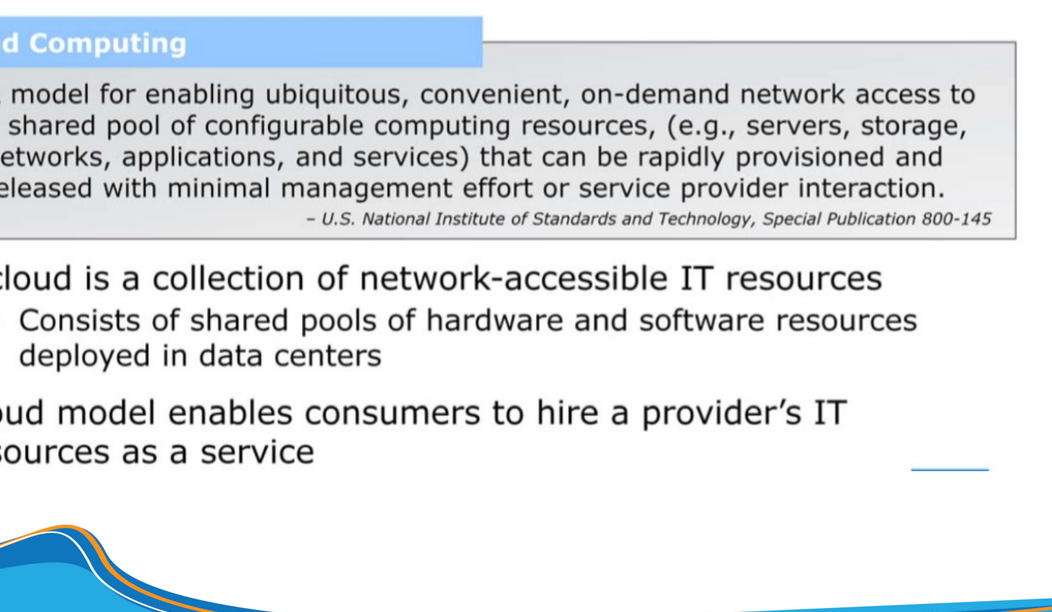
Cloud Computing

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

– U.S. National Institute of Standards and Technology, Special Publication 800-145

- A cloud is a collection of network-accessible IT resources
  - Consists of shared pools of hardware and software resources deployed in data centers
- Cloud model enables consumers to hire a provider's IT resources as a service

What is Cloud Computing? (Cont'd)



Essential Cloud Characteristics

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

On-demand Self-service

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 provider.

– U.S. National Institute of Standards and Technology, Special Publication 800-145

- Consumers use a web-based self-service portal to view a service catalog and request cloud services
- Enables consumers to provision cloud services in a simple and flexible manner
  - Reduces the time needed to provision new or additional IT resources

Broad Network Access

Broad Network Access

Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms, (e.g., mobile phones, tablets, laptops, and workstations).

– U.S. National Institute of Standards and Technology, Special Publication 800-145

- Consumers access cloud services on any client/end-point device from anywhere over a network
- Standard mechanisms support the use of heterogeneous client platforms
  - OSI and TCP/IP protocols
  - SOAP and REST web services

Resource Pooling

Resource Pooling

The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, and network bandwidth.

– U.S. National Institute of Standards and Technology, Special Publication 800-145

- Enables providers to improve resource utilization and to flexibly provision and reclaim resources

Rapid Elasticity

Rapid Elasticity

Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.

– U.S. National Institute of Standards and Technology, Special Publication 800-145

- Consumers can adapt to variations in workloads and maintain required performance levels
- Consumers may be able to avoid excessive costs from over-provisioning resources

Measured Service

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 (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

– U.S. National Institute of Standards and Technology, Special Publication 800-145

- Enables billing of cloud services
- Resource monitoring helps providers with capacity and service planning

Cloud Computing Benefits

Benefit	Description
Business agility	• Enables quick resource provisioning • Facilitates innovation • Reduces time-to-market
Reduces IT costs	• Reduces up-front capital expenditure (CAPEX) • Improves resource utilization • Reduces energy and space consumption
High availability	• Ensures resource availability based on consumer's requirements • Enables fault tolerance

Cloud Computing Benefits (Cont'd)

Benefit	Description
Business continuity	• Reduces impact of downtime • Example: Cloud-based backup
Flexible scaling	• Enables scaling of resources to meet demand • Unilateral and automatic resource scaling
Flexibility of access	• Enables access to services from anywhere • Eliminates dependency on a specific end-point device

Cloud Computing Benefits (Cont'd)

Benefit	Description
Benefit	• Description
Benefit	• Description
Benefit	• Description

Introduction to Cloud Service Models

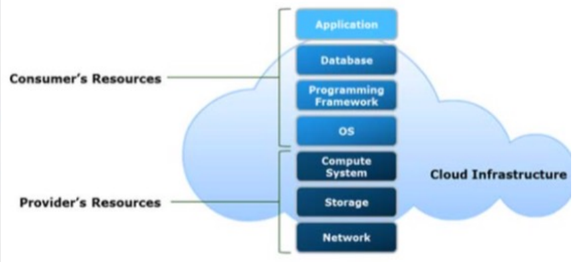
- A cloud service model specifies the services and the capabilities provided to consumers
- NIST specifies three primary cloud service models:
  - Infrastructure as a Service (IaaS)
  - Platform as a Service (PaaS)
  - Software as a Service (SaaS)

Infrastructure as a Service

Infrastructure as a Service

The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer 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 operating systems, storage, and deployed applications; and possibly limited control of select networking components , (e.g., host firewalls).

– U.S. National Institute of Standards and Technology, Special Publication 800-145



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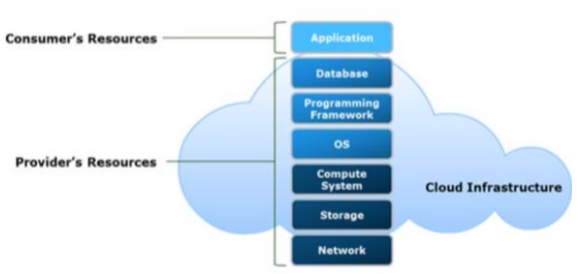
Platform as a Service

Platform as a Service

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.

– U.S. National Institute of Standards and Technology, Special Publication 800-145

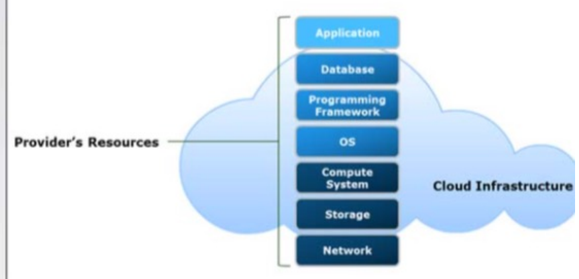


Software as a Service

Software as a Service

The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through either a thin client interface, such as a web browser, (e.g., web-based email, or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.

– U.S. National Institute of Standards and Technology, Special Publication 800-145



Cloud Services Brokerage (CSB)

Cloud Services Brokerage

Cloud services brokerage (CSB) is an IT role and business model in which a company or other entity adds value to one or more (public or private) cloud services on behalf of one or more consumers of that service.

– Gartner IT Glossary

- CSB is provided by a cloud broker
  - An entity that acts as an intermediary between cloud consumers and providers
- Cloud broker manages the use, performance ,and delivery of cloud services

Categories of Cloud Services Brokerage

Service intermediation

The broker enhances and adds value to a given service

Service aggregation

The broker combines and integrates multiple services into one or more new services

Service arbitrage

Similar to service aggregation except that the services being aggregated may vary

Introduction to Cloud Deployment Models

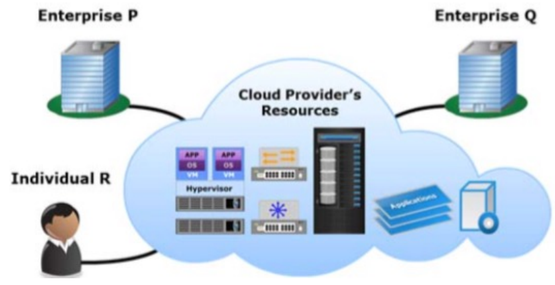
- A cloud deployment model specifies how a cloud infrastructure is built, managed, and accessed
- NIST specifies four primary cloud deployment models:
  - Public
  - Private
  - Community
  - Hybrid

Public Cloud

Public Cloud

The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider.

– U.S. National Institute of Standards and Technology, Special Publication 800-145



Private Cloud

Private Cloud

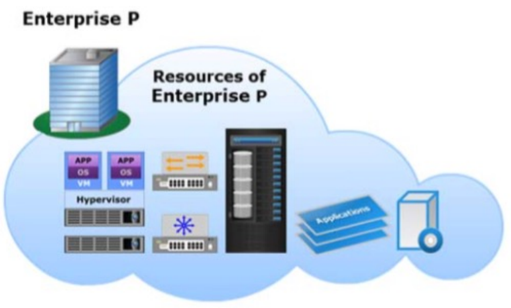
The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (for example, business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.

– U.S. National Institute of Standards and Technology, Special Publication 800-145

- There are two variants of private cloud:
  - On-premise
  - Externally-hosted

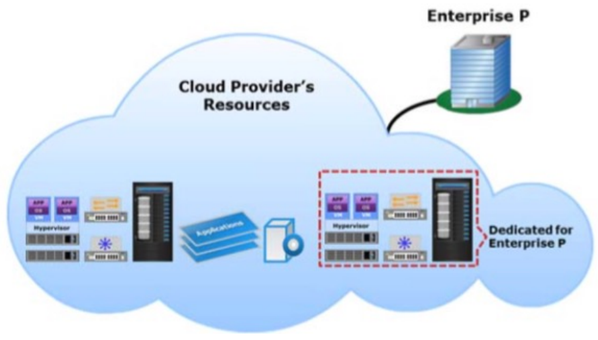
On-premise Private Cloud

- Cloud infrastructure is deployed by an organization on its data centers within its premises
  - Provides complete control over the infrastructure and data
  - Enables standardization of IT resources, processes, and services



Externally-hosted Private Cloud

- Cloud implementation is outsourced to an external provider
- Cloud is hosted on the provider's premises and the consumers connect to it over a secure network
  - Access policies isolate the cloud resources from other tenants



Community Cloud

Community Cloud

The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.

– U.S. National Institute of Standards and Technology, Special Publication 800-145

- There are two variants of community cloud:
  - On-premise
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Q&A