Cloud Computing

Hwajung Lee

Key Reference:
Prof. Jong-Moon Chung's Lecture Notes at Yonsei University

Cloud Computing

- **Cloud Introduction**
- **Cloud Service Model**
- Big Data
- Hadoop
- MapReduce
- HDFS (Hadoop Distributed File System)

Cloud Introduction

Cloud Computing

- **What does Cloud Computing do?**

- Provides online **data storage**

- Enables **configuration** and **accessing** of online applications

- Provides a variety of **software** usage

- Provides **computing platform** and **computing infrastructure**

Cloud Computing

> **Application Example**

- **Using Gmail on my smartphone to check e-mails**

- **Receive an e-mail with a MS Power Point attachment file**

- **However, MS Power Point and Windows OS is not installed on my smartphone!**

- **Google Drive service's Google Docs, Sheets, and Slides can be used to open the file**

Cloud Computing

> **What is a Cloud?**

- **Cloud** can provide services through a **public** or **private Network** or the **Internet**, where the service hosting system is at a **remote location**

- Cloud can support various applications
  - E-mail, Web Conferencing, Games, Database Management, CRM (Customer Relationship Management), etc.

Cloud Computing
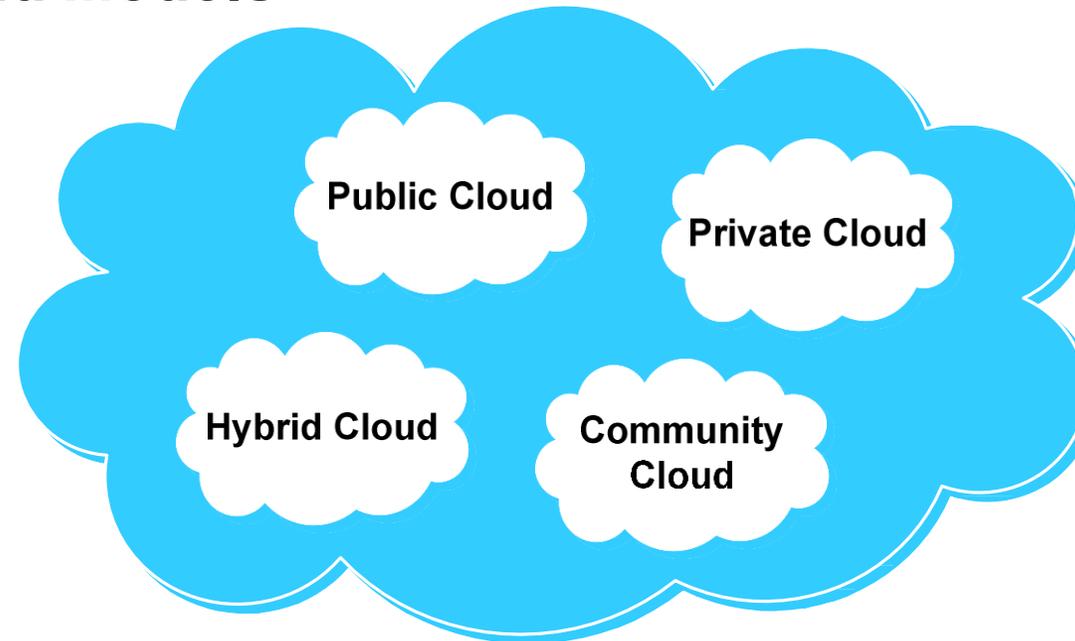
› **Cloud Models**

Cloud Computing

> **Cloud Models**

- **Public Cloud**
  - Enables public systems and service access
  - Open architecture (e.g., e-mail)
  - Could be less secure due to openness

- **Private Cloud**
  - Enables service access within an organization
  - Due to its private nature, it is more secure
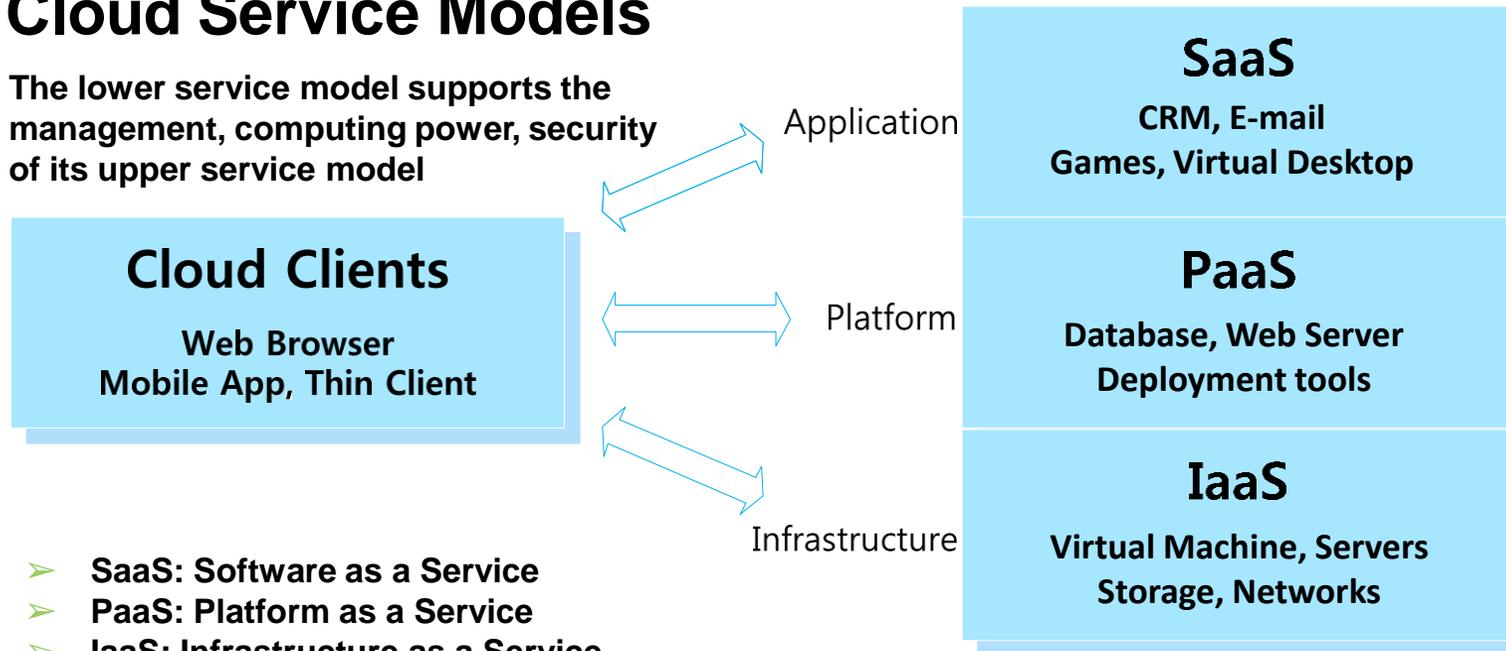
Cloud Computing

> **Cloud Models**

- **Community Cloud**
  - Cloud accessible by a group of organizations

- **Hybrid Cloud**
  - **Hybrid Cloud** = **Public Cloud** + **Private Cloud**
  - Private cloud supports critical activities
  - Public cloud supports non-critical activities

Cloud Computing

❯ Cloud Service Models

The lower service model supports the management, computing power, security of its upper service model

Cloud Clients

**Web Browser
Mobile App, Thin Client**

Application

Platform

Infrastructure

SaaS

**CRM, E-mail
Games, Virtual Desktop**

PaaS

**Database, Web Server
Deployment tools**

IaaS

**Virtual Machine, Servers
Storage, Networks**

- ➢ **SaaS: Software as a Service**
- ➢ **PaaS: Platform as a Service**
- ➢ **IaaS: Infrastructure as a Service**

Cloud Computing

- **Software as a Service (SaaS)**
  - Provides a variety of **software applications** as a service to end users
- **Platform as a Service (PasS)**
  - Provides a program executable platform for applications, development tools, etc.
- **Infrastructure as a Service (IaaS)**
  - Provides the **fundamental computing and security resources for the entire cloud**
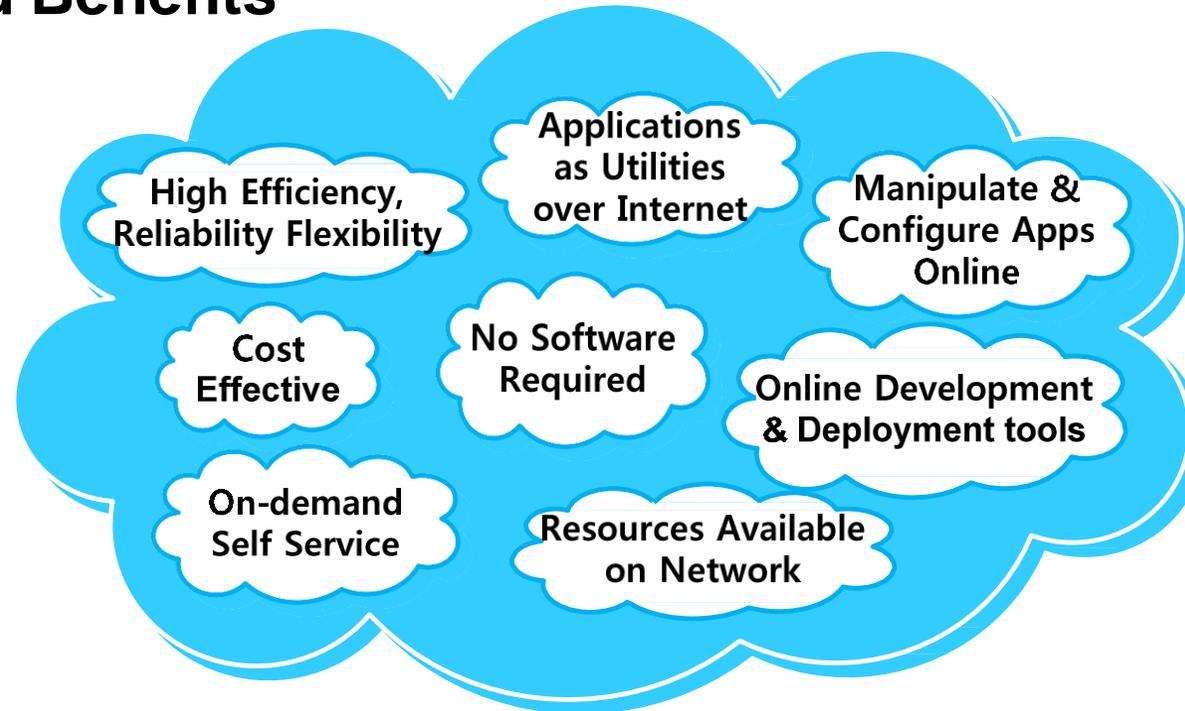 - Backup storage, computing power, VM (Virtual Machines), etc.

Cloud Computing

- **Cloud Service Models**

    - **There are many other service models**

    - **XaaS = Anything as a Service**

        - **NaaS ➔ N for Network as a Service**
        - **DaaS ➔ D for Database as a Service**
        - **BaaS ➔ B for Business as a Service**
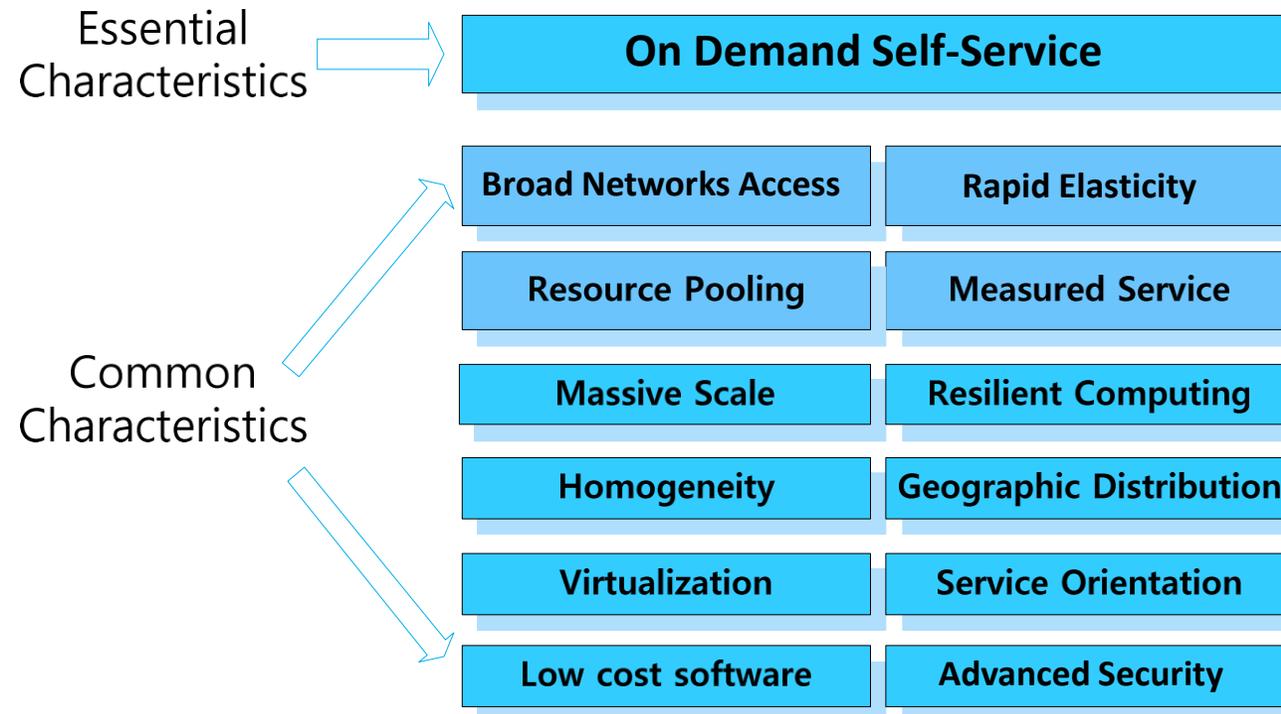   - **etc.**

Cloud Computing

▶ **Cloud Benefits**

High Efficiency, Reliability Flexibility

Applications as Utilities over Internet

Manipulate & Configure Apps Online

Cost Effective

No Software Required

Online Development & Deployment tools

On-demand Self Service

Resources Available on Network

Cloud Computing

❯ **Characteristics**

Essential Characteristics → **On Demand Self-Service**

Common Characteristics →

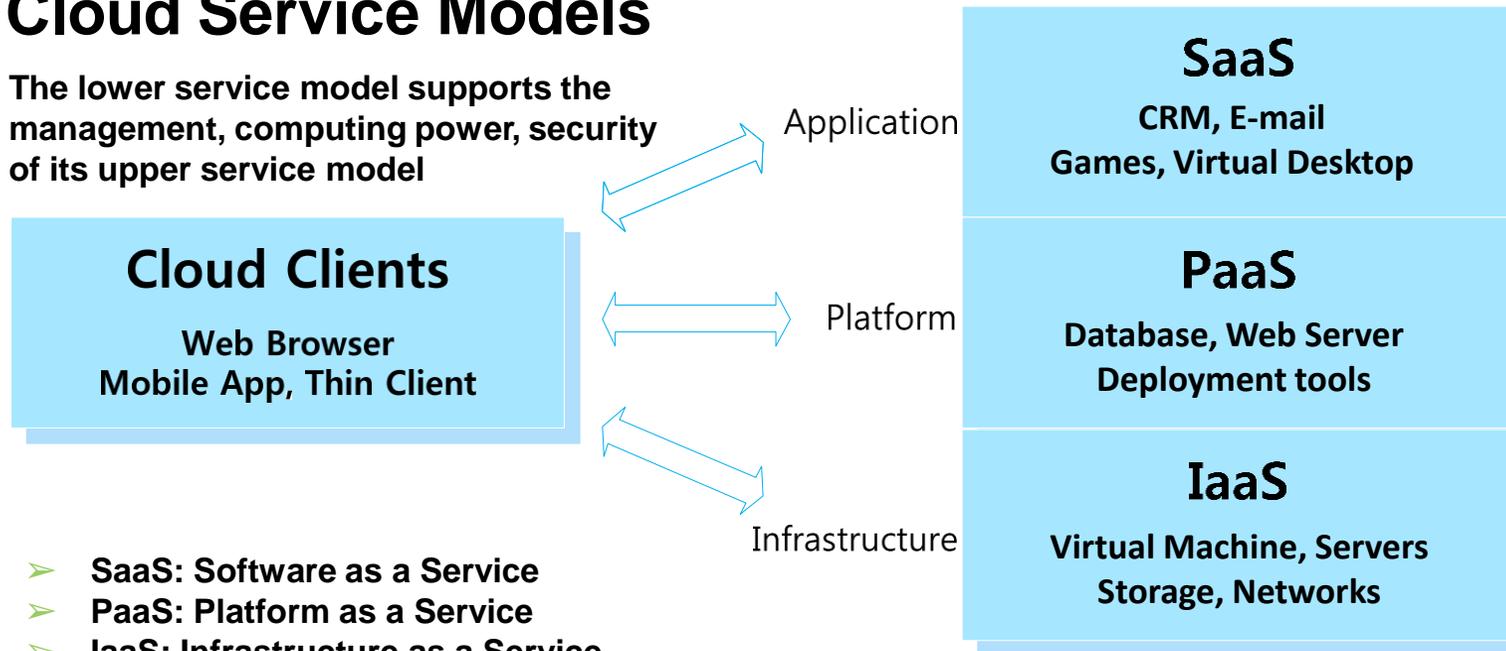| Broad Networks Access	Rapid Elasticity
Resource Pooling	Measured Service
Massive Scale	Resilient Computing
Homogeneity	Geographic Distribution
Virtualization	Service Orientation
Low cost software	Advanced Security

Cloud Service Models

Cloud Computing

Cloud Service Models

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- ➤ **IaaS: Infrastructure as a Service**

IaaS

> **IaaS (Infrastructure as a Service)**

- **Infrastructure** support **over the Internet**
- **Cloud's Computing & Storage Resources**
    - **Computing Power**
    - **Storage Services**
    - **Software Packages & Bundles**
    - **VLAN (Virtual Local Area Network)**
    - **VM (Virtual Machine) Features**

IaaS

> **VM (Virtual Machine) Administration**
> - **IaaS enables control of computing resources through Administrative Access to VMs**
>   - ➔ **Server Virtualization features**
> - **Access to computing resources are enabled by Administrative Access to VMs**
> - **VM Administrative Command examples**
>   - **Save data on cloud server**
>   - **Start web server**
>   - **Install new application**

IaaS Procedures
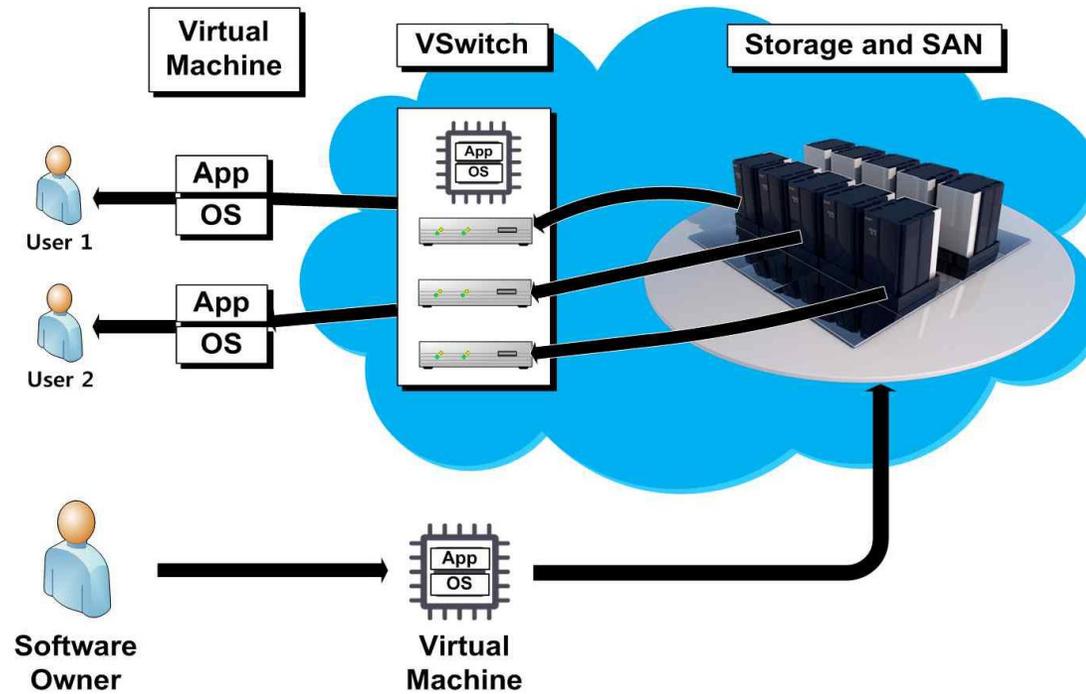
IaaS

- **IaaS Benefits**
  - **Flexible and Efficient Renting of Computer & Server Hardware**
    - **Rentable Resources**
      - **VM, Storage, Bandwidth, IP Addresses, Monitoring Services, Firewalls, etc.**
    - **Rent Payment Basis**
      - **Resource type**
   - **Usage time**
      - **Service packages**

IaaS

- **IaaS Benefits**
  - **Portability & Interoperability with Legacy Applications**

    - **Enables portability based on infrastructure resources that are used through Internet connections**

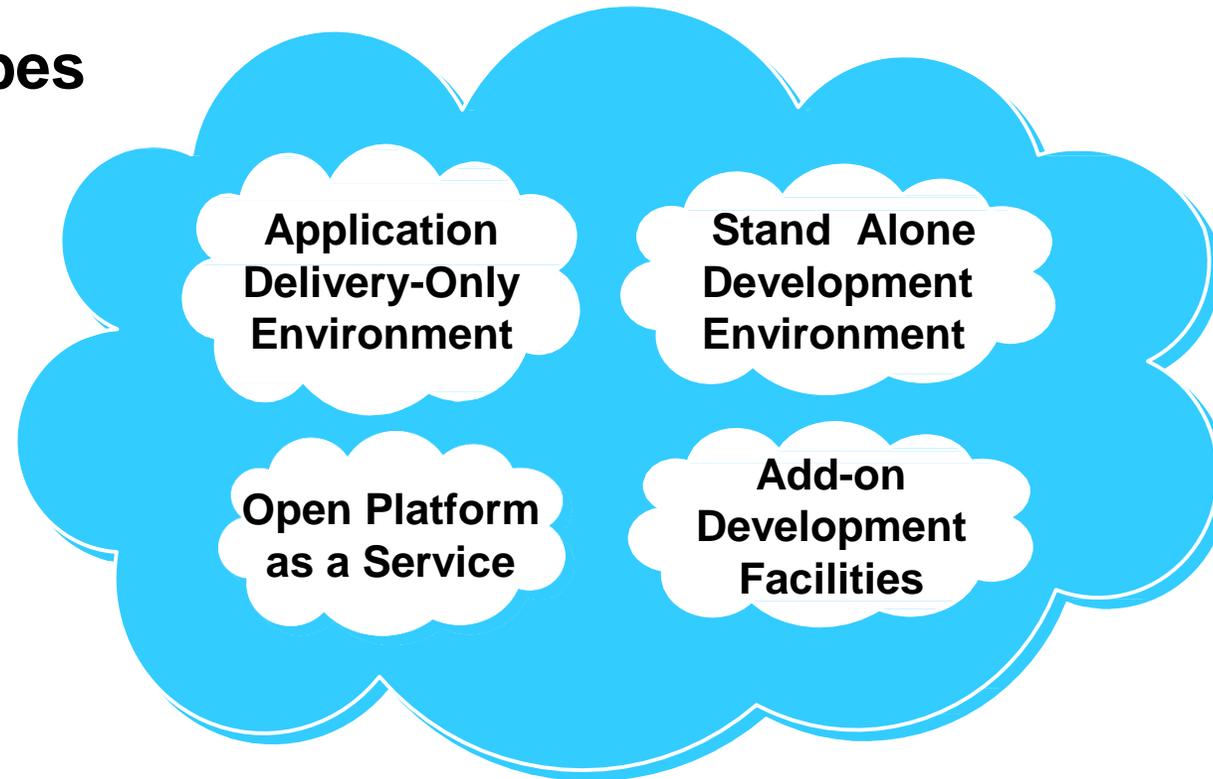   - **Enables a method to maintain interoperability with legacy applications and workloads between IaaS clouds**

PaaS

- **PaaS**
  (Platform as a Service)

  - **Provides development & deployment tools for application development**

  - **Provides runtime environment for apps.**
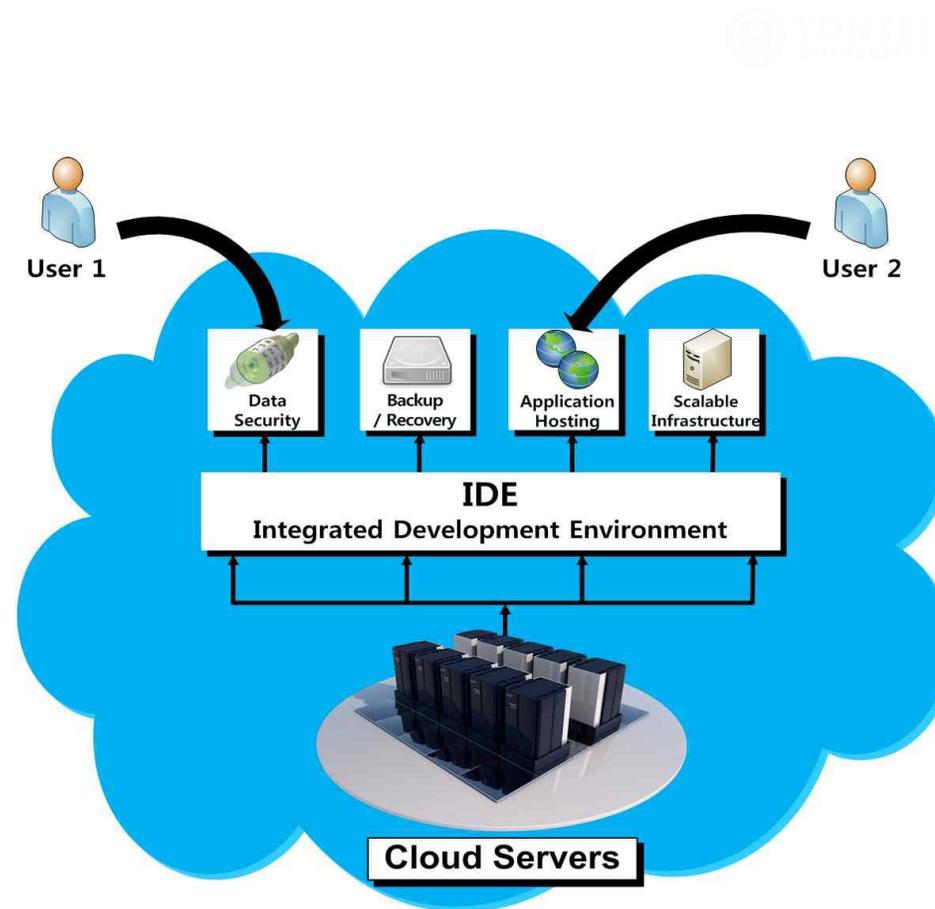
Cloud Services

- **PaaS Types**

- Application Delivery-Only Environment
- Stand Alone Development Environment
- Open Platform as a Service
- Add-on Development Facilities

PaaS

> **PaaS Types (cont.)**

- **Application Delivery-Only Environment**
  - generally focus on hosting services, such as security and on-demand scalability
- **Stand-Alone Development Environment**
  - do not include technical, licensing or financial dependencies on specific SaaS applications or web services, and are intended to provide a generalized development environment

PaaS

- **PaaS Types**
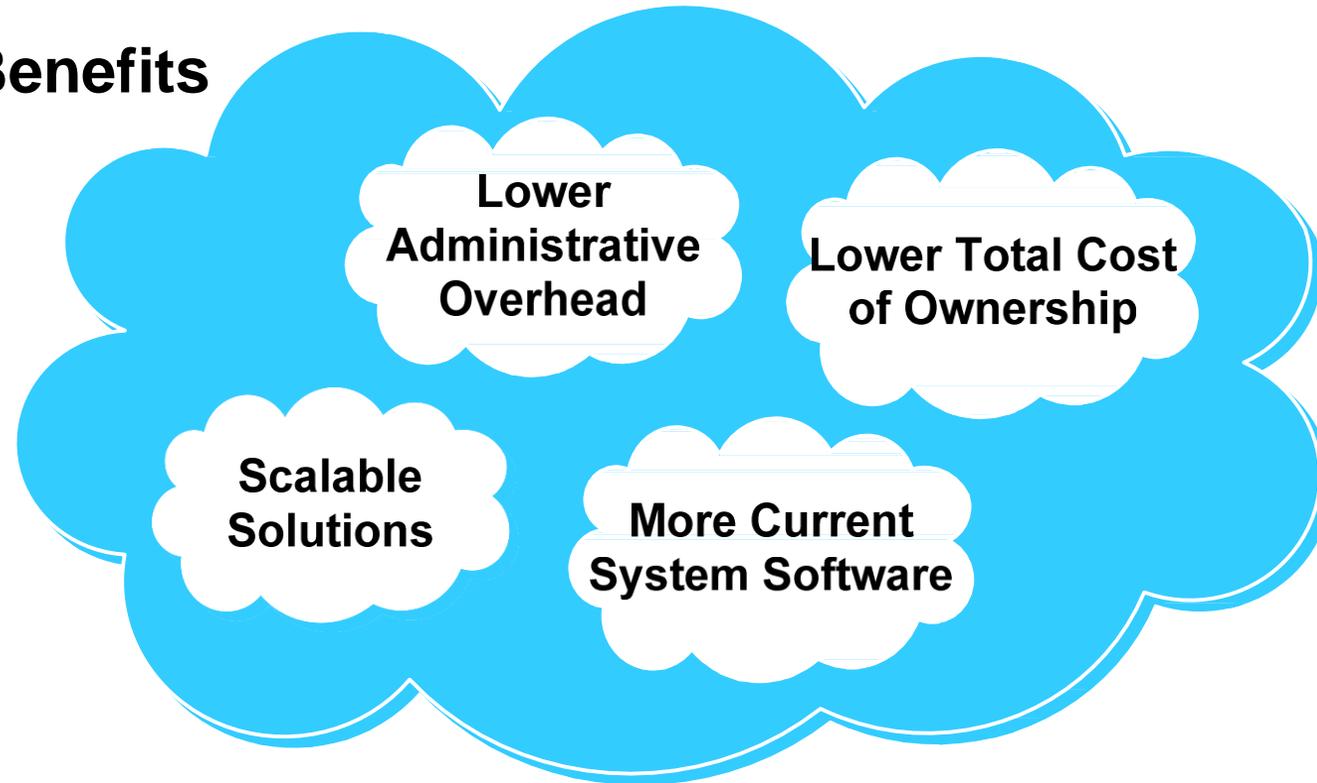 - **Open Platform as a Service**
    - Provides open source software to run applications for PaaS providers
  - **Add-On Development Facilities**
    - allow customization of existing SaaS applications, often requiring PaaS developers and their users to purchase subscriptions to the add-on SaaS application

PaaS

> **Benefits**

- **Lower Administrative Overhead**
  - **User does not need to be involved in any administration of the platform**

- **Lower Total Cost of Ownership**
  - **User does not need to purchase any hardware, memory, or server**

PaaS

> **Benefits**

- **Scalable Solutions**
  - **Application resource demand based automatic resource scale control**

- **More Current System Software**
  - **Cloud provider needs to maintain software upgrades & patch installations**

SaaS

> **SaaS (Software as a Service)**

- **Provides software applications as a service to the user**

- **Software that is deployed on a cloud server which is accessible through the Internet**

SaaS

➤ **Characteristics**

- **On Demand Availability**
  - **Cloud software is available anywhere that the cloud is reachable via Internet**

- **Easy Maintenance**
  - **No user software upgrade or maintenance needed**
    - ➔ **All supported by the cloud**

- **Flexible Scale Up or Scale Down**
- **Centralized Management & Data**

SaaS

❯ Characteristics

- **Enables a Shared Data Model**
  - **Multiple users can share a single data model and database**

- **Cost Effectiveness**
  - **Pay based on usage**
  - **No risk in buying the wrong software**

- **Multitenant Program Solutions**
  - **Multiple uses are ensured to use the same software version**
    - ➔ **No version mismatch problems**

Software-as-a-service

- **Open SaaS Applications**
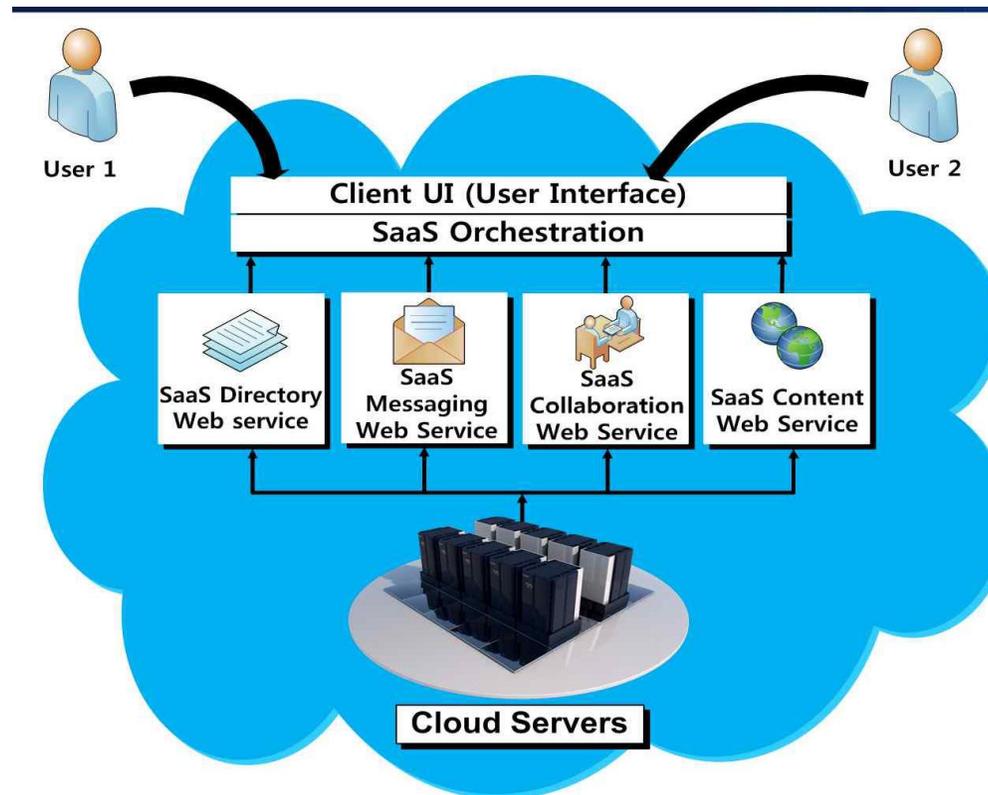
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