Pelatihan ABCD
Modul 5-1: Cloud Computing

Sekolah Teknik Elektro dan Informatika Institut Teknologi Bandung

Unviersitas Singaperbangsa Karawang

Do You Use The Cloud?

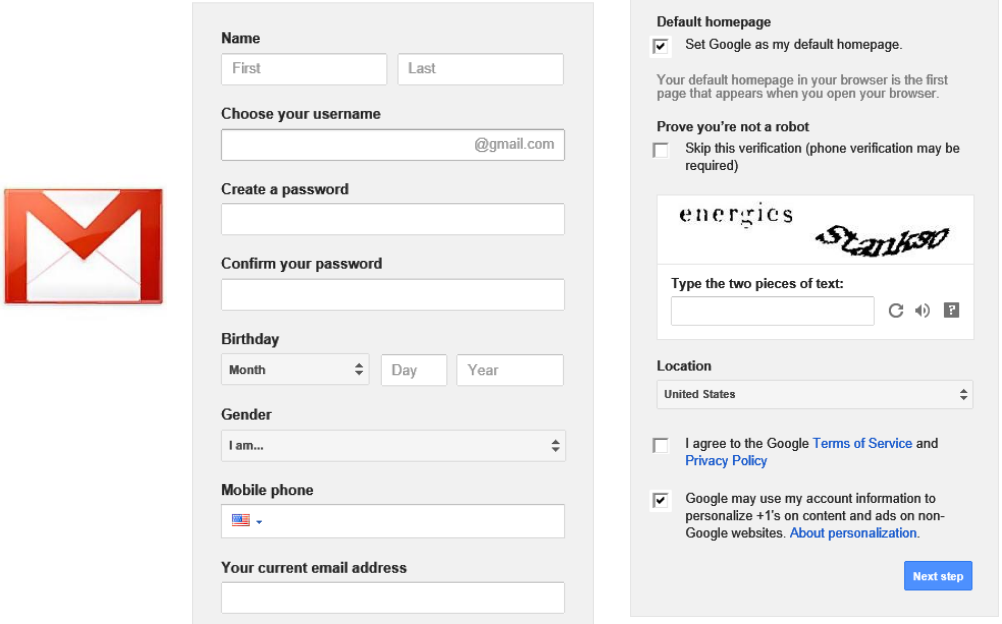
Do you Use the Cloud?

Type of Service

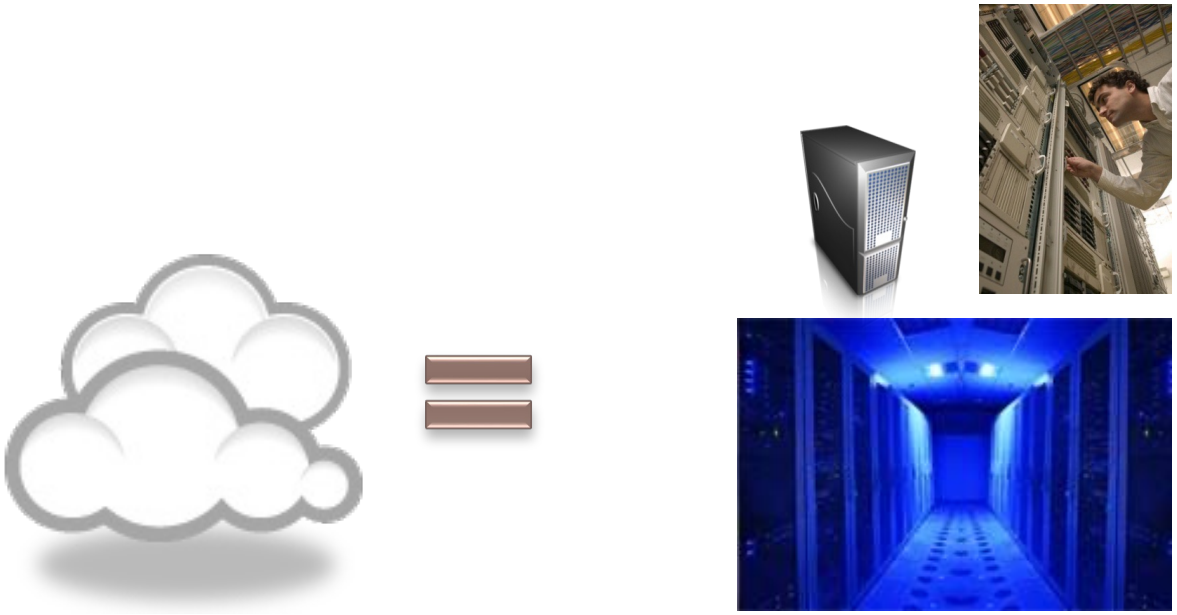
Software as a Service (SaaS) is a software distribution model in which **applications are hosted by a vendor or service provider and made available to customers over a network, typically the Internet.**

The Cloud Requires

- An Internet connection
- An account - Created with a user name and a password
- Agree to Terms



So what is the cloud?



Computing and software resources that are delivered on demand, as service.

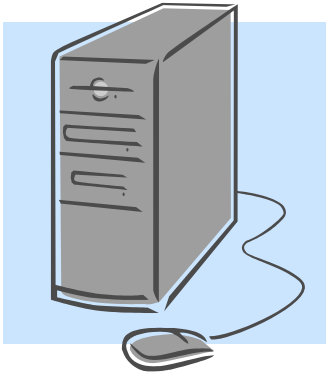
(2013, January) A Walk in the Clouds. *Cloud Computing, CDW-G Reference Guide.*, 3-5.

The Back Story

From Ground to Cloud

Computer Storage

- Computers have internal or hard drive storage (C: Drive)
- CPU has a drive for storing programs, documents, pictures, videos, presentations, etc…



Standard Computer Tower or Central Processing Unit (CPU)

Inside the Computer

Internal Storage

- Content is stored on THAT computer
- To use content must return to THAT computer
- Cannot access this content from another device or computer

Programs

- Purchase programs
- Load to the computer
- Each computer would need the program loaded and stored on the internal drive

External Storage

- Allows your content to become mobile
- Save to the storage device
- Take the device to any compatible computer
- Open and use content

CD/DVD

Thumb Drive

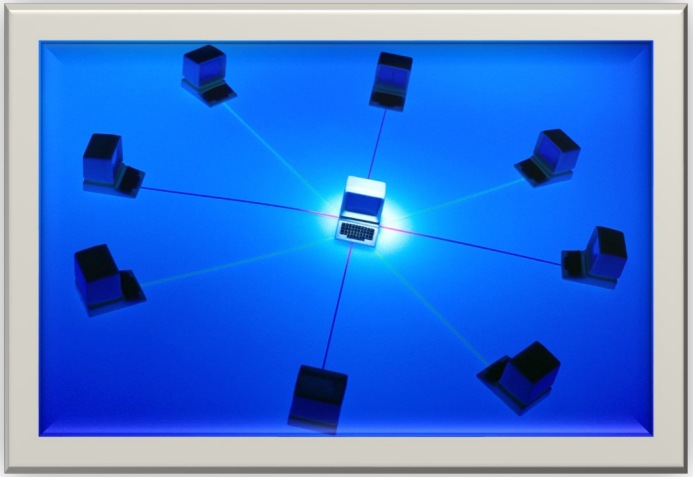
External Hard Drive

SD Card

Micro SD Card

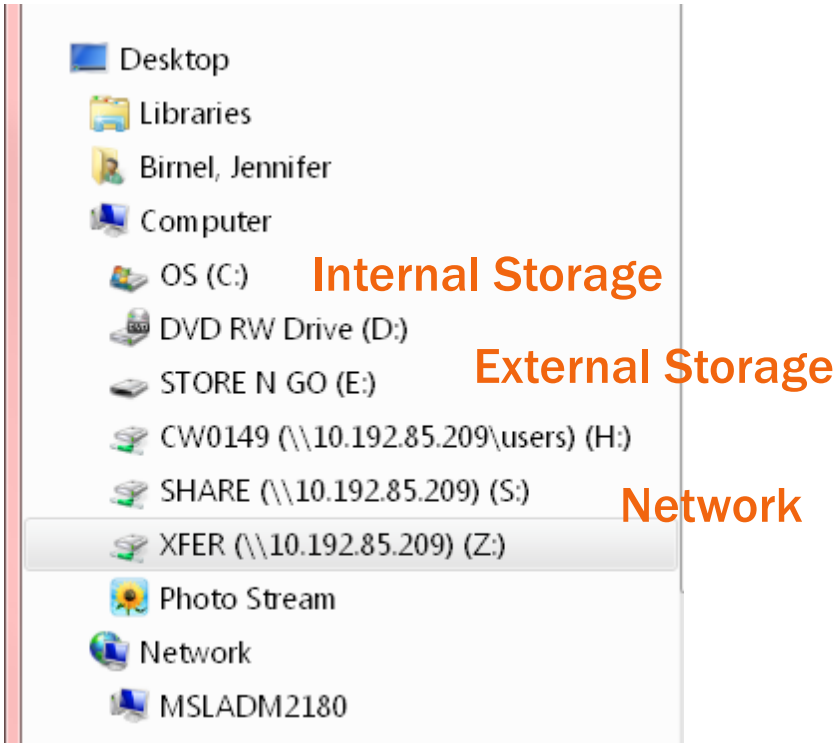
Networked Storage

- Multiple work stations talk to one unit that stores information and data.
- Data is not saved to the C: drive, but to a network drive
- Can retrieve the data stored to the network from any of the connected workstations.



Saving documents

- When you do a “save as” on your computer, you choose where to save the material.



Cloud Storage

- Create an Account – User name and password
- Content lives with the account in the cloud
- Log onto any computer with Wi-Fi to find your content

Downloads for storage

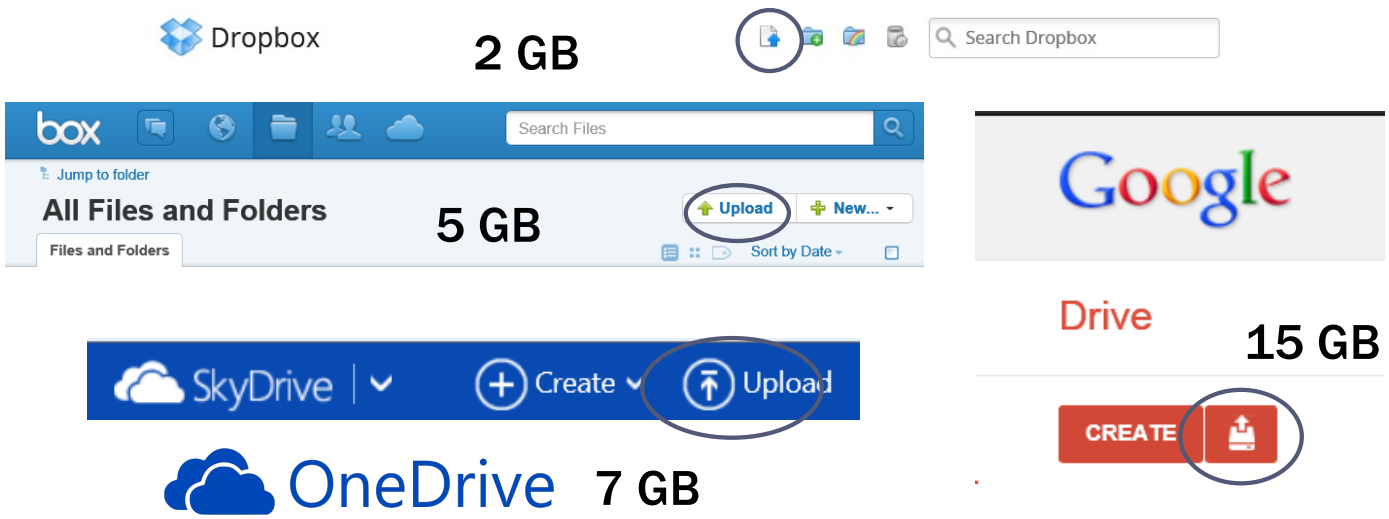
- Download a cloud based app to a computer **you own**
- The app lives on your Computer
- Save files to the app
- When connected to the Internet it will sync with the cloud
- The Cloud can be accessed from any Internet connection

Save file as

- Do “save as” to save a file to your computer and the cloud
- The syncing folders makes data retrieval easier
- Box and DropBox require this download to work

Upload Documents

- Log-in to the online storage account
- Click upload a file
- Find the file on hard drive, network, or external storage
- Upload to cloud storage

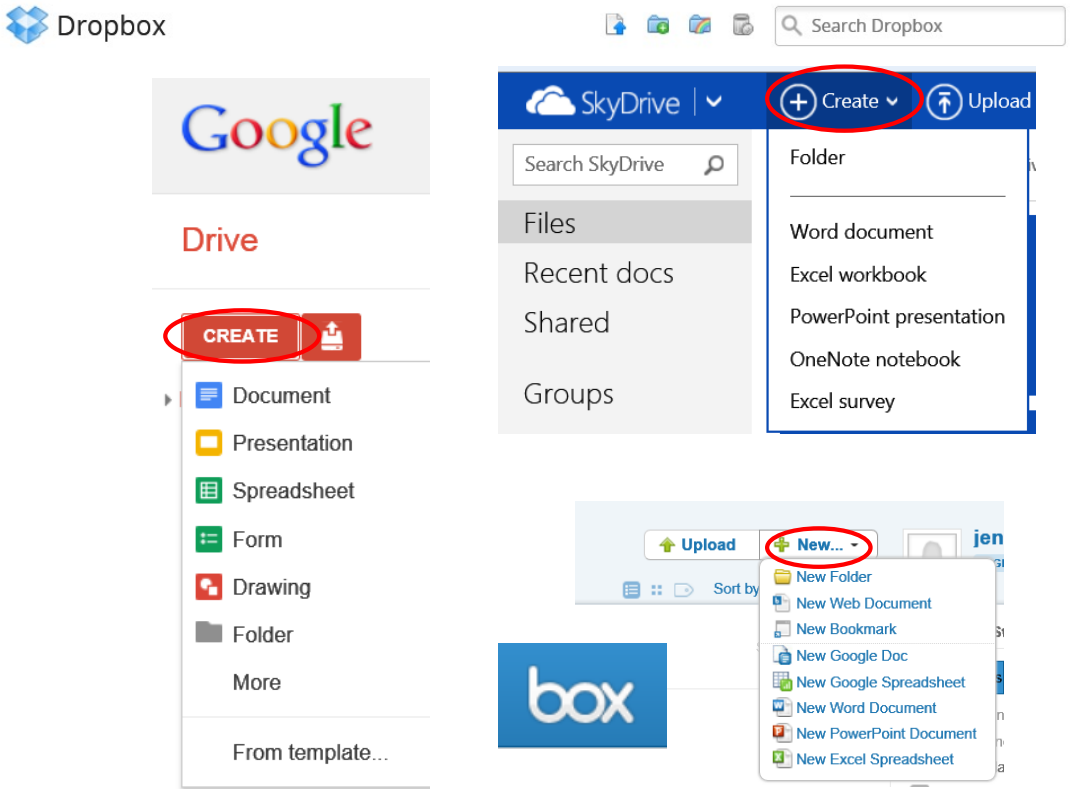


More Than Storage

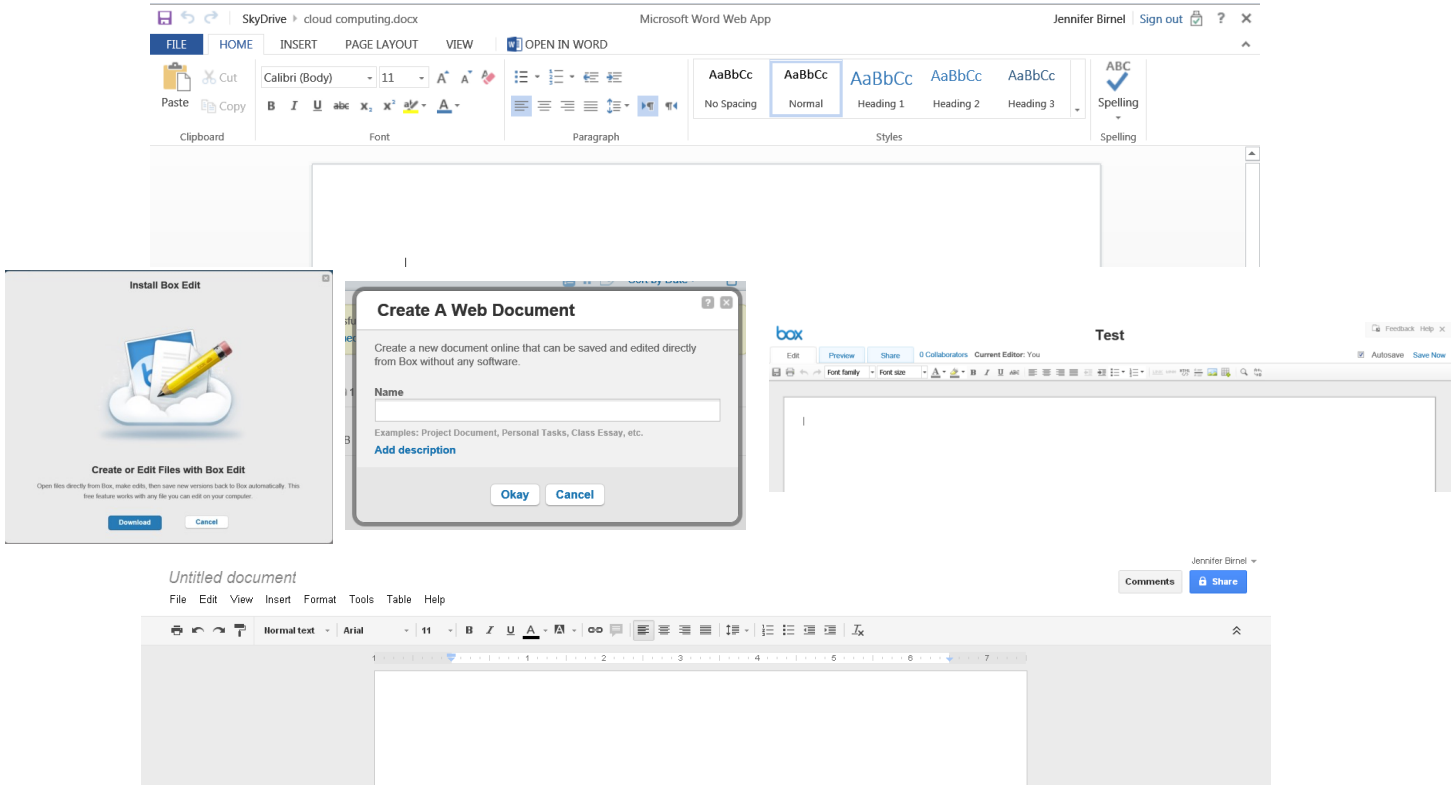
Software and Applications

Document Creation

- Google Docs
- SkyDrive
- Box

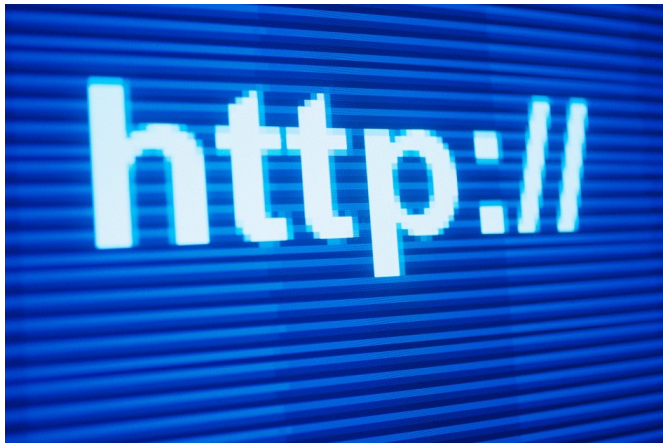


Download required?



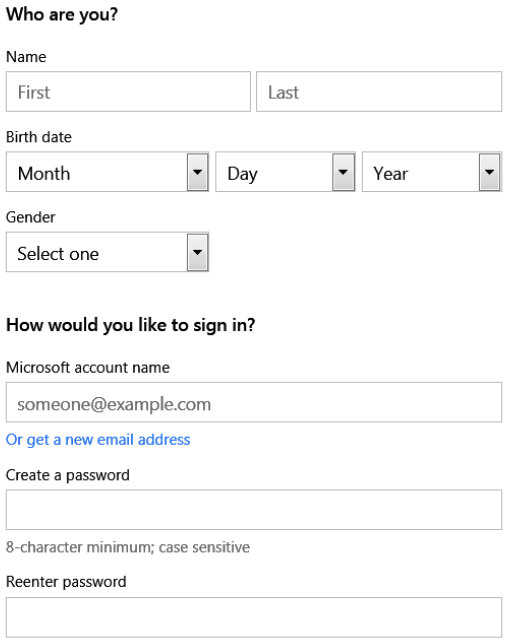
Internet is required

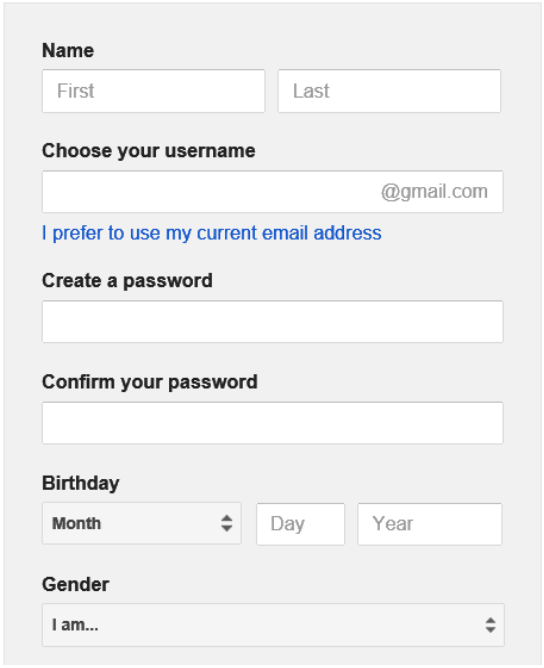
- Creation is happening in the cloud
- Saving is going to the cloud
- To retrieve files, must return to the cloud

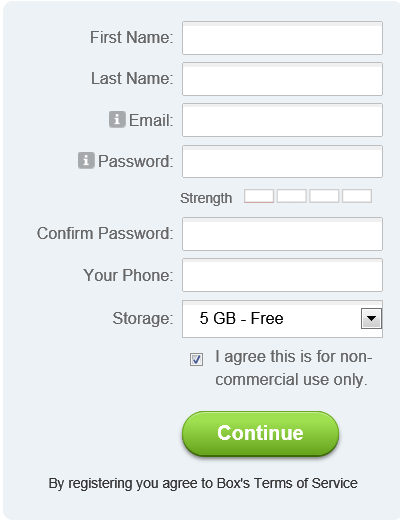


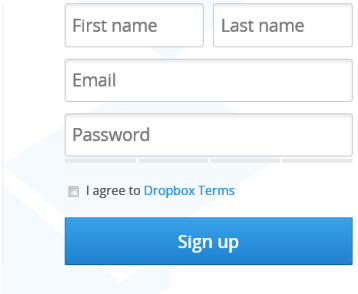
Implications

- What are we comfortable with patrons using?







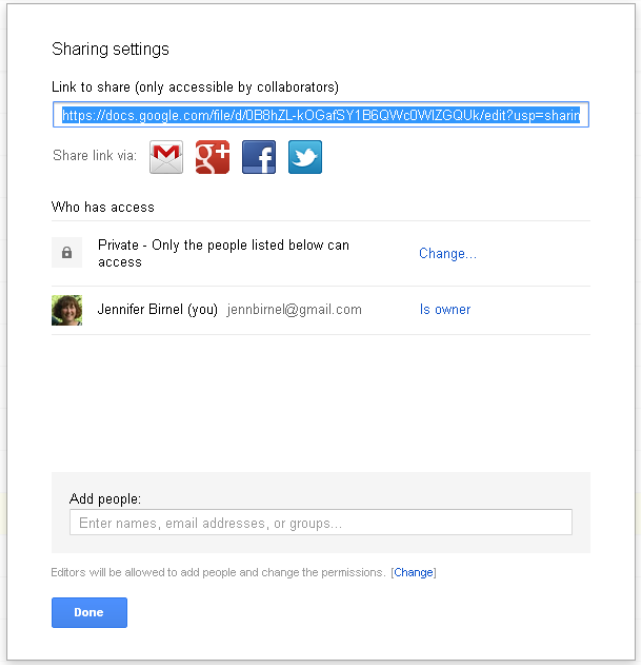


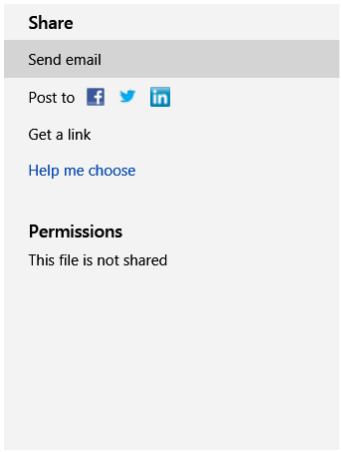
Internet capable Devices

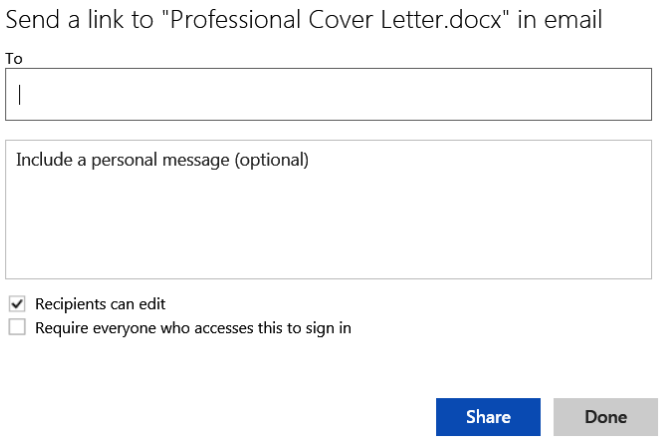
Benefits

- Saving Large Files
- Multiple file types – Photos, videos, presentations, docs
- Back-up of stored files
- File Sharing
- Access from devices
- Nothing to forget (thumb drive, cd)
- Project collaboration

File Sharing







Other Software services

- Photo editing software
- Online banking apps
- Social media apps
- Communication

Library Specific Services

- WorldCat Library Catalog
- M.S.C Library
- Ebsco – E journal Database
- Discover It – Library search tool

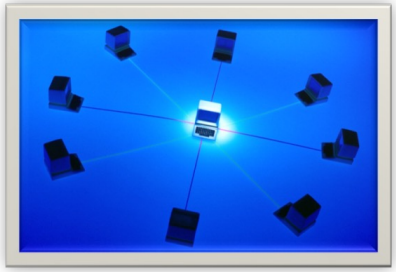
Other Cloud Services

Types of Service

- **Platform as a Service (PaaS)** is a way to rent hardware, operating systems, storage and network capacity over the Internet. **The service delivery model allows the customer to rent virtualized servers and associated services for running existing applications or developing and testing new ones.**

Types of Service

- **Infrastructure as a Service (IaaS)** is a provision model in which an organization outsources the **equipment used to support operations, including storage, hardware, servers and networking components.** The service provider owns the equipment and is responsible for housing, running and maintaining it. The client typically pays on a per-use basis.



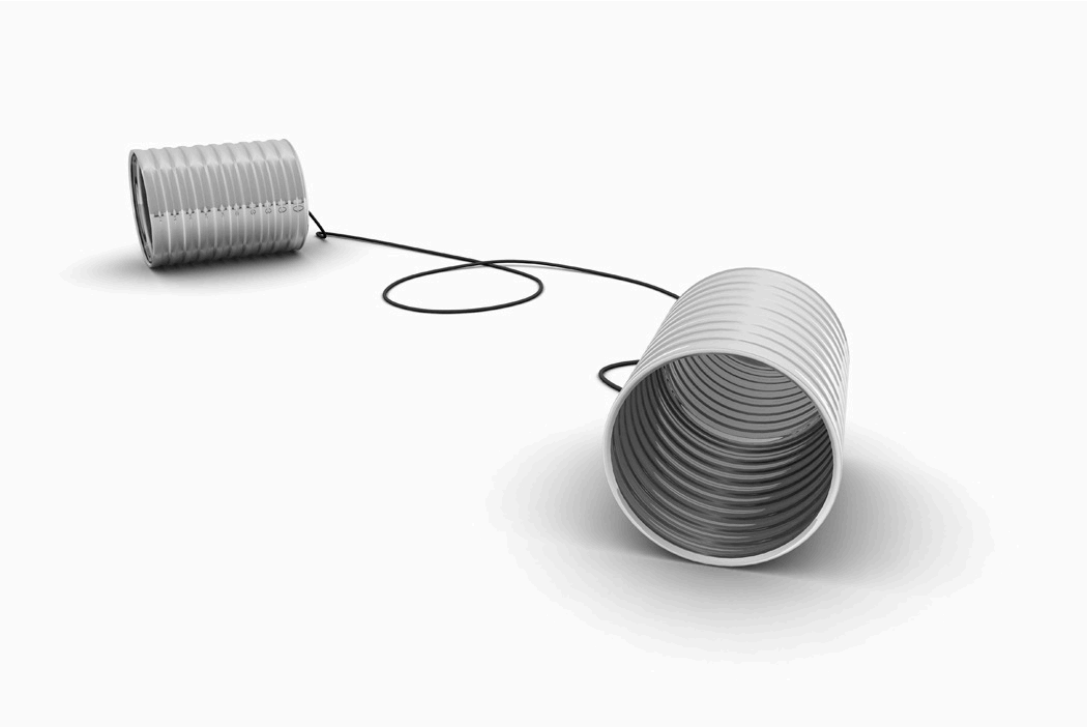
Why the Cloud?

Advantages

- Can be less expensive compared to buying software and hardware
- Can be used from any computer or device with an Internet connection
- The device does not need as large of an internal storage system
- Compatible with most computers and operating systems
- Updates occur across the service

Disadvantages

- Security Issues
- Terms of Service
- Privacy Policies



So What Is Cloud Computing?

Apa kata mereka?

Cloud Disclaimers

- Talk from Oracle CEO ***Larry Ellison***
  - We've redefined Cloud Computing to include everything that we already do. I don't understand what we would do differently other than change the wording of some of our ads.

- Talk from ***Rich Stallman***
  - It's stupidity. It's worse than stupidity: it's a marketing hype campaign. Somebody is saying this is inevitable – and whenever you hear somebody saying that, it's very likely to be a set of businesses campaigning to make it true.

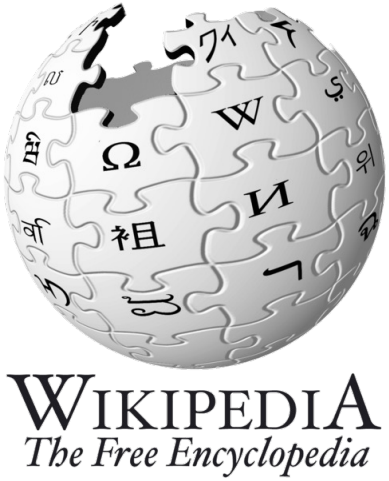
Cloud Definitions

- Definition from ***NIST (National Institute of Standards and Technology)***
  - Cloud computing is a model for enabling 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.
  - This cloud model promotes **availability** and is composed of five essential characteristics, three service models, and four deployment models.

National Institute of Standards and Technology
Technology Administration, U.S. Department of Commerce

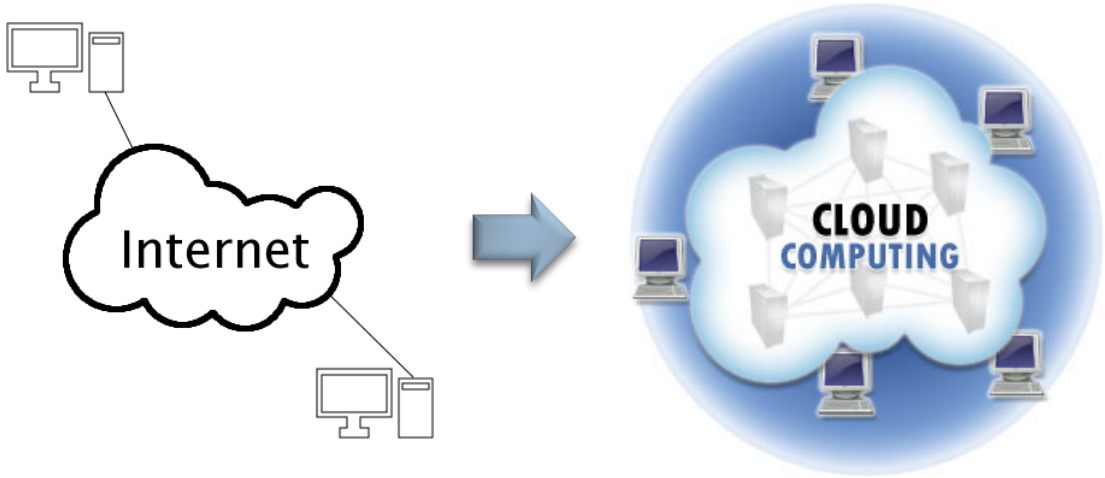
Cloud Definitions

- Definition from ***Wikipedia***
  - Cloud computing is **Internet-based computing**, whereby **shared resources, software, and information** are provided to computers and other devices **on demand**, like the electricity grid.
  - Cloud computing is a style of computing in which **dynamically scalable** and often **virtualized resources** are provided as a **service** over the Internet.



Cloud Definitions

- Definition from ***Whatis.com***
  - The name cloud computing was inspired by the cloud symbol that's often used to represent the Internet in flowcharts and diagrams. Cloud computing is a general term for anything that involves **delivering hosted services over the Internet**.



Cloud Definitions

- Definition from ***Berkeley***
  - Cloud Computing refers to both the applications **delivered as services over the Internet** and the hardware and systems software in the datacenters that provide those services.
  - The services themselves have long been referred to as **Software as a Service (SaaS)**, so we use that term. The datacenter hardware and software is what we will call a Cloud.
  - When a Cloud is made available in a **pay-as-you-go** manner to the public…… The service being sold is **Utility Computing**.

Cloud Definitions

- Definition from ***Buyya***
  - A Cloud is a type of **parallel and distributed system** consisting of a collection of interconnected and **virtualized computers** that are **dynamically provisioned** and presented as one or more unified computing resources based on **service-level agreements** established through negotiation between the service provider and consumers.

Even More Confusing ??

What is Cloud computing ?

Properties and characteristics

In Our Humble Opinion

- Cloud computing is a paradigm of computing, a new way of thinking about IT industry but not any specific technology.
  - Central ideas
    - ***Utility Computing***
    - ***SOA*** - Service Oriented Architecture
    - ***SLA*** - Service Level Agreement
  - Properties and characteristics
    - High ***scalability*** and ***elasticity***
    - High ***availability*** and ***reliability***
    - High ***manageability*** and ***interoperability***
    - High ***accessibility*** and ***portability***
    - High ***performance*** and ***optimization***
  - Enabling techniques
    - Hardware virtualization
    - Parallelized and distributed computing
    - Web service

Service Models

Choose the service you need.

A Simple Analogy

Say, you just moved to a city and you are looking for a place to live.

What is your choice ?

Built a new house ?
Buy an empty house ?
Live in a hotel ?

Let's built a new house !!

You can fully control everything your like your new house to have. But that is a hard work ...

If you buy an empty house ?

You can customize some part of your house.
But never change the original architecture.

How about live in a hotel ?

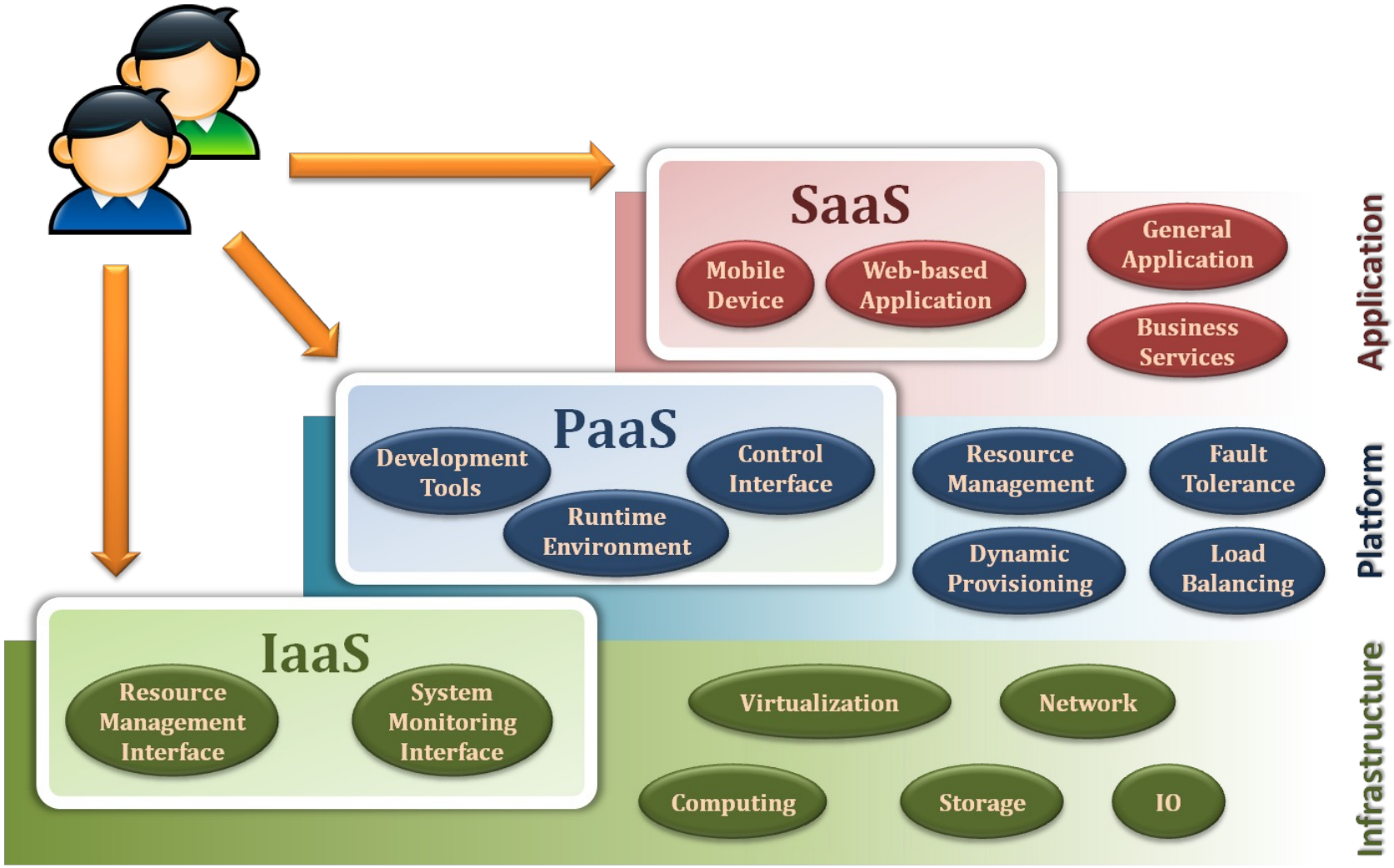
Live in a hotel will be a good idea if the only thing you care is enjoy your life!! There is nothing you can do with the house except living in it.

Let’s translate to Cloud Computing

Service Models Overview

- What if you want to have an IT department ?
  - Similar to ***build a new house*** in previous analogy
    - You can rent some virtualized infrastructure and build up your own IT system among those resources, which may be fully controlled.
    - Technical speaking, use the ***Infrastructure as a Service (IaaS)*** solution.
  - Similar to ***buy an empty house*** in previous analogy
    - You can directly develop your IT system through one cloud platform, and do not care about any lower level resource management.
    - Technical speaking, use the ***Platform as a Service (PaaS)*** solution.
  - Similar to ***live in a hotel*** in previous analogy
    - You can directly use some existed IT system solutions, which were provided by some cloud application service provider, without knowing any detail technique about how these service was achieved.
    - Technical speaking, use the ***Software as a Service (SaaS)*** solution.

Service Model Overview



Service Models

Infrastructure as a Service

Platform as a Service

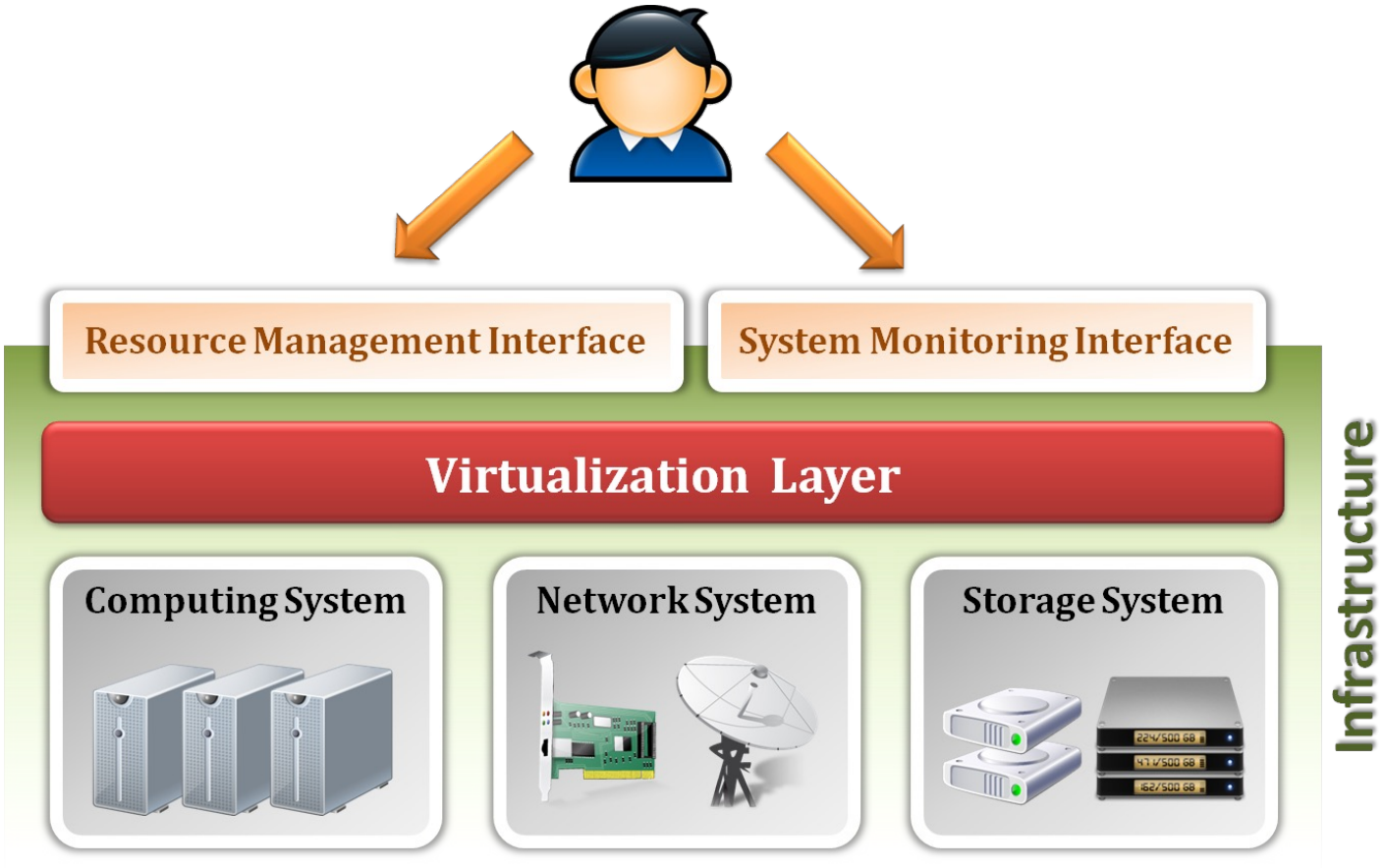
Software as a Service

Infrastructure as a Service

- Infrastructure as a Service - IaaS
  - 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, deployed applications, and possibly limited control of select networking components .
- Examples :
  - Amazon EC2, Eucalyputs, OpenNebula
  - … etc

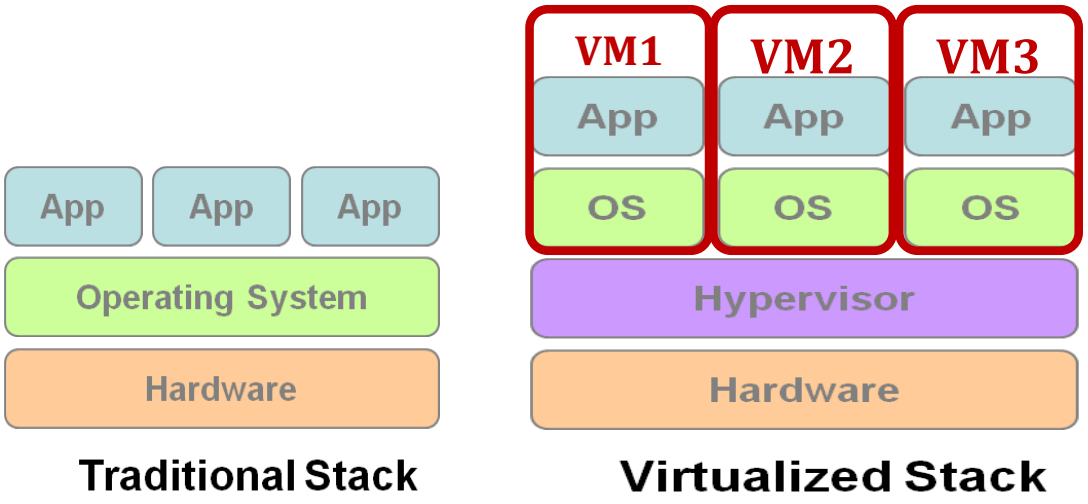
Infrastructure as a Service

- System architecture :



Infrastructure as a Service

- Enabling technique - ***Virtualization***
  - Virtualization is an abstraction of logical resources away from underlying physical resources.
    - Virtualization technique shift OS onto hypervisor.
    - Multiple OS share the physical hardware and provide different services.
    - Improve utilization, availability, security and convenience.



Infrastructure as a Service

- Properties supported by virtualization technique :
  - Manageability and Interoperability
  - Availability and Reliability
  - Scalability and Elasticity

Infrastructure as a Service

- Provide service –**Resource Management Interface**
  - Several types of virtualized resource :
    - ***Virtual Machine*** – As an IaaS provider, we should be able to provide the basic virtual machine operations, such as *creation*, *suspension*, *resumption* and *termination*, …etc.
    - ***Virtual Storage*** – As an IaaS provider, we should be able to provide the basic virtual storage operations, such as *space allocation*, *space release*, *data writing* and *data reading*, …etc.
    - ***Virtual Network*** – As an IaaS provider, we should be able to provide the basic virtual network operations, such as *IP address allocation*, *domain name register*, *connection establishment* and *bandwidth provision*, …etc.

Infrastructure as a Service

- Provide service – **System Monitoring Interface**
  - Several types of monitoring metrics :
    - ***Virtual Machine*** – As an IaaS provider, we should be able to monitor some system states of each virtual machine, such as *CPU loading*, *memory utilization*, *IO loading* and *internal network loading*, …etc.
    - ***Virtual Storage*** – As an IaaS provider, we should be able to monitor some storage states of each virtual storage, such as *virtual space utilization*, *data duplication* and *storage device access bandwidth*, …etc.
    - ***Virtual Network*** – As an IaaS provider, we should be able to monitor some network states of each virtual network, such as *virtual network bandwidth*, *network connectivity* and *network load balancing*, …etc.

IaaS - Summary

- **IaaS is the deployment platform that abstract the infrastructure.**

- IaaS enabling technique
  - Virtualization
    - Server Virtualization
    - Storage Virtualization
    - Network Virtualization

- IaaS provided services
  - Resource Management Interface
  - System Monitoring Interface

Service Models

Infrastructure as a Service

Platform as a Service

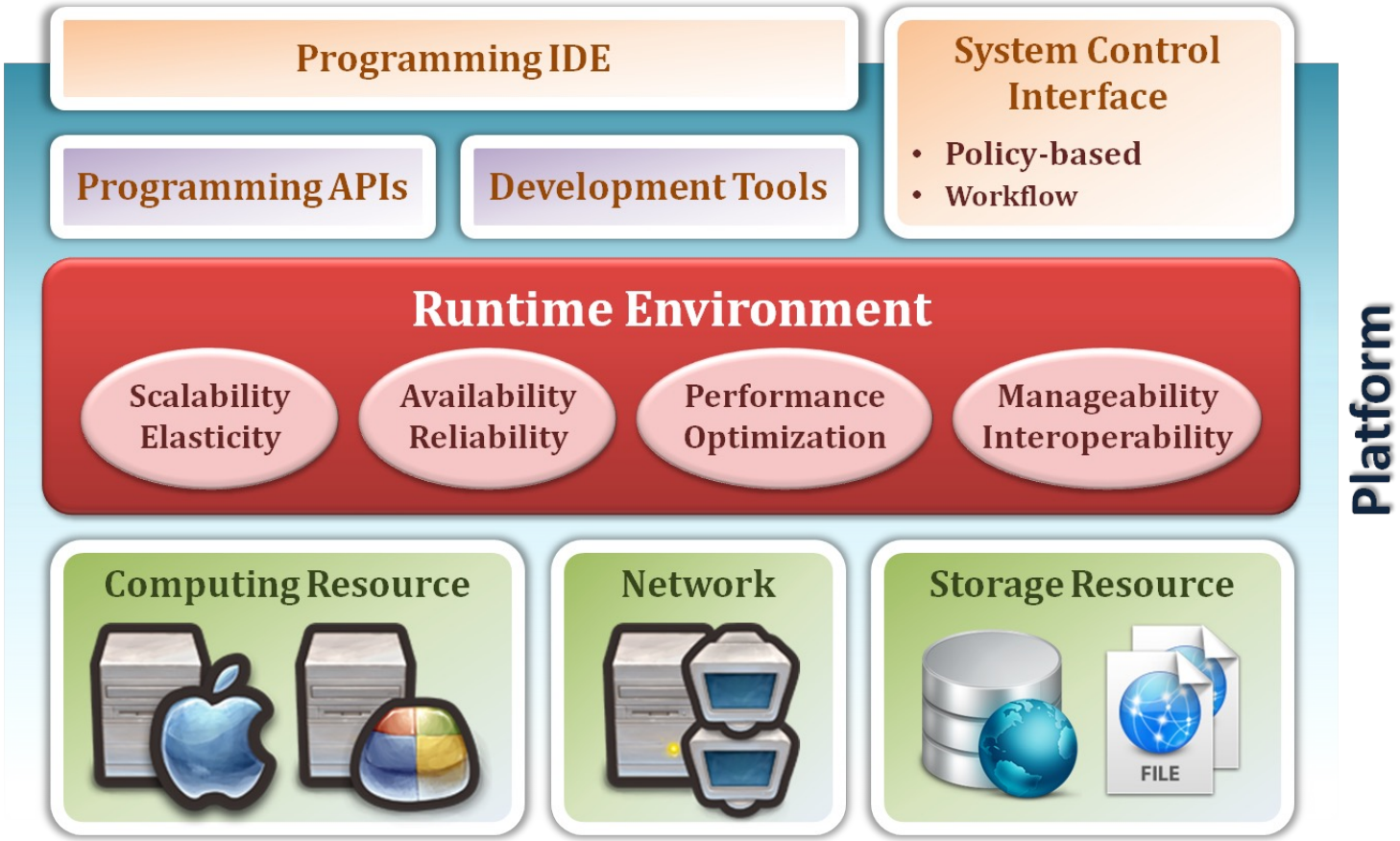
Software as a Service

Platform as a Service

- Platform as a Service - PaaS
  - The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages 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 application hosting environment configurations.
- Examples :
  - Microsoft Windows Azure, Google App Engine, Hadoop
  - … etc

Platform as a Service

- System architecture :



Platform as a Service

- Enabling technique – **Runtime Environment Design**
  - Runtime environment refers to collection of software services available. Usually implemented by a collection of program libraries.
- Common properties in Runtime Environment :
  - Manageability and Interoperability
  - Performance and Optimization
  - Availability and Reliability
  - Scalability and Elasticity

Platform as a Service

- Provide service – **Programming IDE**
  - Users make use of programming IDE to develop their service among PaaS.
    - This IDE should integrate the full functionalities which supported from the underling runtime environment.
    - This IDE should also provide some development tools, such as profiler, debugger and testing environment.
  - The programming APIs supported from runtime environment may be various between different cloud providers, but there are still some common operating functions.
    - Computation, storage and communication resource operation

Platform as a Service

- Provide service – **System Control Interface**
  - Policy-Based Control
    - Typically described as a principle or rule to guide decisions and achieve rational outcome(s)
    - Make the decision according to some requirements
  - Workflow Control
    - Describe the flow of installation and configuration of resources
    - Workflow processing daemon delivers speed and efficient construction and management of cloud resources

PaaS - Summary

- **PaaS is the development platform that abstract the infrastructure, OS, and middleware to drive developer productivity.**

- PaaS enabling technique
  - Runtime Environment

- PaaS provide services
  - Programming IDE
    - Programming APIs
    - Development tools
  - System Control Interface
    - Policy based approach
    - Workflow based approach

Service Models

Infrastructure as a Service

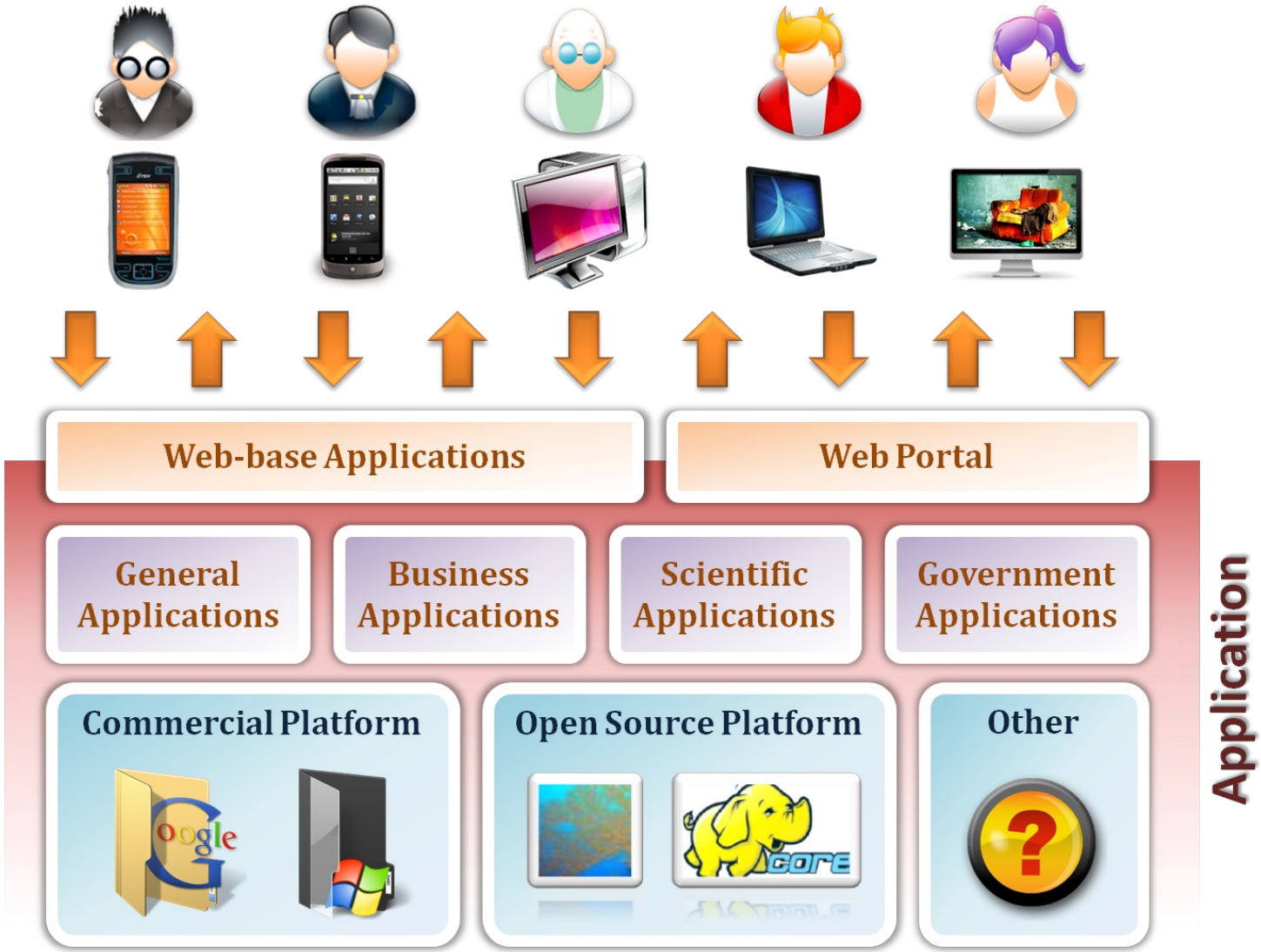
Platform as a Service

Software as a Service

Software as a Service

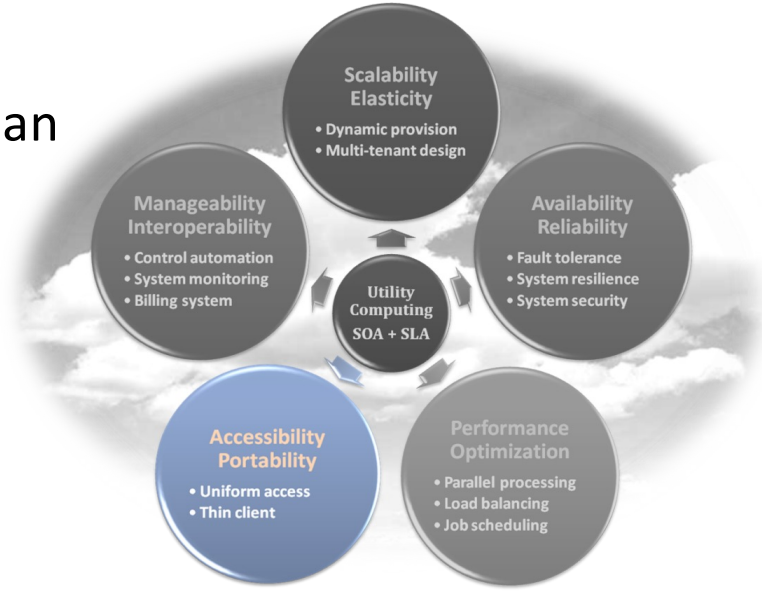
- Software as a Service - SaaS
  - The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a web browser (e.g., web-based email).
  - The consumer 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.
- Examples :
  - Google Apps (e.g., Gmail, Google Docs, Google sites, …etc)
  - SalesForce.com, EyeOS, … etc

Software as a Service



Software as a Service

- Enabling Technique – **Web Service**
  - Web 2.0 is the trend of using the full potential of the web
    - Viewing the Internet as a computing platform
    - Running interactive applications through a web browser
    - Leveraging interconnectivity and mobility of devices
    - Enhanced effectiveness with greater human participation
- Properties provided by Internet :
  - Accessibility and Portability



Software as a Service

- Provide service – **Web-based Applications**
  - Conventional applications should translate their access interface onto web-based platform.
  - Applications in different domains
    - ***General Applications*** – Applications which are designed for general propose, such as office suit, *multimedia* and *instant message*, …etc.
    - ***Business Applications*** – Application which are designed for business propose, such as *ERP*, *CRM* and *market trading system*, …etc.
    - ***Scientific Applications*** – Application which are designed for scientific propose, such as *aerospace simulation* and *biochemistry simulation*, …etc.
    - ***Government Applications*** – Applications which are designed for government propose, such as *national medical system* and *public transportation system service*, …etc.

Software as a Service

- Provide service – **Web Portal**
  - Apart from the standard search engine feature, web portals offer other services such as e-mail, news, stock prices, information, databases and entertainment.
  - Portals provide a way for enterprises to provide a consistent look and feel with access control and procedures for multiple applications and databases, which otherwise would have been different entities altogether.
  - Some examples :
    - iGoogle
    - MSNBC
    - Netvibes
    - Yahoo!

SaaS - Summary

- **SaaS is the finished applications that you rent and customize.**

- SaaS enabling technique
  - Web Service

- SaaS provide services
  - Web-based Applications
    - General applications
    - Business applications
    - Scientific applications
    - Government applications
  - Web Portal

Deployment models

How to deploy a cloud system ?

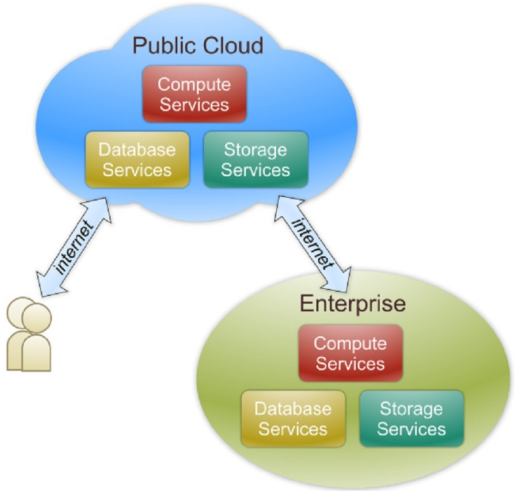
Deployment Model

- There are four primary cloud deployment models :
  - Public Cloud
  - Private Cloud
  - Community Cloud
  - Hybrid Cloud

- Each can exhibit the previously discussed characteristics; their differences lie primarily in the scope and access of published cloud services, as they are made available to service consumers.

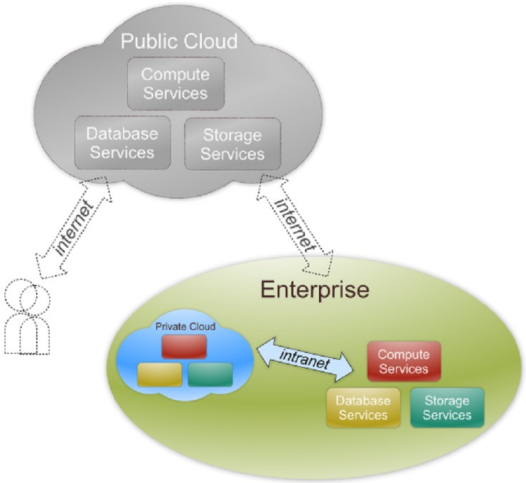
Public Cloud

- Public cloud definition
  - The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.
  - Also known as external cloud or multi-tenant cloud, this model essentially represents a cloud environment that is openly accessible.
  - Basic characteristics :
    - Homogeneous infrastructure
    - Common policies
    - Shared resources and multi-tenant
    - Leased or rented infrastructure
    - Economies of scale



Private Cloud

- Private cloud definition
  - 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.
  - Also referred to as internal cloud or on-premise cloud, a private cloud intentionally limits access to its resources to service consumers that belong to the same organization that owns the cloud.
  - Basic characteristics :
    - Heterogeneous infrastructure
    - Customized and tailored policies
    - Dedicated resources
    - In-house infrastructure
    - End-to-end control



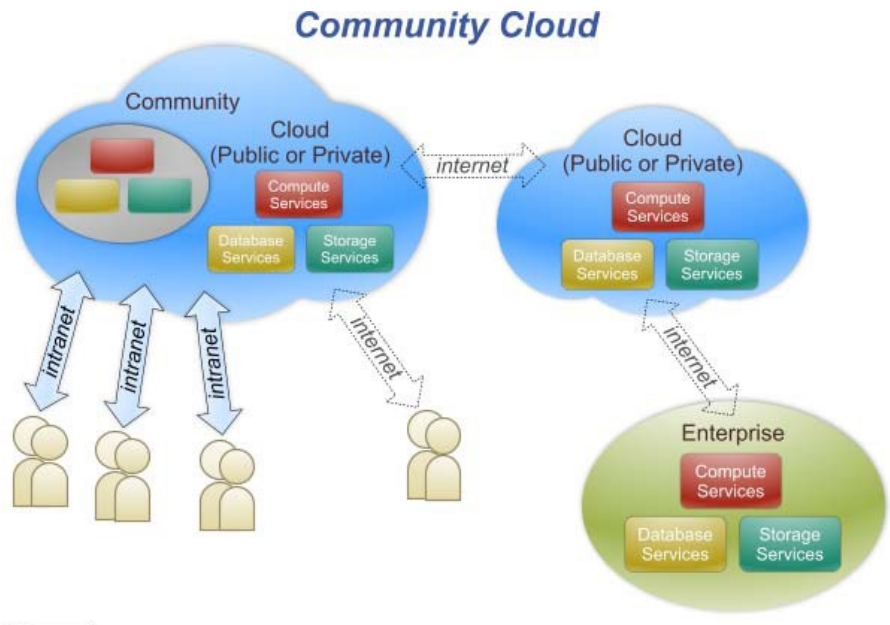
Public vs. Private

- Comparison :

	Public Cloud	Private Cloud
Infrastructure	*Homogeneous*	*Heterogeneous*
Policy Model	*Common defined*	*Customized & Tailored*
Resource Model	*Shared & Multi-tenant*	*Dedicated*
Cost Model	*Operational expenditure*	*Capital expenditure*
Economy Model	*Large economy of scale*	*End-to-end control*

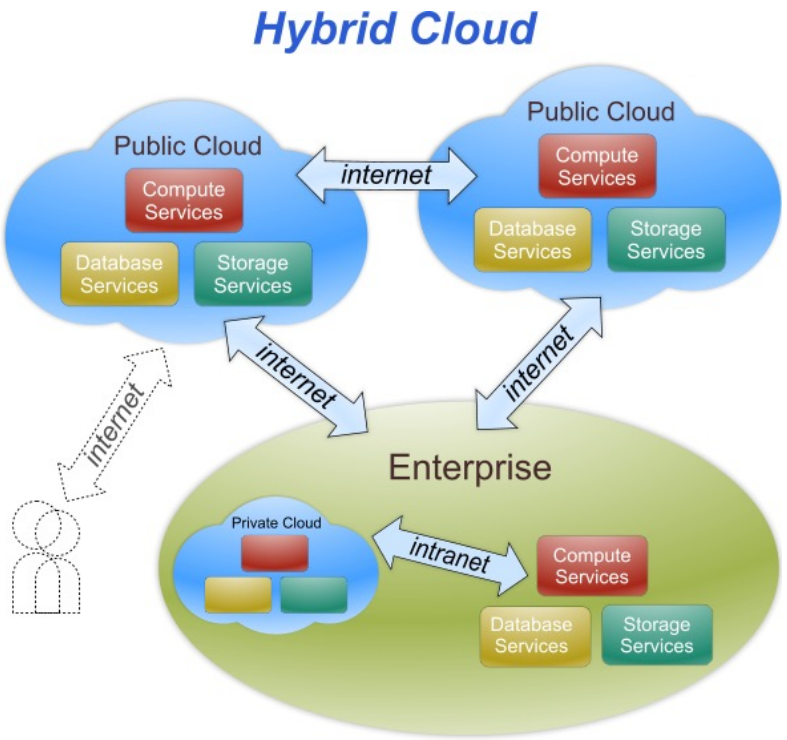
Community Cloud

- Community cloud definition
  - The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations).

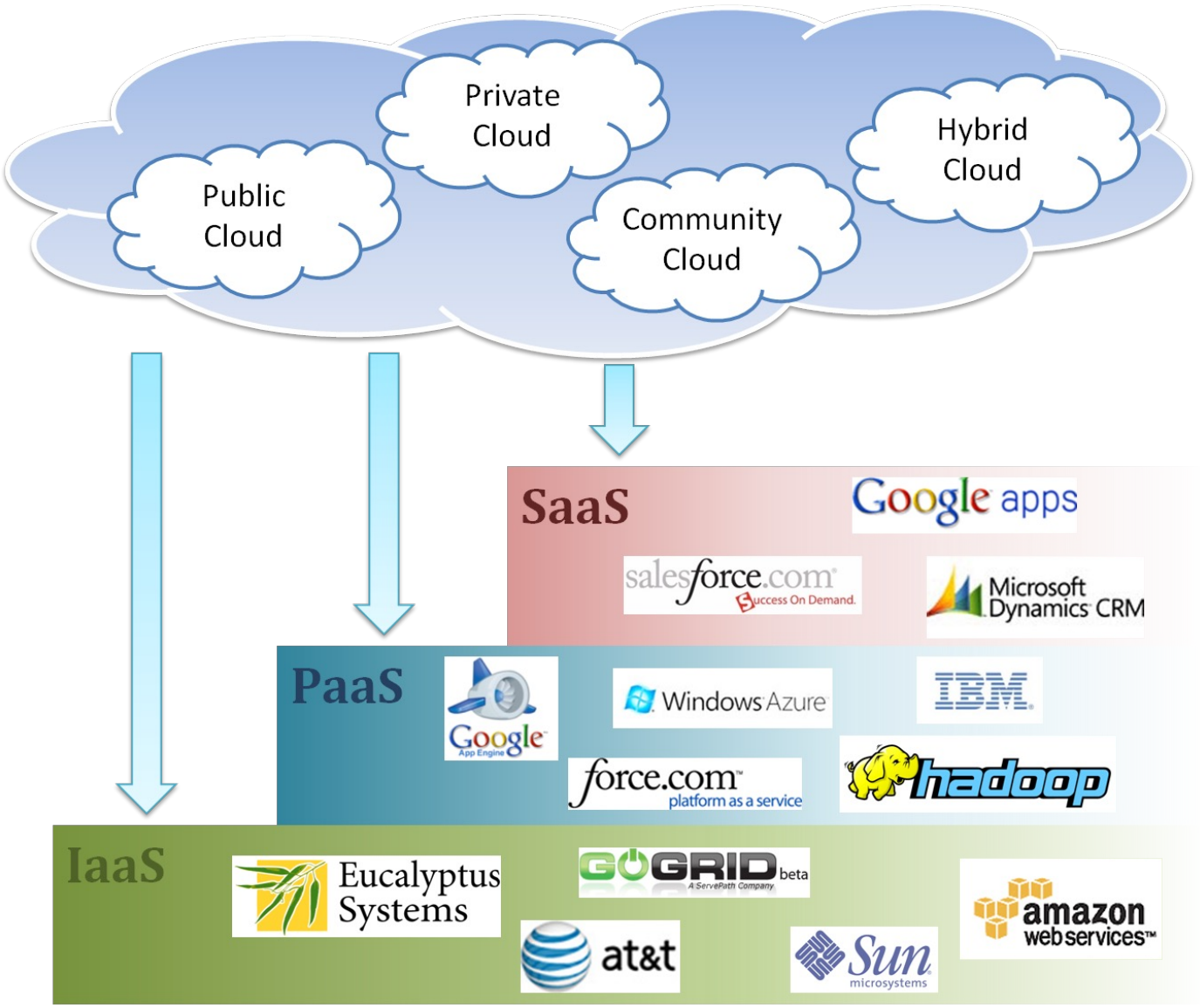


Hybrid Cloud

- Hybrid cloud definition
  - The cloud infrastructure is a composition of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load-balancing between clouds).



Cloud Ecosystem



Summary

- What is cloud computing in your mind
  - Clear or Cloudy?
- Cloud computing is a new paradigm shift of computing
- Cloud computing can provide high quality of properties and characteristics based on essentially central ideas
- Service models and deployment models provide services that can be used to
  - Rent fundamental computing resources
  - Deploy and develop customer-created applications on clouds
  - Access provider's applications over network (wired or wireless)