INTRODUCTION TO CLOUD COMPUTING

EXISTING PROBLEMS

Application

Platform
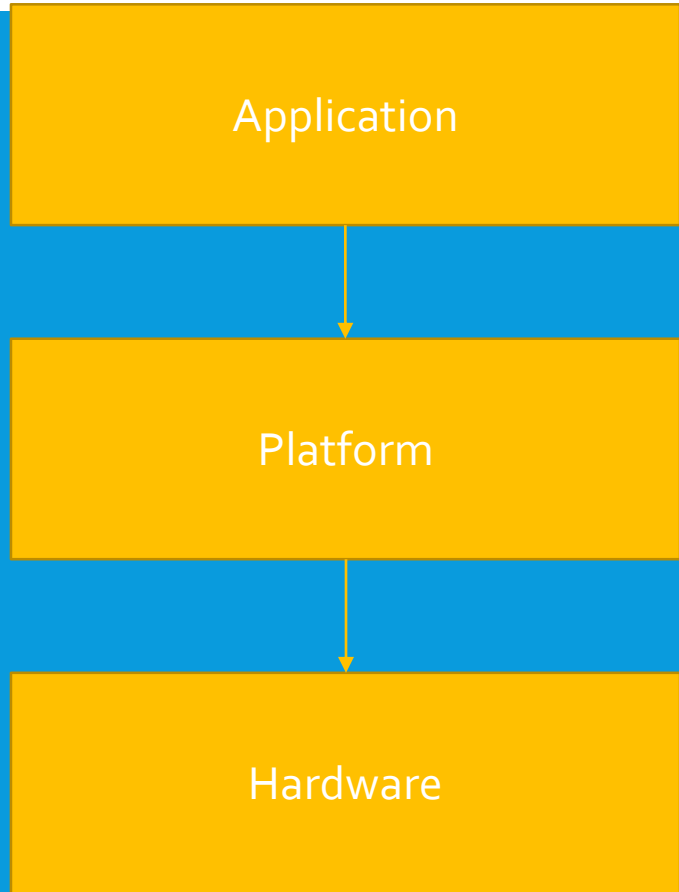
Hardware

Traditional IT Management
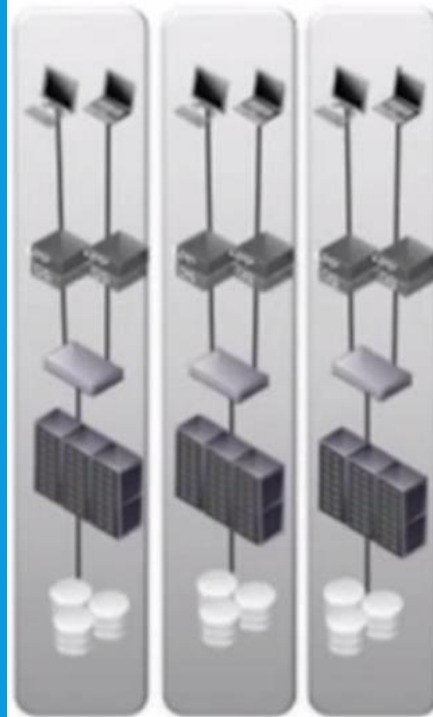
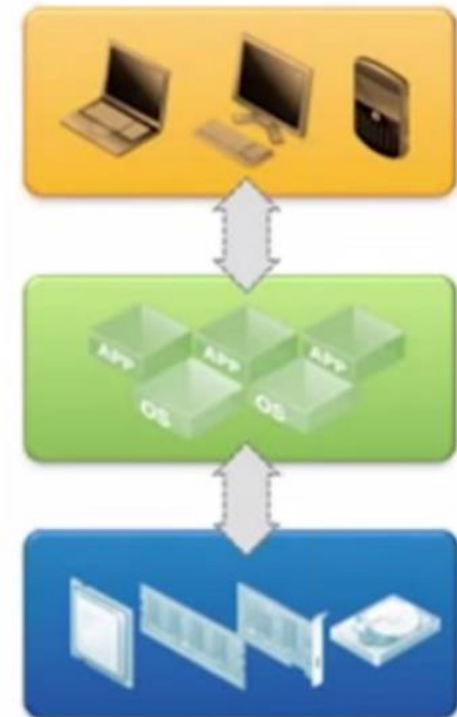**Cloud Management**

Business agility suffers

IT able to keep up with speed of the business

CONTENTS

- What is cloud computing

- Key technologies enabling cloud computing
  - Hardware
  - Internet technologies
  - Distributed computing
  - System management

- Layers of cloud computing

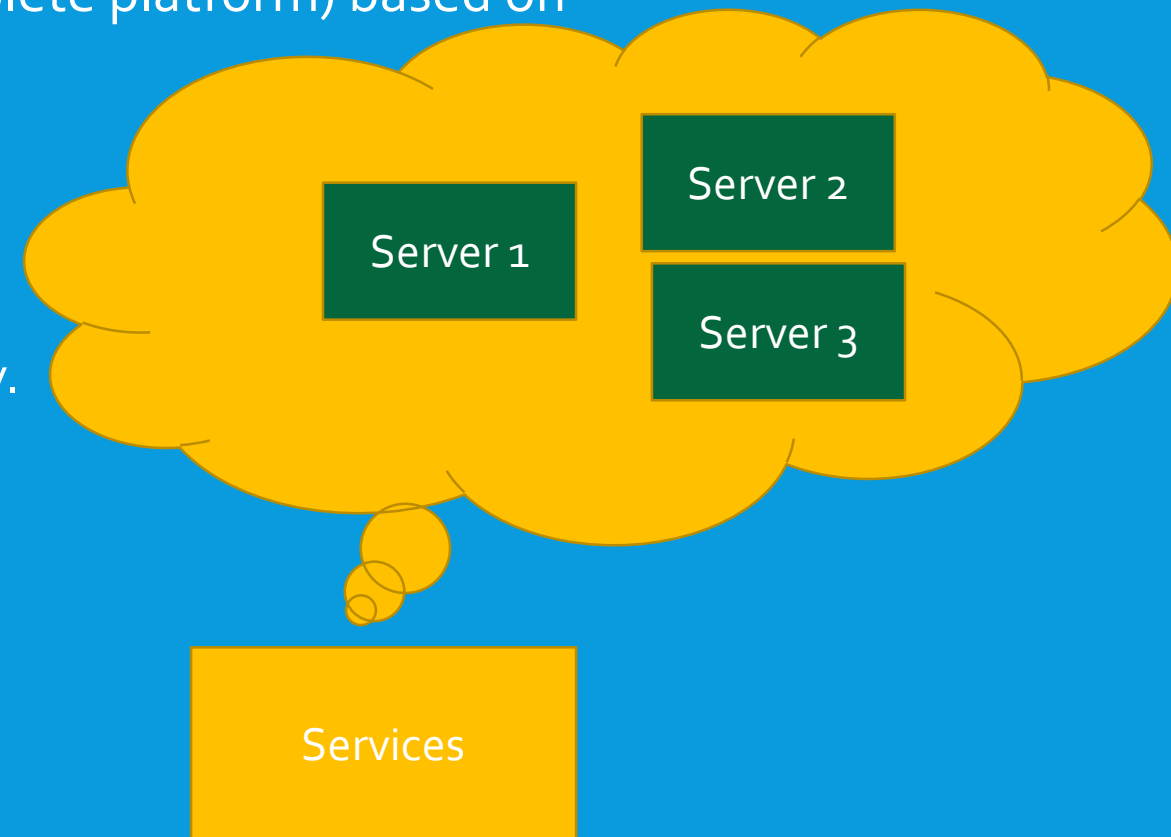- Types of cloud computing

- Cloud Services

WHAT IS CLOUD COMPUTING

- The cloud itself is a set of hardware, networks, storage, services, and interfaces.
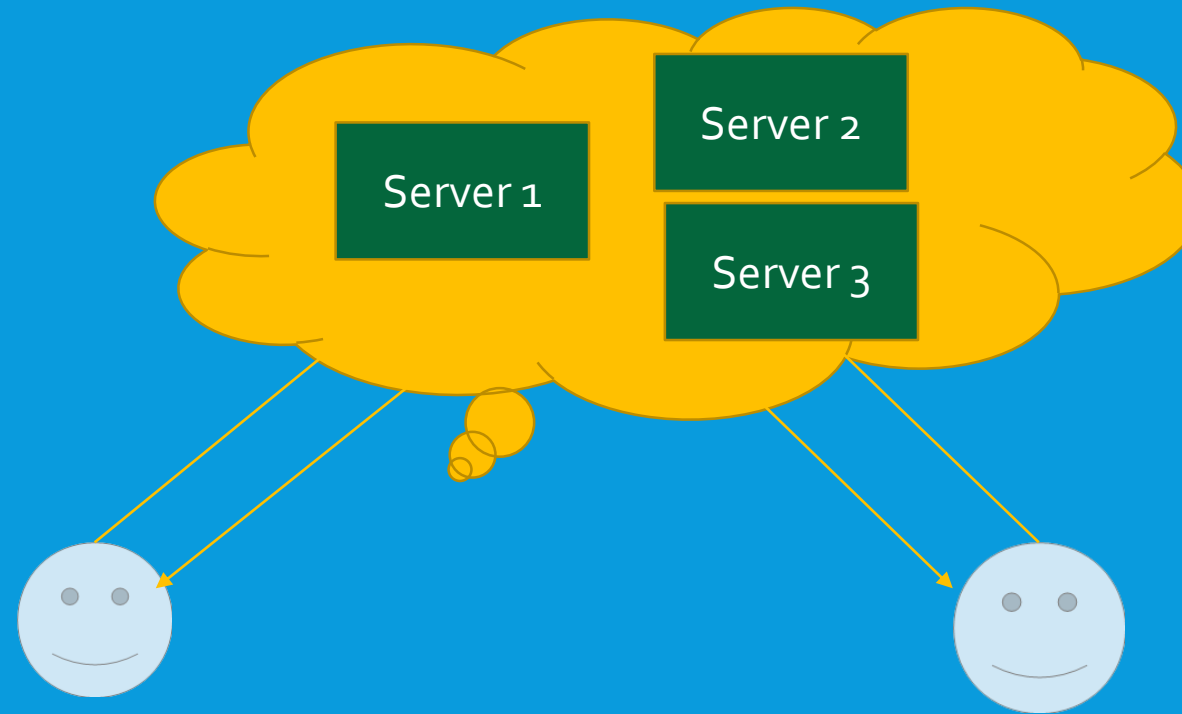
WHAT IS CLOUD COMPUTING

- Cloud services include the delivery of software, infrastructure, and storage over the Internet (either as separate components or a complete platform) based on user demand

- Cloud services like:
  - Social network (Facebook, Twitter, LinkedIn)
  - Collaboration tools (Video conference, Webniar)
 - → Changing the way people in businesses access, delivery.

Server 1

Server 2

Server 3

Services

WHAT IS CLOUD COMPUTING

- Buyya have defined: "Cloud is a parallel and distributed computing system consisting of a collection of inter-connected and virtualised computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements (SLA) established through negotiation between the service provider and consumers."

- The National Institute of Standards and Technology (NIST) characterizes cloud computing as "...a pay-per-use model for enabling available, convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

- → IT as a Service

KEY TECHNOLOGIES ENABLING CLOUD COMPUTING

- Hardware
  - Virtualization
  - Multi-core chips

- Internet Technologies
  - Web services
  - SOA
  - Web 2.0

- Distributed computing
  - Clusters, Grids

- Systems management
  - Autonomic computing
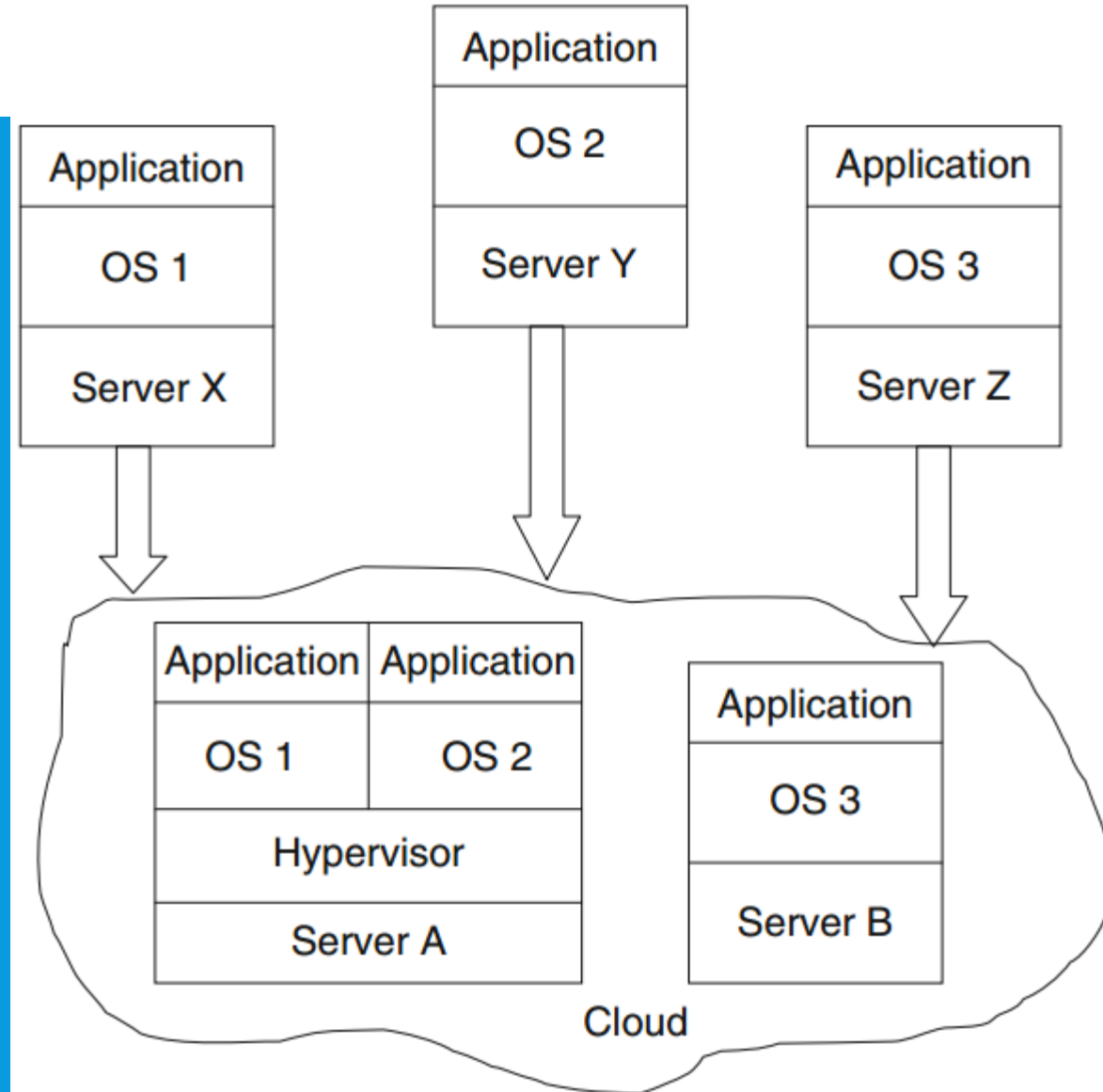 - Data center automation
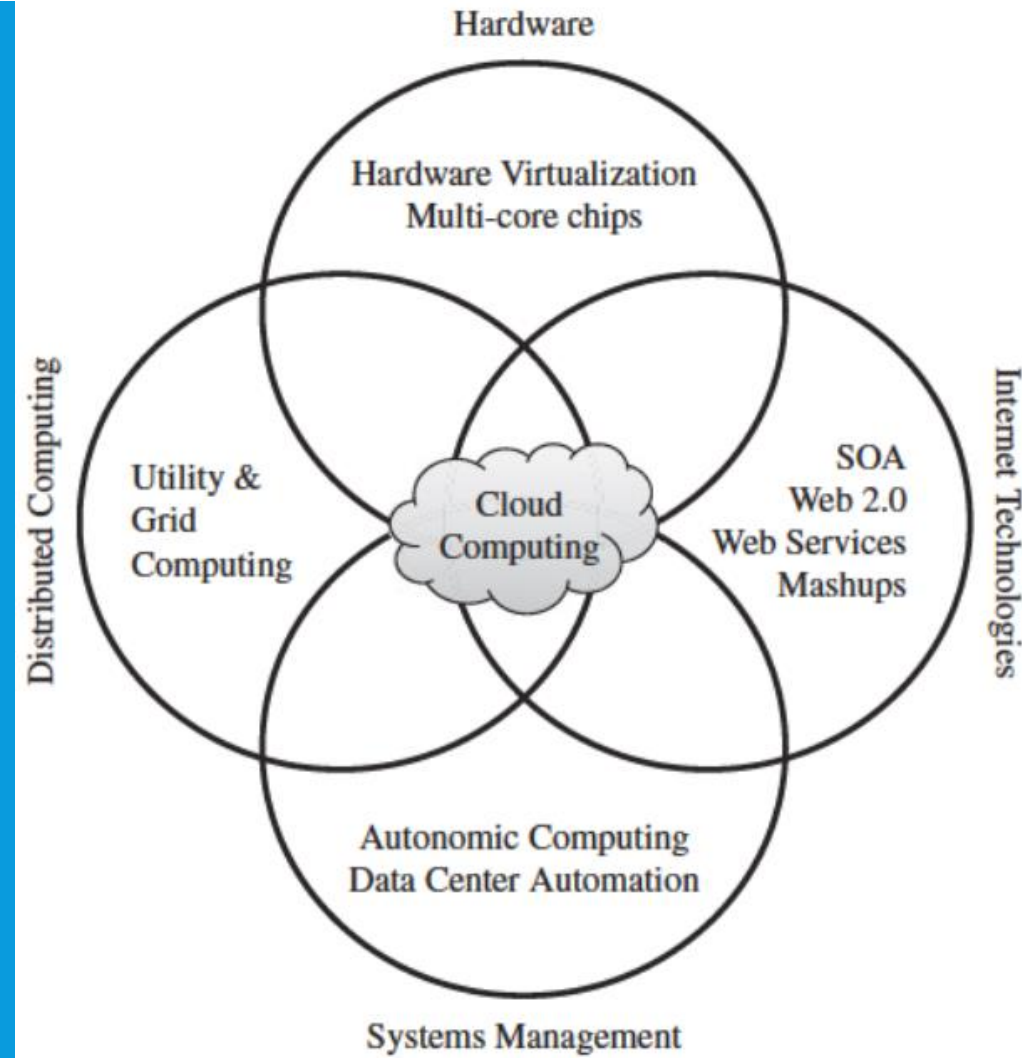
VIRTUALIZATION

- Hardware virtualization allows running multiple operating systems on a single physical platform.

- Hypervisor or Virtual machine monitor
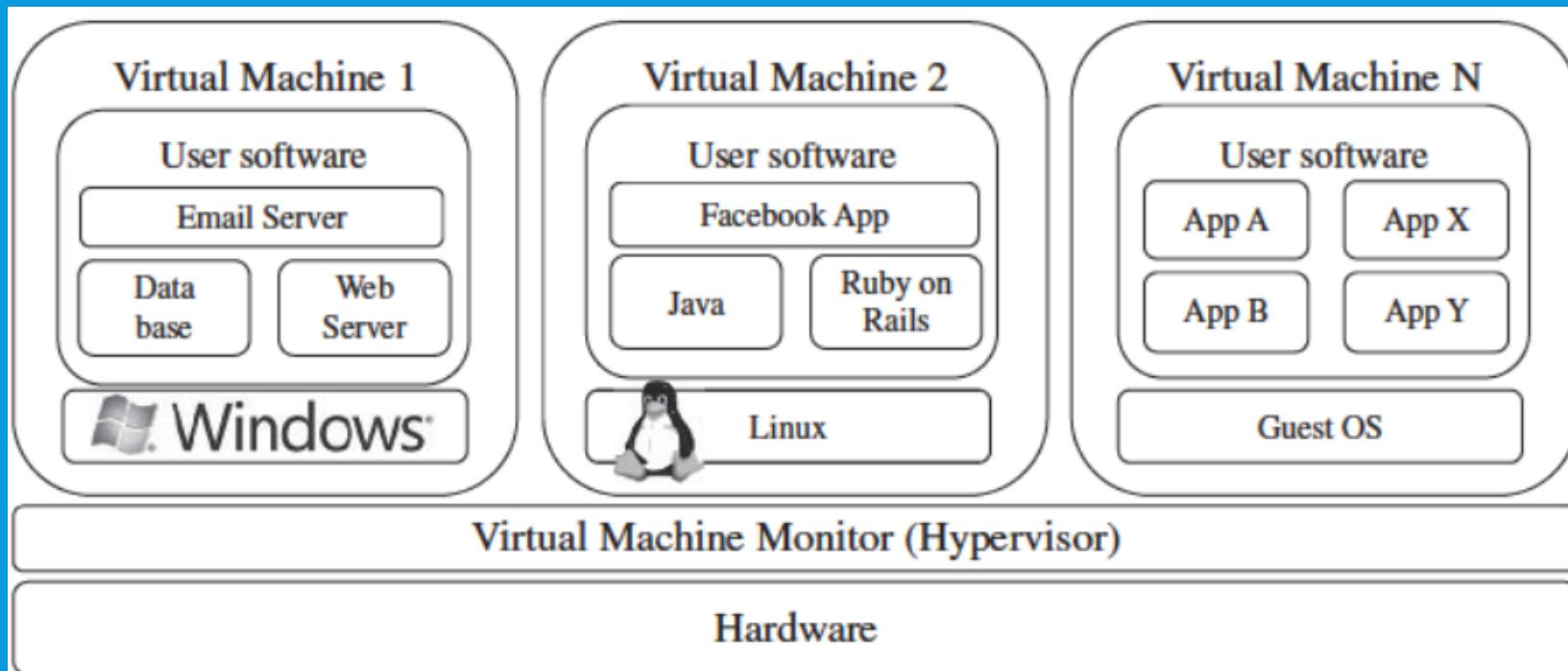
VIRTUALIZATION

- VMM platforms:
  - VMWare ESXi
 - Xen (both commercial and open source)

INTERNET TECHNOLOGIES

- WS (Web services) enable information from one application to be made available to other over the Internet.

- SOA: Software resources are packed as services that well defined, self-contained module.
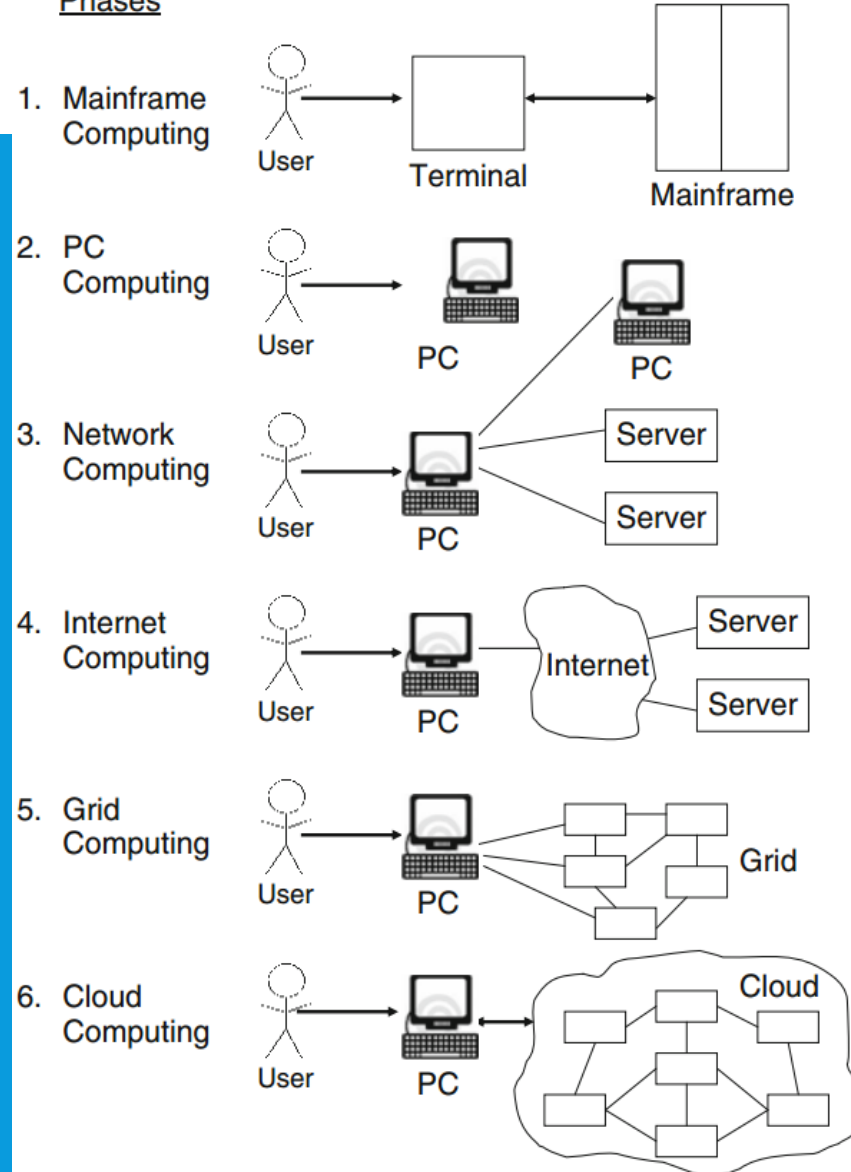
- Web 2.0, Mashup,…

- Improve systems by decreasing human involvement in their operation

- IBM's Autonomic Computing Initiative defined 4 properties of autonomic system:
  - Self-Configuration
  - Self-Optimization
  - Self-Healing
  - Self-Protection
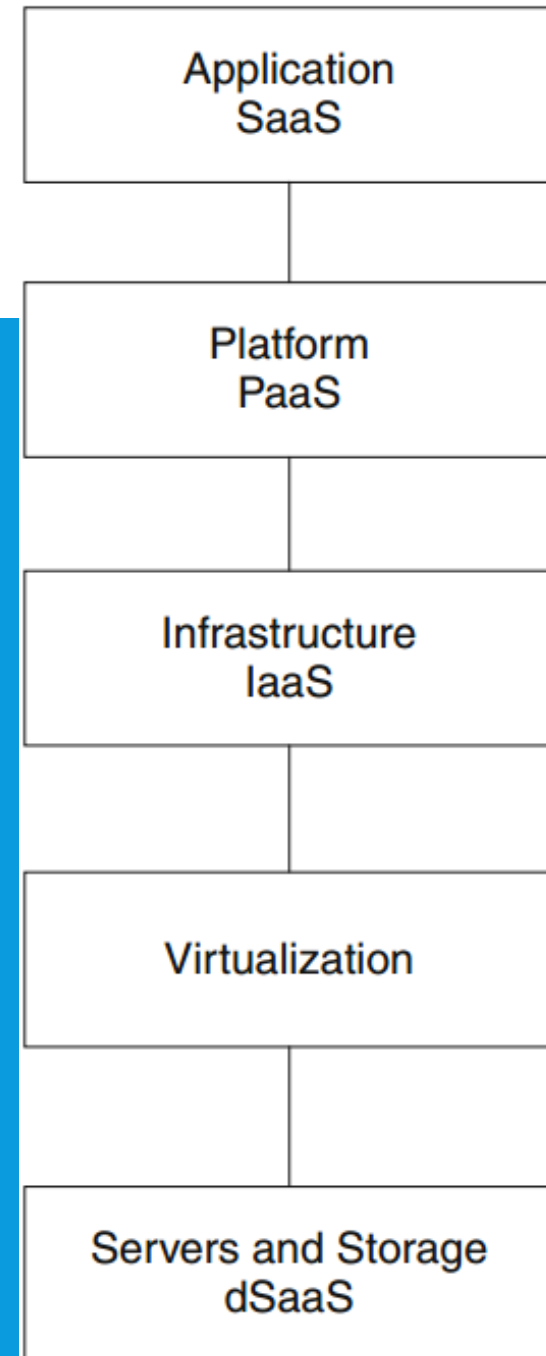
CLUSTERING

Server 1

Service 2
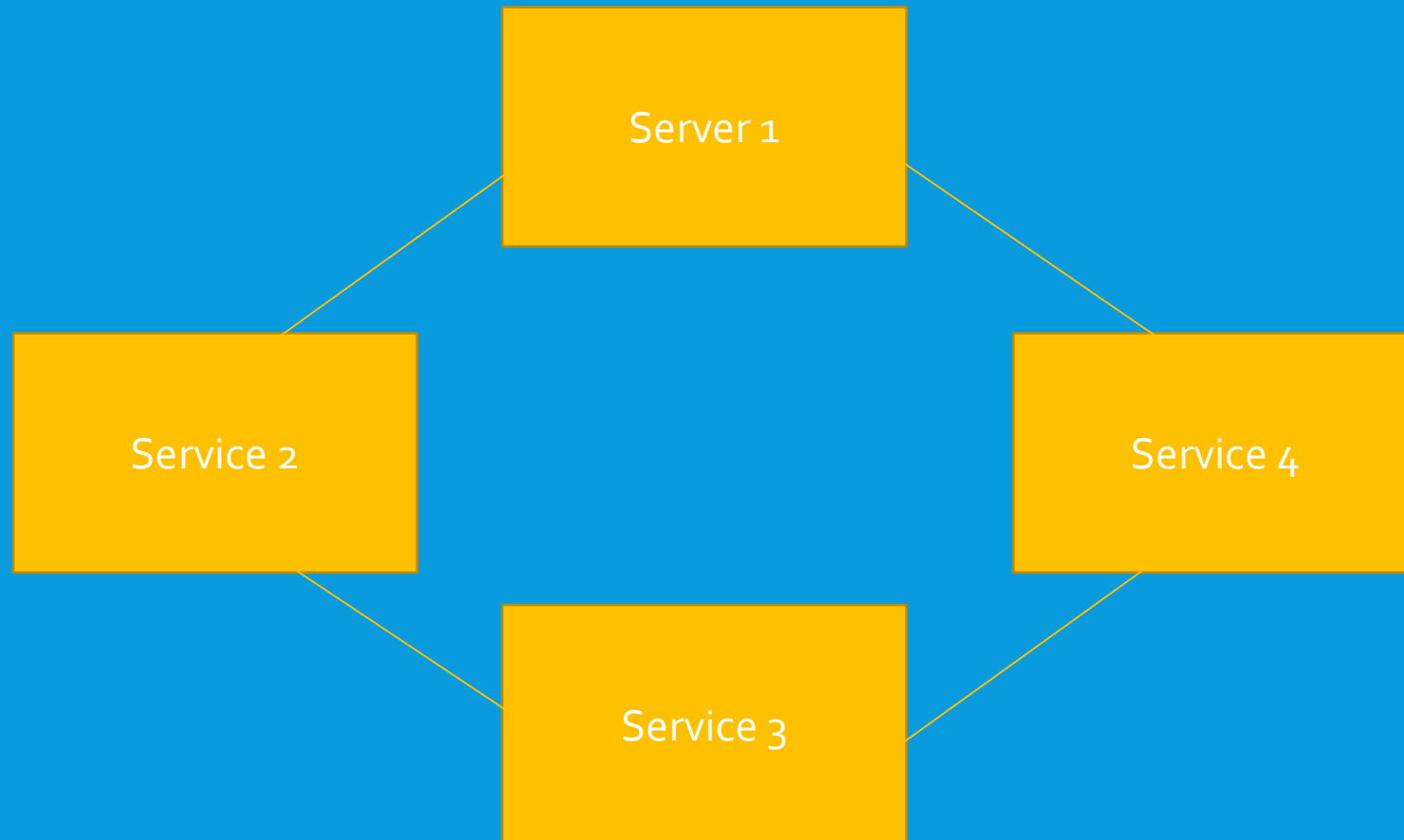
Service 4

Service 3

6 PHASES OF COMPUTING PARADIGMS

LAYERS OF CLOUD COMPUTING

- IaaS: Infrastructure as a Service

- dSaaS: data Storage as a Service

- PaaS: Platform as a Service

- SaaS: Software as a Service

Concept of Zoho Creator PaaS
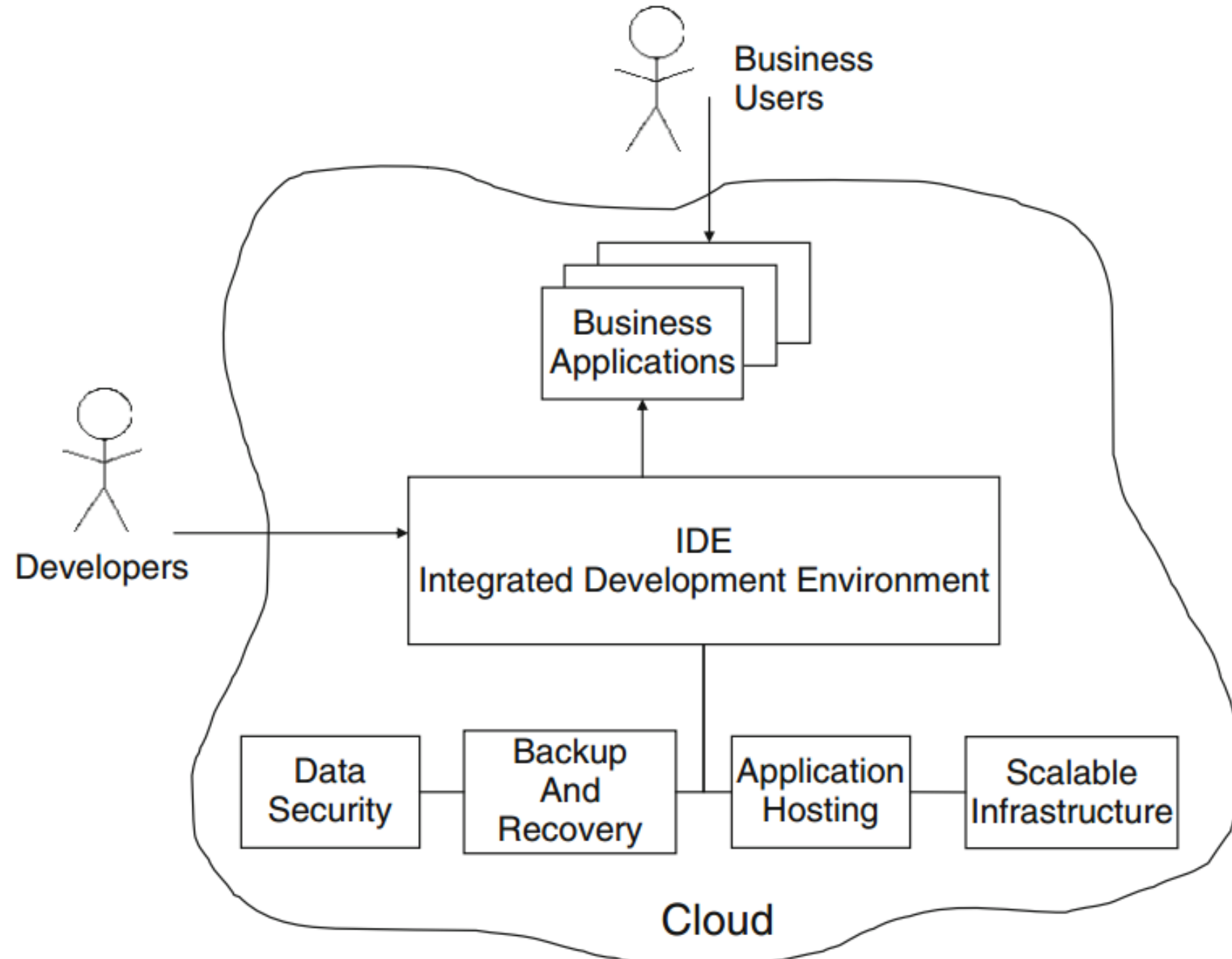
- Categories of cloud computing services

a) Software_as_a_Service

Cloud

Application

Browser/
Client

Users

b) Attached Services

Cloud

Extra
Functions

Application

Users
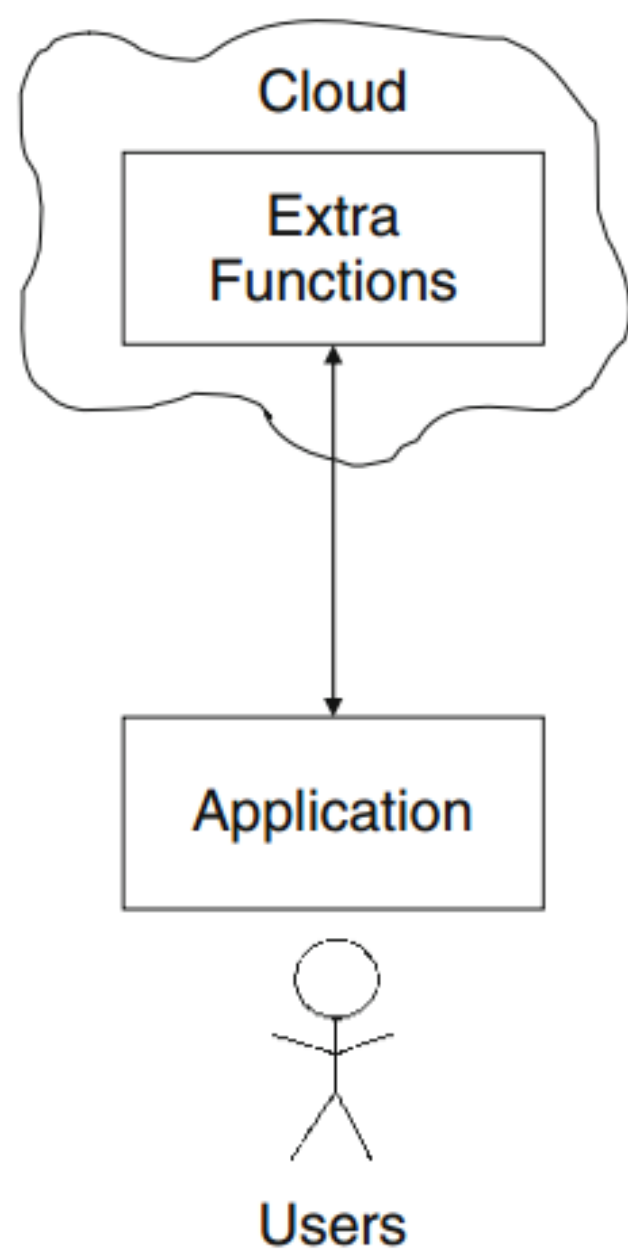
- Using PaaS for creating new SaaS applications

Cloud
Platform

Application

Platform

Application

Developers
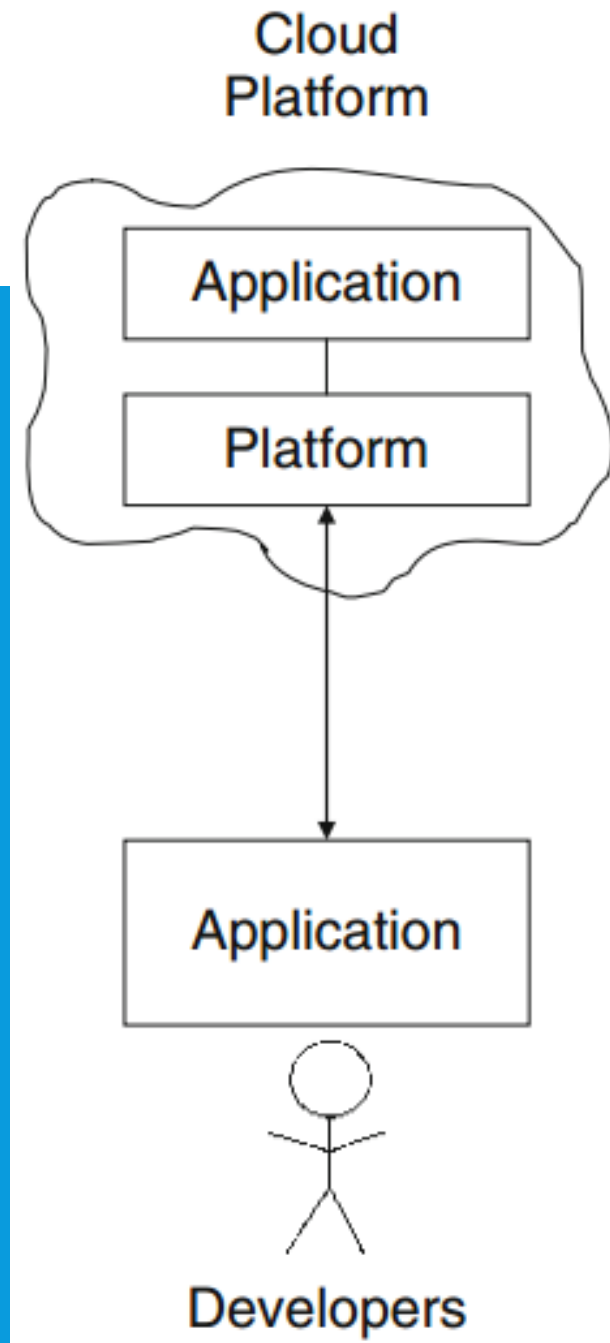
CLOUD TYPES
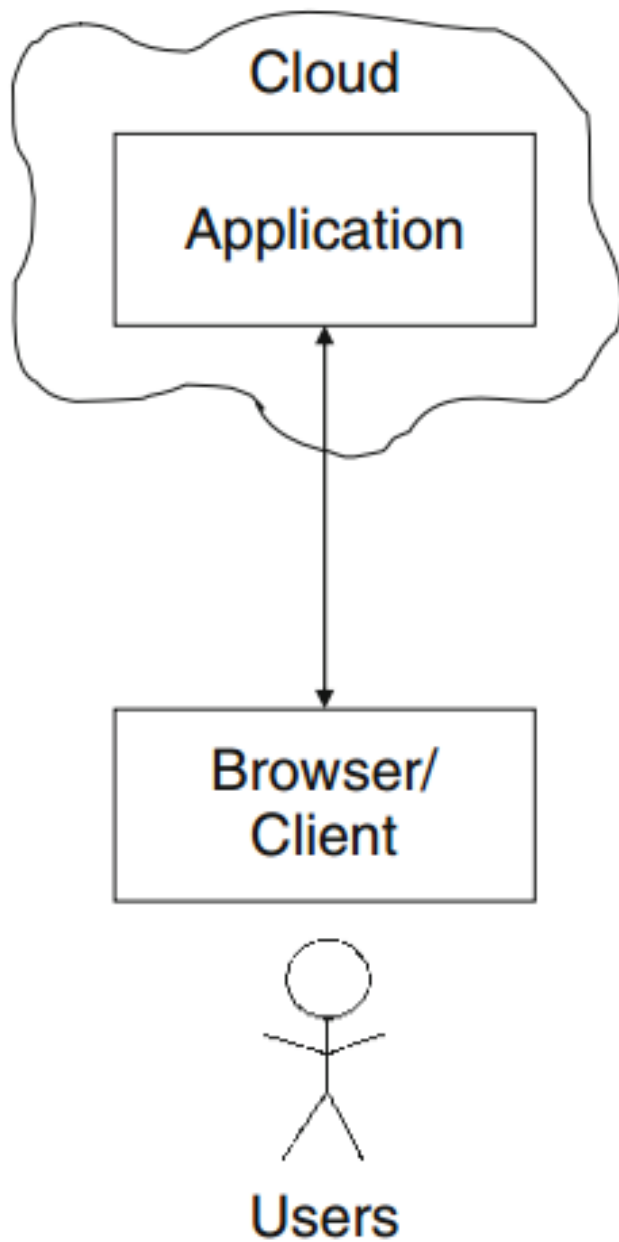
- Public cloud (external cloud): Over the Internet via Web applications or Web services from provider.

- Private cloud (Internal cloud): On private networks. Private clouds are built for exclusive use of one client. (Large companies, governments)

- Hybrid cloud: combines multiple private clouds and public clouds
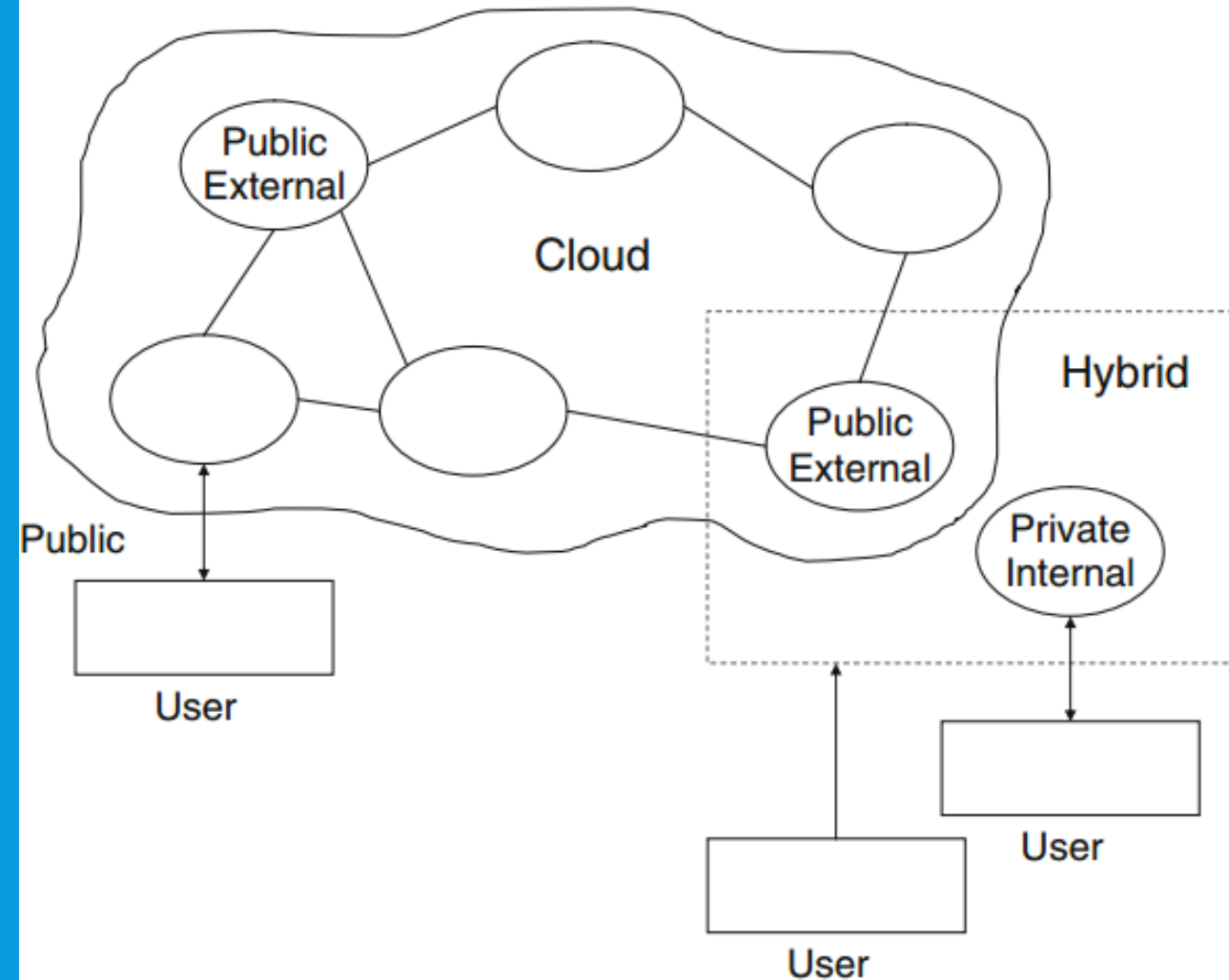
CLOUD SERVICES

- The services provided through cloud systems can be classified into Infrastructure as a service (IaaS), Platform as a Service (PaaS) and Software as a service (SaaS)
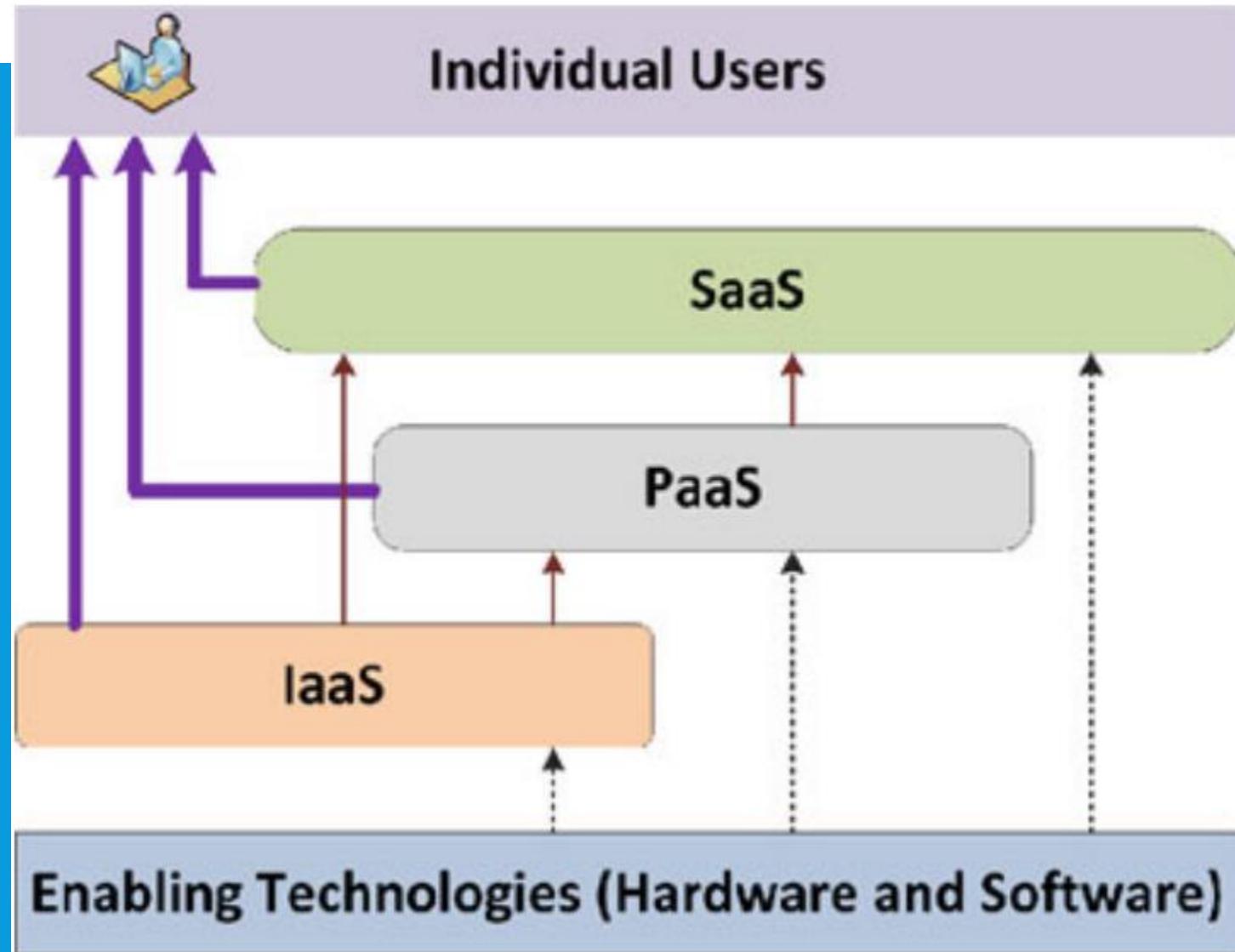
INFRASTRUCTURE AS A SERVICE

- Refer IaaS as Hardware as a Service

- Google, Microsoft, Amazon and IBM are involved in offering such services.

- The IaaS is categorized into:
  - Computation as a Service (CaaS)
  - Data as a Service (DaaS)

- Some popular IaaS systems:
  - Amazon EC2
  - GoGrid
  - Amazon S3
  - ...

AMAZON ELASTIC COMPUTE CLOUD (EC2)

- Released public beta in 2006; dropped beta label in 2008

- Provides VMC based computation environment

CaaS	Amazon EC2
Virtualization	Xen
OS support	Linux, Windows
Server RAM	1.7 GB and going up to 68.4 GB
Load Balancer	Amazon Elastic Load Balancer
Persistent Block Storage	Yes
Hybrid Hosting	No
24/7 Support	No
Pricing	Billed $0.085 – $3.18 per hour (vary for different Instance and Regions). The Data Transfer rates vary based on where the data goes out to and comes in from with pricing between $0.00 to $0.15 per GB transferred.

# AMAZON SIMPLE STORAGE SERVICE (S3)

- The Amazon Simple Storage Service (2010) (S3) is an online storage web service offered by Amazon Web Services

- Slideshare (2010) and Twitter (2010) use Amazon S3 to host images.

- Apache Hadoop (2010) uses S3 to store computation data

- Online synchronization utilities such as Dropbox (2010) and Ubuntu One (2010) use S3 as their storage and transfer facility.

PLATFORM AS A SERVICE

- Platform as a Service (PaaS) cloud systems provide a software execution environment.

- The environment is not just a pre-installed operating system but is also integrated with a programming-language-level platform

- Three typical PaaS:
  - Google App Engine (2010)
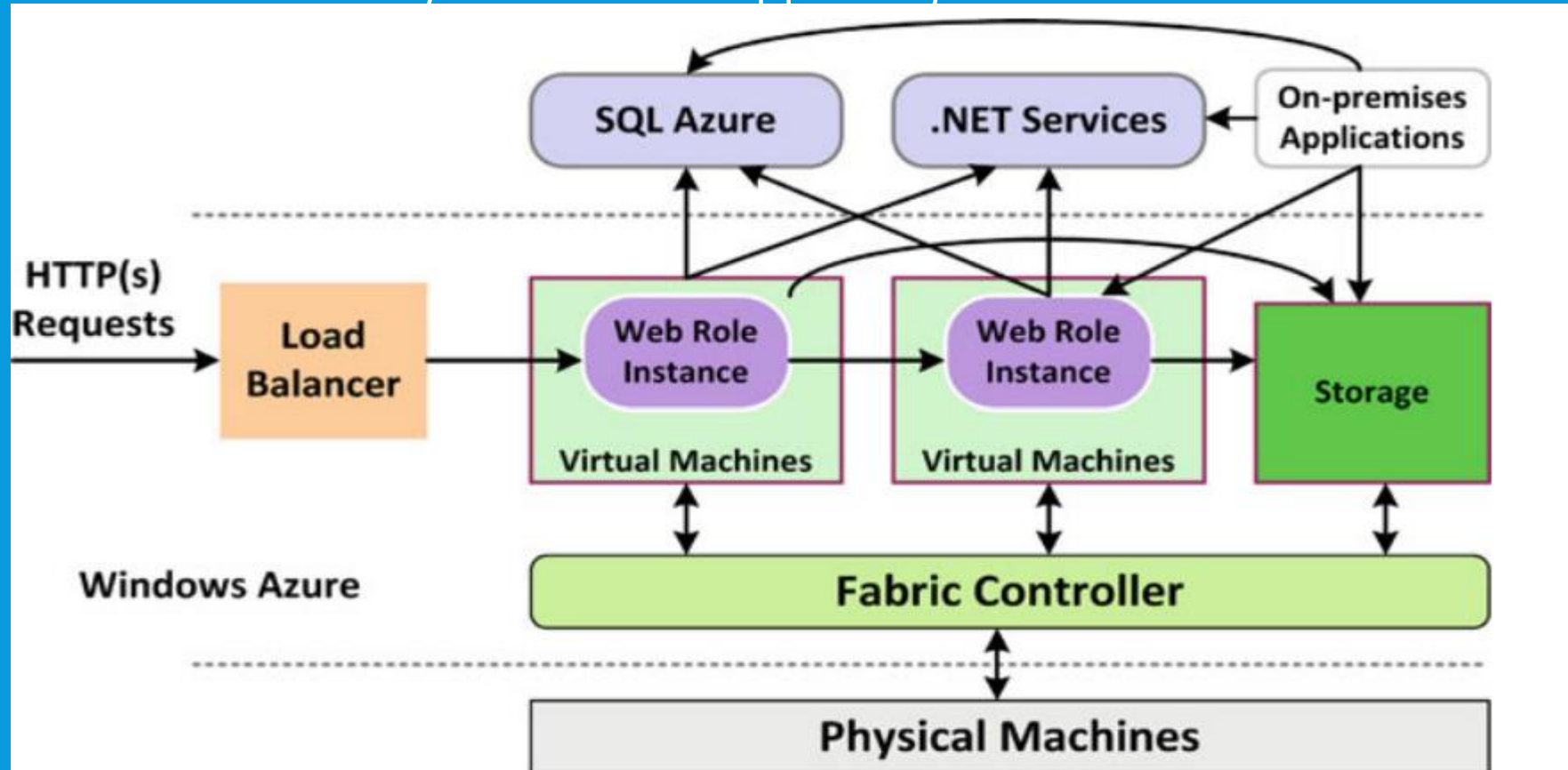 - Microsoft Azure (2010)
  - and Force.com (2010)

GOOGLE APP ENGINE

- Google App Engine (GAE)'s main goal is to efficiently run users' web applications.
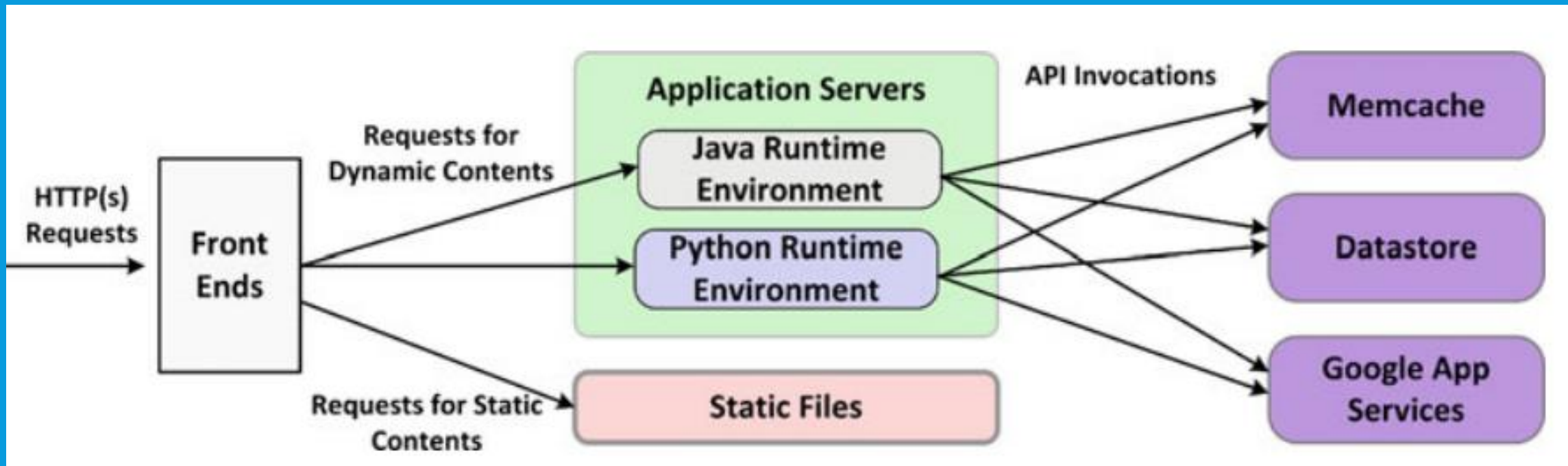
MICROSOFT AZURE

- Windows Azure Platform (WAP), which is composed of a cloud operating system named Windows Azure, and a set of supporting services

SOFTWARE AS A SERVICE

- Software-as-a-Service (SaaS) is based on licensing software use on demand, which is already installed and running on a cloud platform

- Have been developed and deployed on the PaaS or IaaS layer of a cloud platform

- Some Application:
  - Desktop as a Service
  - Google Services
  - Zoho: Mail, Docs, Wiki, CRM, Meeting, Business
  - Microsoft: Office Live, Dynamics CRM, Sharepoint
  - Learn.com: Training, Online Courses
  - Envysion.com: Video Management
  - OpenID: Log in Identification.

DESKTOP AS A SERVICE

- Provides a virtualized desktop-like personal workspace, and sends its image to the user's real desktop

- User can access their own desktop-on-the-cloud from different places for convenience

- The "Global Hosted Operating SysTem" (G.ho.st) (2010) is a free and complete Internet-based Virtual Computer (VC) service suite including a personal desktop, files and applications
  - Hosted by the Amazon Web Services (AWS) platform, so users can utilize EC2 and S3 resources.

- The Desktone Virtual-D Platform (2010) implements a desktop as a service by encapsulating a virtual machine based desktop, called Virtual Desktop infrastructure (VDI)

GOOGLE APPS

- Provides several Web applications with similar functionality to traditional office software (word processing, spreadsheets etc.), but also enables users to communicate, create and collaborate easily and efficiently

- Google mail and Google Talk allow for communication through email, instant messaging and voice calls

- Google Calendar is a flexible calendar application for organizing meetings and events

- With Google's "Web Pages", administrators can easily publish web pages, while "Start Pages" provide users with a rich array of content and applications that can be personalized.

BENEFITS

- Benefits:
  - Lower cost?
  - Easier to manage
  - Scalability
  - Flexibility
  - Elasticity
  - Agility
  - On-demand computing
- ISSUES:
  - Privacy
  - Connectivity
  - Price?