

# CLOUD COMPUTING-(18MCA43C)

## UNIT – II

### *'Cloud Services'*

#### FACULTY:

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# ***UNIT-II***

- Service models
  - Three service models

# *Advantages of Cloud Computing*

- Lower computer costs:
  - You do not need a high-powered and high-priced computer to run cloud computing's web-based applications.
  - Since applications run in the cloud, not on the desktop PC, your desktop PC does not need the processing power or hard disk space demanded by traditional desktop software.
  - When you are using web-based applications, your PC can be less expensive, with a smaller hard disk, less memory, more efficient processor...
  - In fact, your PC in this scenario does not even need a CD or DVD drive, as no software programs have to be loaded and no document files need to be saved.

# *Advantages of Cloud Computing*

- Improved performance:
  - With few large programs hogging your computer's memory, you will see better performance from your PC.
  - Computers in a cloud computing system boot and run faster because they have fewer programs and processes loaded into memory...
- Reduced software costs:
  - Instead of purchasing expensive software applications, you can get most of what you need for free-ish!
    - most cloud computing applications today, such as the Google Docs suite.
  - better than paying for similar commercial software
    - which alone may be justification for switching to cloud applications.

# *Advantages of Cloud Computing*

- Instant software updates:
  - Another advantage to cloud computing is that you are no longer faced with choosing between obsolete software and high upgrade costs.
  - When the application is web-based, updates happen automatically
    - available the next time you log into the cloud.
  - When you access a web-based application, you get the latest version
    - without needing to pay for or download an upgrade.
- Improved document format compatibility.
  - You do not have to worry about the documents you create on your machine being compatible with other users' applications or OSes
  - There are potentially no format incompatibilities when everyone is sharing documents and applications in the cloud.

# *Advantages of Cloud Computing*

- Unlimited storage capacity:
  - Cloud computing offers virtually limitless storage.
  - Your computer's current 1 Tbyte hard drive is small compared to the hundreds of Pbytes available in the cloud.
- Increased data reliability:
  - Unlike desktop computing, in which if a hard disk crashes and destroy all your valuable data, a computer crashing in the cloud should not affect the storage of your data.
    - if your personal computer crashes, all your data is still out there in the cloud, still accessible
  - In a world where few individual desktop PC users back up their data on a regular basis, cloud computing is a data-safe computing platform!

# *Advantages of Cloud Computing*

- Universal document access:
  - That is not a problem with cloud computing, because you do not take your documents with you.
  - Instead, they stay in the cloud, and you can access them whenever you have a computer and an Internet connection
  - Documents are instantly available from wherever you are
- Latest version availability:
  - When you edit a document at home, that edited version is what you see when you access the document at work.
  - The cloud always hosts the latest version of your documents
    - as long as you are connected, you are not in danger of having an outdated version

# *Advantages of Cloud Computing*

- Easier group collaboration:
  - Sharing documents leads directly to better collaboration.
  - Many users do this as it is an important advantages of cloud computing
    - multiple users can collaborate easily on documents and projects
- Device independence.
  - You are no longer tethered to a single computer or network.
  - Changes to computers, applications and documents follow you through the cloud.
  - Move to a portable device, and your applications and documents are still available.



# *Disadvantages of Cloud Computing*

- Requires a constant Internet connection:
  - Cloud computing is impossible if you cannot connect to the Internet.
  - Since you use the Internet to connect to both your applications and documents, if you do not have an Internet connection you cannot access anything, even your own documents.
  - A dead Internet connection means no work and in areas where Internet connections are few or inherently unreliable, this could be a deal-breaker.

# *Disadvantages of Cloud Computing*

- Does not work well with low-speed connections:
  - Similarly, a low-speed Internet connection, such as that found with dial-up services, makes cloud computing painful at best and often impossible.
  - Web-based applications require a lot of bandwidth to download, as do large documents.
- Features might be limited:
  - This situation is bound to change, but today many web-based applications simply are not as full-featured as their desktop-based applications.
    - For example, you can do a lot more with Microsoft PowerPoint than with Google Presentation's web-based offering

# *Disadvantages of Cloud Computing*

- Can be slow:
  - Even with a fast connection, web-based applications can sometimes be slower than accessing a similar software program on your desktop PC.
  - Everything about the program, from the interface to the current document, has to be sent back and forth from your computer to the computers in the cloud.
  - If the cloud servers happen to be backed up at that moment, or if the Internet is having a slow day, you would not get the instantaneous access you might expect from desktop applications.

# *Disadvantages of Cloud Computing*

- Stored data might not be secure:
  - With cloud computing, all your data is stored on the cloud.
    - The questions is How secure is the cloud?
  - Can unauthorised users gain access to your confidential data?
- Stored data can be lost:
  - Theoretically, data stored in the cloud is safe, replicated across multiple machines.
  - But on the off chance that your data goes missing, you have no physical or local backup.
    - Put simply, relying on the cloud puts you at risk if the cloud lets you down.

# *Disadvantages of Cloud Computing*

- HPC Systems:
  - Not clear that you can run compute-intensive HPC applications that use MPI/OpenMP!
  - Scheduling is important with this type of application
    - as you want all the VM to be co-located to minimize communication latency!
- General Concerns:
  - Each cloud systems uses different protocols and different APIs
    - may not be possible to run applications between cloud based systems
  - Amazon has created its own DB system (not SQL 92), and workflow system (many popular workflow systems out there)
    - so your normal applications will have to be adapted to execute on these platforms.



**Choose the service you need.**

## ***SERVICE MODELS***

# 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.



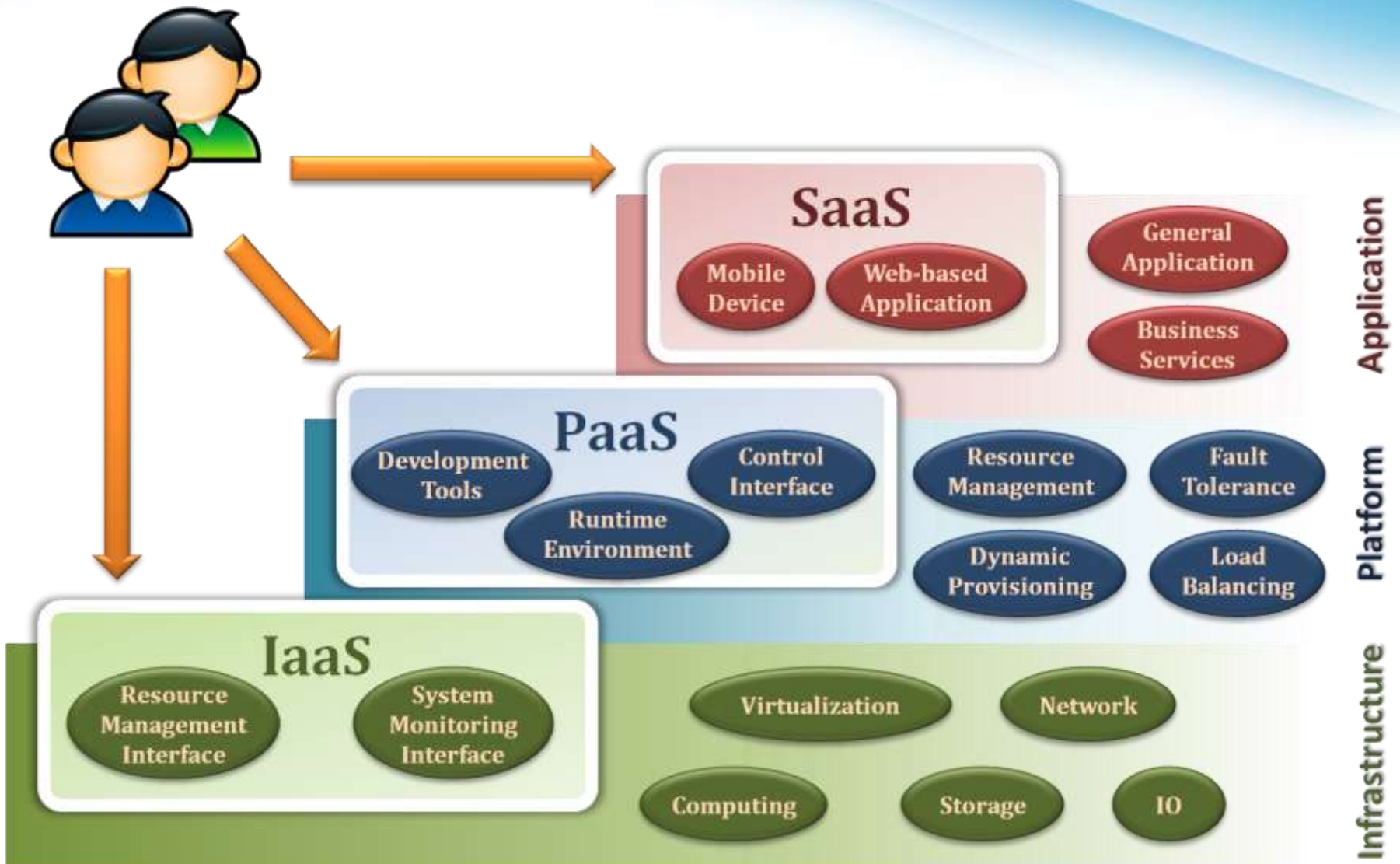
**Let's translate to  
Cloud Computing !!**

# 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



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Infrastructure as a Service

Platform as a Service

Software as a Service

## ***SERVICE MODELS***

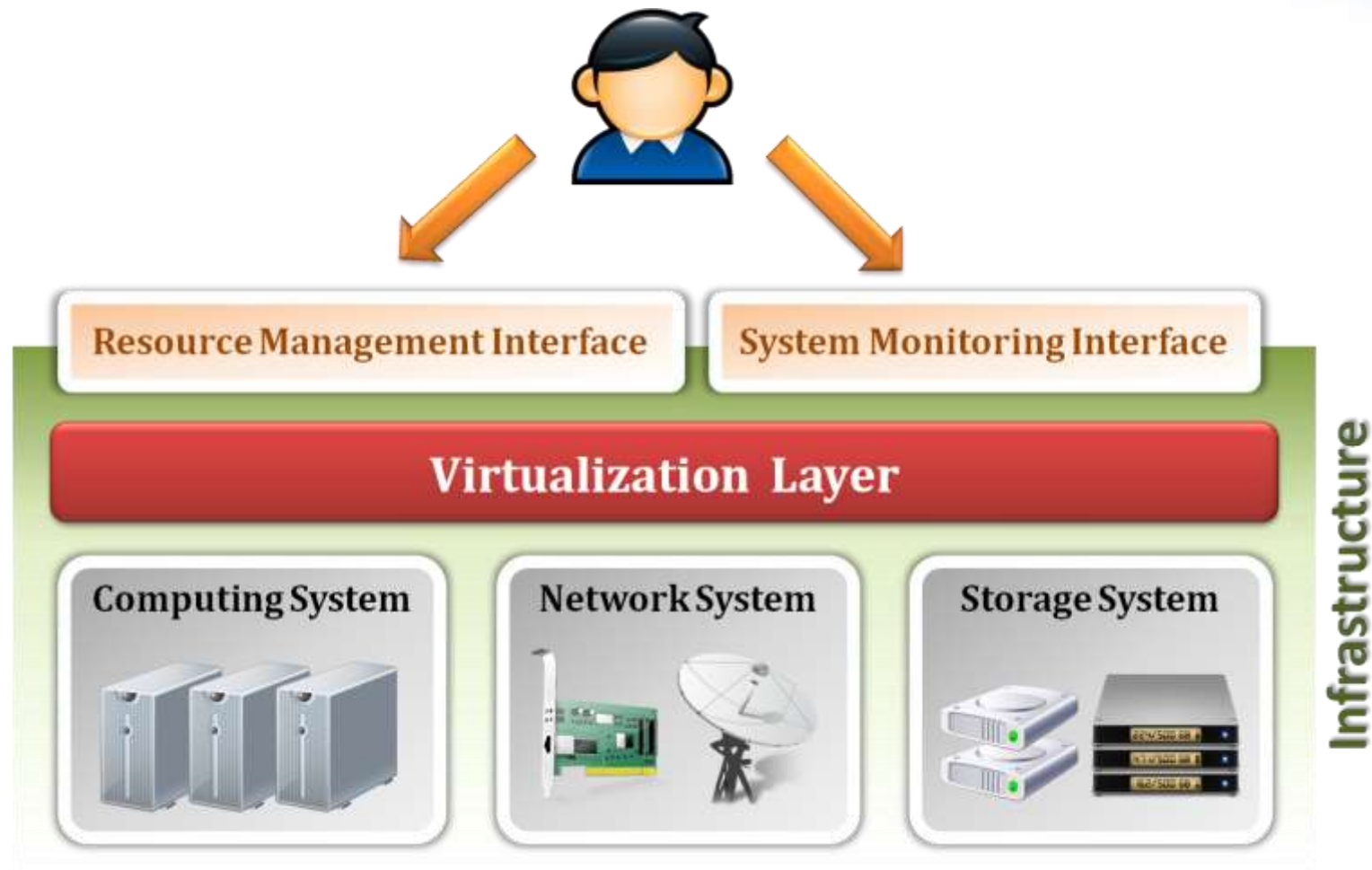
# *Infrastructure as a Service*

- 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



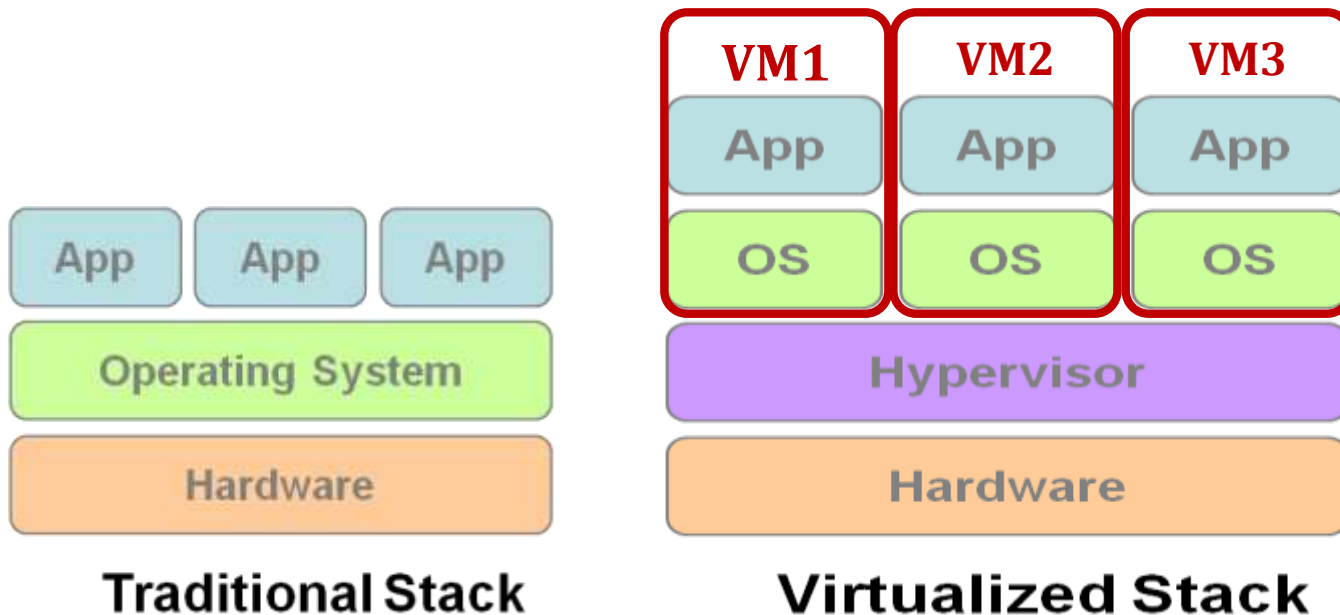
# *Infrastructure as a Service*

- 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**

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Infrastructure as a Service

Platform as a Service

Software as a Service

## ***SERVICE MODELS***



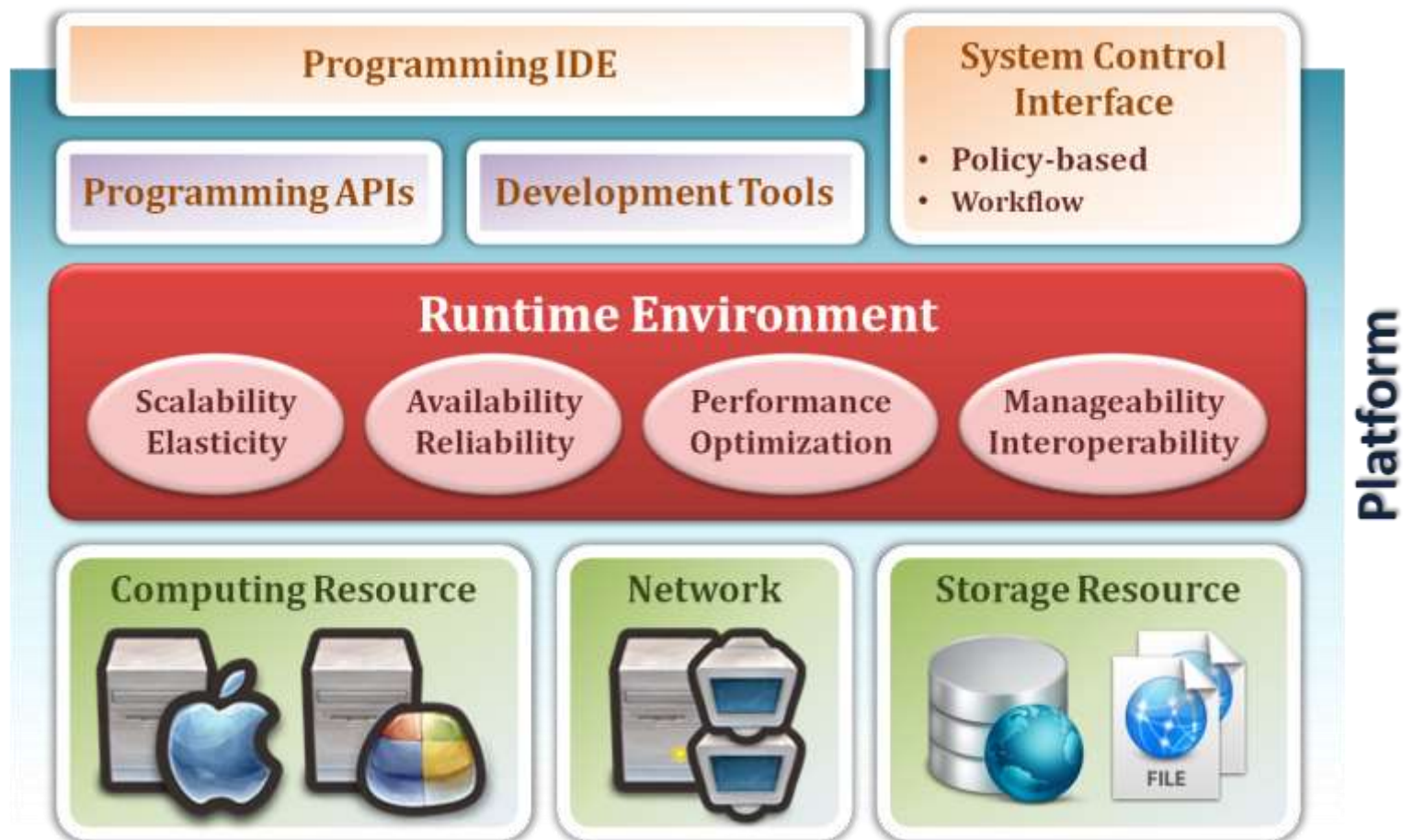
# *Platform as a Service*

- 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 underlying 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**
  - **Police-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 speedy 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

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Infrastructure as a Service

Platform as a Service

Software as a Service

## ***SERVICE MODELS***

# *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

# *Assessment and Design*

Proper alignment with business and technical goals

- **Cloud Assessment and Design**

Working with business users and IT professionals to define high-level requirements (Business Driver)

Assessing the Pros and Cons for using Cloud solutions

Determining appropriate risks and management strategies for Cloud solutions

- **Cloud Solution Selection**

Determining specific business and technical challenges

Choosing the right Cloud alternatives (type and delivery model)

Identifying the management requirements for the different Cloud alternatives

Defining the solution alternatives and the merits / risks with each

- **Security Assessment & Planning**

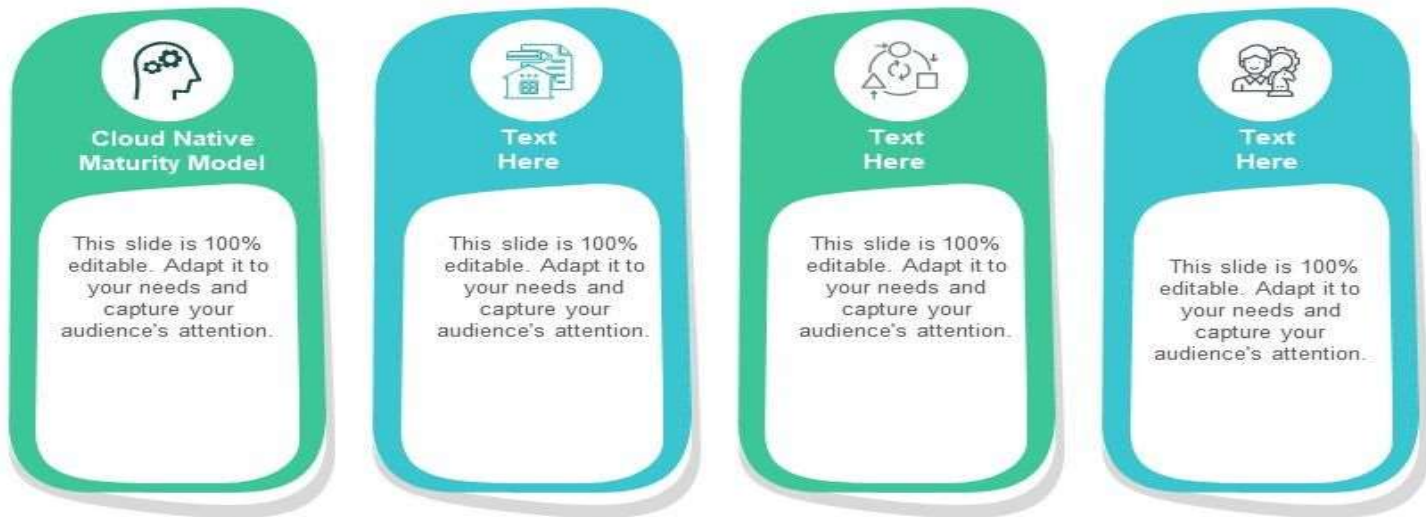
Performing Security Assessment (Regulatory Compliance requirements )

Establishing appropriate security controls and processes

Implementing continuous monitoring and response plan for security breaches

# Cloud maturity model

## Cloud Native Maturity Model



# ***web-based application***

- A web application or web-based application **must have a continuous internet connection to function**. Conversely, a cloud application or cloud-based application performs processing tasks on a local computer or workstation. An internet connection is required primarily for downloading or uploading data.



- **There are six basic maturity levels that organizations go through during their cloud adoption process:**
- Experimenting: What is the cloud?
- Securing the cloud: Can we trust the cloud?
- Enabling servers and SaaS: Lift-and-shift, confirmation the cloud works pretty well
- Enabling value added services: Dynamic cloud becomes a practice
- Enabling unique services: Dynamic cloud is deeply ingrained in the culture
- Mandating cloud usage: Why do we need our own data centers?



**Discovering Cloud Services Development Services and Tools:** Discovering Cloud Services Development Services and Tools: **Cloud computing is at an early stage of its development.** This can be seen by observing the large number of small and start-up companies offering cloud development tools.

# *cloud*

- "The cloud" refers to **servers that are accessed over the Internet**, and the software and databases that run on those servers. Cloud servers are located in data centers all over the world. By using cloud computing, users and companies don't have to manage physical servers themselves or run software applications on their own machines.

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# Thank you

The Content in this Material are from the Textbooks and  
Reference books given in the Syllabus