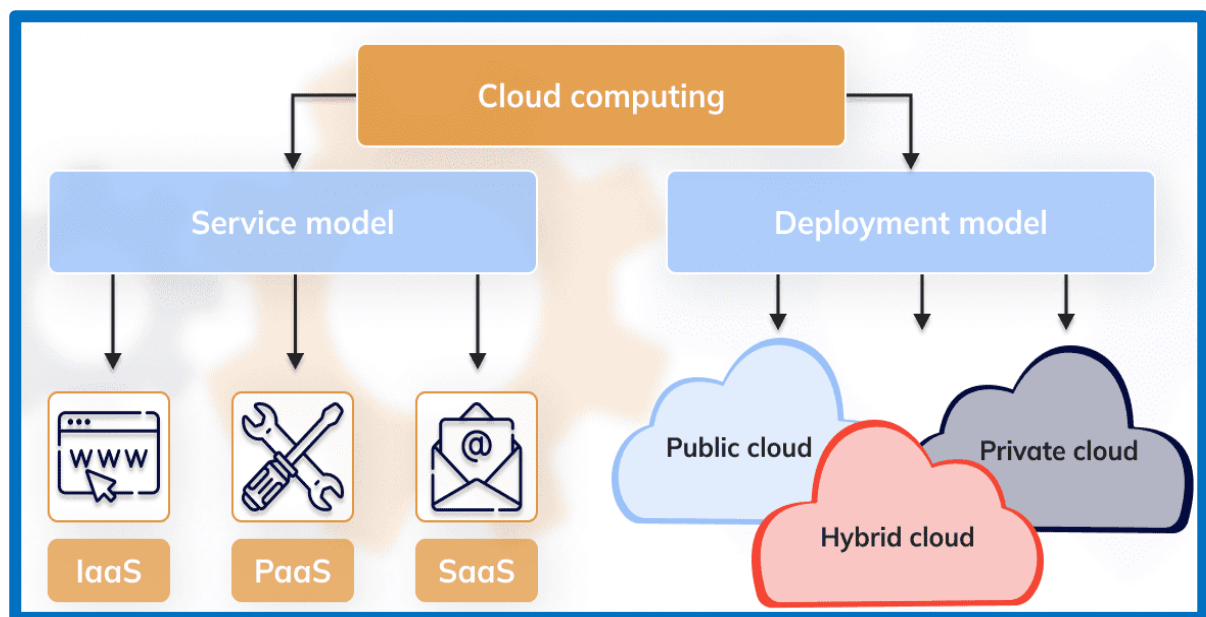




DEPARTMENT OF COMPUTER APPLICATIONS



E-CONTENT: UNIT I NOTES

Subject : CLOUD COMPUTING

Class : III BCA

BATCH : 2021-2024

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UNIT-1:

Foundations: Introduction to Cloud Computing-Migrating into a Cloud-Enriching the 'Integration as a Service' Paradigm for the Cloud Era-The Enterprise Cloud Computing Paradigm

Introduction:

Definition: cloud computing

cloud computing is the delivery of computing services—including servers, storage, databases, networking, software, analytics, and intelligence—over the Internet (“the cloud”) to offer faster innovation, flexible resources, and economies of scale.

cloud computing with an example:



Today, there are several examples of cloud computing applications used by both businesses and individuals. One type of cloud service would be **streaming platforms for audio or video, where the actual media files are stored remotely**. Another would be data storage platforms like Google Drive, Dropbox, OneDrive, or Box.

Why is cloud computing used?

The cloud **offers businesses more flexibility overall versus hosting on a local server**. And, if you need extra bandwidth, a cloud-based service can meet that demand instantly, rather than undergoing a complex (and expensive) update to your IT infrastructure.

Business advantages of cloud computing:

1. Cost Savings
2. Security
3. Flexibility
4. Mobility
5. Insight
6. Increased Collaboration
7. Quality Control
8. Disaster Recovery
9. Loss Prevention
10. Automatic Software Updates
11. Competitive Edge
12. Sustainability

Types of cloud computing:

There are four main types of cloud computing: **private clouds, public clouds, hybrid clouds, and multiclouds.**

Private Cloud:

In a private cloud, **computing resources are dedicated and proprietary, and a single organization hosts and manages the system.** What makes it private is the fact that the underlying hardware layer is segregated from any other client's infrastructure.

Example for private cloud:



HP Data Centers, Microsoft, Elastra-private cloud, and Ubuntu are the example of a private cloud.

Public cloud:

A public cloud is an IT model where public cloud service providers make computing services—including compute and storage, develop-and-deploy environments, and applications—available on-demand to organizations and individuals over the public internet.

Example for public cloud:

The cloud resources (like servers and storage) are owned and operated by a third-party cloud service provider and delivered over the internet. With a public cloud, all hardware, software and other supporting infrastructure are owned and managed by the cloud provider.

Example for public cloud: **Microsoft Azure is an example of a public cloud.**

Hybrid cloud:

Hybrid cloud refers to a mixed computing, storage, and services environment made up of on-premises infrastructure, private cloud services, and a public cloud—such as Amazon Web Services (AWS) or Microsoft Azure—with orchestration among the various platforms.

Multi cloud:

"Multi-cloud" means multiple public clouds. A company that uses a multi-cloud deployment incorporates multiple public clouds from more than one cloud provider.

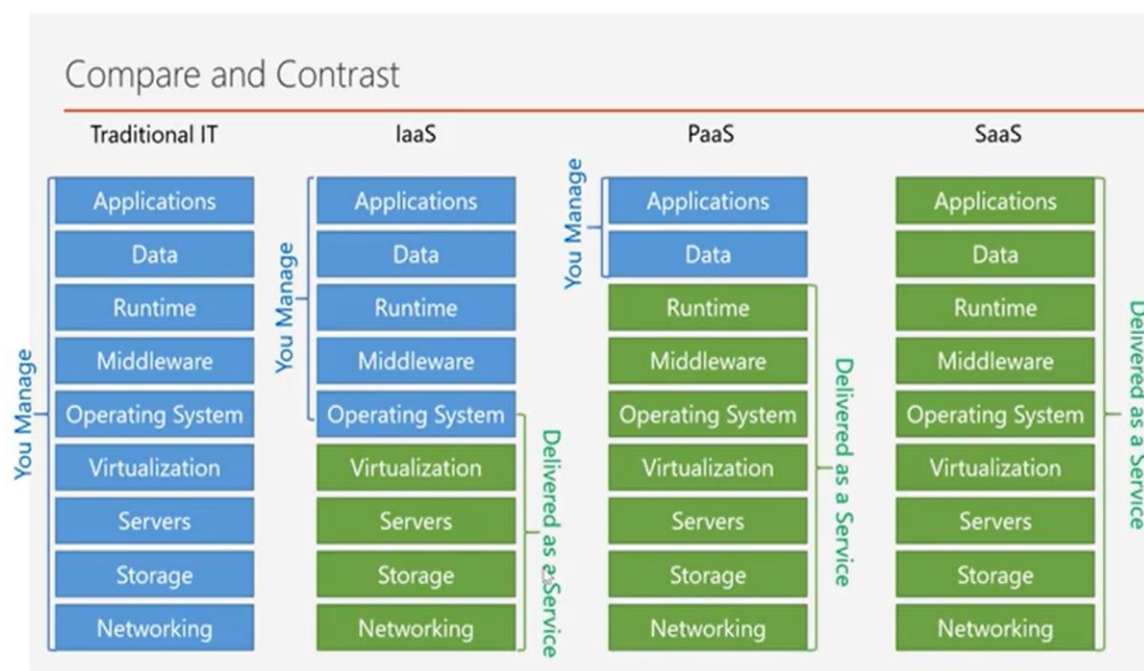
Multi-cloud examples:

Multi cloud computing, as this word suggests, is the use of multiple public cloud services from different vendors within one architecture at the same time. For instance, a business might

use AWS for data storage, Google Cloud Platform for development and testing, and yet Microsoft Azure for disaster recovery.

Types of cloud computing services:

1. Infrastructure-as-a-Service (IaaS)
2. Platforms-as-a-Service (PaaS)
3. Software-as-a-Service (SaaS)



1. Infrastructure as a Service (IaaS):

- **Description:** IaaS provides virtualized computing resources over the internet. It offers virtual machines, storage, and networking infrastructure on a pay-as-you-go basis.
- **Use Cases:**
 - Hosting and running virtual machines.
 - Storage solutions.
 - Networking services.

2. Platform as a Service (PaaS):

- **Description:** PaaS provides a platform that allows customers to develop, run, and manage applications without dealing with the complexity of building and maintaining the underlying infrastructure.
- **Use Cases:**
 - Application development and deployment.
 - Database management.
 - Integration with other services.

3. Software as a Service (SaaS):

- **Description:** SaaS delivers software applications over the internet, eliminating the need for users to install, maintain, and update the software locally.
- **Use Cases:**
 - Email and collaboration tools.

- Customer relationship management (CRM).
- Enterprise resource planning (ERP).
- Productivity software.

CLOUD MIGRATION

Introduction:

Cloud migration is the procedure of transferring **applications, data, and other types of business components** to any cloud computing platform. There are several parts of cloud migration an organization can perform. The most used model is the **applications and data transfer** through an on-premises and local data center to any public cloud.

But, a cloud migration can also entail transferring applications and data from a single cloud environment or facilitate them to another- a model called **cloud-to-cloud migration**. The other type of cloud migration is reverse cloud migration, cloud exit, and cloud repatriation where applications or data are transferred and back to the local data center.

SIX R'S OF CLOUD MIGRATION

- **Resilient:**
 - The cloud provider must be able to withstand unexpected events such as power outages, server crashes, and natural disasters. They must also be able to handle any technical problems that arise.
- **Reliable:**
 - Your data and applications must be available at all times. If you experience downtime, your cloud service provider should be able to restore your services quickly.
- **Reusable:**
 - You shouldn't have to pay for a specific application or service on your cloud provider's platform. You should be able to use a similar application or service on multiple platforms.
- **Rapid:**
 - When you migrate to the cloud, you don't have to wait days or weeks to receive a response from a human. You can immediately access your data and get answers to your questions.
- **Reduced:**
 - Cloud providers offer many of their services on a subscription basis. This means that you won't have to pay for hardware, software, or other resources.
- **Revenue:**
 - Your business will benefit from the cost savings associated with cloud migration. It will also be able to take advantage of new revenue opportunities offered by the cloud.

Cloud Migration Strategies Types

Migrating to a cloud can be a good investment for our business. We might be admiring where to start like several companies.

Gartner specified some options that are widely called "the six Rs of migration", defined as follows:



1. Rehosting (lift-and-shift)

The most general path is rehosting (or lift-and-shift), which implements as it sounds. It holds our application and then drops it into our new hosting platform without changing the architecture and code of the app. Also, it is a general way for enterprises unfamiliar with cloud computing, who profit from the deployment speed without having to waste money or time on planning for enlargement.

Besides, by migrating our existing infrastructure, we are applying a cloud just like other data centers. It pays for making good use of various cloud services present for a few enterprises. For example, adding scalable functions to our application to develop the experience for an improving segment of many users.

2. Re-platforming

Re-platforming is called "**lift-tinker-and-shift**". It includes making some cloud optimizations without modifying our app's core architecture. It is the better strategy for enterprises that are not ready for configuration and expansion, or those enterprises that wish to improve trust inside the cloud.

3. Re-factoring

It means to rebuild our applications from leverage to scratch cloud-native abilities. We could not perform serverless computing or auto-scaling. A potential disadvantage is **vendor lock-in** as we are re-creating on the cloud infrastructure. It is the most expensive and time-consuming route as we may expect. But, it is also future-proof for enterprises that wish to take benefit from more standard cloud features. It covers the most common three approaches for migrating our existing infrastructure.

4. Re-purchasing

It means replacing our existing applications along with a new SaaS-based and cloud-native platform (such as a homegrown CRM using Salesforce). The complexity is losing the existing training and code's familiarity with our team over a new platform. However, the profit is ignoring the cost of the development.

Re-purchasing is the most cost-effective process if moving through a highly personalized legacy landscape and minimizing the apps and service number we have to handle. Once we have accessed the nature and size of our application portfolio, we may detect cloud migration is not correct for us.

5. Retiring

When we don't find an application useful and then simply turn off these applications. The consequence savings may boost our business situation for application migration if we are accessible for making the move.

6. Re-visiting

Re-visiting may be all or some of our applications must reside in the house. For example, applications that have unique sensitivity or handle internal processes to an enterprise. Don't be scared for revisiting cloud computing at any later date. We must migrate only what makes effects to the business.

ENRICHING THE 'INTEGRATION AS A SERVICE' PARADIGM FOR THE CLOUD ERA

INTRODUCTION TO CLOUD INTEGRATION:

- Cloud Integration is about simplifying technology so that it could be adopted by a much broader audience.
- Cloud integration is the process of configuring multiple application programs to share data in the cloud. In a network that incorporates cloud integration; various applications communicate either directly or through third-party software.
- Cloud integration is the linking of information flows between cloud-hosted applications and other applications hosted in different clouds or in the datacenter.

- Without integration, cloud applications can't share data with the rest of the Company and that limits or even eliminates the utility of the cloud.

ADVANTAGES OF CLOUD INTEGRATION: Cloud integration offers the following advantages over older, compartmentalized organizational methods:

- Each user can access personal data in real time from any device and from any location with Internet access.
- Each user can integrate personal data such as calendars and contact lists served by diverse application programs.
- Each user can employ the same logon information (username and password) for all personal applications.
- The system efficiently passes control messages among application programs.
- By avoiding the use of data silos, data integrity is maintained.
- Cloud integration offers scalability to allow for future expansion in terms of the number of users, the number of applications, or both.

INTEGRATION as a service (IaaS):

- In B2B systems are capable of driving this new *on-demand integration* model because they are traditionally employed to automate business processes between manufacturers and their trading partners.
- That means they provide application-to-application connectivity along with the functionality that is very crucial for linking internal and external software securely.
- The use of hub & spoke (H&S) architecture further simplifies the implementation and avoids placing an excessive processing burden on the customer sides.
- The hub is installed at the SaaS provider's cloud center to do the heavy lifting such as reformatting files.
- A spoke unit at each user site typically acts as basic data transfer utility.

THE EVOLUTION OF SaaS:

- There are several ways clouds can be leveraged inspiringly and incredibly for diverse IT problems.
- Today there is a small list of services being delivered via the clouds and in future, many more critical applications will be deployed and consumed.
- IT as a Service (ITaaS) is the most recent and efficient delivery method in the important IT landscape.
- Integration as a service (IaaS) is the budding and distinctive capability of clouds in fulfilling the business integration requirements.

1. The Web is the largest digital information superhighway
2. The Web is the largest repository of all kinds of resources such as web pages, applications comprising enterprise components, business services, POJOs, blogs, corporate data, etc.
3. The Web is turning out to be the open, cost-effective and generic business execution platform (E-commerce, business, auction, etc. happen in the web for global users) comprising a wider variety of containers, adaptors, drivers, connectors, etc.
4. The Web is the global-scale communication infrastructure (VoIP, Video conferencing, IP TV etc.)
5. The Web is the next-generation discovery, Connectivity, and integration middleware.

THE CHALLENGES OF SaaS PARADIGM:

1. *Controllability*
2. *Visibility & flexibility*
3. *Security and Privacy*
4. *High Performance and Availability*
5. *Integration and Composition*
6. *Standards*

- A number of approaches are being investigated for resolving the identified issues and flaws. *Private cloud, hybrid and the latest community cloud* are being prescribed as the solution for most of these *inefficiencies and deficiencies*.
- There are several companies focusing on this issue. Boomi (<http://www.dell.com>) is one among them. This company has published several well-written *white papers* elaborating the issues confronting those enterprises thinking and trying to embrace the third-party public clouds for hosting their services and applications.
- **Integration Challenges:** Challenges specific to integration
- The first issue is that the majority of SaaS applications are point

solutions and service one line of business.

- As a result, companies without a method of synchronizing data between multiple lines of businesses are at a serious disadvantage in terms of maintaining accurate data, forecasting, and automating key business processes.
- Real-time data and functionality sharing is an essential ingredient for clouds.

ENTERPRISE CLOUD COMPUTING PARADIGM:

Introduction:

The enterprise cloud is a model for IT infrastructure and platform services that delivers the advantages of public cloud offerings for enterprise applications without compromising on the value provided by private datacenter environments.

What is Enterprise Cloud?

Enterprise cloud is a computing model where businesses can access virtualized IT resources from a public or private cloud services provider on a pay-per-use basis. These resources can include servers, processing power (CPU cores), data storage, virtualization capabilities, and networking infrastructure.

Enterprise cloud computing creates new opportunities for businesses to reduce costs while enhancing business resiliency, flexibility, and network security.

As organizations undergo digital transformation, they need flexible and scalable access to three types of computing resources: processing power, computer memory, and data storage. In the past, these organizations would bear the cost of implementing and maintaining their own networks and data centers. Now, Enterprise cloud service providers deliver computing resources to their customers through the Internet. They may also provide software cloud management systems or

managed services to help their customers maximize the benefits of enterprise cloud. enterprises can access these resources at a low cost by partnering with public and private enterprise cloud service providers.

Enterprise cloud computing is a computing paradigm that involves delivering various computing services, including storage, processing power, and applications, over the internet. This model offers several advantages to businesses, such as cost savings, scalability, flexibility, and improved collaboration.

Here are key aspects of the enterprise cloud computing paradigm:

- **Service Models**
- **Deployment Models**
- **Key Characteristics**
- **Benefits**
- **Challenges**
- **Technologies and Tools**

1. Service Models:

- **Infrastructure as a Service (IaaS):** Provides virtualized computing resources over the internet. Users can rent virtual machines, storage, and networking components on a pay-as-you-go basis.
- **Platform as a Service (PaaS):** Offers a platform that allows customers to develop, run, and manage applications without dealing with the complexities of underlying infrastructure.
- **Software as a Service (SaaS):** Delivers software applications over the internet on a subscription basis, eliminating the need for users to install, manage, and maintain the software locally.

2. Deployment Models:

- **Public Cloud:** Services are provided by third-party cloud service providers and are available to the general public. Resources are shared among multiple tenants.
- **Private Cloud:** Cloud infrastructure is operated solely for a single organization. It can be managed internally or by a third-party and may exist on-premises or off-premises.
- **Hybrid Cloud:** Combines both public and private cloud models. It allows data and applications to be shared between them.

3. Key Characteristics:

- **On-Demand Self-Service:** Users can provision and manage computing resources as needed without human intervention from the service provider.
- **Broad Network Access:** Cloud resources are accessible over the network and can be accessed by various devices such as laptops, smartphones, and tablets.
- **Resource Pooling:** Computing resources are pooled to serve multiple customers, with different physical and virtual resources dynamically assigned and reassigned according to demand.
- **Rapid Elasticity:** Resources can be rapidly scaled up or down to accommodate changing workloads.

4. Benefits:

- **Cost Efficiency:** Pay-as-you-go pricing model and shared resources contribute to cost savings.
- **Scalability:** Easily scale resources up or down based on demand.
- **Flexibility:** Access to a wide range of services and the ability to choose the best-fit solutions for specific needs.
- **Business Agility:** Enables faster development and deployment of applications, leading to increased agility.

5. Challenges:

- **Security Concerns:** Data security and privacy are primary concerns, especially in public cloud deployments.
- **Compliance Issues:** Adherence to regulatory requirements can be challenging in certain industries.
- **Integration Complexity:** Migrating existing applications and integrating with on-premises systems can be complex.

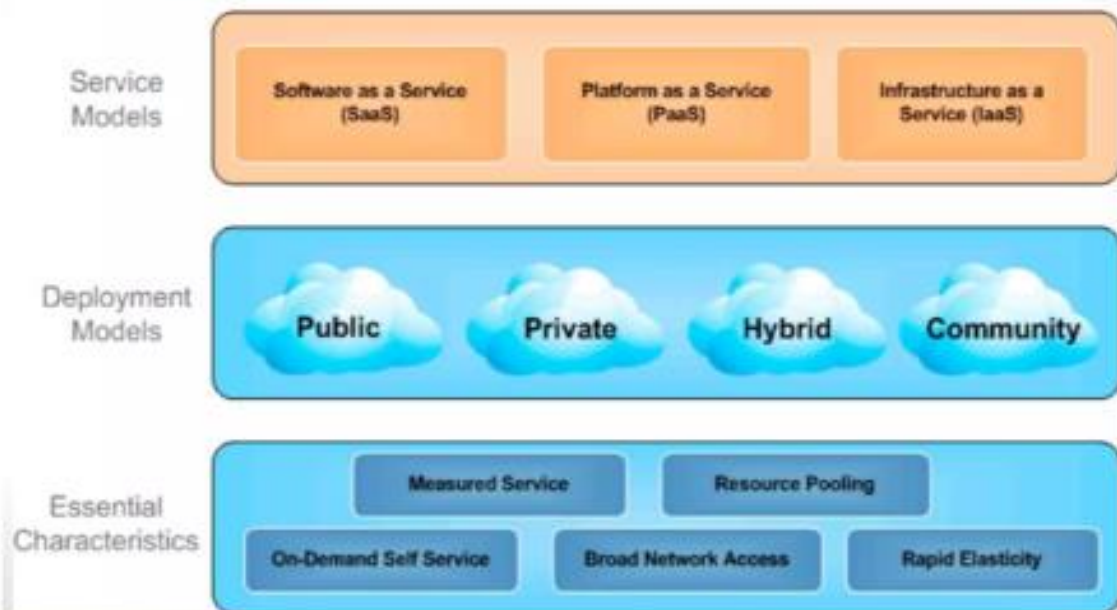
6. Technologies and Tools:

- **Virtualization:** Enables the creation of virtual instances of computing resources.
- **Containers and Orchestration:** Tools like Docker and Kubernetes facilitate efficient application deployment and management.
- **Microservices Architecture:** Breaks down applications into smaller, independent services for easier development and maintenance.

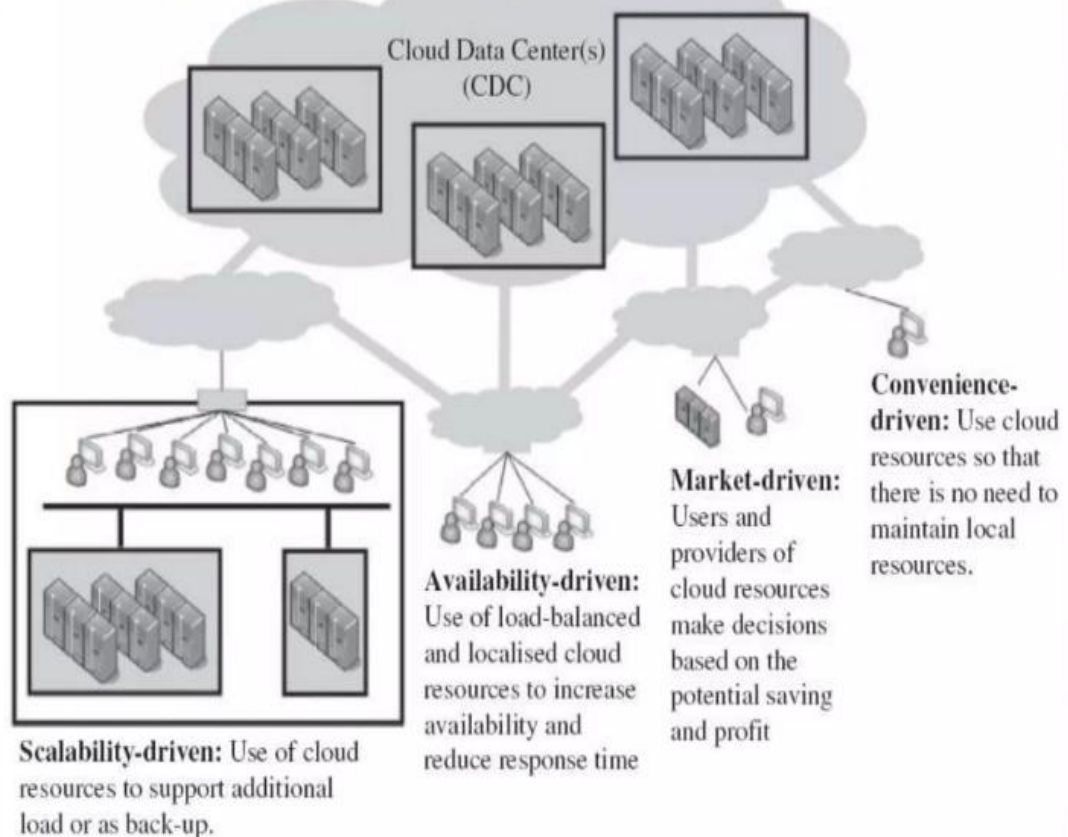
Enterprise Cloud Computing Paradigm



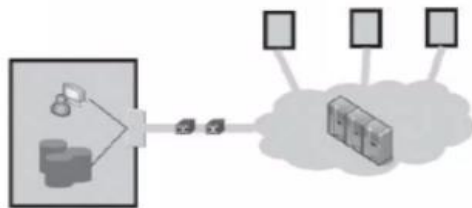
Deployment Models



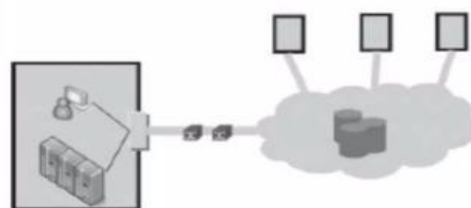
Adoption Strategy



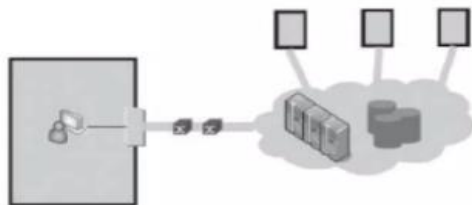
Consumption Strategy



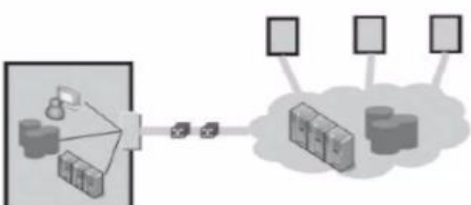
(1) Software Provision: Cloud provides instances of software but data is maintained within user's data center



(2) Storage Provision: Cloud provides data management and software accesses data remotely from user's data center



(3) Solution Provision: Software and storage are maintained in cloud and the user does not maintain a data center



(4) Redundancy Services: Cloud is used as an alternative or extension of user's data center for software and storage

Issues for Enterprise Applications in cloud

- ERP
- Capabilities of ERP
 - Transactional Capabilities
 - OLTP (Online Transaction Processing)
 - manage transaction oriented applications (relational databases)
 - ACID properties, write/update-intensive
 - CRM (Customer Relationship Management)
 - Analytical Capabilities
 - OLAP (Online Analytical Processing)
 - Analysis, reporting, decision support
 - Read only
 - Data-intensive
 - BI (Business Intelligence)