**BIT 2225**

**Pre-requisite –comp networks..Network management n design**

**Cloud** it’s a virtual space where there is a common space for interaction

**Cloud computing** - a virtual network based on distributed system architecture.

**Distributed system**- There is a spread of computing processes.

Cloud computing is paradigm (type of system) in which computing recourses are delivered via the internet or through private networks.

These computing recourses may include software and most cases hardware managed by third parties and they are hosted at remote locations called **data centers.**

**Examples of companies that deliver cloud computing services**

* **Google-**delivers cloud services such as email access document apps, maps, web analyticsand text translations
* **Microsoft-**has a paradigm known as **Microsoft share point** which allows for sharing of content and business intelligence tools between members.

**Cloud computing components**

Have the front end (interface through which the user can access the cloud) and the back end (comprises of data centers that house cloud computing resources)

**Front end** interface through which the user can access the cloud

**Back end** comprises of data centers that house cloud computing resources

Link between the front end and the back end i.e. the **internet** or the private network

**X tics**

1. Accessibility-the accessibility is high i.e. fast access
2. Pulling of resources.
3. Scalability-cloud computing resources are scalable or dynamic
4. Measurable- customers are billed on their usage i.e. they have to pay
5. Cloud computing resources are on demand and self serviced i.e. companies can request for resources and services at their own pleasure

**Advantages**

1. Easy access to resources from any point as long as there is a link or network.
2. Reduced expenses in terms of companies pay for this resources only when they need them or they have accessed them.
3. Robust scalability-this resources can be scaled i.e. increase or reduce them at any time without much hustle.
4. Reliability – This is brought about by the multiple redundant sights that house this cloud computing resources.

**Risks**

1. Insecurity -in public network it is unsafe only in private networks where data has good security
2. Mishandling of data since any user can mess up files.
3. Unwanted charges
4. There is no confidentiality of your data.
5. Vendor operational problems - Legal problems between the vendor and the person the services are being provided for.

**Cloud computing borrows from distributed systems**

**Distributed computing**

This is a field in computer science that studies ideas on how to build distributed systems.

**Distributed system** is a group of independent and autonomous comp hardware and software that are networked together and operate to achieve a common goal.

**Distributed system service models**

1. **Centralized model-** the app is hosted on one machine and the user machines connect to it.
2. **Client server model –** Server that host the resources and a client that request the resources.
3. **Peer to Peer model –** all machines in this model have equal capabilities whereby no machine is dedicated to provide services to other machines.
4. **Thin and thick clients –**in thin client the client has a small amount of client software while the server has the bulk processing power and as such there is no need for much administration.

**In thick** the client has the bulk of data processing capabilities while the server offers services like web service and data storage.

1. **Multi tier client server model-** there is hierarchy in connectivity in that a server would contact other servers to accomplish its task.
2. **Processor pull model -** the CPU is dynamically assigned to a process on demand.

**Cloud computing Architecture**

**Software architecture**

Software architecture is a set of decisions about organizations of a software system.

It also defines the functionality of a system.

It includes selection of structural elements and their interfaces by which the system is composed of, together with their behavior as specified in the collaborations among the elements.

**Cloud computing architecture** refers to the component and sub components required for cloud computing.

This components consist of a front end platform (interface used for interaction) and a backend platform(data centers called servers) .

This two platforms are inter linked by use of a network i.e. internet or private network.

Cloud computing architecture is service oriented.

**Service oriented architecture (SOA)** is an architectural approach that creates services that can be shared and used across multiple platforms thus improving agility to make changes to that data and also lowering the cost associated with accessing this resources individually.

SOA is related with cloud computing in that developers of cloud computing infrastructure can combine multiple applications which are needed for use by the users and provide synchronous and asynchronous access to this locations.

**Advantages of using SOA and cloud computing**

* Enables us to build robust cloud computing systems that are able to handle multiple set of different formats of data.
* Ensures synchronous and asynchronous access of this data which is unlimited in terms of geographical space.
* Combining this two brings down the cost of setting up the cloud computing systems. I.e. by combing SOA with cloud computing environment on is able to a host services and application on one platform therefore reducing the cost of development.

**ARCHITECTURAL CONSIDERATIONS FOR DEVELOPING CLOUD SYSTEMS**

1. **Cloud computing infrastructure model-**organizations need to consider several infrastructure models when developing systems

There are four categories:

1. **Public cloud-** this are stand alone or proprietary clouds mostly off premises run by third party companies such as Google ,Microsoft and Amazon

**Public clouds are hosted off customer premises and usually mix applications from different consumer through shared infrastructure.**

1. **Private cloud** – designed and managed by an IT dept within an organization

It’s usually build to provide services internally to an organization.

This infrastructure gives a high level of control over the cloud services and the cloud infrastructure

1. **Virtual private infrastructure** – this infrastructure allows service providers to offer unique services to private cloud users. This services allow the customer to use their infrastructure serves as part of their private cloud.

Private cloud customers can easily extend the trust boundary which is composed of security, control and service management components to include other virtual private cloud

The virtual private cloud concept introduces the complexity of migrating workloads and related data from a private cloud.

1. **Inter cloud infrastructure –** this is a future for the development of computing which envisions a public, open and decoupled cloud computing inter network.
2. **Service layer of cloud computing**

Service layer provides services that are offered in a traditional IT infrastructure.

The four major layers in cloud computing are **:( Service Models)**

* **Software as a service (SAAS) –** this is where application services are delivered over the network on a subscription or on demand basis. e.g. Microsoft and Google.
* **Platform as a service (PAAS) –** this consists of run time environments and software development frameworks and components delivered over the network on a pay as you go basis.
* **Infrastructure as a service (IAAS) –** this where computing power, network, storage are delivered over the network still on a pay as you go basis. eg Amazon web servers.
* **IT foundation –** provides basic building blocks to develop and enable the above three layers.

**Virtualization**

This is the process of turning a physical IT resource into a virtual IT resource.

The importance of virtualization is it helps in shifting IT focus from managing complex and abstract resources to improving the services being provided to individuals or organizations.

Through virtualization of it resources the following advantages are attained:

* **Saves Money: -** i.e. one can turn a single service server to a multi tasking server and one can turn multiple servers into a computing pool that can adopt more flexibly to change in workloads.
* **Saves Energy:-**It reduces the number of physical server thereby reducing the cost of electricity needed to power them.
* **Saves time:** - with fewer servers one can spend less time on managing them.
* It maximizes the efficiency of a resource:-this is achieved by spreading a resource to multiple consumer thereby maximizing efficiency since each consumer is able to access that resource.

**Types of virtualization**

**Server virtualization: -** partition one physical server into multiple virtual servers whereby each of this multiple server work independently.

**Network virtualization: -** one splits the available bandwidth in a network into independent network channels that can be assigned to specific servers or devices.

**Application virtualization:** - it separates application from the hardware and software of the OS putting them in a container that can be relocated without disrupting other systems.

**Hardware or platform virtualization:** - this refers to the creation of a virtual machine that acts like a real computer with OS software executed on these virtual machines is separated from the underlying hardware resource.

**Service virtualization: -** this emulates the behavior of dependent system components that are needed to exercise an application under test for development or testing purposes.

Rather than virtualizing the entire component it only virtualizes only specific slices of dependent behavior critical to the execution of development and testing tasks.

**Storage virtualization:**-we decouple a physical storage facility into virtual and spread out storage location.

**Databases virtualization:**-coupled with storage virtualization

Memory virtualization:-

**Technical and Business consideration for performance overhead**

1. **Performance overhead: -** virtualization in complex system may not be ideal because this systems may have high work loads with little use for resource sharing and replication.

A poorly formulated virtualization plan can result in excessive performance overhead.

A common strategy used to rectify this overhead issue is called PARA virtualization which persent a software interface to the virtual machines that is not identical to the underlying hardware.

The software interface has instead been modified to reduce the guest operating system processing overhead which is more difficult to manage.

A major drawback of PARA virtualization is the need to adopt the quest OS to PARA virtualization API which can impair the use of standard guest OS while reducing the solution portability.

1. **Special hardware compatibility: -** Many H/W vendors that distribute specialized H/W may not have device drivers that are compatible with the virtualization S/W. Similarly the S/W may be incompatible with latest released H/W versions .This compatibility issues can be resolved using established commodity HW platform and mature virtualization software products.
2. **Portability:** -the programmatic and management interfaces that establish administration environments for a virtualization program to operate with various virtualization solution can introduce portability gaps due to incompatible issues hence initiative such as open virtualization format for the standardization of virtual disk image formats are necessary to alleviate the portability concern.