**Unit-4**

**Q.1) Define cloud computing and explain evolution of cloud computing?**

* **Cloud computing:** Cloud computing is a model of computing in which users can access and use computing resources, such as storage, processing power, and software applications, over the internet. Instead of having to invest in and maintain their own physical infrastructure, users can access and use these resources on a pay-as-you-go basis from a cloud provider.
* cloud computing was primarily used by large organizations to reduce their IT costs and increase their flexibility.
* However, as the technology has matured and become more widespread, it has also become increasingly accessible to small and medium-sized businesses, as well as individuals.
* **The evolution of cloud computing:** The evolution of cloud computing can be traced back to the 1960s, when researchers began exploring ways to share resources, such as data and computing power, over networks. In the 1980s and 1990s, advancements in internet technology, combined with the increasing demand for more computing power and storage, led to the development of cloud computing as we know it today.
* Cloud computing is used by organizations of all sizes in a variety of industries, including healthcare, finance, and retail.
* In recent years, the growth of cloud computing has been driven by the increasing adoption of cloudbased software as a service (SaaS) applications,
* Such as office productivity tools and customer relationship management (CRM) systems, as well as the increasing use of cloud-based infrastructure as a service (IaaS) and platform as a service (PaaS) offerings.

**Q. 2) Explain Cloud services with examples?**

* Cloud services are computer-based services that are made available to users over the internet. They allow users to access and use computing resources, such as storage, processing power, and software applications, on a pay-as-you-go basis rather than having to invest in and maintain their own physical infrastructure. Here are some examples of cloud services:

1. **Storage:** Cloud storage services, such as Google Drive and Dropbox, allow users to store and access their files from any device with an internet connection.
2. **Computing:** Cloud computing services, such as Amazon Web Services (AWS) and Microsoft Azure, provide users with access to virtual servers and other computing resources on a pay-as-you-go basis.
3. **Software as a Service (SaaS):** Cloud-based software applications, such as Google Docs and Microsoft Office 365, allow users to access and use software applications over the internet without having to install them on their own devices.
4. **Infrastructure as a Service (IaaS):** Cloud-based infrastructure services, such as AWS and Azure, provide users with access to virtualized computing resources, such as servers, storage, and networking, that they can use to build and run their own applications.
5. **Platform as a Service (PaaS):** Cloud-based platform services, such as AWS and Azure, provide users with a platform for developing, deploying, and managing applications without having to worry about the underlying infrastructure.

**Q. 3) Explain advantages and challenges of cloud computing ?**

* **There are several advantages to using cloud computing:**

1. **Cost savings:** One of the main benefits of cloud computing is that it can help organizations reduce their IT costs. Because users only pay for the resources they use, they can avoid the upfront expenses associated with purchasing and maintaining their own physical infrastructure.
2. **Scalability:** Cloud computing allows users to quickly and easily scale their resources up or down as needed. This means that organizations can easily adjust to changes in demand without having to invest in additional hardware or infrastructure.
3. **Flexibility:** Cloud computing allows users to access and use computing resources from anywhere with an internet connection. This means that organizations can be more flexible in terms of where and how their employees work.
4. **Reliability:** Cloud providers typically have redundant systems in place to ensure that their services are always available. This means that users can rely on the cloud to provide a high level of uptime and availability.

* **There are also some challenges to using cloud computing:**

1. **Security:** One of the main concerns with cloud computing is the security of data and applications stored in the cloud. While cloud providers typically have strong security measures in place, it's important for organizations to carefully consider their security needs and ensure that their data is protected in the way that they require.
2. **Internet connectivity:** Cloud computing relies on a stable internet connection. If an organization's internet connection is unreliable, it may be difficult to access cloudbased resources.
3. **Integration:** Migrating to the cloud can be complex, particularly for organizations with existing IT infrastructure. It may take time and effort to integrate cloud-based resources with existing systems and processes.
4. **Dependency:** Using cloud-based resources means that organizations are reliant on the availability and performance of the cloud provider's infrastructure. If the provider experiences downtime or other issues, it can impact the organization's ability to access and use their resources.

**Q. 4) Explain Cloud deployment models with examples.**

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* **There are four main cloud deployment models:** public, private, hybrid, and community.

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1. **Public cloud:** A public cloud is owned and operated by a third-party cloud provider, such as Amazon Web Services (AWS), Microsoft Azure, or Google Cloud Platform. Users can access and use the provider's computing resources over the internet on a pay-as-you-go basis. Examples of public cloud services include storage, computing, and software as a service (SaaS) applications.

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1. **Private cloud:** A private cloud is owned and operated by a single organization for its own exclusive use. It can be hosted on-premises or off-premises. Private clouds offer more control and security than public clouds, but they can also be more expensive to set up and maintain.
2. **Hybrid cloud:** A hybrid cloud combines elements of both public and private clouds, allowing organizations to use the best of both worlds. For example, an organization might use a public cloud for storage and a private cloud for sensitive data.

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1. **Community cloud:** A community cloud is shared by a group of organizations with similar needs and goals. It can be hosted by a third-party provider or operated by the organizations themselves. Community clouds offer the benefits of both public and private clouds, while also allowing organizations to share the costs and resources associated with the cloud.

* **Examples of cloud deployment models in action include:**
* An organization using AWS to host its website and store customer data.
* A healthcare provider using a private cloud to store and manage patient records.
* An organization using a hybrid cloud to run its email system on a private cloud and store data on a public cloud.
* A group of nonprofit organizations sharing a community cloud to host their websites and databases.

**Q.5) Explain the Cluster Computing in Detail ?**

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* **Cluster Computing:** Cluster computing is a form of computing in which a group of computers are linked together so that they can act like a single computer.
* **BENEFITS OF CLUSTER COMPUTING:**
* **High availability** – The ability to provide end users with access to a service for a high percentage of time.
* **High reliability** – The ability of a system to reduce frequency of system failure.
* **DISADVANTAGES:**
* With respect to software it is difficult to develop software for distributed systems.
* With respect to Network it shows lossy transmissions.
* With respect to security easy access to secret data.

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**Q.6) Explain the Grid computing in Detail ?**

* **GRID COMPUTING:** Grid computing is the collection of computer resources from multiple locations to reach a common goal.
* Grid computers have each node set to perform a different task or application.
* Grid computer also tend to be more heterogeneous and geographically dispersed than cluster computers .
* Single grid can be dedicated to a particular application.
* **BENEFITS :**
* Exploit under utilized resources.
* Resource load balancing.
* Virtualize resources across an enterprise.
* Enable collaboration for virtual organization .

**Q.7) Explain the Parallel computing** **in Detail ?**

* **PARALLEL COMPUTING:** Parallel computing is the **simultaneous** use of multiple computing resources to solve a computation problem.
* A problem is broken into discrete parts that can be solved concurrently.
* Each part is further broken down to a series of instructions.
* Instruction from each part execute simultaneously on different processors.

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* Co-ordinator mechanism is employed.
* **ADVANTAGES:**
* Saves time
* Cost is saved
* Solve larger and complex problems
* Provide concurrency
* Make better use of underlying parallel hardware.
* **DISADVANTAGES:**
* Portability
* Resource requirements
* Scalability

**Q.8) Explain the Distributed computing in Detail ?**

* **DISTRIBUTED COMPUTING:** A distributed system is a collection of independent computers, interconnected via a network, capable of collaborating on a task
* Distributed computing is computing performed in a distributed system.

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* **ADVANTAGES:**
* The affordability of computers and availability of network access
* Resource sharing
* Scalability
* Fault tolerance
* **DISADVANTAGES:**
* Multiple points of failures
* Security concerns

**Q.9) Explain Data Center in Detail ?**

* **Data Center:** A data center is a facility that centralizes an organization’s shared IT operations and equipment for the purposes of storing, processing, and disseminating data and applications.
* Because they house an organization's most critical and proprietary assets, data centers are vital to the continuity of daily operations.
* Consequently, the security and reliability of data centers and their information are among any organization’s top priorities.
* In the past, data centers were highly controlled physical infrastructures, but the public cloud has since changed that model.
* Except where regulatory restrictions require an on-premises data center without internet connections, most modern data center infrastructures have evolved from on-premises physical servers to virtualized infrastructure that supports applications and workloads across multi-cloud environments.
* **The Role of the Data Center:**
* Data centers are an integral part of the enterprise, designed to support business applications and provide services such as:
* Data storage, management, backup and recovery
* Productivity applications, such as email
* High-volume e-commerce transactions
* Powering online gaming communities
* Big data, machine learning and artificial intelligence
* Today, there are reportedly more than 7 million data centers worldwide. Practically every business and government entity builds and maintains its own data center or has access to someone else's, if not both models.
* Many options are available today, such as renting servers at a colocation facility, using data center services managed by a third party, or using public cloud-based services from hosts like Amazon, Microsoft, Sony and Google.
* **The Core Components of a Data Center:** Data center architectures and requirements can differ significantly.
* **For example,** a data center built for a cloud service provider like Amazon satisfies facility, infrastructure and security requirements that significantly differ from a completely private data center, such as one built for a government facility that is dedicated to securing classified data.
* Regardless of classification, an effective data center operation is achieved through a balanced investment in the facility and the equipment it houses.
* In addition, since data centers often house an organization's business-critical data and applications, it's essential that both facility and equipment are secured against intruders and [cyberattacks](https://www.paloaltonetworks.com/network-security/data-center).
* **The primary elements of a data center break down as follows:**
* **Facility –** the usable space available for IT equipment. Providing round-the-clock access to information makes data centers some of the world’s most energy-consuming facilities. Design to optimize space and environmental control to keep equipment within specific temperature/humidity ranges are both emphasized.
* **Core components –** equipment and software for IT operations and storage of data and applications. These may include storage systems; servers; network infrastructure, such as switches and routers; and various information security elements, such as [firewalls](https://www.paloaltonetworks.com/network-security/next-generation-firewall).
* **Support infrastructure –** equipment contributing to securely sustaining the highest availability possible. The Uptime Institute has defined four tiers of data centers, with availability ranging from 99.671% to 99.995%. Some components for supporting infrastructure include:
* **Uninterruptible Power Sources (UPS)** – battery banks, generators and redundant power sources.
* **Environmental control –** computer room air conditioners (CRAC); heating, ventilation and air conditioning (HVAC) systems; and exhaust systems.
* **Physical security systems –** biometrics and video surveillance systems.
* **Operations staff –** personnel available to monitor operations and maintain IT and infrastructure equipment around the clock.

#**Self-Study**#

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* **INTRODUCTION TO MAINFRAME ARCHITECTURE:** In a a mainframe System, all the processing is done by a single very powerful computer. Individual terminals are used to access the mainframe computer but don’t run by applications themselves.
* Mainframe measured in millions of instructions per second
* Mainframe are built to be reliable for transaction processing.

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* **CLIENT –SERVER ARCHITECTURE :** Client-server Architecture is a computing model in which the server hosts ,delivers and manages most of the resources and services to be consumed by the client.
* This type of architecture has one or more client computers connected to a central server over a network this system shares computing resources.
* It is a producer consumer computing architecture where the server acts as a producer and client as a consumer.
* **BENEFITS AND RISKS IN CLOUD COMPUTING:**
* **CLOUD SERVICES** **:**
* **Infrastructure as a service (IaaS) it includes**
* **Platform as a service (PaaS):**
* **Software as a service (SaaS):**
* **Key characteristics of cloud computing:**