



Institute of Technology of Cambodia
Department of Information Technology
and communication



Distributed Systems

Group: C4

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TP3

1. Explain the concept of remote desktop, and give EX of TeamViewer or VNC or MS Remote Desktop.
2. Explain semaphores in OS and DB.
3. Explain 1 of the topics below:
 - The emergence of mobile computing
 - The emergence of ubiquitous computing
 - The emergence of cloud computing
4. Explain the process how torrent works.
5. Find the advantages of peer-to-peer over client-server architecture.
6. Between client-server and peer-to-peer, which one is more complex, explain.
7. Are multiple servers and cluster the same? Explain.
8. Explain proxy server.

Answer

1. **Remote Desktop** allows users to access and control a computer from a different location over a network, such as the internet. This technology can be useful for IT support, remote work, and accessing files or applications on another device without needing to be physically present.
 - TeamViewer: A popular remote desktop tool that supports cross-platform connections, allowing users to access computers, mobile devices, and servers. It offers features like file transfer, session recording, and multi-user support.
 - VNC (Virtual Network Computing): Uses the RFB (Remote Frame Buffer) protocol to allow screen sharing and remote control. VNC servers and clients exist for most operating systems, and many versions are open-source.
 - Microsoft Remote Desktop (RDP): Built into Windows, it allows users to connect to Windows machines using the Remote Desktop Protocol. RDP is widely used in enterprise environments for remote administration and support.
2. **Semaphores** are synchronization primitives used in operating systems (OS) and databases to manage concurrent processes and prevent issues like data races. They act as signals to control access to shared resources and prevent conflicts when multiple processes access the same resource simultaneously.
 - **In Operating Systems:** Semaphores control resource access between processes. For example, a binary semaphore (mutex) can signal if a resource is in use, allowing only one process access at a time, while a counting semaphore allows a specific number of processes access simultaneously. This prevents deadlocks and race conditions, ensuring safe and efficient process synchronization.
 - **In Databases:** Semaphores are often used to handle locks on records or tables, managing concurrency in multi-user environments. By signaling which data is in use, semaphores prevent simultaneous edits, which could otherwise cause inconsistent or corrupted data.

- Overall, semaphores are crucial in both OS and databases to ensure orderly and conflict-free access to shared resources.

3. **The Emergence of Mobile Computing:** Mobile computing refers to the ability to use computing devices like smartphones, tablets, and laptops to access information, applications, and services while on the move. As mobile technology has advanced, these devices have become more powerful, offering capabilities similar to traditional computers. Key developments contributing to the emergence of mobile computing include:
 - **Miniaturization of hardware:** As hardware components became smaller and more efficient, powerful devices could be created in portable forms.
 - **Wireless connectivity:** Widespread access to Wi-Fi, mobile networks (3G, 4G, and now 5G), and Bluetooth has allowed mobile devices to connect to the internet from almost anywhere.
 - **Battery improvements:** Enhanced battery technologies enable prolonged usage of mobile devices.
 - **Software advancements:** Operating systems like Android and iOS are optimized for mobile use, offering user-friendly interfaces and app ecosystems.
- **The Emergence of Ubiquitous Computing:** Ubiquitous computing, also known as pervasive computing, envisions a world where computing is seamlessly integrated into the environment, allowing for continuous interaction without being consciously noticed by the user. This involves embedding sensors, processors, and communication capabilities in everyday objects, enabling them to collect and exchange data autonomously. Key aspects include:
 - **Internet of Things (IoT):** Everyday objects, from home appliances to industrial machines, are connected to the internet and capable of sensing, processing, and interacting with other devices.
 - **Ambient intelligence:** Environments become “smart,” adjusting to user needs and preferences based on collected data, often with minimal human intervention.
 - **Context-awareness:** Devices can understand and respond to contextual information, such as location or user behavior, providing relevant responses.
- **The Emergence of Cloud Computing:** Cloud computing is the delivery of computing services, such as storage, processing, and applications, over the internet (“the cloud”), enabling access to resources on demand without needing local infrastructure. This technology emerged as bandwidth improved and remote server management became more secure and scalable. Essential aspects of cloud computing include:
 - **Infrastructure-as-a-Service (IaaS):** Provides virtualized hardware, such as virtual machines and storage, so users can manage their own operating systems and applications.
 - **Platform-as-a-Service (PaaS):** Offers a platform with managed infrastructure and tools, allowing developers to build and deploy applications without managing the underlying hardware.

- **Software-as-a-Service (SaaS):** Provides complete software applications over the internet, accessible through a web browser, minimizing the need for local installations.
4. **Torrenting** is a method of file-sharing based on peer-to-peer (P2P) networking, allowing users to distribute files among themselves rather than relying on a central server.
- **How It Works:** When a user downloads a torrent file, they use a torrent client (like BitTorrent or uTorrent) to open it. This client connects them to other peers who have all or parts of the file. Files are broken into small pieces, and as the user downloads, they simultaneously upload pieces to others, enhancing download speeds and reducing server load.
 - **Key Components:**
 - **Torrent File:** Contains metadata about the file being shared, including file structure, size, and information about trackers.
 - **Trackers:** Coordinate communication among peers in the network, helping users find others who have pieces of the file.
 - **Seeds and Peers:** A "seed" is a user who has a complete file and shares it, while "peers" are users who are currently downloading or uploading parts of it.
5. Advantages of Peer-to-Peer over Client-Server Architecture
- **Decentralization:** P2P does not rely on a single central server, reducing the risk of a single point of failure.
 - **Scalability:** As more users join a P2P network, they contribute resources, increasing the network's capacity.
 - **Cost-Effectiveness:** Since each peer contributes resources, there is less reliance on costly centralized infrastructure.
 - **Redundancy:** Files and services in a P2P network are stored across multiple devices, enhancing data availability and resilience against data loss.
 - However, P2P can be more complex to manage and less secure, given its decentralized nature.
6. Complexity Comparison between Client-Server and Peer-to-Peer Architectures
- **Client-Server:** Typically simpler, with a central server managing requests and responses. The server has full control over resource distribution, making management straightforward, though it can become a bottleneck.
 - **Peer-to-Peer (P2P):** More complex, as each device can act as both a client and a server. Coordination between peers requires robust protocols to manage connections, data integrity, and security. P2P networks also face challenges with consistency and resource distribution, as each peer's capabilities can vary significantly.

- Therefore, P2P networks require more complex algorithms for synchronization, load balancing, and fault tolerance compared to client-server setups.

7. Are Multiple Servers and Clusters the Same? Explain

- **Multiple Servers:** Refers to the use of several independent servers, each handling specific tasks or serving as backups. These servers may not work in a tightly integrated way and might be used for load balancing or redundancy but do not necessarily act as a single unit.
- **Cluster:** A cluster involves multiple servers (nodes) that work together as a single system. They are interconnected and often share storage, allowing them to balance workloads and provide high availability. Clusters are commonly used for high-performance computing and services that require fault tolerance, where tasks can shift between nodes in case of failure.
 - In summary, while multiple servers can operate independently, a cluster is a coordinated, integrated system of servers working as a single entity.

8. A **proxy server** acts as an intermediary between a user's device and the internet.

When a user makes a request, it is sent to the proxy server first, which forwards it to the destination server. The response returns to the proxy server, which then sends it back to the user. Benefits of Proxy Servers:

- **Enhanced Security:** They mask the user's IP address, making it harder for third parties to track users.
- **Content Filtering and Caching:** Proxy servers can block access to certain sites and cache frequently requested data, improving load times.
- **Access Control:** Often used in workplaces or educational institutions to control what resources users can access online.
 - Proxy servers are commonly used to improve security, increase privacy, and enable faster access to frequently visited websites.