Q - Explalin diff types of o/s.

**1. Single Processor System**

* A system with only **one** CPU (central processing unit).
* The CPU executes one instruction at a time (though modern CPUs use techniques like **multithreading** to simulate parallelism).
* Example: A **personal computer (PC)** with a single-core processor.

**Advantages:**  
✅ Simple to design and manage.  
✅ Less expensive than multiprocessor systems.

**Disadvantages:**  
❌ Limited processing power.  
❌ If the CPU fails, the entire system stops.

**2. Multiprocessor System**

* A system with **two or more CPUs** sharing memory and devices.
* These CPUs work together to execute tasks faster.
* Can be **Symmetric Multiprocessing (SMP)** (all CPUs share memory equally) or **Asymmetric Multiprocessing (AMP)** (one CPU controls others).

**Example:** Servers, high-performance computing clusters, multi-core processors in modern PCs.

**Advantages:**  
✅ Faster execution by parallel processing.  
✅ Increased reliability—if one CPU fails, others continue working.

**Disadvantages:**  
❌ More complex design and management.  
❌ Higher cost due to multiple CPUs.

**3. Clustered System**

* Multiple computers (nodes) **connected together** and working as a single system.
* Unlike multiprocessors (which share memory), **each node in a cluster has its own memory** but communicates with other nodes.
* Used for **high availability** and **load balancing**.

**Example:** Google Cloud, Amazon Web Services (AWS), supercomputers.

**Advantages:**  
✅ Scalable—more nodes can be added for better performance.  
✅ Fault-tolerant—if one node fails, others continue working.

**Disadvantages:**  
❌ Requires high-speed networking.  
❌ More complex to configure and manage than single/multiprocessor systems.

**4. Client-Server System**

* A system where a **server** provides resources (data, applications, services) to **clients** (computers or devices).
* The server handles multiple client requests over a network.

**Example:** Websites, online banking, file-sharing systems (Google Drive, Dropbox).

**Advantages:**  
✅ Centralized control and management.  
✅ Efficient resource sharing.

**Disadvantages:**  
❌ If the server fails, clients lose access.  
❌ Requires proper security to prevent cyberattacks.

**5. Real-Time Operating System (RTOS)**

* An OS that processes tasks **immediately**, with strict timing constraints.
* Used in time-sensitive applications where delays are unacceptable.
* Two types:
  + **Hard RTOS**: Missing a deadline **causes system failure** (e.g., pacemakers, airbags).
  + **Soft RTOS**: Missing a deadline **reduces performance but doesn't cause failure** (e.g., video streaming).

**Example:** Medical devices, robotics, self-driving cars, industrial control systems.

**Advantages:**  
✅ Highly reliable and fast.  
✅ Ensures real-time processing.

**Disadvantages:**  
❌ More complex and costly to develop.  
❌ Limited flexibility compared to general-purpose OS.

Would you like more details on any of these? 😊

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