Distributed Computing – Revision Notes

◇ **Distributed Computing – Definition**
- **Distributed Computing**: A field of computer science that studies **distributed systems** and their application in solving computational problems.

◇ **Distributed System – Definition**
- A system with **multiple autonomous computers** (nodes), each with **local memory**, communicating via **message passing** (e.g., high-speed buses, telephone lines).

◇ **Examples of Distributed Systems**
- **Internet**
- **ATM Networks**
- **Intranets/Workgroups**
- **Ubiquitous Network-Connected Devices**

◇ **Types of Computers in Distributed Systems**
- **Workstations**: Used by end-users for tasks.
- **Server Systems**: Provide resources/services.
- **Personal Assistance Devices**: Handheld, wireless-connected devices.

◇ **Key Properties of Distributed Systems**
1. **Fault Tolerance**
   - System continues functioning despite node failures (no single point of failure).
2. **Resource Sharing**
   - Nodes share computing power & storage.
3. **Load Sharing**
   - Tasks are distributed across nodes to balance workload.
4. **Scalability**
   - System can be expanded easily by adding nodes.
5. **Limited Global Knowledge**
   - Each node has a partial, incomplete view of the system.
6. **Performance**
   - Supports **parallel computing**, a subset of distributed computing.

◇ **Why Use Distributed Computing?**
- **Nature of Applications**:
  - **Compute-Intensive**: e.g., Monte Carlo simulation for Pi value.
  - **Data-Intensive**: e.g., Facebook data, LHC experiment data.
- **Robustness**:
  - Eliminates single point of failure.
  - Tasks can migrate on failure.

◇ **Distributed Applications**
- Composed of **multiple processes** working together over a network to solve a **common problem**.
- **Client-Server Model**:
  - Centralized resource management at the server.
- **Peer-to-Peer Model**:
  - More decentralized, truly distributed computing.

☑ **Exam-Focused Points to Remember**
- Message passing is the **only way of communication** between nodes.
- Each node has **local memory** – no shared memory.
- **Parallel computing** is a **subset** of distributed computing.
- **Fault tolerance**, **load sharing**, and **resource sharing** are essential features.
- **Peer-to-Peer** is more distributed than **Client-Server**.