

INTRODUCTION TO DISTRIBUTED SYSTEMS

Subject: System Analysis And Design

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INTRODUCTION TO DISTRIBUTED SYSTEMS

A **Distributed System** is a system in which multiple computers work together over a network and appear to users as a single system. In such systems, different computers (called nodes) communicate and coordinate their actions to achieve a common goal.

In modern computing environments, distributed systems are widely used because they allow organizations to share resources, process large amounts of data, and provide services to many users simultaneously.

In System Analysis and Design, understanding distributed systems is important because many modern applications such as **cloud computing, online banking, and e-commerce platforms** rely on distributed architectures.

Key points:

- Multiple computers connected through a network
- Resources and data are shared among nodes
- System works as a single unified system for the user
- Improves performance, scalability, and reliability

CHARACTERISTICS OF DISTRIBUTED SYSTEMS

Distributed systems have several important characteristics that make them different from traditional centralized systems.

1. Resource Sharing

Different computers in the network share hardware, software, and data resources.

2. Scalability

The system can easily expand by adding more computers or servers without affecting performance.

3. Transparency

Users do not need to know that multiple computers are working behind the system. The system appears as a single entity.

CHARACTERISTICS OF DISTRIBUTED SYSTEMS

4. Concurrency

Many users can access the system and perform operations at the same time.

5. Fault Tolerance

If one computer in the system fails, other computers can continue performing tasks.

These characteristics make distributed systems highly efficient and suitable for large-scale applications.

COMPONENTS OF A DISTRIBUTED SYSTEM

1. Nodes (Computers or Servers)

These are individual machines that process data and perform tasks.

2. Network Communication

The network connects different nodes and allows them to communicate using protocols such as TCP/IP.

3. Middleware

Middleware is software that acts as a bridge between applications and the network, helping different systems communicate smoothly.

COMPONENTS OF A DISTRIBUTED SYSTEM

4. Distributed Database

Data may be stored across multiple locations but appears as a single database to the user.

5. Client-Server Architecture

Clients send requests, and servers process those requests and provide responses.

Together, these components ensure smooth communication and coordination within the distributed system.

ADVANTAGES AND CHALLENGES OF DISTRIBUTED SYSTEMS

Advantages

1. **Improved Performance** – Tasks are distributed among multiple computers, increasing processing speed.
2. **High Reliability** – If one system fails, others can continue working.
3. **Scalability** – New nodes can be added easily when demand increases.
4. **Resource Sharing** – Hardware, software, and data can be shared among multiple users.

CHALLENGES

1. **Complex Design** – Designing distributed systems is more complicated than centralized systems.
2. **Security Issues** – Data traveling across networks may be vulnerable to attacks.
3. **Network Dependency** – System performance depends heavily on network stability.
4. **Data Consistency** – Maintaining the same data across multiple systems can be difficult.

APPLICATIONS OF DISTRIBUTED SYSTEMS

Distributed systems are widely used in many real-world applications.

1. Cloud Computing

Services like cloud storage and computing platforms operate using distributed systems.

2. Banking and Financial Systems

Banks use distributed systems to manage transactions across multiple branches.

3. E-Commerce Platforms

Online shopping websites use distributed systems to handle large numbers of users simultaneously.

4. Telecommunications

Mobile networks and internet services rely on distributed computing.