

# Distributed Systems Report

## 1. Definition of Distributed Systems

A **distributed system** is a collection of independent computers (nodes) that communicate over a network and cooperate to perform tasks as a single system. Each node has its own memory and processing power, and coordination is achieved through message passing rather than shared memory. To the end user, the system appears unified, even though its components may be geographically dispersed. Distributed systems are designed to improve **scalability, reliability, availability, and performance**, while tolerating partial failures.

## 2. Transparencies in Distributed Systems

Transparency refers to hiding the complexity of distribution from users. Below are **five transparencies**, explained with real-world examples.

### 2.1 Access Transparency

Access transparency ensures that users interact with resources in the same way regardless of whether they are local or remote.

**Example:** In Google Drive, opening a cloud-stored document feels the same as opening a local file, even though the data resides on remote servers.

### 2.2 Location Transparency

Users do not need to know where a resource is physically located.

**Example:** When using WhatsApp, users send messages without knowing which server or data center processes the message.

### 2.3 Replication Transparency

Multiple copies of data exist, but users see only one logical resource.

**Example:** Google Drive replicates files across servers, yet users interact with a single file version.

### 2.4 Failure Transparency

The system continues operating despite node or network failures.

**Example:** Bitcoin remains operational even when some nodes go offline because the network is decentralized.

## 2.5 Concurrency Transparency

Multiple users can access shared resources simultaneously without conflict.

**Example:** Multiple users can edit or access shared Google Drive files at the same time without corrupting data.

## 3. Transparency Well Implemented by WhatsApp, Google Drive, and Bitcoin

The transparency that **all three systems implement particularly well is *Failure Transparency*.**

- **WhatsApp** reroutes messages through alternative servers if one server fails.
- **Google Drive** uses replication and backup mechanisms to prevent data loss.
- **Bitcoin** is fully decentralized, allowing the system to function even if many nodes fail.

This transparency ensures high availability and reliability, which are essential for large-scale distributed systems.

## 4. Distributed System Diagram

