Fault Tolerance in Distributed Systems

- Fault tolerance is a key feature in distributed systems, designed to ensure that the system continues working even when parts of it fail.
- By using fault tolerance, we can make systems more reliable, reduce downtime, and keep data safe.

1. Use of Redundancy

- Redundancy is like having backup copies or extra resources. If one part fails, we can switch to another to keep things running.
- How it works:
  - - Extra copies of data or systems (like servers) are kept to take over if something fails.
  - - Think of it as a backup plan in case one option doesn’t work.
- Example:
  - - Cloud storage systems keep copies of data in multiple places. If one server goes down, your data is safe and accessible from another server.

2. Active Replication

- Active replication means running multiple copies of the same task at the same time. Each copy does the same job, so if one copy fails, the others keep going.
- How it works:
  - - Multiple servers perform the same task simultaneously.
  - - If one server fails, the others continue, so there's no interruption.
- Example:
  - - In banking, multiple servers may verify a transaction at once. If one server crashes, the others still complete the job.

3. Use of Primary Backup

- Primary backup designates one main system (the "primary") and one or more backups to take over if the primary fails.
- How it works:
  - - The primary system does the work, while the backup "waits" in case it’s needed.
  - - If the primary system fails, the backup quickly steps in to take over.
- Example:
  - - In online shopping, the primary server might handle orders, while a backup server is ready to take over if the primary goes down.

Summary

- Redundancy: Extra copies of resources to avoid data loss.
- Active Replication: Running multiple copies of tasks at the same time for reliability.
- Primary Backup: A main system with a standby backup ready to take over if needed.