

Assignment. No.: 6

Que. 1

Explain the types of distributed database system
→ The two main types of distributed database system
are ↗

1] Homogeneous DDBMS ↗

- All sites use the identical DBMS software and operating system.
- They are aware of each other and cooperating in processing user requests.
- This simplifies design and management.

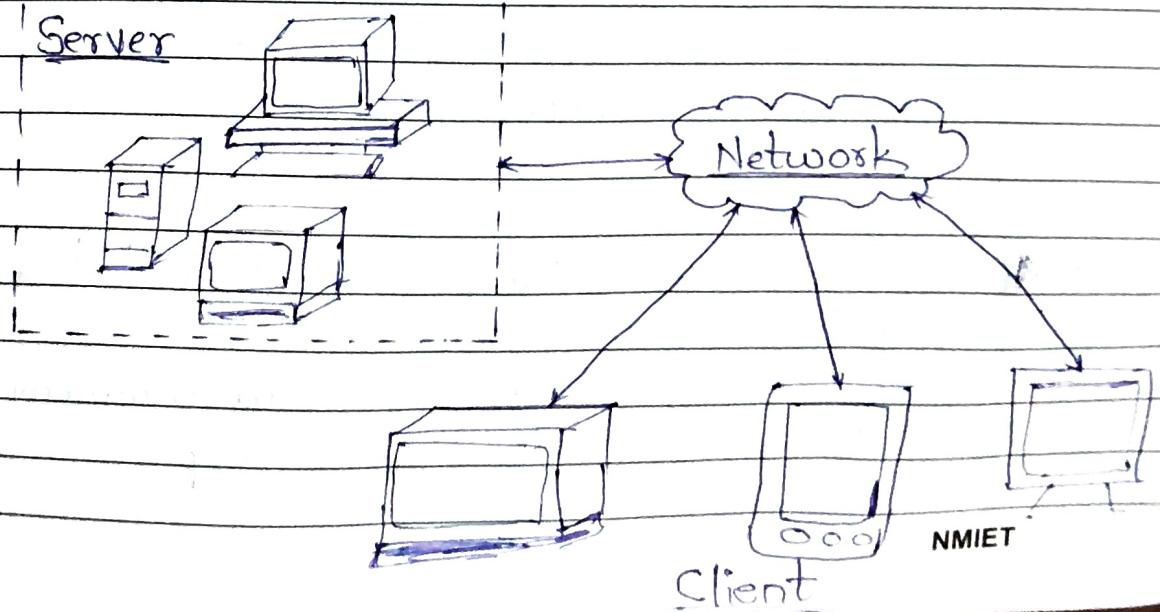
2] Heterogeneous DDBMS ↗

- Different sites use different DBMS software, schemas, or operating systems.
- Communication requires gateways or middleware to translate and coordinate data, making it more complex to manage but offering greater flexibility.

Que. 2

Explain and draw client-server architecture for DDBMS.

→





The Client-Server Architecture separates database functions into two parts:

1] Client \Rightarrow The user interface/application process. It requests services from the server.
(Ex. Submitting queries).

2] Server \Rightarrow The database system process. It manages and processes the database (e.g. executing queries, managing data access, and returning results).

In a DDBMS, the architecture often uses multiple servers located at different sites, and client can access data across these servers.

Client communicate with servers, often through a network. Servers handle the ~~to~~ actual data storage and query execution.

In a DDBMS, a client request might be partially handled by a local server and partially by remote servers, with the final results aggregated before being sent to the client.

Ques-4 Explain the database system failure modes (Any two).

Failure modes in DDBMS can compromise the system's availability or data consistency.

Two common modes are \Rightarrow

⇒ Site (Node) Failure ⇒ An individual computer / site in the network crashes due to hardware, software, or power issues.

- All transactions running at that site are halted, and its local data becomes temporarily unavailable.

⇒ Network Partitioning (Communication Failure) ⇒

- The communication links fail, dividing the network into two or more isolated partitions where sites within a partition can communicate, but communication between partitions is impossible.
- This can lead to inconsistency if updates occur independently in different partitions (the "split-brain" problem).

Ques 5] Explain two-phase commit protocol in distributed database.

→ The two-phase commit (2PC) protocol is a synchronous atomic commitment protocol used in DDBMS to ensure that a distributed transaction either commits at all participating sites or aborts at all sites, maintaining global data consistency (atomicity).

The protocol involves a coordinator site and multiple participant sites, occurring in two phases ⇒

⇒ Phase 1: Voting (Prepare Phase) ⇒

- The coordinator sends a PREPARE message to all participants.
- Each participant determines if it can commit the



transaction locally. IF yes, it writes all changes to stable storage and sends a YES (VOTE-COMMIT) message. IF no, it sends a NO (VOTE-ABORT) message and aborts the transaction.

2) Phase 2: Decision (Commit/ Abort Phase) \Rightarrow

- IF the Coordinator receives YES from ALL participants, it decides to COMMIT and sends a GLOBAL-COMMIT message.
- IF the Coordinator receives ANY NO or times out waiting, it decides to ABORT and sends a GLOBAL-ABORT message.
- Participants execute the final decision (commit or abort) and send an ACK back to the Co-ordinator.

Ques. 6) Describe the two-phase-commit (2PC) protocol? Explain how (2PC) protocol respond in different ways to different types of failures like site failure, coordinator failure, network partition?

\Rightarrow • Two-Phase Commit (2PC) \Rightarrow

- It is a synchronous atomic commitment protocol used in DBMS to ensure that a distributed transaction either commits at all participating sites or aborts at all sites, maintaining global data security (atomicity).

- The protocol involves a Coordinator site and multiple Participant sites, occurring in two phases:

\hookrightarrow Phase 1: Voting (Prepare Phase).



2) Phase 2: Decision (Commit/ Abort Phase).

- It has some failures responses below \Rightarrow

1) Participant Site Failure \Rightarrow

Impact & 2PC Response:

- Coordinator times out and decides ABORT.
- If failure is in the prepared state \Rightarrow

Participant recovers by querying the Co-ordinator (or peers) to learn the global decision (Commit or Abort).

2) Coordinator Failure \Rightarrow

Impact & 2PC Response:

- If failing is during phase 1 \rightarrow

Participants remain blocked in the prepared state (cannot decide unilaterally). A

- A recovery manager/new Coordinator must resolve.

3) Network Partition \Rightarrow

Impact and 2PC Response:

- Sites in different partitions cannot exchange votes or the final decision.
- The transaction becomes blocked (stuck in prepared state) until the network link is restored. It sacrifices availability.

Solution (5)	Punctuality (2)	Understanding (3)	Total (10)