DataBase Management Systems

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• ——— • CAT-3-EXAM • ——— •

8b) **Deadlock Handling** -

consider the following 2 transactions and history with Item x and transaction T_1 at site 1 and Item y and transaction T_2 at site 2

T_1 : write(x) write(y)	T_2 : write(x) write(y)
x lock on x	
write(x)	
	x lock on y
	write(y)
	wait for x-lock on x
wait for x-lock on y	

∴ Here deadlock cant be detected locally at either site.

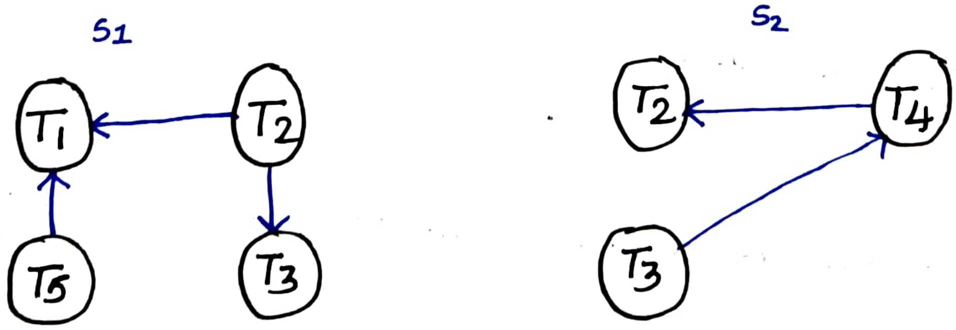
Deadlock Detection -

* In the centralized deadlock detection approch a global wait-for graph is constructed and maintained in a single site.

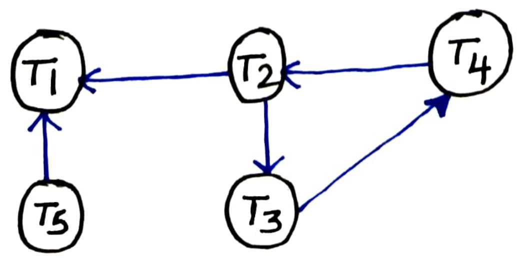
  - Real graph - Real but unknown state of system
  - Constructed Graph - Approximation generated by the controller during the execution.

* The global wait-for graph can be constructed when
  → a new edge is inserted in/removed from one of the local wait for graph.
  → a number of changes have occured in a local wait-for graph.
  → The coordinator needs to invoke cycle detection
  → If the coordinator finds a cycle it selects a victim and notifies all sites. The sites rollback the victim transaction.

[eg]



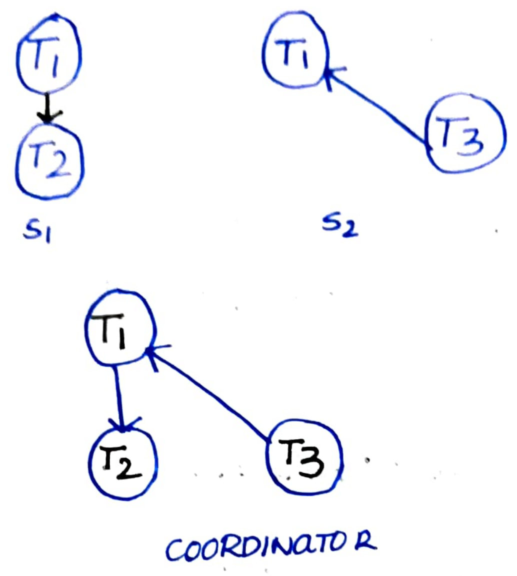
Local



Global

[eg] wait-for graphs for False cycles -

Initial state -



False cycles -

* suppose that starting from the state show in the figure

1. T_2 releases resources at S_1
   → resulting in a message remove $T_1 \to T_2$ message from the transaction Manager at site S_1 to the coordinator.

2. Then T_2 request a resource held by T_3 at S_2
   → resulting in a msg insert $T_2 \to T_3$ from S_2 to the coordinator

* suppose further that insert msg reaches b/w the del message
  → This can happen due to network delays.

* The coordinator would then find a false cycle
  $T_1 \to T_2 \to T_3 \to T_1$

* False cycles cant occur if 2phase locking is used

In distributed deadlocks unecessary rollbacks may result when deadlock has indeed occured the other transactions are aborted unrelated to the deadlock.

Due to False cycle in the graph likelihood of falsecycles is low.

Expensive and not used in practice.

7a)

A torrent files contains a list of files and integrity metadata and optionally contains a list of trackers.

* Each file to be distributed is divided into small information chunks called pieces.
* The technology to ensure fault tolerance is :-

Fault-Tolerant services using Replicated state Machines.

* Key requirement - make a service fault tolerant.
  (eg) Lock manager.

* State machines are powerful approch to create such service.
* A state machine has a stored state and receives I/ps
* Makes state transitions on each I/p and may output some results
  → Transitions and output must be deterministic

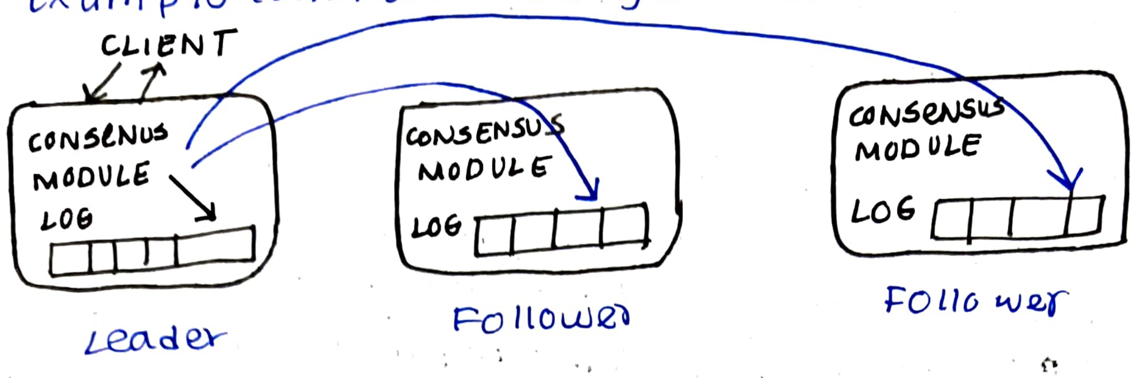
* A replicated state machine is a state machine that is replicated on multiple nodes.

* All replicas must exactly get the same I/ps
  → Replicated Log.

* Even if some of the nodes fail state and output can be obtained from other nodes.

Replicated state Machine -

* Replicated state machine based on replicated log
* Example commands assign values to variables.



* It can be used to implement wide variety of services
  - → Inputs can specify operations with parameters
  - → But operations must be deterministic.
  - → Result of operation can be sent from any replica

(eg) Fault Tolerant lock manager

- → state - Lock table
- → op - lock req & releases
- → output - grant, rollback.
- → centralized implementation is made.

* Fault Tolerant key value store -
  - → State - Key value
  - → operation - get(), put()

* Google spanner uses replicated state machine to implement key- value store.
  - → Data is partitioned, and each partion is replicated accross multiple nodes

→ replicas of a parion form a PAXOS group with one node as leader.

→ operations initiated at leader and rep to other nodes

6b) challenges in maintaining Data consistency

Data discrepancy occurs when data in the target database deviates from the source database. The extent to which the data deviates depends on various factors.

* Even when using products that replicate data reliably such as oracle there remain potential causes of data discrepancy.

* Some of the potential causes of data discrepancy are described in the following sections.

MIGRATION ERRORS –

* Diff kinds of migration tools are employed to facilitate the initial load of the target databases before replication can begin.

* Differences in configuration for handing data by the migration tools and replication products can result in data discrepancies.

LIFT & SHIFT WORKLOAD ON CLOUD :-

* since the world is moving towards cloun this database workload from on premises to cloud is the need of today's IT world.

INSTANTATION ERRORS :-

* Before migration or replication can begin the target database will need to be instantiated with the correct schema and constraints. Failure to do so will result in the source & target being out of sync.

CONFIGURATION ERRORS :-

* Improper and unintended configuration of replication products can cause discrepancies This type of discrepancy doesn't show up in the replication logs since from the replication product's perspective it is performing as configured.

CAP THEOREM—

* 3 properties of a system
  - → consistency
    - an execution of a set of operation on replicated data is said to be consistent if its result is same as if the the operations were executed on a single node in a sequential order.
  - → Availability
    - → via replication

→ Partitions

• Networks can break into 2 or more parts each with active system that can't talk to other parts.

* Brewer's CAP's theorem -

→ You can have at most 2 of these 3 prop for any sys

* very large systems will partition at some point.
* choose one of consistency or availability.
* Latency is another factor.
* Many applications choose to serve potentially stale data to reduce latency.

PART-A

3. ADVANTAGE -

1. Data Retrieval - computer based systems provide enhanced data retrieval techniques to retrieve data.

2. Editing - It is easy to edit any info stored in computers in form of files. Specific application program or editing software can be used for this purpose.

DISADVANTAGES -

1. Data Redundancy - possible that the same info may be duplicated in different files this leads to data redundancy and memory wastage.

2. Data Inconsistency - Beause of data redundancy it is possible that may not be in consistent state.

1. For the 2 disk mirrored case we assume A and B. Inorder to lose data, A and B need to be failded at the same time. If A is alreadly failed and within 100000 hours B disk will fail then dat a will be lost. The other case is B is already failded and within 100,000 hours A will fail and then data will be lost

* For the first case A disk is failded for 100 hours every 100,000 hours. so in order to make B to fail it will need $100000^2/100$ hours. Because the other case the time is reduced to $100000^2/2 \times 100$.

5. SQL server supports storing and querying of geospatial data that is location data referenced to earth. The main distinction b/w these two systems is that the latter takes acount the curvature of the earth.

* Map database management systems are software pgms designed to efficiently store & recall spatial information

2. Database indexing. Hashtables may also be used as diskbased data structures and database indices such as in DBMS although B-trees are more popular in these applications. In multi-node database systems, hash tables are commonly used to distribute rows amongst nodes, reducing network traffic for hash joins.

4. MySQL enables restrictions to be placed on reuse of previous passwords. To eshtablish password-reuse policy globally use the password-history and password-reuse-interval system variables.