12 Transaction Management-DDBMS

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Introductory Questions

How data distribution affects the transaction management protocols?

How centralized concurrency control techniques can be extended to handle data distribution.

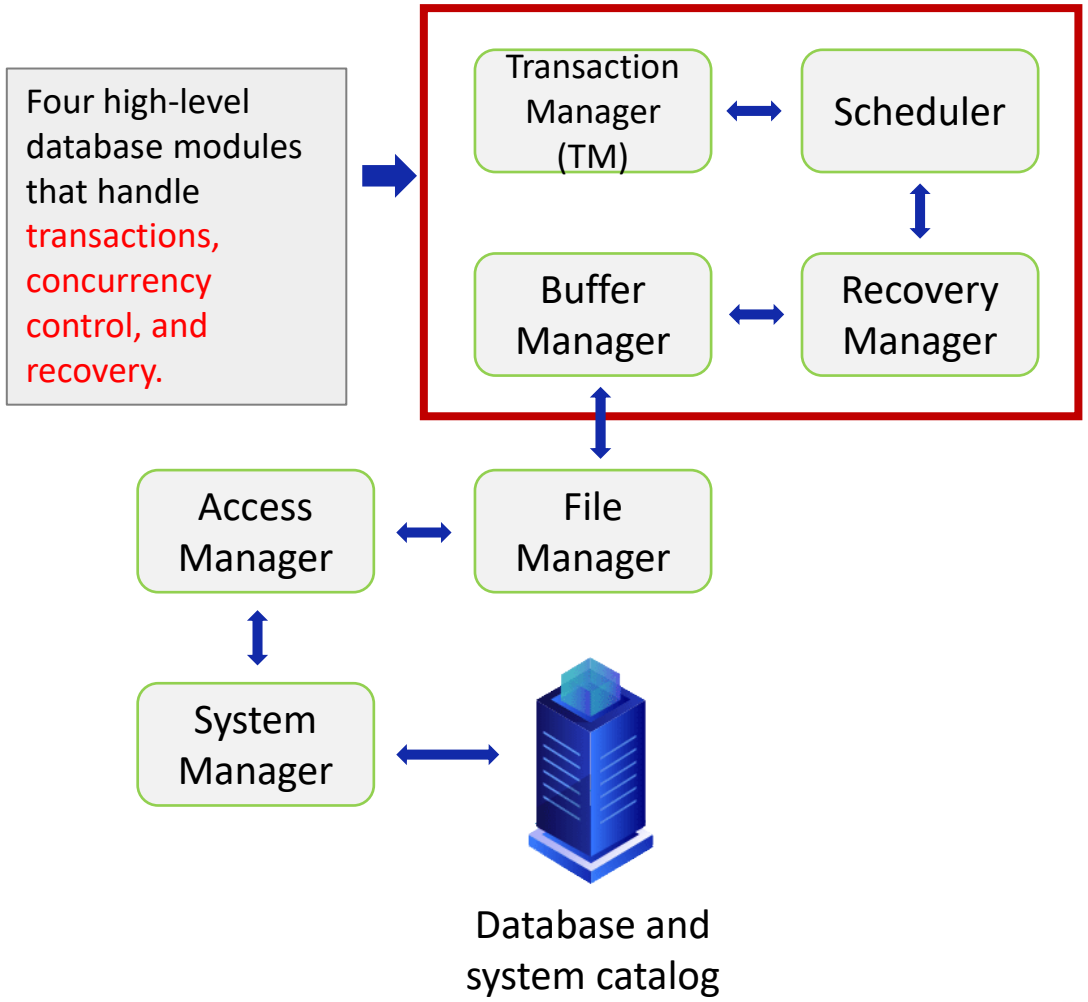
Transactions in Distributed System

The objectives of distributed transaction processing are the same as those of centralized systems, although more complex, because the DDBMS must also ensure the atomicity of the global transaction and each component sub-transaction.

- ✓ In a distributed system, a transaction can either be a local transaction or a global transaction.
- ✓ A local transaction is a transaction that performs all its work at the site where it originates.
- ✓ A global transaction is a transaction that has to perform work at one or more sites different from its originating site.

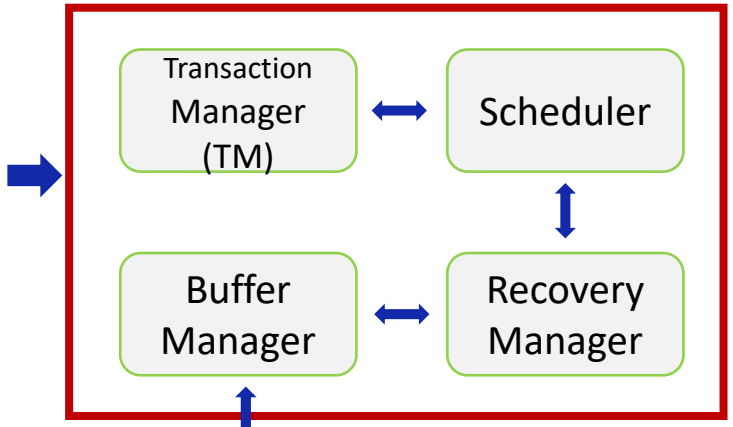
```
Begin_Tran T1
    Begin_Tran T1LA
      R(X)
      Calculate X = X + 200
      W(X)
      Commit T1LA
    End_Tran T1LA
    Begin_Tran T1NY
      R(X)
      Calculate X = X * 1.10
      W(X)
      Commit T1NY
    End_Tran T1NY
    Commit T1
End_Tran T1;
```

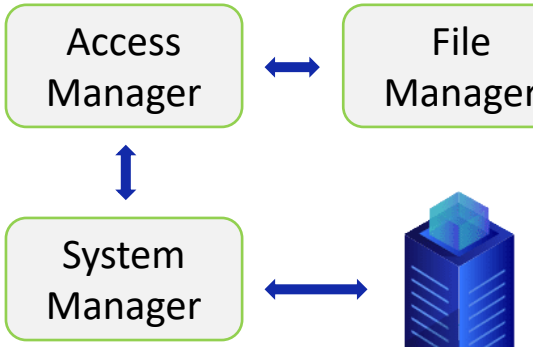
Coordination of Distributed Transaction



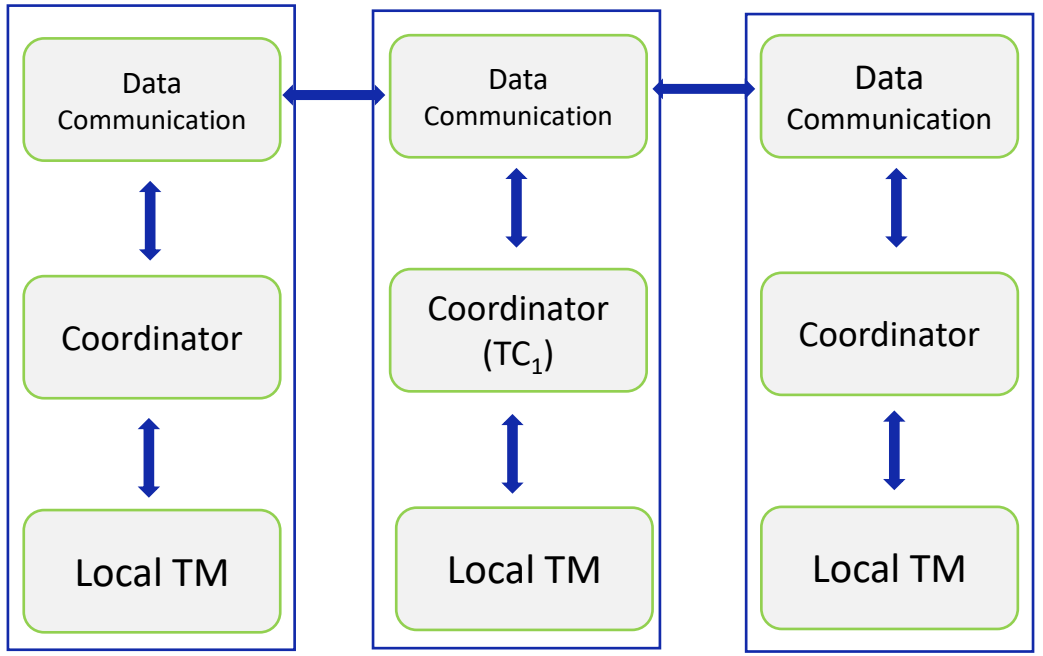
Coordination of Distributed Transaction

Four high-level database modules that handle transactions, concurrency control, and recovery.





Database and system catalog



Distributed Concurrency Control

A good concurrency control mechanism for distributed DBMSs should:

- ✓ be resilient to site and communication failure;
- ✓ permit parallelism to satisfy performance requirements;
- ✓ incur modest computational and storage overhead;
- ✓ perform satisfactorily in a network environment that has significant communication delay;
- ✓ place few constraints on the structure of atomic actions (Kohler, 1981).

Problems with Distributed Concurrency Control

- ✓ Lost update,
- ✓ Uncommitted dependency,
- ✓ Inconsistent analysis
- ✓ **Multiple-copy consistency problem**

We assume in this section that updates to replicated items are carried out synchronously, as part of the enclosing transaction.

Solutions to Concurrency Control in DDBMS

Solution:

Locking

Timestamping

Given a set of transactions to be executed concurrently, then:

- ✓ locking guarantees that the concurrent execution is equivalent to some serial execution of those transactions;
- ✓ timestamping guarantees that the concurrent execution is equivalent to a specific serial execution of those transactions, corresponding to the order of the timestamps.

Locking Protocols

Protocols based on two-phase locking (2PL)

- ✓ Centralized 2PL.
- ✓ Primary Copy 2PL.
- ✓ Distributed 2PL.
- ✓ Majority Locking.

Any Questions