Chapter12 Backing up databases

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Recovery (1)

Restoring a database

- **Basic recovery facilities**

  - Produce a backup copy (or save) of the entire database plus control files and journals

  - Cold backup: the database is shut down

  Hot backup: only the selected portion of the database is shut down

- **Journalizing facilities**

  - Transaction log

  - Database change log: before-image, after-image

- **Checkpoint facilities**

  - The DBMS periodically refuses to accept any new transactions

  - The system is in a quiet state, the database and transaction logs are synchronized

Recovery (2)

Restoring a database (Cont.)

- **Recovery manager**

A module of the DBMS which restored the database to a correct condition when a failure occurs and which resumes processing user requests

Recovery techniques

- Switch: Database must be mirrored; switch to an existing copy of the database
- Restore/Return: reprocess the day's transactions (up to the point of failure) against the backup copy of the database

Recovery (3)

- **Transaction integrity**

- Well-defined business activity

- **ACID properties**

① Atomic: the transaction cannot be subdivided

② Consistent: database constraints must be true before and after the transaction

③ Isolated: changes to the database are not revealed to users until the transaction is committed

④ Durable: changes are permanent

- How to preserve the transaction integrity?

Provide facilities for the user or application program to define transaction boundaries

① Define the transaction boundary: Begin transaction … End transaction

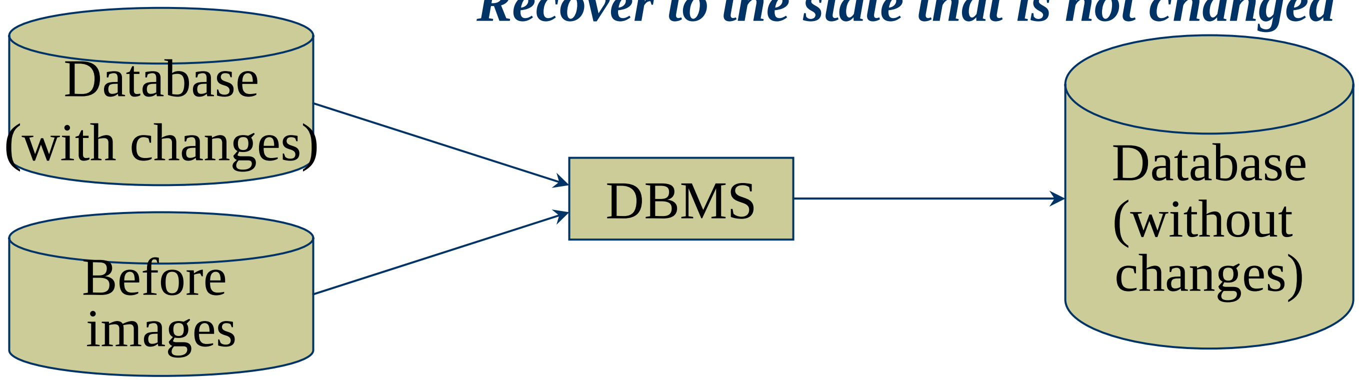
② Commit, Rollback

- Make a database transaction as short as possible

Recovery (4)

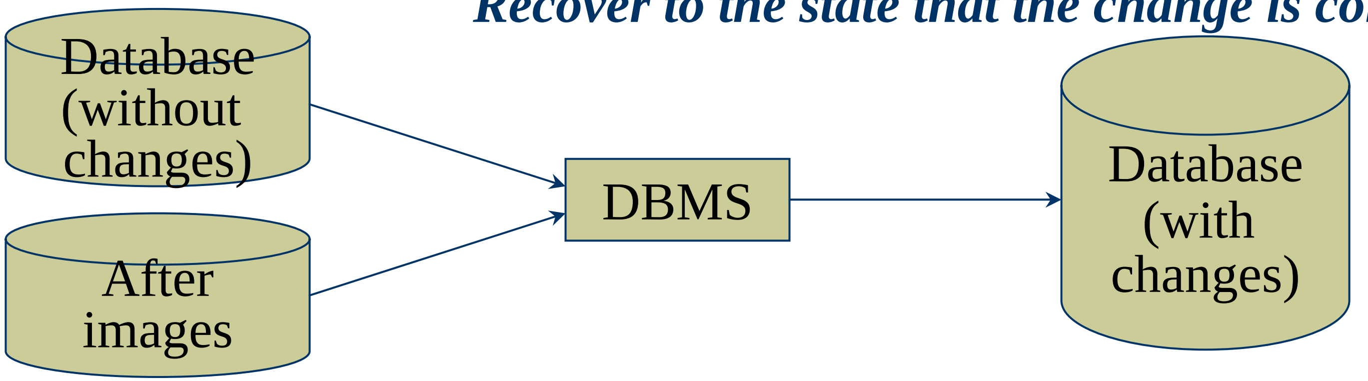
Backward recovery (rollback)

Recover to the state that is not changed



Forward recovery (rollforward)

Recover to the state that the change is correct



Recovery (5)

- **Types of failure**

- Aborted transactions (terminates abnormally)

  rollback, backward recovery

- Incorrect data

  ① Backward recovery

  ② Compensating transaction through human intervention

  ③ Restart from the most recent checkpoint (when above 2 methods can't work)

- System failure

  ① E.g, Power loss, operator error, software failure, etc.

  ② Restart from the most recent checkpoint before the system failure

- Database destruction

  ① The database itself is lost, or destroyed, or cannot be read

  ② Backup copy

  ③ Forward backup

Controlling concurrent access

- **Concurrent control**

  The process of managing simultaneous operations against a database so that data integrity is maintained and the operations do not interfere with each other in a multiuser environment

- **Methods**

  - Pessimistic approach (locking)
  - Optimistic approach

    ① Each transaction is restricted to a view of the database as of the time that transaction started

    ② When a transaction modifies a record, the DBMS creates a new record version instead of overwriting the old record

    ③ No locking is required, but merging is necessary
  - Read-only transaction can run concurrently with updating transactions, without loss of database consistency

The end

Thanks!