

3 Database recovery

Database recovery

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Architecture of relational database server

Persistent storage

Transient storage

Processor

Hard disk drive

RAM

CPU

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Architecture of relational database server

Persistent structures

Transient structures

Executions

Relational tables

Indexes

Clusters

Log files

Control files

Trace files

Hard disk drive

Data buffer cache

Library cache

Log cache

Session areas

Dictionary cache

Sort/hash areas

RAM

Database server processes

CPU

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Data buffer cache

Hard disk drive

RAM

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Log buffer and log file

Log file group

Log buffer

Hard disk drive

RAM

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Log file

Log file is a permanent archive, which register the various actions performed by the database transactions

Log is like "Arianna's thread" used by Theseus to find his way out of the Minotaur's palace; by rewinding the log Theseus could undo the path has taken

In a case of system failure log file is used to either redo the committed and not permanently recorded transactions or undo partially recorded and not committed transactions

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Log file organization

Log file records

- B** Begin transaction [trans. id.]
- U** Update a row [trans. id., before value, after value]
- R** Remove a row [trans. id., before value]
- I** Insert a row [trans. id., after value]
- E** End transaction [commit] or [abort]
- C** Checkpoint [ids. of all running transactions]
- D** Dump (database backup)

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Operations on log file

Log file actions

- B** When a transactions starts then its id. is recorded in a log file
- U** When a row is updated then an update record is recorded in a log file
- R** When a row is deleted, then it is recorded in a log file
- I** When a row is inserted, then it is recorded in a log file
- E** When a transaction commits/aborts then its id. is recorded in a log file

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Operations on log file

Log file actions

- C** When a checkpoint occurs then all modifications performed by the transactions committed since the last checkpoint or dump are recorded in a database
- D** When a dump happens then no new transactions are started until all running transactions are committed/aborted and database is backed up

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Recovery strategies

REDO and not UNDO

All modifications are immediately written to a log file and all permanent modifications in a database are performed after the commit point

If the system fails before commit point then transaction does not exist, if the system fails after commit point then transaction is redone from a log file

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Recovery strategies

not REDO and UNDO

All modifications are immediately written to a log file and all permanent modifications in a database are performed immediately after recording in a redo log

If the system fails before commit point then transaction is undone from a log file, if the system fails after commit point we do not care because all modifications are recorded

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Recovery strategies

REDO and UNDO

All modifications are immediately written to a log file and all permanent modifications in a database are performed either after or before commit point

If the system fails before commit point then transaction is undone from a log file, if the system fails after commit point then transaction is redone from a log file

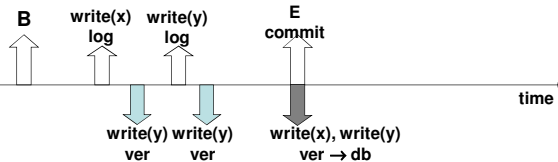
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Recovery strategies

not REDO and not UNDO ?

All modifications are immediately written to a log file and all permanent modifications in a database are performed on the versions of original data items. At the commit point all versions become the current data items in the database



If the system fails before commit point then versions are discarded

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References

Elmasri R., Navathe S., Fundamentals of Database Systems, 6th edition, chapters 21.2, Transaction and System Concepts, pp. 755-758