



#ASLI ENGINEERING

How does a database guarantees reliability?



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Write-ahead logging

For any database system, **Reliability** is super-important



Persistent Database
MySQL, PostgreSQL

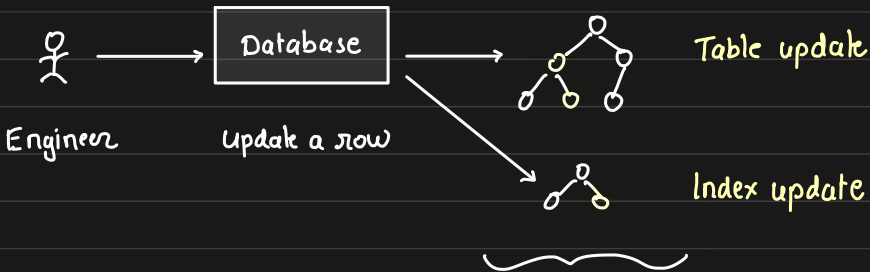
↓
does everything to guarantee reliable operations

Upon commit:

- data/updates are stored on disk (Non-volatile storage)

↓ ↓ ↓
Power loss OS failure Hardware failure

Non-volatile storage safe from



On disk as B+ trees

Disk writes are complicated



Write Ahead logging → standard method for ensuring

Data Integrity

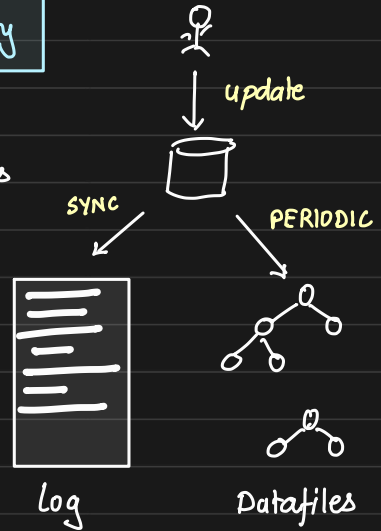
Core idea: Before making changes to actual datafiles (tables and indexes), log those changes describing the changes.

Flow: Update triggered on DB

- log the entry in WAL
- makes changes in table & indexes

Advantages of WAL

- we do not need to flush the data changes on every commit
- in case of crash we can recover by replaying the logs
- * - reduce the number of disk writes



WAL file is sequential
so, cost of logging the changes
is significantly lower than the
cost of changing datafiles

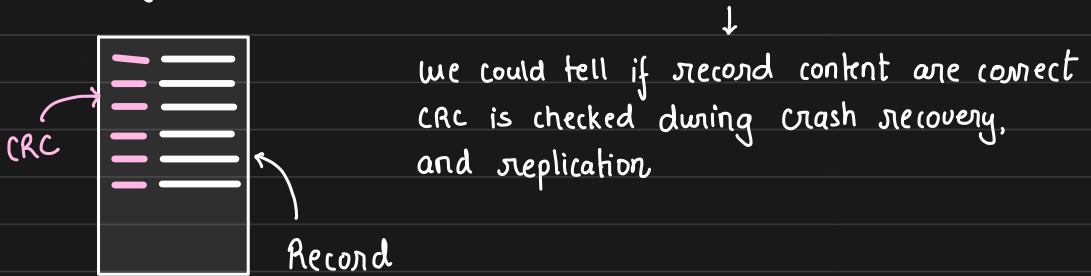
log → 1 disk write
data file → update table
update index
tree rebalance

- Point-in-time recovery is possible with WAL

← Apply WAL on a snapshot

Data integrity in WAL

Every individual record in WAL is CRC-32 protected



WAL is by default enabled by all the databases.

Insert position
↓

log Sequence
Number (LSN)

[Byte offset into logs]

8KB page {

00000	CRC	UPDATE t SET K=V
700012	CRC	DELETE t
00026	CRC	INSERT v

16MB files

Segment - 000000001