Error Scenarios

- power failure
- fire, flood, earthquake, tsunami, burglary, ...
- hardware error (hard disk crash, memory failure, network problem)
- software error
- janitor’s dog...
Recovery in **ANY** Software

- undo-functionality
- backup copies
- journaled file systems (metadata vs content)
  
  "Do not switch off" messages (FAIL!)

\[ \text{File} \rightarrow \text{Copy of File} \]

\[ \square \]

\[ \checkmark \]

\[ \checkmark 2 \]

\[ \downarrow \]

will not be able to recover

Recovery := mechanism allowing us to get back to a consistent state
ACID?
ACID recap

Atomicity: all or nothing

Consistency: consistent state preservation

Isolation: concurrent transactions have same effect as some serial schedule

Durability: committed changes will never be lost
Local Error

error or ABORT in application program

or: ABORT triggered by system due to deadlock

database system: just fine, up and running

tasks:

Local **Undo**: remove persisted changes done by non-committed TAs

A!
Example: Local Error

\[ T_1 \]

\text{transfer 100 € from account A to account B}

committed, must be persisted

\[ T_2 \]

\text{transfer 300 € from account C to account B}

did not commit, must not be persisted

\text{ABORT!}
Loss of Main Memory

=> dirty pages in database buffer lost

database system: still able to restart

tasks:

_Undo:_ remove persisted changes done by non-committed TAs

_Redo:_ persist all non-persisted changes done by committed TAs
Example: Loss of Main Memory

- **Transfer 100 € from account A to account B** (committed, must be persisted)
- **Transfer 300 € from account C to account B** (did not commit, must not be persisted)

**Power Failure!**
Loss of External Memory/Storage

=> database store and/or log lost

database system: still able to restart (but hey: on what data exactly?)

tasks:

  reduce

get/install database store/log replica/copy!

  proceed as in loss of main memory (see above)
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