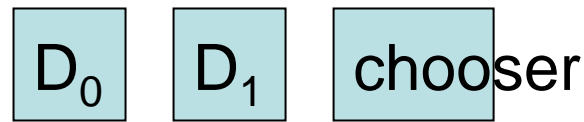


Recoverability



Larger actions?

Recoverable sector



Commit point

`id ← begin_ra()`



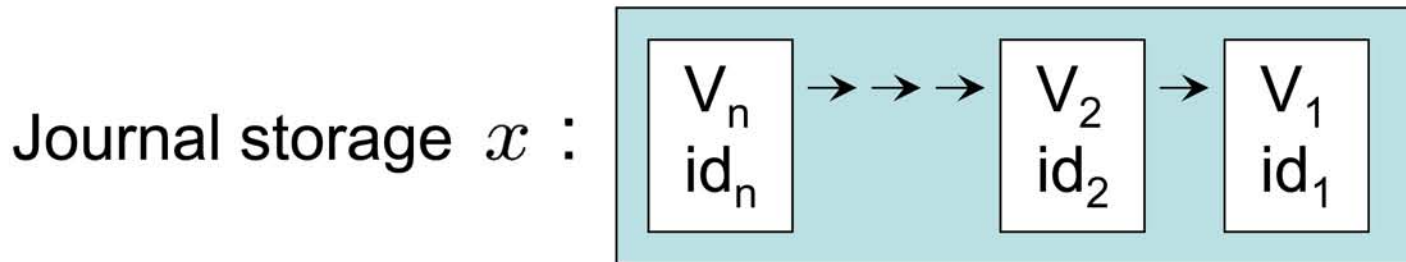
`COMMIT()`



`end_ra()`

`ABORT()`

Version histories



`WriteJournal(item x, v, id)`

ReadJournal(item x, id)

Commit record table

| | |
|-----------------|----------------|
| id ₁ | P C |
| id ₂ | P |
| ⋮ | |
| id ₇ | P A |
| ⋮ | |

- 1) Bootstrap
- 2) Slow

Logging:

Cell st. : read / write

Log : non-volatile + sequential

Plan:

1) Fail → Recover from log

→ uncommitted → back out
(undo)

→ committed → install
(redo)

2) **ABORT()** → undo cur. action (redo)

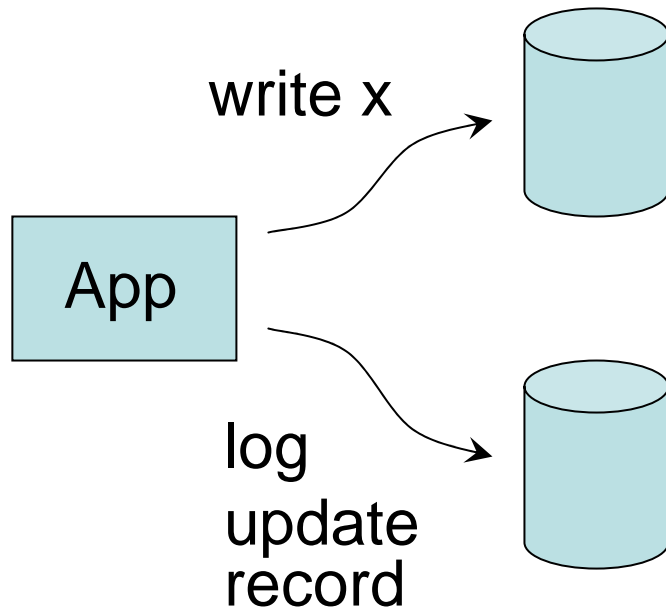
Append-only:

```
type: UPDATE  
id: 172  
undo: x ← old  
redo: x ← new
```

```
type: OUTCOME  
id: 174  
status:  
    COMMITTED
```

- 1) When to write log?
- 2) How to recover?

Disk-bound DB:



- 1) WAL protocol:
Write ahead logging
- 2) Log COMMIT record
before returning from
`commit()`

Recovery:

- 1) Scan log backwards
- 2) Winners: COMMITTED or ABORTED
Losers: Everything else
- 3) Redo COMM. Winners
Undo Losers