Recoverability

Larger actions?

Recoverable sector

Commit point
id ← begin_ra()

⇒ COMMIT()

⇒ ABORT()

⇒ end_ra()}
Version histories

Cell storage

Install

Journal storage:\n
\[ x : \]

\[ V_n \quad \rightarrow \quad V_2 \quad \rightarrow \quad V_1 \quad V \]

WriteJournal(item x, v, id)
ReadJournal(item x, id)

Commit record table

<table>
<thead>
<tr>
<th>id</th>
<th>P</th>
<th>C</th>
<th>1) Bootstrap</th>
</tr>
</thead>
<tbody>
<tr>
<td>id_1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>id_2</td>
<td>P</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2) Slow</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>id_7</td>
<td>P</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

...
Logging:

Cell st. : read / write

Log : non-volatile + sequential
Plan:

1) Fail $\Rightarrow$ Recover from log

   $\Rightarrow$ uncommitted $\Rightarrow$ back out
   (undo)

   $\Rightarrow$ committed $\Rightarrow$ install
   (redo)

2) **ABORT()** $\Rightarrow$ undo cur. action (redo)
Append-only:

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