ARIES Examples

Example 1:

Log:

After a crash, we find the following log:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>BEGIN CHECKPOINT</td>
</tr>
<tr>
<td>5</td>
<td>END CHECKPOINT (EMPTY XACT TABLE AND DPT)</td>
</tr>
<tr>
<td>10</td>
<td>T1: UPDATE P1 (OLD: YYY NEW: ZZZ)</td>
</tr>
<tr>
<td>15</td>
<td>T1: UPDATE P2 (OLD: WWW NEW: XXX)</td>
</tr>
<tr>
<td>20</td>
<td>T1: COMMIT</td>
</tr>
</tbody>
</table>

Analysis phase:

Scan forward through the log starting at LSN 0.
LSN 5: Initialize XACT table and DPT to empty.
LSN 10: Add (T1, LSN 10) to XACT table. Add (P1, LSN 10) to DPT.
LSN 15: Set LastLSN=15 for T1 in XACT table. Add (P2, LSN 15) to DPT.
LSN 20: Change T1 status to "Commit" in XACT table

Redo phase:

Scan forward through the log starting at LSN 10.
LSN 10: Perform the 4 checks. If all are satisfied, redo LSN 10 (set value to ZZZ) and set the page's PageLSN=10.
LSN 15: Perform the 4 checks. If all are satisfied, redo LSN 15 (set value to XXX) and set the page's PageLSN=15.
LSN 21: Write EndTrans for T1

Undo phase:

Do nothing; no transactions to undo.
Example 2:

Log:

After a crash, we find the following log:

<table>
<thead>
<tr>
<th>LSN</th>
<th>Action</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>BEGIN CHECKPOINT</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>END CHECKPOINT (EMPTY XACT TABLE AND DPT)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>T1: UPDATE P1 (OLD: YYY NEW: ZZZ)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>T1: UPDATE P2 (OLD: WWW NEW: XXX)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>T2: UPDATE P3 (OLD: UUU NEW: VVV)</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>T1: COMMIT</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>T2: UPDATE P1 (OLD: ZZZ NEW: TTT)</td>
<td></td>
</tr>
</tbody>
</table>

Analysis phase:

Scan forward through the log starting at LSN 0.
LSN 5: Initialize XACT table and DPT to empty.
LSN 10: Add (T1, LSN 10) to XACT table. Add (P1, LSN 10) to DPT.
LSN 15: Set LastLSN=15 for T1 in XACT table. Add (P2, LSN 15) to DPT.
LSN 20: Add (T2, LSN 20) to XACT table. Add (P3, LSN 20) to DPT.
LSN 25: Change T1 status to "Commit" in XACT table
LSN 30: Set LastLSN=30 for T2 in XACT table.

Redo phase:

Scan forward through the log starting at LSN 10.
LSN 10: Perform the 4 checks. If all are satisfied, redo LSN 10 (set value to ZZZ) and set the page's PageLSN=10.
LSN 15: Perform the 4 checks. If all are satisfied, redo LSN 15 (set value to XXX) and set the page's PageLSN=15.
LSN 20: Perform the 4 checks. If all are satisfied, redo LSN 20 (set value to VVV) and set the page's PageLSN=20.
LSN 30: Perform the 4 checks. If all are satisfied, redo LSN 30 (set value to TTT) and set the page's PageLSN=30.
LSN 31: Write and End_Trans for T1

Undo phase:

T2 must be undone. Put LSN 30 in ToUndo.
LSN 32: Write Abort record to log for T2
LSN 33: Undo LSN 30 - write a CLR for P1 with "set P1=ZZZ" and undonextLSN=20. Write ZZZ into P1. Put LSN 20 in ToUndo.
LSN 34: Undo LSN 20 - write a CLR for P3 with "set P3=UUU" and undonextLSN=NULL. Write UUU into P3. Set page’s PageLSN=34
LSN 35: Write an End_Trans for T2
**Example 3:**

After a crash, we find the following log:

<table>
<thead>
<tr>
<th>LSN</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>T1: UPDATE P1 (OLD: YYY NEW: ZZZ)</td>
</tr>
<tr>
<td>15</td>
<td>T2: UPDATE P3 (OLD: UUU NEW: VVV)</td>
</tr>
<tr>
<td>20</td>
<td>BEGIN CHECKPOINT</td>
</tr>
<tr>
<td>25</td>
<td>END CHECKPOINT (XACT TABLE=[[T1,10],[T2,15]]; DPT=[[P1,10],[P2,15]])</td>
</tr>
<tr>
<td>30</td>
<td>T1: UPDATE P2 (OLD: WWW NEW: XXX)</td>
</tr>
<tr>
<td>35</td>
<td>T1: COMMIT</td>
</tr>
<tr>
<td>40</td>
<td>T2: UPDATE P1 (OLD: ZZZ NEW: TTT)</td>
</tr>
<tr>
<td>45</td>
<td>T2: ABORT</td>
</tr>
<tr>
<td>50</td>
<td>T2: CLR P1(ZZZ), undonextLSN=15</td>
</tr>
</tbody>
</table>

**Analysis phase:**

Scan forward through the log starting at LSN 20.
LSN 25: Initialize XACT table with T1 (LastLSN 10) and T2 (LastLSN 20). Initialize DPT to P1 (RecLSN 10) and P3 (RecLSN 15).
LSN 30: Add (T1, LSN 30) to XACT table. Add (P2, LSN 30) to DPT.
LSN 35: Change T1 status to "Commit" in XACT table
LSN 40: Set LastLSN=40 for T2 in XACT table.
LSN 45: Change T2 status to "Abort" in XACT table
LSN 50: Set LastLSN=50 for T2 in XACT table.

**Redo phase:**

Scan forward through the log starting at LSN 10.
LSN 10: Perform the 4 checks. If all are satisfied, redo LSN 10 (set value to ZZZ) and set the page's PageLSN=10.
LSN 15: Perform the 4 checks. If all are satisfied, redo LSN 15 (set value to VVV) and set the page's PageLSN=15.
LSN 30: Perform the 4 checks. If all are satisfied, redo LSN 30 (set value to XXX) and set the page's PageLSN=30.
LSN 40: Perform the 4 checks. If all are satisfied, redo LSN 40 (set value to TTT) and set the page's PageLSN=40.
LSN 50: Perform the 4 checks. If all are satisfied, redo LSN 45 (set value to ZZZ) and set the page's PageLSN=50.
LSN 51: Write an End_trans for T1

**Undo phase:**

T2 must be undone. Put LSN 50 in ToUndo.
Process ToUndo by removing 50. This is a CLR, so just add LSN 15 in ToUndo.
LSN 52: Undo LSN 15 - write a CLR for P3 with "set P3=UUU" and undonextLSN=NULL. Write UUU into P3. Set pageLSN to 52.
LSN 53: Write an End_Trans for T2.