Checkpoints

Overview

In this video, we discuss checkpoints. A few advantages of these: faster recovery and less space used for the log-file

Simple Checkpointing (for undo logging)

Idea: *checkpoint* the log periodically

- Every *m* min., after *t* transactions since last checkpoint, …
- No need to undo transactions before the checkpoint

Part before checkpoint can therefore be discarded from log

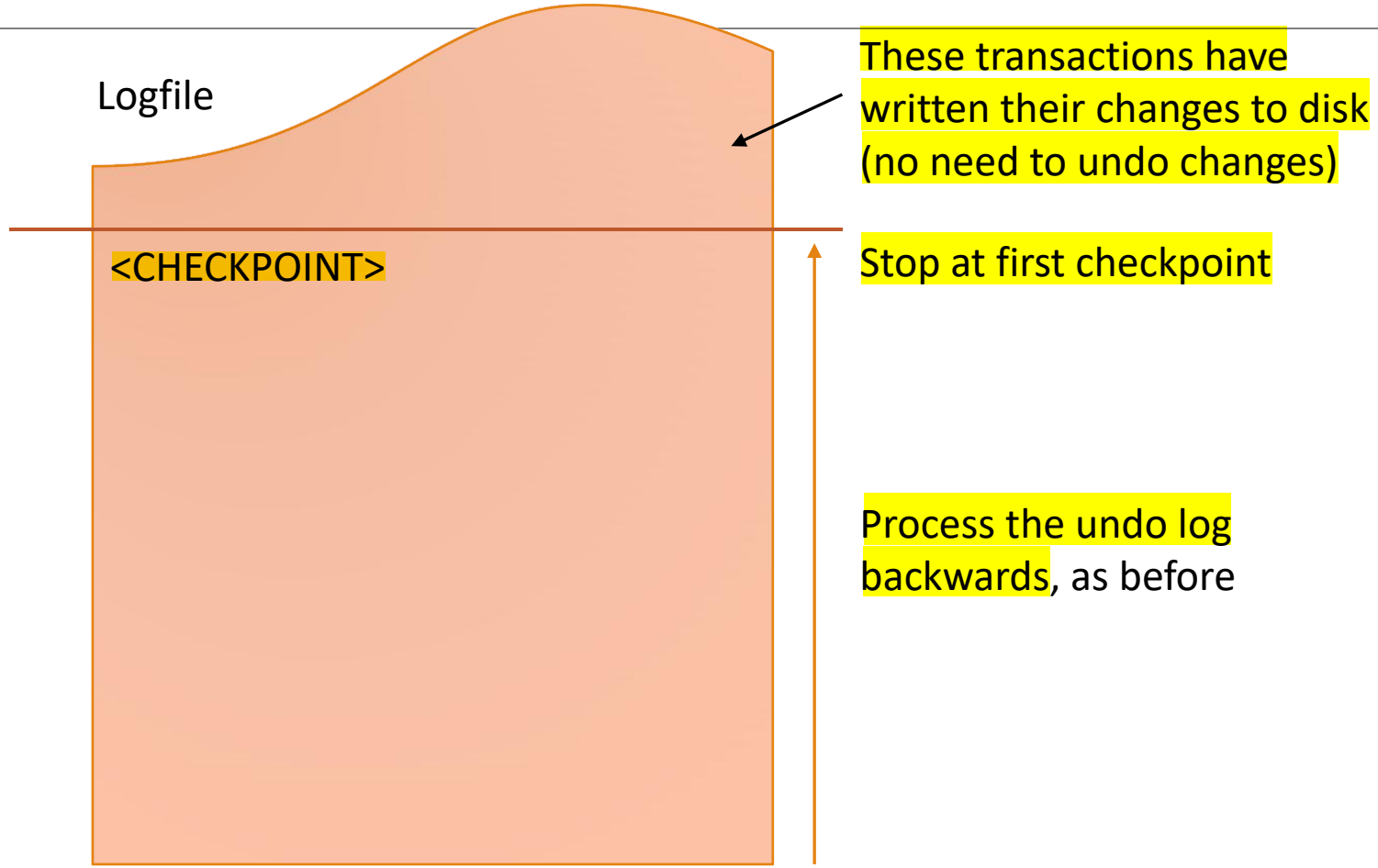
There are variants of checkpointing that avoid this See later!

Procedure:

1. Stop accepting new transactions
2. Wait until all active transactions finish and have written COMMIT or ABORT record to the log.
3. Flush the log to disk.
4. Write a log record **<CHECKPOINT>**.
5. Flush the log to disk again.
6. Resume accepting transactions.

Recovery via Simple Checkpoints

Recovery With Simple Checkpoints



Transaction 3 can then proceed after we wrote <CHECKPOINT

Transaction 3 will have to wait until we are done with our checkpoint

Time	Transaction T_1	Transaction T_2	Log (buffer)	Log (disk)
0			<START T_1>	
1	read(X)			
2	X := X * 2			
3	write(X)		<T_1, X, 1>	
4			<START T_2>	
5		read(X)		
6	read(Y)			
7		X := X * 3		
8		write(X)	<T_2, X, 2>	
9	Y := X + Y			
10	write(Y)		<T_1, Y, 2>	
11	**flush_log**			
12	**output(X)**			
13	**output(Y)**			
14			<COMMIT T_1>	
15	**flush_log**			
16		**flush_log**		
17		**output(X)**		
18			<COMMIT T_2>	
19		**flush_log**		

Checkpointing starts

Transaction T_3 is submitted

Write <CHECKPOINT> in log and flush

ARIES Checkpoints

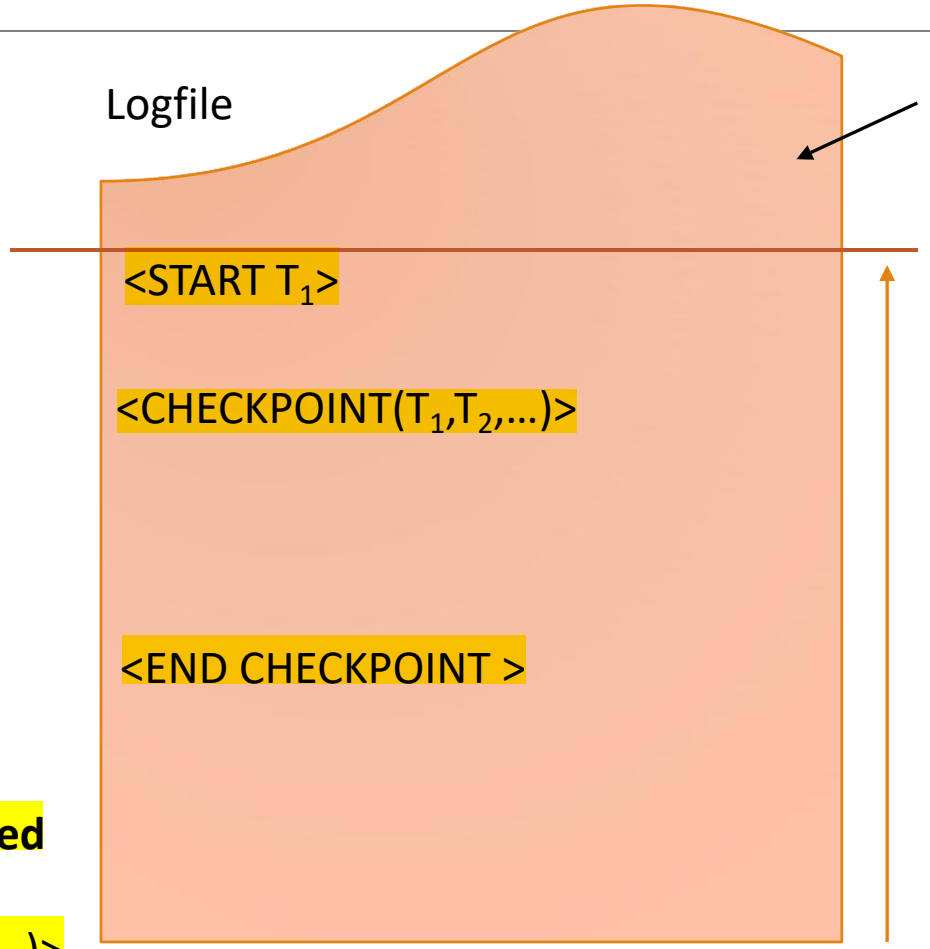
Requirements:

- Undo/Redo logging
- Transactions do not write to buffers(!) before they are sure they want to commit

Procedure:

- Write <CHECKPOINT(T_1, T_2,…)> in log and flush it
  - T_1, T_2,… are the transaction in progress (i.e. not committed and not aborted)
- Write the content of the **buffer** to disk (i.e. **output**)
- Write <END CHECKPOINT> in log and flush it

Recovery via ARIES Checkpoints



These transactions have written their changes to disk (no need to do changes)

Stop after having found a <CHECKPOINT(T_1,T_2,…)> with corresponding <END CHECKPOINT> AND <START T_i> for all mentioned transactions that are **uncommitted**

Process the undo/redo log, as before EXCEPT:

only redo part of **committed** transactions in T_1,T_2,… after <CHECKPOINT(T_1,T_2,…)> AND then undo all of **uncommited** transactions in T_1,T_2,… incl. before <CHECKPOINT(T_1,T_2,…)>

Summary

Checkpoints can be used to speed up recovery and use less space on the log files

We saw Simple Checkpoints which simply prevents new transactions from starting until all are done

We saw ARIES Checkpoints that were more advanced and required undo/redo and you can't write to the buffer before being sure you want to commit