Resolving Latch Contention

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What is a "Latch"

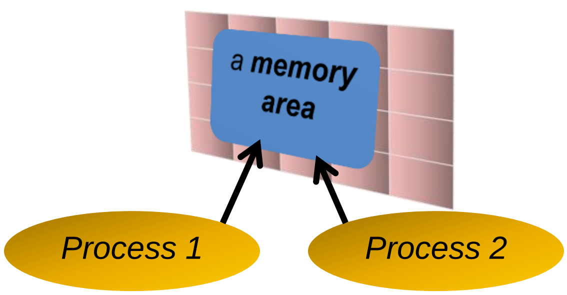
From "Glossary" in Oracle Manuals:

> *A low-level serialization control mechanism used to protect shared data structures …*

Agenda

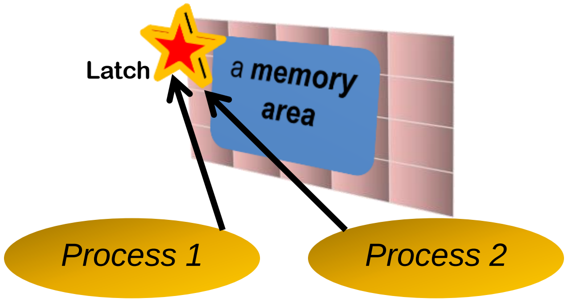
- What are latches – the purpose
- Buffer cache latches
- Shared pool latches
- Identifying latch waits
- When the database is hung
- Plenty of demos.

Latches



**If process 1 and 2 both go after the memory area at the same time, they will end up corrupting the area.
Who makes sure they get their turns?**

Latches



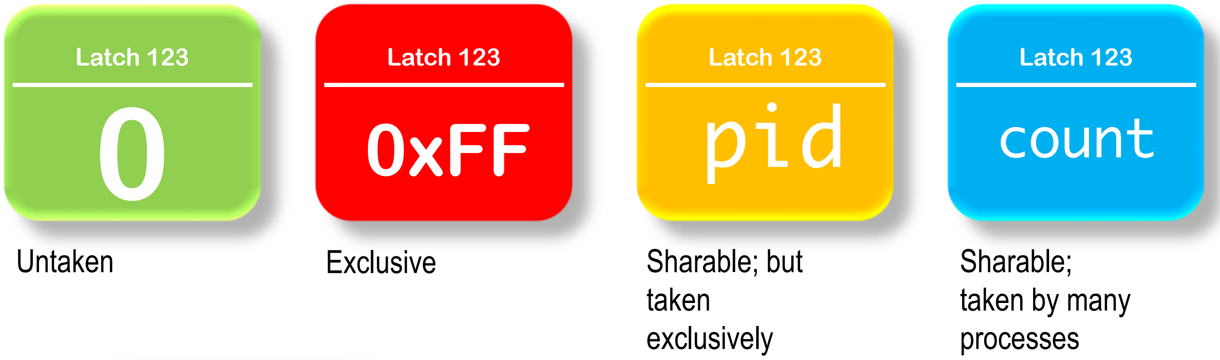
- Process 1 and 2 will try to get the "latch", a area in memory that does not have any required data.
- Whoever gets the latch now gets to access the memory area exclusively
- When done, the process releases the latch

Spinning and Sleeping

- Suppose process 1 gets the latch, accesses the memory
- How will process 2 know when the latch is available?
  - No central latch repository
  - No communication to the process
- Process 2 will constantly loop to check if the latch is free
- This is called **spinning** – a CPU intensive process
- After *n* times, it will stop spinning and will go to sleep
  - *n* = *_spin_count* in init.ora, defaults to 2000
- After that it will wake up after 1 ms, check, go to sleep
- Check again in 1ms, sleep, then check in 2 ms, sleep …

Latches

- 100 or 200 bytes memory in SGA (depending on 32 or 64 bit Oracle)
- Value depends on how it has been taken



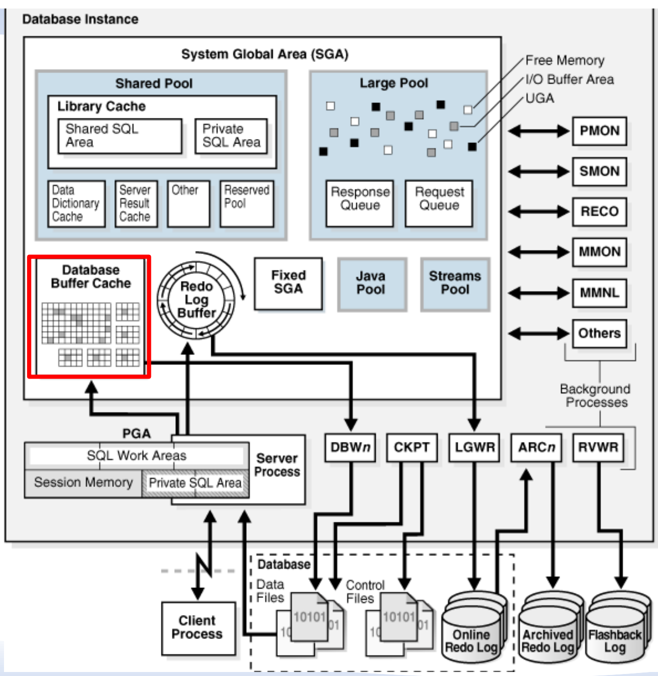
Information on Latches

- V$LATCH – latch
- V$LATCH_CHILDREN – the child latches
- V$LATCH_PARENT – the parent latches
- V$LATCHHOLDER – the holder of latches
  - PID – the process ID
  - SID – the session SID
  - LADDR – the address of the latch
  - NAME – name of the latch
  - GETS – how many times it got the latch

Latches -vs- Locks

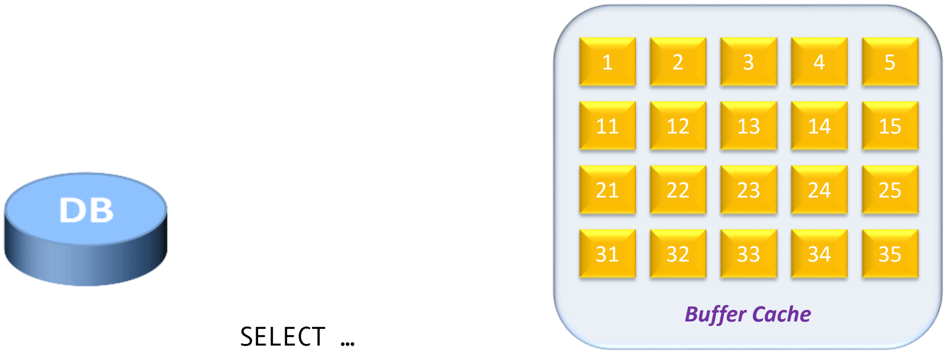
Latches	Locks
On physical components like memory and CPU	On logical structures like rows
No queues	Queues
No ordering	No ordering
When multiple processes compete for the same resource; no guarantee on which one gets it	The sessions get the lock in the order they wait

Oracle Instance



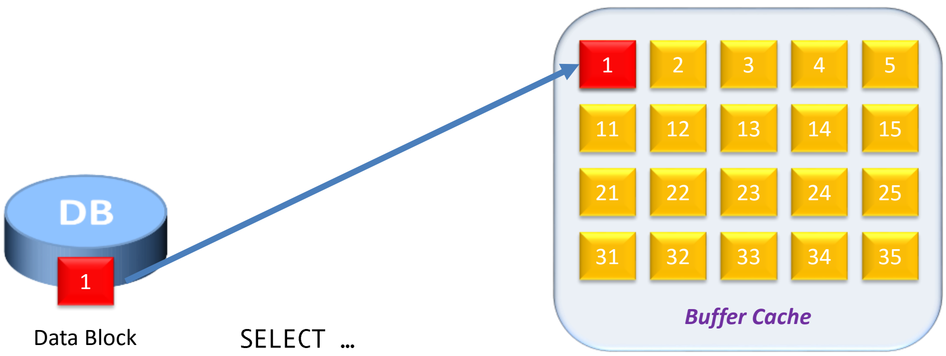
Source: Oracle Database Documentation Concepts Guide

Buffer Operation



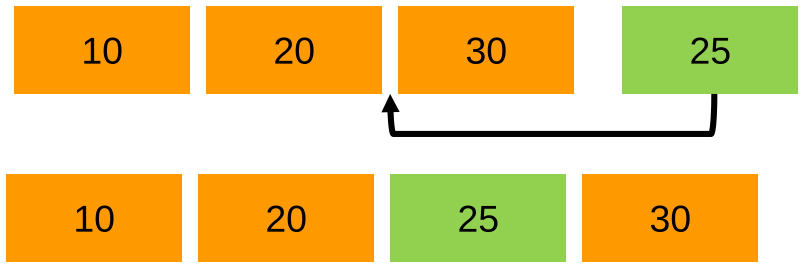

```
SELECT …
FROM EMP
WHERE …
```


Buffer Operation

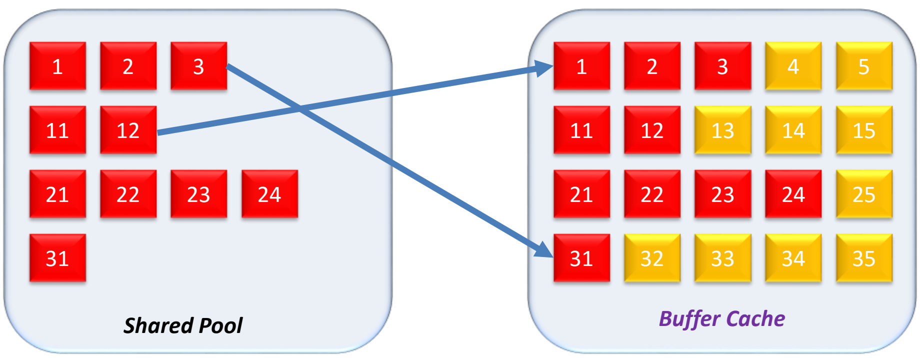



```
SELECT …
FROM EMP
WHERE …
```

Buffer Insertion



Buffer Header

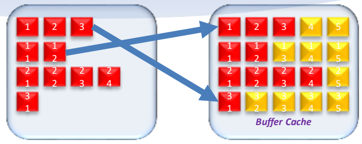


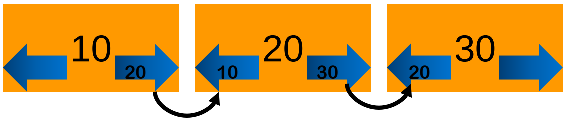
X$BH

V$BH

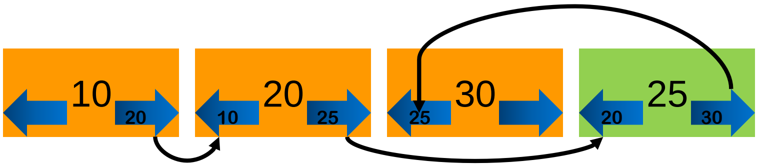
buffhan.sql

Buffer Header Management



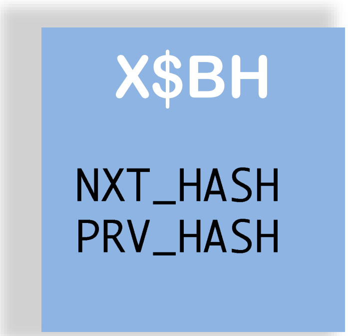


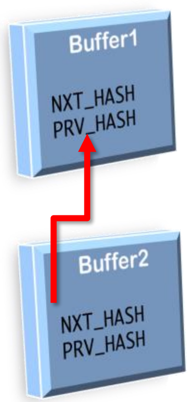
Linked List



When a new buffer comes in, only the pointers are updated

Linked List



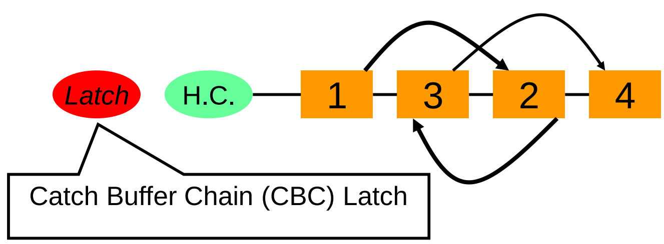


Test for Buffer Header

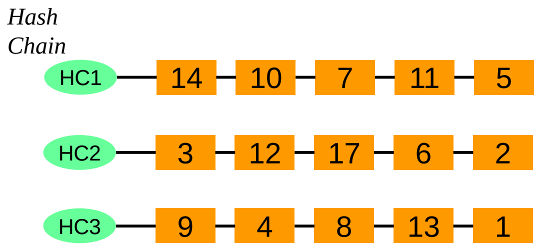
```
select
   ltrim(addr,'0') buffer_address,
   ltrim(nxt_hash,'0') next_buffer,
   ltrim(prv_hash,'0') prev_buffer,
   case
           when nxt_hash = prv_hash then 'Unlinked'
   else
           'Linked'
   end
   as linked
from x$bh
where hladdr = '000007FF3C8B1568'
```

bh1.sql

Buffer Chain



Hash Chains



No. of hash buckets = init.ora parameter
`_db_block_hash_buckets`

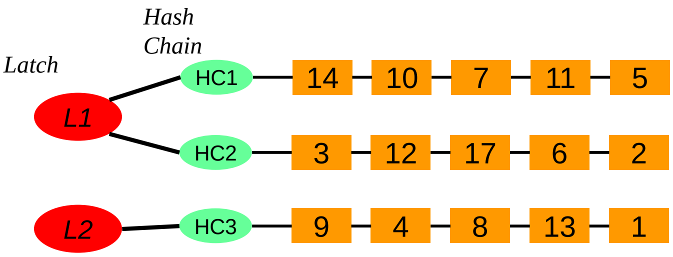
`Undoc.sql`

Data Block Address

- DBA is the unique identifier or a block
- Utility:

  `dbms_utility.make_data_block_address(File#, Block#)`
- Demo:
  – Get the block `Qsales.sql`
  – Get the DBA. `Dba1.sql`

Latches and Hash Chains

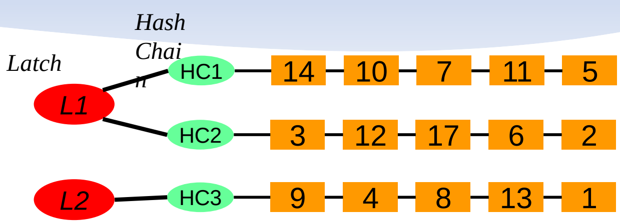


No. of hash buckets = init.ora parameter `_db_block_hash_buckets`
No. of latches = `_db_block_hash_latches`

`Undoc.sql`

`Cbccount.sql`

Which Buffers for a Latch



- Which buffers are being protected by a specific latch?
- X$BH
  - hladdr – the latch address
  - dbarfil – the relative datafile#
  - dbablk – the block#

`hladdr1.sql`

`latchobjs.sql`

Identifying Buffer Latches

- Useful Scripts
  – Find out the rows and blocks – qsales.sql
  – Find out the data object id – dobjid.sql
  – Find out the data block address – dba1.sql
  – Find out the child latch address – hladdr1.sql
  – Find out the partition name – extents1.sql
  – Find out the objects protected by a latch – latchobjs.sql
  – Find out the total buffers per latch – clatchcount.sql

Demo: CBC Latch

- Simulate:
  – Open 3 sessions as SH
  – Session1: Update a record: upd1.sql 10000000
  – Other 2 sessions: Select a different record from that block: sel1.sql 10000000
- From a fourth session as SYS:
  – Check the waits @wait1
  – Get P1RAW for session with event latch: cache buffers chains
  – P2 will show the latch#
  – Get the latch details from address: qlatch.sql addr
  – Get the segments (and partitions) protected by the latch latchobjs.sql

Reducing CBC Latch Waits

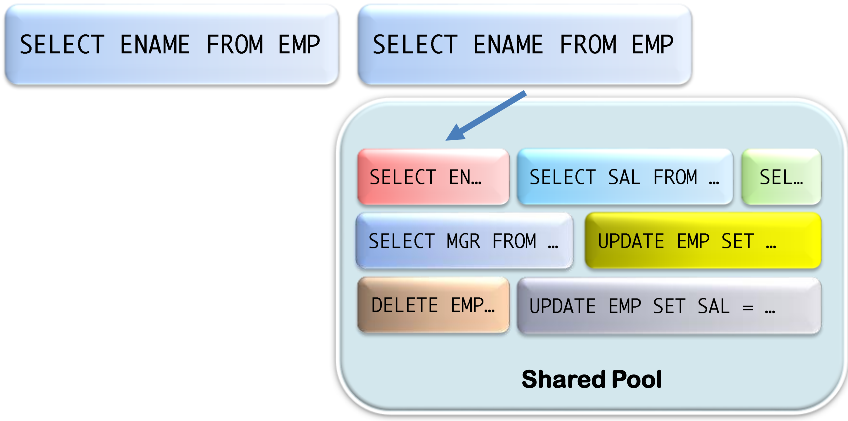
- Less buffers
  - Less logical I/O
  - More index limiting scans
  - Less Nested Loops
- Increase the number of blocks for an object
  - PCTFREE, INITTRANS, etc. to make blocks less compact
- Spread objects across multiple chains
  - Partition the objects
  - Alter Table Move, Alter Index Rebuild
- Increase the number of CBC Latches
- Increase the number of hash buckets

Historical CBC Latch Contention

- EVENT column in V$SESSION shows "%cache buffer%'
- Also in V$ACTIVE_SESSION_HISTORY
- Find out the history – ashlatch.sql
- Convert to hex – tohex.sql

- Blog entry http://arup.blogspot.com/2014/11/cache-buffer-chains-demystified.html

Library Cache Latches



Library Cache Latch Modes

Demo

- Create procedure – cr_testproc.sql
- Session 1 and 2
  – exec testproc (300) exec1.sql
- Session 3 and 4
  – alter procedure testproc compile; compile.sql
- Session 4 (SYS Session):

```
select sid, state, blocking_session, seconds_in_wait,
event, p1, p1text, p1raw from v$session where username =
'SCOTT'
```

wait1.sql

Decoding Library Cache

- x$kgllk – Locks
  – kgllkhdl – the lock handle (address)
  – Kgllkcnt – the number of locks
  – Kgllkmod – mode of the lock
  – Kgllkreq – the requested mode on that lock
- x$kglob ob – Objects
  – kglnaown - owner
  – Kglnaobj – name
  – Kglhdadr – the latch address
- x$ksuse – Sessions
  – Indx – the session SID

Check Library Cache

```
select
   s.sid,
   ob.kglnaown obj_owner,
   ob.kglnaobj obj_name,
   lk.kgllkcnt lck_cnt,
   lk.kgllkmod lock_mode,
   lk.kgllkreq lock_req,
   s.state, s.event, s.wait_time, s.seconds_in_wait
from
  x$kgllk lk, x$kglob ob, x$ksuse ses, v$session s
where lk.kgllkhdl in
(select kgllkhdl from x$kgllk where kgllkreq > 0)
and ob.kglhdadr = lk.kgllkhdl
and lk.kgllkuse = ses.addr
and s.sid = ses.indx;
```

libcache1.sql

Chain of Waiters

- Session 1 waits …
  - On Session 2, which in turn, waits …
    - On Session 3, which in turn, waits …
      - On Session 4
- View V$WAIT_CHAIN

waitchain1.sql

When a SYSDBA Connection Fails

- Connect as PRELIM option
```
$ sqlplus -prelim / as sysdba
```
- Connects to SGA
- Use OraDebug
```
SQL> oradebug setmypid
SQL> oradebug dump hanganalyze 12
```
- Will not work on 11.2
  - MOS note 452358.1

Mutex

- Latches contain much more information sometimes not needed
- Mutex = Mutual Exclusion
- Mutextes
  - are smaller than latches, 28 bytes instead of 110 bytes
  - take less number of instruction: ~30 instead of ~150

Summary

- Latches are just memory structures in SGA
- Provide a locking mechanism for buffer headers, library cache objects, etc.
- No queueing. First come first serve
- X$ and V$ views show the latch activity
- If you see a latch contention,
  - Buffer latch: too much buffer access
  - Shared pool latch: too much concurrent access to objects

Thank You!

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