

Monitoring and Tuning Oracle RAC Database

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Objectives

In this lecture, you should understand and describe the following:

- Performance tuning tools
- Global Cache wait events
- Global Enqueue wait events
- Common RAC-related performance issues and their resolutions
- Tips to tune Oracle RAC performance
- Using ADDM in RAC

Tuning Database Performance: Overview

- Performance Tuning areas:
 - Application and SQL Tuning
 - Operating System
 - Database Objects and configuration settings
 - Hardware
 - Network
- Lecture scope: RAC-specific tuning topics

Performance Tuning in Oracle RAC

- Tuning like a single-instance first
- RAC-specific tuning areas:
 - Single instance bottlenecks get exacerbated in RAC
 - Interconnect traffic
- Database performance tuning tools:
 - Performance views v\$ (specially those that retrieve wait events and System, RAC, and instance statistics)
 - Statspack or AWR reports
 - Enterprise Manager (Cloud Control or Express)

RAC-specific Wait Events

- RAC-related wait events come under the category “Cluster Wait Class”.
 - A significant rise in a wait event could be a symptom to lead you to a performance issue root cause
 - Some wait events and statistics pattern are symptoms of known performance issues in RAC.
 - Used by ADDM to enable cache fusion diagnostics

Wait Event Views

View	Description
V\$SYSTEM_EVENT	Total wait for an event since last startup
V\$SESSION_EVENT	Waits by session
V\$ACTIVE_SESSION_HISTORY	Snapshots of active database sessions taken once a second
V\$SQL	Statistics on shared SQL areas, it contains one row for each SQL statement
V\$SQLAREA	Statistics on shared SQL areas, group by SQL text
V\$SQLSTATS	Basic performance statistics for SQL, one row per SQL statement

Global Cache Wait Events

gc [current/cr] block [2/3]-way

- Received after two or three network hops with no wait

gc [current/cr] block busy

- Received but not sent immediately

gc [current/cr] grant 2-way

- Not received and not mastered locally. Grant received immediately. If 90% of this wait event is less than 2ms, network response time is fine.

gc current grant busy

- Not received and not mastered locally. Grant received with delay.

Global Cache Wait Events (cont..)

gc [current/cr] [block/grant] congested

- Block or grant received with delay because of CPU or memory lack

gc [current/cr] [failure/retry]

- Not received because of failure

gc buffer busy

- Block arrival time less than buffer pin time

gc current/cr request

- A gc request for a cr block or current buffer is in progress. The waits act as placeholders until the request completes

Global Cache Wait Events (cont..)

`gc remaster - gcs drm server freezer - gc quiesce`

- Instance remastering is going on

Global Enqueue Wait Events

- Enqueue wait is not RAC specific, but it involves a global lock operation in RAC. Following are common enqueue types:

Enqueue Type	Description	Session and System Statistics
TX	Transaction enqueue: used to protect from simultaneous update operations	
TM	Table or partition enqueue: used to protect table definitions during DML operations	
HW	High-water mark: acquired to synchronize a new block operation	
SQ	Sequence: used to serialize concurrent request to a sequence number increments	
US	Undo segment: mainly used by the Automatic Undo Management	
TA	Enqueue used mainly for transaction recovery during instance recovery	

Enqueue Statistics

- Enqueue events reported in all wait event views, AWR, and Statspack reports.
- **V\$ENQUEUE_STATISTICS** can be queried to determine which enqueue has the highest impact on database service times and, eventually, response times.

Session and System Statistics

View	Description
V\$SYSSTAT	Retrieves system-wide statistics Can be used to categorize the system statistics
V\$SESSTAT	Retrieves user session statistics. Usually linked with V\$STATNAME to obtain the statistic name. Can be used to obtain the top sessions
V\$INSTANCE_CACHE_TRANSFER	Retrieves statistics for the cache blocks transferred among instances through the interconnect

Common RAC Tuning Tips

Consider application side tuning:

- Reduce long full-table scans in OLTP systems
- Enable and rise sequence caches
- Use partitioning to distribute the workload on instances
- Avoid unnecessary parsing
- Monitor unselective indexes and study how to remove them
- Monitor the interconnect and study configuring it properly
- Minimize locking usage

Using Oracle Sequences in RAC

- High-insert applications lead to leaf block contention
- In RAC, when insert rate is high, this lead to a high rate of current and CR blocks transferred between nodes.

- Known solutions:

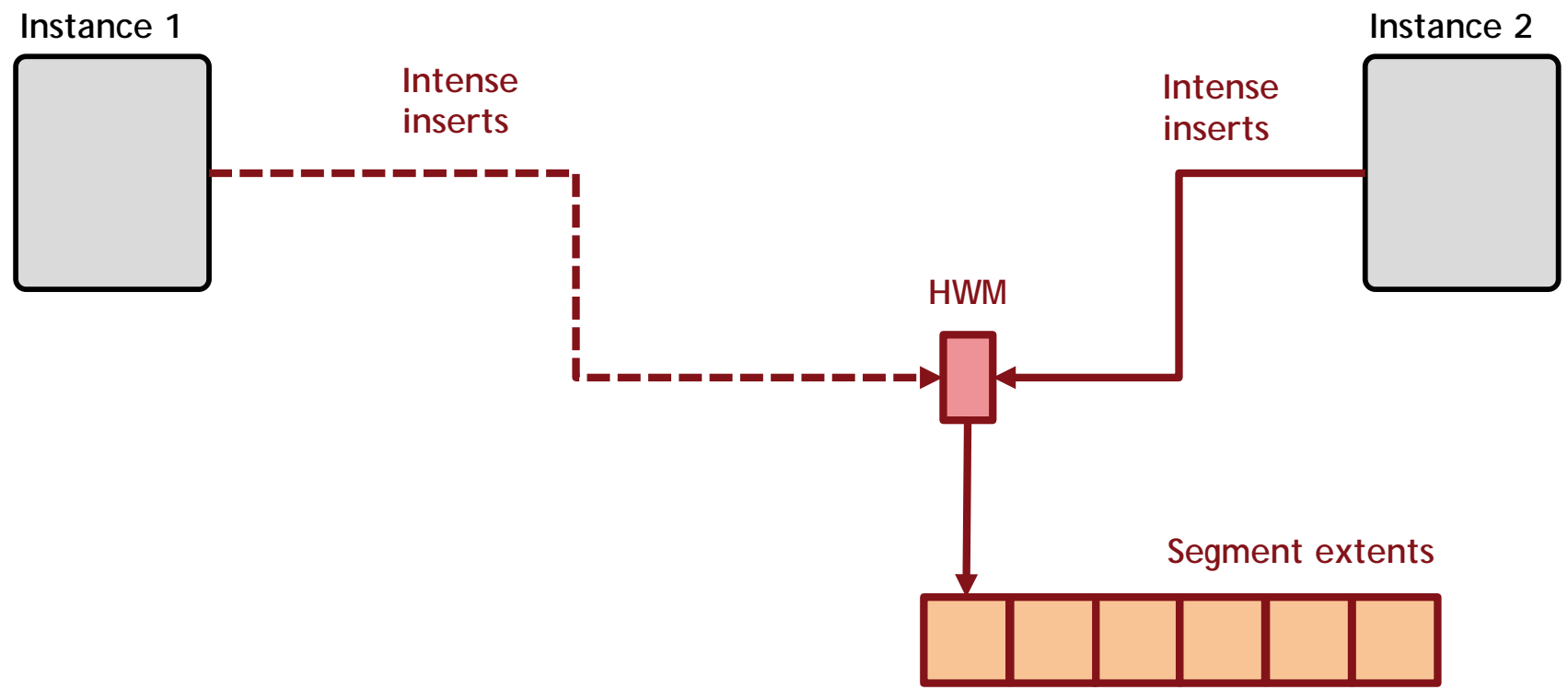
- Enable and increase sequence caches

```
CREATE SEQUENCE seq_rac_test CACHE 1000;
```

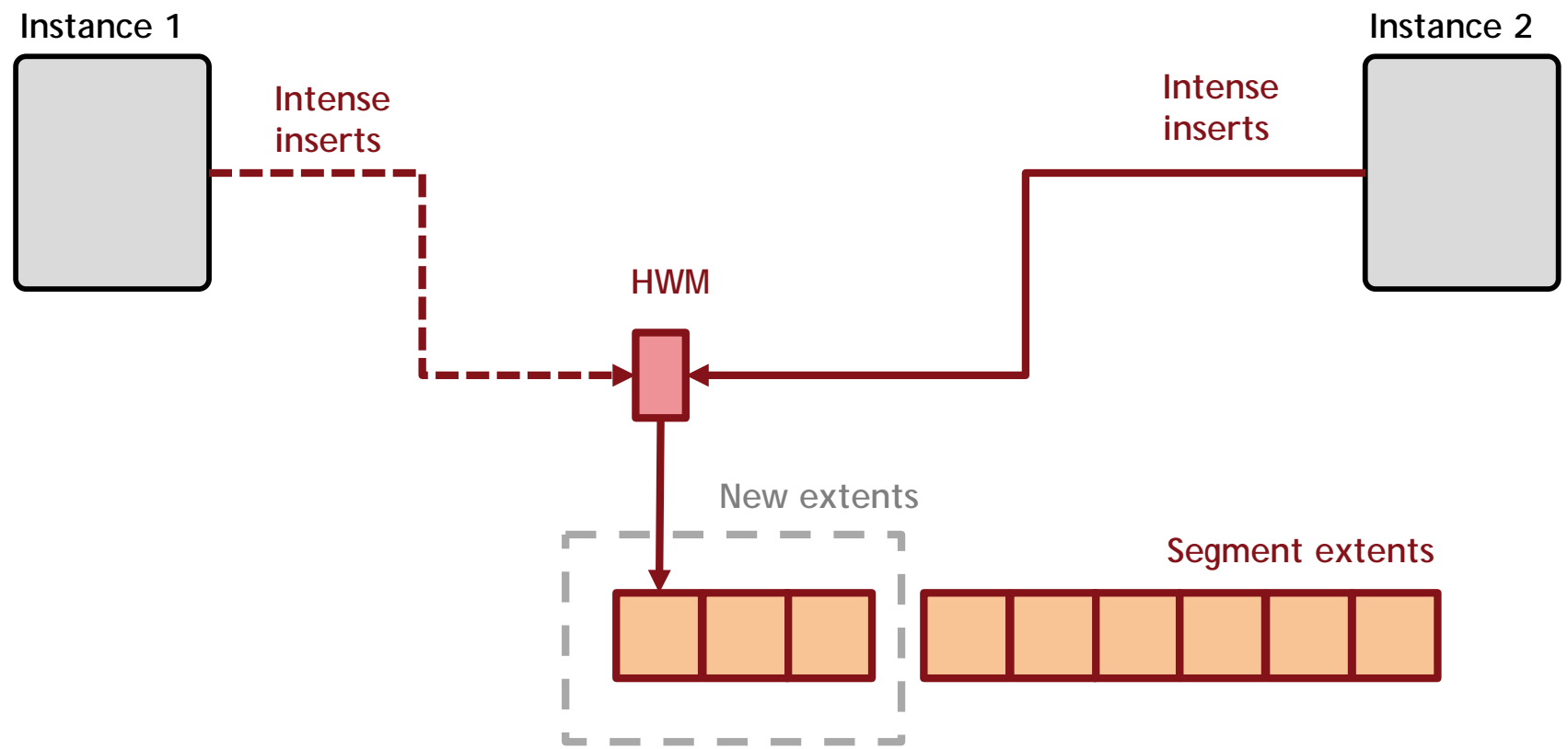
- Each instance use different range

```
CREATE TRIGGER insert_PKs ...  
  SELECT INSTANCE_NUMBER ... FROM V$INSTANCE
```

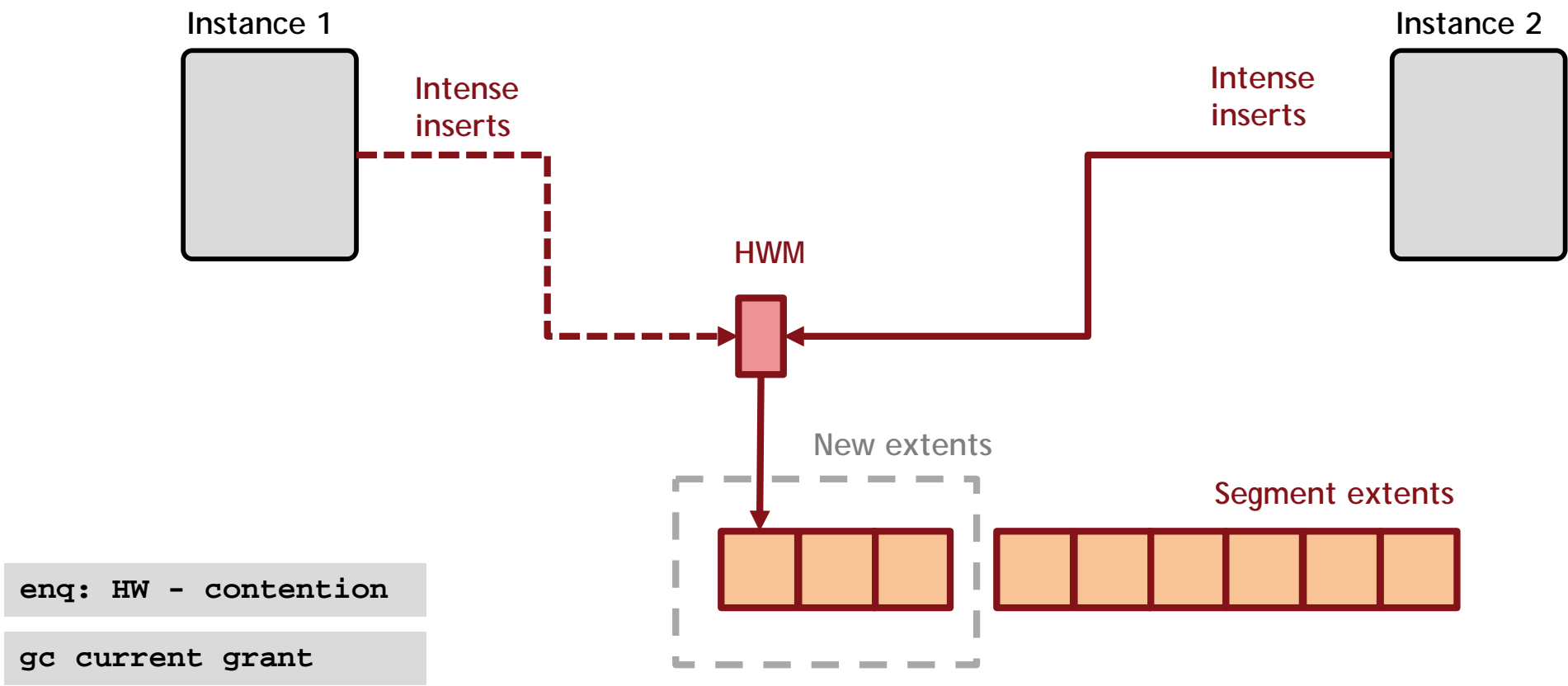

High-watermark Enqueue



High-watermark Enqueue



High-watermark Enqueue



About High-watermark Contention

- High-water mark contention characteristics:
 - Heavy inserts from RAC instances into the same segment at the HWM
 - New extents have to be created
 - Search for free space
- The common symptoms of the issue:
 - `enq: HW - contention`
 - `gc current grant` events
- To defuse the issue:
 - Uniform large extent sizes to the segments
 - Use partitions

Automatic Workload Repository (AWR) in RAC

- Performance statistics are gathered and stored every hour
- In RAC, performance statistics from all active instances are taken
- Data is stored for each instance (but not for the entire cluster)
- Reports can be generated on the instance level or database level
- AWR report has Cluster related sections
- AWR reports can be used for tuning cases
- Requires separate license. If not obtained, use Statspack instead

About Active Session History (ASH)

- Provides statistics about current active sessions
- Useful for diagnosing performance issues
- Any session connected to the database and not idle is *active*
- It is based on `V$ACTIVE_SESSION_HISTORY`
 - Snapshots of active database sessions taken every second
 - Most columns are the same as in `V$SESSION` view
- ASH report can be obtained from OEM or generated in SQL*Plus:

```
$ORACLE_HOME/rdbms/admin/ashrpt.sql
```


Automatic Database Diagnostic Monitor (ADDM) for RAC

- Analyzes AWR snapshots for any possible performance issues
- Runs automatically after ARW snapshot is taken
- In RAC, it presents its data in different granularity:
 - The entire cluster (Database ADDM for RAC mode)
 - A specific instance (Local ADDM mode)
 - Subset of database instances (Partial ADDM mode)
- Can be invoked from OEM or through `DBMS_ADVISOR` and `DBMS_ADDM`

Issues Analyzed by ADDM

- Instance congestion (top instances affecting the entire RAC)
- Object contention (buffer busy, top objects, and so on)
- Top consumers
- Lost blocks
- Interconnect devices issues including their throughput
- Latency problems in interconnect

Summary

In this lecture, you should have learnt how to describe the following:

- Performance tuning tools
- Global Cache wait events
- Global Enqueue wait events
- Common RAC-related performance issues and their resolutions
- Tips to tune Oracle RAC performance
- Using ADDM in RAC