



Oracle 19c Database Tuning

19c Database Tuning

- Course Agenda
 - Day 1)
 - Welcome
 - Course Introduction
 - Student Introduction
 - Database Architecture
 - Query Optimization
 - Queries and Multitenant

- Course Agenda
 - Day2)
 - Executions Plans
 - AWR
 - AWR Baselines
 - Day 3)
 - Optimizer Statistics
 - Oracle Services
 - Bind Variables

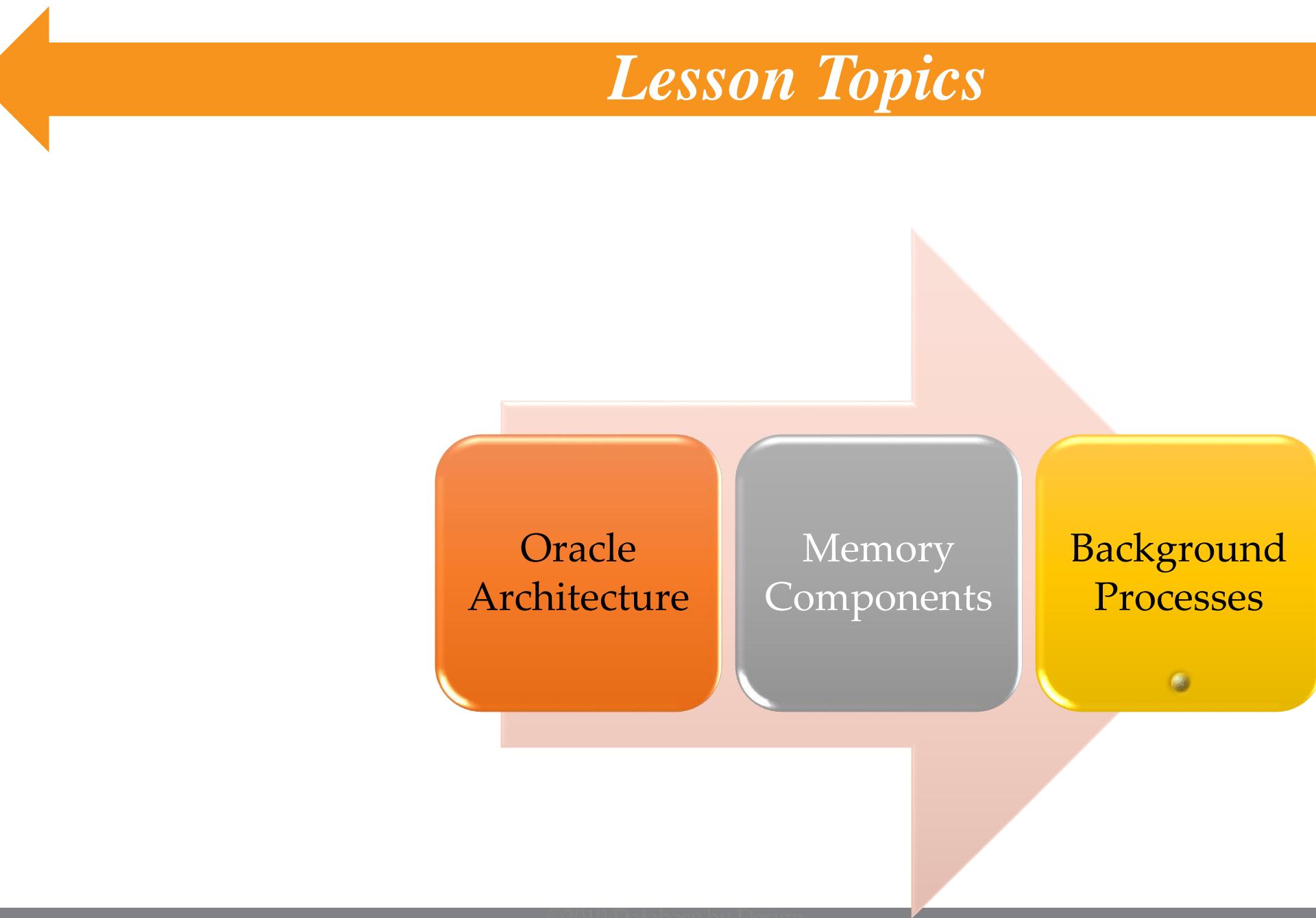
- Course Agenda
 - Day4)
 - Real Application Testings
 - SQL Tuning Advisor
 - Automatic Tuning
 - SQL Plan Management
 - Shared Pool Tuning
 - Day 5)
 - Automatic Memory Management
 - ASSM
 - Automatic Storage Management

- Course Topics
 - Database Architecture
 - Query Optimization
 - Queries in a Multitenant Environment
 - Execution Plans
 - AWR
 - AWR Baselines
 - Optimizer Statistics
 - Oracle Services
 - Bind Variables

- Course Topics

- Real Application Testing
- SQL Tuning Advisor
- Automatic SQL Tuning
- SQL Plan Management
- Shared Pool Tuning
- Automatic Memory Management
- Automatic Segment Space Management (ASSM)
- Automatic Storage Management

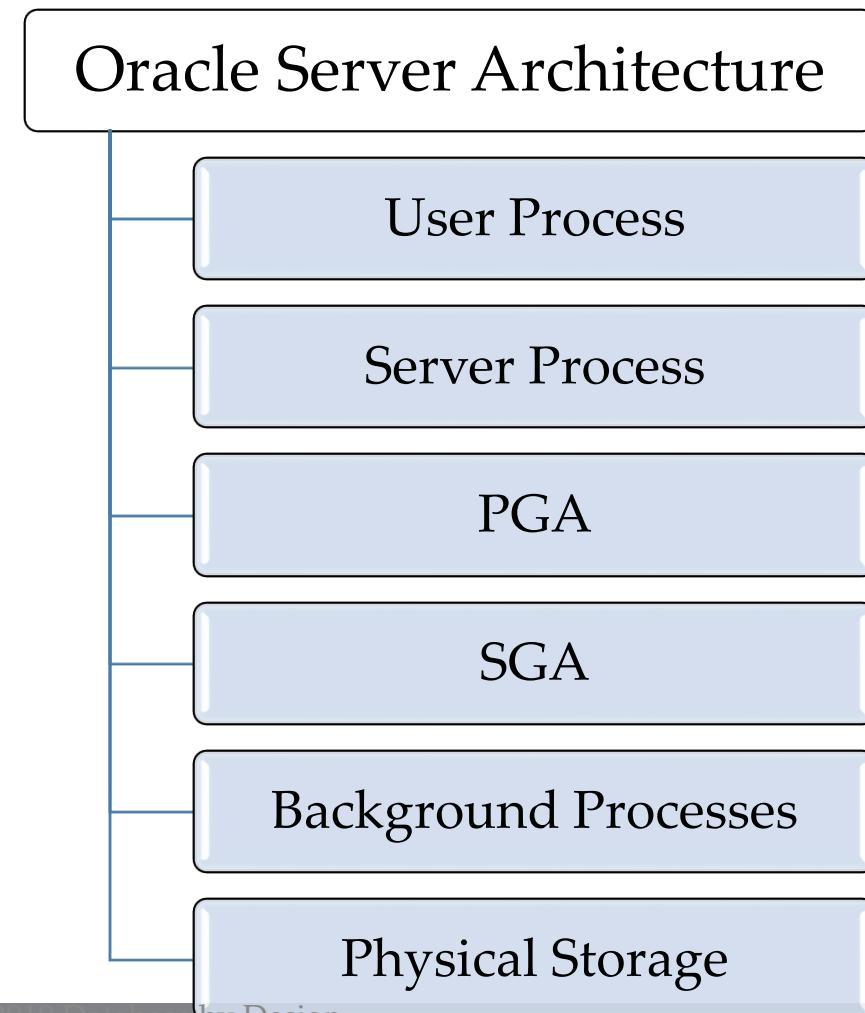
Lesson Topics



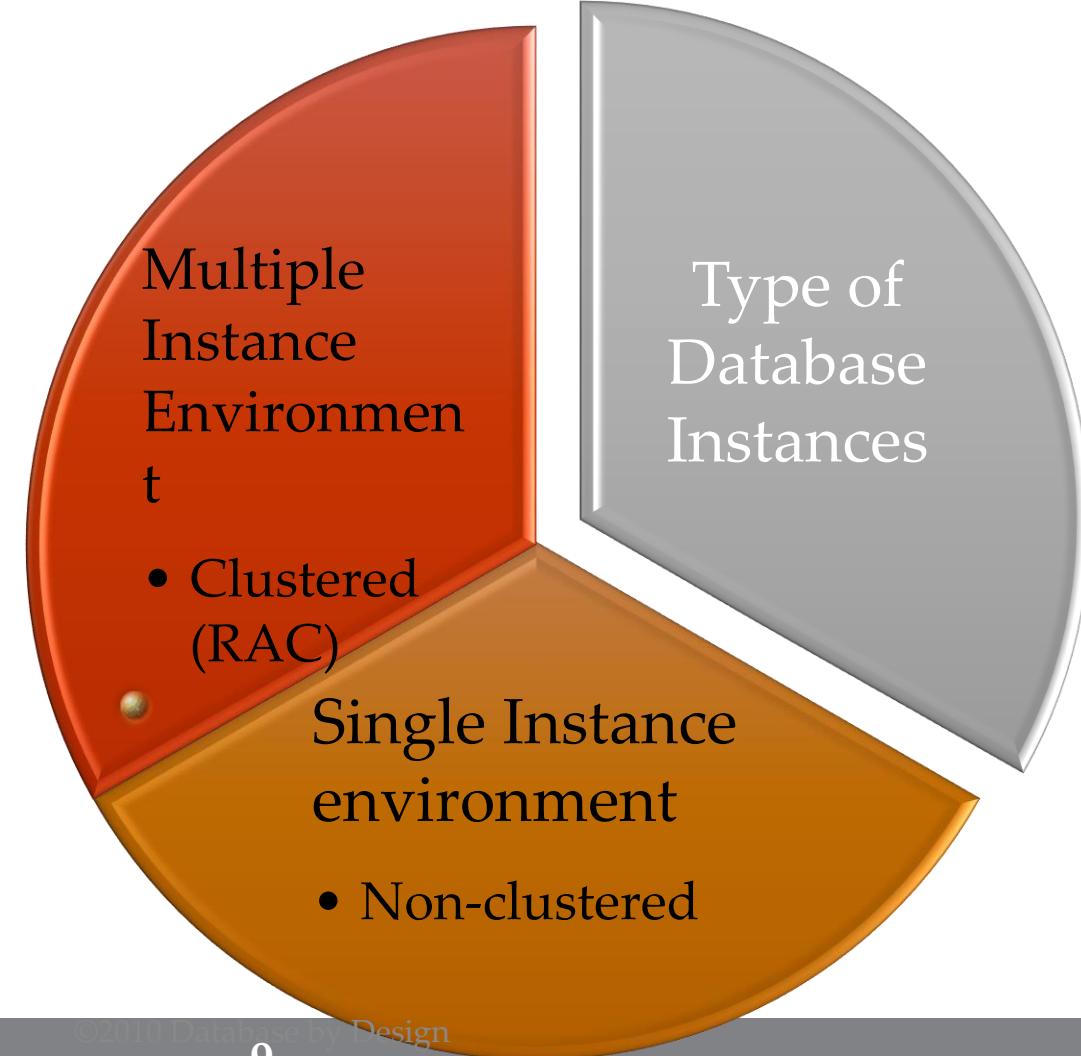
Oracle
Architecture

Memory
Components

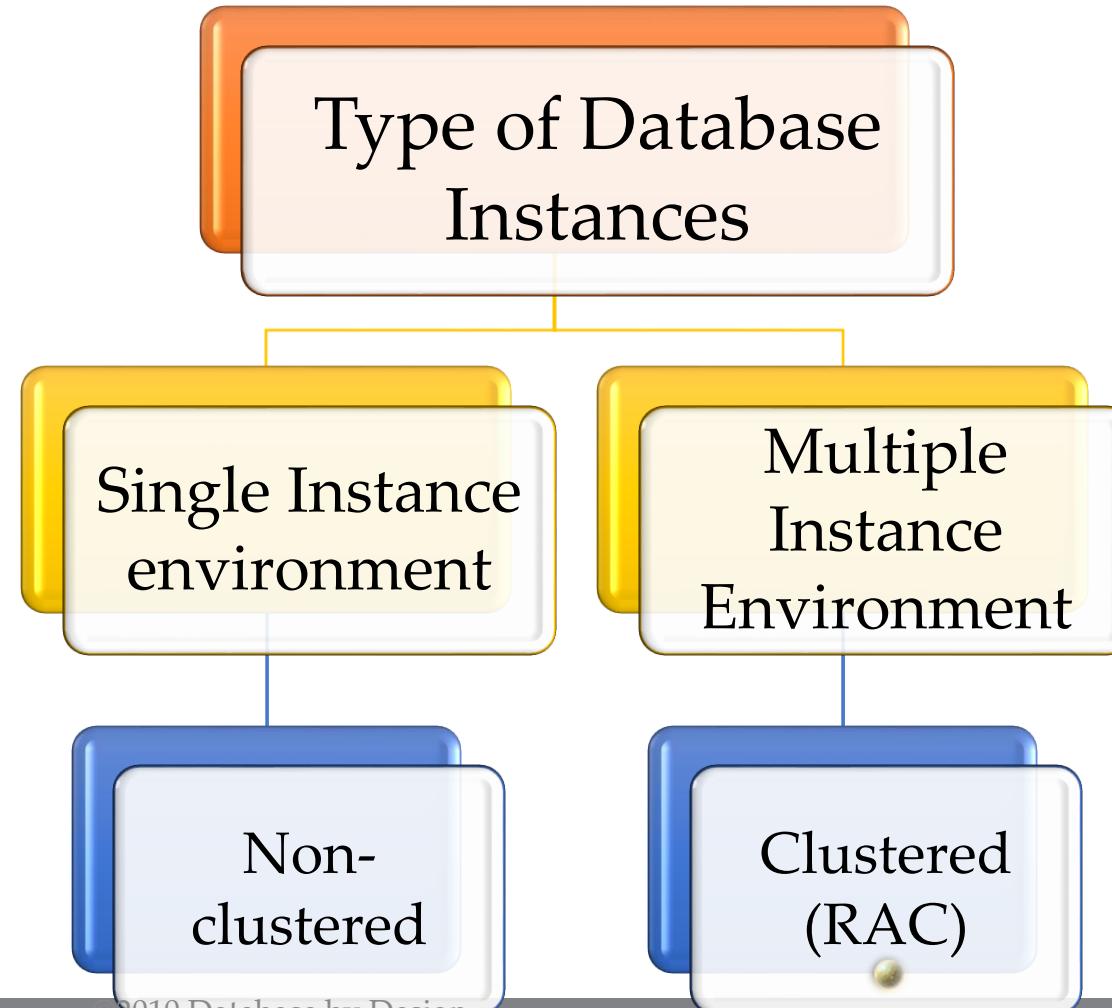
Background
Processes



Oracle 19c Database Architecture



Oracle 19c Database Architecture



Connection

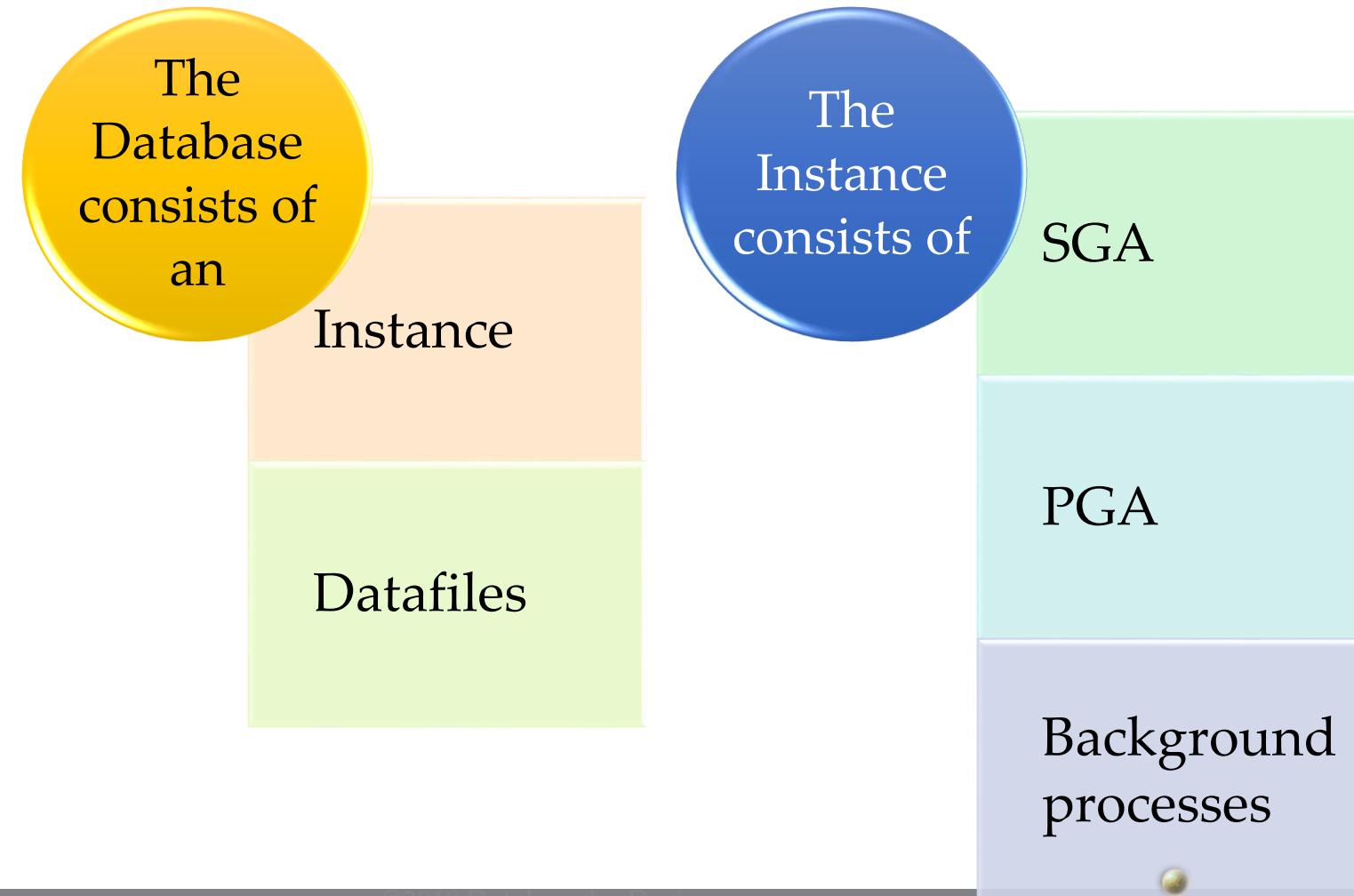
The User process connects to the server process

The server process connects to the SGA

If data is not in memory the server process loads data from the physical structures into the SGA

user --- sql statement -- server --- sga = session

Oracle 19c Database Architecture



Oracle 19c Database Architecture

The Oracle Datafiles are:

Control files

DataFiles

Online Redo Log Files

ASM (Grid Infrastructure)

Non-ASM

Non Database files

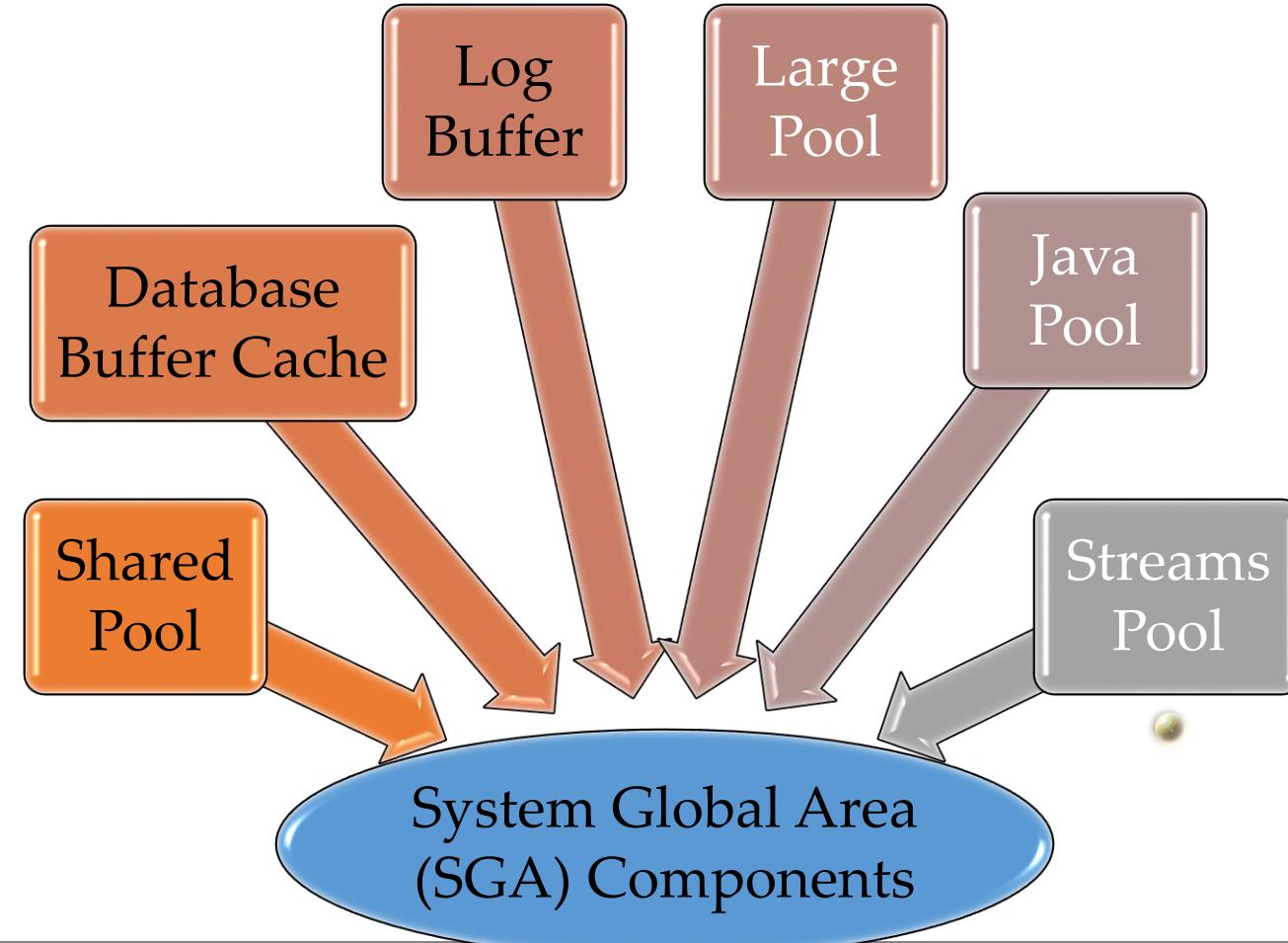
- archivelog files
- alert.log files
- trace files

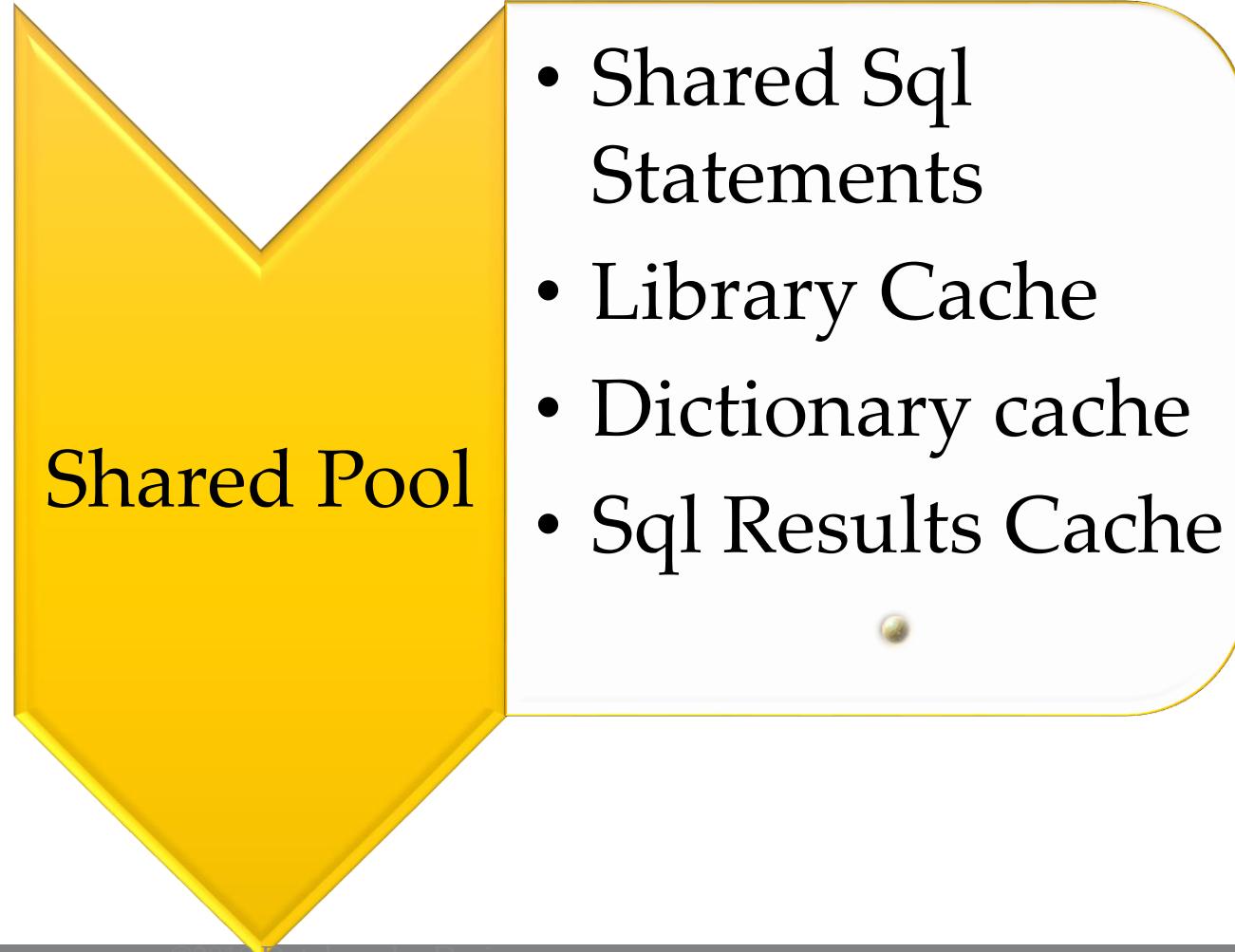
- common_user_prefix
- container_data
- containers_parallel_degree
- db_cache_size
- db_create_file_dest
- db_create_online_log_dest_1
- db_create_online_log_dest_2
- db_create_online_log_dest_3
- db_create_online_log_dest_4
- db_create_online_log_dest_5

- heat_map
- ignore_session_set_param_error
- inmemory_automatic_level
- inmemory_clause_default
- inmemory_expressions_usage
- inmemory_force
- inmemory_optimized_arithmeticy
- inmemory_query
- inmemory_size
- inmemory_virtual_columns

- sga_min_size
- sga_target
- shadow_core_dump
- shared_pool_size
- undo_management
- undo_retention
- Undo_tablespace

Oracle 19c Database Architecture

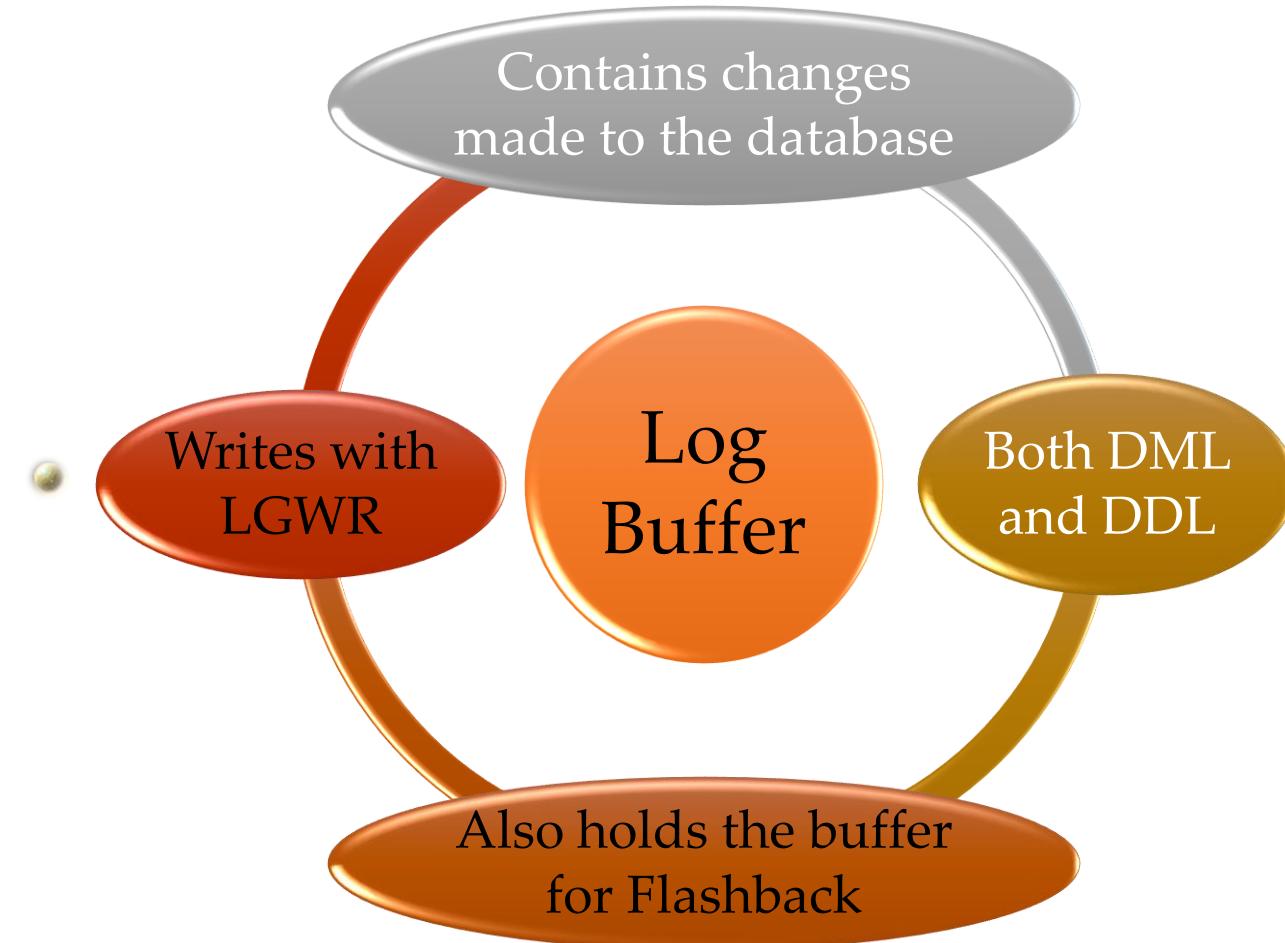




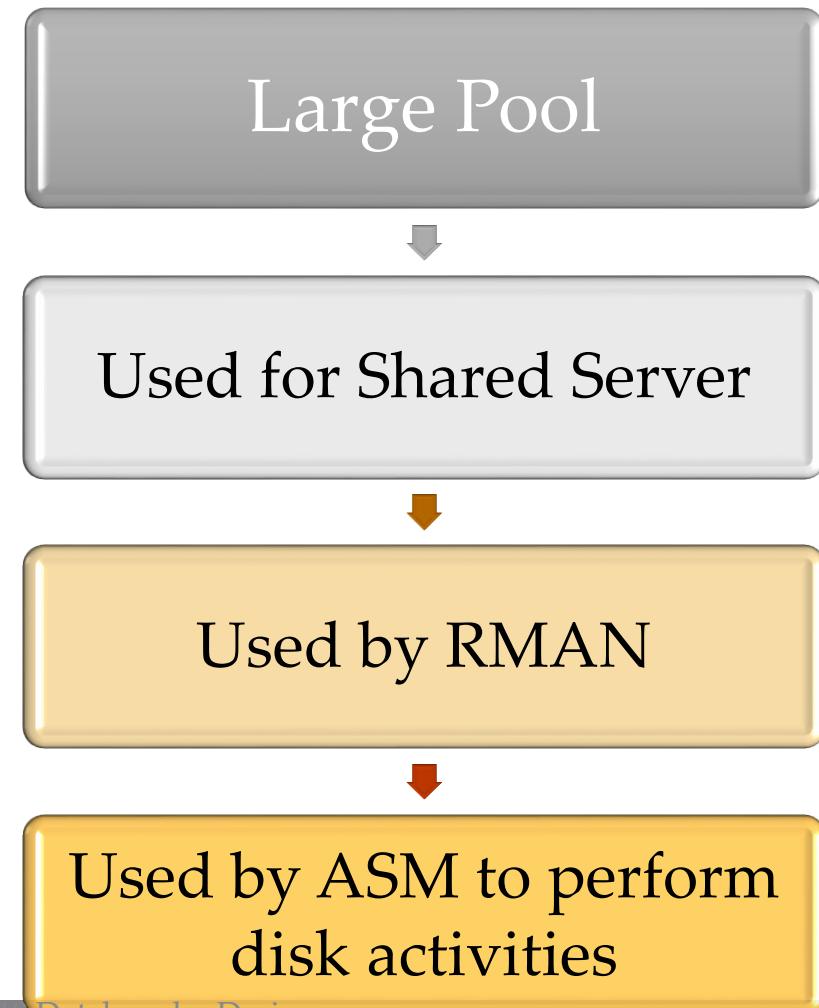
Database Buffer Cache

- Logical data read from the Datafiles
- Goal is to retrieve most information from memory
- Keep Pool
 - Data does not age out
- Default Pool
 - Over time data does age out
- Recycle Pool
 - Data ages out right after processing is complete

Oracle 19c Database Architecture



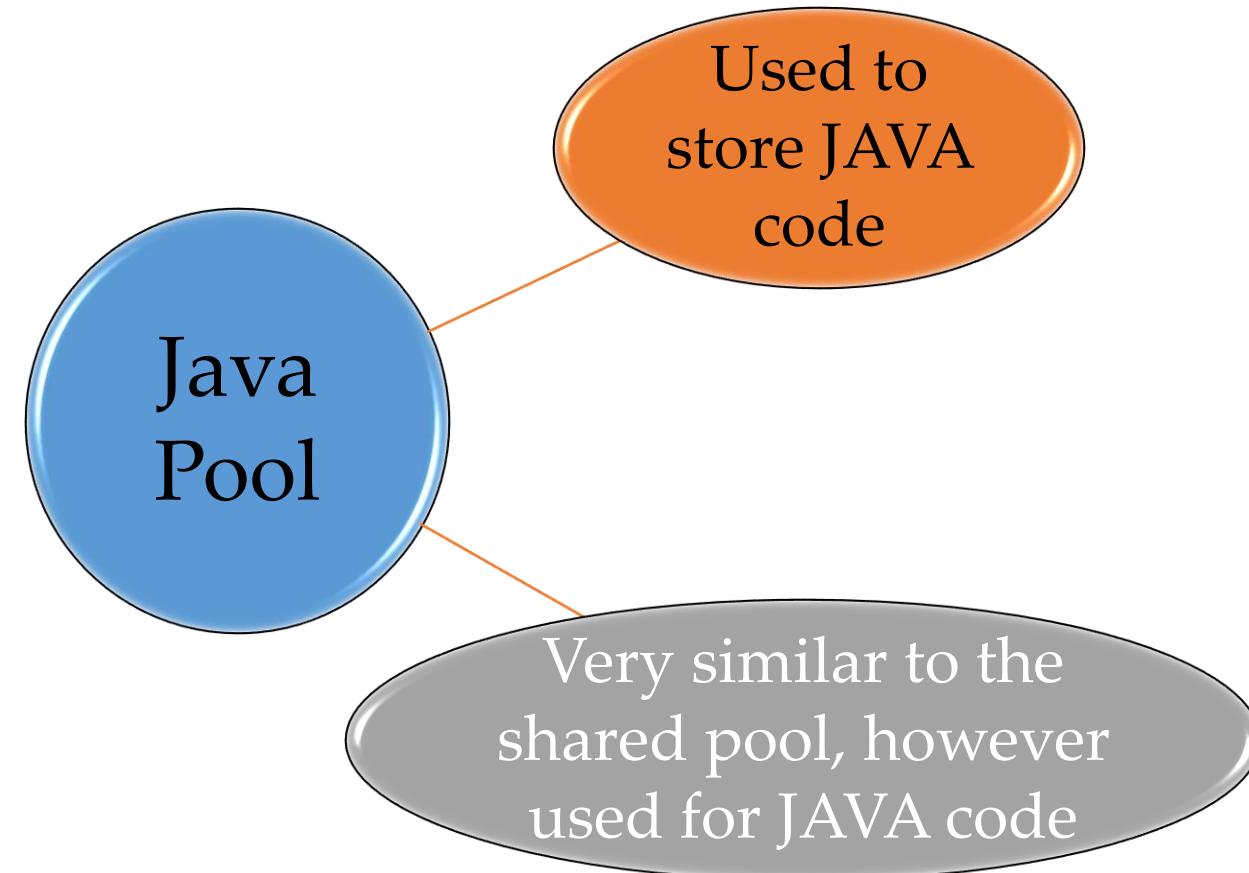
Oracle 19c Database Architecture



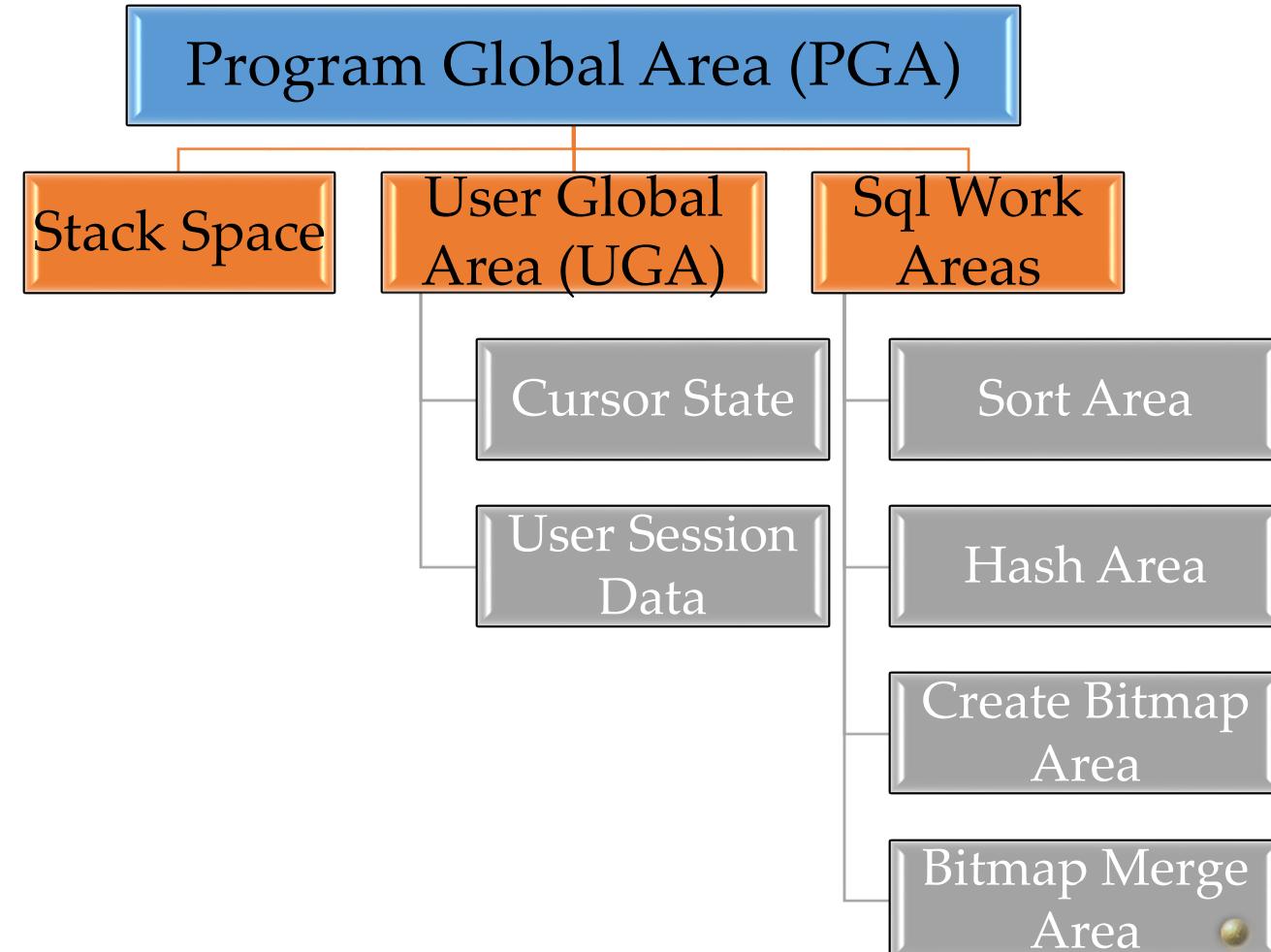
- Used for Oracle Streams product
- Used for buffered queue messages

Streams Pool

Oracle 19c Database Architecture



Oracle 19c Database Architecture



Standard Background processes

Server
Process

- Communicates between the user process and SGA

SMON

- Instance failure

PMON

- Process failure

DBWR

- Writes to data files

Standard Background processes

LGWR

- Writes from the log buffer to online redo logs
 - 1 mb
 - 1/3 full
 - commit

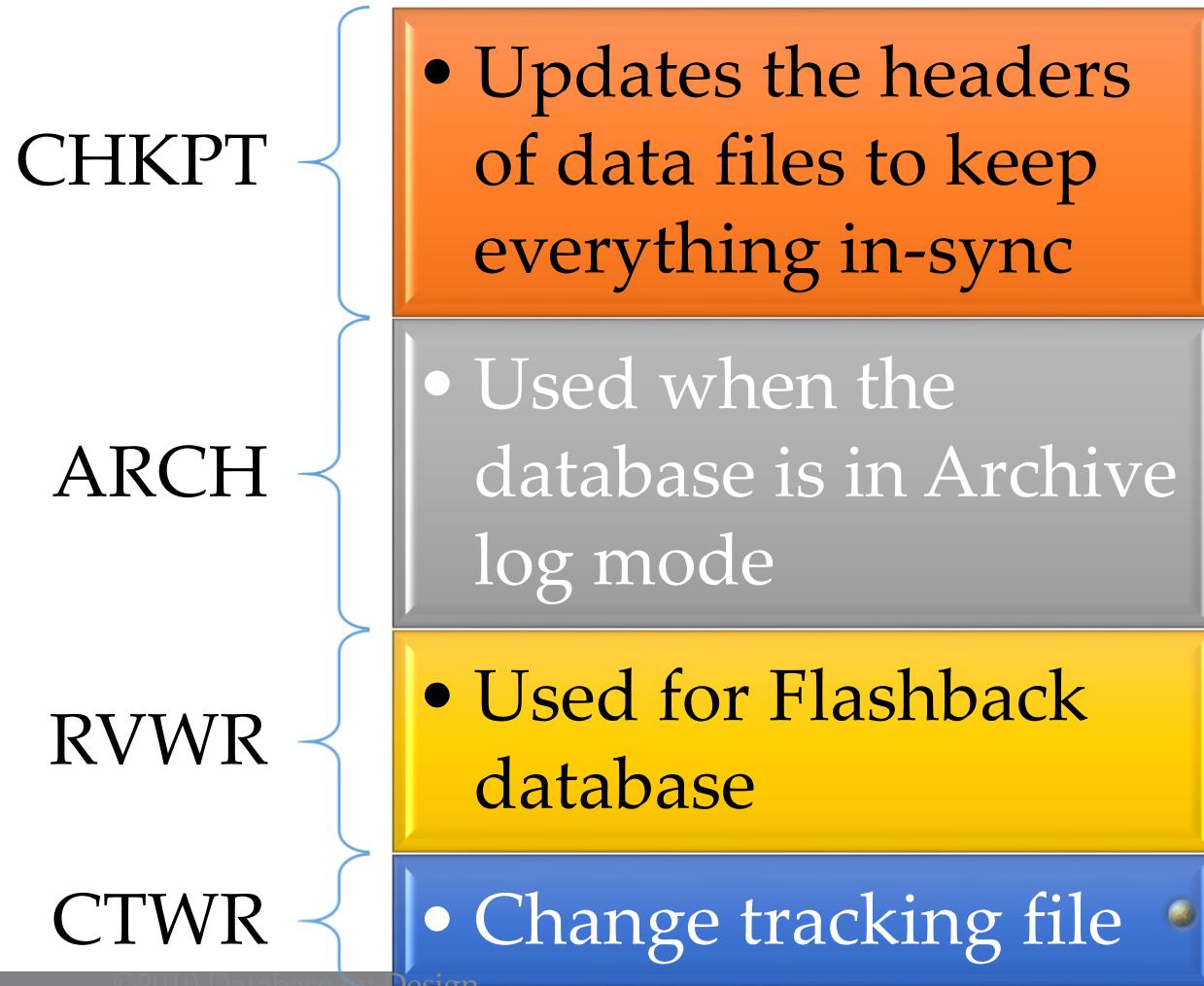
MMON

- AWR

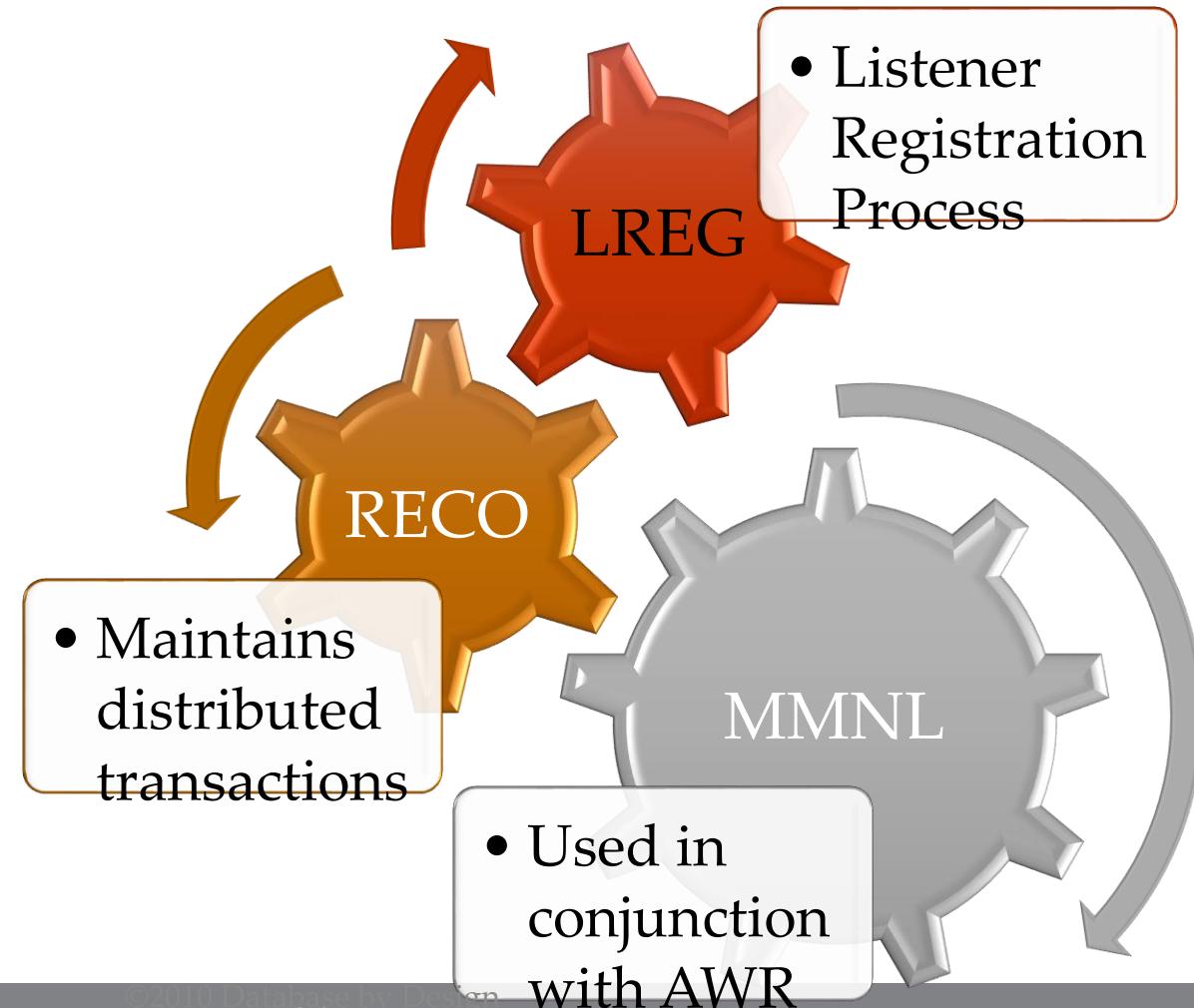
MMAN

- memory target
- sga target

Standard Background processes



Standard Background processes



Grid Infrastructure Processes

OHAS

- Oracle High Availability Services

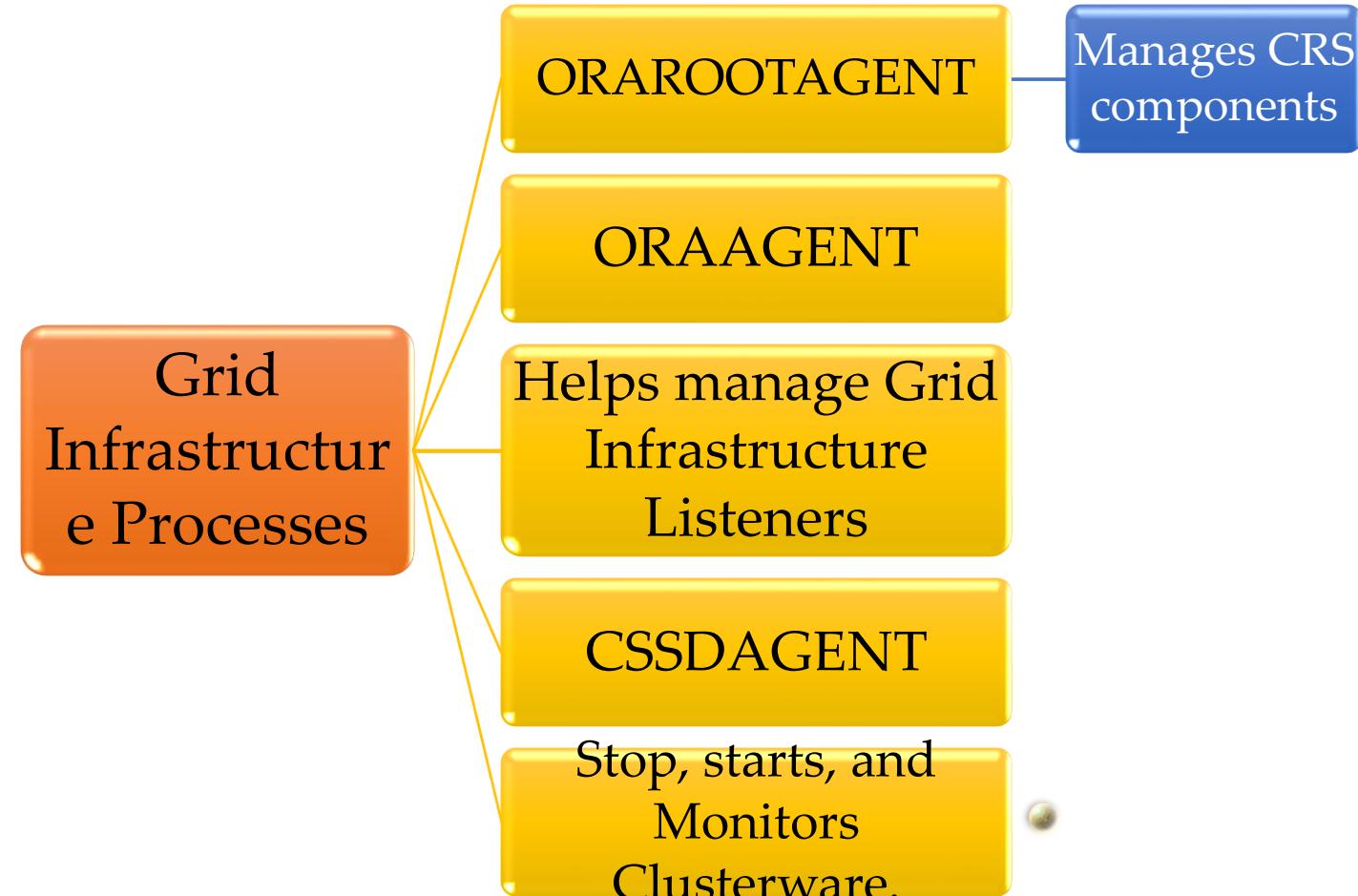
OCCS

- Oracle cluster synchronization services

DISKMON

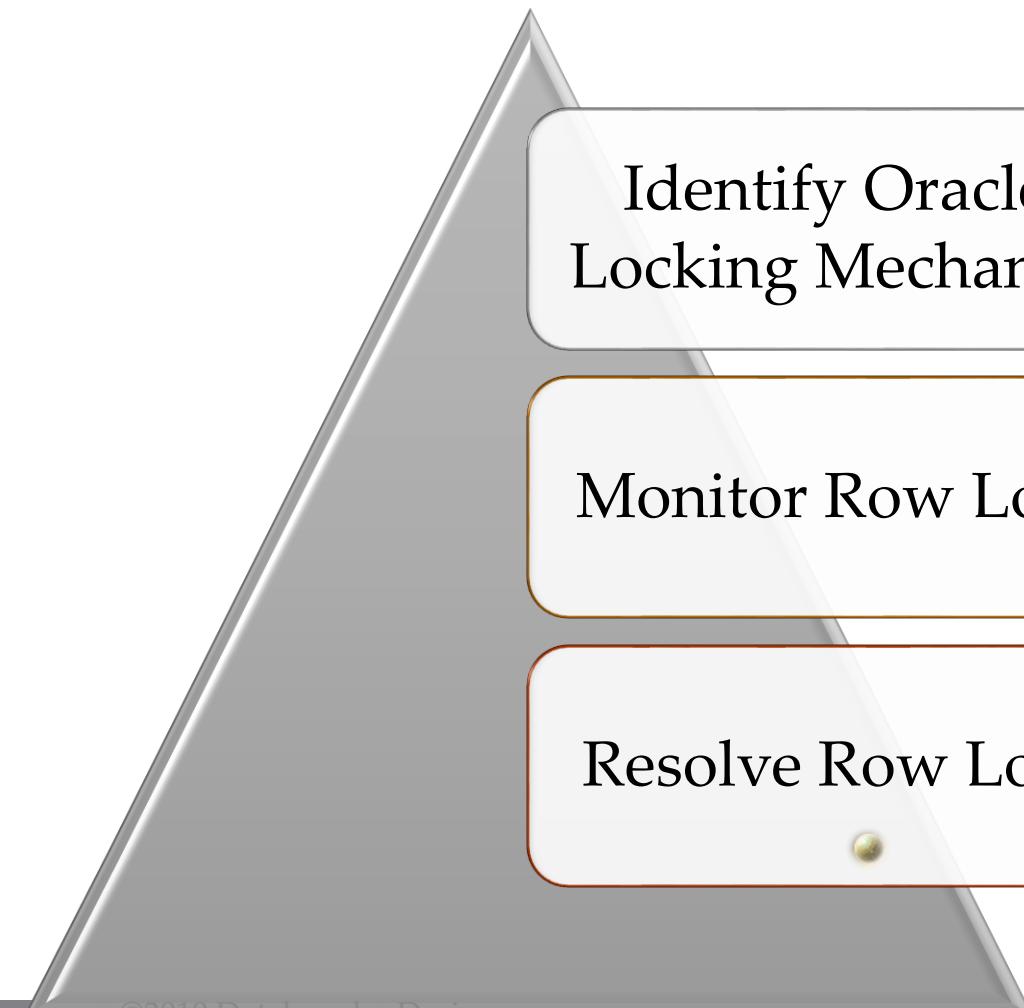
- ASM Disk monitor

Oracle 19c Database Architecture



- Summary
 - Database Processes
 - Database Architecture
 - Database Instance

Lesson Topics

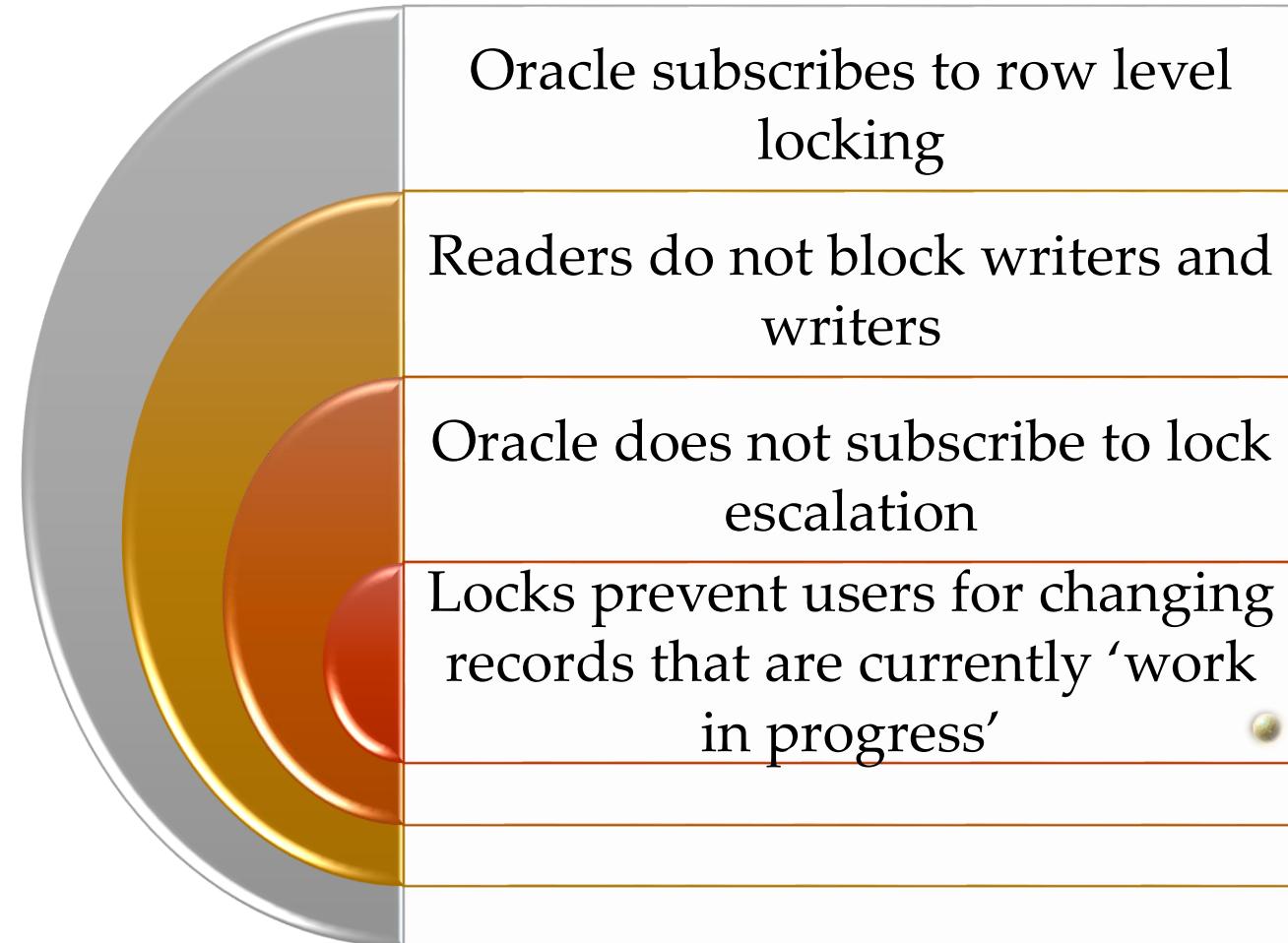


Identify Oracle's
Locking Mechanism

Monitor Row Locks

Resolve Row Locks

Oracle 19c Database Concurrency



Oracle 19c Database Concurrency

Row-level locks are
for

inserts

updates

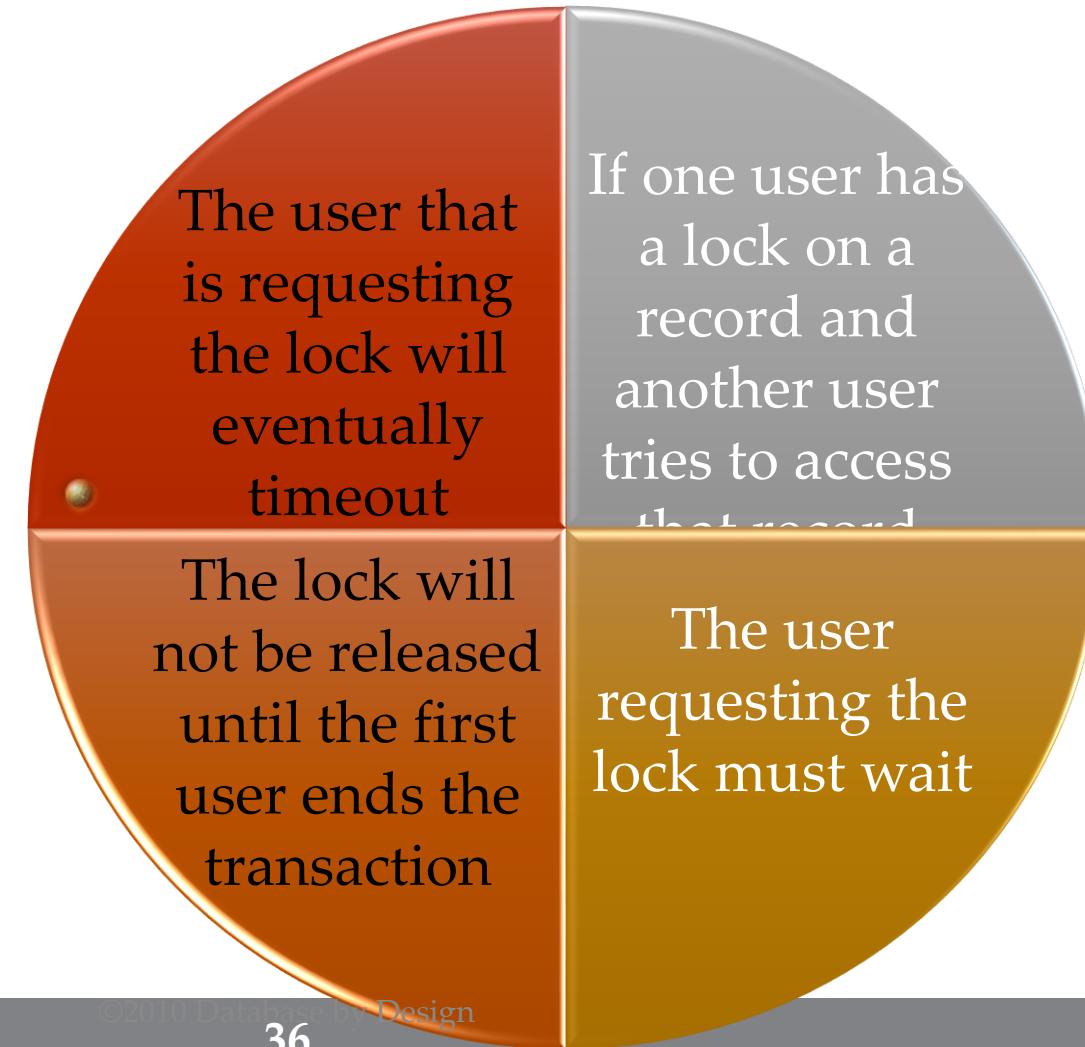
deletes

No locks are
required for
select statements

The lock is held
until the transaction
completes

commit is issued

Oracle 19c Database Concurrency



Oracle 19c Database Concurrency

The locking mechanism is natural Oracle behavior

The DBA does not need to do anything to enable row-level locking

However, the DBA may wish to terminate the session that is either:

- causing the lock
- waiting for the record

To determine locking information
dictionary tables may be queried

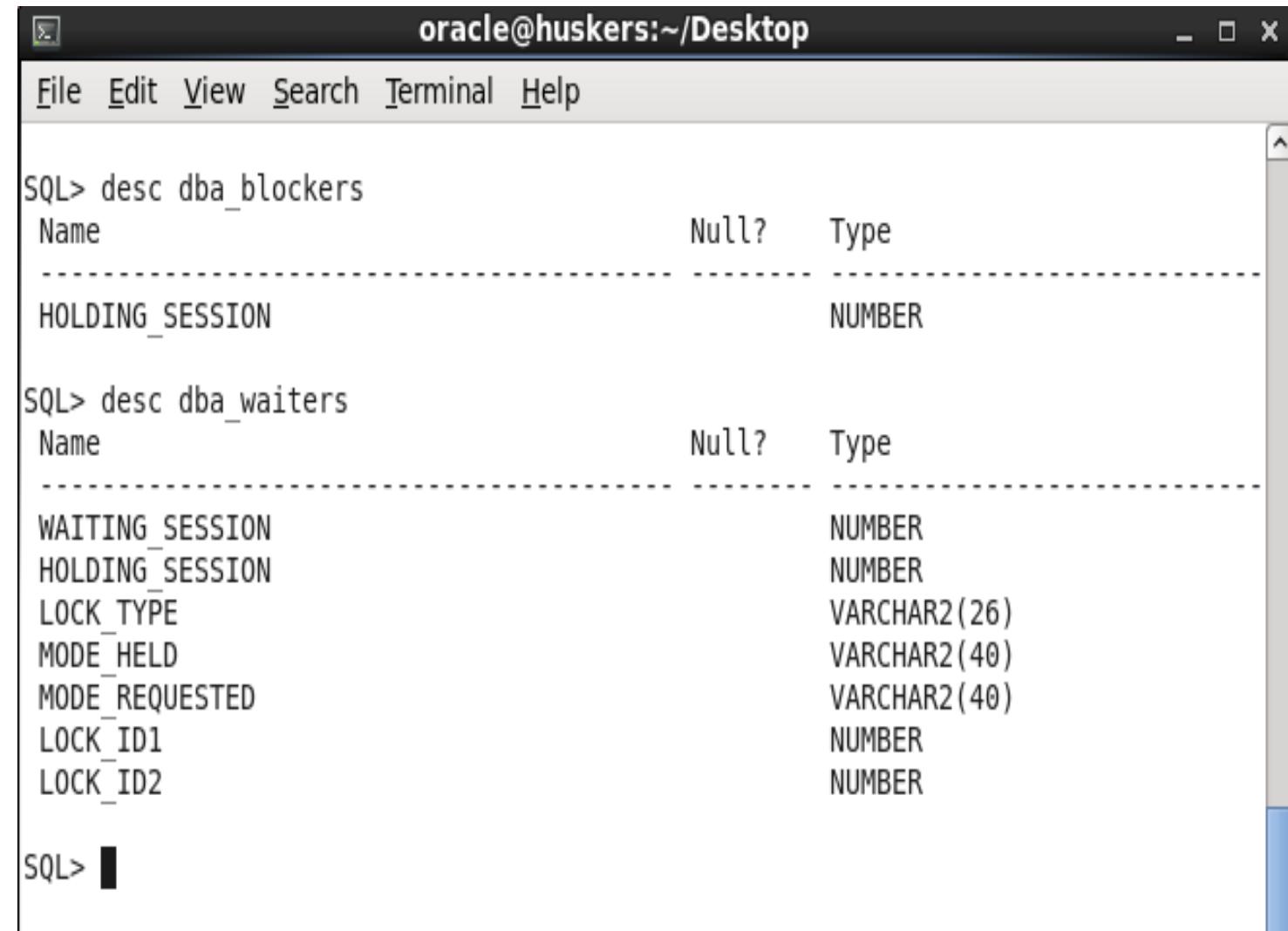
`dba_blockers`

`dba_waiters`

`v$lock`

`v$locked_object`

Oracle 19c Database Concurrency



oracle@huskers:~/Desktop

```
File Edit View Search Terminal Help
```

SQL> desc dba_blockers

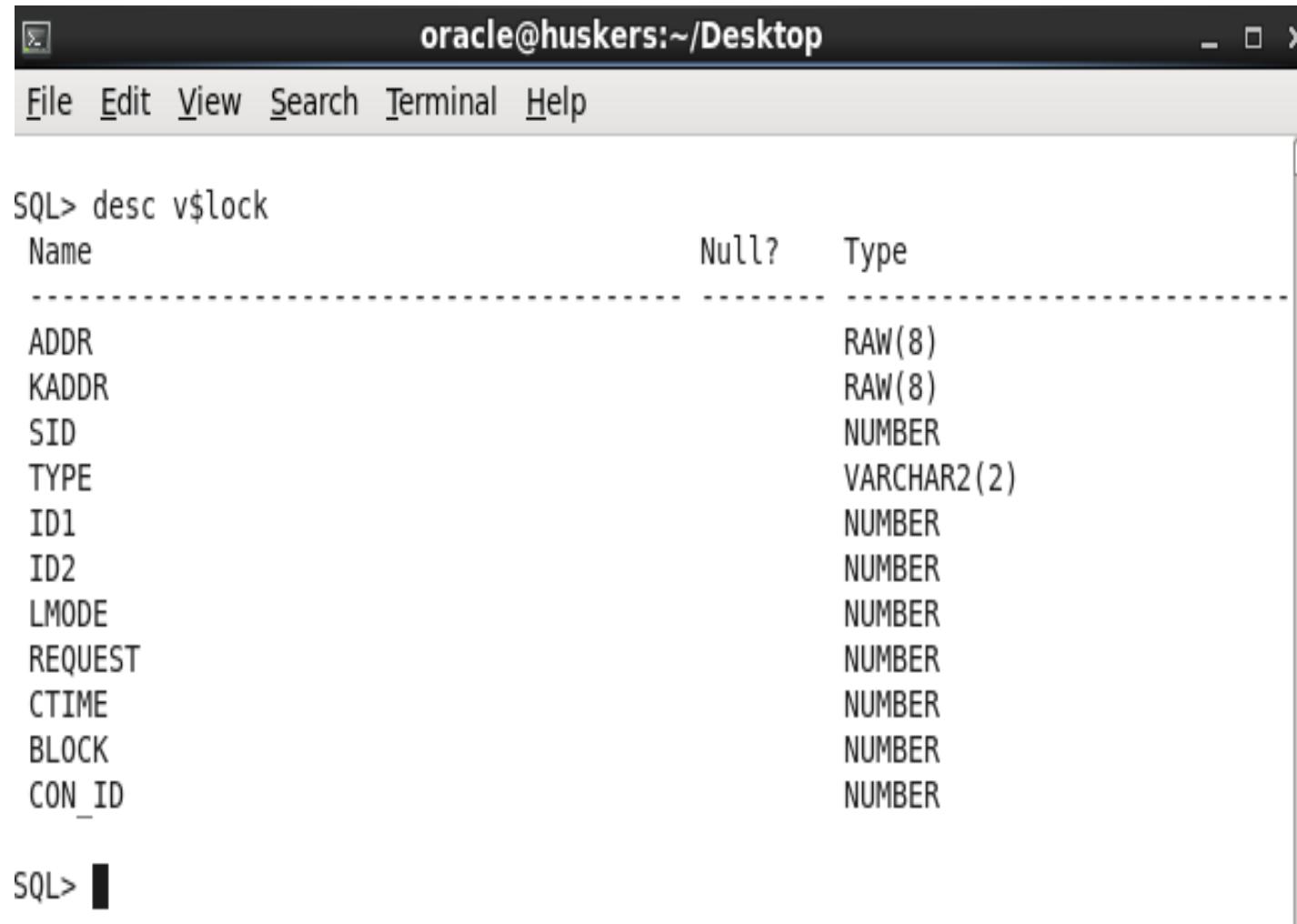
Name	Null?	Type
HOLDING_SESSION		NUMBER

SQL> desc dba_waiters

Name	Null?	Type
WAITING_SESSION		NUMBER
HOLDING_SESSION		NUMBER
LOCK_TYPE		VARCHAR2(26)
MODE_HELD		VARCHAR2(40)
MODE_REQUESTED		VARCHAR2(40)
LOCK_ID1		NUMBER
LOCK_ID2		NUMBER

SQL>

Oracle 19c Database Concurrency



oracle@huskers:~/Desktop

File Edit View Search Terminal Help

```
SQL> desc v$lock
Name                           Null?    Type
-----
ADDR                           RAW(8)
KADDR                          RAW(8)
SID                            NUMBER
TYPE                           VARCHAR2(2)
ID1                            NUMBER
ID2                            NUMBER
LMODE                           NUMBER
REQUEST                         NUMBER
CTIME                           NUMBER
BLOCK                           NUMBER
CON_ID                          NUMBER

SQL> █
```

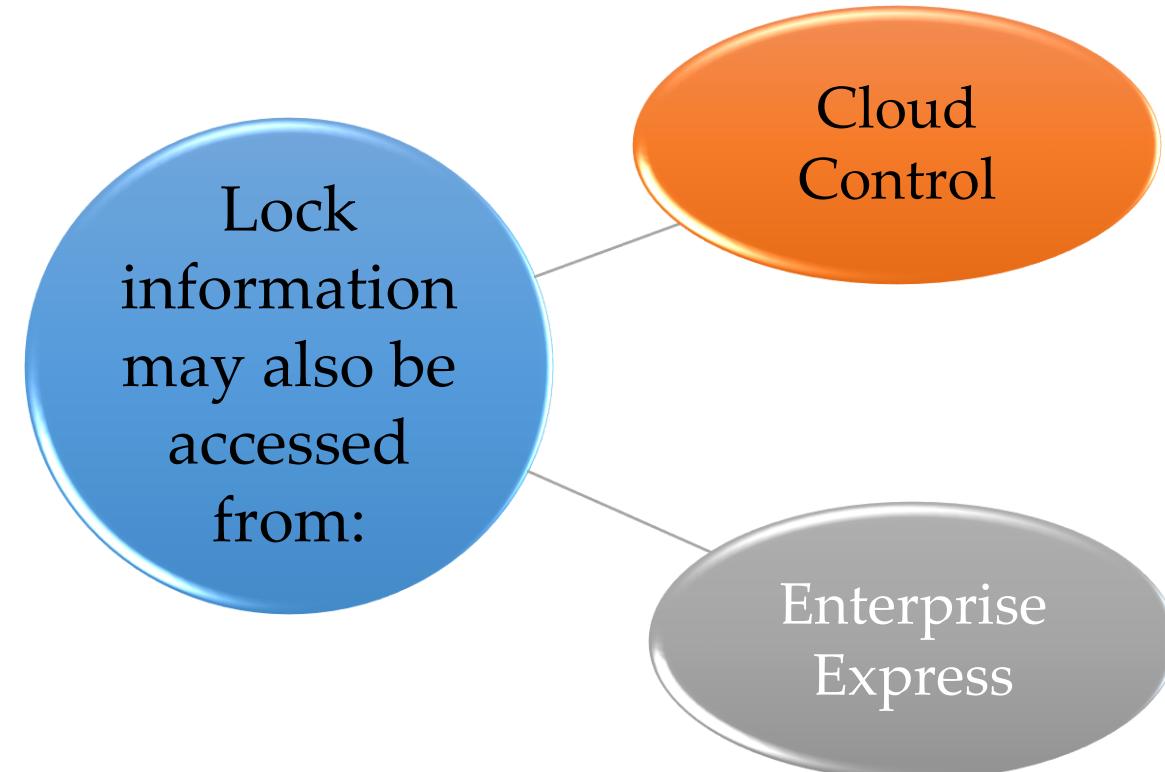
Oracle 19c Database Concurrency

```
SQL> desc v$locked_object
```

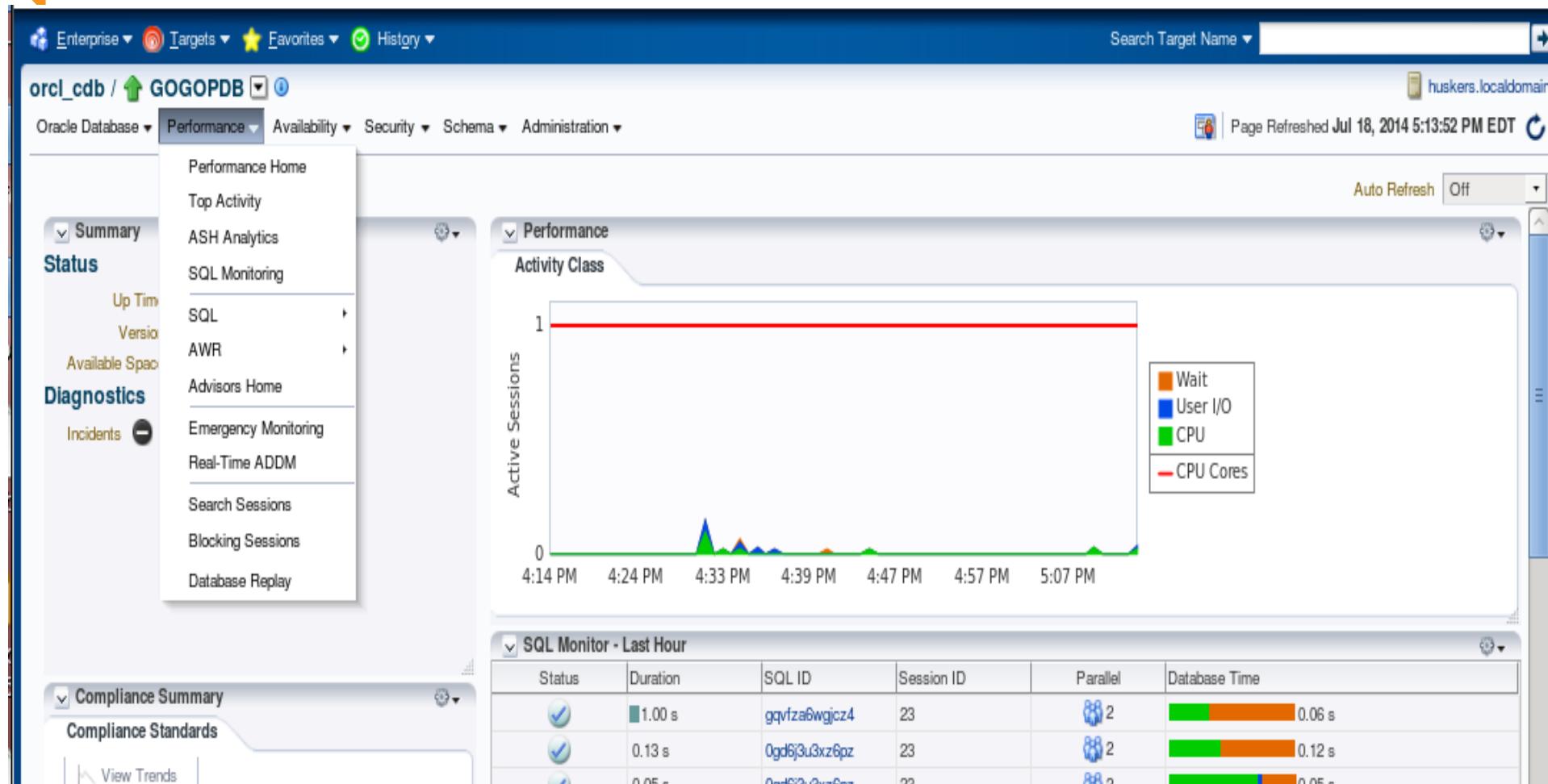
Name	Null?	Type
XIDUSN		NUMBER
XIDSLOT		NUMBER
XIDSQN		NUMBER
OBJECT_ID		NUMBER
SESSION_ID		NUMBER
ORACLE_USERNAME		VARCHAR2(30)
OS_USER_NAME		VARCHAR2(30)
PROCESS		VARCHAR2(24)
LOCKED_MODE		NUMBER
CON_ID		NUMBER

```
SQL>
```

Oracle 19c Database Concurrency



Oracle 19c Database Concurrency



The screenshot shows the Oracle Database Performance Monitoring interface for the database `orcl_cdb / GOGOPDB`. The main menu bar includes `Enterprise`, `Targets`, `Favorites`, `History`, `Search Target Name`, and `Auto Refresh Off`. The top navigation bar has tabs for `Performance`, `Availability`, `Security`, `Schema`, and `Administration`. The `Performance` tab is selected.

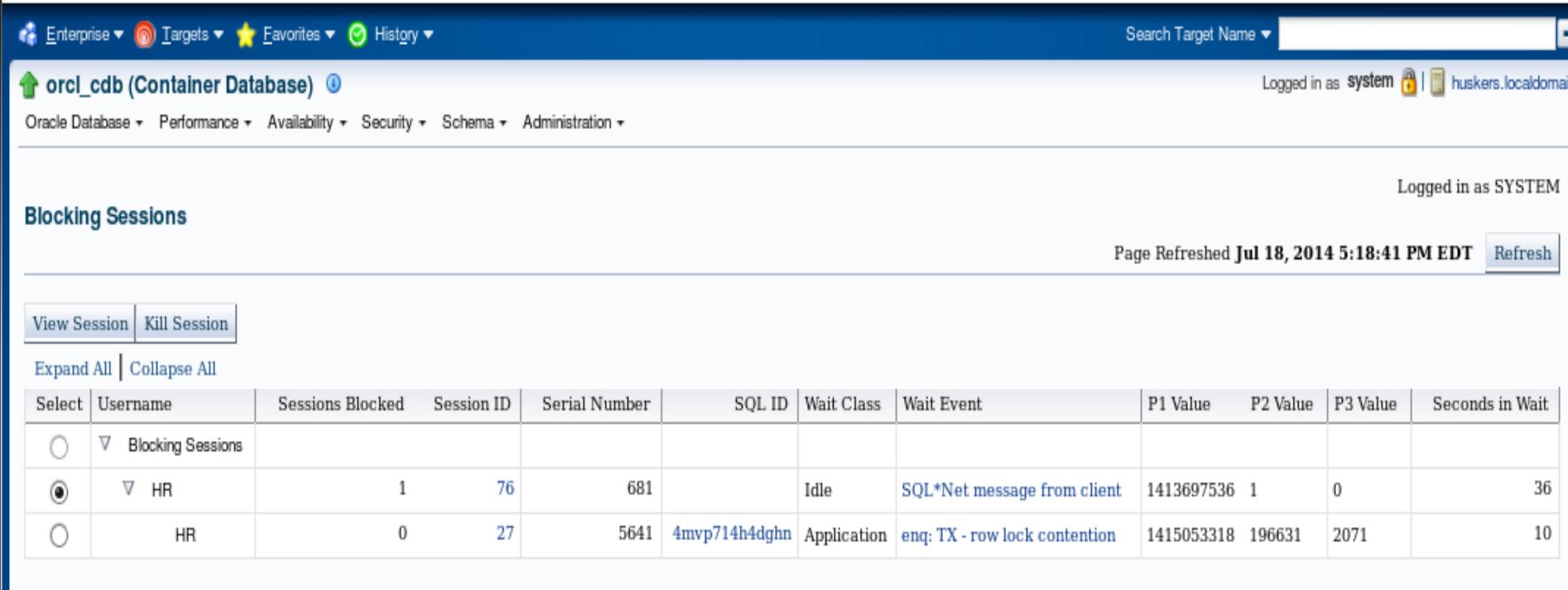
The left sidebar contains sections for `Status` (Up Time, Version, Available Space), `Diagnostics` (Incidents), and `Compliance Summary` (Compliance Standards, View Trends).

The central area displays the `Activity Class` chart, which tracks active sessions over time. The Y-axis is labeled "Active Sessions" with values 0 and 1. The X-axis shows time from 4:14 PM to 5:07 PM. The chart shows a single red line at level 1, indicating CPU Cores usage. A legend on the right identifies the series: `Wait` (orange), `User I/O` (blue), `CPU` (green), and `CPU Cores` (red).

Below the chart is the `SQL Monitor - Last Hour` table, which lists three SQL statements:

Status	Duration	SQL ID	Session ID	Parallel	Database Time
✓	1.00 s	gqvfza6wgjcz4	23	2	0.06 s
✓	0.13 s	0gd63u3xz6pz	23	2	0.12 s
✓	0.05 s	0n4l23u2u4pp	22	2	0.05 s

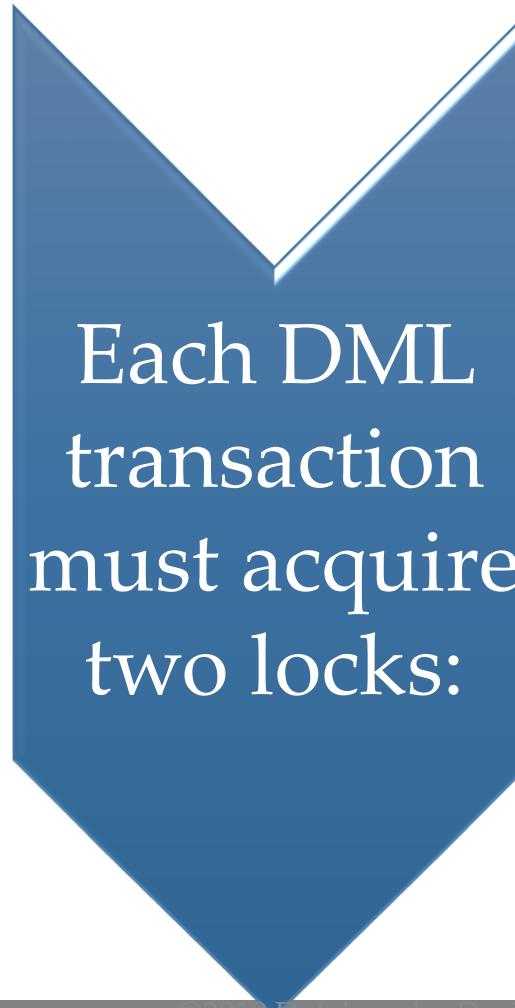
Oracle 19c Database Concurrency



The screenshot shows the Oracle Enterprise Manager Cloud Control interface for the 'orcl_cdb (Container Database)'. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The user is logged in as 'system' on 'huskers.localdomain'. The main content area is titled 'Blocking Sessions' and shows the status 'Logged in as SYSTEM'. A timestamp indicates the page was refreshed on Jul 18, 2014 at 5:18:41 PM EDT. Below the title, there are buttons for 'View Session' and 'Kill Session', along with 'Expand All' and 'Collapse All' links. A table lists blocking sessions with columns: Select, Username, Sessions Blocked, Session ID, Serial Number, SQL ID, Wait Class, Wait Event, P1 Value, P2 Value, P3 Value, and Seconds in Wait. The table contains three rows:

Select	Username	Sessions Blocked	Session ID	Serial Number	SQL ID	Wait Class	Wait Event	P1 Value	P2 Value	P3 Value	Seconds in Wait
<input type="radio"/>	▼ Blocking Sessions										
<input checked="" type="radio"/>	▼ HR	1	76	681		Idle	SQL*Net message from client	1413697536	1	0	36
<input type="radio"/>	HR	0	27	5641	4mvp714h4dghn	Application	enq: TX - row lock contention	1415053318	196631	2071	10

Oracle 19c Database Concurrency



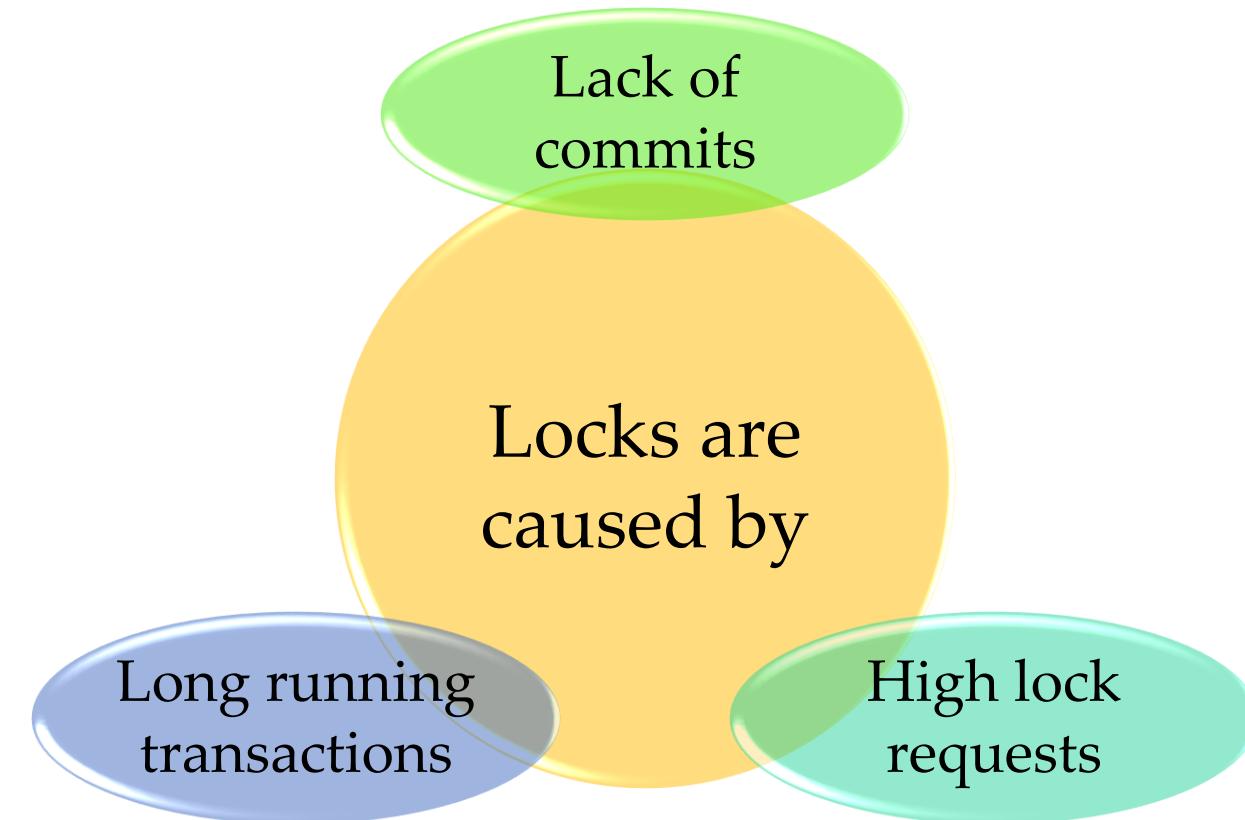
Each DML transaction must acquire two locks:

- **Exclusive** row lock on the row or rows being updated
- Table lock (**TM**) in **ROW EXCLUSIVE (RX)** mode on the table containing the rows

The queuing
mechanism tracks

- Sessions waiting for locks
- Requested lock mode
- Order in which lock are requested

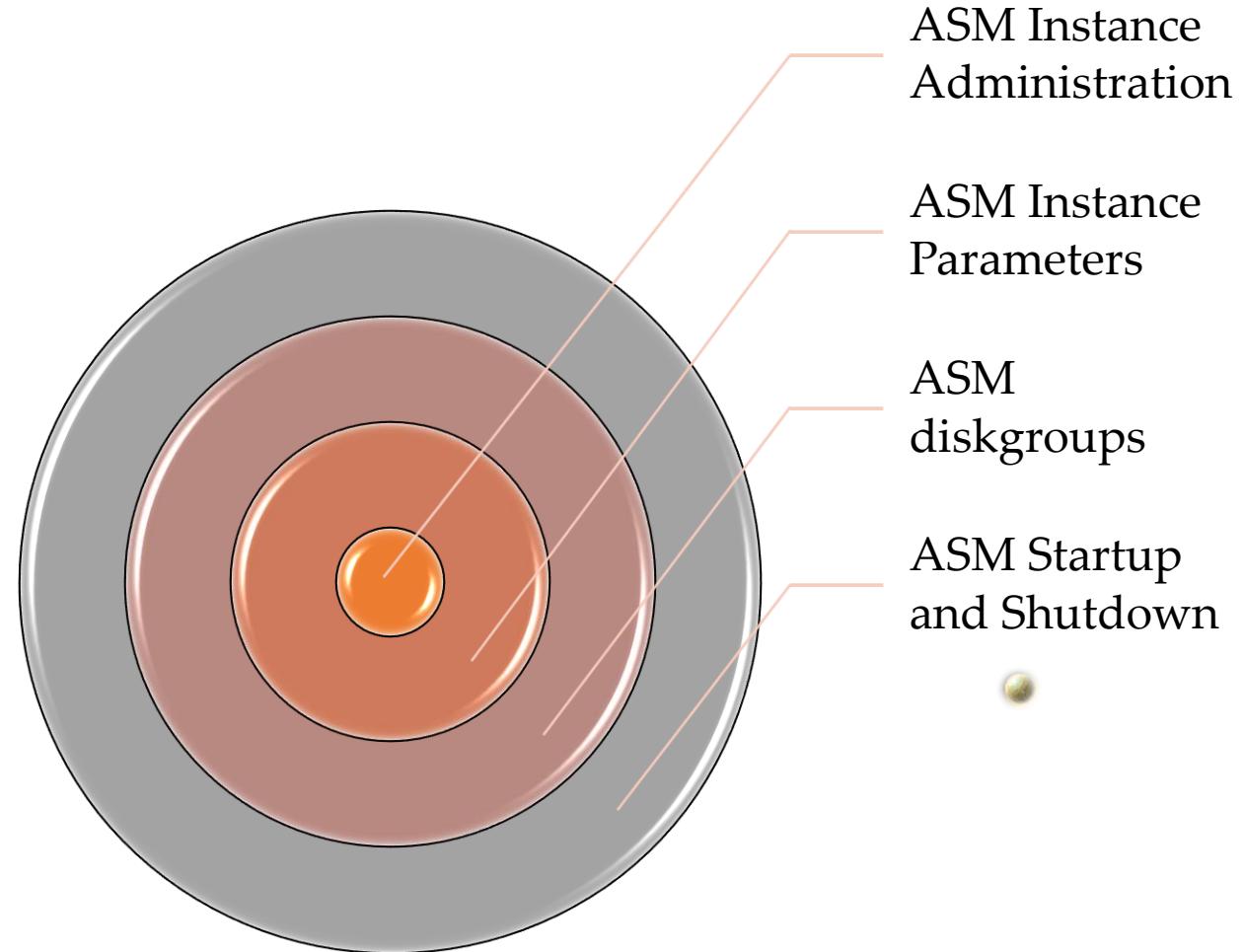
Oracle 19c Database Concurrency



- Thank you

- ASM Instance Management

Lesson Topics

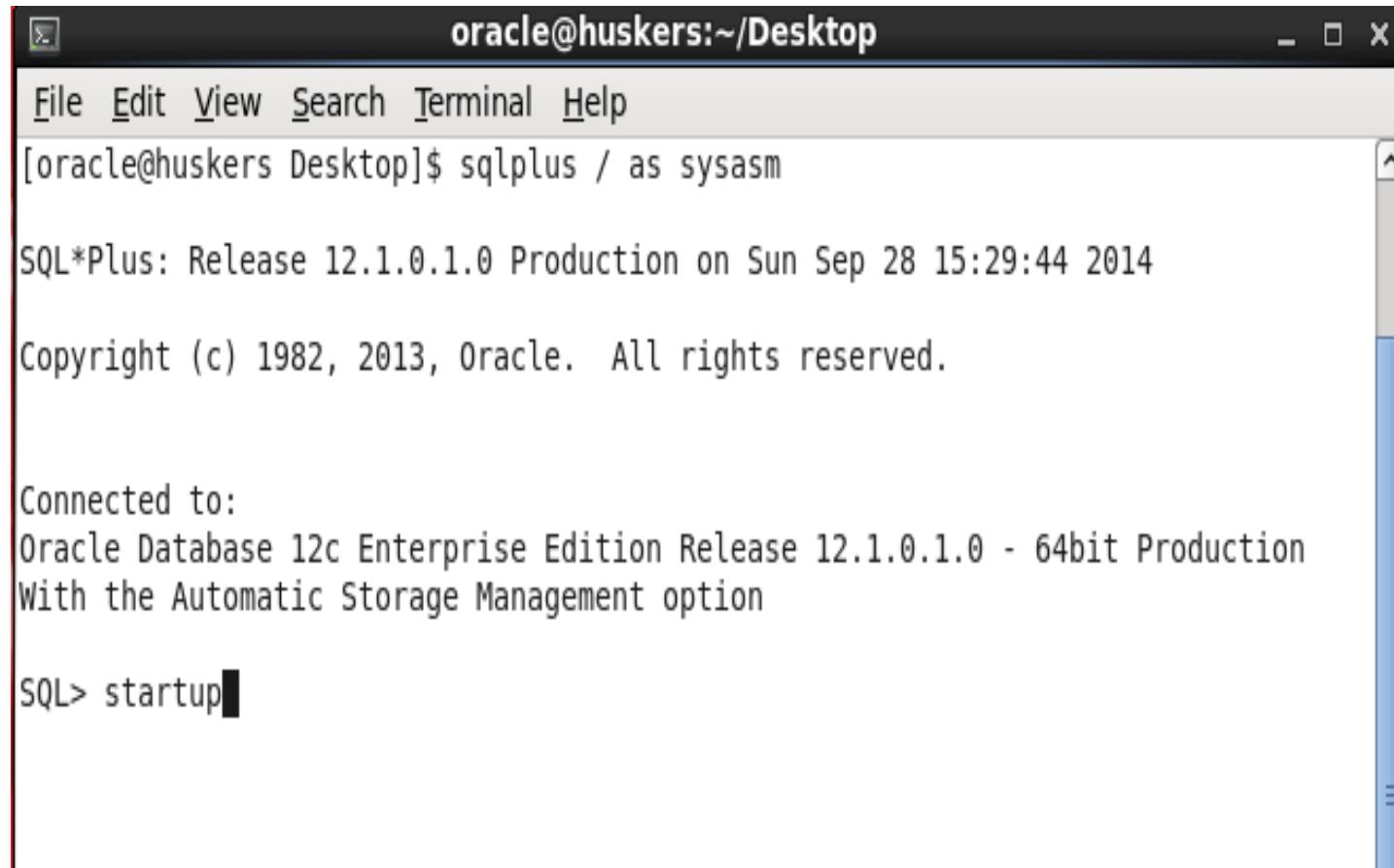


Oracle 19c ASM Instance Management

- SQLPLUS
- Grid Control
- srvctl
 - srvctl start asm
 - srvctl stop asm
 - crsctl stat res -t

Instance may
be managed by

Oracle 19c ASM Instance Management



oracle@huskers:~/Desktop

File Edit View Search Terminal Help

[oracle@huskers Desktop]\$ sqlplus / as sysasm

SQL*Plus: Release 12.1.0.1.0 Production on Sun Sep 28 15:29:44 2014

Copyright (c) 1982, 2013, Oracle. All rights reserved.

Connected to:

Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Automatic Storage Management option

SQL> startup

Oracle 19c ASM Instance Management

```
File Edit View Search Terminal Help
```

```
[oracle@huskers Desktop]$ sqlplus / as sysasm
```

```
SQL*Plus: Release 12.1.0.1.0 Production on Sun Sep 28 15:29:44 2014
```

```
Copyright (c) 1982, 2013, Oracle. All rights reserved.
```

```
Connected to:
```

```
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Automatic Storage Management option
```

```
SQL> shutdown immediate
```

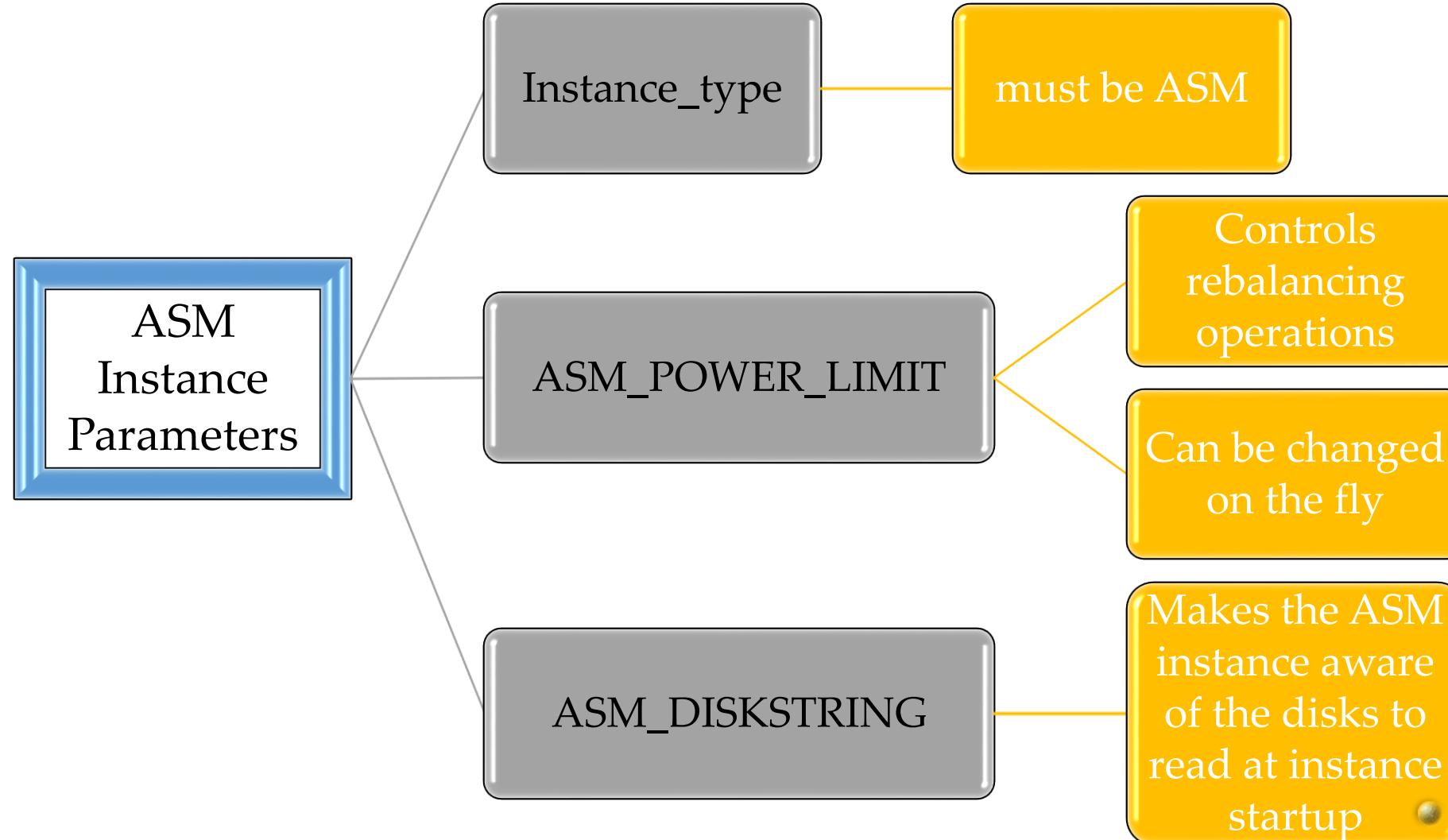
oracle@huskers:~/Desktop

File Edit View Search Terminal Help

```
[oracle@huskers Desktop]$ srvctl status asm  
ASM is running on huskers  
[oracle@huskers Desktop]$
```

```
[oracle@huskers Desktop]$ crsctl stat res -t  
-----  
Name          Target  State        Server          State details  
-----  
Local Resources  
-----  
ora.DATA.dg           ONLINE  ONLINE      huskers        STABLE  
ora.FRA.dg            ONLINE  ONLINE      huskers        STABLE
```

Oracle 19c ASM Instance Management



Oracle 19c ASM Instance Management

ASM Instance Parameters

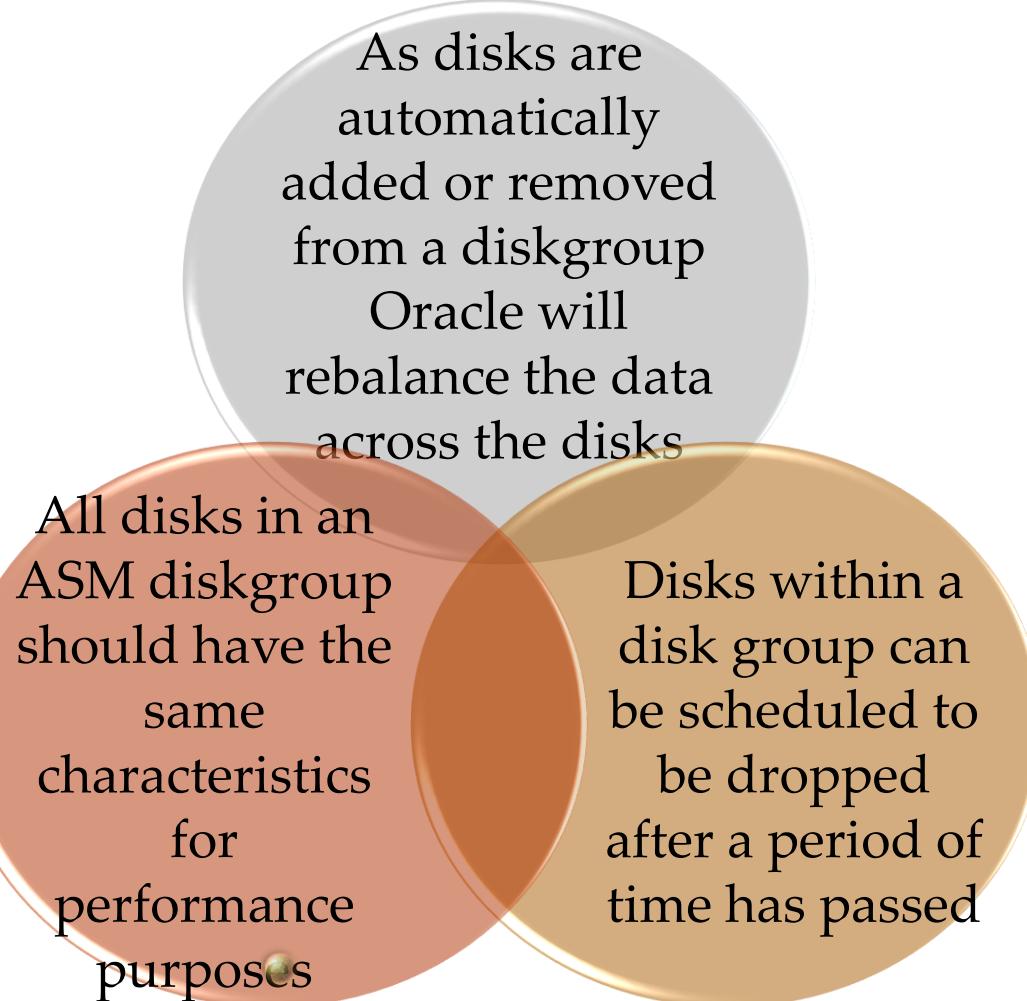
ASM_DISKGROUPS

- Identifies the disk groups to be automatically mounted

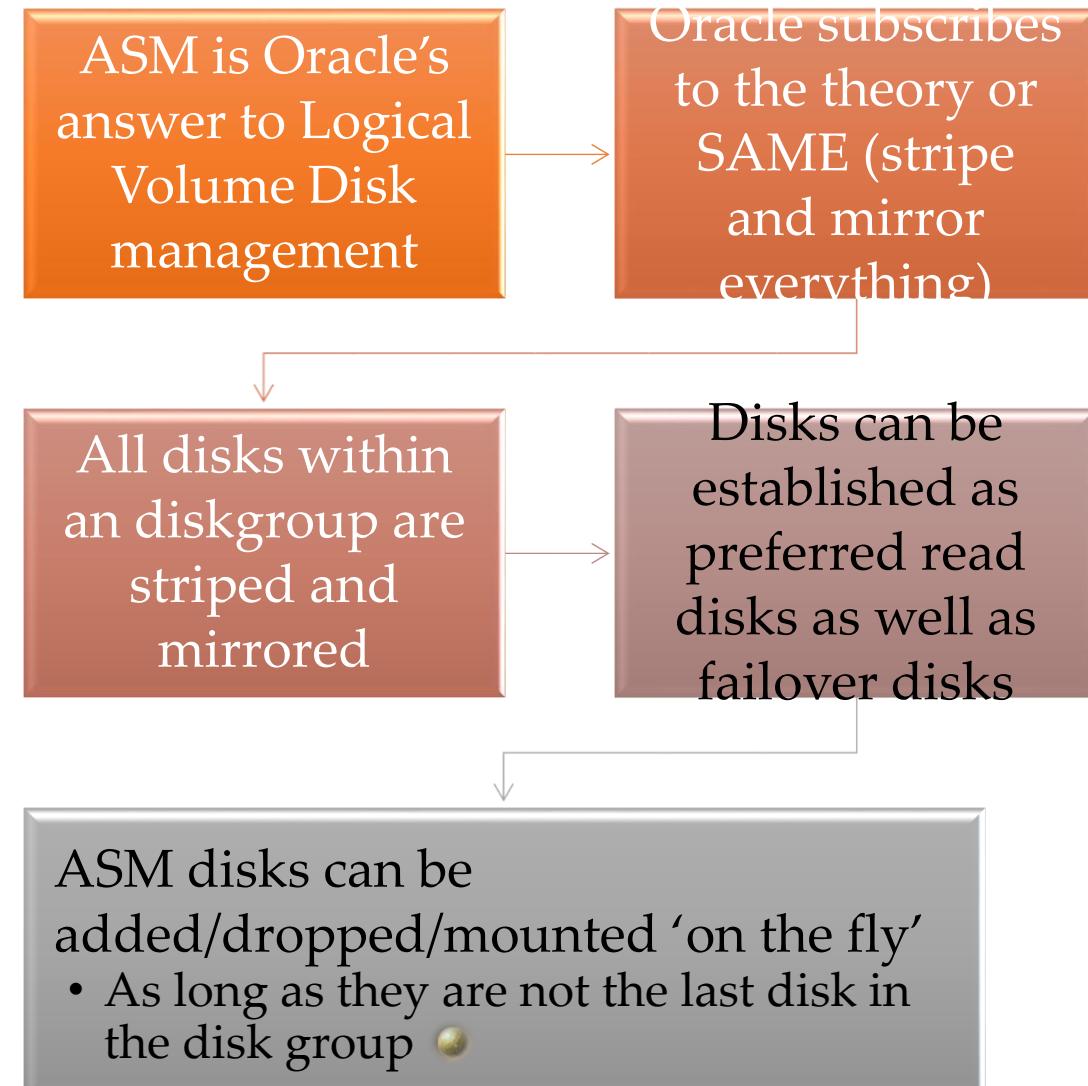
asm_preferred_read_failure_groups

- Defines the failure group to failover too

Oracle 19c ASM Instance Management



Oracle 19c ASM Instance Management



Oracle 19c ASM Instance Management

Name	Property	Value	Description
au_size	C	1,2,4,8,16,32,64mb	Size of the allocation unit in the diskgroup
compatible.rdbms	AC	valid database version	Format of the message between the DB and ASM
compatible.asm	AC	Valid ASM instance version	Format of the ASM metadata structure on the disk

- 
- Disks within a diskgroup will have attributes

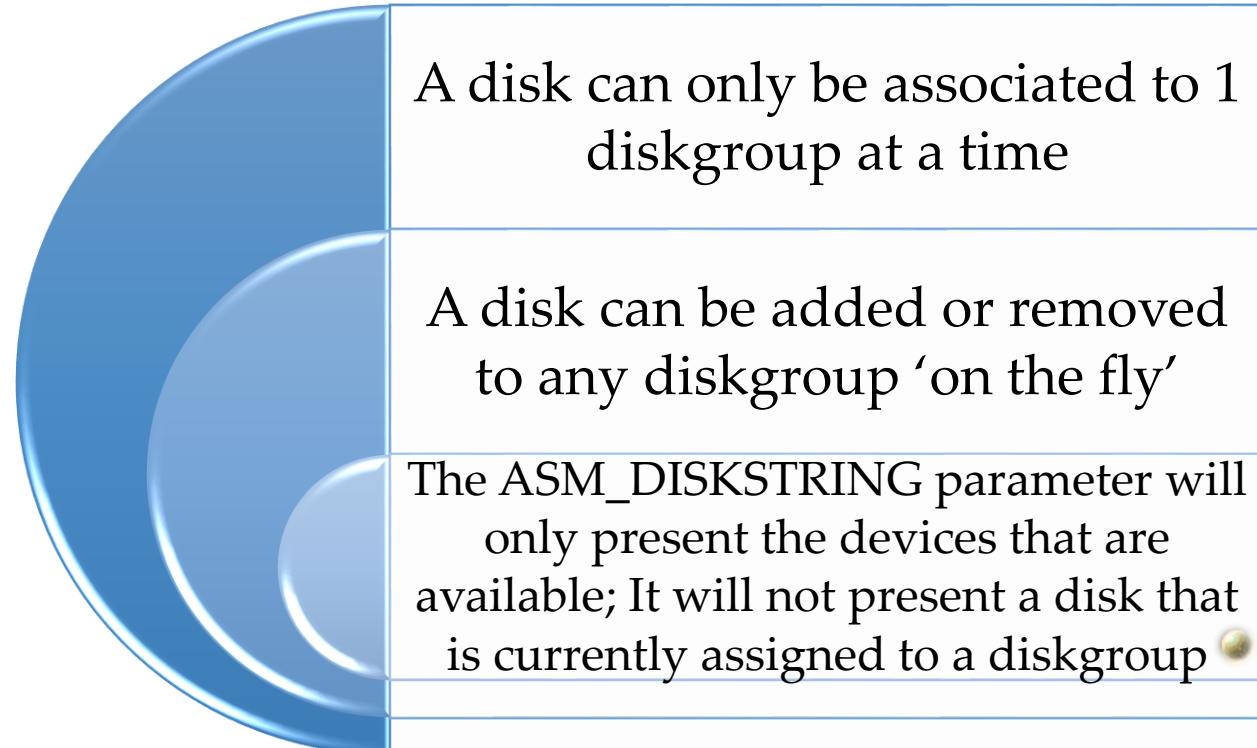
Oracle 19c ASM Instance Management

Name	Property	Value	Description
disk_repair_time	AC	0 M to 2 32	Length of time before removing a disk
template.tname.redundancy	A	unprotected/mirror/high	Redundancy of specified template
template.tname.stripe	A	coarse/fine	striping attribute of specified template



Disks within a diskgroup will have attributes

Oracle 19c ASM Instance Management

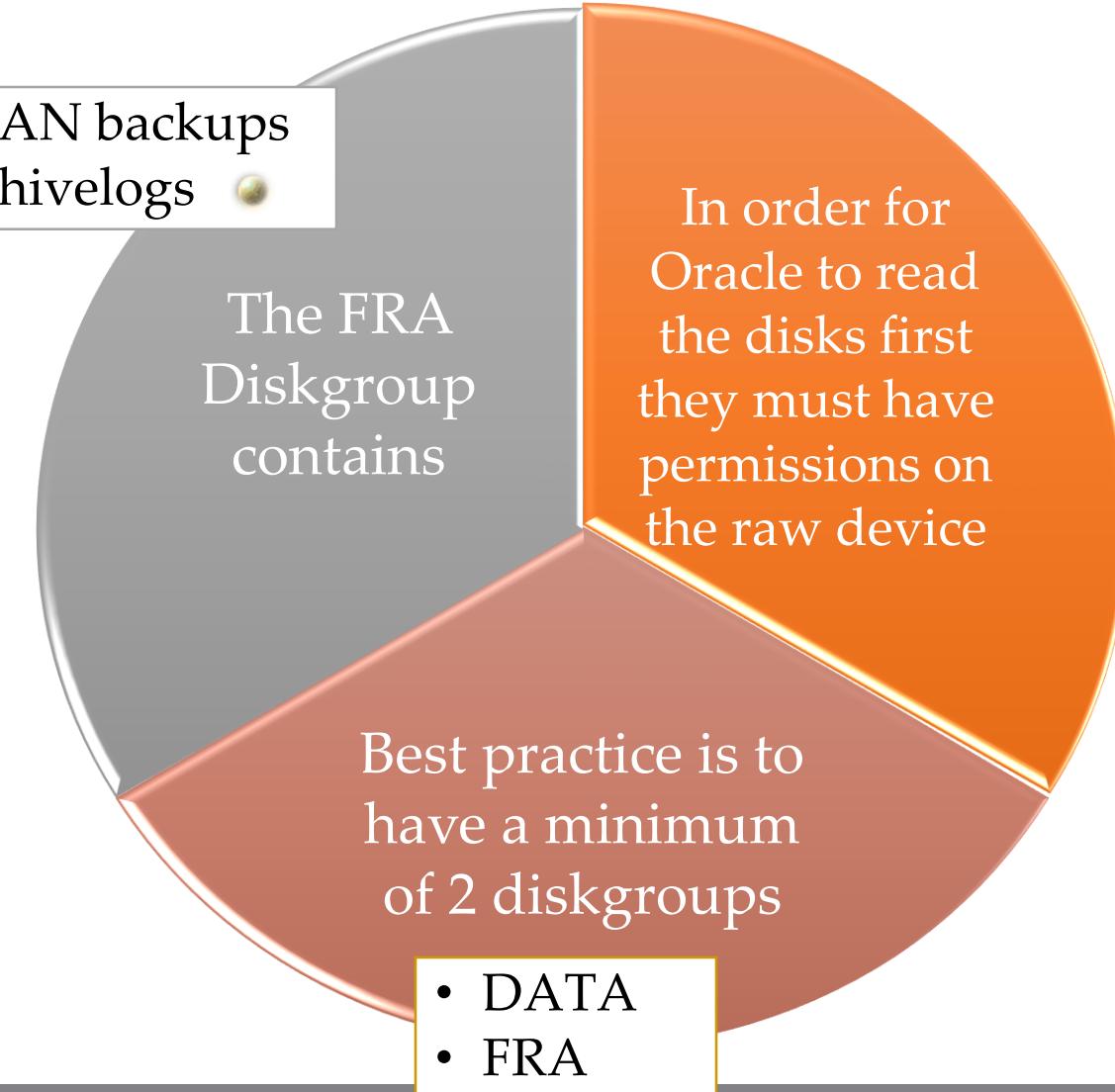


A disk can only be associated to 1 diskgroup at a time

A disk can be added or removed to any diskgroup 'on the fly'

The `ASM_DISKSTRING` parameter will only present the devices that are available; It will not present a disk that is currently assigned to a diskgroup

Oracle 19c ASM Instance Management



External Diskgroup

For a diskgroup to be defined as an external diskgroup, there is no redundancy required

An external diskgroup means the operating system is handling the mirror and striping

```
create diskgroup DATA  
external redundancy  
disk '/dev/sdc1';
```

Normal Diskgroup

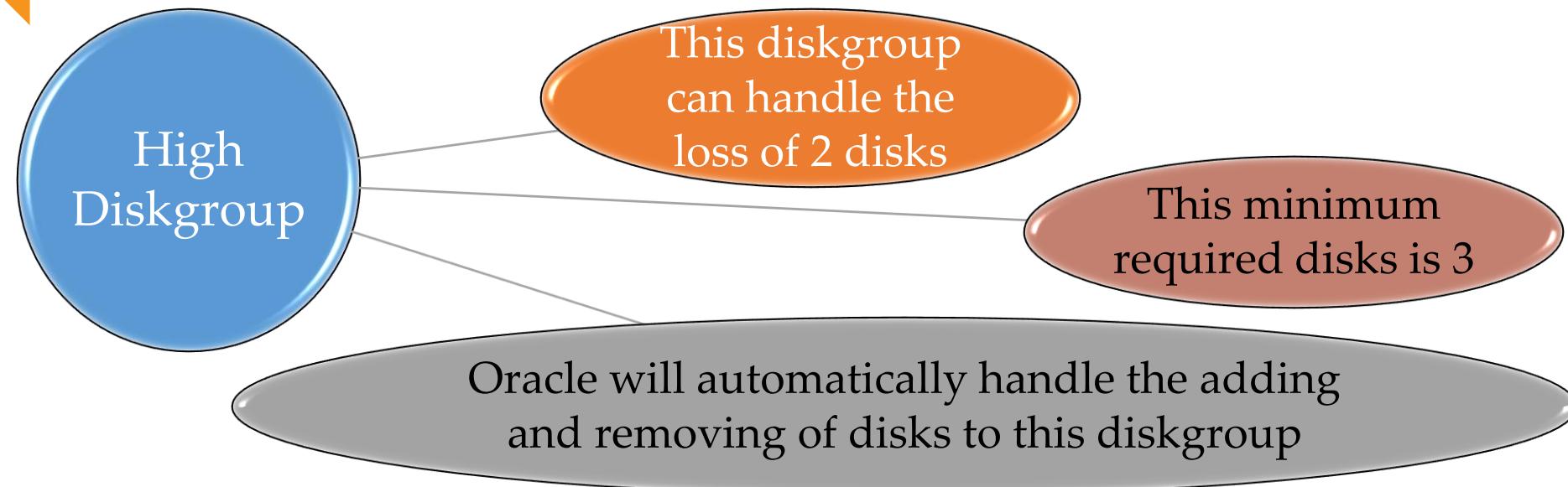
Requires 2 two disk

one primary and one failover

```
create diskgroup DATA  
      normal redundancy
```

```
failgroup fail_group1 disk
```

Oracle 19c ASM Instance Management



```
create diskgroup high_dg high
      redundancy
      failgroup failgroup_01
          disk '/dev/sdc1',
      failgroup failgroup_02
          disk '/dev/sdd1',
      failgroup failgroup_03
          disk '/dev/sde1';
```

Oracle 19c ASM Instance Management

DiskGroup Management



- To increase space just add another disk to a diskgroup
- All tablespaces should use an ASM diskgroup
- Oracle will automatically handle the naming conventions
- Oracle will create a file on the ASM device and associate it to the ASM_TS tablespace

DiskGroup Management

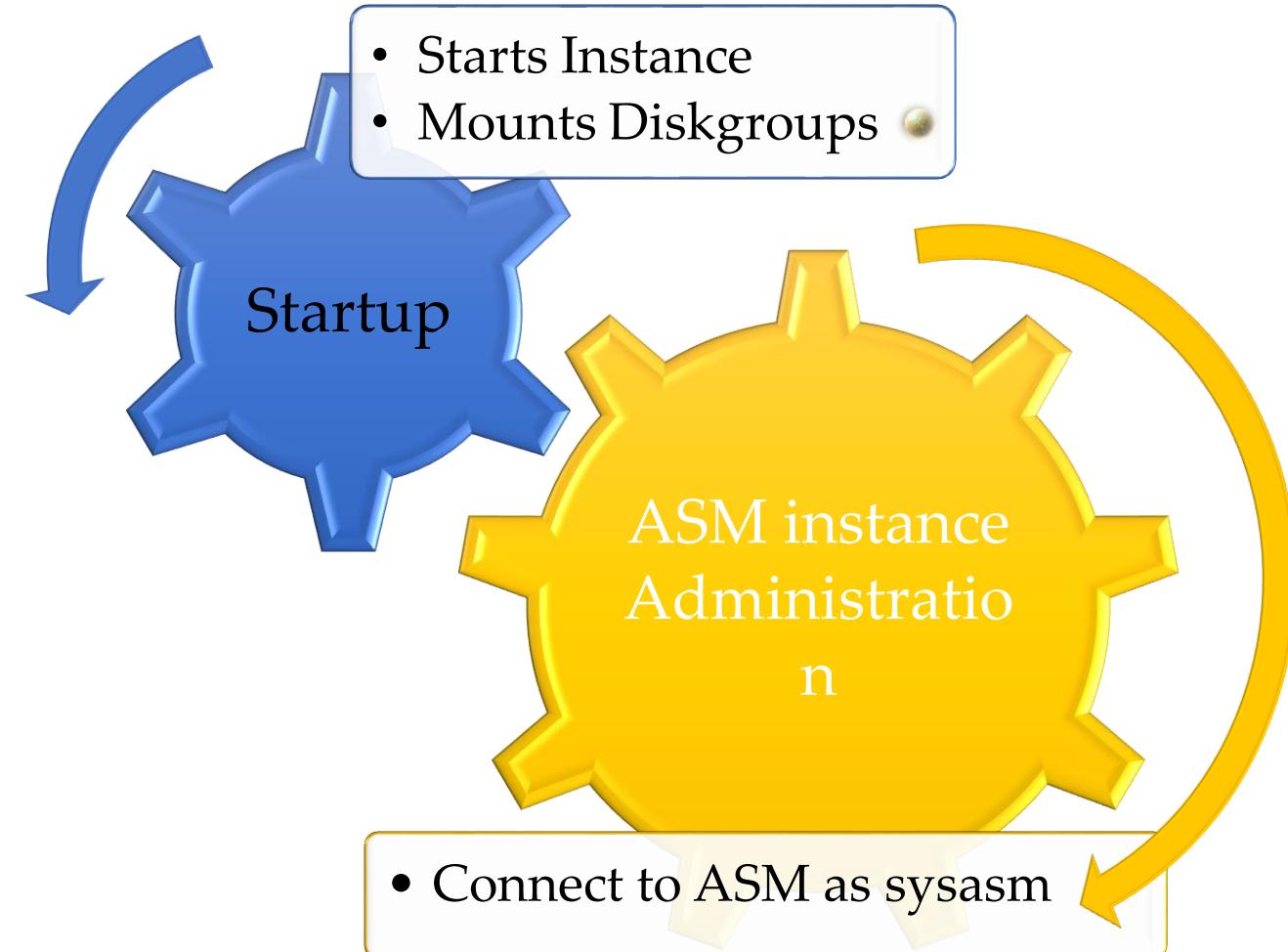
ASM divides files into 1mb extents to evenly distribute the file across asm disks

Oracle ensures IO balancing

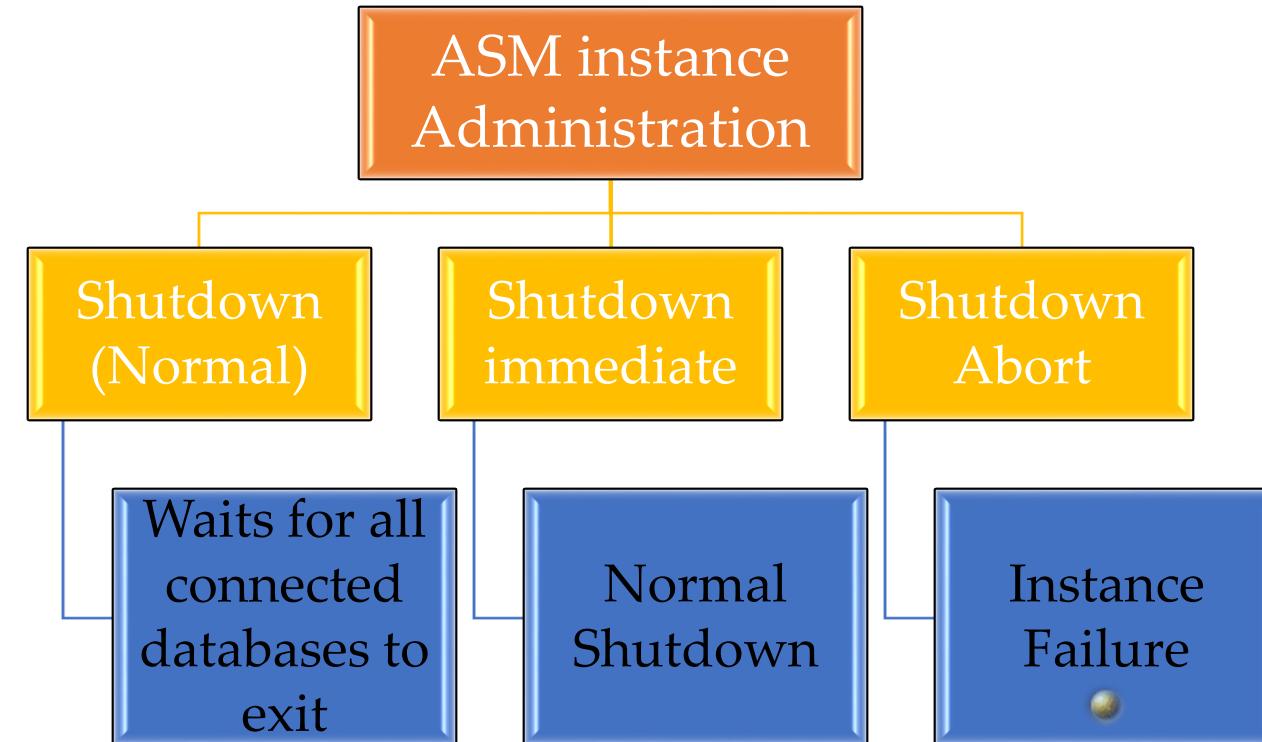
Simplifies data storage and allows Oracle to handle the data management

Do not place any *.txt files or trace files on an ASM devices

Oracle 19c ASM Instance Management

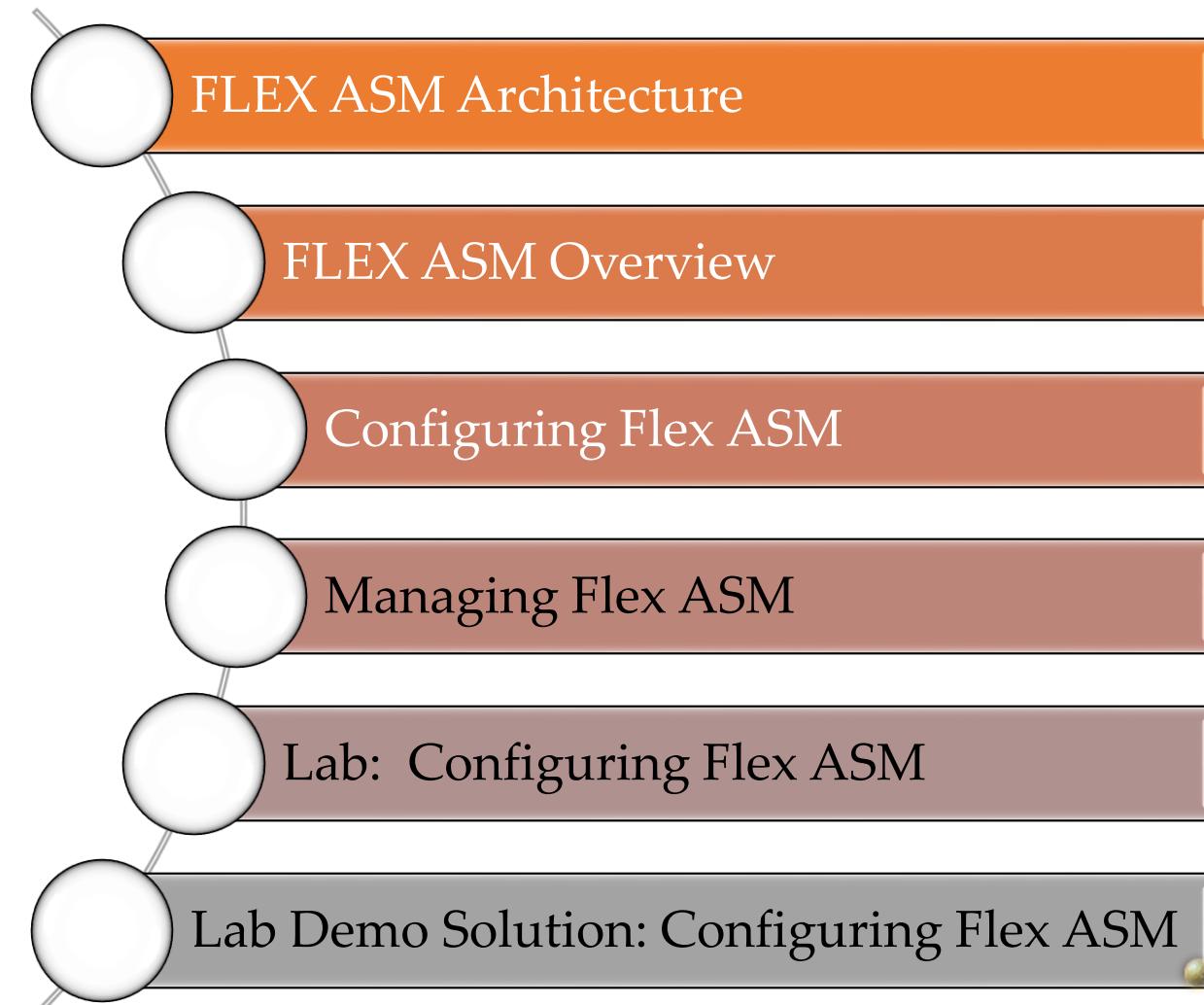


Oracle 19c ASM Instance Management



- Flex ASM

Lesson Topics





Oracle 19c FLEX ASM

What is FLEX ASM?

Oracle's new ASM technology

Used in a RAC environment

Allows for ASM instance to float
between RAC nodes

No longer do all nodes within an
Oracle RAC cluster need an ASM
instance

FLEX ASM Architecture

A series of
ASM instances
run on a
subset of RAC
Nodes

ASM
cardinality is
introduced

An ASM
instance will
be started on a
surviving
node if the
node fails

Databases will
automatically
connect to the new
ASM instance
Similar to SCAN
listener in 11gR2

Oracle 19c FLEX ASM



Database connections will be load balanced across the ASM cluster

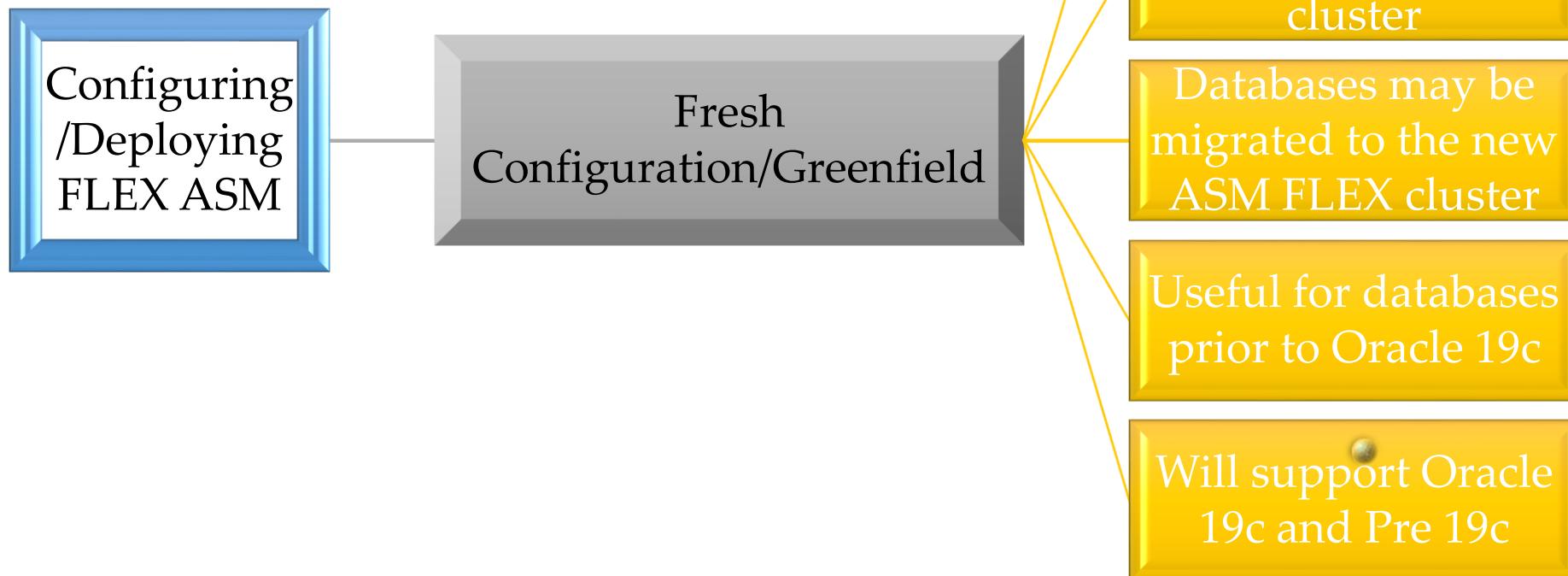
Default ASM cardinality is
3

Failover to an ASM instance is automatic

ASM now supports 32 PB LUNS

ASM diskgroups may be renamed

Oracle 19c FLEX ASM

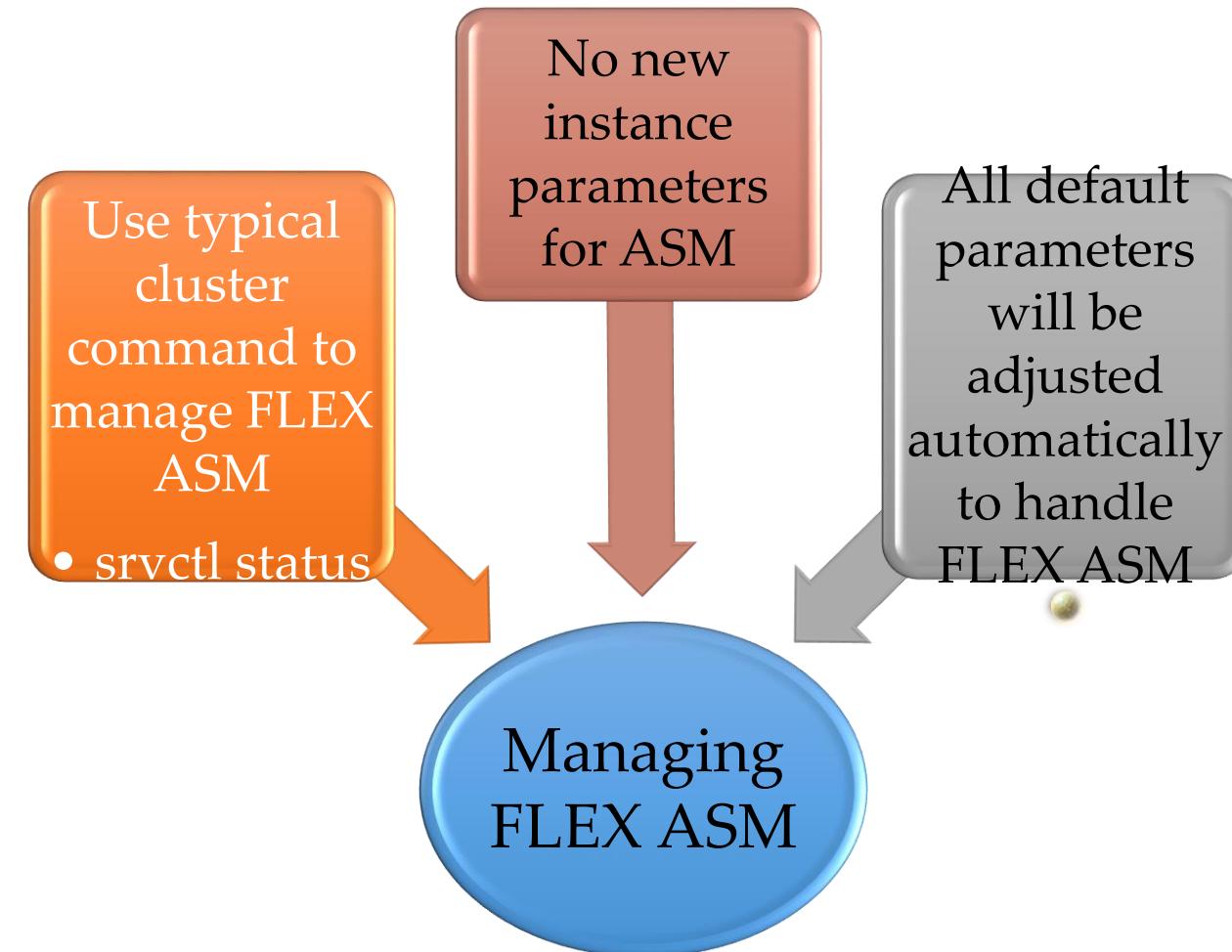


Configuring /Deploying FLEX ASM

Mixed Configuration

- Supports both 19c and pre 19c
- Configuration of typical ASM (Standard mode)
- Installation Flex ASM with a cardinality of 'all'
 - Provides automatic failover
 - ASM Disk Group compatibility parameter must be set so all ASM instances may communicate

Oracle 19c FLEX ASM



Managing FLEX ASM

Use typical cluster command to manage FLEX ASM

- `srvctl status asm -all`

No new instance parameters for ASM

All default parameters will be adjusted automatically to handle FLEX ASM

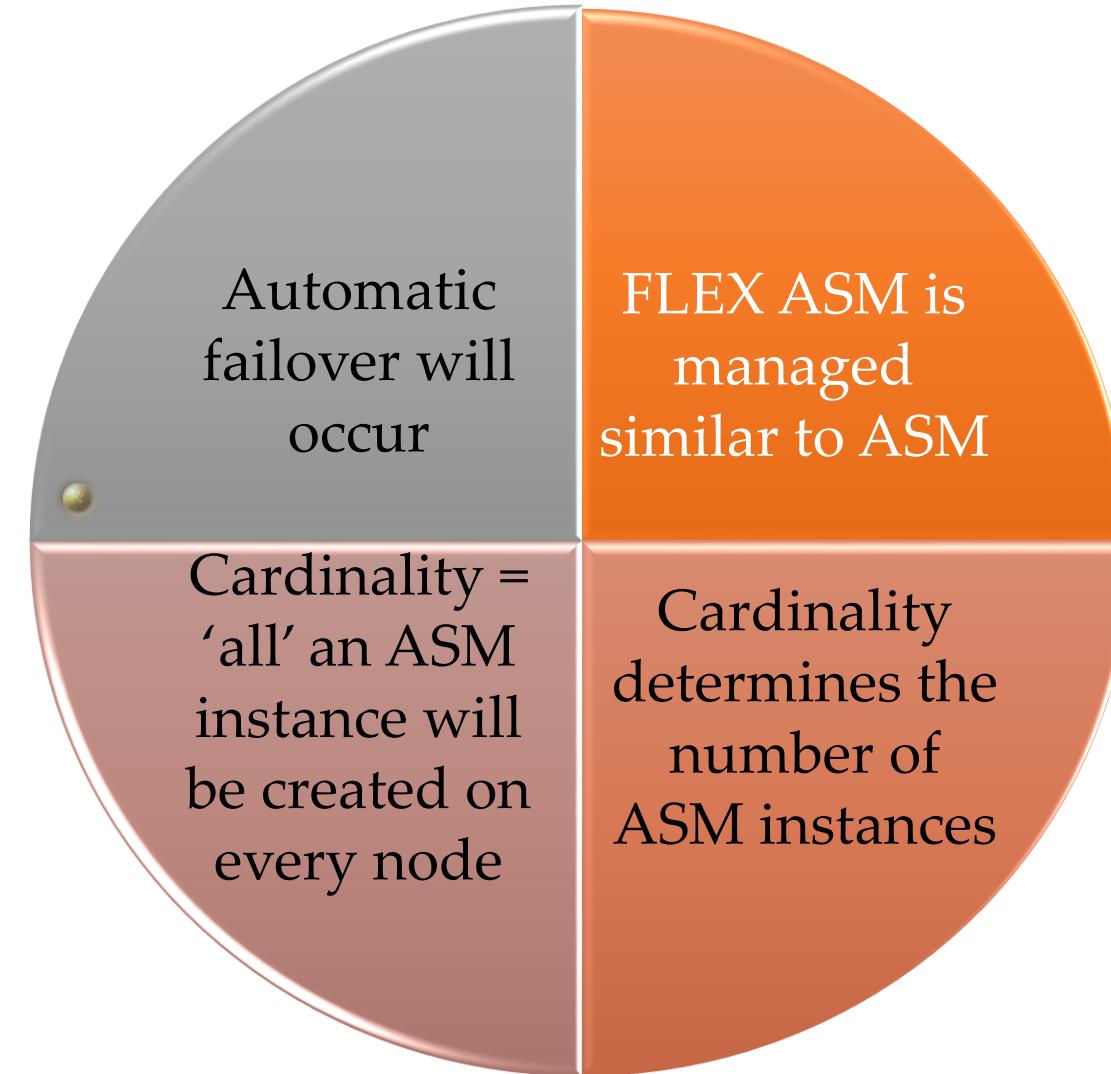
Oracle 19c FLEX ASM



FLEX ASM
provides:

- Less resources
- Better failure
- Automatic load balancing within ASM
- Minimal overhead

Oracle 19c FLEX ASM





Oracle 19c FLEX ASM

Diskgroups now have a
failgroup_repair_time

- default 24 hours

Re-syncing of disks is made simpler

- If the re-synch operation is interrupted,
will pick up where it left off

Corrupted disks may be replaced versus
dropped and re-created

Oracle 19c FLEX ASM

Disk priority may be set of disk rebalancing

Disk corruption checking it now available for non-accessed data blocks

Proactive disk scrubbing has been introduced

Disk groups may now have content type settings

- data
- recovery
- system

Oracle 19c FLEX ASM

Based on the content type setting ASM will handle the striping and mirroring accordingly

New extent reading enhancements allows for ASM to read data from the least loaded available disks

Prior releases would always read from the primary disk

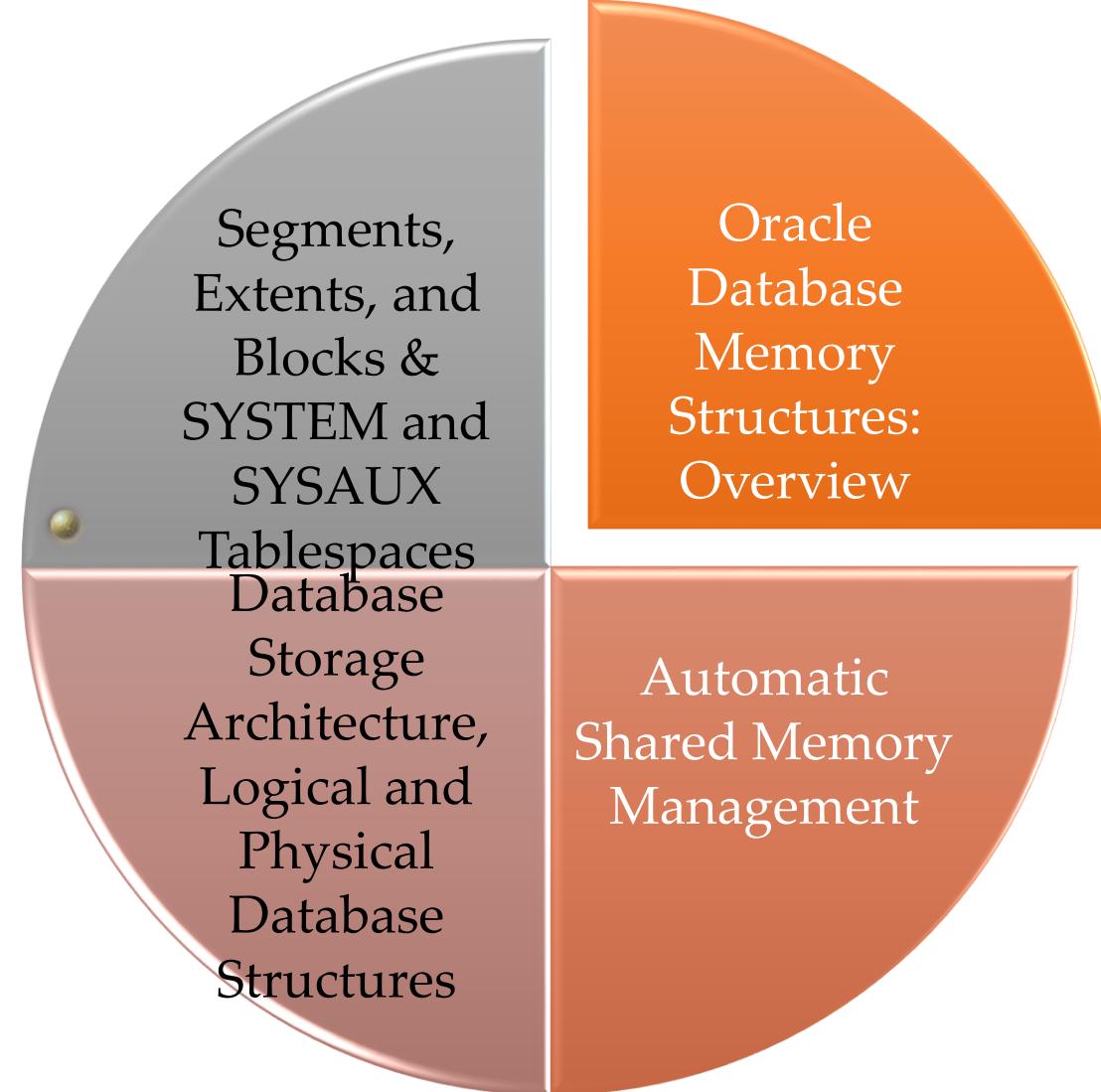


Oracle 19c FLEX ASM

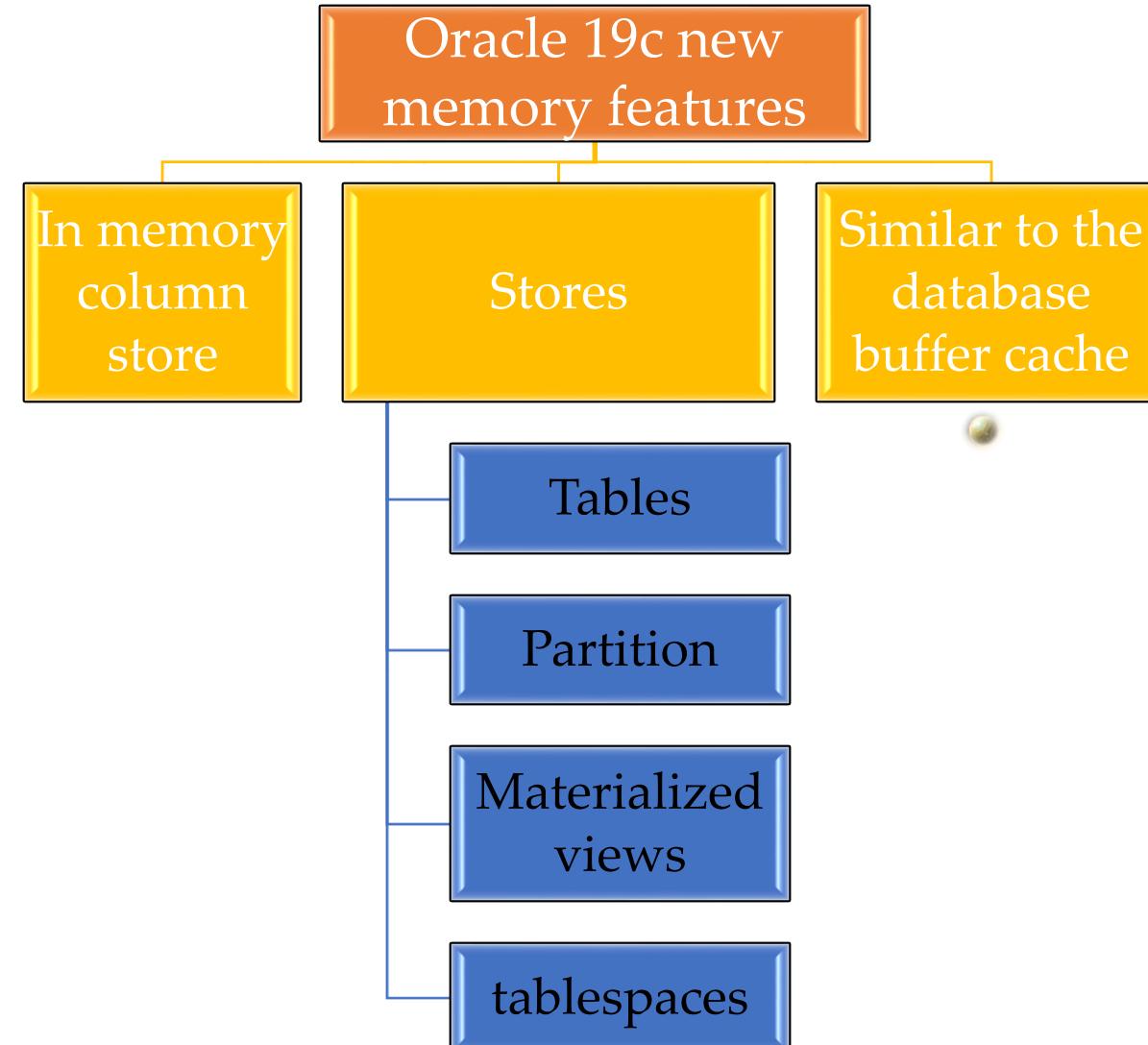
- FLEX ASM is new Oracle 19c
- Provides less overhead
- Automatic failover
- Performance improvement had also be introduced in Oracle 19c ASM

Database Architecture

Lesson Topics



Oracle 19c Overview Oracle Database Architecture



In memory column store

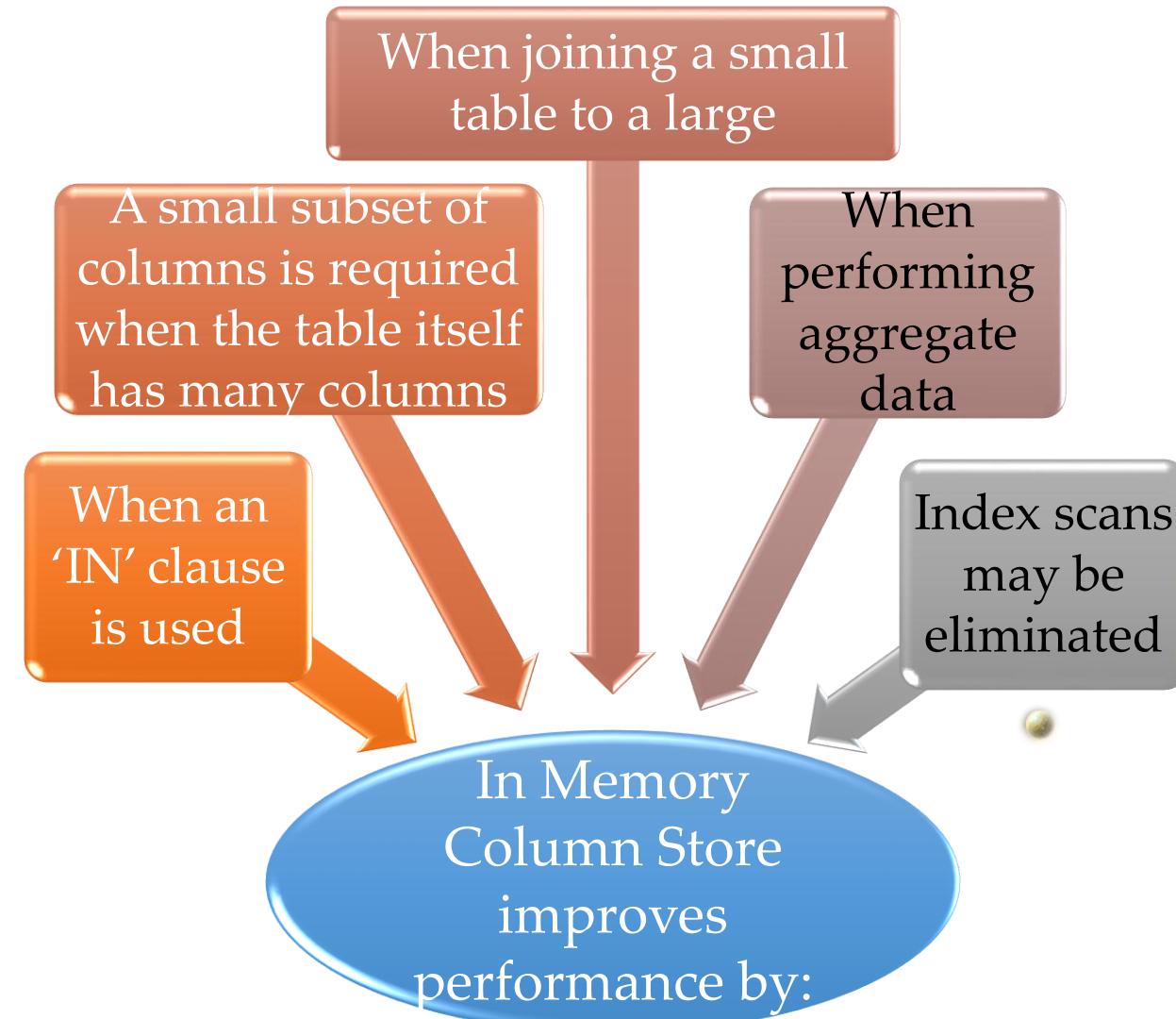
Divided into large memory regions in a columnar format

Each region resides in a contiguous memory area

May store all columns or a subset of columns

Column store at the tablespace level enables all tables and materialized views in the In-Memory column store

Oracle 19c Overview Oracle Database Architecture



In Memory store parameter and settings

In memory_size = 0
(default)

- Disables in memory
- Not a Dynamic parameter

May be set for
pluggable databases



In Memory Store Compression Methods supported

NO MEMCOMPRESS

- does not compress data

MEMCOMPRESS FOR DML

- This compression method results in the best query performance
- This method compresses In-Memory Column Store data more than MEMCOMPRESS FOR DML but less than MEMCOMPRESS FOR QUERY HIGH

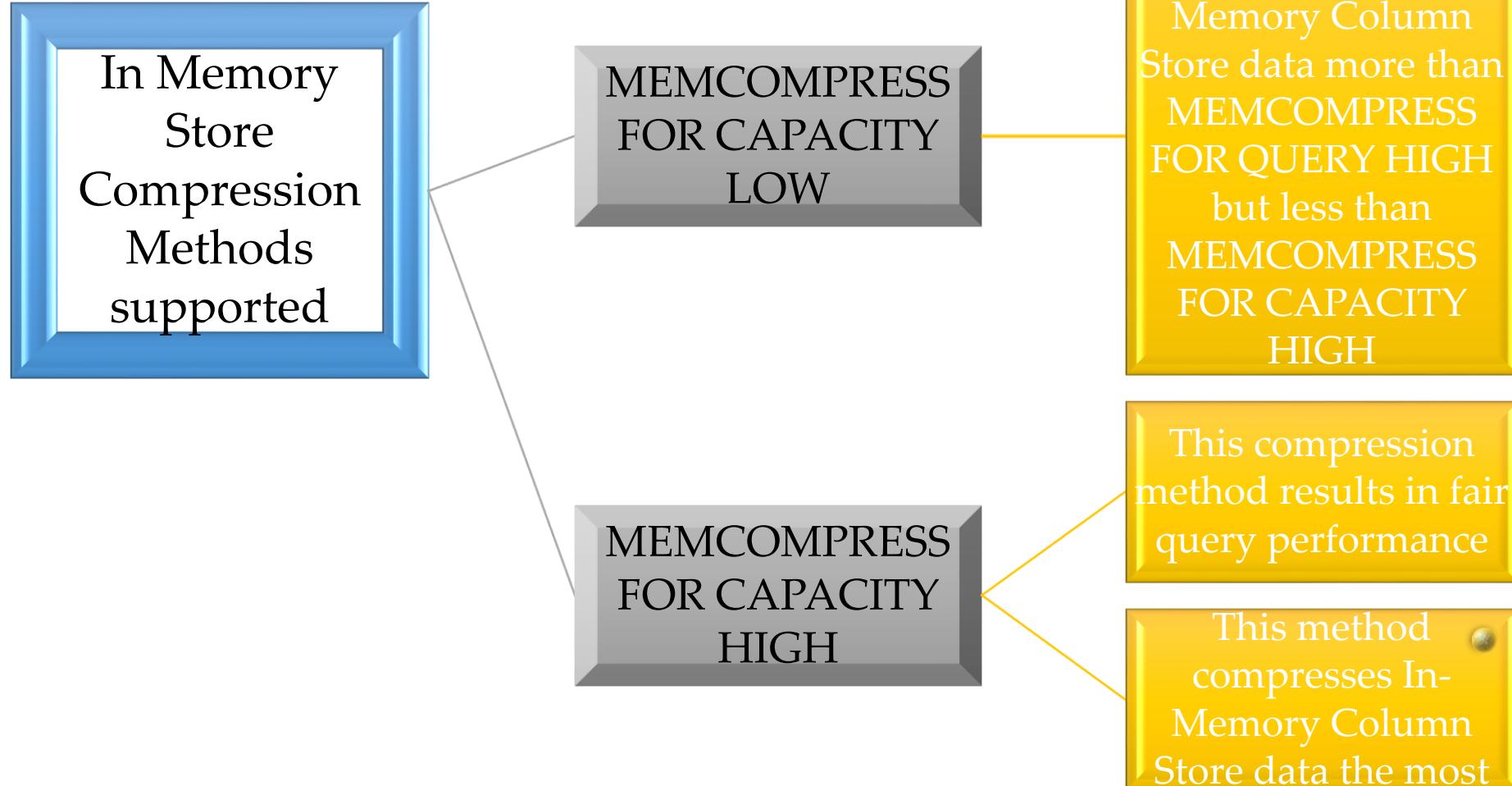


MEMCOMPRESS
FOR QUERY LOW

- This compression method results in the best query performance
- This method compresses In-Memory Column Store data more than MEMCOMPRESS FOR DML but less than MEMCOMPRESS FOR QUERY HIGH

MEMCOMPRESS
FOR QUERY HIGH

- This method compresses In-Memory Column Store data more than MEMCOMPRESS FOR QUERY LOW but less than MEMCOMPRESS FOR CAPACITY LOW



- Alter table <table name> in memory memcompress for capacity high
- Alter table <table name> in memory memcompress for capacity low

How to set a table
to use in memory
column store

Non Auto Tuned Parameters

Db_nk_cache_size

- Do not set this value to the default block size

Db_keep_cache_size

- Used to pin objects in memory

Db_recycle_cache_size

- Used for full tables scans

Non Auto Tuned Parameters

Db_nk_cache_size

This parameter is used when creating tablespaces that are not the database default block size

Values may be

2

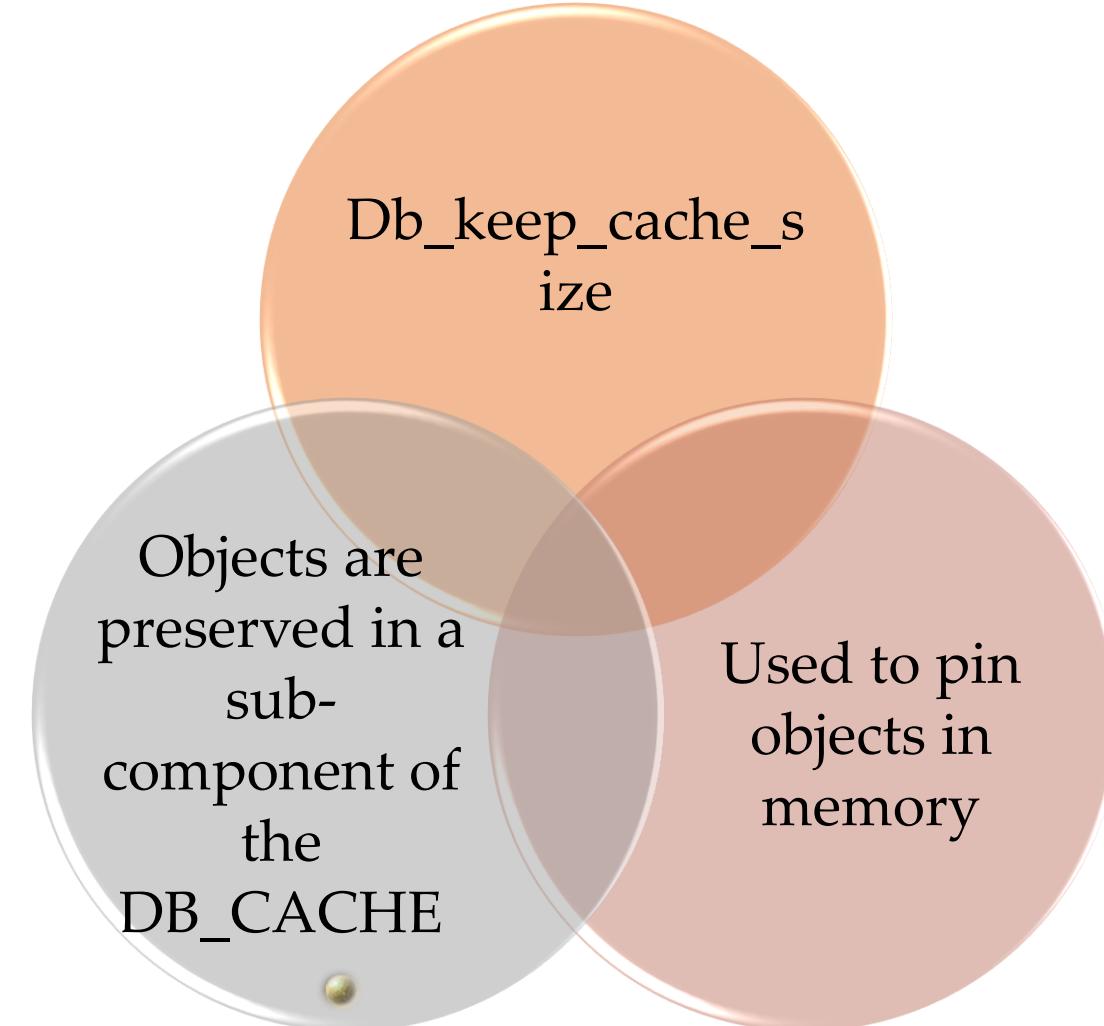
4

8

16

32

64 OS Specific



Objects placed in the KEEP pool will not be aged out

Objects are defined for the keep pool either during object creation time or altering the object

Create table
state_code
..... buffer
pool (keep)

Alter table
state_code
..... buffer
pool (keep)

The first time a select is issued against this table it will be placed in the keep pool

db_recycle_cache_size

Used for full tables scans

Data is immediately aged out after it has been processed

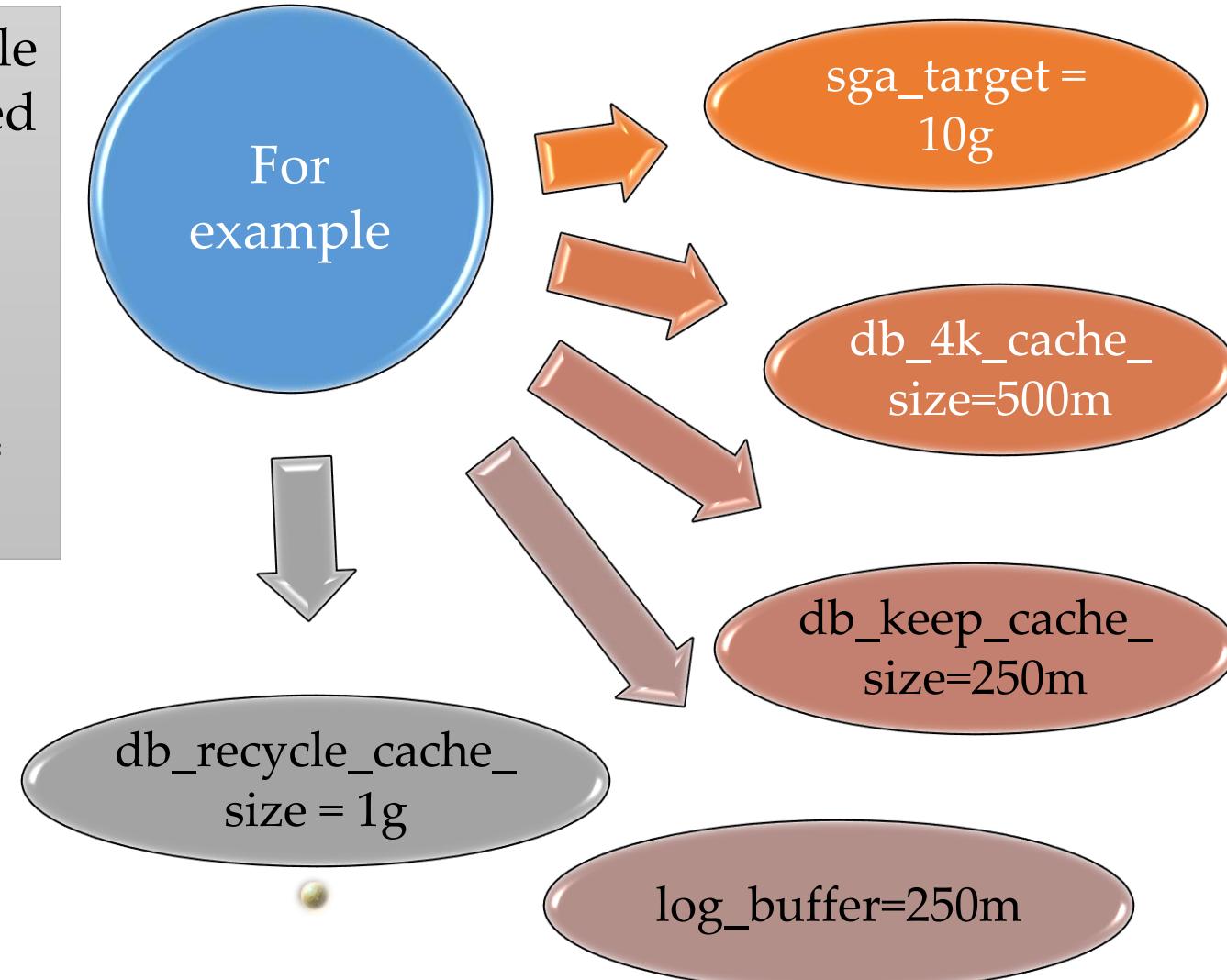
Again a table is assigned to a pool either when it is created or altered

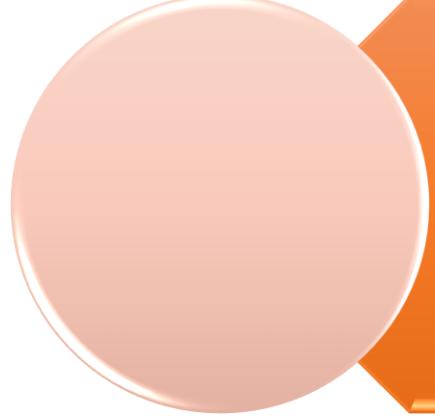
```
create table sales ...  
    buffer pool(recycle)
```

```
alter table sales buffer  
pool(recycle)
```

Oracle 19c Overview Oracle Database Architecture

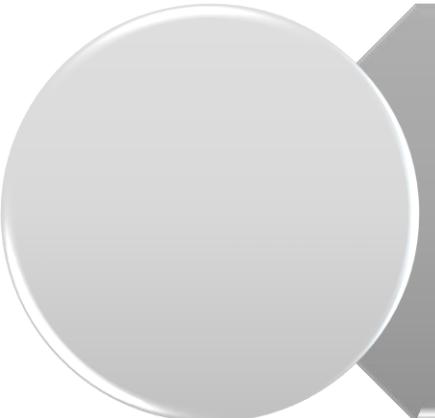
- The size of usable sga is determined by
 - sga_target - non-autotuned parameters = usable sga



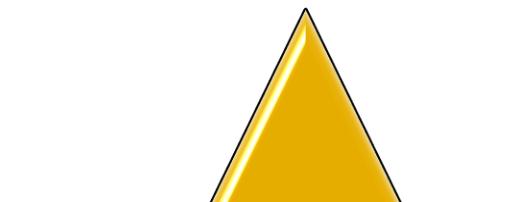


The size of usable sga is determined by

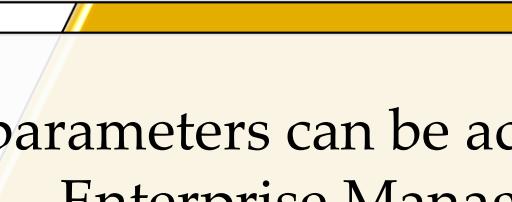
- sga_target-non-autotuned parameters = usable sga
- $10g - (500m + 250M + 250m + 1g) = 8g$



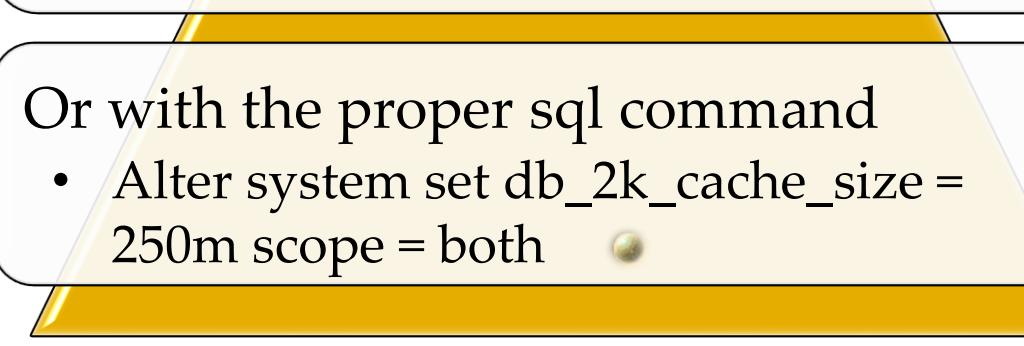
In this example we will have 8g available for SGA_TARGET



In order for these parameters to be dynamic they must have an initial value



These parameters can be adjusted with Enterprise Manager

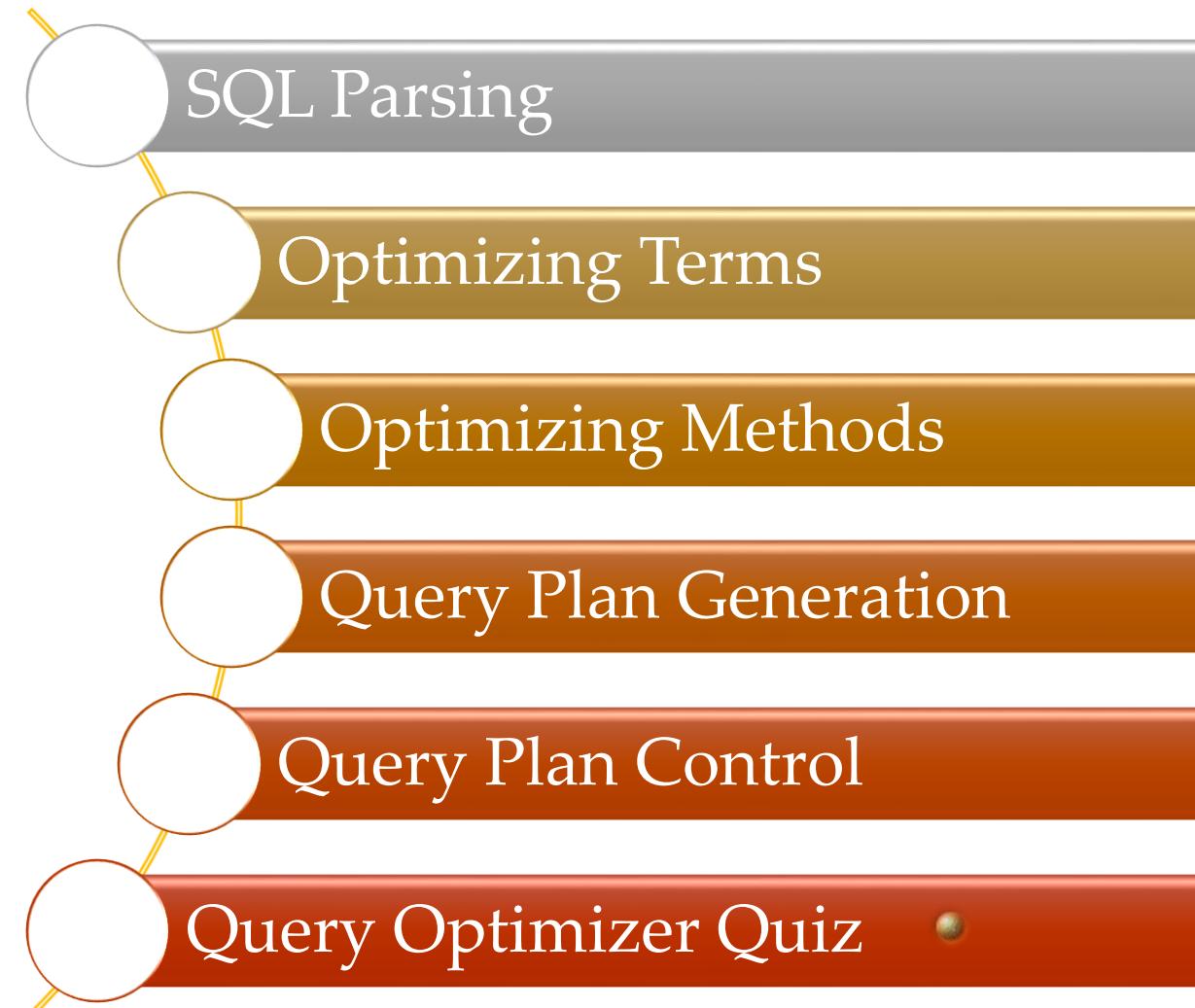


Or with the proper sql command

- Alter system set db_2k_cache_size = 250m scope = both

- Query Optimizer

Lesson Topics



SQL Parsing

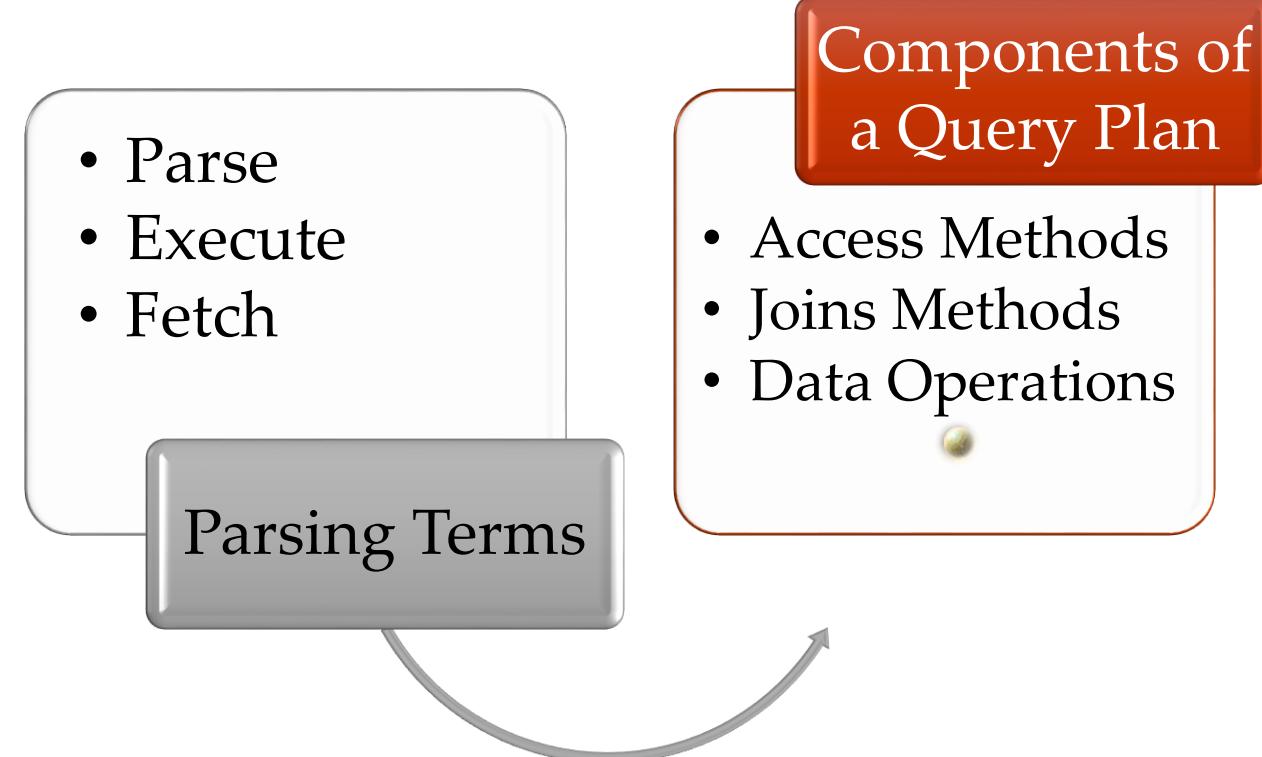
Every SQL statement in the database needs to
be 'Parsed'

The first question that needs to be answered is
'What is Parsing?'

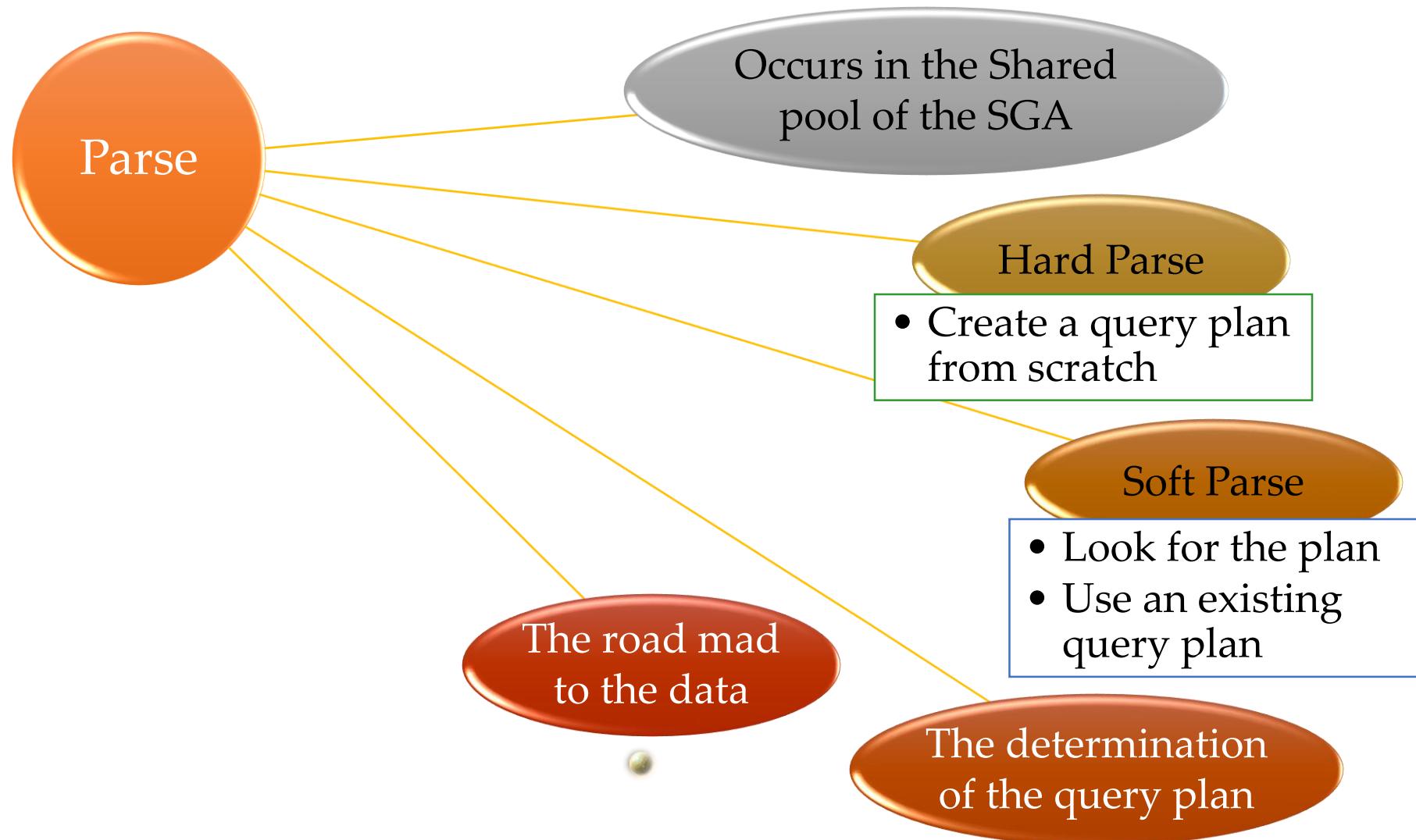
This is just a fancy computer term meaning
'broken apart'

As SQL statements come into the database
they will be analyzed or parsed, to determine
the best route for the SQL statement to take to
retrieve data from the database

Oracle 19c Query Optimizer



Oracle 19c Query Optimizer





Oracle 19c Query Optimizer

Execute Phase

Executes the SQL statement against data

If the information requested resides within the database buffer cache of the SGA, the information will be retrieved from memory

If the information does not reside within the SGA the Oracle sever process will load the information from the physical data files into the database buffer cache



Oracle 19c Query Optimizer

Fetch Phase

Retrieves the information and sends the requested data back to the application

Goal to have few parses and many fetches

This means the query plan is be reused

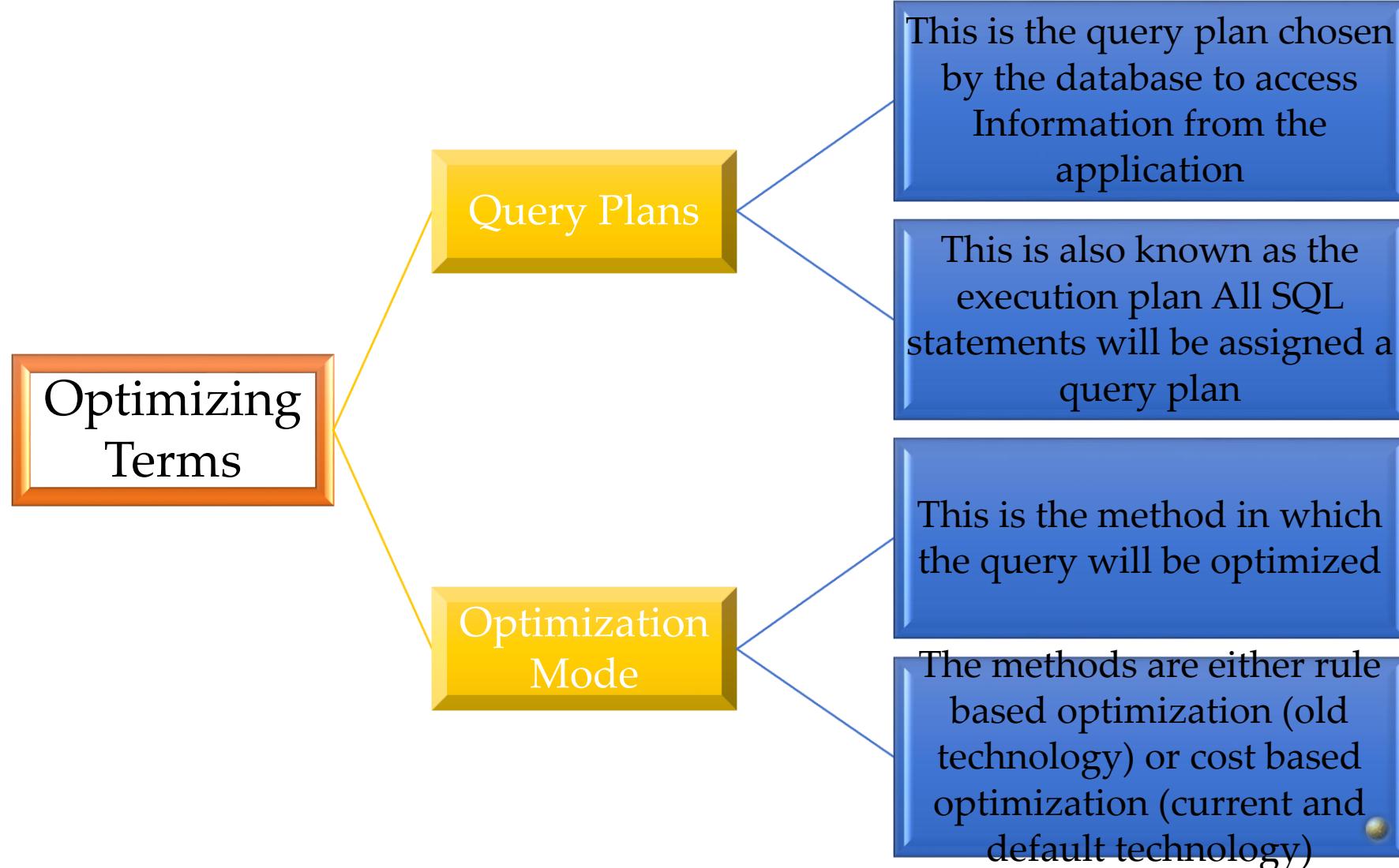
Oracle 19c Query Optimizer

The goal to SQL parsing and establishing query plans is to have a few number for SQL parses to a high number of executes and fetches

Query
Tuning

The first line of defense for any performance analysis is to begin with the application or SQL statement

Oracle 19c Query Optimizer



Optimizing Terms

Rule Based Optimization

- This is how the query is optimized within the database
- With this type of optimization it is dependent upon how the SQL statement is written
- The way the query is optimized can be change by simply re-writing the SQL statement
- This type of optimization is being deprecated

Oracle 19c Query Optimizer

Optimizing Terms

The query is analyzed internally by the database

Cost Based Optimization

A cost is associated with each query plan established

Several permutations of the query are established

Optimizing Terms

Sql Profiling

- Component of SQL Tuning Advisor
- SQL Profiling performs extensive regression analysis
- SQL Profiling is designed to work with third party applications where modifications of a SQL statement is not possible

Optimizing Terms

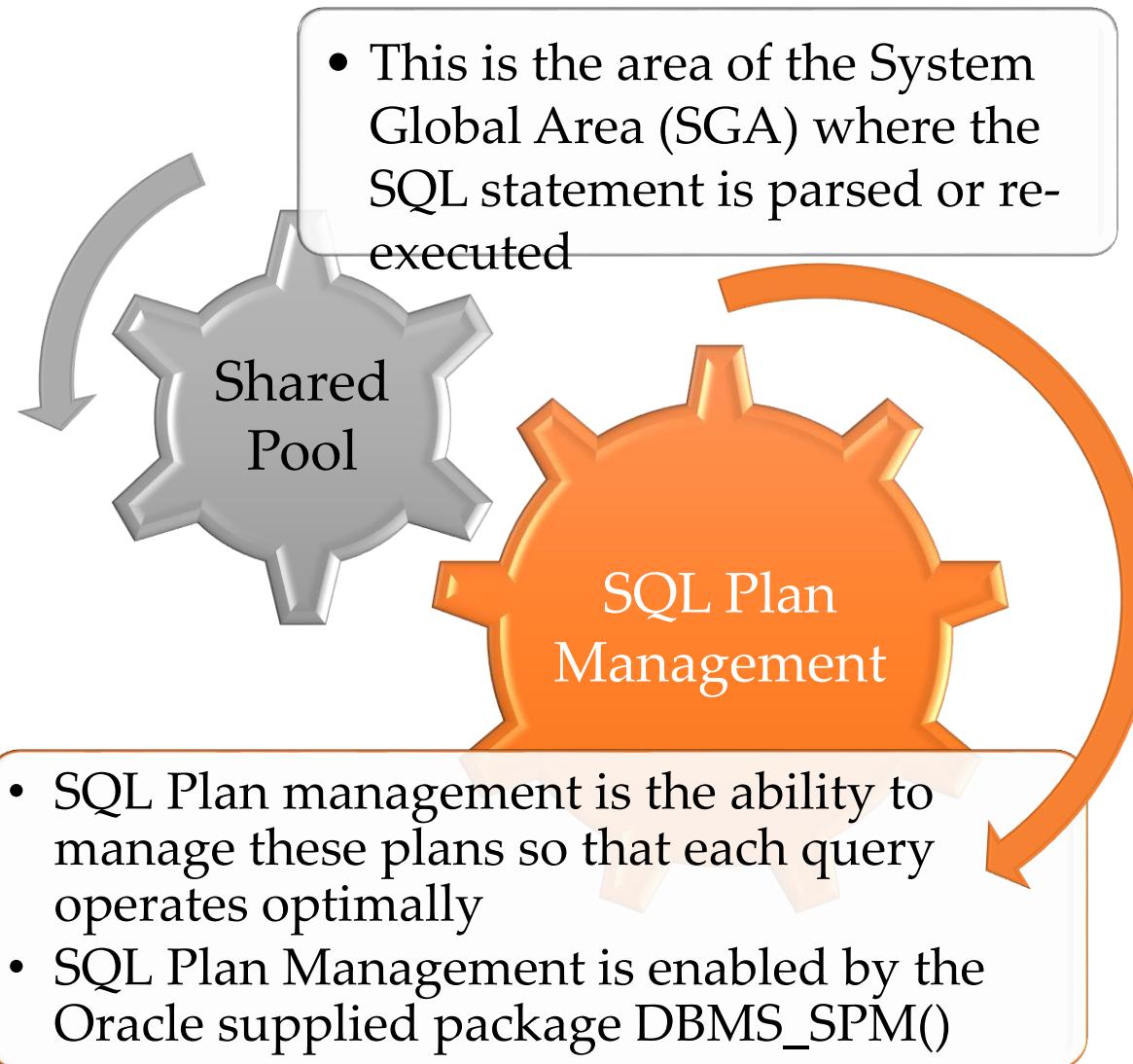
SQL Plan Management

- This is the ability to manage a pre-existing query plan

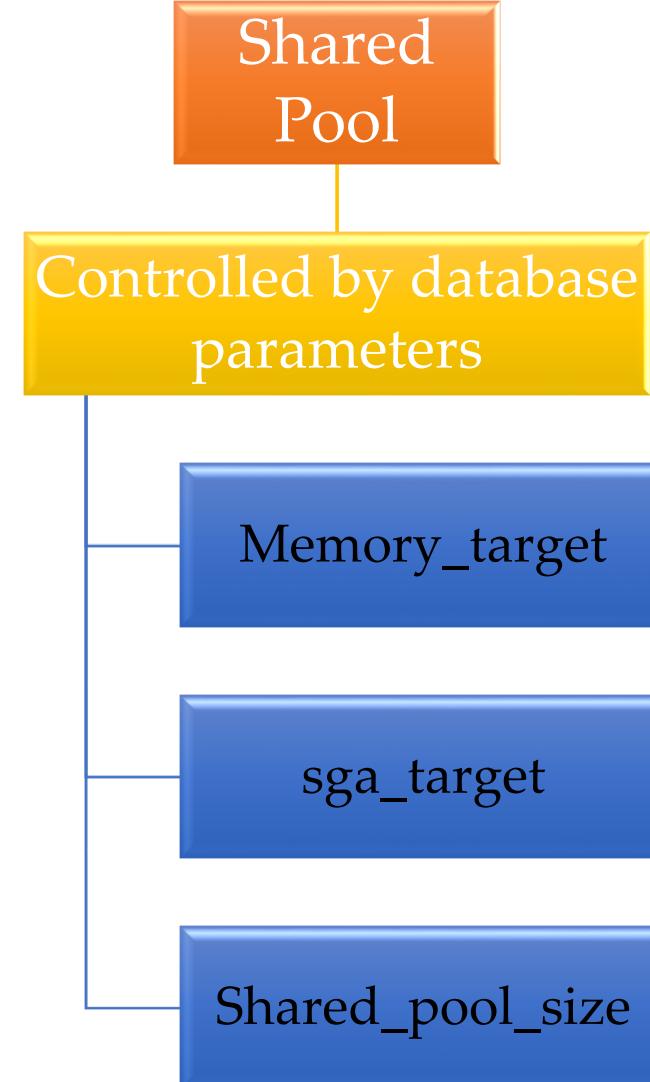
Query plans
are
optimized in
three ways

- Hard parsing within the shared pool
- SQL Profiling
- SQL Plan Baselines

Oracle 19c Query Optimizer



Oracle 19c Query Optimizer



Oracle 19c Query Optimizer

- Describes how the data is accessed
 - Full table scan
 - Index scan
 - Index range scan

Access
Methods

- Part of the execution plans that describes how the tables are joined together
 - Hash join
 - Sort merge join
 - Nested loops
 - Cartesian join

Join
Methods

Oracle 19c Query Optimizer

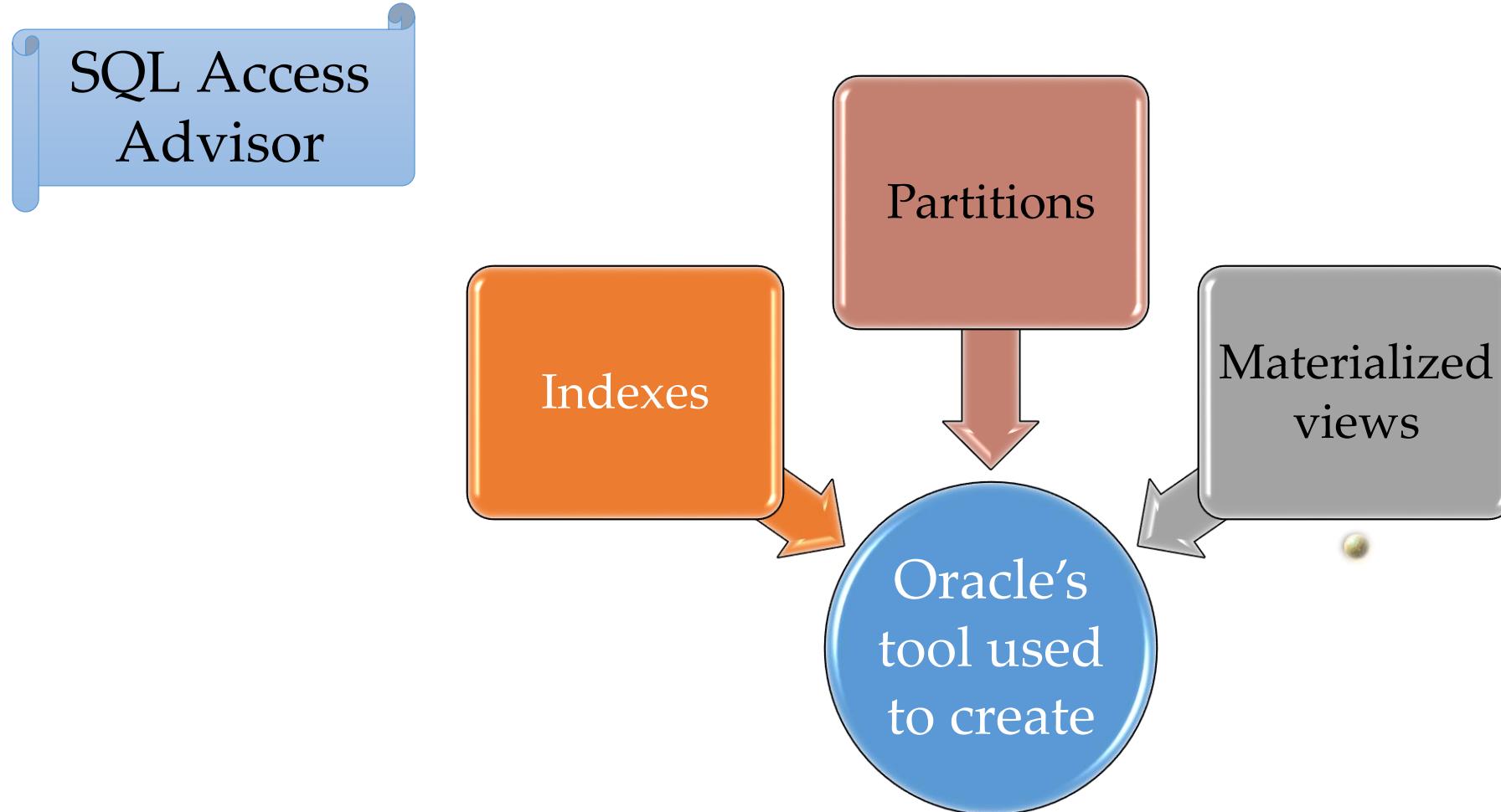


- Identifies what the data is doing
 - Order by
 - Group by
 - Aggregate function



- This is the Oracle tool used to generate recommendations for SQL Profiling, optimizer statistics, and query rewrites

Oracle 19c Query Optimizer



Oracle 19c Query Optimizer

Optimizing Methods

Rule base Optimization

Based on a
series of
rules

RBO

Not
supported

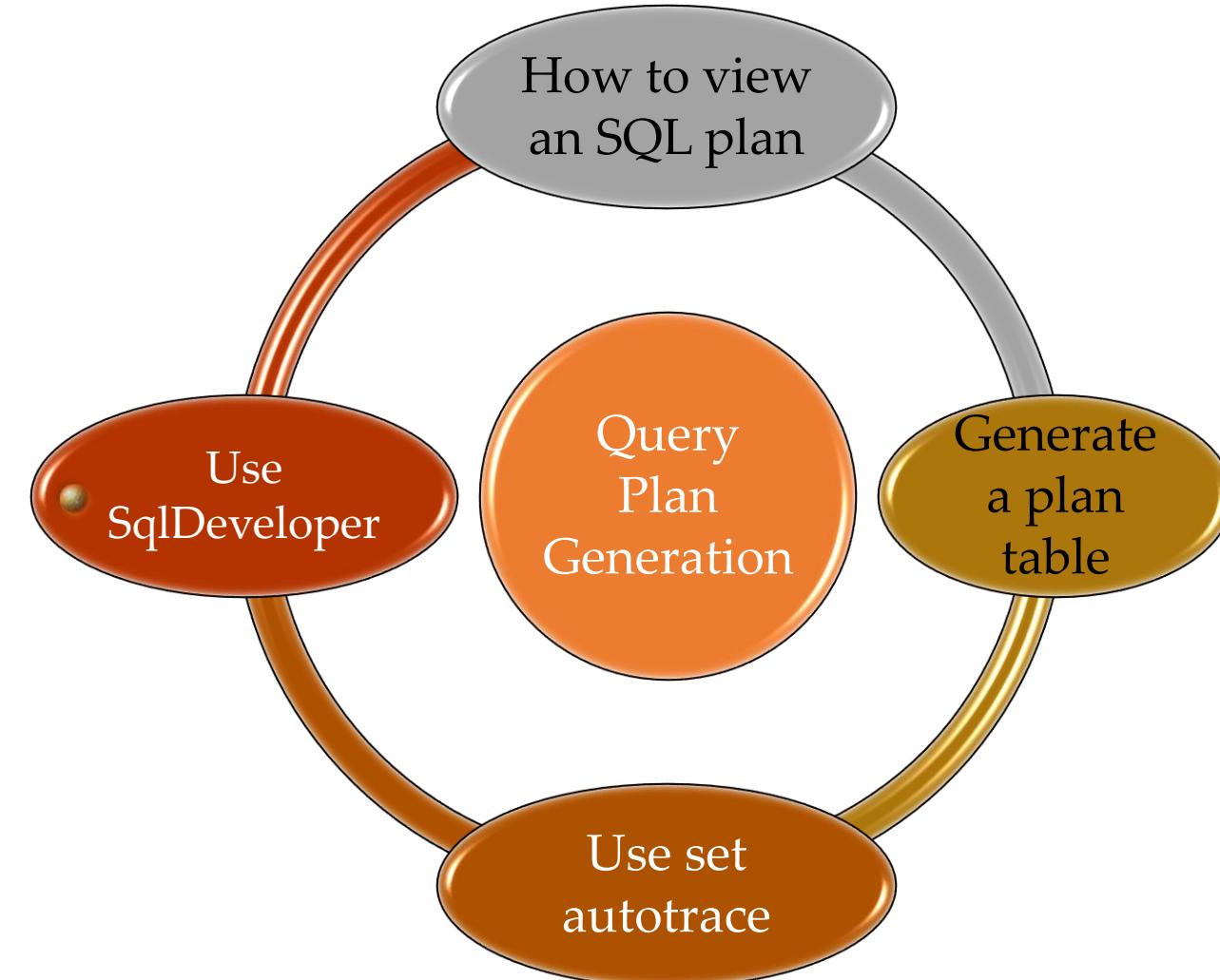
Cost based optimization

Based on
table
statistics

CBO

Best
practiced

Oracle 19c Query Optimizer



Oracle 19c Query Optimizer

```
sqlplus username/password

sql>

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

```
[oracle@huskers logs]$ sqlplus system/password1

SQL*Plus: Release 12.1.0.1.0 Production on Wed Mar 12 20:10:41 2014

Copyright (c) 1982, 2013, Oracle. All rights reserved.

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Advanced Analytics
and Real Application Testing options

SQL> @$ORACLE_HOME/rdbms/admin/utlxplan

Table created.

SQL> desc plan_table
   Name          Null?    Type
-----  -----
STATEMENT_ID           VARCHAR2(30)
PLAN_ID                NUMBER
TIMESTAMP              DATE
REMARKS                VARCHAR2(4000)
OPERATION              VARCHAR2(30)
OPTIONS                VARCHAR2(255)
```

Generate a Plan Table

explain plan

- set statement_id = 'Test1' for
- select *
- from employees
- where employee_id = 100;

Oracle 19c Query Optimizer

```
SQL> explain plan set statement_id = 'Test1'  
  2  for  
  3  select * from hr.employees  
  4  where employee_id = 100;
```

Explained.

```
SQL> █
```

Oracle 19c Query Optimizer

```
SQL> get plan_query
  1  select lpad(' ',2*level)|| operation ||' ' ||
  2    options ||' ' ||
  3    object_name query_plan
  4    from plan_table
  5    where statement_id = 'Test1'
  6      connect by prior id = parent_id
  7      and statement_id = 'Test1'
  8*      start with id = 0
SQL> /
```

```
QUERY_PLAN
```

```
-----  
SELECT STATEMENT  
  TABLE ACCESS BY INDEX ROWID EMPLOYEES  
    INDEX UNIQUE SCAN EMP_EMP_ID_PK
```

```
SQL> ■
```

```
SQL> L
 1* select * from table(dbms_xplan.display)
SQL> /
PLAN_TABLE_OUTPUT
-----
Plan hash value: 1833546154
-----
-----  

| Id  | Operation          | Name      | Rows  | Bytes | Cost (%CPU)
| Time     |  

-----  

PLAN_TABLE_OUTPUT
-----
|  0 | SELECT STATEMENT   |           | 1    | 69   | 0  (0
)| 00:00:01 |
|  1 | TABLE ACCESS BY INDEX ROWID| EMPLOYEES | 1    | 69   | 0  (0
)| 00:00:01 |
|* 2 | INDEX UNIQUE SCAN   | EMP_EMP_ID_PK | 1    |       | 0  (0
)| 00:00:01 |
```



Oracle 19c Query Optimizer

set autotrace on

- Displays the output of the query, the query plan, and statistics

set autotrace traceonly

- Displays only the query plan and statistics
- It does not display the output of the query

set autotrace traceonly exp

- Displays only the query plan
- It does not display statistics or the output of the query

set autotrace on statistics

- Displays the statistics and not the query plan

```
SQL> set autotrace on
SP2-0618: Cannot find the Session Identifier. Check PLUSTRACE role is enabled
SP2-0611: Error enabling STATISTICS report
SQL> connect / as sysdba
Connected.
SQL> @$ORACLE_HOME/sqlplus/admin/plustrce
SQL>
SQL> drop role plustrace;
drop role plustrace
*
ERROR at line 1:
ORA-01919: role 'PLUSTRACE' does not exist

SQL> create role plustrace;
Role created.

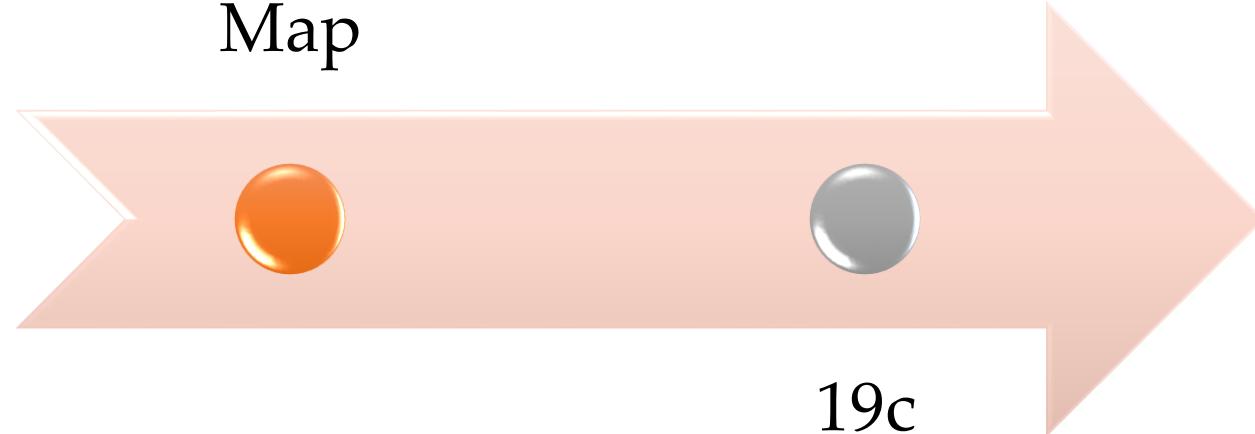
SQL>
SQL> grant select on v_$sesstat to plustrace;
Grant succeeded.
```

- Tuning Features

Lesson Topics



Identifying
and Using
Oracle's Heat
Map



19c
Compression
Levels and
Types



Oracle 19c Tuning Features

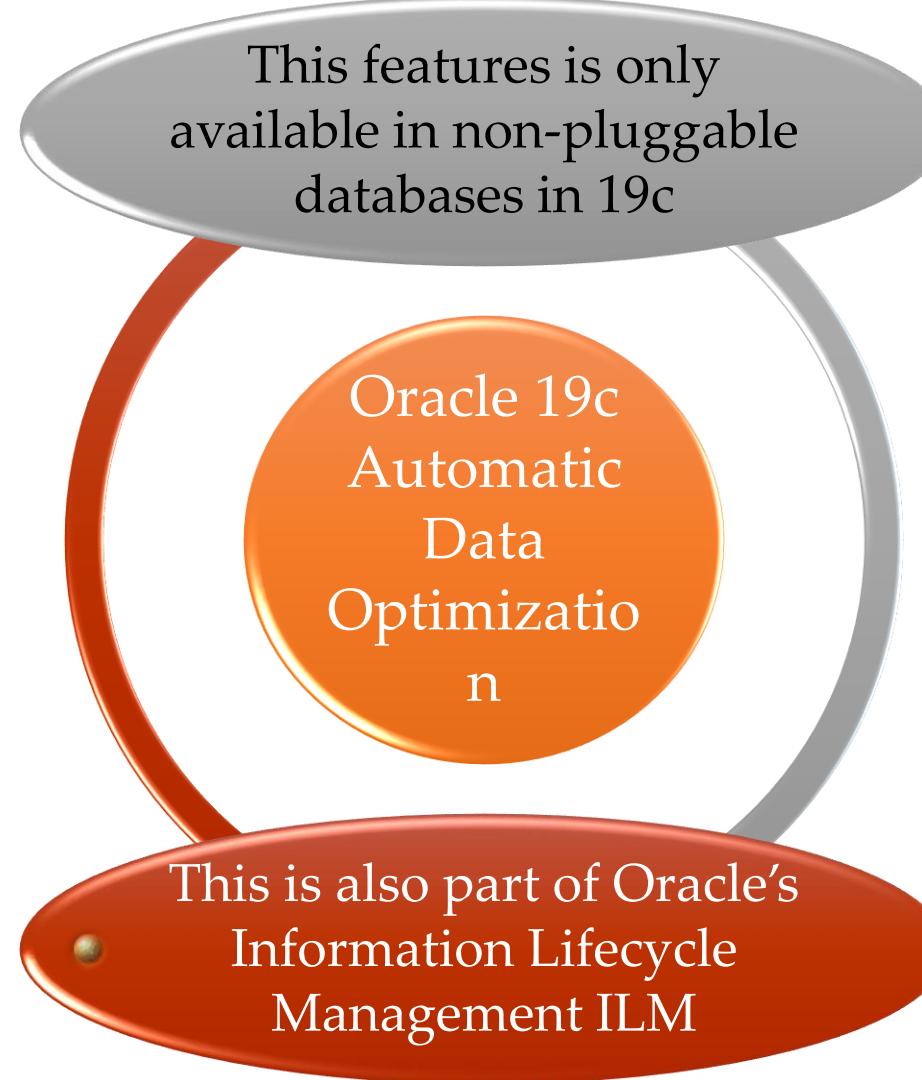
Oracle 19c Automatic Data Optimization

Referred to as Oracle's Heat map

Performs automatic data movement or reorganization based on the volatility and utilization level of the data

Oracle will look for data hot spots and utilization and automatically move the data to a low utilized data partition

Oracle 19c Tuning Features



This features is only
available in non-pluggable
databases in 19c

Oracle 19c
Automatic
Data
Optimizatio
n

This is also part of Oracle's
Information Lifecycle
Management ILM

Oracle 19c Tuning Features

Heat Map

Automatically tracks data utilization at the row and segment level

Displays the actual graph of data being accessed real time

Helps the individual responsible for tuning as to what tables, disks, segments, and blocks that are currently being accessed

Oracle 19c Tuning Features

Heat Map

The table will be partitioned and each square and its relative size indicates a partition

Each partition is color coated to represent a 'hot' spot

Red indicates very hot, yellow medium hot, and blue not hot

Oracle 19c Tuning Features

The features allow the DBAs to create a policy on how and when to migrate the data based on it's 'Heat' level

The policy may include data compression as well as data movement

Automatic Data Optimization

Automatic Data Optimization

Once an ADO policy is created Oracle will evaluate the policy on a pre-determined basis and with the help of 'Heat Map' will either move the data to a less utilized partition or compress the data

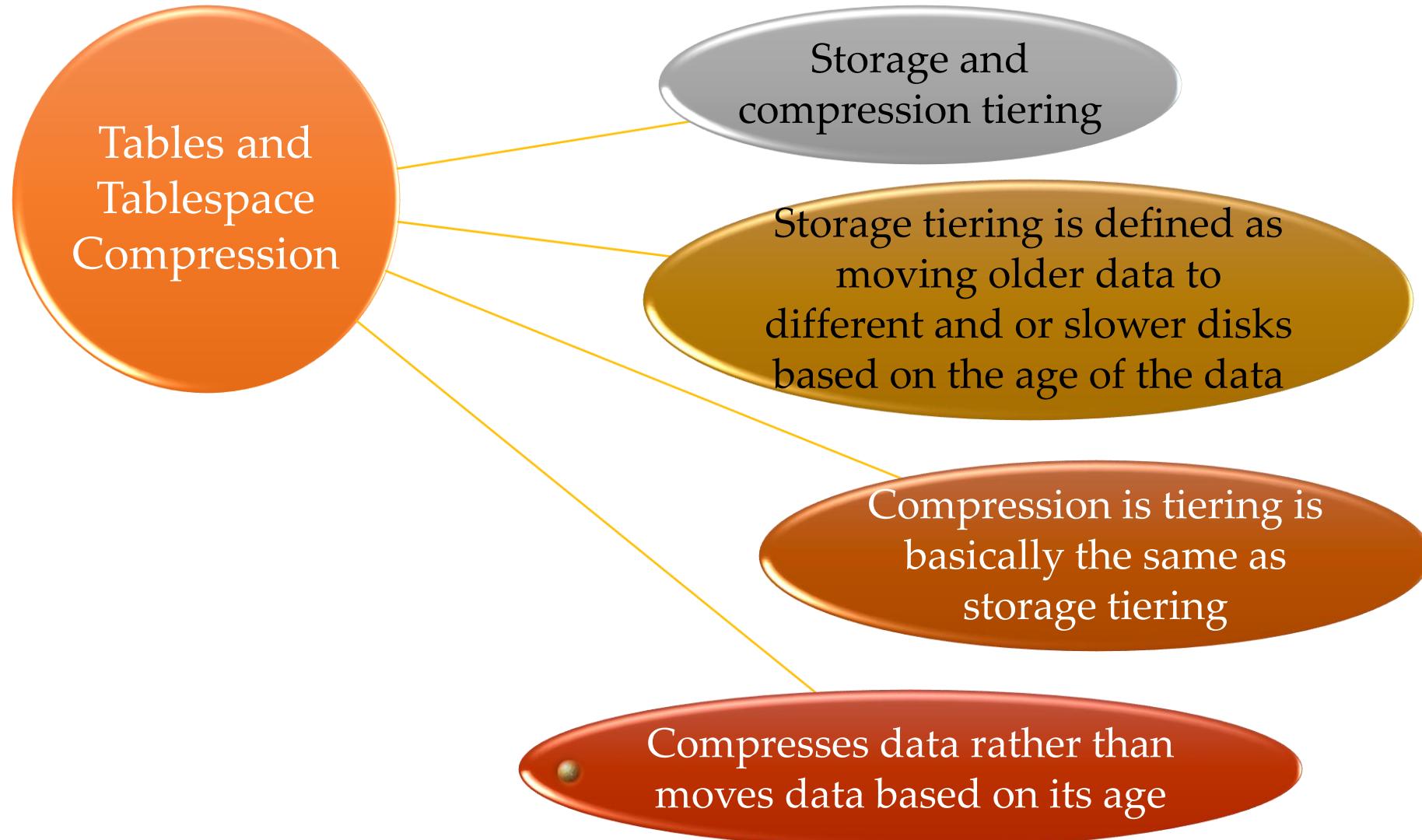
All policies are evaluated and implemented automatically by a background process

ADO policies may be implemented at the partition level, segment level, or row level

Automatic Data Optimization

- Policies can state what action to perform: compress or move data and when to perform the action

Oracle 19c Tuning Features



Tables and Tablespace Compression

- Storage tiering and heat map, the more active data will be placed on the most current and hot disks
- Data that is not accessed often can be placed on slower older disks or even compressed

Oracle 19c Tuning Features



Heat Map and
Tablespace
Compression

Information Lifecycle
Management

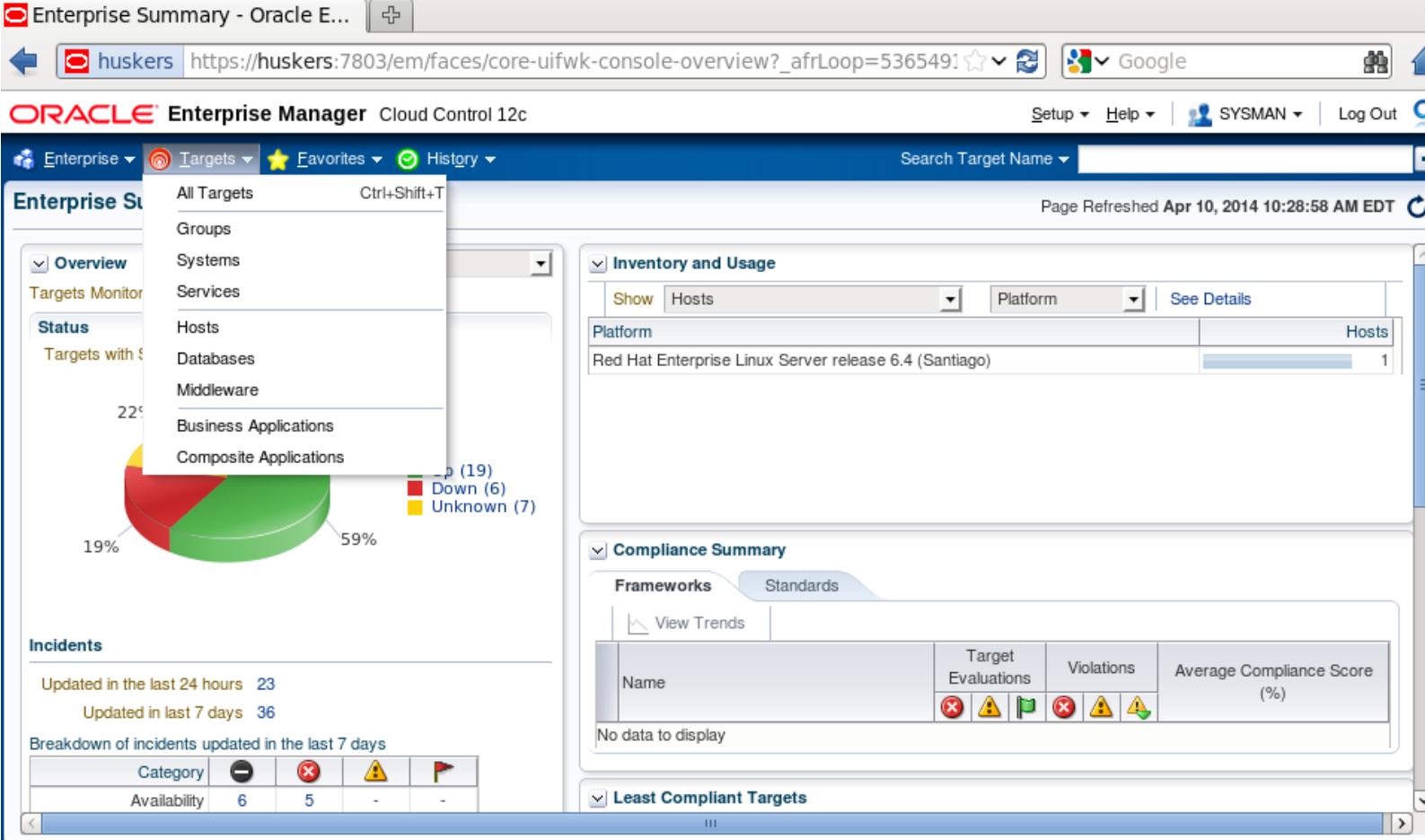
(ILM)

In today's environments where disk space is cheap and everyone is after information, the removal of data is almost prohibited

Oracle 19c Tuning Features

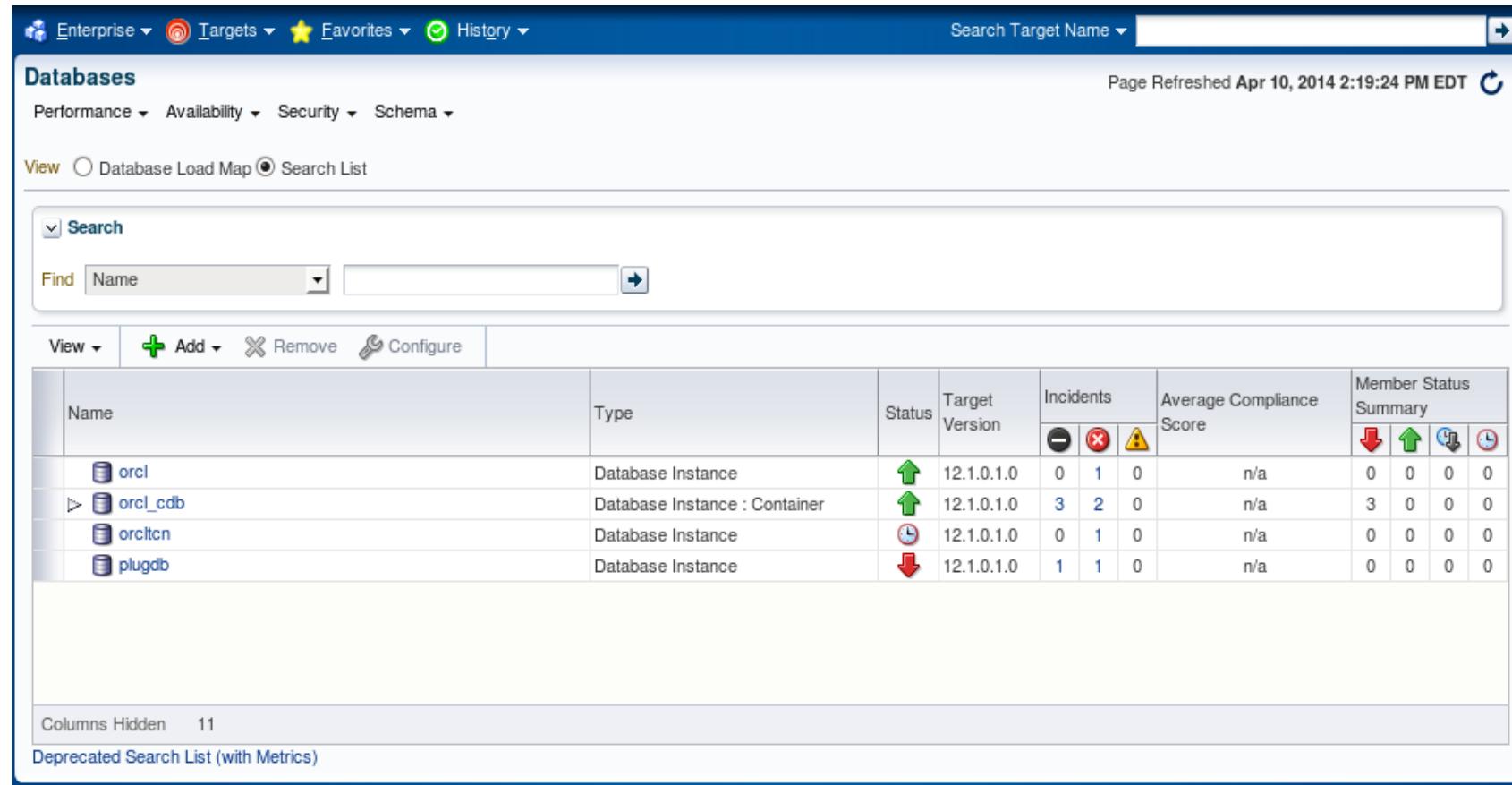


- Oracle's new compression and ADO features we can identify the data not used often and then make a decision as to what should be done with that data
- Oracle will use ILM to track data through its lifetime
- The data will not be removed just replaced



The screenshot shows the Oracle Enterprise Manager Cloud Control 12c interface. At the top, there's a navigation bar with links for Setup, Help, SYSMAN, and Log Out. Below the navigation bar is a search bar labeled "Search Target Name". The main content area is titled "Enterprise Summary - Oracle E..." and displays the following information:

- Targets:** A dropdown menu is open, showing options like All Targets, Groups, Systems, Services, Hosts, Databases, Middleware, Business Applications, and Composite Applications.
- Overview:** A pie chart showing the status of targets: 59% Up (19), 19% Down (6), and 22% Unknown (7).
- Status:** Targets with Status: 22% Unknown, 19% Down, 59% Up.
- Incidents:** Updated in the last 24 hours: 23; Updated in last 7 days: 36. Breakdown of incidents updated in the last 7 days: Availability (Category) - 6, Error (Category) - 5, Warning (Category) - -, Critical (Category) - -.
- Inventory and Usage:** Shows a table for Platform: Red Hat Enterprise Linux Server release 6.4 (Santiago). Hosts: 1.
- Compliance Summary:** Frameworks tab selected. A table shows columns for Name, Target Evaluations (with icons for red X, yellow warning, green checkmark), Violations (with icons for red X, yellow warning, green checkmark), and Average Compliance Score (%). The message "No data to display" is shown.
- Least Compliant Targets:** A section showing the least compliant targets, currently empty.

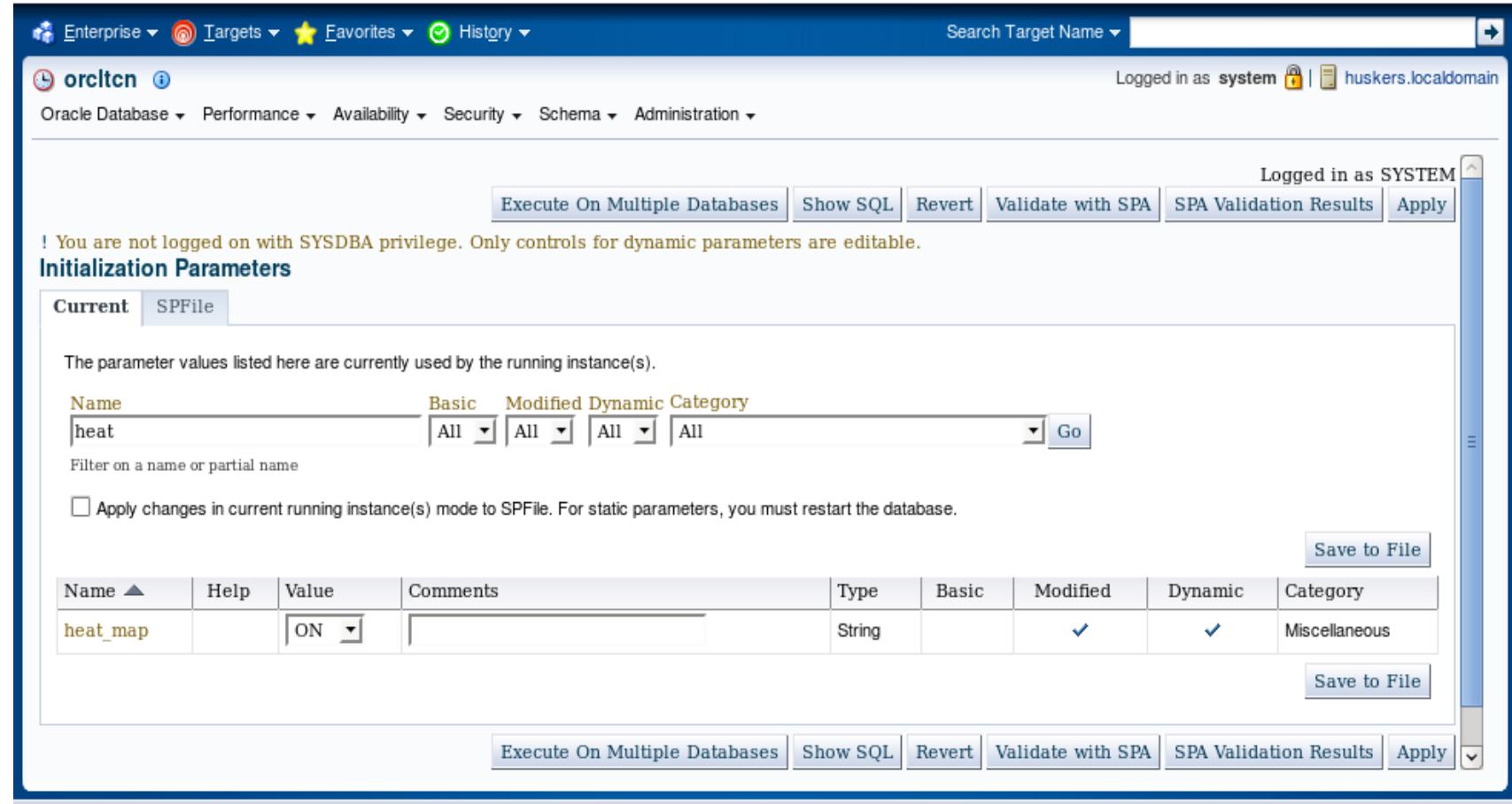


The screenshot shows the Oracle Database Control interface for managing databases. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The page was last refreshed on April 10, 2014, at 2:19:24 PM EDT.

The main section is titled 'Databases' and displays four database entries:

Name	Type	Status	Target Version	Incidents	Average Compliance Score	Member Status Summary
orcl	Database Instance		12.1.0.1.0	0 1 0	n/a	0 0 0 0
orcl_cdb	Database Instance : Container		12.1.0.1.0	3 2 0	n/a	3 0 0 0
orcltn	Database Instance		12.1.0.1.0	0 1 0	n/a	0 0 0 0
plugdb	Database Instance		12.1.0.1.0	1 1 0	n/a	0 0 0 0

At the bottom left, it says 'Columns Hidden 11' and 'Deprecated Search List (with Metrics)'.



Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

Logged in as system  huskers.localdomain

orcltn 

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Logged in as SYSTEM 

Execute On Multiple Databases Show SQL Revert Validate with SPA SPA Validation Results Apply

! You are not logged on with SYSDBA privilege. Only controls for dynamic parameters are editable.

Initialization Parameters

Current SPFile

The parameter values listed here are currently used by the running instance(s).

Name	Basic	Modified	Dynamic	Category
heat	All	All	All	All

Filter on a name or partial name

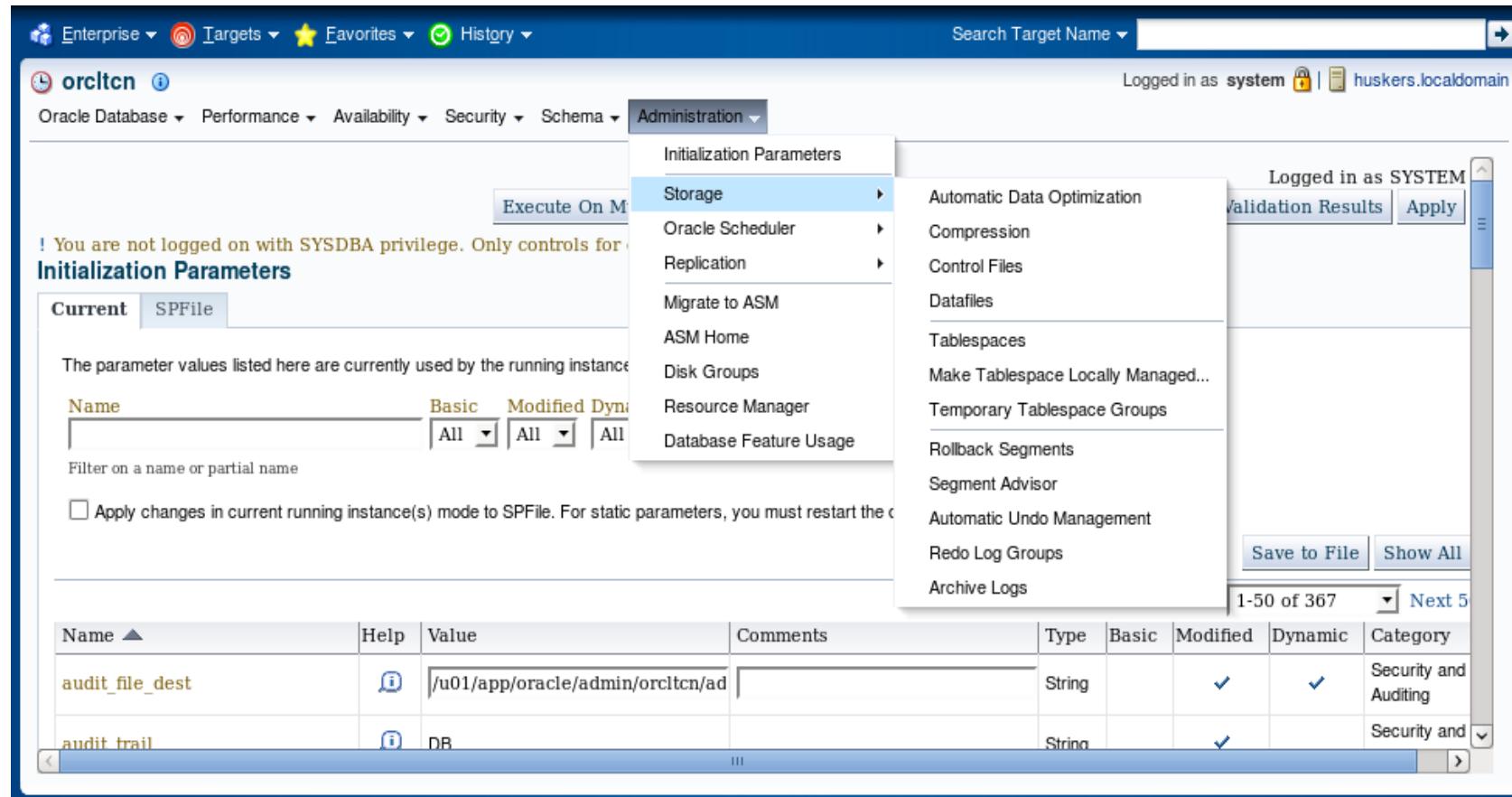
Apply changes in current running instance(s) mode to SPFile. For static parameters, you must restart the database.

Save to File

Name ▲	Help	Value	Comments	Type	Basic	Modified	Dynamic	Category
heat_map		ON		String		✓	✓	Miscellaneous

Save to File

Execute On Multiple Databases Show SQL Revert Validate with SPA SPA Validation Results Apply



The screenshot shows the Oracle Database Administration interface for the database 'orcltn'. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The top right shows the user is logged in as 'system' on 'huskers.localdomain'. The main menu has tabs for Oracle Database, Performance, Availability, Security, Schema, and Administration. The 'Administration' tab is selected, displaying a sub-menu with 'Initialization Parameters' as the active item. Under 'Initialization Parameters', the 'Storage' option is highlighted. Other options include Oracle Scheduler, Replication, Migrate to ASM, ASM Home, Disk Groups, Resource Manager, and Database Feature Usage. To the right of the sub-menu, there is a panel titled 'Automatic Data Optimization' with tabs for 'Validation Results' and 'Apply'. Below the sub-menu, there is a table listing initialization parameters. The table has columns for Name, Help, Value, Comments, Type, Basic, Modified, Dynamic, and Category. Two rows are visible: 'audit_file_dest' with a value of '/u01/app/oracle/admin/orcltn/ad' and 'audit_trail' with a value of 'DB'. The 'Modified' and 'Dynamic' checkboxes are checked for both rows, and the 'Category' column shows 'Security and Auditing' for the first row and 'Security and' for the second.

Name	Help	Value	Comments	Type	Basic	Modified	Dynamic	Category
audit_file_dest		/u01/app/oracle/admin/orcltn/ad		String		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Security and Auditing
audit_trail		DB		String		<input checked="" type="checkbox"/>		Security and

```
[oracle@huskers Desktop]$ . oraenv
ORACLE_SID = [orcltcn] ? orcltcn
The Oracle base remains unchanged with value /u01/app/oracle
[oracle@huskers Desktop]$ sqlplus system/password1

SQL*Plus: Release 12.1.0.1.0 Production on Thu Apr 10 14:44:44 2014

Copyright (c) 1982, 2013, Oracle. All rights reserved.

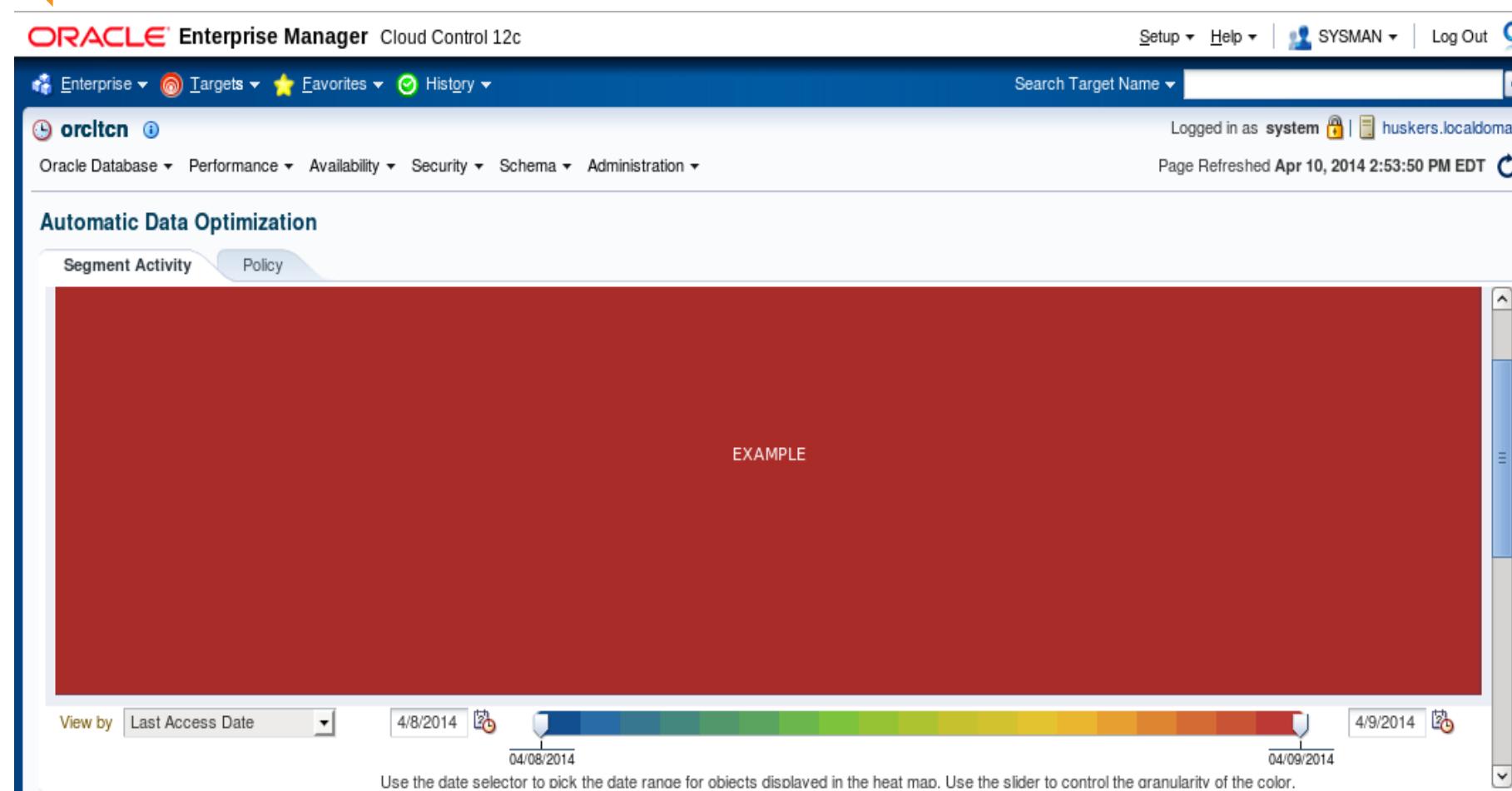
Last Successful login time: Thu Apr 10 2014 14:43:43 -04:00

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Advanced Analytics
and Real Application Testing options

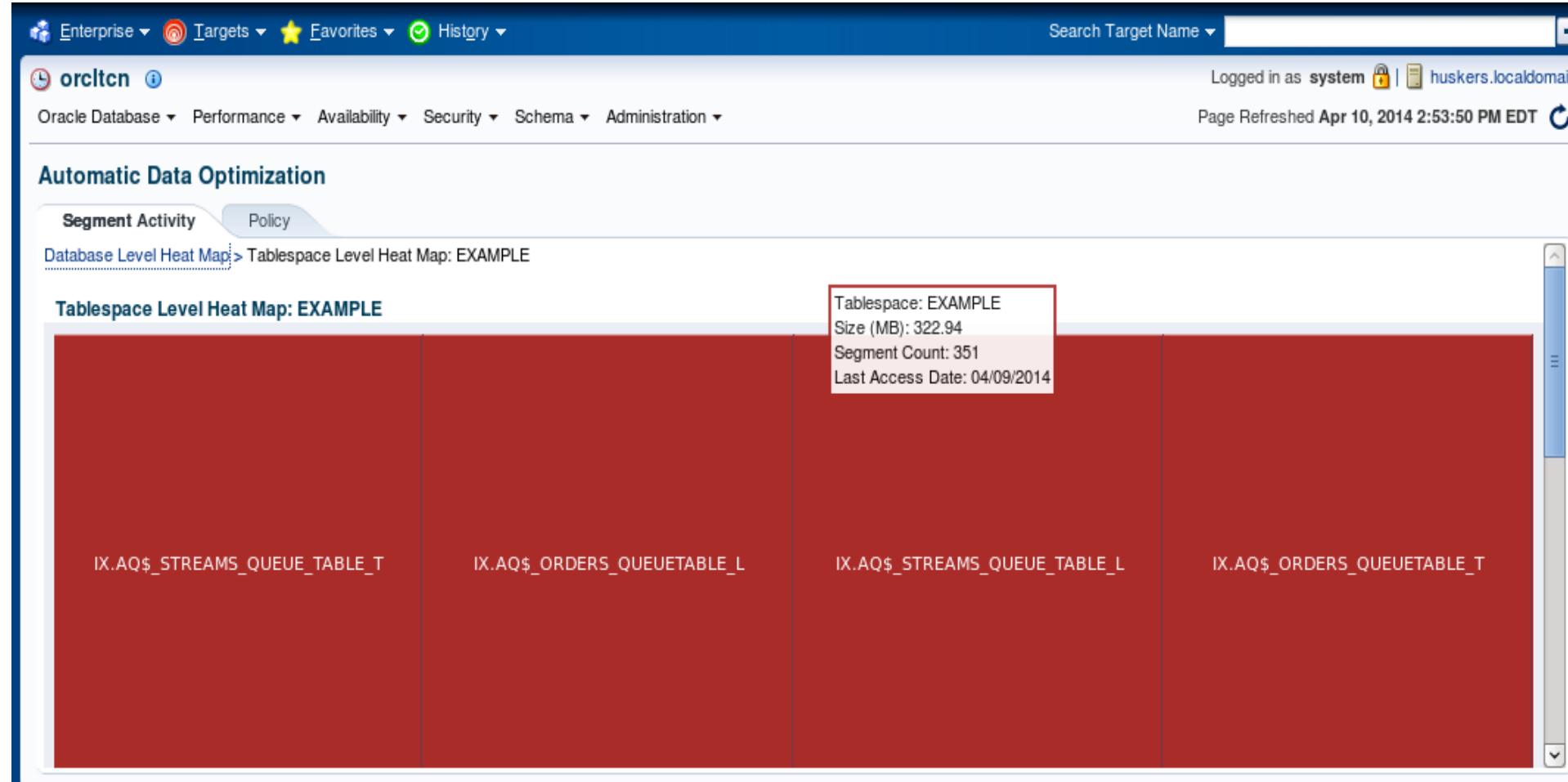
SQL> get ilm_policy
  1 alter table hr.employees ILM add policy
  2 row store compress advanced segment
  3* after 10 days of no modification
SQL> /
Table altered.

SQL> ■
```

Oracle 19c Tuning features

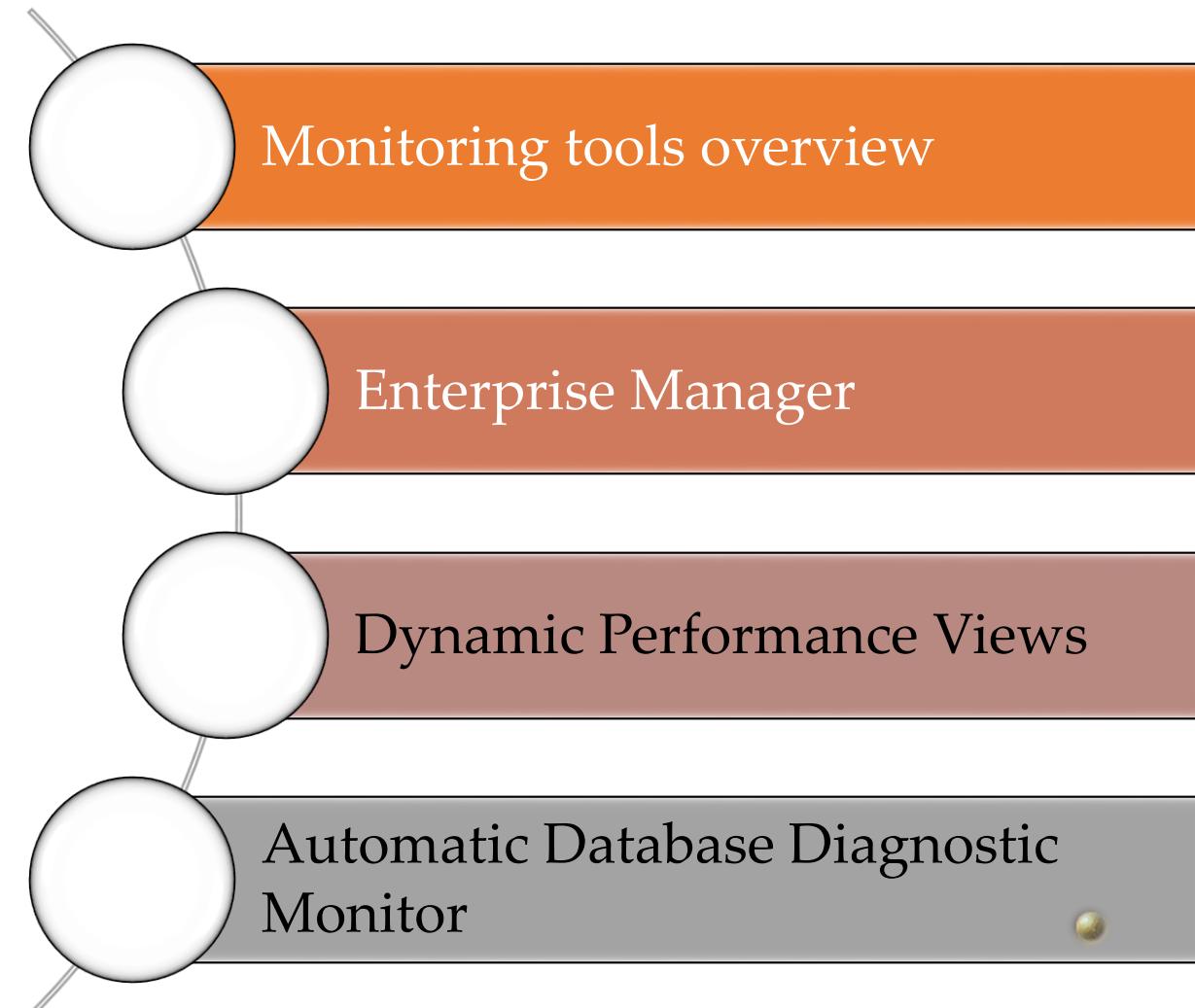


Oracle 19c Tuning features



- Tuning Tools Part 1

Lesson Topics



Oracle 19c Tuning Tools

Monitoring Tools

AWR

- Automatic Workload Repository

Real Time ADDM

- Automatic Database Diagnostic Monitor

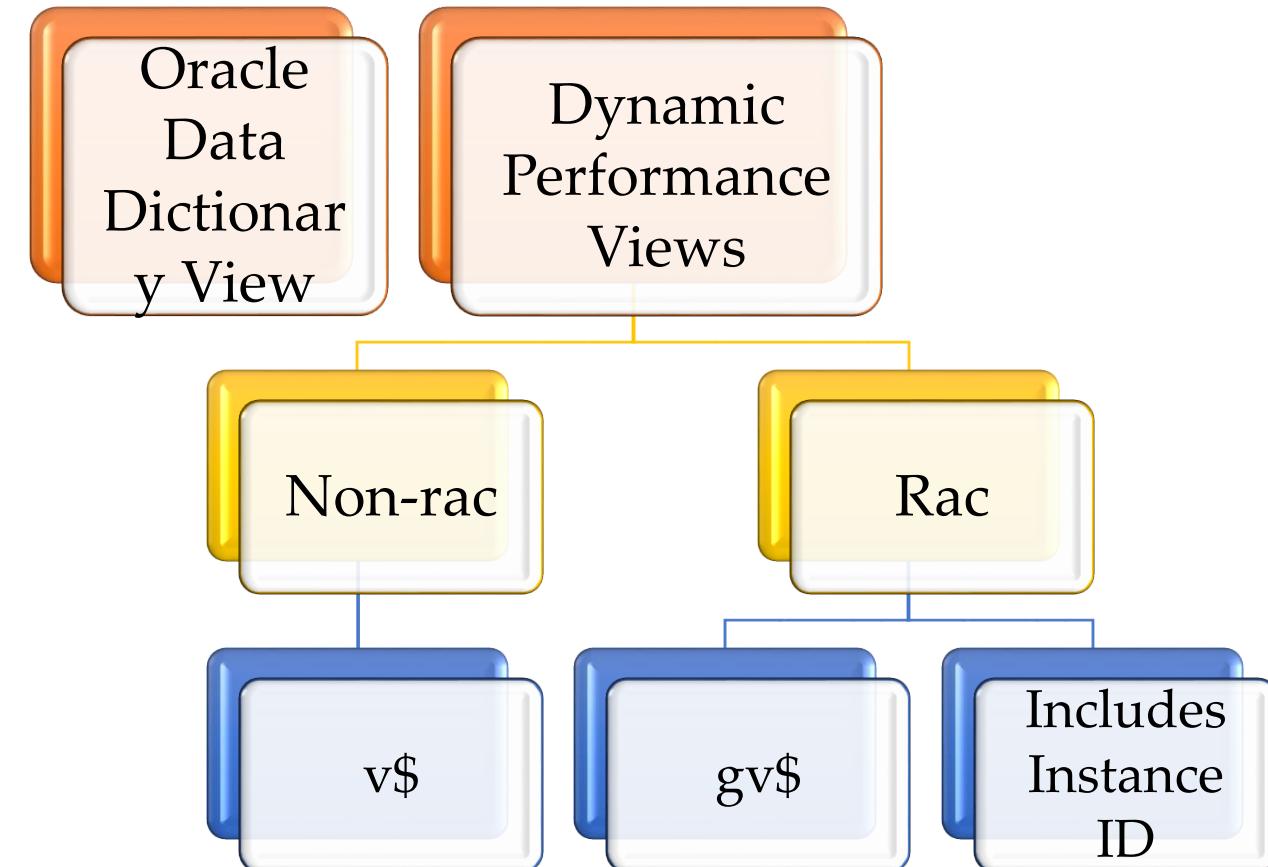
SQL Tuning Advisor

- SQL Profiles

SQL Access Advisor

Oracle 19c Tuning Tools

Monitoring Tools



ORACLE Enterprise Manager Cloud Control 12c

Enterprise Targets Favorites History Search Target Name +
orclcn SYSMAN Log Out

Oracle Database Performance Availability Security Schema Administration

huskers.localdomain Page Refreshed Apr 23, 2014 7:13:58 PM EDT Auto Refresh Off

Summary

Status

- Up Time 0 days, 1 hrs
- Version 12.1.0.1.0
- Load 0.00 average active sessions
- Total Sessions 63
- Last Backup N/A
- Available Space 0.18 GB
- Used Space 2.43 GB
- Total SGA 1,353.92 MB

Diagnostics

- ADDM Findings 6
- Incidents 0 (0 Critical, 5 Warning, 0 Minor, 0 Major)

Compliance Summary

SQL Monitor - Last Hour

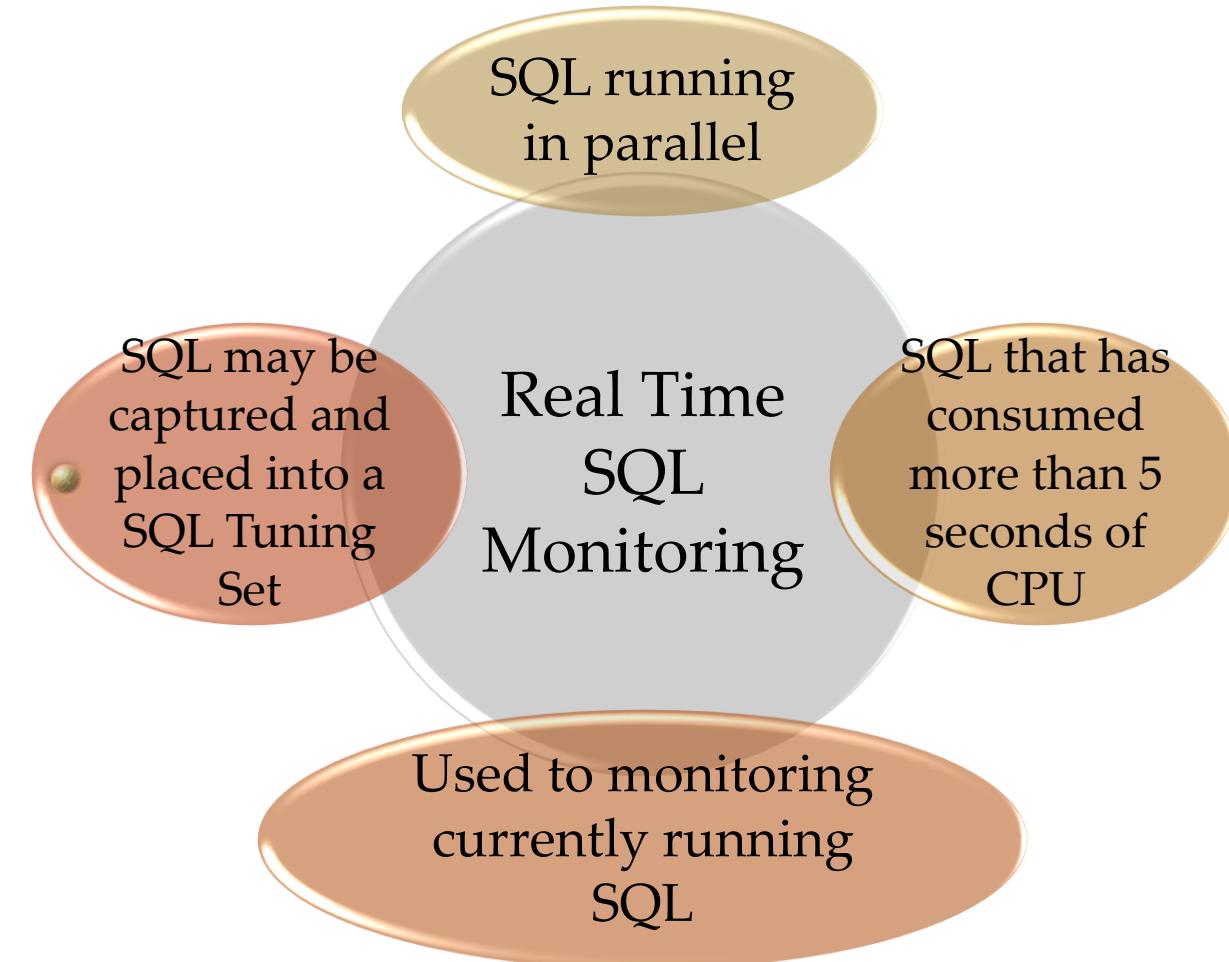
Status	Duration	SQL ID	Session ID	Parallel	Database Time
✓	12:00:00	127xr2mx6r59m6v	69	1	95.43 s
✓	12:00:00	hf8upax5cxsz	79	1	140.57 s
✓	12:00:00	1185k5207588w9ry	79	1	118.66 s
✓	12:00:00	77			07.00 s

https://huskers:7803/em/faces/core...wMode=0&_afrWindowId=jqf9c7umk_1#

Oracle 19c Tuning Tools

The screenshot shows the Oracle Enterprise Manager Cloud Control 12c interface. The top navigation bar includes links for Setup, Help, SYSMAN, and Log Out. The main menu bar has tabs for Enterprise, Targets, Favorites, and History, with the Oracle Database tab selected. The sub-menu for Oracle Database shows options like Performance Home, Top Activity, ASH Analytics, SQL Monitoring, and various monitoring tools. The central area displays a graph titled "Processes" with a "Show Load Average" checkbox checked. The graph tracks four metrics over time from 06:30PM to 07:15PM: Load Average (dark grey line), Non-Database Host CPU (tan line), Instance Background CF (light green line), and Instance Foreground CF (bright green line). A legend on the right identifies these series. Below the graph, there are buttons for "Run ADDM Now" and "Run ASH Report". At the bottom, there's a section for "Average Active Sessions" with a radio button for "Foreground Only". A large orange arrow points to the left side of the slide.

Oracle 19c Tuning Tools



Oracle 19c Tuning Tools

The screenshot shows the Oracle Enterprise Manager Cloud Control 12c interface. The top navigation bar includes links for 'Enterprise', 'Targets', 'Favorites', 'History', 'Setup', 'Help', 'SYSMAN', and 'Log Out'. The main menu bar has tabs for 'Performance' (selected), 'Availability', 'Security', 'Schema', and 'Administration'. The left sidebar displays 'Database Instances' and 'Host' sections, with 'Show Runnable Processes' checked. The main content area features a graph titled 'Processes' showing 'Load Average' over time from 06:30PM to 07:15PM. The graph includes four data series: Load Average (dark grey line), Non-Database Host CPU (brown line), Instance Background CPU (green line), and Instance Foreground CPU (red line). Below the graph, there are buttons for 'Run ADDM Now' and 'Run ASH Report'. At the bottom, there is a section for 'Average Active Sessions' with options for 'Foreground Only' and 'Foreground + Background', and a legend for 'Other' and 'Cluster'.

Oracle 19c Tuning Tools

The screenshot shows the Oracle Enterprise Manager Cloud Service interface. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The target selected is 'orc1tn' (logged in as system). The main menu has tabs for Oracle Database, Performance (which is selected), Availability, Security, Schema, and Administration.

The central area displays the 'Monitored SQL Executions' report. It includes a toolbar with filters for 'Top 100 By Last Active Time' and 'Type All', and buttons for Execution Detail, SQL Detail, Session Detail, and a search field for 'ID'. A refresh interval of '10 Seconds' is set.

The report table lists five SQL executions:

Status	Duration	Type	ID	SQL Plan Hash	User	Parallel	Database Time	IO Requests
✓	2.1m	SQL	7xr2mx6r59m6v				2.1m	119
✓	2.3m	SQL	fhf8upax5cxsz				2.3m	721
✓	2.0m	SQL	5k5207588w9ry	1388734953			2.0m	644
✓	37.0s	SQL	4bymntwnjmw7		SYS		39.7s	2,593
✓	37.0s	SQL	ajymgnp1qnruw	3633724902	SYS		23.1s	2,493

Oracle 19c Tuning Tools



New in Oracle 19c

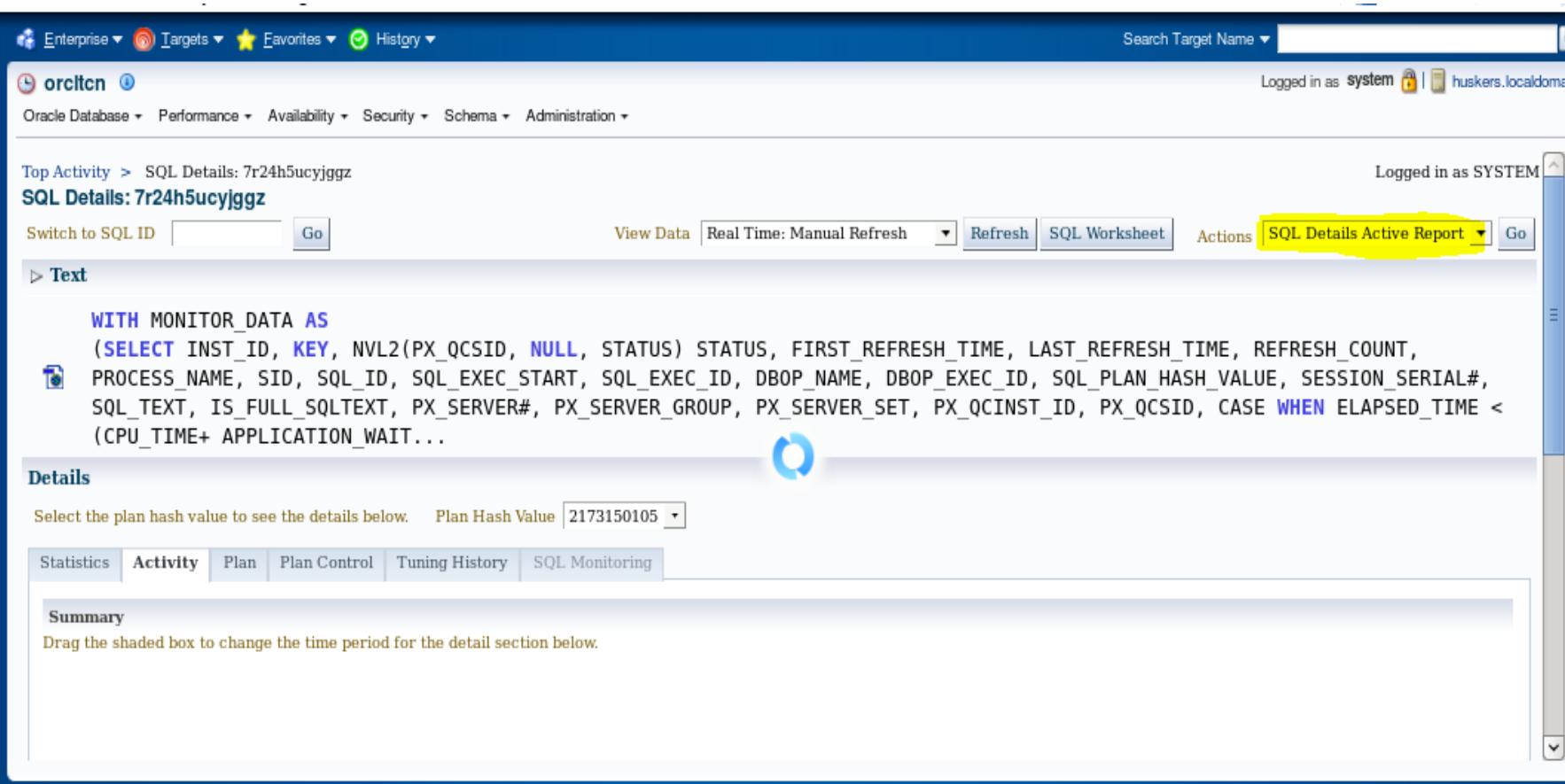
Live reports
against currently
running SQL

Database Active
Reporting

Provides advice

Active report may
be saved or
emailed

Oracle 19c Tuning Tools



The screenshot shows the Oracle Database SQL Details page for SQL ID 7r24h5ucyjggz. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search field for 'Search Target Name'. The session is logged in as system@huskers.localdomain. The main content area displays the SQL code:

```
WITH MONITOR_DATA AS
  (SELECT INST_ID, KEY, NVL2(PX_QCSID, NULL, STATUS) STATUS, FIRST_REFRESH_TIME, LAST_REFRESH_TIME, REFRESH_COUNT,
    PROCESS_NAME, SID, SQL_ID, SQL_EXEC_START, SQL_EXEC_ID, DBOP_NAME, DBOP_EXEC_ID, SQL_PLAN_HASH_VALUE, SESSION_SERIAL#,
    SQL_TEXT, IS_FULL_SQLTEXT, PX_SERVER#, PX_SERVER_GROUP, PX_SERVER_SET, PX_QCINST_ID, PX_QCSID, CASE WHEN ELAPSED_TIME <
    (CPU_TIME+ APPLICATION_WAIT...
```

The 'Actions' dropdown menu is highlighted with a yellow box, showing options like 'SQL Details Active Report' and 'Go'. Below the SQL code, there's a 'Text' section with a 'Details' button. A plan hash value of 2173150105 is selected. The bottom navigation bar includes tabs for Statistics, Activity (which is active), Plan, Plan Control, Tuning History, and SQL Monitoring.

Enterprise ▾ Targets ▾ Favorites ▾ History ▾

Logged in as system huskers.localdomain

Orchestrator (orchtcn)

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

SQL Details Active Report >

SQL Details: 7r24h5ucyjggz

Wed Apr 23, 2014 6:38:45 PM - Wed Apr 23, 2014 7:38:45 PM

Logged in as SYSTEM

Save Mail

Overview

SQL ID: 7r24h5ucyjggz
SQL Text: WITH MONITOR_DATA AS (SELECT I... ⓘ)
SQL Plan Hash: 2173150105

Source

User: SYSTEM
Service: SYS\$USERS
Program: OMS
Module Action: Admin Connection,tabase/instance/sql...
PL/SQL: -
Client ID: SYSMAN@huskers.localdomain@Mozilla...
PL/SQL Entry: SYS,DBMS_REPORT,GET_REPORT

Statistics

Activity %: 100%
Database Time per Exec: 3.4s
IO Requests per Exec: 142
Executions: 1
Rows processed per Exec: 1

Details

Activity Summary Plan Details

160 total sessions 04 average active sessions 7r24h5ucyjggz accounts for 95% of total activity.

This screenshot shows the Oracle Database SQL Monitor report for session 7r24h5ucyjggz. The report is titled "SQL Details: 7r24h5ucyjggz" and covers the period from Wednesday, April 23, 2014, at 6:38:45 PM to 7:38:45 PM. The session was logged in as SYSTEM. The "Source" section provides details about the session's environment, including the user (SYSTEM), service (SYS\$USERS), program (OMS), module action (Admin Connection, tabase/instance/sql...), and client information (SYSMAN@huskers.localdomain@Mozilla...). The "Statistics" section displays performance metrics: Activity % at 100%, Database Time per Exec at 3.4s, IO Requests per Exec at 142, Executions at 1, and Rows processed per Exec at 1. The "Details" section includes tabs for "Activity Summary" and "Plan Details", with a note indicating 160 total sessions and 04 average active sessions, with the current session accounting for 95% of total activity.

Dynamic Performance Views

Oracle 19c Tuning Tools

```
SQL> l
  1 select table_name
  2 from dict
  3 where table_name like 'V$%'
  4* order by 1
SQL> set pause on
SQL> /
```

TABLE_NAME

```
-----
V$ACCESS
V$ACTIVE_INSTANCES
V$ACTIVE_SERVICES
V$ACTIVE_SESSION_HISTORY
V$ACTIVE_SESS_POOL_MTH
V$ADVISOR_CURRENT_SQLPLAN
V$ADVISOR_PROGRESS
V$ALERT_TYPES
V$AQ
V$AQ1
```



Oracle 19c Tuning Tools

```
SQL> desc v$system_event
```

Name	Null?	Type
EVENT		VARCHAR2(64)
TOTAL_WAITS		NUMBER
TOTAL_TIMEOUTS		NUMBER
TIME_WAITED		NUMBER
AVERAGE_WAIT		NUMBER
TIME_WAITED_MICRO		NUMBER
TOTAL_WAITS_FG		NUMBER
TOTAL_TIMEOUTS_FG		NUMBER
TIME_WAITED_FG		NUMBER
AVERAGE_WAIT_FG		NUMBER
TIME_WAITED_MICRO_FG		NUMBER
EVENT_ID		NUMBER
WAIT_CLASS_ID		NUMBER
WAIT_CLASS#		NUMBER
WAIT_CLASS		VARCHAR2(64)
CON_ID		NUMBER

```
SQL> █
```

Oracle 19c Tuning Tools

SQL> desc v\$waitstat

Name	Null?	Type
CLASS		VARCHAR2(18)
COUNT		NUMBER
TIME		NUMBER
CON_ID		NUMBER

SQL> █

SQL> desc v\$sgainfo

Name	Null?	Type
NAME		VARCHAR2(32)
BYTES		NUMBER
RESIZEABLE		VARCHAR2(3)
CON_ID		NUMBER

SQL> █

Oracle 19c Tuning Tools

```
SQL> desc v$undostat
```

Name	Null?	Type
BEGIN_TIME		DATE
END_TIME		DATE
UNDOTSN		NUMBER
UNDOBLKS		NUMBER
TXNCOUNT		NUMBER
MAXQUERYLEN		NUMBER
MAXQUERYID		VARCHAR2(13)
MAXCONCURRENCY		NUMBER
UNXPSTEALCNT		NUMBER
UNXPBLKRELCNT		NUMBER
UNXPBLKREUCNT		NUMBER
EXPSTEALCNT		NUMBER
EXPBLKRELCNT		NUMBER
EXPBLKREUCNT		NUMBER
SSOLDEERRCNT		NUMBER
NOSPACEERRCNT		NUMBER
ACTIVEBLKS		NUMBER
UNEXPIREDBLKS		NUMBER
EXPIREDBLKS		NUMBER
TUNED_UNDORETENTION		NUMBER
CON_ID		NUMBER

```
SQL> █
```

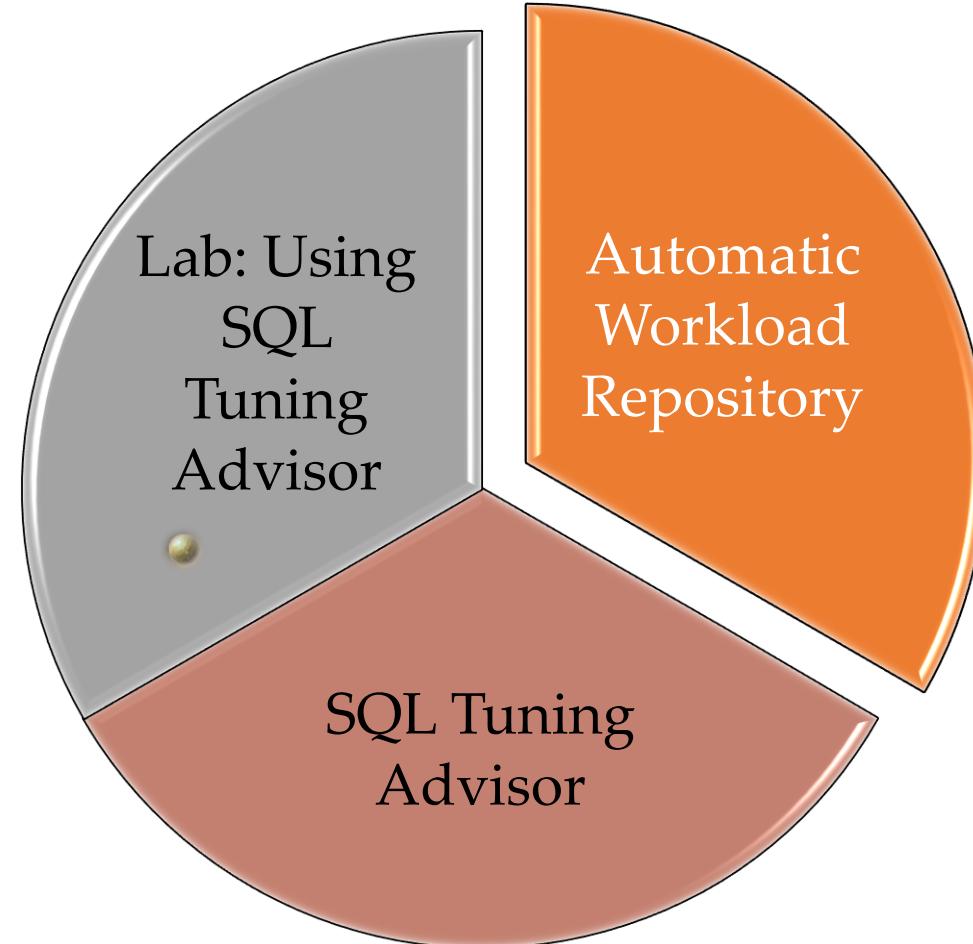
Oracle 19c Tuning Tools

SQL> desc v\$database

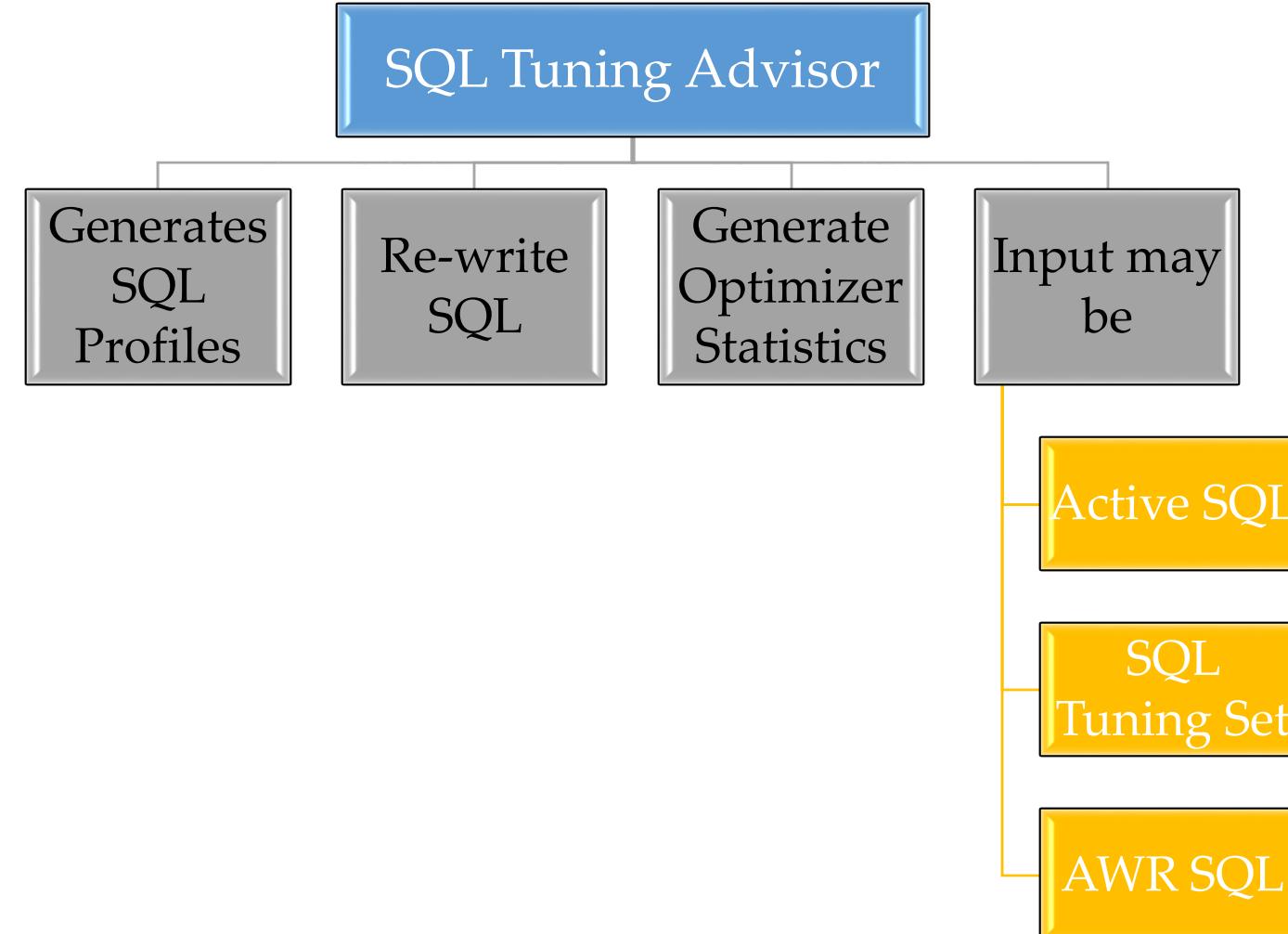
Name	Null?	Type
DBID		NUMBER
NAME		VARCHAR2(9)
CREATED		DATE
RESETLOGS_CHANGE#		NUMBER
RESETLOGS_TIME		DATE
PRIOR_RESETLOGS_CHANGE#		NUMBER
PRIOR_RESETLOGS_TIME		DATE
LOG_MODE		VARCHAR2(12)
CHECKPOINT_CHANGE#		NUMBER
ARCHIVE_CHANGE#		NUMBER
CONTROLFILE_TYPE		VARCHAR2(7)
CONTROLFILE_CREATED		DATE
CONTROLFILE_SEQUENCE#		NUMBER
CONTROLFILE_CHANGE#		NUMBER
CONTROLFILE_TIME		DATE
OPEN_RESETLOGS		VARCHAR2(11)
VERSION_TIME		DATE
OPEN_MODE		VARCHAR2(20)
PROTECTION_MODE		VARCHAR2(20)
PROTECTION_LEVEL		VARCHAR2(20)
REMOTE_ARCHIVE		VARCHAR2(8)
ACTIVATION#		NUMBER

- Tuning Tools Part 2

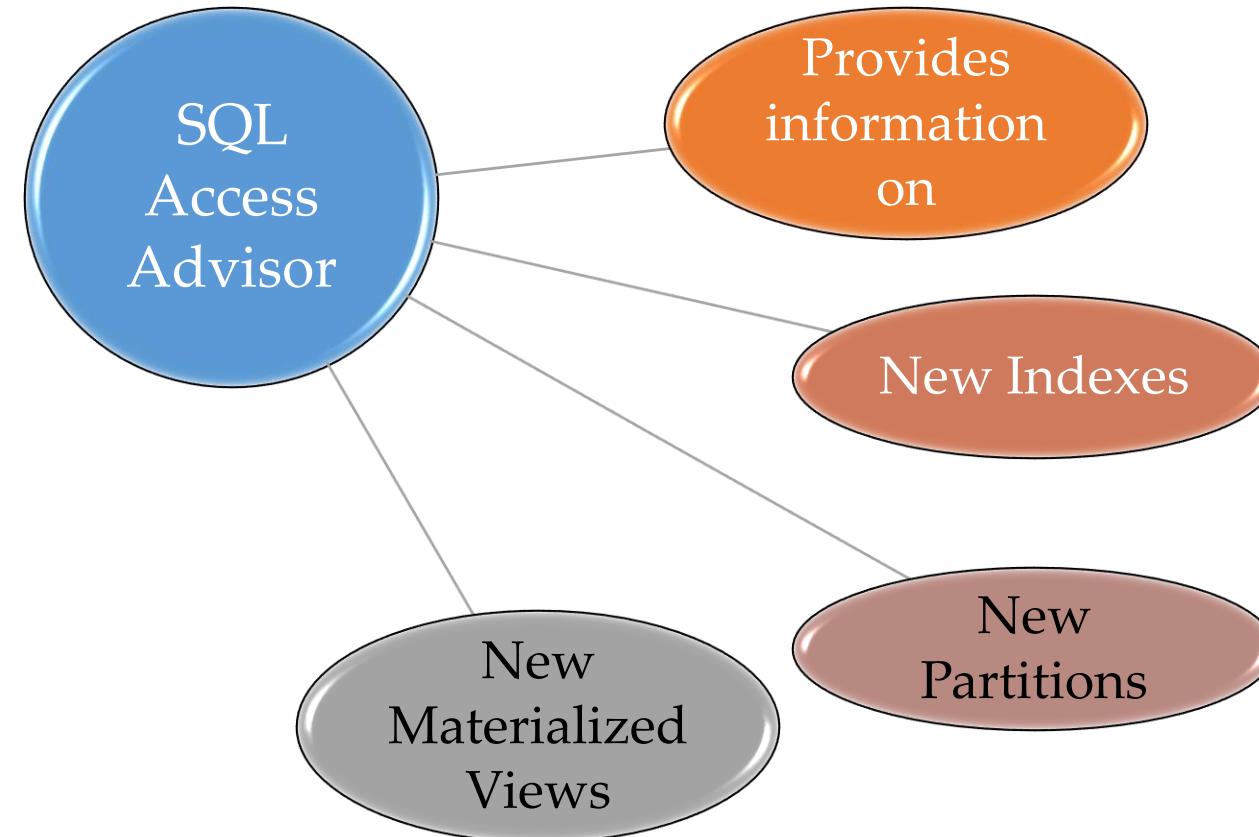
Lesson Topics



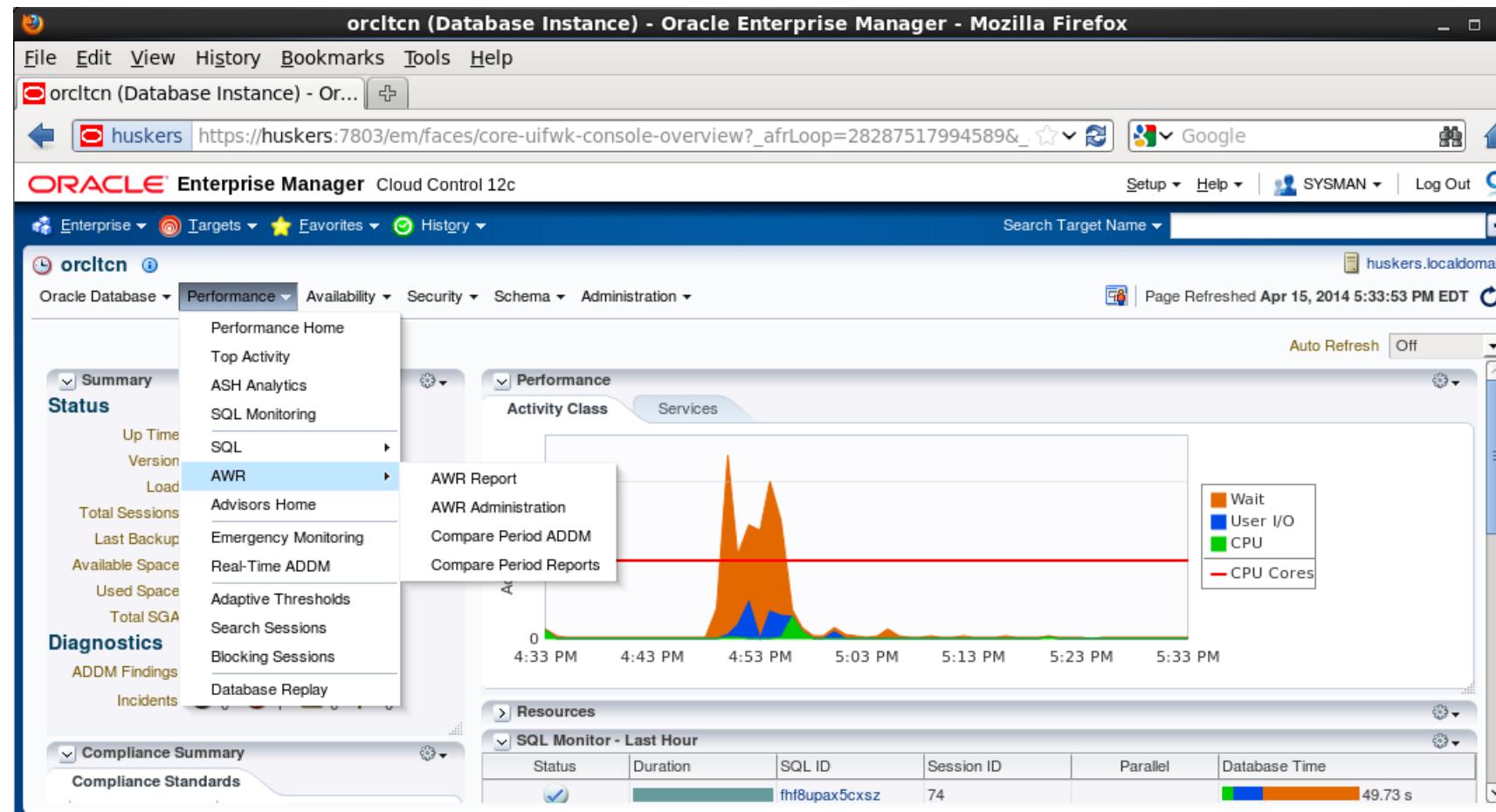
Oracle 19c Tuning Tools

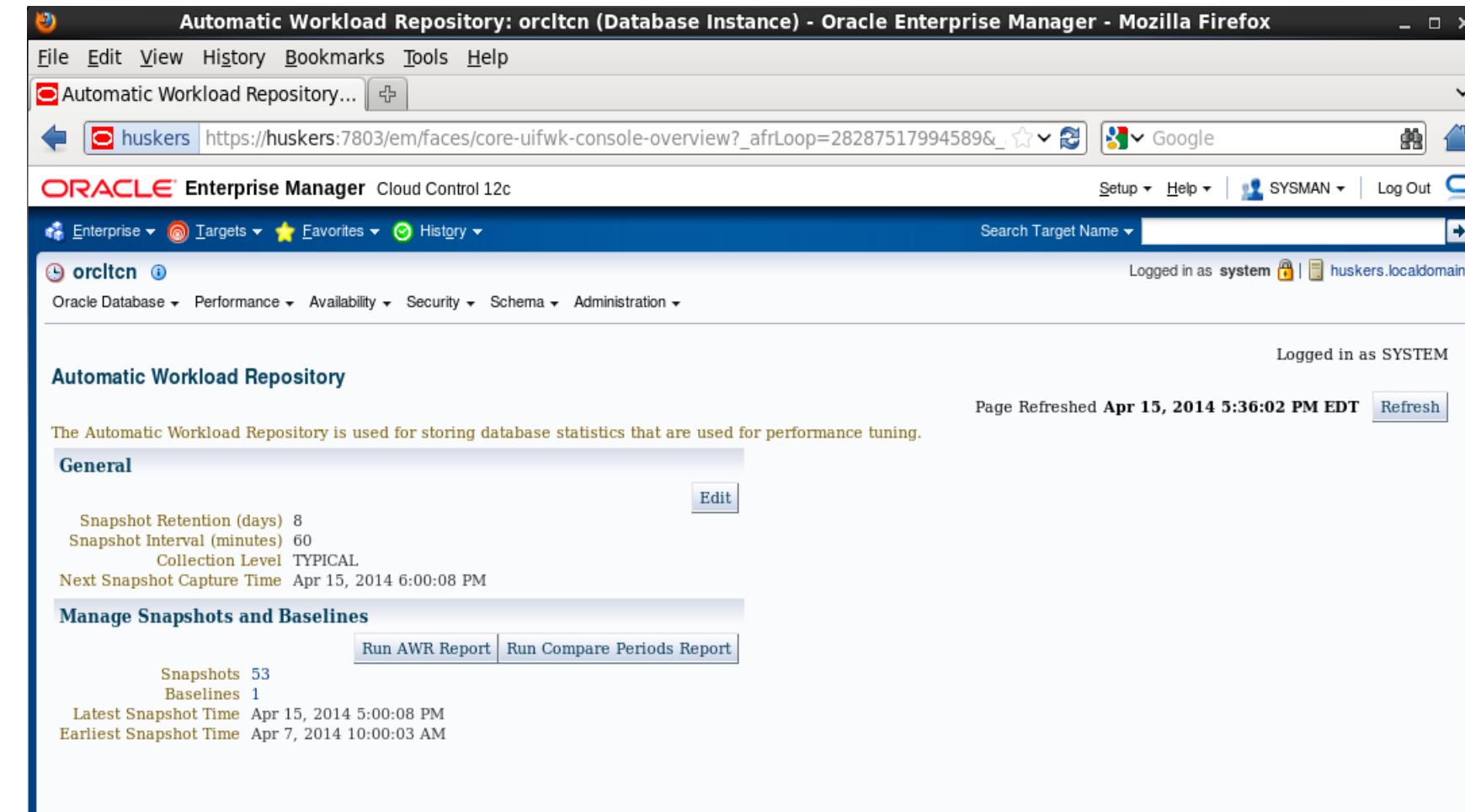


Oracle 19c Tuning Tools



- Both SQL Access Advisor and SQL Tuning Advisor of Oracle's Diagnostic and tuning pack





The screenshot shows the Oracle Enterprise Manager Cloud Control 12c interface for the database instance **orcltn**. The title bar indicates the session is connected to **Automatic Workload Repository: orcltn (Database Instance)** via **Oracle Enterprise Manager - Mozilla Firefox**.

The top navigation bar includes links for **File**, **Edit**, **View**, **History**, **Bookmarks**, **Tools**, and **Help**. The browser address bar shows the URL https://huskers:7803/em/faces/core-uifwk-console-overview?_afrLoop=28287517994589&_star.

The main header displays the **ORACLE Enterprise Manager Cloud Control 12c** logo and the target database name **orcltn**. It also shows the user is logged in as **system** from the host **huskers.localdomain**.

The left sidebar contains navigation links for **Enterprise**, **Targets**, **Favorites**, and **History**. The right sidebar includes a search bar for "Search Target Name" and status information: "Logged in as SYSTEM".

The main content area is titled **Automatic Workload Repository**. A message states: "The Automatic Workload Repository is used for storing database statistics that are used for performance tuning." Below this, a timestamp indicates the page was last refreshed on **Apr 15, 2014 5:36:02 PM EDT**.

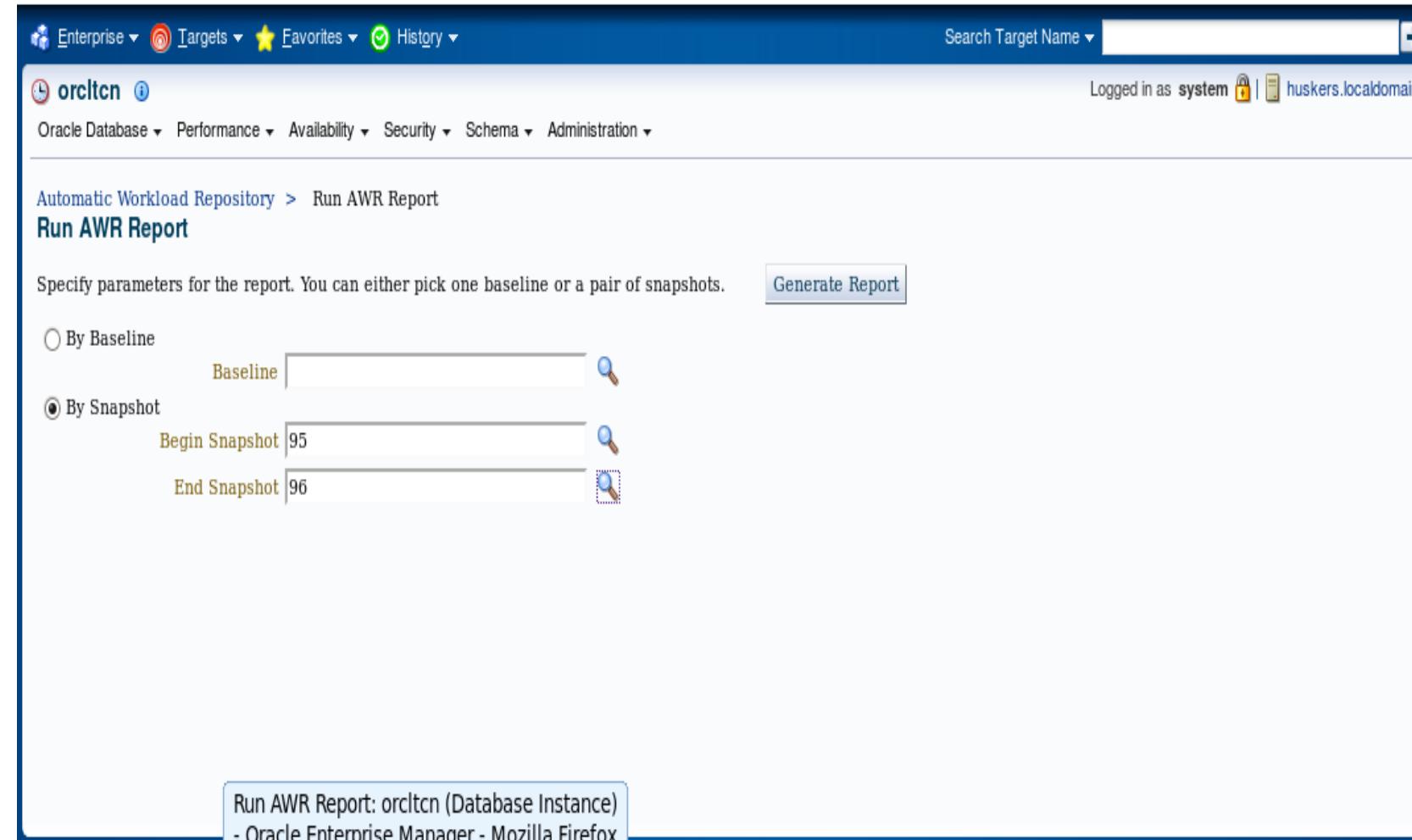
The **General** section displays configuration details:

- Snapshot Retention (days): 8
- Snapshot Interval (minutes): 60
- Collection Level: TYPICAL
- Next Snapshot Capture Time: Apr 15, 2014 6:00:08 PM

The **Manage Snapshots and Baselines** section provides summary statistics:

- Snapshots: 53
- Baselines: 1
- Latest Snapshot Time: Apr 15, 2014 5:00:08 PM
- Earliest Snapshot Time: Apr 7, 2014 10:00:03 AM

Buttons for "Run AWR Report" and "Run Compare Periods Report" are visible.



Enterprise ▾ Targets ▾ Favorites ▾ History ▾

Search Target Name ▾ →

orcltn ⓘ

Logged in as system huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Automatic Workload Repository > Run AWR Report

Run AWR Report

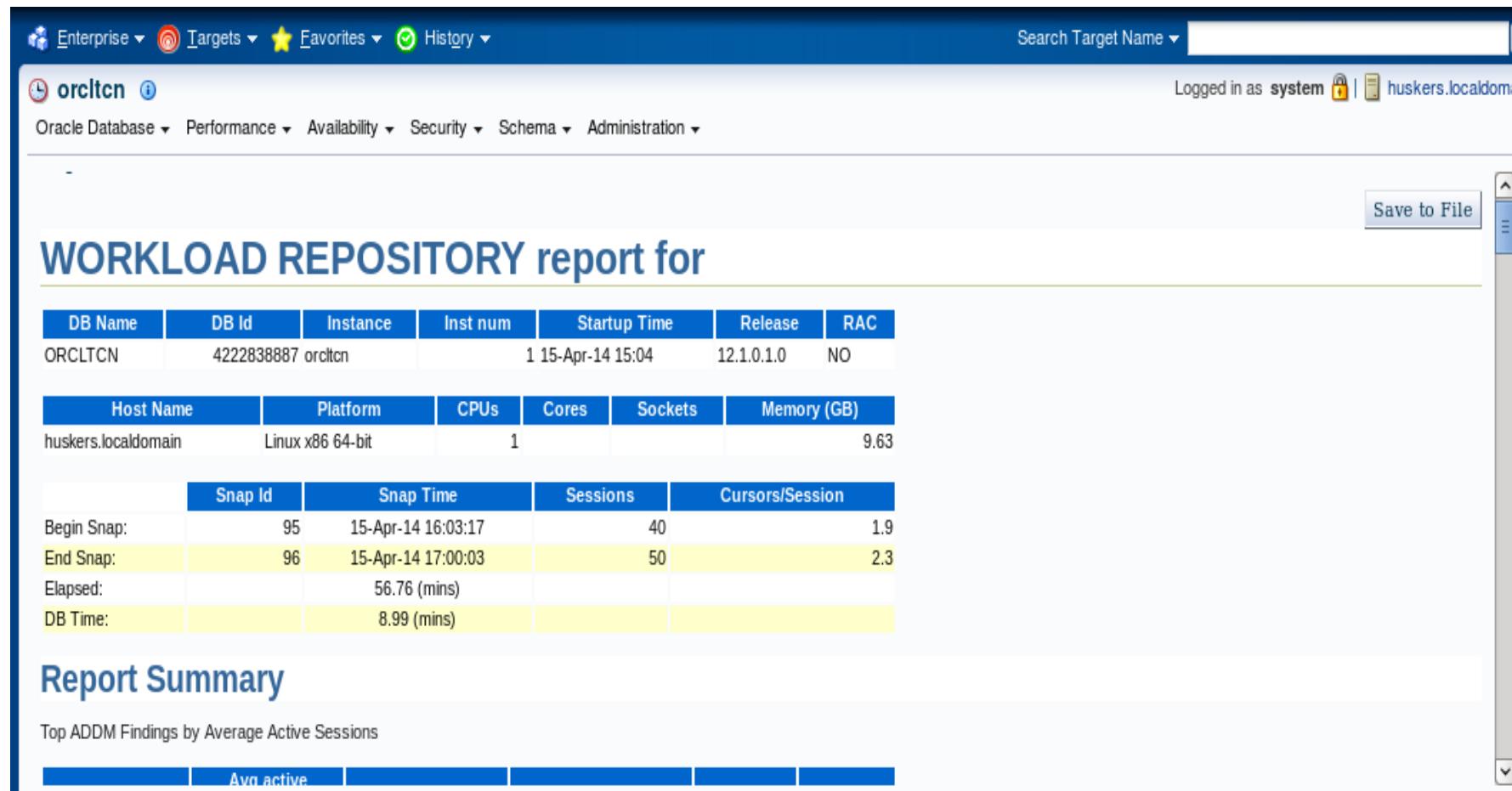
Specify parameters for the report. You can either pick one baseline or a pair of snapshots.

By Baseline
Baseline

By Snapshot
Begin Snapshot
End Snapshot

Generate Report

Run AWR Report: orcltn (Database Instance)
- Oracle Enterprise Manager - Mozilla Firefox



The screenshot shows a browser-based Oracle Database interface. At the top, there are navigation links for Enterprise, Targets, Favorites, and History, along with a search bar for 'Search Target Name'. The target is currently set to 'orcltn' (highlighted in blue). The user is logged in as 'system' with a session ID of 'huskers.localdomain'. Below the header, there are menu options for Oracle Database, Performance, Availability, Security, Schema, and Administration.

WORKLOAD REPOSITORY report for

DB Name	DB Id	Instance	Inst num	Startup Time	Release	RAC
ORCLTCN	4222838887	orcltn		1 15-Apr-14 15:04	12.1.0.1.0	NO

Host Name	Platform	CPUs	Cores	Sockets	Memory (GB)
huskers.localdomain	Linux x86 64-bit	1			9.63

	Snap Id	Snap Time	Sessions	Cursors/Session
Begin Snap:	95	15-Apr-14 16:03:17	40	1.9
End Snap:	96	15-Apr-14 17:00:03	50	2.3
Elapsed:		56.76 (mins)		
DB Time:		8.99 (mins)		

Report Summary

Top ADDM Findings by Average Active Sessions

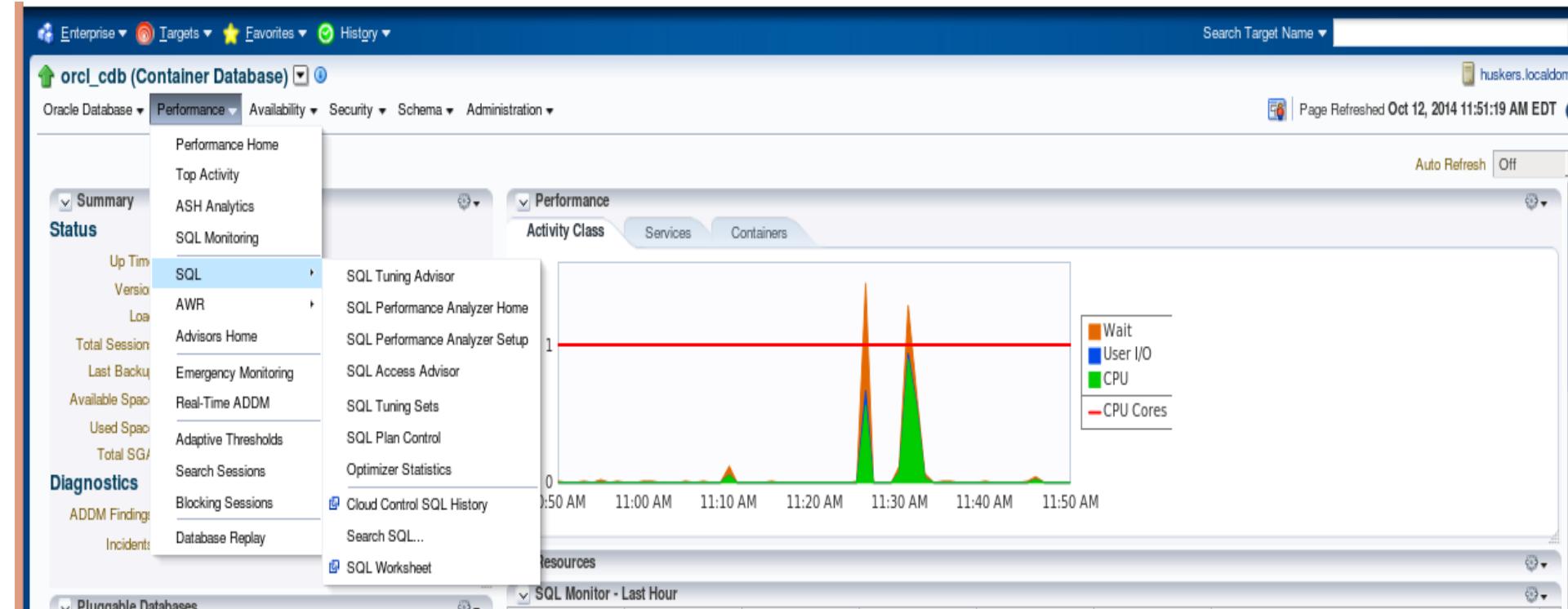
	Avg active				

Oracle 19c Tuning Tools

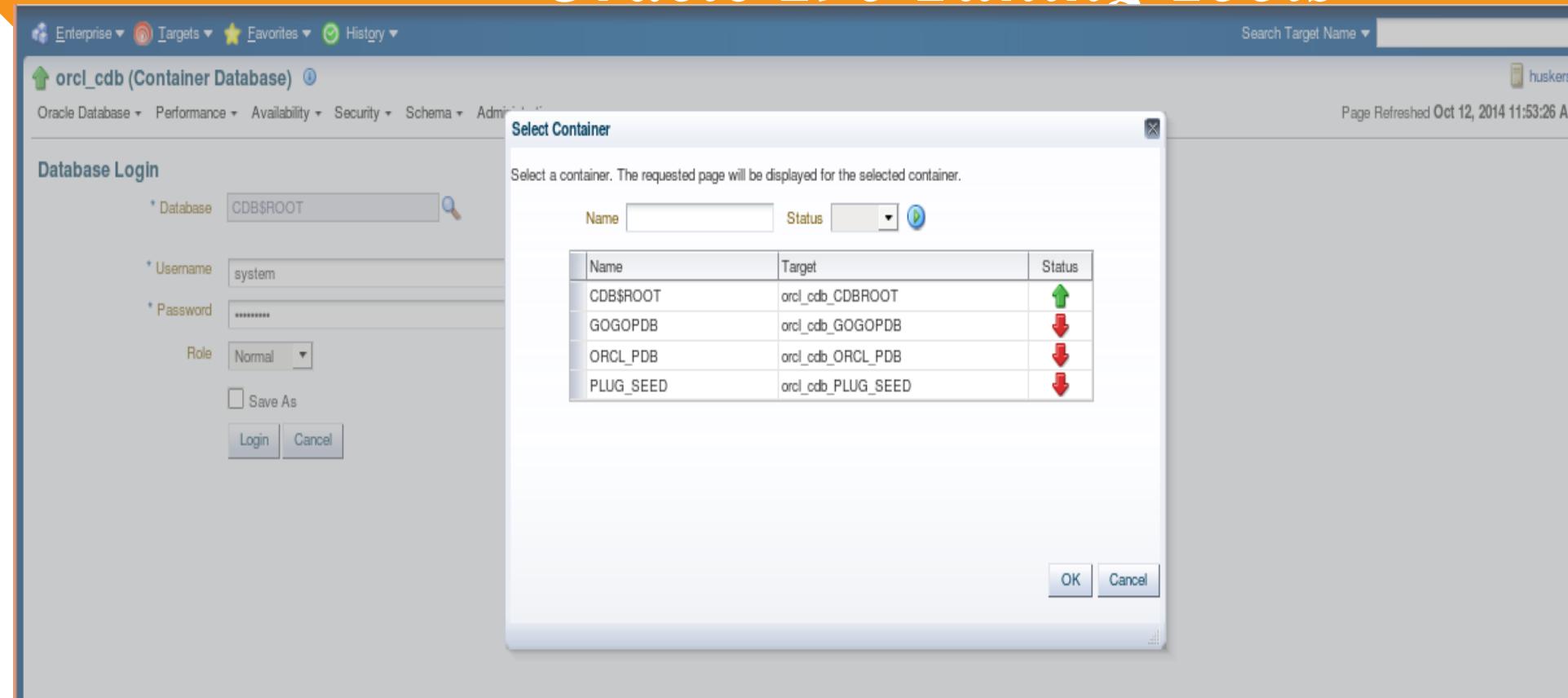
- Available from Performance Tab

SQL Tuning Advisor

Oracle 19c Tuning Tools



Oracle 19c Tuning Tools



Search And Select: SQL Tuning Set

[Cancel](#) [Select](#)

Search

To filter the list or to search for a specific item in the list, enter text in the text field and click Go. To see all items, clear the search box and click Go.

Schema

Name

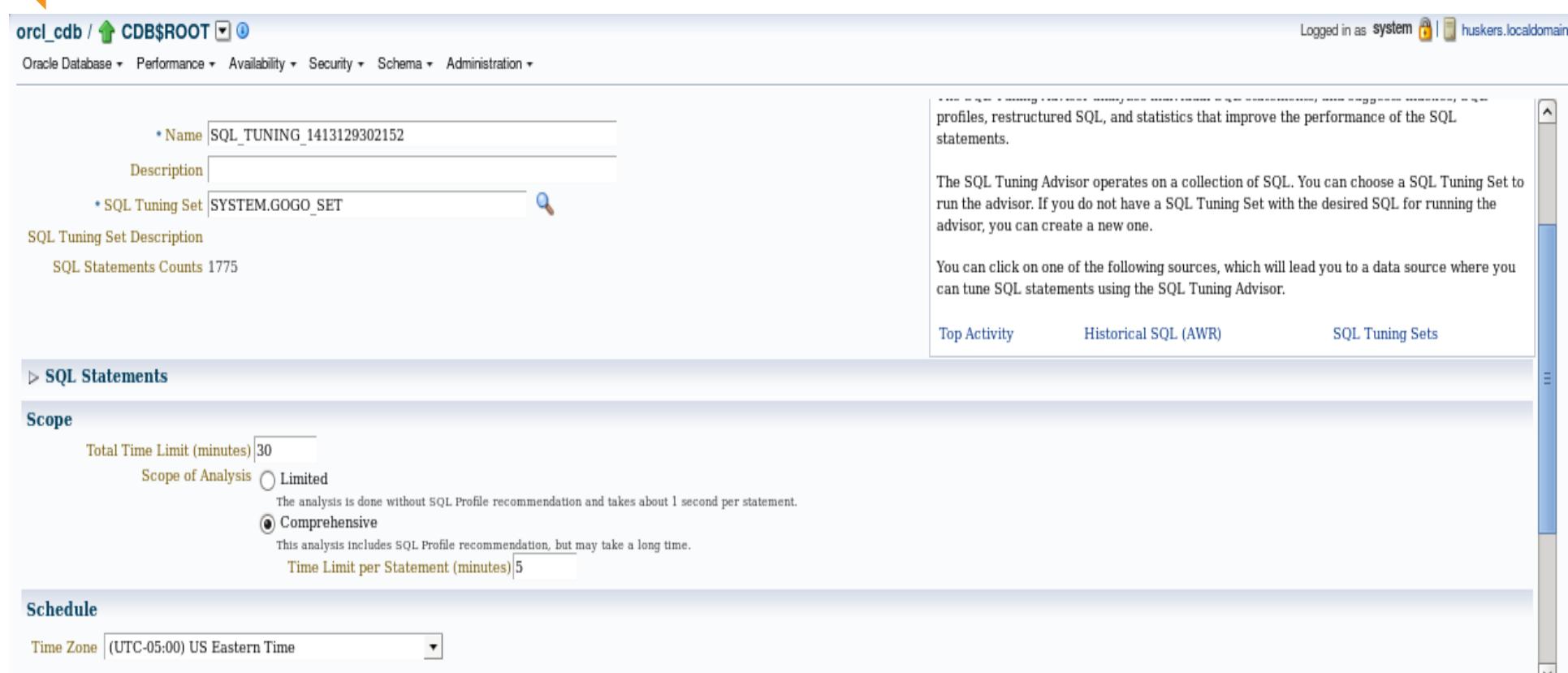
Go

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%, *) in a double-quoted string.

Select	Schema	Name	Description
<input checked="" type="radio"/>	SYSTEM	GOGO_SET	

[Cancel](#) [Select](#)

Oracle 19c Tuning Tools



The screenshot shows the Oracle Database SQL Tuning Advisor interface. At the top, the path is `orcl_cdb / CDB$ROOT`. The top right shows the user is logged in as `system` on `huskers.localdomain`.

The main area displays a configuration for a new SQL Tuning Set:

- Name:** SQL_TUNING_1413129302152
- Description:** (empty)
- SQL Tuning Set:** SYSTEM.GOGO_SET

Below this, the **SQL Tuning Set Description** section indicates there are 1775 SQL statements.

The right panel contains descriptive text and links:

- Text: "profiles, restructured SQL, and statistics that improve the performance of the SQL statements."
- Text: "The SQL Tuning Advisor operates on a collection of SQL. You can choose a SQL Tuning Set to run the advisor. If you do not have a SQL Tuning Set with the desired SQL for running the advisor, you can create a new one."
- Text: "You can click on one of the following sources, which will lead you to a data source where you can tune SQL statements using the SQL Tuning Advisor."
- Links: [Top Activity](#), [Historical SQL \(AWR\)](#), [SQL Tuning Sets](#)

The left sidebar shows the navigation tree: `> SQL Statements`.

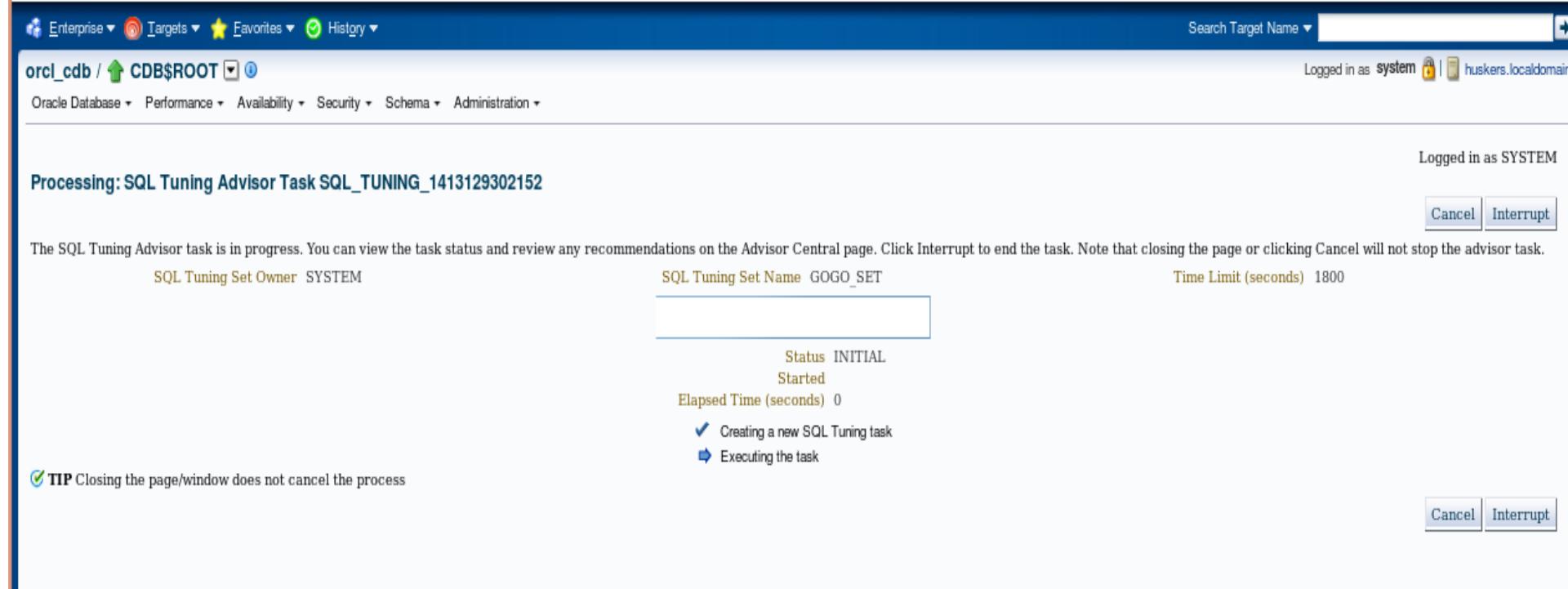
Scope settings include:

- Total Time Limit (minutes): 30
- Scope of Analysis:
 - Limited: "The analysis is done without SQL Profile recommendation and takes about 1 second per statement."
 - Comprehensive: "This analysis includes SQL Profile recommendation, but may take a long time."
- Time Limit per Statement (minutes): 5

Schedule settings include:

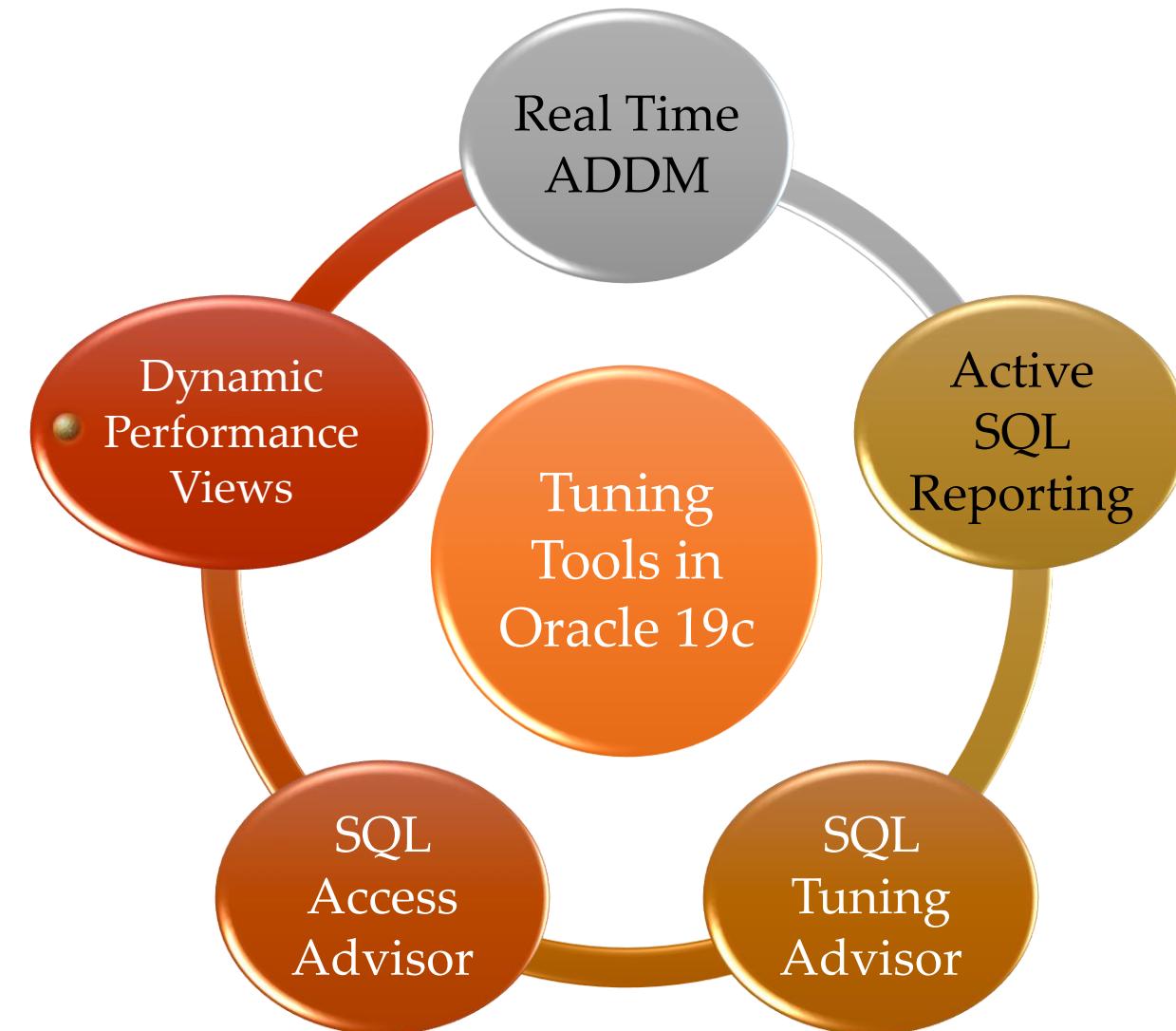
- Time Zone: (UTC-05:00) US Eastern Time

Oracle 19c Tuning Tools



The screenshot shows the Oracle Database Control interface for a CDB\$ROOT database. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The user is logged in as 'system' from 'huskers.localdomain'. The main content area displays a message: 'Processing: SQL Tuning Advisor Task SQL_TUNING_1413129302152'. Below this, a note states: 'The SQL Tuning Advisor task is in progress. You can view the task status and review any recommendations on the Advisor Central page. Click Interrupt to end the task. Note that closing the page or clicking Cancel will not stop the advisor task.' On the right, there are 'Cancel' and 'Interrupt' buttons. The task details show the owner as 'SYSTEM', the name as 'GOGO_SET', and a time limit of '1800 seconds'. The status is 'INITIAL' and it has 'Started'. The elapsed time is '0' seconds. A progress bar indicates the task is 'Creating a new SQL Tuning task' (checked) and 'Executing the task'. A tip at the bottom left notes: 'Closing the page/window does not cancel the process'.

Oracle 19c Tuning Tools



Exercise and Demo: SQL Tuning Advisor



Download the Exercise
Guide



On the Course Page
under the Materials tab



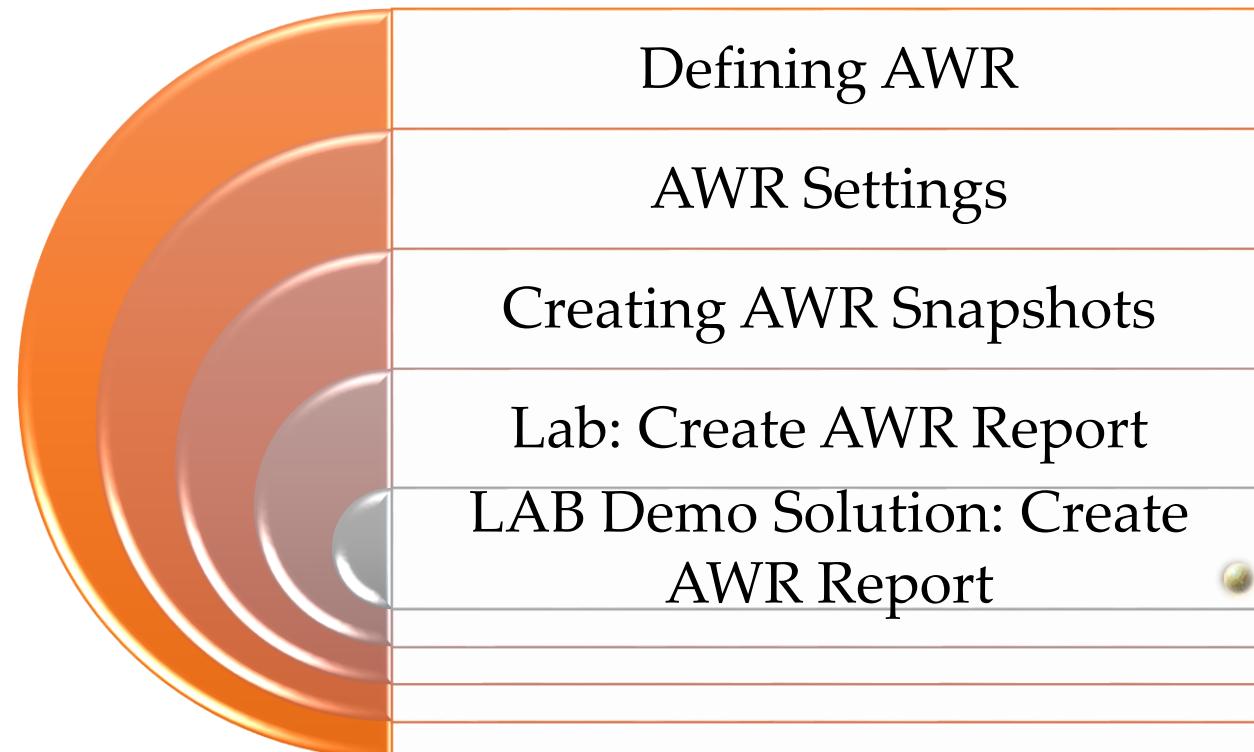
Complete the Exercise



Watch the demo
solution in the next
lesson

- Automatic Workload Repository

Lesson Topics



Automatic Workload Repository (AWR)

Provides performance related information on the Oracle Database

Hit Ratios

IO performance

Instance Performance

Sql Tuning information

Oracle 19c Using Automatic Workload Repository

AWR provides information only

Does not provide advice

Part of Oracle's Diagnostic and tuning pack

Controlled by the database parameter

- Statics_level
 - Basic disabled AWR
 - Typical default setting
 - All Advanced setting

Statistics_level =
Typical

Collects
performance
information every
hour on the hour

Stored in SYSAUX
tablespace

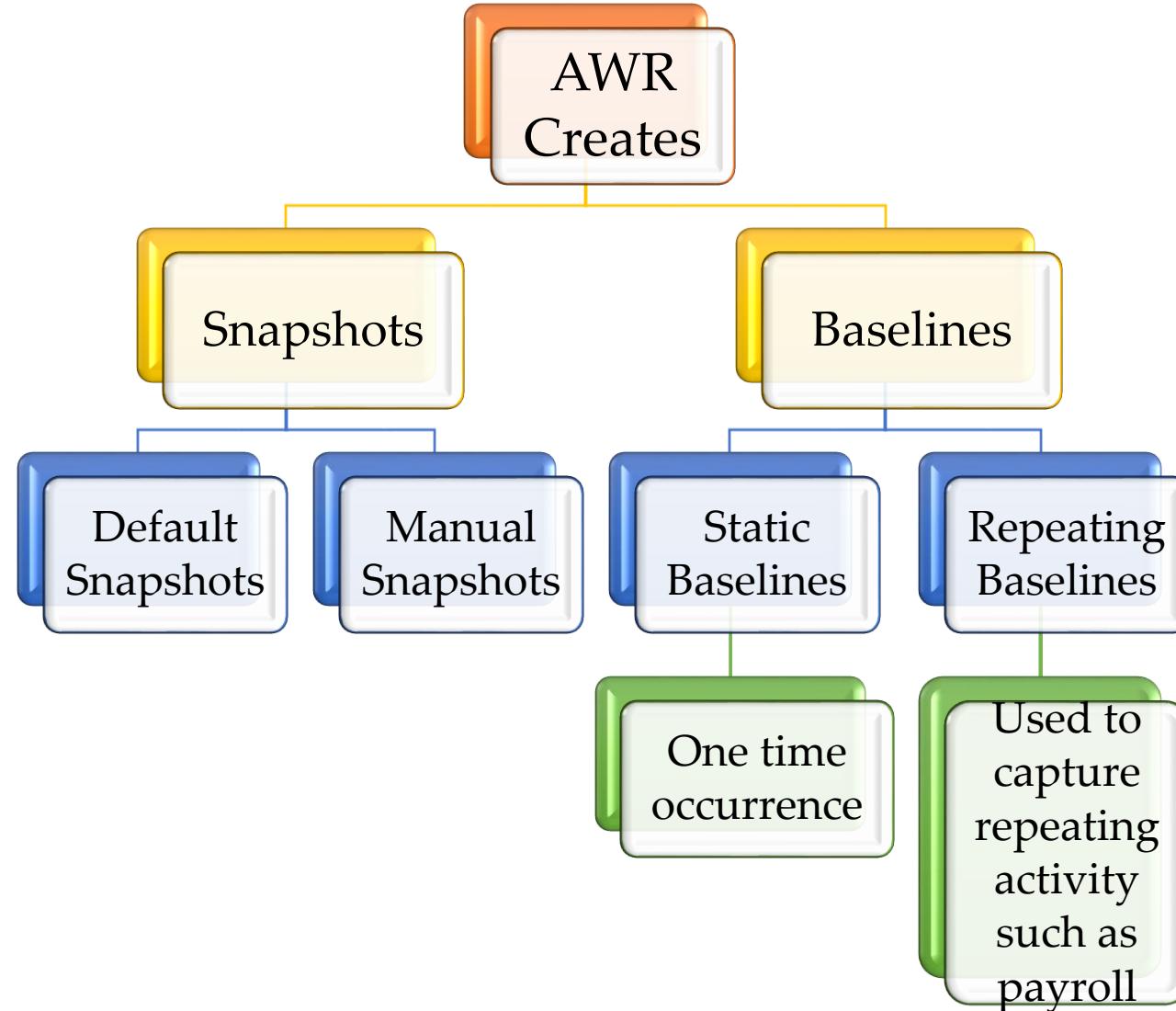
Retained for 8
days

May be used to
create baselines

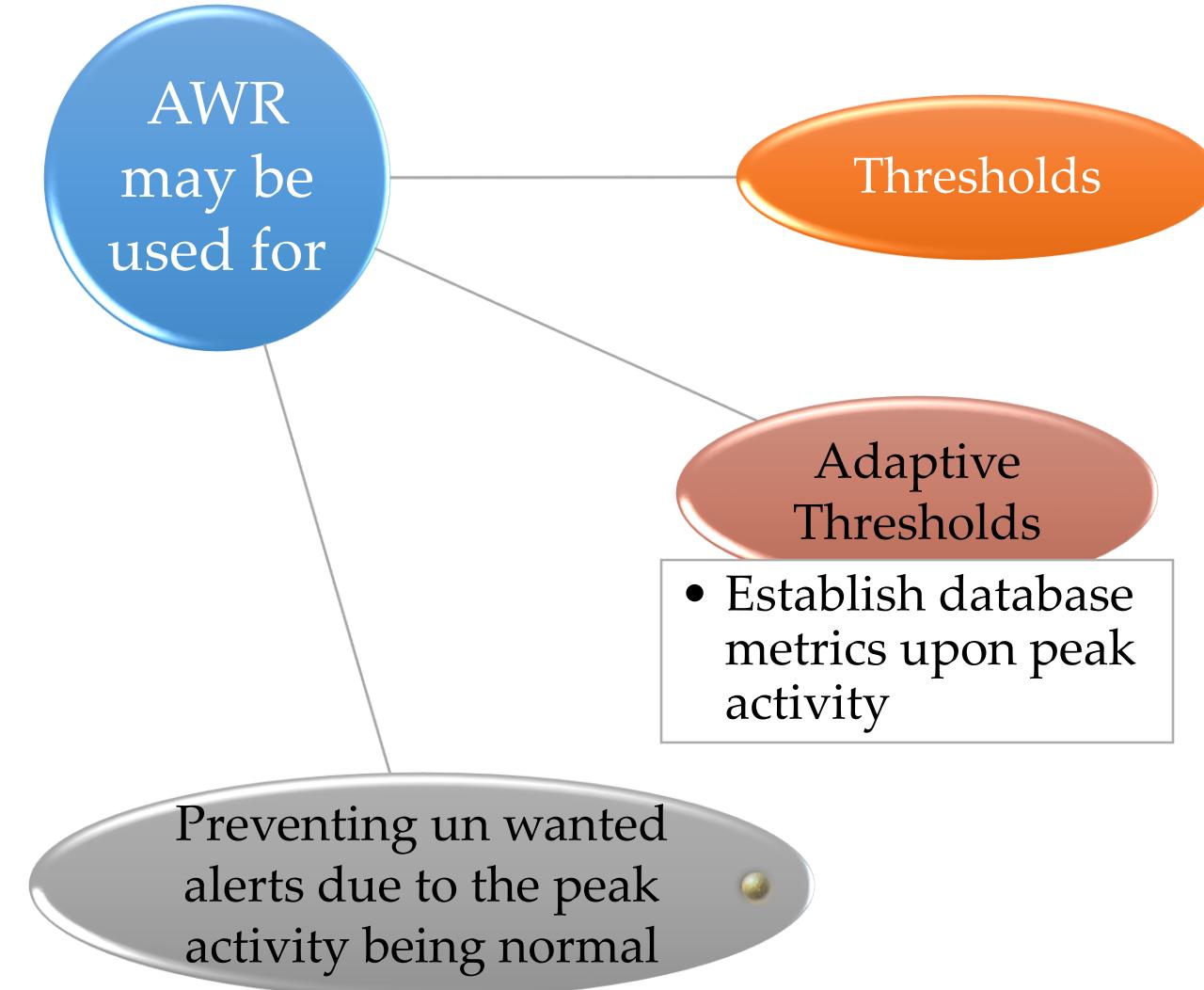
Static Baselines

Repeating
Baselines

Oracle 19c Using Automatic Workload Repository



Oracle 19c Using Automatic Workload Repository



AWR may be invoked
from

- OEM
- Operating system utility
 - AWRRPT.sql
 - \$ORACLE_HOME?rdbms/admin

Oracle 19c Using Automatic Workload Repository

AWR may be used
for

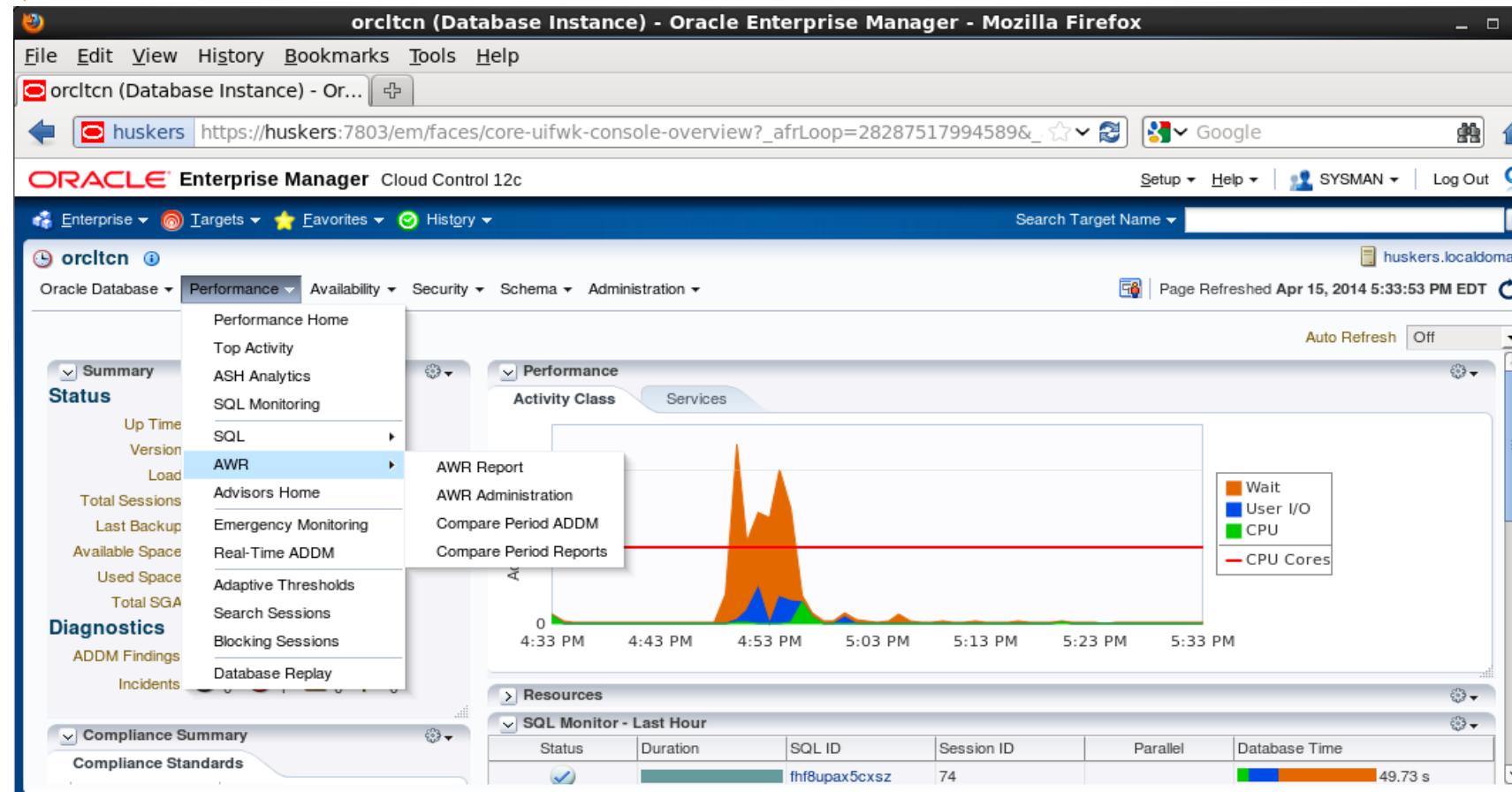
Traditional
Databases

Container
Databases

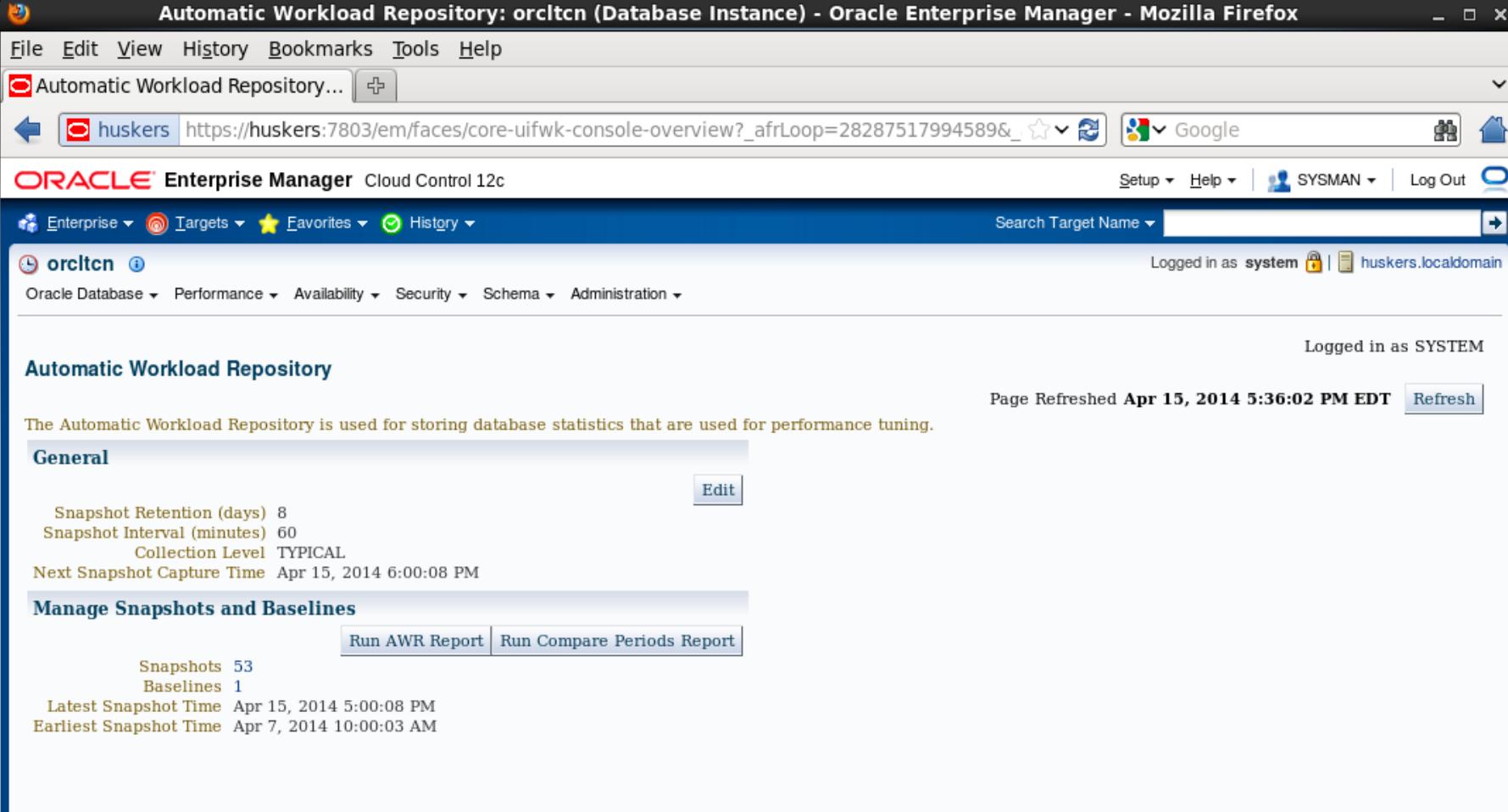
Pluggable
Databases

RAC Instances

Oracle 19c Using Automatic Workload Repository



Oracle 19c Using Automatic Workload Repository



The screenshot shows the Oracle Enterprise Manager Cloud Control 12c interface for the database instance **orcltcn**. The user is logged in as **system** from the IP address **huskers.localdomain**.

Automatic Workload Repository

The AWR is used for storing database statistics for performance tuning.

General

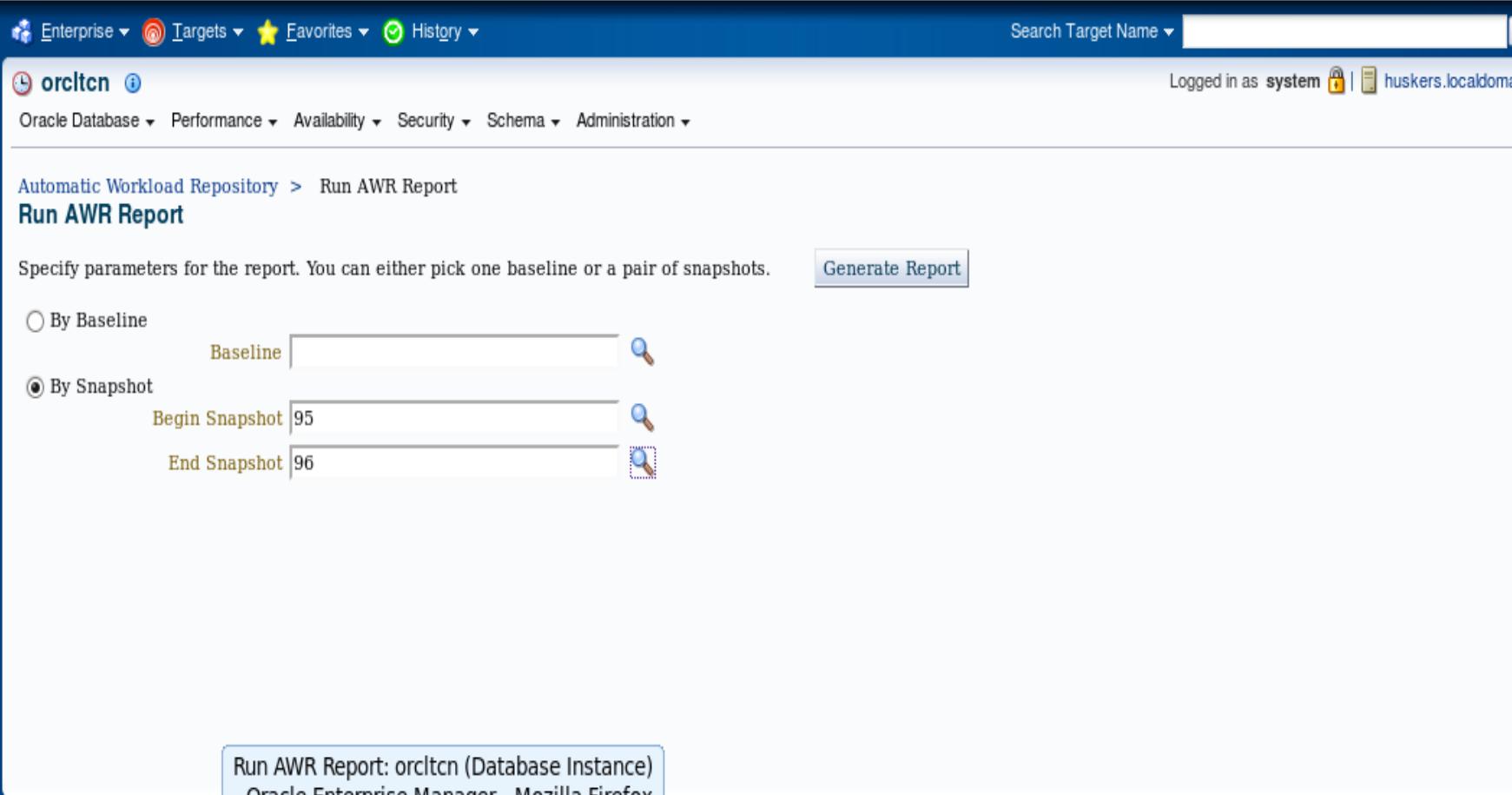
Snapshot Retention (days) 8
Snapshot Interval (minutes) 60
Collection Level TYPICAL
Next Snapshot Capture Time Apr 15, 2014 6:00:08 PM

Manage Snapshots and Baselines

Run AWR Report | Run Compare Periods Report

Snapshots 53
Baselines 1
Latest Snapshot Time Apr 15, 2014 5:00:08 PM
Earliest Snapshot Time Apr 7, 2014 10:00:03 AM

Oracle 19c Using Automatic Workload Repository

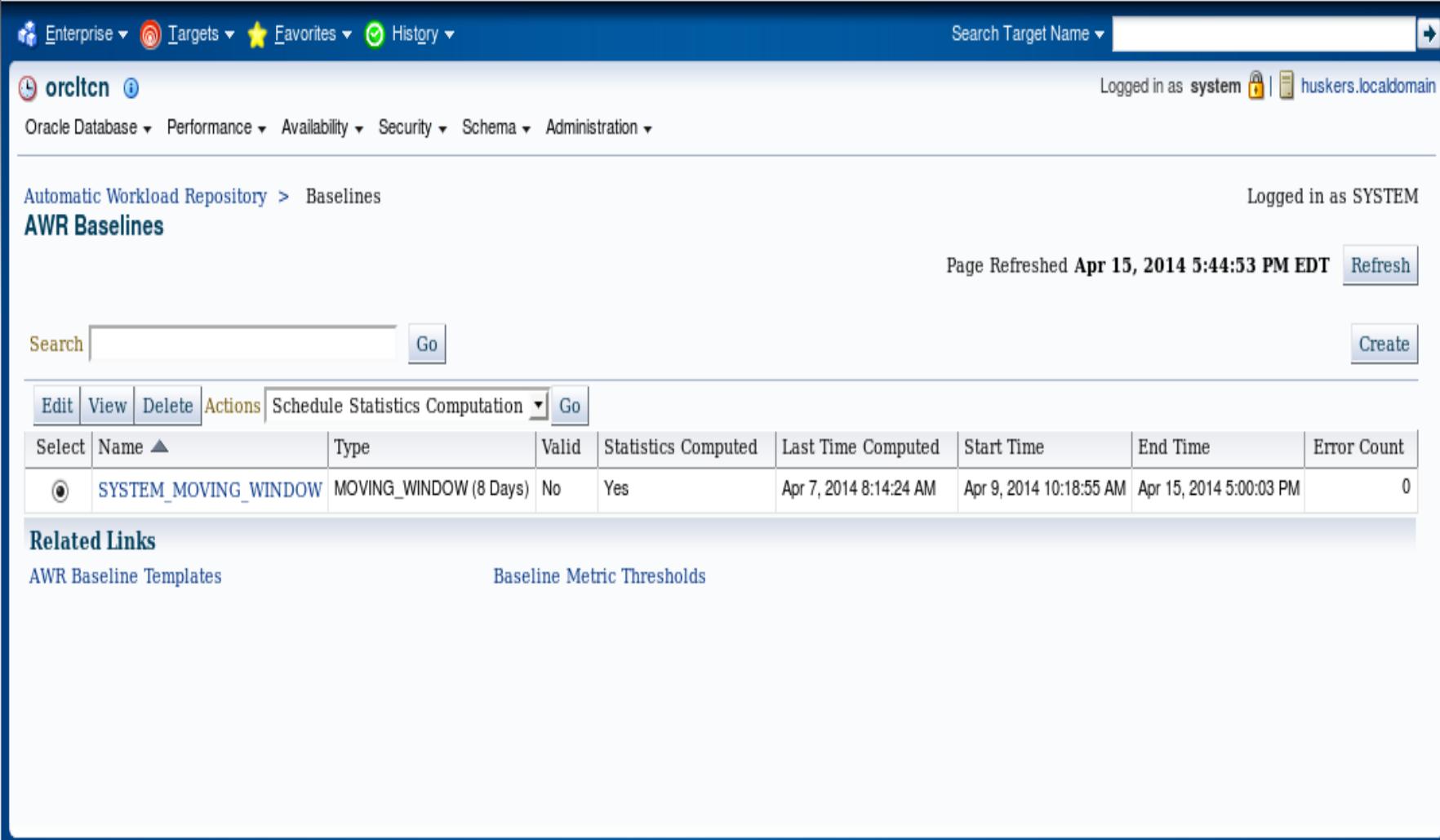


The screenshot shows the Oracle Enterprise Manager interface for running an AWR report. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The target selected is 'orcltn' (Database Instance). The user is logged in as 'system' from 'huskers.localdomain'. The main menu categories are Oracle Database, Performance, Availability, Security, Schema, and Administration.

The current page is 'Automatic Workload Repository > Run AWR Report'. The title is 'Run AWR Report'. Below it, a message says 'Specify parameters for the report. You can either pick one baseline or a pair of snapshots.' There are two options: 'By Baseline' (radio button) and 'By Snapshot' (radio button, which is selected). For 'By Baseline', there is a 'Baseline' input field with a magnifying glass icon. For 'By Snapshot', there are two input fields: 'Begin Snapshot' containing '95' and 'End Snapshot' containing '96', each with a magnifying glass icon.

At the bottom left, a status bar displays 'Run AWR Report: orcltn (Database Instance)' and '- Oracle Enterprise Manager - Mozilla Firefox'.

Oracle 19c Using Automatic Workload Repository



The screenshot shows the Oracle Enterprise Manager interface for managing AWR Baselines. The top navigation bar includes links for Enterprise, Targets, Favorites, and History, along with a search bar for target names. The user is logged in as system@huskers.localdomain. Below the navigation, the current session is identified as orcltn (orcltn). The main menu includes Oracle Database, Performance, Availability, Security, Schema, and Administration.

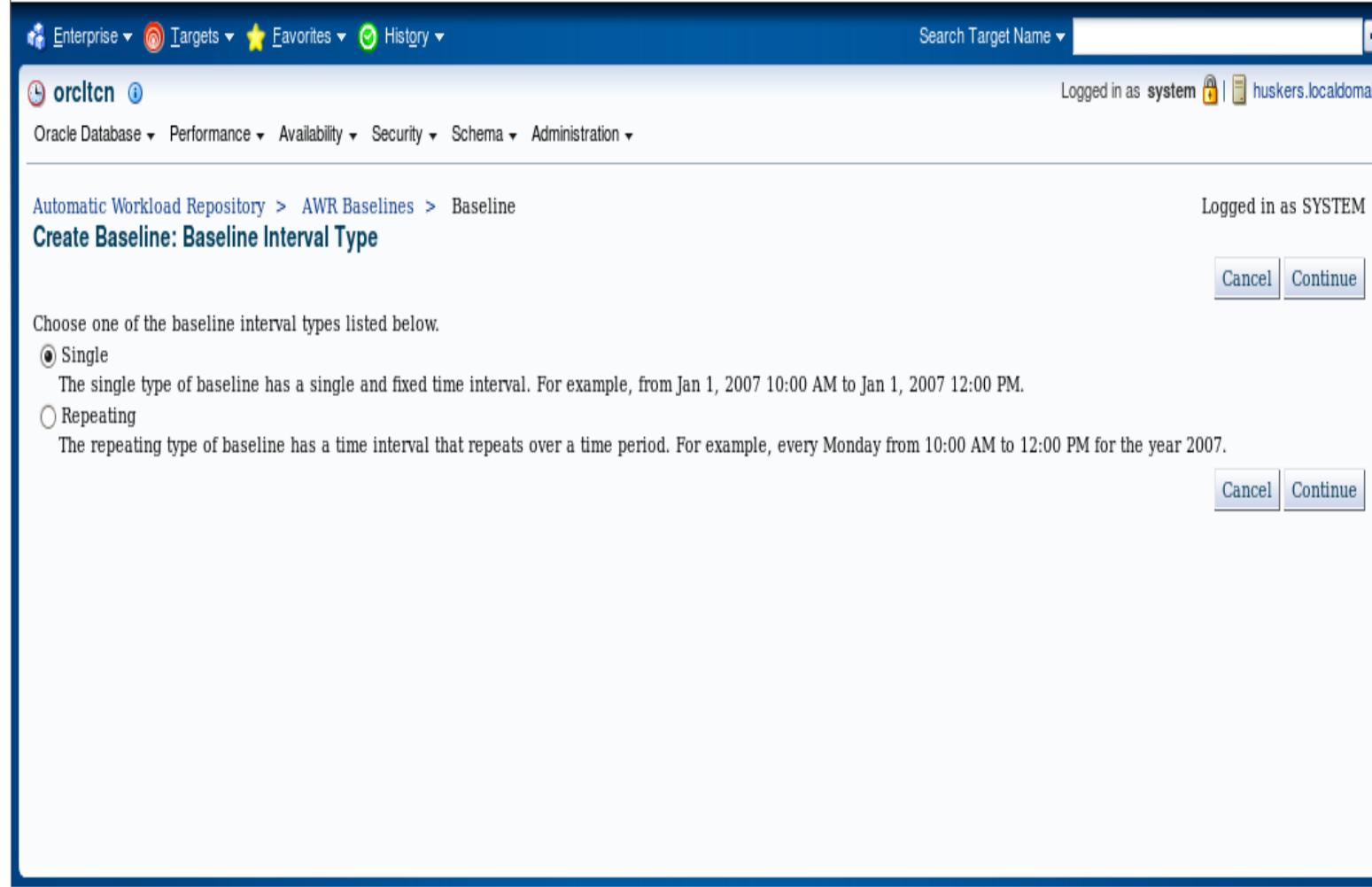
The breadcrumb navigation indicates the user is in the Automatic Workload Repository > Baselines section. The page title is "AWR Baselines". The status message "Logged in as SYSTEM" is displayed. The page was last refreshed on April 15, 2014, at 5:44:53 PM EDT, with a "Refresh" button nearby.

Below the title, there is a search bar and a "Create" button. A toolbar with buttons for Edit, View, Delete, Actions, Schedule Statistics Computation, and Go is present. A table lists the existing baseline, showing details such as Name, Type, Valid status, Statistics Computed, Last Time Computed, Start Time, End Time, and Error Count. The listed baseline is "SYSTEM_MOVING_WINDOW" of type "MOVING_WINDOW (8 Days)".

Related links include "AWR Baseline Templates" and "Baseline Metric Thresholds".

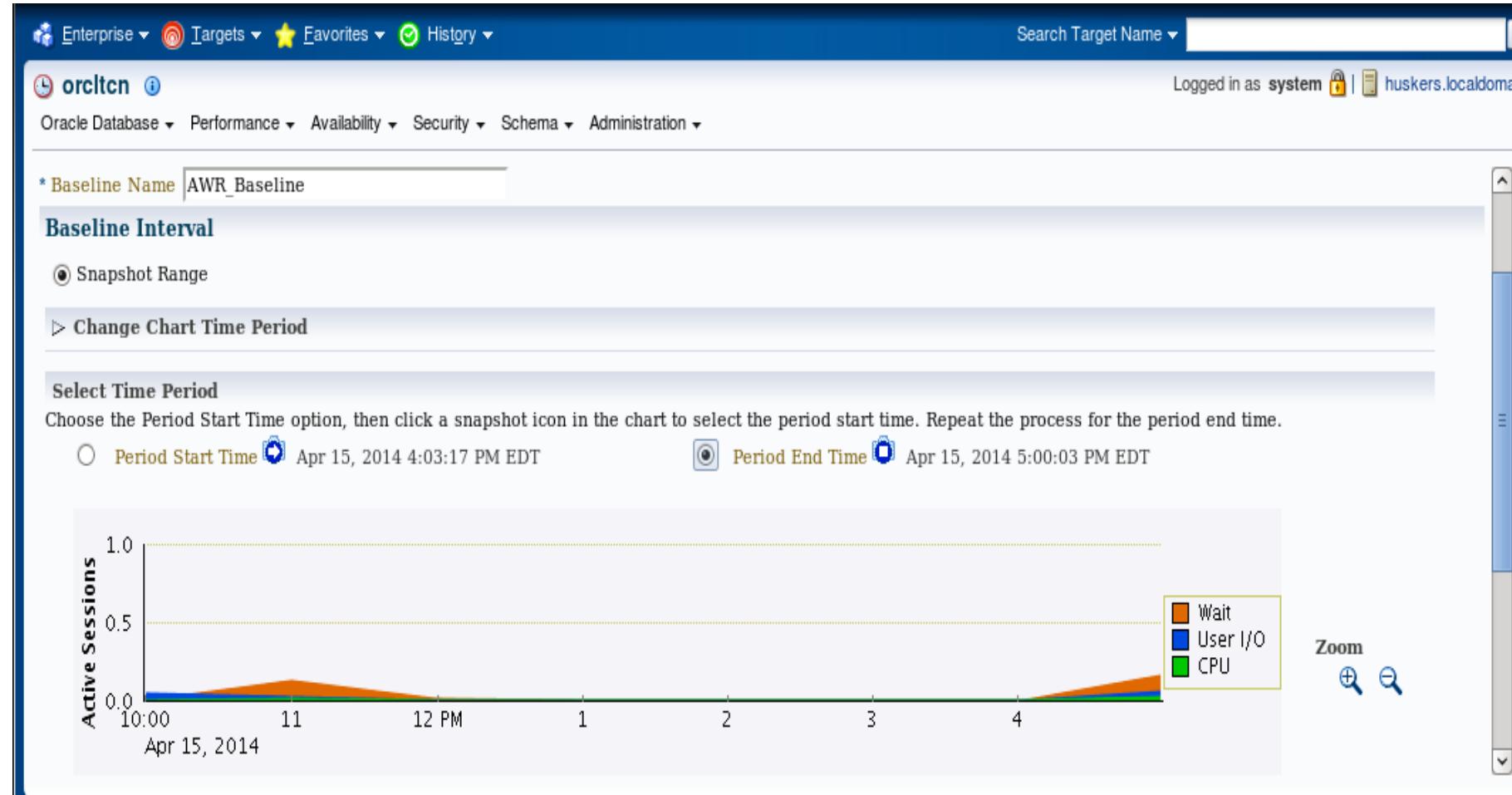
Select	Name ▲	Type	Valid	Statistics Computed	Last Time Computed	Start Time	End Time	Error Count
	SYSTEM_MOVING_WINDOW	MOVING_WINDOW (8 Days)	No	Yes	Apr 7, 2014 8:14:24 AM	Apr 9, 2014 10:18:55 AM	Apr 15, 2014 5:00:03 PM	0

Oracle 19c Using Automatic Workload Repository

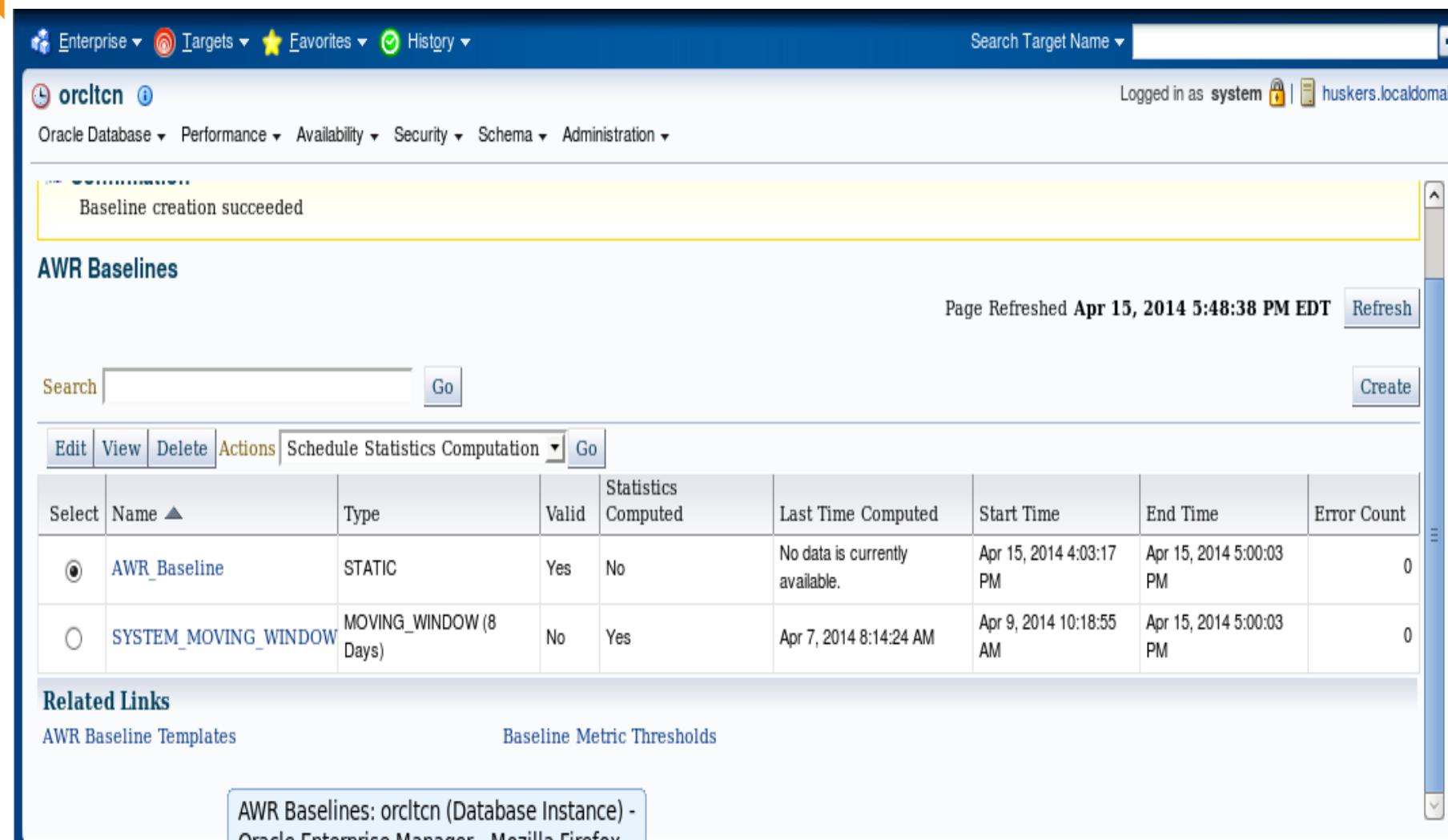


The screenshot shows the Oracle Database AWR Baseline creation interface. At the top, there is a navigation bar with links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. Below the navigation bar, the target is identified as 'orcltn' and the user is logged in as 'system' on 'huskers.localdomain'. The main menu includes Oracle Database, Performance, Availability, Security, Schema, and Administration. The current path is 'Automatic Workload Repository > AWR Baselines > Baseline'. The page title is 'Create Baseline: Baseline Interval Type'. There are two buttons at the bottom right: 'Cancel' and 'Continue'. The main content area asks to choose a baseline interval type, with 'Single' selected. A description follows: 'The single type of baseline has a single and fixed time interval. For example, from Jan 1, 2007 10:00 AM to Jan 1, 2007 12:00 PM.' An alternative option, 'Repeating', is also listed with its description: 'The repeating type of baseline has a time interval that repeats over a time period. For example, every Monday from 10:00 AM to 12:00 PM for the year 2007.'

Oracle 19c Using Automatic Workload Repository



Oracle 19c Using Automatic Workload Repository



The screenshot shows the Oracle Enterprise Manager interface for the database instance **orcitcn**. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The user is logged in as **system** from **huskers.localdomain**.

The main menu at the top has options: Oracle Database, Performance, Availability, Security, Schema, and Administration.

A message box at the top states: **Baseline creation succeeded**.

The page title is **AWR Baselines**. The status message indicates the page was refreshed on **Apr 15, 2014 5:48:38 PM EDT**.

Below the title, there is a search bar and a 'Create' button. A toolbar below the search bar includes buttons for Edit, View, Delete, Actions, Schedule Statistics Computation, and Go.

A table lists the AWR Baselines:

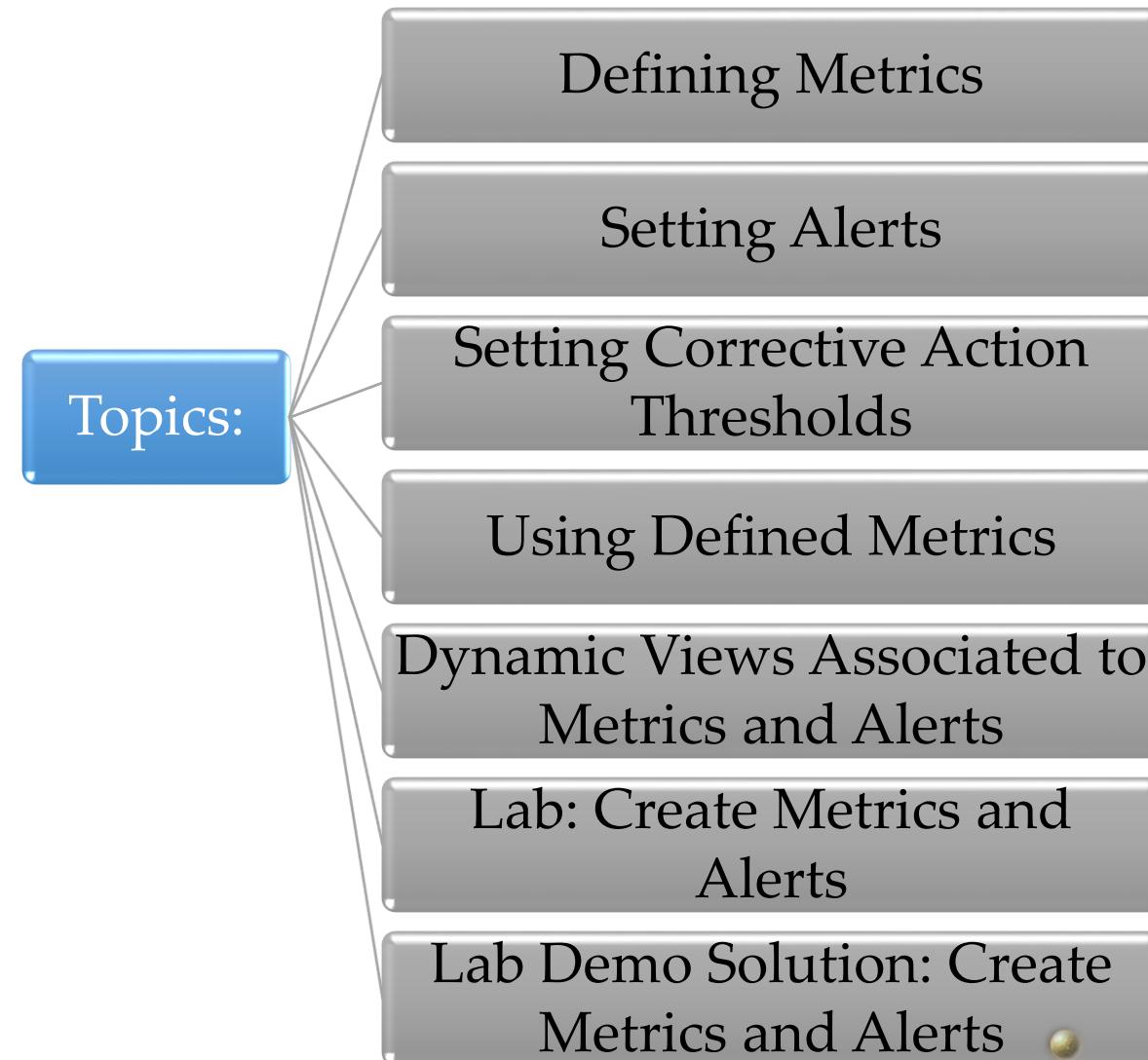
Select	Name ▲	Type	Valid	Statistics Computed	Last Time Computed	Start Time	End Time	Error Count
<input checked="" type="radio"/>	AWR_Baseline	STATIC	Yes	No	No data is currently available.	Apr 15, 2014 4:03:17 PM	Apr 15, 2014 5:00:03 PM	0
<input type="radio"/>	SYSTEM_MOVING_WINDOW	MOVING_WINDOW (8 Days)	No	Yes	Apr 7, 2014 8:14:24 AM	Apr 9, 2014 10:18:55 AM	Apr 15, 2014 5:00:03 PM	0

Related Links include [AWR Baseline Templates](#) and [Baseline Metric Thresholds](#).

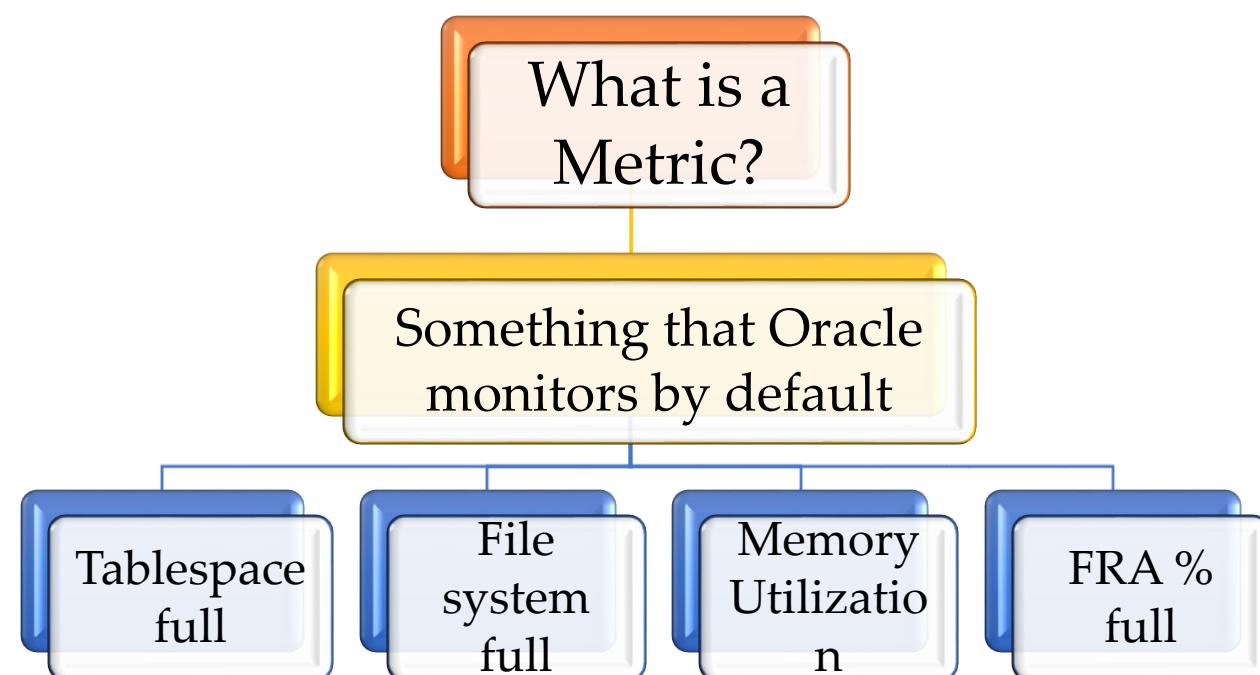
The bottom status bar shows the URL: [AWR Baselines: orcitcn \(Database Instance\) - Oracle Enterprise Manager - Mozilla Firefox](#).

- Metrics and Alerts

Lesson Topics



Oracle 19c Metrics, Alerts, and Thresholds



Oracle 19c Metrics, Alerts, and Thresholds

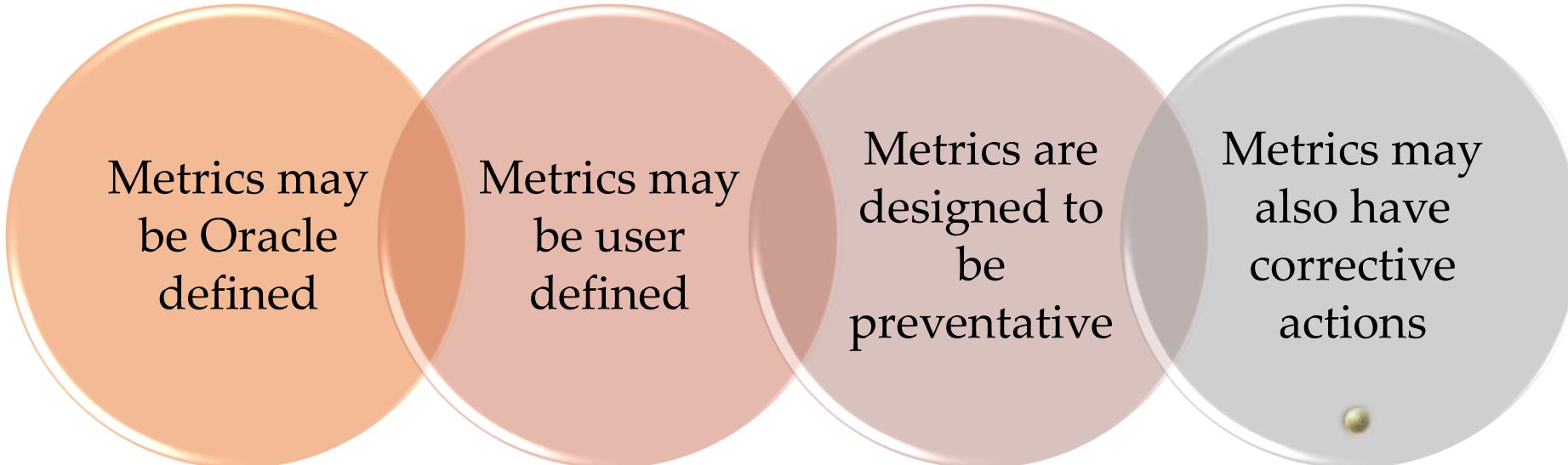
There are several Oracle defined metrics

Metrics refer to issues that may prevent the Oracle database from operating correctly

Each metric may have threshold settings

- Warning
- Critical
- System unavailable

Oracle 19c Metrics, Alerts, and Thresholds



Metrics may
be Oracle
defined

Metrics may
be user
defined

Metrics are
designed to
be
preventative

Metrics may
also have
corrective
actions

Oracle 19c Metrics, Alerts, and Thresholds

Thresholds are assigned to metrics

Thresholds and alerts are at the same level

Warning Threshold

Warning Alert

Critical Threshold

Critical Alert

Oracle 19c Metrics, Alerts, and Thresholds

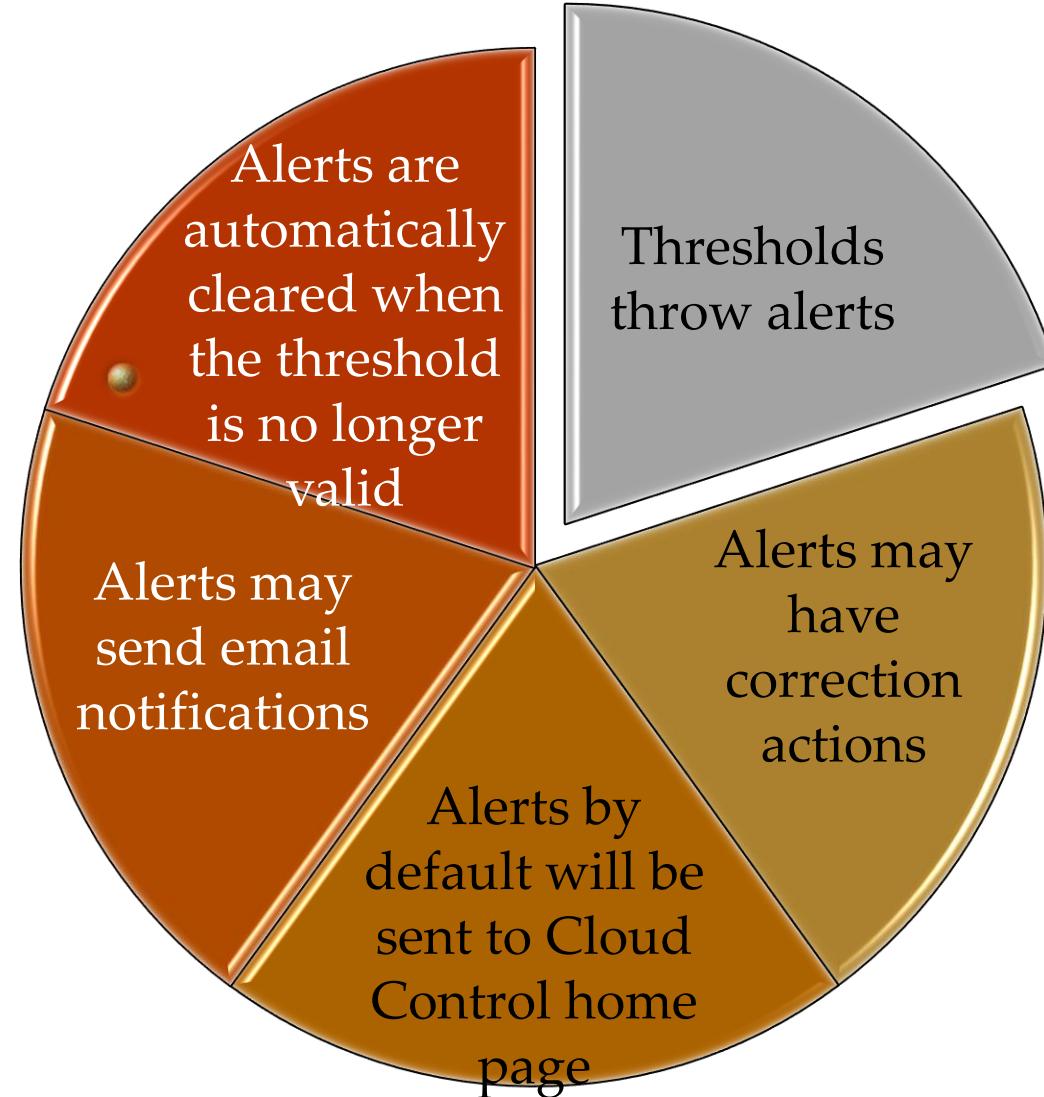
- Something is about to break but not mission critical

Warning
Threshold

- Immediate action needs to be taken to prevent system failure

Critical
Threshold

Oracle 19c Metrics, Alerts, and Thresholds



Oracle 19c Metrics, Alerts, and Thresholds

Alerts may be tied to a notification schedule

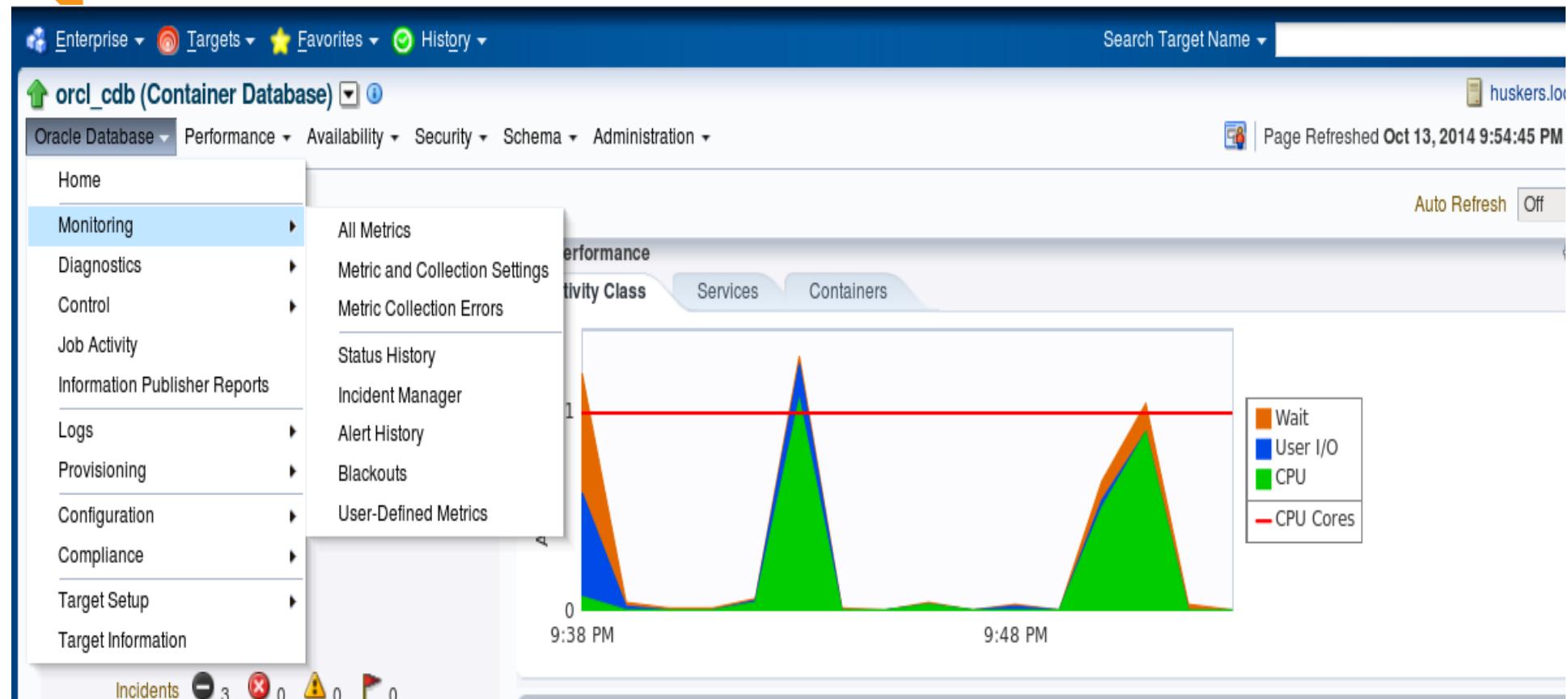
Notification schedules and notification rules may be established

Notification schedule may be based on DBA on-call schedule

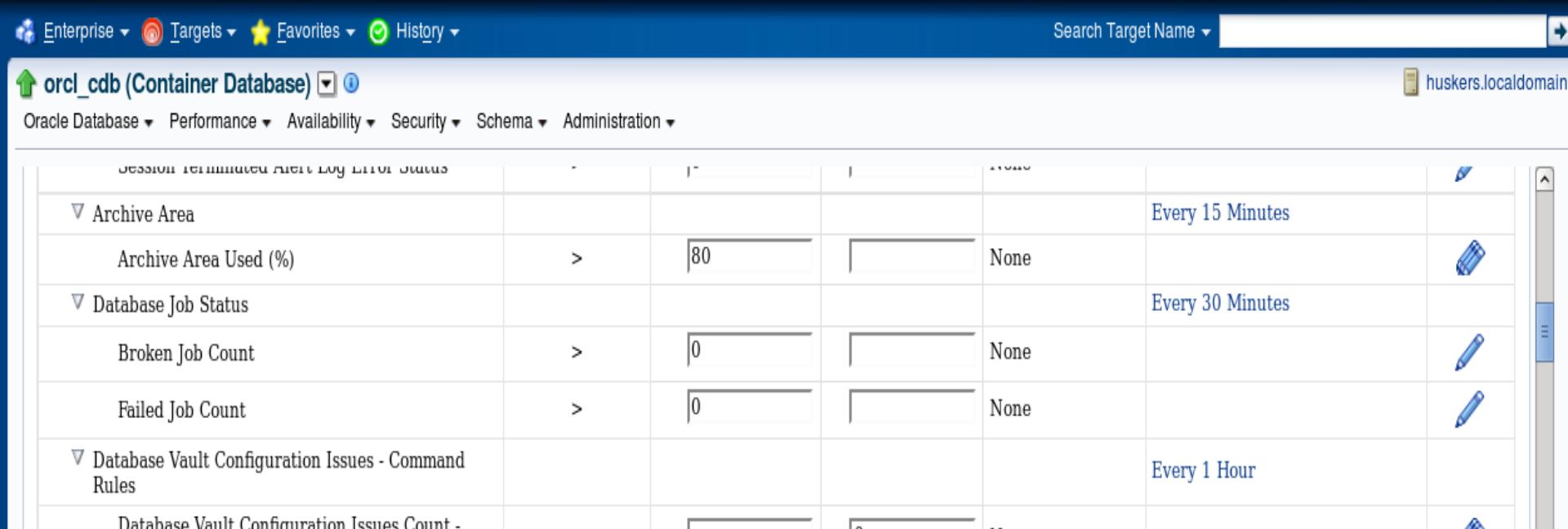
Metrics may be set up at

- Container databases
- Pluggable databases

Oracle 19c Metrics, Alerts, and Thresholds



Oracle 19c Metrics, Alerts, and Thresholds



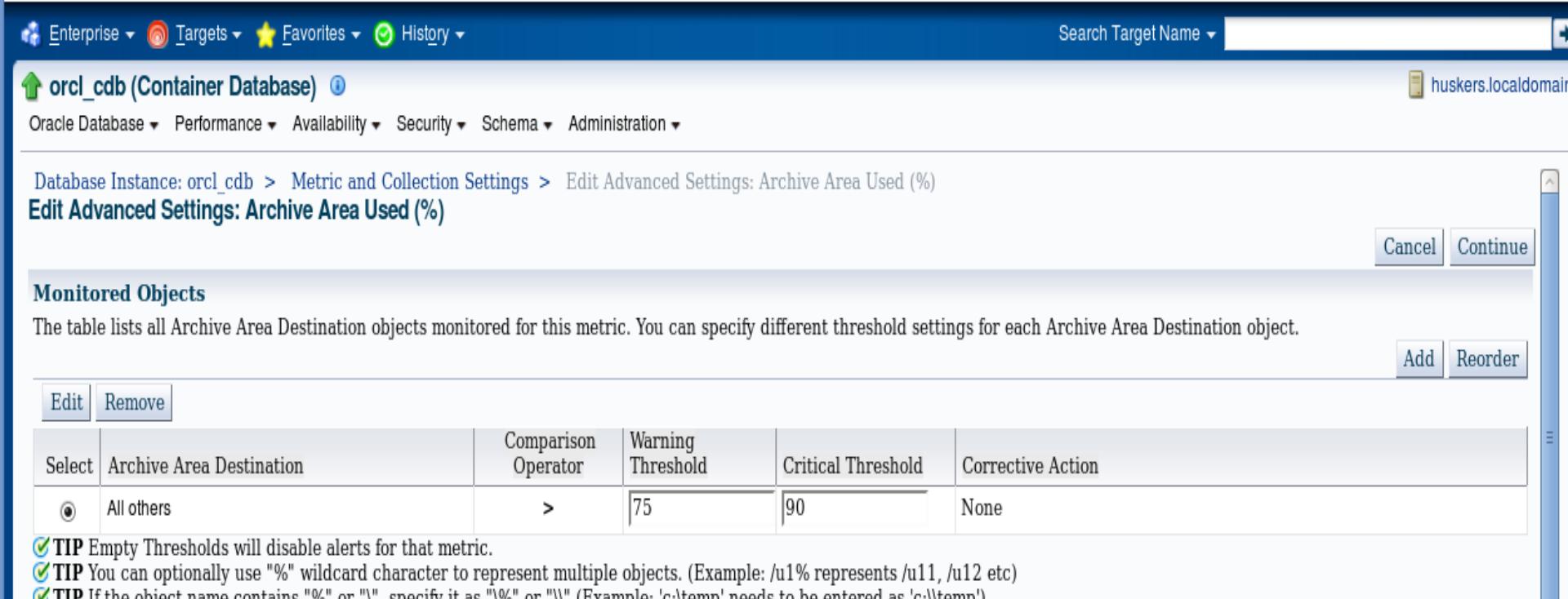
The screenshot shows the Oracle Enterprise Manager interface for the target 'orcl_cdb (Container Database)'. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The target name 'orcl_cdb (Container Database)' is displayed along with its status icon and a help button. The main menu below the navigation bar includes Oracle Database, Performance, Availability, Security, Schema, and Administration.

The main content area displays a table of metrics, alerts, and thresholds:

SESSION TERMINATED WITH LOG ERROR STATUS				
▼ Archive Area				
Archive Area Used (%)	>	80	80	None
▼ Database Job Status				
Broken Job Count	>	0	0	None
Failed Job Count	>	0	0	None
▼ Database Vault Configuration Issues - Command Rules				
Database Vault Configuration Issues Count -	.	10	10	Every 1 Hour

Each row in the table includes edit and delete icons. The 'Every 15 Minutes' threshold is highlighted in blue.

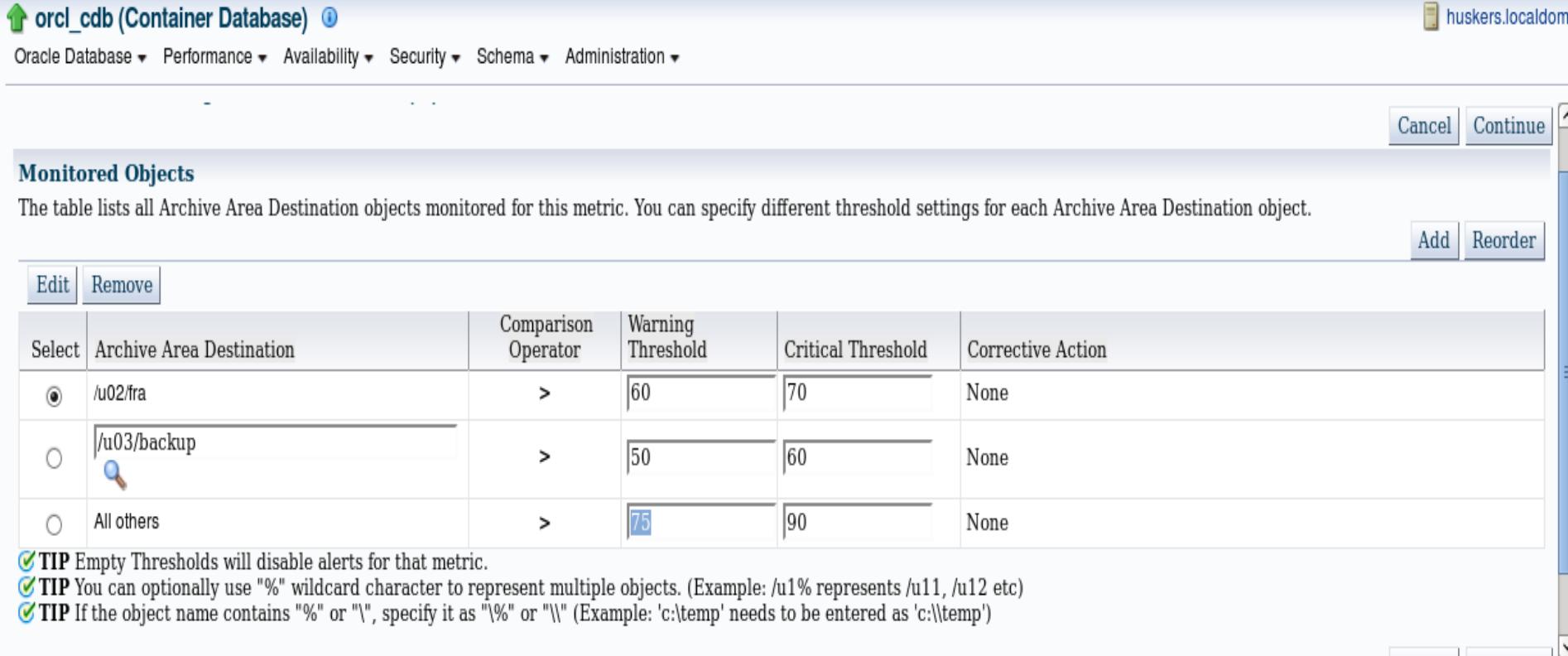
Oracle 19c Metrics, Alerts, and Thresholds



The screenshot shows the Oracle Database Control interface for the 'orcl_cdb (Container Database)'. The navigation path is: Oracle Database > Performance > Availability > Edit Advanced Settings: Archive Area Used (%). The dialog title is 'Edit Advanced Settings: Archive Area Used (%)'. It contains a table titled 'Monitored Objects' with columns: Select, Archive Area Destination, Comparison Operator, Warning Threshold, Critical Threshold, and Corrective Action. A single row is selected with the value 'All others' in the 'Archive Area Destination' column, ' > ' in 'Comparison Operator', '75' in 'Warning Threshold', '90' in 'Critical Threshold', and 'None' in 'Corrective Action'. At the bottom, there are three TIP notes:

- TIP Empty Thresholds will disable alerts for that metric.
- TIP You can optionally use "%" wildcard character to represent multiple objects. (Example: /u1% represents /u11, /u12 etc)
- TIP If the object name contains "%" or "\", specify it as "\%" or "\\\" (Example: 'c:\temp' needs to be entered as 'c:\\temp')

Oracle 19c Metrics, Alerts, and Thresholds



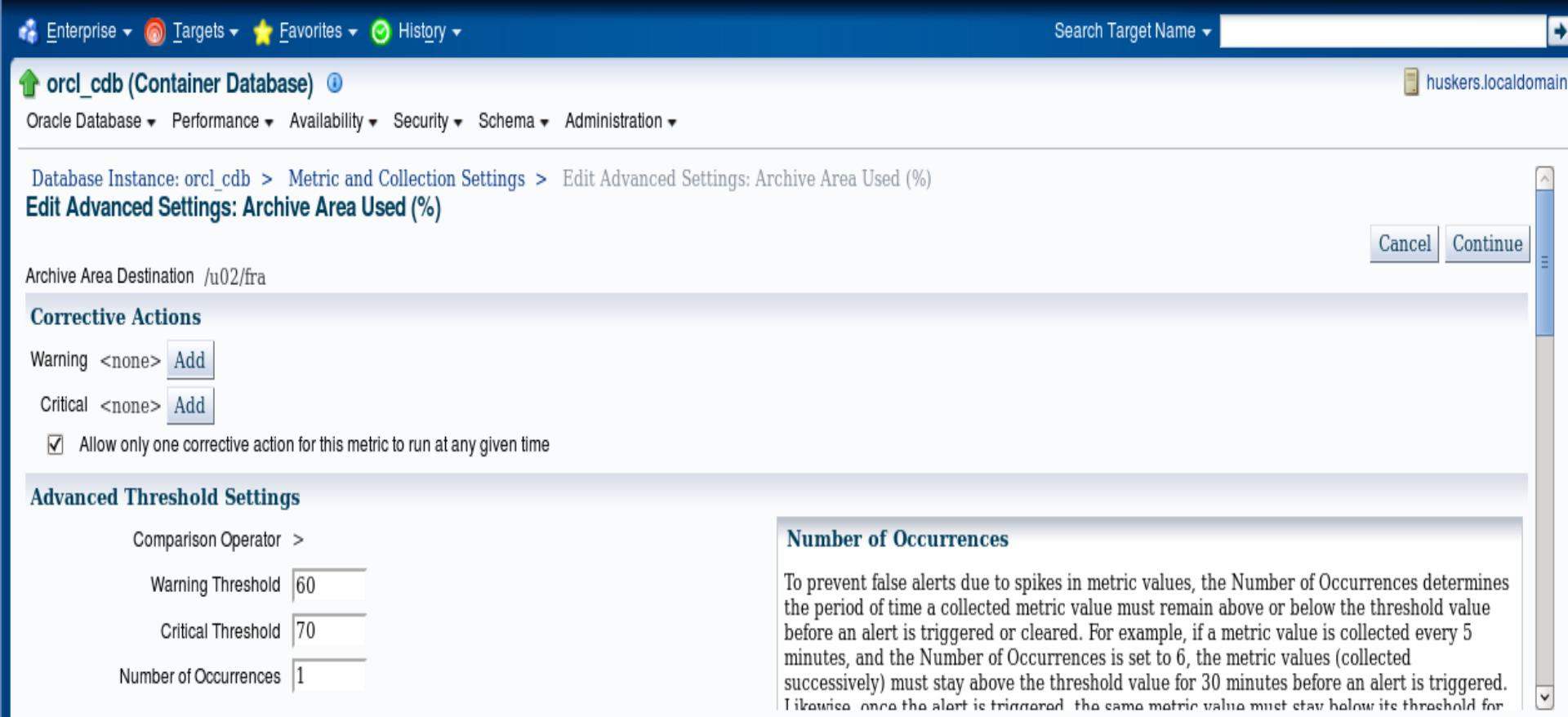
The screenshot shows the Oracle Database 19c interface for managing monitored objects. The title bar indicates the database is `orcl_cdb (Container Database)`. The main content area is titled "Monitored Objects" and displays a table of archive area destination objects being monitored. The table columns are: Select, Archive Area Destination, Comparison Operator, Warning Threshold, Critical Threshold, and Corrective Action. Three rows are listed:

Select	Archive Area Destination	Comparison Operator	Warning Threshold	Critical Threshold	Corrective Action
<input checked="" type="radio"/>	/u02/fra	>	60	70	None
<input type="radio"/>	/u03/backup	>	50	60	None
<input type="radio"/>	All others	>	75	90	None

Below the table, there are three TIP (Tip) items:

-  **TIP** Empty Thresholds will disable alerts for that metric.
-  **TIP** You can optionally use "%" wildcard character to represent multiple objects. (Example: /u1% represents /u11, /u12 etc)
-  **TIP** If the object name contains "%" or "\", specify it as "%\" or "\\\" (Example: 'c:\temp' needs to be entered as 'c:\\temp')

Oracle 19c Metrics, Alerts, and Thresholds



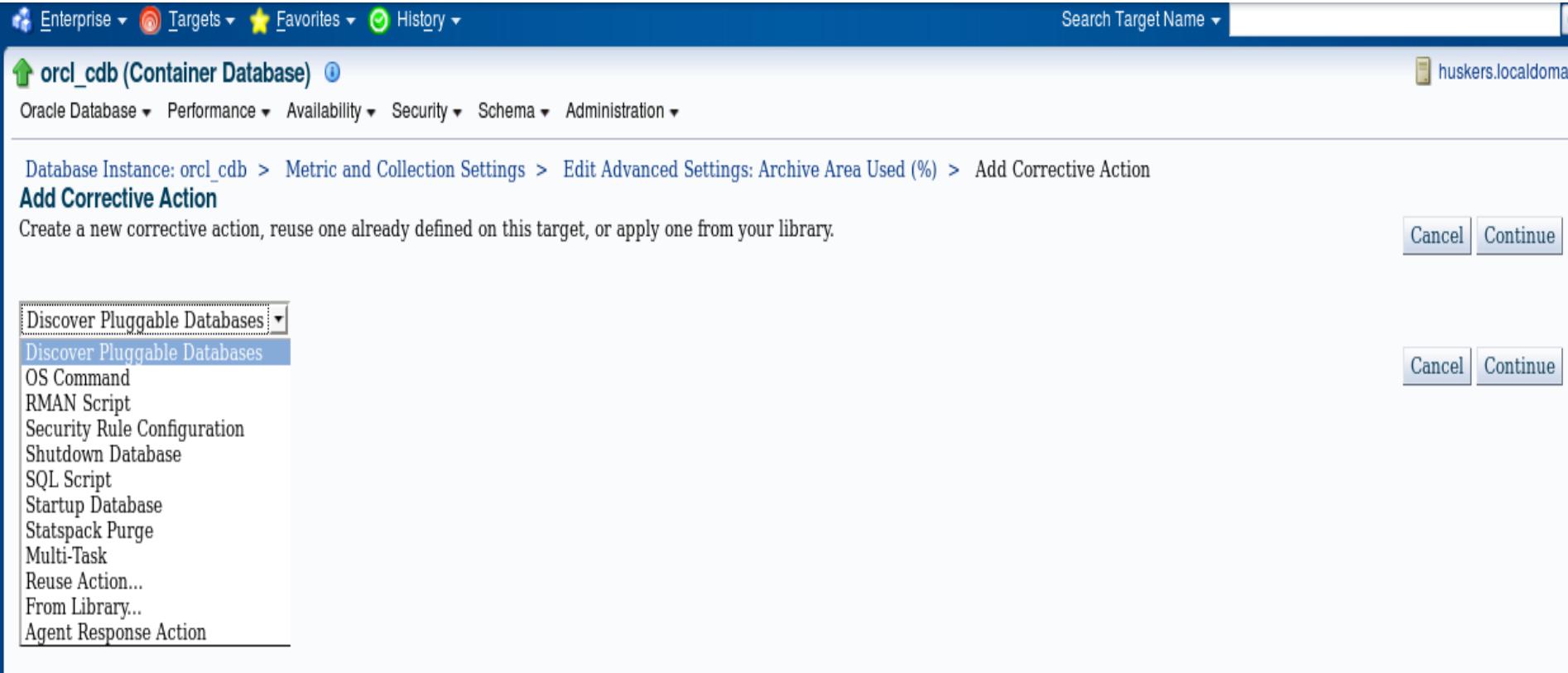
The screenshot shows the Oracle Database Control interface for managing metrics. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The target selected is 'orcl_cdb (Container Database)'. The main menu items are Oracle Database, Performance, Availability, Security, Schema, and Administration.

The current page is 'Edit Advanced Settings: Archive Area Used (%)' under 'Metric and Collection Settings' for the database instance 'orcl_cdb'. The left sidebar lists corrective actions: 'Warning <none>' and 'Critical <none>', each with an 'Add' button. A checked checkbox allows only one corrective action per metric.

The 'Advanced Threshold Settings' section contains fields for the comparison operator (>), warning threshold (60), critical threshold (70), and number of occurrences (1).

The 'Number of Occurrences' section provides a detailed explanation of how alerts are triggered based on the number of consecutive metric values exceeding a threshold over a period of time.

Oracle 19c Metrics, Alerts, and Thresholds



The screenshot shows the Oracle Enterprise Manager interface for managing a Container Database (orcl_cdb). The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for target names. The current target is 'orcl_cdb (Container Database)'. The main menu below the navigation bar includes Oracle Database, Performance, Availability, Security, Schema, and Administration.

The breadcrumb navigation path is: Database Instance: orcl_cdb > Metric and Collection Settings > Edit Advanced Settings: Archive Area Used (%) > Add Corrective Action.

The main content area is titled 'Add Corrective Action' and contains the instruction: 'Create a new corrective action, reuse one already defined on this target, or apply one from your library.' At the bottom right are 'Cancel' and 'Continue' buttons.

A dropdown menu on the left is expanded to show various corrective action types:

- Discover Pluggable Databases
- Discover Pluggable Databases (selected)
- OS Command
- RMAN Script
- Security Rule Configuration
- Shutdown Database
- SQL Script
- Startup Database
- Statspack Purge
- Multi-Task
- Reuse Action...
- From Library...
- Agent Response Action

Oracle 19c Metrics, Alerts, and Thresholds

Advanced Threshold Settings

Comparison Operator >

Warning Threshold

Critical Threshold

Number of Occurrences

Collection Schedule Every 15 Minutes

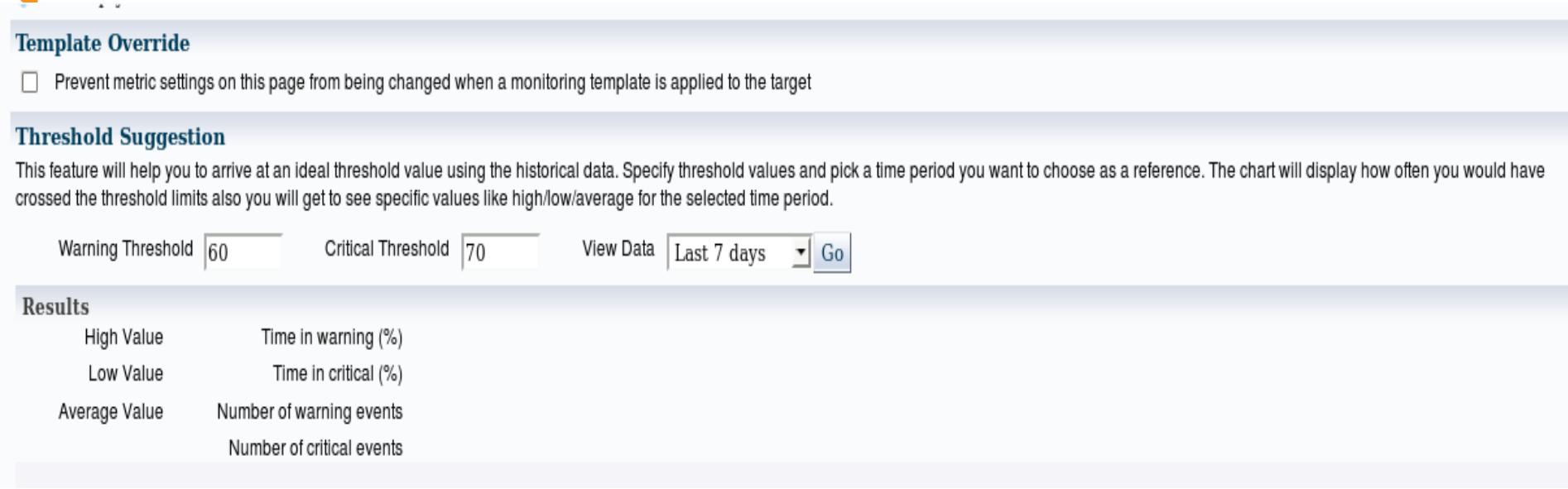
Time before alert is triggered/cleared 15 Minutes

 **TIP** Empty Thresholds will disable alerts for that metric.

Number of Occurrences

To prevent false alerts due to spikes in metric values, the Number of Occurrences determines the period of time a collected metric value must remain above or below the threshold value before an alert is triggered or cleared. For example, if a metric value is collected every 5 minutes, and the Number of Occurrences is set to 6, the metric values (collected successively) must stay above the threshold value for 30 minutes before an alert is triggered. Likewise, once the alert is triggered, the same metric value must stay below its threshold for 6 consecutive occurrences (30 minutes) before it is cleared. For server-generated alerts, the evaluation frequency is determined by Oracle Database internals. Server Evaluation Frequency is used, instead of Collection Schedule.

Oracle 19c Metrics, Alerts, and Thresholds



The screenshot shows a web-based monitoring interface for Oracle 19c. At the top left is a large orange arrow pointing left. Below it, the title "Template Override" is followed by a checkbox labeled "Prevent metric settings on this page from being changed when a monitoring template is applied to the target". A section titled "Threshold Suggestion" explains how it helps users determine ideal threshold values based on historical data. It includes input fields for "Warning Threshold" (60), "Critical Threshold" (70), and a "View Data" dropdown set to "Last 7 days" with a "Go" button. The "Results" section provides summary statistics:

High Value	Time in warning (%)
Low Value	Time in critical (%)
Average Value	Number of warning events
	Number of critical events

Oracle 19c Metrics, Alerts, and Thresholds



▼ Archive Area					Every 15 Minutes
▼ Archive Area Used (%)					
/u02/fra	>	60	70	None	
/u03/backup	>	50	60	None	
All others	>	75	90	None	

Oracle 19c Metrics, Alerts, and Thresholds

Oracle Dynamic Performance views also contain information about metrics

v\$metric

v\$metric_history

v\$metricname

Oracle 19c Metrics, Alerts, and Thresholds

```
SQL> desc v$metric
```

Name	Null?	Type
BEGIN_TIME		DATE
END_TIME		DATE
INTSIZE_CSEC		NUMBER
GROUP_ID		NUMBER
ENTITY_ID		NUMBER
ENTITY_SEQUENCE		NUMBER
METRIC_ID		NUMBER
METRIC_NAME		VARCHAR2(64)
VALUE		NUMBER
METRIC_UNIT		VARCHAR2(64)
CON_ID		NUMBER

Oracle 19c Metrics, Alerts, and Thresholds

```
SQL> desc v$metric_history
```

Name	Null?	Type
BEGIN_TIME		DATE
END_TIME		DATE
INTSIZE_CSEC		NUMBER
GROUP_ID		NUMBER
ENTITY_ID		NUMBER
ENTITY_SEQUENCE		NUMBER
METRIC_ID		NUMBER
METRIC_NAME		VARCHAR2(64)
VALUE		NUMBER
METRIC_UNIT		VARCHAR2(64)
CON_ID		NUMBER

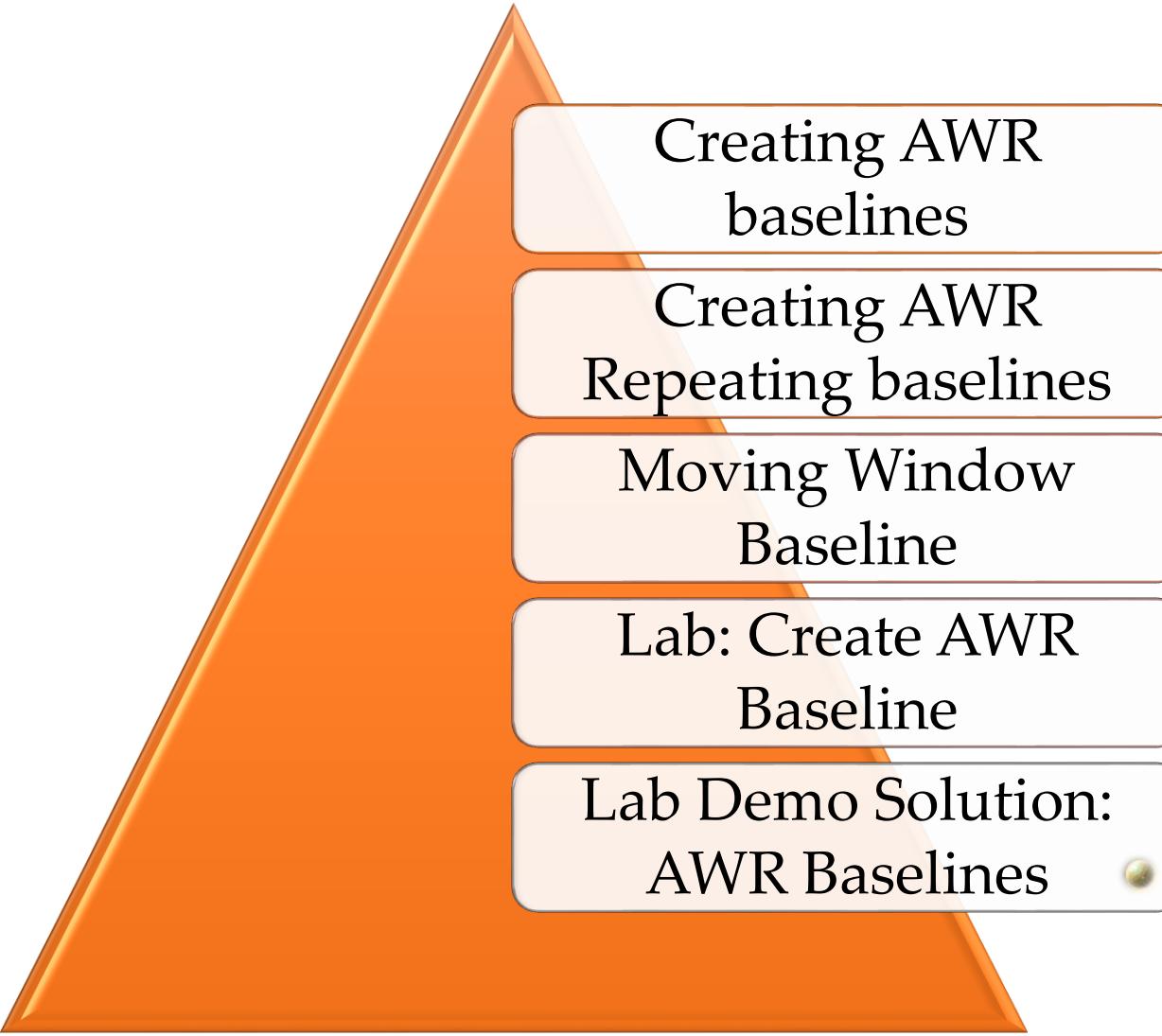
Oracle 19c Metrics, Alerts, and Thresholds

```
SQL> desc v$metricname
```

Name	Null?	Type
GROUP_ID		NUMBER
GROUP_NAME		VARCHAR2(64)
METRIC_ID		NUMBER
METRIC_NAME		VARCHAR2(64)
METRIC_UNIT		VARCHAR2(64)
CON_ID		NUMBER

- AWR Baselines

Lesson Topics



Creating AWR
baselines

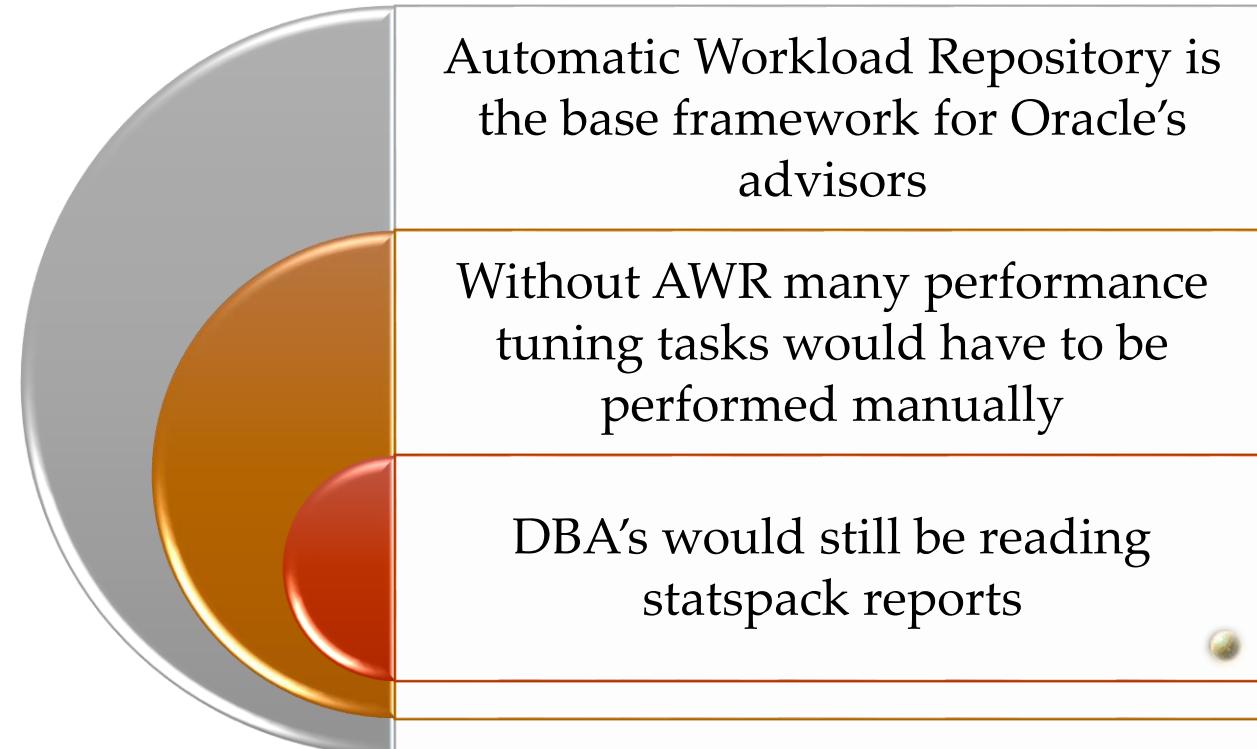
Creating AWR
Repeating baselines

Moving Window
Baseline

Lab: Create AWR
Baseline

Lab Demo Solution:
AWR Baselines

Oracle 19c AWR Baselines



Oracle 19c AWR Baselines





Oracle 19c AWR Baselines

What is a AWR baseline



A static point in time that may
be referenced at a later date

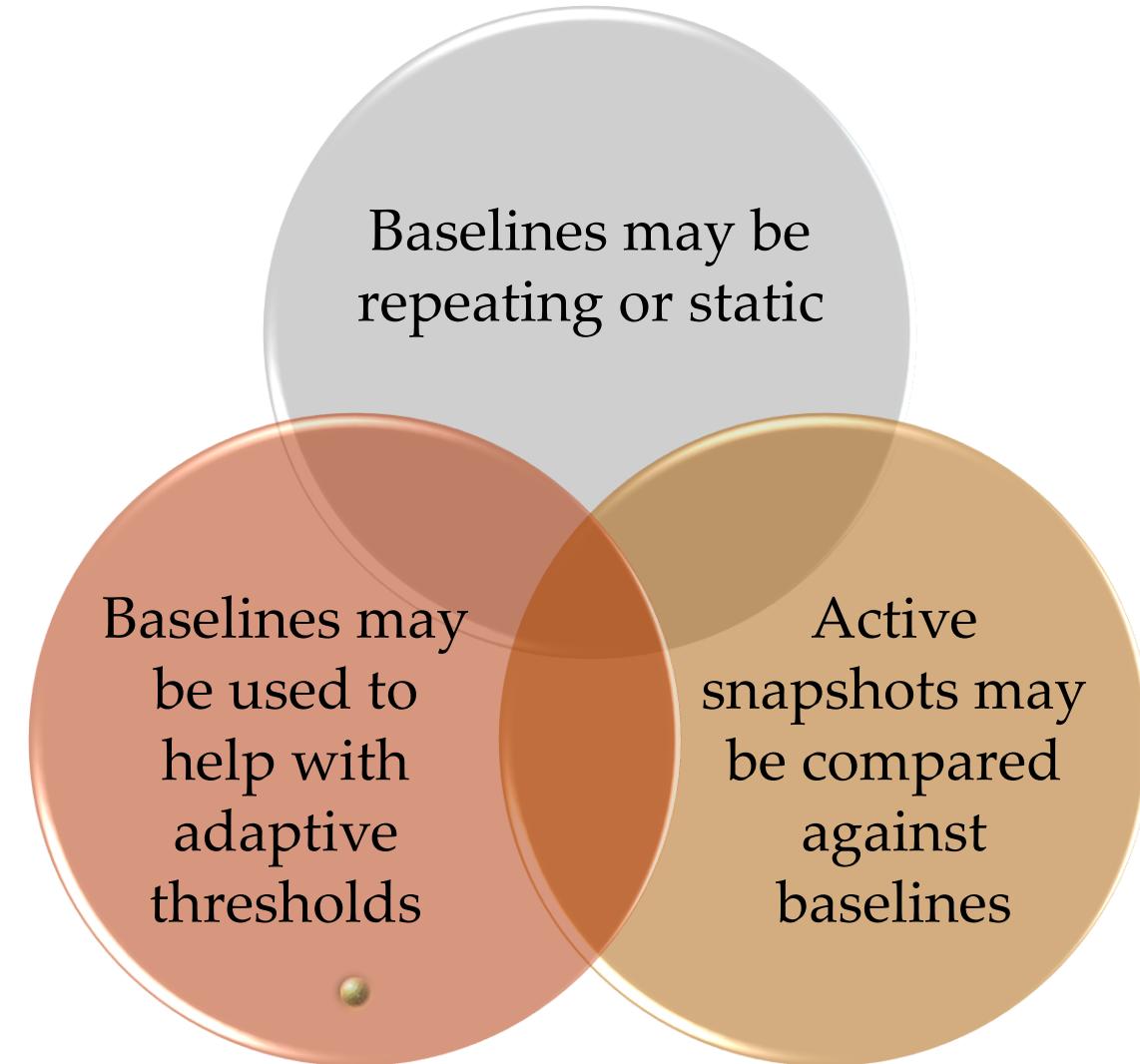


Used as a comparison point



May be kept forever

Oracle 19c AWR Baselines





Oracle 19c AWR Baselines

Baselines may be created at intervals

Create a baseline every payroll run

Compare a good
payroll run versus a
bas payroll run

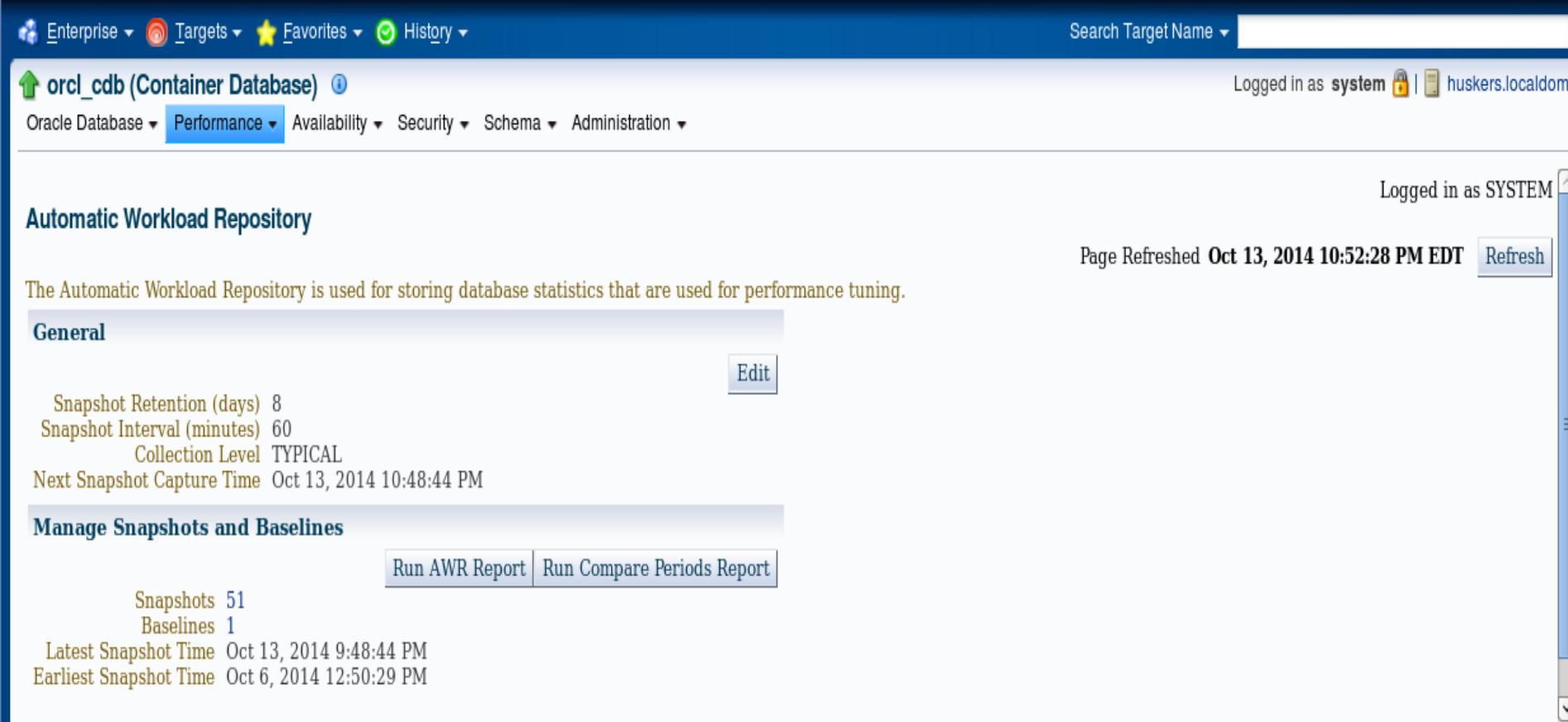
In Oracle 10g
referred to as
preserved snapshot
sets

Oracle 19c AWR Baselines

The screenshot shows the Oracle Database Control interface for a container database named 'orcl cdb'. The top navigation bar includes links for Enterprise, Targets, Favorites, and History, along with a search bar for target names. The main menu is set to 'Performance' mode. On the left, a sidebar lists 'Database Instances' and 'Metric and Collection Settings'. Under 'Metrics', the 'AWR' section is selected, displaying options like 'AWR Report' and 'AWR Administration'. The main content area is titled 'Collection Settings' and contains a table for managing baselines. The table has columns for 'Baseline Name', 'Warning Threshold', 'Critical Threshold', 'Corrective Actions', and 'Collection Schedule'. One row is visible, showing a baseline named 'Disabled' with 'Warning Threshold' and 'Critical Threshold' both set to 'None'.

Baseline Name	Warning Threshold	Critical Threshold	Corrective Actions	Collection Schedule
Disabled				

Oracle 19c AWR Baselines



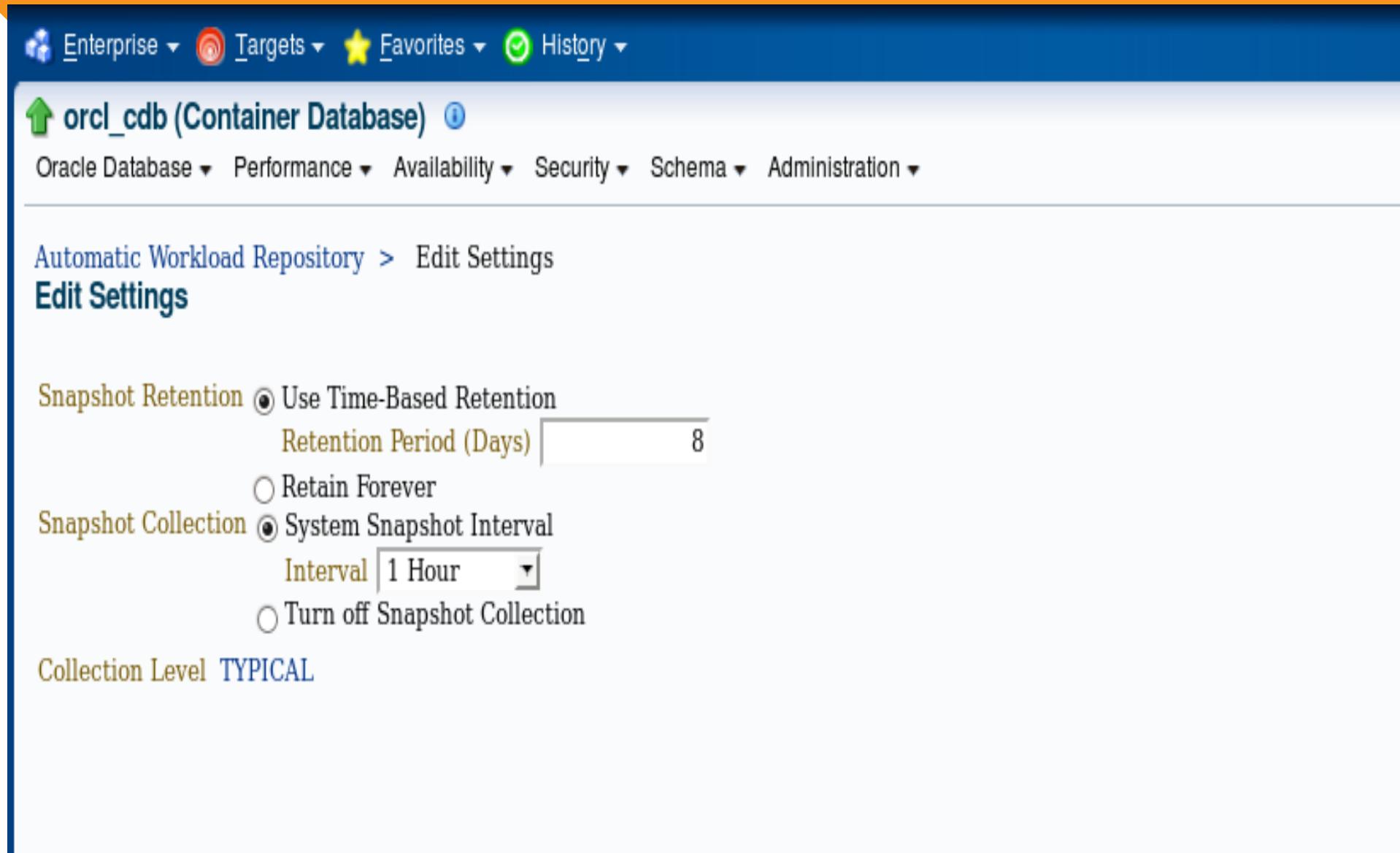
The screenshot shows the Oracle Database Automatic Workload Repository (AWR) Baselines page for the **orcl_cdb (Container Database)**. The page is titled "Automatic Workload Repository".

Key details from the page:

- General** settings:
 - Snapshot Retention (days): 8
 - Snapshot Interval (minutes): 60
 - Collection Level: TYPICAL
 - Next Snapshot Capture Time: Oct 13, 2014 10:48:44 PM
- Manage Snapshots and Baselines** section:
 - Buttons: Run AWR Report | Run Compare Periods Report
 - Snapshots: 51
 - Baselines: 1
 - Latest Snapshot Time: Oct 13, 2014 9:48:44 PM
 - Earliest Snapshot Time: Oct 6, 2014 12:50:29 PM

The page is logged in as **system** on **huskers.localdomain** and **SYSTEM**.

Oracle 19c AWR Baselines



The screenshot shows the Oracle Database AWR Baseline Settings page for the container database 'orcl_cdb'. The top navigation bar includes links for Enterprise, Targets, Favorites, and History. Below the navigation is the database name 'orcl_cdb (Container Database)' with a green upward arrow icon. A secondary navigation bar below the main title includes links for Oracle Database, Performance, Availability, Security, Schema, and Administration.

The main content area displays the 'Edit Settings' section for the AWR baseline. It includes configuration for Snapshot Retention and Snapshot Collection.

Snapshot Retention: The 'Use Time-Based Retention' option is selected. The 'Retention Period (Days)' input field contains the value '8'. There are also two other options: 'Retain Forever' (radio button) and 'Turn off Snapshot Collection' (radio button).

Snapshot Collection: The 'System Snapshot Interval' option is selected. The 'Interval' dropdown menu shows '1 Hour' as the current setting. There is also an option 'Turn off Snapshot Collection' (radio button).

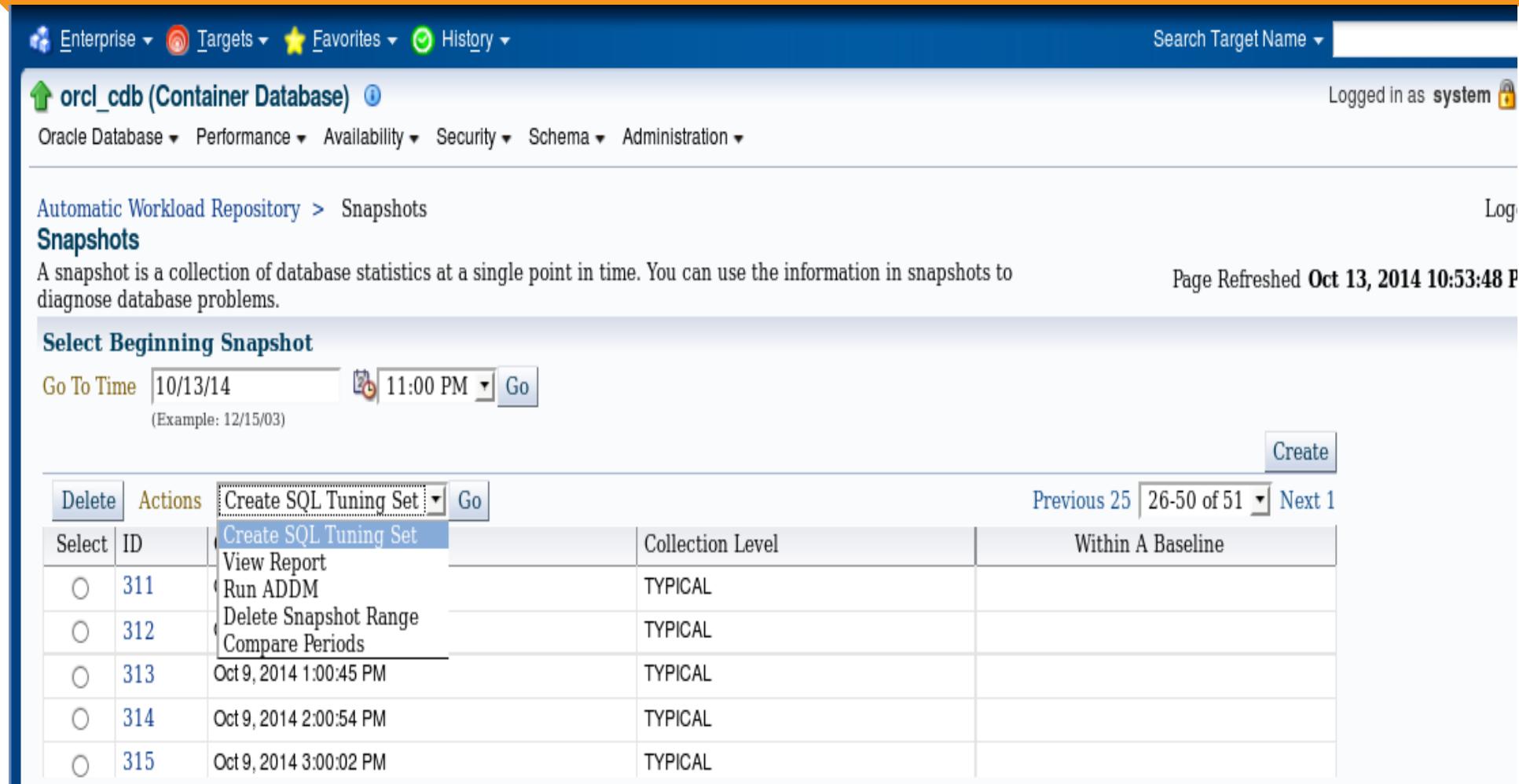
Collection Level: The collection level is set to 'TYPICAL'.

Oracle 19c AWR Baselines

The screenshot shows the Oracle Database AWR interface. At the top, there is a navigation bar with links for Enterprise, Targets, Favorites, History, and a search bar for Target Name. Below the navigation bar, the current target is identified as 'orcl_cdb (Container Database)'. A breadcrumb trail at the top of the main content area shows 'Automatic Workload Repository > Edit Settings > Show SQL'. A link labeled 'Show SQL' is visible. In the main content area, a SQL script is displayed:

```
begin DBMS_WORKLOAD_REPOSITORY.MODIFY_SNAPSHOT_SETTINGS(14400,10); end;
```

Oracle 19c AWR Baselines



Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾ Logged in as system 

orcl_cdb (Container Database) 

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Automatic Workload Repository > Snapshots Log

Snapshots

A snapshot is a collection of database statistics at a single point in time. You can use the information in snapshots to diagnose database problems.

Page Refreshed Oct 13, 2014 10:53:48 P

Select Beginning Snapshot

Go To Time 10/13/14  11:00 PM  Go (Example: 12/15/03)

Create

Actions	Create SQL Tuning Set	Go	Previous 25	26-50 of 51	Next 1
Delete					
Select	ID	Create SQL Tuning Set			
		View Report			
<input type="radio"/>	311	Run ADDM	TYPICAL		
<input type="radio"/>	312	Delete Snapshot Range	TYPICAL		
<input type="radio"/>	313	Compare Periods	TYPICAL		
<input type="radio"/>	314	Oct 9, 2014 1:00:45 PM	TYPICAL		
<input type="radio"/>	315	Oct 9, 2014 2:00:54 PM	TYPICAL		
		Oct 9, 2014 3:00:02 PM	TYPICAL		

Oracle 19c AWR Baselines

The screenshot shows the Oracle Database Automatic Workload Repository (AWR) Baselines page. At the top, there is a navigation bar with links for Enterprise, Targets, Favorites, and History, along with a search bar for 'Search Target Name'. Below the navigation bar, the target is identified as 'orcl_cdb (Container Database)' and the user is logged in as 'system' on 'huskers.localdomain'. The main menu includes Oracle Database, Performance, Availability, Security, Schema, and Administration.

The page title is 'Automatic Workload Repository > Baselines' and the sub-section is 'AWR Baselines'. On the right, it says 'Logged in as SYSTEM' and 'Page Refreshed Oct 13, 2014 10:54:18 PM EDT'. There is a 'Refresh' button.

Below the title, there is a search bar with a 'Go' button and a 'Create' button. A toolbar below the search bar includes 'Edit', 'View', 'Delete', 'Actions', 'Schedule Statistics Computation', and a 'Go' button.

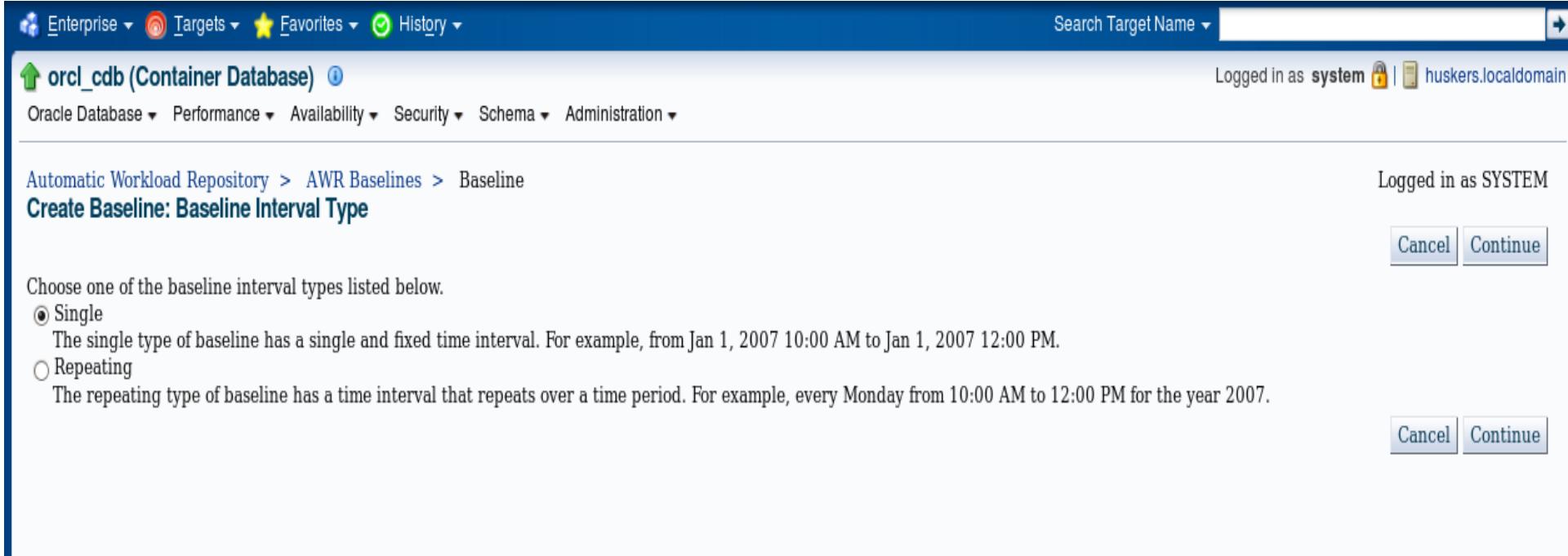
A table lists the baselines:

Select	Name ▲	Type	Valid	Statistics Computed	Last Time Computed	Start Time	End Time	Error Count
<input checked="" type="radio"/>	SYSTEM_MOVING_WINDOW	MOVING_WINDOW (8 Days)	No	Yes	Oct 5, 2014 6:08:40 PM	Oct 6, 2014 12:50:29 PM	Oct 13, 2014 9:48:41 PM	0

Related Links

[AWR Baseline Templates](#) [Baseline Metric Thresholds](#)

Oracle 19c AWR Baselines



The screenshot shows the Oracle Database Control interface for an Oracle Database target named "orcl_cdb (Container Database)". The user is logged in as "system" on the "huskers.localdomain" host. The current page is "Automatic Workload Repository > AWR Baselines > Baseline". The title of the dialog is "Create Baseline: Baseline Interval Type". The dialog instructs the user to choose a baseline interval type, listing "Single" (selected) and "Repeating". The "Single" type is described as having a single and fixed time interval, such as from Jan 1, 2007 10:00 AM to Jan 1, 2007 12:00 PM. The "Repeating" type is described as having a time interval that repeats over a time period, such as every Monday from 10:00 AM to 12:00 PM for the year 2007. There are "Cancel" and "Continue" buttons at the bottom of the dialog.

Enterprise ▾ Targets ▾ Favorites ▾ History ▾

Search Target Name ▾

Logged in as system | huskers.localdomain

orcl_cdb (Container Database) ⓘ

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Automatic Workload Repository > AWR Baselines > Baseline

Create Baseline: Baseline Interval Type

Logged in as SYSTEM

Choose one of the baseline interval types listed below.

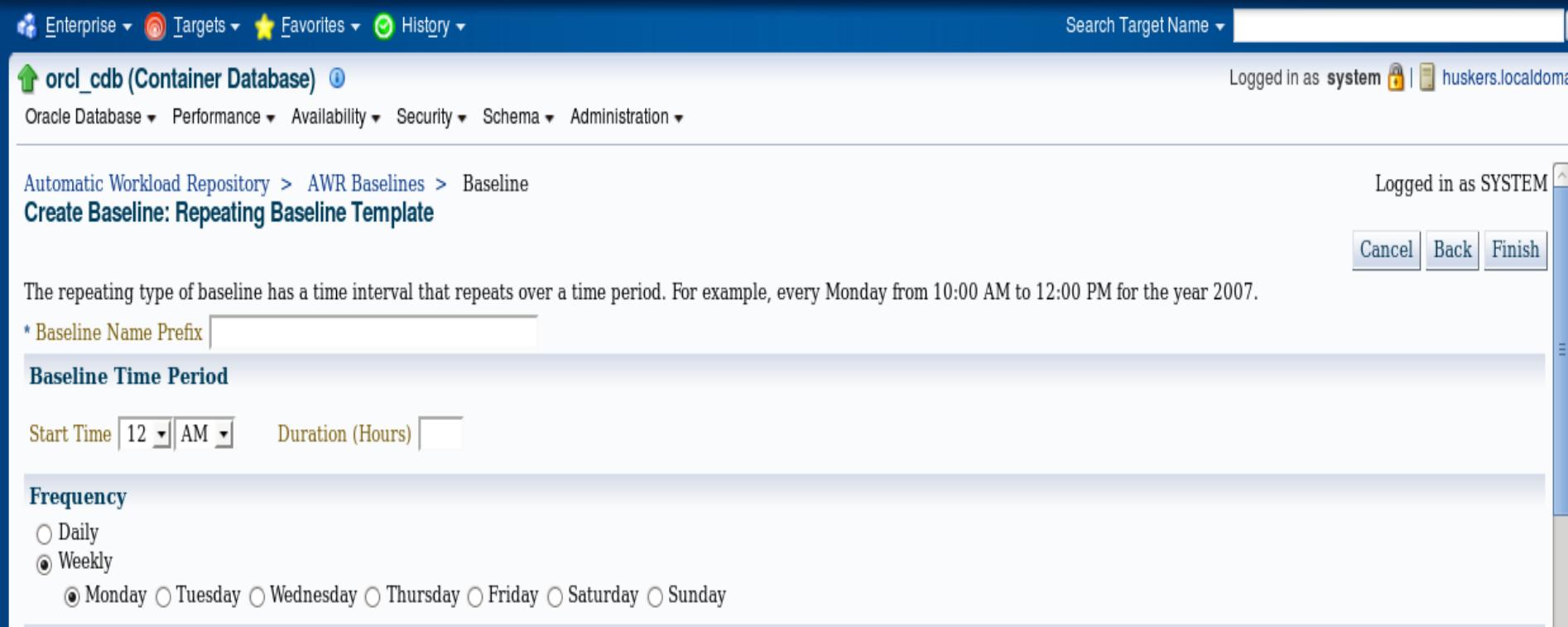
Single
The single type of baseline has a single and fixed time interval. For example, from Jan 1, 2007 10:00 AM to Jan 1, 2007 12:00 PM.

Repeating
The repeating type of baseline has a time interval that repeats over a time period. For example, every Monday from 10:00 AM to 12:00 PM for the year 2007.

Cancel Continue

Cancel Continue

Oracle 19c AWR Baselines



The screenshot shows the Oracle Database Control interface for creating a repeating baseline template. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The target is set to 'orcl_cdb (Container Database)'. The user is logged in as 'system' on 'huskers.localdomain'.

The main content area displays the 'Automatic Workload Repository > AWR Baselines > Baseline' path. The current page is titled 'Create Baseline: Repeating Baseline Template'. A message states: 'The repeating type of baseline has a time interval that repeats over a time period. For example, every Monday from 10:00 AM to 12:00 PM for the year 2007.' The user is prompted to enter a 'Baseline Name Prefix'.

Below this, the 'Baseline Time Period' section allows setting the start time (12 AM) and duration (Hours). The 'Frequency' section is expanded, showing options for Daily, Weekly, and specific days of the week (Monday through Sunday), with Monday selected.

On the right side of the dialog, there are 'Cancel', 'Back', and 'Finish' buttons. The status bar at the bottom indicates 'Logged in as SYSTEM'.

Oracle 19c AWR Baselines

Interval of Baseline Creation

Start Time  End Time 

(example: Oct 13, 2014)

Purge Policy

Retention Time (Days)

 **TIP** A baseline template with the same name as the baseline name prefix will be created.

Cancel **Back** **Finish**

Oracle 19c AWR Baselines

AWR Baselines

Page Refreshed Oct 13, 2014 10:56:43 PM EDT [Refresh](#)

Search Go Create

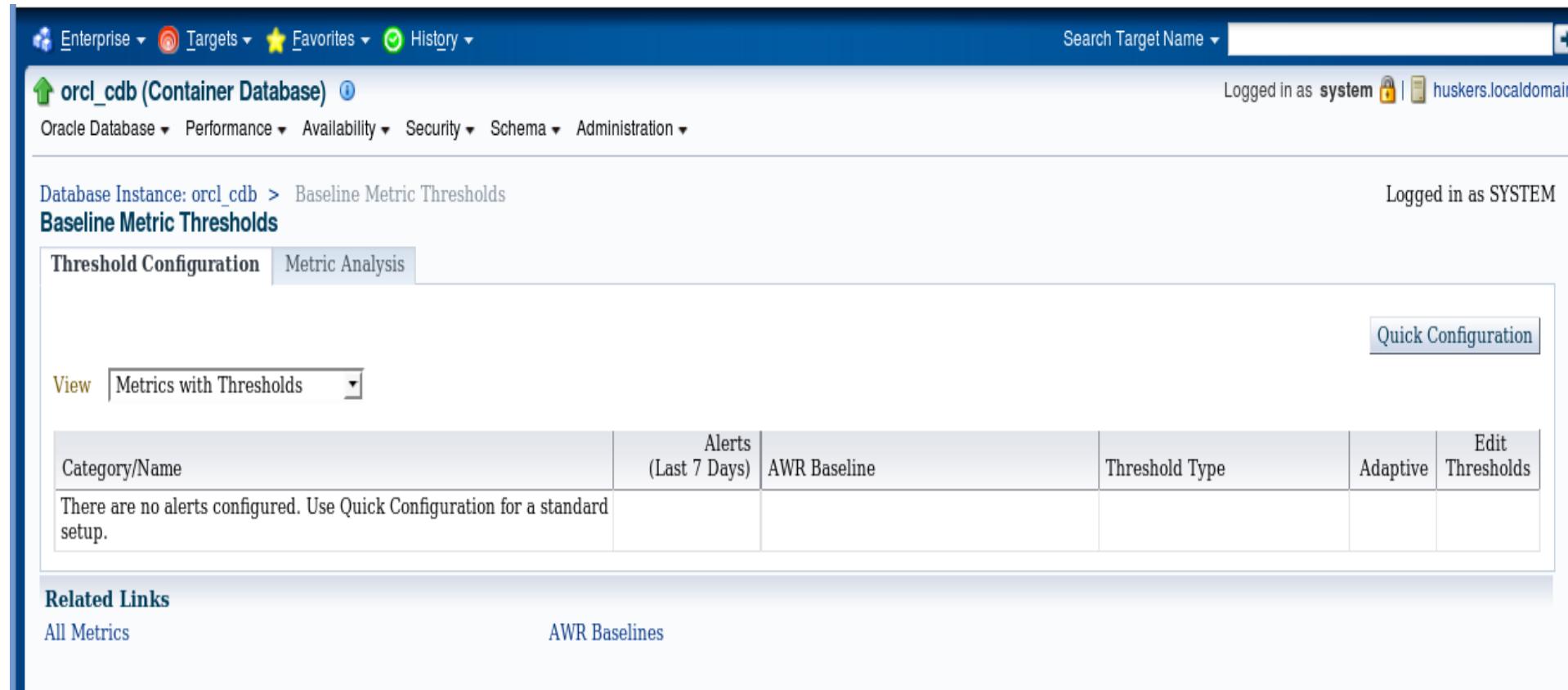
Edit View Delete Actions Schedule Statistics Computation Go

Select	Name ▲	Type	Valid	Statistics Computed	Last Time Computed	Start Time	End Time	Error Count
<input checked="" type="radio"/>	SYSTEM_MOVING_WINDOW	MOVING_WINDOW (8 Days)	No	Yes	Oct 5, 2014 6:08:40 PM	Oct 6, 2014 12:50:29 PM	Oct 13, 2014 9:48:41 PM	0
<input type="radio"/>	gogo_static	STATIC	No	No	No data is currently available.	Oct 13, 2014 7:00:06 PM	Oct 13, 2014 9:48:41 PM	0

Related Links

[AWR Baseline Templates](#) [Baseline Metric Thresholds](#)

Oracle 19c AWR Baselines



The screenshot shows the Oracle Database Control interface for the **orcl_cdb (Container Database)**. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for Target Name. The user is logged in as **system** from **huskers.localdomain**. The main menu categories are Oracle Database, Performance, Availability, Security, Schema, and Administration.

The current page is **Baseline Metric Thresholds**, indicated by the breadcrumb trail: Database Instance: **orcl_cdb** > Baseline Metric Thresholds. The user is also logged in as **SYSTEM**.

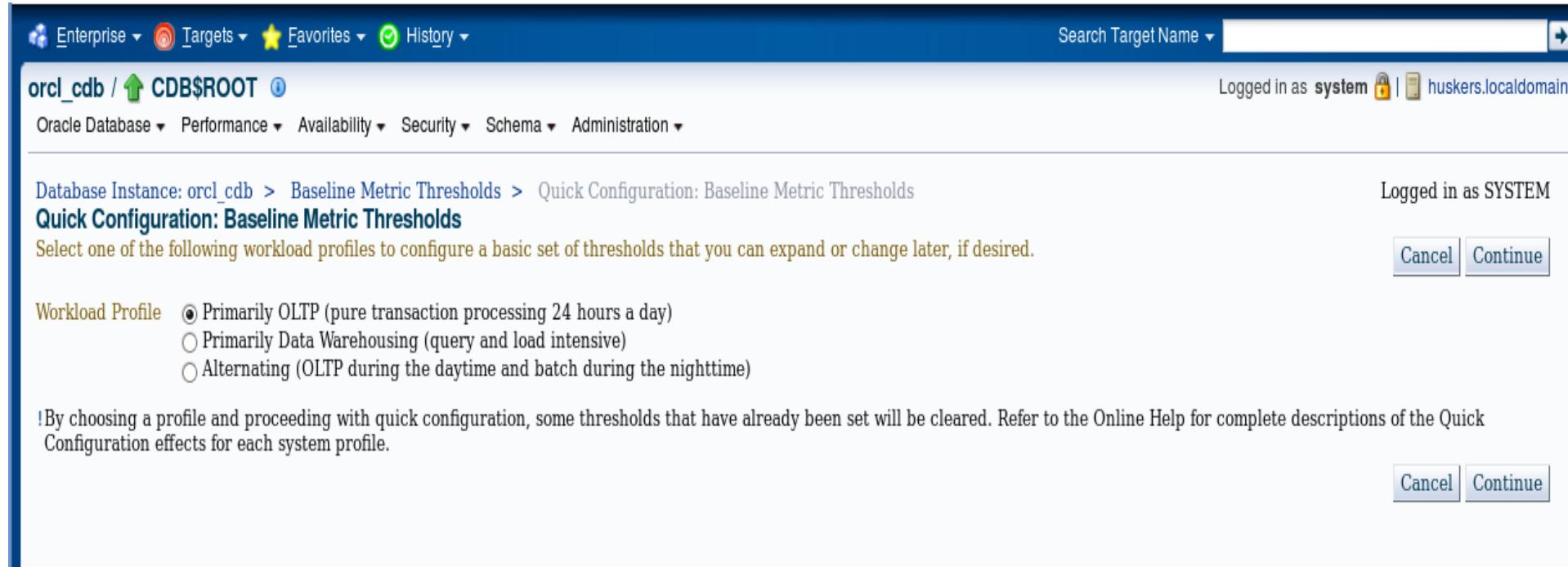
The page displays two tabs: **Threshold Configuration** (selected) and **Metric Analysis**. A **Quick Configuration** button is located in the top right corner of the main content area.

The **View** dropdown is set to **Metrics with Thresholds**. The main content area contains a table with the following columns:

Category/Name	Alerts (Last 7 Days)	AWR Baseline	Threshold Type	Adaptive	Edit Thresholds
There are no alerts configured. Use Quick Configuration for a standard setup.					

Related Links at the bottom include [All Metrics](#) and [AWR Baselines](#).

Oracle 19c AWR Baselines



The screenshot shows the Oracle Database 19c interface for creating AWR baselines. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The current target is 'orcl_cdb / CDB\$ROOT'. The top right shows the user is logged in as 'system' on 'huskers.localdomain'. The main menu at the top has tabs for Oracle Database, Performance, Availability, Security, Schema, and Administration.

The page title is 'Database Instance: orcl_cdb > Baseline Metric Thresholds > Quick Configuration: Baseline Metric Thresholds'. It displays the message 'Quick Configuration: Baseline Metric Thresholds' and instructs the user to 'Select one of the following workload profiles to configure a basic set of thresholds that you can expand or change later, if desired.' There are three radio button options for the 'Workload Profile': 'Primarily OLTP (pure transaction processing 24 hours a day)' (selected), 'Primarily Data Warehousing (query and load intensive)', and 'Alternating (OLTP during the daytime and batch during the nighttime)'. At the bottom left, a note states: 'By choosing a profile and proceeding with quick configuration, some thresholds that have already been set will be cleared. Refer to the Online Help for complete descriptions of the Quick Configuration effects for each system profile.' At the bottom right are 'Cancel' and 'Continue' buttons. The status bar at the bottom right indicates 'Logged in as SYSTEM'.

Oracle 19c AWR Baselines

The screenshot shows the Oracle Database Control interface for the database instance `orcl_cdb / CDB$ROOT`. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for target names. The user is logged in as `system` from the host `huskers.localdomain`. The main menu options are Oracle Database, Performance, Availability, Security, Schema, and Administration.

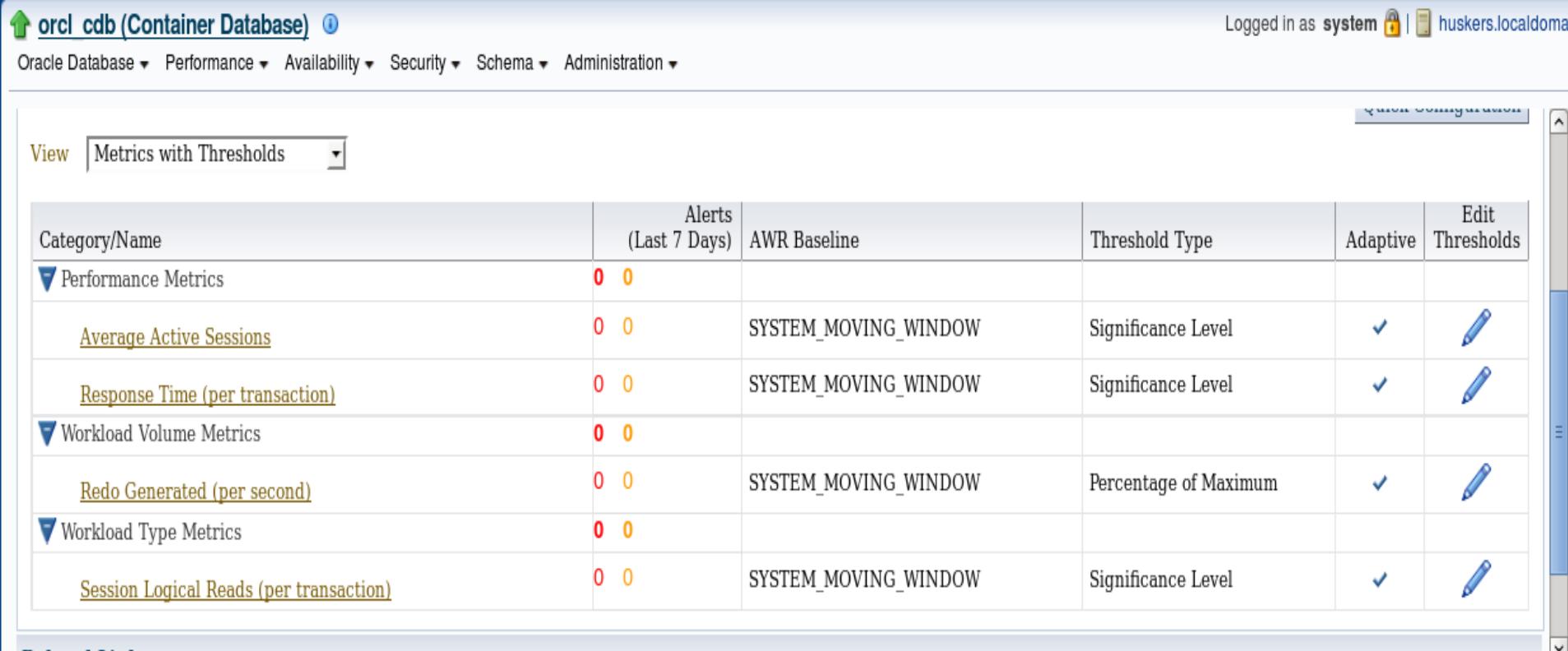
The current page displays the "Baseline Metric Thresholds" section under "Quick Configuration: Baseline Metric Thresholds". The title of this section is "Quick Configuration: Review OLTP Threshold Settings". At the bottom of this section are three buttons: Cancel, Back, and Finish.

A table titled "OLTP Threshold Settings" lists four metrics with their corresponding AWR Baseline, Threshold Type, Warning Level, and Critical Level. The table has five columns:

Metric Name	AWR Baseline	Threshold Type	Warning Level	Critical Level
Average Active Sessions	SYSTEM_MOVING_WINDOW	Significance Level	Very High (0.99)	Extreme (0.9999)
Redo Generated (per second)	SYSTEM_MOVING_WINDOW	Percentage of Maximum	100%	120%
Response Time (per transaction)	SYSTEM_MOVING_WINDOW	Significance Level	Very High (0.99)	Extreme (0.9999)
Session Logical Reads (per transaction)	SYSTEM_MOVING_WINDOW	Significance Level	Very High (0.99)	None

At the bottom of the page, there are three buttons: Cancel, Back, and Finish.

Oracle 19c AWR Baselines



The screenshot shows the Oracle Database Performance Monitoring interface for the 'orcl cdb (Container Database)'. The top navigation bar includes links for Oracle Database, Performance, Availability, Security, Schema, and Administration. The user is logged in as 'system' from 'huskers.localdomain'. The main view displays a table of metrics with thresholds, with the 'Metrics with Thresholds' option selected in the 'View' dropdown.

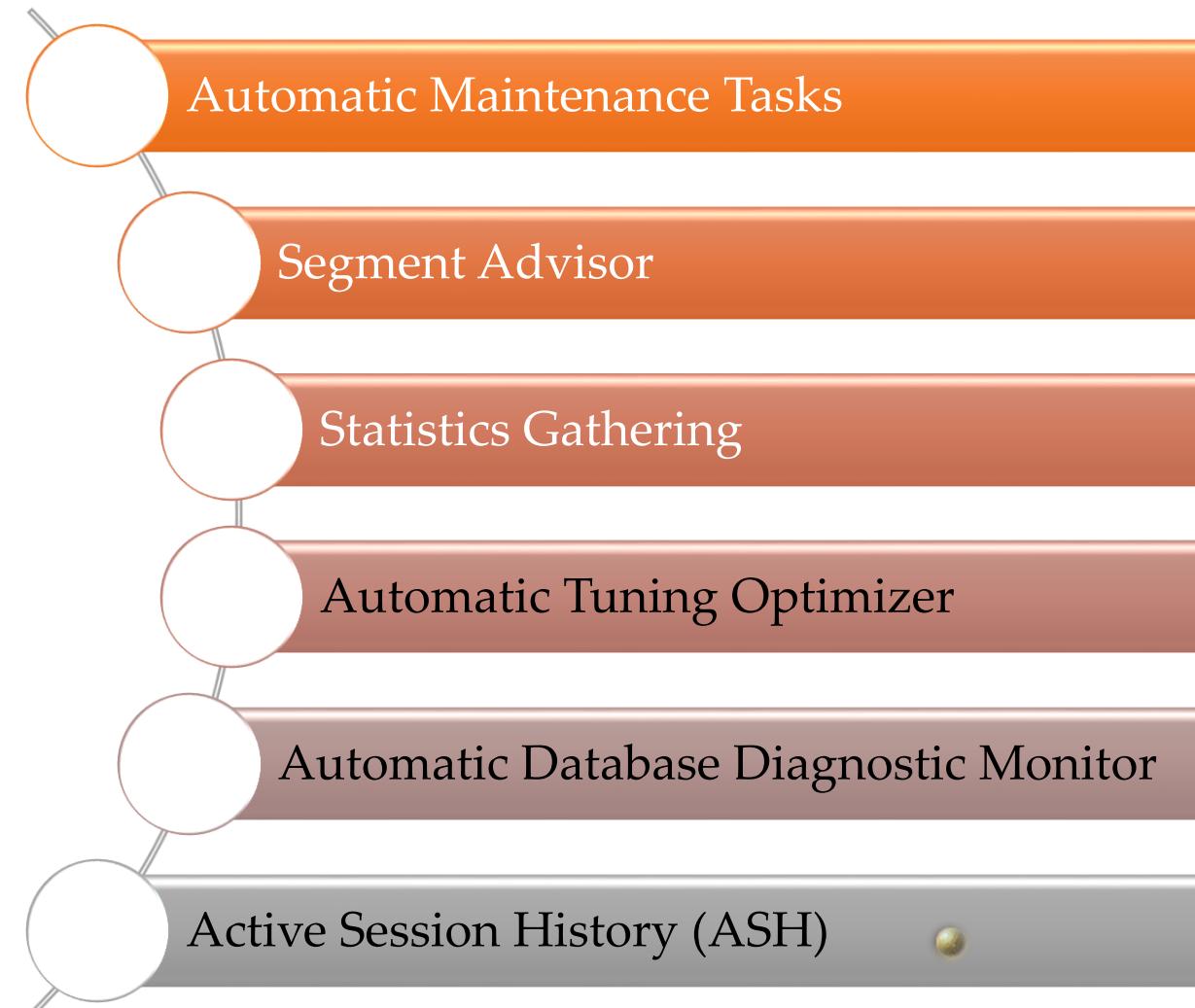
Category/Name	Alerts (Last 7 Days)	AWR Baseline	Threshold Type	Adaptive	Edit Thresholds
Performance Metrics	0 0				
Average Active Sessions	0 0	SYSTEM_MOVING_WINDOW	Significance Level	<input checked="" type="checkbox"/>	
Response Time (per transaction)	0 0	SYSTEM_MOVING_WINDOW	Significance Level	<input checked="" type="checkbox"/>	
Workload Volume Metrics	0 0				
Redo Generated (per second)	0 0	SYSTEM_MOVING_WINDOW	Percentage of Maximum	<input checked="" type="checkbox"/>	
Workload Type Metrics	0 0				
Session Logical Reads (per transaction)	0 0	SYSTEM_MOVING_WINDOW	Significance Level	<input checked="" type="checkbox"/>	

Related Links:

Additional AWR Performance Tools

- Additional AWR Tools

Lesson Topics



Automatic Maintenance Tasks

- Enabled when
`statistics_level=typical/ALL`

Assigned at the

- Container database
- Pluggable database

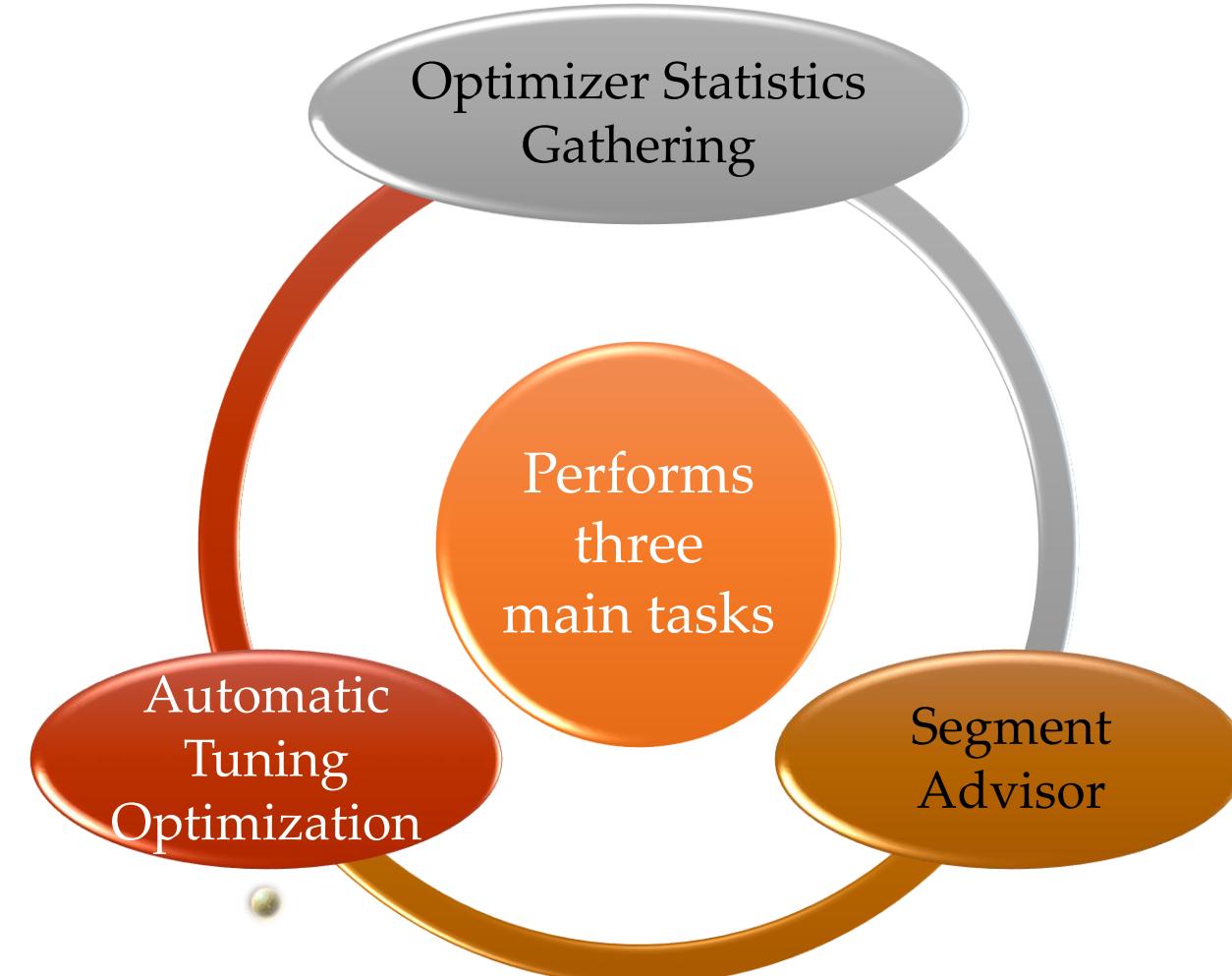
Performed during the normal
maintenance window

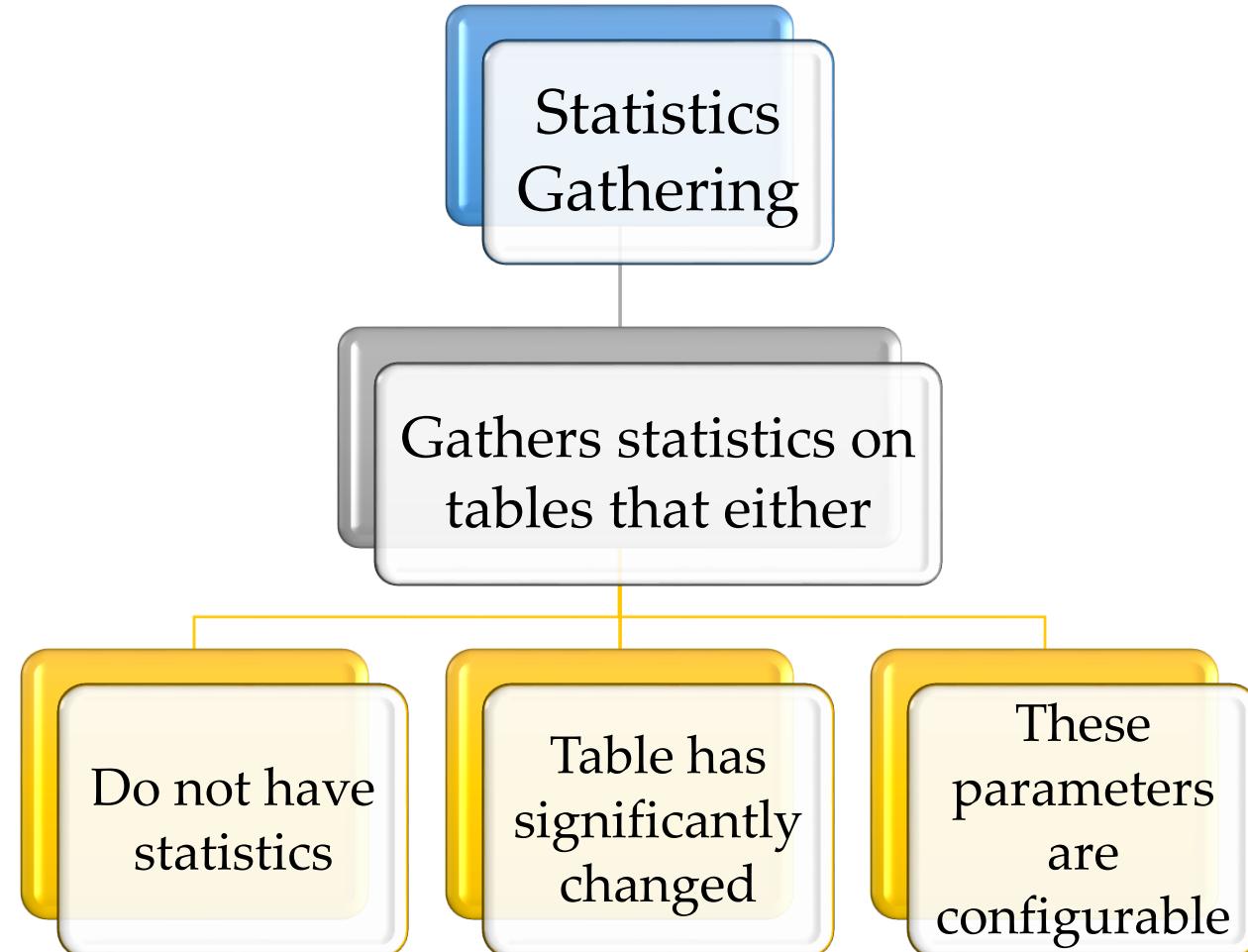
Monday –
Friday 10:00
pm – 2:00 am

Can be
configured

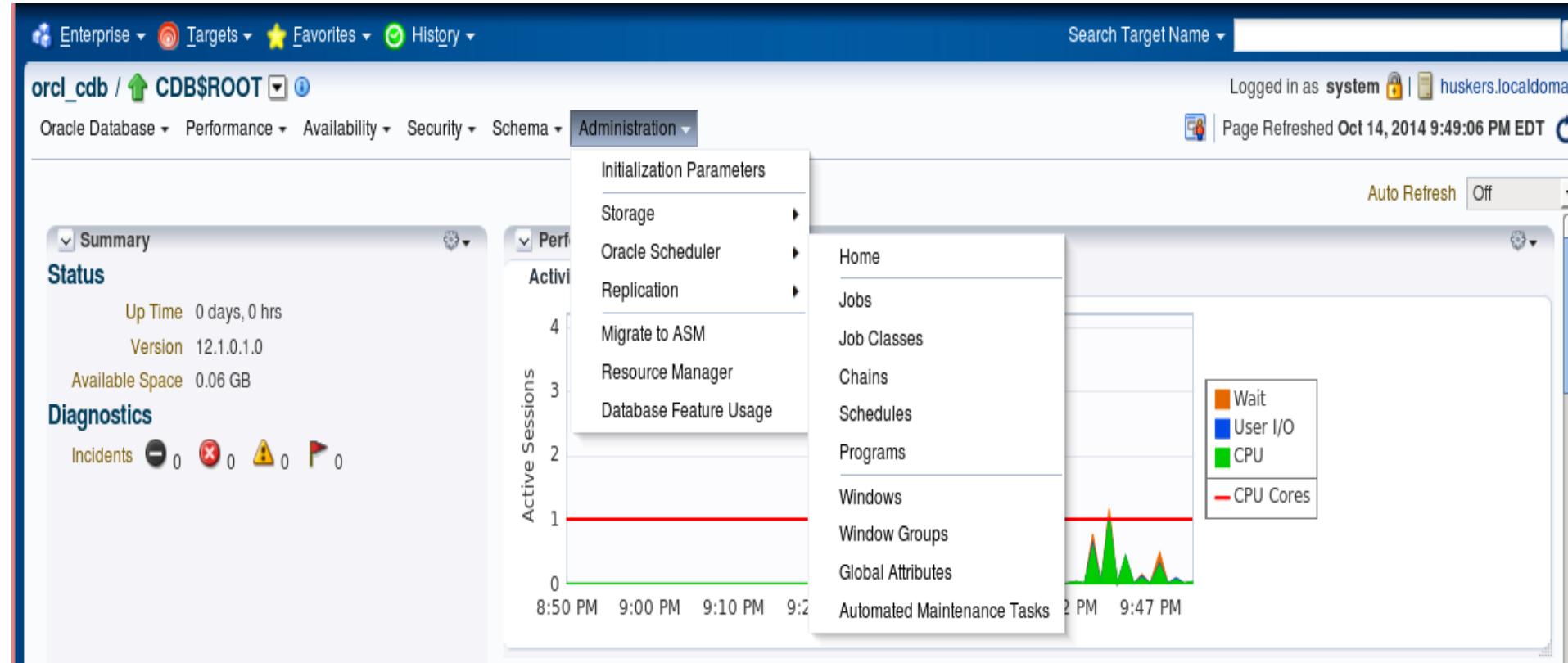
Default
Maintenance
Window



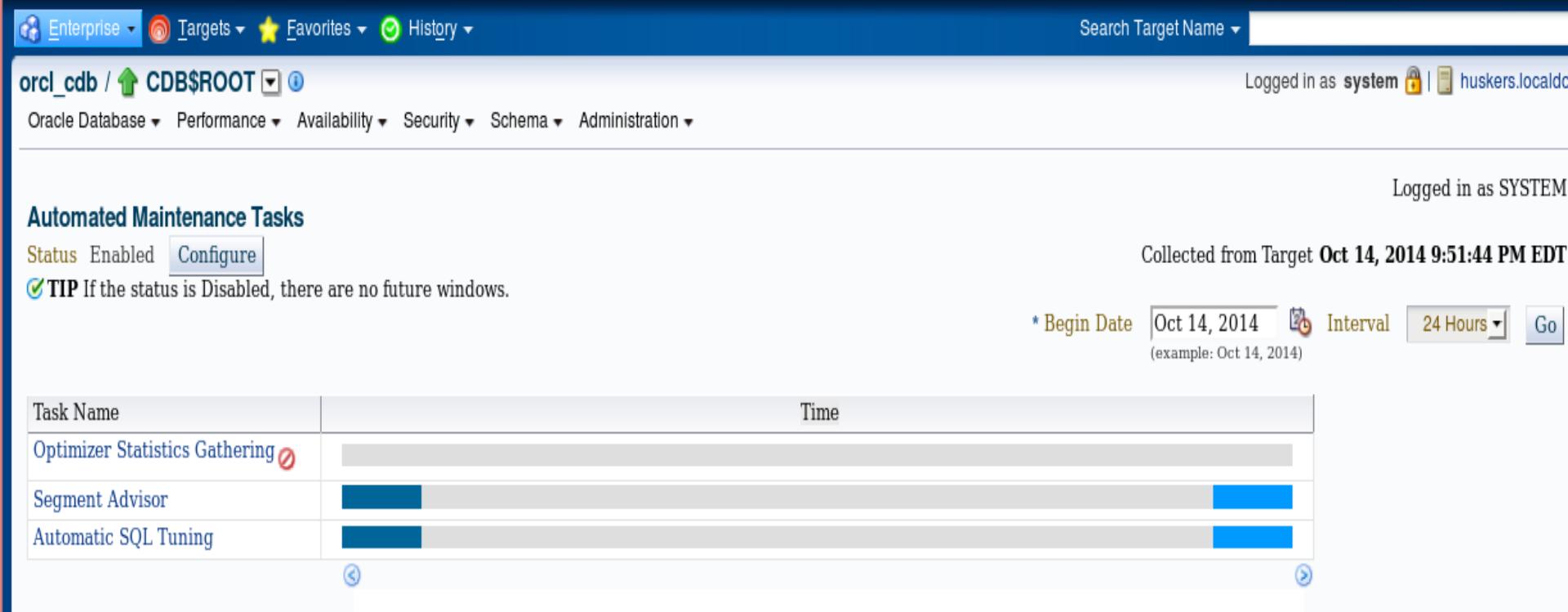




Oracle 19c Additional AWR performance tools



Oracle 19c Additional AWR performance tools

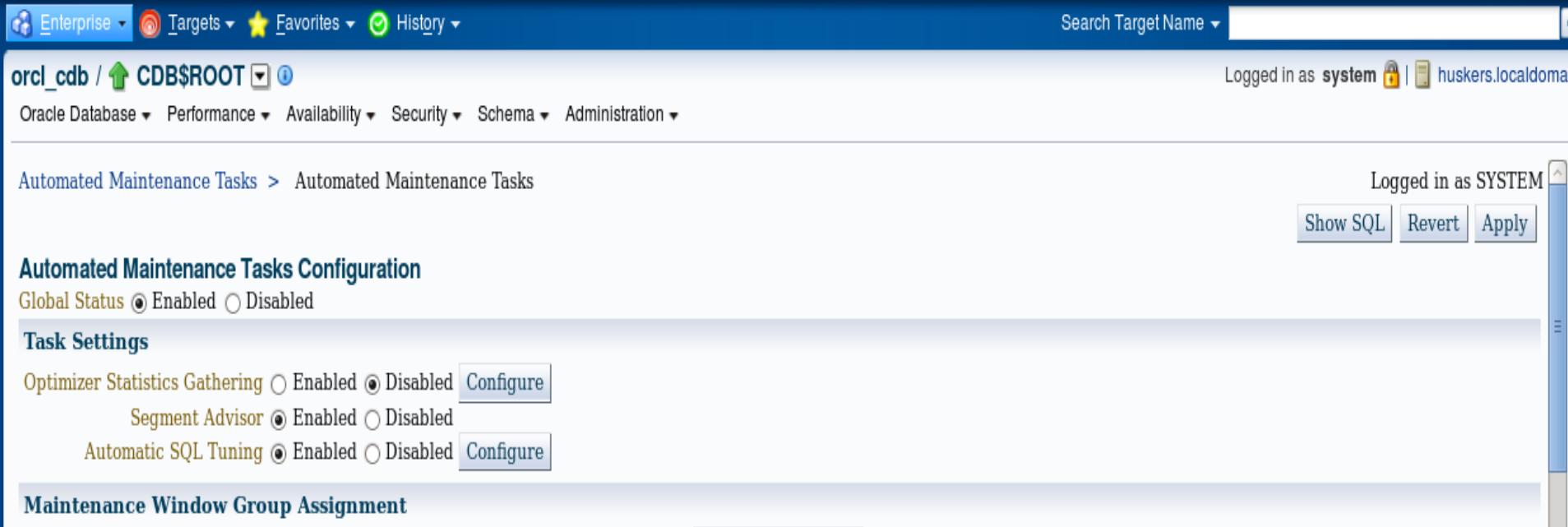


The screenshot shows the Oracle Enterprise Manager interface for the target **orcl_cdb / CDB\$ROOT**. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for Target Name. The user is logged in as **system** from **huskers.localdomain**. The main menu options are Oracle Database, Performance, Availability, Security, Schema, and Administration.

In the center, under the heading **Automated Maintenance Tasks**, the status is shown as **Enabled** with a **Configure** button. A tip message indicates that if the status is **Disabled**, there are no future windows. The tasks listed are Optimizer Statistics Gathering, Segment Advisor, and Automatic SQL Tuning. The time column shows the duration of each task. The interface also displays the collection time as **Collected from Target Oct 14, 2014 9:51:44 PM EDT** and provides filters for *** Begin Date** (Oct 14, 2014), **Interval** (24 Hours), and a **Go** button.

Task Name	Time
Optimizer Statistics Gathering	[Progress Bar]
Segment Advisor	[Progress Bar]
Automatic SQL Tuning	[Progress Bar]

Oracle 19c Additional AWR Performance Tools



The screenshot shows the Oracle Database 19c Control Panel interface. At the top, there are navigation links for Enterprise, Targets, Favorites, and History, along with a search bar for 'Search Target Name'. The current target is 'orcl_cdb / CDB\$ROOT'. The user is logged in as 'system' from 'huskers.localdomain'. Below the header, a menu bar includes Oracle Database, Performance, Availability, Security, Schema, and Administration.

The main content area displays the 'Automated Maintenance Tasks > Automated Maintenance Tasks' configuration page. It features a 'Global Status' section with an 'Enabled' radio button selected. Under 'Task Settings', three tasks are listed: 'Optimizer Statistics Gathering' (disabled), 'Segment Advisor' (disabled), and 'Automatic SQL Tuning' (disabled). Each task has a 'Configure' button next to its status. On the right side of the page, there are buttons for 'Show SQL', 'Revert', and 'Apply' changes, along with a vertical scroll bar.

Segment Advisor

Segments that can be shrunk to re-claim space in the tablespaces

Alter segment shrink space

Alter segment shrink space compact

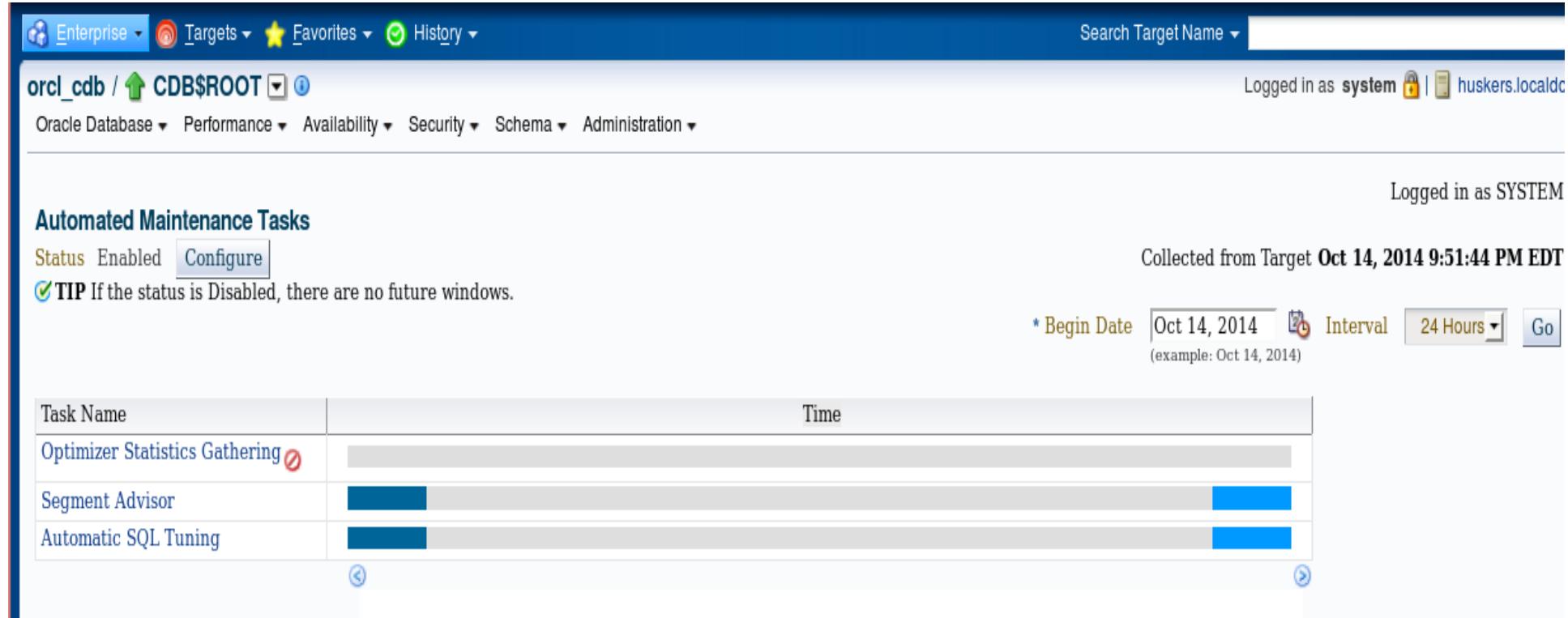
Releases space

Moves the high water mark

Releases space

Does not move the high water mark

Oracle 19c Additional AWR Performance Tools



The screenshot shows the Oracle Database Control interface for the target **orcl_cdb / CDB\$ROOT**. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The status bar indicates the user is logged in as **system** on **huskers.localdc**.

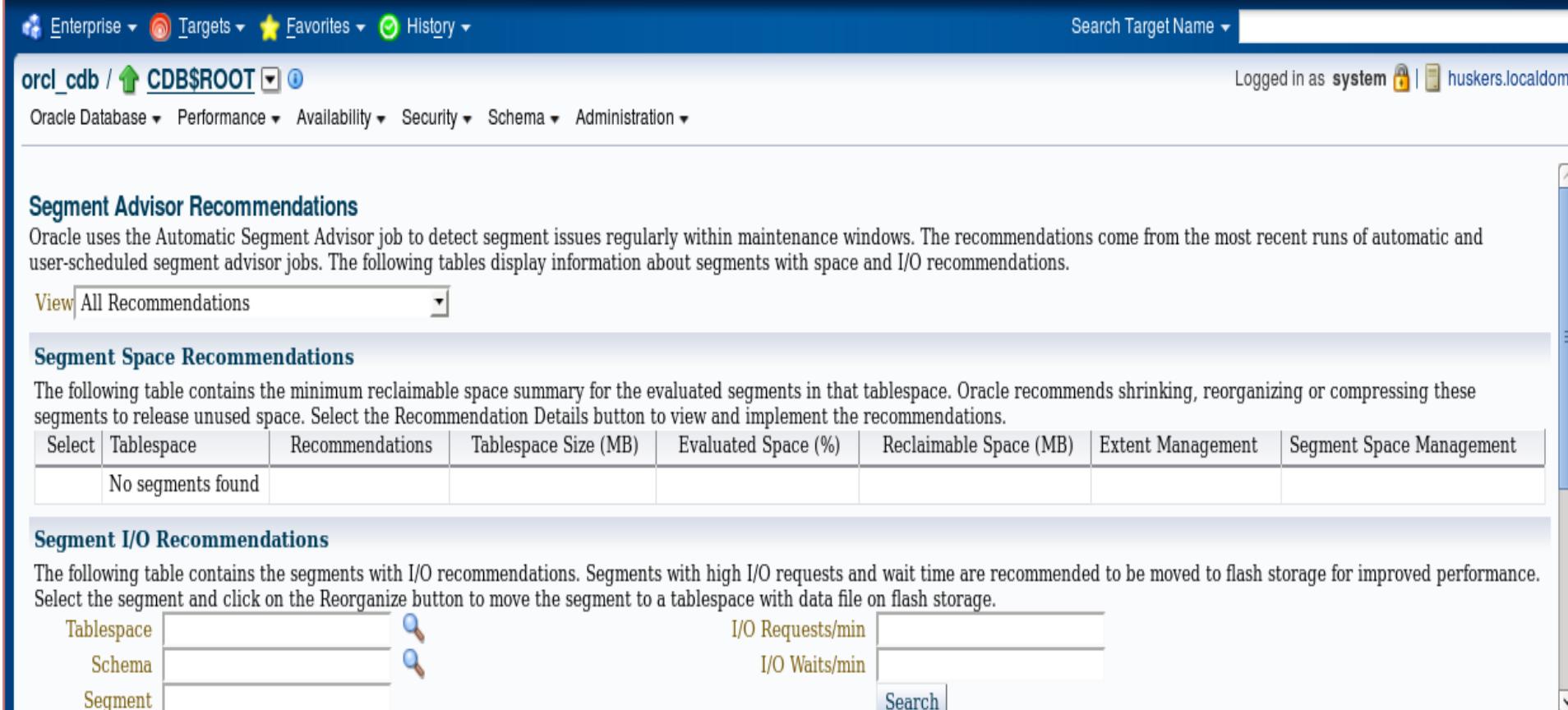
The main content area displays the **Automated Maintenance Tasks** section. It shows three tasks: Optimizer Statistics Gathering, Segment Advisor, and Automatic SQL Tuning. Each task has a progress bar indicating its current status.

Below the tasks, there is a tip message: **TIP** If the status is Disabled, there are no future windows. To the right, there are filters for *** Begin Date** (Oct 14, 2014), **Interval** (24 Hours), and a **Go** button.

At the bottom, there are navigation arrows for the tasks.

Task Name	Time
Optimizer Statistics Gathering	[Progress Bar]
Segment Advisor	[Progress Bar]
Automatic SQL Tuning	[Progress Bar]

Oracle 19c Additional AWR performance tools



The screenshot shows the Oracle Database 19c Segment Advisor Recommendations page. At the top, there are navigation links for Enterprise, Targets, Favorites, and History, along with a search bar for 'Search Target Name'. The target is set to 'orcl_cdb / CDB\$ROOT'. The user is logged in as 'system' from 'huskers.localdomain'. Below the header, there are menu options: Oracle Database, Performance, Availability, Security, Schema, and Administration.

Segment Advisor Recommendations

Oracle uses the Automatic Segment Advisor job to detect segment issues regularly within maintenance windows. The recommendations come from the most recent runs of automatic and user-scheduled segment advisor jobs. The following tables display information about segments with space and I/O recommendations.

View All Recommendations

Segment Space Recommendations

The following table contains the minimum reclaimable space summary for the evaluated segments in that tablespace. Oracle recommends shrinking, reorganizing or compressing these segments to release unused space. Select the Recommendation Details button to view and implement the recommendations.

Select	Tablespace	Recommendations	Tablespace Size (MB)	Evaluated Space (%)	Reclaimable Space (MB)	Extent Management	Segment Space Management
	No segments found						

Segment I/O Recommendations

The following table contains the segments with I/O recommendations. Segments with high I/O requests and wait time are recommended to be moved to flash storage for improved performance. Select the segment and click on the Reorganize button to move the segment to a tablespace with data file on flash storage.

Tablespace	I/O Requests/min
Schema	I/O Waits/min
Segment	Search

Oracle 19c Additional AWR Performance Tools

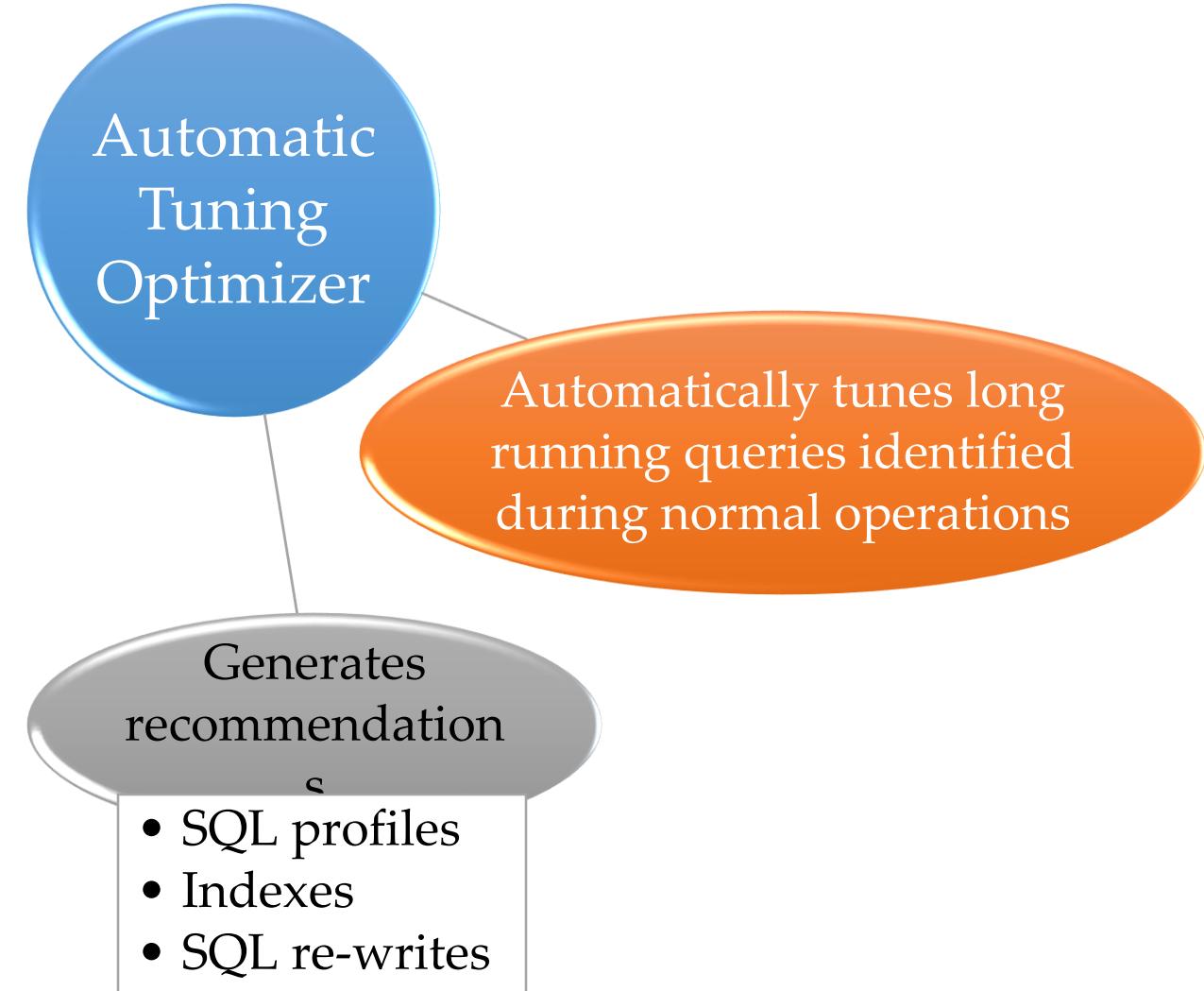
Segment I/O Recommendations

The following table contains the segments with I/O recommendations. Segments with high I/O requests and wait time are recommended to be moved to flash storage for improved performance. Select the segment and click on the Reorganize button to move the segment to a tablespace with data file on flash storage.

Tablespace	USERS	I/O Requests/min						
Schema	APEX_040200	I/O Waits/min						
Segment		Search						
Partition								
Select	Schema	Segment	Recommendation	Allocated Space (MB)	I/O Requests/min	I/O Waits(ms)/min	Segment Type	Tablespace
	No segments found							

Related Links

[Advisor Central](#) [Automated Maintenance Tasks](#)
[Run Segment Advisor Manually](#) [Chained Row Analysis](#)
[Job Scheduler](#)



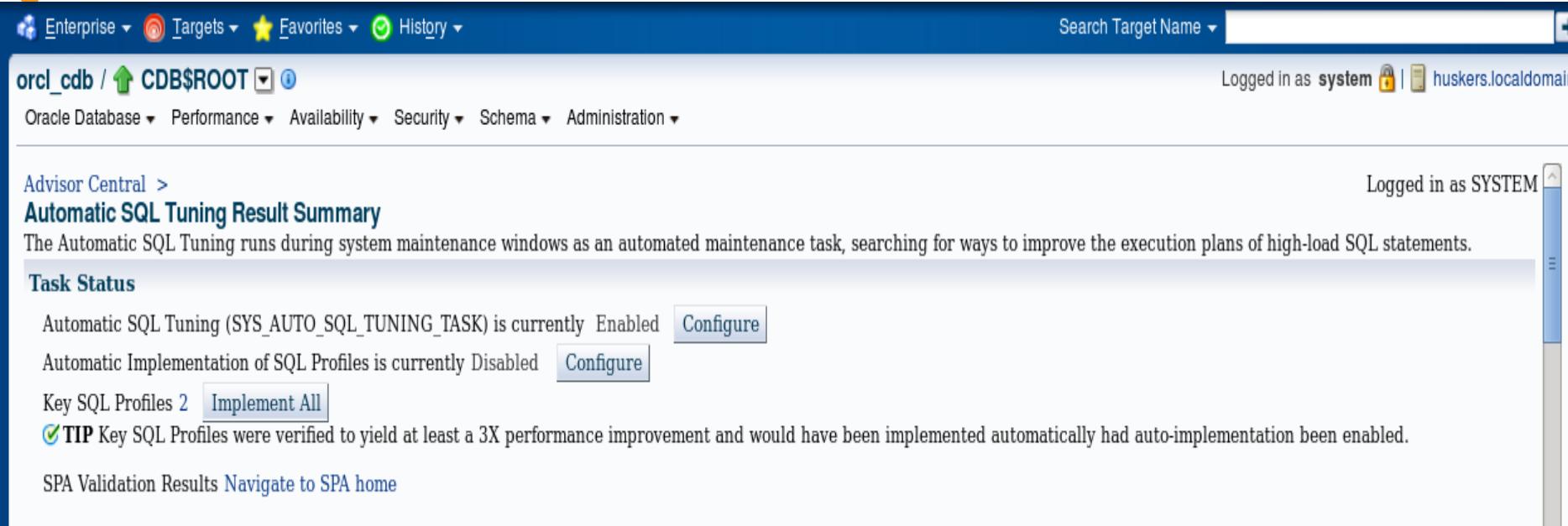
Automatic Tuning Optimizer(ATO)

Key Profiles are profiles Oracle has seen over and over again

ATO is automatically enabled

Implementation of the recommendation may also be enabled

Oracle 19c Additional AWR Performance Tools



The screenshot shows the Oracle Database Control interface for the target 'orcl_cdb / CDB\$ROOT'. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search field for 'Search Target Name'. The user is logged in as 'system' from 'huskers.localdomain'. The main menu at the top has options for Oracle Database, Performance, Availability, Security, Schema, and Administration.

In the center, under 'Advisor Central > Automatic SQL Tuning Result Summary', it states: 'The Automatic SQL Tuning runs during system maintenance windows as an automated maintenance task, searching for ways to improve the execution plans of high-load SQL statements.'

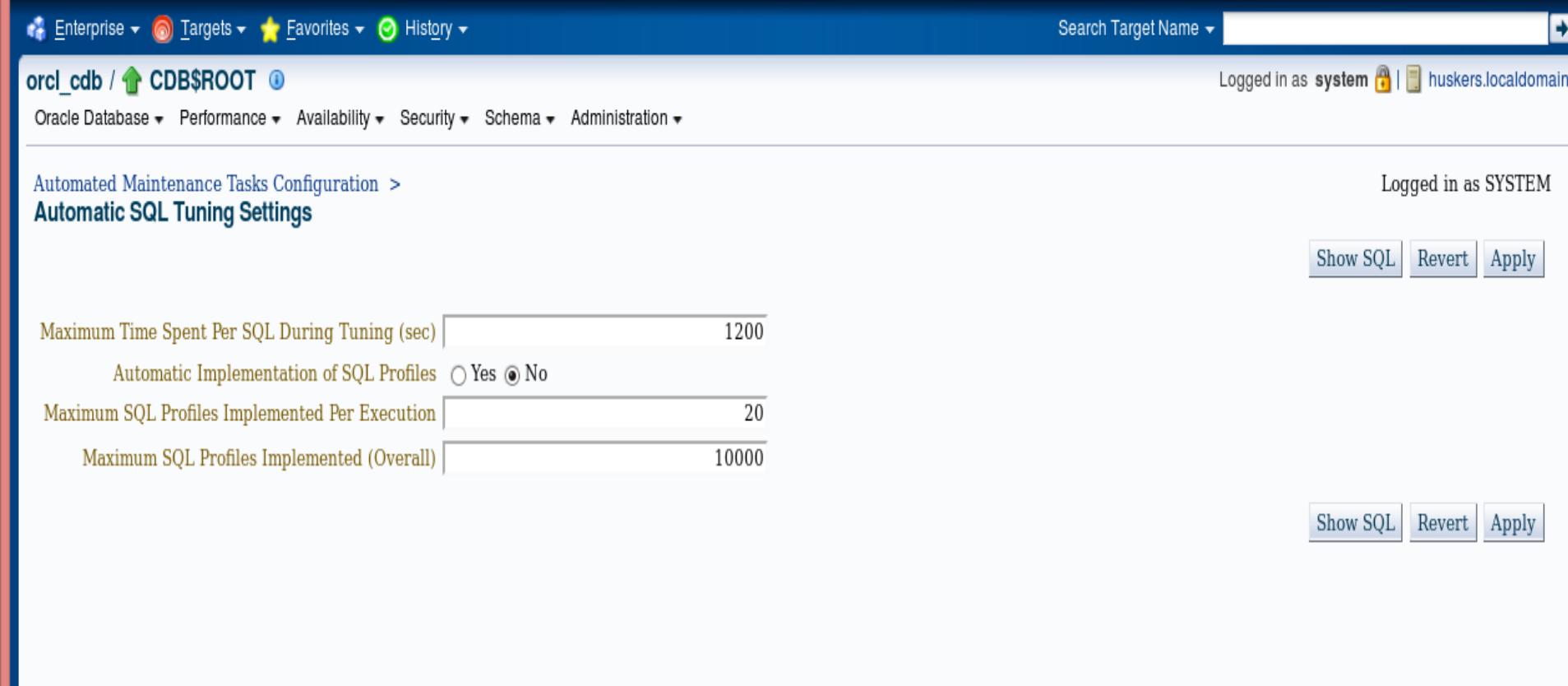
The 'Task Status' section shows:

- Automatic SQL Tuning (SYS_AUTO_SQL_TUNING_TASK) is currently Enabled. There is a 'Configure' button.
- Automatic Implementation of SQL Profiles is currently Disabled. There is a 'Configure' button.
- Key SQL Profiles: 2 profiles found, with a link to 'Implement All'.

A 'TIP' message indicates: 'Key SQL Profiles were verified to yield at least a 3X performance improvement and would have been implemented automatically had auto-implementation been enabled.'

At the bottom, there is a link to 'SPA Validation Results' and a 'Navigate to SPA home' link.

Oracle 19c Additional AWR performance tools



The screenshot shows the Oracle Database Control interface for the database `orcl_cdb / CDB$ROOT`. The user is logged in as `system` from the host `huskers.localdomain`, and the session is running as `SYSTEM`.

The current page is **Automated Maintenance Tasks Configuration > Automatic SQL Tuning Settings**.

Configuration settings displayed:

- Maximum Time Spent Per SQL During Tuning (sec): 1200
- Automatic Implementation of SQL Profiles: Yes No
- Maximum SQL Profiles Implemented Per Execution: 20
- Maximum SQL Profiles Implemented (Overall): 10000

Buttons at the bottom right: Show SQL, Revert, Apply.

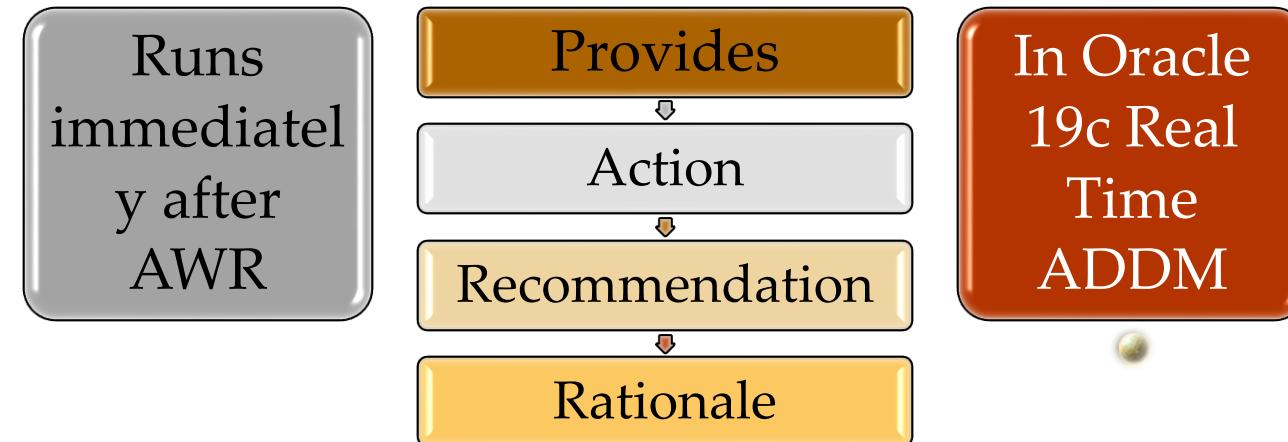
Oracle 19c Additional AWR Performance Tools

Maintenance Window Group Assignment

[Edit Window Group](#)

Window	Optimizer Statistics Gathering		Segment Advisor	Automatic SQL Tuning
	Select All	Select None	Select All	Select None
TUESDAY_WINDOW	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
WEDNESDAY_WINDOW	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
THURSDAY_WINDOW	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
FRIDAY_WINDOW	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SATURDAY_WINDOW	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SUNDAY_WINDOW	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
MONDAY_WINDOW	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Automatic Database Diagnostic Monitor





- Provides detailed analysis or current active sessions and their SQL

- Optimizer Statistics

Lesson Topics

In this
lesson:

Optimizer Statistics Overview

Table and Index Statistics

Statistic Preferences and
Gathering

Locking Statistics, Export/Import
Statistics

Pending and Published Statistics

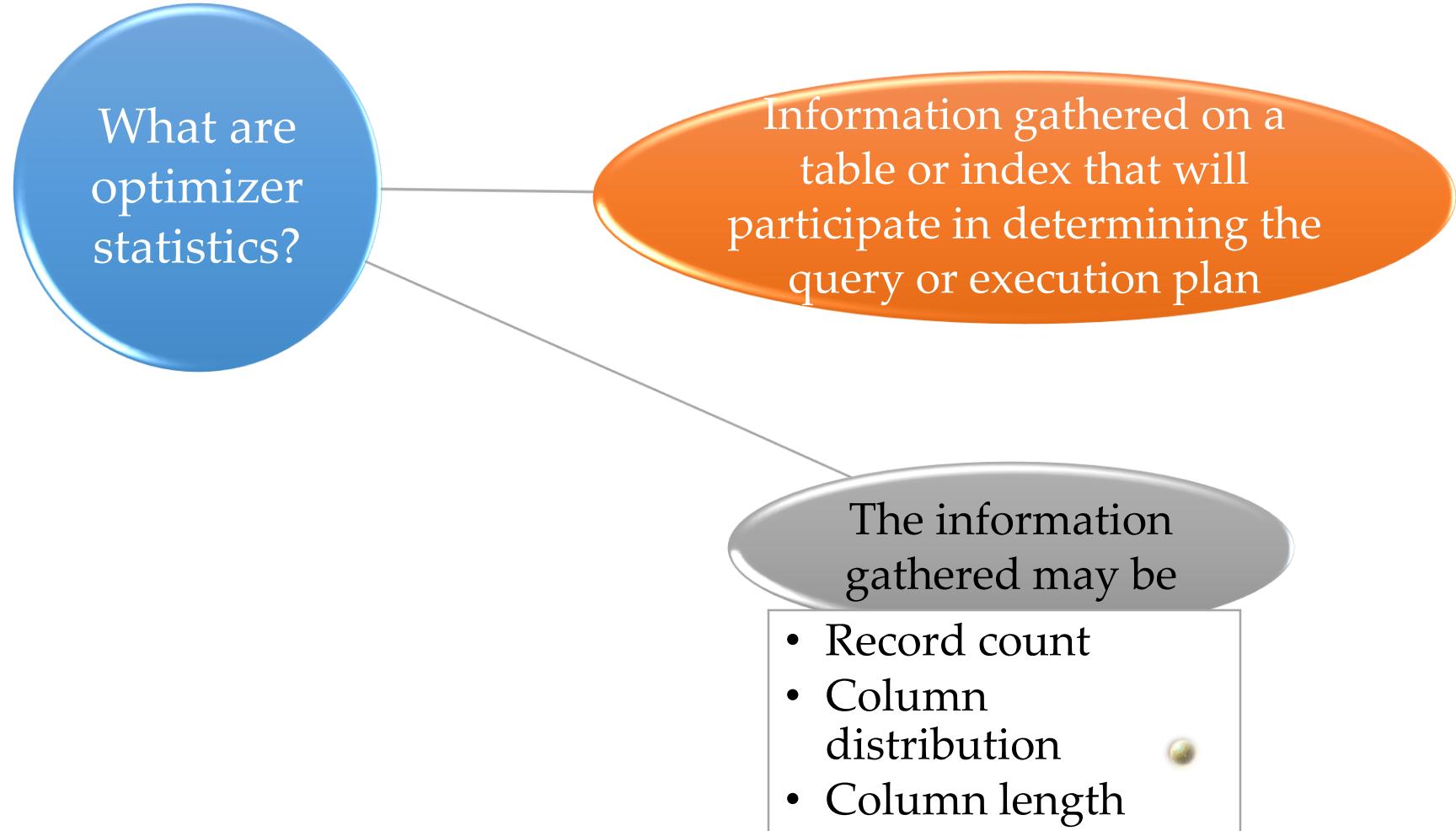
Optimizer Hints and Paths

Cost Base Optimization

Lab: Reading Query Plan

Lab Demo Solution: Reading
Query Plan

Oracle 19c Optimizer Statistics



What are optimizer statistics?

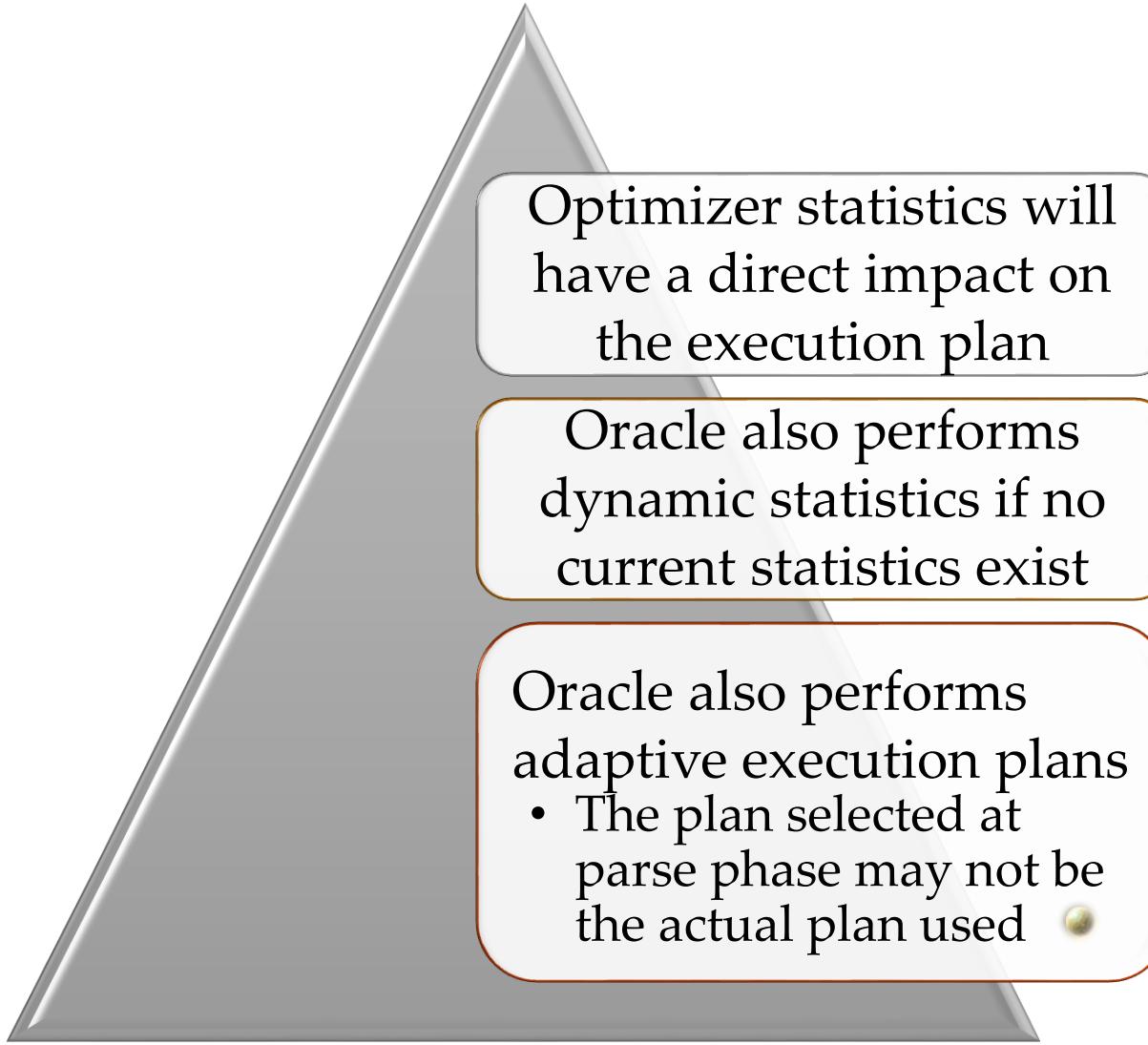
Information gathered on a table or index that will participate in determining the query or execution plan

The information gathered may be

- Record count
- Column distribution
- Column length



Oracle 19c Optimizer Statistics



Optimizer statistics will have a direct impact on the execution plan

Oracle also performs dynamic statistics if no current statistics exist

Oracle also performs adaptive execution plans

- The plan selected at parse phase may not be the actual plan used

Oracle 19c Optimizer Statistics

When are
statistics
gathered?

During the
normal
maintenance
window

Manually

Statistics
may:

Locked

Deleted

Exported
imported

Oracle 19c Optimizer Statistics

Gathering Characteristics

Statistics may be;

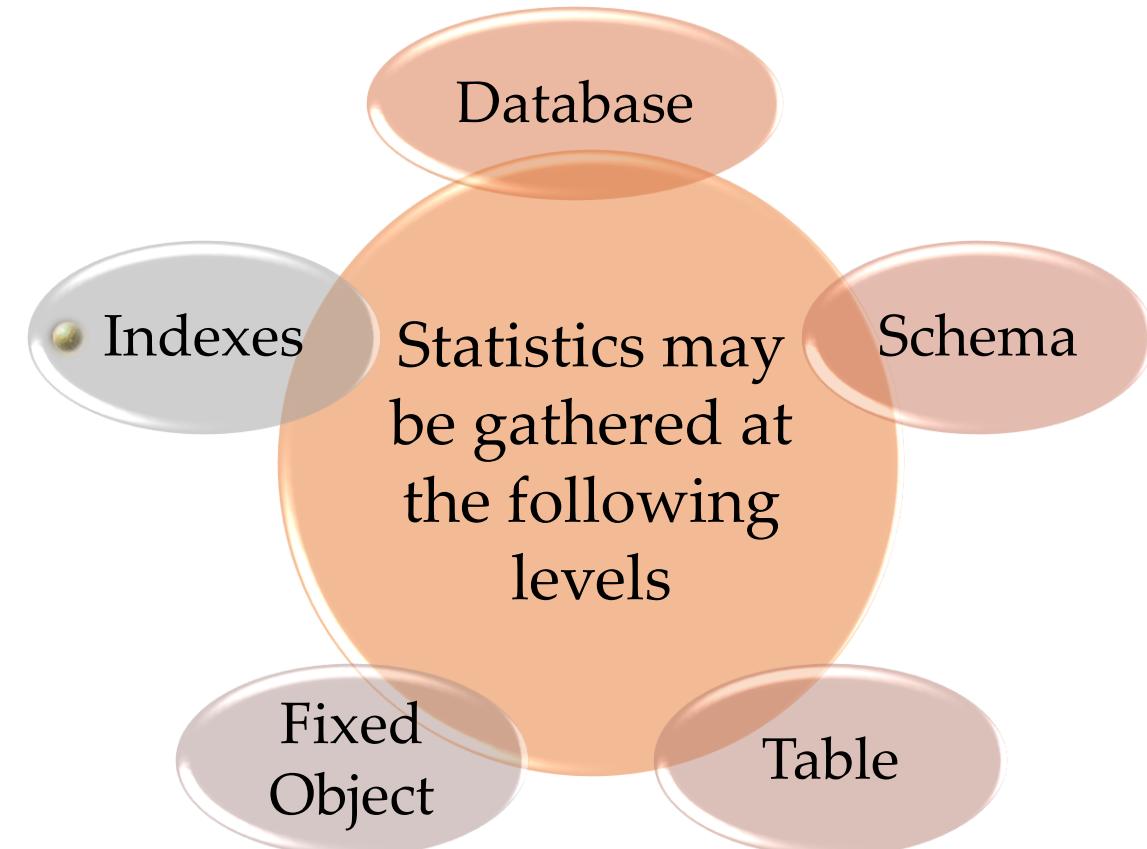
Pending

Published

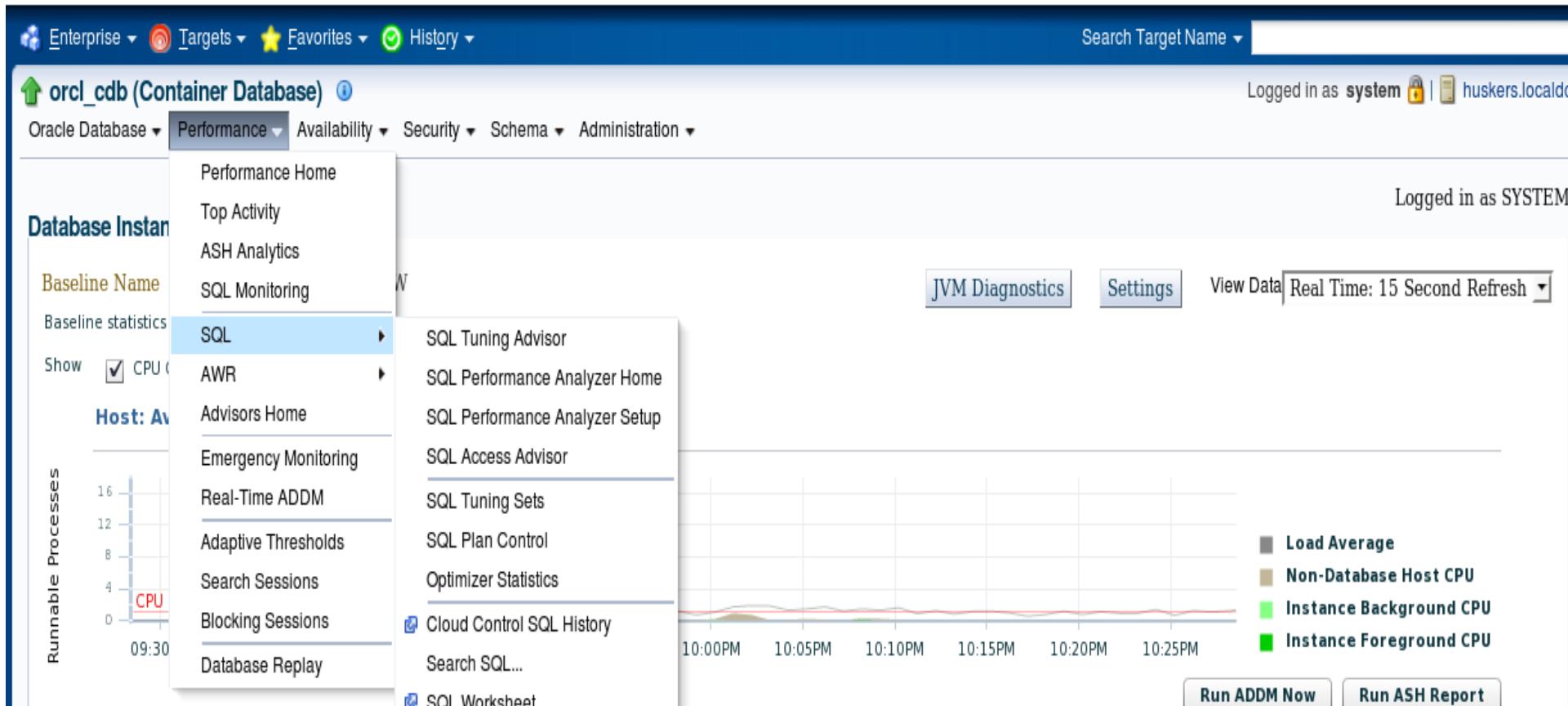
Table stale
percent
may be set

This
determines if a
table has
changed by a
certain % then
statistics will
be gathered

Oracle 19c Optimizer Statistics

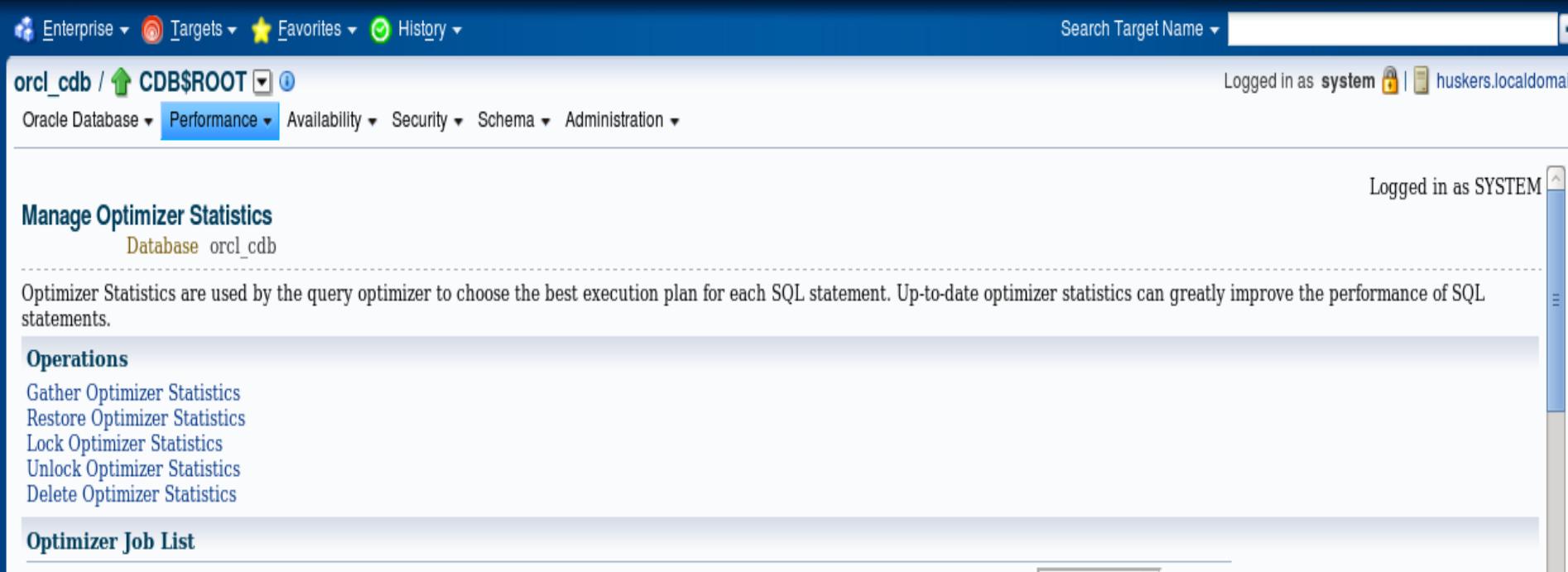


Oracle 19c Optimizer Statistics



The screenshot shows the Oracle Database Performance Monitoring interface for the 'orcl_cdb (Container Database)' target. The 'Performance' tab is selected in the top navigation bar. On the left, the 'Database Instances' sidebar lists various monitoring options, with 'Optimizer Statistics' currently selected under the 'SQL' category. A dropdown menu for 'Optimizer Statistics' is open, listing several sub-options: SQL Tuning Advisor, SQL Performance Analyzer Home, SQL Performance Analyzer Setup, SQL Access Advisor, SQL Tuning Sets, SQL Plan Control, and Optimizer Statistics. Below this menu, there are links for Cloud Control SQL History, Search SQL..., and SQL Worksheet. The main workspace displays a graph titled 'Runnable Processes' over time from 09:30 to 10:25 PM, showing four data series: Load Average (grey), Non-Database Host CPU (brown), Instance Background CPU (green), and Instance Foreground CPU (red). The graph shows a slight increase in foreground CPU usage around 10:10 PM. At the bottom right of the workspace, there are buttons for 'Run ADDM Now' and 'Run ASH Report'.

Oracle 19c Optimizer Statistics



The screenshot shows the Oracle Database Control interface for a CDB\$ROOT database named 'orcl_cdb'. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The user is logged in as 'system' on 'huskers.localdomain'. The main menu at the top has tabs for Oracle Database, Performance (which is selected), Availability, Security, Schema, and Administration.

Manage Optimizer Statistics
Database orcl_cdb

Optimizer Statistics are used by the query optimizer to choose the best execution plan for each SQL statement. Up-to-date optimizer statistics can greatly improve the performance of SQL statements.

Operations

- Gather Optimizer Statistics
- Restore Optimizer Statistics
- Lock Optimizer Statistics
- Unlock Optimizer Statistics
- Delete Optimizer Statistics

Optimizer Job List

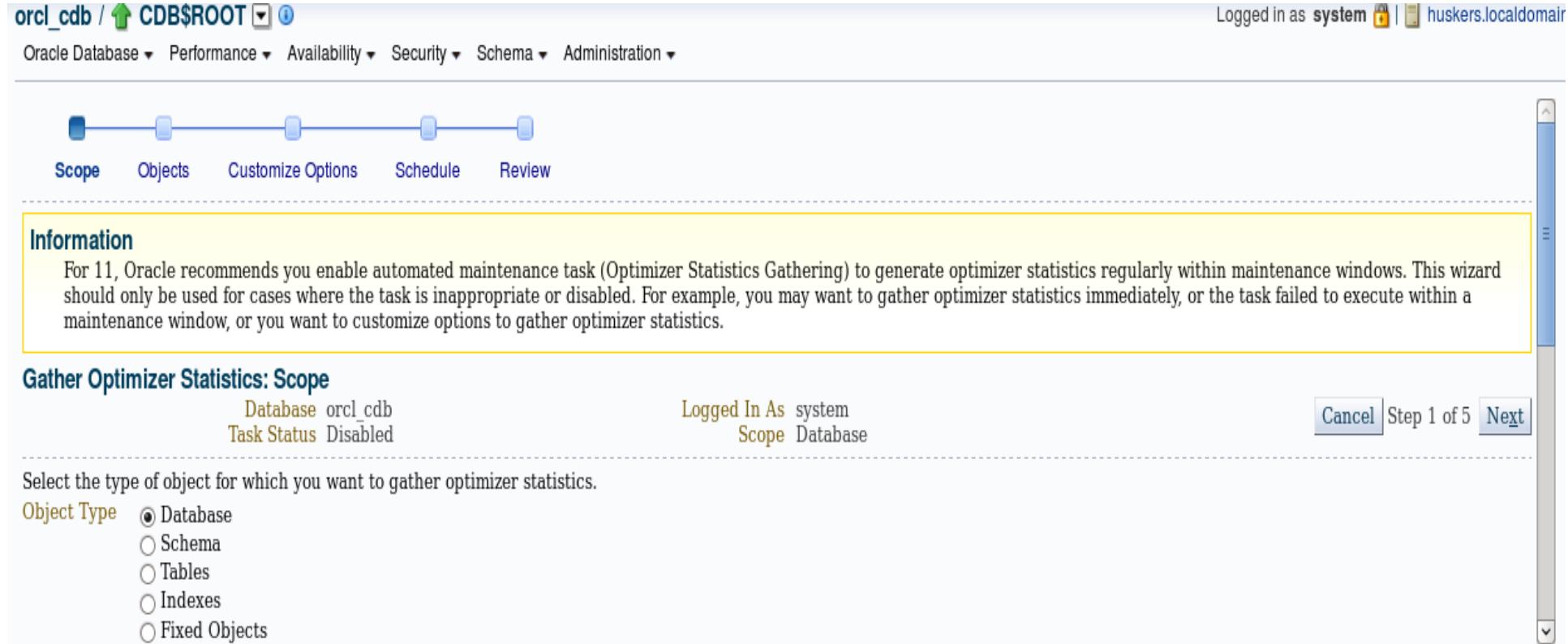
Oracle 19c Optimizer Statistics

Optimizer Job List

Previous | 1-10 of 24 | Next 10

Name	Target	Status	Total Objects	Num Completed	Start Time	Duration
gather_index_stats	SYS.WRI\$_ADV_SQLT_PLAN_HASH_01	COMPLETED	1	1	Oct 12, 2014 12:05:04 PM	00:00:00
gather_index_stats	SYS.WRI\$_ADV_SQLT_PLAN_STATS_PK	COMPLETED	1	1	Oct 12, 2014 12:05:04 PM	00:00:00
gather_index_stats	SYS.WRI\$_ADV_TASKS_IDX_04	COMPLETED	1	1	Oct 12, 2014 12:05:04 PM	00:00:00
gather_index_stats	SYS.SYS_C002225	COMPLETED	1	1	Oct 12, 2014 12:05:04 PM	00:00:00
gather_index_stats	SYS.WRI\$_ADV_EXECS_IDX_03	COMPLETED	1	1	Oct 12, 2014 12:05:04 PM	00:00:00
gather_index_stats	SYS.SYS_C002222	COMPLETED	1	1	Oct 12, 2014 12:05:04 PM	00:00:00
gather_index_stats	SYS.SYS_ILO000006947C00011\$\$	COMPLETED	0	0	Oct 12, 2014 12:05:04 PM	00:00:00
gather_index_stats	SYS.SYS_ILO000006989C00040\$\$	COMPLETED	0	0	Oct 12, 2014 12:05:04 PM	00:00:00

Oracle 19c Optimizer Statistics



The screenshot shows the Oracle Database Control interface for the database `orcl_cdb / CDB$ROOT`. The top navigation bar includes links for Oracle Database, Performance, Availability, Security, Schema, and Administration. The status bar indicates the user is logged in as `system` from the host `huskers.localdomain`.

The main content area displays a five-step wizard titled "Gather Optimizer Statistics". The current step is "Scope". A yellow callout box highlights the information section, which states: "For 11, Oracle recommends you enable automated maintenance task (Optimizer Statistics Gathering) to generate optimizer statistics regularly within maintenance windows. This wizard should only be used for cases where the task is inappropriate or disabled. For example, you may want to gather optimizer statistics immediately, or the task failed to execute within a maintenance window, or you want to customize options to gather optimizer statistics."

The "Gather Optimizer Statistics: Scope" page includes the following details:

- Database: `orcl_cdb`
- Task Status: Disabled
- Logged In As: system
- Scope: Database
- Buttons: Cancel, Step 1 of 5, Next

The "Object Type" section allows selecting the type of object to gather optimizer statistics. The "Database" option is selected (radio button is checked). Other options include Schema, Tables, Indexes, and Fixed Objects.

 **TIP** The Objects step will be skipped when Database, Fixed Objects or Dictionary Objects is selected.

Options for Scope: Database

Use Oracle-recommended option settings

Oracle will select objects for which to gather optimizer statistics based on the activity on the objects. Also, Oracle will use the best options for generating the statistics. The Customize Options step will be skipped if you choose this option.

 [View Oracle-recommended option settings](#)

Customize Options

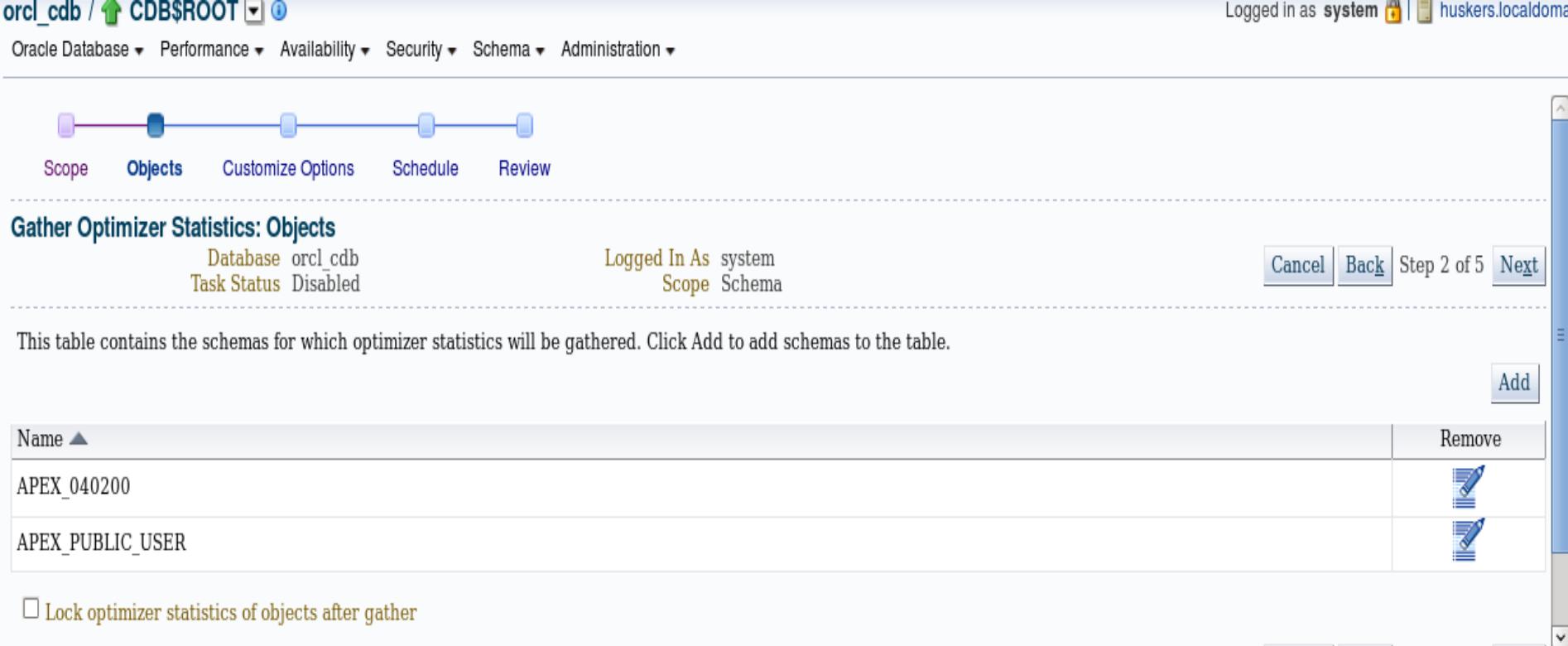
You can customize options on the Customize Options step

Validate With SQL Performance Analyzer

Validate impact of stats on SQL performance prior to publishing (recommended). The database global statistics gathering option PUBLISH will be set to FALSE temporarily during the process.

[Cancel](#) Step 1 of 5 [Next](#)

Oracle 19c Optimizer Statistics



The screenshot shows the Oracle Database Control interface for a CDB\$ROOT database. The top navigation bar includes links for Oracle Database, Performance, Availability, Security, Schema, and Administration. The current page is 'Gather Optimizer Statistics: Objects'. The top right corner shows the user is logged in as 'system' on 'huskers.localdomain'. A progress bar at the top indicates the process is at Step 2 of 5, with tabs for Scope, Objects (selected), Customize Options, Schedule, and Review.

Gather Optimizer Statistics: Objects

Database orcl_cdb
Task Status Disabled

Logged In As system
Scope Schema

Cancel Back Step 2 of 5 Next

This table contains the schemas for which optimizer statistics will be gathered. Click Add to add schemas to the table.

Name	Actions
APEX_040200	 
APEX_PUBLIC_USER	 

Lock optimizer statistics of objects after gather

Options for Scope: Schema

Use Oracle-recommended option settings

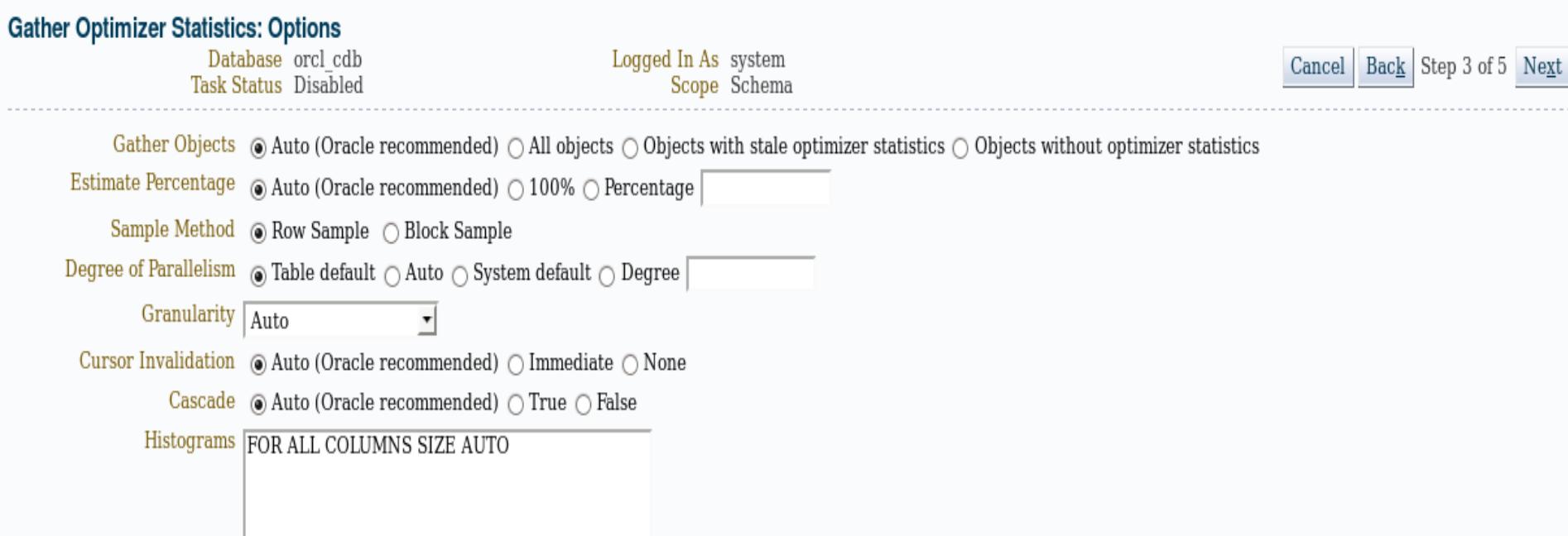
Oracle will select objects for which to gather optimizer statistics based on the activity on the objects. Also, Oracle will use the best options for generating the statistics. The Customize Options step will be skipped if you choose this option.

► View Oracle-recommended option settings

Customize Options

You can customize options on the Customize Options step

Oracle 19c Optimizer Statistics



The screenshot shows the 'Gather Optimizer Statistics: Options' dialog box. At the top, it displays the database name 'orcl_cdb' and the task status 'Disabled'. It also shows the user is 'Logged In As system' with a scope of 'Schema'. Navigation buttons include 'Cancel', 'Back', 'Step 3 of 5', and 'Next'. The main configuration area includes the following settings:

- Gather Objects: Radio button selected for 'Auto (Oracle recommended)'.
- Estimate Percentage: Radio button selected for 'Auto (Oracle recommended)'.
- Sample Method: Radio button selected for 'Row Sample'.
- Degree of Parallelism: Radio button selected for 'Table default'.
- Granularity: A dropdown menu showing 'Auto'.
- Cursor invalidation: Radio button selected for 'Auto (Oracle recommended)'.
- Cascade: Radio button selected for 'Auto (Oracle recommended)'.
- Histograms: A text input field containing 'FOR ALL COLUMNS SIZE AUTO'.

Oracle 19c Optimizer Statistics



The screenshot shows the Oracle Database Control interface for the 'orcl_cdb / CDB\$ROOT' database. The top navigation bar includes links for Oracle Database, Performance, Availability, Security, Schema, and Administration. A large orange arrow points from the left towards the screenshot.

The main content area is titled 'Gather Optimizer Statistics: Schedule'. It displays the following information:

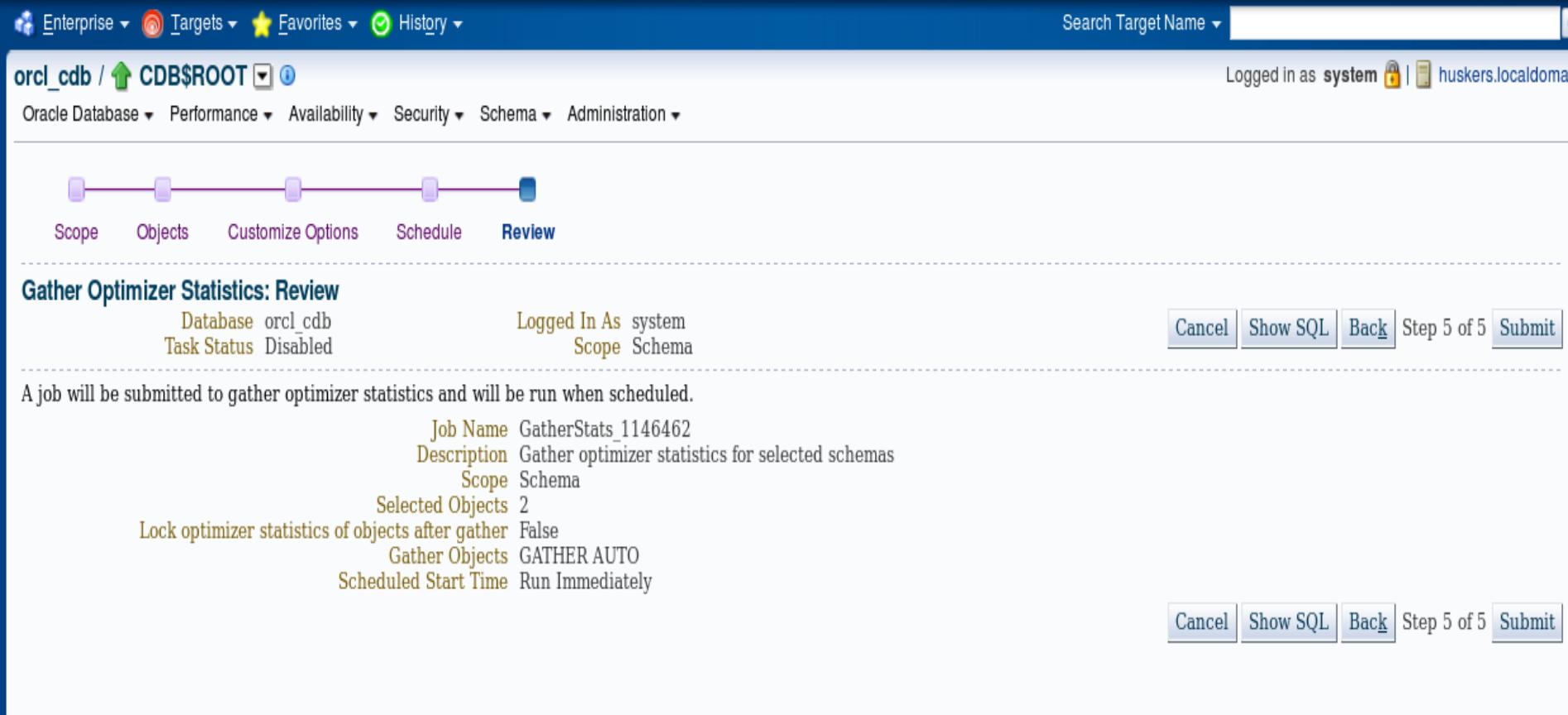
- Database: orcl_cdb
- Task Status: Disabled
- Logged In As: system
- Scope: Schema
- Buttons: Cancel, Back, Step 4 of 5, Next

Form fields for the current step include:

- * Job Name: GatherStats_1146462
- Description: Gather optimizer statistics for selected schemas

A 'Scheduling Option' section contains a 'Schedule Type' dropdown set to 'Standard'.

Oracle 19c Optimizer Statistics



The screenshot shows the Oracle Database Control interface for the database **orcl_cdb / CDB\$ROOT**. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for Target Name. The user is logged in as **system** from **huskers.localdomain**.

The main menu at the top has categories: Oracle Database, Performance, Availability, Security, Schema, and Administration.

A progress bar at the top indicates the process is at Step 5 of 5, specifically the **Review** step. Below the progress bar, the title is **Gather Optimizer Statistics: Review**.

Job details shown:

Database	orcl_cdb	Logged In As	system
Task Status	Disabled	Scope	Schema

Buttons available in the review step include Cancel, Show SQL, Back, Step 5 of 5, and Submit.

The main message in the review step is: "A job will be submitted to gather optimizer statistics and will be run when scheduled." Below this, detailed job parameters are listed:

Job Name	GatherStats_1146462
Description	Gather optimizer statistics for selected schemas
Scope	Schema
Selected Objects	2
Lock optimizer statistics of objects after gather	False
Gather Objects	GATHER AUTO
Scheduled Start Time	Run Immediately

Buttons available in the detailed job parameters step include Cancel, Show SQL, Back, Step 5 of 5, and Submit.

Oracle 19c Optimizer Statistics

Locking Statistics, Export/Import Statistics

Statistics may be locked in place

The statistics will not be overwritten

Determined the 'good statistics'

Pending and Published Statistics

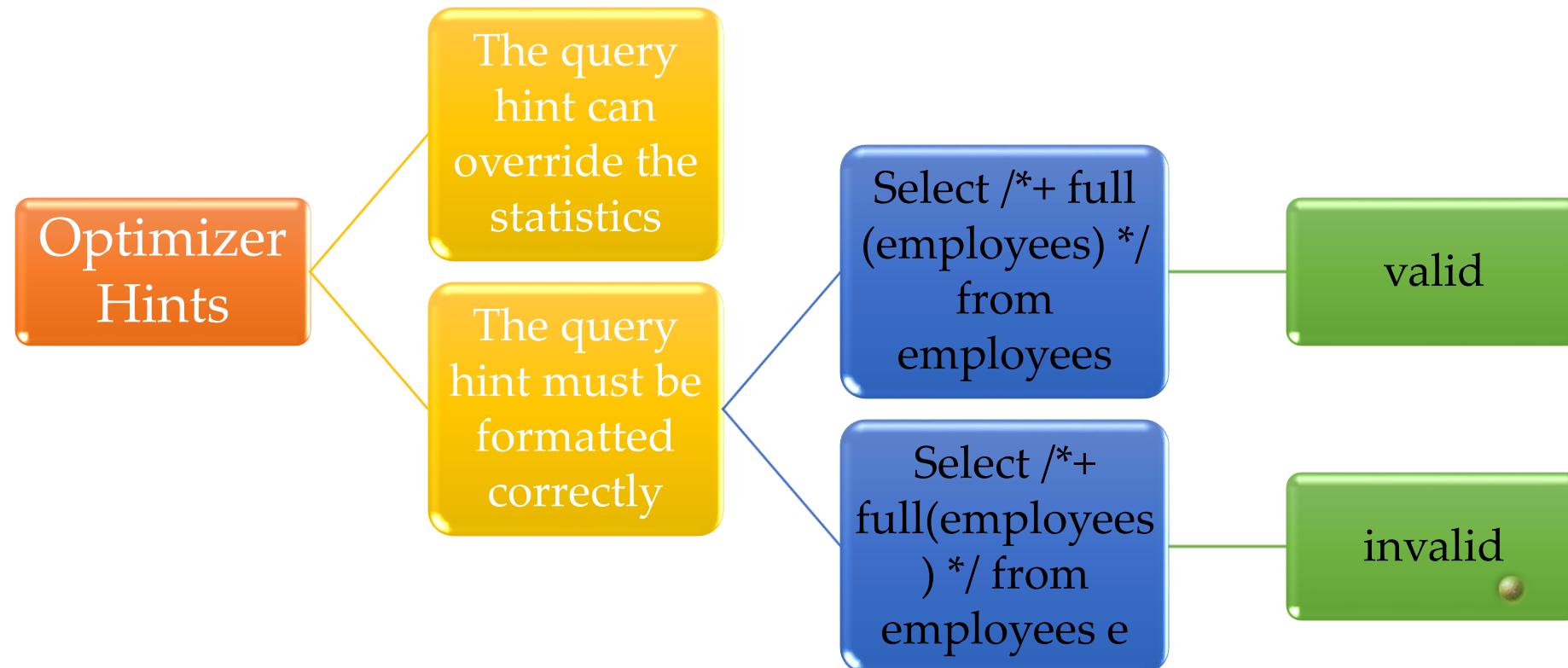
Use dbms_stats.set_table_prefs

To set statistics to be published or not

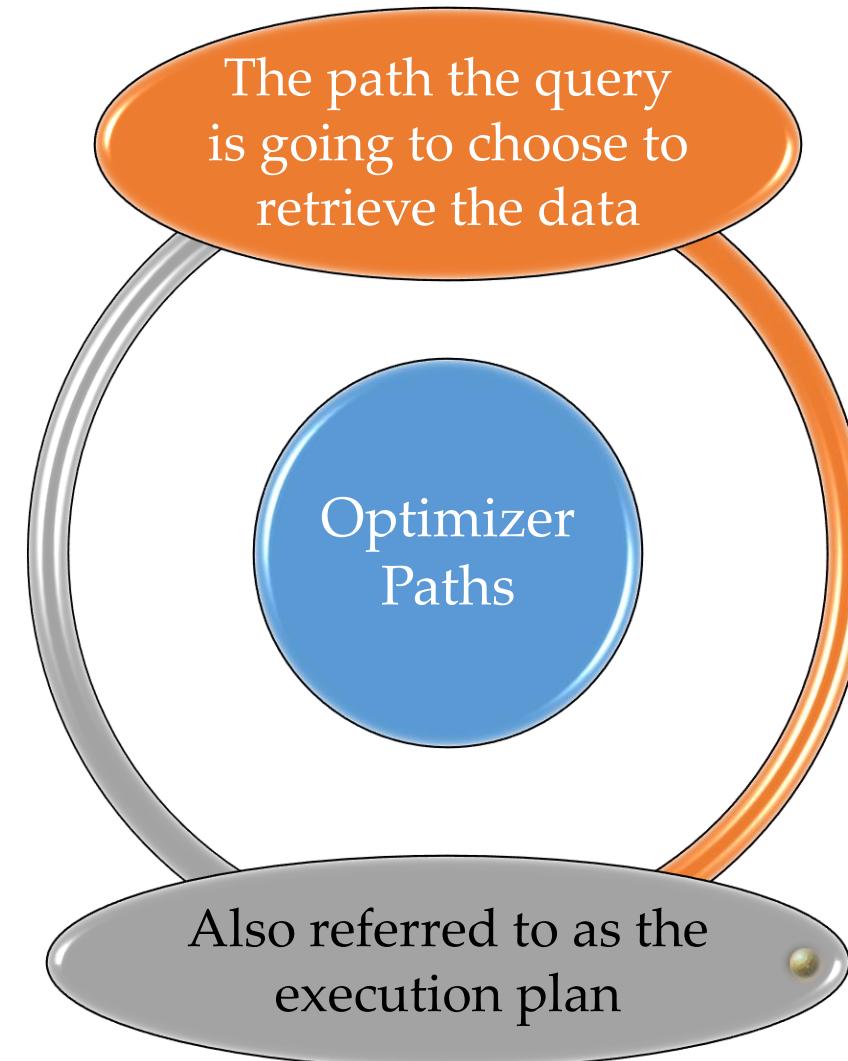
Query Optimizer will not use pending
statistics

```
dbms_stats.set_table_prefs('sh'  
'customers' 'publish' 'false')
```

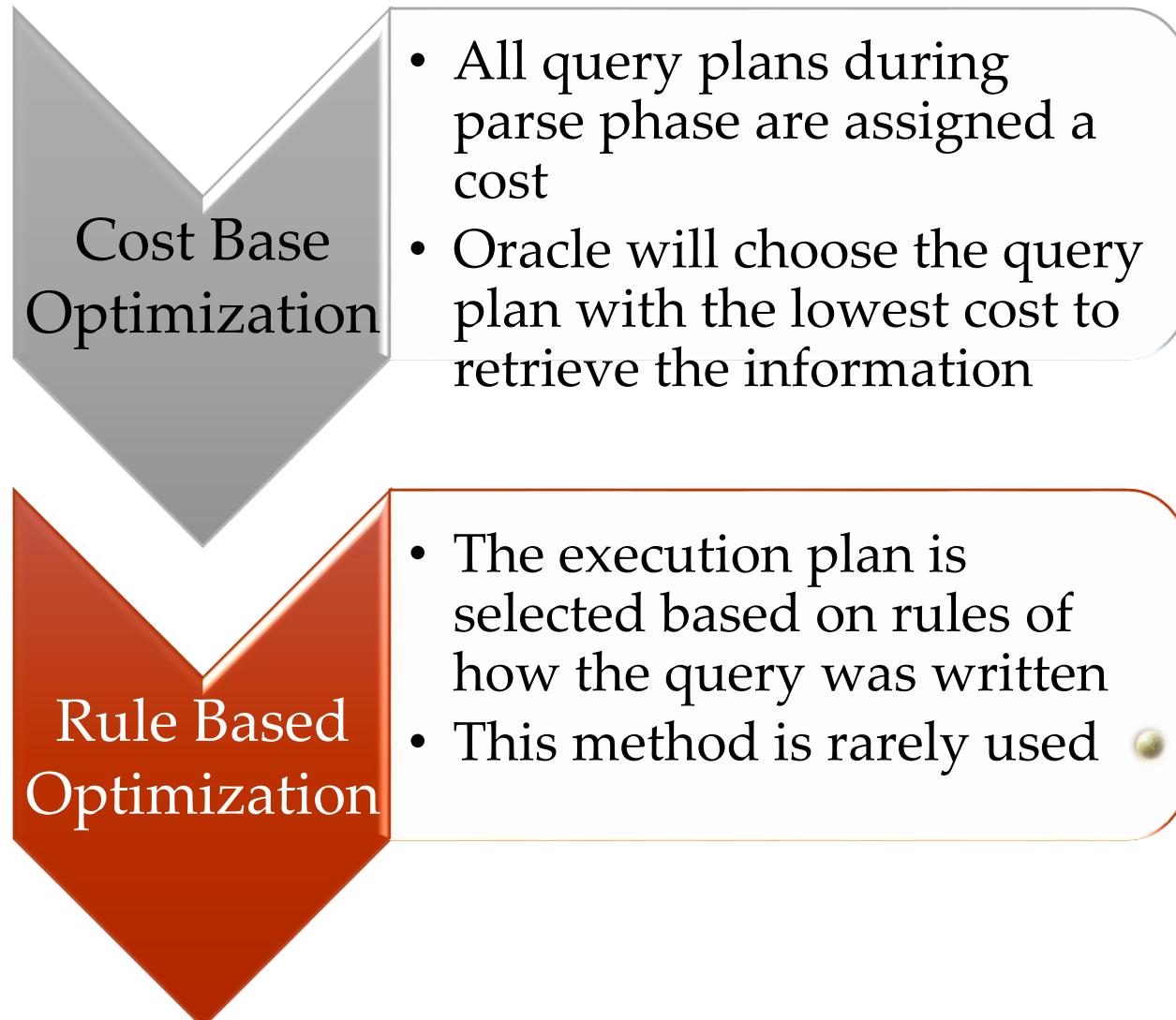
Oracle 19c Optimizer Statistics



Oracle 19c Optimizer Statistics

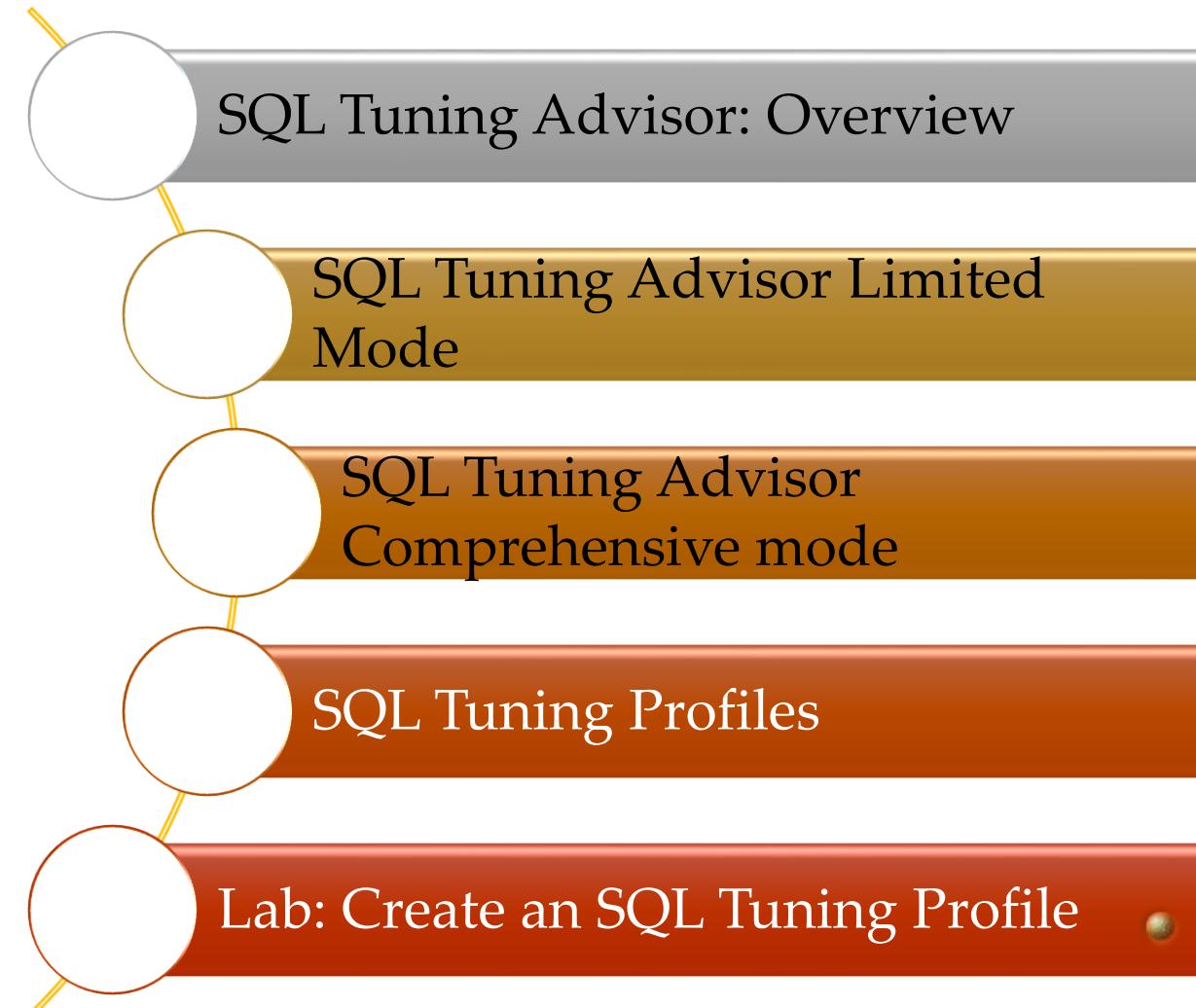


Oracle 19c Optimizer Statistics

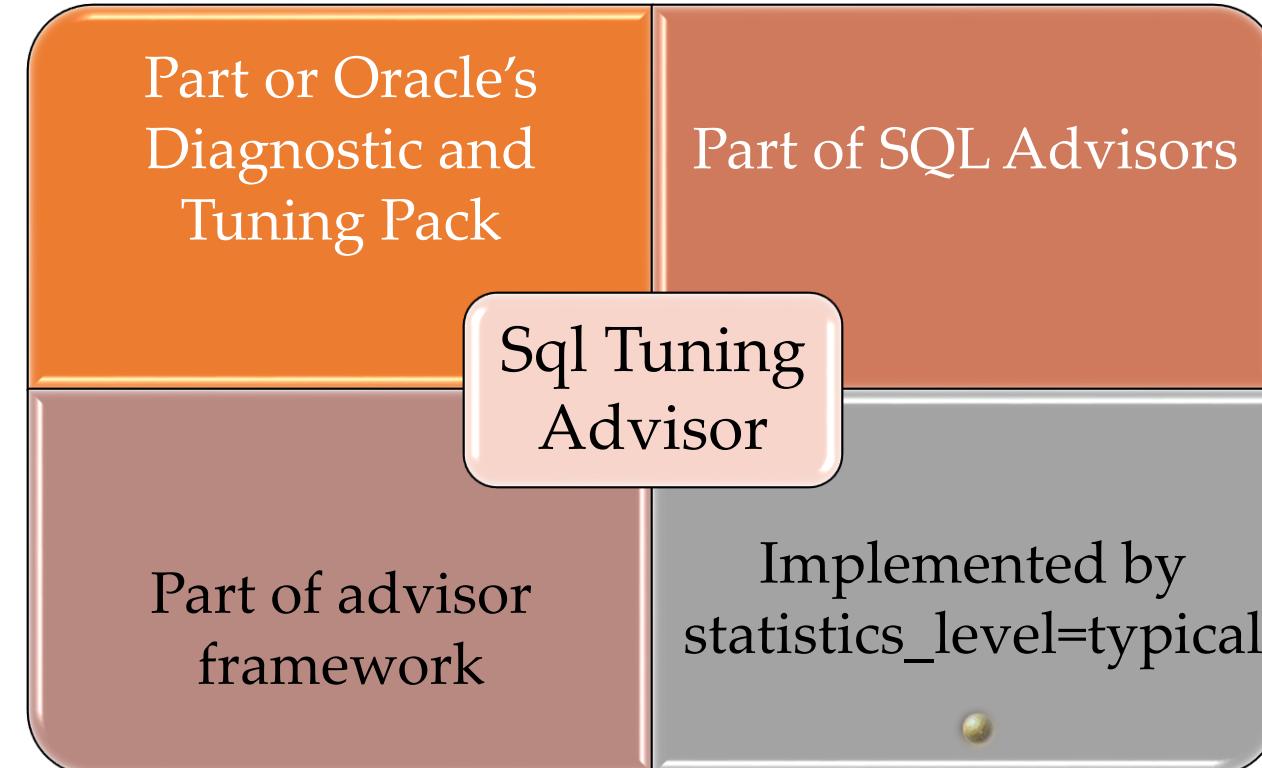


- SQL Tuning Advisor

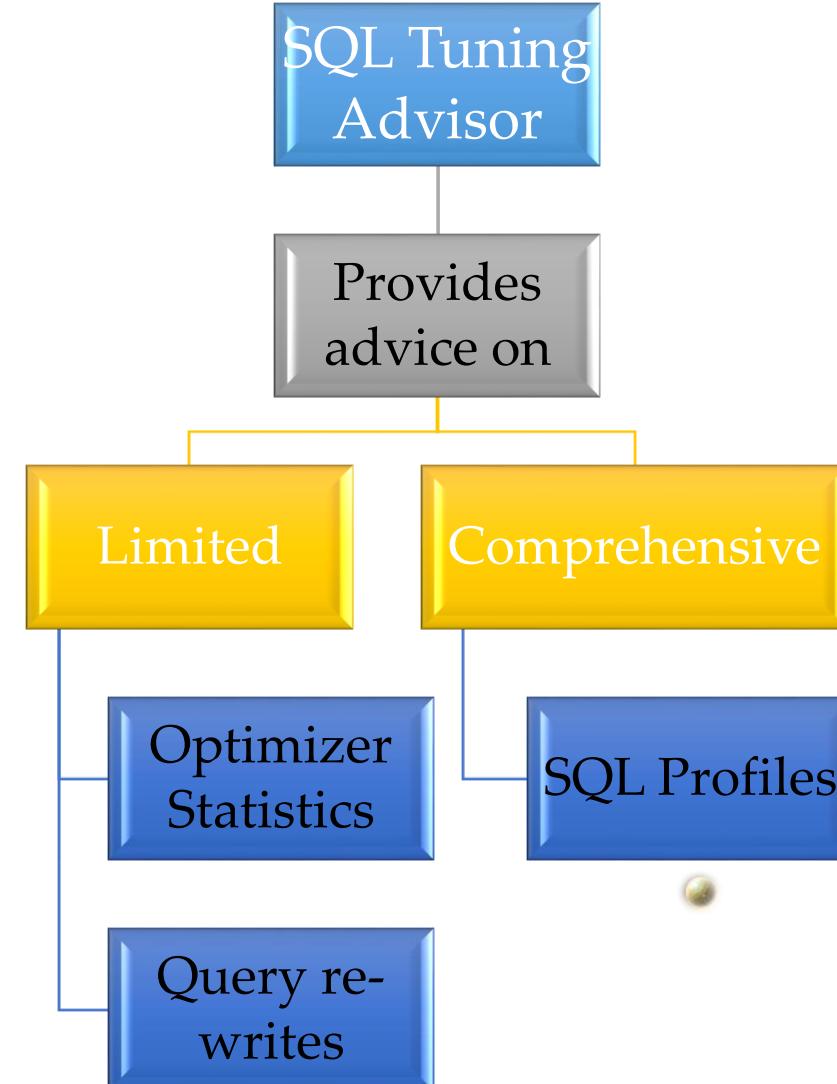
Lesson Topics



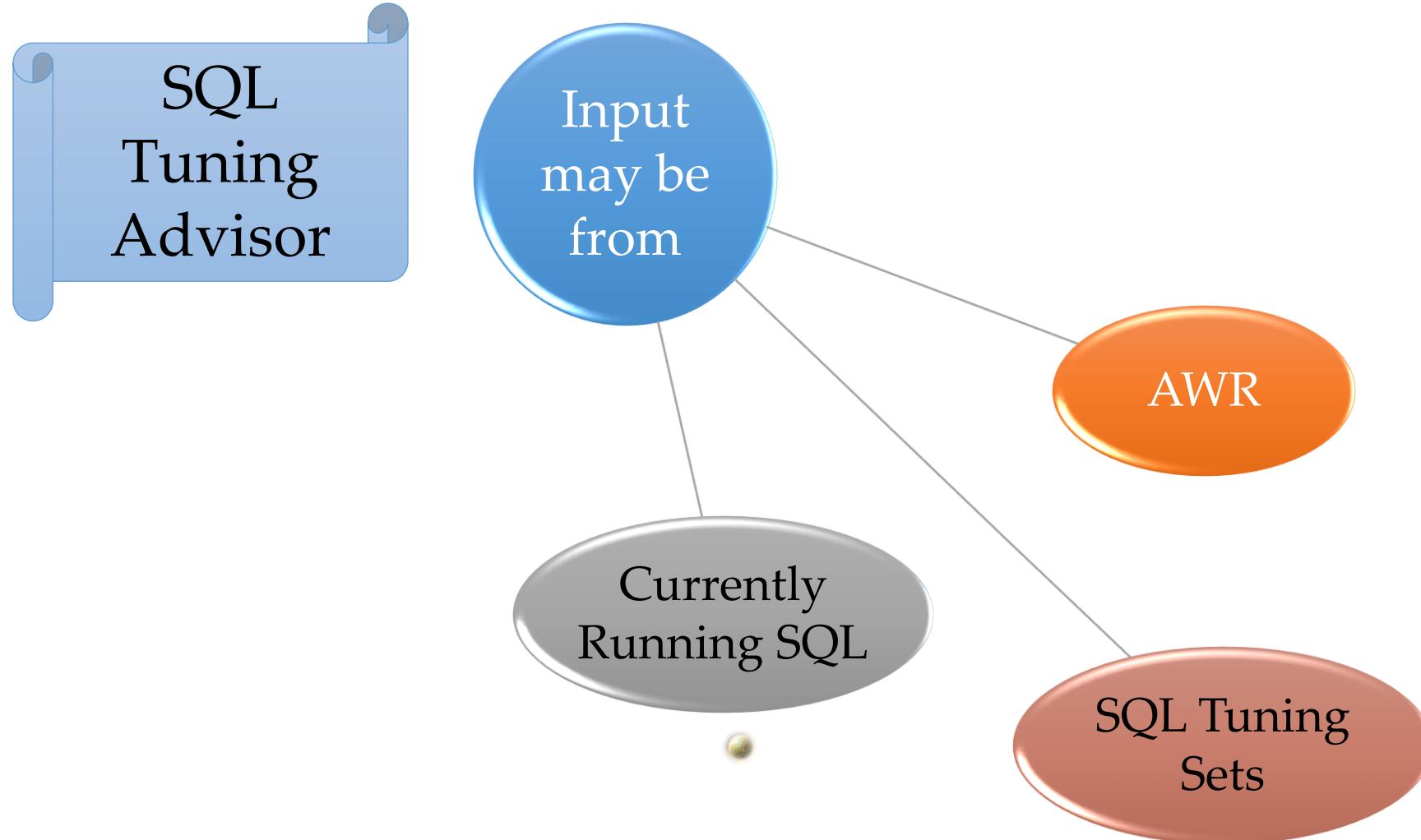
Oracle 19c SQL Tuning Advisor



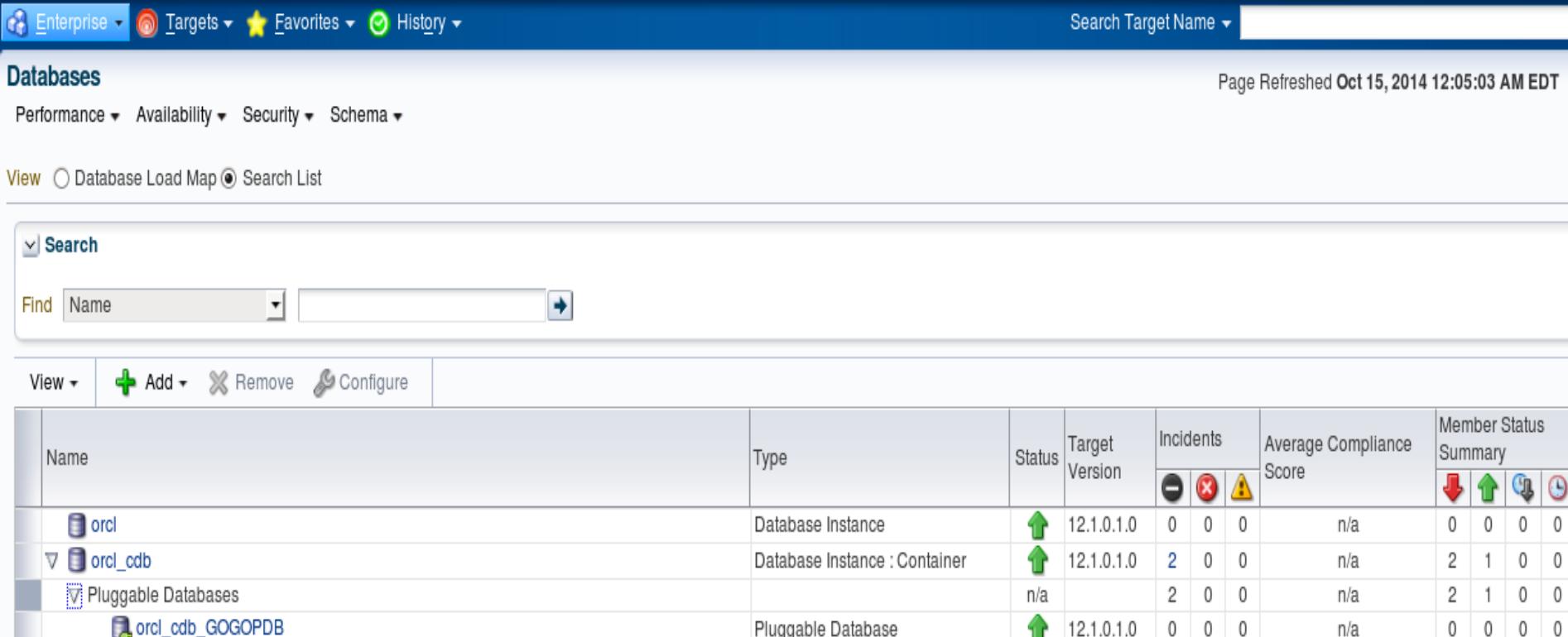
Oracle 19c SQL Tuning Advisor



Oracle 19c SQL Tuning Advisor



Oracle 19c SQL Tuning Advisor

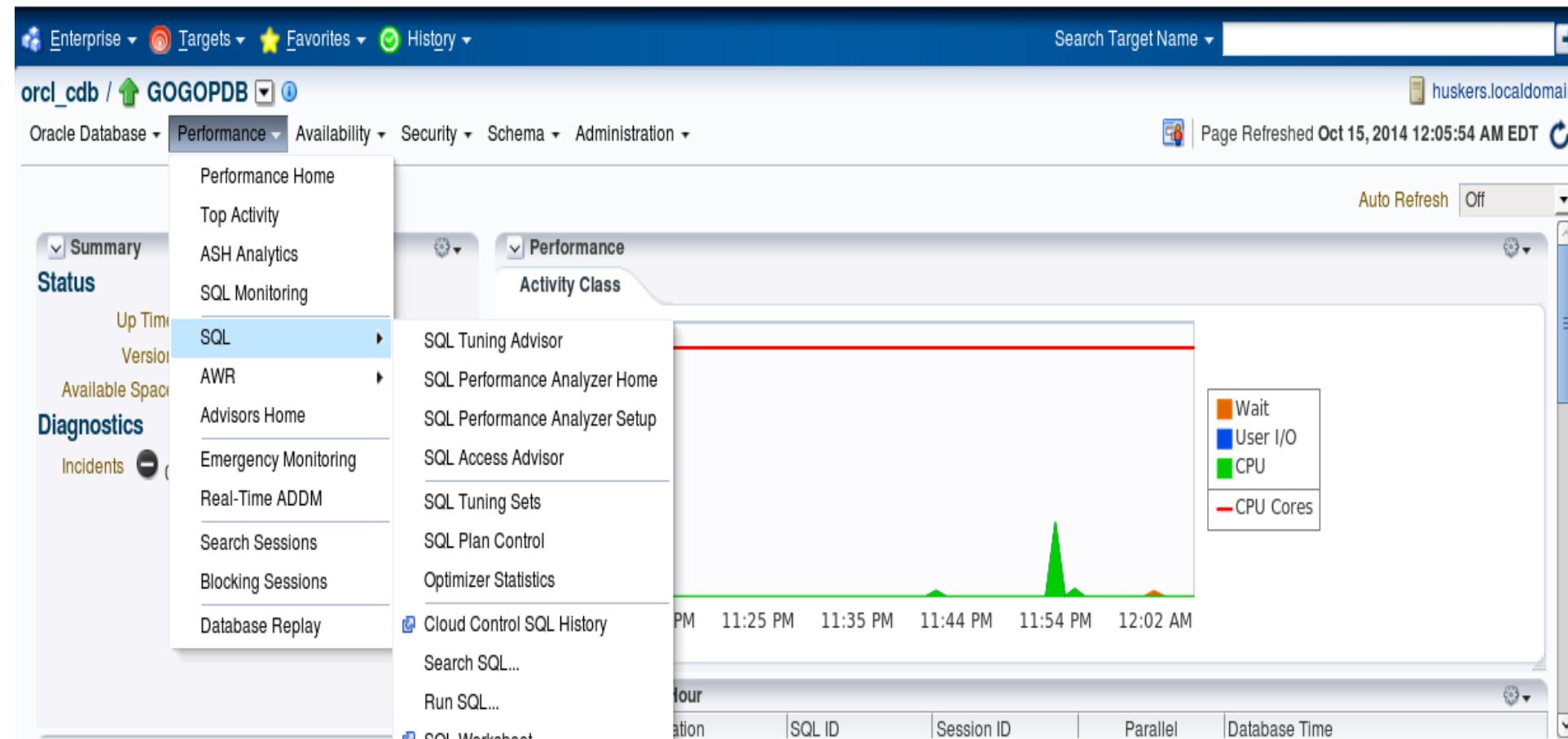


The screenshot shows the Oracle 19c SQL Tuning Advisor interface. At the top, there is a navigation bar with links for Enterprise, Targets, Favorites, and History, along with a search bar for 'Search Target Name'. Below the navigation bar, the page title is 'Databases' with a subtitle 'Page Refreshed Oct 15, 2014 12:05:03 AM EDT'. Under the title, there are dropdown menus for Performance, Availability, Security, and Schema. A 'View' section includes links for Database Load Map and Search List.

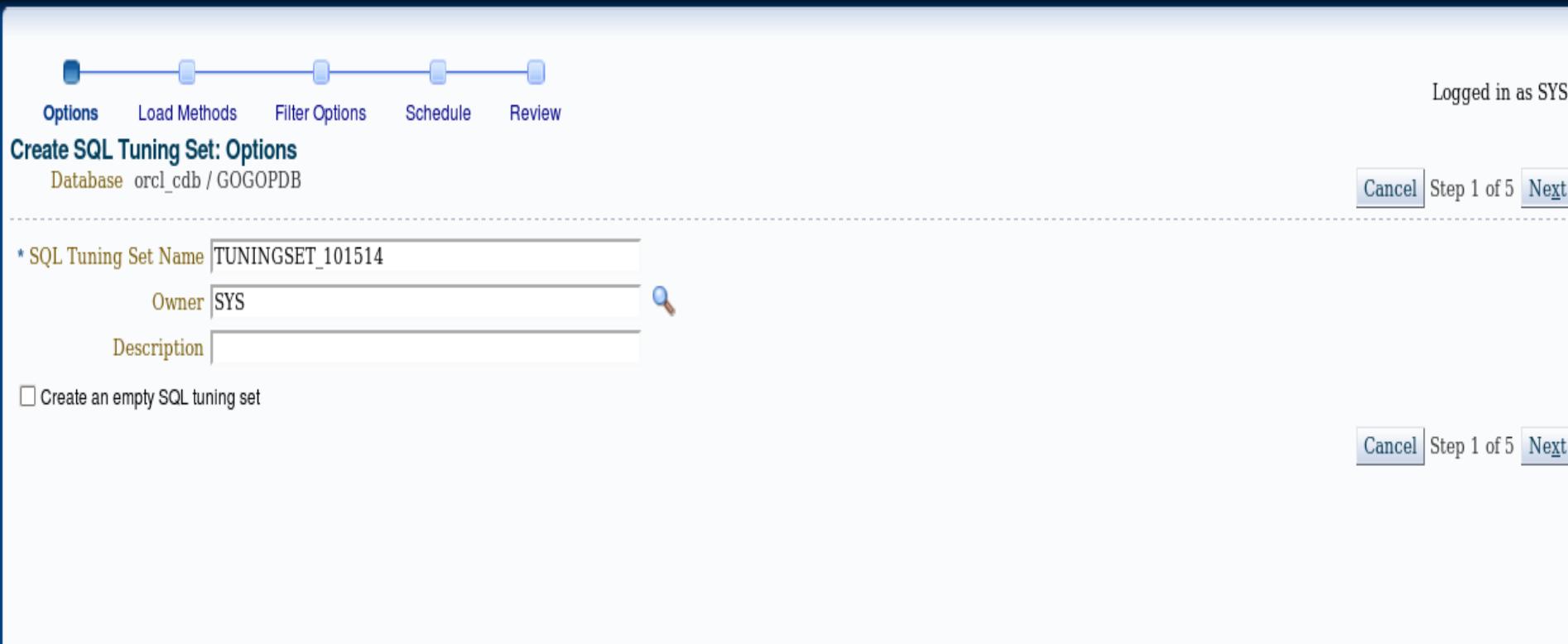
The main content area is titled 'Search' and contains a 'Find' field set to 'Name'. Below this is a toolbar with 'View', 'Add', 'Remove', and 'Configure' buttons. The main table displays database information:

Name	Type	Status	Target Version	Incidents	Average Compliance Score	Member Status Summary
orcl	Database Instance	Green arrow up	12.1.0.1.0	0 0 0	n/a	0 0 0 0
orcl_cdb	Database Instance : Container	Green arrow up	12.1.0.1.0	2 0 0	n/a	2 1 0 0
Pluggable Databases		n/a		2 0 0	n/a	2 1 0 0
orcl_cdb_GOGOPDB	Pluggable Database	Green arrow up	12.1.0.1.0	0 0 0	n/a	0 0 0 0

Oracle 19c SQL Tuning Advisor



Oracle 19c SQL Tuning Advisor



The screenshot shows the 'Create SQL Tuning Set: Options' step of the Oracle 19c SQL Tuning Advisor. The top navigation bar includes 'Options', 'Load Methods', 'Filter Options', 'Schedule', and 'Review'. On the right, it says 'Logged in as SYS'. Below the navigation, the database is set to 'orcl_cdb / GOGOPDB'. The main form has fields for 'SQL Tuning Set Name' (TUNINGSET_101514), 'Owner' (SYS), and 'Description'. A checkbox 'Create an empty SQL tuning set' is checked. At the bottom right are 'Cancel', 'Step 1 of 5', and 'Next' buttons.

Logged in as SYS

Options Load Methods Filter Options Schedule Review

Create SQL Tuning Set: Options

Database orcl_cdb / GOGOPDB

Cancel Step 1 of 5 Next

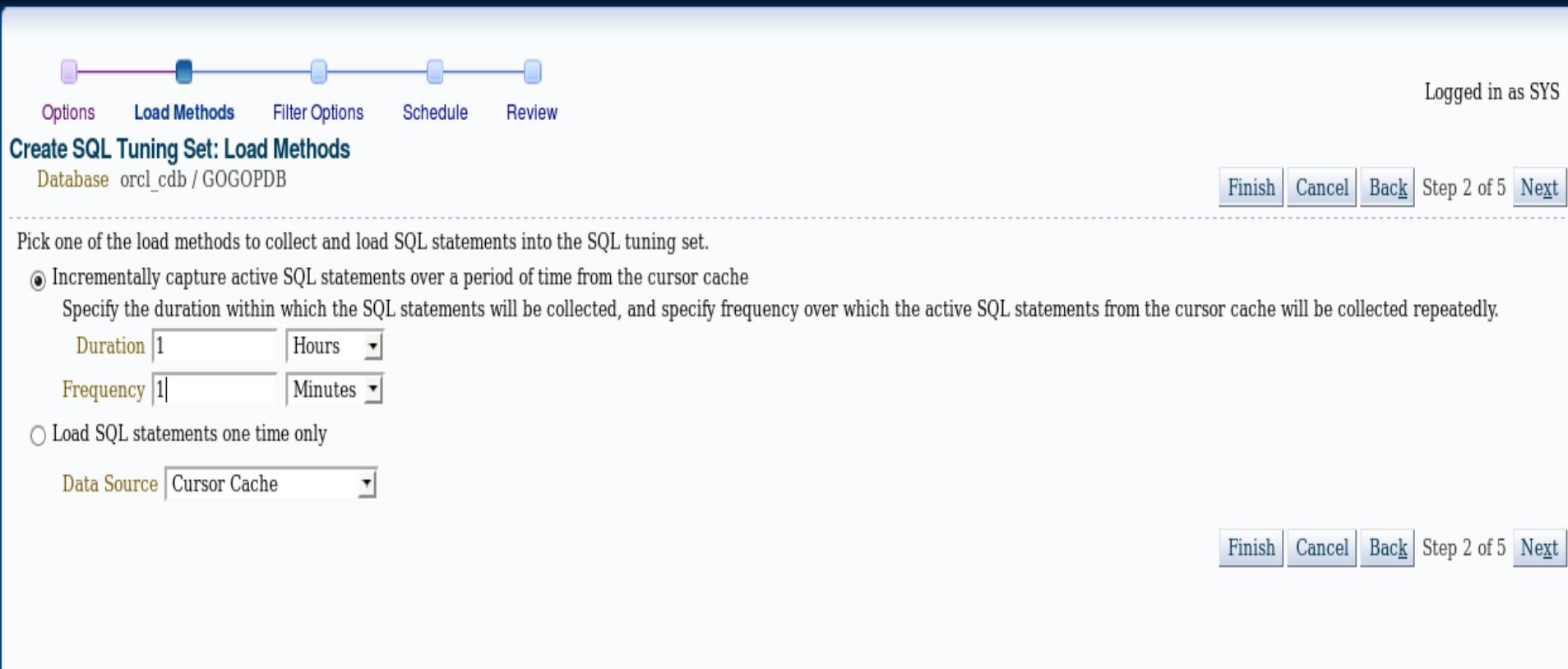
* SQL Tuning Set Name TUNINGSET_101514

Owner SYS

Description

Create an empty SQL tuning set

Cancel Step 1 of 5 Next

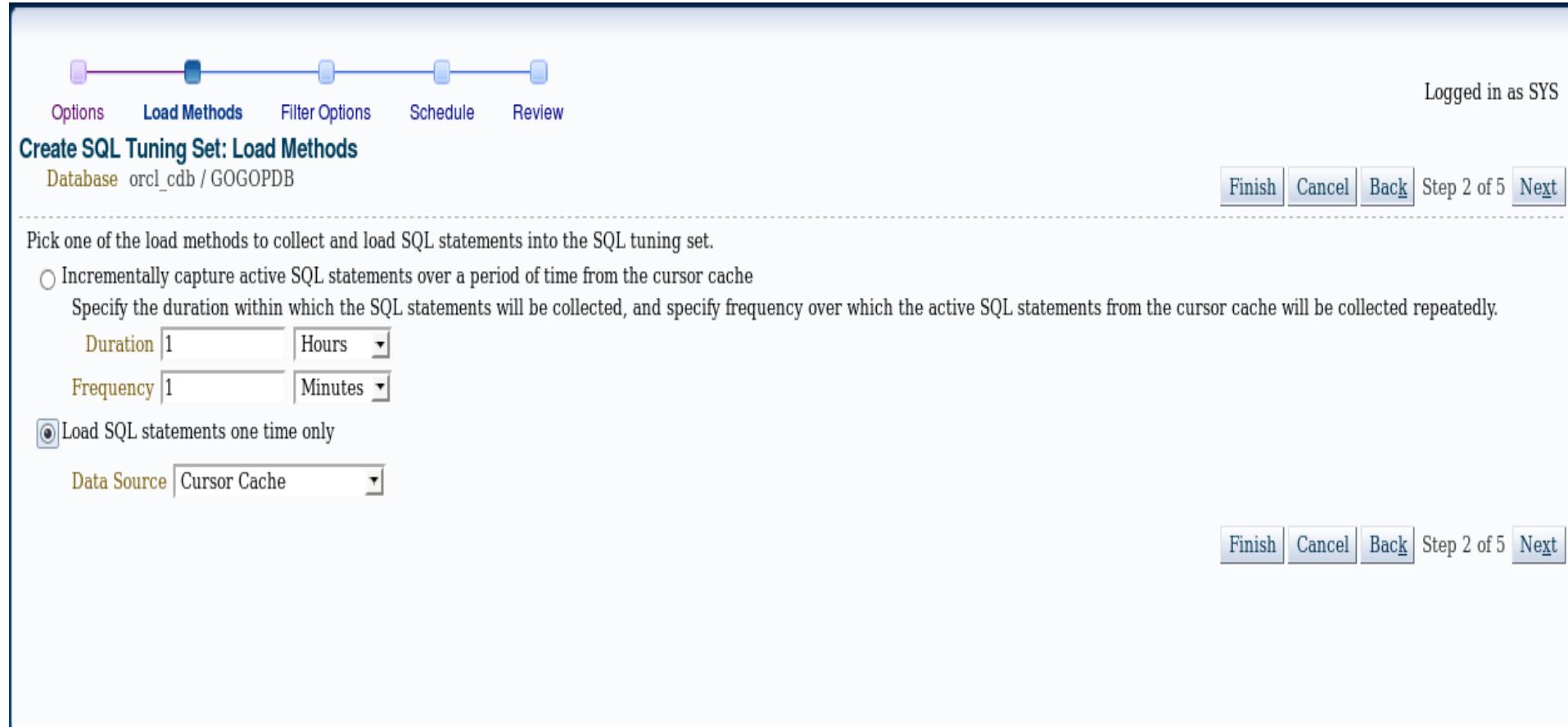


The screenshot shows the 'Create SQL Tuning Set: Load Methods' step of the Oracle 19c SQL Tuning Advisor. The top navigation bar includes 'Options', 'Load Methods' (which is selected), 'Filter Options', 'Schedule', and 'Review'. To the right, it says 'Logged in as SYS'. Below the bar, the title 'Create SQL Tuning Set: Load Methods' is displayed, along with the database information 'Database orcl_cdb / GOGOPDB'. On the right, there are buttons for 'Finish', 'Cancel', 'Back', 'Step 2 of 5', and 'Next'.

The main content area asks 'Pick one of the load methods to collect and load SQL statements into the SQL tuning set.' Two options are available:

- Incrementally capture active SQL statements over a period of time from the cursor cache
 - Specify the duration within which the SQL statements will be collected, and specify frequency over which the active SQL statements from the cursor cache will be collected repeatedly.
Duration Hours
 - Frequency Minutes
- Load SQL statements one time only
Data Source

Oracle 19c SQL Tuning Advisor



The screenshot shows the 'Create SQL Tuning Set: Load Methods' step of the Oracle 19c SQL Tuning Advisor. The top navigation bar includes 'Options', 'Load Methods' (which is highlighted in blue), 'Filter Options', 'Schedule', and 'Review'. To the right, it says 'Logged in as SYS'. Below the navigation is the title 'Create SQL Tuning Set: Load Methods' and the database 'orcl_cdb / GOGOPDB'. On the right are buttons for 'Finish', 'Cancel', 'Back', 'Step 2 of 5', and 'Next'.

Pick one of the load methods to collect and load SQL statements into the SQL tuning set.

Incrementally capture active SQL statements over a period of time from the cursor cache
Specify the duration within which the SQL statements will be collected, and specify frequency over which the active SQL statements from the cursor cache will be collected repeatedly.

Duration Hours

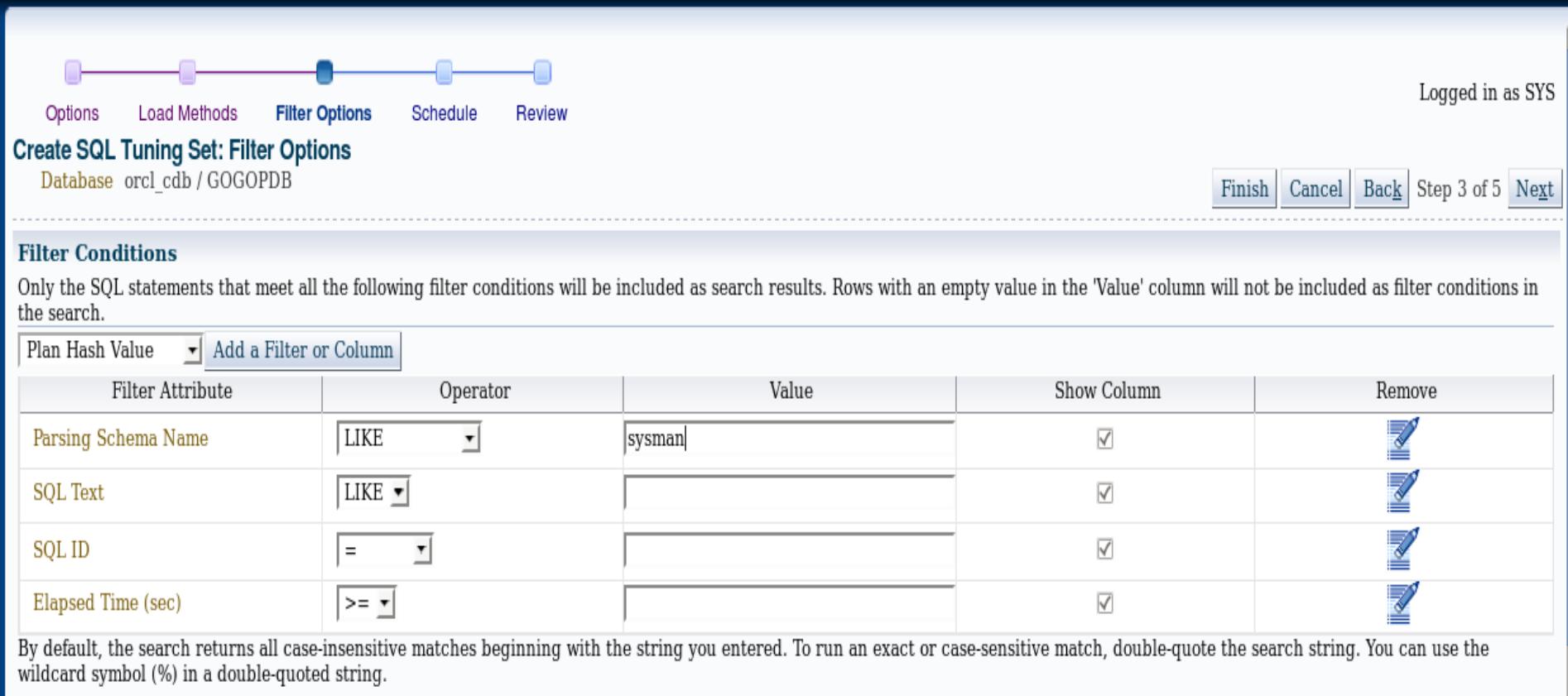
Frequency Minutes

Load SQL statements one time only

Data Source

On the right, there are 'Finish', 'Cancel', 'Back', 'Step 2 of 5', and 'Next' buttons.

Oracle 19c SQL Tuning Advisor



The screenshot shows the 'Create SQL Tuning Set: Filter Options' step of the Oracle 19c SQL Tuning Advisor. The top navigation bar includes tabs for Options, Load Methods, Filter Options (which is selected), Schedule, and Review. To the right, it shows 'Logged in as SYS'. Below the tabs, the database is set to 'orcl_cdb / GOGOPDB'. On the right side of the screen are buttons for Finish, Cancel, Back, Step 3 of 5, and Next.

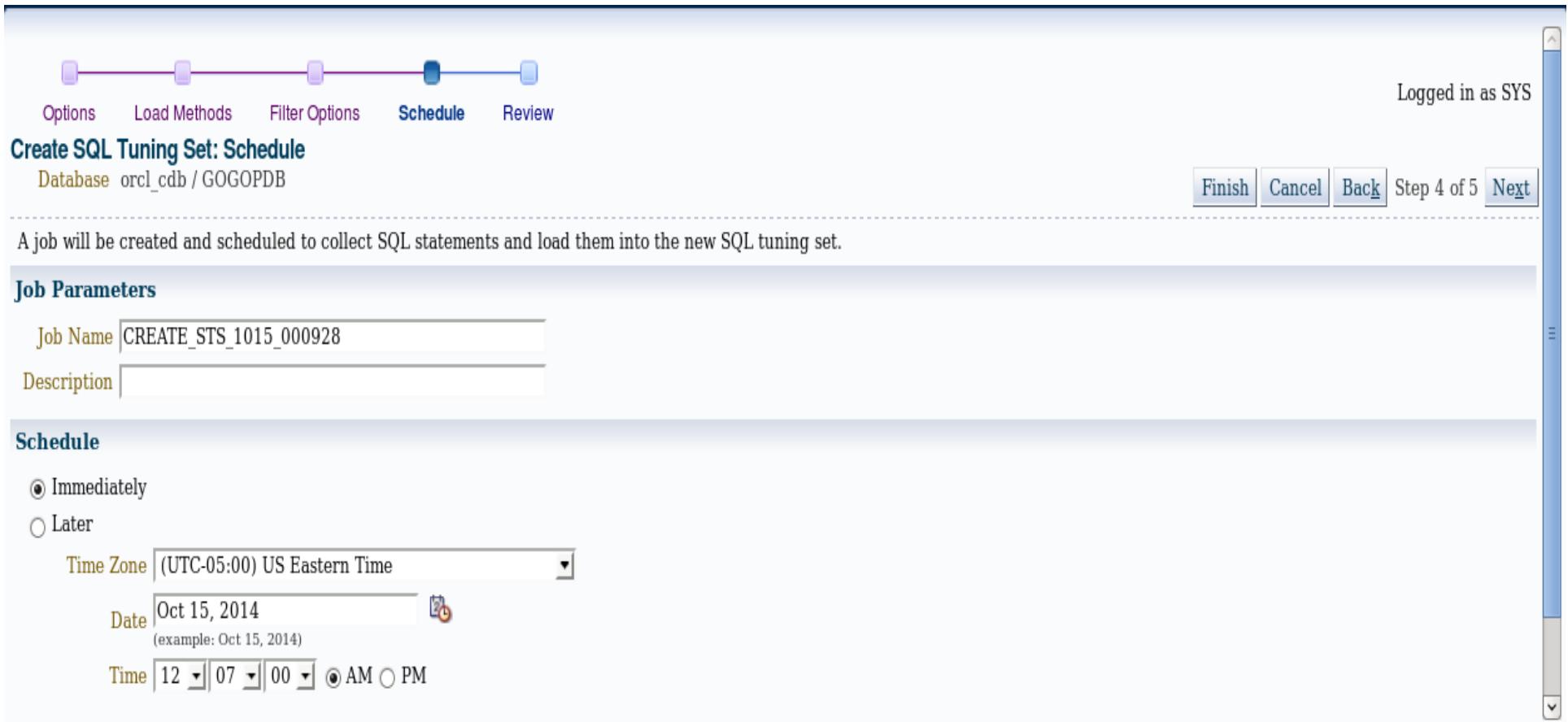
Filter Conditions

Only the SQL statements that meet all the following filter conditions will be included as search results. Rows with an empty value in the 'Value' column will not be included as filter conditions in the search.

Plan Hash Value	Add a Filter or Column				
Filter Attribute	Operator	Value	Show Column	Remove	
Parsing Schema Name	LIKE	sysman	<input checked="" type="checkbox"/>		
SQL Text	LIKE		<input checked="" type="checkbox"/>		
SQL ID	=		<input checked="" type="checkbox"/>		
Elapsed Time (sec)	>=		<input checked="" type="checkbox"/>		

By default, the search returns all case-insensitive matches beginning with the string you entered. To run an exact or case-sensitive match, double-quote the search string. You can use the wildcard symbol (%) in a double-quoted string.

Oracle 19c SQL Tuning Advisor



The screenshot shows the 'Create SQL Tuning Set: Schedule' step of the Oracle 19c SQL Tuning Advisor. The top navigation bar includes tabs for Options, Load Methods, Filter Options, Schedule (which is selected), and Review. To the right, it says 'Logged in as SYS'. Below the tabs, the database is set to 'orcl_cdb / GOGOPDB'. On the right side, there are buttons for Finish, Cancel, Back, Step 4 of 5, and Next. A note at the top states: 'A job will be created and scheduled to collect SQL statements and load them into the new SQL tuning set.' The 'Job Parameters' section contains fields for 'Job Name' (CREATE_STS_1015_000928) and 'Description'. The 'Schedule' section has two options: 'Immediately' (selected) and 'Later'. It includes dropdowns for 'Time Zone' (UTC-05:00 US Eastern Time), 'Date' (Oct 15, 2014), and 'Time' (12:07:00 AM).

Oracle 19c SQL Tuning Advisor



The screenshot shows the 'Create SQL Tuning Set: Review' step of the Oracle 19c SQL Tuning Advisor. The top navigation bar includes a large orange arrow pointing left, followed by 'Options', 'Load Methods', 'Filter Options', 'Schedule', and 'Review'. To the right, it says 'Logged in as SYS'. Below the bar, the title 'Create SQL Tuning Set: Review' is displayed, along with the database information 'Database orcl_cdb / GOGOPDB'. On the right, there are buttons for 'Cancel', 'Back', 'Step 5 of 5', and 'Submit'.

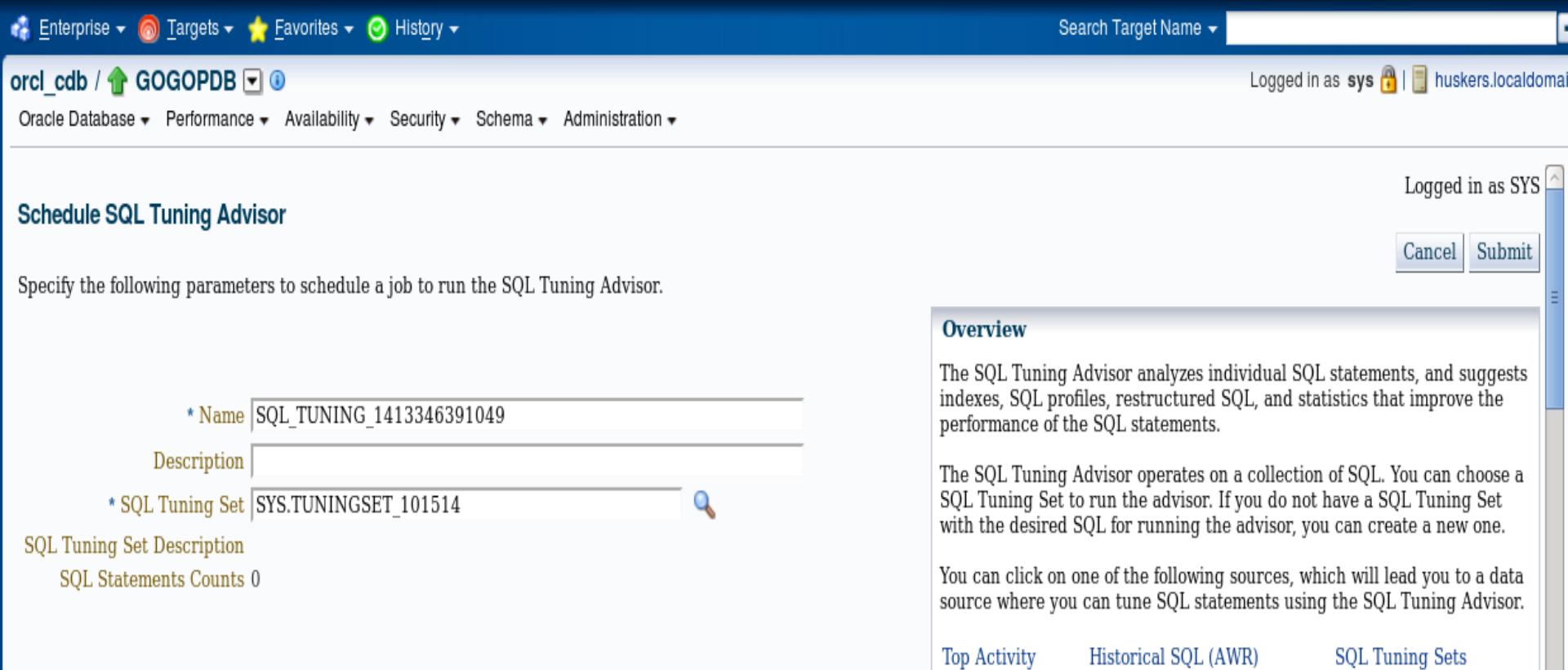
Review the SQL Tuning Set options you have selected.

SQL Tuning Set Name	TUNINGSET_101514
Owner	SYS
Description	
Create an empty SQL tuning set	No
Load Methods	Load SQL statements one time only
Data Source	Cursor Cache
Top N	<ALL>
Filter Conditions	UPPER(PARSING_SCHEMA_NAME) LIKE 'SYSMAN%'
Job Name	CREATE_STS_1015_000928
Scheduled Start Time	Run Immediately

[Show SQL](#)

On the right side of the review area, there are additional 'Cancel', 'Back', 'Step 5 of 5', and 'Submit' buttons.

Oracle 19c SQL Tuning Advisor



The screenshot shows the Oracle 19c SQL Tuning Advisor interface. At the top, there's a navigation bar with links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. Below the navigation is a header bar with the database name 'orcl_cdb / GOGOPDB' and a user status 'Logged in as sys'. The main content area has a title 'Schedule SQL Tuning Advisor' and a sub-instruction 'Specify the following parameters to schedule a job to run the SQL Tuning Advisor.' It contains several input fields: a required 'Name' field with value 'SQL_TUNING_1413346391049', a 'Description' field, and a required 'SQL Tuning Set' field with value 'SYS.TUNINGSET_101514'. To the right of the scheduling form is a sidebar titled 'Overview' which provides a general description of the SQL Tuning Advisor's function. At the bottom of the sidebar are three links: 'Top Activity', 'Historical SQL (AWR)', and 'SQL Tuning Sets'. On the far right of the interface, there are 'Cancel' and 'Submit' buttons.

Enterprise ▾ Targets ▾ Favorites ▾ History ▾

Search Target Name ▾

orcl_cdb / GOGOPDB ▾ ⓘ

Logged in as sys 🔒 huskers.localdomain

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Schedule SQL Tuning Advisor

Specify the following parameters to schedule a job to run the SQL Tuning Advisor.

* Name

Description

* SQL Tuning Set ⚙

SQL Tuning Set Description

SQL Statements Counts 0

Logged in as SYS

Cancel Submit

Overview

The SQL Tuning Advisor analyzes individual SQL statements, and suggests indexes, SQL profiles, restructured SQL, and statistics that improve the performance of the SQL statements.

The SQL Tuning Advisor operates on a collection of SQL. You can choose a SQL Tuning Set to run the advisor. If you do not have a SQL Tuning Set with the desired SQL for running the advisor, you can create a new one.

You can click on one of the following sources, which will lead you to a data source where you can tune SQL statements using the SQL Tuning Advisor.

Top Activity Historical SQL (AWR) SQL Tuning Sets

Oracle 19c SQL Tuning Advisor

Scope

Total Time Limit (minutes)

Scope of Analysis Limited
The analysis is done without SQL Profile recommendation and takes about 1 second per statement.
 Comprehensive
This analysis includes SQL Profile recommendation, but may take a long time.

Time Limit per Statement (minutes)

Schedule

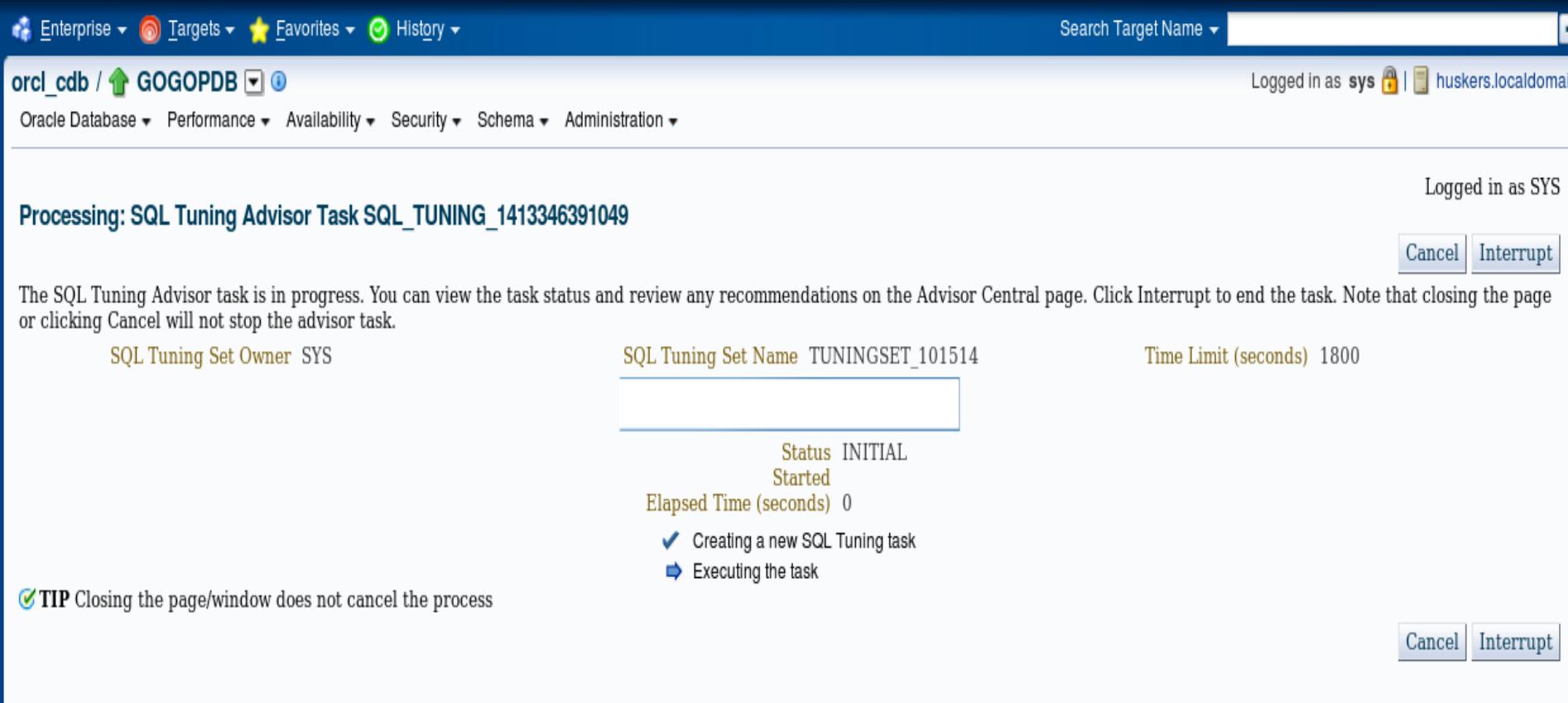
Time Zone

Immediately
 Later

Date 
(example: Oct 15, 2014)

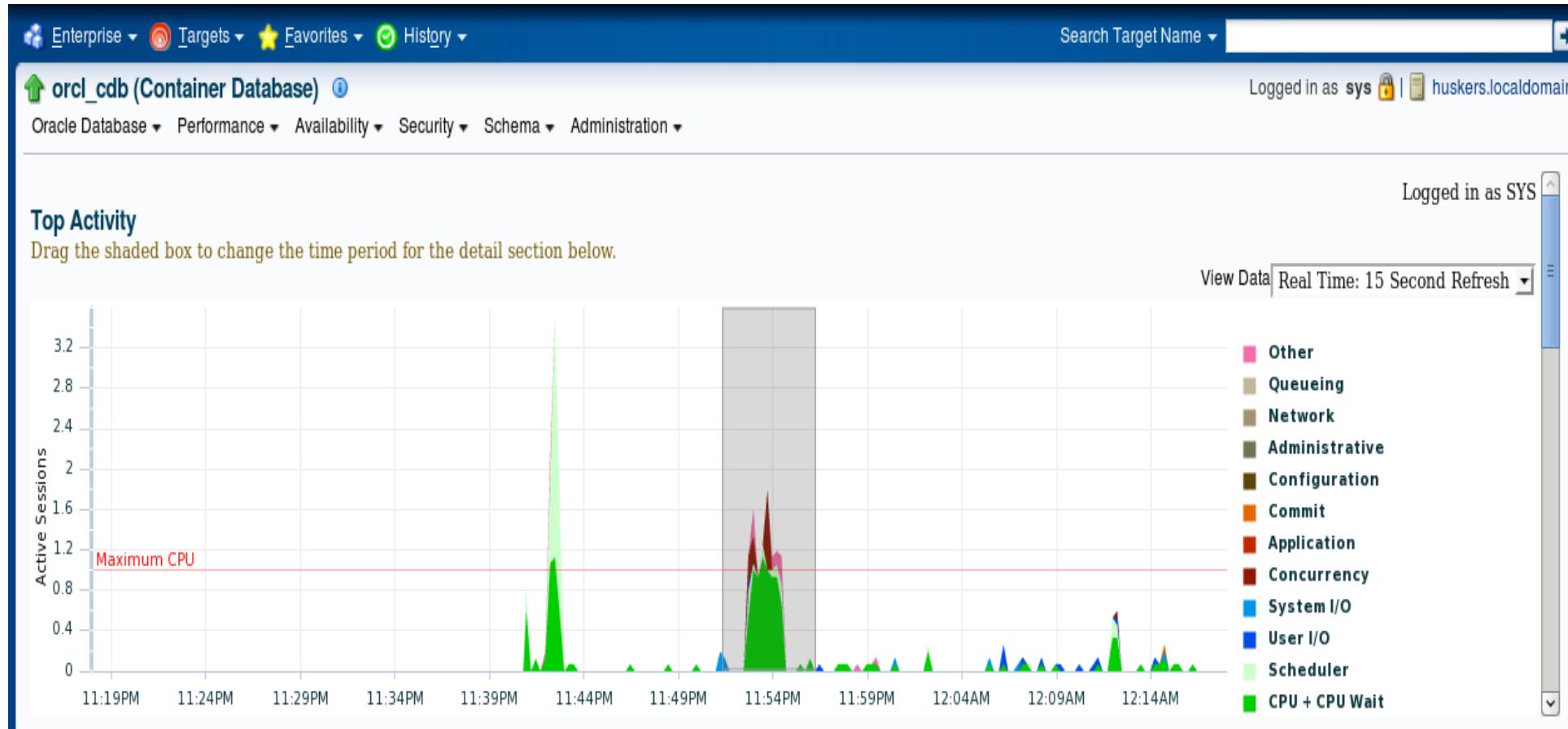
Time AM PM

Oracle 19c SQL Tuning Advisor



The screenshot shows the Oracle 19c SQL Tuning Advisor interface. At the top, there's a navigation bar with links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. Below the navigation is a header showing the target database as 'orcl_cdb / GOGOPDB' and the user as 'Logged in as sys'. A sub-header shows the current schema as 'huskers.localdomain'. The main content area displays a message: 'Processing: SQL Tuning Advisor Task SQL_TUNING_1413346391049'. To the right of this message are two buttons: 'Cancel' and 'Interrupt'. Below this message, a note states: 'The SQL Tuning Advisor task is in progress. You can view the task status and review any recommendations on the Advisor Central page. Click Interrupt to end the task. Note that closing the page or clicking Cancel will not stop the advisor task.' On the left side, it says 'SQL Tuning Set Owner SYS'. In the center, it shows 'SQL Tuning Set Name TUNINGSET_101514' and 'Time Limit (seconds) 1800'. Below these, it shows 'Status INITIAL' and 'Started'. It also shows 'Elapsed Time (seconds) 0'. Underneath, there are two status indicators: a green checkmark followed by 'Creating a new SQL Tuning task' and a blue arrow pointing right followed by 'Executing the task'. At the bottom left, there's a tip: 'TIP Closing the page/window does not cancel the process'. At the bottom right, there are 'Cancel' and 'Interrupt' buttons.

Oracle 19c SQL Tuning Advisor



Oracle 19c SQL Tuning Advisor

Top SQL

Actions Schedule SQL Tuning Advisor Go

Select All | Select None

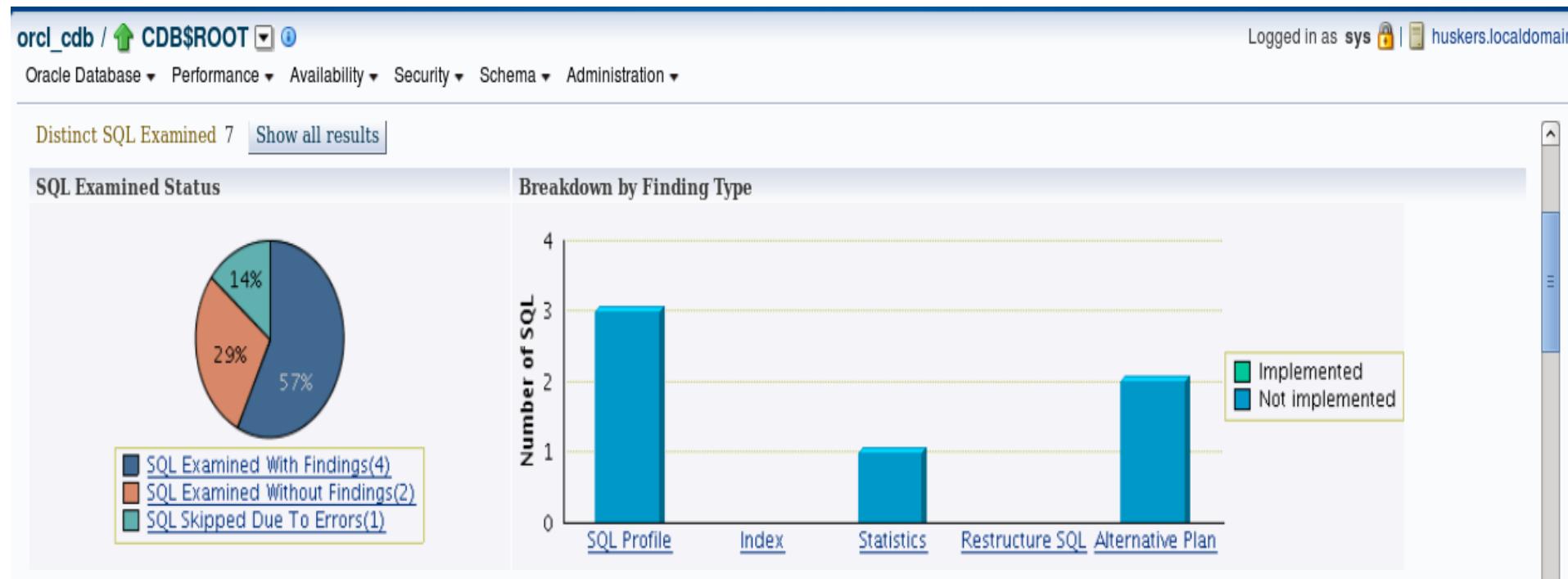
Select	Activity (%) ▾	SQL ID	SQL Type
<input checked="" type="checkbox"/>	83.09	gnhgvbhpucqr5	SELECT
<input checked="" type="checkbox"/>	11.03	gnhgvbhpucqr5	SELECT
<input checked="" type="checkbox"/>	2.21	fuqk3b01ucyxrf	SELECT
<input checked="" type="checkbox"/>	.74	6fwy90bgdvdfln	SELECT
<input checked="" type="checkbox"/>	.74	7r24h5ucyjggz	SELECT
<input checked="" type="checkbox"/>	.74	7fahyz17x8kt2	SELECT
<input checked="" type="checkbox"/>	.74	cm92grr0jqqg2	SELECT
<input checked="" type="checkbox"/>	.74	dqjac6ka84uc	SELECT

Top Sessions

View Top Sessions ▾

Activity (%) ▾	Session ID	QC Session ID	PDB Name	User Name	Program
7.64	77	77	CDB\$ROOT	DBSNMP	JDBC Thin Client
1.27	69	77	CDB\$ROOT	DBSNMP	oracle@huskers.locacldomain (P003)
1.27	3		CDB\$ROOT	SYS	oracle@huskers.locacldomain (PSP0)
.64	85	77	CDB\$ROOT	DBSNMP	oracle@huskers.locacldomain (P009)
.64	76	77	CDB\$ROOT	DBSNMP	oracle@huskers.locacldomain (P009)
.64	73	77	GOGOPDB	DBSNMP	oracle@huskers.locacldomain (P00B)
.64	24	77	GOGOPDB	DBSNMP	oracle@huskers.locacldomain

Oracle 19c SQL Tuning Advisor



Oracle 19c SQL Tuning Advisor

Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾

Logged in as sys | huskers.localdomain

orcl_cdb / CDB\$ROOT ⓘ

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Completed 10/15/2014 00:20:29
Running Time (minutes) 2

Time Limit (seconds) 1800

Recommendations

Only profiles that significantly improve SQL performance were implemented.

Select	SQL Text	Parsing Schema	PDB Name	SQL ID	Cumulative DB Time Benefit(sec)	Per-Execution % Benefit	Statistics	SQL Profile	Index	Restructure SQL	Alternative Plan	Miscell
<input checked="" type="radio"/>	WITH MONITOR DATA AS (SELECT INST_ID, KE...	SYS	CDB\$ROOT	7r24h5ucyjggz	22.70	99		(99%) ✓				
<input type="radio"/>	SELECT /*+ INDEX(ts) */ o.object_type, ...	DBSNMP	CDB\$ROOT	fuqk3b01ucyxf	3.93	99	✓	(99%) ✓			✓	
<input type="radio"/>	SELECT * FROM / WITH nph AS DRSNMP CDB\$ROOT anhahhhnucar5				2.40	<10	<10%					

Oracle 19c SQL Tuning Advisor



The screenshot shows the Oracle 19c SQL Tuning Advisor interface. At the top, there are navigation links for Enterprise, Targets, Favorites, and History, along with a search bar for 'Search Target Name'. The current target is 'orcl_cdb / CDB\$ROOT'. The user is logged in as 'sys' from 'huskers.localdomain'. The main menu includes Oracle Database, Performance, Availability, Security, Schema, and Administration.

A message at the top states: "Only one recommendation should be implemented."

SQL Information

Parsing Schema: SYS
PDB Name: CDB\$ROOT
SQL Text:

```
WITH MONITOR_DATA AS (SELECT INST_ID, KEY, NVL2(PX_QCSID, NULL, STATUS) STATUS, FIRST_REFRESH_TIME, LAST_REFRESH_TIME, REFRESH_COUNT, PROCESS_NAME, SID, SQL_ID, SQL_EXEC_START, SQL_EXEC_ID, DBOP_NAME,...
```

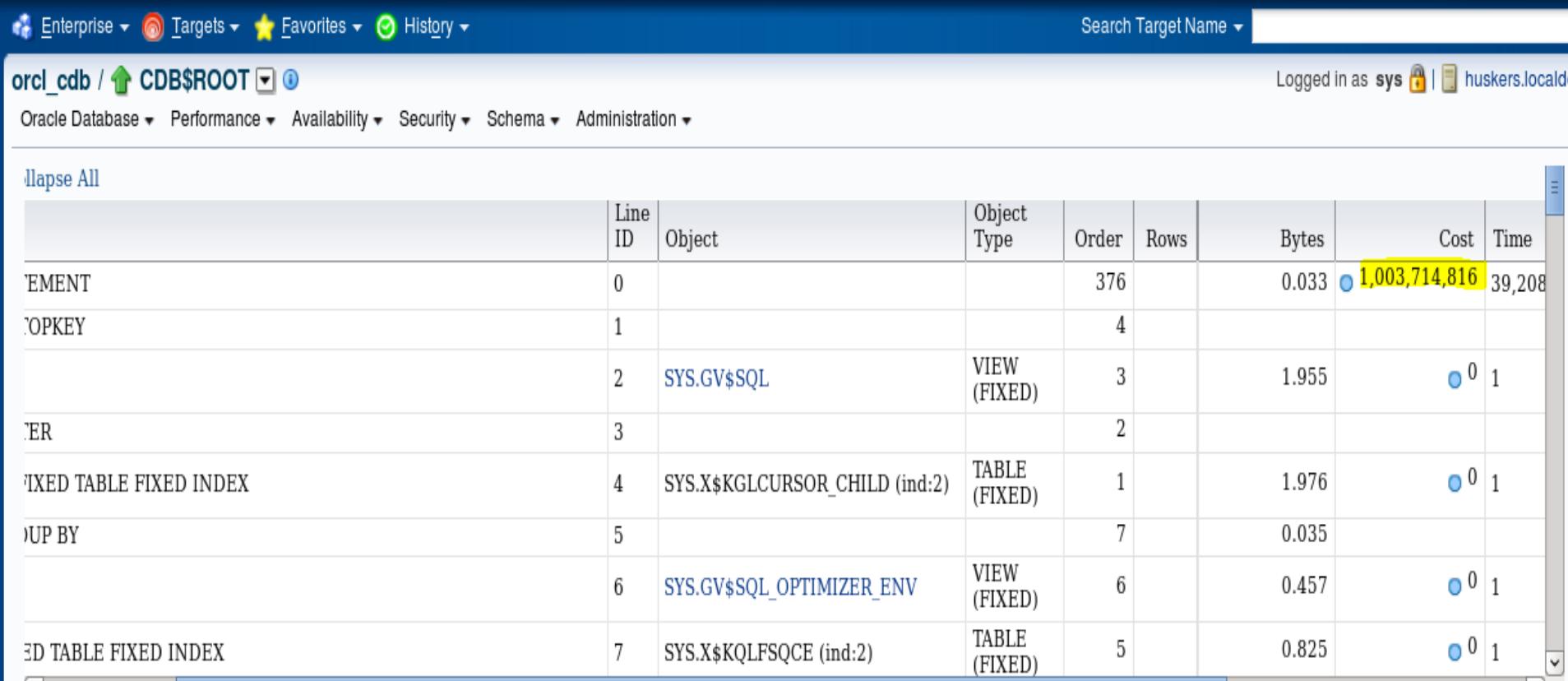
Select Recommendation

Original Explain Plan (Annotated)

Implement | Validate with SPA

Select	Type	Findings	Recommendations	Rationale	Benefit (%)	Other Statistics	New Explain Plan	Compare Explain Plans
	SQL Profile	A potentially better execution plan was found for this statement.	Consider accepting the recommended SQL profile. No SQL profile currently exists for this recommendation.		99.99			

Oracle 19c SQL Tuning Advisor

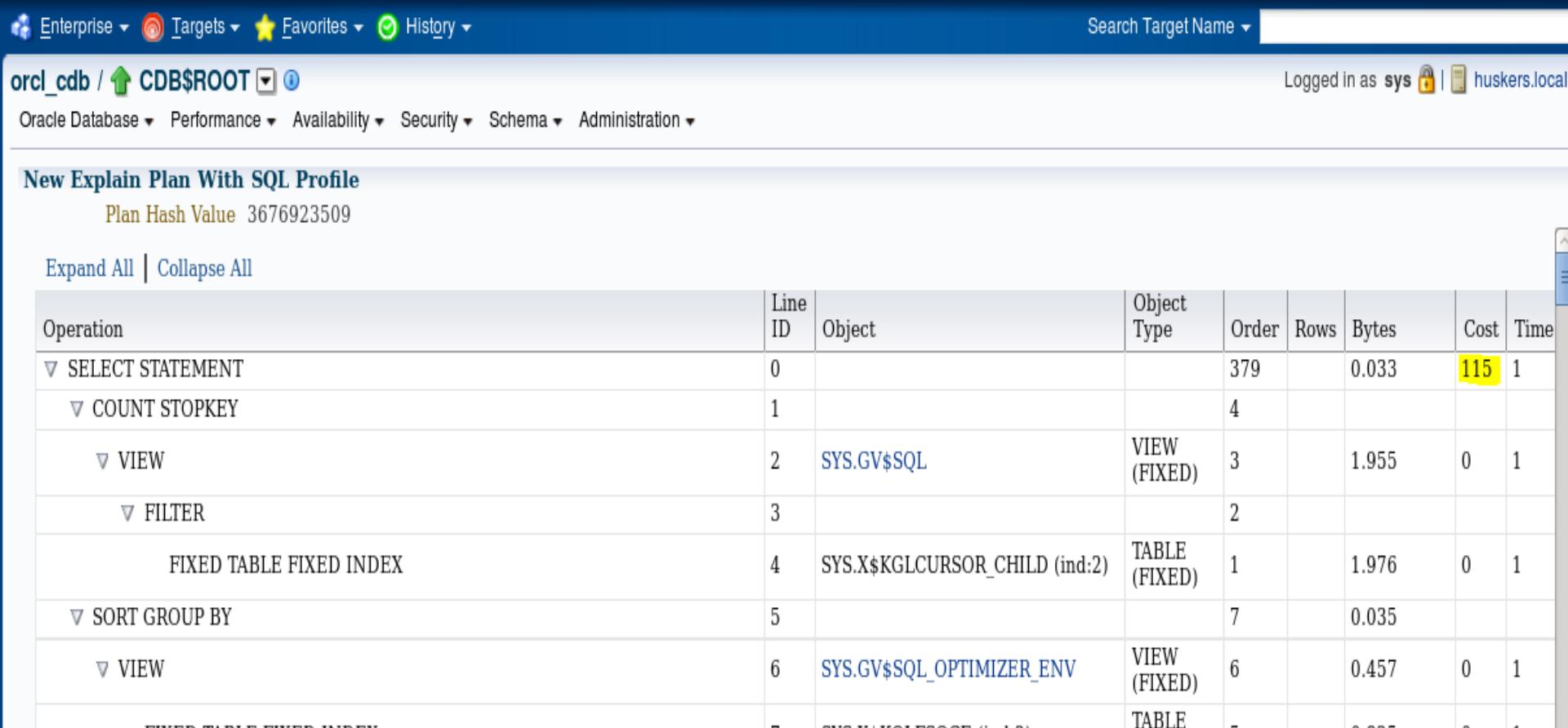


The screenshot shows the Oracle 19c SQL Tuning Advisor interface. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The current target is 'orcl_cdb / CDB\$ROOT'. The user is logged in as 'sys' from 'huskers.localdomain'. The main menu offers options like Oracle Database, Performance, Availability, Security, Schema, and Administration.

A table displays the results of a SQL analysis. The columns are: Line ID, Object, Object Type, Order, Rows, Bytes, Cost, and Time. The table lists several entries, with the first entry highlighted in yellow, indicating it is the primary focus of the tuning session.

	Line ID	Object	Object Type	Order	Rows	Bytes	Cost	Time
EMENT	0			376		0.033	1,003,714,816	39,208
TOPKEY	1				4			
	2	SYS.GV\$SQL	VIEW (FIXED)	3		1.955	0	1
ER	3				2			
FIXED TABLE FIXED INDEX	4	SYS.X\$KGLCURSOR_CHILD (ind:2)	TABLE (FIXED)	1		1.976	0	1
UP BY	5				7	0.035		
	6	SYS.GV\$SQL_OPTIMIZER_ENV	VIEW (FIXED)	6		0.457	0	1
ED TABLE FIXED INDEX	7	SYS.X\$KQLFSQCE (ind:2)	TABLE (FIXED)	5		0.825	0	1

Oracle 19c SQL Tuning Advisor



The screenshot shows the Oracle 19c SQL Tuning Advisor interface. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The current target is 'orcl_cdb / CDB\$ROOT'. The user is logged in as 'sys' on 'huskers.local'. The main menu options are Oracle Database, Performance, Availability, Security, Schema, and Administration.

The main content area displays a 'New Explain Plan With SQL Profile' for a query with a Plan Hash Value of 3676923509. There are 'Expand All' and 'Collapse All' buttons. The explain plan table has columns: Operation, Line ID, Object, Object Type, Order, Rows, Bytes, Cost, and Time.

Operation	Line ID	Object	Object Type	Order	Rows	Bytes	Cost	Time
▼ SELECT STATEMENT	0			379		0.033	115	1
▼ COUNT STOPKEY	1				4			
▼ VIEW	2	SYS.GV\$SQL	VIEW (FIXED)	3		1.955	0	1
▼ FILTER	3				2			
FIXED TABLE FIXED INDEX	4	SYS.X\$KGLCURSOR_CHILD (ind:2)	TABLE (FIXED)	1		1.976	0	1
▼ SORT GROUP BY	5				7		0.035	
▼ VIEW	6	SYS.GV\$SQL_OPTIMIZER_ENV	VIEW (FIXED)	6		0.457	0	1
FIXED TABLE FIXED INDEX	7	SYS.X\$VALOREDDIT (ind:1)	TABLE	5		0.005	0	1

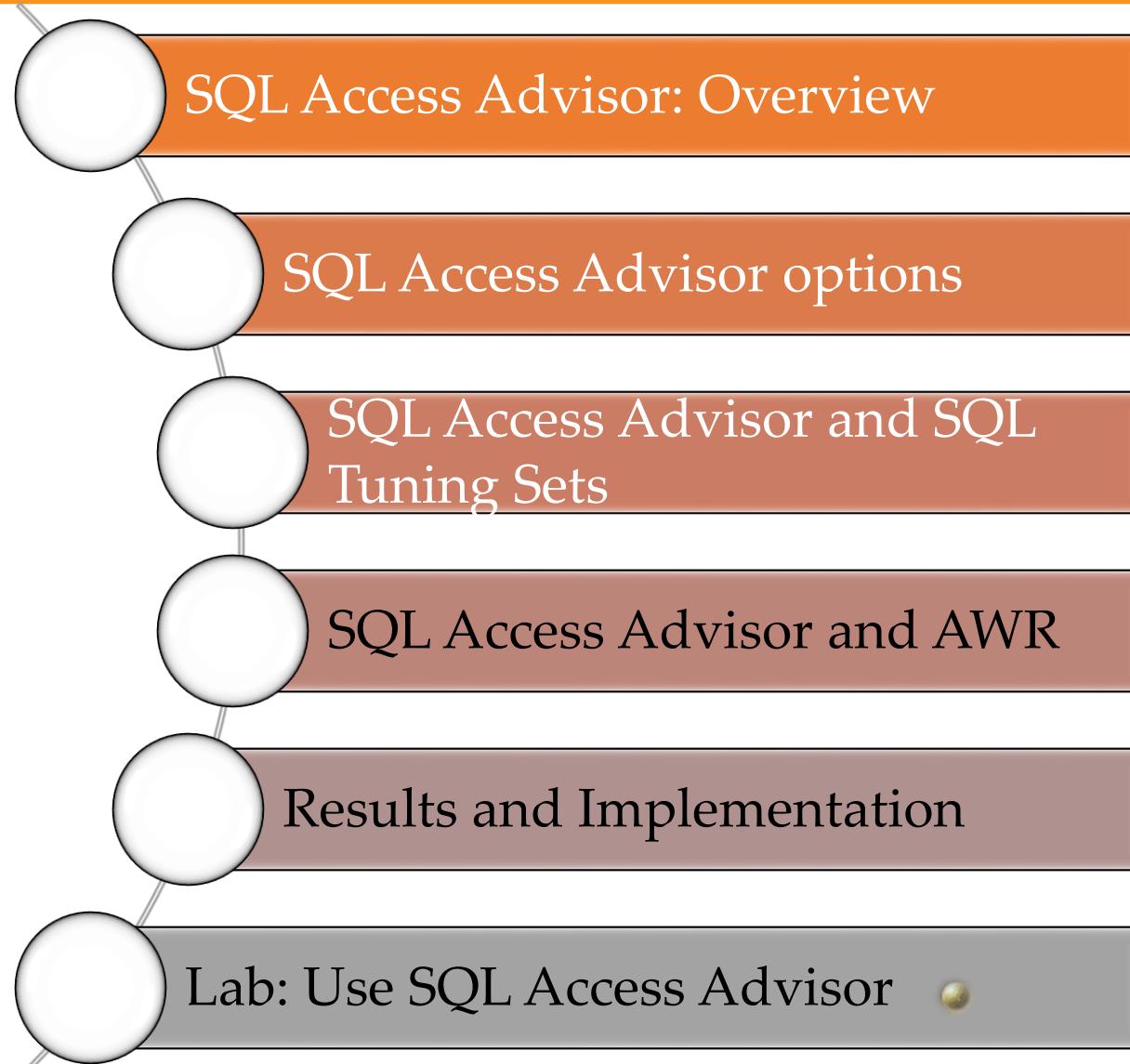
Oracle 19c SQL Tuning Advisor

- Produces SQL profiles
- When a significant change is indicated
- ‘Take it to the bank’ 

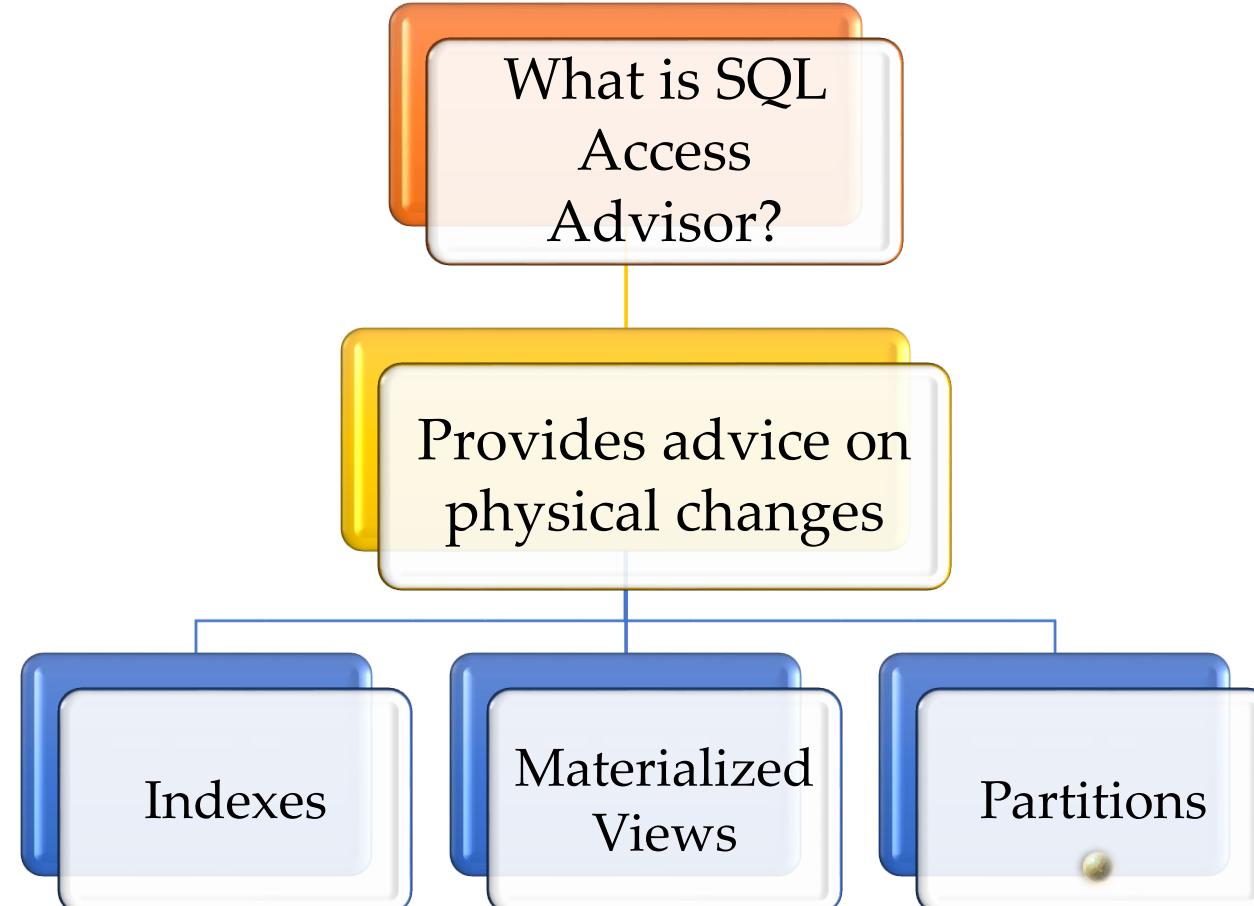
SQL Tuning
Advisor

- SQL Access Advisor

Lesson Topics



Oracle 19c SQL Access Advisor



Oracle 19c SQL Access Advisor

SQL Access Advisor part of Oracle's diagnostic and tuning pack

Input may be:

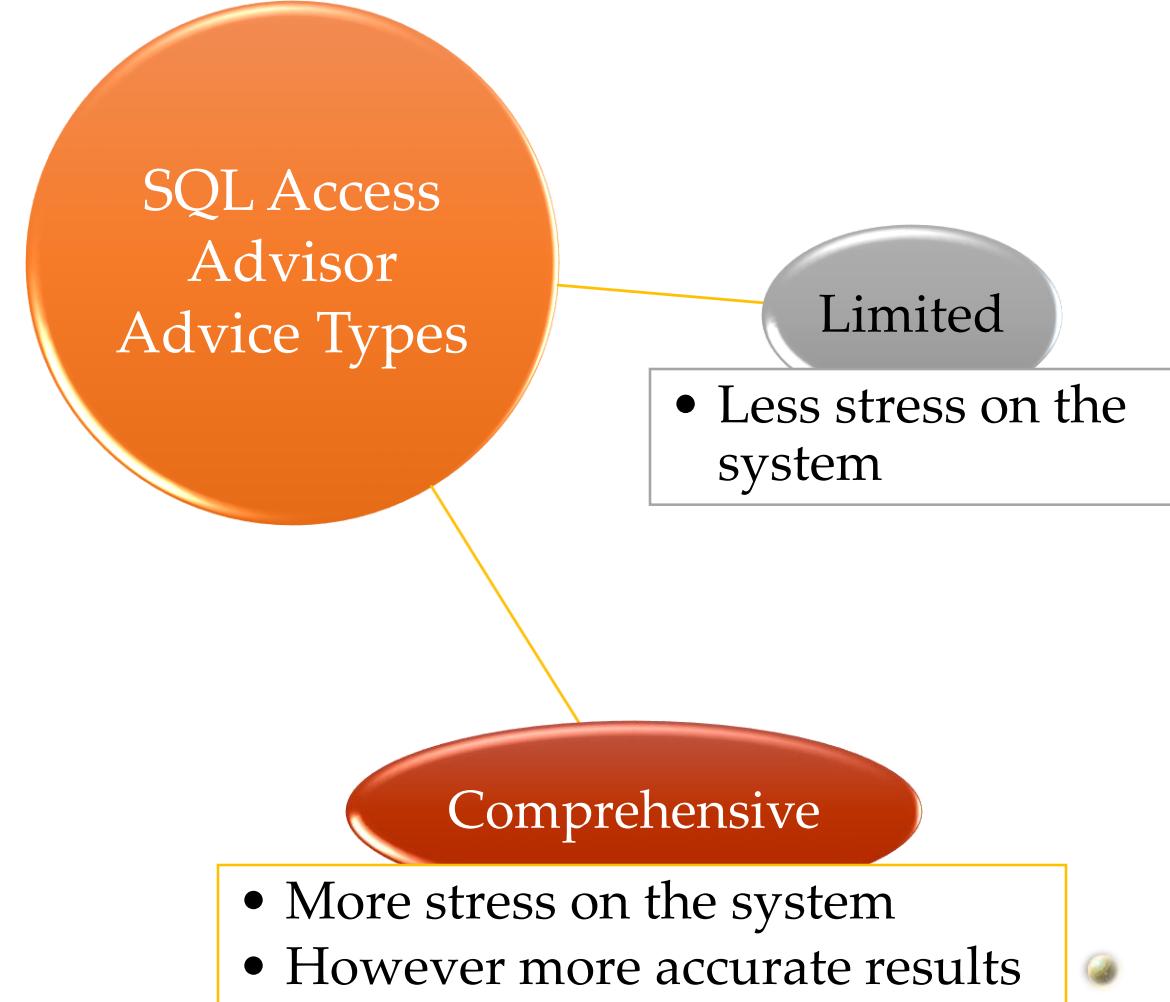
Tuning set

AWR

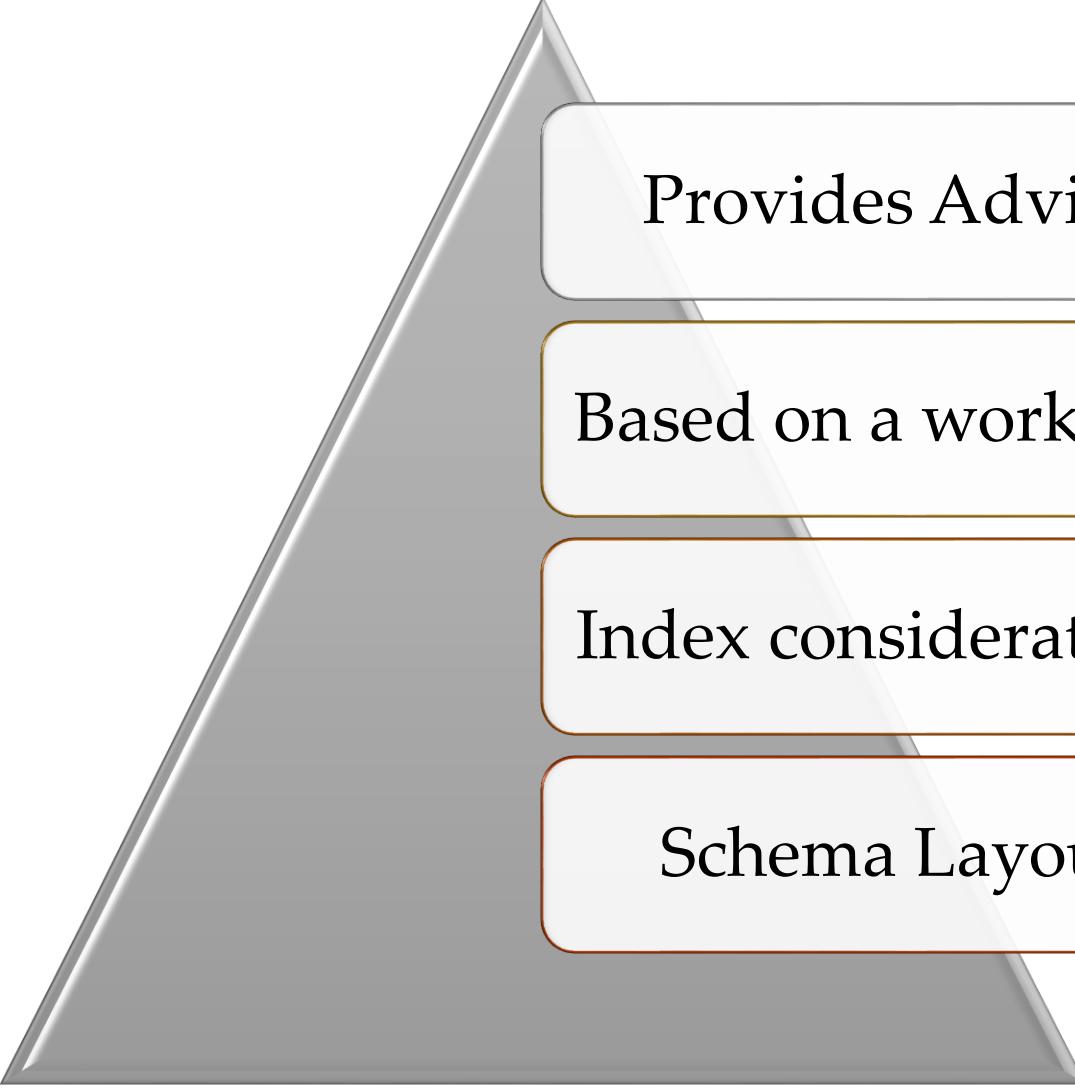
Historical SQL

Workload may also be provided

Oracle 19c SQL Access Advisor



Oracle 19c SQL Access Advisor



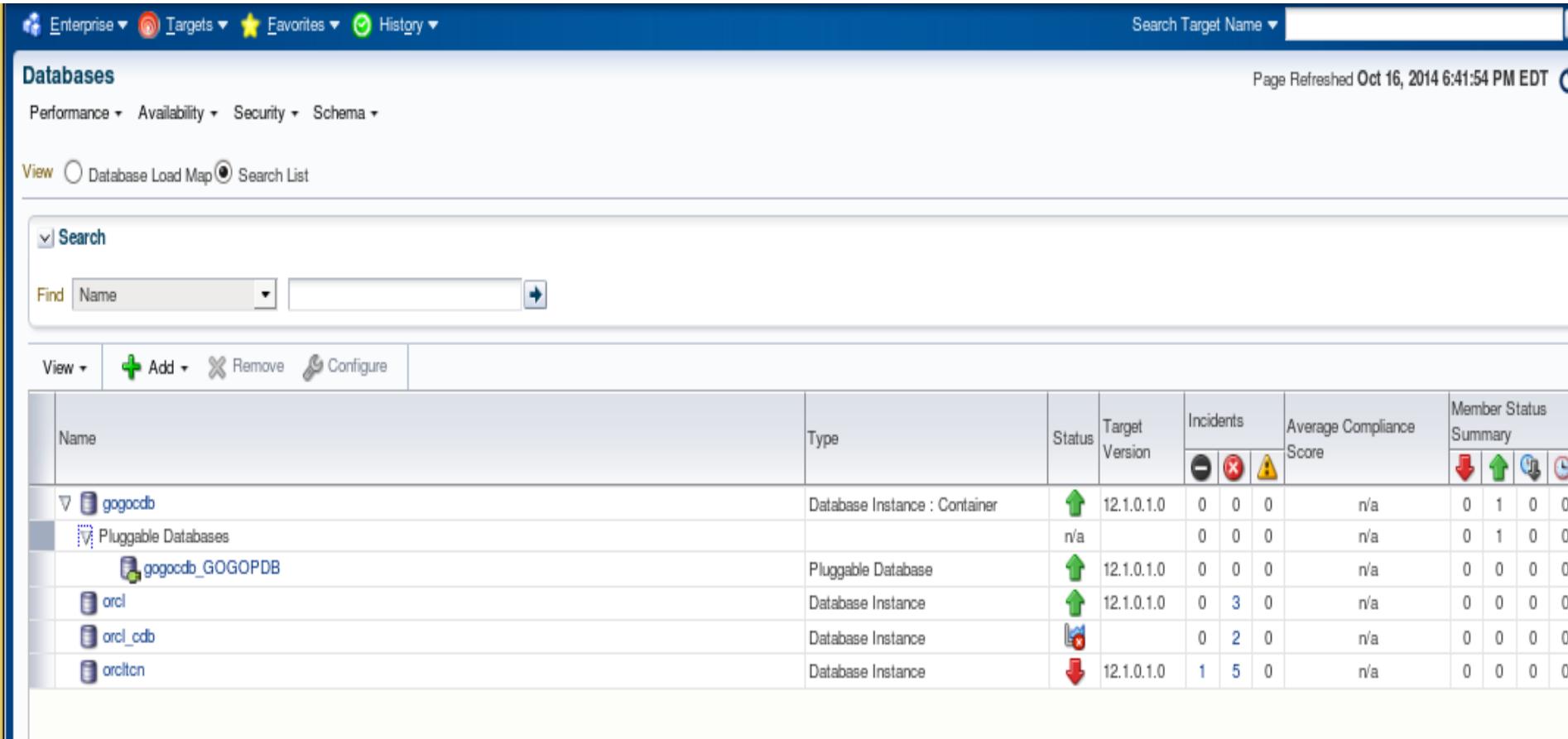
Provides Advice

Based on a workload

Index considerations

Schema Layout

Oracle 19c SQL Access Advisor



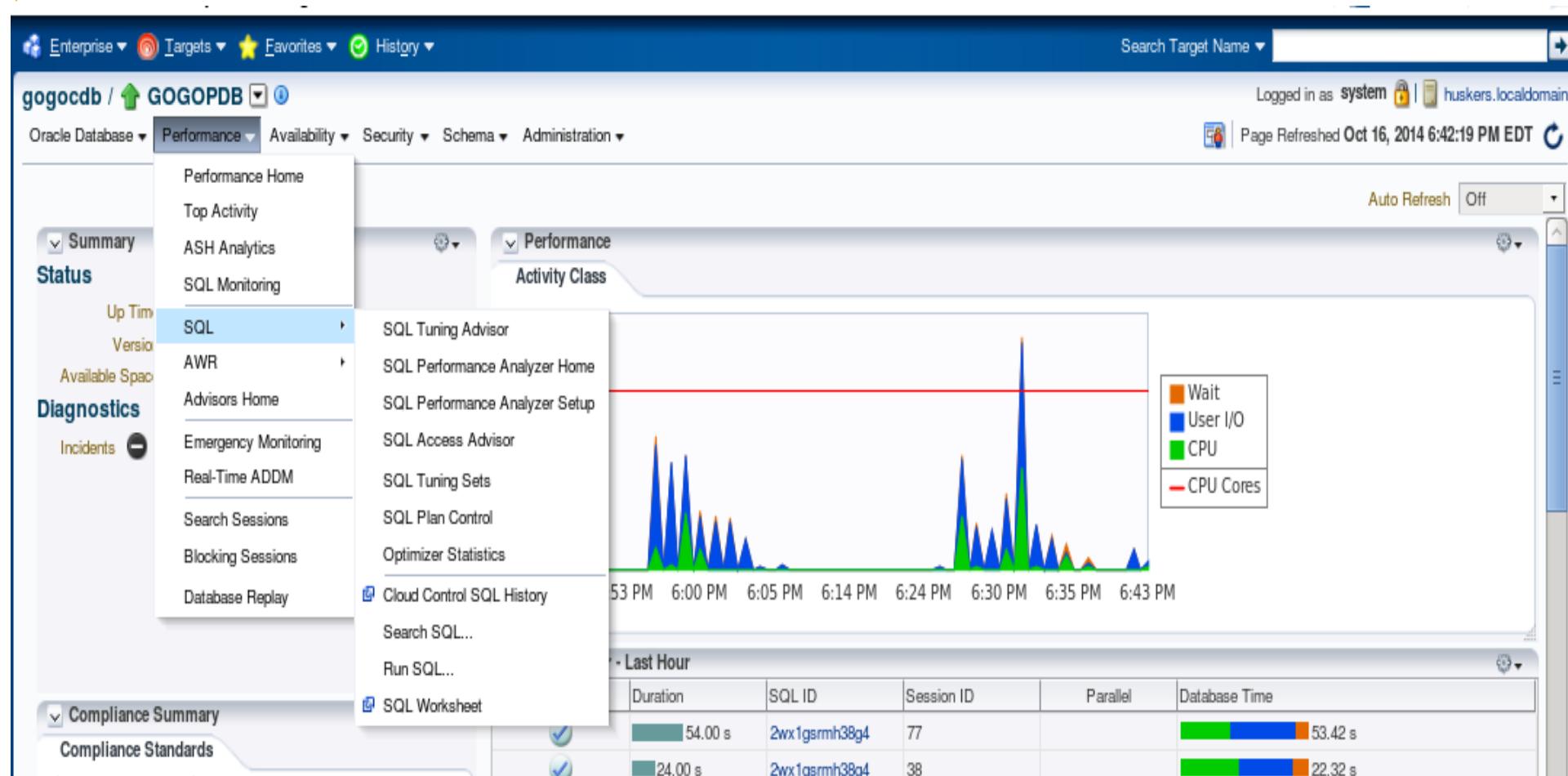
The screenshot shows the Oracle 19c SQL Access Advisor interface for managing databases. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. A message indicates the page was refreshed on Oct 16, 2014, at 6:41:54 PM EDT.

The main area is titled 'Databases' and displays a list of database instances. The columns include:

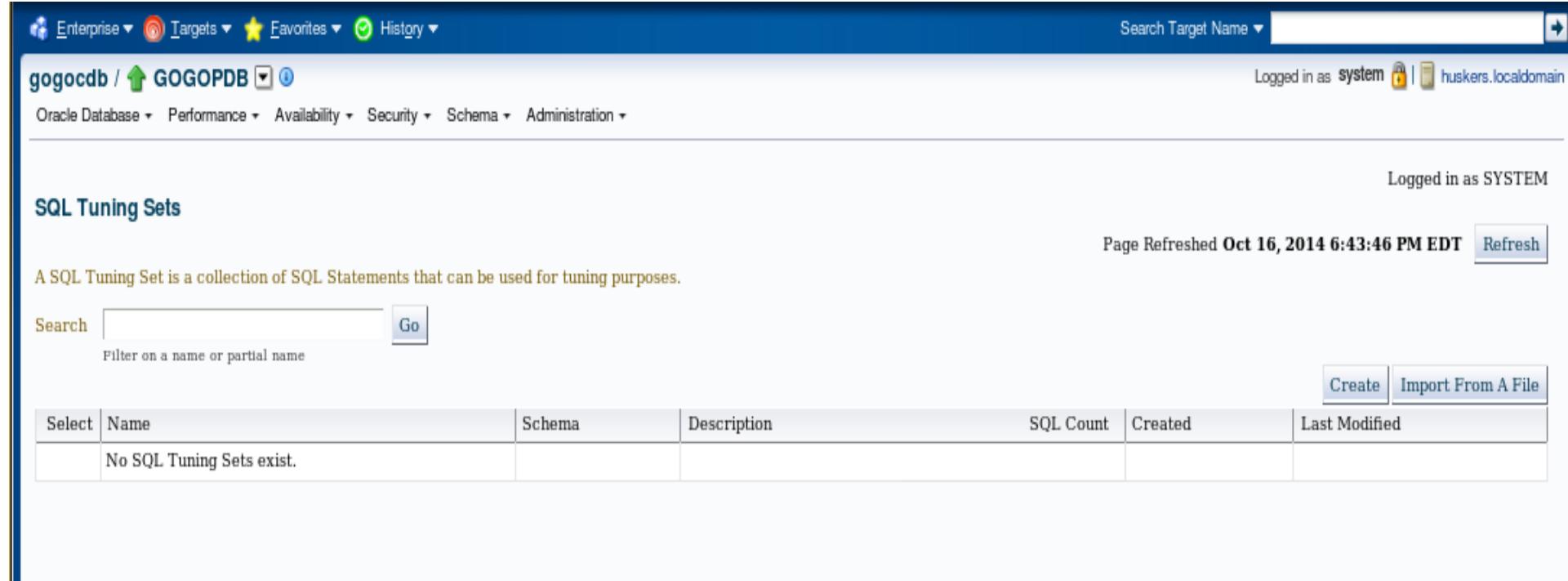
Name	Type	Status	Target Version	Incidents	Average Compliance Score	Member Status Summary
gogodb	Database Instance : Container	green arrow	12.1.0.1.0	0 0 0	n/a	0 1 0 0
Pluggable Databases		n/a		0 0 0	n/a	0 1 0 0
gogodb_GOGOPDB	Pluggable Database	green arrow	12.1.0.1.0	0 0 0	n/a	0 0 0 0
orcl	Database Instance	green arrow	12.1.0.1.0	0 3 0	n/a	0 0 0 0
orcl_cdb	Database Instance	red exclamation		0 2 0	n/a	0 0 0 0
orcltn	Database Instance	red arrow	12.1.0.1.0	1 5 0	n/a	0 0 0 0

Below the table, there are buttons for View, Add, Remove, and Configure.

Oracle 19c SQL Access Advisor

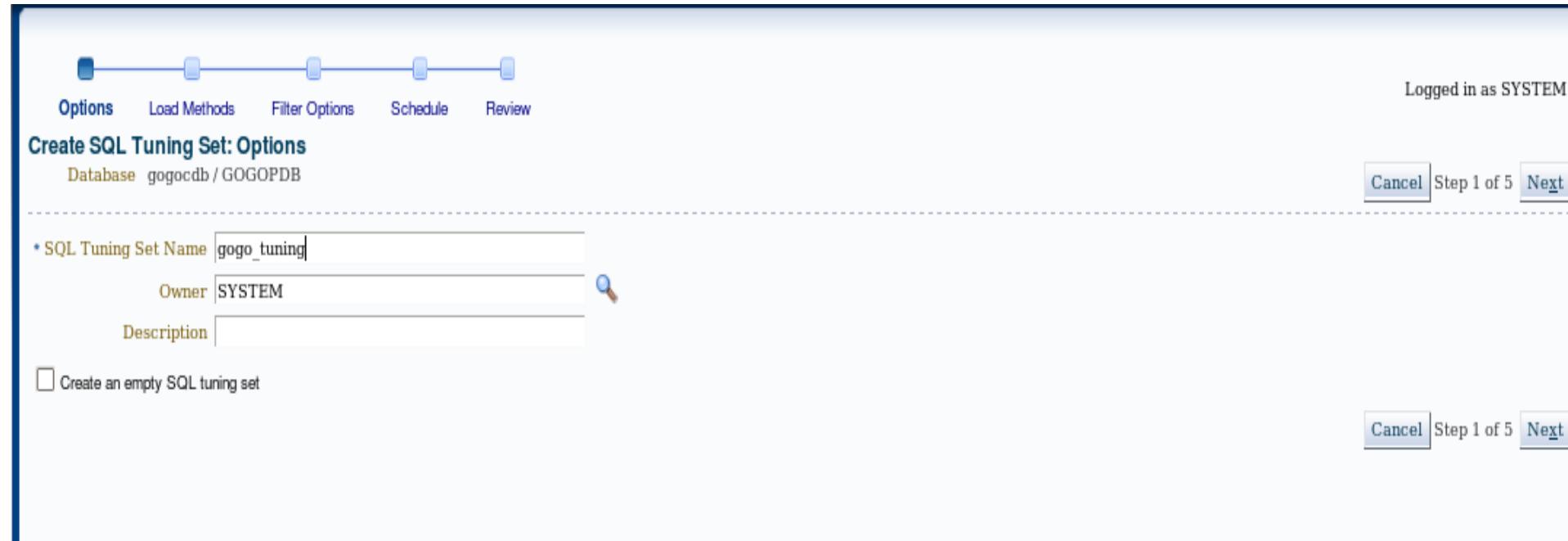


Oracle 19c SQL Access Advisor



The screenshot shows the Oracle 19c SQL Access Advisor interface. At the top, there is a navigation bar with links for Enterprise, Targets, Favorites, and History, along with a search bar for 'Search Target Name'. Below the navigation bar, the target is set to 'gogocdb / GOGOPDB'. The user is logged in as 'system' from 'huskers.localdomain'. A message indicates they are also 'Logged in as SYSTEM'. The main content area is titled 'SQL Tuning Sets'. A sub-header states: 'A SQL Tuning Set is a collection of SQL Statements that can be used for tuning purposes.' Below this, there is a search bar with a 'Go' button and a note: 'Filter on a name or partial name'. On the right, there are 'Create' and 'Import From A File' buttons. A table lists 'SQL Count', 'Created', and 'Last Modified' for each tuning set. The table shows one row: 'No SQL Tuning Sets exist.'

Oracle 19c SQL Access Advisor



Oracle 19c SQL Access Advisor



The screenshot shows the 'Create SQL Tuning Set: Load Methods' step of the Oracle 19c SQL Access Advisor. The top navigation bar includes 'Options', 'Load Methods' (which is selected), 'Filter Options', 'Schedule', and 'Review'. On the right, it says 'Logged in as SYSTEM'. Below the navigation is a sub-header 'Create SQL Tuning Set: Load Methods' with the database 'gogocdb / GOGOPDB' selected. A progress bar at the bottom indicates 'Step 2 of 5'.

Pick one of the load methods to collect and load SQL statements into the SQL tuning set.

Incrementally capture active SQL statements over a period of time from the cursor cache

Specify the duration within which the SQL statements will be collected, and specify frequency over which the active SQL statements from the cursor cache will be collected repeatedly.

Duration: 24 Hours

Frequency: 5 Minutes

Load SQL statements one time only

Data Source: Cursor Cache

At the bottom right are 'Finish', 'Cancel', 'Back', 'Step 2 of 5', and 'Next' buttons.

Oracle 19c SQL Access Advisor

Logged in as SYSTEM

Options Load Methods **Filter Options** Schedule Review

Create SQL Tuning Set: Filter Options

Database gogocdb / GOGOPDB

[Finish](#) [Cancel](#) [Back](#) Step 3 of 5 [Next](#)

Total Number of SQL Statements

Top N <ALL> Sorted By ELAPSED_TIME ▾

Filter Conditions

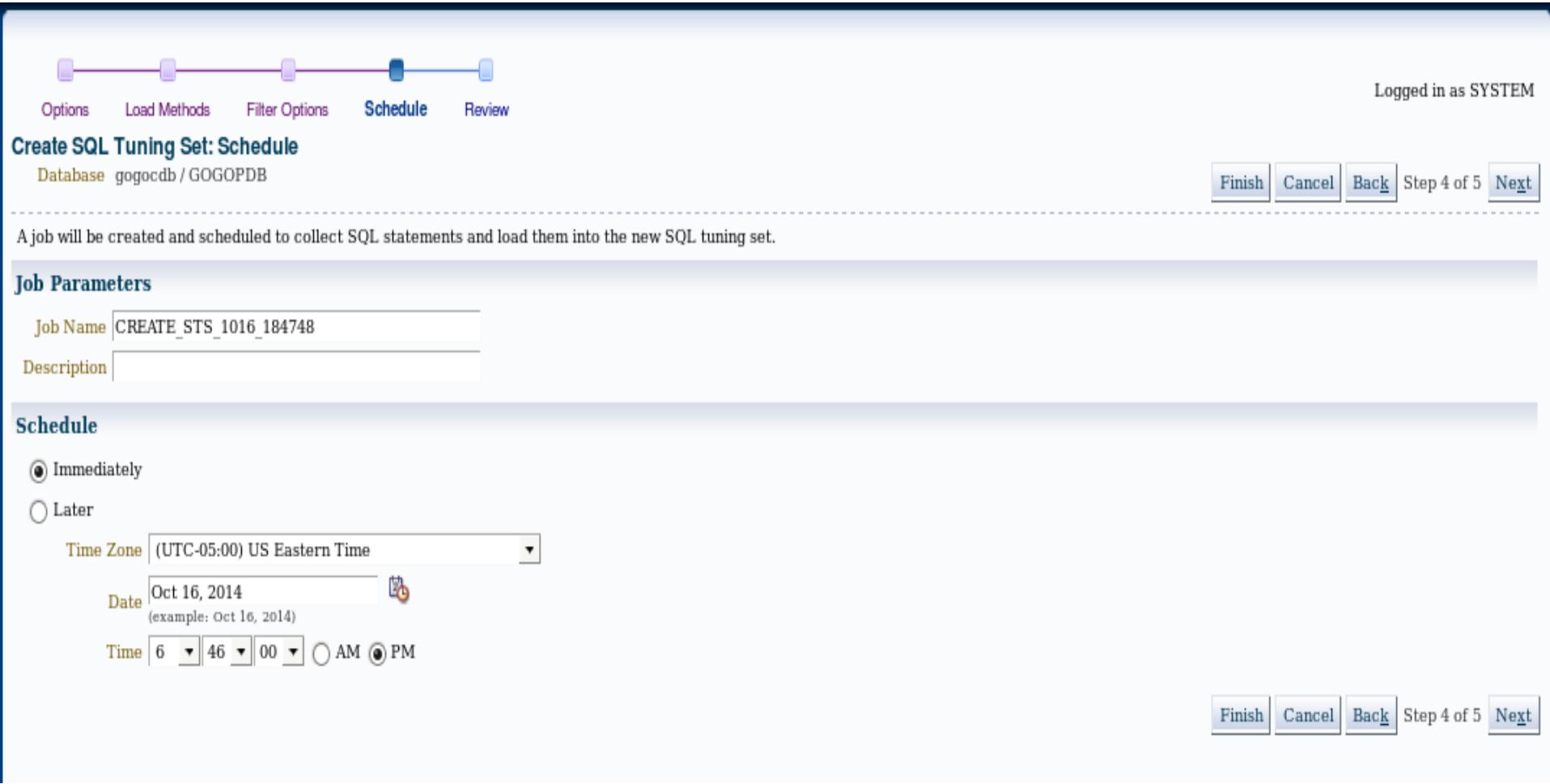
Only the SQL statements that meet all the following filter conditions will be included as search results. Rows with an empty value in the 'Value' column will not be included as filter conditions in the search.

Plan Hash Value ▾	Add a Filter or Column	Filter Attribute	Operator	Value	Show Column	Remove
		Parsing Schema Name	= ▾		<input checked="" type="checkbox"/>	
		SQL Text	LIKE ▾		<input checked="" type="checkbox"/>	
		SQL ID	= ▾		<input checked="" type="checkbox"/>	
		Elapsed Time (sec)	>= ▾		<input checked="" type="checkbox"/>	

By default, the search returns all case-insensitive matches beginning with the string you entered. To run an exact or case-sensitive match, double-quote the search string. You can use the wildcard symbol (%) in a double-quoted string.

[Finish](#) [Cancel](#) [Back](#) Step 3 of 5 [Next](#)

Oracle 19c SQL Access Advisor



The screenshot shows the 'Create SQL Tuning Set: Schedule' step of the Oracle 19c SQL Access Advisor. The top navigation bar includes 'Options', 'Load Methods', 'Filter Options', 'Schedule' (which is selected and highlighted in blue), and 'Review'. On the right, it says 'Logged in as SYSTEM'. Below the navigation is the title 'Create SQL Tuning Set: Schedule' and the database 'gogocdb / GOGOPDB'. At the bottom right are buttons for 'Finish', 'Cancel', 'Back', 'Step 4 of 5', and 'Next'.

A job will be created and scheduled to collect SQL statements and load them into the new SQL tuning set.

Job Parameters

Job Name: CREATE_STS_1016_184748

Description: (empty)

Schedule

Immediately

Later

Time Zone: (UTC-05:00) US Eastern Time

Date: Oct 16, 2014 (example: Oct 16, 2014)

Time: 6:46:00 AM (radio button for AM is selected)

At the bottom right of the main form area are buttons for 'Finish', 'Cancel', 'Back', 'Step 4 of 5', and 'Next'.

Oracle 19c SQL Access Advisor



The screenshot shows the 'Create SQL Tuning Set: Review' step of the Oracle 19c SQL Access Advisor. The top navigation bar includes tabs for Options, Load Methods, Filter Options, Schedule, and Review, with Review being the active tab. It also displays the user is logged in as SYSTEM and shows the database selected is gogocdb / GOGOPDB. On the right, there are buttons for Cancel, Back, Step 5 of 5, and Submit.

Review the SQL Tuning Set options you have selected.

SQL Tuning Set Name: GOGO_TUNING
Owner: SYSTEM

Description:
Create an empty SQL tuning set: No

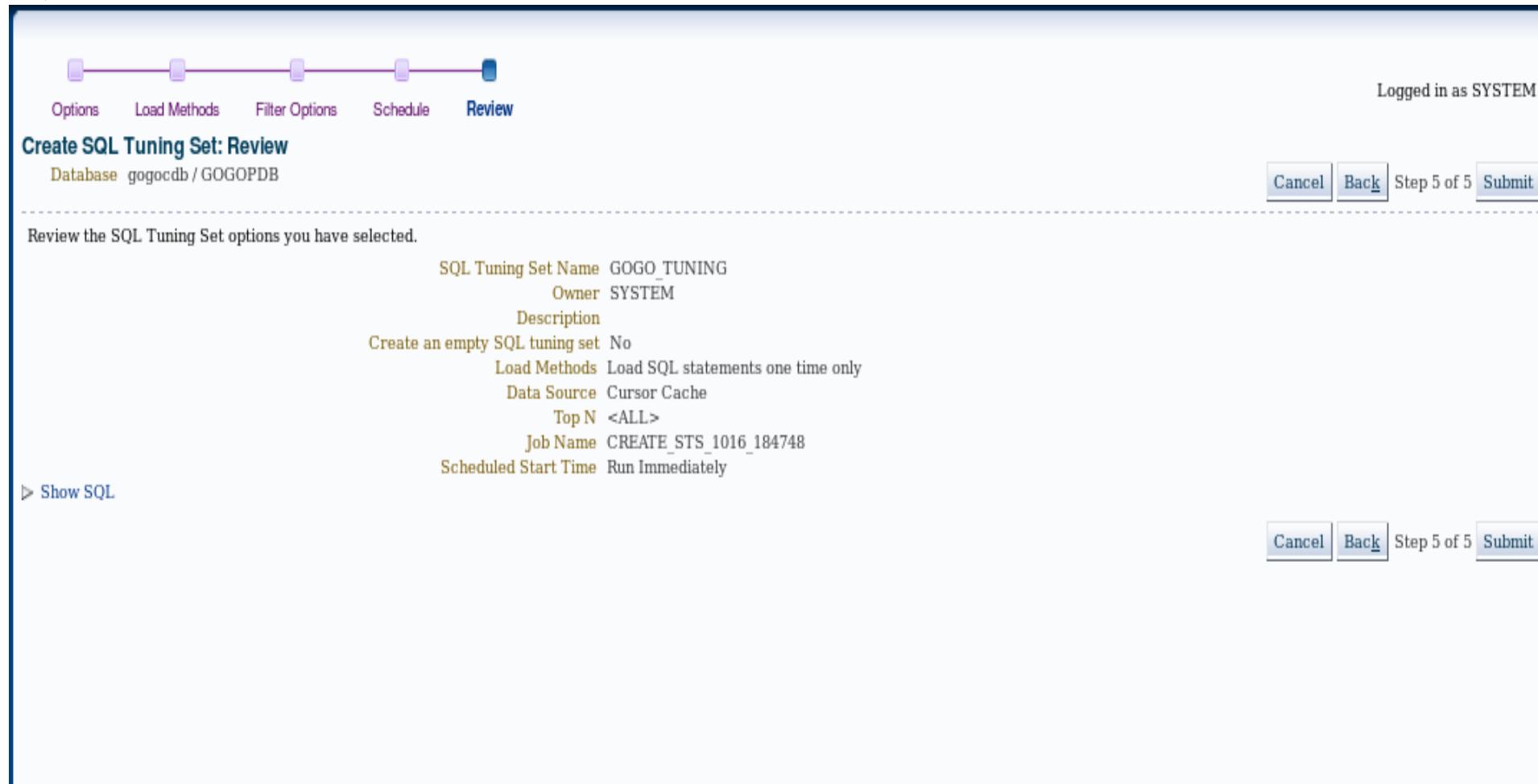
Load Methods: Load SQL statements one time only
Data Source: Cursor Cache
Top N: <ALL>

Job Name: CREATE_STS_1016_184748
Scheduled Start Time: Run Immediately

[Show SQL](#)

Cancel Back Step 5 of 5 Submit

Oracle 19c SQL Access Advisor

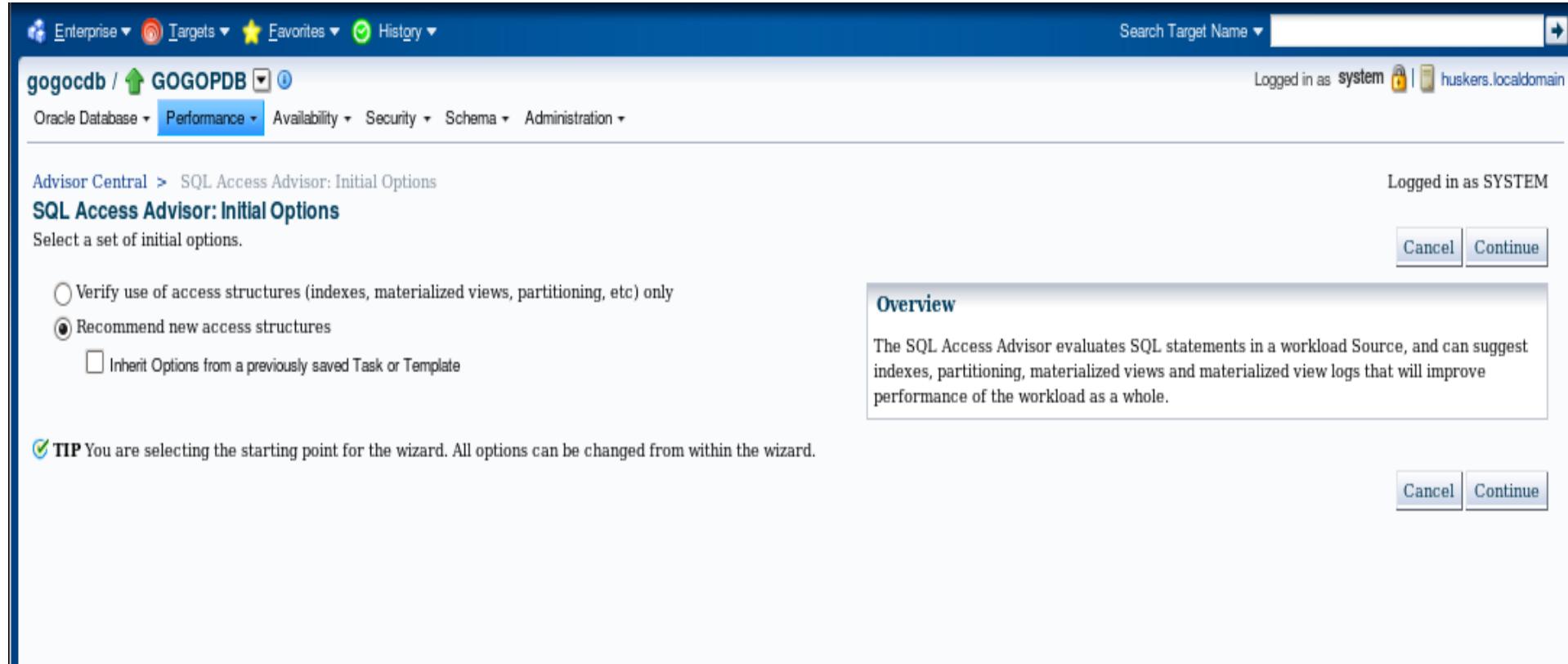


The screenshot shows the 'Create SQL Tuning Set: Review' step of the Oracle 19c SQL Access Advisor. The top navigation bar includes a large orange arrow pointing left, the title 'Oracle 19c SQL Access Advisor', and a sub-header 'Create SQL Tuning Set: Review'. Below the header is a progress bar with five steps: Options, Load Methods, Filter Options, Schedule, and Review (the current step). To the right of the progress bar, it says 'Logged in as SYSTEM'. The main content area displays the selected options for creating a SQL Tuning Set named 'GOGO_TUNING' owned by 'SYSTEM'. The options include:

- Description:** Create an empty SQL tuning set: No
- Load Methods:** Load SQL statements one time only
- Data Source:** Cursor Cache
- Top N:** <ALL>
- Job Name:** CREATE_STS_1016_184748
- Scheduled Start Time:** Run Immediately

At the bottom left, there is a link 'Show SQL'. On the right, there are four buttons: 'Cancel', 'Back', 'Step 5 of 5', and 'Submit'.

Oracle 19c SQL Access Advisor

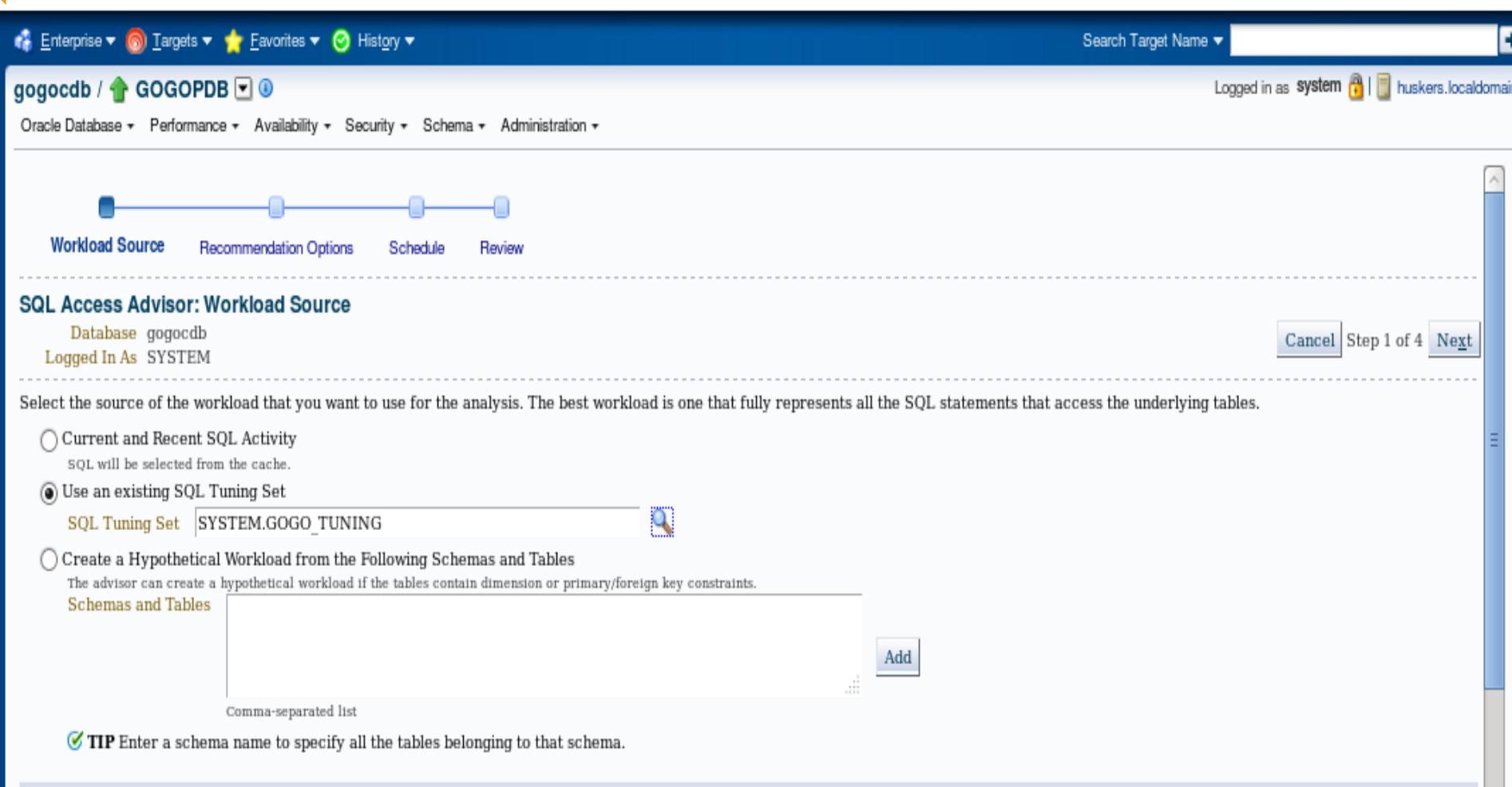


The screenshot shows the Oracle Database Performance Navigator interface. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The target is set to 'gogocdb / GOGOPDB'. The main menu bar has tabs for Oracle Database, Performance (which is selected), Availability, Security, Schema, and Administration.

The current page is 'Advisor Central > SQL Access Advisor: Initial Options'. The title is 'SQL Access Advisor: Initial Options' and the sub-instruction is 'Select a set of initial options.' There are two radio button options: 'Verify use of access structures (indexes, materialized views, partitioning, etc) only' (unchecked) and 'Recommend new access structures' (checked). A checkbox 'Inherit Options from a previously saved Task or Template' is also present. A tip message at the bottom states: 'TIP You are selecting the starting point for the wizard. All options can be changed from within the wizard.'

To the right, there is an 'Overview' section with the following text: 'The SQL Access Advisor evaluates SQL statements in a workload Source, and can suggest indexes, partitioning, materialized views and materialized view logs that will improve performance of the workload as a whole.' Below this are 'Cancel' and 'Continue' buttons.

Oracle 19c SQL Access Advisor



The screenshot shows the Oracle 19c SQL Access Advisor interface. At the top, there's a navigation bar with links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. Below the bar, the target is set to 'gogocdb / GOGOPDB'. On the right, it shows 'Logged in as system' and 'huskers.localdomain'. The main menu includes Oracle Database, Performance, Availability, Security, Schema, and Administration.

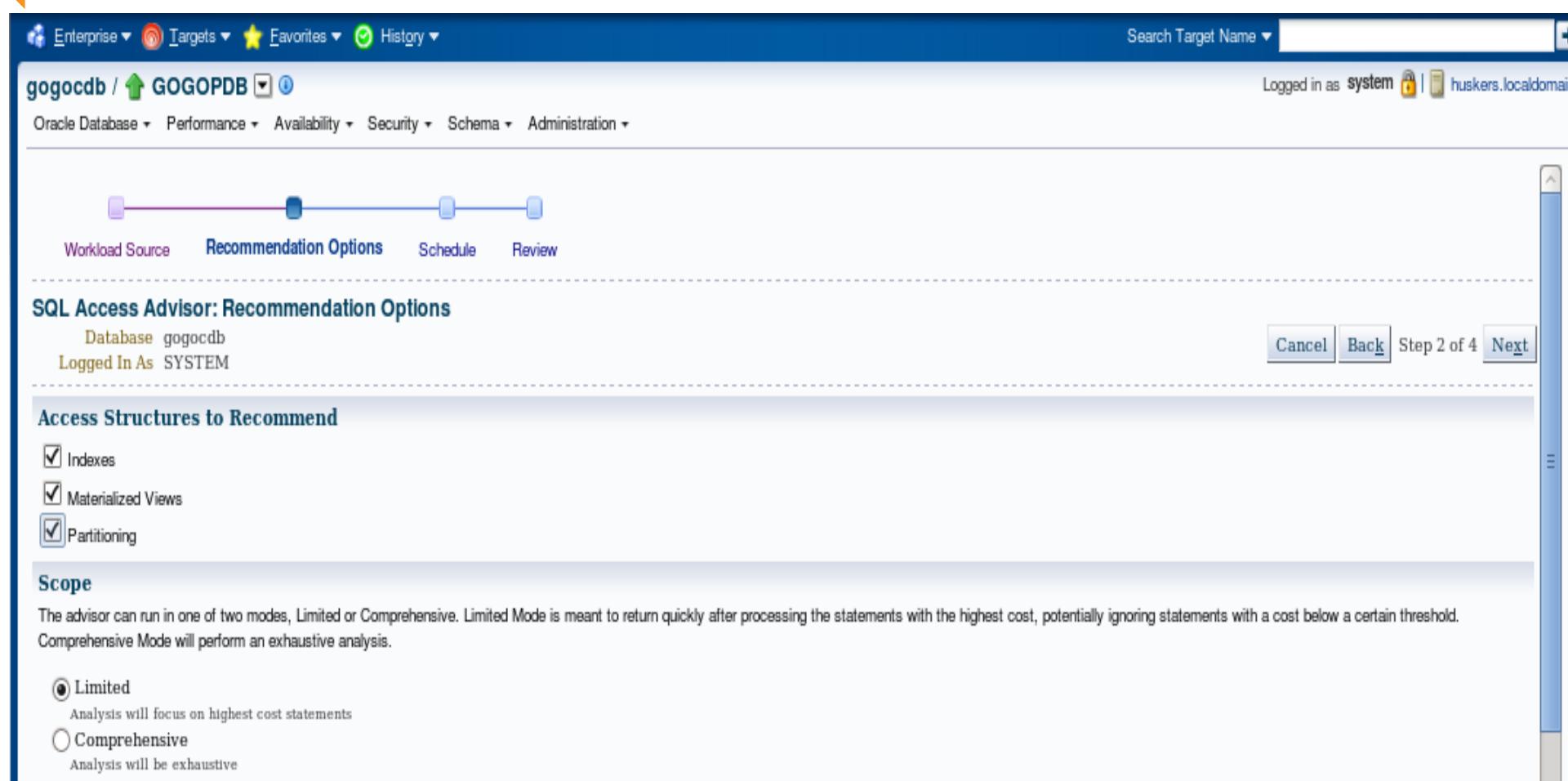
The main content area is titled 'SQL Access Advisor: Workload Source'. It displays the database 'gogocdb' and the user 'SYSTEM'. There are 'Cancel', 'Step 1 of 4', and 'Next' buttons at the top right. A progress bar at the top indicates four steps: 'Workload Source' (selected), 'Recommendation Options', 'Schedule', and 'Review'.

The 'Workload Source' section asks to select the source of the workload. It provides three options:

- Current and Recent SQL Activity
SQL will be selected from the cache.
- Use an existing SQL Tuning Set
SQL Tuning Set: SYSTEM.GOGO_TUNING 
- Create a Hypothetical Workload from the Following Schemas and Tables
The advisor can create a hypothetical workload if the tables contain dimension or primary/foreign key constraints.
Schemas and Tables
Comma-separated list 

A tip at the bottom says:  TIP Enter a schema name to specify all the tables belonging to that schema.

Oracle 19c SQL Access Advisor



The screenshot shows the Oracle 19c SQL Access Advisor interface. At the top, there's a navigation bar with links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. Below the bar, the target is set to 'gogocdb / GOGOPDB'. On the right, it shows 'Logged in as system' and 'huskers.localdomain'. The main menu includes Oracle Database, Performance, Availability, Security, Schema, and Administration.

A progress bar at the top indicates the current step: 'Recommendation Options' (blue square) is selected from four steps: Workload Source, Recommendation Options, Schedule, and Review.

The main content area is titled 'SQL Access Advisor: Recommendation Options'. It displays the database as 'gogocdb' and the user as 'SYSTEM'. On the right, there are 'Cancel', 'Back', 'Step 2 of 4', and 'Next' buttons.

Access Structures to Recommend

Checkboxes for 'Indexes', 'Materialized Views', and 'Partitioning' are all checked.

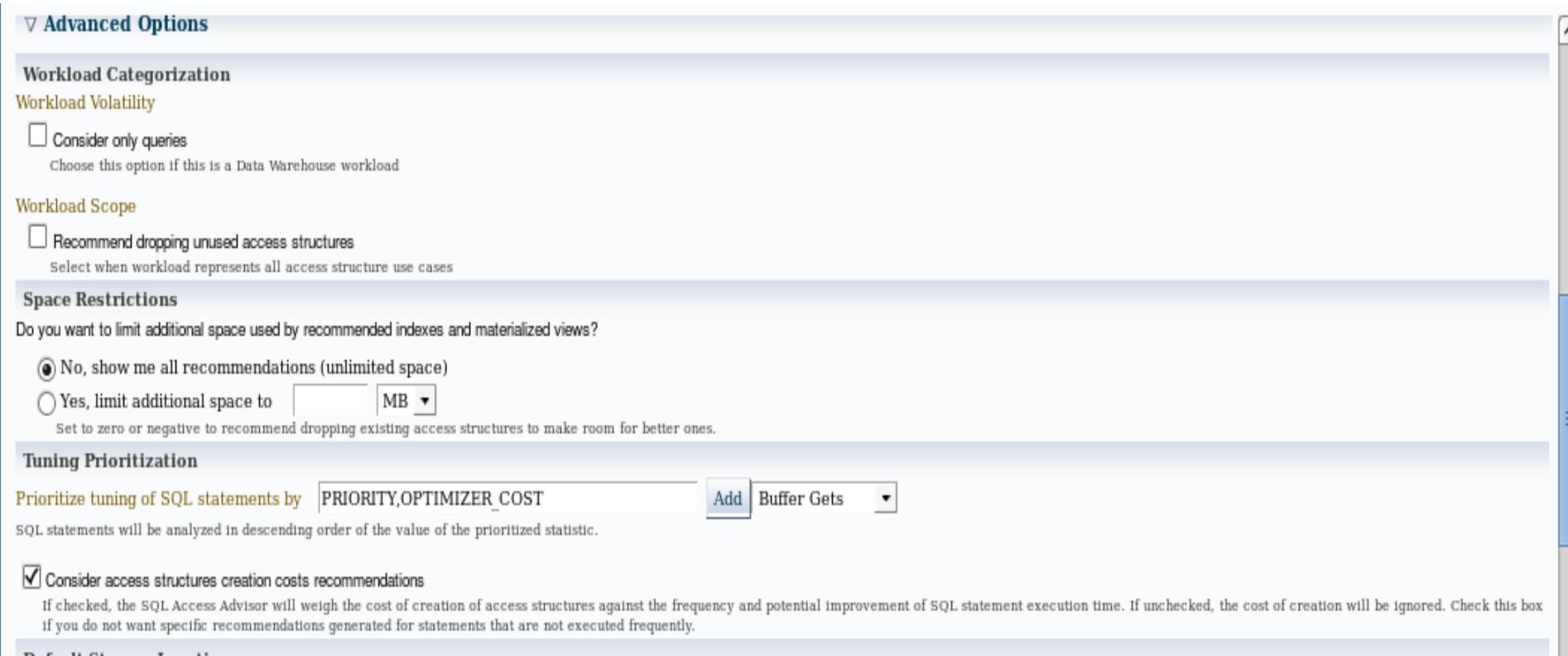
Scope

The text explains that the advisor can run in Limited or Comprehensive mode. Limited Mode focuses on highest cost statements, while Comprehensive Mode performs an exhaustive analysis.

Limited
Analysis will focus on highest cost statements

Comprehensive
Analysis will be exhaustive

Oracle 19c SQL Access Advisor



The screenshot shows the 'Advanced Options' section of the Oracle 19c SQL Access Advisor. It includes settings for Workload Categorization, Workload Volatility, Workload Scope, Space Restrictions, Tuning Prioritization, and a checkbox for access structure creation costs.

Workload Categorization

Workload Volatility

Consider only queries
Choose this option if this is a Data Warehouse workload

Workload Scope

Recommend dropping unused access structures
Select when workload represents all access structure use cases

Space Restrictions

Do you want to limit additional space used by recommended indexes and materialized views?

No, show me all recommendations (unlimited space)

Yes, limit additional space to MB

Set to zero or negative to recommend dropping existing access structures to make room for better ones.

Tuning Prioritization

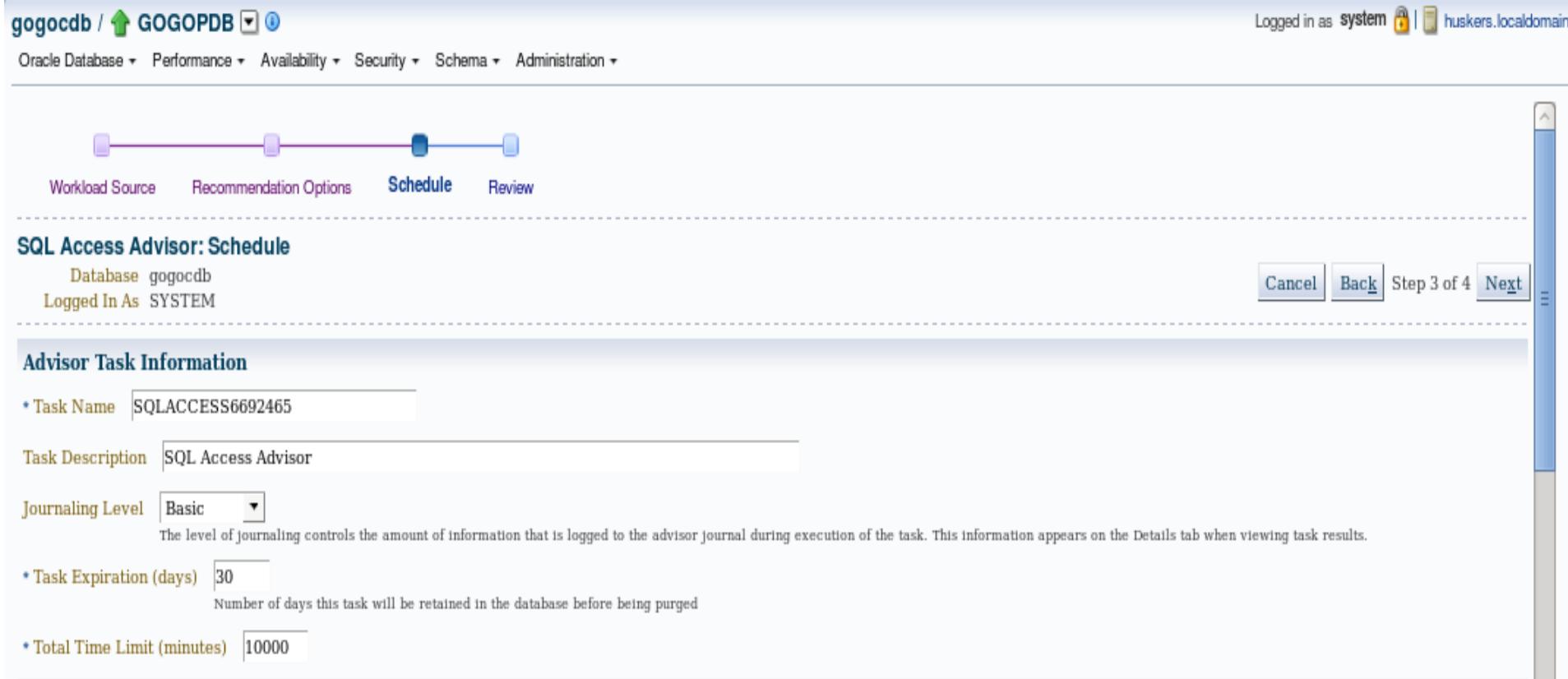
Prioritize tuning of SQL statements by

SQL statements will be analyzed in descending order of the value of the prioritized statistic.

Consider access structures creation costs recommendations

If checked, the SQL Access Advisor will weigh the cost of creation of access structures against the frequency and potential improvement of SQL statement execution time. If unchecked, the cost of creation will be ignored. Check this box if you do not want specific recommendations generated for statements that are not executed frequently.

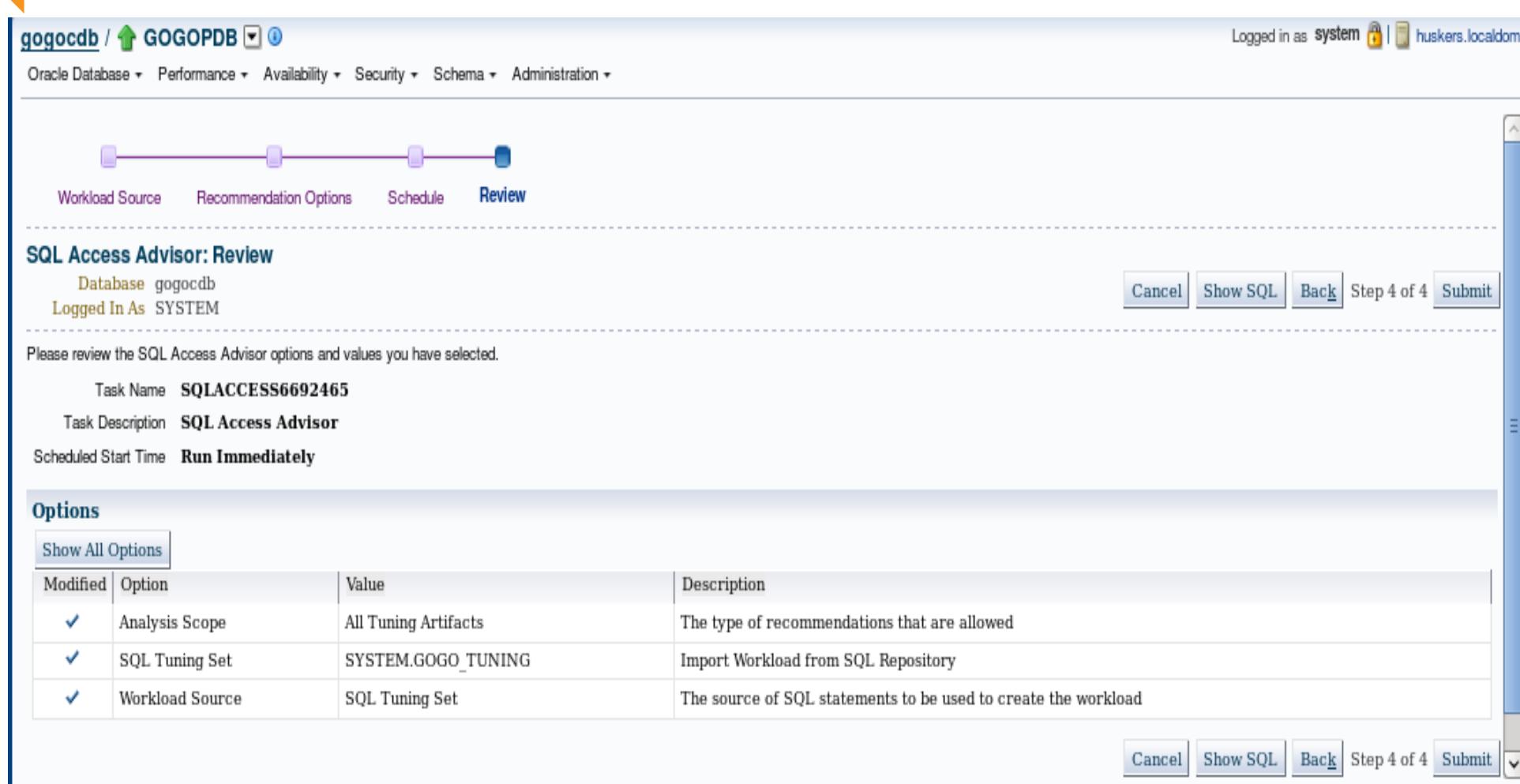
Oracle 19c SQL Access Advisor



The screenshot shows the Oracle Database SQL Access Advisor interface. At the top, it displays the database name "gogocdb / GOGOPDB" and the user "Logged in as system". Below the header is a navigation menu with links: Oracle Database, Performance, Availability, Security, Schema, and Administration. A progress bar at the top indicates the current step is "Schedule" (the third step in a four-step process). The main content area is titled "SQL Access Advisor: Schedule" and specifies the database as "gogocdb" and the user as "SYSTEM". It includes buttons for "Cancel", "Back", "Step 3 of 4", and "Next". The "Advisor Task Information" section contains the following fields:

- * Task Name: SQLACCESS6692465
- Task Description: SQL Access Advisor
- Journaling Level: Basic (dropdown menu)
- The journaling level description states: "The level of journaling controls the amount of information that is logged to the advisor journal during execution of the task. This information appears on the Details tab when viewing task results."
- * Task Expiration (days): 30
- The expiration description states: "Number of days this task will be retained in the database before being purged"
- * Total Time Limit (minutes): 10000

Oracle 19c SQL Access Advisor



The screenshot shows the Oracle 19c SQL Access Advisor interface, specifically the 'Review' step. At the top, there's a navigation bar with tabs: Workload Source, Recommendation Options, Schedule, and Review. The 'Review' tab is selected. On the right, a status bar shows 'Logged in as system' and 'huskers.localdomain'. Below the tabs, a sub-header reads 'SQL Access Advisor: Review'. It displays the database name 'gogocdb' and the user 'SYSTEM'. A progress bar at the bottom indicates Step 4 of 4. The main content area contains task details: Task Name 'SQLACCESS6692465', Task Description 'SQL Access Advisor', and Scheduled Start Time 'Run Immediately'. A large table titled 'Options' lists configuration settings:

Modified	Option	Value	Description
✓	Analysis Scope	All Tuning Artifacts	The type of recommendations that are allowed
✓	SQL Tuning Set	SYSTEM.GOGO_TUNING	Import Workload from SQL Repository
✓	Workload Source	SQL Tuning Set	The source of SQL statements to be used to create the workload

At the bottom right, there are 'Cancel', 'Show SQL', 'Back', 'Step 4 of 4', and 'Submit' buttons.

Oracle 19c SQL Access Advisor

Advisor Central > Results for Task: SQLACCESS6692465 Logged in as SYSTEM

Results for Task: SQLACCESS6692465

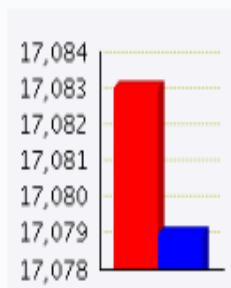
Task Name	SQLACCESS6692465	Started	Oct 16, 2014 6:54:01 PM EDT
Status	COMPLETED	Ended	Oct 16, 2014 6:54:31 PM EDT
Advisor Mode	LIMITED	Running Time (seconds)	30
Scheduler Job	ADV_SQLACCESS6692465	Total Time Limit (minutes)	10000
Publish Point	1		

Summary Recommendations SQL Statements Details

Overall Workload Performance

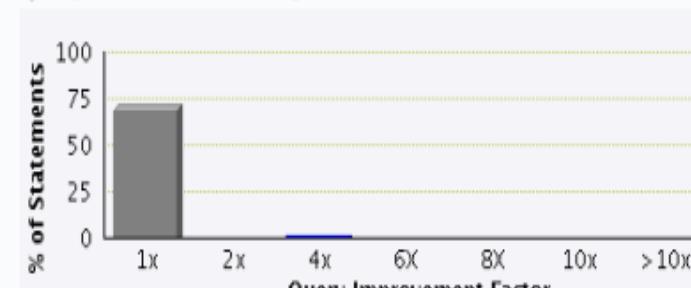
Potential for Improvement

Workload I/O Cost



Cost Type	Value
Original Cost	17083
New Cost	17079

Query Execution Time Improvement



Improvement Factor	Percentage of Statements
1x	~75%
4x	~5%

Legend:

- No Performance Improvement (Grey)
- Potential Performance Improvement (Blue)

Oracle 19c SQL Access Advisor

Advisor Central > Results for Task: SQLACCESS6692465

Logged in as SYSTEM

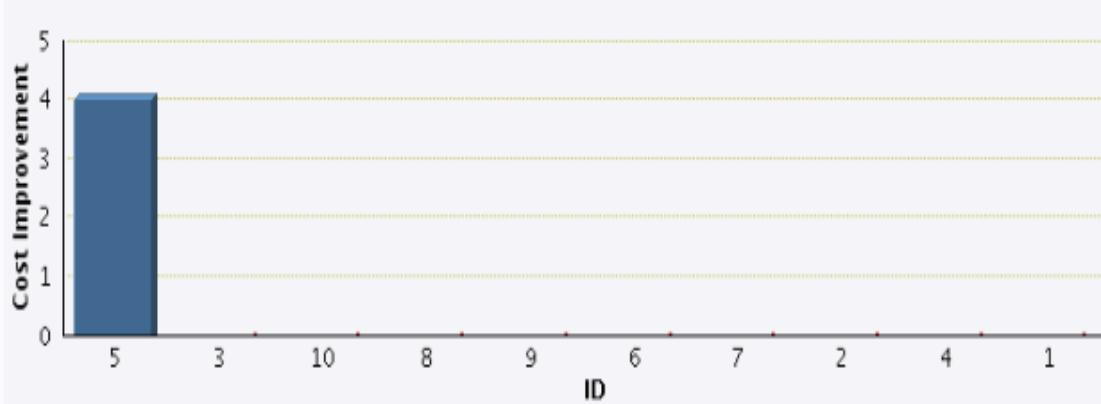
Results for Task: SQLACCESS6692465

Task Name	SQLACCESS6692465	Started	Oct 16, 2014 6:54:01 PM EDT
Status	COMPLETED	Ended	Oct 16, 2014 6:54:31 PM EDT
Advisor Mode	LIMITED	Running Time (seconds)	30
Scheduler Job	ADV_SQLACCESS6692465	Total Time Limit (minutes)	10000
Publish Point	1		

Summary Recommendations SQL Statements Details

This chart and table list recommendations initially ordered by the largest cost improvement. Implementing the top recommendation will improve total performance the most.

Recommendations by Cost Improvement



ID	Cost Improvement
5	4.2
3	0.0
10	0.0
8	0.0
9	0.0
6	0.0
7	0.0
2	0.0
4	0.0
1	0.0

Cost Improvement

Oracle 19c SQL Access Advisor

Select Recommendations for Implementation

Include Retain Actions

[Recommendation Details](#) [Schedule Implementation](#) [Show SQL](#)

Select All | Select None

Select	Implementation Status	ID	Actions	Action Types	Cost Improvement ▾	Cost Improvement (%)	Estimated Space Used (MB)	Affected SQL Statements
<input checked="" type="checkbox"/>	■	5	3	1	4	100.00	0.133	1
<input type="checkbox"/>	✓	3	1	1	0	0.00	0.250	1
<input type="checkbox"/>	✓	10	2	1	0	0.00	0.125	1
<input type="checkbox"/>	✓	8	1	1	0	0.00	0.062	1
<input type="checkbox"/>	✓	9	1	1	0	0.00	0.062	1
<input type="checkbox"/>	✓	6	1	1	0	0.00	0.062	1
<input type="checkbox"/>	✓	7	1	1	0	0.00	0.062	1
<input type="checkbox"/>	✓	2	1	1	0	0.00	0.062	2
...	---	---	...

- Automatic SQL Tuning

Lesson Topics

- Automatic SQL Tuning Maintenance Task
- Automatic Tuning Optimization Implementation(ATO)
- Automatic Tuning Optimization Results
- Enable/Disable Automatic Tuning Optimization
- Lab: Enable ATO
- Lab Demo Solution: Enable ATO

Oracle 19c Automatic SQL Tuning

What is Automatic SQL Tuning

Automatic SQL tuning occurs during Oracle's normal maintenance window

Mon-Fri 10:00 pm – 2:00 am

Identifies long running SQL from the AWR

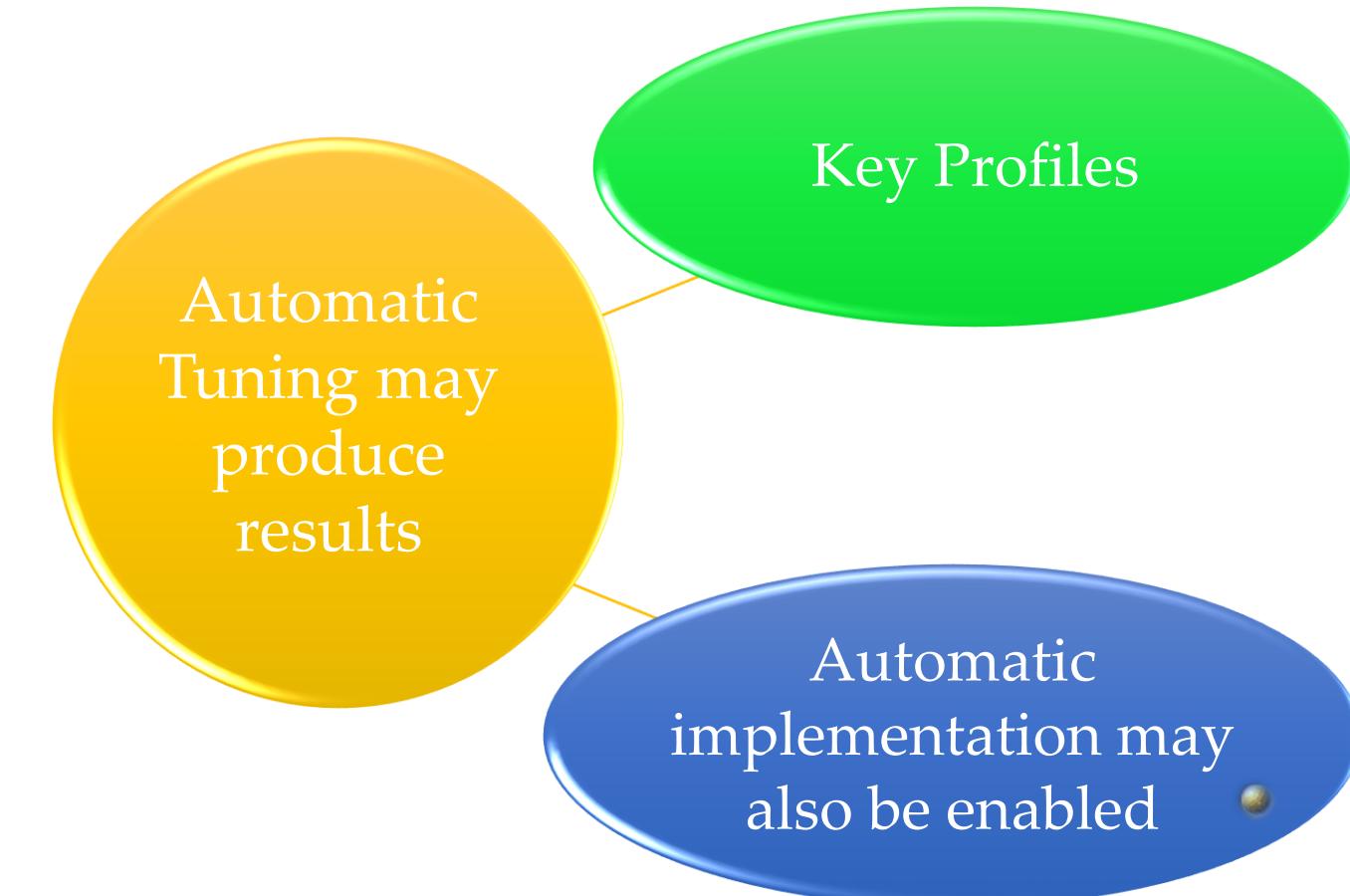
Performs SQL analysis

SQL Profiles

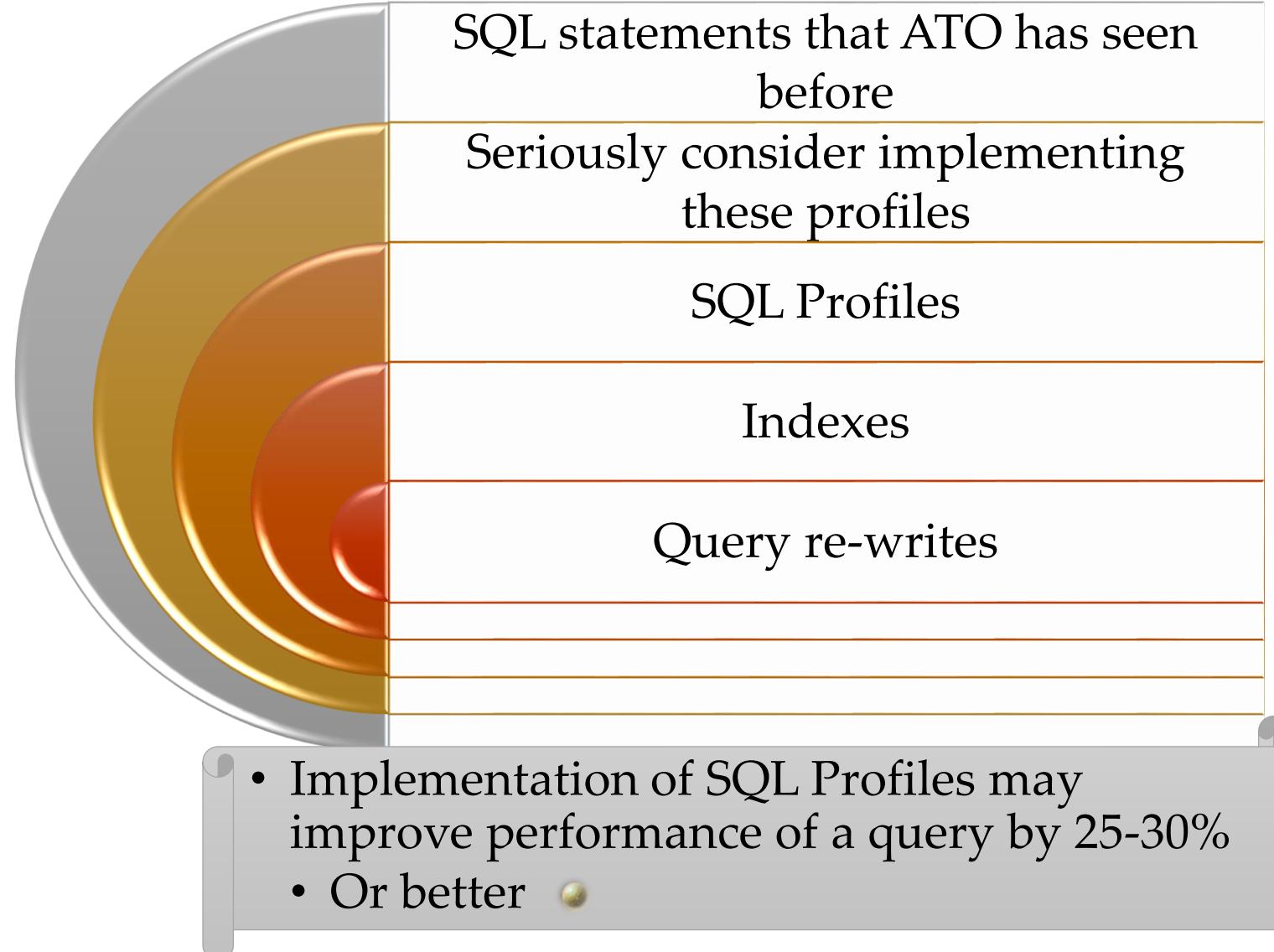
Indexes

SQL re-writes

Oracle 19c Automatic SQL Tuning



Oracle 19c Automatic SQL Tuning



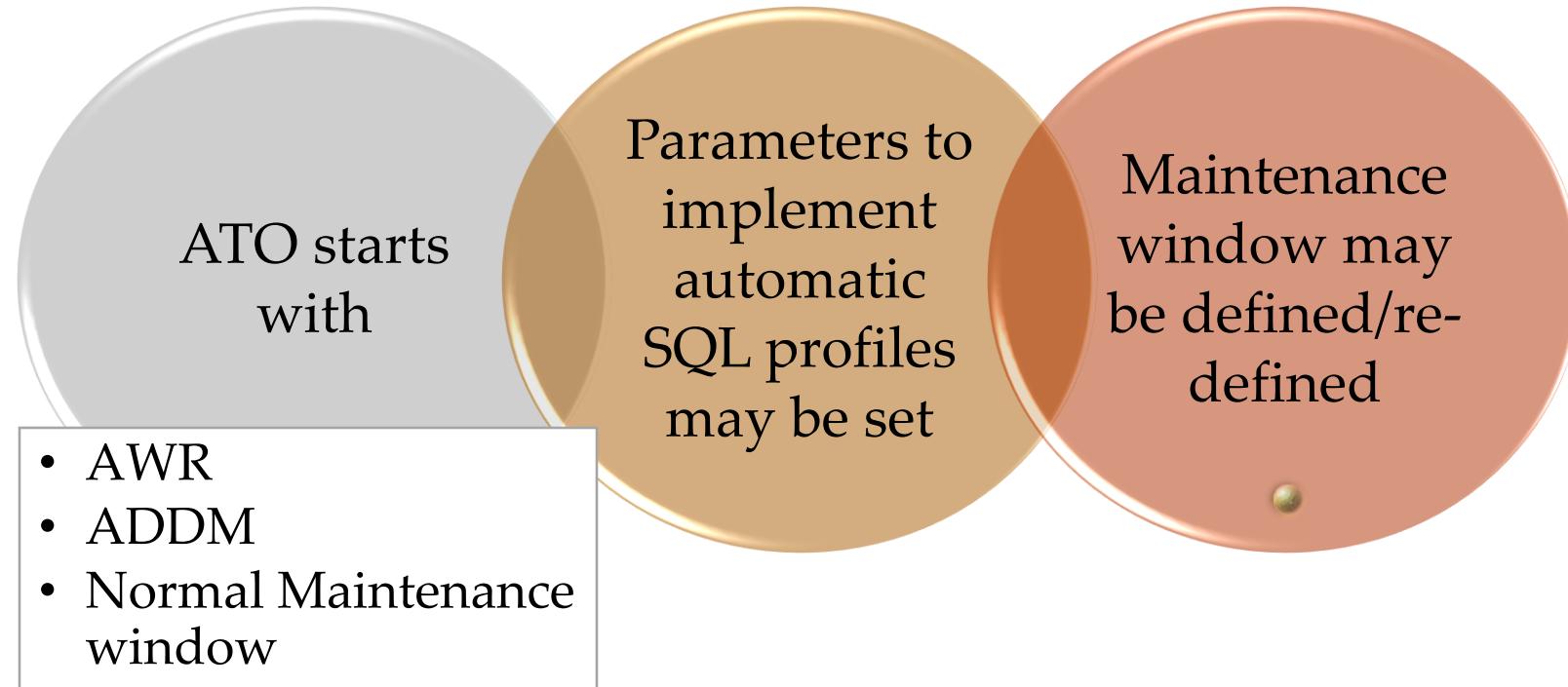
ATO is part of the advisor framework

Enabled by diagnostic and tuning pack

Database parameter

`statistics_level=typical/all`

Oracle 19c Automatic SQL Tuning



Oracle 19c Automatic SQL Tuning

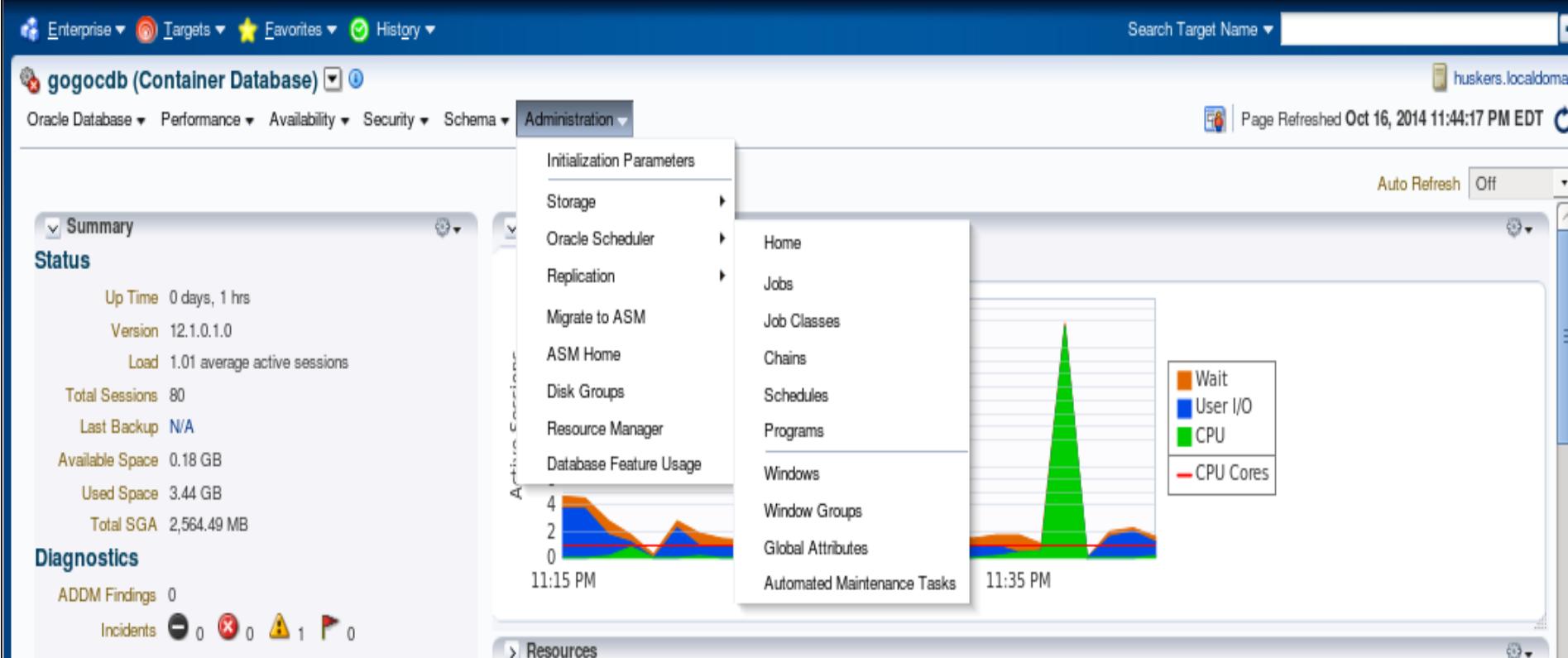
Oracles Maintenance window includes

ATO

Optimizer
statistics

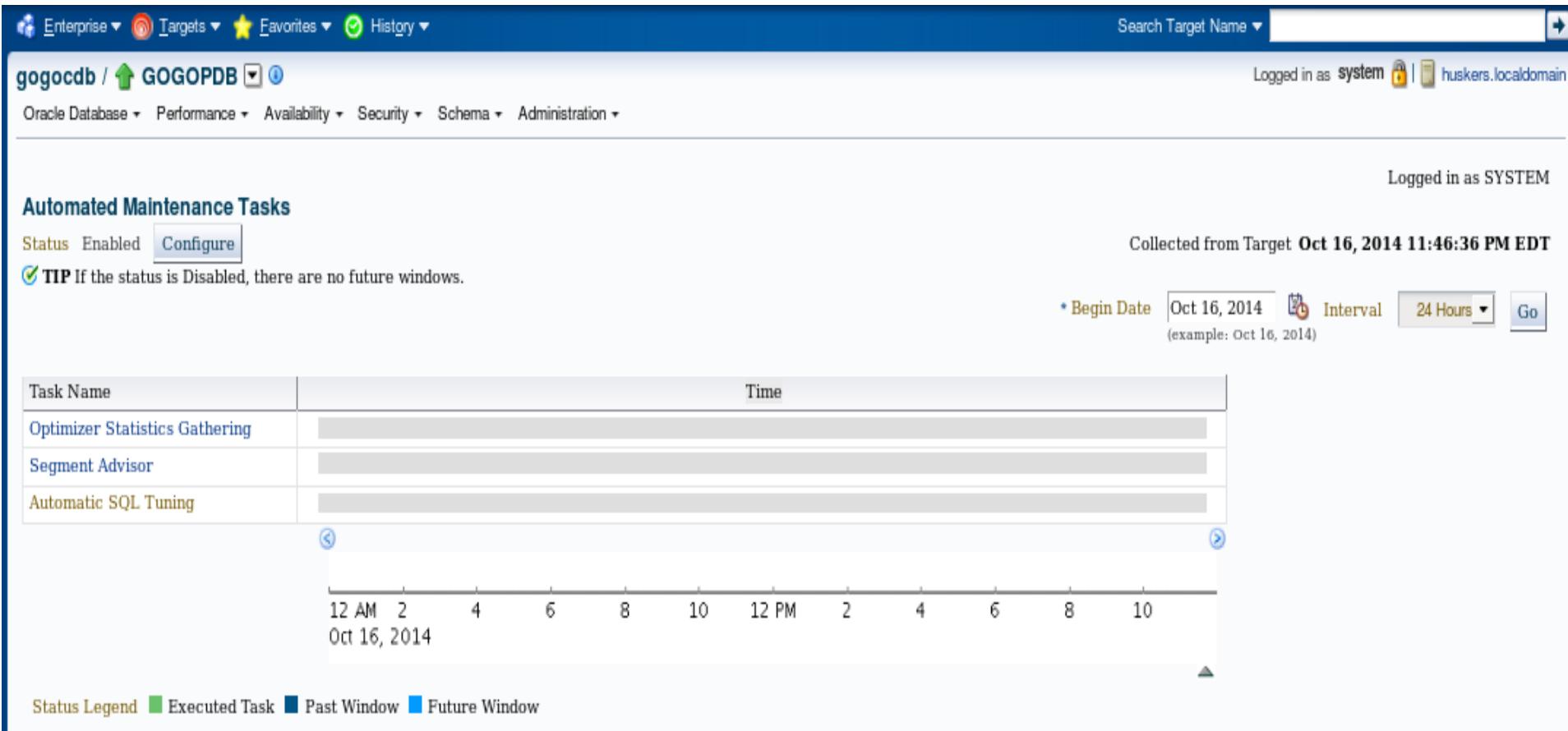
Segment
Advisor

Oracle 19c Automatic SQL Tuning



The screenshot shows the Oracle Database Control interface for a Container Database named "gogocdb". The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for "Search Target Name". The main menu bar has items for Oracle Database, Performance, Availability, Security, Schema, and Administration. The Administration menu is currently open, displaying options such as Initialization Parameters, Storage, Oracle Scheduler, Replication, Migrate to ASM, ASM Home, Disk Groups, Resource Manager, Database Feature Usage, Windows, Window Groups, Global Attributes, and Automated Maintenance Tasks. On the right side of the screen, there is a chart showing resource usage over time, with a legend indicating Wait (orange), User I/O (blue), CPU (green), and CPU Cores (red). The chart shows a significant peak in CPU usage around 11:35 PM.

Oracle 19c Automatic SQL Tuning



The screenshot shows the Oracle Database Control interface for target **gogocdb / GOGOPDB**. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The top right shows the user is logged in as **system** on **huskers.localdomain**.

The main content area displays the **Automated Maintenance Tasks** section. It indicates the status is **Enabled** and provides a **Configure** link. A **TIP** message states: "If the status is Disabled, there are no future windows." To the right, it says "Collected from Target **Oct 16, 2014 11:46:36 PM EDT**".

Below this, there are filters for *** Begin Date: Oct 16, 2014**, **Interval: 24 Hours**, and a **Go** button. A note below the filters specifies: "(example: Oct 16, 2014)".

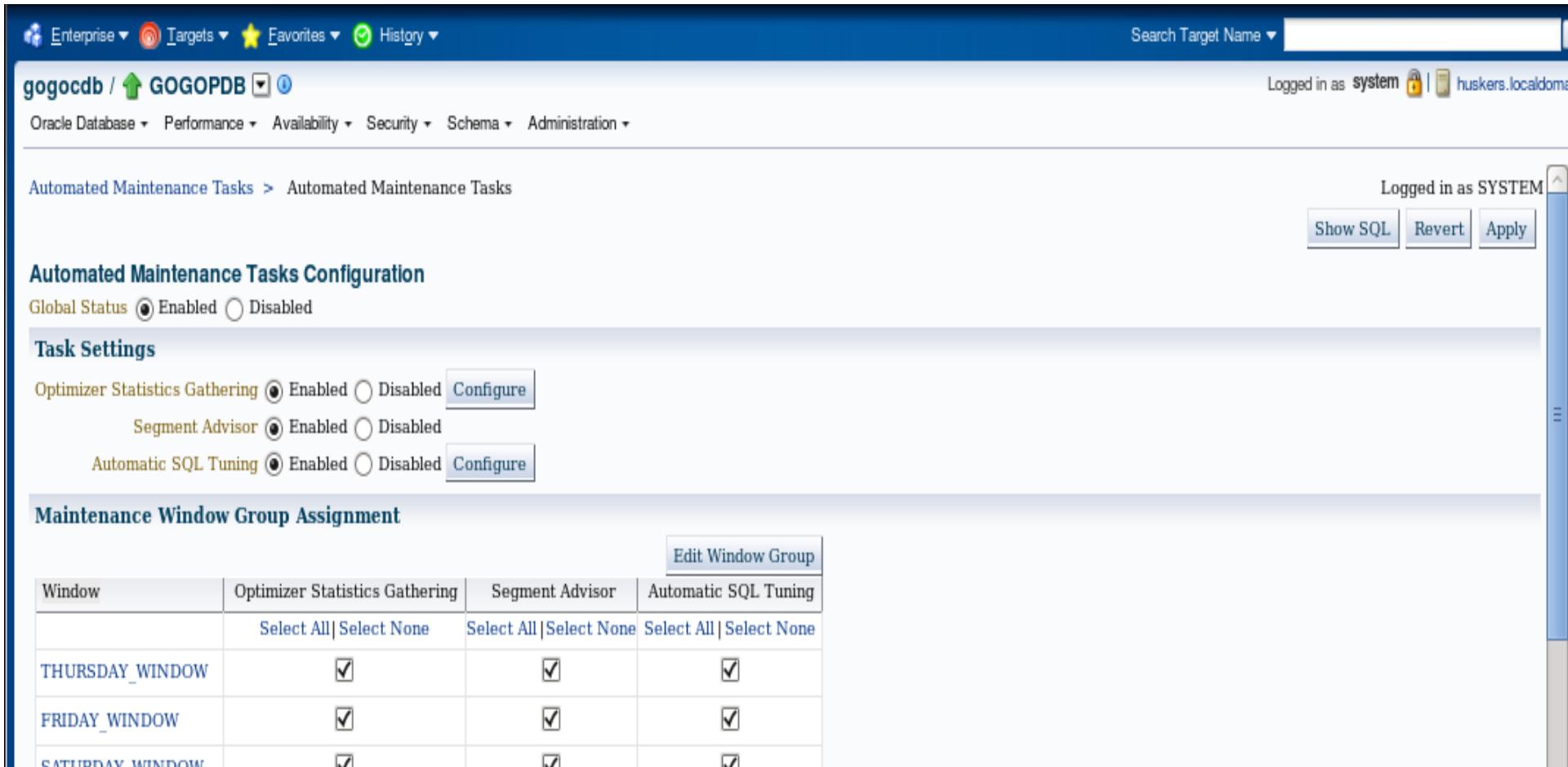
The main table lists the tasks and their execution status:

Task Name	Time
Optimizer Statistics Gathering	[Gray Bar]
Segment Advisor	[Gray Bar]
Automatic SQL Tuning	[Gray Bar]

A timeline at the bottom shows the day of Oct 16, 2014, with markers for 12 AM, 2, 4, 6, 8, 10, 12 PM, 2, 4, 6, 8, 10.

Status Legend: ■ Executed Task ■ Past Window ■ Future Window

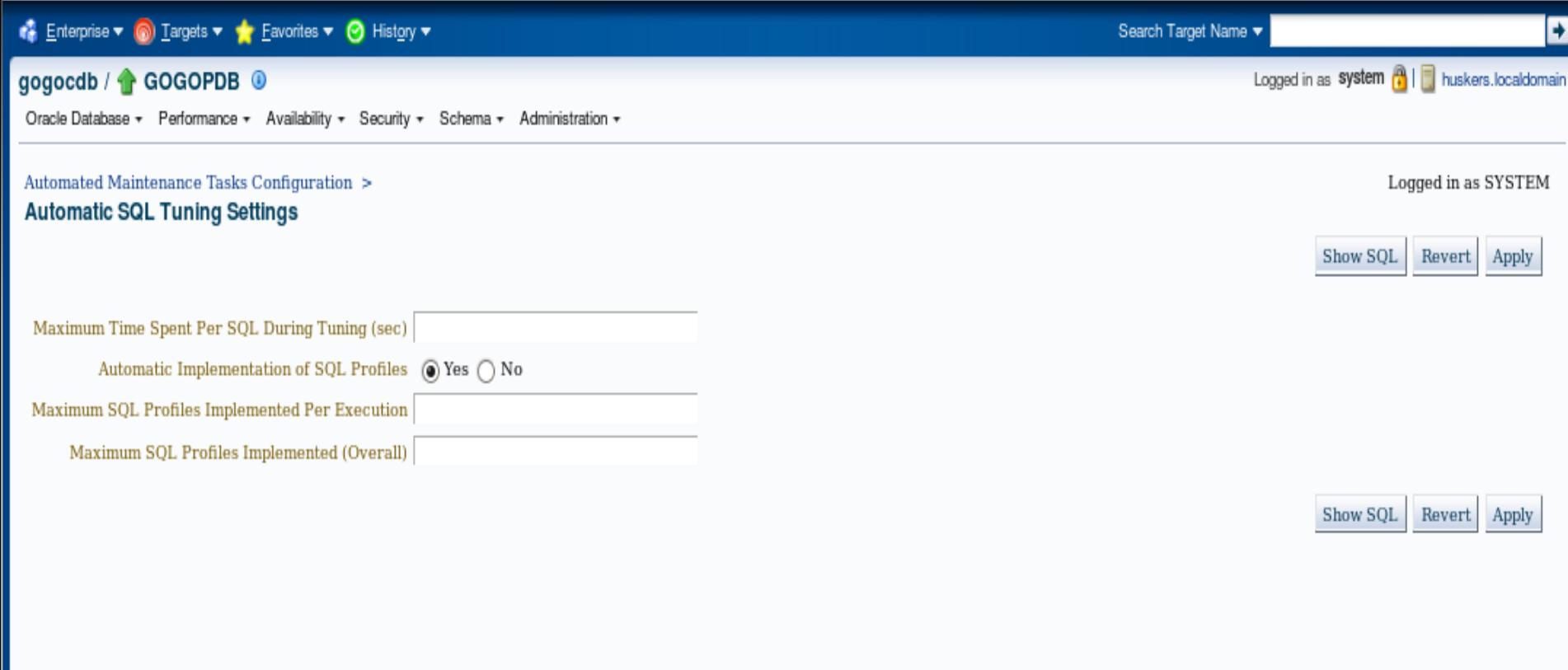
Oracle 19c Automatic SQL Tuning



The screenshot shows the Oracle Database Control interface for a target database named "gogocdb / GOGOPDB". The user is logged in as "system" and "SYSTEM". The "Automated Maintenance Tasks > Automated Maintenance Tasks" page is displayed. Under "Task Settings", three tasks are listed: Optimizer Statistics Gathering (Enabled), Segment Advisor (Enabled), and Automatic SQL Tuning (Enabled). Under "Maintenance Window Group Assignment", a grid shows which windows (THURSDAY_WINDOW, FRIDAY_WINDOW, SATURDAY_WINDOW) have each task assigned. All three tasks are assigned to all three windows.

Window	Optimizer Statistics Gathering	Segment Advisor	Automatic SQL Tuning
	Select All Select None	Select All Select None	Select All Select None
THURSDAY_WINDOW	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
FRIDAY_WINDOW	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SATURDAY_WINDOW	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Oracle 19c Automatic SQL Tuning



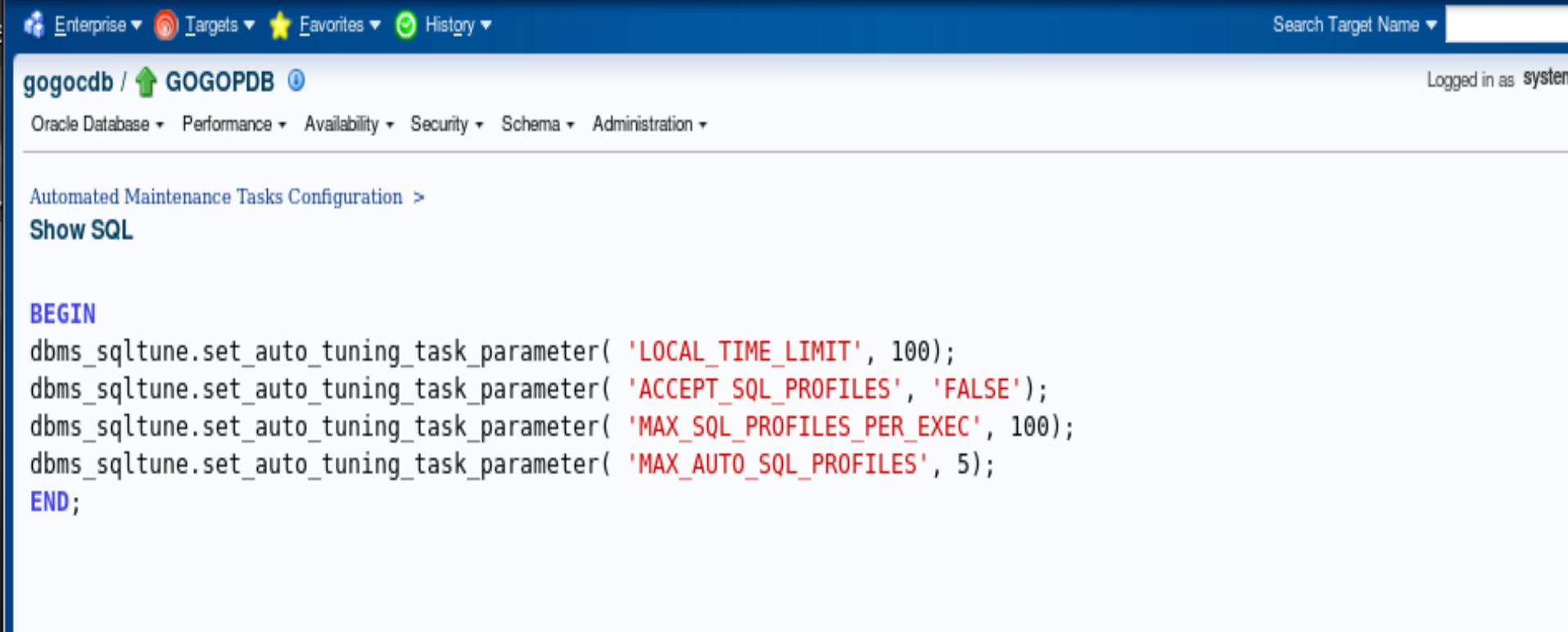
The screenshot shows the Oracle Database Control interface for a target database named "gogocdb / GOGOPDB". The user is logged in as "system" on the "huskers.localdomain" host. The current page is "Automatic SQL Tuning Settings" under "Automated Maintenance Tasks Configuration".

Configuration settings displayed:

- Maximum Time Spent Per SQL During Tuning (sec): [Text input field]
- Automatic Implementation of SQL Profiles: Yes No
- Maximum SQL Profiles Implemented Per Execution: [Text input field]
- Maximum SQL Profiles Implemented (Overall): [Text input field]

Buttons at the bottom right of the configuration section: Show SQL, Revert, Apply.

Oracle 19c Automatic SQL Tuning

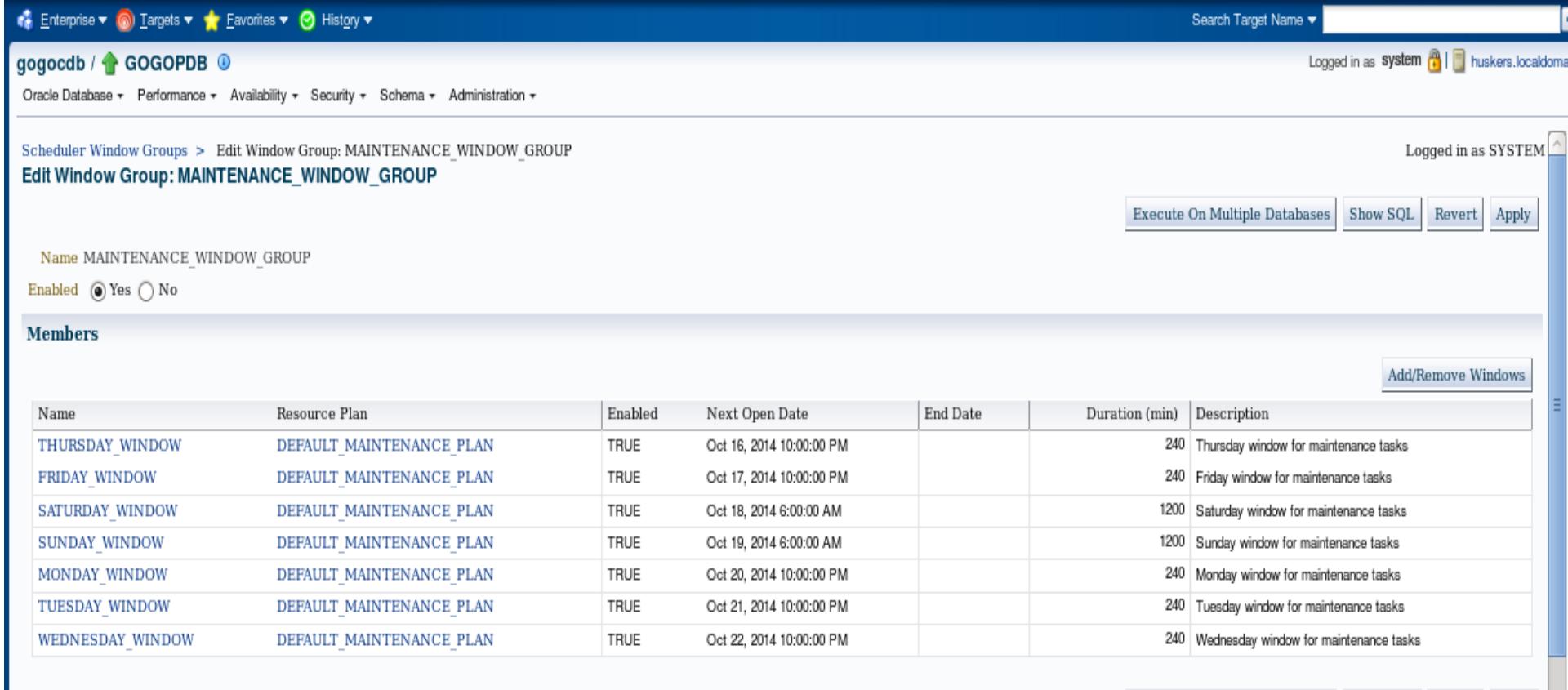


Enterprise ▾ Targets ▾ Favorites ▾ History ▾ Search Target Name ▾
gogocdb /  GOGOPDB ⓘ Logged in as system
Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Automated Maintenance Tasks Configuration >
Show SQL

```
BEGIN
  dbms_sqltune.set_auto_tuning_task_parameter( 'LOCAL_TIME_LIMIT', 100);
  dbms_sqltune.set_auto_tuning_task_parameter( 'ACCEPT_SQL_PROFILES', 'FALSE');
  dbms_sqltune.set_auto_tuning_task_parameter( 'MAX_SQL_PROFILES_PER_EXEC', 100);
  dbms_sqltune.set_auto_tuning_task_parameter( 'MAX_AUTO_SQL_PROFILES', 5);
END;
```

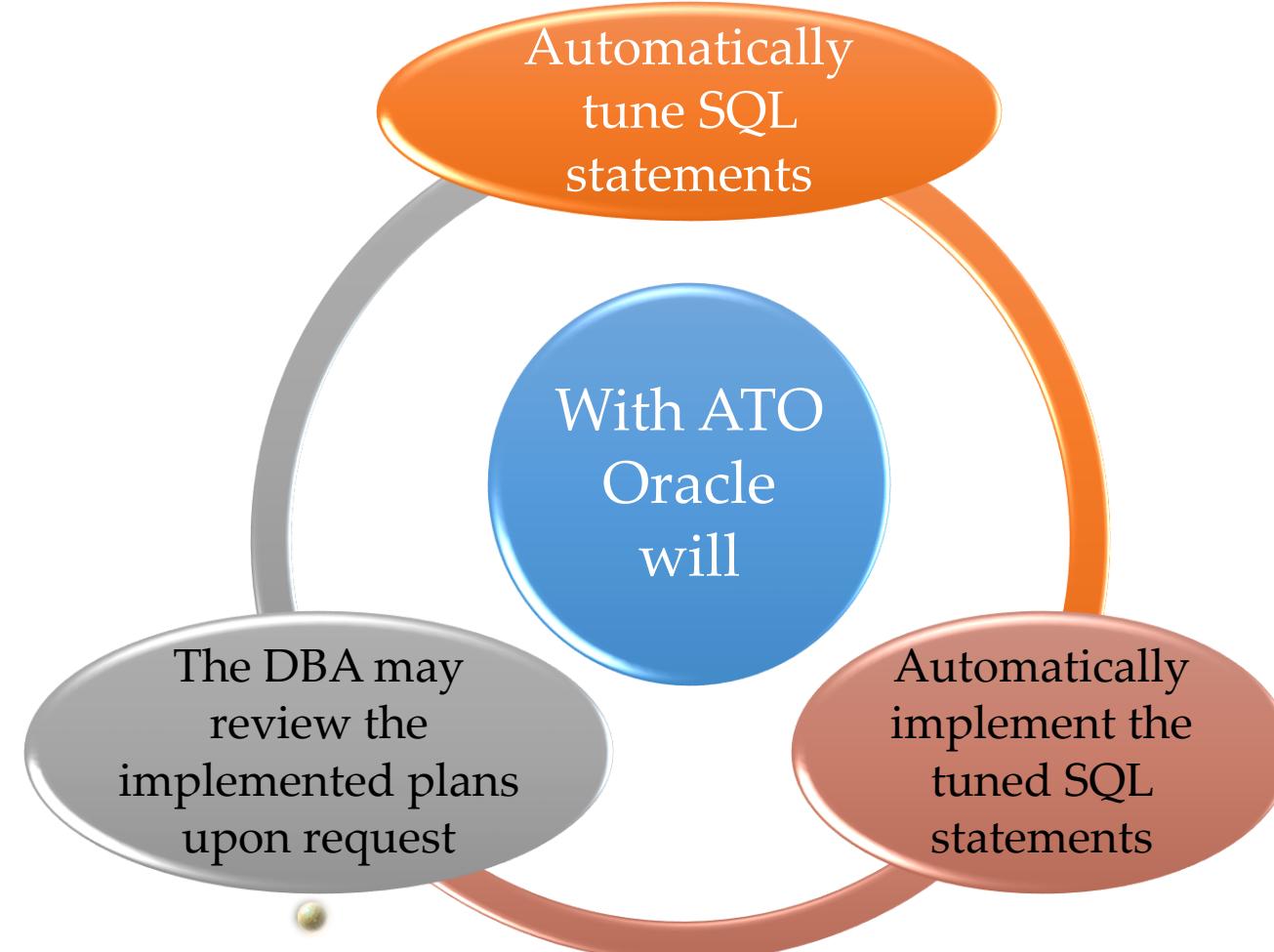
Oracle 19c Automatic SQL Tuning



The screenshot shows the Oracle Database Control interface for the database gogodb / GOGOPDB. The user is logged in as system. The current page is "Edit Window Group: MAINTENANCE_WINDOW_GROUP". The page title is "Edit Window Group: MAINTENANCE_WINDOW_GROUP". The "Members" section displays a table of maintenance windows:

Name	Resource Plan	Enabled	Next Open Date	End Date	Duration (min)	Description
THURSDAY_WINDOW	DEFAULT_MAINTENANCE_PLAN	TRUE	Oct 16, 2014 10:00:00 PM		240	Thursday window for maintenance tasks
FRIDAY_WINDOW	DEFAULT_MAINTENANCE_PLAN	TRUE	Oct 17, 2014 10:00:00 PM		240	Friday window for maintenance tasks
SATURDAY_WINDOW	DEFAULT_MAINTENANCE_PLAN	TRUE	Oct 18, 2014 6:00:00 AM		1200	Saturday window for maintenance tasks
SUNDAY_WINDOW	DEFAULT_MAINTENANCE_PLAN	TRUE	Oct 19, 2014 6:00:00 AM		1200	Sunday window for maintenance tasks
MONDAY_WINDOW	DEFAULT_MAINTENANCE_PLAN	TRUE	Oct 20, 2014 10:00:00 PM		240	Monday window for maintenance tasks
TUESDAY_WINDOW	DEFAULT_MAINTENANCE_PLAN	TRUE	Oct 21, 2014 10:00:00 PM		240	Tuesday window for maintenance tasks
WEDNESDAY_WINDOW	DEFAULT_MAINTENANCE_PLAN	TRUE	Oct 22, 2014 10:00:00 PM		240	Wednesday window for maintenance tasks

Oracle 19c Automatic SQL Tuning



- SQL Plan Management

Lesson Topics



SQL Plan
Management
and Baseline
Overview

Enable SQL
Plan
Management

Loading SQL
Plan
Baselines
into the SGA

Adaptive
Plan
Management

Oracle 19c SQL Plan Management

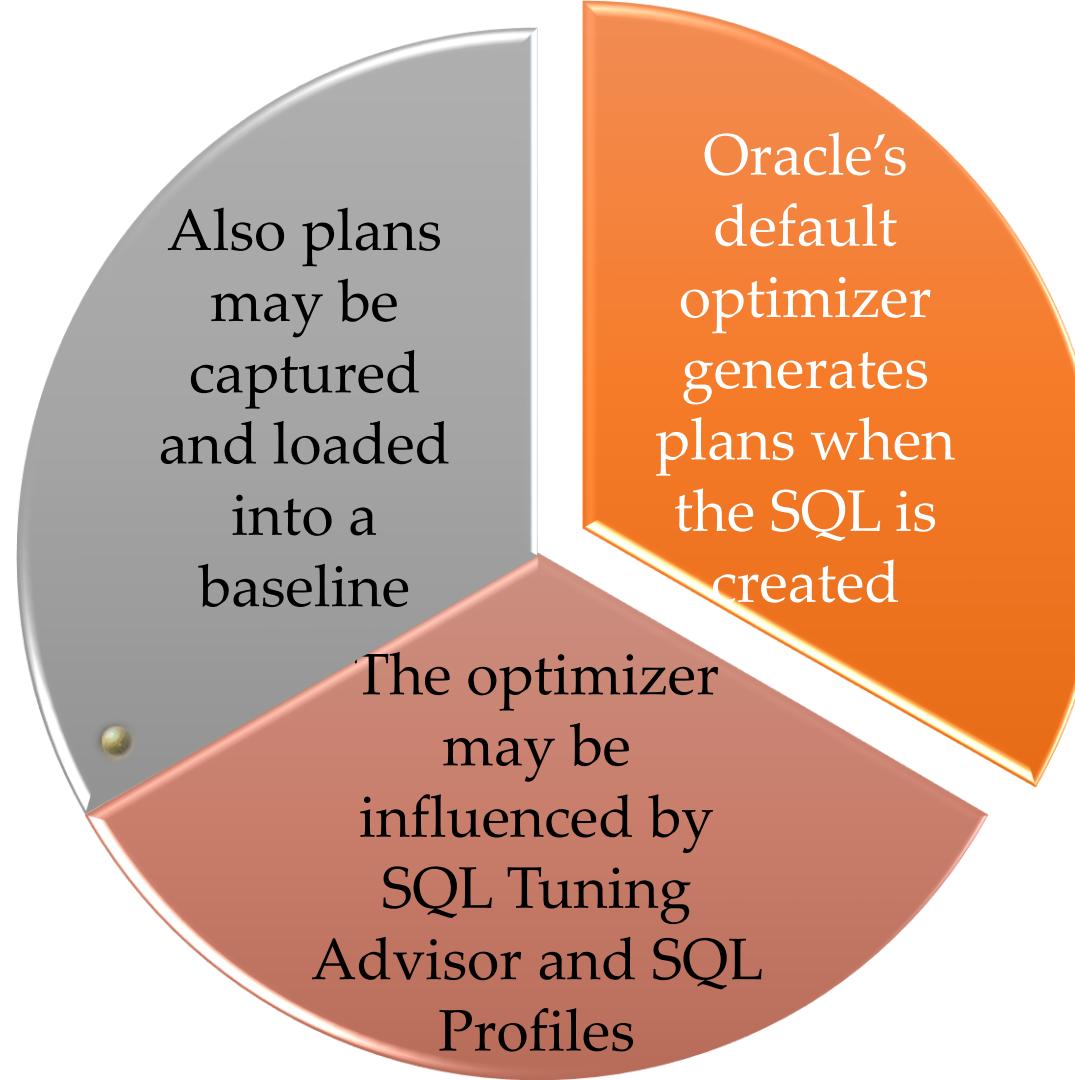
What is SQL Plan Management?

- The Ability to influence the optimizer to a specific plan

Plans are either:

- Created initially
 - Hard parse/soft parse
- Generated from a SQL Profile
- Loaded from a plan baseline

Oracle 19c SQL Plan Management



Also plans may be captured and loaded into a baseline

Oracle's default optimizer generates plans when the SQL is created

The optimizer may be influenced by SQL Tuning Advisor and SQL Profiles

Oracle 19c SQL Plan Management

Plan management is controlled by several database parameters

- OPTIMIZER_CAPTURE_SQL_PLAN_BASELINES=TRUE
- optimizer_use_sql_plan_baselines = true

Loaded plans may be:

- Accepted
- Fixed

Oracle 19c SQL Plan Management



An 'Accepted' plan may be used by the optimizer

A 'Fixed' plan will always be used by the optimizer

- Plans may be captured from
- SGA
 - Supplied SQL
 - SQL Tuning Sets

Oracle 19c SQL Plan Management

SQL Plan management is controlled by the

- dbms_spm package
- Plans can evolve

Plans can reside in memory based on a retention policy

- exec

```
dbms_spm.configure('SPACE_BUDGET_P
ERCENT',20);
```
- Plans reside in SYSAUX
- exec

```
dbms_spm.configure('PLAN_RETENTIO
N_WEEKS',105);
```

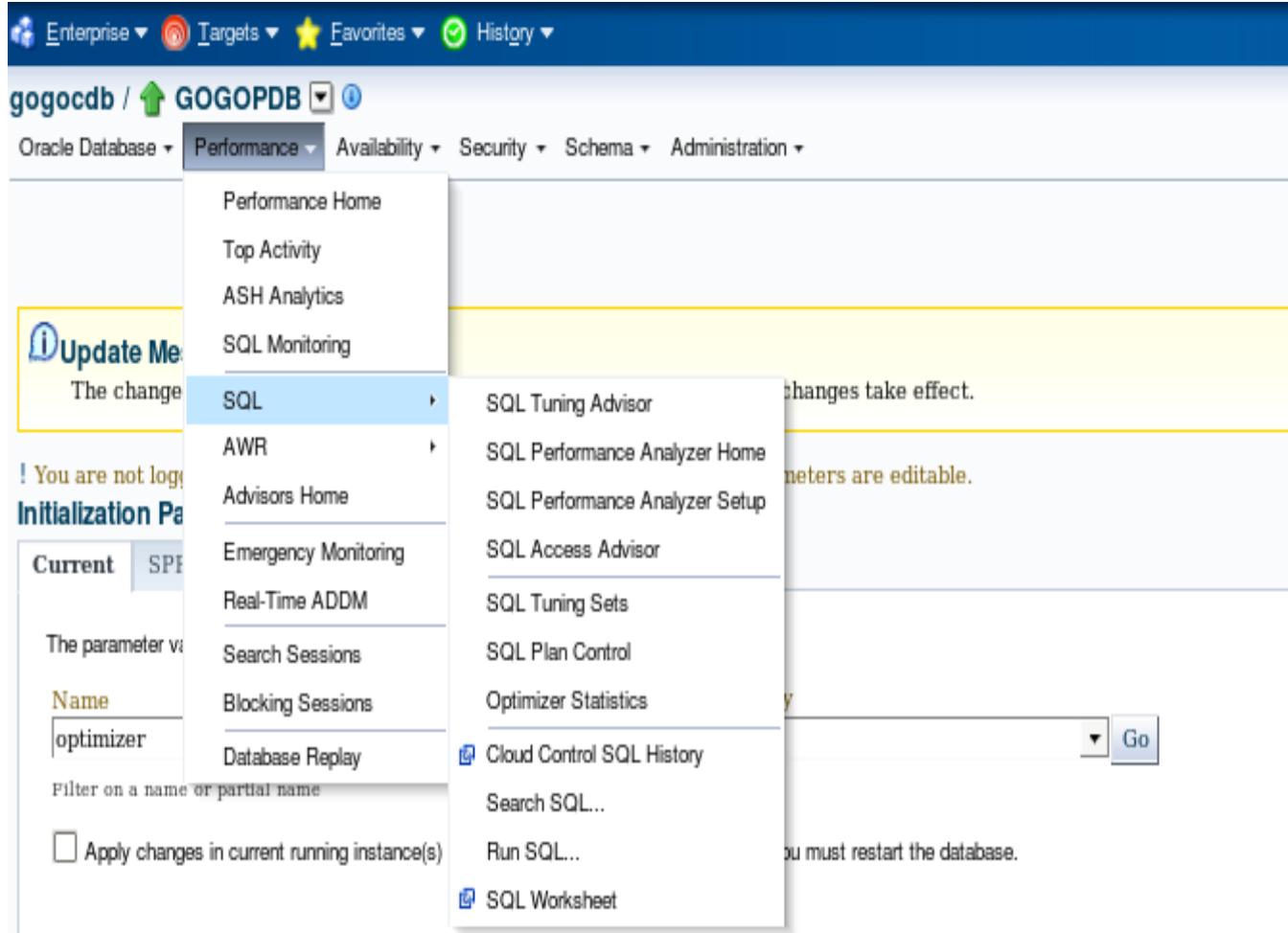
SQL> desc dbms_spm		
PROCEDURE ACCEPT_SQL_PLAN_BASELINE		
Argument Name	Type	In/Out Default?
-----	-----	-----
TASK_NAME	VARCHAR2	IN
OBJECT_ID	NUMBER	IN
TASK_OWNER	VARCHAR2	IN DEFAULT
FORCE	BOOLEAN	IN DEFAULT
FUNCTION ALTER_SQL_PLAN_BASELINE RETURNS BINARY_INTEGER		
Argument Name	Type	In/Out Default?
-----	-----	-----
SQL_HANDLE	VARCHAR2	IN DEFAULT
PLAN_NAME	VARCHAR2	IN DEFAULT
ATTRIBUTE_NAME	VARCHAR2	IN
ATTRIBUTE_VALUE	VARCHAR2	IN
PROCEDURE CANCEL_EVOLVE_TASK		
Argument Name	Type	In/Out Default?
-----	-----	-----
TASK_NAME	VARCHAR2	IN
PROCEDURE CONFIGURE		
Argument Name	Type	In/Out Default?
-----	-----	-----
PARAMETER_NAME	VARCHAR2	IN
PARAMETER_VALUE	NUMBER	IN DEFAULT

FUNCTION CREATE_EVOLVE_TASK RETURNS VARCHAR2			
Argument Name	Type	In/Out	Default?
-----	-----	-----	-----
SQL_HANDLE	VARCHAR2	IN	DEFAULT
PLAN_NAME	VARCHAR2	IN	DEFAULT
TIME_LIMIT	NUMBER	IN	DEFAULT
TASK_NAME	VARCHAR2	IN	DEFAULT
DESCRIPTION	VARCHAR2	IN	DEFAULT
FUNCTION CREATE_EVOLVE_TASK RETURNS VARCHAR2			
Argument Name	Type	In/Out	Default?
-----	-----	-----	-----
PLAN_LIST	NAME_LIST	IN	
TIME_LIMIT	NUMBER	IN	DEFAULT
TASK_NAME	VARCHAR2	IN	DEFAULT
DESCRIPTION	VARCHAR2	IN	DEFAULT
PROCEDURE CREATE_STGTAB_BASELINE			
Argument Name	Type	In/Out	Default?
-----	-----	-----	-----
TABLE_NAME	VARCHAR2	IN	
TABLE_OWNER	VARCHAR2	IN	DEFAULT
TABLESPACE_NAME	VARCHAR2	IN	DEFAULT
PROCEDURE DROP_EVOLVE_TASK			
Argument Name	Type	In/Out	Default?
-----	-----	-----	-----
TASK_NAME	VARCHAR2	IN	
FUNCTION DROP_MIGRATED_STORED_OUTLINE RETURNS BINARY_INTEGER			

Oracle 19c SQL Plan Management

```
FUNCTION LOAD_PLANS_FROM_CURSOR_CACHE RETURNS BINARY_INTEGER
Argument Name          Type          In/Out Default?
-----
ATTRIBUTE_NAME          VARCHAR2        IN
ATTRIBUTE_VALUE          VARCHAR2        IN
FIXED                   VARCHAR2        IN      DEFAULT
ENABLED                 VARCHAR2        IN      DEFAULT
FUNCTION LOAD_PLANS_FROM_CURSOR_CACHE RETURNS BINARY_INTEGER
Argument Name          Type          In/Out Default?
-----
SQL_ID                  VARCHAR2        IN
PLAN_HASH_VALUE          NUMBER         IN      DEFAULT
FIXED                   VARCHAR2        IN      DEFAULT
ENABLED                 VARCHAR2        IN      DEFAULT
FUNCTION LOAD_PLANS_FROM_CURSOR_CACHE RETURNS BINARY_INTEGER
Argument Name          Type          In/Out Default?
-----
SQL_ID                  VARCHAR2        IN
PLAN_HASH_VALUE          NUMBER         IN      DEFAULT
SQL_TEXT                CLOB           IN
FIXED                   VARCHAR2        IN      DEFAULT
ENABLED                 VARCHAR2        IN      DEFAULT
FUNCTION LOAD_PLANS_FROM_CURSOR_CACHE RETURNS BINARY_INTEGER
```

Oracle 19c SQL Plan Management



The screenshot shows the Oracle Database Performance page for the database gogocdb / GOGOPDB. The Performance tab is selected in the top navigation bar. A dropdown menu is open under the Performance tab, showing various SQL-related options:

- Performance Home
- Top Activity
- ASH Analytics
- SQL Monitoring
- SQL
- AWR
- Advisors Home
- Emergency Monitoring
- Real-Time ADDM
- Search Sessions
- Blocking Sessions
- Database Replay
- Apply changes in current running instance(s)

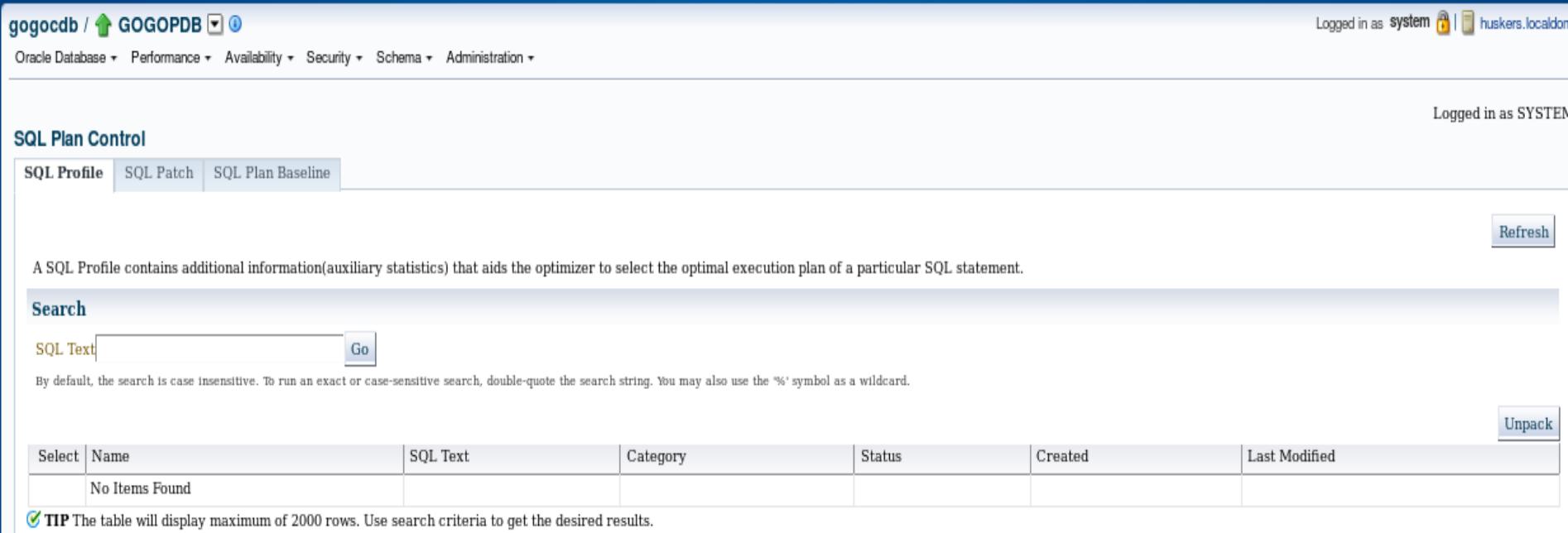
The "SQL" option is highlighted in blue. To the right of the dropdown, there is a large yellow callout box containing the following text:

The changes take effect.
You must restart the database.

Below the dropdown menu, there are several other links:

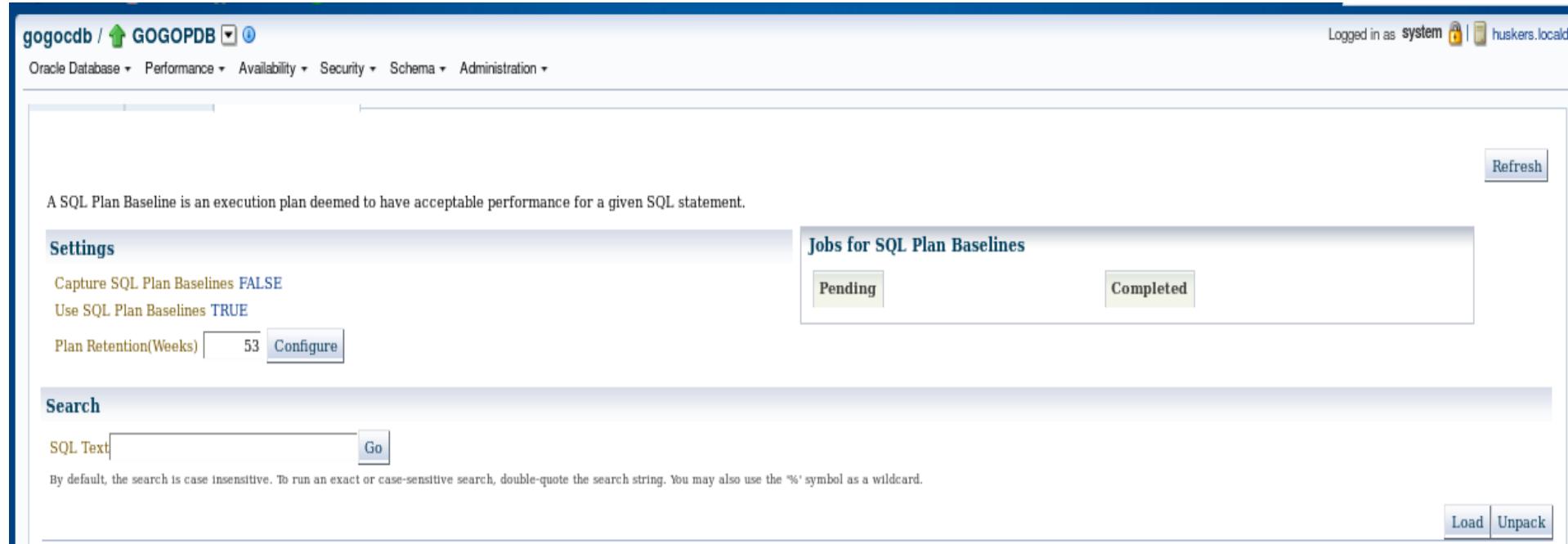
- SQL Tuning Advisor
- SQL Performance Analyzer Home
- SQL Performance Analyzer Setup
- SQL Access Advisor
- SQL Tuning Sets
- SQL Plan Control
- Optimizer Statistics
- Cloud Control SQL History
- Search SQL...
- Run SQL...
- SQL Worksheet

Oracle 19c SQL Plan Management



The screenshot shows the Oracle Database SQL Plan Control interface. At the top, there's a navigation bar with links for Oracle Database, Performance, Availability, Security, Schema, and Administration. On the right, it shows the user is logged in as system (with a lock icon) and huskers.localdomain. Below the navigation, the title "SQL Plan Control" is displayed, followed by tabs for SQL Profile (selected), SQL Patch, and SQL Plan Baseline. A "Refresh" button is located in the top right corner of the main content area. The main content area contains a message about SQL Profiles aiding the optimizer in selecting execution plans. Below this is a "Search" section with a "SQL Text" input field and a "Go" button. A note below the search field states that the search is case insensitive and can use double quotes or the '%' wildcard. A table header with columns for Select, Name, SQL Text, Category, Status, Created, and Last Modified is shown, along with a "Unpack" button. The table body displays a single row: "No Items Found". A tip at the bottom left indicates that the table will show a maximum of 2000 rows.

Oracle 19c SQL Plan Management



The screenshot shows the Oracle Database SQL Plan Management interface for the database GOGOPDB. The top navigation bar includes links for Oracle Database, Performance, Availability, Security, Schema, and Administration. The top right corner shows the user is logged in as system with session ID huskers.localdomain.

A SQL Plan Baseline is an execution plan deemed to have acceptable performance for a given SQL statement.

Settings

- Capture SQL Plan Baselines: FALSE
- Use SQL Plan Baselines: TRUE
- Plan Retention(Weeks): 53 (with a [Configure](#) button)

Jobs for SQL Plan Baselines

	Pending	Completed
Refresh		

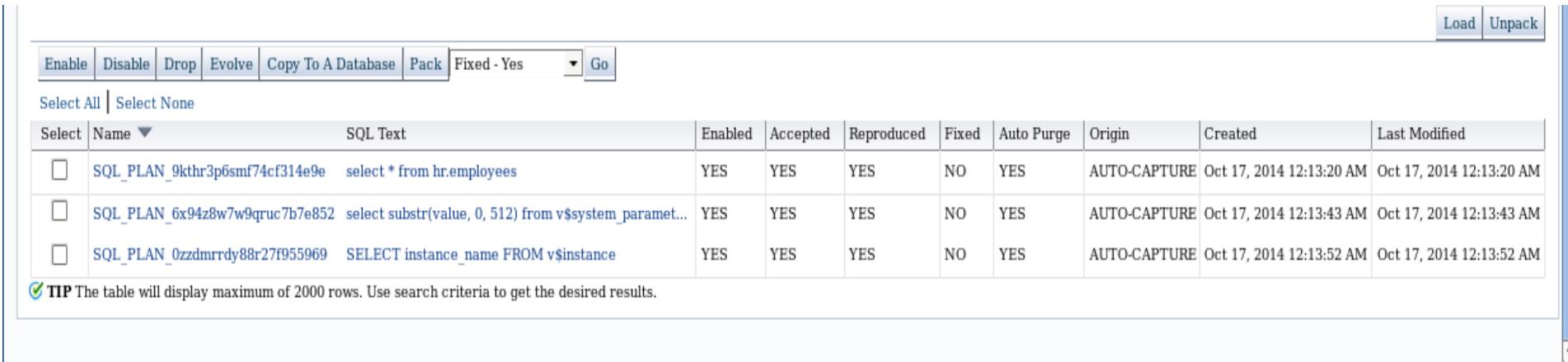
Search

SQL Text: Go

By default, the search is case insensitive. To run an exact or case-sensitive search, double-quote the search string. You may also use the '%' symbol as a wildcard.

Load Unpack

Oracle 19c SQL Plan Management

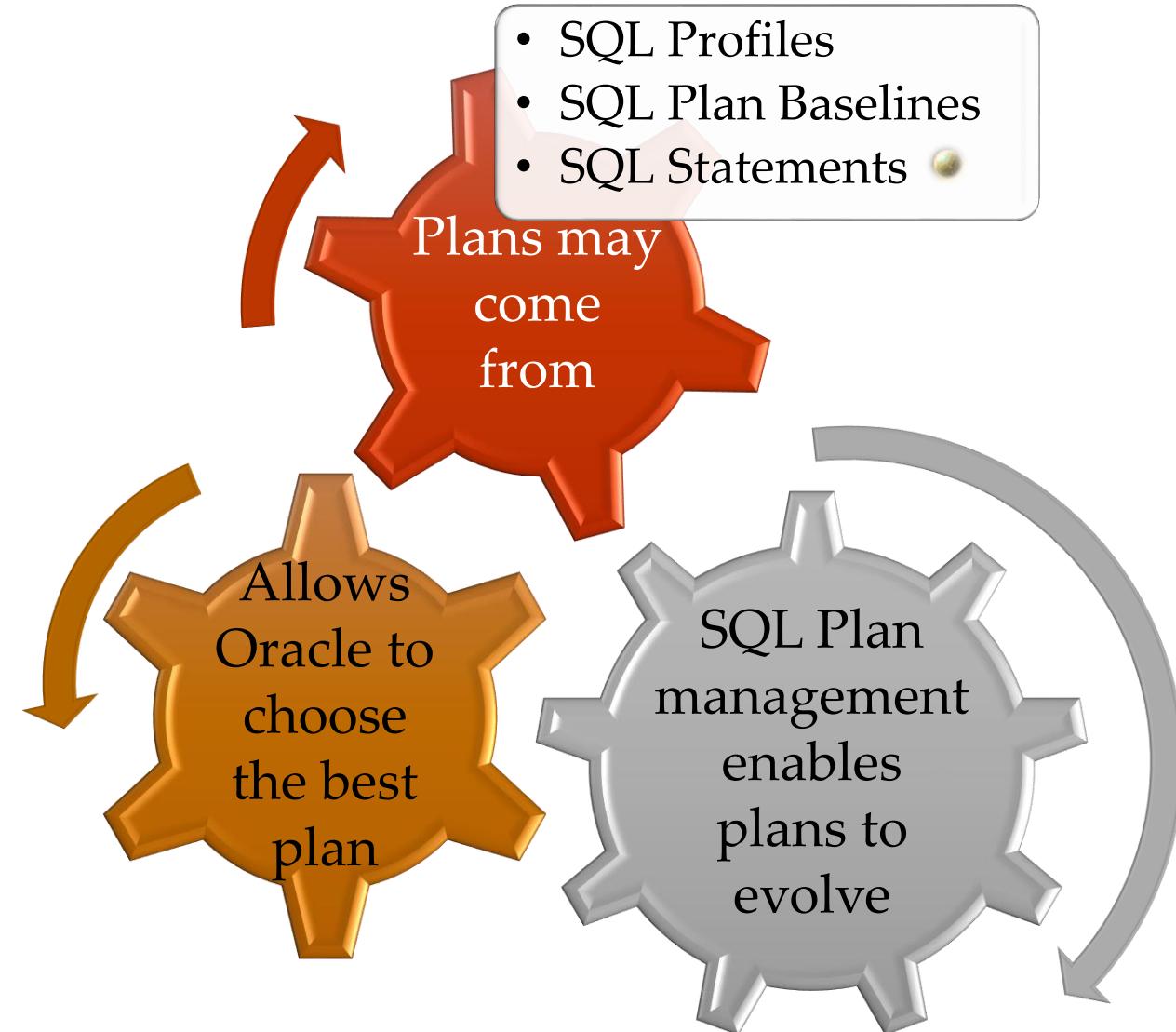


The screenshot shows the Oracle SQL Plan Management interface. At the top, there are buttons for Enable, Disable, Drop, Evolve, Copy To A Database, Pack, Fixed - Yes, Go, Load, and Unpack. Below these are links for Select All and Select None. A table lists three captured SQL plans:

Select	Name	SQL Text	Enabled	Accepted	Reproduced	Fixed	Auto Purge	Origin	Created	Last Modified
<input type="checkbox"/>	SQL_PLAN_9kthr3p6smf74cf314e9e	select * from hr.employees	YES	YES	YES	NO	YES	AUTO-CAPTURE	Oct 17, 2014 12:13:20 AM	Oct 17, 2014 12:13:20 AM
<input type="checkbox"/>	SQL_PLAN_6x94z8w7w9qruc7b7e852	select substr(value, 0, 512) from v\$system_parameter	YES	YES	YES	NO	YES	AUTO-CAPTURE	Oct 17, 2014 12:13:43 AM	Oct 17, 2014 12:13:43 AM
<input type="checkbox"/>	SQL_PLAN_0zzdmrrdy88r27f955969	SELECT instance_name FROM v\$instance	YES	YES	YES	NO	YES	AUTO-CAPTURE	Oct 17, 2014 12:13:52 AM	Oct 17, 2014 12:13:52 AM

 TIP The table will display maximum of 2000 rows. Use search criteria to get the desired results.

Oracle 19c SQL Plan Management



- Shared Pool Tuning

Lesson Topics



Shared Pool Architecture

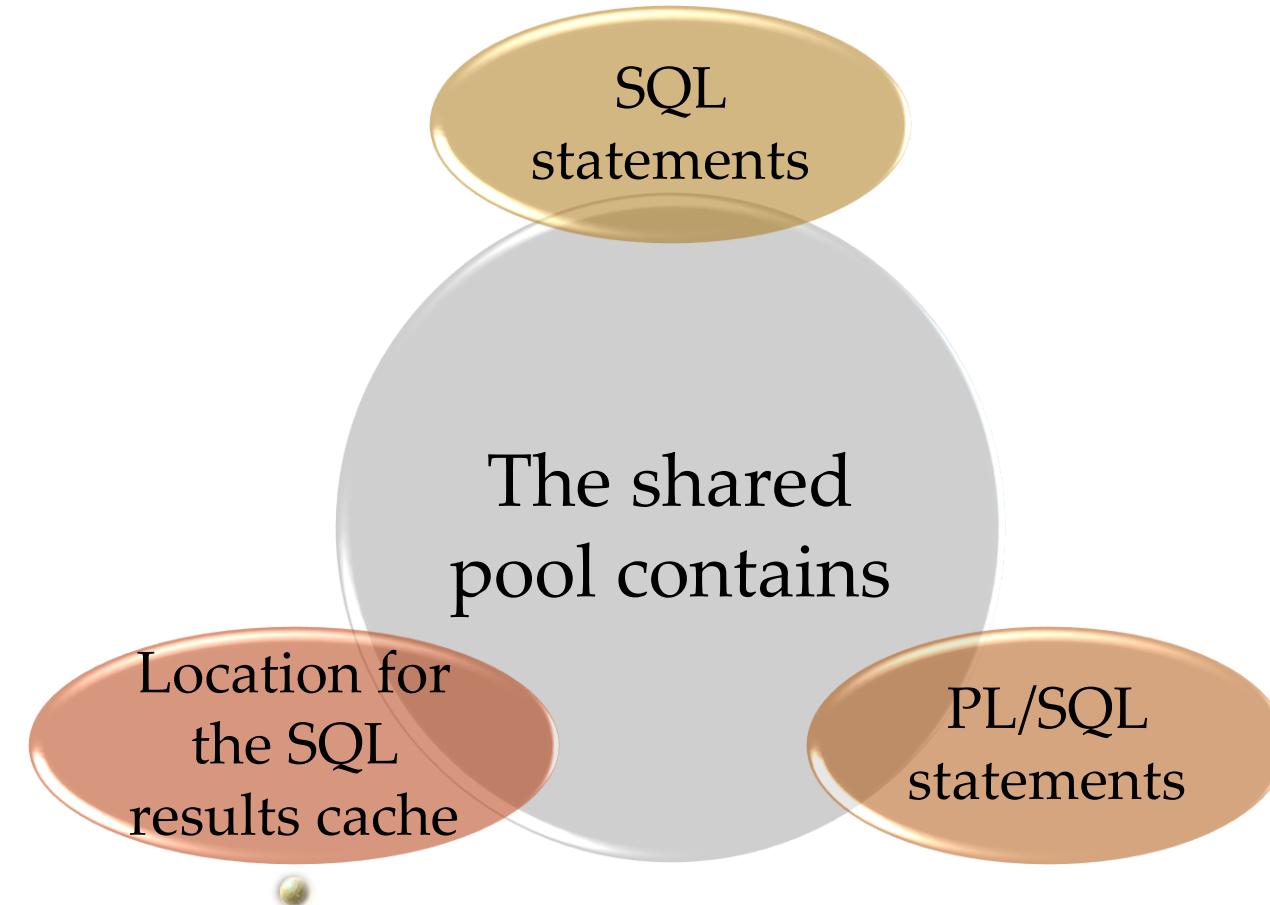
Shared Pool Parameters

Library Cache

Dictionary Cache

Large Pool Considerations
and Contents

Oracle 19c Shared Pool Tuning

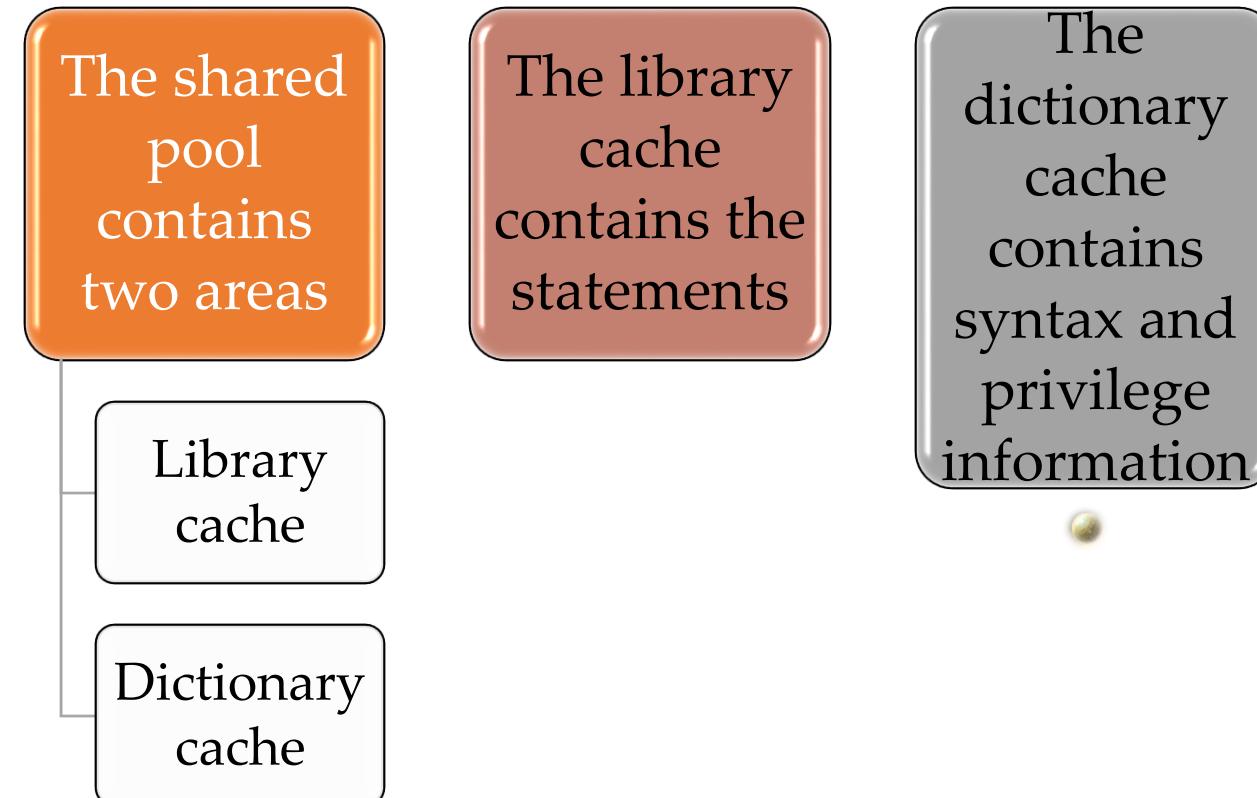


Oracle 19c Shared Pool Tuning

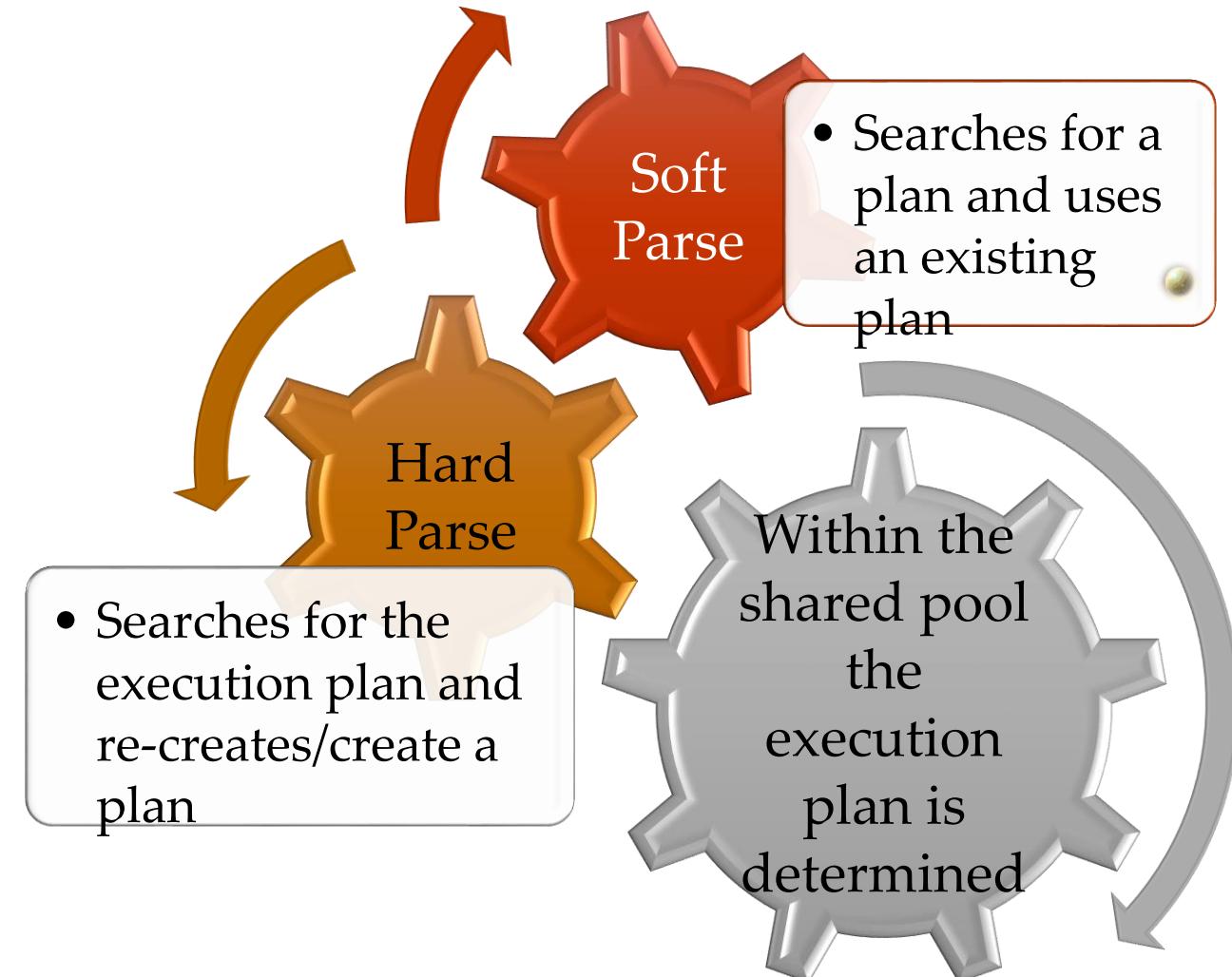
The size of the shared pool is controlled by

- memory_target
- Sga_Target
- Shared_pool_Size
- Client_result_cache_lag
- Client_result_cache_size
- Result_cache_max_result
- Result_cache_max_size
- Result_cache_mode =
auto/manual.force
- Result_cache_remote_expiration

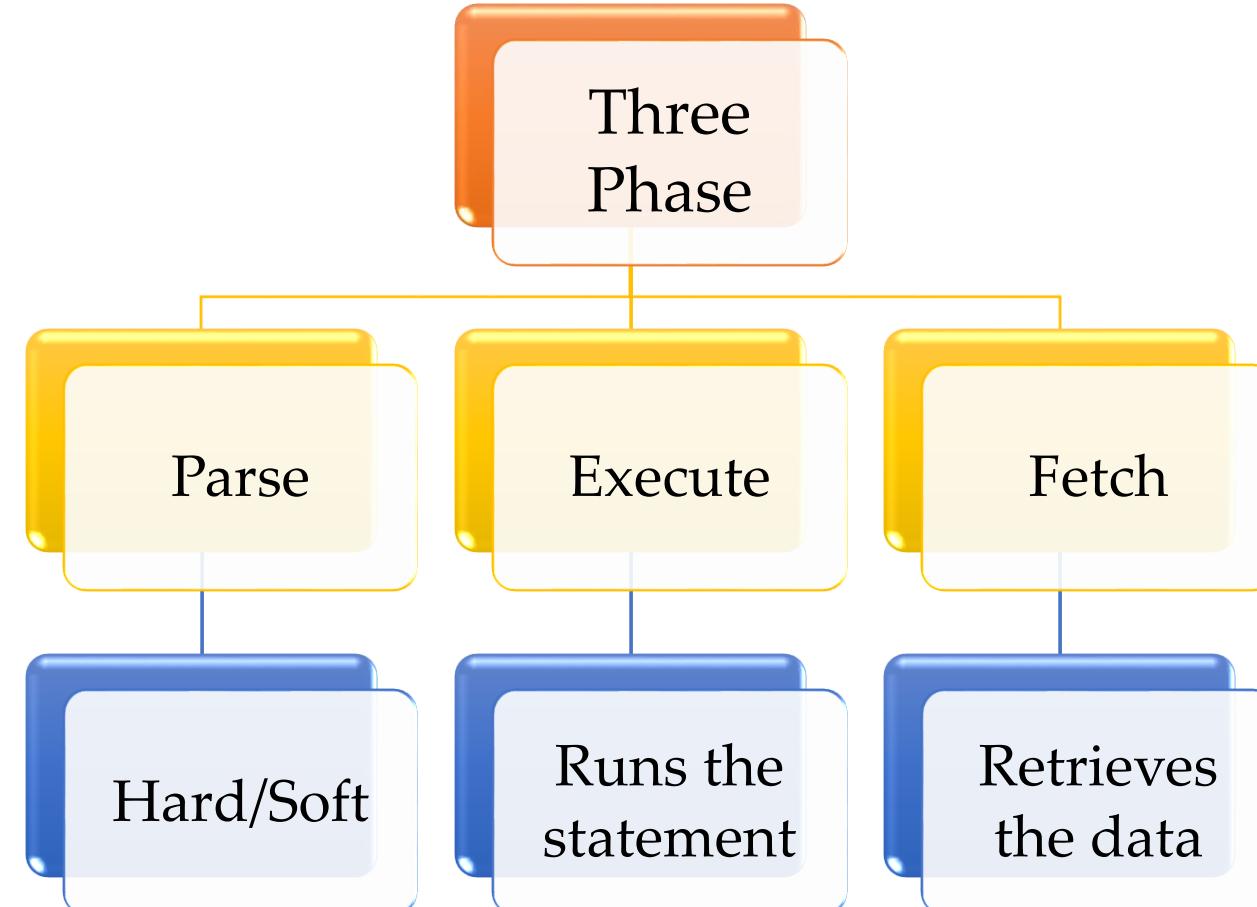
Oracle 19c Shared Pool Tuning



Oracle 19c Shared Pool Tuning



Oracle 19c Shared Pool Tuning



Oracle 19c Shared Pool Tuning

The goal is too many parses and many executions/fetches

Oracle 19c
uses
Adaptive
Plans

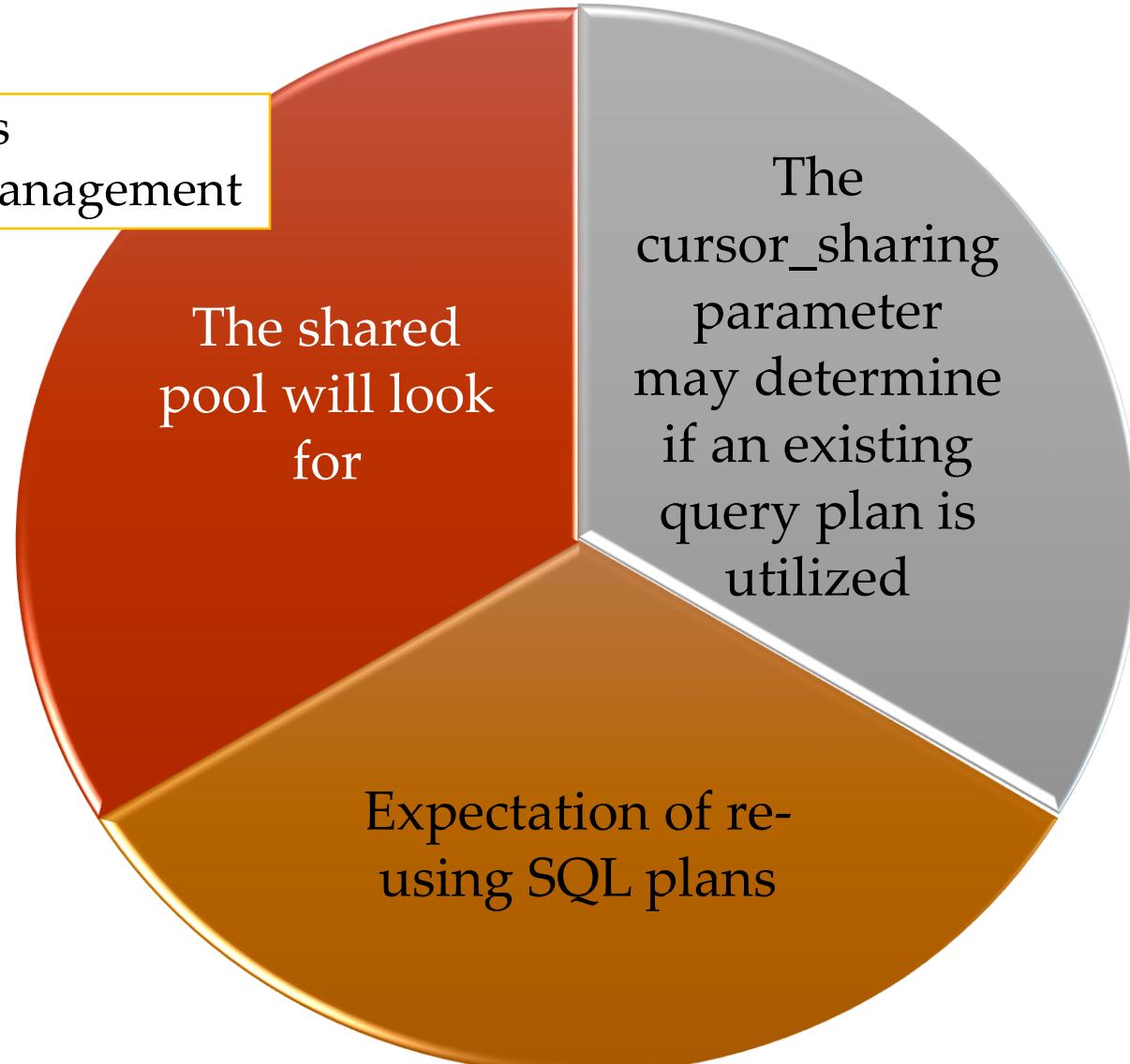
- The plan chosen at the parse phase may not be the plan used at the fetch phase

Database
Parameter

- Cursor_sharing
 - Exact
 - Similar
 - Force

Oracle 19c Shared Pool Tuning

- SQL Profiles
- SQL Plan management



Oracle 19c Shared Pool Tuning

! You are not logged on with SYSDBA privilege. Only controls for dynamic parameters are editable.

Initialization Parameters

Current SPFile

The parameter values listed here are currently used by the running instance(s).

Name	Basic	Modified	Dynamic	Category
shared_pool	All	All	All	All

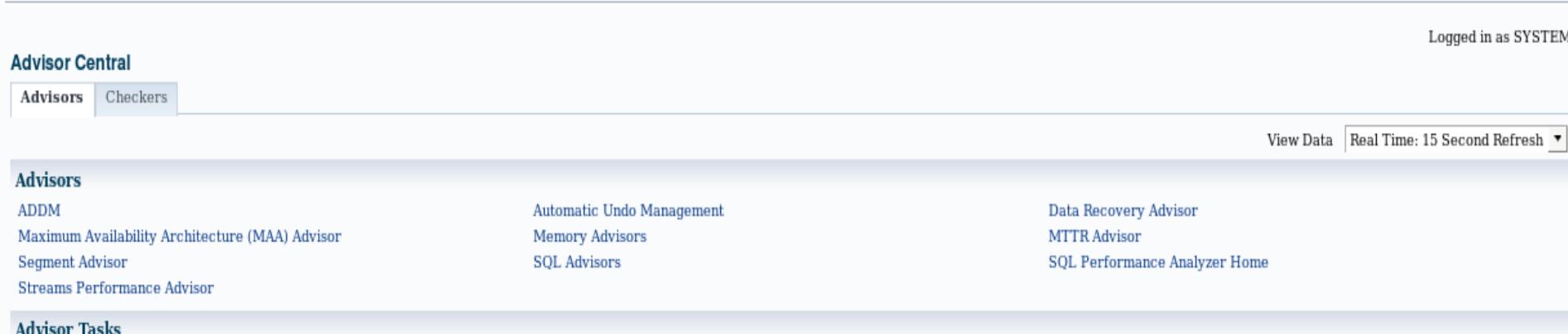
Filter on a name or partial name

Apply changes in current running instance(s) mode to SPFile. For static parameters, you must restart the database.

Save to File

Name ▲	Help	Value	Comments	Type	Basic	Modified	Dynamic	Category
shared_pool_reserved_size	ⓘ	26843545		Big Integer				Memory
shared_pool_size	ⓘ	0		Big Integer			✓	Memory

Oracle 19c Shared Pool Tuning



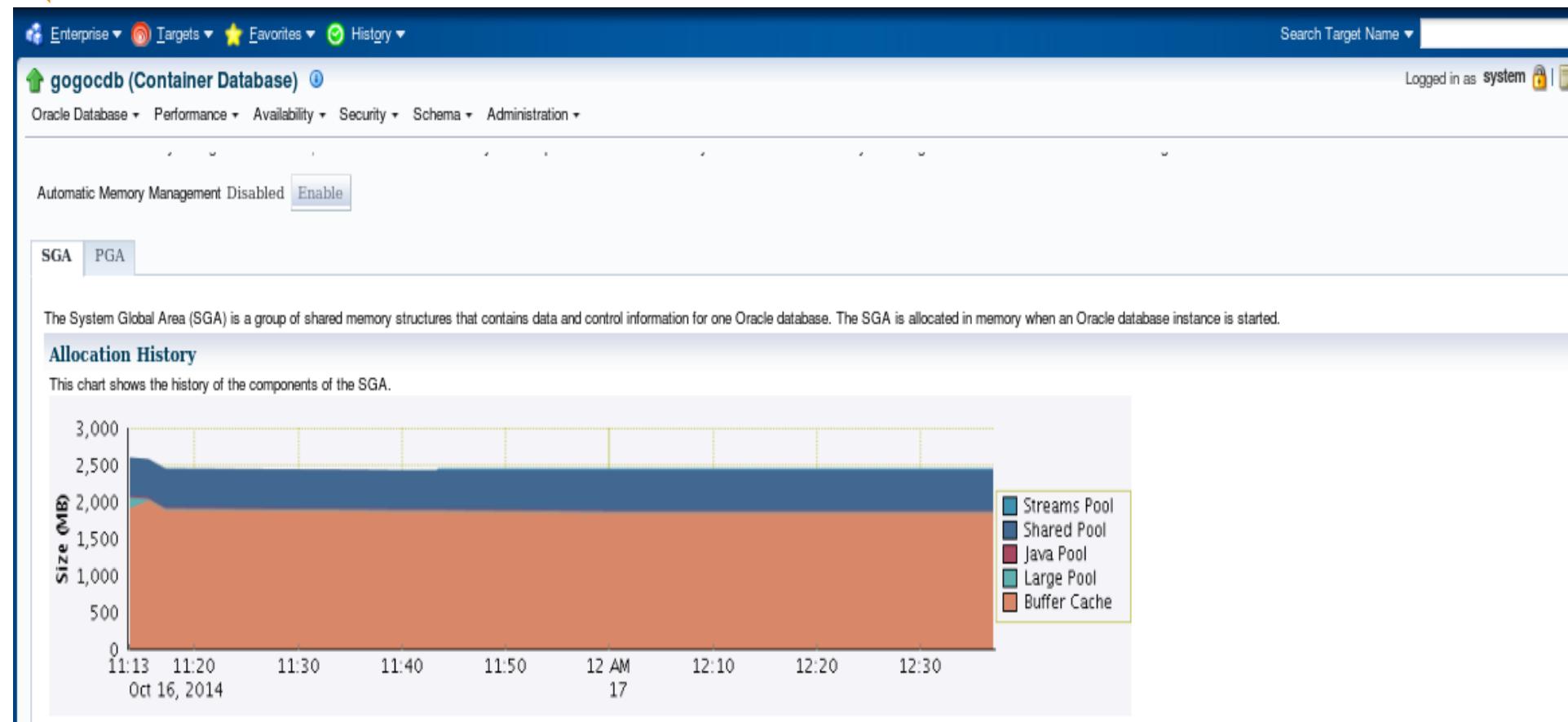
The screenshot shows the Oracle Advisor Central interface. At the top right, it says "Logged in as SYSTEM". Below that, there are two tabs: "Advisors" (which is selected) and "Checkers". At the bottom right, there are buttons for "View Data" and "Real Time: 15 Second Refresh".

Advisors

ADDM	Automatic Undo Management	Data Recovery Advisor
Maximum Availability Architecture (MAA) Advisor	Memory Advisors	MTTR Advisor
Segment Advisor	SQL Advisors	SQL Performance Analyzer Home
Streams Performance Advisor		

Advisor Tasks

Oracle 19c Shared Pool Tuning



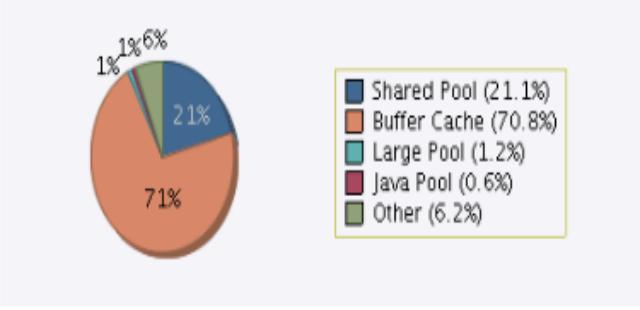
Oracle 19c Shared Pool Tuning

Current Allocation

Automatic Shared Memory Management Enabled

Total SGA Size (MB)

SGA Component	Current Allocation (MB)
Shared Pool	544
Buffer Cache	1824
Large Pool	32
Java Pool	16
Other	160

 A pie chart illustrating the current allocation of memory components. The segments are: Buffer Cache (70.8%), Shared Pool (21.1%), Other (6.2%), Large Pool (1.2%), and Java Pool (0.6%).

Maximum SGA Size

The Maximum SGA Size specifies the maximum memory that the database may allocate. If you specify the Maximum SGA Size, you can later dynamically change the Total SGA Size above (provided Total SGA Size does not exceed the Maximum SGA Size).

Maximum SGA Size (MB)

Disable Automatic Shared Memory Management

Automatic Shared Memory Management will be disabled as soon as you click OK. You can optionally set new sizes for the SGA components.

SGA Component	Current Size (MB)	New Size (MB)
Shared Pool	544	544
Buffer Cache	1824	1824
Large Pool	32	32
Java Pool	16	16
Other	160	160
Total SGA	2576	2576

Oracle 19c Shared Pool Tuning

With automatic memory management disabled, the database will automatically set the optimal distribution of memory. The distribution of memory will change over time to accommodate changes in the workload.

Automatic Memory Management Disabled [Enable](#)

[SGA](#) [PGA](#)

The System Global Area (SGA) is a group of shared memory structures that contains data and control information for one Oracle database. The SGA is allocated in memory when an Oracle database instance is started.

Automatic Shared Memory Management Disabled [Enable](#)

Shared Pool 544 MB [Advice](#)

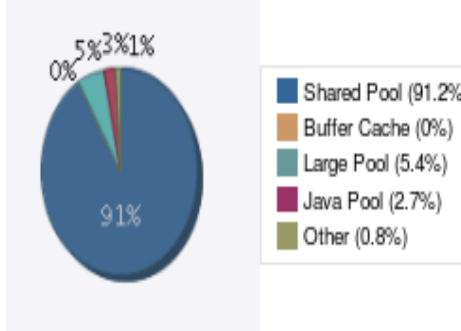
Buffer Cache 1824 MB [Advice](#)

Large Pool 32 MB

Java Pool 16 MB

Other (MB) 4

Total SGA (MB) 596 [Calculate](#)



Component	Percentage
Shared Pool	91.2%
Buffer Cache	0%
Large Pool	5.4%
Java Pool	2.7%
Other	0.8%

Oracle 19c Shared Pool Tuning



IF the shared pool is set and these parameters are set the shared_pool setting will be the minimum size

Oracle 19c Shared Pool Tuning



Careful on using ASMM or AMM

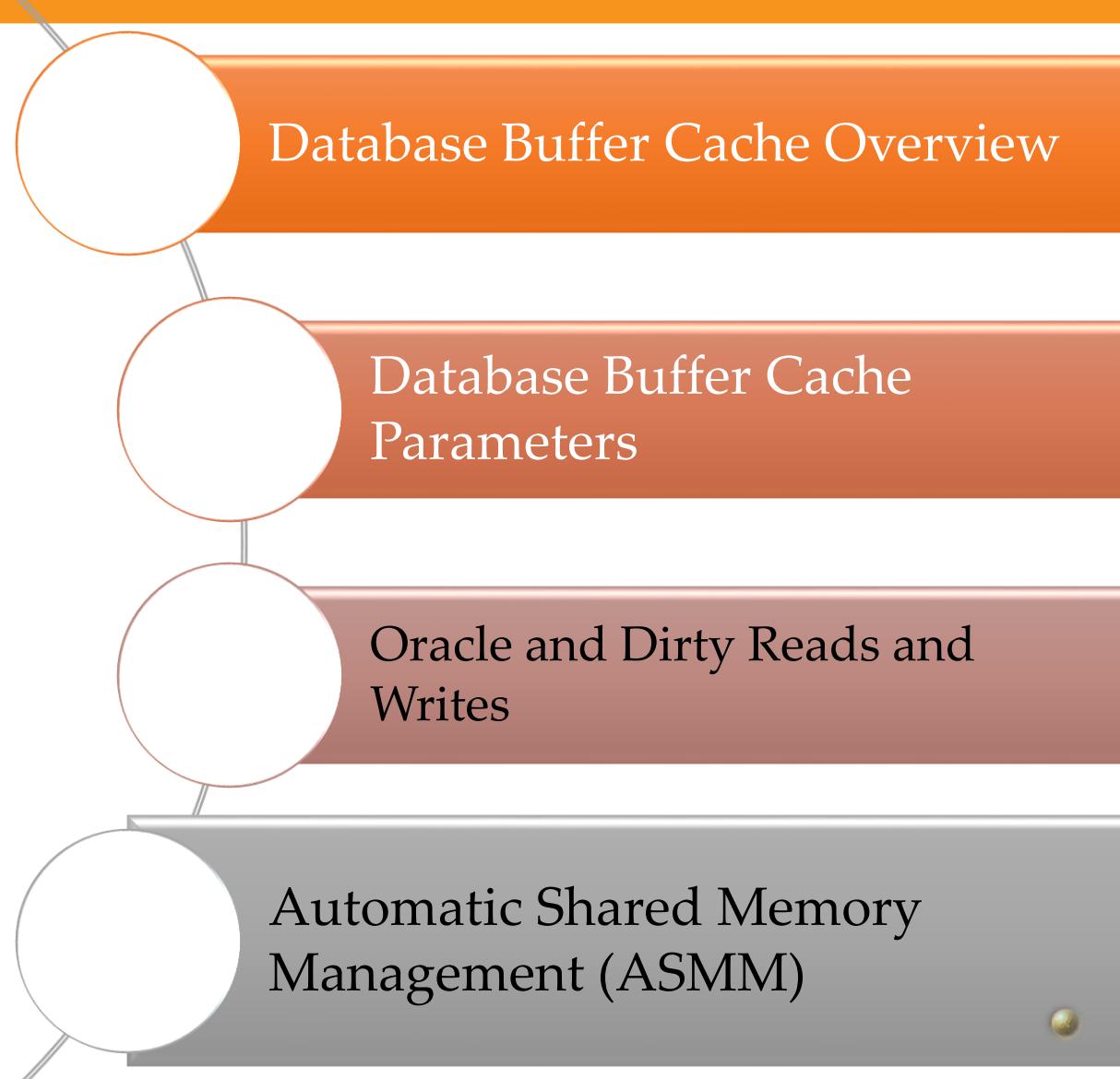


Oracle may be slow to react to the dynamic changes of the application



Set the DB_CACHE_SIZE to a very high minimum so AMM and ASMM adjust accordingly

- Tuning the Database Buffer Cache



Scalable architecture:

Multi-version concurrency control

Proprietary LRU-based replacement policy

Cache fusion

Incremental checkpointing mechanism

Advisors

Private pool for I/O intensive operations

Oracle 19c Tuning the Database Buffer Cache

The symptoms that indicate a buffer cache problem:

- Latch:cache buffer chains
- Latch:cache buffer LRU chains
- Buffer busy waits
- Read waits
- Free buffer waits
- Cache hit ratio

Oracle 19c Tuning the Database Buffer Cache

Contention for this latch indicates:

- Multiple processes attempting to access the same “hot” block
- Excessive block replacement

Characteristics of cache buffer chains latch contention:

- Many accesses to one or more block under the same latch
- Worse with larger block sizes

Oracle 19c Tuning the Database Buffer Cache

A badly tuned database can still have a hit ratio of 99% or better

Hit ratio is only one part in determining tuning performance

Hit ratio does not determine whether a database is optimally tuned

Tune SQL statements

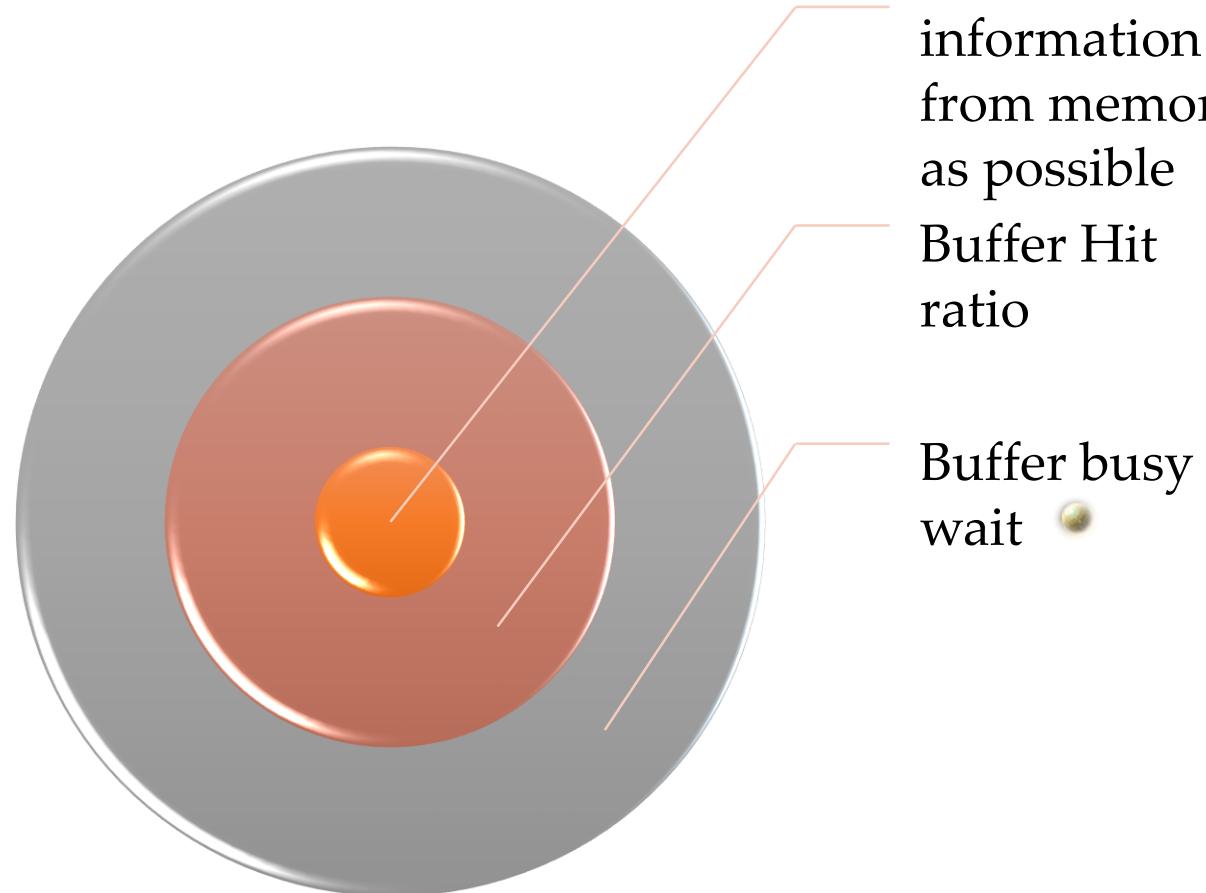
Use the AWR/Statspack report to examine what is causing a bottleneck:

Top 5 Foreground Timed Events

Load Profile (logical and physical reads)

Instance Efficiency Percentage

Oracle 19c Tuning the Database Buffer Cache



The goal is to retrieve as much information from memory as possible

Buffer Hit ratio

Buffer busy wait

Oracle 19c Tuning the Database Buffer Cache

Hit ratio is affected by data access methods:

Full table scans

Repeated scans of the same tables

Large table with random access

Data or application design

Investigate increasing the cache size if:

Hit ratio is low

Application is tuned to avoid full table scans

Oracle 19c Tuning the Database Buffer Cache

• Read Waits

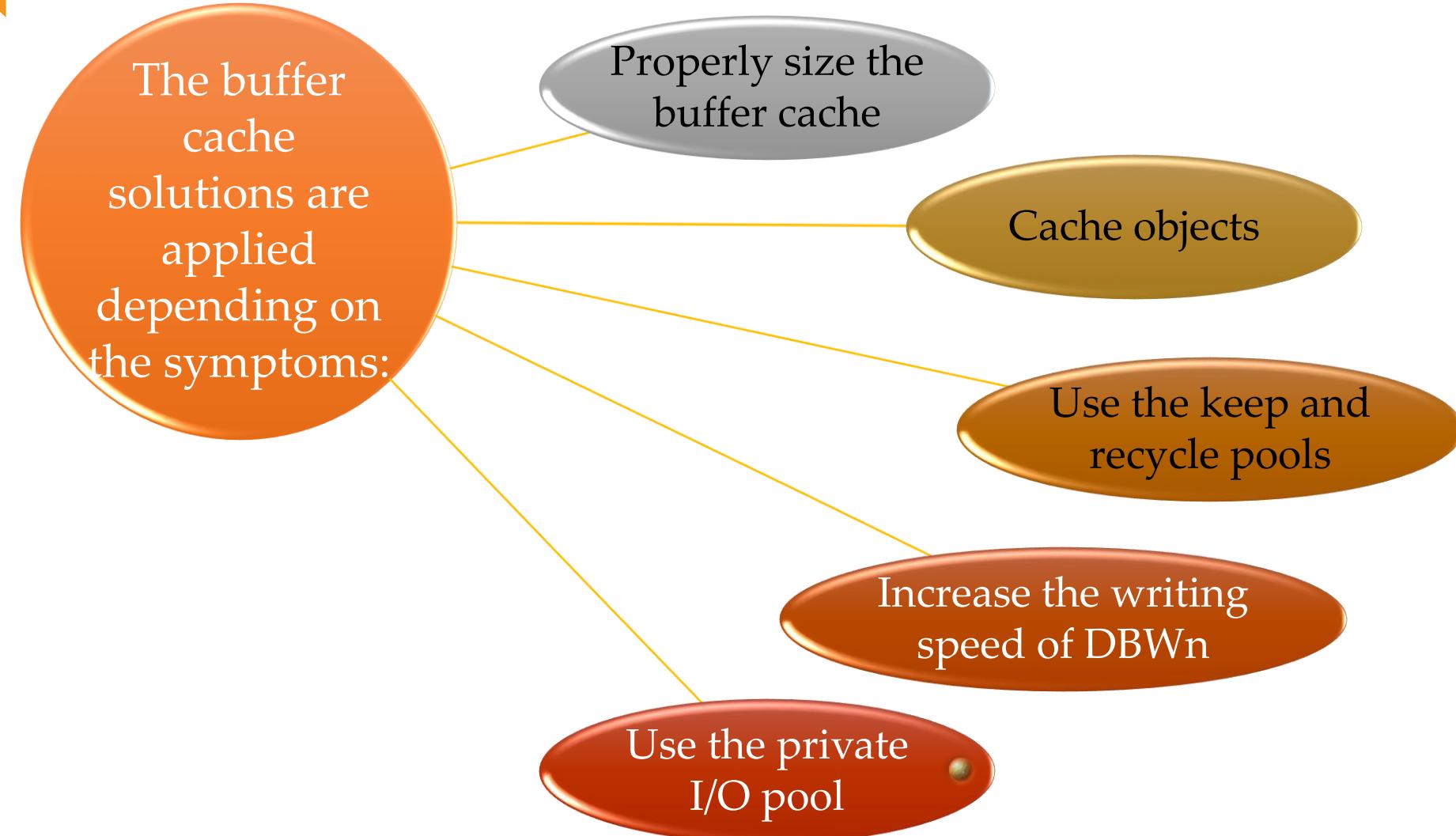
List of wait events performing disk reads into the buffer cache:

- db file sequential read
- db file parallel read
- db file scattered read

If wait time for reads is high:

- Tune the SQL statement that issues most disk reads; check SQL Ordered by Reads in the AWR report
- Increase the buffer cache if needed
- Reduce writes due to checkpointing
- Add more disk capacity

Oracle 19c Tuning the Database Buffer Cache



Oracle 19c Tuning the Database Buffer Cache

Buffer cache size affects several tuning diagnostics; If the cache is too small, this can cause the following:

Extra reads
due to block
replacement

Extra writes
to move
dirty blocks
to disk

Buffer cache
LRU chains
contention

Oracle 19c Tuning the Database Buffer Cache

Set the primary block size for the recycle, keep, and default buffer pools:

Set the size of the buffer pools:

- DB_CACHE_SIZE
- DB_KEEP_CACHE_SIZE
- DB_RECYCLE_CACHE_SIZE

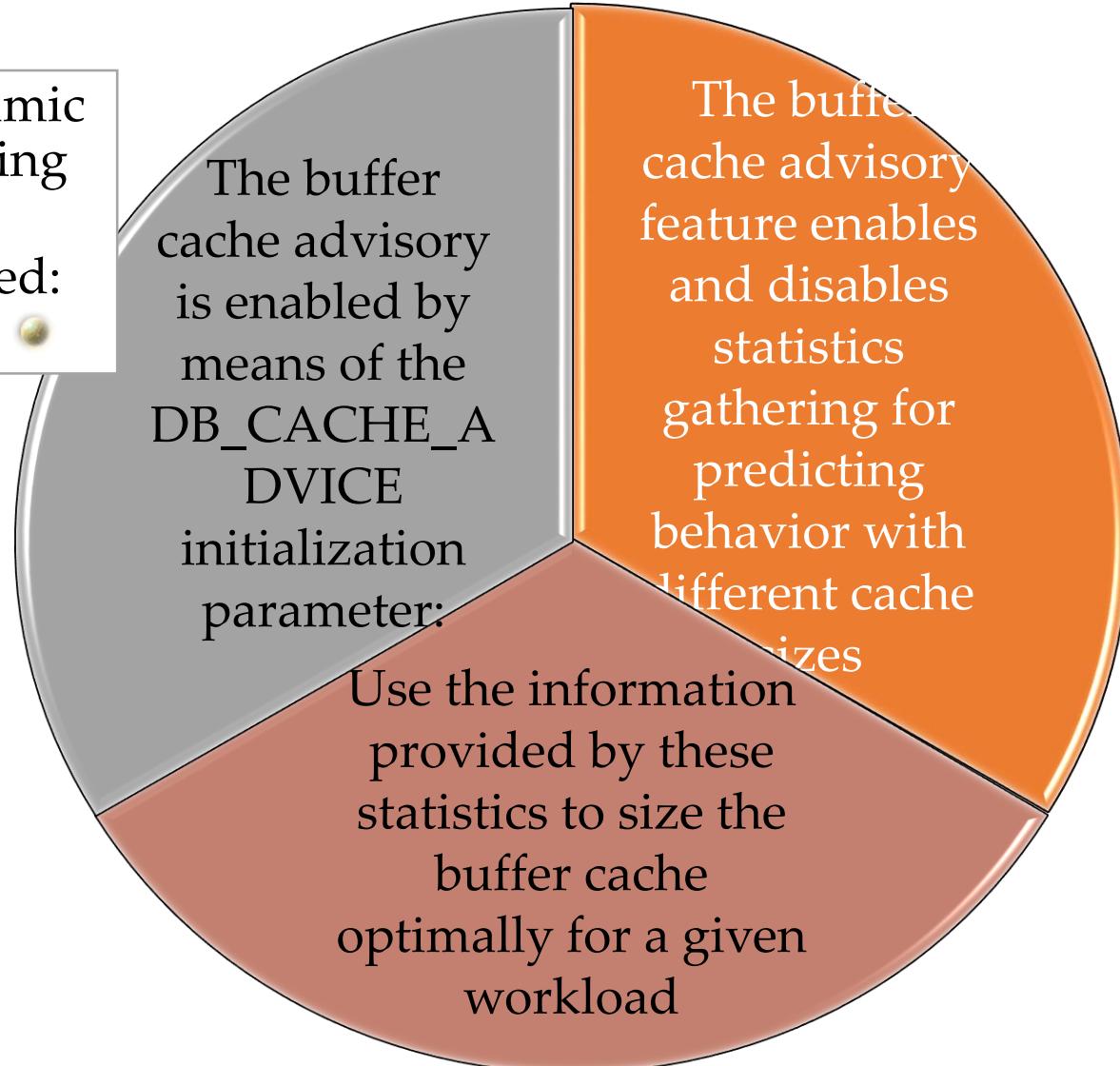
Represent all memory for the buffer cache

Are required to use buffer cache features:

- Dynamic grow/shrink
- Buffer cache advice ◉ Multiple block sizes

Oracle 19c Tuning the Database Buffer Cache

- This parameter is dynamic and can be changed using ALTER SYSTEM
- Three values are allowed: OFF, ON, and READY



Oracle 19c Tuning the Database Buffer Cache

Buffer cache advisory information is collected in the V\$DB_CACHE_SIZE view

The view contains different rows that estimate the number of physical reads for cache sizes between 10% and 200% of the current cache size

The rows also compute a physical read factor, which is the ratio of the number of estimated reads to the number of actual reads

Simulation is done for all buffer pools

Oracle 19c Tuning the Database Buffer Cache

Enable caching during full table scans by:

Creating the table with the CACHE clause

Altering the table with the CACHE clause

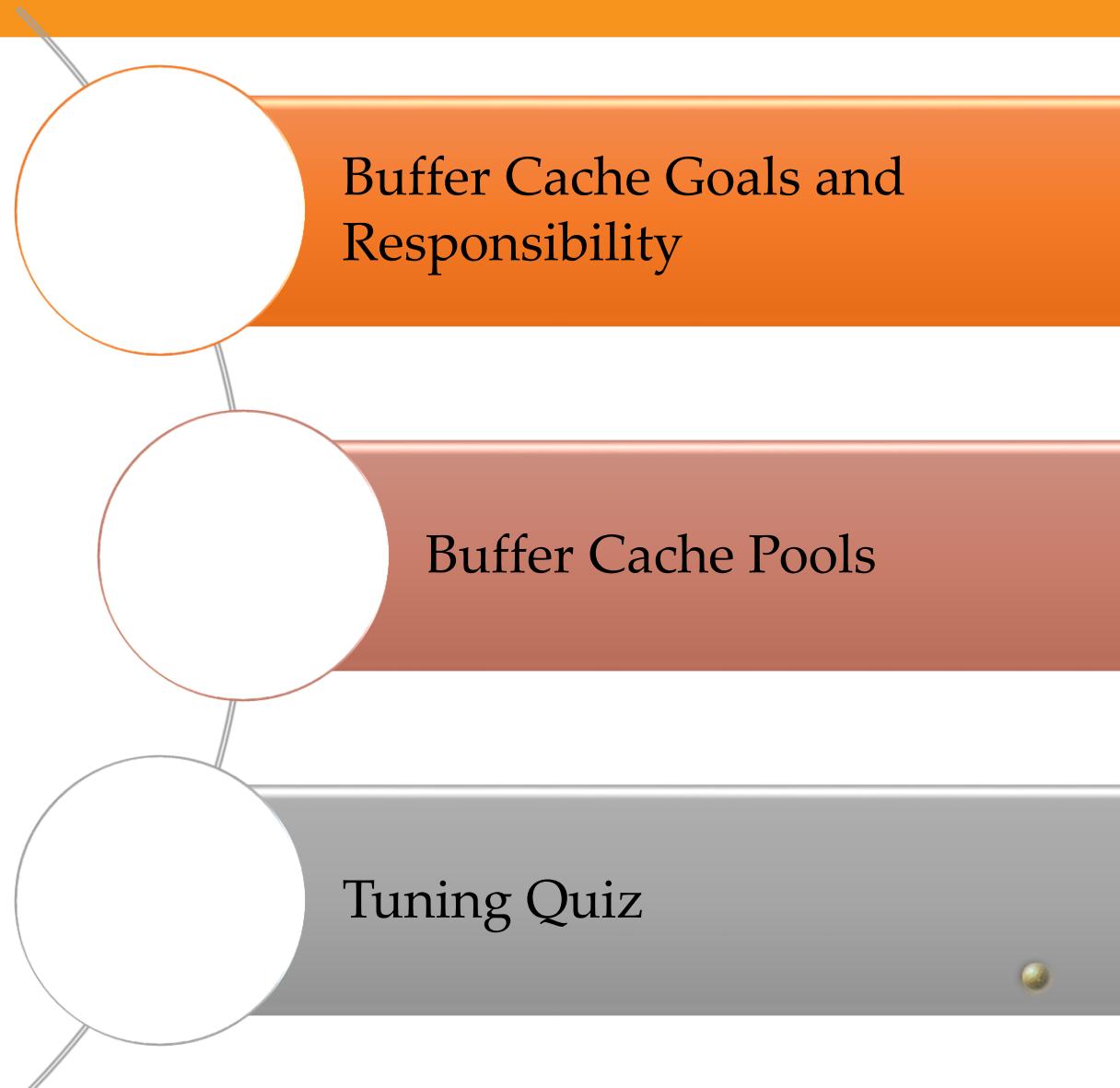
Using the CACHE hint in a query

Caching tables put blocks at the MRU end of the LRU list

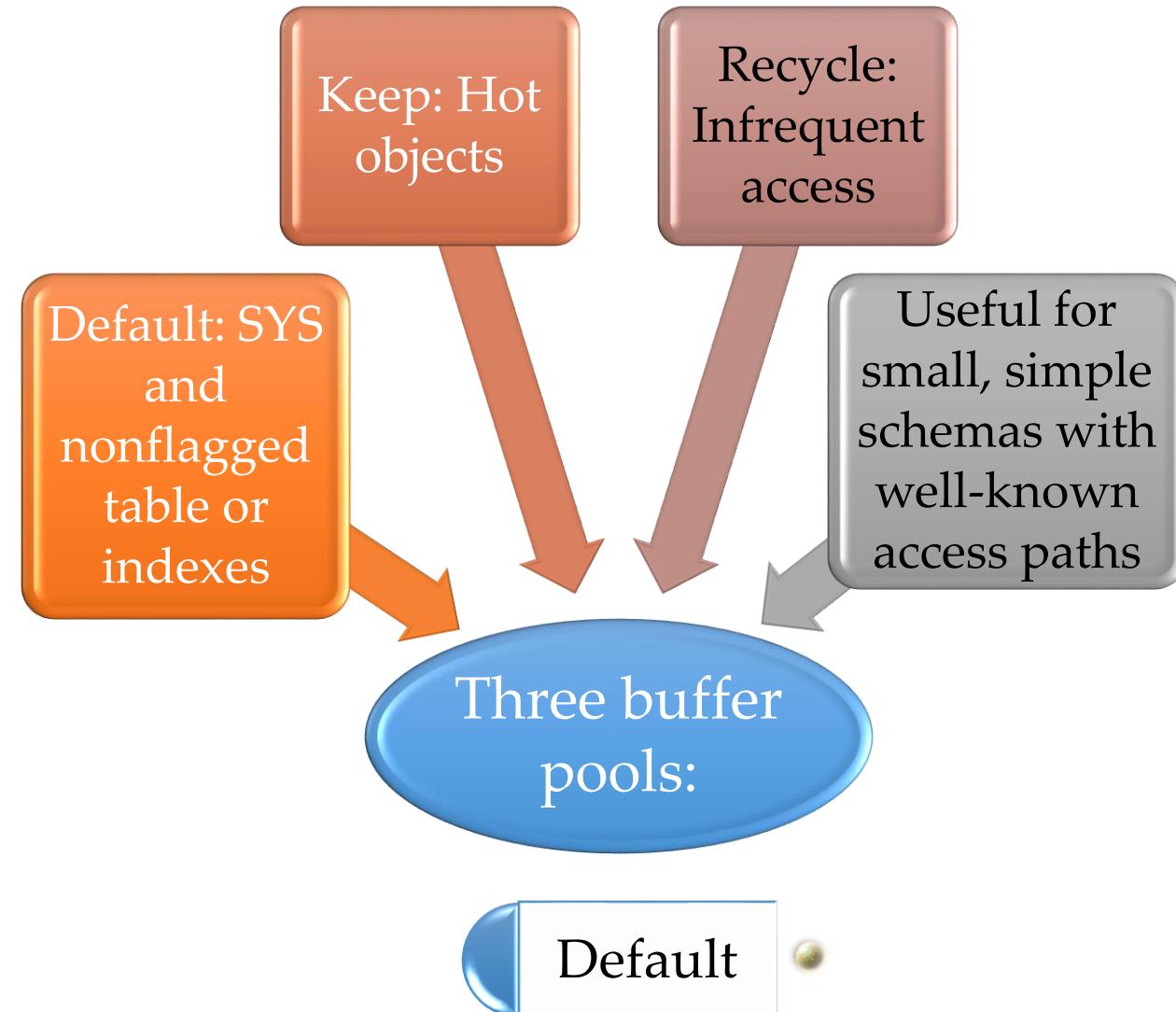
Guideline: Do not overcrowd the buffer cache

Use a keep pool

- Tuning the Database Buffer Cache Part 2



Oracle 19c Tuning the Database Buffer Cache



Oracle 19c Tuning the Database Buffer Cache



Use the BUFFER_POOL clause

This clause is valid for tables, clusters, and indexes

When altered, buffer pool is used for future reads

Objects can have more than one buffer pool

Oracle 19c Tuning the Database Buffer Cache

```
CREATE INDEX  
  cust_idx ...  
  STORAGE  
  (BUFFER_POOL  
   KEEP ...);
```

```
ALTER TABLE  
  customer  
  STORAGE  
  (BUFFER_POOL  
   RECYCLE);
```

```
ALTER INDEX  
  cust_name_idx  
  STORAGE  
  (BUFFER_POOL  
   KEEP);
```

Oracle 19c Tuning the Database Buffer Cache

- Allow buffer caches for nonstandard block sizes
- Parameters:
`DB_nK_CACHE_SIZE {n = 2, 4, 8, 16, 32}`
- `BLOCKSIZE` attribute of `CREATE TABLESPACE` storage clause
- Intended for transportable tablespaces

Non standard
block sizes

Oracle 19c Tuning the Database Buffer Cache



Multiple database writers are a means to increase write throughput useful for large SMP systems



Buffer cache is partitioned between database writers by working sets



Each DBWn process scans its own assigned sets

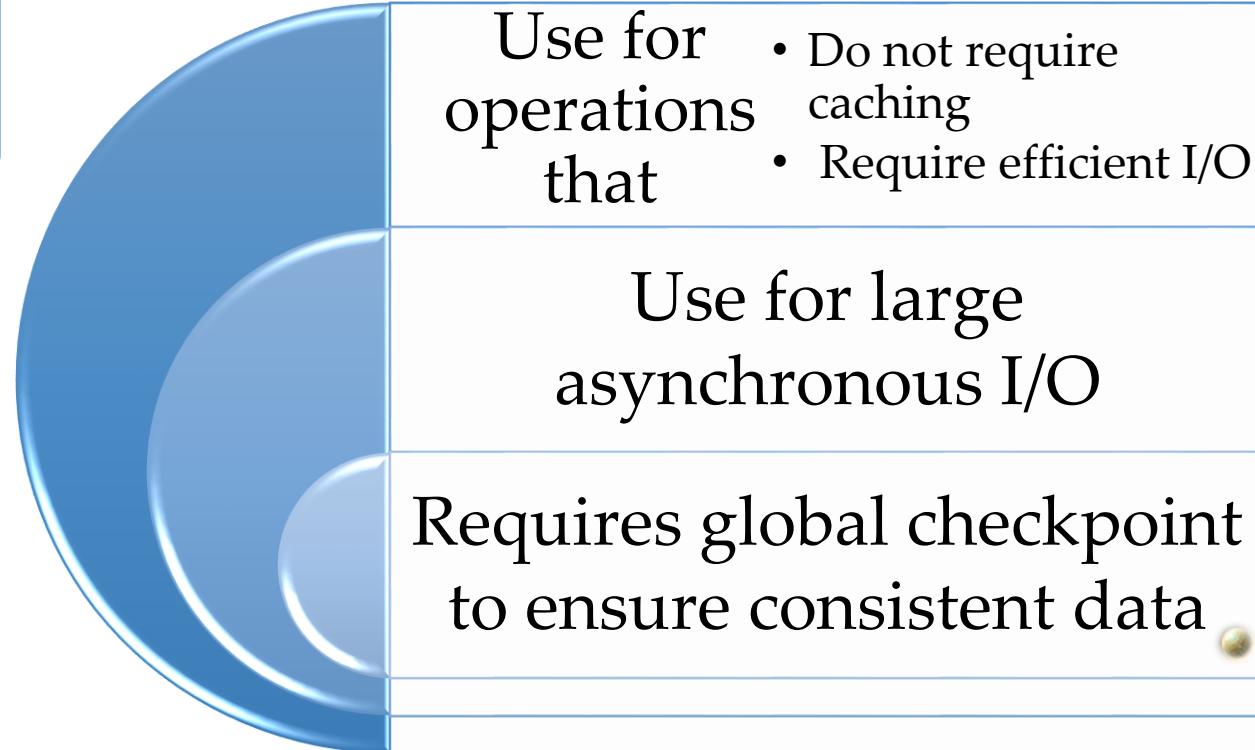


The number of database writes can be manually controlled by `DB_WRITER_PROCESSES`

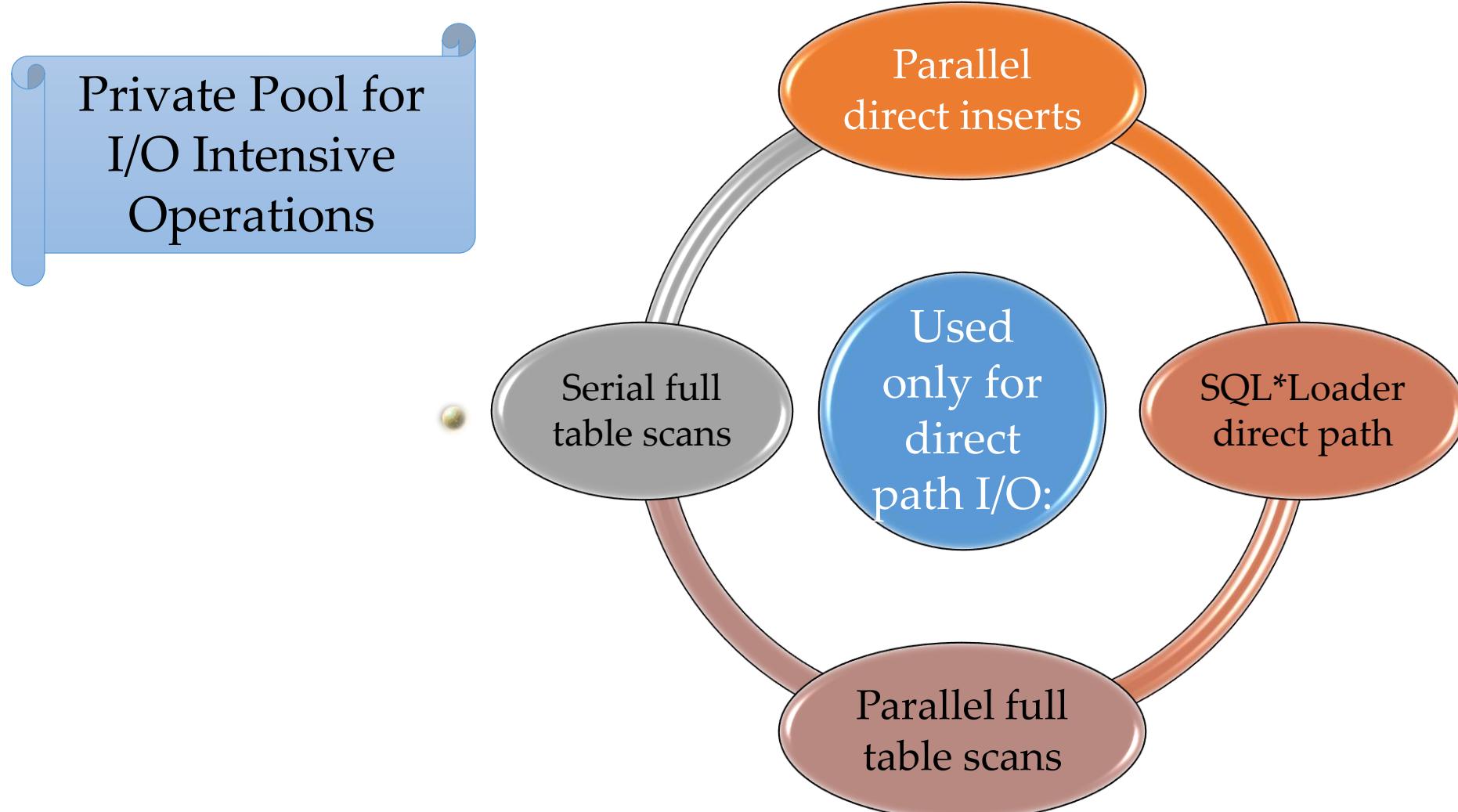


Oracle 19c Tuning the Database Buffer Cache

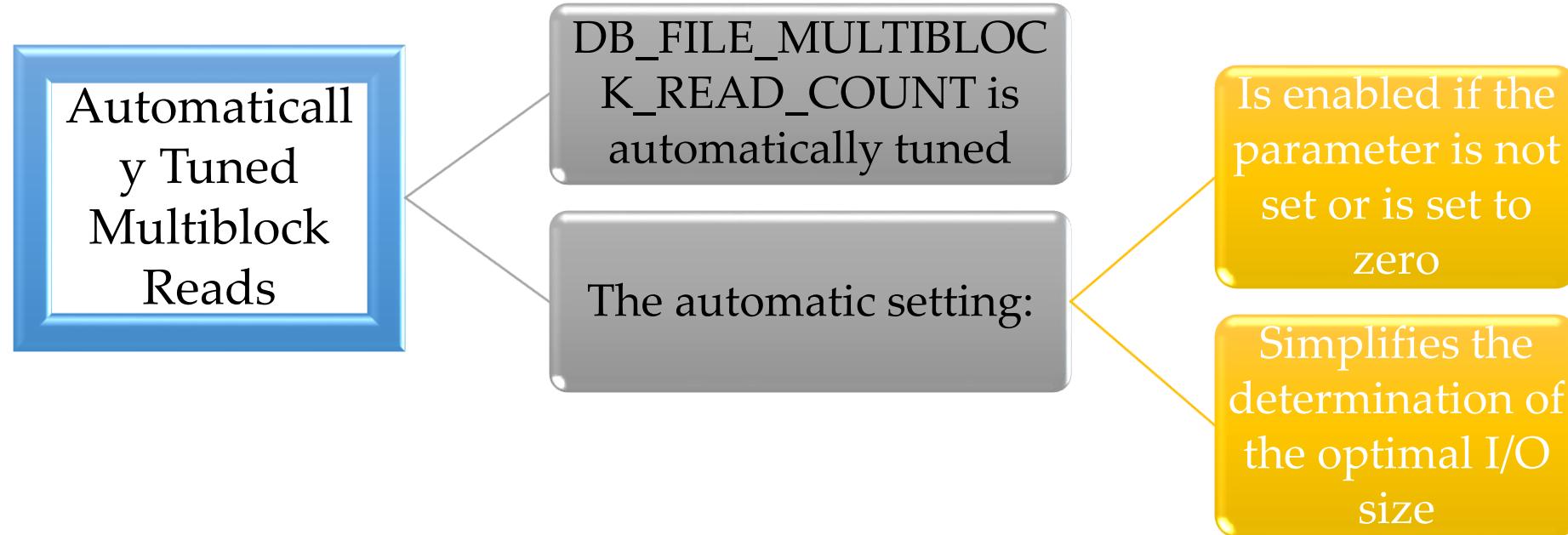
Private Pool for
I/O Intensive
Operations



Oracle 19c Tuning the Database Buffer Cache



Oracle 19c Tuning the Database Buffer Cache



Oracle 19c Tuning the Database Buffer Cache

Automatically
Tuned Multiblock
Reads

Optimal I/O size is:

Platform dependent

The size of the
prefetch

Rules for the automatic parameter
behavior are:

Prefetch is limited to
64 KB, if prefetch
blocks exceed 10% of
the cache

Value of eight blocks
is used for calculating
the cost of full table
scans

DB Smart Flash Cache Overview

DB Smart Flash Cache is an extension of the buffer cache that resides on a flash disk

DB Smart Flash Cache has the following advantages:

Large capacity and cheaper compared to DRAM

Faster throughput and latency compared to disks

Performance improvements at moderate cost

A flash disk must have write IOPs comparable to read IOPs to be used as a flash cache

Using DB Smart Flash Cache

Benefits:

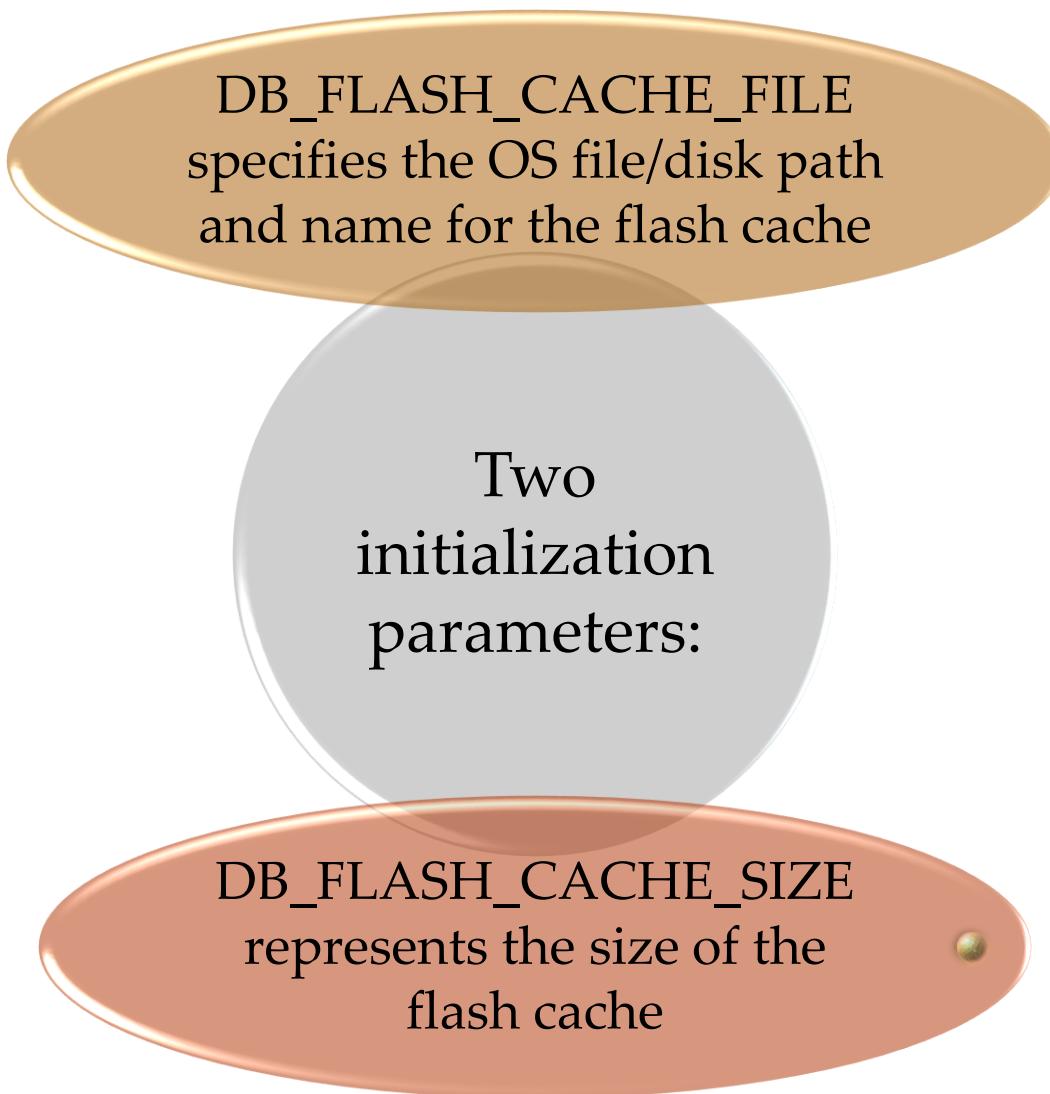
Provides better performance for the same price

Is easy to set up

Provides an interface to fine-tune object-level granularity control of the LRU mechanism

Mainly for read-intensive OLTP workloads

Oracle 19c Tuning the Database Buffer Cache



DB_FLASH_CACHE_FILE
specifies the OS file/disk path
and name for the flash cache

Two
initialization
parameters:

DB_FLASH_CACHE_SIZE
represents the size of the
flash cache

Oracle 19c Tuning the Database Buffer Cache

Nonstandard block size is not supported with DB Smart Flash Cache

All standard block size buffers use the same flash cache

DB Smart Flash Cache is not auto-tuned

Dynamically changing the size of the flash cache is not supported

Oracle 19c Tuning the Database Buffer Cache



Size flash cache to be between 2-10 times the size of the buffer cache

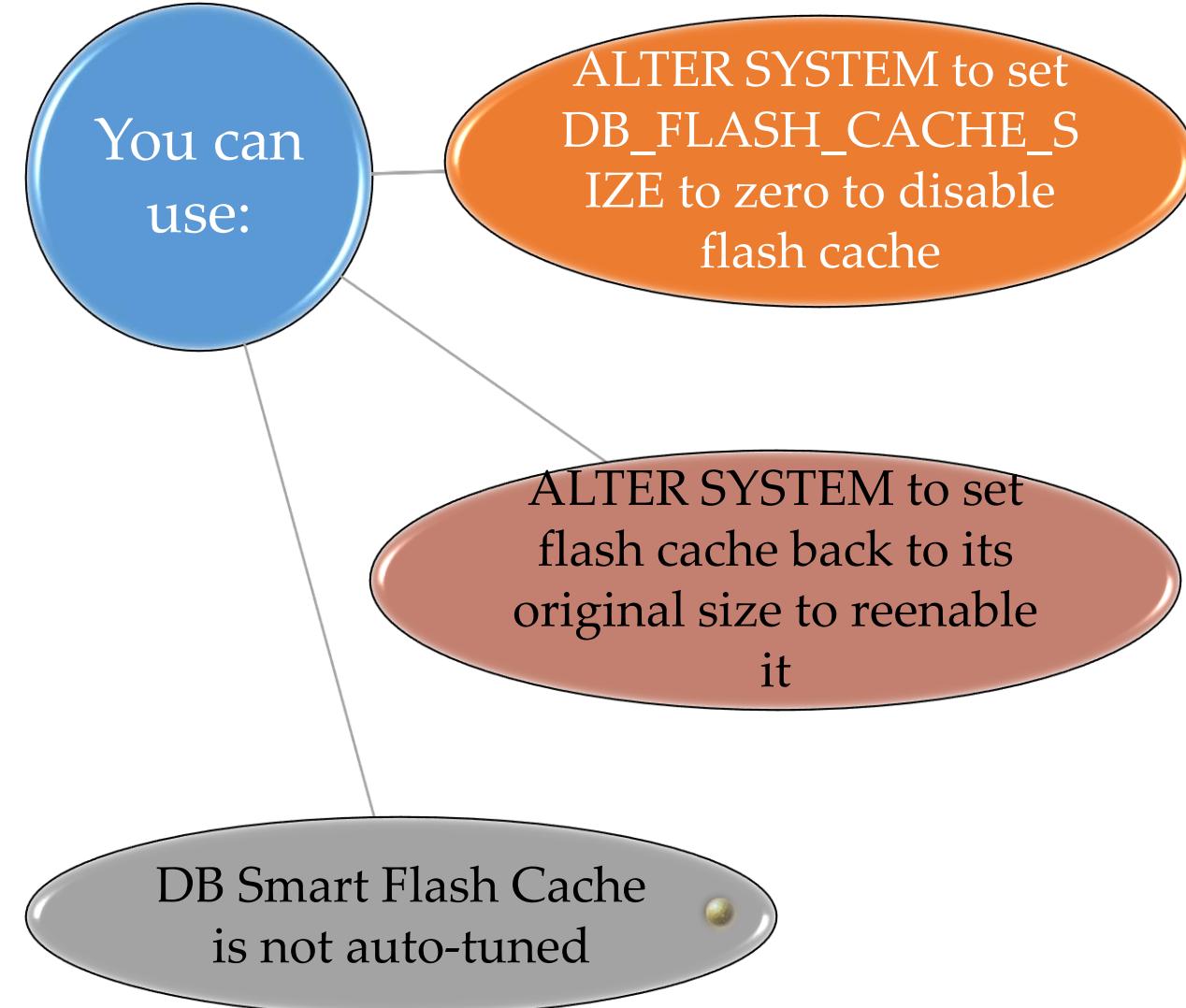


With automatic shared memory management, make flash cache between 2-10 times the size of SGA_TARGET



Add 100-200 bytes to buffer cache for each block moved to flash cache

Oracle 19c Tuning the Database Buffer Cache



Oracle 19c Tuning the Database Buffer Cache

- Describe the buffer cache architecture

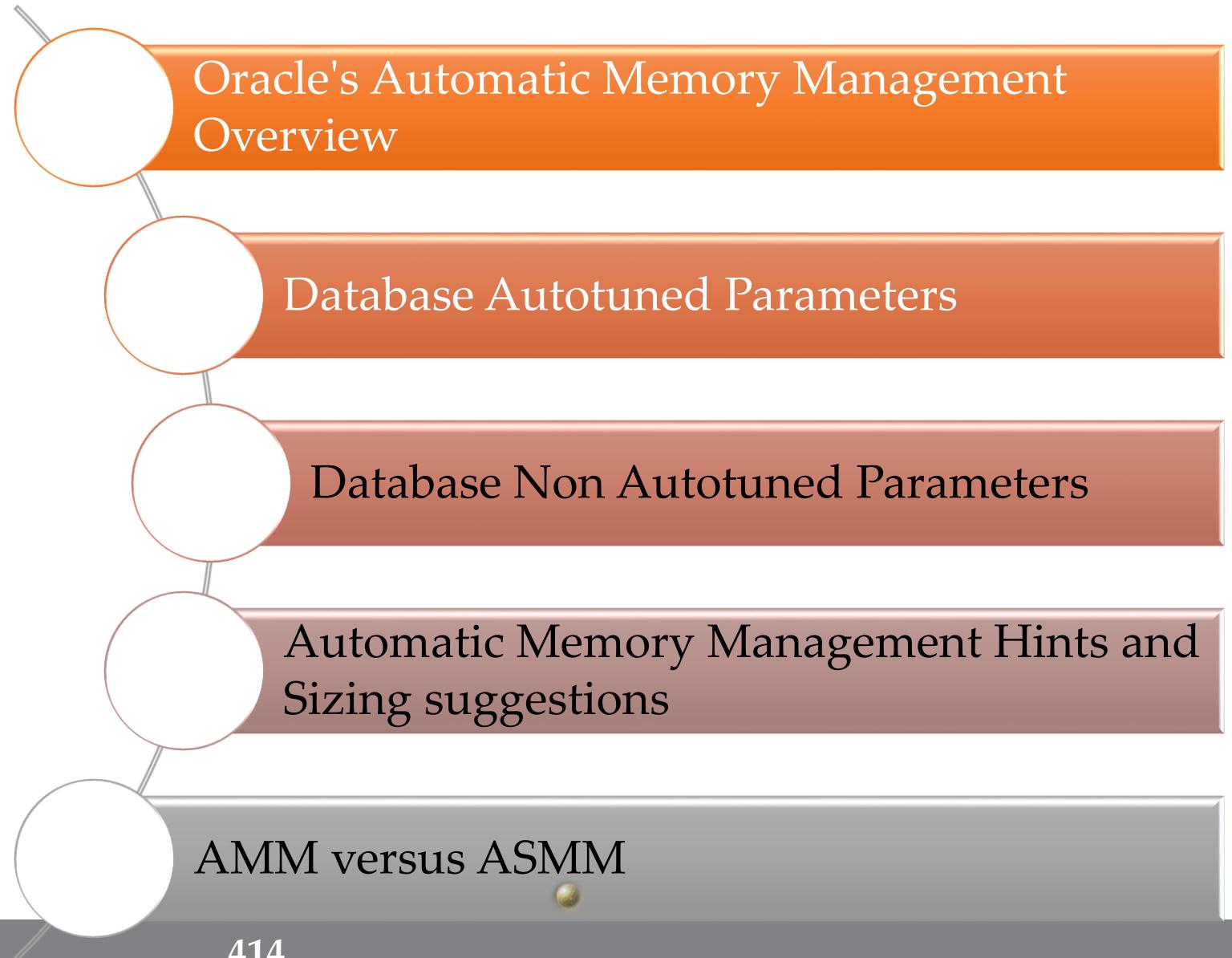
- Size the buffer cache

- Resolve common performance issues related to

- Use common diagnostic indicators to suggest a possible

- Automatic Memory Management

Lesson Topics



Oracle 19c Automatic Memory Management (AMM)

What is
automatic
memory
management
(AMM)

- Setting the database parameter
 - Memory_Target
 - Memory_max_Target

Memory_Target
controls

- Sga_target
- Pga_target

Oracle 19c Automatic Memory Management (AMM)

Memory_max_target

- The total amount of memory allocated to the Oracle database

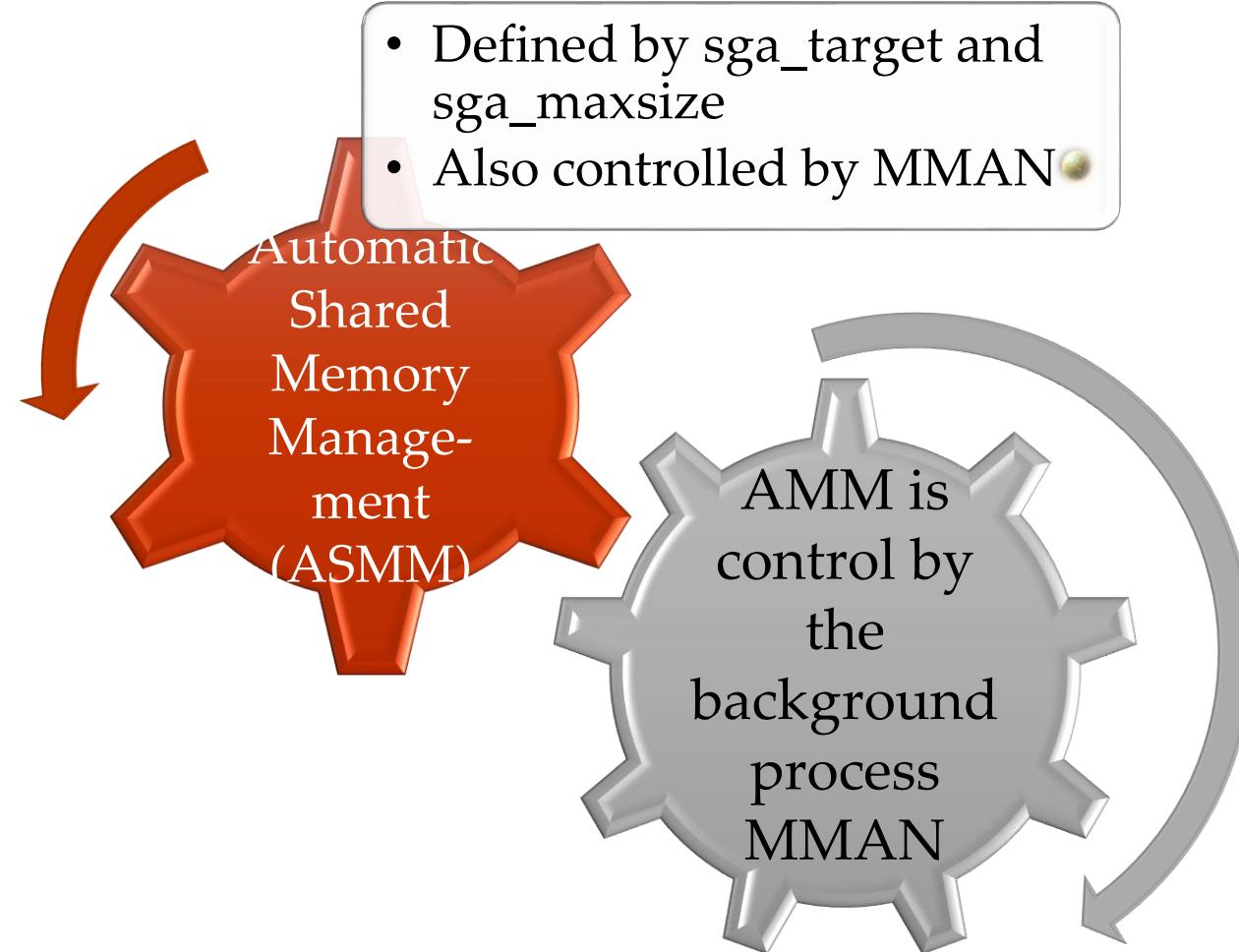
Memory_target

- The total amount of memory the Oracle database can currently use

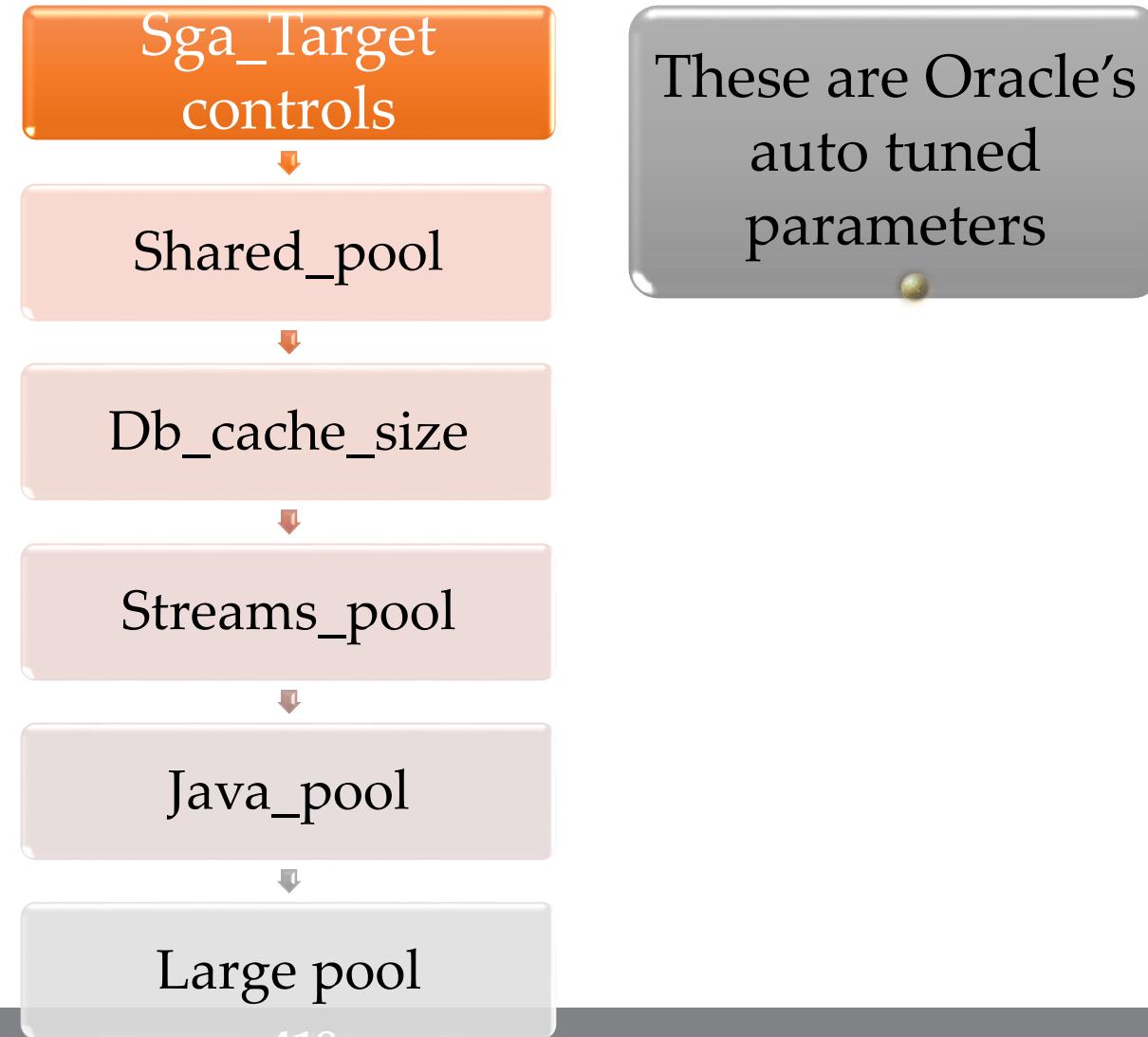
If `memory_max_target` is set higher than `memory_Target`, then memory can be dynamically allocated up to `memory_max_target`

These are part of Oracle's auto tuned parameters

Oracle 19c Automatic Memory Management (AMM)



Oracle 19c Automatic Memory Management (AMM)



Oracle's non-autuned parameters
are

Log_buffer

Db_nk_cache_size

Db_keep_cache_size

Db_recycle_cache_size

Oracle 19c Automatic Memory Management (AMM)

IF the
memory_target
is set

- All parameters
set under this
parameter will
be the lower
value for that
parameter

In some cases
it may be
wise to set a
high
minimum
value

Example

- memory_max_target =15g
- memory_target = 10g
- sga_target = 7g
- pga_target = 1g
- db_cache_size = 4g
- shared_pool_size = 1g

Oracle 19c Automatic Memory Management (AMM)

The total memory available for Oracle to dynamically allocate is 2g

Autotuned values – non autotuned values = available memory

- $10g - 8g = 2g$

Setting the `memory_max` value allows to dynamically increase memory up to the `memory_max` setting

Shared Pool

Contains prior executed SQL commands

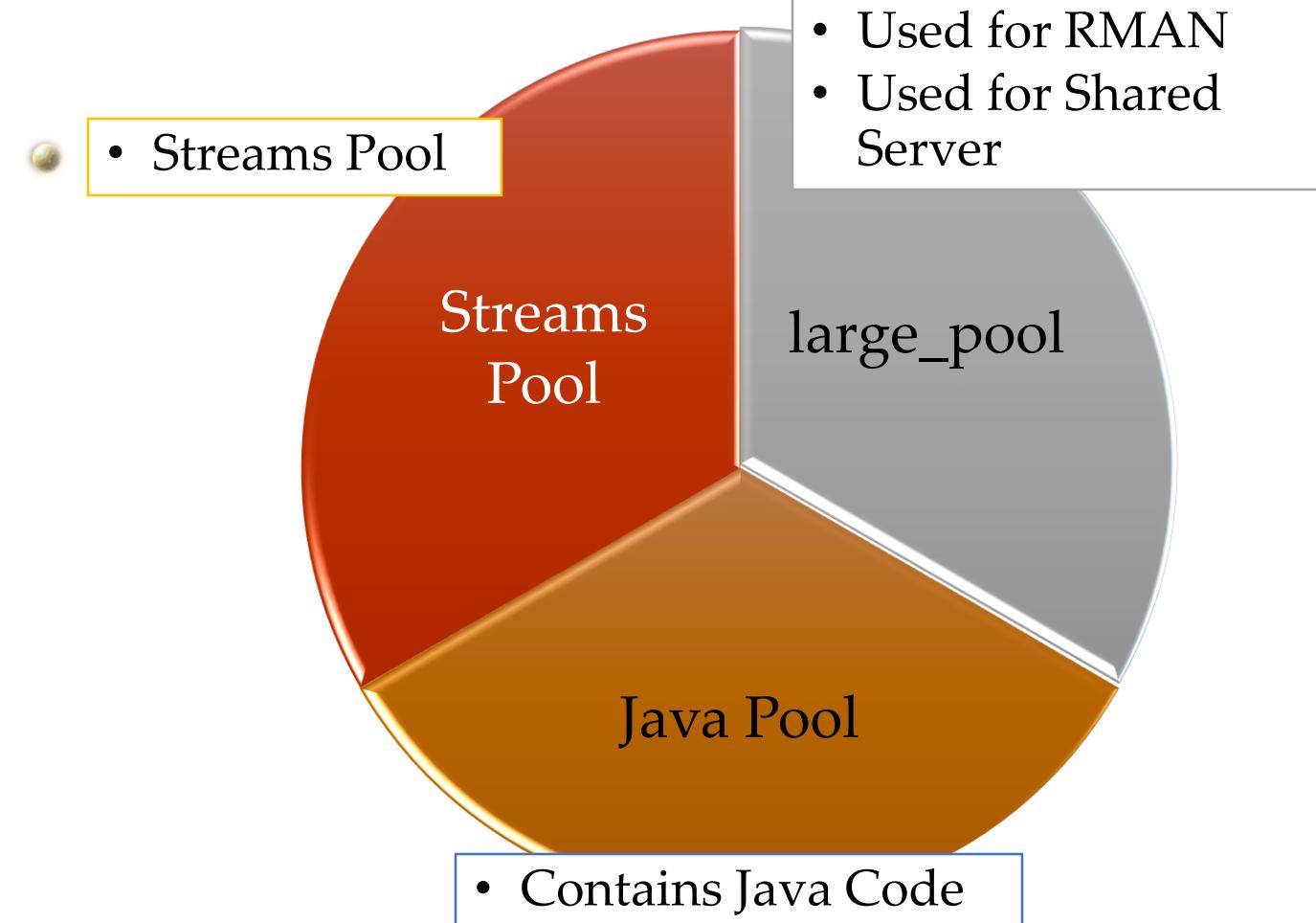
Contains prior executed PL/SQL Programs

db_cache

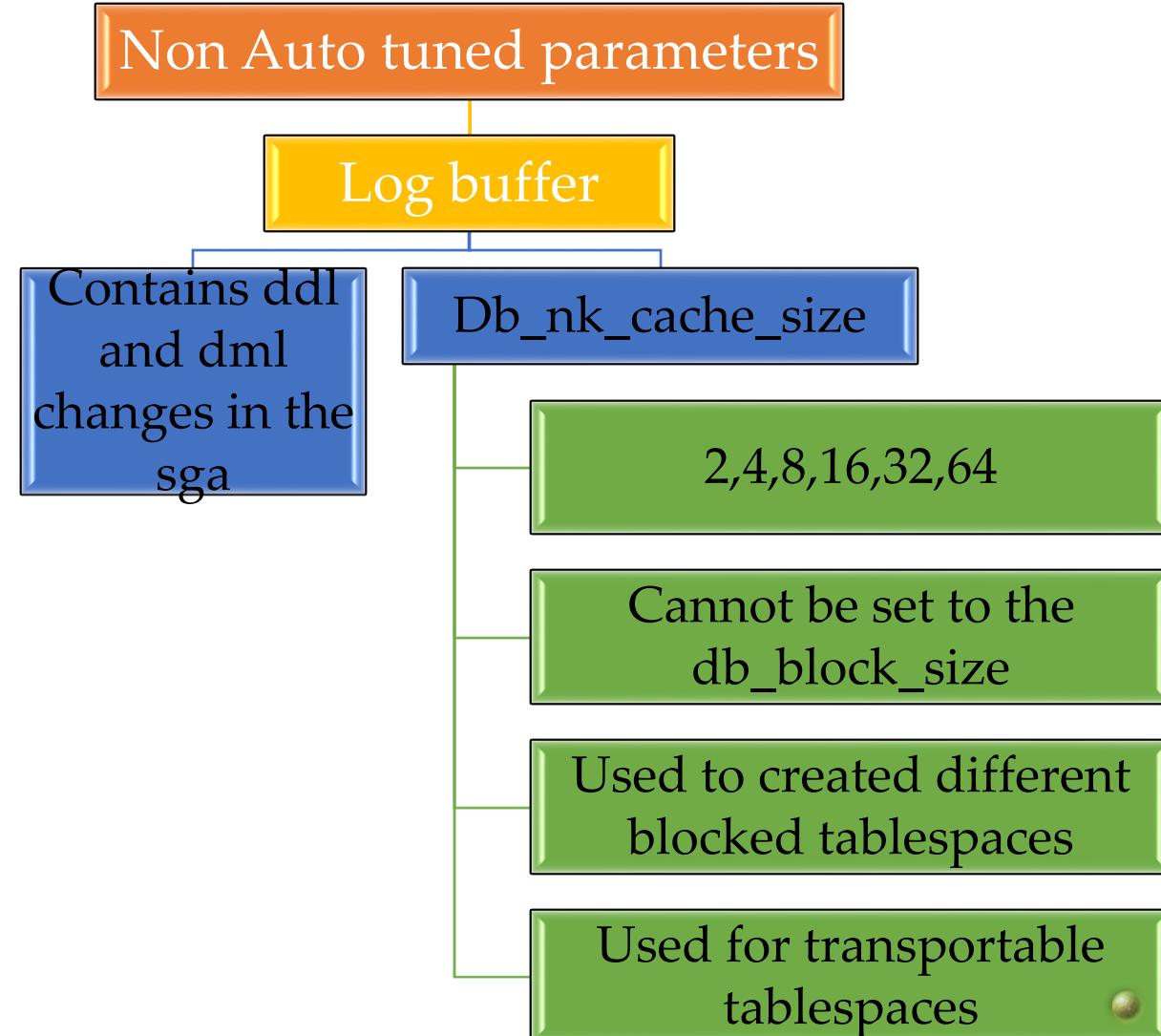
Contains data retrieved by SQL statements in memory

Largest portion of the memory

Oracle 19c Automatic Memory Management (AMM)



Oracle 19c Automatic Memory Management (AMM)



Oracle 19c Automatic Memory Management (AMM)



db_keep_cache_size

- Used to pin tables in memory
 - Small tables
 - State code tables

db_Recycle_cache_size

- Used for large full table scans
- Immediately ages out the table in the sga

Oracle 19c Automatic Memory Management (AMM)

You are not logged on with SYSDBA privilege. Only controls for dynamic parameters are editable.

Initialization Parameters

Current **SPFile**

The parameter values listed here are currently used by the running instance(s).

Name	Basic	Modified	Dynamic	Category
memory	All	All	All	All

Filter on a name or partial name Go

Apply changes in current running instance(s) mode to SPFile. For static parameters, you must restart the database.

Name ▲	Help	Value	Comments	Type	Basic	I
hi_shared_memory_address		0		Integer		
memory_max_target		0		Big Integer		
memory_target		0		Big Integer		
shared_memory_address		0		Integer		

Oracle 19c Automatic Memory Management (AMM)

The parameter values listed here are currently used by the running instance(s).

Name Basic Modified Dynamic Category

Filter on a name or partial name Apply changes in current running instance(s) mode to SPFile. For static parameters, you must restart the database.

Name ▲	Help	Value	Comments	Type
lock_sga		FALSE		Boolean
pre_page_sga		TRUE		Boolean
sga_max_size		2576M	internally adjusted	Big Integer
sga_target		0		Big Integer
unified_audit_sga_queue_size		1048576		Integer

Oracle 19c Automatic Memory Management (AMM)

gogocdb (Container Database)  

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

! You are not logged on with SYSDBA privilege. Only controls for dynamic parameters are editable.

Initialization Parameters

Current SPFile

The parameter values listed here are currently used by the running instance(s).

Name	Basic	Modified	Dynamic	Category
pga	All	All	All	All

Filter on a name or partial name Go

Apply changes in current running instance(s) mode to SPFile. For static parameters, you must restart the database.

Name ▲	Help	Value	Comments	Type	I
pga_aggregate_limit		2G		Big Integer	
pga_aggregate_target		857M		Big Integer	

Oracle 19c Automatic Memory Management (AMM)

Name ▲	Help	Value	Comments	Type	Basic
db_cache_size	ⓘ	1824M		Big Integer	
java_pool_size	ⓘ	16M		Big Integer	
large_pool_size	ⓘ	32M		Big Integer	
shared_pool_size	ⓘ	544M		Big Integer	
db_block_size	ⓘ	8192		Integer	✓
pga_aggregate_target	ⓘ	857M		Big Integer	✓
sga_target	ⓘ	0		Big Integer	✓
memory_target		0		Big Integer	✓
buffer_pool_keep				String	
buffer_pool_recycle				String	
db_16k_cache_size	ⓘ	0		Big Integer	
db_2k_cache_size	ⓘ	0		Big Integer	
db_32k_cache_size	ⓘ	0		Big Integer	
db_4k_cache_size	ⓘ	0		Big Integer	
db_8k_cache_size	ⓘ	0		Big Integer	

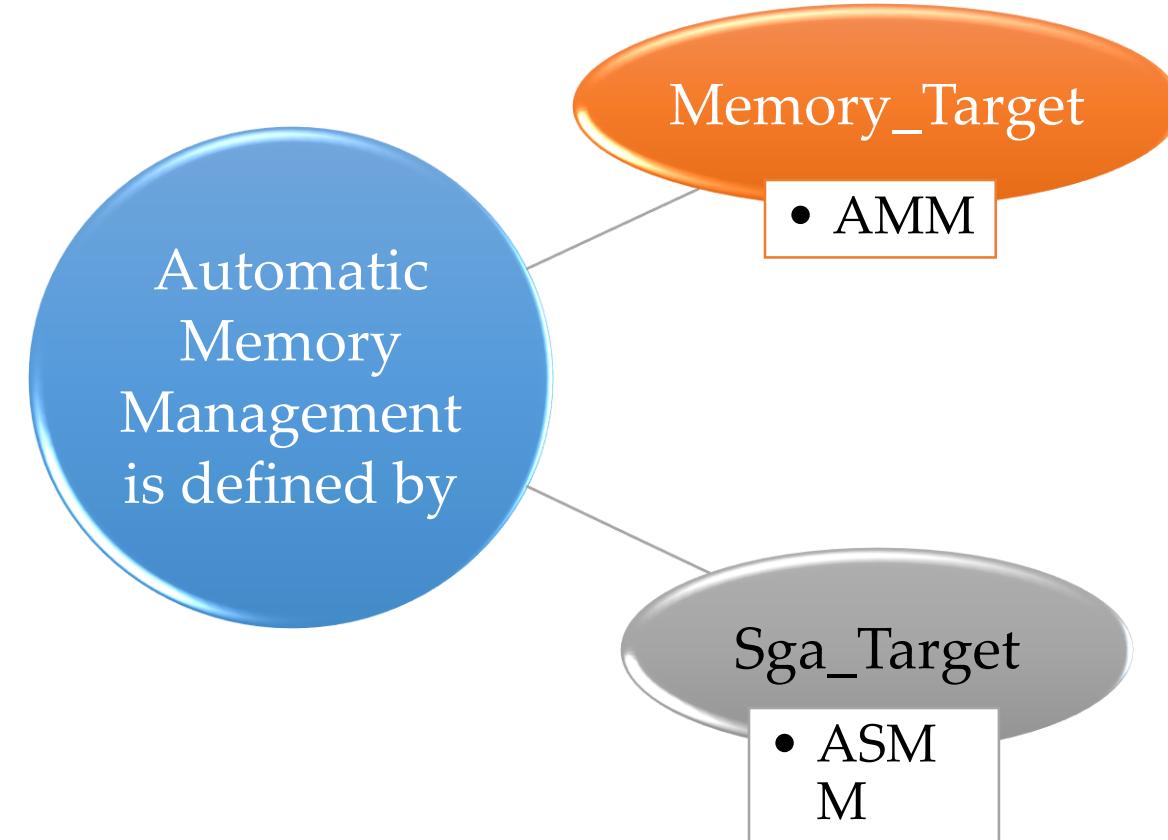
Oracle 19c Automatic Memory Management (AMM)

db_cache_advice	 <input type="button" value="ON"/>			String	
db_file_multiblock_read_count	 <input type="button" value="128"/>			Integer	
db_keep_cache_size	 <input type="button" value="0"/>			Big Integer	
db_recycle_cache_size	 <input type="button" value="0"/>			Big Integer	
db_writer_processes	 <input type="button" value="1"/>			Integer	
dbwr_io_slaves	 <input type="button" value="0"/>			Integer	
disk_asynch_io	 <input type="button" value="TRUE"/>			Boolean	
global_context_pool_size	 <input type="button" value=""/>			String	
hi_shared_memory_address	 <input type="button" value="0"/>			Integer	
lock_sga	 <input type="button" value="FALSE"/>			Boolean	
memory_max_target	 <input type="button" value="0"/>			Big Integer	
olap_page_pool_size	 <input type="button" value="0"/>			Big Integer	
pre_page_sga	 <input type="button" value="TRUE"/>			Boolean	
read_only_open_delayed	 <input type="button" value="FALSE"/>			Boolean	
sga_max_size	 <input type="button" value="2576M"/>	internally adjusted		Big Integer	
shared_memory_address	 <input type="button" value="0"/>			Integer	
shared_pool_reserved_size	 <input type="button" value="28521267"/>			Big Integer	

Oracle 19c Automatic Memory Management (AMM)

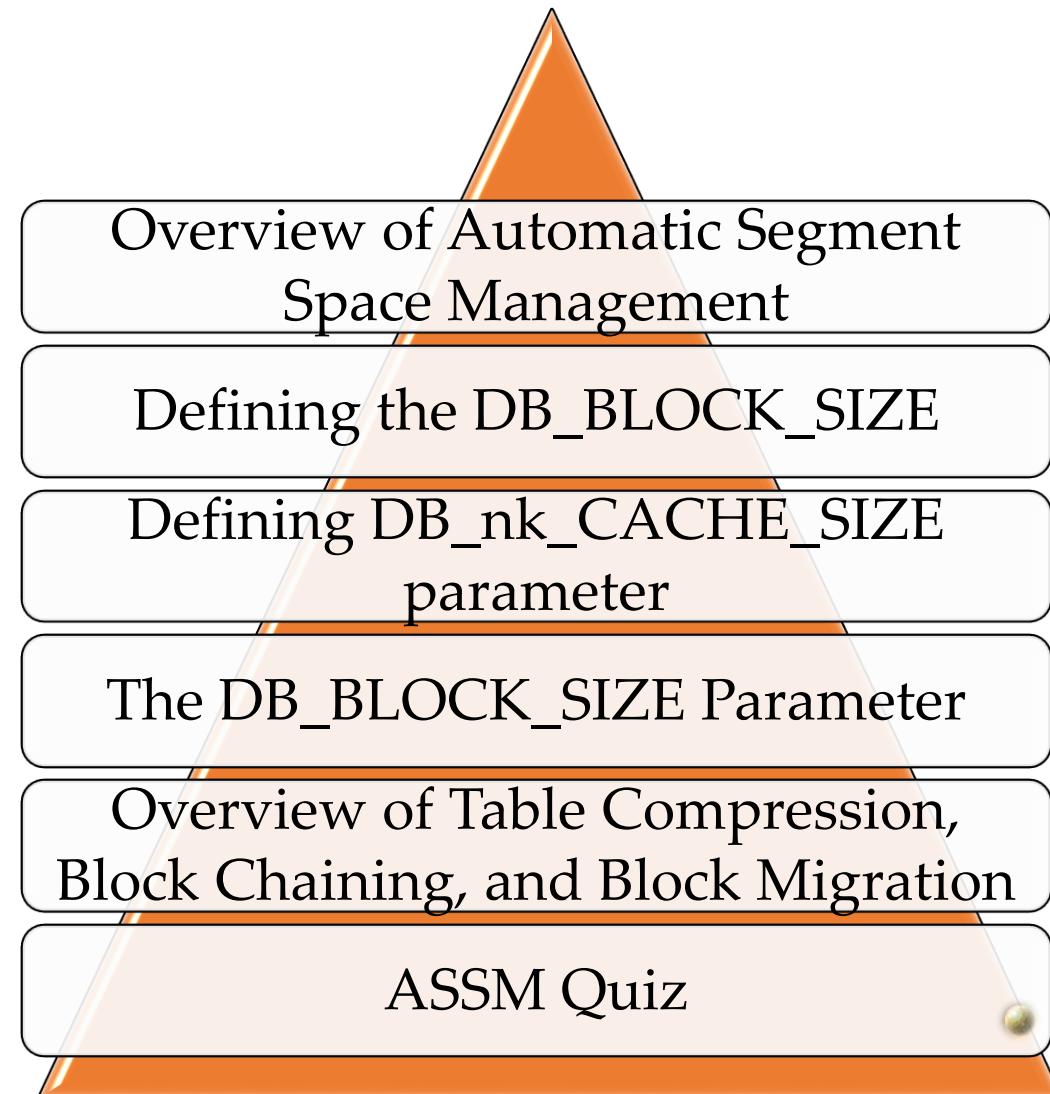
pre_page_sga		TRUE	
read_only_open_delayed		FALSE	
sga_max_size		2576M	internally adjusted
shared_memory_address		0	
shared_pool_reserved_size		28521267	
use_indirect_data_buffers		FALSE	

Oracle 19c Automatic Memory Management (AMM)



- ASSM

Lesson Topics



Overview of Automatic Segment Space Management

Defining the DB_BLOCK_SIZE

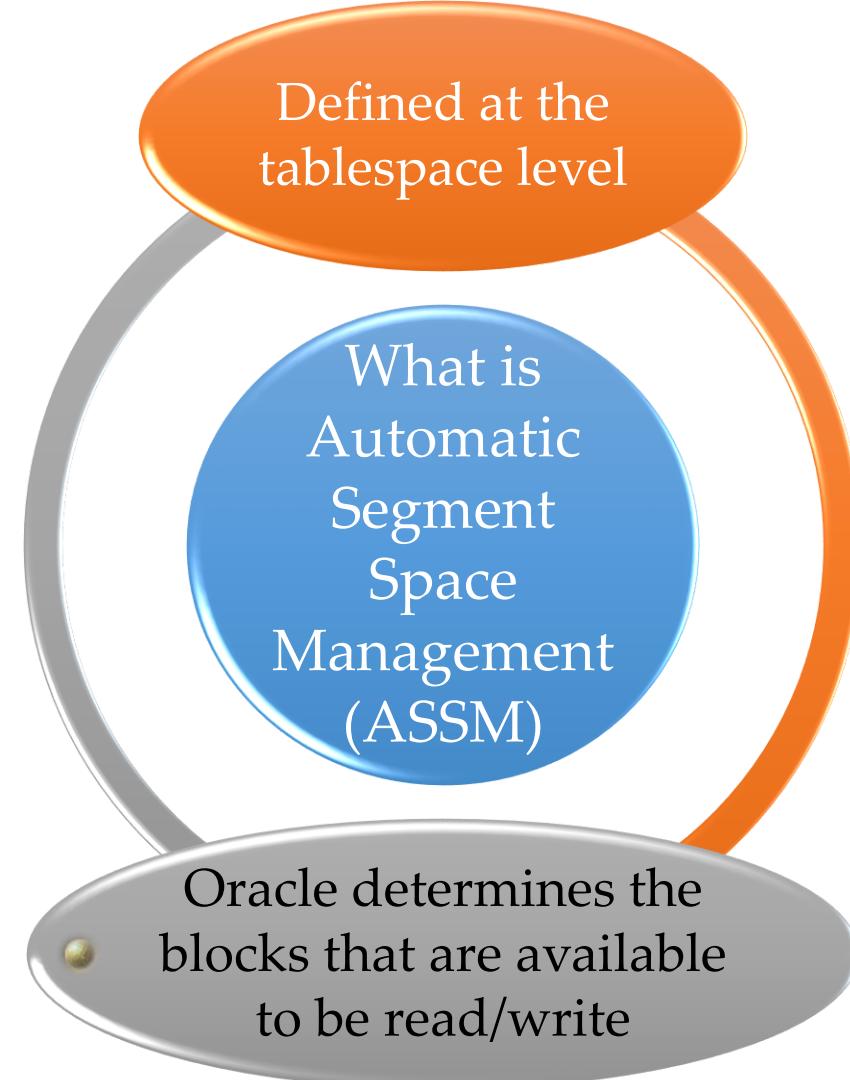
Defining DB_nk_CACHE_SIZE parameter

The DB_BLOCK_SIZE Parameter

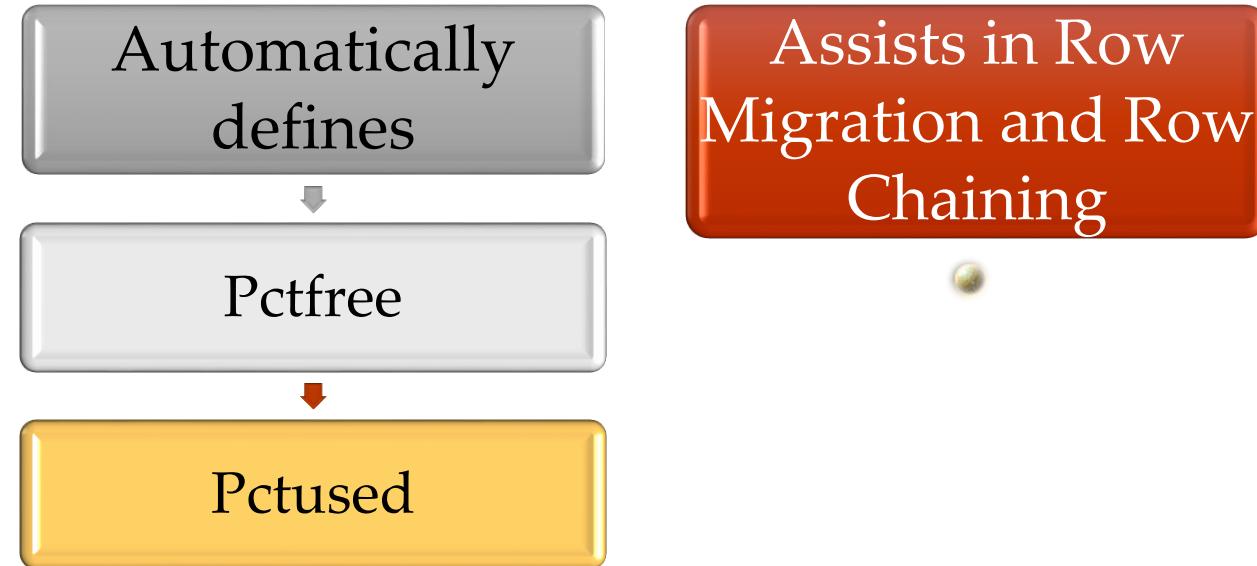
Overview of Table Compression, Block Chaining, and Block Migration

ASSM Quiz

Oracle 19c Tuning Segment Space Utilization (ASSM)



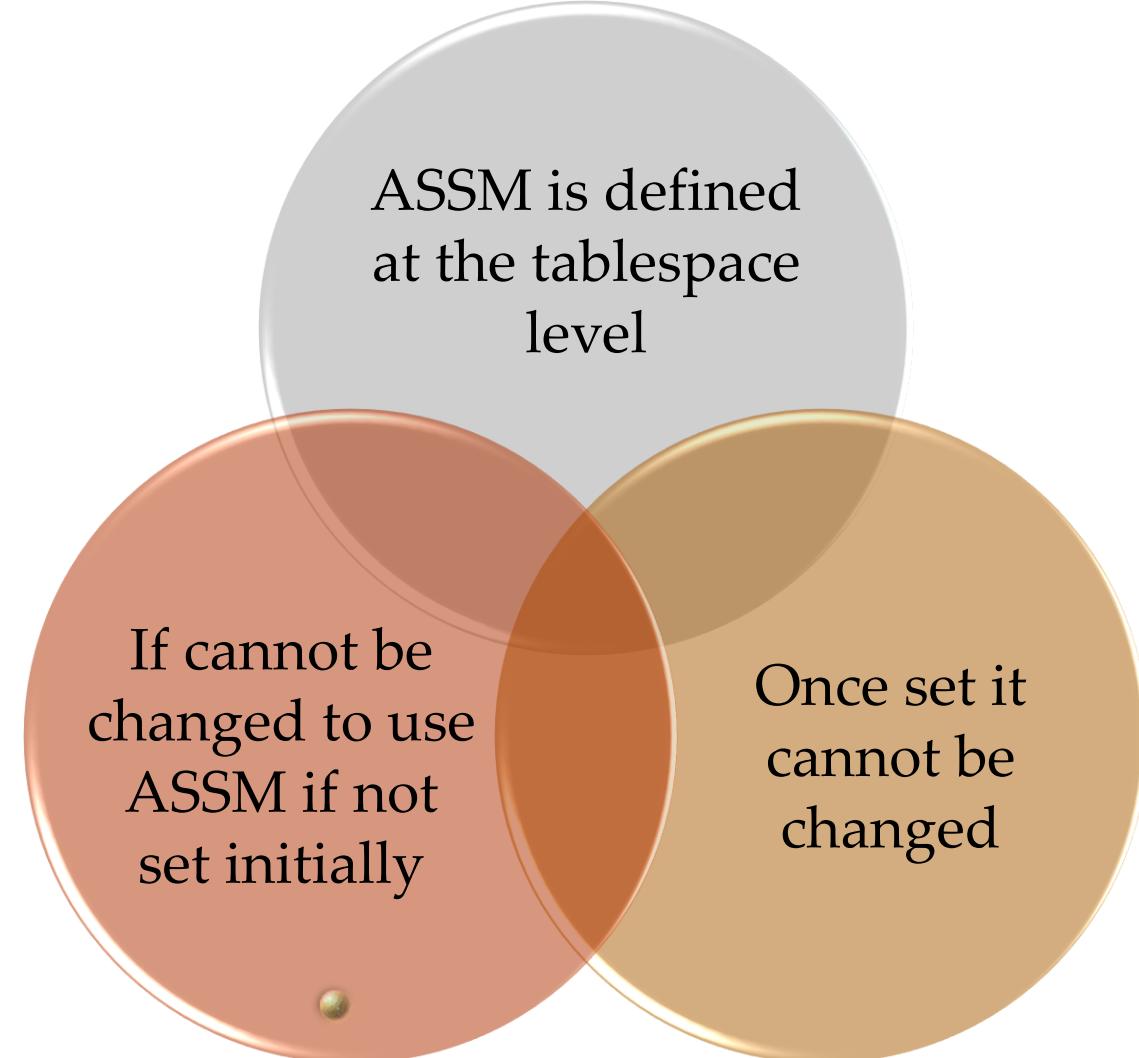
Oracle 19c Tuning Segment Space Utilization (ASSM)



Oracle 19c Tuning Segment Space Utilization (ASSM)

- Row Migration {
 - Oracle will attempt to place an entire record in a row
 - If it cannot it will migrate the row
- Row Chaining {
 - IF the row cannot be migrated Oracle will chain the row across multiple blocks
- Row Chaining it worse than Row Migration {
 - Db_block_size affects row chaining

Oracle 19c Tuning Segment Space Utilization (ASSM)



DB_BLOCK_SIZE		
Determines the default block size for the Oracle database	Database datafiles and SGA will be formatted in this block size	The default block size cannot be changed

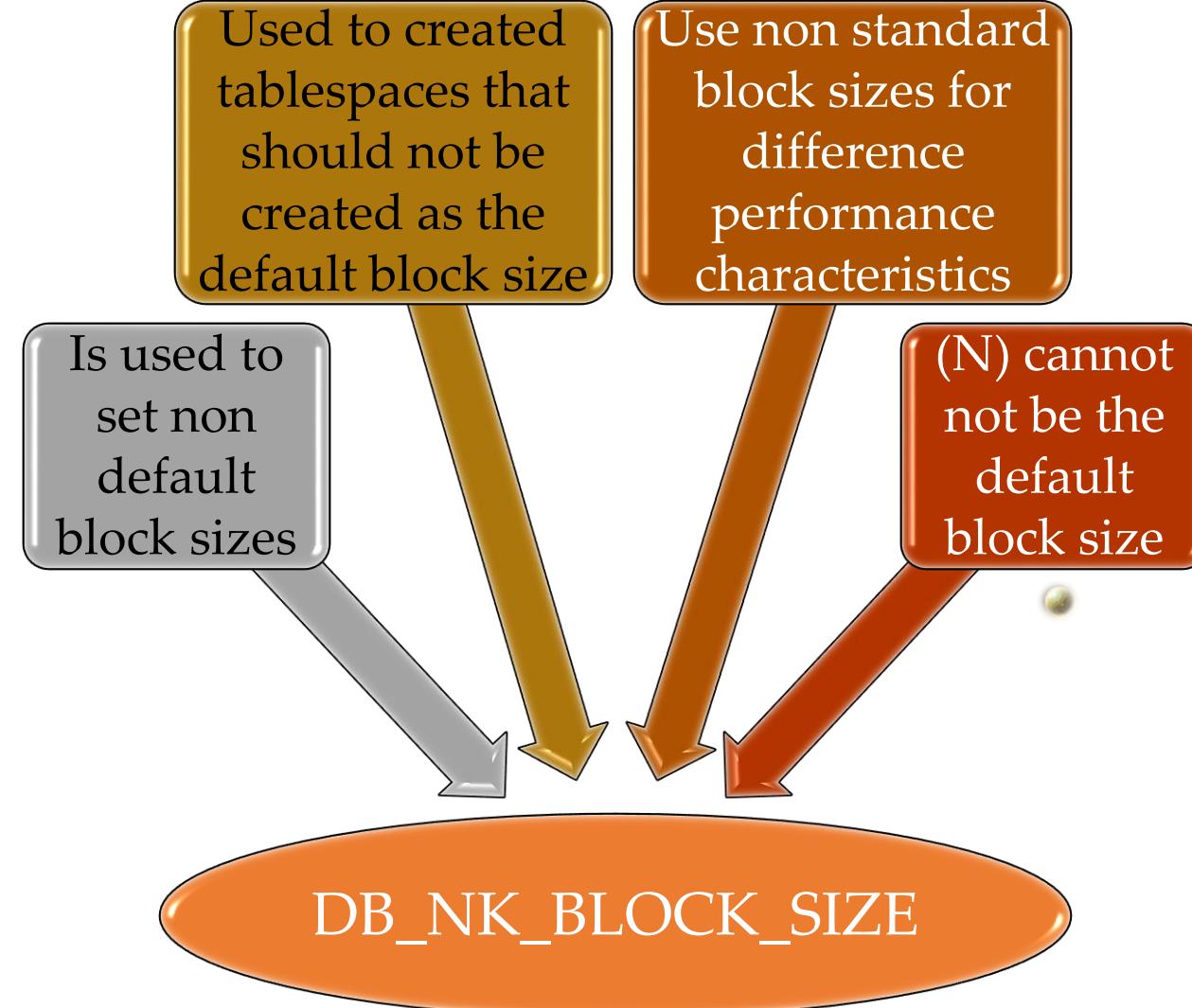
IF the DB_BLOCK_SIZE = 8k

- All datafiles will be formatted in 8k blocks
- All sga buffer cache structures will be formatted at 8k structures

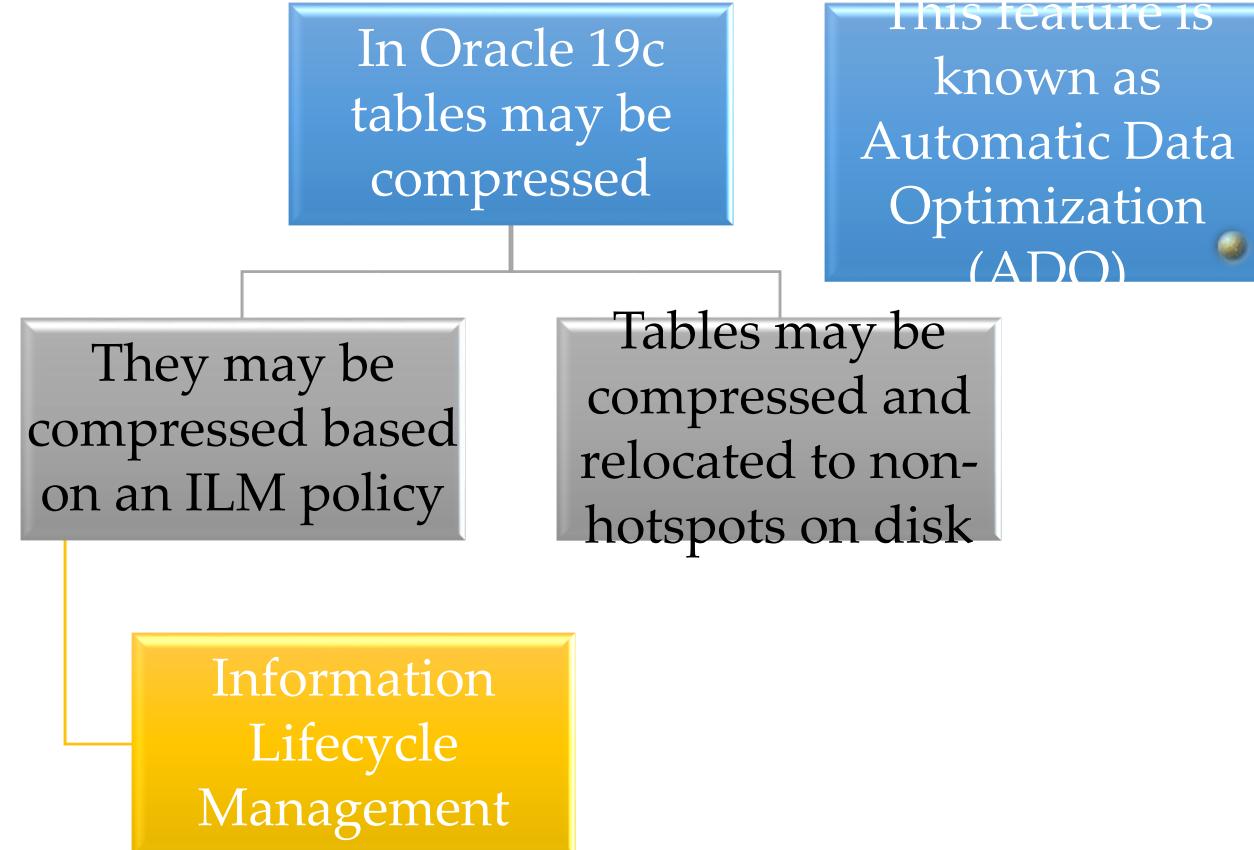
Valid values for DB_BLOCK_SIZE

- 2,4,8,16,32,64

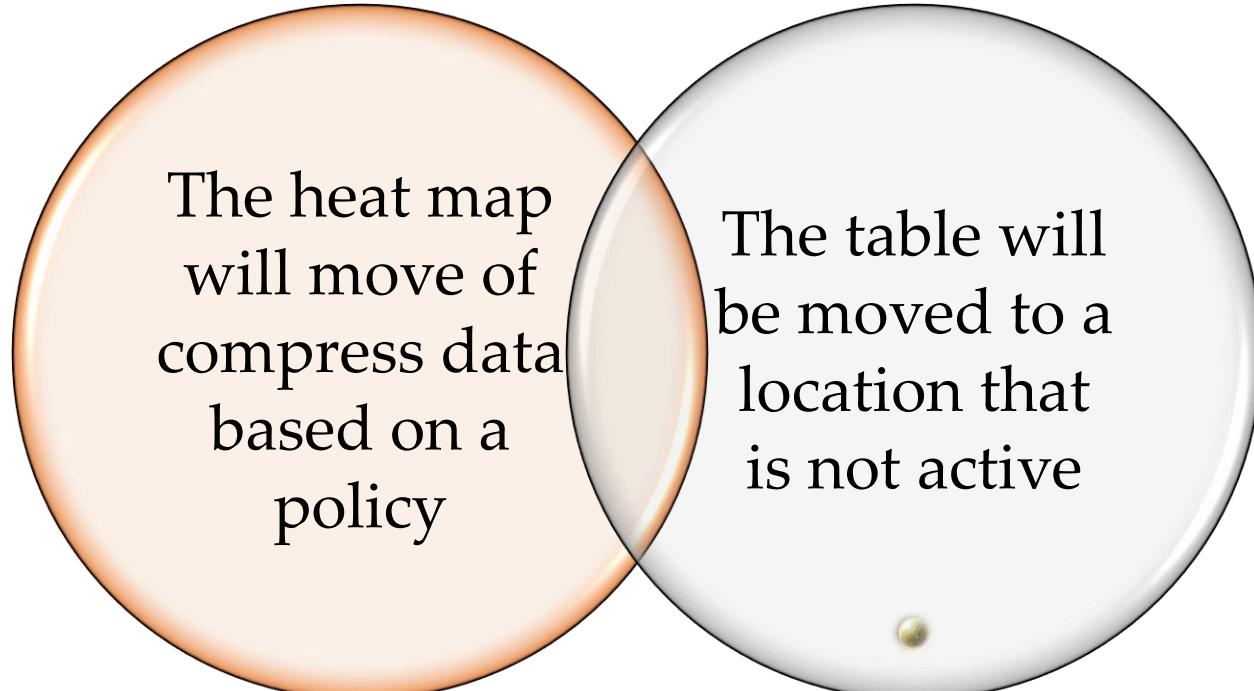
Oracle 19c Tuning Segment Space Utilization (ASSM)



Oracle 19c Tuning Segment Space Utilization (ASSM)



Oracle 19c Tuning Segment Space Utilization (ASSM)



The heat map will move or compress data based on a policy

The table will be moved to a location that is not active

In Oracle 19c Tables and Tablespaces
may be compressed

Compression is divided into

Compression
Tiering

Storage Tiering

Oracle 19c Tuning Segment Space Utilization (ASSM)

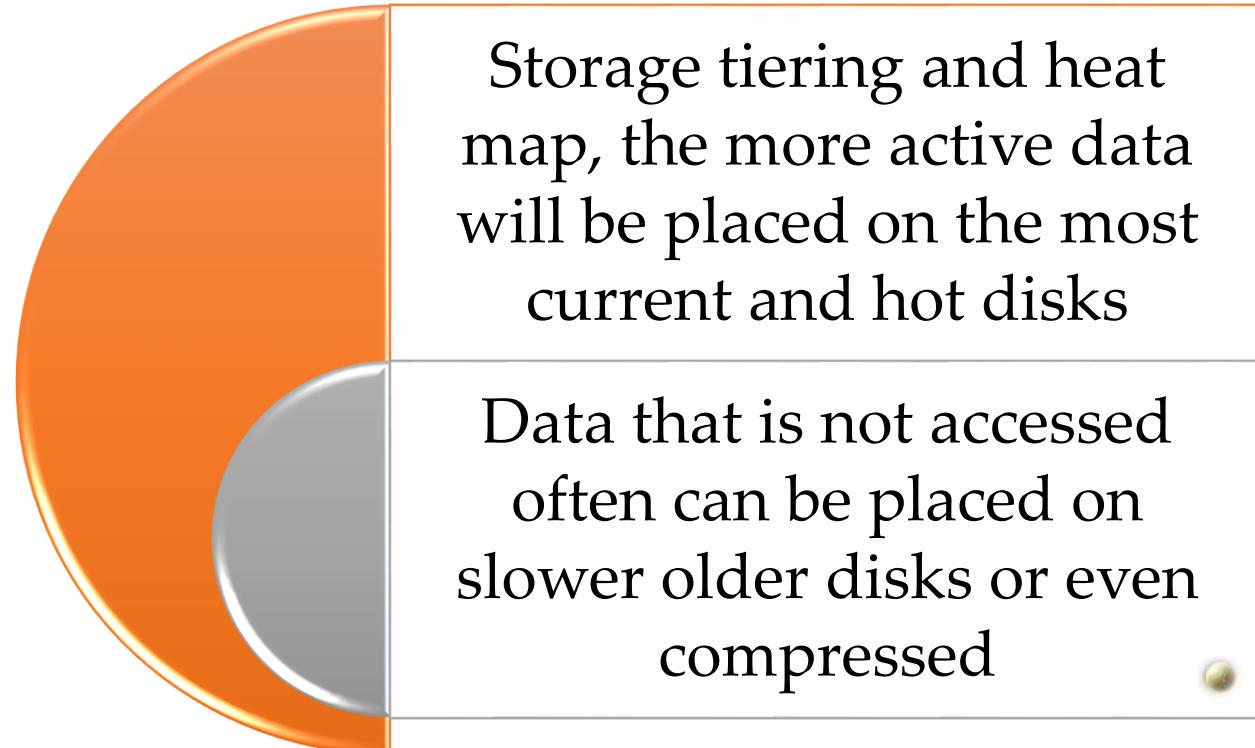
- Tiering is defined as moving older data to different and/or slower disks based on the age of the data

Storage
Tiering is
defined by:

- Compresses data rather than moves data based on its age

Compression
Tiering

Oracle 19c Tuning Segment Space Utilization (ASSM)



Oracle 19c Tuning Segment Space Utilization (ASSM)

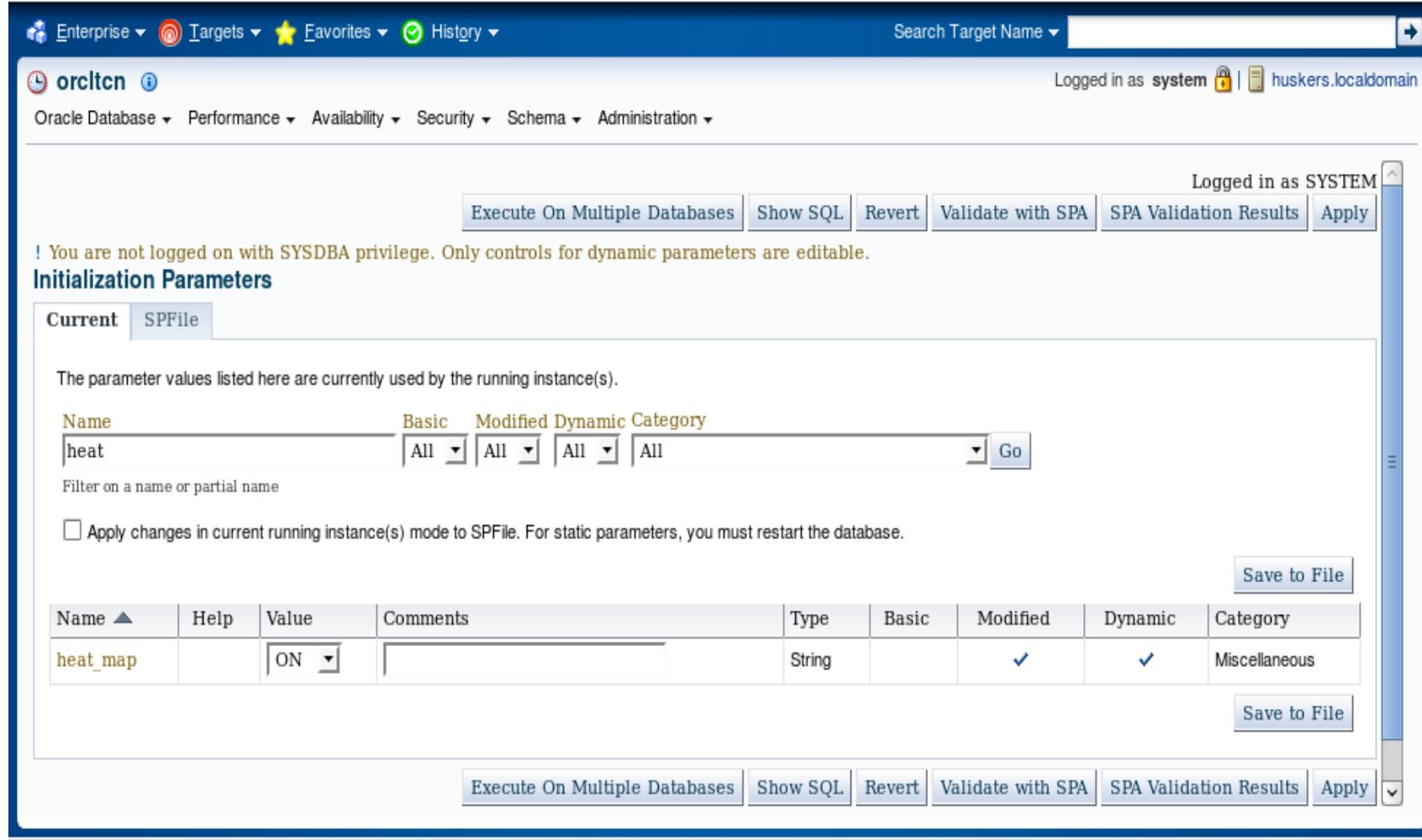
Data Compression, Automatic Data Optimization, and Oracle Heat Map are all part of Oracle Information Lifecycle Management system or ILM

Basically the IT organizations never get rid of data

In today's environments where disk space is cheap and everyone is after information

Oracle will use ILM to track data through its lifetime

Oracle 19c Tuning Segment Space Utilization (ASSM)



The screenshot shows the Oracle Database 19c Tuning Segment Space Utilization (ASSM) interface. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The session information shows 'Logged in as system' and 'huskers.localdomain'. The main menu has options for Oracle Database, Performance, Availability, Security, Schema, and Administration.

In the center, a message states: '! You are not logged on with SYSDBA privilege. Only controls for dynamic parameters are editable.' Below this, the 'Initialization Parameters' section is displayed. It has tabs for 'Current' (selected) and 'SPFile'. A note says: 'The parameter values listed here are currently used by the running instance(s).'

The 'heat' parameter is listed in the table:

Name	Basic	Modified	Dynamic	Category
heat	All	All	All	All

A 'Go' button is next to the filters. A 'Filter on a name or partial name' input field is below the table. An unchecked checkbox says: '□ Apply changes in current running instance(s) mode to SPFile. For static parameters, you must restart the database.'

A 'Save to File' button is located at the bottom right of the table area. The table below lists the 'heat_map' parameter:

Name ▲	Help	Value	Comments	Type	Basic	Modified	Dynamic	Category
heat_map		ON		String		✓	✓	Miscellaneous

A second 'Save to File' button is located at the bottom right of this table area. The bottom navigation bar includes links for Execute On Multiple Databases, Show SQL, Revert, Validate with SPA, SPA Validation Results, and Apply.

Oracle 19c Tuning Segment Space Utilization (ASSM)

Enterprise ▾ Targets ▾ Favorites ▾ History ▾

Search Target Name ▾ →

Logged in as **system** huskers.localdomain

orcltn

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Execute On

Initialization Parameters

Storage Logged in as SYSTEM

- Automatic Data Optimization
- Compression
- Control Files
- Datafiles
- Tablespaces
- Make Tablespace Locally Managed...
- Temporary Tablespace Groups
- Rollback Segments
- Segment Advisor
- Automatic Undo Management
- Redo Log Groups
- Archive Logs

1-50 of 367 Next 5

Name	Help	Value	Comments	Type	Basic	Modified	Dynamic	Category
audit_file_dest		/u01/app/oracle/admin/orcltn/ad		String		✓	✓	Security and Auditing
audit_trail		DB		String		✓		Security and

Oracle 19c Tuning Segment Space Utilization (ASSM)

```
[oracle@huskers Desktop]$ . oraenv
ORACLE_SID = [orcltcn] ? orcltcn
The Oracle base remains unchanged with value /u01/app/oracle
[oracle@huskers Desktop]$ sqlplus system/password1

SQL*Plus: Release 12.1.0.1.0 Production on Thu Apr 10 14:44:44 2014

Copyright (c) 1982, 2013, Oracle. All rights reserved.

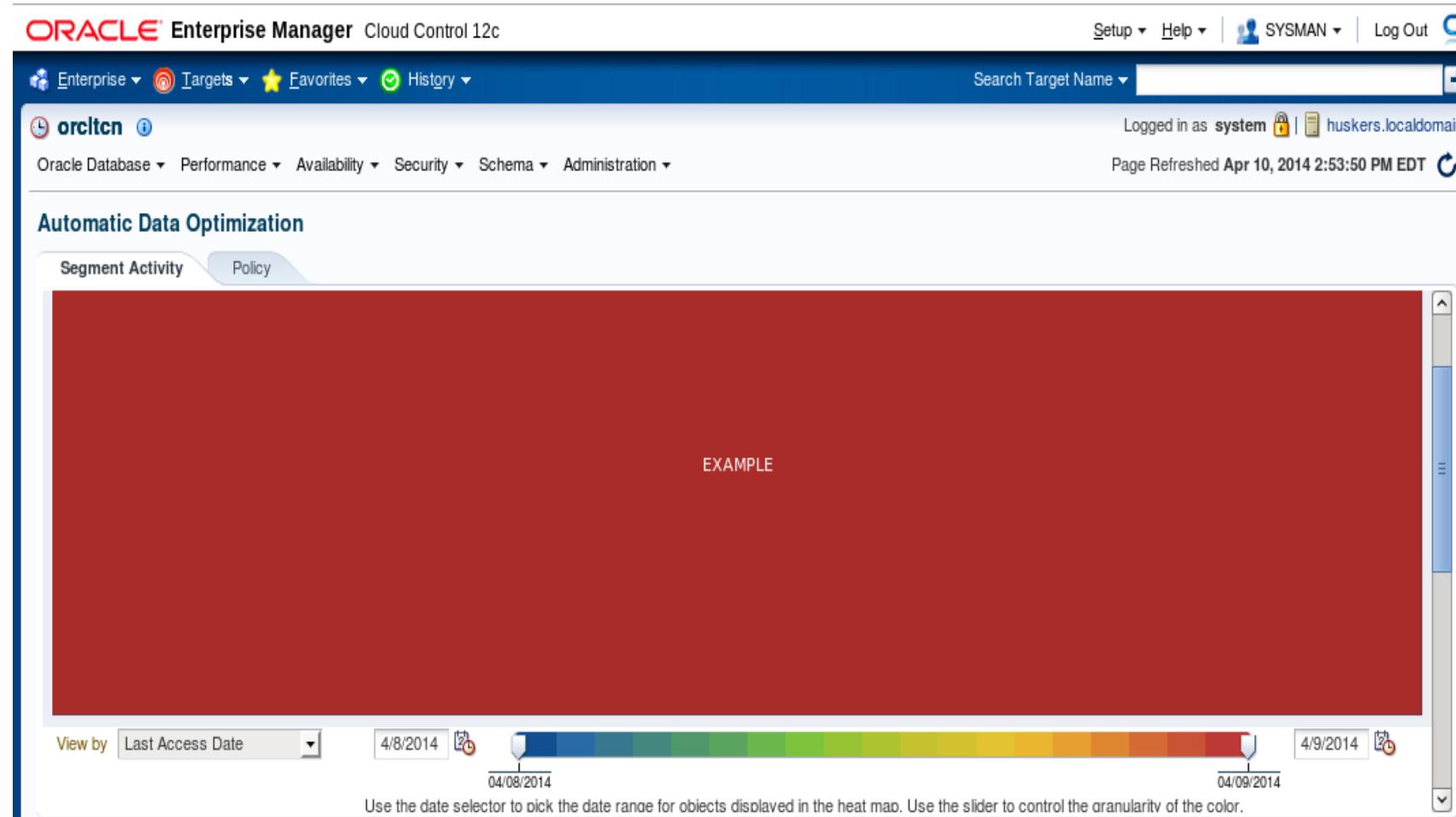
Last Successful login time: Thu Apr 10 2014 14:43:43 -04:00

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, Automatic Storage Management, OLAP, Advanced Analytics
and Real Application Testing options

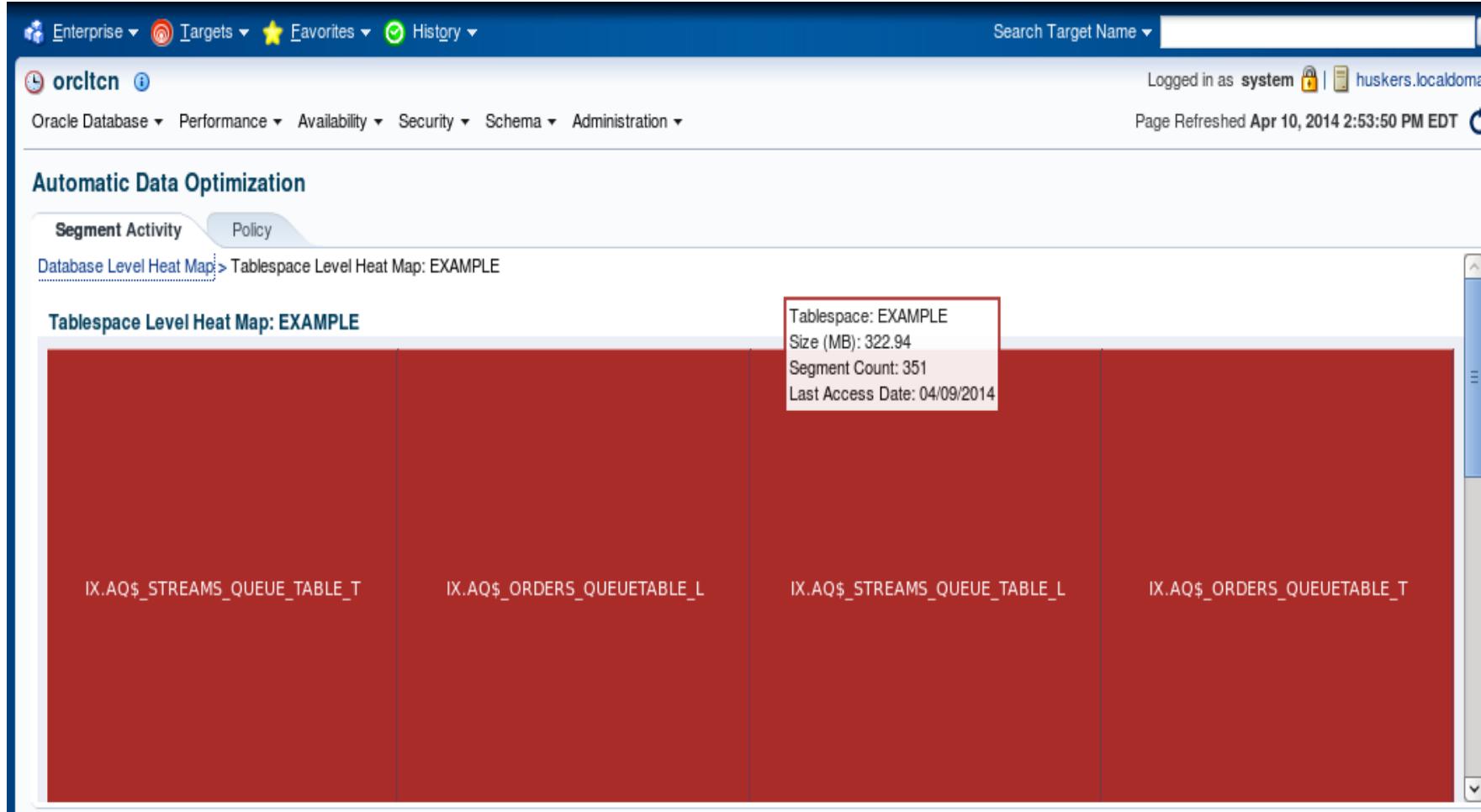
SQL> get ilm_policy
  1 alter table hr.employees ILM add policy
  2 row store compress advanced segment
  3* after 10 days of no modification
SQL> /
Table altered.

SQL> █
```

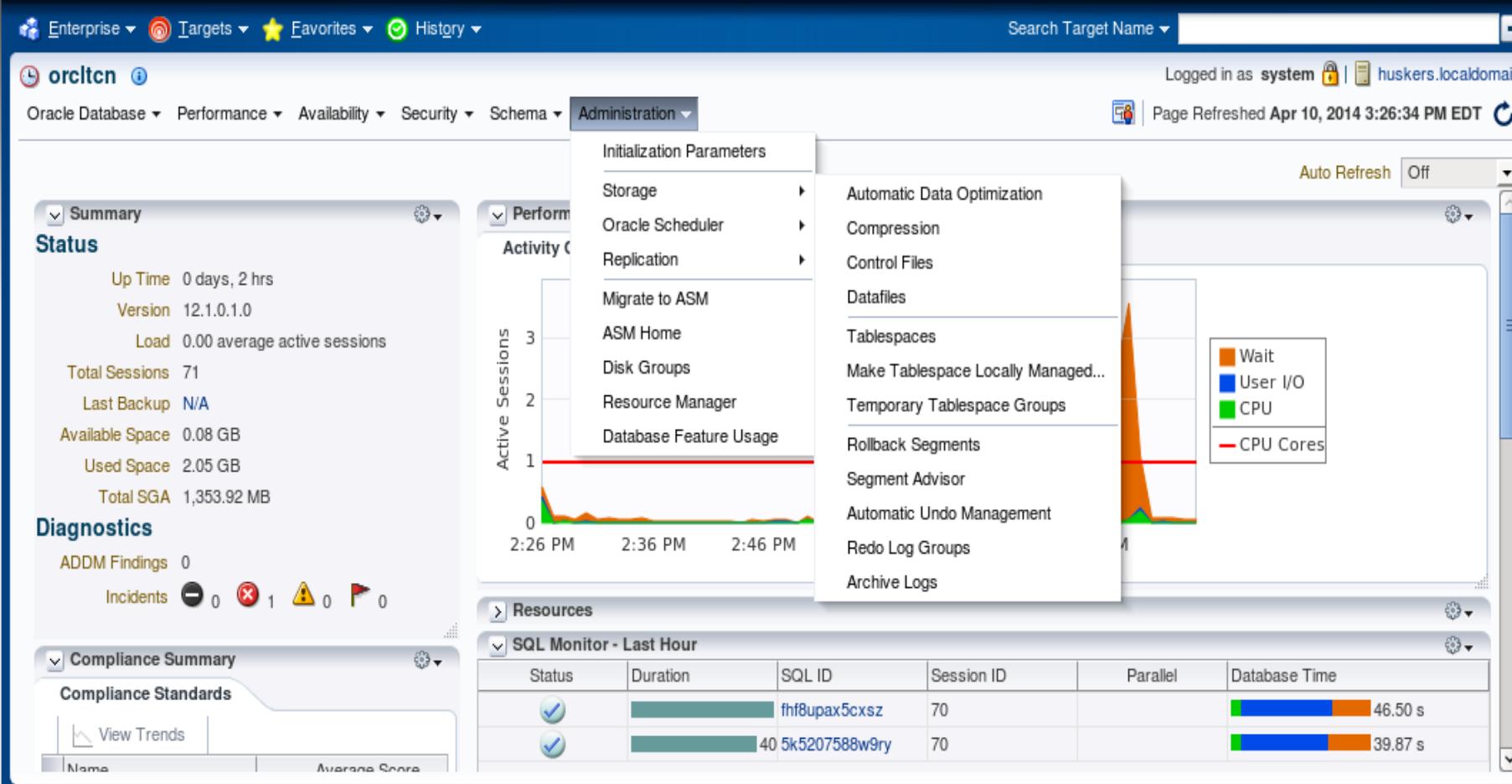
Oracle 19c Tuning Segment Space Utilization (ASSM)



Oracle 19c Tuning Segment Space Utilization (ASSM)



Oracle 19c Tuning Segment Space Utilization (ASSM)



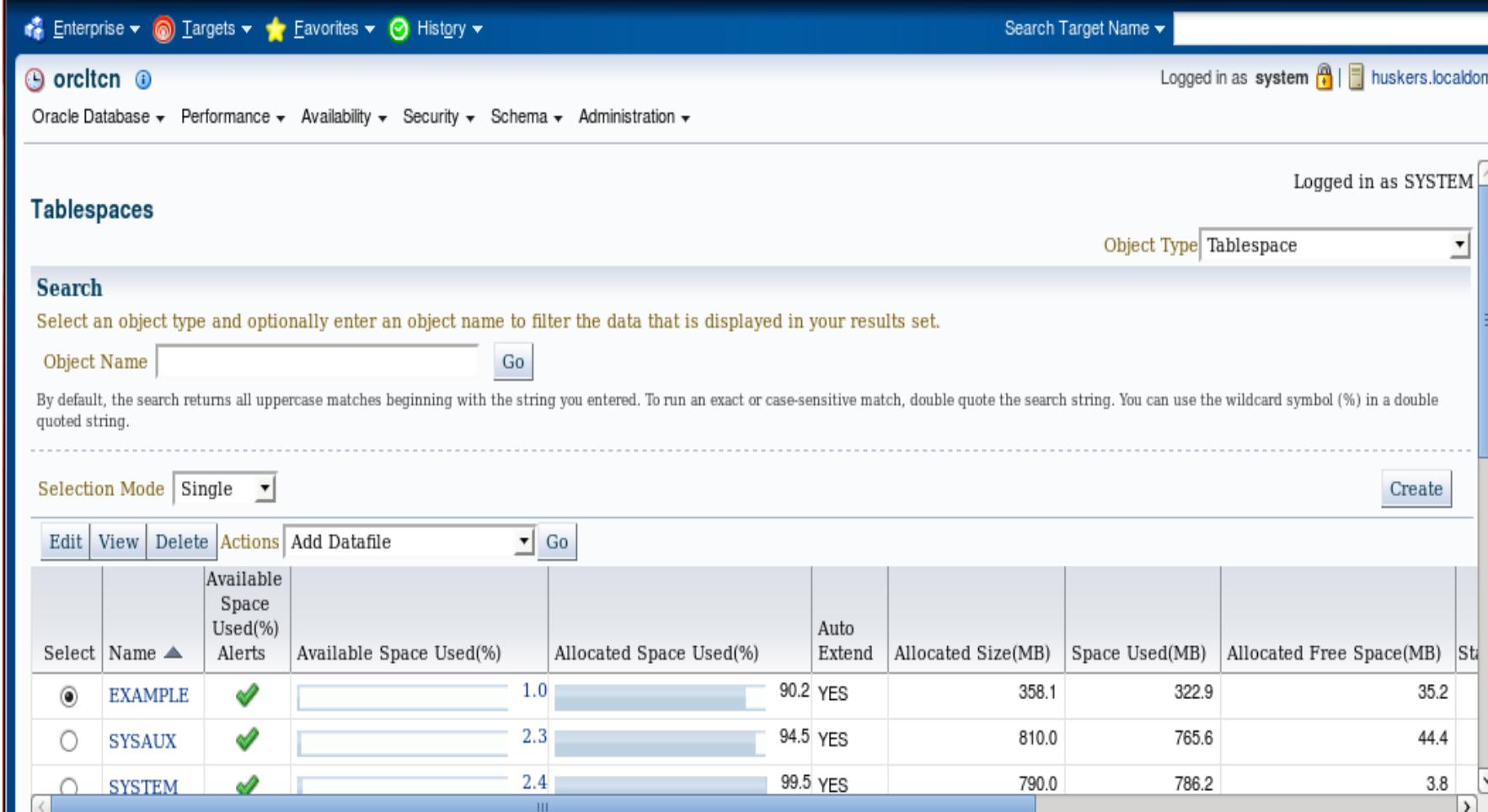
The screenshot shows the Oracle Database Control interface for a target database named 'orc1tn'. The 'Administration' menu is open, displaying various configuration options:

- Initialization Parameters
- Storage
- Oracle Scheduler
- Replication
- Migrate to ASM
- ASM Home
- Disk Groups
- Resource Manager
- Database Feature Usage
- Automatic Data Optimization
- Compression
- Control Files
- Datafiles
- Tablespaces
- Make Tablespace Locally Managed...
- Temporary Tablespace Groups
- Rollback Segments
- Segment Advisor
- Automatic Undo Management
- Redo Log Groups
- Archive Logs

The interface also includes a 'Summary' section with status information, a 'Diagnostics' section with ADDM Findings and Incidents, a 'Compliance Summary' section, and a 'SQL Monitor - Last Hour' table.

Status	Duration	SQL ID	Session ID	Parallel	Database Time
✓	fhf8upax5cxsz	70			46.50 s
✓	40 5k5207588w9ry	70			39.87 s

Oracle 19c Tuning Segment Space Utilization (ASSM)



The screenshot shows the Oracle Database 19c Tuning Segment Space Utilization (ASSM) interface. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The session information shows 'Logged in as system' and 'Logged in as SYSTEM'. The main menu has options like Oracle Database, Performance, Availability, Security, Schema, and Administration. The current view is on 'Tablespaces'.

Tablespaces

Object Type: Tablespace

Search
Select an object type and optionally enter an object name to filter the data that is displayed in your results set.
Object Name: Go

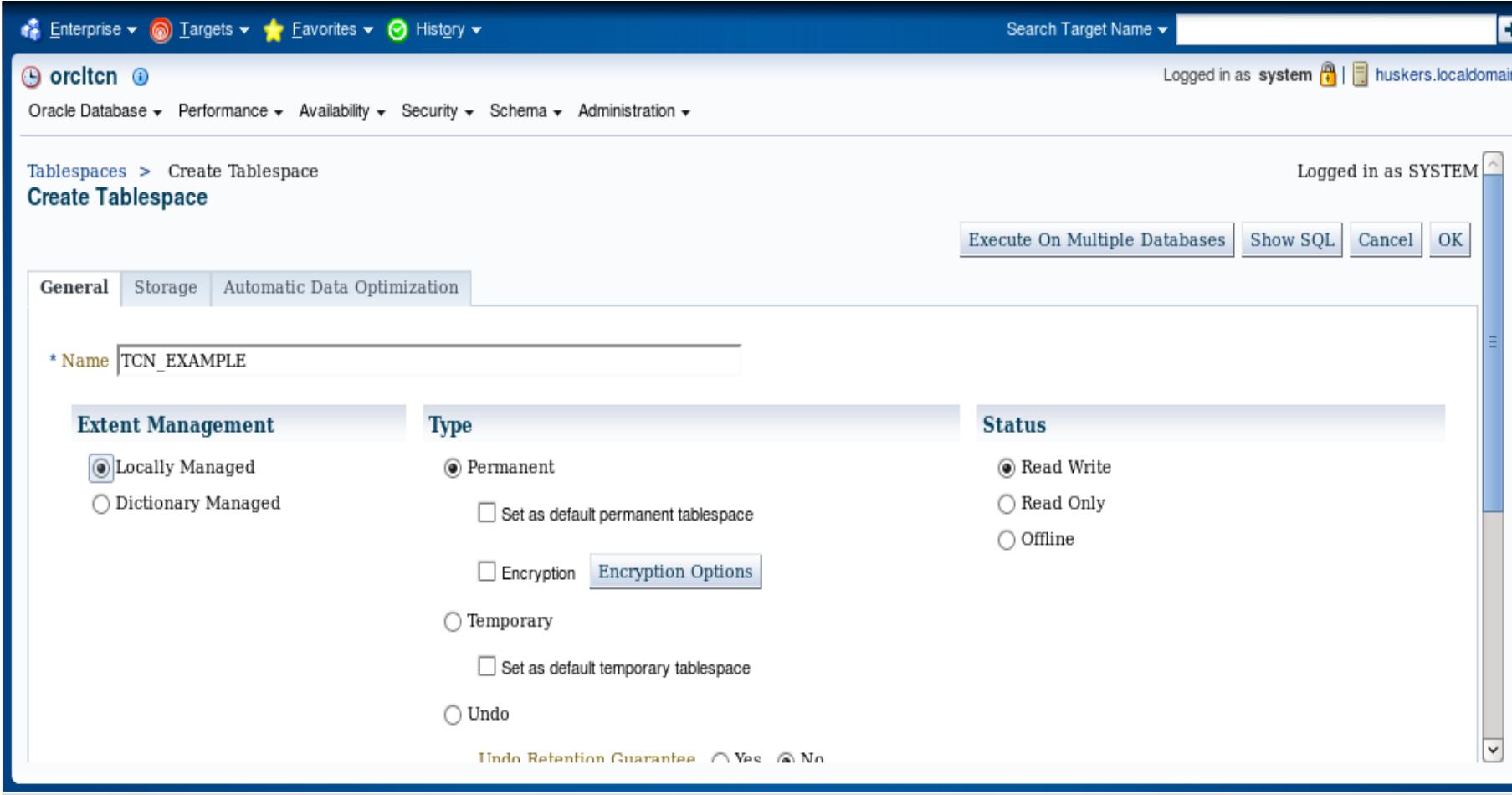
By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

Selection Mode: Single

Actions: Edit, View, Delete, Add Datafile, Go

Select	Name ▲	Available Space Used(%) Alerts	Available Space Used(%)	Allocated Space Used(%)	Auto Extend	Allocated Size(MB)	Space Used(MB)	Allocated Free Space(MB)	St
<input checked="" type="radio"/>	EXAMPLE		1.0	90.2	YES	358.1	322.9	35.2	
<input type="radio"/>	SYSAUX		2.3	94.5	YES	810.0	765.6	44.4	
<input type="radio"/>	SYSTEM		2.4	99.5	YES	790.0	786.2	3.8	

Oracle 19c Tuning Segment Space Utilization (ASSM)



The screenshot shows the Oracle Database Control interface for creating a new tablespace named 'TCN_EXAMPLE'. The 'General' tab is selected. Under 'Extent Management', 'Locally Managed' is chosen. Under 'Type', 'Permanent' is selected, with options to set it as the default permanent or temporary tablespace. Under 'Status', 'Read Write' is selected. At the bottom, there is an 'Undo Retention Guarantee' section with 'Yes' and 'No' radio buttons.

Enterprise Targets Favorites History

Search Target Name

Logged in as system huskers.localdomain

orcltn

Oracle Database Performance Availability Security Schema Administration

Tablespaces > Create Tablespace

Create Tablespace

Logged in as SYSTEM

Execute On Multiple Databases Show SQL Cancel OK

General Storage Automatic Data Optimization

* Name TCN_EXAMPLE

Extent Management

Locally Managed
 Dictionary Managed

Type

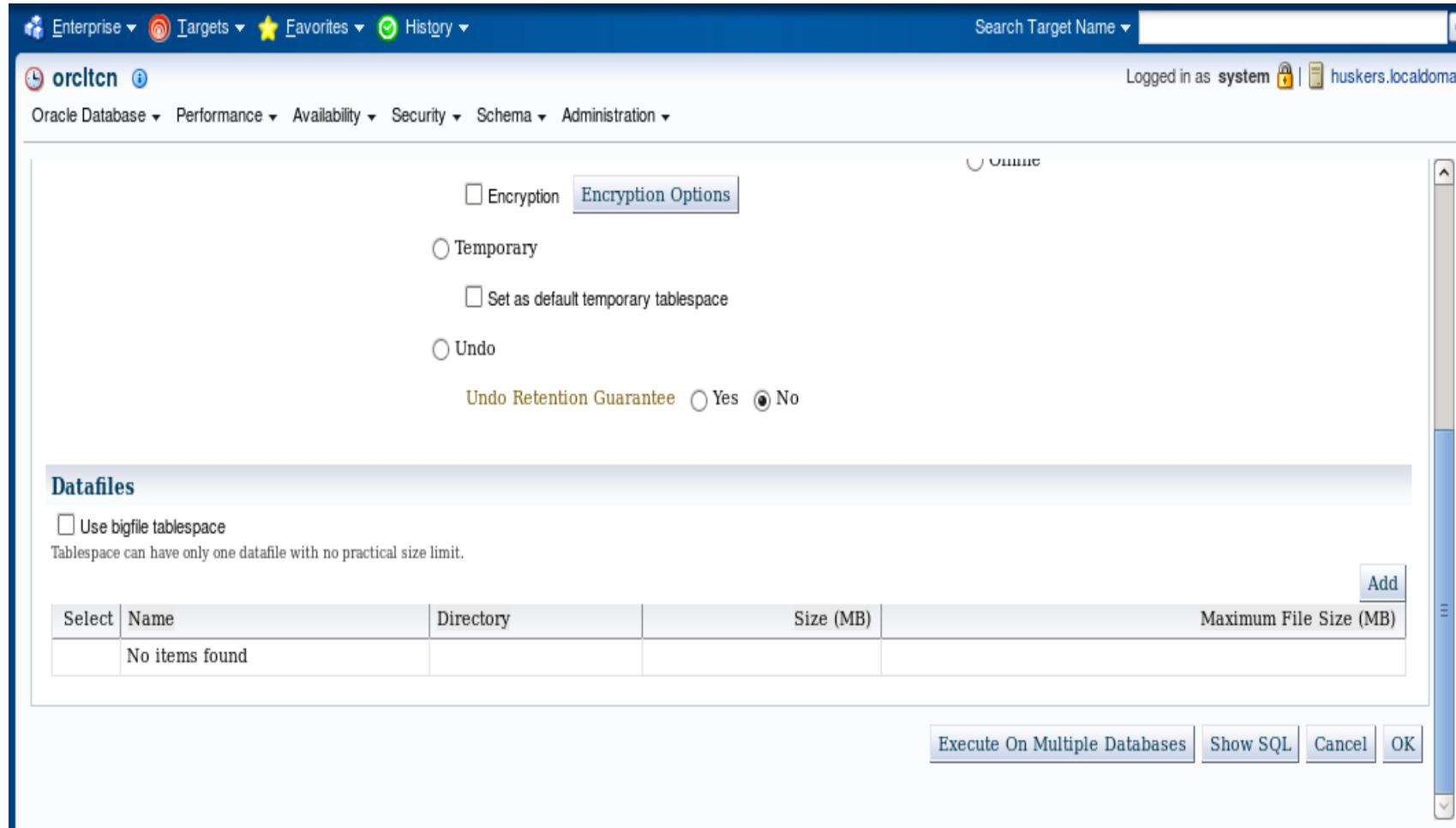
Permanent
 Set as default permanent tablespace
 Encryption [Encryption Options](#)

Status

Read Write
 Read Only
 Offline

Undo Retention Guarantee Yes No

Oracle 19c Tuning Segment Space Utilization (ASSM)



Enterprise ▾ Targets ▾ Favorites ▾ History ▾

Search Target Name ▾

Logged in as system huskers.localdomain

orclcn

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Online

Encryption **Encryption Options**

Temporary
 Set as default temporary tablespace

Undo

Undo Retention Guarantee Yes No

Datafiles

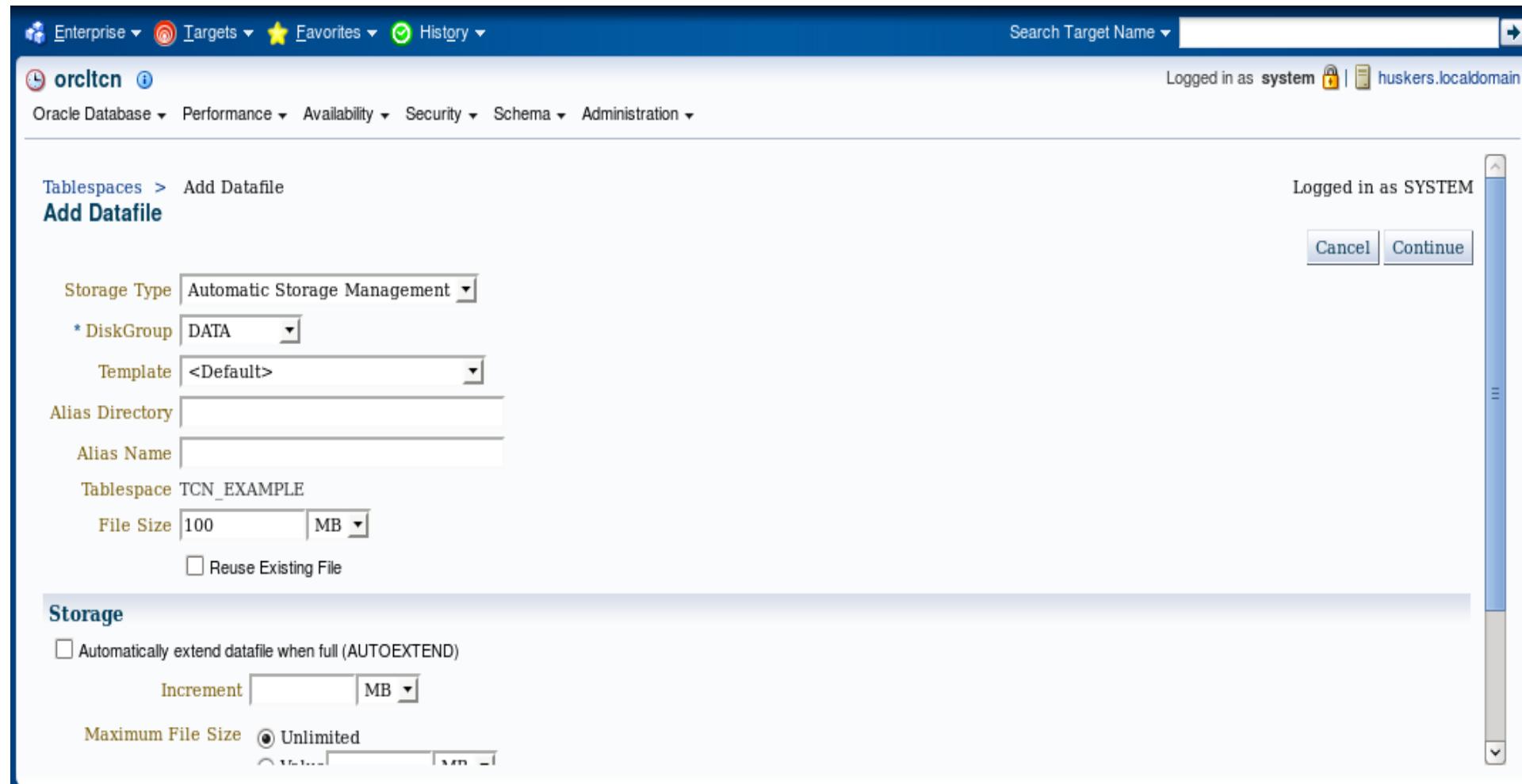
Use bigfile tablespace
Tablespace can have only one datafile with no practical size limit.

Select	Name	Directory	Size (MB)	Maximum File Size (MB)
	No items found			

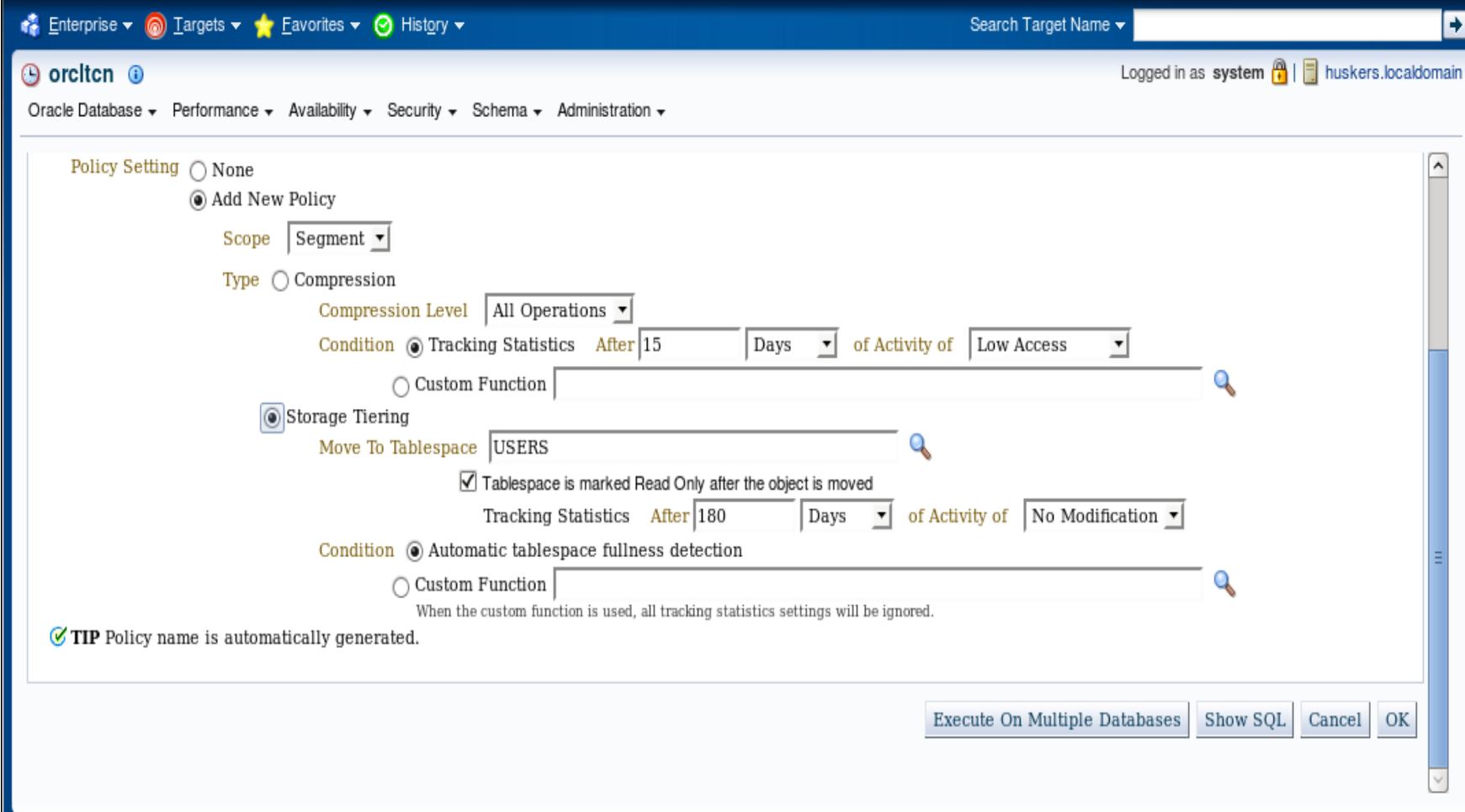
Add

Execute On Multiple Databases Show SQL Cancel OK

Oracle 19c Tuning Segment Space Utilization (ASSM)



Oracle 19c Tuning Segment Space Utilization (ASSM)



The screenshot shows the Oracle Database 19c Tuning Segment Space Utilization (ASSM) interface. The top navigation bar includes links for Enterprise, Targets, Favorites, History, and a search bar for 'Search Target Name'. The user is logged in as system@huskers.localdomain.

The main menu has options: Oracle Database, Performance, Availability, Security, Schema, and Administration.

The 'Policy Setting' section is active, showing:

- Policy Setting:** None (selected), Add New Policy
- Scope:** Segment
- Type:** Compression (selected)
- Compression Level:** All Operations
- Condition:** Tracking Statistics After 15 Days of Activity of Low Access
- Custom Function

The 'Storage Tiering' section is also visible:

- Move To Tablespace:** USERS
- Tablespace is marked Read Only after the object is moved
- Tracking Statistics:** After 180 Days of Activity of No Modification
- Condition:** Automatic tablespace fullness detection
- Custom Function

A note at the bottom states: "When the custom function is used, all tracking statistics settings will be ignored."

TIP: Policy name is automatically generated.

At the bottom right are buttons: Execute On Multiple Databases, Show SQL, Cancel, and OK.