

# Optimizing Oracle 18c Performance

## The Memoptimize Pool and Private Temporary Tables

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♠ Oracle ACE Director Alum

- Oracle Educator

🏛 Curriculum author and primary instructor, Oracle Program, University of Washington 1998-2009

אוניברסיטת הרווארד Consultant: Harvard University

- Guest lecturer at universities in Canada, Chile, Costa Rica, New Zealand, Norway, Panama
- Frequent lecturer at Oracle conferences ... 43 countries since 2008

- IT Professional

- 2019 will be my 50<sup>th</sup> year in IT
- First computer: IBM 360/40 in 1969: Fortran IV
- Oracle Database since 1988-9 and Oracle Beta tester
- The Morgan behind [www.morganslibrary.org](http://www.morganslibrary.org)
- Member Oracle Data Integration Solutions Partner Advisory Council
- Founding member International TidalScale User Community (ITUC)

**Morgan's Library**

International Oracle Events 2016-2017 Calendar

Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct

**The Library**

The library is a spam-free on-line resource with code demos for DBAs and Developers. If you would like to see new Oracle database functionality added to the library ... just email us. Oracle Database 12cR2 is now available in the Cloud. If you are not already working in a 12cR1 CDB database ... you are late to the party and you are losing your competitive edge.

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**Mad Dog Morgan**



**Training Events and Travels**

- OTN APAC, Sydney, Australia - Oct 31
- OTN APAC, Gold Coast, Australia - Nov 02
- OTN APAC, Beijing China - Nov 04-05
- OTN APAC, Shanghai China - Nov 06
- Sangam16, Bangalore, India - Nov 11-12
- NYOUG, New York City - Dec 07

**Next Event: Indiana Oracle Users Group**

**Morgan**



aboard USA-71

**ORACLE** ACE Director

**Library News**

- Morgan's Blog
- Morgan's Oracle Podcast
- US Govt. Mil. STIGs (Security Checklists)
- Bryn Llewellyn's PL/SQL White Paper
- Bryn Llewellyn's Editioning White Paper
- Explain Plan White Paper

**Oracle Events**



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**ACE News**

Would you like to become an Oracle ACE? 

Learn more about becoming an ACE



- ACE Directory
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## Performance Problems Have Serious Consequences . . .

- Internal and External customers have expectations
- There is a long history of disappointment
- Thus, we have Service Level Agreements

## When We Fail To Deliver . . .

- Internal customers develop their own solutions
- External customers go elsewhere
- SLA violations result in financial penalties
- Management wonders whether we are providing value

# Only 2 Things Matter In Business Computing . . .

## QoS

- Stability
- Security
- Scalability
- Usability
- Performance

## TCO

- Affordability

# The History of Oracle Performance Tuning . . .



# How Many Books Read?

# How Many Oracle Tools Deployed?

- DBMS\_SUPPORT (version 7.2)
- DBMS\_TRACE (version 8.1.5)
- DBMS\_MONITOR (version 10gR1)
- Oracle Enterprise Manager (OEM)
- StatsPack, ADDM, ASH, AWR, TKPROF, ....

```
ALTER SESSION SET tracefile_identifier = 'test_plan1';

ALTER SESSION SET EVENTS '10053 trace name context forever, level 1';

ALTER SESSION SET EVENTS '10046 trace name context forever, level 12';

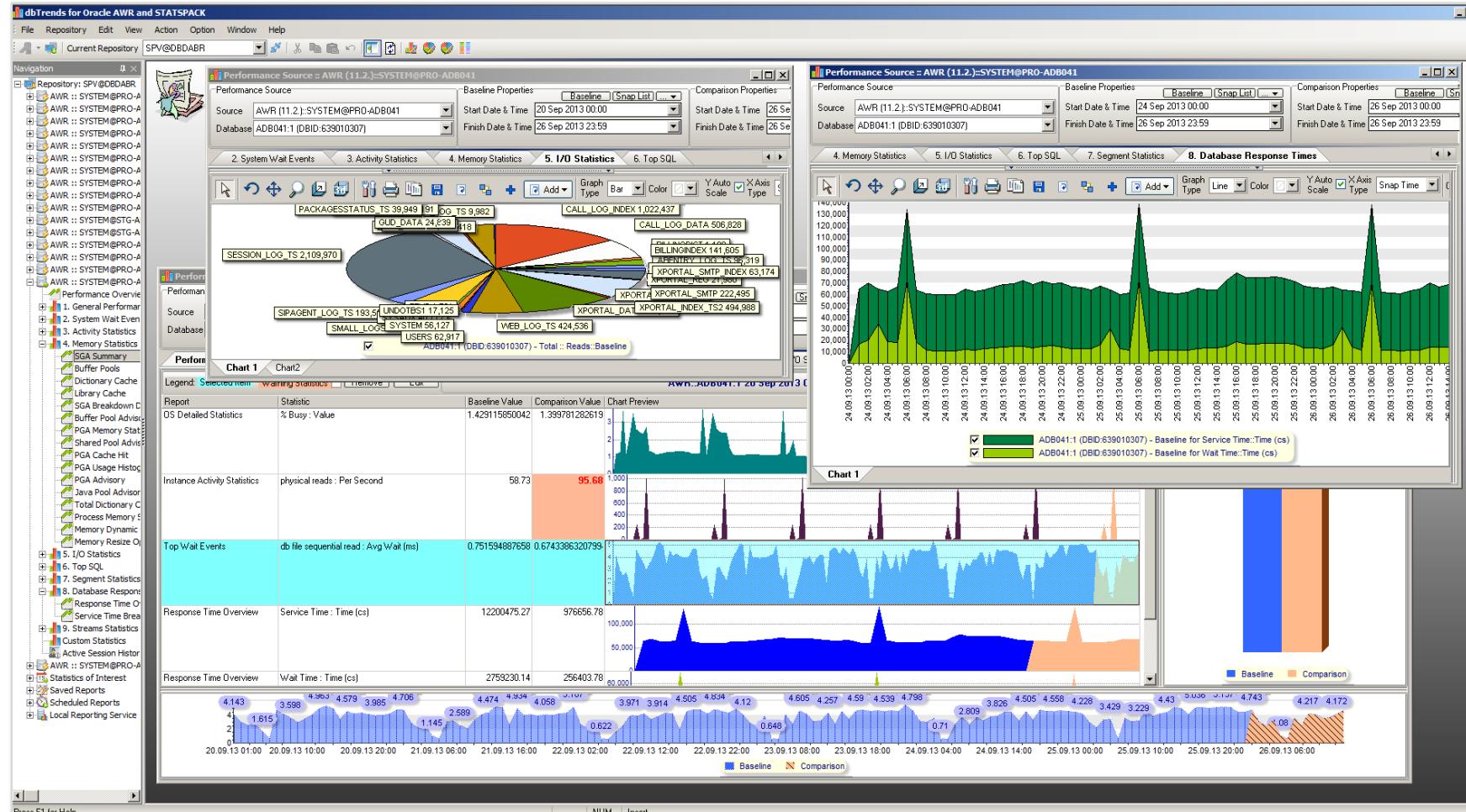
-- execute SQL

ALTER SESSION SET EVENTS '10053 trace name context OFF';
ALTER SESSION SET EVENTS '10046 trace name context OFF';
or
ALTER SESSION SET SQL_TRACE=FALSE;

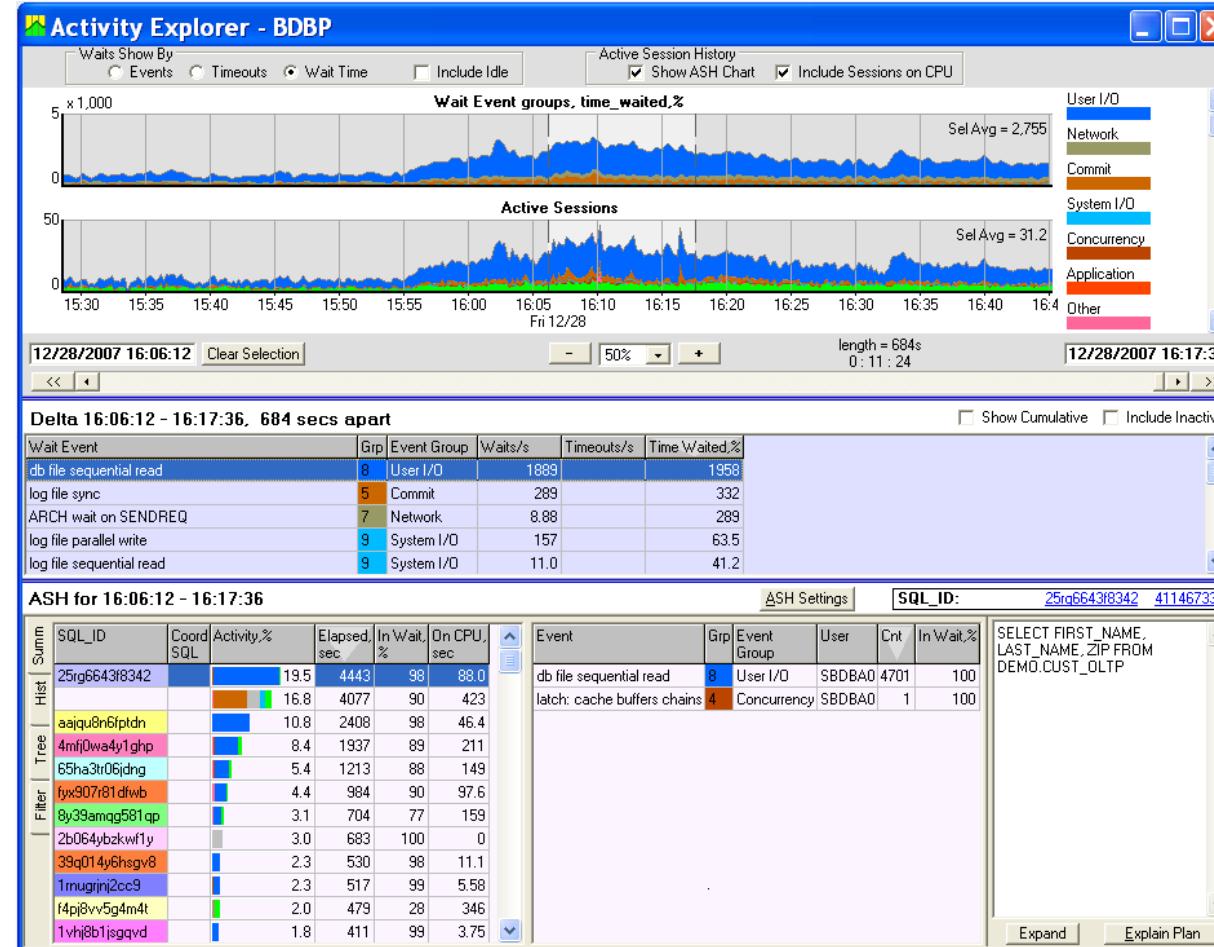
review the trace file in $ORACLE_BASE/diag/orabase/orabase/trace
```



# How Many Tools Have You Purchased?



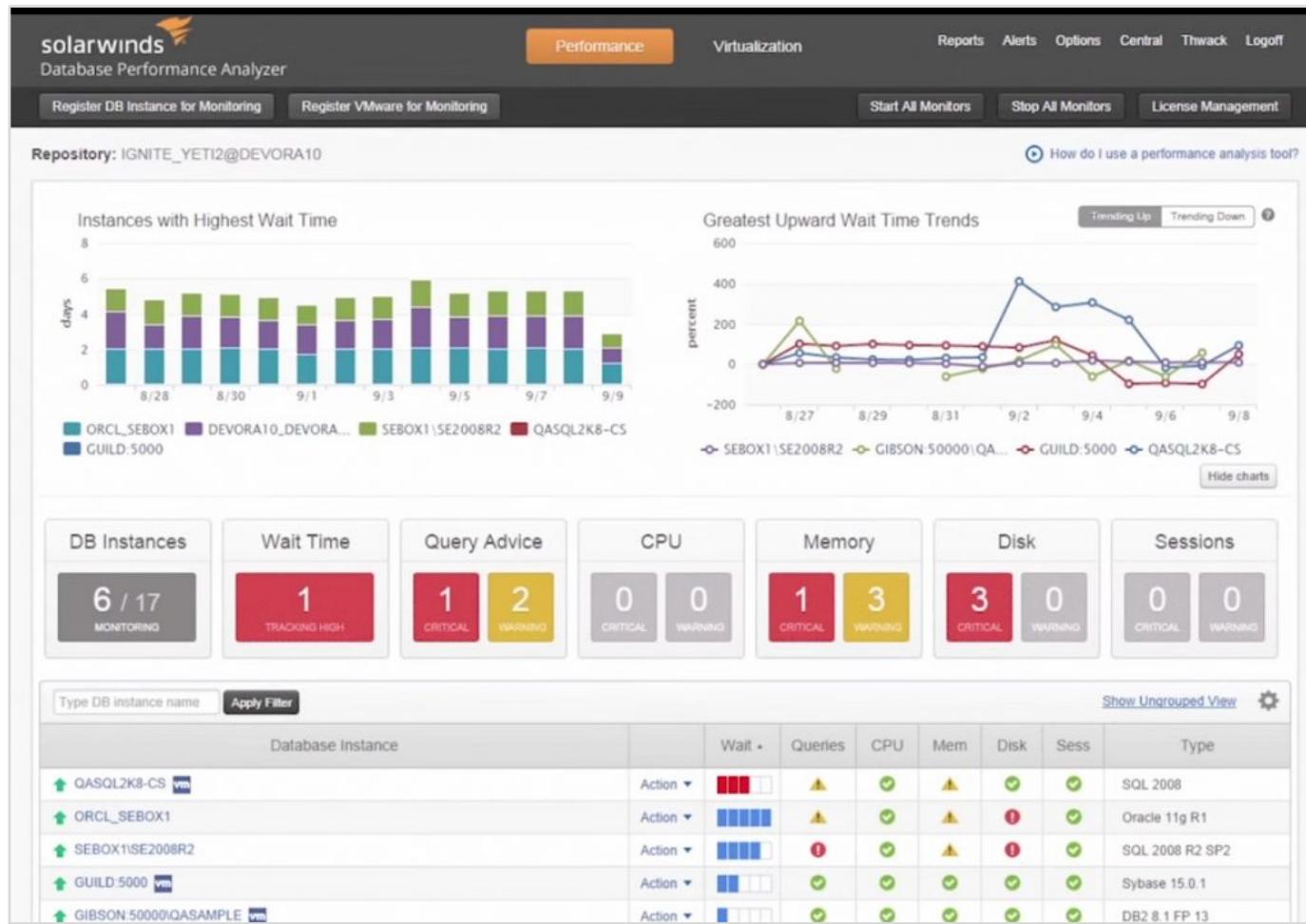
# How Many Tools Have You Purchased?



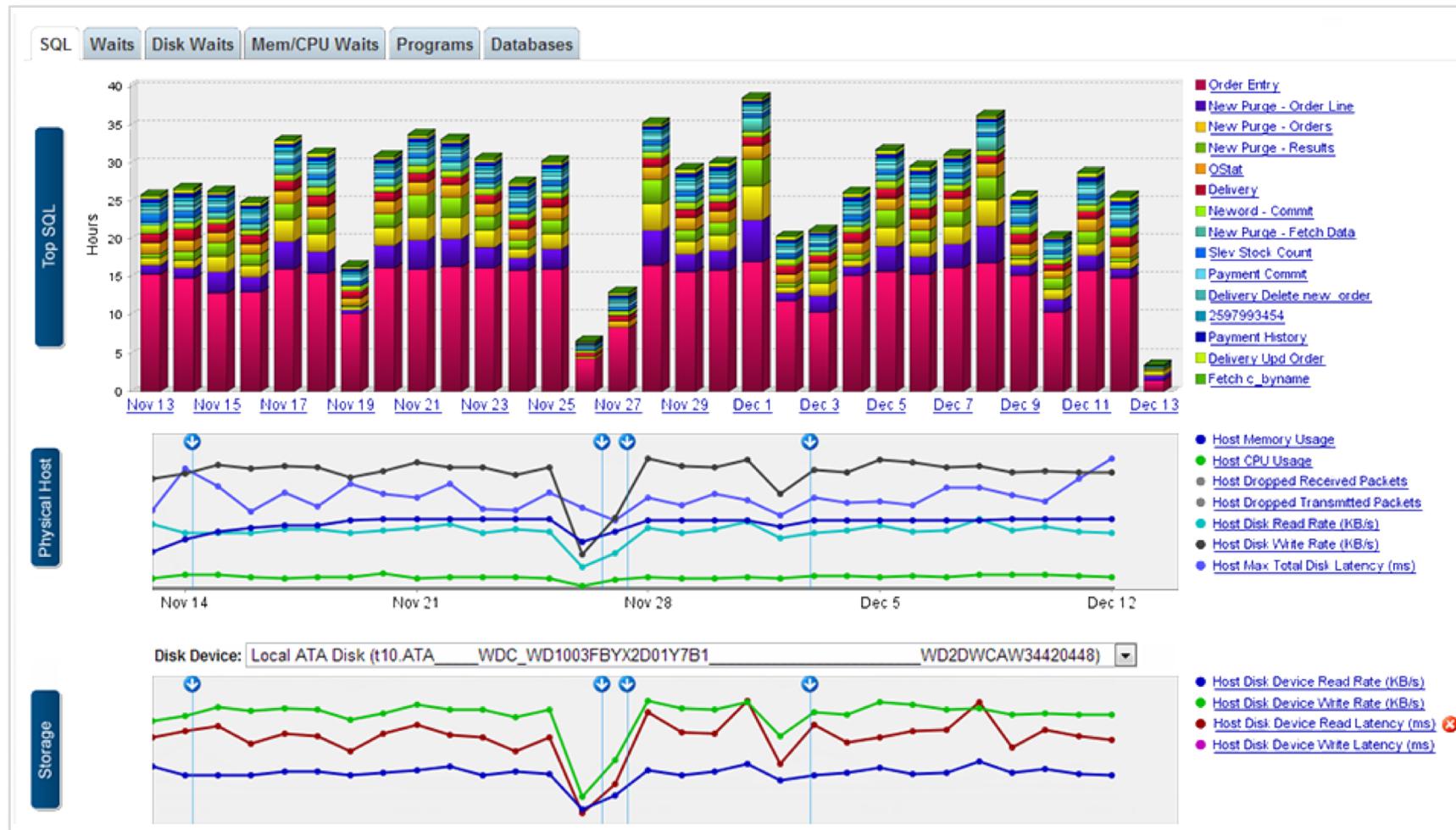
# How Many Tools Have You Purchased?



# How Many Tools Have You Purchased?



# How Many Tools Have You Purchased?



# How Many Startup Parameters Configured?

Initialization Parameter	Description
BITMAP_MERGE_AREA_SIZE	Specifies the amount of memory used to merge bitmaps retrieved from an index range scan
DB_BIG_TABLE_CACHE_PERCENT_TARGET	Specifies the cache section target size for automatic big table caching, as a percentage of the buffer cache
DB_nK_CACHE_SIZE	Holds 8K table and index blocks
CREATE_BITMAP_AREA_SIZE	Memory allocated for bitmap creation a larger value may speed up index creation
DB_BLOCK_BUFFERS	Specifies the number of database buffers in the buffer cache
DB_CACHE_SIZE	Specifies the size of the DEFAULT buffer pool for buffers with the primary block size
DB_FLASH_CACHE_SIZE	Specifies the size of the Database Smart Flash Cache
DB_KEEP_CACHE_SIZE	Specifies the size of the KEEP buffer pool
DB_RECYCLE_CACHE_SIZE	Specifies the size of the RECYCLE buffer pool
HASH_AREA_SIZE	Specifies the maximum amount of memory, in bytes, to be used for hash joins
JAVA_MAX_SESSIONSPACE_SIZE	Memory that holds Java state from one database call to another
JAVA_POOL_SIZE	Pool, from which the Java memory manager allocates most Java state during runtime execution
LARGE_POOL_SIZE	Specifies (in bytes) the size of the large pool allocation heap
LOG_BUFFER	Memory used when buffering redo entries to a redo log file
MEMOPTIMIZE_POOL_SIZE	Specifies the size of the memoptimize pool, a memory area in the SGA used by the Memoptimized Rowstore

Initialization Parameter	Description
MEMORY_MAX_TARGET	Specifies the maximum value to which a DBA can set the MEMORY_TARGET initialization parameter
MEMORY_TARGET	Specifies the Oracle system-wide usable memory
OBJECT_CACHE_MAX_SIZE_PERCENT	specifies the percentage of the optimal cache size that the session object cache can grow past the optimal size
OBJECT_CACHE_OPTIMAL_SIZE	Specifies the size by which the session object cache is reduced when the cache size exceeds the maximum size
OLAP_PAGE_POOL_SIZE	Specifies the size of the OLAP page pool
PGA_AGGREGATE_LIMIT	Specifies a limit on the aggregate PGA memory consumed by the instance
PGA_AGGREGATE_TARGET	Specifies the target aggregate PGA memory available to all server processes attached to the instance
PRE_PAGE_SGA	Specifies whether Oracle reads the entire SGA into memory at startup so that O/S page table entries are pre-built for the SGA
SGA_MAX_SIZE	Specifies the maximum size of the SGA for the lifetime of the instance
SGA_MIN_SIZE	Specifies the minimum size of the SGA for the lifetime of the instance
SGA_TARGET	Specifies the total size of all SGA components
SHARED_POOL_RESERVED_SIZE	Specifies the shared pool space reserved for large contiguous requests for shared pool memory
SHARED_POOL_SIZE	Specifies the size of the shared pool which contains shared cursors, stored procedures, control and other structures
SORT_AREA_RETAINED_SIZE	Specifies the maximum amount of the user global area (UGA) memory retained after a sort run completes
SORT_AREA_SIZE	Specifies the maximum amount of memory Oracle will use for a sort
STREAMS_POOL_SIZE	Specifies the memory allocated for Streams, GoldenGate Integrated Capture and other related processes
USE_LARGE_PAGES	Specify the management of the database's use of large pages for SGA memory

WORKLOAD REPOSITORY report for								
DB Name	DB Id	Unique Name	Role	Edition	Release	RAC	CDB	
ORCL	1499046141	orcl	PRIMARY	EE	12.2.0.1.0	NO	NO	
Instance Inst Num Startup Time								
oracle	1	25-Aug-18 16:08						
Host Name	Platform	CPUs	Cores	Sockets	Memory (GB)			
oracle7002	Linux x86 64-bit	36	36	36	1153.16			
Snap Id	Snap Time	Sessions	Cursors/Session					
Begin Snap:	2713	27-Aug-18 00:46:47	47		.8			
End Snap:	2714	27-Aug-18 00:58:57	103		.8			
Elapsed:		12.18 (mins)						
DB Time:		138.66 (mins)						
Report Summary								
Top ADDM Findings by Average Active Sessions								
Finding Name	Avg active sessions of the task	Percent active sessions of finding	Task Name	Begin Snap Time	End Snap Time			
Top SQL Statements	11.40	70.40	ADDM:1499046141_1_2714	27-Aug-18 00:46	27-Aug-18 00:58			
Undersized PGA	11.40	3.47	ADDM:1499046141_1_2714	27-Aug-18 00:46	27-Aug-18 00:58			
Undersized SGA	11.40	2.82	ADDM:1499046141_1_2714	27-Aug-18 00:46	27-Aug-18 00:58			
Unusual "Other" Wait Event	11.40	2.27	ADDM:1499046141_1_2714	27-Aug-18 00:46	27-Aug-18 00:58			

Memory Statistics		
	Begin	End
Host Mem (MB):	1,180,832.7	1,180,832.7
SGA use (MB):	972,800.0	972,800.0
PGA use (MB):	361.9	7,848.7
% Host Mem used for SGA+PGA:	82.41	83.05

Cache Sizes		
	Begin	End
Buffer Cache:	96,768M	96,768M Std Block Size: 8K
Shared Pool Size:	202,163M	202,149M Log Buffer: 495,048K
In-Memory Area:	665,600M	665,600M

Shared Pool Statistics		
	Begin	End
Memory Usage %:	3.57	3.66
% SQL with executions>1:	91.10	90.41
% Memory for SQL w/exec>1:	89.90	87.87

Foreground Wait Events						
Event	Waits	%Time-outs	Total Wait Time (s)	Avg wait	Waits /bn	% DB time
direct path write temp	25,156		286	11.37ms	613.56	3.44
PGA memory operation	191,325		189	99ms	4,666.46	2.27
library cache: mutex X	2,415		27	11.24ms	58.90	0.33

## Memoptimize Pool

- Caches data to optimizes read operations for key based SELECT statements from uncompressed heap tables created or altered with the MEMOPTIMIZE FOR READ clause
- When populated provides significant performance improvements with statements of the form

```
SELECT <column_name_list>
  FROM <table_name>
 WHERE <primary_key_column_name> = <value>;
```

which is pretty much every query ever written

- Manage the pool with the DBMS\_MEMOPTIMIZE built-in PL/SQL package

```
SSQL> exec dbms_memoptimize.populate('C##UWCLASS', 'SERVERS');

SQL> exec dbms_memoptimize.drop_object('C##UWCLASS', 'SERVERS');
```

# Memoptimize Pool

```
SQL> conn / as sysdba

SQL> show parameter memopt

NAME          TYPE        VALUE
-----
memoptimize_pool_size big integer      0

SQL> col value format 9999999999
SQL> SELECT * FROM v$sga;

NAME          VALUE        CON_ID
-----
Fixed Size    8907792      0
Variable Size 1040187392    0
Database Buffers 4429185024    0
Redo Buffers  74977280      0

SQL> ALTER SYSTEM SET memoptimize_pool_size = 1G sid='*' scope=SPFILE;

System altered.
```

# Memoptimize Pool

```
SQL> SHUTDOWN IMMEDIATE;
Database closed.
Database dismounted.
ORACLE instance shut down.

SQL> STARTUP;
ORACLE instance started.

Total System Global Area 5553257488 bytes
Fixed Size 8907792 bytes
Variable Size 2030043136 bytes
Database Buffers 3439329280 bytes
Redo Buffers 74977280 bytes
Database mounted.
Database opened.
```

# Memoptimize Pool

```
SQL> show parameter memopt
```

NAME	TYPE	VALUE
memoptimize_pool_size	big integer	1G

```
SQL> col value format 9999999999
```

```
SQL> SELECT * FROM v$sga;
```

NAME	VALUE	CON_ID
Fixed Size	8907792	0
Variable Size	1912602624	0
Database Buffers	3556769792	0
Redo Buffers	74977280	0

-- compare the yellow and green highlighted rows before and after enabling the memoptimize pool.

```
SQL> col component format a30
```

NAME	VALUE	CON_ID
Fixed Size	8907792	0
Variable Size	1040187392	0
Database Buffers	4429185024	0
Redo Buffers	74977280	0

## Private Temporary Tables

- First available in Oracle 18c
- A memory-based temporary table that is dropped at the end of the session or transaction
  - Global Temporary Tables (Temp Tablespace)
  - Private Temporary Tables (In-Memory)
  - SYS cannot create PTTs
- With Private Temporary Tables Oracle has a temporary table that behaves like those in products based on the UC Berkeley Ingres model

```
SQL> sho parameter private

NAME                           TYPE    VALUE
-----
private_temp_table_prefix      string  ORA$PTT_


SQL> CREATE PRIVATE TEMPORARY TABLE ora$ptt_ocdr(
  2  rid    NUMBER(10),
  3  rname  VARCHAR2(20))
  4  ON COMMIT PRESERVE DEFINITION;

SQL> SELECT table_name, tablespace_name
  2  FROM dba_private_temp_tables

TABLE_NA.      TABLESPACE_NAME
-----
ORA$PTT_OCDR   TEMP
```

## Wrap Up . . .

- Memory is 300X faster than flash
- The more of your data you can cache in memory the more your performance will improve due to reducing PIO and increasing LIO
- If you are running OLTP loads that will not benefit from Database In-Memory examine the advantage of
  - Using TidalScale Software Defined Servers to provide you with sufficient memory
  - Enable the Memoptimize Pool
  - Building your biggest tables at Private Temporary Tables reducing PIO
- TidalScale Software Defined Servers let you create an ideal environment with the cpu and memory customized to
  - Improve performance
  - Control your licensing cost

# Next Steps

**Contact me directly to**

- Answer questions about TidalScale Software Defined Servers
- Present TidalScale Software Defined Servers to your team
- Identify opportunities in your organization for Software Defined Servers



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