

What's New In Database 18c ...



You Won't Hear About From Oracle

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- No one from Oracle knows what I am going to say
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- Everything I present is existing, proven, functionality



Introduction



- Director of Applications @ TidalScale



Oracle ACE Director Alumni

- Oracle Educator



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

- Consultant: Harvard University
- Guest lecturer at universities in Canada, Chile, Costa Rica, New Zealand, Norway, Panama
- Frequent lecturer at Oracle conferences ... visiting 130 countries (41 different) since 2008


- IT Professional

- 2019 will be my 50th 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
- Member Oracle Data Integration Solutions Partner Advisory Council
- Founding member International TidalScale User Community (ITUC)



System/370-145 system console

www.morganslibrary.org



Morgan's Library

☒ www ☐ library

International Oracle Events 2016-2017 Calendar

NovDecJanFebMarAprMayJunJulAugSepOct

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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- 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


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- [Morgan's Blog](#)
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- [Bryn Llewellyn's PL/SQL White Paper](#)
- [Bryn Llewellyn's Editioning White Paper](#)
- [Explain Plan White Paper](#)



ACE News

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
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- Not VMs like VMware, not containers like Docker, LPARs and LDOMs ... literally software defined servers providing flexible provisioning of both cpu and memory ... visualize a software defined motherboard
- We solve both performance and cost issues with Oracle Database and enhance new memory-specific 12c and 18c capabilities and options
 - Full Database Caching (12c)
 - In-Memory Aggregation (12c)
 - In-Memory Column Store (12c)
 - Memoptimize Pool (18c)
 - Private Temporary Tables (18c)
- What we can do
 - Aggregate up to 64TB of DRAM
 - Using only the cpu cores on a single node
 - Dynamically reconfigure a server in minutes

Software Defined Servers: Google

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Artículos académicos para software defined servers
... : Experience with a globally-deployed **software defined** ... - [Jain](#) - Citado por 1494
... SDN? Implementation challenges for **software-defined** ... - [Sezer](#) - Citado por 684
Improving network management with **software defined** ... - [Kim](#) - Citado por 890

What Are Software-Defined Servers? Webopedia Definition
https://www.webopedia.com/TERM/.../software-defined_servers.h... ▾ Traducir esta página
Benefits of **Software Defined Servers**. **Software-defined servers** achieve these feats by sharing a variety of components, including cooling and networking and power supplies, as well as management **software** such as HP's Integrated Lights-Out **software** tools.

Why 2018 is the Year of the Software-Defined Server - TidalScale
<https://blog.tidalscale.com/2018-is-the-year-of-the-software-defined-server> ▾
17 ene. 2018 - A **Software-Defined Server** combines all the resources of multiple commodity **servers** into one or more virtual **servers**. Applications and operating systems need no modification, and they think they're looking at an actual single hardware system.

Software-Defined Servers Explained - TidalScale
<https://www.tidalscale.com/software-defined-servers> ▾
Software-defined future. Servers are the missing piece of the Software-Defined Data Center. Roll your own. How to build a **Software-Defined Server**.

[PDF] Software-Defined Servers - TidalScale
<https://www.tidalscale.com/hubfs/.../TidalScale-1-4RB0JXJ.pdf?t...> - Traducir esta página
A **Software-Defined Server** combines all the resources of multiple commodity **servers** into one virtual

Software Defined Servers: Baidu



The screenshot shows a Baidu search interface. At the top left is the Baidu logo. The search bar contains the text 'software defined servers'. To the right of the search bar is a camera icon and a blue button with the text '百度一下'. Below the search bar is a horizontal menu with links: '网页' (Web), '资讯' (News), '知道' (Know), '图片' (Images), '视频' (Videos), '贴吧' (Tieba), '文库' (Wenku), '地图' (Map), '音乐' (Music), and '更多»' (More). Below the menu, it says '百度为您找到相关结果约3,060,000个' and '搜索工具'. A filter option '您可以仅查看: 英文结果' is shown. The first search result is for 'Windows Server Software Defined Datacenter (WSSD) | Microsoft'. It includes a link to the Chinese translation, a description in English, and the URL 'www.microsoft.com/wssd'. The second search result is for 'TidalScale Software-Defined Servers', also with a link to the Chinese translation, an English description, and the URL 'https://www.tidalscale.com/'.

Baidu 百度

software defined servers

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您可以仅查看: [英文结果](#)

[Windows Server Software Defined Datacenter \(WSSD\) | Microsoft](#)

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www.microsoft.com/wssd - [百度快照](#)

[TidalScale Software-Defined Servers](#)

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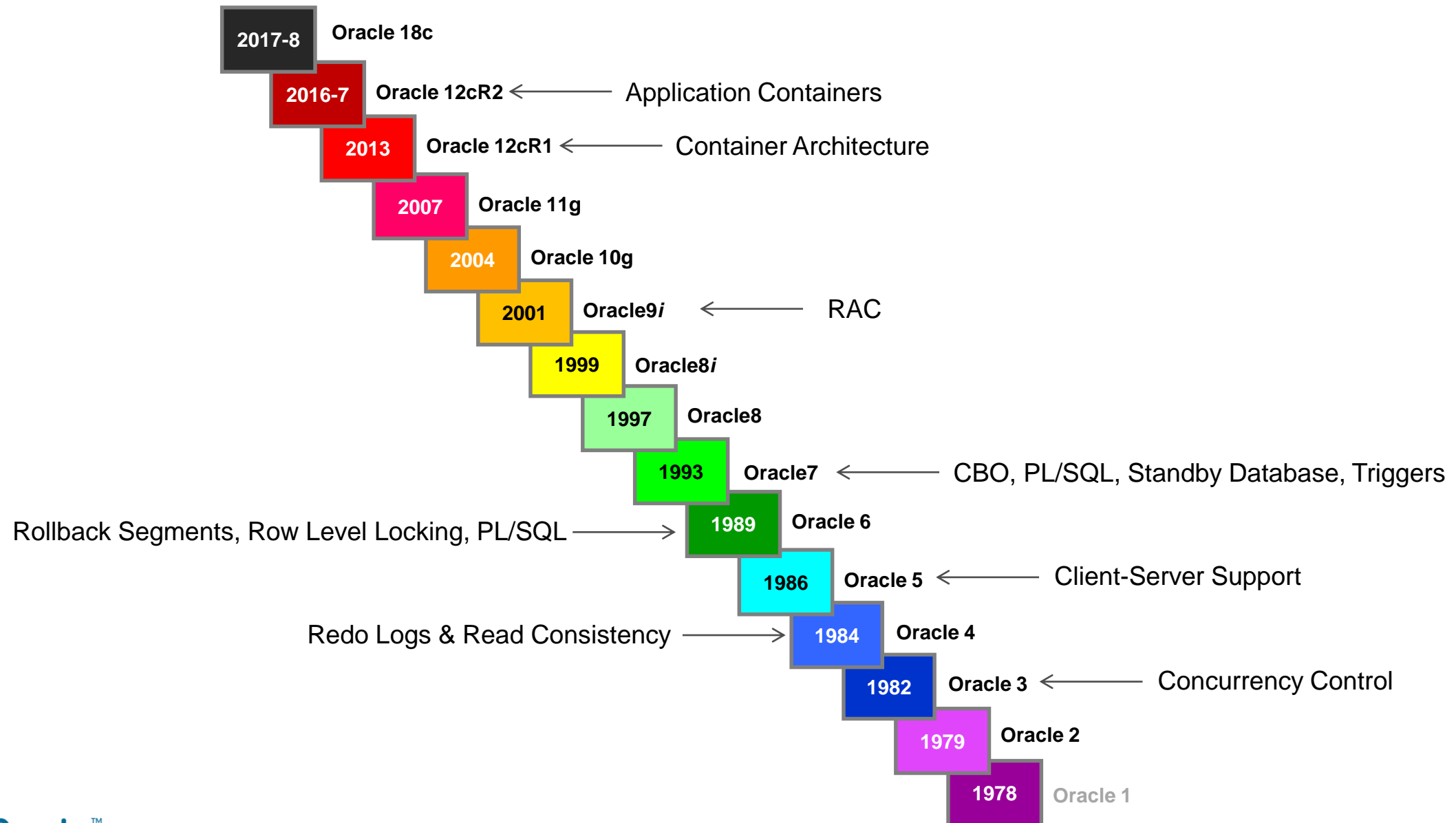
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TidalScale Software-Defined Servers
<https://www.tidalscale.com> ▼
TidalScale - Bring real flexibility to data centers by right-sizing servers on the fly.

What's New in 18c

A Brief History of the Oracle Database



Installation (1:2)

```
[opc@oem13c2-demo-db18c ~]$ sudo su - oracle
[oracle@oem13c2-demo-db18c ~]$ pwd
/home/oracle
[oracle@oem13c2-demo-db18c ~]$ ls -al
total 3372948
drwx----- 8 oracle oinstall      4096 May 15 01:00 .
drwxr-xr-x. 5 root   root          4096 May  1 16:24 ..
-rw-r--r--  1 oracle oinstall       181 May 14 23:10 afiedt.buf
-rw-----  1 oracle oinstall    13202 May 16 02:49 .bash_history
-rw-r--r--  1 oracle oinstall       18 Mar 22  2017 .bash_logout
-rw-r--r--  1 oracle oinstall       175 May  9 18:02 .bash_profile
-rw-r--r--  1 oracle oinstall      1383 May  9 19:42 .bashrc
-rw-r--r--  1 root   root          135 Mar 13 18:23 .bashrc2018-03-13_18:23:24
-rw-r--r--  1 root   root          207 Mar 13 18:24 .bashrc2018-03-13_18:24:49
-rw-r--r--  1 root   root          788 Mar 13 18:42 .bashrc2018-03-13_18:42:36
drwxr-xr-x  3 root   root          4096 Mar 13 18:33 bkup
drwxr-xr-x  7 root   root          4096 Jan 26  2017 database
-rw-r-----  1 oracle oinstall    26662 May 12 18:37 dbca_122_container.rsp
-rw-r-----  1 oracle oinstall    26577 May  8 16:50 dbca_noncontainer.rsp
-rw-r--r--  1 root   root          5500 Mar 13 18:44 dbsetup.out.2872
-rwxr-xr-x  1 oracle oinstall    14204 Jan 24 00:43 dbsetup.sh
-rw-r--r--  1 oracle oinstall     4657 May  6 00:29 initparams.txt
-rwxr-xr-x  1 root   root          2892 Jan 24 00:43 dinject-sshkeys.sh
-rw-r--r--  1 oracle oinstall       171 Nov 15 18:39 .kshrc
-rw-rw-r--  1 oracle oinstall 3453696911 May  9 16:15 linuxx64_12201_database.zip
drwxr-xr-x  4 oracle oinstall      4096 Jan  9 22:32 .mozilla
drwxr-xr-x  2 oracle oinstall      4096 May  9 18:15 .oracle_jre_usage
drwx-----  2 oracle oinstall      4096 Mar 13 18:19 .ssh
drwxr-xr-x  2 oracle oinstall      4096 Mar 13 18:19 tmp
-rw-----  1 oracle oinstall    10376 May 15 01:00 .viminfo
-rw-----  1 oracle oinstall        64 May 12 18:32 .Xauthority
```

```
[oracle@oem13c2-demo-db18c ~]$ cd database
[oracle@oem13c2-demo-db18c database]$ ls -al
total 44
drwxr-xr-x  7 root  root    4096 Jan 26  2017 .
drwx----- 8 oracle oinstall 4096 May 15 01:00 ..
drwxr-xr-x  4 root  root    4096 Jan 26  2017 install
drwxrwxr-x  2 root  root    4096 Jan 26  2017 response
drwxr-xr-x  2 root  root    4096 Jan 26  2017 rpm
-rwxr-xr-x  1 root  root   8771 Jan 26  2017 runInstaller
drwxrwxr-x  2 root  root    4096 Jan 26  2017 sshsetup
drwxr-xr-x 14 root  root    4096 Jan 26  2017 stage
-rwxr-xr-x  1 root  root     500 Feb  6  2013 welcome.html
[oracle@oem13c2-demo-db18c database]$
```

Read Only Oracle Home (1:4)

- This is one of the most important new Oracle 18c features and is a game changer with respect to how database software is installed
- It is something that was needed for decades for security and now has appeared to satisfy the requirements of the Oracle Cloud and Docker
- Docker containers are read-only ... so how can you deploy an Oracle Database in a Docker container if every ALTER SYSTEM that modifies the spfile is non-persistent?
 - Of course you can create symbolic links to the spfile, to sqlnet.ora, listener.ora, tnsnames.ora, the password file, etc.
 - But it is incredibly clumsy
- The Cloud also benefits from a read only home when looked at from the standpoint of Oracle wanting to make claims for security and high availability in the Oracle Cloud





**World's First
"Self-Driving"
Database**

**Oracle
Autonomous
Database**

**No Human Labor – Half the Cost
No Human Error – 100x More Reliable**

ORACLE


oracle.com/selfdrivingdb

Human labor refers to tuning, patching, upgrading, and maintenance of database.
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Read Only Oracle Home (3:4)

- \$ORACLE_HOME/bin
 - executable: roohctl

```
[oracle@oem13c2-demo-db18c bin]$ pwd
/u01/app/oracle/product/18.0.0/dbhome_1/bin
[oracle@oem13c2-demo-db18c bin]$ ls -al *ctl
-rwxr-x--x 1 oracle oinstall 234586 Mar 13 18:23 agtctl
-rwxr-x--x 1 oracle oinstall  1578 Feb  8 08:45 aqxmlctl
-rwxr-x--x 1 oracle oinstall 254444 Mar 13 18:24 wdrdactl
-rwxr-x--x 1 oracle oinstall 178299 Mar 13 18:24 lsnrctl
-rwxr-x-- 1 oracle oinstall  35759 Feb  7 18:55 mtactl
-rwxr-xr-x 1 oracle oinstall  33548 Nov 27 08:12 wolfscctl
-rwxr-xr-x 1 oracle oinstall  14558 Feb  8 08:45 onsctl
-rwxr-xr-x 1 oracle oinstall   5440 Nov 23 06:18 wrhpctl
-rwxr-x-- 1 oracle oinstall   4631 Feb  8 08:45 roohctl
-rwxr-xr-x 1 oracle oinstall  11460 Feb  8 08:45 srvctl
[oracle@oem13c2-demo-db18c bin]$
```



Read Only Oracle Home (4:4)

```
[oracle@oem13c2-demo-db18c bin]$ roohctl -help
Usage: roohctl [<flag>] [<command> <option>]
Following are the possible flags:
    -help

Following are the possible commands:
    -enable Enable Read-only Oracle Home
            [-nodeList List of nodes in a cluster environment]
```

- Now we have 4 different environment variables to improve our deployments
- ORACLE_BASE
 - Used to externalize the mutable files outside of the ORACLE_HOME directory structure
- ORACLE_HOME
 - The name provided when installing using OUI and DBCA ... findable in the Inventory
- ORACLEBASE_HOME
 - Mutable SQL*NET config, log and trace files and the /assistant DBCA templates
- ORACLEBASE_CONFIG
 - Mutable configuration files (.ora and .dat usually found in /dbs)

\$ORACLE_HOME/rdbms/admin/secconf.sql

- Creating an Oracle 12c or above database by upgrading an 10g or 11g database does not create the same result as a new install

```
Rem
Rem $Header: rdbms/admin/secconf.sql /main/19 2017/06/30 18:37:09 amunnoli Exp $
Rem
Rem secconf.sql
Rem
Rem Copyright (c) 2006, 2017, Oracle and/or its affiliates.
Rem All rights reserved.
Rem
Rem      NAME
Rem      secconf.sql - SECure CONFiguration script
Rem
Rem      DESCRIPTION
Rem      Secure configuration settings for the database include a reasonable
Rem      default password profile, password complexity checks, audit settings
Rem      (enabled, with admin actions audited), and as many revokes from PUBLIC
Rem      as possible. In the first phase, only the default password profile is
Rem      included.
Rem
Rem
Rem      NOTES
Rem      Only invoked for newly created databases, not for upgraded databases
```

\$ORACLE_HOME/rdbms/admin/secconf.sql

- Creating an Oracle 12c or above database by upgrading an 10g or 11g database does not create the same result as a new install

```
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Rem Copyright (c) 2006, 2017, Oracle and/or its affiliates.
Rem All rights reserved.
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Rem      as possible. In the first phase, only the default password profile is
Rem      included.
Rem
Rem
Rem      NOTES
Rem      Only invoked for newly created databases, not for upgraded databases
```

Users

New: 12cR2

APEX_050100
APEX_INSTANCE_ADMIN_USER
APEX_LISTENER
APEX_REST_PUBLIC_USER
DBJSON
DBSFUSER
GGSYS
HRREST
OBE
ORDS_METADATA
ORDS_PUBLIC_USER
REMOTE_SCHEDULER_AGENT
RESTFUL
SYS\$UMF
SYSRAC
XDBEXT
XDBPM
XFILES

Dropped:

SPATIAL_WFS_USR

New: 18c

None

Dropped:

SPATIAL_CSW_ADMIN_USR

Schema Only Accounts

- Schema only accounts
 - Do not have a password
 - Do not allow a login (direct connection)
 - Applications should NEVER have access to the schema owner account

```
CREATE USER <user_name>  
NO AUTHENTICATION  
DEFAULT TABLESPACE <data_tablespace_name>  
TEMPORARY TABLESPACE <temp_tablespace_name>  
QUOTA <value> ON <data_tablespace_name>  
PROFILE <profile_name>  
[ENABLE EDITIONS];
```

```
SQL> CREATE USER noauth  
2 NO AUTHENTICATION  
3 DEFAULT TABLESPACE uwdata  
4 TEMPORARY TABLESPACE temp  
5 QUOTA 20M ON uwdata  
6 PROFILE default  
7 ENABLE EDITIONS;
```

User created.

Roles

New: 18c

None

Dropped:

JAVA_DEPLOY
SPATIAL_CSW_ADMIN
XFILES_ADMINISTRATOR
XFILES_USER

New: 18c

READ ANY ANALYTIC VIEW CACHE
TEXT DATASTORE ACCESS
WRITE ANY ANALYTIC VIEW CACHE

Dropped:

EXEMPT DDL REDACTION POLICY
EXEMPT DML REDACTION POLICY

Initialization Parameters (1:3)

New: 18c

ADG_ACCOUNT_INFO_TRACKING
AWR_PDB_MAX_PARALLEL_SLAVES
DBFIPS_140
FORWARD_LISTENER
INMEMORY_AUTOMATIC_LEVEL
INMEMORY_OPTIMIZED_ARITHMETIC
INMEMORY_PREFER_XMEM_MEMCOMPRESS
INMEMORY_PREFER_XMEM_PRIORITY
INMEMORY_XMEM_SIZE
MEMOPTIMIZE_POOL_SIZE
MULTISHARD_QUERY_DATA_CONSISTENCY
MULTISHARD_QUERY_PARTIAL_RESULTS
OPTIMIZER_IGNORE_HINTS
OPTIMIZER_IGNORE_PARALLEL_HINTS
PARALLEL_MIN_DEGREE
PDB_TEMPLATE
PRIVATE_TEMP_TABLE_PREFIX
RESOURCE_MANAGER_CPU_ALLOCATION
STANDBY_PDB_SOURCE_FILE_DBLINK
STANDBY_PDB_SOURCE_FILE_DIRECTORY
TDE_CONFIGURATION
UNIFIED_AUDIT_SYSTEMLOG
WALLET_ROOT

Changed Values: 18c

DB_BLOCK_CHECKING

Desupported / Changed Values: 18c

DBA_REGISTERED_MVIEW_GROUPS

GLOBAL_CONTEXT_POOL_SIZE
MAX_ENABLED_ROLES
OPTIMIZER_ADAPTIVE_FEATURES
PARALLEL_AUTOMATIC_TUNING
PARALLEL_IO_CAP_ENABLED
PARALLEL_SERVER
PARALLEL_SERVER_INSTANCES
STANDBY_ARCHIVE_DEST
USE_INDIRECT_DATA_BUFFERS
UTL_FILE_DIR

Initialization Parameters (2:3)

- **ADG_ACCOUNT_INFO_TRACKING**
 - Controls login attempts of users on Active Data Guard Standby databases by extending the control of user account security information
- **AWR_PDB_MAX_PARALLEL_SLAVES**
 - Enables a DBA to allocate the correct amount of resources to enable quick and timely Automatic Workload Repository (AWR) flushes
- for multitenant container databases (CDBs).
- **DBFIPS_140**
 - Enables Transparent Data Encryption (TDE) and DBMS_CRYPTO PL/SQL package program units to run in a mode compliant to the Federal Information Processing Standard (known as "FIPS mode")
- **FORWARD_LISTENER**
 - Specifies the name of a listener to which a connection must be forwarded by an existing set of remote listeners
- **MEMOPTIMIZE_POOL_SIZE**
 - Sets the size of the Memoptimized Rowstore in the SGA

Initialization Parameters (3:3)

- **OPTIMIZER_IGNORE_HINTS**
 - Causes the optimizer to ignore all hints ... this should be the default setting in most databases
- **OPTIMIZER_IGNORE_PARALLEL_HINTS**
 - Causes the optimizer to ignore all parallel hints ... this should be the default setting in all databases
- **PRIVATE_TEMP_TABLE_PREFIX**
 - Specifies the prefix that the database uses for private temporary tables
- **TDE_CONFIGURATION**
 - Used for per-PDB configuration for Transparent Data Encryption (TDE)
 - Before 18c, each PDB stored their separate encryption keys in the CDB's keystore (united mode)
 - Starting with Oracle Database 18c, a PDB can optionally store its encryption keys in a separate keystore (isolation mode) allowing protection by a separate keystore password
 - The WALLET_ROOT initialization parameter must be set for TDE_CONFIGURATION to take effect

Dropped Built-In PL/SQL Packages

- All of Streams Change Data Capture (CDC)
 - DBMS_CDC_EXPDP
 - DBMS_CDC_EXPVDP
 - DBMS_CDC_IMPDP
 - DBMS_CDC_IMPDPV
 - DBMS_CDC_IPUBLISH
 - DBMS_CDC_ISUBSCRIBE
 - DBMS_CDC_PUBLISH
 - DBMS_CDC_SUBSCRIBE
 - DBMS_CDC_SYS_IPUBLISH
 - DBMS_CDC_DPUTIL
 - DBMS_CDC_UTILITY
 - DBMS_FEATURE_CDC
- DBMS_XMLQUERY
- DBMS_XMLSAVE
- Oracle Multimedia and DICOM

Temporary Tables (1:3)

- Global Temporary Tables are persistent tables defined in the data dictionary but created in the temporary tablespace

```
CREATE GLOBAL TEMPORARY TABLE gtt_zip (  
  zip_code      VARCHAR2(5),  
  by_user       VARCHAR2(30),  
  entry_date    DATE)  
ON COMMIT DELETE ROWS;
```

```
CREATE GLOBAL TEMPORARY TABLE gtt_zip3 (  
  zip_code      VARCHAR2(5),  
  by_user       VARCHAR2(30),  
  entry_date    DATE)  
ON COMMIT PRESERVE ROWS;
```

- Private Temporary Tables have similar characteristics but are created in memory

```
CREATE PRIVATE TEMPORARY TABLE ora$ptt_ocdr(  
  rid  NUMBER(10),  
  rname VARCHAR2(20))  
ON COMMIT PRESERVE DEFINITION  
ON COMMIT DELETE ROWS AS  
SELECT * FROM servers;
```

```
CREATE PRIVATE TEMPORARY TABLE uwclass.ora$ptt_ocpr(  
  ON COMMIT DROP DEFINITION  
  ON COMMIT PRESERVE ROWS AS  
  SELECT * FROM uwclass.servers;
```

- Included in your existing license
- If your database is memory starved you will have no way to utilize this feature

Temporary Tables (2:3)

- The Oracle docs are incomplete about PTTs so keep the following in mind when use them
 - A PTT's name must be prefixed with the parameter string value for "private_temp_table_prefix". If you don't like the Oracle Corp default, and I don't (too many bytes) change it

```
SQL> show parameter private
```

NAME	TYPE	VALUE
private_temp_table_prefix	string	ORA\$PTT_

- You cannot create a PTT as SYS and possibly with other privileged accounts. If you try to do so the error message you get will be misleading: Ignore it and move to a non-privileged schema

```
SQL> sho user
USER is "SYS"

SQL> CREATE PRIVATE TEMPORARY TABLE ora$ptt_msg_fail
2  ON COMMIT PRESERVE DEFINITION
3  ON COMMIT DELETE ROWS AS
4* SELECT * FROM user_objects;
ON COMMIT DELETE ROWS AS
*
ERROR at line 3:
ORA-00922: missing or invalid option
```


Temporary Tables (3:3)

- All DDL contains 2 implicit commits
- If you create a Temporary Table with `ON COMMIT DELETE ROWS ...` any DDL will empty the temporary table(s)

■ APPROX_COUNT

- Returns the approximate count of an expression. With MAX_ERROR the function returns the maximum error between the actual and approximate count

```
APPROX_COUNT(<expression> [, 'MAX_ERROR']) RETURN NUMBER;  
  
SELECT department_id, job_id, APPROX_COUNT(*)  
FROM employees  
GROUP BY department_id, job_id  
HAVING APPROX_RANK (PARTITION BY department_id  
ORDER BY APPROX_COUNT(*) DESC) <= 10;
```

■ APPROX_RANK

- Returns the approximate rank from an optional PARTITION BY clause followed by a mandatory ORDER BY ... DESC clause. The PARTITION BY key must be a subset of the GROUP BY key. The ORDER BY clause must include either APPROX_COUNT or APPROX_SUM

```
APPROX_MEDIAN(<expression> [PARTITION BY <partition_by_clause> [ORDER BY <order_by_clause> DESC])  
  
SELECT department_id, job_id, APPROX_COUNT(*)  
FROM employees  
GROUP BY department_id, job_id  
HAVING APPROX_RANK (PARTITION BY department_id ORDER BY APPROX_COUNT(*) DESC) <= 10;
```

■ APPROX_SUM

- Returns the approximate sum of an expression. If you supply MAX_ERROR as the second argument, then the function returns the maximum error between the actual and approximate sum. You must use this function with a corresponding APPROX_RANK function in the HAVING clause. If a query uses APPROX_COUNT, APPROX_SUM, or APPROX_RANK, then the query must not use any other aggregation functions

```
APPROX_COUNT(<expression> [, 'MAX_ERROR']) RETURN NUMBER;  
  
SELECT department_id, job_id, APPROX_SUM(salary)  
FROM employees  
GROUP BY department_id, job_id  
HAVING APPROX_RANK (PARTITION BY department_id  
ORDER BY APPROX_SUM(salary) DESC) <= 10;
```

■ ROUND_TIED_TO_EVEN

- Returns n rounded to integer places according to the following rules:
 - If integer is positive, n is rounded to integer places to the right of the decimal point
 - If integer is not specified, then n is rounded to 0 places
 - If integer is negative, then n is rounded to integer places to the left of the decimal point

```
ROUND_TIES_TO_EVEN(n [, INTEGER DESC])
```

```
SQL> SELECT round_ties_to_even(0.05, 1) "ROUND_EVEN"  
2 FROM dual;
```

```
ROUND_EVEN  
-----  
0
```

```
SQL> SELECT round_ties_to_even(41.572,-1) "ROUND_EVEN"  
2 FROM dual;
```

```
ROUND_EVEN  
-----  
40
```

```
SQL> SELECT round_ties_to_even(41.572,1) "ROUND_EVEN"  
2 FROM dual;
```

```
ROUND_EVEN  
-----  
41.6
```

```
SQL> SELECT round_ties_to_even(41.572,2) "ROUND_EVEN"  
2 FROM dual;
```

```
ROUND_EVEN  
-----  
41.57
```

Polymorphic Table Functions (1:4)

- PTFs are a new type of table function, a function that returns a collection of rows, whose return type is determined by the arguments passed into the PTF
- The new PTFs provides an efficient and scalable framework to extend the analytical capabilities of the Oracle Database
- A query writer is able to call these functions without knowing the details of the implementation and the PTF doesn't need to know about the details or how the function is being executed or whether the input rows are partitioned or ordered
- PTFs are useful when SQL developers and database administrators want to provide generic extensions which work for arbitrary input tables or queries
- Making possible queries like this producing JSON as output

```
SELECT * FROM to_doc(scott.dept)

{"DEPTNO":10, "DNAME":"ACCOUNTING", "LOC":"NEW YORK"}
{"DEPTNO":20, "DNAME":"RESEARCH", "LOC":"DALLAS"}
{"DEPTNO":30, "DNAME":"SALES", "LOC":"CHICAGO"}
{"DEPTNO":40, "DNAME":"OPERATIONS", "LOC":"BOSTON"}
```


Polymorphic Table Functions (2:4)

- The DBMS_TF package was initially released in version 12.2 and is now extended with new capabilities in 18c
 - Contains types, constants, and subprograms that can be used by PTFs
 - Provides server and client services to get rows from the database and send back new rows

12.2

```
GET_COL  
GET_ENV  
GET_XID  
GET_ROW_SET  
PUT_COL  
PUT_ROW_SET  
SUPPORTED_TYPE  
TRACE
```

18c

```
COLUMN_TYPE_NAME  
COL_TO_CHAR  
CSTORE_EXISTS  
CSTORE_GET  
ROW_REPLICATION  
ROW_TO_CHAR  
XSTORE_CLEAR  
XSTORE_EXISTS  
XSTORE_GET  
XSTORE_REMOVE  
XSTORE_SET
```

Polymorphic Table Functions (3:4)

■ Examples from the web of DBMS_TF usage

```
CREATE PACKAGE to_doc_p AS
  FUNCTION desc(tab IN OUT dbms_tf.table_t,cols IN dbms_tf.columns_t DEFAULT NULL) RETURN dbms_tf.describe_t;
END to_doc_p;
```

```
CREATE PACKAGE BODY to_doc_p AS
  FUNCTION desc(tab IN OUT dbms_tf.table_t,cols IN dbms_tf.columns_t DEFAULT NULL) RETURN dbms_tf.describe_t AS
  BEGIN
    FOR i IN 1 .. tab.column.COUNT LOOP
      CONTINUE WHEN NOT DBMS_TF.supported_type(tab.column(i).description.TYPE);
      IF cols IS NULL THEN
        tab.column(i).for_read := TRUE;
        tab.column(i).pass_through := FALSE;
        CONTINUE;
      END IF;
      FOR j IN 1 .. cols.COUNT LOOP
        IF (tab.column(i).description.name = cols(j)) THEN
          tab.column(i).for_read := TRUE;
          tab.column(i).pass_through := FALSE;
        END IF;
      END LOOP;
    END LOOP;
    RETURN dbms_tf.describe_t(new_columns => dbms_tf.columns_new_t(1 =>
      dbms_tf.column_metadata_t(name => 'DOCUMENT')));
  END;
END;
```

Polymorphic Table Functions (4:4)

- Examples from the web of DBMS_TF usage

```
dbms_tf.get_col(  
  ColumnId   IN          NUMBER,  
  Collection IN OUT NOCOPY "<V2_TABLE_1>");  
pragma interface(c, Get_Col);
```

```
CREATE OR REPLACE PROCEDURE fetch_rows AUTHID CURRENT_USER IS  
  col1 dbms_tf.tab_clob_t;  
  col2 dbms_tf.tab_colb_t;  
  out1 dbms_tf.tab_clob_t;  
  out2 dbms_tf.tab_clob_t;  
BEGIN  
  dbms_tf.get_col(1, col1);  
  dbms_tf.get_col(2, col2);  
  
  FOR i IN 1 .. col1.COUNT LOOP  
    out1(i) := 'ECHO-' || col1(i);  
  END LOOP;  
  
  FOR i IN 1 .. col2.COUNT LOOP  
    out2(i) := 'ECHO-' || col2(i);  
  END LOOP;  
  
  dbms_tf.put_col(1, out1);  
  dbms_tf.put_col(2, out2);  
END fetch_rows;  
/
```

SYS_CONTEXT (1:2)

- SYS_CONTEXT is a function that returns information about the environment in which an operation is running
- Here are some examples from earlier versions of SYS_CONTEXT

```
SELECT sys_context('USERENV', 'AUTHENTICATION_METHOD') FROM dual;
```

```
SYS_CONTEXT('USERENV', 'AUTHENTICATION_METHOD')
-----
PASSWORD
```

```
SELECT sys_context('USERENV', 'IS_DG_ROLLING_UPGRADE')
FROM dual;
```

```
SYS_CONTEXT('USERENV', 'IS_DG_ROLLING_UPGRADE')
-----
FALSE
```

```
SELECT sys_context('USERENV', 'ORACLE_HOME')
FROM dual;
```

```
SYS_CONTEXT('USERENV', 'ORACLE_HOME')
-----
/u01/app/oracle/product/18.1.0\dbhome_1
```

SYS_CONTEXT (2:2)

- In 18c LDAP_SERVER_TYPE returns the configured LDAP server type, one of OID, AD (Active Directory), OID_G, or OPENLDAP

```
SQL> SELECT sys_context('USERENV', 'LDAP_SERVER_TYPE') FROM dual;
```

```
SYS_CONTEXT('USERENV', 'IS_DG_ROLLING_UPGRADE')
```

```
-----
```

```
OID
```


18c Feature Usage Procs

- DBMS_FEATURE_VPD
 - Collects metadata about the use of Virtual Private Database (DBMS_RLS)

```
dbms_feature_vpd(  
feature_boolean OUT NUMBER,  
aux_count      OUT NUMBER,  
feature_info    OUT CLOB);
```

```
set serveroutput on
```

```
DECLARE
```

```
  i NUMBER;
```

```
  j NUMBER;
```

```
  k CLOB;
```

```
BEGIN
```

```
  dbms_feature_vpd(i, j, k);
```

```
  dbms_output.put_line('1: ' || i);
```

```
  dbms_output.put_line('2: ' || j);
```

```
  dbms_output.put_line('3: ' || k);
```

```
END;
```

```
/
```

```
1: 0
```

```
2: 0
```

```
3: Number of policies=0, Number of enabled policies=0, Number of objects that have VPD policies=0, Number  
of policies on SELECT statement=0, Number of policies on INSERT statement=0, Number of policies on UPDATE  
statement=0, Number of policies on DELETE statement=0, Number of policies on INDEX statement=0, Number of  
DYNAMIC policies=0, Number of STATIC policies=0, Number of SHARED_STATIC policies=0, Number of  
CONTEXT_SENSITIVE policies=0, Number of SHARED_CONTEXT_SENSITIVE policies=0, Number of attribute associated  
CONTEXT_SENSITIVE policies=0, Number of policies with long predicate=0, Number of COLUMN LEVEL policies=0,  
Number of COMMON policies=0, Number of INHERITED policies=0
```

New Built-In Packages

- DBMS_AWR_PROTECTED
- DBMS_ISCHEDFW
- DBMS_ISCHED_AGENT
- DBMS_ISCHED_UTL
- DBMS_MEMOPTIMIZE
- DBMS_PDB_APP_CON
- DBMS_SODA
- DBMS_SQLSET
- DBMS_STATS_INTERNAL_AGG
- DBMS_WORKLOAD_CAPTURE_I
- DBMS_WORKLOAD_REPLAY_I
- DBMS_WRR_REPORT
- DBMS_XDS_INT

DBMS_MEMOPTIMIZE

- Provides an interface for managing data in the memoptimize pool which is an SGA cache that stores table data and hash index related to the Memoptimized Rowstore
- The package provides the following functionality
 - DROP_OBJECT
 - Removes a table's in-memory hash index

```
dbms_memoptimize.drop_object(  
  schema_name      IN VARCHAR2,  
  table_name       IN VARCHAR2,  
  partition_name   IN VARCHAR2 DEFAULT NULL);
```

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

- POPULATE
 - Populates a table's in-memory hash index

```
dbms_memoptimize.populate(  
  schema_name      IN VARCHAR2,  
  table_name       IN VARCHAR2,  
  partition_name   IN VARCHAR2 DEFAULT NULL);
```

```
SQL> exec dbms_memoptimize.populate('UWCLASS', 'SERVERS');
```

Memoptimize Pool: Memory Matters (1:2)

- Activating and resizing the memoptimize pool

```
SQL> conn / as sysdba

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

System altered.

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: Memory Matters (2:2)

- Space is transferred from Database Buffers to Variable Size

Before giving space to the memoptimize pool

```
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

After giving space to the 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

- Included in your existing license
- If your database is memory starved you will have no way to utilize this feature

DBMS_SODA

- A PL/SQL package implementing Simple Oracle Document Access (SODA)
- SODA allows use of the Oracle Database as a NoSQL document store
- The core abstraction provided by SODA is that of document collections
- The DBMS_SODA package allows developers to create, list, and delete document collections with PL/SQL, and to perform CRUD (create, replace, update, delete) operations on documents
- All DDL functions are encapsulated within this package
- The package contains the following objects
 - CREATE_COLLECTION
 - DROP_COLLECTION
 - LIST_COLLECTION_NAMES
 - OPEN_COLLECTION

- The DBMS_SQLSET package provides a new an interface for managing SQL tuning sets
- It provides the same subprograms, although in some cases with slightly different names, as the SQL tuning set subprograms in DBMS_SQLTUNE
- The important difference is that use of DBMS_SQLSET **does not require the Oracle Tuning Pack license**
- Execute is granted to PUBLIC
 - Which I recommend you **revoke** unless you can come up with valid a justification why a user with no privilege other than CREATE SESSION has a need to tune SQL Sets

```
SQL> REVOKE EXECUTE ON DBMS_SQLSET FROM PUBLIC;
```

Oracle ... this is an example of security irresponsibility like granting SELECT on ALL_SOURCE to PUBLIC ... please stop compromising the integrity of your products

■ ADD_REFERENCE

- Adds a new reference to an existing SQL tuning set to indicate its use by a client

```
dbms_sqlset.add_reference(  
  sqlset_name  IN VARCHAR2,  
  description  IN VARCHAR2 := NULL,  
  sqlset_owner IN VARCHAR2 := NULL)  
RETURN NUMBER;
```

```
DECLARE  
  retVal NUMBER;  
BEGIN  
  retVal := dbms_sqlset.add_reference('UW_SQLSET', 'Test Add Ref');  
  dbms_output.put_line(retVal);  
END;  
/
```

■ CAPTURE_CURSOR_CACHE

- Polls the cache multiple times over a time period, and updates the workload data stored there. It can execute over as long a period as required to capture an entire system workload

```
dbms_sqlset.capture_cursor_cache(  
  sqlset_name      IN VARCHAR2,  
  time_limit       IN POSITIVE := 1800,  
  repeat_interval  IN POSITIVE := 300,  
  capture_option   IN VARCHAR2 := 'MERGE',  
  capture_mode     IN NUMBER    := MODE_REPLACE_OLD_STATS,  
  basic_filter     IN VARCHAR2 := NULL,  
  sqlset_owner     IN VARCHAR2 := NULL,  
  recursive_sql    IN VARCHAR2 := HAS_RECURSIVE_SQL);
```

```
DECLARE  
  retVal NUMBER;  
BEGIN  
  retVal := dbms_sqlset.add_reference('UW_SQLSET', 'Test Add Ref');  
  dbms_output.put_line(retVal);  
END;  
/
```

- CREATE_SQLSET
 - Creates a SQL tuning set object in the database
 - Overload 1

```
dbms_sqlset.create_sqlset(  
  sqlset_name  IN VARCHAR2,  
  description  IN VARCHAR2 := NULL,  
  sqlset_owner IN VARCHAR2 := NULL);
```

```
SQL> exec dbms_sqlset.create_sqlset('UW_SQLSET', 'MLib workload');
```

- Overload 2

```
dbms_sqlset.create_sqlset(  
  sqlset_name  IN VARCHAR2 := NULL,  
  description  IN VARCHAR2 := NULL,  
  sqlset_owner IN VARCHAR2 := NULL)  
RETURN VARCHAR2;
```

```
DECLARE  
  retVal VARCHAR2(60);  
BEGIN  
  retVal := dbms_sqlset.create_sqlset('UW_SQLSET', 'MLib workload', 'UWCLASS');  
  dbms_output.put_line(retVal);  
END;  
/
```

■ CREATE_STGTAB

- Creates a staging table through which SQL tuning sets are imported and exported

```
dbms_sqlset.create_stgtab(  
  table_name      IN VARCHAR2,  
  schema_name     IN VARCHAR2 := NULL,  
  tablespace_name IN VARCHAR2 := NULL,  
  db_version      IN NUMBER   := NULL);
```

```
SQL> exec dbms_sqlset.create_stgtab('SQLSET_TAB', 'UWCLASS', 'UWDATA',  
dbms_sqlset.sts_stgtab_18_1_version);
```

■ DELETE_SQLSET

- Deletes a set of SQL statements from a SQL tuning set

```
dbms_sqlset.delete_sqlset(  
  sqlset_name IN VARCHAR2,  
  basic_filter IN VARCHAR2 := NULL,  
  sqlset_owner IN VARCHAR2 := NULL);
```

```
SQL> exec dbms_sqlset.delete_sqlset('UW_SQLSET', 'elapsed_time < 250000', 'UWCLASS');
```

- DROP_SQLSET
 - Drops a SQL tuning set if it is not active

```
dbms_sqlset.drop_sqlset(  
  sqlset_name  IN VARCHAR2,  
  sqlset_owner IN VARCHAR2 := NULL);
```

```
exec dbms_sqlset.drop_sqlset('UW_SQLSET', 'UWCLASS');
```


- **LOAD_SQLSET**
 - Populates the sqlset with a set of selected SQL

```
dbms_sqlset.load_sqlset(  
  sqlset_name      IN VARCHAR2,  
  populate_cursor  IN sqlset_cursor,  
  load_option      IN VARCHAR2 := 'INSERT',  
  update_option    IN VARCHAR2 := 'REPLACE',  
  update_condition IN VARCHAR2 := NULL,  
  update_attributes IN VARCHAR2 := NULL,  
  ignore_null      IN BOOLEAN  := TRUE,  
  commit_rows      IN POSITIVE := NULL,  
  sqlset_owner     IN VARCHAR2 := NULL);
```

```
DECLARE  
  l_cursor dbms_sqltune.sqlset_cursor;  
BEGIN  
  OPEN l_cursor FOR  
  SELECT VALUE(p)  
  FROM TABLE(dbms_sqltune.select_workload_repository (  
    765,      -- begin_snap  
    766,      -- end_snap  
    NULL,     -- basic_filter  
    NULL,     -- object_filter  
    NULL,     -- ranking_measure1  
    NULL,     -- ranking_measure2  
    NULL,     -- ranking_measure3  
    NULL,     -- result_percentage  
    10)) p; -- result_limit  
  
  dbms_sqltune.load_sqlset('UW_SQLSET', l_cursor);  
  dbms_sqlset.load_sqlset('UW_SQLSET', l_cursor);  
END;  
/
```

■ PACK_STGTAB

- Moves one or more STS from their location in the SYS schema to a staging table created by the create_stgtab function

```
dbms_sqlset.pack_stgtab(  
  sqlset_name          IN VARCHAR2,  
  sqlset_owner          IN VARCHAR2 := NULL,  
  staging_table_name    IN VARCHAR2,  
  staging_schema_owner  IN VARCHAR2 := NULL,  
  db_version            IN NUMBER   := NULL);
```

```
SQL> exec dbms_sqlset.pack_stgtab('UW_SQLSET', 'UW_SQLSET_TAB');
```

■ REMAP_STGTAB

- Changes the sqlset names and owners in the staging table so that they can be unpacked with different values than they had on the host system

```
dbms_sqlset.remap_stgtab(  
old_sqlset_name      IN VARCHAR2,  
old_sqlset_owner     IN VARCHAR2 := NULL,  
new_sqlset_name      IN VARCHAR2 := NULL,  
new_sqlset_owner     IN VARCHAR2 := NULL,  
staging_table_name  IN VARCHAR2,  
staging_schema_owner IN VARCHAR2 := NULL,  
old_con_dbid        IN NUMBER   := NULL,  
new_con_dbid        IN NUMBER   := NULL);
```

```
SQL> exec dbms_sqlset.remap_stgtab('UW_SQLSET', 'UW_SQLSET_TAB');
```

■ REMOVE_REFERENCE

- Deactivates a sqlset to indicate it is no longer used by the client

```
dbms_sqlset.remove_reference(  
  sqlset_name  IN VARCHAR2,  
  reference_id IN NUMBER,  
  sqlset_owner IN VARCHAR2 := NULL,  
  force_remove IN NUMBER   := 0);
```

■ SELECT_CURSOR_CACHE

- Provided to be able to collect SQL statements from the Cursor Cache

```
dbms_sqlset.select_cursor_cache(  
  basic_filter      IN VARCHAR2 := NULL,  
  object_filter     IN VARCHAR2 := NULL,  
  ranking_measure1  IN VARCHAR2 := NULL,  
  ranking_measure2  IN VARCHAR2 := NULL,  
  ranking_measure3  IN VARCHAR2 := NULL,  
  result_percentage IN NUMBER    := 1,  
  result_limit      IN NUMBER    := NULL,  
  attribute_list    IN VARCHAR2 := 'TYPICAL',  
  recursive_sql     IN VARCHAR2 := HAS_RECURSIVE_SQL)  
RETURN sys.sqlset PIPELINED;
```

■ SELECT_SQL_TRACE

- Reads the content of one or more trace files and returns the SQL statements it finds in the format of sqlset_row

```
dbms_sqlset.select_sql_trace(  
  directory          IN VARCHAR2,  
  file_name          IN VARCHAR2          := NULL,  
  mapping_table_name IN VARCHAR2          := NULL,  
  mapping_table_owner IN VARCHAR2          := NULL,  
  select_mode        IN POSITIVE          := SINGLE_EXECUTION,  
  options            IN BINARY_INTEGER := LIMITED_COMMAND_TYPE,  
  pattern_start      IN VARCHAR2          := NULL,  
  pattern_end        IN VARCHAR2          := NULL,  
  result_limit       IN POSITIVE          := NULL)  
RETURN sys.sqlset PIPELINED;
```

■ SELECT_SQLPA_TASK

- Collects SQL statements from a Performance Analyzer task for creating a SQL Tuning Set containing the subset of SQL statements that regressed during a SQL Performance Analyzer (SPA) run

```
dbms_sqlset.select_sqlpa_task(  
  task_name      IN VARCHAR2,  
  task_owner     IN VARCHAR2 := NULL,  
  execution_name IN VARCHAR2 := NULL,  
  level_filter   IN VARCHAR2 := 'REGRESSED',  
  basic_filter   IN VARCHAR2 := NULL,  
  object_filter  IN VARCHAR2 := NULL,  
  attribute_list IN VARCHAR2 := 'TYPICAL')  
RETURN sys.sqlset PIPELINED;
```


- SELECT_SQLSET
 - Reads SQL tuning set contents

```
dbms_sqlset.select_sqlset(  
  sqlset_name      IN VARCHAR2,  
  basic_filter     IN VARCHAR2 := NULL,  
  object_filter    IN VARCHAR2 := NULL,  
  ranking_measure1 IN VARCHAR2 := NULL,  
  ranking_measure2 IN VARCHAR2 := NULL,  
  ranking_measure3 IN VARCHAR2 := NULL,  
  result_percentage IN NUMBER   := 1,  
  result_limit     IN NUMBER   := NULL,  
  attribute_list   IN VARCHAR2 := 'TYPICAL',  
  plan_filter      IN VARCHAR2 := NULL,  
  sqlset_owner     IN VARCHAR2 := NULL,  
  recursive_sql    IN VARCHAR2 := HAS_RECURSIVE_SQL)  
RETURN sys.sqlset PIPELINED;
```

```
SQL> exec dbms_sqlset.select_sqlset('UW_SQLSET');
```

■ SELECT_WORKLOAD_REPOSITORY

- Overload 1: Collects SQL statements from the workload repository to collect SQL statements from all snapshots between begin_snap and end_snap
- Overload 2: Collects SQL statements from the workload repository to collect SQL statements from a specified baseline

```
dbms_sqlset.select_workload_repository(  
begin_snap          IN NUMBER,  
end_snap            IN NUMBER,  
basic_filter        IN VARCHAR2 := NULL,  
object_filter       IN VARCHAR2 := NULL,  
ranking_measure1    IN VARCHAR2 := NULL,  
ranking_measure2    IN VARCHAR2 := NULL,  
ranking_measure3    IN VARCHAR2 := NULL,  
result_percentage   IN NUMBER    := 1,  
result_limit        IN NUMBER    := NULL,  
attribute_list      IN VARCHAR2 := 'TYPICAL',  
recursive_sql       IN VARCHAR2 := HAS_RECURSIVE_SQL,  
dbid                IN NUMBER    := NULL)  
RETURN sys.sqlset PIPELINED;
```

```
dbms_sqlset.select_workload_repository(  
baseline_name       IN VARCHAR2,  
basic_filter        IN VARCHAR2 := NULL,  
object_filter       IN VARCHAR2 := NULL,  
ranking_measure1    IN VARCHAR2 := NULL,  
ranking_measure2    IN VARCHAR2 := NULL,  
ranking_measure3    IN VARCHAR2 := NULL,  
result_percentage   IN NUMBER    := 1,  
result_limit        IN NUMBER    := NULL,  
attribute_list      IN VARCHAR2 := 'TYPICAL',  
recursive_sql       IN VARCHAR2 := HAS_RECURSIVE_SQL,  
dbid                IN NUMBER    := NULL)  
RETURN sys.sqlset PIPELINED;
```

■ UNPACK_STGTAB

- Moves one or more STS from the staging table, as populated by a call to pack_stgtab and moved by the user, into the STS schema, making them proper STS
- Users can drop the staging table after this procedure completes successfully

```
dbms_sqlset.unpack_stgtab(  
  sqlset_name          IN VARCHAR2 := '%',  
  sqlset_owner         IN VARCHAR2 := NULL,  
  replace              IN BOOLEAN,  
  staging_table_name   IN VARCHAR2,  
  staging_schema_owner IN VARCHAR2 := NULL);
```

```
SQL> exec dbms_sqlset.unpack_stgtab(replace => TRUE, staging_table_name => 'UW_SQLSET_TAB');
```

■ UPDATE_SQLSET

- updates selected string fields for a SQL statement in a sqlset (2 overloads)
- Overload 1

```
dbms_sqlset.update_sqlset(  
  sqlset_name      IN VARCHAR2,  
  sql_id           IN VARCHAR2,  
  plan_hash_value  IN NUMBER    := NULL,  
  attribute_name   IN VARCHAR2,  
  attribute_value  IN VARCHAR2 := NULL,  
  sqlset_owner     IN VARCHAR2 := NULL);
```

■ Overload 2

```
dbms_sqlset.update_sqlset(  
  sqlset_name IN VARCHAR2,  
  sql_id      IN VARCHAR2,  
  plan_hash_value IN NUMBER    := NULL,  
  attribute_name IN VARCHAR2,  
  attribute_value IN NUMBER    := NULL,  
  sqlset_owner  IN VARCHAR2 := NULL);
```

Modified Built-In Packages (1:2)

- DBMS_ADR
- DBMS_AUDIT_MGMT
- DBMS_DEBUG
- DBMS_DISTRUPT
- DBMS_DRS
- DBMS_DST
- DBMS_DB_VERSION
- DBMS_EDITIONS_UTILITIES
- DBMS_FREQUENT_ITEMSET
- DBMS_GOLDENGATE_ADM
- DBMS_HPROF
- DBMS_PDB
- DBMS_QOPATCH

Modified Built-In Packages (2:2)

- DBMS_REDEFINITION
- DBMS_SESSION
- DBMS_SPM
- DBMS_WORKLOAD_CAPTURE
- DBMS_WORKLOAD_REPLAY
- DBMS_XPLAN
- XS_PRINCIPAL

- ADR is the Automatic Diagnostic Repository
- The package has three new objects
 - GET_CALL_ERROR_MSG
 - Returns the error message for the most recent call to the ADR API
 - GET_CALL_STATUS
 - Returns the error status of the last call to the ADR API
 - RUN_PURGE
 - Purges diagnostics for the current container

- The package has four new objects two of interest
 - ALTER_PARTITION_INTERVAL
 - Alters the interval of partitioned table AUDSYS.AUD\$UNIFIED
 - IS_DROPPABLE_PARTITION
 - Returns 1 if the partition can be dropped

- The package has two new objects
 - GET_DIAGNOSTIC_LEVEL
 - Returns the current diagnostic level
 - GET_TIMEOUT
 - Returns the current debug timeout value

```
SELECT dbms_debug.get_diagnostic_level
FROM dual;
```

```
GET_DIAGNOSTIC_LEVEL
-----
                      0
```

```
exec dbms_debug.set_diagnostic_level(2);
```

```
SELECT dbms_debug.get_diagnostic_level
FROM dual;
```

```
GET_DIAGNOSTIC_LEVEL
-----
                      2
```

```
SELECT dbms_debug.get_timeout
FROM dual;
```

```
GET_TIMEOUT
-----
          3600
```

```
SELECT dbms_debug.set_timeout(2400)
FROM dual;
```

```
DBMS_DEBUG.SET_TIMEOUT(2400)
-----
                          2400
```

```
SELECT dbms_debug.get_timeout
FROM dual;
```

```
GET_TIMEOUT
-----
          2400
```

- The DBMS_DISRUPT built-in package is officially undocumented in the Types and Packages reference but worthy of your attention as it provides a PL/SQL interface for disrupting sessions and services using these subprograms
 - DISRUPT SERVICES
 - DISRUPT SESSION
- Originally released in version 12.2.0.1 the DISRUPT_SESSIONS procedure added a new parameter in 18.1.0.0

```
dbms_disrupt.disrupt_sessions(  
  job_name          IN VARCHAR2 ,  
  user_names        IN VARCHAR2 := '?',  
  service_names     IN VARCHAR2 := '*',  
  instance_names    IN VARCHAR2 := '?',  
  module_names      IN VARCHAR2 := '*',  
  percentage        IN NUMBER ,  
  sleep_interval    IN NUMBER ,  
  duration          IN NUMBER   := 0 ,  
  output_file       IN VARCHAR2 := NULL) ;
```

- The package is owned by SYS with no privileges granted and you might want to keep an eye on the fact that it stays that way

- The DBMS_DRS built-in package supporting Data Guard has 27 new objects
- DBMS_DRS is not documented and supported for DBAs and Developers but these new functions provide an excellent window into changes Oracle is making to Data Guard Physical Standbys and are an excellent way of learning how it changing and improving
 - ADD_DATABASE
 - Add a standby database to a broker configuration. database_ci is the connection identifier
 - ADD_FAR_SYNC
 - Add a far sync instance to a broker configuration. far_sync_ci is the connection identifier
 - CHECK_CONNECT
 - Check network connectivity to the specified member

```
dbms_drs.check_connect(  
  member_name    IN VARCHAR2,  
  instance_name  IN VARCHAR2);
```

```
SQL> exec dbms_drs.check_connect('ORABASE_DR', 'ORABASE1');
```

- **CREATE_CONFIGURATION**
 - Creates a broker configuration. The primary database will be automatically added to the configuration by this procedure. Must be called on a primary database
- **DISABLE_FS_FAILOVER**
 - Disables Fast Start Failover
- **DO_OBSERVE**
 - Observer operation API - observer's operation to control FSFO since 12.2. (replaces Ping, ReadyToFailover, and StateChangeRecorded)
- **DUMP_BROKER**
 - Dumps critical internal data of the broker process to a file
- **DUMP_OBSERVER**
 - Dumps critical internal data of client-side observer process to a file
- **ENABLE_CONFIGURATION**
 - Enables broker management of a Data Guard configuration. It must be called on the primary database. Return 0 means enable was successful, otherwise returns an error number

- **ENABLE_DATABASE**
 - Used to enable broker management of a database within the broker configuration
 - Must be called on the primary database
- **ENABLE_FAR_SYNC**
 - Enable broker management of a far sync instance within the broker configuration
 - Must be called on the primary database
- **ENABLE_FS_FAILOVER**
 - Used to enable fast-start failover
- **REMOVE_CONFIGURATION**
 - Removes a broker configuration
 - Must be called on the primary database
- **REMOVE_DATABASE**
 - Used to remove a database from the broker configuration
 - Must be called on the primary database
- **REMOVE_FAR_SYNC**
 - Removes a far sync instance from the broker configuration
 - Must be called on the primary database

- REPLACE_MEMBER_NAME_IN_PROPS
 - Replaces a member name with another member name in all broker properties
- RESET_CONFIGURATION_PROPERTY
 - Resets configuration-level property, not database or far sync instance property, to its default value
- RESET_DATABASE_PROPERTY
 - Resets a database configurable property to its default value
- RESET_FAR_SYNC_PROPERTY
 - Resets a far sync instance configurable property to its default value
- SET_CONFIGURATION_PROPERTY
 - Used to set configuration-level property (not a database or far sync property)
 - Can be used to set both integer and character string properties.
- SET_DATABASE_PROPERTY
 - Used to set a database configurable property
 - Can be used to set both integer and character string properties

- SET_FAR_SYNC_PROPERTY
 - Used to set a far sync instance's configurable property
 - Can be used to set both integer and character string properties
- SET_PROTECTION_MODE
 - Changes the protection mode to the mode specified
 - To prevent including database restart logic this procedure does not support the promotion of the protection mode from maximum performance to maximum protection
- STOP_OBSERVER
 - Stops the fast-start failover observers in a data guard broker configuration
- WAIT
 - Waits up to the number of seconds specified by the max_wait_time argument for the event specified by the event_type parameter to prevail

- Subprograms in this package allow users to apply Daylight Saving Time (DST) patches to the TIMESTAMP WITH TIME ZONE (TSTZ) data type
- FIND_AFFECTED_TABLES has a new PARALLEL parameter
 - During a "prepare window" finds all the tables which have affected TSTZ data due to the new time zone version

```
dbms_dst.find_affected_tables(  
  affected_tables IN VARCHAR2 := 'sys.dst$affected_tables',  
  log_errors      IN BOOLEAN  := FALSE,  
  log_errors_table IN VARCHAR2 := 'sys.dst$error_table',  
  parallel        IN BOOLEAN  := FALSE);
```

```
BEGIN  
  dbms_dst.begin_prepare(31);  
  dbms_dst.find_affected_tables;  
  dbms_dst.end_prepare;  
END;  
/  
  
SELECT * FROM sys.dst$affected_tables;
```

- This package can be used to specify the Oracle version numbers and other information useful for simple conditional compilation selections based on the Oracle or TimesTen Database version
- New Constant: VERSION_LE_18

```
BEGIN
  $IF dbms_db_version.ver_le_10 $THEN
    dbms_output.put_line('version 10 and earlier');
  $ELIF dbms_db_version.ver_le_11 $THEN
    dbms_output.put_line('version 11');
  $ELIF dbms_db_version.ver_le_12 $THEN
    dbms_output.put_line('version 12c');
  $ELIF dbms_db_version.ver_le_18 $THEN
    dbms_output.put_line('version 18c');
  $ELSE
    dbms_output.put_line('Unknown version');
  $END -- note that there is no semi-colon
END;
/
```

- This package has one new procedure
- **CLEAN_UNUSABLE_EDITIONS**
 - Drops covered objects in unusable editions, and drops empty unusable editions if possible

```
exec dbms_editions.clean_unusable_editions;
```

- This package has three new objects
- FI_HORIZONTAL_INNER
 - Counts all frequent itemsets given a cursor for input data which is in 'TRANSACTIONAL' row format, support threshold, minimum itemset length, maximum itemset length, items to be included, items to be excluded. The result will be a table of rows in form of itemset, support, length, total number of transactions.
- FI_TRANSACTIONAL_INNER
- FI_TRANSACTIONAL_OUTER

- This package has one new procedure
- UPDATE_IDENTITY_COLUMN_HWM
 - Updates the HighWaterMark for all instance Identity column sequence objects

- This package is used for hierarchical profiling of PL/SQL objects
 - ANALYZE
 - 2 new overloads for analyzing the raw profiler output and produces hierarchical profiler information in database tables

New Overload 4

```
dbms_hprof.analyze(  
  trace_id      IN NUMBER,  
  summary_mode  IN BOOLEAN      DEFAULT FALSE,  
  trace         IN VARCHAR2     DEFAULT NULL,  
  skip          IN PLS_INTEGER  DEFAULT 0,  
  collect       IN PLS_INTEGER  DEFAULT NULL,  
  run_comment   IN VARCHAR2     DEFAULT NULL,  
  profile_uqa   IN BOOLEAN      DEFAULT NULL,  
  profile_pga   IN BOOLEAN      DEFAULT NULL)  
RETURN NUMBER;
```

New Overload 5

```
dbms_hprof.analyze(  
  trace_id      IN NUMBER,  
  report_clob   OUT CLOB,  
  trace         IN VARCHAR2     DEFAULT NULL,  
  skip          IN PLS_INTEGER  DEFAULT 0,  
  collect       IN PLS_INTEGER  DEFAULT NULL,  
  profile_uqa   IN BOOLEAN      DEFAULT NULL,  
  profile_pga   IN BOOLEAN      DEFAULT NULL);
```

- CREATE TABLES
 - Creates the table dbmshp_trace_data and sequence dbmshp_tracenum

```
dbms_hprof.start_profiling(force_it IN BOOLEAN DEFAULT FALSE);
```

```
exec dbms_hprof.create_tables(TRUE);
```


- START_PROFILING
 - 1 new overload for starting PL/SQL profiling

```
dbms_hprof.start_profiling(  
  max_depth    IN PLS_INTEGER DEFAULT NULL,  
  profile_uga  IN BOOLEAN      DEFAULT NULL,  
  profile_pga  IN BOOLEAN      DEFAULT NULL,  
  sqlmonitor   IN BOOLEAN      DEFAULT TRUE,  
  run_comment  IN VARCHAR2     DEFAULT NULL)  
RETURN NUMBER;
```

- Removed Subprogram
 - DBMS_PDB.REMOVE_LINK
- New Subprograms
 - CHECK_PLUG_COMPATIBILITY
 - Determines whether a pluggable database described is compatible with the current CDB

```
ALTER PLUGGABLE DATABASE pdbdev CLOSE;

ALTER PLUGGABLE DATABASE pdbdev OPEN READ ONLY;

exec dbms_pdb.describe('/home/oracle/pdbdev.xml', 'PDBDEV');

BEGIN
  IF dbms_pdb.check_plug_compatibility('/home/oracle/pdbdev.xml', 'PDBDEV') THEN
    dbms_output.put_line('TRUE');
  ELSE
    dbms_output.put_line('FALSE');
  END IF;
END;
/

SELECT *
FROM pdb_plug_in_violations;
```

- CLEAR_PLUGIN_VIOLATIONS
 - Undocumented but you need to know what it is and how it works
 - Determines whether a pluggable database described by file pdb_descr_file is compatible with the current CDB

```
SQL> SELECT time, name, cause, type, message, status, action
2  FROM pdb_plug_in_violations
3* WHERE rownum = 1;
```

TIME	NAME	TYPE	MESSAGE
04-APR-18 10.20.20.929000 PM	PDBDEV	WARNING	CDB parameter shared_pool_size mismatch: Previous 800M Current 0

STATUS	ACTION
RESOLVED	Please check the parameter in the current CDB

```
exec dbms_pdb.clear_plugin_violations('PDBDEV');
```

- CONVERT_TO_LOCAL
 - Converts a common object to local object

```
exec dbms_pdb.convert_to_local('UWCLASS', 'TESTPROC', 1);
```

- IS_VALID_PATH
 - Undocumented but a potentially valuable tool

```
BEGIN
  IF dbms_pdb.is_valid_path('/u04/app/oracle/oradata/uwapp/') THEN
    dbms_output.put_line('T');
  ELSE
    dbms_output.put_line('F');
  END IF;
END;
/
```

- SET_SHARING_NONE
 - Undocumented but you should know what it is and how it works
 - Used to set SHARING=NONE status on an object in an App Root
 - Intended to be used in migration cases where an application was already installed in a PDB or a non-CDB, where there was no support for application containers

```
dbms_pdb.set_sharing_none(  
  schema_name  IN VARCHAR2,  
  object_name  IN VARCHAR2,  
  namespace    IN NUMBER,  
  edition_name IN VARCHAR2 DEFAULT NULL);
```

```
exec dbms_pdb.set_sharing_none('UWCLASS', 'SSNONE', 1, 'ORA$BASE');
```

- This package has 4 new objects
- OPATCH_COMPARE_GOLD_IMAGE
 - Performs a comparison with a Gold Image
- OPATCH_CREATE_IMAGE
 - Creates an inventory image

```
SELECT directory_name, directory_path
FROM dba_directories
WHERE directory_name LIKE 'OPATCH%';
```

DIRECTORY_NAME	DIRECTORY_PATH
OPATCH_INST_DIR	/u01/orahome18/OPatch
OPATCH_LOG_DIR	/u01/orahome18/rdbms/log
OPATCH_SCRIPT_DIR	/u01/orahome18/QOpatch

```
exec dbms_qopatch.opatch_create_image('OPATCH_LOG_DIR');
```

```
SQL> host
```

```
$ cd $ORACLE_HOME/rdbms/log
```

```
$ ls
```

- This package has 5 new objects
- **ABORT_ROLLBACK**
 - Aborts the intention to ROLLBACK the changes made during online re-organization
- **ABORT_UPDATE**
 - Cleans up any residual objects after an online re-organization with an UPDATE statement
- **EXECUTE_UPDATE**
 - Executes an UPDATE statement
- **ROLLBACK**
 - Rolls back changes made during an online re-organization
- **SET_PARAM**
 - Sets a parameter with a value for use in a redefinition

■ ADD_SQL_CONNECTION_TEST

- Creates connection test an application servers can use to check the health of a database connection before using it

```
dbms_session.add_sql_connection_test(  
  connection_test IN VARCHAR2,  
  service_name     IN VARCHAR2 DEFAULT NULL);
```

```
SQL> exec dbms_session.add_sql_connection_test('OurTest', 'SYS$USERS');
```

■ DELETE_SQL_CONNECTION_TEST

- Remove a connection test

```
SQL> exec dbms_session.add_sql_connection_test('OurTest', 'SYS$USERS');
```

- **DISABLE_CONNECTION_TEST**
 - Disables an application connection test

```
dbms_session.disable_connection_test(  
  connection_test_type IN NUMBER,  
  connection_test      IN VARCHAR2 DEFAULT NULL,  
  service_name         IN VARCHAR2 DEFAULT NULL);
```

Connection Test Types

- ENDREQUEST_TEST
- PING_TEST
- SQL_TEST

```
SQL> exec dbms_session.disable_connection_test(dbms_session.ping_test, 'OurTest', 'SYS$USERS');
```

- **ENABLE_CONNECTION_TEST**
 - Enables an application connection test

```
SQL> exec dbms_session.disable_connection_test(dbms_session.sql_test, 'OurTest', 'SYS$USERS');
```

- **SLEEP**
 - Because having SLEEP procedures in dbms_backup_restore, dbms_drs, dbms_lock, and user_lock was not sufficient ... this capability is now added to a 5th package

```
SQL> exec dbms_session.sleep(10);
```

- This package has 1 new procedure
- **LOAD_PLANS_FROM_AWR**
 - Load plans from the AWR as SQL Plan Baselines
 - Can be used to load the SQL Management Base (SMB) with SQL plan baselines for a set of SQL statements using the plans from the AWR

```
SELECT TO_CHAR(s.startup_time) INST_START,  
di.instance_name INST_NAME, di.db_name DB_NAME, s.snap_id SNAP_ID,  
TO_CHAR(s.end_interval_time,'DD MON YYYY HH24:MI') SNAPDAT, s.snap_level LVL  
FROM dba_hist_snapshot s, dba_hist_database_instance di  
WHERE di.dbid = s.dbid  
AND di.instance_number = s.instance_number  
AND di.startup_time = s.startup_time  
ORDER BY snap_id;  
  
DECLARE  
    retVal PLS_INTEGER;  
BEGIN  
    retVal :=c dbms_spm.load_plans_from_awr(277, 289);  
    dbms_output.put_line(TO_CHAR(retVal));  
END;  
/
```

- We have had a major security hole in the Oracle Database that has now been plugged with version 18 ... we can now encrypt capture for Real Application Testing
- DECRYPT_CAPTURE

```
dbms_workload_capture.decrypt_capture(  
  src_dir IN VARCHAR2,  
  dst_dir IN VARCHAR2);
```

```
SQL> exec dbms_workload_capture.decrypt_capture('SRCDIR', 'TGTDIR');
```

- ENCRYPT_CAPTURE

```
dbms_workload_capture.encrypt_capture(  
  src_dir      IN VARCHAR2,  
  dst_dir      IN VARCHAR2,  
  encryption IN VARCHAR2 DEFAULT 'AES256'); -- options: 'AES128', 'AES192', 'AES256'
```

```
SQL> exec dbms_workload_capture.encrypt_capture('SRCDIR', 'TGTDIR', 'AES256');
```

- New Public Capabilities
 - START_CAPTURE (new parameters)
 - PLSQL_MODE
 - TOP_LEVEL: only top-level PL/SQL calls are captured
 - EXTENDED: both top-level PL/SQL calls and SQL called from PL/SQL are captured
 - ENCRYPTION
 - NULL: no encryption
 - AES128
 - AES 192
 - AES256

```
dbms_workload_capture.start_capture(  
name          IN VARCHAR2,  
dir           IN VARCHAR2,  
duration      IN NUMBER   DEFAULT NULL,  
default_action IN VARCHAR2 DEFAULT 'INCLUDE',  
auto_unrestrict IN BOOLEAN DEFAULT TRUE,  
capture_sts    IN BOOLEAN DEFAULT FALSE,  
sts_cap_interval IN NUMBER DEFAULT 300,  
plsql_mode     IN VARCHAR2 DEFAULT 'TOP_LEVEL',  
encryption     IN VARCHAR2 DEFAULT NULL);
```

- GET_STATE (unsupported)
 - Returns 1 if a session is being capture: Else 0

```
SQL> SELECT dbms_workload_capture.get_state
       2    FROM dual;

GET_STATE
-----
         0
```

- Not supported but worth knowing are coming in the future
 - START_BATCH_CAPTURE
 - Starts a workload capture and stores data in different buckets
 - For instance, workload in 9AM - 10AM will be stored in bucket 1 while workload in 10AM - 12PM will be stored in bucket 2
 - SWITCH_BUCKET
 - Signals all connected sessions to store workload captures into a new bucket
 - By default, SWITCH_BUCKET will create an AWR snapshot for the workload captured in the current bucket

- **ASSIGN_GROUP_TO_INSTANCE**

- Assigns a group of capture files to be processed by a particular node in a RAC cluster

```
dbms_workload_replay.assign_group_to_instance(  
  group_id          IN NUMBER,  
  instance_number IN NUMBER);
```

```
SQL> exec dbms_workload_replay.assign_group_to_instance(6, 2);
```

- **LOAD_LONG_SQLTEXT**

- Loads captured SQL statements whose length is greater than 1000 characters

```
dbms_workload_replay.load_long_sqltext(capture_id IN NUMBER);
```

```
SQL> exec dbms_workload_replay.load_long_sqltext(1107);
```

DBMS_WORKLOAD_REPLAY (1:2)

■ SET_SQL_MAPPING

- Specifies SQL statements to be skipped or replaced in replay
- Overload 1

```
dbms_workload_replay.set_sql_mapping(  
  schedule_cap_id      IN NUMBER,  
  sql_id               IN VARCHAR2,  
  operation            IN VARCHAR2,  
  replacement_sql_text IN VARCHAR2);
```

- Overload 2

```
dbms_workload_replay.set_sql_mapping(  
  sql_id              IN VARCHAR2,  
  operation           IN VARCHAR2,  
  replacement_sql_text IN VARCHAR2);
```


- DISPLAY_CURSOR has 2 new overloads
 - The original pipelined table function is now Overload 3
 - Overload 1

```
dbms_xplan.display_cursor(  
  sql_id          IN VARCHAR2 DEFAULT NULL,  
  cursor_child_no IN INTEGER  DEFAULT 0,  
  format          IN VARCHAR2 DEFAULT 'TYPICAL',  
  shard_id        IN NUMBER)  
RETURN dbms_xplan_type_table PIPELINED;
```

- Overload 2

```
dbms_xplan.display_cursor(  
  sql_id          IN VARCHAR2 DEFAULT NULL,  
  cursor_child_no IN INTEGER  DEFAULT 0,  
  format          IN VARCHAR2 DEFAULT 'TYPICAL',  
  shard_ids        IN num_tab_type)  
RETURN dbms_xplan_type_table PIPELINED;
```

- A built-in package supporting Real Application Security (RAS)
 - Database Security Guide
 - Data Guard Concepts and Administration book
- CREATE_DYNAMIC_ROLE
 - Creates a new Application Security Role

```
exec xs_principal.create_dynamic_role('DYN_ROLE', 60, description=>'RAS Dynamic Role');  
  
SELECT name, duration, system_defined, scope, description  
FROM dba_xs_dynamic_roles;
```

- CREATE_USER
 - Creates a new Real Application Security user

```
SQL> CREATE USER sec_mgr
2 IDENTIFIED BY oracle1
3 DEFAULT TABLESPACE uwdata
4 TEMPORARY TABLESPACE temp
5* QUOTA UNLIMITED ON uwdata;
```

User created.

```
SQL> GRANT create user TO sec_mgr;
```

Grant succeeded.

```
SQL> exec sys.xs_principal.create_user('SEC_USER', 'HR', start_date=>SYSDATE, end_date=>SYSDATE+30);
```

PL/SQL procedure successfully completed.

```
SQL> exec sys.xs_principal.set_password('sec_user', 'oracle2');
```

PL/SQL procedure successfully completed.

```
SQL> SELECT name, roles_default_enabled, status, account_status, profile, direct_logon_user, description
2 FROM dba_xs_users;
```

- GRANT_ROLES

- Grants a role to a principal

```
SQL> exec xs_principal.grant_roles('SEC_USER', 'RAS_ROLE', SYSDATE, SYSDATE+1);
```

- SET_ACL

- Assigns an Access Control List to a principal

```
SQL> exec xs_principal.set_acl('XS_USER_EXT', 'mlib-org-permissions.xml');
```

Conclusions

*

ERROR at line 1:

ORA-00028: your session has been killed

email: damorgan18c@gmail.com

web: www.morganslibrary.com/reference/new_18_1.html

www.tidalscale.com/tidalscale-for-oracle

Read The Docs

Visit my website to learn about new features

email: `damorgan18c@gmail.com`

web: `www.morganslibrary.com/reference/new_18_1.html`
`www.tidalscale.com/tidalscale-for-oracle`

Support Your User Group

Thank you for attending ...

I hope to see you here again at our next meeting on May 23

email: `damorgan18c@gmail.com`

web: `www.morganslibrary.com/reference/new_18_1.html`

`www.tidalscale.com/tidalscale-for-oracle`