

# 21c New Features

## You Won't Hear About From Oracle





**AKA**  
Do You Want Fries With That?

# *Introduction*



# Unsafe Harbor Statement

- This room is an unsafe harbor
- You can rely on the information in this presentation to help you protect your data, your databases, your organization, and your career
- No one from Oracle has previewed this presentation
- No one from Oracle knows what I am going to say
- No one from Oracle has supplied any of my materials
- Warning: Oracle employees cannot criticize Oracle's customers ...  
I've never been an Oracle employee ... so ...  
I can ... and ... I do ... and ... I will






- 🏆 Oracle ACE Director Alumnus
- Oracle Educator
  - 🏛️ Adjunct Professor, University of Washington, Oracle Program, 1998-2009
  - 🏰 Consultant: Harvard University
    - Guest lecturer at universities in Canada, Chile, Costa Rica, New Zealand, Norway, Panama, and the U.S.
    - Conference seminars ... 153 country visits, 43 countries ... since 2008
- IT Professional
  - Member, Oracle Database Security Partner Advisory Council
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Migration

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Zione's focused and experienced IT professionals possess a deep track record providing the maximum QoS to our customers; enabling them to improve and grow their business.

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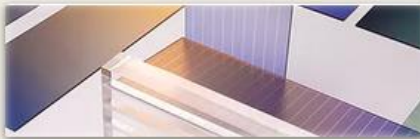


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- Rapid Response
- Flexibility
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## Defense-in-Depth Requires Protecting Data & Databases

DBSecWorx enhances your security by reducing the exploitable landscape

### DBSecWorx News

- The DBSecWorx team has taken on a new project: Building a working demo of Oracle Label Security (OLS).

OLS is under-appreciated and under-utilized: Something we need to change if we are going to support our community's efforts to harden databases.

To follow our work on the project follow the [OLS Project](#) link.

- Database 21c is available in the OCI Cloud. We are securing it today.

We start with the assumption that every network is vulnerable; that there is always an insider.

Our focus is the Oracle Databases where your secrets are stored.

What makes us different?

## Defense in Depth Delivered


### SQLcillin GLOGIN



[Oracle Database Exploit Protection](#)

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www.morganslibrary.org

## Morgan's Library

☒ www ☐ library

### The Library

Did you miss Oracle 20c? Oracle 21c has been released in the OCI Cloud and the docs are available for download. The Morgan's Library team has both a 20c and a 21c database and we are updating the Library. 21c security monographs will be posted at dbsecworx.com soon.

Home


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#### Mad Dog Morgan




#### Morgan @ OpenWorld





Next Event: Tahiti

#### Oracle Events



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#### Aboard USA-71



#### The Daily Rant: Working in 21c Yet? Why Not?

```
[dmorgan@test21 ~]$ sudo su oracle
[oracle@test21 dmorgan]$ cd $ORACLE_HOME
[oracle@test21 dbhome_1]$ sqlplus / as sysdba

SQL*Plus: Release 21.0.0.0.0 - Production on Fri Dec 11 21:12:38 2020
Version 21.1.0.0.0

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Connected to:
Oracle Database 21c Enterprise Edition Release 21.0.0.0.0 - Production
Version 21.1.0.0.0

SQL> |
```



# Business Case

- Some time in the next 3-5 years you will be forced to do one of two things
  - Migrate to an Oracle Container Database
  - Execute a career change
- The organization you current work for will either upgrade to CDBs and PDBs or do business with unsupported applications running on an unsupported database with limited or no access to bug fixes and security patches
- That upgrade to 21c+ will force a legacy architecture to working with a mandatory migration from Oracle's a container database
- If you do not know how to create a common user, common role, and behind where you should be a common profile you are a decade
- And, needless to say it is your responsibility to not only learn how to work with and manage a container database ... it is your responsibility to learn all of the critically important new features in Oracle Database versions 20c through 23c
- Today is an excellent day to start that adventure



*New in 20c*




# 20c Legacy Architecture No Longer Supported

- As of Oracle Database 20c the legacy, non container, architecture is
  - Not just deprecated
  - Not just not supported
  - It is no longer available
- If you are waiting for your employer to migrate to a Container Database to learn it ... expect to make some expensive errors at work
- It likely isn't going to turn out well for either of you

# 20c Persistent Memory Database (1:2)

- One of the first things I noticed in Oracle 20c was that it is now configurable as a PMEM database

[Intel® Optane™ PMem Solutions](#)[Get More Information](#)[Customer Stories](#)[Resources](#)



## PMem Is a Revolutionary Memory Technology

PMem provides a unique combination of affordable larger capacity and support for data persistence. With innovative technology offering distinctive operating modes, it adapts to your needs across workloads.

### Boost Performance with Data Persistence

PMem gives you access to more data in memory enabling you to process large amounts of data faster. Unlike DRAM, data remains in PMem allowing you to retain data even when powered off - helping protect your systems from data loss.

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Optane™ PMem enables you to affordably increase your memory capacity per socket, extract value from larger data sets and increase the utility of each server.

### Flexible Configuration with Two Modes

Operational modes in Optane™ Persistent Memory offer different functions giving you flexible configuration, the two modes are Memory Mode and App Direct Mode. [Learn more here.](#)

### Hardware Encryption

Intel® Optane™ persistent memory incorporates hardware encryption. With AES 256-bit encryption, it helps protect data at rest from cyberattacks with minimal impact on performance.

[Click for more Optane™ technology options.](#)

[Read the Optane™ PMem 200 series product brief](#)



## 20c Persistent Memory Database (2:2)

- If you can get the servers ... Oracle already has the database that supports it

```
CREATE PMEM FILESTORE <filestore_name>
MOUNTPOINT '<path_and_file_name>'
BACKINGFILE '<path_and_backing_file_name>' [REUSE]
SIZE <integer> <M | G | T>
BLOCK SIZE <2 | 4 | 8 | 16 | 32>K
AUTOEXTEND ON NEXT <integer> <K | M | G | T>
MAXSIZE <integer> <K | M | G | T>;
```

```
CREATE PMEM FILESTORE uw_pmfs
MOUNTPOINT '/u03/oracle/pmemfs/perfile1'
BACKINGFILE '/u04/oracle/pmembf/bakfile1'
SIZE 500G
BLOCK SIZE 8K
AUTOEXTEND ON NEXT 25G
MAXSIZE 10T;
```

```
ALTER PMEM FILESTORE uw_pmfs AUTOEXTEND;
ALTER PMEM FILESTORE uw_pmfs DISMOUNT;

ALTER PMEM FILESTORE uw_pmfs MOUNT
MOUNTPOINT '/u03/oracle/pmemfs/perfile2'
BACKINGFILE '/u04/oracle/pmembf/bakfile2

ALTER PMEM FILESTORE uw_pmfs RESIZE 20T;

DROP PMEM FILESTORE uw_pmfs INCLUDING CONTENTS FORCE;
```

# 20c SecureFile Defragmentation

- SecureFile fragmentation negatively impacts
  - LOB sequential read performance
  - Secure file DML performance
  - Free space search efficiency

- 19c

```
-- not supported
ALTER TABLE <table_with_LOB_storage> SHRINK SPACE CASCADE;

-- very expensive
ALTER TABLE <table_with_LOB_storage> MOVE LOB ....;
```

- 21c

```
supported
ALTER TABLE <table_name> MODIFY LOB (lob_column_name) (SHRINK SPACE);

ALTER TABLE <table_name> SHRINK SPACE CASCADE;
```

- Restarts and recovers from failure or interrupted
- Honors LOB Retention
- Supported everywhere including RAC
- New dynamic performance view V\$SECUREFILE\_SHRINK



# 20c Security (1:2)



- Forces upgraded password files to be case sensitive
- Database clients can be configured to maintain multiple SSL sessions using different certs
- Support for centrally managed wallets
- STIG compliance built in with the Profile, Password Verify Function and Unified Audit Policies are predefined

```
catpvf.sql:Rem          catpvf.sql - Create Password Verify Function, STIG profile
catpvf.sql:Rem          This script also creates the STIG compliant user profile
catpvf.sql:Rem          ORA_STIG_PROFILE with CIS for 12c v3.0.0 and
catpvf.sql:Rem Function: "ora12c_stig_verify_function" - provided from 12c onwards for
catpvf.sql:Rem          "STIG for Oracle 12c" password complexity check requirement.
catpvf.sql:Rem Defense Database Security Technical Implementation Guide (STIG) v1 r2
catpvf.sql:create or replace function ora12c_stig_verify_function
catpvf.sql:GRANT EXECUTE ON ora12c_stig_verify_function TO PUBLIC container=current;
catpvf.sql:Rem Defining ora_cis_profile and ora_stig_profile
catpvf.sql:  -- Security Technical Implementation Guide for 12c[STIG v1R17].
catpvf.sql:  execute immediate 'create profile ora_stig_profile limit

c19.sql:  'Audit policy to implement auditing recommendations from STIG v1 (4 Jan 2019)';
c19.sql:  'Audit policy to track all top level actions to help comply with STIG v1 (4
c19.sql:  'Audit policy to track session logon and logoff actions to help comply with STIG v1
(4 Jan 2019) and CIS V2.0.0 (12-28-2016) It should be enabled only on privileged users;
Otherwise it could generate large number of audit records for users who frequently connect
to the system.';
c19.sql:CREATE AUDIT POLICY ORA_STIG_RECOMMENDATIONS
```

```
c20.sql:  execute immediate 'alter profile ora_stig_profile limit
c20.sql:                password_verify_function ora12c_stig_verify_function';

secconf.sql:      'CREATE AUDIT POLICY ORA_STIG_RECOMMENDATIONS ' ||
secconf.sql:      '''Audit policy to implement auditing recommendations from STIG v1 ' ||
secconf.sql:      'comply with STIG v1 (4 Jan 2019) and CIS V2.0.0 (12-28-2016)' ||
secconf.sql: 'ORA_STIG_RECOMMENDATIONS',
```

# 20c Users & Roles

- New Users
  - DV\_OWNER
- New Roles
  - AVTUNE\_PKG\_ROLE
  - BDSQL\_ADMIN
  - BDSQL\_USER
  - GSMROOTUSER\_ROLE
  - PPLB\_ROLE
- Desupported Role
  - CSW\_USR\_ROLE

# 20c Data Dictionary Views

## ■ New

- DBA\_OGG\_AUTO\_CAPTURED\_TABLES
- USER\_OGG\_AUTO\_CAPTURED\_TABLES



## Desupported

- ALL\_DEF\_AUDIT\_OPTS
- AUDIT\_ACTIONS
- DBA\_AUDIT\_EXISTS
- DBA\_AUDIT\_OBJECT
- DBA\_AUDIT\_SESSION
- DBA\_AUDIT\_STATEMENT
- DBA\_AUDIT\_TRAIL
- DBA\_COMMON\_AUDIT\_TRAIL
- DBA\_FGA\_AUDIT\_TRAIL
- DBA\_OBJ\_AUDIT\_OPTS
- DBA\_PRIV\_AUDIT\_OPTS
- DBA\_STMT\_AUDIT\_OPTS
- USER\_AUDIT\_OBJECT
- USER\_AUDIT\_SESSION
- USER\_AUDIT\_STATEMENT
- USER\_AUDIT\_TRAIL
- USER\_OBJ\_AUDIT\_OPTS
- V\$XML\_AUDIT\_TRAIL

**This should serve as a really strong hint that if you haven't studied Unified Auditing you are running out of time to get your skills current**



# 20c Initialization (Startup) Parameters

## ■ New

- DBNEST\_ENABLE
- DBNEST\_PDB\_FS\_CONF
- DIAGNOSTICS\_CONTROL
- INMEMORY\_DEEP\_VECTORIZATION
- PMEM\_FILESTORE
- TABLESPACE\_ENCRYPTION\_DEFAULT\_ALGORITHM



## Desupported

- AUDIT\_FILE\_DEST
- AUDIT\_SYS\_OPERATIONS
- AUDIT\_SYSLOG\_LEVEL
- AUDIT\_TRAIL
- IGNORE\_CASE
- UNIFIED\_AUDIT\_SGA\_QUEUE\_SIZE


**Another reminder that you need to get yourself up to speed on Unified Auditing**



# 20c PL/SQL Packages: Desupported

- DBMS\_CLR
- ★ DBMS\_OBFUSCATION\_TOOLKIT
  - DBMS\_OBFUSCATION\_TOOLKIT\_FFI
  - ORDIMDPCALLOUTS
  - ORD\_ADMIN

**If any of your security is based on DBMS\_OBFUSCATION\_TOOLKIT ... the clock is ticking**

# 20c PL/SQL Packages: New

- DBFS\_OFS\_CONVERSION
- DBMS\_ADBTASK\_ADMIN
- DBMS\_AQ\_IND\_MON
- DBMS\_AQ\_SUB
- DBMS\_AUTO\_SQLSET
- **DBMS\_AUTO\_ZONEMAP**
- DBMS\_AUTO\_ZONEMAP\_INTERNAL
- **DBMS\_AVTUNE**
- DBMS\_AWRHUB\_SERVER
- DBMS\_AWRHUB\_SOURCE
- DBMS\_AWR\_ANALYTICS
-  **DBMS\_BLOCKCHAIN\_TABLE**
- DBMS\_BLOCKCHAIN\_UTL
- **DBMS\_CLOUD**
- DBMS\_CLOUD\_TYPES
- DBMS\_DLM

- DBMS\_GSM\_DDL
- DBMS\_GSM\_SEC
- DBMS\_HCS\_LOG
- DBMS\_MAX\_STRING\_SIZE
- DBMS\_MDX\_UTIL
-  **DBMS\_MLE**
- **DBMS\_OPTIM\_BUNDLE**
- DBMS\_PQDIAG
- **DBMS\_TABLE\_DATA**
- DBMS\_TSDP\_PROTECT\_INT
-  **DBMS\_USER\_CERTS**
- LBAC\_POLICY\_ADMIN\_INT
- LTI

- Subprograms



- DELETE\_EXPIRED\_ROWS

- GET\_BYTES\_FOR\_ROW\_HASH
    - GET\_BYTES\_FOR\_ROW\_SIGNATURE
    - GET\_SIGNED\_BLOCKCHAIN\_DIGEST
    - SIGN\_ROW

- VERIFY\_ROWS



- VERIFY\_TABLE\_BLOCKCHAIN



- In addition to introducing this supported package DBMS\_MLE in 20 the new Object Type MLE Language is in namespaces 1 and 147
- The Multi-Lingual Engine (MLE) package allows users to execute JavaScript code inside the Oracle Database and exchange data seamlessly between PL/SQL and JavaScript
- The JavaScript code can execute PL/SQL and SQL through the use of built-in JavaScript modules

- The JavaScript code itself can execute PL/SQL and SQL through built-in JavaScript modules

```
set serveroutput on;

DECLARE
  ctxh      dbms_mle.context_handle_t;
  source    CLOB;
  greeting  dbms_id;
BEGIN
  ctxh := dbms_mle.create_context();           -- create MLE execution context
  dbms_mle.export_to_mle(ctxh, 'person', 'World'); -- export value from PL/SQL

  source := q'~
var bindings = require("mle-js-bindings");
var person = bindings.importValue("person"); // Imp. value prev. exported with PL/SQL
var greeting = "Hello, " + person + "!";
bindings.exportValue("greeting", greeting); // Export value to PL/SQL
~';

  dbms_mle.eval(ctxh, 'JAVASCRIPT', source);           -- eval src in execution context
  dbms_mle.import_from_mle(ctxh, 'greeting', greeting); -- Imp. previously exported val
  dbms_output.put_line('Greetings from MLE: ' || greeting);
  dbms_mle.drop_context(ctxh);
END;
/
Greetings from MLE: Hello, World!
```

# 20c SQL: New



Block Chain Tables

Immutable Tables

- EXCEPT Set Operator
- INTERSECT ALL Set Operator
- MINUS ALL Set Operator

```
SQL> UPDATE ledger0 SET tx_value = 200;
UPDATE ledger0 SET tx_value = 200
*
ERROR at line 1:
ORA-05715: operation not allowed on the blockchain table

SQL> DELETE FROM ledger0;
DELETE FROM ledger0
*
ERROR at line 1:
ORA-05715: operation not allowed on the blockchain table

SQL> TRUNCATE TABLE ledger0;
TRUNCATE TABLE ledger0
*
ERROR at line 1:
ORA-05715: operation not allowed on the blockchain table

SQL> DROP TABLE ledger0;
DROP TABLE ledger0
*
ERROR at line 1:
ORA-05723: drop blockchain or immutable table LEDGER0 not allowed
```

## 20c SYS\_CONTEXT Function: New

- SYS\_CONTEXT Process Identifier (PID)
- Returns the process from V\$SESSION for the current session in one step / without a subquery

```
SELECT UNIQUE sid FROM v$mystat;
```

```
SID  
-----  
261
```

```
SELECT process FROM v$session WHERE sid=261;
```

```
PROCESS  
-----  
1680:4228
```

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

```
SYS_CONTEXT('USERENV', 'PID')  
-----  
1680:4228
```



# 20c PL/SQL Pragma and PL/SQL Warnings: New

- Pragma SUPPRESSES\_WARNING\_6009
  
- Informational Warning Messages
  - 06027      -- Pragma Inline
  - 06028      -- Pragma Coverage
  - 06029      -- Pragma Suppress Warning
- Severe Warning Messages
  - 05026      -- Identifier should not be specified on the END statement for an unlabeled construct
  - 05027      -- END statement identifier 'string' should match label 'string' at line string, column string
  - 05028      -- END statement identifier 'string' should match the name of TRIGGER 'string'
  - 05029      -- Statement has more than one label specified for it.

## 20c Feature Usage Report Procedures: New

- DBMS\_FEATURE\_APPROX\_QP -- approximate query processing
- DBMS\_FEATURE\_IM\_BASE\_LEVEL -- in-memory level usage

*New in 21c*

# Welcome to 21c: 21.3.0.0

- I am now 258 days into working with Oracle 21c

```
[dmorgan@test21 ~]$ sudo su oracle
[oracle@test21 dmorgan]$ cd $ORACLE_HOME
[oracle@test21 dbhome_1]$ sqlplus / as sysdba

SQL*Plus: Release 21.0.0.0.0 - Production on Fri Dec 11 21:12:38 2020
Version 21.1.0.0.0

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Oracle Database 21c Enterprise Edition Release 21.0.0.0.0 - Production
Version 21.1.0.0.0

SQL> █
```



# Welcome to 21c

- 8 days into the GA release: 21.3.0.0.0

```
[dmorgan@test21 ~]$ sudo su oracle
[oracle@test21 dmorgan]$ cd $ORACLE_HOME
[oracle@test21 dbhome_1]$ sqlplus / as sysdba

SQL*Plus: Release 21.0.0.0.0 - Production on Thu Aug 26 02:52:47 2021
Version 21.3.0.0.0

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Oracle Database 21c Enterprise Edition Release 21.0.0.0.0 - Production
Version 21.3.0.0.0

SQL> █
```

- There are only 2 versions of the Oracle Database that should be on your radar ... 19.11 and 21.3 ... everything else is a distraction

# Welcome to 21c

- Download 21.3 at <https://otn.oracle.com> or <https://edelivery.oracle.com>
- Download the current docs at <https://docs.oracle.com>
- If you thought there was a lot of content in 20c ... you might want to tighten your seat belt



## 21c Attention Log (1:2)

- The new attention log is a structured, externally modifiable file that contains information about critical and highly visible database events
- The log contains a pre-determined, translatable series of messages, with one message for each event
- Use the log to quickly access information about critical events that require action ... this is Oracle's answer to the Alert Log hardly anyone reads until there is an outage
- Each instance, in a RAC environment has its own attention log
- Messages Types: Error, Warning, Notification, or Additional information
- Urgency Values: Immediate, Soon, Deferrable, or Information
- Scope Values: Session, Process, PDB Instance, CDB Instance, CDB Cluster, PDB (for issues in persistent storage that a database restart will not fix), or CDB (for issues in persistent storage that a database restart will not fix)
- Target User Values: The user who must act on the message (Clusterware Admin, CDB admin, or PDB admin)

# 21c Attention Log (2:2)

```
[oracle@test21 log]$ pwd
/u01/app/oracle/diag/rdbms/test21db_iad25g/test21db/log
[oracle@test21 log]$ ls -l
total 56
drwxr-x--- 2 oracle asmadmin 4096 Dec 11 2020 attention
-rw-r----- 1 oracle asmadmin 19353 Aug 19 16:07 attention.log
drwxr-x--- 2 oracle asmadmin 4096 Dec 11 2020 ddl
drwxr-x--- 2 oracle asmadmin 4096 Dec 19 2020 debug
-rw-r----- 1 oracle asmadmin 3108 May 3 01:09 debug.log
drwxr-x--- 2 oracle asmadmin 4096 Dec 17 2020 hcs
-rw-r----- 1 oracle asmadmin 1410 Aug 24 14:24 hcs_test21db.log
drwxr-x--- 2 oracle asmadmin 4096 Dec 11 2020 imdb
drwxr-x--- 2 oracle asmadmin 4096 Dec 11 2020 test
[oracle@test21 log]$
```

```
{
  "ERROR"      : "GEN0 (ospid: 24229): terminating the instance due to ORA error 495",
  "URGENCY"    : "IMMEDIATE",
  "INFO"       : "Additional Information Not Available",
  "CAUSE"      : "The instance termination routine was called",
  "ACTION"     : "Check alert log for more information relating to instance termination rectify the error and
restart the instance",
  "CLASS"      : "CDB Instance / CDB ADMINISTRATOR / AL-1003",
  "TIME"       : "2021-01-17T02:19:27.281+00:00"
}
```





## 21c Security

- Oracle Wallet Manager
  - SHA-1 for DBMS\_CRYPTO
  - SHA-1 for SQL\*Net
  - MD4
  - MD5
- 
- Oracle has changed the AUTHID of a lot of their built-in packages from DEFINER to CURRENT\_USER ... this has the potential to break things so substantial testing must be built into upgrade planning

**Just like the wake-up call earlier about Unified Auditing**

**You should be making a note right now to check use of each of these ... you have only a year or two to replace them**

# 21c Users, Roles and Profiles

- New Users
  - DGPDB\_INT
- New Roles
  - MAINTPLAN\_APP
- Desupported Role
  - DV\_PUBLIC
  - DV\_REALM\_OWNER
  - DV\_REALM\_SOURCE
- New Profile Resource
  - ★ PASSWORD\_ROLLOVER\_TIME
    - After a password change: The number of days during which both passwords are simultaneously valid

```
ALTER PROFILE default LIMIT password_rollover_time 2;
```

- Though you really should NEVER assign anyone to the default profile unless you want to be the next T-Mobile

## 21c System Privileges: New

- Create Logical Partition Tracking
- Drop Logical Partition Tracking
- Execute Dynamic MLE
- Enable Diagnostics

# 21c Dynamic Performance Views: New

- GV\$ACTIVITY\_MVIEW
- GV\$ACTIVITY\_TABLE
- GV\$ALL\_ACTIVE\_SESSION\_HISTORY
- GV\$ALL\_SQL\_MONITOR
- GV\$ALL\_SQL\_PLAN
- GV\$ALL\_SQL\_PLAN\_MONITOR
- GV\$AQ\_DEQUEUE\_SESSIONS
- GV\$AQ\_PARTITION\_STATS
- GV\$ASM\_ACFSAUTORESIZE
- GV\$AV\_BTT\_CACHE
- GV\$BCAPPLY\_STATS
- GV\$BUILD\_INFO
- GV\$COMPATIBILITY\_REQUIREMENT
- GV\$CONNECTION\_BROKER
- GV\$CONSENSUS\_CLIENTS
- GV\$CONSENSUS\_LOGS
- GV\$CONSENSUS\_STATS
- GV\$CONTAINER\_TOPOLOGY
- GV\$CON\_WAITCLASSMETRIC
- GV\$CON\_WAITCLASSMETRIC\_HISTORY
- GV\$DG\_BROKER\_PROPERTY
- GV\$DG\_BROKER\_PROPERTY\_INT
- GV\$DIAG\_USER\_TRACE\_RECORDS
- GV\$EQ\_CACHED\_PARTITIONS
- GV\$EQ\_CROSS\_INSTANCE\_JOB
- GV\$EQ\_DEQUEUE\_SESSIONS
- GV\$EQ\_INACTIVE\_PARTITIONS
- GV\$LCR\_CACHE
- GV\$LISTENER\_HEALTH
- GV\$EQ\_MESSAGE\_CACHE
- GV\$EQ\_MESSAGE\_CACHE\_ADVICE
- GV\$EQ\_MESSAGE\_CACHE\_STAT
- GV\$EQ\_NONDUR\_SUBSCRIBER
- GV\$EQ\_NONDUR\_SUBSCRIBER\_LWM
- GV\$EQ\_PARTITION\_STATS
- GV\$EQ\_REMOVE\_DEQUEUE\_AFFINITY
- GV\$EQ\_SUBSCRIBER\_LOAD
- GV\$EQ\_SUBSCRIBER\_STAT
- GV\$EQ\_SUBSCR\_REGISTRATION\_STATS
- GV\$EQ\_UNCACHED\_PARTITIONS
- GV\$FOREIGN\_DATAFILE\_COPY
- GV\$GCS\_LOCK\_STATE\_RESOLUTION\_HISTORY
- GV\$LISTENER\_HEALTH
- GV\$MDX\_CURSOR
- GV\$MDX\_CURSOR\_DEPENDENCY
- GV\$PKCS11\_PATH
- GV\$PQ\_SLAVEINFO
- GV\$QUERY\_BLOCK\_ORIGIN
- GV\$RESULT\_SUBCACHE\_STATISTICS
- GV\$SECUREFILE\_SHRINK

# 21c Dynamic Performance Views: Desupported

- V\$CELL\_DB\_HISTORY
- V\$OBJECT\_USAGE
- V\$XML\_AUDIT\_TRAIL

# 21c Native JSON Data Type: New

- JSON data type defined as BLOB\_BASE

```
SQL*Plus: Release 21.0.0.0.0 - Production on Thu Aug 26 18:03:28 2021
Version 21.3.0.0.0
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Oracle Database 21c Enterprise Edition Release 21.0.0.0.0 - Production
Version 21.3.0.0.0

SQL> create table json_test (testcol JSON);

Table created.

SQL> desc json_test
  Name          Null?    Type
  -----
TESTCOL                JSON

SQL> SELECT object_name, object_type FROM dba_objects WHERE created > sysdate-1/24;

OBJECT_NAME                                OBJECT_TYPE
-----
SYS_IL0000175194C00001$$                  INDEX
JSON_TEST                                 TABLE
SYS_LOB0000175194C00001$$                  LOB
```



# 21c PL/SQL Packages: Desupported

- DBMS\_CRYPTO\_TOOLKIT
- DBMS\_CRYPTO\_TOOLKIT\_FFI
- DBMS\_CRYPTO\_TOOLKIT\_TYPES
- DBMS\_HETEROGENEOUS\_SNAPSHOT
- DBMS\_HS\_PARALLEL
- DBMS\_HS\_PARALLEL\_METADATA
- DBMS\_HS\_PASSTHROUGH
- DBMS\_IAS\_CONFIGURE
- DBMS\_IAS\_QUERY
- DBMS\_IAS\_SESSION
- DBMS\_IAS\_TEMPLATE
- DBMS\_LIBCACHE
- DBMS\_LIBCACHE\$DEF
- DBMS\_MGWMDG
- DBMS\_SERVER\_TRACE
- DBMS\_WRR\_STATE
  - present in 21.1 but dropped in 21.3
- DBMS\_WRR\_STATE\_BASE
  - present in 21.1 but dropped in 21.3
- ORDIMGSIG\_PKG
- ORDIMGSI\_PKG
- ORD\_DICOM\_ADMIN\_PRV
- ORD\_DICOM\_CT
- ORD\_DICOM\_PKG
- UTL\_ORAMTS
- UTL\_SPADV

**Are any applications at your organization dependent on IAS?  
Internet Application Server**

# 21c PL/SQL Packages: New

- DBMS\_ACTIVITY
- DBMS\_APP\_CONT\_REPORT
- DBMS\_AUDIT\_MGMT\_SUPPORT
- DBMS\_AUTO\_MV
- DBMS\_CLOUD\_ADMIN\_INTERNAL
- DBMS\_CLOUD\_CAPABILITY
- DBMS\_CLOUD\_CORE
- DBMS\_CLOUD\_INTERNAL
- DBMS\_CLOUD\_MACADM
- DBMS\_CLOUD\_REQUEST
- DBMS\_CLOUD\_TASK
- DBMS\_CUBE\_PRVTEXP
- DBMS\_EDITIONS\_UTILITIES2
- DBMS\_FLASHBACK\_ARCHIVE\_MIGRATE
- **DBMS\_IMMUTABLE\_TABLE**
- DBMS\_MAINTPLAN
- DBMS\_REPLAYHUB
- DBMS\_SWAT
- DBMS\_SWAT\_ARM\_INTERNAL
- DBMS\_SWAT\_INTERNAL
- DBMS\_SWAT\_MM\_INTERNAL
- DBMS\_SWAT\_MM\_UTILS
- DBMS\_SWAT\_VER\_INTERNAL
- DBMS\_SYS\_MLE
- DBMS\_TEQK
- TKHCS\_LOG\_PKG
- UTL\_RECOMP2

# 21c DBMS\_IMMUTABLE\_TABLE

- So far not part of the official online documentation
- The packages contain utilities that manage automatically created, self-tuning, materialized views

```
dbms_immutable_table.delete_expired_rows(  
  schema_name          IN  VARCHAR2,  
  table_name           IN  VARCHAR2,  
  before_timestamp     IN  TIMESTAMP WITH TIME ZONE DEFAULT NULL,  
  number_of_rows_deleted OUT NUMBER)
```

```
DECLARE  
  delRows INTEGER;  
BEGIN  
  dbms_immutable_table.delete_expired_rows('C##UWCLASS', 'AUDIT_LOG', SYSDATE-90, delRows);  
  dbms_output.put_line(TO_CHAR(delRows));  
END;  
/
```

- So far not part of the official online documentation
- The packages contain utilities that manage automatically created, self-tuning, materialized views

# 21c PL/SQL Packages Changes (1:4)

- CTX\_ENTITY has 1 new object
- DBMS\_APP\_CONT\_ADMIN has 5 new objects
- DBMS\_AQ has new SEEK procedure
- DBMS\_AQADM has 6 new objects
- DBMS\_ASH has new FETCH\_OBJ\_NAME and FETCH\_SQLTEXT objects and FETCH\_OBJ\_NAME\_AWR and 3 other objects removed
- DBMS\_ASSERT has new SIMPLE\_SQL\_NAME\_LIST function
- DBMS\_AUDIT\_MGMT\_LSBY has 10 new objects
- DBMS\_AUTOTASK\_PRVT has new REQUEST\_GRACE\_PERIOD function
- DBMS\_AUTO\_INDEX has new DROP\_AUTO\_INDEXES procedure
- DBMS\_AUTO\_INDEX\_INTERNAL has 4 new objects
- DBMS\_AW dropped 3 ...\_ACCESS\_TRACKING objects
- DBMS\_AW\_INTERNAL has 4 new objects
- DBMS\_BACKUP\_RESTORE has 5 new objects
- DBMS\_BLOCKCHAIN\_TABLE has 4 new objects
- DBMS\_BLOCKCHAIN\_UTL has new IS\_COPIER object
- DBMS\_CLOUD has 11 new objects
- DBMS\_CRYPTO has new PKDECRYPT, PKENCRYPT, SIGN and VERIFY objects
- DBMS\_CRYPTO\_FFI has new PKDECRYPT, PKENCRYPT, SIGN and VERIFY objects
- DBMS\_CUBE has new IMPORT\_XML\_BLOB procedure
- DBMS\_CUBE\_LOG has new TABLE\_DROP and TABLE\_TRUNCATE procedures
- DBMS\_DBFS\_CONTENT has 5 new objects
- DBMS\_DBFS\_HS dropped UNLOCKPATH procedure
- DBMS\_DBFS\_SFS has 25 new objects
- DBMS\_DBFS\_SFS\_ADMIN has new NEWIDAUX object

# 21c PL/SQL Packages Changes (2:4)

- DBMS\_DRS has 37 new objects
- DBMS\_EDITIONS\_UTILITIES has new ACTUALIZE\_ALL procedure
- DBMS\_FUSE has new FS\_MKSOC function with 3 overloads
- DBMS\_GSM\_FIX has 12 new objects
- DBMS\_GSM\_FIXED has 4 new objects
- DBMS\_GSM\_POOLADMIN has 11 new objects
- DBMS\_GSM\_UTILITY has 8 new objects
- DBMS\_GSM\_SEC has new PUTCATUSER procedure
- DBMS\_HADOOP\_INTERNAL has new EVAL\_PART\_KEY\_OPERATOR procedure and has dropped 3 objects
- DBMS\_HIERARCHY has 3 new objects
- DBMS\_INDEX\_UTL has new GET\_REORG\_INDEX\_ACTION procedure
- DBMS\_INTERNAL\_ROLLING has new IS\_PLSQL\_PRAGMA procedure
- DBMS\_IR has new UPDATEFEASABILITYANDIMPACT procedure
- DBMS\_ISCHED has new CREATE\_CLOUD\_CREDENTIAL and RESOLVE3\_NAME and dropped DEFINE\_CHAIN\_RULE and DEFINE\_CHAIN\_STEP
- DBMS\_I\_INDEX\_UTL has new I\_ANALYZE\_INDEX and I\_COMPUTE\_ACTION objects
- DBMS\_JSON has new BLOB\_TO\_JSON, GATHER\_STATS, and GET\_VIEW\_SQL objects
- DBMS\_JSON0 has new CHECKPK and GETMAXVCSIZE objects
- DBMS\_JSON\_INT has new BLOB2JSON procedure
- DBMS\_LOGMNR.INIT\_REPLICATION\_METADATA dropped
- DBMS\_LOB LOADFROMFILE and LOB new buffering support
- DBMS\_METADATA\_UTIL has new IS\_SHARD\_TBL\_IN\_SHARD\_CATALOG function
- DBMS\_ODCI has UPGRADE\_SECOBJ procedure removed
- DBMS\_PARALLEL\_EXECUTE\_INTERNAL has 4 new objects
- DBMS\_PLSQL\_CODE\_COVERAGE has new GET\_BLOCK\_MAP function



# 21c PL/SQL Packages Changes (3:4)

- DBMS\_PLUGTS has new KCP\_SETPIRENA procedure
- DBMS\_PREUP dropped 20 objects from 19c and added 14 new objects
- DBMS\_RVCAT has 26 new objects, drops ISTRANSLATEDPDBID, KTRANSLATEPDBNAME
- DBMS\_RCVMAN has 13 new objects
- DBMS\_RCVVPC has 8 new objects
- DBMS\_REDEFINITION\_INTERNAL has 9 new objects
- DBMS\_REGISTRY dropped 2 objects
- DBMS\_REGISTRY\_SYS has 2 new objects
- DBMS\_RESULT\_CACHE has 7 new objects
- DBMS\_SMB\_INTERNAL has new INIT\_SMB\_PARAMETER procedure
- DBMS\_SODA has 12 new objects
- DBMS\_SODA\_ADMIN has 11 new objects
- DBMS\_SODA\_DML has 3 new objects
- DBMS\_SPM\_INTERNAL has 6 new objects and dropped LOAD\_AUTO\_EVOLVE\_TASK\_CONFIG
- DBMS\_SQADM\_SYSCALLS has 2 new objects
- DBMS\_SQLCONTROL\_INTERNAL renamed by prefix dropping all four previously existing objects and added new GET\_OBJECT\_NAME procedure
- DBMS\_SQLPATCH has new VERIFY\_QUERYABLE\_INVENTORY function
- DBMS\_SQLQ\_INTERNAL procedures renamed to drop l\_ prefix and 4 objects dropped
- DBMS\_SQLQ\_INTERNAL.CREATE\_QUARANTINE\_BY\_TEXT renamed to \_BY\_SQLTEXT
- DBMS\_SQLTCB\_INTERNAL has new FIXQ object
- DBMS\_SQLTUNE has1 has 1 new object
- DBMS\_SQLTUNE\_UTIL0 has 1 new object
- DBMS\_SQLTUNE\_UTIL1 has 3 new objects
- DBMS\_SQLTUNE\_UTIL2 has 5 new objects

# 21c PL/SQL Packages Changes (4:4)

- DBMS\_STATS\_INTERNAL has 35 new objects
- DBMS\_SWRF\_INTERNAL has 3 new objects
- DBMS\_WORKLOAD\_CAPTURE dropped GET\_STATE function
- DBMS\_WORKLOAD\_CAPTURE\_I dropped GET\_STATE and USER\_CALLS\_GRAPH
- DBMS\_WORKLOAD\_REPLAY dropped GET\_STATE adds new CONFIGURE
- DBMS\_WORKLOAD\_REPLAY\_I dropped GET\_STATE adds new CONFIGURE
- DBMS\_WORKLOAD\_REPOSITORY has new AWR\_EXP procedure
- DBMS\_WRR\_INTERNAL dropped the EXPORT\_REP\_EXT\_TBL procedure
- DBMS\_WRR\_PROTECTED has new GET\_DBREPLAY\_PATCH\_INFO function
- DBMS\_XPLAN has new COMPARE\_CURSOR and COMPARE\_EXPLAIN objects
- DBMS\_XSTREAM\_GG\_ADM has new PURGE\_TXN\_CDR\_INFO object
- DBMS\_XSTREAM\_GG\_INTERNAL has new PURGE\_TXN\_CDR\_INFO\_INTERNAL object
- DBMS\_XS\_SIDP has new DODHEXCHANGE2 and DODHEXCHANGE3 procedures
- EXCHANGE has new DO\_DDL\_JOB procedure
- KBRSI\_ICD has 4 objects removed and 19 new objects added
- KUPP\$PROC has 4 new objects
- PRVTEMX\_DBHOME has new REPORT\_ASH\_XML function
- PRVTEMX\_PERF has new ACTION\_CANCEL\_SQL\_XML function
- PRVT\_AWR\_VIEWER has 9 new objects
- PRVT\_DBMS\_INMEMORY\_ADMIN has SPACE\_USAGE2 and TRACE removed
- PRVT\_DIMENSION\_SYS\_UTIL dropped the SET\_DEBUG procedure
- PRVT\_EMX has new OMX\_LOCALES function
- XS\_ACL has new GRANT\_PRIVILEGE and REVOKE\_PRIVILEGE procedures

*Wrap Up*

# Business Case

- Some time in the next 3-5 years you will be forced to do one of two things
  - Migrate to an Oracle Container Database
  - Execute a career change
- The organization you current work for will either upgrade to CDBs and PDBs or do business with unsupported applications running on an unsupported database with limited or no access to bug fixes and security patches
- That upgrade to 21c+ will force a legacy architecture to working with a mandatory migration from Oracle's a container database
- If you do not know how to create a common profile you are a decade behind where you should be
- And, needless to say it is your responsibility to not only learn how to work with and manage a container database ... it is your responsibility to learn all of the critically important new features in Oracle Database versions 12c through 21c so that you are prepared for 23c
- I hope today you started down the road of a synapse stimulating adventure



# Thank you

- For inviting me here today
- To the volunteers that make this user group function
- Please contact them and volunteer a few hours of your time to help them continue to provide programs such as the one you are enjoying today