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NORTH AMERICA

Technology Overview

Database: 18c / 19c

Company: Oracle Corporation

Topic: Snapshot Carousel

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On the Eleventh Day of 18c/19c, Viscosity Gave to me...

Snapshot Carousel

December 22, 2020

The Snapshot Carousel, introduced in Oracle Database 18c, provides customers a library of PDBs taken over a period of time. Customers now have access to point-in-time copies of PDBs, to use for hot cloning or restoring. Snapshot carousels are great, because it does not rely on storage snapshot technologies.

Unfortunately, as of this article, snapshot carousels are only available on the Engineered Systems (Exadata and ODAs with ACFS) platforms including Exadata Cloud services. For testing purposes, you can leverage the underscore "`_exadata_feature_on`" initialization parameter.

Snapshot Carousels provide point-in-time sparse or full copies of the entire pluggable database depending on the storage support for thin/sparse provisioning. You can configure snapshots to occur every day with the `SNAPSHOT MODE EVERY 24 HOURS` clause, or any threshold in minutes or hours. This option can be specified during the `CREATE PLUGGABLE DATABASE` or `ALTER PLUGGABLE DATABASE` option. Acceptable thresholds for automatically creating snapshots are:

- Every x hours - a snapshot is automatically created every "x" hours between 1 and 1999 hours.
- Every x minutes - a snapshot is automatically created every "x" minutes between 1 and 2999 minutes.

Customers can provision clones from any given day, from any of the eight copies maintained by Oracle. As of now, the maximum number of snapshots is governed by the `MAX_PDB_SNAPSHOTS` parameter, which has a default value of 8 copies. When the maximum copy is reached, Oracle will drop the oldest snapshot before it provisions the next snapshot of the PDB. This allows customers to go back in time, up to 8 days (or whatever is the snapshot interval is defined to be), to provide the most current or prior snapshot images of the PDB. Some use cases for snapshot carousels are:

- Take a snapshot prior to a data load and be able to go back prior to the load
- Provision (Recover) from past snapshots
- Hot fix testing on a snapshot
- Provisioning lower environments, by coupling snapshot carousels with refreshable pluggable database technology

To create a snapshot every day for the pluggable database use the following syntax:

```
SQL> alter pluggable database snapshot mode every 24 hours;
```

```
Pluggable database altered.
```

We can query the CDB_PDBS view to see the snapshot interval and snapshot mode columns for the pluggable database. Notice that the snapshot interval has a numeric value of 1440 which represents the number of minutes in a 24 hour period.

```
col snapshot_interval for 999999 hea "SNAP|INTERVAL"  
col pdb_name for a15  
set lines 122  
select pdb_id, pdb_name, status, snapshot_mode, snapshot_interval  
from dba_pdb;  
/
```

PDB_ID	PDB_NAME	SNAP STATUS	SNAPSH INTERVAL
3	PDB19C01	NORMAL	AUTO 1440

For our reporting purposes, we are going to initiate a snapshot to be provisioned every 15 minutes:

```
SQL> alter pluggable database snapshot mode every 15 minutes;
```

```
Pluggable database altered.
```

Since this technology leverages sparse cloning techniques, it essentially presents the complete image of the PDB that does not need to be materialized.

We can query the CDB_PROPERTIES view to see the current setting for the MAX_PDB_SNAPSHOTS parameter.

```
set lines 150 tab off  
col property_value for a10 head PROPERTY|VALUE  
col property_name for a30  
col description for a55
```

```
SELECT cp.con_id,  
       p.pdb_name,  
       cp.property_name,  
       cp.property_value,  
       cp.description  
FROM   cdb_properties cp, cdb_pdb p  
where  cp.con_id = p.con_id  
and    cp.property_name = 'MAX_PDB_SNAPSHOTS'  
ORDER BY cp.property_name  
/
```

CON_ID	PDB_NAME	PROPERTY_NAME	PROPERTY VALUE	DESCRIPTION
3	PDB19C01	MAX_PDB_SNAPSHOTS	8	maximum number of snapshots for a given PDB

Trying to set this value to a greater number than 8 will trigger the error below. Setting this value to zero, will instantly remove all the snapshot PDBs.

```
SQL> ALTER PLUGGABLE DATABASE SET MAX_PDB_SNAPSHOTS=10;
ALTER PLUGGABLE DATABASE SET MAX_PDB_SNAPSHOTS=10
*
ERROR at line 1:
ORA-65383: unable to set MAX_PDB_SNAPSHOTS property to greater than 8
```

We can query the DBA_PDB_SNAPSHOTS view to see the full path of our PDBs that were “snapshotted”, based on our defined threshold:

```
set lines 200 trims on tab off
col full_snapshot_path for a58
col con_id for 999999
col con_name for a10
col snapshot_name for a28
```

```
SELECT con_id,
       con_name,
       snapshot_name,
       snapshot_scn,
       full_snapshot_path
FROM   dba_pdb_snapshots
```

```
/
```

CON_ID	CON_NAME	SNAPSHOT_NAME	SNAPSHOT_SCN	FULL_SNAPSHOT_PATH
3	PDB19C01	SNAP_2655339241_1059639563	2743335	/u02/app/oracle/oradata/DB19c/snap_2655339241_2743335.pdb
3	PDB19C01	SNAP_2655339241_1059637763	2738486	/u02/app/oracle/oradata/DB19c/snap_2655339241_2738486.pdb
3	PDB19C01	SNAP_2655339241_1059640463	2744473	/u02/app/oracle/oradata/DB19c/snap_2655339241_2744473.pdb
3	PDB19C01	SNAP_2655339241_1059638663	2740512	/u02/app/oracle/oradata/DB19c/snap_2655339241_2740512.pdb

Provisioning (Recovering) From PDB Snapshots

Let’s create a couple of PDBs leveraging the snapshots that we created automatically. First, we will create a snapshot clone called pdb_dev01 from our SNAP_2655339241_1059638663 snapshot:

```
SQL> create pluggable database pdb_dev01 from PDB19C01 using snapshot
SNAP_2655339241_1059638663;
Pluggable database created.
SQL> alter pluggable database PDB_DEV01 open read write;
Pluggable database altered.

SQL> alter pluggable database PDB_DEV01 save state;
Pluggable database altered.
```

Next, let's create another snapshot clone called `pdb_dev02` from our `SNAP_2655339241_1059640463` snapshot. However, this time we will have it start maintaining snapshots carousels of its own as well, every day:

```
SQL> create pluggable database pdb_dev02 from PDB19C01 using snapshot
SNAP_2655339241_1059640463 snapshot mode every 24 hours;
Pluggable database created.
SQL> alter pluggable database PDB_DEV02 open read write;
Pluggable database altered.

SQL> alter pluggable database PDB_DEV02 save state;
Pluggable database altered.
```

Manually Maintaining Snapshot PDBS

We can manually create and drop a snapshot PDB. When manually creating a snapshot PDB, the database can assign a system generated name or assign the snapshot PDB name at the time of creation.

```
SQL> ALTER PLUGGABLE DATABASE SNAPSHOT;
Pluggable database altered.

SQL> ALTER PLUGGABLE DATABASE SNAPSHOT pdb_dev01_19DEC20_snap;
Pluggable database altered.
```

We can see from the output below the two snapshots created.

CON_ID	CON_NAME	SNAPSHOT_NAME	SNAPSHOT_SCN	FULL_SNAPSHOT_PATH
4	PDB_DEV01	SNAP_911704418_1059642190	2751692	/u02/app/oracle/oradata/DB19c/snap_911704418_2751692.pdb
4	PDB_DEV01	PDB_DEV01_19DEC20_SNAP	2756645	/u02/app/oracle/oradata/DB19c/snap_911704418_2756645.pdb

If you are logged into a PDB, the `DBA_PDB_SNAPSHOTS` view only records values relative to its own snapshots. If you want to see all the snapshots, you can issue the same query from the root container to see the PDBs and all of the associated snapshots.

To drop a snapshot PDB, we issue to `ALTER PLUGGABLE DATABASE` command but with the `DROP` option:

```
SQL> ALTER PLUGGABLE DATABASE drop snapshot SNAP_2655339241_1059639563;
ALTER PLUGGABLE DATABASE drop snapshot SNAP_2655339241_1059639563
*
ERROR at line 1:
ORA-65364: snapshot not found

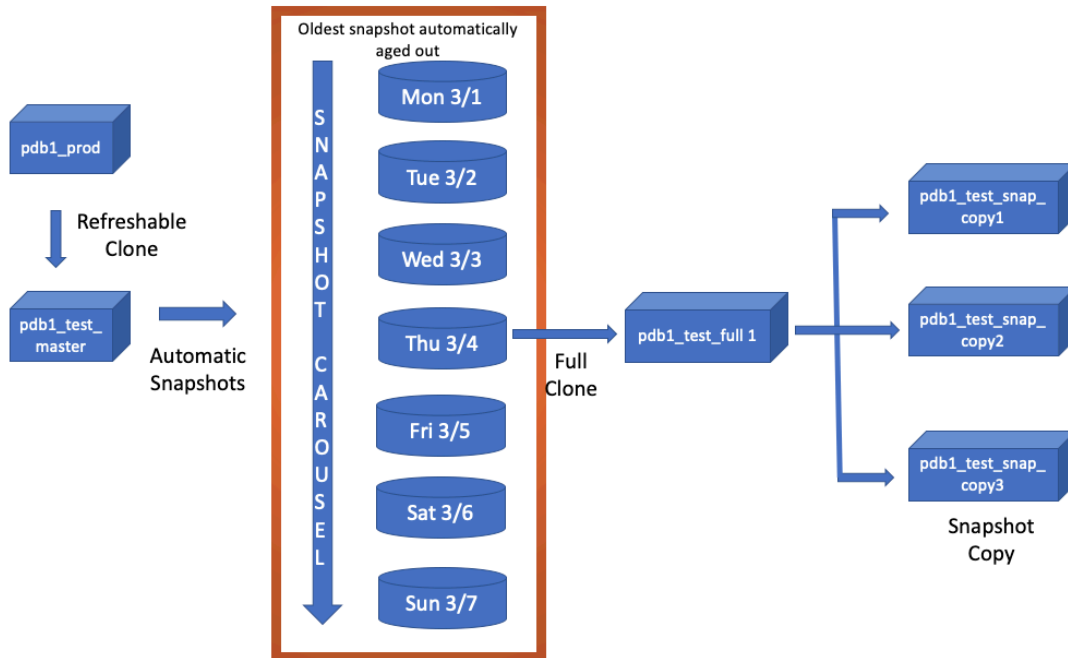
SQL> alter session set container=PDB19C01;
Session altered.

SQL> ALTER PLUGGABLE DATABASE drop snapshot SNAP_2655339241_1059639563;
Pluggable database altered.
```

As you can see, you must be logged into the PDB, to be able to drop the snapshot associated with the PDB. Attempting to drop a snapshot PDB from the root container will produce the "snapshot not found" error.

Summary

A great start to understanding the snapshot carousel is to understand the flow. In the image below, you can visually see how the Snapshot Carousel works to create eight point-in-time clones, on different days, that can be used for other purposes.

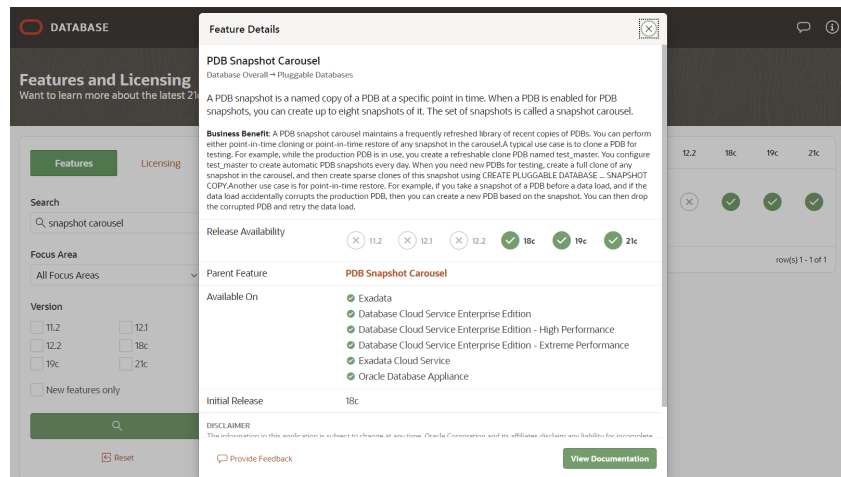


If you go to Oracle's online documentation, you'll find that it is available on Exadata & DBCS EE (Database Cloud Service Enterprise Edition). From the looks of it, Oracle is making PDB snapshot carousels available in Exadata and Oracle Database Appliance (ODA) engineered systems including Exadata Cloud:

<https://docs.oracle.com/en/database/oracle/oracle-database/19/dblic/Licensing-Information.html#GUID-0F9EB85D-4610-4EDF-89C2-4916A0E7AC87>

Feature / Option / Pack	SE2	EE	EE-ES	DBCS SE	DBCS EE	DBCS EE-HP	DBCS EE-EP	ExaCS	Notes
Oracle Multitenant - # of PDBs	3	252	4096	3	3	4096	4096	4096	<p>The number value in each column indicates the maximum number of pluggable databases (PDBs) that can be created for each offering.</p> <ul style="list-style-type: none"> For all offerings, if you are not licensed for Oracle Multitenant, then you may have up to 3 user-created PDBs in a given container database at any time. EE: Extra cost option; if you are licensed for Oracle Multitenant, then you can create up to 252 PDBs. EE-ES: Extra cost option; if you are licensed for Oracle Multitenant, then you can create up to 4096 PDBs. DBCS EE-HP, DBCS EE-EP, and ExaCS: Included option; you can create up to 4096 PDBs. <p>Note: For licensing purposes, one non-CDB instance is equivalent to one user-created PDB inside one CDB.</p>
CDB Fleet Management	N	N	Y	N	Y	Y	Y	Y	
PDB Snapshot Carousel	N	N	Y	N	Y	Y	Y	Y	
Refreshable PDB switchover	N	N	Y	Y	Y	Y	Y	Y	

Getting more updated information, the following screenshot provides information to include support for Oracle Database Appliances too:



Oracle continues to innovate multi-tenant capabilities and specifically Pluggable Databases (PDBs) to rapidly provide data for consumption. PDBs can easily be cloned full/sparse, migrated to other container databases without any downtime, and even re-located to future versions of the database containers with minimal downtime. PDB adoption will be the norm starting with Oracle Database 19c with all Oracle customers. Remember, starting in Oracle Database 21c, Oracle will only support containerized databases. When you look to understand or implement new features on Oracle, remember to give Viscosity a call to help.

One of the sayings we have at Viscosity is our customer's, "have four aces in their pocket". Over the previous 10 days, the talented staff at Viscosity along with our Oracle ACEs have addressed more Oracle Database 18c and 19c new features. Continue to join us next year, as we continue our Oracle Database 19c hands-on-lab workshops.

Happy Holidays!