Oracle Boot Camp
Chennai -14 Oct 2023

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About Me

- I'm Abhilash Kumar Bhattaram - Founder Nabhaas Cloud Consulting
- My core area of expertise is Enterprise consulting on Cloud Databases
    - OCI - Database Families On Prem Oracle Databases / ExaCS , Exadata and Sun Super Cluster
    - Oracle Golden Gate
    - AWS RDS
    - Google BigQuery

- I'm from Chennai - India
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DISCLAIMER : All my views and presentations are from personal experience and do not represent any Technology Vendor

OCI Oracle Cloud Infrastructure - Where to Begin

- A lot of this slide will be on the marker board
- OCI - Documentation

https://docs.oracle.com/en-us/iaas/Content/home.htm

What DBA's / Developers can learn from this OracleBootCamp

- The Agenda for this presentation is for Customers / Engineer's / DBA's to understand the details of services provided by DB Systems and ExaCS and how Oracle manages them.
- There is wealth of Information available in Oracle Documentation but it is not clear when it comes to choosing the services to match the requirements.
- The challenge is to suit the OCI Cloud services to match the requirements and in most cases a bulk of time spent by projects are at this stage.

OCI - Database Families

Let's take a step back and first understand the Database Families before getting in to any internals of Databases

OCI Managed Oracle Databases

- DB Systems a.k.a Oracle Base Database Service
- ExaCS (Cloud Service) - Exadata Cloud Service
- Autonomous Databases

Customer Managed

- ExaCC (Cloud at Customer)

The Scope of current presentation is to explain the internals of DB Systems and ExaCS Systems which are primarily the most used category of databases.

DB Systems

- Before we begin a note on Documentation
  - Oracle Documentation : If you are new or novice or expert, always refer the documentation reference [here](#) for the source of truth.

Use Case for DB Systems

- So what are the need of DB Systems , why should a customer go for a DB System, below are some typical examples to understand the use cases.
- DB Systems are meant to to be database engines which can be available as a Cloud service independently
- These can be Single Node DB Systems or RAC DB Systems on Virtual Machines
  - Bare Metal's are also available on specific shapes
- The following Editions are available for DB Systems
  - Standard Edition
  - Enterprise Edition
  - Enterprise Edition - High Performance
  - Enterprise Edition - Extreme Performance

DB Systems … contd.

Examples of Typical DB System Usage

- An ERP Application like (Oracle EBS , PeopleSoft) with database needed to be on Oracle would need to have a dedicated database environment as Cloud Service.
- One DB System essentially means 1 CDB and 1 PDB is available as a cloud service by default.
- Only 1 CDB is allowed additional PDB's can be added if required.

DB System Cloud Service - What does it offer - How does it make managing Databases better

Manageability

- ➔ First things comes first for managing databases for DBA's for day to day activities.
- ➔ Below are the list of things that OCI provides as Cloud Services for managing the databases
  - ◆ **Backups**
    - Database Backup Life cycles are Cloud Managed (RMAN Object Storage)
    - You can take custom backups as needed (File Storage and Object Storage)
  - ◆ **Monitoring**
    - OCI Provides Performance Hub for monitoring for OEM like monitoring
    - OCI Metrics are integrated with DB System to create Alarms for CPU / AM Storage
  - ◆ **Refresh Databases**
    - OCI Clone Database is available to create a clone copies of Databases

DB Systems … contd.

DB System Internals - DB System Memory Settings

- DB Systems come with Max possible HugePages allocated to SGA
- Scaling up of Memory will require scale up of CPU's
- Caution : Do not attempt to scale up SGA higher than HugePages (database service will not start up)
- Quick Reference of HugePages here

DB Systems … contd.

DB System Memory Settings (example)

```
|--------------------------------------- Memory VM.Standard2.8

orcl> show parameter sga
NAME                              |TYPE        |VALUE
----------------------------------|-----------|---------------------------------
sga_max_size                      |big integer|59904M
sga_min_size                      |big integer|0
pga_aggregate_limit               |big integer|29952M
pga_aggregate_target              |big integer|14976M


$ more /proc/meminfo | grep -i Huge
AnonHugePages:        0 kB
ShmemHugePages:       0 kB
HugePages_Total:   31450
HugePages_Free:     1548
HugePages_Rsvd:       52
HugePages_Surp:        0
Hugepagesize:       2048 kB


1548*2048/1024/1024 = 3.02 GB Free      [ Only additional 3 GB available for SGA allocation ]

$ free -g
               total        used        free      shared  buff/cache   available
Mem:             117          78           9           0          29          36
Swap:              9           0           9
```

DB Systems … contd.

DB System Internals - DB System CPU Settings

- DB Systems come with cpu settings derived from host VM's
- Scaling up of CPU will also scale up memory proportionally
- Scaling up and Scaling Down of CPU is not dynamic as it will effect a restart of the database.
- Scaling up and Scaling Down will automatically change the memory settings accordingly
- Documentation on DB System shapes can be referenced [here](#)

DB Systems … contd.

DB System CPU Settings (example)

```
------------------------------------------ CPU   VM.Standard2.8

$ more /proc/cpuinfo | grep -i proc | wc -l
16


orcl> show parameter cpu
NAME                                  |TYPE        |VALUE
--------------------------------------|-----------|------------------------------
cpu_count                             |integer     |16
parallel_threads_per_cpu              |integer     |2
resource_manager_cpu_allocation       |integer     |16

orcl> conn / as sysdba
Connected.

orcl> show parameter cpu
NAME                                  |TYPE        |VALUE
--------------------------------------|-----------|------------------------------
cpu_count                             |integer     |16
parallel_threads_per_cpu              |integer     |2
resource_manager_cpu_allocation       |integer     |16
```

DB Systems … contd.

DB System Internals - DB System Storage

- DB System Storage has External Redundancy by Default
- Storage cannot be downscaled once upscaled

```
-------------------------------------- Storage

GROUP_NUMBER|NAME                |STATE      |TYPE   |  TOTAL_GB| MIRROR GB|   USED_GB|   FREE_GB|USEABLE_GB|  USAGE(%)|DATABASE_COMPAT|COMPATIBILITY
-----------|----                |-----      |-----  |--------- |----------|----------|----------|----------|----------|-------------- |--------------
          1|DATA                |CONNECTED  |EXTERN |    12288 |         0|10777.6602|1510.33984|      1510|87.7088229|11.2.0.4.0     |19.0.0.0.0
          2|RECO                |CONNECTED  |EXTERN |     2456 |         0|1981.71484|474.285156|       474|80.6887151|11.2.0.4.0     |19.0.0.0.0
```

DB Systems … a summary

Cloud Resource	DB Systems
Oracle Home	1
CDB's	1
PDB's	> 1
CPU	Upscalable and Downsclable
Memory	Upscalable and Downsclable
ASM Storage	Upsclable Only
Backups	OCI Managed [RMAN Object Storage] Custome Backups can be taken as needed
Performance Hub	OCI Performance Hub
Refreshes	OCI Clone DB System
Metrics	OCI DB System Metrics liked to Alarms
Database Patching	OCI Managed Patching Service
Infra Patching	OCI Managed Cloud Agent/Softwares

ExaCS - Exadata Cloud Service

- Before we begin a note on Documentation
  - Oracle Documentation : If you are new or novice or expert, always refer the documentation reference [here](#) for the source of truth.
- ExaCS is basically Oracle Exadata Engineered Appliance where the Infra Layer is managed by Oracle and Database / Data Layer is managed by the customer

Use Case for ExaCS

- In short ExaCS are mainly used for mission critical applications where there is required to be redundancy at all layers from storage to infiniband to databases, i.e. a smallest downtime mounting to a lot of $'s
- Similar to Exadata , ExaCS allows coexisting of multiple database homes
- Many enterprises databases are spread across a few databases and Exadata can co-host them.

ExaCS … contd.

Manageability

There are host of ExaCS features , but we will start with some of the essential things needed for DBA's available as cloud offerings from ExaCS are the ones below

Backups

- **Backups**
  - Database Backup Life cycles are Cloud Managed (RMAN Object Storage)
  - You can take custom backups as needed (File Storage and Object Storage)
- **Monitoring**
  - OCI Provides Performance Hub for monitoring for OEM like monitoring
  - OCI Metrics are integrated with DB System to create Alarms for CPU / AM Storage
- **Refreshes**
  - SPARSE Disk Groups are available for Sparse Clones , this essentially helps clones PDB's within ExaCS , this could be a useful reference for Sparse Clones [here](#)
  - ExaCS also has a provision to create new CDB's from backups witthin the ExaCS
  - In case SPARSE clones does not suit the customer architecture of hosting the databases , there is no direct way to refresh ExaCS to DB System (say a Prod to Dev Refresh) , but I have this covered in my blog [here](#) as details of how this is done is beyond the scope of this presentation.

ExaCS … contd.

The Exadata Shapes are as below

Documentation of ExaCS shapes are available [here](#) ,

Exadata.Base.48   [Smallest Shape of ExaCS Families]

X6 - Shapes

- Exadata.Quarter 1.84
- Exadata.Half 1.168
- Exadata.Full 1.336

X7 - Shapes

- Exadata.Quarter 2.92
- Exadata.Half 2.184
- Exadata.Full 2.368

X8 - Shapes

- Exadata.Quarter 2.92
- Exadata.Half 2.184
- Exadata.Full 2.368]

NOTE : the important thing to note is that ASM storage is fixed for all the shapes, unlike DB System's additional storage for a particular ExaCS shape cannot be provisioned.

ExaCS … contd.

Benefits of ExaCS from On Prem Exadata

- Unlike traditional On Prem Exadata , ExaCS families can be scaled on demand.
- I.e. for example if a customer chooses the base variant of ExaCS - Exadata.Base.48 , the customer can start with a 8 core configuration and scale up cores on Demand , the Cloud costs would be set for 8 cores only ,
- This is an added advantage to reduce costs to avoid spending for the entire Exadata machines (as On Prem)
- This auto scaling of ExaCS core is one of the major advantages where customers can grow their systems as their application / business grow.
  - NOTE : It is to be noted that the entire ASM Storage will be available to the customer at the initial setting up of the ExaCS environment , the scale up and scale down of Cores would be On Demand.
- The Infra Layer is completely managed by Oracle , the customer has to manage only the Databases / Data

ExaCS … contd.

ExaCS Host CPU

- ExaCS CPU cores are as the configuration in setup.
- I.e. let's take an example of a Exadata.Base.48 family ,
  - The configuration can have 8 cores initially and can be scaled up
  - These 8 cores are available to all of it's Databases

ExaCS Database CPU Usage

- As mentioned earlier , ExaCS can host multiple Oracle Homes and multiple Databases
- For extremely busy databases it is recommended to have a segregation of resources.
  - I.e. in the above example , let's consider the Exadata.Base.48 family has 8 cores with the following
    - 2 Oracle Homes
    - 1 Database in each Oracle Home
  - In such cases 3 cores for each of the databases can be provided and 2 as a buffer can be reserved for future use , this is achieved via Instance Caging.
    - The following MOS is a good document about Instance Caging "Configuring and Monitoring Instance Caging (Doc ID 1362445.1)"

ExaCS … contd.

ExaCS Database Memory Usage

- ExaCS Memory Usage by databases is one of the most underlooked part by DBA's and OCI Engineers
- ExaCS has Hugepages Enabled at Linux (similar to DB Systems) , the challenge is to size the database memory adequately.
- While Provisioning the ExaCS the most important part is to identify how many reserved HugePages are available.
- Coming back to the previous example Exadata.Base.48 with all 48 cores allocated would have 375 GB of RAM per ExaCS node , BUT
  - Not all of available memory is available as HugePages , the following needs to considered.
  - **# more /proc/meminfo | grep -i Hiuge**
  - The value of **HugePages_Free** is the number of HugePages for all of the instances on the node.
- So essentially we need to calculate the Memory Required for the databases and scale up the ExaCS cores ill the required HugePages are available for the databases.
  - This is exactly why a DBA's understanding of the systems are so important.

DB Systems and ExaCS .. putting it all together

Cloud Resource	DB Systems	ExaCS
Oracle Home	1	>1
CDB's	1	>1
PDB's	> 1	> 1
CPU	Upscalable and Downsclable	Upscalable and Downsclable
Memory	Upscalable and Downsclable	Upscalable and Downsclable [Customer Managed Configuration for Databases]
ASM Storage	Upsclable Only	Fixed per ExaCS Shape
Backups	OCI Managed [RMAN Object Storage] Custome Backups can be taken as needed	OCI Managed [RMAN Object Storage] Custome Backups can be taken as needed
Performance Hub	OCI Performance Hub	OCI Performance Hub
Refreshes	OCI Clone DB System	SPARSE PDB Clones Exadata Backup / Restore within ExaCS ExaCS refresh to DBCS (blog)
Metrics	OCI DB System Metrics liked to Alarms	OCI DB System Metrics liked to Alarms
Database Patching	OCI Managed Patching Service	OCI Managed Patching Service
Infra Patching	OCI Managed Cloud Agent/Softwares	OCI Managed Quarterly Patching of ExaCS Components

Questions ?