Managing Database Memory

By Ahmed Baraka

Objectives

In this lecture, you will learn how to perform the following:

- Enable Automatic Memory Management (AMM)
- Enable the Automatic Shared Memory Management (ASMM)
- Enable the Manual Shared Memory Management
- Monitor the Automatic Memory Management
- Tuning memory using advisors

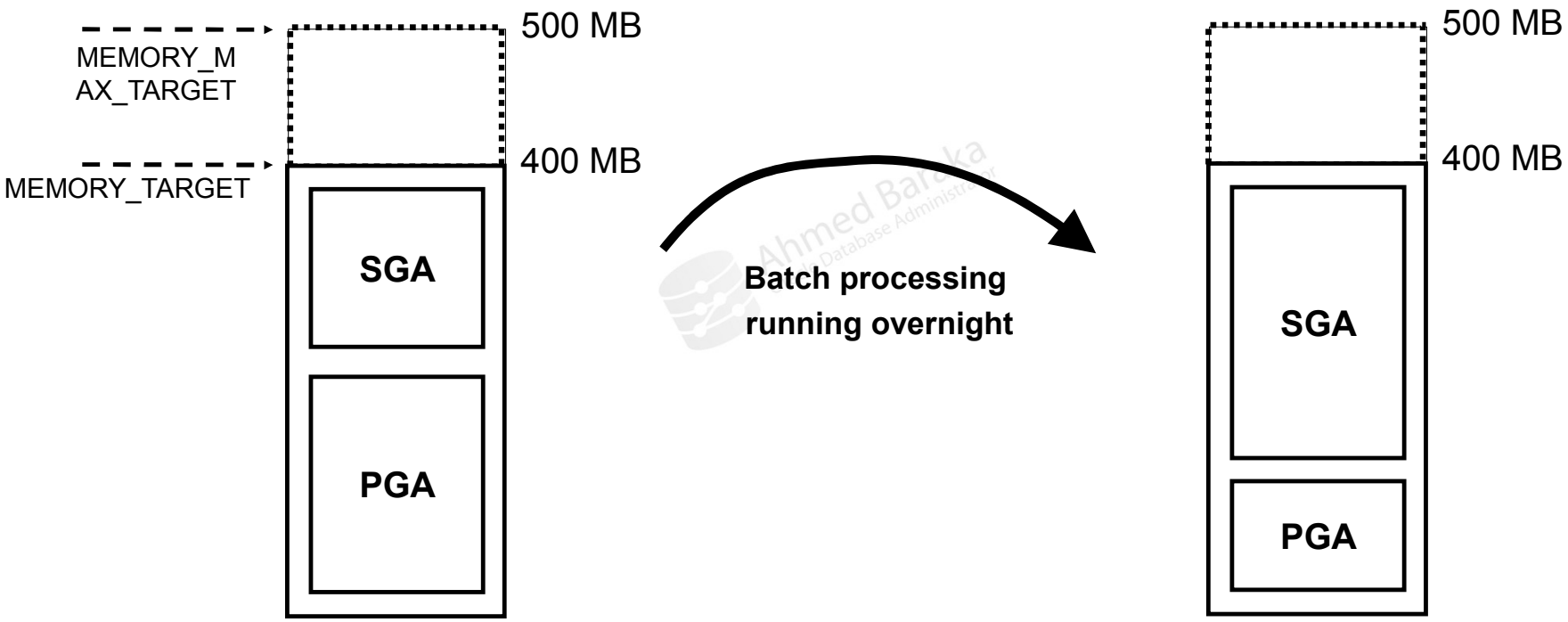
Managing Oracle Database Memory Methods

- **Automatic Memory Management (AMM):**
  - SGA and PGA sizes are dynamically set
  - Enabled by setting **`MEMORY_TARGET`**
- **Automatic Shared Memory Management (ASMM)**
  - Set SGA size and the database dynamically sets the SGA components
  - Set the PGA aggregate size
  - Enabled by setting **`MEMORY_TARGET`** to zero and setting **`SGA_TARGET`** and **`PGA_AGGREGATE_TARGET`**
- **Manual Memory Management**
  - All memory components are manually set

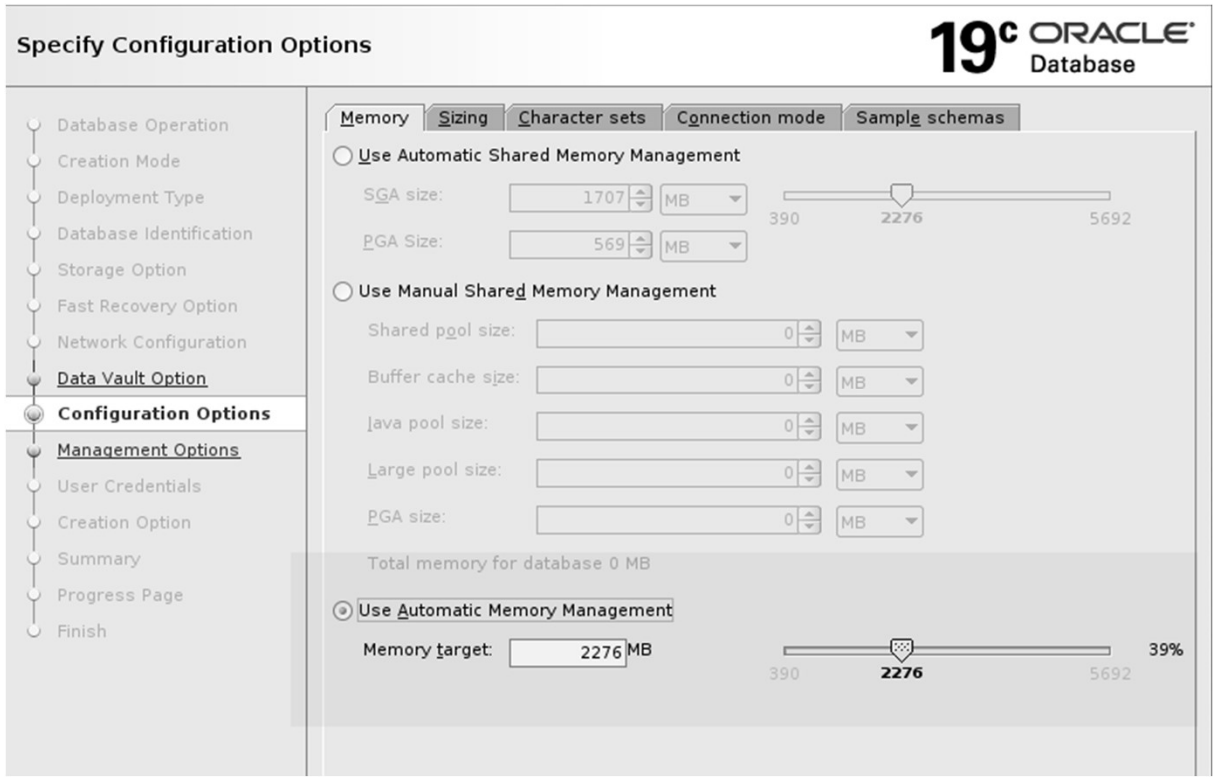
Automatic Memory Management (AMM)

- Enabled by setting the parameter **`MEMORY_TARGET`**
- Allows the Database to manage SGA memory and instance PGA memory sizing automatically based on the processing needs
- **`MEMORY_MAX_TARGET`** helps us from accidentally setting the target memory size too high
- Set the **`MEMORY_MAX_TARGET`** to its maximum possible value straight away after creating a new database
- The system must have total memory size of 4G or less
- In Linux, the AMM cannot exceed the total shared memory size

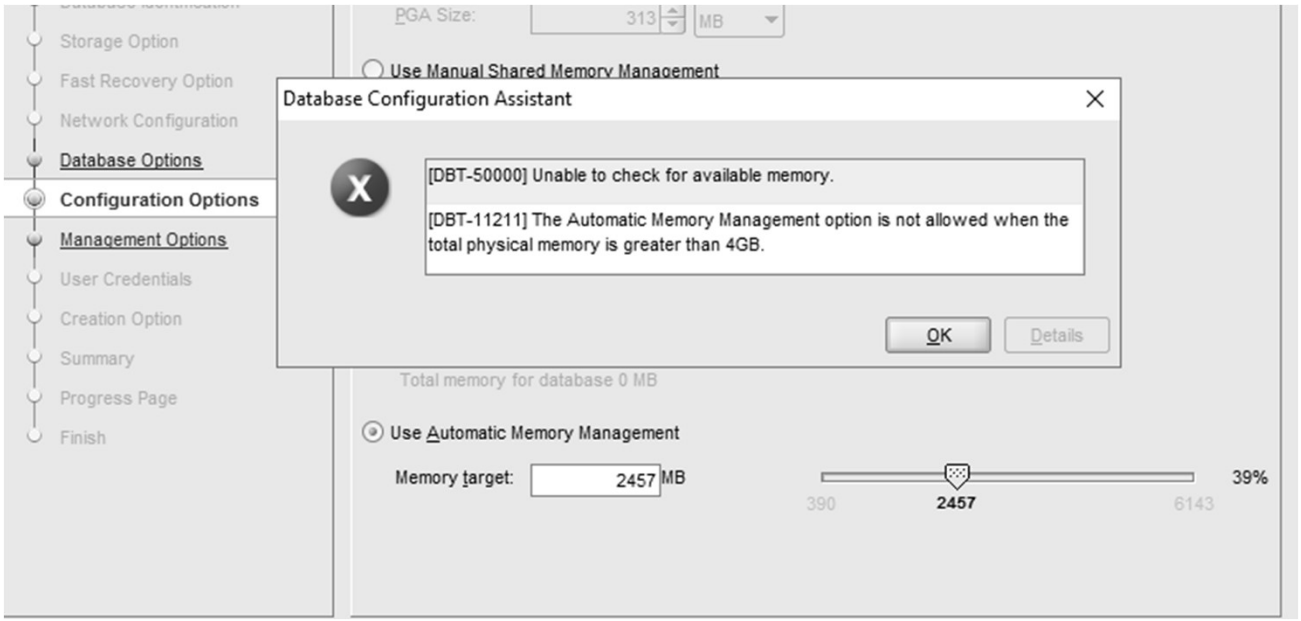
Automatic Memory Management Example



Enabling Automatic Memory Management at the Time of Database Creation



Enabling Automatic Memory Management at the Time of Database Creation



Enabling Automatic Memory Management

1. As sysdba, retrieve the maximum memory targe size:

```
SHOW PARAMETER MEMORY_MAX_TARGET
```

2. If the required memory target less than or equal to the maximum:

```
ALTER SYSTEM SET MEMORY_TARGET = nM  SCOPE = BOTH;
```

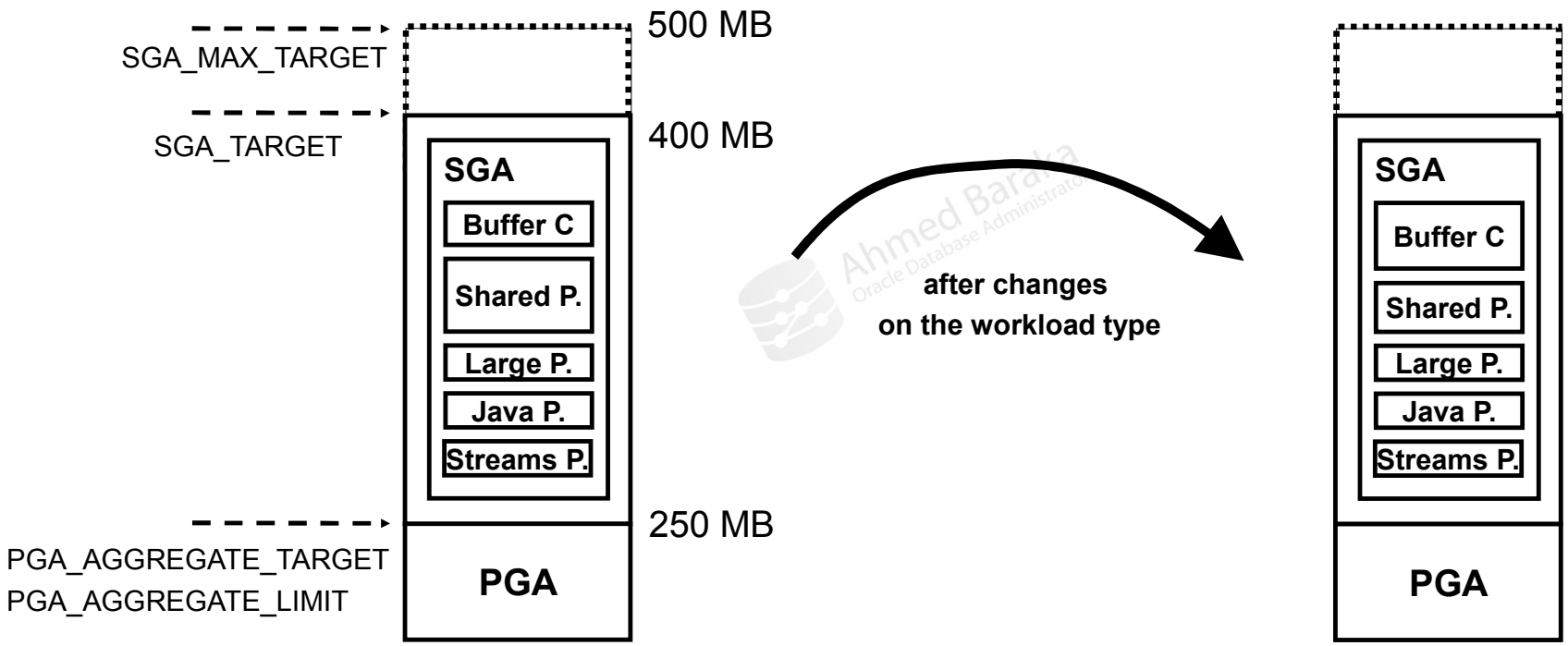
3. If the required memory target is greater than the maximum:

```
ALTER SYSTEM SET MEMORY_MAX_TARGET = nM  SCOPE = SPFILE;
ALTER SYSTEM SET MEMORY_TARGET = nM  SCOPE = SPFILE;
-- restart the instance
```

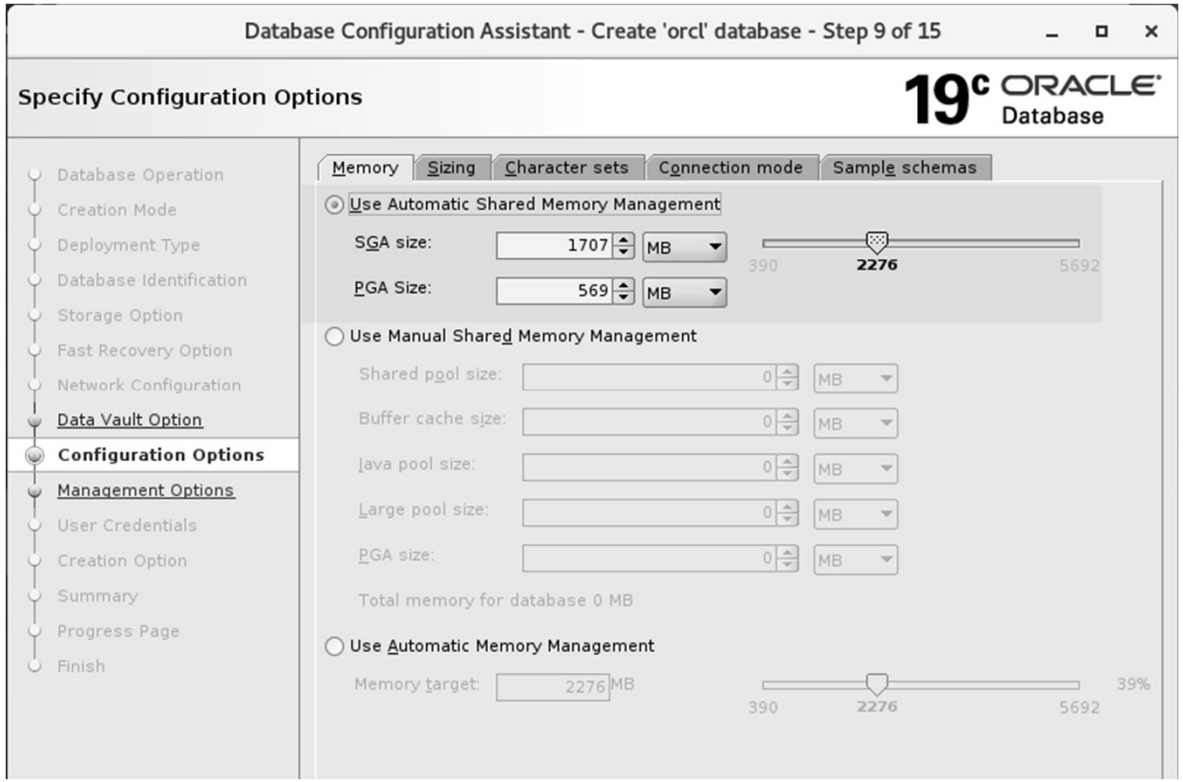
About Automatic Shared Memory Management

- Oracle database automatically tunes the SGA and the PGA sizes
- **`MEMORY_TARGET`** must be zero
- Specify the SGA size by setting **`SGA_TARGET`** (dynamic)
  - Cannot exceed **`SGA_MAX_TARGET`** (static)
- Automatically tune areas: Buffer cache, Shared pool, Large pool, Java pool, Streams pool, and Data transfer cache
- Specify the PGA size by setting **`PGA_AGGREGATE_TARGET`**
  - Specify its maximum value by setting **`PGA_AGGREGATE_LIMIT`**. It defaults to 200% of **`PGA_AGGREGATE_TARGET`**.
- ASMM is the recommended memory management method

Automatic Shared Memory Management Example



Enabling Automatic Shared Memory Management at the Time of Database Creation



Enabling Automatic Shared Memory Management

1. Disable the AMM (if it is enabled):

```
SHOW PARAMETER MEMORY_TARGET
ALTER SYSTEM SET MEMORY_TARGET = 0 SCOPE=BOTH;
```

2. Retrieve the maximum SGA size:

```
SHOW PARAMETER SGA_MAX_SIZE
```

3. If the required SGA target is greater than the maximum:

```
ALTER SYSTEM SET SGA_MAX_SIZE = nM  SCOPE=SPFILE;
ALTER SYSTEM SET SGA_TARGET = nM  SCOPE=SPFILE;
-- restart the instance
```

4. If the required SGA target is less than or equal to **SGA_MAX_SIZE**

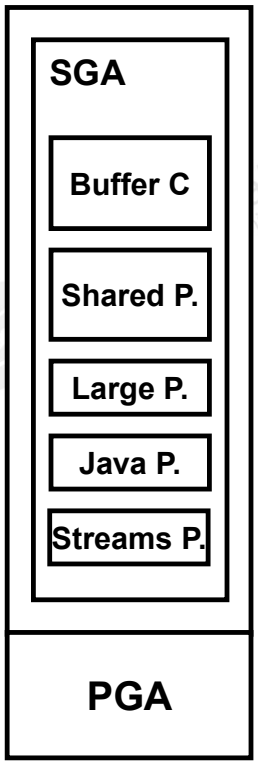
```
ALTER SYSTEM SET SGA_TARGET = nM  SCOPE=BOTH;
```

Enabling Automatic Shared Memory Management

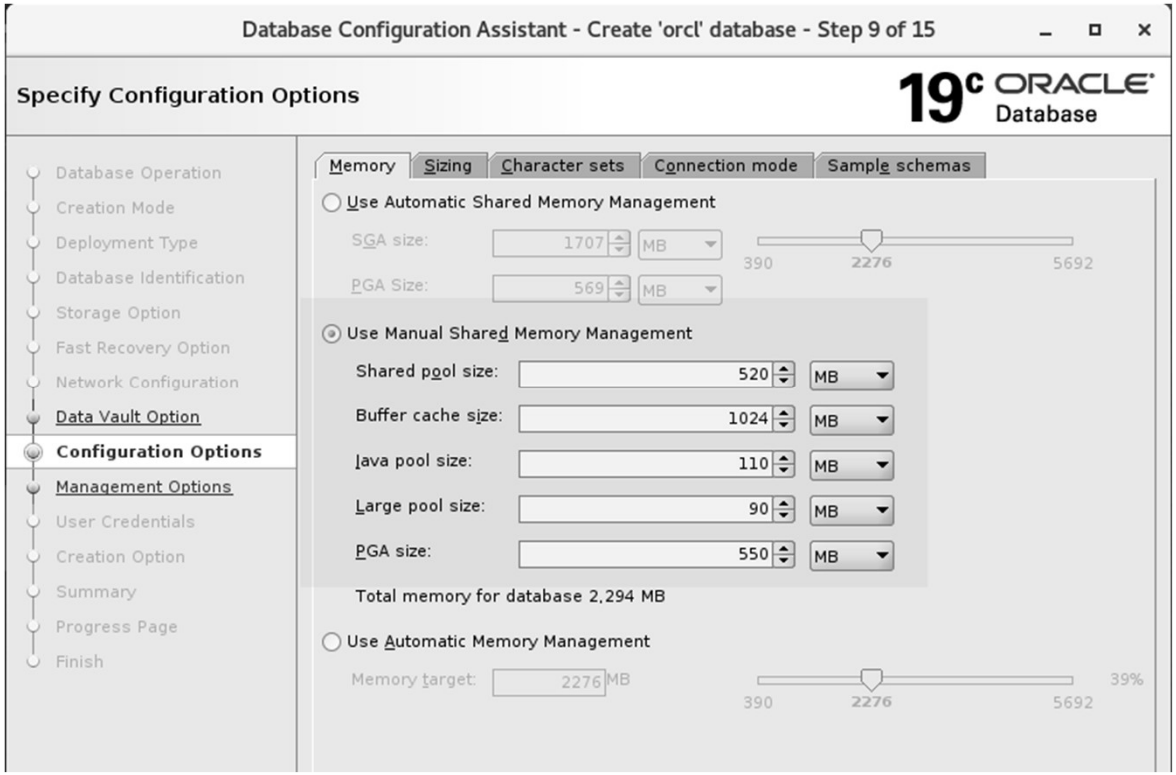
5. Enable the automatic PGA management:

```
ALTER SYSTEM SET PGA_AGGREGATE_TARGET=2G SCOPE=BOTH;
```

Manual Shared Memory Management Overview



Enabling Manual Shared Memory Management at the Time of Database Creation



Enabling Manual Shared Memory Management

1. Disable the AMM and ASMM:

```
ALTER SYSTEM SET MEMORY_TARGET = 0 SCOPE = BOTH;
ALTER SYSTEM SET SGA_TARGET = 0  SCOPE = BOTH;
```

2. Set the SGA memory sizes:

```
ALTER SYSTEM SET DB_CACHE_SIZE =...
.. SHARED_POOL_SIZE ..
.. LARGE_POOL_SIZE ..
.. JAVA_POOL_SIZE ..
.. STREAMS_POOL_SIZE ..
```

Monitoring Automatic Memory Management

- Query the view **V$MEMORY_DYNAMIC_COMPONENTS**:

```
SELECT COMPONENT, CURRENT_SIZE, USER_SPECIFIED_SIZE FROM
V$MEMORY_DYNAMIC_COMPONENTS WHERE CURRENT_SIZE<>0;

COMPONENT                      CURRENT_SIZE USER_SPECIFIED_SIZE
------------------------------ ------------ ------------------
shared pool                       536870912                  0
large pool                         16777216                  0
SGA Target                       2516582400         2516582400
DEFAULT buffer cache             1811939328                  0
Shared IO Pool                    134217728          134217728
PGA Target                        838860800          838860800
```

```
Allocated memory: 536870912+16777216+1811939328=2256M
Unallocated memory: 2400M (SGA_TARGET) - 2256M = 144M
```

Tuning Automatic Memory Management

- Query the **V$MEMORY_TARGET_ADVICE**:

```
SQL> SELECT * FROM V$MEMORY_TARGET_ADVICE ORDER BY MEMORY_SIZE;

MEMORY_SIZE MEMORY_SIZE_FACTOR ESTD_DB_TIME ESTD_DB_TIME_FACTOR
----------- ------------------ ------------ ------------------
180         .5                 458          1.344
270         .75                367          1.0761
360         1                  341          1
450         1.25               335          .9817
540         1.5                335          .9817
630         1.75               335          .9817
720         2                  335          .9817
```

Tuning Automatic Shared Memory Management

- Query the **V$SGA_TARGET_ADVICE**:

```
SQL> SELECT SGA_SIZE, SGA_SIZE_FACTOR, ESTD_DB_TIME,
ESTD_DB_TIME_FACTOR FROM V$SGA_TARGET_ADVICE ORDER BY SGA_SIZE;

SGA_SIZE   SGA_SIZE_FACTOR ESTD_DB_TIME ESTD_DB_TIME_FACTOR
---------- --------------- ------------ ------------------
      1200              .5           61                  1
      1800             .75           61                  1
      2400               1           61                  1
      3000            1.25           60                  1
      3600             1.5           60                  1
      4200            1.75           60                  1
      4800               2           60                  1
```

An Approach for Setting Memory Areas

- When the total available memory size is 4GB or more, Oracle recommends using ASMM
- Assumption: single database instance running in the machine, the machine is dedicated to the database
- Suggested initial settings:
  - Leave 30% of the total memory for the OS operations and others
  - For OLTP: set 60% of the remaining size for the **`SGA_TARGET`** and %40 for the PGA
  - For warehouse: set 70% of the remaining size for the **`SGA_TARGET`** and %30 for the PGA
  - After a few days of normal operations, query the memory advisor and adjust accordingly

Multiple Buffer Cache Areas

- For further tuning Buffer Cache, multiple buffer cache areas can be configured:
  - Keep and Recycle pools
  - **DB_*n*K_CACHE_SIZE**

Summary

In this lecture, you should have learnt how to perform the following:

- Enable Automatic Memory Management (AMM)
- Enable the Automatic Shared Memory Management (ASMM)
- Enable the Manual Shared Memory Management
- Monitor the Automatic Memory Management
- Tuning memory using advisors