ORACLE 12c
DATABASE
IN-MEMORY

An Oracle White Paper
June, 2016

Oracle Database In-Memory Advisor Usage Examples

ORACLE®

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Intended Audience

Readers are assumed to have hands-on experience with Oracle Database technologies from the perspective of a DBA or performance specialist.

Introduction

Oracle Database 12.1.0.2 introduced Oracle Database In-Memory allowing a single database to efficiently support mixed analytic and transactional workloads.   An Oracle Database configured with Database In-Memory delivers optimal performance for transactions while simultaneously supporting real-time analytics and reporting.

For complete details about Oracle Database In-Memory, see the Oracle Database In-Memory whitepaper and the Oracle Database In-Memory Page on oracle.com.

This paper contains examples of how to use the Oracle Database In-Memory Advisor.   The Advisor analyzes your workload and makes specific recommendations regarding how to size Oracle Database In-Memory and which objects would render the greatest benefit to your system when placed In-Memory. The Oracle Database In-Memory Advisor can be downloaded from My Oracle Support (MOS) note 1965343.1.   MOS note 1965343.1 also contains a whitepaper describing how to install and run the Advisor.

How to Use This Document

This document is designed to give detailed examples of using the In-Memory Advisor in a variety of scenarios.   The easiest way to use this document is to review the table of contents for the scenario that best matches your intended use and then go directly to that section to see an example of using the Advisor in that manner.

Scenarios for Running the Advisor

Running the Advisor on a Live Workload

The Oracle Database In-Memory Advisor was designed to be easily executed on a database.   Below are the steps to run the Advisor on a workload currently executing on your system.

These steps can also be used to run the Advisor on any time frame within the Automatic Workload Repository (AWR) retention period on your system.   By default, AWR data is retained for eight days. Therefore, if you have the default AWR configuration on your system, you can use these steps to run the Advisor for any time period in the last eight days.

The high level steps are:

- Run SQLPLUS as an appropriately privileged user such as SYSTEM or a user who has been granted ADVISOR privilege
- Execute the imadvisor_recommendations.sql script
  - Supply a task name
  - If you know the amount of memory you'd like to use, enter it at the prompt, or hit <ENTER> to let the Advisor give a list of sizes and estimated benefits
  - Enter the time range for analysis
  - If not specified at the earlier prompt, select a size from the table of estimated sizes and benefits
- Review the reports

Below is an example that session would look like. User input is highlighted in yellow.

```
$ sqlplus / as sysdba
SQL*Plus: Release 12.1.0.2.0 Production on Tue May 31 17:14:15 2016
Copyright (c) 1982, 2014, Oracle.  All rights reserved.


Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real Application Testing
options

SQL> @imadvisor_recommendations

This script creates and runs an In-Memory Advisor task that analyzes
your workload to determine an optimal In-Memory configuration.
```

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This script then generates an HTML recommendation report file in the
current working directory: imadvisor_<task_name>.html

This script also generates a sqlplus DDL script to implement the
recommendations: imadvisor_<task_name>.sql

NOTE: Once you have existing tasks, you can use this script again with a task
that has already gathered and analyzed statistics to optimize for a different
In-Memory size.

Default task_name (new task): im_advisor_task_20160531171426
Enter value for task_name: TASK01

Advisor task name specified: TASK01

New Advisor task will be named: TASK01...

Analyzing and reporting on a live workload on this database
(DBID=2026721262)...

The In-Memory Advisor optimizes the In-Memory configuration for a specific
In-Memory size that you choose.

After analysis, the In-Memory Advisor can provide you a list of performance
benefit estimates for a range of In-Memory sizes. You may then choose the
In-Memory size for which you wish to optimize.

If you already know the specific In-Memory size you wish, please enter
the value now. Format: nnnnnnn[KB|MB|GB|TB]

Or press <ENTER> to get performance estimates first.
Enter value for inmemory_size:

The In-Memory Advisor will display performance benefit estimates after
analysis.

Enter begin time for report:

--   Valid input formats:
--   To specify absolute begin time:
--   [MM/DD[/YY]] HH24:MI[:SS]
--   Examples: 02/23/03 14:30:15

```
--                 02/23 14:30:15
--                 14:30:15
--                 14:30
--      To specify relative begin time: (start with '-' sign)
--         -[HH24:]MI
--         Examples: -1:15  (SYSDATE - 1 Hr 15 Mins)
--                   -25    (SYSDATE - 25 Mins)


Default begin time: -60
Enter value for begin_time: -60


Report begin time specified: -60


Enter duration in minutes starting from begin time:
(defaults to SYSDATE - begin_time)


Enter value for duration: 60


Report duration specified:   60


Using 2016-MAY-31 16:15:08.000000000 as report begin time
Using 2016-MAY-31 17:15:08.000000000 as report end time


In-Memory Advisor: Adding statistics...
In-Memory Advisor: Finished adding statistics.
In-Memory Advisor: Analyzing statistics...
In-Memory Advisor: Finished analyzing statistics.
```

The Advisor estimates the following performance benefits:

```
_____
|                                                                       |
|                                ESTIMATED    ESTIMATED                  |
|                                ANALYTICS    ANALYTICS                  |
|                                PROCESSING   PROCESSING                 |
|                   PERCENTAGE     TIME       PERFORMANCE                |
|       IN-MEMORY   OF MAXIMUM   REDUCTION    IMPROVEMENT                |
|        SIZE        SGA SIZE    (SECONDS)*    FACTOR*                   |
|       ---------   ----------  ---------------- -----------             |
|        1.074GB       97          837          2.8X                     |
|        1.021GB       92          778          2.5X                     |
|        990.3MB       87          778          2.5X                     |
|        935.2MB       82          347          1.4X                     |
|        880.2MB       77          347          1.4X                     |
|        825.2MB       73          347          1.4X                     |
|        770.2MB       68          347          1.4X                     |
|        715.2MB       63          347          1.4X                     |
|        660.2MB       58          347          1.4X                     |
|        605.2MB       53          347          1.4X                     |
|        550.1MB       48          347          1.4X                     |
|        495.1MB       44          347          1.4X                     |
|        440.1MB       39          347          1.4X                     |
|        385.1MB       34          347          1.4X                     |
|        330.1MB       29          347          1.4X                     |
|        275.1MB       24          347          1.4X                     |
|        220.1MB       19          154          1.1X                     |
|        165.0MB       15          154          1.1X                     |
|        110.0MB       10          154          1.1X                     |
|        55.01MB       5           105          1.1X                     |
|                                                                       |
| *Estimates: The In-Memory Advisor's estimates are useful for making   |
|  In-Memory decisions.  But they are not precise.  Due to performance  |
|  variations caused by workload diversity, the Advisor's performance   |
|  estimates are conservatively limited to no more than 10.0X           |
|  faster.                                                              |
|                                                                       |
|_____|
```

```
Choose the In-Memory size you wish for optimization (default=1.074GB):
1.074GB

The Advisor is optimizing for an In-Memory size of 1.074GB...
Fetching recommendation files for task: TASK01
Placing recommendation files in: the current working directory

Fetched file: imadvisor_TASK01.html
Purpose:       recommendation report primary html page

Fetched file: imadvisor_TASK01.sql
Purpose:       recommendation DDL sqlplus script

You can re-run this task with this script and specify a different an In-
Memory size.  Re-running a task to optimize for a different In-Memory size is
faster than creatng and running a new task from scratch.

SQL>
```

Generating Recommendations for Different In-Memory Sizes

When you run the In-Memory Advisor on a specific time range, the Advisor analyzes and stores recommendations for a range of possible In-Memory sizes. You can produce a report of recommendations for a different In-Memory size for the same workload by specifying an existing analysis task. This requires significantly fewer resources than rerunning the full analysis:

The high level steps are:

- Run SQLPLUS as an appropriately privileged user such as SYSTEM or a user who has been granted ADVISOR privilege

- Execute the imadvisor_recommendations.sql script

  - Choose an existing task name

  - Enter the new amount of memory for Database In-Memory for the Advisor to report on.

  - Review the reports

Below is what that session would look like. User input is highlighted in yellow.

```
$ sqlplus / as sysdba

SQL*Plus: Release 12.1.0.2.0 Production on Tue May 31 17:31:34 2016
Copyright (c) 1982, 2014, Oracle.  All rights reserved.

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options

SQL> @imadvisor_recommendations

This script creates and runs an In-Memory Advisor task that analyzes
your workload to determine an optimal In-Memory configuration.

This script then generates an HTML recommendation report file in the
current working  directory: imadvisor_<task_name>.html

This script also generates a sqlplus DDL script to implement the
recommendations: imadvisor_<task_name>.sql

NOTE: You may specify one of your existing tasks if you wish to optimize for
a different In-Memory size.
```

Using an existing, executed task is faster than a new task since a new task
requires statistics gathering and analysis.

But if you wish to analyze a different workload or use a different statistics
capture window or add a SQLSET, you must specify a new task.

The following is a list of your existing tasks:

```
TASK_NAME                       DATE_CREATED
------------------------------ --------------------
TASK01                          2016-MAY-31 17:15:13
```

Default task_name (new task): im_advisor_task_20160531173140
Enter value for task_name: TASK01

Advisor task name specified: TASK01

Analyzing and reporting on a live workload on this database
(DBID=2026721262)...

The Advisor estimates the following performance benefits:

```
_____
|                                                                        |
|                                      ESTIMATED     ESTIMATED           |
|                                      ANALYTICS     ANALYTICS           |
|                                      PROCESSING    PROCESSING          |
|                          PERCENTAGE  TIME          PERFORMANCE         |
|            IN-MEMORY      OF MAXIMUM  REDUCTION     IMPROVEMENT         |
|              SIZE         SGA SIZE    (SECONDS)*    FACTOR*             |
|            ---------      ----------  ----------------  -----------     |
|            1.074GB            97          837          2.8X             |
|            1.021GB            92          778          2.5X             |
|            990.3MB            87          778          2.5X             |
|            935.2MB            82          347          1.4X             |
|            880.2MB            77          347          1.4X             |
|            825.2MB            73          347          1.4X             |
|            770.2MB            68          347          1.4X             |
|            715.2MB            63          347          1.4X             |
|            660.2MB            58          347          1.4X             |
```

```
|        605.2MB        53           347          1.4X             |
|        550.1MB        48           347          1.4X             |
|        495.1MB        44           347          1.4X             |
|        440.1MB        39           347          1.4X             |
|        385.1MB        34           347          1.4X             |
|        330.1MB        29           347          1.4X             |
|        275.1MB        24           347          1.4X             |
|        220.1MB        19           154          1.1X             |
|        165.0MB        15           154          1.1X             |
|        110.0MB        10           154          1.1X             |
|        55.01MB        5            105          1.1X             |
|                                                                 |
| *Estimates: The In-Memory Advisor's estimates are useful for making  |
|  In-Memory decisions.  But they are not precise.  Due to performance |
|  variations caused by workload diversity, the Advisor's performance  |
|  estimates are conservatively limited to no more than 10.0X          |
|  faster.                                                             |
|                                                                 |
```

Choose the In-Memory size you wish for optimization (default=1.074GB):
990.3MB

The Advisor is optimizing for an In-Memory size of 990.3MB...
Fetching recommendation files for task: TASK01
Placing recommendation files in: the current working directory

Fetched file: imadvisor_TASK01.html
Purpose: recommendation report primary html page

Fetched file: imadvisor_TASK01.sql
Purpose: recommendation DDL sqlplus script

You can re-run this task with this script and specify a different an In-
Memory
size. Re-running a task to optimize for a different In-Memory size is faster
than creatng and running a new task from scratch.

SQL>

Running the Advisor On AWR Data from a Different Database

You can run the Advisor on a workload from another database by exporting the Automatic Workload Data (AWR) along with some supplemental information from the production database and importing it into another database. You might want to do this to lessen the impact on the production database or to preserve the AWR data for longer than the default.

In addition to the AWR data, the Advisor needs some data dictionary information to complete its analysis.   A script is provided to export and then import the additional required information.   The additional export script should be run immediately after running the AWR export script.

The high level steps to do this are:

- Run SQLPLUS as an appropriately privileged user such as SYSTEM or a user who has been granted ADVISOR privilege

- Execute the AWR extract script: $ORACLE_HOME/rdbms/admin/awrextr.sql

- Execute the additional data 'augment' export script : imadvisor_awr_augment_export.sql

- Copy the AWR export and augment export dump files to the system with the database that will be used to run the Adviosr

- Install the Advisor on the target database

- Import the AWR data using: $ORACLE_HOME/rdbms/admin/awrload.sql (Note: you can only import AWR data into the same or higher version of the Oracle database.)

- Import the AWR augment data using the import script: imadvisor_augment_import.sql

- Run the Advisor as described in prior use cases

Below is what that session would look like. User input is highlighted in yellow.

Export the data

```
$ sqlplus / as sysdba
SQL*Plus: Release 12.1.0.2.0 Production on Wed Jun 1 16:04:08 2016
Copyright (c) 1982, 2014, Oracle.  All rights reserved.

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real Application Testing
options

SQL> set pagesize 100
SQL> @?/rdbms/admin/awrextr.sql
~~~~~~~~~~~~~~
AWR EXTRACT
```

```
~~~~~~~~~~~~~
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~  This script will extract the AWR data for a range of snapshots  ~
~  into a dump file.  The script will prompt users for the         ~
~  following information:                                          ~
~      (1) database id                                             ~
~      (2) snapshot range to extract                               ~
~      (3) name of directory object                                ~
~      (4) name of dump file                                       ~
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~


Databases in this Workload Repository schema
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

   DB Id      DB Name      Host
------------ ------------ ------------
* 2026721262 O120250       node50
  957820695  O120250       node50


The default database id is the local one: '2026721262'.  To use this
database id, press <return> to continue, otherwise enter an alternative.


Enter value for dbid:

Using 2026721262 for Database ID

Specify the number of days of snapshots to choose from
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Entering the number of days (n) will result in the most recent
(n) days of snapshots being listed.  Pressing <return> without
specifying a number lists all completed snapshots.


Enter value for num_days: 1

Listing the last day's Completed Snapshots

DB Name         Snap Id   Snap Started
------------ --------- ------------------
O120250          1785 01 Jun 2016 11:00
                 1786 01 Jun 2016 12:00
                 1787 01 Jun 2016 13:00
```

```
                   1788 01 Jun 2016 14:00
                   1789 01 Jun 2016 15:00
                   1790 01 Jun 2016 16:00


Specify the Begin and End Snapshot Ids
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Enter value for begin_snap: 1785
Begin Snapshot Id specified: 1785


Enter value for end_snap: 1790
End   Snapshot Id specified: 1790


Specify the Directory Name
~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Directory Name                 Directory Path
------------------------------ -------------------------------------------
ADVISORDIR                     /tmp
DATA_PUMP_DIR                  /u01/oracle/admin/o120250/dpdump/

OPATCH_INST_DIR                /u01/oracle/product/12.1.0/dbhome_1/OPatch
OPATCH_LOG_DIR                 /u01/oracle/product/12.1.0/dbhome_1/QOpatch
OPATCH_SCRIPT_DIR              /u01/oracle/product/12.1.0/dbhome_1/QOpatch
ORACLE_BASE                    /
ORACLE_HOME                    /

ORACLE_OCM_CONFIG_DIR2         /u01/oracle/product/12.1.0/dbhome_1/ccr/state

XMLDIR                         /u01/oracle/product/12.1.0/dbhome_1/rdbms/xml

Choose a Directory Name from the above list (case-sensitive).

Enter value for directory_name: ADVISORDIR

Using the dump directory: ADVISORDIR

Specify the Name of the Extract Dump File
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
The prefix for the default dump file name is awrdat_1785_1790.
To use this name, press <return> to continue, otherwise enter
an alternative.
```

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```
Enter value for file_name:

Using the dump file prefix: awrdat_1785_1790
|
| ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
|  The AWR extract dump file will be located
|  in the following directory/file:
|   /tmp
|   awrdat_1785_1790.dmp
| ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
|
|  *** AWR Extract Started ...
|
|  This operation will take a few moments. The
|  progress of the AWR extract operation can be
|  monitored in the following directory/file:
|   /tmp
|   awrdat_1785_1790.log
|

End of AWR Extract
SQL>
SQL>
SQL> @imadvisor_awr_augment_export.sql


*****************************************************************************
* This script will create for you an Automatic Workload Repository (AWR)
* augment that will supply additional data required by the Oracle Database
* In-Memory Advisor.  Without this data augment, you cannot use an AWR export
* with the In-Memory Advisor.  (But with it, you can!)
*
* Note: While the AWR on this database holds data imported from other
* databases, only AWR data from this local database (DBID=2026721262) can
* be used with the AWR augment you are about to create.
*
* Please make sure your AWR export is for DBID=2026721262.
*
* Also note: It is best to capture an AWR augment in the same timeframe
* (preferably after) the corresponding AWR export.
*****************************************************************************
```

```
ADVISORDIR                        /tmp
DATA_PUMP_DIR                     /u01/oracle/admin/o120250/dpdump/
OPATCH_INST_DIR                   /u01/oracle/product/12.1.0/dbhome_1/OPatch
OPATCH_LOG_DIR                    /u01/oracle/product/12.1.0/dbhome_1/QOpatch
OPATCH_SCRIPT_DIR                 /u01/oracle/product/12.1.0/dbhome_1/QOpatch
ORACLE_BASE                       /
ORACLE_HOME                       /
ORACLE_OCM_CONFIG_DIR2            /u01/oracle/product/12.1.0/dbhome_1/ccr/state
XMLDIR                            /u01/oracle/product/12.1.0/dbhome_1/rdbms/xml


Please enter the Oracle directory object to use for export
(default=DATA_PUMP_DIR)?
ADVISORDIR
Using directory ADVISORDIR...


The default IM Advisor AWR augment dump file name prefix is
imadvisor_awr_augment.
Please press <return> to use this name prefix; otherwise, enter an
alternative name prefix?


Using "imadvisor_awr_augment" as the AWR augment dump file name prefix...


Setting up the AWR agument staging schema...
No errors.
old 931:   dmp_name := NVL('&&dump_file_name_prefix', :dmp_name_default);
new 931:   dmp_name := NVL('imadvisor_awr_augment', :dmp_name_default);


PL/SQL procedure successfully completed.


Exporting AWR agument data...
IMADVISOR_AWR_AUGMENT_EXPORT Data Pump status: SUCCESS


PL/SQL procedure successfully completed.


Dropping the AWR agument staging schema...
Directory path for Data Pump dump and log files: /tmp
Data Pump dump file: imadvisor_awr_augment.dmp
Data Pump log file: imadvisor_awr_augment_export.log


PL/SQL procedure successfully completed.
```

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```
All done.
SQL>
```

Copy the data

```
$ scp /location_of_dump_files/*.dmp username@differenthost:/targetdir
```

Import the data

```
$ sqlplus / as sysdba
SQL*Plus: Release 12.1.0.2.0 Production on Thu Jun 2 07:18:24 2016
Copyright (c) 1982, 2014, Oracle.  All rights reserved.

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real Application Testing
options

SQL> set pagesize 100
SQL> @?/rdbms/admin/awrload.sql
~~~~~~~~~~
AWR LOAD
~~~~~~~~~~
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~  This script will load the AWR data from a dump file. The   ~
~  script will prompt users for the following information:    ~
~      (1) name of directory object                           ~
~      (2) name of dump file                                  ~
~      (3) staging schema name to load AWR data into          ~
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Specify the Directory Name
~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Directory Name                 Directory Path
------------------------------ ---------------------------------------------
DATA_PUMP_DIR                  /u01/oracle/admin/o120249/dpdump/
DUMPDIR                        /scratch/oracle/imadvisor

OPATCH_INST_DIR                /u01/oracle/product/12.1.0/dbhome_1/OPatch
OPATCH_LOG_DIR                 /u01/oracle/product/12.1.0/dbhome_1/QOpatch
OPATCH_SCRIPT_DIR              /u01/oracle/product/12.1.0/dbhome_1/QOpatch
```

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```
ORACLE_BASE                        /
ORACLE_HOME                        /

SUBDIR                             /u01/oracle/product/12.1.0/dbhome_1/demo/schema

XMLDIR                             /u01/oracle/product/12.1.0/dbhome_1/rdbms/xml
XSDDIR                             /u01/product/12.1.0/dbhome_1/xml/schema


Choose a Directory Name from the list above (case-sensitive).

Enter value for directory_name: DATA_PUMP_DIR

Using the dump directory: DATA_PUMP_DIR

Specify the Name of the Dump File to Load
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Please specify the prefix of the dump file (.dmp) to load:

Enter value for file_name: awrdat_1785_1790

Loading from the file name: awrdat_1785_1790.dmp

Staging Schema to Load AWR Snapshot Data
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
The next step is to create the staging schema
where the AWR snapshot data will be loaded.
After loading the data into the staging schema,
the data will be transferred into the AWR tables
in the SYS schema.



The default staging schema name is AWR_STAGE.
To use this name, press <return> to continue, otherwise enter
an alternative.

Enter value for schema_name:

Using the staging schema name: AWR_STAGE

Choose the Default tablespace for the AWR_STAGE user
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Choose the AWR_STAGE users's default tablespace.  This is the
```

tablespace in which the AWR data will be staged.

```
TABLESPACE_NAME                 CONTENTS  DEFAULT TABLESPACE
------------------------------ --------- ------------------
EXAMPLE                         PERMANENT
SYSAUX                          PERMANENT *
USERS                           PERMANENT
```

Pressing <return> will result in the recommended default
tablespace (identified by *) being used.

Enter value for default_tablespace: USERS

Using tablespace USERS as the default tablespace for the AWR_STAGE

Choose the Temporary tablespace for the AWR_STAGE user
~~~~~~
Choose the AWR_STAGE user's temporary tablespace.

```
TABLESPACE_NAME                 CONTENTS  DEFAULT TEMP TABLESPACE
------------------------------ --------- -----------------------
TEMP                            TEMPORARY *
```

Pressing <return> will result in the database's default temporary
tablespace (identified by *) being used.

Enter value for temporary_tablespace:

Using tablespace TEMP as the temporary tablespace for AWR_STAGE

... Creating AWR_STAGE user

```
|
| ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
|  Loading the AWR data from the following
|  directory/file:
|   /scratch/oracle/imadvisor
|   awrdat_1785_1790.dmp
| ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
|
|  *** AWR Load Started ...
```

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```
|
|  This operation will take a few moments. The
|  progress of the AWR load operation can be
|  monitored in the following directory/file:
|   /scratch/oracle/imadvisor
|   awrdat_1785_1790.log
|
... Dropping AWR_STAGE user

End of AWR Load
SQL>
SQL>


SQL>
SQL> @imadvisor_awr_augment_import.sql

DATA_PUMP_DIR                 /u01/oracle/admin/o120249/dpdump/
DUMPDIR                       /scratch/oracle/imadvisor
LOG_FILE_DIR                  /u01/product/12.1.0/dbhome_1/demo/schema/log/
OPATCH_INST_DIR               /u01/oracle/product/12.1.0/dbhome_1/OPatch
OPATCH_LOG_DIR                /u01/oracle/product/12.1.0/dbhome_1/QOpatch
OPATCH_SCRIPT_DIR             /u01/oracle/product/12.1.0/dbhome_1/QOpatch
ORACLE_BASE                   /
ORACLE_HOME                   /
SUBDIR                        /u01/product/12.1.0/dbhome_1/demo/schema
XMLDIR                        /u01/oracle/product/12.1.0/dbhome_1/rdbms/xml

Please enter the Oracle directory object to use for import
(default=DATA_PUMP_DIR)?
DATA_PUMP_DIR
Using directory DATA_PUMP_DIR...

The default IM Advisor AWR augment dump file name prefix is
imadvisor_awr_augment.
Please press <return> to use this name prefix; otherwise, please enter an
alternative name prefix?

Using "imadvisor_awr_augment" as the AWR augment dump file name prefix...

Gathering information about the AWR agument...
IMADVISOR_AWR_AUGMENT_MASTER Data Pump status: SUCCESS
```

```
Setting up the AWR agument schema...

Importing AWR agument data...
IMADVISOR_AWR_AUGMENT_IMPORT Data Pump status: SUCCESS

Granting access on the AWR augment schema to DBMS_INMEMORY_ADVISOR...

All done.
SQL> exit
```

Run the Advisor on the imported data

```
$ sqlplus / as sysdba
SQL*Plus: Release 12.1.0.2.0 Production on Thu Jun 2 07:23:45 2016
Copyright (c) 1982, 2014, Oracle.  All rights reserved.

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real Application Testing
options

SQL> @imadvisor_recommendations


This script creates and runs an In-Memory Advisor task that analyzes
your workload to determine an optimal In-Memory configuration.

This script then generates an HTML recommendation report file in the
current working  directory: imadvisor_<task_name>.html

This script also generates a sqlplus DDL script to implement the
recommendations: imadvisor_<task_name>.sql

NOTE: Once you have existing tasks, you can use this script again with a task
that has already gathered and analyzed statistics to optimize for a different
In-Memory size.

Default task_name (new task): im_advisor_task_20160602072358
Enter value for task_name: TASK02

Advisor task name specified: TASK02
```

New Advisor task will be named: TASK02...

By default, the Advisor runs against a live workload on this database.
This database also has imported, augmented AWR workloads.

Press ENTER or respond NO to run against a live workload.
Respond YES to run against an augmented AWR workload.

Enter value for run_against_augmented_awr: YES

The Advisor can use the following augmented AWR imports:

Augmented AWR Import DBID

2026721262

Enter value for dbid: 2026721262

Analyzing and reporting on an augmented AWR workload with DBID=2026721262...

The In-Memory Advisor optimizes the In-Memory configuration for a specific
In-Memory size that you choose.

After analysis, the In-Memory Advisor can provide you a list of performance
benefit estimates for a range of In-Memory sizes. You may then choose the
In-Memory size for which you wish to optimize.

If you already know the specific In-Memory size you wish, please enter
the value now. Format: nnnnnnn[KB|MB|GB|TB]

Or press <ENTER> to get performance estimates first.
Enter value for inmemory_size:

The In-Memory Advisor will display performance benefit estimates after
analysis.

```
Enter begin time for report:

--     Valid input formats:
--       To specify absolute begin time:
--         [MM/DD[/YY]] HH24:MI[:SS]
--         Examples: 02/23/03 14:30:15
--                   02/23 14:30:15
--                   14:30:15
--                   14:30
--       To specify relative begin time: (start with '-' sign)
--         -[HH24:]MI
--         Examples: -1:15  (SYSDATE - 1 Hr 15 Mins)
--                   -25    (SYSDATE - 25 Mins)


Default begin time: 06/01/16 10:00:25
Enter value for begin_time:


Report begin time specified:



Enter duration in minutes starting from begin time:
(defaults to <latest-snapshot-end-time> - begin_time)


Enter value for duration:


Report duration specified:

Using 2016-JUN-01 10:00:25.000000000 as report begin time
Using 2016-JUN-01 16:00:16.000000000 as report end time


In-Memory Advisor: Adding statistics...

In-Memory Advisor: Finished adding statistics.

In-Memory Advisor: Analyzing statistics...

In-Memory Advisor: Finished analyzing statistics.



The Advisor estimates the following performance benefits:
```

```
 _____
|                                                               |
|                          ESTIMATED      ESTIMATED             |
|                          ANALYTICS      ANALYTICS             |
|                          PROCESSING     PROCESSING            |
|              PERCENTAGE     TIME         PERFORMANCE          |
|   IN-MEMORY  OF MAXIMUM  REDUCTION      IMPROVEMENT           |
|     SIZE     SGA SIZE    (SECONDS)*      FACTOR*              |
|   ---------  ----------  ---------------  -----------         |
|    1.074GB      97          6164           2.4X               |
|    1.021GB      92          5946           2.3X               |
|    990.3MB      87          5946           2.3X               |
|    935.2MB      82          2970           1.4X               |
|    880.2MB      77          2970           1.4X               |
|    825.2MB      73          2970           1.4X               |
|    770.2MB      68          2970           1.4X               |
|    715.2MB      63          2970           1.4X               |
|    660.2MB      58          2970           1.4X               |
|    605.2MB      53          2970           1.4X               |
|    550.1MB      48          2970           1.4X               |
|    495.1MB      44          2970           1.4X               |
|    440.1MB      39          2970           1.4X               |
|    385.1MB      34          2970           1.4X               |
|    330.1MB      29          2970           1.4X               |
|    275.1MB      24          2970           1.4X               |
|    220.1MB      19          1317           1.1X               |
|    165.0MB      15          1317           1.1X               |
|    110.0MB      10          1317           1.1X               |
|    55.01MB       5          1010           1.1X               |
|                                                               |
| *Estimates: The In-Memory Advisor's estimates are useful for making |
|  In-Memory decisions.  But they are not precise.  Due to performance |
|  variations caused by workload diversity, the Advisor's performance |
|  estimates are conservatively limited to no more than 10.0X   |
|  faster.                                                      |
|                                                               |
|_____|
```

Choose the In-Memory size you wish for optimization (default=1.074GB):
1.074GB

The Advisor is optimizing for an In-Memory size of 1.074GB...
Fetching recommendation files for task: TASK02
Placing recommendation files in: the current working directory

Fetched file: imadvisor_TASK02.html
Purpose: recommendation report primary html page

Fetched file: imadvisor_TASK02.sql
Purpose: recommendation DDL sqlplus script

You can re-run this task with this script and specify a different an In-
Memory
size. Re-running a task to optimize for a different In-Memory size is faster
than creatng and running a new task from scratch.

SQL>

Running the Advisor on a Batch Workload

Oracle Database In-Memory optimizes analytical workload.   Analytical workload tends to be long running SQL which scans a large amount of data.   It's common to have batch operations that run to produce reports regularly. Oracle Database In-Memory is well suited for this type of workload.

The In-Memory Advisor can run efficiently if its input time period is constrained to batch reporting workload executions.   Running the Advisor for a batch reporting workload is the same as running the Advisor on a live (currently executing workload).   You just need to specify the time period that you wish the Advisor to analyze when prompted for the begin time and duration.

The high level steps are:

- Run SQLPLUS as an appropriately privileged user such as SYSTEM or a user who has been granted ADVISOR privilege

- Execute the imadvisor_recommendations.sql script

  - Supply a task name

  - If you know the amount of memory you'd like to use, enter it at the prompt, or hit RETURN to let the Advisor give a list of sizes and estimated benefits

  - Enter the time range to run the analysis for the batch reporting workload

  - Select a size from the table of estimated sizes and benefits

- Review the reports

Running the Advisor on a Pluggable Database

The Oracle Database In-Memory Advisor supports multitenant databases which were introduced with Oracle Database 12.1.

One way to run the In-Memory Advisor on multitenant databases is to install the Advisor in the root container, the CDB.   Then you can run the Advisor on the root container and specify one of the pluggable databases – PDBs.

The high level steps are:

- Install the In-Memory Advisor in the CDB$ROOT of the database

Run SQLPLUS with a connection to the root container as an appropriately privileged user such as SYSTEM or a user who has been granted ADVISOR privilege

- Execute the imadvisor_recommendations.sql script

  - Supply a task name

  - Supply a pluggable database name, PDB, to be analyzed

  - If you know the amount of memory you'd like to use, enter it at the prompt, or hit RETURN to let the Advisor give a list of sizes and estimated benefits

  - Enter the time range for analysis

  - Select a size from the table of estimated sizes and benefits

- Review the reports

Below is an example that session would look like. User input is highlighted in yellow.


```
$ sqlplus / as sysdba

SQL*Plus: Release 12.2.0.0.3 Production on Sat Jun 4 14:57:05 2016
Copyright (c) 1982, 2016, Oracle.  All rights reserved.

Connected to:
Oracle Database 12c Enterprise Edition Release 12.2.0.1.0 - 64bit Production

SQL> @imadvisor_recommendations

This script creates and runs an In-Memory Advisor task that analyzes
your workload to determine an optimal In-Memory configuration.

This script then generates an HTML recommendation report file in the
current working  directory: imadvisor_<task_name>.html
```

This script also generates a sqlplus DDL script to implement the
recommendations: imadvisor_<task_name>.sql

NOTE: Once you have existing tasks, you can use this script again with a task
that has already gathered and analyzed statistics to optimize for a different
In-Memory size.

Default task_name (new task): im_advisor_task_20160604145711
Enter value for task_name: TASK05

Advisor task name specified: TASK05

New Advisor task will be named: TASK05...

Analyzing and reporting on a live workload on this database
(DBID=1049723161)...
Enter value for pdb_name: SALES_NA

SALES_NA

The In-Memory Advisor optimizes the In-Memory configuration for a specific
In-Memory size that you choose.

After analysis, the In-Memory Advisor can provide you a list of performance
benefit estimates for a range of In-Memory sizes. You may then choose the
In-Memory size for which you wish to optimize.

If you already know the specific In-Memory size you wish, please enter
the value now. Format: nnnnnnn[KB|MB|GB|TB]

Or press <ENTER> to get performance estimates first.
Enter value for inmemory_size:

The In-Memory Advisor will display performance benefit estimates after
analysis.

Enter begin time for report:

--   Valid input formats:
--   To specify absolute begin time:

```
--          [MM/DD[/YY]] HH24:MI[:SS]
--          Examples: 02/23/03 14:30:15
--                    02/23 14:30:15
--                    14:30:15
--                    14:30
--       To specify relative begin time: (start with '-' sign)
--          -[HH24:]MI
--          Examples: -1:15  (SYSDATE - 1 Hr 15 Mins)
--                    -25    (SYSDATE - 25 Mins)


Default begin time: -60
Enter value for begin_time:


Report begin time specified:



Enter duration in minutes starting from begin time:
(defaults to SYSDATE - begin_time)


Enter value for duration:


Report duration specified:


Using 2016-JUN-04 13:57:46.000000000 as report begin time
Using 2016-JUN-04 14:57:47.000000000 as report end time



In-Memory Advisor: Adding statistics...

In-Memory Advisor: Finished adding statistics.

In-Memory Advisor: Analyzing statistics...

In-Memory Advisor: Finished analyzing statistics.



The Advisor estimates the following performance benefits:
```

IN-MEMORY SIZE	PERCENTAGE OF MAXIMUM SGA SIZE	ESTIMATED ANALYTICS PROCESSING TIME REDUCTION (SECONDS)*	ESTIMATED ANALYTICS PROCESSING PERFORMANCE IMPROVEMENT FACTOR*
1.074GB	37	227	3.1X
1.021GB	35	207	2.6X
990.3MB	33	207	2.6X
935.2MB	31	76	1.3X
880.2MB	29	76	1.3X
825.2MB	27	76	1.3X
770.2MB	26	76	1.3X
715.2MB	24	76	1.3X
660.2MB	22	76	1.3X
605.2MB	20	76	1.3X
550.1MB	18	76	1.3X
495.1MB	16	76	1.3X
440.1MB	15	76	1.3X
385.1MB	13	76	1.3X
330.1MB	11	76	1.3X
275.1MB	9	76	1.3X
220.1MB	7	35	1.1X
165.0MB	5	35	1.1X
110.0MB	4	35	1.1X
55.01MB	2	23	1.1X

*Estimates: The In-Memory Advisor's estimates are useful for making In-Memory decisions. But they are not precise. Due to performance variations caused by workload diversity, the Advisor's performance estimates are conservatively limited to no more than 10.0X faster.

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```
Choose the In-Memory size you wish for optimization (default=1.074GB):
1.074GB

The Advisor is optimizing for an In-Memory size of 1.074GB...
Fetching recommendation files for task: TASK05
Placing recommendation files in: the current working directory

Fetched file: imadvisor_TASK05.html
Purpose:      recommendation report primary html page

Fetched file: imadvisor_TASK05.sql
Purpose:      recommendation DDL sqlplus script

You can re-run this task with this script and specify a different an In-
Memory
size.  Re-running a task to optimize for a different In-Memory size is faster
than creatng and running a new task from scratch.

SQL>
```

Running the Advisor with a Customized Script

The Oracle Database In-Memory Advisor ships with a predefined script you can use to run the Advisor.   There also is a PL/SQL interface to the Advisor which is described in the whitepaper which documents the installation and usage of the Advisor.

There are many additional options using the PL/SQL interface.   In this example, a script will be used to run the Advisor with data from the ADD_HIST_STATISTICS PL/SQL procedure, which takes as input AWR snapshot ids, rather than the ADD_STATISTICS procedure in the default script which takes a time range.   Here is an example of running the Advisor with a customized script.

The high level steps are:

- Create the Advisor script

- Run SQLPLUS as an appropriately privileged user

- Execute script

- Review the reports

Here is a sample script, using the ADD_HIST_STATISTICS procedure:

```
SET SERVEROUTPUT ON;
BEGIN
  BEGIN
    dbms_inmemory_advisor.drop_task ('TASK03', force=>TRUE);
  EXCEPTION
    WHEN OTHERS THEN NULL;
  END;
  dbms_inmemory_advisor.create_task ('TASK03');
  dbms_inmemory_advisor.add_hist_statistics ('TASK03',1814,1820);
  dbms_inmemory_advisor.execute_task ('TASK03');
  dbms_inmemory_advisor.generate_recommendations('TASK03',
    directory_name=>'ADVISORDIR');
END;
/

DEFINE task_name='TASK03';
@imadvisor_fetch_recommendations.sql
```

Here is the output from the session where this script was executed:

```
$ sqlplus / as sysdba
SQL*Plus: Release 12.1.0.2.0 Production on Thu Jun 2 17:55:07 2016
Copyright (c) 1982, 2014, Oracle.  All rights reserved.

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real Application Testing
options

SQL> SET SERVEROUTPUT ON;
SQL> SQL> BEGIN
  2    BEGIN
  3      dbms_inmemory_advisor.drop_task ('TASK03', force=>TRUE);
  4    EXCEPTION
  5      WHEN OTHERS THEN NULL;
  6    END;
  7    dbms_inmemory_advisor.create_task ('TASK03');
  8    dbms_inmemory_advisor.add_hist_statistics ('TASK03',1814,1820);
  9
 10    dbms_inmemory_advisor.execute_task ('TASK03');
 11
 12    dbms_inmemory_advisor.generate_recommendations ('TASK03');
 13  END;
 14  /

DEFINE task_name='TASK03';
@imadvisor_fetch_recommendations.sql

PL/SQL procedure successfully completed.

SQL> SQL> SQL> Fetching recommendation files for task: TASK03
Enter value for client_directory_path: .
Placing recommendation files in: the current working directory

Fetched file: imadvisor_TASK03.html
Purpose:      recommendation report primary html page

Fetched file: imadvisor_sql_TASK03.html
Purpose:      SQL detail secondary html page with link from primary html page

Fetched file: imadvisor_object_TASK03.html
```

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```
Purpose:      object detail secondary html page with link from primary html

Fetched file: imadvisor_auxiliary_TASK03.html
Purpose:      rationale secondary html page with link from primary html page

Fetched file: imadvisor_TASK03.sql
Purpose:      recommendation DDL sqlplus script
SQL>
```

Conclusion

The Oracle Database In-Memory Advisor is a flexible tool that can be used to help you identify the workload and objects in your database that will benefit the most with Oracle Database In-Memory.

ORACLE®

White Paper Title
June 2016
Author: [OPTIONAL]
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