Getting Started with the Oracle Compression Advisor

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Public
Purpose statement

This document provides an overview of features and enhancements included in release Oracle Database 21c. It is intended solely to help you assess the business benefits of upgrading to Oracle Database 21c and to plan your I.T. projects.

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Introduction

Oracle Advanced Compression includes a comprehensive set of compression capabilities to help organizations maximize resource utilization and reduce costs. It allows IT administrators to significantly reduce their overall database storage footprint, and improve performance, by enabling compression for all types of data, including:

**Advanced Row Compression**

Enables table data to be compressed during all types of data manipulation operations, including DML INSERT and UPDATE operations -- intelligent algorithm minimizes compression overhead during write operations, thereby making compression viable for both data warehouse and OLTP workloads.

**Advanced LOB Compression**

Provides compression for LOB segments managed by Oracle SecureFiles – a high performance and powerful infrastructure for managing unstructured data such as images, documents, videos and more.

**Advanced Index Compression**

Reduces the size of all supported unique and non-unique indexes. Advanced Index Compression HIGH automatically chooses the right compression per index block. Advanced Index Compression provides significant space savings while also improving performance for queries that are executed using indexes.

**Compression Advisor**

An easy way to get started, with Advanced Compression, is by using the free compression advisor. The “DBMS_COMPRESSION” PL/SQL package (commonly called compression advisor) gathers compression-related information within a database environment. This includes estimating the compressibility of both uncompressed partitioned, and non-partitioned tables, and gathering row-level compression information on previously compressed tables/partitions. Compression advisor provides organizations with the storage reduction information needed to make compression-related usage decisions.

The output of running compression advisor is an estimation of the compression ratio, for the specific table, that was the target of compression advisor. The output indicates the “COMPRESSION RATIO” presented as a number such as 2.1. This number indicates that, for this specific table or partition, the estimated compression ratio is 2.1x, which represents about a 50% reduction in the footprint of the table or partition should compression be enabled.

The compression ratio achieved in a given environment depends on the data being compressed, specifically the cardinality of the data. In general, organizations can expect to reduce their storage space consumption by a factor of 2x to 4x by using Advanced Row Compression. That is, the amount of space consumed by uncompressed data will be two to four times larger than that of the compressed data.

A version of compression advisor, which supports Oracle Database 9i Release 2 through 11g Release 1, is available on the Advanced Compression page on Oracle.com. This version can only report the compression ratio for data tables – those tables (and partitions) that would be targets for OLTP Table Compression.

Another version of the DBMS_COMPRESSION PL/SQL package is included with Oracle Database 11g Release 2 and above. This version can report the compression ratio for data tables (targets for Advanced Row...
Compression, LOB segments managed by SecureFiles (targets for Advanced LOB Compression) and indexes (targets for Advanced Index Compression).

Compression Advisor is free to use with Oracle Database Enterprise Edition.

**Using the GET_COMPRESSION_RATIO Procedure**

When using the GET_COMPRESSION_RATIO procedure to estimate compression ratios, different constants are specified as parameters, these include:

<table>
<thead>
<tr>
<th>Constant</th>
<th>Type</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP_NONE</td>
<td>NUMBER</td>
<td>1</td>
<td>No compression</td>
</tr>
<tr>
<td>COMP_ADVANCED</td>
<td>NUMBER</td>
<td>2</td>
<td>Advanced row compression</td>
</tr>
<tr>
<td>COMP_QUERY_HIGH</td>
<td>NUMBER</td>
<td>4</td>
<td>High for query warehouses compression (Hybrid Columnar Compression)</td>
</tr>
<tr>
<td>COMP_QUERY_LOW</td>
<td>NUMBER</td>
<td>3</td>
<td>Low for query warehouses compression (Hybrid Columnar Compression)</td>
</tr>
<tr>
<td>COMP_ARCHIVE_HIGH</td>
<td>NUMBER</td>
<td>10</td>
<td>High archive compression (Hybrid Columnar Compression)</td>
</tr>
<tr>
<td>COMP_ARCHIVE_LOW</td>
<td>NUMBER</td>
<td>22</td>
<td>Low archive compression (Hybrid Columnar Compression)</td>
</tr>
<tr>
<td>COMP_BLOCK</td>
<td>NUMBER</td>
<td>66</td>
<td>Compressed block</td>
</tr>
<tr>
<td>COMP_LOB_HIGH</td>
<td>NUMBER</td>
<td>120</td>
<td>High compression level for LOB operations</td>
</tr>
<tr>
<td>COMP_LOB_MEDIUM</td>
<td>NUMBER</td>
<td>256</td>
<td>Medium compression level for LOB operations</td>
</tr>
<tr>
<td>COMP_LOB_LOW</td>
<td>NUMBER</td>
<td>128</td>
<td>Low compression level for LOB operations</td>
</tr>
<tr>
<td>COMP_INDEX_ADVANCED_HIGH</td>
<td>NUMBER</td>
<td>1024</td>
<td>High compression level for indexes</td>
</tr>
<tr>
<td>COMP_INDEX_ADVANCED_LOW</td>
<td>NUMBER</td>
<td>2048</td>
<td>Low compression level for indexes</td>
</tr>
<tr>
<td>COMP_RATIO_LOB_MIDRANGE</td>
<td>NUMBER</td>
<td>1000</td>
<td>Minimum required number of LOBs in the object for which LOB compression ratio is to be estimated</td>
</tr>
<tr>
<td>COMP_BASIC</td>
<td>NUMBER</td>
<td>4096</td>
<td>Basic table compression</td>
</tr>
<tr>
<td>COMP_RATIO_LOB_MIDRANGE</td>
<td>NUMBER</td>
<td>5000</td>
<td>Maximum number of LOBs used to compute the LOB compression ratio</td>
</tr>
<tr>
<td>COMP_MEMORY_NONE</td>
<td>NUMBER</td>
<td>0</td>
<td>In-Memory with no compression</td>
</tr>
<tr>
<td>COMP_MEMORY_IMM</td>
<td>NUMBER</td>
<td>16384</td>
<td>In-Memory compression level for DML</td>
</tr>
<tr>
<td>COMP_MEMORY_QUERY_LOW</td>
<td>NUMBER</td>
<td>25768</td>
<td>In-Memory compression level optimized for query performance</td>
</tr>
<tr>
<td>COMP_MEMORY_QUERY_HIGH</td>
<td>NUMBER</td>
<td>65536</td>
<td>In-Memory compression level optimized on query performance as well as space saving</td>
</tr>
<tr>
<td>COMP_MEMORY_CACHING_LOW</td>
<td>NUMBER</td>
<td>12288</td>
<td>In-Memory low compression level optimizing for capacity</td>
</tr>
<tr>
<td>COMP_MEMORY_CACHING_HIGH</td>
<td>NUMBER</td>
<td>24576</td>
<td>In-Memory high compression level optimizing for capacity</td>
</tr>
<tr>
<td>COMP_RATIO_MIDRANGE</td>
<td>NUMBER</td>
<td>10000</td>
<td>Minimum required number of rows in the object for which HCC ratio is to be estimated</td>
</tr>
<tr>
<td>COMP_RATIO_ALLOW</td>
<td>NUMBER</td>
<td>-1</td>
<td>To indicate the use of all the rows in the object to estimate HCC ratio</td>
</tr>
<tr>
<td>OUTPUT_TABLE</td>
<td>PLS_INTEGER</td>
<td>1</td>
<td>Identifies the object whose compression ratio is estimated as of type table</td>
</tr>
<tr>
<td>OUTPUT_INDEX</td>
<td>PLS_INTEGER</td>
<td>2</td>
<td>Identifies the object whose compression ratio is estimated as of type index</td>
</tr>
</tbody>
</table>
**GET_COMPRESSION_RATIO Procedure Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>scratchtabname</td>
<td>Temporary scratch tablespace that can be used for analysis</td>
</tr>
<tr>
<td>owner / tabowner</td>
<td>Schema of the table to analyze</td>
</tr>
<tr>
<td>tabname</td>
<td>Name of the table to analyze</td>
</tr>
<tr>
<td>objname</td>
<td>Name of the object</td>
</tr>
<tr>
<td>subobjname</td>
<td>Name of the partition or sub-partition of the object</td>
</tr>
<tr>
<td>compobj</td>
<td>Compression types for which analysis should be performed. When the object is an index, only the following compression types are valid: <strong>comp_index_advanced</strong> (value 1024) and <strong>comp_index_advanced_cop</strong> (value 2048). <strong>Note:</strong> The following compression types cannot be specified in this parameter for any type of object <strong>comp_block</strong> (value 64) and <strong>comp_rdb</strong> (value 4096).</td>
</tr>
<tr>
<td>blkcnt_cmp</td>
<td>Number of blocks used by compressed sample of the table</td>
</tr>
<tr>
<td>blkcnt_uncomp</td>
<td>Number of blocks used by uncompressed sample of the table</td>
</tr>
<tr>
<td>row_cmp</td>
<td>Number of rows in a block in compressed sample of the table</td>
</tr>
<tr>
<td>row_uncomp</td>
<td>Number of rows in a block in uncompressed sample of the table</td>
</tr>
<tr>
<td>cmp_ratio</td>
<td>Compression ratio, blkcnt_uncomp divided by blkcnt_cmp</td>
</tr>
<tr>
<td>comp_type_str</td>
<td>String describing the compression type</td>
</tr>
<tr>
<td>subset_numrows</td>
<td>Number of rows sampled to estimate compression ratio</td>
</tr>
<tr>
<td>objtype</td>
<td>Type of the object, either <strong>OBJTYPE_TABLE</strong> or <strong>OBJTYPE_INDEX</strong></td>
</tr>
<tr>
<td>lobname</td>
<td>Name of the LOB column</td>
</tr>
<tr>
<td>partname</td>
<td>In case of partitioned tables, the related partition name</td>
</tr>
<tr>
<td>lobcnt</td>
<td>Number of LOBs actually sampled to estimate compression ratio</td>
</tr>
<tr>
<td>index_nr</td>
<td>List of indexes and their estimated compression ratios</td>
</tr>
</tbody>
</table>

Please see the Oracle Database documentation for additional information.

**Usage Examples**

Below are syntax examples, of the GET_COMPRESSION_RATIO procedure, to estimate the compression ratio of a data table, index, and LOB.

Syntax for GET_COMPRESSION_RATIO for a data table and indexes:

```sql
DBMS_COMPRESSION.GET_COMPRESSION_RATIO (  
scratchtabname IN VARCHAR2,  
owner IN VARCHAR2,  
tabname IN VARCHAR2,  
objname IN VARCHAR2,  
subobjname IN VARCHAR2,  
compobj IN NUMBER,  
blkcnt_cmp OUT PLS_INTEGER,  
blkcnt_uncomp OUT PLS_INTEGER,  
row_cmp OUT PLS_INTEGER,  
row_uncomp OUT PLS_INTEGER,  
cmp_ratio OUT NUMBER,  
comp_type_str OUT VARCHAR2,  
subset_numrows IN NUMBER DEFAULT COMP_RATIO_MINROWS,  
objtype IN PLS_INTEGER DEFAULT OBJTYPE_TABLE);```
Example: Estimating Compression Ratio for Advanced Row Compression

SET SERVEROUTPUT ON
DECLARE
  blkcnt_cmp    PLS_INTEGER;
  blkcnt_uncmp  PLS_INTEGER;
  row_cmp       PLS_INTEGER;
  row_uncmp     PLS_INTEGER;
  cmp_ratio     NUMBER;
  comptype_str  VARCHAR2(32767);
BEGIN
  DBMS_COMPRESSION.GET_COMPRESSION_RATIO (  
    scratchtbsname => 'USERS',           
    ownname       => 'TEST',             
    objname       => 'SALES',            
    subobjname    => NULL,               
    comptype      => DBMS_COMPRESSION.COMP_ADVANCED, 
    blkcnt_cmp    => blkcnt_cmp, 
    blkcnt_uncmp  => blkcnt_uncmp, 
    row_cmp       => row_cmp,            
    row_uncmp     => row_uncmp,          
    cmp_ratio     => cmp_ratio,          
    comptype_str  => comptype_str,       
    subset_numrows=> DBMS_COMPRESSION.comp_ratio_minrows, 
    objtype       => DBMS_COMPRESSION.objtype_table  
  ) ;
  DBMS_OUTPUT.put_line( 'Number of blocks used by the compressed sample of the object : ' || blkcnt_cmp);
  DBMS_OUTPUT.put_line( 'Number of blocks used by the uncompressed sample of the object : ' || blkcnt_uncmp);
  DBMS_OUTPUT.put_line( 'Number of rows in a block in compressed sample of the object : ' || row_cmp);
  DBMS_OUTPUT.put_line( 'Number of rows in a block in uncompressed sample of the object : ' || row_uncmp);
  DBMS_OUTPUT.put_line( 'Estimated Compression Ratio of Sample : ' || cmp_ratio);
  DBMS_OUTPUT.put_line( 'Compression Type : ' || comptype_str);
END;
/

Output of Compression Advisor Estimate for Advanced Row Compression (Entire Table)

  Number of blocks used by the compressed sample of the object : 165
  Number of blocks used by the uncompressed sample of the object : 629
  Number of rows in a block in compressed sample of the object : 599
  Number of rows in a block in uncompressed sample of the object : 157
  Estimated Compression Ratio of Sample : 3.8
  Compression Type : “Compress Advanced”
Example: Estimating Compression Ratio for Advanced Index Compression (LOW)

SET SERVEROUTPUT ON
DECLARE
  blkcnt_cmp    PLS_INTEGER;
  blkcnt_uncmp PLS_INTEGER;
  row_cmp       PLS_INTEGER;
  row_uncmp     PLS_INTEGER;
  cmp_ratio     NUMBER;
  comptype_str  VARCHAR2(32767);
BEGIN
  DBMS_COMPRESSION.GET_COMPRESSION_RATIO (   
    scratchtbsname => 'USERS',
    ownname        => 'TEST',
    objname        => 'SALES_IDX',
    subobjname     => NULL,
    comptype       => DBMS_COMPRESSION.COMPRESS_INDEX_ADVANCED_LOW,
    blkcnt_cmp     => blkcnt_cmp,  
    blkcnt_uncmp   => blkcnt_uncmp, 
    row_cmp        => row_cmp,     
    row_uncmp      => row_uncmp,   
    cmp_ratio      => cmp_ratio,   
    comptype_str   => comptype_str, 
    subset_numrows => DBMS_COMPRESSION.comp_ratio_minrows, 
    objtype        => DBMS_COMPRESSION.objtype_index 
  );
  DBMS_OUTPUT.put_line( 'Number of blocks used by the compressed sample of the object ' || 
    blkcnt_cmp); 
  DBMS_OUTPUT.put_line( 'Number of blocks used by the uncompressed sample of the object ' || 
    blkcnt_uncmp); 
  DBMS_OUTPUT.put_line( 'Number of rows in a block in compressed sample of the object ' || 
    row_cmp); 
  DBMS_OUTPUT.put_line( 'Number of rows in a block in uncompressed sample of the object ' || 
    row_uncmp); 
  DBMS_OUTPUT.put_line( 'Estimated Compression Ratio of Sample ' || 
    cmp_ratio); 
  DBMS_OUTPUT.put_line( 'Compression Type ' || 
    comptype_str);
END;
/

Output of Compression Advisor Estimate for Advanced Index Compression (LOW)

Number of blocks used by the compressed sample of the object : 243
Number of blocks used by the uncompressed sample of the object : 539
Number of rows in a block in compressed sample of the object : 499
Number of rows in a block in uncompressed sample of the object : 145
Estimated Compression Ratio of Sample : 2.2
Compression Type : “Compress Advanced Low”
Syntax for GET_COMPRESSION_RATIO for LOBs:

```sql
DBMS_COMPRESSION.GET_COMPRESSION_RATIO (    scratchtbsname => 'USERS',    tabowner => 'TEST',    tabname => 'PARTS',    lobname => 'PART_DESCRIPTION',    partname => NULL,    compctype => DBMS_COMPRESSION.COMP_LOB_MEDIUM,    blkcnt_cmp => blkcnt_cmp,    blkcnt_uncmp => blkcnt_uncmp,    row_cmp => row_cmp,    lobcnt => lobcnt,    cmp_ratio => cmp_ratio,    compctype_str => compctype_str,    subset_numrows=> DBMS_COMPRESSION.comp_ratio_lob_maxrows);
```

Example: Estimating Compression Ratio for Advanced LOB Compression (MEDIUM)

SET SERVEROUTPUT ON
DECLARE
  blkcnt_cmp PLS_INTEGER;
  blkcnt_uncmp PLS_INTEGER;
  row_cmp PLS_INTEGER;
  lobcnt PLS_INTEGER;
  cmp_ratio NUMBER;
  compctype_str VARCHAR2(32767);
BEGIN
  DBMS_COMPRESSION.GET_COMPRESSION_RATIO (    scratchtbsname => 'USERS',    tabowner => 'TEST',    tabname => 'PARTS',    lobname => 'PART_DESCRIPTION',    partname => NULL,    compctype => DBMS_COMPRESSION.COMP_LOB_MEDIUM,    blkcnt_cmp => blkcnt_cmp,    blkcnt_uncmp => blkcnt_uncmp,    row_cmp => row_cmp,    lobcnt => lobcnt,    cmp_ratio => cmp_ratio,    compctype_str => compctype_str,    subset_numrows=> DBMS_COMPRESSION.comp_ratio_lob_maxrows);
END;
```

DBMS_OUTPUT.put_line( 'Number of blocks used by the compressed sample of the object blkcnt_cmp: ' || blkcnt_cmp);
DBMS_OUTPUT.put_line( 'Number of blocks used by the uncompressed sample of the object blkcnt_uncmp: ' || blkcnt_uncmp);
DBMS_OUTPUT.put_line( 'Number of rows in a block in compressed sample of the object row_cmp: ' || row_cmp);
DBMS_OUTPUT.put_line( 'Number of LOBS actually sampled lobcnt: ' || lobcnt);
DBMS_OUTPUT.put_line( 'Estimated Compression Ratio of Sample cmp_ratio: ' || cmp_ratio);
Output of Compression Advisor Estimate for Advanced LOB Compression (MEDIUM)

Number of blocks used by the compressed sample of the object : 199
Number of blocks used by the uncompressed sample of the object : 389
Number of rows in a block in compressed sample of the object : 293
Number of LOBS actually sampled : 55
Estimated Compression Ratio of Sample : 1.9
Compression Type : “Compress Medium”

Understanding Compression Advisor Results

The example advisor output below, the result of running the advisor code above for Advanced Row Compression (Compress Advanced), shows the type of output that is possible with compression advisor.

Number of blocks used by the compressed sample of the object : 165
Number of blocks used by the uncompressed sample of the object : 629
Number of rows in a block in compressed sample of the object : 599
Number of rows in a block in uncompressed sample of the object : 157
Estimated Compression Ratio of Sample : 3.8
Compression Type : “Compress Advanced”

In this example, the “Estimated Compression Ratio of Sample” for Advanced Row Compression (Compress Advanced) determined by compression advisor, is 3.8x. This represents an approximate space reduction of 74% the table when compressed with Advanced Row Compression.

Compression advisor typically provides accurate estimates, of the actual compression results obtained after implementing compression. In general, typical compression ratios for data, indexes and LOBS includes:

- OLTP Table Compression and Advanced Row Compression users can typically expect compression ratios in the range of 2x to 4x
- Hybrid Columnar Compression users can typically expect compression ratios in the range of 6x to 15x
- Advanced Index Compression users can typically expect compression ratios in the range of 2x to 5x
- Advanced LOB Compression users can typically expect compression ratios in the range of 2x to 3x

Note: The compression ratio achieved, in a given environment, depends on the nature of the data being compressed.

It is important to note that compression advisor builds two temporary tables (for comparison purposes) as part of the estimation process for Advanced Row Compression (Hybrid Columnar Compression uses four tables). The temporary tables are created using the prefix ‘cmp3$’ and/or ‘cmp4$’ and are dropped by the compression advisor when no longer required. Although these temporary tables are removed after
compression advisor completes, you will need available free space for compression advisor to build the temporary tables.

For additional information about using DBMS_COMPRESSION, please see the Oracle Database documentation.

**Compression Advisor Best Practices**

- If you get this type of message when estimating Hybrid Columnar Compression:
  
  ORA-12801: error signaled in parallel query server P002  
  ORA-64307: Exadata Hybrid Columnar Compression is not supported for tablespaces on this storage type  
  
  **Solution:** Disable parallel processing for the session (set `parallel_max_servers=0`)  

- Compression adviser has the restriction that the scratch tablespace cannot be uniform

- In earlier releases, Oracle did require 1M rows in a table for estimating HCC compression ratios with compression advisor – this restriction was removed in Oracle Database release 12.1.0.2 and above.

- Outside compression advisor, there are no restrictions with Hybrid Columnar Compression in regards to the minimal amount of data needed (in tables/partitions) with HCC.

**More Information**

For more information, and examples, about compression advisor, please see this MOS note:

How Does Compression Advisor Work (DOC ID: 1284972.1)