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Benefits of Oracle Advanced Compression Overview

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Purpose Statement

This document provides an overview of features and enhancements included in release 23ai. It is intended solely to help you assess the business benefits of upgrading to 23ai and planning for the implementation and upgrade of the product features described.

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Advanced Compression Key Feature Overviews

Advanced Compression provides a comprehensive set of compression capabilities to maximize storage utilization, reduce costs and improve query performance.

This Tech Brief discusses the potential benefits of Advanced Row Compression, Advanced Index Compression and Advanced LOB Compression, features of Advanced Compression.

Advanced Row Compression (tables)

Advanced Row Compression uses a unique compression algorithm specifically designed to work with OLTP and Data Warehouse applications. The algorithm works by eliminating duplicate values within a database block, even across multiple columns.

Compressed blocks contain a structure, called a symbol table, which maintains compression metadata. When a block is compressed, duplicate values are eliminated by first adding a single copy of the duplicate value to the symbol table. Each duplicate value is then replaced by a short reference to the appropriate entry in the symbol table. Through this innovative design, compressed data is self-contained within the database block, as the metadata used to translate compressed data into its original state is stored in the block header.

When compared with competing compression algorithms that maintain a global database symbol table, Oracle's approach offers significant performance benefits by not introducing additional IO (needed with a global symbol table when accessing compressed data).

Advanced Index Compression (indexes)

Indexes are typically extensively used inside OLTP databases since they are capable of efficiently supporting a wide variety of access paths to the data stored in relational tables. It is very common to find large numbers of indexes, created on a single table, to support the multitude of access paths for OLTP applications. This can cause indexes to contribute a greater share to the overall storage of a database when compared to the size of the base tables alone.

Creating an index using Advanced Index Compression reduces the size of all supported unique and non-unique indexes -- while still providing efficient access to the indexes. Advanced Index Compression works well on all supported indexes, including those indexes that are not good candidates -- indexes with no duplicate values, or few duplicate values for given number of leading columns of the index.

Advanced LOB Compression (SecureFiles LOBs)

Advanced LOB Compression utilizes industry standard compression algorithms to minimize the storage requirements of SecureFiles LOB segments. With Advanced LOB Compression, LOBs such as documents or XML files typically experience up to a 2x to 3x compression ratio.

Advanced LOB Compression also automatically avoids compressing LOBs that would not benefit from compression, such as a document already compressed via a 3rd party tool.

Benefits Overview

Although storage cost savings and optimization across servers is the most tangible benefit, all the features with Advanced Compression are designed to provide benefits across components of your IT infrastructure, including memory, network bandwidth and storage.

The typical benefits include:

- REDUCES DATABASE STORAGE REQUIREMENTS
  - 50% OR GREATER STORAGE REDUCTION IS TYPICAL
  - COMBINE WITH HYBRID COLUMNAR COMPRESSION TO OPTIMIZE COMPRESSION BASED UPON DATA USAGE
- SCALABILITY OF STORAGE BANDWIDTH AND CAPACITY
- REDUCES CPU UTILIZATION
  - ENABLES MORE ROWS PER BLOCK AND REDUCES NUMBER OF BLOCK ACCESSES PER ROW ACCESS
  - IMPROVES BUFFER CACHE HIT RATE
- IMPROVES IO EFFICIENCY
  - FREES UP IO BANDWIDTH, REDUCES IO LATENCY

Key Benefits

Defer (or eliminate) Future Storage Purchases

Enterprises are experiencing an explosion in the volume of data required to effectively run their businesses. This ongoing growth in data volume presents a daunting management challenge for organizations.

First and foremost are the spiraling storage costs even though the cost per MB of storage has been declining dramatically. The enormous growth in the volume of data, that needs to be retained online for longer periods of time, makes storage one of the biggest cost elements of most IT budgets.

Oracle's table, index and LOB compression features are non-obtrusive, compression solutions, that typically result in up to a 50%, (or more) reduction in overall storage requirement for databases. With little, or no disruption for implementation.

The compression ratio achieved in each 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 up to 2x to 4x. That is, the amount of space consumed by uncompressed data will be two to four times larger than that of the compressed data.

This will allow you to better utilize existing database storage and possibly defer, or eliminate, additional purchases (or leases) of new storage for growing applications. Because Advanced Compression helps reduce the total data size in the application database, storage requirements grow much slower than non-compressed databases.

Improve Query Performance

Fortunately, the benefits of Advanced Compression go beyond just on-disk storage savings. Another significant advantage is Oracle Database's ability, when using table and index compression, to read compressed data and indexes directly, in memory, without having to uncompress first.

This can help improve query performance due to the reduction in IO (fewer blocks to move), and the reduction in system calls related to the IO operations (which reduces CPU overhead). Further, the database's buffer cache becomes more efficient by storing more data (using fewer blocks) without having to add memory.

Advanced Compression users typically report up to a 2x to 3x improvement in query performance.

Reduce RMAN Backup and Recover Times

Due to RMAN's tight integration with Advanced Compression, already compressed blocks remain compressed during RMAN backups and do not need to be uncompressed before recovery. Providing a

reduction in backup storage space requirements, and typically a reduction in backup, and restore, times.

Optimize Compression Based on Actual Data Usage

Oracle Database provides several types of row-based, and hybrid columnar-based compression allowing organizations to choose the type of compression best suited to the current usage, as the organizations data moves through its lifecycle - from hot/active to warm/less active to cold/historical. While still meeting the performance, and availability, requirements for the application.

When enabled, Heat Map, a feature of Oracle Database Enterprise Edition, automatically tracks usage (query/modification) activity at the row and segment levels.[1] Data modification times are tracked at the row-level and aggregated to the block-level. Modification times, full table scan times, and index lookup times are tracked at the segment-level.

Heat Map tracking enables a detailed view of how tables, and partitions, are accessed, and how access patterns change over time. This information enables organizations to choose, and automatically enable using Oracle's Automatic Data Optimization feature, the level of compression that is the most optimal, based upon current usage.

To learn more about Oracle's Heat Map, and Automatic Data Optimization features for Information Lifecycle Management (ILM), see the *More Information* section below.

Conclusion

Advanced Compression, and Oracle Database, together provide a robust set of compression, performance and data storage optimization capabilities that enable organizations to succeed in complex environments.

Whether it is a cloud, or an on-premise database, Advanced Compression can deliver robust table, index, and LOB compression with no changes in your SQL, or applications.

Get Started with Compression Advisor

An easy way to get started, with Advanced Compression, is by using 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 or partition 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.

More Information

- See the Oracle *Database Administrator's Guide* documentation for more information about Oracle compression.

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[1] Database rows are stored in database blocks, which are grouped in extents. A segment is a set of extents that contains all the data for a logical storage structure within a tablespace (i.e., a table or partition).

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- See the Oracle *VLDB and Partitioning Guide* documentation for more information about Heat Map and Automatic Data Optimization

- See the *PL/SQL Packages and Types Reference* for more information, and usage examples, about the Compression Advisor (DBMS_COMPRESSION)

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