



Exploring Oracle Database 11g/12c Partitioning New Features and Best Practices

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About Me

- Oracle ACE  
- Oracle Certified Professional DBA (OCP) 
- Founder and CEO, DBAces
- President, Israel Oracle User Group 
- Oracle DBA consultant and instructor, dealing with Oracle database core technologies
- Frequent speaker at Oracle Open World annual event and various user group conferences around the globe



About DBAces

- Providing complete end-to-end 24x7 expert remote database services and leading solutions for customer's database and big data environments
 - Committed to providing the highest quality technical services delivered by the industry's top experts
 - Implementing advanced security tools and solutions
 - Professional expertise in delivering on-site customized and vendor official professional trainings
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Agenda

- Oracle Partitioning:
 - Basics
 - Strategies
 - Benefits
 - Best Practices
 - Oracle 11g Partitioning New Features
 - Oracle 12c Partitioning New Features
 - Live Demo
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Oracle Partitioning

- Enhances database manageability, performance, and availability for a wide variety of applications
 - Allows tables and indexes to be subdivided into smaller more manageable pieces called partitions or even sub-partitions
 - Each piece is a different database segment and can be managed individually and function independently of others
 - One of the most important functionalities of the Oracle database, a key tool for building large systems with high performance and availability requirements
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Partitioning Strategies – Single Level

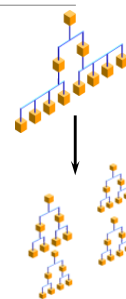
- Range (Oracle 8): maps data to partitions based on ranges of partition key values for each partition
 - Hash (Oracle 8i): maps data to partitions by using a hashing algorithm applied to a partitioning key
 - List (Oracle 9i): maps data to partitions by using a list of discrete values for the partitioning column
 - Interval (Oracle 11g): maps data to partitions or ranges that are automatically created following a specified interval
 - System (Oracle 11g): allows the application to explicitly map rows to arbitrary partitions
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Composite Partitioning Techniques

1 st Level Partitioning	2 nd Level Partitioning	Oracle Database Version
Range	Hash	Oracle 8i
	List	Oracle 9i
	Range	Oracle 11g
List	Range	Oracle 11g
	List	Oracle 11g
	Hash	Oracle 11g
Hash	Hash	Oracle 11g
	List	Oracle 11g
	Range	Oracle 11g
Interval	Range	Oracle 11g
	List	Oracle 11g
	Hash	Oracle 11g

Partitioning Benefits

- Different partitions that belong to the same table/index can:
 - Reside in different tablespaces
 - Have distinct storage clauses
 - Be maintained by granular commands
- Transparent to existing applications
- Optimizer eliminates partitions that do not need to be scanned (Partition Pruning)
- Join operations can be optimized to perform the join “by the partition” (Partition-wise Joins)



Partitioning Best Practices

- EXCHANGE PARTITION:

- One of the best features in partitioning tables
- Swap-out standard tables and partitioned tables
- Ability to load data quickly and easily with minimal impact on current users

```
ALTER TABLE ... EXCHANGE PARTITION ... WITH TABLE ...;
```

- Using Compression:

- Compress some or all partitions using table compression (defined at either tablespace, table or partition level)
- Compress some or all partitions of a B-tree index using key compression to eliminate repeated occurrences of key column prefix values

Partitioning Best Practices

- Copy Statistics:

- Available since 10.2.0.4
- Can be used to copy statistics of the source [sub] partition to the destination [sub] partition

- Sub-Partition Templates:

- Used for composite partitioned table
- Simplifies the specification of sub-partitions by not requiring that a sub-partition descriptor be specified for every partition in the table

Oracle 11g Partitioning New Features

- Interval Partitioning
- Virtual Column-Based Partitioning
- Reference Partitioning
- System Partitioning

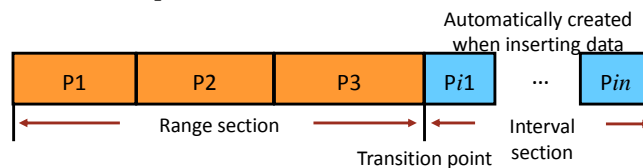


Oracle 11g Partitioning New Features

- Interval Partitioning
 - Automates the creation of range partitions
 - Oracle will create any partition automatically as needed whenever data for a partition is inserted for the very first time
 - Greatly improves the manageability of a ranged partitioned table
 - Available techniques are interval, interval-list, interval-hash, interval-range and interval-reference (12c only)
 - You must specify at least one range partition
 - Partitioning key column must be of NUMBER or DATE type

Interval Partitioning Example

```
CREATE TABLE INTERVAL_PARTITIONING_TBL
(serial_num NUMBER,
 name VARCHAR2(32))
PARTITION BY RANGE (serial_num) INTERVAL (10000)
( PARTITION p1 VALUES LESS THAN (10000) ,
 PARTITION p2 VALUES LESS THAN (20000) ,
 PARTITION p3 VALUES LESS THAN (30000) );
```



Interval_Partitioning.sql **ORACLE DATABASE 11g**

Oracle 11g Partitioning New Features

- Virtual Column-Based Partitioning
 - Allows partitioning key to be defined by an expression, using one or more existing columns of a table and storing the expression as metadata only
 - Enables a more comprehensive match various business requirements
 - Supported with all basic partitioning strategies
 - Can also be used with interval partitioning as well as the partitioning key for reference partitioned tables
 - Virtual columns are treated as regular real columns except no DML operations are allowed

Virtual Column-Based Partitioning Example

```

CREATE TABLE SALES
( PROD_ID          NUMBER          NOT NULL,
  CUST_ID          NUMBER          NOT NULL,
  TIME_ID         DATE            NOT NULL,
  CHANNEL_ID      NUMBER          NOT NULL,
  PROMO_ID       NUMBER          NOT NULL,
  QUANTITY_SOLD  NUMBER(10,2) NOT NULL,
  AMOUNT_SOLD    NUMBER(10,2) NOT NULL,
  PROD_TYPE      NUMBER(1) AS (TO_NUMBER(SUBSTR(TO_CHAR(PROD_ID),1,1)))
TABLESPACE USERS
PARTITION BY RANGE (PROD_TYPE) INTERVAL (1)
(PARTITION p1 VALUES LESS THAN (1));
  
```

Interval_Virtual_Partitioning.sql

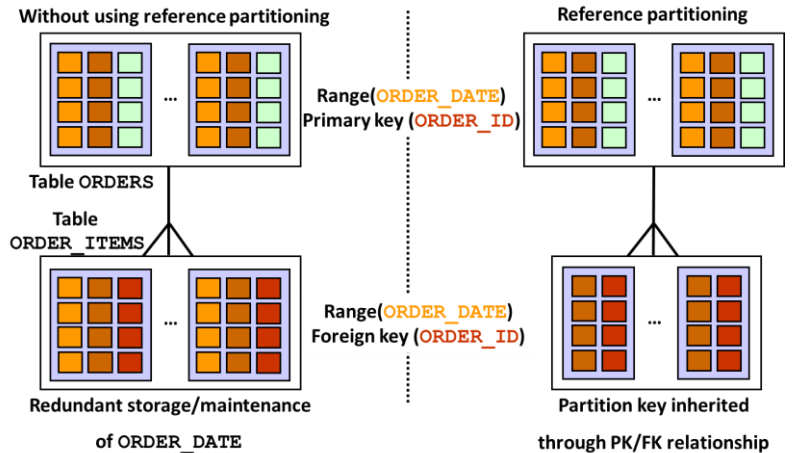



Oracle 11g Partitioning New Features

- Reference Partitioning
 - Allow to partition a table by leveraging an existing parent-child relationship
 - Partitioning strategy of parent table is inherited to its child table without the necessity to store the parent's partitioning key column in the child table
 - Transparently inherits all partitioning maintenance operations that change the logical shape of a table from the parent table to the child table
 - Automatically enables partition-wise joins for the equal-partitions of the parent and child tables
 - Perfect for star schemas in data warehouses; partition the fact table according to the dimension table



Reference Partitioning



Reference_Partitioning.sql 

Oracle 11g Partitioning New Features

- System Partitioning
 - Enables application-controlled partitioning
 - Allows the application to explicitly map rows to arbitrary partitions
 - Provides the ability to break down a table into meaningless partitions
 - All aspects of partitioning are controlled by the application
 - Common performance benefits of partitioned tables are not available (there is no partitioning key)
 - No support for traditional partition pruning, partition wise joins, and so on

Oracle 12c Partitioning New Features

- Partial Indexes for Partitioned Tables
- ONLINE Move Partitions
- Partition Maintenance Operations on Multiple Partitions
- Asynchronous Global Index Maintenance for DROP and TRUNCATE Partition
- Interval Reference Partitioning



Oracle white paper: Partitioning with Oracle Database 12c

<http://www.oracle.com/technetwork/database/options/partitioning/partitioning-wp-12c-1896137.pdf>

Oracle 12c Partitioning New Features

- Partial Indexes for Partitioned Tables
 - New index attribute only applicable to indexes on partitioned tables
 - Indexes can be created on a subset of the partitions of a table
 - Provide more flexibility in index creation for partitioned tables
 - For example, you can choose not to index the most recent partition to avoid any index maintenance work at data insertion time, therefore maximizing data load speed

Oracle 12c Partitioning New Features

- ONLINE Move Partitions
 - Partition maintenance operations can be done in a completely online fashion, allowing DML operations to occur while the data maintenance operation is in process
 - ALTER TABLE ... MOVE PARTITION becomes non-blocking online DDL while DML operations continue to run uninterrupted on the partition that is being moved
 - Global indexes are maintained during the move partition, so a manual index rebuild is no longer required
 - With the ONLINE clause, the move operation waits for the transaction to be finished (commit or rollback) and is then executed

Oracle 12c Partitioning New Features

- Partition Maintenance Operations on Multiple Partitions
 - Partition maintenance operations can be performed on multiple partitions as part of a single partition maintenance operation (one atomic operation)
 - Simplifies application development and leads to more efficient partition maintenance using less system resources
 - For example:

```
ALTER TABLE table_name ADD
PARTITION partition_name...,
PARTITION partition_name...,
PARTITION partition_name...;
```



Oracle 12c Partitioning New Features

- Asynchronous Global Index Maintenance for DROP and TRUNCATE Partition
 - Global index maintenance is decoupled from DROP and TRUNCATE partition maintenance operations without rendering a global index unusable
 - Index maintenance is done asynchronously and can be delayed to a later point in time

ORACLE 12^c
DATABASE



Oracle 12c Partitioning New Features

- Interval Reference Partitioning
 - Referenced partitioned table leverages interval partitioning as the top partitioning strategy
 - Enhances Oracle's partitioning capabilities to model the database schema according to real business needs

```
CREATE TABLE parent_table_name
(column_name..., column_name..., ...)
PARTITION BY RANGE (column_name) INTERVAL(n)...;
CREATE TABLE child_table_name
(column_name..., column_name..., FOREIGN KEY...)
PARTITION BY REFERENCE (fk_constraint_name)...;
```

ORACLE 12^c
DATABASE



Thank You!

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and Best Practices

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