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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 Brillix-DBAces

- Provide complete end-to-end 24x7 expert on-site and remote managed services for customer's databases and big data environments
- Committed to provide the highest quality of technical services delivered by the industry's top experts
- Implement advanced security tools and solutions
- Deliver on-site customized and vendor official trainings led by our team of Oracle ACEs and OCPs

Agenda

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

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

Partitioning Strategies – Single Level

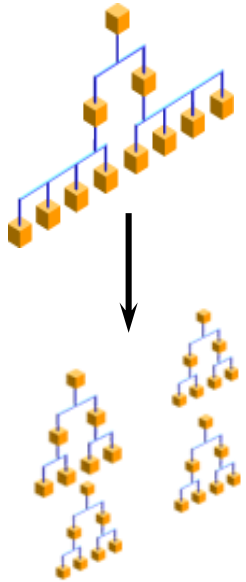
- Range (Oracle 8): maps data to partitions based on ranges of partition key values for each partition
- Hash (Oracle 8i): maps data to partitions by using a hashing algorithm applied to a partitioning key
- List (Oracle 9i): maps data to partitions by using a list of discrete values for the partitioning 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

Composite Partitioning Techniques

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

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

Range_List_Template.sql

Oracle 11g Partitioning New Features

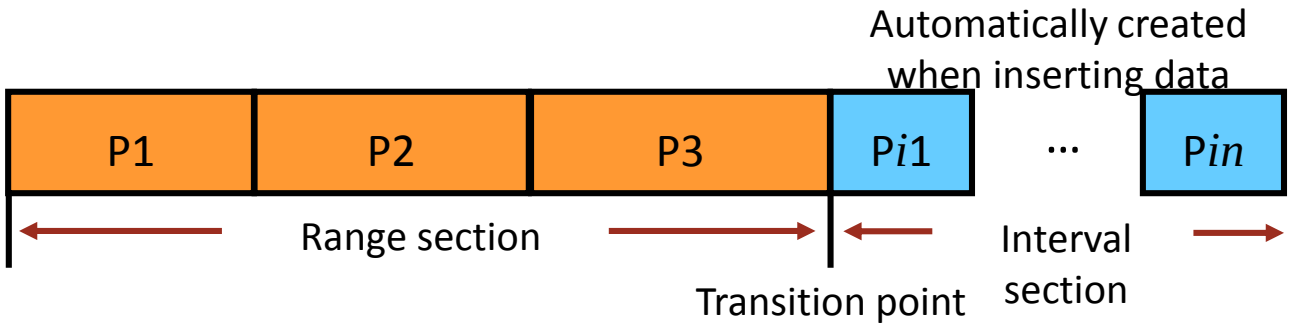
- Interval Partitioning
- Virtual Column-Based Partitioning
- Reference Partitioning
- System Partitioning

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 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

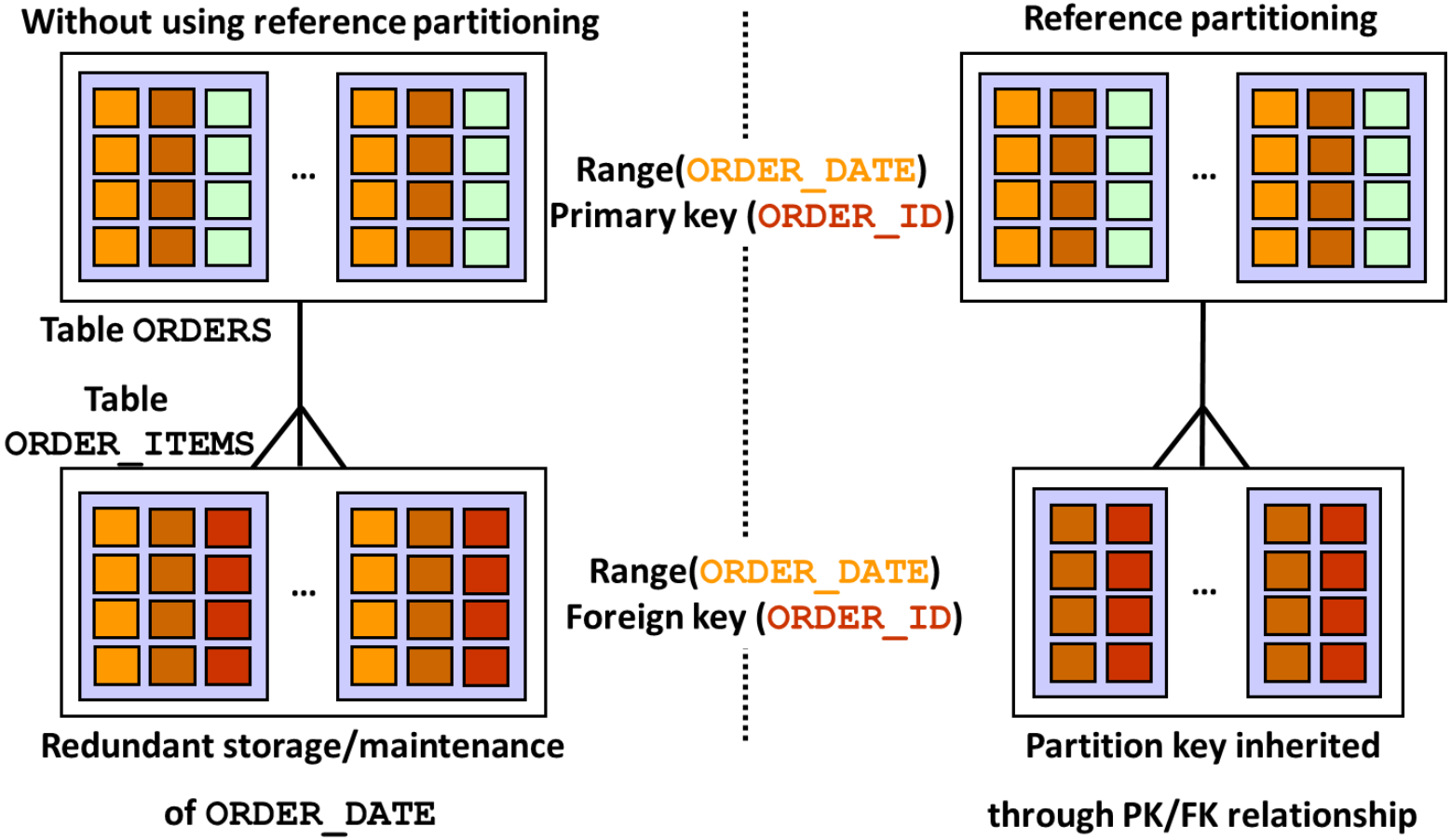
```
CREATE TABLE SALES
( PROD_ID        NUMBER        NOT NULL,
  CUST_ID        NUMBER        NOT NULL,
  TIME_ID        DATE          NOT NULL,
  CHANNEL_ID     NUMBER        NOT NULL,
  PROMO_ID       NUMBER        NOT NULL,
  QUANTITY_SOLD  NUMBER(10,2)  NOT NULL,
  AMOUNT_SOLD    NUMBER(10,2)  NOT 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

Partial_Indexes.sql

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 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)…;
```

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Thank You!

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