Beginners’ Guide
to
Partitioning

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Who am I?

Independent Consultant.
23+ years in IT
20+ using Oracle
Strategy, Design, Review
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One of the directors of the UKOUG
Member of the Oak Table Network.
Oracle Author of the year 2006
"Select" Editor’s choice 2007
Highlights

Partitioning possibilities

Potential Benefits

Possible Problems

Basic Options:

Range - continuous measures
   Typically time-based for aging data
Hash - random distribution
   Typically for reducing contention
   Large number of distinct values
   Powers of 2 for number of partitions
List - explicit distribution
   Short list of interesting values
   Based only on single column
   Histogram on partition key with literal values in queries
Composite - range / (list or hash) – until 11g
   But CBO doesn’t use subpartition stats until 10.2.0.4+
Benefits

Partition elimination on queries
Effectively “free indexing” effect

Partition-wise joins
Splits one big join into several small joins

Faster data loading
Less contention on concurrent activity
Exchange partition tricks for bulk loads

Dropping old data (ILM – information lifecycle management)
Range partition by time

Simple Partitioning

Non-partitioned table

Simple partitioned table
Composite Partitioning

Simple partitioned table


Composite partitioned table


Theoretical Advantages - 1

Querying a few small chunks can be quicker than querying the whole object.

You can add or drop an entire partition without generating lots of undo and redo.

Rebuild, compress, recycle cache and read-only tablespaces for aging, stable, data.
**Theoretical Advantages - 2**

<table>
<thead>
<tr>
<th>P000</th>
<th>P001</th>
<th>P002</th>
<th>P003</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Tab A" /></td>
<td><img src="image2.png" alt="Tab A" /></td>
<td><img src="image3.png" alt="Tab A" /></td>
<td><img src="image4.png" alt="Tab A" /></td>
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<tr>
<td><img src="image5.png" alt="Tab B" /></td>
<td><img src="image6.png" alt="Tab B" /></td>
<td><img src="image7.png" alt="Tab B" /></td>
<td><img src="image8.png" alt="Tab B" /></td>
</tr>
</tbody>
</table>

**Partition-wise joins:**
- Turn one big job into several little ones
- Can minimise inter-process messaging when running parallel

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**Indexing - 1**

Locally Partitioned index

Simple partitioned table

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Basic Partitioning 9/25

Basic Partitioning 10/25
**Indexing - 2**

Composite partitioned table with local index

**Plus Points**

Less contention when inserting into different partitions – especially relevant to indexes, and potentially very useful with hash partitioning

Can still drop a single table partition cheaply – you only take out the matching indexes.
If your queries don’t allow partition elimination, the workload and the contention \textit{get worse.}

With larger numbers of partitions and a small result set the overhead can be dramatic.
**Plans can change:**
e.g. until this table was hash partitioned the query could use a “sort order by (nosort)” operation based on a range scan. Now it has to do a sort.

**Indexing - 3**

Global Index

Simple partitioned table
Basic Partitioning 17 /35

Indexing - 4

Globally Partitioned index

Simple partitioned table

Indexing - 5

“Semi-local” global index

Composite partitioned table

Careful \textit{manual} control allows you to index along one dimension of a composite table.
A hash-partitioned index (10g) may be particularly useful for reducing index contention.

Benefits - reprise

Partition elimination on queries
Effectively “free indexing” effect

Partition-wise joins
Splits one big join into several small joins

Faster data loading
Less contention on small concurrent DML
Exchange partition tricks for bulk loads

Dropping old data (ILM - information lifecycle management)
Range partition by time
Partition Elimination - 1

Needs high visibility of predicate in partition key

Does not need prefixed local indexes

Bind values and dates may cause CBO oddities
  - be particularly careful to use 4-digit years

Driving Table

Will appear on nested loop join to partition key column.

pstart / pstop in execution plan show as (Key)
Won’t appear for hash joins to partition keys unless **subquery pruning** occurs. (The “Bloom filter” appears in 10g)

pstart / pstop displays as Key(SQ) for subquery pruning
pstart / pstop displays as :BF0000 for bloom filtering

If you have two partitioned tables after the driver, it may be impossible to eliminate on the second partitioned table unless you get **Bloom filters** working (may be 11g only)
Joining on the partition key.
Needs exact matches on the partitions
same number, same high values
Be careful with list partitioning ('CA', 'TX') != ('TX', 'CA')
Can be “broken” by high degrees of parallelism.
Oracle may do “broadcast” distribution in error.

Can be “synthesised” (especially relevant to PX)
Add an empty partition.
Create a clone table and fill it with the latest data.
Index it, and collect statistics
Exchange partition

**Bulk loading - 2**

**Plus points.**
The data doesn’t move, it’s a dictionary update.
Avoids contention and read consistency issues

**But ...**
*Global* indexes still have a bulk update
Table level statistics need correction
Integrity constraints need special handling

*Enable SQL trace and test everything (with some data) to see the SQL that happens under the covers.*
Referential Integrity – 1

```sql
alter table child drop partition p1000;
Table altered.

alter table parent drop partition p1000;

alter table parent drop partition p1000 *
ERROR at line 1:
ORA-02266: unique/primary keys in table referenced by enabled foreign keys

There may be child rows in the next partition up when you make the call to drop the “matching” parent.
```

Referential Integrity – 2

To drop the parent end of a Referential Integrity constraint
You need to disable the foreign key constraint.

You can still exchange a child partition with another table,
But the foreign key constraint has to be set as novalidate.
(The error message is a little misleading if you don’t do this:
ORA-02266: unique/primary keys in table referenced by enabled foreign keys)

11g allows for “ref partitioning”.
This doesn’t apply if your parent key is part of the child key
(i.e. if your database design is correct).
Uniqueness – 1

```
alter table parent
  exchange partition p3000 with table parent_ex
-- including indexes
-- without validation
-- update [global] indexes
;
```

The resources used in the operation depend on:
- the options chosen (indexes, validation)
- the constraint state (validate/novalidate, enable/disable)

Always test with some data, and SQL trace enabled.

Uniqueness – 2

```
select /*+ first_rows(1) ordered */ 1
from
  parent_ex  a,
  parent     b
where  a.id = b.id
and (  tbl$or$idx$part$num(parent,0,0,0,b.rowid) < 2
       or tbl$or$idx$part$num(parent,0,0,0,b.rowid) > 2
   )
and  tbl$or$idx$part$num(parent,0,0,0 ,a.id) <> 2
and  rownum < 2
;
```

Primary Key in **validate** state, Exchange **without** validation

Oracle checks the data integrity for all OTHER partitions.
**Uniqueness – 3**

*Primary Key in either state, Exchange *with* validation*

```
select 1
from parent_ex
where tbl$or$idx$part$num(parent, 0, 3,1048576,id) != :1
```

*Oracle checks every new row belongs in THIS partition.*

*There is no under-cover check when the PK is in the novalidate state, and you exchange without validation.*

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**Left as exercise**

*where :b1 between dt_start and dt_end ?*

<table>
<thead>
<tr>
<th>End &lt; 01-Apr</th>
<th>End &lt; 01-May</th>
<th>End &lt; 01-Jun</th>
<th>End &lt; 01-Jul</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Start &lt; 01-Feb</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 01-Mar</td>
</tr>
<tr>
<td>&lt; 01-Apr</td>
</tr>
<tr>
<td>&lt; 01-May</td>
</tr>
<tr>
<td>&lt; 01-Jun</td>
</tr>
<tr>
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</table>

*11g offers more options in partitioning. Some (e.g. interval partitioning) are administrative – but range/range composites may be very useful in carefully constructed special cases.*
Summary

Partition for:

- Housekeeping (partition maintenance)
- Reducing contention
- Partition elimination / “free indexing”
- Partition-wise joins

Threat points when partitioning.

- Impact when elimination does not occur
- Issues with unique and referential integrity
- Effects of local or global indexes