Oracle 12c Top 20 New Features for Developers

Arup Nanda
Longtime Oracle DBA
Agenda

• Top features of Oracle 12c for Developers
• Excludes PL/SQL
  – Covered in a different session
• Of interest to developers and users
  – Not to DBAs
Online DDL

- DDLs do not need lock.
- DML continues as usual
  - drop index i1 online
  - alter index i1 unusable online
  - alter table t1 set unused columns online
  - alter table t1 drop column c1 online
  - alter table t1 move partition p1 online
    - subpartition too
Cascading Truncate

• When you truncate a parent table with child tables, you get:
  ORA-02266: unique/primary keys in table referenced by enabled foreign keys

• In Oracle 12c, you can use:
  truncate table <Parent> cascade;

• Must have defined the FK as ON DELETE CASCADE.

• Otherwise ORA-14705: unique or primary keys referenced by enabled foreign keys in table will result
Top-N Query

• First 10, second 10 rows, etc.
  select ... from (select ... from ... order by ...) where rownum <= 10

• 12c way:
  select *
  from sales_fact
  order by year, week, country, region, product
  fetch first 10 rows only;

• Next 10 rows
  – offset 10 rows fetch first 10 rows only
  – offset 10 rows fetch first 0.1 percent rows only
  – offset 10 rows fetch first 0.1 percent rows with ties
TopN Query Plan

- **TopN Plan**

<table>
<thead>
<tr>
<th>Rows</th>
<th>Execution Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>SELECT STATEMENT MODE: ALL_ROWS</td>
</tr>
<tr>
<td>5</td>
<td>SORT (ORDER BY)</td>
</tr>
<tr>
<td>5</td>
<td>VIEW</td>
</tr>
<tr>
<td>5</td>
<td>WINDOW (SORT PUSHED RANK)</td>
</tr>
<tr>
<td>100000</td>
<td>TABLE ACCESS MODE: ANALYZED (FULL) OF 'ACCOUNTS' (TABLE)</td>
</tr>
</tbody>
</table>

- **Regular Plan**

<table>
<thead>
<tr>
<th>Rows</th>
<th>Execution Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>SELECT STATEMENT MODE: ALL_ROWS</td>
</tr>
<tr>
<td>5</td>
<td>COUNT (STOPKEY)</td>
</tr>
<tr>
<td>5</td>
<td>VIEW</td>
</tr>
<tr>
<td>5</td>
<td>SORT (ORDER BY STOPKEY)</td>
</tr>
<tr>
<td>100000</td>
<td>TABLE ACCESS MODE: ANALYZED (FULL) OF 'ACCOUNTS' (TABLE)</td>
</tr>
</tbody>
</table>
TopN Restrictions

- If you have a SELECT statement with FOR UPDATE, you can’t use it.
- The SELECT statement can’t CURRVAL or NEXTVAL of sequences
- If the query of the Materialized Views has this clause, then you can’t do an incremental refresh of that MV
Bottom-N

```
select round(principal+interest,2) tot_bal,
round((sysdate-created_dt)) age, accno
from accounts
order by 1 desc
offset ((select count(1) from accounts) - 5) rows
fetch next 5 rows only
```
Session Sequences

- `select seq1.nextval from dual;`
- Session Seq: values visible only in the session
- Not persistent

```
SQL> create sequence sessseq session;
SQL> create sequence globseq global;
SQL> select globseq.nextval from dual; 3
SQL> select sessseq.nextval from dual; 1
```

Seq.sql sqqs.sql
DDL Logging

- **Enable** `alter system set enable_ddl_logging=true;`
  - The logs are written in `C:\oracle\diag\rdbms\anl2\anl2\log\ddl`
  - In XML format

```xml
<msg time='2013-08-30T20:29:36.635-04:00' org_id='oracle' comp_id='rdbms'
  msg_id='opiexe:4181:2946163730' type='UNKNOWN' group='diag_adl'
  level='16' host_id='STARUPNANT420B' host_addr='fe80::58b8:d0b2:f7c9:3147%27'
  version='1'>
  <txt> create table t11 (col1 number) </txt>
</msg>

<msg time='2013-08-30T20:32:56.719-04:00' org_id='oracle' comp_id='rdbms'
  msg_id='opiexe:4181:2946163730' type='UNKNOWN' group='diag_adl'
  level='16' host_id='STARUPNANT420B' host_addr='fe80::58b8:d0b2:f7c9:3147%27'>
  <txt> drop table t11 </txt>
</msg>
```
View Expansion

create view v1 as select * from t1;

select * from v1;

SQL> var o clob
SQL> begin
2    dbms_utility.expand_sql_text (3             'select * from v1',:o);
3    'select * from v1',:o);
4    end;
5   /

SQL> print o

SELECT "A1"."COL2" "COL2" FROM (SELECT "A2"."COL2" "COL2" FROM ARUP."T1" "A2")

Exp1.sql
Multiple Indexes

SQL> create table t3 (col1 number, col2 number);
Table created.

SQL> create index in_t3 on t3(col1);
Index created.

SQL> create index in_t3_02 on t3(col1);
create index in_t3_02 on t3(col1) *
ERROR at line 1:
ORA-01408: such column list already indexed

SQL> create bitmap index in_t3_02 on t3(col1) invisible;
Index created.

Rules
• Different types: b-tree/bitmap
• Unique/nonUnique
• Only one is visible at a time

Multind1.sql
Invisible Column

SQL> create table t4 (col1 number, col2 number invisible);
SQL> desc t4
Name Null? Type
----- ----- ----- 
COL1 NUMBER
SQL> insert into t4 values (1);
1 row created.
SQL> select * from t4;
COL1
----------
1
SQL> select col1, col2 from t4;
  COL1     COL2
---------- ---------- 
1
SQL> insert into t4 (col1,col2) values (2,2);
1 row created.

Invcol1.sql
Invisible Columns, contd.

SQL> set colinvisble on
SQL> desc t4
    Name          Null?    Type
    -------------- -------- ------------COL1                       NUMBER
    COL2 (INVISIBLE)           NUMBER

SQL> create index in_t4 on t4(col2);
Index created.
SQL> create table t5 (col1 number, col2 number default on null 0);
Table created.

SQL> desc t5
Name              Null?    Type----------------- -------- ------COL1                       NUMBERCOL2              NOT NULL NUMBER

SQL> insert into t5 values (1, null);
SQL> insert into t5 values (2,2);

SQL> select * from t5;
<table>
<thead>
<tr>
<th>COL1</th>
<th>COL2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Defval1.sql
### Identity Column

```sql
SQL> create table t6 (col1 number generated always as identity);

SQL> create table t7 (col1 number generated always as identity (start with 1000 increment by 10));

SQL> insert into t6 values (1);
insert into t6 values (1)
*    
ERROR at line 1:
ORA-32795: cannot insert into a generated always identity column

SQL> create table t9 (col1 number, col2 number generated by default as identity);
SQL> insert into t9 values (9,9);
SQL> insert into t9 values (10,default);
SQL> insert into t9 (col1) values (11);
SQL> select * from t9;

<table>
<thead>
<tr>
<th>COL1</th>
<th>COL2</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
</tr>
</tbody>
</table>
```

Idcol1.sql
Longer VARCHAR2

• VARCHAR2 is now 32676 bytes
  – Param MAX_STRING_SIZE should be set to EXTENDED
  – DB must be in upgrade mode
  – Irreversible
  – CLOB behind the scenes
Outer Join

col prod_name format a30
col promo_name format a30
set lines 132 pages 45
set pau on
select prod_name, promo_name, channel_desc, count(amount_sold) cnt
from sales s, channels h, promotions m, products p
where h.channel_id = s.channel_id (+)
and m.promo_id = s.promo_id (+)
and p.prod_id = s.prod_id (+)
group by prod_name, promo_name, channel_desc
order by prod_name, promo_name, channel_desc
### Outer Join, contd.

<table>
<thead>
<tr>
<th>PROD_NAME</th>
<th>PROMO_NAME</th>
<th>CHANNEL_DESC</th>
<th>CNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.44MB External 3.5&quot; Diskette</td>
<td>NO PROMOTION #</td>
<td>Catalog</td>
<td>0</td>
</tr>
<tr>
<td>1.44MB External 3.5&quot; Diskette</td>
<td>NO PROMOTION #</td>
<td>Direct Sales</td>
<td>13655</td>
</tr>
<tr>
<td>1.44MB External 3.5&quot; Diskette</td>
<td>NO PROMOTION #</td>
<td>Internet</td>
<td>2457</td>
</tr>
<tr>
<td>1.44MB External 3.5&quot; Diskette</td>
<td>NO PROMOTION #</td>
<td>Partners</td>
<td>6265</td>
</tr>
<tr>
<td>1.44MB External 3.5&quot; Diskette</td>
<td>NO PROMOTION #</td>
<td>Tele Sales</td>
<td>0</td>
</tr>
<tr>
<td>... truncated</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cross Apply

SELECT ...
FROM T1, Collection
WHERE ...

Oracle12c Top 20 New Features for Developers

Arup Nanda
create or replace type final_acc_int as table of number;

create or replace function get_final_int_tab (p_acctype in accounts.acctype%type) return final_acc_int is
    l_ret final_acc_int;
begin
    select
        cast(
            collect(interest)
        as final_acc_int
        )
    into l_ret
    from accounts
    where acctype = p_acctype;
    return l_ret;
end;
/

Oracle12c Top 20 New Features for Developers

Arup Nanda
Cross Apply, contd. 2

```sql
select * from
    account_types a
  cross apply
    get_final_int_tab(a.acctype)
where acctype in 'S'
order by column_value
/
```

<table>
<thead>
<tr>
<th>A</th>
<th>ACC_DESC</th>
<th>COLUMN_VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>----------</td>
<td>----------------</td>
</tr>
<tr>
<td>...</td>
<td>output truncated ...</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Savings</td>
<td>9921.56003</td>
</tr>
<tr>
<td>S</td>
<td>Savings</td>
<td>9943.34883</td>
</tr>
<tr>
<td>S</td>
<td>Savings</td>
<td>9957.86381</td>
</tr>
</tbody>
</table>

Cross.sql
Outer Apply

select *
    from account_types a
outer apply
get_final_int_tab(a.acctype)
where acctype in 'T'
order by column_value
/

Outer.sql
Objective:
select acc_desc, interest
from accounts a,
    (select * from account_types t where t.acctype = a.accttype);

Will fail with
ORA-00904: "A"."ACCTYPE": invalid identifier
select acc_desc, interest 
from accounts a, 
    lateral (select * from account_types t 
where a.accttype = t.accttype) 
/

Lateral.sql
impdp arup/arup tables=ACCOUNTS
transform=DISABLE_ARCHIVE_LOGGING:Y
table_exists_action=append
.. imported "ARUP"."ACCOUNTS"
10.67 MB 100000 rows
Job "ARUP"."SYS_IMPORT_TABLE_01" successfully completed at Mon Oct 21 23:57:09 2013 elapsed 00:00:06
select *
from sales
match_recognize(
    partition by prod_id
    order by time_id
    measures strt.time_id as start_date,
    last(down.time_id) as bottom_date,
    last(up.time_id) as end_date,
    sum(amount_sold) as tot_sold
    one row per match
    after match skip to last up
    pattern (strt down+ up+)
    define
        down as down.amount_sold < prev(down.amount_sold),
        up as up.amount_sold > prev(up.amount_sold)
    ) matcher
where prod_id = 13
order by matcher.start_date
Match Recognize, contd.

MATCH_RECOGNIZE includes:

- PARTITION Segregate data
- ORDER BY Order with partitions
- MEASURES Define output columns
- AFTER Return single/multiple rows
- PATTERN Define regular expression
- DEFINE Specify expression tags

<table>
<thead>
<tr>
<th>PROD_ID</th>
<th>START_DATE</th>
<th>BOTTOM_DA</th>
<th>END_DATE</th>
<th>TOT_SOLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>02-DEC-01</td>
<td>02-DEC-01</td>
<td>02-DEC-01</td>
<td>3752.1</td>
</tr>
<tr>
<td>13</td>
<td>03-DEC-01</td>
<td>03-DEC-01</td>
<td>10-DEC-01</td>
<td>2914.48</td>
</tr>
<tr>
<td>13</td>
<td>10-DEC-01</td>
<td>10-DEC-01</td>
<td>10-DEC-01</td>
<td>2719.28</td>
</tr>
<tr>
<td>13</td>
<td>17-DEC-01</td>
<td>17-DEC-01</td>
<td>17-DEC-01</td>
<td>3000.86</td>
</tr>
<tr>
<td>13</td>
<td>17-DEC-01</td>
<td>17-DEC-01</td>
<td>17-DEC-01</td>
<td>3752.1</td>
</tr>
<tr>
<td>13</td>
<td>20-DEC-01</td>
<td>20-DEC-01</td>
<td>20-DEC-01</td>
<td>2719.28</td>
</tr>
<tr>
<td>13</td>
<td>20-DEC-01</td>
<td>20-DEC-01</td>
<td>20-DEC-01</td>
<td>2719.28</td>
</tr>
<tr>
<td>13</td>
<td>23-DEC-01</td>
<td>23-DEC-01</td>
<td>23-DEC-01</td>
<td>2816.88</td>
</tr>
<tr>
<td>13</td>
<td>23-DEC-01</td>
<td>24-DEC-01</td>
<td>24-DEC-01</td>
<td>3752.1</td>
</tr>
<tr>
<td>13</td>
<td>23-DEC-01</td>
<td>23-DEC-01</td>
<td>23-DEC-01</td>
<td>2719.3</td>
</tr>
<tr>
<td>13</td>
<td>23-DEC-01</td>
<td>23-DEC-01</td>
<td>23-DEC-01</td>
<td>2719.3</td>
</tr>
</tbody>
</table>
Thank You!

My Blog: arup.blogspot.com
My Tweeter: arupnanda