



# Oracle12c New Features including Release 2 New Features

**Dan Hotka**

**Author/Instructor**

**Oracle Ace Director** 



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Dan Hotka  
Author/Instructor/Oracle Expert  
CEO  
DHotka@Earthlink.net  
515 279 3361


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www.*DanHotka*.com

# Dan is a Training Consultant

## ❖ Dan Hotka

### – Oracle ACE Director

- Oracle ACEs and Oracle ACE Directors  are known for their strong credentials as Oracle community enthusiasts and advocates, with candidates nominated by anyone in the Oracle Technology and Applications communities.
- [www.oracle.com/technology/community/oracle\\_ace/index.html](http://www.oracle.com/technology/community/oracle_ace/index.html)

### – Oracle Authored Expert

- 34 Years in IT – 28 years working with Oracle
- 12 books – hundreds of articles

## ❖ Register for Monday Lunch n Learn

- Short technical webinars every Monday

## ❖ DanHotka.Blogspot.com

- I also blog on TOADWorld.com

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- Public Web-based training
- Half day lectures with hands-on lab exercises
- Almost like being there!

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  - Price includes my portable computer lab!
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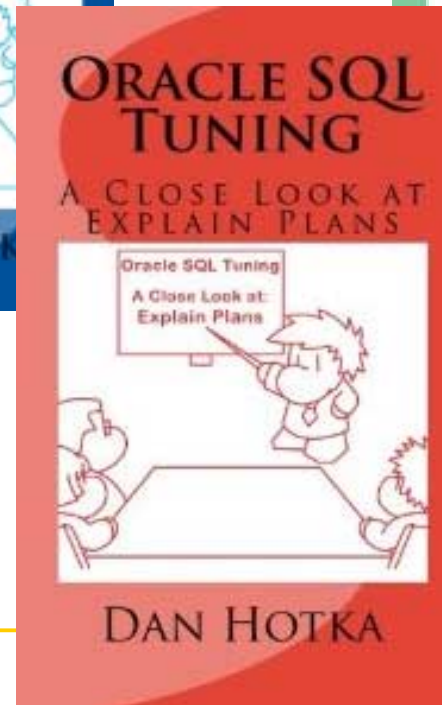
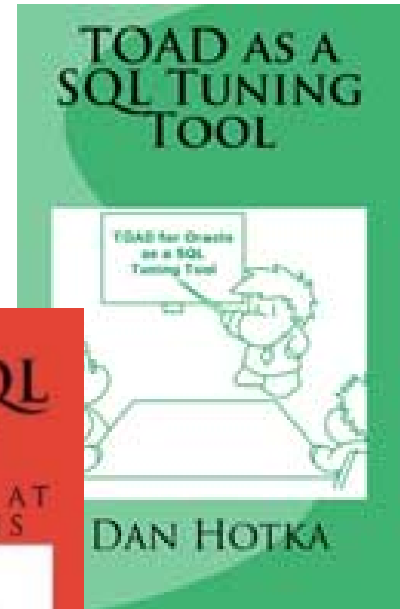
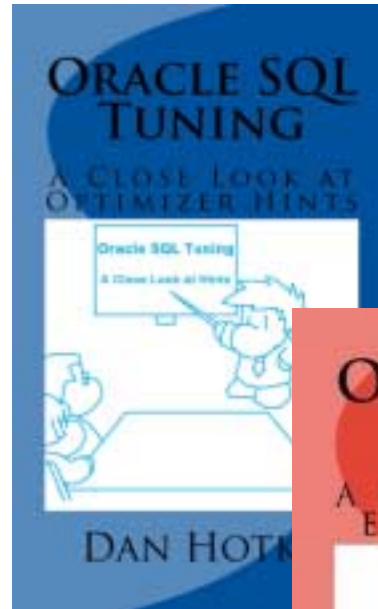
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- Oracle12 New Features!!!!
- Oracle Advanced PL/SQL
- Oracle SQL Tuning
- TOAD Courses
- Oracle OBIEE – Admin & Queries/Reports
- Discoverer, Intro courses, Cross training!



[www.Amazon.com](http://www.Amazon.com)

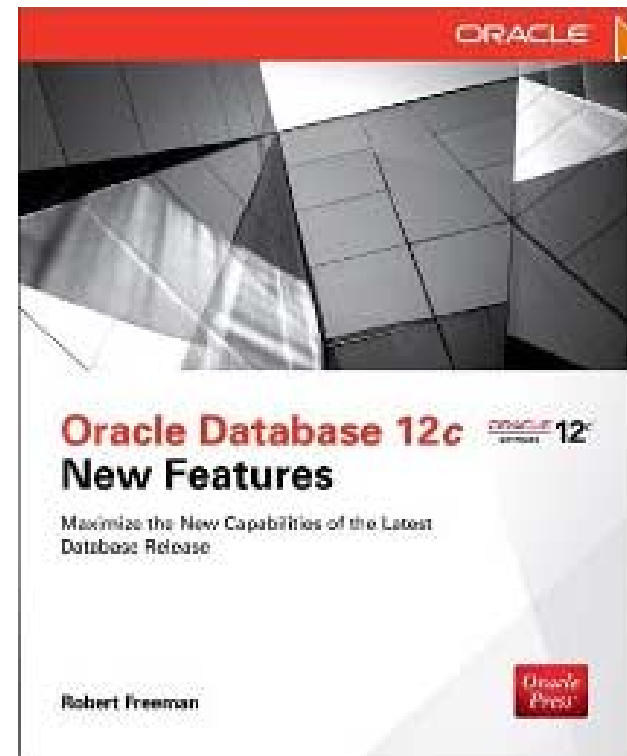
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# Additional Reading

## ❖ Oracle12c New Features

- By Robert Freeman;
- Available in the book store???
- [www.Amazon.com](http://www.Amazon.com)





# Agenda

## ❖ Oracle New Features

- Pluggable Database
- New Table/Index Partitioning
- More New Features
  - Full Transportable Export/Import
  - Temporary Undo
  - Multiple Indexes using same columns
  - Transaction Guard



# Agenda

## ❖ New SQL Syntax

- New Analytical Functions
- New SQL Features
- New Options for Sequences
- Enhanced Join Syntax
- Increased column size limits



# Agenda

## ❖ New PL/SQL Features

- PL/SQL And SQL
- Enhanced DBMS\_UTILITY
- New UTL\_CALL\_STACK
- Enhanced DBMS\_SQL
- Enhanced Native SQL







# Audience Background

## ❖ A few questions:

- What Oracle Database are you running?
- When do you plan to go to Oracle12?
- Working with Oracle12 Now?
- What is your Oracle background?
  - Newbee 1 – 3 years 4 – 8 years 8+ years?
- What is your main role?
  - Power User Analyst Developer DBA Management?



# #1 Pluggable DB



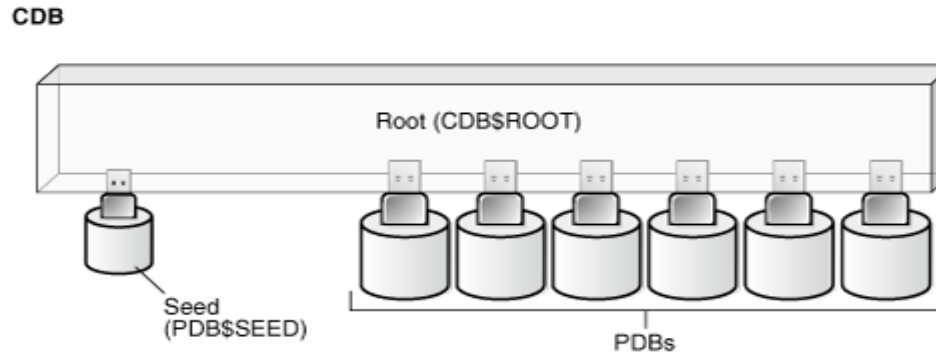
# Pluggable Database

## ❖ Pluggable Database

- The 'c' in Oracle12
  - Container
    - Pluggable databases come into the environment as a database that 'contains' other database
  - Consolidate
    - Allows for the sharing of resources, backup/recovery schemes, and ease of management of similar application DBs
  - Cloud
    - This new environment lends itself well for the cloud computing environment



# Pluggable Database



## ❖ How it works:

- Root
  - Contains metadata and common users
- Seed
  - A template for new PDB's
- PDB
  - The actual application DB...just like a non-CDB.



# Pluggable Database

## ❖ How it works:

- 1 set of Oracle executables per container
  - Think of the savings in memory/processing power alone!
- Sharing of features:
  - Container setup features shared across all PDB's automatically
  - Data guard, rac,
  - Resource management (memory, disk, etc)
  - Backup
- Eases management of lots of similar database environments



# Pluggable Database

## ❖ Support

- Supports up to 252 databases per container DB
- Users can share PDB's
  - Called common users
- Can use SQL\*Plus, DBCA, Enterprise Mngr Cloud Control, SQL Developer, or Server Control to manage the CDB and PDB's.



# Pluggable Database

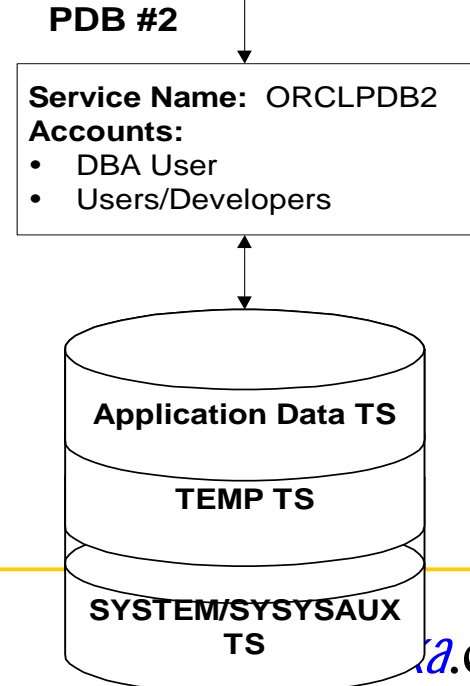
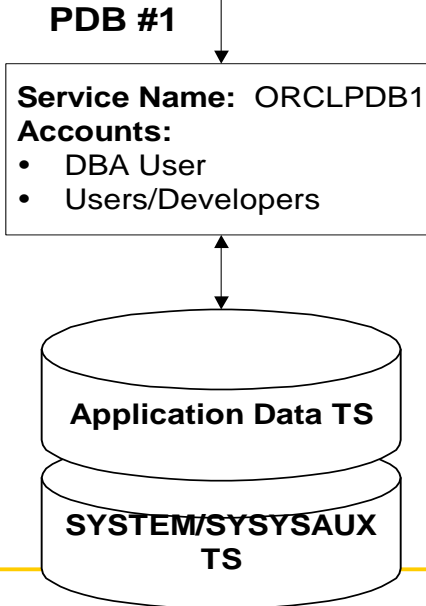
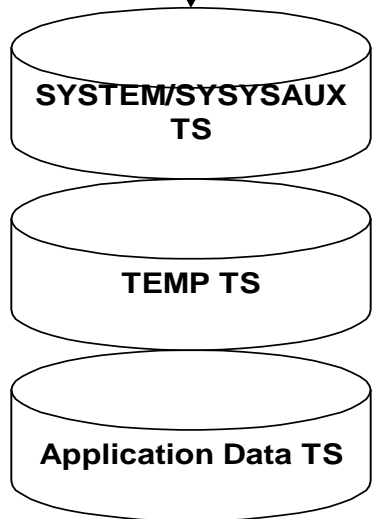
## Oracle12 CDB

SID: Orcl  
Service Name: ORCL  
Container Name: CDB\$ROOT  
Accounts:

- Sys
- System
- C## - common users

Alter Session Set container = <service name>;

upto 250  
more  
PDB's





# Pluggable Database

## ❖ Oracle 12.1.0.2 New Features

- Can do cross PDB queries
  - Select ename from containers(user0.EMP) where CON\_ID in (3,5)
  - This will search these 2 PDB's for the schema and table
  - Downside...less flexibility if you code this way...
    - Maybe a synonym solution in a future release???
- Standby DB – No Logging clause at the PDB Level
- Can subset PDB's by tablespace



# Pluggable Database

## ❖ Oracle 12.1.0.2 New Features

- Support for new In-Memory solutions
- Support for flashback options
- Maintains state of PDB's between database restarts





# Pluggable Database

## ❖ Problems

- Same synonym names pointing to different objects
- Same schema names
- Supports Oracle12 DBs only

## ❖ **Some planning is needed to insure consistency of common names across applications**



# Partitioning Enhancements



# Partitioning Enhancements

## ❖ Moving Partitions online

- Can now move partitions and subpartitions online.

## ❖ Interval-Reference Partitioning

- Interval partitioning allows for automatic partitioning of values outside the range of values defined.
- Reference partitioning has child partitions off the main partition, based on foreign key which becomes the child partition key value
- Prior releases could not create an interval partition for the parent table, this restriction has been lifted





# Partitioning Enhancements

## ❖ **Cascade Functionality**

- Can now truncate the reference partitioning
- A single command now removes all the old/related data
- Now an all-or-nothing operation

## ❖ **Partition maintenance on multiple partitions**

- Alter partition [add, truncate, drop, split, merge]



# Partitioning Enhancements

## ❖ Partial Indexes

- Can now have indexes just on some partitions!
  - Oracle11...had to build the index unuseable then rebuild just the ones you wanted...
- New partition syntax 'indexing on' or 'indexing off' to define which partitions can/can't have indexes

# Partitioning Enhancements

## ❖ Partial Indexes

```
CREATE TABLE PRODUCTS (  
  MFGID NUMBER,  
  PRODUCTID NUMBER,  
  RECEIVED_DATE DATE)  
INDEXING OFF  
PARTITION BY RANGE (RECEIVED_DATE)  
(  
  PARTITION PART_2011 VALUES LESS THAN  
    (TO_DATE('01-JAN-2012', 'DD-MON-YYYY')) INDEXING OFF,  
  PARTITION PART_2012 VALUES LESS THAN  
    (TO_DATE('01-JAN-2013', 'DD-MON-YYYY')) INDEXING ON,  
  PARTITION PART_2013 VALUES LESS THAN  
    (TO_DATE('01-JAN-2014', 'DD-MON-YYYY'))  
)  
ENABLE ROW MOVEMENT;
```



# Partitioning Enhancements

## ❖ Partial Indexes

- Useful scripts to see indexing across partitions

```
SELECT TABLE_NAME, PARTITION_NAME, INDEXING
FROM USER_TAB_PARTITIONS
WHERE TABLE_NAME = 'PRODUCTS'
ORDER BY PARTITION_POSITION;
```

TABLE_NAME	PARTITION_NAME	INDEXING
PRODUCTS	PART_2011	OFF
PRODUCTS	PART_2012	ON
PRODUCTS	PART_2013	OFF

```
SELECT TABLE_NAME, INDEX_NAME, INDEXING
FROM USER_INDEXES
WHERE TABLE_NAME = 'PRODUCTS'
ORDER BY 2 DESC;
```

TABLE_NAME	INDEX_NAME	INDEXING
PRODUCTS	PRODUCTS_PARTIAL	PARTIAL
PRODUCTS	PRODUCTS_FULL	FULL

# Partitioning Enhancements

## ❖ Global Index Maintenance

- Drop/truncate/modify partition indexing off ALL make global indexes go 'stale'
- Easy to see now with new column ORPHANED\_ENTRIES
  - Views: dba/all/user/ \_INDEXES, \_IND\_PARTITION
  - Yes...has orphaned entries
  - No...does not have orphaned entries
  - N/A...does not apply...ie: local index or non partitioned table

# Partitioning Enhancements

## ❖ Global Index Maintenance

- Automatic scheduled job:  
SYS.PMO\_DEFERREDGIDX\_MAINT\_JOB
  - Runs at 2am daily
- Alter index rebuild and alter index coalesce partition cleanup also restores these indexes
- Oracle12 New method
  - Dbms\_part.cleanup\_didx
    - Uses schema name and table name.



# Partitioning Enhancements

## ❖ Automatic Global Stats

- Oracle12 gives some control over how partition stats are determined to be stale
- Tables with incremental set to true...ANY DML makes stats stale
- Exec `DBMS_STATS.set_table_prefs(<schema>, <table>, INCREMENTAL_STALENESS, value)`
  - Value = NULL - default behavior
  - `USED_LOCKED_STATS` - stats never go stale
  - `USE_STALE_PERCENT` – stats stale after this % of DML
    - And `stale_percent` can be adjusted using similar syntax



# New SQL and PL/SQL Features



# New Limits

## ❖ Increased column size limits

- IF MAX\_STRING\_SIZE = EXTENDED
  - Varchar2 – new limit 32K
  - NVarchar2 – new limit 32K
  - RAW – new limit 32K
- MAX\_STRING\_SIZE = STANDARD (default behavior)
  - Varchar2 –limit 4K
  - NVarchar2 –limit 4K
  - RAW – limit 2K





# New Limits

Database Type	Current Table Limit	Current PL/SQL Limit	Oracle12c New Limit
Varchar2	2K	4K	32K
Nvarchar2	2K	4K	32K
Raw	2K	4K	32K



# New Limits

## ❖ New init.ora setting: Max\_String\_Size

- Set to EXTENDED
  - Allows new limits
- Set to STANDARD
  - Old limits used
- NO Going Back!!!!
- Indexed column max size 6400 Bytes
  - Make sure no indexes are using long varchar columns
- [Read my blog on this topic](#)



# New SQL Syntax

## ❖ New SQL Syntax

- JSON Support (Release 12.1.0.2)
- New Analytic SQL Features
- New SQL Features
- New Functions
- New Options for Sequences
- Enhanced Join Syntax
- Increased column size limits





# New SQL Syntax

## ❖ **JSON Database support**

- Oracle12.1.0.2 now supports JSON stored in the database
- Can use SQL to access via JSON documents

# New SQL Syntax

JSON doc stored in Customers.Document column

```
{
  "firstName": "John",
  "lastName": "Smith",
  "age": 25,
  "address": {
    "streetAddress": "21 2nd Street",
    "city": "New York",
    "state": "NY",
    "postalCode": "10021",
    "isBusiness": false},
  "phoneNumbers": [
    {
      "type": "home",
      "number": "212 555-1234" },
    {
      "type": "fax",
      "number": "646
555-4567" } ]
}
```

Accessed via SQL!

```
select
  c.document.firstName,
  c.document.lastName,
  c.document.address.city,
  c.document.phoneNumbers
from customers c;
```



# New SQL Syntax

## ❖ New Analytical SQL Features

- Clustering works with groupings of survey data in BI
- Cluster\_Details New Function
  - Returns xml string cluster details for each row selected
- Cluster\_Id Function Enhanced
  - Can use either a pre-defined clustering model or perform dynamic clustering
- Cluster\_Distance New Function
  - Predicts cluster membership.





# New SQL Syntax

## ❖ New SQL Syntax

- Table Syntax (create or alter)
  - Period\_Definition – temporary validity (start and end date) for which each row in the table is valid
  - Visible/Invisible
  - Truncate now has a cascade feature
- Partitioning
  - A plethora of changes – Attend the seminar or class...



# New SQL Syntax

## ❖ New SQL Syntax

### – Index Syntax

- Drop index online
- Can set UNUSED online now
- Drop a constraint online as well
- Partitioning options with indexes covered with the Table partitioning new features
- Indexes can be on the same set of columns IF:
  - The indexes are of different types/partitioning/uniqueness
  - ONLY one of the indexes is VISIBLE at any given time



# New SQL Syntax

## ❖ Oracle12.1.0.2 New Syntax

### – Approx Count

- Perfect when 'close enough' is good enough
- Much faster than count
- Smaller foot print
- [See Dan Hotka Blog on this topic](#)
- Oracle claims 97% accurate
- Ignores nulls
- Cannot use on blobs/clobs/external objects/etc



```
C:\WINDOWS\system32\cmd.exe - sqlplus Student02/Student02@ora12

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real Application Testing opt
ions

SQL> set autotrace on explain
SQL> set timing on
SQL>
SQL> select COUNT(DISTINCT<lahmanid>) from master;

COUNT(DISTINCT<LAHMANID>)
-----
15350

Elapsed: 00:00:00.28

Execution Plan
-----
Plan hash value: 3951756302

-----
| Id | Operation          | Name      | Rows | Bytes | Cost (<%CPU)| Time
|----|-----|-----|-----|-----|-----|-----|
| 0 | SELECT STATEMENT  |           | 1    | 8     | 138  (2)| 00:00:01
| 1 | SORT AGGREGATE    |           | 1    | 8     |         |
| 2 | VIEW              | UW_DAG_0  | 15350 | 119K  | 138  (2)| 00:00:01
| 3 | HASH GROUP BY     |           | 15350 | 149K  | 138  (2)| 00:00:01
| 4 | TABLE ACCESS FULL| MASTER    | 61400 | 599K  | 136  (0)| 00:00:01
-----
```

```
C:\WINDOWS\system32\cmd.exe - sqlplus Student03/Student03@ora12

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real Application Testing options

SQL> set autotrace on explain
SQL> set timing on
SQL>
SQL> select APPROX_COUNT_DISTINCT<lahmanid> from master;

APPROX_COUNT_DISTINCT<LAHMANID>
-----
                           15247

Elapsed: 00:00:00.25

Execution Plan
-----
Plan hash value: 123011908

-----
| Id  | Operation                | Name    | Rows  | Bytes | Cost (<CPU>)| Time     |
-----
|  0  | SELECT STATEMENT         |         |      1 |    10 |    136 (<0>)| 00:00:01 |
|  1  |  SORT AGGREGATE APPROX  |         |      1 |    10 |              |          |
|  2  |    TABLE ACCESS FULL   | MASTER | 61400 | 599K  |    136 (<0>)| 00:00:01 |
-----

SQL> _
```



# New SQL Syntax

## ❖ New Options for Sequences

- KEEP and NOKEEP feature added
  - Works with database Replay
  - Controls if NEXTVAL retains its original value (keep feature) or not (nokeep feature)
- Can be used as Table column default values!





# New SQL Syntax

## ❖ Oracle12.1.0.2 New Features

- New READ privilege
  - Better than SELECT privilege as SELECT can lock for update
- True Read-only privilege



# New SQL Syntax

## ❖ New SQL Syntax

### – VIEW Enhancements

- Columns can be made visible and invisible as well
- BEQUEATH option to override default Invokers rights

# New SQL Syntax

## ❖ Functions in WITH Clause

- Now can have a PL/SQL function as part of a WITH clause

**WITH**

```
FUNCTION get_domain(url VARCHAR2) RETURN  
VARCHAR2 IS
```

```
    pos BINARY_INTEGER;
```

```
    len BINARY_INTEGER;
```

```
BEGIN
```

```
    pos := INSTR(url, 'www.');
```

```
    len := INSTR(SUBSTR(url, pos + 4), '.') - 1;
```

```
    RETURN SUBSTR(url, pos + 4, len);
```

```
END;
```

```
SELECT DISTINCT get_domain(catalog_url)
```

```
    FROM product_information;
```

```
/
```



# New SQL Syntax

## ❖ New SELECT Syntax

- Pattern Matching enables patterns to be found across multiple rows

```
SELECT *  
FROM Ticker MATCH_RECOGNIZE (  
    PARTITION BY symbol  
    ORDER BY tstamp  
    MEASURES STRT.tstamp AS start_tstamp,  
        LAST(DOWN.tstamp) AS bottom_tstamp,  
        LAST(UP.tstamp) AS end_tstamp  
    ONE ROW PER MATCH  
    AFTER MATCH SKIP TO LAST UP  
    PATTERN (STRT DOWN+ UP+)  
    DEFINE  
        DOWN AS DOWN.price < PREV(DOWN.price),  
        UP AS UP.price > PREV(UP.price)  
    ) MR  
ORDER BY MR.symbol, MR.start_tstamp;
```

# New SQL Syntax

## ❖ New SELECT Syntax

- Row\_Limiting clause works with Top-N to specify the number or percentage of rows to return
- Does not work with For Update
- Offset is 0 if not defined
  - 0 if negative number
  - Fractions truncated
- WITH TIES works with the order by clause
  - To return the % of rows including matching values of the last item

```
SELECT employee_id, last_name  
FROM employees  
ORDER BY employee_id  
OFFSET 5 ROWS FETCH FIRST 5 ROWS ONLY;
```

```
SELECT employee_id, last_name  
FROM employees  
ORDER BY employee_id  
OFFSET 5 ROWS FETCH NEXT 5 ROWS ONLY;
```

```
SELECT employee_id, last_name, salary  
FROM employees  
ORDER BY salary  
FETCH FIRST 5 PERCENT ROWS ONLY;
```



# New SQL Syntax

## ❖ New Join Syntax

- Cross\_Outer\_Apply\_Clause
  - Allows a variation of the ANSI CROSS JOIN or ANSI LEFT OUTERJOIN with left correlation support.
  - Specify CROSS APPLY to perform a variation of the ANSI Cross Join
  - Specify OUTER APPLY to perform a variation of the ANSI Left Outer Join





# New SQL Syntax

```
SELECT d.department_name, v.employee_id, v.last_name  
FROM departments d CROSS APPLY (SELECT * FROM employees e  
WHERE e.department_id = d.department_id) v  
WHERE d.department_name IN ('Marketing', 'Operations', 'Public Relations')  
ORDER BY d.department_name, v.employee_id;
```

```
SELECT d.department_name, v.employee_id, v.last_name  
FROM departments d OUTER APPLY (SELECT * FROM employees e  
WHERE e.department_id = d.department_id) v  
WHERE d.department_name IN ('Marketing', 'Operations', 'Public Relations')  
ORDER by d.department_name, v.employee_id;
```

# New SQL Syntax

## ❖ New Join Syntax

- Lateral clause for Inline Views
  - Allows for columns in the inline view to be accessed!

```
SELECT * FROM employees e, (SELECT * FROM departments d  
WHERE e.department_id = d.department_id);
```

```
ORA-00904: "E"."DEPARTMENT_ID": invalid identifier
```

```
SELECT * FROM employees e, LATERAL(SELECT * FROM  
departments d  
WHERE e.department_id = d.department_id);
```



# New SQL Syntax

## ❖ New Join Syntax

- Partial Join Evaluation
- Goal is to avoid generating duplicate rows
- Replaces DISTINCT operation
- Used with aggregate functions off of UNION clauses
  - S = Semi Join which stops with the first hit
  - NA = null-aware



# New SQL Syntax

```
SELECT COUNT (*)
FROM CUSTOMERS C,
WHERE C.CUST_CREDIT_LIMIT > ALL
  (SELECT T.UNIT_COST
   FROM SALES S, COSTS T
   WHERE T.PROD_ID = S.PROD_ID);
```

Oracle11 – runs for minutes

Oracle12 with Null-Aware  
Join runs in 7 seconds

```
SELECT COUNT (*)
FROM CUSTOMERS C,
  (SELECT T.UNIT_COST
   FROM SALES S, COSTS T
   WHERE T.PROD_ID S= S.PROD_ID) V ←
WHERE C.CUST_CREDIT_LIMIT NA <= V.UNIT_COST;
```

# New SQL Syntax

```
SELECT P.prod_id, S.quantity_sold, S.cust_id
FROM   Sales S, Product P
WHERE  P.prod_list_price > 11 and
       P.prod_id = S.prod.id and
       (S.cust_id is NULL OR
        EXISTS (SELECT 1
                 FROM   Customer C
                 WHERE  C.cust_id = S.cust_id AND
                        C.country_id = 'U.S.'));
```

Another Example:

Oracle11 syntax vs  
Oracle12 syntax

```
SELECT P.prod_id, S.quantity_sold, S.cust_id
FROM   Sales S, Product P, Customer C
WHERE  P.prod_list_price > 11 and
       P.prod_id = S.prod.id and
       S.cust_id NS=C.cust_id and ←
       C.country_id = 'U.S.';
```



# New SQL Syntax

## ❖ Increased column size limits

- IF MAX\_STRING\_SIZE = EXTENDED
  - Varchar2 – new limit 32K
  - NVarchar2 – new limit 32K
  - RAW – new limit 32K
- MAX\_STRING\_SIZE = STANDARD (default behavior)
  - Varchar2 –limit 4K
  - NVarchar2 –limit 4K
  - RAW – limit 2K





# New PL/SQL Features

## ❖ New PL/SQL Features

- PL/SQL And SQL
- Enhanced DBMS\_UTILITY
- New UTL\_CALL\_STACK
- Enhanced DBMS\_SQL
- Enhanced Native SQL



# New PL/SQL Features

## ❖ PL/SQL and SQL

- Same new size limits on Varchar2, Nvarchar2, and Raw
  - Same options to turn it on...
- Bulk Collect supports the Fetch First SQL Features
- PL/SQL Functions that Run Faster in SQL
  - Support for the previously discussed WITH SQL syntax
- Invisible Columns
  - CAN be directly referenced via PL/SQL
    - NOT using '\*' syntax...
  - Can make columns visible/invisible too



# New PL/SQL Features

## ❖ Granting Roles to PL/SQL Programs

- A major problem in the past is a called program accesses a table...the connected user needed permissions to both the program and the underlying table
- Oracle12 allows for permissions to be granted to just the package/procedure/function so the users cannot directly access the underlying tables!





# New PL/SQL Features

- ❖ **Easily another 25 or so packages**

- Not time to cover all here
- Coverage for PDB's, etc

- ❖ **DBMS\_Utility**

- Expand\_SQL\_Text
  - Easily exposes the SQL contained in a view

- ❖ **UTL\_Call\_Stack**

- Provides info on currently executing sub programs
  - Info includes name, owner, and line numbers

- 
- Enhanced Native SQL



# New PL/SQL Features

## ❖ UTL\_Call\_Stack

- Provides info on currently executing sub programs
  - Info includes name, owner, and line numbers
- Programs include:
  - Backtrace\_Depth \_Line \_Unit
  - Error\_Depth \_Msg \_Number
  - Unit\_Line
  - Subprogram



# New PL/SQL Features

- ❖ **DBMS\_SQL.Parse**

- Now has a schema input parameter

- ❖ **Enhanced Native SQL**

- Also now supports the Fetch First SQL feature



# Additional Oracle12c New Features

## ❖ Oracle12c New Features

- Index compression – 1x to 3x greater
  - [See Dan Hotka blog on this topic](#)



# Additional 12.1.0.2 Features

## ❖ Additional 12.1.0.2 New Features

- APEX Listener added to release
- Restful access/services now available for mobile apps
  - Can tie directly to JSON documents
  - Works well with JavaScript
  - Oracle NoSQL
  - APEX (came from APEX!)



# Additional 12.1.0.2 Features

## ❖ Additional 12.1.0.2 New Features

- HADOOP Support
  - SQL via External Tables
  - New HIVE data storage types
- New init.ora for Temporary Tables
  - TEMP\_UNDO\_ENABLE
    - Stores redo info in temp tablespace reducing redo TS activity
    - Can be altered at the session level



# What have we learned?

- ❖ **New Database Features**
- ❖ **New SQL Syntax**
- ❖ **New PL/SQL Features**
- ❖ **Keep in touch**
  - [Dan@DanHotka.com](mailto:Dan@DanHotka.com)

