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NYOUG

Oracle 18c New Features

(includes a little 12cR2 & ADW)

Rich Niemiec @richniemiec

ORACLE ACE Director

June 20, 2018

Quick **FREE** notes and Book Raffle

Text CLOUD to 444999 for a chance to win the Cloud Book.

Send email to (for slides):
hello@viscosityna.com

@richniemiec twitter

(Special Thanks: Charles Kim, Kay Cavender, Andy Mendelsohn, Debbie Migliore, Maria Colgan, Penny Avril)

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Rich's Overview…

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12cR2 Book Available Now!

VISCOSITY NORTH AMERICA

- Chief Innovation Officer, Viscosity North America
- Board Member – TEC, Entrigna, Ask DB Experts
- Former CEO of TUSC
  - Inc. 500 Company (Fastest Growing 500 Private Companies)
  - 10 Offices in the United States (U.S.); Based in Chicago
  - Oracle Advantage Partner in Tech & Applications
- Former President Rolta TUSC & President Rolta EICT International & Executive Advisor to Board
- Author (4 Oracle Best Sellers – #1 Oracle Tuning Book for two Decades – **12c R2 Tuning in March 2017**):
  - Oracle Performing Tips & Techniques (Covers Oracle7 & 8i)
  - Oracle9i & 10g Performance Tips & Technique
  - Oracle Database 11g Performance Tips & Techniques
  - Quick Start Guide to Oracle Query Tuning (2015)

ORACLE ACE Director

- Former President of the International Oracle Users Group
- Current President of the Midwest Oracle Users Group
- Chicago Entrepreneur Hall of Fame - 1998
- E&Y Entrepreneur of the Year & National Hall of Fame - 2001
- IOUG Top Speaker in 1991, 1994, 1997, 2001, 2006, 2007
- MOUG Top Speaker Twelve Times
- National Trio Achiever award - 2006
- Oracle Certified Master & Oracle Ace Director
- Purdue Outstanding Electrical & Computer and Engineer - 2007

June 20, 2018

Customer Services!

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Oracle License Management
Get the most out of your Oracle investment

ZERO DOWNTIME
Migrations

CUSTOM
Application Development

Professional Services
Where you need it most

Performance Health Checks
How's it running?

Staff Aug
Workforce Capacity on Demand

DBA Services
Remote and On-site

On-Call Support
Managed Services

We wrote the books - many Experts!

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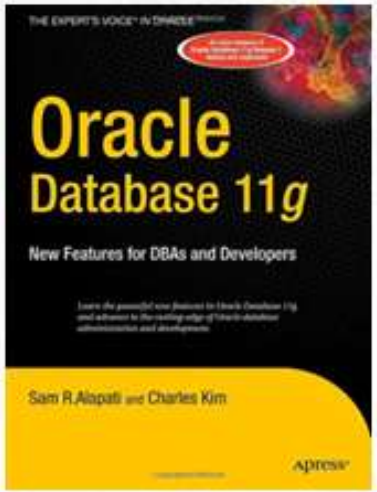

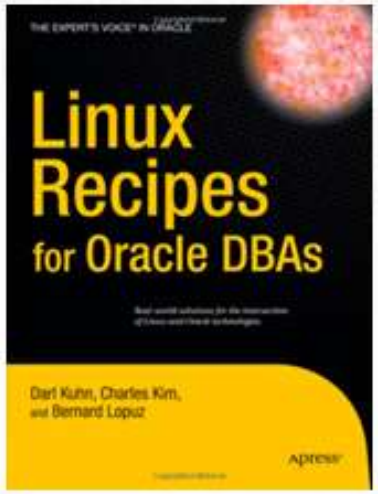

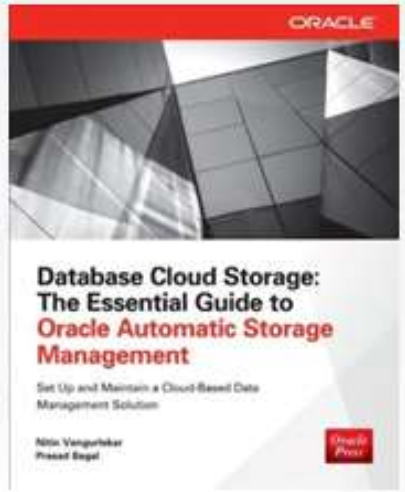

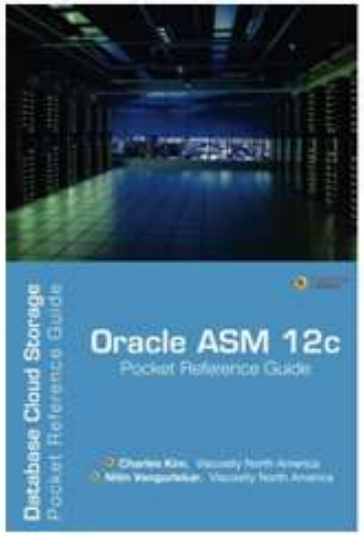

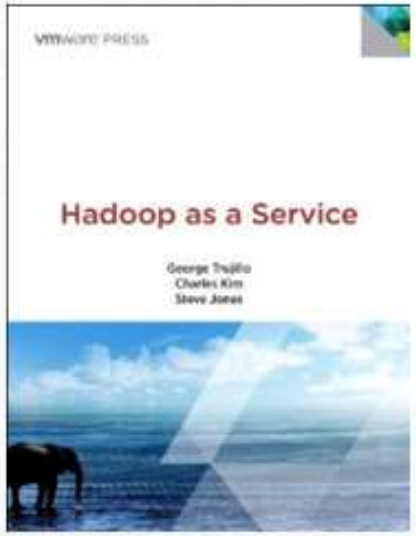

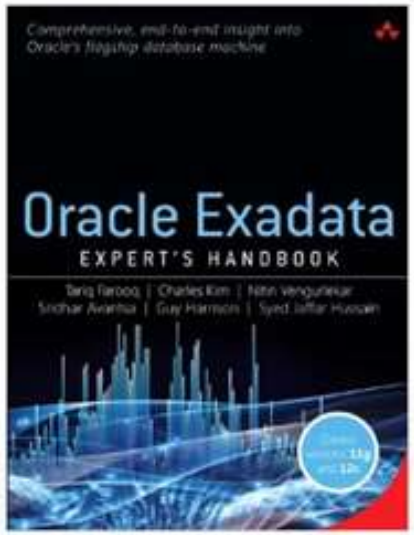

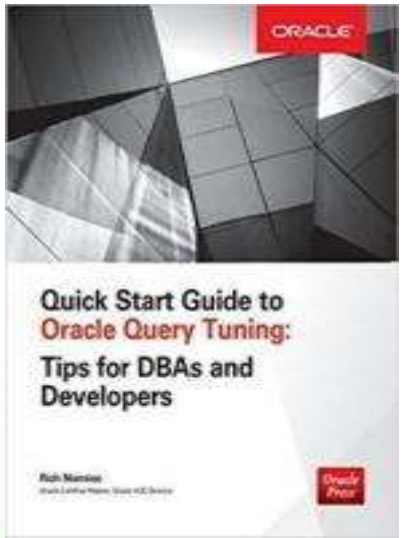

"We Enable Business Transformation at a Time when Companies must Change to Survive"

12c R2 Book – Available Now!

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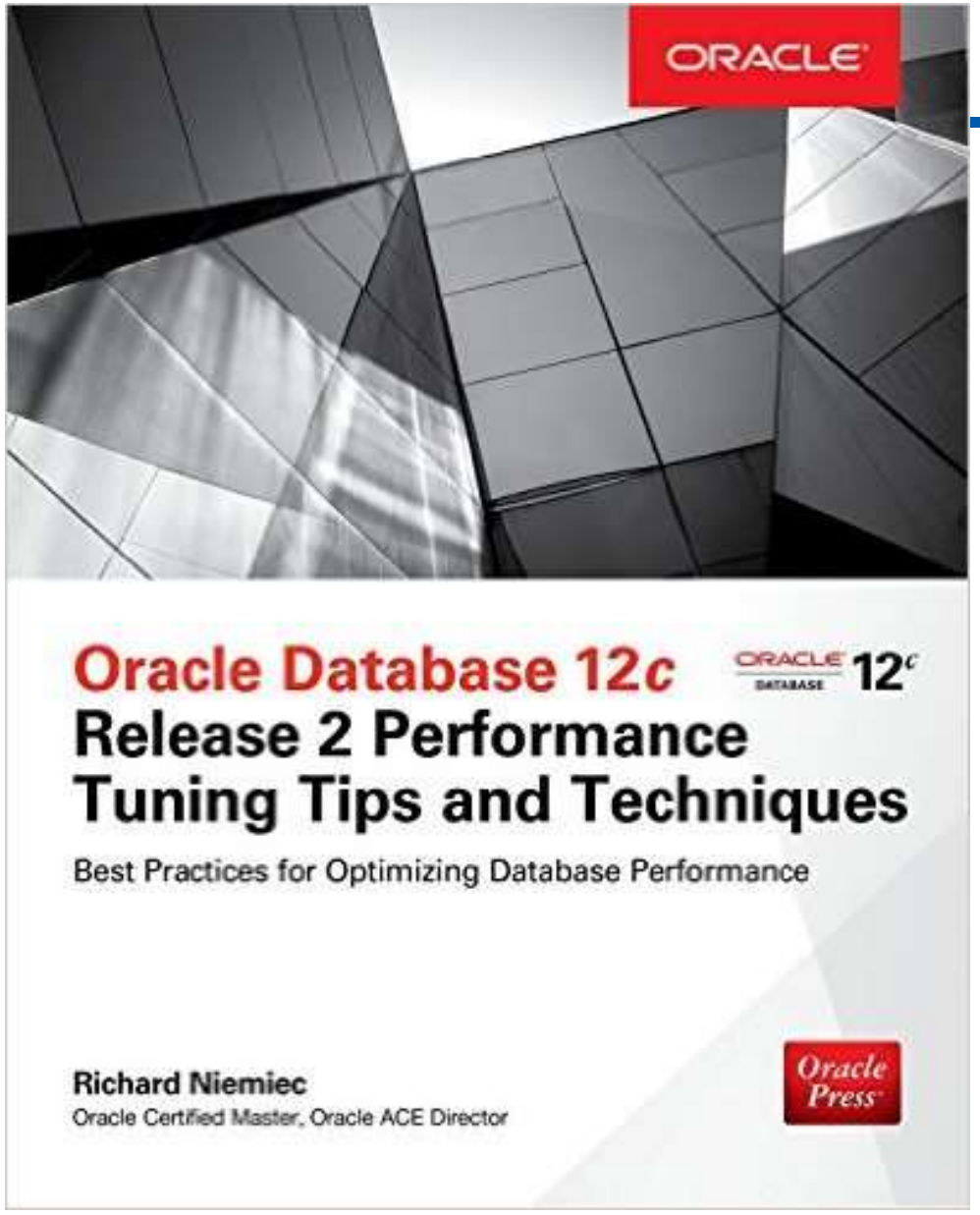
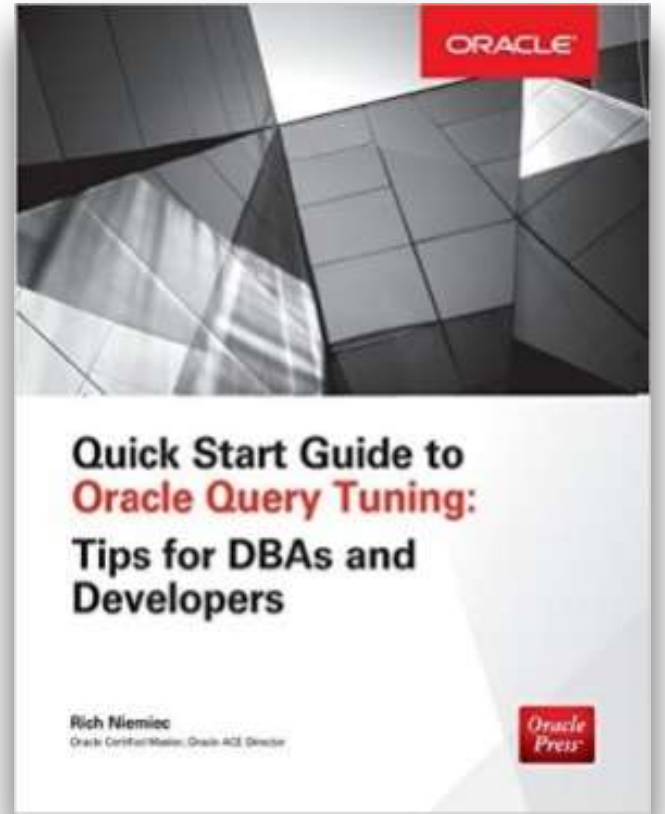


Top New Release



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Agenda – 12c R1 & R2 (Briefly), 18c & 18c ADWC

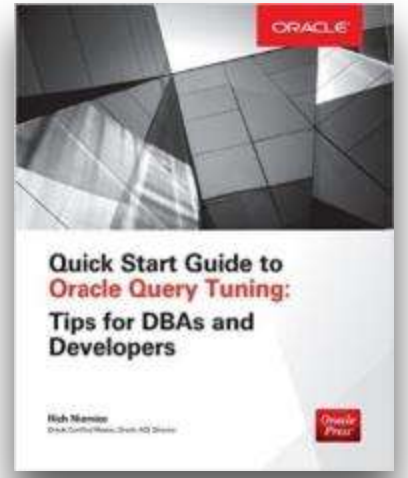
- Know the Oracle!
- In-Memory Virtual Columns (12cR2), Multiple indexes on the same Column (12c) & Fetch First x Rows(12c)
- Approximate Query New Features (12cR2)
- Pluggable Databases & new 12cR2 Features
- Adaptive Query Optimization and CAQP (12cR2)
- Runaway Query Management
- Security Enhancements (12cR2)
- Exadata
- Oracle Database In-Memory (12.1.0.2+)
- New Partitioning & Online Features (12cR2)
- Other 12c R1 & R2 New Features
- **18c / 19c / 20c**
- **18c New Features**
- **The Oracle Cloud**
- **Autonomous Database Warehouse Cluster (ADWC)**
- **Prepare for the Future!**
- Summary

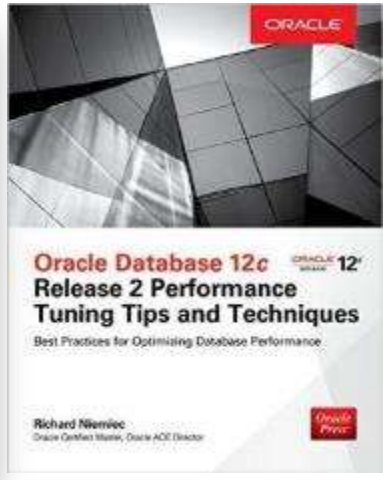
ORACLE 11g DATABASE

12c

Oracle Database 12c Release 2 Performance Tuning Tips and Techniques

18c Oracle Database





Oracle Firsts – *Innovation to Acquisitions*

**On-premise (Production 12cR2 first came out in 2016 in the Oracle Cloud)*

1979 First commercial SQL RDBMS
1983 First 32-bit mode RDBMS & First with read consistency
1987 First client-server database with multilevel secure database evaluations
1995 First 64-bit mode RDBMS
1996 First to break the 30,000 TPC-C barrier
1997 First Web database
1998 First Database - Native Java Support;, Linux, Breaks 100,000 TPC-C
2000 First database with XML, RAC & First middle-tier database cache
2004 First True Grid DB & 2005 FREE Oracle Database (10g Express Edition)
2006 First Oracle Support for LINUX Offering
2007 Oracle 11g Released!
2008 Exadata V1 Server Announced (Oracle buys BEA)
2009 Oracle buys Sun – Java; MySQL; Solaris; Hardware; OpenOffice, StorageTek
2010 Oracle announces MySQL Cluster 7.1, Exadata, Exalogic, America's Cup Win
2011 X2-2 Exadata, ODA, Exalytics, SuperCluster, Big Data, Cloud, Social Network
2012 X3-2 Exadata, Expanded Cloud Offerings, Solaris 11.1
2013 Oracle12c Released! Oracle X3-8 Exadata, Acquisitions (Acme Packet…etc.)!
2014 Oracle X-4, Acquisitions: Responsys & Corente, IN-MEMORY DB
2015 X5-2, X5-8, FS1 Flash Array, Acquisitions & Cloud Solutions
2016 X6-2 (all flash if you want), X6-8, M7 SuperCluster, Cloud Solutions & Acquisitions
2017: Production 12cR2*, X7, Autonoumous Database Warehouse Cloud (ADWC) & ML Security announced
2018: Production ADWC, Oracle 18c, & Production Autonomous Database for OLTP
2019: Oracle 19c 2020: Oracle 20c 2021: Oracle 21c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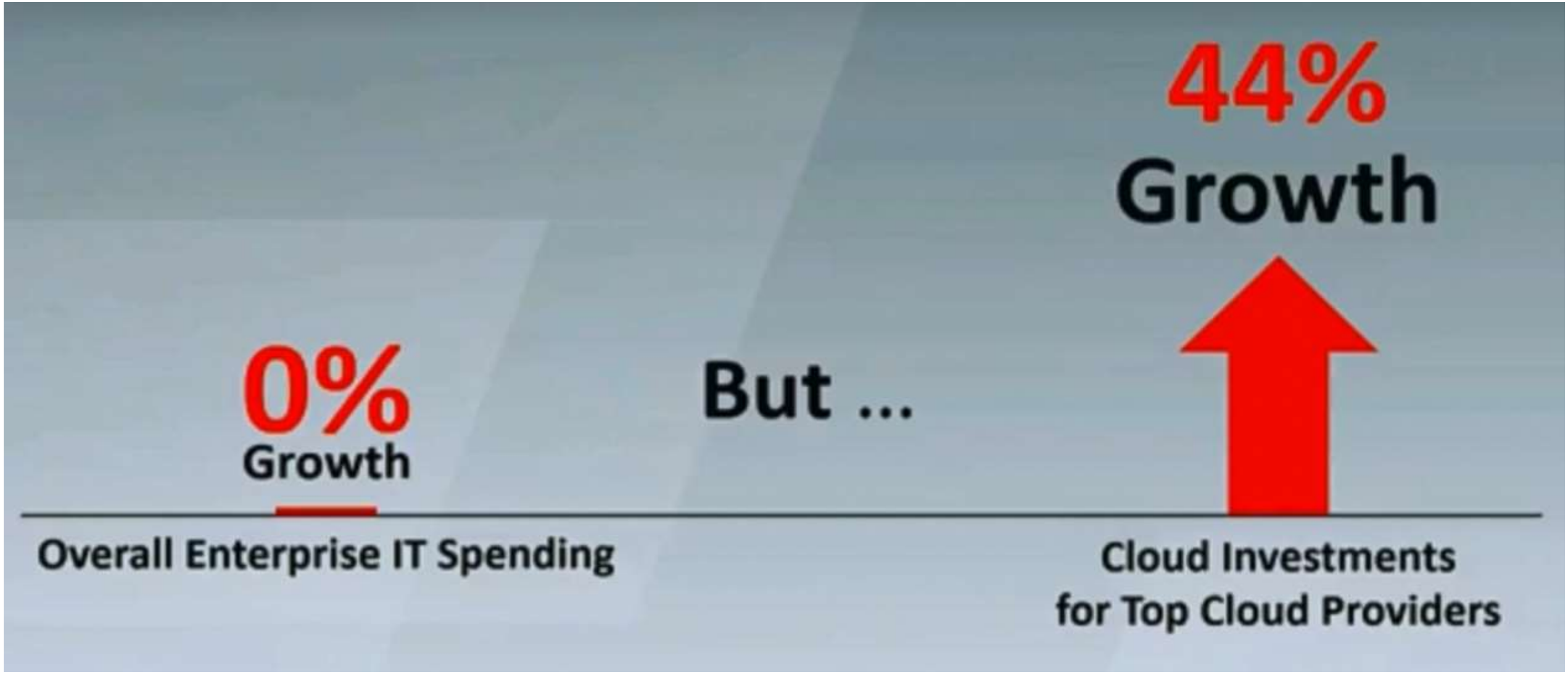
CLOUD
PLATFORM
ORACLE


Adobe
ORACLE OPENWORLD 2016
Oracle Appreciation Event
AT&T Park, San Francisco

Direction of Market is Very Clear!



The Elephant in the Room – Cloud & Future of the DBA

(an issue that's present but avoided discussing at times)

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COMPUTERWORLD

NEWS

White House sees robots taking well-paying jobs

MORE LIKE THIS

Workers earning up to $40/hour at risk

By Patrick Thibodeau FOLLOW

If a robot takes your job, don't say the government didn't warn you.

Federal economic advisers issued a stark assessment Monday about the nation's technology direction. Innovation in the U.S. is slowing, and federal

The 10 Happiest Jobs in America: Dealing with your DBA…

6. Oracle database administrator

Database administrators (DBAs) use software to store and organize data, such as financial information or customer records, ensuring information is secure and available only to authorized users. An Oracle DBA administers the Oracle database server.

Cloud Choices – Less than you think

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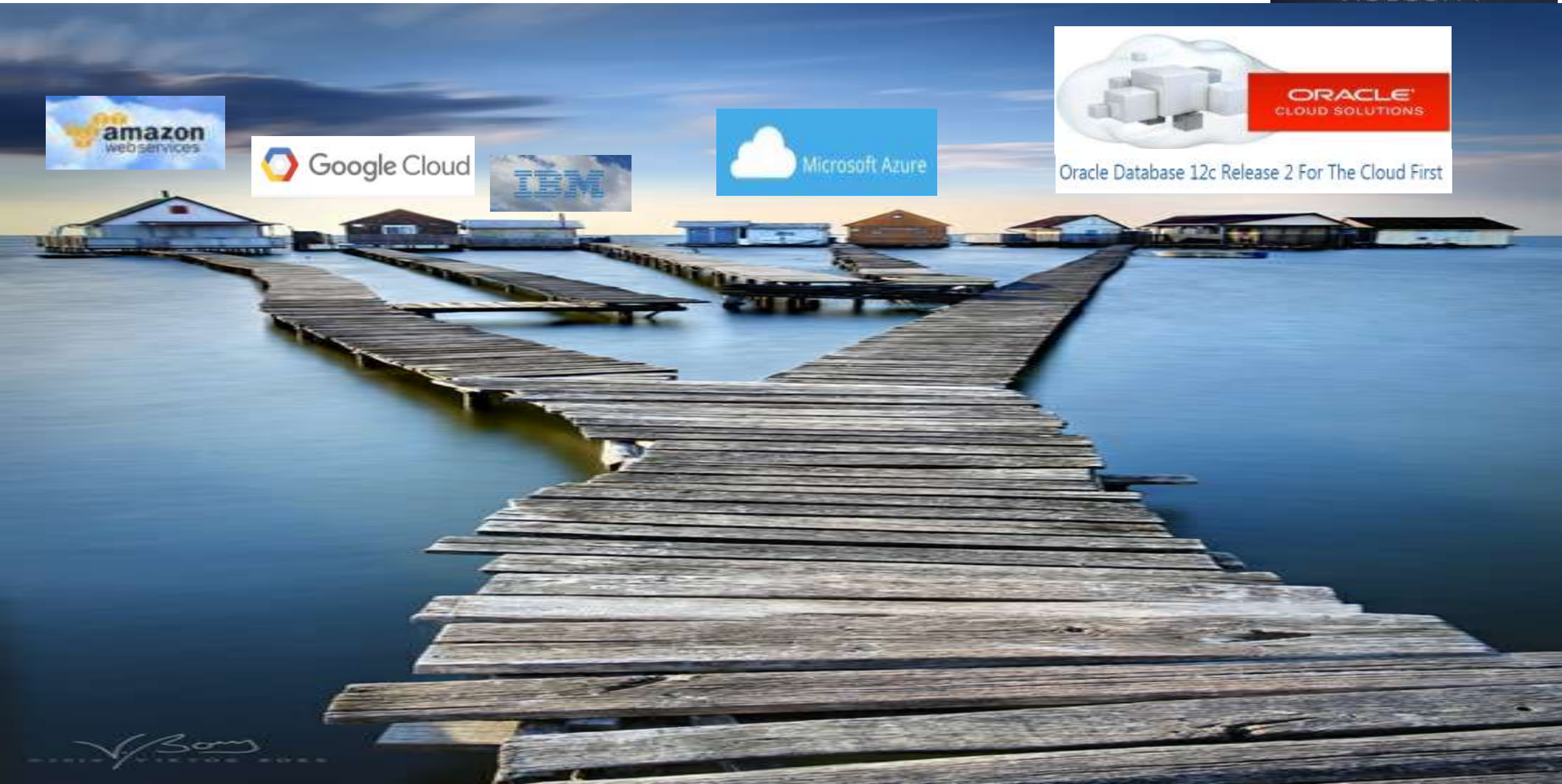

Vendor’s view of the Cloud

Vendor’s path for you to the Cloud

How Easy to Move to Cloud **Quickly**

A Few Years Later on the Cloud

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Oracle Database Cloud Service (DBaaS - PaaS)

Use Cases to Consider:

- Disaster Recovery (DR) to the Cloud (Backup)
- Business Critical Workloads in the Cloud (Scale)
- Dev/Test for 12c Database in the Cloud (Test)
- Web Application Development Anywhere (Dev)
- Migration of On-Premise Apps to the Cloud (Migrate)

cloud.oracle.com/tryit

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ORACLE Cloud

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Applications | Platform | Infrastructure | Resources

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Verify your contact information

Start building with Oracle Cloud

View Details & Sign Up >

Frequently Asked Questions

Available Oracle Services

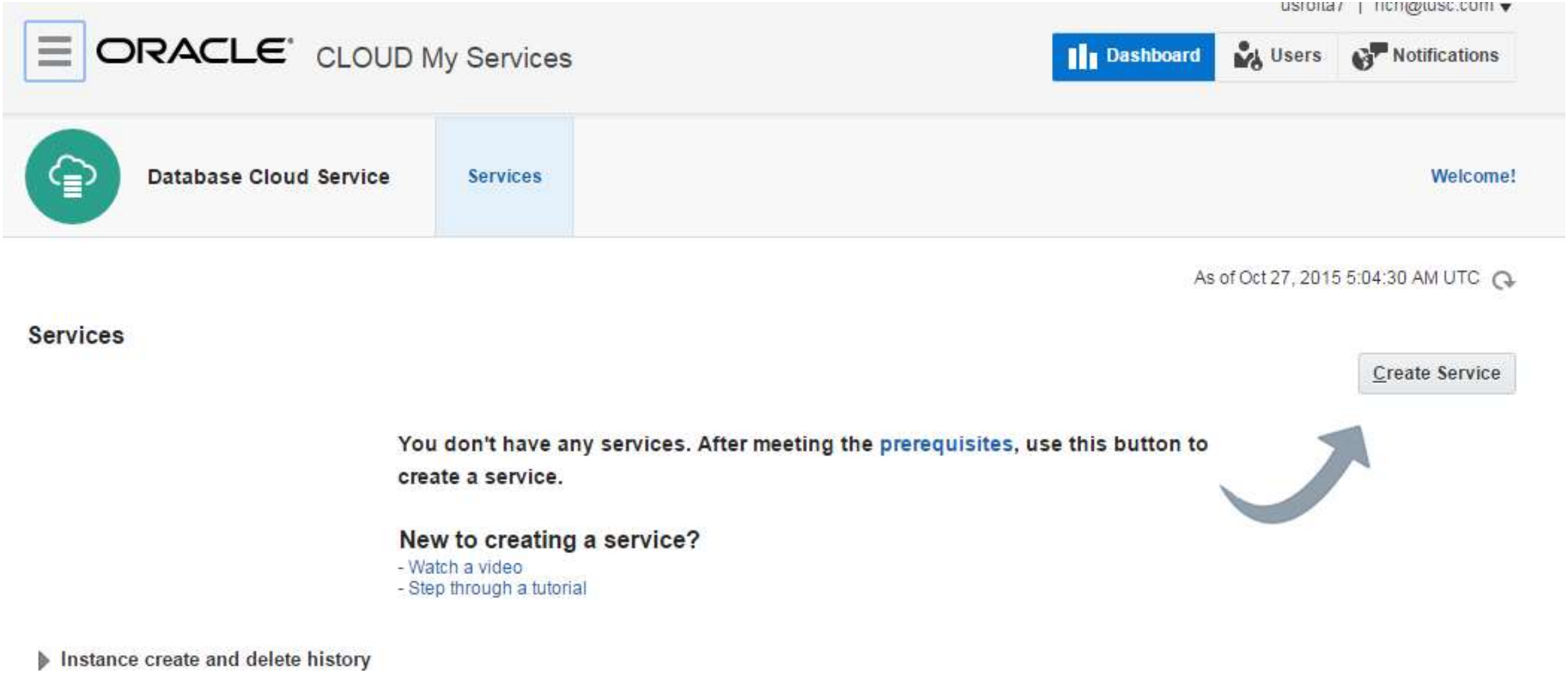
Database

Compute

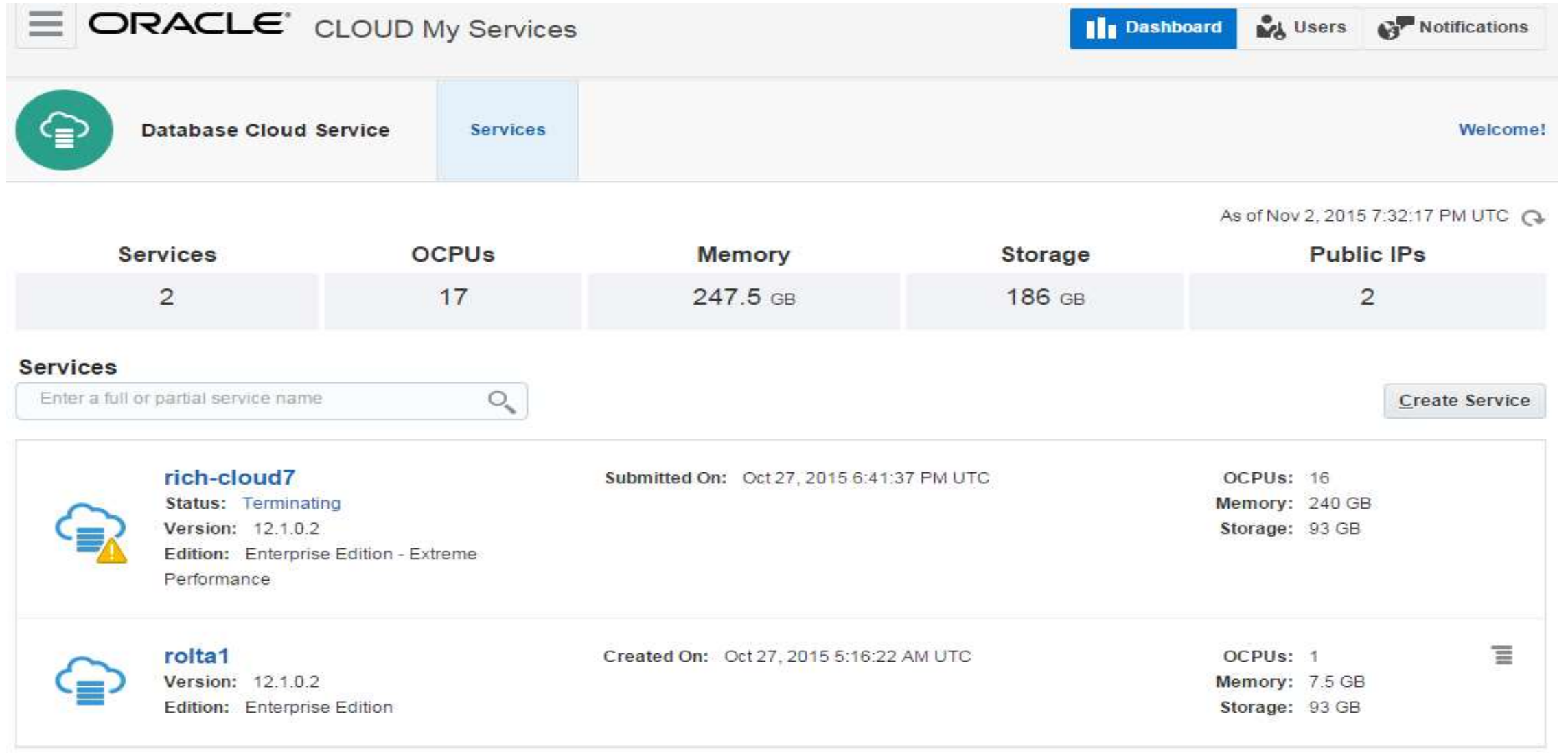
Java

Storage

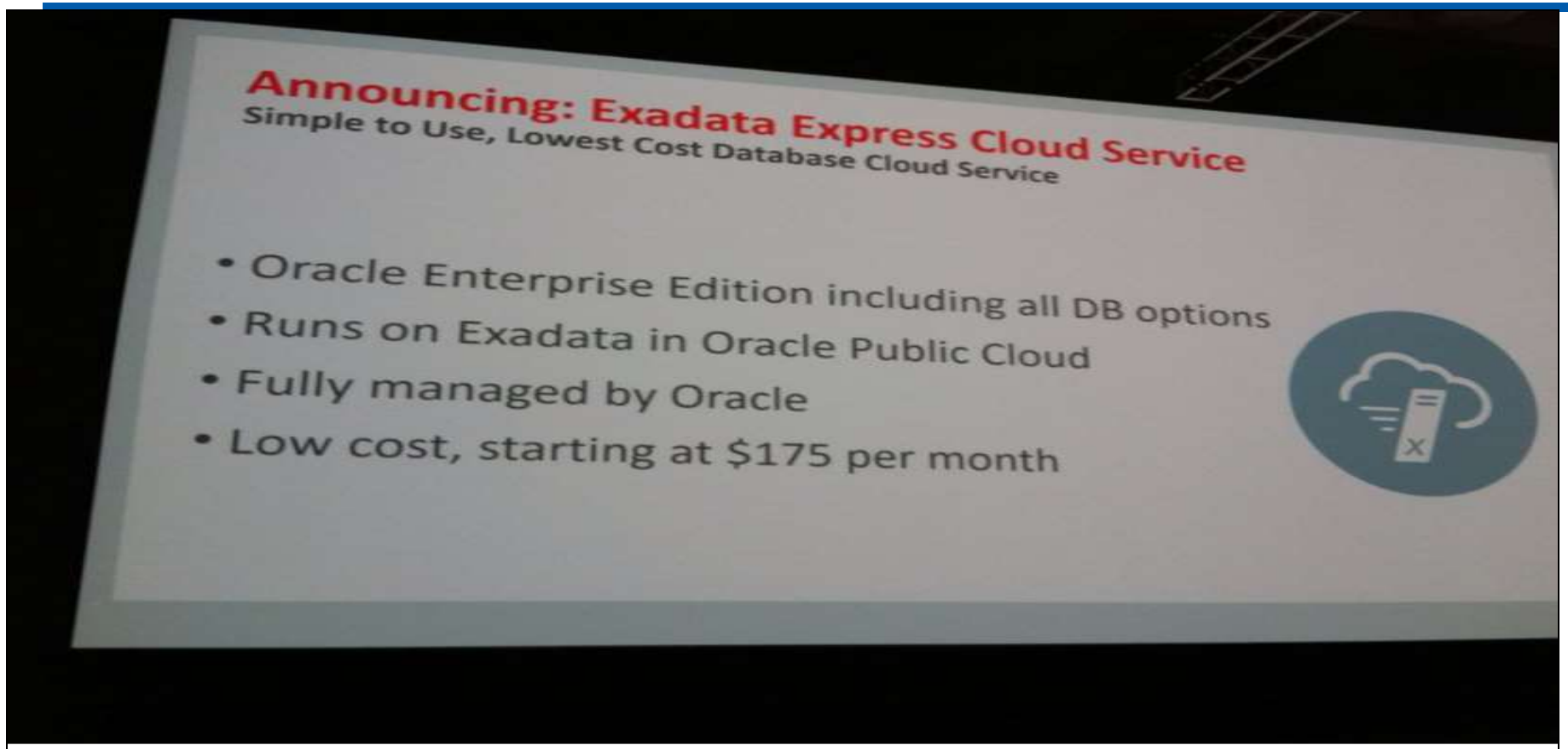
Create a Service (this will give me a Database)



Created Both: I Have TWO Database Services now



Oracle 12cR2 introduced on the Cloud 9/17/2016
On-Premise 12cR2 released just under 6 months later on 3/1/17

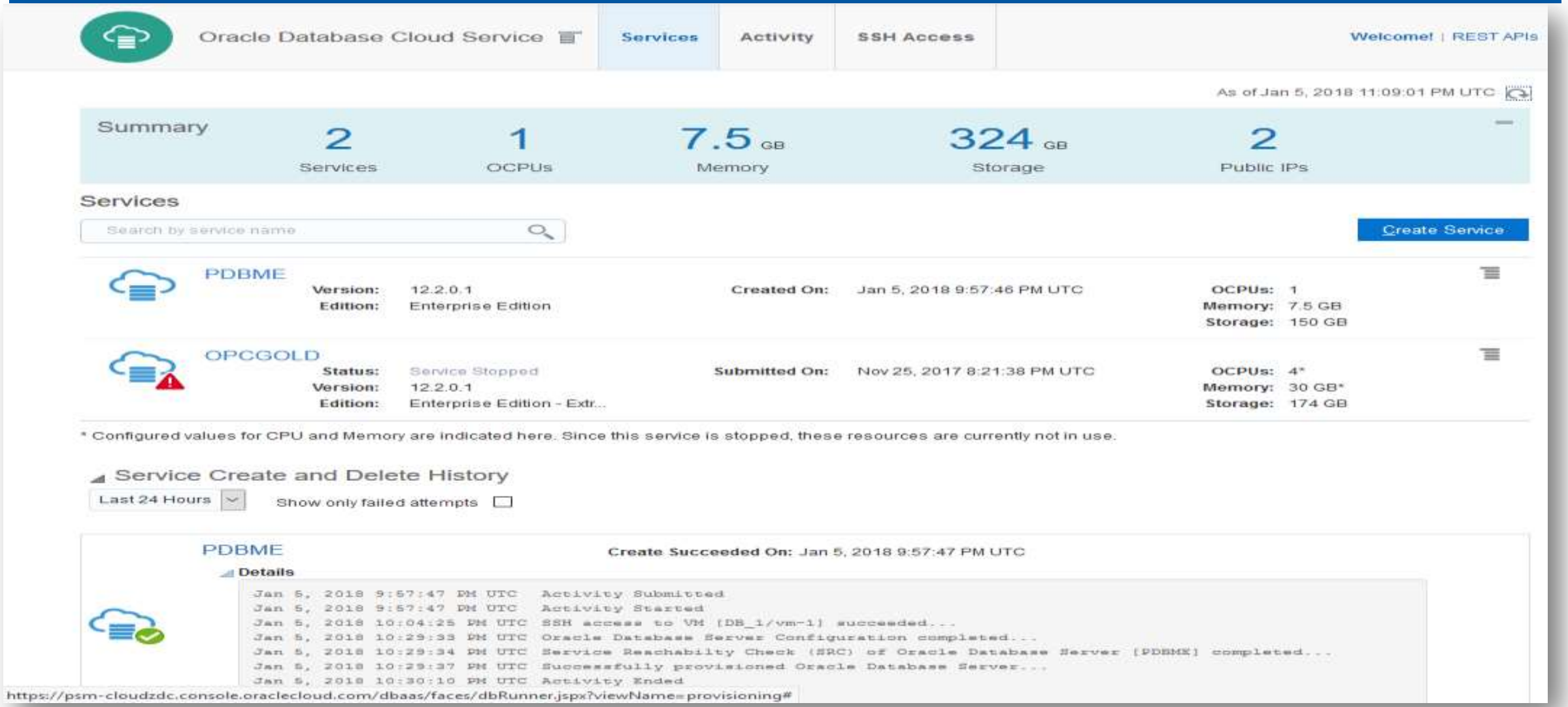


Rich Niemiec @RichNiemiec · 18 Sep 2016
Larry announces Exadata Express Cloud Service running 12cR2 for $175/month with all features. Available now! pic.twitter.com/3tqJdDuzJe

2 21 23

12cR2 Tuning Book allowed to be released 3/10/2017

Database as a Service – Exadata Express (same look)



Similar Look with ADWC…My Services

ORACLE CLOUD My Services

Oracle Data Warehouse Cloud Service | Services | Activity

Summary

1	2	10 GB	8 TB
Services	OCPUs	Memory	Storage

Services

Search by service name

Create Service

DWCS-1

Created On: May 9, 2017 3:10:20 AM UTC

OCPUs: 2
Memory: 10 GB
Storage: 8 TB

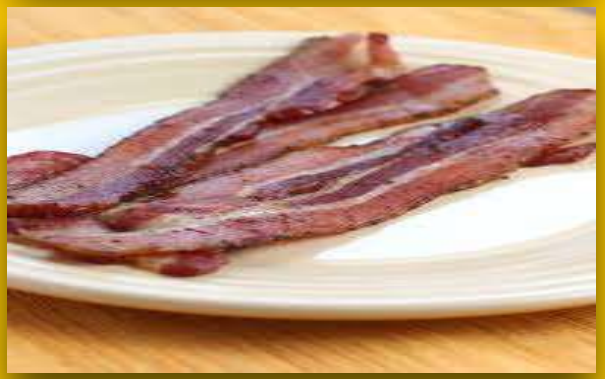
Service Create and Delete History

New Versions: Who is Truly Committed?

The CEO is *Interested*

The CIO is *Invested*

The DBA is *Committed*



The New Version – Life is Good!

```
Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.0.1 - 64bit
With the Partitioning, OLAP, Data Mining and Real Application Tes

SQL> sho sga

Total System Global Area  626327552 bytes
Fixed Size                  2276008 bytes
Variable Size             524289368 bytes
Database Buffers           92274688 bytes
Redo Buffers                7487488 bytes
SQL>
```

Cloud Control 12c

Type	Status	Target Version
Database Instance : Container	↑	12.1.0.1.0
	n/a	
Pluggable Database	↑	12.1.0.1.0
Pluggable Database	↑	12.1.0.1.0
Database Instance : Container	↑	12.1.0.1.0
	n/a	
Pluggable Database	↑	12.1.0.1.0
Database Instance	↑	11.2.0.3.0
Database Instance	↑	11.2.0.3.0
Database Instance : Container	↑	12.1.0.1.0

12.1.0.2 – In-Memory Column Store (IM) … more later…

```
[oracle@localhost bin]$ sqlplus / as sysdba

SQL*Plus: Release 12.1.0.2.0 Production on Thu Sep 25 19:00:46 2014

Copyright (c) 1982, 2014, Oracle.  All rights reserved.


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> sho sga

Total System Global Area 4194304000 bytes
Fixed Size                  2932336 bytes
Variable Size             570425744 bytes
Database Buffers         2013265920 bytes
Redo Buffers               13844480 bytes
In-Memory Area           1593835520 bytes
SQL>
```

The **Database In-Memory (IM)** is ***NOT*** **enabled if**:

INMEMORY_SIZE is set to zero!

HUGE Improvements – 12cR2

- In 12*c*, **object names for users, roles, tables, columns, indexes, constraints, etc. have been increased from 30 bytes to 128 bytes** with a few limitations.
- The **helps in migrations** from non-Oracle systems where the name is longer than 30 characters.
- The limit for **tablespace names and pluggable databases is still 30 bytes**, but others all increase to 128 bytes.
- You will **notice this change in the dictionary views** where the **VARCHAR2 columns will shows as 128 bytes** instead of 30 bytes.
- Best enhancement in **12c R2** is **32K VARCHAR is default so far on cloud**. This allows the extending of the VARCHAR data types without having to enable the extended mode specifically (early 12c). The size limit for both **VARCHAR2 and NVARCHAR2 is 32K**.

Long Name Identifiers

- Table Name to 128 bytes
- Column Name to 128 bytes

Long Table Name

```
SQL> create table ioug_oracle_dbas_are_super_cool_in_new_york_in_2018_tab
(oracle_database_12c_release_2_is_available_for_general_availability_column_1 integer);

Table created.
```

Long Column Name

SQL*Plus
History Command (hist)

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Oracle Database 12c 12c
Release 2 Performance Tuning Tips and Techniques

```
SQL> help hist
HIST[ORY] [N {RUN | EDIT | DEL[ETE]}] | [CLEAR]

SQL> show hist

SQL> hist 2 run
SQL> hist 3 del

SQL> hist clear
```

```
SQL> hist
  1  select name from v$database;
  2  select instance_name, host_name from v$instance;
  3  help hist

SQL> hist 3 del
SQL> hist 1 run

NAME
---------
MERIT

SQL> hist 1 edit
```

- set hist on
- SQL> set hist 1000
- SQL> show hist
  history is ON and set to "1000"

http://www.dbcloudshifu.com/12-2-sqlplus-history-command-features-and-fumbles/

```
SQL> select name from v$database;

NAME
---------
MERIT

SQL> select instance_name, host_name from v$instance;

INSTANCE_NAME
----------------
HOST_NAME
----------------------------------------------------------------
merit
ika82


SQL> hist
  1  select name from v$database;
  2  select instance_name, host_name from v$instance;
```

The Virtual Column

Oracle Database 12c
Release 2 Performance
Tuning Tips and Techniques

- In 12cR2 You can have **In-Memory Virtual Columns**

The Virtual Column

```
create table emp_rich
  (empno number(4),
   m_sal   number(7,2),
   yearly_sal generated always as (m_sal*12),
   deptno number(2));

Table created.
insert into emp_rich(empno, m_sal, deptno)
                select empno, sal, deptno from scott.emp;
14 rows created.
```

The Virtual Column

```
select * from emp_rich;
```

EMPNO	M_SAL	**YEARLY_SAL**	DEPTNO
7369	800	9600	20
7499	1600	19200	30
7521	1250	15000	30
7566	2975	35700	20
7654	1250	15000	30
7698	2850	34200	30

In-Memory (IM) Virtual Columns – 12cR2

The following initialization parameter must be set (can set when DB running):

INMEMORY_VIRTUAL_COLUMNS=ENABLE (set to DISABLE to turn it off)

To put the table INMEMORY (in the main IM area IMCU):

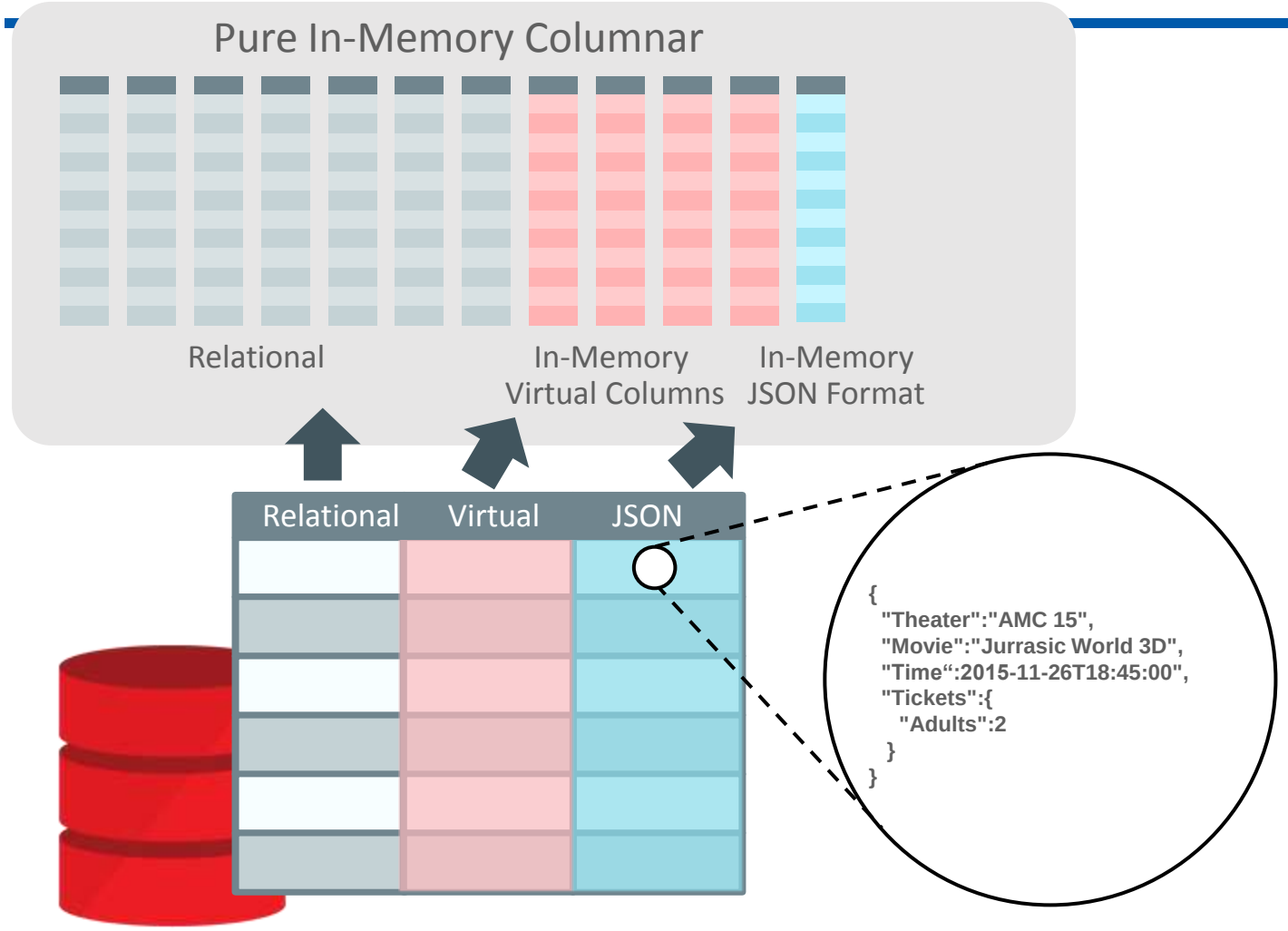
alter table scott.emp_rich INMEMORY; (**virtual column IM if above parameter set**)

To specifically put virtual column INMEMORY (a **separate area of IM** – IMEU):

alter table scott.emp_rich INMEMORY(yearly_sal);

IMCU=*In-Memory Compression Unit;* IMEU=*In-Memory Expression Unit*

In-Memory JSON Queries Loaded into In-Memory Virtual Columns (IMEU*)



- **Virtual columns from JSON** objects **loaded into In-Memory Virtual Cols**
- Full JSON documents loaded using a optimized In-Memory binary format
- Query operations on JSON content automatically directed to In-Memory
  - Simple queries on virtual columns
  - More complex JSON processing using in-memory binary format

<u>In 18c</u>: Support Indexing of JSON Key Names > 64 Characters & Spatial JSON Support

18c

IMCU=*In-Memory Compression Unit;* IMEU=*In-Memory Expression Unit

Thanks Oracle: Graphics

Multiple *Types* of Indexes on the *Same Column*

(Using the Invisible Index even more)

(Briefly – See "12c Best Tuning Features" for more)

Multiple Types of Indexes on the Same Column(s)

- Create MORE than one index on a column
- Set only ONE index to VISIBLE
- Great to use different types of indexes for ***batch, query, or data warehousing at different times.***
- Some restrictions apply…for a give column(s)
  - You can not create a B-tree AND B-tree cluster index
  - You can not create a B-tree and an index-organized table (IOT)
- **All indexes ARE MAINTAINED during DML**
  - **DML could be slow if TOO MANY indexes are created**
- Great for ***variable*** workloads!

Multiple Types of Indexes on the Same Column(s)

Check the Indexes Views – FIVE Indexex *on the same column*:

```
select a.table_name, a.index_name,
       b.column_name, a.uniqueness, a.visibility
from   user_indexes a, user_ind_columns b
where  a.index_name = b.index_name
and    a.table_name = 'DEPT';
```

TABLE_NAME	INDEX_NAME	COLUMN_NAME	UNIQUENESS	VISIBILITY
DEPT	**DEPT_UNIQUE1**	DEPTNO	UNIQUE	**INVISIBLE**
DEPT	**DEPT_REVERSE**	DEPTNO	NONUNIQUE	**INVISIBLE**
DEPT	**DEPT_NORMAL**	DEPTNO	NONUNIQUE	**INVISIBLE**
DEPT	**DEPT_BITMAP**	DEPTNO	NONUNIQUE	**VISIBLE**
DEPT	**DEPT_FB**	SYS_NC00004$	NONUNIQUE	**VISIBLE**

(Index types: NORMAL, NORMAL/REV, UNIQUE, BITMAP, FUNCTION-BASED NORMAL)

12c Approximate Query and 12cR2 Features

Oracle Database 12c
Release 2 Performance
Tuning Tips and Techniques

Approximate Query – 12cR2

- **Approximate Query Processing**, counts distinct values and adds approximate percentile aggregation.
- This allows faster processing of large data sets using approximation instead of exact aggregation.
- Since this is an aggregation it is not assured to be completely accurate, however, in most cases it is very close and acceptable considering the large performance boost it provides.
- Note that the **results other than approximated value returned are 100% accurate**, it is only how the query is processed and the amounts that are approximated (for instance the departments with approximately $1M in sales will give the correct departments that are within 97% of $1M in sales with 95% accuracy … but, NOT give a department with only $100 in sales).

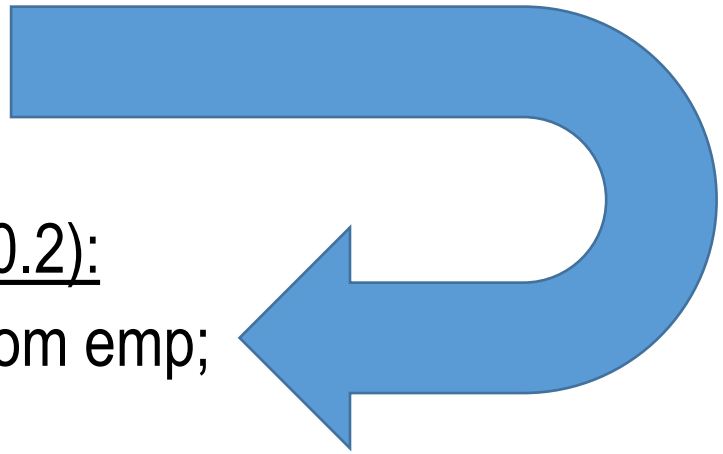
Approximate Query: 100x+ Faster
(Depending on the Query)

Instead of (100% accurate – 12.1.0.2):

select count(distinct(empno)) from emp;

Use this for speed (97% accurate – 12.1.0.2):

select **approx_count_distinct**(empno) from emp;



- Oracle: Approximate amount within 97% or so from the actual.
- Explain Plan: with change from SORT GROUP BY to **SORT AGGREGATE APPROX**

In 12c R2, toggle approximate mode for distincts:

alter session set approx_for_count_distinct = TRUE; (12.2 only – distinct counts ***all*** approximate)

Approximate Query Expanded! – 12cR2 Only
More Advances in 18c

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Oracle Database 12c 12c
Release 2 Performance
Tuning Tips and Techniques

Other initialization parameters:

approx_for_aggregation=TRUE

approx_for_percentile=TRUE

Other Approximate Functions:

- APPROX_COUNT_DISTINCT_DETAIL
- APPROX_COUNT_DISTINCT_AGG
- TO_APPROX_COUNT_DISTINCT
- APPROX_MEDIAN
- APPROX_PERCENTILE
- APPROX_PERCENTILE_DETAIL
- APPROX_PERCENTILE_AGG
- TO_APPROX_PERCENTILE

18c Oracle Database

In 18c: Top-N Approximate Aggregation

Also in 12cR2 is support for Materialized Views and Query Rewrite

Pluggable Databases

Oracle Database 12c
Release 2 Performance
Tuning Tips and Techniques

Pluggable Databases

- CDB = Container Database (has Root DB & also has a seed PDB)
- PDB = Pluggable Database (plugged into a CDB)
- Non-CDB = Original type of Database (neither a CDB or PDB)
- Why?: Can't consolidate 100's of databases on one machine … too many resources required when you add the SGAs up! Enter PDBs.
  - Share: Big Data Sources, Acquisitions, Partners, Shared Research, Governments
- Quickly create a new database (PDB) or copy existing one (PDB)
- Move existing PDBs to new platform or location or clone it (snapshot)
- Patch/Upgrade PDB by plugging it into a CDB at a later version
- Physical machine runs more PDBs old way: Easier to manage/tune
- Backup entire CDB + any number of PDBs
- New syntax for commands: PLUGGABLE DATABASE

Consolidate PDBs … but, How Many?

Rich Niemiec @RichNiemiec · Aug 16

Consolidate 252 non-PDBs to 252 PDBs;Save Memory, IO reads & writes (less log writing & DB flush): tinyurl.com/pkpmrs7 #oracleace #ioug

Deployment	Aggregate Throughput	Avg. Response Time	CPU Utilization	Memory Footprint per DB	Storage IOPS
252 non-CDBs	72,600 tps	6.7 ms	68%	1702 MB	271,400
252 PDBs	130,300 tps	9.9 ms	68%	208 MB	131,200
PDBs vs. non-CDBs	+80%	+3 ms	identical	-8x	-2x

Next Few Slides are FYI Only for Example of Commands

Is the database a CDB or non-CDB?

```
SQL> SELECT NAME, CREATED, CDB, CON_ID
  2  FROM V$DATABASE;

NAME      CREATED   CDB      CON_ID
--------- --------- --- ----------
CDB1      19-FEB-12 YES           0
```

Query the PDBs

```
select name, open_mode, open_time
from v$pdbs;

NAME            OPEN_MODE  OPEN_TIME
--------------- ---------- ---------------------------
PDB$SEED        READ ONLY  23-FEB-13 05.29.19.861 AM
PDB1            READ WRITE 23-FEB-13 05.29.25.846 AM
PDB_SS          READ WRITE 23-FEB-13 05.29.37.587 AM
```

Clone PDB (Source does ***NOT*** need Read-Only in12cR2)

Oracle Database 12c Release 2 Performance Tuning Tips and Techniques

```
CREATE PLUGGABLE DATABASE pdb2 FROM pdb1
  PATH_PREFIX = '/disk2/oracle/pdb2/'
  FILE_NAME_CONVERT = ('/disk1/oracle/pdb1/',
  '/disk2/oracle/pdb2/');

CREATE PLUGGABLE DATABASE pdb2 FROM pdb1
  FILE_NAME_CONVERT = ('/disk1/oracle/pdb1/',
  '/disk2/oracle/pdb2/')  STORAGE (MAXSIZE 2G
  MAX_SHARED_TEMP_SIZE 100M);

CREATE PLUGGABLE DATABASE pdb2 FROM
  pdb1@pdb1_link;
```

Unplugging & Dropping PDBs

```
ALTER PLUGGABLE DATABASE dwpdb UNPLUG INTO
  '/oracle/data/dwpdb.xml';

DROP PLUGGABLE DATABASE dwpdb KEEP DATAFILES;

DROP PLUGGABLE DATABASE dwpdb INCLUDING
  DATAFILES;
```

Set PDB Level Memory Parameters in **12cR2**

(*there are many **restrictions** not all listed**)

You can now set at the PDB level (must have MEMORY_TARGET=0 in CDB root):

- DB_CACHE_SIZE** (<=50% of CDB & sum of all PDBs<=50% of CDB level)
- SHARED_POOL_SIZE** (<=50% of CDB & sum of all PDBs<=50% of CDB level)
- PGA_AGGREGATE_TARGET (<= CBD level setting)
- PGA_AGGREGATE_LIMIT* (<= CBD level setting)
- SGA_MIN_SIZE*
- SGA_TARGET*
- INMEMORY_SIZE*

Must have NONCDB_COMPATIBLE=FALSE (in CDB root)

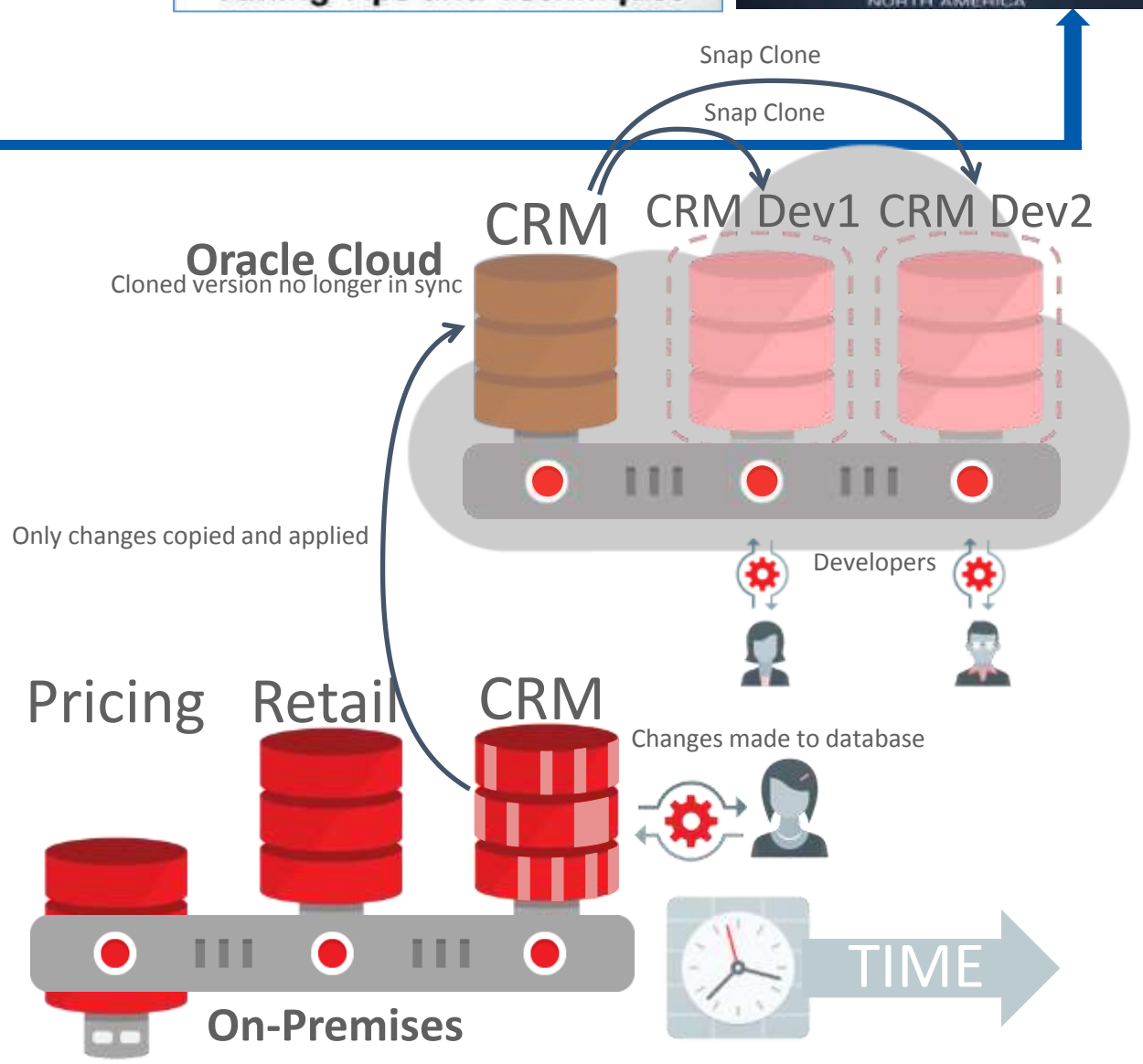
**DB_CACHE_SIZE + SHARED_POOL_SIZE <= 50% CDB level SGA_TARGET

New features with PDBs – **12cR2**

- Source no longer needs to be Read-Only when cloning a PDB (**point-in-time or hot clone**)
- You can do a **PDB refresh of clones** manually or automated (they must be Read-Only).
- Create **class of PDB (Gold/Silver/Bronze)** by setting **DB_PERFORMANCE_PROFILE** and then use **Resource Manager** to set directives for each class of PDB.
- You can do a **FLASHBACK of a PDB** and restore points to **only** that PDB!
- You can build a **Subset Standby** of just one or a portion of your PDBs (*next slide*)!
- You can now have **4096 PDBs, not just 252**.
- You can use **local UNDO for PDBs** in *12cR2.*

PDB Refresh

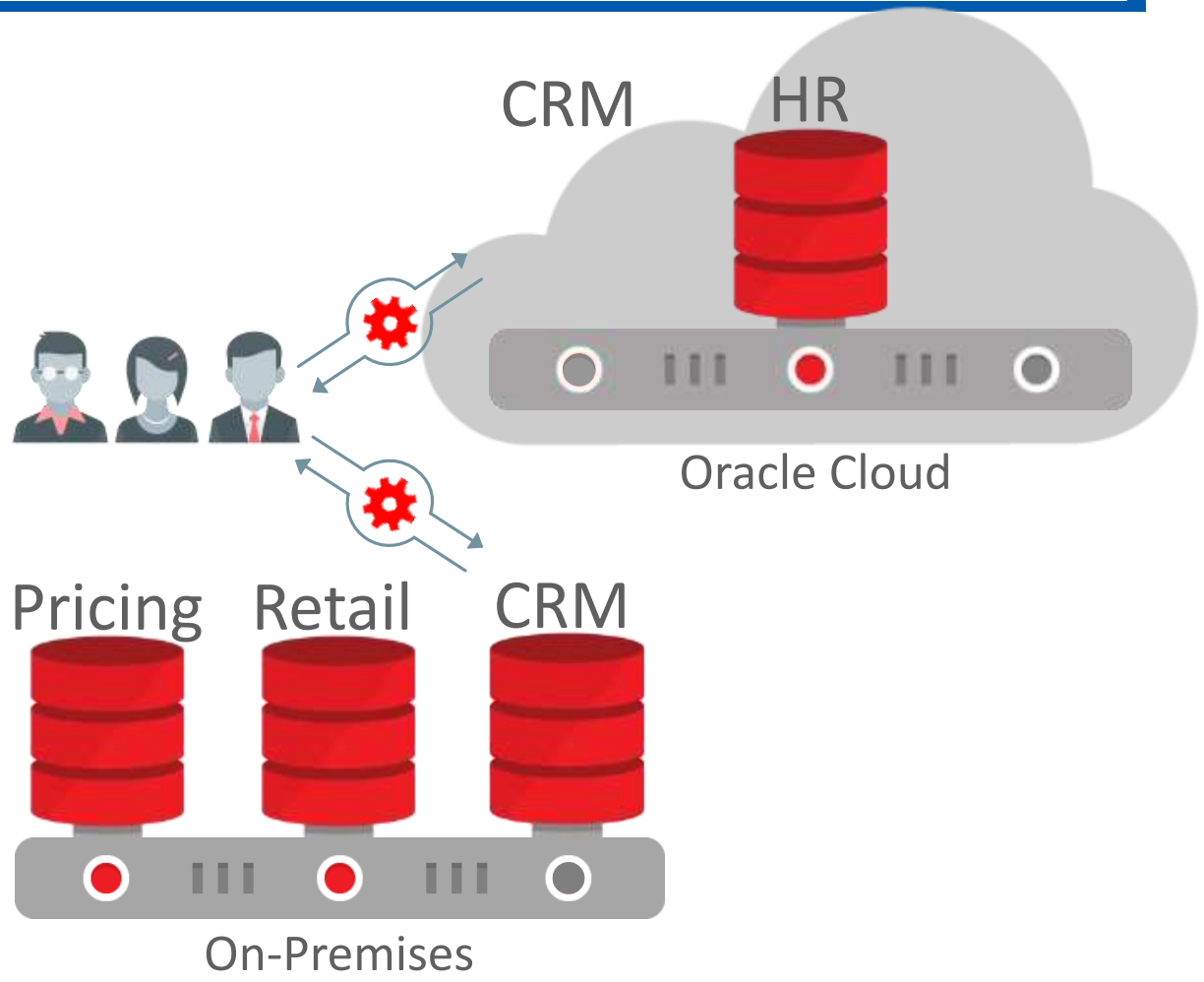
- PDB Hot Clone
  - Online test master instantiation
- PDB Refresh
  - Incremental refresh of clone with latest data




```
CREATE PLUGGABLE DATABASE pdb2 FROM pdb1@pdb1_link REFRESH MODE EVERY 60 MINUTES;
```

PDB Relocate

- PDB Hot Clone
  - Online test master instantiation
- PDB Refresh
  - Incremental refresh of clone with latest data
- PDB Relocate
  - Relocate with no downtime



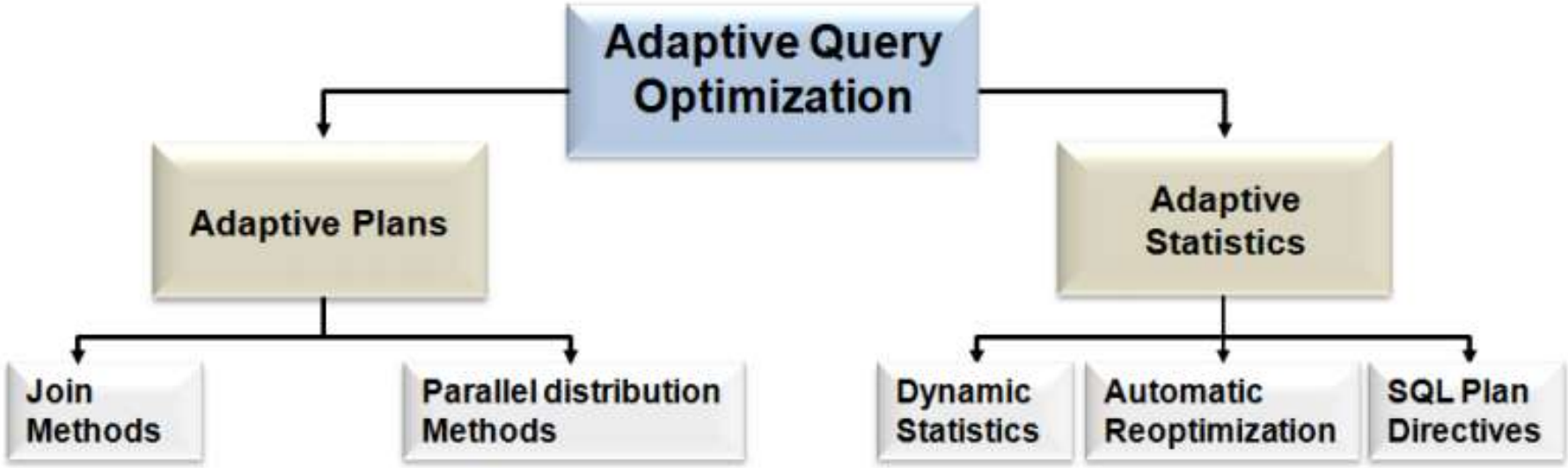
Flashback PDB – **12cR2**

- In **12*c*R2**, you can also issue a **FLASHBACK** of a **PDB** and have **restore points to only that PDB**.
- This can be done using the SCN, Restore Point, Clean Restore Point, or Guarantee Restore Point.
- The FLASHBACK command for an individual PDB is shown below (you can get SCNs from V$ARCHIVED_LOG, V$DATABASE, V$FLASHBACK_DATABASE_LOG & V$LOG):

SQL> FLASHBACK PLUGGABLE DATABASE **pdb1** TO SCN **830124**;

Adaptive Query Optimization – Some Cautions Shortly

(Thanks Oracle docs.)

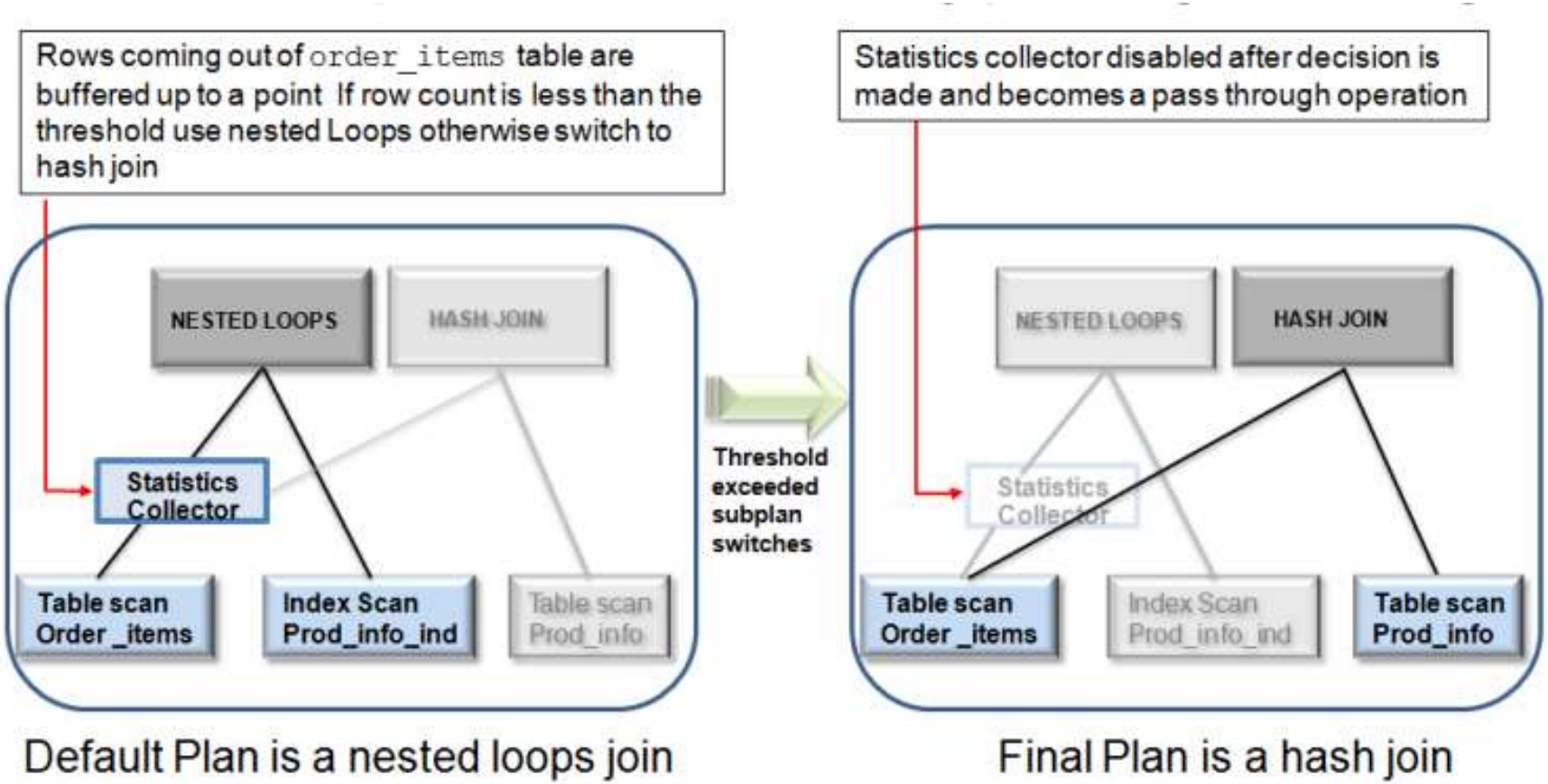


In 12cR2, Oracle introduced Continuous Adaptive Query Plans (CAQP) where certain queries, based on input data, can benefit **from continuous adaptive join methods** (such as a Recursive WITH that has different input data compared to previous iteration).

In 18c: Adaptive Query Plans: Bitmap Index Pruning (uses some/not others)
Adaptive plans prune indexes that do not significantly reduce number of matched rows.

18c Oracle Database

Adaptive Query Optimization: Oracle Docs Great Example



Adaptive Query Optimization: Oracle Docs Great Example

```
SQL> explain plan for
  2  select /*+ gather_plan_statistics*/ p.product_name
  3  from order_items2 o, product_information p
  4  where o.unit_price = 15
  5    and o.quantity > 1
  6    and p.product_id = o.product_id;

Explained.

SQL>
SQL> select * from table(dbms_xplan.display());

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 983807676

-------------------------------------------------------------------------------
| Id  | Operation                     | Name                |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT              |                     |
|   1 |  NESTED LOOPS                 |                     |
|   2 |   NESTED LOOPS                |                     |
|*  3 |    TABLE ACCESS FULL          | ORDER_ITEMS2        |
|*  4 |    INDEX UNIQUE SCAN          | PRODUCT_INFORMATION_PK |
|   5 |   TABLE ACCESS BY INDEX ROWID| PRODUCT_INFORMATION |
-------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   3 - filter("O"."UNIT_PRICE"=15 AND "O"."QUANTITY">1)
   4 - access("P"."PRODUCT_ID"="O"."PRODUCT_ID")

Note
-----
   - this is an adaptive plan
```

Explain plan command shows

Shows Initial Plan

```
SQL> select * from table(dbms_xplan.display_cursor());

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
SQL_ID  d3wzkmzxn264d, child number 0
-------------------------------------
select /*+ gather_plan_statistics */ p.product_name from order_items2
o, product_information p where o.unit_price = 15   and o.quantity > 1
and p.product_id = o.product_id

Plan hash value: 2886494722

--------------------------------------------------------------------------------
| Id  | Operation          | Name                | Rows  | Bytes | Cost (%CPU)|
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |                     |       |       |     7 (100)|
|*  1 |  HASH JOIN         |                     |     4 |   128 |     7   (0)|
|*  2 |   TABLE ACCESS FULL| ORDER_ITEMS2        |     4 |    48 |     3   (0)|
|   3 |   TABLE ACCESS FULL| PRODUCT_INFORMATION |     1 |    20 |     1   (0)|
--------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   1 - access("P"."PRODUCT_ID"="O"."PRODUCT_ID")
   2 - filter(("O"."UNIT_PRICE"=15 AND "O"."QUANTITY">1))

Note
-----
   - this is an adaptive plan
```

DBMS_XPLAN.DISPLAY_CURSOR shows

Shows Final Plan

From @richniemiec: Important note on Adaptive Features (Doc ID 2187449.1)

VISCOSITY

Recommendations Adaptive Features (Doc ID 2187449.1)

Adaptive features are divided into two components:

1. **Adaptive Plans** - Adaptive plans allow plans to change during execution.
2. **Adaptive Statistics** - Adaptive statistics allow plans to be built based upon the results of previous executions. Some changes may be persisted in the data dictionary via SQL Plan Directives or the automatic creation of extended statistics.

In 12.1, both components are controlled by the dynamic parameter optimizer_adaptive_features. This parameter defaults to TRUE. When optimizer_features_enable is set to 12.1.0.1 or higher, all adaptive features controlled by this parameter are enabled.
In 12.2, the parameter optimizer_adaptive_features has been obsoleted. The adaptive features are controlled by two new parameters, optimizer_adaptive_plans and optimizer_adaptive_statistics. The optimizer_adaptive_plans parameter controls whether the optimizer creates adaptive plans and defaults to TRUE. When optimizer_features_enable is set to 12.1.0.1 or higher, all features controlled by optimizer_adaptive_plans are enabled. The optimizer_adaptive_statistics parameter controls whether the optimizer uses adaptive statistics and defaults to FALSE. These defaults have been chosen to place emphasis on achieving stable SQL execution plans.
We recommend that upgrades to 12.1 adopt the 12.2 defaults. This may be done by applying the following patches for your version and platform:

- Patch 22652097 splits the parameter optimizer_adaptive_features into two, as above, and disables adaptive statistics.
- Patch 21171382 disables the automatic creation of extended statistics unless the optimizer preference AUTO_STAT_EXTENSIONS is set to ON

Runaway Query Management – FYI ONLY

- Resource Manager now pro-actively manages problems queries and takes action based on settings for a given consumer group when:
  - CPU is exceeded
  - Physical I/O is exceeded (disk)
  - Logical I/O is exceeded (memory)
  - Elapsed Time is exceeded
- This can be automated!
- New views allow the DBA to see problem queries that are over the limit for each Consumer Group (can be set to automatically be terminated or can be switched to a new group with lower resources)
- Views are persisted in the AWR
- Must have the appropriate resources to manage this
- Can be set based on start of session or start of SQL or PL/SQL:
  - SWITCH_FOR_CALL resource plan directive

Runaway Query Management

(Oracle 12c DBA Guide example…)

Create a Resource plan Directive that kills any session that exceeds 60 seconds of CPU time

```
BEGIN
DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE (
PLAN => 'DAYTIME',
GROUP_OR_SUBPLAN => 'OLTP',
COMMENT => 'OLTP group',
MGMT_P1 => 75,
SWITCH_GROUP => 'KILL_SESSION',
SWITCH_TIME => 60);
END;
/
```

Create a Resource plan Directive that switches sessions to the low_group if they exceed 10000 physical IO's or 2500M of data transferred. Session returns back to original group after bad query ends

```
BEGIN
DBMS_RESOURCE_MANAGER.CREATE_PLAN_DIRECTIVE (
PLAN => 'DAYTIME',
GROUP_OR_SUBPLAN => 'OLTP',
COMMENT => 'OLTP group',
MGMT_P1 => 75,
SWITCH_GROUP => 'LOW_GROUP',
SWITCH_IO_REQS => 10000,
SWITCH_IO_MEGABYTES => 2500,
SWITCH_FOR_CALL => TRUE);
END;
/
```

PDB Level in DBMS_RESOURCE_MANAGER – 12cR2

(can only be used with Database Smart Flash Cache)

PDB Level: MEMORY_LIMIT and MEMORY_MIN (12c R2):

- In addition to the new MEMORY_TARGET parameter to set all of memory for Oracle SGA+PGA, there are **PDB specific parameters** to ensure a minimum amount and a maximum setting. Those parameters set at the PDB level are:
- **MEMORY_LIMIT** - Limits the PDB to this *percentage* of PGA+SGA
- **MEMORY_MIN** - Guarantees the PDB this *percentage* of PGA + SGA

- You'll also see in the INMEMORY (IM) section that there is both an INMEMORY_SIZE at the CDB level and then also **INMEMORY_SIZE at the PDB level (which can be over-subscribed)** as well.

Oracle Database Security

Built over MANY years...

Fully Encrypted Database

Tablespace Encryption (TDE)

Encryption in the Silicon (M7)

Oracle Multi-Tenant Security (PDBs)

Oracle Audit Vault

Oracle Database Vault

DB Security Evaluation #19

Transparent Data Encryption

EM Configuration Scanning

Fine Grained Auditing (9i)

Secure application roles

Client Identifier / Identity propagation

Oracle Label Security (2000)

Proxy authentication

Enterprise User Security

Global roles

Virtual Private Database (8i)

Database Encryption API

Strong authentication (PKI, Kerberos, RADIUS)

Native Network Encryption (Oracle7)

Database Auditing

Government customer

1977

2017 +

Security Enhancements

Zero Downtime Encryption and Decryption

- TDE **encryption** now available for all tablespaces; **including SYSTEM, SYSAUX, and UNDO**
- Extend encryption and hashing algorithms to include ARIA, GOST, and SEED Encryption Algorithms.
- Perform offline conversion of a tablespace, without additional storage overhead.
- To encrypt an existing tablespace online, you must login to the database with the SYSKM role. To encrypt the SYSTEM or SYSAUX tablespace, you must login with the SYSDBA role:

```
SQL> ALTER TABLESPACE sysaux ENCRYPTION ONLINE USING 'AES256'
ENCRYPT;
```

- Decrypt a tablespace online without any downtime:

```
SQL> ALTER TABLESPACE sysaux ENCRYPTION ONLINE DECRYPT;
```

- **Starting in 18c**: You can encrypt sensitive credential data stored in data dictionary - SYS.LINK$ & SYS.SCHEDULER$_CREDENTIAL system tables; Previously obfuscated.

Exadata Cloud Machine with all Features

Exadata Cloud: Compatible, Scalable, Available, Secure

Decades of Database Innovation Proven at Millions of Mission-Critical Deployments

	Multitenant
	In-Memory DB
	Real Application Clusters
	Active Data Guard
	Partitioning
	Advanced Compression
	Advanced Security, Label Security, DB Vault
	Real Application Testing
	Advanced Analytics, Spatial and Graph
	Management Packs for Oracle Database

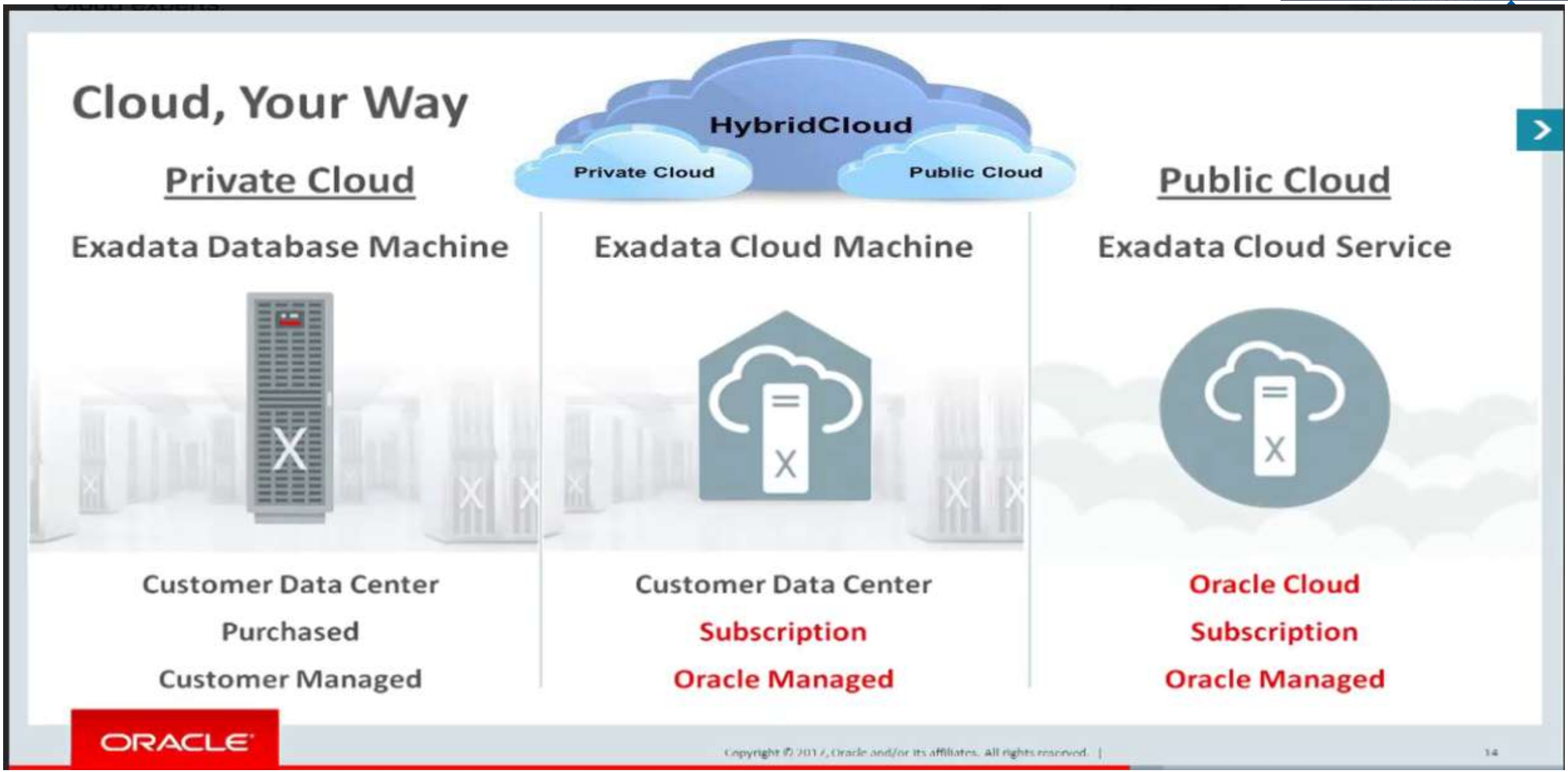
All Oracle Database Innovations

All Exadata DB Machine Innovations

Offload SQL to Storage	
InfiniBand Fabric	
Smart Flash Cache, Log	PCI Flash
Storage Indexes	
Columnar Flash Cache	
Hybrid Columnar Compression	
I/O Resource Management	
Network Resource Management	
In-Memory Fault Tolerance	
Exafusion Direct-to-Wire Protocol	

Oracle Exadata Cloud Machine (X6-2)

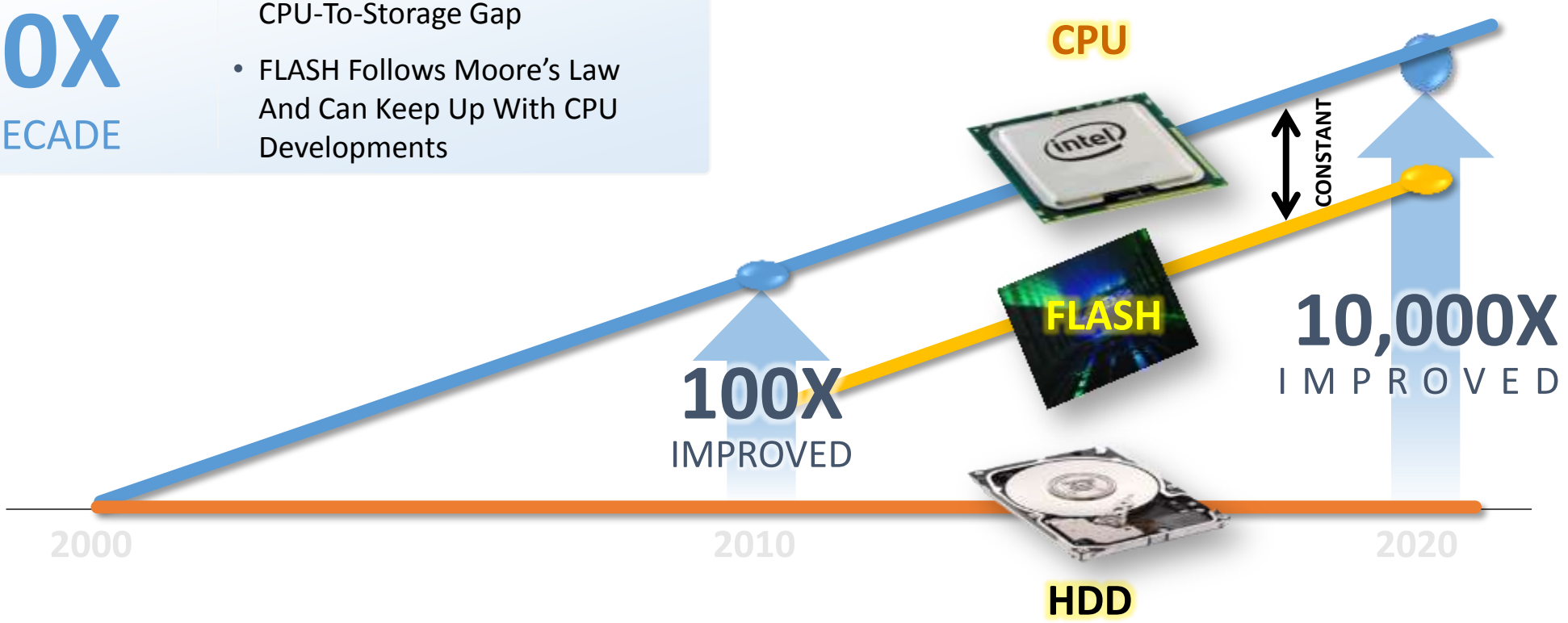
(Oracle's Juan Loaiza presentation on Exadata Cloud Machine)



CPU Speed Improves 100 Times Every Decade, Spinning Disk Drive speed has not

MOORE'S LAW:
100X
PER DECADE

- FLASH Closes The CPU-To-Storage Gap
- FLASH Follows Moore's Law And Can Keep Up With CPU Developments

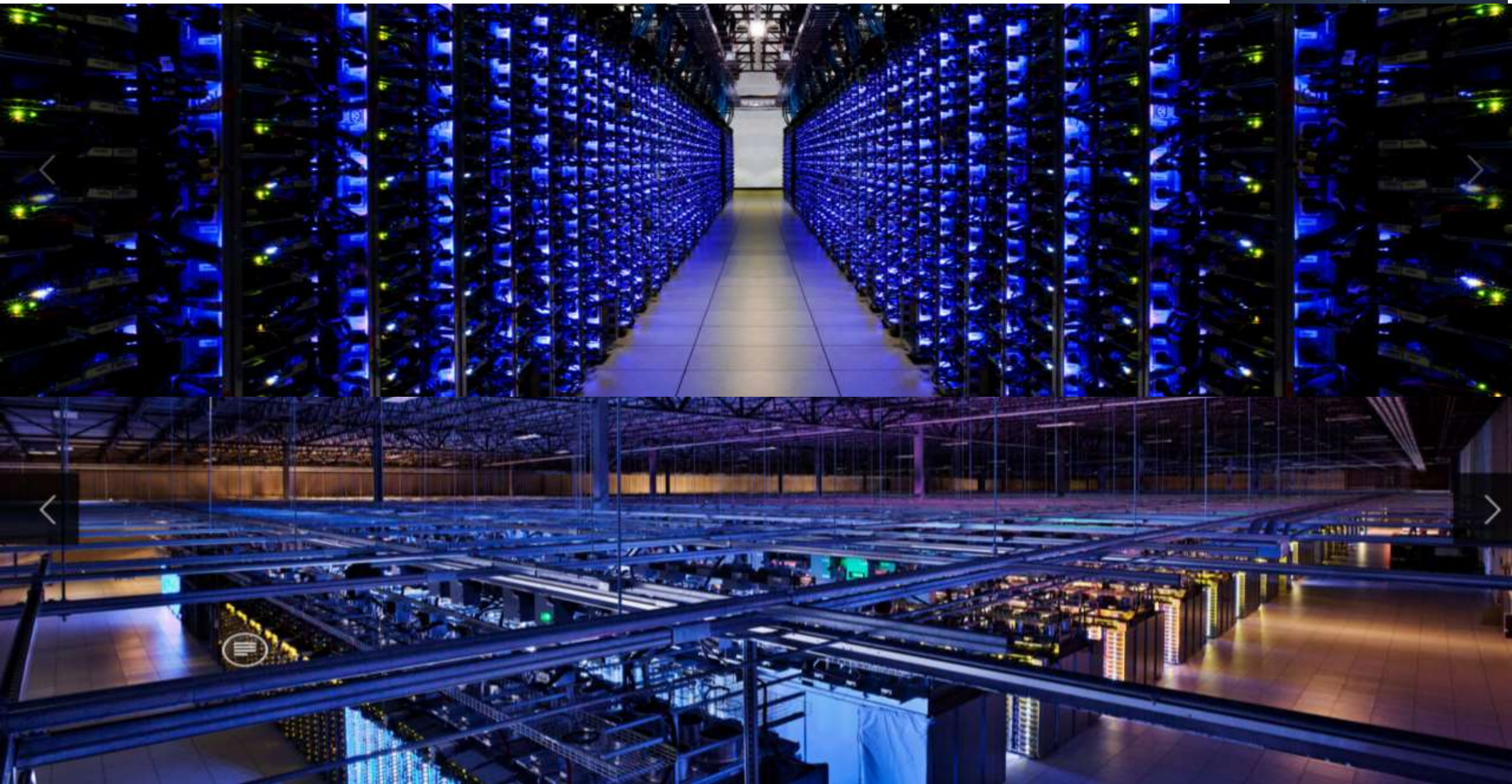


Thanks: Matt Kaberlein, EMC

facebook's Data Center

amazon's Data Center

Google's Data Center (two of them - GA/IA)



Oracle FS1 Flash Array in the Cloud (or Flash of X7-2)

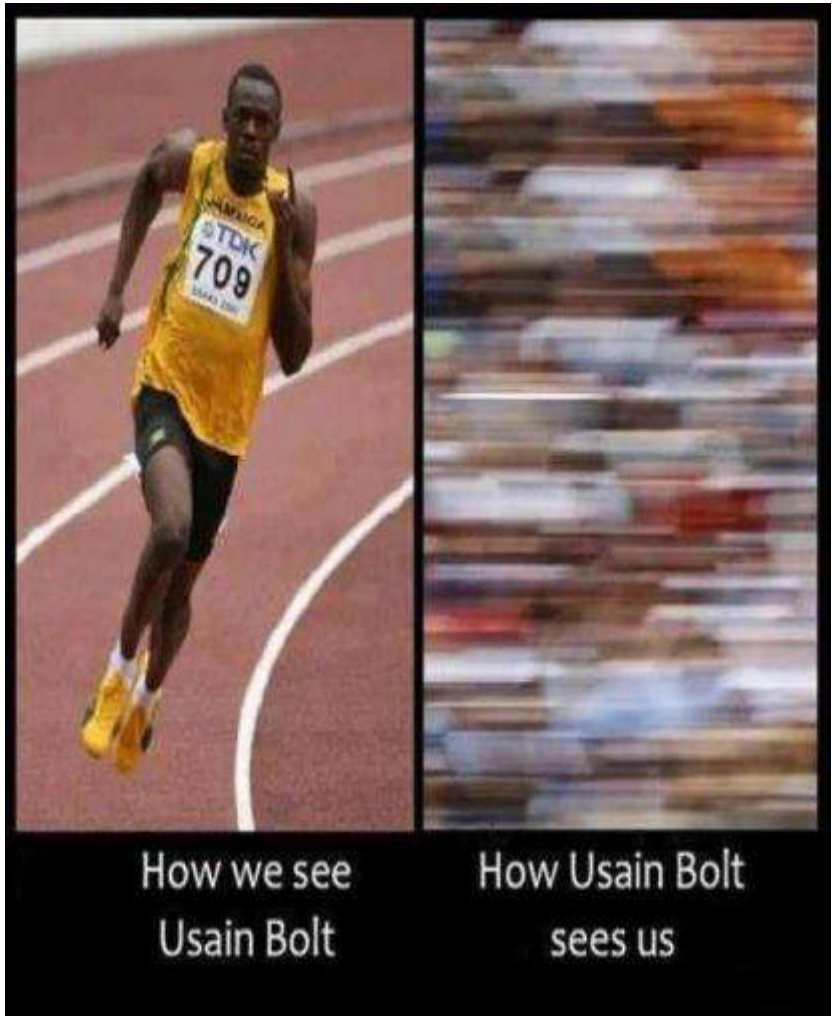
A Single FS1-2 Storage System:

- 912T of Flash
- 2.9P of Flash/Disk
- 4 CPU / 24 cores
- 64G RAM / 16G NV-DIMM

(base controller)

- 384G RAM / 16G NV-DIMM

(performance controller)



The In-Memory Column Store (IM)

*(Examples are **FYI Only**)*

See many IM Deep Dives this week!

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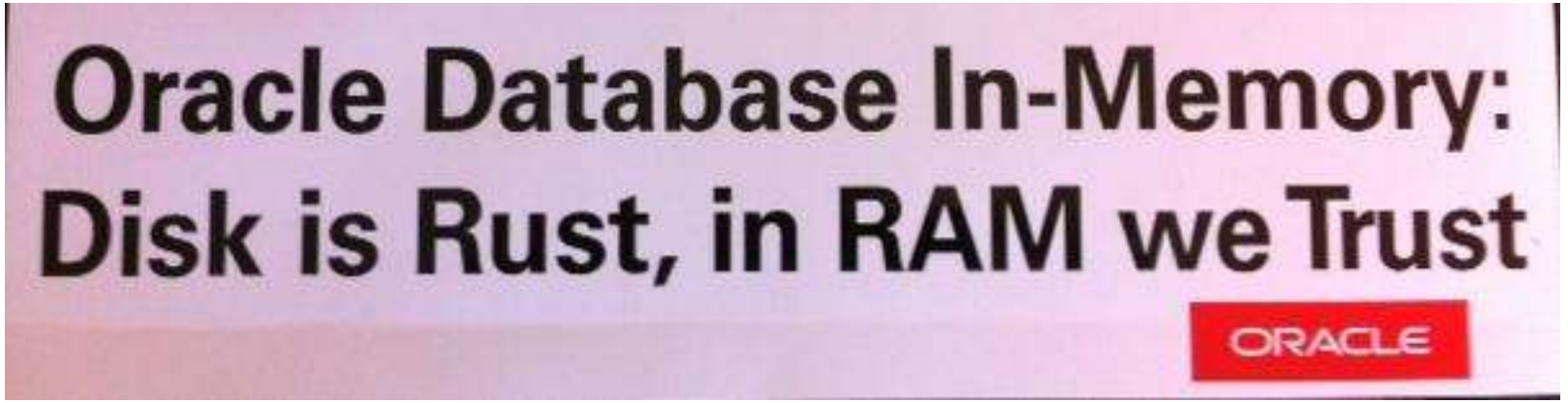
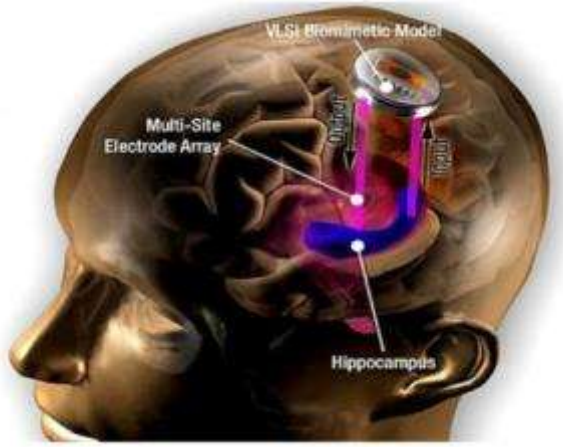
Oracle Database 12c Release 2 Performance Tuning Tips and Techniques

12c

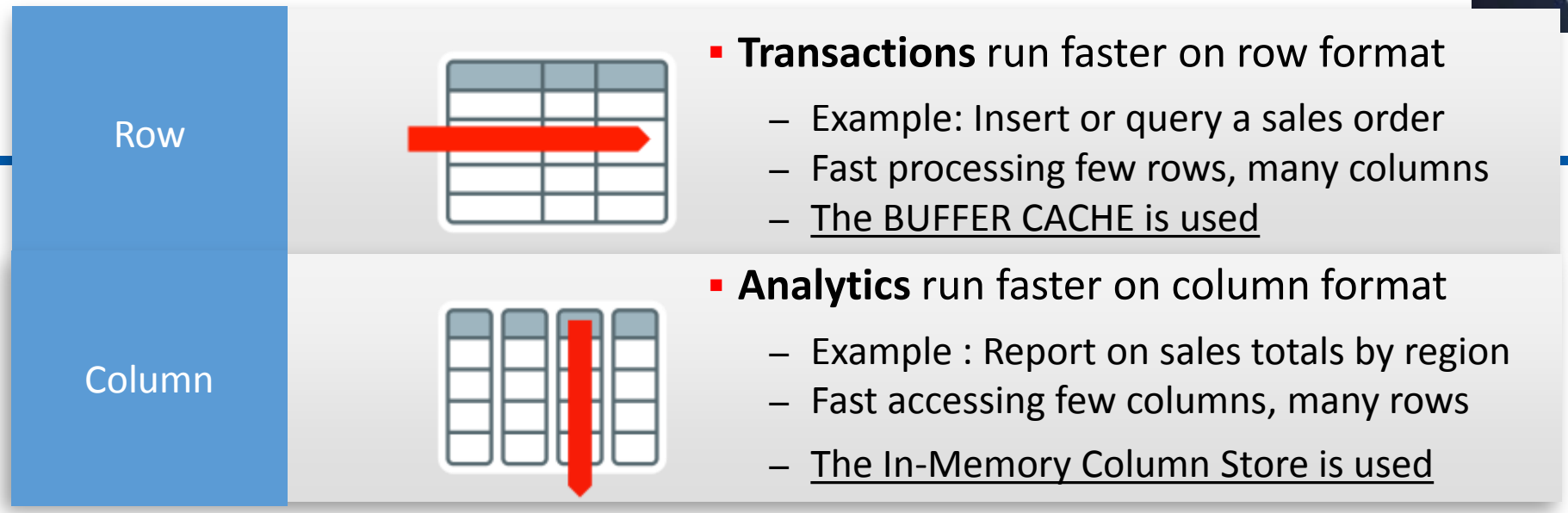
12.1.0.2

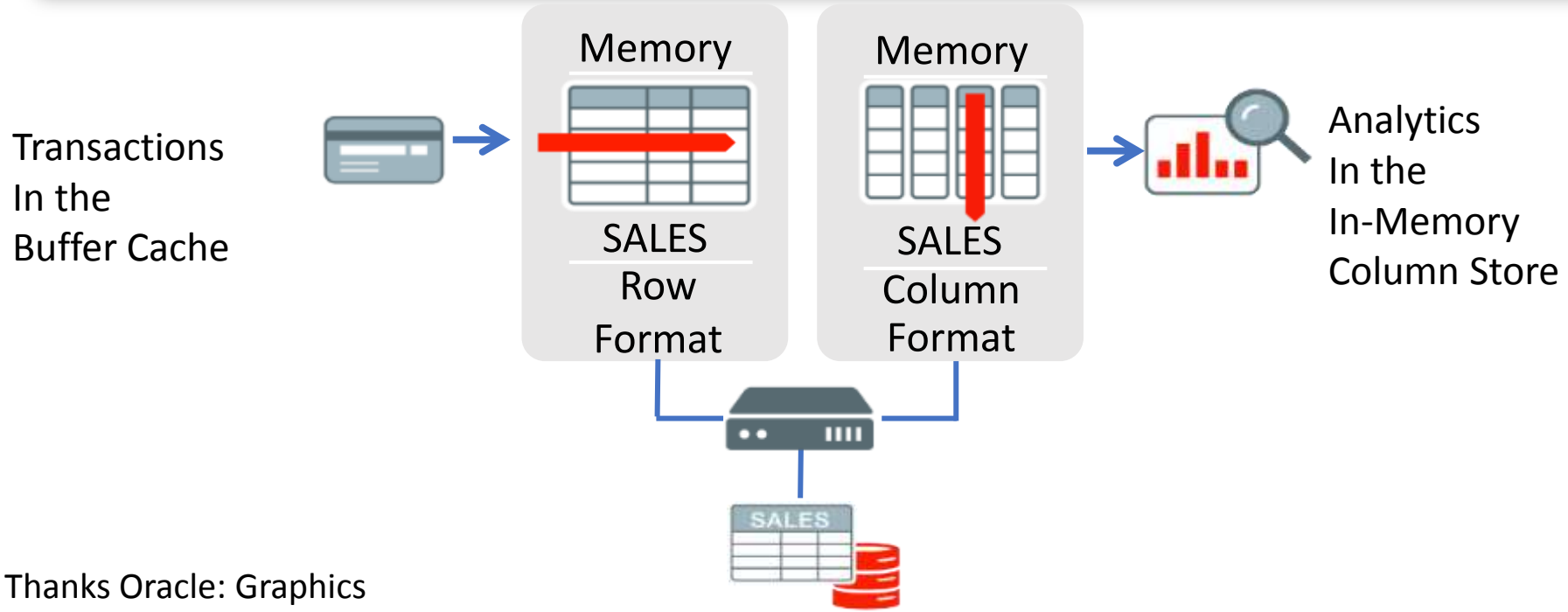



```
Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.2.0
With the Partitioning, OLAP, Advanced Analytics and Real A
ions

SQL> sho sga

Total System Global Area 4194304000 bytes
Fixed Size                  2932336 bytes
Variable Size             570425744 bytes
Database Buffers         2013265920 bytes
Redo Buffers              13844480 bytes
In-Memory Area           1593835520 bytes
SQL>
```



In-Memory (IM) – Overview





Thanks Oracle: Graphics

IMCS: Turning Sideways For Better Performance

Pre-12.1.0.2: Row-major storage (ORGANIZATION HEAP)

ord#	12389	12389	12389	12389	12389	12389	12389	12389
part#	103	987	623	103	103	623	623	109
suppl#	19	22	23	19	19	23	23	22
line#	1	2	3	4	5	6	7	8
qty	19	48	10	5	17	5	1	34
extdamt	190.00	960.00	200.00	100.00	51.00	190.00	190.00	68.50
rtn	N	N	N	N	N	Y	N	Y
sts	A	A	A	A	A	I	A	P
shipdt	2014-01-01	2014-01-01	2014-01-01	2014-01-02	2014-01-02	2014-01-02	2014-01-05	2014-01-05
comtdt	2014-01-02	2014-01-02	2014-01-02	2014-01-04	2014-01-04	2014-01-03	2014-01-05	2014-01-05
Rcptdt	2014-01-05	2014-01-04	2014-01-05	2014-01-05	2014-01-05	2014-01-05	2014-01-14	2014-01-08

Row-major storage works **great** for single-row access, especially DML …

```
INSERT INTO tpch.h_lineitem
VALUES (12389, 109, 22 ...);
```

```
UPDATE tpch.h_lineitem
   SET rtn = 'N'
 WHERE ord# = 12389
   AND ...);
```

By sid… sidew…

```
SELECT COUNT(*)
  FROM tpch.h_lineitem
 WHERE rtn <> 'N'
   AND sts <> 'A';
```

… but can seriously reduce query performance when just a few column values must be accessed

…r fewer I/Os than with row major format.

…ing the rest is called *columnar projection*.

What's in the IM?

12.1.0.2

12.1.0.2

INMEMORY can be specified at the:

- Table
- Tablespace
- Partition
- Subpartition
- Materialized view level
- The dual-format architecture does not double memory and is expected to cause less than 20% memory overhead. There could be some performance impact on the IM side when the OLTP side does a DML if a table is in both.

IM – Setting INMEMORY*

12.1.0.2

Create EMP and put it into the IM:

SQL> CREATE TABLE *emp8*

(EMPNO number, ENAME varchar2 (30)) **INMEMORY**;

Table created.

Alter DEPT table to be in the IM:

SQL> ALTER TABLE *dept* **INMEMORY**;

Table altered.

*Enable object INMEMORY or PRIORITY set to NONE, and want to **populate immediately, you MUST**:

- Force a full table scan
- Use DBMS_INMEMORY.POPULATE procedure

Check IM in USER_TABLES

```
SQL> alter table emp inmemory;

Table altered.

select table_name, inmemory, inmemory_priority,
        inmemory_compression
from  user_tables
where table_name = 'EMP'

TABLE_NAME                     INMEMORY  INMEMORY_P INMEMORY_COMPRESS
------------------------------ --------  ---------- -----------------
EMP                            ENABLED   NONE       FOR QUERY LOW
```

Running queries using IM

12.1.0.2

<u>Execution Plans for IM (*may* use IM for this query):</u>

SELECT EMPNO

FROM EMP

ORDER BY EMPNO;

EMPNO

7839 …

```
-----------------------------------------------------------------------------
| Id  | Operation                              |Name  |
------------------------------------------------------------------------------
|   0 | SELECT STATEMENT                       |      |
|   1 |  SORT AGGREGATE                        |      |
|   2 |   PARTITION RANGE ALL                  |      |
|*  3 |    TABLE ACCESS INMEMORY FULL          | EMP  |
-------------------------------------------------------------------------
```

IM –IMCUs & Compression

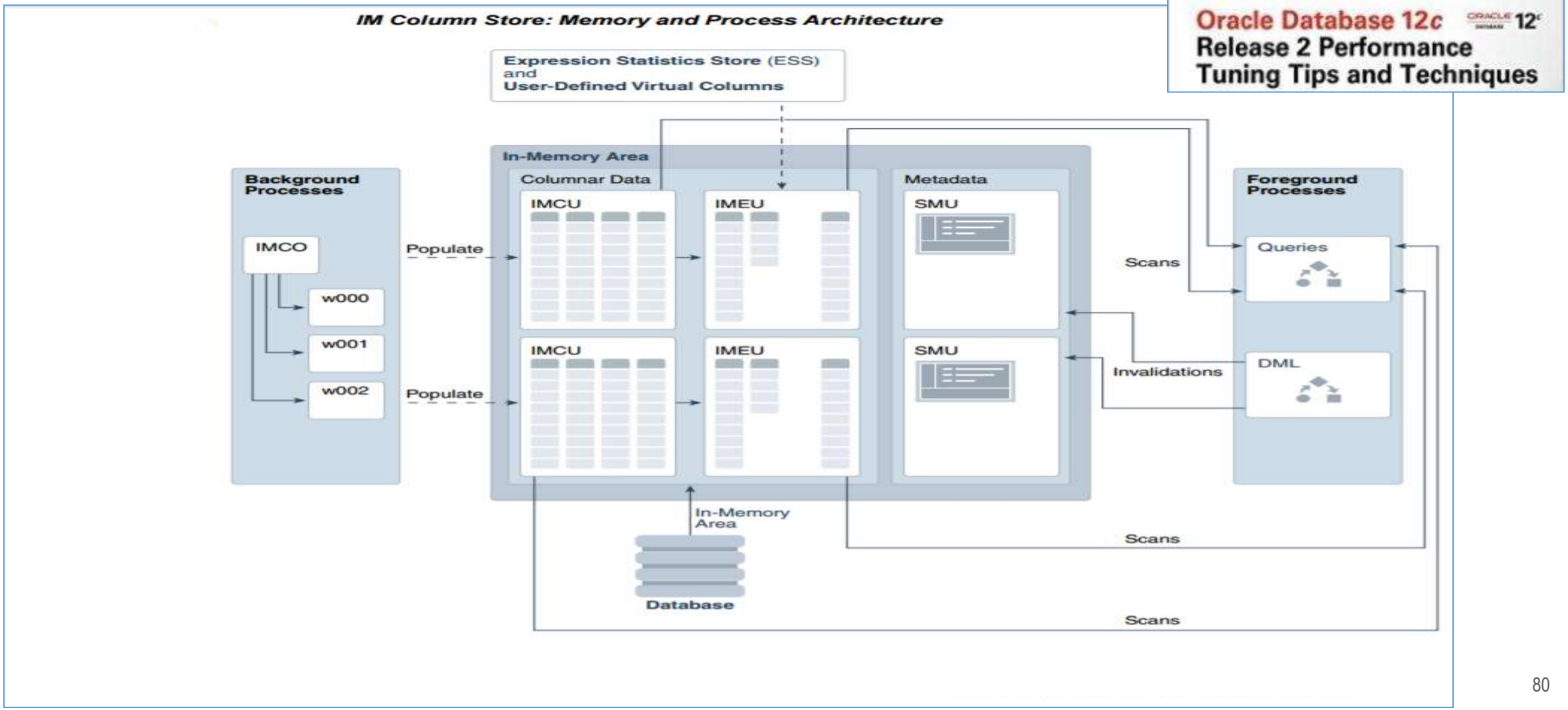
Create the EMP table using the IM, with compression settings for QUERY, not populating DEPTNO column, and compressing the ename column at higher level (Works now):

```
CREATE TABLE emp77 (EMPNO number(4), ENAME
                                varchar2(10), DEPTNO number (2))
  INMEMORY MEMCOMPRESS FOR QUERY HIGH
  NO INMEMORY(deptno)
  INMEMORY MEMCOMPRESS FOR CAPACITY HIGH(ename);
```

Table created.

In-Memory – Put it all together (Oracle Image - IM Paper

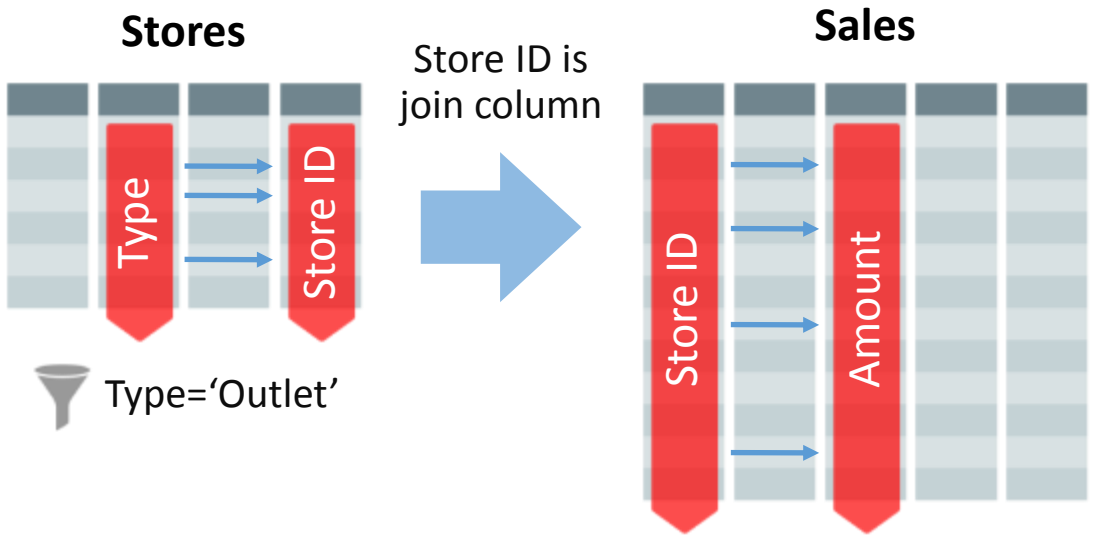
IMCU=*In-Memory Compression Unit;* IMEU=*In-Memory Expression Unit*)



Oracle Database 12c Release 2 Performance Tuning Tips and Techniques

Faster **In-Memory Joins** (12.2 only)

Example: Find total sales in outlet stores



- Join Group specifies columns used to join tables
  - **Columns share compression dictionary**
- Joins occur on dictionary rather than data
- In 12*c*R2, the **join group** (column joined between two tables) is also **compressed so that decompression is not needed** when tables are joined.

```
Create Join Group store_sales_jg
(STORES (STORE_ID),SALES (STORE_ID);
```


Thanks Oracle: Graphics

Nice 12c & 12cR2 DBA Tools & New Features – FYI Only

Online Table Move

Zero DownTime

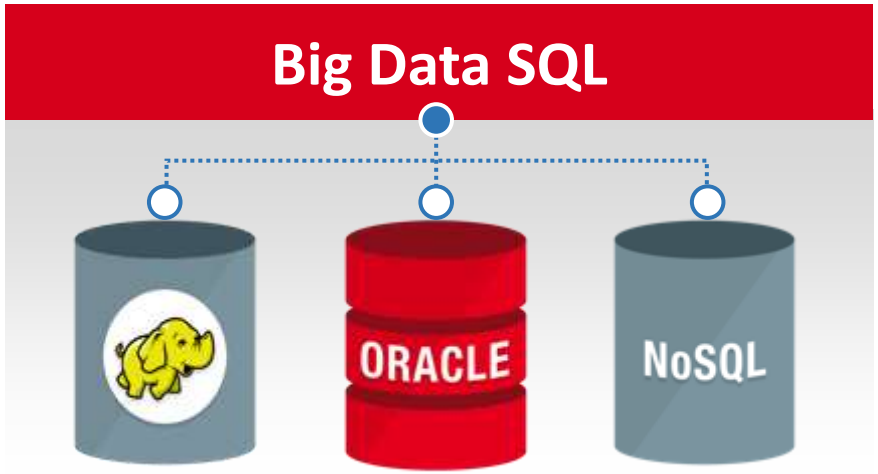
- ALTER TABLE … MOVE … **ONLINE**
- ALTER TABLE … MOVE PARTITION … **ONLINE**
- ALTER TABLE … MOVE SUBPARTITION … **ONLINE**
- ALTER TABLE consultant_details
  MOVE **ONLINE**
  COMPRESS
  TABLESPACE data_ts1
  UPDATE INDEXES (idx1 TABLESPACE index_ts1,
  idx2 TABLESPACE index_ts2);

- Table move operation now also supports automatic index maintenance as part of the move.
- With UPDATE INDEXES clause, the indexes remain usable during the move operation

Fast SQL access for Relational, Hadoop and NoSQL

Using Oracle Big Data SQL

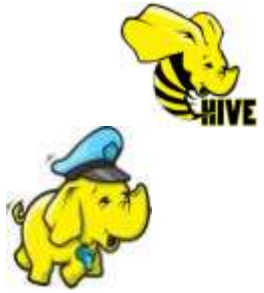
- Unified SQL language for all data sources
  - With full power of Oracle SQL
- Massively parallel, distributed query processing
  - Local processing using 'Smart Scan' technology
  - **Scalable joins between data sources**
- Secure data access
  - Redaction and row-based security on all data sources



Thanks Oracle: Graphics

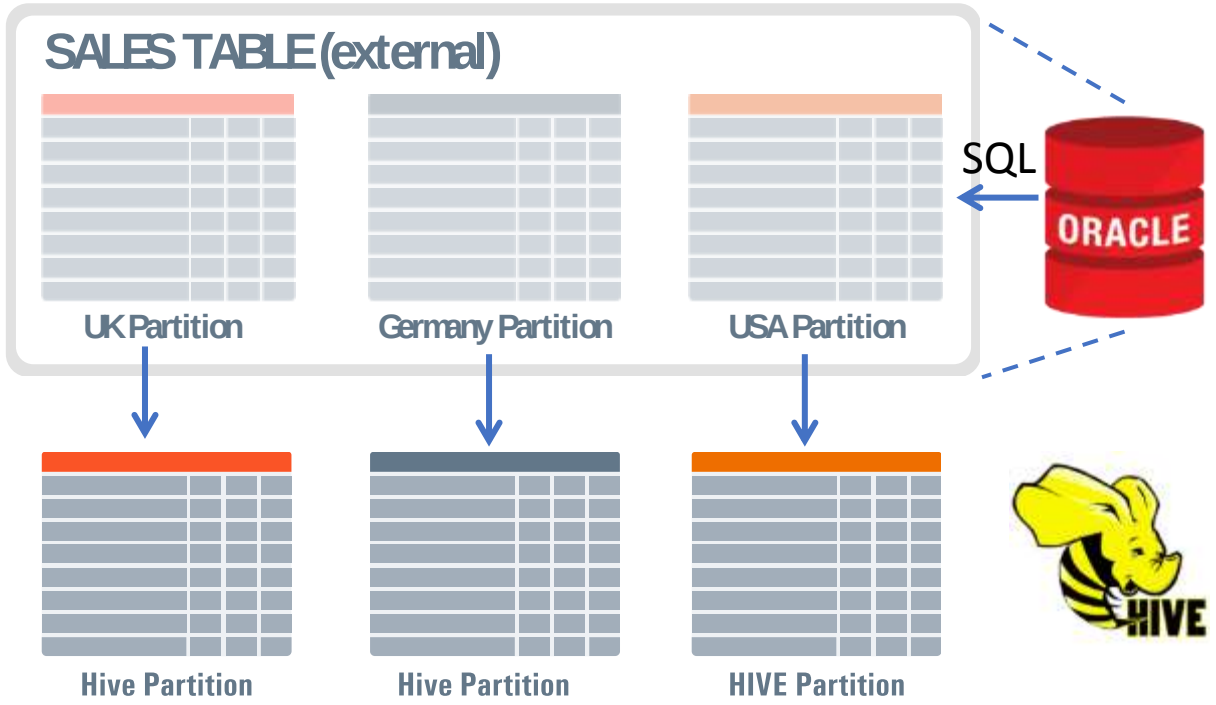
Big Data Innovations

Partitioned External Tables



Oracle Database 12c 12c
Release 2 Performance
Tuning Tips and Techniques

- External tables can be partitioned
  - using any partitioning technique
- Partition pruning
  - For faster query performance
- Basic partition maintenance
  - Add, drop, exchange



18c Oracle Database

In 18c: Inline and In-Memory External Tables

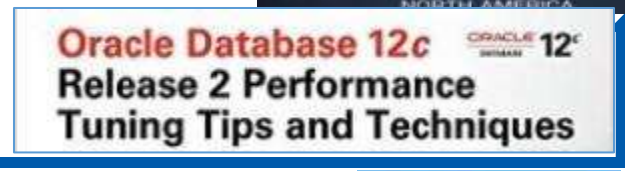
Thanks Oracle: Graphics

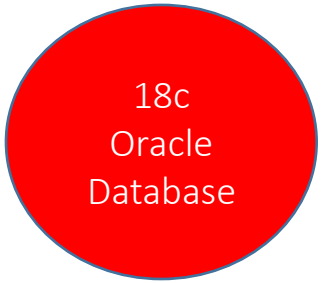
Other 12cR2 New Features

Other 12c Features … – FYI ONLY

- Database Instance Smart Flash Cache Support for Multiple Devices (can access/combine) without the overhead of the local volume manager.
- Supports **In-Memory Jobs** & In-Memory Temporary Tablespaces
- Active Data Guard Security has in-memory table of failed login attempts
- **Heat Map** that tracks modifications of rows (block level), table, partition levels
- Automate policy-driven data movement and compression using Heat Map
- Move partitions while ONLINE with DML happening / **Flex ASM to other storage**
- Improved query performance against OLAP cubes (especially Exadata)
- Automatic extended stats for groups of columns accessed together
- DBMS_STATS.GATHER_TABLE_STATS run on a partitioned table when CONCURRENT is set to TRUE will gather stats using multiple jobs concurrently
- Online statistics gathered during a bulk load (similar to rebuild index command)
- Flashback Data Archive (FDA) can be fully used on HCC tables on Exadata
- Enterprise Manager Database Express 12c ships with every database (NICE!)
- “Spot ADDM” triggered by high CPU or I/O into AWR Reports
- **Mask Data** At Source for testing & Oracle Masking templates for E-Business
- **Oracle Data Redaction** (prevents things like SSN from being displayed)

Other 12c Features … – FYI ONLY



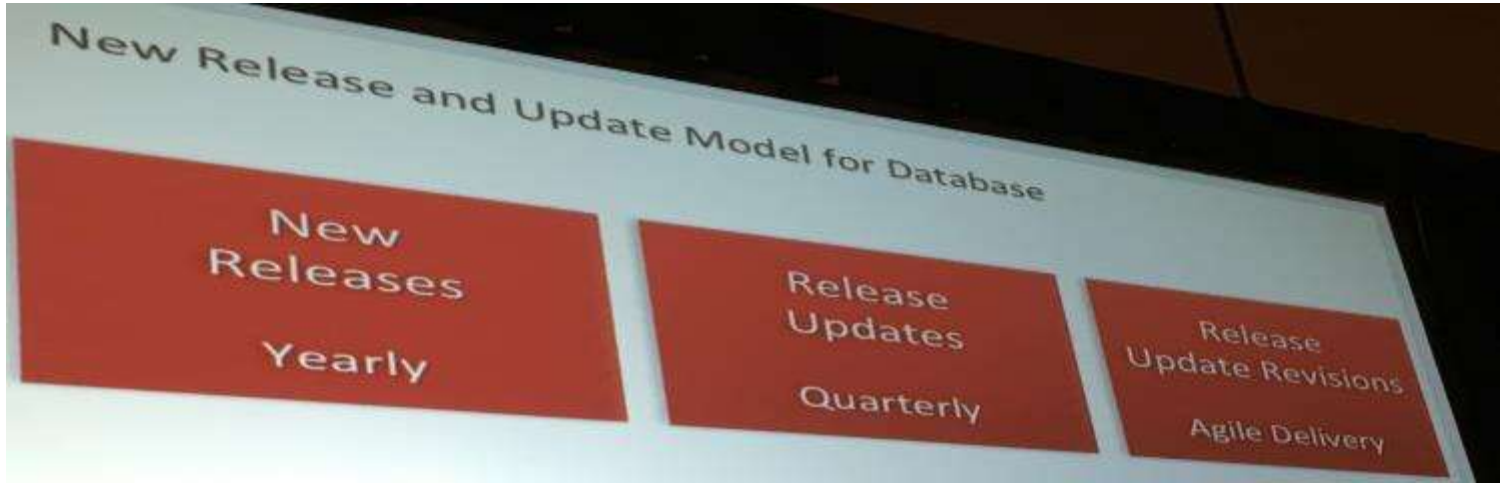


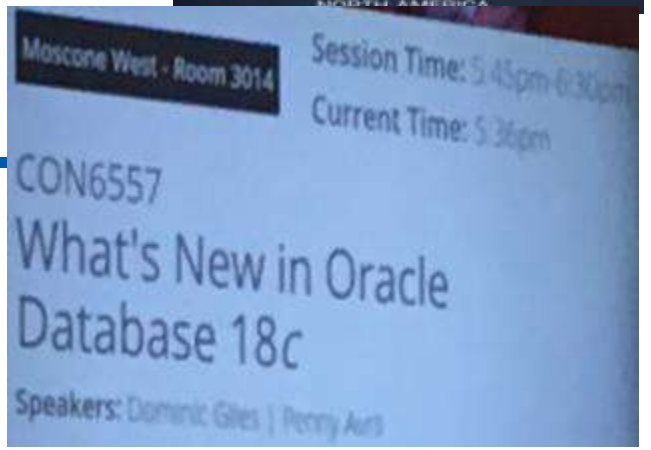
- Full Transportable support & Point-in-time recovery for PDBs
- **TRUNCATE TABLE …CASCADE (truncate child tables too);**
- **In 18c: Use CASCADE with Dropping ASM File Groups (ALTER DISKGROUP…DROP FILEGROUP…CASCADE)**
- Data Pump No Logging Option for import
- No-echo of Encryption Passwords on expdp/impdp commands
- Sql*Loader Express Mode – no control file!
- **In-Database MapReduce (Big Data)**
- Update strong user authentication using kerberos & Simplified Vault administration
- Many Windows enhancements (if you must use Windoze)
- Fast Application Notification (FAN) gets improved with Application Continuity which helps recover incomplete requests without executing more than once.
- Real-Time Apply (redo) is now default for Data Guard vs. applying archive logs
- SQL Apply Support for Objects, Collections, XML Type, & SecureFiles LOBs
- Oracle Spacial is now Oracle Spacial & Graph – Enhancements include routing engine enhancements, caching of index metadata, vector performance, Asian address support (geocoding), raster algebra & analytics, enhance image processing
- Many ACFS, Oracle Multimedia, Oracle Text & Oracle XML enhancements
- **VARCHAR2(32767) –not default (except on Cloud – so far)**/4K stored inline/>4K out of line(like a LOB)

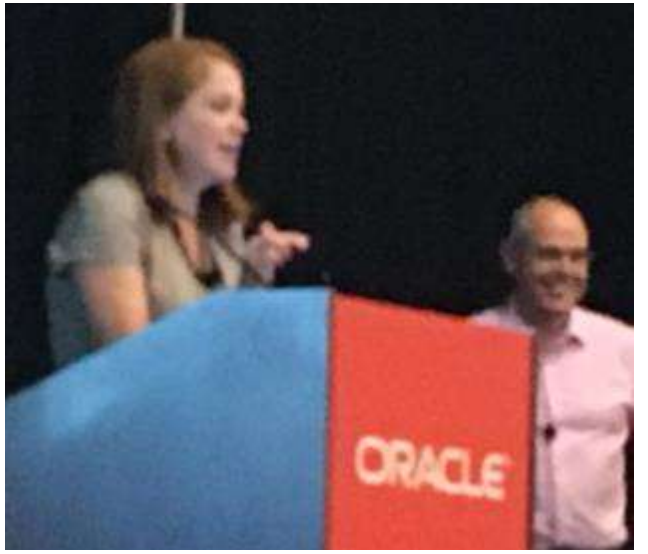
Oracle Database 18c

Simplified Version Number Timelines With RUs and RURs

- 3 digit format
  - Year.Update.Revision
- Year is the last 2 digits of year a release is delivered
  - e.g. 18 used for release date shipping Dec 2017 or early 2018
- Update tracks Release Update (RU)
- Revision tracks the associated RU Revision levels (0,1,2)







What Database is next … Oracle18?
From @richniemiec:

Rich Niemiec @RichNiemiec · Aug 28

Oracle18 next Oracle DB? - More info see tinyurl.com/yca7d687 &
tinyurl.com/y7wo9lw2 @oracleace @ioug @oracle @ViscosityNA @racdba

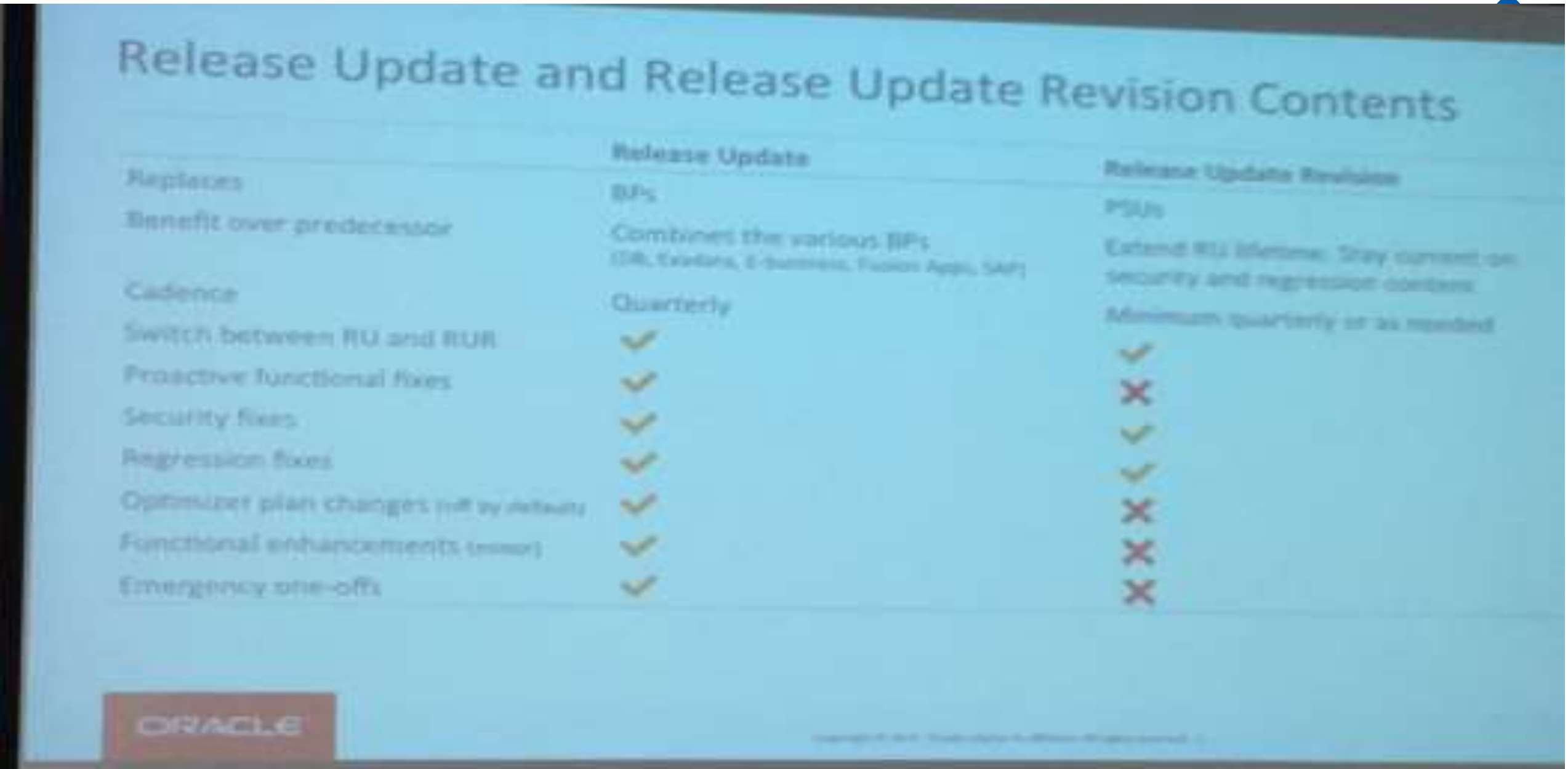
Oracle 18 to be released in 2018, let's skip versions 13,14,15,16 and 17, those are thrown away just like PSU's and Proactive Patch Bundles.

Bug 23557076 : PUBLIC SLEEP FUNCTION

Bug Attributes

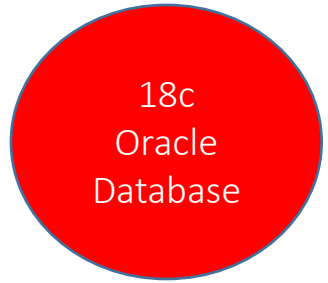
Type	E - Enhancement	**Fixed in Product Version**	18.1
Severity	1 - Extremely desirable feature	**Product Version**	12.1.0.2
Status	98 - Suggestion Implemented	**Platform**	289 - GENERIC (All Platforms)
Created	08-Jun-2016	**Platform Version**	NO DATA
Updated	10-Jun-2017	**Base Bug**	N/A
Database Version	12.1.0.2.0	**Affects Platforms**	Generic

From @richniemiec

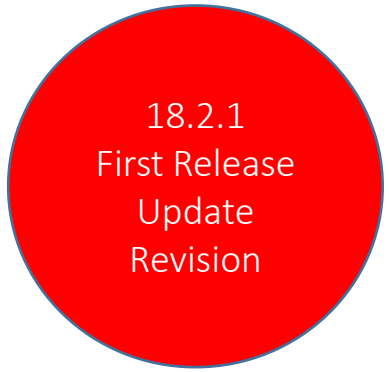


Oracle Database 18c

Production Path for Most Companies may be the Following



Production	April	July	October	January	April
18.1.0	18.2.0	18.3.0	18.4.0	18.5.0	18.6.0
		18.2.1	18.3.1	18.4.1	18.5.1
			18.2.2	18.3.2	18.4.2



Oracle Database 18c

Sample Version Number Timelines With RUs and RURs

19c Oracle Database

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Production	April	July	October	January	April	July
18.1.0	18.2.0	18.3.0	18.4.0	**19.1.0** *& 18.5.0*	**19.2.0** *& 18.6.0*	**19.3.0**
	No 18.1.1	18.2.1	18.3.1	18.4.1	18.5.1?	**19.2.1**
			18.2.2	18.3.2	18.4.2	18.5.2?

In 3 years, you may run either:

- 18.4.2
- 19.4.2
- 20.1.0

with different RU or RUR then above ones.

19.1.0 Production

19.2.0 First Release Update

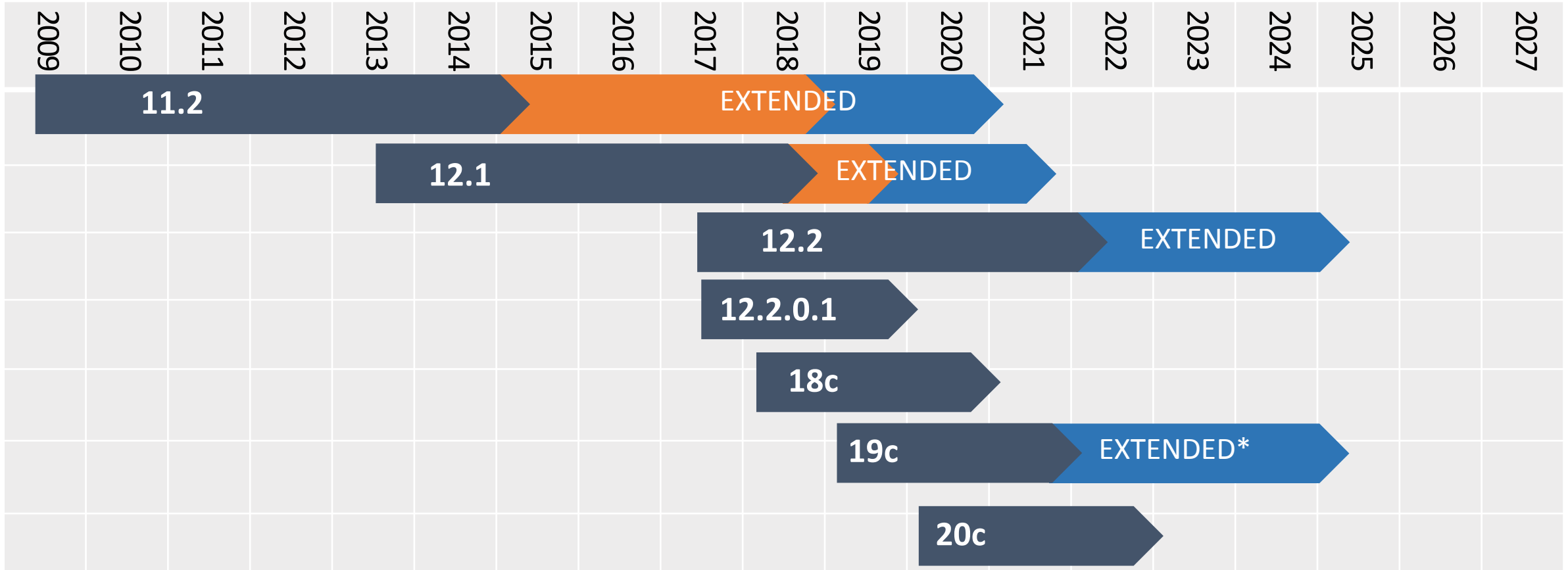
19.2.1 First Release Update Revision

Oracle's Next 3 Databases: 18c/19c/20c Lifetime Support

18c Oracle Database

19c Oracle Database

20c Oracle Database



***Oracle Database 19c is expected to the long term support release. Always check MOS Note 742060.1 for the latest schedule.**

Premier | **Waived Extended Support Fee** | **Paid Extended Support**

Performance Improvements

18c Oracle Database

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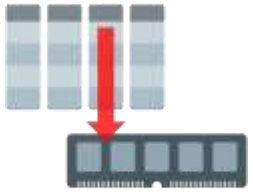
Oracle 12.1.0.2



- In-Memory Column Store
- Software in Silicon
- Engineered Systems

Oracle 18c

- Low Latency Memory Transactions
- In-Memory Column Store Improvements
  - Performance improvements
  - Automatic Population
- Non Volatile Memory Support
  - Multi Tiered Database Cache

Non Volatile Memory keeps its contents even if the power is lost.

In-Memory buffer for IOT gives 21M inserts/sec

18c Oracle Database

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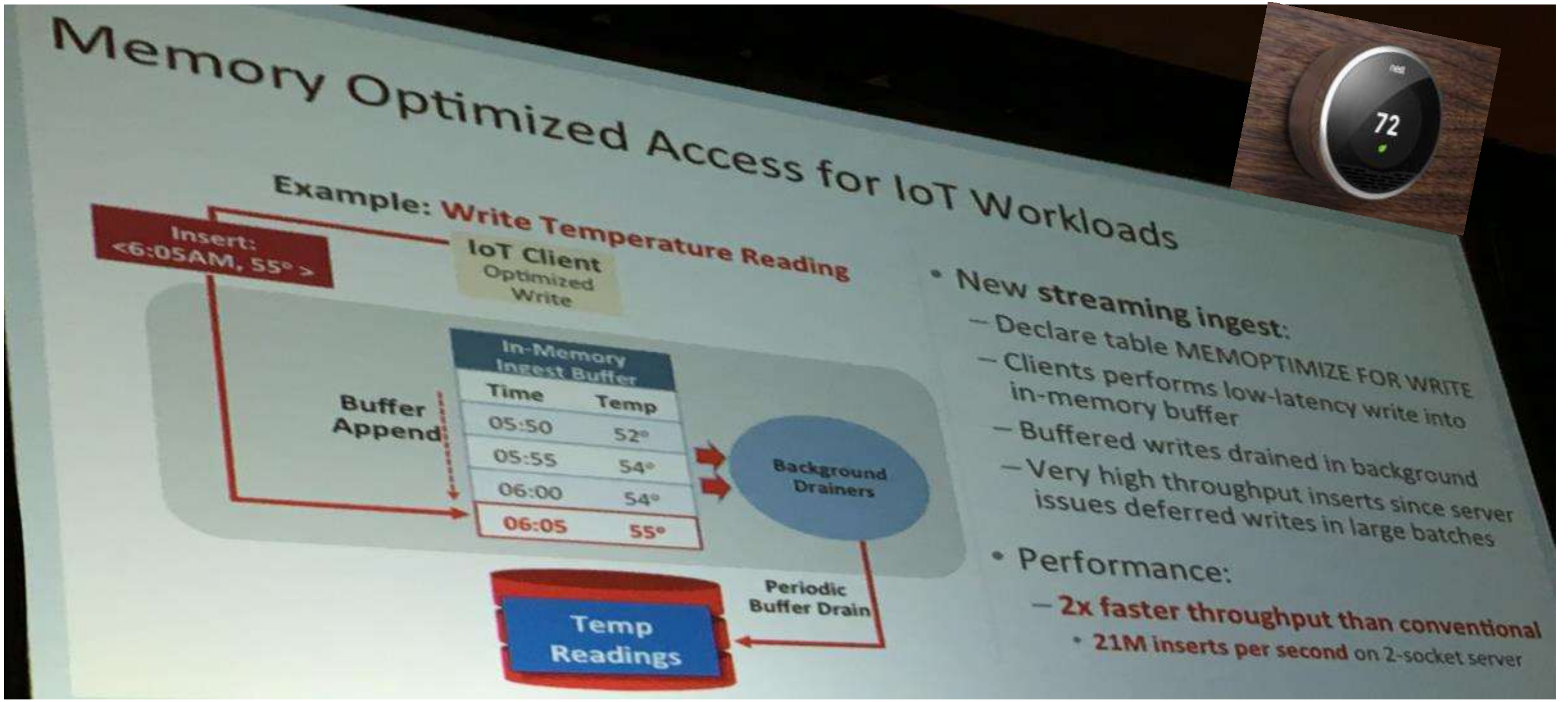

Multitenant

18c Oracle Database

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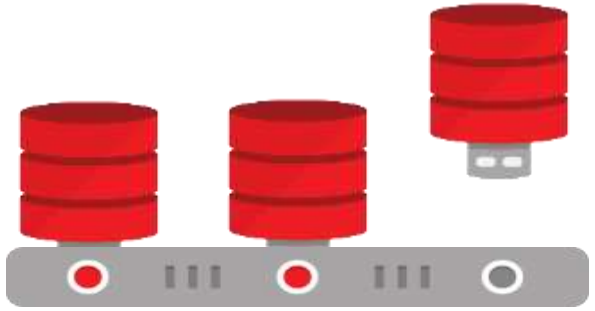
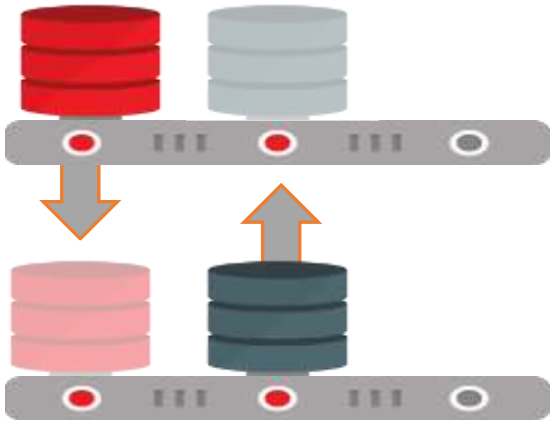
Oracle 12c



- Container managed database virtualization
- Manage Many as one (Great!)
  - Patching, Backup, Security, Online Cloning, Online Relocation

Oracle Database 18c



- Per-PDB Switchover
- Transportable Backups
- Snapshot Carousel
- Faster Upgrades

Snapshot Carousel

18c Oracle Database

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Just Another DBA Task…

Snapshot Carousel

18c Oracle Database

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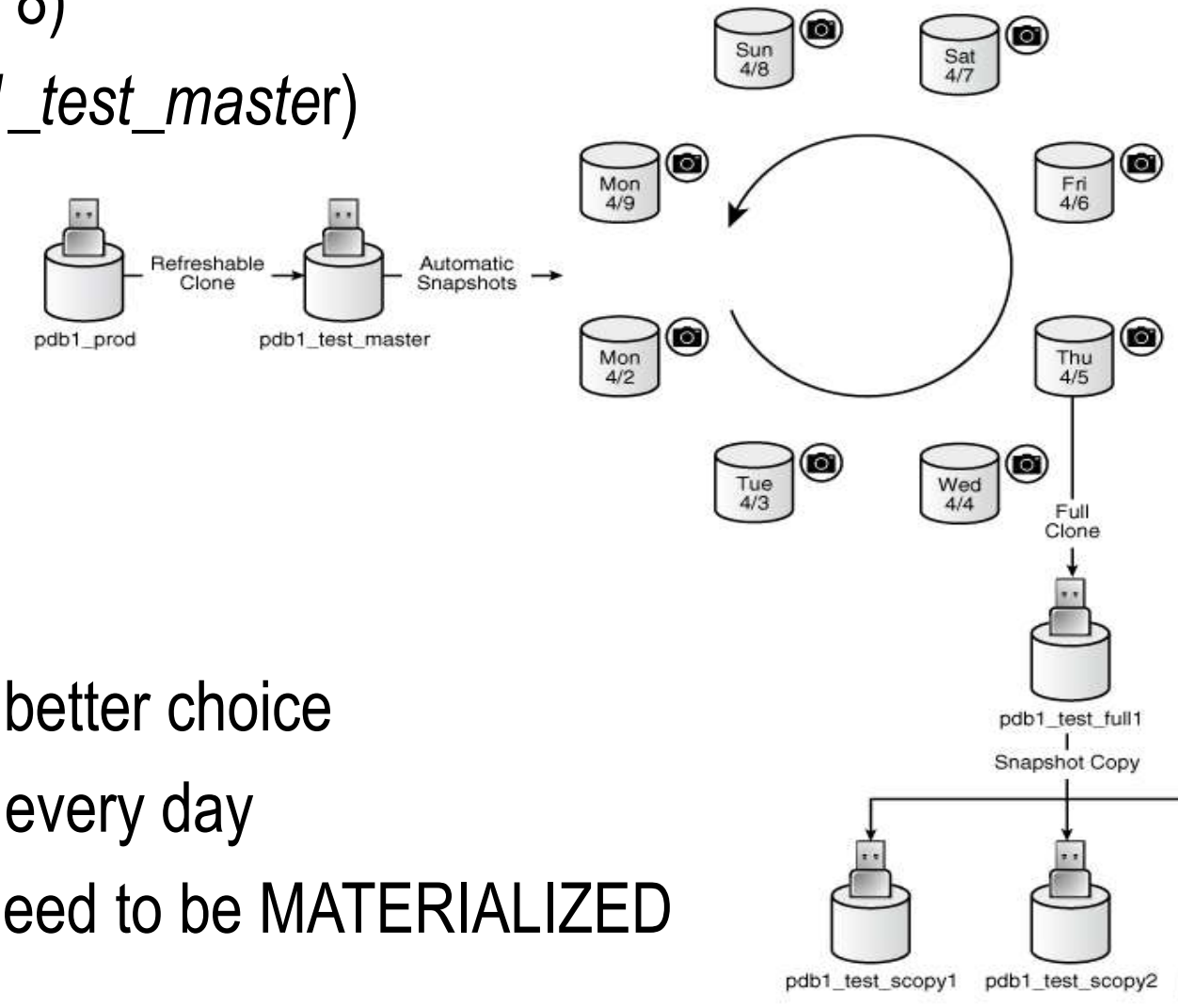
- Point in Time PDB Copy (Default is 8)
- Create a Refreshable Master (*pdb1_test_master*)
- Master creates clones daily
- Use for testing
- Use to make clones
- Use to restore back in time
- Could take 1 per day at 12:01AM
- Could refresh more often if that's a better choice
- Could take one prior to a data load every day
- Creates a FULL PDB … does not need to be MATERIALIZED



Snapshot Carousel

18c Oracle Database

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Number of Snapshots for a given PDB:

```
SELECT        r.CON_ID, p.PDB_NAME, PROPERTY_NAME, PROPERTY_VALUE AS value,
              DESCRIPTION
FROM          CDB_PROPERTIES r, CDB_PDBS p
WHERE         r.CON_ID = p.CON_ID AND    PROPERTY_NAME LIKE 'MAX_PDB%'
ORDER BY      PROPERTY_NAME;

CON_ID PDB_NAME   PROPERTY_NAME      VAL DESCRIPTION
------ --------- ----------------- --- ------------------------------------
     3 CDB1_PDB1 MAX_PDB_SNAPSHOTS   8 maximum number of snapshots for a given PDB
```

*Note that a hot clone is transactionally consistent with the source PDB as of the SCN at the completion of the `ALTER PLUGGABLE DATABASE ... OPEN` statement.

Snapshot Carousel

18c Oracle Database

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Change to 7 Snapshots:

```
ALTER PLUGGABLE DATABASE SET MAX_PDB_SNAPSHOTS=7;
```

Drop all Snapshots:

```
ALTER PLUGGABLE DATABASE SET MAX_PDB_SNAPSHOTS=0;
```

(Fastest way to DROP ALL SNAPSHOTS vs. Dropping them all individually)

You can also set the following parameter:

MAX_PDB_SNAPSHOTS to 0 or…

Snapshot Carousel

18c Oracle Database

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Set the Snapshot Mode to be once per day (note that the name is system generated):

```
ALTER PLUGGABLE DATABASE SNAPSHOT MODE EVERY 24 HOURS;
```

Check the Snapshot Mode:

```
SELECT SNAPSHOT_MODE "S_MODE", SNAPSHOT_INTERVAL/60 "SNAP_HRS"
FROM DBA_PDBS;

S_MODE      SNAP_HRS
------ ------------
AUTO              24
```

Make the Snapshot Mode every 2 hours (note that the name is system generated):

```
ALTER PLUGGABLE DATABASE SNAPSHOT MODE EVERY 120 MINUTES;
```

Snapshot Carousel – Manually Create with Specified Name

Can also create a snapshot before/after a data load:

```
ALTER PLUGGABLE DATABASE SNAPSHOT cdb1_pdb1_before;
```

<perform a data load>

```
ALTER PLUGGABLE DATABASE SNAPSHOT cdb1_pdb1_after;
```

*Note that the PDB is the one you are logged into, the snapshot filename will be system generated and will be in the dbs directory with name starting with snap_

```
ALTER PLUGGABLE DATABASE DROP SNAPSHOT cdb1_pdb1_before;
```

Snapshot Carousel

18c Oracle Database

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More information on Snapshots:

```
SELECT    CON_ID, CON_NAME, SNAPSHOT_NAME, SNAPSHOT_SCN
          AS snap_scn, FULL_SNAPSHOT_PATH
FROM      DBA_PDB_SNAPSHOTS
ORDER BY SNAP_SCN;
```

```
CON_ID CON_NAME   SNAPSHOT_NAME     SNAP_SCN FULL_SNAPSHOT_PATH
------ ---------- ---------------- -------- ------------------------------
3       CDB1_PDB1  CDB1_PDB1_BEFORE 2962078 /…/dbs/snap_3489077498_2962078.pdb
3       CDB1_PDB1  CDB1_PDB1_AFTER  2962938 /…/dbs/snap_3489077498_2962938.pdb
…
```

Snapshot Carousel

18c Oracle Database

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Important Notes:

- A PDB snapshot created with USING SNAPSHOT (this is how the Snapshot Carousel creates Snapshot) and a snapshot copy PDB created with the SNAPSHOT COPY clause are different. USING SNAPSHOT clause creates full PDB (Snapshot Carousel) that does not need to be materialized. The SNAPSHOT COPY clause creates a sparse PDB that must be materialized if you want to drop the PDB snapshot on which it is based.
- A Snapshot COPY (underlying storage matters & CLONEDB parameter) is dependent on the storage snapshot (coordinated with hardware level)… you can't unplug the Snapshot COPY PDB from the CDB (you can DROP it) – you must MATERIALIZE it to make it a full PDB with non-sparse files. Below, PDB1 is PDB, PDB1_SNAP3 is PDB1 at an SCN/time.

```
CREATE PLUGGABLE DATABASE pdb1_snap_copy FROM pdb1 USING SNAPSHOT pdb1_snap3 SNAPSHOT COPY;
ALTER PLUGGABLE DATABASE ... MATERIALIZE;
```

- 18c also has ASM Split Mirror Clone PDBs

Per PDB **Switchover**

18c Oracle Database

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PDB Switchover Clause

18c Oracle Database

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- Reverses the roles between a refreshable clone PDB and a primary PDB.
- The former Refreshable clone PDB becomes the primary PDB, which can now be opened in read write mode.
- The *formerly* primary PDB now is the refreshable clone and can only be opened in READ ONLY mode.
- This command must be executed from the primary PDB.
- The dblink must point to the root CDB where the refreshable clone PDB resides.

```
alter pluggable database refresh mode auto every 2
 minutes from new_pdb@dblink switchover;
```

Per-PDB Switchover

18c Oracle Database

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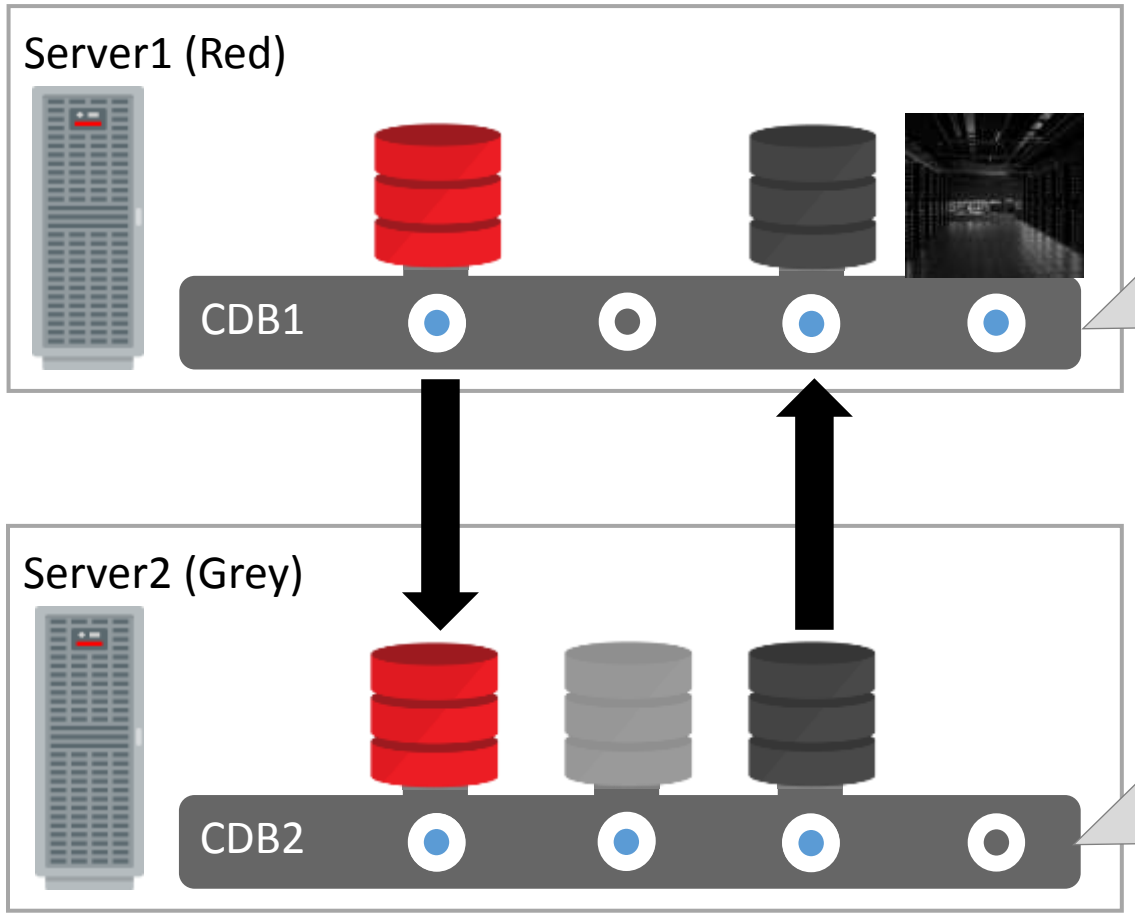


```
create pluggable database Grey
from Grey@CDB2_Link
refresh mode auto every 2 minutes;
```

```
create pluggable database Red
from Red@CDB1_Link
refresh mode auto every 2 minutes;
```

Per-PDB Switchover

18c Oracle Database

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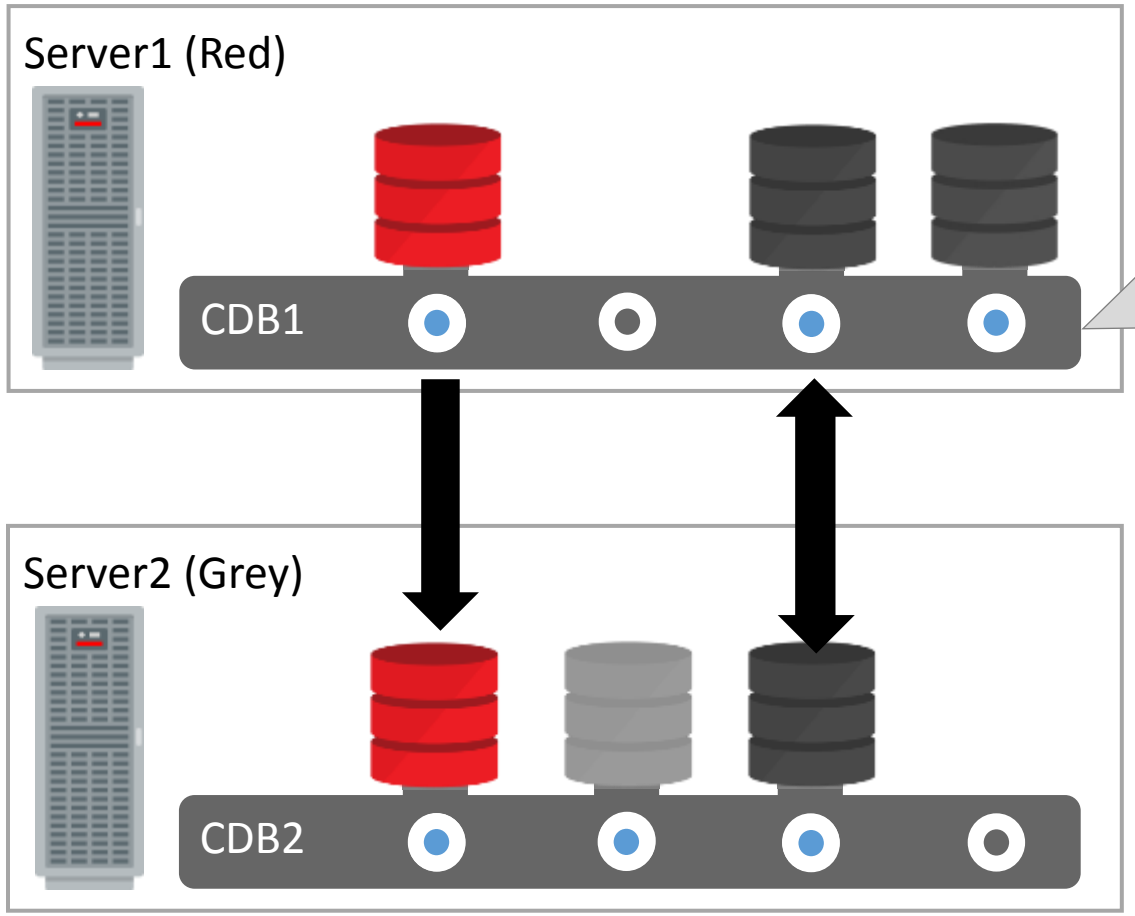

1. alter pluggable database refresh mode auto every 2 minutes from Grey@dblink **switchover**;
2. alter pluggable database Grey open read write;

Data Warehousing and Big Data

18c Oracle Database

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Today

- The most advanced analytics engine available today
  - Partitioning, Compression, SQL, Analytical Views, Analytical SQL, Data Mining
- Easily analyze data held in Hadoop with Big Data SQL
- Big Data Appliance

Oracle Database 18c

- In-Memory for external tables
- Automatic propagation of nologged data to standby
- More Machine Learning algorithms
- Polymorphic Table Functions
- Alter Table Merge Partition Online
- Approximate Query Improvements

In-Memory External Tables

18c Oracle Database

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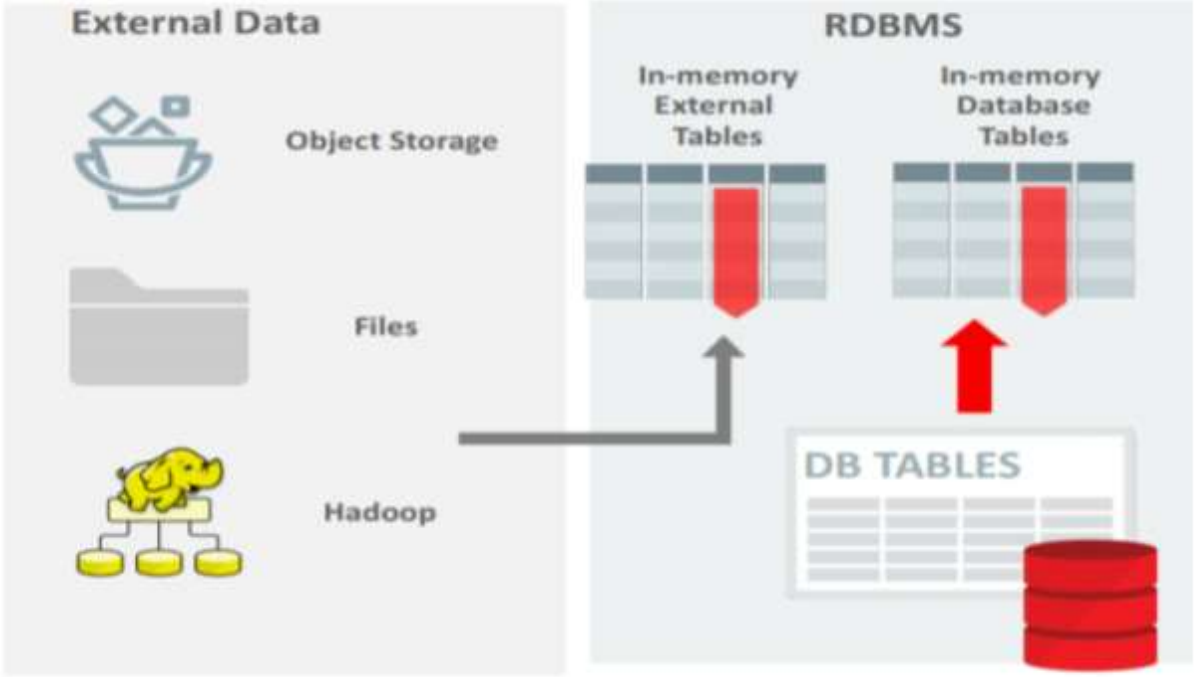
In-Memory For External Tables

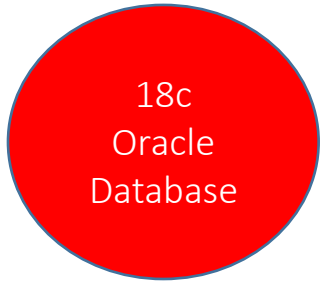
Fast Analytics on External Data



- External Tables allow transparent access to data outside the DB
- In-Memory For External Tables builds in-memory column cache of data outside the DB for ultra-fast analytics on external data
- All In-Memory Optimizations apply
  - Vector processing, JSON expressions extend transparently to external data
- Up to 100X faster

ORACLE

In-Memory External Tables



- You can specify the INMEMORY clause for individual columns in an internal table. **External tables do not support specifying INMEMORY at the column level**.
- Benefit by running advanced analytics on other data sources outside of the Oracle database.
- Data from external sources such as Hadoop or other Big Data sources can be summarized and populated into the IM column store.
- **Run ad hoc analytic queries that might be too expensive in performance to run on source data.**

In-Memory External Tables

18c Oracle Database

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```
CREATE TABLE big_hadoop_table (cust_no NUMBER, …)
     ORGANIZATION EXTERNAL
     ( TYPE ORACLE_LOADER
       DEFAULT DIRECTORY admin_dat_dir
       ACCESS PARAMETERS
       ( records delimited by newline
         badfile admin_bad_dir:'…bad'
         logfile admin_log_dir:`...log'
         fields terminated by ','
         missing field values are null
         ( prod_no, … ) )
       LOCATION (`filename.csv'))
     REJECT LIMIT UNLIMITED
     INMEMORY;
```

In-Memory External Tables

18c Oracle Database

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Check In-Memory External Tables:

```
SELECT OWNER,TABLE_NAME,INMEMORY,INMEMORY_COMPRESSION
FROM   ALL_EXTERNAL_TABLES
WHERE  TABLE_NAME = 'BIG_HADOOP_TABLE';

OWNER      TABLE_NAME          INMEMORY INMEMORY_COMPRESS
---------- ------------------- -------- ------------------
RICH       BIG_HADOOP_TABLE    ENABLED  FOR QUERY LOW
```

- Other In-Memory Enhancements include: Automatic In-Memory, Flexible Parallelization Using In-Memory Dynamic Scans, and **In-Memory Optimized Arithmetic**

Oracle 18c – Inline External Tables

18c Oracle Database

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Inline external tables

- External table definition provided at runtime
  - Similar to inline view
- No need to pre-create external tables that are used one time only
  - Increased developer productivity

```
CREATE TABLE sales_xt
    (prod_id number, … )
     TYPE ORACLE_LOADER
     …
     LOCATION 'new_sales_kw13')
     REJECT LIMIT UNLIMITED );
INSERT INTO sales SELECT * FROM
sales_xt;
DROP TABLE sales_xt;
```

```
INSERT INTO sales
SELECT sales_xt.*
FROM EXTERNAL(
      (prod_id number, … )
       TYPE ORACLE_LOADER
       …
       LOCATION 'new_sales_kw13')
       REJECT LIMIT UNLIMITED );
```

ORACLE

Standby Nologging

18c
Oracle
Database

VISCOSITY
NORTH AMERICA

- Standby Nologging tells the database not to log operations that qualify to be done without logging.
- **Standby Nologging tells the database to send the data blocks created by the Nologging operation to each qualifying standby database in Data Guard** configuration
- <u>This typically results in those standbys NOT having invalid blocks.</u>
- You can **set standby no logging** for load performance or data availability in the following statements:
  - ALTER DATABASE
  - ALTER PLUGGABLE DATABASE
  - CREATE DATABASE
  - CREATE CONTROLFILE

Standby Nologging

18c Oracle Database

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- **Database nologging** extended for **better use with Oracle Active Data Guard** environment (without significantly increasing the amount of redo generated).

There are two new nologging modes:

- **Standby Nologging for Load Performance – Standbys receive non-logged data changes** (minimum impact on loading speed at). Non-logged blocks automatically **resolved by managed standby recovery**.
- **Standby Nologging for Data Availability** - Standbys have data when primary load commits (at the cost of throttling the speed of loading data at the primary), which means the **standbys never have any non-logged blocks to worry about**.
- ***Nologging*** *can be used when loading data into your production databases* ***without compromising the integrity of Data Guard standby databases****, pick your level of synchronization between primary & standby databases.*

Partitioning
Split Partitions Example in 12cR2


```
ALTER TABLE mytable
SPLIT PARTITION p1 at (100)
INTO (PARTITION p1_1, PARTITION p1_2) ONLINE;
```

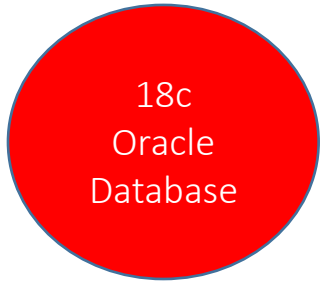
(Can Split Sub-Partitions too – both in 12cR2)

18c Oracle Database

In 18c: Alter Table **Merge Partition Online**
&
Alter Table **Merge Subpartition Online**

(Examples on next slide…)

Partitioning
Merge Partitions Example in 18c



- With UPDATE INDEXES clause, the indexes remain usable during the move operation

Merge Range Partitions:

```
ALTER TABLE four_seasons
MERGE PARTITIONS quarter_one, quarter_two
INTO PARTITION quarter_two UPDATE INDEXES ONLINE;
```

Merge List Partitions:

```
ALTER TABLE q1_sales_by_region
MERGE PARTITIONS q1_northcentral, q1_southcentral
INTO PARTITION q1_central STORAGE(MAXEXTENTS 20) ONLINE;
```

Approximate Query Expanded in 12cR2
Advances in 18c – Top-N

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Oracle Database 12c 12c
Release 2 Performance
Tuning Tips and Techniques

Other initialization parameters:

approx_for_aggregation=TRUE

approx_for_percentile=TRUE

Other Approximate Functions:

- APPROX_COUNT_DISTINCT_DETAIL
- APPROX_COUNT_DISTINCT_AGG
- TO_APPROX_COUNT_DISTINCT
- APPROX_MEDIAN
- APPROX_PERCENTILE
- APPROX_PERCENTILE_DETAIL
- APPROX_PERCENTILE_AGG
- TO_APPROX_PERCENTILE

18c Oracle Database

In 18c: Top-N Approximate Aggregation

Also in 12cR2 is support for Materialized Views and Query Rewrite

Oracle 18c – Top-N Approximate Aggregation

18c Oracle Database

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Top-N approximate aggregation

- Approximate results for common top n queries
  - Approximately how many page views did the top five blog posts get last week?
  - What were the top 50 customers in each region and their approximate spending?
- Order of magnitudes faster processing with high accuracy (error rate < 0.5%)
- New approximate functions APPROX_COUNT(), APPROX_SUM(), APPROX_RANK()

Top 5 blogs with approximate hits

```
SELECT blog_post, APPROX_COUNT(*)
FROM weblog
GROUP BY blog_post
FETCH FIRST 5 ROWS ONLY;
```

Top 50 customers per region with approximate spending

```
SELECT region, customer_name,
       APPROX_RANK(PARTITION BY region
                   ORDER BY APPROX_SUM(sales) DESC) appr_rank,
       APPROX_SUM(sales) appr_sales
FROM sales_transactions
GROUP BY region, customer_name
HAVING APPROX_RANK(..) <=50;
```

Oracle 18c – Top-N Approximate Aggregation

18c Oracle Database

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- Getting the Top-10 values (using APPROX_SUM) when used with the APPROX_RANK function.

```
SELECT    department_id, job_id, APPROX_SUM(salary)
FROM      employees
GROUP BY department_id, job_id
HAVING    APPROX_RANK
         (PARTITION BY department_id
          ORDER BY APPROX_SUM(salary)
          DESC ) <= 10;
```

APPROX_RANK Experiment (Oracle on 18c)
1G Temp to 0; 1G+ Sort to only 50M

18c Oracle Database

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Operation	Name	Line ID	Estimated Rows	Cost	Timeline(101s)	Executions	Actual Rows	Memory (Max)	Temp (Max)	Other	IO Requests	IO Bytes	Activity %
SELECT STATEMENT		0				33	4,492						
PX COORDINATOR		1				33	4,492						
PX SEND QC (RANDOM)	:TQ10001	2	200M	1,287K		16	4,492						
VIEW		3	200M	1,287K		16	4,492						
WINDOW SORT PUSHED RANK		4	200M	1,287K		16	6,814	813MB	32MB		4	48KB	.8
SORT GROUP BY		5	200M	1,287K		16	14M	1GB	1GB		8,147	2GB	26
PX RECEIVE		6	200M	1,287K		16	195M						.68
PX SEND HASH	:TQ10000	7	200M	1,287K		16	195M						2.46
SORT GROUP BY		8	200M	1,287K		16	195M	101MB					1.72
PX BLOCK ITERATOR		9	200M	1,086K		16	200M						
TABLE ACCESS FULL			200M	1,086K		468	200M				449K	438GB	68

Lots of temp

Exact query

Operation	Name	Line ID	Estimated Rows	Cost	Timeline(71s)	Executions	Actual Rows	Memory (Max)	Temp (Max)	Other	IO Requests	IO Bytes	Activity %
SELECT STATEMENT		0				33	4,245						
PX COORDINATOR		1				33	4,245						
PX SEND QC (RANDOM)	:TQ10001	2	4,370	1,083K		16	4,245						
SORT GROUP BY APPROX		3	4,370	1,083K		16	4,245	3MB					
PX RECEIVE		4	4,370	1,083K		16	6,919						
PX SEND HASH	:TQ10000	5	4,370	1,083K		16	6,919						
SORT GROUP BY APPROX		6	4,370	1,083K		16	6,919	47MB					15
PX BLOCK ITERATOR		7	200M	1,082K		16	200M						
TABLE ACCESS FULL			200M	1,082K		468	200M				449K	438GB	85

20X memory reduction

No temp

Approx query

Polymorphic Tables

18c Oracle Database

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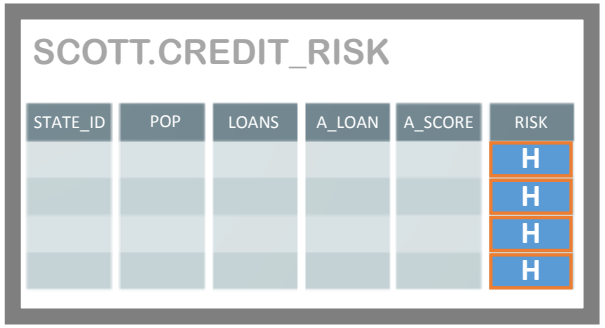
- Moves more processing back inside DB
- Simpler to design and build
- Simpler to deploy
- Provides complete reusability
- Simpler integration with existing and future performance optimizations



Polymorphic table functions

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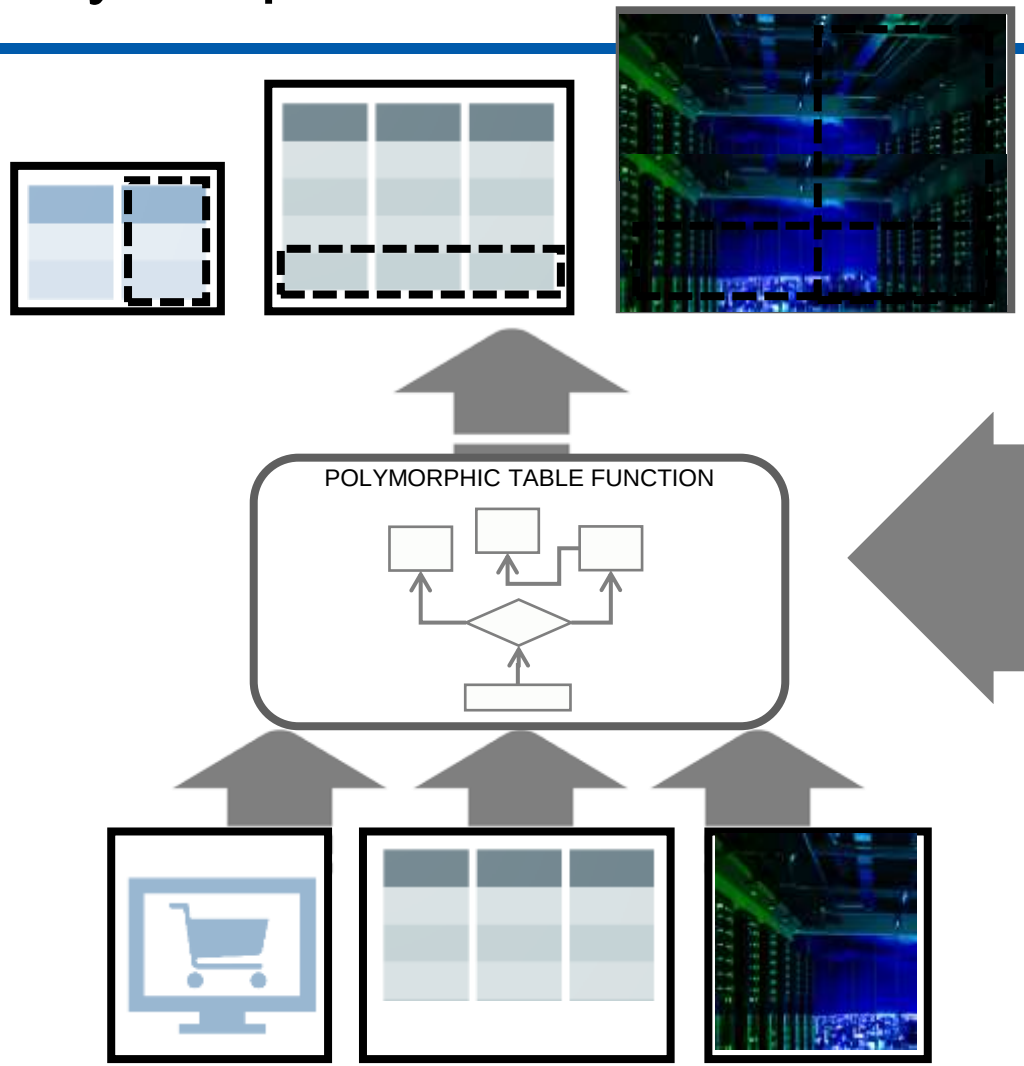


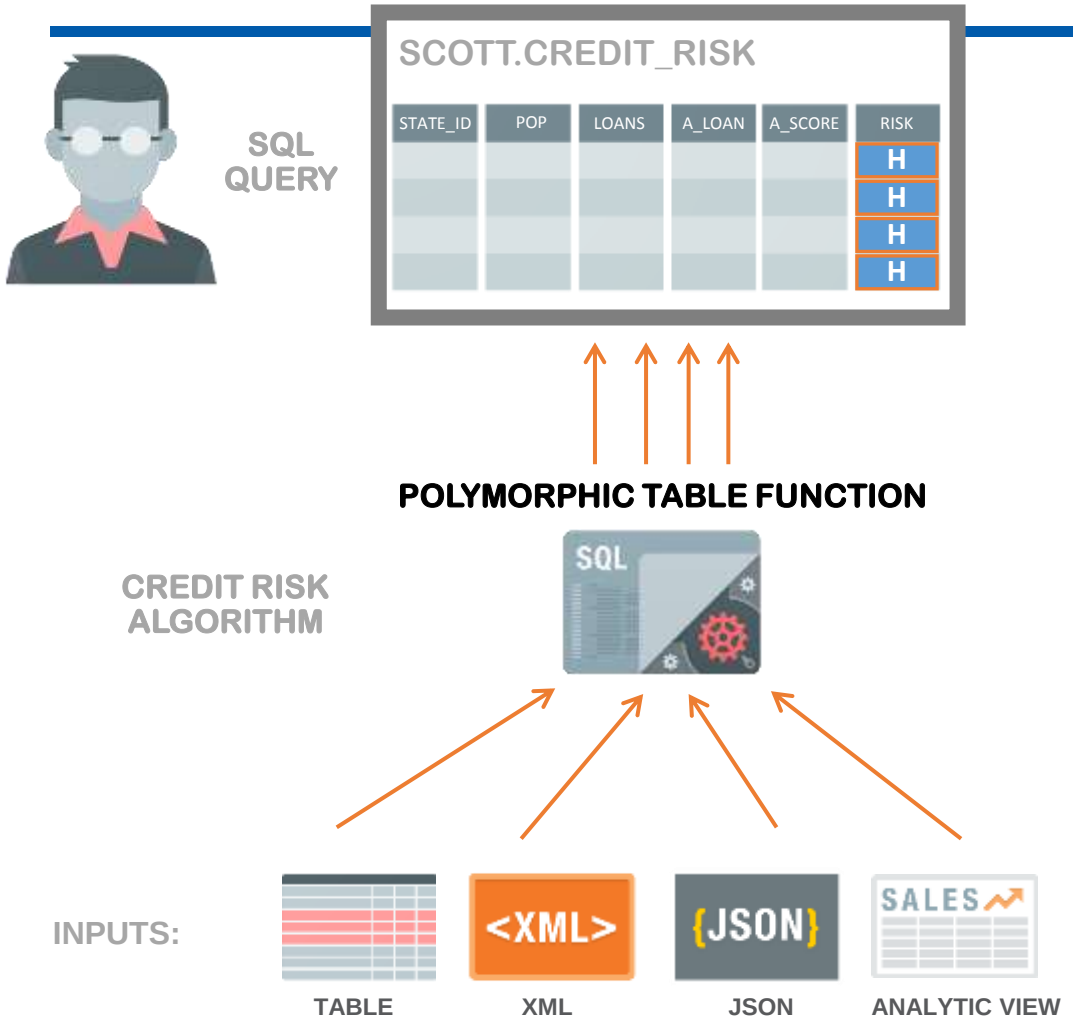
3. Result sets can contain **more/fewer columns** and **more/fewer rows**

2. Hides sophisticated custom computations

1. Accepts any table

Polymorphic Tables: Self-Describing, Fully Dynamic SQL

18c Oracle Database



- Part of ANSI 2016
- Encapsulate **sophisticated algorithms**
  - Hides implementation of algorithms
  - Leverage powerful, dynamic capabilities of SQL
  - Pass in any table-columns for processing
  - Returns SQL rowset (table, JSON, XML doc etc)
    - E.g. return credit score and associated risk level

```
SELECT
 state_id, . . .,  AVG(credit_score), risk
FROM CREDIT_RISK(
  tab  => scott.customers,
  cols => columns(dob, zip,loan_default),
  outs => columns(credit_score, risk_level))
WHERE risk_level = 'High'
GROUP BY state_id;
```

Zero Impact GI Patching, Sharded RAC

18c Oracle Database

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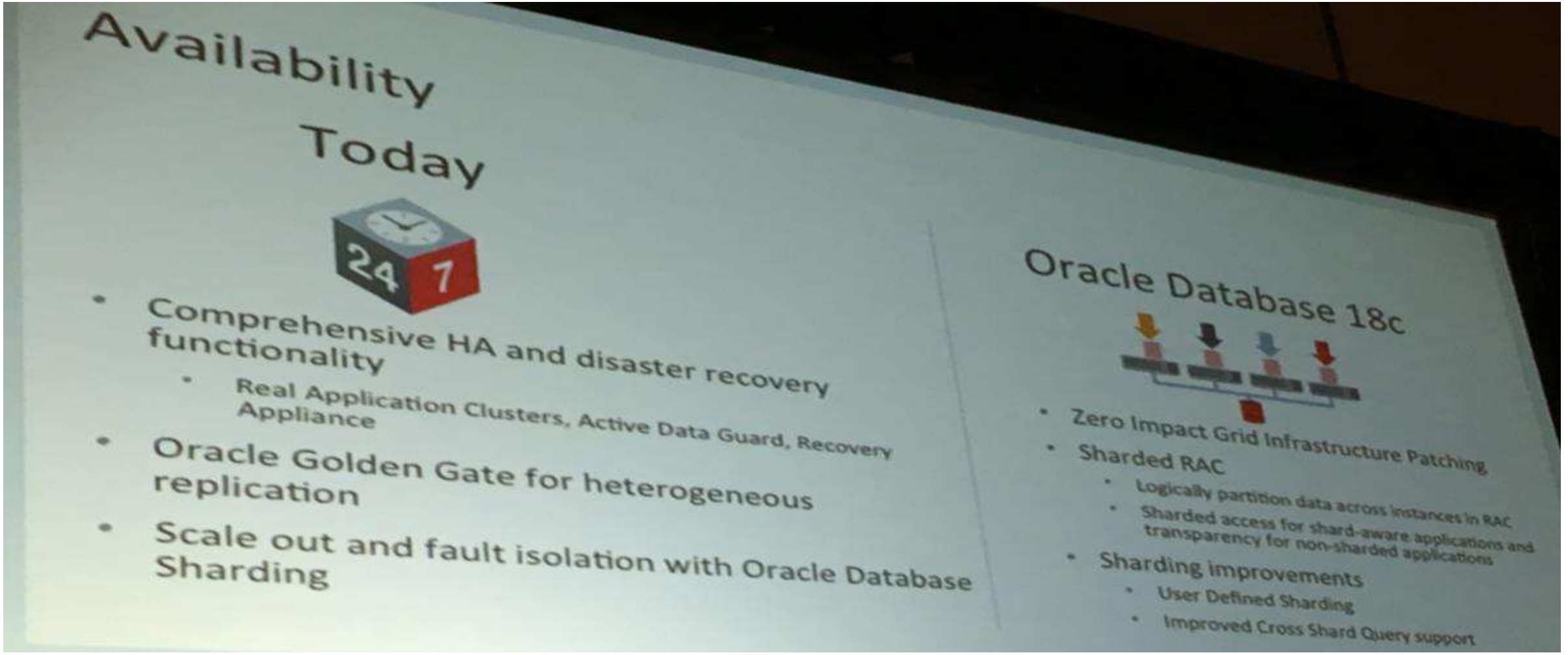

Note: Lot's of people do not know that GI PSU needs to be applied to GI stack and DB stack

Statistics Maintenance for Sharded Tables

Collect Statistics in Shard Coordinator – fyi only

18c Oracle Database

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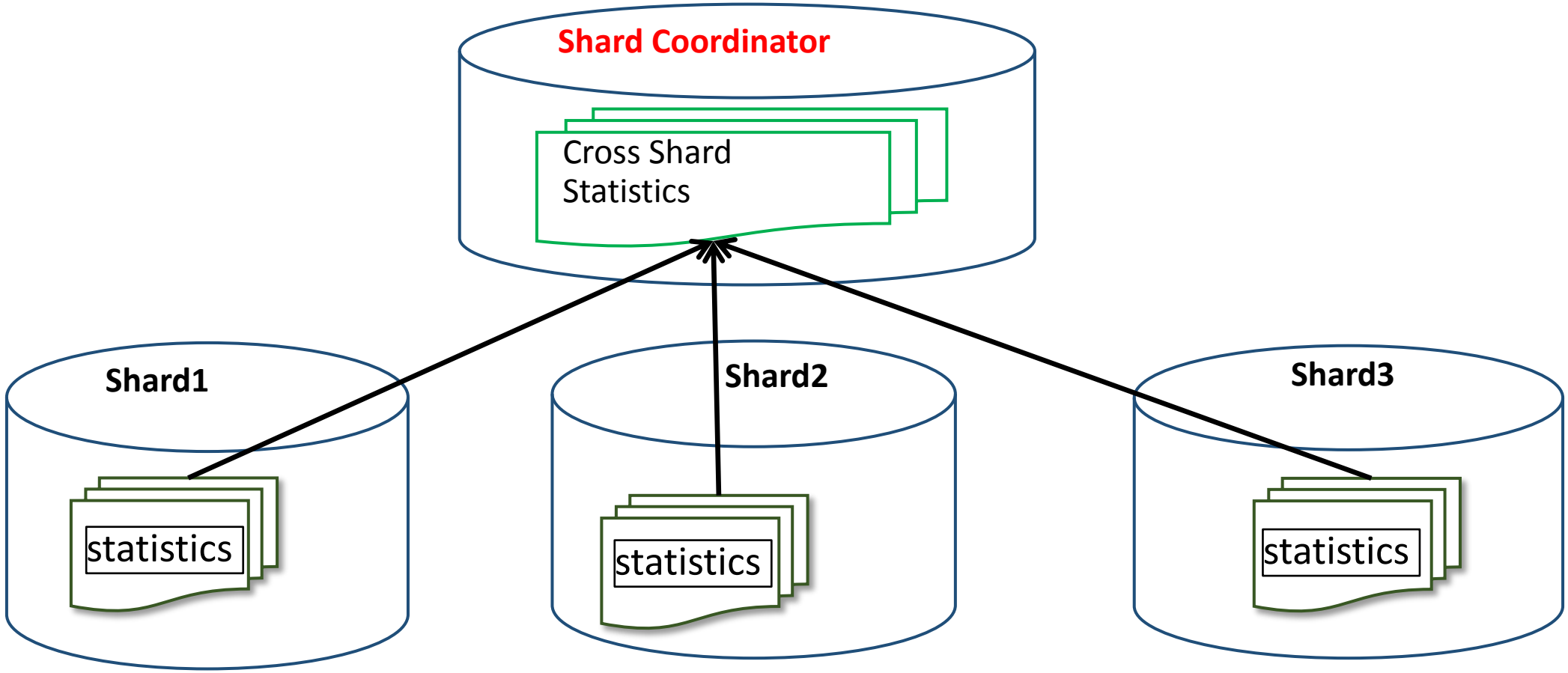

Many Improvements for Sharding included Sharded RAC & Sharded DB with Spatial data types

Private temporary tables

Transient tables useful for reporting applications

18c Oracle Database

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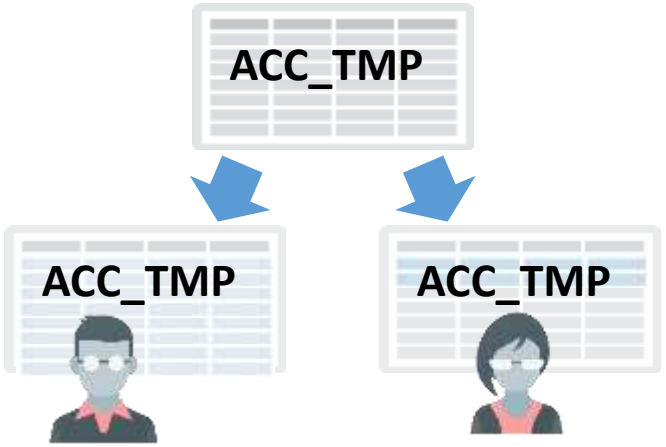

Global temporary tables (Pre-18c)

- Persistent, **shared** (global) **table definition**
- Temporary, **private** (session-based) **data content**
  - Data physically exists for a transaction or session
  - Session-private statistics

Private temporary tables (18c+)

- Temporary, **private (session-based) table definition**
  - Private table name and shape
- Temporary, **private (session-based) data content**
  - Session or transaction duration

Private temporary tables vs. Global temporary Tables FYI Only…

Characteristic	Global Temporary Table	Private Temporary Table	Cursor-Duration Temporary Table
Visibility of Data	Session inserting data	Session inserting data	Session inserting data
Storage of Data	Persistent	Memory or tempfiles, but only for the duration of the session or transaction	Only in memory
Visibility of Metadata	**All sessions**	**Session that created table** (in `USER_PRIVATE_TEMP_TABLES` view, which is based on a `V$` view)	Session executing cursor
Duration of Metadata	Until table is explicitly dropped	Until table is explicitly dropped, or end of session (`PRESERVE DEFINITION`) or transaction (`DROP DEFINITION`)	Until cursor ages out of shared pool
Creation of Table	**`CREATE GLOBAL TEMPORARY`** `TABLE`(supports `AS SELECT`)	**`CREATE PRIVATE TEMPORARY`** `TABLE`(supports `AS SELECT`)	Implicitly created when optimizer considers it useful
Effect of Creation on Existing Transactions	No implicit commit	No implicit commit	No implicit commit
Naming Rules	Same as for permanent tables	Must begin with `ORA$PTT_`	Internally generated unique name
Dropping of Table	`DROP GLOBAL TEMPORARY TABLE`	`DROP PRIVATE TEMPORARY TABLE`, or implicitly dropped at end of session (`PRESERVE DEFINITION`) or transaction (`DROP DEFINITION`)	Implicitly dropped at end of session

Oracle Read-Only Oracle Home

18c Oracle Database

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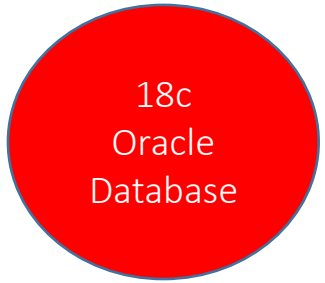
- Some Files that used to be in ORACLE_HOME are in ORACLE_BASE_HOME and ORACLE_BASE_CONFIG
- Biggest **benefit is Patching and Update the Database** without large downtimes.
- One Read-Only Image can be to distribute to many Databases
- Note "**roohctl**": "rooh" stands for Read Only Oracle Home. To enable/help commands:

```
$roohctl -enable (next, run ./dbca from the bin directory)
$roohctl -help

Following are the possible commands:
-enable Enable Read-only Oracle Home
-disable Disable Read-only Oracle Home
```

Oracle Read-Only Oracle Home & RPM Install



- **The database tools and processes write under the ORACLE_BASE path instead of under the Oracle home directory.**
- **A read-only Oracle home separates the software from the database configuration information and log files.**
- This separation enables you to easily share the software across different deployments.
- **A read-only Oracle home also simplifies version control and standardization.**

- Oracle 18c also includes an **RPM-based Database Installation:**
  - `$rpm -ivh` (performs preinstallation validations, extracts packaged software, reassigns ownership, executes root operations for the installation...etc.)

Oracle 18c XE will come out in 2018

18c Oracle Database

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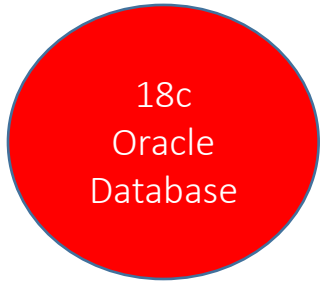
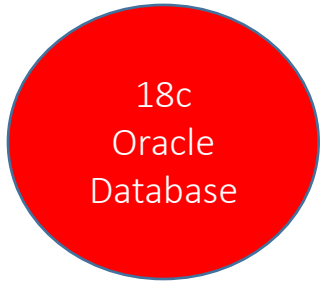
- The Express Edition (XE) is free use for development or production (not recommended)
- Expected Calendar Year 2018
- Nearly all functionality is Included
- Limited to 12G of user storage (was 11G in 11g)
- Limited to 2G of SGA

Oracle 18c – Other Features



- **Private Temporary Tables** 18c (to go along with current Global Temporary Tables)
- **Official Docker Support** for 18c (and RAC Support Coming)
- Standby support for NOLOGGING operations (propagate nologged data to standby)
- ONLINE Partition Merge
- Approximate Query Enhancements (Top-N approximate aggregation)
- In-Memory External Tables
- In-Memory Management
- In-Memory Dynamic Scans & In-Memory Optimized Arithmetic (Data Warehouses)
- In-Memory for Extreme Capacity NVRAM Memory (e.g. Flash – stores with power off)

Oracle 18c – Other Features



- **Transportable Backups**
- **Snapshot Carousel**
- Affinitizes shards to RAC instances
- Sharded RAC - Requests that don't specify sharding key still work transparently
- Per PDB Key Storage
- **Password-less schema creation**
- Integration with Active Directory
- More Calculations with Analytics Views
- **Not just Star Schema Support for Analytics Views (Snowflake & Flat/Denormalized)**

livesql.oracle.com (play with 18c Live – ***NOT*** DBA though)

Two major Announcements by Larry (excluding 18c) Autonomous Database & Machine Learning (ML)Security

(Next sections' slides included from Rich Niemiec's: "What you Missed at OpenWorld")

Autonomous Database – Replacing the DBA?

Rich Niemiec @RichNiemiec · Oct 2

I'll ask #Pepper if she can tune my #database in 11 AM session on #innovation #iot #robotics #cloud at #oow17 #ioug #viscosityna #oracleace

Self Driving Database!
Autonomous Database – Larry Ellison presentation 9/22/2017

Oracle Platform as a Service Strategy: More Automation

Announcing: The World's First Autonomous "Self-Driving" Database

- Total Database Automation based on Machine Learning
- Eliminates 100% of the human labor associated with managing the database
- Database automatically upgrades, patches and tunes itself while running
- Unprecedented Reliability: SLA Guaranteed 99.995% Availability
  - Less that 30 minutes for all planned and unplanned downtime per year
- Available in December – Details at Oracle Open World

'DBAS ARE BEING ASKED TO UNDERSTAND WHAT BUSINESSES DO WITH DATA RATHER THAN JUST THE MECHANICS OF KEEPING THE DATABASE HEALTHY AND RUNNING.'

Autonomous Database – DBA Job Changing
No Tuning and yet price of Cloud Depends on Tuning!

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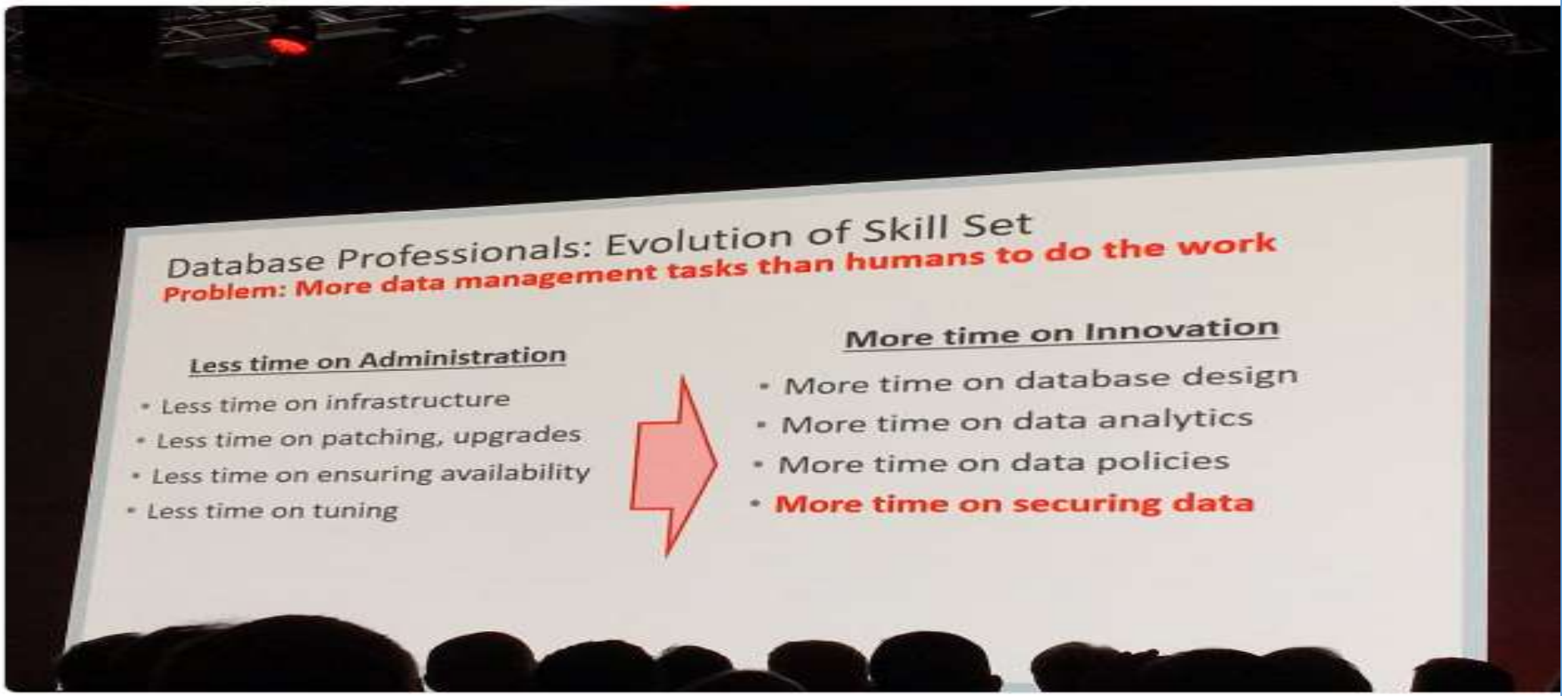
You Retweeted

Rich Niemiec @RichNiemiec · Oct 1

The #DBA time moves from patching to security & other areas. Rich says: Tune your Database before you move it to the #cloud to save money.



5 12

The Autonomous Database & the DBA

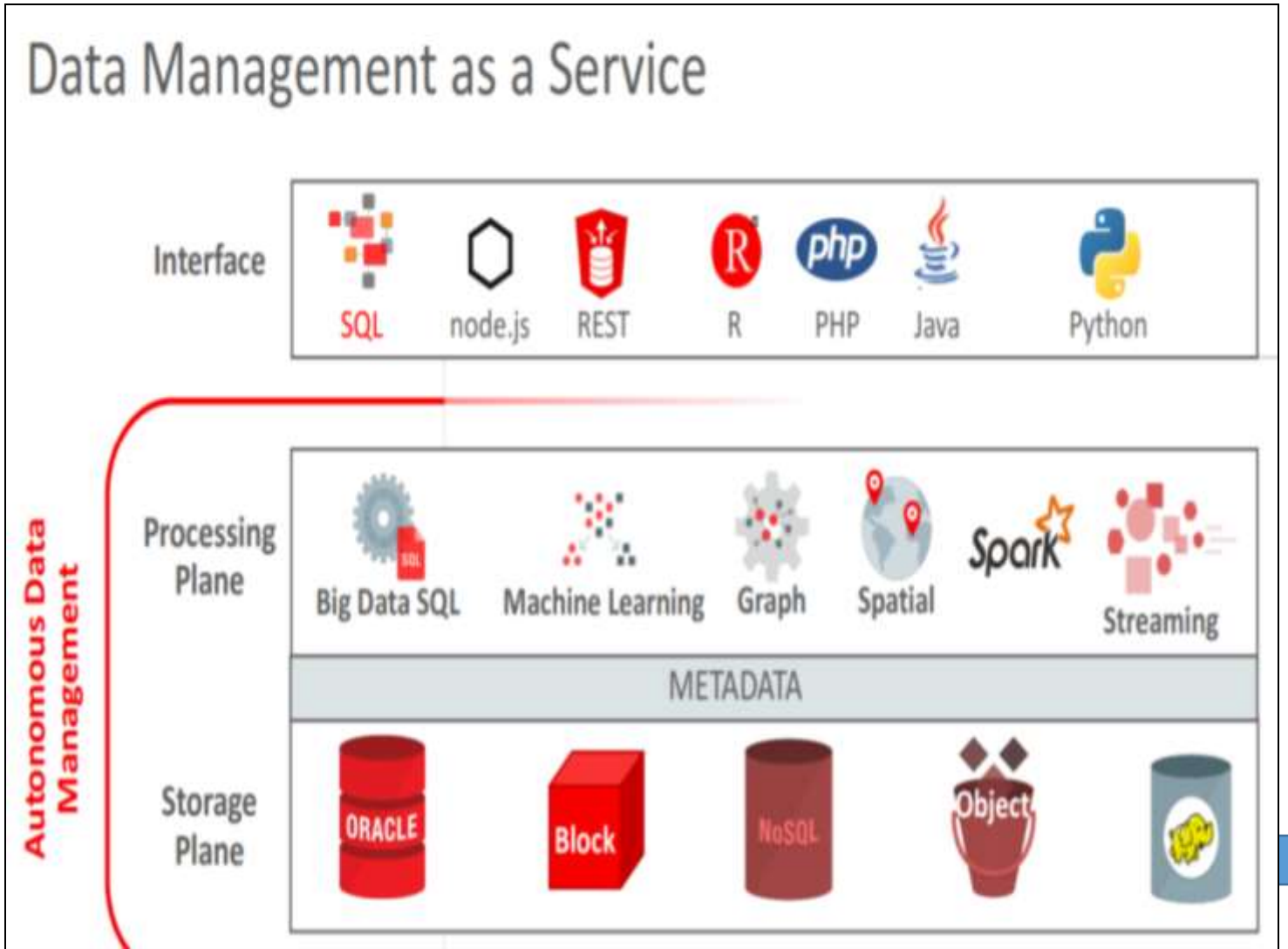
Adaptive
Machine Learning

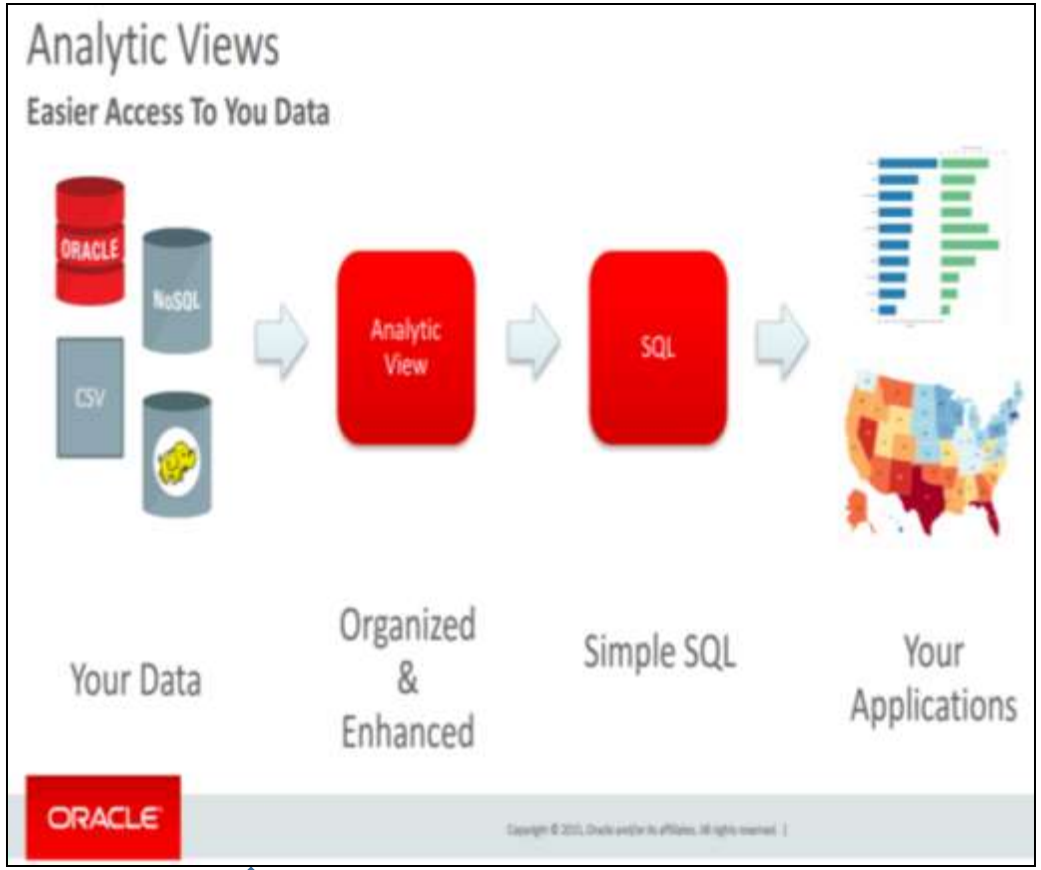
Autonomous Databases into the future:

- Who ensures database is tuned before it gets to the Cloud?
- Who ensures the cloud vendor is charging correctly?
- Who ensures the backup, security, or recovery is correct?
- Who decides what kind of service the databases will be?
- Who will build the policies for those autonomous databases?
- Who will have the knowledge to decide or estimate the cost of these services?
- Who decides the complex IT Infrastructure when we have more options & vendors?

- The answer is obvious: **A DBA**, but not a simple DBA; A DBA that has evolved with all this new generation of databases on Cloud. On-prem 18c has NO effect on DBA.

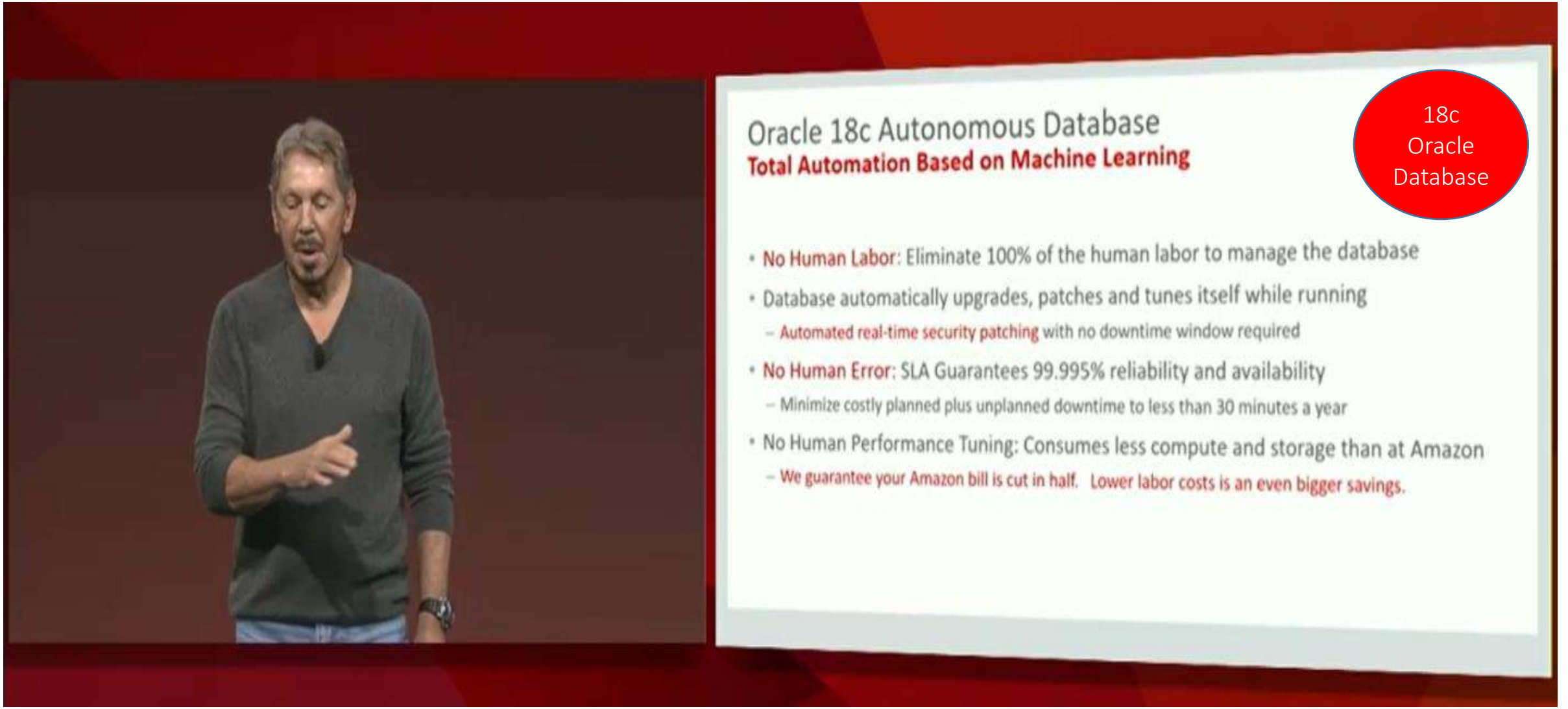
Become a Data Manager (DA) – Not just a DBA



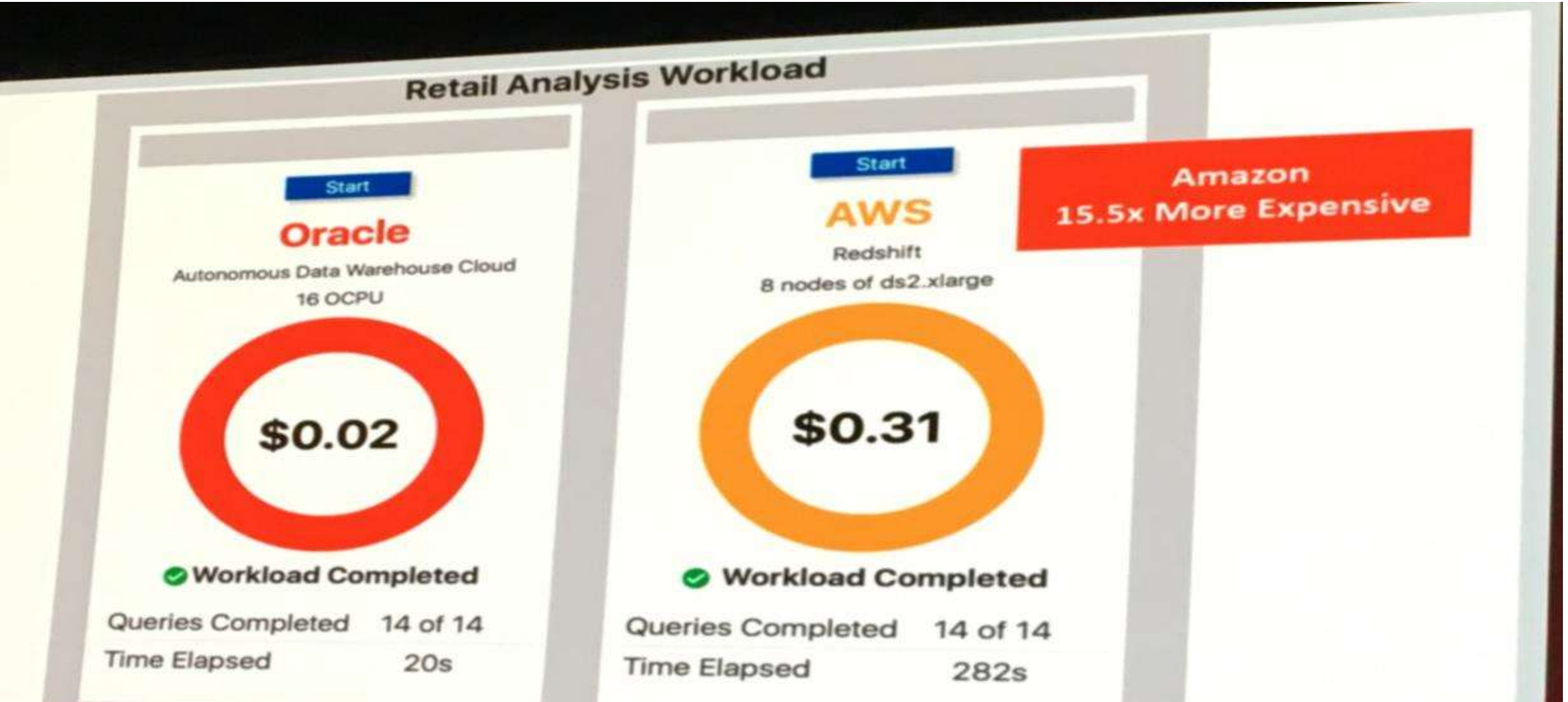


Data is the New Oil…

Autonomous Database – 99.995% (99.95% w/o Standby)
Patches itself, Backs itself up, Upgrades itself – Self-Driving!



Autonomous Database – Summary & Speed



Autonomous DB for OLTP will come in June 2018!

18c Oracle Database

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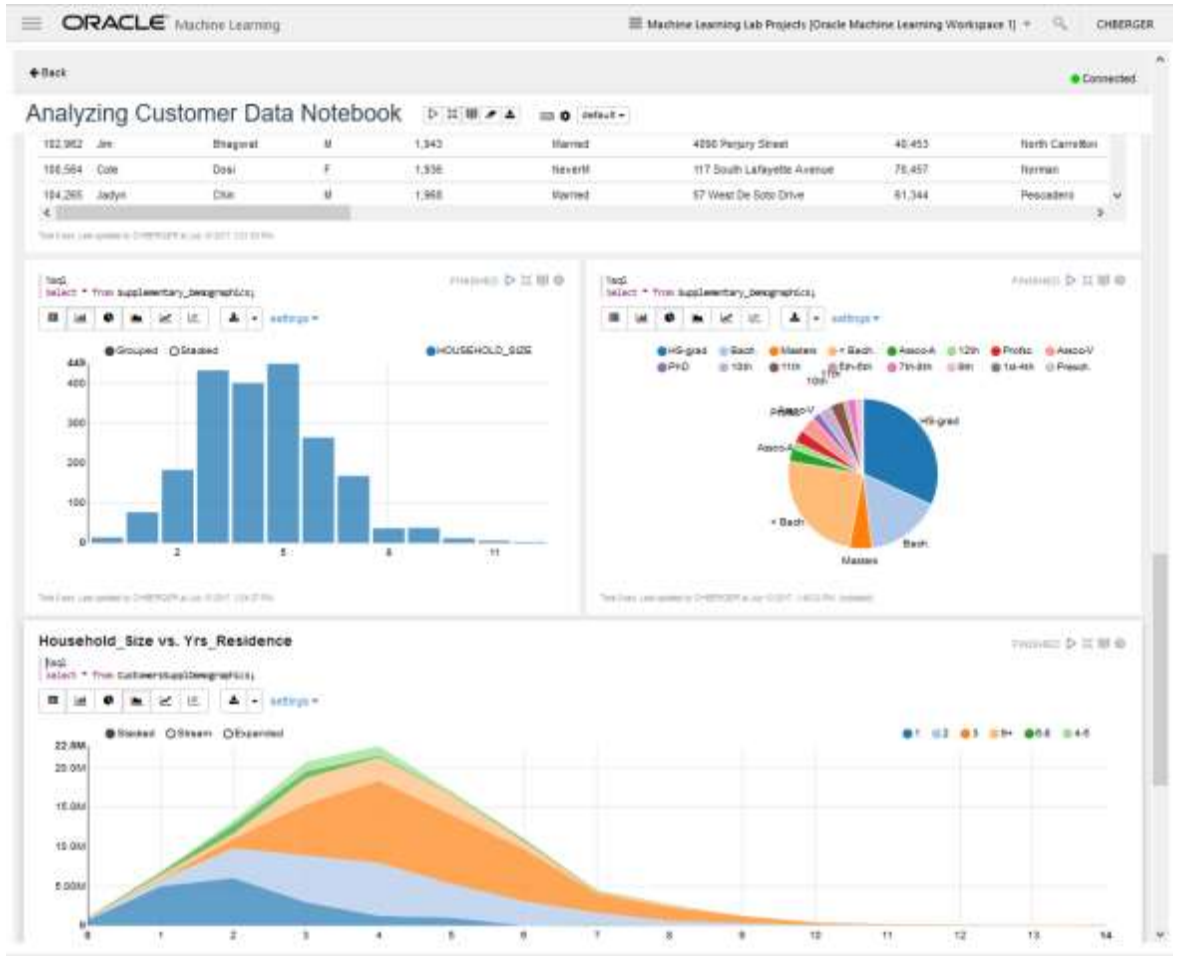
ADWC – Fully-tuned

- "Load and go"
  - Define tables, load data, run queries
    - No tuning
    - No special database expertise required
  - Good performance out of the box
- Query using any business analytics tool or cloud service
  - Built-in SQL worksheet and notebook also included



18c Oracle Database

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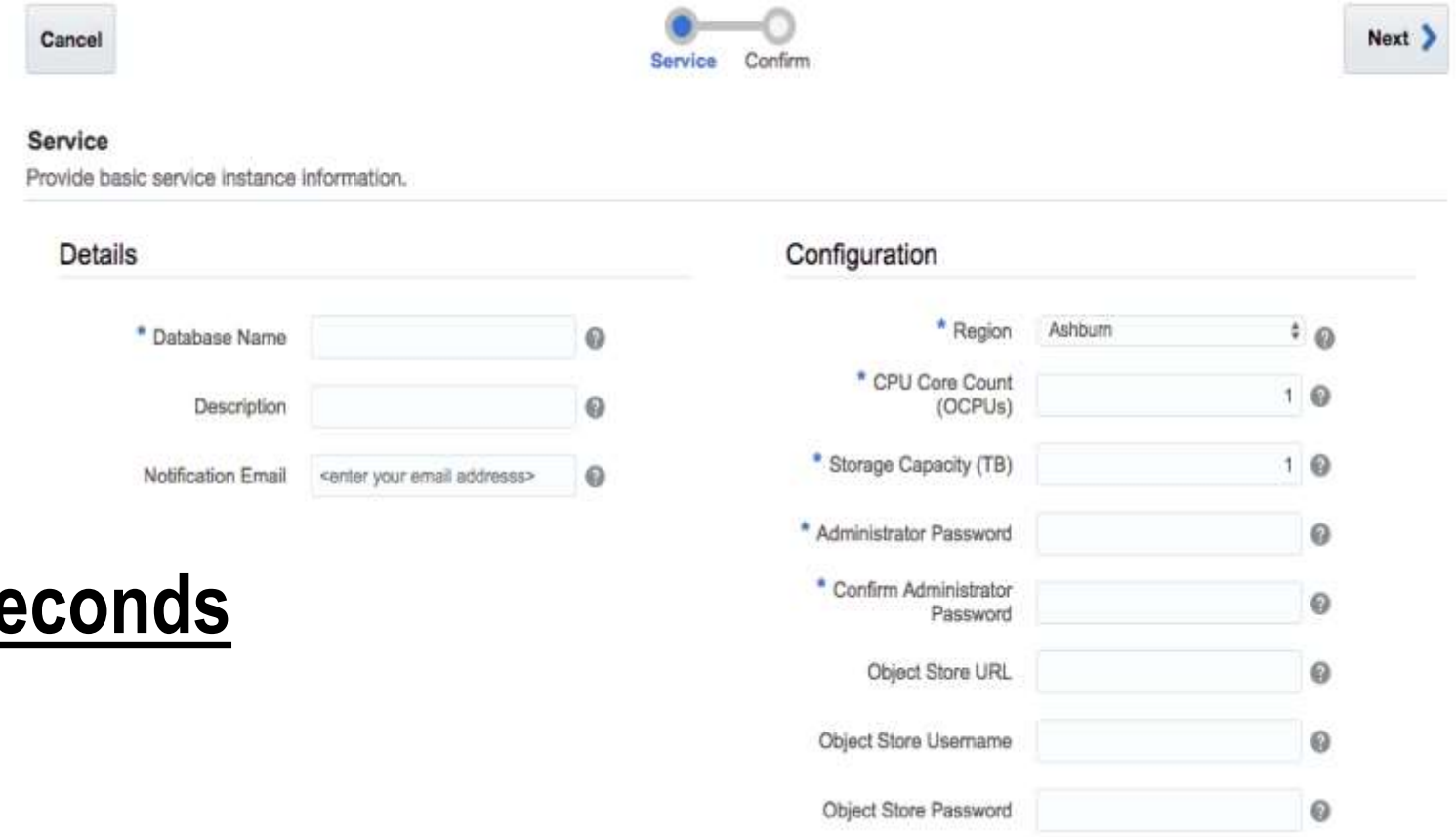
ADWC – Provisioning a Database

- Provisioning requires only 4 simple questions:
  - Database name?
  - Data center?
  - Number of CPUs?
  - Storage capacity?
  - Admin user password?
- **New service created in < 30 seconds** (regardless of size)
  - Ready to connect



18c Oracle Database

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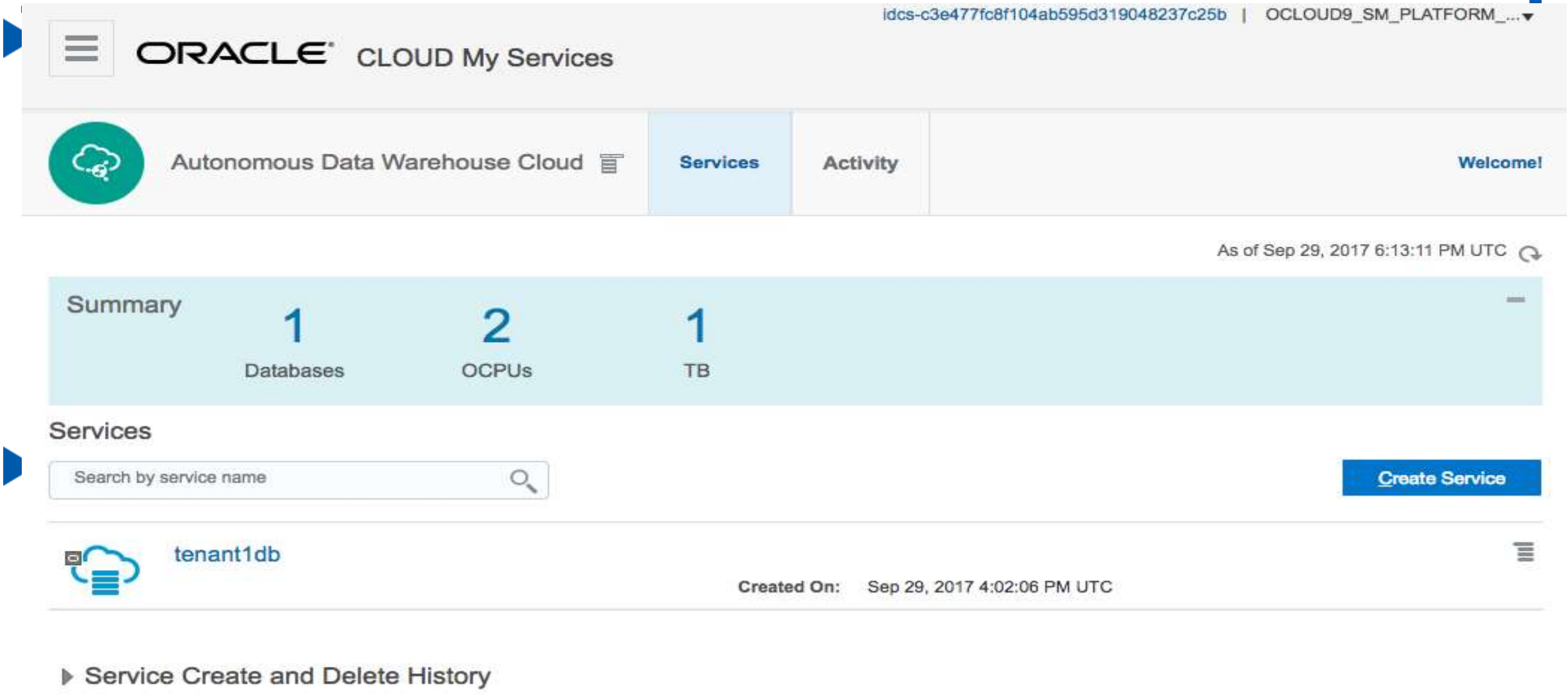
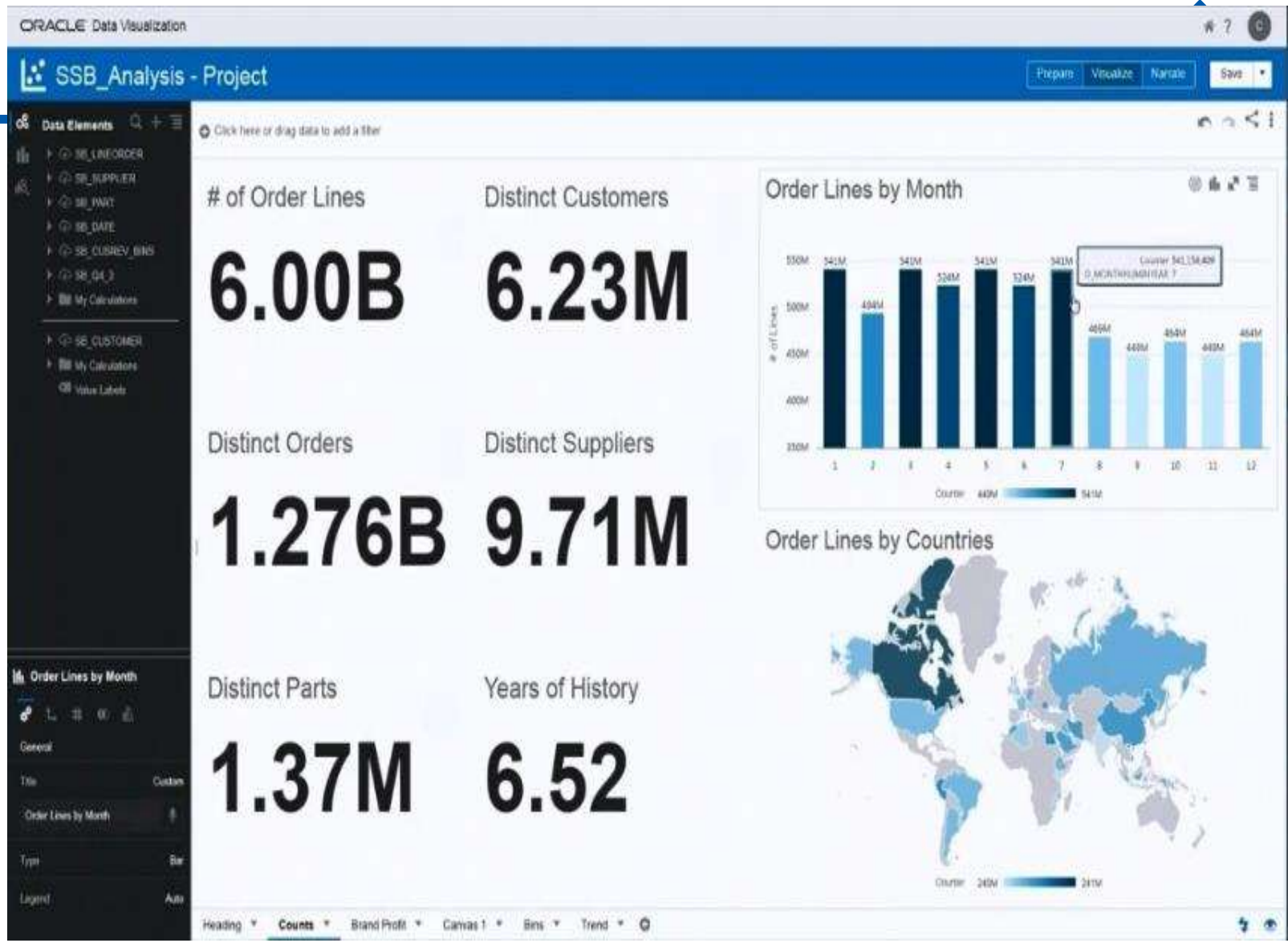
ADWC – Fully-managed



George Shows How to Mine ADW with Oracle Analytics



18c Oracle Database

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Security Focus & Machine Learning

Word of the Day Archive →

Quote of the Day

"Fixing security vulnerabilities as they happen with automatic patching and using machine learning log mining for anomalies is the first step of autonomous security in the database." - Richard Niemiec

Meet The Editor

Complete and Integrated Management and Security Cloud

- One suite, one vendor, one cloud
- Unified data architecture
- Secure & manage any technology
- On-premise, Oracle Cloud, AWS...
- No integration required
- High degree of automation
- ML based anomaly detection
- Easy to operate and use
- Integrates with Enterprise Manager

Cyber Attacks are Growing Rapidly – Costs also Growing!

Cyber Attacks: More Data Stolen Every Year

Cyber Criminals and State Actors are Winning the Cyber War

- Equifax: Records of 143,000,000 Americans plus…
  - –**Credit Card Numbers**, Social Security Numbers, home addresses…
  - –Equifax CEO, executives and IT management team resigns
- Office of Personnel Management: Records of 20 Million Federal Employees
  - –**Security clearance data**, finger print data, social security numbers, home addresses
  - –White House, Foreign Embassies, State Department, Defense Department…
  - –Director of OPM Resigns
- Cyber Criminals and **State Actors** steal more data every year
  - –**Formidable and sophisticated adversaries** stealing corporate & government data

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Security Focus

Threat Intelligence Data Feeds add to the Context

Subscribe to any additional Feeds and Threat Intelligence Sources

- Phishing Sites
  - Legitimate sites can be compromised
  - Partial matches with corporate site may mean customers of the company may be compromised
- Malicious IPs and Domains
  - Malware, Botnet, Ransomware
  - Attempted connections may indicate an endpoint infection
  - Correlating connection attempts with host and user info can aid in initial triage
- IP Obfuscation sites
  - Typically an indicator of malicious or risky behavior
  - See if users are going to obfuscation IP sites like TOR
- URL Classification
  - Adult/Gambling/Etc.

ORACLE

Security Focus

Complete Entity Data Model and Unified Data Architecture

Enables End-to-End Analysis – User to Network to Application to Database…

END USER

APPLICATION

MIDDLE TIER

DATA TIER

VIRTUALIZATION TIER

INFRASTRUCTURE NETWORK TIER

RAW DATA

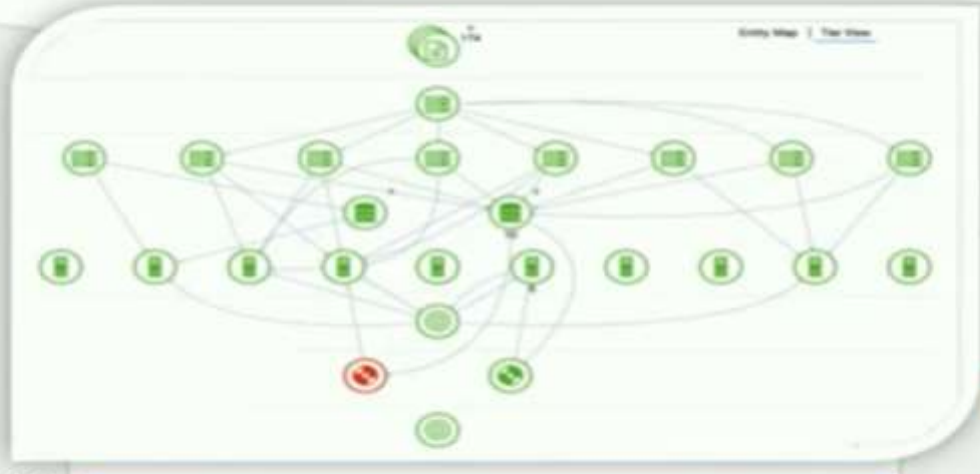
Logs

Metrics

Configurations

Activity

Threat Intelligence



ENTITY
Apps, Hosts, Databases, Users, Devices

METADATA

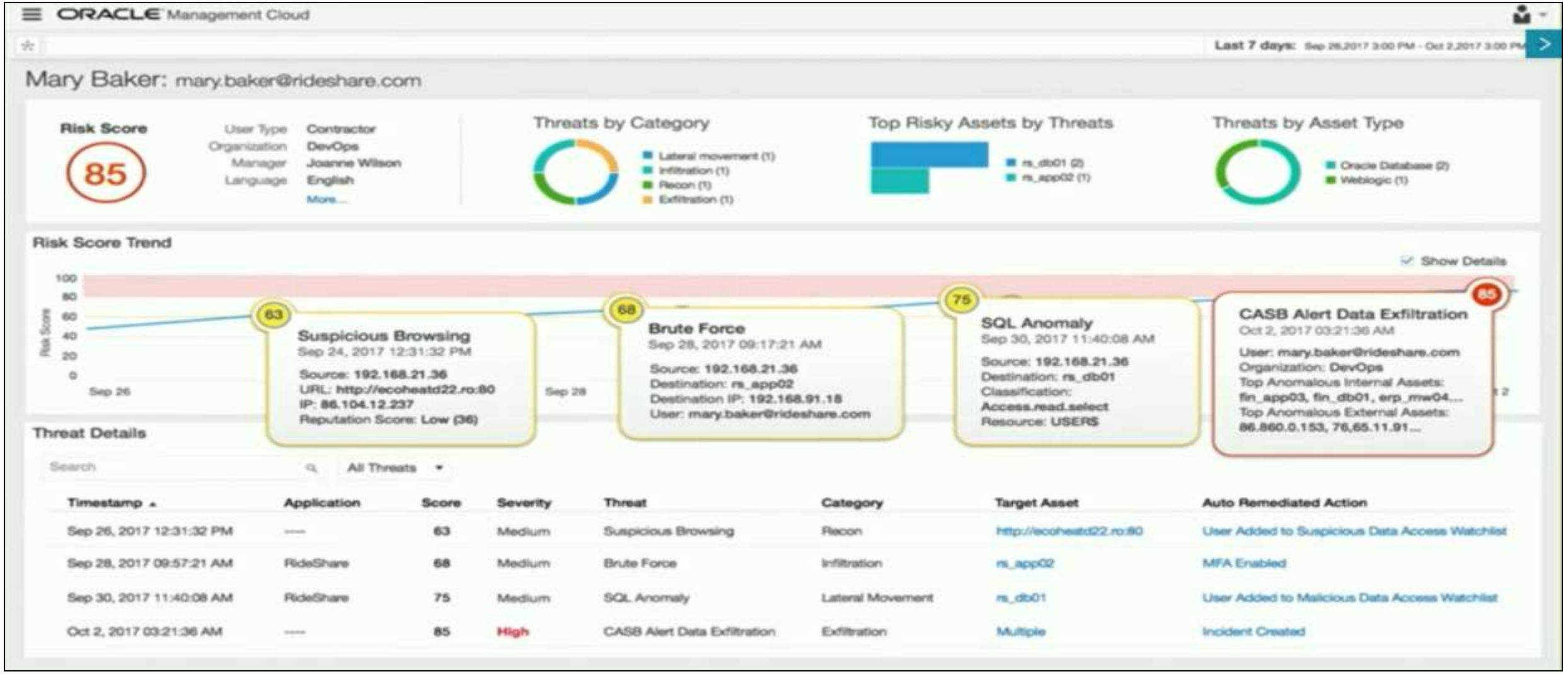
Associations, Tags, Properties, Topology

PROCESSED DATA

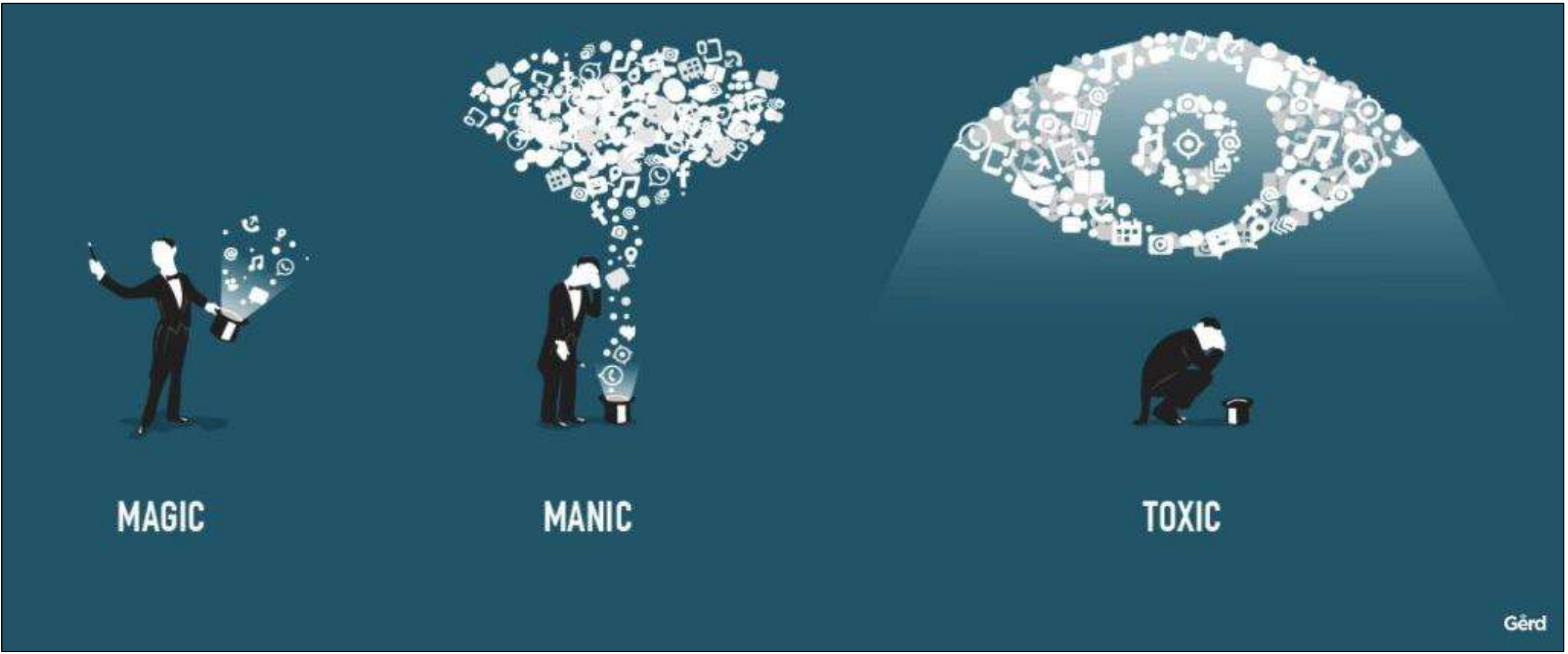
Enriched logs, Anomalies, Alerts, Threats, Compliance Violations

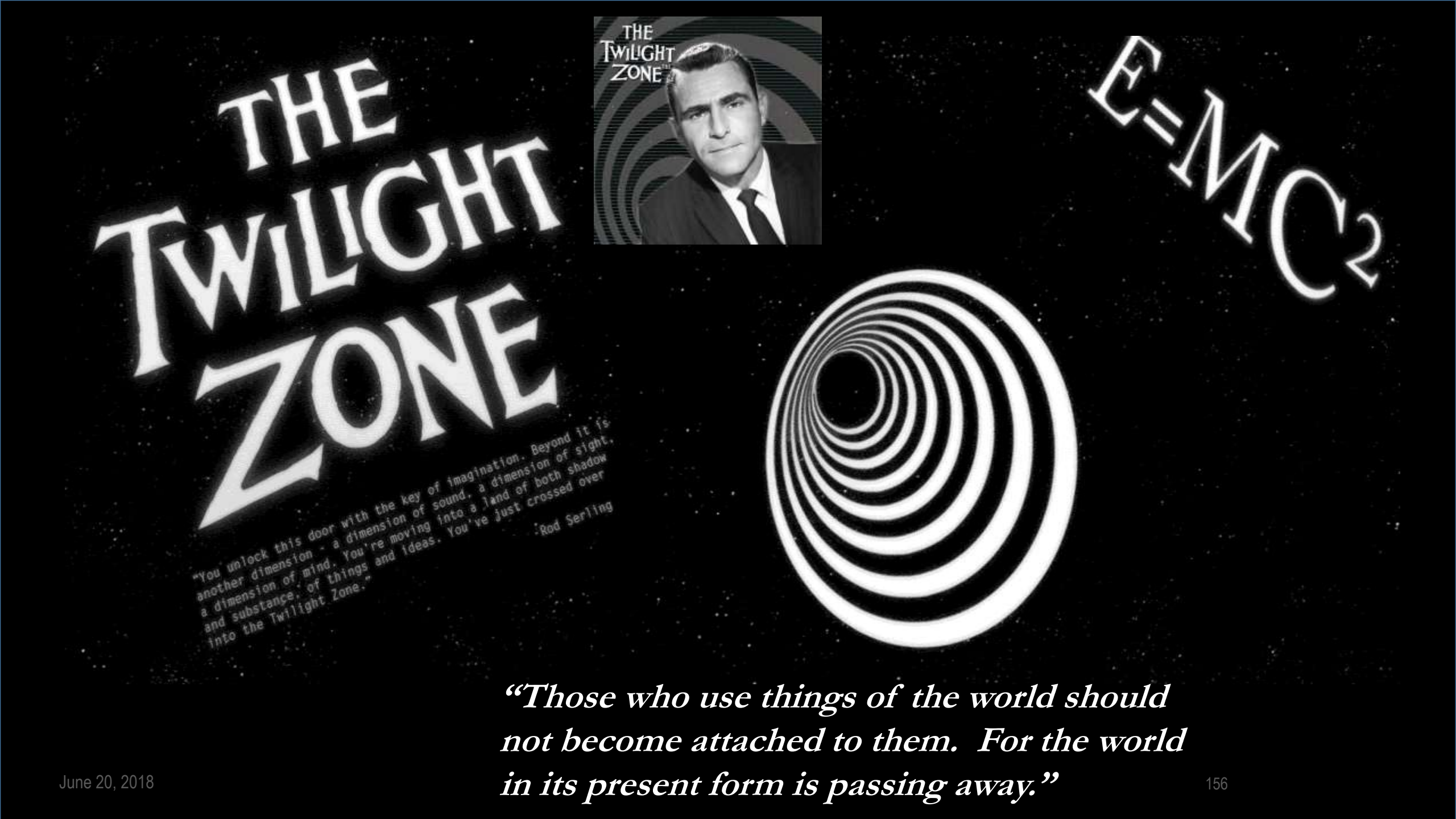
ORACLE

Security Focus – Excellent Metrics



You are the Last Line of Defense!





"Those who use things of the world should not become attached to them. For the world in its present form is passing away."

64-Bit advancement of
Directly addressable memory

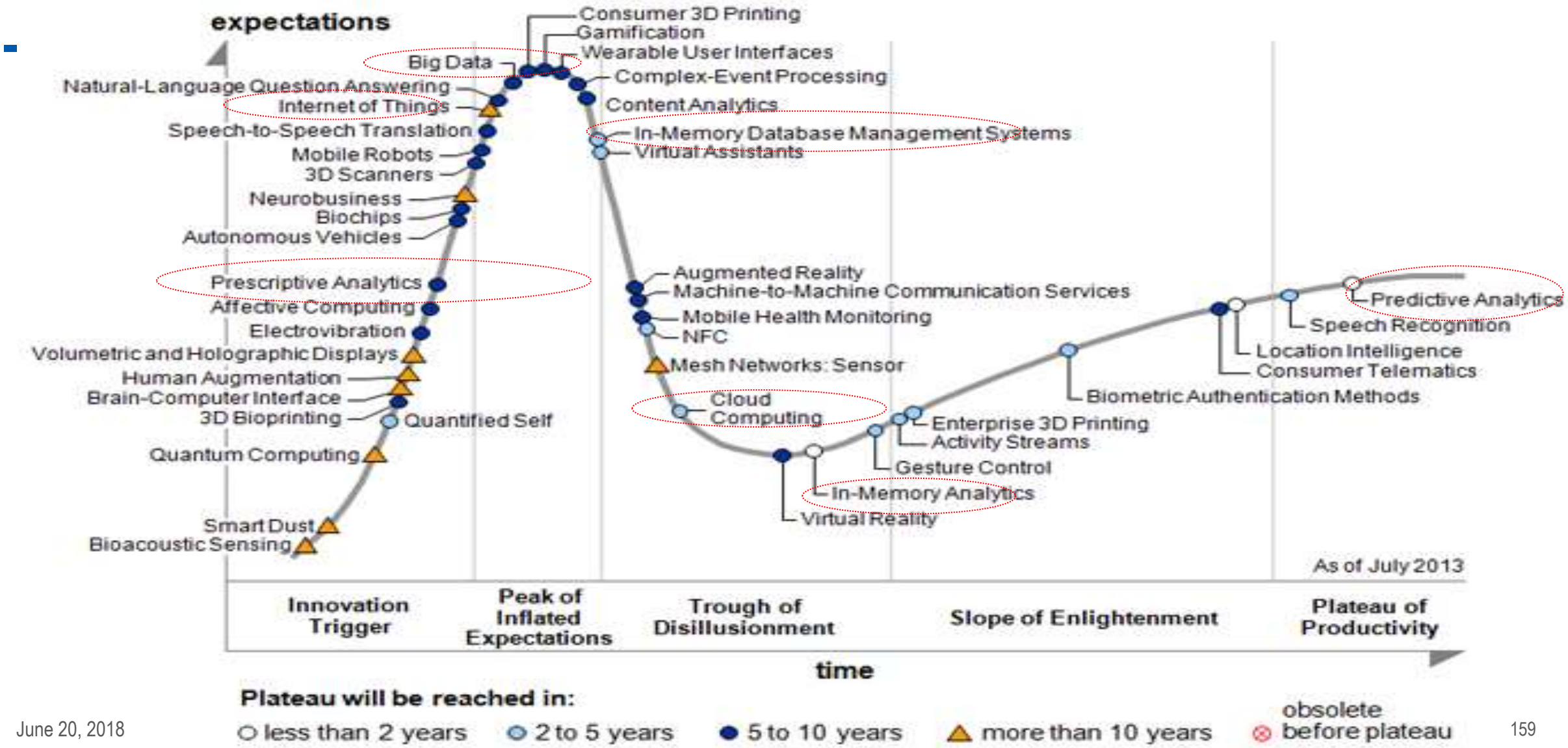
	Address Direct	Indirect/Extended
4 Bit:	16	(640)
8 Bit:	256	(65,536)
16 Bit:	65,536	(1,048,576)
32 Bit:	4,294,967,296	
64 Bit:	18,446,744,073,709,551,616	

When the hardware physically implements the theoretical possibilities of 64-Bit, things will dramatically change…. …moving from 32 bit to 64 bit will be like moving from 4 bit to 32 bit or like moving from 1971 to 2000 overnight.

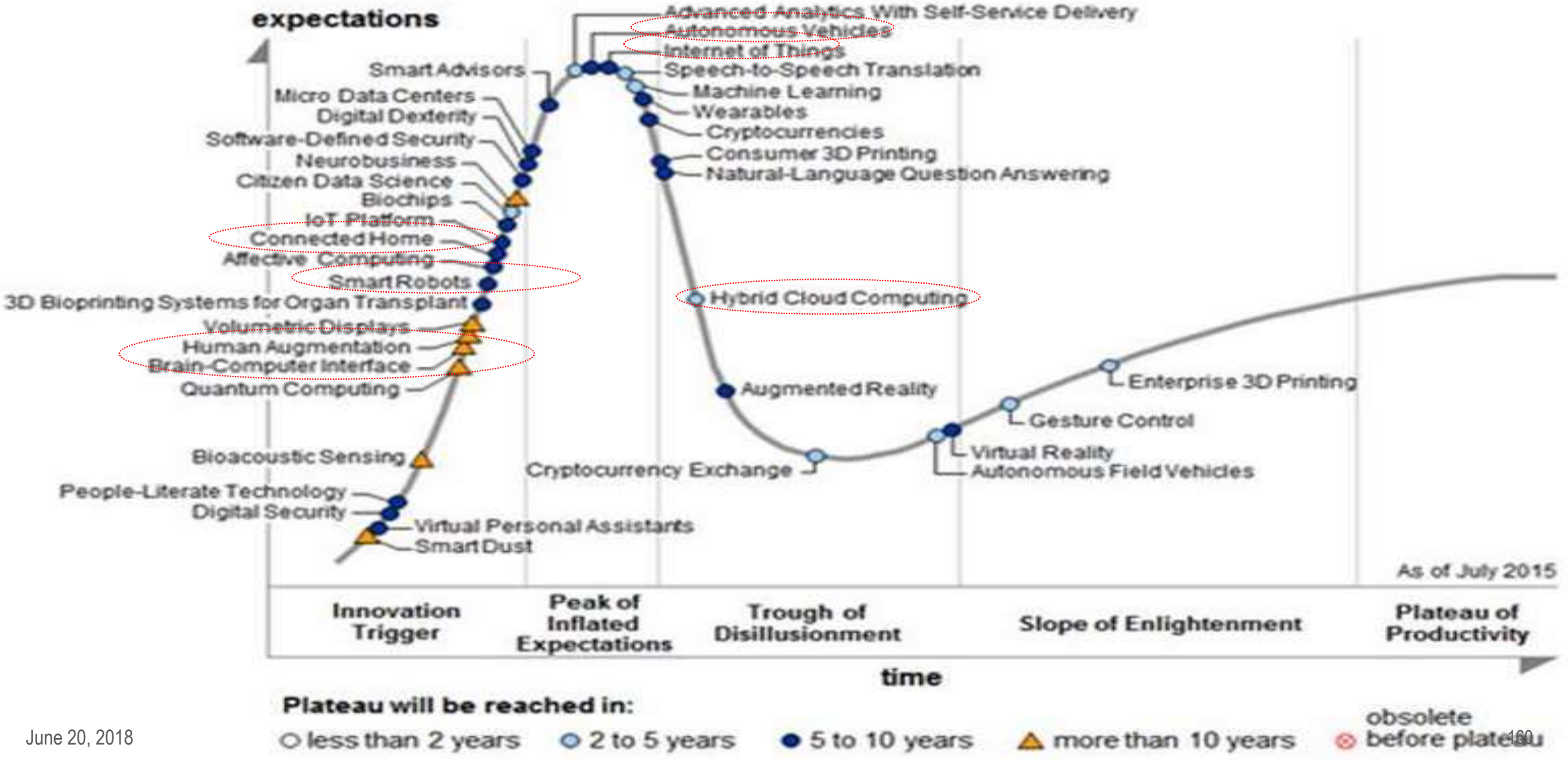
Addressable Memory

Shift	Increase (Result)
• 8-bit to 16-bit	1 mph (Windows)
• 16-bit to 32-bit	65K mph (Internet)
• 32-bit to 64-bit	300T mph (Robotics/3D…etc.)
• 64-bit to 128-bit	5T*T*B mph

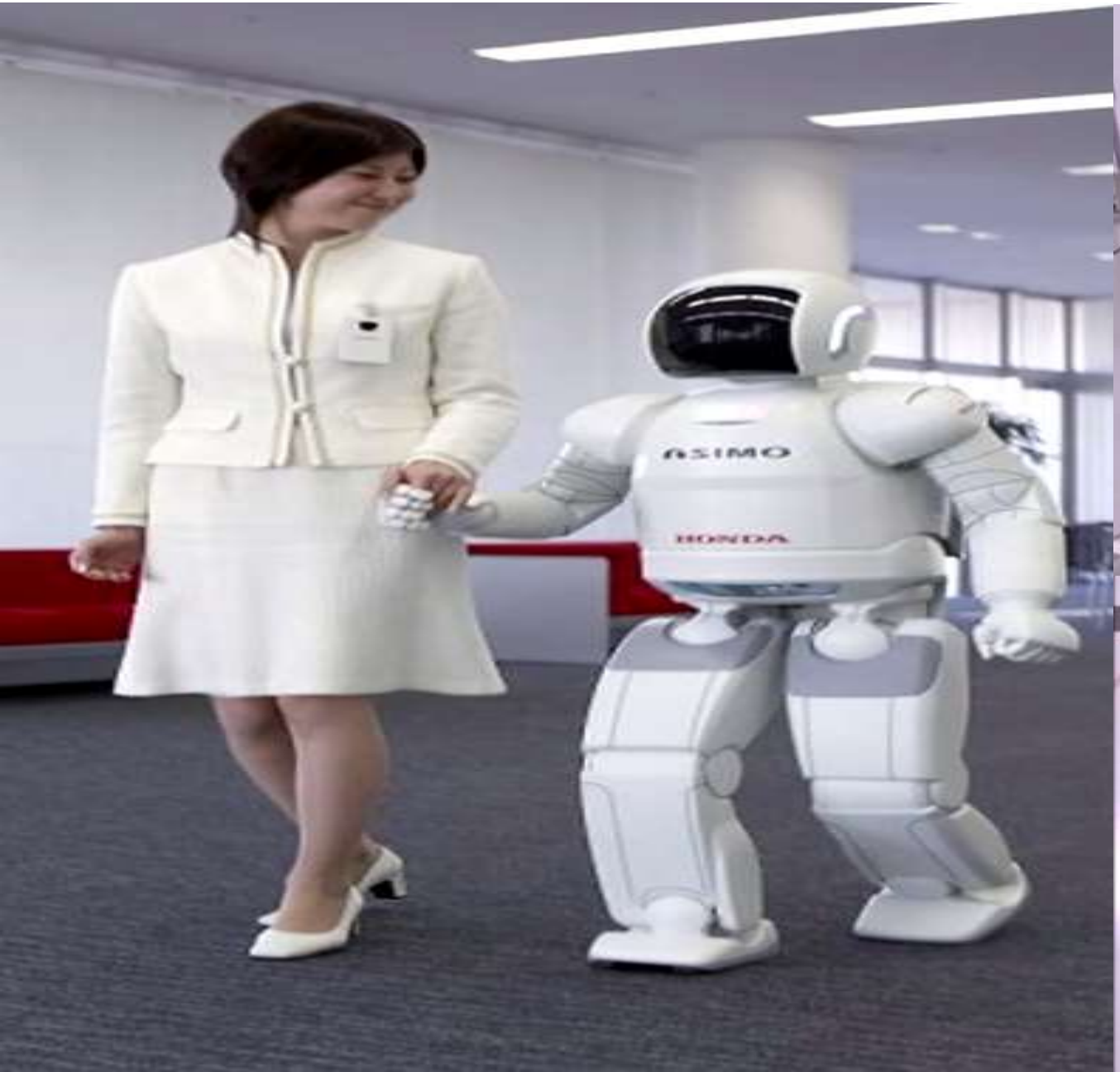
Technology Trends: Gartner Hype Cycle **2013 All about Tech …**

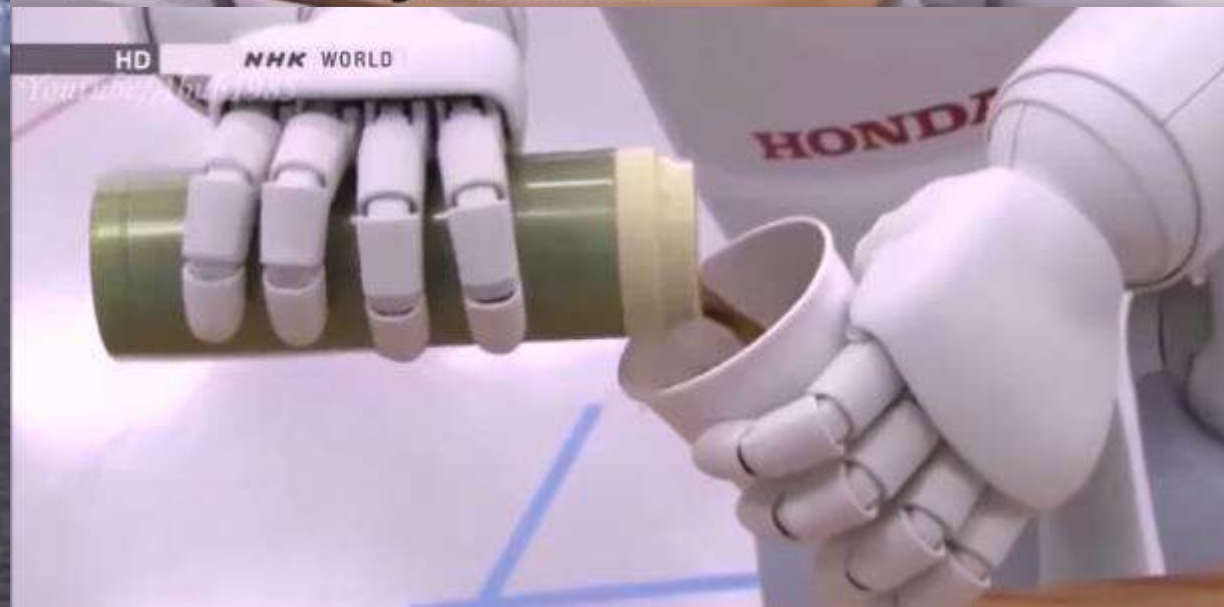


Technology Trends: Gartner Hype Cycle **2015 All about Robotics …**

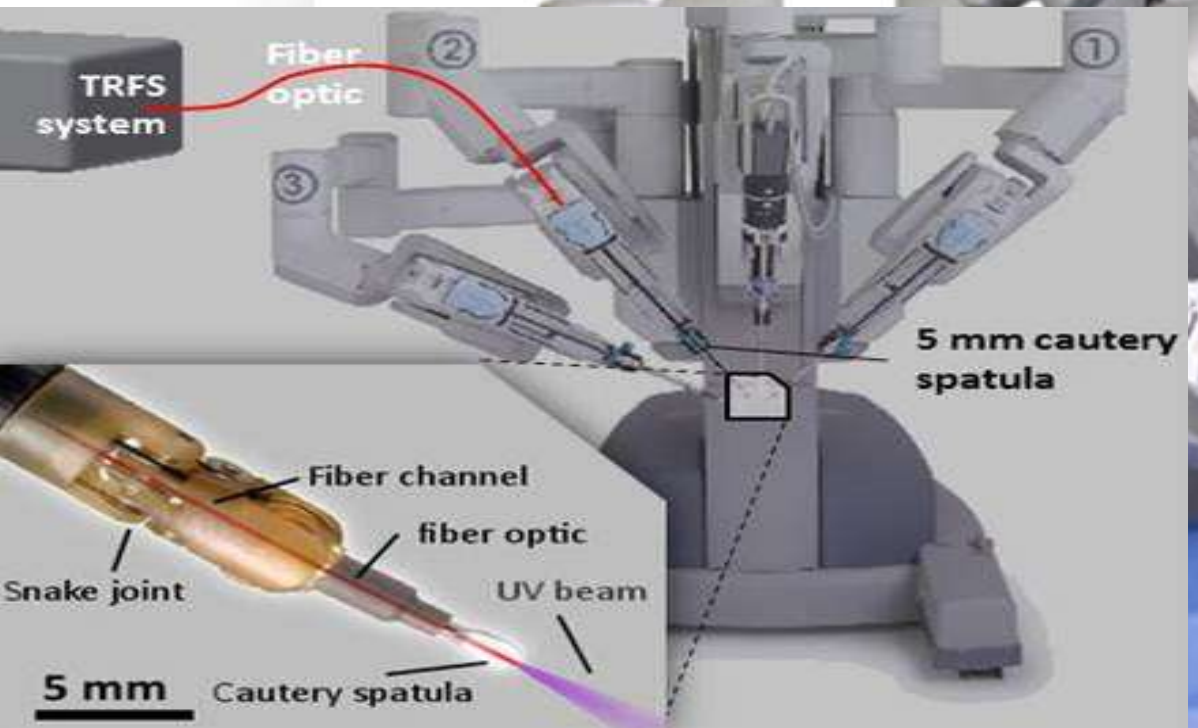


Innovation is coming fast - Robotics!



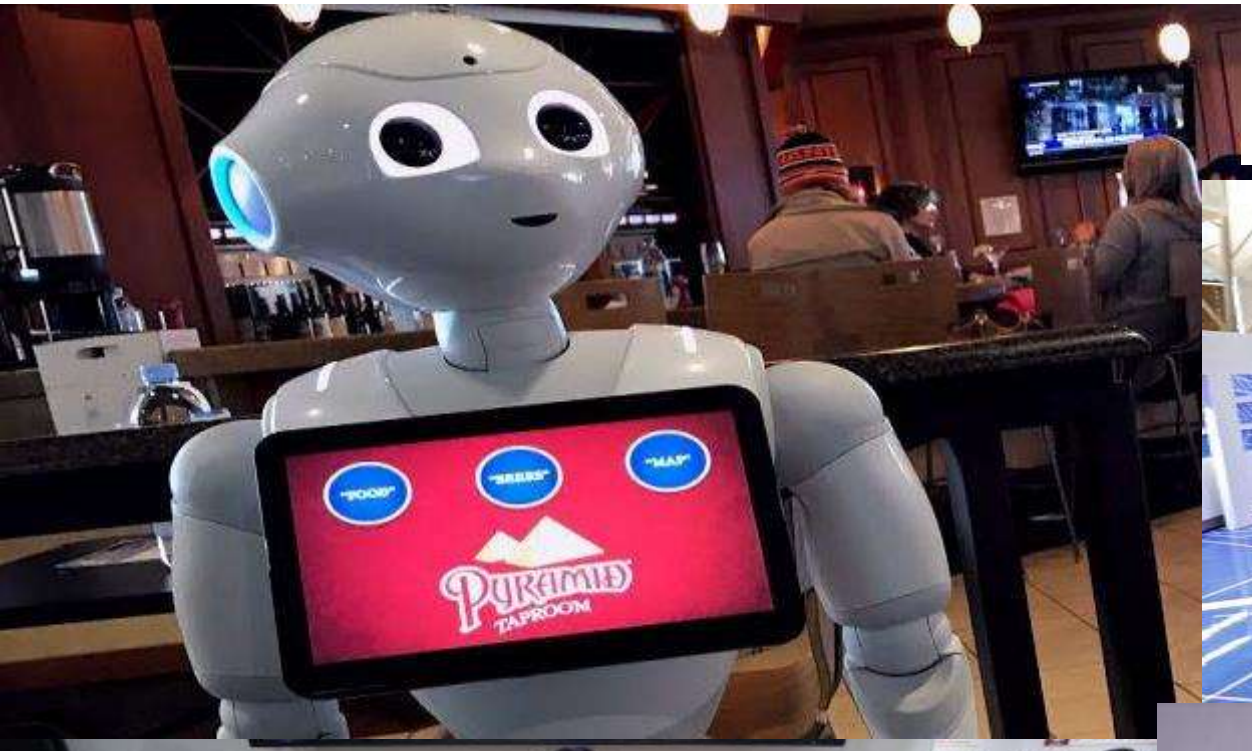


Da Vinci Surgical System



Innovation is coming fast - Robotics!

Robots at Work… 24x7



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Final Thoughts… world changing fast!

"Those who use things of the world should not become attached to them. For the world in its present form is passing away."

1 Corinthians 7:31

The Singularity & Transcendent Man: Humans Transcend Biology (back yourself up…)

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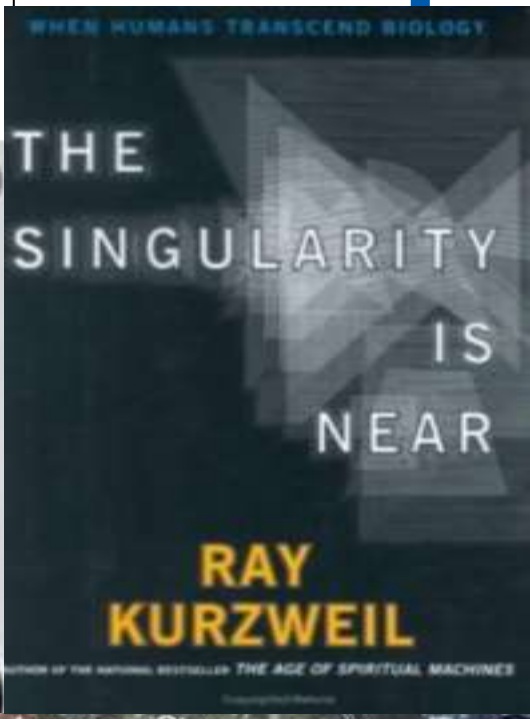
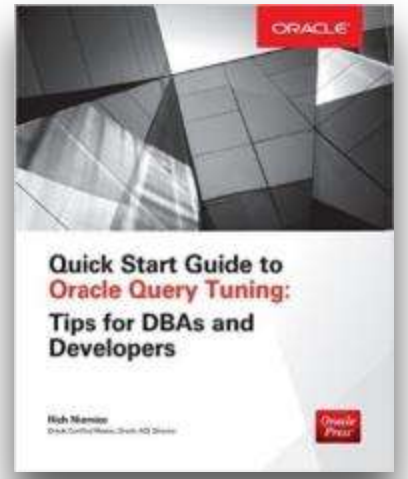
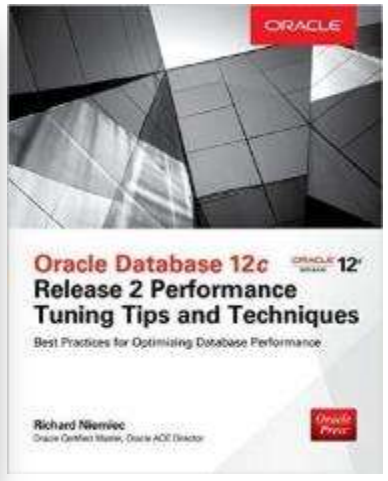


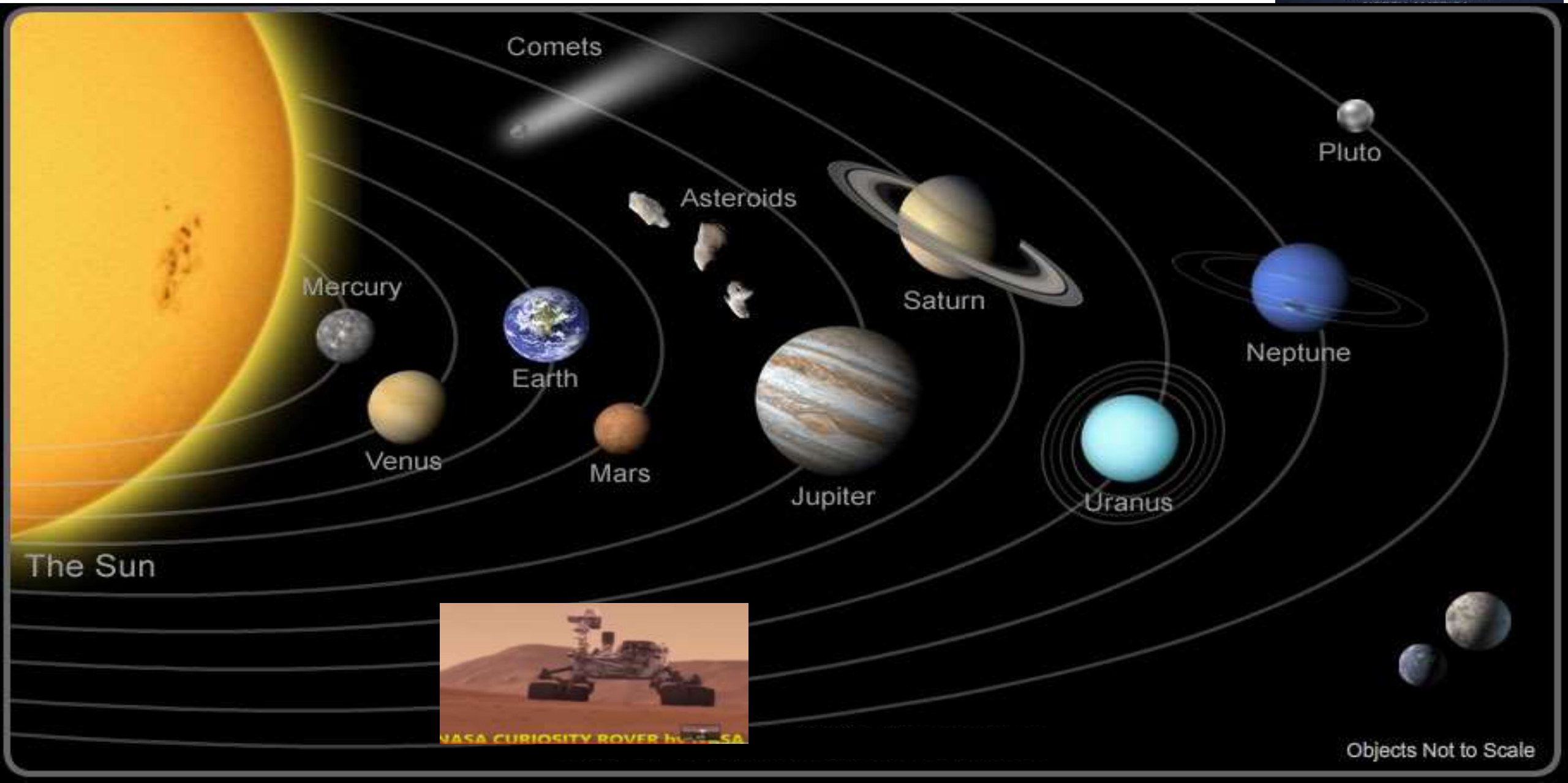
Summary – 12c R1 & R2, 18c & 18c ADWC

- Know the Oracle!
- In-Memory Virtual Columns (12cR2), Multiple indexes on the same Column (12c) & Fetch First x Rows(12c)
- Approximate Query New Features (12cR2)
- Pluggable Databases & new 12cR2 Features
- Adaptive Query Optimization and CAQP (12cR2)
- Runaway Query Management
- Security Enhancements (12cR2)
- Exadata
- Oracle Database In-Memory (12.1.0.2+)
- New Partitioning & Online Features (12cR2)
- Other 12c R1 & R2 New Features
- 18c / 19c / 20c
- Autonomous Database Warehouse Cluster (ADWC)
- 18c New Features
- Summary



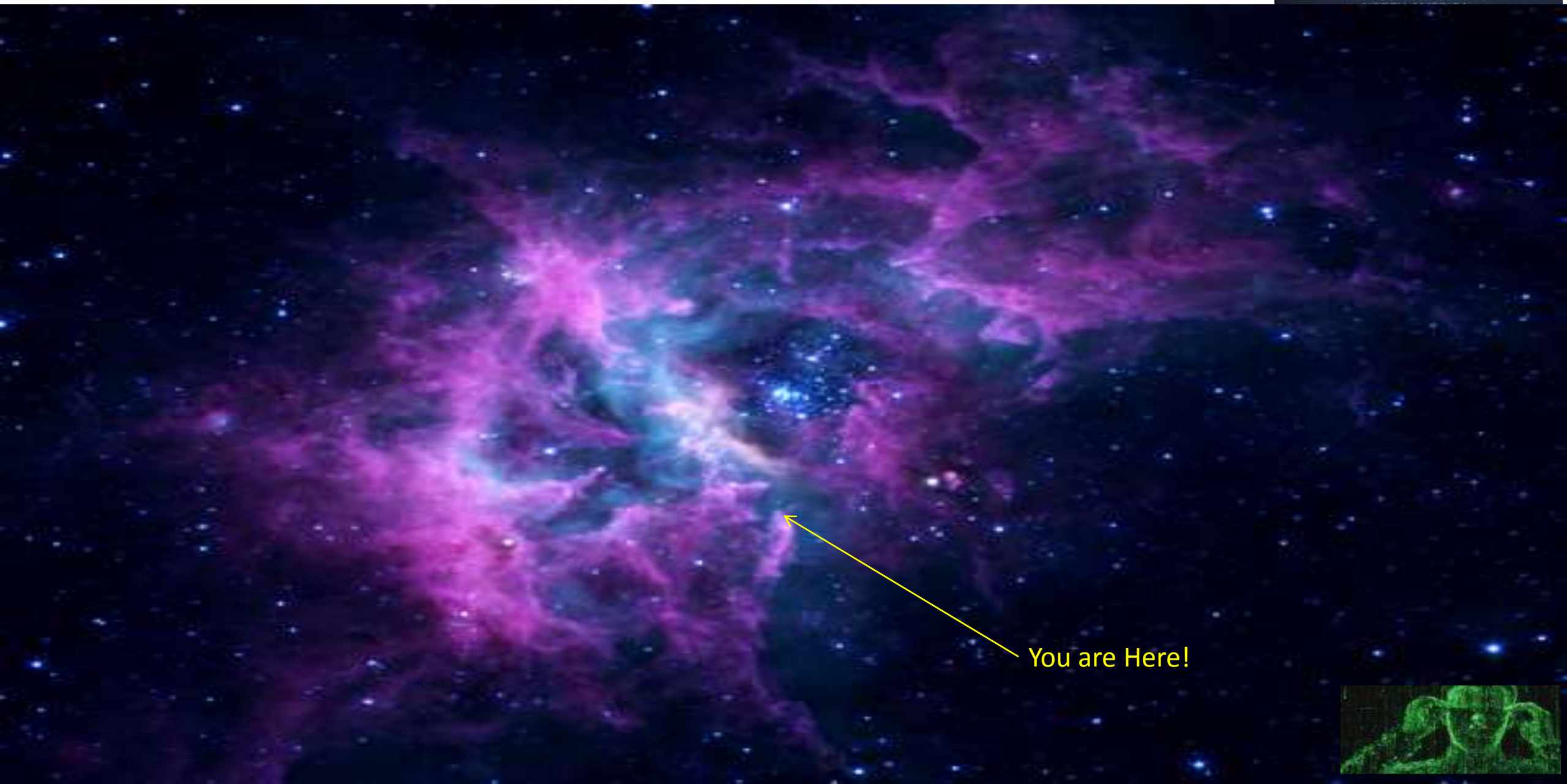


You are Here in the Solar System

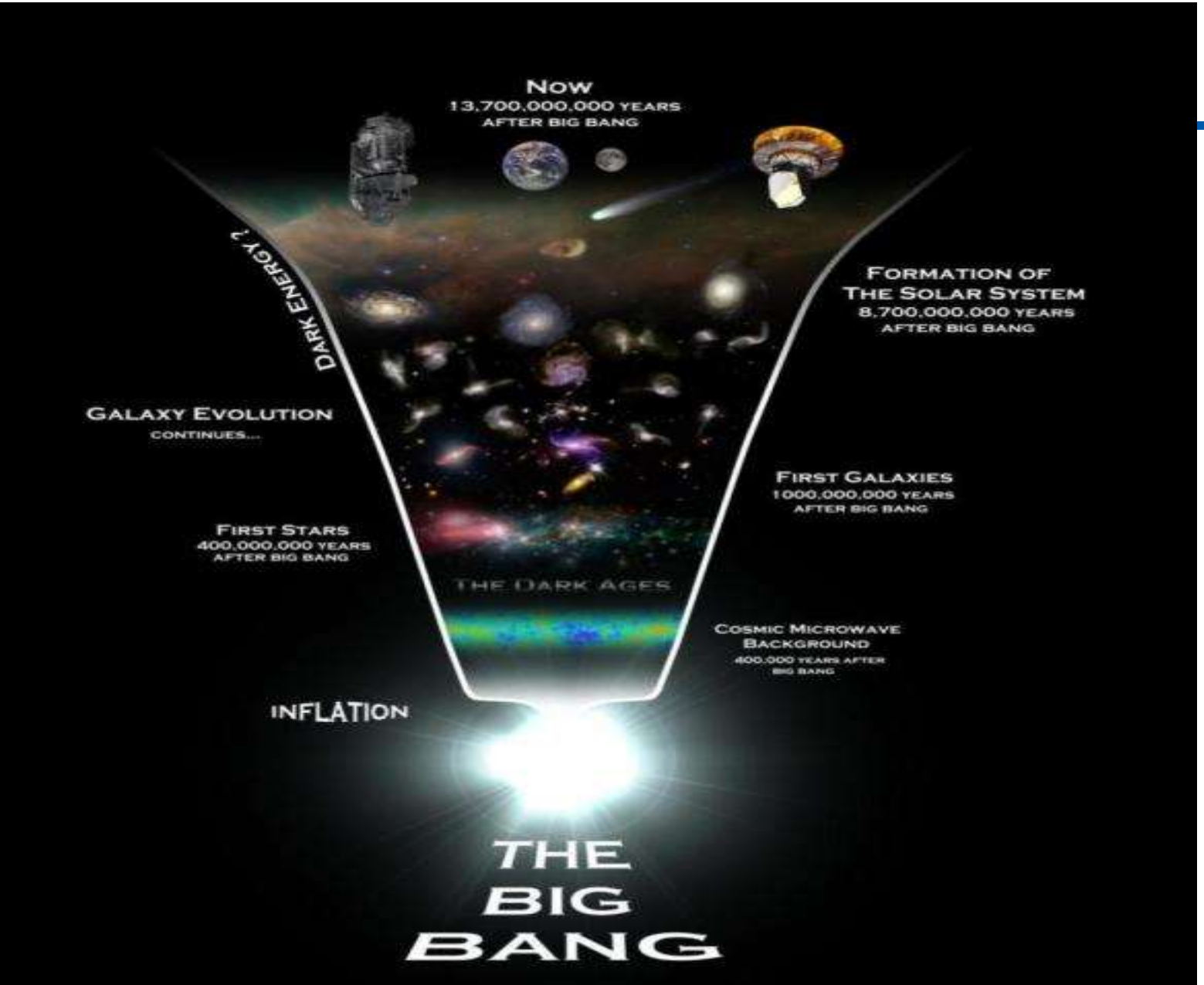


You are Here in the Milky Way Galaxy

You are Here in the Universe



YOU Live in an AMAZING Time!



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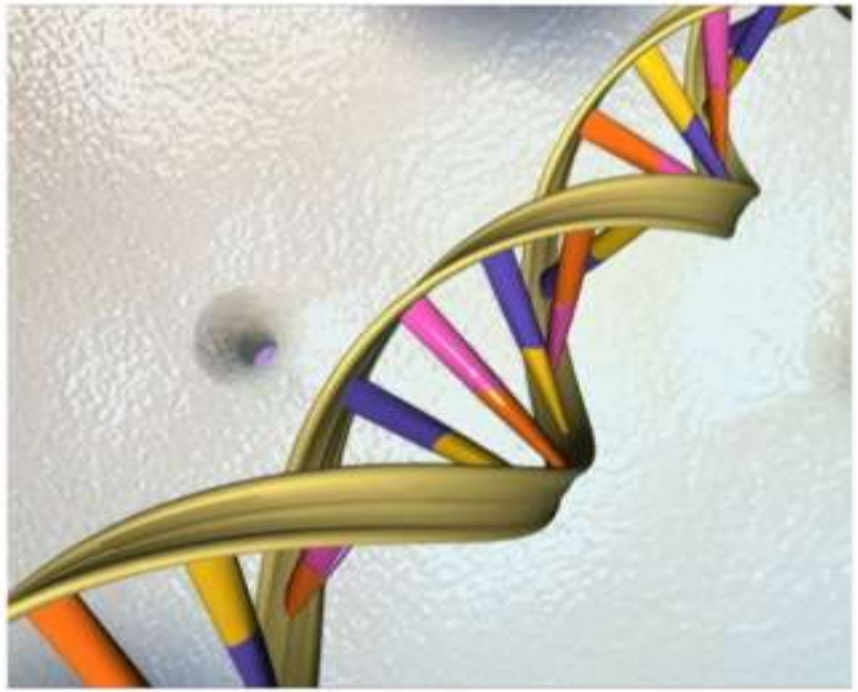
A Working Transistor Built Out Of DNA Within A Living Cell

We're *this* close to having a usable biocomputer.

By Shaunacy Ferro Posted 04.01.2013 at 12:36 pm 3 Comments



DNA Double Helix *National Human Genome Research Institute*

Pretty much anything can be a computer, if it can compute logical functions, store data, and transmit information -- even living cells. A team at Stanford University has accomplished one of the the final tasks necessary to turn cells into working computers: They've created a biological transistor, called a transcriptor, that uses DNA and RNA instead of electrons and responds to logical functions.

The Digital Transformation Ahead

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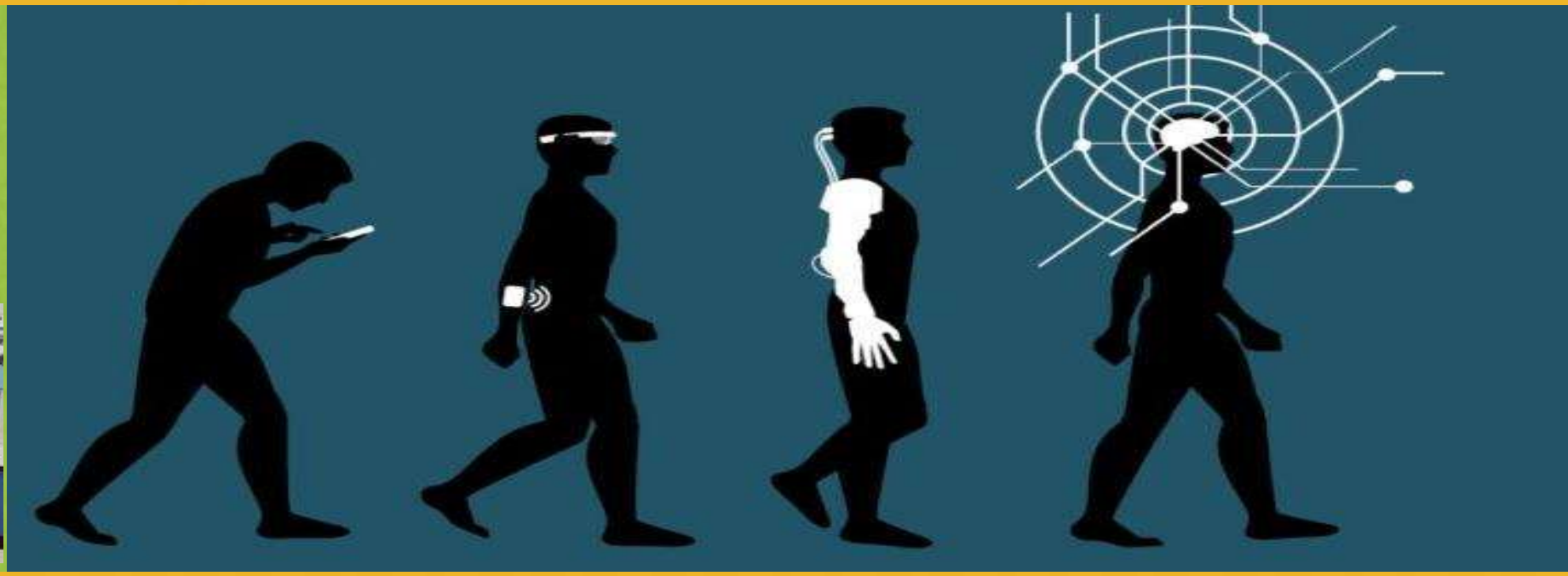
Digital Transformation 2000 to 2050

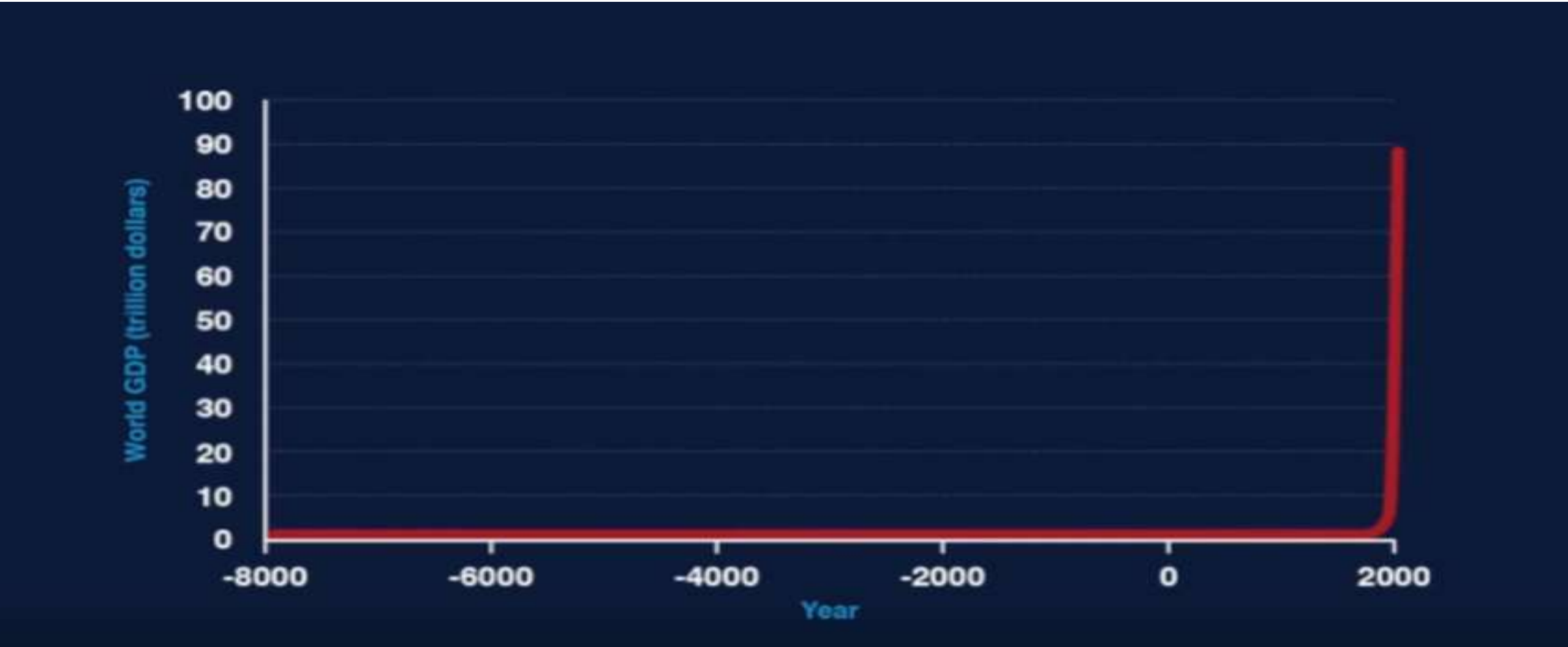
Gerd

A historically significant change in humanity...



Disconnected *The Dark Ages* | Using Digital | Wearing Digital | Implanting Digital | The Hive Mind

World GDP over 10,000 Years



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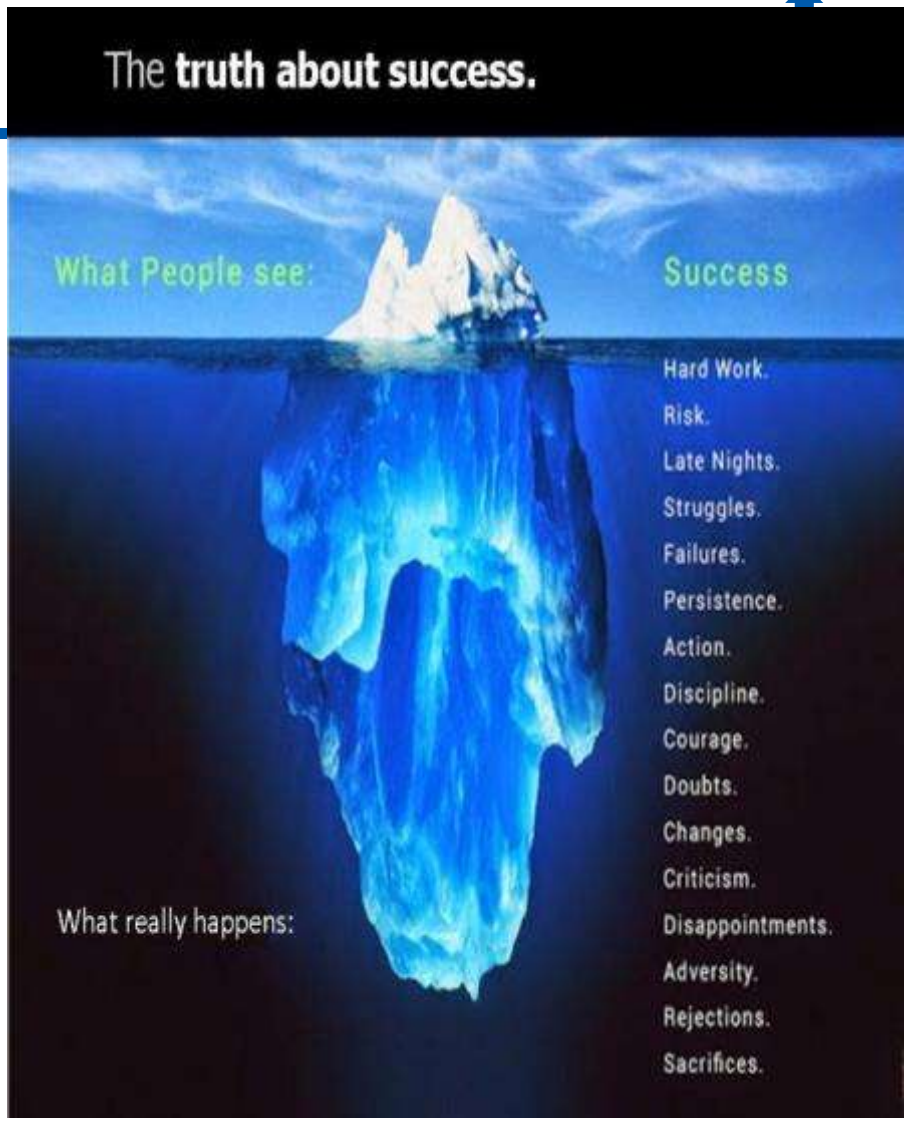
"We make a Living by what we get; We make a Life by what we give."



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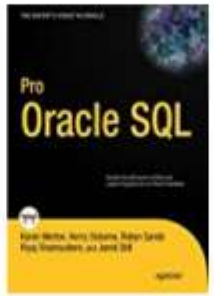
2. 

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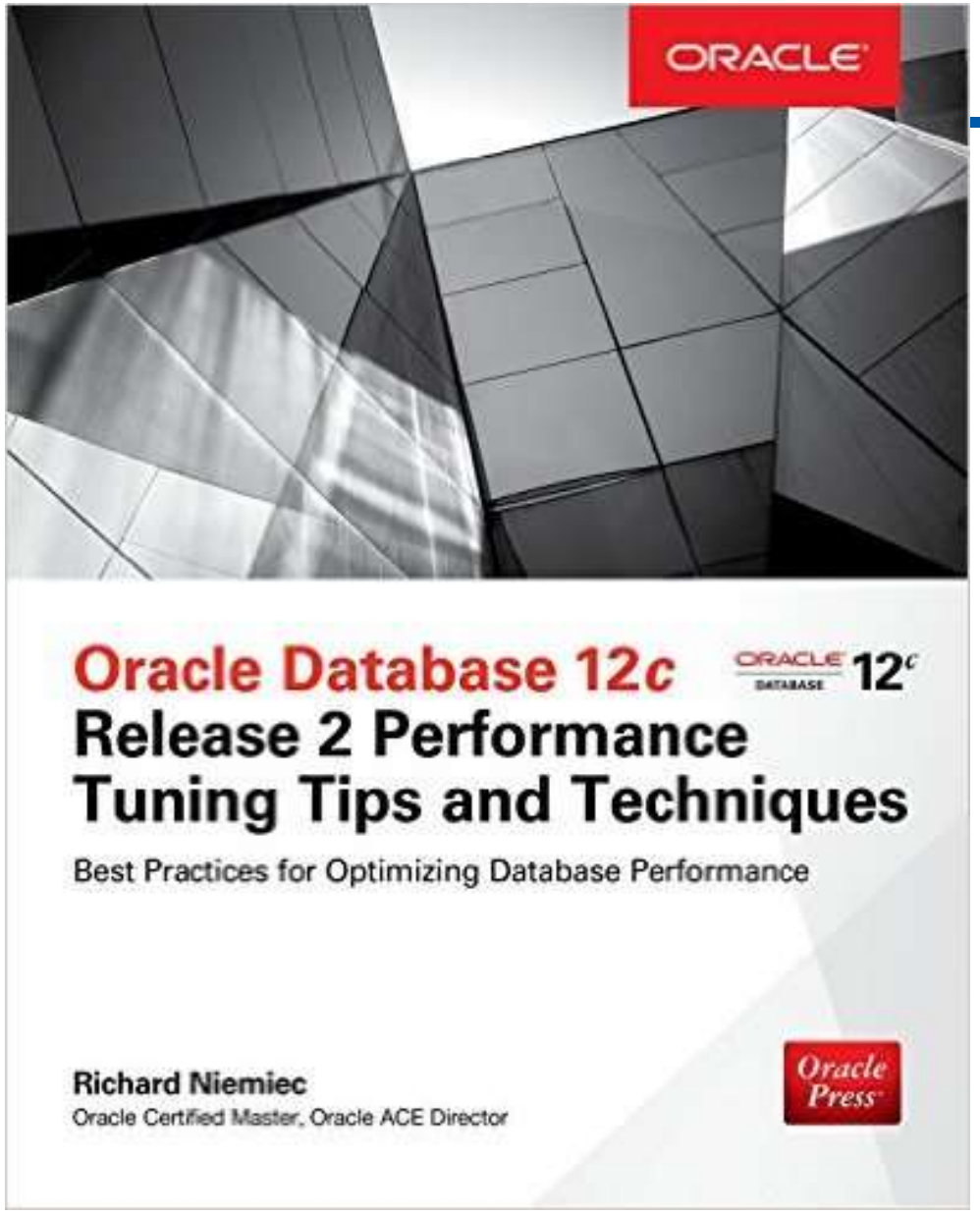
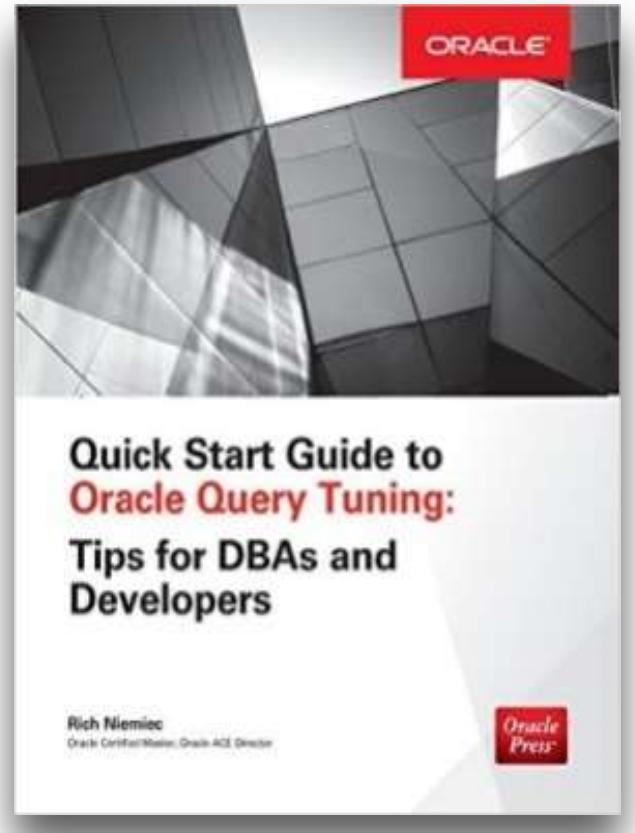
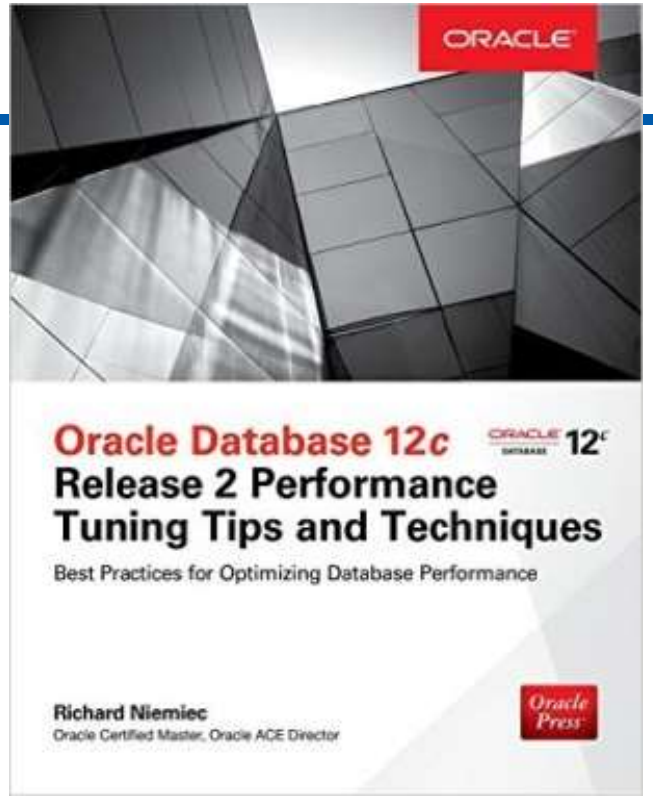
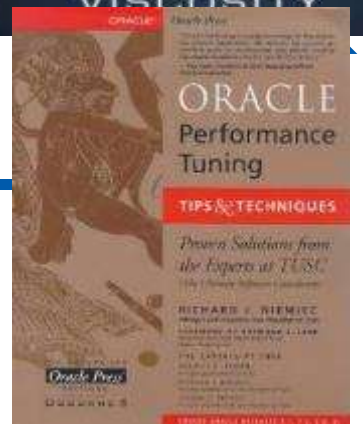


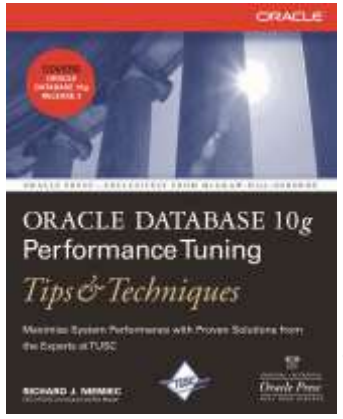


For More Information

- *Oracle 12c Release 2 Performance Tuning Tips & Techniques; Richard J. Niemiec; Oracle Press (Available now)*







"If you are going through hell, keep going" - Churchill

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- Thanks Dan M., Bob T., Brad, Joe, Heidi, Mike K., Debbie, Maria, Linda, Shyam
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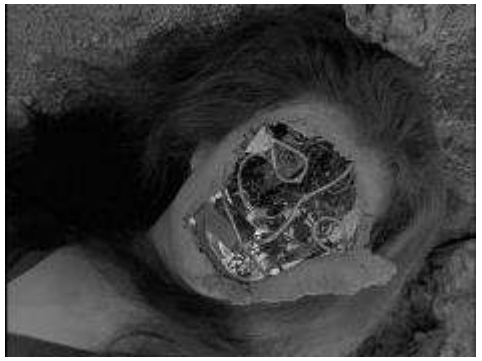
- Oracle Exadata Implementation Workshop, Oracle Corporation, McLean, Virginia - Multiple Exadata sessions
- Oracle Learning Library – multiple sessions/topics
- Oracle 11g R1/R2 Best Features, Rich Niemiec
- Oracle Enterprise Manager Deployment and High Availability Best Practices, Jim Viscusi (Oracle Corporation), Jim Bulloch (Oracle Corporation), Steve Colebrook-Taylor (Barclays Global Investors)
- *Oracle11g Performance Tuning Tips & Techniques,* Rich Niemiec, Oracle Press McGraw-Hill
- Advanced Compression with Oracle Database 11g Release 2, Oracle Corporation, Steven Lu
- Tech Crunch
- Twilight Zone Series
- Rod Serling; Submitted for Your Approval, American Masters
- YouTube/oracle Oracle OpenWorld On Demand



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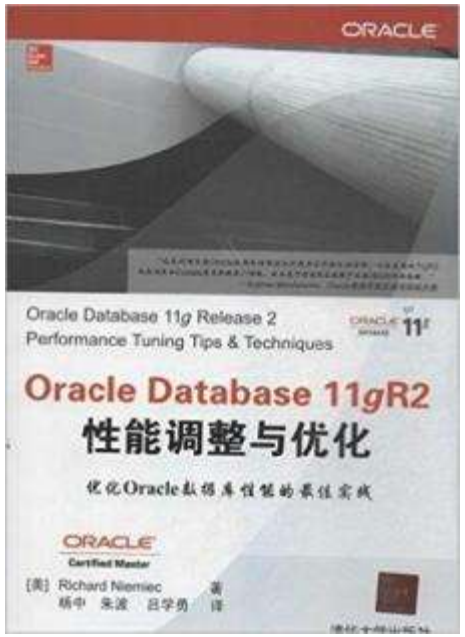
Oracle9i Tuning (May 2003)
Oracle10g Tuning (June 2007)
Oracle11g Tuning (Jan 2014)
Oracle12c Tuning (TDB)



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- Henry David Thoreau

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