Connor McDonald

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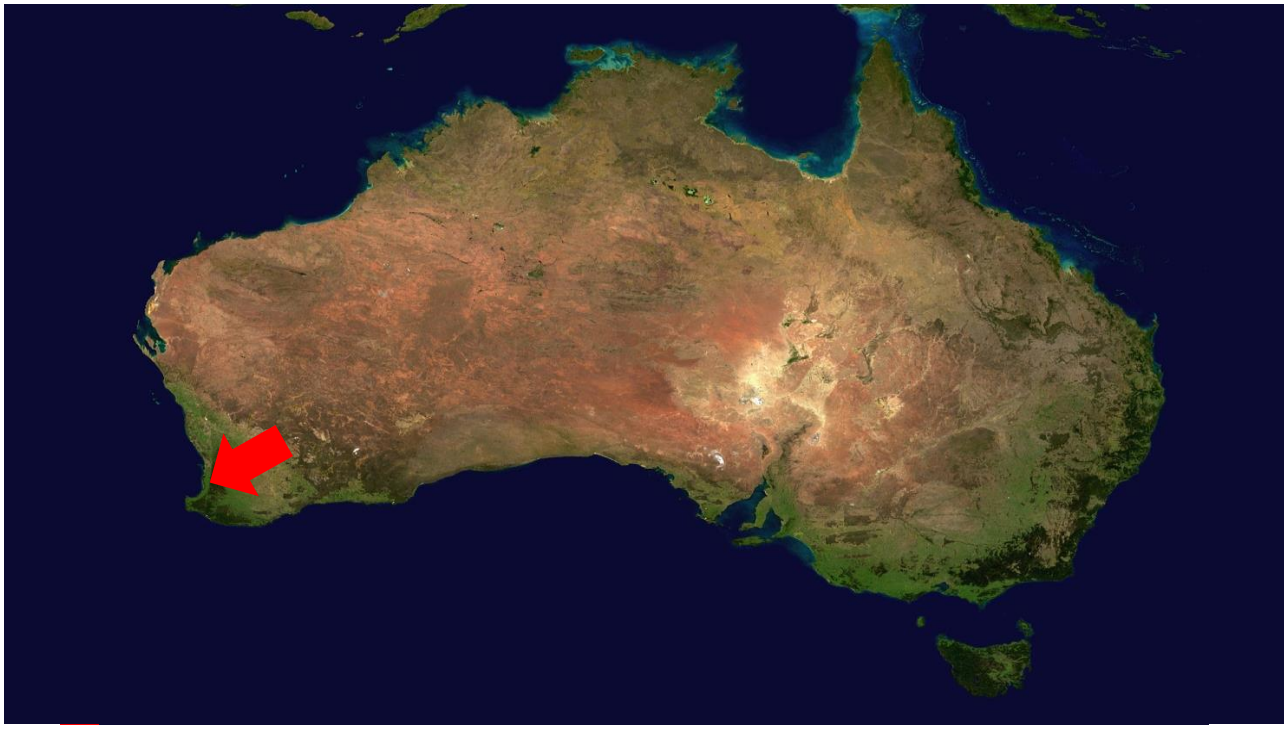
1

2



3

mi dispiace non parlo italiano :-(

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4

Stuff

blog bit.ly/blog-connor

400+ posts mainly on database & development

youtube bit.ly/youtube-connor

250 technical videos, new uploads every week

twitter bit.ly/twitter-connor

rants and raves on tech and the world :-)

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5

etc…

facebook bit.ly/facebook-connor

linkedin bit.ly/linkedin-connor

instagram bit.ly/instagram-connor

slideshare bit.ly/slideshare-connor

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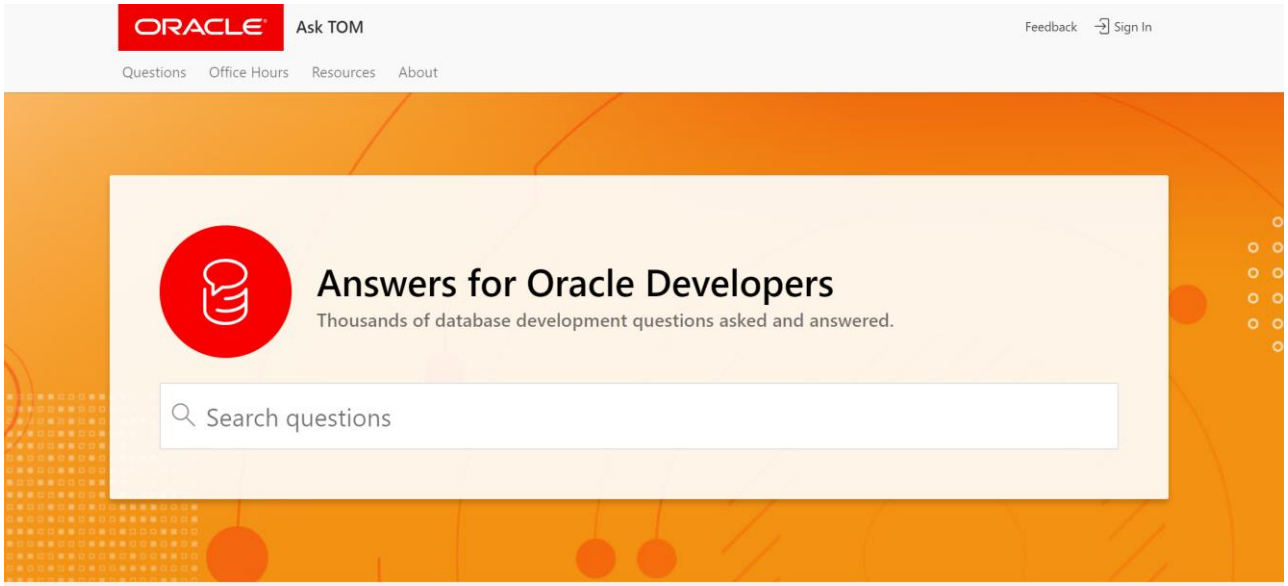
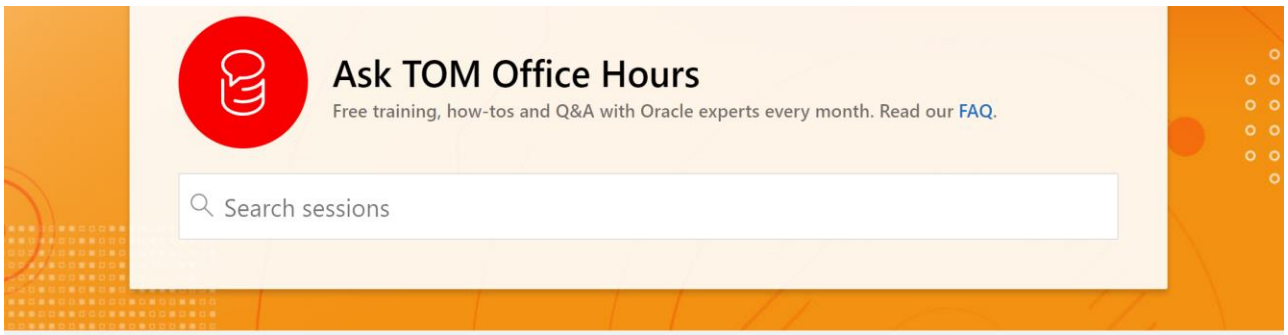
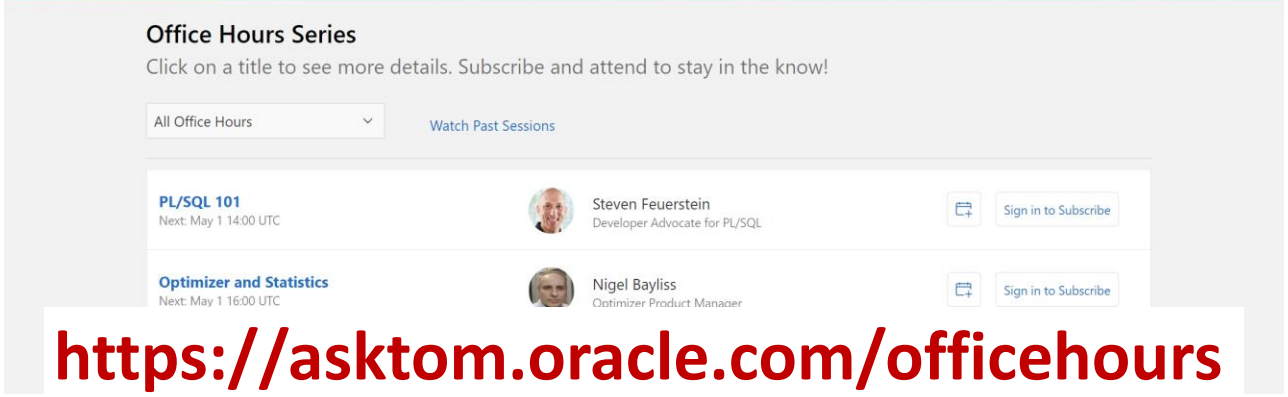
6



https://asktom.oracle.com

7





https://asktom.oracle.com/officehours

8

150 hours of free access (so far)

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9

Cool stuff on 12c, 18c ... and 19c!

Connor McDonald
Database Advocate

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10

why me ?

11

11

12

Top Ten Oracle 10*g Release 1* Things

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13

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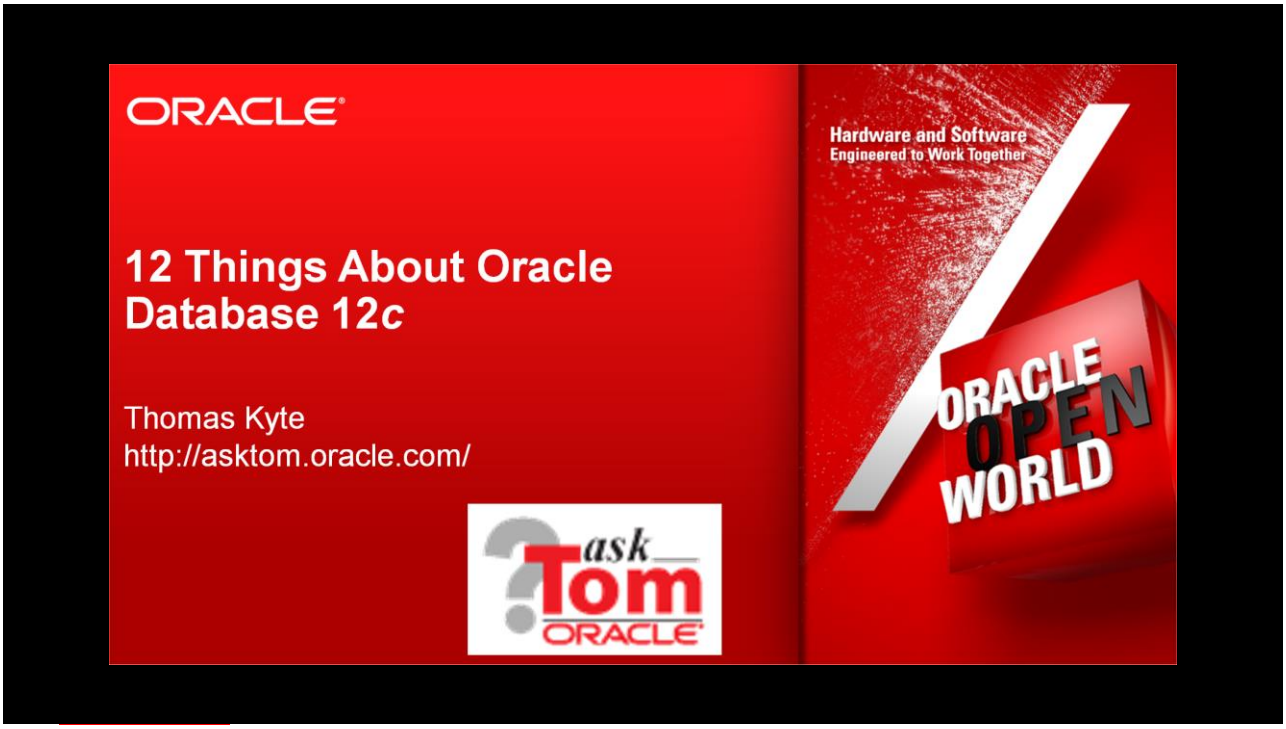
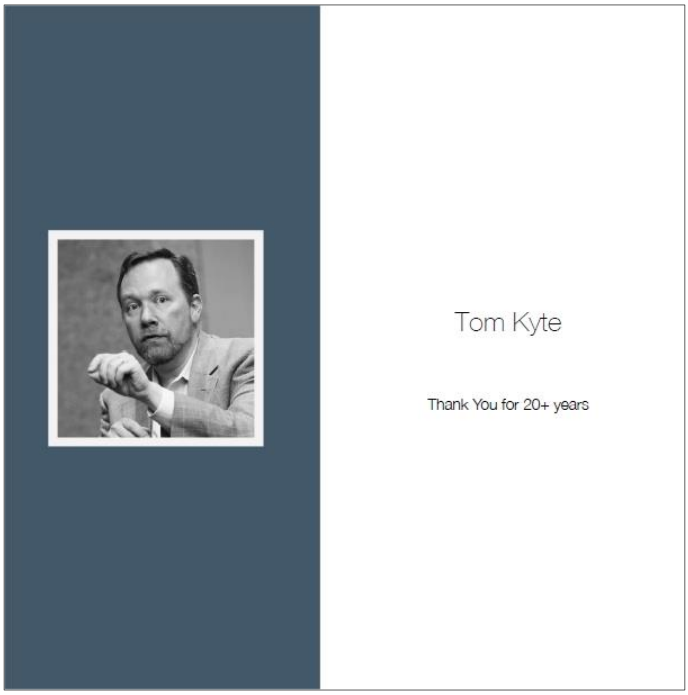
Top 10, no – make that 11, things about Oracle Database 11g Release 1

Thomas Kyte
http://asktom.oracle.com

14

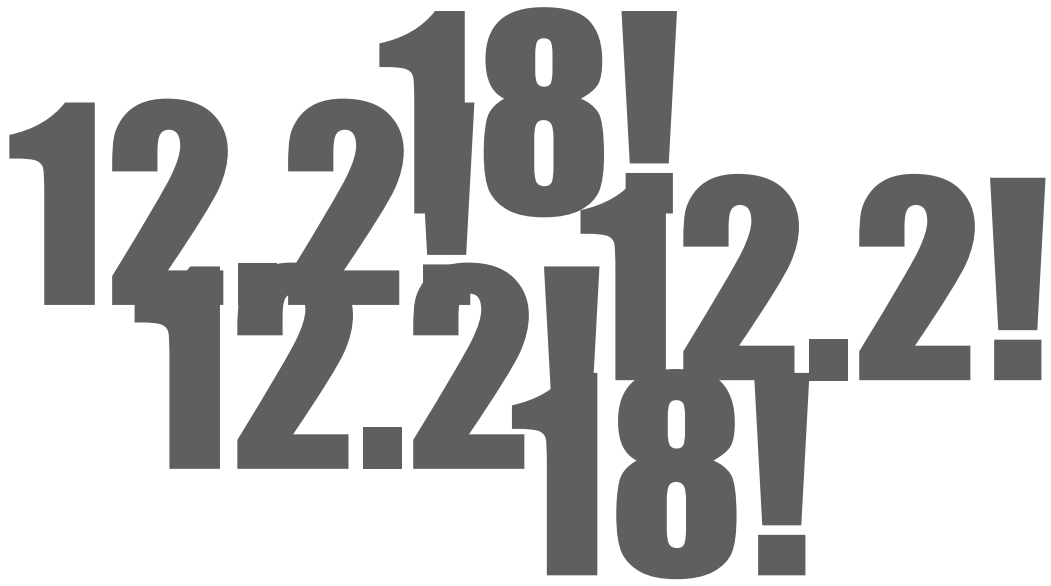

ORACLE
12 Things About Oracle Database 12c
Thomas Kyte
http://asktom.oracle.com/
ask Tom ORACLE
Hardware and Software Engineered to Work Together
ORACLE OPEN WORLD

15


Tom Kyte
Thank You for 20+ years

16

17



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18

18

reality

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19

19

20

20

```
SQL> select * from v$version;

BANNER
----------------------------------------------------------------
Oracle8i Enterprise Edition Release 8.1.7.4.0 - Production
PL/SQL Release 8.1.7.4.0 - Production
CORE    8.1.7.0.0       Production
TNS for HPUX: Version 8.1.7.4.0 - Production
NLSRTL Version 3.4.1.0.0 - Production
```

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21

```
SQL> select * from v$version;

BANNER
----------------------------------------------------------------
Oracle8i Enterprise Edition Release 8.1.7.4.0 - Production
PL/SQL Release 8.1.7.4.0 - Production
CORE    8.1.7.0.0       Production
TNS for HPUX: Version 8.1.7.4.0 - Production
NLSRTL Version 3.4.1.0.0 - Production
```

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22

```
SQL> select * from v$version;

BANNER
----------------------------------------------------------------
Oracle8i Enterprise Edition Release 8.1.7.4.0 - Production
PL/SQL Release 8.1.7.4.0 - Production
CORE    8.1.7.0.0       Production
TNS for HPUX: Version 8.1.7.4.0 - Production
NLSRTL Version 3.4.1.0.0 - Production
```

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23

you still should be here

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24

there's a lot in 12.2/18/19

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get started right now

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install nothing

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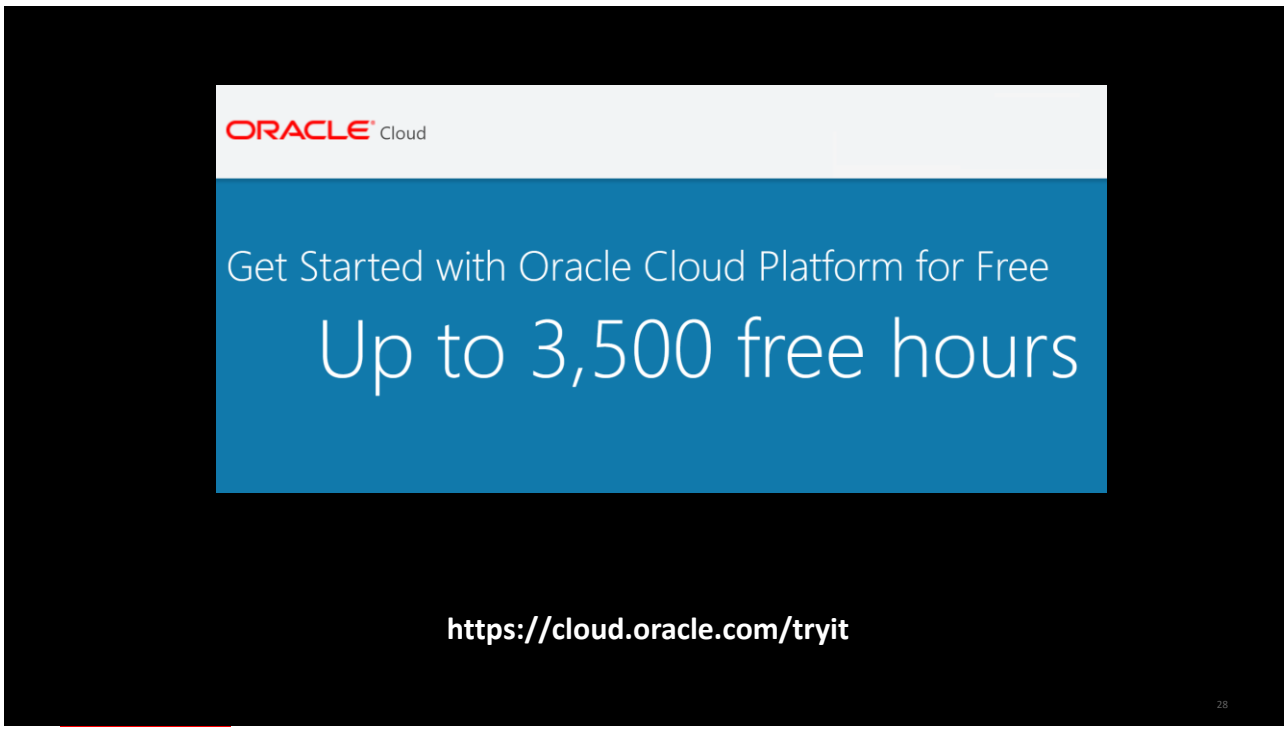
27

27



28

install a little bit

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29

29

Oracle Technology Network

Database Virtual Box Appliance / Virtual Machine

Set-Up instructions: Database Application Development Hands On Labs
Updated: 10/18/2018

Welcome to the **Oracle Technology Network - Hands-on Database Application Development** lab installation instructions. This document describes how to install a virtual guest appliance that provides pre-configured Oracle software for your use.

Please note that this appliance is **for testing purposes only**, as such it is **unsupported** and should not to be used in production environment. This virtual machine contains:

- Oracle Linux 7
- Oracle Database 18.3 Linux x86-64
- Oracle SQL Developer 18.3
- Oracle Application Express 18.2
- Hands-On-Labs (accessed via the Toolbar Menu in Firefox)
  - Oracle REST Data Services 18.3
  - Oracle SQL Developer Data Modeler 18.3
  - Oracle XML DB

https://tinyurl.com/ora18vm

30

30

install lots :-)

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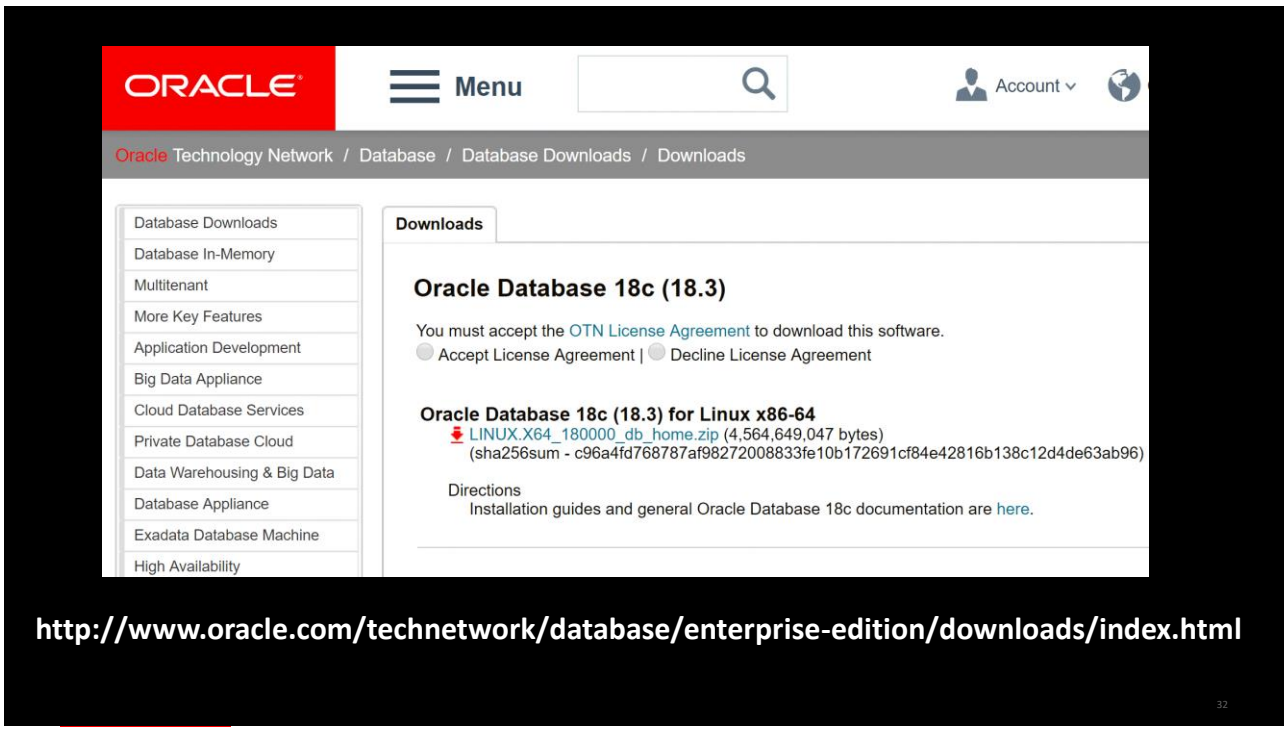
31



http://www.oracle.com/technetwork/database/enterprise-edition/downloads/index.html

32

18c install later -) easier !

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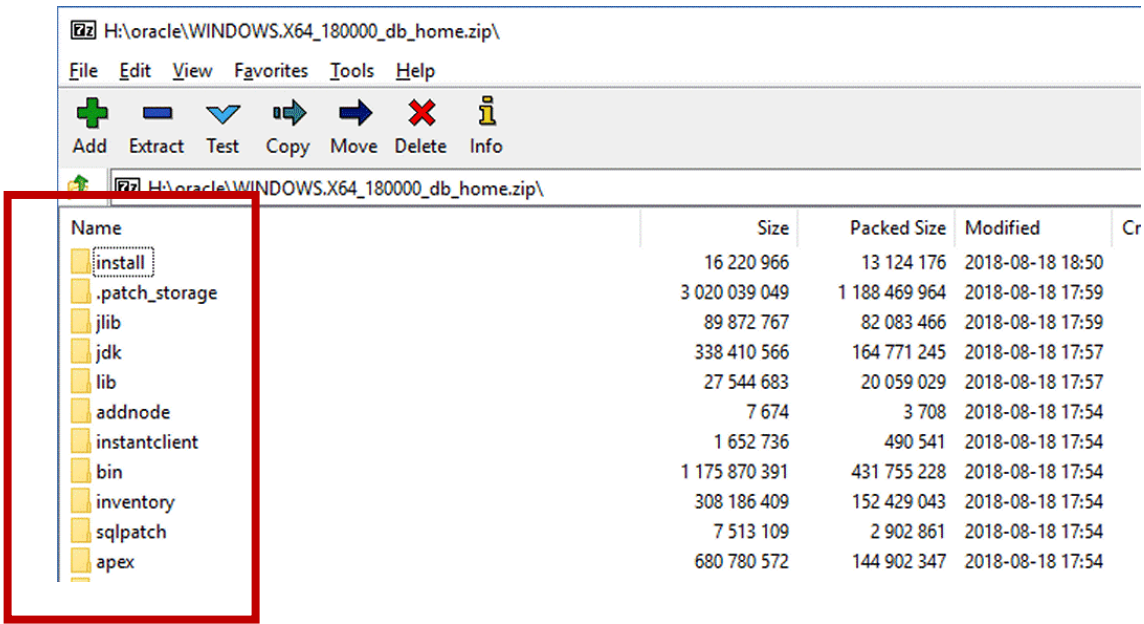
33

33



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34

34

18c install lots :)

more easier !

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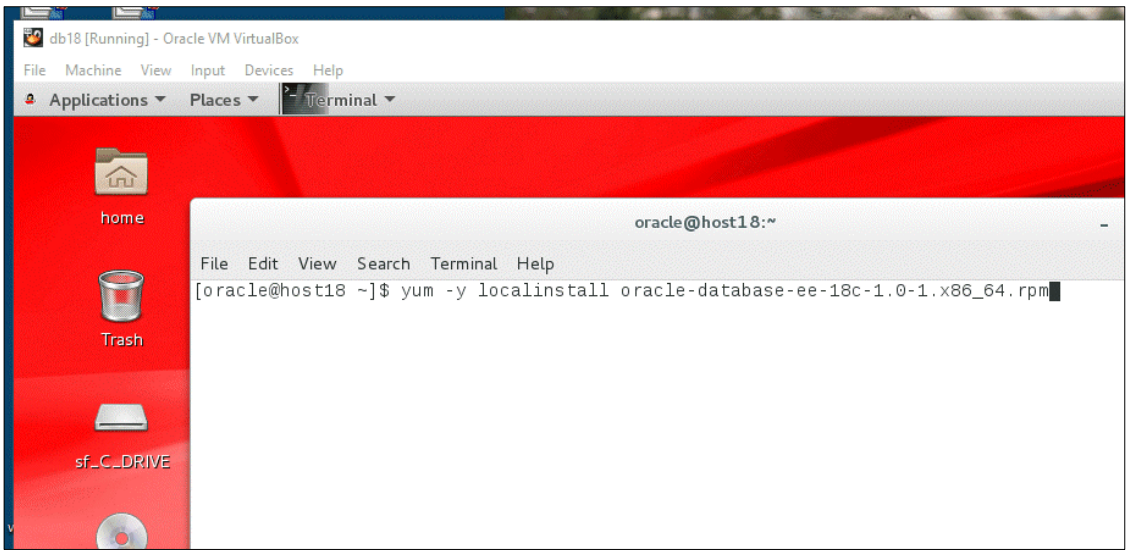
35

35



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36

36

because there's 19c stuff in here

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37

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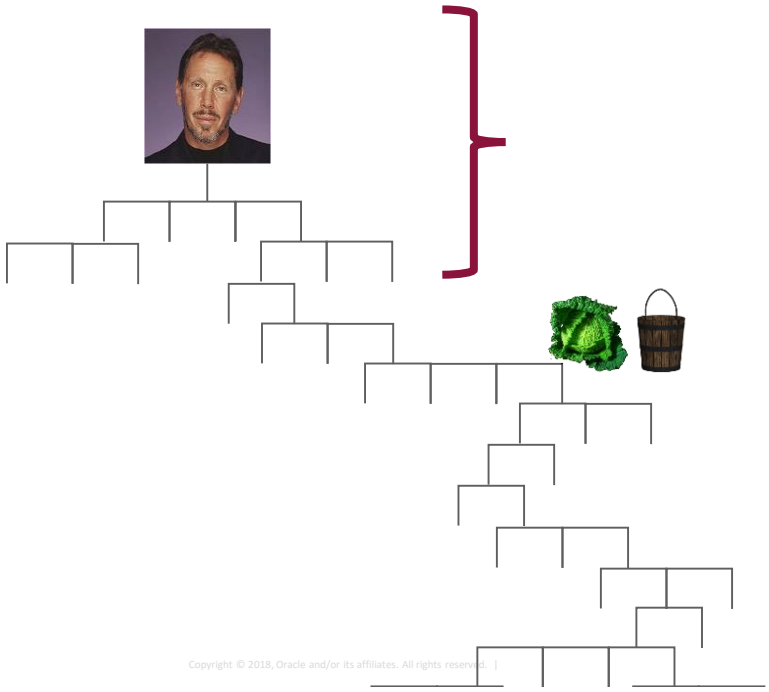

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41

1

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42

external tables

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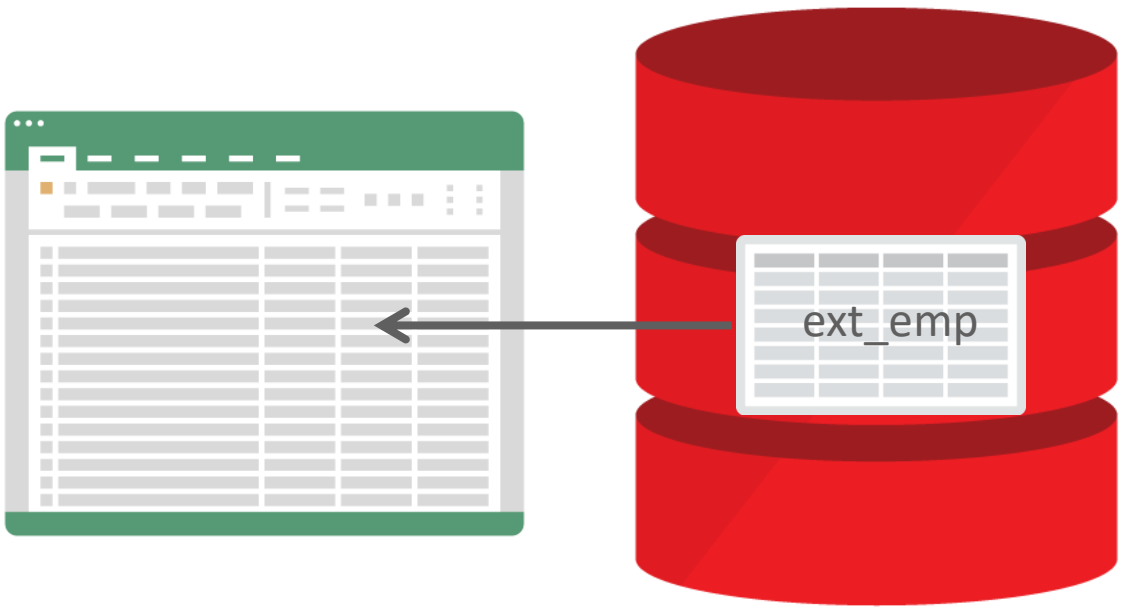
43



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44

```
SQL> create table ext_emp (
  2    empno      number(4),
  3    ename      varchar2(10),
 12   ( type oracle_loader
 13     default directory TMP
 14     access parameters
 15     ( records delimited by newline
 16       fields terminated by ','
 17       missing field values are null
 18       ( empno,ename,job,mgr,hiredate,sal,comm,deptno )
 19     )
 20     location ('emp20161001.dat'));

Table created.
```

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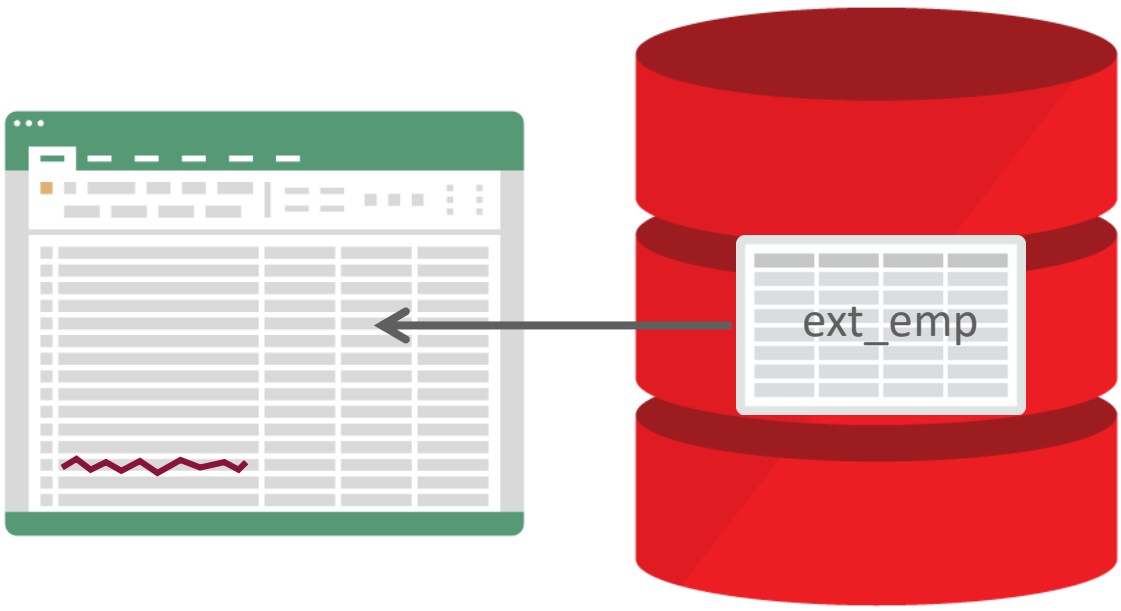
45



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46

```
SQL> select * from ext_emp;
select * from ext_emp
*
ERROR at line 1:
ORA-29913: error in executing ODCIEXTTABLEFETCH callout
ORA-30653: reject limit reached
```

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47

easy fix

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48

48

```
SQL> create table ext_emp (
  2    empno      number(4),
       ...
 12  ( type oracle_loader
 13    default directory TMP
 14    access parameters
 15    ( records delimited by newline
 16      fields terminated by ','
 17      missing field values are null
 18      ( empno,ename,job,mgr,hiredate,sal,comm,deptno )
 19    )
 20    location ('emp20161001.dat'))
 21    REJECT LIMIT UNLIMITED;

Table created.
```

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49

12.2

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50

50

query time modification

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51

```
SQL> select * from ext_emp
  2
```

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52

```
SQL> select * from ext_emp
  2    external modify ( location ('emp20161002.dat') );

     EMPNO ENAME      JOB              MGR HIREDATE          SAL
---------- ---------- --------- ---------- --------- ---------- ---
      7902 FORD       ANALYST          7566 03-DEC-81        3000
      7934 MILLER     CLERK            7782 23-JAN-82        1300
      7566 JONES      MANAGER          7839 02-APR-81        2975

      ...

      7499 ALLEN      SALESMAN         7698 20-FEB-81        1600
      7521 WARD       SALESMAN         7698 22-FEB-81        1250

8 rows selected.
```

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53

```
select * from ext_tab external modify (
   [ default directory ]
   [ location ]
   [ access parameters ]
   [ reject limit ]
);
```

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54

18c

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zero ddl option

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```
SQL> select * from external (
  2         empno      number(4),
  3         ename      varchar2(10),
  4         ...
 12        ( type oracle_loader
 13          default directory TMP
 14          access parameters
 15          ( records delimited by newline
 16            fields terminated by ','
 17            missing field values are null
 18            ( empno,ename,job,mgr,...)
 19          )
 20          location ('emp20161001.dat')
 21  );
```

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57

2

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58

column level collation

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59

```
SQL> select *
  2  from   customers
  3  where  cust_name = 'ADAMS';

COUNTRY      CREATED   CUST_NAME
------------ --------- --------------------
AUS          08-NOV-16 ADAMS
```

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60

looks great... until

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```
SQL> select *
  2  from   customers
  3  where  upper(cust_name) = 'ADAMS';

COUNTRY      CREATED   CUST_NAME
------------ --------- ------------
AUS          07-NOV-16 Adams
AUS          08-NOV-16 ADAMS
AUS          09-NOV-16 adams
```

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```
SQL> select * from customers
  2  where upper(cust_name) = 'ADAMS';
```

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63

63

```
SQL> select column_name
  2  from   user_ind_columns
  3  where  index_name = 'CUST_IX';

COLUMN_NAME
------------------------------
CUST_NAME

SQL> select * from customers
  2  where upper(cust_name) = 'ADAMS';

-----------------------------------------------------------
| Id  | Operation         | Name      | Rows  | Bytes |
-----------------------------------------------------------
|   0 | SELECT STATEMENT  |           |     1 |   152 |
|*  1 |  TABLE ACCESS FULL| CUSTOMERS |     1 |   152 |
-----------------------------------------------------------
```

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64

```
SQL> create index cust_ix
  2     on customers ( cust_name );

Index created.
```

```
SQL> create index cust_ix2
  2    on customers ( upper(cust_name) );

Index created.
```

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65

"DML slower"

"more contention"

"more redo/undo"

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66

"not my problem"

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67

68

unforeseen consequences

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69

```
SQL> alter table customers shrink space;

*
ERROR at line 1:
ORA-10631: SHRINK clause should not be specified for this object
```

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70

12.2+

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column level collation

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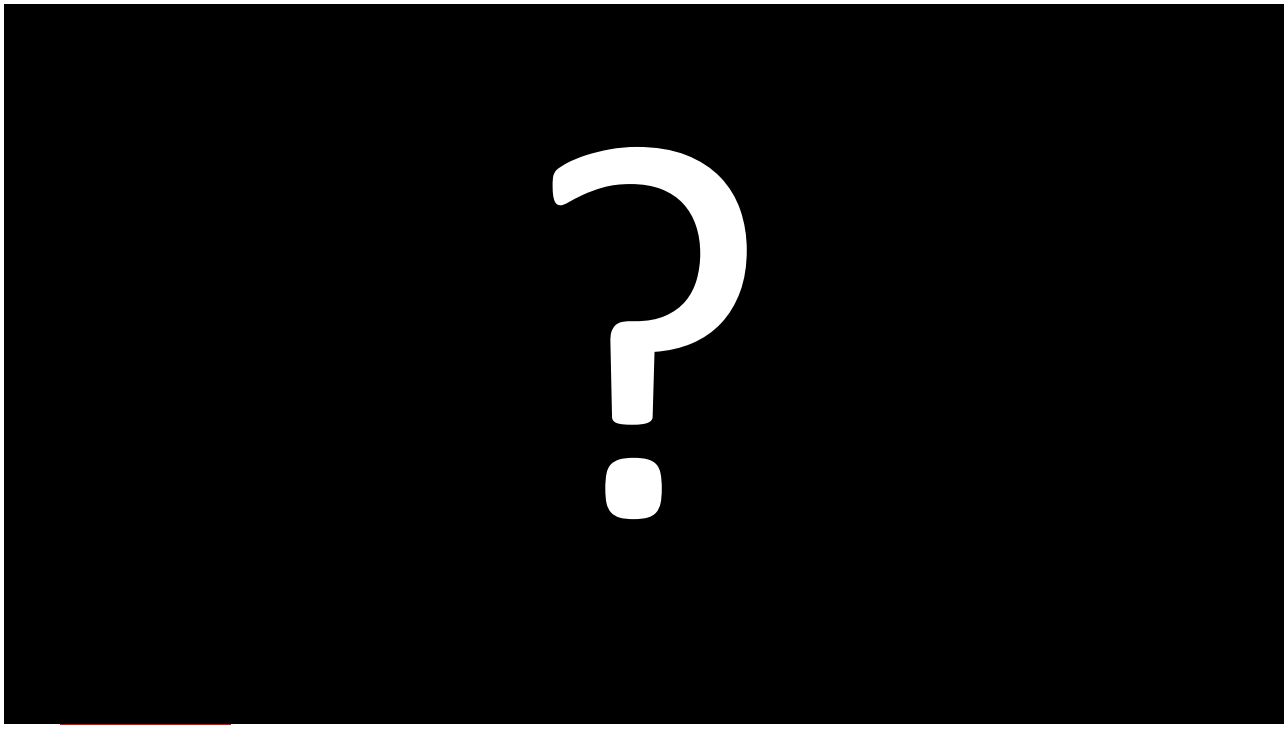

73

```
SQL> CREATE TABLE CUSTOMERS
  2  (
  3    COUNTRY   VARCHAR2(128),
  4    CREATED   DATE,
  5    CUST_NAME VARCHAR2(150) COLLATE BINARY_CI
  6  );

Table created.
```

"case insenstive"

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74

```
SQL> create index cust_ix
  2    on customers ( cust_name);

Index created.

SQL> set autotrace traceonly explain
SQL> select * from customers
  2  where cust_name = 'ADAMS';

-------------------------------------------------------------------
| Id  | Operation                            | Name      | Rows  |
-------------------------------------------------------------------
|   0 | SELECT STATEMENT                     |           |     1 |
|   1 |  TABLE ACCESS BY INDEX ROWID BATCHED| CUSTOMERS |     1 |
|*  2 |   INDEX RANGE SCAN                   | CUST_IX   |     1 |
-------------------------------------------------------------------
```

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75

"big deal"

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76

76

```
SQL> select * from customers
  2  where cust_name = 'ADAMS';

COUNTRY      CREATED   CUST_NAME
------------ --------- ----------------
AUS          07-NOV-16 Adams
AUS          08-NOV-16 ADAMS
AUS          09-NOV-16 adams
```

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77

binary_ci

```
SQL> select * from customers
  2  where cust_name = 'ADAMS';

COUNTRY      CREATED   CUST_NAME
------------ --------- ----------------
AUS          07-NOV-16 Adams
AUS          08-NOV-16 ADAMS
AUS          09-NOV-16 adams
```

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78

78

binary_ai

```
SQL> select * from customers
  2  where cust_name = 'ADAMS';

COUNTRY      CREATED   CUST_NAME
------------ --------- ----------------
AUS          07-NOV-16 Adams
AUS          08-NOV-16 ADAMS
AUS          09-NOV-16 adams
AUS          10-NOV-16 adáms
```

adáms

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79

column | table | user

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80

```
SQL> alter table people default collation binary_ai;
```

new columns only

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81

key point

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82

82

```
SQL> alter table people default collation binary_ai;

*
ERROR at line 1:
ORA-43929: Collation cannot be specified if
 parameter MAX_STRING_SIZE=STANDARD
```

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83

3

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84

84

remember temporary undo?

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85

```
SQL> insert into t values ('Hello','There');
insert into t values ('Hello','There')
            *
ERROR at line 1:
ORA-16000: database open for read-only access
```

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86

Active Data Guard

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87

```
SQL> alter session set temp_undo_enabled=true;

Session altered.

SQL> create global temporary table GTT_REPORT_STAGING
  2  ( ... );

SQL> insert into GTT_REPORT_STAGING
  2  select ...

SQL> select * from GTT_REPORT_STAGING join FIN_RESULTS
  2  ...
```

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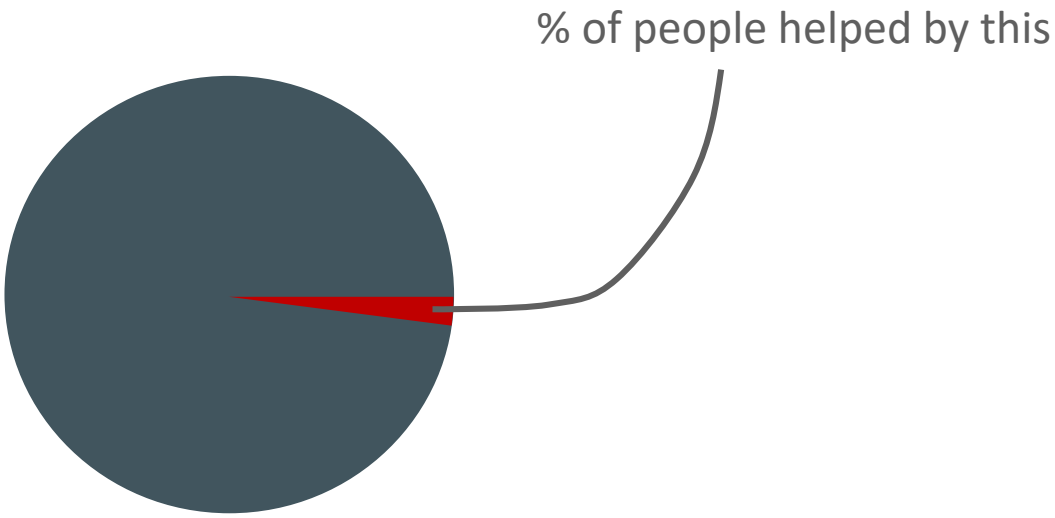
88



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89

19c

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90

DML redirect

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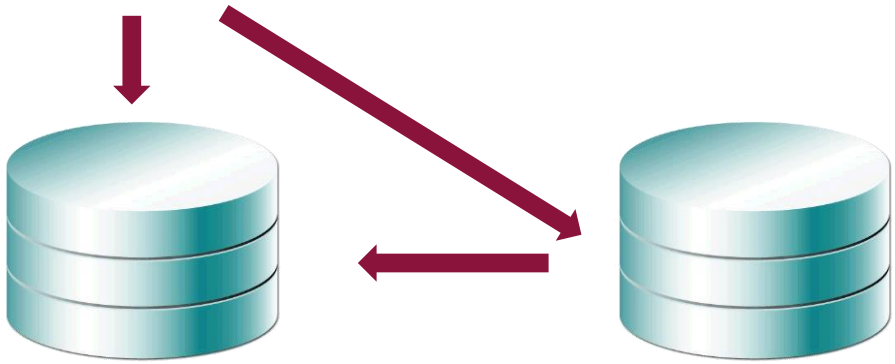
```
SQL> insert into REPORTING_STAGING
  2  select * from ...
```



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4

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a nice form of murder :-)

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aka, #1 reason for upgrading to 18c

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95

```
SQL>  insert into MY_TABLE
  2   select *
  3   from   MY_HUGE_GREAT_FAT_TABLE;
```

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97

```
SQL>  insert into MY_TABLE
  2   select *
  3   from   MY_HUGE_GREAT_FAT_TABLE
  4   where  LOAD_DATE > sysdate - 1;
```

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98

```
SQL> alter system kill session '123,456' immediate
```

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99

18c

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100

```
SQL> alter system kill cancel sql '123,456';
```

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101

5

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102

speaking of "#1 reason"

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#1 reason for upgrading to 19c

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```
SQL> select deptno, ename
  2  from   emp
  3  order by 1,2;

    DEPTNO ENAME
---------- ----------
        10 CLARK
        10 KING
        10 MILLER
        20 ADAMS
        20 FORD
        20 JONES
        20 SCOTT
        20 SMITH
        30 ALLEN
        30 BLAKE
        30 JAMES
        30 MARTIN
        30 TURNER
        30 WARD
```

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```
    DEPTNO MEMBERS
---------- -----------------------------------
        10 CLARK,KING,MILLER
        20 SMITH,JONES,SCOTT,ADAMS,FORD
        30 ALLEN,WARD,MARTIN,BLAKE,TURNER,JAMES
```

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106

how we used to do it

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```
SQL> select deptno , rtrim(ename,',') enames
  2  from ( select deptno,ename,rn
  3         from emp
  4         model
  5         partition by (deptno)
  6         dimension by (
  7            row_number() over
  8             (partition by deptno order by ename) rn
  9               )
 10         measures (cast(ename as varchar2(40)) ename)
 11         rules
 12         ( ename[any]
 13             order by rn desc = ename[cv()]||','||ename[cv()+1])
 14         )
 15   where rn = 1
 16   order by deptno;

    DEPTNO ENAMES
---------- ----------------------------------------
        10 CLARK,KING,MILLER
        20 ADAMS,FORD,JONES,SCOTT,SMITH
        30 ALLEN,BLAKE,JAMES,MARTIN,TURNER,WARD
```

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```
SQL> select deptno,
  2         substr(max(sys_connect_by_path(ename, ',')), 2) members
  3  from (select deptno, ename,
  4                row_number ()
  5                    over (partition by deptno order by empno) rn
  6        from emp)
  7  start with rn = 1
  8  connect by prior rn = rn - 1
  9  and prior deptno = deptno
 10  group by deptno
 11  /

    DEPTNO MEMBERS
---------- --------------------------------------------------------
        30 ALLEN,WARD,MARTIN,BLAKE,TURNER,JAMES
        20 SMITH,JONES,SCOTT,ADAMS,FORD
        10 CLARK,KING,MILLER
```

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```
SQL> select deptno,
  2     xmltransform
  3     ( sys_xmlagg
  4        ( sys_xmlgen(ename)
  5        ),
  6       xmltype
  7       (
  8         '<?xml version="1.0"?><xsl:stylesheet version="1.0"
  9           xmlns:xsl="http://www.w3.org/1999/XSL/Transform">
 10            <xsl:template match="/">
 11              <xsl:for-each select="/ROWSET/ENAME">
 12                <xsl:value-of select="text()"/>,</xsl:for-each>
 13            </xsl:template>
 14          </xsl:stylesheet>'
 15       )
 16    ).getstringval() members
 17  from emp
 18  group by deptno;

    DEPTNO MEMBERS
---------- --------------------------------------------------------
        10 CLARK,MILLER,KING,
        20 SMITH,FORD,ADAMS,SCOTT,JONES,
        30 ALLEN,JAMES,TURNER,BLAKE,MARTIN,WARD,
```

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```
SQL> create or replace type string_agg_type as object
  2  (
  3     total varchar2(4000),
  4
  5     static function
  6          ODCIAggregateInitialize(sctx IN OUT string_agg_type )
  7          return number,
  8
  9     member function
 10          ODCIAggregateIterate(self IN OUT string_agg_type ,
 11                               value IN varchar2 )
 12          return number,
 13
 14     member function
 15          ODCIAggregateTerminate(self IN string_agg_type,
 16                                 returnValue OUT  varchar2,
 17                                 flags IN number)
 18          return number,
 19
 20     member function
 21          ODCIAggregateMerge(self IN OUT string_agg_type,
 22                             ctx2 IN string_agg_type)
 23          return number
 24  );
 25  /
```

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111

11g

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112

```
SQL> select deptno,
  2         listagg( ename, ',')
  3              within group (order by empno) members
  4  from    emp
  5  group   by deptno;

    DEPTNO MEMBERS
---------- ----------------------------------------
        10 CLARK,KING,MILLER
        20 SMITH,JONES,SCOTT,ADAMS,FORD
        30 ALLEN,WARD,MARTIN,BLAKE,TURNER,JAMES
```

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except

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```
SQL> select deptno
 2          listagg(job,',') within group ( order by job) as jobs
 3   from   scott.emp
 4   group by deptno
 5   order by 1;

   DEPTNO JOBS
--------- --------------------------------------------------
       10 CLERK,MANAGER,PRESIDENT
       20 ANALYST,ANALYST,CLERK,CLERK,MANAGER
       30 CLERK,MANAGER,SALESMAN,SALESMAN,SALESMAN,SALESMAN
```

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115

```
SQL> select owner
 2          listagg(object_type,',') within group
 3              ( order by object_id ) as types
 4   from   all_ojects
 5   group by owner
 6   order by 1;
ERROR:
ORA-01499: result of string concatenation is too long
```

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116

19c

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117

```
SQL> select deptno
 2          listagg(distinct job,',') within group ( order by job) as jobs
 3   from   scott.emp
 4   group by deptno
 5   order by 1;

    DEPTNO JOBS
---------- --------------------------------------------------
        10 CLERK,MANAGER,PRESIDENT
        20 ANALYST,CLERK,MANAGER
        30 CLERK,MANAGER,SALESMAN
```

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6

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back to bad SQL

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maybe murder won't help

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122

bad SQL just keeps coming back...

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resource consumption

automatic quarantine of bad SQL

elapsed time

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error on subsequent execution

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1) alerts to administrator

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or...

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2) automated historical diagnosis/repair

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7

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maybe murder wasn't the right thing

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131

```
SQL>  insert into MY_TABLE
  2   select *
  3   from   MY_HUGE_GREAT_FAT_TABLE
  4   where  LOAD_DATE > sysdate - 90;
```

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133

```
SQL>  insert into MY TABLE
  2   select /*+ INDEX(W CUST_DATE_IX) */ *
  3   from   MY_HUGE_GREAT_FAT_TABLE w
  4   where  LOAD_DATE > sysdate - 90;
```

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134

18c

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135

```
SQL> alter system set optimizer_ignore_hints = true
```

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136

8

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137

cool

138

maybe it was the opposite ?

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139

```
SQL>  insert into MY_TABLE
  2   select *
  3   from   MY_HUGE_GREAT_FAT_TABLE
  4   where  LOAD_DATE > sysdate - 1/24;
```

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but what is best practice ?

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1) monitor the SQL workload

AWR / Top SQL

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2) consider indexes per SQL

leading columns

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3) consolidate tables/columns

(a)
(a,b)
(a,b,c)

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4) create nosegment/unusable

dictionary only

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5) check "virtual" explain plan

cost/cardinality

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6) create true index (as invisible)

no impact risk

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7) test execute each SQL for benefit

response time/IO

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149

8) decide on each index worth

"majority wins"

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150

9) add NO_INDEX hint to others

no regression

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10) make new indexes visible

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we're done!

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153

154

go to step 1

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automatic indexes

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157

we follow best practice

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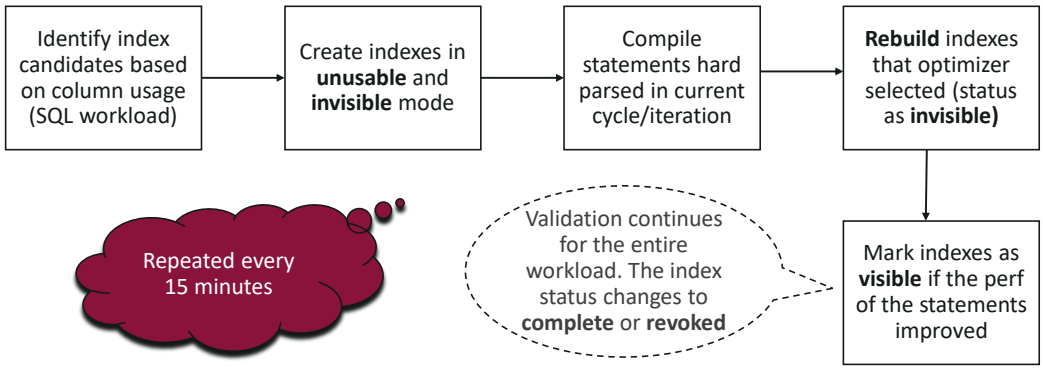
158



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159

only preferences required

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160

AUTO_INDEX_EXCLUDE_SCHEMA
AUTO_INDEX_REPORT_RETENTION
AUTO_INDEX_RETENTION_FOR_AUTO
AUTO_INDEX_RETENTION_FOR_MANUAL
AUTO_INDEX_DEFAULT_TABLESPACE
AUTO_INDEX_TEMP_TABLESPACE
AUTO_INDEX_MODE
AUTO_INDEX_SPACE_BUDGET

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expect this to evolve over time

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9

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outages...

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12.2

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online "everything"

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```
SQL> alter table t move online;

Table altered.
```

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really is "everything"

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partition existing table

one command

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169

```
SQL> create table T as
  2  select d.*
  3  from dba_Objects d,
  4       ( select 1 from dual
  5         connect by level <= 20 )
  6  where d.object_id is not null;

Table created.

SQL> create index IX on t ( object_id );

Index created.

SQL> create index IX2 on t ( created, object_name );

Index created.
```

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170

170

```
SQL> alter table T modify
                                                    compress
```

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one thing missing

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fixed in 18c

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online merge partition

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"big deal"

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175

```
SQL> create table sales
  2    ( ts   timestamp,
  3      id   int,
  4      amt  number,
  5      product int,
  6      customer int,
         ...
         ...
 17    )
 18  partition by range ( ts )
 19  interval ( numtodsinterval(1,'HOUR') )
 20  (
 21    partition p1 values less than ( timestamp '2018-07-01 00:00:00' )
 22  );

Table created.
```

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176

24 hours later

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177

```
SQL> select partition_name, high_value
  2  from user_tab_partitions
  3  where table_name = 'SALES'
  4  order by partition_position;

PARTITION_NAME                 HIGH_VALUE
------------------------------ ----------------------------------
P1                             TIMESTAMP' 2018-07-01 00:00:00'
P20180701_00                   TIMESTAMP' 2018-07-01 01:00:00'
P20180701_01                   TIMESTAMP' 2018-07-01 02:00:00'
P20180701_02                   TIMESTAMP' 2018-07-01 03:00:00'
P20180701_03                   TIMESTAMP' 2018-07-01 04:00:00'
...
...
P20180702_13                   TIMESTAMP' 2018-07-02 14:00:00'
P20180702_14                   TIMESTAMP' 2018-07-02 15:00:00'
P20180702_15                   TIMESTAMP' 2018-07-02 16:00:00'

41 rows selected.
```

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178

```
SQL> select * from sales
  2  where ts > timestamp '2018-07-02 15:00:00';

-------------------------------------------------------------------------------------------
| Id  | Operation                | Name  | Rows  | Bytes | Cost (%CPU)| Pstart| Pstop |
-------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT         |       |     9 |   387 |     7   (0)|       |       |
|   1 |  PARTITION RANGE ITERATOR|       |     9 |   387 |     7   (0)|    41 |1048575|
|*  2 |   TABLE ACCESS FULL      | SALES |     9 |   387 |     7   (0)|    41 |1048575|
-------------------------------------------------------------------------------------------
```

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179

one year later ...

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180

... lot of partitions

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18c

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182

```
SQL> declare
  2    d date := date '2018-07-01';
  3    ddl varchar2(4000);
  4  begin
  5    select listagg(partition_name||chr(10),',') within group ( order by partition_position )
  6    into   ddl
  7    from   user_tab_partitions
  8    where  table_name = 'SALES'
  9    and    partition_name like 'P'||to_char(d,'yyyymmdd')||'%';
 10
 11    ddl := 'alter table sales merge partitions '||ddl||
 12           ' into partition p'||to_char(d,'yyyymmdd')||' online';
 13
 14    dbms_output.put_line(ddl);
 15    execute immediate ddl;
 16  end;
 17  /
alter table sales merge partitions
    P20180701_00
   ,P20180701_01
   ,P20180701_02
   ...
   ,P20180701_23
into partition p20180701 online
```

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183

10

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184

security

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common technique

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186

```
SQL> alter user data_owner account lock

User altered.
```

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187

security risk

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188

188

```
SQL> conn wmsys/wmsys
ERROR:
ORA-28000: the account is locked


Warning: You are no longer connected to ORACLE.
```

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190

190

better schema management

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191

```
SQL> create user data_owner
  2           no authentication;
```

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192

```
SQL> conn data_owner/random_password

ORA-01017: invalid username/password; logon denied
```

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bonus security

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194

194

DBSAT

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195

196

not a typo

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download from MOS

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bonus security

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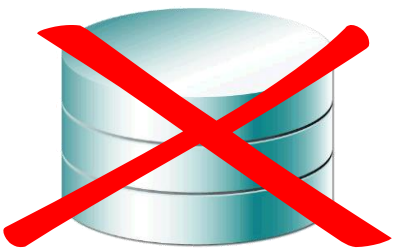

etc etc etc

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Oracle
Directory Services

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201

last

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202

this is the big one

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203

18c XE

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204

100% free

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206

12 GB of user data
2 GB of database RAM
2 CPU threads
3 Pluggable Databases

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207

"Is it feature hobbled?"

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208

Oracle Multitenant
SQLJ
Online index rebuild
Online table reorg
Online table redefinition
Trial recovery
Fast start recovery
Flashback table
Flashback query
Flashback database
Advanced Queueing
Network Compression

Client side result cache
Server side result cache
Adaptive plans
In-memory column store
In-memory aggregation
Attribute Clustering
Column encryption
Tablespace encryption
Advanced Security
Database Vault
Label Security
AD users

Privilege Analysis
Real Application Security
Data Redaction
Virtual Private Database
Spatial
Graph
Partitioning
Advanced Analytics
Advanced Compression
Advanced Index Compression
Transportable Tablespace
Query Rewrite

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EE plus most extra cost options

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210

FREE

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211

wrap up

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212

there's a lot in 12.2/18/19

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new feature model

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lots not covered today

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plenty to excite

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ORACLE

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217