ORACLE

When Things Go South

Skill First & Fast

Daniel Overby Hansen

Senior Principal Product Manager

Photo by Dion Tavenier on Unsplash

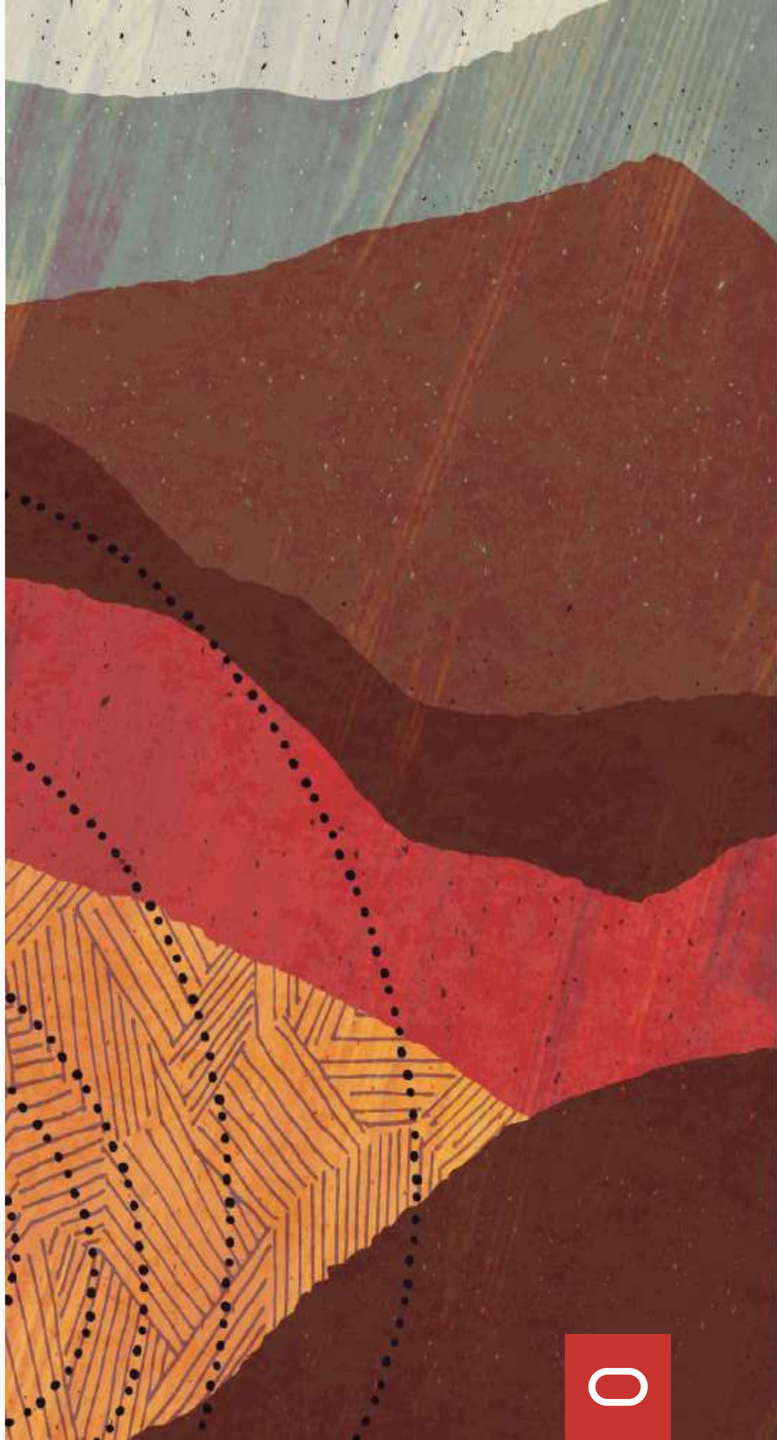
Daniel Overby Hansen

Senior Principal Product Manager
Cloud Migration

https://dohdatabase.com

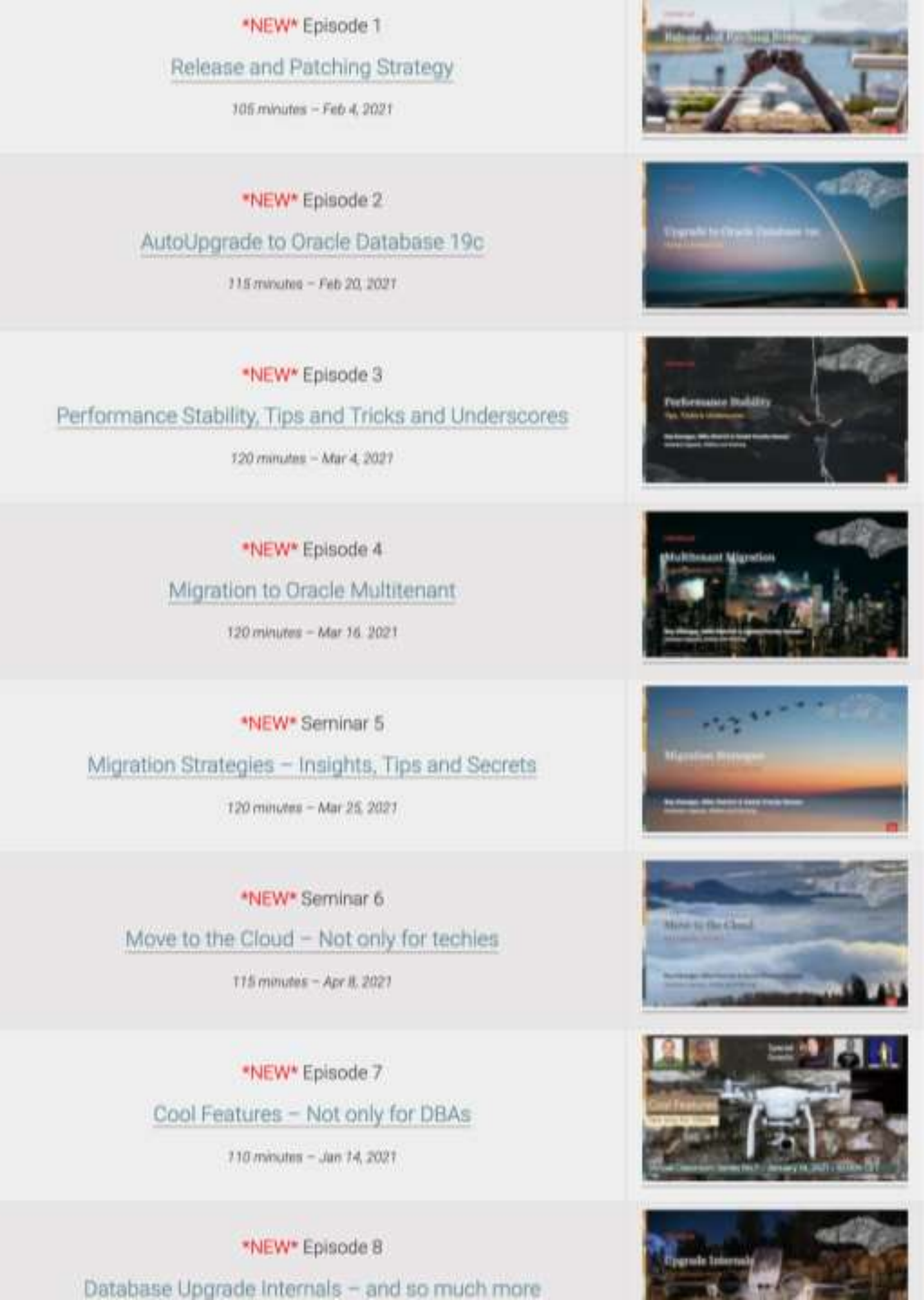
@dohdatabase

dohdatabase



Recorded Web Seminars

https://dohdatabase.com/webinars



NEW Episode 1

Release and Patching Strategy

105 minutes – Feb 4, 2021

NEW Episode 2

AutoUpgrade to Oracle Database 19c

115 minutes – Feb 20, 2021

NEW Episode 3

Performance Stability, Tips and Tricks and Underscores

120 minutes – Mar 4, 2021

NEW Episode 4

Migration to Oracle Multitenant

120 minutes – Mar 16, 2021

NEW Seminar 5

Migration Strategies – Insights, Tips and Secrets

120 minutes – Mar 25, 2021

NEW Seminar 6

Move to the Cloud – Not only for techies

115 minutes – Apr 8, 2021

NEW Episode 7

Cool Features – Not only for DBAs

110 minutes – Jan 14, 2021

NEW Episode 8

Database Upgrade Internals – and so much more

don't PANIC

Photo by Usman Yousaf on Unsplash

don't

ANSWER

Photo by Icons8 Team on Unsplash

brew COFFEE

Photo by Icons8 Team on Unsplash

In Case of Emergency

1. Gather
2. Resume or Fallback
3. Learn

gather DIAGNOSTIC information

Photo by Darwin Vegher on Unsplash

AutoUpgrade | What if … AutoUpgrade fails

1. Create zip file

```
$ java -jar autoupgrade.jar -config config.cfg -zip
```

2. Optionally, add `opatch lsinventory`

```
$ $ORACLE_HOME/OPatch/opatch lsinventory > opatch.txt
$ zip -r AUPG_210419_0735_461.zip opatch.txt
```

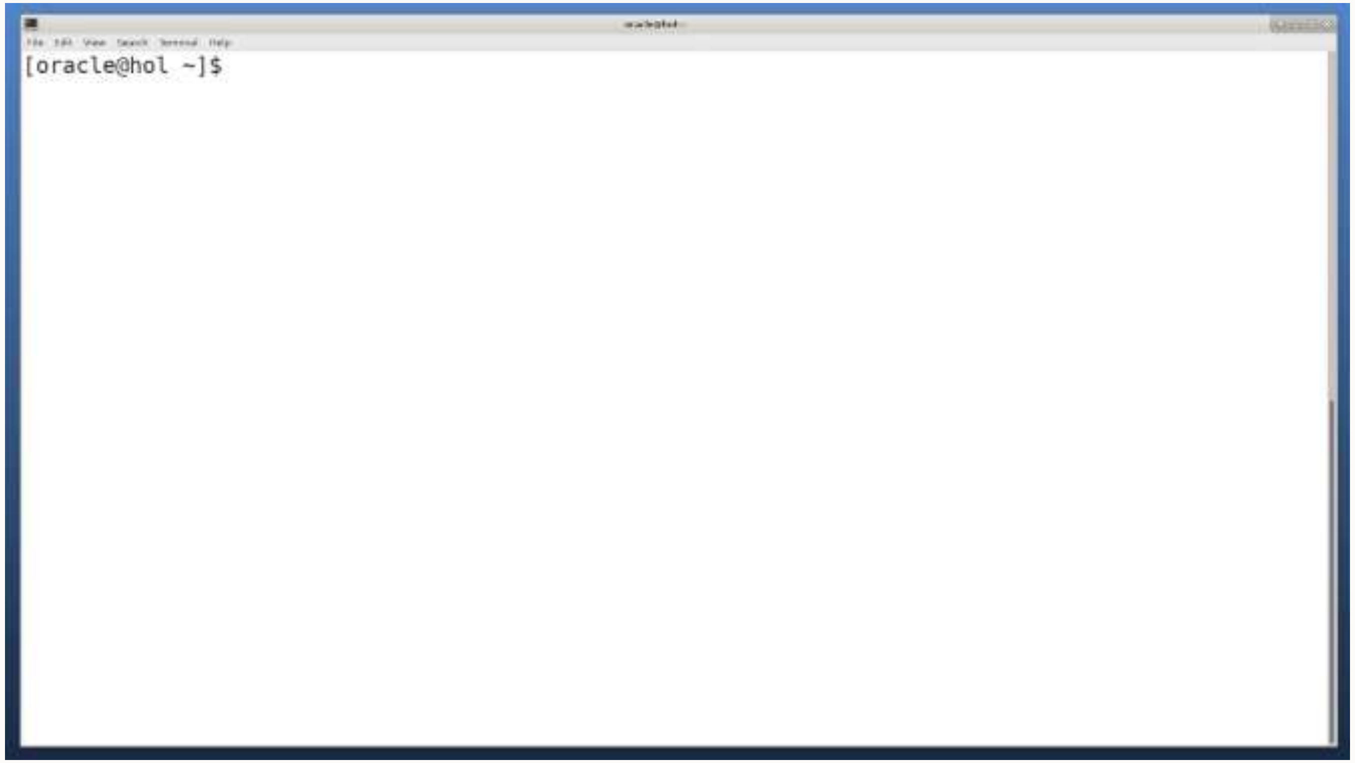
3. Upload it to My Oracle Support

My Oracle Support

Welcome

Search our Knowledge base and engage Communities to learn about products, services, and to find help resolving issues

AutoUpgrade | What if … AutoUpgrade fails



```
[oracle@hol ~]$
```

Watch on YouTube

Upgrade | Debug

Debug the upgrade engine - the Perl scripts

```
$ dbupgrade -z -Z n
```

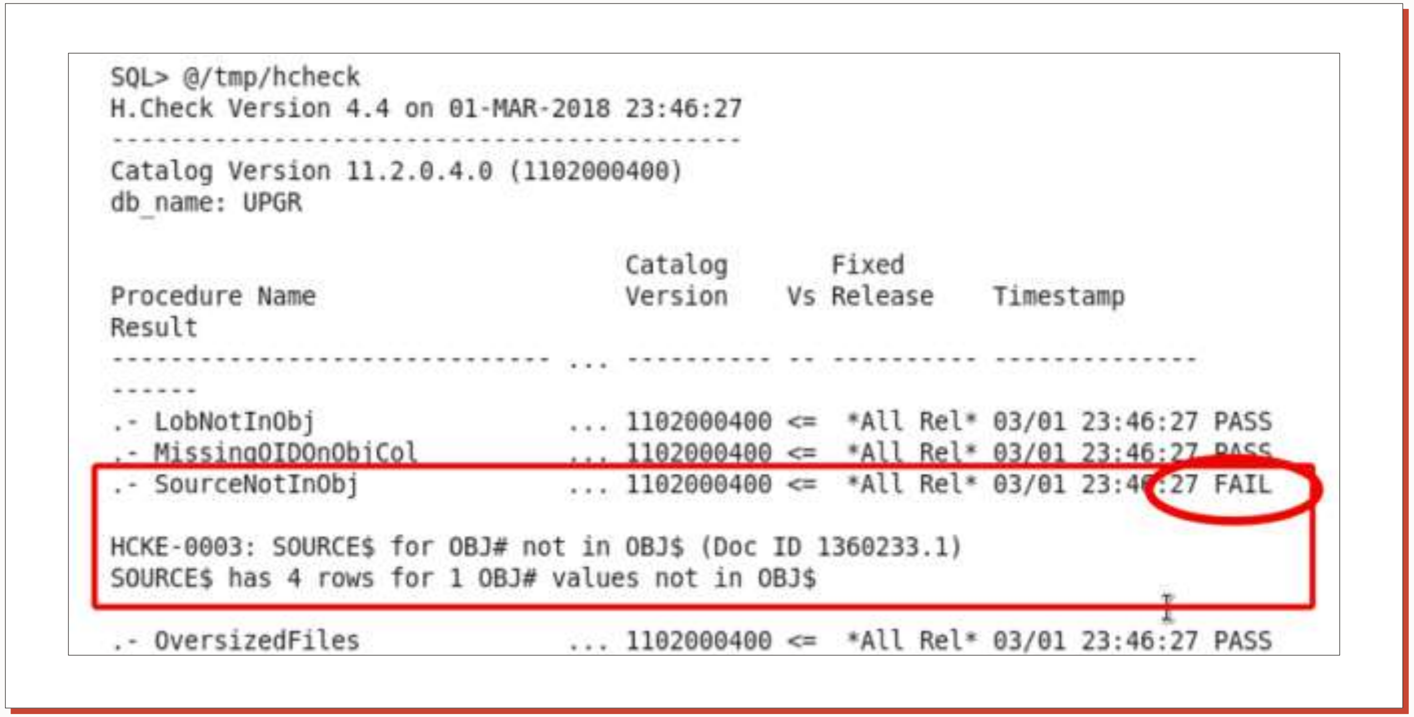
Via AutoUpgrade (config file)

```
upg1.catctl_options=-z
```

Health Check | hcheck.sql

If your database is highly important, do a health check

- `hcheck.sql` - Script to Check for Known Problems (MOS Note: 136697.1)



```
SQL> @/tmp/hcheck
H.Check Version 4.4 on 01-MAR-2018 23:46:27
-------------------------------------------
Catalog Version 11.2.0.4.0 (1102000400)
db_name: UPGR

                                   Catalog       Fixed
Procedure Name                     Version    Vs Release    Timestamp
Result
------------------------------ ... ---------- -- ---------- --------------
------
.- LobNotInObj                 ... 1102000400 <=  *All Rel* 03/01 23:46:27 PASS
.- MissingOIDOnObjCol          ... 1102000400 <=  *All Rel* 03/01 23:46:27 PASS
.- SourceNotInObj              ... 1102000400 <=  *All Rel* 03/01 23:46:27 FAIL

HCKE-0003: SOURCE$ for OBJ# not in OBJ$ (Doc ID 1360233.1)
SOURCE$ has 4 rows for 1 OBJ# values not in OBJ$

.- OversizedFiles              ... 1102000400 <=  *All Rel* 03/01 23:46:27 PASS
```

Diagnostics | Other Options

Misbehaving statements

- Create SQL Test Case (DBMS_SQLDIAG)
- Create SQL Tuning Set (DMBS_SQLSET)
- SQLT

Diagnostics | Daniel's Law

Better too much than too little

RESUME

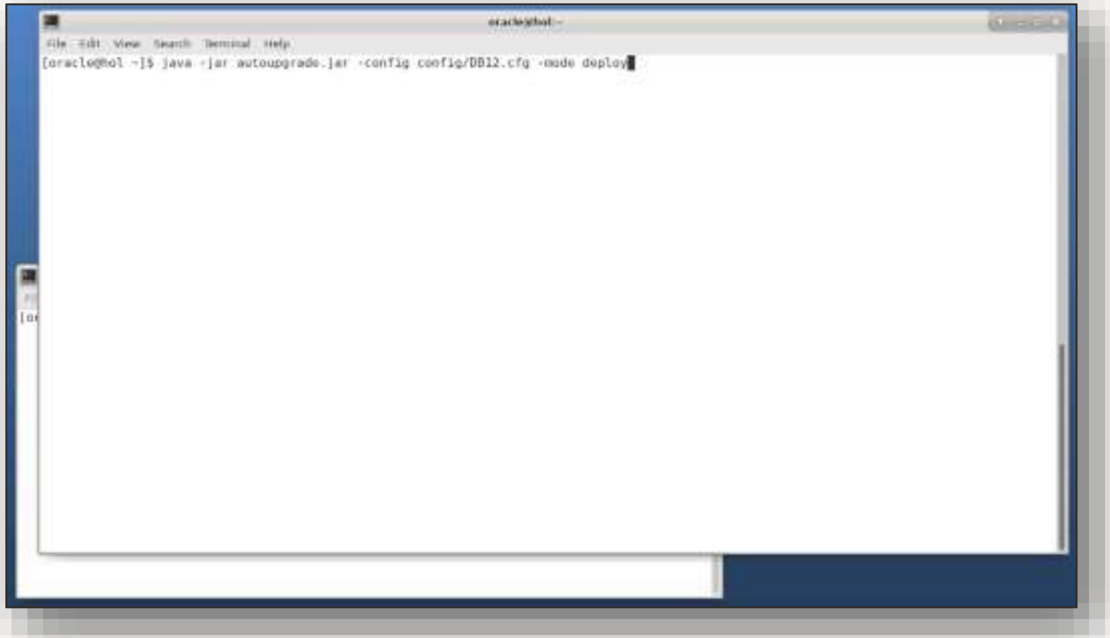
or

FALLBACK

Photo by Jim Wilson on Unsplash

Upgrade | Resumable

- AutoUpgrade is fully resumable
- Restart using the same command line
- Previous work is preserved
  - upgrade restarts from where it left



```
[oracle@hol ~]$ java -jar autoupgrade.jar -config config/DB12.cfg -mode deploy
```

Watch on YouTube

Upgrade | Resumable

Or better, use `nohup`

```
nohup java -jar autoupgrade.jar -config db.cfg -mode deploy -noconsole &
```

Or even better, use a terminal multiplexer

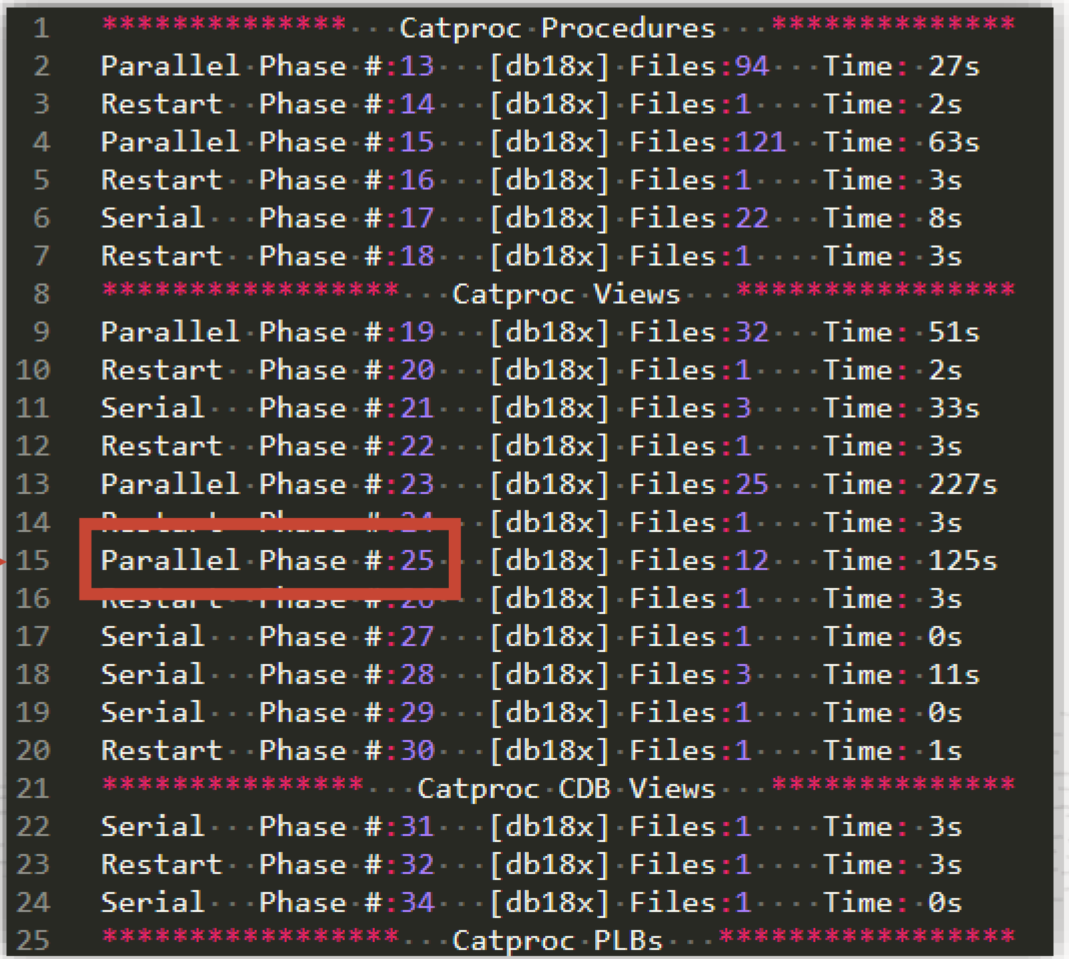
- `tmux`
- `screen`

Upgrade | Resumable

`dbupgrade` is also fully resumable

```
# Resume from failed phase
$ dbupgrade -R

# Resume from specific phase
$ dbupgrade -p 25
```



```
***************   Catproc Procedures   ***************
Parallel Phase #:13   [db18x] Files:94    Time: 27s
Restart  Phase #:14   [db18x] Files:1     Time: 2s
Parallel Phase #:15   [db18x] Files:121   Time: 63s
Restart  Phase #:16   [db18x] Files:1     Time: 3s
Serial   Phase #:17   [db18x] Files:22    Time: 8s
Restart  Phase #:18   [db18x] Files:1     Time: 3s
*****************   Catproc Views   ****************
Parallel Phase #:19   [db18x] Files:32    Time: 51s
Restart  Phase #:20   [db18x] Files:1     Time: 2s
Serial   Phase #:21   [db18x] Files:3     Time: 33s
Restart  Phase #:22   [db18x] Files:1     Time: 3s
Parallel Phase #:23   [db18x] Files:25    Time: 227s
Restart  Phase #:24   [db18x] Files:1     Time: 3s
Parallel Phase #:25   [db18x] Files:12    Time: 125s
Restart  Phase #:26   [db18x] Files:1     Time: 3s
Serial   Phase #:27   [db18x] Files:1     Time: 0s
Serial   Phase #:28   [db18x] Files:3     Time: 11s
Serial   Phase #:29   [db18x] Files:1     Time: 0s
Restart  Phase #:30   [db18x] Files:1     Time: 1s
***************   Catproc CDB Views   **************
Serial   Phase #:31   [db18x] Files:1     Time: 3s
Restart  Phase #:32   [db18x] Files:1     Time: 3s
Serial   Phase #:34   [db18x] Files:1     Time: 0s
*****************   Catproc PLBs   *****************
```

DBUA is not!

Photo by David Maunsell on Unsplash

Fallback Strategies

For Database Upgrades

Fallback | Database Downgrade

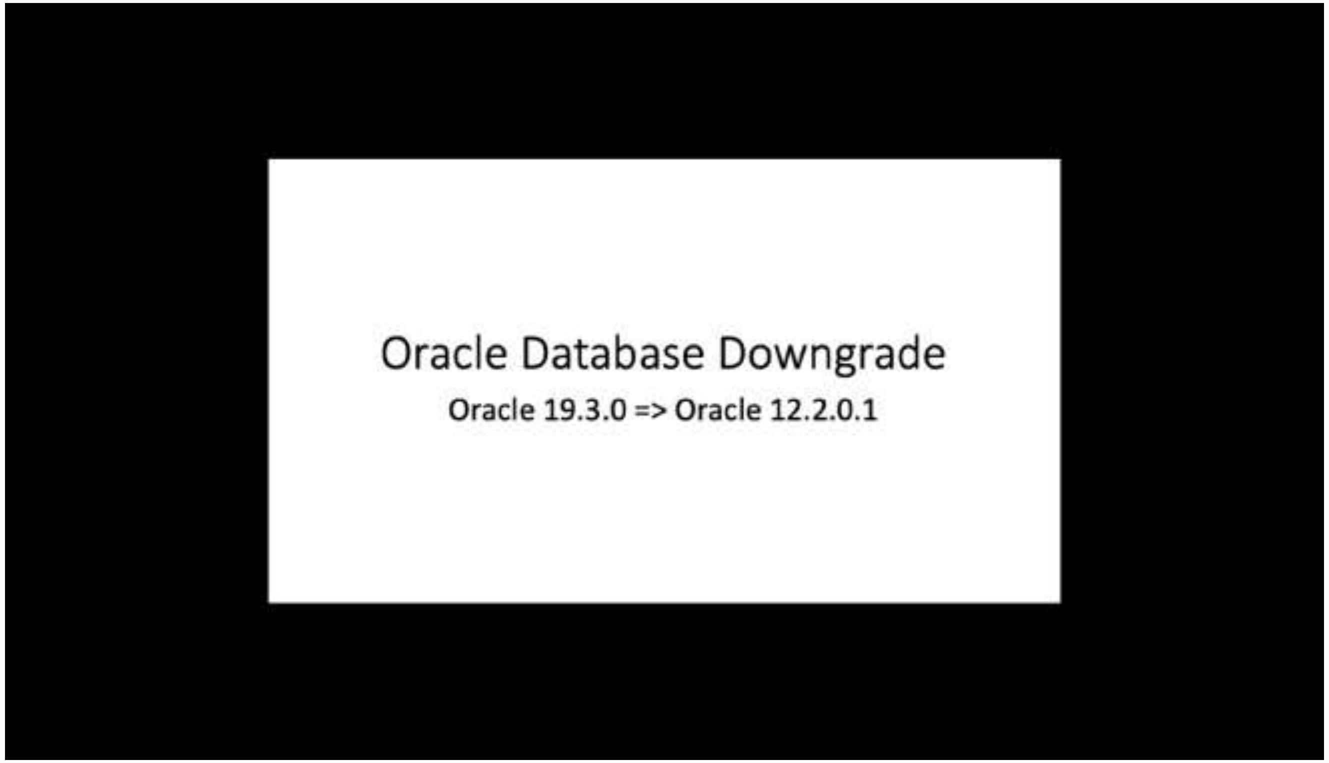
- Works also days after the upgrade without losing any changes
- `COMPATIBLE` must not be changed
- How to:
  - Run `catdwgrd.sql` in the 19c environment

    ```
    SQL> STARTUP DOWNGRADE
    SQL> @catdwgrd.sql
    ```

  - Run `catrelod.sql` in the source environment

    ```
    SQL> STARTUP UPGRADE
    SQL> @catrelod.sql
    ```

Fallback | Database Downgrade



Oracle Database Downgrade

Oracle 19.3.0 => Oracle 12.2.0.1

Watch on YouTube

Fallback | Database Downgrade

A downgraded database is not identical to the pre-upgraded database

The data dictionary will be different - but compatible

Examples:

- New table is not dropped, but truncated
- New index is not dropped
- Generally, dropping is avoid

Fallback | Flashback Database

Standard technique in AutoUpgrade

- COMPATIBLE must not be changed

Pre Upgrade Environment	Post Upgrade Environment

CREATE RESTORE POINT **grpt**
GUARANTEE FLASHBACK DATABASE;	

UPGRADE	
	SHUTDOWN IMMEDIATE
	STARTUP MOUNT;
	FLASHBACK DATABASE TO RESTORE POINT **grpt**;
	SHUTDOWN IMMEDIATE
STARTUP MOUNT;	
ALTER DATABASE OPEN RESETLOGS;	
DROP RESTORE POINT **grpt**;	

Fallback | Flashback Database

Guaranteed Restore Points

```
upg1.source_home=/u01/app/oracle/product/12.2.0.1
upg1.target_home=/u01/app/oracle/product/19
upg1.sid=CDB1
upg1.restoration=yes
upg1.drop_grp_after_upgrade=no
```

- Default behavior:
  - AutoUpgrade creates GRP except for
    - Standard Edition 2
    - `restoration=no`
  - GRP will be kept
  - GRP needs to be removed manually except for
    - `drop_grp_after_upgrade=yes` will only remove it when upgrade completed successfully

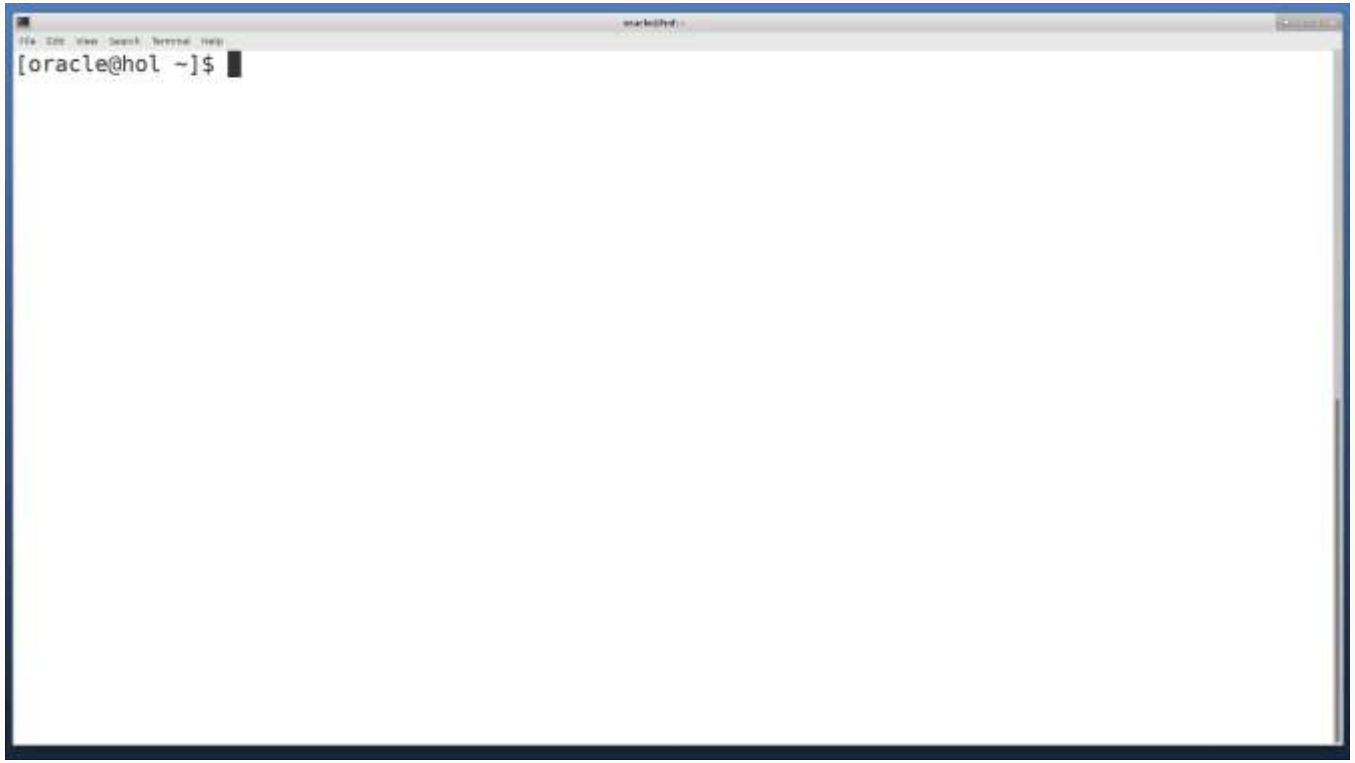
Fallback | Flashback Database

Use AutoUpgrade to:

- Flashback the database
- Revert a plug-in operation (only when data files are copied)
- Revert a non-CDB to PDB conversion (only when data files are copied)

```
java -jar autoupgrade.jar -restore -jobs n
```

Fallback | Flashback Database



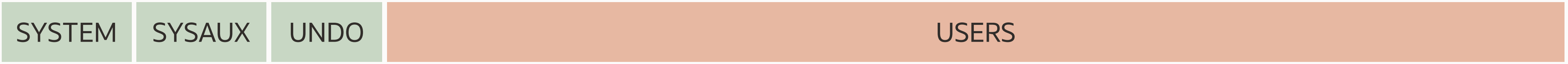
```
[oracle@hol ~]$ 
```

Watch on YouTube

Fallback | Partial Offline Backup

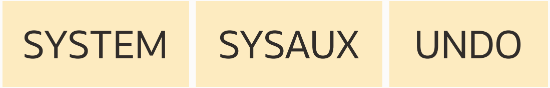
A database upgrade does not touch user data

Your data files



SYSTEM SYSAUX UNDO USERS

Partial offline backup (plus redo log and control files)



SYSTEM SYSAUX UNDO

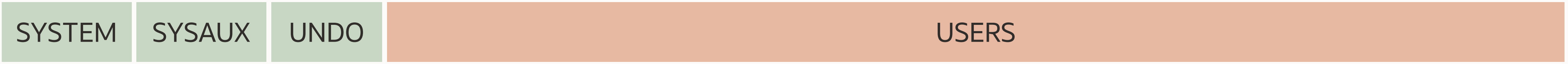
Start upgrade

Pro tip: Works for SE2 and databases in NOARCHIVELOG mode

Fallback | Partial Offline Backup

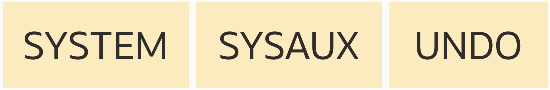
To restore

Your data files



SYSTEM SYSAUX UNDO USERS

Your backup (plus redo log and control files)



SYSTEM SYSAUX UNDO

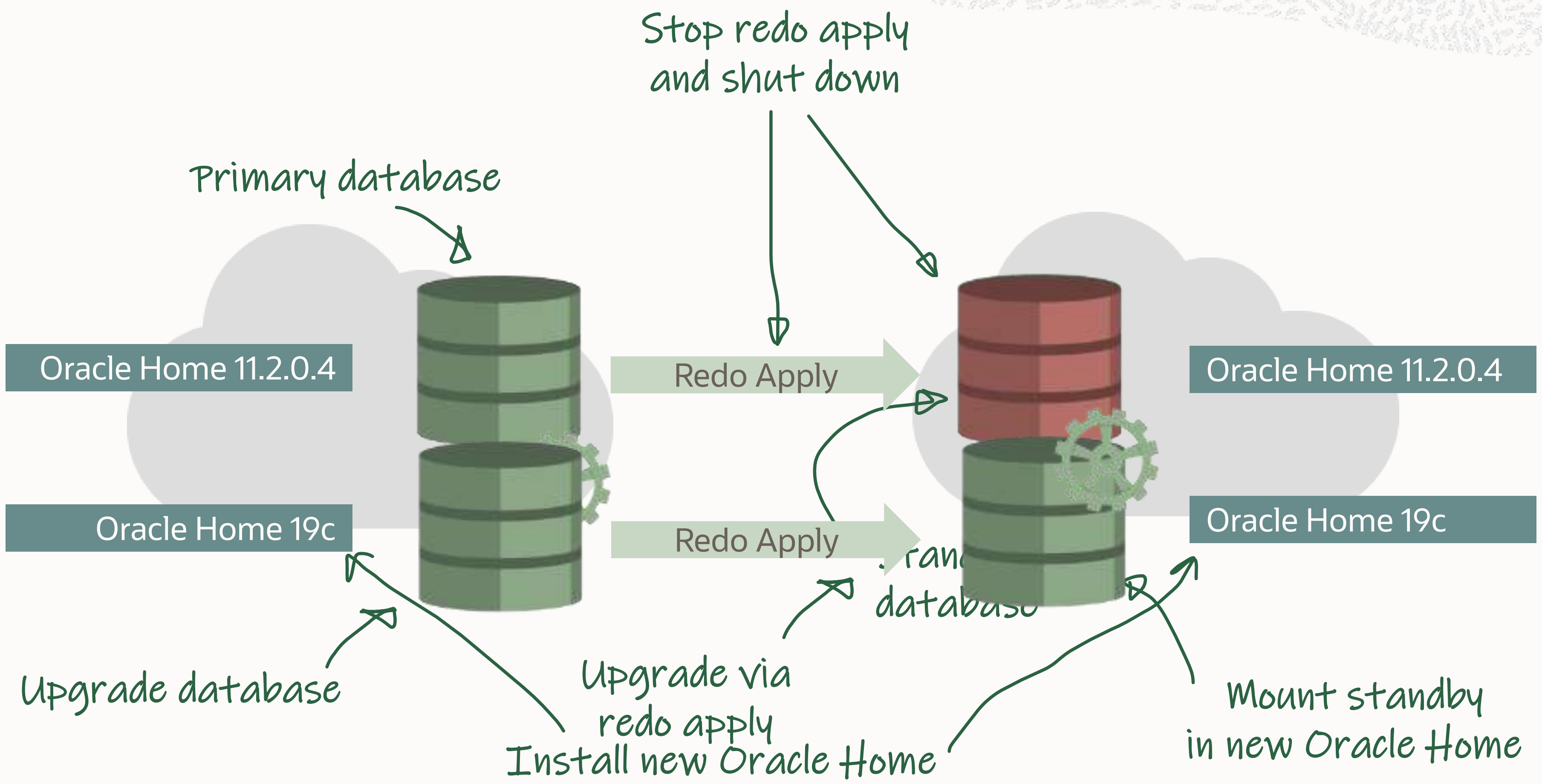
Fallback | Partial Offline Backup

Oracle Database Downgrade with Partial Offline Backup

Oracle 18.3.0 => Oracle 11.2.0.4

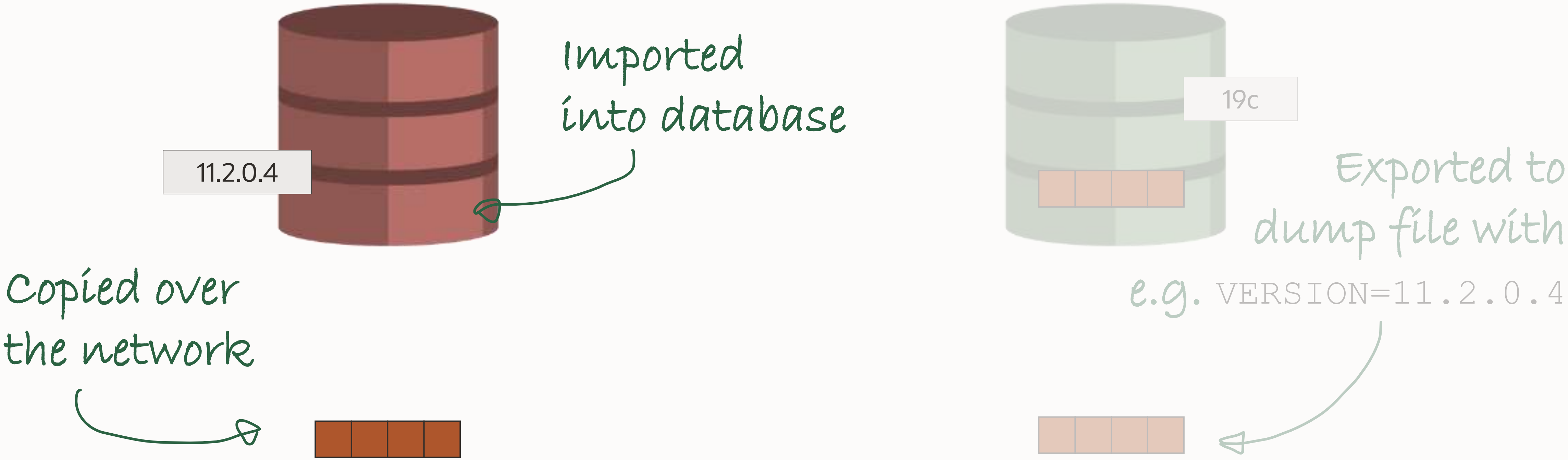
Watch on YouTube

Fallback | Data Guard



Remember use latest
Release Update

Fallback | Data Pump



Fallback | Data Pump

To create a dump file compatible with a lower release

```
version=11.2.0.4
```

Other options are

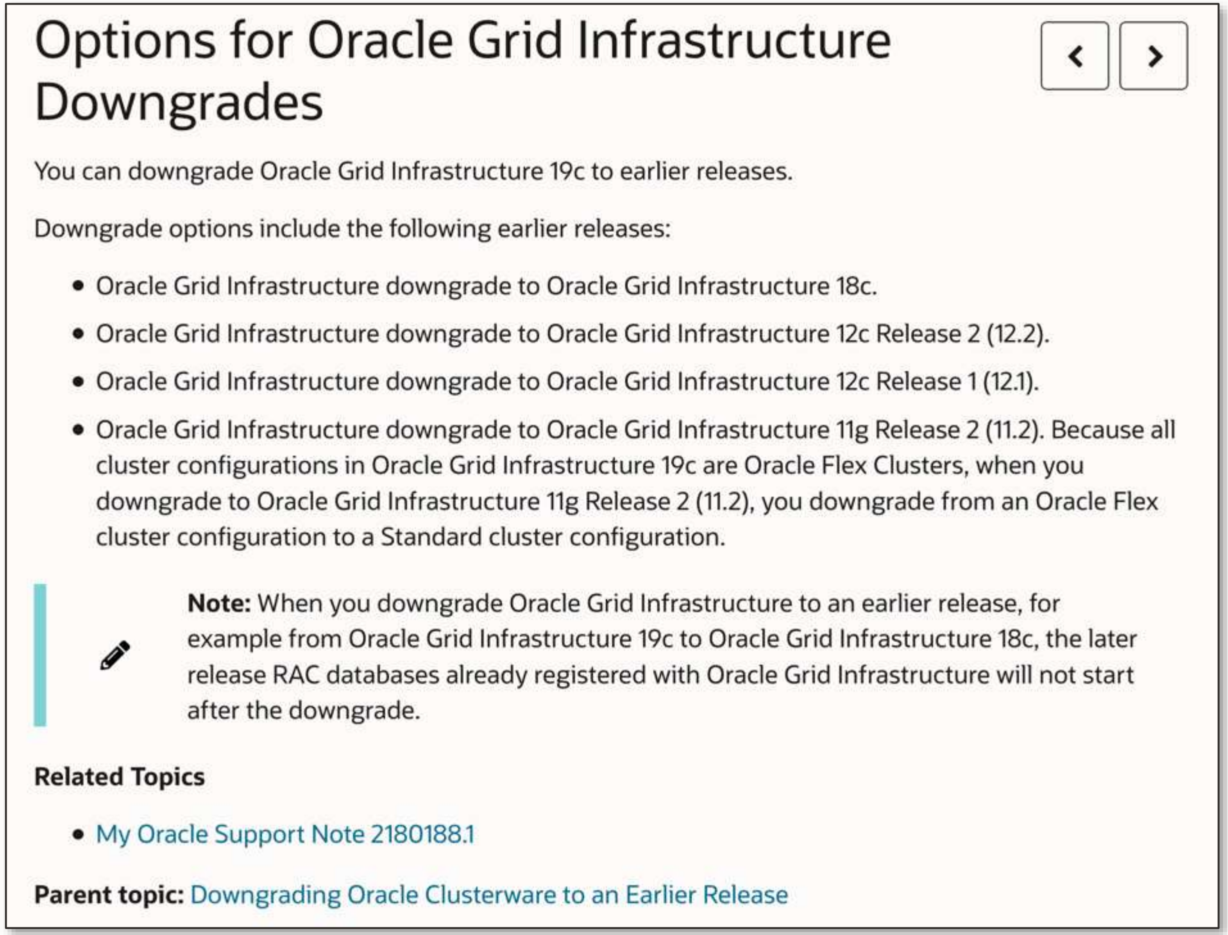
- `COMPATIBLE`
- `LATEST`

Export/Import DataPump Parameter VERSION - Compatibility of Data Pump Between Different Oracle Versions (Doc ID 553337.1)

Pro tip: Read more about VERSION in the documentation

Fallback | Grid Infrastructure Downgrade

- Documentation



Options for Oracle Grid Infrastructure Downgrades

You can downgrade Oracle Grid Infrastructure 19c to earlier releases.

Downgrade options include the following earlier releases:

- Oracle Grid Infrastructure downgrade to Oracle Grid Infrastructure 18c.
- Oracle Grid Infrastructure downgrade to Oracle Grid Infrastructure 12c Release 2 (12.2).
- Oracle Grid Infrastructure downgrade to Oracle Grid Infrastructure 12c Release 1 (12.1).
- Oracle Grid Infrastructure downgrade to Oracle Grid Infrastructure 11g Release 2 (11.2). Because all cluster configurations in Oracle Grid Infrastructure 19c are Oracle Flex Clusters, when you downgrade to Oracle Grid Infrastructure 11g Release 2 (11.2), you downgrade from an Oracle Flex cluster configuration to a Standard cluster configuration.

Note: When you downgrade Oracle Grid Infrastructure to an earlier release, for example from Oracle Grid Infrastructure 19c to Oracle Grid Infrastructure 18c, the later release RAC databases already registered with Oracle Grid Infrastructure will not start after the downgrade.

Related Topics

- My Oracle Support Note 2180188.1

Parent topic: Downgrading Oracle Clusterware to an Earlier Release

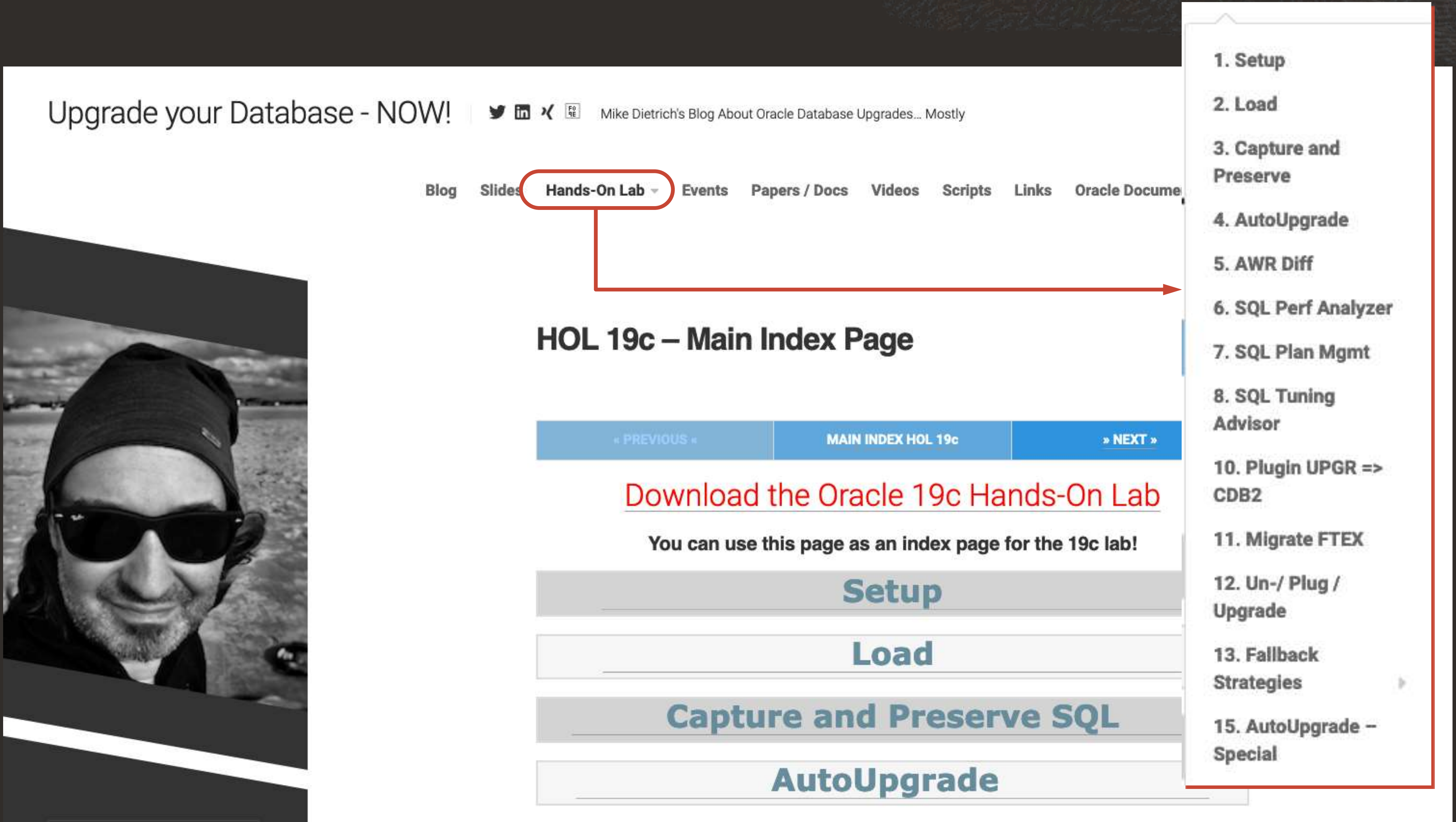
LEARN

from your mistakes

… and our mistakes

Photo by Road Trip with Raj on Unsplash

HOL | https://MikeDietrichDE.com



Upgrade your Database - NOW! Mike Dietrich's Blog About Oracle Database Upgrades... Mostly

HOL 19c – Main Index Page

Download the Oracle 19c Hands-On Lab

You can use this page as an index page for the 19c lab!

Photo by Nick Fewings on Unsplash

Database Upgrade

Why is Upgrade so different?

Why Upgrade is Different | Short or Long?

Things that matter a lot

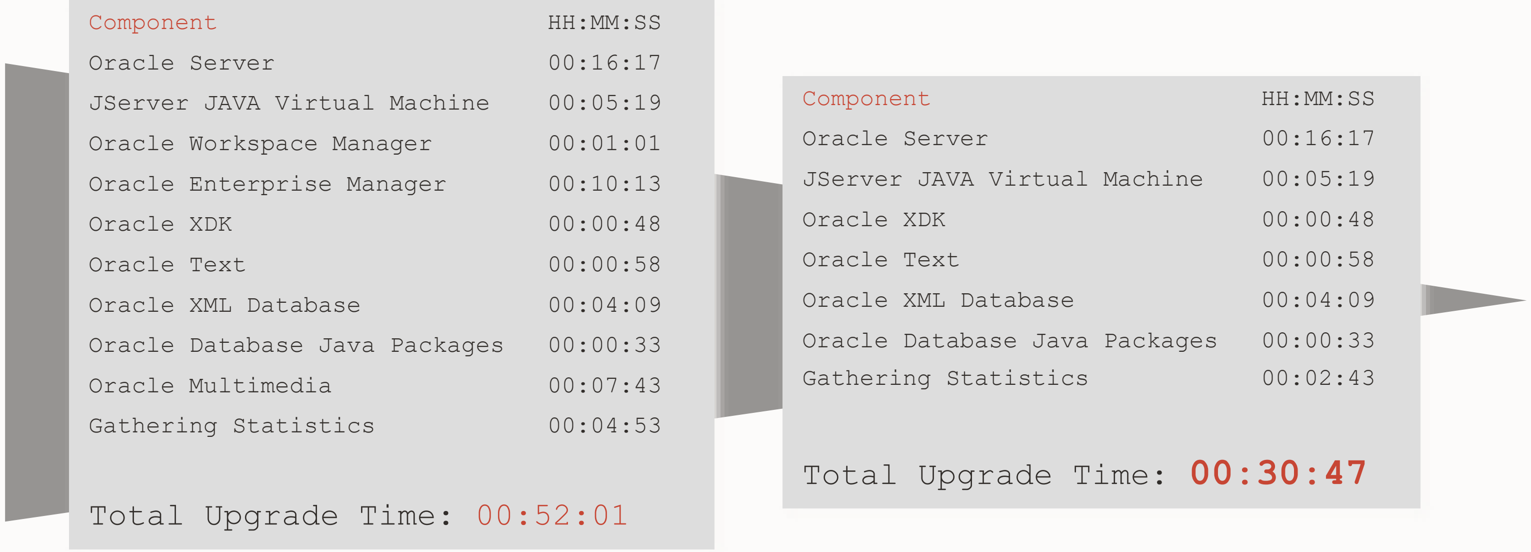
- Number of installed components ⟷ `select COMP_ID, STATUS from CDB_REGISTRY;`
- Size & complexity of dictionary ⟷ `select count(*) from OBJ$;`
- Some feature/version combinations

Things that matter a little

- CPU and disk speed
- SGA/PGA

Things that don't matter

- Amount of user data



```
Component                                HH:MM:SS
Oracle Server                            00:16:17
JServer JAVA Virtual Machine             00:05:19
Oracle Workspace Manager                 00:01:01
Oracle Enterprise Manager                00:10:13
Oracle XDK                               00:00:48
Oracle Text                              00:00:58
Oracle XML Database                      00:04:09
Oracle Database Java Packages            00:00:33
Oracle Multimedia                        00:07:43
Gathering Statistics                     00:04:53

Total Upgrade Time: 00:52:01
```

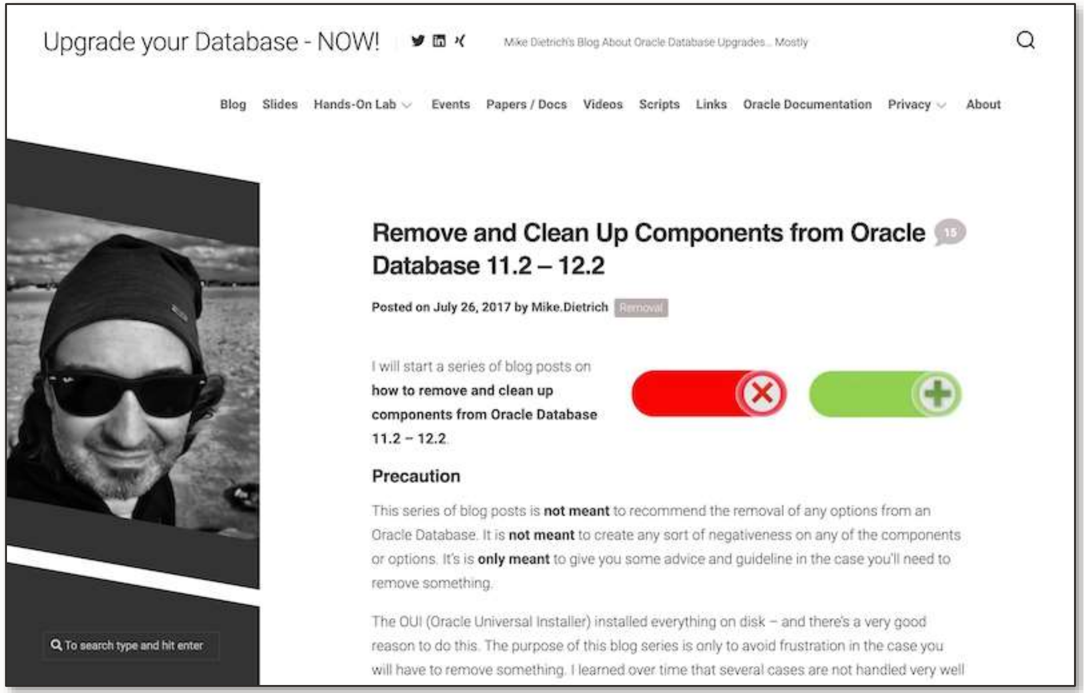
```
Component                                HH:MM:SS
Oracle Server                            00:16:17
JServer JAVA Virtual Machine             00:05:19
Oracle XDK                               00:00:48
Oracle Text                              00:00:58
Oracle XML Database                      00:04:09
Oracle Database Java Packages            00:00:33
Gathering Statistics                     00:02:43

Total Upgrade Time: 00:30:47
```

Why Upgrade is Different | Component Invalid or Removal?

Remove and Clean Up Components

- If you plan to do this, do it BEFORE the upgrade
- Especially components which don't exist in the new release should be removed beforehand



Upgrade your Database - NOW!

Mike Dietrich's Blog About Oracle Database Upgrades... Mostly

Remove and Clean Up Components from Oracle Database 11.2 – 12.2

Posted on July 26, 2017 by Mike.Dietrich Removal

I will start a series of blog posts on **how to remove and clean up components from Oracle Database 11.2 – 12.2**.

Precaution

This series of blog posts is **not meant** to recommend the removal of any options from an Oracle Database. It is **not meant** to create any sort of negativeness on any of the components or options. It's is **only meant** to give you some advice and guideline in the case you'll need to remove something.

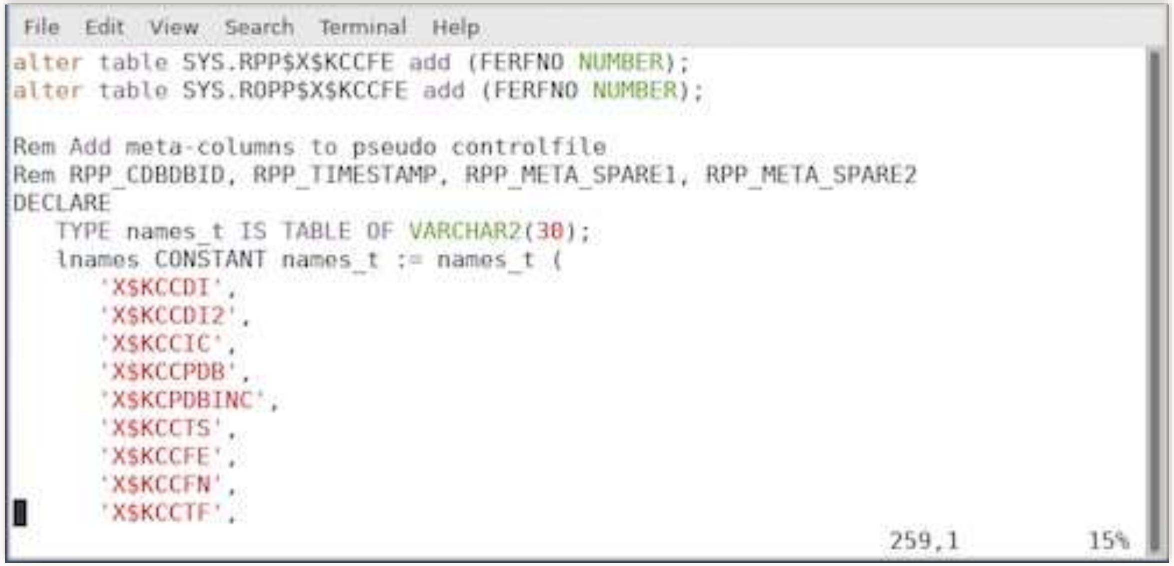
The OUI (Oracle Universal Installer) installed everything on disk – and there's a very good reason to do this. The purpose of this blog series is only to avoid frustration in the case you will have to remove something. I learned over time that several cases are not handled very well

Why Upgrade is Different | DDL Workload

Heavy DDL workload

- A trivial upgrade from 11.2.0.4 to 19c includes approximately
  - 2,500 `ALTER`s (mostly tables, also types and users)
  - 16,500 `CREATE OR REPLACE`s (views, types, synonyms, procedures, packages, functions)
  - 10,200 `GRANT` statements
  - 1150 `CREATE TABLE` statements
  - 360 `CREATE INDEX` statements
  - And more…

Almost exclusively in SYSTEM,
partially also in SYSAUX tablespaces



```
alter table SYS.RPP$X$KCCFE add (FERFNO NUMBER);
alter table SYS.ROPP$X$KCCFE add (FERFNO NUMBER);

Rem Add meta-columns to pseudo controlfile
Rem RPP_CDBDBID, RPP_TIMESTAMP, RPP_META_SPARE1, RPP_META_SPARE2
DECLARE
   TYPE names_t IS TABLE OF VARCHAR2(30);
   lnames CONSTANT names_t := names_t (
      'X$KCCDI',
      'X$KCCDI2',
      'X$KCCIC',
      'X$KCCPDB',
      'X$KCPDBINC',
      'X$KCCTS',
      'X$KCCFE',
      'X$KCCFN',
      'X$KCCTF',
                                                    259,1          15%
```

Why Upgrade is Different | Upgrade Mode

`STARTUP UPGRADE` limits many aspects of the database

- Requires SYSDBA privilege
- Suppresses expected errors
  - Based on object type and error code
    - Example: ORA-955 during CREATE TABLE ("table or view does exist")
- Enforces exclusive access for the upgrade process
  - `CLUSTER_DATABASE=FALSE`
  - No system triggers
  - No AQ
  - No resource manager
  - No AWR
  - etc.

```
ALTER SYSTEM SET _system_trig_enabled=FALSE SCOPE=MEMORY;
Autotune of undo retention is turned off.
ALTER SYSTEM SET _undo_autotune=FALSE SCOPE=MEMORY;
ALTER SYSTEM SET undo_retention=900 SCOPE=MEMORY;
ALTER SYSTEM SET aq_tm_processes=0 SCOPE=MEMORY;
ALTER SYSTEM SET enable_ddl_logging=FALSE SCOPE=MEMORY;
Resource Manager disabled during database migration: plan '' not set
ALTER SYSTEM SET resource_manager_plan='' SCOPE=MEMORY;
ALTER SYSTEM SET recyclebin=‘OFF’ DEFERRED SCOPE=MEMORY;
Resource Manager disabled during database migration
```

Note:This is an excerpt from the alert.log – these parameters will be set implicitly during a STARTUP UPGRADE

Photo by Joshua Sortino on Unsplash

AutoUpgrade

The ONLY recommended way to upgrade databases

Photo by Joshua Fernandez on Unsplash

Compatible

Compatible | Recommendation

When should you change `COMPATIBLE`?

A week or two after the upgrade - requires a database restart

Caution: When you change `COMPATIBLE` you can't:

- Flashback to restore point
- Downgrade

Compatible | Recommendation

Which value should you use for `COMPATIBLE`?

- The default of the database release
- 11.2.0
- 12.1.0
- 12.2.0
- 18.0.0
- 19.0.0

Should you change `COMPATIBLE` when patching?

- NEVER!
  - Except for …

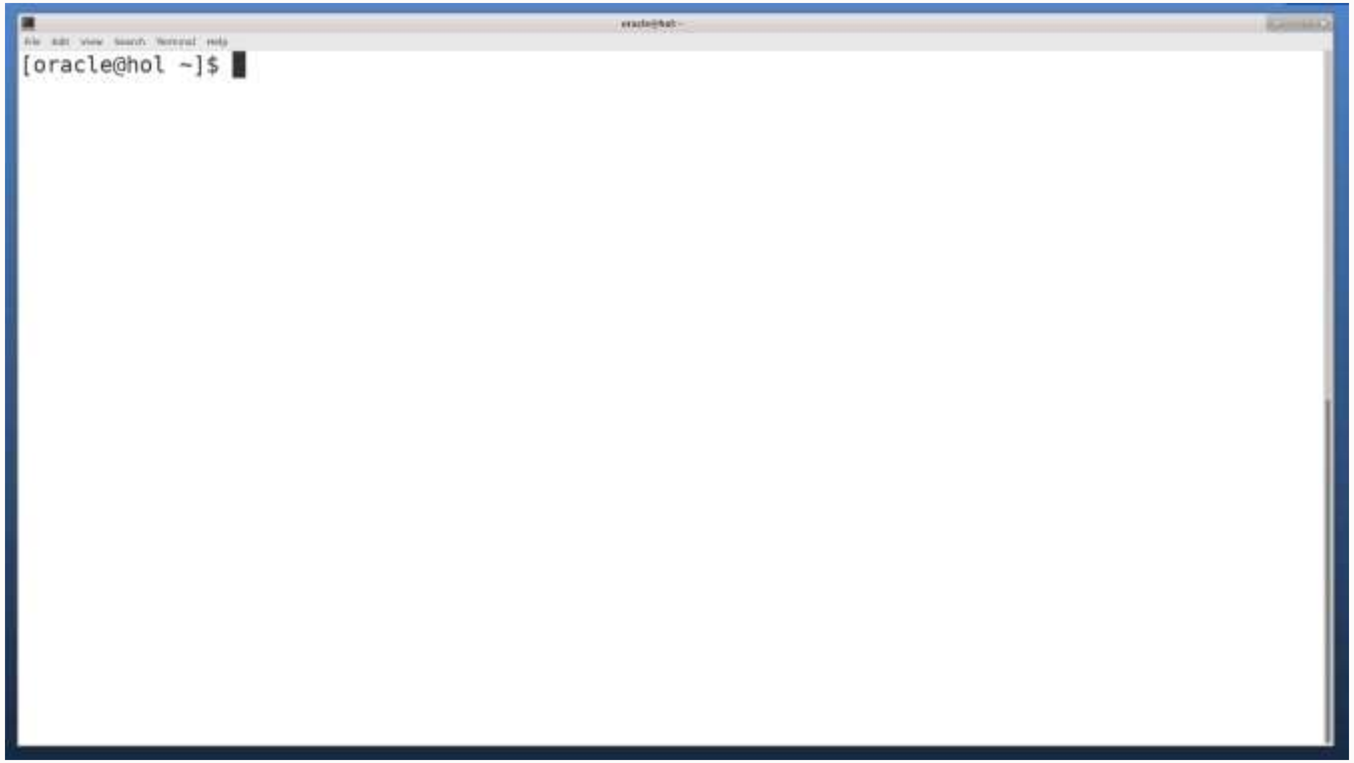
Compatible | AutoUpgrade

AutoUpgrade does not change `COMPATIBLE`

Unless you want it

```
upg1.drop_grp_after_upgrade=yes
upg1.raise_compatible=yes
```

Compatible | Demo



```
[oracle@hol ~]$ 
```

Watch on YouTube

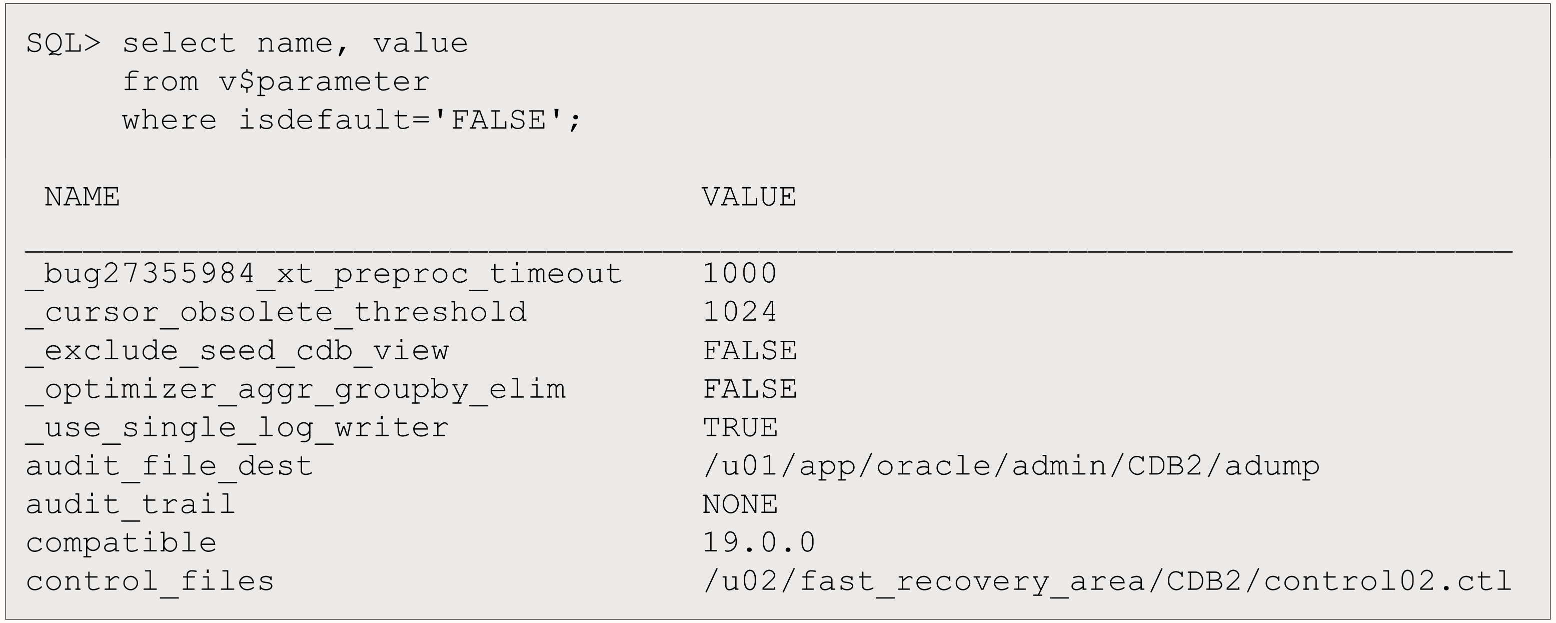
Photo by Alexander Andrews on Unsplash

Parameters

Parameters | General Recommendations

- **Default**
- Deprecated/desupported
- Underscores/events
- Applications

The fewer parameters, the better



```
SQL> select name, value
     from v$parameter
     where isdefault='FALSE';

 NAME                              VALUE
_____________________________________________________________________________
_bug27355984_xt_preproc_timeout    1000
_cursor_obsolete_threshold         1024
_exclude_seed_cdb_view             FALSE
_optimizer_aggr_groupby_elim       FALSE
_use_single_log_writer             TRUE
audit_file_dest                    /u01/app/oracle/admin/CDB2/adump
audit_trail                        NONE
compatible                         19.0.0
control_files                      /u02/fast_recovery_area/CDB2/control02.ctl
```

Parameters | General Recommendations

- Default
- **Deprecated/desupported**
- Underscores/events
- Applications

```
SQL> startup
ORA-32004: obsolete or deprecated parameter(s) specified for RDBMS instance
ORACLE instance started.

Total System Global Area       1577055360 bytes
Fixed Size                        9135232 bytes
Variable Size                   385875968 bytes
Database Buffers               1174405120 bytes
Redo Buffers                      7639040 bytes
Database mounted.
Database opened.
```

Pro tip: The Upgrade Guide contains a list of deprecated and desupported parameters

Parameters | General Recommendations

Default

Deprecated/desupported

Underscores/events

Applications

Use

- as few as possible
- not longer than needed

```
SQL> select name, value
     from v$parameter
     where substr(name, 0, 1) = '_' or name='event';
```

Create plan for remove it again

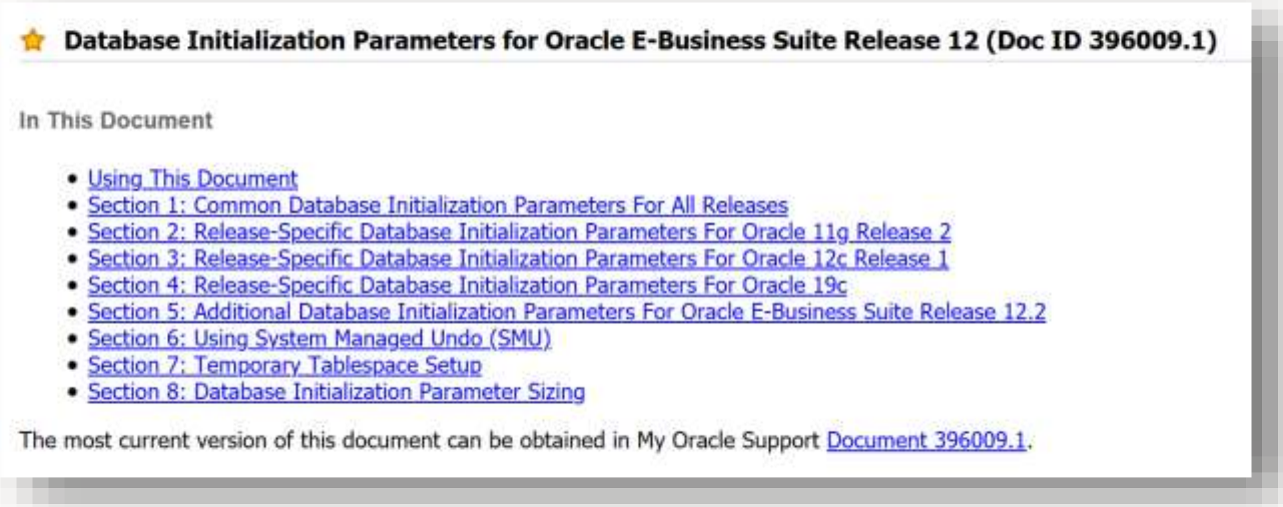
Pro tip: During upgrade it is recommended to remove all underscores and events

Parameters | General Recommendations

Default
Deprecated/desupported
Underscores/events
Applications

Follow application specific recommendations

- E-Business Suite
- Siebel
- ...



Database Initialization Parameters for Oracle E-Business Suite Release 12 (Doc ID 396009.1)

In This Document

- Using This Document
- Section 1: Common Database Initialization Parameters For All Releases
- Section 2: Release-Specific Database Initialization Parameters For Oracle 11g Release 2
- Section 3: Release-Specific Database Initialization Parameters For Oracle 12c Release 1
- Section 4: Release-Specific Database Initialization Parameters For Oracle 19c
- Section 5: Additional Database Initialization Parameters For Oracle E-Business Suite Release 12.2
- Section 6: Using System Managed Undo (SMU)
- Section 7: Temporary Tablespace Setup
- Section 8: Database Initialization Parameter Sizing

The most current version of this document can be obtained in My Oracle Support Document 396009.1.

Parameters | Tracking Your Changes

Never implement a change without a comment

```
SQL> alter system set
     "_cursor_obsolete_threshold"=1024
     comment='04-03-2021 Daniel: MOS 2431353.1, evaluate after upgrade'
     scope=both;
```

Or, in your PFile

```
*._cursor_obsolete_threshold=1024#04-03-2021 Daniel: MOS 2431353.1, evaluate after upgrade
```

View your comments

```
SQL> select value, update_comment from v$parameter where name='_cursor_obsolete_threshold';

VALUE    UPDATE_COMMENT

________ ___________________________________________________________
1024     04-03-2021 Daniel: MOS 2431353.1, evaluate after upgrade
```

Parameters

COMPATIBLE vs OPTIMIZER_FEATURES_ENABLE

Fully independent from each other

- `COMPATIBLE`
  - Enables features
  - Always use the default value 19.0.0 in Oracle 19c
- `OPTIMIZER_FEATURES_ENABLE`
  - Just reverts to the parameters used in a previous release
  - Avoid using it if possible
  - This is not a Swiss Army knife!
  - You will turn off a lot of great features

> *Modifying the OPTIMIZER_FEATURES_ENABLE parameter generally is strongly discouraged and should only be used as a short term measure at the suggestion of Oracle Global Support.*

Use Caution if Changing the OPTIMIZER_FEATURES_ENABLE Parameter After an Upgrade (Doc ID 1362332.1)

Photo by Sidney Pearce on Unsplash

Patches

your key to

Successful Database Upgrades

Step 1
Download and install Oracle 19c
eDelivery.oracle.com

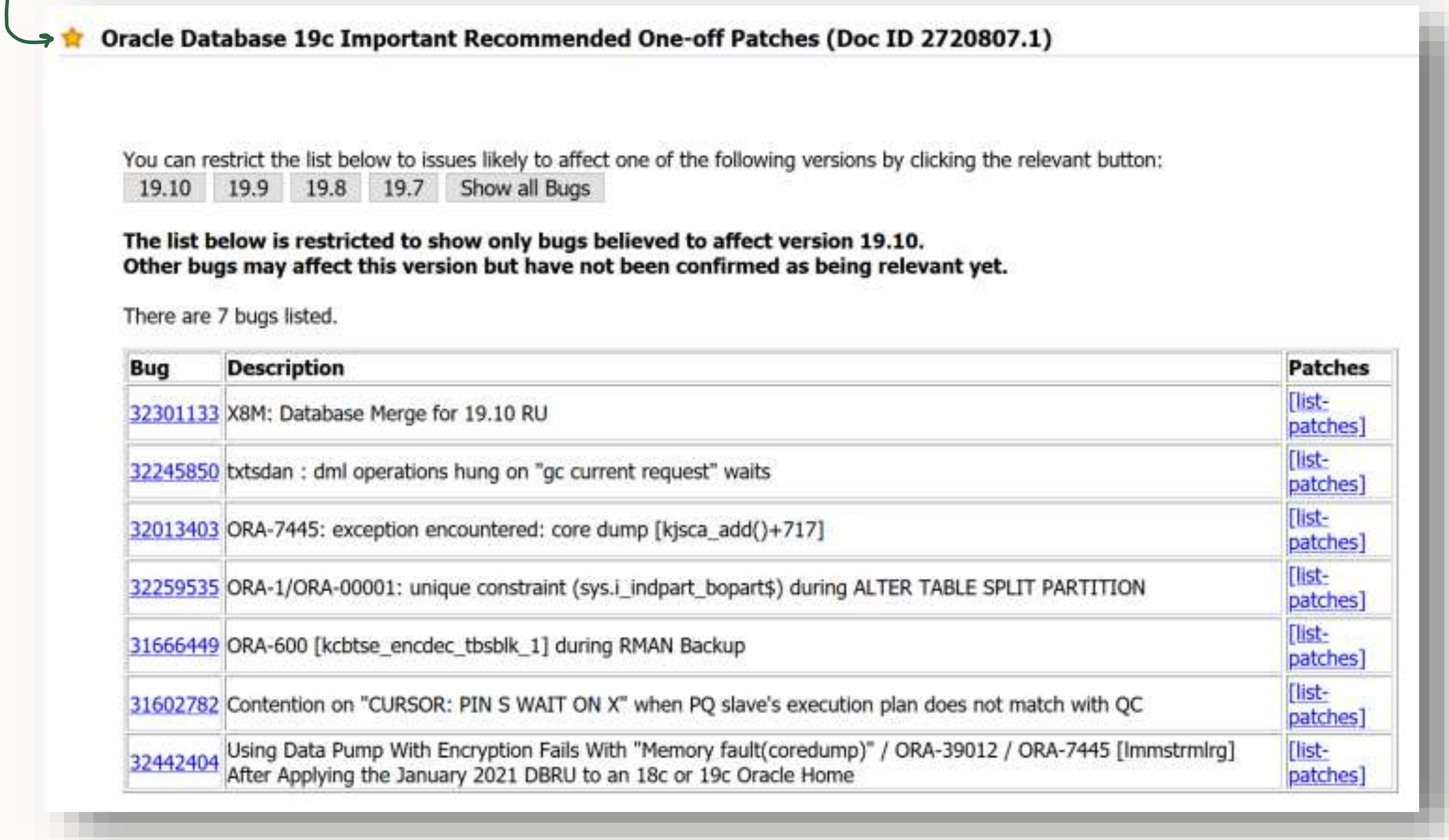
Step 2
Download and install newest RU
MOS Note: 2118136.2

Step 3
Download and use AutoUpgrade
MOS Note: 2485457.1

Step 4
Performance Stability with SPM, STA and RAT

Patches | Important One-Offs

Mark as favorite



★ **Oracle Database 19c Important Recommended One-off Patches (Doc ID 2720807.1)**

You can restrict the list below to issues likely to affect one of the following versions by clicking the relevant button:

The list below is restricted to show only bugs believed to affect version 19.10.
Other bugs may affect this version but have not been confirmed as being relevant yet.

There are 7 bugs listed.

Bug	Description	Patches
32301133	X8M: Database Merge for 19.10 RU	[list-patches]
32245850	txtsdan : dml operations hung on "gc current request" waits	[list-patches]
32013403	ORA-7445: exception encountered: core dump [kjsca_add()+717]	[list-patches]
32259535	ORA-1/ORA-00001: unique constraint (sys.i_indpart_bopart$) during ALTER TABLE SPLIT PARTITION	[list-patches]
31666449	ORA-600 [kcbtse_encdec_tbsblk_1] during RMAN Backup	[list-patches]
31602782	Contention on "CURSOR: PIN S WAIT ON X" when PQ slave's execution plan does not match with QC	[list-patches]
32442404	Using Data Pump With Encryption Fails With "Memory fault(coredump)" / ORA-39012 / ORA-7445 [lmmstrmlrg] After Applying the January 2021 DBRU to an 18c or 19c Oracle Home	[list-patches]

Oracle Database 19c
Important Recommended One-off Patches
(Doc ID 2720807.1)

Photo by Veri Ivanova on Unsplash

Statistics

Dictionary Statistics | Overview

Statistics on SYS and other oracle maintained schemas

Gets executed by automatic optimizer statistics gathering

If disabled, consider instead to allow it to work only of dictionary stats

```
SQL> exec dbms_stats.set_global_prefs('autostats_target','oracle');
```

Dictionary Statistics | Gather

Refresh manually:

- Before and after upgrade
- Before (source) and after (target) logical migration
- After major application upgrades

Gather manually

```
SQL> BEGIN
        DBMS_STATS.GATHER_SCHEMA_STATS('SYS');
        DBMS_STATS.GATHER_SCHEMA_STATS('SYSTEM');
     END;
/
```

```
$ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl \
  -l /tmp \
  -b gatherstats -- \
  --x"begin dbms_stats.gather_schema_stats('SYS'); dbms_stats.gather_schema_stats('SYSTEM'); end;"
```

Fixed Objects Stats | Overview

> *After an upgrade, or after other database configuration changes, Oracle strongly recommends that you regather fixed object statistics after you have run representative workloads on Oracle Database.*

Database 19c Upgrade Guide, chapter 7

Never run it right after upgrade

Fixed Objects Stats | Definition

What is it?

```
SQL> SELECT owner, table_name
     FROM dba_tab_statistics
     WHERE object_type = 'FIXED TABLE';

OWNER    TABLE_NAME
________ _______________
SYS      X$KQFTA
SYS      X$KQFVI
SYS      X$KQFVT
SYS      X$KQFDT
SYS      X$KQFCO
SYS      X$KQFOPT
SYS      X$KYWMPCTAB
...
```

Pro tip: Dynamic statistics (sampling) are not used for X$ tables

Fixed Objects Stats | After Upgrade

Ask yourself: Do you remember this?

If not, DBMS_SCHEDULER to the rescue

Fixed Objects Stats | After Upgrade

1. Create a .sql script

```
BEGIN
   DBMS_SCHEDULER.CREATE_JOB (
      job_name => '"SYS"."GATHER_FIXED_OBJECTS_STATS_ONE_TIME"',
           job_type => 'PLSQL_BLOCK',
           job_action => 'BEGIN DBMS_STATS.GATHER_FIXED_OBJECTS_STATS; END;',
           start_date => SYSDATE+7,
           auto_drop => TRUE,
           comments => 'Gather fixed objects stats after upgrade - one time'
   );
   DBMS_SCHEDULER.ENABLE (
      name => '"SYS"."GATHER_FIXED_OBJECTS_STATS_ONE_TIME"'
   );
END;
/
```

Fixed Objects Stats | After Upgrade

2. Create a .sh script

```
$ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl \
   -n 4 -e \
   -C 'PDB$SEED' \
   -b sched_gfos -d /home/oracle/sched_gfos/ sched_gfos.sql
```

3. Execute .sh script after upgrade

```
upg1.after_action=/home/oracle/sched_gfos/sched_gfos.sh
```

Fixed Objects Stats | Other situations

Also gather fixed objects stats after:

1. Major application upgrades
2. Using new functionality in the database
3. Major database configuration change

Always gather fixed objects stats when the system is warmed up - after your representative workload

Check out Best Practices for Gathering Optimizer Statistics with Oracle Database 19c

Pro tip: Automated stats gathering only gather fixed objects stats if they are completely missing

Statistics | Check

Has my stats been refreshed within the last 7 days?

```
SQL> select con_id, operation, target, end_time
from cdb_optstat_operations
where
  (   (operation = 'gather_fixed_objects_stats')
   or (operation = 'gather_dictionary_stats' and (target is null or target in ('SYS', 'SYSTEM')))
   or (operation = 'gather_schema_stats' and target in ('SYS', 'SYSTEM'))
  )
  and end_time > sysdate - 7
order by con_id, end_time;

 CON_ID   OPERATION                     TARGET    END_TIME

_________ _____________________________ _________ _________________________________________
        1 gather_schema_stats           SYS       26-FEB-21 07.00.19.182084000 AM +01:00
        1 gather_schema_stats           SYSTEM    26-FEB-21 07.00.22.351981000 AM +01:00
        1 gather_dictionary_stats                 26-FEB-21 07.05.17.931954000 AM +01:00
        1 gather_fixed_objects_stats              26-FEB-21 07.14.55.088707000 AM +01:00
        2 gather_schema_stats           SYS       26-FEB-21 07.02.40.485494000 AM +01:00
        2 gather_schema_stats           SYSTEM    26-FEB-21 07.02.46.151578000 AM +01:00
        3 gather_schema_stats           SYS       26-FEB-21 07.02.46.171862000 AM +01:00
        3 gather_schema_stats           SYSTEM    26-FEB-21 07.02.49.725878000 AM +01:00
```

Statistics | Good Stats During Upgrade

Upgrade duration for Oracle E-Business Suite

	DURATION	REDUCTION
No dictionary and fixed objects stats	10 hrs 56 min 52 sec	
Gathered dictionary and fixed objects stats	52 min 42 sec	93 %
Gathered schema and cluster index stats	52 min 25 sec	0.5 % to previous
Total downtime saved	**10 hrs 4 min 14 sec**	**93.5 % overall**

Statistics | Good Stats During Upgrade

Stale / no stats

```
   ID OPERATION            OPTIONS                 OBJECT_NAME
----- -------------------- --------------------    -----------
    0 UPDATE STATEMENT
    1   UPDATE                                     DEPENDENCY$
    2     FILTER
    3       TABLE ACCESS   FULL                    DEPENDENCY$
    4       INDEX          FULL SCAN               I_OBJ2
    5       INDEX          FULL SCAN               I_OBJ2
    6       TABLE ACCESS   BY INDEX ROWID BATCHED  OBJ$
    7         INDEX        RANGE SCAN              I_OBJ1
    8     TABLE ACCESS     BY INDEX ROWID BATCH    OBJ$
    9       INDEX          RANGE SCAN              I_OBJ1
```

Good stats

```
 ID OPERATION            OPTIONS                   OBJECT_NAME
----- -------------------- --------------------    -----------
   0  UPDATE STATEMENT
   1    UPDATE                                     DEPENDENCY$
   2      FILTER
   3        TABLE ACCESS   FULL                    DEPENDENCY$
   4        INDEX          RANGE SCAN              I_OBJ1
   5        INDEX          RANGE SCAN              I_OBJ1
   6        TABLE ACCESS   BY INDEX ROWID BATCHED  OBJ$
   7          INDEX        RANGE SCAN              I_OBJ1
   8      TABLE ACCESS     BY INDEX ROWID BATCH    OBJ$
   9        INDEX          RANGE SCAN              I_OBJ1
```

9h 59m 23s 87ms

2s 33ms

System Statistics | Overview

> *The system statistics describe hardware characteristics such as I/O and CPU performance and utilization.*
> *System statistics enable the query optimizer to more accurately estimate I/O and CPU costs when choosing execution plans.*

Database 19c SQL Tuning Guide, chapter 10

That sounds like a good idea

System Statistics | Recommendation

> *... in most cases you should use the defaults and not gather system statistics.*

> *Databases supporting a pure data warehouse workload on an Oracle Exadata Database Machine can benefit from system statistics gathered using the EXADATA option*
>
> *... if the workload is mixed or you are not in a position to test the effect of using EXADATA system statistics, then stick to the defaults even on this platform.*

Nigel Bayliss, Optimizer blog

System Statistics | Reference

To delete system statistics (and revert to defaults)

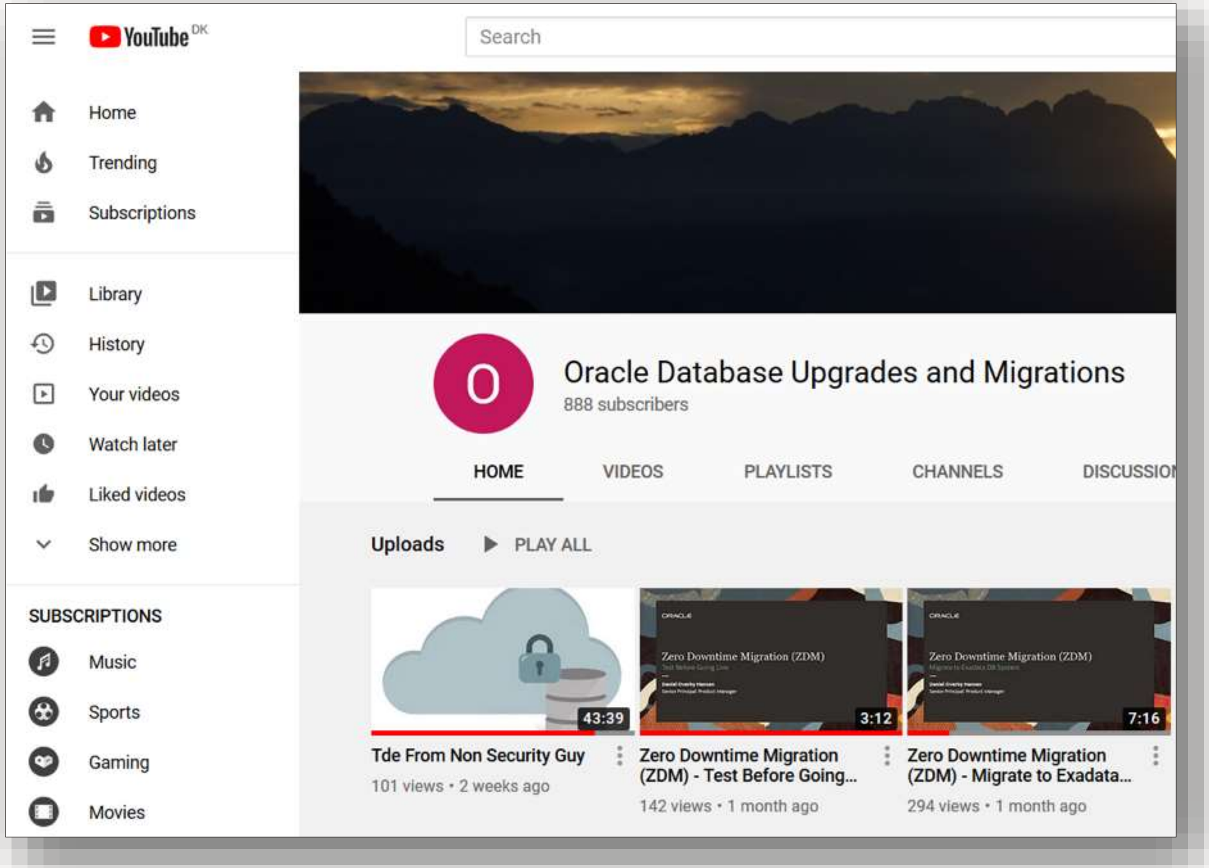
```
SQL> EXEC DBMS_STATS.DELETE_SYSTEM_STATS
```

References:

- Optimizer blog, Should You Gather System Statistics?
- SQL Tuning Guide, System Statistics
- SQL Tuning Guide, Guidelines for Gathering Optimizer Statistics Manually
- Database Performance Tuning Guide, Session and System Statistics

Almost there

YouTube | Oracle Database Upgrades and Migrations



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Thank you!