Oracle Database World

Database Upgrade Best Practices

Upgrade Now!

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Prepare

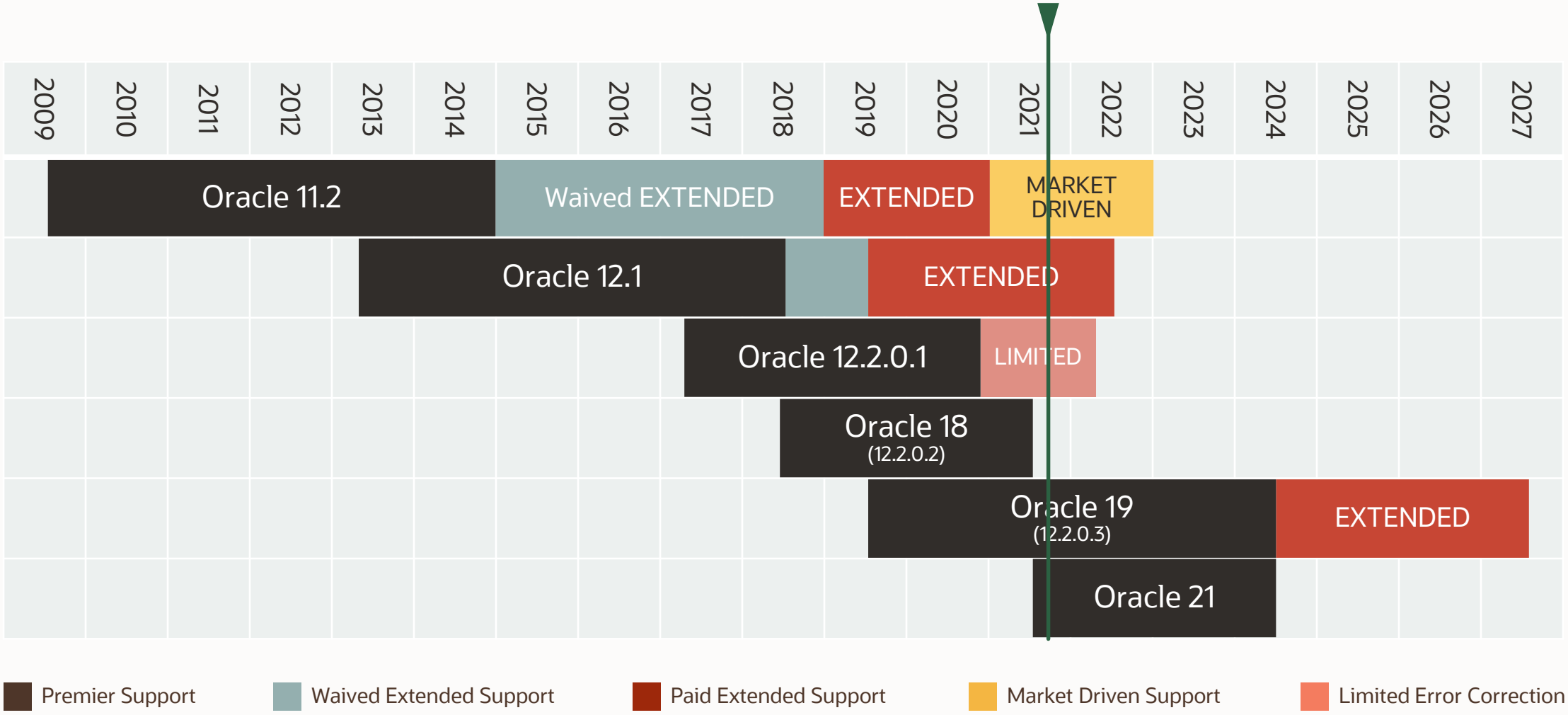
Release

Oracle Database 19c - Long Term Support Release

- Support until end of April 2027
- MOS: Release Schedule of Current Database Releases (Doc ID 742060.1)

Pro tip: Production databases should go from one Long Term Support release to the next

Lifetime Support Policy

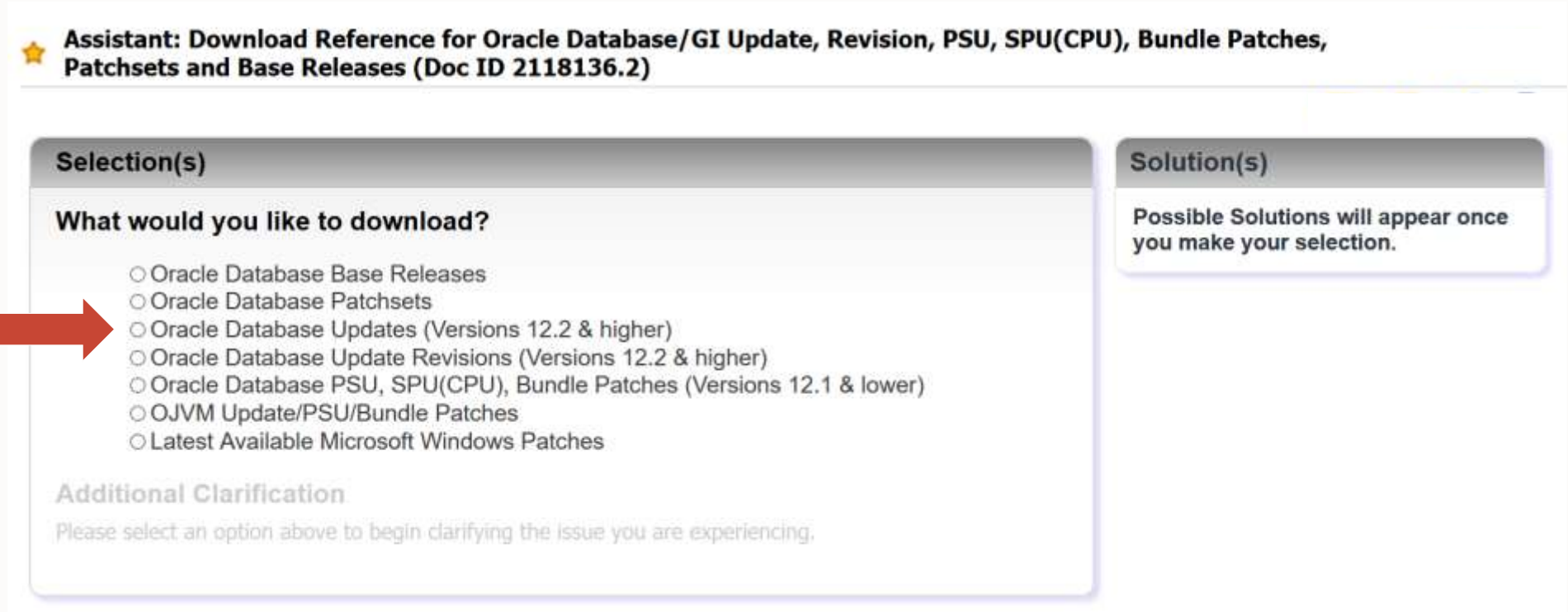


Patches

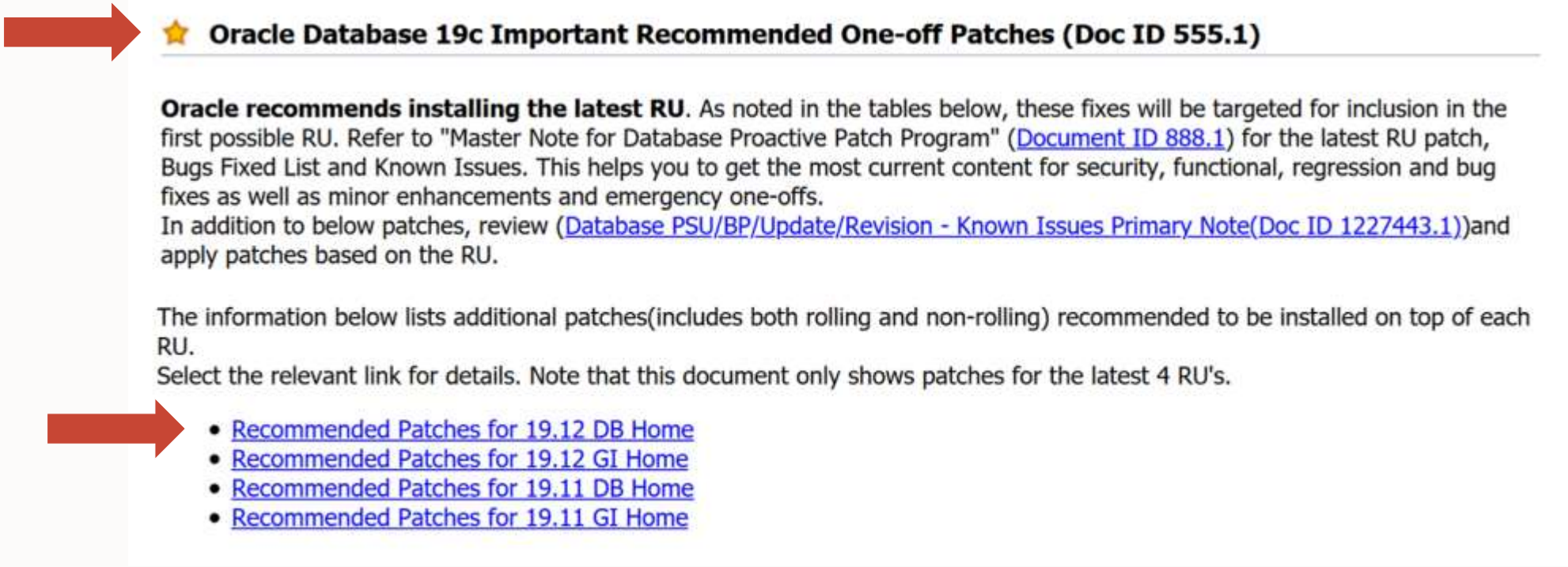
Apply latest Release Update before upgrade

- Keep applying Release Updates (RU) quarterly
- Review MOS Oracle Database 19c Important Recommended One-off Patches (Doc ID 555.1)

Patches



Patches



Oracle Database 19c Important Recommended One-off Patches (Doc ID 555.1)

Oracle recommends installing the latest RU. As noted in the tables below, these fixes will be targeted for inclusion in the first possible RU. Refer to "Master Note for Database Proactive Patch Program" (Document ID 888.1) for the latest RU patch, Bugs Fixed List and Known Issues. This helps you to get the most current content for security, functional, regression and bug fixes as well as minor enhancements and emergency one-offs.
In addition to below patches, review (Database PSU/BP/Update/Revision - Known Issues Primary Note(Doc ID 1227443.1))and apply patches based on the RU.

The information below lists additional patches(includes both rolling and non-rolling) recommended to be installed on top of each RU.
Select the relevant link for details. Note that this document only shows patches for the latest 4 RU's.

- Recommended Patches for 19.12 DB Home
- Recommended Patches for 19.12 GI Home
- Recommended Patches for 19.11 DB Home
- Recommended Patches for 19.11 GI Home

Familiarize

Learn about the new release

- Read about desupported and deprecated functionality in Database Upgrade Guide
- Visit the Database New Features Guide

Familiarize

BEHAVIOUR CHANGE	DEPRECATED	DESUPPORTED
DBMS_JOB	Non-CDB Architecture SQLNET.ENCRYPTION_WALLET_LOCATION	Multimedia Streams

Read the Database Upgrade Guide for a complete list

Familiarize

Oracle Database 19c is the final release supporting the non-CDB architecture

Certification

Check the operating system platform certifications

- Certifications tab in My Oracle Support contains an up-to-date list
- Oracle Database 19c supported - amongst others - on Oracle Linux 7 and 8

Practice

Prepare yourself for all scenarios - including fallback

- Practice and test your upgrade runbook - and your fallback/downgrade runbook
- Use our Hands-On-Lab on Oracle LiveLabs

Pro tip: Check out our webinar Performance Testing using the Oracle Cloud for Upgrades

Performance

Avoid plan regression after upgrade

- Most upgrade problems are in fact performance issues after upgrade
- Use SQL Plan Management to ensure plan stability

Pro tip: SQL Plan Management is part of Enterprise Edition

Performance

Performance Stability Perscription

- Use Oracle supplied tools to test your upgrade
- Proactively implement changes ensuring plan stability

Pro tip: Get the details in webinar Performance Stability, Tips and Tricks and Underscores

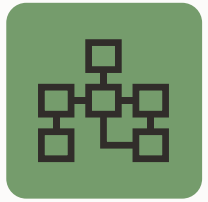
Performance Stability Prescription

COLLECT

SQL Tuning Set
AWR Snapshots

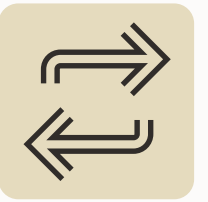
ANALYZE

SQL Performance Analyzer
AWR Diff Reports



FIX

SQL Plan Management
SQL Tuning Advisor
SQL Patch



VERIFY

Database Replay

Pro tip: Some performance tools don't require additional license in OCI

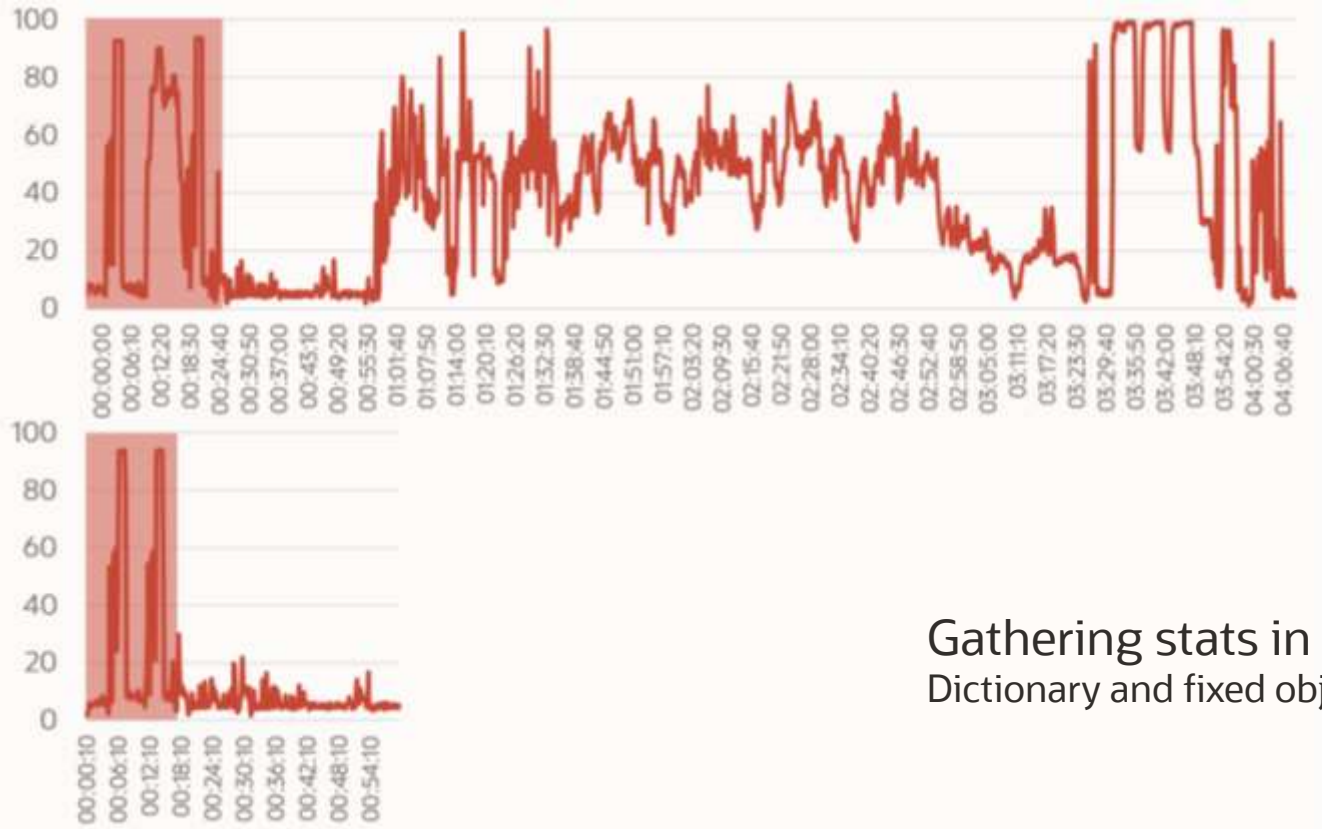
Statistics

Reduce downtime by gathering essential statistics in advance

- Dictionary and fixed objects statistics must be current
- Up to seven days in advance

Pro tip: If you forget it, AutoUpgrade will take care of it for you automatically

Statistics



Gathering stats in advance saves 12 minutes

Dictionary and fixed objects

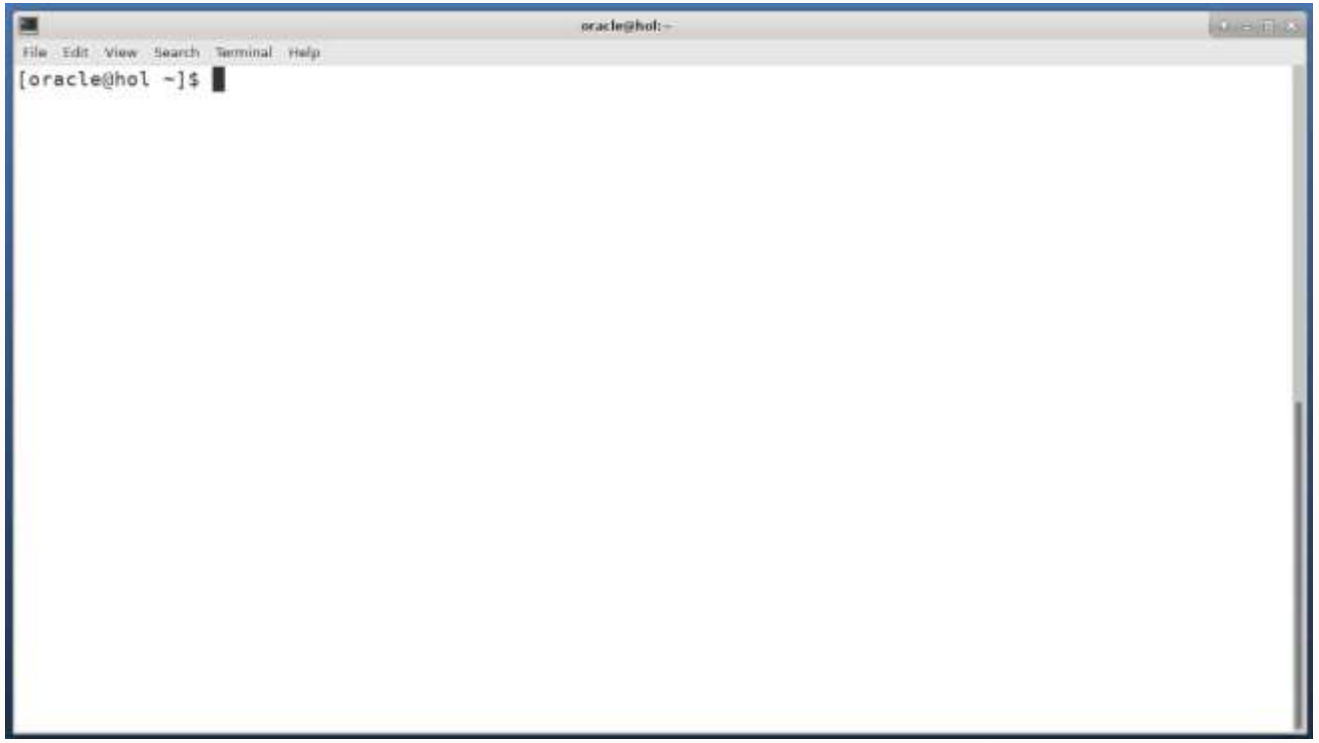
Upgrade

AutoUpgrade

Use AutoUpgrade to upgrade your database

- The only recommended method
- End-to-end automation

AutoUpgrade



AutoUpgrade

Always use latest version of AutoUpgrade

- Always download and use the latest version of AutoUpgrade
- Download from My Oracle Support (Doc ID 2485457.1)

Pro tip: Overwrite the existing *autoupgrade.jar* in `$ORACLE_HOME/rdbms/admin`

AutoUpgrade

Check the version of AutoUpgrade

- AutoUpgrade is fully backwards compatible
-

```
$ java -jar autoupgrade.jar -version

build.version 21.2.210721
build.hash 680914c
build.date 2021/07/21 11:14:54
build.max_target_version 21
build.supported_target_versions 12.2,18,19,21
build.type production
```

Duration

Have your database upgrade run faster

- Biggest impact by removing unused database components
- Adding CPU and memory has a minor effect

Duration

```
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
Oracle Multimedia                      00:07:43
Oracle Workspace Manager               00:01:01
Oracle Enterprise Manager              00:10:13
Gathering Statistics                   00:04:53

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

```
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
```

Fallback

Use Guaranteed Restore Points as your primary fallback option

- Fast and reliable
- Fully automated in AutoUpgrade

Pro tip: Use partial offline backup for Standard Edition 2 databases

Fallback

Flashback Database doesn't work for fallback after go-live

- Downgrade
- Data Pump

Compatible

Determine when to raise `COMPATIBLE` parameter

- Recommended: 7-10 days after upgrade - requires database restart
- Raising `COMPATIBLE` prevents use of `FLASHBACK DATABASE` and database downgrade

Compatible

Determine the value of `COMPATIBLE`

- Always use the default of the release, for Oracle Database 19c: `19.0.0`
- Only change it after upgrades, never after patching

Compatible

Changing COMPATIBLE immediately after upgrade

- Only if you can't afford the additional downtime
- Only change it after upgrades, never after patching
- AutoUpgrade

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

Caution: Prevents use of Flashback Database and database downgrade

Multitenant

Get the benefits of the multitenant architecture

- From 19c onward, have up to 3 user-created PDBs without a multitenant license
- Fully automated in AutoUpgrade

```
upg1.sid=DB12
upg1.source_home=/u01/app/oracle/product/ora12
upg1.target_home=/u01/app/oracle/product/ora19
upg1.target_cdb=CDB1
```

Pro tip: Set `max_pdbs=3` to ensure you don't create too many

We upgraded 735 databases to 19c, and the task was mostly relatively relaxed.

Start the AutoUpgrade tool and monitor the progress from time to time.

Sitting in front of the screen the whole time is not necessary.

ALAIN FUHRER

Ex-Head IT Database Services

La Mobilière

Bern, Switzerland

Reality Check

La Mobilière

- Upgrade 2000 PDBs from 12.2 to 19c
- Between 50 and 150 PDBs per CDB

Reality Check

First batch consisted of 735 PDBs

- CDB1 144 PDBs
- CDB2 148 PDBs
- CDB3 148 PDBs
- CDB4 147 PDBs
- CDB5 148 PDBs

Reality Check

Dispatcher finished for CDB1		Dispatcher finished for CDB2		Dispatcher finished for CDB3		Dispatcher finished for CDB4	
INFO ---------- Stages		INFO ---------- Stages		INFO ----------Stages		INFO ----------Stages	
SETUP	<1 min	SETUP	<1 min	SETUP	<1 min	SETUP	<1 min
PREUPGRADE	<1 min	PREUPGRADE	<1 min	PREUPGRADE	<1 min	PREUPGRADE	<1 min
PRECHECKS	4 min	PRECHECKS	4 min	PRECHECKS	5 min	PRECHECKS	5 min
GRP	<1 min	GRP	<1 min	GRP	<1 min	GRP	<1 min
PREFIXUPS	9 min	PREFIXUPS	9 min	PREFIXUPS	12 min	PREFIXUPS	14 min
DRAIN	2 min	DRAIN	2 min	DRAIN	2 min	DRAIN	2 min
DBUPGRADE	279 min	DBUPGRADE	305 min	DBUPGRADE	286 min	DBUPGRADE	293 min
POSTCHECKS	4 min	POSTCHECKS	7 min	POSTCHECKS	4 min	POSTCHECKS	4 min
POSTFIXUPS	60 min	POSTFIXUPS	93 min	POSTFIXUPS	78 min	POSTFIXUPS	80 min
POSTUPGRADE	19 min	POSTUPGRADE	21 min	POSTUPGRADE	20 min	POSTUPGRADE	21 min
Total	380 min	Total	444 min	Total	410 min	Total	422 min

** Logs from CDB5 were lost*

Reality Check

Lessons Learned

- Always use latest version of AutoUpgrade
- Use latest version OPatch in Oracle Home
- Increase `PROCESSES` parameter

Pro tip: Read the full story on Mobiliar DB blog

Post Upgrade

Statistics

Don't regather optimizer statistics

- Older statistics are perfectly usable in Oracle Database 19c
- For 11.2 databases, consider using new histogram types

Pro tip: Read more about the new histogram types in SQL Tuning Guide

Statistics

Don't gather system statistics

- In most cases it is not recommended to gather system statistics
- Only in rare cases when you have the capability to thoroughly test the changes

Pro tip: Learn more in a blog post by Nigel Bayliss, Optimizer Product Manager

Statistics

Regather fixed objects statistics

- Never do it immediately after upgrade
- Wait until database is warmed up and has run a representative workload

Pro tip: Use the database scheduler to gather statistics

Parameters

Evaluate database parameters

- Generally, the fewer, the better
- Get rid of underscores and events

Parameters

OPTIMIZER_FEATURES_ENABLE

- Use only under guidance of Oracle Support
- For plan stability, use SQL Plan Management

Pro tip: Watch webinar Performance Stability, Tips and Tricks and Underscores

Parameters

_CURSOR_OBSOLETE_THRESHOLD

- Increased from 1024 to 8192 in Oracle Database 12.2
- Parent cursors not getting obsoleted causing massive concurrency issues (mutex)

Pro tip: Check MOS Doc ID 2431353.1

Parameters

_CURSOR_OBSOLETE_THRESHOLD

- In Oracle Database 12.2 – 21c, revert to 12.1 setting

```
SQL> alter system set "_cursor_obsolete_threshold"=1024
     comment="MOS 2431353.1"
     scope=both;
```

Parameters

_SQL_PLAN_DIRECTIVE_MGMT_CONTROL

- SQL Plan Directives are collected even when Adaptive Statistics are disabled
- SQL Plan Directives will not be used when Adaptive Statistics are disabled (default)

Pro tip: Check MOS Doc ID 2209560.1

Parameters

_SQL_PLAN_DIRECTIVE_MGMT_CONTROL

- In Oracle Database 12.2 and newer – disables background collection of SQL Plan Directives
-

```
SQL> alter system set "_sql_plan_directive_mgmt_control"=0
     comment="MOS 2209560.1"
     scope=both;
```


Parameters

DEFERRED_SEGMENT_CREATION

- Empty tables or indexes take up no space - at first insert space will be allocated
- Save space at the cost of performance penalty on first insert
- Various issues seen

Pro tip: Check MOS Doc ID 1216282.1

Parameters

DEFERRED_SEGMENT_CREATION

- In Oracle Database 11.2 and newer - use only with massive number of empty tables and indexes
-

```
SQL> alter system set deferred_segment_creation=false
     comment="MOS 1216282.1"
     scope=both;
```


Parameters

OPTIMIZER_ADAPTIVE_PLANS/STATISTICS

- Optimizer adaptive features introduced in 12.1 caused massive performance issues
- Fixed since late 2017 in bundle patches for 12.1, and generally since Oracle 12.2.0.1

Pro tip: Read this blog post for more information

Parameters

OPTIMIZER_ADAPTIVE_PLANS/STATISTICS

- For Oracle Database 12.2 and newer use the default values
- Adaptive plans are enabled, and adaptive statistics are disabled

Pro tip: Read this blog post for more information

Wrapping Up

your key to

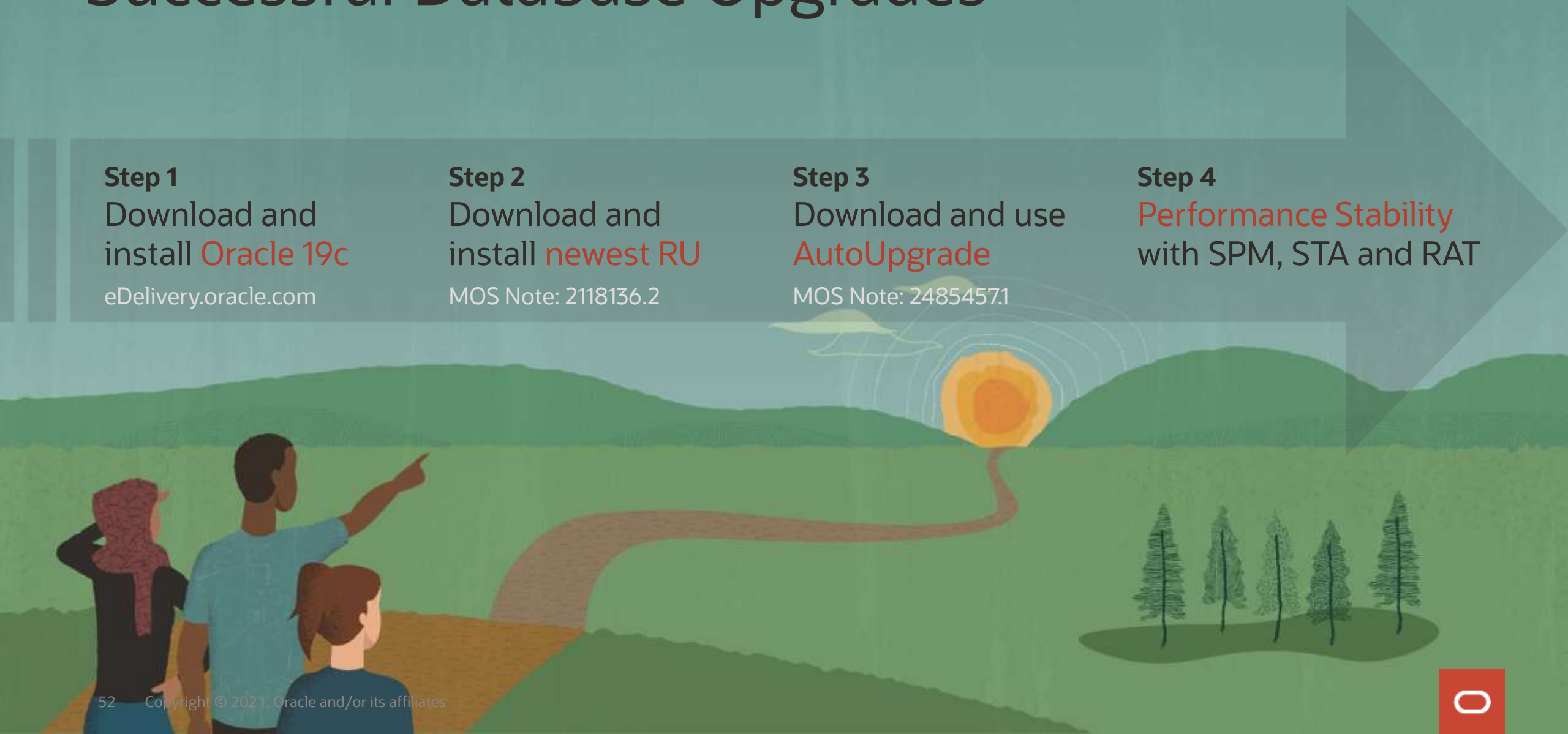
Successful Database Upgrades

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: 24854571

Step 4
Performance Stability with SPM, STA and RAT



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Future

BLOGS

Mike

Daniel

Rodrigo

VIDEOS

YouTube

Thank You