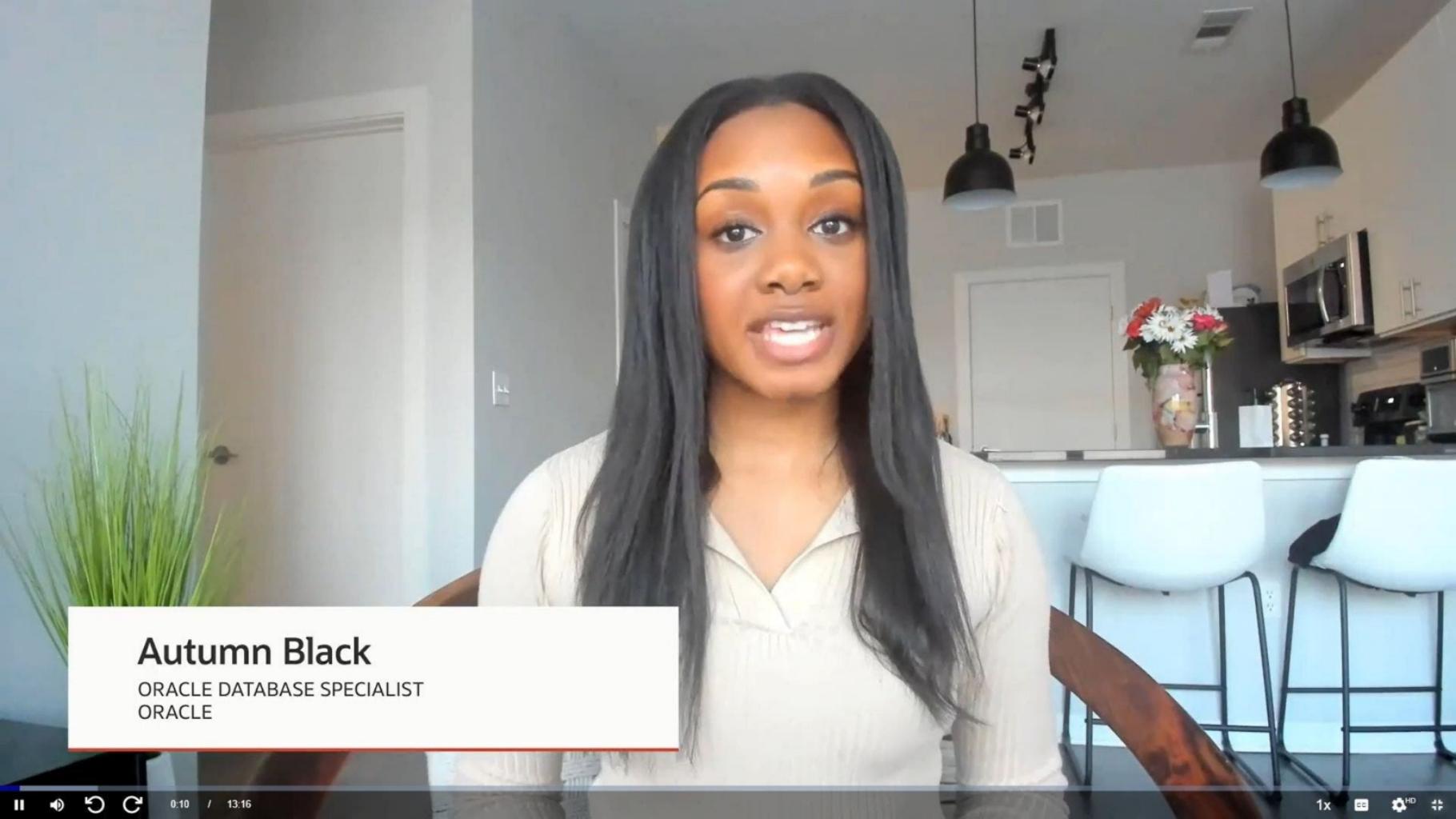


Oracle Cloud Infrastructure

Database Upgrade Best Practices

Upgrade Now!



Autumn Black

ORACLE DATABASE SPECIALIST
ORACLE

Prepare



Release

Oracle Database 19c – Long Term Support Release

Five years of
premier support



At least two years
of extended support

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

Release

Oracle Database 19c – Long Term Support Release

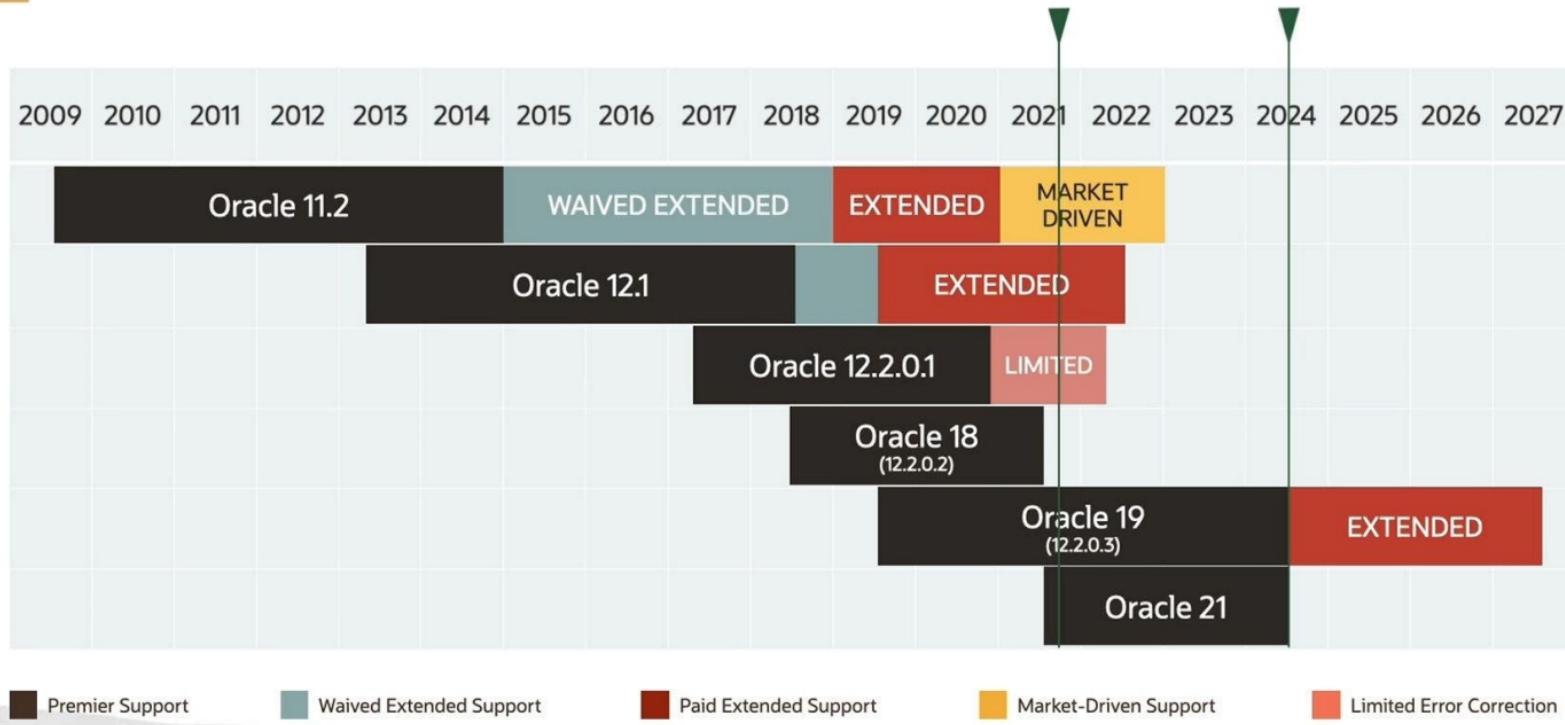
- Support until end of April 2027
- MOS: [Release Schedule of Current Database Releases \(Doc ID 742060.1\)](#)

Next long term support release will be 23c

23c releasing in 2023

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

Lifetime Support Policy



Premier Support

Waived Extended Support

Paid Extended Support

Market-Driven Support

Limited Error Correction

Familiarize



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

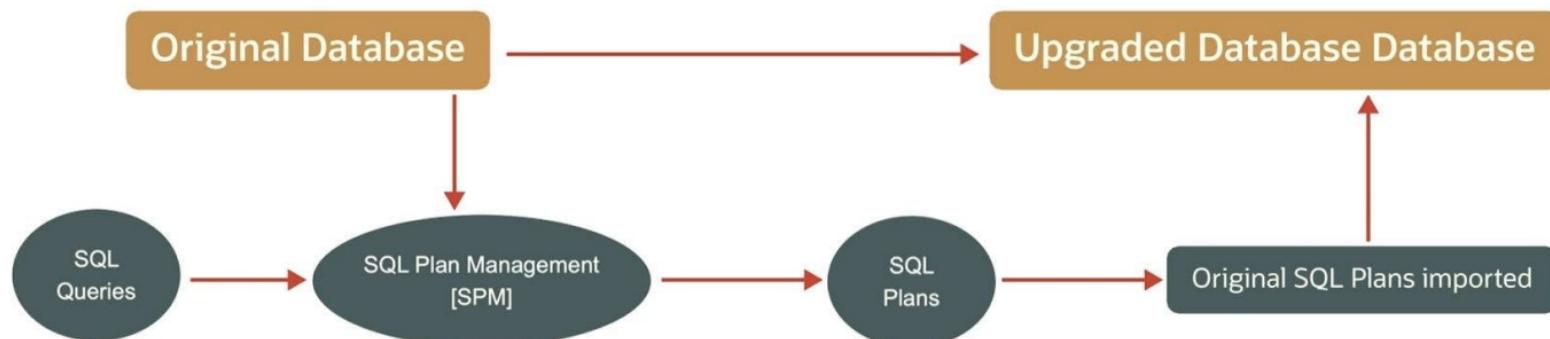
3 user pdbs



Requires no extra license

Performance

Avoid Plan Regression



No Regression

Pro tip: SQL Plan Management is part of Enterprise Edition.

Performance

Performance **Stability** Prescription

- 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



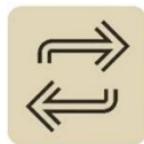
Analyze

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

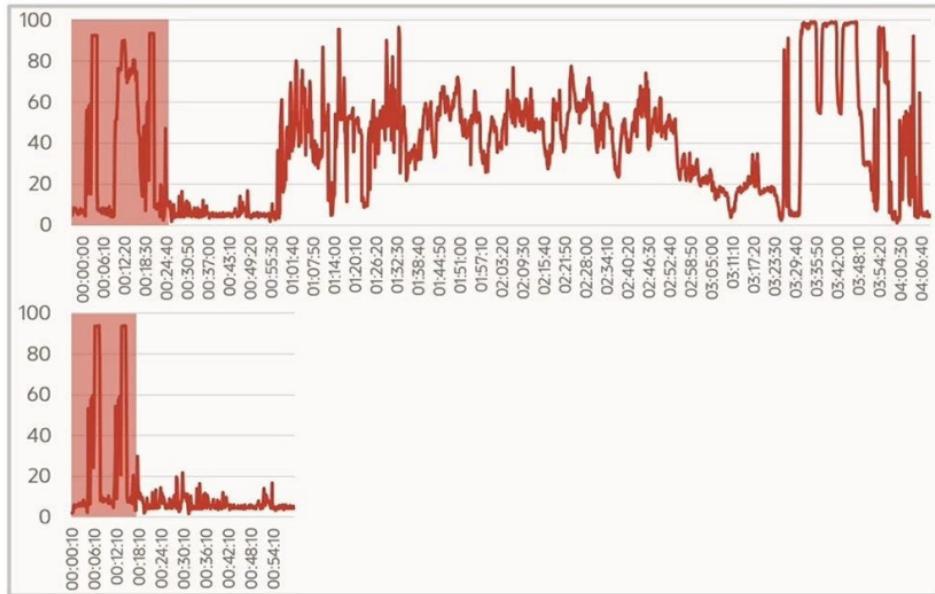
- Dictionary and fixed objects statistics must be current
- Up to seven days in advance

AutoUpgrade

Seven days

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

Statistics

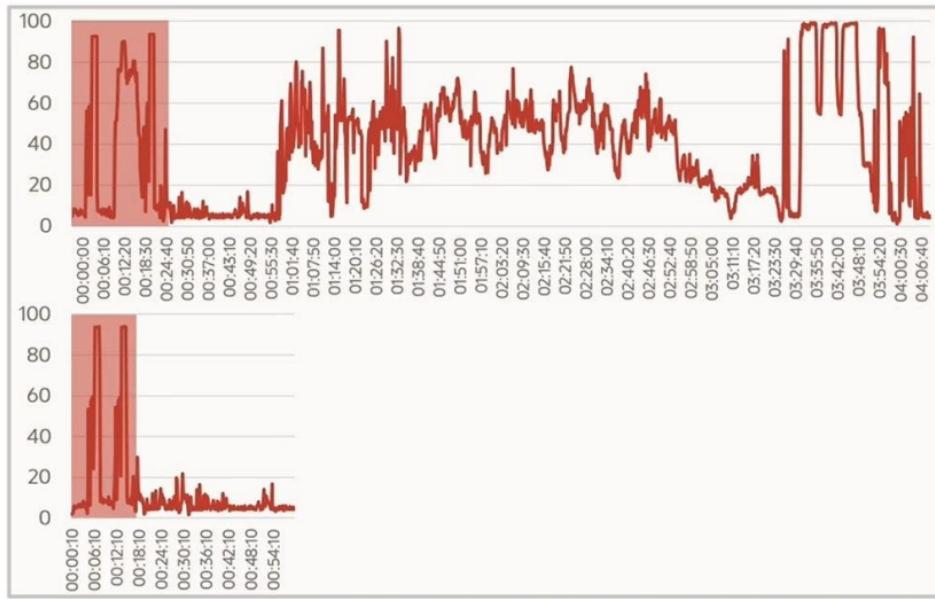


Save Time by collecting Stats
before running AutoUpgrade

CPU Utilization

with 52 pdbs

Statistics



Gathering stats in advance saves 12 minutes
Dictionary and fixed objects

AutoUpgrade

Use AutoUpgrade to upgrade your database

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

Single Database Support

Multiple Database Support

AutoUpgrade

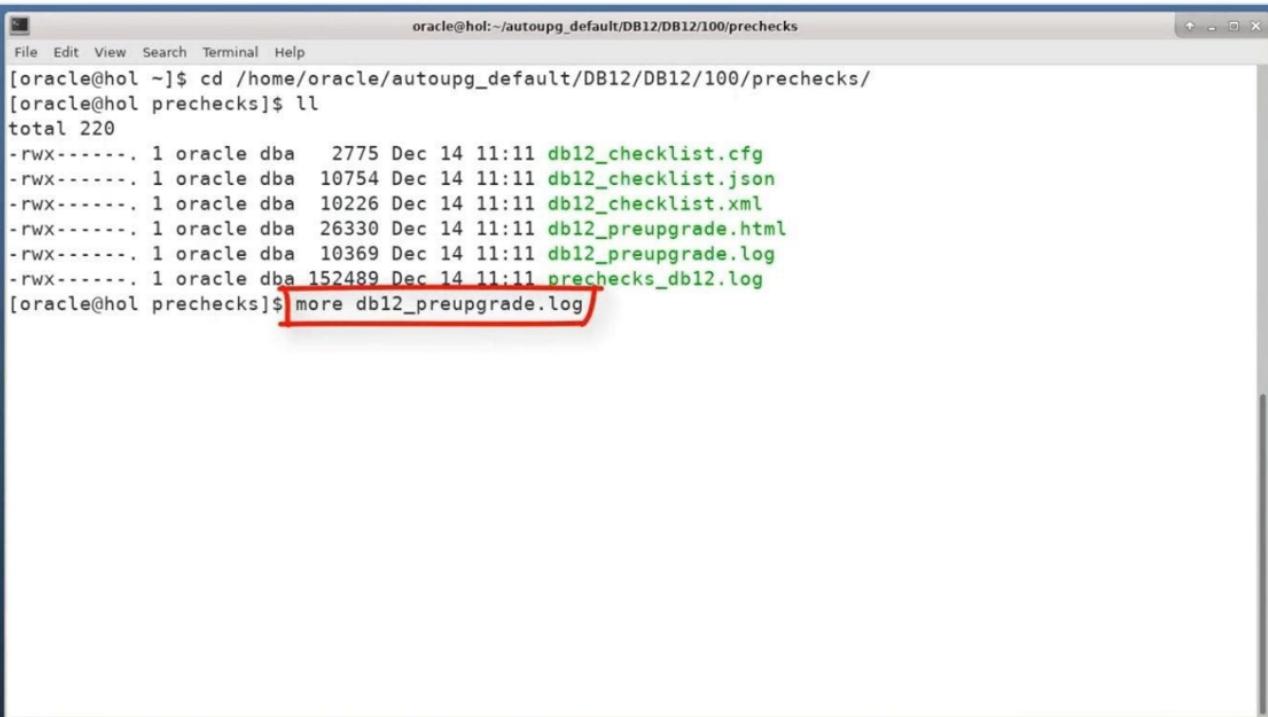
```
oracle@hol:~$ more DB12.cfg
upg1.source_home=/u01/app/oracle/product/12.2.0.1
upg1.target_home=/u01/app/oracle/product/19
upg1.sid=DB12
[oracle@hol ~]$ java -jar autoupgrade.jar -config DB12.cfg -mode analyze
No parameter 'global.autoupg_log_dir' found in config file, using /home/oracle/autoupg_default
AutoUpgrade tool launched with default options
Processing config file ...
+-----+
| Starting AutoUpgrade execution |
+-----+
1 databases will be analyzed
Type 'help' to list console commands
upg> lsj
+---+---+---+---+---+---+---+
|Job#|DB_NAME| STAGE|OPERATION| STATUS| START_TIME| UPDATED| MESSAGE|
+---+---+---+---+---+---+---+
| 100| DB12|PRECHECKS|PREPARING|RUNNING|20/12/14 11:11|11:11:30|Remaining 1/79|
+---+---+---+---+---+---+---+
Total jobs 1

upg>
```

AutoUpgrade

```
oracle@hol:~$  
File Edit View Search Terminal Help  
AutoUpgrade tool launched with default options  
Processing config file ...  
+-----+  
| Starting AutoUpgrade execution |  
+-----+  
1 databases will be analyzed  
Type 'help' to list console commands  
upg> lsj  
+-----+-----+-----+-----+-----+-----+  
|Job#|DB_NAME| STAGE|OPERATION| STATUS| START_TIME| UPDATED| MESSAGE|  
+---+---+---+---+---+---+---+---+  
| 100| DB12|PRECHECKS|PREPARING|RUNNING|20/12/14 11:11|11:11:30|Remaining 1/79|  
+-----+-----+-----+-----+-----+-----+  
Total jobs 1  
  
upg> Job 100 completed  
----- Final Summary -----  
Number of databases [ 1 ]  
  
Jobs finished successfully [1]  
Jobs failed [0]  
Jobs pending [0]  
----- JOBS FINISHED SUCCESSFULLY -----  
Job 100 for DB12  
  
[oracle@hol ~]$
```

AutoUpgrade



The screenshot shows a terminal window titled "oracle@hol:~/autoupg_default/DB12/DB12/100/prechecks". The window displays the following command-line session:

```
File Edit View Search Terminal Help
[oracle@hol ~]$ cd /home/oracle/autoupg_default/DB12/DB12/100/prechecks/
[oracle@hol prechecks]$ ll
total 220
-rwx----- 1 oracle dba 2775 Dec 14 11:11 db12_checklist.cfg
-rwx----- 1 oracle dba 10754 Dec 14 11:11 db12_checklist.json
-rwx----- 1 oracle dba 10226 Dec 14 11:11 db12_checklist.xml
-rwx----- 1 oracle dba 26330 Dec 14 11:11 db12_preupgrade.html
-rwx----- 1 oracle dba 10369 Dec 14 11:11 db12_preupgrade.log
-rwx----- 1 oracle dba 152489 Dec 14 11:11 prechecks_db12.log
[oracle@hol prechecks]$ more db12_preupgrade.log
```

The command `more db12_preupgrade.log` is highlighted with a red rectangular box.

AutoUpgrade

```
oracle@hol:~/autoupg_default/DB12/DB12/100/prechecks
File Edit View Search Terminal Help
[dbname]          [DB12]
=====
[container]       [DB12]
=====
[checkname]       DEPEND_USR_TABLES
[stage]           POSTCHECKS
[fixup_available] YES
[runfix]          YES
[severity]        WARNING
[action]          If you use the -T option for the database upgrade, then run $ORACLE_HOME/rdbms/admin/utluptabdata.sql after the upgrade is complete, to VALIDATE and UPGRADE any user tables affected by changes to Oracle-Maintained types.
[broken rule]     There are user tables dependent on Oracle-Maintained object types.
[rule]            If the -T option is used to set user tablespaces to READ ONLY during the upgrade, user tables in those tablespaces, that are dependent on Oracle-Maintained types, will not be automatically upgraded. If a type is evolved during the upgrade, any dependent tables need to be re-validated and upgraded to the latest type version AFTER the database upgrade completes.
-----
[checkname]       DICTIONARY_STATS
[stage]           PRECHECKS
[fixup_available] YES
[runfix]          YES
[severity]        RECOMMEND
[action]          Gather stale data dictionary statistics prior to database upgrade in off-peak time
--More--(12%)
```

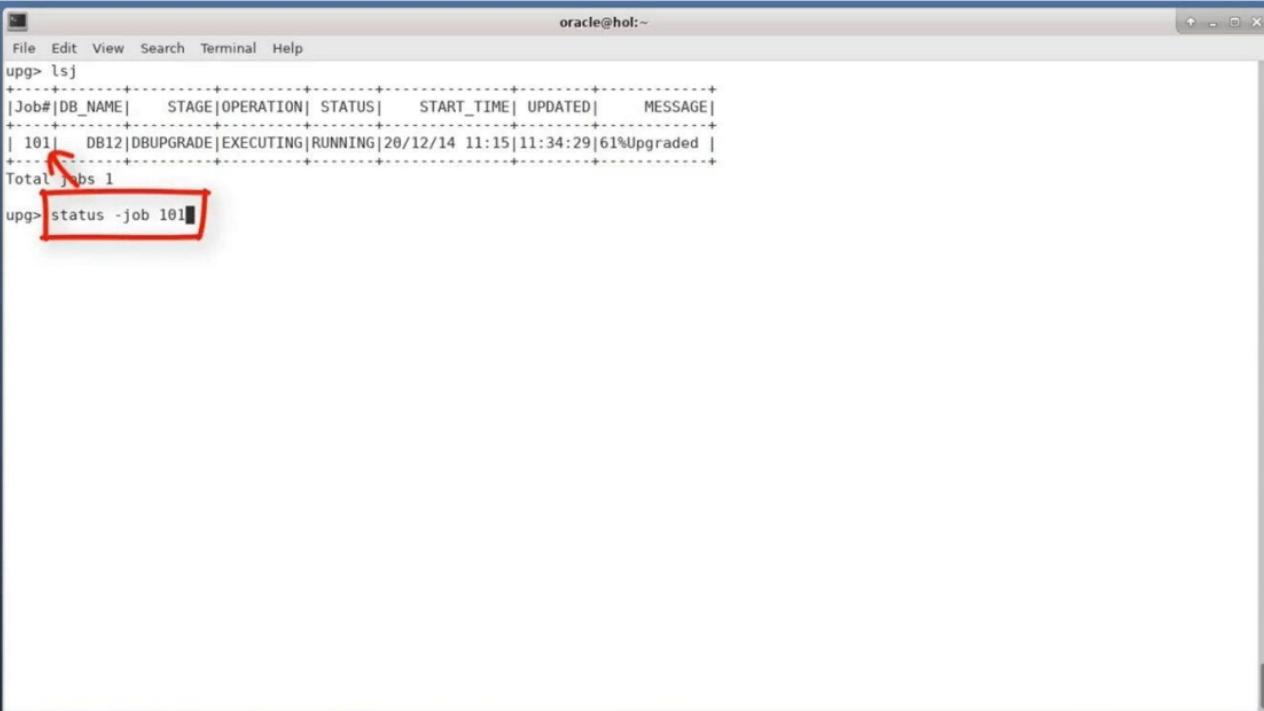
AutoUpgrade

```
File Edit View Search Terminal Help
oracle@hol:~$ java -jar autoupgrade.jar -config DB12.cfg -mode deploy
No parameter 'global.autoupg_log_dir' found in config file, using /home/oracle/autoupg_default
AutoUpgrade tool launched with default options
Processing config file ...
+-----+
| Starting AutoUpgrade execution |
+-----+
1 databases will be processed
Type 'help' to list console commands
upg> lsj
+-----+-----+-----+-----+-----+-----+
|Job#|DB_NAME|STAGE|OPERATION| STATUS| START_TIME| UPDATED| MESSAGE|
+-----+-----+-----+-----+-----+-----+
| 101| DB12|PREFIXUPS|EXECUTING|RUNNING|20/12/14 11:15|11:16:01|Remaining 4/4|
+-----+-----+-----+-----+-----+-----+
Total jobs 1

upg> lsj
+-----+-----+-----+-----+-----+-----+
|Job#|DB_NAME|STAGE|OPERATION| STATUS| START_TIME| UPDATED| MESSAGE|
+-----+-----+-----+-----+-----+-----+
| 101| DB12|DRAIN|EXECUTING|RUNNING|20/12/14 11:15|11:18:28|Shutting down database|
+-----+-----+-----+-----+-----+-----+
Total jobs 1

upg>
```

AutoUpgrade



A screenshot of a terminal window titled "oracle@hol:~". The window displays the output of the "lsj" command, which lists a single upgrade job. A red arrow points to the job ID "101" in the first column of the table. Below the table, the message "Total jobs 1" is shown. At the bottom of the window, the command "status -job 101" is entered and highlighted with a red box.

```
File Edit View Search Terminal Help  
oracle@hol:~  
upg> lsj  
+-----+-----+-----+-----+-----+-----+  
|Job#|DB_NAME| STAGE|OPERATION| STATUS| START_TIME| UPDATED| MESSAGE|  
+-----+-----+-----+-----+-----+-----+  
| 101| DB12|DBUPGRADE|EXECUTING|RUNNING|20/12/14 11:15|11:34:29|61%Upgraded |  
+-----+-----+-----+-----+-----+-----+  
Total jobs 1  
upg> status -job 101
```

AutoUpgrade

```
oracle@hol:~
```

File Edit View Search Terminal Help

End time: N/A
Last update: 2020-12-14T11:34:29.900
Stage: DBUPGRADE
Operation: EXECUTING
Status: RUNNING

Pending stages: 1

Stage summary:

SETUP	<1 min
GRP	<1 min
PREUPGRADE	<1 min
PRECHECKS	<1 min
PREFIXUPS	2 min
DRAIN	<1 min
DBUPGRADE	18 min (IN PROGRESS)

Job Logs Locations

Logs Base: /home/oracle/autoupg_default/DB12/DB12
Job logs: /home/oracle/autoupg_default/DB12/DB12/101
Stage logs: /home/oracle/autoupg_default/DB12/DB12/101/dbupgrade
TimeZone: /home/oracle/autoupg_default/DB12/DB12/temp

Additional information

Details:
[Upgrading] is [61%] completed for [db12]

+-----+-----+
CONTAINER PERCENTAGE
+-----+-----+
DB12 UPGRADE [61%]
+-----+-----+

Error Details:
None

upg>

AutoUpgrade

```
oracle@hol:~
```

File Edit View Search Terminal Help

DBUPGRADE 18 min (IN PROGRESS)

Job Logs Locations

Logs Base: /home/oracle/autoupg_default/DB12/DB12

Job logs: /home/oracle/autoupg_default/DB12/DB12/101

Stage logs: /home/oracle/autoupg_default/DB12/DB12/101/dbupgrade

TimeZone: /home/oracle/autoupg_default/DB12/DB12/temp

Additional information

Details:

[Upgrading] is [61%] completed for [db12]

CONTAINER PERCENTAGE
DB12 UPGRADE [61%]

Error Details:

None

upg> Job 101 completed

----- Final Summary -----

Number of databases [1]

Jobs finished successfully [1]

Jobs failed [0]

Jobs pending [0]

----- JOBS FINISHED SUCCESSFULLY -----

Job 101 for DB12

---- Drop GRP at your convenience once you consider it is no longer needed ----

Drop GRP from DB12: drop restore point AUTOUPGRADE_9212_DB12122010

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

AutoUpgrade

```
File Edit View Search Terminal Help
[oracle@hol ~]$ . oraenv
ORACLE_SID = [DB12] DB12
The Oracle base remains unchanged with value /u01/app/oracle
[oracle@hol ~]$ sqlplus / as sysdba

SQL*Plus: Release 19.0.0.0 - Production on Mon Dec 14 11:54:38 2020
Version 19.9.0.0.0

Copyright (c) 1982, 2020, Oracle. All rights reserved.

Connected to:
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
Version 19.9.0.0.0

SQL> select version_full from v$instance;

VERSION_FULL
-----
19.9.0.0.0

SQL>
```

AutoUpgrade

Always use the 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

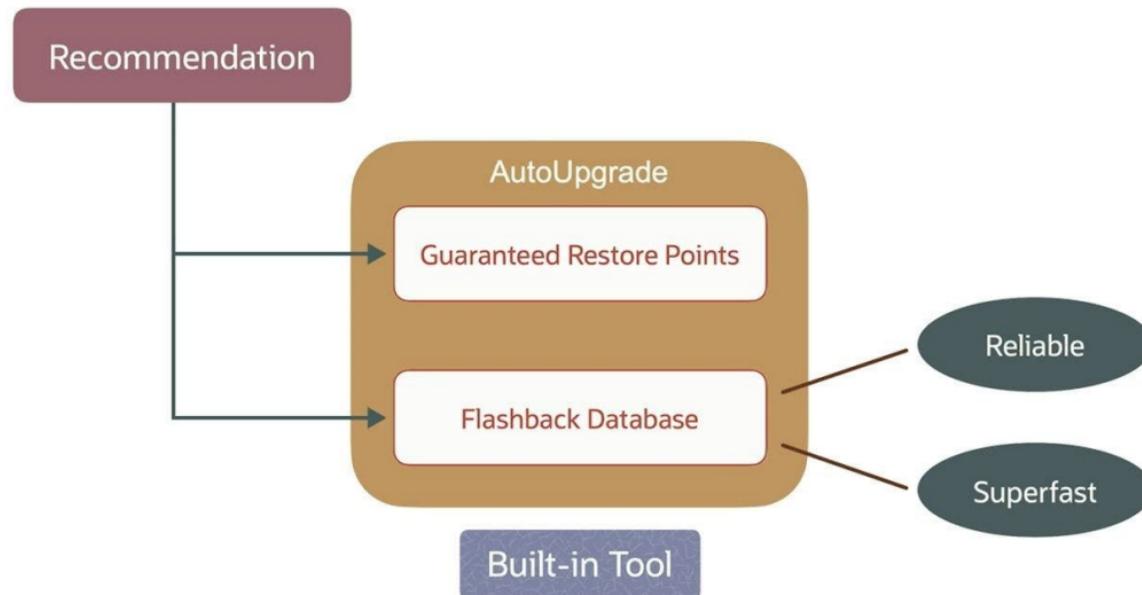
Check the **version** of AutoUpgrade

- AutoUpgrade is fully backwards compatible

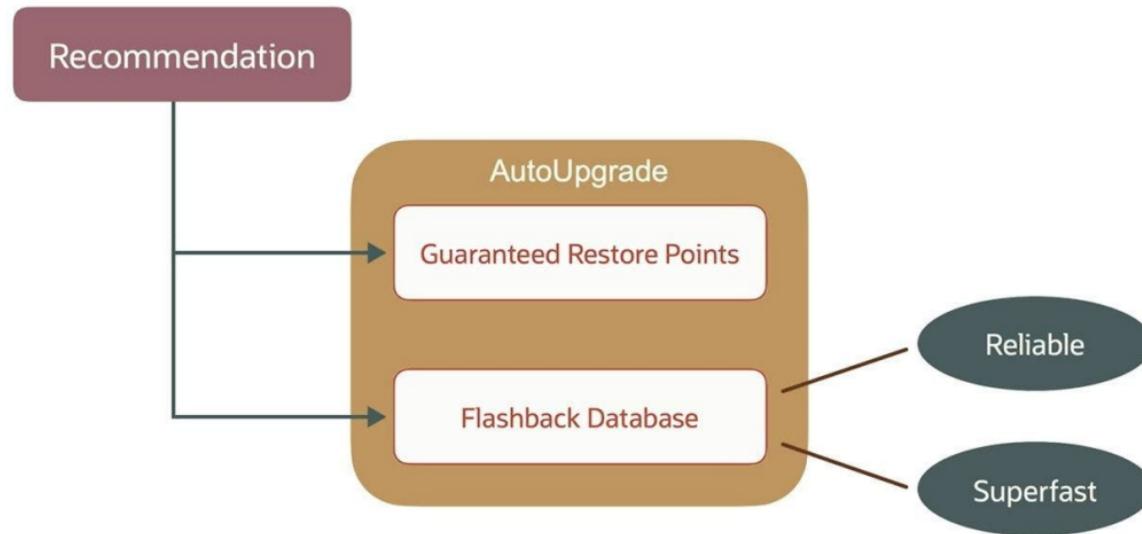
```
$ java -jar autoupgrade.jar -version

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
```

Fallback



Fallback



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

Fallback

Fallback After go-live



Flashback Database

Data Loss



Compatible

Determine **when** to raise the COMPATIBLE parameter

- Recommended: 7–10 days after upgrade,
requires database restart

After Raising Compatible
Parameter



Flashback Database



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

```
upgl.drop_grp_after_upgrade=yes  
upgl.raise_compatible=yes
```

Caution: Prevents use of Flashback Database and database downgrade

Statistics

Re-Gathering Statistics After Upgrade



Optimizer Statistics

System Statistics

Object Statistics

Older Statistics are Usable

Regathering Stats only Effect
Missing or Stale Stats

Pro tip: Read more about the new histogram types in [SQL Tuning Guide](#).

Statistics

Re-Gathering Statistics After Upgrade

Pro tip: Learn more in a [blog post](#) by Nigel Bayliss, Optimizer Product Manager.



Optimizer Statistics

System Statistics

Object Statistics

Not Recommended

More Trouble than Gain

dbms_stats.delete_system_stats

Statistics

Re-Gathering Statistics After Upgrade

Pro tip: Learn more in a [blog post](#) by Nigel Bayliss, Optimizer Product Manager.



Optimizer Statistics

System Statistics

Object Statistics

Not Recommended

More Trouble than Gain

Significant Testing Effort

Statistics

Re-Gathering Statistics
After Upgrade

Pro tip: Use the [database scheduler](#) to gather statistics.

Optimizer Statistics

System Statistics

Object Statistics

Statistics on certain
Memory Structures

Statistics

Re-Gathering Statistics After Upgrade

Pro tip: Use the [database scheduler](#) to gather statistics.

Optimizer Statistics

System Statistics

Object Statistics

Utmost Important for Fixed Objects

Gather only after Database
has been Used by Application



Parameters

Paramenter Change
Recommendation

Fewer Parameter Change

Run at Default Configuration
as much as possible

Parameters

Paramenter Change
Recommendation

Fewer Parameter Change

Remove Underscore
Parameter and Events

Evaluate Underscores, Events
during Upgrade and Remove

Parameters

Paramenter Change
Recommendation

Fewer Parameter Change

Remove Underscore
Parameter and Events

Adhere to the
Recommendations



Wrapping Up

Your Key to

Successful Database Upgrades

Step 1

Download and
install Oracle 19c

eDelivery.oracle.com

Step 2

Download and install
the 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

