



Upgrade, Migration and Patching to Oracle AI Database 26ai EXTREME EDITION

Utrecht, May 2026

Oracle

DBAs




run the world





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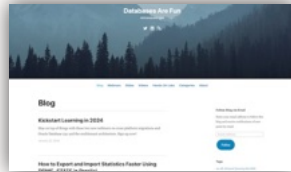


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Virtual Classroom Seminars

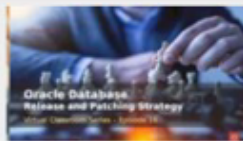
Slides

Episode 16

(replaces Episode 1 from Feb 2021)

[Oracle Database Release and Patching Strategy for 19c and 23c](#)

115 minutes – May 10, 2023



Episode 17

[From SR to Patch – Insights into the Oracle Database Development](#)

[process](#)

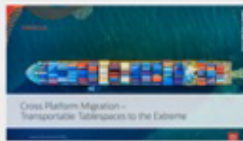
55 minutes – June 22, 2023



Episode 18

[Cross Platform Migration – Transportable Tablespaces to the Extreme](#)

145 min – February 22, 2024



Episode 19

[Move to Oracle Database 23ai – Everything you need to know about](#)

[Multitenant PART 1](#)

145 min – May 16, 2024



Episode 20

[Move to Oracle Database 23ai – Everything you need to know about](#)

[Multitenant PART 2](#)

100 min – June 28, 2024



Episode 21

[One-Button Patching with AutoUpgrade – Easing every DBA's life](#)

55 min – October 24, 2024



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09:30

Welcome
Upgrade to 26ai
Internals

11:15

Next-level patching
Grid Infrastructure

13:30

Performance/migrations
Statistics

15:15

AutoMigrate
DBA vs. AI

11:00

Coffee break

12:45

Lunch

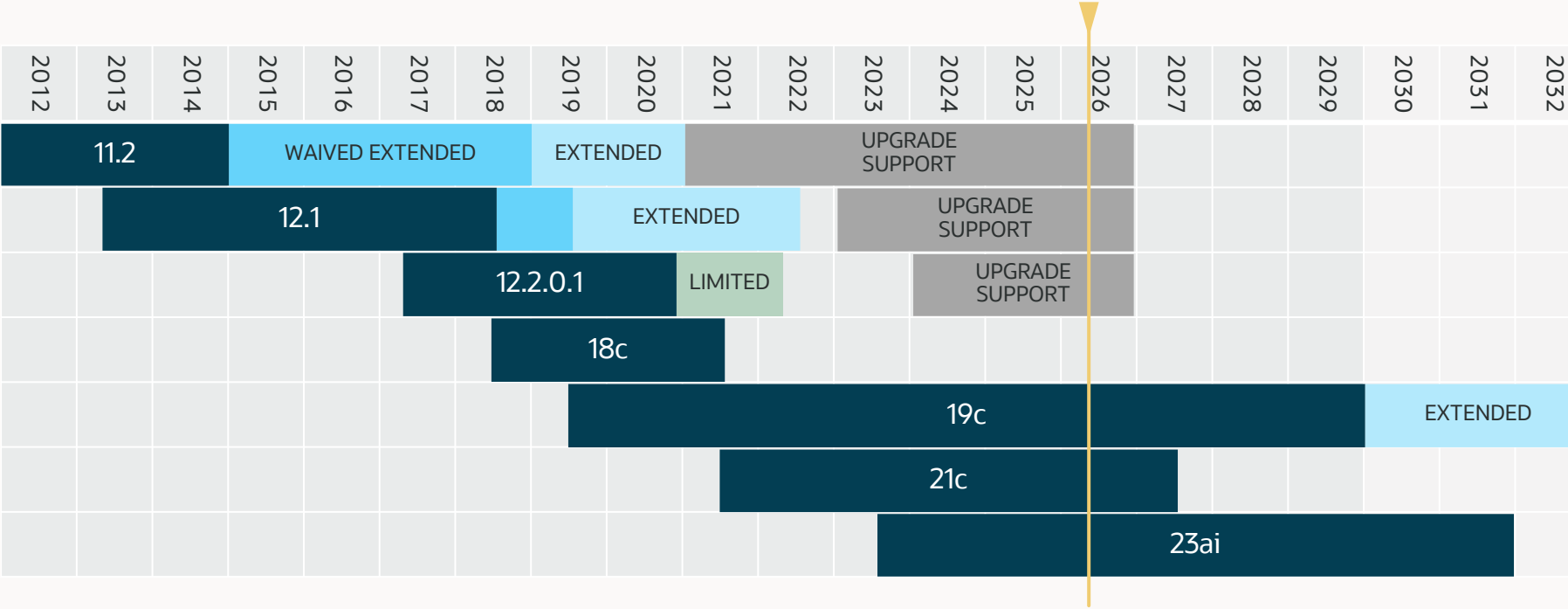
15:00

Coffee break



Upgrade to 26ai

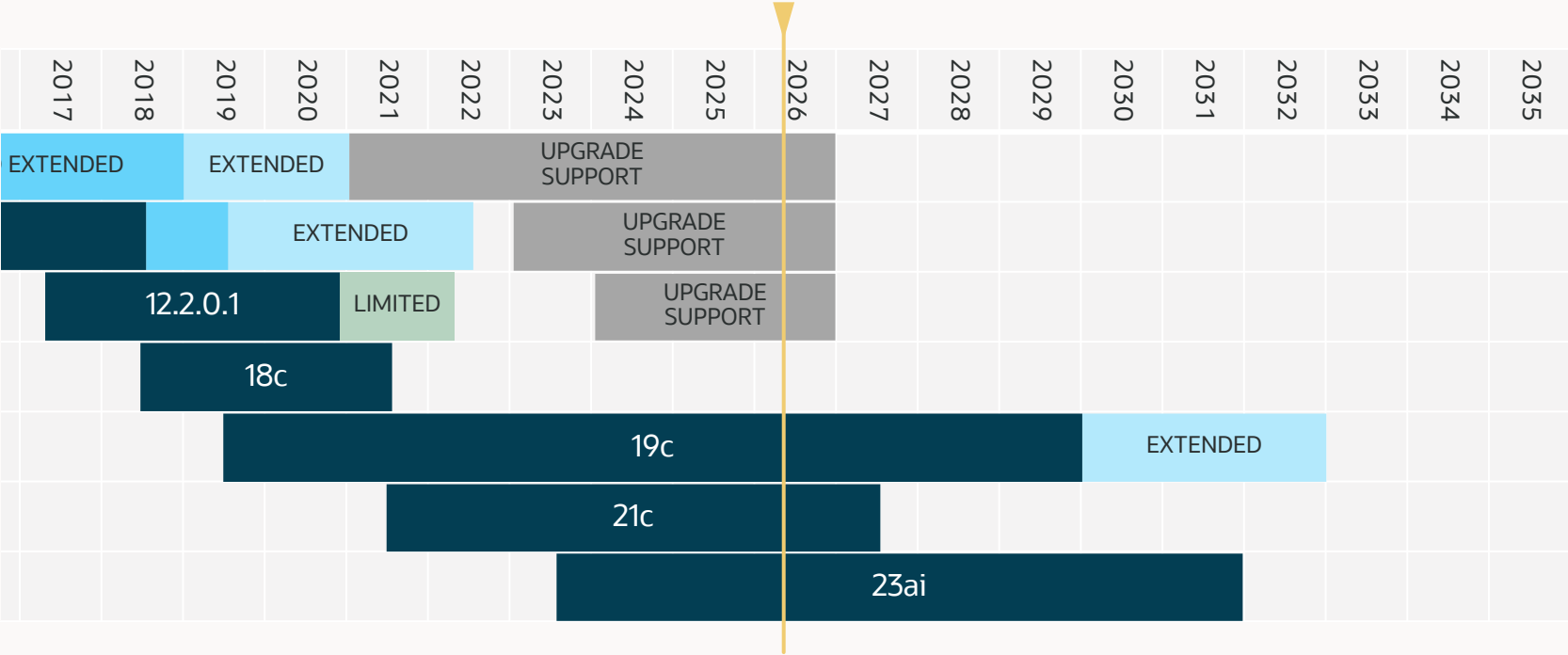
Lifetime Support Policy



Premier Support
 Waived Extended Support
 Paid Extended Support
 Restricted Upgrade Support
 Limited Error Correction



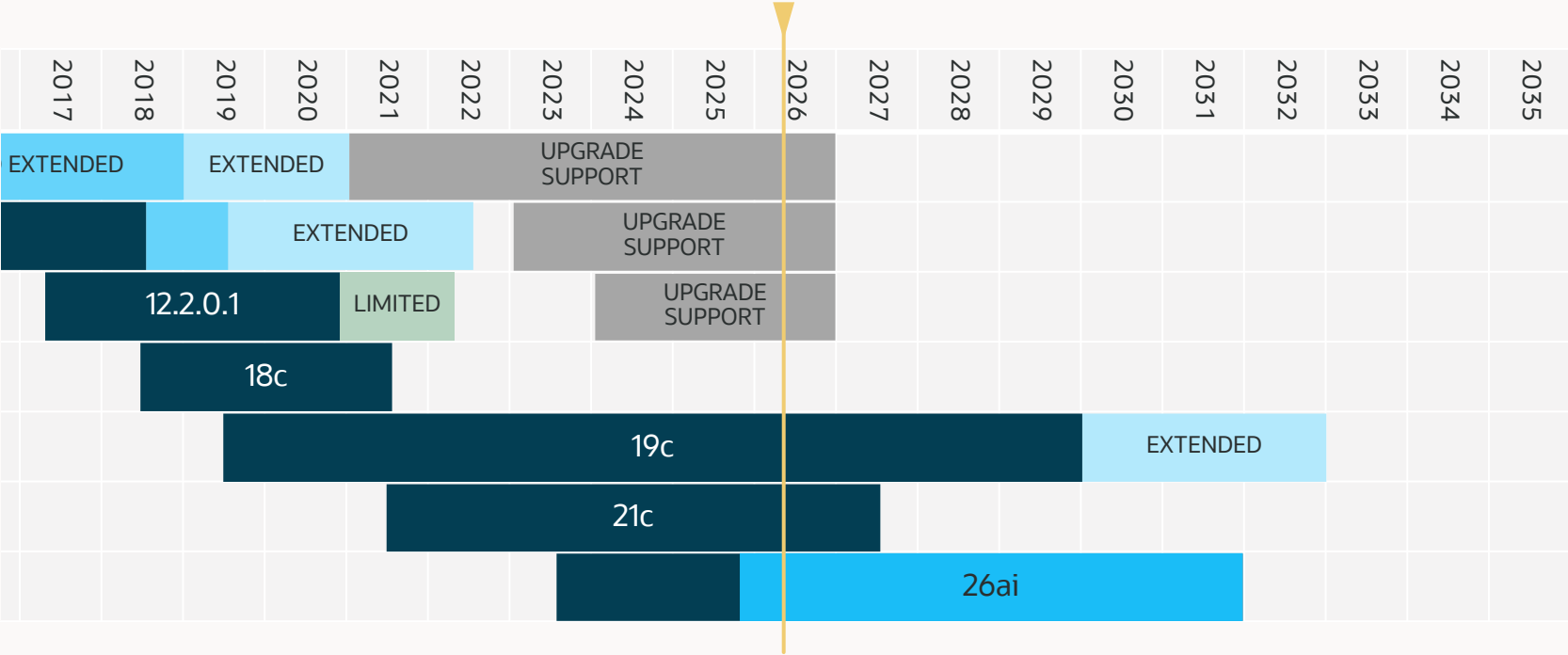
Lifetime Support Policy



Premier Support
 Waived Extended Support
 Paid Extended Support
 Restricted Upgrade Support
 Limited Error Correction



Lifetime Support Policy



■ Premier Support
 ■ Waived Extended Support
 ■ Paid Extended Support
 ■ Restricted Upgrade Support
 ■ Limited Error Correction





Oracle **strongly recommends** that you upgrade to a Long Term Support Release

- Oracle Database 19c or Oracle AI Database 26ai

26^{ai}

When will it be available on-prem?

On-Premises Server Releases (includes client)[\(Download here\)](#)

Linux x86	<i>Not Planned</i>	<i>Not Planned</i>	<i>Not planned</i>	<i>Not planned</i>	<i>Not planned</i>	<i>Not planned</i>	<i>Not planned</i>	<i>Not planned</i>	28-Aug-2013		
Linux x86-64	January 2026 Release Update (23.26.1) (Instant Client and Full Client are available today)	13-Aug-2021	25-Apr-2019	23-Jul-2018	1-Mar-2017	22-Jul-2014	25-Jun-2013	27-Aug-2013			
Linux on Arm	TBA	<i>Not Planned</i>	28-June-2023 Client: May-2021 download	<i>Not Planned</i>	<i>Not Planned</i>	<i>Not Planned</i>	<i>Not Planned</i>	<i>Not Planned</i>			
Oracle Solaris SPARC (64-	TBA	See KR126264	26-Apr-2019	30-Jul-2018	1-Mar-2017	22-Jul-2014	25-Jun-2013	29-Aug-2013			

26^{ai}

What about the other platforms?

Platforms

Microsoft Windows x64 (64-bit)

IBM AIX on POWER Systems

- CY2026

Oracle Solaris SPARC (64-bit)

IBM Linux on System z

- CY2027

Linux on Arm

- TBA

[Release Schedule of Current Database Releases \(PNEWS1360\)](#)

26^{ai}

There is no need to re-certify your app

- Certification for Oracle Database 23ai applies to Oracle AI Database 26ai

Types of Upgrades

Types of Upgrades



CDB
upgrade



PDB
unplug-plug



Non-CDB
upgrade and convert



CDB Upgrade



- Upgrades entire CDB including all PDBs
- *Many-as-one* principle
- Less work, more automation
- In-place upgrade, no extra resources needed
- Supports Flashback Database
- Seamless Data Guard + RMAN integration
- At least 30-45 minutes, possibly hours

CDB Upgrade



- Less control
- Common SLAs needed

PDB Upgrade



- Upgrades single PDB
- More flexibility
- More control
- Typically 10-30 minutes

PDB Upgrade



- Additional CDB needed
- Out-of-place upgrade, extra resources needed
- PDB is moved or cloned
- No support for Flashback Database
- Extra work for Data Guard
- Restore between containers requires pre-plugin backups

Non-CDB to PDB



- Similar to unplug-plug upgrade
- One-time conversion
- Irreversible
- No support for Flashback Database
- Extra work for Data Guard
- Typically 5-10 minutes
- Restore requires pre-plugin backups



Comparing CDB and PDB upgrades

Next,
seed and user PDBs



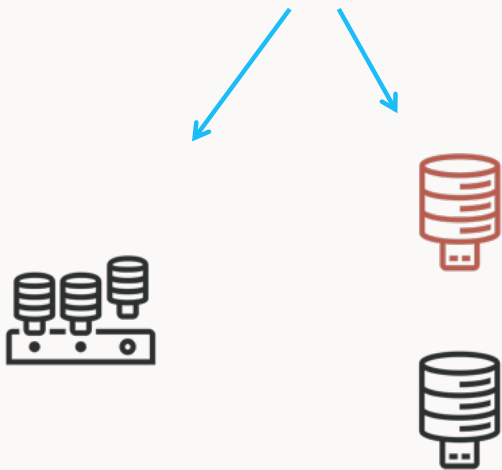
First,
upgrade root



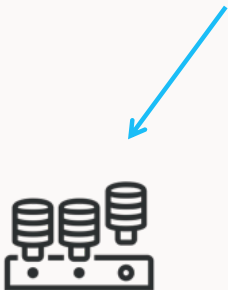
Proceed in batches



Single tenant,
always two batches



Oracle Database 19c



Oracle AI Database 26ai





Unplug-plug upgrades are faster than upgrading an entire CDB



Comparing **UPGRADE** types

	CDB upgrade	PDB upgrade	PDB conversion
Time	Longest	Shorter	Very short
Complexity	Easy	Moderate	Moderate
Outage	One big outage	Many smaller outages	Many smaller outages
Rollback	Flashback Database	Other rollback options	Other rollback options
Data Guard + RMAN	Seamless integration	Extra work	Extra work



Upgrading an entire CDB

```
global.global_log_dir=/home/oracle/autoupgrade/logs/CDB1  
upg1.source_home=/u01/app/oracle/product/19  
upg1.target_home=/u01/app/oracle/product/26  
upg1.sid=CDB1
```



```
global.global_log_dir=/home/oracle/autoupgrade/logs/CDB19  
upg1.source_home=/u01/app/oracle/product/19  
upg1.target_home=/u01/app/oracle/product/26  
upg1.sid=CDB1  
upg1.timezone_upg=no
```



```
global.global_log_dir=/home/oracle/autoupgrade/logs/CDB1  
upg1.source_home=/u01/app/oracle/product/19  
upg1.target_home=/u01/app/oracle/product/26  
upg1.sid=CDB1  
upg1.timezone_upg=no  
upg1.run_dictionary_health=full
```



```
global.global_log_dir=/home/oracle/autoupgrade/logs/CDB1
upg1.source_home=/u01/app/oracle/product/19
upg1.target_home=/u01/app/oracle/product/26
upg1.sid=CDB1
upg1.timezone_upg=no
upg1.run_dictionary_health=full
upg1.raise_compatible=yes
```



```
global.global_log_dir=/home/oracle/autoupgrade/logs/CDB1
upg1.source_home=/u01/app/oracle/product/19
upg1.target_home=/u01/app/oracle/product/26
upg1.sid=CDB1
upg1.timezone_upg=no
upg1.run_dictionary_health=full
upg1.raise_compatible=yes
upg1.emcli_path=/u01/app/oracle/oem
upg1.em_target_name=CDB1_myhost.domain.int
```



```
global.global_log_dir=/home/oracle/autoupgrade/logs/CDB1
upg1.source_home=/u01/app/oracle/product/19
upg1.target_home=/u01/app/oracle/product/26
upg1.sid=CDB1
upg1.timezone_upg=no
upg1.run_dictionary_health=full
upg1.raise_compatible=yes
upg1.emcli_path=/u01/app/oracle/oem
upg1.em_target_name=CDB1_myhost.domain.int
upg1.rman_catalog_connect_string=catalogdb
```



```
java -jar autoupgrade.jar -config CDB1.cfg -mode analyze
```



```
java -jar autoupgrade.jar -config CDB1.cfg -mode analyze
```

```
java -jar autoupgrade.jar -config CDB1.cfg -mode deploy
```





Use AutoUpgrade to download patches
and install Oracle home

Upgrade



- Webinar: [Best Practices for Upgrading to Oracle AI Database 26ai](#)
- Blog post: [Upgrade to Oracle AI Database 26ai](#)

Upgrade Internals



Oracle home

Binaries



Database

Data dictionary



Binaries and data dictionary
release must match



Oracle Database 19c



Data dictionary 19c



Oracle AI Database 26ai



Data dictionary 26ai



Database Upgrade Guide



This Book This Release

Table of Contents

Oracle Database

- [Preface](#)
- [Introduction](#)
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- [After Upgrading a Database](#)
- [Compatibility and Interoperability](#)
- [Upgrading Your Applications](#)

3 Upgrading to the New Oracle Database 10g Release

This chapter guides you through the process of upgrading a database to the new Oracle Database 10g release. This chapter covers the following topics:

- [System Considerations and Requirements](#)
- [Install the Release 10.2 Oracle Software](#)
- [Install the Latest Available Patch Set Release and Any Required Patches](#)

9. Set the system to spool results to a log file for later verification of success:

```
SQL> SP00L upgrade.log
```

10. Run `catupgrd.sql`:

```
SQL> @catupgrd.sql
```

The `catupgrd.sql` script determines which upgrade scripts need to be run and then runs each necessary script. You must run the script in the new release 10.2 environment.

The upgrade script creates and alters certain data dictionary tables. It also upgrades or installs the following database components in the new release 10.2 database:

- Oracle Database Catalog Views
- Oracle Database Packages and Types
- JServer JAVA Virtual Machine

dbua

dbupgrade

↳ catctl

↳ @catupgrd.sql

↳ @@catupstr.sql
@@catalog.sql
@@cdstrt.sql
@@cdfixed.sql
...
@catshutdown.sql

dbua

dbupgrade

```
java -jar autoupgrade.jar -config UPGR26.cfg -mode deploy
```

```
↳ catctl
```

```
↳ @catupgrd.sql
```

```
↳ @@catupstr.sql  
  @@catalog.sql  
    @@cdstrt.sql  
    @@cdfixed.sql  
    ...  
  @catshutdown.sql
```

catupgrd.sql Overview

Initialize

- i-script / c-script

RDBMS upgrade

- catalog/catproc
- a-script

Components

- javavm,dv,ols,sdo,...

Finalizing

- bootstrap upgrade

```
$ ll $ORACLE_HOME/rdbms/admin
```

```
-rw-r-----. 1 oracle oinstall 46693 Feb 10 2025 a19.sql  
-rw-r-----. 1 oracle oinstall 11261 Nov 10 2022 a20.sql  
-rw-r-----. 1 oracle oinstall 113582 Jul 4 06:47 a21.sql  
  
-rw-r-----. 1 oracle oinstall 106648 Feb 27 2025 c19.sql  
-rw-r-----. 1 oracle oinstall 70597 Oct 18 2024 c20.sql  
-rw-r-----. 1 oracle oinstall 406297 Jul 10 06:42 c21.sql  
  
-rw-r-----. 1 oracle oinstall 3933 Jul 20 2020 i19.sql  
-rw-r-----. 1 oracle oinstall 3712 Nov 23 2022 i20.sql  
-rw-r-----. 1 oracle oinstall 13877 Oct 9 2024 i21.sql
```

```
$ ll $ORACLE_HOME/rdbms/admin
```

```
-rw-r-----. 1 oracle oinstall 46693 Feb 10 2025 a19.sql  
-rw-r-----. 1 oracle oinstall 11261 Nov 10 2022 a20.sql  
-rw-r-----. 1 oracle oinstall 113582 Jul 4 06:47 a21.sql  
  
-rw-r-----. 1 oracle oinstall 106648 Feb 27 2025 c19.sql  
-rw-r-----. 1 oracle oinstall 70597 Oct 18 2024 c20.sql  
-rw-r-----. 1 oracle oinstall 406297 Jul 10 06:42 c21.sql  
  
-rw-r-----. 1 oracle oinstall 3933 Jul 20 2020 i19.sql  
-rw-r-----. 1 oracle oinstall 3712 Nov 23 2022 i20.sql  
-rw-r-----. 1 oracle oinstall 13877 Oct 9 2024 i21.sql
```

```
$ vi i19.sql
```

(output truncated)

```
Rem =====  
Rem Bug 28618619: Add new col to lob$ and lobfrag$, with values  
Rem           4000 for enable and 0 for disable storage in row  
Rem =====  
  
alter table lob$ add maxinl number;  
update lob$ set maxinl =  
           case when bitand(property, 2) != 0 then 4000 else 0 end;  
commit;  
alter table lob$ modify maxinl not null;  
  
alter table lobfrag$ add maxinl number;  
update lobfrag$ set maxinl =  
           case when bitand(fragpro, 2) != 0 then 4000 else 0 end;  
commit;  
alter table lobfrag$ modify maxinl not null;
```



Upgrading from Oracle Database 19c to Oracle AI Database 26ai:

- 20,000 CREATE OR REPLACE
- 7,000 CREATE ...
- 1,500 ALTER TABLE
- 300 ALTER TYPE
- 7,000 ALTER SESSION
- ... and many more statements



Parallel Upgrade

```
$ vi catupgrd.sql
```



```
Rem
Rem Initial checks and RDBMS upgrade scripts
Rem
@@catupstr.sql
```

```
Rem
Rem Execute upgrade and catalog session script
Rem
@@catupses.sql --CATFILE -SES
@@catalogses.sql --CATFILE -SESS
@@catalogses.sql --CATFILE -SESS
```

```
Rem
Rem Run catalog with some multiprocess phases
Rem
@@catalog.sql --CATFILE -X
```

```
Rem
Rem Execute catproc session script
Rem
@@catprocses.sql --CATFILE -SESE -SESS
```

```
Rem
Rem Run catproc with some multiprocess phases
Rem
@@catproc.sql --CATFILE -X
```

```
Rem
Rem Initial checks and RDBMS upgrade scripts
Rem
@@catupstr.sql

Rem
Rem Execute upgrade and catalog session script
Rem
@@catupses.sql    --CATFILE -SES
@@catalogses.sql  --CATFILE -SESS
@@catalogses.sql  --CATFILE -SESS
```

```
Rem
Rem Run catalog with some multiprocess phases
Rem
@@catalog.sql     --CATFILE -X
```

```
Rem
Rem Execute catproc session script
Rem
@@catprocres.sql --CATFILE -SESE -SESS
```

```
Rem
Rem Run catproc with some multiprocess phases
Rem
@@catproc.sql    --CATFILE -X
```

```
Rem
Rem Initial checks and RDBMS upgrade scripts
Rem
Rem
@@catupstr.sql

Rem
Rem Execute upgrade and catalog session script
Rem
Rem
@@catupses.sql      --CATFILE -SES
@@catalogses.sql    --CATFILE -SESS
@@catalogses.sql    --CATFILE -SESS
```

```
Rem
Rem Run catalog with some multiprocess phases
Rem
Rem
@@catalog.sql      --CATFILE -X
```

```
Rem
Rem Execute catproc session script
Rem
Rem
@@catprocses.sql  --CATFILE -SESE -SESS
```

```
Rem
Rem Run catproc with some multiprocess phases
Rem
Rem
@@catproc.sql     --CATFILE -X
```



```
Rem
Rem Initial checks and RDBMS upgrade scripts
Rem
@@catupstr.sql

Rem
Rem Execute upgrade and catalog session script
Rem
@@catupses.sql      --CATFILE -SES
@@catalogses.sql    --CATFILE -SESS
@@catalogses.sql    --CATFILE -SESS

Rem
Rem Run catalog with some multiprocess phases
Rem
@@catalog.sql       --CATFILE -X

Rem
Rem Execute catproc session script
Rem
@@catprocses.sql    --CATFILE -SESE -SESS

Rem
Rem Run catproc with some multiprocess phases
Rem
@@catproc.sql       --CATFILE -X
```

```
--CATCTL -S -D "Catalog Core SQL"
```

Initial scripts single process

```
@@cdstrt.sql
```

```
@@cdfixed.sql
```

```
@@catcdbviews.sql
```

```
@@catblock.sql
```

```
@@cdcore.sql
```

```
--CATCTL -R
```

```
--CATCTL -M -D "Catalog Tables and Views"
```

```
@@cdplsql.sql
```

```
@@cdsqlddl.sql
```

```
@@cdmanage.sql
```

```
@@cdtxnspc.sql
```

```
@@cdenv.sql
```

```
@@cdrac.sql
```

```
@@cdsec.sql
```

```
@@cdobj.sql
```

```
@@cdjava.sql
```

```
@@cdpart.sql
```

```
@@cdrep.sql
```

```
@@cdaw.sql
```

```
@@cdsummt.sql
```

```
@@cdtools.sql
```

```
@@cdexttab.sql
```

```
@@cddm.sql
```

```
@@cdclst.sql
```



```
--CATCTL -S -D "Catalog Core SQL"    Initial scripts single process
@@cdstrt.sql
@@cdfixed.sql
@@catcdbviews.sql
@@catblock.sql
@@cdcore.sql
```

```
--CATCTL -R
```

```
--CATCTL -M -D "Catalog Tables and Views"
@@cdplsql.sql
@@cdsqlddl.sql
@@cdmanage.sql
@@cdtxnspc.sql
@@cdenv.sql
@@cdrac.sql
@@cdsec.sql
@@cdobj.sql
@@cdjava.sql
@@cdpart.sql
@@cdrep.sql
@@cdaw.sql
@@cdsumgmt.sql
@@cdtools.sql
@@cdexttab.sql
@@cddm.sql
@@cdclst.sql
```

```
--CATCTL -S -D "Catalog Core SQL"    Initial scripts single process
```

```
@@cdstrt.sql
```

```
@@cdfixed.sql
```

```
@@catcdbviews.sql
```

```
@@catblock.sql
```

```
@@cdcore.sql
```

```
--CATCTL -R
```

```
--CATCTL -M -D "Catalog Tables and Views"
```

```
@@cdp1sql.sql
```

```
@@cdsqlddl.sql
```

```
@@cdmanage.sql
```

```
@@cdtxnspc.sql
```

```
@@cdenv.sql
```

```
@@cdrac.sql
```

```
@@cdsec.sql
```

```
@@cdobj.sql
```

```
@@cdjava.sql
```

```
@@cdpart.sql
```

```
@@cdrep.sql
```

```
@@cdaw.sql
```

```
@@cdsumgmt.sql
```

```
@@cdtools.sql
```

```
@@cdexttab.sql
```

```
@@cddm.sql
```

```
@@cdclst.sql
```



```
$ grep "jloaiza" catalog.sql
```

```
Rem      jloaiza      06/20/94 - fix all_tables  
Rem      jloaiza      06/16/94 - add disable dml locks  
Rem      jloaiza      05/23/94 - add new fixed views  
Rem      jloaiza      10/28/92 - add v$db_object_cache and v$open_cursor
```



A man with glasses, wearing a dark blue blazer over a light blue button-down shirt, stands on a stage. He is smiling and gesturing with his hands. He holds a small black device in his right hand and has his left hand open and palm up. The background is a dark blue gradient with a curved line.

Juan Loaiza

EVP, Database Technologies, Oracle

```
Rem
Rem Run catproc with some multiprocess phases
Rem
@@catproc.sql      --CATFILE -X
```

```
--CATCTL -R
--CATCTL -S -D "Final RDBMS scripts"
Rem
Rem Final RDBMS upgrade scripts
Rem
@@catupprc.sql
```

```
Rem
Rem Upgrade components with some multiprocess phases
Rem
@@cmpupgrd.sql    --CATFILE -X -SESE
```

```
--CATCTL -S -D "Final Upgrade scripts"
Rem
Rem Final upgrade scripts
Rem
@@catupend.sql
```

```
--CATCTL -M -D "Upgrading Java and non-Java"  
Rem  
Rem Java upgrade (JAVAVM, XML, CATJAVA)  
Rem  
@@cmpupjav.sql
```

```
Rem  
Rem non-Java dependent upgrades (include XDB and Dependent since all  
Rem single process while Java components being upgraded in other single  
Rem process):  
Rem APS, AMD, OLS, DV, CONTEXT, XDB, OWM, MGW, RAC  
Rem  
@@cmpupnjv.sql
```

```
--CATCTL -R  
--CATCTL -S  
Rem  
Rem Extracted grants/revokes of bootstrap tables for component scripts  
Rem These are run serially as to not run into timeout/deadlocking issues  
Rem  
@@cmpupprv.sql
```

```
--CATCTL -R -D "Upgrading XDB"  
Rem  
Rem Oracle XDB (uses catctl directly)  
Rem  
--CATCTL -CP XDB -X
```

```
--CATCTL -M -D "Upgrading Java and non-Java"  
Rem  
Rem Java upgrade (JAVAVM, XML, CATJAVA)  
Rem  
@@cmpupjav.sql
```

```
Rem  
Rem non-Java dependent upgrades (include XDB and Dependent since all  
Rem single process while Java components being upgraded in other single  
Rem process):  
Rem APS, AMD, OLS, DV, CONTEXT, XDB, OWM, MGW, RAC  
Rem  
@@cmpupnjv.sql
```

```
--CATCTL -R  
--CATCTL -S  
Rem  
Rem Extracted grants/revokes of bootstrap tables for component scripts  
Rem These are run serially as to not run into timeout/deadlocking issues  
Rem  
@@cmpupprv.sql
```

```
--CATCTL -R -D "Upgrading XDB"  
Rem  
Rem Oracle XDB (uses catctl directly)  
Rem  
--CATCTL -CP XDB -X
```

```
$ pwd  
/u02/app/oracle/autoupgrade/runs/LONGHORN1/LONGHORN1/101/dbupgrade
```

```
$ vi autoupgrade*cdbroot.log
```



```
-----  
Phases [0-106]          Start Time:[2025_08_22 18:00:46]  
Container Lists Inclusion:[CDB$ROOT] Exclusion:[NONE]  
-----
```

```
***** Executing Change Scripts *****  
Serial Phase #:0 [CDB$ROOT] Files:1 Time: 51s  
***** Catalog Core SQL *****  
Serial Phase #:1 [CDB$ROOT] Files:5 Time: 40s  
Restart Phase #:2 [CDB$ROOT] Files:1 Time: 0s  
***** Catalog Tables and Views *****  
Parallel Phase #:3 [CDB$ROOT] Files:21 Time: 18s  
Restart Phase #:4 [CDB$ROOT] Files:1 Time: 0s  
***** Catalog Final Scripts *****  
Serial Phase #:5 [CDB$ROOT] Files:7 Time: 12s  
***** Catproc Start *****  
Serial Phase #:6 [CDB$ROOT] Files:1 Time: 9s  
***** Catproc Types *****  
Serial Phase #:7 [CDB$ROOT] Files:2 Time: 9s  
Restart Phase #:8 [CDB$ROOT] Files:1 Time: 0s
```

(output truncated)

```
*** End PDB Application Upgrade Post-Shutdown **  
Serial Phase #:104 [CDB$ROOT] Files:2 Time: 101s  
Serial Phase #:105 [CDB$ROOT] Files:1 Time: 0s  
Serial Phase #:106 [CDB$ROOT] Files:1 Time: 24s  
Serial Phase #:106 [CDB$ROOT] Files:1 Time: 24s
```



```
-----
Phases [0-106]          Start Time:[2025_08_22 18:00:46]
Container Lists Inclusion:[CDB$ROOT] Exclusion:[NONE]
-----
```

```
***** Executing Change Scripts *****
```

```
Serial Phase #:0 [CDB$ROOT] Files:1 Time: 51s
```

```
***** Catalog Core SQL *****
```

```
Serial ← Phase #:1 [CDB$ROOT] Files:5 Time: 40s
```

```
Restart Phase #:2 [CDB$ROOT] Files:1 Time: 0s
```

```
***** Catalog Tables and Views *****
```

```
Parallel Phase #:3 [CDB$ROOT] Files:21
```

```
Restart Phase #:4 [CDB$ROOT] Files:1
```

```
***** Catalog Final Scripts *****
```

```
Serial Phase #:5 [CDB$ROOT] Files:7
```

```
***** Catproc Start *****
```

```
Serial Phase #:6 [CDB$ROOT] Files:1
```

```
***** Catproc Types *****
```

```
Serial Phase #:7 [CDB$ROOT] Files:2
```

```
Restart Phase #:8 [CDB$ROOT] Files:1
```

```
(output truncated)
```

```
*** End PDB Application Upgrade Post-Shutd
```

```
Serial Phase #:104 [CDB$ROOT] Files:2
```

```
Serial Phase #:105 [CDB$ROOT] Files:1
```

```
Serial Phase #:106 [CDB$ROOT] Files:1
```

```
Serial Phase #:106 [CDB$ROOT] Files:1 Time: 24s
```

```
--CATCTL -S -D "Catalog Core SQL" Initial scripts single process
@@cdstrt.sql
@@cdfixed.sql
@@catcdbviews.sql
@@catblock.sql
@@cdcore.sql

--CATCTL -R
--CATCTL -M -D "Catalog Tables and Views"
@@cdp1sql.sql
@@cdsqlddl.sql
@@cdmanage.sql
@@cdtxnspc.sql
@@cdenv.sql
@@cdrac.sql
@@cdsec.sql
@@cdobj.sql
@@cdjava.sql
```

```
-----
Phases [0-106]          Start Time:[2025_08_22 18:00:46]
Container Lists Inclusion:[CDB$ROOT] Exclusion:[NONE]
-----
```

```
***** Executing Change Scripts *****
```

```
Serial Phase #:0 [CDB$ROOT] Files:1 Time: 51s
```

```
***** Catalog Core SQL *****
```

```
Serial Phase #:1 [CDB$ROOT] Files:5 Time: 40s
```

```
Restart Phase #:2 [CDB$ROOT] Files:1 Time: 0s
```

```
***** Catalog Tables and Views *****
```

```
Parallel Phase #:3 [CDB$ROOT] Files:21
```

```
Restart Phase #:4 [CDB$ROOT] Files:1
```

```
***** Catalog Final Scripts *****
```

```
Serial Phase #:5 [CDB$ROOT] Files:7
```

```
***** Catproc Start *****
```

```
Serial Phase #:6 [CDB$ROOT] Files:1
```

```
***** Catproc Types *****
```

```
Serial Phase #:7 [CDB$ROOT] Files:2
```

```
Restart Phase #:8 [CDB$ROOT] Files:1
```

```
(output truncated)
```

```
*** End PDB Application Upgrade Post-Shutd
```

```
Serial Phase #:104 [CDB$ROOT] Files:2
```

```
Serial Phase #:105 [CDB$ROOT] Files:1
```

```
Serial Phase #:106 [CDB$ROOT] Files:1
```

```
Serial Phase #:106 [CDB$ROOT] Files:1 Time: 24s
```

```
--CATCTL -S -D "Catalog Core SQL" Initial scripts single process
@@cdstrt.sql
@@cdfixed.sql
@@catcdbviews.sql
@@catblock.sql
@@cdcore.sql

--CATCTL -R
--CATCTL -M -D "Catalog Tables and Views"
@@cdp1sql.sql
@@cdsqlddl.sql
@@cdmanage.sql
@@cdtxnspc.sql
@@cdenv.sql
@@cdrac.sql
@@cdsec.sql
@@cdobj.sql
@@cdjava.sql
```

```
-----  
Phases [0-106]          Start Time:[2025_08_22 18:00:46]  
Container Lists Inclusion:[CDB$ROOT] Exclusion:[NONE]  
-----
```

```
***** Executing Change Scripts *****
```

```
Serial Phase #:0 [CDB$ROOT] Files:1 Time: 51s
```

```
***** Catalog Core SQL *****
```

```
Serial Phase #:1 [CDB$ROOT] Files:5 Time: 40s
```

```
Restart Phase #:2 [CDB$ROOT] Files:1 Time: 0s
```

```
***** Catalog Tables and Views *****
```

```
Parallel Phase #:3 [CDB$ROOT] Files:21
```

```
Restart Phase #:4 [CDB$ROOT] Files:1
```

```
***** Catalog Final Scripts *****
```

```
Serial Phase #:5 [CDB$ROOT] Files:7
```

```
***** Catproc Start *****
```

```
Serial Phase #:6 [CDB$ROOT] Files:1
```

```
***** Catproc Types *****
```

```
Serial Phase #:7 [CDB$ROOT] Files:2
```

```
Restart Phase #:8 [CDB$ROOT] Files:1
```

```
(output truncated)
```

```
*** End PDB Application Upgrade Post-Shutd
```

```
Serial Phase #:104 [CDB$ROOT] Files:2
```

```
Serial Phase #:105 [CDB$ROOT] Files:1
```

```
Serial Phase #:106 [CDB$ROOT] Files:1
```

```
Serial Phase #:106 [CDB$ROOT] Files:1
```

```
--CATCTL -S -D "Catalog Core SQL" Initial scripts single process  
@@cdstrt.sql  
@@cdfixed.sql  
@@catcdbviews.sql  
@@catblock.sql  
@@cdcore.sql  
  
--CATCTL -R  
--CATCTL -M -D "Catalog Tables and Views"  
@@cdp1sql.sql  
@@cdsqlddl.sql  
@@cdmanage.sql  
@@cdtxnspec.sql  
@@cdenv.sql  
@@cdrac.sql  
@@cdsec.sql  
@@cdobj.sql  
@@cdjava.sql
```





For parallel upgrade, AutoUpgrade

- Uses **8** threads for CDB\$ROOT
- Uses **2** threads per PDB
- Upgrades **CPU_COUNT / 2** PDBs concurrently



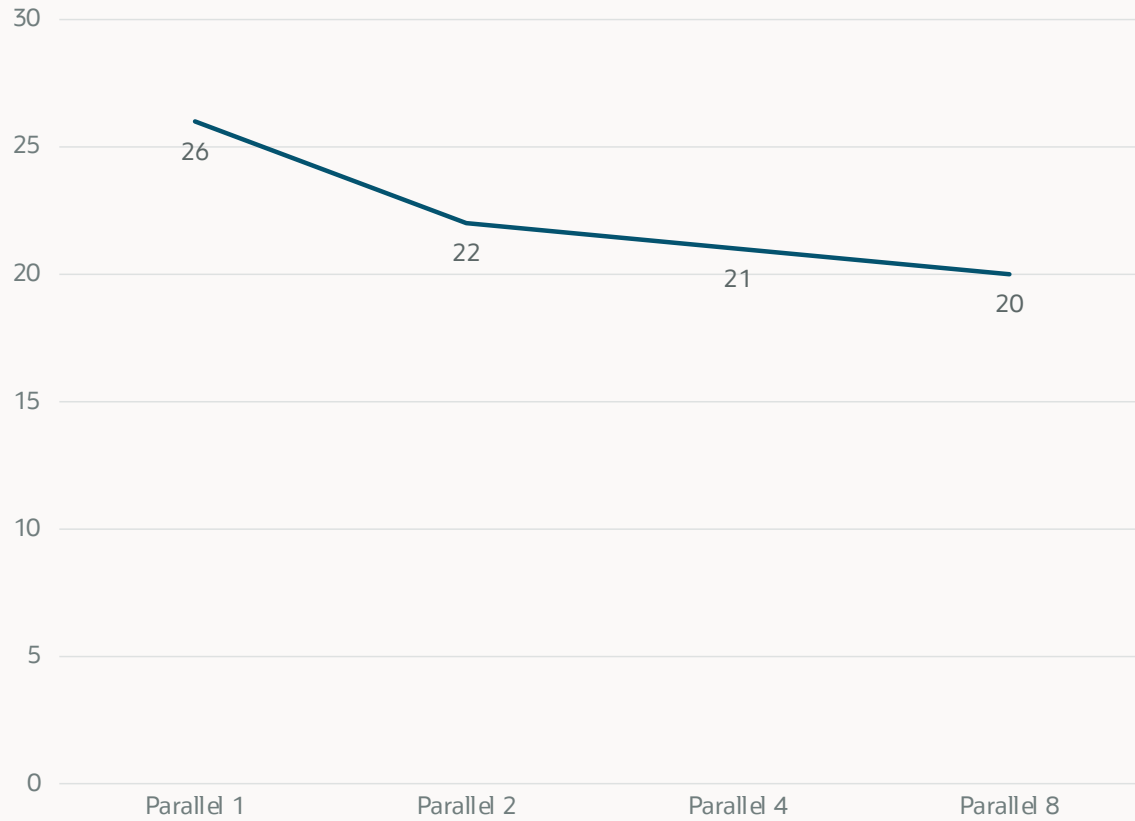
For parallel upgrade, AutoUpgrade

- Uses **8** threads for CDB\$ROOT
- Uses **2** threads per PDB
 - Overridable with `upg1.catctl_options=-N <value>`
- Upgrades **CPU_COUNT / 2** PDBs concurrently
 - Overridable with `upg1.catctl_options=-n <value>`



More threads leads to
more contention

PDB upgrade (minutes)





Scale by upgrading
more PDBs concurrently

Upgrade Details



You must **startup upgrade** to upgrade a database

- Enables restricted session

```
ALTER SYSTEM SET "_SYSTEM_TRIG_ENABLED" = FALSE
                 "_UNDO_AUTOTUNE"         = FALSE
                 AQ_TM_PROCESSES          = 0
                 DB_SECUREFILE            = PERMITTED
                 ENABLE_DDL_LOGGING       = FALSE
                 PLSQL_WARNINGS           = 'DISABLE:ALL'
                 RECYCLEBIN                = OFF
                 RESOURCE_MANAGER_PLAN    = ''
                 UNDO_RETENTION            = 900
```

```
SQL> startup upgrade
```

```
ORACLE instance started.
```

```
Total System Global Area 1002435912 bytes
```

```
Fixed Size 8947016 bytes
```

```
Variable Size 272629760 bytes
```

```
Database Buffers 713031680 bytes
```

```
Redo Buffers 7827456 bytes
```

```
Database mounted.
```

```
Database opened.
```

```
SQL> create table t1 (c1 number);
```

```
Table created.
```

```
SQL> create table t1 (c1 number);
```

```
Table created.
```

```
SQL> create table t1 (c1 number);
```

```
Table created.
```



A restart is the only way
out of *upgrade* mode



AutoUpgrade recompiles invalid objects at the end

- Only those owned by Oracle-maintained schemas

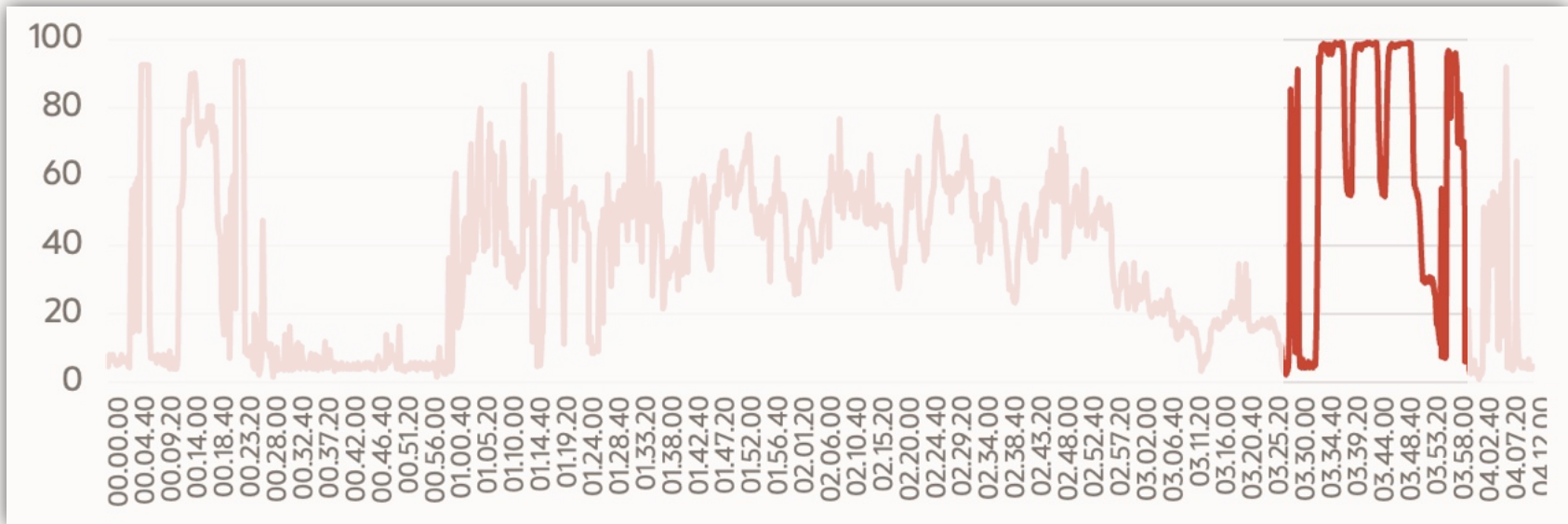
@?/rdbms/admin/utlrp

~~@?/rdbms/admin/utlprp~~

@?/rdbms/admin/utlprpom.sql <n>

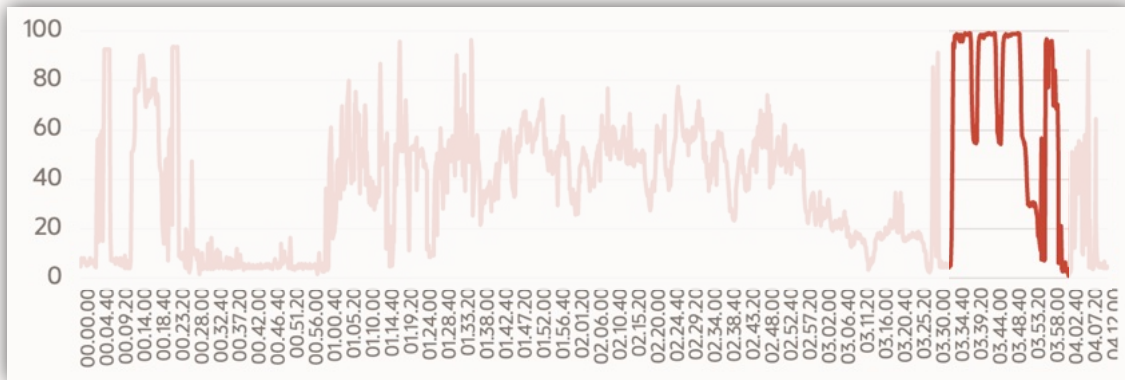


Recompilation



Recompilation

- Uses the scheduler (DBMS_SCHEDULER) to parallelize
- Lowering JOB_QUEUE_PROCESSES might limit the recompilation
- Very CPU intensive



Bootstrapping

STARTUP MOUNT

```
ALTER SESSION SET EVENTS '10046 TRACE NAME CONTEXT FOREVER, LEVEL 12';
```

```
ALTER DATABASE OPEN;
```



```
grep -i "CREATE TABLE" FTEX_ora_328857.trc | cut -c1-100
```



```

create table bootstrap$ ( line#          number not null,   obj#          number not null,   sql_tex
CREATE TABLE TAB$( 'OBJ#' NUMBER NOT NULL, 'DATAOBJ#' NUMBER, 'TS#' NUMBER NOT NULL, 'FILE#' NUMBER NOT
CREATE TABLE CLU$( 'OBJ#' NUMBER NOT NULL, 'DATAOBJ#' NUMBER, 'TS#' NUMBER NOT NULL, 'FILE#' NUMBER NOT
CREATE TABLE FET$( 'TS#' NUMBER NOT NULL, 'FILE#' NUMBER NOT NULL, 'BLOCK#' NUMBER NOT NULL, 'LENGTH' NU
CREATE TABLE UET$( 'SEGFILE#' NUMBER NOT NULL, 'SEGBLOCK#' NUMBER NOT NULL, 'EXT#' NUMBER NOT NULL, 'TS#'
CREATE TABLE SEG$( 'FILE#' NUMBER NOT NULL, 'BLOCK#' NUMBER NOT NULL, 'TYPE#' NUMBER NOT NULL, 'TS#' NUM
CREATE TABLE UNDO$( 'US#' NUMBER NOT NULL, 'NAME' VARCHAR2(30) NOT NULL, 'USER#' NUMBER NOT NULL, 'FILE#'
CREATE TABLE TS$( 'TS#' NUMBER NOT NULL, 'NAME' VARCHAR2(30) NOT NULL, 'OWNER#' NUMBER NOT NULL, 'ONLINE
CREATE TABLE FILE$( 'FILE#' NUMBER NOT NULL, 'STATUS$' NUMBER NOT NULL, 'BLOCKS' NUMBER NOT NULL, 'TS#'
CREATE TABLE OBJ$( 'OBJ#' NUMBER NOT NULL, 'DATAOBJ#' NUMBER, 'OWNER#' NUMBER NOT NULL, 'NAME' VARCHAR2(
CREATE TABLE IND$( 'OBJ#' NUMBER NOT NULL, 'DATAOBJ#' NUMBER, 'TS#' NUMBER NOT NULL, 'FILE#' NUMBER NOT
CREATE TABLE ICOL$( 'OBJ#' NUMBER NOT NULL, 'BO#' NUMBER NOT NULL, 'COL#' NUMBER NOT NULL, 'POS#' NUMBER
CREATE TABLE COL$( 'OBJ#' NUMBER NOT NULL, 'COL#' NUMBER NOT NULL, 'SEGCOL#' NUMBER NOT NULL, 'SEGCOLLEN
CREATE TABLE USER$( 'USER#' NUMBER NOT NULL, 'NAME' VARCHAR2(128) NOT NULL, 'TYPE#' NUMBER NOT NULL, 'PA
CREATE TABLE PROXY_DATA$( 'CLIENT#' NUMBER NOT NULL, 'PROXY#' NUMBER NOT NULL, 'CREDENTIAL_TYPE#' NUMBE
CREATE TABLE PROXY_ROLE_DATA$( 'CLIENT#' NUMBER NOT NULL, 'PROXY#' NUMBER NOT NULL, 'ROLE#' NUMBER NOT
CREATE TABLE CON$( 'OWNER#' NUMBER NOT NULL, 'NAME' VARCHAR2(128) NOT NULL, 'CON#' NUMBER NOT NULL, 'SPA
CREATE TABLE CDEF$( 'CON#' NUMBER NOT NULL, 'OBJ#' NUMBER NOT NULL, 'COLS' NUMBER, 'TYPE#' NUMBER NOT NU
CREATE TABLE CCOL$( 'CON#' NUMBER NOT NULL, 'OBJ#' NUMBER NOT NULL, 'COL#' NUMBER NOT NULL, 'POS#' NUMBE

```



```
create table bootstrap$ ( line#          number not null,   obj#          number not null,   sql_tex
CREATE TABLE TAB$("OBJ#" NUMBER NOT NULL,"DATAOBJ#" NUMBER,"TS#" NUMBER NOT NULL,"FILE#" NUMBER NOT
CREATE TABLE CLU$("OBJ#" NUMBER NOT NULL,"DATAOBJ#" NUMBER,"TS#" NUMBER NOT NULL,"FILE#" NUMBER NOT
CREATE TABLE FET$("TS#" NUMBER NOT NULL,"FILE#" NUMBER NOT NULL,"BLOCK#" NUMBER NOT NULL,"LENGTH" NU
CREATE TABLE UET$("SEGFILE#" NUMBER NOT NULL,"SEGBLOCK#" NUMBER NOT NULL,"EXT#" NUMBER NOT NULL,"TS#"
CREATE TABLE SEG$("FILE#" NUMBER NOT NULL,"BLOCK#" NUMBER NOT NULL,"TYPE#" NUMBER NOT NULL,"TS#" NUM
CREATE TABLE UNDO$("US#" NUMBER NOT NULL,"NAME" VARCHAR2(30) NOT NULL,"USER#" NUMBER NOT NULL,"FILE#"
CREATE TABLE TS$("TS#" NUMBER NOT NULL,"NAME" VARCHAR2(30) NOT NULL,"OWNER#" NUMBER NOT NULL,"ONLINE
CREATE TABLE FILE$("FILE#" NUMBER NOT NULL,"STATUS$" NUMBER NOT NULL,"BLOCKS" NUMBER NOT NULL,"TS#"
CREATE TABLE OBJ$("OBJ#" NUMBER NOT NULL,"DATAOBJ#" NUMBER,"OWNER#" NUMBER NOT NULL,"NAME" VARCHAR2(
CREATE TABLE IND$("OBJ#" NUMBER NOT NULL,"DATAOBJ#" NUMBER,"TS#" NUMBER NOT NULL,"FILE#" NUMBER NOT
CREATE TABLE ICOL$("OBJ#" NUMBER NOT NULL,"BO#" NUMBER NOT NULL,"COL#" NUMBER NOT NULL,"POS#" NUMBER
CREATE TABLE COL$("OBJ#" NUMBER NOT NULL,"COL#" NUMBER NOT NULL,"SEGCOL#" NUMBER NOT NULL,"SEGCOLLEN
CREATE TABLE USERS$("USER#" NUMBER NOT NULL,"NAME" VARCHAR2(128) NOT NULL,"TYPE#" NUMBER NOT NULL,"PA
CREATE TABLE PROXY_DATA$("CLIENT#" NUMBER NOT NULL,"PROXY#" NUMBER NOT NULL,"CREDENTIAL_TYPE#" NUMBE
CREATE TABLE PROXY_ROLE_DATA$("CLIENT#" NUMBER NOT NULL,"PROXY#" NUMBER NOT NULL,"ROLE#" NUMBER NOT
CREATE TABLE CON$("OWNER#" NUMBER NOT NULL,"NAME" VARCHAR2(128) NOT NULL,"CON#" NUMBER NOT NULL,"SPA
CREATE TABLE CDEF$("CON#" NUMBER NOT NULL,"OBJ#" NUMBER NOT NULL,"COLS" NUMBER,"TYPE#" NUMBER NOT NU
CREATE TABLE CCOL$("CON#" NUMBER NOT NULL,"OBJ#" NUMBER NOT NULL,"COL#" NUMBER NOT NULL,"POS#" NUMBE
```





Bootstrap tables are a core part of the data dictionary

- `OBJECT_ID` below 56

```
SQL> select obj#, sql_text from bootstrap$ order by 1;
```

OBJ#

SQL_TEXT

```
0 CREATE ROLLBACK SEGMENT SYSTEM STORAGE ( INITIAL 112K NEXT 56K MINEXTENTS 1 MAX ...
2 CREATE CLUSTER C_OBJ#("OBJ#" NUMBER) PCTFREE 5 PCTUSED 40 INITRANS 2 MAXTRANS 25 ...
3 CREATE INDEX I_OBJ# ON CLUSTER C_OBJ# PCTFREE 10 INITRANS 2 MAXTRANS 255 STORAGE ...
4 CREATE TABLE TAB$("OBJ#" NUMBER NOT NULL,"DATAOBJ#" NUMBER,"TS#" NUMBER NOT NULL ...
5 CREATE TABLE CLU$("OBJ#" NUMBER NOT NULL,"DATAOBJ#" NUMBER,"TS#" NUMBER NOT NULL ...
6 CREATE CLUSTER C_TS#("TS#" NUMBER) PCTFREE 10 PCTUSED 40 INITRANS 2 MAXTRANS 255 ...
7 CREATE INDEX I_TS# ON CLUSTER C_TS# PCTFREE 10 INITRANS 2 MAXTRANS 255 STORAGE ( ...
8 CREATE CLUSTER C_FILE#_BLOCK#("TS#" NUMBER,"SEGFILE#" NUMBER,"SEGBLOCK#" NUMBER) ...
9 CREATE INDEX I_FILE#_BLOCK# ON CLUSTER C_FILE#_BLOCK# PCTFREE 10 INITRANS 2 MAXT ...
10 CREATE CLUSTER C_USER#("USER#" NUMBER) PCTFREE 10 PCTUSED 40 INITRANS 2 MAXTRANS ...
11 CREATE INDEX I_USER# ON CLUSTER C_USER# PCTFREE 10 INITRANS 2 MAXTRANS 255 STORA ...
12 CREATE TABLE FET$("TS#" NUMBER NOT NULL,"FILE#" NUMBER NOT NULL,"BLOCK#" NUMBER ...
13 CREATE TABLE UET$("SEGFILE#" NUMBER NOT NULL,"SEGBLOCK#" NUMBER NOT NULL,"EXT#" ...
14 CREATE TABLE SEG$("FILE#" NUMBER NOT NULL,"BLOCK#" NUMBER NOT NULL,"TYPE#" NUMBE ...
15 CREATE TABLE UNDO$("US#" NUMBER NOT NULL,"NAME" VARCHAR2(30) NOT NULL,"USER#" NU ...
16 CREATE TABLE TS$("TS#" NUMBER NOT NULL,"NAME" VARCHAR2(30) NOT NULL,"OWNER#" NUM ...
17 CREATE TABLE FILE$("FILE#" NUMBER NOT NULL,"STATUS$" NUMBER NOT NULL,"BLOCKS" NU ...
```

```
CREATE CLUSTER C_OBJ#("OBJ#" NUMBER)
PCTFREE 5 PCTUSED 40 INITRANS 2 MAXTRANS 255
STORAGE (
    INITIAL 136K NEXT 200K
    MINEXTENTS 1 MAXEXTENTS 2147483645
    PCTINCREASE 0
    OBJNO 2
    EXTENTS (FILE 1 BLOCK 144)
) SIZE 800
```



```
SQL> alter table registry$sqlpatch add(daniel number);
```

Table altered.

```
SQL> alter table registry$sqlpatch add(daniel number);
```

```
Table altered.
```

```
SQL> alter table tab$ add(daniel number);  
alter table tab$ add(daniel number)
```

```
*
```

```
ERROR at line 1:
```

```
ORA-00701: object necessary for warmstarting database cannot be altered
```

```
SQL> startup
```

```
ORA-01092: ORACLE instance terminated. Disconnection forced
```

```
ORA-00704: bootstrap process failure
```

```
ORA-39700: database must be opened with UPGRADE option
```

```
Process ID: 22211
```

```
Session ID: 1125 Serial number: 3
```



Diagnosing Upgrades

```
$ pwd
```

```
/u02/app/oracle/autoupgrade/runs/FIREBALL1/FIREBALL1/101
```

```
$ ll
```

```
total 23936
```

```
-rw-r----- 1 oracle oinstall 24279072 Aug 22 13:41 autoupgrade_20250822.log
-rw-r----- 1 oracle oinstall 110170 Aug 22 13:41 autoupgrade_20250822_user.log
-rw-r----- 1 oracle oinstall 20655 Aug 22 13:30 autoupgrade_err.log
drwxr-x--- 2 oracle oinstall 32768 Aug 22 13:04 dbupgrade
drwxr-x--- 2 oracle oinstall 4096 Aug 22 11:33 drain
drwxr-x--- 2 oracle oinstall 4096 Aug 22 13:04 postchecks
drwxr-x--- 2 oracle oinstall 12288 Aug 22 13:30 postfixups
drwxr-x--- 2 oracle oinstall 4096 Aug 22 13:31 postupgrade
drwxr-x--- 2 oracle oinstall 4096 Aug 22 11:29 prechecks
drwxr-x--- 2 oracle oinstall 12288 Aug 22 11:29 prefixups
drwxr-x--- 2 oracle oinstall 4096 Aug 22 11:20 preupgrade
drwxr-x--- 2 oracle oinstall 4096 Aug 22 13:41 sysupdates
drwxr-x--- 2 oracle oinstall 4096 Aug 22 13:04 upgstat
```

```
$ pwd
/u02/app/oracle/autoupgrade/runs/FIREBALL1/FIREBALL1/101/dbupgrade
```

```
$ grep -h "Grand Total" autoupgrade* | sort
```

```
Grand Total Time: 1456s
Grand Total Time: 1690s [PDB017]
Grand Total Time: 1691s [PDB007]
Grand Total Time: 1702s [PDB028]
Grand Total Time: 1703s [PDB019]
...
Grand Total Time: 2157s [PDB006]
Grand Total Time: 2161s [PDB008]
Grand Total Time: 2168s [PDB005]
Grand Total Time: 2180s [PDB003]
Grand Total Time: 2182s [PDB029]
```

```
$ grep -ih "Elapsed" catupgrd*pdb029*.log | sort
```

```
...
```

```
Elapsed: 00:01:06.01
```

```
Elapsed: 00:01:37.71
```

```
Elapsed: 00:01:47.52
```

```
Elapsed: 00:02:36.98
```

```
Elapsed: 00:09:59.70
```

```
$ grep -i "00:09:59.70" -B5 catupgrd*pdb0290.log
```

```
11:32:26 SQL>
```

```
11:32:26 SQL> EXECUTE xdk_drop_package;
```

```
PL/SQL procedure successfully completed.
```

```
Elapsed: 00:09:59.70
```

Bug 32004389 : XDK_DROP_PACKAGE CAN BE MORE EFFICIENT



Bug Attributes

Type	E - Enhancement	Fixed in Product Version	
Severity	2 - Very desirable feature	Product Version	12.1
Status	15 - Enhancement Req. Internal (Oracle) Review	Platform	226 - Linux x86-64
Created	Oct 12, 2020	Platform Version	RED HAT ENTERPRISE LINUX 4
Updated	Oct 12, 2020	Base Bug	N/A
Database Version	12.1	Affects Platforms	Generic
Product Source	Oracle	Knowledge, Patches, Service Requests and Bugs related to this bug	





You can't use AWR while upgrading

- Or, can you?

```
SQL> select status from v$instance;
```

```
STATUS
```

```
-----
```

```
OPEN MIGRATE
```

```
SQL> select status from v$instance;
```

```
STATUS
```

```
-----  
OPEN MIGRATE
```

```
SQL> exec dbms_workload_repository.create_snapshot();  
BEGIN dbms_workload_repository.create_snapshot(); END;
```

```
*
```

```
ERROR at line 1:
```

```
ORA-13516: AWR Operation failed: CATPROC not valid
```

```
ORA-06512: at "SYS.DBMS_WORKLOAD_REPOSITORY", line 99
```

```
ORA-06512: at "SYS.DBMS_WORKLOAD_REPOSITORY", line 145
```

```
ORA-06512: at line 1
```

```
Help: https://docs.oracle.com/error-help/db/ora-13516/
```



--After upgrading CDB\$ROOT and while PDBs are upgrading,
--you can use AWR in the root container

```
SQL> alter session set container=CDB$ROOT;
```

```
SQL> select status from v$instance;
```

```
STATUS
```

```
-----
```

```
OPEN
```

```
SQL> exec dbms_workload_repository.create_snapshot();
```

```
PL/SQL procedure successfully completed.
```



```
$ pwd
```

```
/u02/app/oracle/autoupgrade/runs/DB08221/DB08221/101/upgstat
```

```
$ ll
```

```
total 144
```

```
-rw-r----- 1 oracle oinstall 65575 Aug 24 08:20 fullpdb.txt  
-rw-r----- 1 oracle oinstall 49978 Aug 24 08:20 nonpdb_catproc.txt  
-rw-r----- 1 oracle oinstall 21428 Aug 24 08:20 nonpdb_upg.txt
```



AUStats Database Upgrade Report

Database Name : DB0822
Instance Name : DB08221
Upgrade from : 19.28.0.0.0 to 23.9.0.25.07
Snapshots : 42-62

Note: This report displays selective data from internal Oracle views for database upgrades via AutoUpgrade. For a full Oracle statistics report, use AWR (Automatic Workload Repository).

Begin Snap ID	End Snap ID	Elapsed Time	
-----	-----	-----	-----
42	62	66 mins	

Begin Snap ID	Begin Time	Description
-----	-----	-----
42	2025-Aug-24 07:13:28 +00:00	PDBS_START

End Snap ID	End Time	Description
-----	-----	-----
62	2025-Aug-24 08:19:41 +00:00	PDBS_END



#4 Top 20 Foreground Events

- Ordered by Total Wait Time, Waits

Event	Waits	Total Wait Time (sec)	Avg Wait (ms)	% DB Wait Time Class
Disk file operations I/O	20,968,536	7,622.0	0.36	11.0 User I/O
library cache lock	26,145	4,959.8	189.70	7.2 Concurr
latch: shared pool	518,161	2,127.7	4.11	3.1 Concurr
library cache: mutex X	180,079	436.2	2.42	.6 Concurr
cell list of blocks physical r	240,920	338.1	1.40	.5 User I/O
cell single block physical rea	65,887	319.3	4.85	.5 User I/O
latch free	1,457,213	287.4	0.20	.4 Other
cell multiblock physical read	132,588	279.5	2.11	.4 User I/O
library cache: bucket mutex X	37,309	191.3	5.13	.3 Concurr
Free private memory to OS	415,968	114.2	0.27	.2 Other
DBWR range invalidation sync	827	74.0	89.50	.1 Configur
online DDL delay	31	60.0	1935.54	.1 Other
row cache lock	15,504	58.2	3.75	.1 Concurr
Allocate CGA memory from OS	2,589,636	50.0	0.02	.1 Other
cursor: pin S wait on X	4,352	48.5	11.15	.1 Concurr
ASM IO for non-blocking poll	1,269,052	46.2	0.04	.1 User I/O



#4 Top 20 Foreground Events

- Ordered by Total Wait Time, Waits

Event	Waits	Total Wait Time (sec)	Avg Wait (ms)	% DB Wait Time	Class
Disk file operations I/O	20,968,536	7,622.0	0.36	11.0	User I/O
library cache lock	26,145	4,959.8	189.70	7.2	Concurre
latch: shared pool	518,161	2,127.7	4.11	3.1	Concurre
library cache: mutex X	180,079	436.2	2.42	.6	Concurre
cell list of blocks physical r	240,920	338.1	1.40	.5	User I/O
cell single block physical rea	65,887	319.3	4.85	.5	User I/O
latch free	1,457,213	287.4	0.20	.4	Other
cell multiblock physical read	132,588	279.5	2.11	.4	User I/O
library cache: bucket mutex X	37,309	191.3	5.13	.3	Concurre
Free private memory to OS	415,968	114.2	0.27	.2	Other
DBWR range invalidation sync	827	74.0	89.50	.1	Configur
online DDL delay	31	60.0	1935.54	.1	Other
row cache lock	15,504	58.2	3.75	.1	Concurre
Allocate CGA memory from OS	2,589,636	50.0	0.02	.1	Other
cursor: pin S wait on X	4,352	48.5	11.15	.1	Concurre
ASM IO for non-blocking poll	1,269,052	46.2	0.04	.1	User I/O



#5. Background Wait Events

Event	Waits	Total Wait Time (s)	Avg Wait Time (ms)
AQPC idle	773	3,987	5,158.37
log file parallel write	2,584,727	123	.05
Streams AQ: load balancer id	316	116	367.73
flashback log file write	118,767	115	.97
db file parallel write	209,083	68	.32
db file async I/O submit	361,607	67	.18
log file sequential read	14,937	28	1.85
latch: shared pool	2,132	21	9.73
oracle thread bootstrap	371	10	27.03
latch free	3,957	9	2.24
ASM file metadata operation	24,151	9	.36
ASM IO for non-blocking poll	189,219	7	.04
latch: MGA shared context la	28	7	265.10
LGWR wait for redo copy	259,860	5	.02
LGWR worker group ordering	8,105	4	.53
resmgr:internal state change	26	3	100.09
KSV master wait	7,368	2	.33
os thread creation	632	2	3.50

#8 Wait Event Histogram for Top 20 Foreground Events

Event	Foreground Waits	Total Waits	% of Waits			
			<1ms	1 to <32ms	32 to <1024ms	>= 1024ms
Disk file operations I/O	20,968,536	20981704	97.45	2.46	.09	.00
library cache lock	26,145	26211	4.65	61.25	31.08	3.02
latch: shared pool	518,161	520308	70.62	26.97	2.41	.00
library cache: mutex X	180,079	180242	80.36	19.51	.13	.00
cell list of blocks physical	240,920	241951	89.49	10.06	.45	.00
cell single block physical	65,887	65886	60.97	37.49	1.54	.00
latch free	1,457,213	1461626	97.60	2.40	.00	.00
cell multiblock physical r	132,588	133264	84.26	15.20	.54	.00
library cache: bucket mute	37,309	37345	54.06	45.66	.28	.00
Free private memory to OS	415,968	415995	98.17	1.82	.01	.00
DBWR range invalidation sy	827	829	1.45	49.46	49.10	.00
online DDL delay	31	31	3.23	.00	.00	96.77
row cache lock	15,504	15539	42.29	57.30	.40	.01
Allocate CGA memory from 0	2,589,636	2611823	100.00	.00	.00	.00
cursor: pin S wait on X	4,352	4553	8.41	87.44	4.13	.02
ASM IO for non-blocking po	1,269,052	1458394	99.90	.10	.00	.00

```
SQL> select table_name from dba_tables where table_name like 'UPD$%' and owner='SYS';
```

```
TABLE_NAME
```

```
-----  
UPD$_TOP_FG_EVENTS  
UPD$_EVENT_HISTOGRAM  
UPD$_OSSTAT  
UPD$_PARAMETER  
UPD$_SESSION_EVENT  
UPD$_SESSTAT  
UPD$_SESS_TIME_MODEL  
UPD$_SNAPSHOT  
UPD$_SYSSTAT  
UPD$_SYSTEM_EVENT  
UPD$_SYS_TIME_MODEL  
UPD$_THREAD
```

```
12 rows selected.
```





An upgrade is always resumable and restartable

- All scripts are idempotent, including `catalog.sql` and `catproc.sql`

```
INSERT INTO sys.registry$supg_resume(version,phaseno,errorcnt,starttime,endtime)
VALUES ('23.0.0.0.0', 57,-1, sysdate, sysdate);
```

...

```
UPDATE sys.registry$supg_resume SET endtime=sysdate WHERE phaseno=57;
```

```
$ java -jar autoupgrade.jar ... -mode deploy
```

```
Previous execution found loading latest data
```

```
Total jobs recovered: 1
```

```
+-----+  
| Starting AutoUpgrade execution |  
+-----+
```

```
Type 'help' to list console commands
```

```
upg>
```

```
upg> resume -job 100 -catctl_options=-p 0
```

Replay Upgrade

--The database automatically starts an upgrade
--when you plug in a lower-release PDB

```
SQL> alter pluggable database pdb1 open;
```

Pluggable database altered.

Elapsed: 00:14:01.95

```
SQL> select property_name, property_value
       from database_properties
       where property_name like '%OPEN%';
```

PROPERTY_NAME	PROPERTY_VALUE
-----	-----
CONVERT_NONCDB_ON_OPEN	true
UPGRADE_PDB_ON_OPEN	true



Classic Upgrade

Phase 1

Phase 2

Phase 3

Phase 4

Phase 5

Phase 6

Phase 7

Phase 8

...

Phase *nnn*

Classic Upgrade

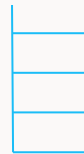
Phase 1

Phase 2

Phase 3

Phase 4

Phase 5



- @a2300932.sql
- @a2300933.sql
- @a23009xx.sql

@c2300000.sql

Phase 6

Phase 7

Phase 8

...

Phase *nnn*

Classic Upgrade

@a2300932.sql

```
VARIABLE initfile VARCHAR2(32)
COLUMN :initfile NEW_VALUE init_file NOPRINT;

Rem =====
Rem SQLJTYPE
Rem =====

BEGIN
  IF sys.dbms_registry.is_loaded('JAVAVM',sys.dbms_registry.release_version) = 1 THEN
    :initfile := 'initsjty.sql';
  ELSE
    :initfile := 'nothing.sql';
  END IF;
END;
/
SELECT :initfile FROM DUAL;
@@&init_file
```

Classic Upgrade

@@&init_file

```
.  
. [more PL/SQL code]  
. .  
CREATE TABLE SYS.T1 ...  
CREATE INDEX SYS.T1I1 ...  
. .  
[more PL/SQL code]  
. .
```

Comparison

Classic

Phase 1

Phase 2

Phase 3

Phase 4

Phase 5

Phase 6

Phase 7

Phase 8

...

Phase *nnn*

Replay

```
DROP INDEX SYSTEM.IDX$FLOW ...
```

```
CREATE OR REPLACE ...
```

```
ALTER TYPE ...
```

```
CREATE FUNCTION ...
```

```
CREATE TABLE SYS.T1 ...
```

```
CREATE INDEX SYS.T1I1 ...
```

```
DROP INDEX MDSYS.IDX$IK ...
```

```
DROP TABLE MDSYS.TBL$TT ...
```

```
CREATE OR REPLACE ...
```

```
ALTER TYPE ...
```

```
GRANT SELECT ON ...
```

```
CREATE VIEW ...
```

```
select sqlstmt from pdb_sync$;
```

```
ALTER SESSION SET "_oracle_script_counter"=7
alter pluggable database application app$cdb$pdonly$ncdbtopdb begin install '1.0.upgmode'
alter session set "_enable_view_pdb"=false
alter session set NLS_LENGTH_SEMANTICS=BYTE
INSERT INTO sys.utl_recomp_skip_list select obj# from obj$ where BITAND(flags, 4194304)=0 ...
create or replace view sys.cdb$common_root_objects sharing=object as
select u.name owner, o.name object_name, o.type# object_type, o.namespace nsp,
       o.subname object_subname, o.signature object_sig,
       decode(bitand(o.flags, (65536+131072+4294967296)),
              4294967296+65536, 'EDL', 131072, 'DL', 'MDL') sharing
       from sys.obj$ o, sys.user$ u
where o.owner#=u.user# and bitand(o.flags, (65536+131072+4294967296)) <> 0
       and bitand(o.flags,0)=0
```

(output truncated)

Classic

- Triggered by AutoUpgrade
- Runs `catalog.sql / catproc.sql`
- Many **CREATE OR REPLACE** statements for objects that didn't change
- Customizable
- Used by AutoUpgrade

Replay

- Triggered by **OPEN** command
- Runs the captured statements
- Only statements that actually do some change
- Automated

Classic

Stages

SETUP	<1 min
PREUPGRADE	<1 min
PRECHECKS	<1 min
PREFIXUPS	<1 min
DRAIN	<1 min
DBUPGRADE	19 min
DISPATCH	<1 min
UNPLUGWORK	<1 min
POSTCHECKS	<1 min
POSTFIXUPS	10 min
POSTUPGRADE	<1 min
SYSUPDATES	<1 min

Replay

Stages

SETUP	<1 min
PREUPGRADE	<1 min
PRECHECKS	<1 min
PREFIXUPS	<1 min
DRAIN	<1 min
DBUPGRADE	17 min
DISPATCH	<1 min
UNPLUGWORK	<1 min
POSTCHECKS	<1 min
POSTFIXUPS	10 min
POSTUPGRADE	<1 min
SYSUPDATES	<1 min



Replay upgrade doesn't handle pre- and post-upgrade tasks

- You must run these manually
- Or use *Replay Upgrade* through AutoUpgrade

```
SQL> alter pluggable database pdb1 open;  
alter pluggable database pdb1 open  
*
```

ERROR at line 1:

ORA-60510: encountered an error during Replay Upgrade

If Replay Upgrade fails

- Check for errors:
 - `SELECT * FROM dba_replay_upgrade_errors`
 - `SELECT * FROM dba_app_errors`
 - `SELECT * FROM dba_applications WHERE app_name='APPCDBCATALOG';`
 - Check alert log
 - Trace files
- Revert to classic upgrade
 - Use AutoUpgrade (`upg1.replay=no`)

```
--To disable replay upgrade  
ALTER DATABASE UPGRADE SYNC OFF;
```

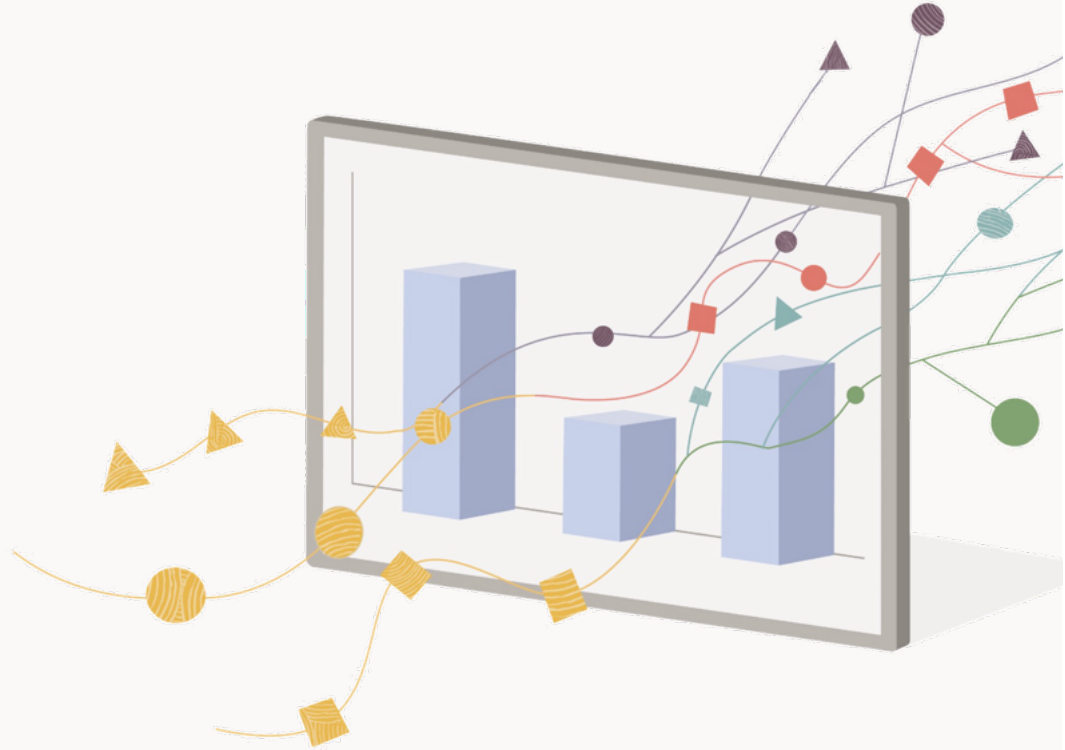
```
--Or  
ALTER DATABASE PROPERTY SET UPGRADE_PDB_ON_OPEN='false';
```

```
--To disable convert on open  
ALTER DATABASE PROPERTY SET CONVERT_NONCDB_ON_OPEN='false';
```



Distributed Upgrades

41%
faster



If you are upgrading a cluster database ...

**... you must manually separate
the database instance from the cluster.
Set the `CLUSTER_DATABASE`
initialization parameter to `FALSE`.**

Regular RAC Database Upgrade



- `CLUSTER_DATABASE = FALSE`
- Upgrade root and all PDBs
- One instance active
- All other nodes are **idle**

Distributed Upgrade



- `CLUSTER_DATABASE = FALSE`
- Upgrade root only
- `CLUSTER_DATABASE = TRUE`
- Upgrade all PDBs
- All instances **active**

Distributed Upgrade

NODE 1

CDB\$ROOT

PDB1

PDB3

PDB5

PDB7

PDB9

PDB2

PDB4

PDB6

PDB8

PDB10

CLUSTER_DATABASE=FALSE

NODE 2

NODE 3

Distributed Upgrade



```
cat RACDB.cfg
```

```
global.autoupg_log_dir=/u01/app/oracle/autoupgrade
```

```
upg1.source_home=/u01/app/oracle/product/19
```

```
upg1.target_home=/u01/app/oracle/product/23
```

```
upg1.sid=RACDB
```

```
upg1.tune_setting=distributed_upgrade=true
```

```
java -jar autoupgrade.jar -config RACDB.cfg -mode deploy
```

```
cat RACDB.cffg
```

```
global.autoupg_log_dir=/u01/app/oracle/autoupgrade  
upg1.source_home=/u01/app/oracle/product/19  
upg1.target_home=/u01/app/oracle/product/23  
upg1.sid=RACDB  
upg1.tune_setting=distributed_upgrade=true
```

```
java -jar autoupgrade.jar -config RACDB.cfg -mode deploy
```

```
batch1.source_home=/u01/app/oracle/product/19  
batch1.target_home=/u01/app/oracle/product/23  
batch1.sid=RACDB1  
batch1.upgrade_node=NODE1  
batch1.pdbs=PDB1,PDB2,PDB3,PDB4  
batch2.source_home=/u01/app/oracle/product/19  
batch2.target_home=/u01/app/oracle/product/23  
batch2.sid=RACDB2  
batch2.upgrade_node=NODE2  
batch2.pdbs=PDB5,PDB6,PDB7  
batch3.source_home=/u01/app/oracle/product/19  
batch3.target_home=/u01/app/oracle/product/23  
batch3.sid=RACDB3  
batch3.upgrade_node=NODE3  
batch3.pdbs=PDB8,PDB9,PDB10
```

```
cat RACDB.cffg
```

```
global.autoupg_log_dir=/u01/app/oracle/autoupgrade  
upg1.source_home=/u01/app/oracle/product/19  
upg1.target_home=/u01/app/oracle/product/23  
upg1.sid=RACDB  
upg1.tune_setting=distributed_upgrade=true
```

```
java -jar autoupgrade.jar -config RACDB.cfg -mode deploy
```

```
batch1.source_home=/u01/app/oracle/product/19  
batch1.target_home=/u01/app/oracle/product/23
```

```
batch1.sid=RACDB1
```

```
batch1.upgrade_node=NODE1
```

```
batch1.pdbs=PDB1,PDB2,PDB3,PDB4
```

```
batch2.source_home=/u01/app/oracle/product/19
```

```
batch2.target_home=/u01/app/oracle/product/23
```

```
batch2.sid=RACDB2
```

```
batch2.upgrade_node=NODE2
```

```
batch2.pdbs=PDB5,PDB6,PDB7
```

```
batch3.source_home=/u01/app/oracle/product/19
```

```
batch3.target_home=/u01/app/oracle/product/23
```

```
batch3.sid=RACDB3
```

```
batch3.upgrade_node=NODE3
```

```
batch3.pdbs=PDB8,PDB9,PDB10
```

```
cat RACDB.cffg
```

```
global.autoupg_log_dir=/u01/app/oracle/autoupgrade  
upg1.source_home=/u01/app/oracle/product/19  
upg1.target_home=/u01/app/oracle/product/23  
upg1.sid=RACDB  
upg1.tune_setting=distributed_upgrade=true
```

```
java -jar autoupgrade.jar -config RACDB.cfg -mode deploy
```

```
batch1.source_home=/u01/app/oracle/product/19  
batch1.target_home=/u01/app/oracle/product/23  
batch1.sid=RACDB1
```

```
batch1.upgrade_node=NODE1
```

```
batch1.pdbs=PDB1,PDB2,PDB3,PDB4
```

```
batch2.source_home=/u01/app/oracle/product/19  
batch2.target_home=/u01/app/oracle/product/23  
batch2.sid=RACDB2
```

```
batch2.upgrade_node=NODE2
```

```
batch2.pdbs=PDB5,PDB6,PDB7
```

```
batch3.source_home=/u01/app/oracle/product/19  
batch3.target_home=/u01/app/oracle/product/23  
batch3.sid=RACDB3
```

```
batch3.upgrade_node=NODE3
```

```
batch3.pdbs=PDB8,PDB9,PDB10
```

```
java -jar autoupgrade.jar -config RACDB.cfg -mode deploy
```



```
Node 1      java -jar autoupgrade.jar -config mod.conf -mode upgrade -follower
```

```
Node 2      java -jar autoupgrade.jar -config mod.conf -mode upgrade -follower
```

```
Node 3      java -jar autoupgrade.jar -config mod.conf -mode upgrade -follower
```

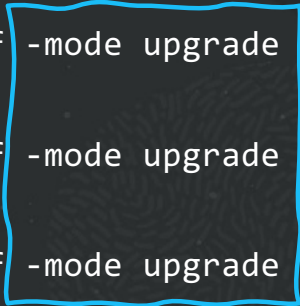
```
java -jar autoupgrade.jar -config RACDB.cfg -mode deploy
```



```
Node 1      java -jar autoupgrade.jar -config mod.conf -mode upgrade -follower
```

```
Node 2      java -jar autoupgrade.jar -config mod.conf -mode upgrade -follower
```

```
Node 3      java -jar autoupgrade.jar -config mod.conf -mode upgrade -follower
```



```
java -jar autoupgrade.jar -config RACDB.cfg -mode deploy
```



```
Node 1      java -jar autoupgrade.jar -config mod.conf -mode upgrade -follower
```

```
Node 2      java -jar autoupgrade.jar -config mod.conf -mode upgrade -follower
```

```
Node 3      java -jar autoupgrade.jar -config mod.conf -mode upgrade -follower
```

```
upg> status -job 101
```

```
+-----+-----+-----+-----+
|Database|  Stage|Progress|      Node|
+-----+-----+-----+-----+
|PDB$SEED|DBUPGRADE|  10 %| dragon-dbvui1|
|  PDB001|DBUPGRADE|   6 %| dragon-dbvui2|
|  PDB002|DBUPGRADE|  10 %| dragon-dbvui1|
|  PDB003|DBUPGRADE|   6 %| dragon-dbvui2|
  
(output truncated)
  
|  PDB027|DBUPGRADE|   6 %| dragon-dbvui2|
|  PDB028|DBUPGRADE|  10 %| dragon-dbvui1|
|  PDB029|DBUPGRADE|   6 %| dragon-dbvui2|
|  PDB030|DBUPGRADE|  10 %| dragon-dbvui1|
+-----+-----+-----+-----+
```

```
# Control the number of nodes used, default 2
```

```
upg1.tune_setting=distributed_upgrade=true,active_nodes_limit=n
```

Downgrade



A downgraded data dictionary
is *different*, but **compatible**

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

```
SQL> select count(*) from dba_tables where owner='SYS';
```

```
COUNT_BEFORE
```

```
-----
```

```
1549
```

```
COUNT_AFTER
```

```
-----
```

```
1805
```

Downgrade

1

Actions in 26ai Oracle home

- Apply latest Release Update
- Open in downgrade mode
- Execute `catdwgrd.sql`
 - Rolls back one-off patches
 - Prepares for old release

2

Actions in 19c Oracle home

- Apply latest Release Update
- Open in upgrade mode
- Execute `catrelod.sql`
 - Invalidates all PL/SQL
 - Executes catalog/catproc
 - Reloads all components
 - Gather stats on bootstrap tables
- Open in normal mode
- Recompile all PL/SQL
- Gather dictionary/fixed objects stats

```
$ grep -i "truncate *table" catdwgrd0.log
```

```
...  
11:56:38 SQL> truncate table wri$_optstat_tab_model;  
11:56:38    3          execute immediate 'truncate table hcs_av_fact_column$';  
11:56:38 SQL> Rem truncate table to store service conflicts stats persistently  
11:56:38 SQL> truncate table svcobj_conflict$;  
11:56:38 SQL> truncate table data_guard_site$;  
11:56:38 SQL> truncate table dgpdb_site$;  
11:56:39    4          execute immediate 'truncate table hcs_tbl$';  
11:56:39 SQL> truncate table rsrc_cnt_history$;
```



```
$ grep -i "truncate *table" catdwgrd0.log
...
11:56:38 SQL> truncate table wri$_optstat_tab_model;
11:56:38      3          execute immediate 'truncate table hcs_av_fact_column$';
11:56:38 SQL> Rem truncate table to store service conflicts stats persistently
11:56:38 SQL> truncate table svcobj_conflict$;
11:56:38 SQL> truncate table data_guard_site$;
11:56:38 SQL> truncate table dgpdb_site$;
11:56:39      4          execute immediate 'truncate table hcs_tbl1$';
11:56:39 SQL> truncate table rsrc_cnt_history$;
```

```
$ grep -i "truncate *table" catdwgrd0.log | wc -l
```

311



```
SQL> desc pdb_sync$
```

Name	Null?	Type
SCNWRP	NOT NULL	NUMBER
SCNBAS	NOT NULL	NUMBER
CTIME	NOT NULL	DATE
SQLSTMT		VARCHAR2(4000)
NAME	NOT NULL	VARCHAR2(128)
AUXNAME1		VARCHAR2(128)
AUXNAME2		VARCHAR2(128)
OPCODE	NOT NULL	NUMBER
FLAGS		NUMBER
LONGSQLTXT		CLOB
REPLAY#	NOT NULL	NUMBER
CREATION#		NUMBER
SPARE3		VARCHAR2(128)
SPARE4		VARCHAR2(128)
SPARE5		VARCHAR2(4000)
SPARE6		NUMBER
SPARE7		NUMBER
SPARE8		NUMBER
SQLID		VARCHAR2(13)
APPID#		NUMBER
VER#		NUMBER
PATCH#		NUMBER
APP_STATUS		NUMBER
SESSSERIAL#		NUMBER

```
SQL> desc pdb_sync$
```

Name	Null?	Type
SCNWRP	NOT NULL	NUMBER
SCNBAS	NOT NULL	NUMBER
CTIME	NOT NULL	DATE
SQLSTMT		VARCHAR2(4000)
NAME	NOT NULL	VARCHAR2(128)
AUXNAME1		VARCHAR2(128)
AUXNAME2		VARCHAR2(128)
OPCODE	NOT NULL	NUMBER
FLAGS		NUMBER
LONGSQLTXT		CLOB
REPLAY#	NOT NULL	NUMBER
CREATION#		NUMBER
SPARE3		VARCHAR2(128)
SPARE4		VARCHAR2(128)
SPARE5		VARCHAR2(4000)
SPARE6		NUMBER
SPARE7		NUMBER
SPARE8		NUMBER
SQLID		VARCHAR2(13)
APPID#		NUMBER
VER#		NUMBER
PATCH#		NUMBER
APP_STATUS		NUMBER
SESSSERIAL#		NUMBER
OWNER		VARCHAR2(128)
OBJNAME		VARCHAR2(128)
EDNAME		VARCHAR2(128)
NAMESPACE		NUMBER
SIGNATURE		RAW(16 BYTE)
MODULE		VARCHAR2(64)
ACTION		VARCHAR2(64)

```
SQL> desc REGISTRY$LOG
```

Name	Null?	Type
CID		VARCHAR2(30)
NAMESPACE		VARCHAR2(30)
OPERATION	NOT NULL	NUMBER
OPTIME		TIMESTAMP(6)
ERRMSG		VARCHAR2(1000)

```
SQL> desc REGISTRY$LOG
```

Name	Null?	Type
CID		VARCHAR2(30)
NAMESPACE		VARCHAR2(30)
OPERATION	NOT NULL	NUMBER
OPTIME		TIMESTAMP(6) WITH TIME ZONE
ERRMSG		VARCHAR2(1000)



Downgrade, Guidelines


- Generally, dropping is avoided
- Some types of statistics are marked STALE
- Complete rebuild of certain components, such as Data Pump



Don't change **COMPATIBLE** if you want the option of downgrading



All initialization parameters

 Update the initialization parameters only when it is required. Refer to the Oracle documentation to learn more about each initialization parameter and its valid set of values.

(Storage related parameter(s) value is shown in MB) Show advanced parameters

Name	Value	Include in spfile	Category
undo_tablespace	UNDOTBS1	<input checked="" type="checkbox"/>	Cluster Database
sga_target	19202	<input checked="" type="checkbox"/>	SGA Memory
db_block_size (bytes)	8192	<input checked="" type="checkbox"/>	Cache and I/O
nls_language	AMERICAN	<input checked="" type="checkbox"/>	NLS
control_files	(* {ORACLE_BASE}/oradata/...	<input checked="" type="checkbox"/>	File Configuration
remote_login_passwordfile	EXCLUSIVE	<input checked="" type="checkbox"/>	Security and Auditing
processes	640	<input checked="" type="checkbox"/>	Processes and Sessions
pga_aggregate_target	6401	<input checked="" type="checkbox"/>	Sort, Hash Joins, Bitmap Indexes
nls_territory	AMERICA	<input checked="" type="checkbox"/>	NLS
open_cursors	300	<input checked="" type="checkbox"/>	Cursors and Library Cache
db_domain	livelabs.oraclevcn.com	<input checked="" type="checkbox"/>	Database Identification
compatible	23.6.0	<input checked="" type="checkbox"/>	Miscellaneous
db_name	orcl	<input checked="" type="checkbox"/>	Database Identification
cluster_database	FALSE	<input type="checkbox"/>	Cluster Database

Description:

compatible: Allows you to use a new release, while at the same time guaranteeing backward compatibility with an earlier release.
Range of Values: Default to current release. Default Value: Release dependent





You can downgrade days, months, or even years after upgrading

- No data loss

Final Pointers



Use ORAdiff to learn about data dictionary differences

- oradiff.oracle.com



How can I make my upgrades faster?

Things that

Matter a lot

- Number of components
- Dictionary size
- Dictionary complexity
- Some feature/version combinations

Things that

Matter a lot

- Number of components
- Dictionary size
- Dictionary complexity
- Some feature/version combinations

Matter a little

- CPU speed
- I/O capabilities
- Memory
- SGA/PGA

Things that

Matter a lot

- Number of components
- Dictionary size
- Dictionary complexity
- Some feature/version combinations

Matter a little

- CPU speed
- I/O capabilities
- Memory
- SGA/PGA

Don't matter

(usually)

- Physical size
- Amount of user data



Unplug-plug upgrades are faster than upgrading an entire CDB

- Consider your rollback options
- Use refreshable clone PDBs

Key Learnings



- 1 Use AutoUpgrade
- 2 Scale by upgrading more PDBs in parallel
- 3 Use Distributed Upgrade

BREAK

We start again at 11:15

Next-Level Patching



How often do you apply patches?

<https://www.oracle.com/security-alerts>

Critical Patch Updates

Critical Patch Updates provide security patches for supported Oracle on-premises products. A Critical Patch Update is a collection of patches for multiple security vulnerabilities. These patches address vulnerabilities in Oracle code and in third party components included in Oracle products. These patches are usually cumulative. They are available to customers with valid support contracts. Critical Patch Updates are released on the third Tuesday of January, April, July, and October. The next four dates are:

- 21 July 2026
- 20 October 2026
- 19 January 2027
- 20 April 2027

A pre-release announcement will be published on the Thursday preceding each Critical Patch Update release.

The Critical Patch Updates released since 2021 are listed in the following table. Critical Patch Updates released before 2021 are available [here](#).

Critical Patch Update	Latest Version/Date
Critical Patch Update - April 2026	Rev 2, 24 April 2026
Critical Patch Update - January 2026	Rev 3, 02 February 2026
Critical Patch Update - October 2025	Rev 1, 21 October 2025
Critical Patch Update - July 2025	Rev 4, 28 July 2025

Critical Patch Updates

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- 20 April 2027

A pre-release announcement will be published on the Thursday preceding each Critical Patch Update release.

The Critical Patch Updates released since 2021 are listed in the following table. Critical Patch Updates released before 2021 are available [here](#).

Critical Patch Update	Latest Version/Date
Critical Patch Update - April 2026	Rev 2, 24 April 2026
Critical Patch Update - January 2026	Rev 3, 02 February 2026
Critical Patch Update - October 2025	Rev 1, 21 October 2025
Critical Patch Update - July 2025	Rev 4, 28 July 2025

Oracle Critical Patch Update Advisory - April 2026

Description

A Critical Patch Update is a collection of patches for multiple security vulnerabilities. These patches address vulnerabilities in Oracle code and in third party components included in Oracle products. These patches are usually cumulative, but each advisory describes only the security patches added since the previous Critical Patch Update Advisory. Thus, prior Critical Patch Update advisories should be reviewed for information regarding earlier published security patches. Refer to [“Critical Patch Updates, Security Alerts and Bulletins”](#) for information about Oracle Security advisories.

Oracle continues to periodically receive reports of attempts to maliciously exploit vulnerabilities for which Oracle has already released security patches. In some instances, it has been reported that attackers have been successful because targeted customers had failed to apply available Oracle patches. Oracle therefore strongly recommends that customers remain on actively-supported versions and apply Critical Patch Update security patches without delay.

This Critical Patch Update contains 481 new security patches across the product families listed below. Please note that an MOS note summarizing the content of this Critical Patch Update and other Oracle Software Security Assurance activities is located at [April 2026 Critical Patch Update: Executive Summary and Analysis](#).

Please note that since the release of the January 2026 Critical Patch Update, Oracle has released a Security Alert for Oracle Identity Manager and Oracle Web Services Manager, [CVE-2026-21992 \(March 20, 2026\)](#). Customers are strongly advised to apply the April 2026 Critical Patch Update for Fusion Middleware products, which includes patches for this Alert as well as additional patches.

Oracle Communications Operations Monitor, versions 5.2, 6.0, 6.1	Oracle Communications Operations Monitor
Oracle Communications Order and Service Management, versions 7.5.0, 8.0.0	Oracle Communications Order and Service Management
Oracle Communications Performance Intelligence Center, versions 10.5.0.0-10.5.0.2	Oracle Communications Performance Intelligence Center
Oracle Communications Policy Management, versions 15.0.0.0.0, 15.0.0.1.0	Oracle Communications Policy Management
Oracle Communications Service Catalog and Design, versions 8.0.0.6.0, 8.1.0.5.0, 8.2.0.2.0	Oracle Communications Service Catalog and Design
Oracle Communications Session Border Controller, versions 9.3.0, 10.0.0, 10.1.0	Oracle Communications Session Border Controller
Oracle Communications Session Report Manager, versions 9.0.0-9.0.4	Oracle Communications Session Report Manager
Oracle Communications Unified Assurance, versions 6.1.1-7.0.0	Oracle Communications Unified Assurance
Oracle Communications Unified Inventory Management, versions 7.5.0-7.5.1, 7.6.0-7.8.0, 8.0.0	Oracle Communications Unified Inventory Management
Oracle Configuration Manager, versions 13.5, 24.1	Oracle Enterprise Manager
Oracle Data Integrator, versions 12.2.1.4.0, 14.1.2.0.0	Fusion Middleware
Oracle Database Server, versions 12.1.0.2.0, 12.2.0.1.0, 19.3-19.30, 21.3-21.21, 23.4.0-23.26.1	Database
Oracle Documaker, versions 12.7.2-13.0.2	Contact Support
Oracle E-Business Suite, versions 12.2.3-12.2.15, 15.0	Oracle E-Business Suite
Oracle Enterprise Communications Broker, versions 4.2.0, 5.0.0	Oracle Enterprise Communications Broker
Oracle Enterprise Manager Base Platform, versions 13.5, 24.1	Oracle Enterprise Manager
Oracle Enterprise Manager for Fusion Middleware, versions 13.5, 24.1	Oracle Enterprise Manager

Oracle Critical Patch Update Advisory - April 2026

CVE ID	Component	Package and/or Privilege Required	Protocol	Remote Exploit without Auth.?	CVSS VERSION 3.1 RISK (see Risk Matrix Definitions)									Supported Versions Affected	Notes
					Base Score	Attack Vector	Attack Complex	Privs Req'd	User Interact	Scope	Confidentiality	Integrity	Availability		
CVE-2026-33870	Clusterware (Micronaut)	None	HTTP	Yes	7.5	Network	Low	None	None	Un-changed	None	High	None	19.3-19.30, 23.4.0-23.26.1	
CVE-2026-35229	Java VM	Create Session	Oracle Net	Yes	7.5	Network	Low	None	None	Un-changed	High	None	None	19.3-19.30, 21.3-21.21	
CVE-2026-31790	RDBMS (OpenSSL)	None	Multiple	No	7.2	Network	Low	High	None	Un-changed	High	High	High	19.3-19.30, 23.4.0-23.26.1	
CVE-2026-26007	RDBMS (Python)	Create Session	Multiple	Yes	6.5	Network	Low	None	Required	Un-changed	High	None	None	21.3-21.21, 23.4.0-23.26.1	
CVE-2026-21999	XML Database	HTTP Listener	HTTPS	Yes	5.3	Network	High	None	Required	Un-changed	High	None	None	23.4.0-23.26.1	
CVE-2025-31948	Data Mining (Intel oneAPI Toolkit OpenMP)	Authenticated User	None	No	3.3	Local	Low	Low	None	Un-changed	None	None	Low	19.3-19.30, 21.3-21.21, 23.4.0-23.26.1	
CVE-2025-48924	RDBMS (Apache Commons Lang)	DBMS Developer	Multiple	No	3.3	Local	Low	None	Required	Un-changed	None	None	Low	23.4.0-23.26.1	
CVE-2026-34312	RDBMS	Row Access Method	Multiple	No	2.4	Network	Low	High	Required	Un-changed	Low	None	None	19.3-19.30	



Oracle Critical Patch Update Advisory - April 2026

CVE ID	Component	Package and/or Privilege Required	Protocol	Remote Exploit without Auth.?	Base Score	CVSS VERSION 3.1 RISK (see Risk Matrix Definitions)								Supported Versions Affected	Notes
						Attack Vector	Attack Complex	Privs Req'd	User Interact	Scope	Confidentiality	Integrity	Availability		
CVE-2026-33870	Clusterware (Micronaut)	None	HTTP	Yes	7.5	Network	Low	None	None	Un-changed	None	High	None	19.3-19.30, 23.4.0-23.26.1	
CVE-2026-35229	Java VM	Create Session	Oracle Net	Yes	7.5	Network	Low	None	None	Un-changed	High	None	None	19.3-19.30, 21.3-21.21	
CVE-2026-31790	RDBMS (OpenSSL)	None	Multiple	No	7.2	Network	Low	High	None	Un-changed	High	High	High	19.3-19.30, 23.4.0-23.26.1	
CVE-2026-26007	RDBMS (Python)	Create Session	Multiple	Yes	6.5	Network	Low	None	Required	Un-changed	High	None	None	21.3-21.21, 23.4.0-23.26.1	
CVE-2026-21999	XML Database	HTTP Listener	HTTPS	Yes	5.3	Network	High	None	Required	Un-changed	High	None	None	23.4.0-23.26.1	
CVE-2025-31948	Data Mining (Intel oneAPI Toolkit OpenMP)	Authenticated User	None	No	3.3	Local	Low	Low	None	Un-changed	None	None	Low	19.3-19.30, 21.3-21.21, 23.4.0-23.26.1	
CVE-2025-48924	RDBMS (Apache Commons Lang)	DBMS Developer	Multiple	No	3.3	Local	Low	None	Required	Un-changed	None	None	Low	23.4.0-23.26.1	
CVE-2026-34312	RDBMS	Row Access Method	Multiple	No	2.4	Network	Low	High	Required	Un-changed	Low	None	None	19.3-19.30	



Oracle Critical Patch Update Advisory - April 2026

CVE ID	Component	Package and/or Privilege Required	Protocol	Remote Exploit without Auth.?	CVSS VERSION 3.1 RISK (see Risk Matrix Definitions)									Supported Versions Affected	Notes
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CVE-2026-33870	Clusterware (Micronaut)	None	HTTP	Yes	7.5	Network	Low	None	None	Un-changed	None	High	None	19.3-19.30, 23.4.0-23.26.1	
CVE-2026-35229	Java VM	Create Session	Oracle Net	Yes	7.5	Network	Low	None	None	Un-changed	High	None	None	19.3-19.30, 21.3-21.21	
CVE-2026-31790	RDBMS (OpenSSL)	None	Multiple	No	7.2	Network	Low	High	None	Un-changed	High	High	High	19.3-19.30, 23.4.0-23.26.1	
CVE-2026-26007	RDBMS (Python)	Create Session	Multiple	Yes	6.5	Network	Low	None	Required	Un-changed	High	None	None	21.3-21.21, 23.4.0-23.26.1	
CVE-2026-21999	XML Database	HTTP Listener	HTTPS	Yes	5.3	Network	High	None	Required	Un-changed	High	None	None	23.4.0-23.26.1	
CVE-2025-31948	Data Mining (Intel oneAPI Toolkit OpenMP)	Authenticated User	None	No	3.3	Local	Low	Low	None	Un-changed	None	None	Low	19.3-19.30, 21.3-21.21, 23.4.0-23.26.1	
CVE-2025-48924	RDBMS (Apache Commons Lang)	DBMS Developer	Multiple	No	3.3	Local	Low	None	Required	Un-changed	None	None	Low	23.4.0-23.26.1	
CVE-2026-34312	RDBMS	Row Access Method	Multiple	No	2.4	Network	Low	High	Required	Un-changed	Low	None	None	19.3-19.30	





Be sure to [subscribe](#) to email notifications

- Critical Patch Updates and Security Alerts

Patching News

Security Updates

Accelerating Vulnerability Detection and Response at Oracle

April 29, 2026 | 3 minute read



Integrated Cyber Center (ICC)

The latest generation of AI is transforming how software vulnerabilities are identified and fixed, increasing the speed and scale of discovery and remediation.

At Oracle, we have long applied AI across our cloud and software environments to support security testing, vulnerability detection, and code analysis. These capabilities run on Oracle Cloud Infrastructure (OCI), leveraging OCI AI services, infrastructure, and development platforms to operate continuously at scale.

Oracle has access to leading frontier AI models, including Anthropic's Claude Mythos Preview and OpenAI's most capable models through Trusted Access for Cyber, and we are extending our capabilities with these models to improve how quickly and effectively vulnerabilities are identified. Combined with our AI-enabled security operations, these capabilities are applied across Oracle-developed software and services, Oracle Health, and the open-source components we build and use in our products.

The result is stronger code, earlier identification of risk and mitigations, and better protection for Oracle and our





The security practices of yesterday
are not sufficient today anymore



You must upgrade to Oracle Database 19c
or Oracle AI Database 26ai



You must patch your database
with the most recent Release Update

Older Release Updates?

File Download

Click each file name to download the selected files.

Tip: Use a Download Manager [Learn More...](#)

DATABASE RELEASE UPDATE 19.28.0.0.0(Patch:Linux x86)

[p37960098_190000_LINUX.zip](#) (299.3 MB)

Why a Password?

Password

Total Size 299.3 MB

[Download File Metadata](#) [View Digest Details](#) [Download wget Script](#) [Close](#)



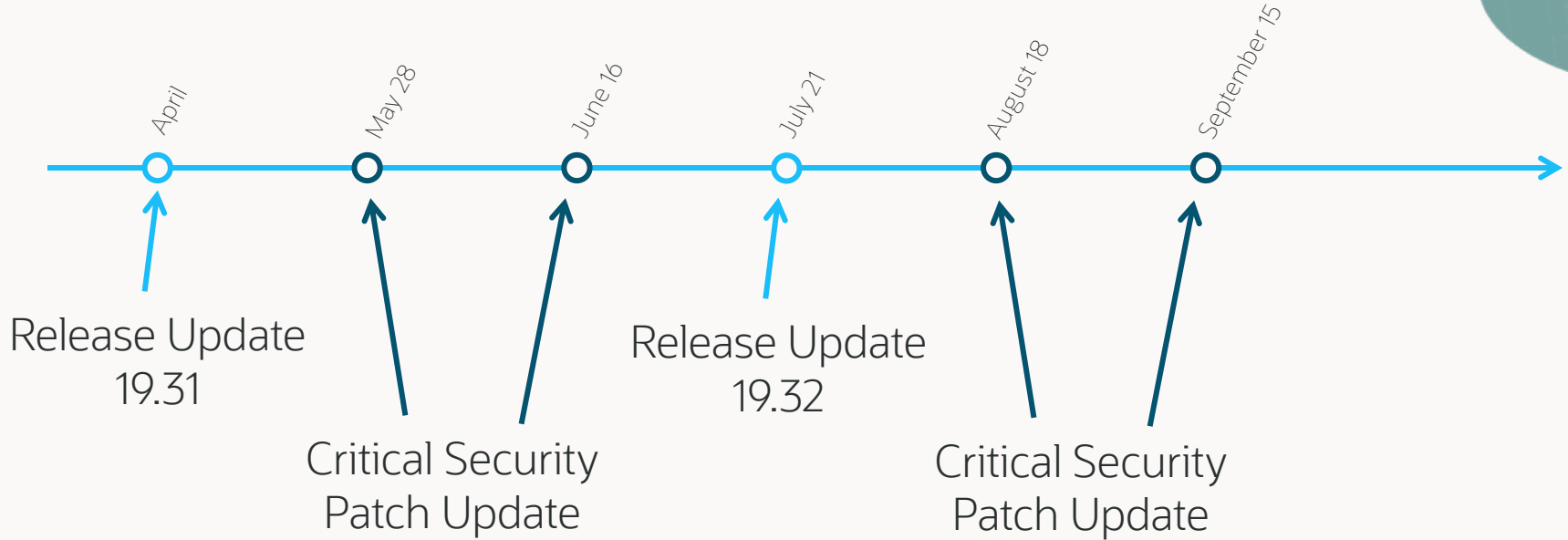


Oracle also recommends
applying monthly patches

Critical Security Patch Update

- **Monthly Critical Security Patch Updates**
Deliver timely, high-priority fixes for critical issues
- **Quarterly Release Updates**
Remain cumulative, including all fixes released in prior CSPUs

Critical Security Patch Update



Blog Posts



- [Accelerating Vulnerability Detection and Response at Oracle](#)
- [Update: Monthly Critical Security Patch Updates \(CSPUs\) Begin May 28, 2026](#)
- [Take Action Today: Protect Your Oracle Database Against AI-Enabled Cybersecurity Threats](#)
- [Recommendations to Help Protect Oracle Databases from Emerging AI-enabled Security Threats \(PNEWS3015\)](#)



Long Term Release Updates

Quarterly Release Updates

	2023				2024				2025				2026		
	January	April	July	October	January	April	July	October	January	April	July	October	January	April	July
19c	19.18.0	19.19.0	19.20.0	19.21.0	19.22.0	19.23.0	19.24.0	19.25.0	19.26.0	19.27.0	19.28.0	19.29.0	19.30.0	19.31.0	19.32.0
21c	21.9.0	21.10.0	21.11.0	21.12.0	21.13.0	21.14.0	21.15.0	21.16.0	21.17.0	21.18.0	21.19.0	21.20.0	21.21.0	21.22.0	21.23.0
26ai							23.5.0	23.6.0	23.7.0	23.8.0	23.9.0	23.26.0	23.26.1	23.26.2	23.26.3



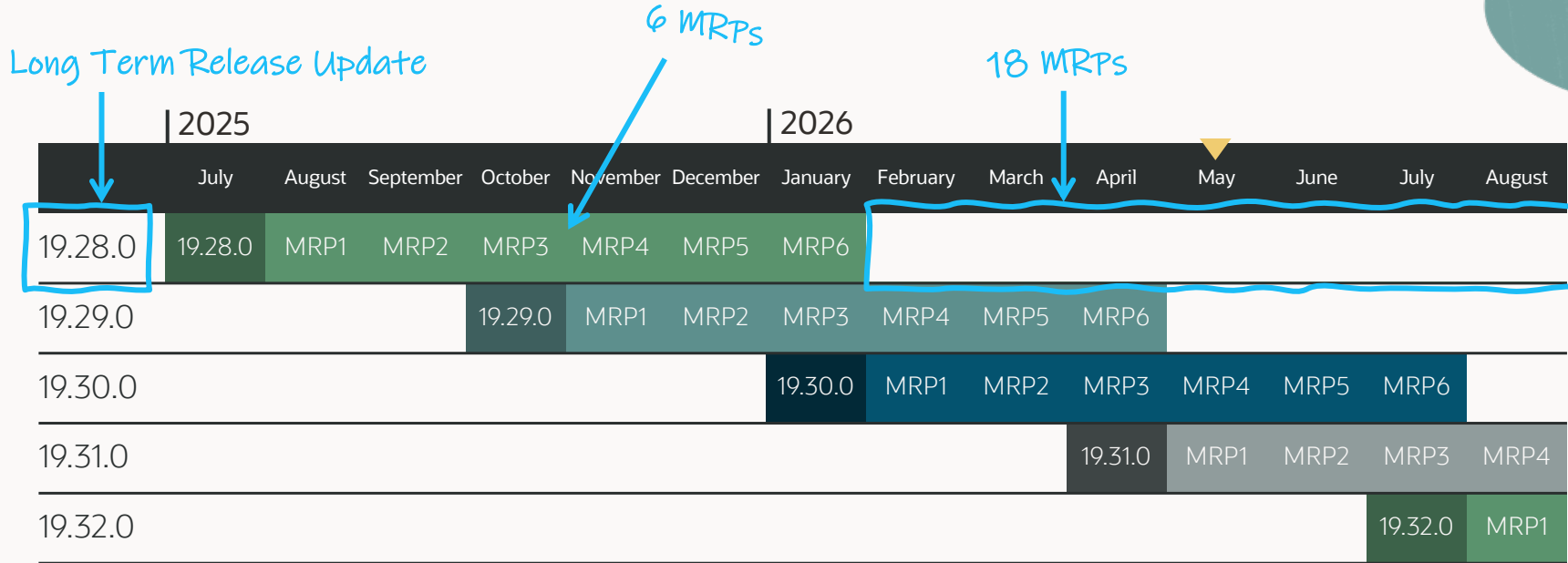


Monthly Recommended Patches

	2025						2026							
	July	August	September	October	November	December	January	February	March	April	May	June	July	August
19.28.0	19.28.0	MRP1	MRP2	MRP3	MRP4	MRP5	MRP6							
19.29.0				19.29.0	MRP1	MRP2	MRP3	MRP4	MRP5	MRP6				
19.30.0							19.30.0	MRP1	MRP2	MRP3	MRP4	MRP5	MRP6	
19.31.0										19.31.0	MRP1	MRP2	MRP3	MRP4
19.32.0													19.32.0	MRP1



Monthly Recommended Patches





19.28 is the first **Long Term Release Update**

- Future announcements in [KB625385](#)

Long Term Release Updates



- 1** Security and compliance for 18 months
- 2** Receive critical updates
- 3** Less changes, higher stability



Patching Oracle AI Database

1

DOWNLOAD

2

INSTALL

3

PATCH

4

FINALIZE

Download



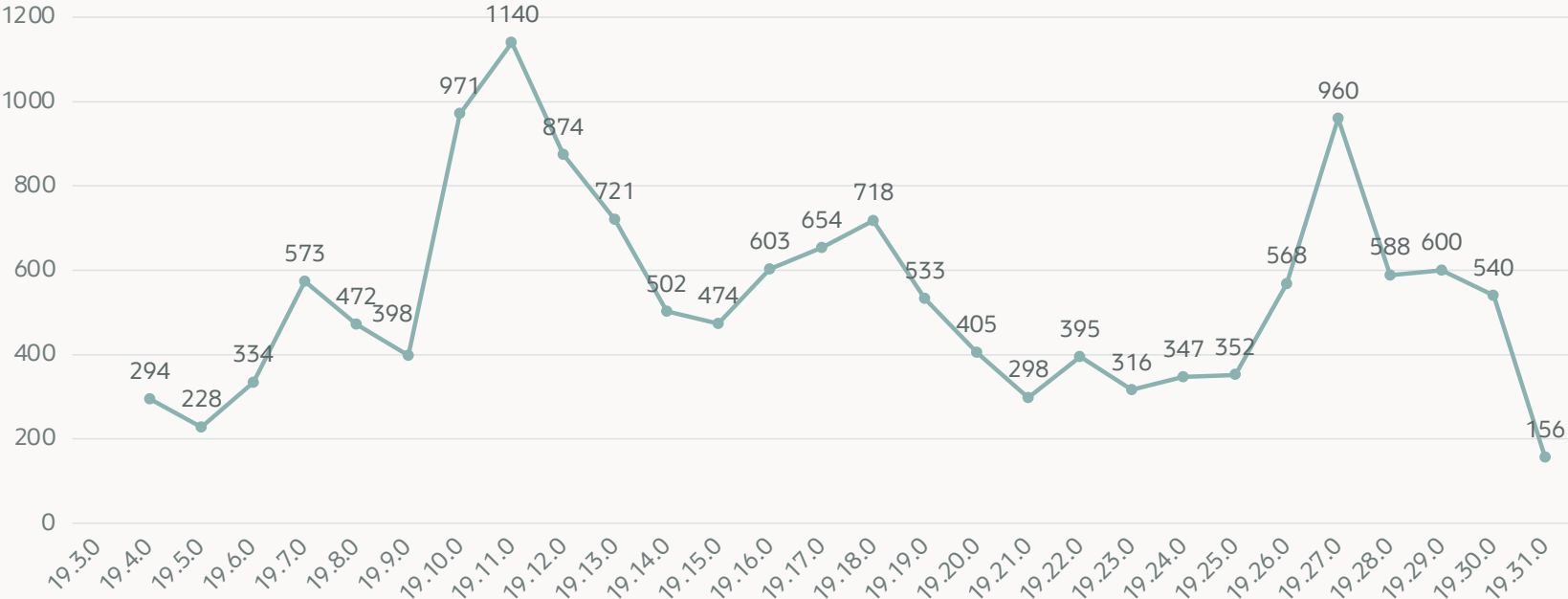
Finding and downloading the right patches



Release Updates are the primary vehicle for delivering patches

- Include security fixes

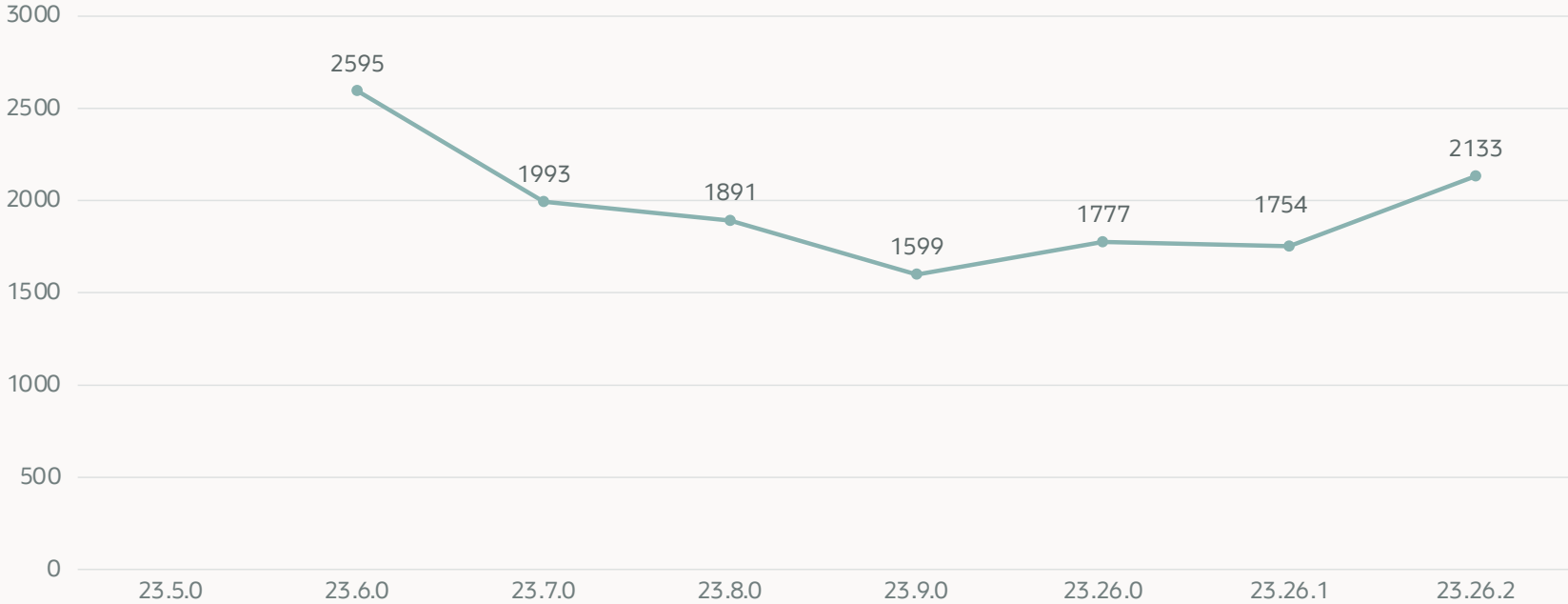
Release Update Contents – Oracle Database 19c



[Database 19 Release Updates and Revisions Bugs Fixed Lists \(Doc ID 2523220.1\)](#)



Release Update Contents – Oracle AI Database 26ai



Source: oradiff.oracle.com





If you don't apply a recent Release Update, you will miss **thousands** of fixes

- Almost 15,000 fixes on 19c
- Almost 14,000 fixes on 26ai



The easiest way you can download patches is using AutoUpgrade

-- Always use the latest version of AutoUpgrade
-- Available via direct download from oracle.com or [KB123450](https://kb123450)


```
wget https://download.oracle.com/otn-pub/otn_software/autoupgrade.jar
```



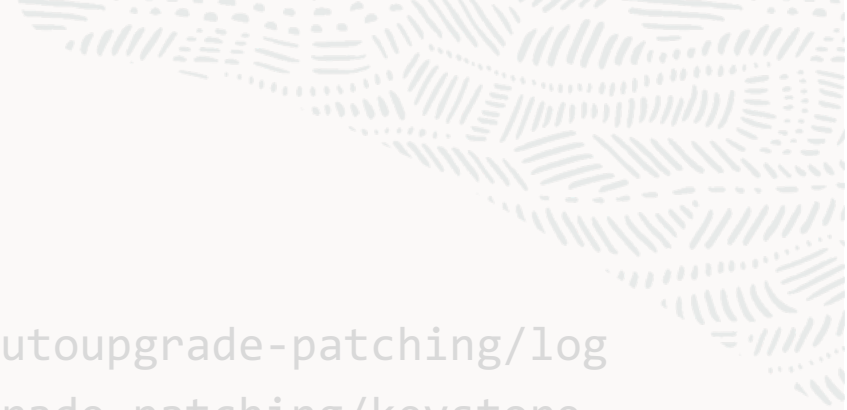
One single tool for everything
- on all platforms

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
```

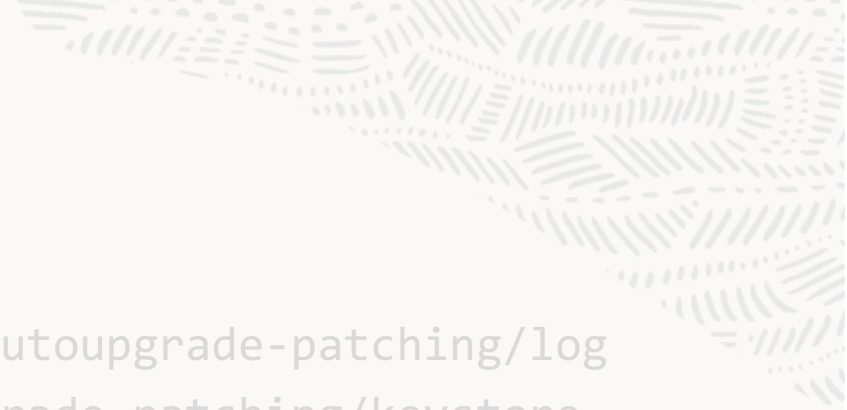




```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
```



```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```



```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
```



```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
patch1.patch=RU
```

```
$ opatch apply
```

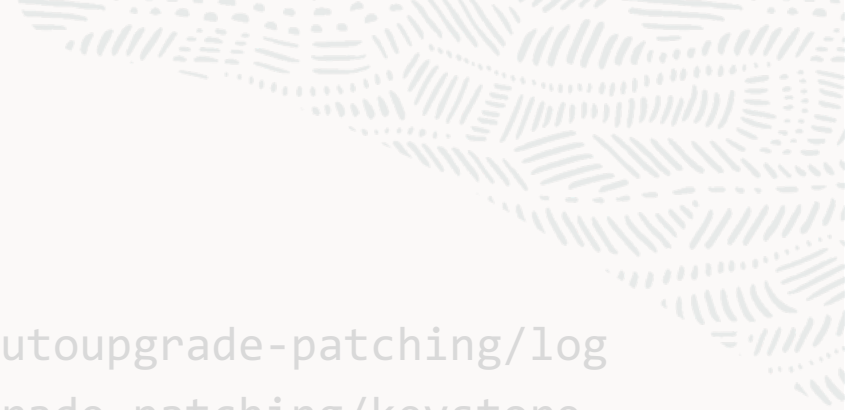
```
Oracle Interim Patch Installer version 12.2.0.1.17  
Copyright (c) 2025, Oracle Corporation. All rights reserved.
```

```
...
```

```
The OPatch being used has version 12.2.0.1.17 while the following patch(es)  
require higher versions:
```

```
Patch 38291812 requires OPatch version 12.2.0.1.47.
```

```
Please download latest OPatch from My Oracle Support.
```



```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
patch1.patch=OPATCH,RU
```



You can only download the latest Release Update

- Previous Release Updates are password protected
- File an SR if you need an older Release Update

AutoUpgrade Patching 26.3.260401 launched with default internal options

Processing config file ...

Loading AutoUpgrade Patching keystore

AutoUpgrade Patching keystore is loaded

Connected to MOS - Searching for specified patches

There were conditions found preventing AutoUpgrade Patching from successfully running

*Downloading files

Cannot find the latest Release Update





Stay secure with monthly Critical Security Patch Updates

- CSPUs complement quarterly Release Updates



AutoUpgrade will support
Critical Security Patch Updates (CSPU)



Stay fully up-to-date with
the most important one-off patches

Oracle Database 19c and Oracle AI Database 26ai Important Recommended One- off Patches

KB188772

Last Updated
Feb 4, 2026

Service
Oracle Database - Enterprise
Edition



1.9

Applies To

All Users

Summary

This note provides a list of important recommended patches that resolve issues affecting Database and Grid Infrastructure 19c and 23ai software homes. These patches resolve issues that have a high likelihood of occurring or that can cause significant impact if they do occur.

This document was MOS Document ID: 555.1 in Legacy MOS.

Solution

NOTE: Unless there is an urgent fix, this document will be updated once a week on Tuesdays at 9AM EST if any new patch is identified.

Through our review of service requests, we often find that issues encountered are the result of customers being on an older Release Update (RU) or Monthly Recommended Patch (MRP). Many issues will have been fixed in the latest updates, which we always recommend.

As noted in the RU-specific tables below, fixes for known issues are targeted for inclusion in the next available MRP and RU. You can always find the latest RUs, MRPs, other patches, lists of fixed bugs and known issues in [KB106822](#) Identifying and installing the latest updates (patches) helps ensure you are using the most current content for security, functional, regression and bug fixes, as well as minor enhancements and any emergency one-offs.

Note:

Oracle encourages customers to install the latest MRP whenever possible. MRPs deliver the safest, fully-tested path to receive the fixes in this document. Refer to [FAQ2283](#) for further details.

In addition to the relevant patches listed below, you should apply patches based on the specific RU after reviewing the following My Oracle Support knowledge documents:

1. [Database PSU/BP/Update/Revision - Known Issues Primary Note](#)[Database PSU/BP/Update/Revision - Known Issues Primary Note](#) KB260868)
2. [Oracle Database Patches to Consider for 19c \(Doc ID KA912\)](#) which contains patches to consider for specific areas such as Data Guard, Data Pump, GoldenGate.

Recommended Patches for 19.30 DB Home

Below is the list of important patches to consider applying on top of 19.30.

Bug	KM Article	Fixed in RU	Fixed in MRP	Description	Patches	RAC Rolling Installable	Database Online Installable	Added
38854064	PALRT2888			[RAC] (DB55) RAC rolling database update when fix 34352668 is present may cause data/redo corruption	PATCH 38854064	YES	NO	28-JAN-2026
37690446	KI40534	Not Eligible	Not Eligible	[SQL EXECUTION] ORA-600 [ktatmkref-rs] errors in the alert log post-patch 37260974 (19.26.0.0.250121 dbu and above) - Workarounds Available	PATCH 37690446	NO	NO	23-SEP-2025
34672698 (replaces 34286265)	KI54797	Not Eligible	Not Eligible	[VOS] DB50: ORA-800: soft external error, arguments: [set priority failed], [vktm] , dism(16)	PATCH 34672698	YES	NO	22-FEB-2024
34774667	KI36203	Not Eligible	Not Eligible	[AQ] ORA-7445 in Purge Queue Table / High CPU usage in SVCB Service	PATCH 34774667	NO	NO	11-JUL-2023
29213893	KI24589	Not Eligible	Not Eligible	[QRY OPTIMIZER] DBMS_STATS Failing With Error Ora-1422 When Gathering Stats for User\$ Table	PATCH 29213893	NO	NO	01-SEP-2021

Version DB 19.30_555.1: [38854064](#), [37690446](#), [34672698](#), [34774667](#), [29213893](#)

Recommended Patches for 19.30 GI Home

Below is the list of important patches to consider applying on top of 19.30. *Only one OCW (Oracle Clusterware) patch should be applied to GI homes. Ensure you apply the patch starting with X8M if you are on an X8M system.*

Watch for conflicts



```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
```

```
patch1.patch=OPATCH,RU,38854064,37690446,34672698,34774667,29213893
```



Monthly Recommended Patches

A collection of recommended one-off fixes provided at monthly intervals via a single downloadable patch

Primary Note for Database Quarterly Release Updates

KB106822

Last Updated

Dec 17, 2025

Service

Dec 17, 2025

Service

Gen 2 Exadata Cloud at Customer, Generation 1 - Exadata Cloud at Customer (First Generation Cloud Machine), Oracle Cloud Infrastructure - Exadata Cloud Service, Oracle Database - Enterprise Edition, Oracle Database - Standard Edition



1.7

Authoring Instructions

This is a crossover article and must be edited only in Legacy MOS for Document ID : 888.1. Any changes made here will be lost in the next update.

Applies To

All Users

Summary

The purpose of this document is to list Database patches for both proactive and reactive maintenance.

This was MOS Document ID: 888.1 in Legacy MOS. Post migration, we will be moving to KB888 (Date TBA)

Solution

[1.0 Overview](#)

[2.0 Oracle Recommendation](#)

[3.0 Latest Release Updates](#)

- [3.1 Oracle Database Long Term Releases](#)
 - [3.1.1 Database 19c](#)

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
patch1.patch=OPATCH,RU,MRP
```



MRPs and CSPUs are cumulative
but only within one Release Update



CSPU and MRPs will co-exist



Customers on Linux may adopt the MRP

- CSPU content is part of MRP

Content

MRP – Monthly Recommended Patch

- [KB188772](#)
 - Critical fixes
 - Regression fixes
 - RAC rolling fixes
- Security fixes

CSPU – Critical Security Patch Update

- Security fixes





Apply the OJVM bundle patch

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
patch1.patch=OPATCH,RU,OJVM
```





OJVM is embedded in Release Updates

- No separate download
- Complete RAC Rolling patching support



Don't miss out on all the Data Pump fixes

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
patch1.patch=OPATCH,RU,OJVM,DPBP
```

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
```

```
patch1.patch=OPATCH,RU,OJVM,DPBP
```

```
patch1.patch=RECOMMENDED
```

Recommended Patches

`patch1.patch=RECOMMENDED`

OPATCH

The latest OPatch

RU

The latest Release Update

OJVM

OJVM bundle matching Release Update

DPBP

Data Pump bundle patch matching RU

AU

Latest version of AutoUpgrade



Apply product-specific bundle patches
based on your usage

Oracle Database Patches to Consider for 19c

KA912

Last Updated
Feb 17, 2026



1.4

Getting Started

Performance

Golden Gate

Oracle Text

Platform Specific

Data Guard High Availability

DN FS

Data Pump

Partitioning

Multitenant

General

Oracle Spatial

Search This Document

Print

Getting Started

When applying Database patches, Oracle recommends that you take a 3-tiered step-by-step approach.

LEVEL 1: Apply latest quarterly patches:

- Apply latest quarterly updates using [Master Note for Database Proactive Patch Program \(Doc ID KB106822\)](#)

LEVEL 2: Apply Critical/Recommended patches:

- For Exadata environments: [Exadata Critical Issues \(KB623062\)](#)
- For Database environments:
 - Customers on Linux x86-64 - Apply the latest [Monthly Recommended Patches - MRP \(FAQ2283\)](#) for the specific RU
 - For customers on other platforms, apply critical patches using [Oracle Database 19c Important Recommended One-off Patches \(KB858385\)](#)

LEVEL 3: Apply additional patches based on features or focus areas:

- Use the tabs in this document for quick access to additional feature based patches

Article Feedback



Rate this

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
patch1.patch=RECOMMENDED, SDOBP
```

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
patch1.patch=RECOMMENDED,SDOBP,TEXT
```



Apply other bundle patches
via patch number

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
```

```
patch1.patch=RECOMMENDED,SDOBP,TEXT,38879426
```



Any other bundle patch AutoUpgrade should download?

- Use the Q&A and drop us a note



Apply latest JDK patch

*"Why is the JDK in my brand-new Oracle home always **3 months old**, or even older?"*

```
$ORACLE_HOME/jdk/bin/java -version
```

```
java version "1.8.0_471"
```

```
Java(TM) SE Runtime Environment (build 1.8.0_471-b09)
```

```
Java HotSpot(TM) 64-Bit Server VM (build 25.471-b09, mixed mode)
```



JDK and PERL Patches for Oracle Database Home and Grid Home

KB118730

Last Updated

Feb 17, 2026

Service

Gen 2 Exadata Cloud at Customer, Generation 1 - Exadata Cloud at Customer (First Generation Cloud Machine), Oracle Cloud Infrastructure - Exadata Cloud Service, Oracle Database - Enterprise Edition, Oracle Database - Standard Edition



3.0

JDK and PERL Patches for Oracle Database Home and Grid Home

2.1 Latest JDK Patches for Database

Jan2026 Quarter

Version	Patch	Linux64	Windows64	WindowsNT	Sparc64	Solaris.x64	Linux32	AIX64	HPIA64	ZLinux64	ARM64
26ai	JDK11.0.30	Included in DBRU	***	***	***	***	***	***	***	***	Included in DBRU
21c	JDK8u481 38586761	Released	Released	*	*	*	*	*	*	*	*
19c	JDK8u481 38586770	Released	Released	Released	Released	Released	Released	Released	Released	Released	Released

* This platform is not planned for 21c, as 21c is an Innovation Release

** Some of the JDK's provided by Oracle are dependent on platform vendors. When those platform vendors provide Oracle with the JDK we then package it for Data base Customers, and document it in this table.

*** This platform is not planned for 26ai.

2.2 Latest Perl Patches for Database

As of January 2023, the latest PERL Patches are included with the quarterly security patches and are no longer provided separately.

3.0 Historical Patches

3.1 Historical JDK Patches for Database

Oct2025 Quarter

Version	Patch	Linux64	Windows64	WindowsNT	Sparc64	Solaris.x64	Linux32	AIX64	HPIA64	ZLinux64	ARM64
26ai	JDK11.0.29	Released	***	***	***	***	***	***	***	***	Included in DBRU

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
patch1.patch=RU, JDK
```



Patch the OCW component

```
$ORACLE_HOME/OPatch/opatch lspatches
```

```
38632161;Database Release Update : 19.30.0.0.260120(REL-JAN260130) (38632161)  
29585399;OCW RELEASE UPDATE 19.3.0.0.0 (29585399)
```





It is mandatory to update OCW with Oracle RAC Database and Oracle Restart

- In the database Oracle home

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
patch1.patch=RECOMMENDED,OCW
```

```
$ORACLE_HOME/OPatch/opatch lspatches
```

```
38632161;Database Release Update : 19.30.0.0.260120(REL-JAN260130) (38632161)
```

```
38661284;OCW RELEASE UPDATE 19.30.0.0.0 (38661284)
```





AutoUpgrade downloads the GI RU
- use it to patch Grid Infrastructure



What about AutoUpgrade itself?

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
patch1.patch=AU
```

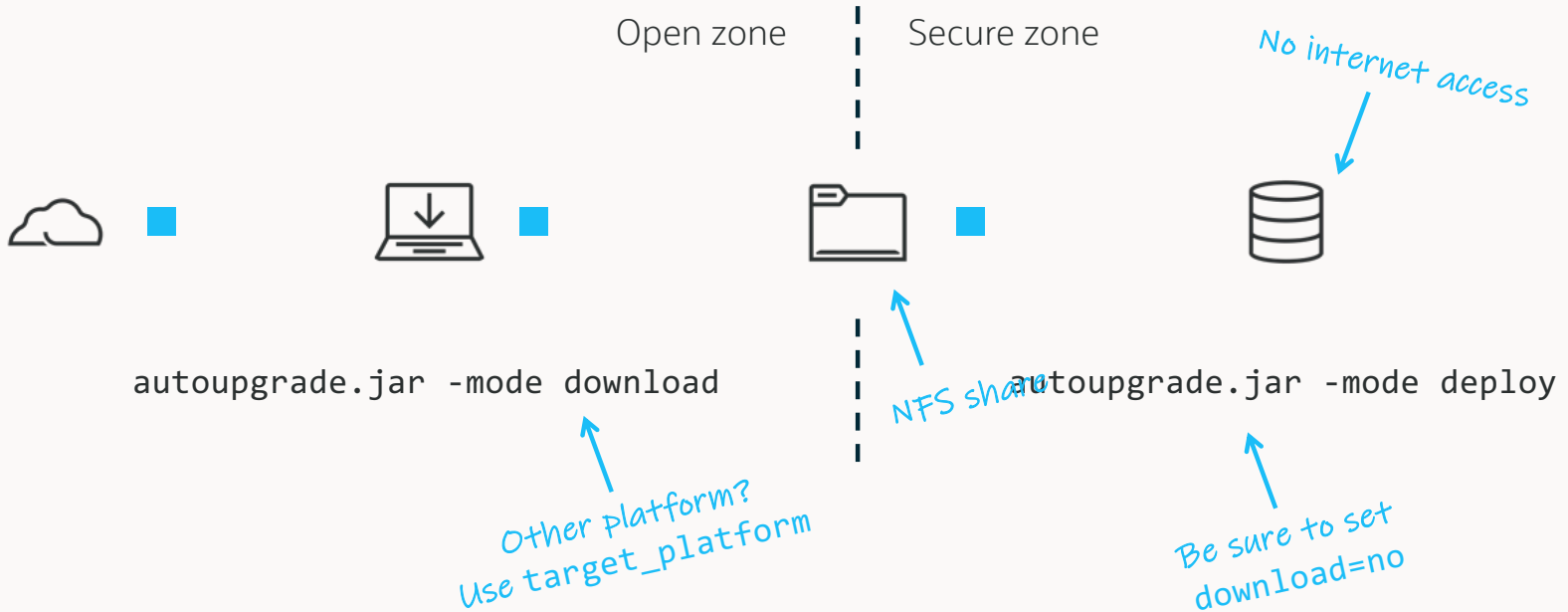
```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
patch1.patch=AU,AHF,CVU,SQLCL
```



Your database host
doesn't have internet access?

Using Download Mode



Using Proxy to Download Patches

```
$ export https_proxy='https://proxy.example.com:8080'
```

```
$ java -jar autoupgrade.jar ... -mode download
```



Let's get those patches

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
```

```
patch1.platform=LINUX.X64
```

```
patch1.patch=RECOMMENDED,MRP,38854064,37690446,34672698,34774667,29213893,SDOBP,TEXT,JDK,OCW
```

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
patch1.platform=LINUX.X64
patch1.patch=RECOMMENDED,MRP,38854064,37690446,34672698,34774667,29213893,SDOBP,TEXT,JDK,OCW
```

```
patch2.target_version=19
patch2.platform=AIX.X64
patch2.patch=RECOMMENDED,JDK,OCW
```

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.target_version=19
patch1.platform=LINUX.X64
patch1.patch=RECOMMENDED,MRP,38854064,37690446,34672698,34774667,29213893,SDOBP,TEXT,JDK,OCW
```

```
patch2.target_version=19
patch2.platform=AIX.X64
patch2.patch=RECOMMENDED,JDK,OCW
```

```
patch3.target_version=26
patch3.platform=LINUX.X64
patch3.patch=RECOMMENDED,JDK,OCW
```

-- Start AutoUpgrade in download mode to get the patches specified in the config file

```
java -jar autoupgrade.jar -config get.cfg -patch -mode download
```

DEMO

Download patches

- Multiple releases
- Multiple platforms

 [Watch on YouTube](#)



Why isn't my Release Update available?

- Post Release Patches

Oracle Critical Patch Update Advisory - April 2026

Description

A Critical Patch Update is a collection of patches for multiple security vulnerabilities. These patches address vulnerabilities in Oracle code and in third party components included in Oracle products. These patches are usually cumulative, but each advisory describes only the security patches added since the previous Critical Patch Update Advisory. Thus, prior Critical Patch Update advisories should be reviewed for information regarding earlier published security patches. Refer to [“Critical Patch Updates, Security Alerts and Bulletins”](#) for information about Oracle Security advisories.

Oracle continues to periodically receive reports of attempts to maliciously exploit vulnerabilities for which Oracle has already released security patches. In some instances, it has been reported that attackers have been successful because targeted customers had failed to apply available Oracle patches. Oracle therefore strongly recommends that customers remain on actively-supported versions and apply Critical Patch Update security patches without delay.

This Critical Patch Update contains 481 new security patches across the product families listed below. Please note that an MOS note summarizing the content of this Critical Patch Update and other Oracle Software Security Assurance activities is located at [April 2026 Critical Patch Update: Executive Summary and Analysis](#).

Please note that since the release of the January 2026 Critical Patch Update, Oracle has released a Security Alert for Oracle Identity Manager and Oracle Web Services Manager, [CVE-2026-21992 \(March 20, 2026\)](#). Customers are strongly advised to apply the April 2026 Critical Patch Update for Fusion Middleware products, which includes patches for this Alert as well as additional patches.

Oracle Communications Operations Monitor, versions 5.2, 6.0, 6.1	Oracle Communications Operations Monitor
Oracle Communications Order and Service Management, versions 7.5.0, 8.0.0	Oracle Communications Order and Service Management
Oracle Communications Performance Intelligence Center, versions 10.5.0.0-10.5.0.2	Oracle Communications Performance Intelligence Center
Oracle Communications Policy Management, versions 15.0.0.0.0, 15.0.0.1.0	Oracle Communications Policy Management
Oracle Communications Service Catalog and Design, versions 8.0.0.6.0, 8.1.0.5.0, 8.2.0.2.0	Oracle Communications Service Catalog and Design
Oracle Communications Session Border Controller, versions 9.3.0, 10.0.0, 10.1.0	Oracle Communications Session Border Controller
Oracle Communications Session Report Manager, versions 9.0.0-9.0.4	Oracle Communications Session Report Manager
Oracle Communications Unified Assurance, versions 6.1.1-7.0.0	Oracle Communications Unified Assurance
Oracle Communications Unified Inventory Management, versions 7.5.0-7.5.1, 7.6.0-7.8.0, 8.0.0	Oracle Communications Unified Inventory Management
Oracle Configuration Manager, versions 13.5, 24.1	Oracle Enterprise Manager
Oracle Data Integrator, versions 12.2.1.4.0, 14.1.2.0.0	Fusion Middleware
Oracle Database Server, versions 12.1.0.2.0, 12.2.0.1.0, 19.3-19.30, 21.3-21.21, 23.4.0-23.26.1	Database
Oracle Documaker, versions 12.7.2-13.0.2	Contact Support
Oracle E-Business Suite, versions 12.2.3-12.2.15, 15.0	Oracle E-Business Suite
Oracle Enterprise Communications Broker, versions 4.2.0, 5.0.0	Oracle Enterprise Communications Broker
Oracle Enterprise Manager Base Platform, versions 13.5, 24.1	Oracle Enterprise Manager
Oracle Enterprise Manager for Fusion Middleware, versions 13.5, 24.1	Oracle Enterprise Manager

Oracle Critical Patch Update (CPU) Apr 2026 for Oracle Database Products

CPU58

Last Updated
Yesterday 4:41 PM



1.4

Critical Patch Update (CPU) Apr 2026 for Oracle Database Products

My Oracle Support CPU58

Released April 21, 2026

This document contains the following sections:

- Critical Patch Update April 2026 Patch Availability Document (PAD)
 - 1 Overview
 - 1.1 How to Use This Document
 - 1.2 Terminology in the Tables
 - 1.3 On-Request Patches
 - 1.4 CPU Program and My Oracle Support Patch Recommendations
 - 1.5 My Oracle Support (MOS) Conflict Checker Tool
 - 2 What's New in April 2026
 - 2.1 Final CPU Information (Error Correction Policies)
 - 2.2 Post Release Patches
 - 2.3 Separate PADs for Separate Products
 - 2.4 Monthly Recommended Patches (MRPs)
 - 3 Patch Availability for Oracle Products
 - 3.1 Oracle Database
 - 3.2 Oracle Sun Middleware
 - 3.3 Tools
 - 4 Final CPU History
 - 5 Sources of Additional Information
 - 6 Modification History
 - 7 Documentation Accessibility

Patch	Patch Number	Platform	Availability
23.26.2 Database Release Update 23.26.2.0.0 GoldImage	39099680	Linux x86-64	Available
23.26.2 GI Release Update 23.26.2.0.0 GoldImage	39099896	Linux x86-64	Available
23.26.2 Client Release Update 23.26.2.0.0 GoldImage	39099870	Linux x86-64	Available
23.26.12 CMAN Client Release Update 23.26.2.0.0 GoldImage	39099840	Linux x86-64	Available
23.26.2 GSM Client Release Update 23.26.2.0.0 GoldImage	39099882	Linux x86-64	Available
23.26.2 Database Release Update 23.26.2.0.0 Patch	39093711	Linux x86-64	Available
23.26.2 GI Release Update 23.26.2.0.0 Patch	39088031	Linux x86-64	Available
21.22.0.0.260421 Database RU	39073698	Linux 32 bit	Available
21.22.0.0.260421 GI RU	39073631	Linux 32 bit	Available
21.22.0.0.260421 Database RU	38955012	Windows 64-bit & 32-bit	ETA: 15-MAY-2026
19.31.0.0.260421 DB RU & COMBO	DB 39034528	Linux x86-64:	Available
	Combo 39062931	All Others	ETA: 15-May-2026
19.31.0.0.260421 GI RU & COMBO	GI 39036936	Linux x86-64:	Available
	Combo 39062956	All Others	ETA: 15-May-2026
19.31.0.0.260421 OJVM RU	38906621	ALL	Available
19.31.0.0.260421 WIN BP & OJVM		Windows 64-bit & Windows 32-bit	ETA: 12-May-2026
	38818049	Windows OJVM	
19.31 QFSDP for Exadata	39063037	Linux x86-64	Available
		Solaris.X64	ETA: 15-May-2026
21.22 QFSDP for Exadata	39063054	Linux x86-64	Available
23.26.2 QFSDP for Exadata	39063134	Linux x86-64	Available
GoldenGate for Distributed Applications and Analytics 23.26.2.0.0	39220416	Linux x86-64	ETA: 22-May-2026
Oracle GoldenGate for Big Data 21.22.0.0.0 Microservices	39220426	Linux x86-64	ETA: 15-May-2026
Oracle GoldenGate for Big Data 21.22.0.0.0	39220427	Linux x86-64	ETA: 15-May-2026
Oracle GoldenGate for Big Data 19.1.0.0.23	38858573	Linux x86-64	ETA: 22-May-2026
Oracle GoldenGate for Big Data 23.26.2.0.0 (Current Access)	39063141	Linux x86-64	Available

Patch	Patch Number	Platform	Availability
23.26.2 Database Release Update 23.26.2.0.0 GoldImage	39099680	Linux x86-64	Available
23.26.2 GI Release Update 23.26.2.0.0 GoldImage	39099896	Linux x86-64	Available
23.26.2 Client Release Update 23.26.20.0 GoldImage	39099870	Linux x86-64	Available
23.26.12 CMAN Client Release Update 23.26.2.0.0 GoldImage	39099840	Linux x86-64	Available
23.26.2 GSM Client Release Update 23.26.2.0.0 GoldImage	39099882	Linux x86-64	Available
23.26.2 Database Release Update 23.26.2.0.0 Patch	39093711	Linux x86-64	Available
23.26.2 GI Release Update 23.26.2.0.0 Patch	39088031	Linux x86-64	Available
21.22.0.0.260421 Database RU	39073698	Linux 32 bit	Available
21.22.0.0.260421 GI RU	39073631	Linux 32 bit	Available
21.22.0.0.260421 Database RU	38955012	Windows 64-bit & 32-bit	ETA: 15-MAY-2026
19.31.0.0.260421 DB RU & COMBO	DB 39034528	Linux x86-64:	Available
	Combo 39062931	All Others	ETA: 15-May-2026
19.31.0.0.260421 GI RU & COMBO	GI 39036936	Linux x86-64:	Available
	Combo 39062956	All Others	ETA: 15-May-2026
19.31.0.0.260421 OJVM RU	38906621	ALL	Available
19.31.0.0.260421 WIN BP & OJVM	38818049	Windows 64-bit & Windows 32-bit	ETA: 12-May-2026
		Windows OJVM	
19.31 QFSDP for Exadata	39063037	Linux x86-64	Available
		Solaris.X64	ETA: 15-May-2026
21.22 QFSDP for Exadata	39063054	Linux x86-64	Available
23.26.2 QFSDP for Exadata	39063134	Linux x86-64	Available
GoldenGate for Distributed Applications and Analytics 23.26.2.0.0	39220416	Linux x86-64	ETA: 22-May-2026
Oracle GoldenGate for Big Data 21.22.0.0.0 Microservices	39220426	Linux x86-64	ETA: 15-May-2026
Oracle GoldenGate for Big Data 21.22.0.0.0	39220427	Linux x86-64	ETA: 15-May-2026
Oracle GoldenGate for Big Data 19.1.0.0.23	38858573	Linux x86-64	ETA: 22-May-2026
Oracle GoldenGate for Big Data 23.26.2.0.0 (Current Access)	39063141	Linux x86-64	Available

Further Information

Downloading Patches



- [Assistant: Download Reference for Oracle Database/GI Update, Revision, PSU, SPU\(CPU\), Bundle Patches, Patchsets and Base Releases \(KA958\)](#)
- [Oracle Database 19c and Oracle AI Database 26ai Important Recommended One-off Patches \(KB188772\)](#)
- [Oracle Database Patches to Consider for 19c \(KA912\)](#)
- [Things to Consider to Avoid SQL Performance Problems on 19c \(KB138000\)](#)
- [Long Term Support Model for 19c Database Release Updates \(KB625385\)](#)
- [ORAdiff](#)
- Blog post: [The Easiest Way to Download 19.27 Release Update](#)
- Blog post: [The Easiest Way To Download Patches for Oracle Grid Infrastructure](#)
- Blog post: [AutoUpgrade New Features: Patch OCW Component In Oracle Home](#)

Install

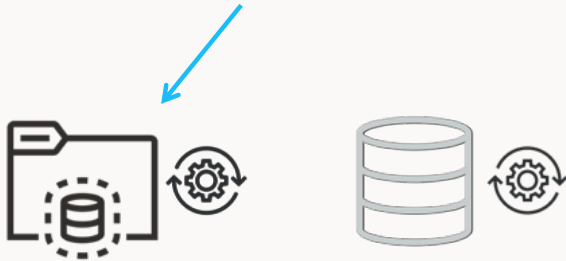


Creating Oracle home



In-Place Patching

Oracle Home, 19.30.0



```
$ORACLE_HOME/OPatch/opatch rollback -id ...
```

Out-of-Place Patching

Oracle Home, 19.30.0



SHUTDOWN IMMEDIATE



`$ORACLE_HOME/OPatch/datapatch`

New Oracle Home 19.31.0

Out-of-place Patching Benefits

- Less downtime
- Less risk
- Easier rollback
- Leaner Oracle home



Always patch Out-of-Place



But if you insist ...

```
du -sh $ORACLE_HOME/.patch_storage
```

```
14.2G    /u01/app/oracle/product/19/.patch_storage
```

```
-- Clean up Oracle home if you use in-place patching  
-- or use out-of-place patching with cloned Oracle homes.  
-- Delete obsolete files from $ORACLE_HOME/.patch_storage and trims OPatch XML files
```

```
./opatch util deleteinactivepatches
```



Create new Oracle home
- matching the current Oracle home

```
cat install19.cfg
```

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
```

```
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.source_home=/u01/app/oracle/product/dbhome_19_30 ← Settings
```

```
patch1.target_home=/u01/app/oracle/product/dbhome_19_31
```

```
patch1.patch=RECOMMENDED
```

↑
Patches

```
cat install19.cfg
```

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log  
global.folder=/home/oracle/autoupgrade/patches  
patch1.source_home=/u01/app/oracle/product/dbhome_19_30  
patch1.target_home=/u01/app/oracle/product/dbhome_19_31  
patch1.patch=RECOMMENDED
```

```
java -jar autoupgrade.jar -config install19.cfg -patch -mode create_home
```





Override source home setting

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.source_home=/u01/app/oracle/product/dbhome_19_30
patch1.target_home=/u01/app/oracle/product/dbhome_19_31
patch1.patch=RECOMMENDED
patch1.home_settings.home_name=OraDbHome1931
```



```
global.global_log_dir=/home/oracle/autoupgrade-patching/log  
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.source_home=/u01/app/oracle/product/dbhome_19_30  
patch1.target_home=/u01/app/oracle/product/dbhome_19_31  
patch1.patch=RECOMMENDED  
patch1.home_settings.home_name=OraDbHome1931  
patch1.home_settings.binopt.part=no
```



```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.folder=/home/oracle/autoupgrade/patches
```

```
patch1.source_home=/u01/app/oracle/product/dbhome_19_30
patch1.target_home=/u01/app/oracle/product/dbhome_19_31
patch1.patch=RECOMMENDED
patch1.home_settings.home_name=OraDbHome1931
patch1.home_settings.binopt.part=no
patch1.home_settings.binopt.uniaud=yes
```





The [documentation](#) lists all the Oracle home options



Are you using Oracle RAC Database? Also works for cluster Oracle homes!

- Automatically detected
- No additional configuration



AutoUpgrade runs `root.sh` script

- `oracle` user must have sudo privilege

Further Information

Downloading Patches



- [\(KB104015\) OPatch 12.2.0.1.37+ Introduces a New Feature to Delete Inactive Patches in the ORACLE_HOME/.patch_storage Directory](#)
- Blog post: [AutoUpgrade New Features: Install Oracle Home on Brand-New, Empty Server](#)
- Blog post: [Cleaning up older patch artifacts – improving opatch performance](#)
- Hands-on lab: [Patch Me If You Can](#)

Patch



Patching Oracle AI Database



Start by performing a pre-patch analysis

Analyze

- Analyzes database for patch readiness
- Datapatch Sanity Checks
- Lightweight
- Non-intrusive
- Recommended, not required

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
patch1.sid=CDB19
patch1.source_home=/u01/app/oracle/product/dbhome_19_30
patch1.target_home=/u01/app/oracle/product/dbhome_19_31
```



```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
patch1.sid=CDB19
patch1.source_home=/u01/app/oracle/product/dbhome_19_30
patch1.target_home=/u01/app/oracle/product/dbhome_19_31
```

```
$ java -jar autoupgrade.jar -config CDB19.cfg -mode analyze
```





Patch a single instance database

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
```

```
patch1.sid=CDB19
```

```
patch1.source_home=/u01/app/oracle/product/dbhome_19_30
```

```
patch1.target_home=/u01/app/oracle/product/dbhome_19_31
```



```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
```

```
patch1.sid=CDB19
```

```
patch1.source_home=/u01/app/oracle/product/dbhome_19_30
```

```
patch1.target_home=/u01/app/oracle/product/dbhome_19_31
```

```
patch1.rman_catalog_connect_string=catalogdb
```



```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
```

```
patch1.sid=CDB19
```

```
patch1.source_home=/u01/app/oracle/product/dbhome_19_30
```

```
patch1.target_home=/u01/app/oracle/product/dbhome_19_31
```

```
patch1.rman_catalog_connect_string=catalogdb
```

```
patch1.emcli_path=/u01/app/oracle/oem
```

```
patch1.em_target_name=ORCL_myhost.domain.int
```

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
global.keystore=/home/oracle/autoupgrade-patching/keystore
```

```
patch1.sid=CDB19
patch1.source_home=/u01/app/oracle/product/dbhome_19_30
patch1.target_home=/u01/app/oracle/product/dbhome_19_31
patch1.rman_catalog_connect_string=catalogdb
patch1.emcli_path=/u01/app/oracle/oem
patch1.em_target_name=ORCL_myhost.domain.int
patch1.before_action=/home/oracle/scripts/before_db.sh Y
patch1.after_action=/home/oracle/scripts/after_db.sh Y
```

-- Patch the database according to the specification in the config file
-- This takes care of all the necessary steps, including pre- and post-tasks

```
java -jar autoupgrade.jar -config CDB19.cfg -mode deploy
```



AutoUpgrade fully supports Oracle Restart

- No additional configuration



You can also patch individual PDBs
- also using refreshable clone PDBs



Patching Data Guard

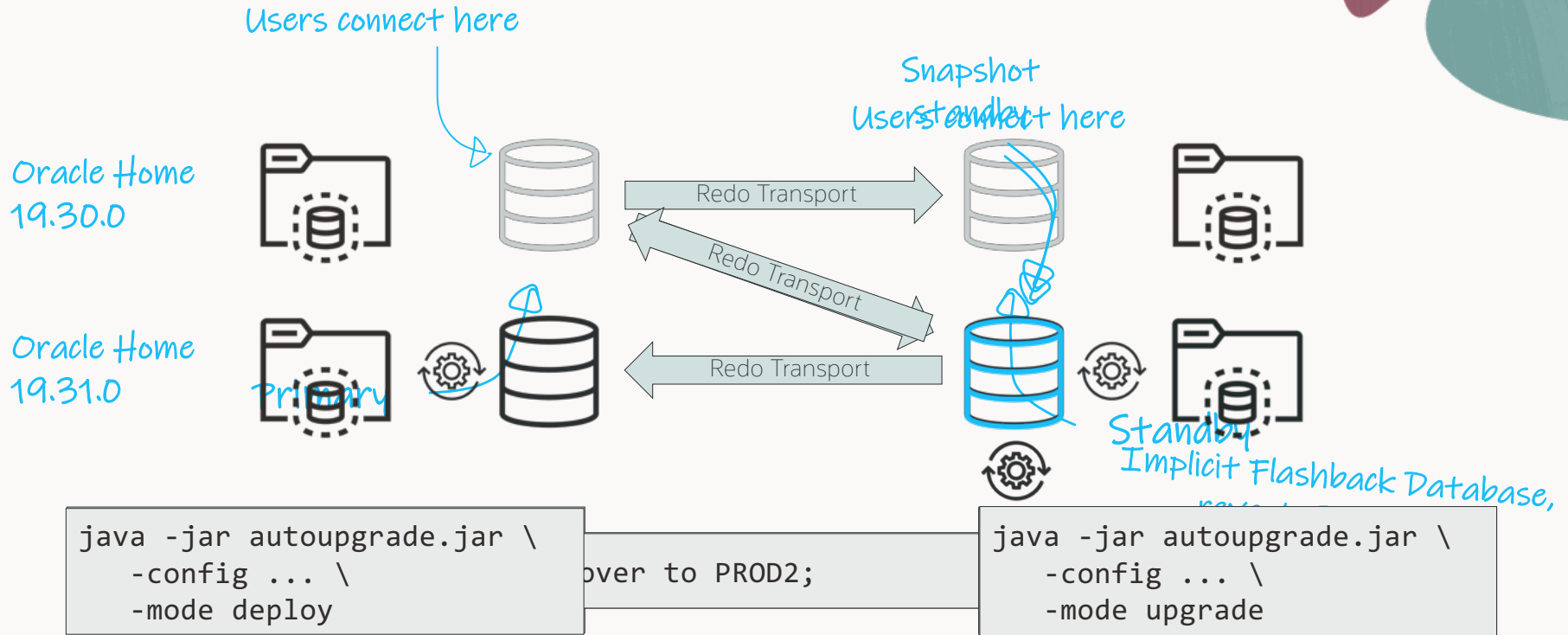


Reduce downtime to the time it takes
to perform a switchover



Safely test and verify patches with Standby-First Patch Apply

Standby-First Patching



DEMO

Patch Data Guard

 [Watch on YouTube](#)



Patch must Standby-First installable

- Check the patch readme

Data Guard Patching



Primary



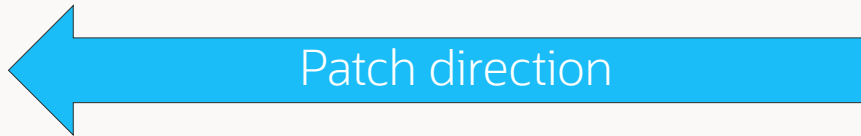
Far sync



Standby



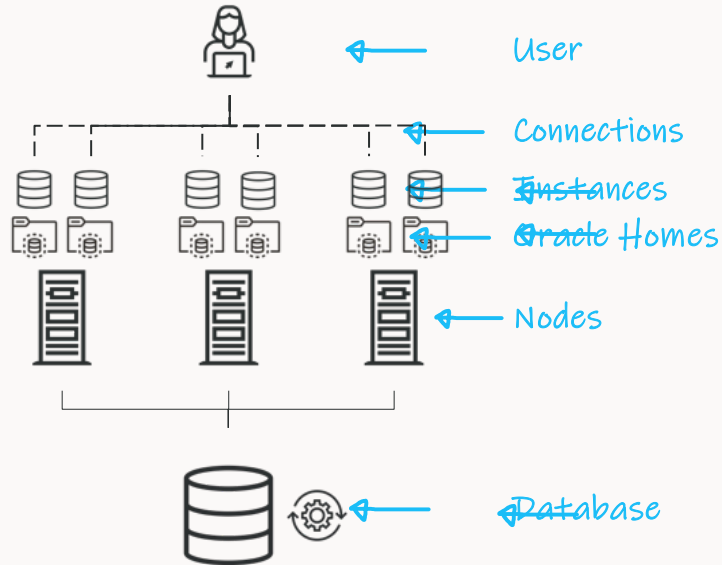
Cascading standby





Rolling patch apply on Oracle RAC Database

RAC Rolling Patching



- New DB home

```
autoupgrade.jar ... -mode create_home
```

- Move to new home

```
autoupgrade.jar ... -mode deploy
```

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
```

```
patch1.sid=CDB191
```

```
patch1.source_home=/u01/app/oracle/product/dbhome_19_30
```

```
patch1.target_home=/u01/app/oracle/product/dbhome_19_31
```

```
patch1.rac_rolling=auto
```


Default value

DEMO

Patch Oracle RAC Database

- Using AutoUpgrade
- Rolling

 [Watch on YouTube](#)

patch1.rac_rolling

DISABLED

Patch using non-rolling method
(outage)

REQUIRED

Patch using rolling method or stop
if non-rolling patches are detected

AUTO

Automatically detects the best approach
(default)

FORCE

Force using rolling method





AutoUpgrade stops the service
using the default drain timeout

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
```

```
patch1.sid=CDB191
```

```
patch1.source_home=/u01/app/oracle/product/dbhome_19_30
```

```
patch1.target_home=/u01/app/oracle/product/dbhome_19_31
```

```
patch1.rac_rolling=auto
```

```
patch1.drain_timeout=300
```





But my application doesn't drain ...

```
global.global_log_dir=/home/oracle/autoupgrade-patching/log
```

```
patch1.sid=CDB191
```

```
patch1.source_home=/u01/app/oracle/product/dbhome_19_30
```

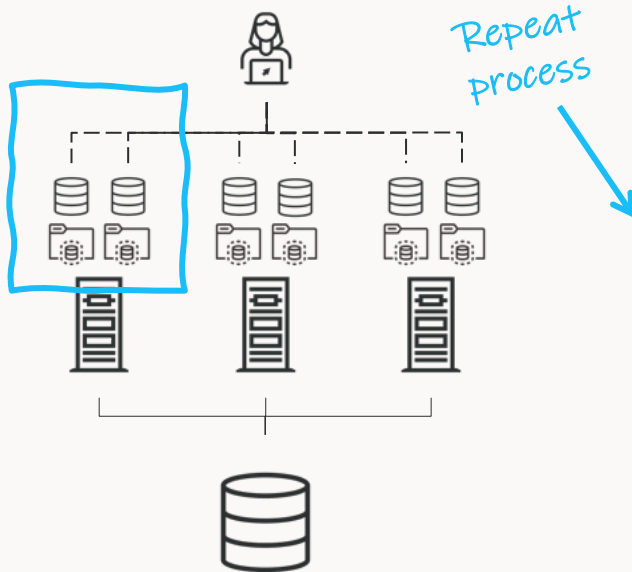
```
patch1.target_home=/u01/app/oracle/product/dbhome_19_31
```

```
patch1.rac_rolling=auto
```

```
patch1.drain_timeout=WAIT
```



Controlling the Draining



```
autoupgrade.jar ... -mode deploy
```

```
srvctl relocate service \  
-stopoption TRANSACTIONAL \  
-drain_timeout 2592000 ...
```

```
upg> proceed -job 101
```

```
srvctl srvctl stop instance \  
-stopoption IMMEDIATE \  
-drain_timeout 0 ...
```

drain_timeout

```
patch1.drain_timeout = WAIT
```

```
srvctl relocate service  
-oldinst node1  
-stopoption TRANSACTIONAL  
-drain_timeout 2592000  
-wait yes  
-verbose
```

```
> proceed -job 101
```

```
srvctl stop instance  
-instance node1  
-stopoption IMMEDIATE  
-drain_timeout 0  
-failover  
-verbose  
-force
```

```
patch1.drain_timeout = 120
```

```
srvctl stop instance  
-instance node1  
-stopoption IMMEDIATE  
-drain_timeout 120  
-failover  
-verbose  
-force
```

```
patch1.drain_timeout (unset)
```

```
srvctl stop instance  
-instance node1  
-stopoption IMMEDIATE  
-failover  
-verbose  
-force
```

↑
*When unset, value used
will be the MAX drain
of all running services
on that instance.*

Further Information

Patching Database



- [Oracle Patch Assurance - Data Guard Standby-First Patch Apply \(KB137118\)](#)
- Blog post: [Upgrade RMAN Catalog Schema](#)
- Blog post: [Update Enterprise Manager Configuration](#)
- Blog post: [Introduction to Patching Oracle Data Guard](#)
- Blog post: [Downloading and using Gold Image with AutoUpgrade](#)
- Blog post: [RAC Rolling mode in AutoUpgrade](#)
- Blog post: [How to patch Oracle Database using controlled RAC Rolling with AutoUpgrade](#)
- Blog post: [Announcing Oracle Update Advisor](#)
- Hands-on lab: [Patch Me If You Can](#)

Finalize



A few things more ...



Don't forget the clients

Security Bug Fixes in Clients

CPU	Clients Affected
Apr 2026	Client-only
Jan 2026	Client-only, SQLcl
Oct 2025	Client-only, SQLcl
Jul 2025	Client-only, JDBC
Apr 2025	Client-only, SQLcl
Jan 2025	
Oct 2024	Client-only
Jul 2024	Client-only
Apr 2025	SQLcl
Jan 2025	

Oracle Critical Patch Update Advisory - April 2026

Description

A Critical Patch Update is a collection of patches for multiple security vulnerabilities. These patches address vulnerabilities in Oracle code and in third party components included in Oracle products. These patches are usually cumulative, but each advisory describes only the security patches added since the previous Critical Patch Update Advisory. Thus, prior Critical Patch Update advisories should be reviewed for information regarding earlier published security patches. Refer to [“Critical Patch Updates, Security Alerts and Bulletins”](#) for information about Oracle Security advisories.

Oracle continues to periodically receive reports of attempts to maliciously exploit vulnerabilities for which Oracle has already released security patches. In some instances, it has been reported that attackers have been successful because targeted customers had failed to apply available Oracle patches. Oracle therefore strongly recommends that customers remain on actively-supported versions and apply Critical Patch Update security patches without delay.

This Critical Patch Update contains 481 new security patches across the product families listed below. Please note that an MOS note summarizing the content of this Critical Patch Update and other Oracle Software Security Assurance activities is located at [April 2026 Critical Patch Update: Executive Summary and Analysis](#).

Please note that since the release of the January 2026 Critical Patch Update, Oracle has released a Security Alert for Oracle Identity Manager and Oracle Web Services Manager, [CVE-2026-21992 \(March 20, 2026\)](#). Customers are strongly advised to apply the April 2026 Critical Patch Update for Fusion Middleware products, which includes patches for this Alert as well as additional patches.

Affected Products and Patch Information

Security vulnerabilities addressed by this Critical Patch Update affect the products listed below.

Please click on the links in the Patch Availability Document column below to access the documentation for patch availability information and installation instructions.

Oracle Database Server Risk Matrix

This Critical Patch Update contains 8 new security patches, plus additional third party patches noted below, for Oracle Database Products. 4 of these vulnerabilities may be remotely exploitable without authentication, i.e., may be exploited over a network without requiring user credentials.


1 of these patches is applicable to client-only installations, i.e., installations that do not have the Oracle Database Server installed. The English text form of this Risk Matrix can be found here.

CVE ID	Component	Package and/ or Privilege Required	Protocol	Remote Exploit without Auth.?	CVSS VERSION 3.1 RISK (see Risk Matrix Definitions)									Supported Versions Affected	Notes
					Base Score	Attack Vector	Attack Complex	Privs Req'd	User Interact	Scope	Confidentiality	Integrity	Availability		
CVE-2026-33870	Clusterware (Micronaut)	None	HTTP	Yes	7.5	Network	Low	None	None	Un-changed	None	High	None	19.3-19.30, 23.4.0-23.26.1	
CVE-2026-35229	Java VM	Create Session	Oracle Net	Yes	7.5	Network	Low	None	None	Un-changed	High	None	None	19.3-19.30, 21.3-21.21	
CVE-2026-31790	RDBMS (OpenSSL)	None	Multiple	No	7.2	Network	Low	High	None	Un-changed	High	High	High	19.3-19.30, 23.4.0-23.26.1	
CVE-2026-26007	RDBMS (Python)	Create Session	Multiple	Yes	6.5	Network	Low	None	Required	Un-changed	High	None	None	21.3-21.21, 23.4.0-23.26.1	
CVE-2026-21999	XML Database	HTTP Listener	HTTPS	Yes	5.3	Network	High	None	Required	Un-changed	High	None	None	23.4.0-23.26.1	
CVE-2025-31948	Data Mining (Intel oneAPI Toolkit OpenMP)	Authenticated User	None	No	3.3	Local	Low	Low	None	Un-changed	None	None	Low	19.3-19.30, 21.3-21.21, 23.4.0-23.26.1	
CVE-2025-48924	RDBMS (Apache Commons Lang)	DBMS Developer	Multiple	No	3.3	Local	Low	None	Required	Un-changed	None	None	Low	23.4.0-23.26.1	
CVE-2026-34312	RDBMS	Row Access Method	Multiple	No	2.4	Network	Low	High	Required	Un-changed	Low	None	None	19.3-19.30	

Oracle Database Server Risk Matrix

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CVE-2026-31790	RDBMS (OpenSSL)	None	Multiple	No	7.2	Network	Low	High	None	Un- changed	High	High	High	19.3-19.30, 23.4.0-23.26.1	
CVE-2026-26007	RDBMS (Python)	Create Session	Multiple	Yes	6.5	Network	Low	None	Required	Un- changed	High	None	None	21.3-21.21, 23.4.0-23.26.1	
CVE-2026-21999	XML Database	HTTP Listener	HTTPS	Yes	5.3	Network	High	None	Required	Un- changed	High	None	None	23.4.0-23.26.1	
CVE-2025-31948	Data Mining (Intel oneAPI Toolkit OpenMP)	Authenticated User	None	No	3.3	Local	Low	Low	None	Un- changed	None	None	Low	19.3-19.30, 21.3-21.21, 23.4.0-23.26.1	
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CVE-2026-34312	RDBMS	Row Access Method	Multiple	No	2.4	Network	Low	High	Required	Un- changed	Low	None	None	19.3-19.30	



Every quarter, you should evaluate the need for client patching

- Establish a structured process



Create a process for patching your clients

- Automation is key
- Also useful for upgrading clients



Database clients are generally very stable



If possible, Oracle recommends upgrading clients to the latest 26ai driver

Client / Server Interoperability

Client Version	Server Version						
	26ai	21c	19c	18c	12.2.0	12.1.0	11.2.0
26ai#11	Yes	Yes	Yes	No	No	No	No
21c	Yes	Yes	Yes	Was	Was	Yes#12	No
19c	Yes	Yes	Yes	Was	Was	Yes#12	Yes#9
18c	No	Was	Was	Was	Was	Was	Was#9
12.2.0	No	Was	Was	Was	Was	Was	Was
12.1.0	No	Yes#12	Yes#12	Was	Was	Yes#12	Yes#12
11.2.0	No	No	Yes#9	Was#9	Was	Yes#12	Yes#9

MOS Note: KB141043 - Client / Server Interoperability Support Matrix





If you must use a 19c driver,
update to the latest version



To maintain plan stability certain optimizer fixes are installed but disabled

- Automatic Fix Control Persistence

```
int optimGenerateCost(char *sql) {  
    n = getBaseSost(sql);  
    n = n * 2;  
    n = n + 10;  
    n = n / 3;  
    n = n - 5;  
    return n;  
}
```

```
int optimGenerateCost(char *sql) {  
    n = getBaseSost(sql);  
    n = n * 2;  
  
    if (fixEnabled(32854286)) {  
        // fixed code  
        n = n + 8;  
    } else {  
        // original code  
        n = n + 10;  
    }  
  
    n = n / 3;  
    n = n - 5;  
    return n;  
}
```

```
int optimGenerateCost(char *sql) {
    n = getBaseSost(sql);
    n = n * 2;

    if (fixEnabled(32854286)) {
        // fixed code
        n = n + 8;
    } else {
        // original code
        n = n + 10;
    }

    n = n / 3;
    n = n - 5;
    return n;
}
```

```
int optimGenerateCost(char *sql) {
    n = getBaseSost(sql);
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        // fixed code
        n = n + 8;
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        n = n + 10;
    }

    n = n / 3;
    n = n - 5;
    return n;
}
```

```
int optimGenerateCost(char *sql) {  
    n = getBaseSost(sql);  
    n = n * 2;
```

```
    if (fixEnabled(32854286)) {  
        // fixed code  
        n = n + 8;  
    } else {  
        // original code  
        n = n + 10;  
    }  
}
```

```
    n = n / 3;  
    n = n - 5;  
    return n;
```

```
}
```



The fix is installed, but disabled

```
-- Selectively enable a specific optimizer fix

exec dbms_optim_bundle.set_fix_controls(
  fix_control_string      => '32854286',
  scope                  => 'BOTH',
  current_setting_precedence => 'NO'
);
```

```
-- List all optimizer fixes
```

```
set serveroutput on;
```

```
exec dbms_optim_bundle.getBugsforBundle;
```



- Home
- Parameters
- Users, Roles, etc
- Privileges
- Included Fixes
 - List of Fixes
 - Total Fixes
 - Search Fixes
 - List of CVEs
 - CPU Explore
 - Fix Control
- Oracle Database Ho...
- Objects
- Fixed Objects
- Audit
- System

Version Selector

Source Release 19c	Source Patch Level 19.3.0 (Base Release)
Target Release 19c	Target Patch Level 19.30.0

List Mode

V_\$SYSTEM_FIX_CONTROL

Added Removed Modified

BUGNO	VALUE	SQL_FEATURE	DESCRIPTION	OPTIMIZER_FEATURE_ENABLE	EVENT	IS_DEFAULT
9876287	0	QKSFM_PQ_9876287	Fix perf slowdown due to wait event PXNSQ:PQLOADINFOQUERY		0	1
10123661	0	QKSFM_CURSOR_SHARING_10123661	Enable cursor sharing for AS OF queries		0	1
17295505	0	QKSFM_OBJ_EXT_17295505	allow stateful-access to image operator for ODCI table function		0	1
18101156	0	QKSFM_PARTITION_18101156	no RowCR for global index access on partitioned table		0	1

- Home
- Parameters
- Users, Roles, etc
- Privileges
- Included Fixes**
 - List of Fixes
 - Total Fixes
 - Search Fixes
 - List of CVEs
 - CPU Explore
 - Fix Control
- Oracle Database Ho...
- Objects
- Fixed Objects
- Audit
- System

BUGNO	VALUE	SQL_FEATURE	DESCRIPTION	OPTIMIZER_FEATURE_ENABLE	EVENT	IS_DEFAULT
			table			
29487407	0	QKSFM_SQL_CODE_GENERATOR_29487407	Streamline traversal of CAST_PSR operator		0	1
29499077	0	QKSFM_CBO_29499077	correct sel for LIKE preds with char binds holding numeric data		0	1
29590666	0	QKSFM_ALL_29590666	Do not perform xmlexists(fn:not) rewrite		0	1
29651517	0	QKSFM_COMPILATION_29651517	do not mark load into CDT as multi-start with result cache		0	1
29653132	0	QKSFM_ALL_29653132	Force the usage of BLOB in XMLAGG and XMLELEMENT		0	1
29657973	0	QKSFM_ACCESS_PATH_29657973	for update: force VC base column into row vector for top qbc onl		0	1
29687220	0	QKSFM_CBO_29687220	improve costing for indexes with empty statistics.		0	1
29696242	0	QKSFM_ACCESS_PATH_29696242	use only the best auto index for access path analysis		0	1
29712727	0	QKSFM_DYNAMIC_SAMPLING_29712727	analysis of skipped non-empty table partitions		0	1

1 - 50 of 306 >





The Release Update should fix it.
Why does it still fail?

- Check for a matching fix control

Should You Enable Optimizer Fixes?

PATCHING



Selective enable optimizer fixes
Enable all, if you can properly test

NEW DATABASE



Enable all optimizer fixes
Perform testing

Further Information

Optimizer Fixes



- [Managing "installed but disabled" bug fixes in Database Release Updates using DBMS_OPTIM_BUNDLE \(KB142297\)](#)
- [ORAdiff - Fix Control](#)
- Blog post: [Should you enable fix controls with DBMS_OPTIM_BUNDLE?](#)



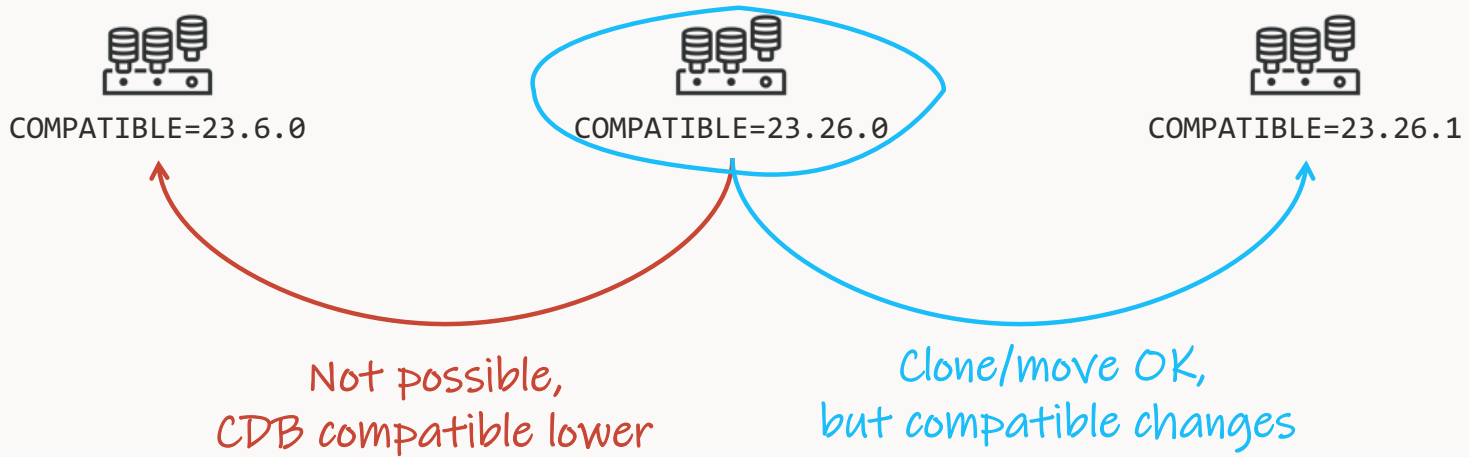
Don't raise COMPATIBLE when you patch



In rare cases, new functionality requires that you raise **COMPATIBLE** after patching

- Vector functionality
- Blockchain and immutable tables

Compatible





- You can now update the COMPATIBLE parameter without a restart
- Works within a release, e.g., from 23.9.0 to 23.26.0
- Cross-release changes, e.g., 19.0.0 to 23.9.0, still requires a restart

```
alter database set downgrade compatibility to '23.9.0';
```





Purge old rollback scripts from the data dictionary

Rollback Scripts



Apply/rollback scripts

```
$ORACLE_HOME/sqlpatch/.../nnn_apply.sql  
$ORACLE_HOME/sqlpatch/.../nnn_rollback.sql
```



Rollback scripts:

```
INSERT INTO REGISTRY$SQLPATCH  
VALUES ... ;
```

```
INSERT INTO REGISTRY$SQLPATCH_RU_INFO  
VALUES ... ;
```

PATCH_ID	RU_VERSION	RU_BUILD_TS	LOB_SIZE_MB
29517242	19.3.0.0.0	04/10/2019 12:27:20	4
30125133	19.5.0.0.0	09/09/2019 18:05:49	18
30557433	19.6.0.0.0	12/17/2019 15:50:04	24
30869156	19.7.0.0.0	04/04/2020 03:50:18	30
31281355	19.8.0.0.0	07/03/2020 03:15:01	37
31771877	19.9.0.0.0	09/30/2020 18:32:49	43
32218454	19.10.0.0.0	01/08/2021 18:50:17	51
32545013	19.11.0.0.0	04/13/2021 00:40:09	59
32904851	19.12.0.0.0	07/16/2021 14:18:10	67
33192793	19.13.0.0.0	10/04/2021 16:50:50	75
33515361	19.14.0.0.0	12/25/2021 12:21:23	83
34133642	19.16.0.0.0	07/03/2022 02:22:23	99
34419443	19.17.0.0.0	09/24/2022 22:40:51	108
34765931	19.18.0.0.0	01/11/2023 17:17:38	116
35643107	19.21.0.0.0	09/30/2023 15:19:51	141

15 rows selected.

```
CON_ID  LOB_SIZE_MB
```

```
-----
```

```
1      953
```

```
2      953
```

```
3      953
```

```
...
```

```
4098   953
```



--Available since 19.28.0. Purges no longer needed zip files.

--Run in off-peak period after patching

`./datapatch -purge_old_metadata`

Major retailer in
the US

Saved **20 TB/year** in total:

- *5000 DBs*
- *5 PDBs (3 PDBs + Root + Seed)*
- *200 Mb in each per patch*
- *4 patches annually*

Datapatch Purge

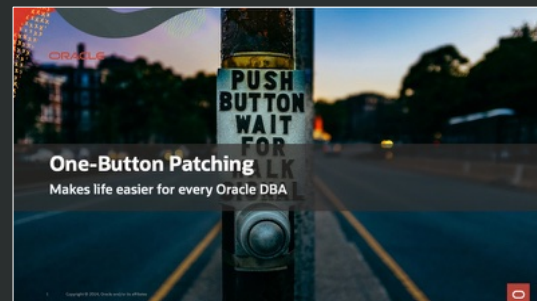
- Removes the rollback scripts for all patches (except the currently applied)
- Doesn't prevent rolling back the currently applied patches
- Doesn't remove the patching history, just the rollback scripts

Webinar

One-Button Patching

Makes life easier for every Oracle DBA

Recording on [YouTube](#)
Get the [slides](#)



Patch smarter, not harder

Makes life easier for every Oracle DBA

Recording on [YouTube](#)
Get the [slides](#)



Hands-on Lab

Patch Me If You Can

It's better to fail in our lab, than in production



[Access lab on Oracle Live Labs](#)

Key Learnings



- 1 Apply the Release Update
- 2 Stay current
- 3 Use AutoUpgrade

BREAK

We start again at 13:30

Performance and Migrations

What's the Worst That Can Happen?





Photo by [Dave Hoefler](#) on [Unsplash](#)



What's the worst that can happen
after the migration?



What if we had a *one-button* tool that points out the bad statements...



SQL Performance Analyzer

Database Licensing Information User Manual



1 Licensing Information

- [Introduction](#)
- [Oracle AI Database Offerings](#)
- [Permitted Features, Options, and Management Packs by Oracle AI Database Offering](#)
- [Oracle AI Database Options and Their Permitted Features](#)
- [Oracle Management Packs and Their Permitted Features](#)
- [Checking for Feature, Option, and Management Pack Usage](#)
- [Special License Rights](#)
- [Restricted Use Licenses](#)

1.1 Introduction

This Licensing Information document is a part of the product or program documentation under the terms of your Oracle license agreement and is intended to help you understand the program editions, entitlements, restrictions, prerequisites, special license rights, and/or separately licensed third party technology terms associated with the Oracle software program(s) covered by this document (the "Program(s)"). Entitled or restricted use products or components identified in this document that are not provided with the particular Program may be obtained from the Oracle Software Delivery Cloud website (<https://edelivery.oracle.com>) or from media Oracle may provide. If you have a question about your license rights and obligations, please contact your Oracle sales representative, review the information provided in Oracle's Software Investment Guide (<http://www.oracle.com/us/>



Oracle Real Application Testing

Extra cost option: **EE-ES**

Included option: **BaseDB EE, BaseDB EE-HP, BaseDB EE-EP, ExaDB**

Oracle Real Application Testing includes the following features:

- Database Replay
- SQL Performance Analyzer (SPA)
 - Database Migration Planner
 - Database Migration Workbench

Database Replay

- The Oracle Real Application Testing license is required on both capture and replay systems for Database Replay and is charged by the total number of CPUs on those systems. Licensing is also charged by the total number of CPUs on both systems when the capture is done on any read-only standby database and the workload is replayed on a True Cache.
- Use of Capture and Replay ASH Analytics Reports, Compare Period ADDM Reports, and Replay Compare Period Reports also requires an Oracle Diagnostics Pack license.
- An Oracle Real Application Testing license permits you to access Database Replay functionality through Oracle Enterprise Manager, as well as through the following database server command-line APIs:
DBMS_WORKLOAD_CAPTURE package and DBMS_WORKLOAD_REPLAY package.
The use of the DBMS_WORKLOAD_REPLAY.COMPARE_PERIOD_REPORT () function also requires a license for Oracle Diagnostics Pack.

SQL Performance Analyzer (SPA)

An Oracle Real Application Testing license permits you to access SQL Performance Analyzer functionality through Oracle Enterprise Manager, as well as through the following database server command-line API: DBMS_SQLPA





PERFORMANCE STABILITY

1

CAPTURE

2

ANALYZE

3

FIX

4

REMEDY

1

CAPTURE

Capture
workload information
into SQL Tuning Set

2

ANALYZE

3

FIX

4

REMEDY

SQL Tuning Set | Definition

SQL Tuning Set



SQL statement

Context

Statistics

Plans





```
--Capture directly from cursor cache at regular intervals  
exec DBMS_SQLSET.CAPTURE_CURSOR_CACHE ( ... );
```

```
--One time sample from cursor cache  
exec DBMS_SQLSET.SELECT_CURSOR_CACHE ( ... );
```



```
--Capture directly from cursor cache at regular intervals  
exec DBMS_SQLSET.CAPTURE_CURSOR_CACHE ( ... );
```

```
--One time sample from cursor cache  
exec DBMS_SQLSET.SELECT_CURSOR_CACHE ( ... );
```

```
--Capture from AWR  
SQL> exec DBMS_SQLSET.SELECT_WORKLOAD_REPOSITORY ( ... );
```

```
SQL> select name, statement_count from dba_sqlset;
```

NAME	STATEMENT_COUNT
SALES_APP_WORKLOAD	43

```
SQL> select view_name from dba_views where view_name like  
'DBA%SQLSET%';
```

VIEW_NAME

DBA_SQLSET

DBA_SQLSET_REFERENCES

DBA_SQLSET_STATEMENTS

DBA_SQLSET_BINDS

DBA_SQLSET_PLANS





Automatic SQL Tuning Set captures statements at regular intervals

- Off by default

```
SQL> select name, statement_count from dba_sqlset;
```

NAME	STATEMENT_COUNT
SALES_APP_WORKLOAD	43
SYS_AUTO_STS	3320



Gather at least a full month of workload data

- Assist in testing your database
- Useful in solving post-migration performance problems

```
EXEC DBMS_SQLSET.PACK_STGTAB ( ... );
```

...

```
EXEC DBMS_SQLSET.UNPACK_STGTAB ( ... );
```

-- If you have many bind variables in your queries, increase the number of binds
-- to capture from 400 (default) to 3999 (max)

```
alter system set "_cursor_bind_capture_area_size"=3999;
```



Further Information

SQL Tuning Set



- Blog post: [Oracle SQL Tuning Sets \(STS\) – The foundation for SQL Tuning](#)
- Blog post: [What is the automatic SQL tuning set?](#)

1

CAPTURE

2

ANALYZE

Analyze performance after migration using SQL Performance Analyzer

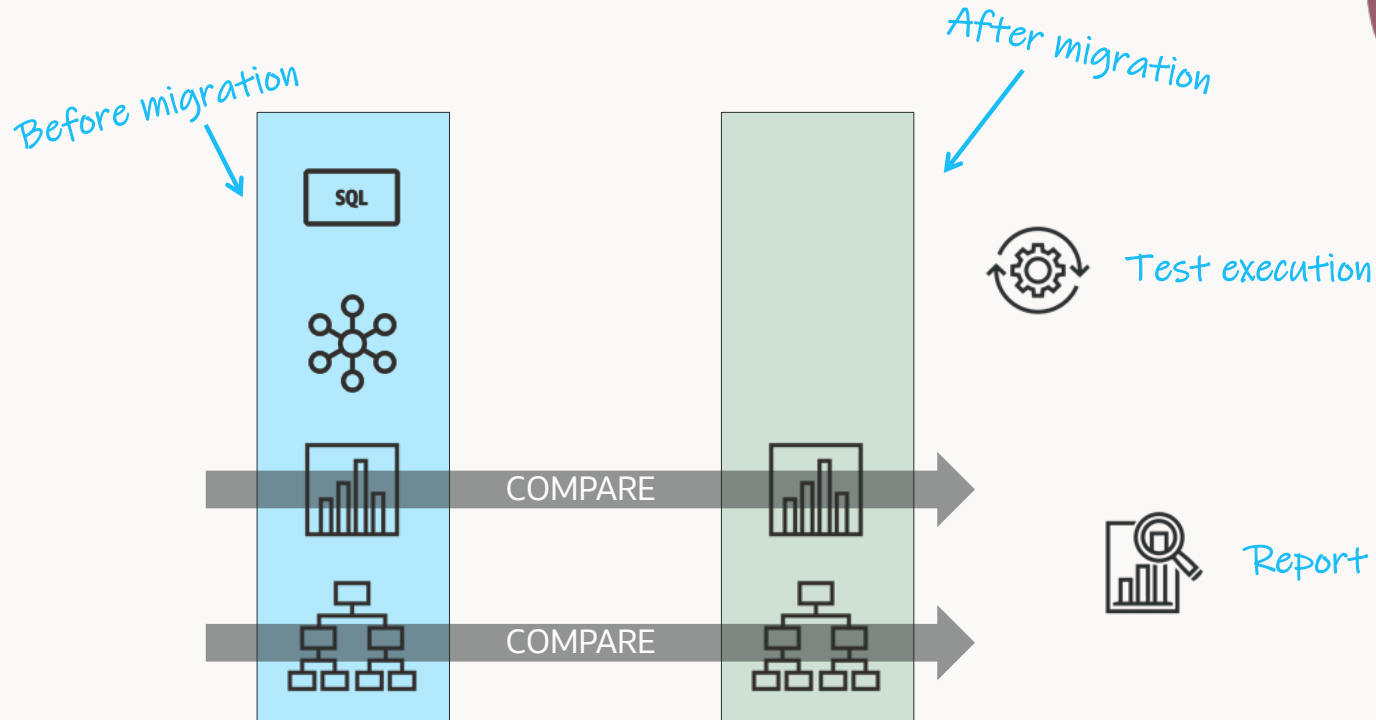
3

FIX

4

REMEDY

SQL Performance Analyzer



Report Summary

Projected Workload Change Impact:

Overall Impact : 4.64%
Improvement Impact : 30.98%
Regression Impact : -26.35%

SQL Statement Count

SQL Category	SQL Count	Plan Change Count
Overall	43	5
Improved	1	1
Regressed	1	1
Unchanged	30	3
Unsupported	11	0

Top 32 SQL Sorted by Absolute Value of Change Impact on the Workload

object_id	sql_id	Impact on Workload	Execution Frequency	Metric Before	Metric After	Impact on SQL	Plan Change
83	f90zn75aphu4w	30.98%	2828	139319.505304102	41950	69.89%	y
47	0cwuxyv314wcg	-26.35%	18254	981.459680070122	13809	-1306.99%	y
80	csv0xdm9c394t	-.36%	2734	4689.26664228237	5868	-25.14%	n
60	4hbzjyh4p336s	.21%	2818	668.862668559262	10	98.5%	n
76	a8ntu3081hfgw	-.18%	2818	262.609297374024	828	-215.3%	y

Report Summary

Projected Workload Change Impact:

Overall Impact : 4.64%
Improvement Impact : 30.98%
Regression Impact : -26.35%

SQL Statement Count

SQL Category	SQL Count	Plan Change Count
Overall	43	5
Improved	1	1
Regressed	1	1
Unchanged	30	3
Unsupported	11	0

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80	csv0xdrm9c394t	-.36%	2734	4689.26664228237	5868	-25.14%	n
60	4hbzjyh4p336s	.21%	2818	668.862668559262	10	98.5%	n
76	a8ntu3081hfgw	-.18%	2818	262.609297374024	828	-215.3%	y

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60	4hbzjyh4p336s	.21%	2818	668.862668559262	10	98.5%	n
76	a8ntu3081hfgw	-.18%	2818	262.609297374024	828	-215.3%	y

SQL Details:

Object ID : 47
Schema Name : TPCC
Container Name : Unknown (con_dbid: 344460545)
SQL ID : 0cwuxyv314wcg
Execution Frequency : 18254
SQL Text : SELECT ROWID FROM CUSTOMER WHERE C_W_ID = :B3 AND C_D_ID = :B2 AND C_LAST = :B1

Bind Variables:

1 - (NUMBER): 3
2 - (NUMBER): 7
3 - (VARCHAR2): ESEEINGOUGHT

Execution Statistics:

Stat Name	Impact on Workload	Value Before	Value After	Impact on SQL
elapsed_time	-26.35%	.000981	.013809	-1306.99%
parse_time			.000477	
cpu_time	-106.5%	.000494	.013743	-2681.43%
user_io_time			0	
buffer_gets	-130.82%	253	7252	-2759.03%
cost	-745969.19%	255	1982	-677.25%
reads	0%	0	0	0%
writes	0%	0	0	0%

SQL Details:

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elapsed_time	-26.35%	.000981	.013809	-1306.99%
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buffer_gets	-130.82%	253	7252	-2759.03%
cost	-745969.19%	255	1982	-677.25%
reads	0%	0	0	0%
writes	0%	0	0	0%

Execution Plan Before Change:

Plan Hash Value : 612465046

Id	Operation	Name	Rows	Bytes	Cost	Time
0	SELECT STATEMENT				255	
1	SORT ORDER BY		2	92	255	00:00:01
2	TABLE ACCESS BY INDEX ROWID BATCHED	CUSTOMER	2	92	254	00:00:01
3	INDEX RANGE SCAN	CUSTOMER_I1	3000		10	00:00:01

Execution Plan After Change:

Plan Id : 545

Plan Hash Value : 4040750106

Id	Operation	Name	Rows	Bytes	Cost	Time
0	SELECT STATEMENT		2	92	1982	00:00:01
1	SORT ORDER BY		2	92	1982	00:00:01
* 2	TABLE ACCESS FULL	CUSTOMER	2	92	1981	00:00:01

Predicate Information (identified by operation id):

- 2 - filter("C_LAST"=:B1 AND "C_D_ID"=:B2 AND "C_W_ID"=:B3)

Execution Plan Before Change:

Plan Hash Value : 612465046

Id	Operation	Name	Rows	Bytes	Cost	Time
0	SELECT STATEMENT				255	
1	SORT ORDER BY		2	92	255	00:00:01
2	TABLE ACCESS BY INDEX ROWID BATCHED	CUSTOMER	2	92	254	00:00:01
3	INDEX RANGE SCAN	CUSTOMER_I1	3000		10	00:00:01

Execution Plan After Change:

Plan Id : 545

Plan Hash Value : 4040750106

Id	Operation	Name	Rows	Bytes	Cost	Time
0	SELECT STATEMENT		2	92	1982	00:00:01
1	SORT ORDER BY		2	92	1982	00:00:01
* 2	TABLE ACCESS FULL	CUSTOMER	2	92	1981	00:00:01

Predicate Information (identified by operation id):

- 2 - filter("C_LAST"=:B1 AND "C_D_ID"=:B2 AND "C_W_ID"=:B3)



You don't need to connect your app
to use SQL Performance Analyzer



You can use SQL Performance Analyzer
to test any change to your database



Schema changes may interfere with
SQL Performance Analyzer

Further Information

SQL Performance Analyzer



- Blog post: [Smooth transition to Autonomous Database using SPA](#)

1

CAPTURE

2

ANALYZE

3

FIX

Fix regressing statements

4

REMEDY

Fixing Statements

Most cloud offerings have access to a number of tools:

- SQL Tuning Advisor
- Real-time SQL Monitoring
- SQL Access Advisor



Perhaps you even have access to a DBA



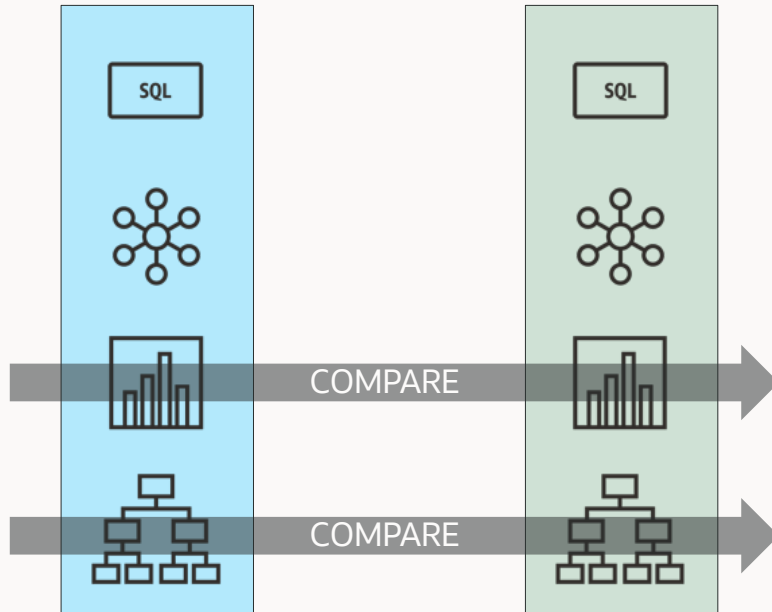
You could also ask ChatGPT



What is the best fix?

- Does it have any side effects?

Continuous Improvement



Continuous Improvement



Implement
change



Test
execute



Check
outcome



Repeat

1

CAPTURE

2

ANALYZE

3

FIX

4

REMEDY

Stabilize performance
using
SQL Plan Management

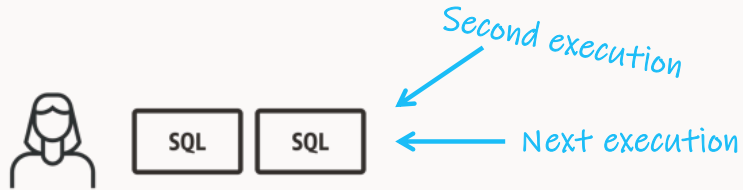


SQL Plan Management is the best tool
to ensure plan stability

-- Toggles creation of SQL plan baselines for all repeatable statements
-- Usually, not recommended to capture and create baselines for all statements

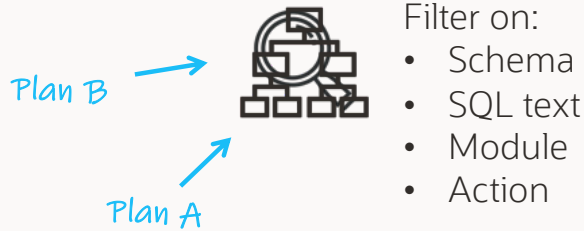
```
alter system set optimizer_capture_sql_plan_baselines=true;
```

SQL Plan Management



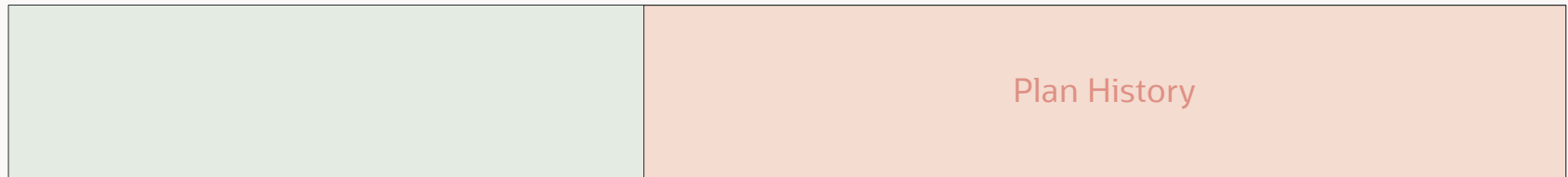
Something changed:

- New statistics
- New parameters
- Upgrade



No plans in baseline

Plan history



Plan A
Accepted

Plan B
Not accepted



```
-- Restricts the optimizer to only use plans that are accepted  
-- This is the default value
```

```
alter system set optimizer_use_sql_plan_baselines=true;
```



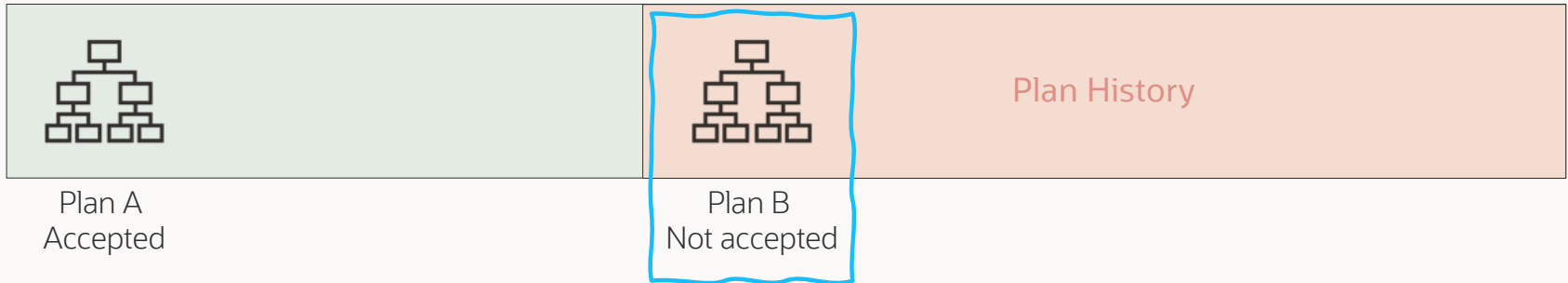
SQL Plan Management

SQL

Optimizer chooses one of the accepted plans

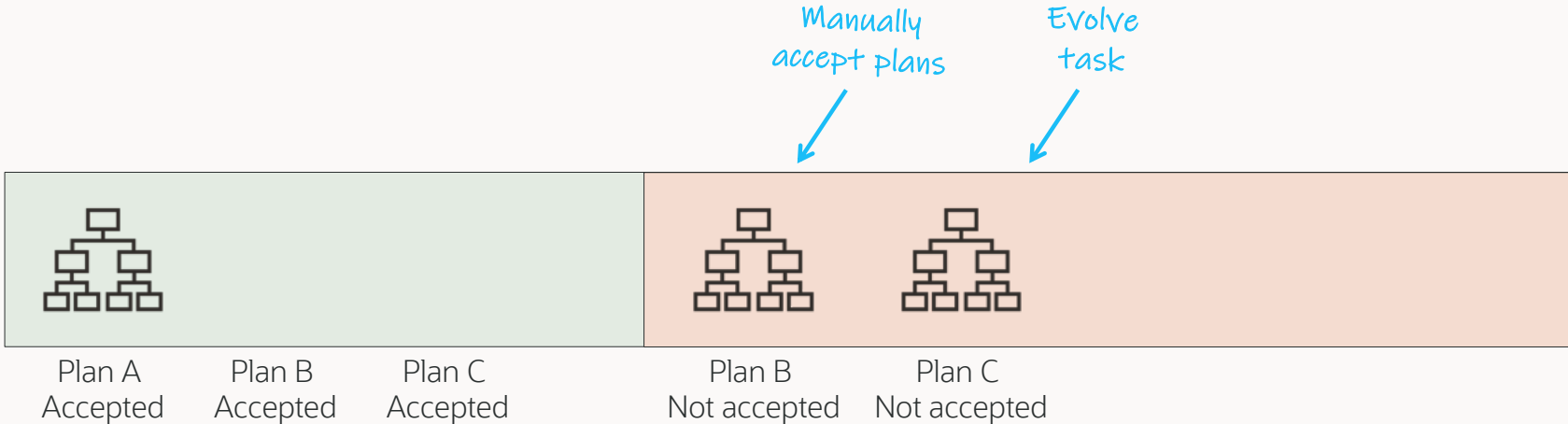


Optimizer discards plan B



SQL Plan Management

SQL



```
-- The database stores plans in the plan history for 53 weeks.  
-- This might consume a lot of space. Consider lowering the limit.
```

```
exec dbms_spm.configure('plan_retention_weeks', 5);
```





You can manually create plan baselines for specific statements

- Don't capture all plans

```
-- Load all plans from a SQL tuning set into plan baselines
-- Plans are accepted automatically without test execution
```

```
var cnt number;
```

```
exec :cnt := DBMS_SPM.LOAD_PLANS_FROM_SQLSET(  
    basic_filter => 'sql_id='''0cwuxyv314wcg''',  
    ...  
);
```





Plan baselines are transportable;
create in test, use in production

```
-- Pack baselines from "problematic" statements into staging table  
exec DBMS_SPM.PACK_STGTAB_BASELINE(sql_handle => SQL_130f372d9ffe4df9, ...);
```



```
-- Pack baselines from "problematic" statements into staging table  
exec DBMS_SPM.PACK_STGTAB_BASELINE(sql_handle => SQL_130f372d9ffe4df9, ...);  
exec DBMS_SPM.PACK_STGTAB_BASELINE(sql_handle => SQL_51dc7232adc62849, ...);  
exec DBMS_SPM.PACK_STGTAB_BASELINE(sql_handle => SQL_3f38bc33ae7086c9, ...);
```



```
-- Pack baselines from "problematic" statements into staging table
exec DBMS_SPM.PACK_STGTAB_BASELINE(sql_handle => SQL_130f372d9ffe4df9, ...);
exec DBMS_SPM.PACK_STGTAB_BASELINE(sql_handle => SQL_51dc7232adc62849, ...);
exec DBMS_SPM.PACK_STGTAB_BASELINE(sql_handle => SQL_3f38bc33ae7086c9, ...);
```

...

```
-- After production migration, import plan baselines to fix regressions
exec DBMS_SPM.UNPACK_STGTAB_BASELINE( ... );
```



Let's automate it

Automatic SQL Plan Management



-
- Background job (30 min)
 - Finds resource-intensive SQLs
 - Evaluate execution statistics against previous executions

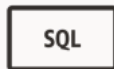
Automatic SQL Plan Management



-
- Creates a plan baseline with the best plan
 - Next execution uses an accepted plan

 - Oracle Database 19c Enterprise Edition, RU 19.22
 - Exadata and Autonomous AI Database

Real-Time SQL Plan Management



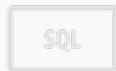
-
- User executes SQL
 - Optimizer chooses a different execution plan
 - Executes with new plan

Real-Time SQL Plan Management



-
- Compares execution statistics with history
 - Comparison is performed in the [user foreground session](#)

Real-Time SQL Plan Management



-
- Creates a plan baseline with the best plan
 - Next execution uses an accepted plan
-
- Oracle AI Database 26ai Enterprise Edition
 - Autonomous AI Database 19c



Here's one for the **Top Gun DBA**

```
--Loads all known plans from cursor cache, AWR,  
--and automatic SQL tuning sets into a SQL plan baseline.  
--Use Evolve Advisor to find the best plan and mark that as accepted.
```

```
var report clob;  
exec :report := dbms_spm.add_verified_sql_plan_baseline('<sql_id>');  
select :report report from dual;
```

SQL

Who said literals?

- SQL Plan Management is not a good fit for an application that doesn't use bind variables

--Application using literals creates many distinct statements

--You'd get 4 plan baselines

```
select * from sales where order_id=42;
```

```
select * from sales where order_id=56;
```

```
select * from sales where order_id=101;
```

```
select * from sales where order_id=220;
```

--Application using literals creates many distinct statements

--You'd get 4 plan baselines

```
select * from sales where order_id=42;
```

```
select * from sales where order_id=56;
```

```
select * from sales where order_id=101;
```

```
select * from sales where order_id=220;
```

--Ideally change the application to use literals

--You'd get only 1 plan baseline

```
select * from sales where order_id=:b1;
```



Generally, avoid setting
`CURSOR_SHARING=FORCE`

- [Advice from Real-World Performance Group](#)



Use SQL Profiles

- Part of Tuning Pack included in most cloud offerings

Further Information

SQL Plan Management



- Blog post: [SQL Plan Management Cheat Sheet – Part 1](#)
- Blog post: [SQL Plan Management Cheat Sheet – Part 2](#)
- Blog post: [What is automatic SQL plan management and why should you care?](#)
- Blog post: [What is Real-time SQL plan Management?](#)
- My Oracle Support: [Things to Consider to Avoid SQL Plan Management \(SPM\) Related Problems on 19c \(KB139467\)](#)

1

CAPTURE

2

ANALYZE

3

FIX

4

REMEDY

A Word About Statistics



PHYSICAL



LOGICAL



PHYSICAL



LOGICAL

Statistics



Object Statistics

Statistics Preferences

Column Usage Information

Statistics



Statistics Preferences

Object Statistics

Column Usage Information

BEGIN

DBMS_STATS.SET_TABLE_PREFS (

OWNNAME => 'APPUSER',

TABNAME => 'SALES',

PNAME => 'TABLE_CACHED_BLOCKS',

PVALUE => '42'

);

END;

Table 171-131 SET_TABLE_PREFS Procedure Parameters

Parameter	Description
ownname	Owner name
tabname	Table name
pname	Preference name. You can set the default value for following preferences: <ul style="list-style-type: none">• APPROXIMATE_NDV_ALGORITHM• AUTO_STAT_EXTENSIONS• CASCADE• DEGREE• ESTIMATE_PERCENT• GRANULARITY• INCREMENTAL• INCREMENTAL_LEVEL• INCREMENTAL_STALENESS• METHOD_OPT• NO_INVALIDATE• OPTIONS• PREFERENCE_OVERRIDES_PARAMETER• PUBLISH• STALE_PERCENT• TABLE_CACHED_BLOCKS
pvalue	Preference value. If NULL is specified, it will set the Oracle default value.



```
EXEC DBMS_STATS.EXPORT_TABLE_PREFS('APPUSER', 'SALES',  
'STAGING_TAB');
```

...

```
EXEC DBMS_STATS.IMPORT_TABLE_PREFS('APPUSER', 'SALES',  
'STAGING_TAB');
```



It is not possible to export or transport global statistics preference

- Define manually using `DBMS_STATS.SET_GLOBAL_PREFS`



You often use statistics preferences to solve a particular problem

- Evaluate whether that problem exists in the target environment

Statistics



Object Statistics

Statistics Preferences

Column Usage Information

Column Usage Information

- Information on how you join tables
- Stored internally in `SYS.COL_USAGE$`
- Used by the optimizer to determine when to create histograms
`METHOD_OPT => ... SIZE AUTO`
- When missing, statistics gathering creates no or few histograms

1

Include statistics in Data Pump

2

Exclude statistics in Data Pump
Regather statistics after import

3

Exclude statistics in Data Pump
Import statistics using DBMS_STATS



Importing statistics using Data Pump is a convenient, but slow option

- Includes object statistics, table-level preferences and column usage information
- Not recommended

1

Include statistics in Data Pump

2

Exclude statistics in Data Pump
Regather statistics after import

3

Exclude statistics in Data Pump
Import statistics using DBMS_STATS



Be sure to gather statistics fast

- Use **DEGREE** and **CONCURRENT** options
- [Blog post](#) by Nigel Bayliss



You're missing preferences and
column usage information





EXCLUDE

EXCLUDE=STATISTICS

COL_USAGE\$ empty



REGATHER

First time only

METHOD_OPT =>
SIZE SKEWONLY



GO LIVE

Column usage
information is
updated



REGATHER

Use default

METHOD_OPT =>
SIZE AUTO

Further Information

Transporting statistics



- Blog post: [How to Export and Import Statistics Faster Using DBMS_STATS in Parallel](#)
- Blog post: [If Importing Statistics Using DBMS_STATS Is Slow](#)
- Blog post: [Does Exporting Database Statistics Include the Dictionary Statistics?](#)
- Video: [Transporting optimizer statistics - pro tips](#)
- Video: [Transporting optimizer statistics - demo](#)
- Video: [Transporting optimizer statistics - the concept](#)

1

Include statistics in Data Pump

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Exclude statistics in Data Pump
Regather statistics after import

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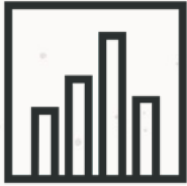
Exclude statistics in Data Pump
Import statistics using DBMS_STATS

```
EXEC DBMS_STATS.EXPORT_SCHEMA_STATS('APPUSER', 'STAGING_TAB');
```

...

```
EXEC DBMS_STATS.IMPORT_SCHEMA_STATS('APPUSER', 'STAGING_TAB');
```





The database considers imported statistics as *current*

- Be sure those statistics are accurate

Importing or transporting statistics might be a bad idea...

When source and target database do not match

Statistics | When Importing Stats Is Bad



Fragmented table

Blocks	12000
Leaf blocks	11000
B-level	4
Clustering factor	10000

Compacted table

Blocks	12000
Leaf blocks	11000
B-level	4
Clustering factor	10000

```
DBMS_STATS.GATHER_TABLE_STATS(...
```

Blocks	5000
Leaf blocks	4000
B-level	2
Clustering factor	20000



Statistics | When Importing Stats Is Bad

- Potentially a problem
 - Fragmented tables
 - Changing block size
 - Changing character set
 - Compress or decompress
 - ...
- Only a problem for table and index base statistics, column statistics remain accurate



Comparing **STATISTICS**

options

	Import with Data Pump	Regather	Import with DBMS_STATS
Time	Significant	Significant	Short
Column usage information	Included	Missing	Missing
Accuracy	Potentially inaccurate	Accurate	Potentially inaccurate
Statistics preferences	Included	Missing	Optional

Our Favorite

1. Perform test migration
 - Regather in test database
 - Test and adjust
 - Export statistics using `DBMS_STATS`
2. Perform production migration
 - Import from test migration



Autonomous AI Database gathers statistics differently

Statistics and Migrations

Well-Kept Secrets Revealed

June 18 2026, 14:00 CET - [Sign Up](#)



Hands-on Lab

Hitchhiker's Guide for upgrading to Oracle AI Database 26ai

It's better to fail in our lab, than in production



[Access lab on Oracle Live Labs](#)

Key Learnings



- 1 Gather workload information
- 2 Analyze with SQL Performance Analyzer
- 3 Use SQL Plan Management

BREAK

We start again at 15:15



Autonomous AI Database Migrations

Made easy – a sneak preview

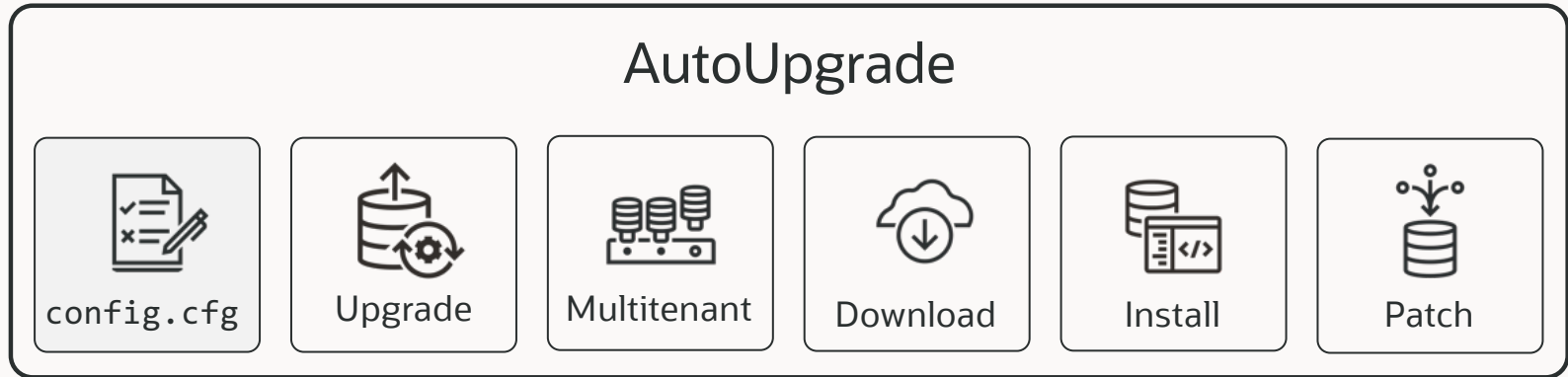
KEYNOTE PRESENTATION

Oracle OpenWorld San Francisco 2017



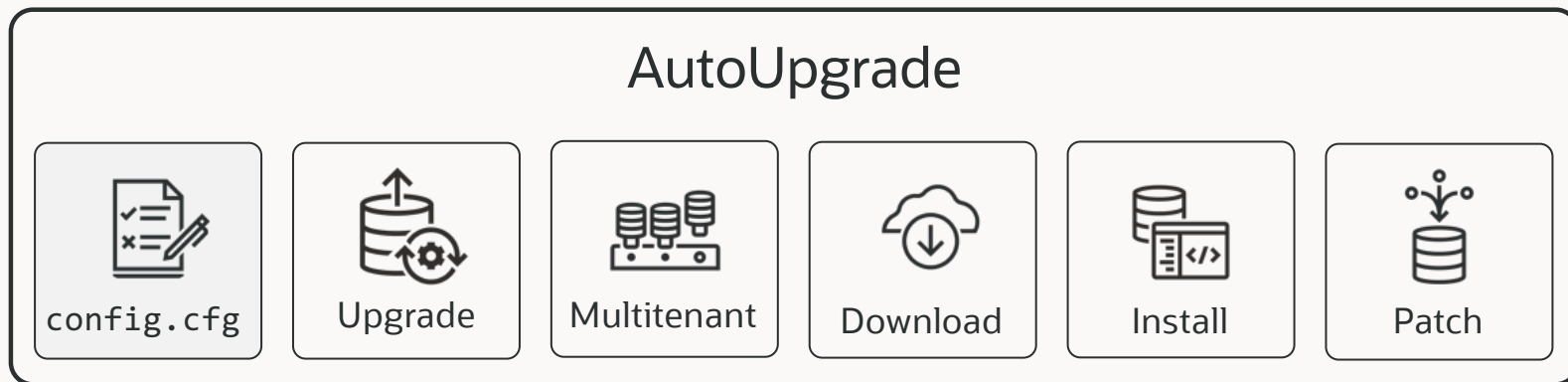
Recap AutoUpgrade

End-to-end automation



Recap AutoUpgrade

End-to-end automation

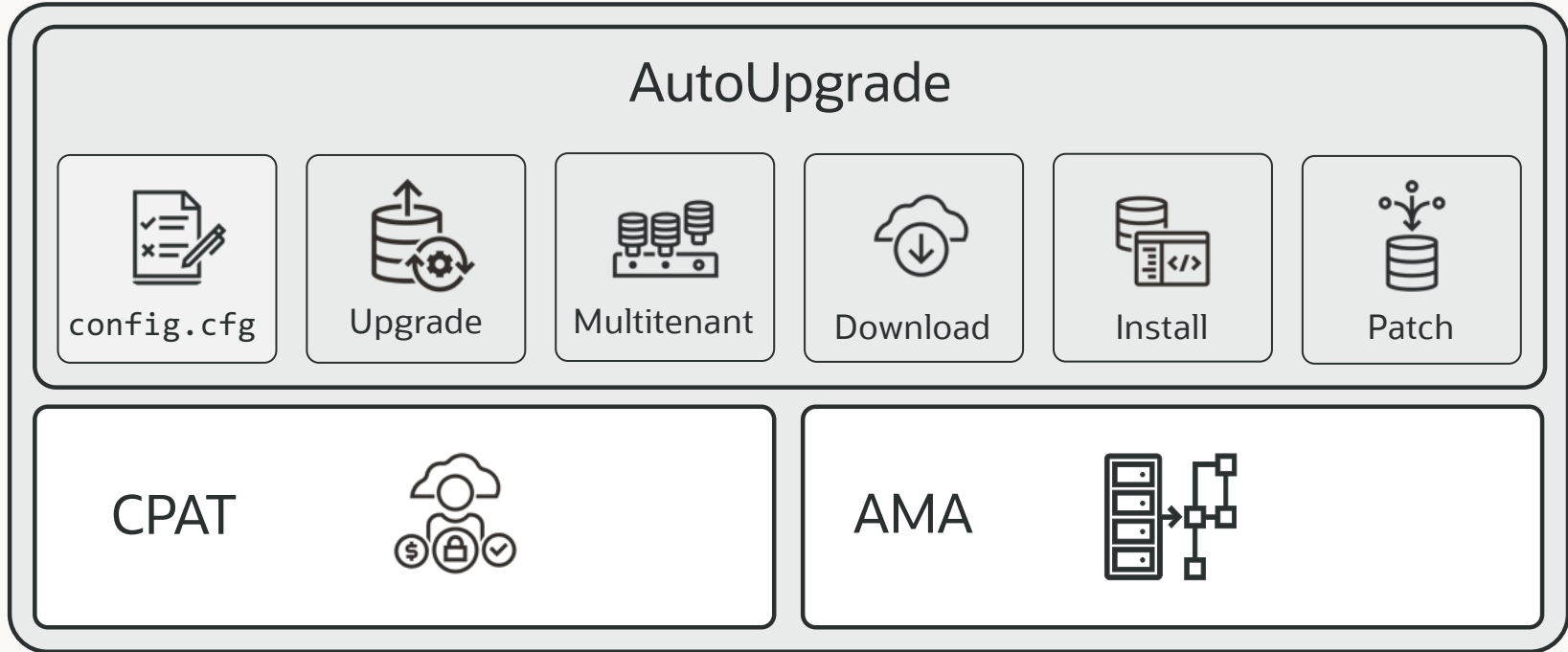


- Small, flexible, agile, available on all platforms
- Prechecks, pre/post-fixups
- Used by thousands of customers
- Deployed in every Oracle home



Why shouldn't AutoUpgrade migrate databases to Oracle Autonomous AI Database Serverless?

Overview



What if we combine these tools together?
And there it is, **AutoMigrate!!**



AutoMigrate

What we are going to do



ADB migrations for every DBA

Simple and well-known interface

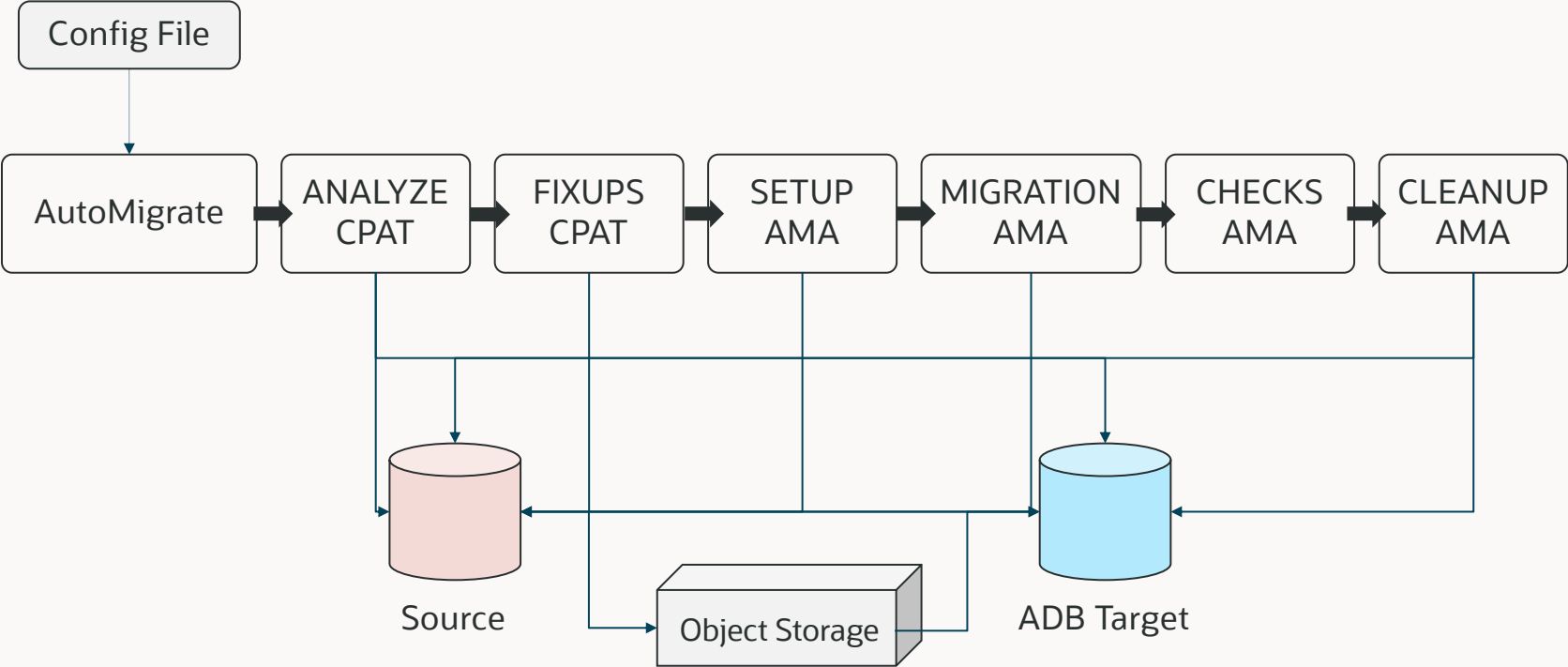
Available everywhere

Works with Windows as source platform

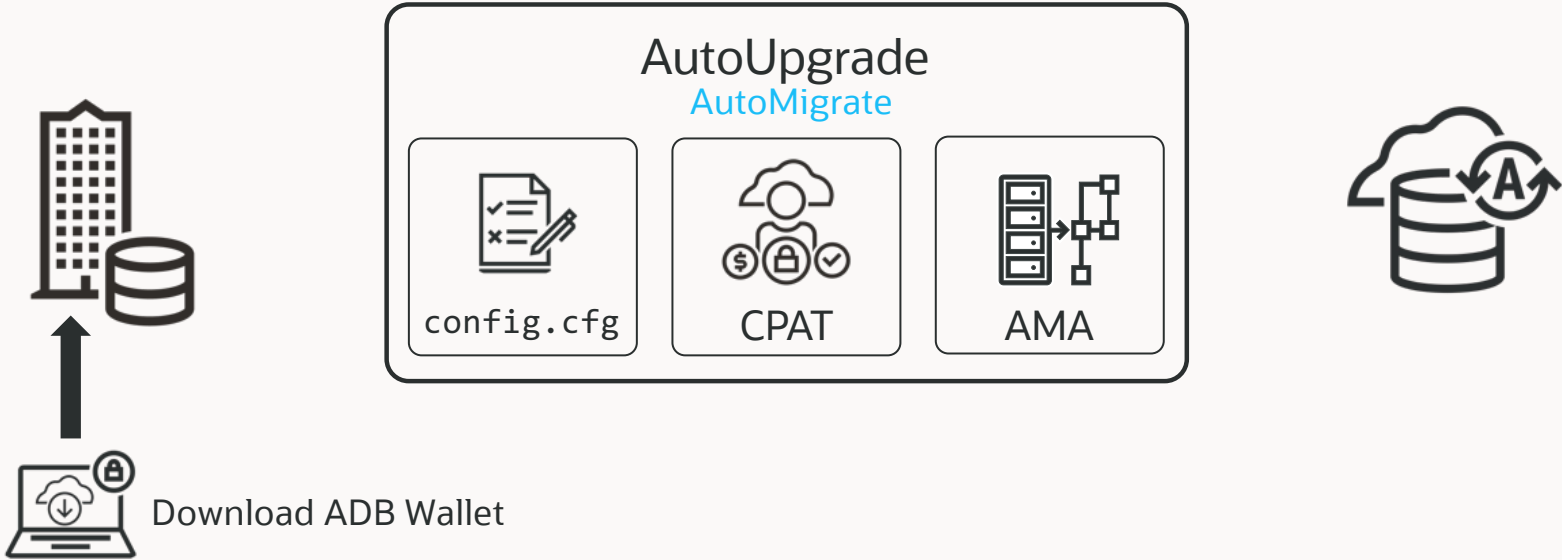
Can be embedded in any automation framework

Can be embedded into other tools

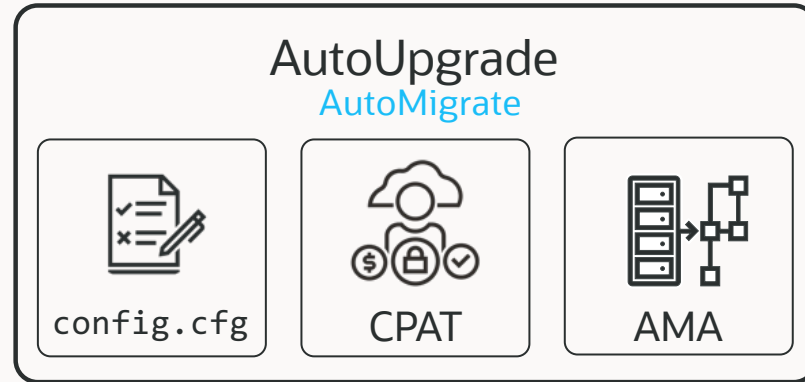
Conceptual Overview



Architecture Overview



Architecture Overview

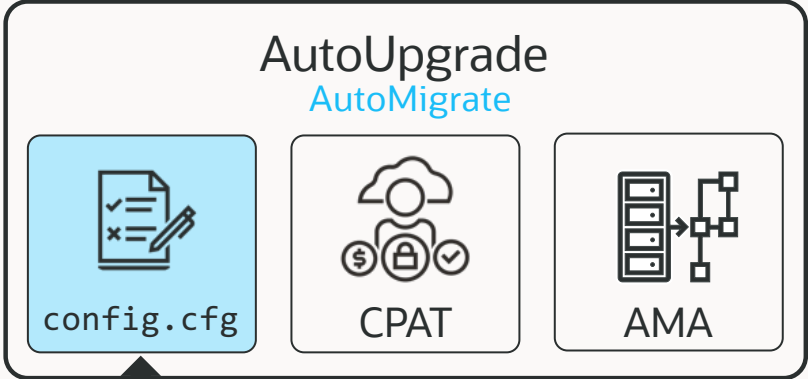


Load passwords into CPAT keystore (SEPS)

- ADMIN user
- Data Pump dump file encryption password (optional)
- Token for objectstore (if no pre-auth URL is used)



Architecture Overview



Edit config.cfg



global.**keystore**=/home/oracle/AUTOMIGRATE_DEMO/KEYSTORE

global.**username**=ADMIN

demo26ai.**source_home**=/opt/oracle/product/26ai/dbhomeFree

demo26ai.**sid**=FREE

demo26ai.**src_pdb_name**=FREEPDB1

demo26ai.**src_pdb_service_name**=localhost:1521/FREEPDB1

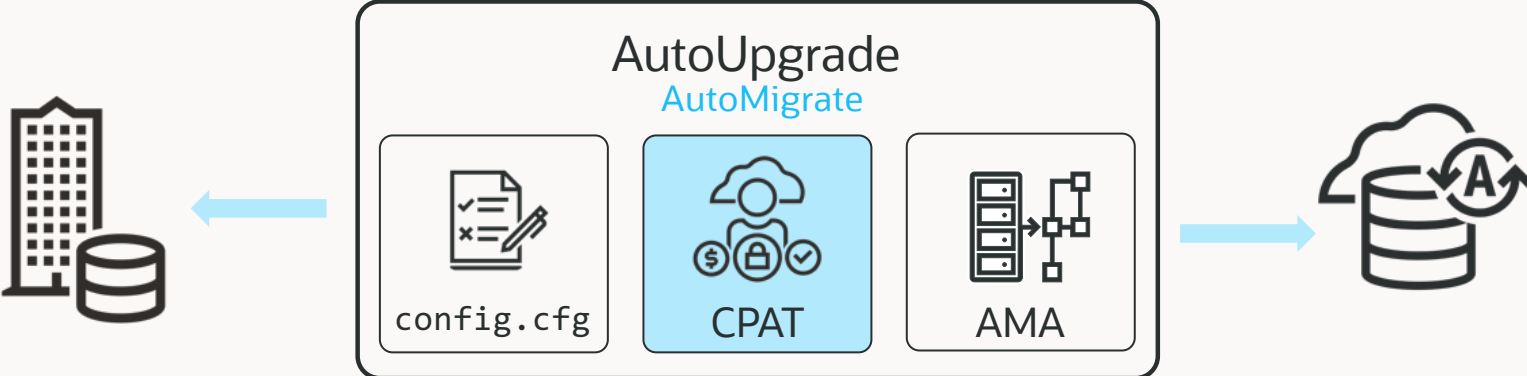
demo26ai.**target_service_name**=amademo26_tpurgent

demo26ai.**target_wallet_location**=/home/oracle/AUTOMIGRATE_DEMO/WALLET

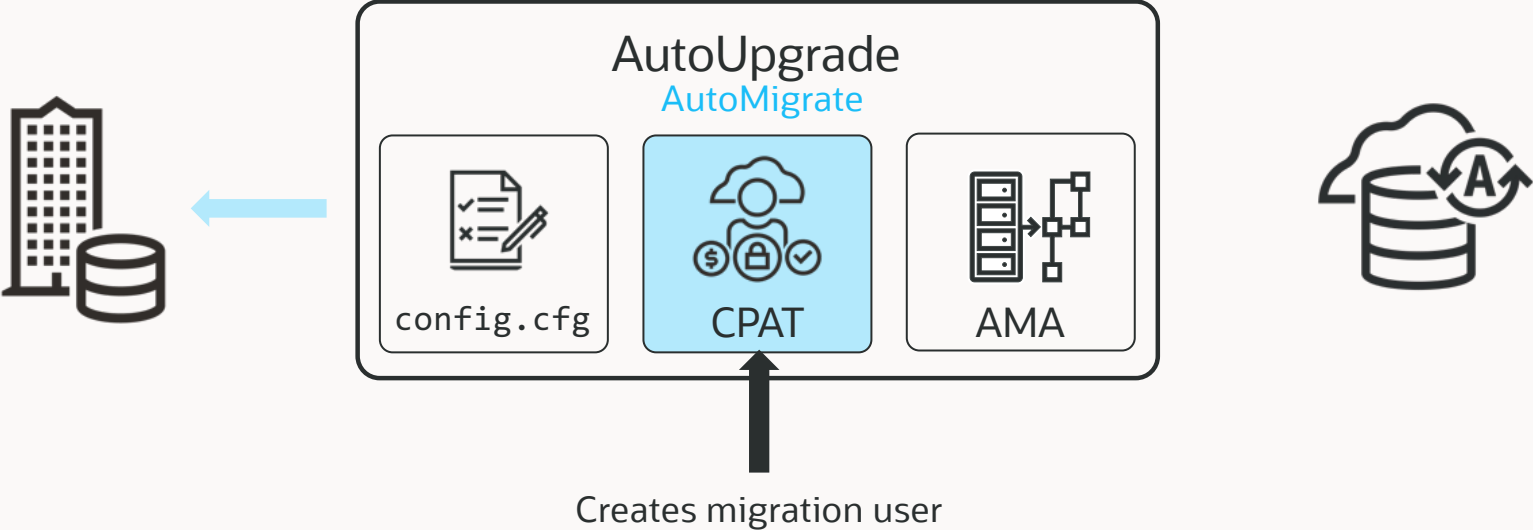
demo26ai.**curl_target_url**=https://swiftobjectstorage.eu-frankfurt-1.oraclecloud.com/v1/oradbclouducm/AMADemo/

demo26ai.**curl_target_user_name**=ORACLE-SSO/klaus.gronau@oracle.com

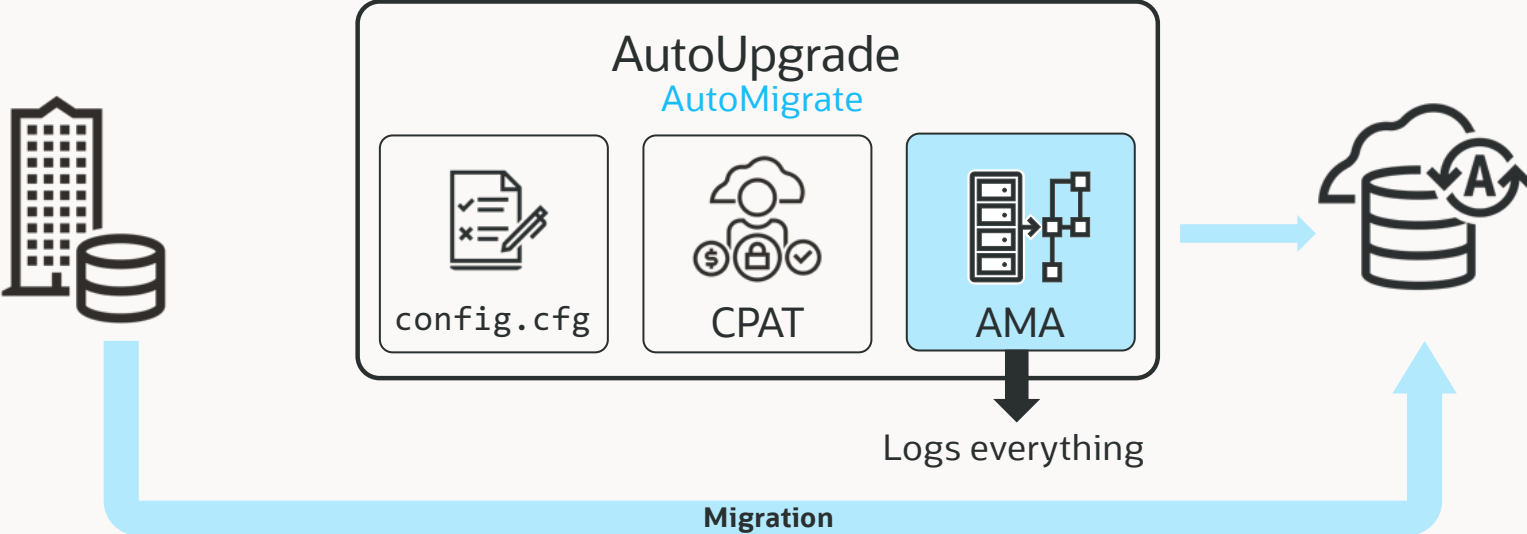
Architecture Overview



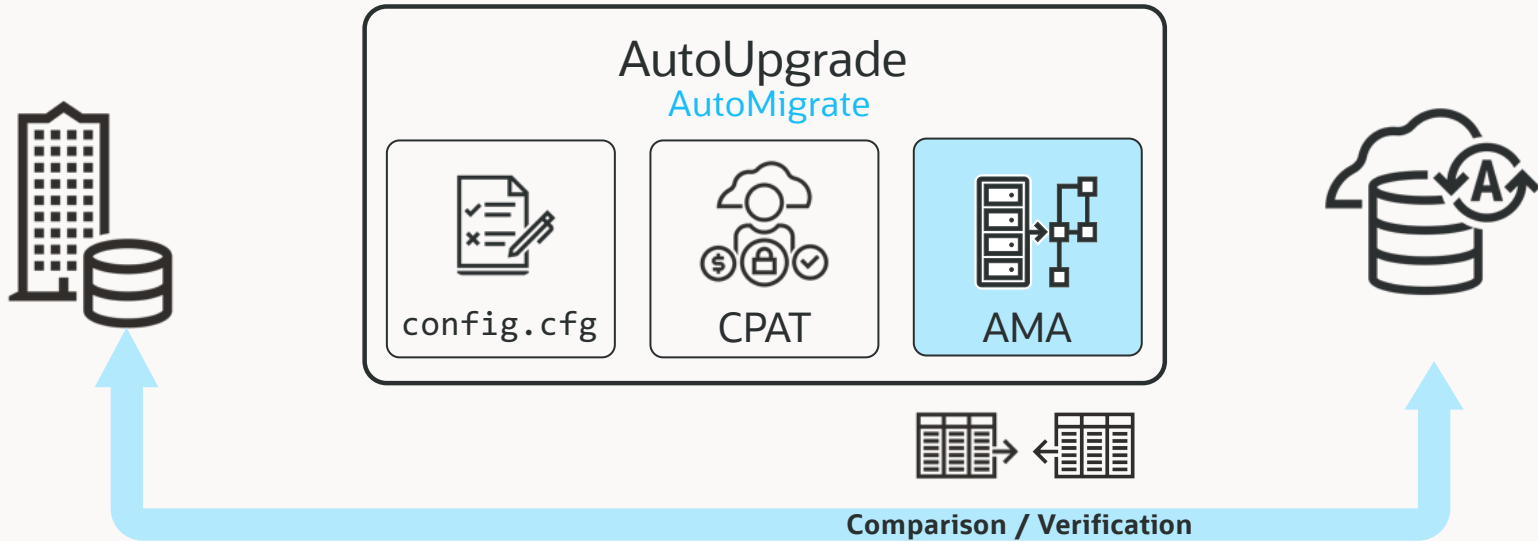
Architecture Overview



Architecture Overview



Architecture Overview



Comparison / Verification

- Invalid objects
- Table row count
- Object count



AutoMigrate Sneak Preview



Download required

- **AutoUpgrade** from oracle.com or MOS
- **CPAT** from oracle.com or MOS
- **Wallet** for Autonomous Serverless from cloud.oracle.com
- **Token** for the Object Storage

DEMO

AutoMigrate

- Migrate a local database of 15GB into Oracle Autonomous AI Database



Demo

Regression testing DB with plenty of objects

- Size: 15GB
- Duration: 20 mins – end-to-end migration

```
[oracle@47544c5be592 100]$ more autoupgrade_20260310.log
2026-03-10 07:16:26.809 INFO [23]
build.MOS_LINK:https://support.oracle.com/support/?anchorId=&kmContentId=2485457&page=sptemplate&sptemplate=km-article
....
2026-03-10 07:32:44.057 INFO [27] Adding Job context key[dispatcher_stage] value[4] for job [100] - CommonBackBone.addJobContext#270
2026-03-10 07:32:44.057 INFO [27] Stopping background threads for Job - JobDefinition.stopJobThreads#132
2026-03-10 07:32:44.058 INFO [27] [0] threads have been stopped by JobDefinition - JobDefinition.stopJobThreads#134
2026-03-10 07:32:44.058 INFO [27] Dispatcher finished for 100 - RunJobDefinition.runJob#177
2026-03-10 07:32:44.058 INFO [27] End - RunJobDefinition.runJob#178
2026-03-10 07:32:44.059 INFO [27] -----Stages Summary----- - Utilities.writeStageSummary#1153
2026-03-10 07:32:44.059 INFO [27]     SETUP <1 min - Utilities.writeStageSummary#1153
2026-03-10 07:32:44.059 INFO [27]     MIGRATIONCPATANALYZE <1 min - Utilities.writeStageSummary#1153
2026-03-10 07:32:44.059 INFO [27]     MIGRATIONCPATFIXUPS <1 min - Utilities.writeStageSummary#1153
2026-03-10 07:32:44.059 INFO [27]     MIGRATIONAMA 16 min - Utilities.writeStageSummary#1153
2026-03-10 07:32:44.059 INFO [27]     COMPLETED <1 min - Utilities.writeStageSummary#1153
2026-03-10 07:32:44.059 INFO [27] End of dispatcher instance for N/A - CommonBackBone.finalJobLogging#436
```



Prototype is already fully operational

- If you want to [beta test](#) from July 1 on, send mail to: mike.dietrich@oracle.com

DBA vs. AI

Harvard Business Review

***“AI won’t replace humans -
but humans with AI will
replace humans without AI”***

Karim Lakhani





AI Database

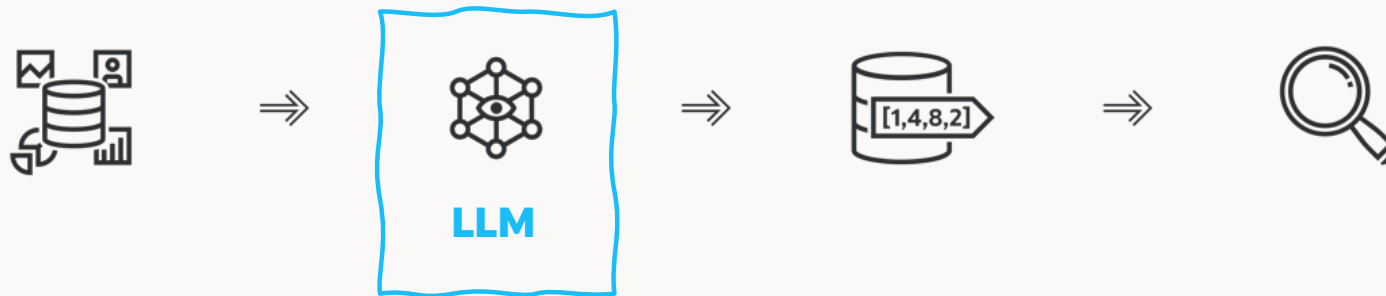


Using AI

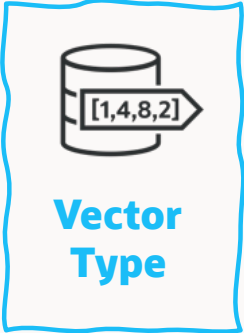
Vector Database



Vector Database



Vector Database



Vector Database





AI Database



Using AI

Let us create an
AutoMigrate Data Pump Log Analyzer
using Oracle AI Database 26ai



What do we need?

Oracle AI Database 26ai

- On-premises or cloud or [Oracle Autonomous AI Database](#)

Transforming model

- [Turning text into Vectors](#), e.g. [Hugging Face's all_MiniLM_L12_v2.onnx](#)

LLM

Table with VECTOR column and VECTOR index

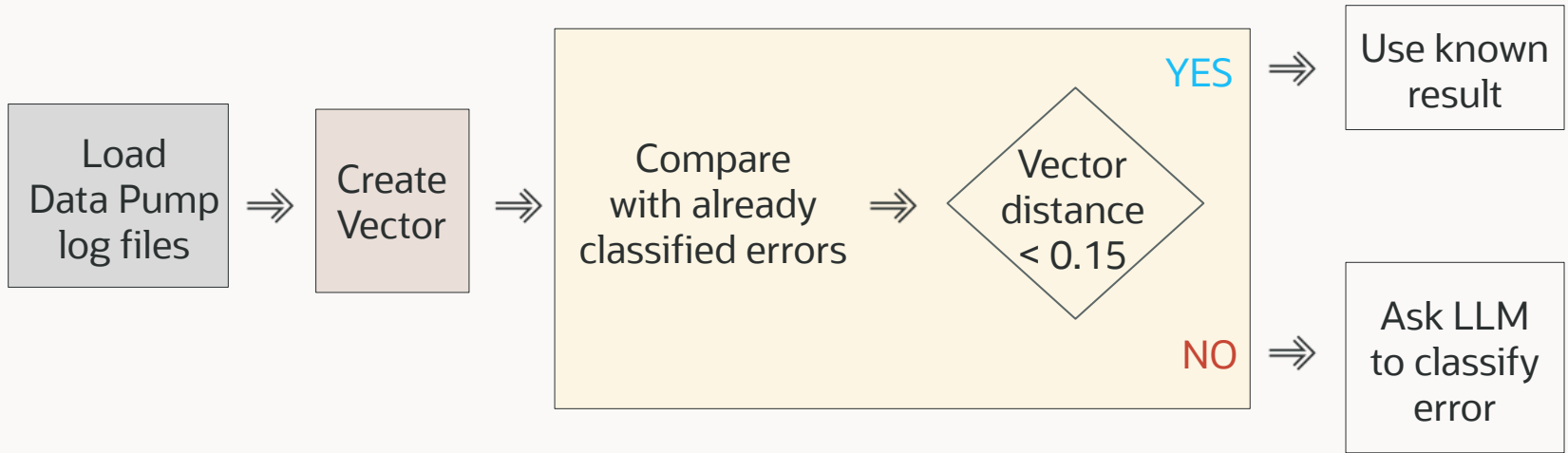
Predefined rules for errors



Analyzing hundreds of Data Pump migration log files



Analyzing hundreds of Data Pump migration log files



It may take a while to load, classify and report

```
Processed 1000 rows; last severity=low
Processed 2000 rows; last severity=medium
Processed 3000 rows; last severity=low
Processed 4000 rows; last severity=medium
Processed 5000 rows; last severity=low
Processed 6000 rows; last severity=medium
Processed 7000 rows; last severity=low
Processed 8000 rows; last severity=medium
Processed 9000 rows; last severity=low
Processed 10000 rows; last severity=medium
Processed 11000 rows; last severity=low
Processed 12000 rows; last severity=medium
Processed 13000 rows; last severity=low
Processed 14000 rows; last severity=medium
Processed 15000 rows; last severity=low
Processed 16000 rows; last severity=low
Done. Total processed=16846
```

Elapsed: 00:32:01.43

```
Report uploaded successfully.
Object URI:
https://.../oracle_error_severity_report.html
```

Elapsed: 00:00:26.75

Example report from test migration with Fusion Apps (FA)

Oracle Error Severity Report

Status: **WARN**

Generated: 2026-05-06 13:10:53.042732000 +00:00

Files: 151

Errors: 37413

Critical: 0

Medium: 18087

Low: 19326

Unclassified: 0

AI: 12226

Exact: 0

Vector: 25187

Critical 0 **Medium 18087** **Low 19326** **Unclassified 0**



AI 12226 **Exact 0** **Vector 25187**



Scope: all errors



Example report from test migration with Fusion Apps (FA)

IMPDP (125 file(s))

critical 0 medium 5 low 13126 errors 13131

00018_PDB1_IMPDP_SCHEMA_FUSION_260430_202439.log critical 0 medium 3 low 12357 errors 12360

00034_PDB1_IMPDP_SCHEMA_AZ_MIG_260430_202439.log critical 0 medium 2 low 2 errors 4



00022_PDB1_IMPDP_SCHEMA_FUSION_GRC_260430_202439.log critical 0 medium 0 low 323 errors 323

00030_PDB1_IMPDP_SCHEMA_FUSION_SETUP_260430_202439.log critical 0 medium 0 low 208 errors 208



Example report from test migration with Fusion Apps (FA)

medium rows 2, messages 2

Seq	Error code	Error message	Source	Confidence	Action	Context / SQL snippet
1	ORA-31685	ORA-31685: Object type SYSTEM_GRANT:"AZ_MIG"."EXPORT FULL DATABASE" failed due to insufficient privileges. Failing sql is: GRANT EXPORT FULL DATABASE TO "AZ_MIG" W-1 Completed 11 SYSTEM_GRANT objects in 0 seconds W-1 Processing object type SCHEMA_EXPORT/ROLE_GRANT	ai	.8	investigate	ORA-31685: Object type SYSTEM_GRANT:"AZ_MIG"."EXPORT FULL DATABASE" failed due to insufficient privileges. Failing sql is: GRANT EXPORT FULL DATABASE TO "AZ_MIG" W-1 Completed 11 SYSTEM_GRANT objects in 0 seconds W-1 Processing object type SCHEMA_EXPORT/ROLE_GRANT
2	ORA-39083	ORA-39083: Object type ROLE_GRANT failed to create with error:	ai	.8	investigate	ORA-39083: Object type ROLE_GRANT failed to create with error:

Example report from test migration with Fusion Apps (FA)

low rows 323, messages 323

Seq	Error code	Error message	Source	Confidence	Action	Context / SQL snippet
1	ORA-31684	ORA-31684: Object type FUNCTION:"FUSION_GRC"."GRC_ACCESS_TYPE_B=" already exists	vector_cache	.95	ignore	ORA-31684: Object type FUNCTION:"FU SION_GRC"."G RC_ACCESS_TY PE_B=" already exists
2	ORA-31684	ORA-31684: Object type FUNCTION:"FUSION_GRC"."GRC_ACCESS_TYPE_TL=" already exists	vector_cache	.95	ignore	ORA-31684: Object type FUNCTION:"FU SION_GRC"."G RC_ACCESS_TY PE_TL=" already exists



What would help you?



Quick Demo

- Microsoft VS Code
- Github Copilot Chat
- SQL Developer Web Extensions for VS Code
- Any LLM

EXTENSIONS

Search Extensions in Marketplace


INSTALLED 5

- Cline** 504ms
Autonomous coding agent right in your IDE, capable of crea...
Cline
- GitHub Copilot Chat** 404ms
AI chat features powered by Copilot
GitHub
- Oracle Code Assist**
Oracle Code Assist
Oracle
- Oracle SQL Developer Extension for VSCode** 91ms
End-to-end development tools for your SQL and PL/SQL ap...
Oracle Corporation
- GitHub Copilot
Your AI pair programmer
GitHub

RECOMMENDED 3

- SQLTools** 6M 3.5
Connecting users to many of the most commonly used data...
Matheus Teixeira [Install](#)
- Vim** 8.3M 4
Vim emulation for Visual Studio Code
vscodevim [Install](#)

MCP SERVERS


MCP Servers
Browse and install [Model Context Protocol \(MCP\)](#)


Untitled-1

```

1 Generate code (*I), or select a language (*K M). Start typing to dismiss or don't show this again.

```

CHAT



Build with Agent

AI responses may be inaccurate.

[Generate Agent Instructions](#) to onboard AI onto your codebase.

Untitled-1

Describe what to build next

Agent GPT-5 mini

Key Learnings



- 1** Precise prompting is important
- 2** Never use a read/write user
- 3** Keep your brain turned on – always!!

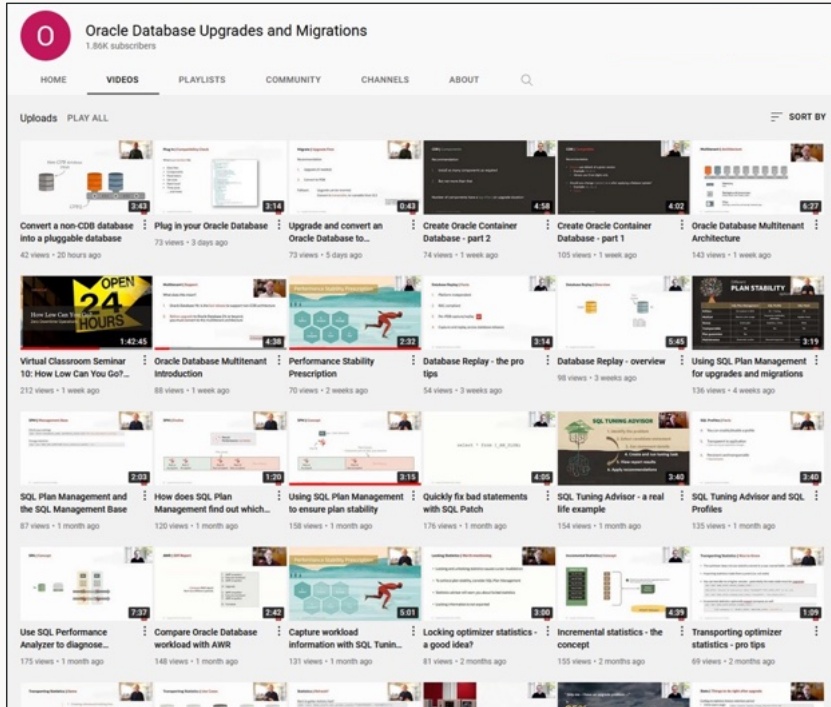
Oracle

DBAs

run the world



YouTube Channel



<https://www.youtube.com/@upgradenow>

- 600+ videos
- New videos every week
- No marketing
- No buzzword
- All tech



ORACLE