

Hitchhiker's Guide to upgrade to Oracle Database 19c

AOUG Everything Cloud? - 2023





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AGENDA

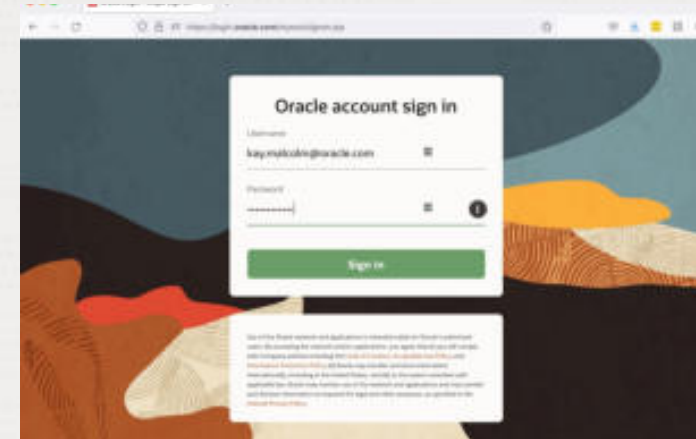
09:30	Intro and labs provisioning
09:45	Upgrade to Oracle Database 19c
10:15	Labs - part 1
11:00	Performance Stability Prescription
11:30	Labs - part 2
11:55	Wrap-up



Requirements for running this HOL



Laptop / Tablet



Oracle Account

Lab Provisioning

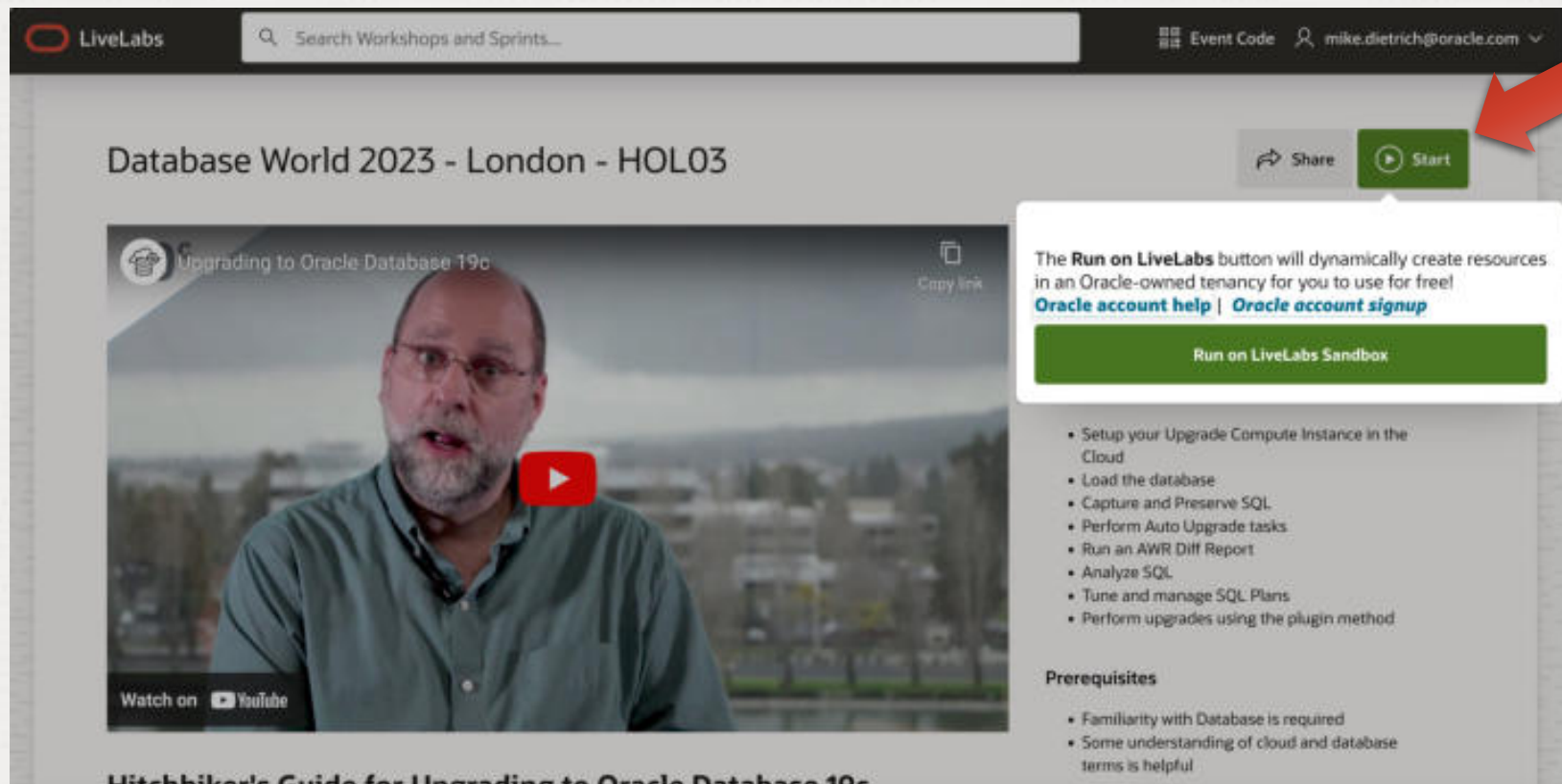
- ➔ Open a web browser
- ➔ Type in this link below to get access to the workshop page

<https://tinyurl.com/aoug2023hol>



Lab Provisioning

Click on the Green Button "Start"



The screenshot shows the LiveLabs interface for a workshop titled "Database World 2023 - London - HOL03". The interface includes a search bar, a user profile, and a video player. A red arrow points to the "Start" button, which is highlighted with a tooltip. The tooltip text reads: "The Run on LiveLabs button will dynamically create resources in an Oracle-owned tenancy for you to use for free! [Oracle account help](#) | [Oracle account signup](#)". Below the tooltip is a green button labeled "Run on LiveLabs Sandbox".

LiveLabs Search Workshops and Sprints... Event Code mike.dietrich@oracle.com

Database World 2023 - London - HOL03

Share Start

Upgrading to Oracle Database 19c Copy link

Watch on YouTube

The Run on LiveLabs button will dynamically create resources in an Oracle-owned tenancy for you to use for free!
[Oracle account help](#) | [Oracle account signup](#)

Run on LiveLabs Sandbox

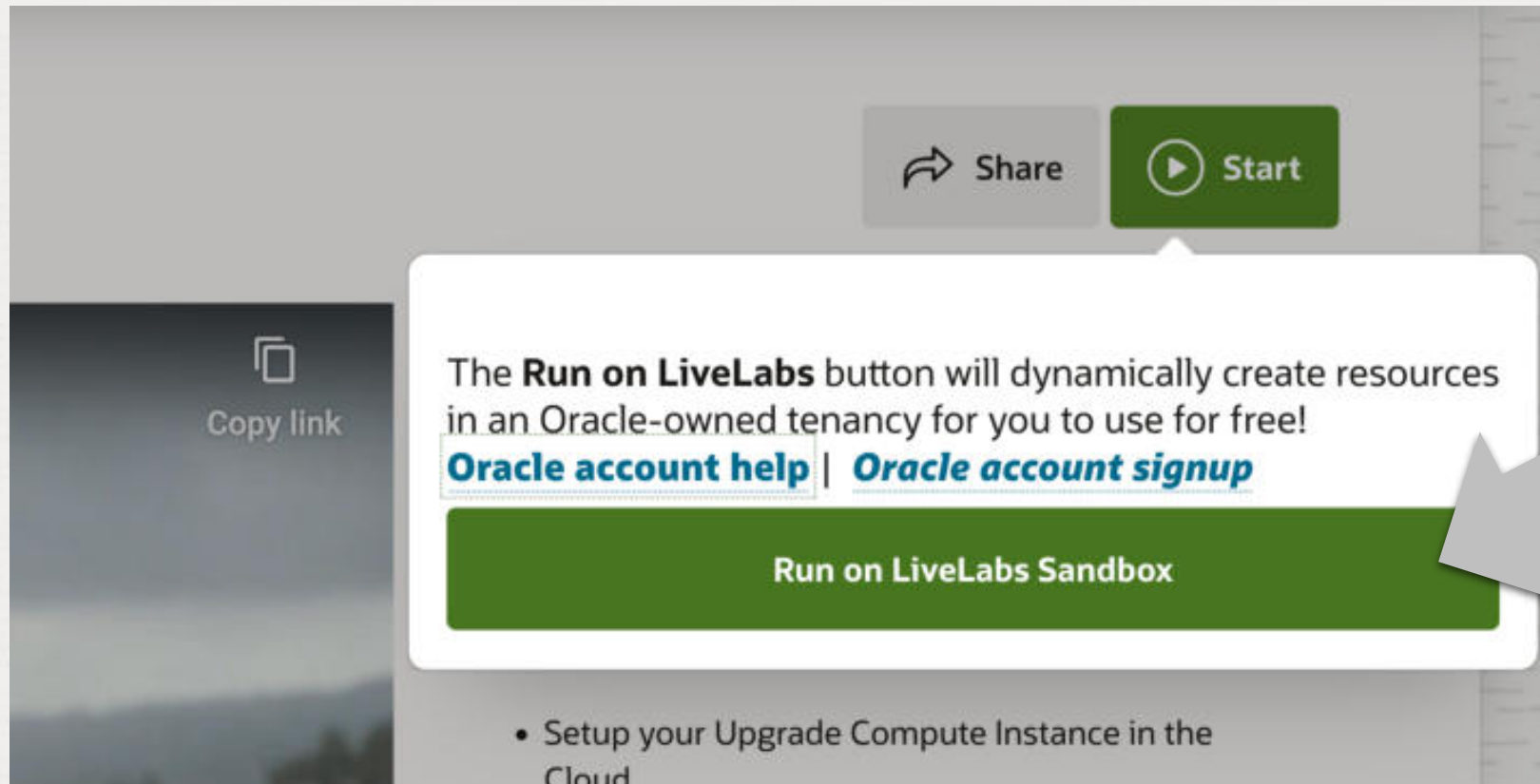
- Setup your Upgrade Compute Instance in the Cloud
- Load the database
- Capture and Preserve SQL
- Perform Auto Upgrade tasks
- Run an AWR Diff Report
- Analyze SQL
- Tune and manage SQL Plans
- Perform upgrades using the plugin method

Prerequisites

- Familiarity with Database is required
- Some understanding of cloud and database terms is helpful

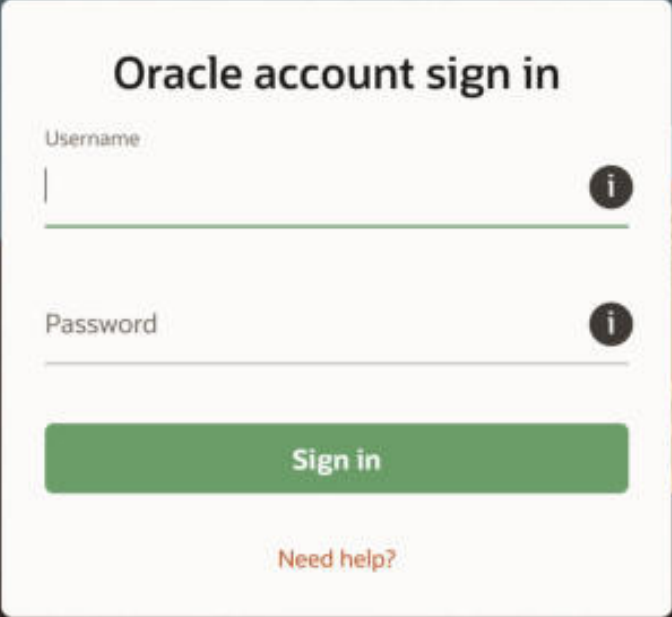
Lab Provisioning

Click on the next Green Button "Run on LiveLabs Sandbox"



Lab Provisioning

Logon with your Oracle SSO user



The image shows a screenshot of the Oracle account sign-in interface. It features a white rectangular form centered on a dark background with abstract orange and blue shapes. The form has the title "Oracle account sign in" at the top. Below the title are two input fields: "Username" and "Password". Each field has a small information icon (a lowercase 'i' inside a circle) to its right. Below the input fields is a green "Sign in" button. At the bottom of the form is a link that says "Need help?" in orange text.

- If you don't have an Oracle SSO User yet, please create one: <https://tinyurl.com/OracleSSO>



Lab Provisioning

Click on "Start Workshop Now", on the CONSENT checkbox, and then "Submit Reservation"

Reserve Workshop [X]

Attendee Email Address
mike.dietrich@oracle.com

Attendee Timezone
US/Eastern (-04:00) [v]
Required

Start Workshop Now?
☒

☒ I consent to receive emails from LiveLabs for my reservation and I agree that I will not upload sensitive personal or company information to Oracle Cloud Infrastructure *

Submit Reservation




Lab Provisioning

This will take you to "My Reservations" – now we have 11 mins to explain the exercises

My Reservations

All your current workshop reservations are shown below. You can edit active or pending reservations, view workshop details, attend an available workshop, or delete a reservation.

Note: The status of your reservations will be emailed to you. Check your mail for any status updates.



Hitchhiker's Guide for Upgrading to Oracle Database 19c
Friday August 19th, 8:44am (08:44) US/Eastern

Status: Estimated remaining setup time: 10m 10s










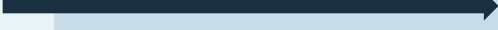


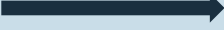




1 - 1



Introduction into the Lab: Hitchhikers Guide to Oracle Database 19c

Upgrade to Oracle Database 19c and ensure performance stability

Lab Overview

	Database 11.2.0.4	Database 12.2	Database 19c
Upgrade to 19c AutoUpgrade	 UPGR 		
Convert to PDB AutoUpgrade			 UPGR     CDB2
Migrate to 19c Full transportable export/import	 FTEX 		 CDB2 / PDB2
Unplug-plug upgrade AutoUpgrade		 PDB3 	 CDB2
Upgrade to 19c AutoUpgrade		 DB12 	



- You have completed
 - Lab: Prepare Setup
 - Lab: Environment Setup
 - Lab: Initialize Environment

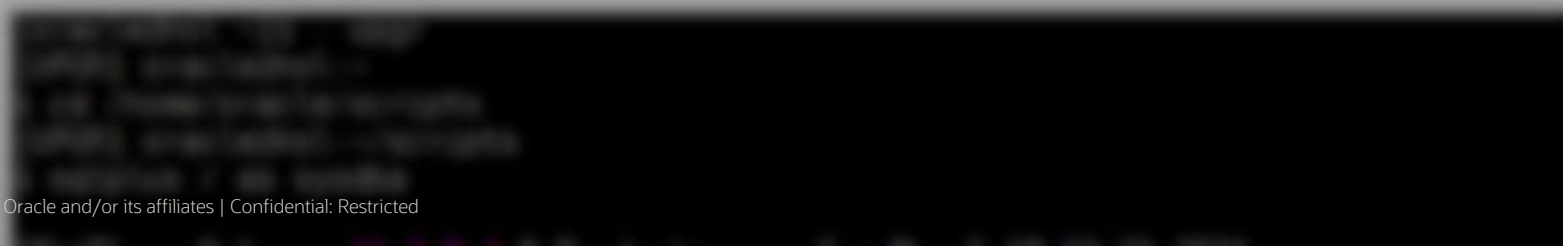
Collapsing All Tasks

Task 1: Generate an AWR snapshot

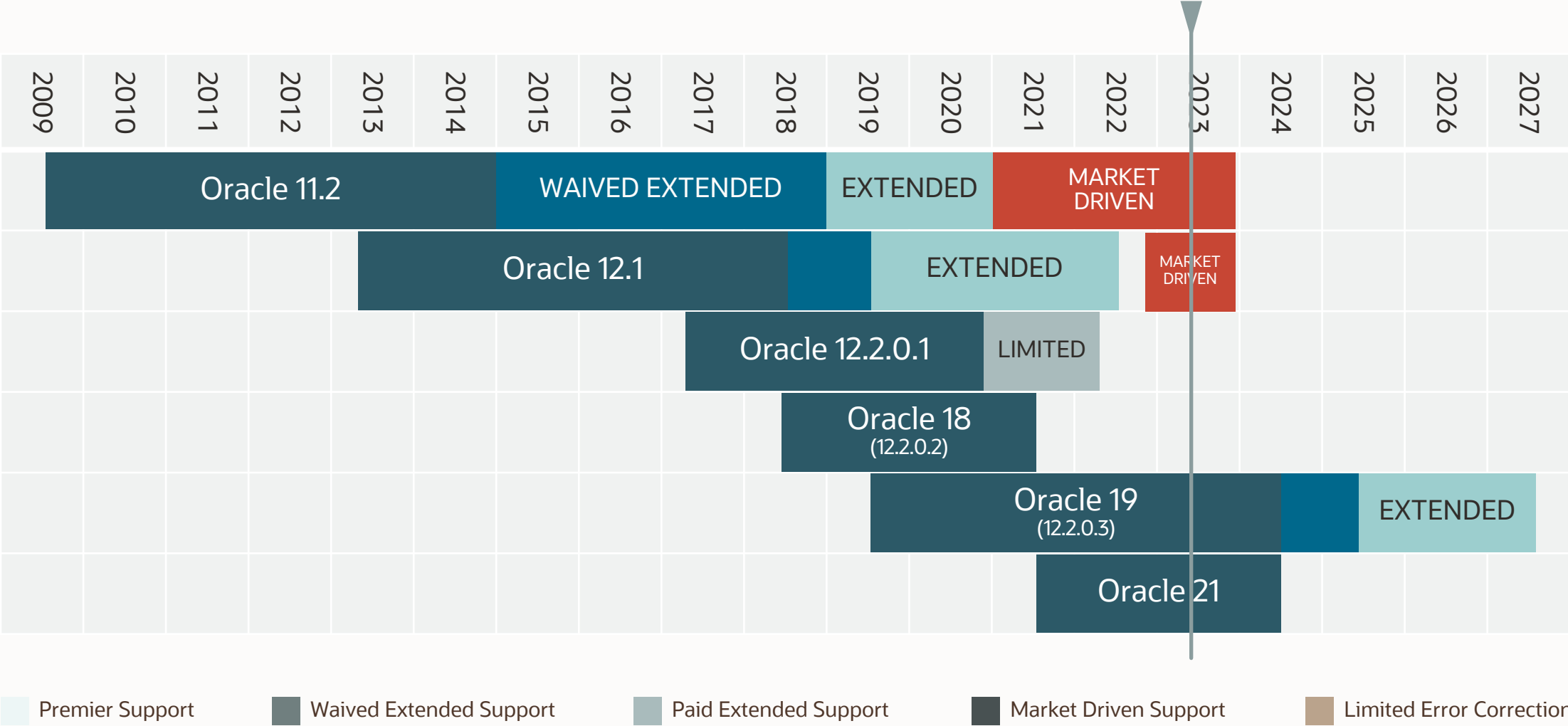
AutoUpgrade

Upgrade to Oracle Database 19c and ensure performance stability

```
cd /home/oracle/upgrade
sqlplus / as sysdba
startup
```



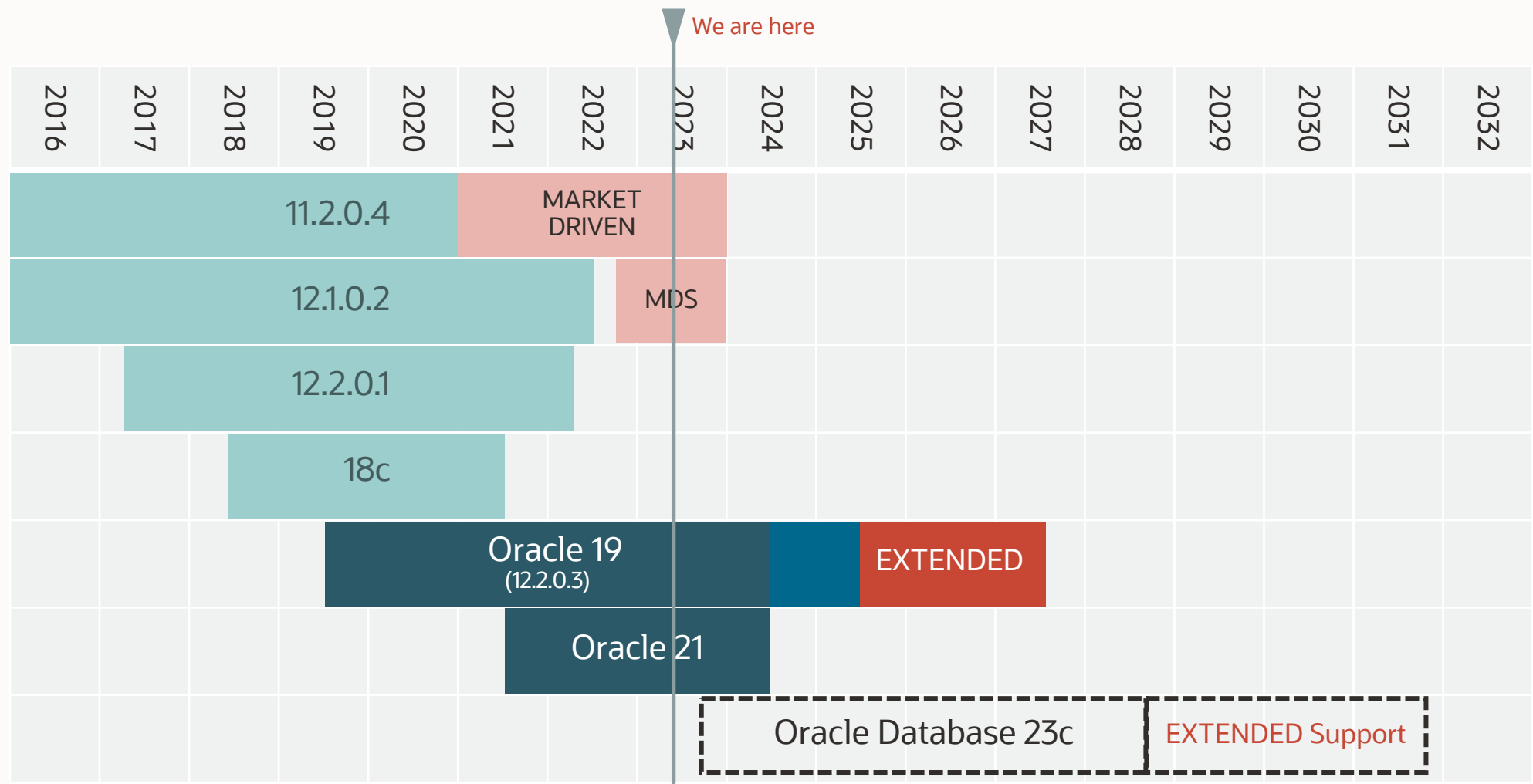
Lifetime Support Policy



Premier Support Waived Extended Support Paid Extended Support Market Driven Support Limited Error Correction



Release Strategy | Make Your Plan



Release Types



LONG TERM SUPPORT

5+ years of Premier Support followed by
3+ years of Extended Support



INNOVATION

2 years of Premier Support
No Extended Support

Innovation

Long Term Support

Extended

Innovation

Long Term Support

Extended



Move production databases from one
Long Term Support release to the next

Next Long Term Support release

Oracle Database 23c

Upgrade possible only from:

- Oracle Database 19c
- Oracle Database 21c

Do you want to upgrade?

Oracle Database 11.2.0.4

Oracle Database 12.1.0.2

Oracle Database 12.2.0.1

Oracle Database 18c

Oracle Database 11.2.0.4
Oracle Database 12.1.0.2
Oracle Database 12.2.0.1
Oracle Database 18c



Oracle Database 19c



Oracle Database 23c



Everybody must upgrade to Oracle Database 19c

- With or without Multitenant

--As of Oracle Database 19c you can create up to 3 PDBs without
--having the multitenant license. Applies to SE2 as well

```
SQL> alter system set max_pdb=3;
```




Have at least a few environments in Oracle Database 19c using Oracle Multitenant

Your path to successful database upgrades

1

Install Oracle Home
including RU and MRP

MOS Note: 2118136.2

MOS Note: 555.1

MOS Note: 2781612.2

2

Download and deploy the
most recent AutoUpgrade

MOS Note: 2485457.1

3

Collect performance
information from current
source and test thoroughly



AutoUpgrade | Overview



AutoUpgrade Overview

START

1. DOWNLOAD

2. CONFIG

3. DEPLOY

SUCCESS

Supported source releases

- 11.2.0.4
- 12.1.0.2
- 12.2.0.1
- 18
- 19

All architectures (CDB and non-CDB)

All supported operating systems

All editions (SE2, EE)

All types (single instance and RAC)



AutoUpgrade Overview

START

1. DOWNLOAD

2. CONFIG

3. DEPLOY

SUCCESS

Always download the newest edition from [MOS Note: 2485457.1](#)



AutoUpgrade Overview

START

1. DOWNLOAD

2. CONFIG

3. DEPLOY

SUCCESS

Shortest possible config text file

```
upg1.source_home=/u01/app/oracle/product/12.2.0.1  
upg1.target_home=/u01/app/oracle/product/19  
upg1.sid=CDB1
```



AutoUpgrade Overview

START

1. DOWNLOAD

2. CONFIG

3. DEPLOY

SUCCESS

One command

```
$ java -jar autoupgrade.jar -config cdb1.cfg -mode deploy
```

Advanced monitoring and logging



AutoUpgrade Overview

START

1. DOWNLOAD

2. CONFIG

3. DEPLOY

SUCCESS

Supported target releases

- 12.2.0.1
- 18
- 19
- 21
- Any future release



AutoUpgrade Essentials




AutoUpgrade | Essentials

Download

Configure
Analyze
Check
Upgrade

Always download [latest version](#) from MOS

 **AutoUpgrade Tool (Doc ID 2485457.1)**

In this Document

- [Main Content](#)
- [Benefits](#)
- [Target Versions Supported](#)
- [AutoUpgrade documentation](#)
- [References](#)

APPLIES TO:

Oracle Database - Enterprise Edition - Version 12.2.0.1 and later
Oracle Database - Standard Edition - Version 12.2.0.1 and later
Information in this document applies to any platform.

MAIN CONTENT

Description
Oracle Database AutoUpgrade allows DBAs to upgrade one or many databases without human intervention, all with one

AutoUpgrade | Essentials

Download

Configure
Analyze
Check
Upgrade

Check your version

```
$ java -jar autoupgrade.jar -version  
  
build.version 22.5.221011  
build.date 2022/10/11 14:23:59 -0400  
build.hash e9428661  
build.hash_date 2022/10/11 12:55:45 -0400  
build.supported_target_versions 12.2,18,19,21  
build.type production
```

AutoUpgrade | Essentials

Download

Configure

Analyze

Check

Upgrade

AutoUpgrade handles older releases as well

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

build.version 22.5.221011
build.date 2022/10/11 14:23:59 -0400
build.hash e9428661
build.hash_date 2022/10/11 12:55:45 -0400
build.supported_target_versions 12.2,18,19,21
build.type production
```

AutoUpgrade | Essentials

Download

Configure

Analyze

Check

Upgrade

Shortest possible config file version

```
upg1.source_home=/u01/app/oracle/product/12.2.0.1  
upg1.target_home=/u01/app/oracle/product/19  
upg1.sid=CDB1
```

Or, generate a sample config file

```
$ java -jar autoupgrade.jar -create_sample_file config  
  
Created sample configuration file /home/oracle/sample_config.cfg
```

Pro tip: *upg1* is a prefix that you decide.
Use it to define multiple databases

AutoUpgrade | Essentials

Download

Configure

Analyze

Check

Upgrade

Analyze your database

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

...

upg> Job 100 completed

Please check the summary report at:
/u01/app/oracle/cfgtoollogs/autoupgrade/cfgtoollogs/upgrade/auto/status/status.html
/u01/app/oracle/cfgtoollogs/autoupgrade/cfgtoollogs/upgrade/auto/status/status.log
```

Pro tip: Analyze is similar to running `preupgrade.jar`



AutoUpgrade | Essentials

Download

Configure

Analyze

Check

Upgrade

Summary report - text

```
=====
                        Autoupgrade Summary Report
=====
[Date]                  Tue Jan 12 10:26:19 CET 2021
[Number of Jobs] 1
=====
[Job ID] 100
=====
[DB Name]                CDB1
[Version Before Upgrade] 12.2.0.1.0
[Version After Upgrade]  19.9.0.0.0
-----
[Stage Name]    PRECHECKS
[Status]        SUCCESS
[Start Time]    2021-01-12 10:25:58
[Duration]      0:00:20
[Log Directory] /u01/app/oracle/upg/CDB1/100/prechecks
[Detail]        /u01/app/oracle/upg/CDB1/100/prechecks/cdb1_preupgrade.log
                  Precheck passed and no manual intervention needed
-----
```

AutoUpgrade | Essentials

Download

Configure

Analyze

Check

Upgrade

Summary report - HTML

ORACLE®					
Date: Tue Jan 12 10:26:19 CET 2021					
Number of Jobs: 1					
Job ID: 100					
DB Name: CDB1					
DB Version Before Upgrade: 12.2.0.1.0					
DB Version After Upgrade: 19.9.0.0.0					
Autoupgrade Stage List					
Stage Name	Status	Start Time	Duration	Log Directory	Detail
PRECHECKS	SUCCESS	2021-01-12 10:25:58	0:00:20	/u01/app/oracle/flashlogs/autoupgrade/CDB1/CDB1/100/prechecks	Prechecks Report Precheck passed and no manual intervention needed

AutoUpgrade | Essentials

Download
Configure
Analyze
Check
Upgrade

CDB1

DATABASE

DB Compatible	12.2.0
DB Version	12.2.0.1.0
Operating System	Linux
Blocksize	8192
Timezone	26
LogMode	ARCHIVELOG
Readonly	false
Edition	EE

Containers

CDB\$ROOT

PreChecks Recommend(3)
PreChecks Info(4)
PostChecks Warning(3)
PostChecks Recommend(3)

PDB\$SEED

PreChecks Recommend(3)
PreChecks Info(1)
PostChecks Warning(3)
PostChecks Recommend(3)

PDB1

PreChecks Warning(2)
PreChecks Recommend(3)
PreChecks Info(1)
PostChecks Warning(4)
PostChecks Recommend(3)

PDB2

PreChecks Recommend(3)
PreChecks Info(1)
PostChecks Warning(3)

COMPONENTS

Oracle Component	Version	Upgrade Action	Current Status
Oracle Workspace Manager	12.2.0.1.0	to be upgraded	VALID
Oracle Catalog Views	12.2.0.1.0	to be upgraded	VALID
Real Application Clusters	12.2.0.1.0	to be upgraded	OPTION OFF
Oracle XML Database	12.2.0.1.0	to be upgraded	VALID
Oracle Label Security	12.2.0.1.0	to be upgraded	VALID
Oracle Packages and Types	12.2.0.1.0	to be upgraded	VALID

CDB\$ROOT

CheckName: DICTIONARY_STATS FixUp Available: YES Severity: RECOMMEND Stage: PRECHECKS

Gather stale data dictionary statistics prior to database upgrade in off-peak time using:

EXECUTE DBMS_STATS.GATHER_DICTIONARY_STATS;

Dictionary statistics help the Oracle optimizer find efficient SQL execution plans and are essential for proper upgrade timing. Oracle recommends gathering dictionary statistics in the last 24 hours before database upgrade.

For information on managing optimizer statistics, refer to the 12.2.0.1 Oracle Database SQL Tuning Guide.

Dictionary statistics do not exist or are stale (not up-to-date).

CheckName: HIDDEN_PARAMS FixUp Available: NO Severity: RECOMMEND Stage: PRECHECKS

Review and remove any unnecessary HIDDEN/UNDERSCORE parameters.

Remove hidden parameters before database upgrade unless your application vendors and/or Oracle Support state differently. Changes will need to be made in the pfile/spfile.

The database contains the following initialization parameters whose name begins with an underscore:

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AutoUpgrade | Essentials

Download

Configure

Analyze

Check

Upgrade

Preupgrade report comes in:

- HTML
- Text
- JSON

AutoUpgrade | Essentials

Download

Configure

Analyze

Check

Upgrade

Upgrade

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



Have a cup of coffee and wait, or ...

AutoUpgrade | Essentials

- Download
- Configure
- Analyze
- Check

Upgrade

Monitor

```
upg> lsj
```

Job#	DB_NAME	STAGE	OPERATION	STATUS	START_TIME	UPDATED	MESSAGE
101	CDB1	PREFIXUPS	EXECUTING	RUNNING	20/11/24 13:38	13:39:26	Remaining 12/13



AutoUpgrade | Essentials

Download

Configure

Analyze

Check

Upgrade

All the details

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

Progress

```
-----  
Start time:      20/11/24 13:38  
Elapsed (min):   13  
Last update:    2020-11-24T13:48:52.139  
Stage:          DBUPGRADE  
Operation:      EXECUTING  
Status:         RUNNING
```

Stage summary:

SETUP	<1 min
GRP	<1 min
PREUPGRADE	<1 min
PRECHECKS	<1 min
PREFIXUPS	8 min
DRAIN	<1 min
DBUPGRADE	3 min (IN PROGRESS)

Job Logs Locations

```
-----  
Logs Base:      /home/oracle/autoupg_default/CDB1/CDB1  
Job logs:       /home/oracle/autoupg_default/CDB1/CDB1/101  
Stage logs:     /home/oracle/autoupg_default/CDB1/CDB1/101/dbupgrade  
TimeZone:       /home/oracle/autoupg_default/CDB1/CDB1/temp
```

AutoUpgrade | Essentials

Download

Configure

Analyze

Check

Upgrade

All the details - continued

...

Additional information

Details:

[Upgrading] is [0%] completed for [cdbl-cdb\$root]

CONTAINER	PERCENTAGE
CDB\$ROOT	UPGRADE [12%]
PDB\$SEED	UPGRADE PENDING
PDB3	UPGRADE PENDING

Error Details:

None

AutoUpgrade | Essentials

Download

Configure

Analyze

Check

Upgrade

Success

```
upg> Job 101 completed
----- Final Summary -----
Number of databases          [ 1 ]

Jobs finished successfully    [1]
Jobs failed                   [0]
Jobs pending                  [0]
----- JOBS FINISHED SUCCESSFULLY -----
Job 101 for CDB1

---- Drop GRP at your convenience once you consider it is no longer needed ----
Drop GRP from CDB1: drop restore point AUTOUPGRADE_9212_CDB1122010
```

And it includes:

- Recompilation (utlrb.sql)
- Time zone file upgrade
- Postupgrade fixups
- ... and so much more

AutoUpgrade | Essentials

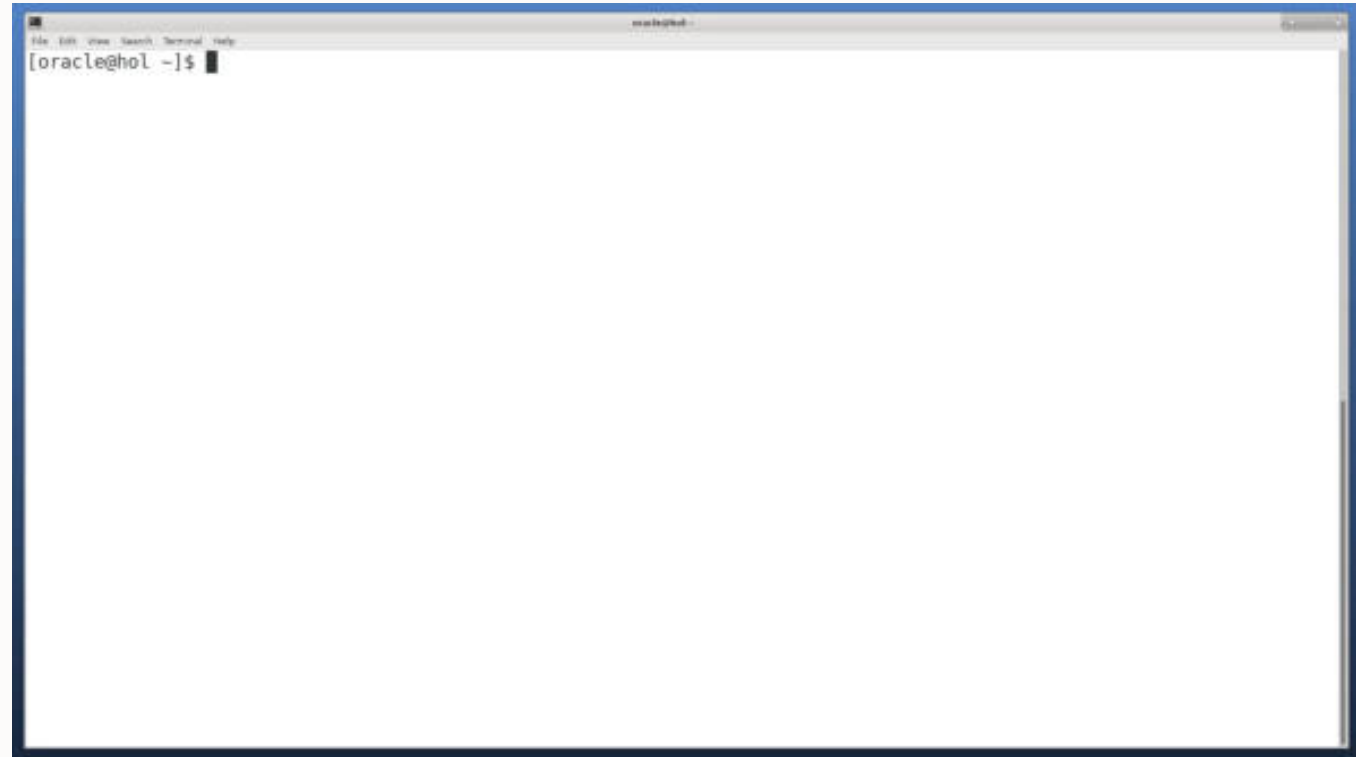
Download

Configure

Analyze

Check

Upgrade



[Watch on YouTube](#)

AWR Snapshot

Generate AWR Snapshot

Lab 2: Generate AWR Snapshot

19c, not installed

Generate AWR

Database Information

Lab

19c, not installed

Lab

Lab 2: Generate AWR Snapshot

- You have completed
 - Lab Program Setup
 - Lab Environment Setup
 - Lab Initiative Environment

Collapse All Tasks

Task 1: Generate an AWR snapshot

Lab Exercises

Upgrade to Oracle Database 19c and ensure performance stability

```
cd /home/oracle/19c
sqlplus / as sysdba
startup
```

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

Lab Exercises

Eleven units covering multiple use cases

1. Initialize Environment
2. Pre-upgrade: Generate AWR Snapshot
3. Pre-upgrade: Capture and Preserve SQL
4. Upgrade: AutoUpgrade
5. Post-Upgrade: AWR Compare Report
6. Post-Upgrade: SQL Performance Analyzer
7. Post-Upgrade: SQL Plan Management
8. Post-Upgrade: SQL Tuning Advisor
9. Use Case: Plugin UPGR into CDB2
10. Alternative: Transportable Export/Import
11. Use Case: Unplug Plug Upgrade





Let's get started

Upgrade to Oracle Database 19c and ensure performance stability

Lab Provisioning

Now you start - click "Launch Workshop"

My Reservations

All your current workshop reservations are shown below. You can edit active or pending reservations, view workshop details, attend an available workshop, or delete a reservation.

To access this page again click the user dropdown in the top right corner and select **My Reservations**

Note: The status of your reservations will be emailed to you. Check your mail for any status updates.



Hitchhiker's Guide for Upgrading to Oracle Database 19c

Friday August 19th, 8:44am (08:44) US/Eastern

Status: Available



Launch Workshop



Details

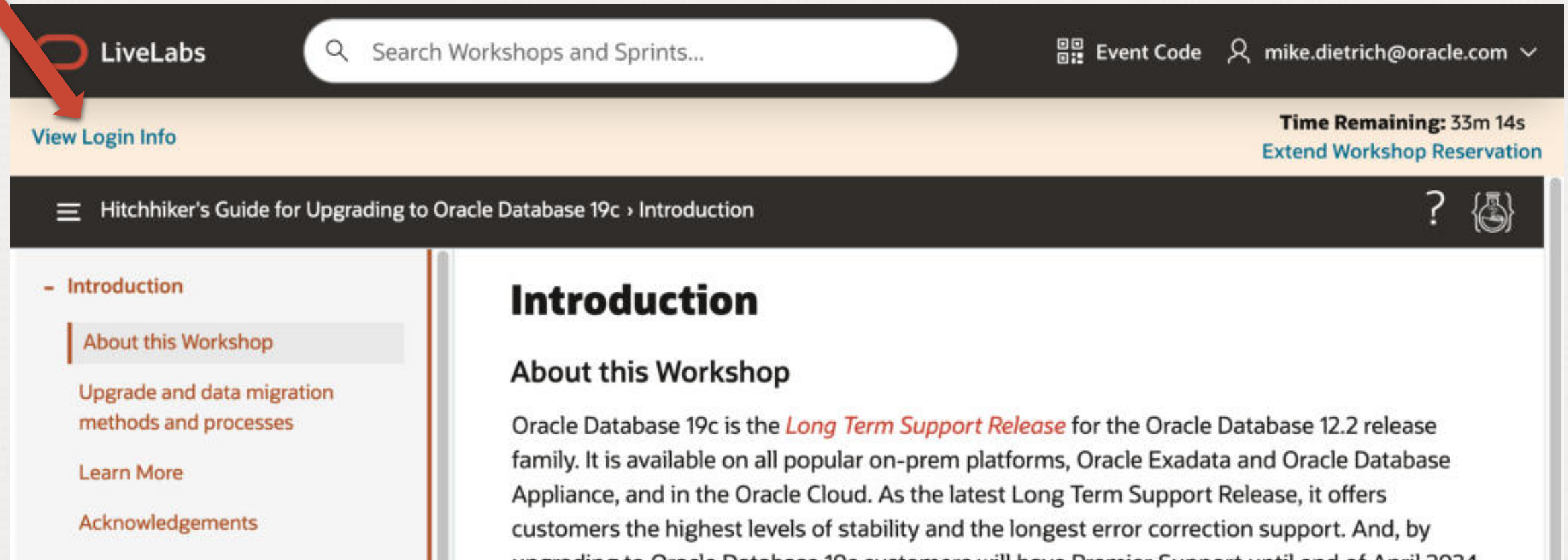


Remove

1-1

Lab Provisioning

Click on "View Login Info"



The screenshot shows the LiveLabs interface. At the top, there is a dark header with the LiveLabs logo, a search bar labeled "Search Workshops and Sprints...", and user information including "Event Code" and "mike.dietrich@oracle.com". Below the header, a light orange banner contains the text "View Login Info" on the left and "Time Remaining: 33m 14s Extend Workshop Reservation" on the right. The main content area has a dark header with a hamburger menu, the title "Hitchhiker's Guide for Upgrading to Oracle Database 19c > Introduction", and a help icon. The left sidebar lists navigation items: "Introduction" (selected), "About this Workshop", "Upgrade and data migration methods and processes", "Learn More", and "Acknowledgements". The main content area displays the "Introduction" section, starting with "About this Workshop" and a paragraph about Oracle Database 19c being a Long Term Support Release.

LiveLabs

Search Workshops and Sprints...

Event Code

mike.dietrich@oracle.com

View Login Info

Time Remaining: 33m 14s
Extend Workshop Reservation

Hitchhiker's Guide for Upgrading to Oracle Database 19c > Introduction

Introduction

About this Workshop

Upgrade and data migration methods and processes

Learn More

Acknowledgements

Introduction

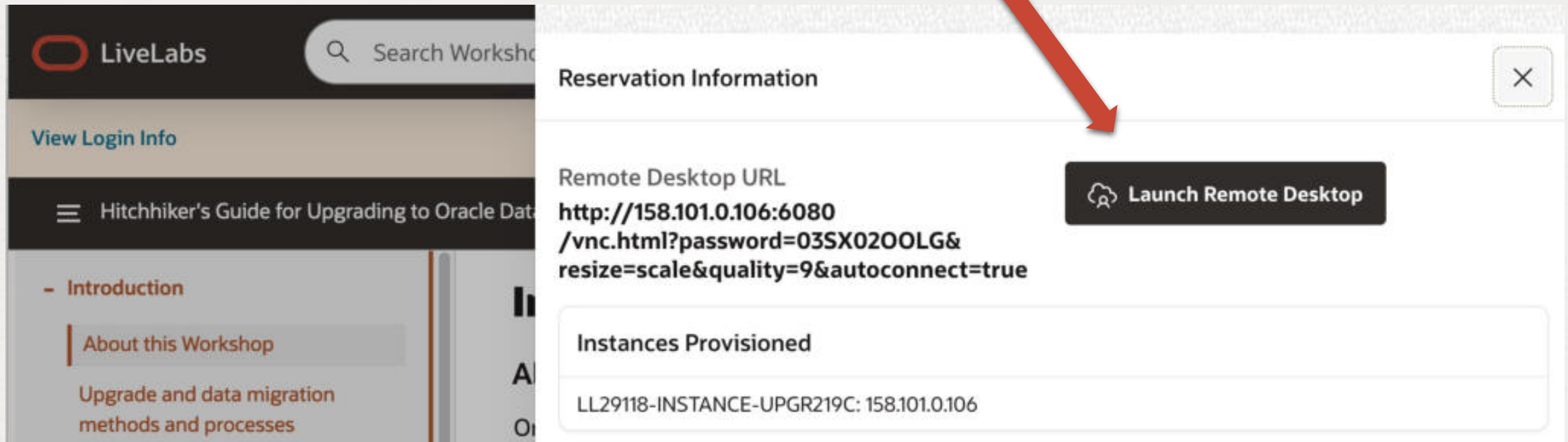
About this Workshop

Oracle Database 19c is the *Long Term Support Release* for the Oracle Database 12.2 release family. It is available on all popular on-prem platforms, Oracle Exadata and Oracle Database Appliance, and in the Oracle Cloud. As the latest Long Term Support Release, it offers customers the highest levels of stability and the longest error correction support. And, by upgrading to Oracle Database 19c customers will have Premier Support until end of April 2024.



Lab Provisioning

Click on "Launch Remote Desktop"



The screenshot displays the LiveLabs interface. On the left, a sidebar contains the LiveLabs logo, a search bar, and a list of workshop sections: 'View Login Info', 'Hitchhiker's Guide for Upgrading to Oracle Data', 'Introduction', 'About this Workshop', and 'Upgrade and data migration methods and processes'. The main content area is titled 'Reservation Information' and includes a close button (X) in the top right corner. It displays the 'Remote Desktop URL' as `http://158.101.0.106:6080/vnc.html?password=03SX02OOLG&resize=scale&quality=9&autoconnect=true`. Below this, a section titled 'Instances Provisioned' lists the instance 'LL29118-INSTANCE-UPGR219C' with IP address '158.101.0.106'. A red arrow points from the text 'Click on "Launch Remote Desktop"' to a black button labeled 'Launch Remote Desktop' which features a cloud and user icon.

LiveLabs

Search Workshop

View Login Info

Hitchhiker's Guide for Upgrading to Oracle Data

Introduction

About this Workshop

Upgrade and data migration methods and processes

Reservation Information

Remote Desktop URL

`http://158.101.0.106:6080/vnc.html?password=03SX02OOLG&resize=scale&quality=9&autoconnect=true`

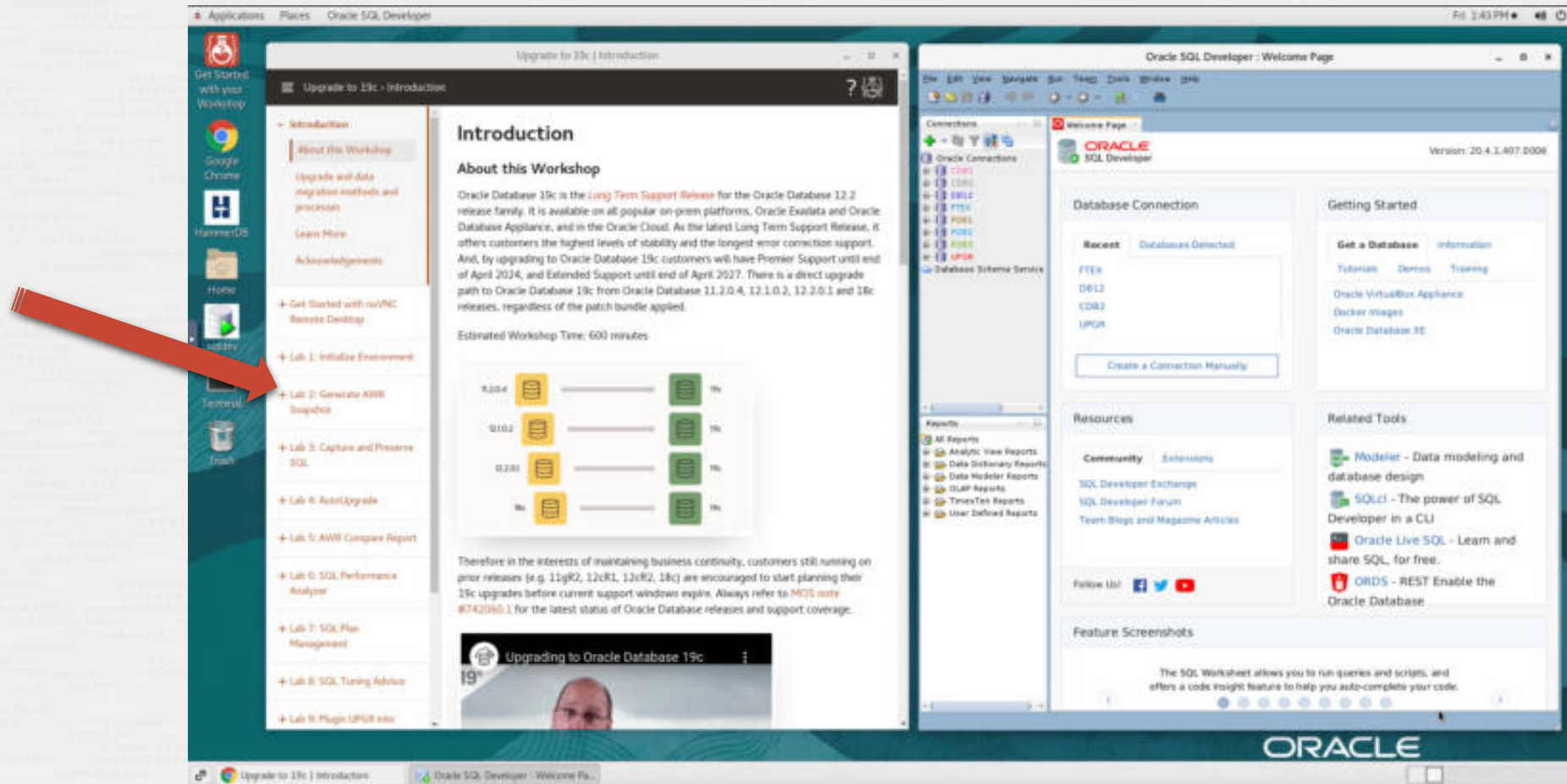
Instances Provisioned

LL29118-INSTANCE-UPGR219C: 158.101.0.106

Launch Remote Desktop

Lab Provisioning

Start with LAB #2 "Generate AWR Snapshot"



Lab Provisioning

You may want to close SQL Developer – then you have more space to work

The screenshot displays the Oracle Cloud Workshop interface for the 'Upgrade to 19c | Lab 2: Generate AWR Snapshot' task. The sidebar on the left contains navigation links: 'Get Started with your Workshop', 'Google Chrome', 'HammerDB', 'Home', 'sqldev', 'Terminal', and 'Trash'. The main content area is titled 'Upgrade to 19c | Lab 2: Generate AWR Snapshot' and includes a table of contents with links to 'Introduction', 'Task 1: Generate an AWR snapshot', 'Task 2: Load driver script and start virtual Users', 'Task 3: Capture SQL, run workload and monitor', 'Task 4: Generate another AWR snapshot', 'Appendix 1: Additional information on HammerDB', 'Learn More', and 'Acknowledgements'. The 'Task 1: Generate an AWR snapshot' section is expanded, showing a list of completed tasks: 'Lab: Prepare Setup', 'Lab: Environment Setup', and 'Lab: Initialize Environment'. Below this, a 'Collapse All Tasks' button is visible. The 'Task 1: Generate an AWR snapshot' section contains a list of instructions: '1. Open a terminal session and set the environment to UPGR using `. upgr`, change directory to `/home/oracle/scripts` and startup the database in SQL*Plus:'. A code block shows the commands: `. upgr`, `cd /home/oracle/scripts`, `sqlplus / as sysdba`, and `startup`. A 'Copy' button is next to the code block. Below the code block, a terminal window shows the execution of the commands: `[oracle@hol ~]$. upgr`, `[UPGR] oracle@hol:~`, `$ cd /home/oracle/scripts`, `[UPGR] oracle@hol:~/scripts`, and `$ sqlplus / as sysdba`.

Performance Stability Prescription

1.
Collect

3.
Analyze

5.
Manage

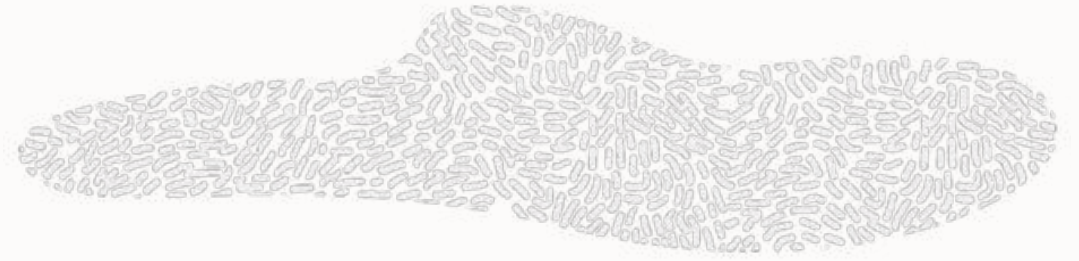
2.
Compare

4.
Tune

6.
Test



SQL Tuning Set | Definition



SQL statement

SQL

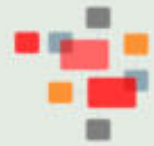
Context



Statistics



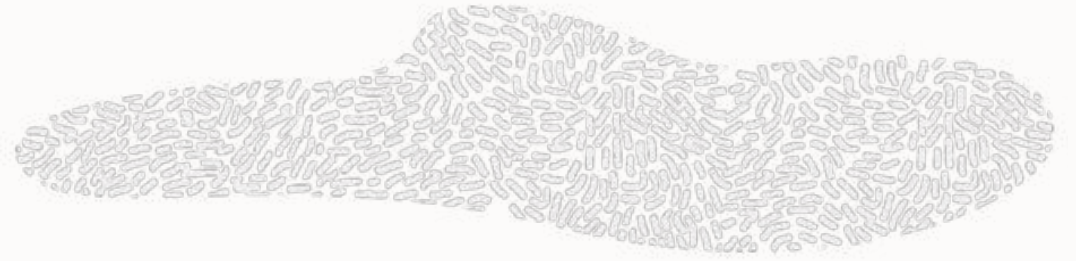
Plans





Collect at least
one full month of workload data
before any upgrade or migration

Workload Information



AWR – Automatic Workload Repository

Change the retention to a minimum of 40 days

```
exec  
dbms_workload_repository.modify_snapshot_settings(  
retention=>57600, interval=>30);
```



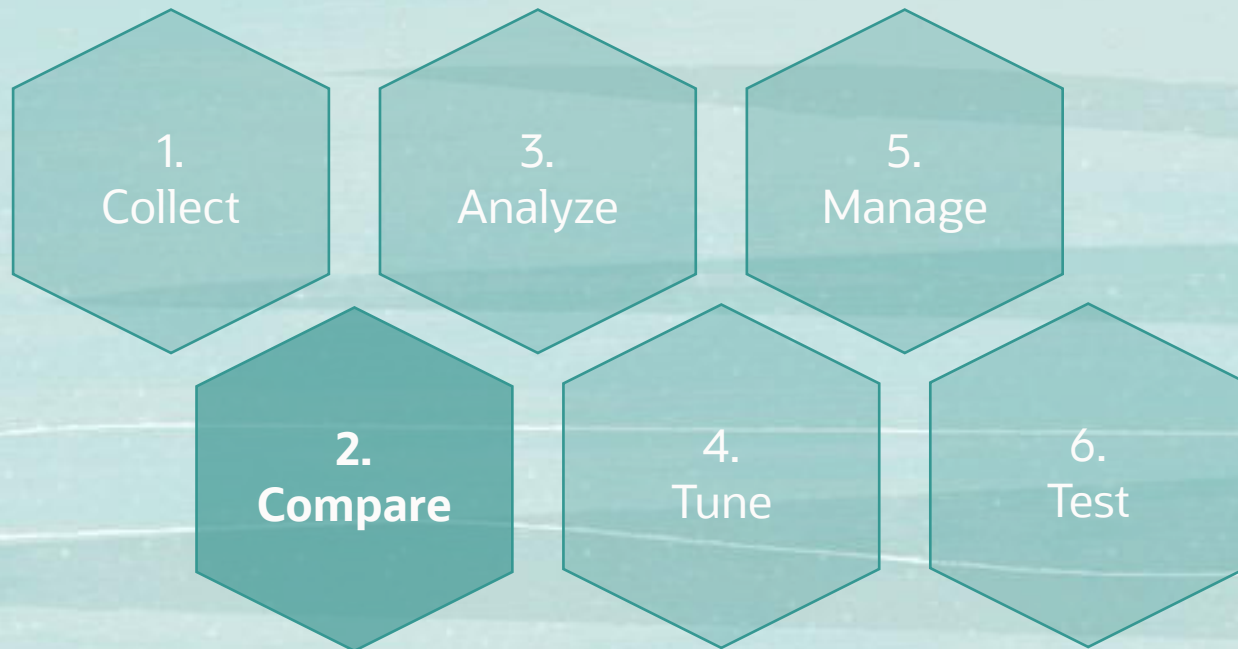
Collect SQL statements and plans

Use AWR as main source

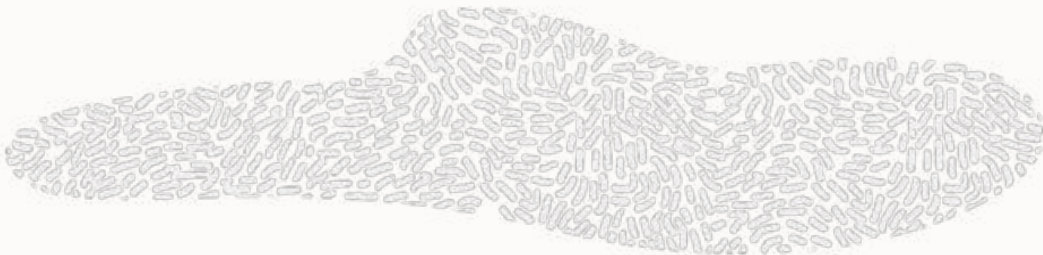
Capture from Cursor Cache for OLTP

Collect statements, plans and stats in SQL Tuning Sets

Performance Stability Prescription



AWR | Diff Report



Use script `awrddrpt.sql`

Top Timed Events

- Events with a "-" did not make the Top list in this set of snapshots, but are displayed for comparison purposes

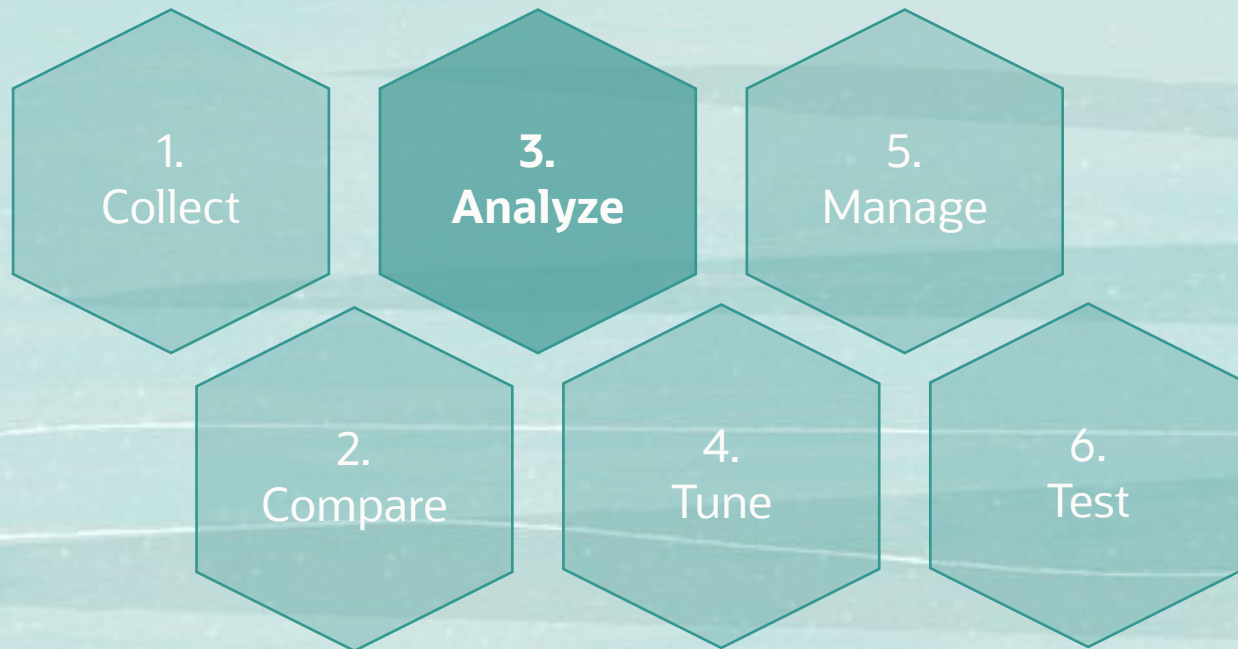
1st						2nd					
Event	Wait Class	Waits	Time(s)	Avg Time(ms)	%DB time	Event	Wait Class	Waits	Time(s)	Avg Time(ms)	%DB time
CPU time			68,289.05		43.73	db file sequential read	User I/O	22,193,998	114,919.21	5.18	23.17
db file sequential read	User I/O	6,686,953	37,737.81	5.64	24.17	enq: SS - contention	Configuration	3,913	98,997.90	25,299.74	19.96
gc buffer busy	Cluster	12,508,244	23,886.55	1.91	15.30	CPU time			73,786.55		14.88
TCP Socket (KGAS)	Network	680,629	12,514.65	18.39	8.01	row cache lock	Concurrency	73,940	48,472.30	655.56	9.77
db file scattered read	User I/O	1,572,296	4,271.68	2.72	2.74	reliable message	Other	41,148	47,600.87	1,156.82	9.60

Requires Enterprise Edition + Diagnostic pack

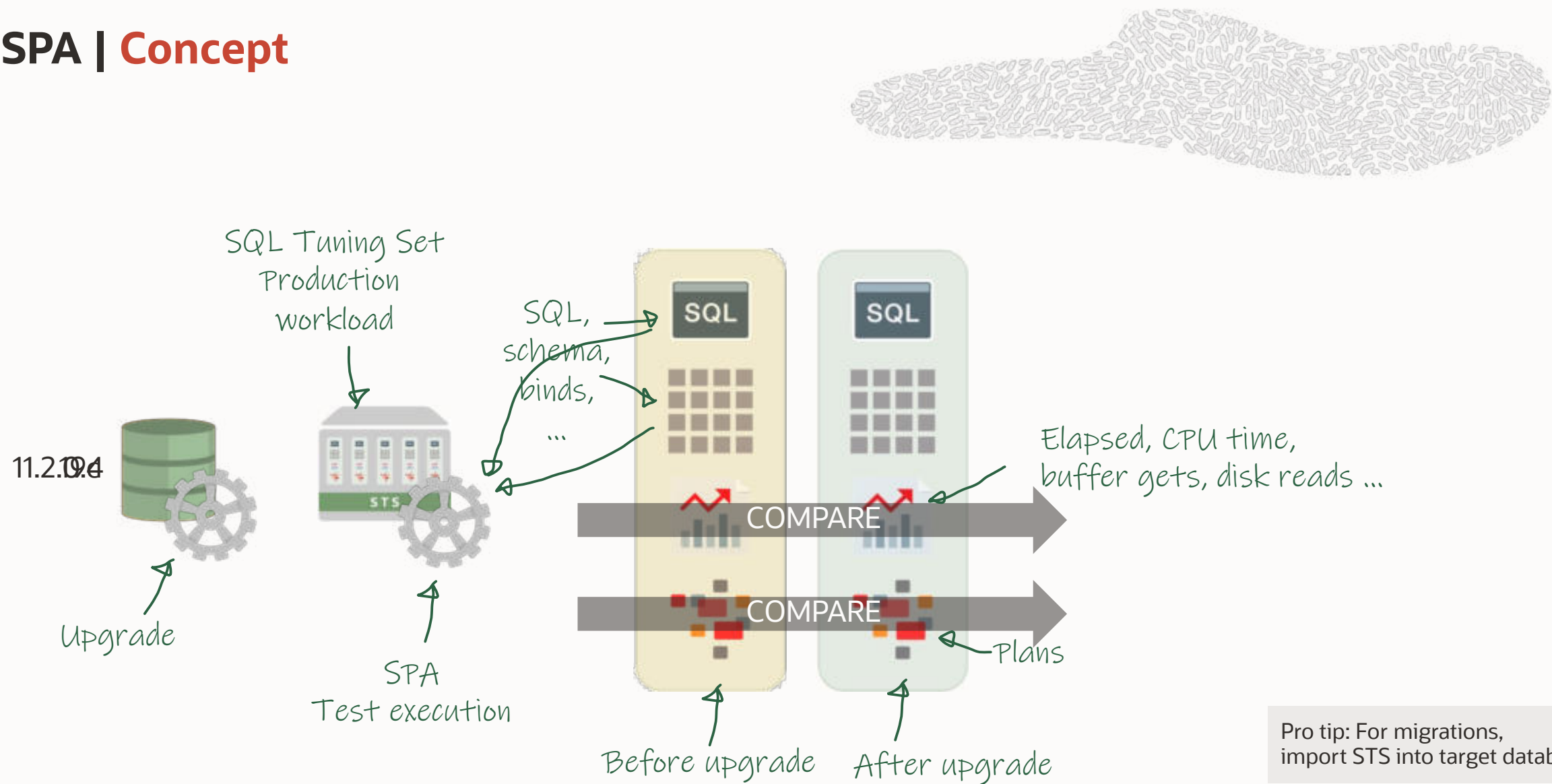
Pro tip: For migrations, you can [transport AWR data](#)



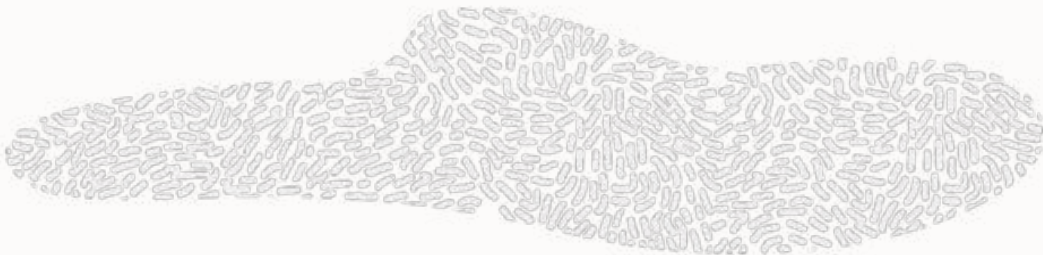
Performance Stability Prescription



SPA | Concept



SPA | Regressed Report



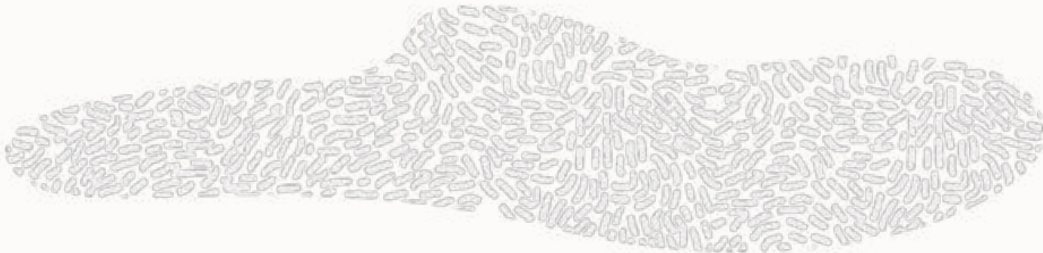
Regressed SQL Statements						
	SQL ID	Net Impact on Workload (%)	Buffer Gets		Net Impact on SQL (%)	New Plan
			SQL Trial 1	SQL Trial 2		
⬇	3fv28gfu9y0aq	-0.050	26,504	29,573	-11.580	Y
⬇	czzzubf8fjz96	-0.030	1,410	1,981	-40.500	Y

From production
workload

From test
execution

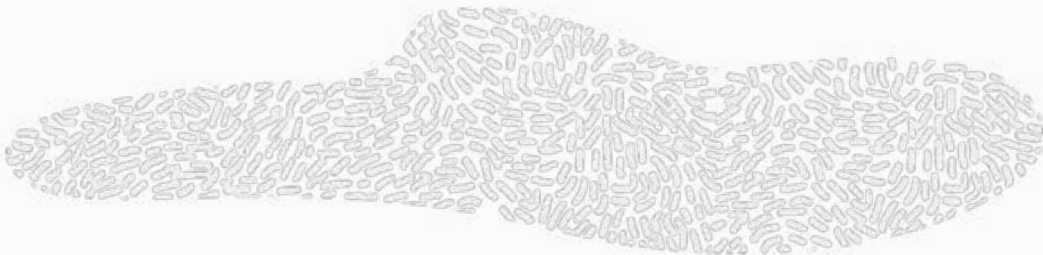


SPA | Regressed Report



Regressed SQL Statements						
	SQL ID	Net Impact on Workload (%)	Buffer Gets		Net Impact on SQL (%)	New Plan
			SQL Trial 1	SQL Trial 2		
↓	3fv28gfu9y0aq	-0.050	26,504	29,573	-11.580	Y
↓	czzzubf8fjz96	-0.030	1,410	1,981	-40.500	Y

SPA | Regressed Report



Regressed SQL Statements

	SQL ID	Net Impact on Workload (%)	Buffer Gets		Net Impact on SQL (%)	New Plan
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↓	3fv28qfu9y0aq	-0.050	26,504	29,573	-11.580	Y
↓	czzzubf8fjz96	-0.030	1,410	1,981	-40.500	Y

SQL Details: czzzubf8fjz96

Parsing Schema APPS

Execution Frequency 3

> SQL Text

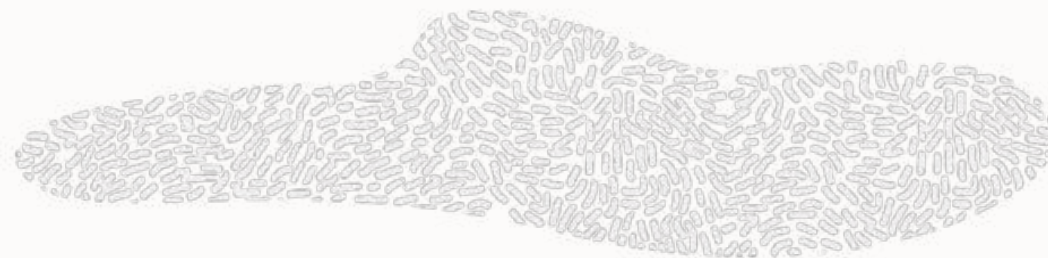


SELECT /* my_query_21 */ /*+ ORDERED INDEX(t1) USE_HASH(t1) */ 'B' || t2.take_02 take_02, 'B' || t2.take_15 take_15, 'B' || t2.take_08 take_08, 'r' || t3.record_nr price_eur_id,...

Single Execution Statistics

	Execution Statistic Name	Net Impact on Workload (%)	Execution Statistic Collected		Net Impact on SQL (%)
			SQL Trial 1	SQL Trial 2	
↓	Elapsed Time (sec)	-0.240	0.112	0.164	-46.170
↑	Parse Time (sec)	0.220	0.001	0.001	14.490
↓	CPU Time (sec)	-0.030	0.108	0.114	-5.040
→	User I/O Time (sec)	0.000	0.000	0.000	0.000
↓	Buffer Gets	-0.030	1,410	1,981	-40.500

SPA | Regressed Report



Regressed SQL Statements						
	SQL ID	Net Impact on Workload (%)	Buffer Gets		Net Impact on SQL (%)	New Plan
			SQL Trial 1	SQL Trial 2		
↓	3fv28qfu9v0aq	-0.050	26,504	29,573	-11.580	Y
↓	czzzubf8fjz96	-0.030	1,410	1,981	-40.500	Y

Plan Comparison

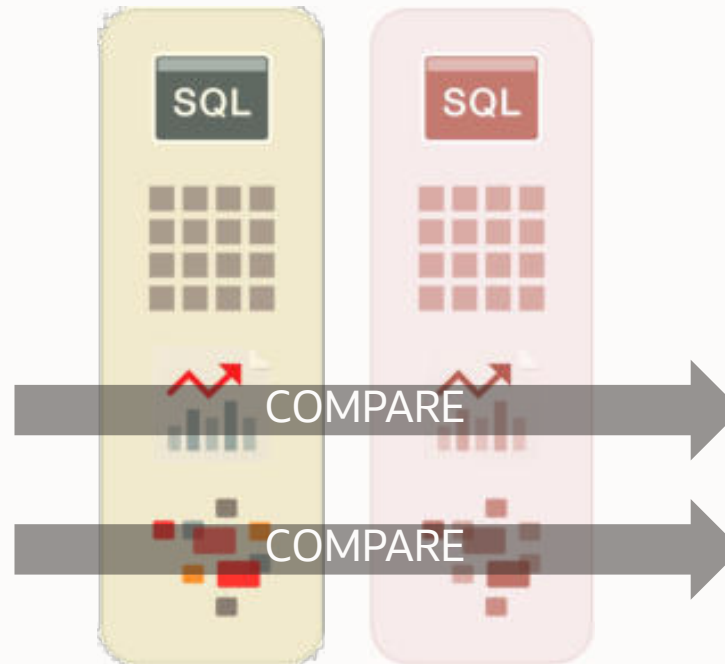
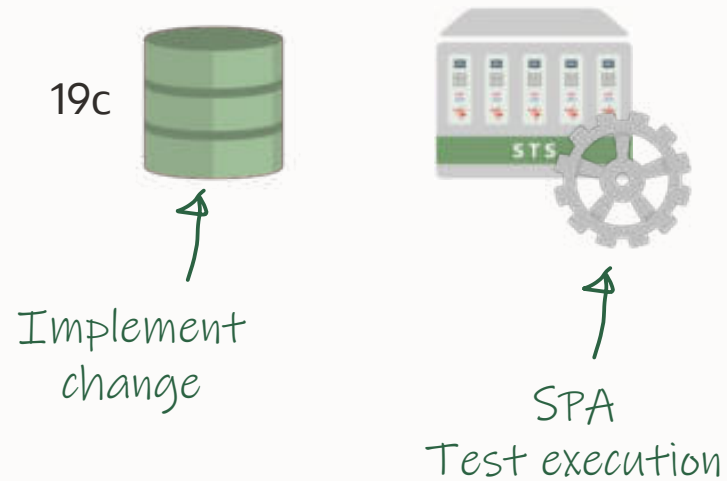
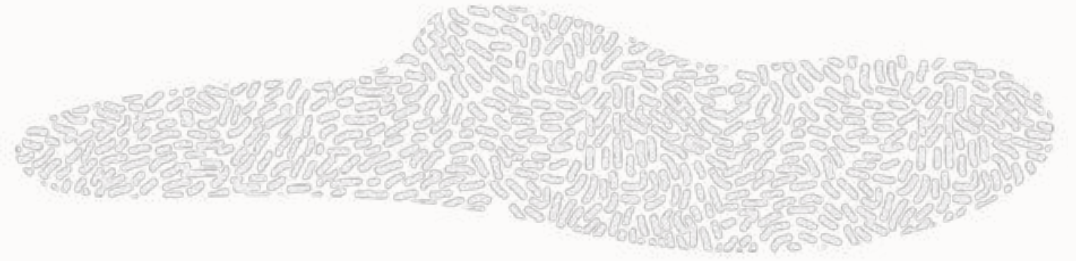
SQL_TRIAL_1353942463446

Plan Hash Value 1165613724

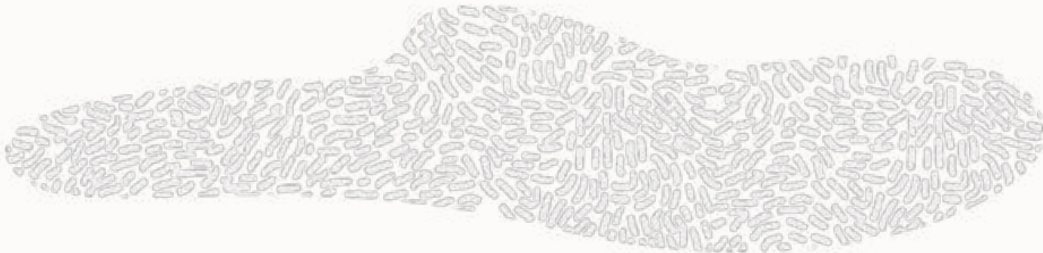
[Expand All](#) | [Collapse All](#)

Operation	Line ID	Object	Rows	Cost	Predicate
▽ SELECT STATEMENT	0		1	9,830	
▽ HASH GROUP BY	1		1	9,830	
▽ MERGE JOIN	2		1	9,829	
▽ SORT JOIN	3		8	9,795	
▽ HASH JOIN	4		8	9,794	"T1"."PERIOD_CODE"="T4"."FLYER...
INDEX RANGE SCAN	5	APPS.IDX\$\$_080F0004	1	2	"T4"."EXPORT_LIC_NR"=14659
▽ HASH JOIN	6		14,210	9,792	"T1"."SKU_NR"="T2"."SKU_NR" AN...

SPA | Continuous Improvement



SPA | Regressed Report



Regressed SQL Statements

	SQL ID	Net Impact on Workload (%)	Buffer Gets		Net Impact on SQL (%)	New Plan
			SQL Trial 1	SQL Trial 2		
⬇	3fv28gfu9y0aq	-0.050	26,504	29,573	-11.580	Y
⬇	czzzubf8fjz96	-0.030	1,410	1,981	-40.500	Y

Performance Stability Prescription



SQL Tuning Advisor | Findings

Types of findings:

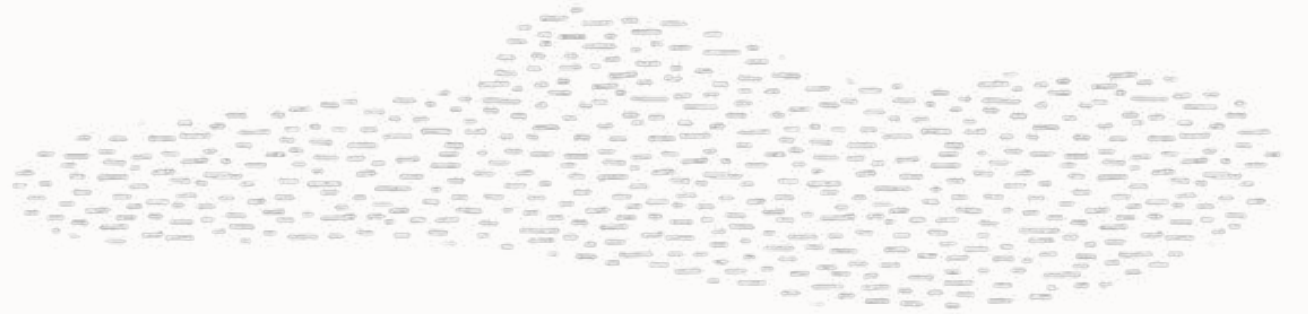
1. Collection of object statistics
 2. Creation of indexes
 3. Rewriting SQL statements
 4. Creation of SQL profiles
- and more



Pro tip: SQL Developer has a good [interface](#) to SQL Tuning Advisor

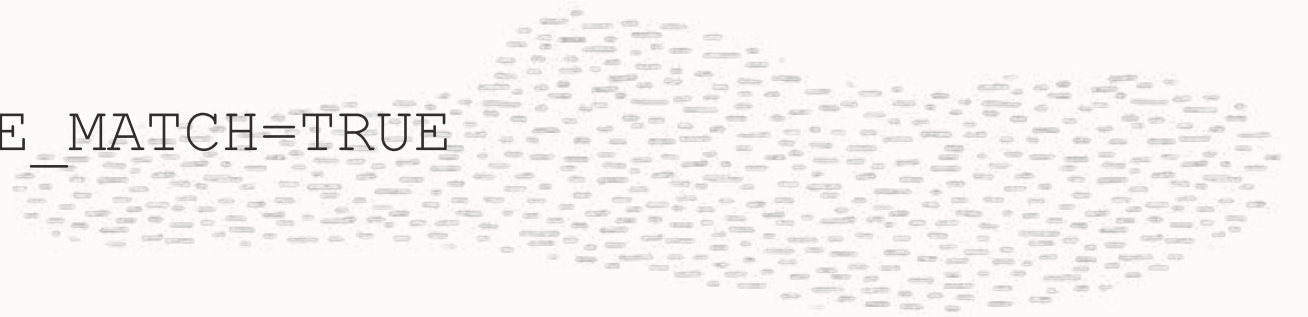
SQL Profiles | Facts

1. Part of Tuning Pack
 - Included in some cloud offerings
2. Stores a set of hints that causes the optimizer to select a plan
3. Affects one statement only



SQL Profiles | Facts

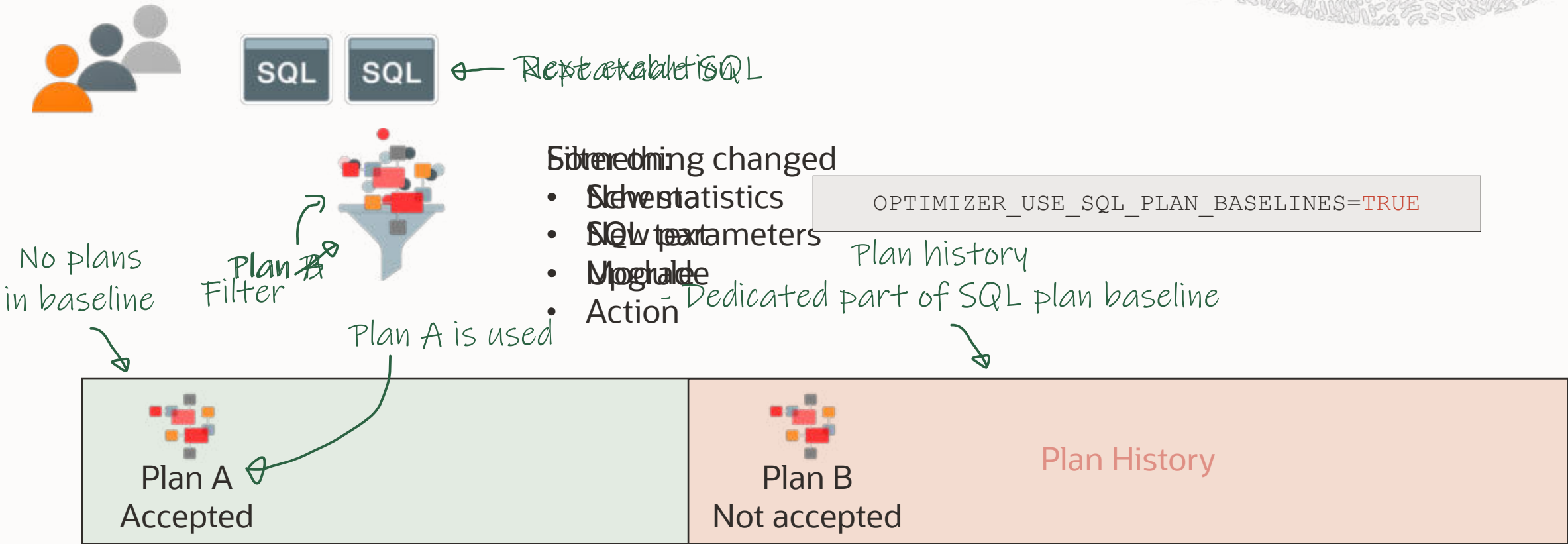
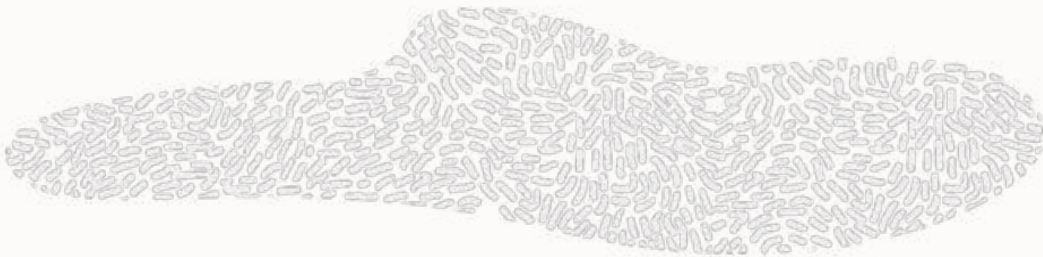
4. You can enable/disable a profile
5. Transparent to application
 - Does not require application changes
6. Persistent and transportable
 - [Documentation](#)
7. Useful with literals using `FORCE_MATCH=TRUE`



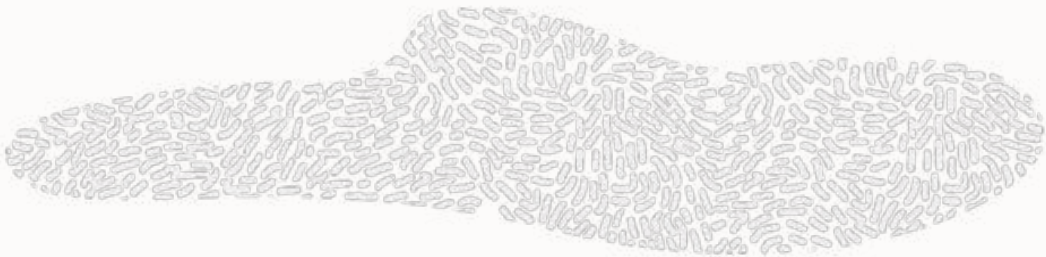
Performance Stability Prescription




SPM | Concept



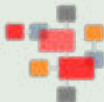



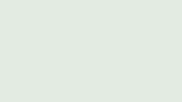
SPM | Evolve





Result:
Performance better

Test execute Test execute
Plan stays




 Plan A Accepted			 Plan B Not accepted		 Plan D Not accepted	Plan History
 Plan C Accepted			 Plan D Accepted			



SPM | Load from STS



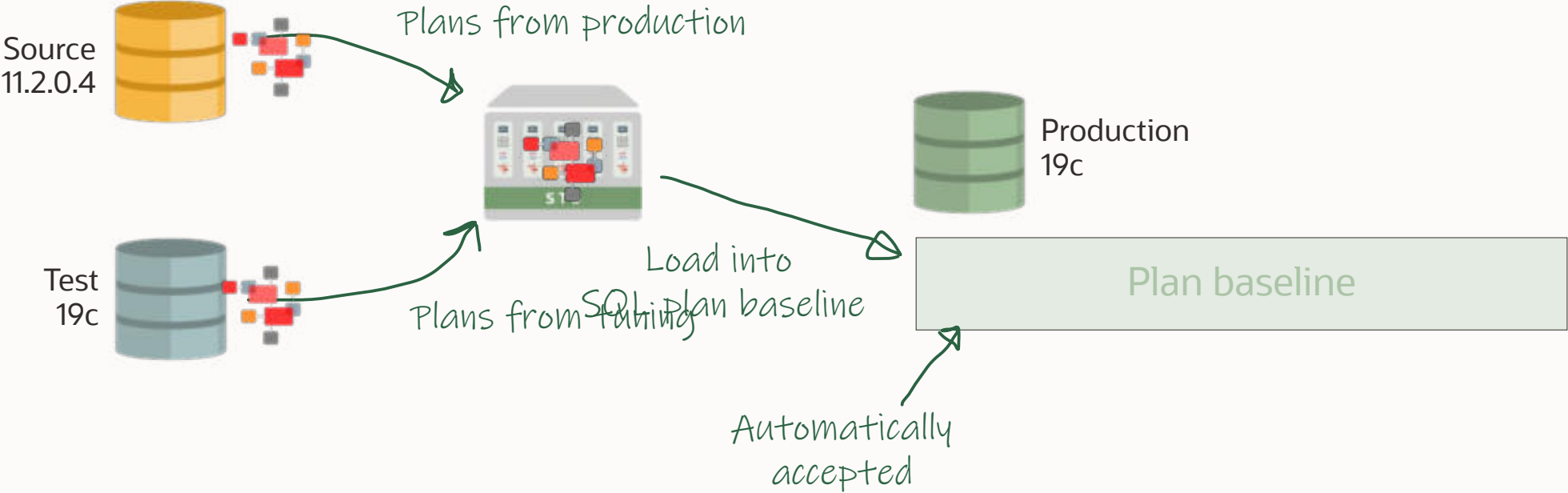
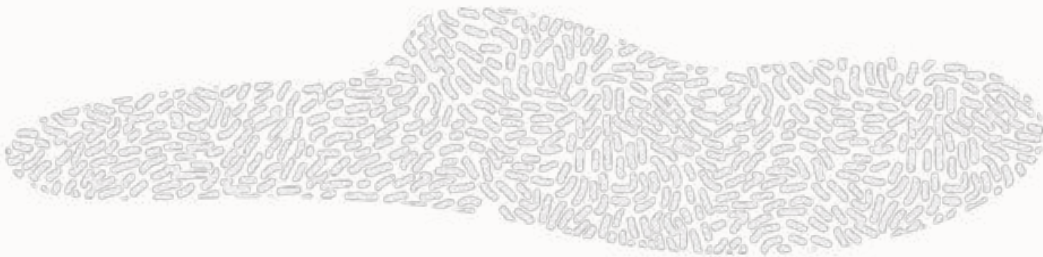
```
SQL> DECLARE
      cnt number;
BEGIN
      cnt := DBMS_SPM.LOAD_PLANS_FROM_SQLSET('UPG_STS_1');
END;
/
```

 Plan A Accepted		 Plan B Not accepted	
 Plan C Accepted		Plan History	

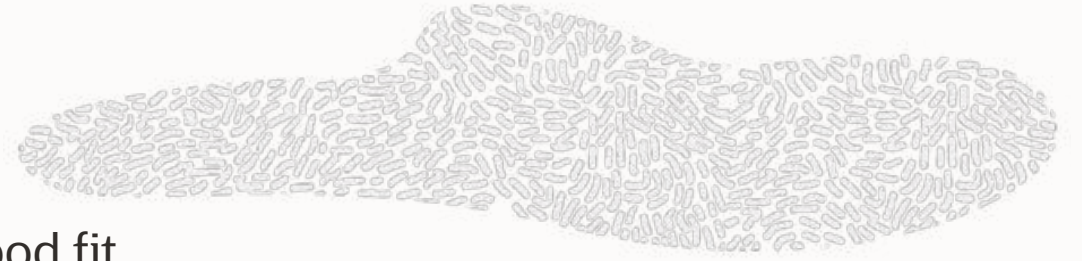
Automatically
accepted



SPM | Use Case



SPM | What if ... literals

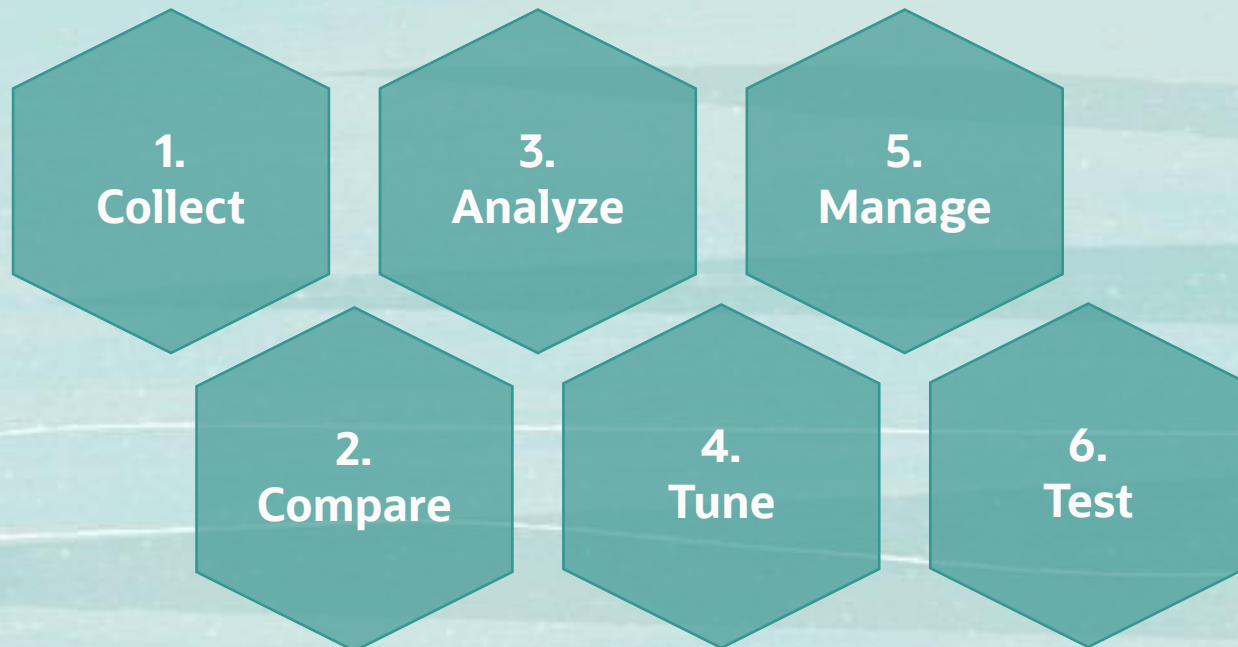


SQL Plan Management in a system with literals is not a good fit

- Many distinct statements
- CURSOR_SHARING = FORCE? No!
- SQL profiles can do force matching

Optimal solution: Change your application to use bind variables

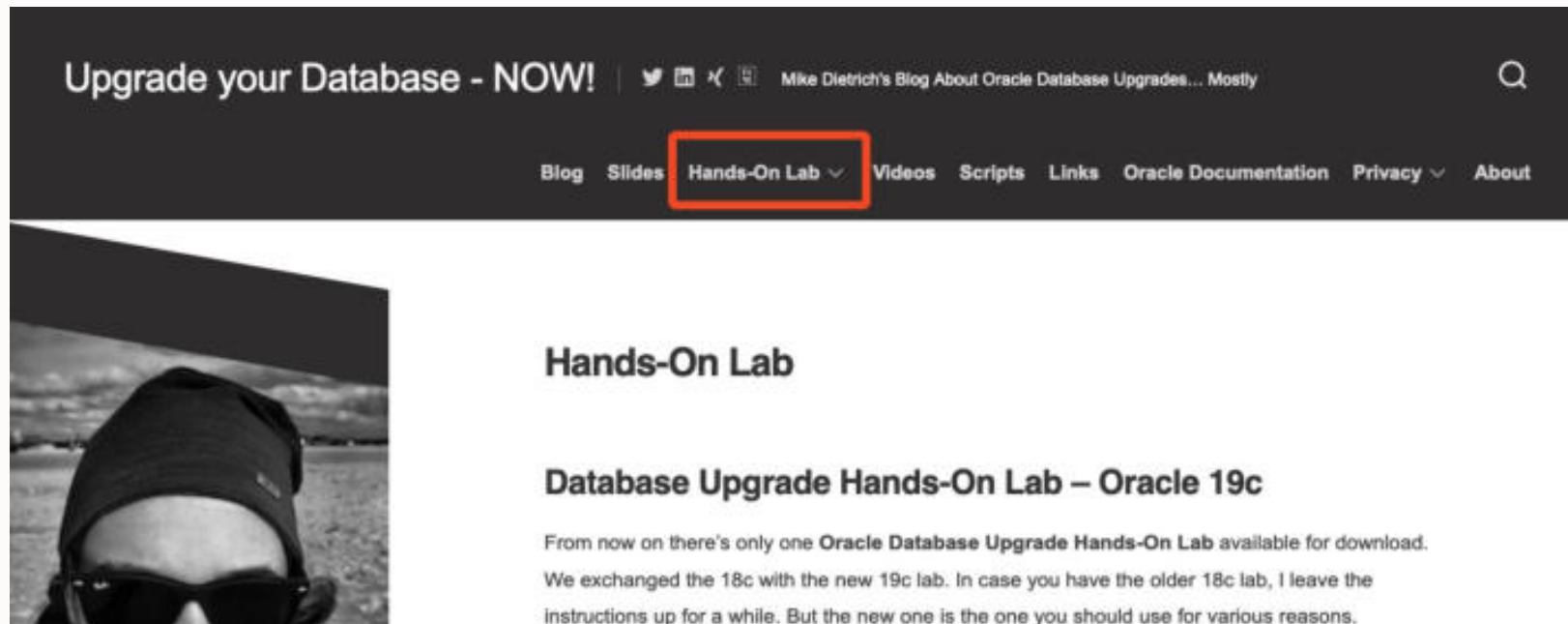
Performance Stability Prescription



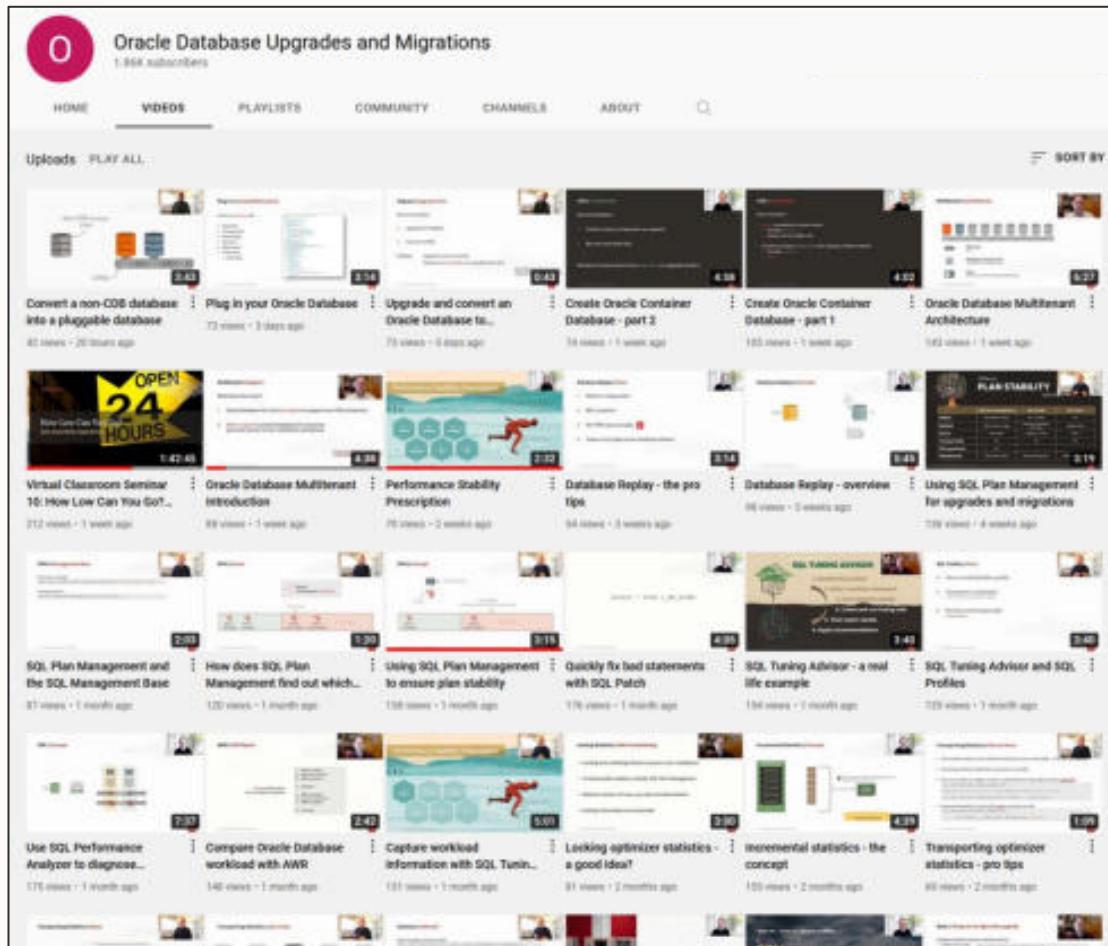
Hands-On Lab | Create Your Lab

On Mike's blog (<https://mikedietrichde.com>) get

- the lab as Virtual Box image
- the instructions



YouTube | Oracle Database Upgrades and Migrations



[Link](#)

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





From SR to Patch

Insights into the Oracle Database Development Process

June 22, 2023 – 16:00 CEST



THANK
YOU

