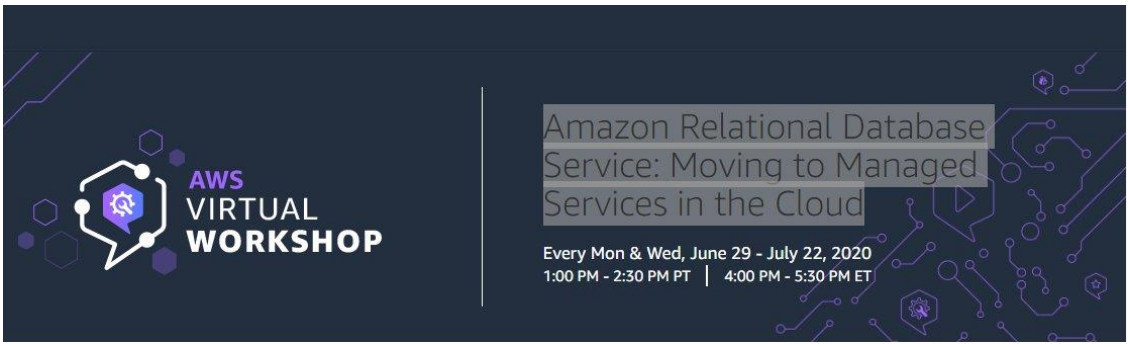

Running production Oracle databases on Amazon RDS for Oracle
July 20, 1:00 PM - 2:30 PM PT | 4:00 PM - 5:30 PM ET

AMAZON RELATIONAL DATABASE SERVICE (RDS) FOR ORACLE LAB GUIDE

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Abstract:
Description: Amazon Relational Database Service (RDS) for Oracle hands-on workshop guide.

Prerequisites before you start:

1. *An active AWS account to use AWS services. All the participants will be using pre-provisioned AWS accounts to run this lab.*
2. *The AWS account should have required privileges to be able to create all the resources created in this lab. The pre-provisioned AWS account will have all required privilege to run this lab.*
3. *Pre-installed Oracle Database client tools like SQL Developer to connect to the RDS Oracle Database. Optionally you can also use pre-installed SQL*Plus on your machine or can download the SQL*Plus here which require Oracle OTN account.*

Lab1: Creating RDS Oracle Database Instance (ETC ~10 -15 minutes)

This lab assumes participants are are working in the "Ireland" region

Login in to your AWS console and go to RDS landing page

https://eu-west-1.console.aws.amazon.com/rds/home?region=eu-west-1#

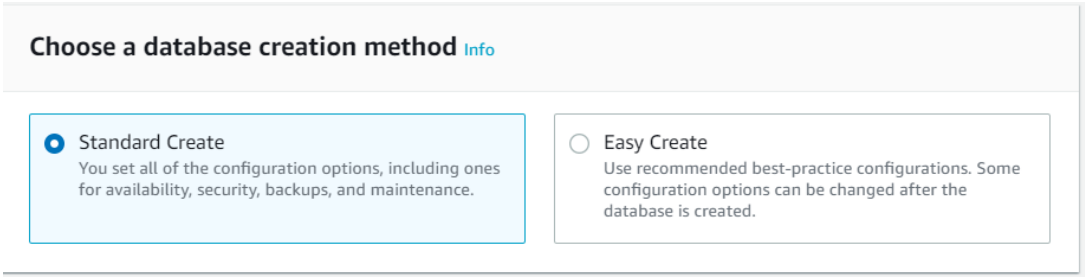
(This is for **Ireland region***, you can find the RDS service in all supported regions in your console)*

Please use the below table for all the input parameters which requires input from the participants

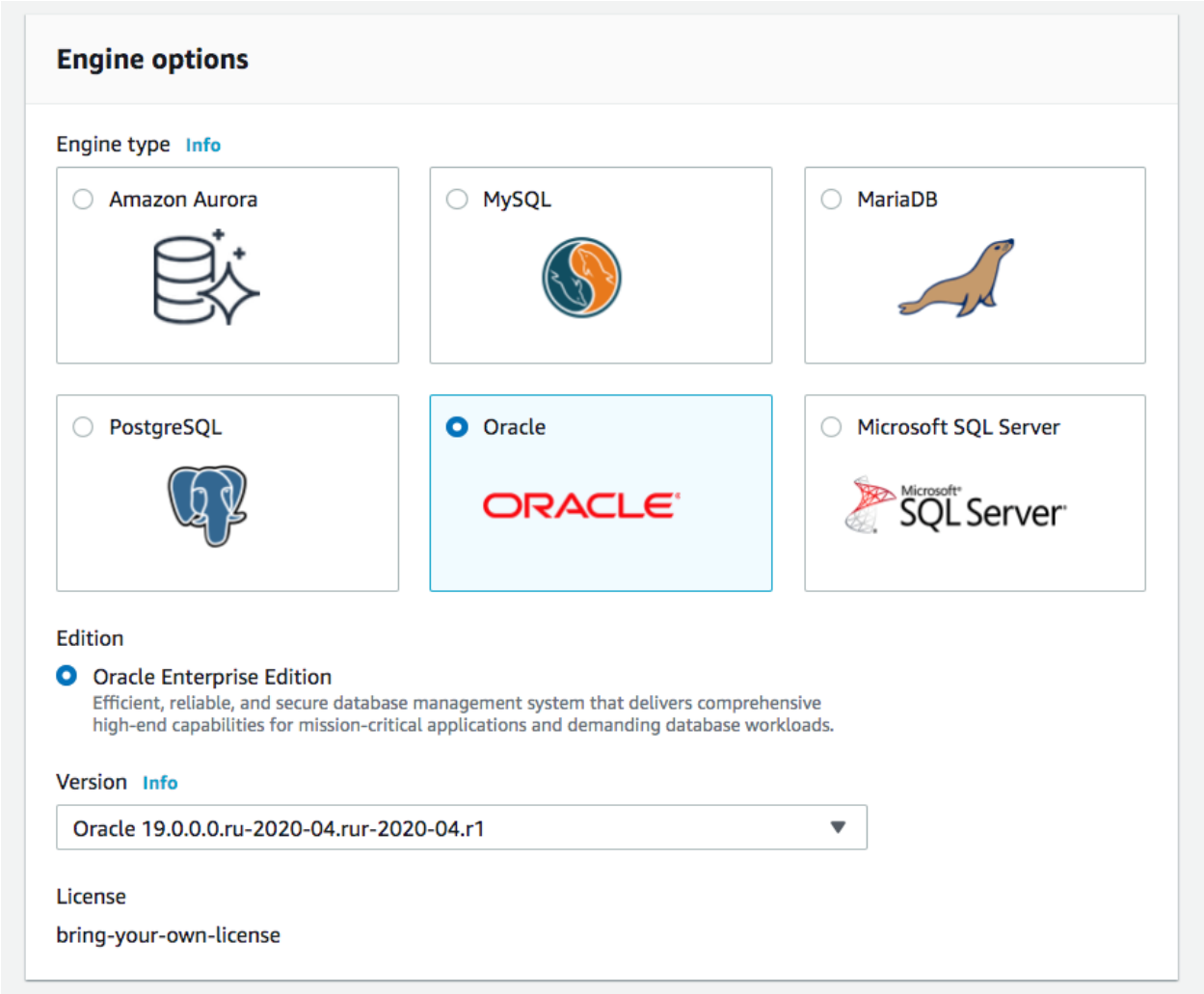
Parameter	**Value**
Database Creation Method	*Standard Create*
Engine Option	*Oracle*
Edition	*Oracle Enterprise Edition*
Version	*Oracle 19.0.0.0.ru-2020-04.rur-2020-01.r1*
License	*bring-your-own-license*
Templates	*Dev/Test*
DB Instance Identifier	*mydatabase*
Master Username	*oraadmin*
Master Password	*<user defined password>*
DB Instance size	*Choose Standard class (db.m5.xlarge)*
Storage	*General Purpose (SSD)*
Performance Insights	*20*
Storage autoscaling	*Enable storage autoscaling*
Maximum storage threshold	*1000 (default)*
Multi-AZ- Deployment	*Do not create a standby instance*
Virtual private Cloud (vpc)	*Use the default vpc*
Subnet group	*default*
Publicly accessible	*Yes*
VPC security group	*Choose existing (default)*
Availability zone	*No Preference*
Database port	*1521 (default)*
Initial Database name	*ORACLEDB or ORCL(by default)*
DB parameter group	*default.oracle.ee. -19.1 (default)*
Option group	*default:oracle-ee-19.1 (default)*
Character set	*AL32UTF8 (default)*

Backup	*Enable automatic backups*
Backup retention period	*7 days*
Backup window	*No Preference*
Encryption	*Enable Encryption*
Performance Insights	*Don't enable*
Monitoring	*Don't enable enhanced monitoring*
Log Exports	*Don't select anything*
Maintenance	*Don't enable auto minor version upgrade*
Maintenance window	*No Preference (default)*
Delete protection	*Don't enable delete protection*

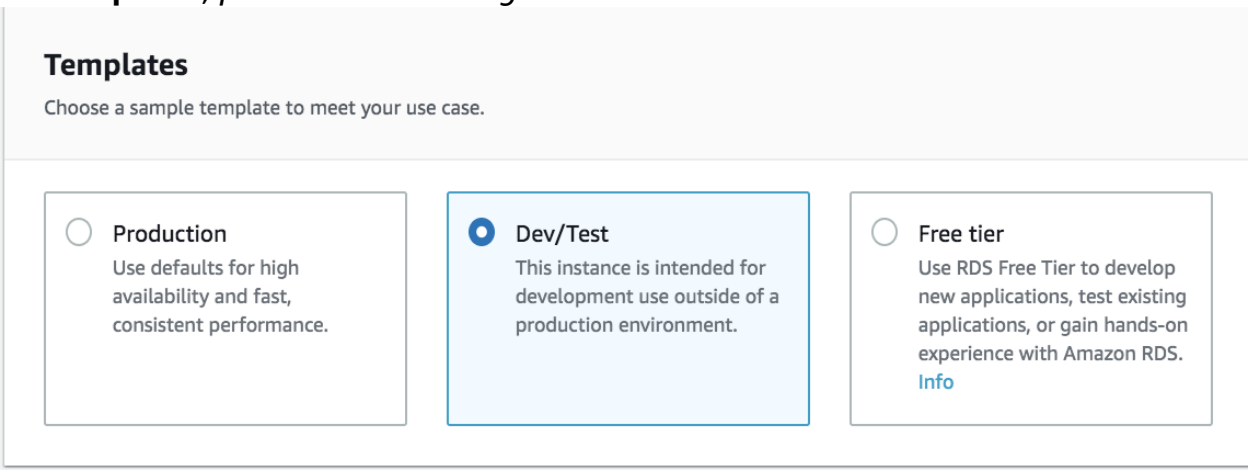
Click "Create Database" and then choose "Standard Create" Radio button



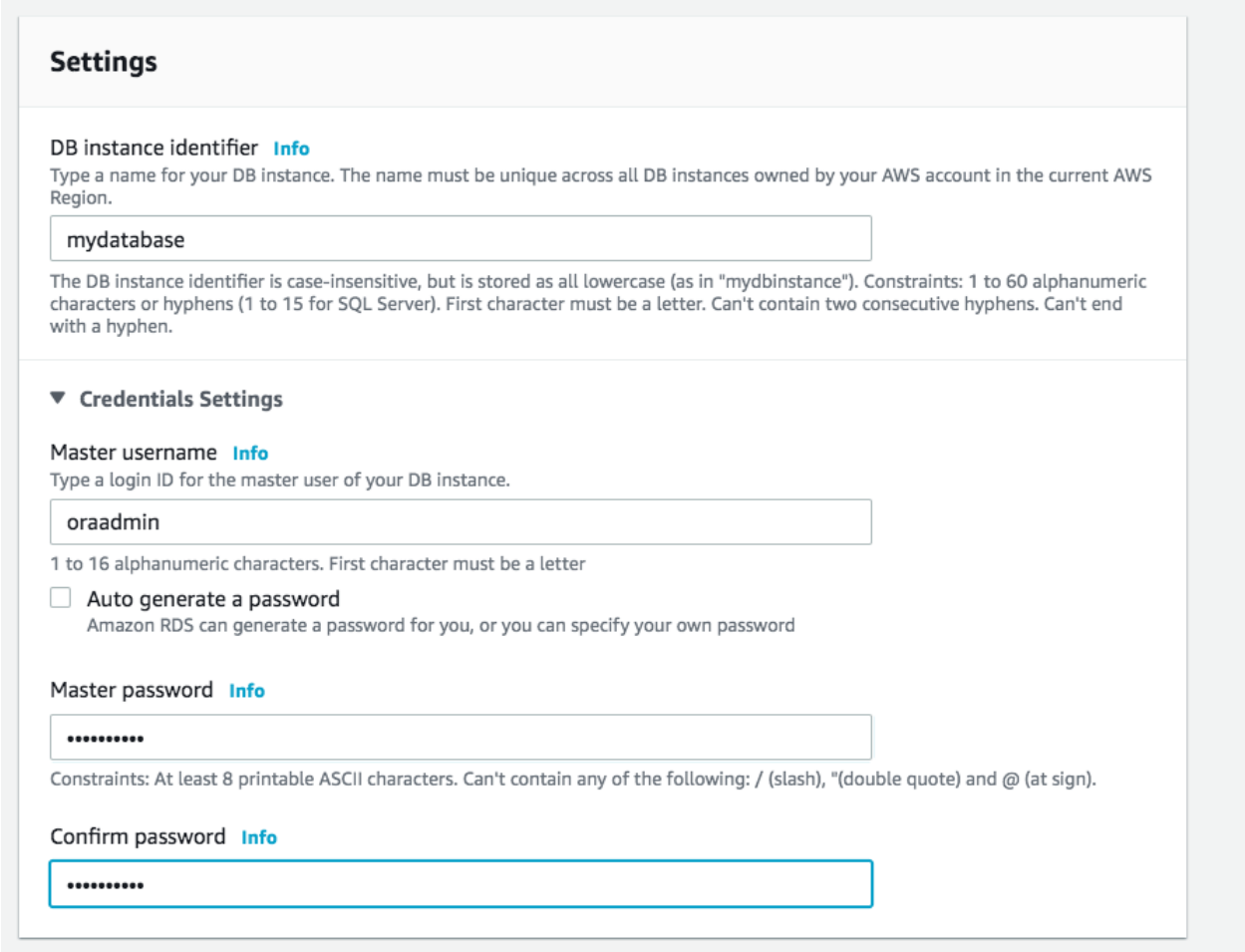
Under the Engine options, choose "Oracle" and the edition as "Oracle Enterprise Edition" and the version as "Oracle 19.0.0.0.ru-2020-04.rur-2020-01.r1"



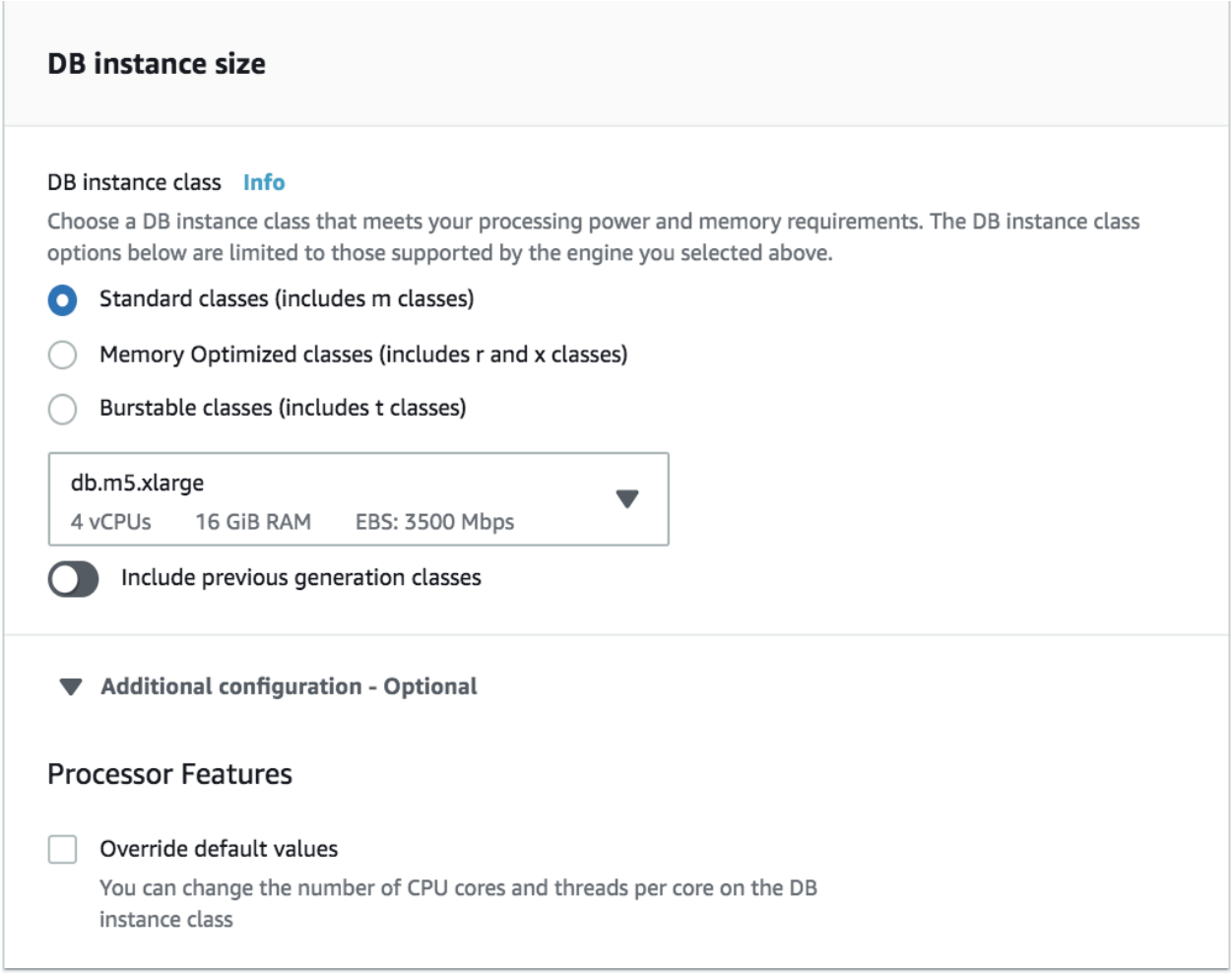
Under **Templates**, *provide the following*



For Settings, Choose the DB Instance identifier as "mydatabase". Master Username as "oraadmin". Select a preferred password and note it for future reference.



For the DB Instance size, select standard Class



For Storage, select General purpose and leave the allocated storage to 20 GiB. Also leave the Storage Auto scaling checked.

Storage

Storage type Info

General Purpose (SSD)

Allocated storage

20 GiB

(Minimum: 20 GiB, Maximum: 65536 GiB) Higher allocated storage may improve IOPS performance.

Provisioning less than 100 GiB of General Purpose (SSD) storage for high throughput workloads could result in higher latencies upon exhaustion of the initial General Purpose (SSD) IO credit balance. external link for more details.

Storage autoscaling Info

Provides dynamic scaling support for your database's storage based on your application's needs.

☑ Enable storage autoscaling

Enabling this feature will allow the storage to increase once the specified threshold is exceeded.

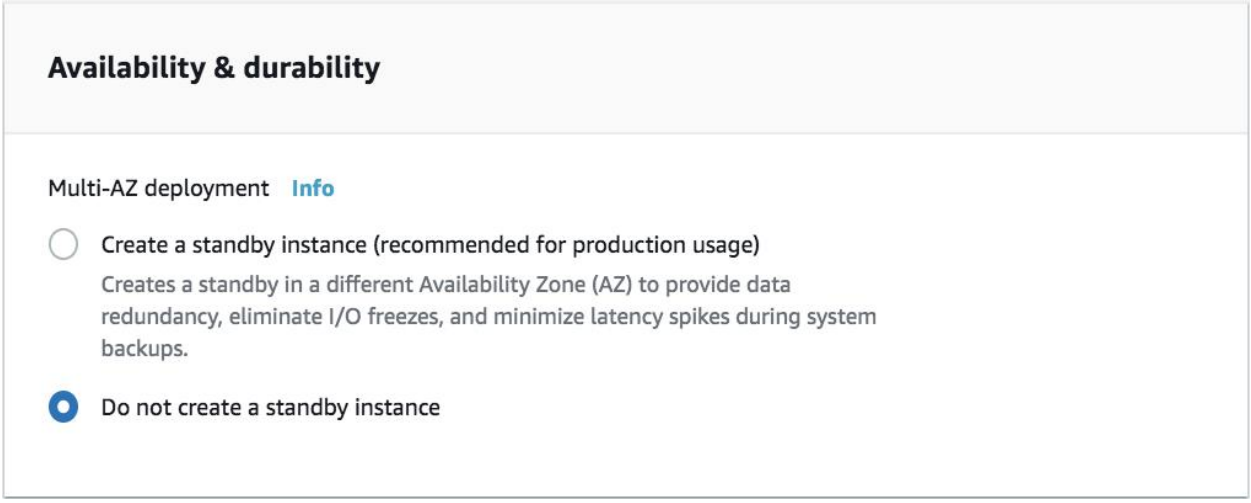
Maximum storage threshold Info

Charges will apply when your database autoscales to the specified threshold

1000 GiB

Minimum: 21 GiB, Maximum: 65536 GiB

For now, do not create the standby database. That would be a separate lab



Next is Connectivity, select the VPC where you want to have the database created. For this lab purpose it's ok to use the default VPC. However, in the real-world it is highly recommended to use a dedicated VPC for databases.

Also, please note that setting "publicly accessible" option to "No" will not allow connections to the RDS Oracle Database outside the VPC (including your laptop).

Connectivity

Virtual Private Cloud (VPC) Info
VPC that defines the virtual networking environment for this DB instance.

Default VPC ([redacted]

Only VPCs with a corresponding DB subnet group are listed.

After a database is created, you can't change the VPC selection.

Additional connectivity configuration

Subnet group Info
DB subnet group that defines which subnets and IP ranges the DB instance can use in the VPC you selected.

default

Publicly accessible Info

- Yes
  Amazon EC2 instances and devices outside the VPC can connect to your database. Choose one or more VPC security groups that specify which EC2 instances and devices inside the VPC can connect to the database.
- No
  RDS will not assign a public IP address to the database. Only Amazon EC2 instances and devices inside the VPC can connect to your database.

VPC security group
Choose one or more RDS security groups to allow access to your database. Ensure that the security group rules allow incoming traffic from EC2 instances and devices outside your VPC. (Security groups are required for publicly accessible databases.)

- Choose existing
  Choose existing VPC security groups
- Create new
  Create new VPC security group

Existing VPC security groups

Choose VPC security groups

default ×

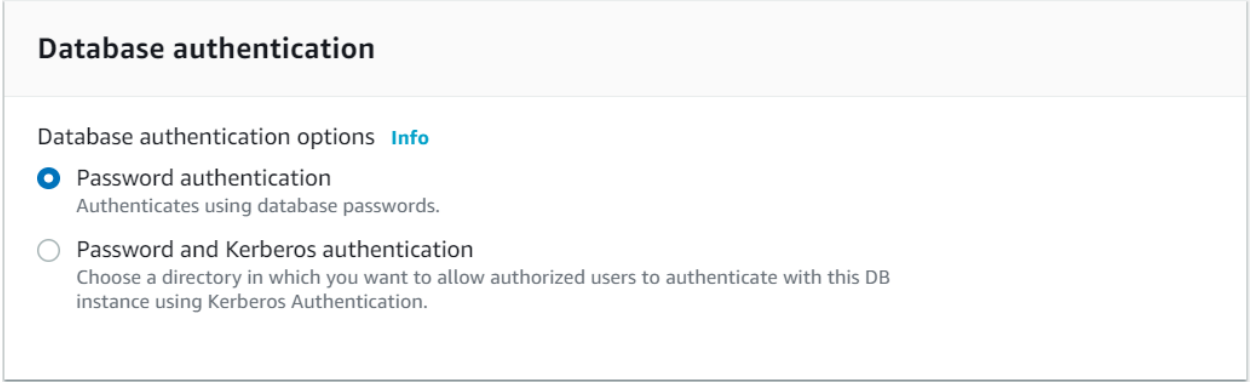
Availability zone Info

No preference

Database port Info
TCP/IP port the database will use for application connections.

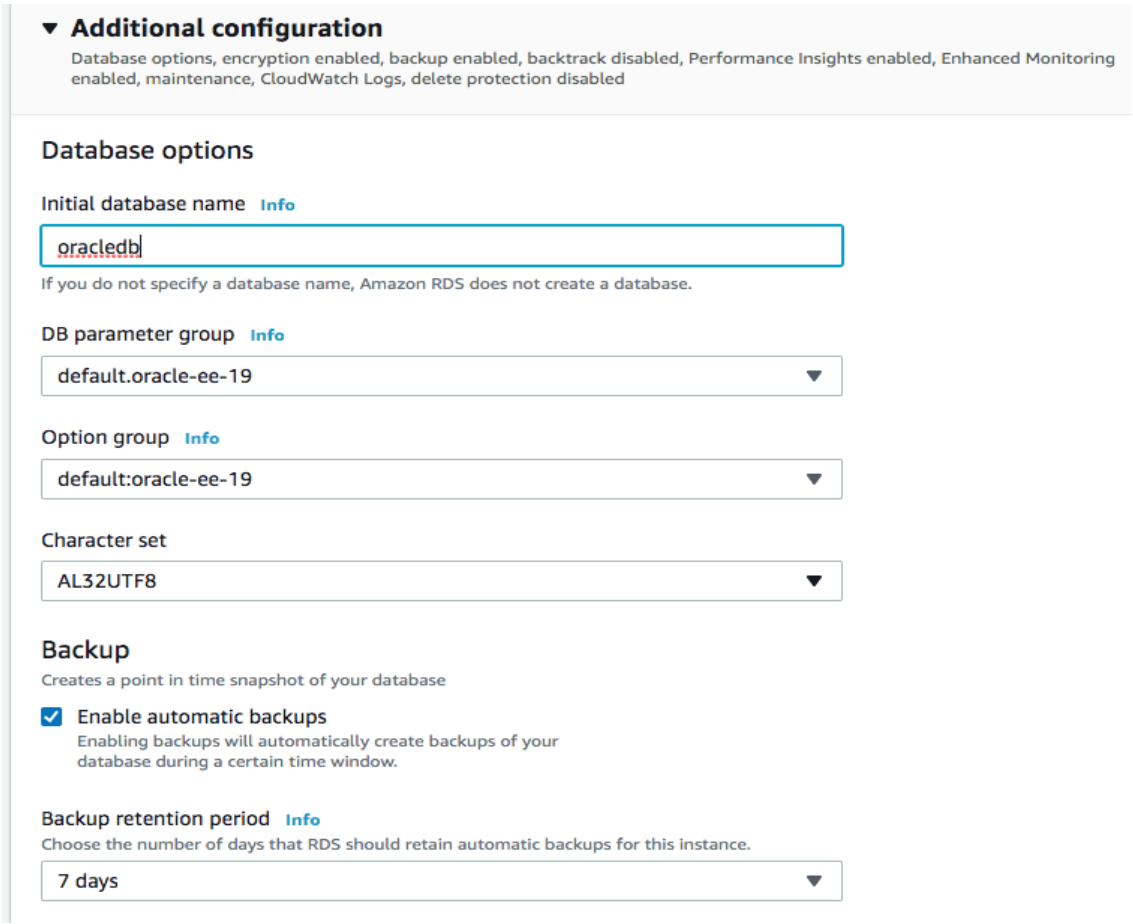
1521

Choose the type of password Authentication. For Kerberos integration, a separate Active directory or a Kerberos installation is required which is outside the scope of this LAB



Under **Additional configuration section**

Database name: - <user defined DB name> e.g. oracledb by default ORCL
Leave other fields with the default values.



Encryption

☑ Enable Encryption
Choose to encrypt the given instance. Master key ids and aliases appear in the list after they have been created using the Key Management Service(KMS) console. Info

Master key Info

(default) aws/rds

Account

862756250442

KMS key ID

c9d708f5-c15e-444b-9778-042c1c657333

Performance Insights Info

☑ Enable Performance Insights

Retention period Info

Default (7 days)

Master key Info

(default) aws/rds

Account

862756250442

KMS key ID

c9d708f5-c15e-444b-9778-042c1c657333

⚠ Performance Insights master KMS key cannot be changed after enabling Performance Insights.

Maintenance and Delete protection: - choose the default values

Monitoring

☑ Enable Enhanced monitoring
Enabling Enhanced monitoring metrics are useful when you want to see how different processes or threads use the CPU

Granularity

5 seconds

Monitoring Role

default

Clicking "Create database" will authorize RDS to create the IAM role rds-monitoring-role

Log exports

Select the log types to publish to Amazon CloudWatch Logs

- ☐ Alert log
- ☐ Audit log
- ☐ Listener log
- ☐ Trace log

IAM role
The following service-linked role is used for publishing logs to CloudWatch Logs.

RDS Service Linked Role

ⓘ Ensure that General, Slow Query, and Audit Logs are turned on. Error logs are enabled by default. Learn more

Maintenance

Auto minor version upgrade **Info**

☐ Enable auto minor version upgrade
Enabling auto minor version upgrade will automatically upgrade to new minor versions as they are released. The automatic upgrades occur during the maintenance window for the database.

Maintenance window **Info**
Select the period you want pending modifications or maintenance applied to the database by Amazon RDS.

- ○ Select window
- ◉ No preference

Deletion protection

☐ Enable deletion protection
Protects the database from being deleted accidentally. While this option is enabled, you can't delete the database.

Estimated monthly costs

DB instance	249.66 USD
Storage	2.30 USD
Total	**251.96 USD**

This billing estimate is based on on-demand usage as described in Amazon RDS Pricing. Estimate does not include costs for backup storage, IOs (if applicable), or data transfer.

Estimate your monthly costs for the DB Instance using the AWS Simple Monthly Calculator.

Click on Create Database to start the Instance creation

Cancel **Create database**

Optional: - Using AWSCLI to launch RDS Oracle Database Instance

You could also use AWS CLI to create the database. Make sure to verify the parameters used in the cli that suits your requirement.

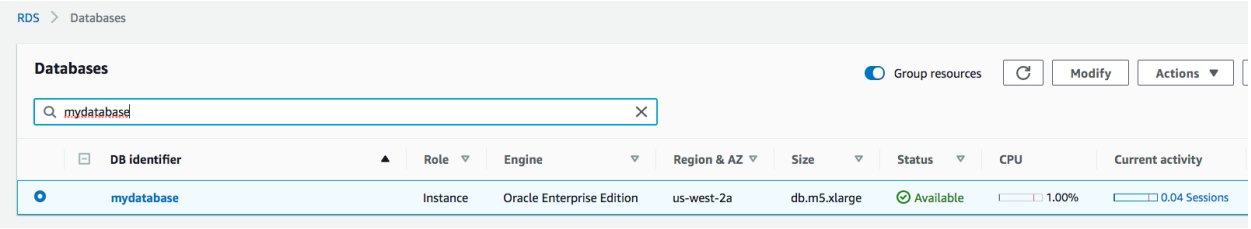
Example Command:

```
aws rds create-db-instance \
  --db-instance-identifier mydbinstance \
  --db-name MYDB \
  --allocated-storage 20 \
  --storage-type gp2 \
  --db-instance-class db.m5.xlarge \
  --engine oracle-ee  \
  --port 1521 \
  --backup-retention-period 1 \
  --license-model byol \
  --master-user-password fjie87bna09bfe3 \
  --master-username admin \
  --engine-version 19.0.0.0.ru-2020-01.rur-2020-01.r1
```

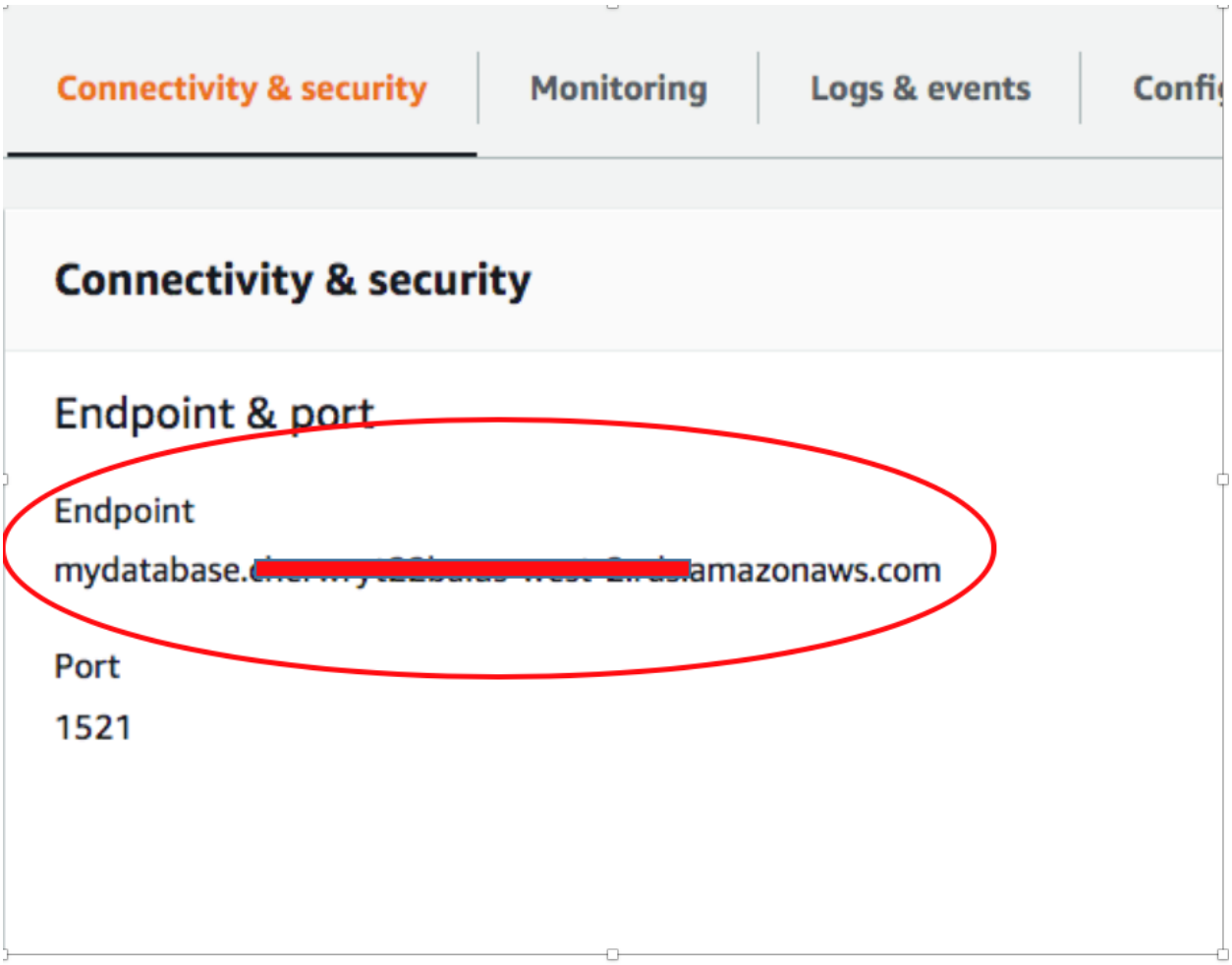
Lab 2: Connecting to the RDS Oracle DB (ETC ~2 -5 minutes)

Users are advised to disable firewalls and VPNs where possible so that they we can verify their IP address for whitelisting the connection to the newly created RDS Oracle Database instance. Please refer this website https://checkip.amazonaws.com/ to verify the client IP address.

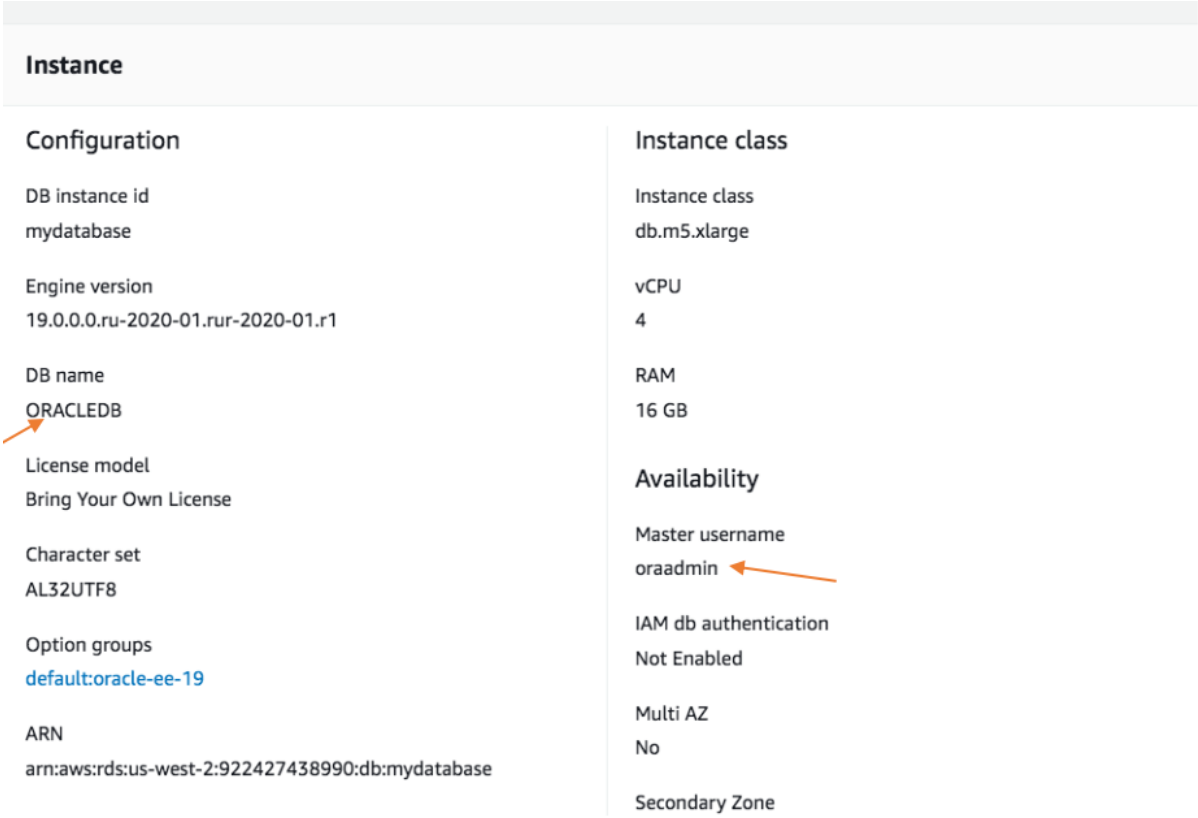
1. *Find the newly created RDS Oracle instance under the "**Databases**" tab and click on the DB Instance name and verify the status column to make sure it shows "available"*



2. *Click on the Database name under the "DB Identifier" and look under the "Connectivity and security" tab for the endpoint and the port information of your DB Instance.*

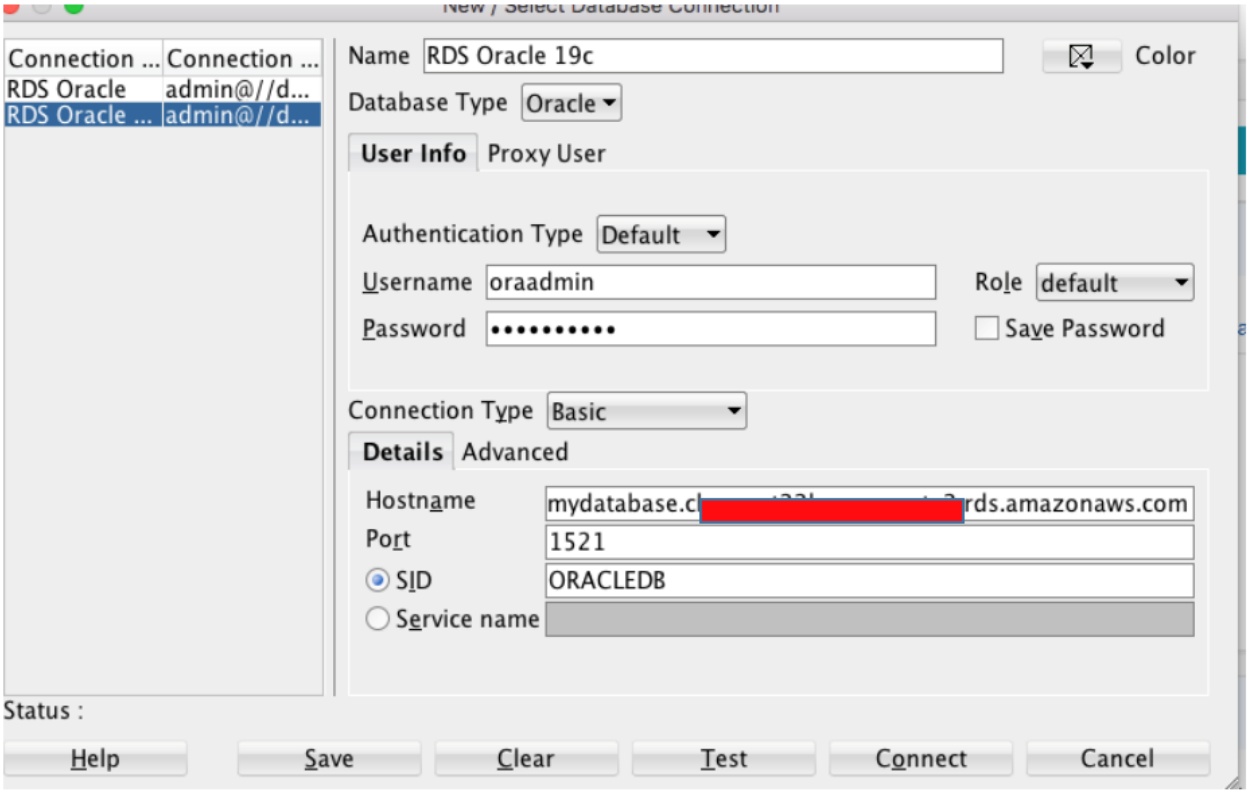


Click on the "configuration" tab to get the additional details such as "Master Username" and "DB name" etc.



3. *Start the SQL Developer -> New Connection, provide following inputs*
   SQL Developer can be downloaded [here]

Connection name	*< User defined connection name> RDS Oracle 19C*
Username	*Master Username provided during Database creation <oraadmin>*
Password	*Password provided for the Master Username during Database creation*
Hostname	*Endpoint copied in the step #1 above*
SID	*Database name provided during Database Creation <ORACLEDB>*



4. *In case connection to SQL Developer fails, then do this*
   Find the newly created RDS Oracle instance under the "Databases" tab

   Click on Link: Security Groups under the "Security group rules" (takes you to EC2 service page)

   Inbound -> Edit -> Add Rule

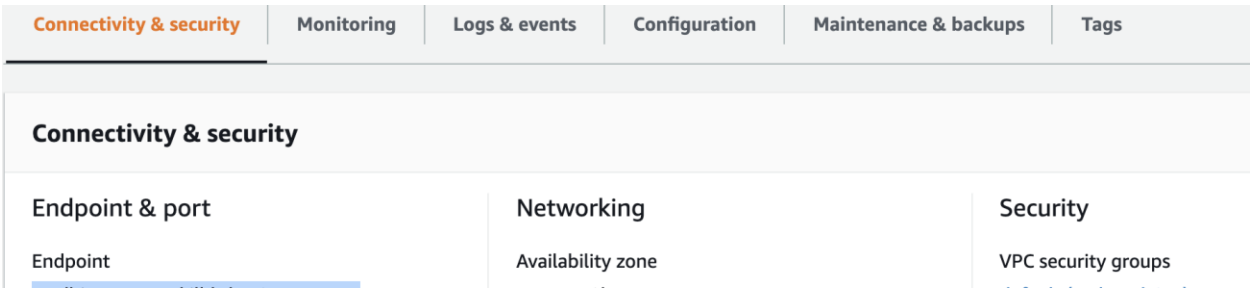
   Type: Oracle-RDS

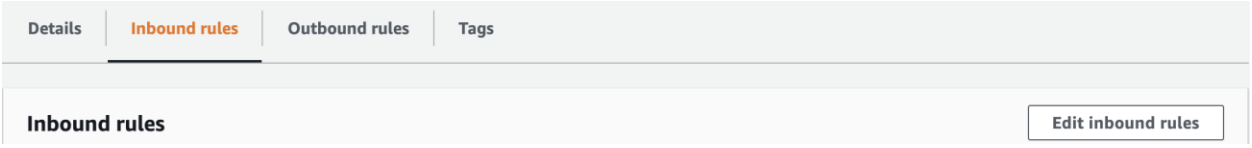
   Protocol: TCP

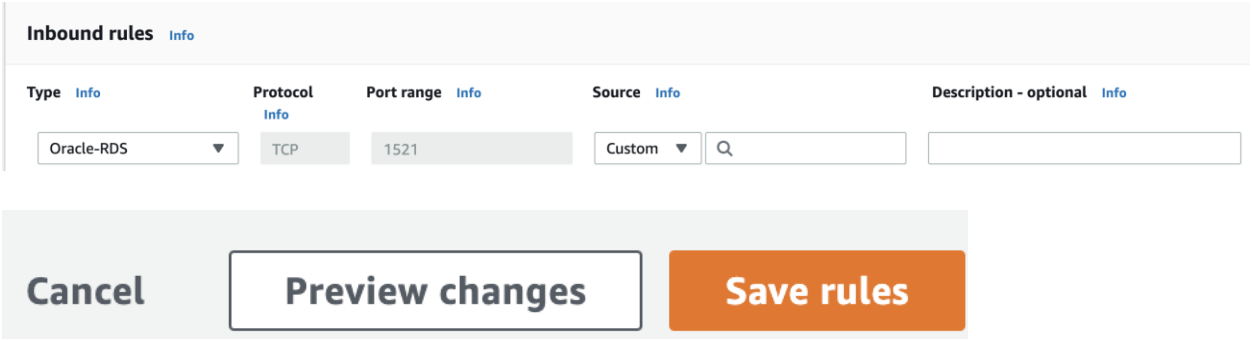
   Port Range: 1521

   Source: My IP (avoid 0.0.0.0/0) refer https://checkip.amazonaws.com/

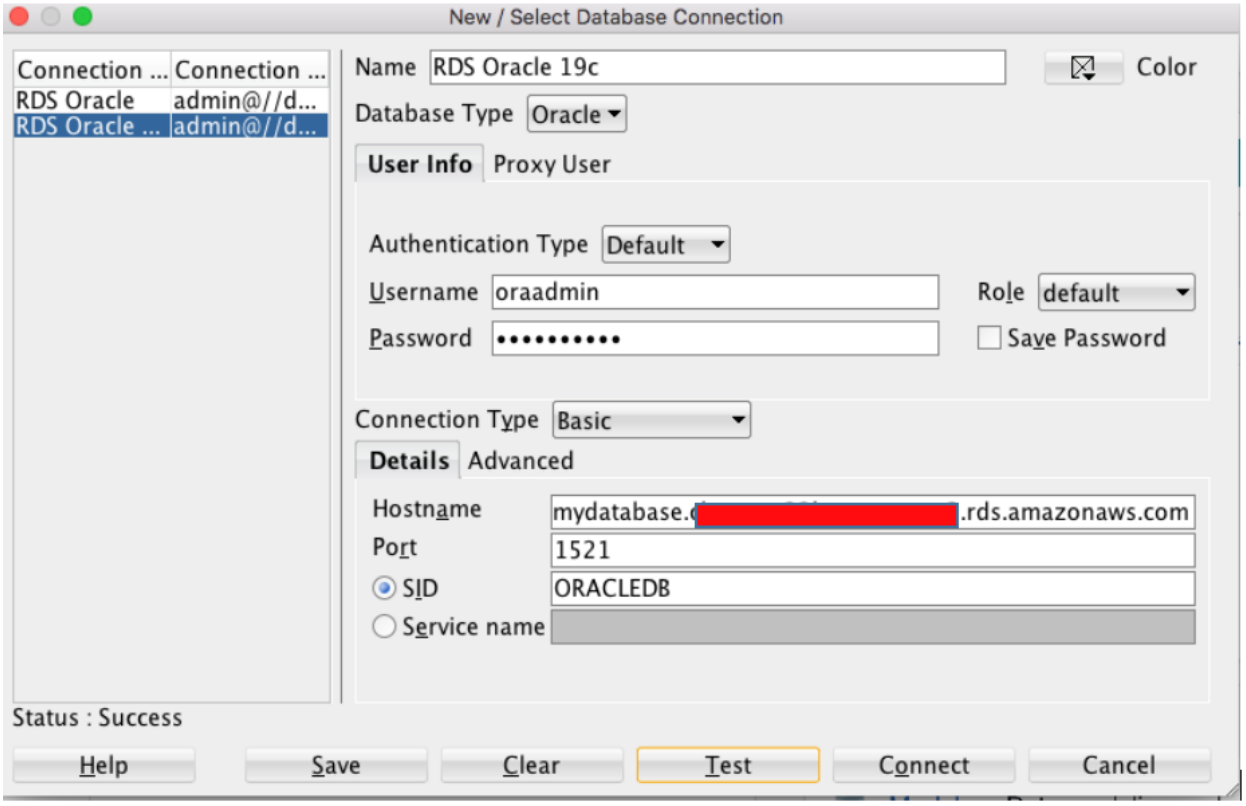
   Save







Test connection again



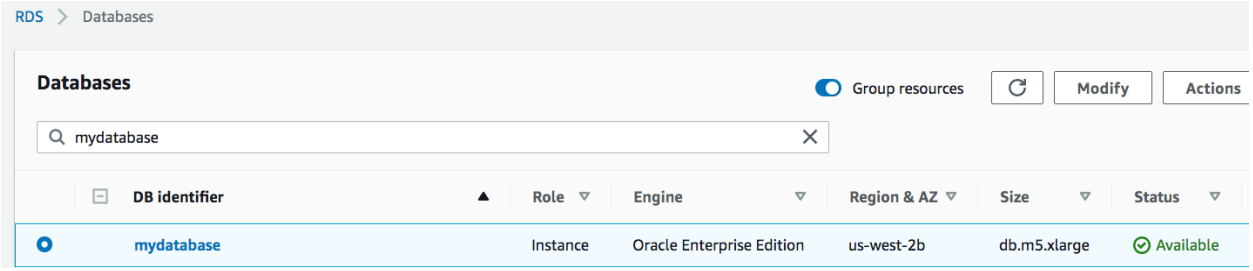
*Optional: - Use SQL*Plus to connect to the Database*

```
sqlplus oraadmin@'(DESCRIPTION =(ADDRESS = (PROTOCOL = TCP)(HOST
=mydatabase.xxxxxxx.rds.amazonaws.com)(PORT = 1521))(CONNECT_DATA =(SID =
ORACLEDB)))'

SQL*Plus: Release 12.2.0.1.0 Production on Fri Jun 5 04:47:49 2020

Copyright (c) 1982, 2016, Oracle.  All rights reserved.

Enter password:
Last Successful login time: Fri Jun 05 2020 04:33:34 +00:00

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

SQL> exit
Disconnected from Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production
```

Lab 3: High Availability on RDS Oracle (Multi-AZ) (ETC ~10 - 15 minutes)

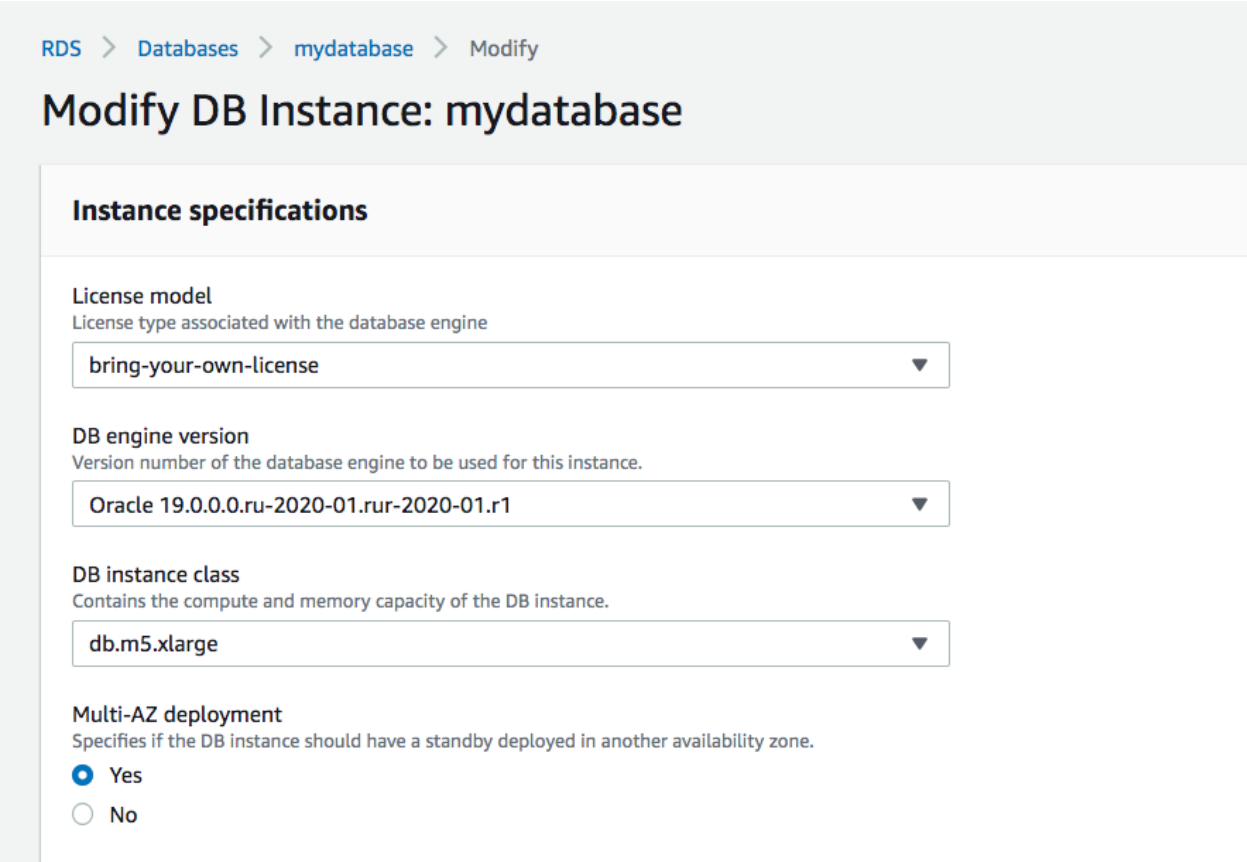
Configuring the Multi-AZ on RDS Oracle Database

1. *Find the newly created RDS Oracle instance under the "Databases" tab and click on the DB Instance name. Verify that the status column shows status as "available"*



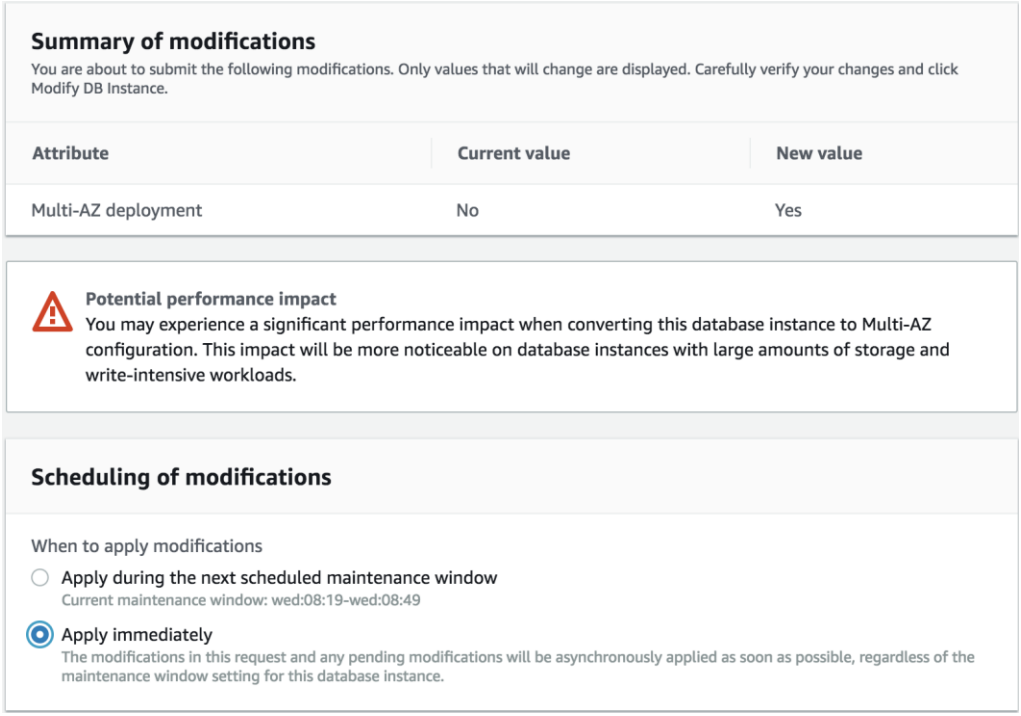
2. *Click on the "Modify"*

3. *On the Instance specification page, under Multi-AZ deployment choose "Yes" and leave other fields as is*



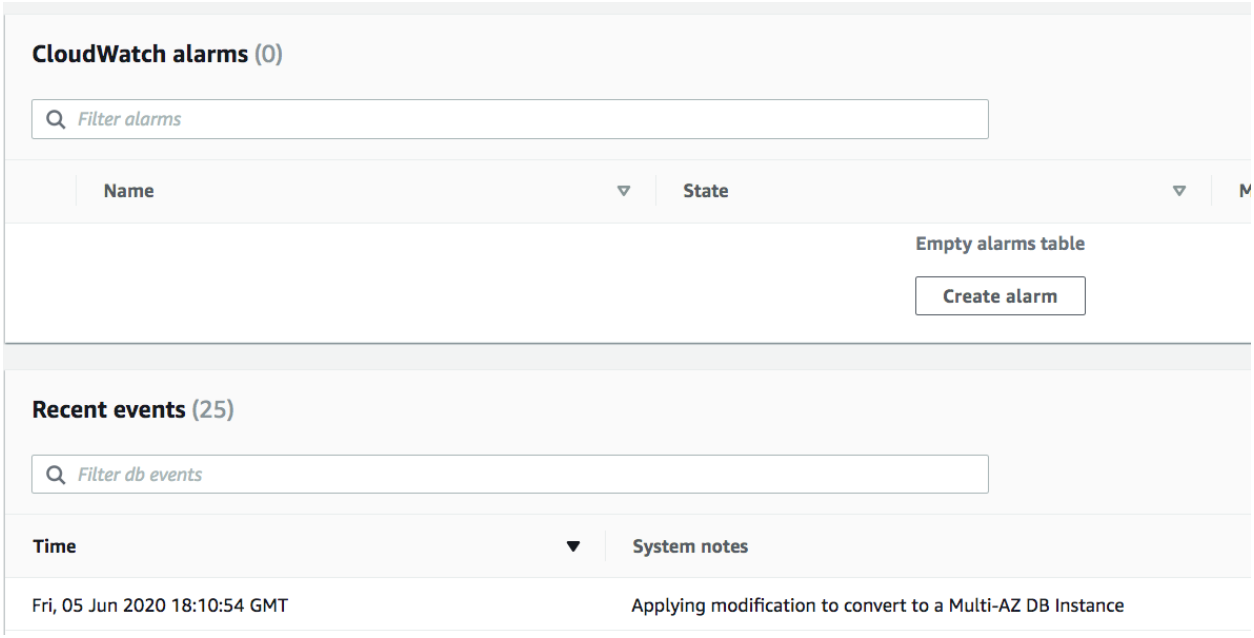
Leave everything else as default and Click "Continue"

4. *On the next screen under the "Scheduling of Modifications" choose "Apply immediately"*

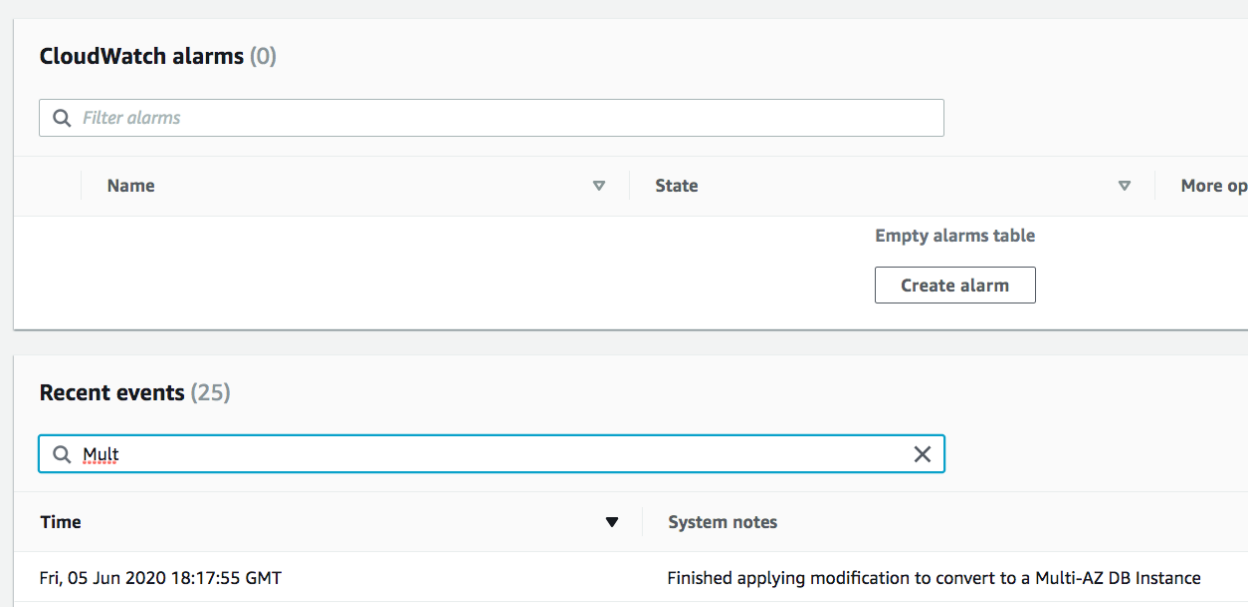


5. *Click on "Modify DB Instance" to continue with the modification*

You can also verify the modification is taking place by clicking the Database name and go to "Logs & events" and look under **"Recent events"** *you can find the most recent events on the top*



6. *Once the modify instance task is completed, this can be verified by looking at the status column for your Database instance on the Instances page. When the status column shows "available" it means the modification to the instance is completed.*



7. *Verify the Multi-AZ status for your instance on your Instance details page. Click on the Instances tab and select your instance and click to go to the Instance detail page and under the section "Availability and Durability" check the status of Multi-AZ*

Instance

Configuration

DB instance id
mydatabase

Engine version
19.0.0.0.ru-2020-01.rur-2020-01.r1

DB name
ORACLEDB

License model
Bring Your Own License

Character set
AL32UTF8

Option groups
ora19c-ee-optiongroup

ARN
arn:aws:rds:us-west-2:922427438990:db:mydatabase

Resource id
db-T34GSQBPZ2G4IEMO6QDTOUMOWY

Instance class

Instance class
db.m5.xlarge

vCPU
4

RAM
16 GB

Availability

Master username
oraadmin

IAM db authentication
Not Enabled

Multi AZ
Yes

Secondary Zone
us-west-2b

Availability

Master username

admin

IAM db authentication

Not Enabled

Multi AZ

Yes

Secondary Zone

us-west-2c

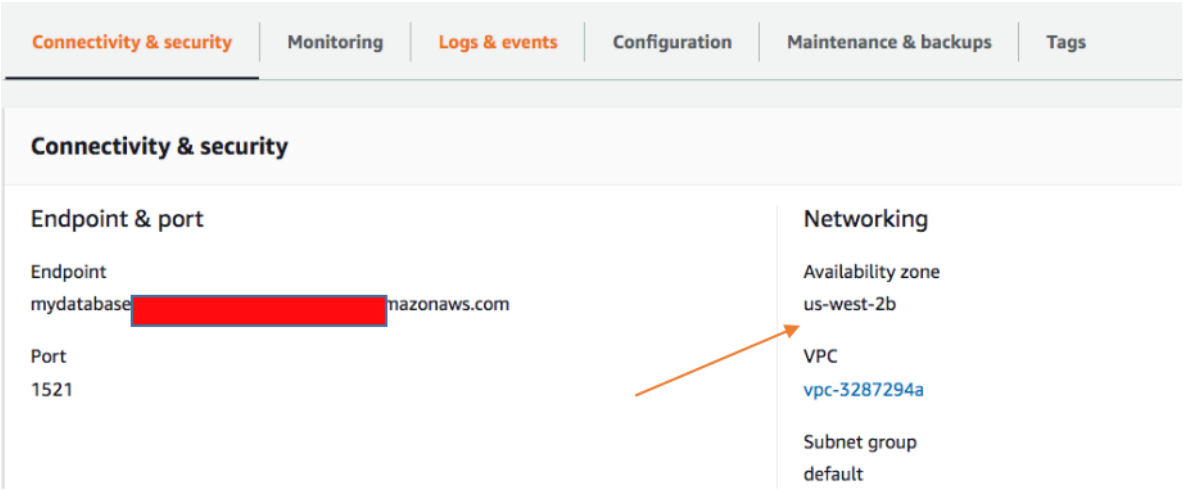
Simulating the AZ failover on RDS Oracle Database

RDS Oracle does provide customer's an option to simulate the AZ failure and High Availability by offering the option to reboot the RDS Oracle Instance with the failover option. This option will initiate AZ level failover for the Instance, the instance on the secondary AZ will become primary and the instance on the primary become secondary.

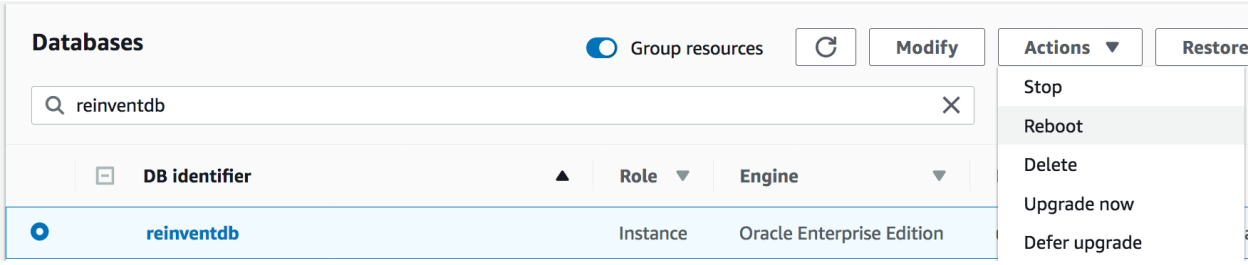
8. *Verify the primary and secondary AZ for the RDS Oracle Database Instance.*

   Choose your RDS Oracle Instance from the RDS home page by clicking "Instances" and after selecting your instance click to go the Instance details page

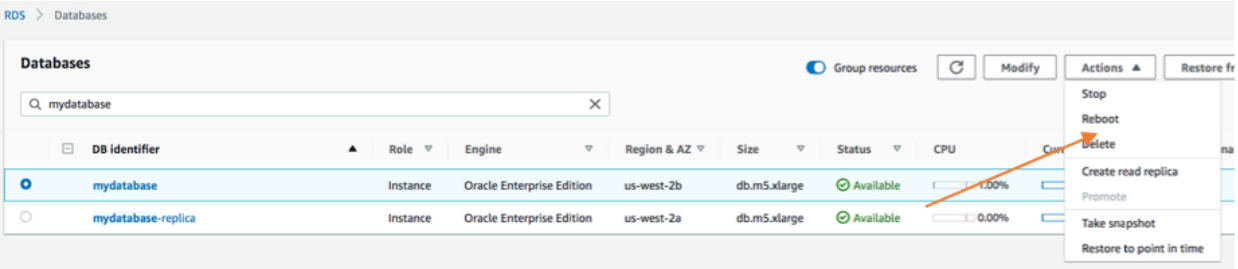
   On the Instance detail page, the primary AZ for the instance is shown under the section "Connectivity & Security" tab. In our case, it is us-west-2b. Also take a note on the endpoint connection string.

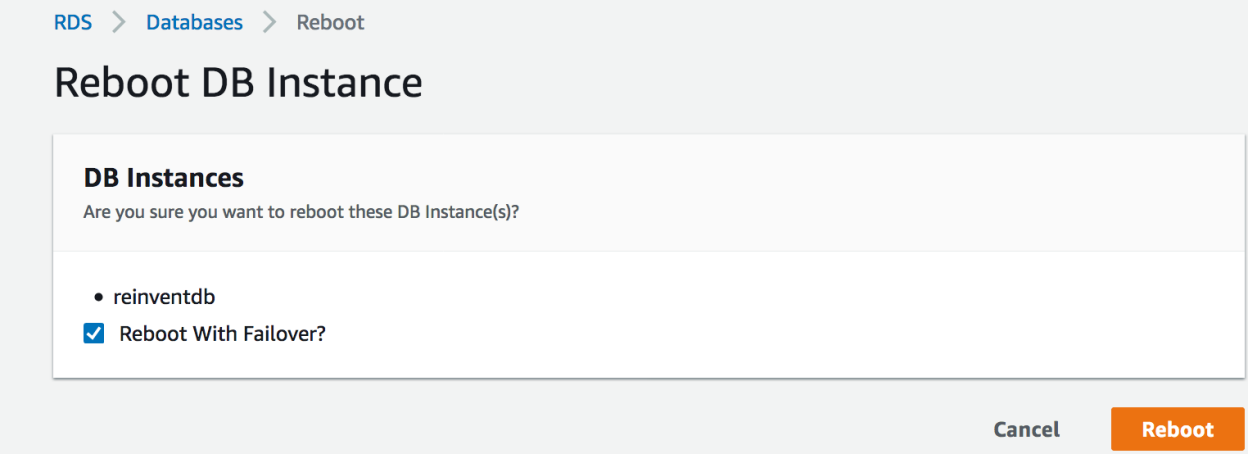


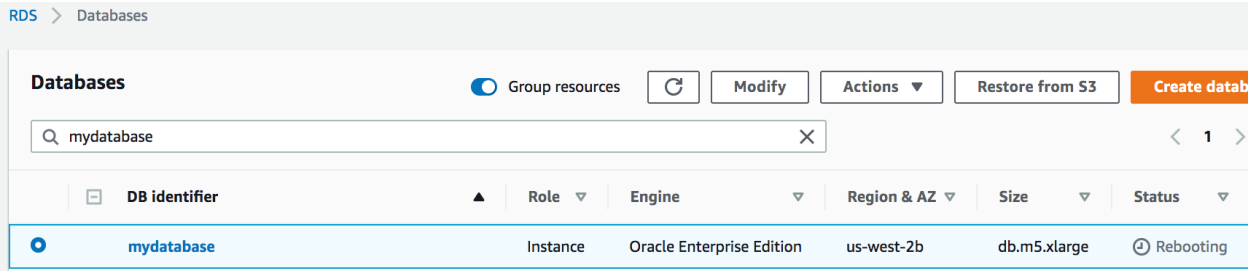
9. *To initiate AZ failover, Choose your RDS Oracle Databases from the RDS home page by clicking "Databases" and after selecting your Database click to go the "Actions" drop down choose "Reboot"*



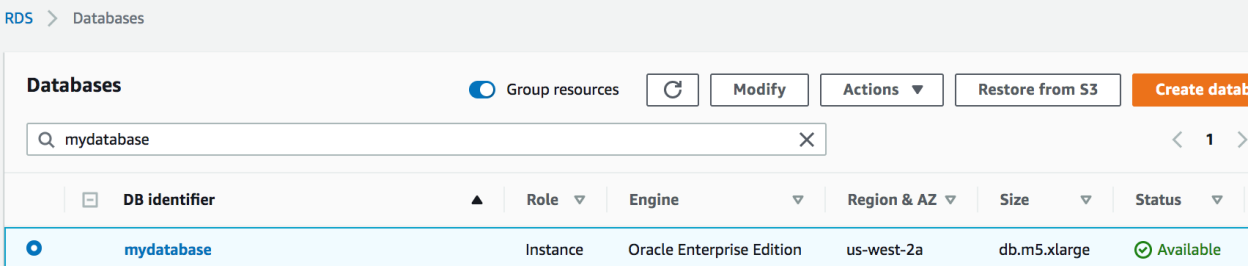
10. *Choose the checkbox for "Reboot with Failover" and click on the "Reboot" to initiate the failover.*







11. Once the RDS Oracle Database Instance is rebooted and status shows available



You can also verify the modification is taking place by clicking the Database name and go to "Logs & events" and look under **"Recent events"** *you can find the most recent events on the top*

Connectivity & security | Monitoring | Logs & events | Configuration | Maintenance & backups | Tags

CloudWatch alarms (0)

Filter alarms

Name	State
	Empty alarms table

Create alarm

Recent events (25)

Filter db events

Time	System notes
Fri, 05 Jun 2020 18:34:44 GMT	DB instance restarted
Fri, 05 Jun 2020 18:34:30 GMT	Multi-AZ instance failover completed
Fri, 05 Jun 2020 18:32:35 GMT	Multi-AZ instance failover started.

On the "Connectivity & Security" tab the Availibity zone for the Database is flipped. The primary availability zone is show as "us-west-2c" and the secondary availabilty zone is changed to "us-west-2b" . Also, observe the hostname. It remained the same before and after failover. That way you don't have to make any change on the application or client side.

Connectivity & security | Monitoring | Logs & events | Configuration | Maintenance & backups | Tags

Connectivity & security

Endpoint & port

Endpoint
mydatabase.[redacted]aws.com

Port
1521

Networking

Availability zone
us-west-2a

VPC
vpc-3287294a

Subnet group
default

Connectivity & security | Monitoring | Logs & events | Configuration

Availability

Master username

admin

IAM db authentication

Not Enabled

Multi AZ

Yes

Secondary Zone

us-west-2b

Lab 4: Amazon RDS Read Replica (Oracle Data guard) (ETC ~10 -15 minutes)

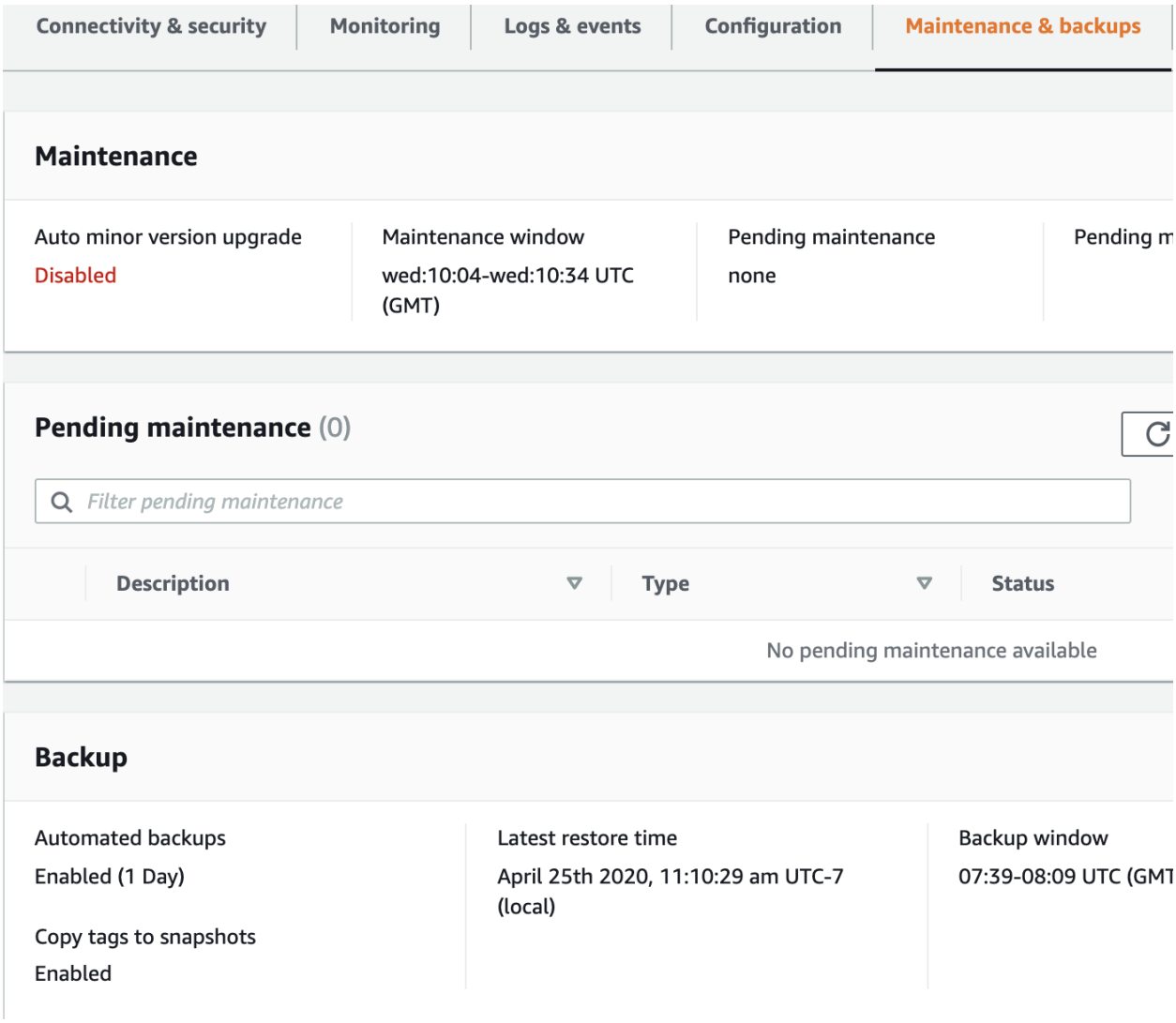
Amazon RDS Read Replicas provide enhanced performance and durability for database (DB) instances.

Amazon RDS creates a second DB instance using a snapshot of the source DB instance. It then uses the engines' native asynchronous replication using Oracle Active Data guard for Amazon RDS Oracle.

In order to enable Read replica, you must enable automatic backups on the source DB instance. To do so, you set the backup retention period to a value other than 0. We have already enabled the automatic backups on the Database we created above.

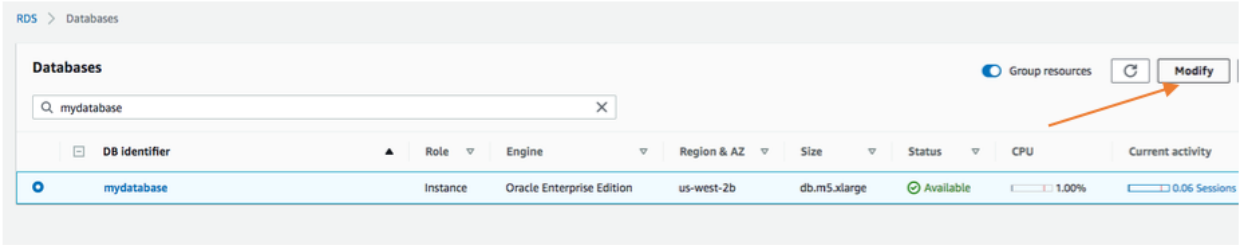
To verify if the automatic backups are enabled

Click on the "mydatabase" under the "DB Identifier" and look click on the "Maintenance and backups" tab and look under the "Backup" section.

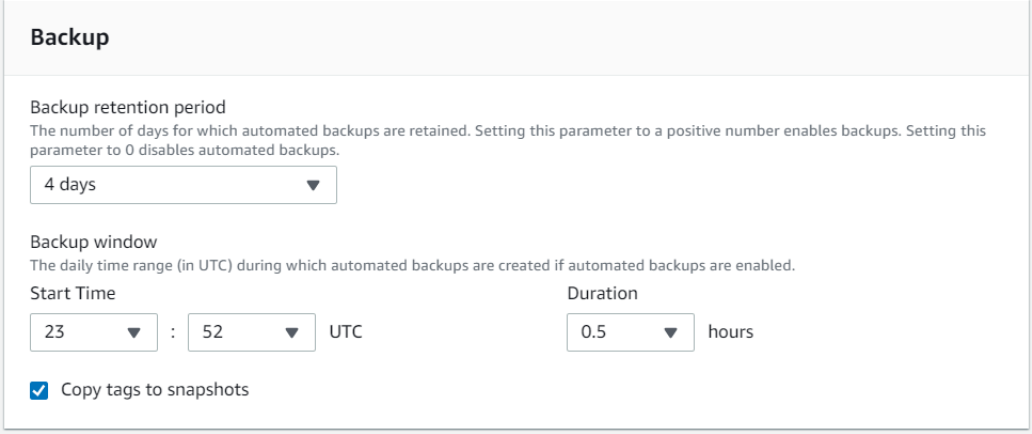


If you need to enable the backups then do the following:

1. *Click databases in the left and click the radio button next to the "mydatabase". Click Modify tab at the top*



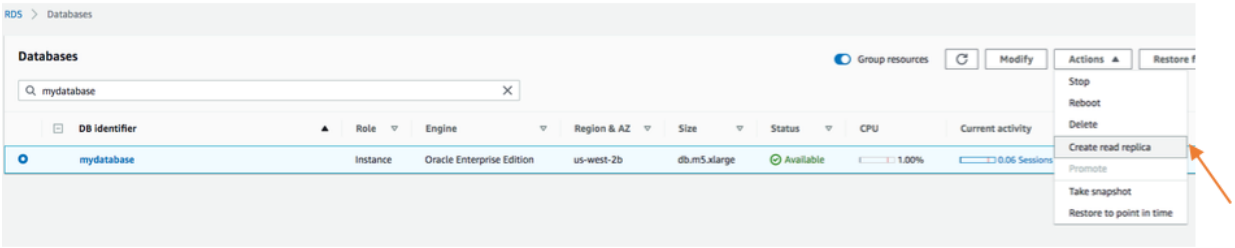
2. *Move to the backup section of the next page. Change it from 0 days to 4 days. Keep the rest to the default value*



3. *Move all the way to the bottom of the page and click continue. You will get "Summary of modifications followed by scheduling of modification screen. Click the radio button "Apply immediately" and click modify DB Instance. This might take 3 to 5 minutes*

Creating Read replica

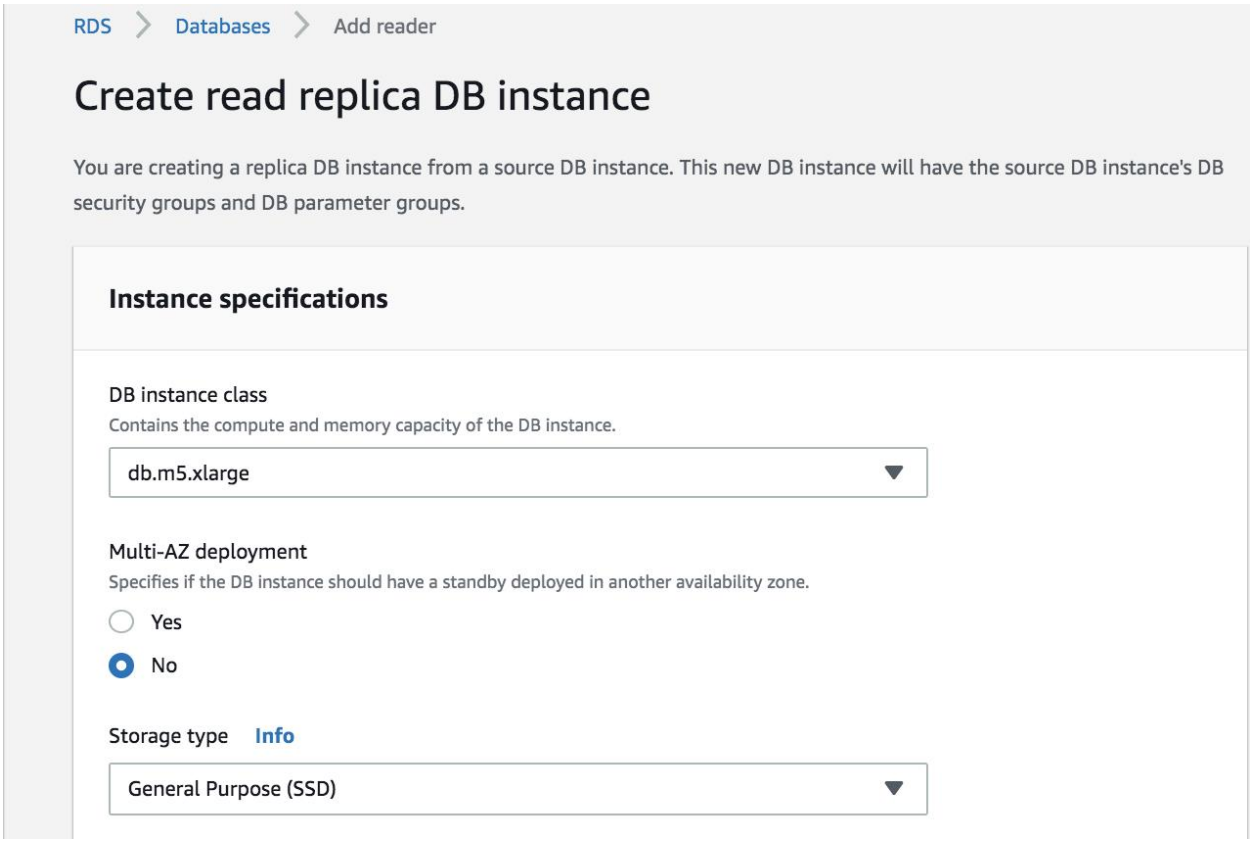
Click databases in the left and click the radio button next to the "mydatabase". Click "Actions" from the dropdown



4. *In the next screen, enter values as follows:*

Parameter	Subclass	Value

Instance specifications	*DB instance class:*	*db.m5.xlarge*
Instance specifications	*Multi-AZ deployment*	*No*
Instance specifications	*General Purpose (SSD)*	
Network & Security	*Destination Region*	*Us-east-1*
Network & Security	*Destination subnet group*	*default*
Network & Security	*Publicly accessible*	*Yes*
Network & Security	*VPC security groups*	*default*
Settings	*Read replica source*	*mydatabase*
Settings	*DB instance identifier*	*mydatabase-replica*
Monitoring	*Enhanced Monitoring*	*Choose Disable option*
Log Export		*Leave all options unchecked*
Performance Insights		*Choose Disable option*
Maintenance	*Auto Minor version upgrade*	*No*



Network & Security

Destination region
The region in which the replica will be launched

US East (N. Virginia)

Destination DB subnet group

default

Availability zone
The EC2 Availability Zone that the database instance will be created in.

No preference

Publicly accessible

- (●) Yes
  EC2 instances and devices outside of the VPC hosting the DB instance will connect to the DB instances. You must also select one or more VPC security groups that specify which EC2 instances and devices can connect to the DB instance.
- ( ) No
  DB instance will not have a public IP address assigned. No EC2 instance or devices outside of the VPC will be able to connect.

VPC security groups

Choose VPC security groups

default ×

Encryption

Encryption

- ( ) Enable encryption Learn more
  Select to encrypt the given instance. Master key ids and aliases appear in the list after they have been created using the Key Management Service(KMS) console.
- (●) Disable encryption

Settings

Read replica source
Source DB instance Identifier

mydatabase

DB instance identifier
DB instance identifier. This is the unique key that identifies a DB instance. This parameter is stored as a lowercase string (e.g. mydbinstance).

mydatabase-replica

Monitoring

Enhanced monitoring

- (●) Enable enhanced monitoring
  Enhanced monitoring metrics are useful when you want to see how different processes or threads use the CPU.
- ( ) Disable enhanced monitoring

Monitoring Role: Default

Granularity: 5 seconds

[x] I authorize RDS to create the IAM role rds-monitoring-role.

Log exports

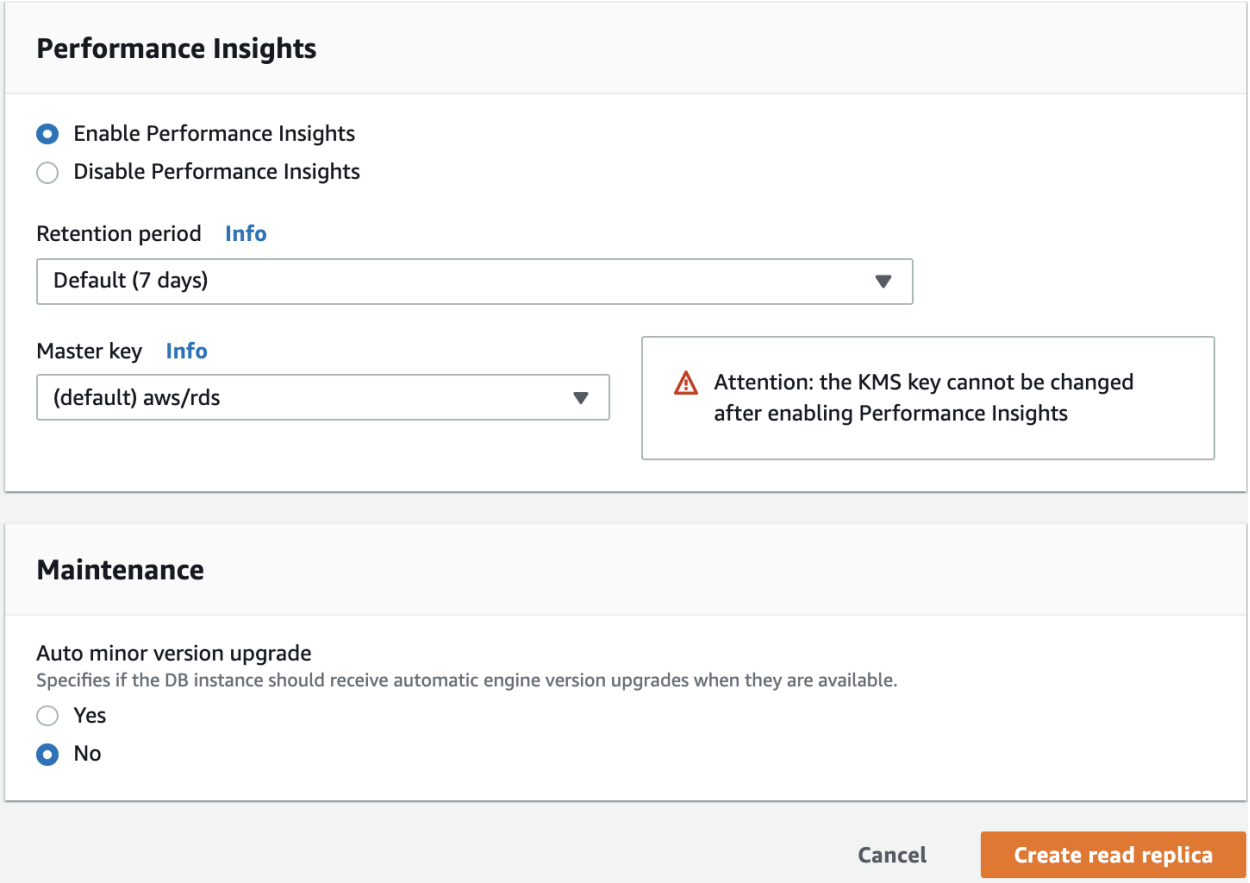
Select the log types to publish to Amazon CloudWatch Logs

- [ ] Alert log
- [ ] Audit log
- [ ] Listener log
- [ ] Trace log

IAM role

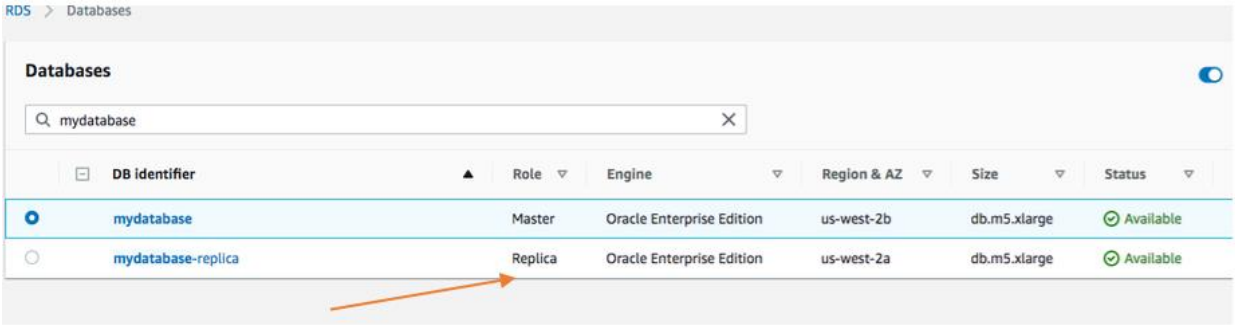
The following service-linked role is used for publishing logs to CloudWatch Logs.

RDS Service Linked Role



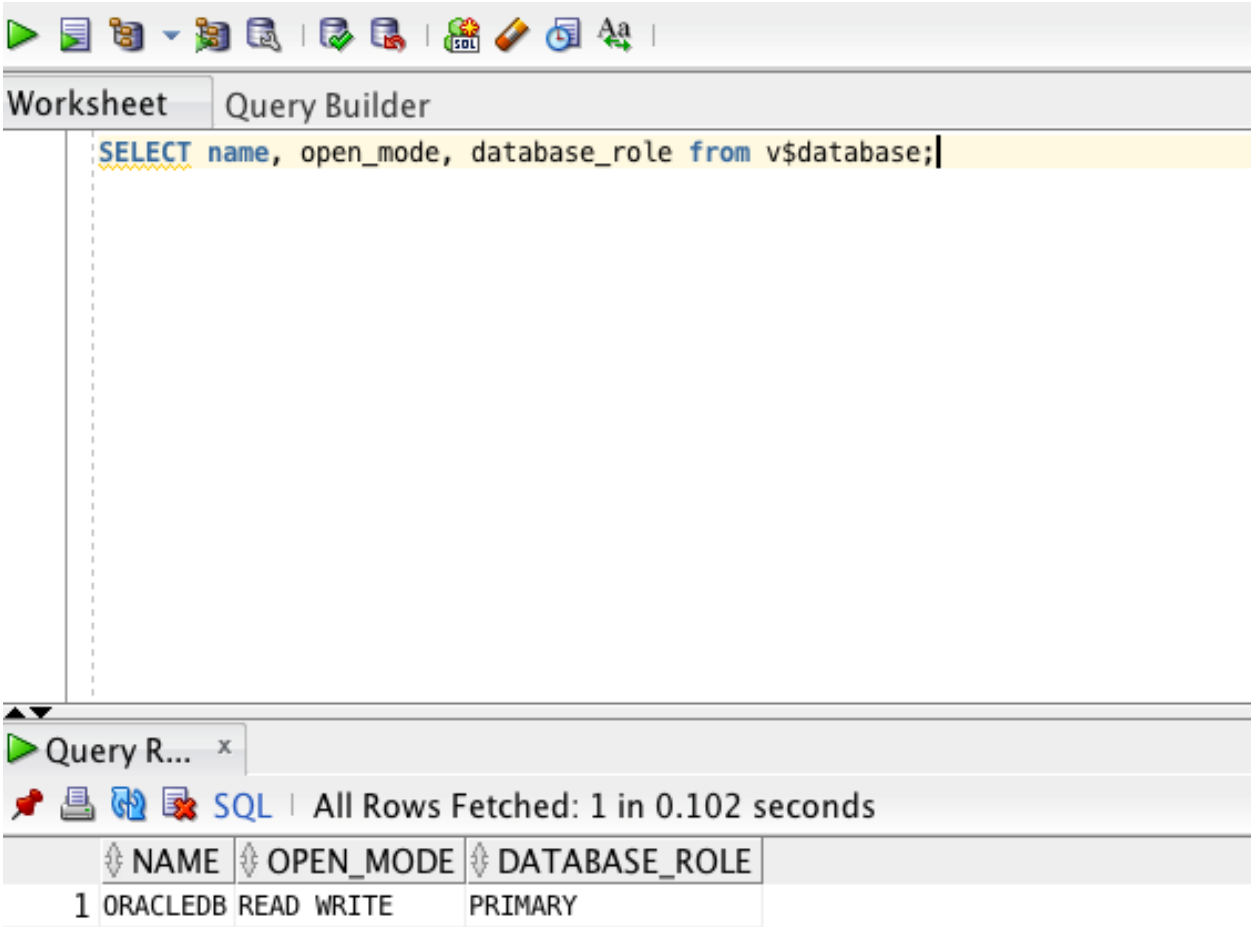
5. *Now click "Create Read Replica". Since this will take about 10-15 minutes to complete, just so be able to save some time we can proceed to the next lab and come back to this later.*

6. *Upon successful completion after 10-15 minutes or so, you will see*



And pay attention about the role of "mydatabase" changed to **Master** *and the role of mydatabase-replica* **is Replica**

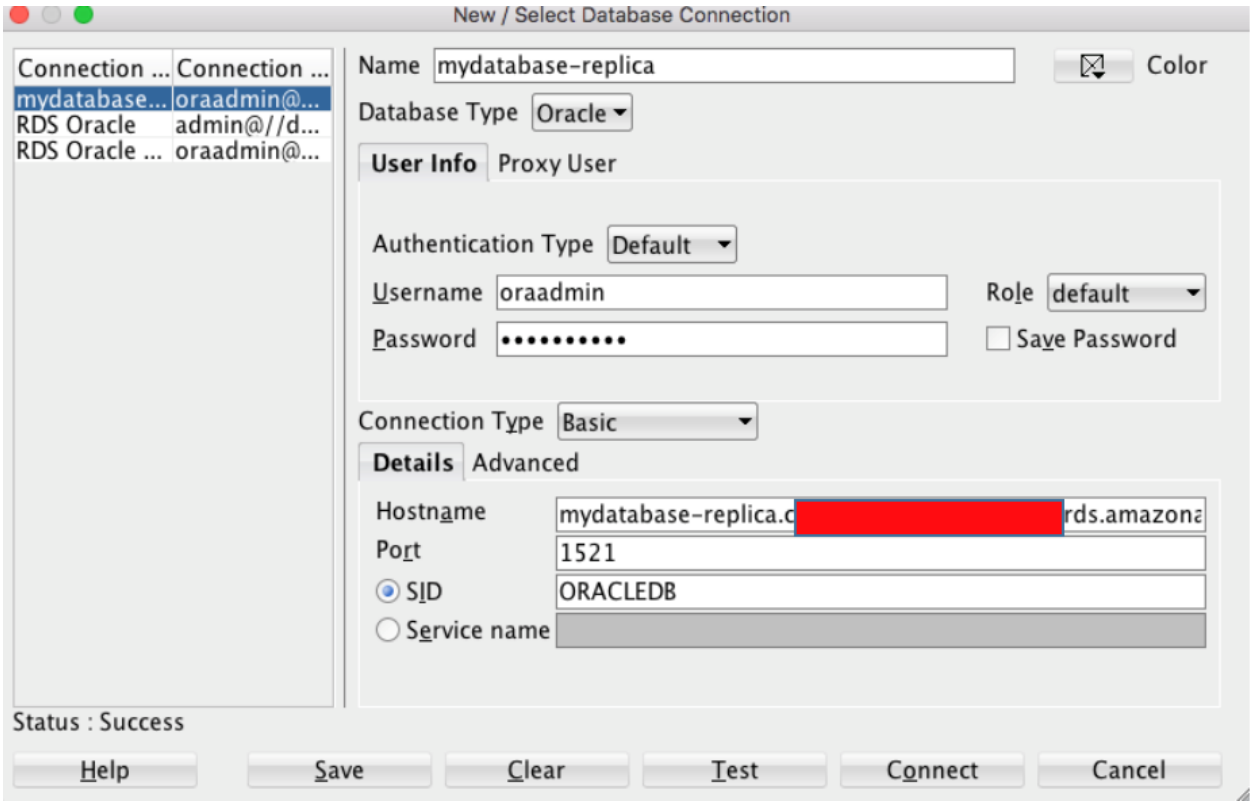
7. *Now, open the SQL Developer and connect to the mydatabase database. Run the following sql*

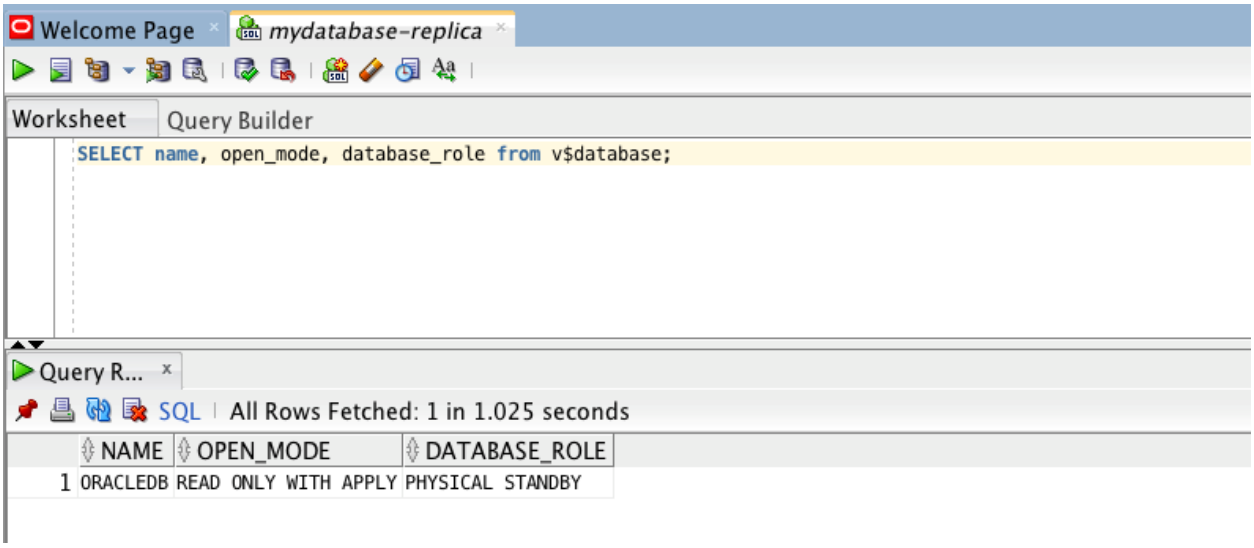



```
$ sqlplus oraadmin@'(DESCRIPTION =(ADDRESS = (PROTOCOL = TCP)(HOST
=mydatabase.xxxxxxxx.amazonaws.com)(PORT = 1521))(CONNECT_DATA =(SID =
ORACLEDB)))'

SQL*Plus: Release 12.2.0.1.0 Production on Fri Jun 5 16:10:10 2020

Copyright (c) 1982, 2016, Oracle.  All rights reserved.

Enter password:
Last Successful login time: Fri Jun 05 2020 16:05:15 +00:00

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

SQL> SELECT name, open_mode, database_role from v$database;
```

```
NAME       OPEN_MODE        DATABASE_ROLE
--------- -------------------- ----------------
ORACLEDB  READ WRITE        PRIMARY

SQL>
```

8. *You would get output like this when you connect to the "mydatabase-replica"*

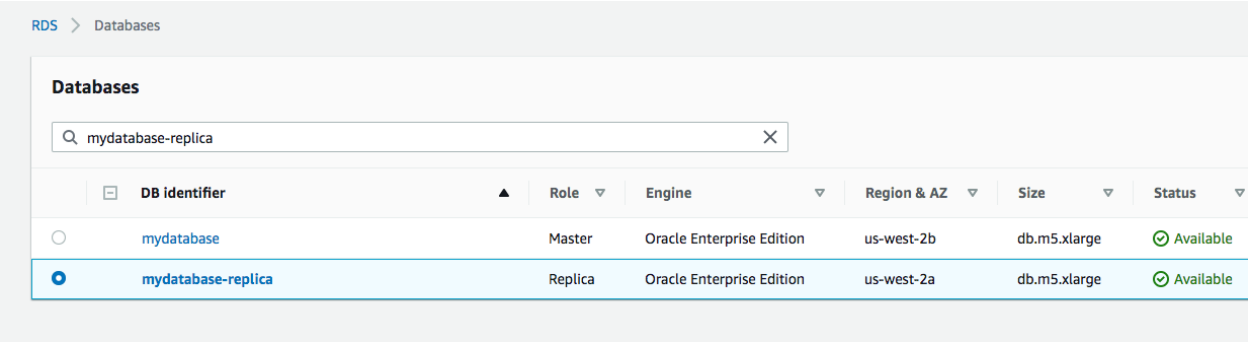




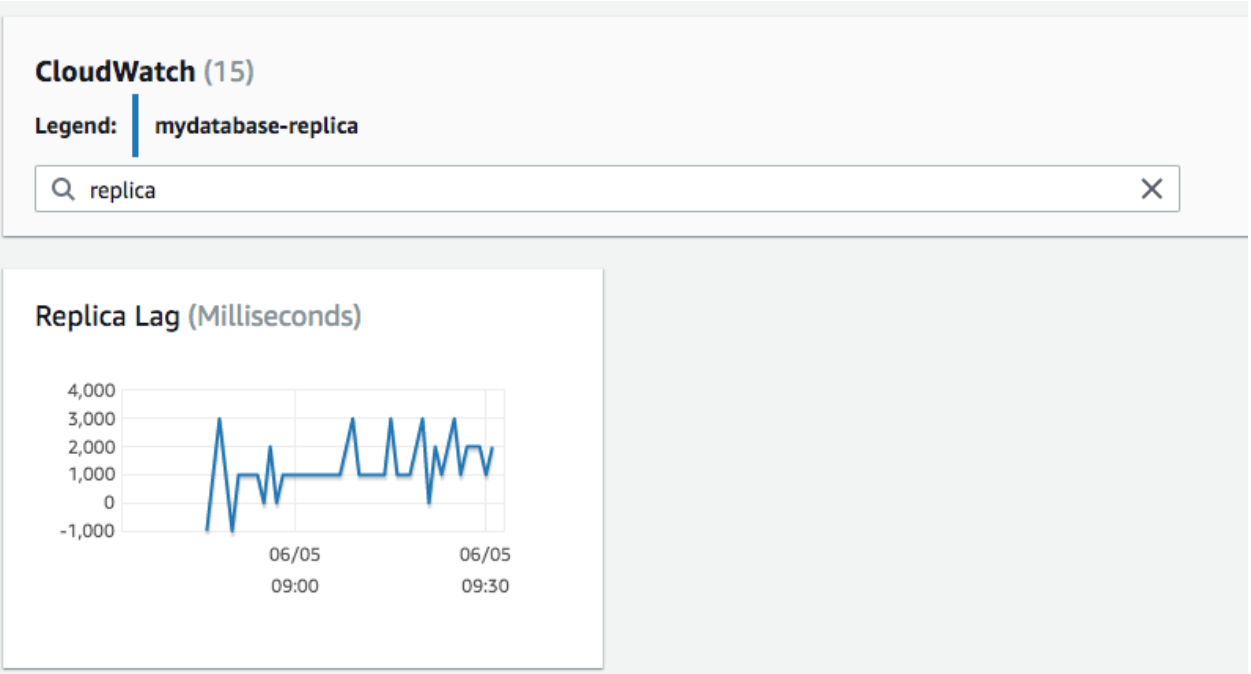

```
$ sqlplus oraadmin@'(DESCRIPTION =(ADDRESS = (PROTOCOL = TCP)(HOST
=mydatabase-replica.xxxxxx.rds.amazonaws.com)(PORT = 1521))(CONNECT_DATA
=(SID = ORACLEDB)))'

SQL*Plus: Release 12.2.0.1.0 Production on Fri Jun 5 16:23:10 2020

Copyright (c) 1982, 2016, Oracle.  All rights reserved.

Enter password:
Last Successful login time: Fri Jun 05 2020 16:10:14 +00:00

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

SQL> SELECT name, open_mode, database_role from v$database;

NAME      OPEN_MODE        DATABASE_ROLE
--------- -------------------- ----------------
ORACLEDB  READ ONLY WITH APPLY PHYSICAL STANDBY

SQL>
```

Monitoring the replication lag

Select the read replica instance (instance with the role -replica)



Click on Monitoring and type "replica lag" in the search box



Welcome Page | mydatabase-replica

Worksheet | Query Builder

```
select name, value, datum_time, time_computed from v$dataguard_stats where name='apply lag';
```

Query Result

SQL | All Rows Fetched: 1 in 0.388 seconds

	NAME	VALUE	DATUM_TIME	TIME_COMPUTED
1	apply lag	+00 00:00:00	06/05/2020 16:36:47	06/05/2020 16:36:48

Welcome Page | mydatabase-replica

Worksheet | Query Builder

```
select * from v$standby_event_histogram where name='apply lag' order by last_time_updated  ;
```

Query Result

SQL | All Rows Fetched: 9 in 0.042 seconds

	NAME	TIME	UNIT	COUNT	LAST_TIME_UPDATED	CON_ID
1	apply lag	4	seconds	1	06/05/2020 15:50:22	0
2	apply lag	5	seconds	1	06/05/2020 15:50:23	0
3	apply lag	6	seconds	1	06/05/2020 15:50:24	0
4	apply lag	7	seconds	1	06/05/2020 15:50:25	0
5	apply lag	8	seconds	1	06/05/2020 15:50:26	0
6	apply lag	1	seconds	15	06/05/2020 16:35:41	0
7	apply lag	2	seconds	13	06/05/2020 16:40:54	0
8	apply lag	0	seconds	2773	06/05/2020 16:41:08	0
9	apply lag	3	seconds	0	(null)	0

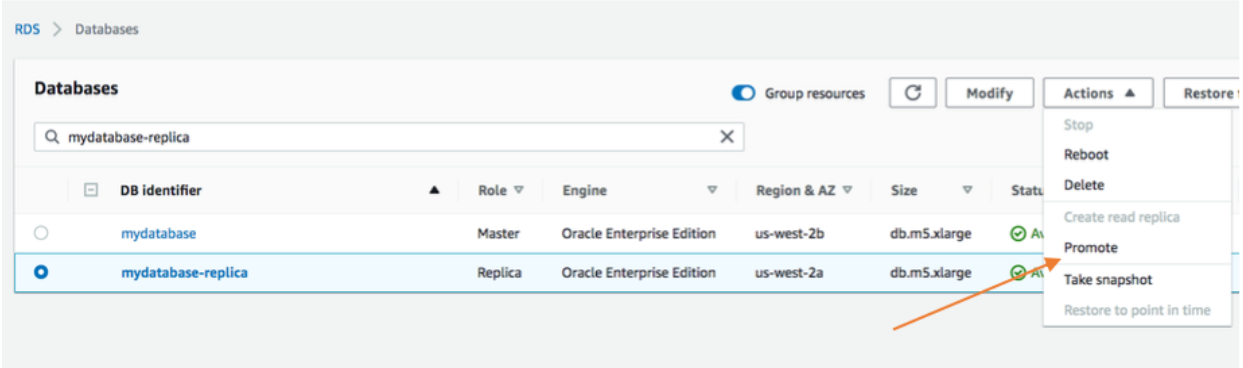
$ sqlplus oraadmin@'(DESCRIPTION =(ADDRESS = (PROTOCOL = TCP)(HOST =mydatabase-replica.xxxxxxxx.amazonaws.com)(PORT = 1521))(CONNECT_DATA =(SID = ORACLEDB)))'

*SQL*Plus: Release 12.2.0.1.0 Production on Fri Jun 5 16:46:45 2020*

```
Copyright (c) 1982, 2016, Oracle.  All rights reserved.

Enter password:
Last Successful login time: Fri Jun 05 2020 16:10:14 +00:00

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

SQL> set lines 250 pages 10000
SQL> show parameter db_uniq

NAME                                 TYPE     VALUE
------------------------------------ ----------- ------------------------------
db_unique_name                       string    ORACLEDB_B
SQL> select open_mode,database_role from v$database;

OPEN_MODE        DATABASE_ROLE
-------------------- ----------------
READ ONLY WITH APPLY PHYSICAL STANDBY

SQL> col name format a30
SQL> col value format a30
SQL> ALTER SESSION SET nls_date_format='dd-mon-yyyy hh24:mi:ss';

Session altered.

SQL> SELECT NAME,VALUE,DATUM_TIME,TIME_COMPUTED FROM
V$DATAGUARD_STATS WHERE UPPER(NAME)='APPLY LAG';

NAME                           VALUE                          DATUM_TIME
TIME_COMPUTED
------------------------------ ------------------------------ ------------------------------ ------
------------------------
apply lag                      +00 00:00:00                   06/05/2020 16:48:04
06/05/2020 16:48:04
```

9. *Manual Failover to the read replica:*

In order to manually failover to the read replica, from the database main page, select the mydatabase-replica. At the top right corner, click the tab "Action" and select promote



10. *This will take you to the next screen*

Select as follows:

Parameter	Subclass	Value
Enable automatic backups:	*Yes*	
Backup retention period	*1 Days*	
Backup window	*No preference*	

RDS > Databases > Promote read replica

Promote Read Replica: mydbinstance-ro

Preferences

Enable automatic backups

- (●) Yes
- ( ) No

  Selecting no will disable automated backups

Backup retention period

The number of days for which automated backups are retained. Setting this parameter to a positive number enables backups. Setting this parameter to 0 disables automated backups.

1 days

Backup window

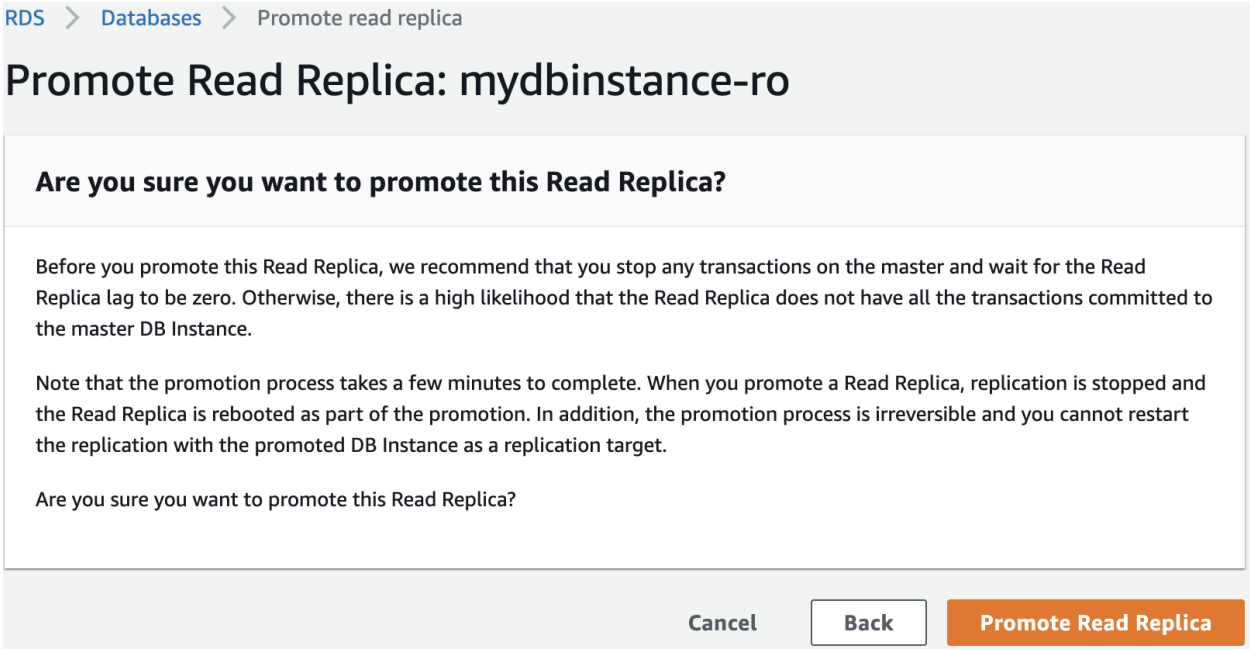
The daily time range (in UTC) during which automated backups are created if automated backups are enabled.

- ( ) Select Window
- (●) No preference

11. Then Click Continue

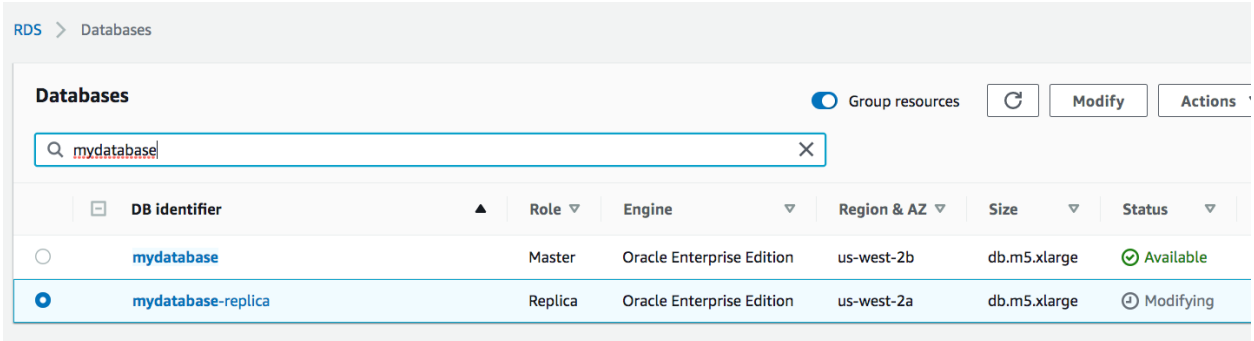
Cancel **Continue**

You will be prompted for confirmation:

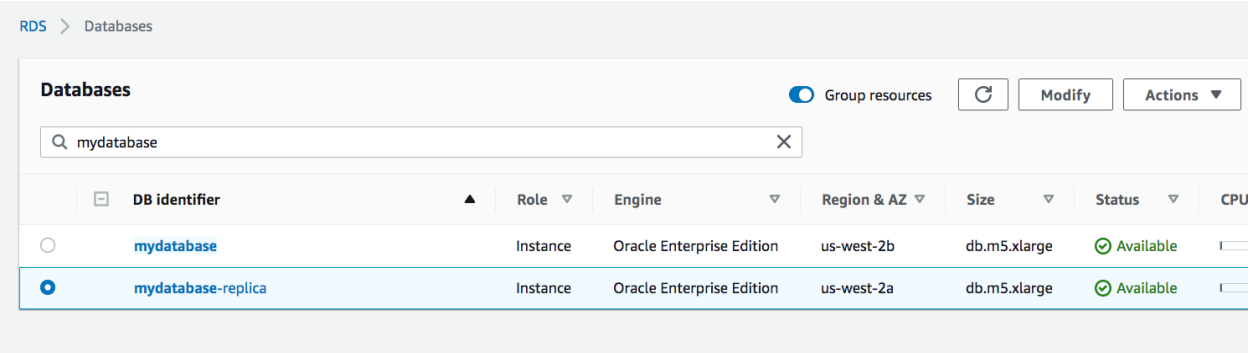


Click "Promote Read Replica"

12. *This would take 5 minutes. In order to check if it is successfully completed, verify the status of the* **mydatabase-replia** *database from the RDS database console*

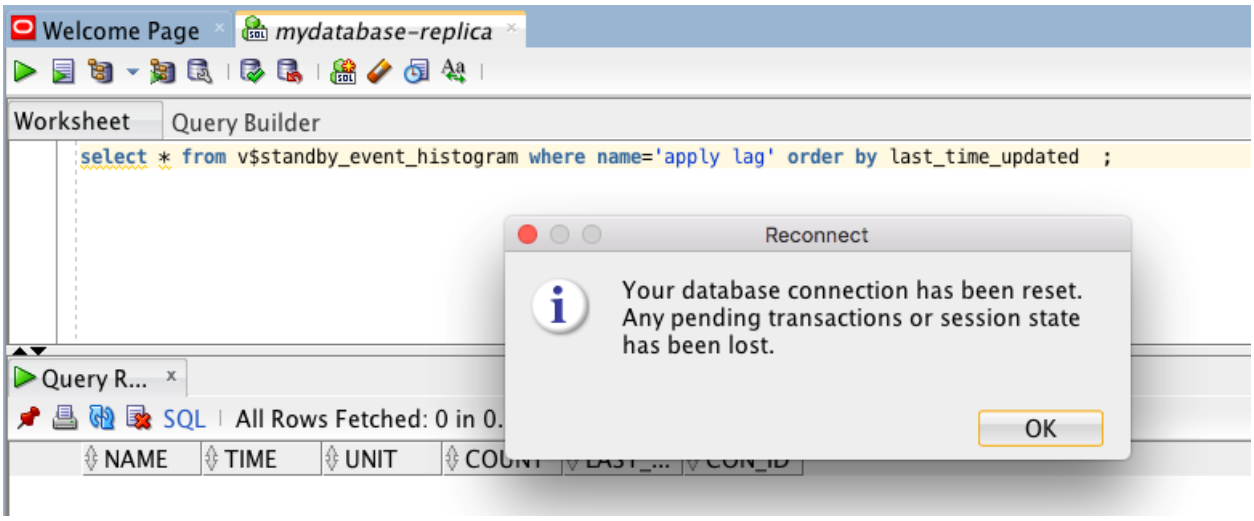


After the completion, it will look like this

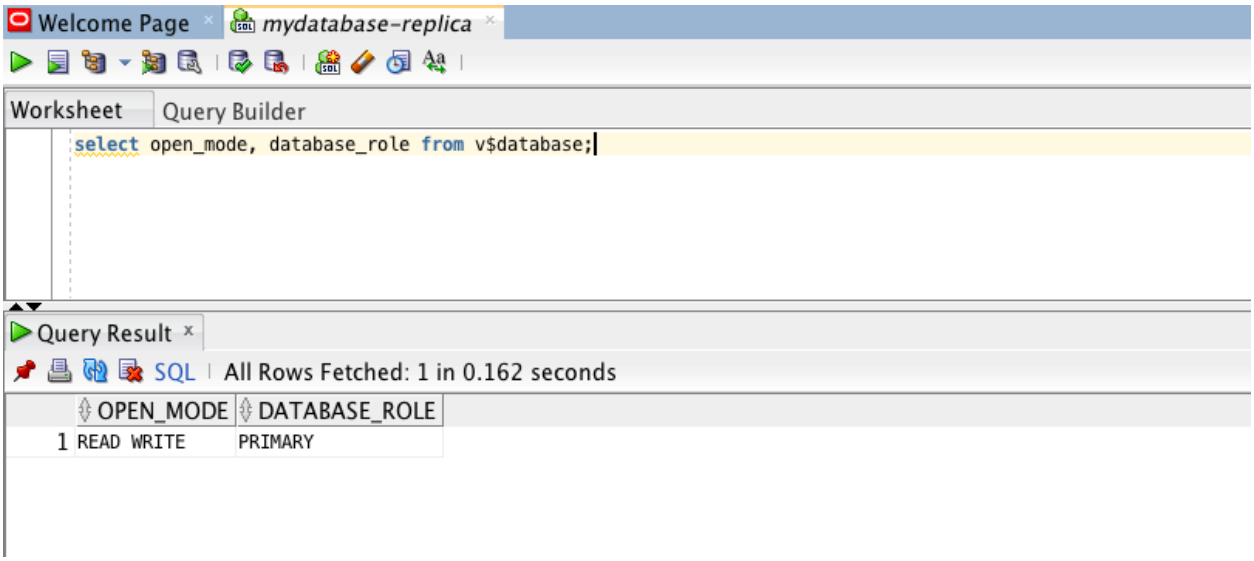


13. *As you might have noticed, the column "Role" changed from Master/Replica to Instance/Instance. This is because, after the promotion, read replica becomes a standalone database.*

14. *After successful failover, if you run the same sql that you ran in the nydatabase-replica it fails with the below error*



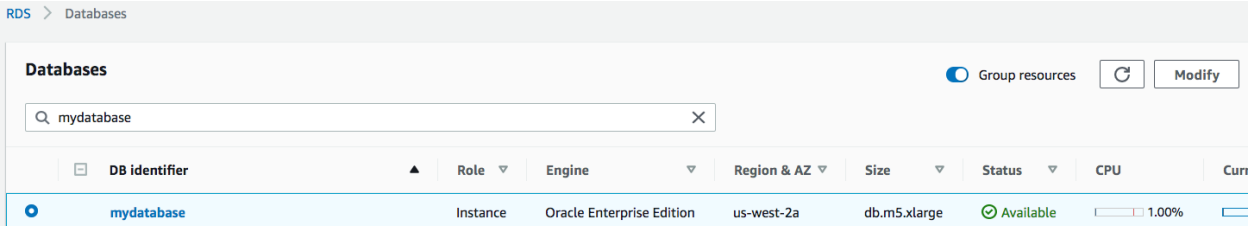
15. *You need to reconnect to the same database "mydatabase-replica" using sqldeveloper and upon successful connection, run the same query that was ran before. Observe the output this time.*



Lab 5: Enabling Performance Insights ,Enhanced Monitoring and Export logs to Cloudwatch (ETC ~10 -15 minutes)

Enabling Enhanced monitoring, export logs to CloudWatch and the Performance Insights.

1. *Find the newly created RDS Oracle instance under the "Databases" tab and click on the DB Instance name. Verify that the status column shows status as "available"*



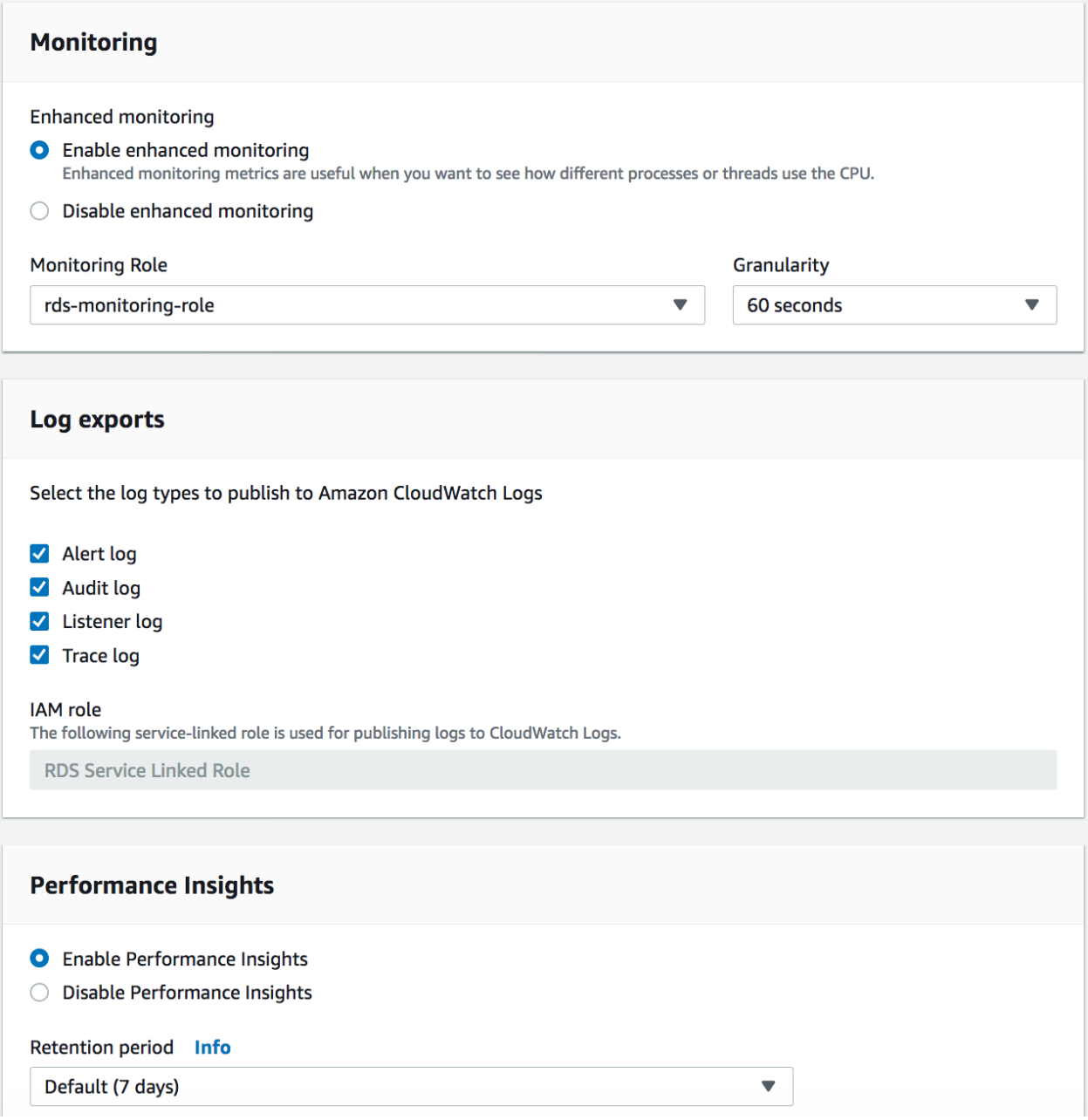
2. *Click on the "Modify"*

3. *On the next screen we are going to modify the Monitoring, Log Exports and Performance Insights.*

For the Monitoring check the "Enable enhanced monitoring" option and leave the "Monitoring Role" and the "Granularity" to the default values.

For the Log Exports select the log you would want to export to the Cloudwatch, choose all.

For the Performance Insights select "Enable Performance Insights" and leave all other values to the default.



Go to the bottom of the page and click on "Continue"

On the next page verify the "summary of the modifications" and choose "Apply Immediately" under the "scheduling of modifications" section. And then finally click on the "Modify DB Instance" to make the modifications.

RDS > Databases > Modify

Modify DB Instance: reinventdb

Summary of modifications

You are about to submit the following modifications. Only values that will change are displayed. Carefully verify your changes and click Modify DB Instance.

Attribute	Current value	New value
Enable Enhanced Monitoring	Yes	Yes
Granularity	0	60
Monitoring Role	rds-monitoring-role (arn:aws:iam::862756250442:role/rds-monitoring-role)	rds-monitoring-role (arn:aws:iam::862756250442:role/rds-mor
Enable publish to cloudWatch logs		Alert log, Audit log, Listener log, Trace log
Enable Performance Insights	No	Yes
Performance Insights KMS Key		alias/aws/rds

Scheduling of modifications

When to apply modifications

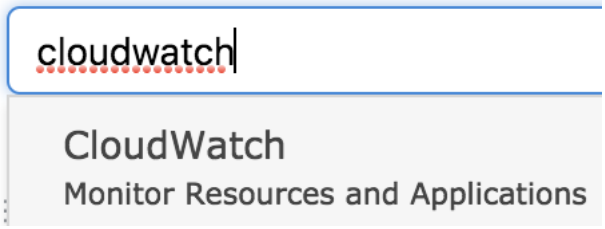
- ○ Apply during the next scheduled maintenance window
  Current maintenance window: fri:10:30-fri:11:00
- ◉ Apply immediately
  The modifications in this request and any pending modifications will be asynchronously applied as soon as possible, regardless of the maintenance window setting for this database instance.

Potential unexpected downtime
If you choose to apply changes immediately, please note that any changes in the pending modifications queue are also applied. If any of the pending modifications require downtime, choosing this option can cause unexpected downtime.

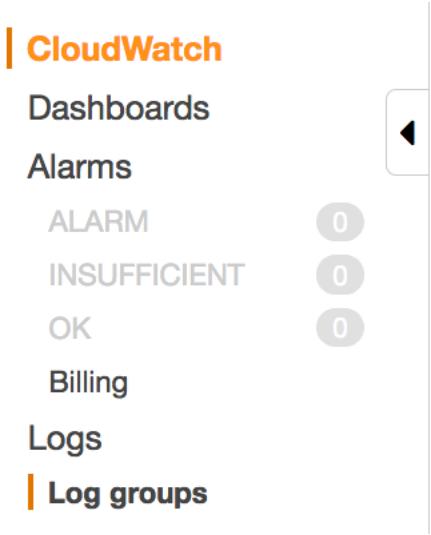
Cancel | Back | Modify DB Instance

View RDS Oracle logs on CloudWatch

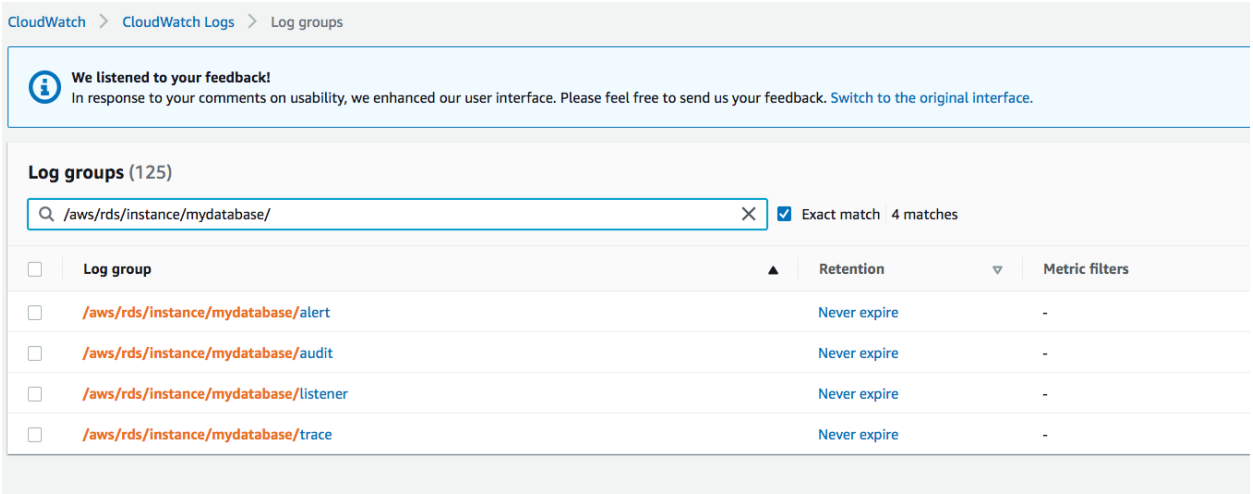
1. *On the AWS console home page type CloudWatch in the search box and click on CloudWatch*



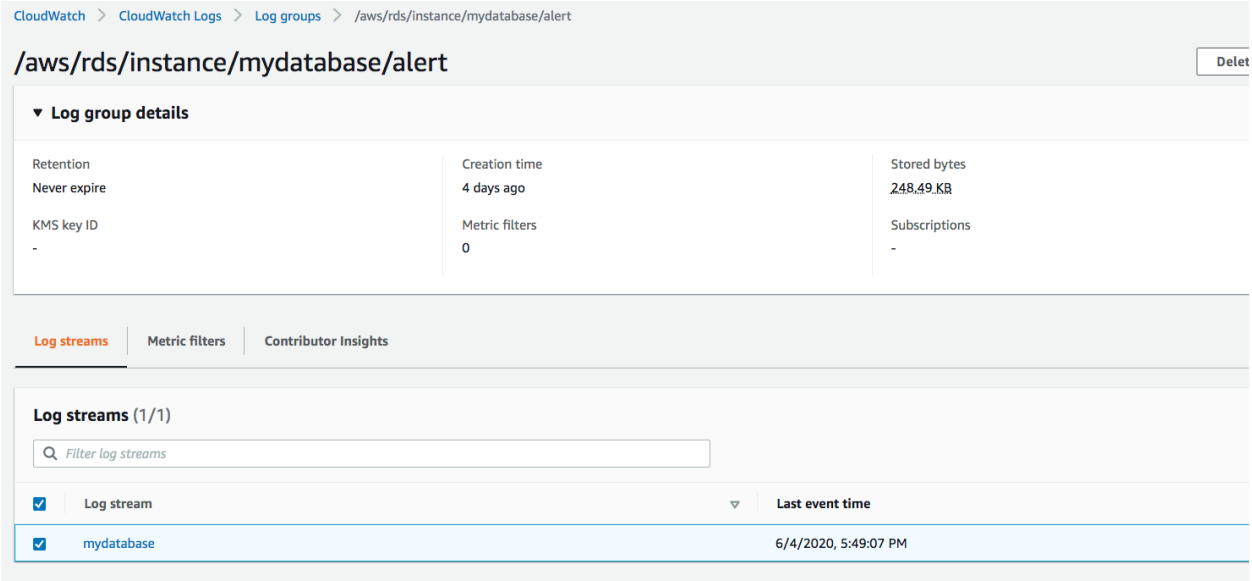
2. *On the CloudWatch home page click on "Logs" on the left-hand side*

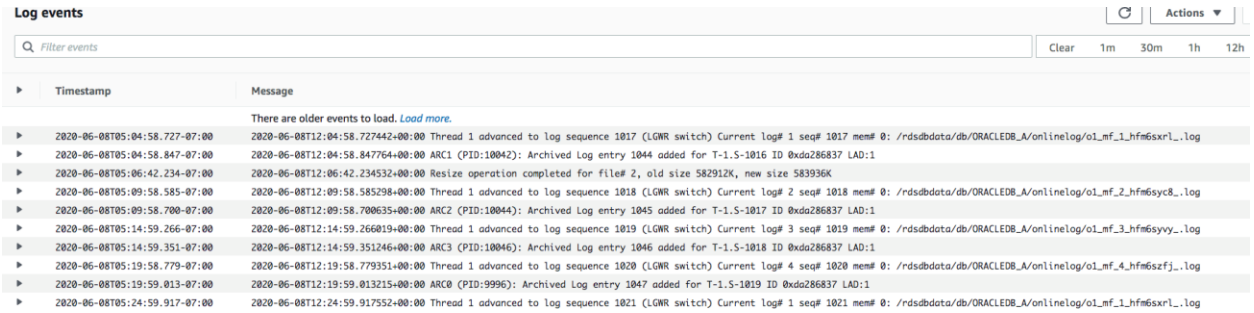


3. *On the Filter bar type /aws/rds/instance/<yourinstancename> and hit enter button. Replace the <yourinstancename> with RDS instance you created.*



4. *Select the file you want to view and click on the corresponding line item*





Log events

Actions

Filter events

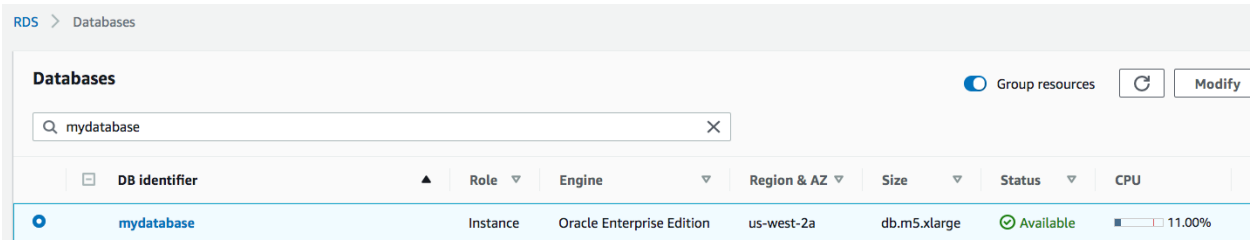
Clear 1m 30m 1h 12h

Timestamp	Message
	There are older events to load. Load more.
2020-06-08T05:04:58.727-07:00	2020-06-08T12:04:58.727442+00:00 Thread 1 advanced to log sequence 1017 (LGWR switch) Current log# 1 seq# 1017 mem# 0: /rdsdbdata/db/ORACLEDB_A/onlinelog/o1_mf_1_hfm6sxrl_.log
2020-06-08T05:04:58.847-07:00	2020-06-08T12:04:58.847764+00:00 ARC1 (PID:10042): Archived Log entry 1044 added for T-1.S-1016 ID 0xda286837 LAD:1
2020-06-08T05:06:42.234-07:00	2020-06-08T12:06:42.234532+00:00 Resize operation completed for file# 2, old size 582912K, new size 583936K
2020-06-08T05:09:58.585-07:00	2020-06-08T12:09:58.585298+00:00 Thread 1 advanced to log sequence 1018 (LGWR switch) Current log# 2 seq# 1018 mem# 0: /rdsdbdata/db/ORACLEDB_A/onlinelog/o1_mf_2_hfm6syc8_.log
2020-06-08T05:09:58.700-07:00	2020-06-08T12:09:58.700635+00:00 ARC2 (PID:10044): Archived Log entry 1045 added for T-1.S-1017 ID 0xda286837 LAD:1
2020-06-08T05:14:59.266-07:00	2020-06-08T12:14:59.266019+00:00 Thread 1 advanced to log sequence 1019 (LGWR switch) Current log# 3 seq# 1019 mem# 0: /rdsdbdata/db/ORACLEDB_A/onlinelog/o1_mf_3_hfm6syvy_.log
2020-06-08T05:14:59.351-07:00	2020-06-08T12:14:59.351246+00:00 ARC3 (PID:10046): Archived Log entry 1046 added for T-1.S-1018 ID 0xda286837 LAD:1
2020-06-08T05:19:58.779-07:00	2020-06-08T12:19:58.779351+00:00 Thread 1 advanced to log sequence 1020 (LGWR switch) Current log# 4 seq# 1020 mem# 0: /rdsdbdata/db/ORACLEDB_A/onlinelog/o1_mf_4_hfm6szfj_.log
2020-06-08T05:19:59.013-07:00	2020-06-08T12:19:59.013215+00:00 ARC0 (PID:9996): Archived Log entry 1047 added for T-1.S-1019 ID 0xda286837 LAD:1
2020-06-08T05:24:59.917-07:00	2020-06-08T12:24:59.917552+00:00 Thread 1 advanced to log sequence 1021 (LGWR switch) Current log# 1 seq# 1021 mem# 0: /rdsdbdata/db/ORACLEDB_A/onlinelog/o1_mf_1_hfm6sxrl_.log

Enabling and accessing Performance Insights

1. *We have already enabled the Performance insights for this instance with the previous modification. Accessing Performance Insights require "***AmazonRDSFullAccess***" permissions from AWS Identity and Access Management (IAM).*

2. *To access the Performance Insight Dashboard for specific RDS Database Instance is to go to the Instance page and select the desired Instance name and under the "current activity" column you will see the average number of sessions in last 5 minutes. Click on the "sessions" and it will take you to the Performance Insights Dashboard for that specific Instance.*



RDS > Databases

Databases

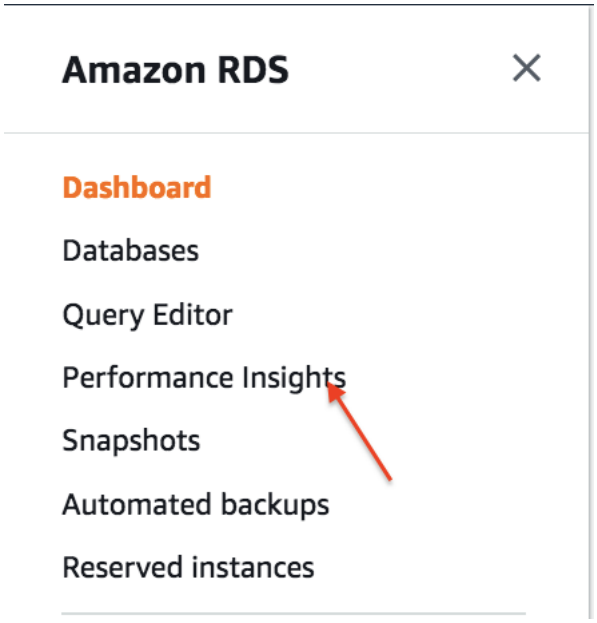
Group resources

Modify

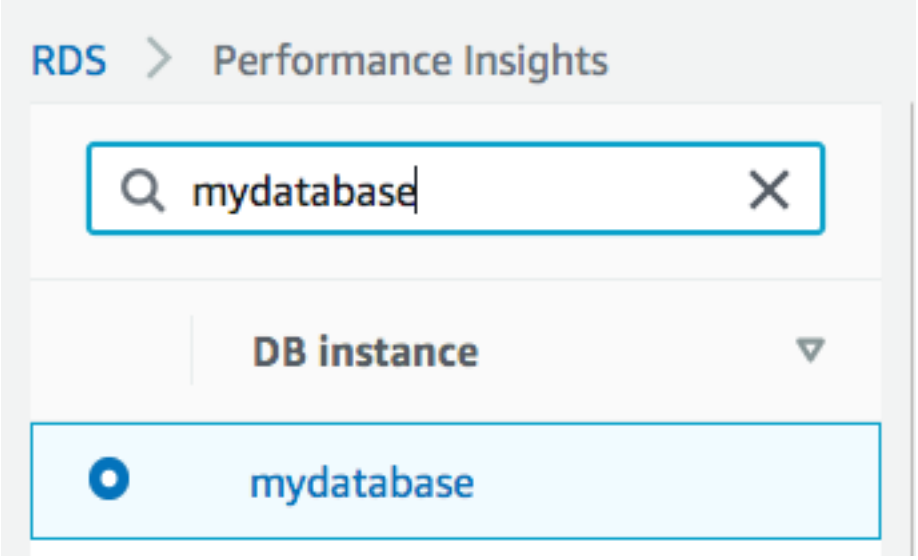
mydatabase

DB identifier	Role	Engine	Region & AZ	Size	Status	CPU
mydatabase	Instance	Oracle Enterprise Edition	us-west-2a	db.m5.xlarge	Available	11.00%

3. *Another way to access Performance Insights, go to the RDS homepage and click on the Performance Insights tab on the left-hand side*



On the next screen type the instance name you want to monitor (in this your RDS Oracle Database Instance) and click on the Instance name

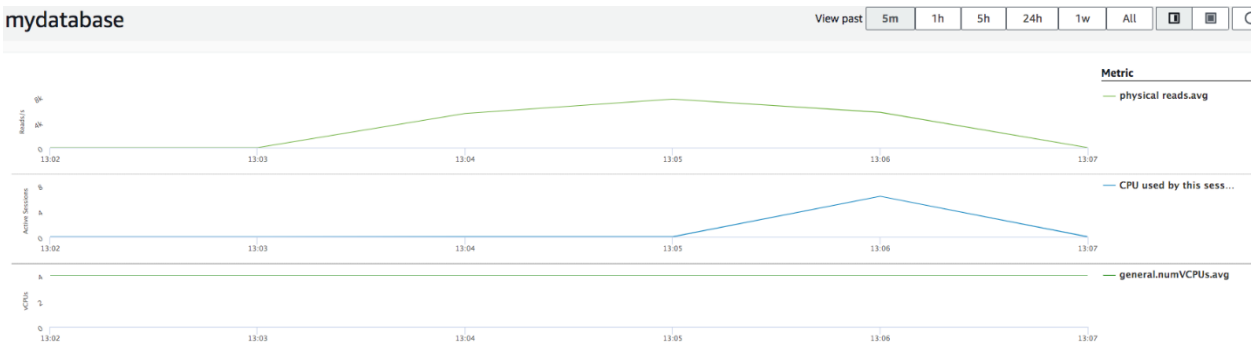


4. *With the Performance Insights dashboard, you can visualize the database load and filter the load by waits, SQL statements, hosts, or users. The central metric for Performance Insights is DB Load, which represents the average number of active sessions for the DB engine. An active session is a connection that has submitted work to the DB engine and is waiting for a response from it. The Dashboard is divided into 3 sections.*

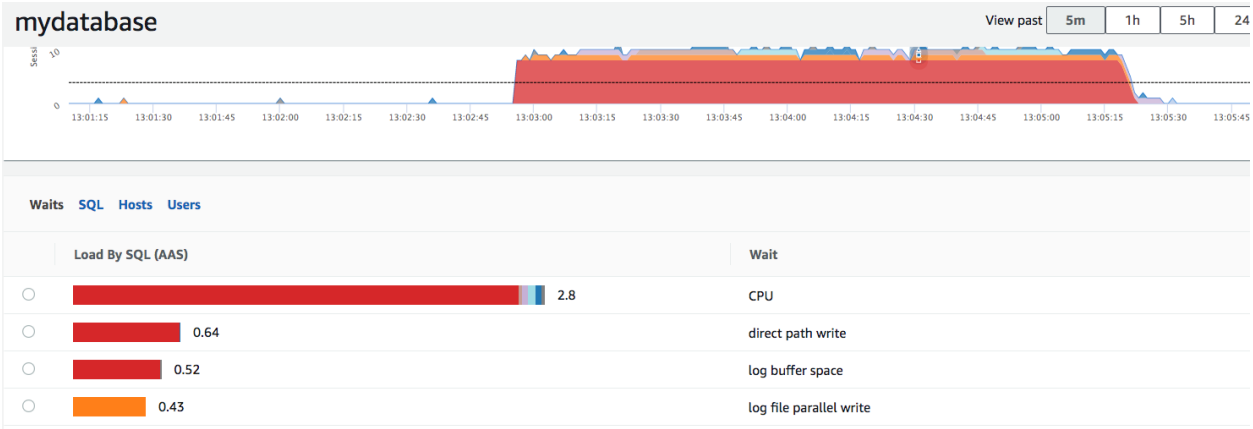
Counter Metrics: - With counter metrics, you can customize the Performance Insights dashboard to include up to 10 additional graphs. These graphs that show a selection of dozens of operating system and database performance metrics. This information can be correlated with database load to help identify and analyze performance problems

Average Active Sessions: - The Average Active Sessions chart shows how the database load compares to DB instance capacity as represented by the Max CPU line. By default, load is shown as active sessions grouped by wait states. You can also choose instead to display load as active sessions grouped by SQL queries, hosts, or users.

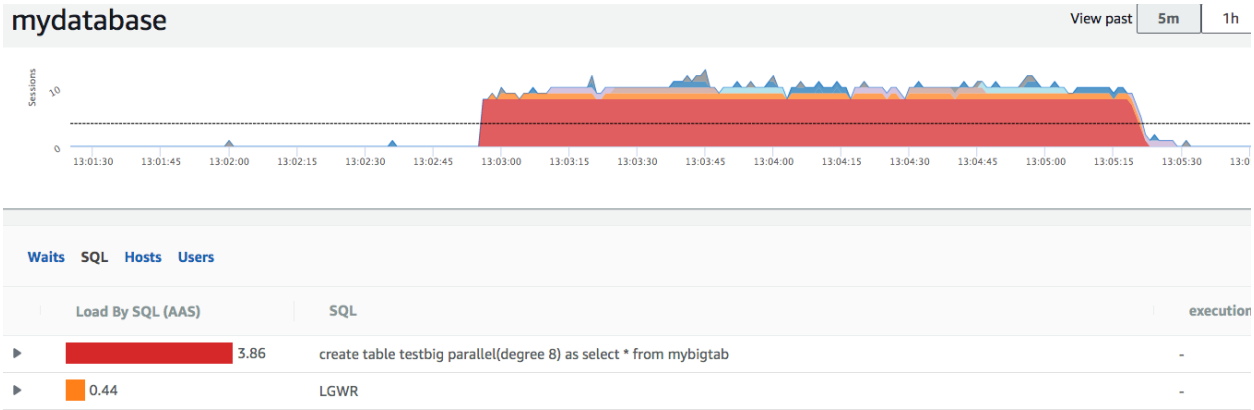
Top Load Items Table: - The Top Load Items table shows the top items contributing to database load. By default, the top SQL queries that are contributing to the database load are shown. Queries are displayed as digests of multiple actual queries that are structurally similar but that possibly have different parameters. You can choose to display top wait states, hosts, or users instead.



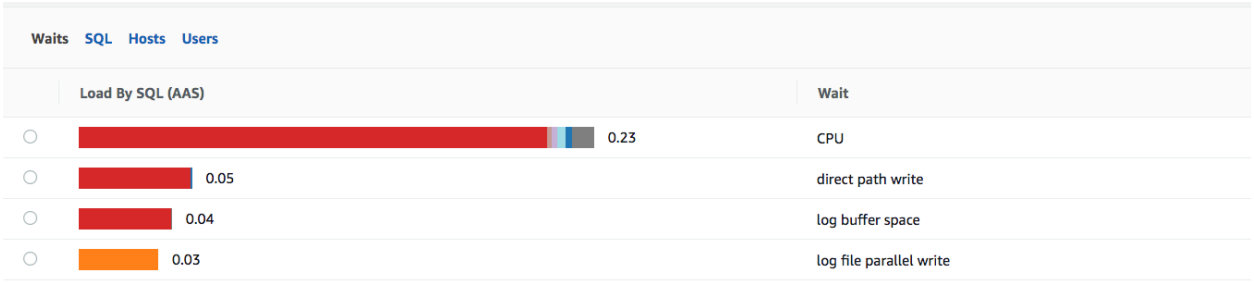
Database load by top Waits



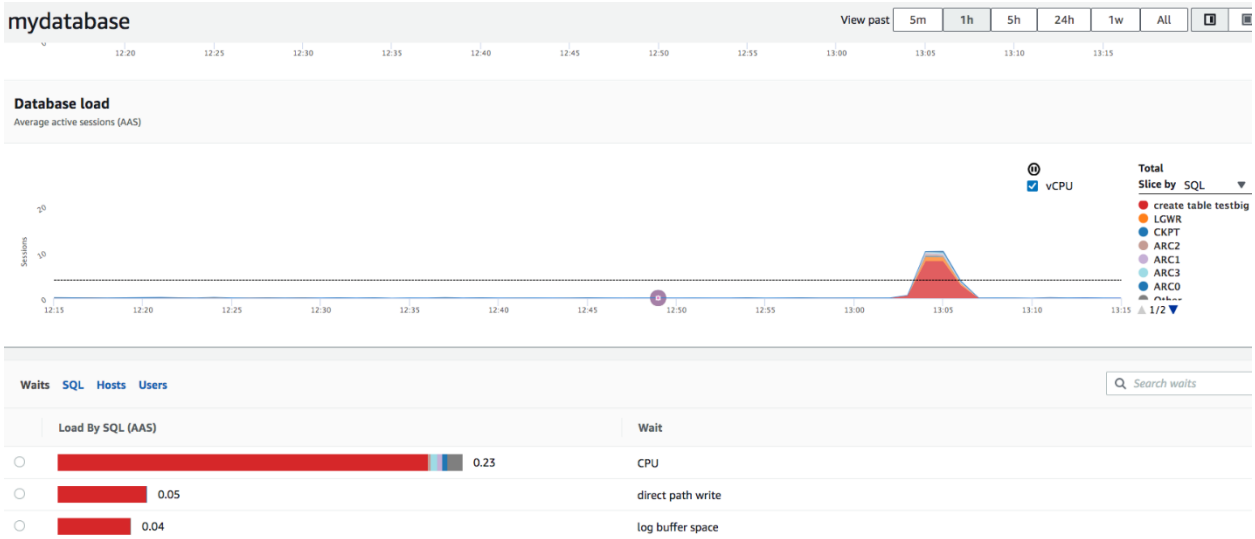
Database load by top SQL



Database Load by waits displayed by top waits



Database Load by waits displayed by top SQLs



Database Load by waits displayed by top users