

# Migration Guide: Amazon RDS to HeatWave MySQL on Oracle Cloud Infrastructure (OCI)

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## Before you start:

- You must have an account on Oracle Cloud Infrastructure (OCI) and Amazon Web Services (AWS).
- Some OCI knowledge is preferred.
- This migration guide only covers how to migrate your database from Amazon RDS for MySQL to HeatWave MySQL on OCI. Before performing the migration, you should have considered downtime (the length of the downtime will mostly depend on the size of your database and checks you may want to perform before bringing your database back online), application compatibility, current database metrics (CPU, storage size, RAM, max number of concurrent users, backups, binary logs expiration, number of replicas if any, etc.), desired database metrics, networking, security, user testing, etc.
- The migration method shown in this guide works for Amazon RDS for MySQL v5.7 and above.
- When following the guide, you should always execute the commands/steps shown as an admin/root user wherever applicable.
  - On OCI and AWS you must have the ability to create and manage resources.
  - For your Amazon RDS MySQL instance, use an admin/root user.
- You do not need to make any configuration changes to your Amazon RDS MySQL for this downtime migration.
- If you have MySQL replication configured in your current Amazon RDS MySQL environment, you can perform the migration steps shown in this guide from either your source or replica instance.
- The Overview section of this migration guide contains all the steps that are needed to finish the database migration from Amazon RDS MySQL to HeatWave MySQL on OCI.
- In the Walkthrough section, we will apply the information provided in the Overview section and give you a simple step-by-step guide. In this step-by-step guide, we will have an Amazon RDS for MySQL instance with some sample data pre-loaded and will migrate it over to HeatWave MySQL on OCI. This will help you follow and better visualize the process/information provided in the Overview section.
- You can use the Walkthrough section's step-by-step guide as a reference for your migration from Amazon RDS MySQL to HeatWave MySQL. When following the guide, make changes along the way to your AWS and OCI environments accordingly or as required. Since each user following the step-by-step guide will have their environments configured differently, we cannot provide an ideal example that works for everyone.

## Overview:

Following are the required steps to migrate data from Amazon RDS MySQL to HeatWave MySQL on OCI:

### I) Have an Oracle Cloud Infrastructure (OCI) account and Amazon Web Services (AWS) account.

OCI Sign in/Sign up page: <https://cloud.oracle.com>

AWS Sign in/Sign up page: <https://aws.amazon.com/>

### II) Set up a VPN connection from OCI to AWS.

[A VPN connection will allow you to bridge your AWS network with the OCI VCN. The VPN connection will allow your Amazon RDS MySQL to connect to HeatWave MySQL on OCI and it also ensures that your data in transit is encrypted while it is being migrated.]

VPN Connection to AWS: [https://docs.oracle.com/en-us/iaas/Content/Network/Tasks/vpn\\_to\\_aws.htm](https://docs.oracle.com/en-us/iaas/Content/Network/Tasks/vpn_to_aws.htm)

### III) On OCI, create a HeatWave MySQL instance.

[You can create either a Standalone or High Availability HeatWave MySQL instance. Both options are fully-managed.]

Provision OCI HeatWave MySQL: <https://docs.oracle.com/en-us/iaas/mysql-database/doc/creating-db-system1.html>

### IV) Install MySQL Shell 8.1 or above on an EC2 instance that can connect to Amazon RDS MySQL.

[MySQL Shell on the EC2 will be used to copy DDL and data from Amazon RDS MySQL to HeatWave MySQL on OCI. You must download MySQL Shell 8.1 or above.]

Download MySQL Shell: <https://dev.mysql.com/downloads/shell/>

Install MySQL Shell: <https://dev.mysql.com/doc/mysql-shell/8.0/en/mysql-shell-install.html>

### V) Connect to Amazon RDS MySQL using MySQL Shell on EC2. Afterwards, execute the MySQL Shell `util.copyInstance()` utility to export all schemas (including users, indexes, routines, triggers) from Amazon RDS MySQL to HeatWave MySQL on OCI.

[The dump created by MySQL Shell's instance copy utility comprises DDL files specifying the schema structure, and tab-separated `.tsv` files containing the data.]

MySQL Shell Copy Utilities: <https://dev.mysql.com/doc/mysql-shell/8.1/en/mysql-shell-utils-copy.html>

### VI) (Optional) On OCI, use the Cloud Shell to verify whether the data was migrated successfully from Amazon RDS MySQL to HeatWave MySQL on OCI.

[Cloud Shell is a web browser-based terminal accessible from the Oracle Cloud Console.]

OCI Cloud Shell: <https://docs.oracle.com/en-us/iaas/Content/API/Concepts/cloudshellintro.htm>

### VII) (Optional) On OCI, if the HeatWave option was enabled during HeatWave MySQL DB creation, add the HW Cluster and load data from the MySQL InnoDB storage into the HW Cluster using automation.

[Attaching the HeatWave in-memory Cluster combines transactions, analytics, and machine learning services into one MySQL Database.]

Add a HeatWave Cluster: <https://docs.oracle.com/en-us/iaas/mysql-database/doc/adding-heatwave-cluster.html#GUID-2335AC1F-FB01-4701-9EFD-810A3489A850>

Load Data into HeatWave: <https://dev.mysql.com/doc/heatwave/en/mys-hw-auto-parallel-load.html>

## Walkthrough:

### I) Have an Oracle Cloud Infrastructure (OCI) account and Amazon Web Services (AWS) account.

OCI Sign in/Sign up page: <https://cloud.oracle.com>

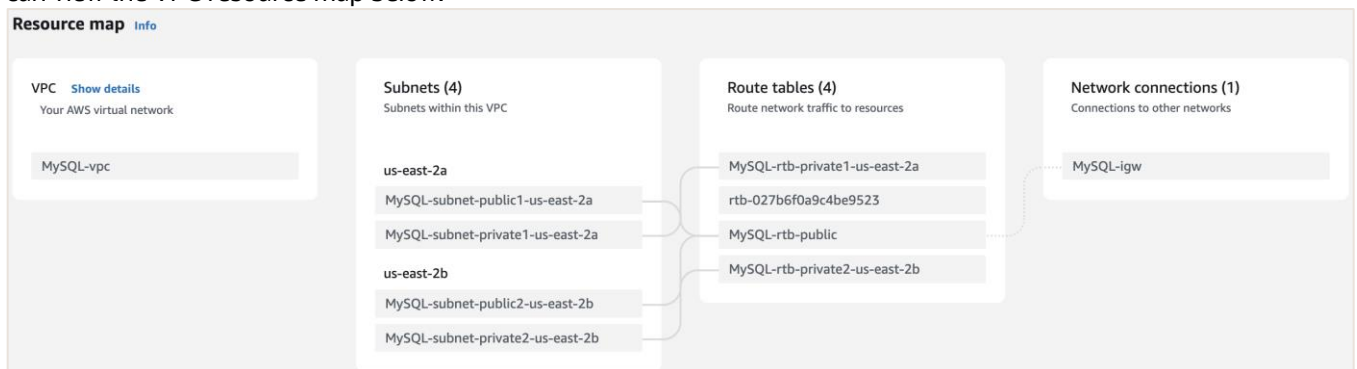
AWS Sign in/Sign up page: <https://aws.amazon.com/>

### II) Set up a VPN connection from OCI to AWS.

1. Below is the Amazon RDS MySQL instance version and [the sample database \("world"\)](#) that will be migrated for this guide. The sample world database consists of 3 tables. The Amazon RDS MySQL instance used for this does not have public access.

```
MySQL database-1.([REDACTED]).us-east-2.rds.amazonaws.com:3306 ssl world SQL > SELECT @@VERSION;
+-----+
| @@VERSION |
+-----+
| 5.7.37    |
+-----+
1 row in set (0.0009 sec)
MySQL database-1.([REDACTED]).us-east-2.rds.amazonaws.com:3306 ssl world SQL > SHOW SCHEMAS;
+-----+
| Database |
+-----+
| information_schema |
| innodb          |
| mysql          |
| performance_schema |
| sys            |
| world          |
+-----+
6 rows in set (0.0007 sec)
MySQL database-1.([REDACTED]).us-east-2.rds.amazonaws.com:3306 ssl world SQL > SHOW TABLES IN world;
+-----+
| Tables_in_world |
+-----+
| city             |
| country          |
| countrylanguage |
+-----+
3 rows in set (0.0007 sec)
MySQL database-1.([REDACTED]).us-east-2.rds.amazonaws.com:3306 ssl world SQL >
```

2. The AWS VPC associated with the above Amazon RDS MySQL instance uses an IPv4 CIDR: 10.1.0.0/16. You can view the VPC resource map below:



3. Log in to [OCI](#) and create a VCN. Open the OCI navigation menu, click **Networking**, and click **Virtual cloud networks**.



- Ensure you are in your desired compartment - we have chosen the `root` compartment. Click **Start VCN Wizard**.

Networking

Virtual Cloud Networks in `(root)` Compartment

A Virtual Cloud Network is a virtual private network that you set up in Oracle data centers. It closely resembles a traditional network, with firewall rules and specific types of communication gateways that you can choose to use.

Create VCN Start VCN Wizard

Name	State	IPv4 CIDR Block	IPv6 Prefix	Default Route Table	DNS Domain Name	Created
No items found.						

Showing 0 items < 1 of 1 >

- Select **Create VCN with Internet Connectivity** and click **Start VCN Wizard**.

Start VCN Wizard

Create VCN with Internet Connectivity

Add Internet Connectivity and Site-to-Site VPN to a VCN

Creates a VCN with a public subnet that can be reached from the internet. Also creates a private subnet that can connect to the internet through a NAT gateway, and also privately connect to the Oracle Services Network.

**Includes:** VCN, public subnet, private subnet, internet gateway (IG), NAT gateway (NAT), service gateway (SG).

Start VCN Wizard Cancel

- Enter a **VCN name** and **configure your VCN's IPv4 CIDR block - including the public and the private subnet**. The guide uses the default values for all. Make sure that the OCI VCN IPv4 CIDR block does not overlap with your AWS VPC IPv4 CIDR.

**Configuration**

Resource availability checked successfully. Close

**Basic information**

VCN name

Compartment

**Configure VCN**

VCN IPv4 CIDR block

If you plan to peer this VCN with another VCN, the VCNs must not have overlapping CIDR blocks. [Learn more.](#)

IPv6 prefixes *Optional*

Enable IPv6 in this VCN

DNS resolution

**VCN with internet connectivity**

Includes:

- Virtual cloud network (VCN)
- Public subnet
- Private subnet
- Internet gateway (IG)
- NAT gateway (NAT)
- Service gateway (SG)

Next Cancel

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- Click **Next** after the configuration for your VCN is completed.

**Configuration**

**DNS resolution**

Use DNS hostnames in this VCN

Required for instance hostname assignment if you plan to use VCN DNS or a third-party DNS. This choice cannot be changed after the VCN is created. [Learn more.](#)

**Configure public subnet**

IP address type

IPv4 CIDR block

Example: 172.16.0.0/16.

(Maximum number of items added) + Another IP address type

**Configure private subnet**

IP address type

IPv4 CIDR block

Example: 172.16.0.0/16.

(Maximum number of items added) + Another IP address type

[Show tagging options](#)

Next Cancel

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8. On the Review and create page, validate the information for your VCN and click **Create**.

The screenshot shows the 'Review and create' step of the 'Create a VCN with internet connectivity' wizard. A notification at the top states 'Resource availability checked successfully.' Below this, the 'Oracle VCN' details are listed: Name: MySQL-VCN, Compartment: (root), Tags: VCN: VCN-2023-05-15T14:57:35, IPv4 CIDR block: 10.0.0.0/16, DNS label: MySQLVCN, and DNS domain name: MySQLVCN.oraclevcn.com. The 'Subnets' section shows a 'Public subnet' with details: Subnet name: public subnet-MySQL-VCN, IPv4 CIDR block: 10.0.0.0/24, Security list name: default security list for MySQL-VCN, and Route table name: default route table for MySQL-VCN. At the bottom, there are 'Previous', 'Create', and 'Cancel' buttons.

9. Click **View VCN** after your VCN creation has been completed.

The screenshot shows the 'Created VCN' page, indicating that the VCN creation is complete. A 'Creating resources' section lists the following tasks, all marked as 'Done' with a green checkmark: VCN creation complete, Create VCN (1 resolved), Create subnets (2 resolved), Create internet gateway (1 resolved), Create NAT gateway (1 resolved), Create service gateway (1 resolved), Create route table for private subnet (1 resolved), Create security list for private subnet (1 resolved), Update route tables (2 resolved), and Update private subnet (1 resolved). A 'View VCN' button is located at the bottom left of the main content area.

- On the Virtual Cloud Network Details page under Resources, click **Subnets** section. Click on **private subnet-  
<vcn-name>**.

The screenshot shows the Oracle Cloud console for a Virtual Cloud Network (VCN) named "MySQL-VCN". The VCN is in an "AVAILABLE" state. The "Subnets in (root) Compartment" section displays a table with two subnets:

Name	State	IPv4 CIDR Block	IPv6 Prefixes	Subnet Access	Created
<a href="#">private subnet-MySQL-VCN</a>	Available	10.0.1.0/24	-	Private (Regional)	Tue, Sep 19, 2023, 16:17:26 UTC
<a href="#">public subnet-MySQL-VCN</a>	Available	10.0.0.0/24	-	Public (Regional)	Tue, Sep 19, 2023, 16:17:26 UTC

VCN Information:

- Compartment: (root)
- Created: Tue, Sep 19, 2023, 16:17:24 UTC
- IPv4 CIDR Block: 10.0.0.0/16
- IPv6 Prefix: -
- OCID: ...qsivya
- DNS Resolver: MySQL-VCN
- Default Route Table: default route table for MySQL-VCN
- DNS Domain Name: mysqlvcn.oraclevcn.com

- Click on **security list for private subnet-  
<vcn-name>** to add an Ingress Rule which will allow HeatWave MySQL to access the RDS instance on AWS and the Compute instance on OCI.

The screenshot shows the Oracle Cloud console for a subnet named "private subnet-MySQL-VCN". The "Security Lists" section displays a table with one security list:

Name	State	Compartment	Created
<a href="#">security list for private subnet-MySQL-VCN</a>	Available	(root)	Tue, Sep 19, 2023, 16:17:26 UTC

Subnet Information:

- OCID: ...6xni2a
- IPv4 CIDR Block: 10.0.1.0/24
- IPv6 Prefix: -
- Virtual Router MAC Address: 00:00:17:2D:45:1A
- Subnet Type: Regional
- Compartment: (root)
- DNS Domain Name: sub09191617221... Show Copy
- Subnet Access: Private Subnet
- DHCP Options: Default DHCP Options for MySQL-VCN
- Route Table: route table for private subnet-MySQL-VCN

12. Click **Add Ingress Rules**.

The screenshot shows the Oracle Cloud console interface for a Security List. The breadcrumb navigation is 'Networking > Virtual cloud networks > MySQL-VCN > Security List Details'. The security list is named 'security list for private subnet-MYSQL-VCN' and is in an 'AVAILABLE' state. The 'Ingress Rules' section contains a table with the following data:

<input type="checkbox"/>	Stateless	Source	IP Protocol	Source Port Range	Destination Port Range	Type and Code	Allows	Description
<input type="checkbox"/>	No	10.0.0.0/16	TCP	All	22		TCP traffic for ports: 22 SSH Remote Login Protocol	
<input type="checkbox"/>	No	0.0.0.0/0	ICMP			3, 4	ICMP traffic for: 3, 4 Destination Unreachable: Fragmentation Needed a	

13. For **Source CIDR** type **0.0.0.0/0** (you can be more restrictive here and enter only the AWS and OCI VPC and VCN IPv4 CIDR). For **Destination Port Range**, enter **3306,33060**. Click **Add Ingress Rules**.

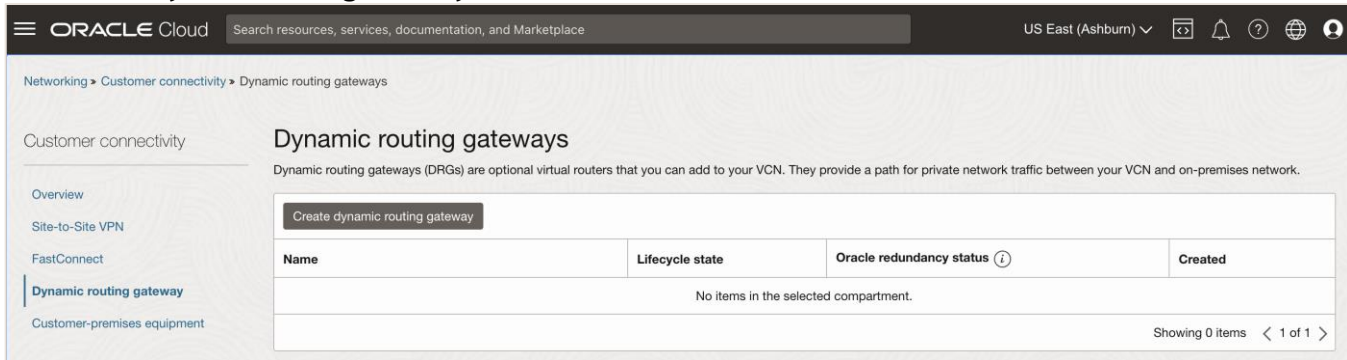
The screenshot shows the 'Add Ingress Rules' dialog box in the Oracle Cloud console. The configuration for 'Ingress Rule 1' is as follows:

- Allows TCP traffic 3306,33060**
- Stateless
- Source Type:** CIDR
- Source CIDR:** 0.0.0.0/0 (Specified IP addresses: 0.0.0.0-255.255.255.255 (4,294,967,296 IP addresses))
- IP Protocol:** TCP
- Source Port Range:** All (Optional)
- Destination Port Range:** 3306,33060 (Optional)
- Description:** MySQL Ports (Optional, Maximum 255 characters)

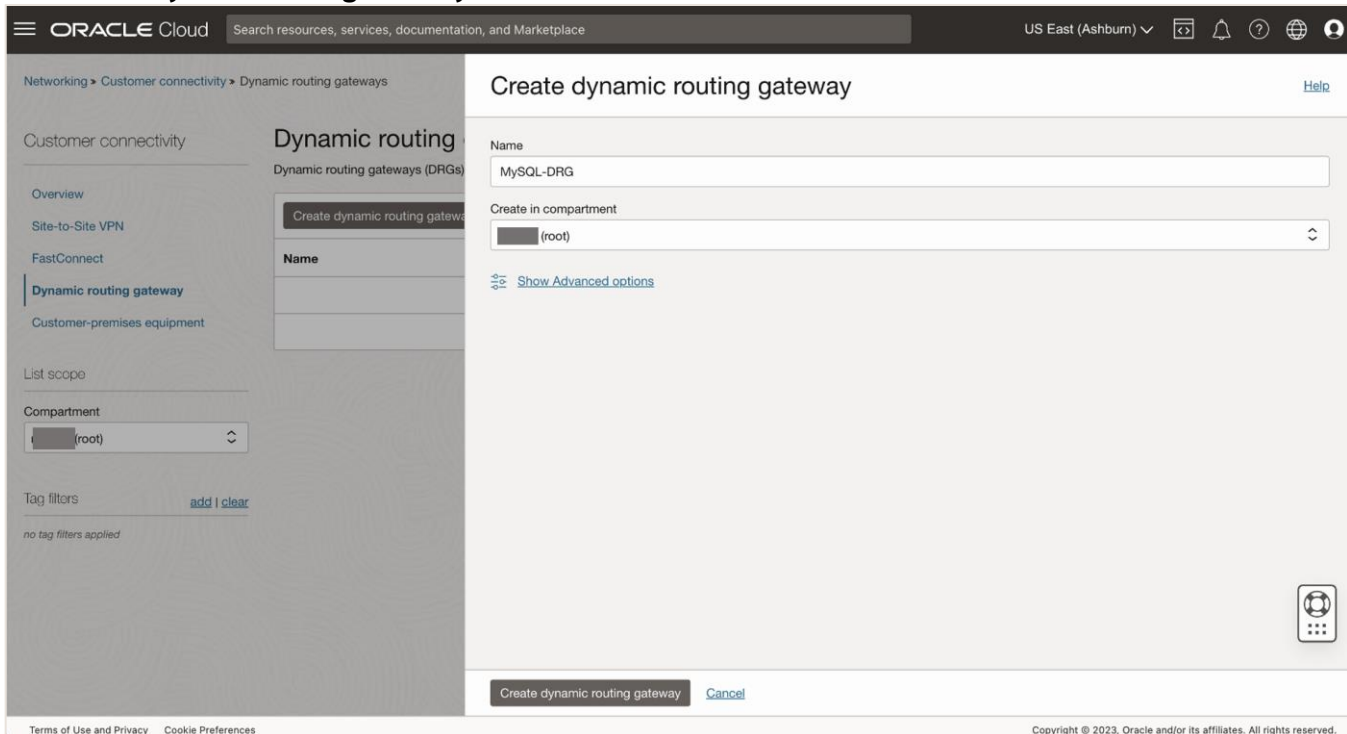
14. Open the OCI navigation menu, click **Networking** and click **Dynamic routing gateway** under Customer Connectivity.



15. Click **Create Dynamic Routing Gateway**.



16. Enter a **DRG name**. Under **Create in compartment** - choose the compartment where your VCN resides. Click **Create Dynamic Routing Gateway**.



- You will be taken to the DRG Details page. Once your DRG changes its state from Provisioning to **Available**, under Resources, click **Virtual Cloud Network Attachment**. Click **Create Virtual Cloud Network Attachment**.

The screenshot shows the Oracle Cloud console interface for a MySQL-DRG. The top navigation bar includes the Oracle Cloud logo, a search bar, and the region 'US East (Ashburn)'. The breadcrumb trail is 'Networking > Customer connectivity > Dynamic routing gateways > MySQL-DRG'. The main content area features a large green 'DRG' icon with the state 'AVAILABLE'. Below this are buttons for 'Edit', 'Add tags', 'Move resource', and 'Terminate'. The 'Dynamic routing gateway information' section displays details such as 'Compartment: (root)', 'OCID: ...fx4nt5ypq', and 'Created: Tue, Sep 19, 2023, 16:28:53 UTC'. The 'VCN attachments in (root) Compartment' section includes a 'Create virtual cloud network attachment' button and a table with columns: 'Attachment name', 'Lifecycle state', 'Virtual cloud network', 'DRG route table', 'VCN route type', and 'Created'. The table currently shows 'No items found.' and 'Showing 0 items'.

- Enter a **Virtual Cloud Network Attachment name** and **select the appropriate VCN** from the drop-down list. Click **Create Virtual Cloud Network Attachment**.

The screenshot shows the 'Create VCN attachment' dialog box overlaid on the MySQL-DRG details page. The dialog has a title bar with 'Create VCN attachment' and a 'Help' link. It contains the following fields: 'Attachment name' (Optional) with the value 'MySQL-VCN-Attachment', and 'Virtual cloud network in (root) (Change compartment)' with a dropdown menu showing 'MySQL-VCN'. There is a 'Show Advanced options' link below the dropdown. At the bottom of the dialog are 'Create VCN attachment' and 'Cancel' buttons. The background page is dimmed, showing the same DRG details as the previous screenshot.



19. Wait for your VCN Attachment to be in an **Attached** state.

The screenshot shows the Oracle Cloud console for a MySQL-DRG resource. The breadcrumb navigation is: Networking > Customer connectivity > Dynamic routing gateways > MySQL-DRG. The resource name is MySQL-DRG, and its state is AVAILABLE. The dynamic routing gateway information shows it is in the (root) compartment, created on Tue, Sep 19, 2023, 16:28:53 UTC. Below this, the VCN attachments section shows a table with one attachment:

Attachment name	Lifecycle state	Virtual cloud network	DRG route table	VCN route type	Created
MySQL-VCN-Attachment	Attached	MySQL-VCN	Autogenerated Drg Route Table for VCN attachments	Subnet CIDR blocks	Tue, Sep 19, 2023, 16:33:45 UTC

20. Open the OCI navigation menu, click **Networking** and click on **Virtual cloud networks**. After landing on the Virtual Cloud Networks page, click on **the name of your VCN**.

21. On the Virtual Cloud Network Details page, under Resources, click on **Route Tables**.

The screenshot shows the Oracle Cloud console for a MySQL-VCN resource. The breadcrumb navigation is: Networking > Virtual cloud networks > Virtual Cloud Network Details > Subnets. The resource name is MySQL-VCN, and its state is AVAILABLE. The VCN information shows it is in the (root) compartment, created on Tue, Sep 19, 2023, 16:17:24 UTC. Below this, the Subnets section shows a table with two subnets:

Name	State	IPv4 CIDR Block	IPv6 Prefixes	Subnet Access	Created
private-subnet-MySQL-VCN	Available	10.0.1.0/24	-	Private (Regional)	Tue, Sep 19, 2023, 16:17:26 UTC
public-subnet-MySQL-VCN	Available	10.0.0.0/24	-	Public (Regional)	Tue, Sep 19, 2023, 16:17:26 UTC

22. You should see two Route Tables, one for your private subnet and the other for your public subnet. Click on **route table for private subnet-<vcn-name>**.

Resources

Subnets (2)

CIDR Blocks/Prefixes (1)

**Route Tables (2)**

Internet Gateways (1)

Dynamic Routing Gateways Attachments (1)

Network Security Groups (0)

### Route Tables in [redacted] (root) Compartment

Create Route Table

Name	State	Number of Rules	Created
<a href="#">route table for private subnet-MySQL-VCN</a>	● Available	2	Tue, Sep 19, 2023, 16:17:26 UTC
<a href="#">default route table for MySQL-VCN</a>	● Available	1	Tue, Sep 19, 2023, 16:17:24 UTC

Showing 2 items < 1 of 1 >

23. On the private subnet route table page, click **Add Route Rules**.

ORACLE Cloud Search resources, services, documentation, and Marketplace US East (Ashburn) [icons]

Networking > Virtual cloud networks > MySQL-VCN > Route Table Details

## route table for private subnet-MySQL-VCN

Move resource Add tags Terminate

**RT**

AVAILABLE

Resources

**Route Rules (2)**

### Route Table Information

Tags

OCID: ...2ffena Show Copy

Compartment [redacted] (root)

Created: Tue, Sep 19, 2023, 16:17:26 UTC

### Route Rules

Traffic within the VCN is handled by the VCN's local routing by default. Intra-VCN routing allows you more control over routing between subnets. [Learn more](#). If you're having problems, use [Network Path Analyzer](#) to check your connections.

Add Route Rules Edit Remove

<input type="checkbox"/>	Destination	Target Type	Target	Route Type	Description
<input type="checkbox"/>	0.0.0.0/0	NAT Gateway	<a href="#">NAT_gateway-MySQL-VCN</a>	Static	
<input type="checkbox"/>	<a href="#">All IAD Services In Oracle Services Network</a>	Service Gateway	<a href="#">Service_gateway-MySQL-VCN</a>	Static	

0 selected Showing 2 items < 1 of 1 >

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- Under **Target Type**, select **Dynamic Routing Gateway** from the drop-down list. For **Destination Type**, select **CIDR Block** and for **Destination CIDR Block** - enter your **AWS VPC IPv4 CIDR block** that you will be using to connect to OCI. The AWS VPC CIDR block that will be used for this guide is **10.1.0.0/16**. Click **Add Route Rules** afterwards.

**Important:**  
For a route rule that targets a Private IP, you must first enable "Skip Source/Destination Check" on the VNIC that the Private IP is assigned to.

**Route Rule**

Target Type: Dynamic Routing Gateway

Destination Type: CIDR Block

Destination CIDR Block: 10.1.0.0/16  
Example: 10.0.0.0/24

Target Dynamic Routing Gateway Name: MySQL-DRG  
Compartment: (root)

Description: Optional  
Maximum 255 characters

Add Route Rules Cancel

- Now, repeat the same process for the other route table. Go back to Virtual Cloud Network Details page, click **Route Tables**, and click on **default route table for <vcn-name>**.

**MySQL-VCN**

VCN Information

Compartment: (root)  
Created: Tue, Sep 19, 2023, 16:17:24 UTC  
IPV4 CIDR Block: 10.0.0.0/16  
IPV6 Prefix: -

OCID: ...qsviya Show Copy  
DNS Resolver: MySQL-VCN  
Default Route Table: default route table for MySQL-VCN  
DNS Domain Name: mysqlvcn.oraclevcn.com

**Route Tables in (root) Compartment**

Name	State	Number of Rules	Created
<a href="#">route table for private subnet-MySQL-VCN</a>	Available	3	Tue, Sep 19, 2023, 16:17:26 UTC
<a href="#">default route table for MySQL-VCN</a>	Available	1	Tue, Sep 19, 2023, 16:17:24 UTC

Showing 2 items < 1 of 1 >

26. On the default route table page, click **Add Route Rules**.

27. Under **Target Type**, select **Dynamic Routing Gateway** from the drop-down list. For **Destination Type**, select **CIDR Block** and for **Destination CIDR Block** - enter your **AWS VPC IPv4 CIDR block** that you will be using to connect to OCI. The AWS VPC CIDR block that will be used for this guide is **10.1.0.0/16**. Click **Add Route Rules** afterwards.



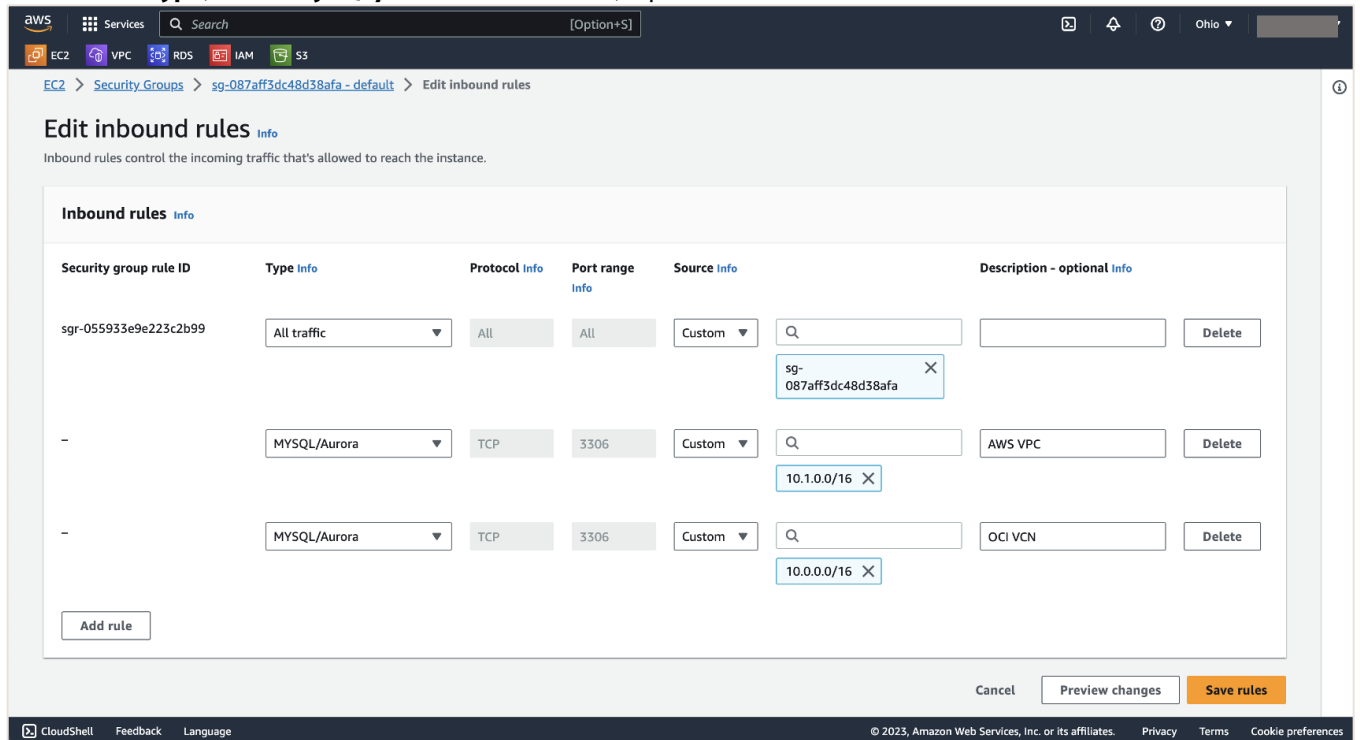
28. Login to [AWS](#) to modify the VPC security groups for the RDS MySQL instance which will allow RDS to access the HeatWave MySQL instance on OCI and the EC2 instance on AWS. From the main AWS portal, expand the Services menu at the top left of the screen, click **Databases**, click **RDS**, and **select your RDS instance**. Click **Connectivity & security**, under the **Security** section, look for **VPC security groups** and click on **the security group**. For this guide, our RDS instance only uses one security group - **default**.

The screenshot shows the AWS Management Console for an Amazon RDS instance named 'database-1'. The 'Connectivity & security' tab is selected, and the 'Security' section is expanded. The 'VPC security groups' are listed as 'default (sg-087aff3dc48d38afa)' with a status of 'Active'. The 'Publicly accessible' option is set to 'No'. Other details shown include the endpoint 'database-1.██████████.rds.amazonaws.com', port '3306', and the engine 'MySQL Community'.

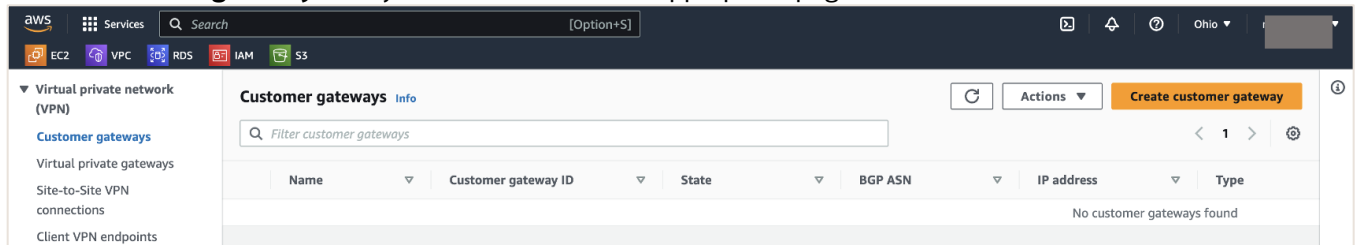
29. On the Security Groups page, select your RDS security group. From **Actions**, choose **Edit inbound rules**.

The screenshot shows the AWS Management Console for the 'Security Groups' page. The security group 'sg-087aff3dc48d38afa - default' is selected. The 'Actions' dropdown menu is open, and 'Edit inbound rules' is chosen. The 'Inbound rules' section shows a single rule with the name '-', security group rule ID 'sgr-055933e9e223c2b...', IP version '-', type 'All traffic', protocol 'All', and port range 'All'.

30. Click **Add rule**. Under **Type**, select **MySQL/Aurora**. For **Source**, input the **AWS VPC IPv4 CIDR**. Click **Add rule**. Under **Type**, select **MySQL/Aurora**. For **Source**, input the **OCI VCN IPv4 CIDR block**. Click **Save rules**.



31. From the main AWS Services menu, navigate to **Networking & Content Delivery** and click **VPC**. From the left-hand AWS menu, scroll down and click **Customer Gateways** under Virtual private network (VPN). Click **Create customer gateway** once you have landed on the appropriate page.



32. Enter a **temporary customer gateway name**. For **BGP ASN** input **31898** and for **IP address** enter **1.1.1.1**. Leave the rest as-is and click **Create Customer Gateway**.

The screenshot shows the AWS console interface for creating a customer gateway. The breadcrumb navigation is VPC > Customer gateways > Create customer gateway. The main heading is 'Create customer gateway' with an 'Info' link. Below the heading is a brief description: 'A customer gateway is a resource that you create in AWS that represents the customer gateway device in your on-premises network.'

The 'Details' section contains the following fields:

- Name tag - optional:** A text input field containing 'Temp-Gateway'. Below it, a note states: 'Creates a tag with a key of 'Name' and a value that you specify. Value must be 256 characters or less in length.'
- BGP ASN:** A text input field containing '31898'. Below it, a note states: 'The ASN of your customer gateway device. Value must be in 1 - 2147483647 range.'
- IP address:** A text input field containing '1.1.1.1'. Below it, a note states: 'Specify the IP address for your customer gateway device's external interface.'
- Certificate ARN:** A dropdown menu with the text 'Select certificate ARN'.
- Device - optional:** A text input field with the placeholder 'Enter device name'.

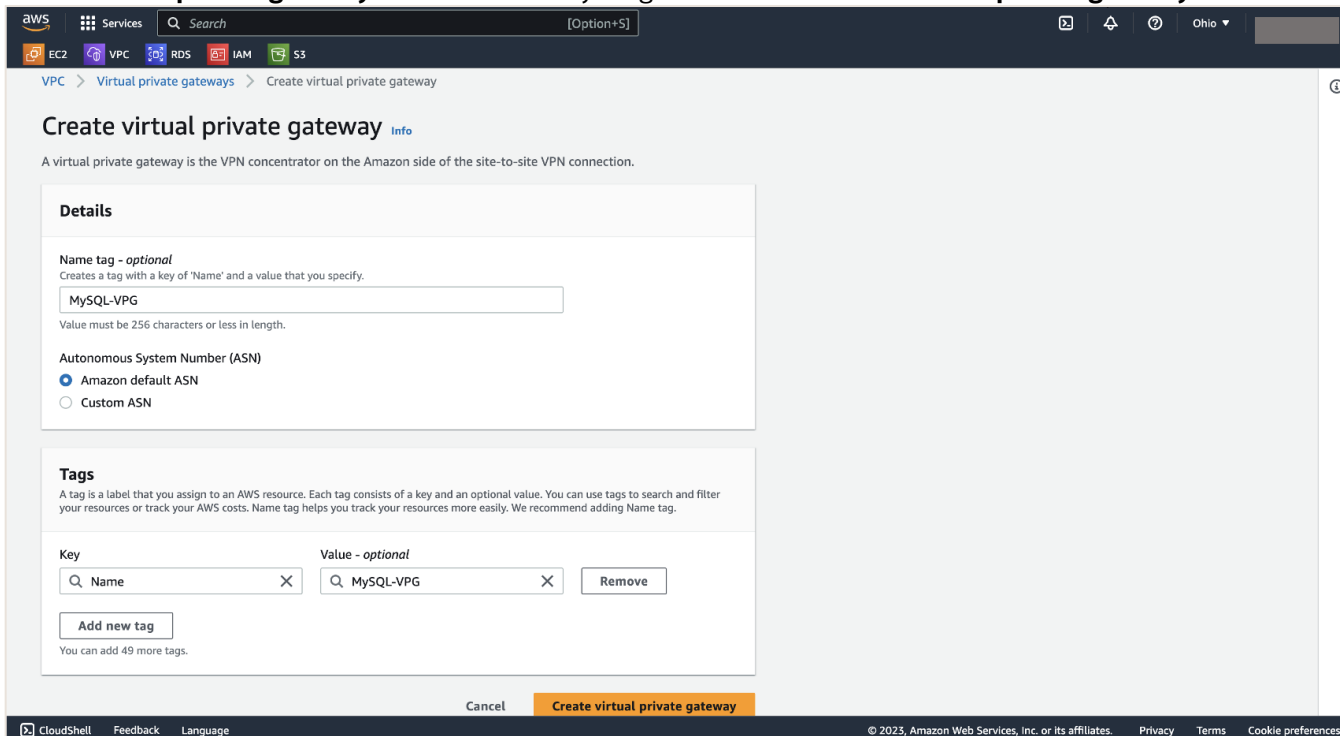
The footer of the console shows '© 2023, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences'.

33. From the Customer gateways page, scroll down on the left-hand AWS menu. Under Virtual private network click **Virtual private gateways**. Click **Create virtual private gateway**.

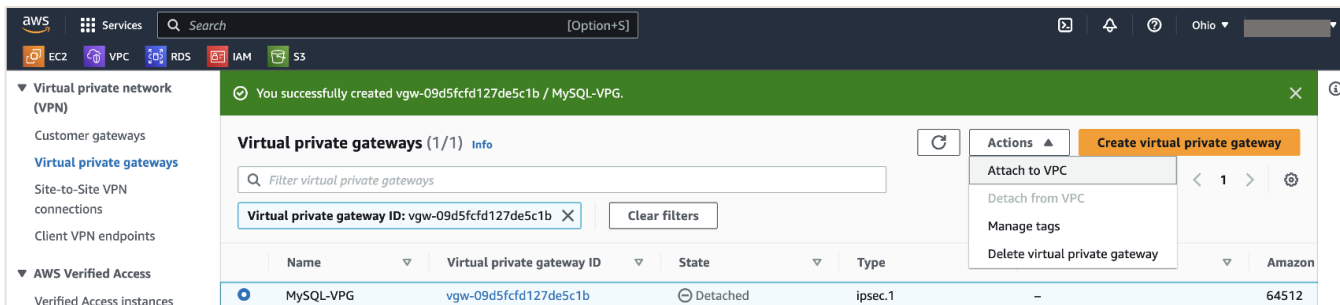
The screenshot shows the AWS console interface for the 'Virtual private gateways' page. The breadcrumb navigation is Virtual private network (VPN) > Virtual private gateways. The main heading is 'Virtual private gateways' with an 'Info' link. Below the heading is a search bar with the placeholder 'Filter virtual private gateways'. To the right of the search bar are 'Actions' and 'Create virtual private gateway' buttons. Below the search bar is a table with the following columns: Name, Virtual private gateway ID, State, Type, VPC, and Amazon. The table is empty, and a message below it says 'No virtual private gateways found'. The left-hand navigation menu is expanded to show 'Virtual private network (VPN)' with 'Virtual private gateways' selected.



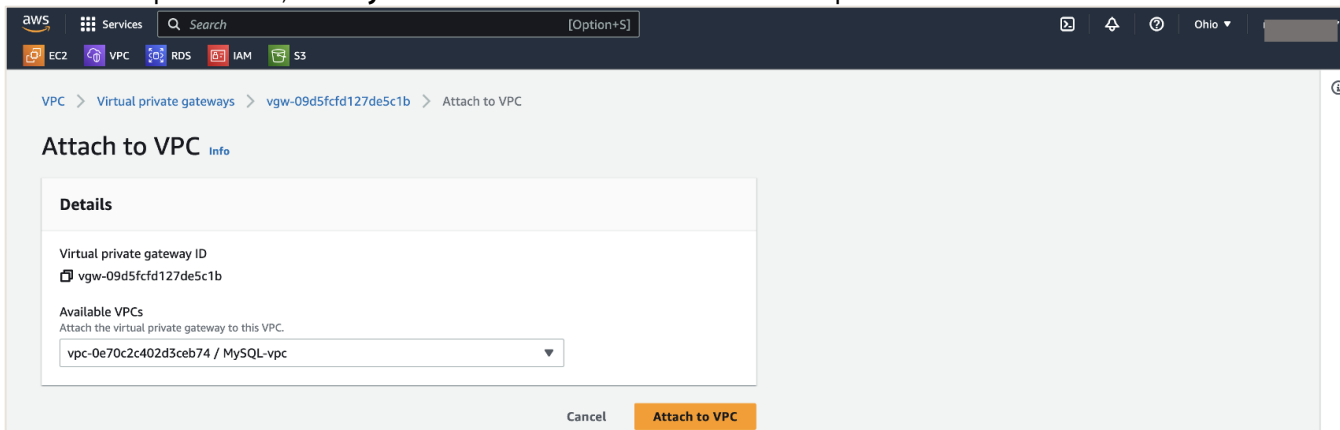
34. Enter a **virtual private gateway name**. Leave everything as-is and click **Create virtual private gateway**.



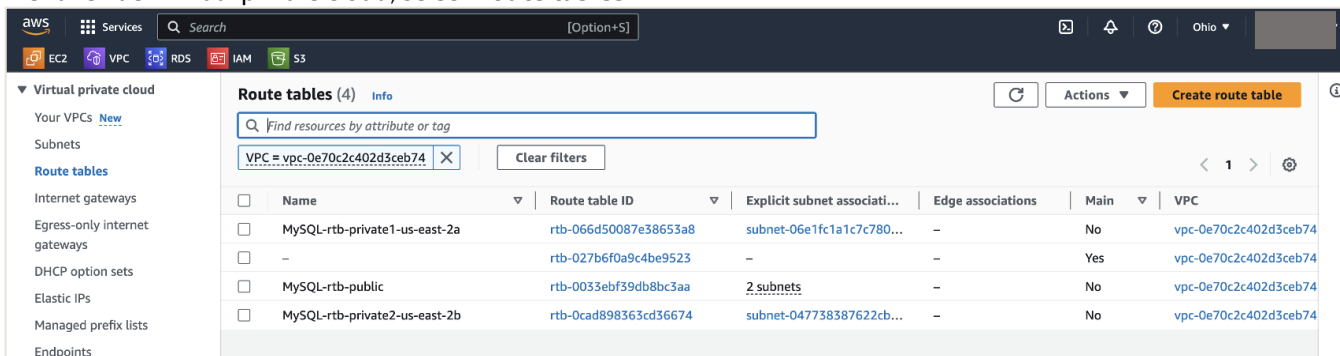
35. While still on the Virtual Private Gateway page, select the **virtual private gateway** that we just created. Click on the **Actions** menu and select **Attach to VPC**.



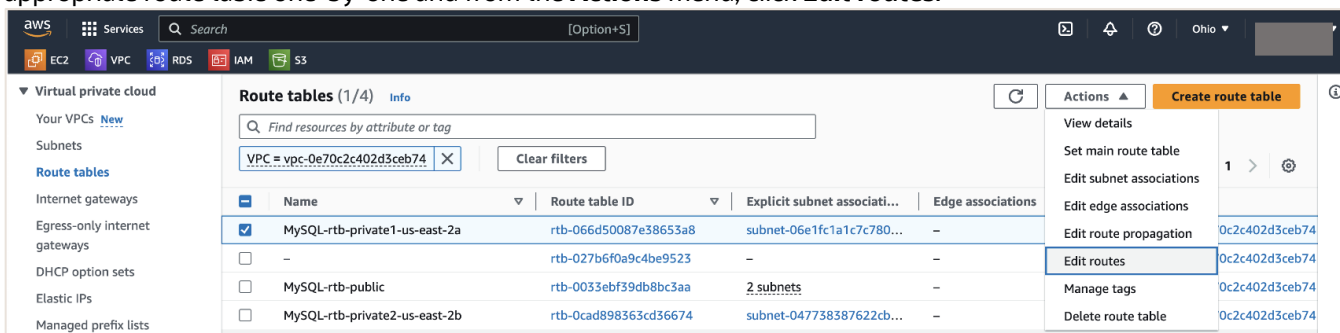
36. From the drop-down list, select **your VPC**. Click **Attach to VPC** once completed.



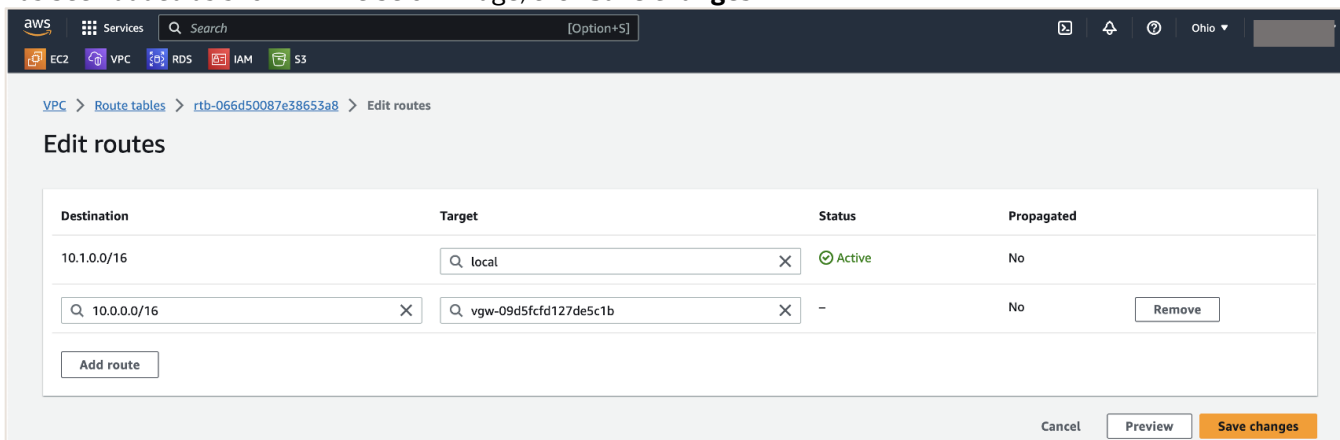
37. Wait until your Virtual private gateway changes its state to **Attached**. It is now time to update the AWS route tables - similar to what we did on OCI. From the Virtual private gateways page, scroll up on the left-hand AWS menu. Under Virtual private cloud, select **Route tables**.



38. For this guide, the main route table (rtb-027b6f0a9c4be9523 - the one with no name) is not being used, although we will use the public route table (to deploy on EC2 later) and both private route tables (for RDS). For each of the route tables that you wish to use, you will need to add an additional route rule. Select the appropriate route table one-by-one and from the **Actions** menu, click **Edit routes**.



39. Click **Add route** and under the **Destination**, input your **OCI VCN CIDR block** that you are using when you created your OCI VCN (the guide uses OCI VCN CIDR block of **10.0.0.0/16**). Afterwards, for **Target**, click **Virtual Private Gateway** from the drop-down list and **select your Virtual Private Gateway**. Once your route has been added as shown in the below image, click **Save changes**.



40. Repeat the same process for the remaining route tables that you will use.

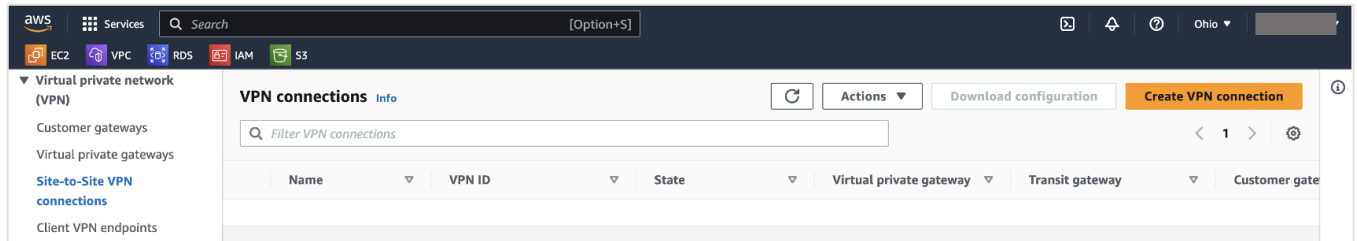
The screenshot shows the AWS Management Console interface for the 'Route tables' section of a VPC. The selected route table is 'MySQL-rtb-public' with ID 'rtb-0033ebf39db8bc3aa'. The right-hand menu shows the 'Edit routes' option highlighted.

Destination	Target	Status	Propagated
10.1.0.0/16	local	Active	No
0.0.0.0/0	igw-05181c48b2dd21e7d	Active	No
10.0.0.0/16	vgw-09d5fcd127de5c1b	-	No

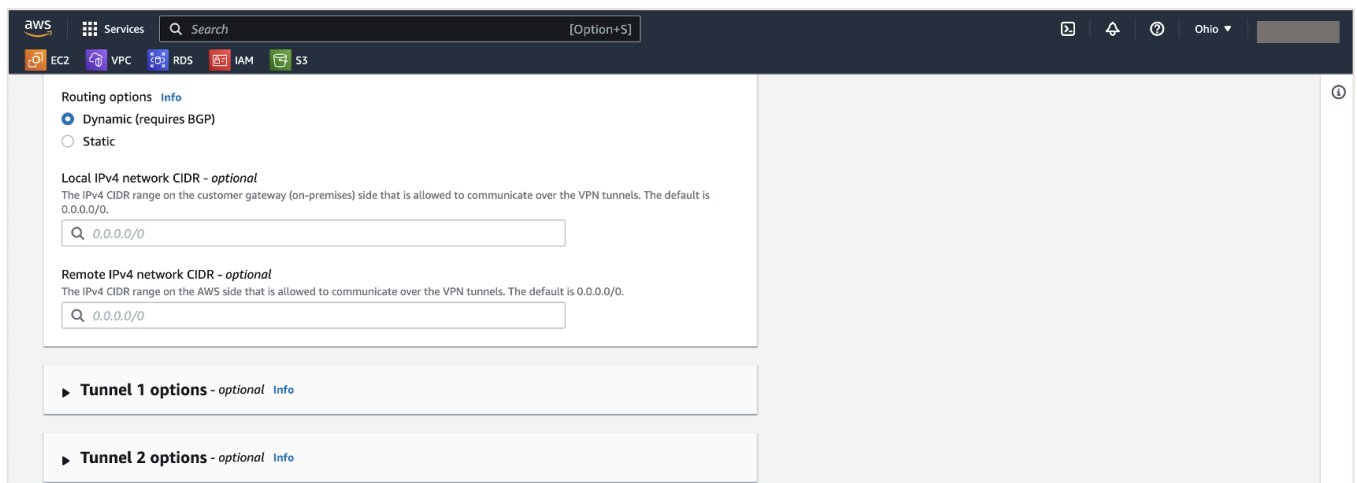
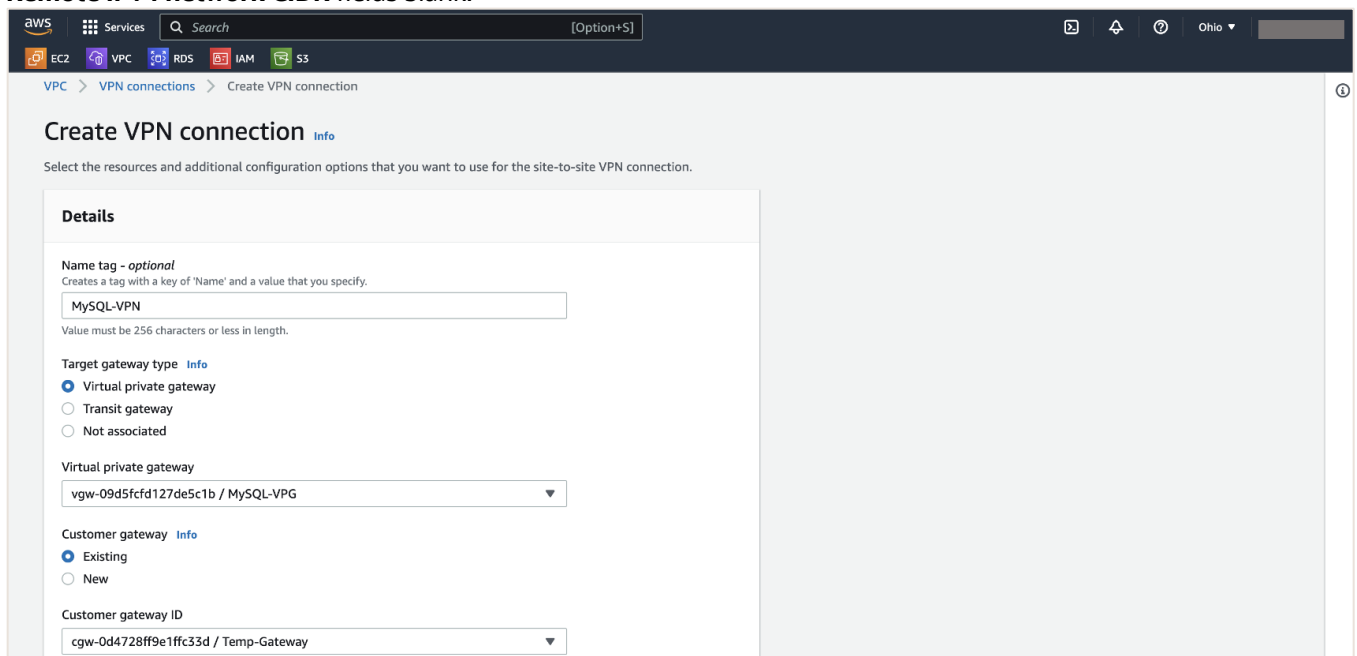
The screenshot shows the AWS Management Console interface for the 'Route tables' section of a VPC. The selected route table is 'MySQL-rtb-private2-us-east-2b' with ID 'rtb-0cad898363cd36674'. The right-hand menu shows the 'Edit routes' option highlighted.

Destination	Target	Status	Propagated
10.1.0.0/16	local	Active	No
10.0.0.0/16	vgw-09d5fcd127de5c1b	-	No

- After you have updated all your route tables on AWS, from the left-hand menu, scroll down and click **Site-to-Site VPN Connections** under Virtual Private Network (VPN). Once on the appropriate page, click **Create VPN Connection**.



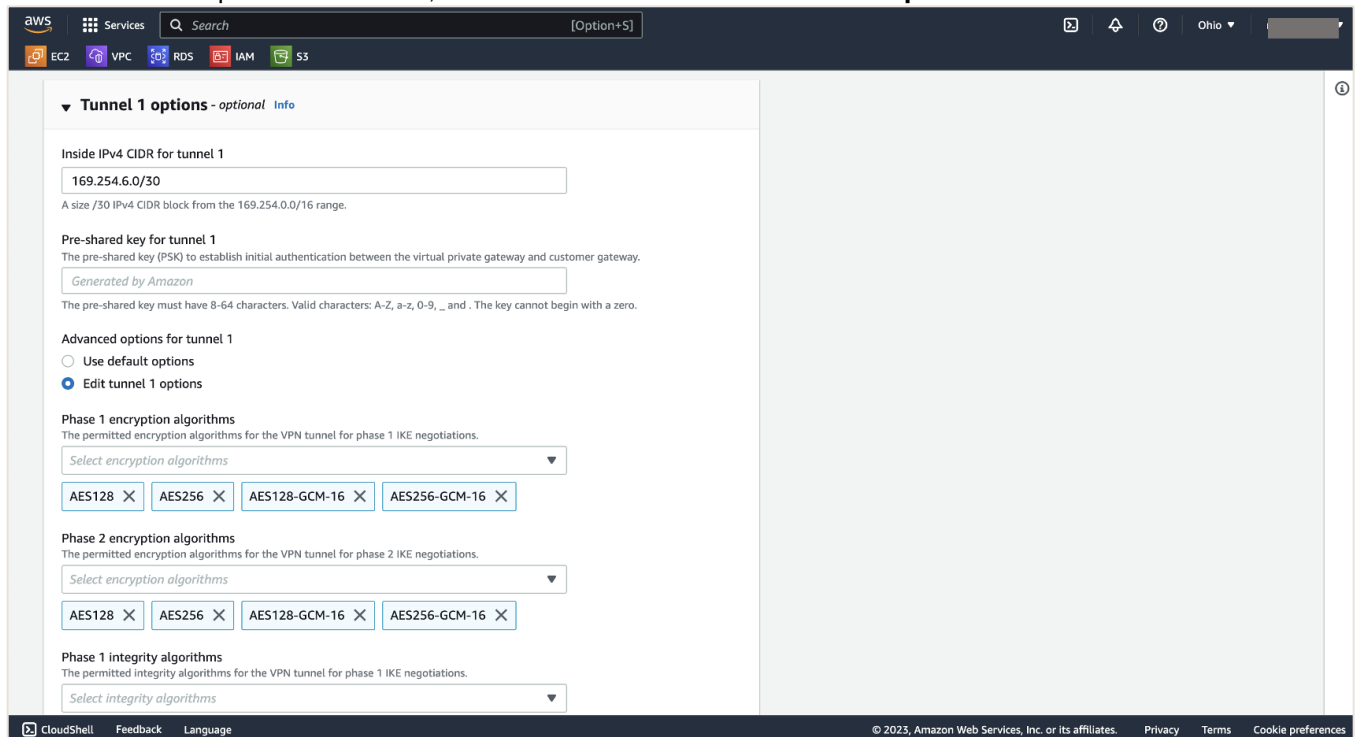
- Give a **VPN connection name**, for **Target gateway type** select **Virtual private gateway**. Under **Virtual private gateway** drop-down - select the **VPG that we had created earlier**. For **Customer gateway** select **Existing** and under the **Customer gateway ID** drop-down - select the **temporary Customer Gateway that we had created earlier**. Under **Routing options** select **Dynamic (requires BGP)**. Leave the **Local and Remote IPv4 network CIDR** fields blank.



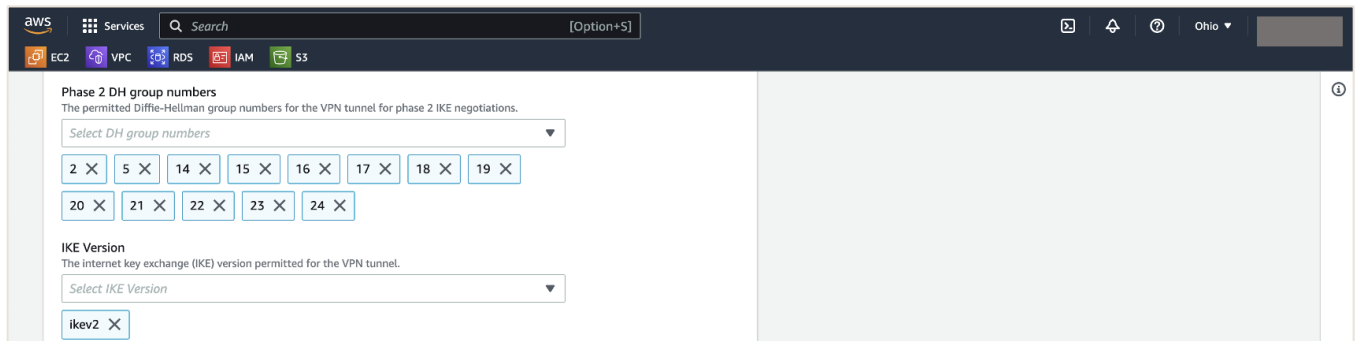
43. While still on the Create VPN Connection page, expand the **Tunnel 1 options**. Choose a **/30 CIDR from within the link local 169.254.0.0/16 range**. Input the full CIDR in the **Inside IPv4 CIDR for Tunnel 1** field. The guide uses the CIDR block of **169.254.6.0/30**. Ensure that OCI supports the chosen /30 address for the inside tunnel IPs. OCI does not allow you to use the following IP ranges for inside tunnel IPs:

- 169.254.10.0-169.254.19.255
- 169.254.100.0-169.254.109.255
- 169.254.192.0-169.254.201.255

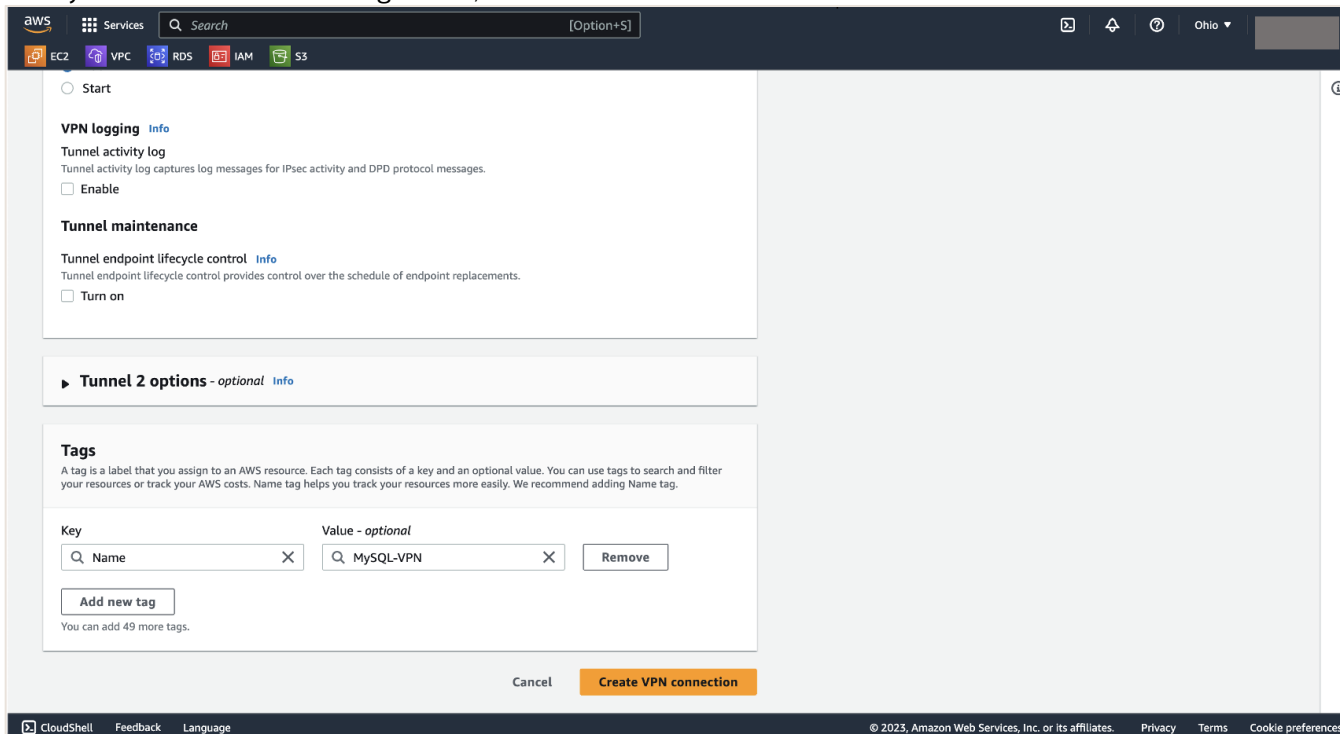
Under Advanced options for tunnel 1, click the radio button for **Edit tunnel 1 options**.



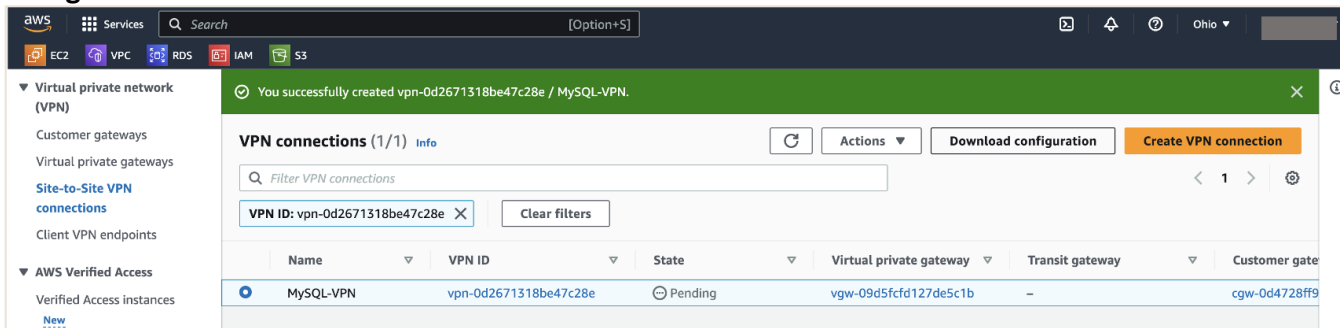
44. Once the tunnel 1 options expand, scroll down and look for **IKE Version**. Click the **X** and remove the **ikev1** field.



45. After you have finished the configuration, click **Create VPN connection**.



46. On the VPN Connections page, make sure that your VPN connection is selected and click the **Download configuration** button.

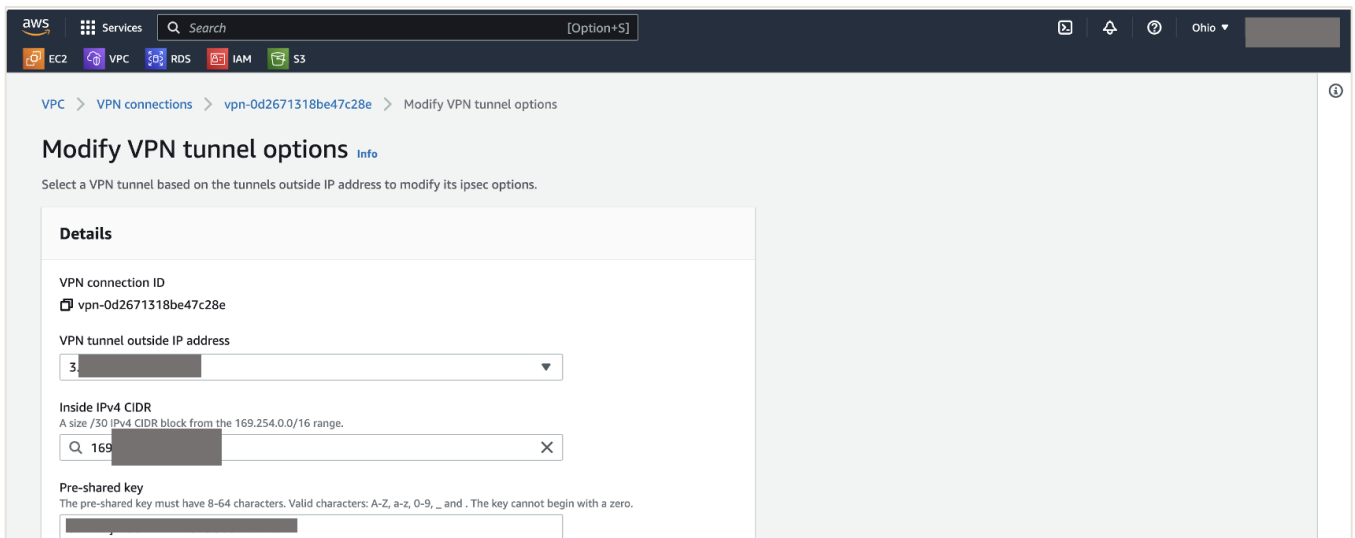
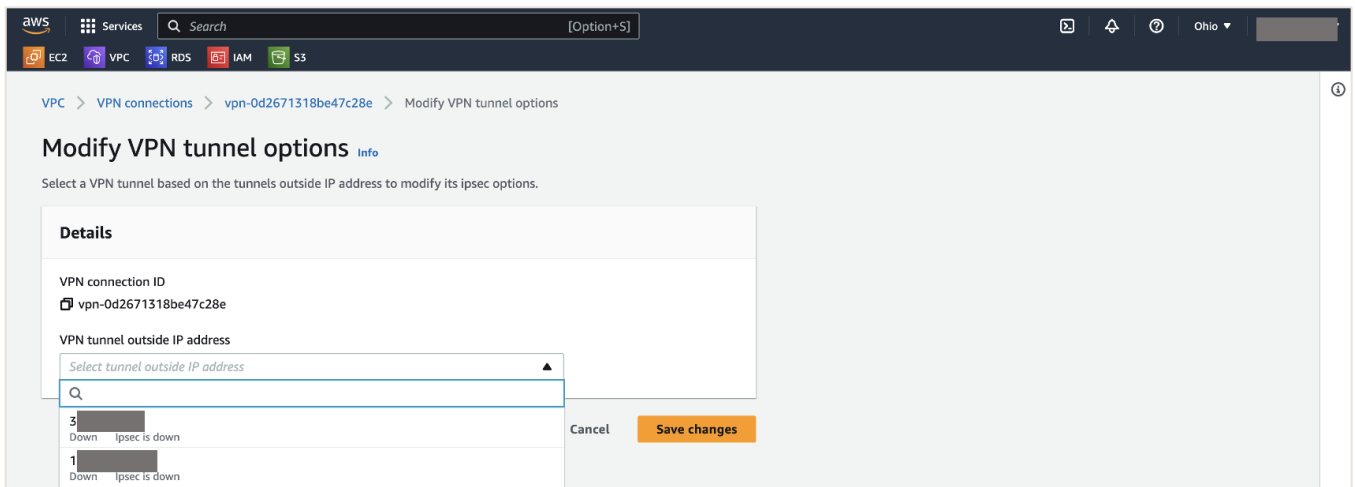
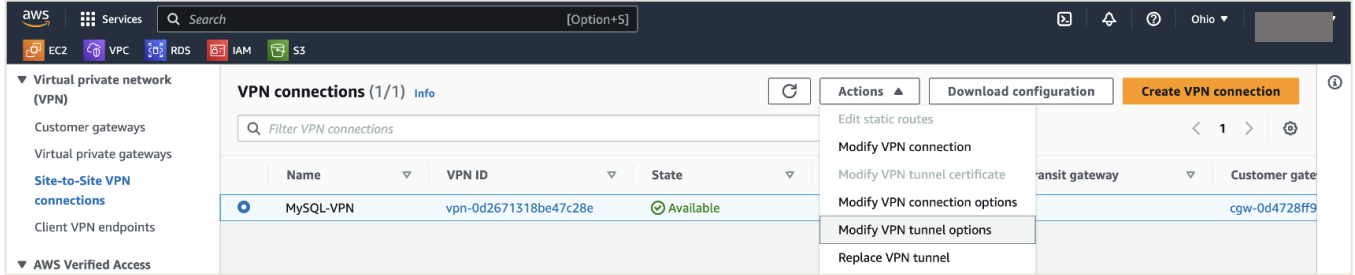








Note: AWS might generate a pre-shared key using the period or underscore characters (. or \_). OCI does not support using those characters in a pre-shared key. A key that includes these values must be changed. To change your pre-shared key in AWS for a tunnel, select your VPN connection, click the **Actions** button, then **Modify VPN Tunnel Options**. Select the **IPSec Tunnel #1 Virtual Private Gateway outside IP address** from the drop-down (you can find this in the AWS downloaded configuration file). Remove the period or underscore characters from your pre-shared key and click **Save changes**.



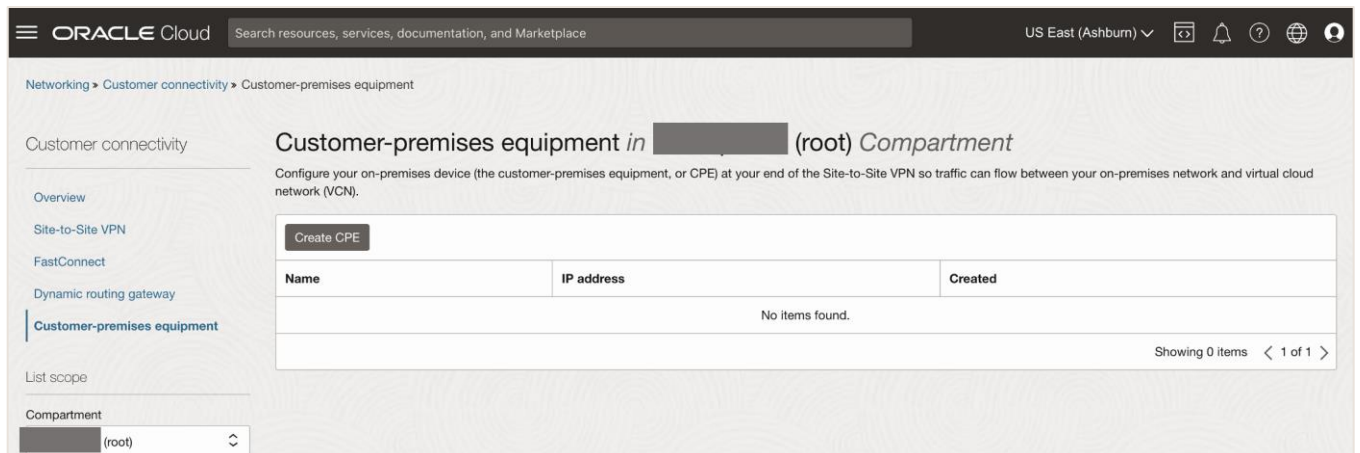
49. While still under Tunnel 1 in the downloaded configuration, scroll down to section **#3 Tunnel Interface Configuration**. Here, note down all the values for **Outside IP Addresses** and **Inside IP Addresses**.

Scroll down to section **#4: Border Gateway Protocol (BGP) Configuration** and note down the **Virtual Private Gateway ASN** value.

```
85 The Customer Gateway outside IP address was provided when the Customer Gateway
86 was created. Changing the IP address requires the creation of a new
87 Customer Gateway.
88
89 The Customer Gateway inside IP address should be configured on your tunnel
90 interface.
91
92 Outside IP Addresses:
93 - Customer Gateway           : 1.1.1.1
94 - Virtual Private Gateway    : 3.
95
96 Inside IP Addresses
97 - Customer Gateway           : 169.
98 - Virtual Private Gateway    : 169.
99
100 Configure your tunnel to fragment at the optimal size:
101 - Tunnel interface MTU      : 1436 bytes
102
103 #4: Border Gateway Protocol (BGP) Configuration:
104
105 The Border Gateway Protocol (BGPv4) is used within the tunnel, between the inside
106 IP addresses, to exchange routes from the VPC to your home network. Each
107 BGP router has an Autonomous System Number (ASN). Your ASN was provided
108 to AWS when the Customer Gateway was created.
109
110 BGP Configuration Options:
111 - Customer Gateway ASN       : 31898
112 - Virtual Private Gateway ASN : 64512
113 - Neighbor IP Address        : 16
114 - Neighbor Hold Time         : 30
```

50. Log back in to [OCI](#). From the OCI Navigation menu, navigate to **Networking**, click **Customer connectivity**, and click on **Customer-premises equipment**.

51. Click **Create CPE**.



52. Enter a **CPE name**. For the **Public IP address**, input the **Outside IP Address of the Virtual Private Gateway** - you can find this in the configuration file downloaded from AWS. For **CPE Vendor**, select **Other** from the dropdown. Click **Create CPE**.

**Create CPE**

Name: MySQL-CPE

Create in compartment: (root)

Allow IPSec over FastConnect

IP address: 3. ...  
This IP address will be used as your CPE IKE identifier.

Cpe vendor information ⓘ  
 Vendor ⓘ: Other

Add tags to organize your resources. [What can I do with tagging?](#)

Tag namespace: None (add a free-form tag) | Tag key: | Tag value: | Add tag

Buttons: Create CPE, Save as stack, Cancel

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53. From the OCI Navigation menu, navigate to **Networking** and click on **Site-to-Site VPN**.
54. Click **Create IPSec connection**.

Networking > Customer connectivity > Site-to-Site VPN

Customer connectivity

Site-to-Site VPN in (root) Compartment

Site-to-Site VPN securely connects your on-premises corporate network to Oracle Cloud Infrastructure, using your existing internet connection.  
 If your users have client devices that need offsite access to Oracle Cloud resources, you can also create an OpenVPN access server. See their [marketplace solution](#).

Buttons: Create IPSec connection, Start VPN wizard

Name	Lifecycle state	Customer-premises equipment	Dynamic routing gateway	Created
No items found.				

Showing 0 items < 1 of 1 >

- Enter a **IPSec connection name**. Under **Customer-premises equipment** dropdown, select the CPE we previously created. For **Dynamic routing gateway compartment** select the DRG we created. For **Routes to your on-premises network**, enter **0.0.0.0/0**.

- While on the Create IPSec connection page, configure your **Tunnel 1**. Enter a **tunnel name**, check the **Provide custom shared secret** box, and input the **Pre-Shared Key** from the AWS VPN configuration file. For **IKE version**, select **IKEv2** and under **Routing type** - make sure **BGP dynamic routing** is selected.

57. Under **BGP ASN**, input the **BGP Virtual Private Gateway ASN** from the AWS VPN configuration file. The default AWS BGP ASN is **64512**. For **IPv4 inside tunnel interface - CPE**, enter the **Inside IP Address of the Virtual Private Gateway**. For **IPv4 inside tunnel interface - Oracle**, enter the **Inside IP Address of the Customer Gateway**. You can find all this information from the AWS VPN configuration file.

58. Configure your **Tunnel 2** by copying and pasting the same values from Tunnel 1 into Tunnel 2. Click **Create IPsec connection**.

Note: only Tunnel 1 will be used for this VPN connection and migration. We need to configure Tunnel 2 otherwise we cannot click Create IPsec connection.



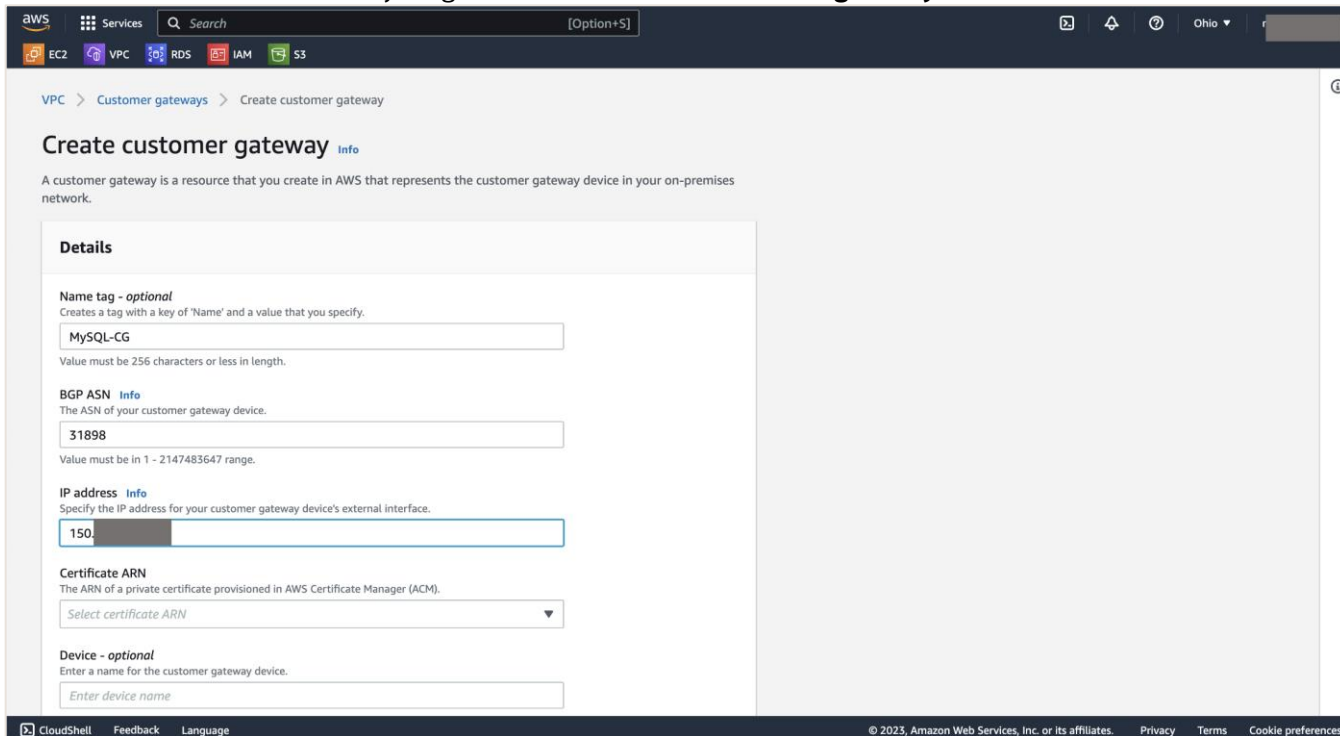
59. After your IPSec connection is provisioned, make note of the **Oracle VPN IP Address of Tunnel-1**. This address will be used to create a new customer gateway in the AWS portal.

Oracle Cloud console showing MySQL-VPN configuration. The page displays a green hexagonal icon with 'IPC' and the status 'AVAILABLE'. Below this, there are tabs for 'IPSec connection information', 'CPE & tunnels information', and 'Tags'. The 'IPSec connection information' tab is active, showing details such as 'Static route CIDR block: Not in use (all tunnels use BGP)', 'Created: Wed, Sep 20, 2023, 13:22:29 UTC', 'Site-to-Site VPN version: v2', 'OCID: ...hgydda', 'DRG: MySQL-DRG', and 'CPE: MySQL-CPE'. A table titled 'Tunnels in (root) Compartment' lists two tunnels: 'Tunnel-1' and 'Tunnel-2'. Both are in an 'Available' state with an 'IPSec status' of 'Down'. The 'Oracle VPN IP address' for 'Tunnel-1' is highlighted in a grey box.

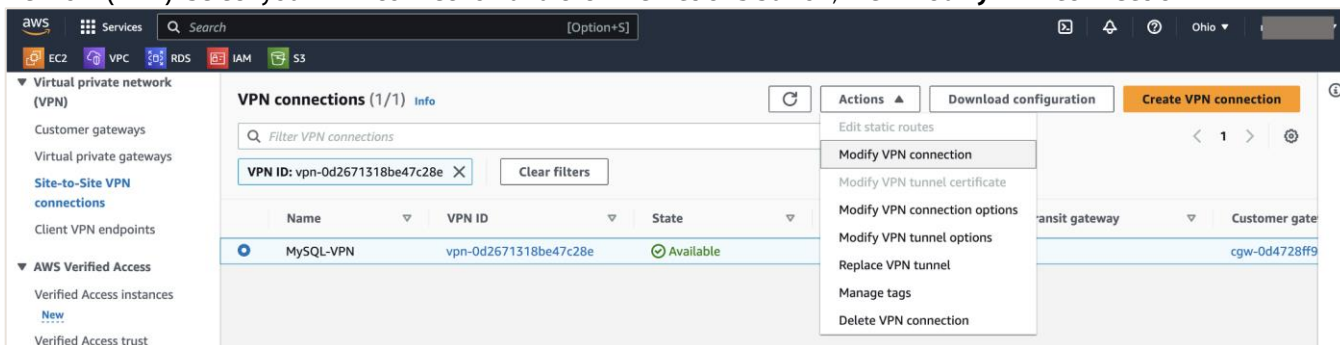
60. Log back in to [AWS](#). Expand the Services menu at the top left of the screen. Navigate to **Networking & Content Delivery** and select **VPC**. From the left-hand menu, scroll down and click **Customer Gateways** under Virtual private network (VPN). Click **Create customer gateway** once you have landed on the appropriate page.

AWS console showing the 'Customer gateways' page. The page title is 'Customer gateways (1) Info'. There is a search bar and a 'Create customer gateway' button. A table lists one customer gateway: 'Temp-Gateway' with a 'Customer gateway ID' of 'cgw-0d4728ff9e1ffc33d', a 'State' of 'Available', a 'BGP ASN' of '31898', an 'IP address' of '1.1.1.1', and a 'Type' of 'ipsec.1'.

- Enter a **customer gateway name**. For **BGP ASN**, enter **31898** and for **IP address**, enter the **Oracle VPN IP address for tunnel 1**. Leave everything as-is and click **Create customer gateway**.

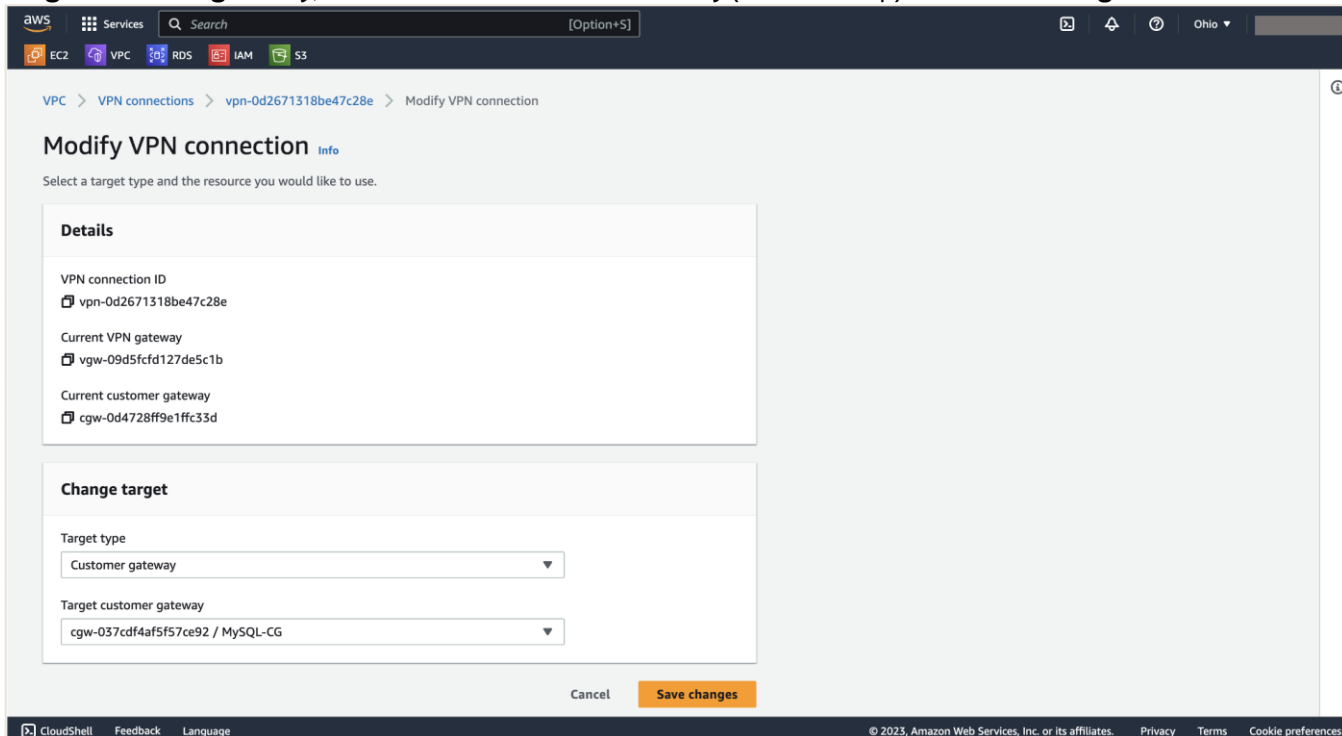


- From the left-hand AWS menu, scroll down and click **Site-to-Site VPN Connections** under Virtual Private Network (VPN). Select your VPN connection and click the **Actions** button, then **Modify VPN connection**.

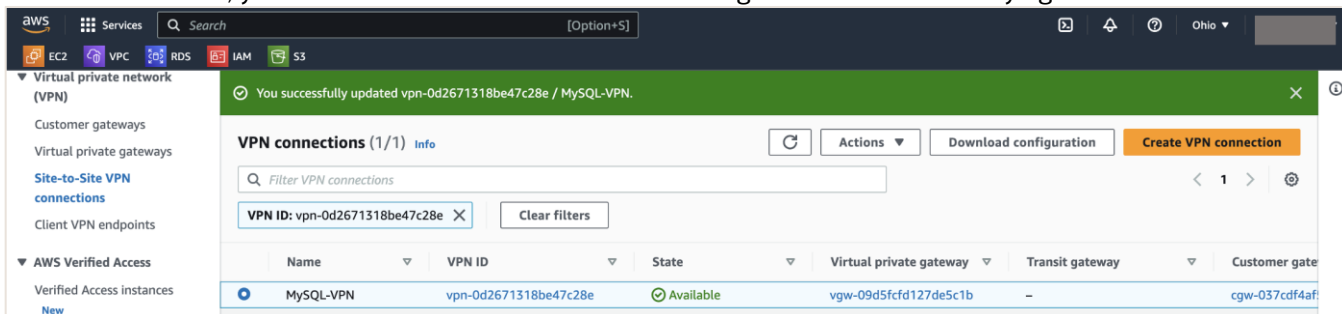




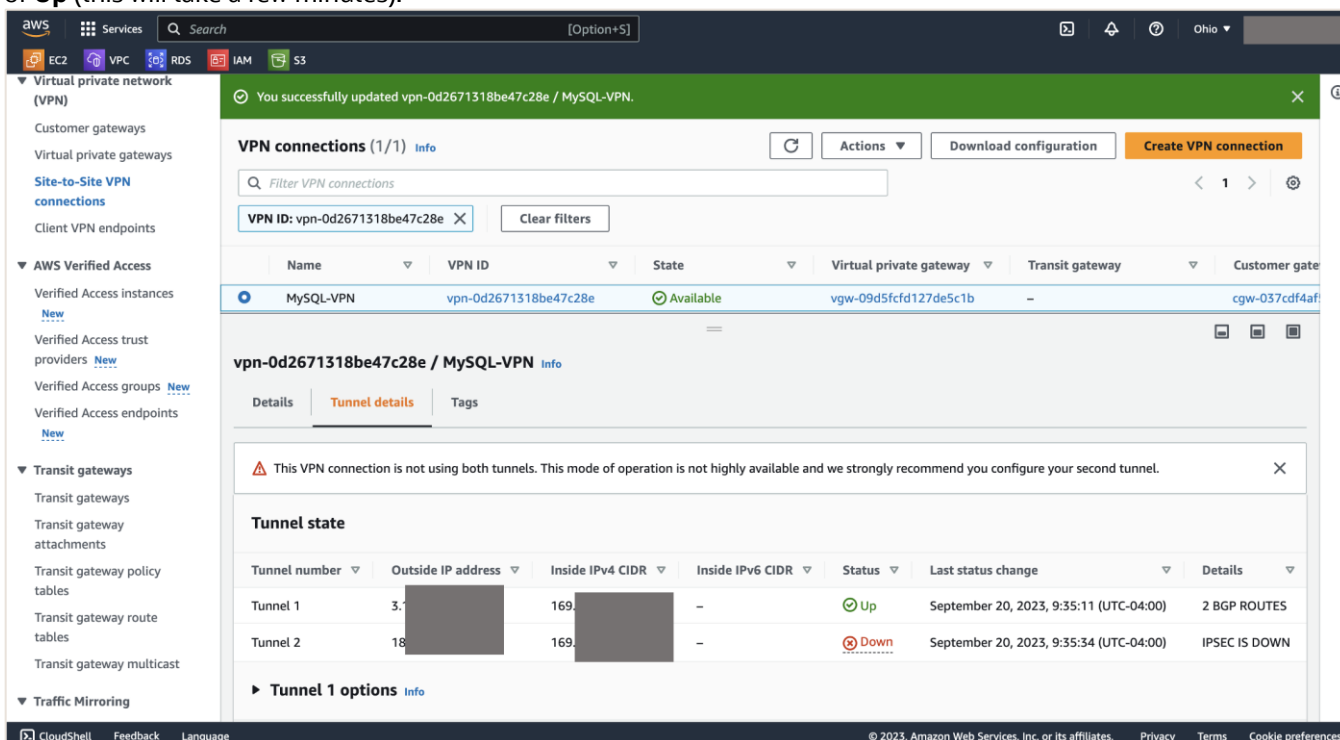
63. You will land on the Modify VPN connection page. Under **Target type**, select **Customer gateway** and for **Target customer gateway**, select the **new Customer Gateway** (not the Temp). Click **Save changes**.



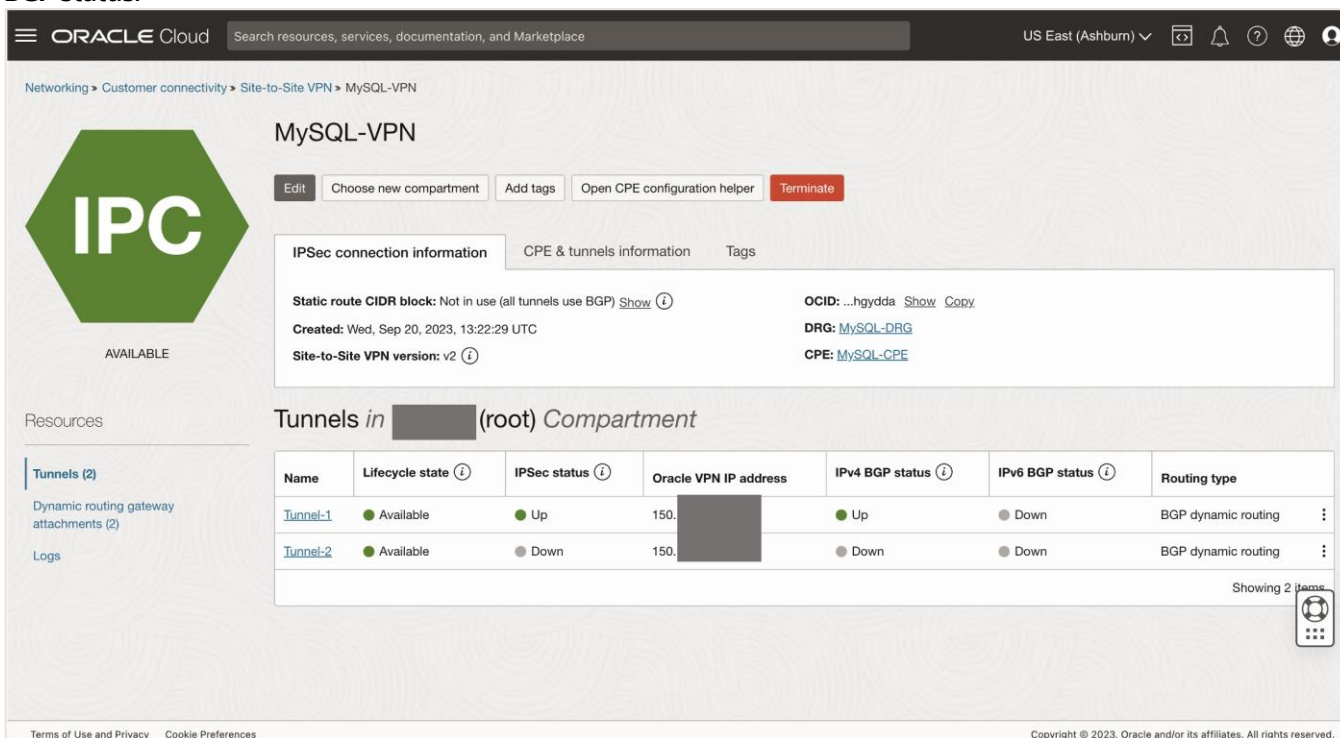
64. After a few minutes, your modified VPN connection should change its **State** from Modifying to **Available**.



65. The VPN connection from OCI to AWS is now setup. To verify if your VPN tunnel is up, select your VPN connection and go to the **Tunnel details** tab which can be found on the same page. You should see a **Status of Up** (this will take a few minutes).



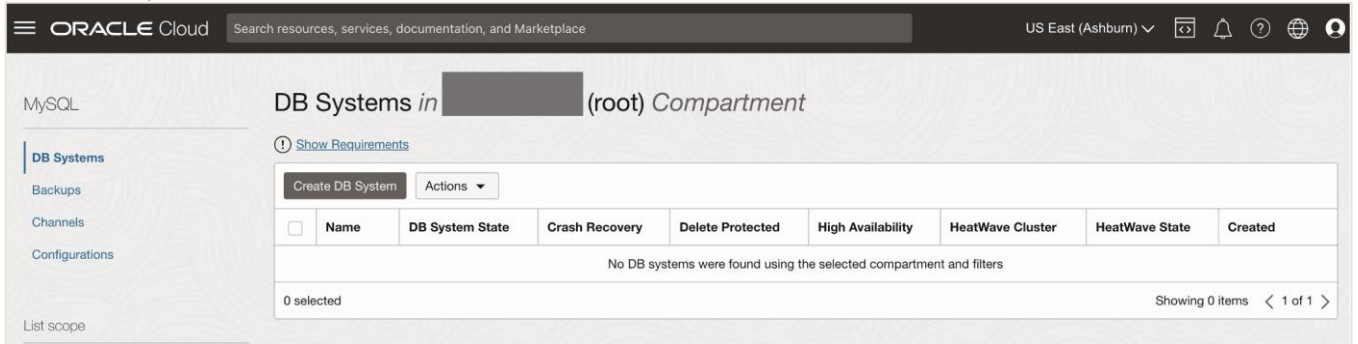
66. You can verify the same on the OCI side. Select your Site-to-Site VPN and under the Resources, click **Tunnels** (the page where you got the Oracle VPN IP address). You should see an **Up** status for **IPSec status** and **IPv4 BGP status**.



67. We are now ready to perform the migration.

### III) On OCI, create a HeatWave MySQL instance.

68. From the OCI Console, click on the navigation menu, click **Databases**, and click **HeatWave MySQL**. Click **Create DB System**.



MySQL DB Systems in [redacted] (root) Compartment

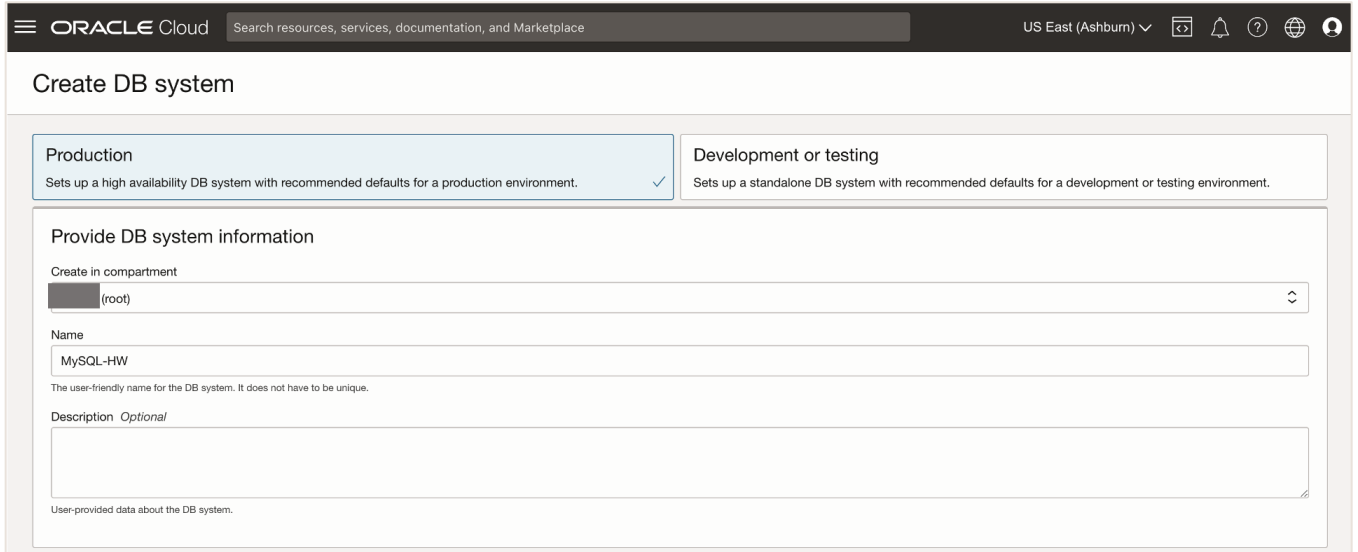
[Show Requirements](#)

Create DB System Actions

<input type="checkbox"/>	Name	DB System State	Crash Recovery	Delete Protected	High Availability	HeatWave Cluster	HeatWave State	Created
No DB systems were found using the selected compartment and filters								
0 selected								

Showing 0 items < 1 of 1 >

69. Pick **Production** or **Development or testing** and enter a **MySQL DB system name**.



Create DB system

Production Development or testing

Production Sets up a high availability DB system with recommended defaults for a production environment. ✓

Development or testing Sets up a standalone DB system with recommended defaults for a development or testing environment.

Provide DB system information

Create in compartment [redacted] (root)

Name MySQL-HW

The user-friendly name for the DB system. It does not have to be unique.

Description *Optional*

User-provided data about the DB system.

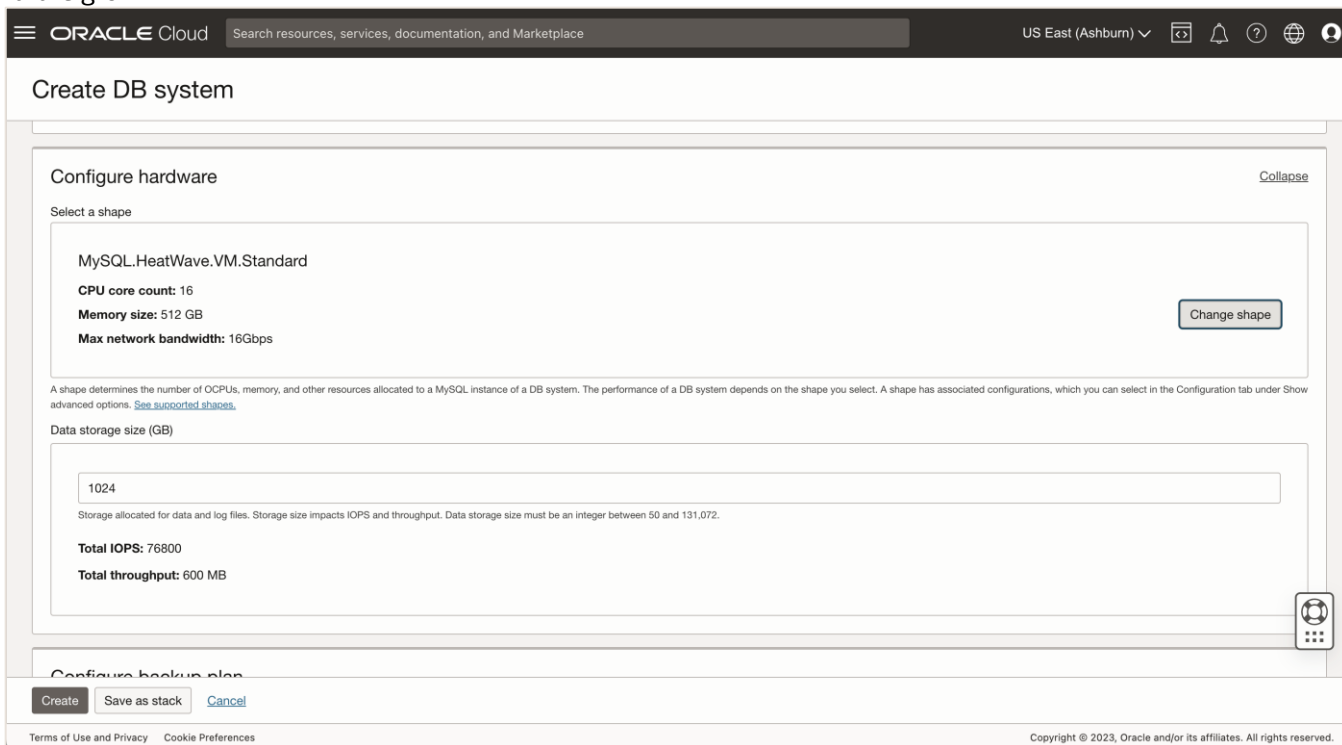
70. Select **Standalone** or **High Availability**. Turn **ON** the button for HeatWave MySQL - if you want to run OLTP, OLAP, and ML workloads. Afterwards, create your **Administrator credentials** that will be used to manage the HeatWave MySQL database.

The screenshot shows the 'Create DB System' page in the Oracle Cloud console. At the top, there's a navigation bar with 'ORACLE Cloud', 'Cloud Classic', a search bar, and the region 'US East (Ashburn)'. The main heading is 'Create DB System'. Below this, there are two tabs: 'Standalone' (selected, with a checkmark) and 'High availability'. The 'Standalone' tab is described as a 'Single-instance DB system'. Below the tabs, there's a section for 'Configure MySQL HeatWave' with a toggle switch turned on. The next section is 'Create administrator credentials', which includes three input fields: 'Username' (containing 'admin'), 'Password', and 'Confirm password'. At the bottom, there's a 'Configure networking' section which is currently collapsed. At the very bottom, there are three buttons: 'Create', 'Save as stack', and 'Cancel'.

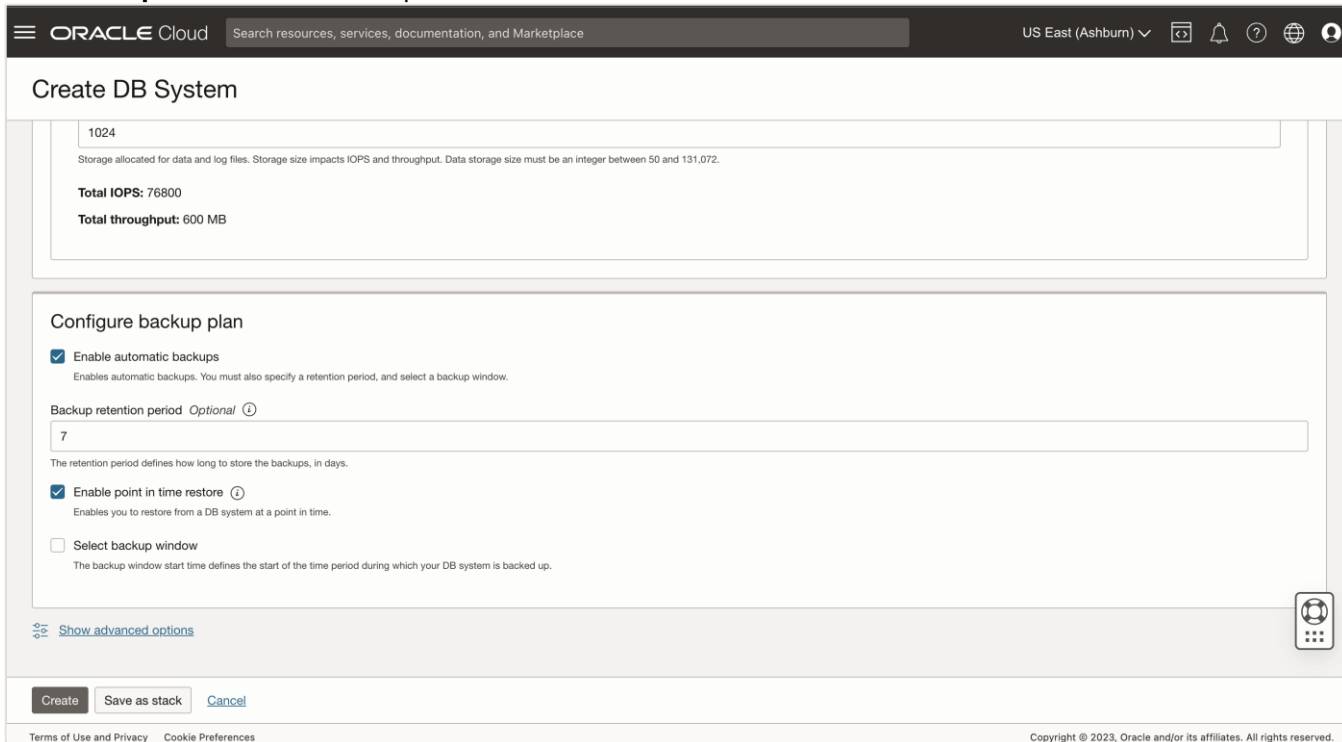
71. For **Configuring Networking** - choose the earlier created VCN and make sure the **Private Subnet** is selected under **Subnet in <compartment-name>**. For **Configure Placement** leave it as-is.

The screenshot shows the 'Create DB system' page in the Oracle Cloud console, focusing on the 'Configure networking' and 'Configure placement' sections. The 'Configure networking' section is expanded and shows a description: 'The VCN and subnet where the DB system endpoint will be attached. The DB system endpoint uses a private IP address and is not directly accessible from the internet. How do I connect to a DB system? If you do not have a VCN, create a VCN.' Below this, there are two dropdown menus: 'Virtual cloud network in' (set to 'MySQL-VCN') and 'Subnet in' (set to 'private subnet-MySQL-VCN (Regional)'). The 'Configure placement' section is also expanded and shows a description: 'The availability domain/fault domain in which the DB system endpoint will be physically placed. It is recommended to allow Oracle to choose the best placement for the fault domain.' Below this, there are three availability domain options: 'AD-1' (selected, with a checkmark), 'AD-2', and 'AD-3'. There is also an unchecked checkbox for 'Choose a fault domain'. At the bottom, there are three buttons: 'Create', 'Save as stack', and 'Cancel'. The footer contains 'Terms of Use and Privacy', 'Cookie Preferences', and 'Copyright © 2023, Oracle and/or its affiliates. All rights reserved.'

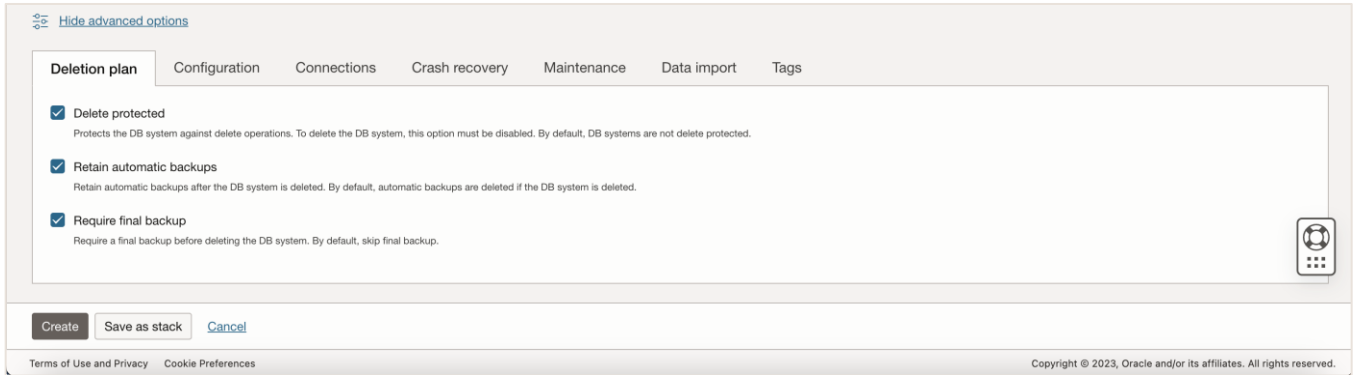
72. **Configure hardware** (OCPU and Memory) for MySQL by choosing an appropriate DB Shape. For this guide, we will use the default HeatWave shape. For the **Data Storage Size** be sure to make the size large enough for future growth.



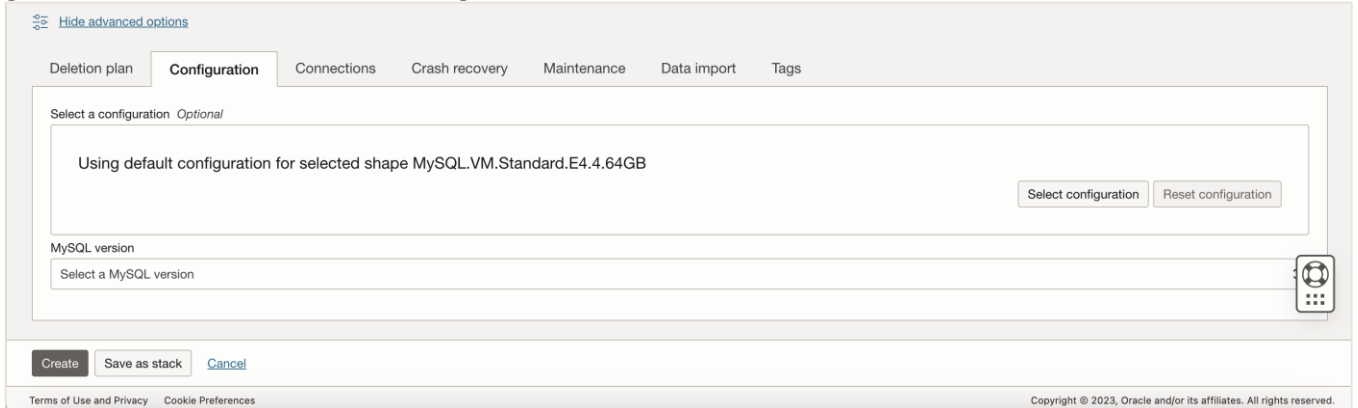
73. **Configure a backup plan** according to what suits your needs. Lastly, scroll down until you see **Show advanced options**. Click on it to expand.







74. From the advanced options screen, go to the **Configuration** tab. If you have a custom configuration that you would like to apply to your HeatWave MySQL instance - you can do so by clicking **Select configuration**. Custom configurations allow you to tweak MySQL variables (i.e., max connections, binary log expire seconds, etc.) rather than using the default values. You must create a custom configuration in advance before applying. For more information regarding custom configurations, see [Configuration of a DB System](#). For this guide, we have chosen the default configuration.



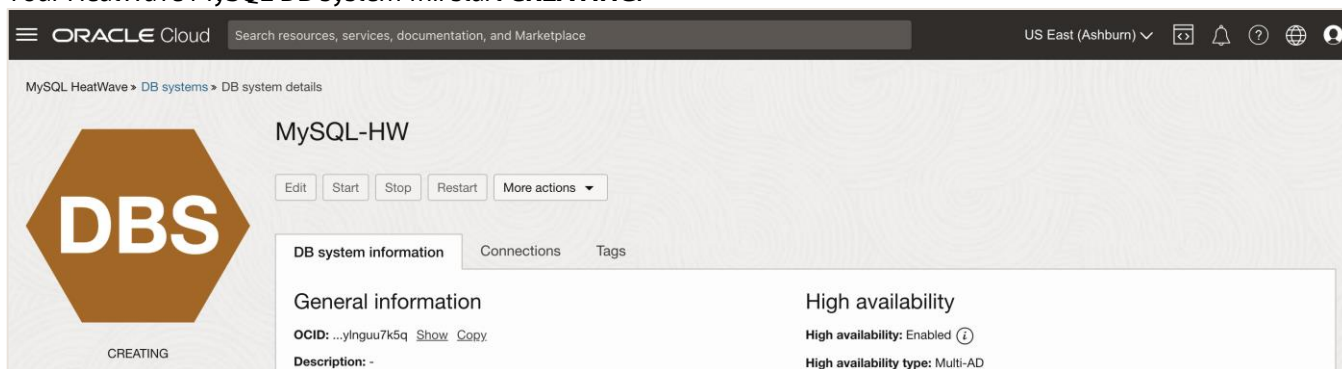
75. For **MySQL version**, choose either **Innovation** or **Bug fix**. With the new MySQL versioning model, you have the flexibility to select an innovation or a bug fix release. Both releases are production-grade quality. MySQL innovation releases allows you to access the latest features and improvements. Innovation releases are ideal for fast-paced development environments with high levels of automated tests and modern continuous integration techniques for faster upgrade cycles. MySQL bug fix releases (aka long-term support releases) allow you to reduce the risks associated with changes in the database software behavior, as these releases only contain necessary fixes (bugfix and security patches). For more information regarding MySQL innovation and bug fix releases, see [Introducing MySQL Innovation and Bug fix versions](#). For this guide, we have chosen **8.0.34 - Bug fix**.

The screenshot shows the 'Configuration' tab of the HeatWave MySQL DB system creation process. The 'MySQL version' dropdown menu is open, displaying a list of versions. The version '8.0.34 - Bug fix' is selected and highlighted. Other versions listed include '8.0.33 - Bug fix (Deprecated)', '8.0.32 - Bug fix (Deprecated)', '8.0.31 - Bug fix (Deprecated)', '8.0.30 - Bug fix (Deprecated)', and '8.1.0 - Innovation'. The 'Create' button is visible at the bottom left of the configuration area.

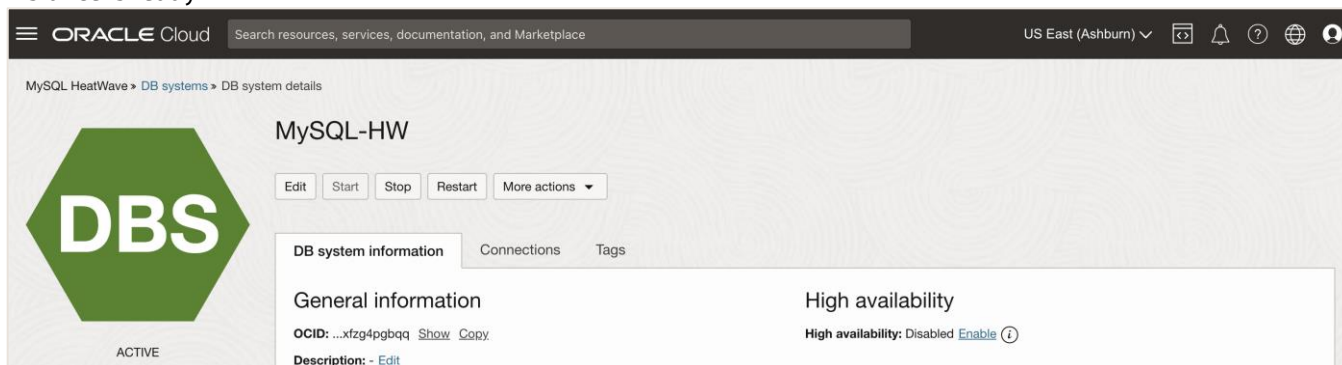
76. Click **Create** to finish the HeatWave MySQL DB system creation process.

The screenshot shows the 'Configuration' tab of the HeatWave MySQL DB system creation process. The 'MySQL version' dropdown menu is closed, and the selected option '8.0.34 - Bug fix' is visible. The 'Create' button is visible at the bottom left of the configuration area.

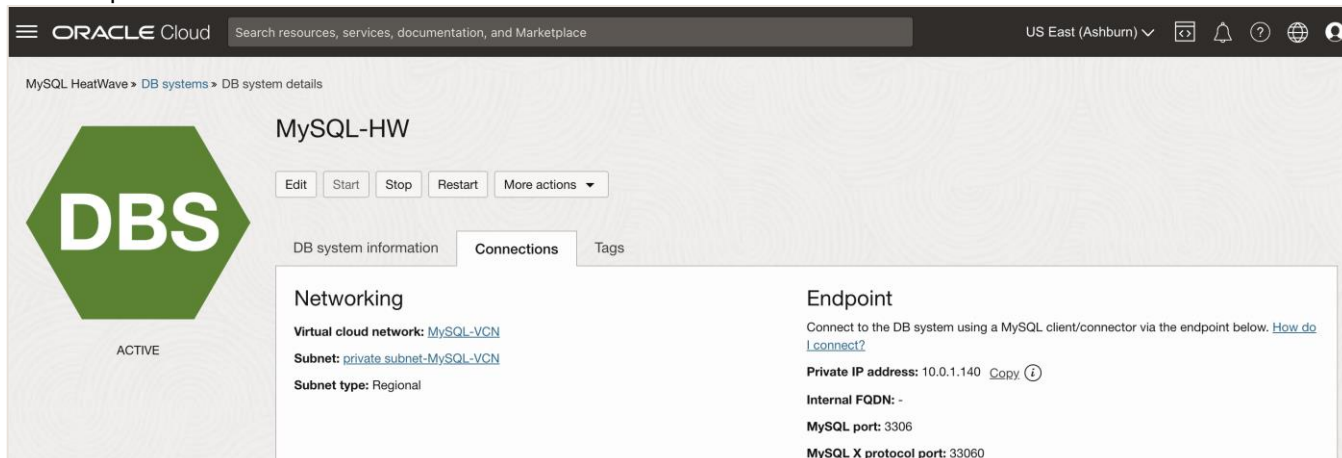
77. Your HeatWave MySQL DB system will start **CREATING**.



78. Within a few minutes, HeatWave MySQL DB system will change its state from CREATING to **ACTIVE** once the instance is ready.



79. On the same DB system details page, click **Connections** to grab the **private IP address** for HeatWave MySQL. Save the private IP Address for later use.

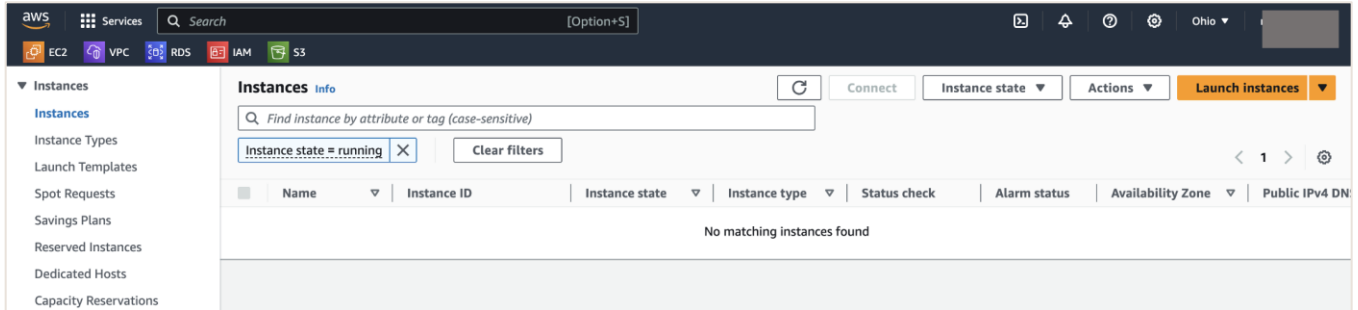


Note: you can navigate to the **DB System Details** page by going to the Navigation menu in OCI. Click **Databases** and click **HeatWave MySQL**. Click on the name of your MySQL DB System to open the **DB System Details** page.

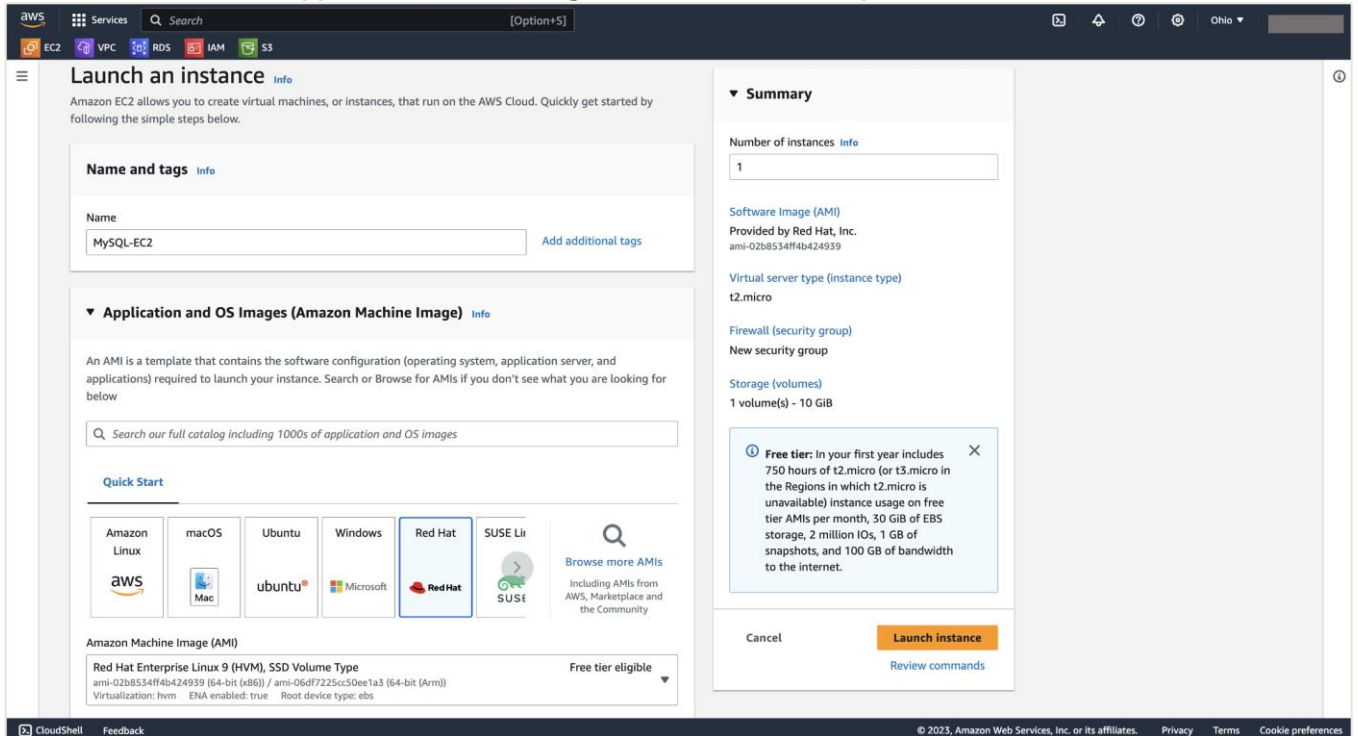
#### IV) Install MySQL Shell 8.1 or above on an EC2 instance that can connect to Amazon RDS MySQL.

80. Login to [AWS](#). From the Services menu, go to **Compute** and select **EC2**.

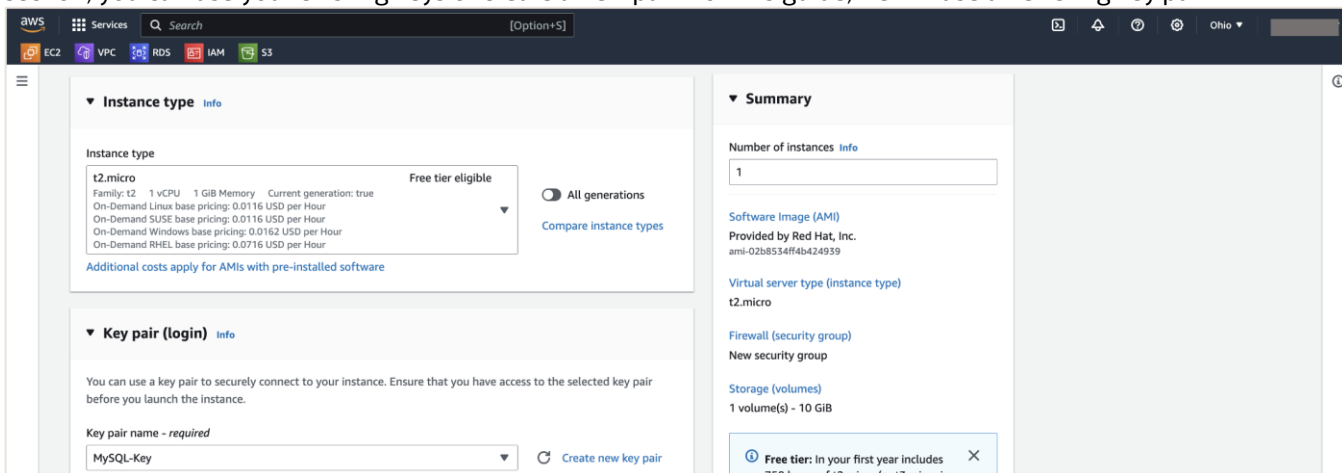
81. Click **Launch instance**.



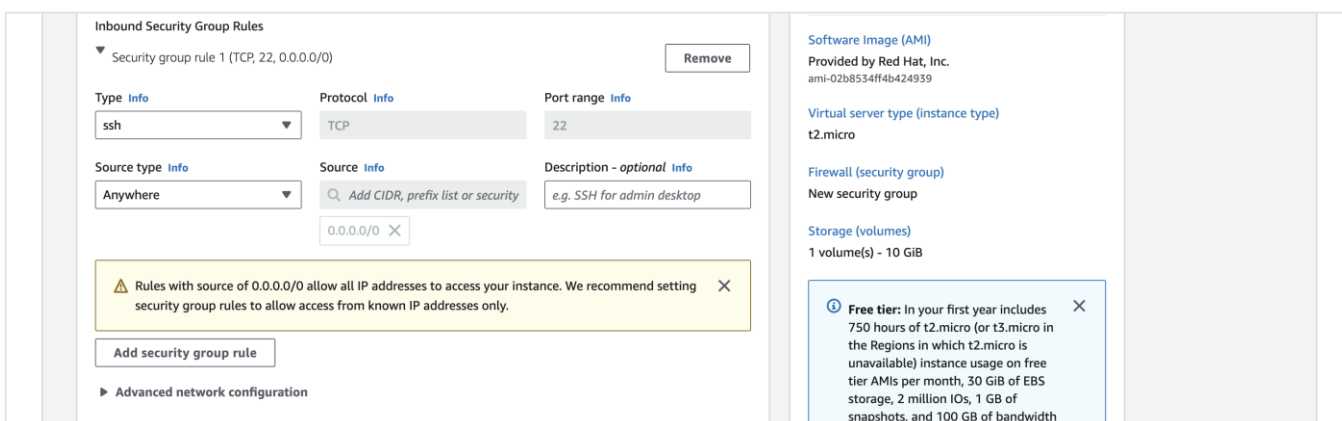
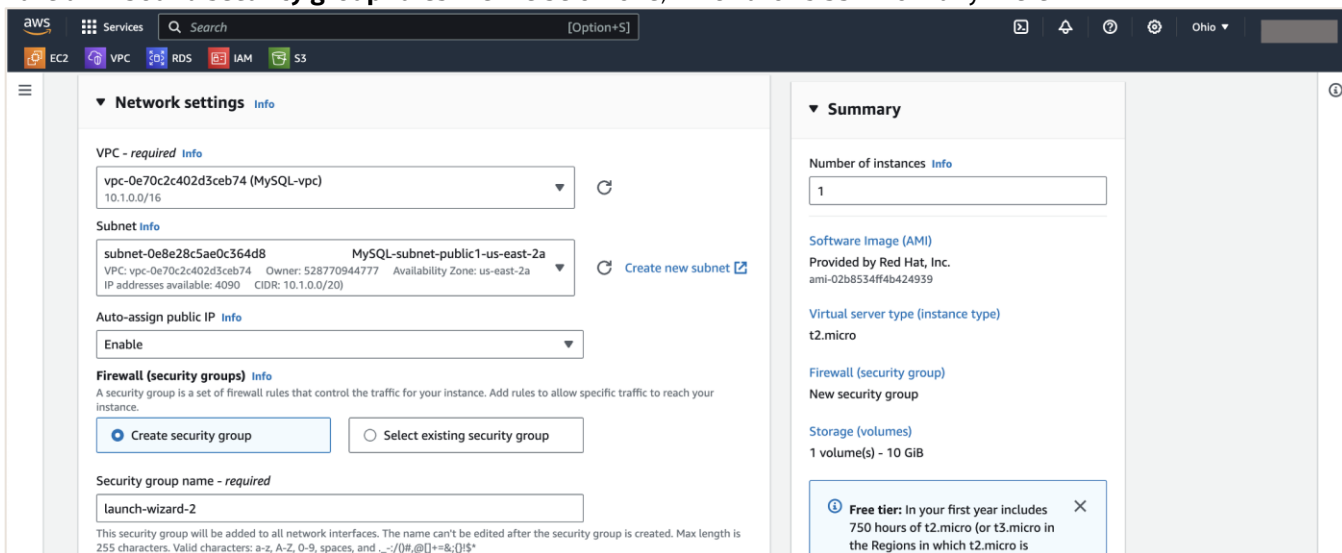
82. Enter an **EC2 name**. For **Application and OS Images**, select **Red Hat Enterprise Linux 9**.



83. For **Instance type**, choose an instance type you think is appropriate. If you have large amounts of data - provisioning an EC2 with more vCPUs and Memory will speed up the migration process. For the **Key pair** section, you can use your existing keys or create a new pair. For this guide, we will use an existing key pair.

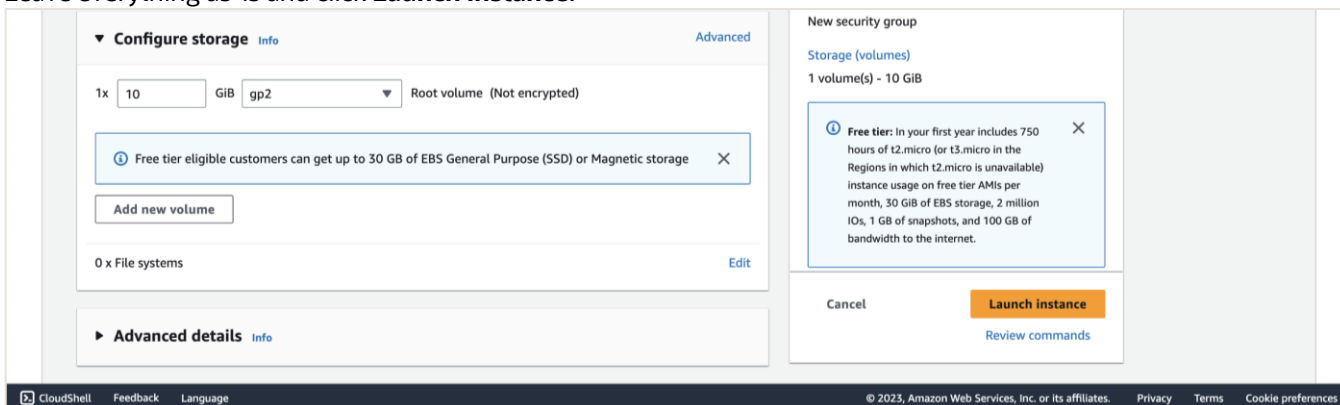


84. Under Network settings, ensure that the correct **VPC** (the VPC that is associated with your RDS instance) and **Subnet** are selected. For this guide - we have decided to deploy the EC2 inside a public subnet. For **Auto-assign public IP** select **Enable**. Under the **Firewall (security groups)**, choose **Create security group** and have an **Inbound security group rules** like the below one, which allows SSH from anywhere.

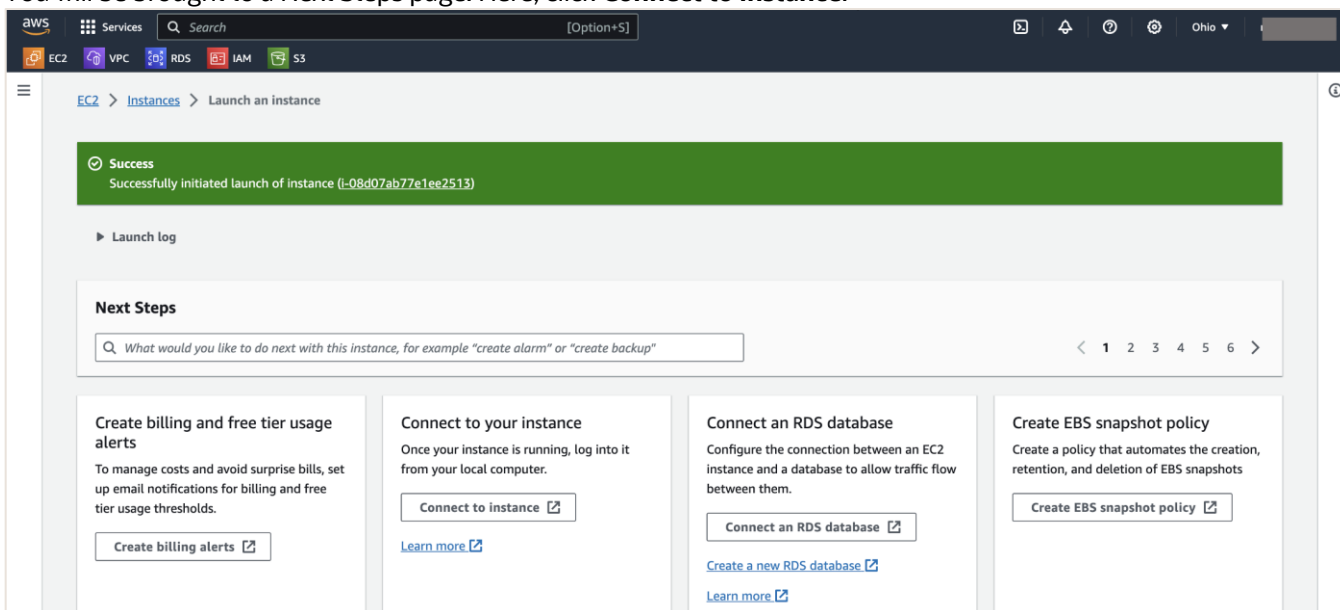




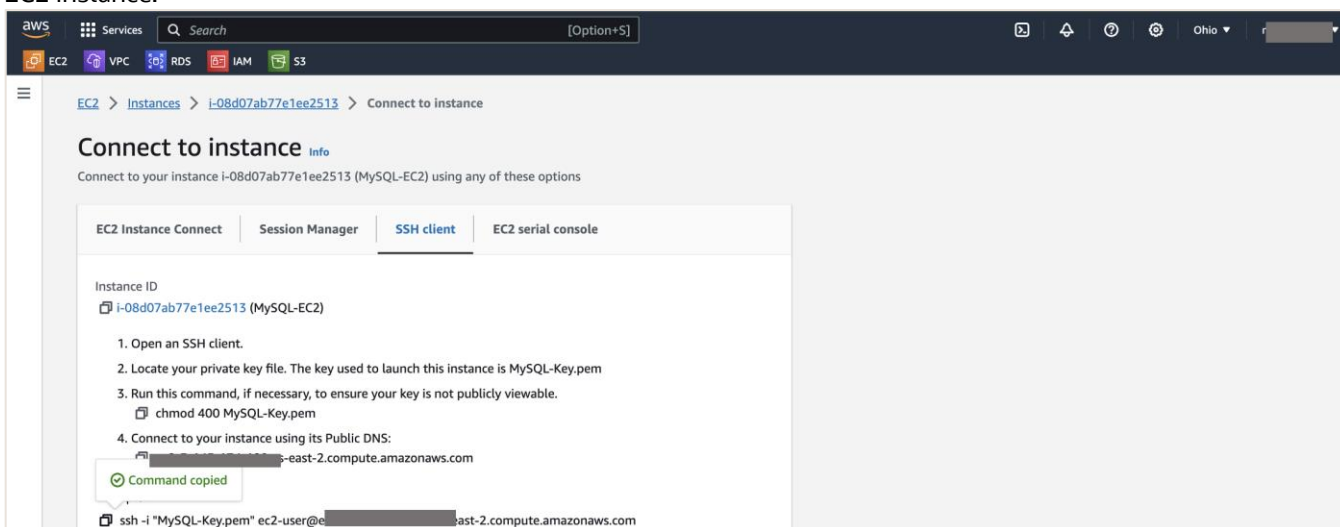
85. Leave everything as-is and click **Launch instance**.



86. You will be brought to a Next Steps page. Here, click **Connect to instance**.

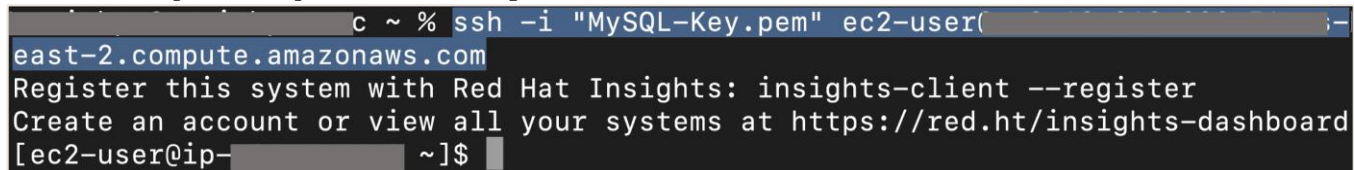


87. If you are using the SSH client to connect to your EC2, copy the **Example SSH command** and login to your EC2 instance.



88. You can SSH into EC2 using the below command:

```
$ ssh -i </path/to/private-ssh-key> ec2-user@<ec2-Public-DNS>
```



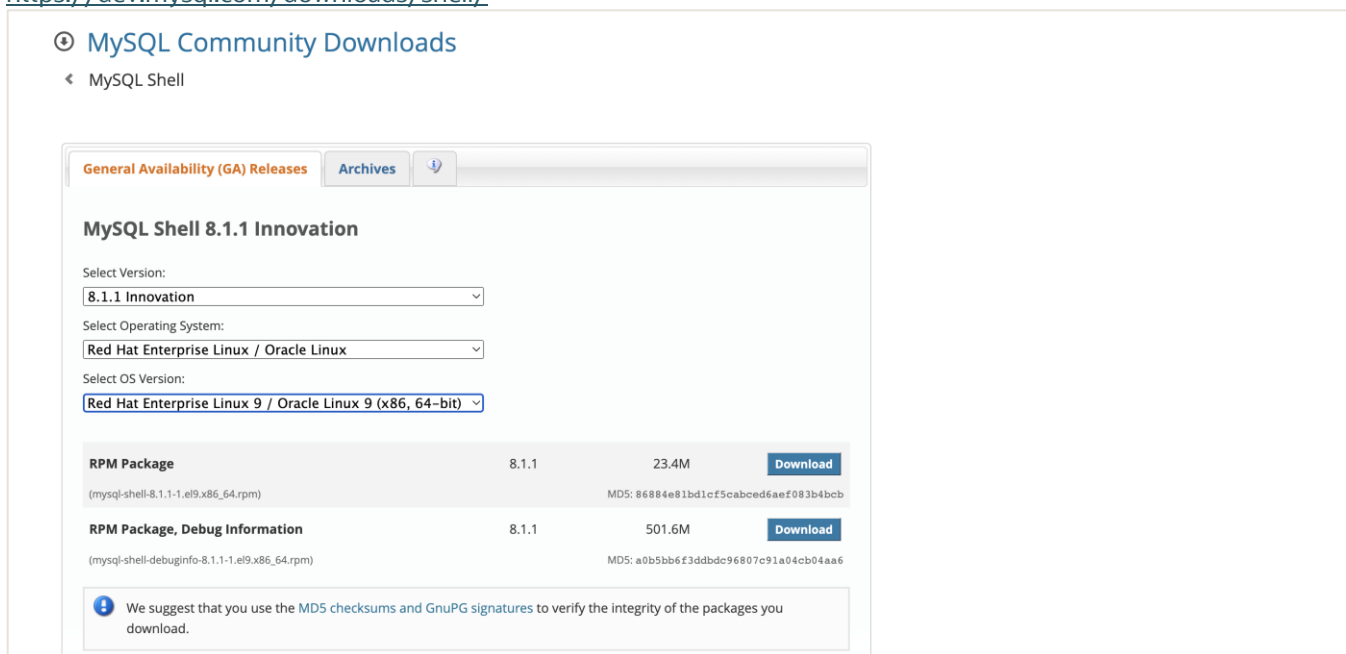
```
c ~ % ssh -i "MySQL-Key.pem" ec2-user@east-2.compute.amazonaws.com
Register this system with Red Hat Insights: insights-client --register
Create an account or view all your systems at https://red.ht/insights-dashboard
[ec2-user@ip-~]$
```

Note: after running the above SSH command, if prompted **Are you sure you want to continue connecting (yes/no/[fingerprint])?**, type **yes**.

89. We are now successfully connected to the EC2 instance.

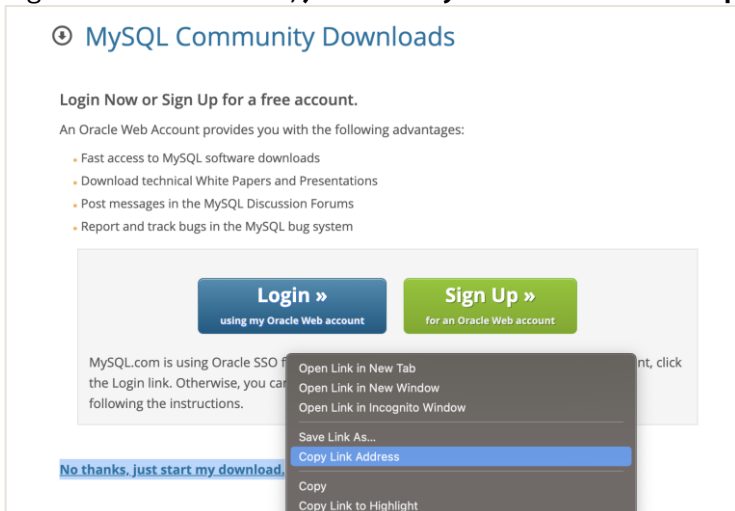
90. After making a connection to the EC2 instance, go to the below website and download MySQL Shell 8.1 on your EC2 instance. From the MySQL Shell download page, ensure **8.1.x Innovation or higher** is selected under **Select Version**. MySQL Shell 8.1 is fully compatible with MySQL 8.1, 8.0, and 5.7. For **Operating System** and **OS Version** - pick the appropriate option depending on the OS and the OS Version that you are running. Click **Download**.

<https://dev.mysql.com/downloads/shell/>



Note: for this guide, we will show you how to install MySQL Shell on a Linux environment. For other environments, see [Installing MySQL Shell on Windows](#), [Installing MySQL Shell on Linux](#), and [Installing MySQL Shell on macOS](#).

91. Right-click on **No thanks, just start my download** and click **Copy link address**.



92. Go back to the EC2 instance that can connect to your Amazon RDS MySQL and execute the below command to download MySQL Shell:

```
$ wget <MySQL-Shell-Download-Link>
```

Replace the link with what you have.

```
$ wget https://dev.mysql.com/get/Downloads/MySQL-Shell/mysql-shell-8.1.1-1.e19.x86_64.rpm
```

```
[ec2-user@ ~]$ wget https://dev.mysql.com/get/Downloads/MySQL-Shell/mysql-shell-8.1.1-1.e19.x86_64.rpm
--2023-09-20 15:45:58-- https://dev.mysql.com/get/Downloads/MySQL-Shell/mysql-shell-8.1.1-1.e19.x86_64.rpm
Resolving dev.mysql.com (dev.mysql.com)... 23.8.77.254, 2600:1407:b800:488::2e31, 2600:1407:b800:484::2e31
Connecting to dev.mysql.com (dev.mysql.com)|23.8.77.254|:443... connected.
HTTP request sent, awaiting response... 302 Moved Temporarily
Location: https://cdn.mysql.com//Downloads/MySQL-Shell/mysql-shell-8.1.1-1.e19.x86_64.rpm [following]
--2023-09-20 15:45:58-- https://cdn.mysql.com//Downloads/MySQL-Shell/mysql-shell-8.1.1-1.e19.x86_64.rpm
Resolving cdn.mysql.com (cdn.mysql.com)... 23.60.78.219, 2600:1407:b800:4ae::1d68, 2600:1407:b800:4b1::1d68
Connecting to cdn.mysql.com (cdn.mysql.com)|23.60.78.219|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 24542157 (23M) [application/x-redhat-package-manager]
Saving to: 'mysql-shell-8.1.1-1.e19.x86_64.rpm'

mysql-shell-8.1.1-1 100%[=====>] 23.40M 28.0MB/s in 0.8s

2023-09-20 15:46:00 (28.0 MB/s) - 'mysql-shell-8.1.1-1.e19.x86_64.rpm' saved [24542157/24542157]
```

Note: to install `wget` on the EC2, execute:

```
$ sudo yum install wget
```

93. After downloading the MySQL Shell rpm, install MySQL Shell:

```
$ sudo yum localinstall mysql-shell*
```

```
[ec2-user@ip-10.0.1.10 ~]$ sudo yum localinstall mysql-shell*
Updating Subscription Management repositories.
Unable to read consumer identity

This system is not registered with an entitlement server. You can use subscription-manager to register.

Last metadata expiration check: 0:00:30 ago on Wed 20 Sep 2023 03:54:28 PM UTC.
Dependencies resolved.
=====
Package                Architecture Version           Repository         Size
=====
Installing:
mysql-shell            x86_64           8.1.1-1.el9       @commandline      23 M
Transaction Summary
=====
Install 1 Package
```

94. You can now verify if MySQL Shell has successfully installed on your EC2 instance by executing the below command:

```
$ mysqlsh --version
```

```
[ec2-user@ip-10.0.1.10 ~]$ mysqlsh --version
mysqlsh Ver 8.1.1 for Linux on x86_64 - for MySQL 8.1.0 (MySQL Community Server (GPL))
[ec2-user@ip-10.0.1.10 ~]$
```

95. To login to your Amazon RDS MySQL using MySQL Shell, use the below commands:

```
$ mysqlsh <user>@<hostname>:<port-number>
```

-OR-

```
$ mysqlsh -u <user> -p -h <hostname> -P <port-number>
```

```
[ec2-user@ip-... ~]$ mysqlsh admin@database-1. ....us-east-2.rds.
s.amazonaws.com
Please provide the password for 'admin@database-1. ....us-east-2.rds.am
amazonaws.com': *****
Save password for 'admin@database-1. ....us-east-2.rds.amazonaws.com'?
[Y]es/[N]o/[e]xit (default No): Y
MySQL Shell 8.1.1

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Other names may be trademarks of their respective owners.

Type '\help' or '\?' for help; '\quit' to exit.
Creating a session to 'admin@database-1. ....us-east-2.rds.amazonaws.co
m'
Fetching schema names for auto-completion... Press ^C to stop.
Your MySQL connection id is 288
Server version: 5.7.37 Source distribution
No default schema selected; type \use <schema> to set one.
MySQL database-1. ....us-east-2.rds JS >
```

Note: you can interact with MySQL Shell using JavaScript, Python, or SQL mode. The default is JavaScript. To switch between the different modes, execute `/js` for JavaScript, `/py` for Python, and `/sql` for SQL mode inside MySQL Shell. To exit out of MySQL Shell, execute `/q`.



**V) Connect to Amazon RDS MySQL using MySQL Shell on EC2. Afterwards, execute the MySQL Shell `util.copyInstance()` utility to export all schemas (including users, indexes, routines, triggers) from Amazon RDS MySQL to HeatWave MySQL on OCI.**

96. Before connecting to Amazon RDS MySQL using MySQL Shell and proceeding with the below steps, it is highly recommended that you use a command like **screen** or **tmux**. These commands will allow you to reconnect to a dropped session in case your connection drops in the middle of performing the MySQL Shell export using `util.copyInstance()`. For small databases, the screen or tmux may not be necessary. For this guide, we will use tmux. To learn more about tmux, see [A beginner's guide to tmux](#). Below are the basics of using the tmux command:

- Install tmux on Linux: `$ sudo yum install tmux`
- Start a new tmux session, from your terminal execute: `$ tmux`
- List all the active tmux sessions: `$ tmux ls`
- Detach from a tmux session and leave it running in the background: `$ Ctrl+B d`
- Attach a tmux session running in the background: `$ tmux attach`
- End a tmux session: `$ Ctrl+B &`

97. Start a tmux session and connect to your Amazon RDS MySQL using MySQL Shell on EC2.

```
$ tmux
$ mysqlsh <user>@<hostname>:<port-number>
```

-OR-

```
$ mysqlsh -u <user> -p -h <hostname> -P <port-number>
```

```
[ec2-user@ ~]$ tmux
[ec2-user@ ~]$ mysqlsh admin@database-1.([REDACTED]).us-east-2.rds.
s.amazonaws.com
MySQL Shell 8.1.1

Copyright (c) 2016, 2023, Oracle and/or its affiliates.
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Other names may be trademarks of their respective owners.

Type '\help' or '\?' for help; '\quit' to exit.
Creating a session to 'admin@database-1.([REDACTED]).us-east-2.rds.amazonaws.co
m'
Fetching schema names for auto-completion... Press ^C to stop.
Your MySQL connection id is 298
Server version: 5.7.37 Source distribution
No default schema selected; type \use <schema> to set one.
MySQL database-1.([REDACTED]).us-east-2.rds JS >
```

98. Change to the JavaScript mode of MySQL Shell and run the `util.copyInstance()` utility to export all Amazon RDS MySQL data into HeatWave MySQL on OCI.

```
MySQL JS> \js
MySQL JS> util.copyInstance('mysql://admin@10.0.1.39', {"compatibility":
["force_innodb", "skip_invalid_accounts", "strip_definers",
"strip_restricted_grants", "strip_tablespace", "ignore_wildcard_grants",
"strip_invalid_grants", "create_invisible_pks"], users: "true", threads: 4,
dryRun:"true"})
```

Note: replace the username (`admin`) and IP address (`10.0.1.39`) with your HeatWave MySQL username and IP address (not the Amazon RDS MySQL username and IP address).

```
MySQL database-1. .us-east-2.rds.amazonaws JS > util.copyInstance('mysql://admin@
10.0.1.39', {"compatibility": ["force_innodb", "skip_invalid_accounts", "strip_definers", "str
ip_restricted_grants", "strip_tablespace", "ignore_wildcard_grants", "strip_invalid_grants",
"create_invisible_pks"], users: "true", threads: 4, dryRun:"true"})
Please provide the password for 'admin@10.0.1.39': *****
Save password for 'admin@10.0.1.39'? [Y]es/[N]o/[N]e[v]er (default No): Y
Copying DDL, Data and Users from in-memory FS, source: ip :3306, target: klgbkf63cr
stdaur:3306.
SRC: dryRun enabled, no locks will be acquired and no files will be created.
NOTE: SRC: Backup lock is not supported in MySQL 5.7 and DDL changes will not be blocked. The
dump may fail with an error if schema changes are made while dumping.
SRC: Acquiring global read lock
WARNING: SRC: The current user lacks privileges to acquire a global read lock using 'FLUSH TAB
LES WITH READ LOCK'. Falling back to LOCK TABLES...
ERROR: SRC: The current user does not have required privileges to execute FLUSH TABLES WITH RE
AD LOCK.
Backup lock is not supported in MySQL 5.7 and DDL changes cannot be blocked.
The gtid_mode system variable is set to OFF or OFF_PERMISSIVE.
The log_bin system variable is set to OFF or the current user does not have required privi
leges to execute SHOW MASTER STATUS.
The consistency of the dump cannot be guaranteed.
ERROR: SRC: Unable to acquire global read lock neither table read locks.
SRC: Global read lock has been released
Initializing - done
Util.copyInstance: While 'Initializing': Unable to lock tables: Consistency check has failed.
(MYSQLSH 52002)
```

99. Running the above step 98 command may generate **Errors** regarding **table locks** (see step 98 image). If you do encounter such problem (if and only if) run the same command as in step 98 but this time add an additional option: `consistent: "false"` and re-run the command.

```
MySQL JS> util.copyInstance('mysql://admin@10.0.1.39', {"compatibility":
["force_innodb", "skip_invalid_accounts", "strip_definers",
"strip_restricted_grants", "strip_tablespace", "ignore_wildcard_grants",
"strip_invalid_grants", "create_invisible_pks"], users: "true", threads: 4,
dryRun:"true", consistent: "false"})
```

Note: replace the username (`admin`) and IP address (`10.0.1.39`) with your HeatWave MySQL username and IP address (not the Amazon RDS MySQL username and IP address).

```
MySQL database-1. .us-east-2.rds.amazonaws JS > util.copyInstance('mysql://admin@
10.0.1.39', {"compatibility": ["force_innodb", "skip_invalid_accounts", "strip_definers", "str
ip_restricted_grants", "strip_tablespace", "ignore_wildcard_grants", "strip_invalid_grants",
"create_invisible_pks"], users: "true", threads: 4, dryRun:"true", consistent: "false"})
Copying DDL, Data and Users from in-memory FS, source: ip- :3306, target: klgbkf63cr
stdaur:3306.
SRC: dryRun enabled, no locks will be acquired and no files will be created.
Initializing - done
SRC: 2 out of 6 schemas will be dumped and within them 3 tables, 0 views.
SRC: 2 out of 4 users will be dumped.
Gathering information - done
WARNING: SRC: The dumped value of gtid_executed is not guaranteed to be consistent
SRC: Checking for compatibility with MySQL Database Service 8.1.1
NOTE: SRC: MySQL Server 5.7 detected, please consider upgrading to 8.0 first.
SRC: Checking for potential upgrade issues.
SRC: The MySQL server at database-1. .us-east-2.rds.amazonaws.com:3306,
SRC: version 5.7.37 - Source distribution, will now be checked for compatibility
SRC: issues for upgrade to MySQL 8.1.1...
```

[... output truncated]

```
TGT: Starting data load
?% (0 bytes / ?), 0.00 B/s, 0 / 3 tables done
Recreating indexes - done
TGT: Executing common postamble SQL
TGT: No data loaded.
TGT: 0 accounts were loaded
TGT: 0 warnings were reported during the load.
```

```
---
Dump_metadata:
  Binlog_file: ''
  Binlog_position: 0
  Executed_GTID_set: ''
```

```
MySQL database-1. .us-east-2.rds.amazonaws JS >
```

Note:

- `util.copyInstance(connectionData[, options])`: MySQL instance copy utility enables copying of an entire instance to another server. By default, this utility includes all schemas, users, indexes, routines, and triggers. See [Copy Utilities](#).
  - `connectionData`: Defines the connection details for the destination server you want to copy to.
- `compatibility`: Apply the specified requirements for compatibility with HeatWave MySQL for all tables in the dump output, altering the dump files as necessary.
  - `force_innodb`: Change `CREATE TABLE` statements to use the InnoDB storage engine for any tables that do not already use it.
  - `skip_invalid_accounts`: You cannot export a user that has no password defined. This option skips any such users.
  - `strip_definers`: Remove the `DEFINER` clause from views, routines, events, and triggers, so these objects are created with the default definer (the user invoking the schema), and change the `SQL SECURITY` clause for views and routines to specify `INVOKER` instead of `DEFINER`. HeatWave MySQL requires special privileges to create these objects with a definer other than the user loading the schema. If your security model requires that views and routines have more privileges than the account querying or calling them, you must manually modify the schema before loading it.
  - `strip_restricted_grants`: Certain privileges are restricted in HeatWave MySQL. Privileges such as `RELOAD`, `FILE`, `SUPER`, `BINLOG_ADMIN`, and `SET_USER_ID`. You cannot create users granting these privileges. This option strips these privileges from dumped `GRANT` statements.
  - `strip_tablespaces`: Tablespaces have some restrictions in HeatWave MySQL. If you need tables created in their default tablespaces, this option strips the `TABLESPACE=` option from `CREATE TABLE` statements.
  - `ignore_wildcard_grants`: If enabled, ignores errors from grants on schemas with wildcards, which are interpreted differently in systems where the `partial_revokes` system variable is enabled.
  - `strip_invalid_grants`: If enabled, strips grant statements which would fail when users are copied. Such as grants referring to a specific routine which does not exist.
  - `create_invisible_pks`: Primary keys are required by High Availability and HeatWave. If you intend to export data for use in a highly available DB system or a HeatWave DB system, add primary keys as they are not defined on the tables. This compatibility flag adds invisible primary keys to each table that requires them.
- `users`: Include (`true`) or exclude (`false`) users and their roles and grants in the dump.
- `threads`: (Optional) The number of parallel threads to use to copy chunks of data from the MySQL instance. Each thread has its own connection to the MySQL instance. The default is 4. The copy utilities require twice the number of threads, one thread to copy and one thread to write. If `threads` is set to `N`, `2N` threads are used.
- `dryRun`: Displays information about the copy with the specified set of options, and about the results of HeatWave MySQL Service compatibility checks, but does not proceed with the copy. Setting this option enables you to list out all the compatibility issues before starting the copy.

- consistent: Enable (true) or disable (false) consistent data copies by locking the instance for backup during the copy.

100. Once you have run the command in step 98/99 and did not see any errors in the output (warnings are okay), run the same step 98/99 command but this time change the `dryRun` option to `false`.

```
MySQL JS> util.copyInstance('mysql://admin@10.0.1.39', {"compatibility":
["force_innodb", "skip_invalid_accounts", "strip_definers",
"strip_restricted_grants", "strip_tablespaces", "ignore_wildcard_grants",
"strip_invalid_grants", "create_invisible_pks"], users: "true", threads: 4,
dryRun:"false", consistent: "false"})
```

Note: replace the username (`admin`) and IP address (`10.0.1.39`) with your HeatWave MySQL username and IP address (not the Amazon RDS MySQL username and IP address).

```
MySQL database-1. .us-east-2.rds.amazonaws JS > util.copyInstance('mysql://admin@
10.0.1.39', {"compatibility": ["force_innodb", "skip_invalid_accounts", "strip_definers", "str
ip_restricted_grants", "strip_tablespaces", "ignore_wildcard_grants", "strip_invalid_grants",
"create_invisible_pks"], users: "true", threads: 4, dryRun:"false", consistent: "false"})
Copying DDL, Data and Users from in-memory FS, source: ip-:3306, target: klgbkf63cr
stdaur:3306.
Initializing - done
SRC: 2 out of 6 schemas will be dumped and within them 3 tables, 0 views.
SRC: 2 out of 4 users will be dumped.
Gathering information - done
WARNING: SRC: The dumped value of gtid_executed is not guaranteed to be consistent
SRC: Checking for compatibility with MySQL Database Service 8.1.1
NOTE: SRC: MySQL Server 5.7 detected, please consider upgrading to 8.0 first.
SRC: Checking for potential upgrade issues.
SRC: The MySQL server at database-1. .us-east-2.rds.amazonaws.com:3306,
SRC: version 5.7.37 - Source distribution, will now be checked for compatibility
SRC: issues for upgrade to MySQL 8.1.1..
```

[... output truncated]

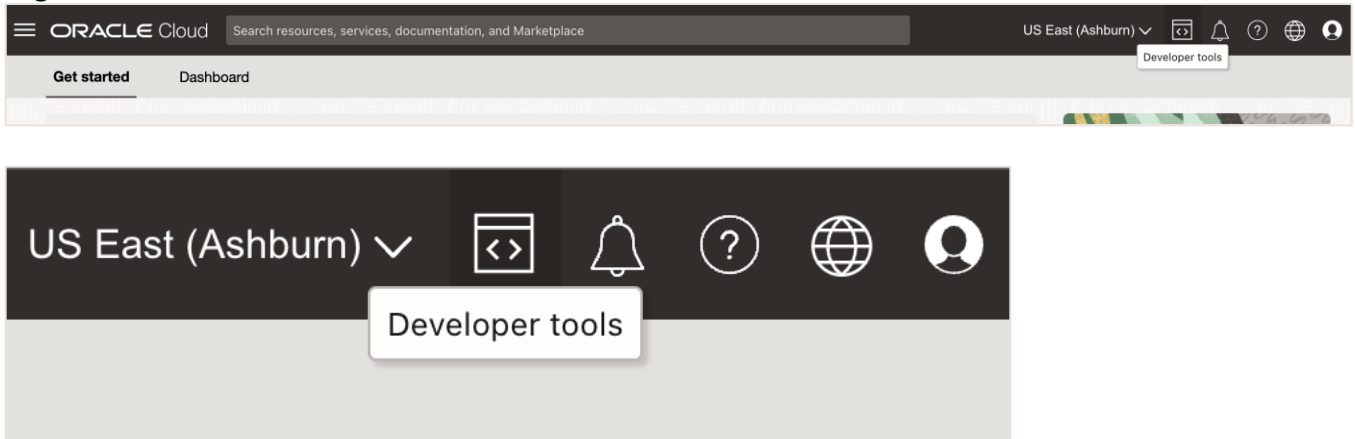
```
100% (5.30K rows / ~5.27K rows), 0.00 rows/s, 0.00 B/s
SRC: Dump duration: 00:00:01s
SRC: Total duration: 00:00:02s
SRC: Schemas dumped: 2
SRC: Tables dumped: 3
SRC: Data size: 194.61 KB
SRC: Rows written: 5302
SRC: Bytes written: 194.61 KB
SRC: Average throughput: 169.78 KB/s
TGT: Executing common postamble SQL
100% (194.61 KB / 194.61 KB), 0.00 B/s, 3 / 3 tables done
Recreating indexes - done
TGT: 3 chunks (5.30K rows, 194.61 KB) for 3 tables in 2 schemas were loaded in 1 sec (avg thro
ughput 194.61 KB/s)
TGT: 1 accounts were loaded
TGT: 0 warnings were reported during the load.
---
Dump_metadata:
  Binlog_file: ''
  Binlog_position: 0
  Executed_GTID_set: ''
MySQL database-1. .us-east-2.rds.amazonaws JS >
```

Note: once the MySQL Shell copy utility finishes, all your data will be copied over from Amazon RDS MySQL to HeatWave MySQL on OCI. This completes the migration process. You can end your tmux session.

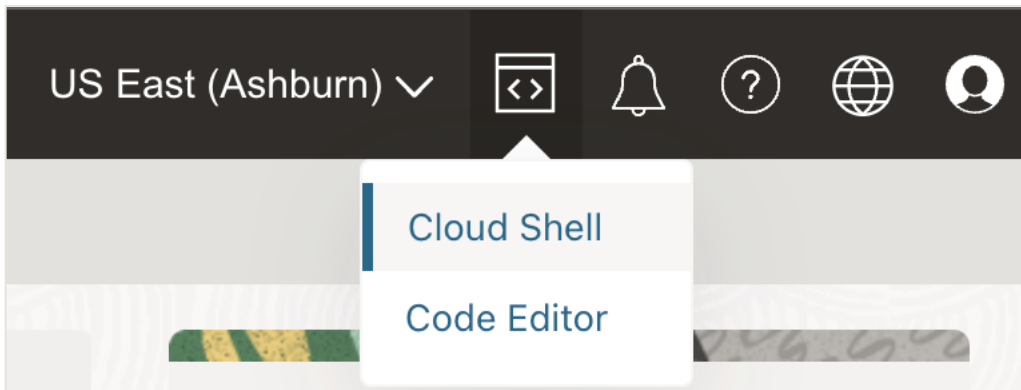


**VI) (Optional) On OCI, use the Cloud Shell to verify whether the data was migrated successfully from Amazon RDS MySQL to HeatWave MySQL on OCI.**

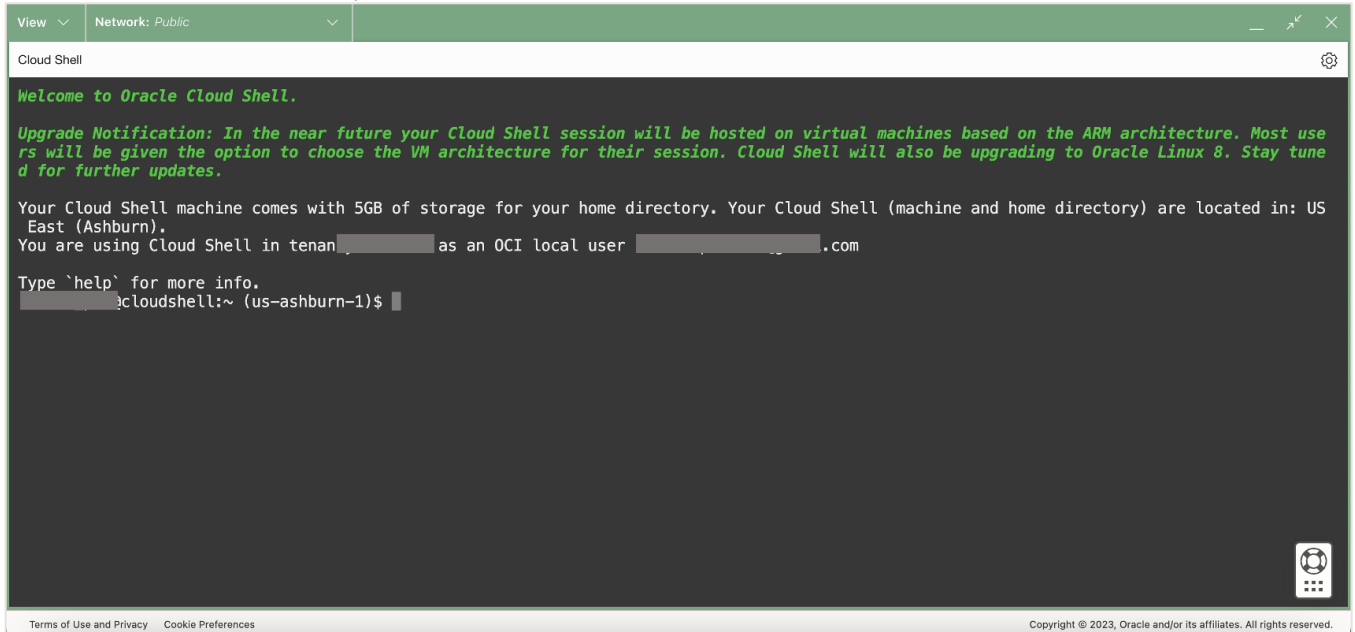
101. Login to [OCI](#), navigate to the top right corner and click on **Developer tools** right next to your OCI Region.



102. Click **Cloud Shell**.

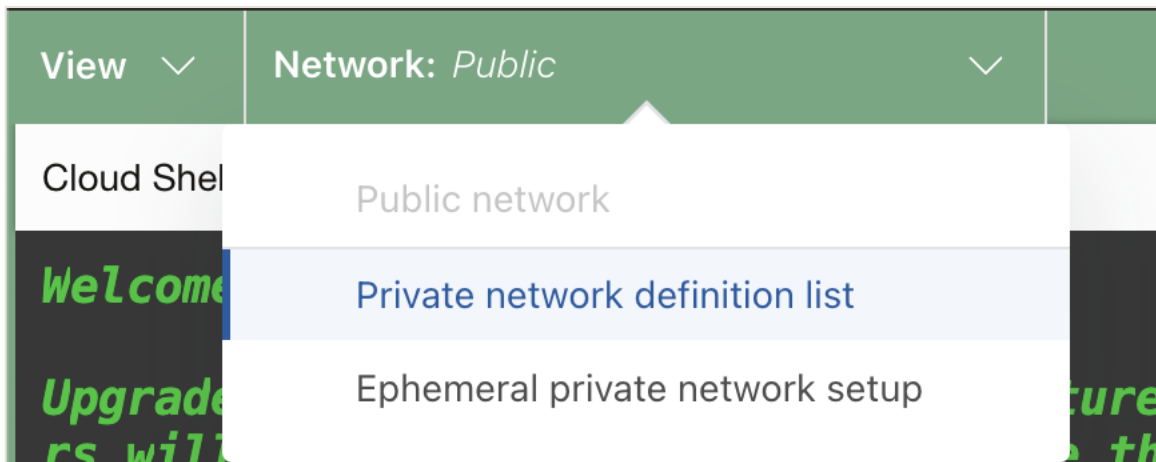
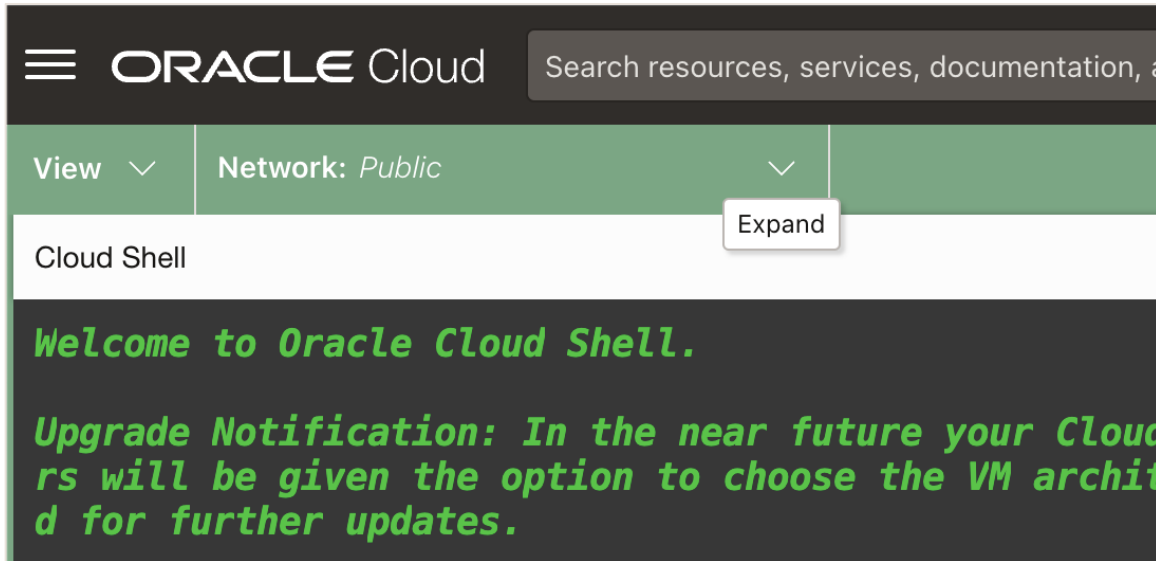


103. Within a few minutes, you will be connected to the OCI Cloud Shell like below:

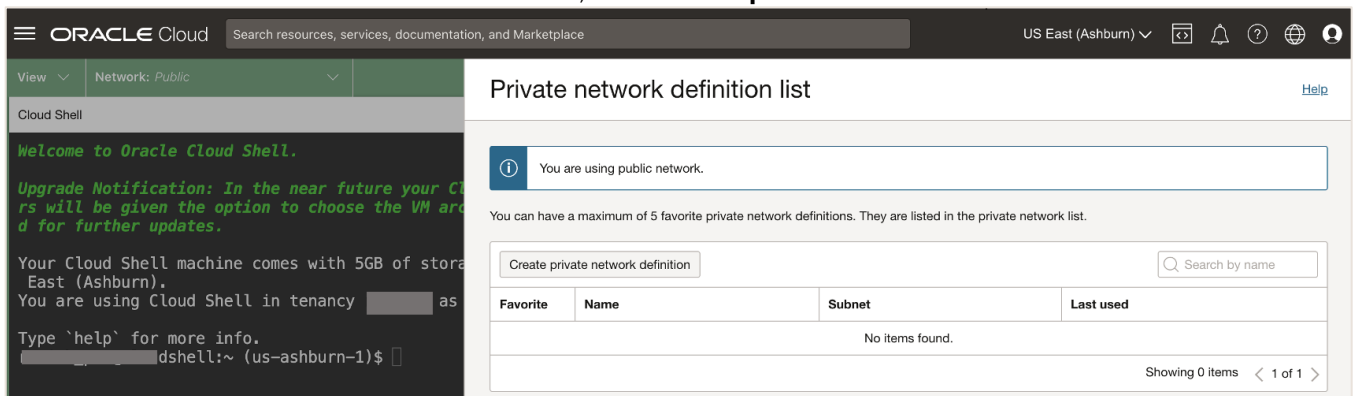




104. Click on the **down arrow** next to **Network: Public** and select **Private network definition list**.



105. On the Private network definition list form, select **Create private network definition**.



106. Enter a **private network definition name**. From the **VCN in <compartment-name>** dropdown, select the **VCN associated with HeatWave MySQL**. For **Subnet in <compartment-name>** dropdown, select the **private subnet**. Leave the **Network security groups** as-is and **check the box** where it says **Use as active network**. Click **Create**.

**Create private network definition** [Help](#)

Name  
MySQL-HW-CS

VCN in **(root)** [\(Change compartment\)](#)  
MySQL-VCN

Subnet in **(root)** [\(Change compartment\)](#)  
private subnet-MySQL-VCN

**Network security groups (Optional)**

Network security groups in **(root)** [\(Change compartment\)](#)  
Select a network security group

Use as active network

**Create** [Cancel](#)

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107. Click **Close**.

**ORACLE Cloud** Search resources, services, documentation, and Marketplace US East (Ashburn) [?](#) [Globe](#) [User](#)

View **Network: MySQL-HW-CS (Connecting...)** [Details](#)

Cloud Shell

```
Welcome to Oracle Cloud Shell.

Upgrade Notification: In the near future your Cloud Shell VMs will be given the option to choose the VM architecture for further updates.

Your Cloud Shell machine comes with 5GB of storage in the US East (Ashburn) region.
You are using Cloud Shell in tenancy (root) as as.

Type 'help' for more info.
(root)@cloudshell:~ (us-ashburn-1)$
```

**Private network definition list** [Help](#)

**i** You are using private network "MySQL-HW-CS".

You can have a maximum of 5 favorite private network definitions. They are listed in the private network list.

Create private network definition

Favorite	Name	Subnet	Last used
☆	MySQL-HW-CS	...yciry4ma <a href="#">Show</a> <a href="#">Copy</a>	-

Showing 1 item < 1 of 1 >

**Default network**

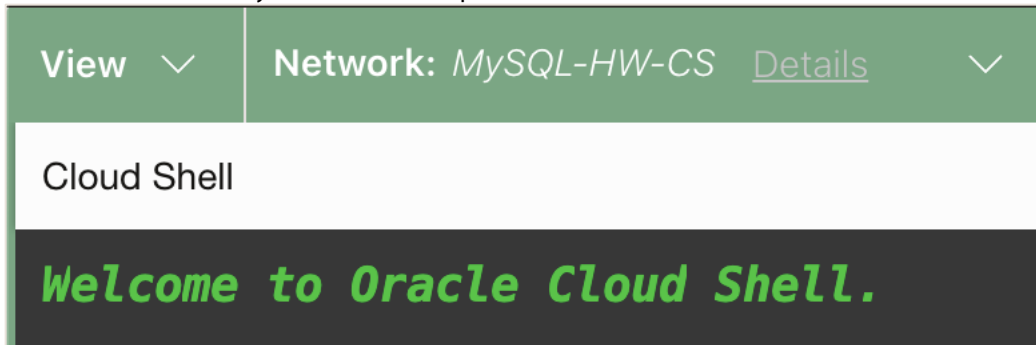
Select default network description

Public

**Close**

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108. Within a few minutes, you will be able to access your private subnet (where HeatWave MySQL resides) from the Cloud Shell. You should see the **Network** change from Public to the **private network definition name** that you entered in step 106.



109. From the Cloud Shell terminal, login to your HeatWave MySQL instance (by providing the username and private IP of HeatWave MySQL) using MySQL Shell to validate whether the migration was successful:

```
$ mysqlsh <user>@<hostname>:<port-number>
```

-OR-

```
$ mysqlsh -u <user> -p -h <hostname> -P <port-number>
```

```
cloudshell:~ (us-ashburn-1)$ mysqlsh admin@10.0.1.39
Please provide the password for 'admin@10.0.1.39': *****
Save password for 'admin@10.0.1.39'? [Y]es/[N]o/[e]xit (default No): Y
MySQL Shell 8.0.34-commercial

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Other names may be trademarks of their respective owners.

Type '\help' or '? ' for help; '\quit' to exit.
Creating a session to 'admin@10.0.1.39'
Fetching schema names for auto-completion... Press ^C to stop.
Your MySQL connection id is 346 (X protocol)
Server version: 8.0.34-u3-cloud MySQL Enterprise - Cloud
No default schema selected; type \use <schema> to set one.
MySQL 10.0.1.39:33060+ ssl JS >
```

110. Change to the SQL mode of MySQL Shell and run the below commands:

```
MySQL JS> \sql
```

```
MySQL SQL> SHOW SCHEMAS;
```

```
MySQL SQL> SHOW TABLES IN <schema-name>;
```

```
MySQL 10.0.1.39:33060+ ssl JS > \sql
Switching to SQL mode... Commands end with ;
Fetching global names for auto-completion... Press ^C to stop.
MySQL 10.0.1.39:33060+ ssl SQL > SHOW SCHEMAS;
+-----+
| Database |
+-----+
| information_schema |
| innodb |
| mysql |
| mysql_audit |
| performance_schema |
| sys |
| world |
+-----+
7 rows in set (0.0010 sec)
MySQL 10.0.1.39:33060+ ssl SQL > SHOW TABLES IN world;
+-----+
| Tables_in_world |
+-----+
| city |
| country |
| countrylanguage |
+-----+
3 rows in set (0.0019 sec)
```

111. You can run the below query on every table that you have for your Amazon RDS MySQL and OCI HeatWave MySQL to ensure that the row count matches on both sides:

```
MySQL SQL> SELECT COUNT(*) FROM <schema-name>.<table-name>;
```

112. Here is our row count comparison for Amazon RDS MySQL and OCI HeatWave MySQL:

Amazon RDS MySQL row count:

```
MySQL database-1. (.....).us-east-2.rds.amazonaws SQL > USE world;
Default schema set to `world`.
Fetching global names, object names from `world` for auto-completion... Press ^C to stop.
MySQL database-1. (.....).us-east-2.rds.amazonaws world SQL > SELECT COUNT(*) FROM city;
+-----+
| COUNT(*) |
+-----+
|      4079 |
+-----+
1 row in set (0.0013 sec)
MySQL database-1. (.....).us-east-2.rds.amazonaws world SQL > SELECT COUNT(*) FROM country;
+-----+
| COUNT(*) |
+-----+
|       239 |
+-----+
1 row in set (0.0008 sec)
MySQL database-1. (.....).us-east-2.rds.amazonaws world SQL > SELECT COUNT(*) FROM countrylan
guage;
+-----+
| COUNT(*) |
+-----+
|       984 |
+-----+
1 row in set (0.0390 sec)
```

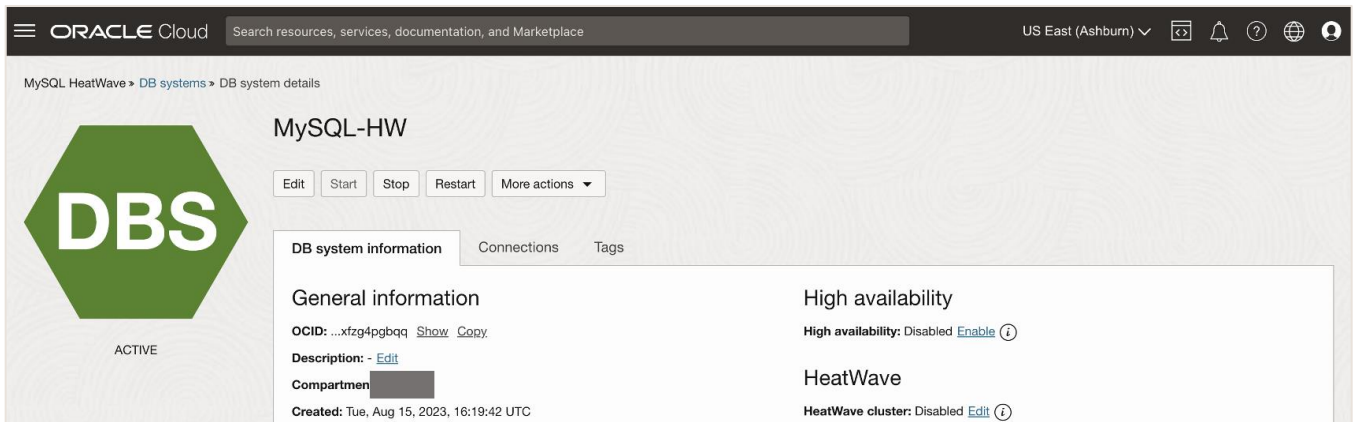
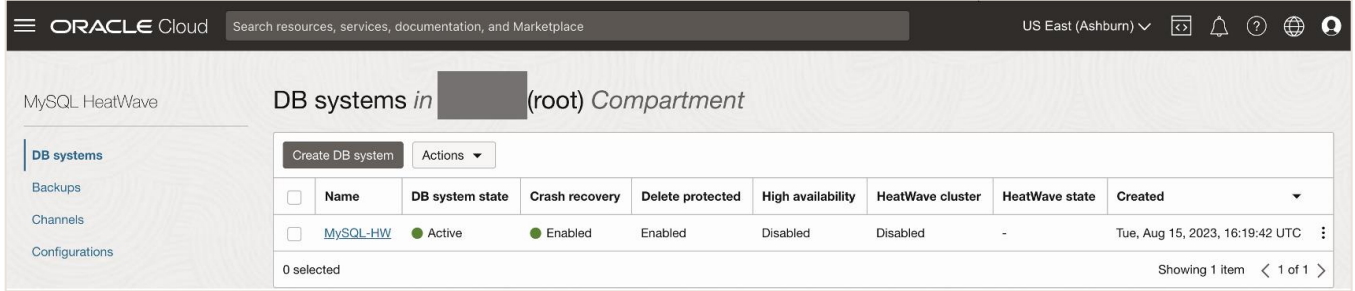
OCI HeatWave MySQL row count:

```
MySQL 10.0.1.39:33060+ ssl SQL > USE world;
Default schema set to `world`.
Fetching global names, object names from `world` for auto-completion... Press ^C to stop.
MySQL 10.0.1.39:33060+ ssl world SQL > SELECT COUNT(*) FROM city;
+-----+
| COUNT(*) |
+-----+
|      4079 |
+-----+
1 row in set (0.0027 sec)
MySQL 10.0.1.39:33060+ ssl world SQL > SELECT COUNT(*) FROM country;
+-----+
| COUNT(*) |
+-----+
|       239 |
+-----+
1 row in set (0.0050 sec)
MySQL 10.0.1.39:33060+ ssl world SQL > SELECT COUNT(*) FROM countrylanguage;
+-----+
| COUNT(*) |
+-----+
|       984 |
+-----+
1 row in set (0.0094 sec)
MySQL 10.0.1.39:33060+ ssl world SQL > 
```

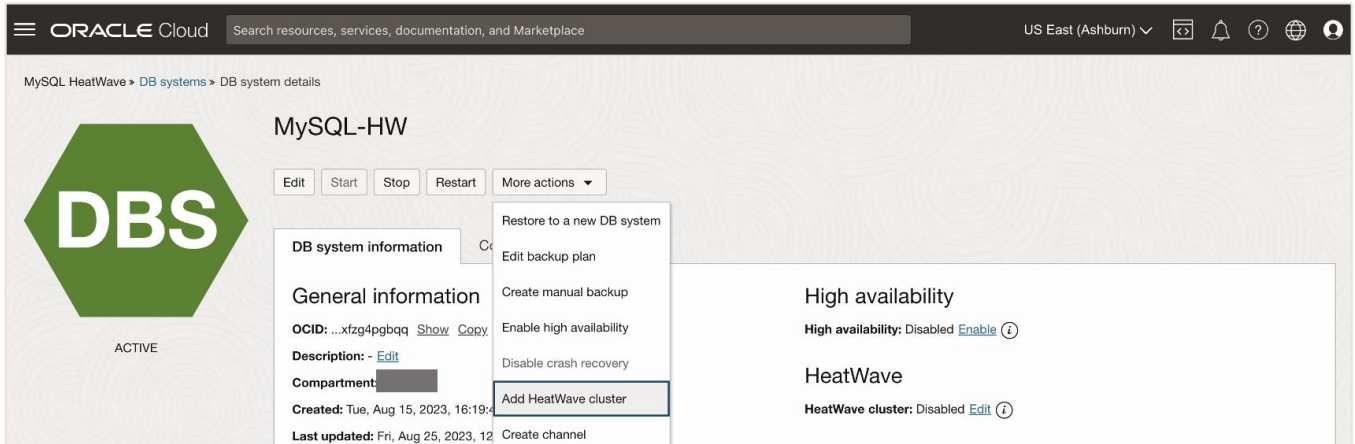
113. After validating, you can have your application/s point to the new OCI HeatWave MySQL instance.

**VII) (Optional) On OCI, if the HeatWave option was enabled during HeatWave MySQL DB creation, add the HW Cluster and load data from the MySQL InnoDB storage engine into the HW Cluster using automation.**

- 114. Login to [OCI](#). Click on the navigation menu, go to **Databases**, and click **HeatWave MySQL**.
- 115. Click on the name of your HeatWave MySQL instance to go to the **DB System Details** page.



- 116. Click **More actions** and click **Add HeatWave cluster**.





117. Click **Estimate node**.

The screenshot shows the Oracle Cloud console interface for adding a HeatWave cluster. The page title is "Add HeatWave cluster". At the top, there is a navigation bar with the Oracle Cloud logo, a search bar, and the region "US East (Ashburn)". Below the navigation bar, there is a main heading "Add HeatWave cluster" and a sub-heading "Configure HeatWave cluster". The configuration options include: "Select a shape" (HeatWave.512GB, CPU core count: 16, Memory size: 512 GB, Max network bandwidth: 16Gbps), "Node" (1), and "MySQL HeatWave Lakehouse" (disabled). The "Estimate node" button is highlighted in blue. At the bottom, there are buttons for "Add HeatWave cluster" and "Cancel".

118. Click **Generate estimate**. This step will estimate the number of HeatWave nodes required by selecting the schemas or tables you want to analyze with HeatWave.

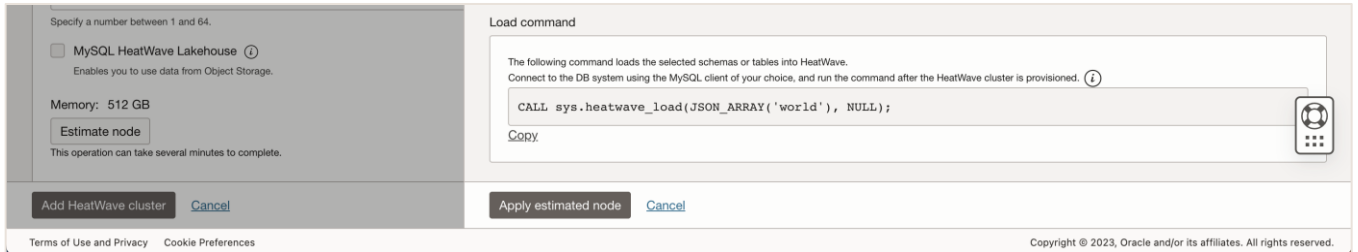
The screenshot shows the Oracle Cloud console interface for adding a HeatWave cluster, with the "Estimate node" sub-page open. The "Estimate node" sub-page has a heading "Estimate node" and a sub-heading "Estimate number of required nodes by selecting the schemas or tables you want to analyze with HeatWave. This operation takes few minutes to complete." Below this, there is a "Generate estimate" button highlighted in blue. The sub-page also displays "No schema information available." At the bottom, there are buttons for "Apply estimated node" and "Cancel".

119. Within a few minutes, the list of your schemas that are in the MySQL InnoDB storage engine will be listed. **Check the box** next to the schema or table name that you wish to load in HeatWave for query acceleration and to run OLAP and ML workloads - alongside OLTP.

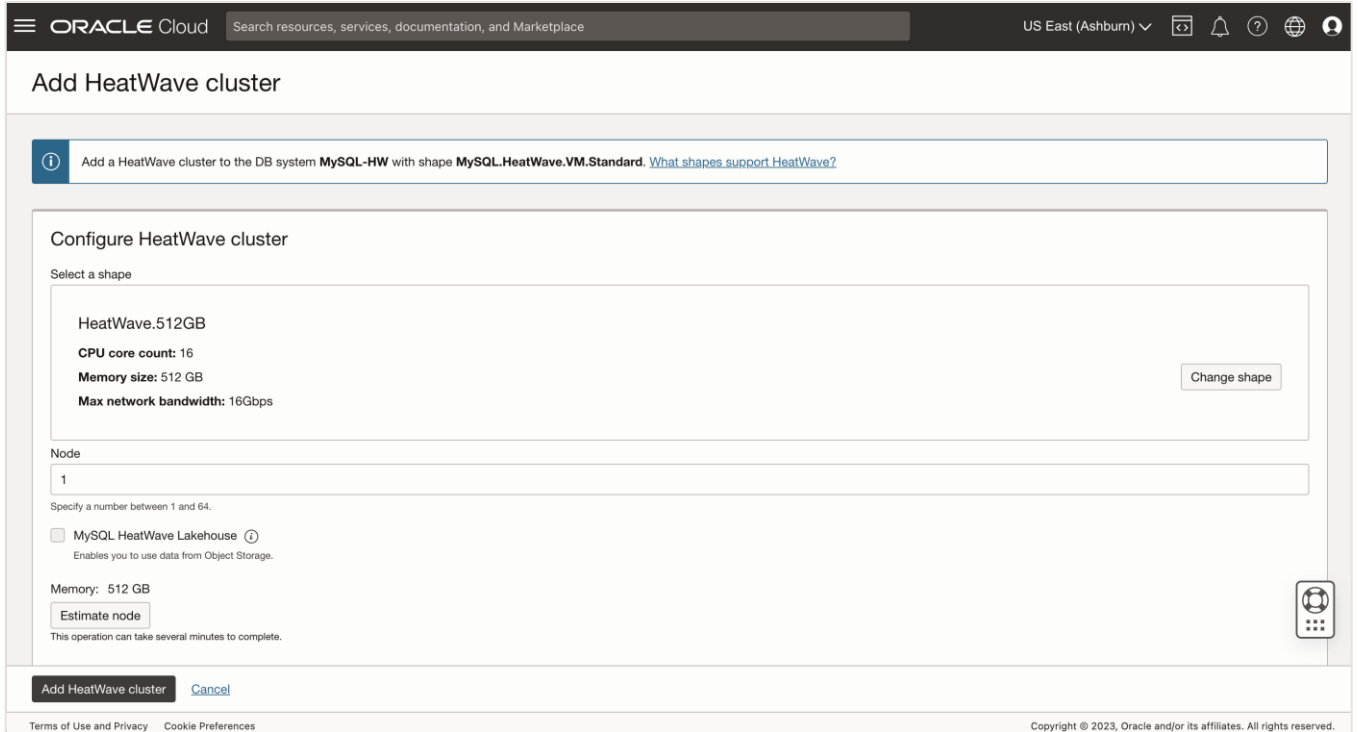
The screenshot shows the Oracle Cloud console interface for configuring a HeatWave cluster. On the left, the 'Configure HeatWave cluster' section is visible, showing the selected shape 'HeatWave.512GB' with 16 CPU cores and 512 GB of memory. The 'Estimate node' section on the right allows selecting schemas or tables for analysis. A table lists the 'world' schema with a memory estimate of 9 MB and 3 tables. The 'Total memory selected' is 0 Bytes. The summary indicates that no schema or table has been selected.

120. After selecting the schemas or tables, scroll down on that page until you see the **Load command**. Copy the **CALL sys.heatwave\_load** command and save it. Click **Apply estimated node**.

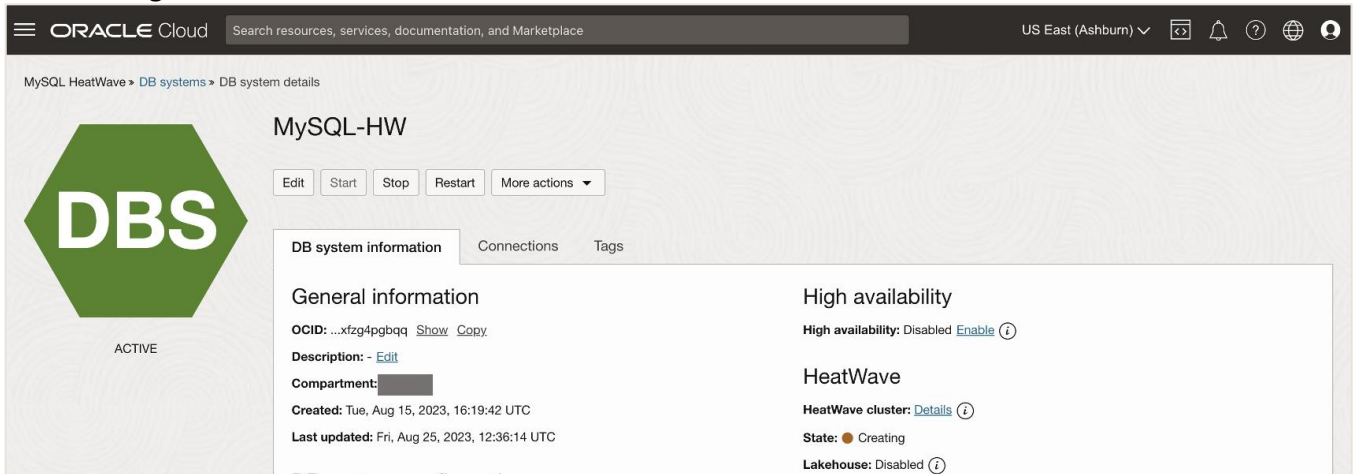
This screenshot shows the same Oracle Cloud console interface as the previous one, but with the 'world' schema selected. The 'Total memory selected' is now 9 MB. The summary section provides a detailed overview of the configuration: HeatWave.512GB shape, 16 CPU cores, 512 GB memory, 16Gbps network bandwidth, 1 node, 9 MB total memory required, and 512 GB total memory. A 'Load command' section is visible at the bottom of the 'Estimate node' panel.



121. Executing the previous step will change the HeatWave node count depending on the data you have selected to load into HeatWave’s in-memory engine. Click **Add HeatWave cluster** to finish adding the HeatWave cluster creation process.



122. The HeatWave cluster will be ready within a few minutes. You should see the HeatWave state change from **Creating** to **Active**.



ORACLE Cloud Search resources, services, documentation, and Marketplace US East (Ashburn)

MySQL HeatWave > DB systems > DB system details

### MySQL-HW

ACTIVE

Edit Start Stop Restart More actions

DB system information Connections Tags

**General information**

OCID: ...xfzg4pgbqq Show Copy

Description: - Edit

Compartment: [REDACTED]

Created: Tue, Aug 15, 2023, 16:19:42 UTC

Last updated: Fri, Aug 25, 2023, 12:36:14 UTC

**High availability**

High availability: Disabled Enable ⓘ

**HeatWave**

HeatWave cluster: Details Edit ⓘ

State: ● Active

123. Connect to your HeatWave MySQL system using MySQL Shell via Cloud Shell.

```
$ mysqlsh <user>@<hostname>:<port-number>
```

-OR-

```
$ mysqlsh -u <user> -p -h <hostname> -P <port-number>
```

```
cloudshell:~ (us-ashburn-1)$ mysqlsh admin@10.0.1.39
Please provide the password for 'admin@10.0.1.39': *****
Save password for 'admin@10.0.1.39'? [Y]es/[N]o/[e]ver (default No): Y
MySQL Shell 8.0.34-commercial

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Type '\help' or '? ' for help; '\quit' to exit.
Creating a session to 'admin@10.0.1.39'
Fetching schema names for auto-completion... Press ^C to stop.
Your MySQL connection id is 346 (X protocol)
Server version: 8.0.34-u3-cloud MySQL Enterprise - Cloud
No default schema selected; type \use <schema> to set one.
MySQL 10.0.1.39:33060+ ssl JS >
```

124. Switch to the SQL mode of MySQL Shell and execute the Load command that we had copied earlier to load data into HeatWave from the MySQL InnoDB storage.

```
MySQL JS> \sql
```

```
MySQL SQL> CALL sys.heatwave_load(JSON_ARRAY('world'), NULL);
```

Note: replace the `sys.heatwave_load` command with what you have.

```
MySQL 10.0.1.39:33060+ ssl world JS > \sql
Switching to SQL mode... Commands end with ;
MySQL 10.0.1.39:33060+ ssl world SQL > CALL sys.heatwave_load(JSON_ARRAY('world'), NULL);
+-----+
| INITIALIZING HEATWAVE AUTO PARALLEL LOAD |
+-----+
| Version: 2.20                             |
| Load Mode: normal                         |
| Load Policy: disable_unsupported_columns  |
| Output Mode: normal                       |
+-----+
6 rows in set (1.5581 sec)
+-----+
| OFFLOAD ANALYSIS                          |
+-----+
| Verifying input schemas: 1                |
| User excluded items: 0                    |
+-----+
| SCHEMA NAME          OFFLOADABLE TABLES  OFFLOADABLE COLUMNS  SUMMARY OF ISSUES |
+-----+
| `world`              3                    24                    |
+-----+
```

[... output truncated]

```
| TABLE (3 of 3): `world`.`countrylanguage` |
| Commands executed successfully: 3 of 3      |
| Warnings encountered: 0                    |
| Table loaded successfully!                 |
| Total columns loaded: 4                    |
| Table loaded using 1 thread(s)            |
| Elapsed time: 327.02 ms                    |
+-----+
8 rows in set (1.5581 sec)
+-----+
| LOAD SUMMARY                              |
+-----+
| SCHEMA NAME          TABLES LOADED  TABLES FAILED  COLUMNS LOADED  LOAD DURATION |
+-----+
| `world`              3                    0                24                1.44 s         |
+-----+
6 rows in set (1.5581 sec)
Query OK, 0 rows affected (1.5581 sec)
MySQL 10.0.1.39:33060+ ssl world SQL >
```

125. You now have a complete HeatWave MySQL cluster.

To learn more about using HeatWave, please visit [our documentation](#).

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