Databases

RDS - Relational Database Service

AWS RDS

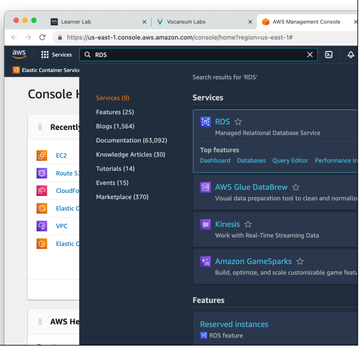
Managed Database Service

- RDS (Relational Database Server) is Amazon’s SQL offering
- Of course, you can always run your own database server, on an instance anywhere…
  - https://www.mysql.com/
- But why go to all that trouble?

AWS RDS

Managed Database Service

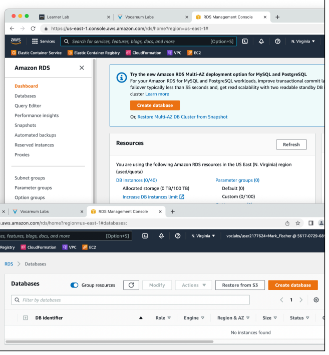
- Search for RDS in the top search bar.
- Click on RDS in the Services results.



AWS RDS

Managed Database Service

- From the dashboard, you may see a “Create Database” button in an announcement.
- If not, click on “Databases” in the left sidebar.
- Click “Create Database”



Try the new Amazon RDS Multi-AZ deployment option for MySQL and PostgreSQL
For your Amazon RDS for MySQL and PostgreSQL workloads, improve transactional commit la failover typically less than 35 seconds and, get read scalability with two readable standby DB cluster Learn more

Or, Restore Multi-AZ DB Cluster from Snapshot

Resources

You are using the following Amazon RDS resources in the US East (N. Virginia) region (used/quota)

DB Instances (0/40)
Allocated storage (0 TB/100 TB)
Increase DB instances limit

Parameter groups (0)
Default (0)
Custom (0/100)

Databases

DB identifier	Role	Engine	Region & AZ	Size	Status
No instances found					

AWS RDS

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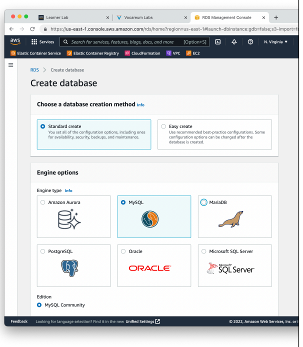
- Select “Standard Create.” We have to turn off some features which aren’t allowed in AWS Academy.
- Select MySQL
- Leave the Edition and version as default.
  - MySQL Community
  - Version 8.0.x



Learner Lab
Vocareum Labs
RDS Management Console
https://us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#launch-dbinstance:gdb=false;s3-import=f
Services
Search for services, features, blogs, docs, and more
[Option+S]
N. Virginia
Elastic Container Service
Elastic Container Registry
CloudFormation
VPC
EC2
RDS
Create database
ORACLE
SQL Server
Feedback
Unified Settings

Create database

Choose a database creation method Info

● Standard create
You set all of the configuration options, including ones for availability, security, backups, and maintenance.

○ Easy create
Use recommended best-practice configurations. Some configuration options can be changed after the database is created.

Engine options

Engine type Info

○ Amazon Aurora
● MySQL
○ MariaDB
○ PostgreSQL
○ Oracle
○ Microsoft SQL Server

Edition
● MySQL Community

Looking for language selection? Find it in the new Unified Settings

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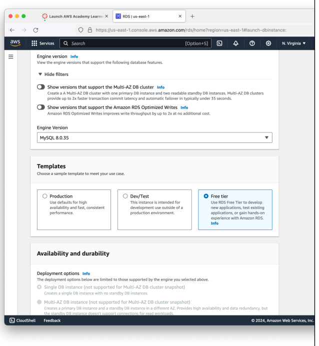
AWS RDS

Managed Database Service

- Make sure to select “Free tier”



Launch AWS Academy Learne
RDS | us-east-1
https://us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#launch-dbinstance:
Services
Search
[Option+S]
N. Virginia
CloudShell
Feedback

Engine version Info
View the engine versions that support the following database features.

▼ Hide filters

Show versions that support the Multi-AZ DB cluster Info
Create a A Multi-AZ DB cluster with one primary DB instance and two readable standby DB instances. Multi-AZ DB clusters provide up to 2x faster transaction commit latency and automatic failover in typically under 35 seconds.

Show versions that support the Amazon RDS Optimized Writes Info
Amazon RDS Optimized Writes improves write throughput by up to 2x at no additional cost.

Engine Version
MySQL 8.0.35

Templates
Choose a sample template to meet your use case.

○ Production
Use defaults for high availability and fast, consistent performance.

○ Dev/Test
This instance is intended for development use outside of a production environment.

● Free tier
Use RDS Free Tier to develop new applications, test existing applications, or gain hands-on experience with Amazon RDS. Info

Availability and durability

Deployment options Info
The deployment options below are limited to those supported by the engine you selected above.

○ Single DB instance (not supported for Multi-AZ DB cluster snapshot)
Creates a single DB instance with no standby DB instances.

○ Multi-AZ DB instance (not supported for Multi-AZ DB cluster snapshot)
Creates a primary DB instance and a standby DB instance in a different AZ. Provides high availability and data redundancy, but the standby DB instance doesn't support connections for read workloads.

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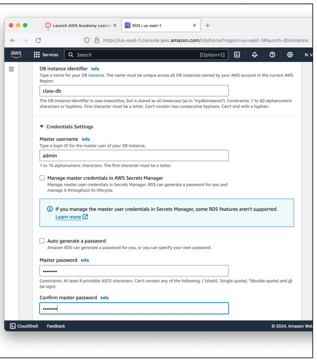
AWS RDS

Managed Database Service

- Set a name for your DB Instance. This only shows up in the AWS console, its not used for connecting to the database
- Choose a good password, and keep it somewhere safe and memorable.
  - If you forget it, you can reset this later.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CloudShell
Feedback
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DB instance identifier Info
Type a name for your DB instance. The name must be unique across all DB instances owned by your AWS account in the current AWS Region.
class-db
The DB instance identifier is case-insensitive, but is stored as all lowercase (as in "mydbinstance"). Constraints: 1 to 60 alphanumeric characters or hyphens. First character must be a letter. Can't contain two consecutive hyphens. Can't end with a hyphen.

▼ Credentials Settings

Master username Info
Type a login ID for the master user of your DB instance.
admin
1 to 16 alphanumeric characters. The first character must be a letter.

□ Manage master credentials in AWS Secrets Manager
Manage master user credentials in Secrets Manager. RDS can generate a password for you and manage it throughout its lifecycle.

ⓘ If you manage the master user credentials in Secrets Manager, some RDS features aren't supported.
Learn more

□ Auto generate a password
Amazon RDS can generate a password for you, or you can specify your own password.

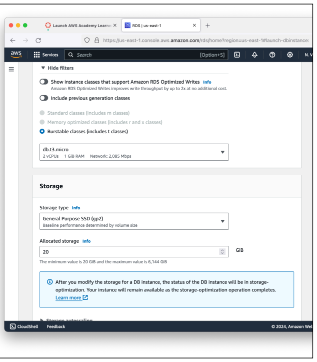
Master password Info
••••••••
Constraints: At least 8 printable ASCII characters. Can't contain any of the following: / (slash), '(single quote), "(double quote) and @ (at sign).

Confirm master password Info
••••••••

AWS RDS

Managed Database Service

- Change the instance class to `db.t3.micro`
- Change the Allocated storage to the smallest allowed: 20 GiB
- Un-check "Enable storage autoscaling"
  - We won't use anywhere near that much space.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CloudShell
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▼ Hide filters

Show instance classes that support Amazon RDS Optimized Writes Info
Amazon RDS Optimized Writes improves write throughput by up to 2x at no additional cost.
Include previous generation classes

○ Standard classes (includes m classes)
○ Memory optimized classes (includes r and x classes)
● Burstable classes (includes t classes)

db.t3.micro
2 vCPUs 1 GiB RAM Network: 2,085 Mbps

Storage

Storage type Info
General Purpose SSD (gp2)
Baseline performance determined by volume size

Allocated storage Info
20 GiB
The minimum value is 20 GiB and the maximum value is 6,144 GiB

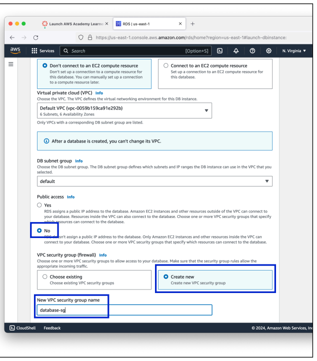
ⓘ After you modify the storage for a DB instance, the status of the DB instance will be in storage-optimization. Your instance will remain available as the storage-optimization operation completes.
Learn more

▶ Storage autoscaling

AWS RDS

Managed Database Service

- Don't connect to an EC2 resource (we'll configure that ourselves)
- Make sure you have "No" selected for Public access.
- Create a new security group
- Name your security group "database-sg"
  - If you delete this RDS instance and create a new one later, you can re-use this VPC security group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aws
Services
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CloudShell
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● Don't connect to an EC2 compute resource
Don't set up a connection to a compute resource for this database. You can manually set up a connection to a compute resource later.

○ Connect to an EC2 compute resource
Set up a connection to an EC2 compute resource for this database.

Virtual private cloud (VPC) Info
Choose the VPC. The VPC defines the virtual networking environment for this DB instance.
Default VPC (vpc-0059b159ca91e292b)
6 Subnets, 6 Availability Zones
Only VPCs with a corresponding DB subnet group are listed.

ⓘ After a database is created, you can't change its VPC.

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

Public access Info
○ Yes
RDS assigns a public IP address to the database. Amazon EC2 instances and other resources outside of the VPC can connect to your database. Resources inside the VPC can also connect to the database. Choose one or more VPC security groups that specify which resources can connect to the database.
● No
RDS doesn't assign a public IP address to the database. Only Amazon EC2 instances and other resources inside the VPC can connect to your database. Choose one or more VPC security groups that specify which resources can connect to the database.

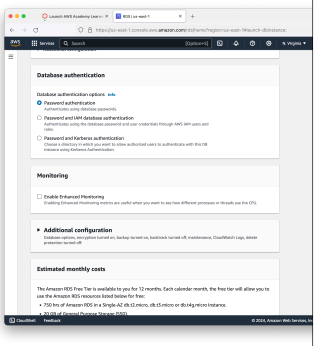
VPC security group (firewall) Info
Choose one or more VPC security groups to allow access to your database. Make sure that the security group rules allow the appropriate incoming traffic.
○ Choose existing
Choose existing VPC security groups
● Create new
Create new VPC security group

New VPC security group name
database-sg

AWS RDS

Managed Database Service

- Leave “Password authentication” selected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aws
Services
Search
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Database authentication

Database authentication options Info

● Password authentication
Authenticates using database passwords.

○ Password and IAM database authentication
Authenticates using the database password and user credentials through AWS IAM users and roles.

○ Password and Kerberos authentication
Choose a directory in which you want to allow authorized users to authenticate with this DB instance using Kerberos Authentication.

Monitoring

□ Enable Enhanced Monitoring
Enabling Enhanced Monitoring metrics are useful when you want to see how different processes or threads use the CPU.

▸ **Additional configuration**
Database options, encryption turned on, backup turned on, backtrack turned off, maintenance, CloudWatch Logs, delete protection turned off.

Estimated monthly costs

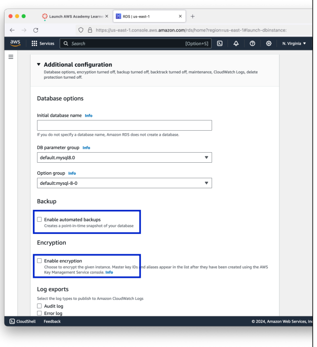
The Amazon RDS Free Tier is available to you for 12 months. Each calendar month, the free tier will allow you to use the Amazon RDS resources listed below for free:

- 750 hrs of Amazon RDS in a Single-AZ db.t2.micro, db.t3.micro or db.t4g.micro Instance.
- 20 GB of General Purpose Storage (SSD).

AWS RDS

Managed Database Service

- Expand “Additional configuration”
- Disable automated backups
  - Automated backups are usually the correct default for things, but we really want to minimize costs for the class, and daily backups really add up!
- Disable encryption
  - Usually a good idea, keep it simple for class.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▾ **Additional configuration**
Database options, encryption turned off, backup turned off, backtrack turned off, maintenance, CloudWatch Logs, delete protection turned off.

Database options

Initial database name Info

If you do not specify a database name, Amazon RDS does not create a database.

DB parameter group Info
default.mysql8.0

Option group Info
default:mysql-8-0

Backup

□ Enable automated backups
Creates a point-in-time snapshot of your database

Encryption

□ Enable encryption
Choose to encrypt the given instance. Master key IDs and aliases appear in the list after they have been created using the AWS Key Management Service console. Info

Log exports

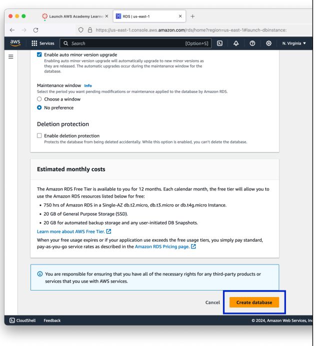
Select the log types to publish to Amazon CloudWatch Logs

□ Audit log
□ Error log

AWS RDS

Managed Database Service

- Click “Create database”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https://us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#launch-dbinstance:
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Cancel
Create database
CloudShell
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☑ Enable auto minor version upgrade
Enabling auto minor version upgrade will automatically upgrade to new minor versions as they are released. The automatic upgrades occur during the maintenance window for the database.

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

○ Choose a window
● No preference

Deletion protection

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

Estimated monthly costs

The Amazon RDS Free Tier is available to you for 12 months. Each calendar month, the free tier will allow you to use the Amazon RDS resources listed below for free:

- 750 hrs of Amazon RDS in a Single-AZ db.t2.micro, db.t3.micro or db.t4g.micro Instance.
- 20 GB of General Purpose Storage (SSD).
- 20 GB for automated backup storage and any user-initiated DB Snapshots.

Learn more about AWS Free Tier.

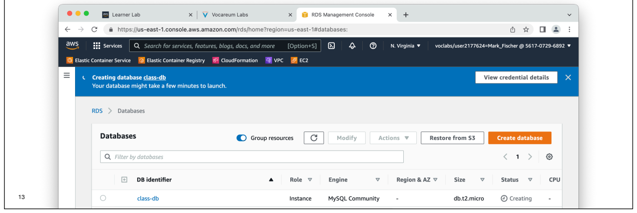
When your free usage expires or if your application use exceeds the free usage tiers, you simply pay standard, pay-as-you-go service rates as described in the Amazon RDS Pricing page.

ⓘ You are responsible for ensuring that you have all of the necessary rights for any third-party products or services that you use with AWS services.

AWS RDS

Managed Database Service

- Your database may take several minutes to be ready for use. The cloud is not instant 🤪



https://us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#databases:

Creating database class-db
Your database might take a few minutes to launch.

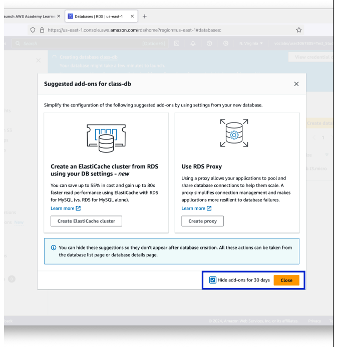
Databases

DB identifier	Role	Engine	Region & AZ	Size	Status	CPU
class-db	Instance	MySQL Community	-	db.t2.micro	Creating	-

AWS RDS

Managed Database Service

- Dark Patterns:
  - AWS now tries to up-sell you when creating things
  - Can only “hide” for 30 days!
  - You can avoid this by deploying resources through automation



https://us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#databases:

Suggested add-ons for class-db

Simplify the configuration of the following suggested add-ons by using settings from your new database.

Create an ElastiCache cluster from RDS using your DB settings - *new*

You can save up to 55% in cost and gain up to 80x faster read performance using ElastiCache with RDS for MySQL (vs. RDS for MySQL alone).
Learn more

Use RDS Proxy

Using a proxy allows your applications to pool and share database connections to help them scale. A proxy simplifies connection management and makes applications more resilient to database failures.
Learn more

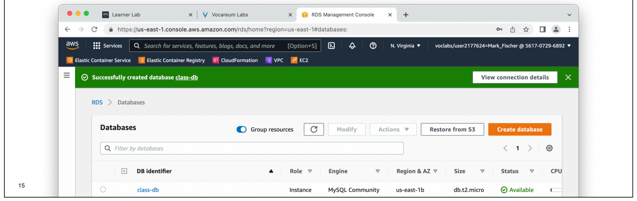
You can hide these suggestions so they don't appear after database creation. All these actions can be taken from the database list page or database details page.

☑ Hide add-ons for 30 days

AWS RDS

Managed Database Service

- Eventually your RDS instance will complete. This may take 5 minutes or more.
- Click on your database name to get details on it.



https://us-east-1.console.aws.amazon.com/rds/home?region=us-east-1#databases:

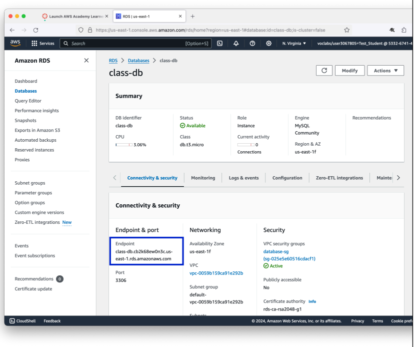
Successfully created database class-db

Databases

DB identifier	Role	Engine	Region & AZ	Size	Status	CPU
class-db	Instance	MySQL Community	us-east-1b	db.t2.micro	Available	

AWS RDS

- You will need to copy down the Endpoint domain name. This is how you will connect to your database from a server.



class-db

Summary

DB identifier: class-db
Status: Available
Role: Instance
Engine: MySQL Community
Recommendations
CPU: 3.06%
Class: db.t3.micro
Current activity: 0 Connections
Region & AZ: us-east-1f

Connectivity & security

Endpoint & port
Endpoint: class-db.cb2k68ew0n3c.us-east-1.rds.amazonaws.com
Port: 3306

Networking
Availability Zone: us-east-1f
VPC: vpc-0059b159ca91e292b
Subnet group: default-vpc-0059b159ca91e292b

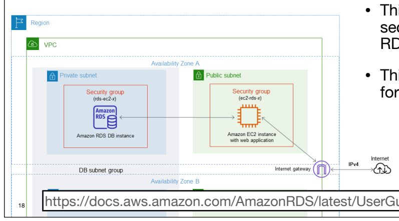
Security
VPC security groups: database-sg (sg-025e5e60516cdacf1) Active
Publicly accessible: No
Certificate authority Info: rds-ca-rsa2048-g1

AWS RDS
Security Groups

- Our new RDS instance does NOT have a public IP address
  - Because RDS is a fully managed service, you cannot ssh into it
  - With no Public IP you cannot connect to it directly from your laptop
- Our new RDS instance has a private IP address, and is listening on port 3306
  - We need to give our EC2 instance access

AWS RDS
Security Groups

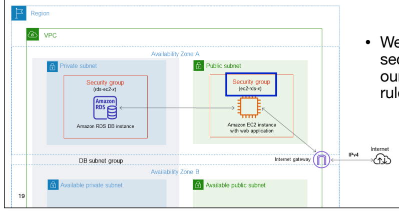
- With no public access, we must allow our EC2 instance access to the RDS instance
- This is done by allowing the security group attached to the RDS instance
- This is a very common pattern for cloud applications



https://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/USER_VPC.Scenarios.html

AWS RDS

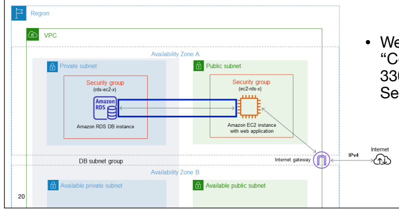
Security Groups



- We'll do this by adding the security group ID attached to our EC2 instance to the ingress rules of the RDS security group

AWS RDS

Security Groups

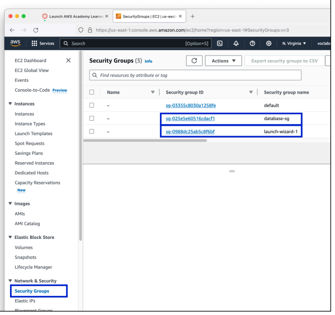


- We want to add a rule that says, “Connections to the DB [port 3306] are allowed from the EC2 Security Group.”

AWS RDS

Security Groups

- In the EC2 console, select “Security Groups” from the left sidebar
- the launch-wizard-1 SG is the one attached to our EC2 instance
- The database-sg SG is attached to our database

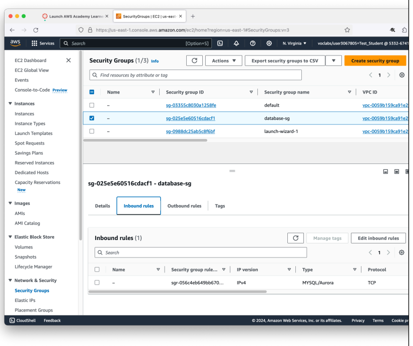


Security Groups (3) Info

Name	Security group ID	Security group name
–	sg-03355c8030a1258fe	default
–	sg-025e5e60516cdacf1	database-sg
–	sg-0988dc25ab5c8f6bf	launch-wizard-1

AWS RDS
Security Groups

- We need to update the database security group, so select that one
- Then click "Edit inbound rules"



https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#SecurityGroups:v=3

Security Groups (1/3)

	Name	Security group ID	Security group name	VPC ID
□	–	sg-03355c8030a1258fe	default	vpc-0059b159ca91e2
☑	–	sg-025e5e60516cdacf1	database-sg	vpc-0059b159ca91e2
□	–	sg-0988dc25ab5c8f6bf	launch-wizard-1	vpc-0059b159ca91e2

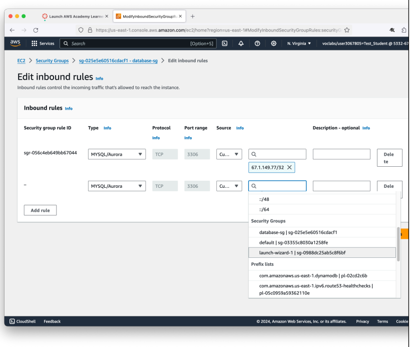
sg-025e5e60516cdacf1 - database-sg

Inbound rules (1)

	Name	Security group rule...	IP version	Type	Protocol
□	–	sgr-056c4eb649bb670...	IPv4	MYSQL/Aurora	TCP

AWS RDS
Security Groups

- Add a new rule
- Select MySQL/Aurora for the rule type
- For the source, click in the input field, and scroll down until you find the "launch-wizard-1" security group
- Click "Save rules"



https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#ModifyInboundSecurityGroupRules:securityG

EC2 > Security Groups > sg-025e5e60516cdacf1 - database-sg > Edit inbound rules

Edit inbound rules

Inbound rules control the incoming traffic that's allowed to reach the instance.

Inbound rules

Security group rule ID	Type	Protocol	Port range	Source		Description - optional
sgr-056c4eb649bb67044	MYSQL/Aurora	TCP	3306	Cu...	67.1.149.77/32	
–	MYSQL/Aurora	TCP	3306	Cu...		

::/48

::/64

Security Groups

database-sg | sg-025e5e60516cdacf1

default | sg-03355c8030a1258fe

launch-wizard-1 | sg-0988dc25ab5c8f6bf

Prefix lists

com.amazonaws.us-east-1.dynamodb | pl-02cd2c6b

com.amazonaws.us-east-1.ipv6.route53-healthchecks | pl-05c0959a59362110e

Launch AWS Academy Learne
ModifyInboundSecurityGroupRu
Services
Search
[Option+S]
N. Virginia
voclabs/user3067805=Test_Student @ 5332-67
Info
Dele te
Dele
Add rule
CloudShell
Feedback
© 2024, Amazon Web Services, Inc. or its affiliates.
Privacy
Terms
Cookie

ECS ➡ RDS
Connecting at last

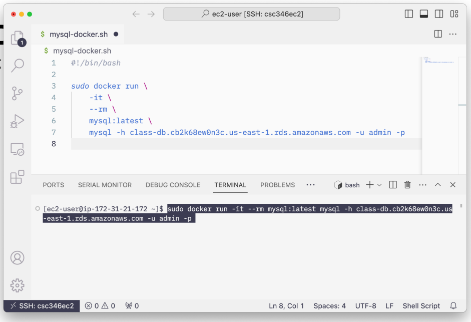
- Connect to your EC2 instance using your method of choice
- We need the mysql client software
- Docker!
- Use the hostname for your RDS instance, and the password you wrote down for the admin user (you did write down the password, right?)

```
sudo docker run -it --rm mysql:latest mysql -h class-db...rds.amazonaws.com -u admin -p
```

ECS ➡ RD

Connecting at

- Docker lets us run programs without installing them permanently



mysql-docker.sh

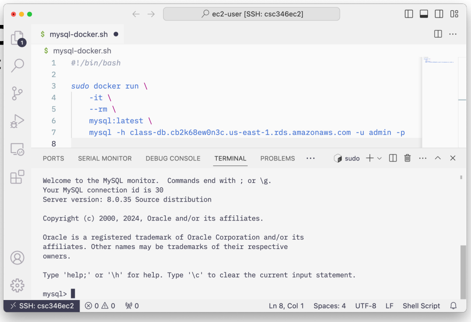
```
#!/bin/bash

sudo docker run \
    -it \
    --rm \
    mysql:latest \
    mysql -h class-db.cb2k68ew0n3c.us-east-1.rds.amazonaws.com -u admin -p

```

```
[ec2-user@ip-172-31-21-172 ~]$ sudo docker run -it --rm mysql:latest mysql -h class-db.cb2k68ew0n3c.us
-east-1.rds.amazonaws.com -u admin -p
```

ECS ➡ RD

Connecting at

- Docker lets us run programs without installing them permanently



mysql-docker.sh

```
#!/bin/bash

sudo docker run \
    -it \
    --rm \
    mysql:latest \
    mysql -h class-db.cb2k68ew0n3c.us-east-1.rds.amazonaws.com -u admin -p

```

```
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 30
Server version: 8.0.35 Source distribution

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> 
```

ECS ➡ RDS

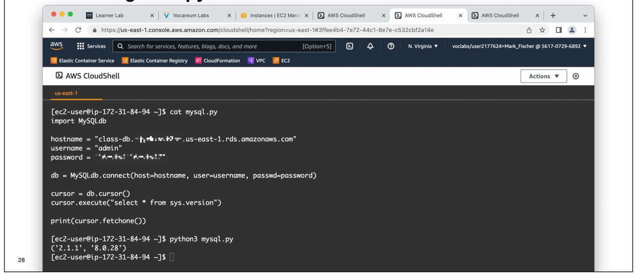
Connecting from python

```
sudo yum install mariadb105-devel gcc python3.11-devel python3.11-pip
sudo pip3.11 install mysqlclient
```

- Now we can use the `MySQLdb` module within python on our EC2 instance.

ECS ➡ RDS

Connecting from python

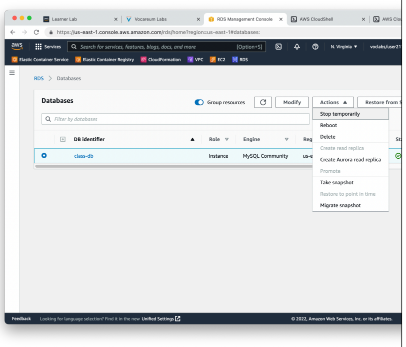

Learner Lab
Vocareum Labs
Instances | EC2 Mana
AWS CloudShell
AWS CloudShell
AWS CloudShell
https://us-east-1.console.aws.amazon.com/cloudshell/home?region=us-east-1#3ffee4b4-7e72-44c1-8e7e-c532cbf2a14e
Services
Search for services, features, blogs, docs, and more
[Option+S]
N. Virginia
voclabs/user2177624=Mark_Fischer @ 5617-0729-6892
Elastic Container Service
Elastic Container Registry
CloudFormation
VPC
EC2
AWS CloudShell
Actions
us-east-1

```
[ec2-user@ip-172-31-84-94 ~]$ cat mysql.py
import MySQLdb

hostname = "class-db.[redacted].us-east-1.rds.amazonaws.com"
username = "admin"
password = [redacted]

db = MySQLdb.connect(host=hostname, user=username, passwd=password)

cursor = db.cursor()
cursor.execute("select * from sys.version")

print(cursor.fetchone())

[ec2-user@ip-172-31-84-94 ~]$ python3 mysql.py
('2.1.1', '8.0.28')
[ec2-user@ip-172-31-84-94 ~]$ 
```

AWS RDS

Cleaning Up

- RDS instances are NOT automatically stopped when your AWS Academy lab session ends
- You will keep getting charged as long as it is active
- You can temporarily stop an RDS instance though

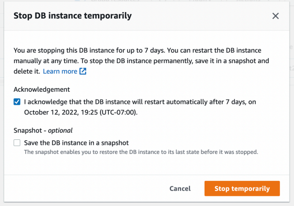


DB identifier	Role	Engine	Reg	St
○ class-db	Instance	MySQL Community	us-e	✓

AWS RDS

Cleaning Up

- Can stop an RDS instance for up to 7 days
- After that it will automatically restart so AWS can keep it patched
- Still have to pay for the storage
- If you are done with an RDS instance, terminate it instead


Stop DB instance temporarily ✕

You are stopping this DB instance for up to 7 days. You can restart the DB instance manually at any time. To stop the DB instance permanently, save it in a snapshot and delete it. Learn more

Acknowledgement

☑ I acknowledge that the DB instance will restart automatically after 7 days, on October 12, 2022, 19:25 (UTC-07:00).

Snapshot - *optional*

☐ Save the DB instance in a snapshot
The snapshot enables you to restore the DB instance to its last state before it was stopped.