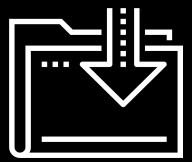
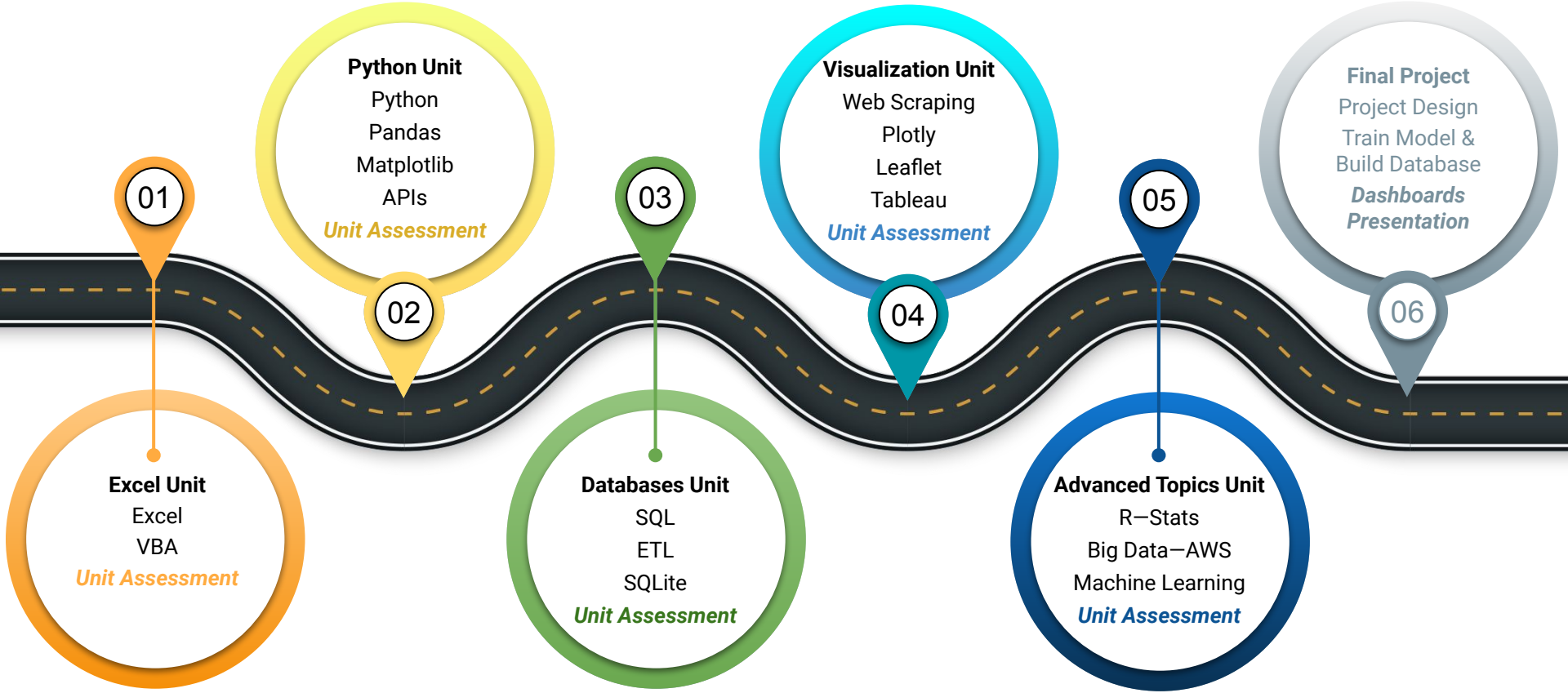
ETL with Amazon Web Services

Data Boot Camp

Lesson 16.2



The Big Picture



This Week: Big Data

By the end of this week, you'll know how to:

- Define big data and describe the challenges associated with it
- Define Hadoop and name the main elements of its ecosystem
- Explain how MapReduce processes data
- Define Spark and explain how it processes data
- Describe how NLP collects and analyzes text data
- Use AWS Simple Storage Service (S3) and relational databases for basic cloud storage

This Week's Challenge

Using the skills learned throughout the week, connect to an AWS RDS instance and perform ETL on an Amazon customer-review dataset to determine if Vine reviews show bias towards being more favorable.

Today's Agenda

By completing today's activities, you'll learn the following skills:

01 Using AWS

02 Creating a relational database (RDS) in AWS

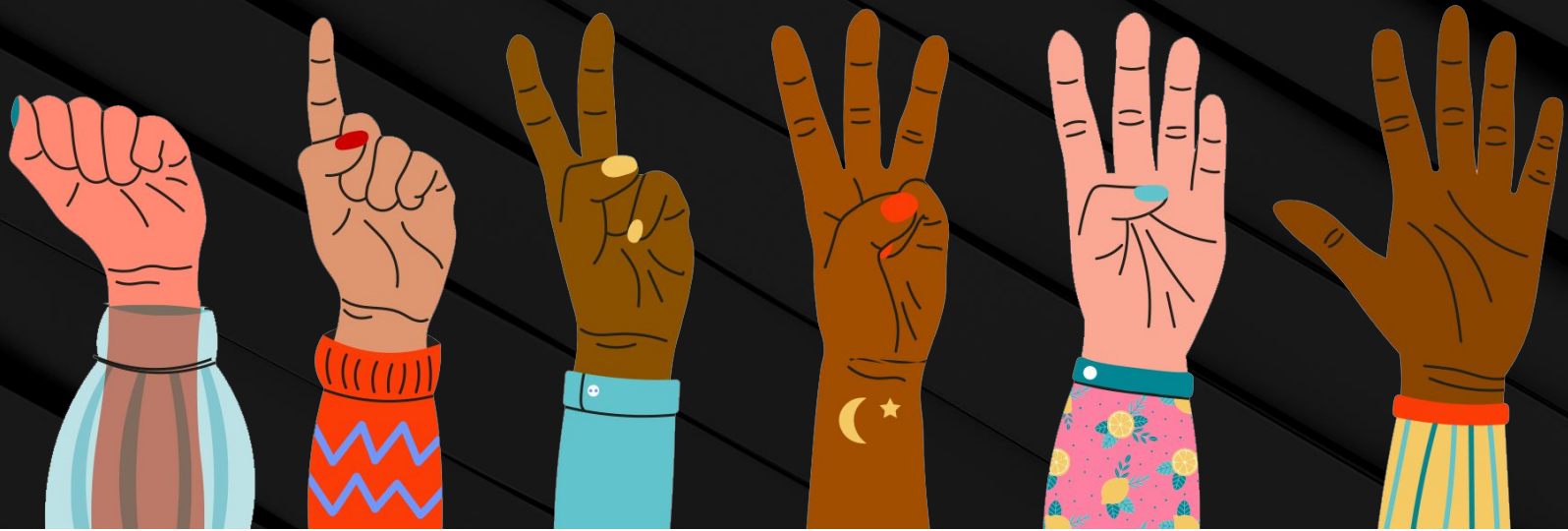
03 Connecting an RDS to pgAdmin

04 Storing data on AWS Simple Storage Service (Amazon S3)

Make sure you've downloaded any relevant class files!

FIST TO FIVE:

How comfortable do you feel with this topic?



Creating an AWS Relational Database

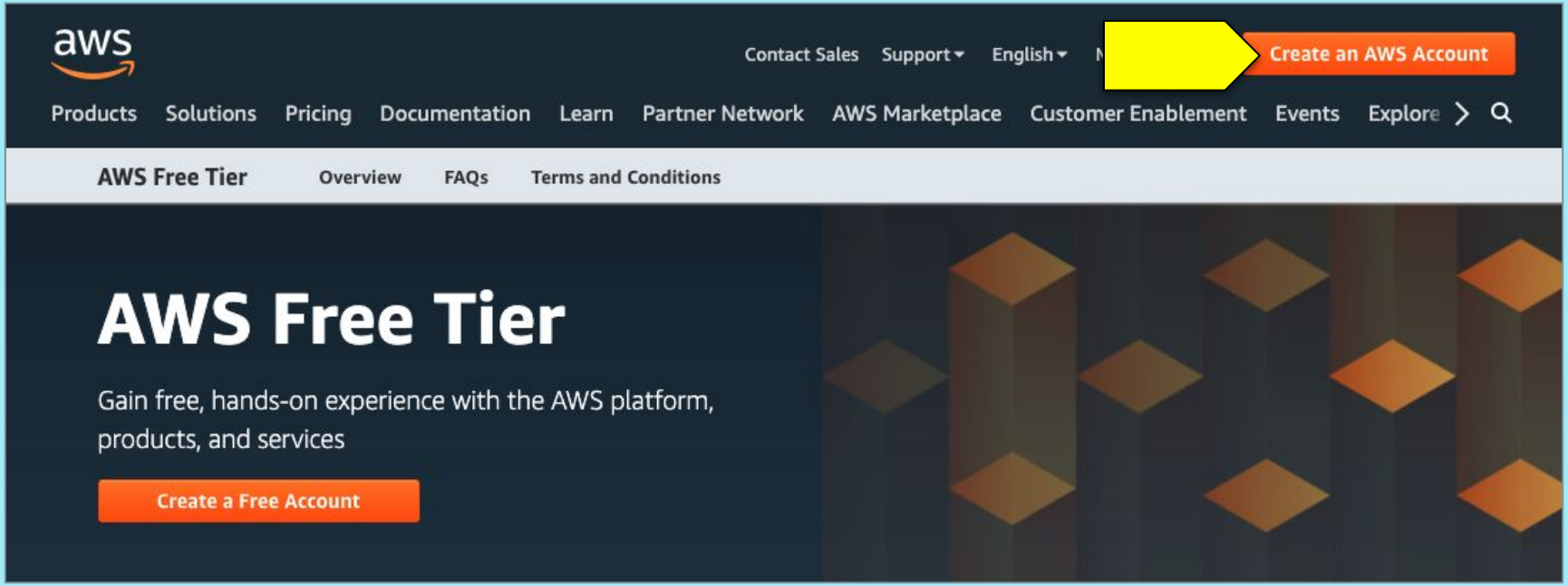
Create a PostgreSQL Database in RDS

Suggested Time:

15 minutes

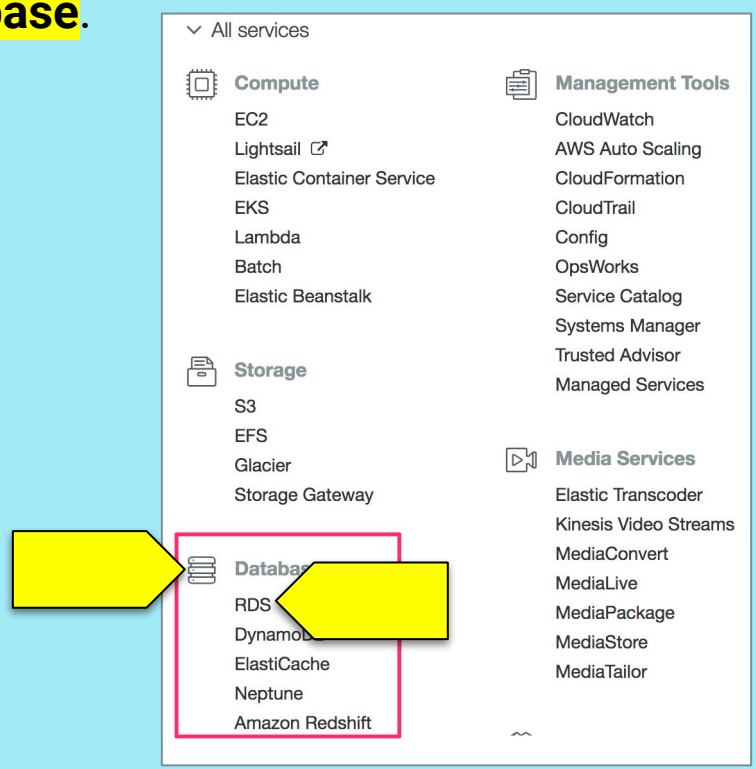
Create a PostgreSQL Database in RDS

Create a Free Tier account.



PostgreSQL on RDS

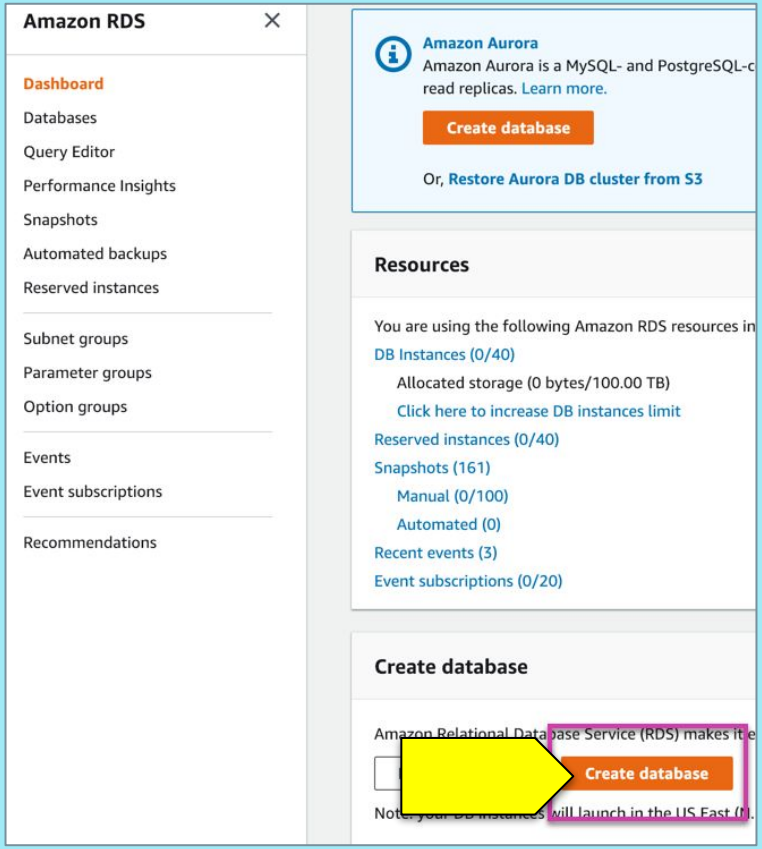
Start by logging in to the AWS Management Console, then navigate to the **RDS** section under **Database**.



PostgreSQL on RDS

Click **Create database** from the **Create database** section to the right.

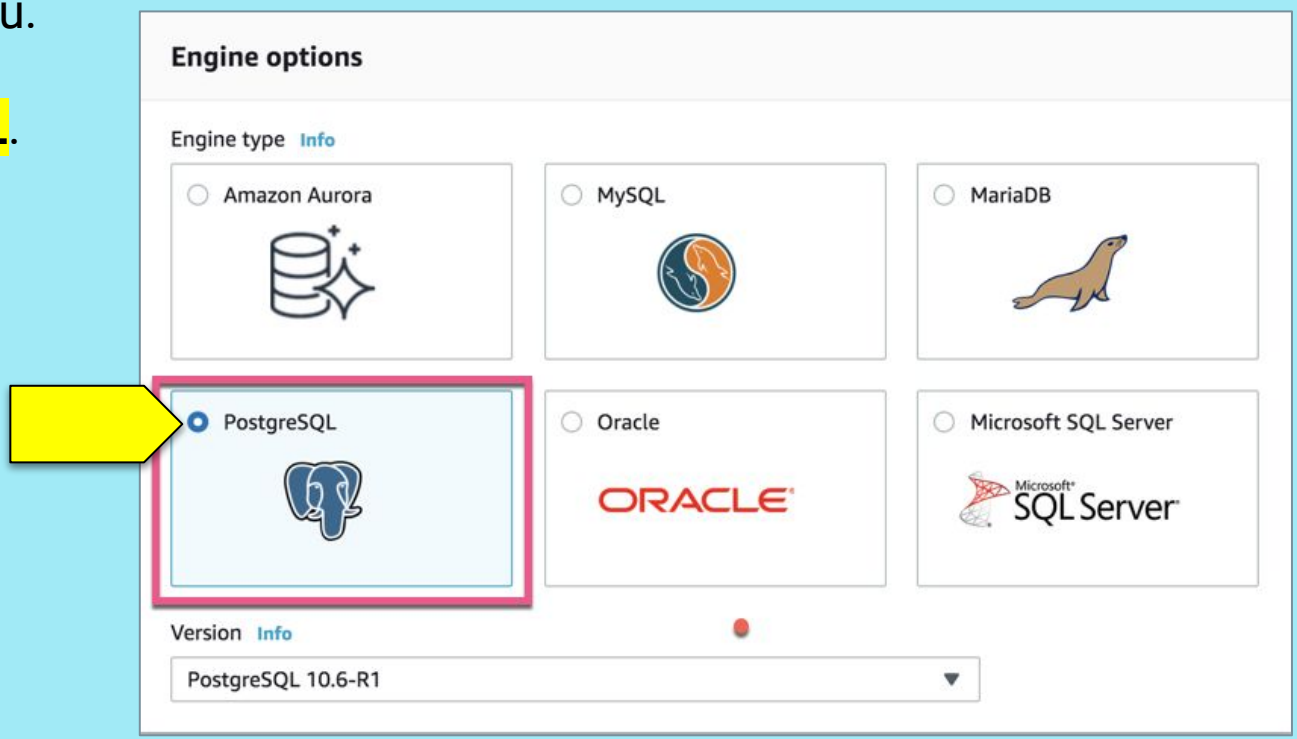
This button will take you to the **Engine options** page, which brings up a menu of different relational databases.



PostgreSQL on RDS

Check the box next to **Only enable options eligible for RDS Free Usage Tier** at the bottom of the menu.

Select PostgreSQL.



PostgreSQL on RDS

Under **Templates**, select **Free tier**.

Fill out the fields under **Settings**. Use **myPostgresDB** as the database instance identifier and **root** as the master username.

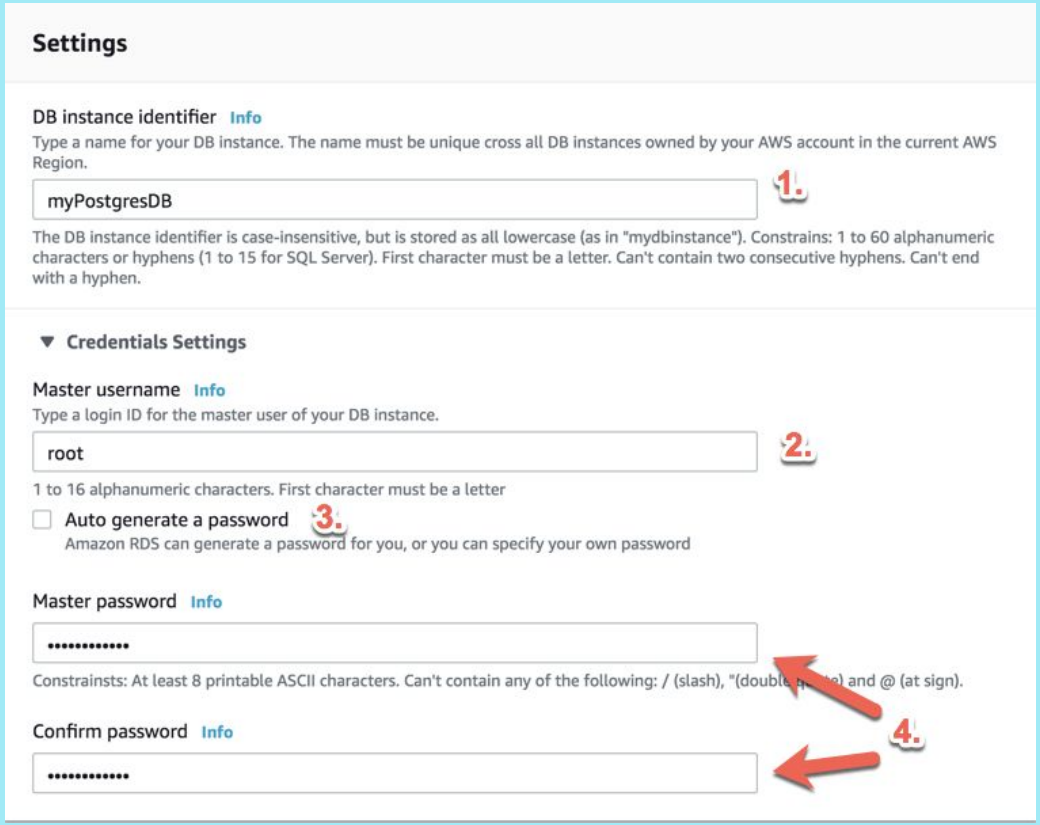
Note: Although the database instance identifier and master username can take any name, we recommend sticking to these settings in this case for consistency.

PostgreSQL on RDS

Uncheck the box next to **Auto generate a password**.

Enter a password and be sure to record it somewhere.

The other settings will be accessible in the future, but the password will not.



PostgreSQL on RDS - NEW

Under **Storage**, uncheck the box for **Enable storage autoscaling**.

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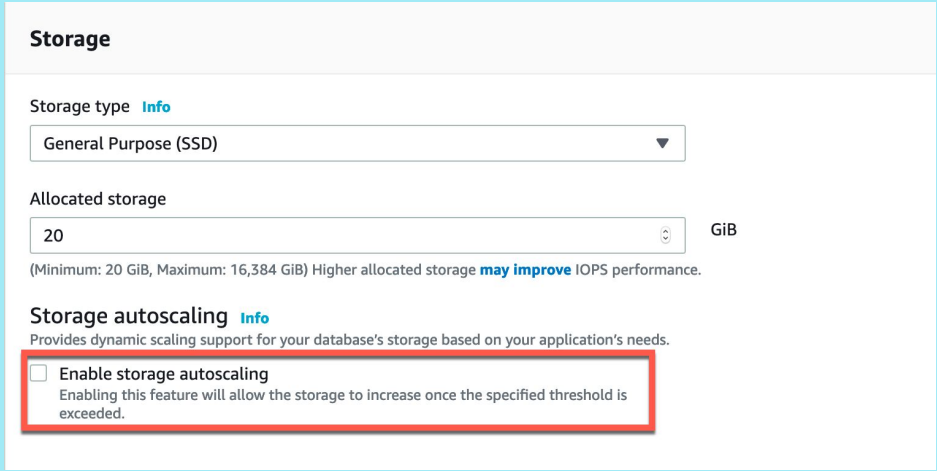
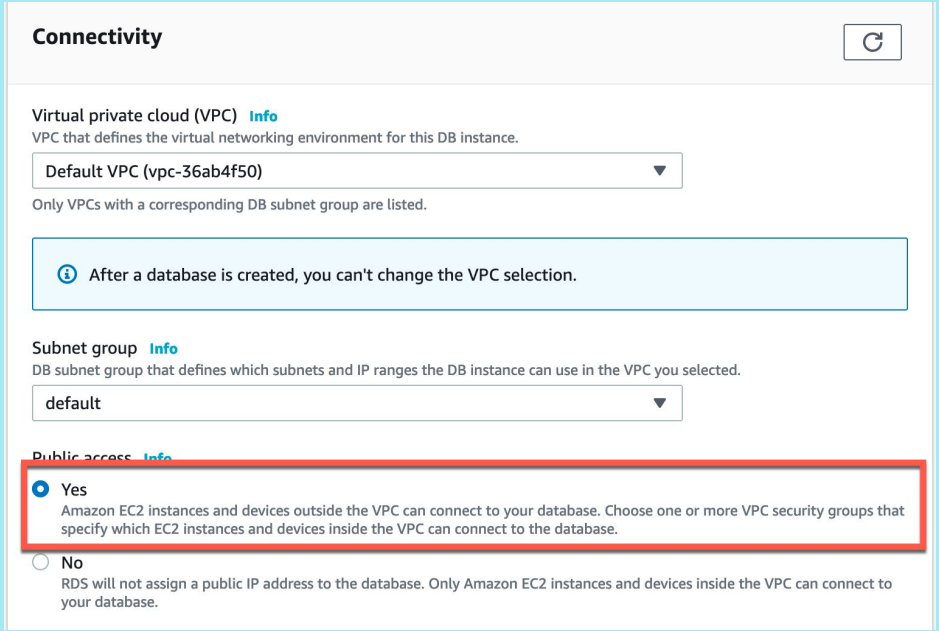


PostgreSQL on RDS - New

Under **Connectivity**, select **Yes** under the **Public access** option.

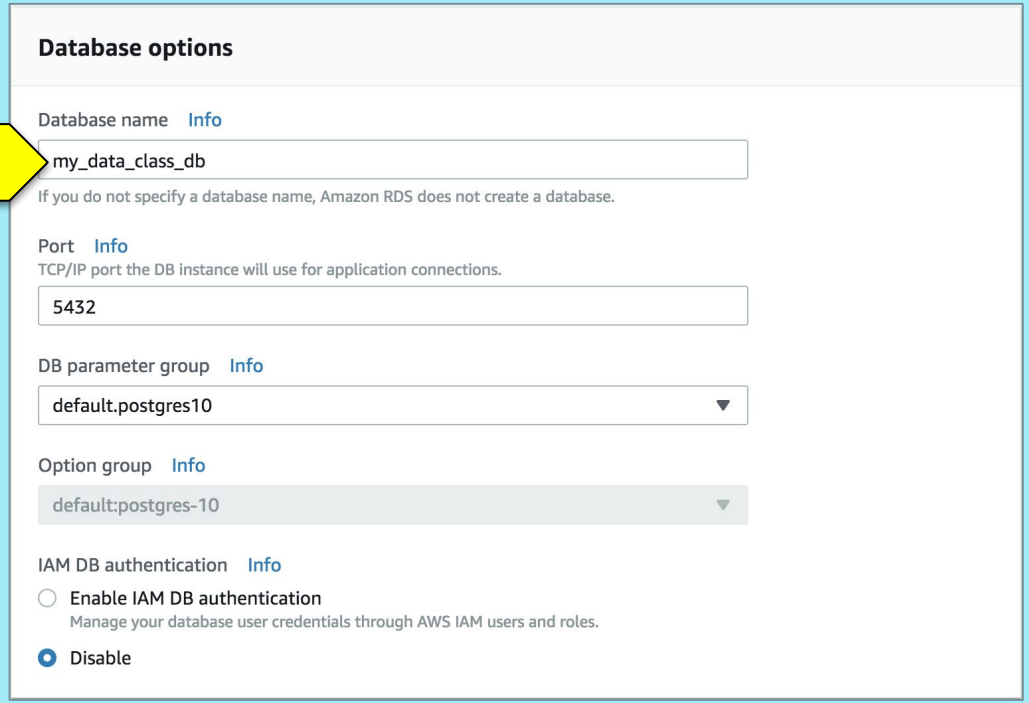
This does not mean anyone can access the database, as a password is still required, but it allows connections from outside sources like pgAdmin.



PostgreSQL on RDS

Under **Additional configuration**, click the down arrow and make the database name **my_data_class_db**.

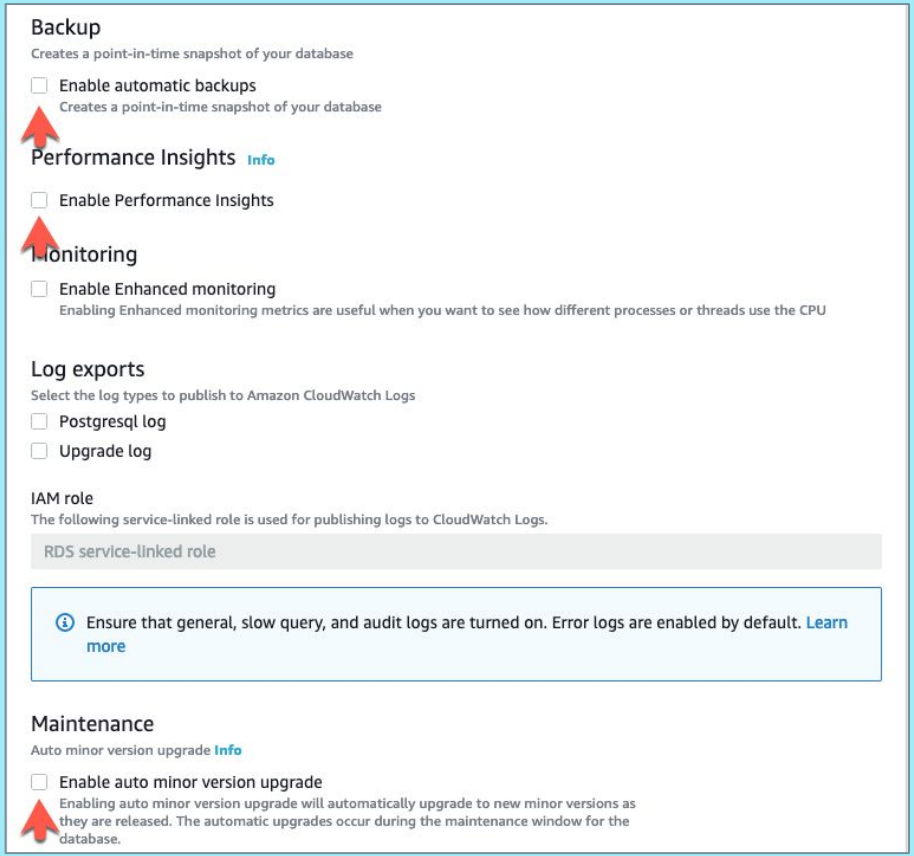
Use this name for the sake of consistency. In the future, any name can be used. Keep the default settings in the other fields.

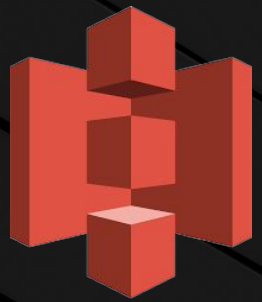


PostgreSQL on RDS

Uncheck the boxes for **Enable automatic backups**, **Enable performance insights**, and **Enable auto minor version upgrade**.

Click **Create Database** followed by **View DB Instance details** to navigate to the instance console page. The database creation on AWS's end will take anywhere from 10 to 15 minutes.

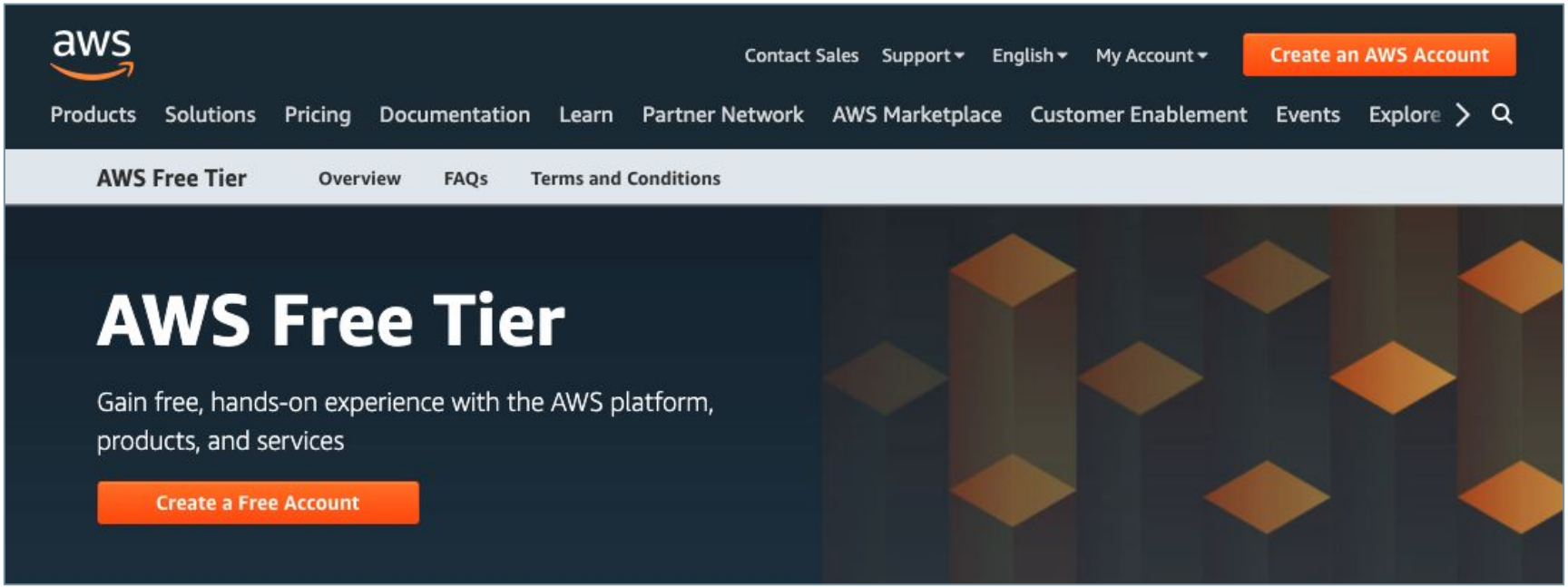




Storage with AWS S3

Storage with AWS S3

Simple Storage Service, or S3, is Amazon's cloud file-storage service that uses key-value pairs. Files are stored on multiple servers and have a high rate of availability.



Storage with AWS S3

S3 uses **buckets** to store files, which are similar to computer folders or directories. Buckets can contain additional folders and files. Each bucket must have a unique name.

S3 has fine-grained control over files, such as read and write permissions. Buckets can assign individual access or total public access.

The S3 bucket structure is somewhat similar to a GitHub repository, which also holds files and folders.

Storage with AWS S3

An S3 bucket can contain files, but it cannot contain another bucket.

Amazon guarantees an uptime, or availability, of over 99.99% for S3 files

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Each S3 bucket must have a URL that is unique across AWS

Questions?

Cloud Storage with S3

Suggested Time:

15 minutes

PostgreSQL on RDS Introduction

AWS is a cloud-computing platform provided by Amazon, offering over 175 different services via the cloud

Because the infrastructure is already in place, companies can easily scale up as needed without a huge up-front investment, and because they offer flexible usage options there is a cost-appropriate option for everyone.

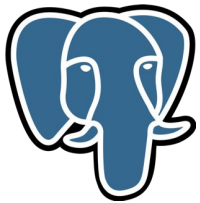
RDS

RDS stands for **Relational Database Service**.

This is what Amazon uses to host a variety of relational databases in the cloud.

These databases can have different dialects, such as MySQL, PostgreSQL, and Amazon's own Aurora database.

PostgreSQL, usually referred to as "Postgres," is an object-relational database system that uses the SQL language.

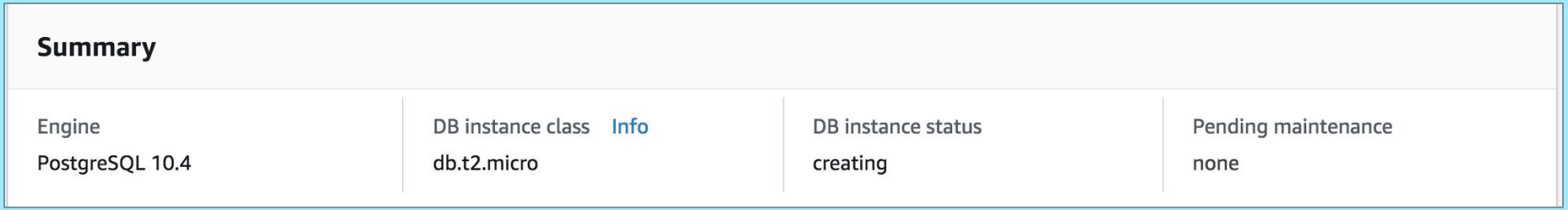


Instructor Demonstration

PostgreSQL on RDS

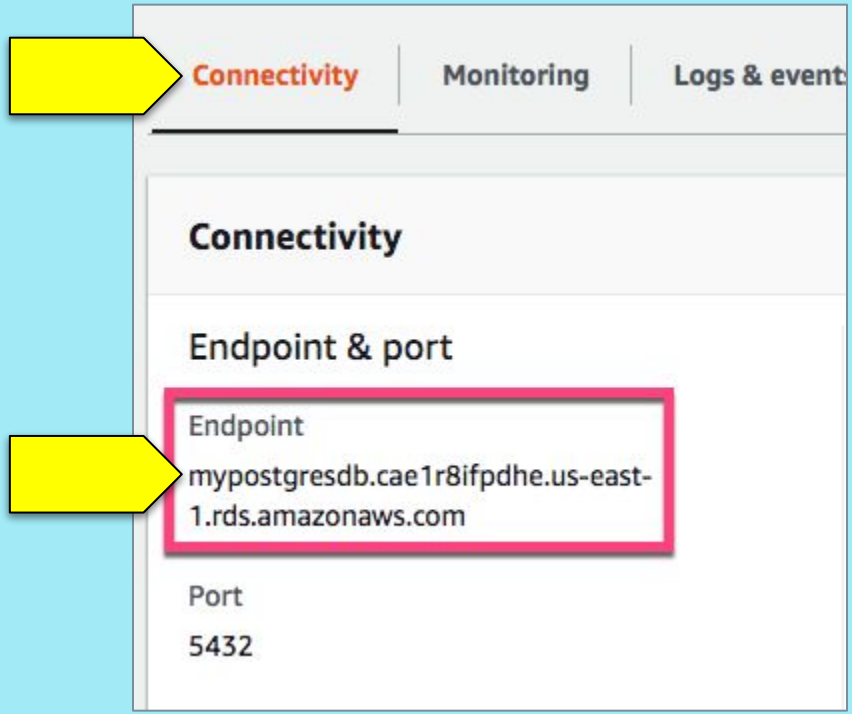
PostgreSQL on RDS

The **Summary** section shows what kind of database the instance is and whether it is available.



PostgreSQL on RDS

The **Connectivity** tab lists the endpoint, port, and security groups associated with the instance. The endpoint will be used to connect to the database.



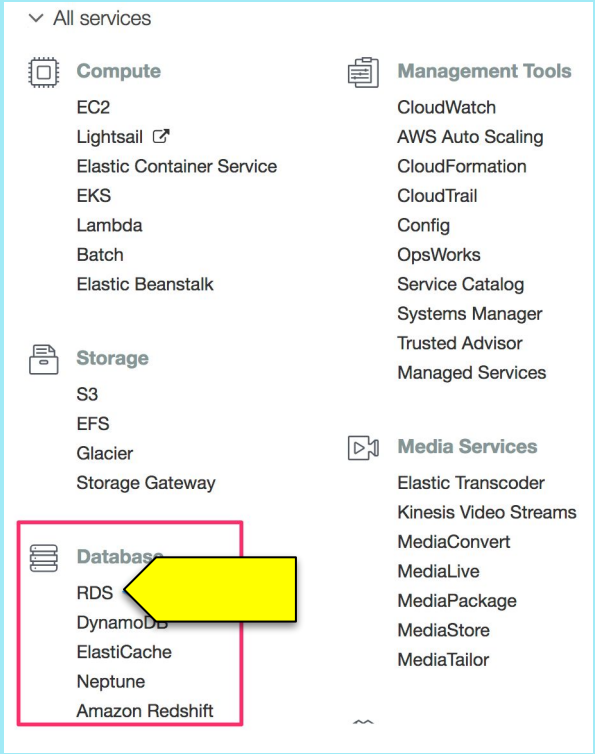
RDS PostgreSQL and pgAdmin with CRUD

Suggested Time:

20 minutes

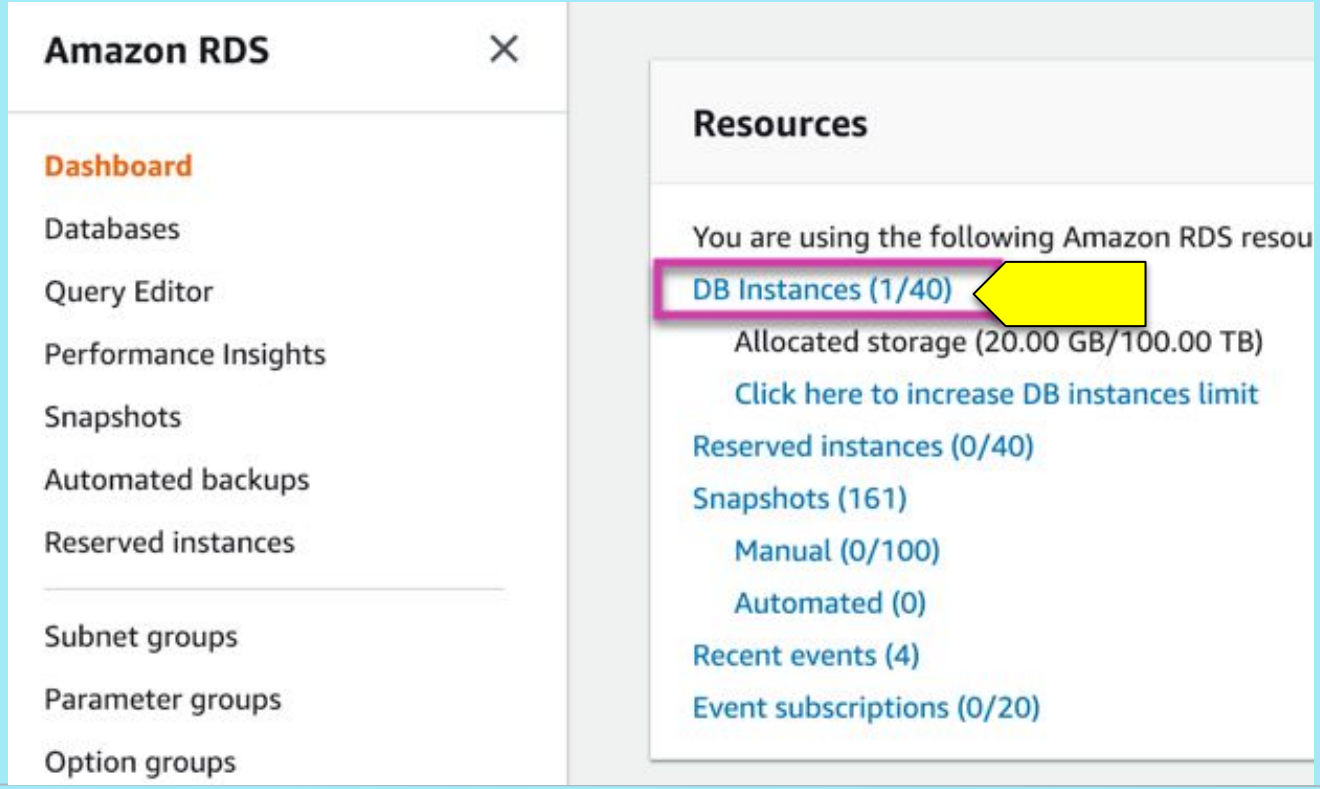
RDS PostgreSQL and pgAdmin with CRUD

Log in to the AWS console, then navigate to **RDS** under **Database**.



RDS PostgreSQL and pgAdmin with CRUD

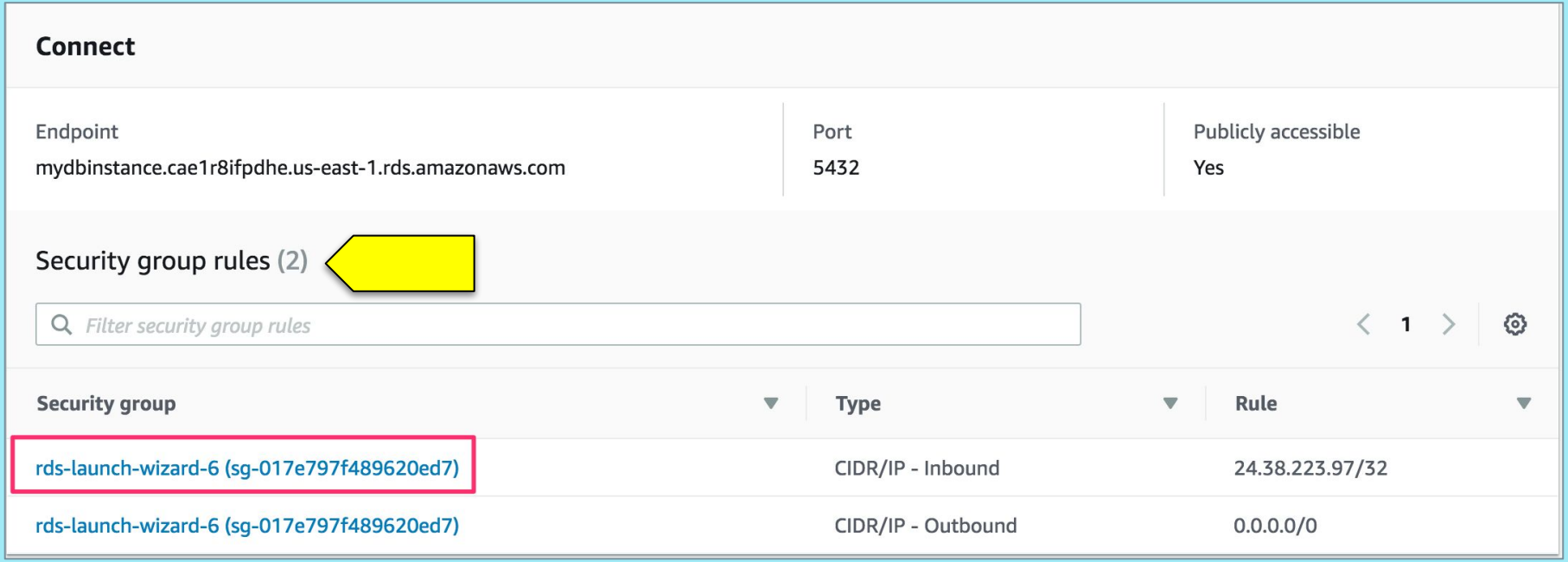
Navigate to **DB Instances** in the **Resources** section to the right.



RDS PostgreSQL and pgAdmin with CRUD

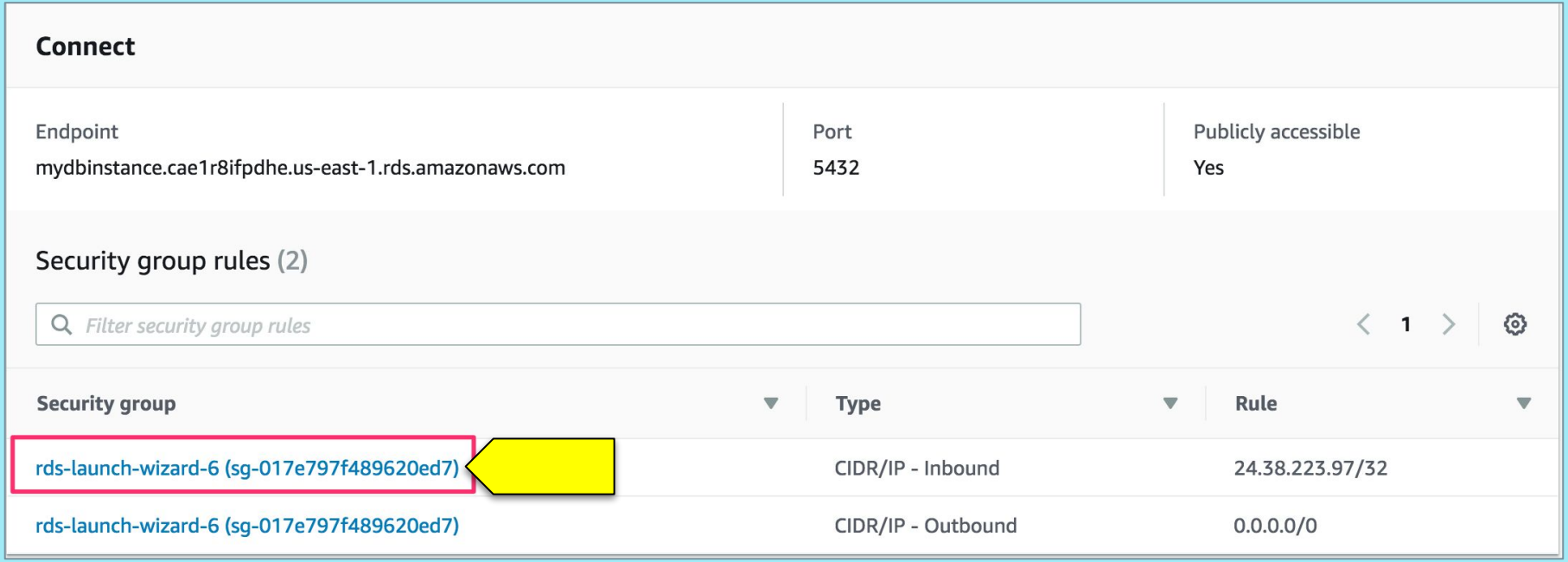
Go to the database created earlier, `mypostgresdb`.

Navigate to the **Security group rules** section on the right:



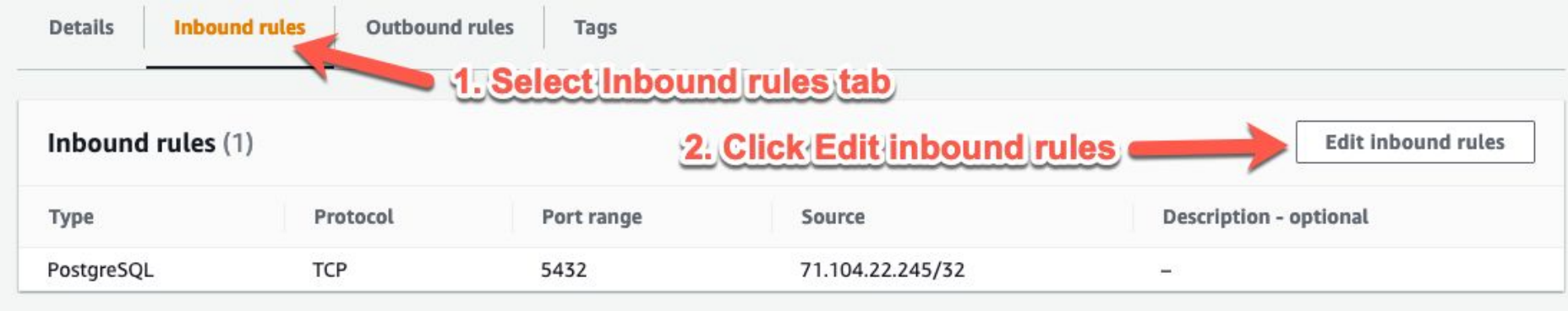
RDS PostgreSQL and pgAdmin with CRUD

Click the security group for type **CIDR/IP - Inbound**.



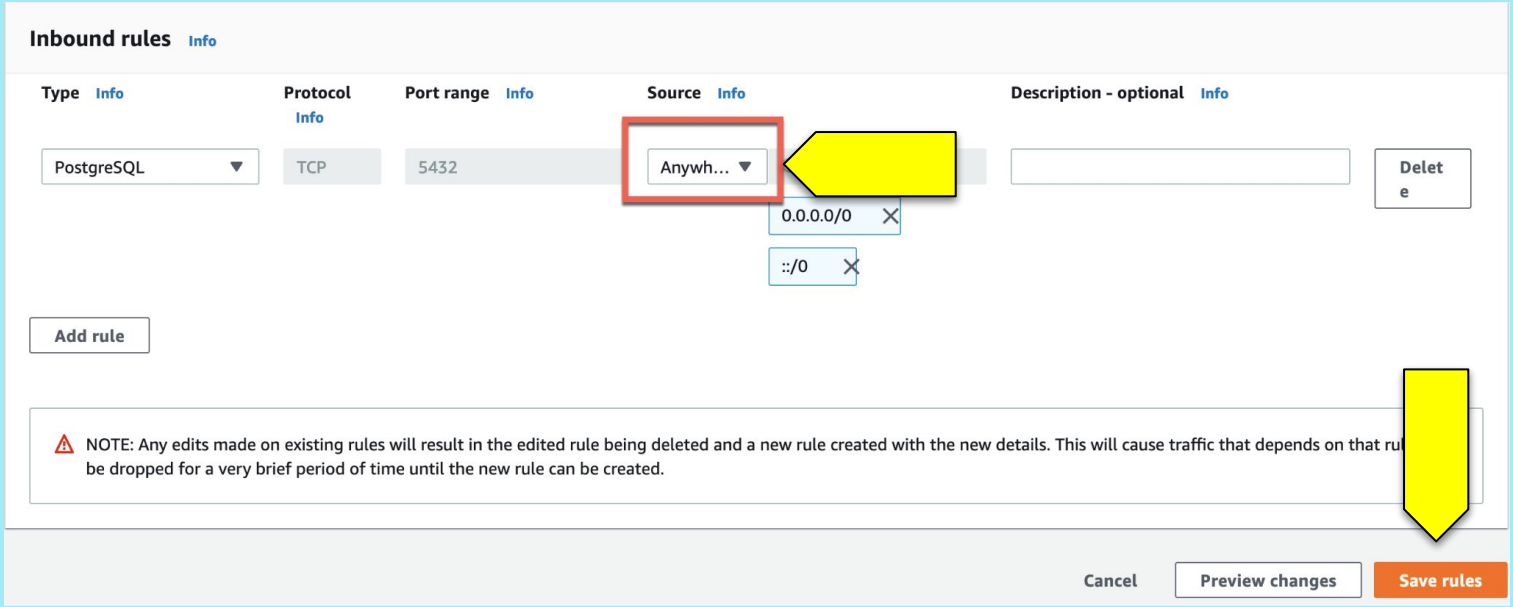
RDS PostgreSQL and pgAdmin with CRUD

From the management console, navigate to the **Inbound ruels** tab on the bottom part of the screen, and then click **Edit inbound rules**. This will bring up a menu to set rules for the security group.



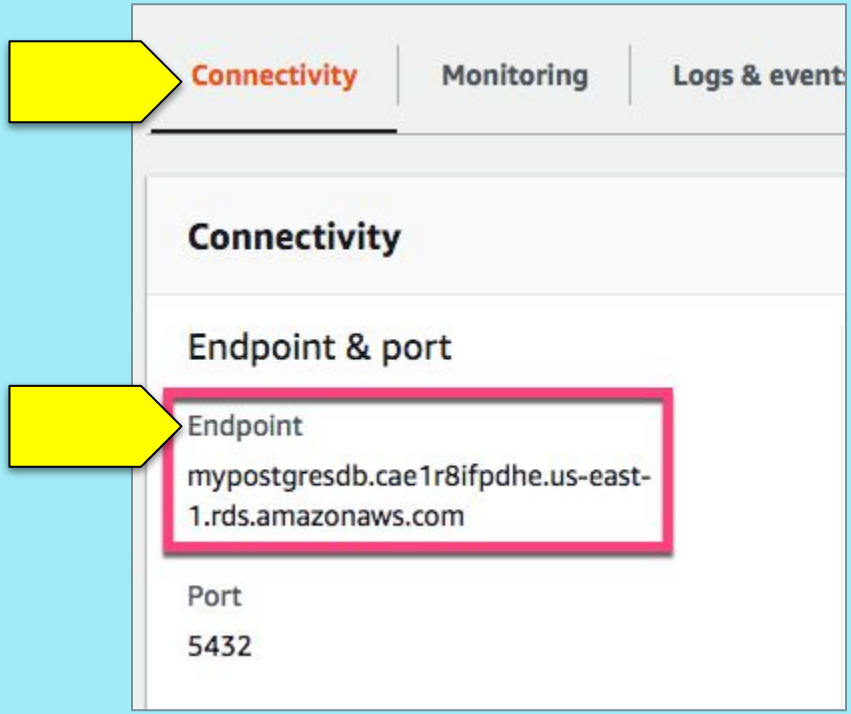
RDS PostgreSQL and pgAdmin with CRUD

Change the **Source** to **Anywhere**, then click **Save rules**. The RDS instance will now accept a connection from anywhere. This isn't completely open to the world because the endpoint, username, and password are still needed to connect.



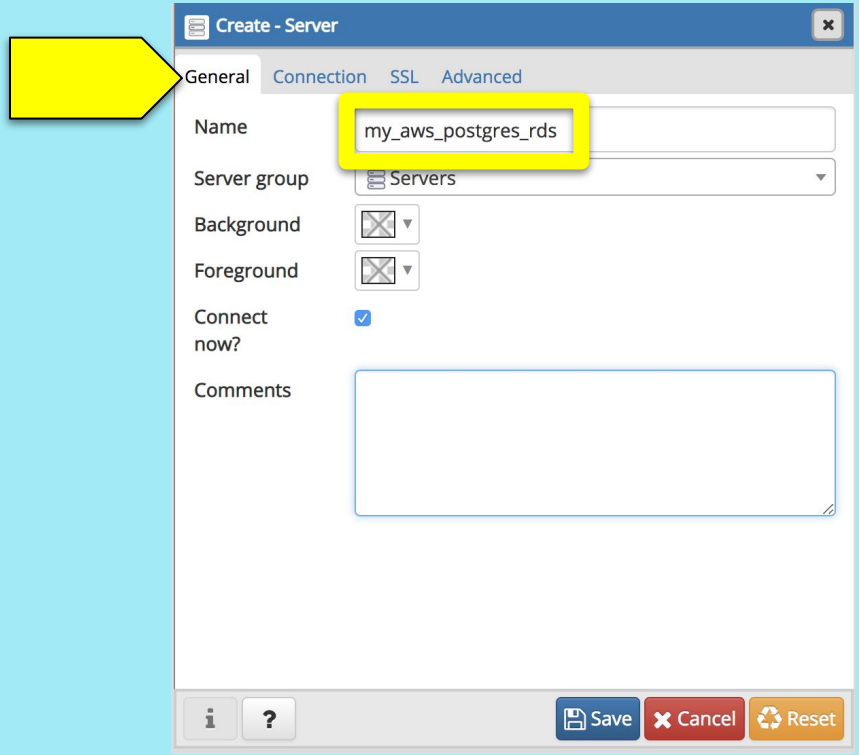
RDS PostgreSQL and pgAdmin with CRUD

Navigate back to the instance console and have the class find the endpoint, which is found in the **Connectivity** tab.



RDS PostgreSQL and pgAdmin with CRUD

Under the **General** tab, enter the server name as **my_aws_postgres_rds**.



RDS PostgreSQL and pgAdmin with CRUD

Under the **Connection** tab, do the following:

Enter the endpoint in the **Host name/address** field. This is unique to the instance.

Enter **postgres** in the **Maintenance database** field. This is the default for all Postgres RDS instances.

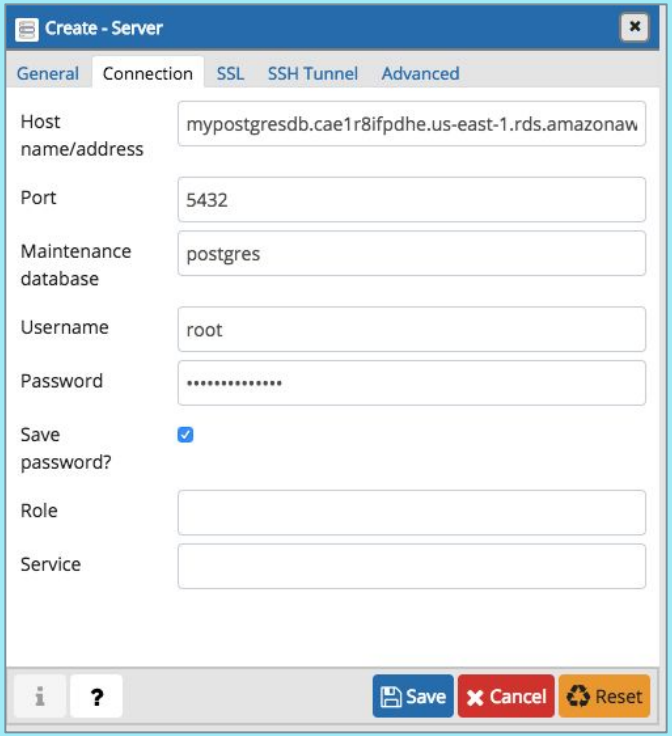
Enter the username **root** in the **Username** field.

Enter the password that was created for your RDS instance.

Check the box next to **Save password**.

RDS PostgreSQL and pgAdmin with CRUD

Click **Save**. If all information is entered correctly, this will set up the connection and not return an error.



RDS PostgreSQL and pgAdmin with CRUD

The four basic functions of persistent data storage are create, read, update, and delete (CRUD).

Create	`INSERT table info (column1, column2, column3)`
Read	`SELECT * FROM table`
Update	`UPDATE table SET column1 = VALUE WHERE id = 1`
Delete	`DELETE FROM table WHERE id = 4`

RDS PostgreSQL and pgAdmin with CRUD

This schema consists of the first part of CRUD, create.

Create	`INSERT table info (column1, column2, column3)`
Read	`SELECT * FROM table`
Update	`UPDATE table SET column1 = VALUE WHERE id = 1`
Delete	`DELETE FROM table WHERE id = 4`

RDS PostgreSQL and pgAdmin with CRUD

The schema will create the tables. The insertion creates the data.

A foreign key is used in the `patients` table to reference the `doctor` table.

Create a new database named `medical`, open a query tool, and then run the schema. This creates two tables and uploads the data.

RDS PostgreSQL and pgAdmin with CRUD

The read functions of a database are run with `SELECT` statements.

```
-- Read tables
SELECT * FROM doctors;

SELECT * FROM patients;
```

RDS PostgreSQL and pgAdmin with CRUD

An error will occur after running the first `INSERT`.

This is because the `doctor_id` key 22 does not exist in the `doctor` table.

```
-- Inserting with invalid foreign key
INSERT INTO patients(id, doctor_id, health_status)
VALUES
(6, 22, 'sick');
```

RDS PostgreSQL and pgAdmin with CRUD

The second `INSERT` statement will run because the foreign key is located in the doctor table.

```
-- Inserting with invalid foreign key
INSERT INTO patients(id, doctor_id, health_status)
VALUES
(6, 22, 'sick');
```

RDS PostgreSQL and pgAdmin with CRUD

The update functions are run with `UPDATE`.

```
-- Update rows
UPDATE doctors
SET taking_patients = FALSE
WHERE id = 1;

UPDATE patients
SET health_status = 'healthy'
WHERE id = 1;
```

RDS PostgreSQL and pgAdmin with CRUD

The delete functions are run with `DELETE`.

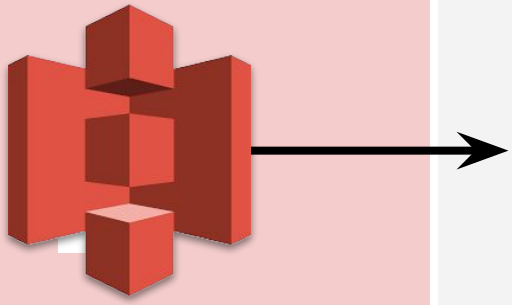
```
-- Delete row
DELETE FROM patients
WHERE id = 1;
```

Questions?

ETL with AWS

ETL with AWS

Files are stored in a cloud location such as an AWS S3 bucket. These files are extracted from S3 and read into PySpark DataFrames using Google Colab.

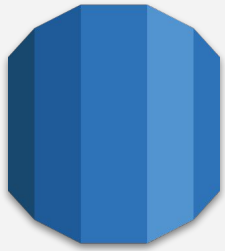


S3

Files are stored in a cloud location, such as an AWS S3 bucket.

Google Colab

Google Colab uses PySpark to perform transformations.

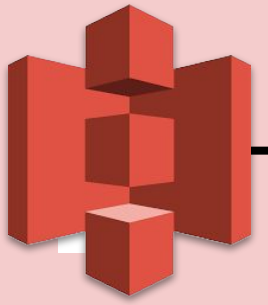


PostgreSQL RDS

Google Colab loads the transformed dataset to an RDS database.

ETL with AWS

Once the files are extracted into Google Colab, transformations can take place. PySpark is used to transform the data.

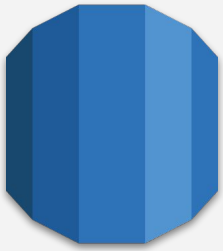


S3

Files are stored in a cloud location, such as an AWS S3 bucket.

Google Colab

Google Colab uses PySpark to perform transformations.

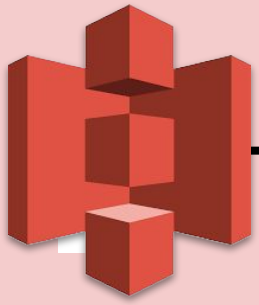


PostgreSQL RDS

Google Colab loads the transformed dataset to an RDS database.

ETL with AWS

After the data is transformed, Google Colab creates a connection to an RDS instance. Once connected, Google Colab loads the DataFrame into the RDS database.

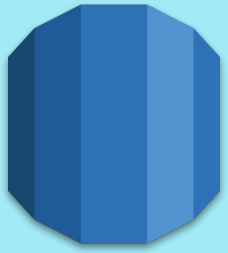


S3

Files are stored in a cloud location such as an AWS S3 bucket.

Google Colab

Google Colab uses PySpark to perform transformations.

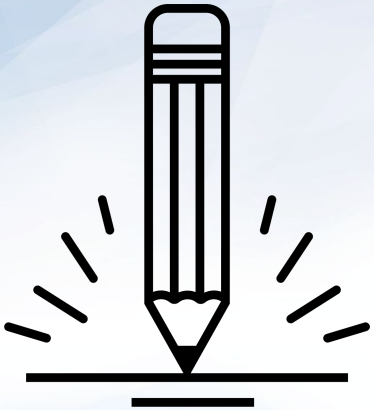


PostgreSQL RDS

Google Colab loads the transformed dataset to an RDS database.

Instructor Demonstration

ETL with S3, PySpark, and RDS



Activity: ETL with S3, PySpark, and RDS

As the sole data person at your new company, you have been tasked with cleaning the data from an Excel spreadsheet—which has been exported as a CSV—and creating a SQL database with this data. In other words, you will be performing ETL.

Suggested Time:
15 minutes

ETL with S3, PySpark, and RDS

Take a moment to review the SQL table schema, which reflects the requirements for the company's new database. Your company will be using S3 for file storage and RDS to host SQL databases.

Then, complete the following tasks:

Upload the CSV file to S3, and be sure to make the S3 bucket public.

Use Spark on Colab to clean and transform the data.

Use pgAdmin to create the table schema in RDS.

Load the data from Pandas DataFrames into RDS.

Let's Review

AWS Cleanup

Everything we have done today will fall under the AWS Free Tier. However, as a precaution, we will delete everything we created.

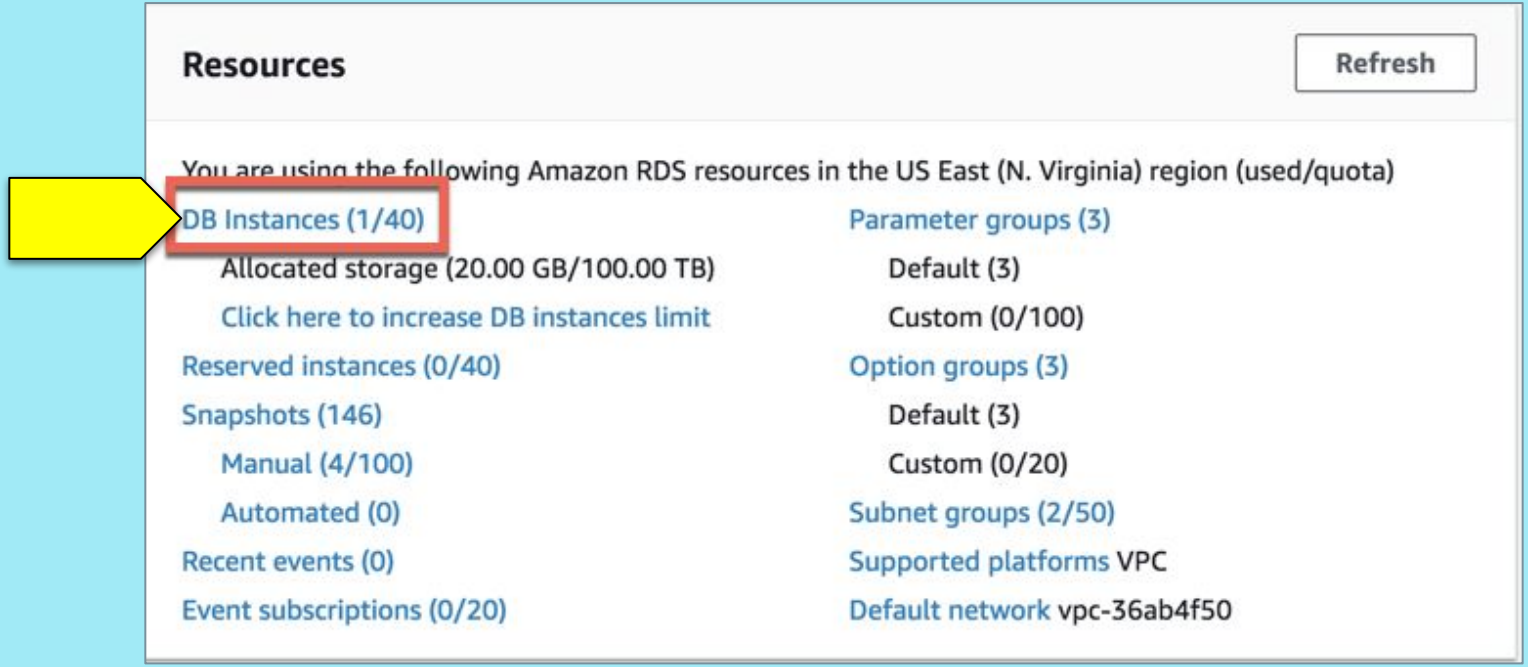
AWS Cleanup

Suggested Time:

15 minutes

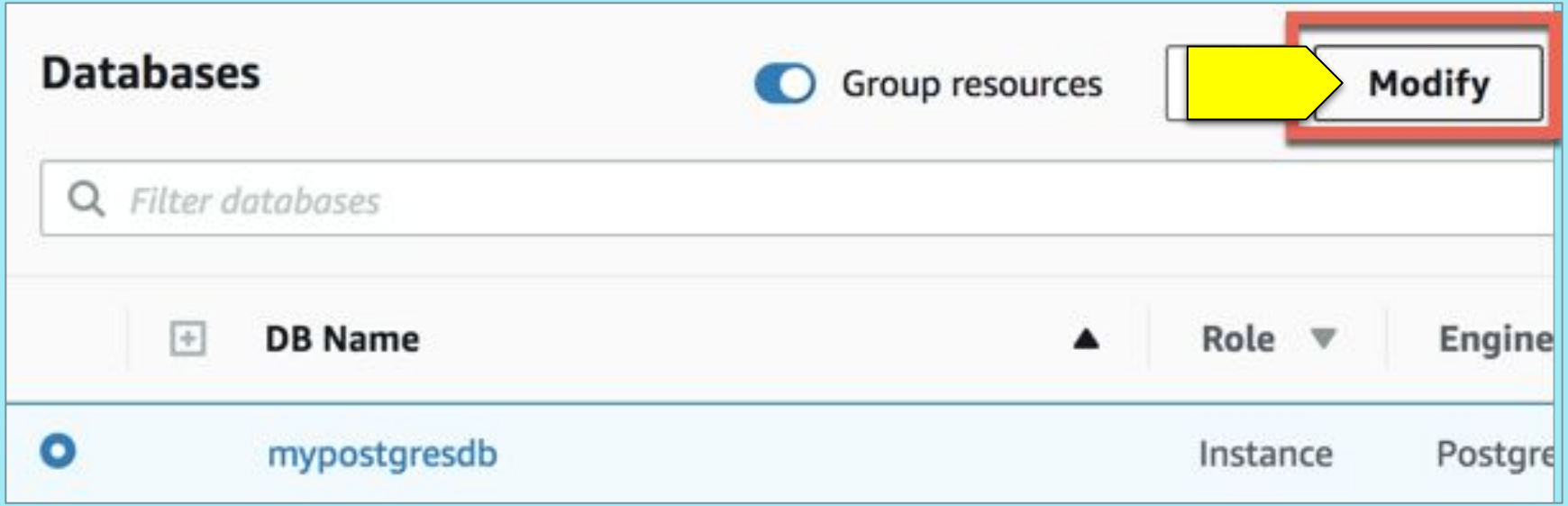
AWS Cleanup

Log in to the AWS management console and navigate to the RDS dashboard. Click **DB Instances**.



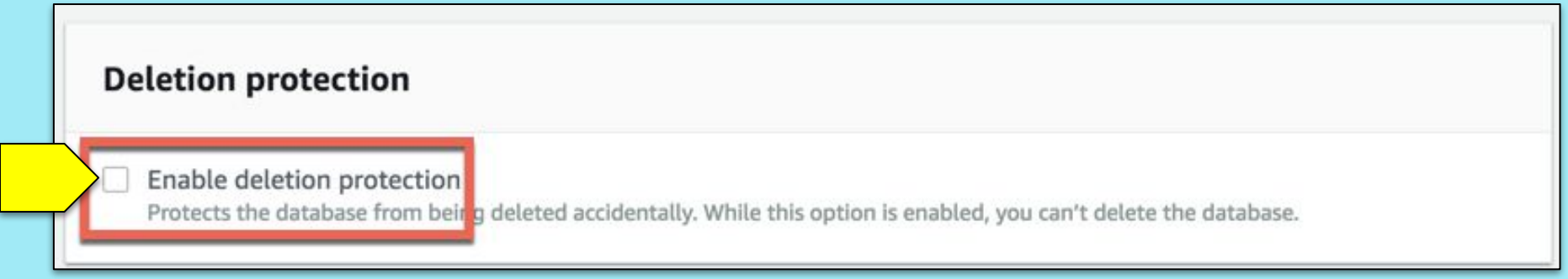
AWS Cleanup

Select our database under **DB Name**, then click **Modify**.



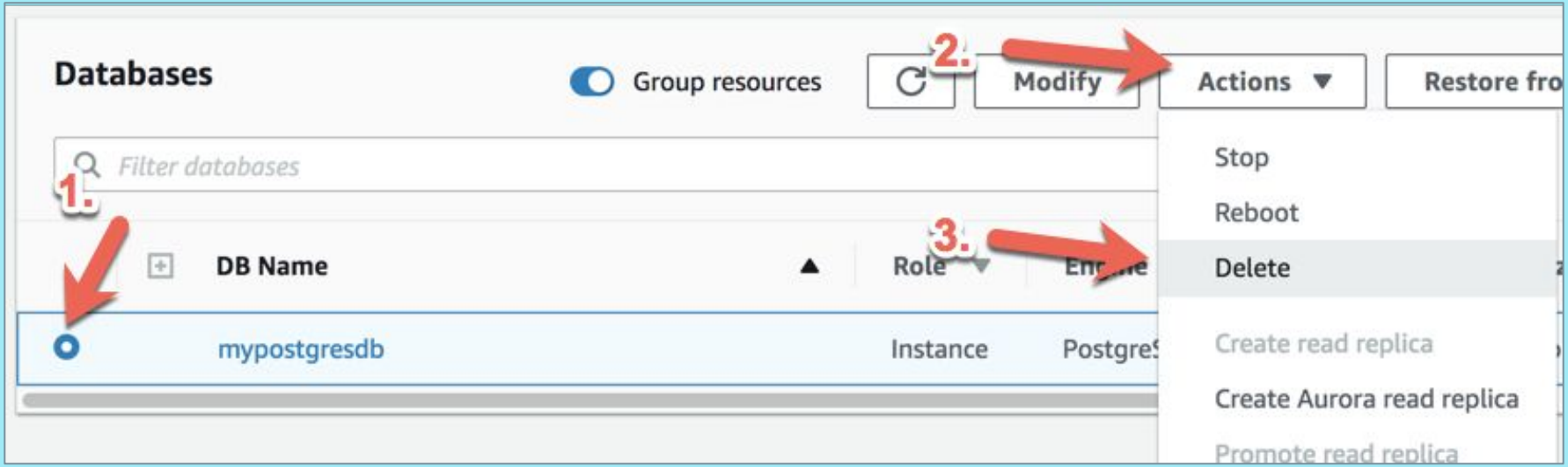
AWS Cleanup

Scroll down to **Deletion protection**. If the box next to **Enable deletion protection** is selected, uncheck the box. Then, click **Continue**, **Apply immediately**, and **Modify DB Instance**. If the box is already empty, return back to the instance page.



AWS Cleanup

Next, on the database dashboard, make sure the database is selected, and then click **Actions** followed by **Delete**.

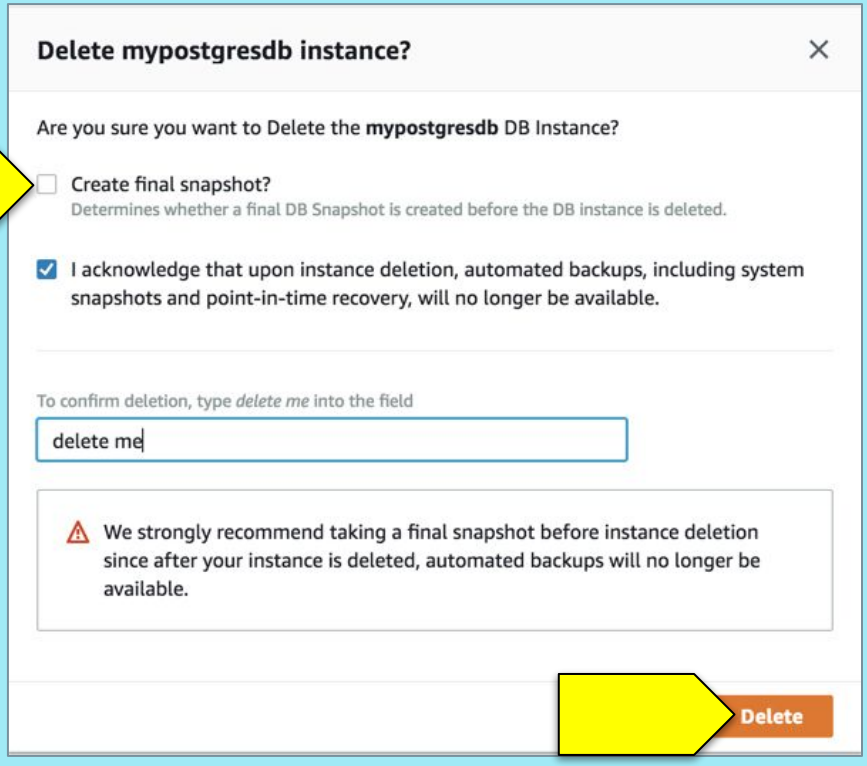


AWS Cleanup

Important: Uncheck **Create final snapshot?**, then check the acknowledgement box.

Type delete me, then click Delete.

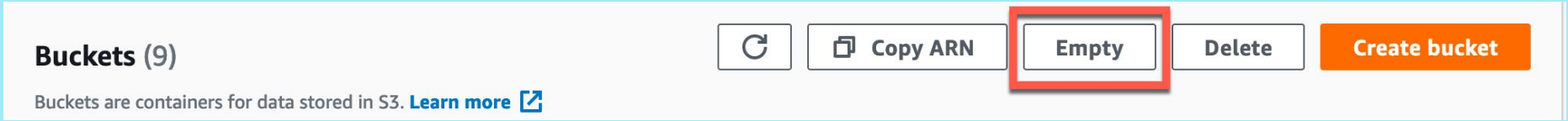
If you do not uncheck this box, your databases will create a backup that could accrue additional costs, so be sure not to skip over this step.



This will take a few minutes to fully delete.

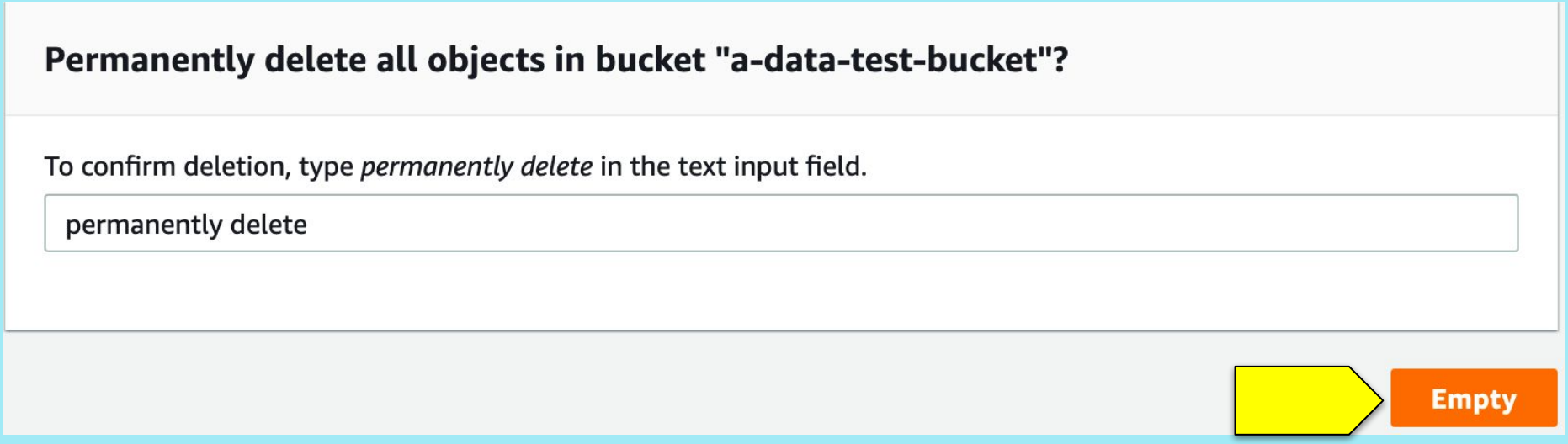
AWS Cleanup

Check the box next to the bucket you want to remove files from, then click **Empty**.



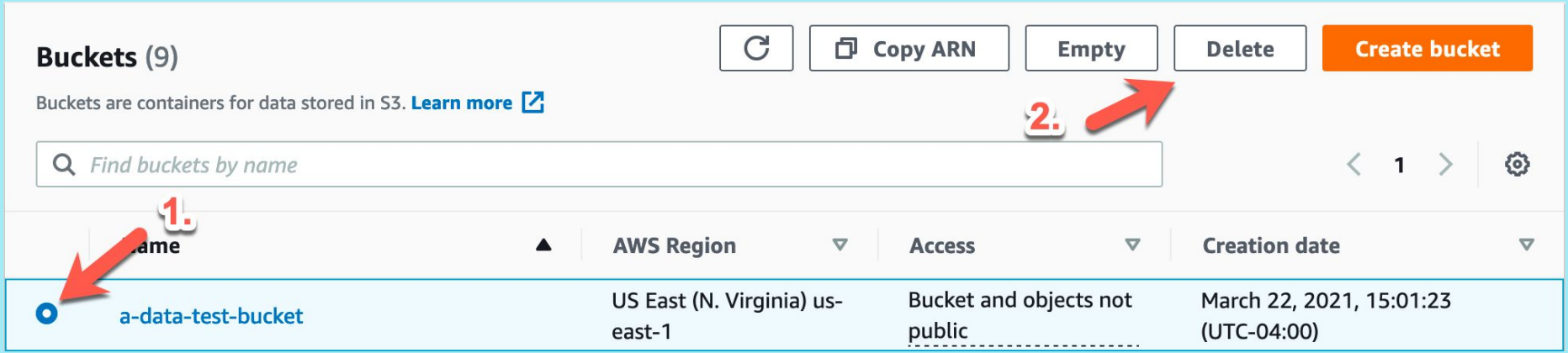
AWS Cleanup

Type **permanently delete** in the text input field, then click **Empty**.



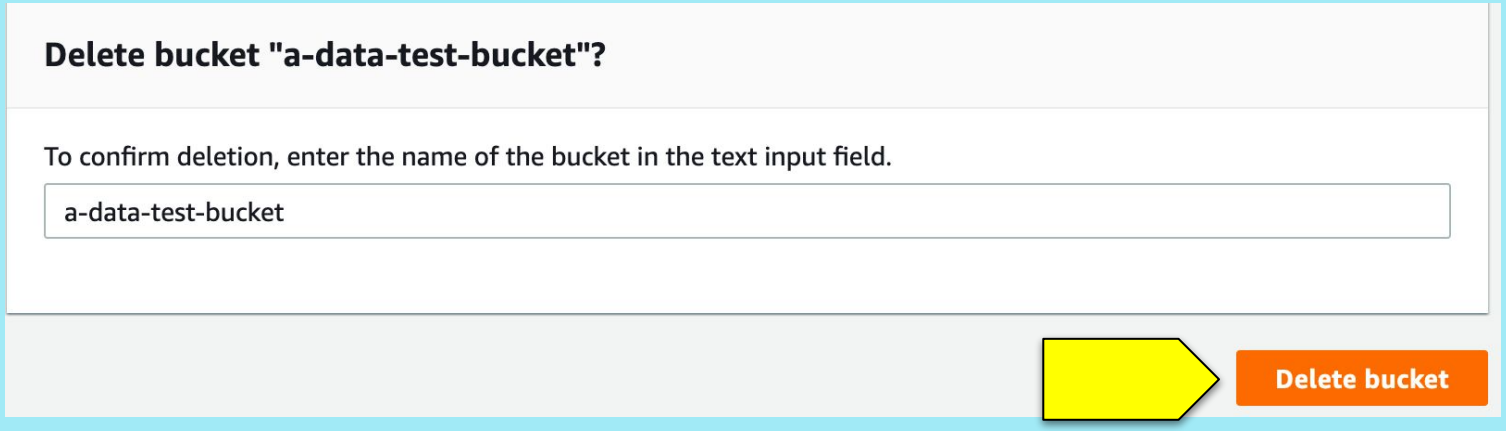
AWS Cleanup

Select the circle next to the bucket you want to delete, then click **Delete**.



AWS Cleanup

Type the name of the bucket, then click **Delete bucket**.



Questions?