Amazon Web Services
Data Engineering Immersion Day

Prelab1. Instructor Environment Setup

July 2021

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Limit Instruction:

This immersion day required each student to have their own account. If you are sharing single account with multiple students by creating a multiple IAM users, Account can hit following default service limit:

- VPC – VPCs per Region 5
- Glue - Number of crawlers per account 50
- Glue - Number of concurrent jobs runs per account 50
- Glue - Maximum DPUs used by a role at one time 300
- S3 – Number of buckets per account 100
- Athena - Number of DDL queries you can submit at the same time 20
- Athena - Number of DML queries you can submit at the same time 20
- RDS – Make sure you have enough disk space available in your RDS instance, if want to run DMS Change Data Capture (CDC) as generating large amount of data can exhaust RDS disk space.
- DMS - Make sure you have enough disk space available in your DMS replication instance, if want to run DMS Change Data Capture (CDC) as transferring large amount of CDC data can exhaust disk space.

Introduction

*****Make sure you select the appropriate AWS region and stick to it for whole of the workshop*****

The Database Migration Services (DMS) hands-on lab provide a scenario, where participant learns to hydrate Amazon S3 data lake with a relational database. To achieve that, participants need a source endpoint and this guide helps instructors set up a PostgreSQL database with public endpoint as the source database.

In this prelab, you will complete the following tasks:

1. Create a Postgres RDS source database environment.
2. Install the source database.

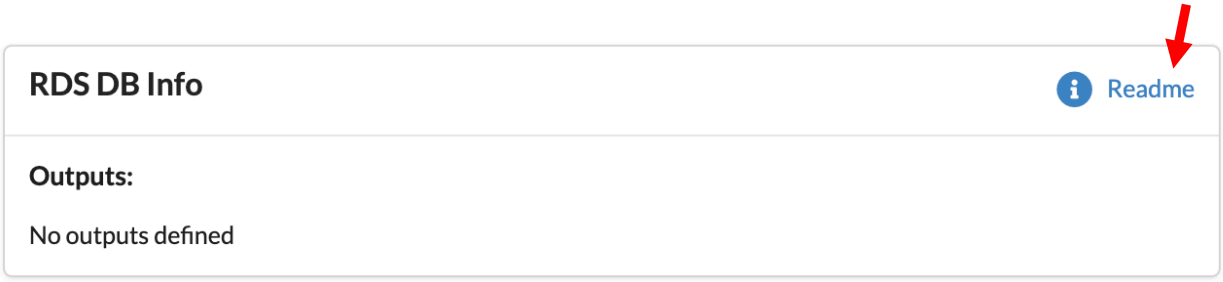
Once the full data replication is finished by DMS, go to the next step if the CDC lab is required:

3. Execute Lambda function to generate CDC data at the source database environment, to demonstrate CDC (Change Data Capture) replication within DMS.

Relevant information about this prelab:

- CloudFormation execution time: 15 minutes
- Source DB installation time: 20 mins

In an instructor-led AWS event, participants can get the Postgres RDS database detail from an event dashboard. (The instructor is required to update the database information before each event)



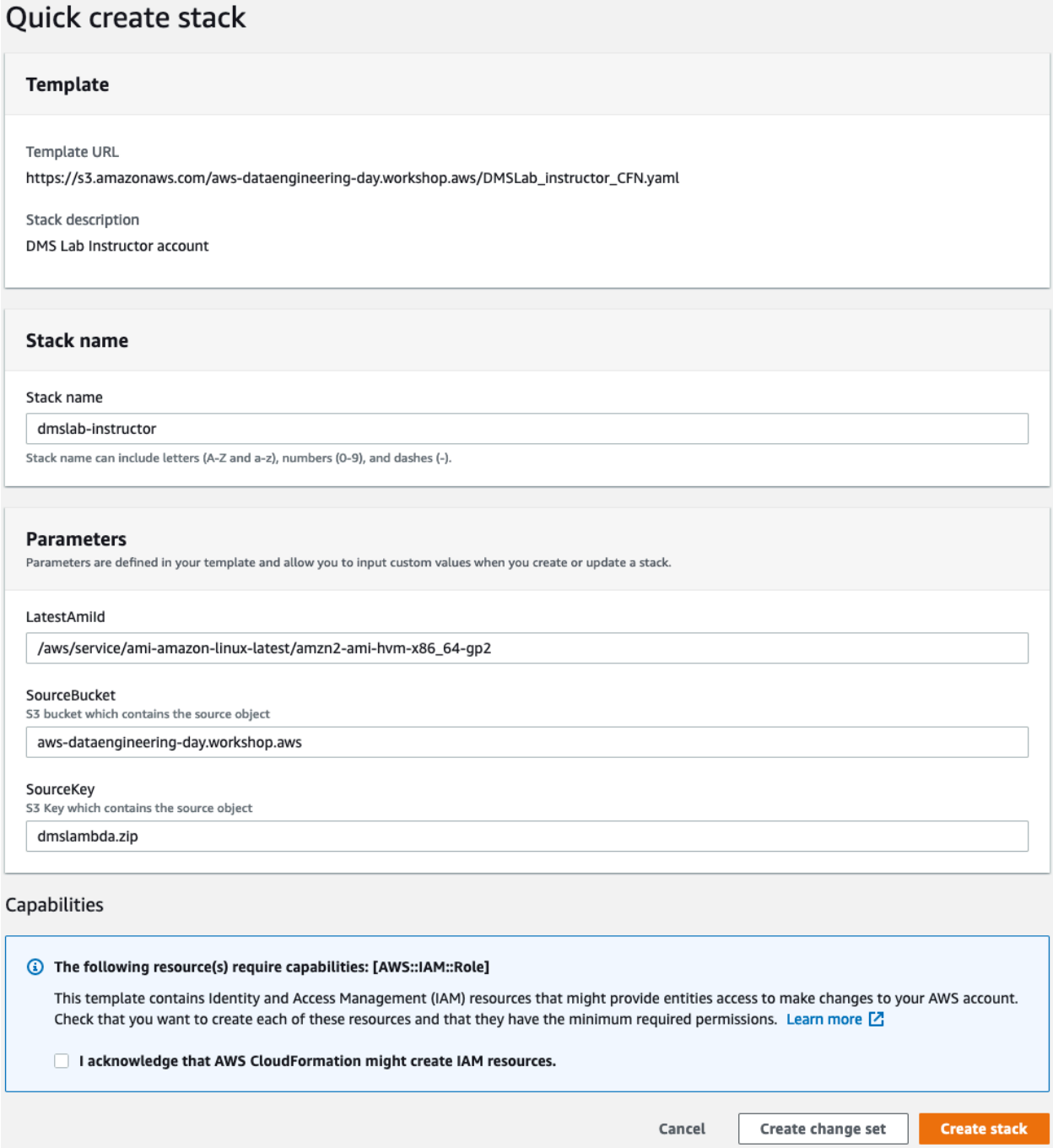
The instructor setup is also available in our online workshop: https://aws-dataengineering-day.workshop.aws/400/410-pre-lab-1.html

Create the Instructor Environment

In this section, you are going to create a PostgreSQL RDS instance as data source for AWS Data Migration Service to consume, for data migration to Amazon S3 data lake.

1. Launch the instructor CloudFormation stack. *(Make sure you select the correct AWS region)*

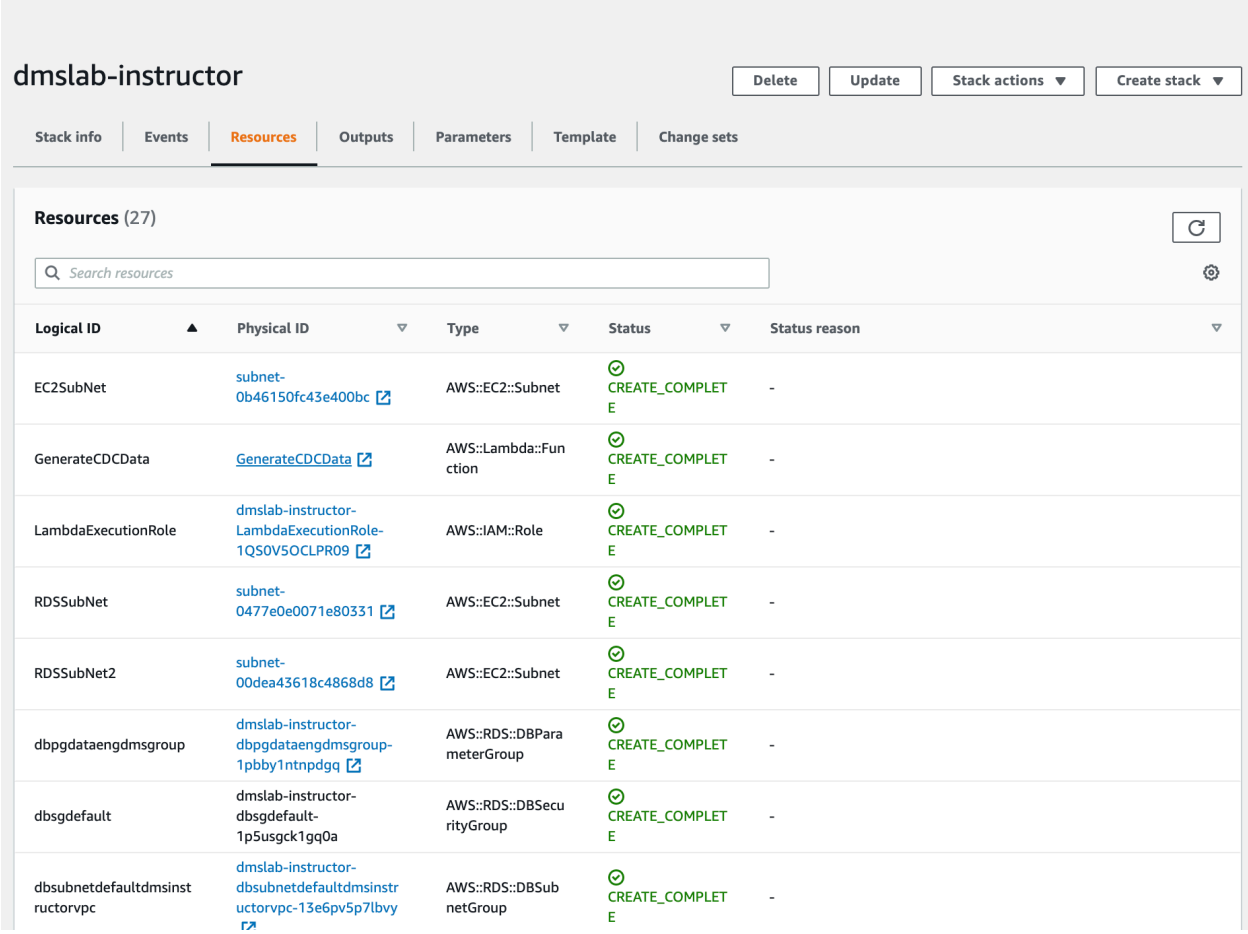
2. Under **Capabilities** select the checkbox for "**I acknowledge that AWS CloudFormation might create IAM resources**" and select "**Create stack**".



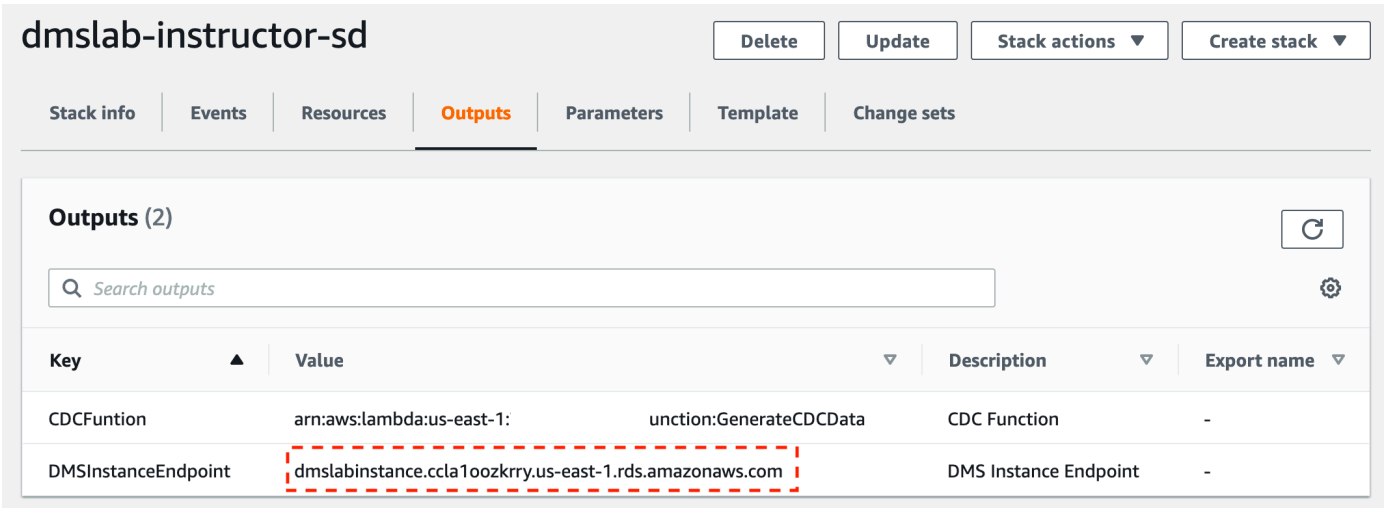
It may take 15 minutes for the stack to launch.
This stack creates a new VPC, Subnets, Security groups, EC2 instance, Route table, Routes, and an RDS Postgres instance.

Warning: make sure the Postgres database is fully populated before proceed to the DMS lab. It takes additional 20 minutes to finish, after the CloudFormation setup is completed.

You can see all resources listed below:



a. Go to the **Outputs** tab of AWS CloudFormation stack and you can find the Postgres RDS database endpoint, which will be similar to information shown in below screenshot



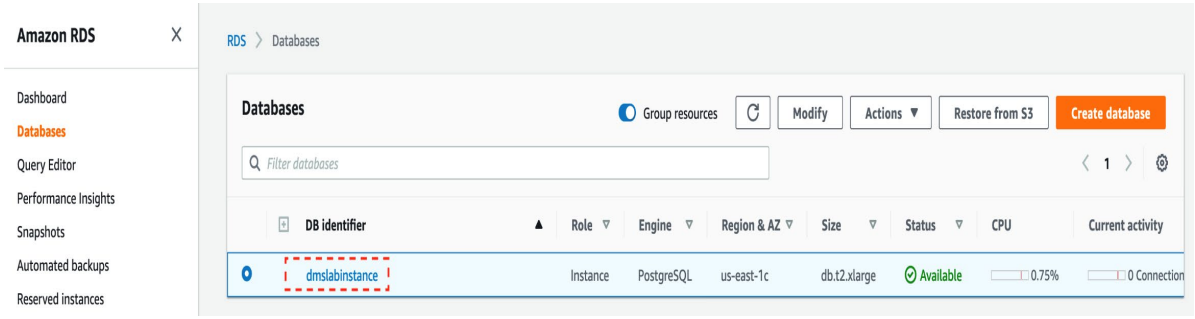
Changing RDS Security Group

Currently your RDS source end point is not open to connect to outside world for security reason. You need to open RDS security group to accept traffic from intended range of IP address. As it is difficult to determine range of IP address of workshop environment, so to have smooth experience of running lab you can temporally allow inbound traffic from all IP address (0.0.0.0/0 CIDR range).

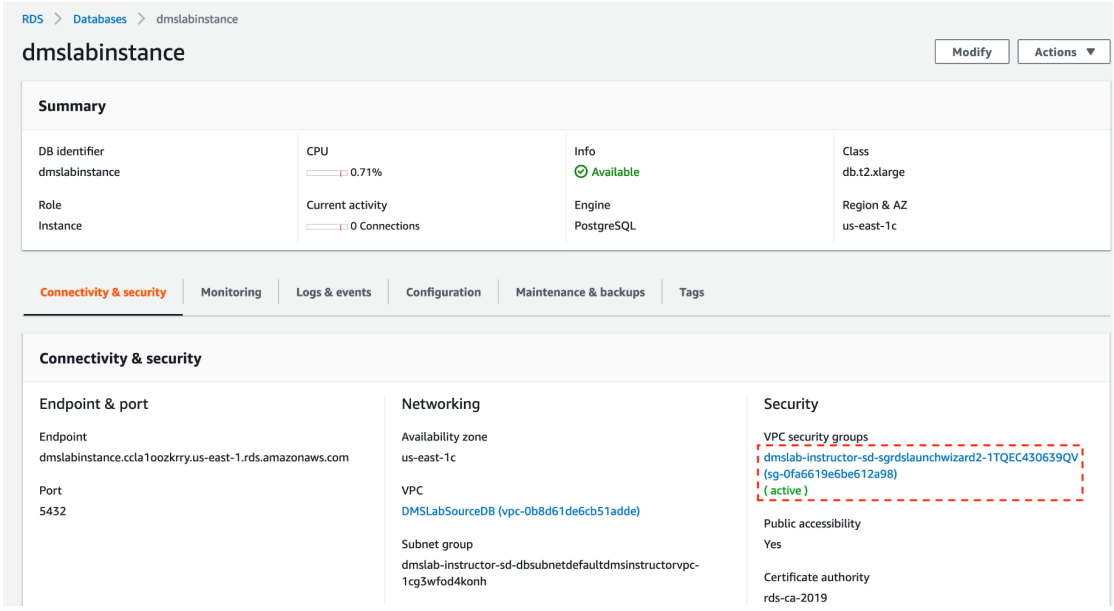
Warning: It is not best practice to allow ALL CIDR range in your database security group. You should never apply open to all IP CIDR range while working on actual workload. If you are in a self-paced workshop, the better secure way is to whitelist an IP address from DMS lab.

Follow below steps to open security group for students to connect with source RDS data base for DMS full data and CDC data dump:

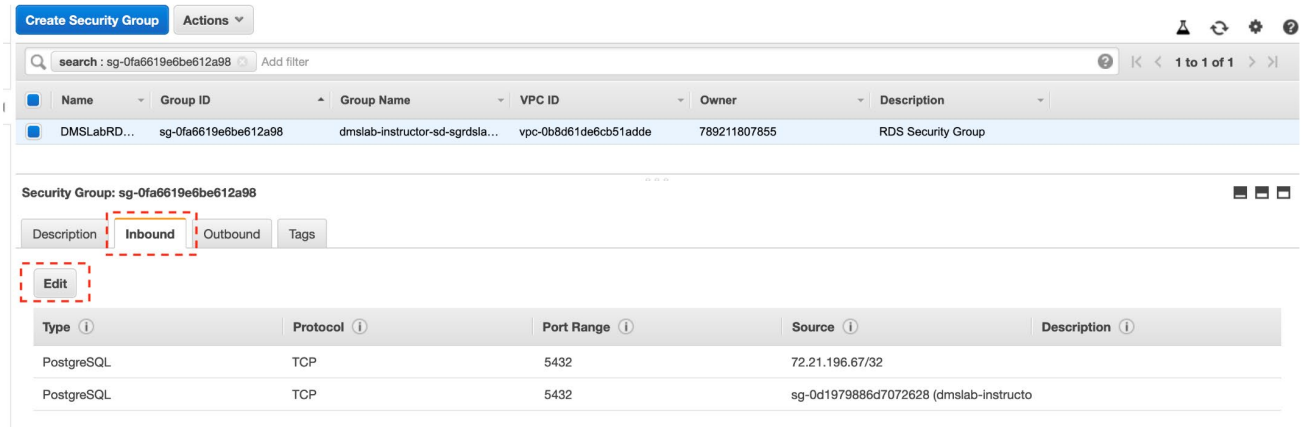
1. Go to the RDS Console and double click on “dmslabinstance” DB identifier as shown below:



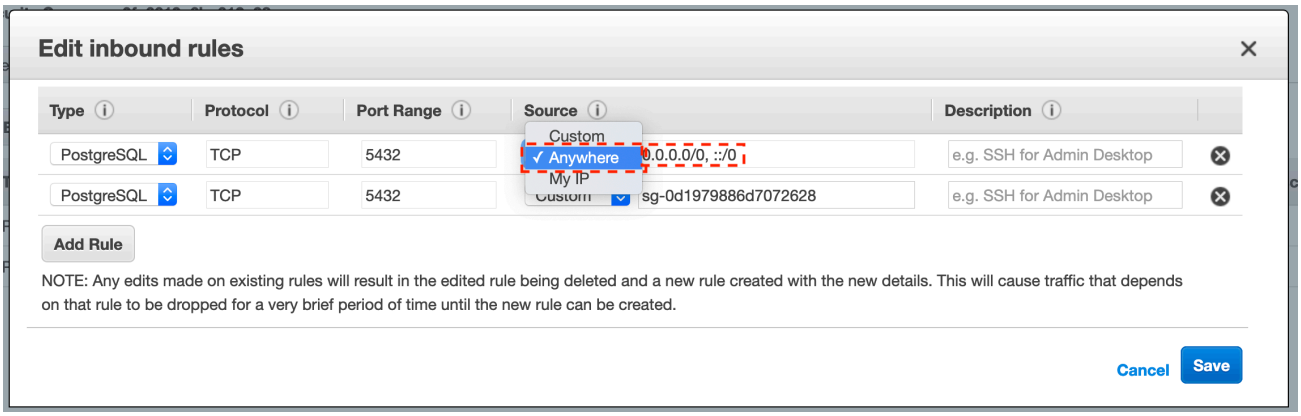
2. Click **VPC security groups** under **Connectivity & security** tab as shown below:



3. In Security group screen, Go to **Inbound** tab and click on **Edit** as shown below

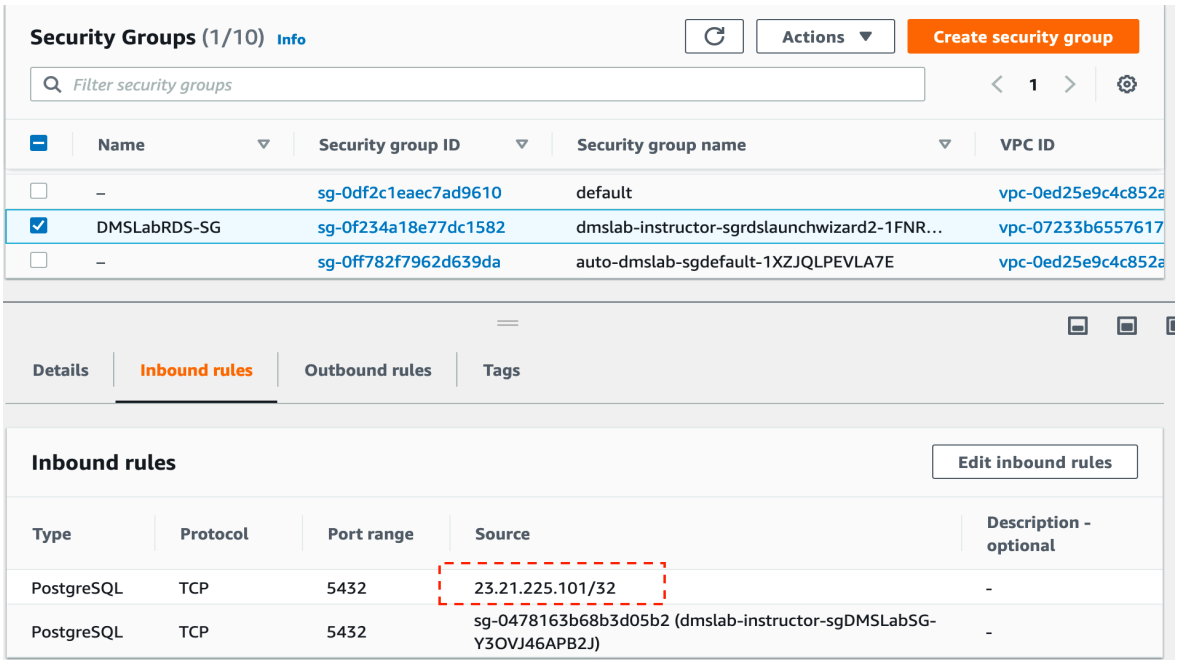


4. Update Inbound rule to “Anywhere” from hard coded value “**10.0.0.5/32**”, as shown in below screen. Make sure to remove the “Anywhere” inbound rule from security group, as soon as you are done with DMS lab.



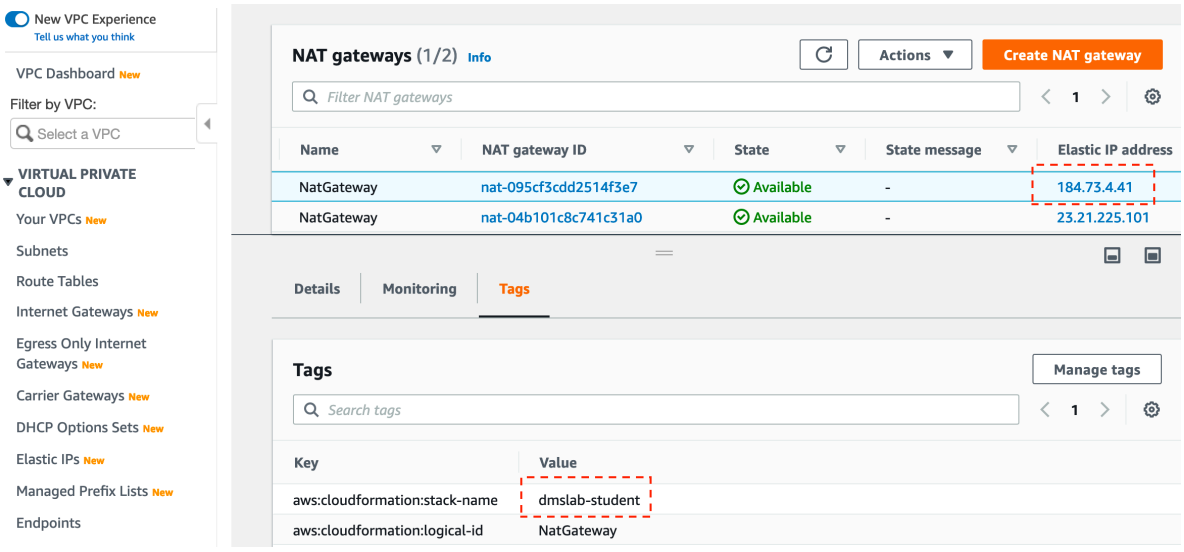
5. If you are in an AWS hosted event, proceed to **step 8**.

6. If you are running both instructor and student labs in a single AWS account, for example in a self-paced environment, replace the “Anywhere” rule by an IP address from student lab instead. In this example, we will allow AutoComplete DMS lab to access the RDS.

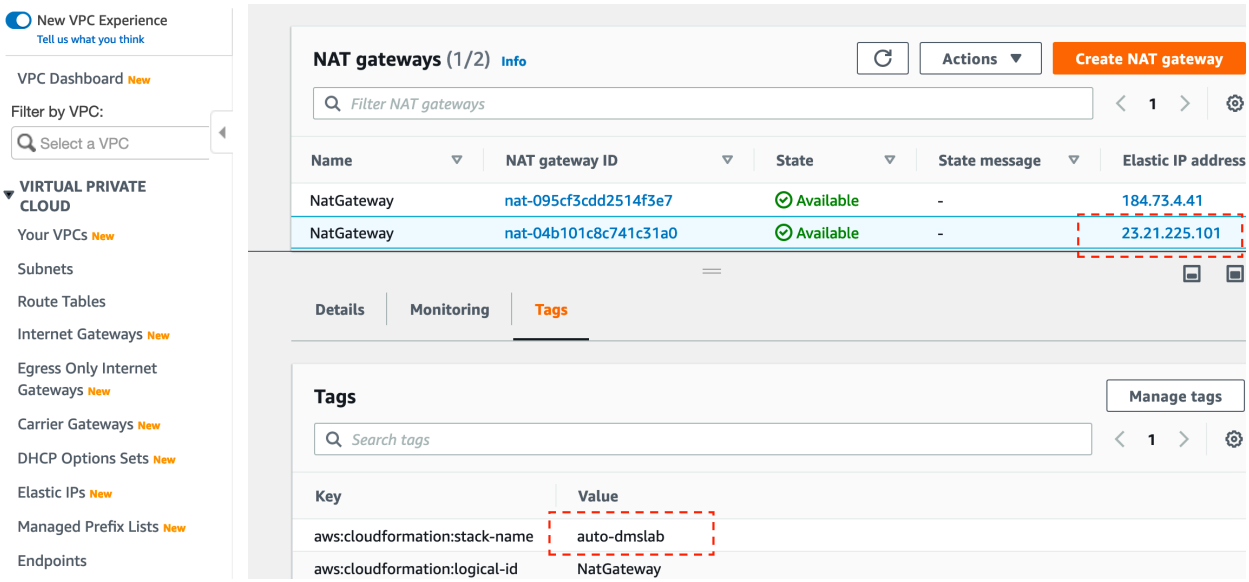


7. Go to VPC NAT gateways Console, and look for the IP address you need to add to the RDS security group.

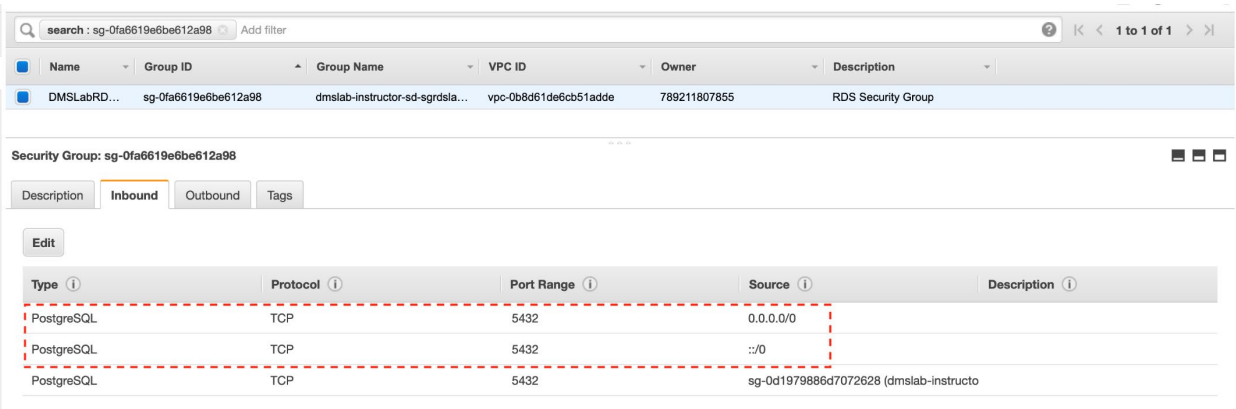
   - If you are running DMS hands-on lab, note down the IP address tagged with "dmslab-student".



   - Or if you are running the AutoComplete DMS Lab, copy the IP address tagged with "auto-dmslab".



8. Click on **Save**. Now everyone will be able to connect to source RDS instance for lab purpose to ingest data using DMS endpoint.



Note: Make sure to remove "Anywhere" inbound rule from security group as soon as you are done with DMS lab.

Optionally, you can read though the documentation to better understand the source database environment. The GitHub repository for aws-database-migration-samples is located here:

https://github.com/aws-samples/aws-database-migration-samples/tree/master/PostgreSQL/sampledb/v1

Access Database from SQL Client (Optional)

You can follow below instruction to setup SQL Workbench to access your Postgres Database from SQL client:

https://aws.amazon.com/getting-started/tutorials/create-connect-postgresql-db/

In SQL Workbench:

Run following query to find out all Schema and table created.

```
SELECT * FROM pg_catalog.pg_tables;
```

Ensure the following 2 functions exists. If anything is missing, check the solution at **Troubleshooting** section.

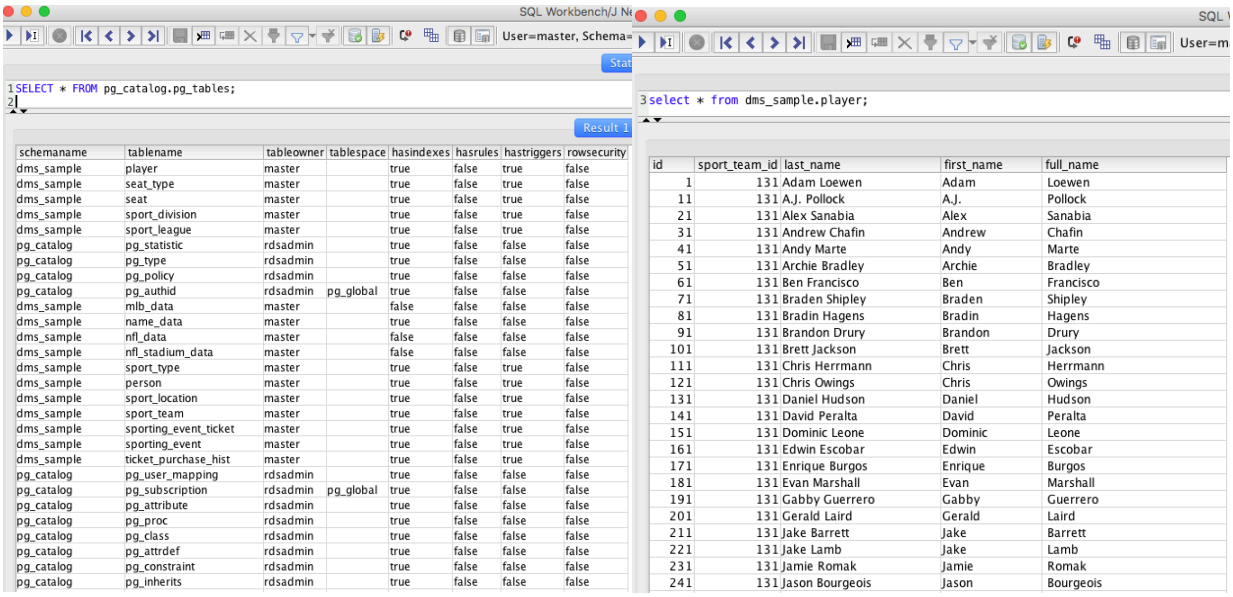
```
SELECT * FROM pg_stat_user_functions
WHERE funcname in ('generateticketactivity','generatetransferactivity')
```

Use following query to analyze a table

```
select * from schemaname.tablename;
```

For example:

```
select * from dms_sample.player;
```



schemaname	tablename	tableowner	tablespace	hasindexes	hasrules	hastriggers	rowsecurity
dms_sample	player	master		true	false	true	false
dms_sample	seat_type	master		true	false	true	false
dms_sample	seat	master		true	false	true	false
dms_sample	sport_division	master		true	false	true	false
dms_sample	sport_league	master		true	false	true	false
pg_catalog	pg_statistic	rdsadmin		true	false	false	false
pg_catalog	pg_type	rdsadmin		true	false	false	false
pg_catalog	pg_policy	rdsadmin		true	false	false	false
pg_catalog	pg_authid	rdsadmin	pg_global	true	false	false	false
dms_sample	mlb_data	master		false	false	false	false
dms_sample	name_data	master		true	false	false	false
dms_sample	nfl_data	master		false	false	false	false
dms_sample	nfl_stadium_data	master		false	false	false	false
dms_sample	sport_type	master		true	false	true	false
dms_sample	person	master		true	false	true	false
dms_sample	sport_location	master		true	false	true	false
dms_sample	sport_team	master		true	false	true	false
dms_sample	sporting_event_ticket	master		true	false	true	false
dms_sample	sporting_event	master		true	false	true	false
dms_sample	ticket_purchase_hist	master		true	false	true	false
pg_catalog	pg_user_mapping	rdsadmin		true	false	false	false
pg_catalog	pg_subscription	rdsadmin	pg_global	true	false	false	false
pg_catalog	pg_attribute	rdsadmin		true	false	false	false
pg_catalog	pg_proc	rdsadmin		true	false	false	false
pg_catalog	pg_class	rdsadmin		true	false	false	false
pg_catalog	pg_attrdef	rdsadmin		true	false	false	false
pg_catalog	pg_constraint	rdsadmin		true	false	false	false
pg_catalog	pg_inherits	rdsadmin		true	false	false	false

id	sport_team_id	last_name	first_name	full_name
1	131	Adam Loewen	Adam	Loewen
11	131	A.J. Pollock	A.J.	Pollock
21	131	Alex Sanabia	Alex	Sanabia
31	131	Andrew Chafin	Andrew	Chafin
41	131	Andy Marte	Andy	Marte
51	131	Archie Bradley	Archie	Bradley
61	131	Ben Francisco	Ben	Francisco
71	131	Braden Shipley	Braden	Shipley
81	131	Bradin Hagens	Bradin	Hagens
91	131	Brandon Drury	Brandon	Drury
101	131	Brett Jackson	Brett	Jackson
111	131	Chris Herrmann	Chris	Herrmann
121	131	Chris Owings	Chris	Owings
131	131	Daniel Hudson	Daniel	Hudson
141	131	David Peralta	David	Peralta
151	131	Dominic Leone	Dominic	Leone
161	131	Edwin Escobar	Edwin	Escobar
171	131	Enrique Burgos	Enrique	Burgos
181	131	Evan Marshall	Evan	Marshall
191	131	Gabby Guerrero	Gabby	Guerrero
201	131	Gerald Laird	Gerald	Laird
211	131	Jake Barrett	Jake	Barrett
221	131	Jake Lamb	Jake	Lamb
231	131	Jamie Romak	Jamie	Romak
241	131	Jason Bourgeois	Jason	Bourgeois

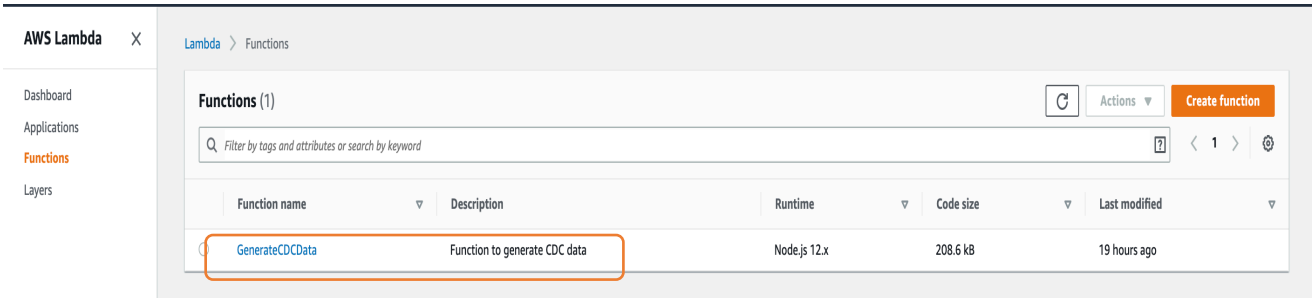
Following sections are optional you only need to execute, if you want to show change data capture replication with DMS.

Generate and Replicate the CDC Data (Optional)

Warning: This step is not required at your initial lab environment setup.

Once the full data replication in DMS lab is completed, you can start to generate extra transactions in source database to demonstrate DMS CDC (Change Data Capture) functionality.

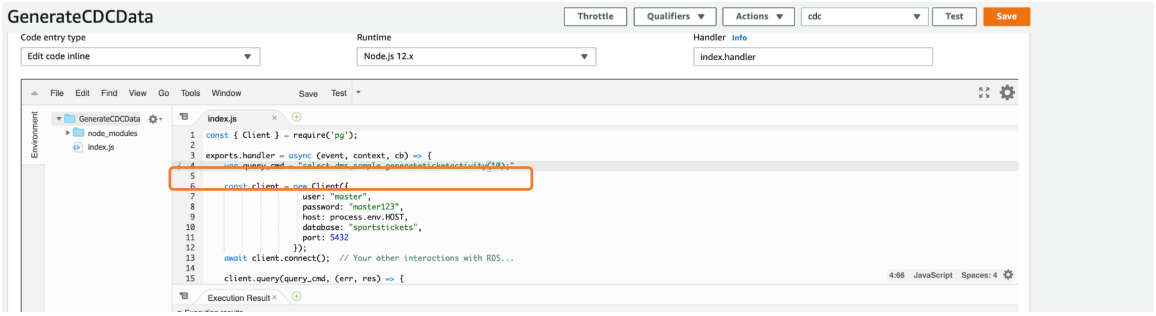
Navigate to Lambda console and you will see a pre-built Lambda function named "**GenerateCDCData**".



1. Click on the function and scroll down. You will see the code for this function. Copy the below query and paste it in the placeholder (value) of this code line:

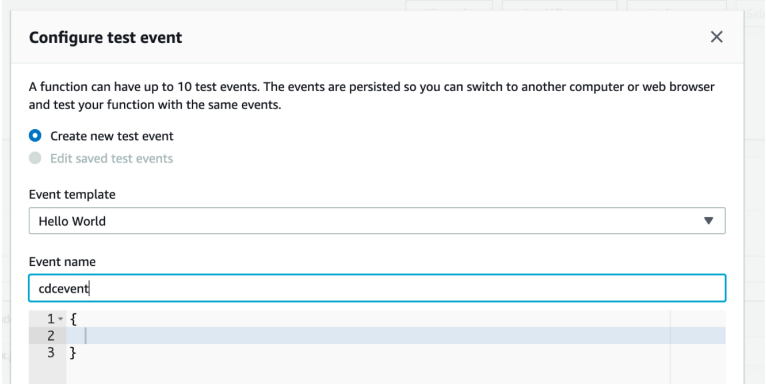
   var query_cmd= "<insert-SQL-query-here>"

2. Run this query first: **select dms_sample.generateticketactivity(10);**

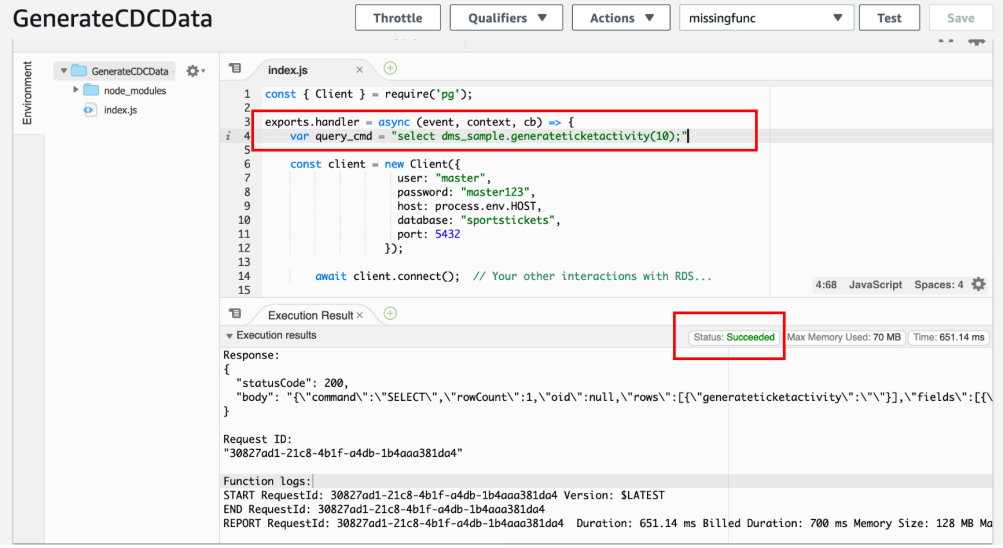


This query will generate 10 ticket sales in batches of 1-6 tickets to randomly selected people for a random price (within a range.) A record of each transaction is recorded in the **ticket_purchase_hist** table.

3. Click on **Save** and then click on **Test** to run the function. You can create an empty event as shown here:



You will see no error in lambda log

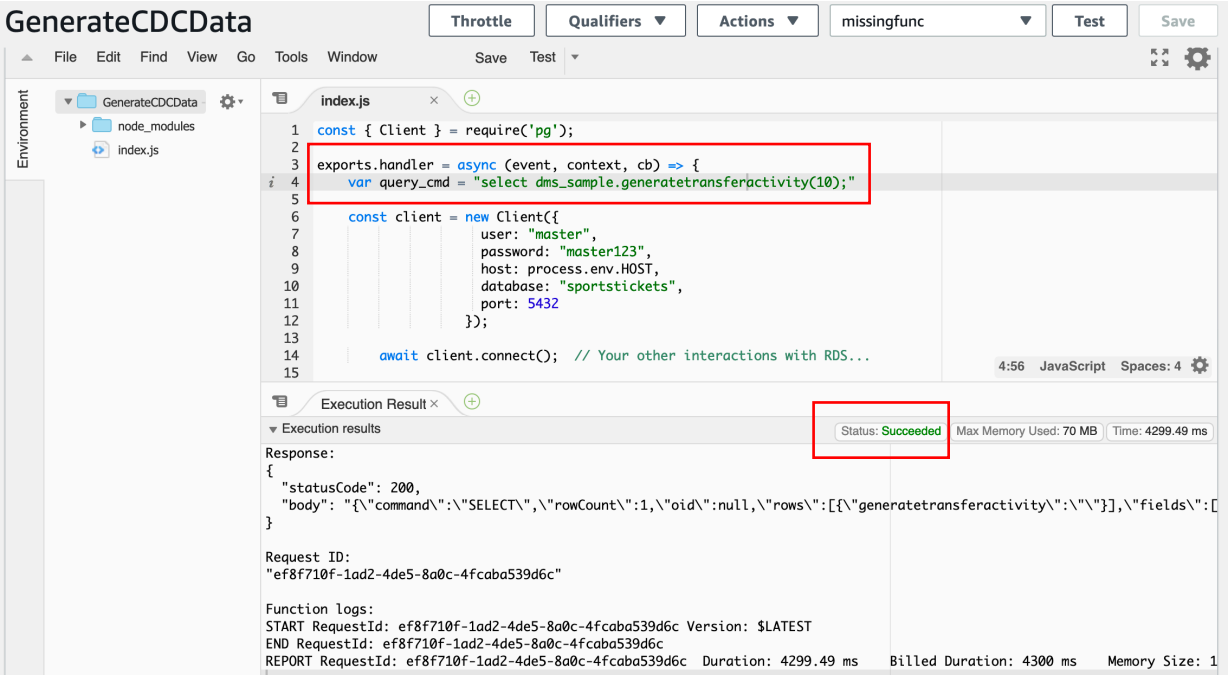


4. Once you've sold some tickets you can run the generateTransferActivity procedure. The following will transfer tickets from the owner to another person. The whole "batch" of tickets purchased is transferred 80% of the time and 20% of the time an individual ticket is transferred.

   Run this query next in the lambda function:

   ```
   select dms_sample.generatetransferactivity(10);
   ```

   Click on **Save** and then click on **Test** to run the function.



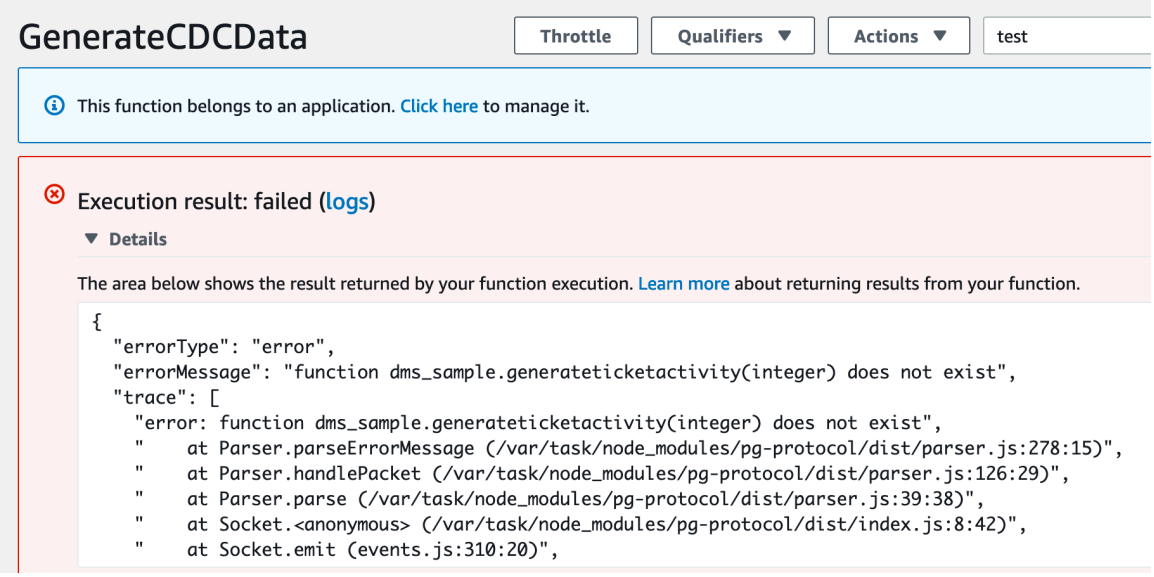
Note:

When enabling CDC functionality in DMS, only one DMS instance/task should activate “Ongoing replication” to avoid conflicts.

When replicating to multiple targets, the processing to fan out the updates should begin with the Amazon S3 bucket, that is the target of the DMS task responsible for Ongoing replication. The process should not begin with the source database, as only one CDC process should be tracking and setting the last committed transaction that was replicated.

Troubleshooting

1. Failed to run Lambda function '**GenerateCDCData'**.



Cause

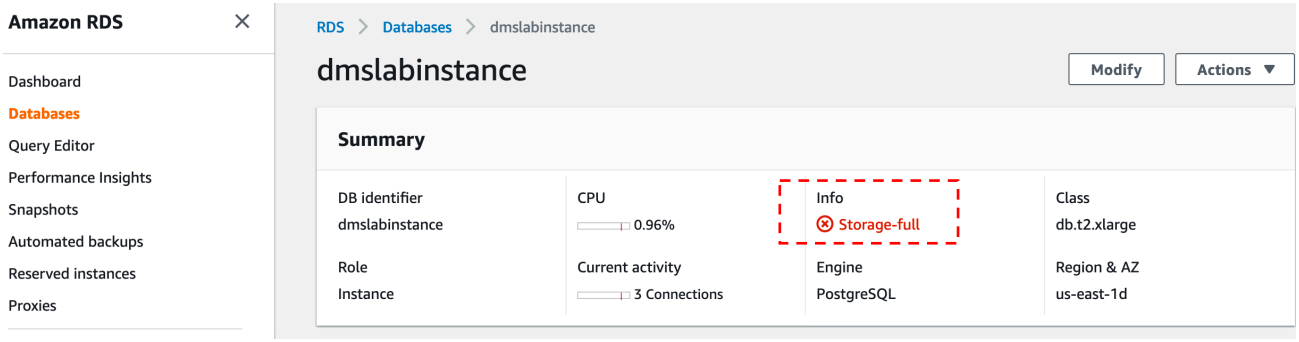
The source database setup is interrupted. Some database objects, such as the function **generateticketactivity()** is missing.

Resolution

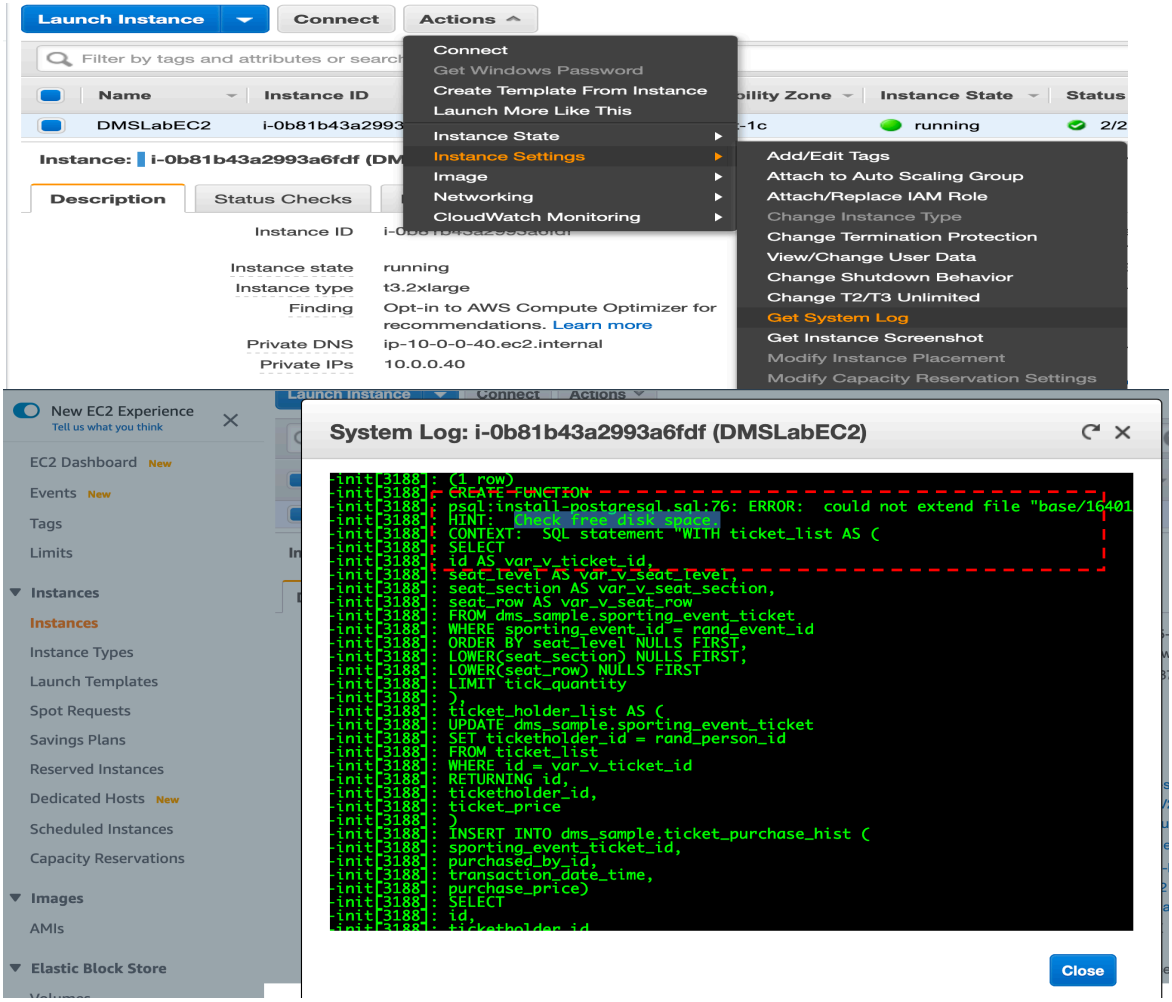
Go to EC2 console, reboot the instance **DMSLabEC2**. It will reload the DB and create any objects that were missing. Due to the re-run issue, the table sporting_event_ticket will be doubled in size at each reboot. You can manually drop the table by the following script before each reboot. Then wait for 20 minutes before checking the missing DB object again.

```
DROP TABLE dms_sample. sporting_event_ticket CASCADE
```

2. RDS source database is **out of storage** space.



Or you may see 'No Space left on device' error from DMSLabEC2 system log



Cause

Check the knowledge center here

Resolution

Increate the RDS instance disk size, as a quick fix.