Real-time leaderboard with Amazon Aurora Serverless and Amazon ElastiCache- (Snapshots of the steps)

Services used:

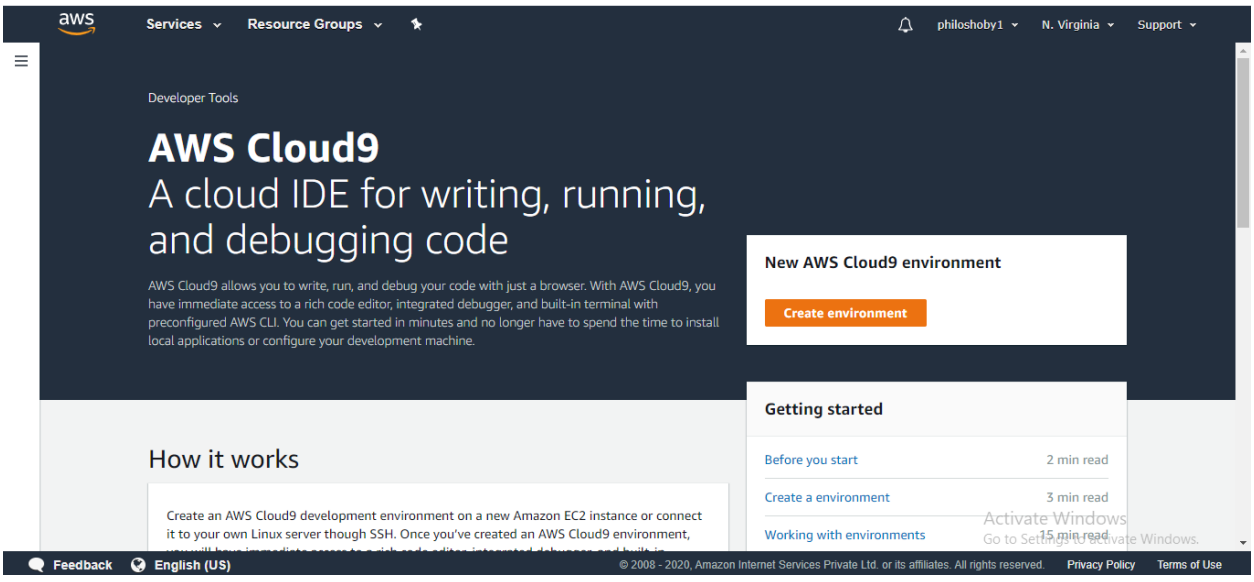
- Amazon Aurora Serverless for data storage, including the Data API for HTTP-based database access from your Lambda function.
- AWS Secrets Manager for storing your database credentials when using the Data API.
- Amazon ElastiCache for data storage of global leaderboards, using the Redis engine and Sorted Sets to store your leaderboards.
- Amazon Cognito for user registration and authentication.
- AWS Lambda for compute.
- Amazon API Gateway for HTTP-based access to your Lambda function.

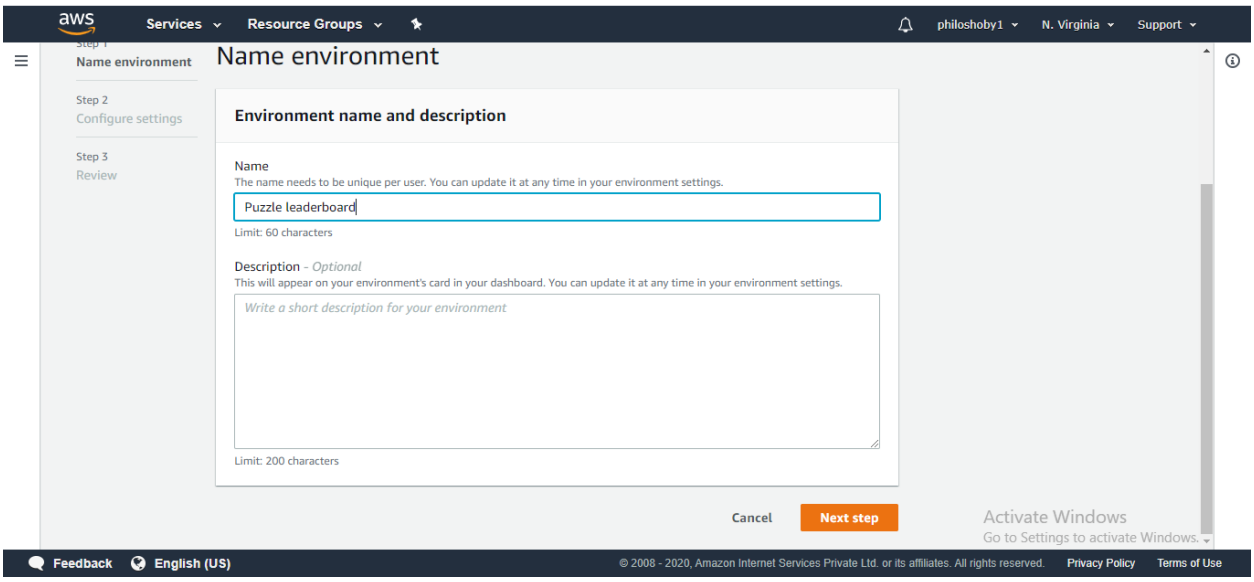
Utilities used :

- First, you start with a Registration endpoint, where a new user signs up and creates their account.
- Second, you use a Login endpoint where a user can use a client (such as a web application or a mobile app) to authenticate and receive an ID token.
- Third, you use a AddUserScore endpoint to record a score for a user.
- Fourth, you use the FetchUserScores endpoint to retrieve the top scores for a particular user.
- Finally, you use the FetchTopScores endpoint to retrieve the global top scores for the current day and month as well as the top scores of all time.

Steps:

Create Cloud9 Environment:




aws
Services
Resource Groups
philoshoby1
N. Virginia
Support
Name environment
Step 2
Configure settings
Step 3
Review
Name environment
Environment name and description
Name
The name needs to be unique per user. You can update it at any time in your environment settings.
Puzzle leaderboard
Limit: 60 characters
Description - Optional
This will appear on your environment's card in your dashboard. You can update it at any time in your environment settings.
Write a short description for your environment
Limit: 200 characters
Cancel
Next step
Activate Windows
Go to Settings to activate Windows.
Feedback
English (US)
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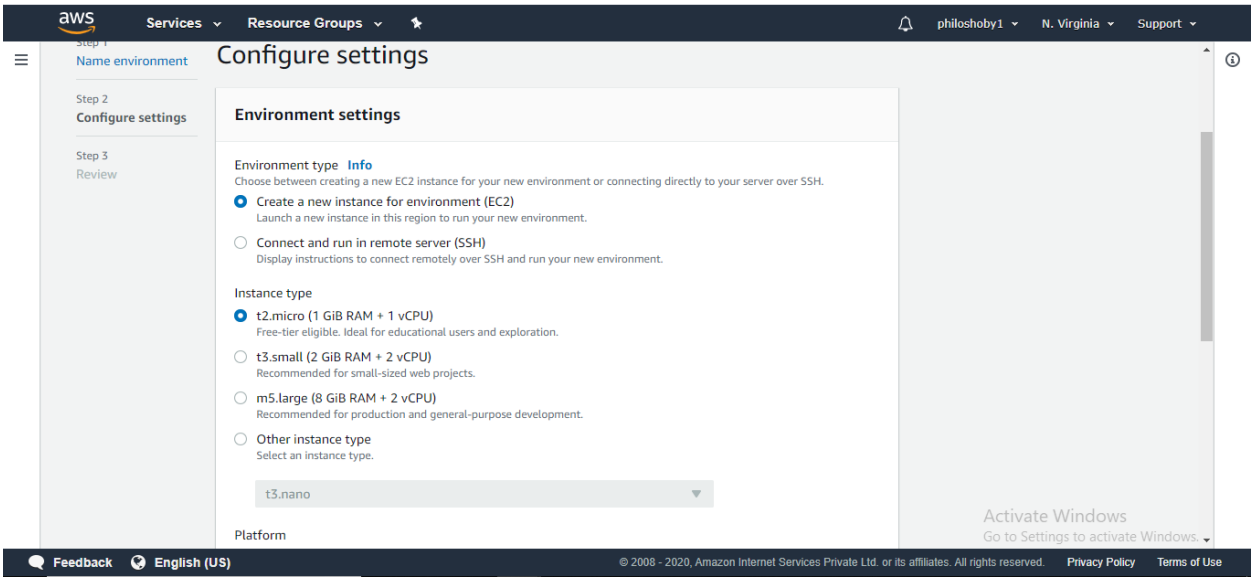
Privacy Policy
Terms of Use


aws
Services
Resource Groups
philoshoby1
N. Virginia
Support
Name environment
Step 2
Configure settings
Step 3
Review
Configure settings
Environment settings
Environment type Info
Choose between creating a new EC2 instance for your new environment or connecting directly to your server over SSH.
Create a new instance for environment (EC2)
Launch a new instance in this region to run your new environment.
Connect and run in remote server (SSH)
Display instructions to connect remotely over SSH and run your new environment.
Instance type
t2.micro (1 GiB RAM + 1 vCPU)
Free-tier eligible. Ideal for educational users and exploration.
t3.small (2 GiB RAM + 2 vCPU)
Recommended for small-sized web projects.
m5.large (8 GiB RAM + 2 vCPU)
Recommended for production and general-purpose development.
Other instance type
Select an instance type.
t3.nano
Platform
Activate Windows
Go to Settings to activate Windows.
Feedback
English (US)
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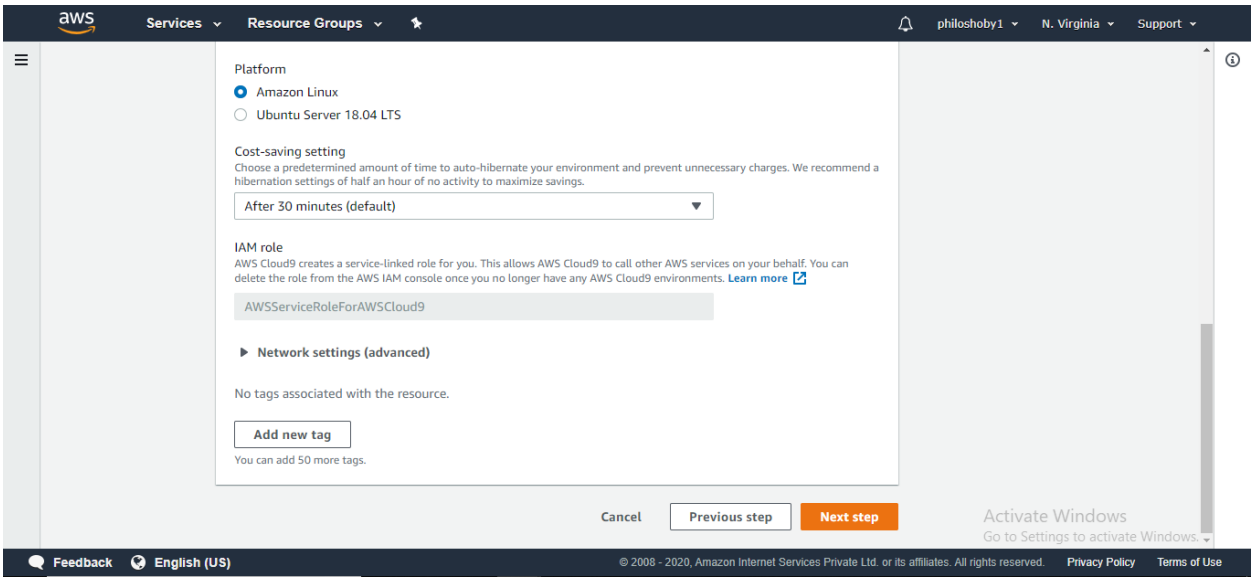
aws
Services
Resource Groups
philoshoby1
N. Virginia
Support
Platform
Amazon Linux
Ubuntu Server 18.04 LTS
Cost-saving setting
Choose a predetermined amount of time to auto-hibernate your environment and prevent unnecessary charges. We recommend a hibernation settings of half an hour of no activity to maximize savings.
After 30 minutes (default)
IAM role
AWS Cloud9 creates a service-linked role for you. This allows AWS Cloud9 to call other AWS services on your behalf. You can delete the role from the AWS IAM console once you no longer have any AWS Cloud9 environments. Learn more
AWSServiceRoleForAWSCloud9
Network settings (advanced)
No tags associated with the resource.
Add new tag
You can add 50 more tags.
Cancel
Previous step
Next step
Activate Windows
Go to Settings to activate Windows.
Feedback
English (US)
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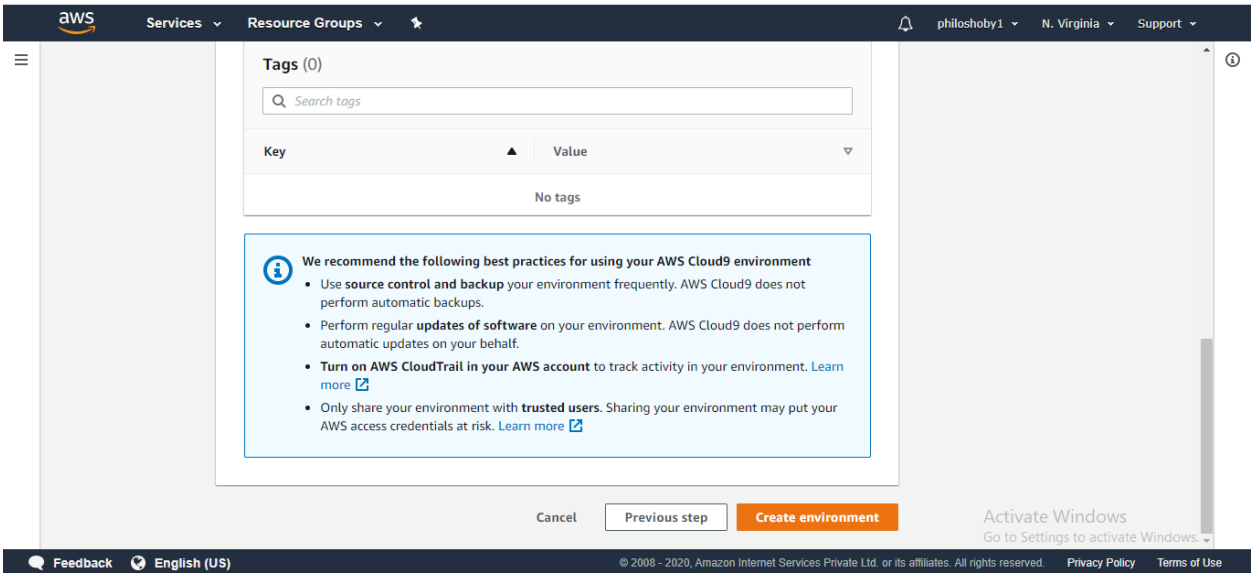
Terms of Use


aws
Services
Resource Groups
philoshoby1
N. Virginia
Support
Tags (0)
Search tags
Key
Value
No tags
We recommend the following best practices for using your AWS Cloud9 environment
Use source control and backup your environment frequently. AWS Cloud9 does not perform automatic backups.
Perform regular updates of software on your environment. AWS Cloud9 does not perform automatic updates on your behalf.
Turn on AWS CloudTrail in your AWS account to track activity in your environment. Learn more
Only share your environment with trusted users. Sharing your environment may put your AWS access credentials at risk. Learn more
Cancel
Previous step
Create environment
Activate Windows
Go to Settings to activate Windows.
Feedback
English (US)
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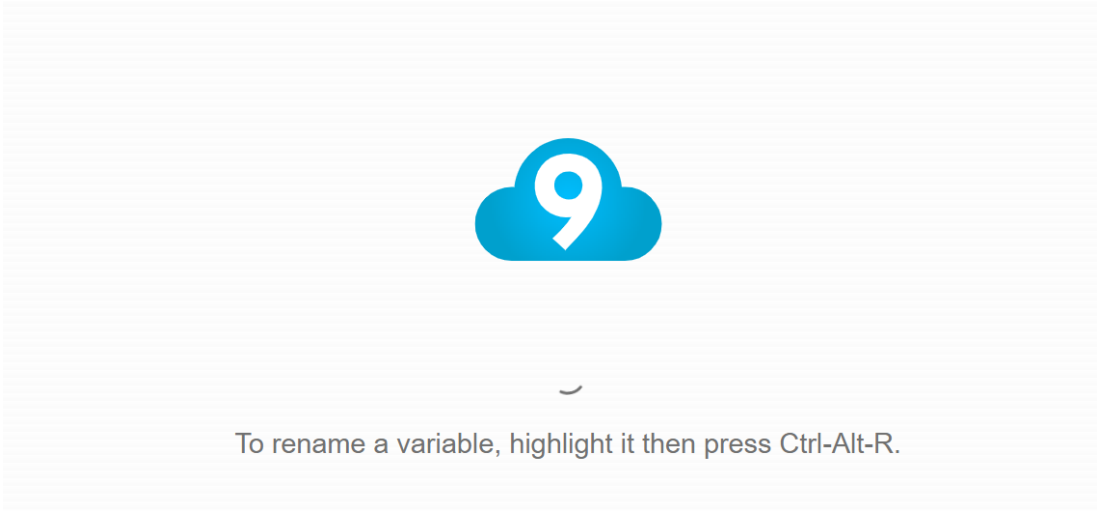
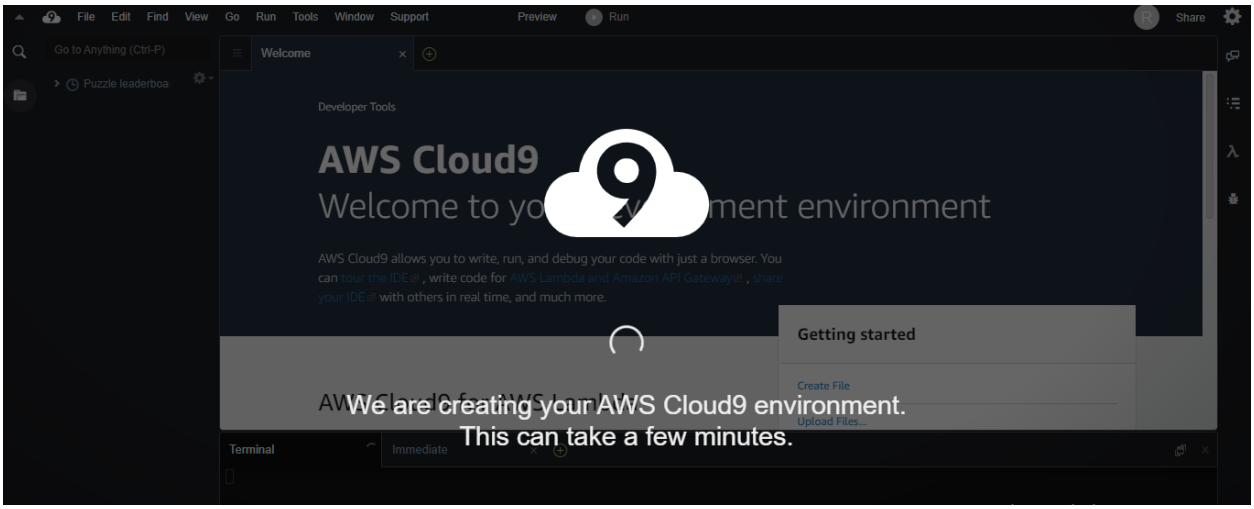
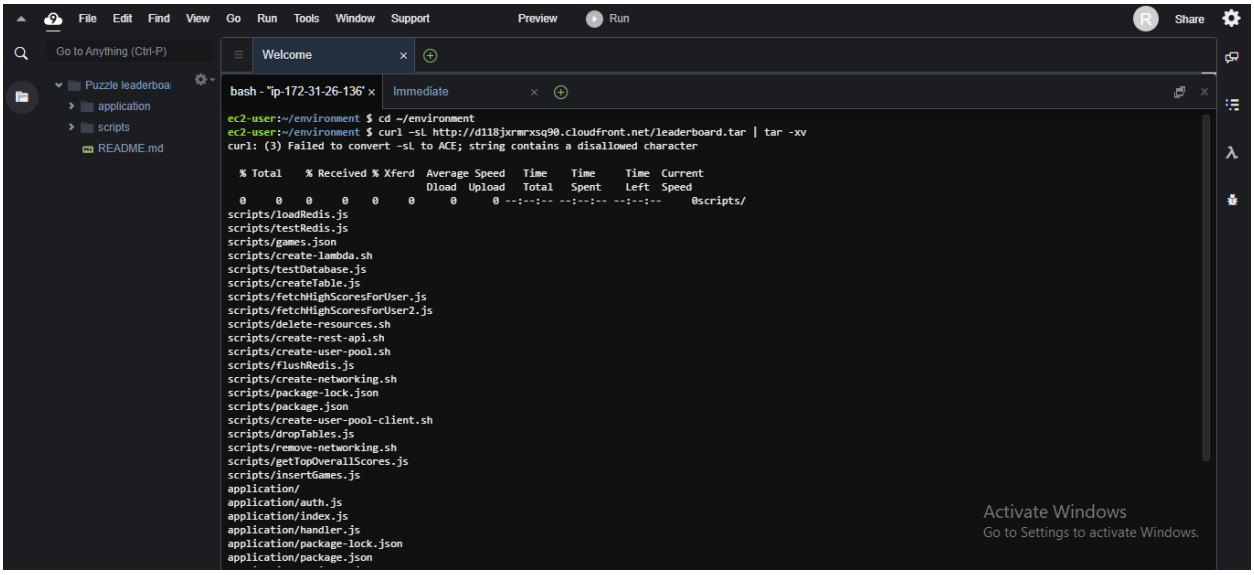
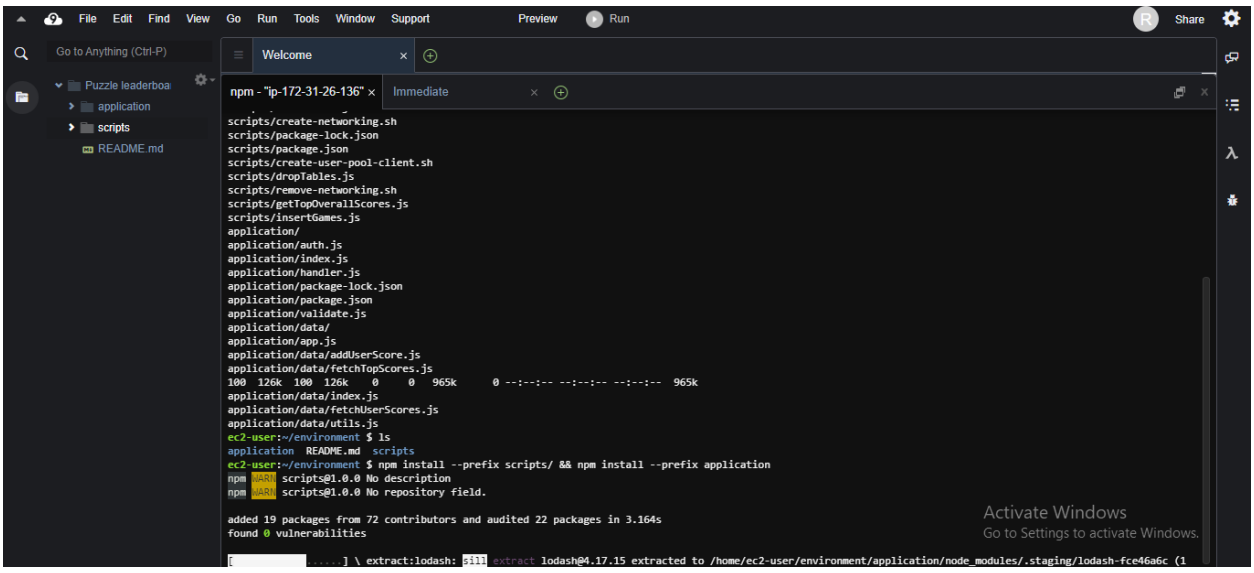
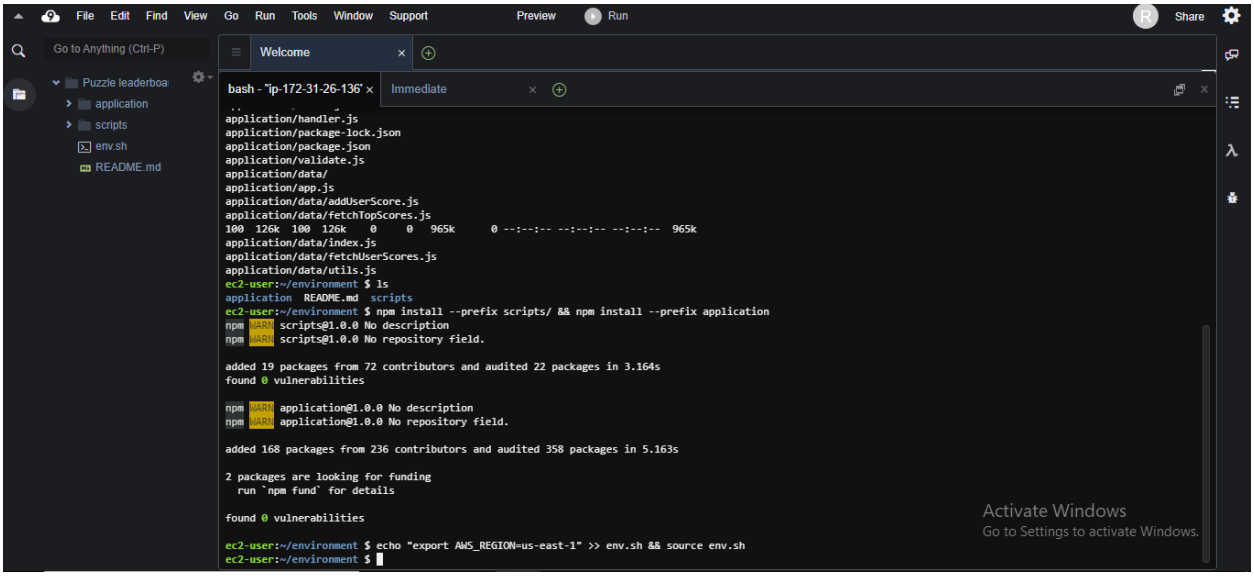

To rename a variable, highlight it then press Ctrl-Alt-R.

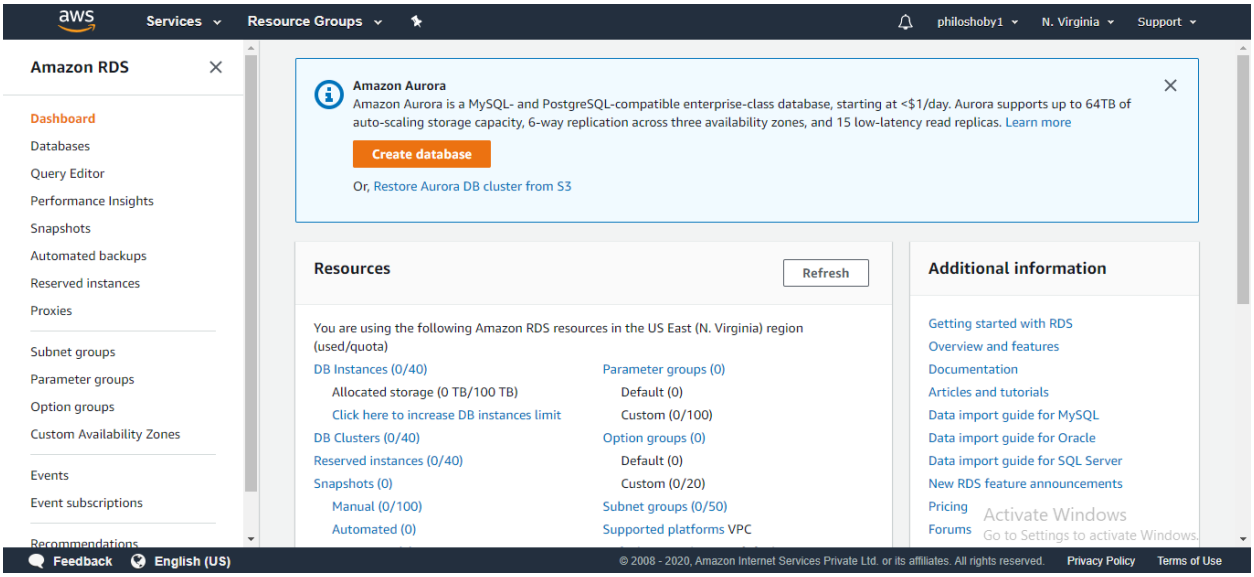

File Edit Find View Go Run Tools Window Support Preview Run Share
Go to Anything (Ctrl-P)
Welcome
Developer Tools
AWS Cloud9
Welcome to your development environment
AWS Cloud9 allows you to write, run, and debug your code with just a browser. You can tour the IDE, write code for AWS Lambda and Amazon API Gateway, share your IDE with others in real time, and much more.
Getting started
Create File
Upload Files...
We are creating your AWS Cloud9 environment.
This can take a few minutes.
Terminal
Immediate

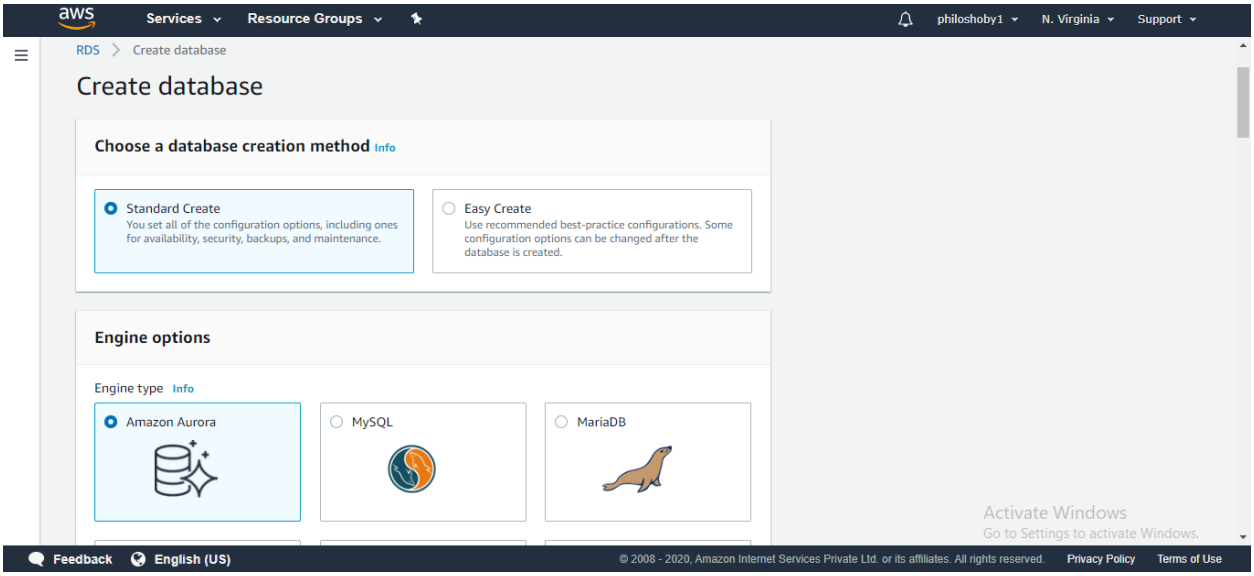

File Edit Find View Go Run Tools Window Support Preview Run Share
Go to Anything (Ctrl-P)
Welcome
Puzzle leaderboa
application
scripts
README.md
bash - "ip-172-31-26-136"
Immediate
ec2-user:~/environment $ cd ~/environment
ec2-user:~/environment $ curl -sL http://d11&jxrmrxsq90.cloudfront.net/leaderboard.tar | tar -xv
curl: (3) Failed to convert -sL to ACE; string contains a disallowed character
% Total % Received % Xferd Average Speed Time Time Time Current
Dload Upload Total Spent Left Speed
0 0 0 0 0 0 0 0 --:--:-- --:--:-- --:--:-- 0scripts/
scripts/loadRedis.js
scripts/testRedis.js
scripts/games.json
scripts/create-lambda.sh
scripts/testDatabase.js
scripts/createTable.js
scripts/fetchHighScoresForUser.js
scripts/fetchHighScoresForUser2.js
scripts/delete-resources.sh
scripts/create-rest-api.sh
scripts/create-user-pool.sh
scripts/flushRedis.js
scripts/create-networking.sh
scripts/package-lock.json
scripts/package.json
scripts/create-user-pool-client.sh
scripts/dropTables.js
scripts/remove-networking.sh
scripts/getTopOverallScores.js
scripts/insertGames.js
application/
application/auth.js
application/index.js
application/handler.js
application/package-lock.json
application/package.json
Activate Windows
Go to Settings to activate Windows.


File Edit Find View Go Run Tools Window Support Preview Run Share
Go to Anything (Ctrl-P)
Welcome
Puzzle leaderboa
application
scripts
README.md
npm - "ip-172-31-26-136"
Immediate
scripts/create-networking.sh
scripts/package-lock.json
scripts/package.json
scripts/create-user-pool-client.sh
scripts/dropTables.js
scripts/remove-networking.sh
scripts/getTopOverallScores.js
scripts/insertGames.js
application/
application/auth.js
application/index.js
application/handler.js
application/package-lock.json
application/package.json
application/validate.js
application/data/
application/app.js
application/data/addUserScore.js
application/data/fetchTopScores.js
100 126k 100 126k 0 0 965k 0 --:--:-- --:--:-- --:--:-- 965k
application/data/index.js
application/data/fetchUserScores.js
application/data/utils.js
ec2-user:~/environment $ ls
application README.md scripts
ec2-user:~/environment $ npm install --prefix scripts/ && npm install --prefix application
npm WARN scripts@1.0.0 No description
npm WARN scripts@1.0.0 No repository field.
added 19 packages from 72 contributors and audited 22 packages in 3.164s
found 0 vulnerabilities
extract:lodash: sill extract lodash@4.17.15 extracted to /home/ec2-user/environment/application/node_modules/.staging/lodash-fce46a6c (1
Activate Windows
Go to Settings to activate Windows.



Create Amazon Aurora Serverless Database:





Edition

- Amazon Aurora with MySQL compatibility
- Amazon Aurora with PostgreSQL compatibility

Version Info

Aurora (MySQL)-5.6.10a

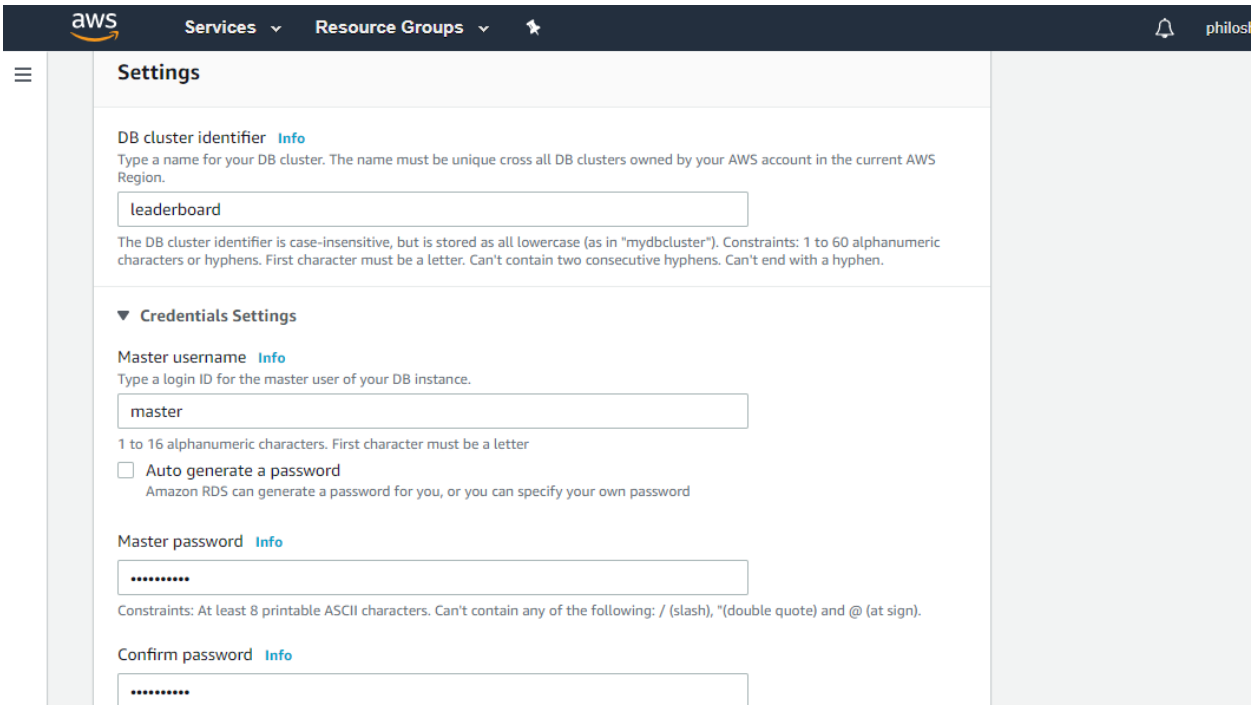
Database features are supported with specific engine versions. Info

Database Location

- Regional
  You provision your Aurora database in a single AWS Region.
- Global
  You can provision your Aurora database in multiple AWS Regions. Writes in the primary AWS Region are replicated with typical latency of less than 1 sec to secondary AWS Regions.

Database features

- ○ **One writer and multiple readers**
  Supports multiple reader instances connected to the same storage volume as a single writer instance. This is a good general-purpose option for most workloads.
- ○ **One writer and multiple readers - Parallel query**
  Improves the performance of analytic queries by pushing processing down to the Aurora storage layer. This is a good option for hybrid transactional/analytic workloads.
- ○ **Multiple writers**
  Supports multiple writer instances connected to the same storage volume. This is a good option for when continuous writer availability is required.
- ◉ **Serverless**
  You specify the minimum and maximum amount of resources needed, and Aurora scales the capacity based on database load. This is a good option for intermittent or unpredictable workloads.



Capacity settings

This billing estimate is based on published prices. **Learn more**

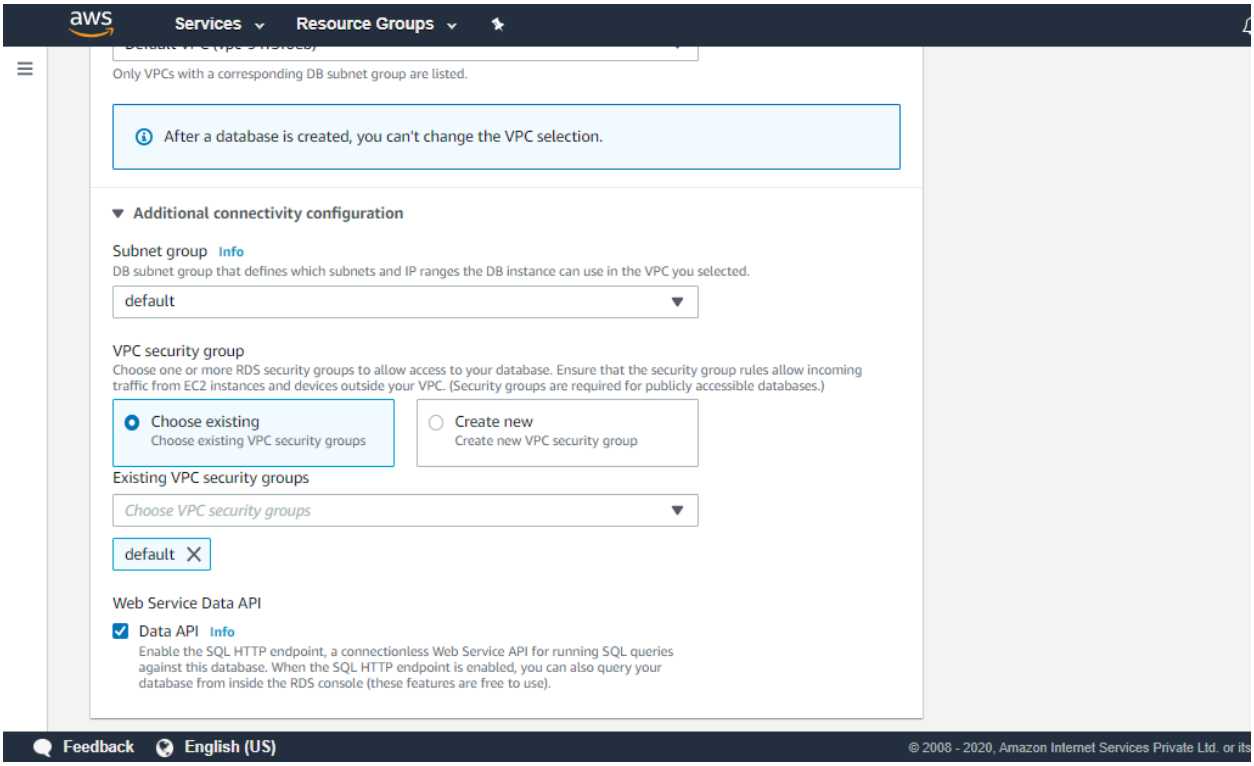
Minimum Aurora capacity unit Info

1
2GB RAM

Maximum Aurora capacity unit Info

1
2GB RAM

▶ **Additional scaling configuration**


aws
Services
Resource Groups
Only VPCs with a corresponding DB subnet group are listed.
After a database is created, you can't change the VPC selection.
Additional connectivity configuration
Subnet group Info
DB subnet group that defines which subnets and IP ranges the DB instance can use in the VPC you selected.
default
VPC security group
Choose one or more RDS security groups to allow access to your database. Ensure that the security group rules allow incoming traffic from EC2 instances and devices outside your VPC. (Security groups are required for publicly accessible databases.)
Choose existing
Choose existing VPC security groups
Create new
Create new VPC security group
Existing VPC security groups
Choose VPC security groups
default
Web Service Data API
Data API Info
Enable the SQL HTTP endpoint, a connectionless Web Service API for running SQL queries against this database. When the SQL HTTP endpoint is enabled, you can also query your database from inside the RDS console (these features are free to use).
Feedback
English (US)
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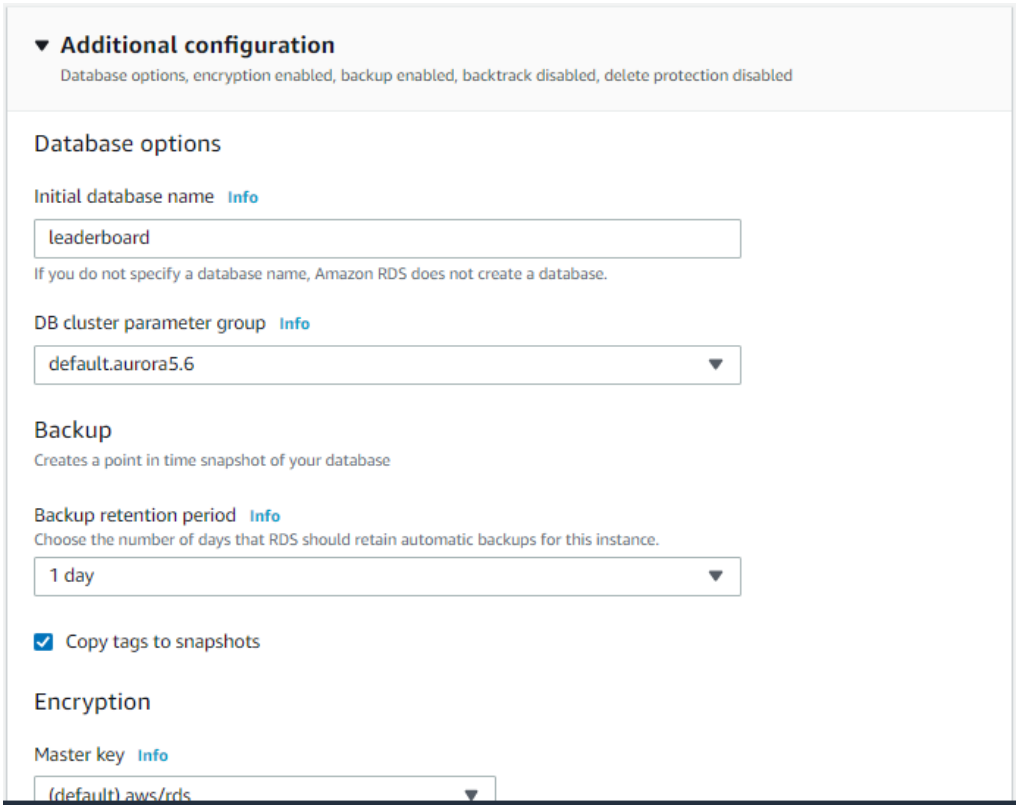
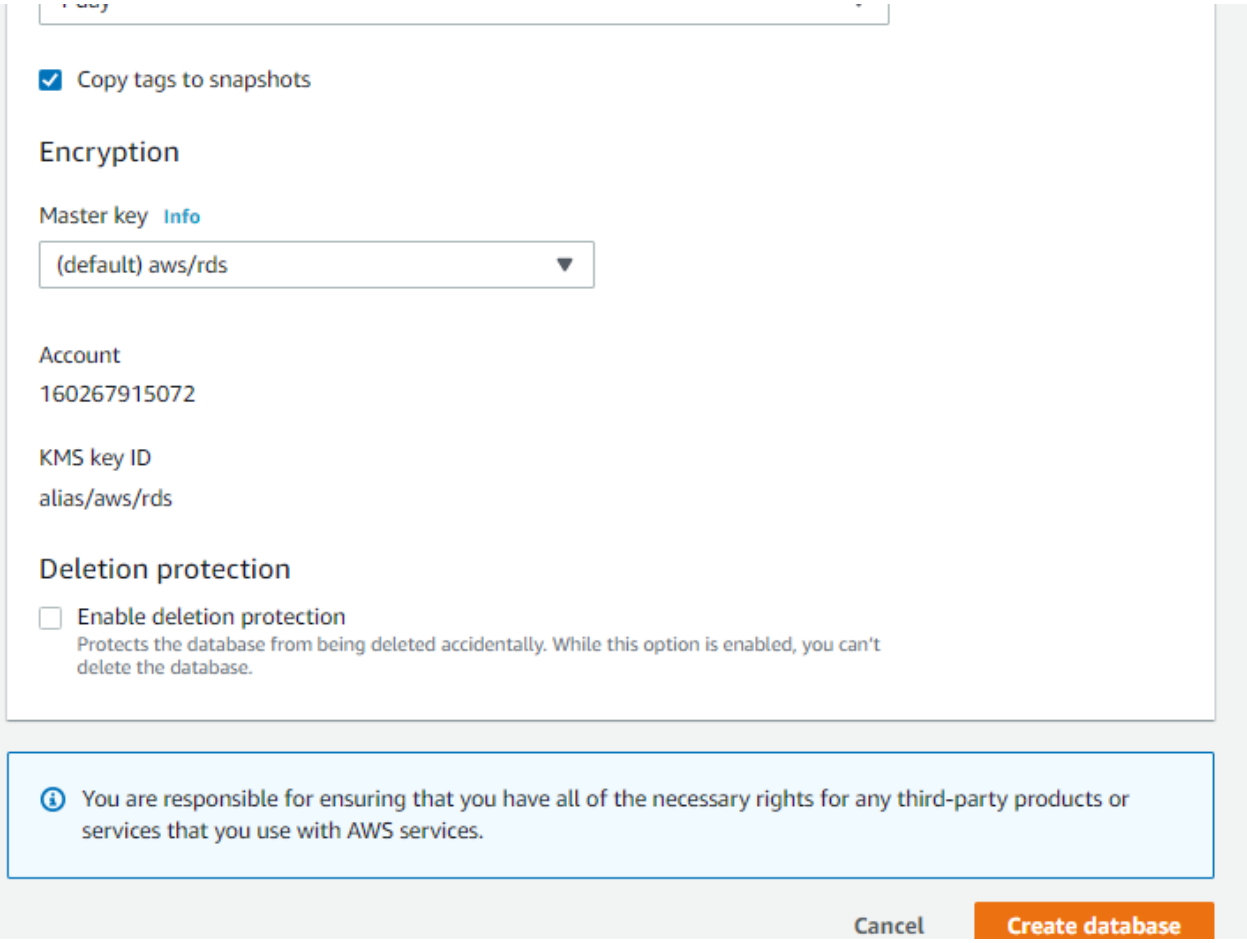
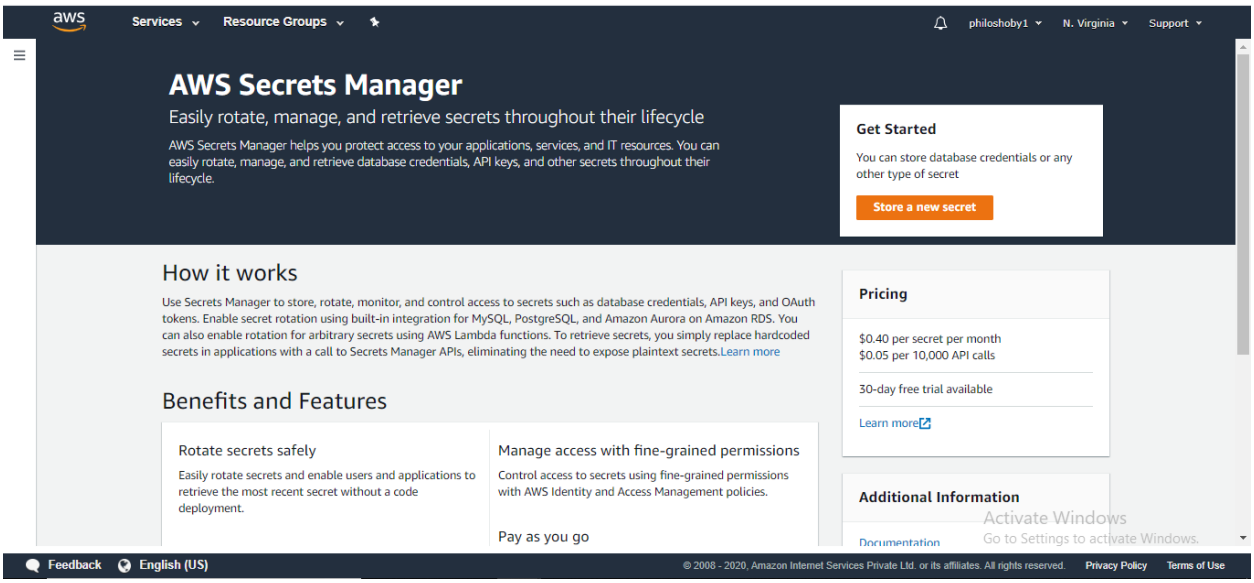
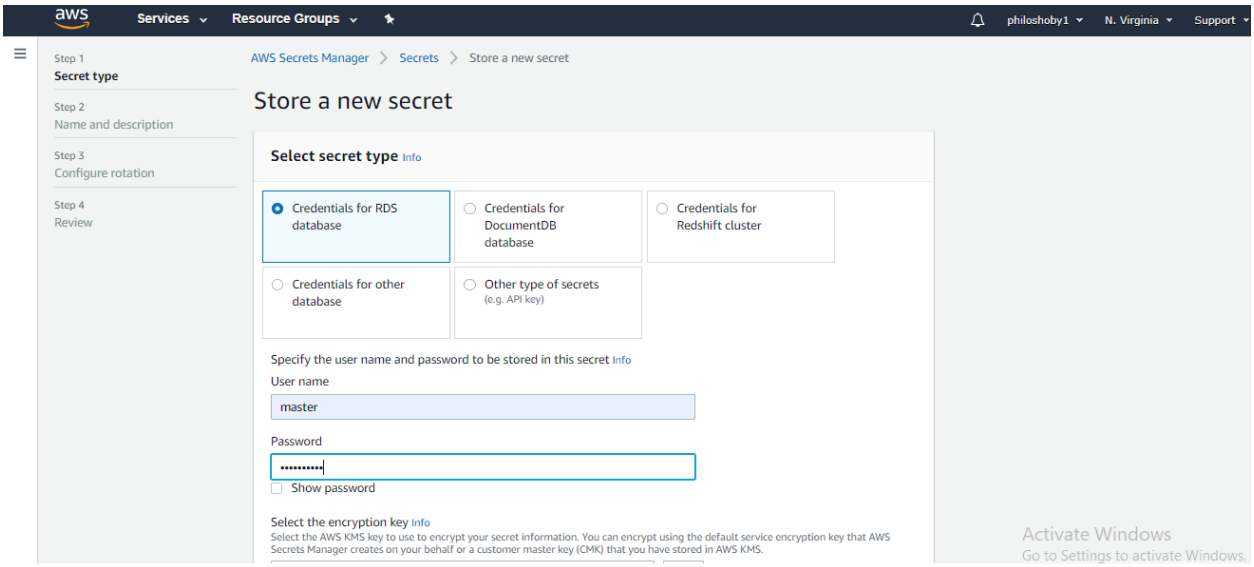
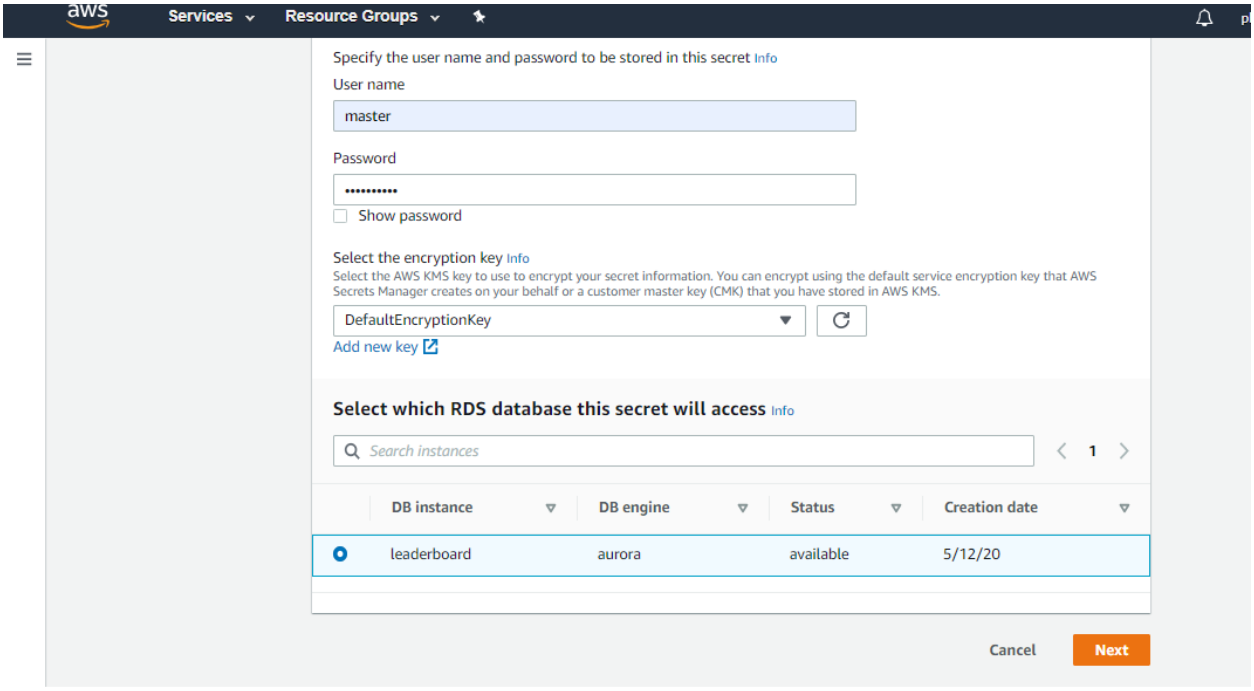

Additional configuration
Database options, encryption enabled, backup enabled, backtrack disabled, delete protection disabled
Database options
Initial database name Info
leaderboard
If you do not specify a database name, Amazon RDS does not create a database.
DB cluster parameter group Info
default.aurora5.6
Backup
Creates a point in time snapshot of your database
Backup retention period Info
Choose the number of days that RDS should retain automatic backups for this instance.
1 day
Copy tags to snapshots
Encryption
Master key Info
(default) aws/rds

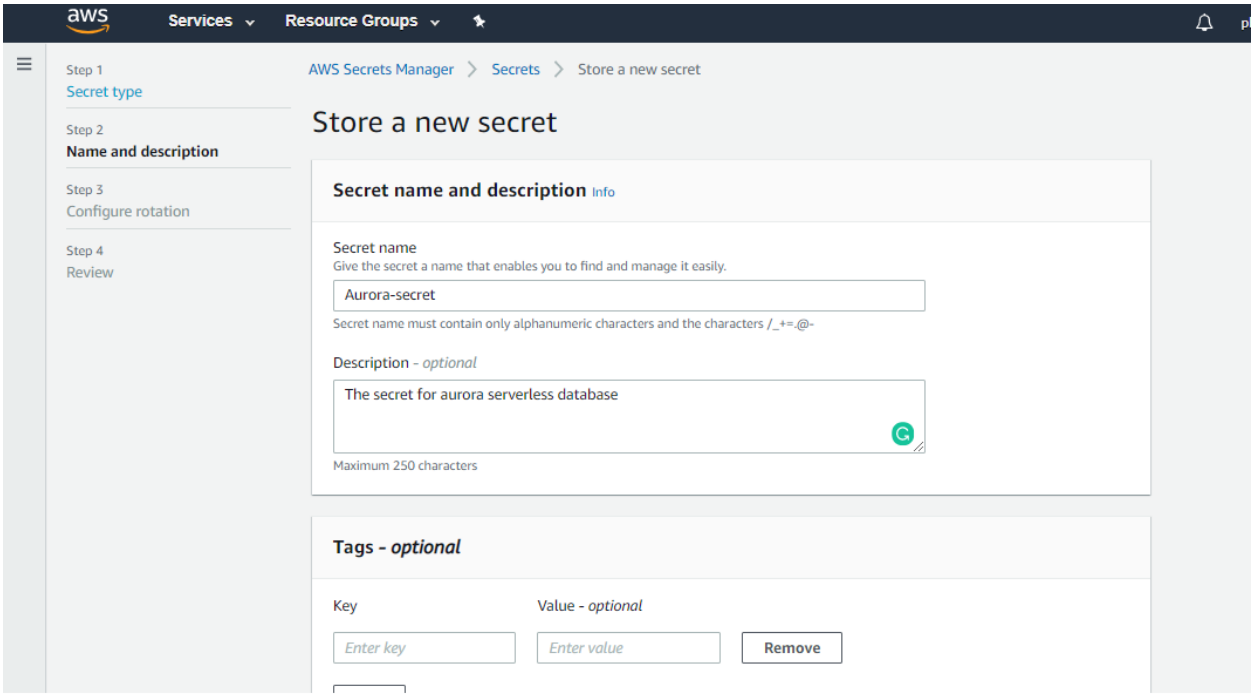


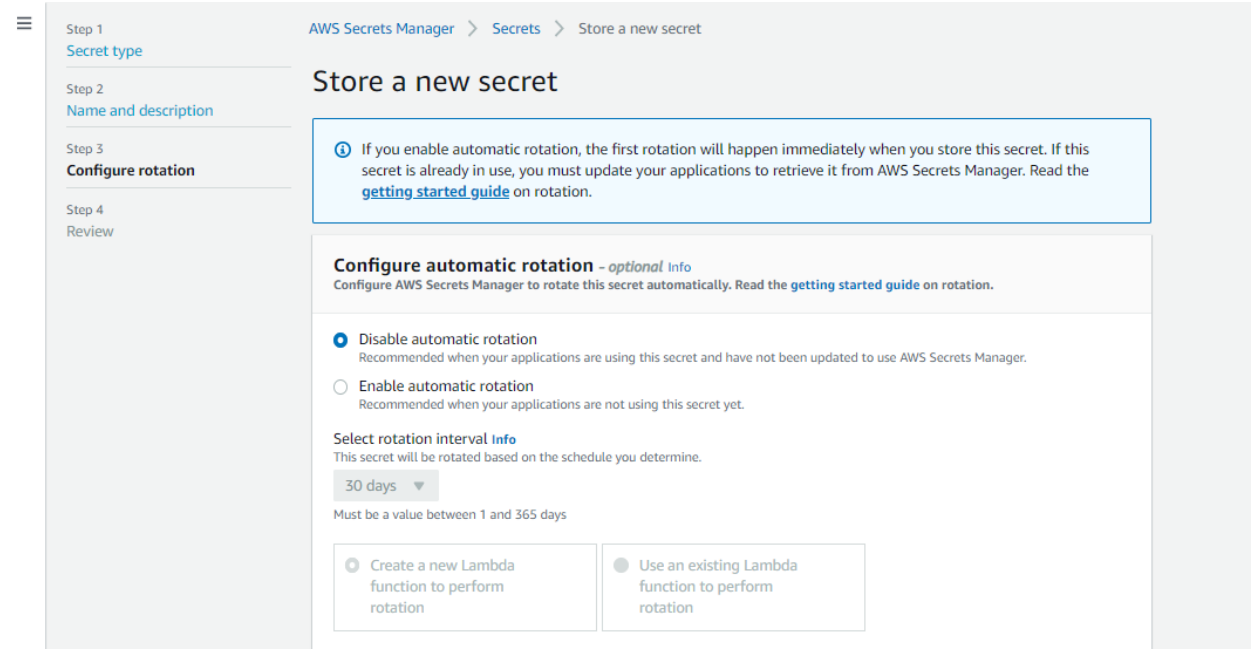
Create Amazon Secret Manager

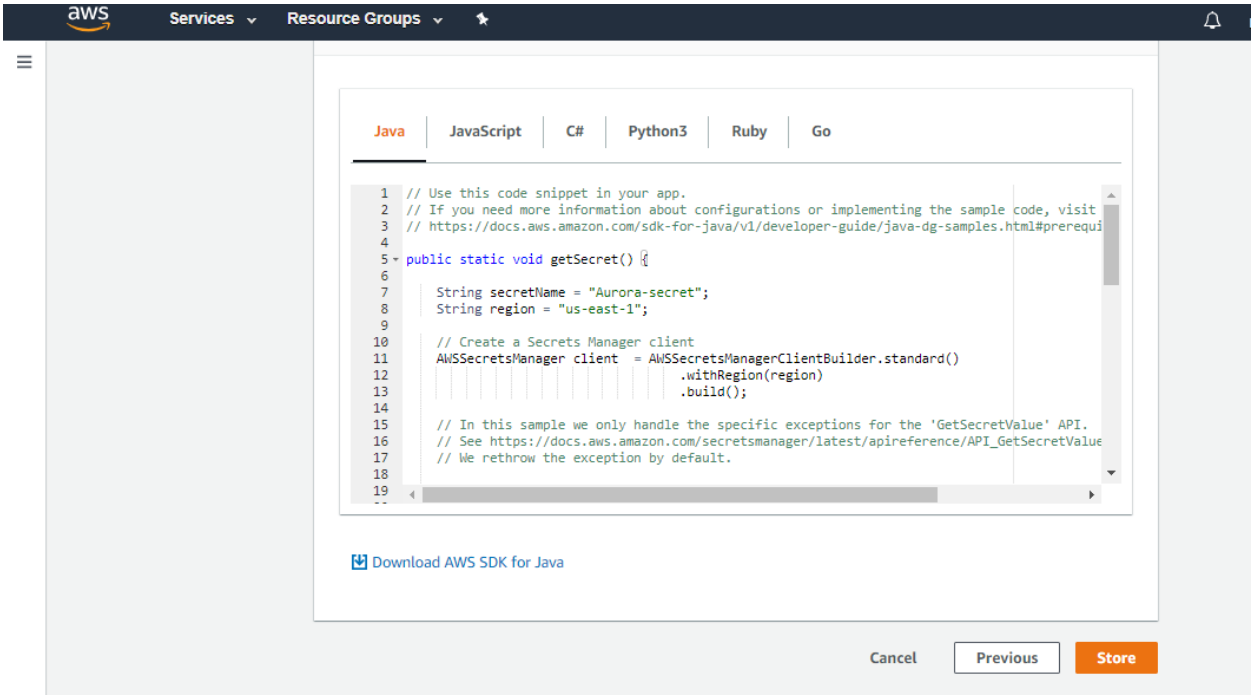


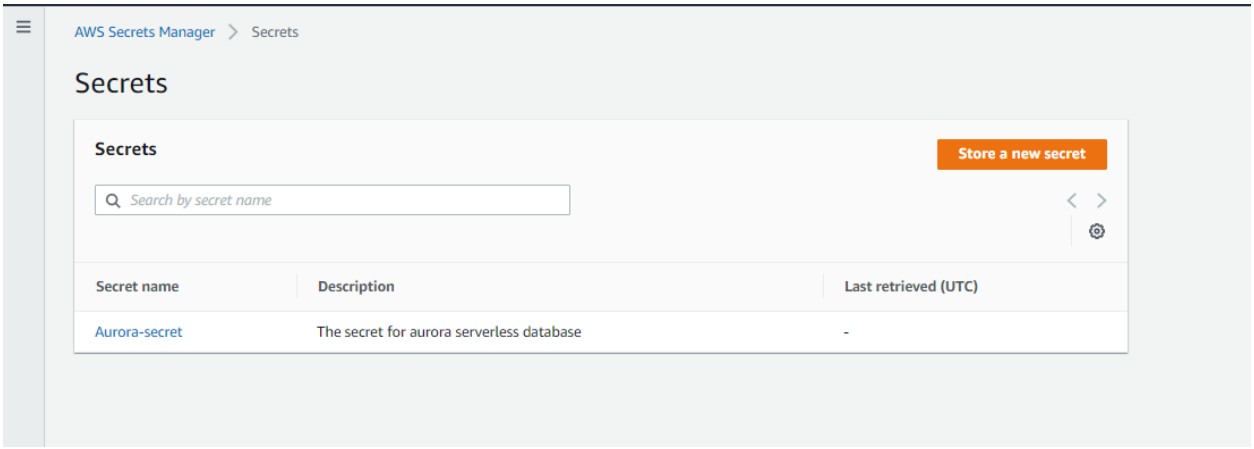

aws
Services
Resource Groups
philoshoby1
N. Virginia
Support
Step 1
Secret type
Step 2
Name and description
Step 3
Configure rotation
Step 4
Review
AWS Secrets Manager > Secrets > Store a new secret
Store a new secret
Select secret type Info
Credentials for RDS database
Credentials for DocumentDB database
Credentials for Redshift cluster
Credentials for other database
Other type of secrets (e.g. API key)
Specify the user name and password to be stored in this secret Info
User name
master
Password
Show password
Select the encryption key Info
Select the AWS KMS key to use to encrypt your secret information. You can encrypt using the default service encryption key that AWS Secrets Manager creates on your behalf or a customer master key (CMK) that you have stored in AWS KMS.
Activate Windows
Go to Settings to activate Windows.

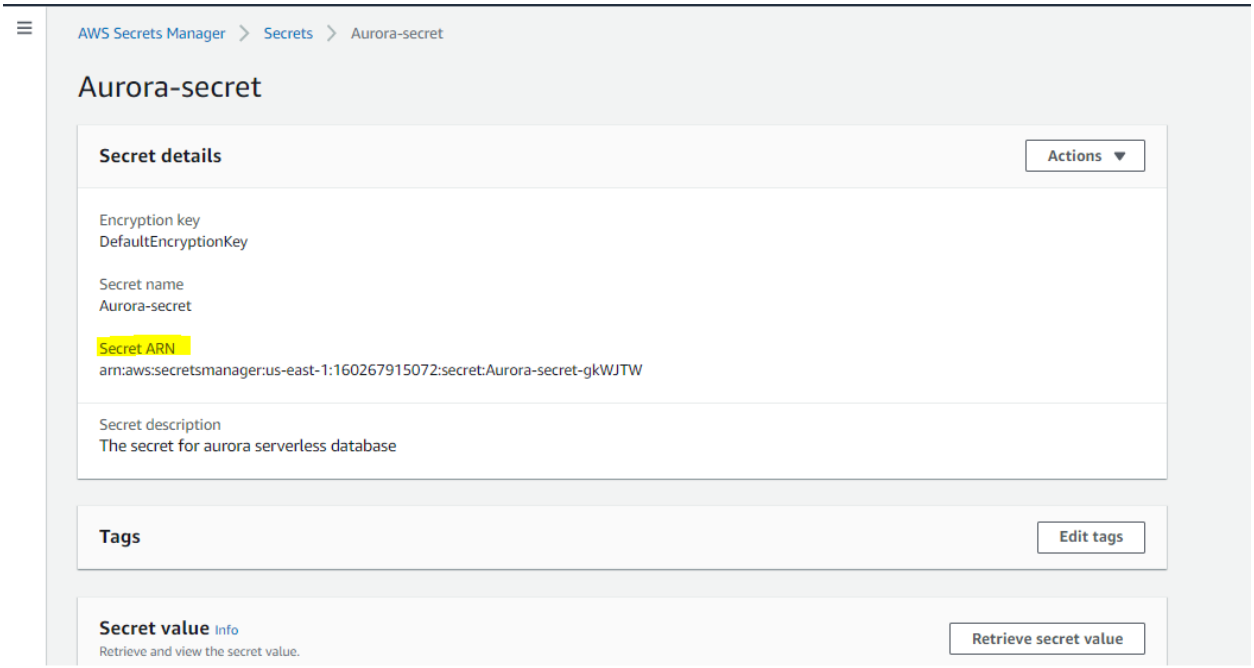

aws
Services
Resource Groups
Specify the user name and password to be stored in this secret Info
User name
master
Password
Show password
Select the encryption key Info
Select the AWS KMS key to use to encrypt your secret information. You can encrypt using the default service encryption key that AWS Secrets Manager creates on your behalf or a customer master key (CMK) that you have stored in AWS KMS.
DefaultEncryptionKey
Add new key
Select which RDS database this secret will access Info
Search instances
1
DB instance
DB engine
Status
Creation date
leaderboard
aurora
available
5/12/20
Cancel
Next

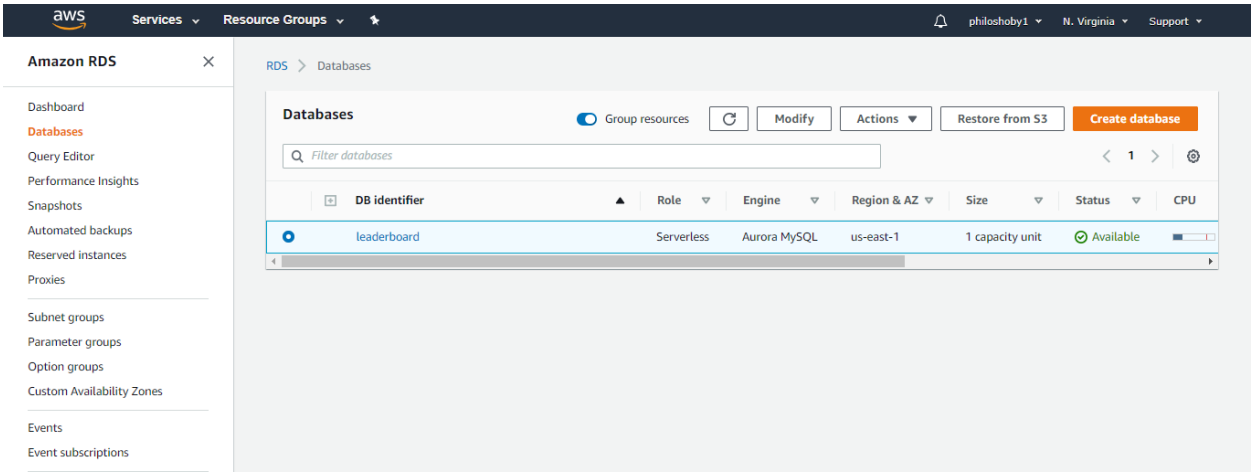

aws
Services
Resource Groups
Step 1
Secret type
Step 2
Name and description
Step 3
Configure rotation
Step 4
Review
AWS Secrets Manager > Secrets > Store a new secret
Store a new secret
Secret name and description Info
Secret name
Give the secret a name that enables you to find and manage it easily.
Aurora-secret
Secret name must contain only alphanumeric characters and the characters /_+=.@-
Description - optional
The secret for aurora serverless database
Maximum 250 characters
Tags - optional
Key
Value - optional
Enter key
Enter value
Remove

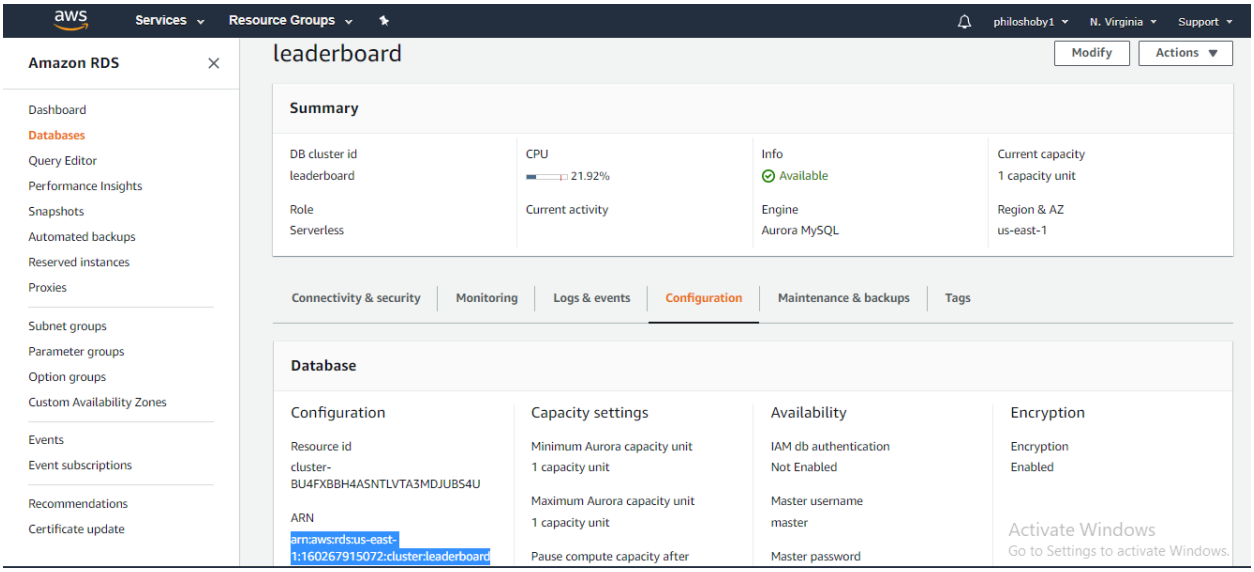

Step 1
Secret type
Step 2
Name and description
Step 3
Configure rotation
Step 4
Review
AWS Secrets Manager > Secrets > Store a new secret
Store a new secret
If you enable automatic rotation, the first rotation will happen immediately when you store this secret. If this secret is already in use, you must update your applications to retrieve it from AWS Secrets Manager. Read the getting started guide on rotation.
Configure automatic rotation - optional Info
Configure AWS Secrets Manager to rotate this secret automatically. Read the getting started guide on rotation.
Disable automatic rotation
Recommended when your applications are using this secret and have not been updated to use AWS Secrets Manager.
Enable automatic rotation
Recommended when your applications are not using this secret yet.
Select rotation interval Info
This secret will be rotated based on the schedule you determine.
30 days
Must be a value between 1 and 365 days
Create a new Lambda function to perform rotation
Use an existing Lambda function to perform rotation


aws
Services
Resource Groups
Java
JavaScript
C#
Python3
Ruby
Go
// Use this code snippet in your app.
// If you need more information about configurations or implementing the sample code, visit
// https://docs.aws.amazon.com/sdk-for-java/v1/developer-guide/java-dg-samples.html#prerequi
public static void getSecret() {
String secretName = "Aurora-secret";
String region = "us-east-1";
// Create a Secrets Manager client
AWSSecretsManager client = AWSSecretsManagerClientBuilder.standard()
.withRegion(region)
.build();
// In this sample we only handle the specific exceptions for the 'GetSecretValue' API.
// See https://docs.aws.amazon.com/secretsmanager/latest/apireference/API_GetSecretValue
// We rethrow the exception by default.
Download AWS SDK for Java
Cancel
Previous
Store


AWS Secrets Manager
Secrets
Secrets
Store a new secret
Search by secret name
Secret name
Description
Last retrieved (UTC)
Aurora-secret
The secret for aurora serverless database
-


AWS Secrets Manager > Secrets > Aurora-secret
Aurora-secret
Secret details
Actions
Encryption key
DefaultEncryptionKey
Secret name
Aurora-secret
Secret ARN
arn:aws:secretsmanager:us-east-1:160267915072:secret:Aurora-secret-gkWJTW
Secret description
The secret for aurora serverless database
Tags
Edit tags
Secret value Info
Retrieve and view the secret value.
Retrieve secret value


aws
Services
Resource Groups
philoshoby1
N. Virginia
Support
Amazon RDS
Dashboard
Databases
Query Editor
Performance Insights
Snapshots
Automated backups
Reserved instances
Proxies
Subnet groups
Parameter groups
Option groups
Custom Availability Zones
Events
Event subscriptions
RDS > Databases
Databases
Group resources
Modify
Actions
Restore from S3
Create database
Filter databases
DB identifier
Role
Engine
Region & AZ
Size
Status
CPU
leaderboard
Serverless
Aurora MySQL
us-east-1
1 capacity unit
Available

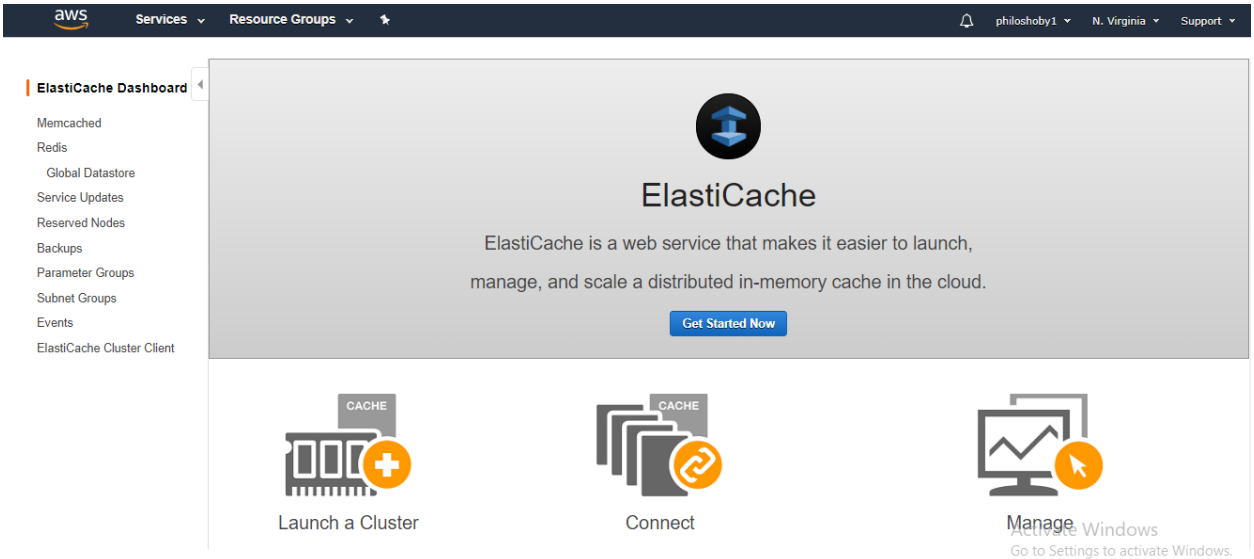



```
ec2-user:~/environment $ echo "export AWS_REGION=us-east-1" >> env.sh && source env.sh
ec2-user:~/environment $ source env.sh
ec2-user:~/environment $ echo "export DATABASE_ARN=arn:aws:rds:us-east-1:160267915072:cluster:leaderboard
> " >> env.sh
ec2-user:~/environment $ echo "export SECRET_ARN=arn:aws:secretsmanager:us-east-1:160267915072:secret:Aurora-secret-gkWJTW" >> env.sh
ec2-user:~/environment $ source env.sh
ec2-user:~/environment $
ec2-user:~/environment $ node scripts/testDatabase.js
{
  "numberOfRecordsUpdated": 0,
  "records": [
    [
      {
        "longValue": 1
      }
    ]
  ]
}
ec2-user:~/environment $
```

```
ec2-user:~/environment $ node scripts/createTable.js
Table created successfully!
ec2-user:~/environment $
```

```
ec2-user:~/environment $ node scripts/insertGames.js
Games inserted successfully!
ec2-user:~/environment $ node scripts/fetchHighScoresForUser.js
{
  "columnMetadata": [
    {
      "arrayBaseColumnType": 0,
      "isAutoIncrement": true,
      "isCaseSensitive": false,
      "isCurrency": false,
      "isSigned": true,
      "label": "game_id",
      "name": "game_id",
      "nullable": 0,
      "precision": 11,
      "scale": 0,
      "schemaName": "",
      "tableName": "games",
      "type": 4,
      "typeName": "INT"
    },
    {
      "arrayBaseColumnType": 0,
      "isAutoIncrement": false,
      "isCaseSensitive": false,
      "isCurrency": false,
      "isSigned": false,
      "label": "username",
      "name": "username",
      "nullable": 0,
      "nullable": 0,
      "precision": 11,
      "scale": 0,
      "schemaName": "",
      "tableName": "games",
      "type": 4,
      "typeName": "INT"
    }
  ],
  "numberOfRecordsUpdated": 0,
  "records": [
    [
      {
        "longValue": 101
      },
      {
        "stringValue": "ubecker"
      },
      {
        "stringValue": "2019-11-06 09:00:37"
      },
      {
        "longValue": 9090
      },
      {
        "longValue": 84
      }
    ]
  ]
}
ec2-user:~/environment $
```

```
ec2-user:~/environment $ node scripts/fetchHighScoresForUser2.js
[
  {
    "game_id": 101,
    "username": "ubecker",
    "gamedate": "2019-11-06 09:00:37",
    "score": 9090,
    "level": 84
  }
]
ec2-user:~/environment $
```



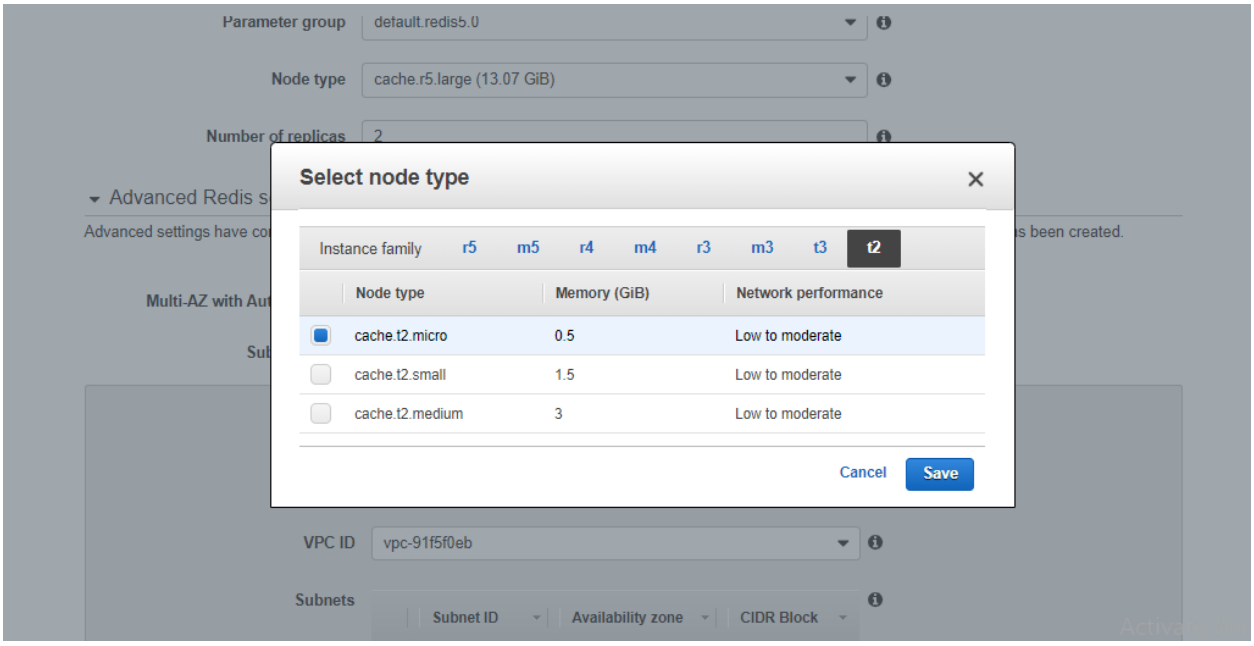
Create your Amazon ElastiCache cluster

Cluster engine

- **Redis**
  In-memory data structure store used as database, cache and message broker. ElastiCache for Redis offers Multi-AZ with Auto-Failover and enhanced robustness.
  - Cluster Mode enabled
- **Memcached**
  High-performance, distributed memory object caching system, intended for use in speeding up dynamic web applications.

Redis settings

Name	leaderboard
Description	
Engine version compatibility	5.0.6
Port	6379
Parameter group	default.redis5.0



Redis settings

Name leaderboard

Engine version compatibility 5.0.6

Port 6379

Parameter group default.redis5.0

Node type cache.t2.micro (0.5 GiB)

Number of replicas 0

Advanced Redis settings

Advanced settings have common defaults set to give you the fastest way to get started. You can modify these now or after your cluster has been created.

Subnet group Create new

Name leaderboard-redis

Description *Description*

VPC ID vpc-91f5f0eb

Subnets

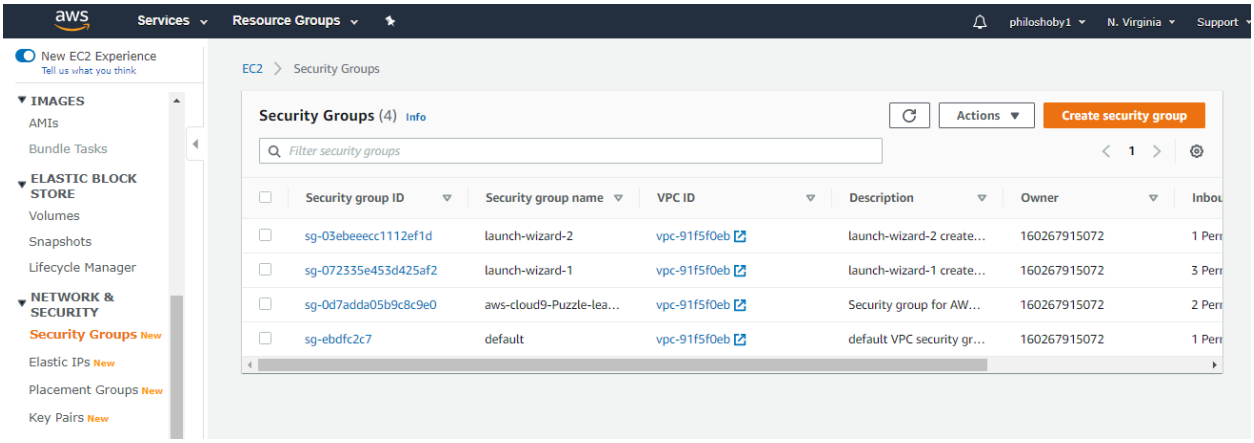
Subnet ID	Availability zone	CIDR Block
subnet-621ebd6c	us-east-1f	172.31.64.0/20
subnet-8ce017ad	us-east-1c	172.31.80.0/20
subnet-7fc67e32	us-east-1d	172.31.16.0/20
subnet-041df462	us-east-1b	172.31.0.0/20
subnet-c02418fe	us-east-1e	172.31.48.0/20

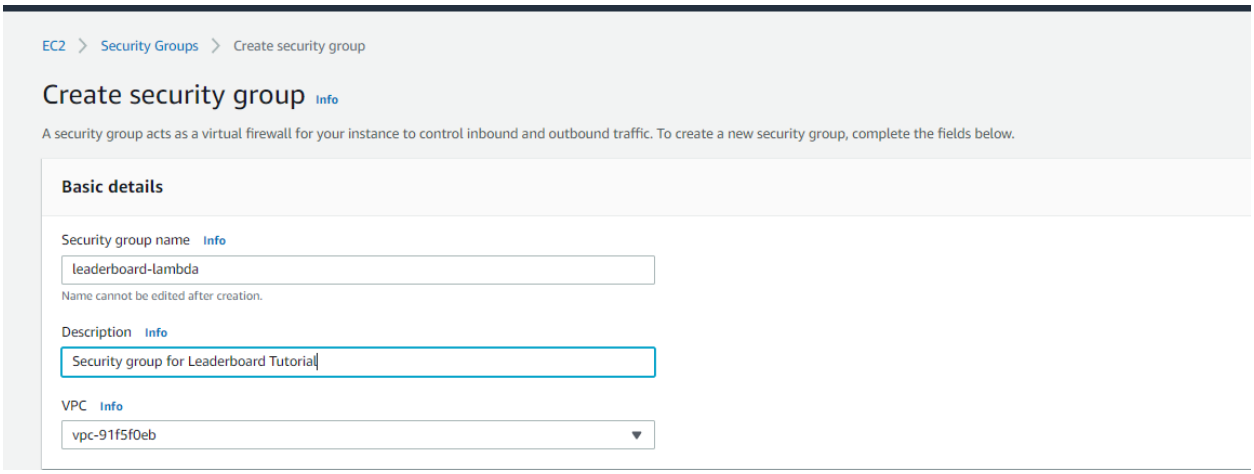
Maintenance

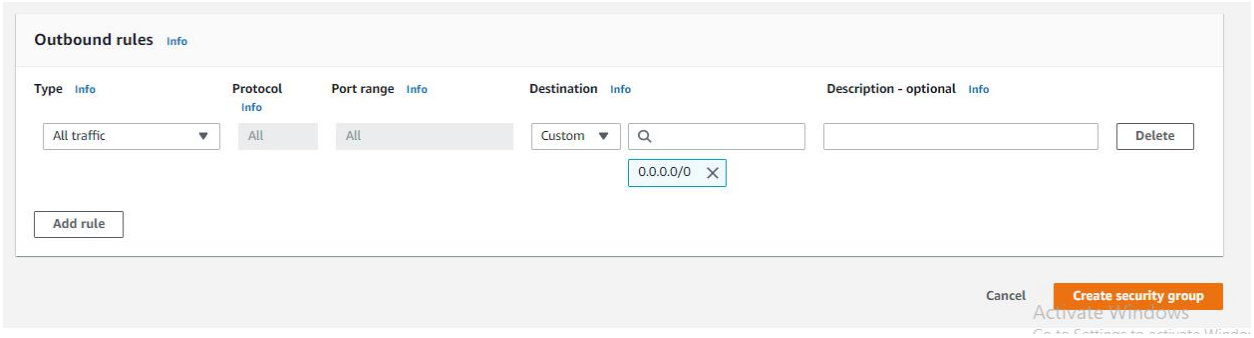
Maintenance window No preference / Specify maintenance window

Topic for SNS notification Disable notifications

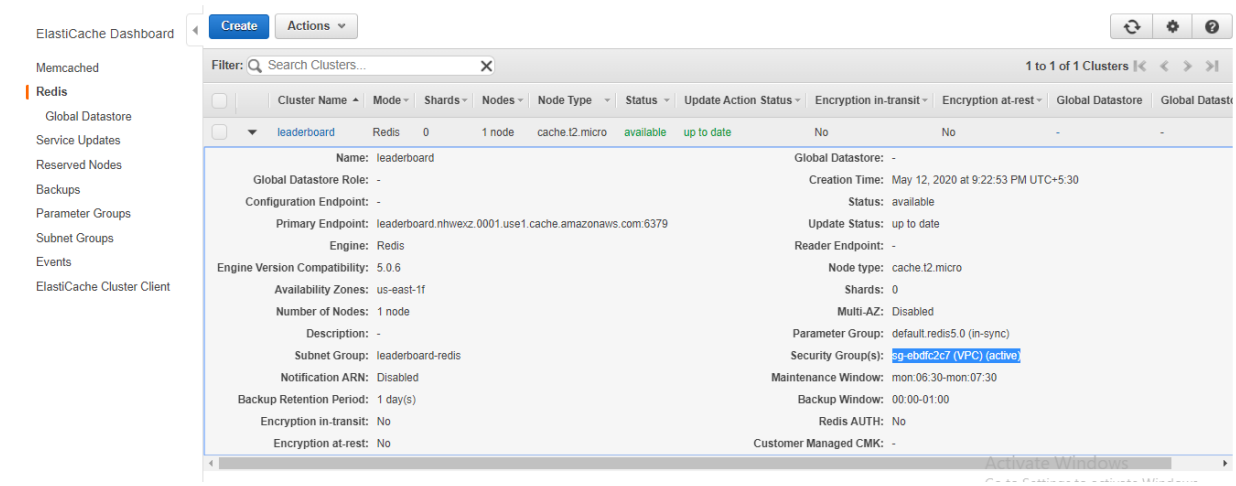
Cancel Create

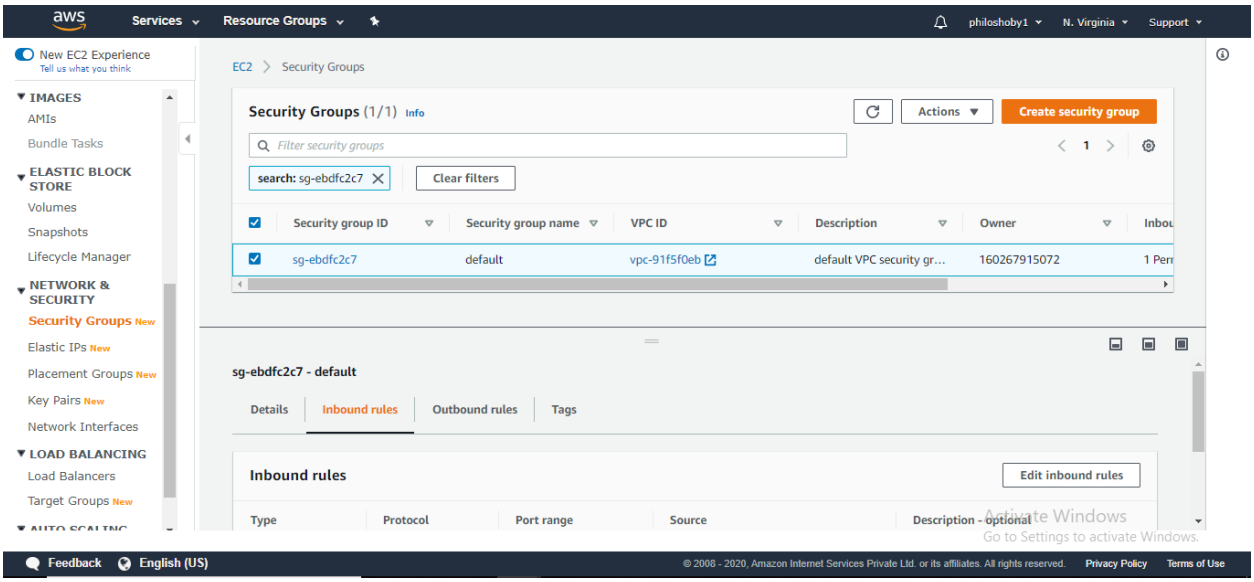

aws
Services
Resource Groups
philoshoby1
N. Virginia
Support
New EC2 Experience
Tell us what you think
IMAGES
AMIs
Bundle Tasks
ELASTIC BLOCK STORE
Volumes
Snapshots
Lifecycle Manager
NETWORK & SECURITY
Security Groups New
Elastic IPs New
Placement Groups New
Key Pairs New
EC2 > Security Groups
Security Groups (4) Info
Actions
Create security group
Filter security groups
Security group ID
Security group name
VPC ID
Description
Owner
sg-03ebeeecc1112ef1d launch-wizard-2 vpc-91f5f0eb launch-wizard-2 create... 160267915072
sg-072335e453d425af2 launch-wizard-1 vpc-91f5f0eb launch-wizard-1 create... 160267915072
sg-0d7adda05b9c8c9e0 aws-cloud9-Puzzle-lea... vpc-91f5f0eb Security group for AW... 160267915072
sg-ebdfc2c7 default vpc-91f5f0eb default VPC security gr... 160267915072


EC2 > Security Groups > Create security group
Create security group Info
A security group acts as a virtual firewall for your instance to control inbound and outbound traffic. To create a new security group, complete the fields below.
Basic details
Security group name Info
leaderboard-lambda
Name cannot be edited after creation.
Description Info
Security group for Leaderboard Tutorial
VPC Info
vpc-91f5f0eb


Outbound rules Info
Type Info
Protocol Info
Port range Info
Destination Info
Description - optional Info
All traffic
All
All
Custom
0.0.0.0/0
Delete
Add rule
Cancel
Create security group


ec2-user:~/environment $ echo "export SECURITY_GROUP_ID=sg-002446d8b599744d9" >> env.sh && source env.sh


ElastiCache Dashboard
Create
Actions
Memcached
Redis
Global Datastore
Service Updates
Reserved Nodes
Backups
Parameter Groups
Subnet Groups
Events
ElastiCache Cluster Client
Filter: Search Clusters...
1 to 1 of 1 Clusters
Cluster Name
Mode
Shards
Nodes
Node Type
Status
Update Action Status
Encryption in-transit
Encryption at-rest
Global Datastore
leaderboard Redis 0 1 node cache.t2.micro available up to date No No
Name: leaderboard
Global Datastore Role: -
Configuration Endpoint: -
Primary Endpoint: leaderboard.nhwexz.0001.use1.cache.amazonaws.com:6379
Engine: Redis
Engine Version Compatibility: 5.0.6
Availability Zones: us-east-1f
Number of Nodes: 1 node
Description: -
Subnet Group: leaderboard-redis
Notification ARN: Disabled
Backup Retention Period: 1 day(s)
Encryption in-transit: No
Encryption at-rest: No
Global Datastore: -
Creation Time: May 12, 2020 at 9:22:53 PM UTC+5:30
Status: available
Update Status: up to date
Reader Endpoint: -
Node type: cache.t2.micro
Shards: 0
Multi-AZ: Disabled
Parameter Group: default.redis5.0 (in-sync)
Security Group(s): sg-ebdfc2c7 (VPC) (active)
Maintenance Window: mon:06:30-mon:07:30
Backup Window: 00:00-01:00
Redis AUTH: No
Customer Managed CMK: -
Activate Windows


aws
Services
Resource Groups
philoshoby1
N. Virginia
Support
New EC2 Experience
Tell us what you think
IMAGES
AMIs
Bundle Tasks
ELASTIC BLOCK STORE
Volumes
Snapshots
Lifecycle Manager
NETWORK & SECURITY
Security Groups New
Elastic IPs New
Placement Groups New
Key Pairs New
Network Interfaces
LOAD BALANCING
Load Balancers
Target Groups New
EC2 > Security Groups
Security Groups (1/1) Info
Actions
Create security group
Filter security groups
search: sg-ebdfc2c7
Clear filters
Security group ID
Security group name
VPC ID
Description
Owner
sg-ebdfc2c7 default vpc-91f5f0eb default VPC security gr... 160267915072
sg-ebdfc2c7 - default
Details
Inbound rules
Outbound rules
Tags
Inbound rules
Edit inbound rules
Type
Protocol
Port range
Source
Description - optional
Activate Windows
Go to Settings to activate Windows.
Feedback
English (US)
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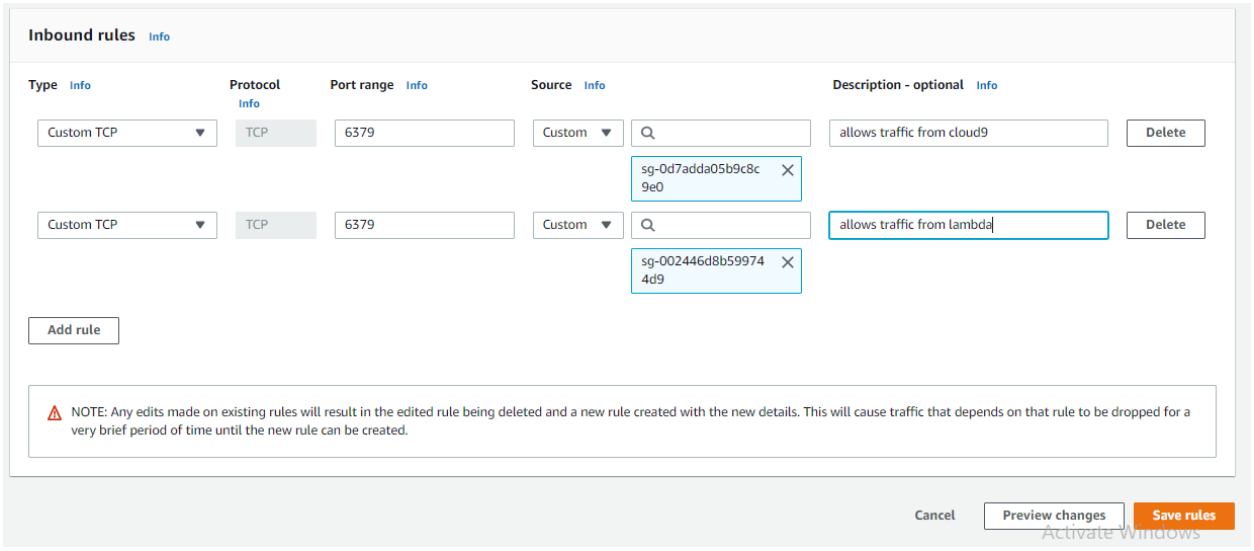
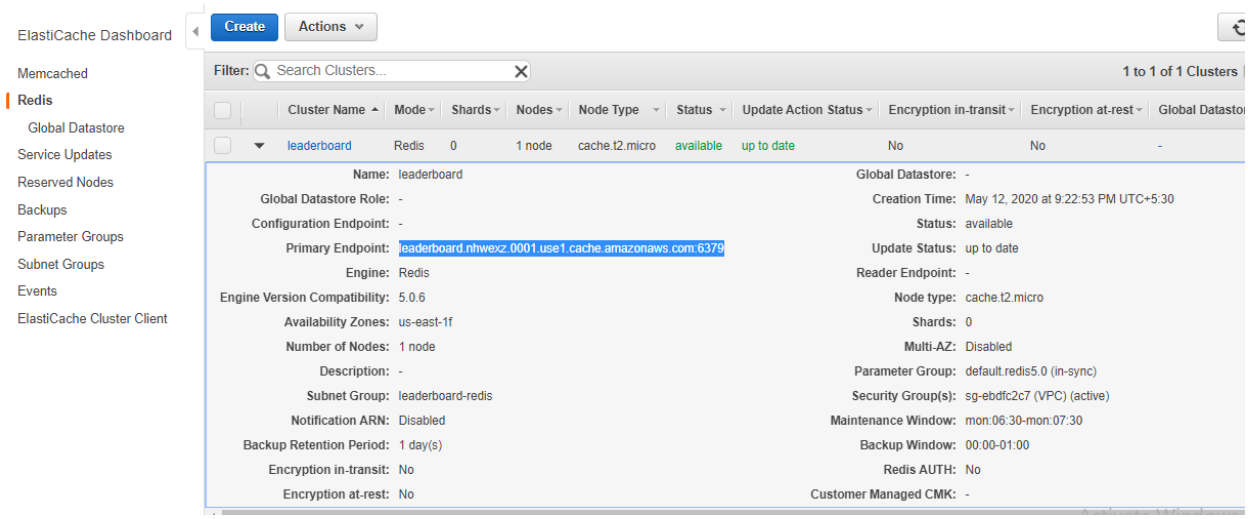
Privacy Policy
Terms of Use


Inbound rules Info
Type Info
Protocol Info
Port range Info
Source Info
Description - optional Info
Custom TCP
TCP
6379
Custom
allows traffic from cloud9
Delete
sg-0d7adda05b9c8c9e0
Custom TCP
TCP
6379
Custom
allows traffic from lambda
Delete
sg-002446d8b599744d9
Add rule
NOTE: Any edits made on existing rules will result in the edited rule being deleted and a new rule created with the new details. This will cause traffic that depends on that rule to be dropped for a very brief period of time until the new rule can be created.
Cancel
Preview changes
Save rules
Activate Windows




```
ec2-user:~/environment $ echo "export REDIS_ENDPOINT=leaderboard.nhwexz.0001.use1.cache.amazonaws.com:6379" >> env.sh && source env.sh
ec2-user:~/environment $ node scripts/testRedis.js
Successful ping! PONG
ec2-user:~/environment $
```

```
ec2-user:~/environment $ node scripts/loadRedis.js
Loaded data!
ec2-user:~/environment $ node scripts/getTopOverallScores.js
Top overall scores:
[ { username: 'debbieschneider',
    gamedate: '2019-11-09T18:41:27',
    level: '28',
    score: '9895' },
  { username: 'alicia39',
    gamedate: '2019-11-09T10:39:59',
    level: '47',
    score: '9824' },
  { username: 'rosecolleen',
    gamedate: '2019-11-10T07:09:51',
    level: '58',
    score: '9765' },
  { username: 'allisonsandra',
    gamedate: '2019-11-07T22:43:32',
    level: '62',
    score: '9760' },
  { username: 'kathrynmorris',
    gamedate: '2019-11-05T04:31:37',
    level: '85',
    score: '9722' } ]
ec2-user:~/environment $
```

```
ec2-user:~/environment $ bash scripts/create-user-pool.sh
User Pool created with id us-east-1_02LfAmz6R
ec2-user:~/environment $ bash scripts/create-user-pool-client.sh
User Pool Client created with id equ6097f5gpd9ff3qji0hump7
ec2-user:~/environment $
```

You will deploy your application code to run on AWS Lambda. For your AWS Lambda function to access your ElastiCache instance, it must be located in a subnet in your VPC and configured with a security group that can access your ElastiCache instance.

Your Lambda function also needs to access your Amazon Aurora Serverless database using the Data API. The Data API is a publicly available endpoint for your database. For a Lambda function in a private subnet to have access to the public internet, you need to configure a NAT Gateway that translates private network traffic into public internet traffic.

```
ec2-user:~/environment $ bash scripts/create-networking.sh
Fetching VPC Id
Fetching subnet Id
Creating Elastic IP address
Creating NAT Gateway
Waiting for NAT Gateway to be ready...
Creating private subnet
Creating route table
Creating route
Associating route table with subnet
Networking resources created!
```

Now, you need to package up your function code and deploy it to AWS Lambda. Lambda expects you to upload a ZIP file containing all of your application code. Additionally, you specify a runtime to use and the file and function that serves as the entry point to your code. This entry point is called a *handler* and is called whenever an incoming event triggers your code.

In addition to the function code, you also need to provide an AWS Identity and Access Management (IAM) role for your Lambda function. This role is assumed by your function upon execution so that it has permissions to access AWS resources, such as reading or writing from a database, sending messages to a queue, or logging output to Amazon CloudWatch.

```
ec2-user:~/environment $ bash scripts/create-lambda.sh
Building zip file
Creating IAM role
Adding policy to IAM role
Sleeping for IAM role propagation
Creating Lambda function
Lambda function created with ARN arn:aws:lambda:us-east-1:160267915072:function:leaderboard-api
ec2-user:~/environment $
```

Now that you have deployed your Lambda function, you can make it accessible over HTTP using Amazon API Gateway. API Gateway provides a powerful access layer to your backend services. It is highly configurable and provides for authentication, validation, rate-limiting, and more.

```
ec2-user:~/environment $ bash scripts/create-rest-api.sh
Creating REST API
Fetching root resource
Creating proxy resource
Creating method
Adding integration
Creating deployment
Fetching account ID
Adding lambda permission
REST API created

Your API is available at: https://p9bhr893o8.execute-api.us-east-1.amazonaws.com/prod
ec2-user:~/environment $
```

```
ec2-user:~/environment $ curl -X GET ${BASE_URL}/users/ubecker
[{"game_id":101,"username":"ubecker","gamedate":"2019-11-06 09:00:37","score":9090,"level":84},{"game_id":14
":30},{"game_id":146,"username":"ubecker","gamedate":"2019-11-06 13:28:49","score":8052,"level":86},{"game_i
evel":18},{"game_id":5,"username":"ubecker","gamedate":"2019-11-07 17:56:25","score":6983,"level":91},{"game
,"level":8},{"game_id":245,"username":"ubecker","gamedate":"2019-11-10 06:16:58","score":5230,"level":75},{"
043,"level":2},{"game_id":282,"username":"ubecker","gamedate":"2019-11-07 02:58:57","score":4884,"level":17}
e":4394,"level":17}]ec2-user:~/environment $
```

Test:

You exercise your working endpoints to see how your components worked together. First, you registered a new user, which involved creating a new user in your Amazon Cognito user pool. Second, you exercised the login endpoint to fetch an ID token that can be used by the client to authenticate the user. Third, you used this ID token to authorize the user recording some new scores for the user. Fourth, you retrieved the top scores for a single user. Finally, you retrieved the top scores around the globe.

Registration:

```
e":4394,"level":17}]ec2-user:~/environment $ curl -X POST ${BASE_URL}/users \
>   -H 'Content-Type: application/json' \
>   -d '{
> "username": "puzzlemaster",
> "password": "Mypassword1",
> "email": "test@hello.com"
> }'
{"username":"puzzlemaster"}ec2-user:~/environment $
```

Login:

```
{"username":"puzzlemaster"}ec2-user:~/environment $ curl -X POST ${BASE_URL}/login \
>   -H 'Content-Type: application/json' \
>   -d '{
> "username": "puzzlemaster",
> "password": "Mypassword1"
> }'
{"idToken":"eyJraWQiOiJiV0JyXC9ieTQ2VXBxSWJybmQzTUxiZGVkdmplc1U4NWM3cEYyOEpYdUVRaz0iLCJhbGc
k3ZjVncGQ5ZmYzcWppMGh1bXA3IiwiZW1haWxfdmVyaWZpZWQiOmZhbHNlLCJldmVudF9pZCI6IjU3ZDIyOGQyLTIzO
3MiOiJodHRwczpcL1wvY29nbml0by1pZHAudXMtZWFzdC0xLmFtYXpvbmF3cy5jb21cL3VzLWVhc3QtMV8wMkxmQW1
NjcsImVtYWlsIjoidGVzdEBoZWxsby5jb20ifQ.d-KKEW9sVXkvBdPYsXoSeOSRdlLOj2j3S5jmoeuTi39XhizFtdXz
b4oWGPno5H1AlOgcbPGZJLWX0ONGankVIBvQw6gg8CtqmTy95VQrNmUAZ9B5cp3NfgNgyzhLcJkvAtCsJQUFlbPKpx
JOaJ2hoP7eCdNPA"}ec2-user:~/environment $
```

Save id token:

```
ec2-user:~/environment $ export ID_TOKEN=eyJraWQiOiJiV0JyXC9ieTQ2VXBxSWJybmQzTUxiZGVkdmplc1U4NWM3cEYyOEpYdUVRaz0
2Q4MDY5NTYiLCJhdWQiOiJlcXU2MDk3ZjVncGQ5ZmYzcWppMGh1bXA3IiwiZW1haWxfdmVyaWZpZWQiOmZhbHNlLCJldmVudF9pZCI6IjU3ZDIyO
aF90aW1lIjoxNTg5MzA3NzY3LCJpc3MiOiJodHRwczpcL1wvY29nbml0by1pZHAudXMtZWFzdC0xLmFtYXpvbmF3cy5jb21cL3VzLWVhc3QtMV8w
5MzExMzY3LCJpYXQiOjE1ODkzMDc3NjcsImVtYWlsIjoidGVzdEBoZWxsby5jb20ifQ.d-KKEW9sVXkvBdPYsXoSeOSRdlLOj2j3S5jmoeuTi39X
P88urIgnqAaONUd_inNt9jjW_4O09b4oWGPno5H1AlOgcbPGZJLWX0ONGankVIBvQw6gg8CtqmTy95VQrNmUAZ9B5cp3NfgNgyzhLcJkvAtCsJQU
uVrvIG6pEgL75nbkm6CdewqwbQlVtJOaJ2hoP7eCdNPA
ec2-user:~/environment $
```

Loading data:

```
ec2-user:~/environment $ curl -X POST ${BASE_URL}/users/puzzlemaster \
>   -H 'Content-Type: application/json' \
>   -H "Authorization: ${ID_TOKEN}" \
>   -d '{
> "level": 37,
> "score": 6541
> }'
{"username":"puzzlemaster","gametime":"2020-05-12T18:32:43.409Z","level":37,"score":6541}ec2-user:~/environment $
ec2-user:~/environment $ curl -X POST ${BASE_URL}/users/puzzlemaster \
>   -H 'Content-Type: application/json' \
>   -d '{
> "level": "37",
> "score": "6541"
> }'
{"message":"jwt must be provided"}ec2-user:~/environment $
ec2-user:~/environment $ curl -X POST ${BASE_URL}/users/puzzlemaster \
>   -H 'Content-Type: application/json' \
>   -H "Authorization: ${ID_TOKEN}" \
>   -d '{
> "level": "42",
> "score": "7142"
> }'
{"username":"puzzlemaster","gametime":"2020-05-12T18:34:28.786Z","level":"42","score":"7142"}ec2-user:~/environment $
ec2-user:~/environment $ curl -X POST ${BASE_URL}/users/puzzlemaster \
>   -H 'Content-Type: application/json' \
>   -H "Authorization: ${ID_TOKEN}" \
>   -d '{
> "level": "48",
> "score": "9901"
> }'
{"username":"puzzlemaster","gametime":"2020-05-12T18:34:32.206Z","level":"48","score":"9901"}ec2-user:~/environment $
```

Fetching top user:

```
ec2-user:~/environment $ curl -X GET ${BASE_URL}/users/puzzlemaster
[{"game_id":303,"username":"puzzlemaster","gamedate":"2020-05-12 18:34:32","score":9901,"level":48},{"game_id":302,"username":"puzzlemaster","gamedate":"2020-05-12 18:34:28","score":7
142,"level":42},{"game_id":301,"username":"puzzlemaster","gamedate":"2020-05-12 18:32:43","score":6541,"level":37}]ec2-user:~/environment $
```

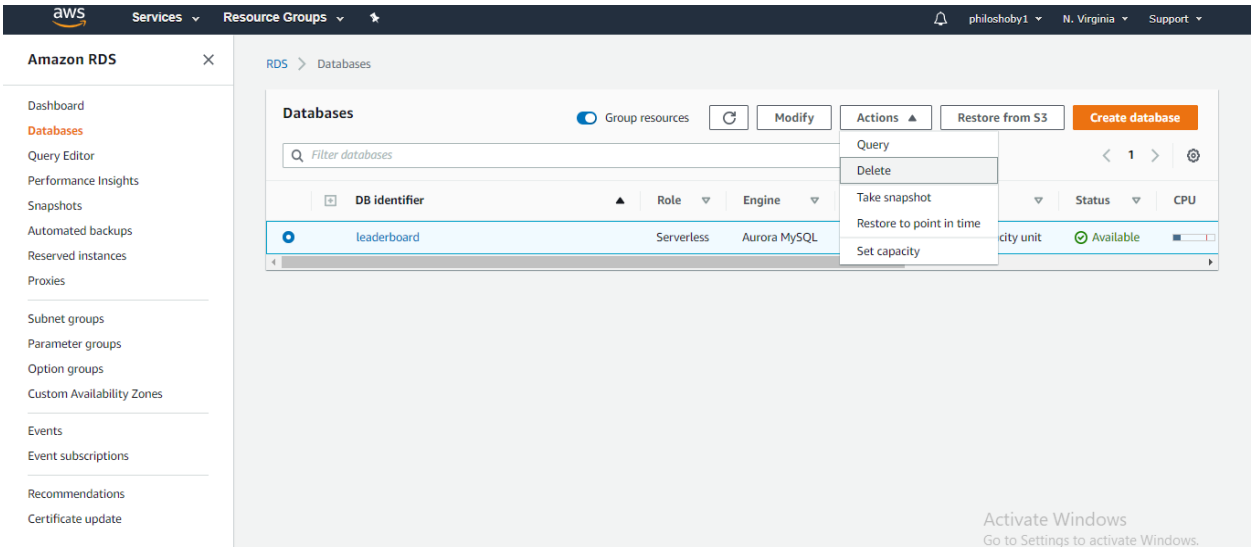
Fetching top score users of a particular date:

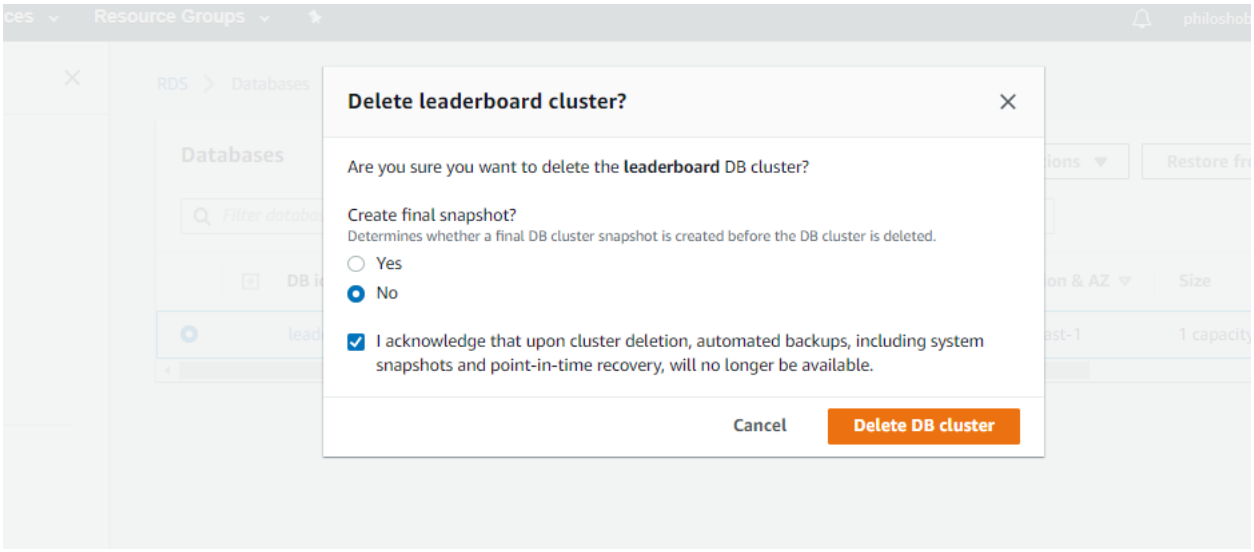
```
ec2-user:~/environment $ curl -X GET ${BASE_URL}/scores/2019-11-08
{"overall":[{"username":"puzzlemaster","gamedate":"Tue May 12 2020 18:34:32 GMT+0000 (Coordinated Universal Time)","lev
":"2019-11-09T18:41:27","level":"28","score":"9895"},{"username":"alicia39","gamedate":"2019-11-09T10:39:59","level":"4
-10T07:09:51","level":"58","score":"9765"},{"username":"allisonsandra","gamedate":"2019-11-07T22:43:32","level":"62","s
":"2019-11-09T18:41:27","level":"28","score":"9895"},{"username":"alicia39","gamedate":"2019-11-09T10:39:59","level":"4
-10T07:09:51","level":"58","score":"9765"},{"username":"allisonsandra","gamedate":"2019-11-07T22:43:32","level":"62","s
T04:31:37","level":"85","score":"9722"}],"daily":[{"username":"terriross","gamedate":"2019-11-08T21:31:47","level":"26"
5:45:30","level":"60","score":"9323"},{"username":"christopherrichardson","gamedate":"2019-11-08T09:51:28","level":"55"
11-08T15:08:32","level":"77","score":"9175"},{"username":"rodriguezjonathan","gamedate":"2019-11-08T13:56:32","level":"
```

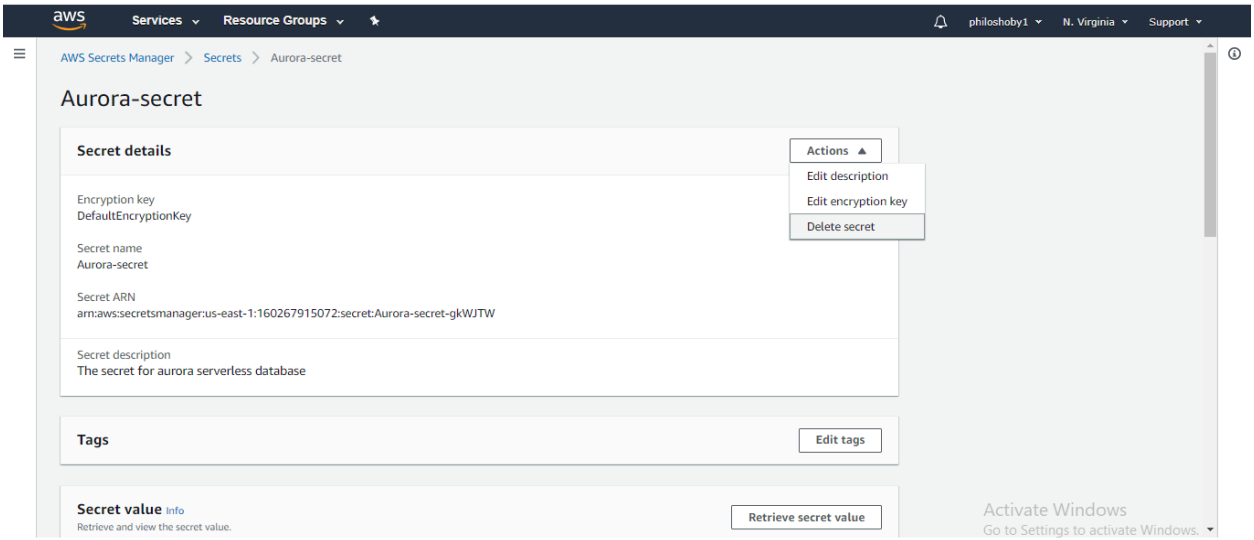
- Amazon Aurora Serverless and the Data API for fast, elastic, fully-managed data storage
- Amazon ElastiCache for fast lookups on your global leaderboard
- Amazon Cognito for user authentication
- AWS Lambda for compute
- Amazon API Gateway for HTTP routing

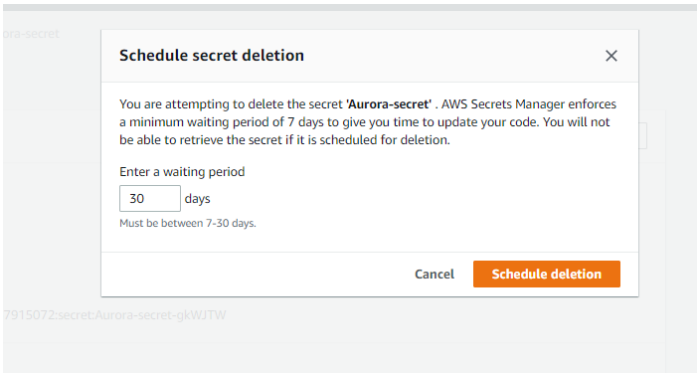
Cleaning up resourses:

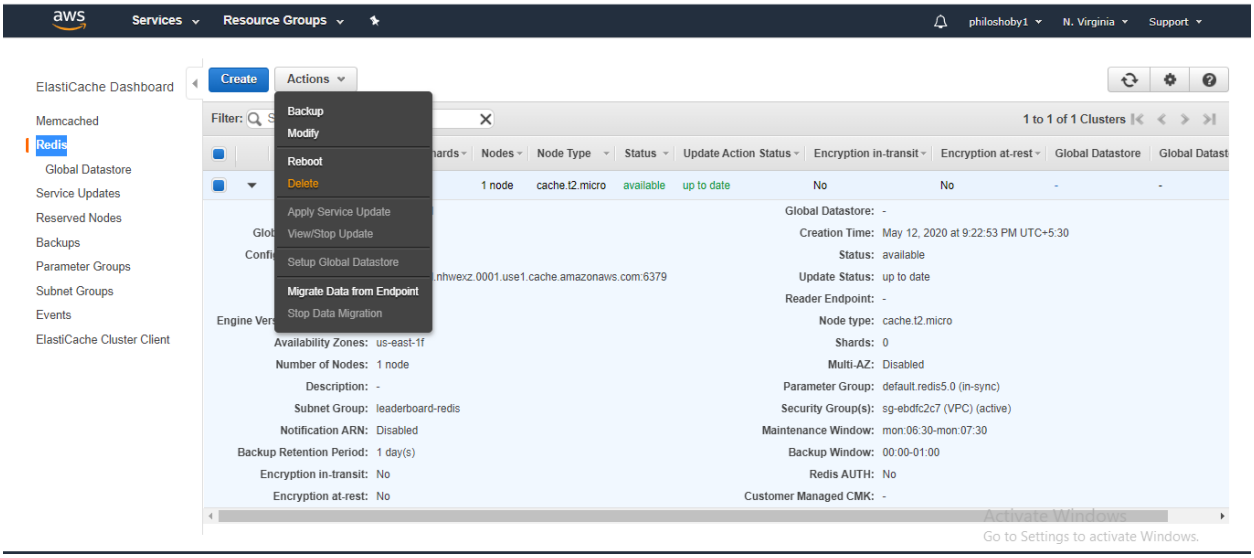
```
ec2-user:~/environment $ bash scripts/delete-resources.sh
Removing REST API
Deleting IAM role
Deleting Lambda function
Deleting Amazon Cognito User Pool
ec2-user:~/environment $
```

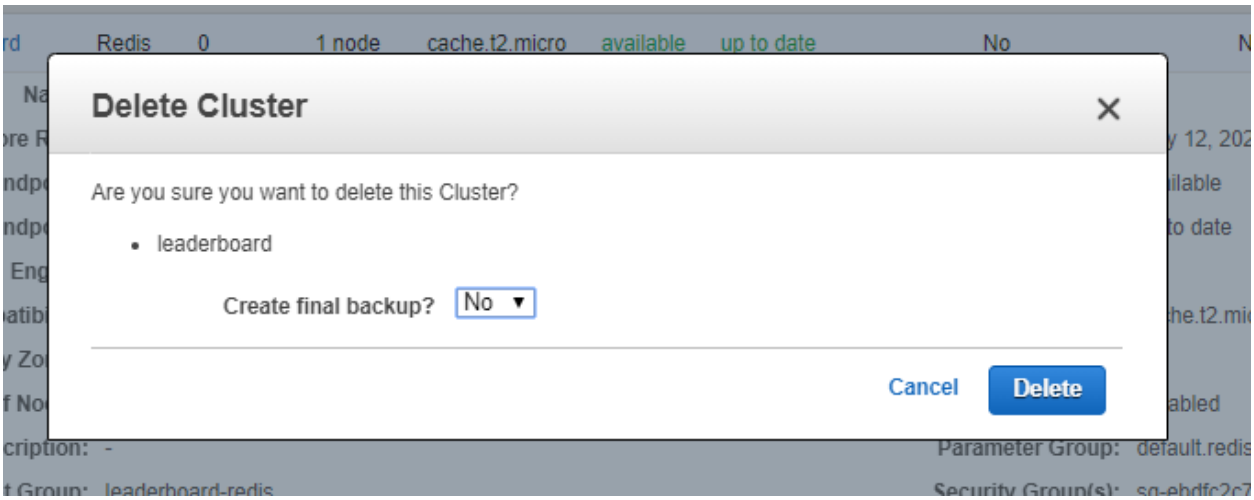



Delete leaderboard cluster?
Are you sure you want to delete the leaderboard DB cluster?
Create final snapshot?
Determines whether a final DB cluster snapshot is created before the DB cluster is deleted.
Yes
No
I acknowledge that upon cluster deletion, automated backups, including system snapshots and point-in-time recovery, will no longer be available.
Cancel
Delete DB cluster

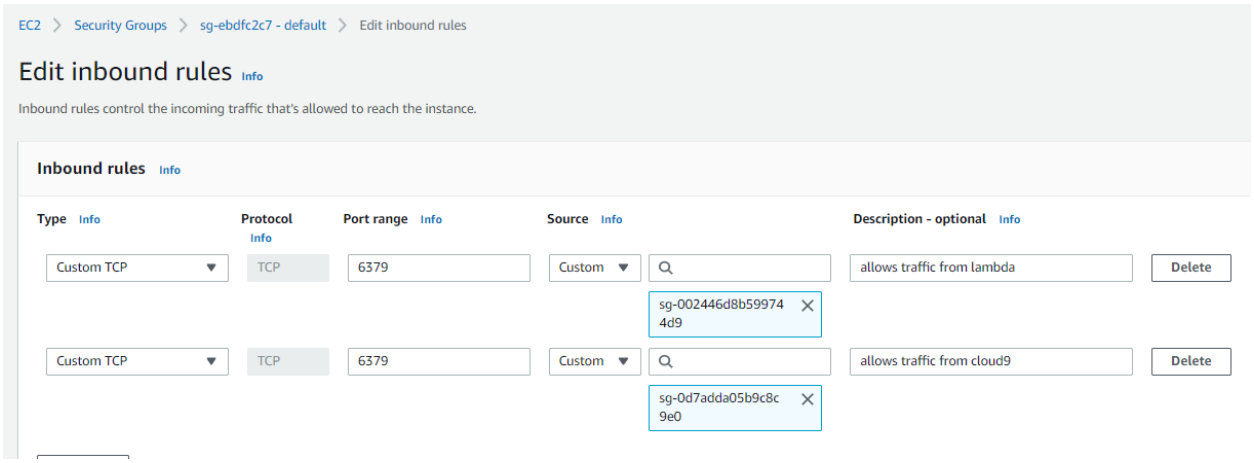

Services
Resource Groups
AWS Secrets Manager
Secrets
Aurora-secret
Aurora-secret
Secret details
Actions
Edit description
Edit encryption key
Delete secret
Encryption key
DefaultEncryptionKey
Secret name
Aurora-secret
Secret ARN
arn:aws:secretsmanager:us-east-1:160267915072:secret:Aurora-secret-gkWJTW
Secret description
The secret for aurora serverless database
Tags
Edit tags
Secret value
Retrieve and view the secret value.
Retrieve secret value

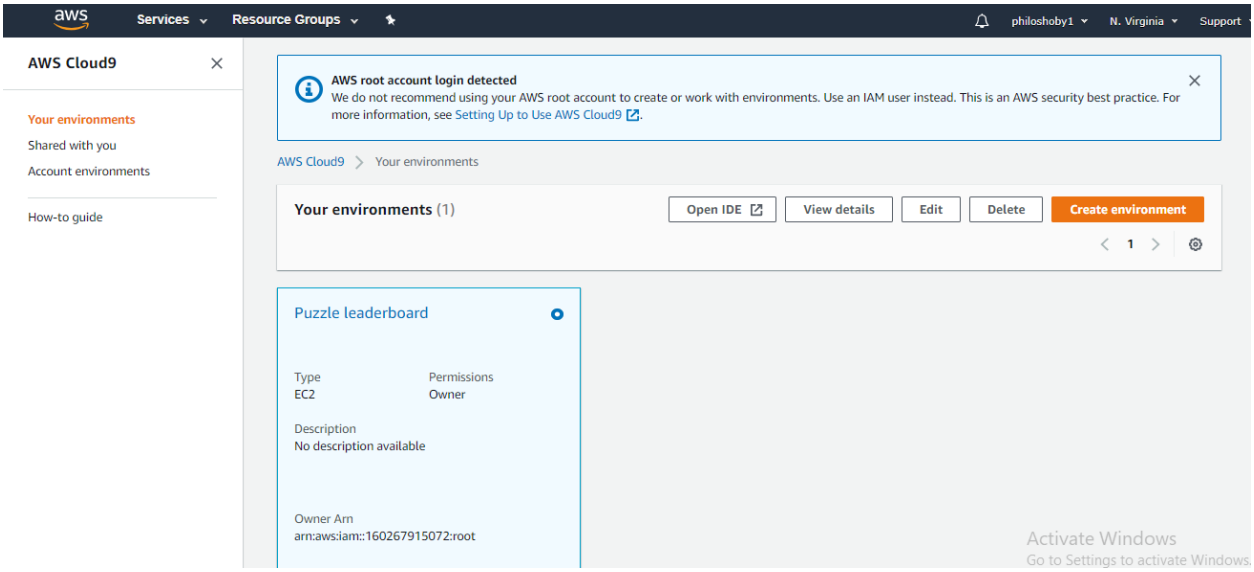

Schedule secret deletion
You are attempting to delete the secret 'Aurora-secret' . AWS Secrets Manager enforces a minimum waiting period of 7 days to give you time to update your code. You will not be able to retrieve the secret if it is scheduled for deletion.
Enter a waiting period
30
days
Must be between 7-30 days.
Cancel
Schedule deletion

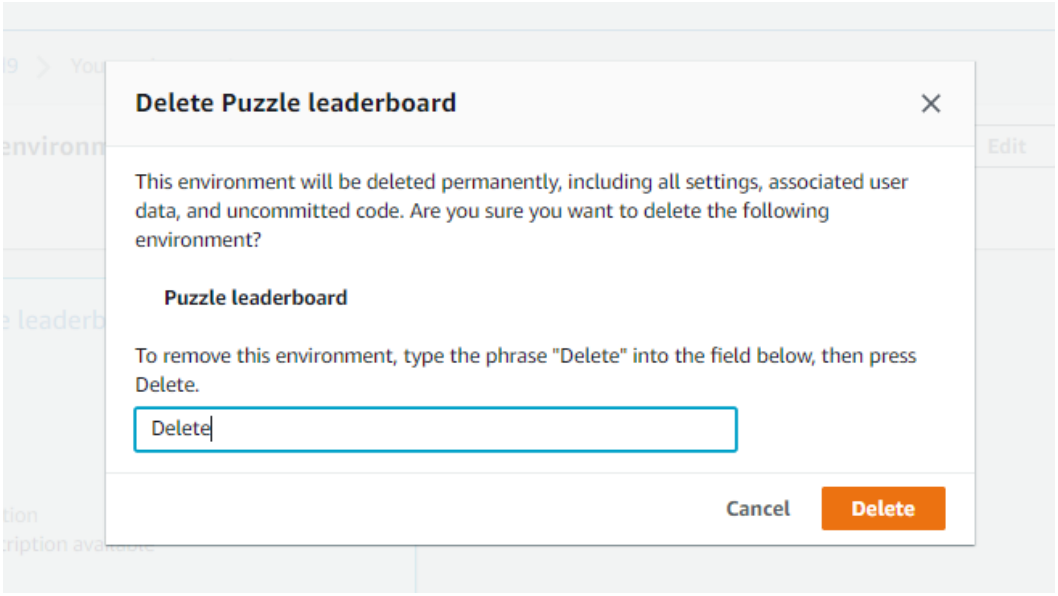





```
ec2-user:~/environment $ bash scripts/remove-networking.sh
Disassociating route table
Deleting route table
Deleting NAT Gateway
Sleeping for EIP disassociation
Releasing Elastic IP
Networking resources deleted!
ec2-user:~/environment $
```


EC2 > Security Groups > sg-ebdfc2c7 - default > Edit inbound rules
Edit inbound rules Info
Inbound rules control the incoming traffic that's allowed to reach the instance.
Inbound rules Info
Type Info
Protocol Info
Port range Info
Source Info
Description - optional Info
Custom TCP
TCP
6379
Custom
sg-002446d8b599744d9
allows traffic from lambda
Delete
Custom TCP
TCP
6379
Custom
sg-0d7adda05b9c8c9e0
allows traffic from cloud9
Delete


aws
Services
Resource Groups
philoshoby1
N. Virginia
Support
AWS Cloud9
Your environments
Shared with you
Account environments
How-to guide
AWS root account login detected
We do not recommend using your AWS root account to create or work with environments. Use an IAM user instead. This is an AWS security best practice. For more information, see Setting Up to Use AWS Cloud9.
AWS Cloud9 > Your environments
Your environments (1)
Open IDE
View details
Edit
Delete
Create environment
Puzzle leaderboard
Type
EC2
Permissions
Owner
Description
No description available
Owner Arn
arn:aws:iam::160267915072:root
Activate Windows
Go to Settings to activate Windows.


Delete Puzzle leaderboard
This environment will be deleted permanently, including all settings, associated user data, and uncommitted code. Are you sure you want to delete the following environment?
Puzzle leaderboard
To remove this environment, type the phrase "Delete" into the field below, then press Delete.
Delete
Cancel
Delete