

SISTEMI ZA UPRAVLJANJE BAZAMA PODATAKA




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# CLOUD BAZE PODATAKA I DATABASE AS A SERVICE NA PRIMERU AMAZON RDS-A

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## RAČUNARSTVO U OBLAKU

- ▶ Skup računarskih resursa na zahtev.
- ▶ Karakteristike računarstva u oblaku:
  - ▶ Self-service
  - ▶ Pay-per-use model
  - ▶ Elastičnost
  - ▶ Mogućnost podešavanja po potrebi

Service Class	Main Access & Management Tool	Service content
 SaaS	Web Browser	<b>Cloud Applications</b> Social networks, Office suites, CRM, Video processing
 PaaS	Cloud Development Environment	<b>Cloud Platform</b> Programming languages, Frameworks, Mashups editors, Structured data
 IaaS	Virtual Infrastructure Manager	<b>Cloud Infrastructure</b> Compute Servers, Data Storage, Firewall, Load Balancer

Slika 1. Slojevi klada

# BAZE PODATAKA U KLAUDU

- ▶ Self-managed ili managed database
- ▶ Prednosti managed baza:
  - ▶ Skalabilnost
  - ▶ Isplativost
  - ▶ Održavanje i upravljanje
  - ▶ Dostupnost
  - ▶ Oporavak od katastrofa
  - ▶ Optimizacija performansi
  - ▶ Bezbednost
- ▶ Upravljanje baze podataka:
  - ▶ Tradicionalne (MySQL, SQL Server,...)
  - ▶ Cloud native (Amazon Aurora)
- ▶ Tipovi upravljanih baza podataka:
  - ▶ Relacione baze (MySQL, Amazon Aurora)
  - ▶ Skladišta podataka (Amazon Redshift)
  - ▶ Nerelacione baze (Amazon DynamoDB)

# AMAZON WEB SERVICES

- ▶ AWS je deo Amazon korporacije, koji pruža klaud usluge na zahtev na baze pay-as-you-go modela.
- ▶ Rešenja za rad sa bazom:
  - ▶ Amazon EC2
  - ▶ Amazon RDS

Feature	On-premises management	Amazon EC2 management	Amazon RDS management
Application optimization	Customer	Customer	Customer
Scaling	Customer	Customer	AWS
High availability	Customer	Customer	AWS
Database backups	Customer	Customer	AWS
Database software patching	Customer	Customer	AWS
Database software install	Customer	Customer	AWS
Operating system (OS) patching	Customer	Customer	AWS
OS installation	Customer	Customer	AWS
Server maintenance	Customer	AWS	AWS
Hardware lifecycle	Customer	AWS	AWS
Power, network, and cooling	Customer	AWS	AWS

Slika 2. Odgovornost korisnika/provajdera kod različitih rešenja hostovanja baze

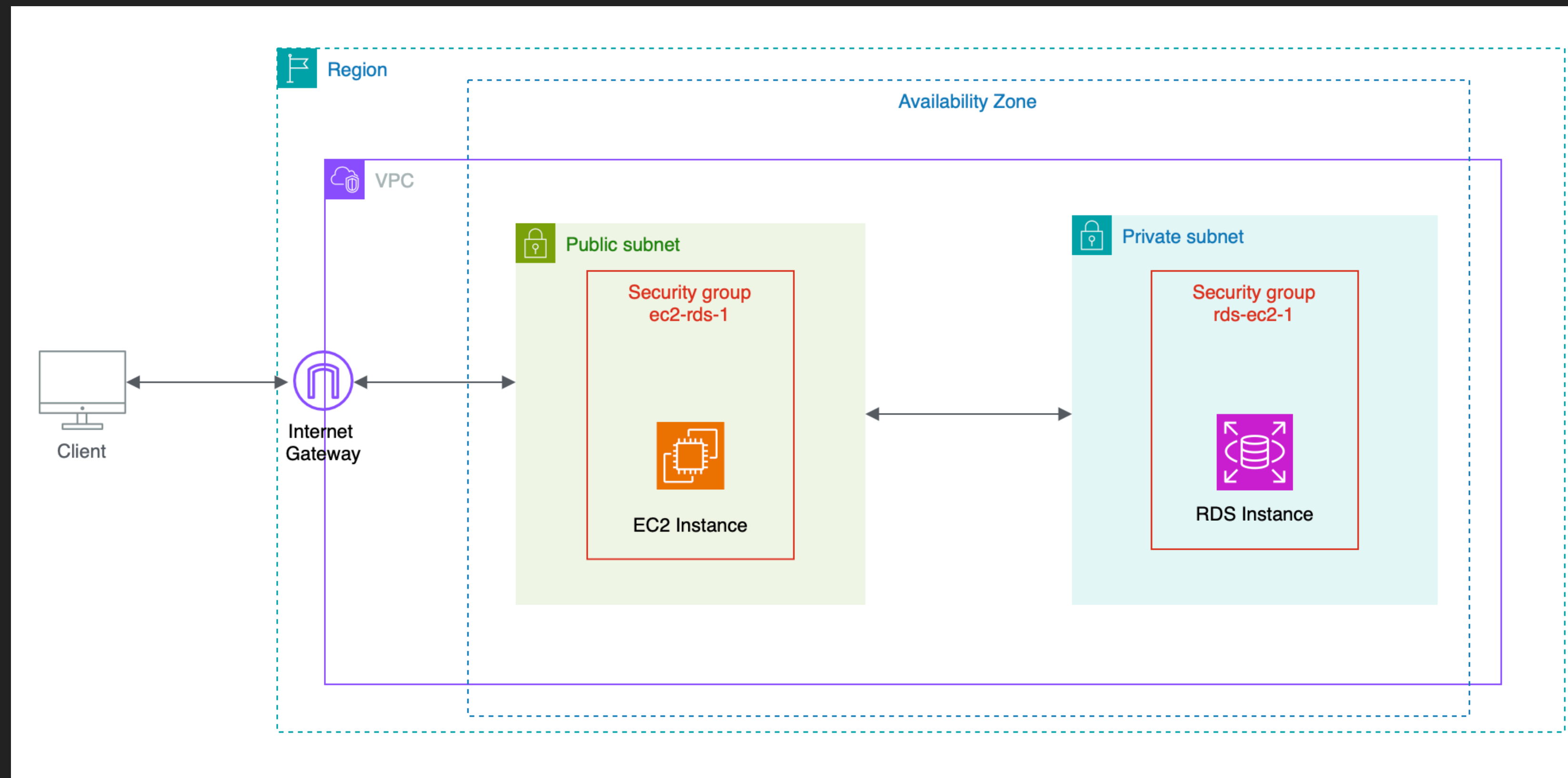
## AMAZON RDS INSTANCA

- ▶ Osnovni gradivni blok Amazon RDS
- ▶ Izolovano okruženje baze u AWS kladu
- ▶ U pozadini se kreira virtualna mašina na EC2, a EBS se koristi za skladištenje.

## POVEZIVANJE SA RDS INSTANCOM

- ▶ RDS instanca se smešta u VPC, koji kontroliše virtuelno mrežno okruženje.
- ▶ Bezbednosne grupe kontrolišu pristup instanci unutar VPC.
- ▶ Scenariji pristupa bazi u VPC:
  - ▶ Sa EC2 instance u istom VPC
  - ▶ Sa EC2 instance iz drugog VPC
  - ▶ Klijentska aplikacija kroz internet
  - ▶ Sa privatne mreže

## ARHITEKTURA SISTEMA



Slika 3. Arhitektura sistema



## KORACI U KREIRANJU RDS INSTANCE

- ▶ Izbor tipa i verzije engine-a
- ▶ Izbor šablona (Production, Dev/Test, Free Tier)
- ▶ Availability & durability
  - ▶ Multi-AZ DB Cluster
  - ▶ Multi-AZ DB Instance
  - ▶ Single DB Instance
- ▶ Identifikator instance
- ▶ Kreiranje glavnog korisnika

**Settings**

**DB cluster identifier** [Info](#)  
Enter a name for your DB cluster. The name must be unique across all DB clusters owned by your AWS account in the current AWS Region.

bazepodataka

The DB cluster identifier is case-insensitive, but is stored as all lowercase (as in "mydbcluster"). 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 cluster.

admin

1 to 16 alphanumeric characters. The first character must be a letter.

**Credentials management**  
You can use AWS Secrets Manager or manage your master user credentials.

☐ **Managed in AWS Secrets Manager - *most secure***  
RDS generates a password for you and manages it throughout its lifecycle using AWS Secrets Manager.

☒ **Self managed**  
Create your own password or have RDS create a password that you manage.

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

**Master password** [Info](#)

.....

**Password strength** **Strong**

Minimum constraints: At least 8 printable ASCII characters. Can't contain any of the following symbols: / ' " @

**Confirm master password** [Info](#)

.....

Slika 4. Izbor identifikatora i kreiranje korisnika



## KORACI U KREIRANJU RDS INSTANCE – NASTAVAK

### ▶ Klasa instance

- ▶ General purpose (db.m\*)
- ▶ Memory optimized (db.z\*  
db.x\* db.r\*)
- ▶ Compute optimized (db.c\*)
- ▶ Burstable performace (db.t\*)
- ▶ Optimized reads (db.r\*)

### Instance configuration

The DB instance configuration options below are limited to those supported by the engine that you selected above.

DB instance class [Info](#)

▼ 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

Slika 5. Klasa instance

## KORACI U KREIRANJU RDS INSTANCE – NASTAVAK

### ► Tip skladišta:

► General purpose SSD

► Provisioned IOPS

► Magnetic

**Storage**

**Storage type** [Info](#)  
Provisioned IOPS SSD (io2) storage volumes are now available.

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

**Storage autoscaling**

**Storage autoscaling** [Info](#)  
Provides dynamic scaling support for your database's storage based on your application's needs.

☐ **Enable storage autoscaling**  
Enabling this feature will allow the storage to increase after the specified threshold is exceeded.

**1**

**2**

**3**

Slika 6. Tip i kapacitet skladišta

## KORACI U KREIRANJU RDS INSTANCE – NASTAVAK

- ▶ Povezivanje sa EC2
- ▶ Kreiranje SSL sertifikata
- ▶ Podešavanje porta
- ▶ Podešavanje autentifikacije

**Connectivity** [Info](#)

**Compute resource**  
Choose whether to set up a connection to a compute resource for this database. Setting up a connection will automatically change connectivity settings so that the compute resource can connect to this database.

☐ 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. **1**

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

**EC2 instance** [Info](#)  
Choose the EC2 instance to add as the compute resource for this database. A VPC security group is added to this EC2 instance. A VPC security group is also added to the database with an inbound rule that allows the EC2 instance to access the database.

i-0f0b70ed67e4d831a  
database-client **2**

Slika 7. Povezivanje sa EC2 instancom



KARAKTERISTIKE RDS INSTANCE

Summary

DB identifier

bazepodataka

CPU

25.49%

Status

Available

Class

db.t3.micro

Role

Instance

Current activity

0 Connections

Engine

MySQL Community

Region & AZ

us-east-1c

Connectivity & security

Monitoring

Logs & events

Configuration

Zero-ETL integrations

Maintenance & backups

Tags

Connectivity & security

Endpoint & port

Endpoint

bazepodataka.c9ses8yau9on.us-east-1.rds.amazonaws.com

Port

3306

Networking

Availability Zone

us-east-1c

VPC

vpc-0eaec1e48af982258

Subnet group

rds-ec2-db-subnet-group-1

Subnets

subnet-0aef323e7e4cbcb4f  
subnet-06ee2a5010e95e652  
subnet-00024c73ad74bdeba  
subnet-02a1982a0c6141282  
subnet-0df832317bebbb982  
subnet-0c1cac09279312312

Security

VPC security groups

rds-ec2-4 (sg-0056fd7deb685a1c1)

Active

Publicly accessible

No

Certificate authority

rds-ca-rsa2048-g1

Info

Certificate authority date

May 26, 2061, 01:34 (UTC+02:00)

DB instance certificate expiration date

August 14, 2025, 17:05 (UTC+02:00)

Slika 8. RDS Instance Summary

The screenshot displays the AWS CloudWatch Metrics console for the 'bazepodataka' RDS instance. The main chart shows 'CPUUtilization' as a line graph over a 1-hour period. The y-axis represents 'Percent' from 0 to 42.1. The x-axis shows time from 22:45 to 01:30. The graph shows a peak in CPU utilization around 00:30. The console also includes tabs for 'Browse', 'Multi source query', 'Graphed metrics (1)', 'Options', and 'Source'. The 'Graphed metrics (1)' tab is selected, showing the 'bazepodataka' instance with a 'Region: us-east-1' and 'RDS' engine. The 'Add dynamic label' dropdown is set to 'Info'. The 'Statistic' is 'Average', the 'Period' is '1 minute', and the 'Y axis' is 'Average'. The 'Add math' and 'Add query' buttons are visible. The 'Clear graph' button is also present.

Slika 9. Monitoring

Recent events (10)		Last 1 day
Find events		< 1 > ⚙
Time	System notes	
August 16, 2024, 02:28 (UTC+02:00)	DB instance restarted	
August 16, 2024, 02:28 (UTC+02:00)	DB instance created	
August 16, 2024, 02:55 (UTC+02:00)	DB instance shutdown	
August 16, 2024, 03:01 (UTC+02:00)	DB instance deleted	
August 16, 2024, 03:13 (UTC+02:00)	DB instance restarted	
August 16, 2024, 03:14 (UTC+02:00)	Restored from snapshot bazepodataka-snapshot	
August 16, 2024, 03:16 (UTC+02:00)	DB instance shutdown	
August 16, 2024, 03:20 (UTC+02:00)	DB instance deleted	
August 16, 2024, 03:22 (UTC+02:00)	DB instance restarted	
August 16, 2024, 03:23 (UTC+02:00)	Restored from snapshot bazepodataka-snapshot	

Slika 10. Events

# RDS INSTANCE LOGOVI

Logs (3)

Filter by DB Logs

< 1 > ⚙

	Name ▲	Last written ▼	Size ▼
<input type="radio"/>	error/mysql-error-running.log	August 16, 2024, 03:30 (UTC+02:00)	17.2 kB
<input checked="" type="radio"/>	error/mysql-error.log	August 16, 2024, 03:33 (UTC+02:00)	223 B
<input type="radio"/>	mysqlUpgrade	August 16, 2024, 02:28 (UTC+02:00)	1 kB

Slika 11. RDS Instance logs

error/mysql-error.log

Back

Download

Logs details

Database identifier

bazepodataka

Log file name

error/mysql-error.log

Last written date

August 16, 2024, 03:33

File size

223 Bytes

Last fetched date

August 16, 2024, 03:34

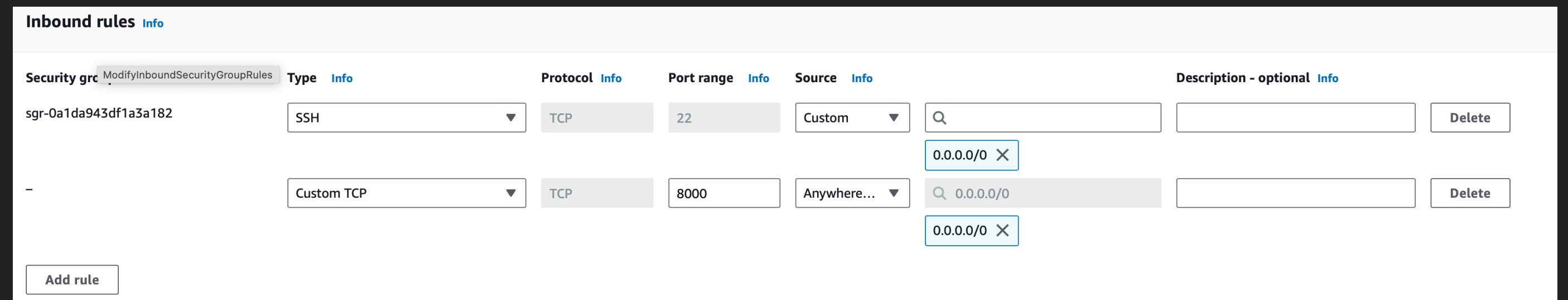
2024-08-16T01:33:17.692496Z 15 [Warning] [MY-013360] [Server] Plugin mysql\_native\_password reported: ''mysql\_native\_password' is deprecated and will be removed in a future release. Please use caching\_sha2\_password instead'

----- END OF LOG -----

Slika 12. Error/mysql-error.log

## PODEŠAVANJE EC2 INSTANCE

- ▶ Kopiranje fajlova
- ▶ Povezivanje putem SSH
- ▶ Instaliranje paketa
- ▶ Povezivanje sa bazom, kreiranje korisnika, dodela privilegija
- ▶ Izvršenje skripte za generisanje i upis podataka u bazu
- ▶ Dodavanje bezbednosnog pravila
- ▶ Startovanje http servera



Slika 13. EC2 security group inbound rules



# VRAĆANJE PODATAKA IZ BAZE

```
svetlanamancic@Svetlanas-MBP Downloads % curl 'http://34.234.90.186:8000/everyone/'
{"results":[[1,"Megan","Chang","gwilliams@example.com","Hullport","Lesotho","+3778242194892411","2012-11-20"],[2,"Gabriella","Kennedy","gomezleslie@example.net","New Thomas","Tonga","+8880801609753513","2014-12-31"],[3,"Jeffrey","Pratt","lindawest@example.org","Nancyfort","Botswana","+3831858398947196","1945-05-26"],[4,"John","White","antoniozavala@example.com","Jonesberg","Turkey","+201868483396947","1965-10-09"],[5,"Danielle","Graves","christopher91@example.com","Meganbury","Andorra","+44 76243525601230989","1987-07-28"]]}%
```

Slika 14 Curl /everyone

```
svetlanamancic@Svetlanas-MBP Downloads % curl 'http://34.234.90.186:8000/by-firstname/?first_name=John'
{"results":[[4,"John","White","antoniozavala@example.com","Jonesberg","Turkey","+201868483396947","1965-10-09"]]}%
```

Slika 15. Curl /by-firstname

```
svetlanamancic@Svetlanas-MBP Downloads % curl 'http://34.234.90.186:8000/by-lastname/?last_name=Chang'
{"results":[[1,"Megan","Chang","gwilliams@example.com","Hullport","Lesotho","+3778242194892411","2012-11-20"]]}%
```

Slika 16. Curl /by-lastname

# Vraćanje baze iz snapshot-a

RDS > Snapshots > bazepodataka-snapshot

bazepodataka-snapshot

Details

ARN	Option group	VPC
arn:aws:rds:us-east-1:010526276026:snapshot:bazepodataka-snapshot	default:mysql-8-0	vpc-0eaec1e48af982258
Instance/Cluster Name	Zone	Status
bazepodataka	us-east-1d	Available
Master username	KMS key ID	Storage type
admin	None	General Purpose SSD (gp2)
DB snapshot name	Source region	DB storage
bazepodataka-snapshot	N/A	20 GiB
Snapshot type	Snapshot Creation Time	IOPS
manual	August 16, 2024, 03:01 (UTC+02:00)	-
DB engine	Original Snapshot Creation Time	Storage throughput
mysql	August 16, 2024, 03:01 (UTC+02:00)	0
DB engine version	Instance/Cluster Creation	Port
8.0.35	August 16, 2024, 02:28 (UTC+02:00)	3306

Actions ▲

Restore snapshot

Copy snapshot

Share snapshot

Migrate snapshot

Export to Amazon S3

Delete snapshot

Slika 17. Snapshot baze

Connected compute resources (1) Info

Connections to compute resources that were created automatically by RDS are shown here. Connections to compute resources that were created manually aren't shown.

Filter by compute resources

< 1 > ⚙

Resource identifier	Resource type	Availability Zone	VPC security group	Compute resource security group	Connected proxy
i-0196c66c8cfcc1a71	EC2 instance	us-east-1c	rds-ec2-1	ec2-rds-1	-

Slika 18. Konekcija sa EC2

**HVALA NA PÁŽŇJI!**