

IS698 - DC93457

Project: Deploying a Scalable AWS Architecture with Infrastructure as Code

A. Infrastructure Deployment

Terraform

```
Command Prompt
aws_subnet.public["1"]: Still creating... [00m10s elapsed]
aws_subnet.public["1"]: Creation complete after 11s [id=subnet-05456803548a6f632]
aws_subnet.public["0"]: Creation complete after 11s [id=subnet-03c59a11ad0897b9a]
aws_route_table_association.public["1"]: Creating...
aws_route_table_association.public["0"]: Creating...
aws_nat_gateway.nat: Creating...
aws_route_table_association.public["1"]: Creation complete after 1s [id=rtbassoc-058bccc2338a9747b]
aws_route_table_association.public["0"]: Creation complete after 1s [id=rtbassoc-09c11ede44664cfb8]
aws_nat_gateway.nat: Still creating... [00m10s elapsed]
aws_nat_gateway.nat: Still creating... [00m20s elapsed]
aws_nat_gateway.nat: Still creating... [00m30s elapsed]
aws_nat_gateway.nat: Still creating... [00m40s elapsed]
aws_nat_gateway.nat: Still creating... [00m50s elapsed]
aws_nat_gateway.nat: Still creating... [01m00s elapsed]
aws_nat_gateway.nat: Still creating... [01m10s elapsed]
aws_nat_gateway.nat: Still creating... [01m20s elapsed]
aws_nat_gateway.nat: Still creating... [01m30s elapsed]
aws_nat_gateway.nat: Still creating... [01m40s elapsed]
aws_nat_gateway.nat: Creation complete after 1m45s [id=nat-0d7f43cbc7b707b00]
aws_route_table.private: Creating...
aws_route_table.private: Creation complete after 1s [id=rtb-0fe558fbf0e26c4c]
aws_route_table_association.private["0"]: Creating...
aws_route_table_association.private["1"]: Creating...
aws_route_table_association.private["1"]: Creation complete after 0s [id=rtbassoc-030b205d5349609f4]
aws_route_table_association.private["0"]: Creation complete after 0s [id=rtbassoc-0a0a51feffc1cde8b]

Apply complete! Resources: 17 added, 0 changed, 0 destroyed.

Outputs:
alb_sg_id = "sg-0d06f1f81d98aa318"
private_subnet_ids = [
  "subnet-03805cdea9c21a314",
  "subnet-04118cf5a7fa934c8",
]
public_subnet_ids = [
  "subnet-03c59a11ad0897b9a",
  "subnet-05456803548a6f632",
]
rds_sg_id = "sg-02b2a6e086eddb1a8"
vpc_id = "vpc-05b1463c0f0bc7fa4"
web_sg_id = "sg-03016daa5a2b032c3"

C:\Users\acer>terraform-form-698>
```

	Name	VPC ID	State	Encryption c...	Encryption control ...	Block Public...	IPv4 CIDR
<input type="checkbox"/>	cloud-arch-project-vpc	vpc-05b1463c0f0bc7fa4	Available	-	-	Off	10.0.0.0/16
<input type="checkbox"/>	-	vpc-06773ba915b6d5b65	Available	-	-	Off	172.31.0.0/16

Subnets (10) Info

Find subnets by attribute or tag

Name	Subnet ID	State	VPC	Block Public...	IPv4 CIDR	IPv6 C
cloud-arch-project-public-0	subnet-03c59a11ad0897b9a	Available	vpc-05b1463c0f6bc7fa4 cloud...	Off	10.0.1.0/24	-
-	subnet-07ed5b2aecdb90065	Available	vpc-06773ba915b6d5b65	Off	172.31.32.0/20	-
-	subnet-06779e79e73cb5a	Available	vpc-06773ba915b6d5b65	Off	172.31.0.0/20	-
cloud-arch-project-private-0	subnet-030b5cdea9c21a314	Available	vpc-05b1463c0f6bc7fa4 cloud...	Off	10.0.11.0/24	-
cloud-arch-project-private-1	subnet-04118cf5a7f934c8	Available	vpc-05b1463c0f6bc7fa4 cloud...	Off	10.0.12.0/24	-
-	subnet-0ecd78dda3b43e643	Available	vpc-06773ba915b6d5b65	Off	172.31.64.0/20	-
cloud-arch-project-public-1	subnet-05456803548a6f632	Available	vpc-05b1463c0f6bc7fa4 cloud...	Off	10.0.2.0/24	-
-	subnet-0ebd125d7bc87da38	Available	vpc-06773ba915b6d5b65	Off	172.31.48.0/20	-

Route tables (4) Info

Find route tables by attribute or tag

Name	Route table ID	Explicit subnet associ...	Edge associations	Main	VPC	Owner ID
cloud-arch-project-public-rt	rtb-0e0e781b10986bb97	2 subnets	-	No	vpc-05b1463c0f6bc7fa4 cloud...	352647309370
-	rtb-0db0303ecf81e8611	-	-	Yes	vpc-05b1463c0f6bc7fa4 cloud...	352647309370
cloud-arch-project-private-rt	rtb-0fe558f10e26c4c4	2 subnets	-	No	vpc-05b1463c0f6bc7fa4 cloud...	352647309370
-	rtb-057c4b496d9cd9fee	-	-	Yes	vpc-06773ba915b6d5b65	352647309370

Internet gateways (2) Info

Find internet gateways by attribute or tag

Name	Internet gateway ID	State	VPC ID	Owner
cloud-arch-project-igw	igw-05a17cf544bc1a86	Attached	vpc-05b1463c0f6bc7fa4 cloud-arch-p...	352647309370
-	igw-0ef1c6591725b5a98	Attached	vpc-06773ba915b6d5b65	352647309370

Security Groups (5) Info

Find security groups by attribute or tag

Name	Security group ID	Security group name	VPC ID	Description
cloud-arch-project-alb...	sg-0d06f1f81d98aa318	cloud-arch-project-alb-sg	vpc-05b1463c0f6bc7fa4	ALB security group
-	sg-0b409e2b37e219e17	default	vpc-06773ba915b6d5b65	default VPC security group
-	sg-083a1e7f3a72563f6	default	vpc-05b1463c0f6bc7fa4	default VPC security group
cloud-arch-project-w...	sg-03016daa5a2b032c3	cloud-arch-project-web-sg	vpc-05b1463c0f6bc7fa4	Web server security group
cloud-arch-project-r...	sg-02b2a6e086eddb1a8	cloud-arch-project-rds-sg	vpc-05b1463c0f6bc7fa4	RDS security group

In this section, I used Terraform to build the core networking layer for the project. Terraform automatically created my VPC, subnets, route tables and security groups exactly the way I defined them in the code. Instead of manually creating networking resources, Terraform handled all of it in one shot.

CloudFormation > Stacks > Create stack

Step 3

Configure stack options

Step 4

Review and create

Stack name

rdsg99

Stack name must contain only letters (a-z, A-Z), numbers (0-9), and hyphens (-) and start with a letter. Max 128 characters. Character count: 6/128.

Parameters

Parameters are defined in your template and allow you to input custom values when you create or update a stack.

DBName

Name of the initial database to create

cloudprojectdb

DBPassword

Master password (at least 8 characters)

DBUsername

Master username (1716 chars, letters/numbers, must start with a letter)

PrivateSubnet1Id

First private subnet ID

subnet-030b5cdea9c21a314

PrivateSubnet2Id

Second private subnet ID

subnet-04118cf5a7fa934c8

RdSecurityGroupId

RDS security group ID (must belong to the same VPC)

sg-02b2a6e086eddb1a8

VpcId

VPC ID from Terraform output vpc_id

AWS

Search

[Alt+S]

Account ID: 3526-4710-9170

Sumanth_Console_User

Aurora and RDS

Databases

rds698-mydbinstance-qfjghsjrhrkc

Aurora and RDS

Dashboard

Databases

Performance insights

Snapshots

Exports in Amazon S3

Automated backups

Reserved instances

Proxies

Subnet groups

Parameter groups

Option groups

Custom engine versions

Zero-ETL integrations

Events

Event subscriptions

Recommendations

Certificate update

rds698-mydbinstance-qfjghsjrhrkc

Summary

DB identifier
rds698-mydbinstance-qfjghsjrhrkc

Status
Available

Role
Instance

Engine
MySQL Community

Recommendations

CPU
3.90%

Class
db.t3.micro

Current activity
0 Connections

Region & AZ
us-east-1a

Connectivity & security

Monitoring

Logs & events

Configuration

Zero-ETL integrations

Maintenance & backups

Data migrations

Tags

Recommendations

Connectivity & security

Endpoint & port

Networking

Security

Endpoint
rds698-mydbinstance-qfjghsjrhrkc.cmtoeaq4zyu
s-east-1.rds.amazonaws.com

Port
3306

Availability Zone
us-east-1a

VPC
cloud-arch-project-vpc (vpc-05b1463c0f6bc7fa4)

Subnet group
rds698-dbsubnetgroup-vvd2xyvytgk

Subnets
subnet-04118cf5a7fa934c8
subnet-032b5cdea9c21a314

Network type
IPv4

VPC security groups
cloud-arch-project-rds-sg (sg-02b2a6e086edcd1a8)
Active

Publicly accessible
No

Certificate authority
rds-ca-rsa2048-g1

Certificate authority date
May 25, 2061, 19:34 (UTC-04:00)

DB Instance certificate expiration date
December 06, 2026, 17:46 (UTC-05:00)

CloudFormation

Stacks

Create stack

Step 3

Configure stack options

Step 4

Review and create

Stack name

ec2698

Stack name must contain only letters (a-z, A-Z), numbers (0-9), and hyphens (-) and start with a letter. Max 128 characters. Character count: 6/128.

Parameters

Parameters are defined in your template and allow you to input custom values when you create or update a stack.

AlbSecurityGroupid

ALB security group ID

sg-0d06f1f81d98aa318

DBEndpointAddress

RDS database endpoint address (from RDS stack output)

rdse98-mydbinstance-qfghsjhrkc.mtoteaqe4zy.us-east-1.rds.amazonaws.com

DBName

Database name created in RDS stack (for example cloudprojectdb)

rdse98-mydbinstance-qfghsjhrkc

DBPassword

RDS master password (same as RDS stack)

DBUsername

RDS master username (same as RDS stack)

PrivateSubnet1Id

First private subnet ID

subnet-030b5cde9c21a314

PrivateSubnet2Id

Second private subnet ID

EC2

Instances

I-04674943ff91fc96b

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KMS Keys

Instance summary for I-04674943ff91fc96b (simple-ec2-public) info

Updated less than a minute ago

Instance ID

I-04674943ff91fc96b

IPv6 address

-

Hostname type

IP name: ip-10-0-1-65.ec2.internal

Answer private resource DNS name

-

Auto-assigned IP address

44.199.236.168 [Public IP]

IAM Role

-

IMDSv2

Required

Operator

-

Public IPv4 address

44.199.236.168 | open address

Instance state

Running

Private IP DNS name (IPv4 only)

ip-10-0-1-65.ec2.internal

Instance type

t3.micro

VPC ID

vpc-05b1463c0f6bc7fa4 (cloud-arch-project-vpc)

Subnet ID

subnet-03c59a11ad0897b9a (cloud-arch-project-public-0)

Instance ARN

arn:aws:ec2:us-east-1:352647309370:instance/I-04674943ff91fc96b

Private IPv4 addresses

10.0.1.65

Public DNS

ec2-44-199-236-168.compute-1.amazonaws.com | open address

Elastic IP addresses

-

AWS Compute Optimizer finding

Opt-in to AWS Compute Optimizer for recommendations. | Learn more

Auto Scaling Group name

-

Managed

false

Details

Status and alarms

Monitoring

Security

Networking

Storage

Tags

Instance details info

AMI ID

ami-0fa3fe0fa7920f68e

AMI name

al2023-ami-2023.9.20251117.1-kernel-6.1-x86_64

Stop protection

Disabled

Monitoring

disabled

Allowed image

-

Launch time

Sat Dec 06 2025 18:19:43 GMT-0500 (Eastern Standard Time) (3 minutes)

Platform details

Linux/UNIX

Termination protection

Disabled

AMI location

amazon/al2023-ami-2023.9.20251117.1-kernel-6.1-x86_64

Hello from a simple EC2 instance!

This instance was created using a basic CloudFormation template in a public subnet.

Configure database with application

```
[ec2-user@ip-10-0-1-65:~]$
$db_user='admin';
$db_pass='admin1234';

$conn = new mysqli($db_host,$db_user,$db_pass,$db_name);

if ($conn->connect_error) {
    echo "Database connection failed: " . $conn->connect_error;
} else {
    echo "Database connection successful to database '$db_name' on '$db_host'.";
}

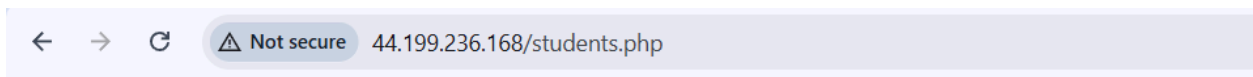
$conn->close();
?>

[ec2-user@ip-10-0-1-65 ~]$ cat /etc/os-release
NAME="Amazon Linux"
VERSION="2023"
ID="amzn"
ID_LIKE="fedora"
VERSION_ID="2023"
PLATFORM_ID="platform:al2023"
PRETTY_NAME="Amazon Linux 2023.9.20251117"
ANSI_COLOR="0;33"
VTS_URL="https://spaces.amazon.com/linux/2023"
HOME_URL="https://aws.amazon.com/linux/amazon-linux-2023/"
DOCUMENTATION_URL="https://docs.aws.amazon.com/linux/"
SUPPORT_URL="https://aws.amazon.com/premiumsupport/"
BUG_REPORT_URL="https://github.com/amazonlinux/amazon-linux-2023"
VENDOR_NAME="AWS"
VENDOR_URL="https://aws.amazon.com/"
SUPPORT_END="2029-06-30"

[ec2-user@ip-10-0-1-65 ~]$ sudo dnf update -y
Last metadata expiration check: 0:42:12 ago on Sat Dec 6 23:20:12 2025.
Dependencies resolved.
Nothing to do.
Complete!

[ec2-user@ip-10-0-1-65 ~]$ sudo dnf install -y httpd php php-mysqld
Last metadata expiration check: 0:42:38 ago on Sat Dec 6 23:20:12 2025.
Package httpd-2.4.65-1.amzn2023.0.2.x86_64 is already installed.
Package php-8.4-8.4.14-1.amzn2023.0.1.x86_64 is already installed.
Package php84-mysqld-8.4.14-1.amzn2023.0.1.x86_64 is already installed.
Dependencies resolved.
Nothing to do.
Complete!

[ec2-user@ip-10-0-1-65 ~]$ sudo systemctl enable httpd
[ec2-user@ip-10-0-1-65 ~]$ sudo systemctl restart httpd
[ec2-user@ip-10-0-1-65 ~]$ sudo nano /var/www/html/index.php
[ec2-user@ip-10-0-1-65 ~]$ sudo systemctl restart httpd
[ec2-user@ip-10-0-1-65 ~]$
```



Student Records from RDS

ID	Name	Major	Year
1	Ken Adams	Computer Science	2
2	Sumanth Reddy	Information Systems	3

In this step I connected my EC2 web server to the RDS database. I wrote a small simple PHP script (db-check.php) using SSH and uploaded it to /var/www/html/. The script tries to connect to RDS using the endpoint, username, and password. Testing this in the browser showed "Database connection successful" which confirms that EC2 and RDS databases are connected.

After the successful connection using MySql in SSH, I created a table 'Students' in database and inserted student values. I created a new php script called 'students.php' where it will connect the database to the dynamic web page. When opened it with EC2 instance then, I see 2 student records in the web page.

Autoscaling

CloudFormation

Stacks

Create stack

Step 3

Configure stack options

Step 4

Review and create

Stack name

ec2autoscaling

Stack name must contain only letters (a-z, A-Z), numbers (0-9), and hyphens (-) and start with a letter. Max 128 characters. Character count: 14/128.

Parameters

Parameters are defined in your template and allow you to input custom values when you create or update a stack.

DBEndpointAddress

RDS endpoint from RDS stack output

rd6698-mydbinstance-qfjghjtrkc.cmtoeaqe4zjy-us-east-1.rds.amazonaws.com

DBName

Database name used on RDS

cloudprojectdb

DBPassword

RDS master password (same as RDS stack)

DBUsername

RDS master username (same as RDS stack)

PublicSubnet1Id

First public subnet ID

subnet-03c59a11ad0897b9a

PublicSubnet2Id

Second public subnet ID

subnet-05456803548a6f632

VpcId

VPC ID where the EC2 instances will be created

Account ID: 3526-4750-9370

Sumanth_Console_User

CloudShell

Feedback

Console Mobile App

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Stacks (3) Filter status

Search by stack name Active ▾

☒ View nested < 1 > ⚙️

- ec2autoscaling**
2025-12-06 19:34:02 UTC-0500
CREATE_COMPLETE
- ec2e988
 2025-12-06 18:00:50 UTC-0500
UPDATE_COMPLETE
- rds698
 2025-12-06 17:44:04 UTC-0500
CREATE_COMPLETE

ec2autoscaling

Delete Update stack ▾ Stack actions ▾ Create stack ▾

Stack info | **Events** | Resources | Outputs | Parameters | Template | Change sets | Git sync

Table view Timeline view View root cause ⚙️

Events (14)

Search events

Operation ID	Timestamp	Logical ID	Status	Detailed status	Status reason
25060f18-fd0e-4c73-9077-f41d75a7e62c	-	-	-	-	-
25060f18-fd0e-4c73-9077-f41d75a7e62c	2025-12-06 19:34:27 UTC-0500	ec2autoscaling iL	CREATE_COMPLETE	-	-
25060f18-fd0e-4c73-9077-f41d75a7e62c	2025-12-06 19:34:26 UTC-0500	CpuTargetTrackingPolicy iL	CREATE_COMPLETE	-	-
25060f18-fd0e-4c73-9077-f41d75a7e62c	2025-12-06 19:34:23 UTC-0500	WebAutoScalingGroup iL	CREATE_COMPLETE	-	-
25060f18-fd0e-4c73-9077-f41d75a7e62c	2025-12-06 19:34:20 UTC-0500	ec2autoscaling iL	CREATE_IN_PROGRESS	CONFIGURATION_COMPLETE	Eventual consistency check initiated

EC2 > Auto Scaling groups

Reserved instances
Dedicated Hosts
Capacity Reservations
Capacity Manager [New](#)

Images

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Elastic Block Store

Volumes
Snapshots
Lifecycle Manager

Auto Scaling groups (1) [Info](#)

Last updated less than a minute ago

[Launch configurations](#)[Launch templates](#)[Actions](#)[Create Auto Scaling group](#)

Search your Auto Scaling groups

<input type="checkbox"/>	Name	Launch template/configuration	Instances	Status	Desired capacity	Min	Max	Availability Zones	Creation time
<input type="checkbox"/>	ec2autoscaling-WebAutoScalingGroup-LKmwhtCMnOBP	ec2autoscaling-web-It Version 1	1	-	1	1	3	2 Availability Zones	Sat Dec 06 2025 19...

EC2 > Launch templates > ec2autoscaling-web-It

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ec2autoscaling-web-It (lt-0c711791cb6ecdb58)

[Actions](#)[Delete template](#)

Launch template details

Launch template ID
lt-0c711791cb6ecdb58

Launch template name
ec2autoscaling-web-It

Default version
1

Owner
arn:aws:iam::352647309370:user/Sumanth_Console_User

Details

Versions

Template tags

Launch template version details

Version
1 (Default)

Description
-

Date created
2025-12-07T00:34:05.000Z

Created by
arn:aws:iam::352647309370:user/Sumanth_Console_User

Instance details

Storage

Resource tags

Network interfaces

Advanced details

AMI ID
ami-0fa3fe0fa7920f68e

Instance type
t3.micro

Availability Zone
-

Availability Zone id
-

Key pair name
638ffnalproject

Security groups
-

Security group IDs
sg-03016daa5a2b032c3

EC2 > Instances > i-0904f17c1ea3561b0

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Instance summary for i-0904f17c1ea3561b0 (asg-web-instance) [Info](#)

Updated less than a minute ago

[Connect](#)[Instance state](#)[Actions](#)

Instance ID
i-0904f17c1ea3561b0

Public IPv4 address
44.204.186.241 | [open address](#)

Private IPv4 addresses
10.0.1.231

IPv6 address
-

Instance state
Running

Public DNS
ec2-44-204-186-241.compute-1.amazonaws.com | [open address](#)

Hostname type
IP name: ip-10-0-1-231.ec2.internal

Private IP DNS name (IPv4 only)
ip-10-0-1-231.ec2.internal

Elastic IP addresses
-

Answer private resource DNS name
-

Instance type
t3.micro

AWS Compute Optimizer finding
[Opt-in to AWS Compute Optimizer for recommendations. | Learn more](#)

Auto-assigned IP address
44.204.186.241 [Public IP]

VPC ID
vpc-05b1463c0f6bc7fa4 (cloud-arch-project-vpc)

Auto Scaling Group name
ec2autoscaling-WebAutoScalingGroup-LKmwhtCMnOBP

IAM Role
-

Subnet ID
subnet-03c59a11ad0897b9a (cloud-arch-project-public-0)

Managed
false

IMDSv2
Required

Instance ARN
arn:aws:ec2:us-east-1:352647309370:instance/i-0904f17c1ea3561b0

Operator
-

Details

Status and alarms

Monitoring

Security

Networking

Storage

Tags

Instance details

AMI ID
ami-0fa3fe0fa7920f68e

Monitoring
disabled

Platform details
Linux/UNIX

AMI name
al2023-ami-2023.9.20251117.1-kernel-6.1-x86_64

Allowed image
-

Termination protection
Disabled

Stop protection
Disabled

Launch time
Sat Dec 06 2025 19:34:15 GMT-0500 (Eastern Standard Time) (4 minutes)

AMI location
amazon/al2023-ami-2023.9.20251117.1-kernel-6.1-x86_64

CloudShellFeedback

Console Mobile App

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Hello from an Auto Scaling EC2 instance!

This instance was launched by an Auto Scaling Group.

To test the database connection, open `/db-check.php`.

```
ec2-user@ip-10-0-1-231:~  
login as: ec2-user  
Authenticating with public key "698finalproject"  
  
#####  
# Amazon Linux 2023  
#####  
|  
###|  
|  
V-+--+>  
|  
m/+--+<-->  
|  
[ec2-user@ip-10-0-1-231 ~]$ sudo yum install -y stress  
Last metadata expiration check: 0:28:31 ago on Sun Dec 7 00:34:42 2025.  
Dependencies resolved.  
  
=====
```

Package	Architecture	Version	Repository	Size
Installing:				
stress	x86_64	1.0.7-2.amzn2023.0.1	amazonlinux	34 k

```
=====
```

Transaction Summary

```
=====
```

Install 1 Package

Total download size: 34 k
Installed size: 68 k
Downloading Packages:
stress-1.0.7-2.amzn2023.0.1.x86_64.rpm 1.1 MB/s | 34 kB 00:00

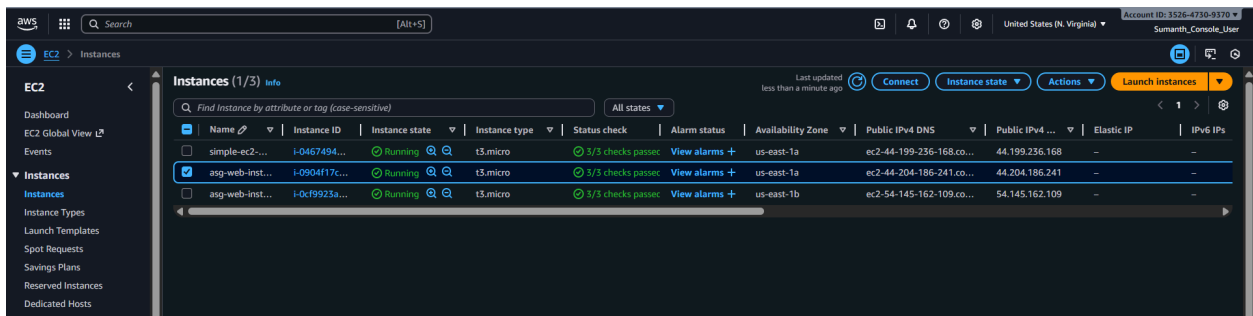
Total	580 kB/s		34 kB	00:00

```
-----
```

Running transaction check
Transaction check succeeded.
Running transaction test
Transaction test succeeded.
Running transaction
Preparing : 1/1
Installing : stress-1.0.7-2.amzn2023.0.1.x86_64 1/1
Running scriptlet: stress-1.0.7-2.amzn2023.0.1.x86_64 1/1
Verifying : stress-1.0.7-2.amzn2023.0.1.x86_64 1/1

Installed:
stress-1.0.7-2.amzn2023.0.1.x86_64

Complete!
[ec2-user@ip-10-0-1-231 ~]\$ stress --cpu 4 --timeout 120
stress: info: [26995] dispatching hogs: 4 cpu, 0 io, 0 vm, 0 hdd



The image displays two screenshots of the AWS Management Console, specifically the 'Auto Scaling groups' page for an Auto Scaling Group (ASG) named 'ec2autoscaling-WebAutoScalingGroup-LKmwhtCMmOBP'.

Top Screenshot: Instance Management

- Details:** Shows 'Desired capacity' as 1, 'Scaling limits (Min - Max)' as 1 - 3, and 'Desired capacity type' as 'Units (number of instances)'. The status is 'Healthy'.
- Instances (2):** A table listing two instances:

Instance ID	Lifecycle	Instance type	Weighted capacity	Launch templ...	Availability Zone	Health status	Protected from
i-0904f17c1ea3561b0	InService	t3.micro	-	ec2autoscaling-web-lt	us-east-1a	Healthy	
i-0cf9923a62fa82bfd	InService	t3.micro	-	ec2autoscaling-web-lt	us-east-1b	Healthy	
- Instance lifecycle policy for lifecycle hooks:** Shows 'Termination hook abandon behavior' set to 'Terminate (default)'.
- Lifecycle hooks (0):** A table with columns: Name, Lifecycle transition, Default result, Heartbeat timeout (seconds), Notification target ARN, and Role ARN. It states 'No lifecycle hooks are currently configured.'

Bottom Screenshot: Activity

- Activity notifications (0):** A table with columns: Send to, On instance action. It states 'No notifications are currently specified'.
- Activity history (2):** A table showing two successful activities:

Status	Description	Cause	Start time	End time
Successful	Launching a new EC2 instance: i-0cf9923a62fa82bfd	At 2025-12-07T01:09:24Z a monitor alarm TargetTracking-ec2autoscaling-WebAutoScalingGroup-LKmwhtCMmOBP-AlarmHigh-3ee58945-5d80-4c38-931b-1dfe90f87741 in state ALARM triggered policy ec2autoscaling-CpuTargetTrackingPolicy-6ZUvgt7nk4 changing the desired capacity from 1 to 2. At 2025-12-07T01:09:34Z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 1 to 2.	2025 December 06, 08:09:35 PM -05:00	2025 December 06, 08:11:40 PM -05:00
Successful	Launching a new EC2 instance: i-0904f17c1ea3561b0	At 2025-12-07T00:34:12Z a user request update of AutoScalingGroup constraints to min: 1, max: 3, desired: 1 changing the desired capacity from 0 to 1. At 2025-12-07T00:34:14Z an instance was started in response to a difference between desired and actual capacity, increasing the capacity from 0 to 1.	2025 December 06, 07:34:16 PM -05:00	2025 December 06, 07:34:21 PM -05:00

Here, I created a launch template and linked it to an Auto Scaling Group (ASG). The ASG automatically launched new EC2 instances in the public subnets whenever the load increased. I tested autoscaling by SSH-ing into the instance and stressing the CPU. When CloudWatch detected high CPU usage, a new EC2 instance was created.

B. AWS Lambda for Logging S3 Uploads

The top screenshot shows the AWS Management Console interface for the 's3lambda698' CloudFormation stack. The 'Events' tab is selected, displaying a list of 14 events. The events include the creation of the stack itself, the creation of an 'AppBucket', and the creation of 'S3InvokeLambdaPermission' for the bucket. The status of the events is 'CREATE_COMPLETE' or 'CREATE_IN_PROGRESS'.

Operation ID	Timestamp	Logical ID	Status	Detailed status	Status reason
a620386a-64b0-4140-aca1-2f5c47356090	2025-12-06 21:05:53 UTC-0500	s3lambda698	CREATE_COMPLETE	-	-
a620386a-64b0-4140-aca1-2f5c47356090	2025-12-06 21:05:52 UTC-0500	AppBucket	CREATE_COMPLETE	-	-
a620386a-64b0-4140-aca1-2f5c47356090	2025-12-06 21:05:38 UTC-0500	S3InvokeLambdaPermission	CREATE_COMPLETE	-	-
a620386a-64b0-4140-aca1-2f5c47356090	2025-12-06 21:05:38 UTC-0500	AppBucket	CREATE_IN_PROGRESS	-	Resource creation Initiated
a620386a-64b0-4140-aca1-2f5c47356090	2025-12-06 21:05:38 UTC-0500	S3InvokeLambdaPermission	CREATE_IN_PROGRESS	-	Resource creation Initiated

The bottom screenshot shows the AWS Management Console interface for the 's3lambda698-appbucket-zebm2iebyvh6' bucket. The 'Objects' tab is selected, displaying a message that there are no objects in the bucket. The interface includes a search bar and a table with columns for Name, Type, Last modified, Size, and Storage class.

The top screenshot shows the AWS Lambda console for the function `s3lambda698-s3-logger`. The function is part of the `s3lambda698` application. The overview shows the function's description, last modified time (3 minutes ago), and its ARN: `arn:aws:lambda:us-east-1:352647309370:function:s3lambda698-s3-logger`. The function is currently in the `Test` state. The code source is `s3lambda698-s3-logger`.

The bottom screenshot shows the CloudWatch Logs for the function `s3lambda698-s3-logger`. The logs are filtered by the function name. The log events show the function's execution details, including the runtime version, request ID, and the event data received from the S3 bucket.

Timestamp	Message
2025-12-07T18:22:22Z	INIT_START Runtime Version: python:3.11.v107 Runtime Version ARN: arn:aws:lambda:us-east-1:runtime:621ac09144e90c95643668b02097cd92d2c95ef16alc74e80767be4952
2025-12-07T18:22:31Z	START RequestId: 0251b64b-b6bd-44ab-bca8-e735b8f01178 Version: \$LATEST
2025-12-07T18:22:32Z	[INFO] 2025-12-07T18:22:31Z 0251b64b-b6bd-44ab-bca8-e735b8f01178 Received event: {"Records": [{"eventVersion": "2.1", "eventSource": "aws:s3", "awsRegion": "us-east-1", "eventTime": "2025-12-07T18:21:88Z", "eventName": "Ob...
2025-12-07T18:22:32Z	[INFO] 2025-12-07T18:22:32Z 0251b64b-b6bd-44ab-bca8-e735b8f01178 New object uploaded: bucket=s3lambda698-appbucket-cdm2iebyv6, key=Test.txt
2025-12-07T18:22:32Z	END RequestId: 0251b64b-b6bd-44ab-bca8-e735b8f01178
2025-12-07T18:22:32Z	REPORT RequestId: 0251b64b-b6bd-44ab-bca8-e735b8f01178 Duration: 1.75 ms Billed Duration: 90 ms Memory Size: 128 MB Max Memory Used: 34 MB Init Duration: 88.89 ms

In this step I created a Lambda function in Python that writes logs to CloudWatch whenever someone uploads a file to a specific S3 bucket. After attaching the S3 event trigger, every upload will trigger the Lambda function. When I checked CloudWatch Logs, I could see the file name and metadata.

C. AWS Interaction

AWS CLI: Manage EC2, S3, and Lambda resources.

Using AWS CLI commands, I listed the running instances in the EC2, listed the Buckets and files in the S3 bucket. Also I invoked the lambda function.

Python Boto3 scripts:

```
Command Prompt
C:\Users\acer>aws ec2 describe-instances
{
  "Reservations": [
    {
      "ReservationId": "r-0d8e95ac7eb8d5367",
      "OwnerId": "352647389370",
      "RequesterId": "043234862703",
      "Groups": [],
      "Instances": [
        {
          "Architecture": "x86_64",
          "BlockDeviceMappings": [
            {
              "DeviceName": "/dev/xvda",
              "Ebs": {
                "AttachTime": "2025-12-06T23:19:44+00:00",
                "DeleteOnTermination": true,
                "Status": "attached",
                "VolumeId": "vol-0ccd1068f6715a76b"
              }
            }
          ],
          "ClientToken": "becicefa-c208-a6ad-7b09-c87ba4f9974f",
          "EbsOptimized": false,
          "EnaSupport": true,
          "Hypervisor": "xen",
          "NetworkInterfaces": [
            {
              "Association": {
                "IpOwnerId": "amazon",
                "PublicDnsName": "ec2-44-199-236-168.compute-1.amazonaws.com",
                "PublicIp": "44.199.236.168"
              },
              "Attachment": {
                "AttachTime": "2025-12-06T23:19:43+00:00",
                "AttachmentId": "eni-attach-06b6c7eba5f9d2f6c",
                "DeleteOnTermination": true,
                "DeviceIndex": 0,
                "Status": "attached",
                "NetworkCardIndex": 0
              },
              "Description": "",
              "Groups": [
                {
                  "GroupId": "sg-0dbf87bf9f91dbf40",
                  "GroupName": "ec2698-WebServerSecurityGroup-ychkDStyzt1m"
                }
              ]
            }
          ],
          "State": {
            "Name": "running",
            "Reason": null
          }
        }
      ]
    }
  ]
}
```

```
Command Prompt
C:\Users\acer>
C:\Users\acer>aws s3 ls
2025-11-23 17:38:12 cf-templates-bgd5h1kx9dt4-us-east-1
2025-12-06 21:05:41 s3lambda698-appbucket-zebm2iebyvh6

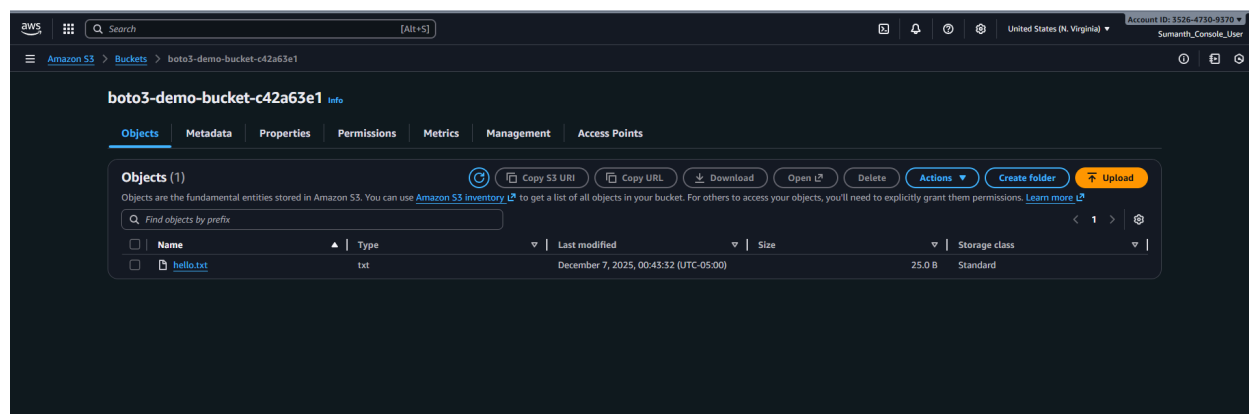
C:\Users\acer>aws s3 ls s3://s3lambda698-appbucket-zebm2iebyvh6/
2025-12-06 21:10:22      12 Test.txt

C:\Users\acer>
```

```
cmd Command Prompt
C:\Users\acer>aws s3 ls
2025-11-23 17:38:12 cf-templates-bgd5h1kx9dt4-us-east-1
2025-12-06 21:05:41 s3lambda698-appbucket-zebm2iebyvh6

C:\Users\acer>aws s3 ls s3://s3lambda698-appbucket-zebm2iebyvh6/
2025-12-06 21:10:22      12 Test.txt

C:\Users\acer>aws lambda list-functions
{
  "Functions": [
    {
      "FunctionName": "s3lambda698-s3-logger",
      "FunctionArn": "arn:aws:lambda:us-east-1:352647309370:function:s3lambda698-s3-logger",
      "Runtime": "python3.11",
      "Role": "arn:aws:iam:352647309370:role/s3lambda698-lambda-role",
      "Handler": "index.lambda_handler",
      "CodeSize": 386,
      "Description": "",
      "Timeout": 10,
      "MemorySize": 128,
      "LastModified": "2025-12-07T02:05:30.909+0000",
      "CodeSha256": "k+a+cYHfo9fwm5jYE8hf/bBJO3N6dDrfQBoKQ5bCPhY=",
      "Version": "$LATEST",
      "TracingConfig": {
        "Mode": "PassThrough"
      },
      "RevisionId": "af49d294-1475-44c3-8939-7772abedb755",
      "PackageType": "Zip",
      "Architectures": [
        "x86_64"
      ],
      "EphemeralStorage": {
        "Size": 512
      },
      "SnapStart": {
        "ApplyOn": "None",
        "OptimizationStatus": "Off"
      },
      "LoggingConfig": {
        "LogFormat": "Text",
        "LogGroup": "/aws/lambda/s3lambda698-s3-logger"
      }
    }
  ]
}
```



```
ec2-user@ip-10-0-1-65:~  
python3-pip-21.3.1-2.amzn2023.0.14.noarch  
  
Complete!  
[ec2-user@ip-10-0-1-65 ~]$ pip3 install requests  
Defaulting to user installation because normal site-packages is not writeable  
Requirement already satisfied: requests in /usr/lib/python3.9/site-packages (2.25.1)  
Requirement already satisfied: idna<3,>=2.5 in /usr/lib/python3.9/site-packages (from requests) (2.10)  
Requirement already satisfied: urllib3<1.27,>=1.21.1 in /usr/lib/python3.9/site-packages (from requests) (1.25.10)  
Requirement already satisfied: chardet<5,>=3.0.2 in /usr/lib/python3.9/site-packages (from requests) (4.0.0)  
[ec2-user@ip-10-0-1-65 ~]$ nano ec2_metadata.py  
[ec2-user@ip-10-0-1-65 ~]$ python3 ec2_metadata.py  
Error fetching metadata: 401 Client Error: Unauthorized for url: http://169.254.169.254/latest/meta-data/instance-id  
[ec2-user@ip-10-0-1-65 ~]$ nano ec2_metadata.py  
[ec2-user@ip-10-0-1-65 ~]$ python3 ec2_metadata.py  
Instance ID: i-04674943ff91fc96b  
Availability Zone: us-east-1a  
Local IPv4: 10.0.1.65  
Public IPv4: 44.199.236.168  
[ec2-user@ip-10-0-1-65 ~]$
```

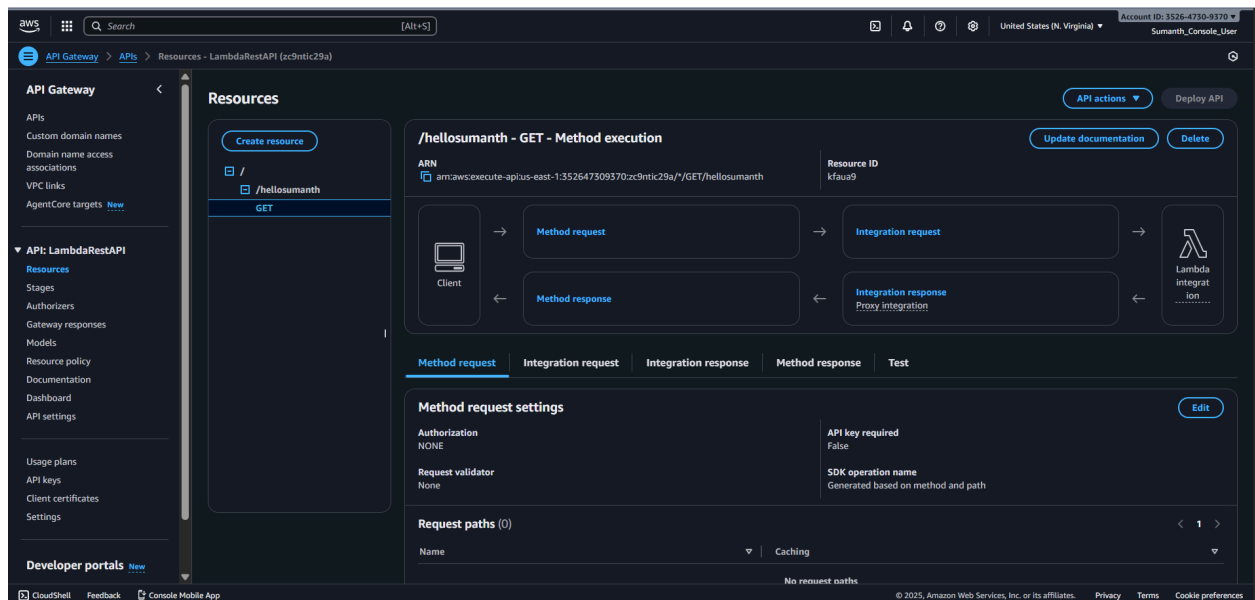
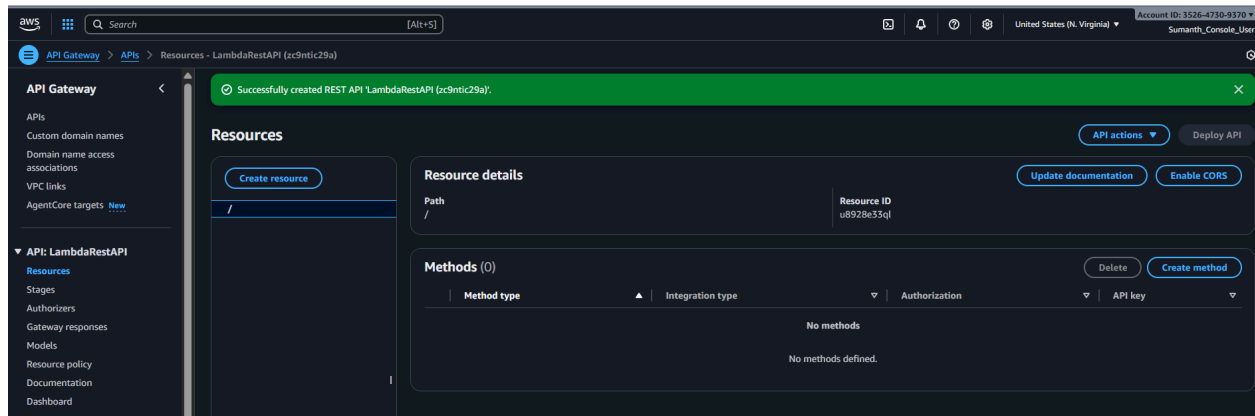
```
Command Prompt  
C:\Users\acer\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\Python 3.13>python create_bucket.py  
Creating bucket: boto3-demo-bucket-c42a63e1  
Uploading hello.txt to boto3-demo-bucket-c42a63e1  
Done. You can verify in S3 console.  
  
C:\Users\acer\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\Python 3.13>python list_ec2.py  
Running EC2 instances:  
- ID: i-04674943ff91fc96b, State: running, Name: simple-ec2-public, Public IP: 44.199.236.168  
- ID: i-0904f17c1ea3561b0, State: running, Name: asg-web-instance, Public IP: 44.204.186.241  
  
C:\Users\acer\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\Python 3.13>python invoke_lambda.py  
Invoking Lambda: s3lambda698-s3-logger  
Lambda response payload:  
{"status": "ok"}  
  
C:\Users\acer\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\Python 3.13>
```

I wrote Python scripts to:

- create an S3 bucket
- upload a file
- retrieve EC2 metadata
- list running EC2 instances
- invoke Lambda manually

Bonus Challenge

Deploy **API Gateway** to invoke Lambda via HTTP requests.



← → ↻ 🔍 `zc9ntic29a.execute-api.us-east-1.amazonaws.com/dev`

Pretty-print ☒

```
{
  "message": "S3 upload logger Lambda executed successfully.",
  "source": "apigateway",
  "uploaded_files": []
}
```