

COS20019 Cloud Computing Architecture

Assignment 2: Developing a highly available photo album website.

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I. Introduction

The purpose of this report is to document the successful completion of Assignment 2, which involved extending and modifying the infrastructure and program developed in Assignment 1B. This assignment introduced various AWS services and required the creation of IAM roles, S3 bucket policies, Lambda functions, custom AMIs, and more. The assignment was divided into two main tasks: modifying the functional requirements of the Photo Album website and modifying the infrastructure.

II. Infrastructure Deployment

Website URL's:

AlbumURL: <http://54.158.242.24/photoalbum/album.php>

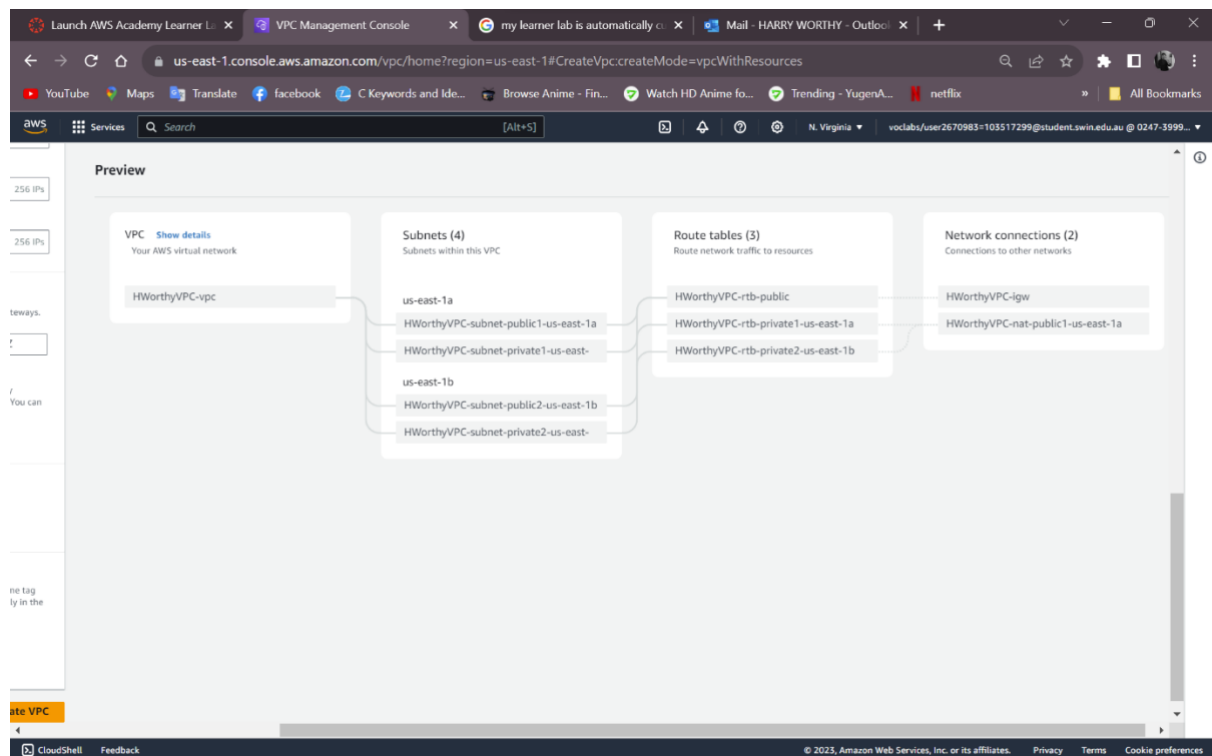
Photouploader: <http://54.158.242.24/photoalbum/photouploader.php>

Via ELB: <http://harryelb-1138575661.us-east-1.elb.amazonaws.com/photoalbum/album.php>

The infrastructure was set up according to the provided architecture diagram, and several components were configured:

VPC:

- Created a VPC with two availability zones, public and private subnets.
- Configured routing tables to route traffic to internet gateways and NAT instances/gateways



Route table:

The screenshot shows the AWS Management Console for a VPC in the us-east-1 region. The VPC ID is vpc-05a48c4698a27c63d. The state is Available. The main route table is rtb-038e4d67a40001d43. The VPC has four subnets: us-east-1a, HworthyVPC-subnet-public1-us-east-1a, HworthyVPC-subnet-private1-us-east-1a, and us-east-1b. The resource map shows the following connections:

- Subnets (4):
 - us-east-1a
 - HworthyVPC-subnet-public1-us-east-1a
 - HworthyVPC-subnet-private1-us-east-1a
 - us-east-1b
- Route tables (4):
 - HworthyVPC-rtb-private2-us-east-1b
 - rtb-038e4d67a40001d43
 - HworthyVPC-rtb-private1-us-east-1a
 - HworthyVPC-rtb-public
- Network connections (3):
 - HworthyVPC-igw
 - HworthyVPC-nat-public1-us-east-1a
 - NAT Gateway

Security Groups & Network ACL:

- security groups for ELB, web servers, RDS, NAT, and Dev server.
- Designed a Network ACL to control ICMP traffic between subnets.

The screenshot displays the AWS Management Console for the us-east-1 region, specifically the Security Groups page. The left sidebar shows the navigation menu with options like VPC dashboard, EC2 Global View, and various VPC resources. The main content area lists 10 security groups. The table below summarizes the visible data:

Name	Security group ID	Security group name	VPC ID	Description	Owner	Inbound rules
-	sg-05813c20c17442b02	WebServerSG	vpc-05a48c4698a27c63d	Assign3	024739990749	2 Inbound r
-	sg-042254a2015d79ee4	ec2-rds-1	vpc-05a48c4698a27c63d	Security group attache...	024739990749	0 Inbound r
-	sg-095c80e8e11a3cbca	default	vpc-0e862fc18d42170a9	default VPC security gr...	024739990749	1 Inbound r
-	sg-0aee4cd304443c2d	DevServerSG	vpc-05a48c4698a27c63d	assign3	024739990749	3 Inbound r
-	sg-09644ec9183b35fe7	ELBSG	vpc-05a48c4698a27c63d	assign3	024739990749	1 Inbound r
-	sg-0f079151cd2c3b725	rds-ec2-1	vpc-05a48c4698a27c63d	Security group attache...	024739990749	1 Inbound r
-	sg-05485e83dc8054008	DBServerSG	vpc-05a48c4698a27c63d	ass3	024739990749	3 Inbound r
-	sg-0109971f4f7a98916	NATServerSG	vpc-05a48c4698a27c63d	ass3	024739990749	4 Inbound r
-	sg-0fce4df98e81b6ec6	default	vpc-09d7ef3989ed43ed2	default VPC security gr...	024739990749	1 Inbound r
-	sg-098643d362b9257cf	default	vpc-05a48c4698a27c63d	default VPC security gr...	024739990749	1 Inbound r

The screenshot displays the AWS Management Console for the us-east-1 region, specifically the Network ACLs page. The left sidebar shows the navigation menu with options like VPC dashboard, EC2 Global View, and various VPC resources. The main content area lists 5 network ACLs. The table below summarizes the visible data:

Name	Network ACL ID	Associated with	Default	VPC ID	Inbound rules
PrivateSubnetNACL	acl-074f61ef0823be57e	2 Subnets	No	vpc-05a48c4698a27c63d / HworthyVP...	3 Inbound r
-	acl-04b2f0c24335d7863	5 Subnets	Yes	vpc-09d7ef3989ed43ed2	2 Inbound r
-	acl-028db409489a70f11	2 Subnets	Yes	vpc-05a48c4698a27c63d / HworthyVP...	2 Inbound r
-	acl-062b45a38b46f5071	3 Subnets	Yes	vpc-0e862fc18d42170a9 / Hworthy-vpc	2 Inbound r
PublicSubnetNACL	acl-0ab8d7ff7e24cd4be	subnet-0886e6db983122b91 / Hworthy-subne...	No	vpc-0e862fc18d42170a9 / Hworthy-vpc	4 Inbound r

Below the table, the details for the selected Network ACL (acl-074f61ef0823be57e / PrivateSubnetNACL) are shown. The details include the Network ACL ID, Associated with (2 Subnets), Default (No), and VPC ID (vpc-05a48c4698a27c63d / HworthyVPC-vpc).

us-east-1.console.aws.amazon.com/vpc/home?region=us-east-1#acls

VPC dashboard

EC2 Global View

Filter by VPC: Select a VPC

Virtual private cloud

Your VPCs

Subnets

Route tables

Internet gateways

Egress-only internet gateways

Carrier gateways

DHCP option sets

Elastic IPs

Managed prefix lists

Endpoints

Endpoint services

NAT gateways

Peering connections

Security

Network ACLs

Security groups

DNS firewall

Rule groups

Domain lists

Network ACLs (1/5)

Find resources by attribute or tag

Name	Network ACL ID	Associated with	Default	VPC ID	Inbound ru
<input checked="" type="checkbox"/> PrivateSubnetNACL	acl-074f61ef0823be57e	2 Subnets	No	vpc-05a48c4698a27c63d / HWorthyVP...	3 Inbound r
<input type="checkbox"/> -	acl-04b2f0c24335d7863	6 Subnets	Yes	vpc-09d7ef3989ed43ed2	2 Inbound r
<input type="checkbox"/> -	acl-028db409489a70f11	2 Subnets	Yes	vpc-05a48c4698a27c63d / HWorthyVP...	2 Inbound r
<input type="checkbox"/> -	acl-062b45a38b46f5071	3 Subnets	Yes	vpc-0e862fc18d42170a9 / HWorthy-vpc	2 Inbound r
<input type="checkbox"/> PublicSubnet2NACL	acl-0ab8dff7e24c0d4be	subnet-0886e6db983122b91 / HWorthy-subne...	No	vpc-0e862fc18d42170a9 / HWorthy-vpc	4 Inbound r

acl-074f61ef0823be57e / PrivateSubnetNACL

Details Inbound rules Outbound rules Subnet associations Tags

Inbound rules (3)

Filter inbound rules

Rule number	Type	Protocol	Port range	Source	Allow/Deny
1	All ICMP - IPv4	ICMP (1)	All	10.0.2.0/24	Deny
2	All traffic	All	All	0.0.0.0/0	Allow
*	All traffic	All	All	0.0.0.0/0	Deny

us-east-1.console.aws.amazon.com/vpc/home?region=us-east-1#acls

You have successfully updated outbound rules for acl-074f61ef0823be57e / PrivateSubnetNACL

VPC dashboard

EC2 Global View

Filter by VPC: Select a VPC

Virtual private cloud

Your VPCs

Subnets

Route tables

Internet gateways

Egress-only internet gateways

Carrier gateways

DHCP option sets

Elastic IPs

Managed prefix lists

Endpoints

Endpoint services

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Security

Network ACLs

Security groups

DNS firewall

Rule groups

Domain lists

Network ACLs (1/5)

Find resources by attribute or tag

Name	Network ACL ID	Associated with	Default	VPC ID	Inbound ru
<input checked="" type="checkbox"/> PrivateSubnetNACL	acl-074f61ef0823be57e	2 Subnets	No	vpc-05a48c4698a27c63d / HWorthyVP...	3 Inbound r
<input type="checkbox"/> -	acl-04b2f0c24335d7863	6 Subnets	Yes	vpc-09d7ef3989ed43ed2	2 Inbound r
<input type="checkbox"/> -	acl-028db409489a70f11	2 Subnets	Yes	vpc-05a48c4698a27c63d / HWorthyVP...	2 Inbound r
<input type="checkbox"/> -	acl-062b45a38b46f5071	3 Subnets	Yes	vpc-0e862fc18d42170a9 / HWorthy-vpc	2 Inbound r
<input type="checkbox"/> PublicSubnet2NACL	acl-0ab8dff7e24c0d4be	subnet-0886e6db983122b91 / HWorthy-subne...	No	vpc-0e862fc18d42170a9 / HWorthy-vpc	4 Inbound r

acl-074f61ef0823be57e / PrivateSubnetNACL

Details Inbound rules Outbound rules Subnet associations Tags

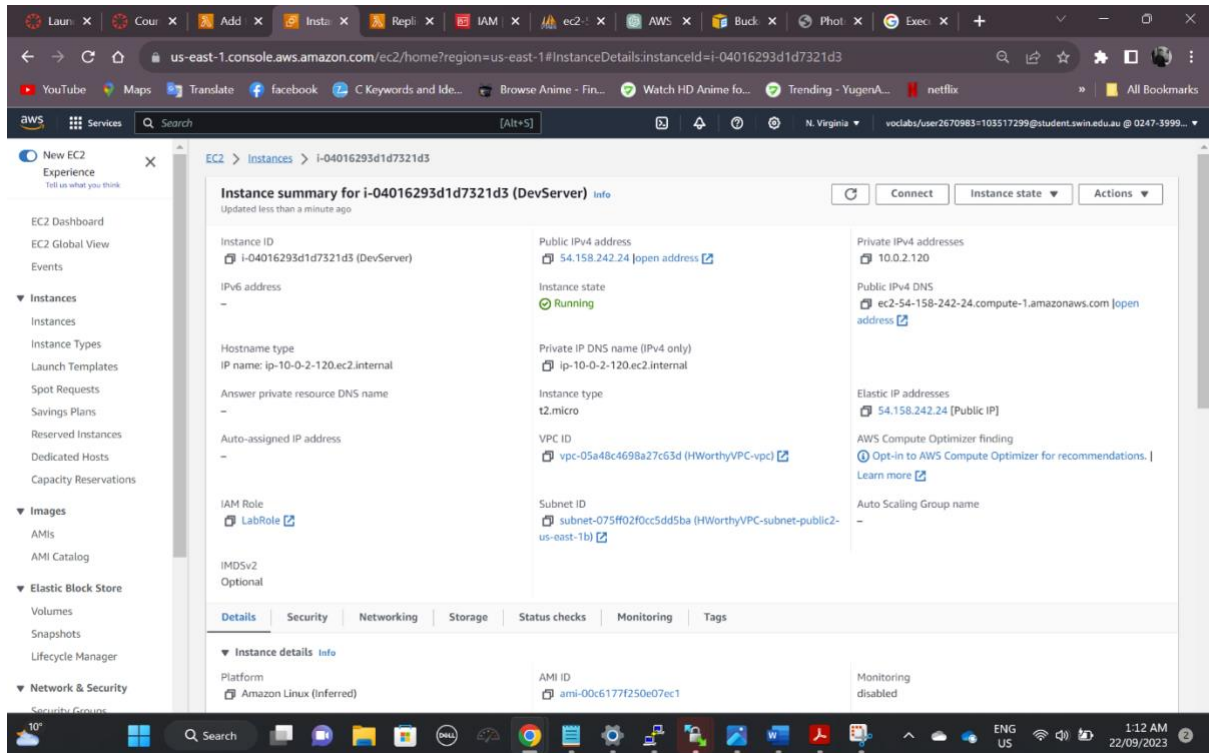
Outbound rules (3)

Filter outbound rules

Rule number	Type	Protocol	Port range	Destination	Allow/Deny
3	All ICMP - IPv4	ICMP (1)	All	10.0.2.0/24	Deny
54	All traffic	All	All	0.0.0.0/0	Allow

EC2 Instance & IAM Role:

- Configured EC2 web server instances with Amazon Linux 2 AMI and proper IAM roles.
- Instances were automatically launched and served Photo Album users.



ASG:

-Defined auto scaling policies to maintain server count based on target tracking.

-Instances were launched into private subnets.

The screenshot displays the AWS Management Console interface for an Elastic Load Balancing Target Group. The browser address bar shows the URL: `us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#TargetGroup:targetGroupArn=arn:aws:elasticloadbalancing:us-east-1:0247-39990749:targetgroup/DevGroup/01919a0736716b2`. The left sidebar contains navigation links for various AWS services. The main content area is titled "Details" and shows the following information:

- Target type:** Instance
- Protocol:** HTTP
- Port:** 80
- Protocol version:** HTTP1
- VPC:** vpc-05a48c4698a27c63d
- IP address type:** IPv4
- Load balancer:** HarryELB

Below this information, a summary table shows the status of the targets:

Total targets	Healthy	Unhealthy	Unused	Initial	Draining
2	2	0	0	0	0

A section titled "Distribution of targets by Availability Zone (AZ)" indicates that values in the table correspond to filters applied to the Registered targets table below.

The "Targets" tab is selected, showing a table of "Registered targets (2)":

Instance ID	Name	Port	Zone	Health status	Health status details
i-0f8e19fee6710fb1d	Dev Instance	80	us-east-1a	healthy	
i-00d49bb212ba9dec5	Dev Instance	80	us-east-1b	healthy	

The screenshot displays the AWS Management Console interface for an Auto Scaling Group (ASG). The browser address bar shows the URL: `us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#AutoScalingGroupDetails:id=DevASG;view=details`. The left sidebar contains navigation links for various AWS services. The main content area is titled "DevASG" and shows the following information:

- Auto Scaling group name:** DevASG
- Desired capacity:** 2
- Status:** -
- Amazon Resource Name (ARN):** arn:aws:autoscaling:us-east-1:024739990749:autoScalingGroup:6159db45-fde6-474b-adc3-aceb43662789:autoScalingGroupName/DevASG
- Date created:** Thu Sep 21 2023 19:42:18 GMT+1000 (Australian Eastern Standard Time)
- Minimum capacity:** 2
- Maximum capacity:** 3

The "Launch template" section shows the following information:

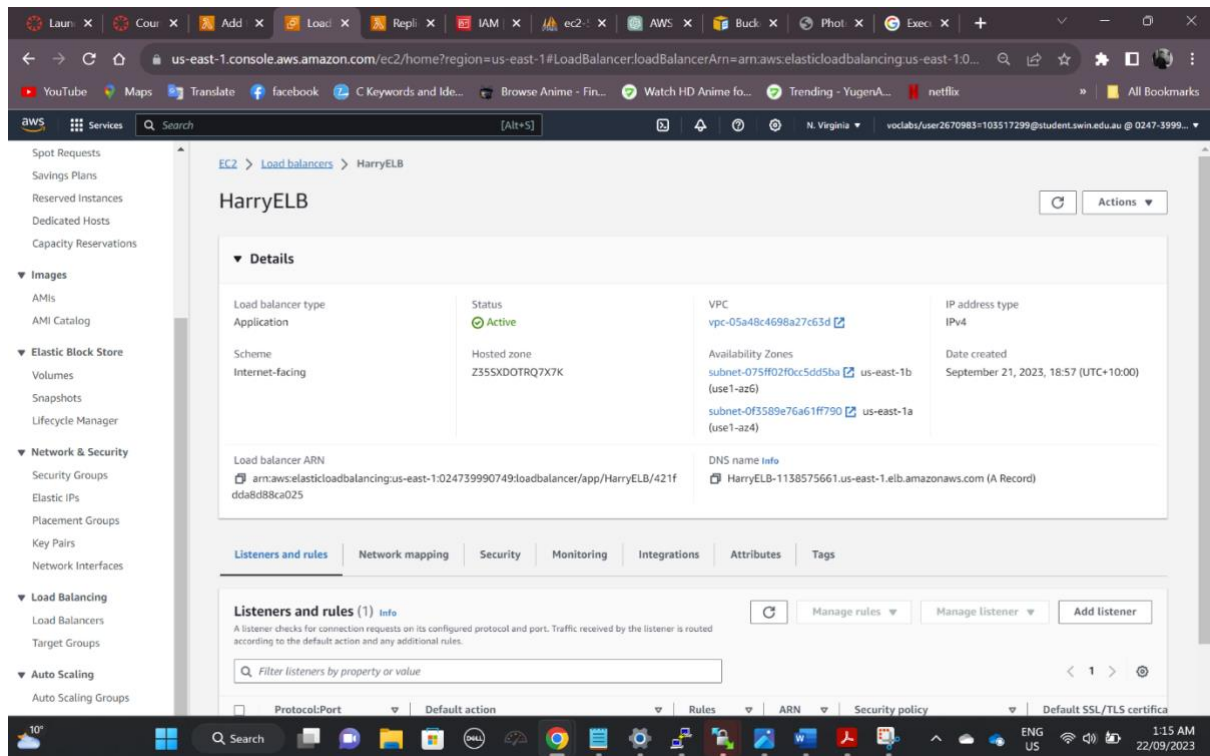
- Launch template:** lt-07c036dca9f60ddbf DevConfig
- AMI ID:** ami-0ca8636ded954c1b7
- Instance type:** t2.micro
- Owner:** arn:aws:sts:024739990749:assumed-role/voclabs/user2670983=103517299@student.swin.edu.au
- Version:** Default
- Security groups:** -
- Security group IDs:** sg-09644ec9183b35fe7
- Create time:** Thu Sep 21 2023 19:01:41 GMT+1000 (Australian Eastern Standard Time)
- Description:** -
- Storage (volumes):** -
- Key pair name:** -
- Request Spot instances:** -

ELB:

HarryELB-1138575661.us-east-1.elb.amazonaws.com

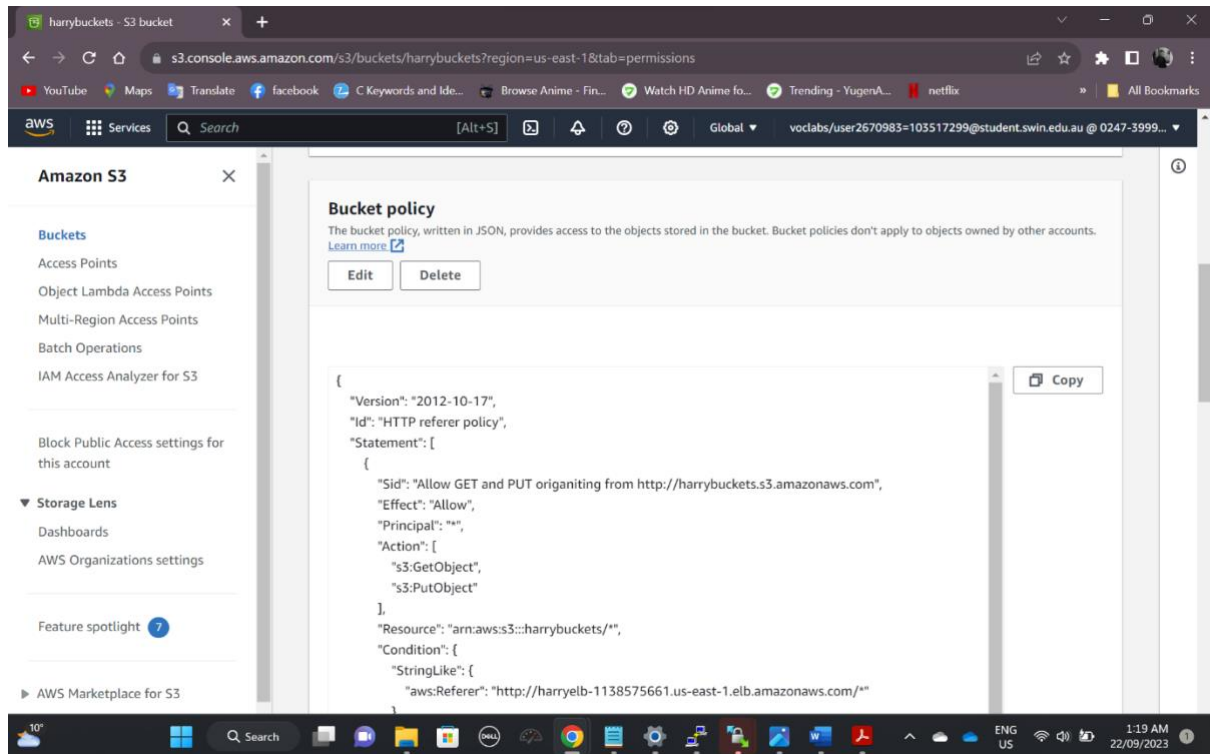
-Implemented a Load Balancer for distributing web traffic.

-Configured health checks to monitor instances.



S3 Bucket:

-Ensured that photos were stored securely in an S3 bucket, restricting access using bucket policies.



Lambda Config:

-Created a Lambda function with appropriate IAM roles to interact with S3.

-Deployed the Lambda function to resize and store images in S3.

us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#/functions/CreateThumbnail/edit/runtime-settings?tab=code

Lambda > Functions > CreateThumbnail > Edit runtime settings

Edit runtime settings

Runtime settings Info

Runtime

Choose the language to use to write your function. Note that the console code editor supports only Node.js, Python, and Ruby.

Python 3.7

New runtime available

A new runtime is available for your function's language: Python 3.11

Handler Info

lambda_function.lambda_handler

Architecture Info

Choose the instruction set architecture you want for your function code.

☒ x86_64

☐ arm64

Cancel Save

Function settings

You pay for the amount of time that your function code runs, multiplied by the amount of memory used. Test your function with different memory settings to see how it affects performance, and find the right balance between cost and speed for your use case.

To increase the memory and CPU power allocated to your function, use the **Memory** setting. Lambda allocates CPU power linearly in proportion to the amount of memory configured. Try various settings to find the right balance of speed and cost for your application.

To increase the /tmp directory size, use the **Ephemeral storage** setting.

Pricing is based on the amount of memory configured and the amount of time that your code runs. To limit the amount of time that your function handler can run

us-east-1.console.aws.amazon.com/lambda/home?region=us-east-1#/functions/CreateThumbnail?tab=testing

CreateThumbnail

The trigger harrybuckets was successfully added to function CreateThumbnail. The function is now receiving events from the trigger.

Function overview Info

CreateThumbnail

Layers (0)

S3

+ Add trigger

+ Add destination

Description

Last modified 1 minute ago

Function ARN

arn:aws:lambda:us-east-1:024739990749:function:CreateThumbnail

Function URL Info

Code Test Monitor Configuration Aliases Versions

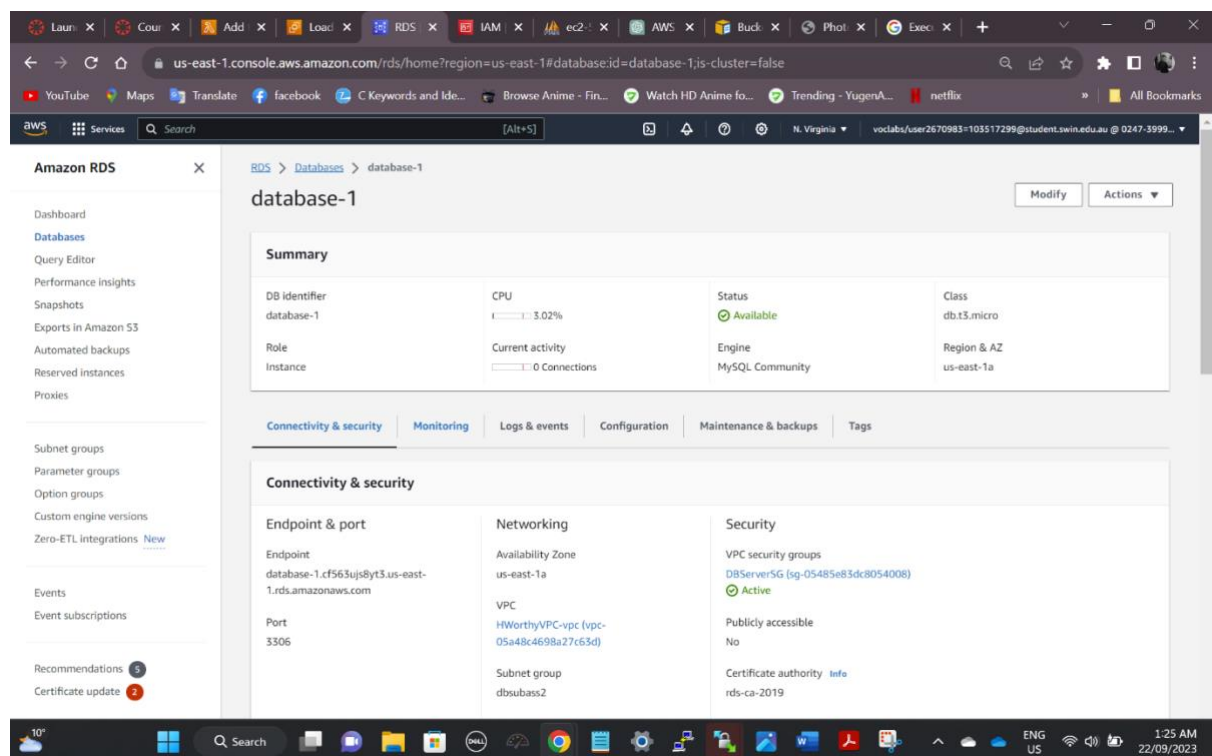
Executing function: succeeded (logs)

Test event Info

Save Test

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RDS:



III. Testing

A comprehensive testing process was conducted to validate the functionality of the deployed infrastructure:

- Verified accessibility of the Photo Album website through the ELB.
- Tested photo uploads and confirmed database records.
- Checked S3 bucket for uploaded photos and resized versions.
- Ensured direct access to S3 photos was restricted.
- Tested Network ACL functionality for ICMP traffic control.
- Validated that security groups and IAM roles adhered to the least-privilege principle.

Website accessible via ELB:

AlbumURL: <http://54.158.242.24/photoalbum/album.php>

Photouploader: <http://54.158.242.24/photoalbum/photouploader.php>

Via ELB: <http://harryelb-1138575661.us-east-1.elb.amazonaws.com/photoalbum/album.php>

Laun x Cour x Add x Load x RDS x IAM x ec2 x AWS x Buck x Phot x Exec x +

Not secure | harryelb-1138575661.us-east-1.elb.amazonaws.com/photoalbum/album.php

YouTube Maps Translate facebook C Keywords and Ide... Browse Anime - Fin... Watch HD Anime fo... Trending - YugenA... netflix All Bookmarks





Student name: Harry

Student ID: 103517299

Tutorial session: Thursday 08:05PM

Uploaded photos:

[Upload more photos](#)

Photo	Name	Description	Creation date	Keywords
	SwinLogo	logo	2023-09-21	uni
	ninja	cool	2023-09-21	damn
	narutio	anim	2023-09-21	ok
	japan	beauty	2023-09-21	yay

10°C Mostly cloudy

Search

YouTube Maps Translate facebook C Keywords and Ide... Browse Anime - Fin... Watch HD Anime fo... Trending - YugenA... netflix All Bookmarks

1:26 AM 22/09/2023

Photo uploader

Photo title:

Select a photo (Select PNG file for best result): iam role.png

Description:

Date:

Keywords (comma-delimited, e.g. keyword1, keyword2, ...):

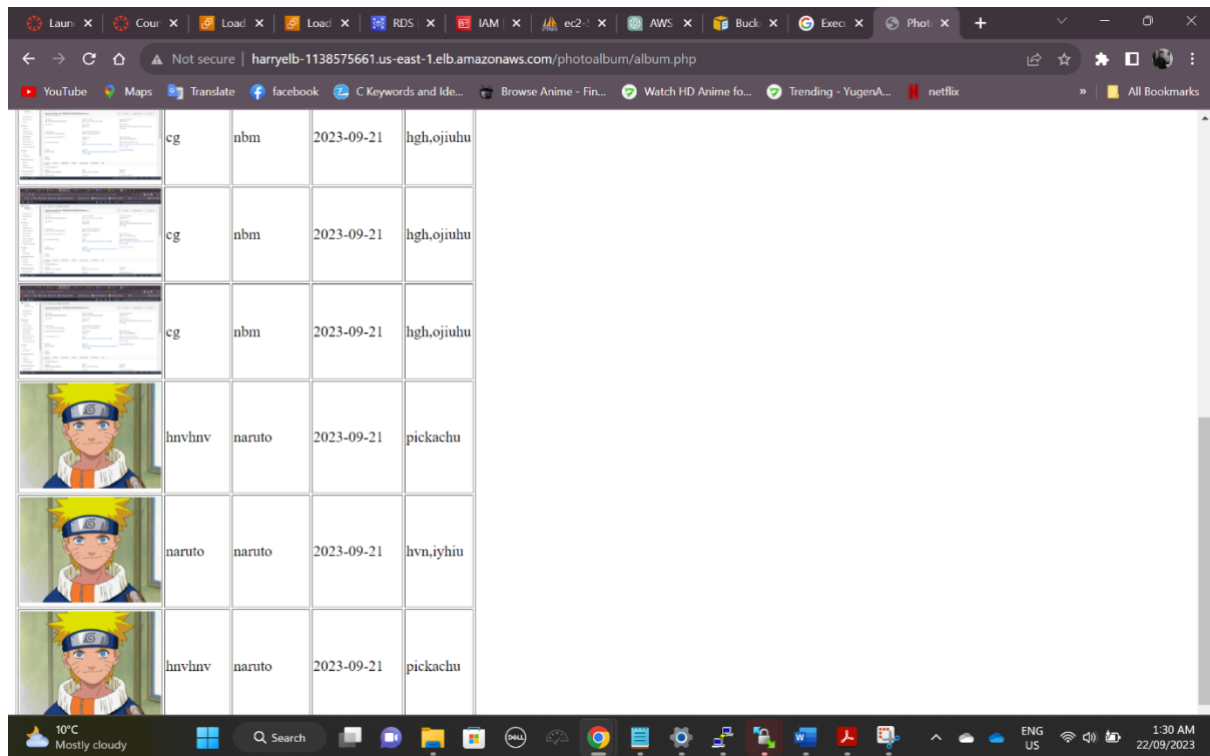
[Photo Album](#)

10°C Mostly cloudy

Search

YouTube Maps Translate facebook C Keywords and Ide... Browse Anime - Fin... Watch HD Anime fo... Trending - YugenA... netflix All Bookmarks

1:32 AM 22/09/2023



III.Conclusion

In conclusion, Assignment 2 involved extending and modifying an existing infrastructure and program to create a highly available Photo Album website on AWS. By successfully completing this assignment, I have gained valuable experience in AWS service configuration and deployment, security practices, and web application development in a distributed environment.