

Assignment-1B Creating and deploying Photo Album website onto a simple AWS infrastructure

Cos20019 |Cloud computing architecture

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Introduction

The Photo Album website leverages AWS's vast infrastructure, offering developers an array of resources from establishing a VPC for secure web application deployment to integrating an S3 bucket for photo storage. AWS's networking capabilities encompass diverse elements, such as implementing Network Access Control Lists (NACLs) and Security Groups, assimilating Amazon RDS, and orchestrating routing tables. To ensure encrypted communication within the VPC, there's an SSH linkage between instances in both public and private subnets.

This framework underlines the significance of security, scalability, and high availability, all paramount for modern cloud applications. The extensive nature of this project serves as an invaluable resource for AWS enthusiasts, shedding light on the intricacies of VPC design, strategic network division, and safeguarded data handling.

Keywords: VPC, NACL, Security Group, Routing Table, SSH, RDS.

For a hands-on understanding and visualization of this setup, the Photo Album website can be accessed via the provided link.

Website Link:

<http://ec2-44-220-13-146.compute-1.amazonaws.com/cos20019/photoalbum/photoalbum/album.php>

IMPLEMENTATION STEPS

Step-1: Create VPC

1. Create VPC select VPC only and allocate to 10.0.0.0/16.

The screenshot shows the AWS VPC dashboard. On the left, there's a sidebar with various VPC-related options like Subnets, Route tables, and Security groups. The main area displays a table titled "Your VPCs (1/2)" with one row for "NSiamVPC". The table columns include Name, VPC ID, State, IPv4 CIDR, IPv6 CIDR, DHCP option set, and Main route table. The "Details" tab is selected, showing specific configuration details for the VPC, such as its VPC ID (vpc-0a5e169d62aa9d28c), state (Available), and associated DHCP option set (dopt-09b23f462656dac5e). It also lists the Main route table (rtb-0090138eb3c73adc4) and DNS resolution status (Enabled).

Figure 1-create VPC.

2. Setting VPC, enable DNS resolution and hostnames.

This screenshot shows the "Edit VPC settings" page for the VPC "NSiamVPC". A modal window at the top left provides information about the new edit VPC settings experience. The main form contains several sections: "VPC details" (VPC ID: vpc-0a5e169d62aa9d28c, Name: NSiamVPC), "DHCP settings" (DHCP option set: dopt-09b23f462656dac5e), "DNS settings" (Enable DNS resolution: checked, Enable DNS hostnames: checked), and "Network Address Usage metrics settings" (Enable Network Address Usage metrics: unchecked). At the bottom right of the form are "Cancel" and "Save" buttons.

Figure 2-Adding VPC DNS

Step2: Create subnets.

Subnet	Ip	Availability Zone
Public Subnet 1	10.0.1.0/24	Us-east-1a
Private Subnet 1	10.0.3.0/24	Us-east- 1a
Public Subnet 2	10.0.2.0/24	Us-east-1b
Private Subnet 2	10.0.4.0/24	Us-east-1b

The screenshot shows the AWS Subnets (10) Info page. The table lists 10 subnets, each with its Name, Subnet ID, State, VPC, IPv4 CIDR, IPv6 CIDR, and Available IPv4 addresses. The subnets are categorized by VPC and Availability Zone:

Name	Subnet ID	VPC	IPv4 CIDR	Available IPv4 addresses
Public Subnet-1	subnet-0169e0d8bc30e5d49	vpc-0a5e169d62aa9d28c NSia...	10.0.1.0/24	251
-	subnet-09375d880a92d301b	vpc-099a2c805182bd70d	172.31.0.0/20	4091
-	subnet-03c5c9f6290d2ce8d	vpc-099a2c805182bd70d	172.31.80.0/20	4091
Private Subnet-1	subnet-0558b45b532de6eb2b	vpc-0a5e169d62aa9d28c NSia...	10.0.3.0/24	251
Public Subnet-2	subnet-045ff4a17f50afabc	vpc-0a5e169d62aa9d28c NSia...	10.0.2.0/24	250
Private Subnet-2	subnet-06b1bb81962013ce14	vpc-0a5e169d62aa9d28c NSia...	10.0.4.0/24	249
-	subnet-00f1559a1e1d738fe	vpc-099a2c805182bd70d	172.31.16.0/20	4091
-	subnet-0d203666172672b23	vpc-099a2c805182bd70d	172.31.32.0/20	4091
-	subnet-03e7bf5c997cf04d8	vpc-099a2c805182bd70d	172.31.48.0/20	4091
-	subnet-0181bab6f757d482f	vpc-099a2c805182bd70d	172.31.64.0/20	4091

Figure 3-Public & Private Subnets

Step3: Create an internet gateway and attach it to the VPC.

The screenshot shows the AWS Internet Gateways (1/2) Info page. It displays two internet gateways, both attached to the same VPC. The table includes columns for Name, Internet gateway ID, State, VPC ID, and Owner.

Name	Internet gateway ID	State	VPC ID	Owner
NsiamIGW	igw-00c2130198f51969b	Attached	vpc-0a5e169d62aa9d28c NSiamVPC	782123962197
-	igw-00dd023e9be939u0	Attached	vpc-099a2c805182bd70d	782123962197

Below the table, a detailed view of the first internet gateway (igw-00c2130198f51969b / NsiamIGW) is shown, confirming its attachment status and VPC information.

Figure 4-Internet Gateway attached to VPC.

Step4: Create 2 routing tables.

1. Public routing table

The screenshot shows the AWS VPC Route Tables page. In the left sidebar, under 'Route tables', 'Public Routable' is selected. The main table lists three route tables: 'rtb-0090138eb3c73adc4', 'rtb-05e7b3c547a74d438', and 'rtb-04c51571e200192b2'. The third row, 'rtb-04c51571e200192b2 / Public Routable', is highlighted. Below the table, the 'Subnet associations' tab is selected, showing two explicit subnet associations: 'Public Subnet-1' and 'Public Subnet-2'.

Name	Route table ID	Explicit subnet associations	Main	VPC	Owner ID
rtb-0090138eb3c73adc4	-	-	Yes	vpc-0a5e169d62aa9d28c NSia...	782123962197
rtb-05e7b3c547a74d438	-	-	Yes	vpc-099a2c805182bd70d	782123962197
Public Routable	rtb-04c51571e200192b2	2 subnets	No	vpc-0a5e169d62aa9d28c NSia...	782123962197
rtb-02a185295a64d6a34	2 subnets	-	No	vpc-0a5e169d62aa9d28c NSia...	782123962197

Figure 5-Public Routing table

2. Private routing table

The screenshot shows the AWS VPC Route Tables page. In the left sidebar, under 'Route tables', 'Private Route Table' is selected. The main table lists three route tables: 'rtb-0090138eb3c73adc4', 'rtb-05e7b3c547a74d438', and 'rtb-04c51571e200192b2'. The fourth row, 'rtb-02a185295a64d6a34 / Private Route Table', is highlighted. Below the table, the 'Details' tab is selected, showing the route table ID 'rtb-02a185295a64d6a34', 'Main' status 'No', 'Owner ID' '782123962197', and 'Explicit subnet associations' '2 subnets'.

Name	Route table ID	Explicit subnet associations	Main	VPC	Owner ID
rtb-0090138eb3c73adc4	-	-	Yes	vpc-0a5e169d62aa9d28c NSia...	782123962197
rtb-05e7b3c547a74d438	-	-	Yes	vpc-099a2c805182bd70d	782123962197
Public Routable	rtb-04c51571e200192b2	2 subnets	No	vpc-0a5e169d62aa9d28c NSia...	782123962197
Private Route Table	rtb-02a185295a64d6a34	2 subnets	No	vpc-0a5e169d62aa9d28c NSia...	782123962197

Figure 6-Private Routing table

3. Edit route of the Public route table to internet gateway and assign destination to 0.0.0.0/0

Destination	Target	Status	Propagated
0.0.0.0/0	igw-00c2130198f51969b	Active	No
10.0.0.16	local	Active	No

Figure 7-Edit routes on Public Route table.

Step5: Create 3 security groups.

Security group name	Security group ID	Description	VPC ID
WebServerSG	sg-038534cff5a145304	Security group for WebServerSG	vpc-0a5e169d62aa9d28c

Figure 8-creating 3 security group.

Step 6: create resources for use when launching web server.

4. Public Elastic IP

The screenshot shows the AWS Elastic IP addresses management interface. On the left, a navigation pane includes options like Instances, Images, Elastic Block Store, Network & Security (with 'Elastic IPs' selected), Load Balancing, Auto Scaling, and more. The main content area displays a table titled 'Elastic IP addresses (1/1)'. A single row is listed with the following details:

Name	Allocated IPv4 address	Type	Allocation ID	Reverse DNS record	Associated instance ID	Private IP address
-	44.220.13.146	Public IP	eipalloc-04158d75bd7b8b11b	-	i-05a4a32d8db33231c	10.0.2.231

Below the table, a 'Summary' tab is active, showing detailed information for the selected IP:

- Allocated IPv4 address: 44.220.13.146
- Type: Public IP
- Allocation ID: eipalloc-04158d75bd7b8b11b
- Reverse DNS record: -
- Association ID: eipassoc-0e12b0f7ccf7ef15
- Scope: VPC
- Associated instance ID: i-05a4a32d8db33231c
- Private IP address: 10.0.2.231
- Network interface ID: eni-0a2097ba8ff8083de
- Network interface owner account ID: 782123962197
- Public DNS: ec2-44-220-13-146.compute-1.amazonaws.com
- Address pool: -
- Network Border Group: -

Figure 9-Elastic Ip

Step 7: launch the instances.

1. Create the Web Server instance in Public Subnet 2 and associate the Elastic IP.

The screenshot shows the AWS Instances management interface. On the left, a navigation pane includes options like Instances, Images, and Network & Security (with 'Elastic IPs' selected). The main content area displays a table titled 'Instances (1/2) Info'. One instance is listed:

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS	Public IPv4 ...	Elastic IP
Test server	i-027cfae51dbed975c	Running	t2.micro	2/2 checks passed	No alarms	us-east-1b	-	-	-
Web Server	i-05a4a32d8db33231c	Running	t2.micro	2/2 checks passed	No alarms	us-east-1b	ec2-44-220-13-146.co...	44.220.13.146	44.220.13.146

Below the table, a detailed view is shown for the instance 'Web Server' (i-05a4a32d8db33231c):

Instance: i-05a4a32d8db33231c (Web Server)

Details tab (selected):

- Instance ID: i-05a4a32d8db33231c (Web Server)
- Public IPv4 address: 44.220.13.146 [Open address]
- Private IPv4 addresses: 10.0.2.231
- Public IPv4 DNS: ec2-44-220-13-146.compute-1.amazonaws.com [Open address]
- Elastic IP addresses: 44.220.13.146 [Public IP]
- AWS Compute Optimizer finding: Opt-in to AWS Compute Optimizer for recommendations. | Learn more

Security, **Networking**, **Storage**, **Status checks**, and **Monitoring** tabs are also present but not selected.

Figure 10-Web Server Instance & Elastic IP.

2. Create the Test server instance in Private Subnet 2

The screenshot shows the AWS EC2 Instances page. On the left, there's a navigation sidebar with links like EC2 Dashboard, EC2 Global View, Events, Instances (selected), Instance Types, Launch Templates, Spot Requests, Savings Plans, Reserved Instances, Dedicated Hosts, Capacity Reservations, Images, AMIs, AMI Catalog, Elastic Block Store, Volumes, Snapshots, Lifecycle Manager, Network & Security, Security Groups, Elastic IPs, Placement Groups, Key Pairs, Network Interfaces, Load Balancing, and Load Balancers. The main area displays two instances:

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS	Public IPv4 IP	Elastic IP
Test server	i-027cfae51dbed975c	Running	t2.micro	2/2 checks passed	No alarms	us-east-1b	-	-	-
Web Server	i-05a4a32d8db33231c	Running	t2.micro	2/2 checks passed	No alarms	us-east-1b	ec2-44-220-13-146.co...	44.220.13.146	44.220.13.146

A modal window titled "Instance: i-027cfae51dbed975c (Test server)" is open, showing the following details:

Details	Security	Networking	Storage	Status checks	Monitoring	Tags
Instance summary						
Instance ID i-027cfae51dbed975c (Test server)	Public IPv4 address -	Private IPv4 address -	Private IP DNS name (IPv4 only) ip-10-0-4-248.ec2.internal	Instance state Running	Public IPv4 DNS -	Private IPv4 addresses 10.0.4.248
IPv6 address -	Instance type t2.micro	Instance type t2.micro	Instance type t2.micro	Subnet ID -	Public IPv4 DNS -	Elastic IP addresses -
Hostname type IP name: ip-10-0-4-248.ec2.internal	VPC ID vpc-0a5e169d62aa9d28c (NSiamVPC)	VPC ID vpc-0a5e169d62aa9d28c (NSiamVPC)	VPC ID vpc-0a5e169d62aa9d28c (NSiamVPC)	Auto Scaling Group name -	AWS Compute Optimizer finding Opt-in to AWS Compute Optimizer for recommendations. Learn more	Auto Scaling Group name -
IAM Role -						

Figure 11-Test instance in Private subnet 2

3. Check that PHP is installed check that PHP is installed

The screenshot shows a web browser window with the URL "http://COS80001". The page displays the output of the "phpinfo.php" script. At the top, it says "Welcome to COS80001. Installed PHP version: 7.2.34". Below this, the page contains extensive PHP configuration information, including details about the PHP engine, Zend Engine, and various modules.

Figure 12- access phpinfo.php to test php functionality

Step 8: Login as ec2-user and SSH to Test Instance using its private IP address, and ping from Test instance to private IP address of Web server.

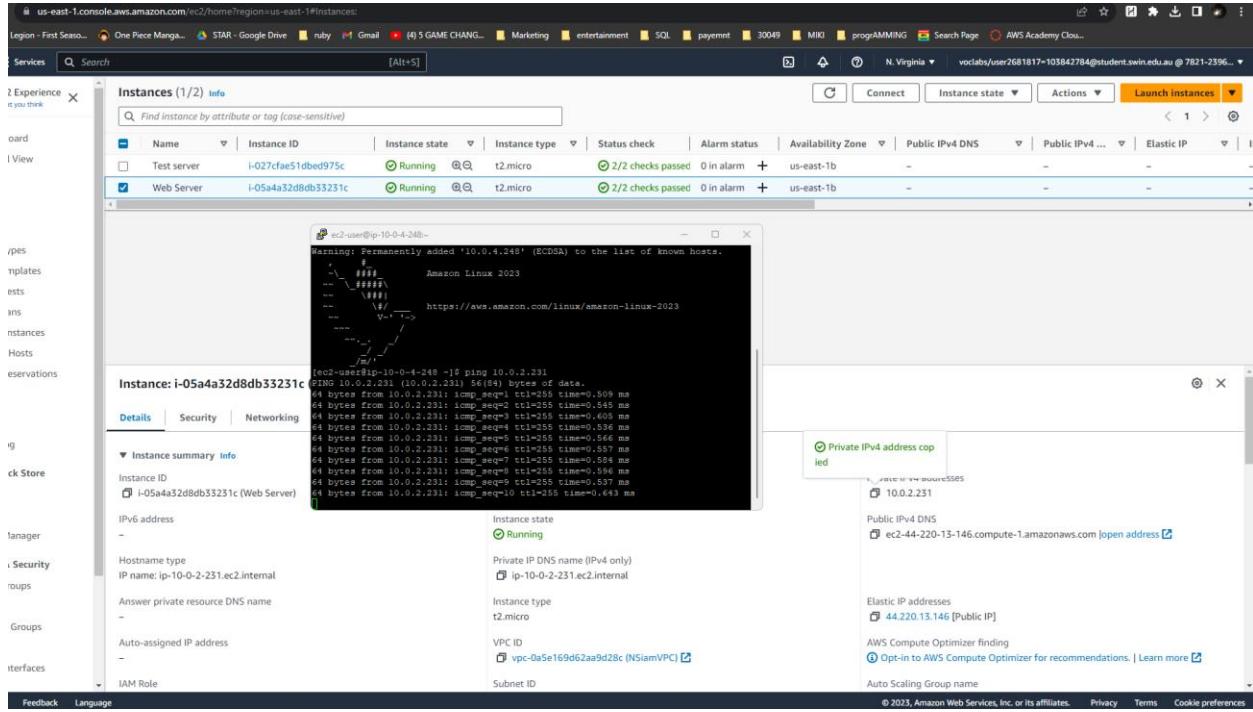


Figure 13- login as EC2 user and Ping

Step 9: Configuring RDS

- In RDS, create a subnet group and allocate two private subnet and create the RDS data base.
- The username = admin & password = admin1234
- RDS END Point = rds-instance.cfg1su8spy97.us-east-1.rds.amazonaws.com
- Install PhpMyAdmin on EC2 and change the file name from config.sample.inc.php to config.inc.php and then from inside the file change the localhost to the RDS end point.

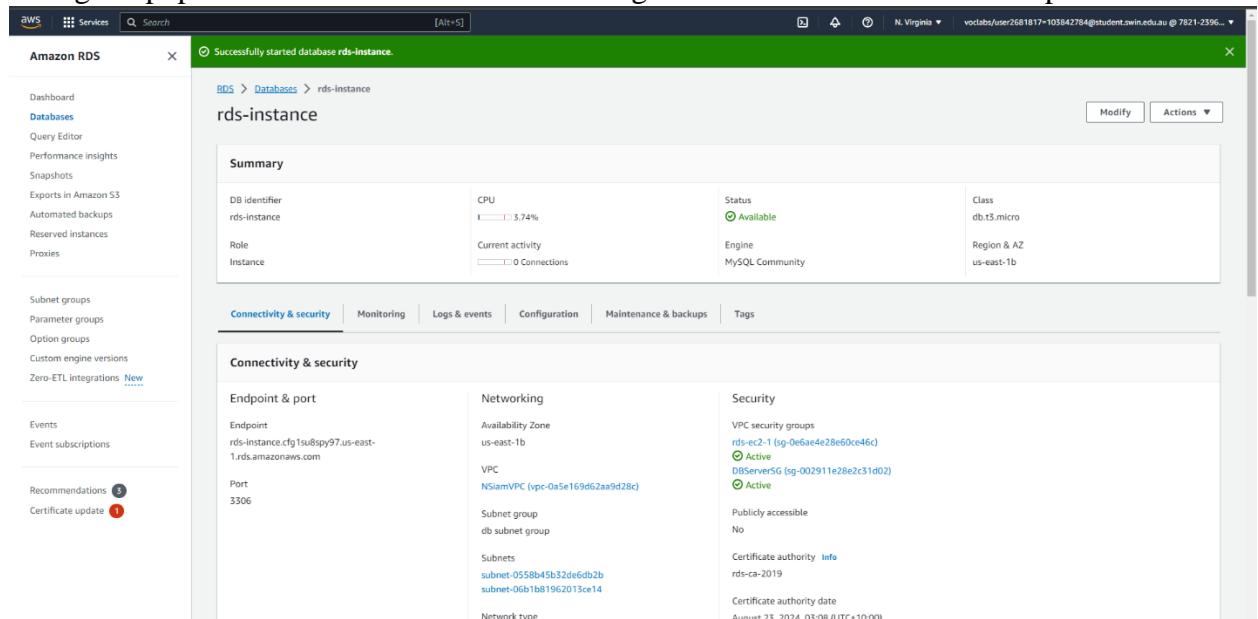


Figure 14- Database RDS

```

10  /* Servers configuration
11 */
12 $1 = 0;
13 /**
14  * First server
15 */
16 $1++;
17 /* Authentication type */
18 $cfg['Servers'][$1]['auth_type'] = 'cookie';
19 /* Server parameters */
20 $cfg['Servers'][$1]['host'] = 'rds-instance.cfg1su8spy97.us-east-1.rds.amazonaws.com';
21 $cfg['Servers'][$1]['compress'] = false;
22 $cfg['Servers'][$1]['AllowNoPassword'] = false;
23 /**
24  * phpMyAdmin configuration storage settings.
25 */
26 /**
27  * User used to manipulate with storage */
28 // $cfg['Servers'][$1]['controlhost'] = '';
29 // $cfg['Servers'][$1]['controlport'] = '';
30 // $cfg['Servers'][$1]['controluser'] = 'pma';
31 // $cfg['Servers'][$1]['controlpass'] = 'pmapass';
32 /**
33  * Storage database and tables */
34 // $cfg['Servers'][$1]['pmadb'] = 'phpmyadmin';
35 // $cfg['Servers'][$1]['bookmarktable'] = 'pma__bookmark';
36
37
38
39
40
41
42
43
44
45
46

```

Figure 15-replacing the local host to RDS end point

Step 10: Go to <http://ec2-44-220-13-146.compute-1.amazonaws.com/phpmyadmin>.

- Create a table named “photos”. Add 5 columns to the table.

The screenshot shows the phpMyAdmin interface for a MySQL database named 'RDS'. A table named 'photos' is selected. The table has four columns: Photo, Title, Description, and Creation Date. Three rows of data are listed:

Photo	Title	Description	Creation Date
Swinburne Logo	This logo represents Swinburne	2016-07-12	Swinburne University Logo
Swinburne Esports club Logo	This logo represents Swinburne University's Esport	2020-09-02	Esports Logo of Swinburne University Of Technology
Swinburne Student Union Logo	This logo represents Swinburne University Of Techn.	2015-09-04	SSU logo Swinburne University

Figure 16-Table creation

Step 11: Creating Network ACL

- In Network ACL Inbound rules and Outbound rules should be the same and attach it to public subnet 2.

The screenshot shows the AWS CloudFormation console. A Network ACL named 'PublicSubnet2NACL' is selected. The 'Inbound rules' tab is active, showing three rules:

Rule number	Type	Protocol	Port range	Source	Action
100	SSH	TCP (6)	22	0.0.0.0/0	Allow
110	All ICMP	ICMP (-1)	All	10.0.4.0/24	Allow
120	HTTP (80)	TCP (6)	80	0.0.0.0/0	Allow

Figure 17-Network ACL with Inbound rules

The screenshot shows the AWS CloudFormation console. A Network ACL named 'PublicSubnet2NACL' is selected. The 'Outbound rules' tab is active, showing three rules:

Rule number	Type	Protocol	Port range	Destination	Action
100	SSH (22)	TCP (6)	22	0.0.0.0/0	Allow
110	All ICMP	ICMP (-1)	All	10.0.4.0/24	Allow
120	HTTP (80)	TCP (6)	80	0.0.0.0/0	Allow

Figure 18-Newtwork ACL with Outbound rules

Step 12: Create S3 Bucket

- Specify Public access and configure the bucket policy.
- Upload the images and copy the URL

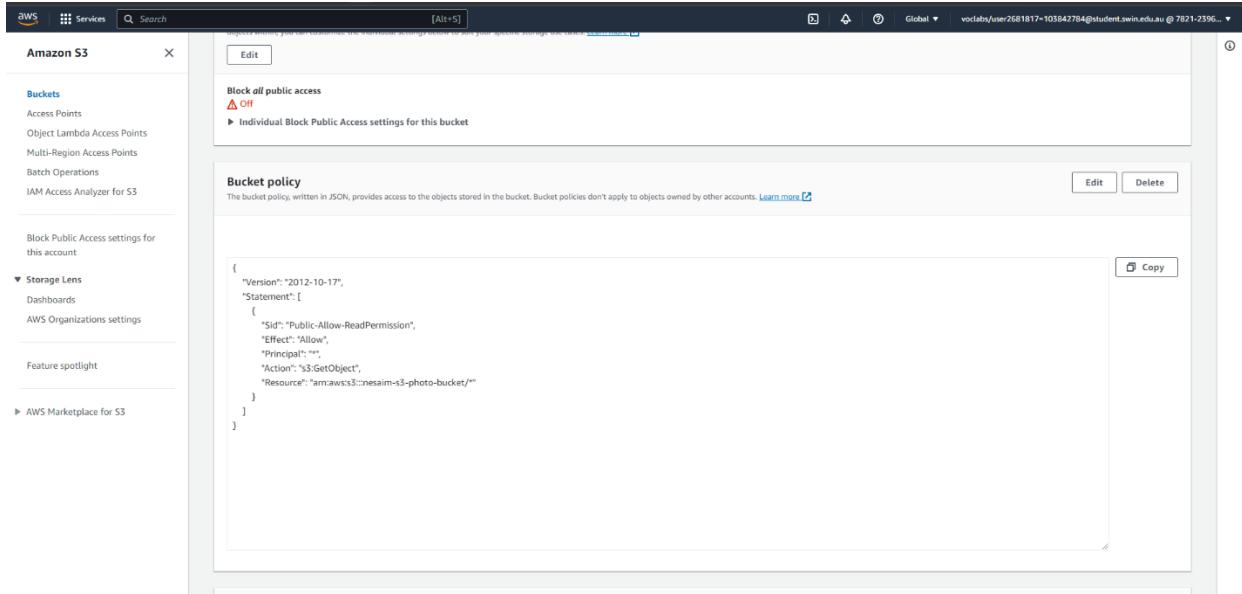


Figure 19-S3 bucket policy and public access enable.

Name	Type	Last modified	Size	Storage class
Arboard 1.jpg	jpg	September 16, 2023, 18:26:07 (UTC+10:00)	65.2 KB	Standard
Swinburne E-Sports_RGB_Light Background.jpg	jpg	September 16, 2023, 18:21:32 (UTC+10:00)	25.0 KB	Standard
swinburne university of technology i52 logo.jpg	jpg	September 15, 2023, 22:11:25 (UTC+10:00)	92.1 KB	Standard

Figure 20-upload the photos

Step 13: In PhpMyAdmin, insert new roles with photos' URLs in photos table.

Photo	Title	Description	Creation Date	Keywords	Reference To Photos In s3
Swinburne Logo	This logo represents Swinburne	2016-07-12	Swinburne University Logo		https://nesalm-s3-photo-bucket.s3.amazonaws.com/sw...
Swinburne Esports club Logo	This logo represents Swinburne University's Esport	2020-09-02	Esports Logo of Swinburne University Of Technology		https://nesalm-s3-photo-bucket.s3.amazonaws.com/sw...
Swinburne Student Union Logo	This logo represents Swinburne University Of Techn...	2015-09-04	SSU logo Swinburne University		https://nesalm-s3-photo-bucket.s3.amazonaws.com/sw...

Figure 21-Table with the picture links

Step 14: In photoalbum_v3, enter the correct code based on the resources in AWS.

```

H > 20019 > assignment 1b > photoalbum_v3.0 > photoalbum_v3.0 > constants.php
File Edit Selection View Go Run Terminal Help /* Search
constants.php X
26 * The values of the constant variables with "[ACTION REQUIRED]" in the comment must be updated. The current values are just examples.
27 * You need to replace the values of those constant variables with values specific to your setup.
28 *
29 *
30 * ----- READ THE ABOVE !!! -----
31 * ----- READ THE ABOVE !!! -----
32 * ----- READ THE ABOVE !!! -----
33 */
34
35 // [ACTION REQUIRED] your full name
36 define('STUDENT_NAME', 'Nur E Saim');
37 // [ACTION REQUIRED] your Student ID
38 define('STUDENT_ID', '103842784');
39 // [ACTION REQUIRED] your tutorial session
40 define('TUTORIAL_SESSION', 'Thursday 6:30PM');
41
42 // [ACTION REQUIRED] name of the S3 bucket that stores images
43 define('BUCKET_NAME', 'nesalm-s3-photo-bucket');
44 // [ACTION REQUIRED] region of the above bucket
45 define('REGION', 'us-east-1');
46 // no need to update this const
47 define('S3_BASE_URL', 'https://.BUCKET_NAME.'.s3.amazonaws.com');
48
49 // [ACTION REQUIRED] name of the database that stores photo meta-data (note that this is not the DB identifier of the RDS instance)
50 define('DB_NAME', 'RDS');
51 // [ACTION REQUIRED] endpoint of RDS instance
52 define('DB_ENDPOINT', 'rds-instance.cfg1subsp97.us-east-1.rds.amazonaws.com');
53 // [ACTION REQUIRED] username of your RDS instance
54 define('DB_USERNAME', 'admin');
55 // [ACTION REQUIRED] password of your RDS instance
56 define('DB_PWD', 'admin1234');
57
58 // [ACTION REQUIRED] name of the DB table that stores photo's meta-data
59 define('DB_PHOTO_TABLE_NAME', 'photos');
60 // The table above has 5 columns
61 // [ACTION REQUIRED] name of the column in the above table that stores photo's titles
62 define('DB_PHOTO_TITLE_COL_NAME', 'Photo.Title');
63 // [ACTION REQUIRED] name of the column in the above table that stores photo's descriptions
64 define('DB_PHOTO_DESCRIPTION_COL_NAME', 'Description');
65 // [ACTION REQUIRED] name of the column in the above table that stores photo's creation dates
66 define('DB_PHOTO_CREATIONDATE_COL_NAME', 'Creation.Date');
67 // [ACTION REQUIRED] name of the column in the above table that stores photo's keywords
68 define('DB_PHOTO_KEYWORDS_COL_NAME', 'Keywords');
69 // [ACTION REQUIRED] name of the column in the above table that stores photo's links in S3
70 define('DB_PHOTO_S3REFERENCE_COL_NAME', 'Reference.To_Photos_In_s3');
71 ?>

```

Figure 22-Fixing the codes in constants.php

Step 15: In WINSCP, create a path of directory where photoalbum is hosting the website.

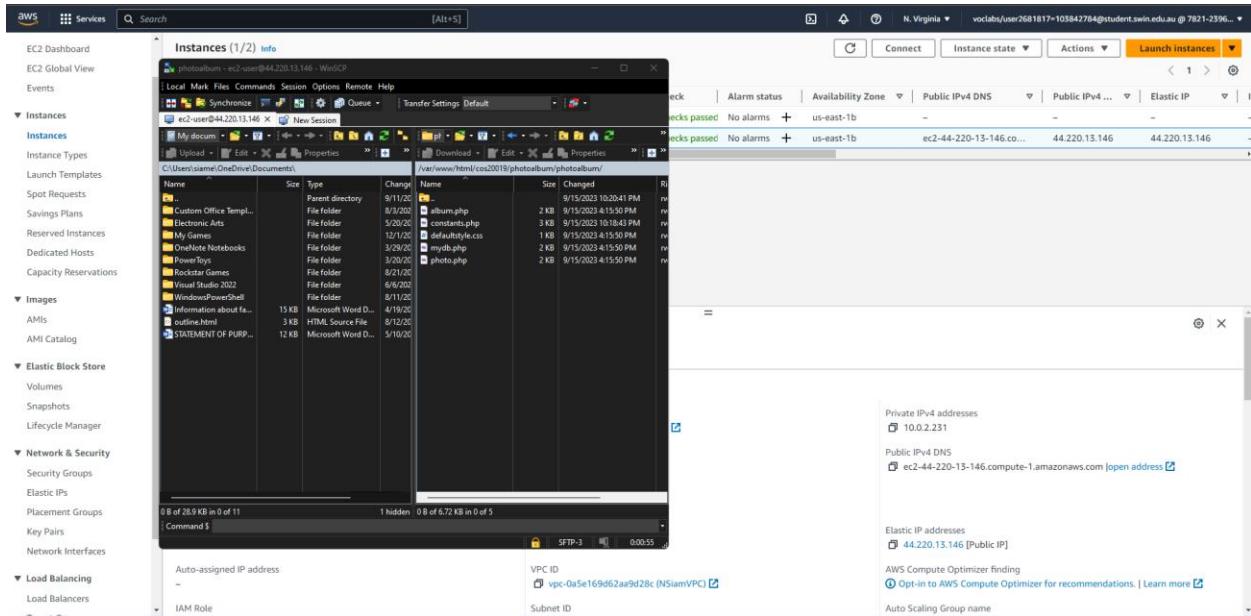


Figure 23-WINSCP uploading the photoalbum file with correct constants.php code

Step 16: Access my newly created website which is its database in cloud.

Website link:

<http://ec2-44-220-13-146.compute-1.amazonaws.com/cos20019/photoalbum/photoalbum/album.php>

Student name: Nur E Siam

Student ID: 103842784

Tutorial session: Thursday 6:30PM

Uploaded photos:

Photo	Name	Description	Creation date	Keywords
	SwinBurne Logo	This logo represents Swinburne	2016-07-12	Swinburne University Logo

Figure 24-Final product the Website

Step 17: Testing

- Add more photos.
- And do a ping to web server again to test Network ACL.

Student name: Nur E Siam

Student ID: 103842784

Tutorial session: Thursday 6:30PM

Uploaded photos:

Photo	Name	Description	Creation date	Keywords
	Swinburne Logo	This logo represents Swinburne	2016-07-12	Swinburne University Logo
	Swinburne Esports club Logo	This logo represents Swinburne University's Esports club	2020-09-02	Esports Logo of Swinburne University Of Technology
	SSU Swinburne Student Union Logo	This logo represents Swinburne University Of Technology's Student Union	2015-09-04	SSU logo Swinburne University

Figure 25- Final website with more photos.

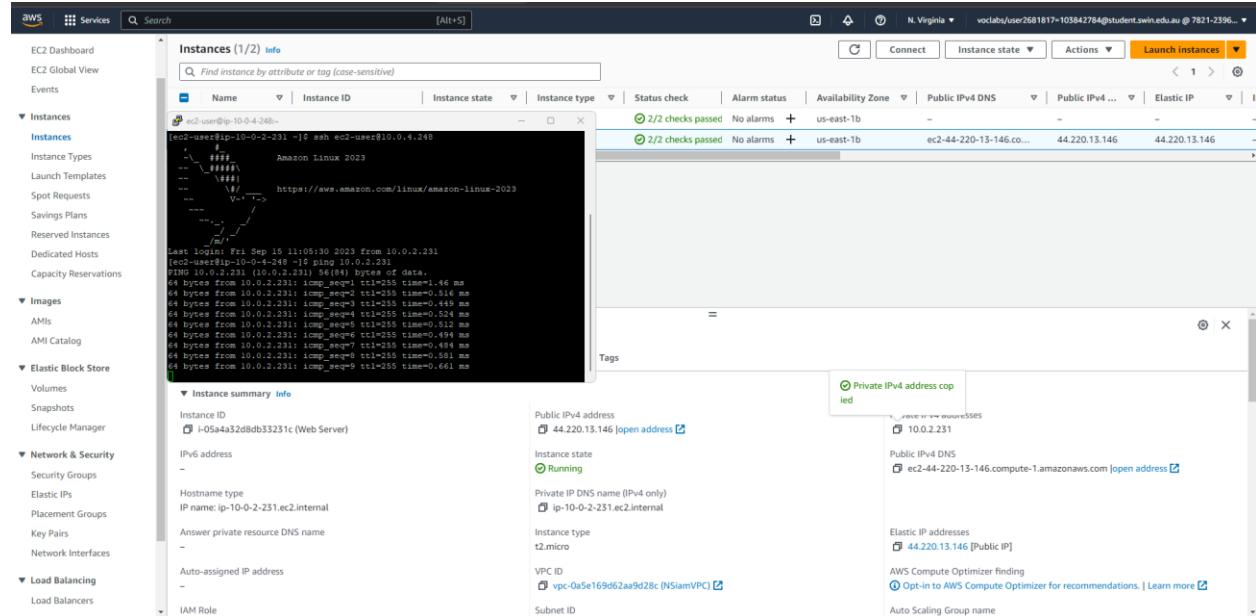


Figure 26- Ping after Network ACL is done with more photos being uploaded.