



COS80001 – Cloud Engineering

Assignment 2: Deploying a Photo Album Web Application on Oracle Cloud Infrastructure (OCI)

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Tutorial Time: Friday – 04:30 PM to 06:30 PM

Tenancy Name: s104837257

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## I. INTRODUCTION

This report explains how a photo album website was successfully deployed using Oracle Cloud Infrastructure (OCI). This included setting up the entire cloud environment, securing the network, deploying a MySQL database, storing images in Object Storage, and running a PHP web app on a virtual machine. Tools used include VCN, subnets, routing, NSGs (Network Security Groups), Security Lists, Reserved Public IP, and phpMyAdmin.

Public URL of the Website: <http://132.226.49.124/cos80001/photoalbum/album.php>

IAM user has been created for tutor and private key - **arunKeyPair**

Search by user name, first name, last name, or email address

Create user

More actions

|                          | Username                                      | Status                       | Email                         | Last access                     | Created                         |
|--------------------------|---|------------------------------|-------------------------------|---------------------------------|---------------------------------|
| <input type="checkbox"/> | <a href="#">howardhao@swin.edu.au</a>         | <div><div></div>Active</div> | howardhao@swin.edu.au         | -                               | Thu, May 10, 2025, 09:01:58 UTC |
| <input type="checkbox"/> | <a href="#">104837257@student.swin.edu.au</a> | <div><div></div>Active</div> | 104837257@student.swin.edu.au | Sun, May 11, 2025, 08:57:13 UTC | Thu, May 10, 2025, 09:01:58 UTC |

0 selected

Profile

104837257@student.swin.edu.au

Identity domain: Default

Tenancy: s104837257

Language: English

User settings

Console settings

Sign out

Figure 1: IAM user created for Tutor

## II. INFRASTRUCTURE SETUP

The full infrastructure was built from scratch in OCI using a custom Virtual Cloud Network (VCN). The setup involved four subnets, two in each availability domain — public and private.

### A. VCN and Subnet Configuration

A Virtual Cloud Network (VCN) named "ARagavendharVCN" was manually created in the us-ashburn-1 region with a CIDR block of 172.17.0.0/16. Within this VCN, four subnets were set up: Public Subnet 1 (172.17.1.0/24), Public Subnet 2 (172.17.2.0/24) for a web server /bastion host, Private Subnet 1 (172.17.3.0/24) intended for the MySQL database, and Private Subnet 2 (172.17.4.0/24) for the test instance. The two public subnets were connected to the internet using a public route table and an Internet Gateway, enabling internet access [1]. The private subnets were associated with a private route table with no internet connectivity.

## Virtual Cloud Networks

Virtual Cloud Networks (VCNs) are private virtual networks you set up in Oracle Cloud Infrastructure. You can attach gateways, route tables, and security rules.

To view service log metrics and additional information about service resources, click [View or manage logs](#)

Create VCN

Start VCN Wizard

| Name                            | State                           | IPv4 CIDR Block | IPv6 Prefix | Default Route Table                                     | DNS Domain Name               | C                               |
|---------------------------------|---------------------------------|-----------------|-------------|---|-------------------------------|---------------------------------|
| <a href="#">ARagavendharVCN</a> | <div><div></div>Available</div> | 172.17.0.0/16   | —           | <a href="#">Default Route Table for ARagavendharVPC</a> | aragavendharvpc.oraclevcn.com | Sat, May 10, 2025, 09:01:58 UTC |

Profile

104837257@student.swin.edu.au

Identity domain: Default

Tenancy: s104837257

Language: English

User settings

Console settings

Sign out

Figure 2: VCN Created in OCI Using CIDR Block 172.17.0.0/16

|                                  |           |                 |               |                                |                                 |  |
|----------------------------------|-----------|-----------------|---------------|--------------------------------|---------------------------------|--|
| <b>Subnets</b><br>Create Subnet  |           |                 |               |                                |                                 | <b>Profile</b><br>104837257@student.swin.edu.au<br>Identity domain: Default<br>Tenancy: s104837257<br>Language: English<br><br>User settings<br>Console settings<br><br>Sign out |
| Name                             | State     | IPv4 CIDR Block | IPv6 Prefixes | Subnet Access                  | Created                         |  |
| <a href="#">Private Subnet 2</a> | Available | 172.17.4.0/24   | —             | Private (vMuY:US-ASHBURN-AD-2) | Sat, May 10, 2025, 09:01:58 UTC |  |
| <a href="#">Private Subnet 1</a> | Available | 172.17.3.0/24   | —             | Private (vMuY:US-ASHBURN-AD-1) | Sat, May 10, 2025, 09:01:58 UTC |  |
| <a href="#">Public Subnet 2</a>  | Available | 172.17.2.0/24   | —             | Public (vMuY:US-ASHBURN-AD-2)  | Sat, May 10, 2025, 09:01:58 UTC |  |
| <a href="#">Public Subnet 1</a>  | Available | 172.17.1.0/24   | —             | Public (vMuY:US-ASHBURN-AD-1)  | Sat, May 10, 2025, 09:54:15 UTC |  |
| Showing 4 items < 1 of 1 >       |           |                 |               |                                |                                 |  |

Figure 3: The 4 subnets and their CIDRs and Availability Domains

**Public Subnet 1**

Subnet Information

- OCID: ...vzlyua [Show](#) [Copy](#)
- IPv4 CIDR Block: 172.17.1.0/24
- IPv6 Prefix: -
- Virtual Router MAC Address: 00:00:17-A3:30:28
- Subnet Type: Availability Domain-Specific
- Availability Domain: vMuY:US-ASHBURN-AD-1
- Compartment: Assignments\_Compartment
- DNS Domain Name: ...evcn.com [Show](#) [Copy](#)
- Subnet Access: Public Subnet
- DHCP Options: Default DHCP Options for ARagavendharVPC [View details](#)
- Route Table: [ARagavendharVPC\\_Public\\_Route\\_Table](#)

Security Lists

| Name                                      | State     | Compartment             | Created                         |
|---|-----------|-------------------------|---------------------------------|
| Default Security List for ARagavendharVPC | Available | Assignments_Compartment | Sat, May 10, 2025, 09:01:58 UTC |

Showing 1 item < 1 of 1 >

Figure 4: Public Subnet 1 configurations – associated route table and associated security list

**Public Subnet 2**

Subnet Information

- OCID: ...uuzaa7mq [Show](#) [Copy](#)
- IPv4 CIDR Block: 172.17.2.0/24
- IPv6 Prefix: -
- Virtual Router MAC Address: 00:00:17-A3:30:28
- Subnet Type: Availability Domain-Specific
- Availability Domain: vMuY:US-ASHBURN-AD-2
- Compartment: Assignments\_Compartment
- DNS Domain Name: ...evcn.com [Show](#) [Copy](#)
- Subnet Access: Public Subnet
- DHCP Options: Default DHCP Options for ARagavendharVPC [View details](#)
- Route Table: [ARagavendharVPC\\_Public\\_Route\\_Table](#)

Security Lists

| Name            | State     | Compartment             | Created                         |
|-----------------|-----------|-------------------------|---------------------------------|
| PublicSubnet2SL | Available | Assignments_Compartment | Sat, May 10, 2025, 09:47:09 UTC |

Showing 1 item < 1 of 1 >

Figure 5: Public Subnet 2 configurations – associated route table and associated security list

**Private Subnet 1**

Subnet Information


- OCID: ...werbspsa [Show](#) [Copy](#)
- IPv4 CIDR Block: 172.17.3.0/24
- IPv6 Prefix: -
- Virtual Router MAC Address: 00:00:17-A3:30:28
- Subnet Type: Availability Domain-Specific
- Availability Domain: vMuY:US-ASHBURN-AD-1
- Compartment: Assignments\_Compartment
- DNS Domain Name: ...evcn.com [Show](#) [Copy](#)
- Subnet Access: Private Subnet
- DHCP Options: Default DHCP Options for ARagavendharVPC [View details](#)
- Route Table: [ARagavendharVPC\\_Private\\_Route\\_Table](#)

Security Lists

| Name             | State     | Compartment             | Created                         |
|------------------|-----------|-------------------------|---------------------------------|
| PrivateSubnet1SL | Available | Assignments_Compartment | Sat, May 10, 2025, 09:47:38 UTC |

Showing 1 item < 1 of 1 >

Figure 6: Private Subnet 1 configurations – associated route table and associated security list



### Private Subnet 2

[Edit](#)
[Move resource](#)
[Add tags](#)
[Terminate](#)
[Create path analysis](#)

Details

Tags

#### Subnet Information

**OCID:** ...4hcm7zq [Show](#) [Copy](#)  
**IPv4 CIDR Block:** 172.17.4.0/24  
**IPv6 Prefix:** -  
**Virtual Router MAC Address:** 00:00:17:A3:30:28  
**Subnet Type:** Availability Domain-Specific  
**Availability Domain:** vMuY:US-ASHBURN-AD-2  
**Compartment:** Assignments\_Compartment  
**DNS Domain Name:** ...evcn.com [Show](#) [Copy](#)  
**Subnet Access:** Private Subnet  
**DHCP Options:** Default DHCP Options for ARagavendharVPC [View details](#)  
**Route Table:** [ARagavendharVPC\\_Private\\_Route\\_Table](#)

#### Resources

[Security Lists \(1\)](#)

[Alarms](#)

[Logs](#)

[IP Address Insights](#)

[CIDR/prefix utilization](#)

#### Security Lists

[Add Security List](#)

| Name  | State     | Compartment             | Created                         |
|---|-----------|-------------------------|---------------------------------|
| <a href="#">Default Security List for ARagavendharVPC</a> | Available | Assignments_Compartment | Sat, May 10, 2025, 09:01:58 UTC |

Showing 1 item < 1 of 1 >

**Profile**  
104837257@student.swin.edu.au  
Identity domain: Default  
Tenancy: s104837257  
Language: English  
[User settings](#)  
[Console settings](#)  
[Sign out](#)

Figure 7: Private Subnet 2 configurations – associated route table and associated security list

### ARagavendharVPC\_Public\_Route\_Table

[Move resource](#)
[Add tags](#)
[Terminate](#)

Details

Tags

#### Route Table Information

**OCID:** ...5ignjr4q [Show](#) [Copy](#)  
**Created:** Sat, May 10, 2025, 09:44:53 UTC  
**Compartment:** Assignments\_Compartment

#### Route Rules

Traffic within the VCN is handled by the VCN's local routing by default. Intra-VCN routing allows you more control over routing between subnets. [Learn more](#). If you're having problems, use [Network Path Analyzer](#) to check your connections.

[Add Route Rules](#)
[Edit](#)
[Remove](#)

| <input type="checkbox"/> | Destination | Target Type      | Target   | Route Type | Description |
|--------------------------|-------------|------------------|--|------------|-------------|
| <input type="checkbox"/> | 0.0.0.0/0   | Internet Gateway | <a href="#">ARagavendharVPC_Internet_Gateway</a> | Static     |             |

0 selected

Showing 1 item < 1 of 1 >

**Profile**  
104837257@student.swin.edu.au  
Identity domain: Default  
Tenancy: s104837257  
Language: English  
[User settings](#)  
[Console settings](#)  
[Sign out](#)

Figure 8: The public route table attached to the internet gateway

### ARagavendharVPC\_Private\_Route\_Table

[Move resource](#)
[Add tags](#)
[Terminate](#)

Details

Tags

#### Route Table Information

**OCID:** ...gank6iva [Show](#) [Copy](#)  
**Created:** Sat, May 10, 2025, 09:45:42 UTC  
**Compartment:** Assignments\_Compartment

#### Route Rules

Traffic within the VCN is handled by the VCN's local routing by default. Intra-VCN routing allows you more control over routing between subnets. [Learn more](#). If you're having problems, use [Network Path Analyzer](#) to check your connections.

[Add Route Rules](#)
[Edit](#)
[Remove](#)

| <input type="checkbox"/> | Destination | Target Type | Target | Route Type | Description |
|--------------------------|-------------|-------------|--------|------------|-------------|
| No items found.          |             |             |        |            |             |

0 selected

Showing 0 items < 1 of 1 >

**Profile**  
104837257@student.swin.edu.au  
Identity domain: Default  
Tenancy: s104837257  
Language: English  
[User settings](#)  
[Console settings](#)  
[Sign out](#)

Figure 9: The private route table with no internet access

## B. Network Security Groups (NSGs)

Two Network Security Groups (NSGs) were configured for the VCN setup. The first, Web-tierNSG, permits HTTP (port 80) and SSH (port 22) traffic from any source, allows ICMP traffic from Private Subnet 2, and enables MySQL traffic from Private Subnet 1. The second, Test-InstanceNSG, allows all incoming traffic and ICMP egress specifically to the public subnet 2 [1].

Networking > Virtual Cloud Networks > ARagavendharVCN > Network Security Group Details

Web-tierNSG

Edit Move resource Add tags Terminate

Security Rules

These security rules apply to all VNICS in this network security group. You can filter the list by ingress or egress. There can be other security rules that apply to a given VNIC in this group: from any other network security groups the VNIC is in, and any security lists associated with the VNIC's subnet. [Learn more about security rules.](#)

Add Rules Edit Remove

| <input type="checkbox"/> | Direction | Stateless | Source Type | Source        | Destination Type | Destination   | Protocol | Source Port Range | Destination Port Range | Type and C |
|--------------------------|-----------|-----------|-------------|---------------|------------------|---------------|----------|-------------------|------------------------|------------|
| <input type="checkbox"/> | Ingress   | No        | CIDR        | 0.0.0.0/0     |                  |               | TCP      | All               | 22                     |            |
| <input type="checkbox"/> | Ingress   | No        | CIDR        | 0.0.0.0/0     |                  |               | TCP      | All               | 80                     |            |
| <input type="checkbox"/> | Ingress   | No        | CIDR        | 172.17.3.0/24 |                  |               | TCP      | All               | All                    |            |
| <input type="checkbox"/> | Ingress   | No        | CIDR        | 172.17.4.0/24 |                  |               | ICMP     |                   |                        | All, All   |
| <input type="checkbox"/> | Egress    | No        |             |               | CIDR             | 172.17.4.0/24 | ICMP     |                   |                        | All, All   |

0 selected Showing 5 items < 1 of 1 >

Figure 10: Web-tierNSG with Ingress (4 rules) and Egress (1 rule) Settings

Networking > Virtual Cloud Networks > ARagavendharVCN > Network Security Group Details

Test-InstanceNSG

Edit Move resource Add tags Terminate

Security Rules

These security rules apply to all VNICS in this network security group. You can filter the list by ingress or egress. There can be other security rules that apply to a given VNIC in this group: from any other network security groups the VNIC is in, and any security lists associated with the VNIC's subnet. [Learn more about security rules.](#)

Add Rules Edit Remove

| <input type="checkbox"/> | Direction | Stateless | Source Type | Source    | Destination Type | Destination   | Protocol      | Source Port Range | Destination Port Range | Type and C |
|--------------------------|-----------|-----------|-------------|-----------|------------------|---------------|---------------|-------------------|------------------------|------------|
| <input type="checkbox"/> | Ingress   | No        | CIDR        | 0.0.0.0/0 |                  |               | All Protocols |                   |                        |            |
| <input type="checkbox"/> | Egress    | No        |             |           | CIDR             | 172.17.2.0/24 | ICMP          |                   |                        | All, All   |

0 selected Showing 2 items < 1 of 1 >

Figure 11: Test-InstanceNSG with Ingress (1 rule) and Egress (1 rule) Settings

## C. Virtual Machine Instances

Two virtual machines were deployed within the VCN. The first was a Web Server/Bastion Host, launched in Public Subnet 2 using Oracle Linux 8 with the VM.Standard.E2.1 shape. It had Apache, PHP, and phpMyAdmin installed via a provided bash script. The second was a Test Instance, created in Private Subnet 2 without any public IP, ensuring it remained inaccessible from the internet. ICMP ping tests were successfully performed from the web server (acting as a bastion host) to the test instance to confirm internal connectivity [1]. Additionally, a Reserved Public IP was manually attached to the web server by first unassigning its default ephemeral IP and then assigning the reserved IP to ensure persistent external access [4].



## Instances in Assignments\_Compartment compartment

An [instance](#) is a compute host. Choose between virtual machines (VMs) and bare metal instances. The image that you use to launch an instance determines the operating system and other software.

**Profile**

104837257@student.swin.edu.au

Identity domain: Default

Tenancy: s104837257

Language: English

User settings

Console settings

Sign out

Create instance

Actions

| <input type="checkbox"/> | Name                                | State   | Public IP      | Private IP   | Shape            | OCPU count | Memory (GB) |
|--------------------------|-------------------------------------|---------|----------------|--------------|------------------|------------|-------------|
| <input type="checkbox"/> | <a href="#">Test_Instance</a>       | Running | -              | 172.17.4.63  | VM.Standard.E2.1 | 1          | 8           |
| <input type="checkbox"/> | <a href="#">Web_Server_Instance</a> | Running | 132.226.49.124 | 172.17.2.183 | VM.Standard.E2.1 | 1          | 8           |

0 selected

Showing 2 items < 1 of 1 >

Figure 12: Web\_Server\_Instance and Test\_Instance

## Reserved public IPv4 addresses

These reserved public IP addresses are available to assign to resources that will be accessed from the internet.

**Profile**

104837257@student.swin.edu.au

Identity domain: Default

Tenancy: s104837257

Language: English

User settings

Console settings

Sign out

Reserve public IP address

| Name                                  | State    | Reserved public IP | VNIC | IP pool |
|---------------------------------------|----------|--------------------|------|---------|
| Web_Server_Reserved_Public_IP_Address | Assigned | 132.226.49.124     | -    | -       |

Figure 13: Reserved Public IP Setup for Web Server

```

user@cloudshell:~ (us-ashburn-1)$ cd .ssh
user@cloudshell:.ssh (us-ashburn-1)$ ssh -i arunKeyPair opc@132.226.49.124
Activate the web console with: systemctl enable --now cockpit.socket

Last login: Sun May 11 13:34:42 2025 from 129.213.201.220
[opc@web-server-instance ~]$ ping 172.17.4.63
PING 172.17.4.63 (172.17.4.63) 56(84) bytes of data.
64 bytes from 172.17.4.63: icmp_seq=1 ttl=64 time=0.443 ms
64 bytes from 172.17.4.63: icmp_seq=2 ttl=64 time=0.393 ms
64 bytes from 172.17.4.63: icmp_seq=3 ttl=64 time=0.461 ms
64 bytes from 172.17.4.63: icmp_seq=4 ttl=64 time=0.405 ms
64 bytes from 172.17.4.63: icmp_seq=5 ttl=64 time=0.420 ms
64 bytes from 172.17.4.63: icmp_seq=6 ttl=64 time=0.366 ms
64 bytes from 172.17.4.63: icmp_seq=7 ttl=64 time=0.398 ms
64 bytes from 172.17.4.63: icmp_seq=8 ttl=64 time=0.448 ms
64 bytes from 172.17.4.63: icmp_seq=9 ttl=64 time=0.451 ms
--- 172.17.4.63 ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8193ms
rtt min/avg/max/mdev = 0.366/0.420/0.461/0.037 ms
[opc@web-server-instance ~]$

```

Figure 14: Successful Ping from Web\_Server\_Instance to Test\_Instance

## D. MySQL Database Setup

A MySQL Database version 8.0.41 was launched using the MySQL2 shape with 50GB storage. Public access was disabled. phpMyAdmin was used to connect and manage the database [2]. A new database *photoalbum* was created with a table called *photosDB*, with the below columns.

- photo\_title (VARCHAR)
- description (VARCHAR)
- creation\_date (DATE)
- keywords (VARCHAR)
- object\_reference (VARCHAR)

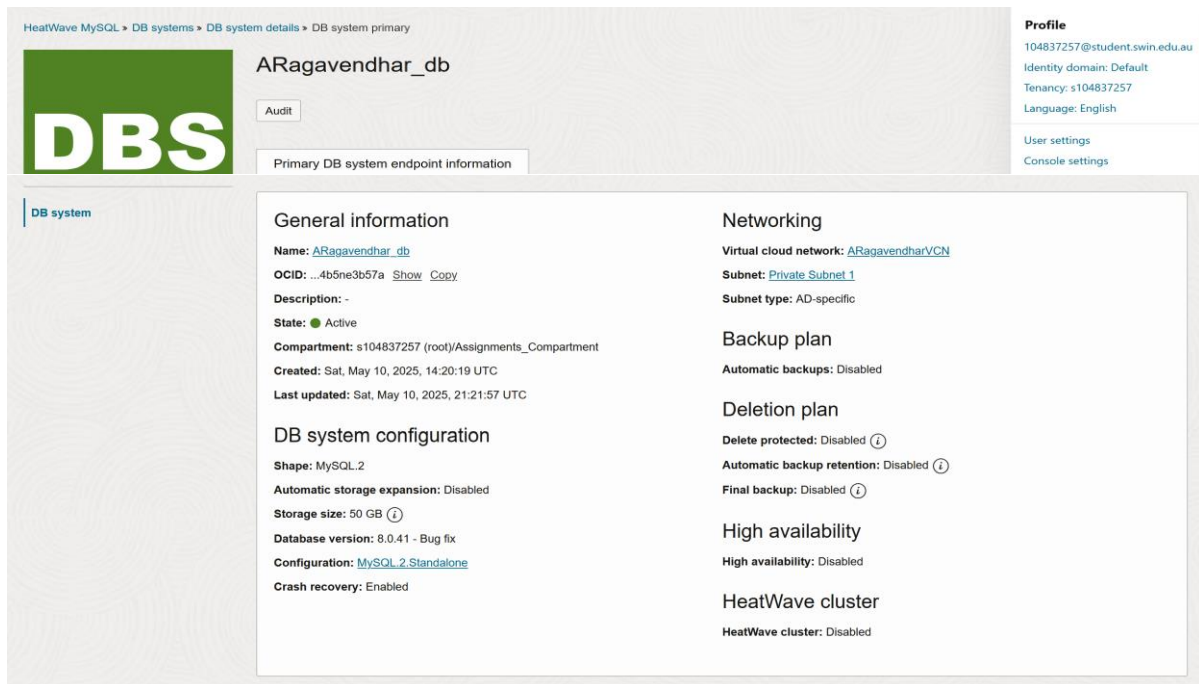


Figure 15: OCI MySQL Database Instance Configuration Settings

The screenshot shows the 'Endpoints' page in the OCI console. It contains a table with the following data:

| Endpoint          | State  | Modes       | Type              | Internal FQDN | Address     | Database port | Database X protocol port |
|-------------------|--------|-------------|-------------------|---------------|-------------|---------------|--------------------------|
| DB system primary | Active | READ, WRITE | Primary DB system | -             | 172.17.3.78 | 3306          | 33060                    |

The table shows 1 item, and the page indicates 'Showing 1 item' and '1 of 1'.

Figure 16: OCI MySQL Database Endpoints

The screenshot shows the phpMyAdmin interface displaying the table schema for 'photosDB'. The table has the following columns:

| # | Name             | Type         | Collation          | Attributes | Null | Default | Comments | Extra | Action           |
|---|------------------|--------------|--------------------|------------|------|---------|----------|-------|------------------|
| 1 | photo_title      | varchar(255) | utf8mb4_0900_ai_ci |            | No   | None    |          |       | Change Drop More |
| 2 | description      | varchar(255) | utf8mb4_0900_ai_ci |            | Yes  | None    |          |       | Change Drop More |
| 3 | creation_date    | date         |                    |            | Yes  | None    |          |       | Change Drop More |
| 4 | keywords         | varchar(255) | utf8mb4_0900_ai_ci |            | Yes  | None    |          |       | Change Drop More |
| 5 | object_reference | varchar(255) | utf8mb4_0900_ai_ci |            | Yes  | None    |          |       | Change Drop More |

Figure 17: phpMyAdmin Showing Table Schema

## E. Security Lists

Dedicated security lists were implemented to manage traffic flow to each subnet, following the principle of least privilege. The PublicSubnet2SL allowed SSH and HTTP access from any source, permitted ICMP traffic to the Test Instance subnet, and allowed traffic originating from the MySQL database subnet. The PrivateSubnet1SL, on the other hand, was configured to allow only traffic from the web server in the public subnet 2 specifically to the MySQL server, ensuring only strictly relevant communications were allowed [1,2].



Networking > Virtual Cloud Networks > ARagavendharVCN > Security List Details

**PublicSubnet2SL**

Instance traffic is controlled by firewall rules on each Instance in addition to this Security List

Move resource Add tags Terminate

**Resources**

Ingress Rules (2)  
Egress Rules (2)

**Ingress Rules**

Add Ingress Rules Edit Remove

| <input type="checkbox"/> | Stateless | Source    | IP Protocol | Source Port Range | Destination Port Range | Type and Code | Allows | Description  |
|--------------------------|-----------|-----------|-------------|-------------------|------------------------|---------------|--------|--|
| <input type="checkbox"/> | No        | 0.0.0.0/0 | TCP         | All               | 80                     |               |        | TCP traffic for ports: 80                              |
| <input type="checkbox"/> | No        | 0.0.0.0/0 | TCP         | All               | 22                     |               |        | TCP traffic for ports: 22<br>SSH Remote Login Protocol |

0 selected Showing 2 items < 1 of 1 >

**Profile**  
104837257@student.swin.edu.au  
Identity domain: Default  
Tenancy: s104837257  
Language: English  
User settings  
Console settings

Figure 18: Ingress Rules for PublicSubnet2SL

**Resources**

Ingress Rules (2)  
Egress Rules (2)

**Egress Rules**

Add Egress Rules Edit Remove

| <input type="checkbox"/> | Stateless | Destination   | IP Protocol | Source Port Range | Destination Port Range | Type and Code | Allows | Description                 |
|--------------------------|-----------|---------------|-------------|-------------------|------------------------|---------------|--------|-----------------------------|
| <input type="checkbox"/> | No        | 172.17.4.0/24 | ICMP        |                   |                        | All           |        | ICMP traffic for: All       |
| <input type="checkbox"/> | No        | 172.17.3.0/24 | TCP         | 32768-61000       | 3306                   |               |        | TCP traffic for ports: 3306 |

0 selected Showing 2 items < 1 of 1 >

Figure 19: Egress Rules for PublicSubnet2SL

Networking > Virtual Cloud Networks > ARagavendharVCN > Security List Details

**PrivateSubnet1SL**

Instance traffic is controlled by firewall rules on each Instance in addition to this Security List

Move resource Add tags Terminate

**Resources**

Ingress Rules (1)  
Egress Rules (0)

**Ingress Rules**

Add Ingress Rules Edit Remove

| <input type="checkbox"/> | Stateless | Source        | IP Protocol | Source Port Range | Destination Port Range | Type and Code | Allows | Description                 |
|--------------------------|-----------|---------------|-------------|-------------------|------------------------|---------------|--------|-----------------------------|
| <input type="checkbox"/> | No        | 172.17.2.0/24 | TCP         | 32768-61000       | 3306                   |               |        | TCP traffic for ports: 3306 |

0 selected Showing 1 item < 1 of 1 >

**Profile**  
104837257@student.swin.edu.au  
Identity domain: Default  
Tenancy: s104837257  
Language: English  
User settings  
Console settings

Figure 20: Ingress Rules for PrivateSubnet1SL

**Resources**

Ingress Rules (1)  
Egress Rules (0)

**Egress Rules**

Add Egress Rules Edit Remove

| <input type="checkbox"/> | Stateless | Destination | IP Protocol | Source Port Range | Destination Port Range | Type and Code | Allows | Description |
|--------------------------|-----------|-------------|-------------|-------------------|------------------------|---------------|--------|-------------|
| No items found.          |           |             |             |                   |                        |               |        |             |

0 selected Showing 0 items < 1 of 1 >

Figure 21: Egress Rules for PrivateSubnet1SL

### III. PHOTO ALBUM APPLICATION DEPLOYMENT

#### A. OCI Object Storage Bucket

A bucket called *ARagavendhar\_bucket* was created. Public access was enabled at the bucket level, not on individual objects. This was done by setting bucket visibility to public access from the management console.

Photos were uploaded using the console and the default URL links were opened and checked to verify objects creation [3].

**ARagavendhar\_bucket**

Edit Visibility Move Resource Re-encrypt Add tags Delete

Bucket Information Tags

**General**

Namespace: idkwwmzg22lm  
 Compartment: [Assignments Compartment](#)  
 Created: Sat, May 10, 2025, 23:00:12 UTC  
 ETag: 651d0379-ccb8-4985-8e34-0e8c48f2e849  
 OCID: ...hja53tpq [Show](#) [Copy](#)

**Usage**

Approximate Object Count: 6 objects ⓘ  
 Approximate Size: 15.8 MiB ⓘ  
 Uncommitted Multipart Uploads Approximate Count: 0 uploads ⓘ  
 Uncommitted Multipart Uploads Approximate Size: 0 bytes ⓘ

**Features**

Default Storage Tier: Standard  
 Visibility: ▲ Public  
 Encryption Key: Oracle managed key [Assign](#)  
 Auto-Tiering: ● Disabled [Edit](#) ⓘ  
 Emit Object Events: ● Disabled [Edit](#) ⓘ  
 Object Versioning: ● Disabled [Edit](#) ⓘ

**Profile**  
 104837257@student.swin.edu.au  
 Identity domain: Default  
 Tenancy: s104837257  
 Language: English  
 User settings  
 Console settings  
 Sign out

Figure 22: OCI Object Storage Bucket Settings – Public Visibility selected from console

Approximate Object Count: 6 objects ⓘ  
 Approximate Size: 15.8 MiB ⓘ  
 Uncommitted Multipart Uploads Approximate Count: 0 uploads ⓘ  
 Uncommitted Multipart Uploads Approximate Size: 0 bytes ⓘ

**Resources**

Objects  
 Metrics  
 Pre-Authenticated Requests  
 Work Requests  
 Lifecycle Policy Rules  
 Replication Policy  
 Retention Rules  
 Uncommitted Multipart Uploads  
 Logs

**Objects**

Upload More Actions ▼

| <input type="checkbox"/> | Name               | Last Modified                   | Size     | Storage Tier |   |
|--------------------------|--------------------|---------------------------------|----------|--------------|---|
| <input type="checkbox"/> | fig_tree.JPG       | Sat, May 10, 2025, 23:10:41 UTC | 3.34 MiB | Standard     | ⋮ |
| <input type="checkbox"/> | flower.JPG         | Sat, May 10, 2025, 23:10:46 UTC | 3.36 MiB | Standard     | ⋮ |
| <input type="checkbox"/> | misty_mountain.JPG | Sat, May 10, 2025, 23:10:36 UTC | 1.72 MiB | Standard     | ⋮ |
| <input type="checkbox"/> | river.JPG          | Sat, May 10, 2025, 23:10:46 UTC | 3.07 MiB | Standard     | ⋮ |
| <input type="checkbox"/> | stream.JPG         | Sat, May 10, 2025, 23:10:48 UTC | 3.19 MiB | Standard     | ⋮ |
| <input type="checkbox"/> | tea.JPG            | Sat, May 10, 2025, 23:10:29 UTC | 1.12 MiB | Standard     | ⋮ |

**Profile**  
 104837257@student.swin.edu.au  
 Identity domain: Default  
 Tenancy: s104837257  
 Language: English  
 User settings  
 Console settings  
 Sign out

Figure 23: Uploaded Photo Objects in the Bucket

**Object Details**

**Basic Information**

Name: fig\_tree.JPG  
 URL Path (URI): [https://objectstorage.us-ashburn-1.oraclecloud.com/n/idkwwmzg22lm/b/ARagavendhar\\_bucket/o/fig\\_tree.JPG](https://objectstorage.us-ashburn-1.oraclecloud.com/n/idkwwmzg22lm/b/ARagavendhar_bucket/o/fig_tree.JPG)

**Storage Tier:** Standard  
**Size:** 3.34 MiB

**Response Headers**

Accept-Ranges: bytes  
 Content Length: 3499129  
 Content MD5 Hash: 90QOnIxDJKIAUjNi6qOycQ==  
 Content Type: image/jpeg  
 date: Sun, 11 May 2025 13:15:50 GMT  
 ETag: 25d29521-fc00-4937-b16b-c69923c79628

[Download](#) [Cancel](#)

**Profile**  
 104837257@student.swin.edu.au  
 Identity domain: Default  
 Tenancy: s104837257  
 Language: English  
 User settings  
 Console settings  
 Sign out

Figure 24: public access URL of fig\_tree object from the bucket

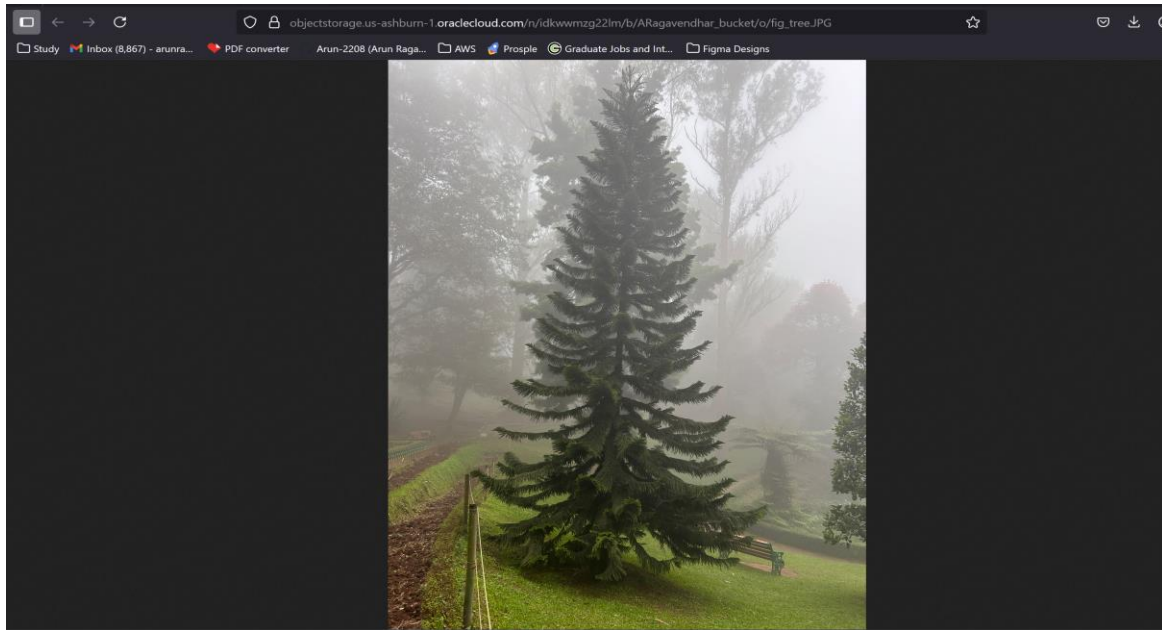


Figure 25: Public Access Confirmation via Object URL

## B. Metadata Entry and Storage in MySQL DB

The metadata for each image was entered into the photosDB table in the database using phpMyAdmin. Each record included the object's individual default URL in the object\_reference column.

|                          | photo_title    | description                                      | creation_date | keywords  | object_reference                                      |
|--------------------------|----------------|--|---------------|---|---|
| <input type="checkbox"/> | fig_tree       | A nice and pleasant Fig Tree in a hill Station   | 2023-10-21    | fig tree, hill station, greenery, plant, nature       | https://objectstorage.us-ashburn-1.oraclecloud.com... |
| <input type="checkbox"/> | flower         | A beautiful flower on a highway roadside         | 2023-11-23    | flower, roadside, highway, bloom, wildflower          | https://objectstorage.us-ashburn-1.oraclecloud.com... |
| <input type="checkbox"/> | misty_mountain | A serene mountain filled with mist in kodaikanal | 2024-04-11    | mist, mountain, kodaikanal, hills, landscape, fog     | https://objectstorage.us-ashburn-1.oraclecloud.com... |
| <input type="checkbox"/> | river          | A calm river on the foothills of a mountain      | 2024-02-06    | river, mountain, foothills, water, nature, landsca... | https://objectstorage.us-ashburn-1.oraclecloud.com... |
| <input type="checkbox"/> | stream         | A gentle stream on a hilltop                     | 2023-12-14    | stream, hilltop, water, flowing, gentle, landscape    | https://objectstorage.us-ashburn-1.oraclecloud.com... |
| <input type="checkbox"/> | tea            | A refreshing cardamom                            | 2024-05-09    | cardamom, tea, hot beverage, nature, close-up         | https://objectstorage.us-ashburn-1.oraclecloud.com... |

Figure 26: phpMyAdmin Showing Metadata Records in photosDB table

## C. Web Application Setup

The provided photo album code was deployed in /var/www/html/cos80001/photoalbum/. The constants.php file was updated to reflect OCI database settings and column names. The application became accessible. Upon testing, the webpage successfully rendered uploaded images alongside metadata in a tabular form.

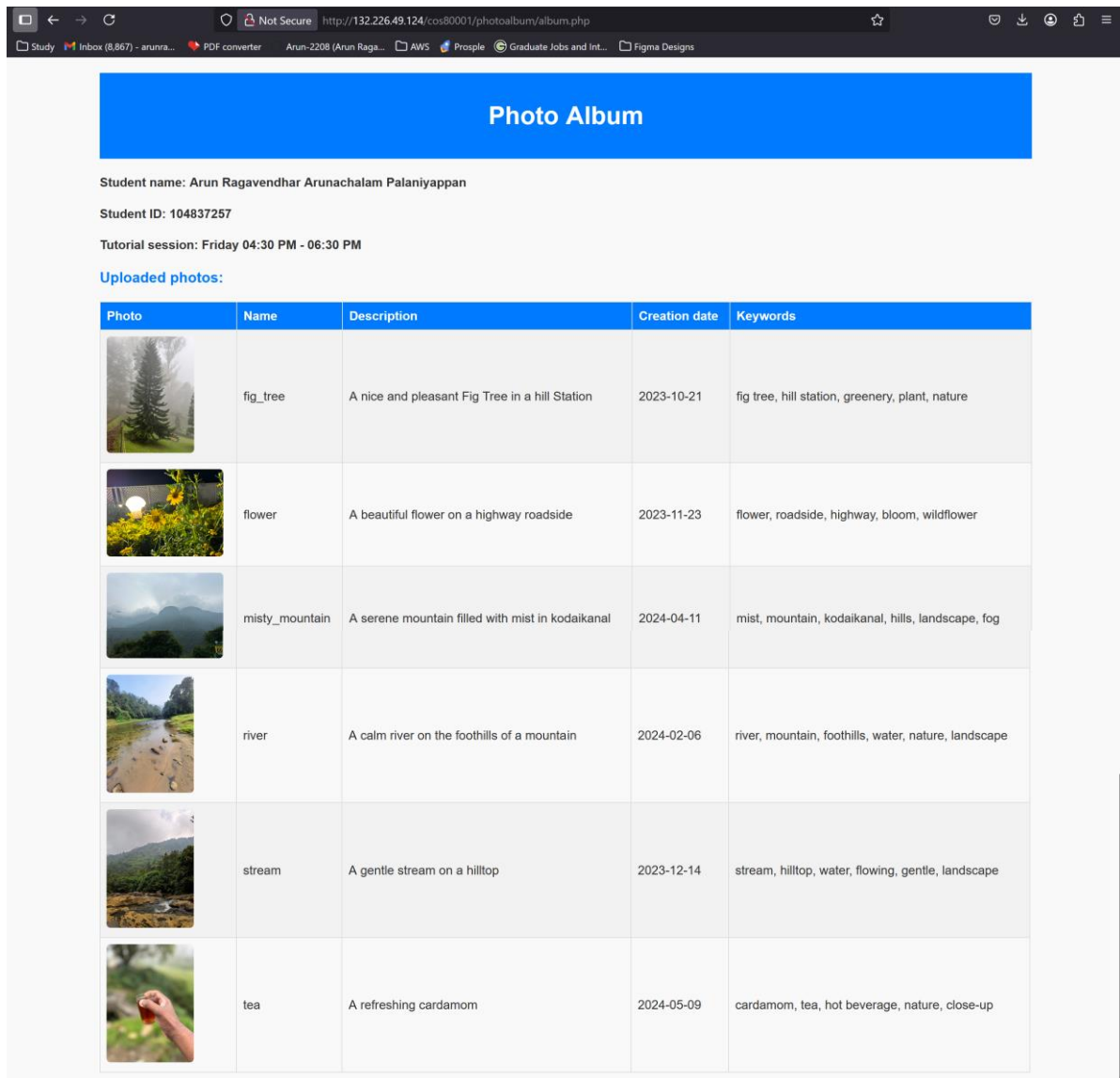


Figure 27: album.php Showing Photoalbum Gallery with Metadata

#### IV. TESTING AND VALIDATION

To verify that the deployed infrastructure and application met all functional and security requirements, a series of tests were conducted. The main objectives of validation were to ensure correct connectivity across subnets, proper public access to the website and object storage, and full application functionality.

##### A. Ping Connectivity Between Web Server and Test Instance

The web server (bastion host) in Public Subnet 2 was used to SSH into and run a successful ping command to the test instance located in Private Subnet 2. This confirmed internal connectivity between subnets and validated both the Network Security Group (NSG) and Security List (SL) configurations.

##### B. Photo Album Website Access Test

Multiple test images stored in the OCI Object Storage bucket were correctly displayed, with associated metadata loaded from the MySQL database. This confirmed the correct setup of the PHP application, successful database connection, and proper configuration of public bucket visibility.

URL: <http://132.226.49.124/cos80001/photoalbum/album.php>

### C. phpMyAdmin Database Test

phpMyAdmin was used to view and manage the photosDB table. Manual insertions and updates were successful. Metadata was verified against live records shown on the album webpage, confirming database integrity and accessibility via the PHP backend.

### D. Object Storage Access Test

All uploaded images were accessible through their public URLs directly from the Object Storage bucket, confirming the correct public visibility configuration at the bucket level and adherence to assignment guidelines.

### E. Website Restart and Reserved IP Persistence

The web server was stopped and restarted multiple times to verify that the Reserved Public IP remained attached. The URL remained unchanged, confirming a persistent and stable endpoint as required.

## V. CHALLENGES AND LEARNINGS

One challenge faced during deployment was the interaction between Network Security Groups (NSGs) and default Security Lists. Initially, the default Security Lists were still active and conflicted with the custom NSGs. This prevented NSG rules from being enforced properly. After removing all rules from the default Security Lists, the NSGs began working as expected. Another issue was with setting up the Reserved Public IP. The default setup assigned a temporary public IP that changed on each reboot. To resolve this, the default public IP was manually unassigned, and a Reserved Public IP was created and attached to the web server instance. This ensured a stable and persistent IP address that met the assignment requirements.

There were also difficulties accessing phpMyAdmin. Even though Apache and PHP were installed correctly, the php-mysql module was missing, causing the phpMyAdmin interface to fail. This was fixed by running `sudo dnf install php-mysqld` and restarting the Apache server with `sudo systemctl restart httpd`. Lastly, for Object Storage access, rather than applying permissions to each image or generating Pre-Authenticated Requests (PARs), the bucket's visibility was configured at the bucket level to allow public access. This enabled all uploaded photos to be accessed directly via their default public URLs, fulfilling the assignment's access requirements without additional configuration.

## VI. CONCLUSION

A photo album website was successfully deployed using Oracle Cloud Infrastructure (OCI). The deployment met all assignment objectives: a secure Virtual Cloud Network (VCN) was configured with properly structured public and private subnets; controlled internet access was established via an Internet Gateway; the provided PHP application was modified to store photo metadata in a MySQL database and retrieve images from an Object Storage bucket; the application was deployed and tested on a virtual machine running Apache; and an additional layer of security was implemented using a Network Security Group. Each service was integrated following OCI best practices, and the system functioned securely and reliably, demonstrating a clear understanding of cloud-based web deployment.

## VII. REFERENCES

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- [3] Oracle Cloud Infrastructure. (2024). Object Storage Overview. <https://docs.oracle.com/en-us/iaas/Content/Object/Concepts/objectstorageoverview.htm>
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## VIII. APPENDIX

### A. Abbreviations

OCI: Oracle Cloud Infrastructure  
VCN: Virtual Cloud Network  
CIDR: Classless Inter-Domain Routing  
NSG: Network Security Group  
SL: Security List  
VM: Virtual Machine  
PHP: Hypertext Preprocessor  
DB: Database  
URL: Uniform Resource Locator  
ICMP: Internet Control Message Protocol  
HTTP: HyperText Transfer Protocol  
SSH: Secure Shell  
PAR: Pre-Authenticated Request

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