

2025

# OCI-Terraform-Project File

**OCI PROJECT – SECURE WEB APPLICATION DEPLOYMENT**

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## **Project Overview**

This project involves designing and deploying a secure, available web application environment on Oracle Cloud Infrastructure (OCI). The solution adheres to OCI security best practices, uses Terraform for automation, and is implemented in a dedicated compartment with restricted access.

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# Architectural Diagram

The following diagram illustrates the overall architecture of the deployed environment on OCI. It shows the VCN, subnets (public and private), compute instances, file storage, load balancer, and security components such as WAF. This design ensures high availability, secure access, and optimized traffic distribution across backend servers.

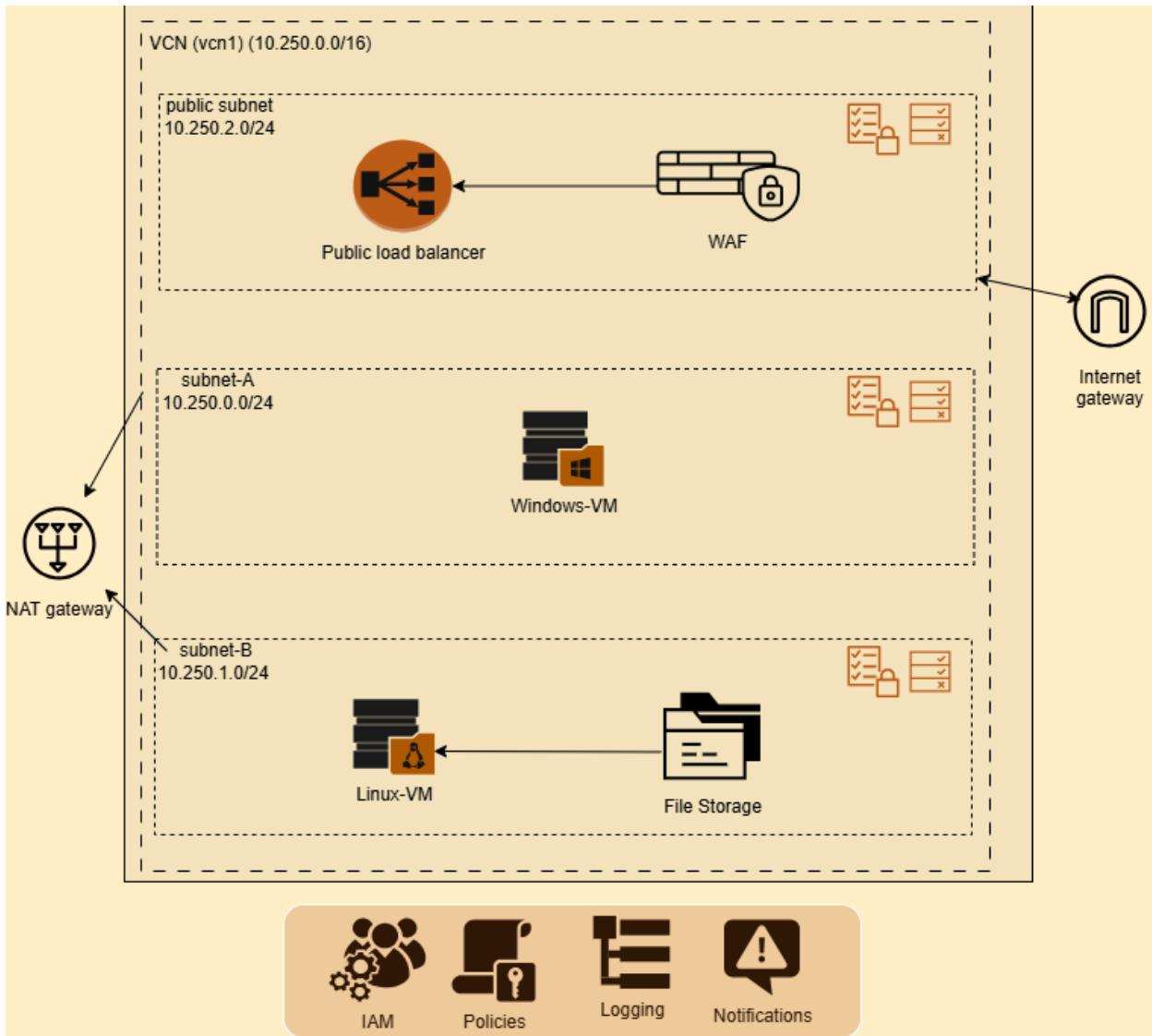


Figure 1:OCI Secure Web Application Architecture Diagram

## Compartments

A dedicated compartment named **Training-Project** was created using Terraform to isolate resources and enforce access control.

```
1 resource "oci_identity_compartment" "Training-Project" {
2   compartment_id = var.tenancy_ocid
3   name=var.Training-Project_name
4   description =var.Training-Project_description
5
6   freeform_tags = {
7     "Environment" = "Dev"
8     "Owner"        = "Esra"
9     "Project"      = "OCI Training"
10    }
11
12 }
```

Figure 2:Compartments created via Terraform.

# Networking

A **VCN Configuration:** Created a Virtual Cloud Network (**vcn1**) with CIDR block 10.250.0.0/16.

## Subnets:

- Private Subnet A: 10.250.0.0/24
- Private Subnet B: 10.250.1.0/24
- Public Subnet (pubSN): 10.250.2.0/24

## Gateways:

- NAT Gateway for private subnets
- Internet Gateway for public subnet

**Security Lists:** Configured custom security rules for each subnet.

All networking resources were provisioned using Terraform modules for consistency.

Details	IP administration	Subnets	Gateways	Routing	Security	VLANs	Work requests	Tags
<h2>Route Tables</h2>								
<input type="text"/> Search and Filter								
Applied filters Compartment Training-Project								
<button>Create Route Table</button>								
Name	State	Number of Rules	Created					
private-route-table	Available	4	Nov 18, 2025, 06:21 UTC					
internet_gateway_route_table	Available	1	Nov 18, 2025, 06:21 UTC					
Default Route Table for vcn1	Available	1	Nov 18, 2025, 06:21 UTC					

Figure 3: Routing Network

# Compute

## Windows VM:

- Subnet: Private Subnet A
- IP: 10.250.0.3
- Shape: VM.Standard.E5.Flex

## Linux VM:

- Subnet: Private Subnet B
- IP: 10.250.1.3
- Shape: VM.Standard.A1.Flex
- SSH key configured

Both instances have **encryption in transit enabled** and were provisioned using Terraform.

□	Name	State	Public IP	Private IP	Shape	OCPUs count	Memory (GB)	Availability domain	Fault domain	...
□	Linux-VM	Running	-	10.250.1.3	VM.Standard.A1.Flex	1	8	AD-1	FD-2	...
□	Windows-VM	Running	-	10.250.0.3	VM.Standard.E5.Flex	1	8	AD-1	FD-2	...

Figure 4:Compute Instances Overview

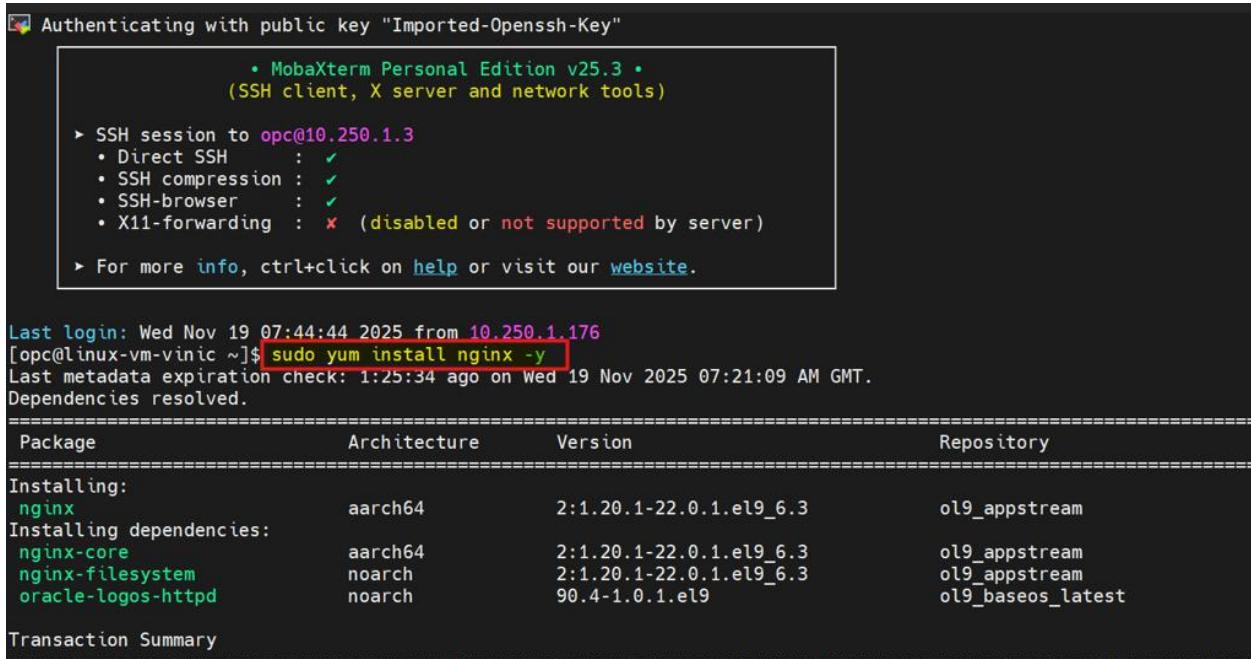
```
34   freeform_tags = [
35     APP_OWNER    = var.APP_OWNER
36     Environment = var.Environment
37   ]
163   APP_OWNER="Esra"
164   Environment="Dev"
```

Figure 5:Added Free Tags to Instances.

# Access to servers and Web Tier

## Nginx web server

Installed **Nginx web server on Linux**, configured index.html with “Welcome”, opened ports 80/443.



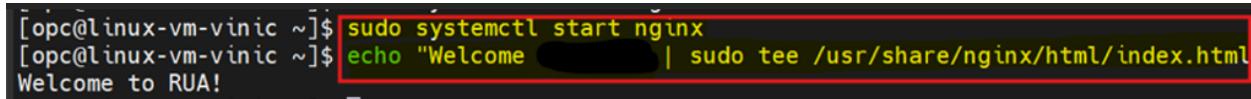
```
Authenticating with public key "Imported-OpenSSH-Key"
  • MobaXterm Personal Edition v25.3 •
  (SSH client, X server and network tools)

> SSH session to opc@10.250.1.3
  • Direct SSH      : ✓
  • SSH compression : ✓
  • SSH-browser     : ✓
  • X11-forwarding  : ✘ (disabled or not supported by server)

> For more info, ctrl+click on help or visit our website.

Last login: Wed Nov 19 07:44:44 2025 from 10.250.1.176
[opc@linux-vm-vinic ~]$ sudo yum install nginx -y
Last metadata expiration check: 1:25:34 ago on Wed 19 Nov 2025 07:21:09 AM GMT.
Dependencies resolved.
=====
 Package          Architecture      Version       Repository
=====
Installing:
 nginx           aarch64          2:1.20.1-22.0.1.el9_6.3   ol9_appstream
Installing dependencies:
 nginx-core      aarch64          2:1.20.1-22.0.1.el9_6.3   ol9_appstream
 nginx-filesystem noarch          2:1.20.1-22.0.1.el9_6.3   ol9_appstream
 oracle-logos-httpd noarch          90.4-1.0.1.el9            ol9_baseos_latest
=====
Transaction Summary
=====
```

Figure 6: Installed Nginx on Linux



```
[opc@linux-vm-vinic ~]$ sudo systemctl start nginx
[opc@linux-vm-vinic ~]$ echo "Welcome" | sudo tee /usr/share/nginx/html/index.html
Welcome to RUA!
```

Figure 7: index.html commands

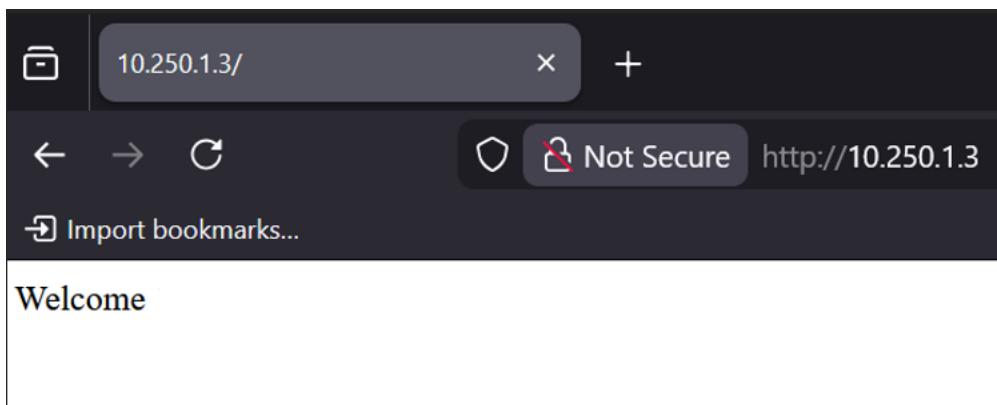


Figure 8: Web App Result.

## IIS web server

On Windows VM Joined RUA domain, configured DNS, enabled RDP users, installed IIS web server, opened the port 80 and 443 in windows defender firewall, created new website called my Site and deployed “Welcome to RUA!” page.



Figure 9: Accessed the Windows Instance

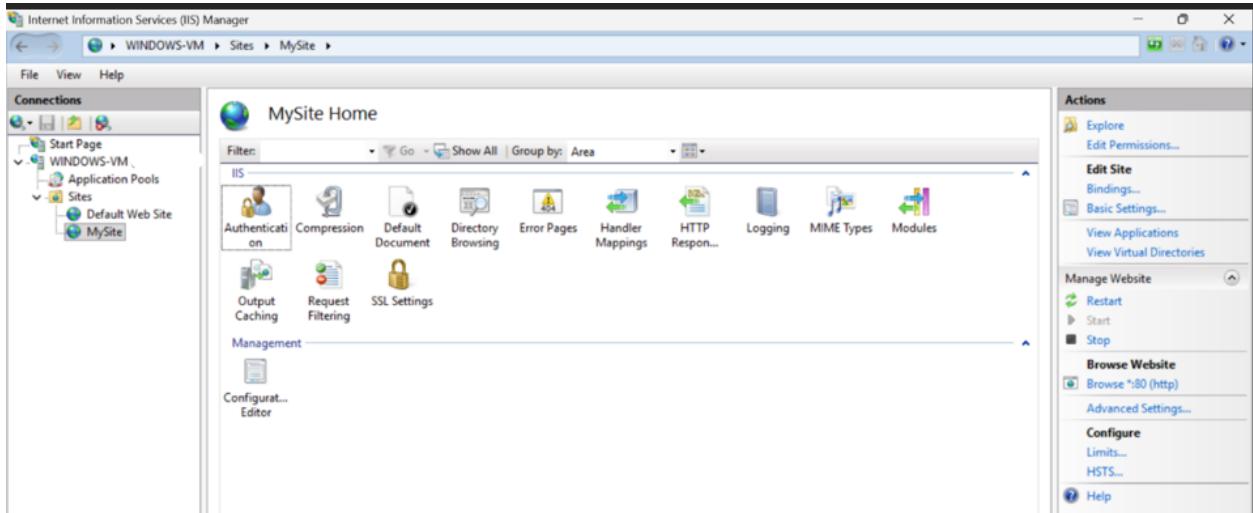


Figure 10: Installed IIS on Windows

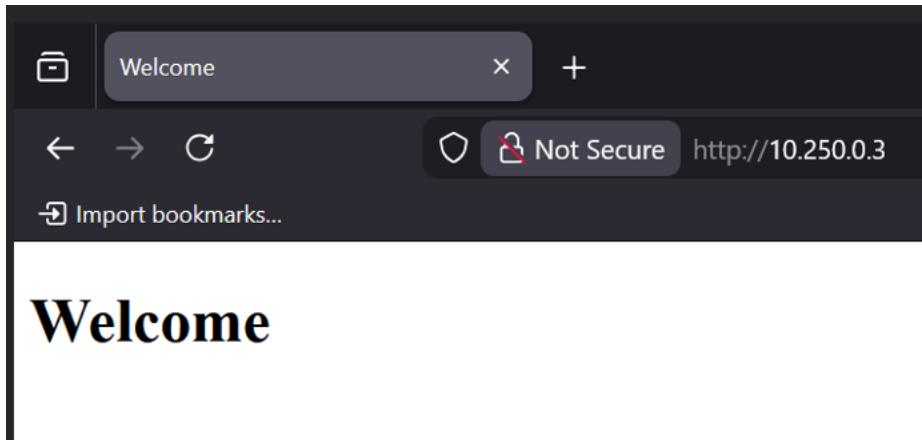


Figure 11:Web App Result.

## File Storage

Created File Storage in Private Subnet B.

Configured policies and security lists, installed NFS on Linux VM, created directory to mounted storage at 10.250.1.238.

Placed the web content under mounted folder, Updated Nginx root directory to point to mounted storage and adjusted permissions.

<input type="checkbox"/>	Stateless	Destination	IP Protocol	Source Port Range	Destination Port Range	Type and Code
<input type="checkbox"/>	No	0.0.0.0/0	All Protocols			
<input type="checkbox"/>	No	0.0.0.0/0	All Protocols			
<input type="checkbox"/>	No	10.250.1.0/24	UDP	111	All	
<input type="checkbox"/>	No	10.250.1.0/24	TCP	111	All	
<input type="checkbox"/>	No	10.250.1.0/24	TCP	2048-2050	All	

Figure 12:Configured Egress Security Lists.

<input type="checkbox"/>	Stateless	Source	IP Protocol	Source Port Range	Destination Port Range	Type and Code
<input type="checkbox"/>	No	10.250.1.0/24	TCP	All	2048-2050	
<input type="checkbox"/>	No	10.250.1.0/24	TCP	All	111	
<input type="checkbox"/>	No	10.250.1.0/24	UDP	All	111	
<input type="checkbox"/>	No	10.250.1.0/24	UDP	All	2048	

Figure 13:Configured Ingress Security Lists.

```
[opc@linux-vm-vinic ~]$ sudo mkdir -p /mnt/FileSystemTraining
[opc@linux-vm-vinic ~]$ sudo mount 10.250.1.238:/FileSystemTraining /mnt/FileSystemTraining
Created symlink /run/systemd/system/remote-fs.target.wants/rpc-statd.service → /usr/lib/systemd/system/rpc-statd.service.
[opc@linux-vm-vinic ~]$ df -h
Filesystem              Size  Used Avail Use% Mounted on
devtmpfs                4.0M   0    4.0M  0% /dev
tmpfs                   3.4G   0    3.4G  0% /dev/shm
tmpfs                   1.4G  111M  1.3G  9% /run
efivarfs                256K  14K   243K  6% /sys/firmware/efi/efivars
/dev/mapper/ocivolume-root  30G  6.7G   23G  23% /
/dev/sda2                2.0G 392M   1.6G  20% /boot
/dev/mapper/ocivolume-oled  15G  799M   15G  6% /var/oled
/dev/sda1                100M  7.5M   93M  8% /boot/efi
tmpfs                    689M   0    689M  0% /run/user/989
tmpfs                    689M   0    689M  0% /run/user/1000
10.250.1.238:/FileSystemTraining  8.0E   0    8.0E  0% /mnt/FileSystemTraining
[opc@linux-vm-vinic ~]$ ^C
```

Figure 14: Mounted File Storage to Linux VM

```
[opc@linux-vm-vinic ~]$ sudo cp /usr/share/nginx/html/index.html /mnt/FileSystemTraining/
[opc@linux-vm-vinic ~]$ ls -l /mnt/FileSystemTraining/
total 8
-rw-r--r--. 1 root root 16 Nov 26 09:13 index.html
```

Figure 15:Placed the web content under mounted folder.

```
[opc@linux-vm-vinic ~]$ sudo -i
[root@linux-vm-vinic ~]# cd /etc/nginx
[root@linux-vm-vinic nginx]# ls
conf.d      fastcgi.conf.default    koi-utf      mime.types.default  scgi_params          uwsgi_params
default.d    fastcgi_params         koi-win      nginx.conf        scgi_params.default  win-utf
fastcgi.conf  fastcgi_params.default mime.types  nginx.conf.default  uwsgi_params
[root@linux-vm-vinic nginx]# vim nginx.conf
[root@linux-vm-vinic nginx]# systemctl reload nginx.service
```

Figure 16: Accessed Nginx Configuration File.

```

include          /etc/nginx/mime.types;
default_type    application/octet-stream;

# Load modular configuration files from the /etc/nginx/conf.d directory.
# See http://nginx.org/en/docs/ngx_core_module.html#include
# for more information.
include /etc/nginx/conf.d/*.conf;

server {
    listen      80;
    listen      [::]:80;
    server_name ;
    root       /mnt/FileSystemTraining;
    index index.html;
    # Load configuration files for the default server block.
    include /etc/nginx/default.d/*.conf;
}

```

Figure 17:Updated Nginx root directory.

## Load Balancer

Deployed Public Load Balancer (public Ip: 80.225.64.77) in pubSN with backend set (Linux & Windows VMs) on port 80.

Configured:

- WAF Policy for security
- Weighted Round Robin load balancing.
- Health checks
- TLS using certificate.

### Policies in Training-Project Compartment

Web application firewall (WAF) policies store configurations that include access control, rate limiting, and other rules to protect web applications from cyber attacks and insider attacks.

The screenshot shows a user interface for managing WAF policies. At the top, there are two buttons: 'Create WAF policy' (in a dark button) and 'Delete'. Below these are two tabs: 'Policies' (selected) and 'Logs'. A search bar contains the placeholder 'Search by name or ID...'. The main area displays a table of policies:

<input type="checkbox"/>	Name	Status	Policy type
<input type="checkbox"/>	waf-training	<span style="color: green;">●</span> Active	WAF policy

Figure 18:WAF policy.



Figure 19: Published IIS on load balancer.

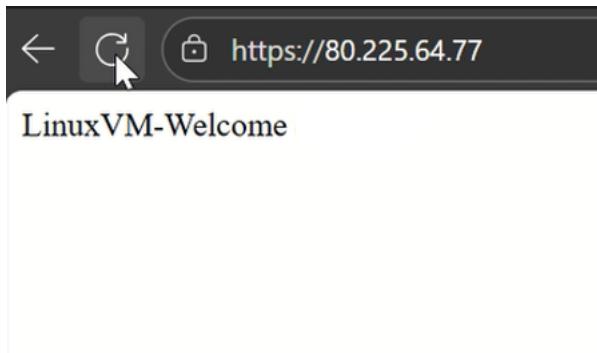


Figure 20: Published Nginx on load balancer.

## Security

Applied Geo-Restriction via WAF to allow only KSA traffic:

```
!i_contains(['SA'], connection.source.geo.countryCode)
```

No public IPs assigned to VMs for added security.

Implemented (**IAM**) policies:

### Policy 1:

Allow group OCI\_Administrators to manage all-resources in compartment Training-Project

### Policy 2:

Allow group OCI\_Administrators to manage file-family in compartment Training-Project.

The screenshot shows the 'Access control' section with two tabs: 'Request control' and 'Response control'. Under 'Request control', there is a 'Manage request control' button. Below it, a table lists a single rule:

Rule name	Action name
block all countries except SA	Pre-configured 401 Response Code Action

Figure 21: Access Control Rule for KSA Only.

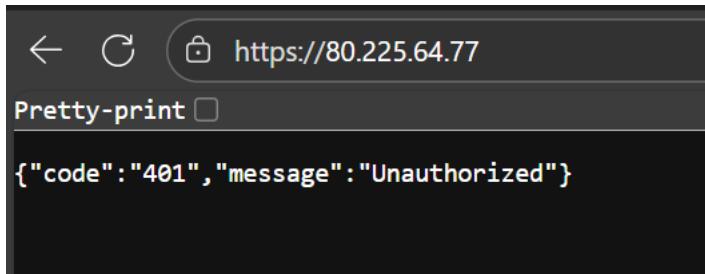


Figure 22: Load Balancer Access from Other Countries.

## Monitoring

Enabled logging and created two alarms:

- **Compute Alarm:** Triggers when CpuUtilization > 80% for 1 minute.
- **Load Balancer Alarm:** Triggers when UnHealthyBackendServers > 1 for 1 minute.

### Alarm Definitions *in Training-Project compartment*

Use the [Monitoring service](#) to set up alarms to notify you when a condition occurs.

The screenshot shows a table of alarms defined in the 'Training-Project' compartment:

<input type="checkbox"/>	Alarm name	Status	Severity	Metric namespace	Notifications destination
<input type="checkbox"/>	<a href="#">compute-alarm-training</a>	<span style="color: green;">●</span> Active	Critical	oci_computeagent	Notifications
<input type="checkbox"/>	<a href="#">LB_Health_Alarm_Training</a>	<span style="color: green;">●</span> Active	Critical	oci_lbbaas	Notifications

Figure 23: List of alarms.

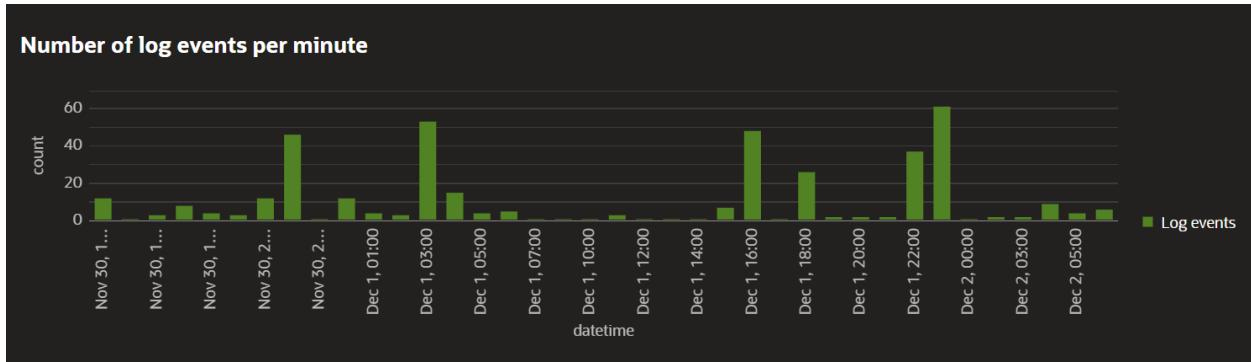


Figure 24:Access logs.

datetime	type	data.message
Dec 02, 2025, 07:59:04	loadbalancer.error	{"data": {"errorLog": {"errorDetails": "Client 64.23.208.64 sent plain HTTP request to HTTPS port", "type": "sslClient"}, "tir ...
Dec 02, 2025, 07:59:02	loadbalancer.error	{"data": {"errorLog": {"errorDetails": "Client 64.23.208.64 sent plain HTTP request to HTTPS port", "type": "sslClient"}, "tir ...
Dec 02, 2025, 07:17:40	loadbalancer.error	{"data": {"errorLog": {"errorDetails": "Client 192.159.99.101 sent plain HTTP request to HTTPS port", "type": "sslClient"}, "tir ...
Dec 02, 2025, 06:18:19	loadbalancer.error	{"data": {"errorLog": {"errorDetails": "healthStatus: Healthy, backendSetName: bs_lb_Training, backend: 10.250.0.3:80, c ...
Dec 02, 2025, 06:18:17	loadbalancer.error	{"data": {"errorLog": {"errorDetails": "healthStatus: Healthy, backendSetName: bs_lb_Training, backend: 10.250.0.3:80, c ...
Dec 02, 2025, 02:20:34	loadbalancer.error	{"data": {"errorLog": {"errorDetails": "Client 85.11.183.6 sent plain HTTP request to HTTPS port", "type": "sslClient"}, "tim ...
Dec 02, 2025, 00:30:10	loadbalancer.error	{"data": {"errorLog": {"errorDetails": "SSL handshake failed for 128.203.201.208", "type": "ssl"}, "timestamp": "2025-12-0 ...

Figure 25:Error logs.