

Swinburne University of Technology

COS20019 Cloud Computing Architecture

ACA Module 9 Challenge Lab - Creating a Scalable and Highly Available Environment for the Cafe

Sunday 12th October, 2023

Task 1: Inspecting your environment

Question 1, 2, 3:

Question 1: Which ports are open in the *CafeSG* security group?

- ☐ Ports 80 and 443
- ☒ Port 80
- ☐ Ports 80, 443, and 3899
- ☐ Ports 22, 80, and 443

Submit

Question 2: Can you connect from the internet to instances in *Public Subnet 1*?

- ☒ Yes - If the instance has a public IP address, and the security group and network ACL allow it
- ☐ No - The public subnet has no internet gateway
- ☐ No - The public subnet has no NAT gateway configured for it
- ☐ No - The network access control list (network ACL) prevents any inbound traffic from the internet

Submit

Question 3: Should an instance in *Private Subnet 1* be able to reach the internet?

- ☒ Yes
- ☐ No

Submit

Question 4, 5, 6:

Question 4: Should an instance in *Private Subnet 2* be able to reach the internet?

- ☐ Yes
- ☒ No

Submit

Question 5: Can you connect to the *CafeWebAppServer* instance from the internet?

- ☐ Yes
- ☒ No

Submit

Question 6: What is the name of the Amazon Machine Image (AMI)?

- ☐ Amazon Linux
- ☐ WebServerAMI
- ☒ Cafe WebServer Image
- ☐ My Amazing Image

Submit

Task 2: Creating a NAT gateway for the second Availability Zone

Create a NAT gateway in the Public Subnet in the second Availability Zone

The screenshot shows the 'Create NAT gateway' page in the AWS Management Console. The breadcrumb navigation is 'VPC > NAT gateways > Create NAT gateway'. The page title is 'Create NAT gateway' with an 'Info' link. A description states: 'A highly available, managed Network Address Translation (NAT) service that instances in private subnets can use to connect to services in other VPCs, on-premises networks, or the internet.'

NAT gateway settings

Name - optional
Create a tag with a key of 'Name' and a value that you specify.
my-nat-gateway-1
The name can be up to 256 characters long.

Subnet
Select a subnet in which to create the NAT gateway.
subnet-0d1acc5a4a1dc7062 (Public Subnet 2)

Connectivity type
Select a connectivity type for the NAT gateway.
☒ Public
☐ Private

Elastic IP allocation ID [Info](#)
Assign an Elastic IP address to the NAT gateway.
eipalloc-0bdf6e646128ec855 [Allocate Elastic IP](#)

[Additional settings](#) [Info](#)

In Private Route Table 2, choose Edit routes

The screenshot shows the 'Route Tables' page in the AWS Management Console. The breadcrumb navigation is 'VPC > Route Tables > rtb-0c00e82a3ce6c79ab'. The page title is 'rtb-0c00e82a3ce6c79ab / Private Route Table 2'.

Details [Info](#)

Route table ID rtb-0c00e82a3ce6c79ab	Main No	Explicit subnet associations subnet-0bfe107c8b53264a0 / Private Subnet 2	Edge associations -
VPC vpc-0c35e3004ee554fb2 Lab VPC	Owner ID 540417225744		

Routes | Subnet associations | Edge associations | Route propagation | Tags

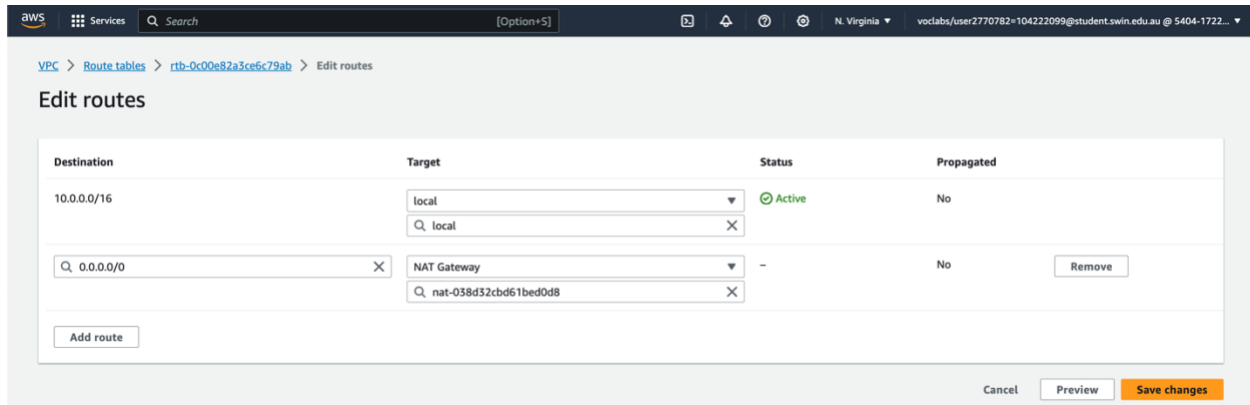
Routes (1)

Filter routes

Destination	Target	Status	Propagated
10.0.0.0/16	local	Active	No

Add new routes with the following configuration:

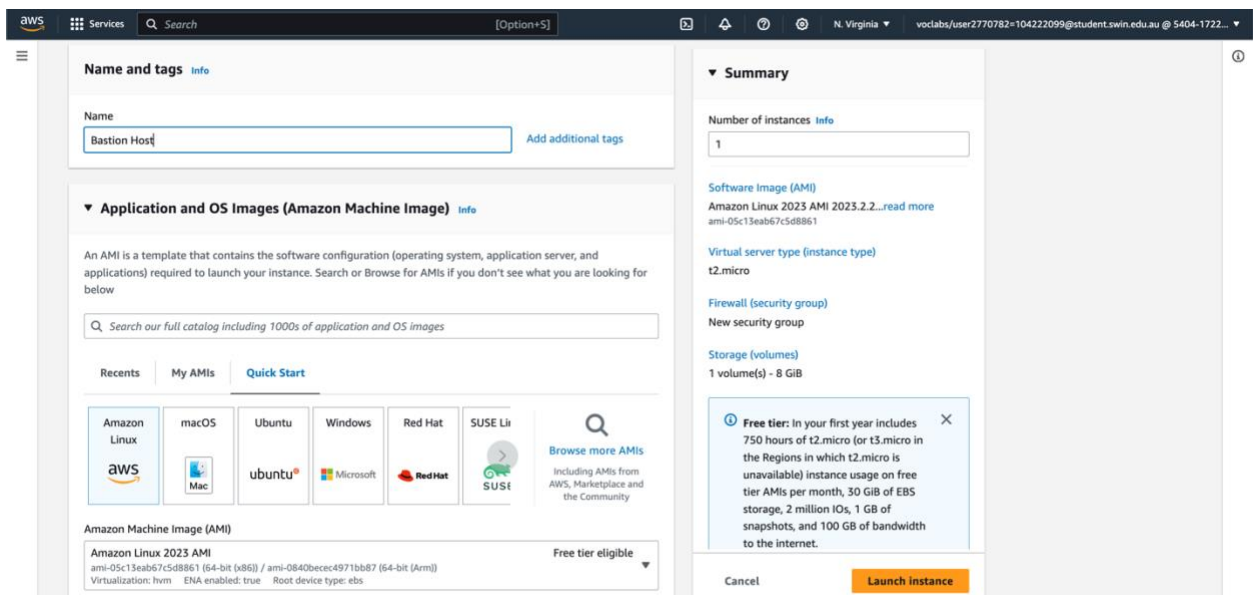
- Destination: 0.0.0.0/0
- Target: Choose earlier created NAT gateway



Task 3: Creating a bastion host instance in a public subnet

From the **Amazon EC2 console**, create an EC2 instance in one of the public subnets of the *Lab* VPC. It must meet the following criteria:

- Name: **Bastion Host**
- **Amazon Machine Image (AMI):** *Amazon Linux 2023 AMI*



- **Instance type:** *t2.micro*
- Uses the **vockey** key pair

Instance type info

Instance type: **t2.micro** Free tier eligible

Family: t2 1 vCPU 1 GiB Memory Current generation: true

On-Demand Windows base pricing: 0.0162 USD per Hour

On-Demand SUSE base pricing: 0.0116 USD per Hour

On-Demand RHEL base pricing: 0.0716 USD per Hour

On-Demand Linux base pricing: 0.0116 USD per Hour

[Additional costs apply for AMIs with pre-installed software](#)

☐ All generations [Compare instance types](#)

Key pair (login) info

You can use a key pair to securely connect to your instance. Ensure that you have access to the selected key pair before you launch the instance.

Key pair name - *required*

Vukey [Create new key pair](#)

Summary

Number of instances **1**

Software image (AMI)

Amazon Linux 2023 AMI 2023.2.2...[read more](#)

ami-05c13eab67c5d8861

Virtual server type (instance type)

t2.micro

Firewall (security group)

New security group

Storage (volumes)

1 volume(s) - 8 GiB

Free tier: In your first year includes 750 hours of t2.micro (or t3.micro in

- **Auto-assign Public IP:** This setting should be enabled

Network settings info

VPC - *required* info

vpc-0c35e3004ee554fb2 (Lab VPC)

10.0.0.0/16

Subnet info

subnet-0d1acc3a4a1dc7062 **Public Subnet 2**

VPC: vpc-0c35e3004ee554fb2 Owner: 540417225744 Availability Zone: us-east-1b

IP addresses available: 248 CIDR: 10.0.1.0/24

[Create new subnet](#)

Auto-assign public IP info

Enable

Summary

Number of instances **1**

Software image (AMI)

Amazon Linux 2023 AMI 2023.2.2...[read more](#)

ami-05c13eab67c5d8861

Virtual server type (instance type)

t2.micro

- Only allows the following traffic:
 - **Type:** *SSH*
 - **Port:** *22*
 - **Source:** Your IP address

Security group name - *required*

BastionSG

This security group will be added to all network interfaces. The name can't be edited after the security group is created. Max length is 255 characters. Valid characters: a-z, A-Z, 0-9, spaces, and _-./[!@#%&*~]

Description - required info

BastionSG for Bastion Host

Inbound Security Group Rules

Security group rule 1 (TCP, 22, 113.161.71.133/32) [Remove](#)

Type info: **ssh**

Protocol info: **TCP**

Port range info: **22**

Source type info: **My IP**

Name info: **113.161.71.133/32**

Description - optional info: **e.g. SSH for admin desktop**

[Add security group rule](#)

[Advanced network configuration](#)

Summary

Number of instances **1**

Software image (AMI)

Amazon Linux 2023 AMI 2023.2.2...[read more](#)

ami-05c13eab67c5d8861

Virtual server type (instance type)

t2.micro

Firewall (security group)

New security group

Storage (volumes)

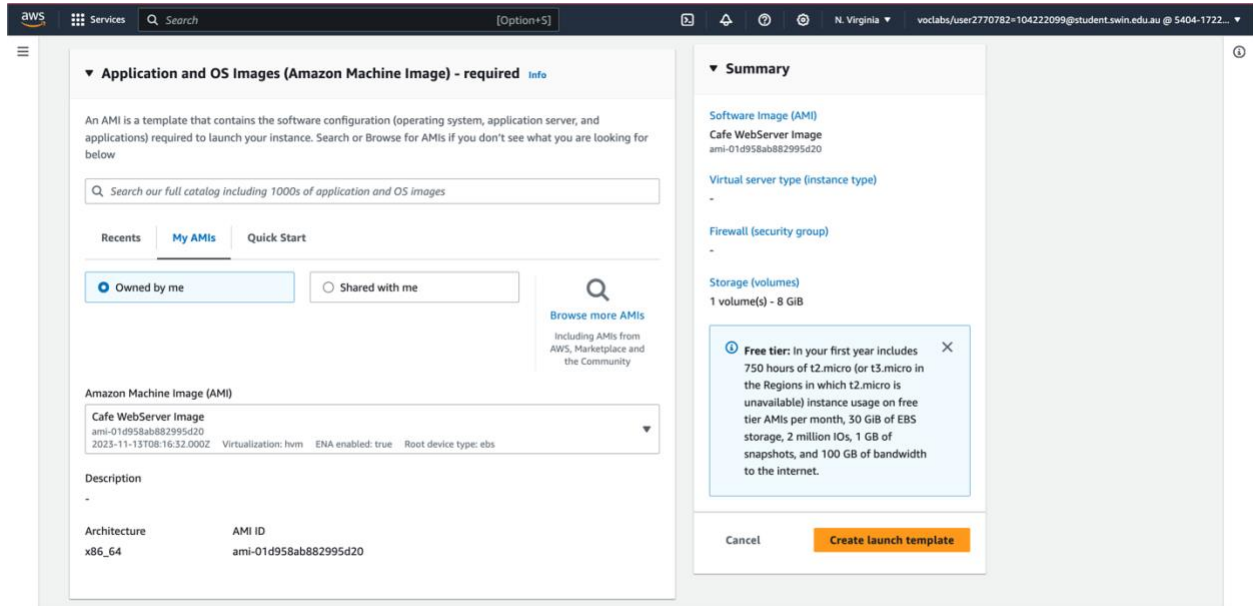
1 volume(s) - 8 GiB

Free tier: In your first year includes 750 hours of t2.micro (or t3.micro in the Regions in which t2.micro is unavailable) instance usage on free

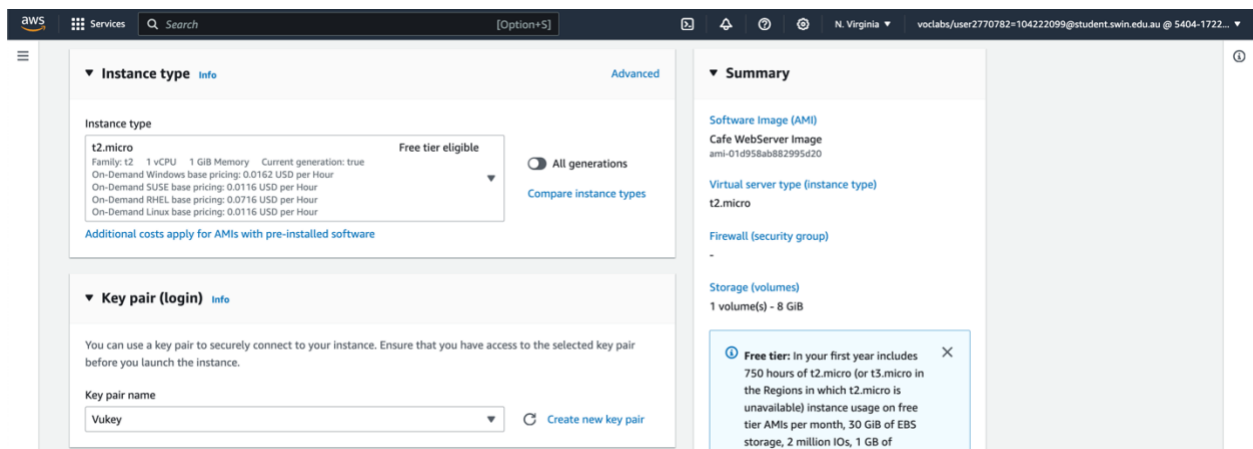
Task 4: Creating a launch template

Create a launch template by using the AMI that was created during lab setup. It must meet the following criteria.

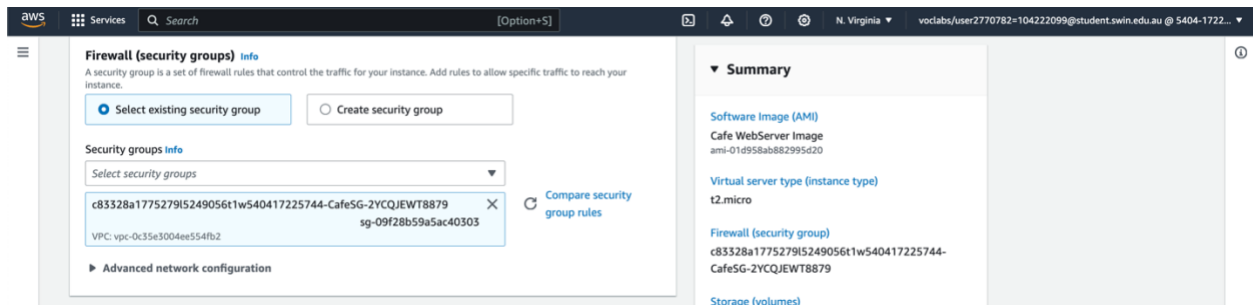
- **AMI:** Cafe WebServer Image



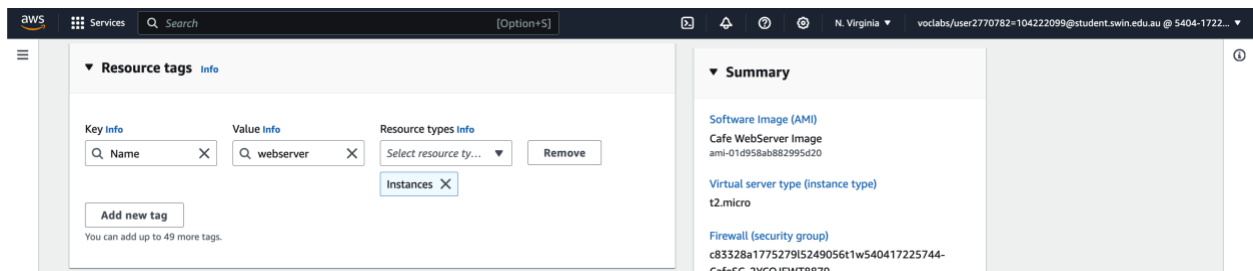
- **Instance type:** *t2.micro*
- **Key pair (login):** Uses a *new key pair*



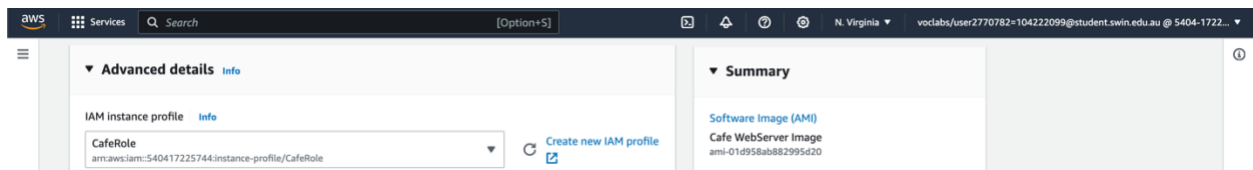
- **Security groups:** CafeSG



- **Resource tags:**
 - **Key:** Name
 - **Value:** webserver
 - **Resource types:** *Instances*



- **IAM Instance Profile:** CafeRole



Task 5: Creating an Auto Scaling group

Create a new Auto Scaling Group that meets the following criteria:

- **Launch template:** Uses the launch template that you created in the previous task

aws Services Search [Option+S] N. Virginia voclabs/user2770782=104222099@student.swin.edu.au @ 5404-1722...

Step 5 - optional
Add notifications

Step 6 - optional
Add tags

Step 7
Review

Launch template info

For accounts created after May 31, 2023, the EC2 console only supports creating Auto Scaling groups with launch templates. Creating Auto Scaling groups with launch configurations is not recommended but still available via the CLI and API until December 31, 2023.

Launch template
Choose a launch template that contains the instance-level settings, such as the Amazon Machine Image (AMI), instance type, key pair, and security groups.

MyTemplate

Create a launch template

Version
Default (1)

Create a launch template version

Description	Launch template	Instance type
MyTemplate for cafe	MyTemplate	t2.micro
AMI ID	lt-0329b7aabf09d1853	Request Spot Instances
ami-01d958ab882995d20	Security groups	No
Key pair name	Security group IDs	
Vukey	sg-09f28b59a5ac40303	

- **VPC:** Uses the VPC that was configured for this lab
- **Subnets:** Uses Private Subnet 1 and Private Subnet 2

aws Services Search [Option+S] N. Virginia voclabs/user2770782=104222099@student.swin.edu.au @ 5404-1722...

scaling_policies

Step 5 - optional
Add notifications

Step 6 - optional
Add tags

Step 7
Review

lt-0329b7aabf09d1853

Instance type
t2.micro

Network info

For most applications, you can use multiple Availability Zones and let EC2 Auto Scaling balance your instances across the zones. The default VPC and default subnets are suitable for getting started quickly.

VPC
Choose the VPC that defines the virtual network for your Auto Scaling group.

vpc-0c35e3004ee554fb2 (Lab VPC)
10.0.0.0/16

Create a VPC

Availability Zones and subnets
Define which Availability Zones and subnets your Auto Scaling group can use in the chosen VPC.

Select Availability Zones and subnets

us-east-1a subnet-0159ddc49fcc03164 (Private Subnet 1) 10.0.2.0/24	X
us-east-1b subnet-0bfe107c8b53264a0 (Private Subnet 2) 10.0.3.0/24	X

Create a subnet

- Skips *all* the advanced options
- Has a **Group size** configured as:
 - **Desired capacity:** 2
 - **Minimum capacity:** 2
 - **Maximum capacity:** 6

aws Services Search [Option+S] N. Virginia voclabs/user2770782=104222099@student.swin.edu.au @ 5404-1722...

EC2 > Auto Scaling groups > Create Auto Scaling group

Step 1: Choose launch template
Step 2: Choose instance launch options
Step 3 - optional: Configure advanced options
Step 4 - optional: **Configure group size and scaling policies**
Step 5 - optional: Add notifications
Step 6 - optional: Add tags
Step 7

Configure group size and scaling policies - optional

Set the desired, minimum, and maximum capacity of your Auto Scaling group. You can optionally add a scaling policy to dynamically scale the number of instances in the group.

Group size - optional

Specify the size of the Auto Scaling group by changing the desired capacity. You can also specify minimum and maximum capacity limits. Your desired capacity must be within the limit range.

Desired capacity: 2
Minimum capacity: 2
Maximum capacity: 6

- Enables the **Target tracking scaling policy** configured as:
 - **Metric type:** *Average CPU utilization*
 - **Target Value:** 25
 - **Instances need:** 60

aws Services Search [Option+S] N. Virginia voclabs/user2770782=104222099@student.swin.edu.au @ 5404-1722...

Review

Scaling policies - optional

Choose whether to use a scaling policy to dynamically resize your Auto Scaling group to meet changes in demand.

☒ **Target tracking scaling policy**
Choose a desired outcome and leave it to the scaling policy to add and remove capacity as needed to achieve that outcome.

☐ None

Scaling policy name: Target Tracking Policy

Metric type: Average CPU utilization

Target value: 25

Instance warmup: 60 seconds

☐ Disable scale in to create only a scale-out policy

Two new instances created

aws Services Search [Option+S] N. Virginia voclabs/user2770782=104222099@student.swin.edu.au @ 5404-1722...

Instances (4) Info

Find Instance by attribute or tag (case-sensitive)

	Name	Instance ID	Instance state	Instanc...	Status check	Alarm status	Availability Zone	Public IPv4 DNS	Public IPv4 .
<input type="checkbox"/>	webserver	i-01ccc869a8c7fe762	Running	t2.micro	2/2 checks passed	User: armaws:	us-east-1a	-	-
<input type="checkbox"/>	webserver	i-0f67e880a720bdac0	Running	t2.micro	2/2 checks passed	User: armaws:	us-east-1b	-	-

Task 6: Creating a load balancer

Create an HTTP Application Load Balancer that meets the following criteria:

- **VPC:** Uses the VPC configured for this lab
- **Subnets:** Uses the two *public subnets*

The screenshot shows the 'Network mapping' configuration page in the AWS Management Console. The page is titled 'Network mapping' and includes a description: 'The load balancer routes traffic to targets in the selected subnets, and in accordance with your IP address settings.' Below this, there are two main sections: 'VPC' and 'Mappings'.

VPC: A dropdown menu is set to 'Lab VPC' (vpc-0c35e3004ee554fb2, IPv4: 10.0.0.0/16). A 'Create new VPC' link is visible.

Mappings: This section allows selecting at least two Availability Zones and one subnet per zone. Two mappings are selected:

- us-east-1a (use1-az2):** Subnet is 'subnet-09a81fd2482489fdd' (Public Subnet 1). IPv4 address is 'Assigned by AWS'.
- us-east-1b (use1-az4):** Subnet is 'subnet-0d1acc3a4a1dc7062' (Public Subnet 2). IPv4 address is 'Assigned by AWS'.

Below these, there are checkboxes for 'us-east-1c (use1-az6)' and 'us-east-1d (use1-az1)', which are currently unchecked.

- Skips the HTTPS security configuration settings
- **Security group:** Creates a *new security group* that allows HTTP traffic from anywhere

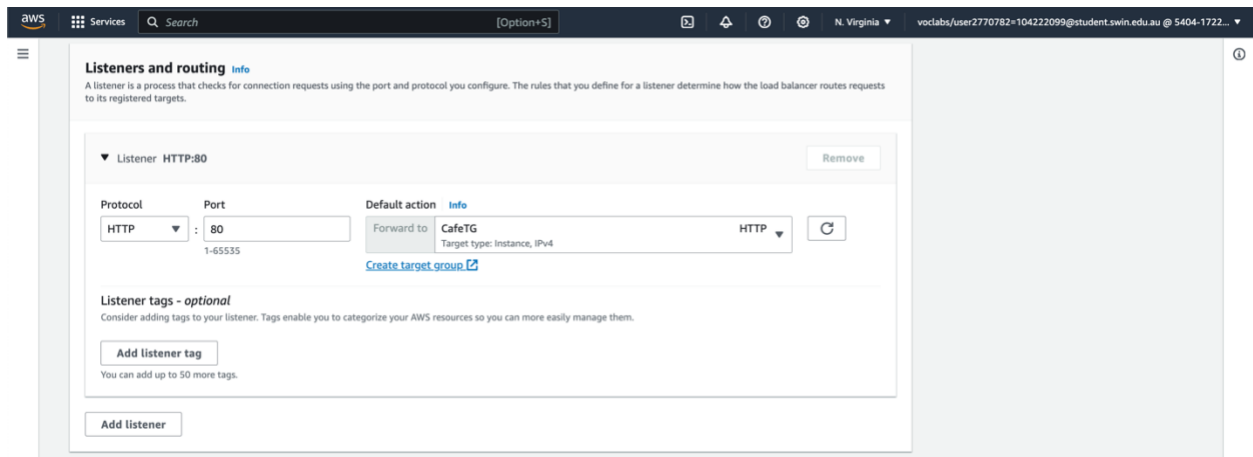
The screenshot shows the 'Edit inbound rules' page for a security group (sg-03624fac150ab0cae - elbSG). The page title is 'Edit inbound rules' and it includes a description: 'Inbound rules control the incoming traffic that's allowed to reach the instance.' Below this, there is a table of inbound rules.

Security group rule ID	Type	Protocol	Port range	Source	Description - optional
sg-0b1d4457e3ba2abc5	HTTP	TCP	80	Custom	

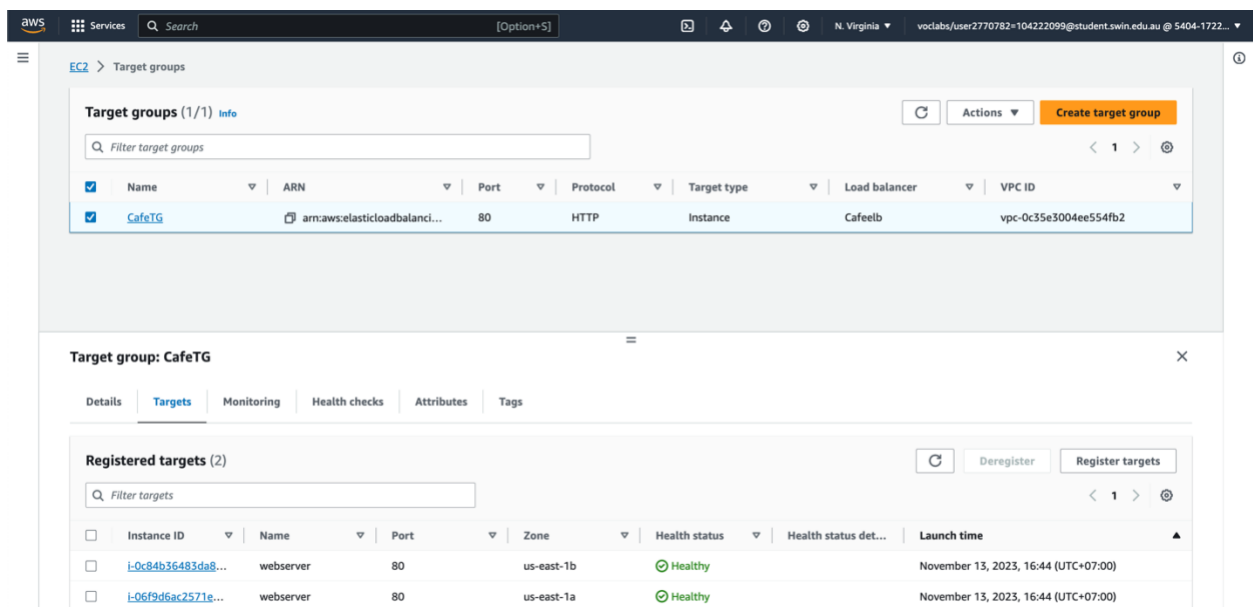
Below the table, there is an 'Add rule' button. The 'Source' field for the existing rule is set to '0.0.0.0/0'.

The screenshot shows the 'Security groups' configuration page in the AWS Management Console. The page is titled 'Security groups' and includes a description: 'A security group is a set of firewall rules that control the traffic to your load balancer. Select an existing security group, or you can create a new security group.' Below this, there is a dropdown menu for selecting a security group. The selected group is 'elbSG' (sg-03624fac150ab0cae, VPC: vpc-0c35e3004ee554fb2). A 'Create new security group' link is visible.

- **Target group:** Creates a *new target group*
- Skips registering targets



Health check target group



Task 7: Testing the web application

To test the café web application, visit the Domain Name System (DNS) name of your load balancer and append /cafe to the URL.

The café application should load.



← → ↻ ⚠ Not Secure | cafealb-66573301.us-east-1.elb.amazonaws.com/cafe/ 🗑 ☆ ⚙ 📄 📱 🧑 Relaunch to update ⋮

Café

Server Information

IP Address: Region/Availability Zone: us-east-1b Instance ID: i-0c84b36483da83c33

Home About Us Contact Us Menu Order History



Our café offers an assortment of delicious and delectable pastries and coffees that will put a smile on your face. From cookies to croissants, tarts and cakes, each treat is especially prepared to excite your tastebuds and brighten your day!

Frank bakes a rich variety of

Task 8: Testing automatic scaling under load

Stress testing target tracking policy group

```

COS20019 — ec2-user@ip-10-0-2-104:~ — ssh -A ec2-user@ec2-54-224-7-144.compute-1.amazonaws.com —...

[ec2-user@ip-10-0-2-104 ~]$ sudo yum install https://dl.fedoraproject.org/pub/epel/epel-release-latest-7.noarch.rpm
Loaded plugins: extras_suggestions, langpacks, priorities, update-motd
epel-release-latest-7.noarch.rpm | 15 kB 00:00
Examining /var/tmp/yum-root-4rf5rP/epel-release-latest-7.noarch.rpm: epel-release-7-14.noarch
Marking /var/tmp/yum-root-4rf5rP/epel-release-latest-7.noarch.rpm to be installed
Resolving Dependencies
--> Running transaction check
---> Package epel-release.noarch 0:7-14 will be installed
--> Finished Dependency Resolution

amzn2-core/2/x86_64 | 3.6 kB 00:00

Dependencies Resolved

=====
Package Arch Version Repository Size
=====
Installing:
epel-release noarch 7-14 /epel-release-latest-7.noarch 25 k

Transaction Summary
=====
Install 1 Package

Total size: 25 k
Installed size: 25 k
Is this ok [y/d/N]: y
Is this ok [y/d/N]: y
Downloading packages:
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
Installing : epel-release-7-14.noarch 1/1
Verifying : epel-release-7-14.noarch 1/1

Installed:
epel-release.noarch 0:7-14

Complete!
[ec2-user@ip-10-0-2-104 ~]$

```

```

COS20019 — ec2-user@ip-10-0-2-104:~ — ssh -A ec2-user@ec2-54-224-7-144.compute-1.amazonaws.com —...

[ec2-user@ip-10-0-2-104 ~]$ sudo yum install stress -y
Loaded plugins: extras_suggestions, langpacks, priorities, update-motd
247 packages excluded due to repository priority protections
Resolving Dependencies
--> Running transaction check
--> Package stress.x86_64 0:1.0.4-16.el7 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

=====
Package Arch Version Size Repository
=====
Installing:
stress x86_64 1.0.4-16.el7 39 k epel

Transaction Summary
=====
Install 1 Package

Total download size: 39 k
Installed size: 94 k
Downloading packages:
warning: /var/cache/yum/x86_64/2/epel/packages/stress-1.0.4-16.el7.x86_64.rpm: Header V3 RSA/SHA256 Signature, key
ID 352c64e5: NOKEY
Public key for stress-1.0.4-16.el7.x86_64.rpm is not installed
stress-1.0.4-16.el7.x86_64.rpm | 39 kB 00:00:00
Retrieving key from file:///etc/pki/rpm-gpg/RPM-GPG-KEY-EPEL-7
Importing GPG key 0x352C64E5:
  Userid : "Fedora EPEL (7) <epel@fedoraproject.org>"
  Fingerprint: 91e9 7d7c 4a5e 96f1 7f3e 888f 6a2f aea2 352c 64e5
  Package : epel-release-7-14.noarch (installed)
  From : /etc/pki/rpm-gpg/RPM-GPG-KEY-EPEL-7
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
  Installing : stress-1.0.4-16.el7.x86_64 1/1
  Verifying : stress-1.0.4-16.el7.x86_64 1/1

Installed:
  stress.x86_64 0:1.0.4-16.el7

Complete!
[ec2-user@ip-10-0-2-104 ~]$ stress --cpu 1 --timeout 600

[ec2-user@ip-10-0-2-104 ~]$ stress --cpu 1 --timeout 600
stress: info: [30333] dispatching hogs: 1 cpu, 0 io, 0 vm, 0 hdd

```

Submitting Work!

Total score

36/36

[Answer 01]

1/1

[Answer 02]

1/1

[Answer 03]

1/1

[Answer 04]

1/1

[Answer 05]

1/1

ENDLAB.