

Swinburne University of Technology

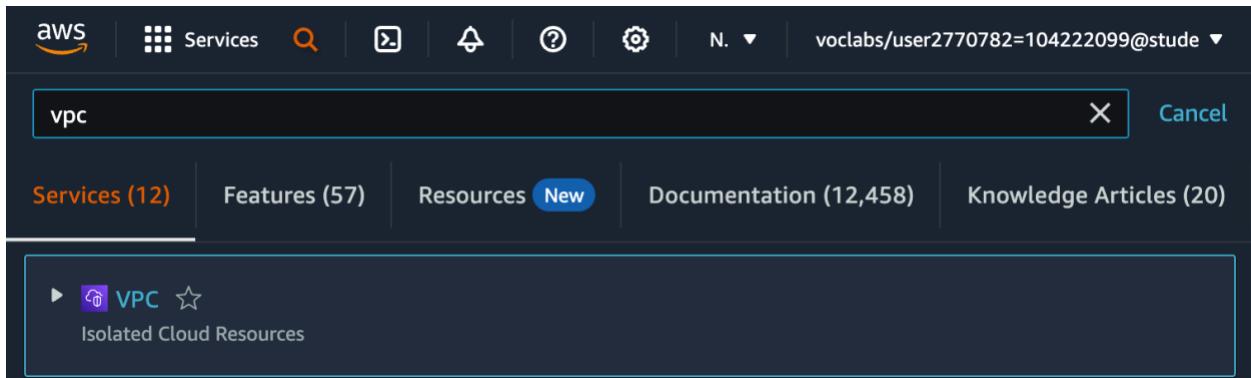
COS20019 Cloud Computing Architecture

Module 9 Guided Lab - Creating a Highly Available Environment

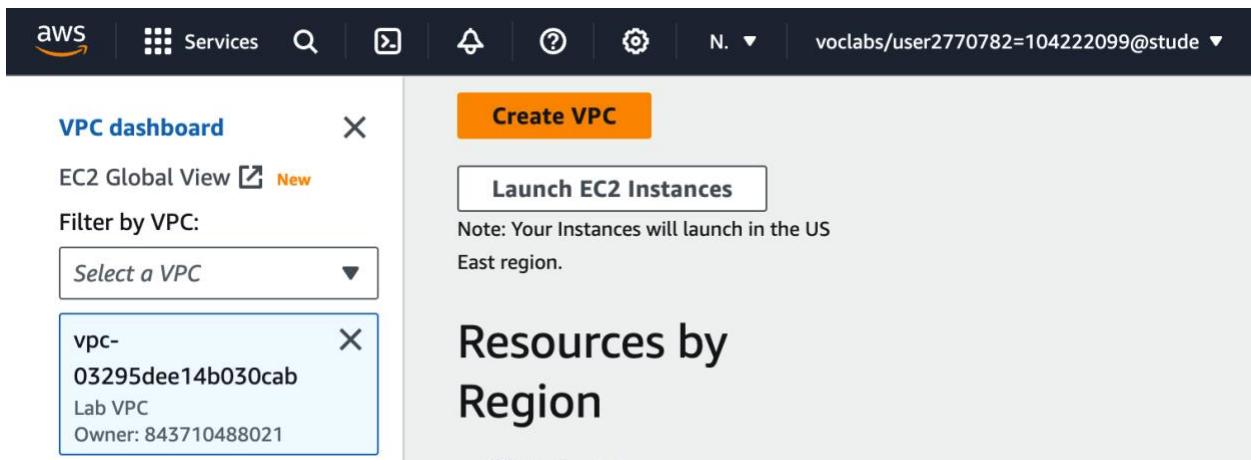
Saturday 28th October, 2023

Task 1: Inspecting your VPC

On the **AWS Management Console**, on the Services menu, choose **VPC**.



In the left navigation pane, under **Filter by VPC**, choose the **Select a VPC** box and select **Lab VPC**.



In the left navigation pane, choose **Your VPCs**.

Here, you can access information about the **Lab VPC** that was created for you. Choose **Lab VPC**.

In the **Details** tab, notice that the **IPv4 CIDR** field has a value of **10.0.0.0/16**, which means that this VPC includes all IP addresses that start with **10.0.x.x**.

Your VPCs (1/1) [Info](#)

VPC ID : [vpc-03295dee14b030cab](#) [X](#) | [Clear filters](#)

<input checked="" type="checkbox"/>	Name	VPC ID	State
<input checked="" type="checkbox"/>	Lab VPC	vpc-03295dee14b030cab	Available

vpc-03295dee14b030cab / Lab VPC

[Details](#) | [Resource map New](#) | [CIDRs](#) | [Flow logs](#) | [Tags](#) | [Integrations](#)

Details

VPC ID vpc-03295dee14b030cab	State Available
Tenancy Default	DHCP option set dopt-0065afdf2f0a13b65
Default VPC No	IPv4 CIDR 10.0.0.0/16
Network Address Usage metrics Disabled	Route 53 Resolver DNS Firewall rule groups -
DNS hostnames Enabled	DNS resolution Enabled

In the left navigation pane, choose **Subnets**.

Here, you can access information about **Public Subnet 1**. In the list of subnets view:

- The **VPC** column for Public Subnet 1 shows that this subnet exists inside of *Lab VPC*.
- The **IPv4 CIDR** column has a value of *10.0.0.0/24*, which means that this subnet includes the 256 IP addresses between *10.0.0.0* and *10.0.0.255*. Five of these addresses are reserved and unusable.
- The **Availability Zone** column lists the Availability Zone where this subnet resides.

Subnets (1/4) Info					
		Actions ▾		Create subnet	
<input type="text"/> Find resources by attribute or tag					
VPC : vpc-03295dee14b030cab X		Clear filters		< 1 > ⚙️	
VPC ▾ IPv4 CIDR ▾ IPv6 CIDR ▾ Available IPv4 addresses ▾					
vpc-03295dee14b030cab Lab VPC	10.0.2.0/23	-	507		
vpc-03295dee14b030cab Lab VPC	10.0.0.0/24	-	249		
vpc-03295dee14b030cab Lab VPC	10.0.4.0/23	-	506		
vpc-03295dee14b030cab Lab VPC	10.0.1.0/24	-	251		

To reveal more details select **Public Subnet 1**.

Details	
Subnet ID	subnet-0295ec7a3a78f6e29
Available IPv4 addresses	249
Network border group	us-east-1
Default subnet	No
Customer-owned IPv4 pool	-
IPv6-only	No
DNS64	
Subnet ARN	arn:aws:ec2:us-east-1:843710488021:subnet/subnet-0295ec7a3a78f6e29
IPv6 CIDR	-
VPC	vpc-03295dee14b030cab Lab VPC
Auto-assign public IPv4 address	Yes
Outpost ID	-
Hostname type	IP name

In the lower half of the page, choose the **Route table** tab.

This tab includes details about the routing for this subnet:

- The first entry specifies that traffic destined within the Classless Inter-Domain Routing (CIDR) range for the VPC (`10.0.0.0/16`) will be routed within the VPC (*local*).
- The second entry specifies that any traffic destined for the internet (`0.0.0.0/0`) is routed to the internet gateway (*igw-*) that exists in Lab VPC. This setting makes the subnet a *public subnet*.

Route table: rtb-0e83878473996c0ee / Public Route Table	
Edit route table association	
Routes (2)	
<input type="text"/> Filter routes	
Destination	Target
10.0.0.0/16	local
0.0.0.0/0	igw-09f5e1c00eab07595

Choose the **Network ACL** tab.

Inbound rules (2)

Filter inbound rules

< 1 > |

Rule number	Type	Protocol	Port range
100	All traffic	All	All
*	All traffic	All	All

Outbound rules (2)

Filter outbound rules

< 1 > |

Rule number	Type	Protocol	Port range
100	All traffic	All	All
*	All traffic	All	All

In the left navigation pane, choose **Internet gateways**.

Notice that an internet gateway with the name **Lab IG** is already attached to **Lab VPC**.

aws		Services	Search	CloudWatch Metrics	CloudWatch Logs	CloudWatch Metrics Insights	CloudWatch Metrics Insights Insights	N.	voclabs/user2770782=104222099@stude								
Internet gateways (1) Info																	
Actions Create internet gateway																	
<input type="text"/> Search																	
<input type="text"/> VPC ID : vpc-03295dee14b030cab X Clear filters																	
< 1 > 																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 2px;"><input type="checkbox"/></th> <th style="text-align: left; padding: 2px;">Name</th> <th style="text-align: left; padding: 2px;">Internet gateway ID</th> <th style="text-align: left; padding: 2px;">State</th> </tr> </thead> <tbody> <tr> <td style="padding: 2px;"><input type="checkbox"/></td> <td style="padding: 2px;">Lab IG</td> <td style="padding: 2px;">igw-09f5e1c00eab07595</td> <td style="padding: 2px;"> Attached</td> </tr> </tbody> </table>										<input type="checkbox"/>	Name	Internet gateway ID	State	<input type="checkbox"/>	Lab IG	igw-09f5e1c00eab07595	Attached
<input type="checkbox"/>	Name	Internet gateway ID	State														
<input type="checkbox"/>	Lab IG	igw-09f5e1c00eab07595	Attached														

In the left navigation pane, choose **Security groups**.

Select **Inventory-DB**.

In the lower half of the page, choose the **Inbound rules** tab.

Inbound rules (1/1)				C	Manage tags	Edit inbound rules
<input type="text"/> Filter security group rules						
1	1		2	2		3
<input checked="" type="checkbox"/>	Name	Security group rule...	IP version			
<input checked="" type="checkbox"/>	-	sgr-0009b2d58c6c108c1	IPv4			

Choose the **Outbound rules** tab.

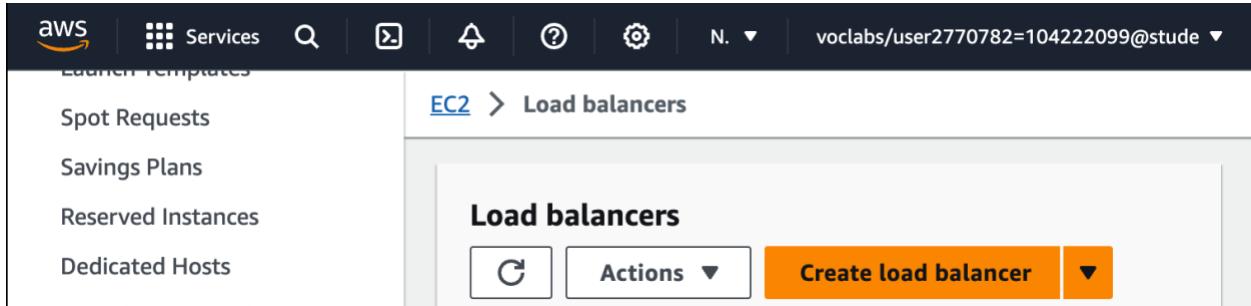
Outbound rules (1/1)				C	Manage tags	Edit outbound rules
<input type="text"/> Filter security group rules						
1	1		2	2		3
<input checked="" type="checkbox"/>	Name	Security group rule...	IP version			
<input checked="" type="checkbox"/>	-	sgr-09d41ea041ba906...	IPv4			

Task 2: Creating an Application Load Balancer

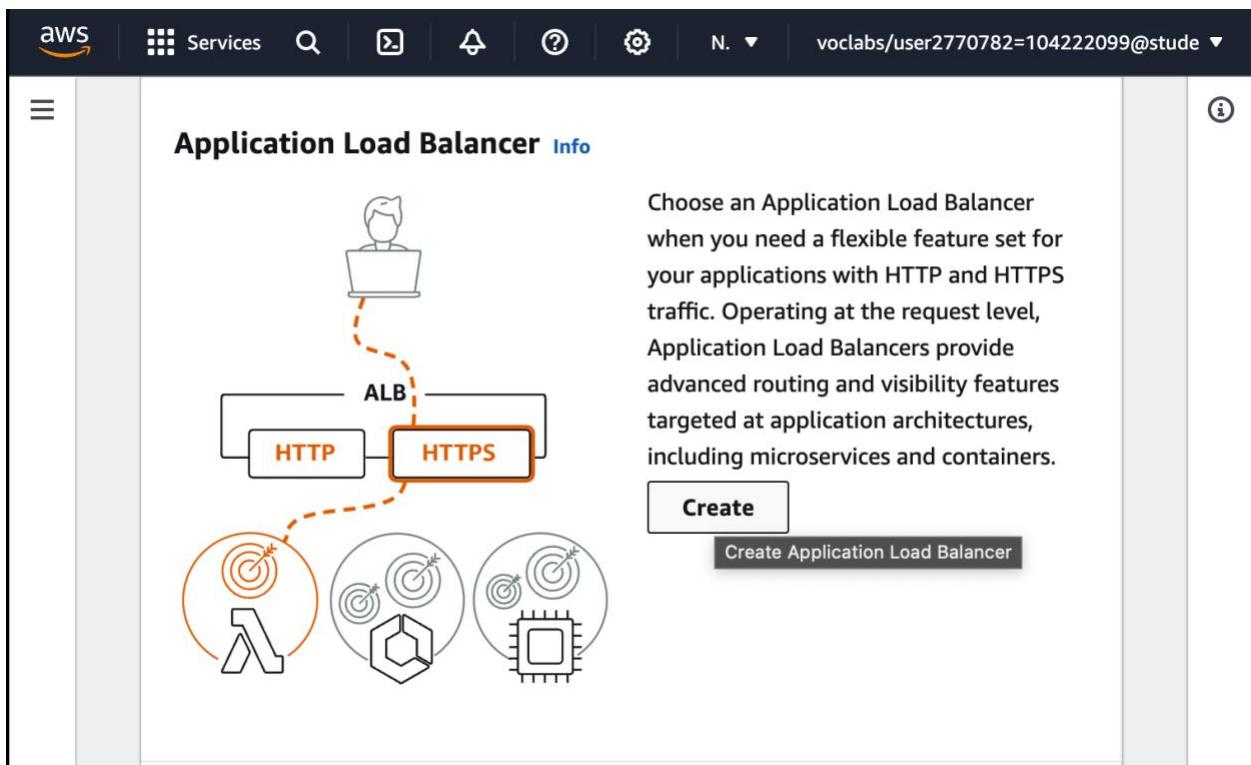
On the Services menu, choose **EC2**.

In the left navigation pane, choose **Load Balancers**.

Choose Create load balancer



Under **Application Load Balancer**, choose **Create**.



For **Load balancer name**, enter: Inventory-LB

The screenshot shows the AWS CloudFormation console with the following details:

- Services**: Services menu.
- Search**: Search bar.
- Help**: Help icon.
- Region**: Region dropdown.
- User**: User dropdown.

Basic configuration

Load balancer name
Name must be unique within your AWS account and can't be changed after the load balancer is created.

A maximum of 32 alphanumeric characters including hyphens are allowed, but the name must not begin or end with a hyphen.

Scroll down to the **Network mapping** section, then for **VPC**, select **Lab VPC**.

Important: Be sure to choose **Lab VPC**. It is likely not the default selection.

Under **Mappings**, choose the **first** Availability Zone, then choose the **Public Subnet** that displays.

Choose the **second** Availability Zone, then choose the **Public Subnet** that displays.

You should now have selected two subnets: **Public Subnet 1** and **Public Subnet 2**. (If not, go back and try the configuration again.)

The screenshot shows the AWS Network mapping configuration page. At the top, there are navigation icons for Services, Search, Home, Help, and Settings, along with a user profile. The main title is "Network mapping" with an "Info" link. A descriptive text states: "The load balancer routes traffic to targets in the selected subnets, and in accordance with your IP address settings." Below this, a "VPC" section with an "Info" link allows selecting a VPC for targets. It includes a dropdown menu showing "Lab VPC" with ID "vpc-03295dee14b030cab" and IPv4 range "10.0.0.0/16". A large "C" icon is present. The "Mappings" section requires selecting at least two Availability Zones and one subnet per zone. It lists "us-east-1a (use1-az4)" and "us-east-1b (use1-az6)". For "us-east-1a", it shows a "Subnet" of "subnet-0295ec7a3a78f6e29" assigned as "Public Subnet 1". For "us-east-1b", it shows a "Subnet" of "subnet-038800e2936491444" assigned as "Public Subnet 2". Both subnets are marked as "IPv4 address" and "Assigned by AWS".

In the **Security groups** section, select the **Create a new security group** hyperlink. This opens a new browser tab. Configure the new security group settings:

- **Security group name:** Inventory-LB
- **Description:** Enable web access to load balancer
- **VPC:** Remove the default VPC by choosing the X to the right of it. Then select **Lab VPC**.

Screenshot of the AWS Security Groups console showing the "Basic details" section for a security group named "Inventory-LB".

Security group name [Info](#)
Inventory-LB
Name cannot be edited after creation.

Description [Info](#)
Enable web access to load balancer

VPC [Info](#)
vpc-03295dee14b03ocab (Lab VPC)

Under **Inbound rules**, choose **Add rule** and configure as described:

- **Type:** *HTTP*
- **Source:** *Anywhere-IPv4*

Screenshot of the AWS Security Groups console showing the "Inbound rules" section. An inbound rule has been added:

Inbound rule 1 [Delete](#)

Type	Protocol
HTTP	TCP

Port range 80 **Source type** Anywhere-IPv4

Source 0.0.0.0/0 [X](#)

Description - optional

Still under **Inbound rules**, choose **Add rule** again and configure:

- **Type:** *HTTPS*

- **Source:** Anywhere-IPv4

Inbound rule 2

Type: HTTPS

Protocol: TCP

Port range: 443

Source type: Anywhere-IPv4

Source: 0.0.0.0/0

Delete

Assign the security group to the load balancer:

- Return to the browser tab where you are still configuring the load balancer.
- In the **Security groups** area and choose the refresh icon.
- For **Security groups**, select the **Inventory-LB** security group you just created.
- Next, below the **Security groups** dropdown menu, select the **X** next to the *default* security group so that Inventory-LB is now the only security group chosen.

Security groups Info

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](#).

Select up to 5 security groups

Inventory-LB
sg-040c32753f43146ed VPC: vpc-03295dee14b030cab

C

In the **Listeners and routing** section, choose **Create target group**.

Configure the target group as described here:

- **Choose a target type:** *Instances*
- **Target group name:** Inventory-App
- **VPC:** Ensure that *Lab VPC* is chosen.
- Scroll down and expand **Advanced health check settings**.
- **Healthy threshold:** 2
- **Interval:** 10 (seconds)
- Choose **Next**. The *Register targets* screen appears.
- Review the settings and choose **Create target group**.

The screenshot shows the AWS Lambda 'Create target group' wizard. At the top, there's a navigation bar with the AWS logo, 'Services' (selected), a search icon, a bell icon, a help icon, and a dropdown menu. The user is identified as 'voclabs/user2770782=104222099@st'. Below the bar, the title 'Basic configuration' is displayed, with a note: 'Settings in this section can't be changed after the target group is created.' A section titled 'Choose a target type' contains a radio button for 'Instances' (which is selected) and a list of benefits: 'Supports load balancing to instances within a specific VPC.' and 'Facilitates the use of [Amazon EC2 Auto Scaling](#) to manage and scale your EC2 capacity.'

aws Services Q N. ▾ vocabs/user2770782=104222099@st ▾

Target group name
Inventory-App

A maximum of 32 alphanumeric characters including hyphens are allowed, but the name must not begin or end with a hyphen.

Protocol : Port

HTTP 80 1-65535

IP address type
Only targets with the indicated IP address type can be registered to this target group.

IPv4
Each instance has a default network interface (eth0) that is assigned the primary private IPv4 address. The instance's primary private IPv4 address is the one that will be applied to the target.

IPv6
Each instance you register must have an assigned primary IPv6 address. This is configured on the instance's default network interface (eth0). [Learn more](#)

VPC
Select the VPC with the instances that you want to include in the target group. Only VPCs that support the IP address type selected above are available in this list.

Lab VPC
vpc-03295dee14b030cab
IPv4: 10.0.0.0/16

Screenshot of the AWS CloudFront configuration page for a load balancer. The top navigation bar shows the AWS logo, Services, a search bar, and user information. The main content area is titled "Health check port" and includes the following settings:

- Traffic port** (selected): A radio button labeled "Traffic port" is selected.
- Override**: An unselected radio button labeled "Override".

Healthy threshold: The number of consecutive health checks successes required before considering an unhealthy target healthy. The value is set to 2.

Unhealthy threshold: The number of consecutive health check failures required before considering a target unhealthy. The value is set to 2.

Timeout: The amount of time, in seconds, during which no response means a failed health check. The value is set to 5 seconds.

Interval: The approximate amount of time between health checks of an individual target. The value is set to 10 seconds.

A "Restore defaults" button is located in the top right corner of the configuration section.

Return to the browser tab where you already started defining the load balancer. In the **Listeners and routing** section, choose the refresh icon. For the **Listener HTTP:80** row, set the **Default action** to forward to the **Inventory-App** target group you just created.

The screenshot shows the AWS Management Console with the Services menu open. A specific configuration for a Listener is displayed, specifically for port 80. The 'Default action' is set to 'Forward to' the 'Inventory-App'.

Scroll to the bottom of the page, and choose **Create load balancer**.

- The load balancer is successfully created.
- Choose **View load balancer**.

The screenshot shows the AWS Management Console with the EC2 service selected. The 'Load balancers' page is displayed, showing a single entry for 'Inventory-LB'. The 'Actions' dropdown menu is visible above the list.

Task 3: Creating an Auto Scaling group

Create an AMI for Auto Scaling

In the **AWS Management Console**, on the Services menu, choose **EC2**.

In the left navigation pane, choose **Instances**.

Wait until the **Status check** for **Web Server 1** displays *2/2 checks passed*. Choose refresh to update.

The screenshot shows the AWS Instances page. At the top, there are navigation links for Services, a search bar, and a user dropdown. Below the header, the title 'Instances (1) Info' is displayed. A toolbar contains buttons for 'Connect', 'Instance state', 'Actions', and 'Launch instances'. A search bar below the toolbar allows finding instances by attribute or tag. The main table lists one instance: 'Web Server 1' with Instance ID 'i-05d3c64f...', status 'Running', and type 't2.micro'. The 'Status check' column shows '2/2 checks passed' with a green checkmark icon. The table has columns for Name, Instance ID, Instance state, Instance type, and Status check.

Select **Web Server 1**.

In the Actions menu, choose **Image and templates > Create image**, then configure:

- **Image name:** Web Server AMI
- **Image description:** Lab AMI for Web Server

The screenshot shows the AWS Instances page with one instance selected, 'Web Server 1'. The 'Actions' menu is open, displaying various options: Connect, View details, Manage instance state, Instance settings, Networking, Security, Create image, Create template from instance, and Launch more like this. The 'Create image' option is highlighted with a blue border. The 'Status check' section of the Actions menu also shows '2/2 checks passed' with a green checkmark icon.

aws Services Search Help N. ▾ voclabs/user2770782=104222099@st ▾

Instance ID
i-05d3c64f0eb417217 (Web Server 1)

Image name
Web Server AMI
Maximum 127 characters. Can't be modified after creation.

Image description - *optional*
Lab AMI for Web Server
Maximum 255 characters

Choose Create image

A banner at the top of the screen displays the **AMI ID** for your new AMI.

aws Services Search Help N. ▾ voclabs/user2770782=104222099@st ▾

Currently creating AMI ami-011203fa81b5c654e from instance i-05d3c64f0eb417217. Check that the AMI status is 'Available' before deleting the instance or carrying out other actions related to this AMI. X

Create a Launch Template and an Auto Scaling Group

In the left navigation pane, choose **Launch Templates**.

Choose Create launch template

New launch template

Create launch template

Configure the launch template settings and create it:

- **Launch template name:** Inventory-LT
- Under **Auto Scaling guidance**, select *Provide guidance to help me set up a template that I can use with EC2 Auto Scaling*

aws Services Q N. voclabs/user2770782=104222099@st

Launch template name and description

Launch template name - *required*

Inventory-LT

Must be unique to this account. Max 128 chars. No spaces or special characters like '&', '*', '@'.

Template version description

A prod webserver for MyApp

Max 255 chars

Auto Scaling guidance [Info](#)

Select this if you intend to use this template with EC2 Auto Scaling

Provide guidance to help me set up a template that I can use with EC2 Auto Scaling

- In the Application and OS Images (Amazon Machine Image) area, choose **My AMIs**.
- **Amazon Machine Image (AMI)**: choose **Web Server AMI**

aws Services Q N. voclabs/user2770782=104222099@st

Recents | My AMIs | Quick Start

Owned by me

Shared with me

Browse more AMIs

Including AMIs from AWS, Marketplace and the Community

Amazon Machine Image (AMI)

Web Server AMI
ami-011203fa81b5c654e
2023-10-28T11:48:53.000Z Virtualization: hvm ENA enabled: true
Root device type: ebs

Description

Lab AMI for Web Server

Architecture	AMI ID
x86_64	ami-011203fa81b5c654e

- **Instance type:** choose *t2.micro*
- **Key pair name:** choose *vockey*

The screenshot shows the AWS Lambda console interface for creating a new function. The 'Function' tab is active. The configuration steps shown are:

- Runtime:** Node.js 14.x
- Handler:** index.handler
- Memory Size:** 128 MB
- Timeout:** 3 minutes
- Environment Variables:** AWS_LAMBDA_FUNCTION_NAME = Inventory-App
- Tracing:** None
- VPC:** None
- Logs:** CloudWatch Logs
- Deployment Source:** GitHub (https://github.com/vockey/Inventory-App, main branch)

- **Firewall (security groups):** choose *Select existing security group*
- **Security groups:** choose *Inventory-App*

The screenshot shows the 'Network settings' configuration page for a new AWS CloudFormation stack. At the top, there's a dropdown menu set to 'Don't include in launch template'. To the right of this is a 'Create new subnet' button with a plus sign icon. Below this, a note states: 'When you specify a subnet, a network interface is automatically added to your template.' Under the 'Firewall (security groups)' section, there are two options: 'Select existing security group' (which is selected, indicated by a blue outline) and 'Create security group'. A dropdown menu below shows 'Select security groups' with an 'Inventory-App sg-05597ea774b0c1f10' entry, which is highlighted with a blue border. To the right of this entry is a 'Compare security group rules' link. At the bottom of the configuration area, there's a '► Advanced network configuration' link.

- Scroll down to the **Advanced details** area and expand it.
 - **IAM instance profile:** choose *Inventory-App-Role*

The screenshot shows the 'Advanced details' configuration page. In the 'IAM instance profile' section, the 'Inventory-App-Role' profile is selected, shown in a dropdown menu with its ARN: 'arn:aws:iam::843710488021:instance-profile/Inventory-App-Role'. To the right of this is a 'Create new IAM profile' button with a plus sign icon. The rest of the page is currently empty, showing the expanded 'Advanced details' section.

- Scroll down to the **Detailed CloudWatch monitoring** setting. Select *Enable*. Note: This will allow Auto Scaling to react quickly to changing utilization.

The screenshot shows the AWS CloudWatch monitoring settings for a specific resource. At the top, there's a header with the AWS logo, navigation links like 'Services' and 'Search', and user information 'voclabs/user2770782=104222099@st'. Below the header, the main content area has a title 'Detailed CloudWatch monitoring' with an 'Info' link. A large button labeled 'Enable' is prominent, with a dropdown arrow next to it. Below the button, a message says 'Additional charges apply'. On the far right, there's an info icon.

- Under **User data**, paste in the script below:

The screenshot shows the 'User data - optional' section of an AWS instance configuration. The header is identical to the previous one. The main area has a sub-header 'User data - optional' with an 'Info' link. It includes a note 'Upload a file with your user data or enter it in the field.' and a 'Choose file' button. Below this is a code editor containing a bash script:

```
#!/bin/bash
# Install Apache Web Server and PHP
yum install -y httpd mysql
amazon-linux-extras install -y php7.2
# Download Lab files
wget https://aws-tc-largeobjects.s3-us-west-2.amazonaws.com/ILT-TF-200-
ACACAD-20-EN/mod9-guided/scripts/inventory-app.zip
unzip inventory-app.zip -d /var/www/html/
# Download and install the AWS SDK for PHP
wget https://github.com/aws/aws-sdk-php/releases/download/3.62.3/aws.zip
unzip aws -d /var/www/html
# Turn on web server
chkconfig httpd on
service httpd start
```

- Choose Create launch template

In the Success dialog, choose the **Inventory-LT** launch template.

The screenshot shows a success dialog box from the AWS EC2 interface. The header is the same as the previous screenshots. The main content area has a green success banner with a checkmark icon and the word 'Success'. It also contains the message 'Successfully created [Inventory-LT\(lt-0b5ce992740e58f40\)](#)'.

From the Actions menu, choose *Create Auto Scaling group*

The screenshot shows the AWS EC2 Launch Templates interface. The navigation bar at the top includes the AWS logo, Services, a search icon, a bell icon, a question mark icon, a gear icon, and a dropdown for the user 'voclabs/user2770782=104222099@st'. Below the navigation bar, the path 'EC2 > Launch templates > Inventory-LT' is shown. The main title 'Inventory-LT (lt-0b5ce992740e58f40)' is displayed. On the left, an 'Actions' menu is open, listing several options: 'Launch instance from template', 'Modify template (Create new version)', 'Delete template version', 'Set default version', 'Manage tags', 'Create Spot Fleet', and 'Create Auto Scaling group'. The 'Create Auto Scaling group' option is highlighted with a blue border. To the right of the actions menu, there are two fields: 'Launch template name' containing 'Inventory-LT' and 'Owner'.

Configure the details in Step 1 (Choose launch template or configuration):

- **Auto Scaling group name:** Inventory-ASG (ASG stands for *Auto Scaling group*)
- **Launch template:** confirm that the *Inventory-LT* template you just created is selected.
- Choose Next

The screenshot shows the AWS Auto Scaling Groups creation wizard. The top navigation bar includes the AWS logo, Services menu, search bar, and user information (voclabs/user2770782=104222099@st). The main form has two sections:

- Name**: A field labeled "Auto Scaling group name" with placeholder "Enter a name to identify the group." containing the value "Inventory-ASG". A note below says "Must be unique across this account in the current Region and no more than 255 characters." with a blue info icon.
- Launch template**: A section with an info icon and a note: "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." Below this is a dropdown menu set to "Inventory-LT" with a downward arrow, and a "Create a launch template" button.

Configure the details in Step 2 (Choose instance launch options):

- **VPC**: choose *Lab VPC*
- **Availability Zones and subnets**: Choose *Private Subnet 1* and then choose *Private Subnet 2*. This will launch EC2 instances in private subnets across both Availability Zones.
- Choose Next

The screenshot shows the AWS Auto Scaling Network configuration page. At the top, there's a navigation bar with the AWS logo, Services, a search bar, and other navigation icons. The main content area has a header "Network Info". Below it, a note says: "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." Under the "VPC" section, it says "Choose the VPC that defines the virtual network for your Auto Scaling group." A dropdown menu is open, showing "vpc-03295dee14b030cab (Lab ...)" and "10.0.0.0/16". To the right of the dropdown is a refresh icon. Below the dropdown is a link "Create a VPC". Under the "Availability Zones and subnets" section, it says "Define which Availability Zones and subnets your Auto Scaling group can use in the chosen VPC." A dropdown menu is open, showing "Select Availability Zones and su...". To the right of the dropdown is a refresh icon. Below the dropdown are two selected subnet entries: "us-east-1a | subnet-0c3bc3163a56f9bbb (Private Subnet 1)" with IP range "10.0.2.0/23" and "us-east-1b | subnet-0c90ede9542cc387c (Private Subnet 2)" with IP range "10.0.4.0/23". Each entry has a delete icon to its right.

Configure the details in Step 3 (Configure advanced options):

- In the **Load balancing** panel:
 - Choose **Attach to an existing load balancer**
 - **Existing load balancer target groups:** select *Inventory-App*.

Schedule, or to a new load balancer that you define.

- No load balancer
Traffic to your Auto Scaling group will not be fronted by a load balancer.
- Attach to an existing load balancer
Choose from your existing load balancers.
- Attach to a new load balancer
Quickly create a basic load balancer to attach to your Auto Scaling group.

Attach to an existing load balancer

Select the load balancers that you want to attach to your Auto Scaling group.

- Choose from your load balancer target groups
This option allows you to attach Application, Network, or Gateway Load Balancers.
- Choose from Classic Load Balancers

Existing load balancer target groups
Only instance target groups that belong to the same VPC as your Auto Scaling group are available for selection.

Select target groups ▾

Inventory-App | HTTP X
Application Load Balancer: Inventory-LB

- In the **Health checks** panel:
 - **Health check grace period:** 90 seconds

The screenshot shows the 'Health checks' configuration page in the AWS CloudWatch Metrics interface. At the top, there's a navigation bar with the AWS logo, services dropdown, search bar, and user information. Below the header, the title 'Health checks' is displayed, followed by a brief description: 'Health checks increase availability by replacing unhealthy instances. When you use multiple health checks, all are evaluated, and if at least one fails, instance replacement occurs.' Under the heading 'EC2 health checks', it says 'Always enabled'. There are two optional health check types: 'Turn on Elastic Load Balancing health checks' (checkbox is unchecked, labeled 'Recommended') and 'Turn on VPC Lattice health checks' (checkbox is checked). Below this, the 'Health check grace period' is set to 90 seconds. On the right side of the page, there's an 'Info' link.

- In the **Additional settings** panel:
 - Select **Enable group metrics collection within CloudWatch**

The screenshot shows the 'Additional settings' configuration page. It includes a 'Monitoring' section where the checkbox for 'Enable group metrics collection within CloudWatch' is checked. Below this is a 'Default instance warmup' section with an info link and a note about CloudWatch metrics for new instances. A checkbox for 'Enable default instance warmup' is also present. At the bottom of the page are four buttons: 'Cancel', 'Skip to review' (highlighted in blue), 'Previous', and 'Next' (highlighted in orange).

- Choose Next

Configure the details in Step 4 (Configure group size and scaling policies - optional):

- Under **Group size**, configure:

- **Desired capacity:** 2
- **Minimum capacity:** 2
- **Maximum capacity:** 2

The screenshot shows the 'Group size - optional' configuration step in the AWS Auto Scaling wizard. The 'Desired capacity' field contains '2'. The 'Minimum capacity' field also contains '2'. The 'Maximum capacity' field contains '2' and has a dropdown arrow next to it.

- Under **Scaling policies**, choose *None*

The screenshot shows the 'Scaling policies - optional' configuration step. The 'None' scaling policy option is selected, indicated by a blue circle with a dot. The other option, 'Target tracking scaling policy', is shown with a description: 'Choose a desired outcome and leave it to the scaling policy to add and remove capacity as needed to achieve that outcome.'

- Choose Next

Configure the details in Step 5 (Add notifications - optional):
You do not need to configure any of these settings.

Configure the details in Step 6 (Add tags - optional):

- Choose Add tag and Configure the following:
 - **Key:** Name
 - **Value:** Inventory-App
- Choose Next

The screenshot shows a 'Tags (1)' configuration screen. It has two columns: 'Key' and 'Value - optional'. Under 'Key', there is a text input field containing 'Name'. Under 'Value - optional', there is a text input field containing 'Inventory-App', which is highlighted with a blue border. Below these fields is a section labeled 'Tag new instances' with a checked checkbox. In the bottom right corner, there is a 'Remove' button.

Configure the details in Step 6 (Review):

- Review the details of your Auto Scaling group
- At the bottom of the page, choose Create Auto Scaling group

The screenshot shows the AWS EC2 Auto Scaling groups page. At the top, there is a green success message: 'Inventory-ASG created successfully. Group metrics collection is enabled.' Below this, the page title is 'EC2 > Auto Scaling groups'. The main content area is titled 'Auto Scaling groups (1) Info' and contains several buttons: 'Launch configurations' (disabled), 'Launch templates' (disabled), 'Actions ▾', and a prominent orange 'Create Auto Scaling group' button. There is also a search bar with the placeholder 'Search your Auto Scaling groups'. At the bottom, a table lists one Auto Scaling group: 'Inventory-ASG' (Launch template/configuration: 'Inventory-LT | Version Default').

The screenshot shows the AWS CloudWatch interface. A prominent green alert message at the top states: "Currently creating AMI ami-011203fa81b5c654e from instance i-05d3c64f0eb417217. Check that the AMI status is 'Available' before deleting the instance or carrying out other actions related to this AMI." Below the alert, there is a section titled "Instances (3) Info" with a search bar and a table listing three instances:

	Name	Instance ID	Instance state	Instance type	Status check
<input type="checkbox"/>	Web Server 1	i-05d3c64f...	Running	t2.micro	2/2 check
<input type="checkbox"/>	Inventory-App	i-09cb65b1...	Running	t2.micro	Initializin
<input type="checkbox"/>	Inventory-App	i-0019faa9...	Running	t2.micro	Initializin

Task 4: Updating security groups

Load balancer security group (Already configured)

Application security group

In the left navigation pane, choose **Security Groups**.

Select **Inventory-App**.

In the lower half of the page, choose the **Inbound rules** tab.

Choose Edit inbound rules.

On the **Edit inbound rules** page, choose Add rule and configure these settings:

- **Type:** *HTTP*
 - **Source:**
 - Choose the search box to the right of **Custom**
 - Delete the current contents
 - Enter sg
 - From the list that appears, select **Inventory-LB**
- **Description:** Traffic from load balancer
- Choose Save rules

The screenshot shows the AWS CloudFormation console with the URL `voclabs/user2770782=104222099@st`. The main section is titled "Inbound rules" with a "Info" link. It displays an "Inbound rule 1" entry. The rule details are as follows:

- Security group rule ID:** -
- Type:** Info (dropdown set to HTTP)
- Protocol:** Info (dropdown set to TCP)
- Port range:** Info (dropdown set to 80)
- Source type:** Info (dropdown set to Custom)
- Source:** Info (search bar containing "sg-040c32753f43146ed" with an "X" button)
- Description - optional:** Info (text input field containing "Traffic from load balancer")

Database security group

In the **Security groups** list, choose **Inventory-DB** (and make sure that no other security groups are selected).

In the **Inbound rules** tab, choose **Edit inbound rules** and configure these settings:

- **Delete** the existing rule.
- Choose **Add rule**.
- For **Type**, choose **MYSQL/Aurora**
- Choose the search box to the right of **Custom**
- Enter sg
- From the list that appears, select **Inventory-App**
- **Description:** Traffic from application servers
- Choose **Save rules**

The screenshot shows the AWS Management Console interface for managing security group inbound rules. The top navigation bar includes the AWS logo, Services menu, search bar, and user information (voclabs/user2770782=104222099@st). Below the header, the title "Inbound rules" with an "Info" link is displayed, along with a help icon.

Inbound rule 1

Security group rule ID: - **Type:** MySQL/Aurora

Protocol: TCP **Port range:** 3306

Source type: Custom **Source:** sg-05597ea774b0c1f10 **X**

Description - optional: Traffic from application servers

Add rule

Task 5: Testing the application

In the left navigation pane, choose **Target Groups**.

Select **Inventory-App**.

In the lower half of the page, choose the **Targets** tab.

In the **Registered targets** area, occasionally choose the refresh icon until the **Status** for both instances appears as *healthy*.

The screenshot shows the AWS EC2 Target groups page. At the top, there is a navigation bar with the AWS logo, Services, a search icon, a refresh icon, a question mark icon, a gear icon, and a dropdown menu. The user is signed in as voclabs/user2770782=104222099@st.

The main content area shows a list of Target groups (1/1). There is a "Create target group" button in an orange box. Below it is a search bar with the placeholder "Filter target groups".

A modal window is open, titled "Target group: Inventory-App". It lists two targets:

Instance ID	Port	Zone	Status
i-0019faa...	80	us-east-1b	Healthy
i-09cb65b...	80	us-east-1a	Healthy

In the left navigation pane, choose **Load Balancers** and then choose **Inventory-LB**.
In the **Details** tab in the lower half of the window, copy the **DNS name** to your clipboard.

The screenshot shows the AWS Elastic Load Balancing (ELB) service in the AWS Management Console. At the top, there's a navigation bar with the AWS logo, a 'Services' dropdown, a search bar, and other navigation icons. The URL in the address bar is `voclabs/user2770782=104222099@st`. Below the navigation bar, the main content area has a title 'Load balancers (1/1)' and a toolbar with a refresh icon, an 'Actions' dropdown, and a prominent orange 'Create load balancer' button. A descriptive text box states: 'Elastic Load Balancing scales your load balancer capacity automatically in response to changes in incoming traffic.' There's also a search bar labeled 'Filter load balancers' and a pagination control showing page 1 of 1. The main table lists one load balancer:

Name	DNS name	State
Inventory-LB	Inventory-LB-1425113508.us-east-1.elb.amazonaws.com	Active

A modal window titled 'Load balancer: Inventory-LB' provides detailed information about the selected load balancer:

Availability zones	Date created
subnet-0295ec7a3a78f6e29 us-east-1a (use1-az4)	October 28, 2023, 18:41 (UTC+07:00)
subnet-038800e2936491444 us-east-1b (use1-az6)	

Load balancer ARN	DNS name Info
arn:aws:elasticloadbalancing:us-east-1:843710488021:loadbalancer/app/Inventory-LB/78e3f8f7adcbdbc9	Inventory-LB-1425113508.us-east-1.elb.amazonaws.com (A Record)

Open a new web browser tab, paste the DNS name from your clipboard and press ENTER.

The screenshot shows a web browser window with the following details:

- Address bar: `inventory-lb-1425113508.us-east-1.elb.amazonaws.com`
- Page title: 'Inventory'
- Page content: 'Please configure Settings to connect to database'
- Page footer: 'This page was generated by instance `i-09cb65b143d369998` in Availability Zone `us-east-1a`.

Reload the page in your web browser. You should notice that the instance ID and Availability Zone sometimes toggles between the two instances.



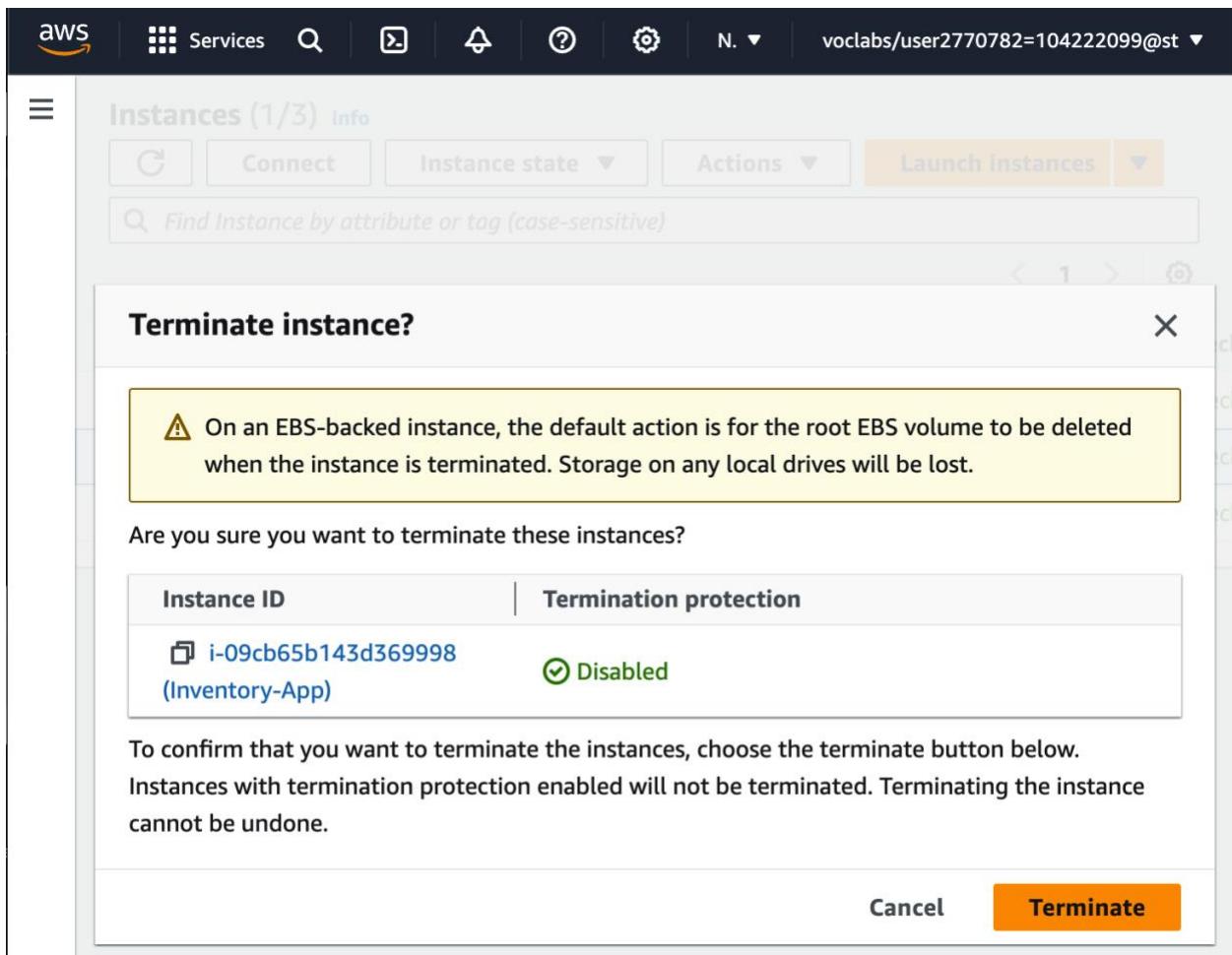
Task 6: Testing high availability

Return to the **EC2 console** tab in your web browser (but do not close the web application tab—you will return to it soon).

In the left navigation pane, choose **Instances**.

Select one of the **Inventory-App** instances

Choose **Instance State > Terminate instance > Terminate**.



Instances (1/3) Info						
	C	Connect	Instance state ▾	Actions ▾	Launch instances ▾	
Find Instance by attribute or tag (case-sensitive)						
	Name ✍	Instance ID	Instance state ▾	Actions ▾	Launch instances	
	<input type="checkbox"/> Web Server 1	i-05d3c64f...	<input checked="" type="checkbox"/> Running 🔍 🔗	t2.micro	<input checked="" type="checkbox"/> 2/2 check	
	<input type="checkbox"/> Inventory-App	i-0019faa9...	<input checked="" type="checkbox"/> Running 🔍 🔗	t2.micro	<input checked="" type="checkbox"/> 2/2 check	
	<input checked="" type="checkbox"/> Inventory-App	i-09cb65b1...	<input type="circle"/> Shutting-d... 🔍 🔗	t2.micro	<input checked="" type="checkbox"/> 2/2 check	

Return to the web application tab in your web browser and reload the page several times.

Availability Zone that is shown at the bottom of the page stays the same.

Please configure Settings to connect to database

This page was generated by instance **i-0019faa9812c694d1** in Availability Zone **us-east-1b**.

Return to the **EC2 console** tab where you have the instances list displayed. In the top-right area, choose the refresh icon every 30 seconds or so until a new EC2 instance appears.

<input type="checkbox"/>	Name ↴	Instance ID	Instance state	Instanc...	Status check
<input type="checkbox"/>	Web Server 1	i-05d3c64f...	Running	t2.micro	2/2 checks p
<input type="checkbox"/>	Inventory-App	i-0019faa9...	Running	t2.micro	2/2 checks p
<input type="checkbox"/>	Inventory-App	i-037876a3...	Running	t2.micro	2/2 checks p
<input type="checkbox"/>	Inventory-App	i-09cb65b1...	Terminated	t2.micro	-

Optional task 1: Making the database highly available

On the Services menu, choose **RDS**.

In the left navigation pane, choose **Databases**.

Choose the link for the name of the **inventory-db** instance.

Choose **Modify**

The screenshot shows the AWS RDS Databases page. At the top, there are navigation links for Services, a search bar, and account information. Below the header, the 'RDS' and 'Databases' sections are selected. A main heading 'Databases (1)' is displayed, followed by a toolbar with 'Group resources' (unchecked), 'Modify' (disabled), and 'Actions' (dropdown). Two buttons are present: 'Restore from S3' (disabled) and 'Create database' (orange). A search bar labeled 'Filter by databases' is available. The main table lists one database entry:

DB identifier	Status	Role	Engine
inventory-db	Available	Instance	MySQL Community

Scroll down to the **Availability & durability** section. For **Multi-AZ deployment**, select **Create a standby instance**.

The screenshot shows the 'Availability & durability' configuration section. It includes a 'Multi-AZ deployment' section with an 'Info' link and two options: 'Create a standby instance (recommended for production usage)' (selected) and 'Do not create a standby instance'. The selected option is described as creating a standby in a different Availability Zone (AZ) to provide data redundancy, eliminate I/O freezes, and minimize latency spikes during system backups.

Scroll back up and for **DB instance class**, select **db.t3.small**.

The screenshot shows the 'Instance configuration' section of the AWS RDS console. At the top, it says 'DB instance class [Info](#)'. Below that is a 'Hide filters' button and a toggle switch for 'Include previous generation classes'. There are three radio buttons: 'Standard classes (includes m classes)', 'Memory optimized classes (includes r and x classes)', and 'Burstable classes (includes t classes)', with the last one selected. A dropdown menu shows 'db.t3.small' with details: '2 vCPUs 2 GiB RAM Network: 2,085 Mbps'.

For **Allocated storage**, enter: 10

The screenshot shows the 'Storage' configuration section of the AWS RDS console. It includes a 'Storage type [Info](#)' section with 'General Purpose SSD (gp2)' selected, and an 'Allocated storage [Info](#)' section where the value '10' is entered into a text input field.

At the bottom of the page, choose Continue

Under **Schedule modifications**, select **Apply immediately**.

Schedule modifications

When to apply modifications

- Apply during the next scheduled maintenance window

Current maintenance window: October 29, 2023 10:26 - 10:56 UTC+7

- Apply immediately

The modifications in this request and any pending modifications will be asynchronously applied as soon as possible, regardless of the maintenance window setting for this database instance.

Choose Modify DB instance

Optional task 2: Configuring a highly available NAT gateway

On the Services menu, choose **VPC**.

In the left navigation pane, choose **NAT gateways**.

Choose Create NAT gateway and configure these settings:

- **Subnet:** *Public Subnet 2*
- Choose Allocate Elastic IP
- Choose Create NAT gateway

The screenshot shows the AWS VPC NAT gateways creation interface. At the top, the navigation bar includes links for Services, Search, Help, and Account Information. The current path is VPC > NAT gateways > Create NAT gateway. The main section is titled "NAT gateway settings".

Name - optional
Create a tag with a key of 'Name' and a value that you specify.
Input field: my-nat-gateway-01
Text below: The name can be up to 256 characters long.

Subnet
Select a subnet in which to create the NAT gateway.
Input field: subnet-038800e2936491444 (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.
Input field: eipalloc-0493fc2c89be7b2aa

Allocate Elastic IP

Additional settings [Info](#)

In the left navigation pane, choose **Route tables**.
Choose Create route table and configure these settings:

- **Name:** Private Route Table 2
- **VPC:** Lab VPC
- Choose **Create route table**.

The screenshot shows the 'Create route table' wizard in the AWS VPC service. The current step is 'Route table settings'. It includes fields for 'Name - optional' (containing 'Private Route Table 2'), 'VPC' (set to 'vpc-03295dee14b030cab (Lab VPC)'), and a note about creating a tag with a key of 'Name'.

Observe the settings in the **Routes** tab.

The 'Routes' tab displays one route entry:

Destina...	Target	Status	Propagated
10.0.0.0/16	local	Active	No

Choose Edit routes and then configure these settings:

- Choose Add route
- **Destination:** 0.0.0.0/0
- **Target:** Select *NAT Gateway*, then select the *nat-* entry that is *not* the entry for *_NATGateway1*

aws Services N. ▾ vocabs/user2770782=104222099@st ▾

VPC > Route tables > rtb-04b884eaf17647c40 > Edit routes

<input checked="" type="checkbox"/> Active	
Propagated	
No	
Edit routes	
Destination	<input type="text"/> 0.0.0.0/0 <input type="button" value="X"/>
Target	<input style="width: 150px;" type="text" value="NAT Gateway"/> <input type="button" value="▼"/>
	<input type="text"/> nat-05aa0fce0f49c7a3b <input type="button" value="X"/>
Status	-
Propagated	<input type="checkbox"/>
No	<input type="checkbox"/>
<input type="button" value="Remove"/>	

Choose Edit subnet associations

Select **Private Subnet 2**.

Choose Save associations

Screenshot of the AWS VPC Route Tables interface showing the "Edit subnet associations" page for a specific route table.

The URL in the browser is: `voclabs/user2770782=104222099@st`

The navigation path is: `VPC > Route tables > rtb-04b884eaf17647c40 > Edit subnet associations`

A green header bar shows the current section: `Details`.

Edit subnet associations

Change which subnets are associated with this route table.

Available subnets (1/4)

Filter subnet associations

<input type="checkbox"/>	Name	Subnet ID	IPv4 CIDR	IPv6 CIDR
<input type="checkbox"/>	Private Subnet 1	subnet-0c3bc3163a56f...	10.0.2.0/23	-
<input type="checkbox"/>	Public Subnet 1	subnet-0295ec7a3a78f...	10.0.0.0/24	-
<input checked="" type="checkbox"/>	Private Subnet 2	subnet-0c90ede9542cc...	10.0.4.0/23	-
<input type="checkbox"/>	Public Subnet 2	subnet-038800e29364...	10.0.1.0/24	-

Selected subnets

subnet-0c90ede9542cc387c / Private Subnet 2 X

Buttons at the bottom: `Cancel` and `Save associations` (highlighted in orange).

Submit the lab.

ENDLAB.