

Building a Highly Available, Scalable Web Application

Overview and objectives

Throughout various AWS Academy courses, you have completed hands-on labs. You have used different AWS services and features to create compute instances, install operating systems (OSs) and software, deploy code, and secure resources. You practiced how to enable load balancing and automatic scaling, and how to architect for high availability to build simple, lab-specific applications.

In this project, you're challenged to use familiar AWS services to build a solution *without* step-by-step guidance. Specific sections of the assignment are meant to challenge you on skills that you have acquired throughout the learning process.

By the end of this project, you should be able to do the following:

- Create an architectural diagram to depict various AWS services and their interactions with each other.
- Estimate the cost of using services by using the AWS Pricing Calculator.
- Deploy a functional web application that runs on a single virtual machine and is backed by a relational database.
- Architect a web application to separate layers of the application, such as the web server and database.
- Create a virtual network that is configured appropriately to host a web application that is publicly accessible and secure.
- Deploy a web application with the load distributed across multiple web servers.
- Configure the appropriate network security settings for the web servers and database.
- Implement high availability and scalability in the deployed solution.
- Configure access permissions between AWS services.

The lab environment and monitoring your budget

This environment is long lived. When the session timer runs to 0:00, the session will end, but any data and resources that you created in the AWS account will be retained. If you later launch a new session (for example, the next day), you will find that your work is still in the lab environment. Also, at any point before the session timer reaches 0:00, you can choose **Start Lab** again to extend the lab session time.

Important: Monitor your lab budget in the lab interface. When you have an active lab session, the latest known remaining budget information displays at the top of this screen. This data comes from AWS Budgets, which typically updates every 8-12 hours. Therefore, *the remaining budget that you see might not reflect your most recent account activity.* **If you exceed your lab budget, your lab account will be disabled, and all progress and resources will be lost.** Therefore, it's important for you to manage your spending.

AWS service restrictions

In this lab environment, access to AWS services and service actions might be restricted to the ones that are needed to complete the lab instructions. You might encounter errors if you attempt to access other services or perform actions beyond the ones that are described in this lab.

Scenario

Example University is preparing for the new school year. The admissions department has received complaints that their web application for student records is slow or not available during the peak admissions period because of the high number of inquiries.

You are a cloud engineer. Your manager has asked you to create a proof of concept (POC) to host the web application in the AWS Cloud. Your manager would like you to design and implement a new hosting architecture that will improve the experience for users of the web application. You're responsible for building the infrastructure to host the student records web application in the cloud.

Your challenge is to plan, design, build, and deploy the web application to the AWS Cloud in a way that is consistent with best practices of the AWS Well-Architected Framework. During the peak admissions period, the application must support thousands of users, and be highly available, scalable, load balanced, secure, and high performing.

The following image shows an example of the student records web application. The site lists records of students who have applied for admission to the university. Users can view, add, delete, and modify student records.



All students

Name	Address	City	State	Email	Phone	
John Doe	Example Address	Example City	example State	example@example.com	9009009009	edit

[Add a new student](#)

Solution requirements

The solution must meet the following requirements:

- **Functional:** The solution meets the functional requirements, such as the ability to view, add, delete, or modify the student records, without any perceivable delay.
- **Load balanced:** The solution can properly balance user traffic to avoid overloaded or underutilized resources.
- **Scalable:** The solution is designed to scale to meet the demands that are placed on the application.
- **Highly available:** The solution is designed to have limited downtime when a web server becomes unavailable.
- **Secure:**
 - The database is secured and can't be accessed directly from public networks.
 - The web servers and database can be accessed only over the appropriate ports.
 - The web application is accessible over the internet.
 - The database credentials aren't hardcoded into the web application.
- **Cost optimized:** The solution is designed to keep costs low.
- **High performing:** The routine operations (viewing, adding, deleting, or modifying records) are performed without a perceivable delay under normal, variable, and peak loads.

Assumptions

This project will be built in a controlled lab environment that has restrictions on services, features, and budget. Consider the following assumptions for the project:

- The application is deployed in one AWS Region (the solution does not need to be multi-Regional).
- The website does not need to be available over HTTPS or a custom domain.

- The solution is deployed on *Ubuntu* machines by using the JavaScript code that is provided.
- Use the JavaScript code as written unless the instructions specifically direct you to change the code.
- The solution uses services and features within the restrictions of the lab environment.
- The database is hosted only in a single Availability Zone.
- The website is publicly accessible without authentication.
- Estimation of cost is approximate.

Disclaimer: A security best practice is to allow access to the website through the university network and authentication. However, because you are building this application as a POC, those features are beyond the scope of this project. You are encouraged to implement this additional functionality.

Approach

Recommendation: Develop your project solution in phases. This will help you ensure that basic functionality is working before the architecture becomes more complex. After the application is working, you are encouraged to enhance the solution with additional requirements.

Phase 1: Planning the design and estimating cost

In this phase, you will plan the design of your architecture. First, you will create an architecture diagram.

Next, you will estimate the cost of the proposed solution, and present the estimate to your educator. An important first step for any solution is to plan the design and estimate the cost. As necessary, review the various components in the architecture to adjust the estimated cost. Cost is an important factor when building a solution because cost can help to determine the components and architecture pattern to use.

Note: You don't need to use the lab environment for this phase of the project, but you might want to use it to refer to AWS services and features as you plan your design.

Task 1: Creating an architectural diagram

Create an architectural diagram to illustrate what you plan to build. Consider how you will accomplish each requirement in the solution.

References

- [AWS Architecture Icons](#): This site provides tools to draw AWS architecture diagrams.

- [AWS Reference Architecture Diagrams](#): This site provides reference architecture diagrams for a variety of use cases.

Task 2: Developing a cost estimate

Develop a cost estimate that shows the cost to run the solution in the us-east-1 Region for 12 months. Use the [AWS Pricing Calculator](#) for this estimate.

If required by your instructor, add your architectural diagram and cost estimate to presentation slides. Your educator might want to evaluate this information as part of assessing your work on this project. A presentation template is provided.

References

- [What Is AWS Pricing Calculator?](#)
- [PowerPoint presentation template](#)

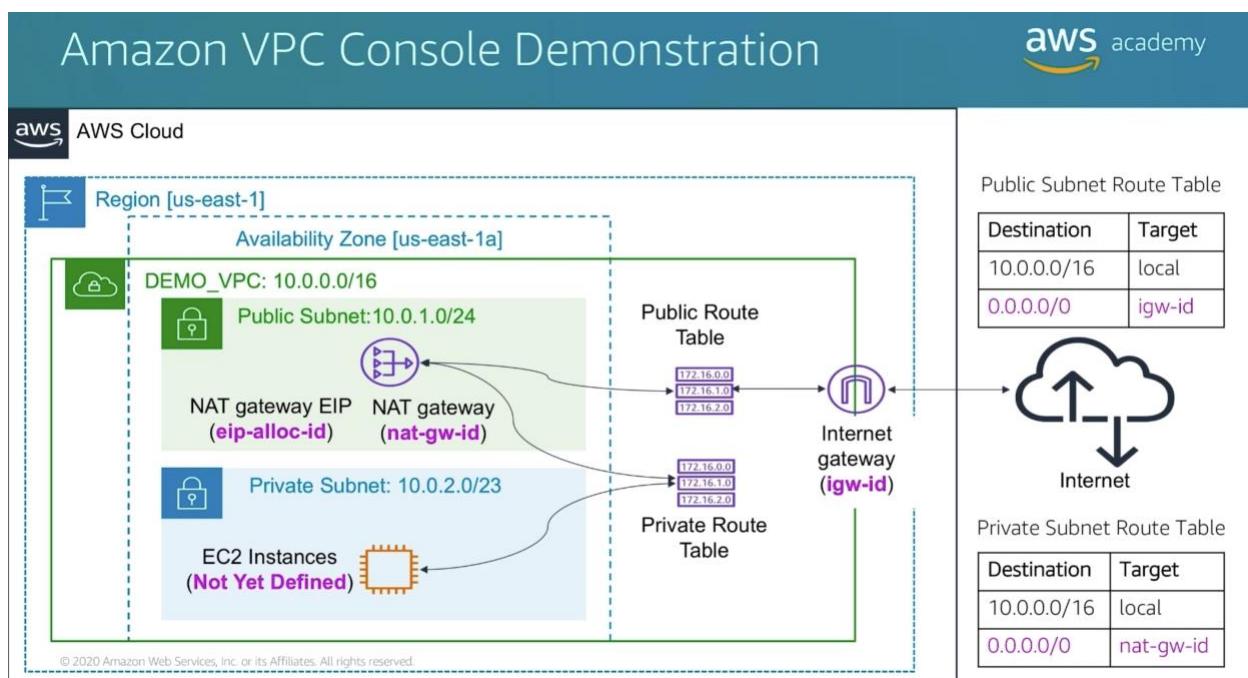
Phase 2: Creating a basic functional web application

In this phase, you will start to build the solution. The objective of this phase is to have a functional web application that works on a single virtual machine in a virtual network that you create. By the end of this phase, you will have a POC to demonstrate hosting the application on the AWS Cloud. You can then build upon your work in later phases.

Task 1: Creating a virtual network

Create a virtual network to host the web application.

Tip: Create networking resources such as a virtual private cloud (VPC) and subnets.



Reference

- AWS Academy Cloud Architecting – Lab: Creating a Virtual Private Cloud

If you have any doubts in creating VPC, please refer to Demo Creating a VPC Using the AWS Console in Module 6 of AWS Cloud Architecting.

MyVPC

Create VPC [Info](#)

A VPC is an isolated portion of the AWS Cloud populated by AWS objects, such as Amazon EC2 instances.

VPC settings

Resources to create [Info](#)
Create only the VPC resource or the VPC and other networking resources.

VPC only VPC and more

Name tag - *optional*
Creates a tag with a key of 'Name' and a value that you specify.

IPv4 CIDR block [Info](#)
 IPv4 CIDR manual input
 IPAM-allocated IPv4 CIDR block

IPv4 CIDR

CIDR block size must be between /16 and /28.

IPv6 CIDR block [Info](#)
 No IPv6 CIDR block
 IPAM-allocated IPv6 CIDR block
 Amazon-provided IPv6 CIDR block
 IPv6 CIDR owned by me

Tenancy [Info](#)

Your VPCs (1/2) [Info](#)

Name	VPC ID	State	IPv4 CIDR	IPv6 CIDR	DHCP option set
-	vpc-01a98d7d4c102dae6	Available	172.31.0.0/16	-	dopt-0639ce4ddcbc43b9...
<input checked="" type="checkbox"/> MyVPC	vpc-0ecf44e5f870dce5a	Available	10.0.0.0/16	-	dopt-0639ce4ddcbc43b9...

vpc-0ecf44e5f870dce5a / MyVPC

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

Details

VPC ID vpc-0ecf44e5f870dce5a	State Available	DNS hostnames Disabled	DNS resolution Enabled
Tenancy Default	DHCP option set dopt-0639ce4ddcbc43b936	Main route table -	Main network ACL -
Default VPC No	IPv4 CIDR 10.0.0.0/16	IPv6 pool -	IPv6 CIDR (Network border group) -
Network Address Usage metrics Disabled	Route 53 Resolver DNS Firewall rule groups -	Owner ID 984309630308	

[VPC](#) > [Your VPCs](#) > [vpc-08a47c28bbc0e66cd](#) > Edit VPC settings

Edit VPC settings Info

VPC details

VPC ID

 [vpc-08a47c28bbc0e66cd](#)

Name

 [MyVPC](#)

DHCP settings

DHCP option set Info

[dopt-01dfa33235e0b4dfe](#) ▾

DNS settings

Enable DNS resolution Info

Enable DNS hostnames Info

Internet Gateway

[VPC](#) > [Internet gateways](#) > Create internet gateway

Create internet gateway Info

An internet gateway is a virtual router that connects a VPC to the internet. To create a new internet gateway specify the name for the gateway below.

Internet gateway settings

Name tag

Creates a tag with a key of 'Name' and a value that you specify.

[my_internet_gateway](#)

Tags - optional

A tag is a label that you assign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter your resources or track your AWS costs.

Key Value - optional









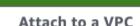
You can add 49 more tags.





Click on Attach to a VPC

 The following internet gateway was created: igw-0ae10ae663e9354fc - myIG. You can now attach to a VPC to enable the VPC to communicate with the internet.





Attached MyVPC

The screenshot shows the AWS VPC Internet Gateways page. The top navigation bar includes 'VPC > Internet gateways > igw-0c0bedd960598813d'. The main title is 'igw-0c0bedd960598813d / my_internet_gateway'. Below the title, there's a 'Details' tab and an 'Actions' dropdown menu. The 'Details' section contains fields for Internet gateway ID (igw-0c0bedd960598813d), State (Attached), VPC ID (vpc-0ecf44e5f870dce5a | MyVPC), and Owner (984309630308). A 'Tags' section shows one tag: 'Name: my_internet_gateway'. There's also a 'Manage tags' button and a pagination indicator showing page 1 of 1.

Public Subnet 1

The screenshot shows the AWS VPC Subnets page. The title is 'Subnet 1 of 1'. Under 'Subnet name', the value 'Public_Subnet_1' is entered. A note says the name can be up to 256 characters long. Under 'Availability Zone', 'us-east-1a' is selected. Under 'IPv4 VPC CIDR block', '10.0.0.0/16' is chosen. Under 'IPv4 subnet CIDR block', '10.0.0.0/24' is selected. A note indicates 256 IPs available. Under 'Tags - optional', a tag 'Name: Public_Subnet_1' is added. A note says 49 more tags can be added. A 'Remove' button is present. At the bottom, there's a 'Remove' button.

Public Route Table 1

The screenshot shows the AWS VPC Route Tables page. The title is 'Create route table'. A note says a route table specifies how packets are forwarded between subnets, the internet, and VPN connections. Under 'Route table settings', the 'Name' field is 'Public_route_table_1'. Under 'VPC', 'vpc-0ecf44e5f870dce5a (MyVPC)' is selected. Under 'Tags', a tag 'Name: Public_route_table_1' is added. A note says 49 more tags can be added. At the bottom, there's a 'Cancel' button and a prominent orange 'Create route table' button.

Public Route Table 1 --> Edit Routes

Screenshot of the AWS VPC Route Tables page showing the 'Edit routes' button highlighted.

Name	Route table ID	Explicit subnet associations	Edge associations	Main	VPC	Own
-	rtb-085627665b08ecc8c	-	-	Yes	vpc-0ecf44e5f870dce5a MyVPC	9843
-	rtb-0e5bbfe296898d393	-	-	Yes	vpc-01a98d7d4c102dae6	9843
Public_route_table_1	rtb-0888ed200aff25f72	-	-	No	vpc-0ecf44e5f870dce5a MyVPC	9843

rtb-0888ed200aff25f72 / Public_route_table_1

Routes (1)

Destination	Target	Status	Propagated
10.0.0.0/16	local	Active	No

Edit routes

VPC > Route tables > rtb-0888ed200aff25f72 > Edit routes

Edit routes

Destination	Target	Status	Propagated
10.0.0.0/16	local	Active	No
0.0.0.0/0	Internet Gateway igw-0c0bedd960598813d	-	No
Add route	igw-0c0bedd960598813d (my_internet_gateway)		

Cancel Preview Save changes

⌚ Updated routes for rtb-0888ed200aff25f72 / Public_route_table_1 successfully

VPC > Route tables > rtb-0888ed200aff25f72

rtb-0888ed200aff25f72 / Public_route_table_1

Actions

Details Info

Route table ID	Main	Explicit subnet associations	Edge associations
rtb-0888ed200aff25f72	No	-	-
VPC	Owner ID		
vpc-0ecf44e5f870dce5a MyVPC	984309630308		

Routes Subnet associations Edge associations Route propagation Tags

Routes (2)

Destination	Target	Status	Propagated
0.0.0.0/0	igw-0c0bedd960598813d	Active	No
10.0.0.0/16	local	Active	No

Route tables (1/3) [Info](#)

[Create route table](#)

Name	Route table ID	Explicit subnet associations	Edge associations	Main	VPC	Own.
-	rtb-085627665b08ecc8c	-	-	Yes	vpc-0ecf44e5f870dce5a MyVPC	9843
-	rtb-0e5bbfe296898d393	-	-	Yes	vpc-01a98d7d4c102dae6	9843
<input checked="" type="checkbox"/> Public_route_table_1	rtb-0888ed200aff25f72	-	-	No	vpc-0ecf44e5f870dce5a MyVPC	9843

Subnet associations

Explicit subnet associations (0)

No subnet associations

You do not have any subnet associations.

Subnets without explicit associations (1)

The following subnets have not been explicitly associated with any route tables and are therefore associated with the main route table:

Subnet associations

Name	Subnet ID	IPv4 CIDR	IPv6 CIDR
Public_Subnet_1	subnet-0b6766bba656d1811	10.0.1.0/24	-

[VPC](#) > [Route tables](#) > rtb-0329542e461e1912e / Public_route_table_1 [Actions](#)

rtb-0329542e461e1912e / Public_route_table_1

Details [Info](#)

Route table ID <input checked="" type="checkbox"/> rtb-0329542e461e1912e	Main <input checked="" type="checkbox"/> No	Explicit subnet associations subnet-04bf56b504492c177 / Public_Subnet_1	Edge associations -
VPC vpc-08a47c28bbc0e66cd MyVPC	Owner ID <input checked="" type="checkbox"/> 984309630308		

Routes [Subnet associations](#) [Edge associations](#) [Route propagation](#) [Tags](#)

Explicit subnet associations (1)

Subnet associations

Name	Subnet ID	IPv4 CIDR	IPv6 CIDR
Public_Subnet_1	subnet-04bf56b504492c177	10.0.0.0/24	-

Private Subnet 1

Subnet settings
Specify the CIDR blocks and Availability Zone for the subnet.

Subnet 1 of 1

Subnet name
Create a tag with a key of 'Name' and a value that you specify.

The name can be up to 256 characters long.

Availability Zone [Info](#)
Choose the zone in which your subnet will reside, or let Amazon choose one for you.

IPv4 VPC CIDR block [Info](#)
Choose the IPv4 VPC CIDR block to create a subnet in.

IPv4 subnet CIDR block
 256 IPs

Elastic IP Address

The screenshot shows the AWS VPC console with the 'Elastic IP addresses' section selected. The main area displays a table with columns: Name, Allocated IPv4 add..., Type, Allocation ID, and Reverse DNS record. A single row is present with the message 'No Elastic IP address'. At the top right, there is an orange 'Allocate Elastic IP address' button.

The screenshot shows the 'Allocate Elastic IP address' configuration page. It includes sections for 'Elastic IP address settings' (with a 'Info' link), 'Network Border Group' (set to 'us-east-1'), 'Public IPv4 address pool' (selected 'Amazon's pool of IPv4 addresses'), and 'Global static IP addresses' (with a note about AWS Global Accelerator). A 'Create accelerator' button is also visible.

NAT Gateway

The screenshot shows the 'Create NAT gateway' configuration page. It includes sections for 'NAT gateway settings' (with a 'Name - optional' field containing 'Nat-Gateway'), 'Subnet' (selected 'subnet-0b6766bba656d1811 (Public_Subnet_1)'), 'Connectivity type' (selected 'Public'), 'Elastic IP allocation ID' (selected 'eipalloc-055b4e10c3330c1b3'), and 'Additional settings' (with an 'Info' link).

NAT gateway nat-0755d6085bbce60e8 | Nat-Gateway was created successfully.

VPC > NAT gateways > nat-0755d6085bbce60e8

nat-0755d6085bbce60e8 / Nat-Gateway

Actions ▾

Details		Info	
NAT gateway ID nat-0755d6085bbce60e8	Connectivity type Public	State Pending	State message -
NAT gateway ARN arn:aws:ec2:us-east-1:984309630308:natgateway/nat-0755d6085bbce60e8	Primary public IPv4 address -	Primary private IPv4 address -	Primary network interface ID -
VPC vpc-0ecf44e5f870dce5a / MyVPC	Subnet subnet-0b6766bba656d1811 / Public_Subnet_1	Created Friday, December 8, 2023 at 12:44:21 EST	Deleted -

Private Route Table 1

AWS Services Search [Option+S] N. Virginia vocabs/user2378920=sowmyavara26@gwu.edu @ 9843-0963-0308

VPC > Route tables > Create route table

Create route table Info

A route table specifies how packets are forwarded between the subnets within your VPC, the internet, and your VPN connection.

Route table settings

Name - optional
Create a tag with a key of 'Name' and a value that you specify.
Private_route_table_1

VPC
The VPC to use for this route table.
vpc-0ecf44e5f870dce5a (MyVPC)

Tags
A tag is a label that you assign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter your resources or track your AWS costs.

Key Value - optional
Name Private_route_table_1 Remove
Add new tag
You can add 49 more tags.

Cancel Create route table

AWS Services Search [Option+S] N. Virginia vocabs/user2378920=sowmyavara26@gwu.edu @ 9843-0963-0308

Route table rtb-07ba5455fc475212 | Private_route_table_1 was created successfully.

VPC > Route tables > rtb-07ba5455fc475212

rtb-07ba5455fc475212 / Private_route_table_1

Actions ▾

Details		Info	
Route table ID rtb-07ba5455fc475212	Main No	Explicit subnet associations -	Edge associations -
VPC vpc-0ecf44e5f870dce5a MyVPC	Owner ID 984309630308		

Routes Subnet associations Edge associations Route propagation Tags

Routes (1)

Filter routes		Both ▾	Edit routes
Destination	Target	Status	Propagated
10.0.0.0/16	local	Active	No

AWS Services Search [Option+S] N. Virginia vclabs/user2378920=sowmyavara26@gwu.edu @ 9843-0963-030

VPC > Route tables > rtb-07ba5455fcd475212 > Edit routes

Edit routes

Destination	Target	Status	Propagated
10.0.0.16	local	Active	No
<input type="text" value="0.0.0.0"/> X	<input type="button" value="Add route"/> <div style="border: 1px solid #ccc; padding: 5px; margin-top: 5px;"> <input type="button" value="Remove"/> </div>		
	<input type="button" value="Cancel"/> <input type="button" value="Preview"/> <input type="button" value="Save changes"/>		

The screenshot shows the AWS VPC Route Tables interface. A modal window titled 'Edit routes' is open for the route table 'rtb-07ba5455fcd475212'. In the 'Target' column for the first row, a dropdown menu is open, showing 'local' selected. Below it, a search bar shows 'local'. A second dropdown menu is open, showing 'NAT Gateway' selected. Below it, a search bar shows 'nat-0755d6085bbce60e8'. A tooltip below the search bar says 'Use: "nat-0755d6085bbce60e8"' and 'nat-0755d6085bbce60e8 (Nat-Gateway)'. The 'Save changes' button is highlighted in orange at the bottom right.

AWS Services Search [Option+S] N. Virginia vclabs/user2378920=sowmyavara26@gwu.edu @ 9843-0963-030

VPC dashboard EC2 Global View Filter by VPC: Select a VPC Virtual private cloud Your VPCs Subnets Route tables Internet gateways Egress-only internet gateways Carrier gateways DHCP option sets Elastic IPs Managed prefix lists Endpoints Endpoint services NAT gateways Peering connections Security Network ACLs

Updated routes for rtb-07ba5455fcd475212 / Private_route_table_1 successfully

VPC > Route tables > rtb-07ba5455fcd475212

rtb-07ba5455fcd475212 / Private_route_table_1

Actions

Details Info				
Route table ID	Main	Explicit subnet associations	Edge associations	
rtb-07ba5455fcd475212	No	-	-	
VPC	Owner ID			
vpc-0ecf44e5f870dce5a MyVPC	984309630308			

Routes Subnet associations Edge associations Route propagation Tags

Routes (2)

Destination	Target	Status	Propagated
0.0.0.0	nat-0755d6085bbce60e8	Active	No
10.0.0.16	local	Active	No

Both Edit routes < 1 > ⌂

The screenshot shows the 'Private_route_table_1' details page. It displays basic information like Route table ID, Main status, and Owner ID. The 'Routes' tab is selected, showing two entries: one to '0.0.0.0' via a NAT gateway and one to '10.0.0.16' via 'local'. The 'Subnet associations' tab is also visible.

AWS Services Search [Option+S] N. Virginia vclabs/user2378920=sowmyavara26@gwu.edu @ 9843-0963-0308

VPC > Route tables > rtb-07ba5455fcd475212

rtb-07ba5455fcd475212 / Private_route_table_1

Actions

Details Info				
Route table ID	Main	Explicit subnet associations	Edge associations	
rtb-07ba5455fcd475212	No	-	-	
VPC	Owner ID			
vpc-0ecf44e5f870dce5a MyVPC	984309630308			

Routes Subnet associations Edge associations Route propagation Tags

Explicit subnet associations (0)

Name	Subnet ID	IPv4 CIDR	IPv6 CIDR
No subnet associations			
You do not have any subnet associations.			

Find subnet association Edit subnet associations < 1 > ⌂

The screenshot shows the 'Private_route_table_1' details page again. This time, the 'Subnet associations' tab is selected. It shows a table with four columns: Name, Subnet ID, IPv4 CIDR, and IPv6 CIDR. The table is currently empty, indicating 'No subnet associations'. An 'Edit subnet associations' button is located in the top right corner of this section.

Edit subnet associations

Change which subnets are associated with this route table.

Available subnets (1/2)

Filter subnet associations					
Name	Subnet ID	IPv4 CIDR	IPv6 CIDR	Route table ID	
<input type="checkbox"/> Public_Subnet_1	subnet-04bf56b504492c177	10.0.0.0/24	-	rtb-0329542e461e1912e / Public_route_table	
<input checked="" type="checkbox"/> Private_Subnet_1	subnet-071af102b1fa7dff3	10.0.1.0/24	-	Main (rtb-06dec9a8e6dea6f8b)	

Selected subnets

subnet-071af102b1fa7dff3 / Private_Subnet_1 X
--

[Cancel](#) [Save associations](#)

rtb-0ceec13b32f625a27 / Private_route_table_1

Actions ▾

Details [Info](#)

Route table ID <input type="checkbox"/> rtb-0ceec13b32f625a27	Main <input type="checkbox"/> No	Explicit subnet associations subnet-071af102b1fa7dff3 / Private_Subnet_1	Edge associations -
VPC vpc-08a47c28bbc0e66cd MyVPC	Owner ID <input type="checkbox"/> 984309630308		

[Routes](#) [Subnet associations](#) [Edge associations](#) [Route propagation](#) [Tags](#)

Explicit subnet associations (1)

Edit subnet associations					
Find subnet association					
Name	Subnet ID	IPv4 CIDR	IPv6 CIDR	DHCP option set	
Private_Subnet_1	subnet-071af102b1fa7dff3	10.0.1.0/24	-	dopt-01dfa33235e0b4dfe	

Resource MAP VIEW of MyVPC

Your VPCs (1/2) [Info](#)

Search					
Name	VPC ID	State	IPv4 CIDR	IPv6 CIDR	DHCP option set
<input type="checkbox"/> -	vpc-0c1c88cd4685e6ea6	Available	172.31.0.0/16	-	dopt-01dfa33235e0b4dfe
<input checked="" type="checkbox"/> MyVPC	vpc-08a47c28bbc0e66cd	Available	10.0.0.0/16	-	dopt-01dfa33235e0b4dfe

vpc-08a47c28bbc0e66cd / MyVPC

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

Resource map [Info](#)

VPC [Show details](#)
Your AWS virtual network

MyVPC

Subnets (2)
Subnets within this VPC

us-east-1a

- Public_Subnet_1
- Private_Subnet_1

Route tables (3)
Route network traffic to resources

- Private_route_table_1
- Public_route_table_1
- rtb-06dec9a8e6dea6f8b

Network connections (2)
Connections to other networks

- my_internet_gateway
- Nat-Gateway

Task 2: Creating a virtual machine

Create a virtual machine in the cloud to host the web application.

To install the required web application and database on the virtual machine, use the JavaScript code from the following link: [SolutionCodePOC](#)

Tips:

- Use a compute service such as Amazon Elastic Compute Cloud (Amazon EC2).
- Use the latest Ubuntu Amazon Machine Image (AMI).

EC2

Create a Security Group

The screenshot shows the AWS EC2 Instances page. The left sidebar includes links for EC2 Dashboard, EC2 Global View, Events, Console-to-Code, Instances (selected), and Instance Types. The main content area displays a table header for 'Instances Info' with columns: Name, Instance ID, Instance state, Instance type, Status check, Alarm status, Availability Zone, and Public. A search bar at the top says 'Find Instance by attribute or tag (case-sensitive)'. Below it, a filter bar shows 'Instance state = running'. The table body is empty, stating 'No instances' and 'You do not have any instances in this region'.

The screenshot shows the AWS Security Groups page. The left sidebar includes links for Dedicated Hosts, Capacity Reservations (New), Images (selected), AMIs, AMI Catalog, Elastic Block Store (Volumes, Snapshots, Lifecycle Manager), and Network & Security (Security Groups). The main content area displays a table header for 'Security Groups (2) Info' with columns: Name, Security group ID, Security group name, and VPC ID. Two entries are listed: 'sg-0ea9176588bcc968' (Security group name: default, VPC ID: vpc-01a98d7d4c102dae6) and 'sg-0ac954cd4a99303d6' (Security group name: default, VPC ID: vpc-0ecf44e5f870dce5a).

The screenshot shows the 'Create security group' wizard. The first step, 'Basic details', has fields for 'Security group name' (Web_app_SG), 'Description' (Allow HTTP Traffic), and 'VPC info' (vpc-0ecf44e5f870dce5a (MyVPC)). The second step, 'Inbound rules', shows a table with columns: Type, Protocol, Port range, Source, and Description - optional. It contains one rule: 'HTTP' (Protocol: TCP, Port range: 80, Source: Any..., Description: 0.0.0.0/0). There is also an 'Add rule' button.

EC2 Instance Creation

▼ Application and OS Images (Amazon Machine Image) [Info](#)

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. Search or Browse for AMIs if you don't see what you are looking for below

Search our full catalog including 1000s of application and OS images

Quick Start



 [Browse more AMIs](#)
Including AMIs from AWS, Marketplace and the Community

Amazon Machine Image (AMI)

Ubuntu Server 22.04 LTS (HVM), SSD Volume Type Free tier eligible ▾
ami-0fc5d935ebf8bc3bc (64-bit (x86)) / ami-016485166ec7fa705 (64-bit (Arm))
Virtualization: hvm ENA enabled: true Root device type: ebs

Description
Canonical, Ubuntu, 22.04 LTS, amd64 jammy image build on 2023-09-19

Architecture AMI ID
64-bit (x86) ▾ ami-0fc5d935ebf8bc3bc Verified provider

▼ Instance type [Info](#) | [Get advice](#)

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

All generations [Compare instance types](#)

Additional costs apply for AMIs with pre-installed software

▼ 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

 [Create new key pair](#)

▼ Network settings [Info](#)

VPC - required [Info](#)

vpc-0ecf44e5f870dce5a (MyVPC)
10.0.0.0/16

Subnet [Info](#)

subnet-0b6766bba656d1811 Public_Subnet_1
VPC: vpc-0ecf44e5f870dce5a Owner: 984309630308 Availability Zone: us-east-1a
IP addresses available: 250 CIDR: 10.0.1.0/24

Create new subnet [\[?\]](#)

Auto-assign public IP [Info](#)

Disable

Firewall (security groups) [Info](#)
A security group is a set of firewall rules that control the traffic for your instance. Add rules to allow specific traffic to reach your instance.

Create security group Select existing security group

Common security groups [Info](#)

Select security groups

Web_app_SG sg-041ba7b21cd61585d X
VPC: vpc-0ecf44e5f870dce5a

Compare security group rules [\[?\]](#)

Security groups that you add or remove here will be added to or removed from all your network interfaces.

Figure: Created the EC2 instance (Virtual Machine): Web_App_EC2

Instances (1/1) [Info](#)

Find Instance by attribute or tag (case-sensitive)

Instance ID = i-0a7043c935570f3db X Clear filters

Actions [\[?\]](#) Launch instances [\[?\]](#)

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS
<input checked="" type="checkbox"/> Web_App_Ser...	i-0a7043c935570f3db	Running	t2.micro	2/2 checks passed	No alarms	us-east-1a	ec2-3-95-224-166.com...

Instance: i-0a7043c935570f3db (Web_App_Server)

Details Security Networking Storage Status checks Monitoring Tags

▼ Instance summary [Info](#)

Instance ID i-0a7043c935570f3db (Web_App_Server)	Public IPv4 address 3.95.224.166 [open address]	Private IPv4 addresses 10.0.0.96
IPv6 address -	Instance state Running	Public IPv4 DNS ec2-3-95-224-166.compute-1.amazonaws.com [open address]
Hostname type IP name: ip-10-0-0-96.ec2.internal	Private IP DNS name (IPv4 only) ip-10-0-0-96.ec2.internal	Elastic IP addresses -
Answer private resource DNS name -	Instance type t2.micro	AWS Compute Optimizer finding Opt-in to AWS Compute Optimizer for recommendations. Learn more
Auto-assigned IP address 3.95.224.166 [Public IP]	VPC ID vpc-038b163a575d577e2 (MyVPC)	

Task 3: Testing the deployment

Test the deployment of the web application to ensure it is accessible from the internet and functional. Perform a few tasks, such as viewing, adding, deleting, or modifying records.

Tip: To access the web application, use the IPv4 address of the virtual machine.

Figure: Copied the Web_app_Server Public IPv4 address and deployed.



Not Secure ec2-3-95-224-166.compute-1.amazonaws.com

XYZ University

Home Students list

Welcome

Use this app to keep track of your student inquiries

[List of students](#)



Not Secure ec2-3-95-224-166.compute-1.amazonaws.com/students

XYZ University

Home Students list

All students

Name	Address	City	State	Email	Phone	
Jay	1234 Elm Street Anytown, USA Postal Code: 54321	Springfield	IL	jaymor@gwu.edu	5551234567	edit
Emily Johnson	789 Maple Lane, Lakeside City, CA, 90210	Lakeside City	CA	emilyj@gwu.edu	5559876543	edit

[Add a new student](#)

Phase 3: Decoupling the application components.

In this phase, you will continue building. The objective is to separate the database and the web server infrastructure so that they run independently. The web application should run on a separate virtual machine, and the database should run on the managed service infrastructure.

Task 1: Changing the VPC configuration

Update or re-create the virtual network components that are necessary to support hosting the database separately from the application.

Note: You need private subnets in a minimum of two Availability Zones.

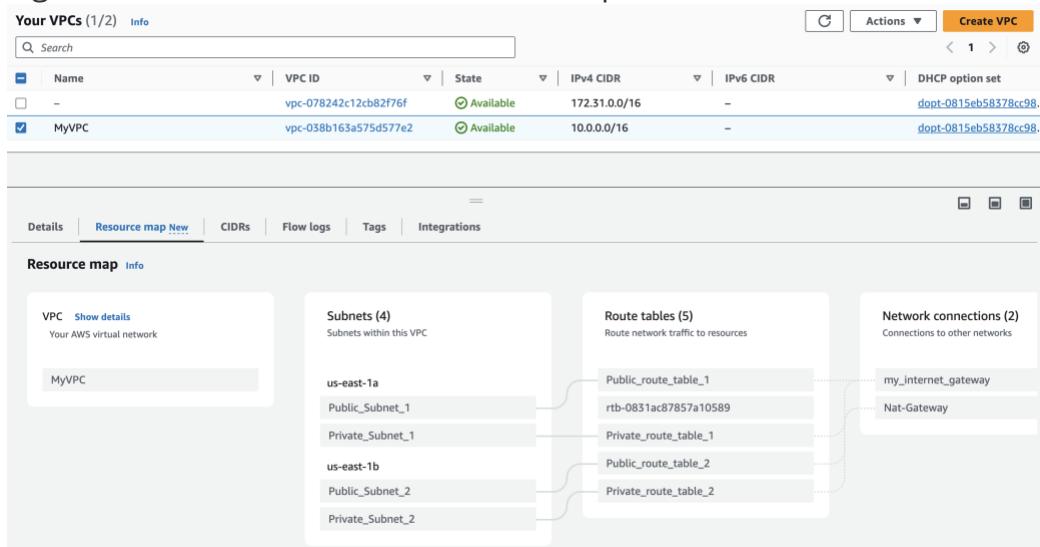
Reference

- AWS Academy Cloud Architecting – Lab: Creating a Virtual Private Cloud

Cloud Architecting MODULE 8 LAB 5

Instead of creating a NEW VPC, RECREATE the existing VPC. As in Phase 2 creation of VPC, create the public subnets and private subnets along with private route table and public route table in different zone.

Figure: Created 2 Private subnets and 2 public subnets in two availability zones



Task 2: Creating and configuring the Amazon RDS database

Create an Amazon Relational Database Service (Amazon RDS) database that runs a MySQL engine. You can choose to create a provisioned instance or run it serverless.

Notes:

- Allow only the web application to access the database.
- Don't enable enhanced monitoring.

Reference

- AWS Academy Cloud Foundations – Lab: Build Your DB Server and Interact With Your DB Using an App

VPC > Security Groups > Create security group

Create security group Info

A security group acts as a virtual firewall for your instance to control inbound and outbound traffic. To create a new security group, complete the fields below.

Basic details

Security group name Info
DB_SG
Name cannot be edited after creation.

Description Info
Database Security Group

VPC Info
vpc-038b163a575d577e2 (MyVPC)

Inbound rules Info

Type	Protocol	Port range	Source	Description - optional
MySQL/Aurora	TCP	3306	Cust... <input type="button" value="Delete"/>	<input type="text" value="sg-0fd1403299b124"/> <input type="button" value="Delete"/>
				<input type="text" value="sg-0fd1403299b124d3f"/> <input type="button" value="Delete"/>

AWS Services Search [Option+S] N. Virginia v vodlabs/user2378920=sowmyavara26@gwu.edu @ 9843-0963-0308

Amazon RDS X

RDS > Subnet groups > Create DB subnet group

Create DB subnet group

To create a new subnet group, give it a name and a description, and choose an existing VPC. You will then be able to add subnets related to that VPC.

Subnet group details

Name
You won't be able to modify the name after your subnet group has been created.

Must contain from 1 to 255 characters. Alphanumeric characters, spaces, hyphens, underscores, and periods are allowed.

Description

VPC
Choose a VPC identifier that corresponds to the subnets you want to use for your DB subnet group. You won't be able to choose a different VPC identifier after your subnet group has been created.

Dashboard
Databases
Query Editor
Performance insights
Snapshots
Exports in Amazon S3
Automated backups
Reserved instances
Proxies

Subnet groups
Parameter groups
Option groups
Custom engine versions
Zero-ETL integrations New

Add subnets

Availability Zones
Choose the Availability Zones that include the subnets you want to add.

us-east-1a X us-east-1b X

Subnets
Choose the subnets that you want to add. The list includes the subnets in the selected Availability Zones.

subnet-09481951a13efdff7 (10.0.2.0/24) X
subnet-06a2a65fc34eb3034 (10.0.4.0/24) X

i For Multi-AZ DB clusters, you must select 3 subnets in 3 different Availability Zones.

Subnets selected (2)

Availability zone	Subnet ID	CIDR block
us-east-1a	subnet-09481951a13efdff7	10.0.2.0/24
us-east-1b	subnet-06a2a65fc34eb3034	10.0.4.0/24

Cancel Create

Both Private subnets are selected above.

Amazon RDS

Successfully created DB-Subnet-Group. [View subnet group](#)

Dashboard
Databases
Query Editor
Performance insights
Snapshots
Exports in Amazon S3
Automated backups
Reserved instances

RDS > Subnet groups

Subnet groups (1)

Name	Description	Status	VPC
db-subnet-group	DB-Subnet-Group	Complete	vpc-038b163a575d577e2

AWS Services Search [Option+S] N. Virginia vclabs/user2378920=sowmyavara26@gwu.edu @ 9843-0963-0308

Amazon RDS

Try the new Amazon RDS Multi-AZ deployment option for MySQL and PostgreSQL.
For your Amazon RDS for MySQL and PostgreSQL workloads, improve transactional commit latencies by 2x, experience faster failover typically less than 35 seconds and, get read scalability with two readable standby DB instances by deploying the Multi-AZ DB cluster [Learn more](#).

Create database Or, [Restore Multi-AZ DB Cluster from Snapshot](#)

Create database

Choose a database creation method [Info](#)

- Standard create
You set all of the configuration options, including ones for availability, security, backups, and maintenance.
- Easy create
Use recommended best-practice configurations. Some configuration options can be changed after the database is created.

Engine options

Engine type [Info](#)

- Aurora (MySQL Compatible) 
- Aurora (PostgreSQL Compatible) 
- MySQL 
- MariaDB 

Templates

Choose a sample template to meet your use case.

- Production
Use defaults for high availability and fast, consistent performance.
- Dev/Test
This instance is intended for development use outside of a production environment.
- Free tier
Use RDS Free Tier to develop new applications, test existing applications, or gain hands-on experience with Amazon RDS.
[Info](#)

Availability and durability

Deployment options [Info](#)
The deployment options below are limited to those supported by the engine you selected above.

- Multi-AZ DB Cluster
Creates a DB cluster with a primary DB instance and two readable standby DB instances, with each DB instance in a different Availability Zone (AZ). Provides high availability, data redundancy and increases capacity to serve requests.
[Cookie preferences](#)
- Multi-AZ DB instance
Creates a primary DB instance and a standby DB instance in a different AZ. Provides high availability and data redundancy, but the standby DB instance doesn't support connections for read workloads.
- Single DB instance
Creates a single DB instance with no standby DB instances.

Settings

DB instance identifier [Info](#)

Type a name for your DB instance. The name must be unique across all DB instances owned by your AWS account in the current AWS Region.

database-1

The DB instance identifier is case-insensitive, but is stored as all lowercase (as in "mydbinstance"). Constraints: 1 to 60 alphanumeric characters or hyphens. First character must be a letter. Can't contain two consecutive hyphens. Can't end with a hyphen.

▼ Credentials Settings

Master username [Info](#)

Type a login ID for the master user of your DB instance.

main

1 to 16 alphanumeric characters. The first character must be a letter.

Manage master credentials in AWS Secrets Manager

Manage master user credentials in Secrets Manager. RDS can generate a password for you and manage it throughout its lifecycle.

 If you manage the master user credentials in Secrets Manager, some RDS features aren't supported.

[Learn more](#) 

Auto generate a password

Amazon RDS can generate a password for you, or you can specify your own password.

Master password [Info](#)

Constraints: At least 8 printable ASCII characters. Can't contain any of the following: / (slash), '(single quote), "(double quote) and @ (at sign).

Instance configuration

The DB instance configuration options below are limited to those supported by the engine that you selected above.

DB instance class [Info](#)

▼ Hide filters

Show instance classes that support Amazon RDS Optimized Writes [Info](#)

Amazon RDS Optimized Writes improves write throughput by up to 2x at no additional cost.

Include previous generation classes

Standard classes (includes m classes)

Memory optimized classes (includes r and x classes)

Burstable classes (includes t classes)

db.t3.micro

2 vCPUs 1 GiB RAM Network: 2,085 Mbps

Storage

Storage type [Info](#)

General Purpose SSD (gp3)

Performance scales independently from storage

Allocated storage [Info](#)

20

GiB

Minimum: 20 GiB. Maximum: 6,144 GiB

Connectivity [Info](#)



Compute resource

Choose whether to set up a connection to a compute resource for this database. Setting up a connection will automatically change connectivity settings so that the compute resource can connect to this database.

Don't connect to an EC2 compute resource

Don't set up a connection to a compute resource for this database. You can manually set up a connection to a compute resource later.

Connect to an EC2 compute resource

Set up a connection to an EC2 compute resource for this database.

Virtual private cloud (VPC) [Info](#)

Choose the VPC. The VPC defines the virtual networking environment for this DB instance.

MyVPC (vpc-038b163a575d577e2)

4 Subnets, 2 Availability Zones

Only VPCs with a corresponding DB subnet group are listed.

After a database is created, you can't change its VPC.

DB subnet group [Info](#)

Choose the DB subnet group. The DB subnet group defines which subnets and IP ranges the DB instance can use in the VPC that you selected.

db-subnet-group

2 Subnets, 2 Availability Zones

Public access [Info](#)

Yes

RDS assigns a public IP address to the database. Amazon EC2 instances and other resources outside of the VPC can connect to your database. Resources inside the VPC can also connect to the database. Choose one or more VPC security groups that specify which resources can connect to the database.

No

RDS doesn't assign a public IP address to the database. Only Amazon EC2 instances and other resources inside the VPC can connect to your database. Choose one or more VPC security groups that specify which resources can connect to the database.

VPC security group (firewall) [Info](#)

Choose one or more VPC security groups to allow access to your database. Make sure that the security group rules allow the appropriate incoming traffic.

Choose existing

Choose existing VPC security groups

Create new

Create new VPC security group

Existing VPC security groups

Choose one or more options

DB_SG

Uncheck the Below

Monitoring

Enable Enhanced monitoring

Enabling Enhanced monitoring metrics are useful when you want to see how different processes or threads use the CPU.

Backup

Enable automated backups

Creates a point-in-time snapshot of your database

Encryption

Enable encryption

Choose to encrypt the given instance. Master key IDs and aliases appear in the list after they have been created using the AWS Key Management Service console. [Info](#)

View Credential details → Copy and Save somewhere safe.

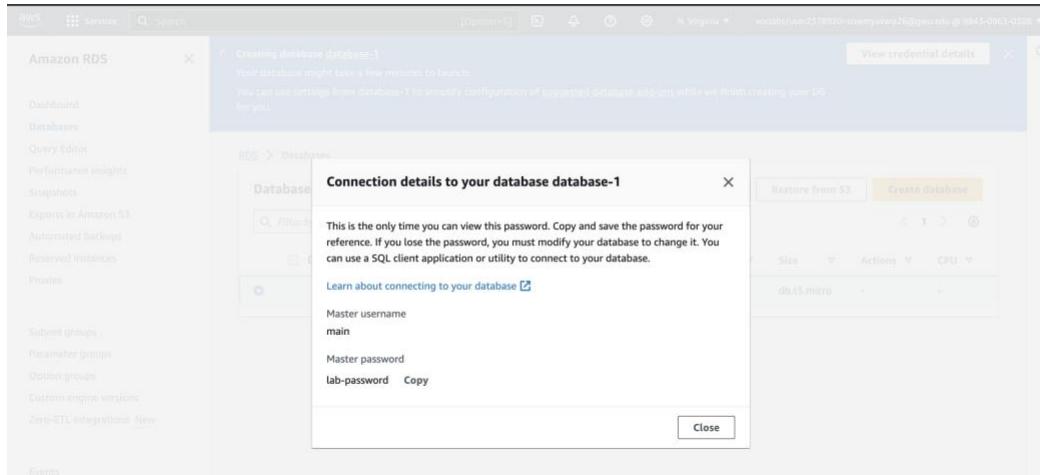


Figure: Created RDS Database: lab-db1

A screenshot of the AWS RDS 'database-1' summary page. The top navigation bar shows 'RDS > Databases > database-1'. The main summary table contains the following data:

DB identifier	CPU	Status	Class
database-1	19.52%	Available	db.t3.micro
Role	Current activity	Engine	Region & AZ
Instance	0 Connections	MySQL Community	us-east-1a

Below the summary are tabs for Connectivity & security, Monitoring, Logs & events, Configuration, Zero-ETL integrations, Maintenance & backups, and Tags. The Connectivity & security tab is selected, showing details like Endpoint (database-1.crqmwxf2me.us-east-1.rds.amazonaws.com), Port (3306), Networking (Availability Zone: us-east-1a, VPC: MyVPC (vpc-038b163a575d577e2)), and Security (VPC security groups: DB_SG (sg-0b820cd4584821e21), Active).

Note down the Endpoint.

Task 3: Configuring the development environment

Provision an AWS Cloud9 environment to run AWS Command Line Interface (AWS CLI) commands in later tasks.

Notes:

- Use a t3.micro instance for the AWS Cloud9 environment.
- Use Secure Shell (SSH) to connect to the environment.

Reference

- [Creating Cloud9 Environment](#)

AWS Cloud9 > Environments > Create environment

Create environment Info

Details

Name Limit of 60 characters, alphanumeric, and unique per user.

Description - *optional* Limit 200 characters.

Environment type Info Determines what the Cloud9 IDE will run on.

New EC2 instance Cloud9 creates an EC2 instance in your account. The configuration of your EC2 instance cannot be changed by Cloud9 after creation.

Existing compute You have an existing instance or server that you'd like to use.

New EC2 instance

Instance type Info The memory and CPU of the EC2 instance that will be created for Cloud9 to run on.

t2.micro (1 GiB RAM + 1 vCPU) Free-tier eligible. Ideal for educational users and exploration.

t3.small (2 GiB RAM + 2 vCPU) Recommended for small web projects.

m5.large (8 GiB RAM + 2 vCPU) Recommended for production and most general-purpose development.

Additional instance types Explore additional instances to fit your need.

Additional instance types

Platform Info This will be installed on your EC2 instance. We recommend Amazon Linux 2.

Timeout How long Cloud9 can be inactive (no user input) before auto-hibernating. This helps prevent unnecessary charges.

Network settings [Info](#)

Connection

How your environment is accessed.

AWS Systems Manager (SSM)

Accesses environment via SSM without opening inbound ports (no ingress).

Secure Shell (SSH)

Accesses environment directly via SSH, opens inbound ports.

► **VPC settings** [Info](#)

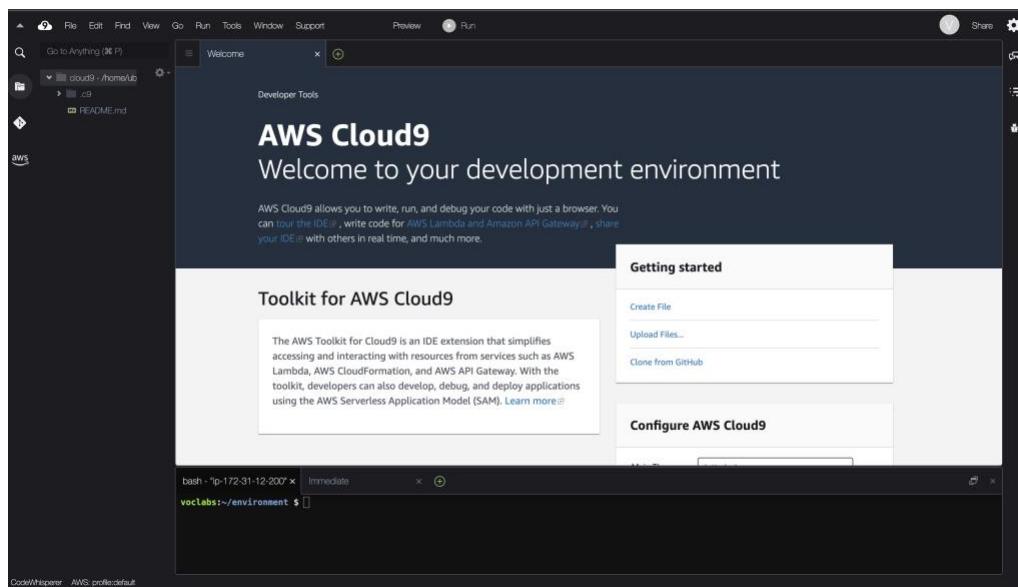
Figure: Created the AWS Cloud9 environment

AWS Cloud9 > Environments

Environments (1)

Name	Cloud9 IDE	Environment type	Connection	Permission	Owner ARN
cloud9	Open	EC2 Instance	Secure Shell (SSH)	Owner	arn:aws:sts::374396164625:assumed-role/voclas/users/2378920=sowmyavara26@gwu.edu

[Create environment](#)



EC2 Dashboard X

EC2 Global View

Events

Console-to-Code Preview

Instances

Instances

Instance Types

Launch Templates

Spot Requests

Savings Plans

Reserved Instances

Dedicated Hosts

Capacity Reservations New

Images

AMIs

AMI Catalog

Elastic Block Store

Instances (1/2) [Info](#)

Find Instance by attribute or tag (case-sensitive)

[Clear filters](#)

Instance state: [running](#) X

[Launch instances](#)

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Pub
Web_App_Ser...	i-0b7043c93550f5db	Running	t2.micro	2/2 checks passed	No alarms	+ us-east-1a	ec2-
aws-cloud9-cl...	i-0bf3554fe278fe8bc	Running	t3.micro	2/2 checks passed	No alarms	+ us-east-1d	ec2-

Instance: i-0bf3554fe278fe8bc (aws-cloud9-cloud9-b650a8f8ed744e68a565d8003ef0f41a)

[Details](#) [Security](#) [Networking](#) [Storage](#) [Status checks](#) [Monitoring](#) [Tags](#)

Instance summary

Instance ID i-0bf3554fe278fe8bc (aws-cloud9-cloud9-b650a8f8ed744e68a565d8003ef0f41a)	Public IPv4 address 3.239.173.25 [open address]	Private IPv4 addresses 172.31.12.200
IPv6 address -	Instance state Running	Public IPv4 DNS ec2-3-239-173-25.compute-1.amazonaws.com [open address]

Task 4: Provisioning Secrets Manager

Use AWS Secrets Manager to create a secret to store the database credentials and configure the web application to use Secrets Manager.

Use *Script-1* from the following link to create a secret in Secrets Manager by using the AWS CLI:
[AWS Cloud9 Scripts](#)

Note: This .yml file also contains scripts that you will use in later tasks.

Reference

- [create-secret in the AWS CLI Command Reference for AWS Secrets Manager](#)

AWS Secrets Manager > [Secrets](#) > Store a new secret

Step 1
[Choose secret type](#)

Step 2
Configure secret

Step 3 - optional
Configure rotation

Step 4
Review

Choose secret type

Secret type [Info](#)

Credentials for Amazon RDS database Credentials for Amazon DocumentDB database Credentials for Amazon Redshift cluster

Credentials for other database Other type of secret
API key, OAuth token, other.

Credentials [Info](#)

User name
main

Password

 Show password

AWS Secrets Manager > [Secrets](#) > Store a new secret

Step 1
[Choose secret type](#)

Step 2
[Configure secret](#)

Step 3 - optional
Configure rotation

Step 4
Review

Configure secret

Secret name and description [Info](#)

Secret name
A descriptive name that helps you find your secret later.
db/mysql/credentials

Secret name must contain only alphanumeric characters and the characters /_+=.=@-

Description - optional
Access to MySQL prod database for my AppBeta

Maximum 250 characters.

Figure: Created a secret in AWS Secret Manager of the lab-db1 credentials

The screenshot shows the AWS Secrets Manager interface. At the top, there is a navigation bar with 'AWS Secrets Manager' and 'Secrets'. Below it is a search bar with the placeholder 'Filter secrets by name, description, tag key, tag value, owning service or primary Region'. A button labeled 'Store a new secret' is on the right. The main area has a table with columns 'Secret name', 'Description', and 'Last retrieved (UTC)'. One row is visible: 'db/mysql/credentials'.

This screenshot shows the details of the 'db/mysql/credentials' secret. It includes sections for 'Secret details' and 'Actions'. Under 'Secret details', there are fields for 'Encryption key' (aws/secretsmanager), 'Secret name' (db/mysql/credentials), and 'Secret ARN' (arn:aws:secretsmanager:us-east-1:984309630308:secret:db/mysql/credentials-G3mvUG). There is also a 'Secret description' field which is empty.

If stored your secret following the above in the cloud9, no need to store it again using the AWS Cloud9 Scripts.

Use the below command in the cloud9 terminal and you can see your stored secrets.

The screenshot shows the AWS Cloud9 terminal window. The terminal output shows the command 'aws secretsmanager list-secrets' being run, and the resulting JSON response. The response includes the ARN, Name, LastChangedDate, Tags, and SecretVersionsToStages for the secret 'db/mysql/credentials'.

```
aws - "ip-172-31-12-200" x Immediate x +
voclabs:~/environment $ aws secretsmanager list-secrets
{
    "SecretList": [
        {
            "ARN": "arn:aws:secretsmanager:us-east-1:984309630308:secret:db/mysql/credentials-G3mvUG",
            "Name": "db/mysql/credentials",
            "LastChangedDate": "2023-12-09T05:28:42.853000+00:00",
            "Tags": [],
            "SecretVersionsToStages": [
                {
                    "d2e0dd21-979c-4465-be03-b0b084ae2449": [
                        "AWSCURRENT"
                    ]
                },
                {
                    "CreatedDate": "2023-12-09T05:28:42.572000+00:00"
                }
            ]
        }
    ]
}
voclabs:~/environment $
```

Figure: Secret Stored in Secrets Manager accessed in Cloud9 Terminal

```
voclabs:~/environment $ aws secretsmanager list-secrets
{
    "SecretList": [
        {
            "ARN": "arn:aws:secretsmanager:us-east-1:374396164625:secret:lab-db1/mysql/secret-U19BRp",
            "Name": "lab-db1/mysql/secret",
            "Description": "User details",
            "LastChangedDate": "2023-11-08T18:24:08.024000+00:00",
            "Tags": [],
            "SecretVersionsToStages": {
                "dd330027-efba-46b3-8ecd-43f018511093": [
                    "AWSCURRENT"
                ],
            },
            "CreatedDate": "2023-11-08T18:24:07.951000+00:00"
        }
    ]
}
voclabs:~/environment $ 
```

Task 5: Provisioning a new instance for the web server

Create a new virtual machine to host the web application.

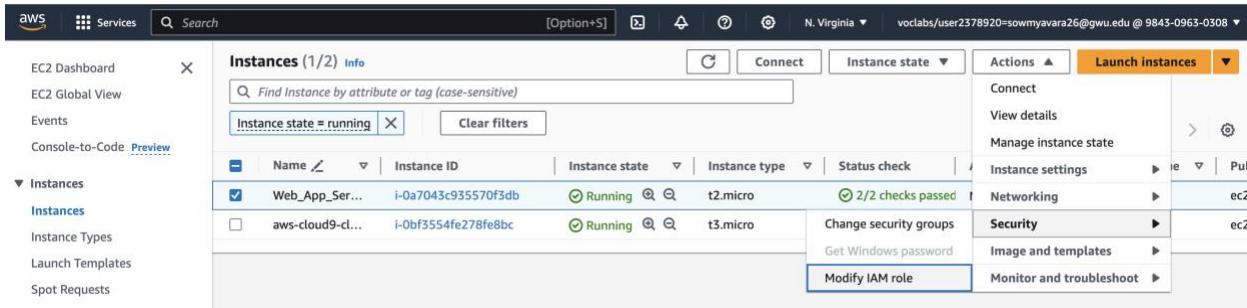
To install the required web application on the virtual machine, use the JavaScript code from the following link: [Solution Code for the App Server](#)

For the AWS Identity and Access Management (IAM) profile on the EC2 instance, attach the existing *LabInstanceProfile* profile. This profile attaches an IAM role called *LabRole* to the instance so that it can fetch the secret securely.

Note: Optionally, you can continue to use the existing virtual machine for the web application. However, you will need to reconfigure the application to connect to Amazon RDS.

Reference

- AWS Academy Cloud Foundations – Lab: Build Your DB Server and Interact with Your DB Using an App



Modify IAM role [Info](#)

Attach an IAM role to your instance.

Instance ID
i-0a7043c935570f3db (Web_App_Server)

IAM role
 Select an IAM role to attach to your instance or create a new role if you haven't created any. The role you select replaces any roles that are currently attached to your instance.

▼

[Create new IAM role](#)

Cancel
Update IAM role

Figure: Updated the existing EC2 instance with IAM profile.

[EC2](#) > [Instances](#) > i-0234df44a687edf24

Instance summary for i-0234df44a687edf24 (Web_app_Server) [Info](#)

Updated less than a minute ago

<p>Instance ID i-0234df44a687edf24 (Web_app_Server)</p> <p>IPv6 address -</p> <p>Hostname type IP name: ip-10-0-1-136.ec2.internal</p> <p>Answer private resource DNS name -</p> <p>Auto-assigned IP address 54.224.4.71 [Public IP]</p> <p>IAM Role LabRole</p> <p>IMDSv2 Required</p>	<p>Public IPv4 address 54.224.4.71 [open address]</p> <p>Instance state Running</p> <p>Private IP DNS name (IPv4 only) ip-10-0-1-136.ec2.internal</p> <p>Instance type t2.micro</p> <p>VPC ID vpc-0fd9db10ba6dcccea (VPC-Web-App)</p> <p>Subnet ID subnet-0a4f6c7bc2bb89bd2 (Public_subnet_WA)</p>
---	--

[AWS](#) [Services](#) [Option+S] N. Virginia voblasts/user2378920=sowmyavara26@gwu.edu @ 9843-0963-0308

EC2 Dashboard

EC2 Global View

Events

Console-to-Code [Preview](#)

Instances

Instances

Instance Types

Launch Templates

Spot Requests

Savings Plans

Reserved Instances

Dedicated Hosts

Capacity Reservations [New](#)

Images

AMIs

AMI Catalog

Elastic Block Store

Volumes

Snapshots

Lifecycle Manager

Successfully attached LabInstanceProfile to instance i-0a7043c935570f3db

Instances (1/2) [Info](#)

Name	Instance ID	Instance state	Instance type	Status check
<input checked="" type="checkbox"/> Web_App_Ser...	i-0a7043c935570f3db	Running		
<input type="checkbox"/> aws-cloud9-cl...	i-0bf3554fe278fe8bc	Running		

Actions **Launch instances**

Connect

View details

Manage instance state

Instance settings

Networking

Security

Image and templates

Monitor and troubleshoot

Edit user data Info

Instance ID

[i-0a7043c935570f3db \(Web_App_Server\)](#)

Current user data

User data currently associated with this instance

```
#!/bin/bash -xe
apt update -y
apt install nodejs unzip wget npm mysql-server -y
#wget https://aws-tc-largeobjects.s3.us-west-2.amazonaws.com/CUR-TF-200-ACCP1-1-DEV/code.zip -P
/home/ubuntu
wget https://aws-tc-largeobjects.s3.us-west-2.amazonaws.com/CUR-TF-200-ACCP1-1-79581/1-lab-capstone-
```

[Copy user data](#)

i To edit your instance's user data you first need to stop your instance.

Cancel

Save

To edit your user data, need to stop the EC2 instance.

The screenshot shows the AWS EC2 Instances page. On the left, there's a sidebar with 'EC2 Dashboard', 'EC2 Global View', 'Events', 'Console-to-Code Preview', and a collapsed 'Instances' section. The main area shows a table with two rows:

Name	Instance ID	Instance state	Instance type
Web_App_Server	i-0a7043c935570f3db	Running	t2.micro
aws-cloud9-cl...	i-0bf3554fe278fe8bc	Running	t3.micro

The 'Actions' dropdown menu is open over the first row, showing options: Stop instance, Start instance, Reboot instance, Hibernate instance, and Terminate instance. The 'Stop instance' option is highlighted.

Edit user data Info

Instance ID

[i-0a7043c935570f3db \(Web_App_Server\)](#)

Current user data

User data currently associated with this instance

```
#!/bin/bash -xe
apt update -y
apt install nodejs unzip wget npm mysql-server -y
#wget https://aws-tc-largeobjects.s3.us-west-2.amazonaws.com/CUR-TF-200-ACCP1-1-DEV/code.zip -P
/home/ubuntu
wget https://aws-tc-largeobjects.s3.us-west-2.amazonaws.com/CUR-TF-200-ACCP1-1-79581/1-lab-capstone-
```

[Copy user data](#)

New user data

This user data will replace the current user data

Modify user data as text
Add your user data below

Modify user data by importing a file
Description of importing a file and what will happen to it

[Choose File](#) UserdataScript-phase-3.sh

Input is already base64-encoded

Cancel

Save

⌚ User data successfully modified

Instances (1/2) Info			Connect	Instance state ▾	Actions ▾	Launch instances ▾
Find Instance by attribute or tag (case-sensitive)						
Name ↴	Instance ID	Instance state ▾	Instance type			
<input checked="" type="checkbox"/> Web_App_Ser...	i-0a7043c935570f3db	Stopped	Running	t2.micro		
<input type="checkbox"/> aws-cloud9-cl...	i-0bf3554fe278fe8bc	Running	Running	t3.micro		

EC2 Dashboard Services Search [Option+S] N. Virginia vclabs/user2378920=sowmyavara26@gwu.edu @ 9843-0963-0308

Instances (1/2) Info

Name ↴	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone
<input checked="" type="checkbox"/> Web_App_Server	i-0a7043c935570f3db	Running	t2.micro	2/2 checks passed	No alarms	us-east-1a
<input type="checkbox"/> aws-cloud9-cl	i-0bf3554fe278fe8bc	Running	t3.micro	2/2 checks passed	No alarms	us-east-1d

Make sure EC2 instance running again and 2/2 checks passed.

EC2 > Instances > i-0a7043c935570f3db

Instance summary for i-0a7043c935570f3db (Web_App_Server) Info

Updated less than a minute ago

Instance ID i-0a7043c935570f3db (Web_App_Server)	Public IPv4 address 3.89.8.247 open address	Private IPv4 addresses Public IPv4 DNS copied ec2-3-89-8-247.compute-1.amazonaws.com open address
IPv6 address -	Instance state Running	

⚠️ Not Secure ec2-3-89-8-247.compute-1.amazonaws.com

XYZ University

Welcome

Use this app to keep track of your student inquiries

List of students

Task 6: Migrating the database

Migrate the data from the original database, which is on an EC2 instance, to the new Amazon RDS database.

Use *Script-3* from the AWS Cloud9 Scripts file (*cloud9-scripts.yml*) to migrate the original data into the Amazon RDS database. Recall that you used a script from this file earlier to create the secret in Secrets Manager.

Create database

Choose a database creation method [Info](#)

Standard create

You set all of the configuration options, including ones for availability, security, backups, and maintenance.

Easy create

Use recommended best-practice configurations. Some configuration options can be changed after the database is created.

Engine options

Engine type [Info](#)

Aurora (MySQL Compatible)



Aurora (PostgreSQL Compatible)



MySQL



MariaDB



Templates

Choose a sample template to meet your use case.

Production

Use defaults for high availability and fast, consistent performance.

Dev/Test

This instance is intended for development use outside of a production environment.

Free tier

Use RDS Free Tier to develop new applications, test existing applications, or gain hands-on experience with Amazon RDS.
[Info](#)

Availability and durability

Deployment options [Info](#)

The deployment options below are limited to those supported by the engine you selected above.

Multi-AZ DB Cluster

Creates a DB cluster with a primary DB instance and two readable standby DB instances, with each DB instance in a different Availability Zone (AZ). Provides high availability, data redundancy and increases capacity to serve read workloads.

Multi-AZ DB instance

Creates a primary DB instance and a standby DB instance in a different AZ. Provides high availability and data redundancy, but the standby DB instance doesn't support connections for read workloads.

Single DB instance

Creates a single DB instance with no standby DB instances.

Settings

DB instance identifier [Info](#)

Type a name for your DB instance. The name must be unique across all DB instances owned by your AWS account in the current AWS Region.

The DB instance identifier is case-insensitive, but is stored as all lowercase (as in "mydbinstance"). Constraints: 1 to 60 alphanumeric characters or hyphens. First character must be a letter. Can't contain two consecutive hyphens. Can't end with a hyphen.

▼ Credentials Settings

Master username [Info](#)

Type a login ID for the master user of your DB instance.

1 to 16 alphanumeric characters. The first character must be a letter.

Manage master credentials in AWS Secrets Manager

Manage master user credentials in Secrets Manager. RDS can generate a password for you and manage it throughout its lifecycle.

 If you manage the master user credentials in Secrets Manager, some RDS features aren't supported.

[Learn more](#)

Auto generate a password

Amazon RDS can generate a password for you, or you can specify your own password.

Master password [Info](#)

Constraints: At least 8 printable ASCII characters. Can't contain any of the following: / (slash), '(single quote), "(double quote) and @ (at sign).

Instance configuration

The DB instance configuration options below are limited to those supported by the engine that you selected above.

DB instance class [Info](#)

▼ Hide filters

Show instance classes that support Amazon RDS Optimized Writes [Info](#)

Amazon RDS Optimized Writes improves write throughput by up to 2x at no additional cost.

Include previous generation classes

Standard classes (includes m classes)

Memory optimized classes (includes r and x classes)

Burstable classes (includes t classes)

2 vCPUs 1 GiB RAM Network: 2,085 Mbps

Storage

Storage type [Info](#)

Performance scales independently from storage

Allocated storage [Info](#)

GiB

Minimum: 20 GiB. Maximum: 6,144 GiB

Connectivity Info



Compute resource

Choose whether to set up a connection to a compute resource for this database. Setting up a connection will automatically change connectivity settings so that the compute resource can connect to this database.

Don't connect to an EC2 compute resource

Don't set up a connection to a compute resource for this database. You can manually set up a connection to a compute resource later.

Connect to an EC2 compute resource

Set up a connection to an EC2 compute resource for this database.

Virtual private cloud (VPC) Info

Choose the VPC. The VPC defines the virtual networking environment for this DB instance.

MyVPC (vpc-038b163a575d577e2)

4 Subnets, 2 Availability Zones



Only VPCs with a corresponding DB subnet group are listed.

After a database is created, you can't change its VPC.

DB subnet group Info

Choose the DB subnet group. The DB subnet group defines which subnets and IP ranges the DB instance can use in the VPC that you selected.

db-subnet-group

2 Subnets, 2 Availability Zones



Public access Info

Yes

RDS assigns a public IP address to the database. Amazon EC2 instances and other resources outside of the VPC can connect to your database. Resources inside the VPC can also connect to the database. Choose one or more VPC security groups that specify which resources can connect to the database.

No

RDS doesn't assign a public IP address to the database. Only Amazon EC2 instances and other resources inside the VPC can connect to your database. Choose one or more VPC security groups that specify which resources can connect to the database.

VPC security group (firewall) Info

Choose one or more VPC security groups to allow access to your database. Make sure that the security group rules allow the appropriate incoming traffic.

Choose existing

Choose existing VPC security groups

Create new

Create new VPC security group

Existing VPC security groups

Choose one or more options



DB_SG

Availability Zone Info

us-east-1a



RDS Proxy

RDS Proxy is a fully managed, highly available database proxy that improves application scalability, resiliency, and security.

Create an RDS Proxy Info

RDS automatically creates an IAM role and a Secrets Manager secret for the proxy. RDS Proxy has additional costs. For more information, see [Amazon RDS Proxy pricing](#).

Certificate authority - optional Info

Using a server certificate provides an extra layer of security by validating that the connection is being made to an Amazon database.

It does so by checking the server certificate that is automatically installed on all databases that you provision.

rds-ca-2019 (default)

Expiry: Aug 22, 2024



If you don't select a certificate authority, RDS chooses one for you.

▼ Additional configuration

Database port Info

TCP/IP port that the database will use for application connections.

3306

Amazon RDS

Creating database database-2

Your database might take a few minutes to launch.

You can use settings from database-2 to simplify configuration of suggested database add-ons while we finish creating your DB for you.

RDS > Databases > database-2

Connection details to your database database-2

This is the only time you can view this password. Copy and save the password for your reference. If you lose the password, you must modify your database to change it. You can use a SQL client application or utility to connect to your database.

Master username: main

Master password: lab-password [Copy](#)

Class: db.t3.micro

Region & AZ: us-east-1a

Subnet groups, Parameter groups, Option groups, Custom engine versions, Zero-ETL Integrations

Events, Event subscriptions, Recommendations, Certificate update

CloudShell, Feedback

RDS > Databases

Databases (2)

Group resources [C](#) Modify Actions ▾ Restore from S3 Create database

Filter by databases

DB identifier	Status	Role	Engine	Region & AZ	Size	Actions	CPU
database-1	Available	Instance	MySQL Community	us-east-1a	db.t3.micro	3 Actions	2
database-2	Backing-up	Instance	MySQL Community	us-east-1a	db.t3.micro	-	6

Systems Manager → Session Manager

AWS Systems Manager

- Quick Setup
- Operations Management
 - Explorer
 - OpsCenter
 - CloudWatch Dashboard
 - Incident Manager
- Application Management
 - Application Manager
 - AppConfig
 - Parameter Store
- Change Management
 - Change Manager
 - Automation
 - Change Calendar
 - Maintenance Windows

AWS Systems Manager > Session Manager > Start a session

Step 1 Specify target

Select an instance to connect to using Session Manager.

Reason

Reason for session – optional

The reason for connecting to the instance. This value is included in the details of the event created by AWS CloudTrail when you start the session.

Connecting

Target instances

Instance n...	Instance ID	Agent vers...	Instance state	Availabilit...	Platform
Web_App_...	i-0a7043c...	3.2.1377.0	running	us-east-1a	Ubuntu

Start session, Cancel, Next

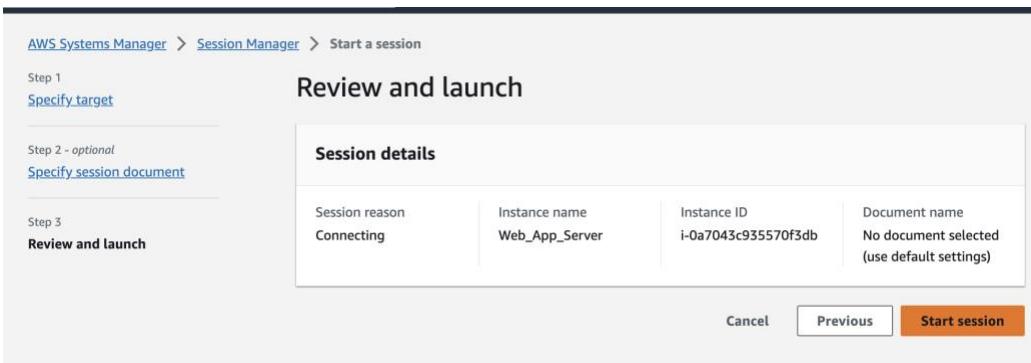


Figure: Started a Session in the Systems Manager

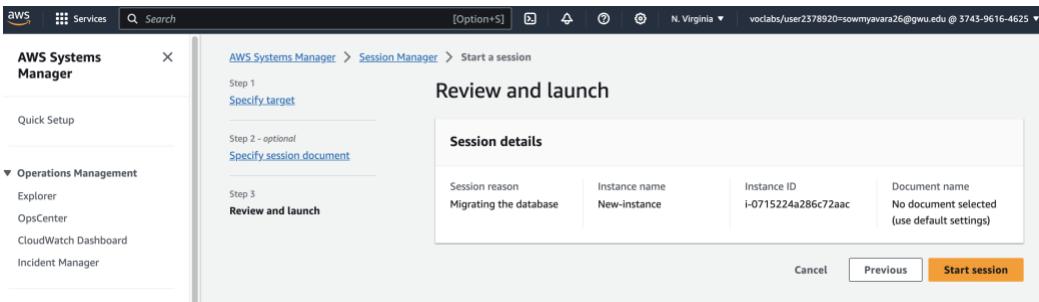


Figure: In the systems manager session executed the script-3 and dumped the file.

```

Session ID: Instance ID: i-0a7043c935570f3db
user2378920=sowmyavara26@gwu.edu-
0bb9e6ec94788a5ea
$ bash
ssm-user@ip-10-0-0-96:/var/snap/amazon-ssm-agent/7528$ sudo su
root@ip-10-0-0-96:/var/snap/amazon-ssm-agent/7528# sudo su ubuntu
ubuntu@ip-10-0-0-96:/var/snap/amazon-ssm-agent/7528$ whoami
ubuntu
ubuntu@ip-10-0-0-96:/var/snap/amazon-ssm-agent/7528$ cd /home/ubuntu
ubuntu@ip-10-0-0-96:-$ service mysql status
● mysql.service - MySQL Community Server
    Loaded: loaded (/lib/systemd/system/mysql.service; enabled; vendor preset: enabled)
      Active: active (running) since Sat 2023-12-09 14:48:40 UTC; 46min ago
        Main PID: 494 (mysqld)
          Status: "Server is operational"
         Tasks: 39 (limit: 1121)
        Memory: 361.7M
          CPU: 12.136s
        CGroup: /system.slice/mysql.service
                  └─494 /usr/sbin/mysqld

Dec 09 14:48:35 ip-10-0-0-96 systemd[1]: Starting MySQL Community Server...
Dec 09 14:48:40 ip-10-0-0-96 systemd[1]: Started MySQL Community Server.
ubuntu@ip-10-0-0-96:~$ mysql --version
mysql Ver 8.0.35-0ubuntu0.22.04.1 for Linux on x86_64 ((Ubuntu))
ubuntu@ip-10-0-0-96:~$ sudo mysql -u root -p
Enter password:
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 12
Server version: 8.0.35-0ubuntu0.22.04.1 (Ubuntu)

Copyright (c) 2000, 2023, Oracle and/or its affiliates.

Oracle is a registered trademark of Oracle Corporation and/or its
affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> show databases;
+-----+
| Database |
+-----+

```

```

mysql> show databases;
+-----+
| Database |
+-----+
| STUDENTS |
| information_schema |
| mysql |
| performance_schema |
| sys |
+-----+
5 rows in set (0.16 sec)

mysql> use STUDENTS;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> show tables;
+-----+
| Tables_in_STUDENTS |
+-----+
| students |
+-----+
1 row in set (0.07 sec)

mysql> select * from `students`;
+----+----+----+----+----+----+----+----+
| id | name | address | city | state | email | phone |
+----+----+----+----+----+----+----+----+
| 1 | Jay | 1234 Elm Street Anytown, USA Postal Code: 54321 | Springfield | IL | jaymor@gwu.edu | 5551234567 |
| 2 | Emily Johnson | 789 Maple Lane, Lakeside City, CA, 90210 | Lakeside City | CA | emilyj@gwu.edu | 5559876543 |
+----+----+----+----+----+----+----+----+
2 rows in set (0.12 sec)

mysql>

```

Do use **exit;**

```

ubuntu@ip-10-0-0-96:~$ sudo mysqldump --databases STUDENTS -u root -p > data.sql
Enter password:
ubuntu@ip-10-0-0-96:~$ ls
code.zip data.sql resources
ubuntu@ip-10-0-0-96:~$ cat data.sql
-- MySQL dump 10.13 Distrib 8.0.35, for Linux (x86_64)
--
-- Host: localhost     Database: STUDENTS
--
-- Server version      8.0.35-0ubuntu0.22.04.1

/*!40101 SET @OLD_CHARACTER_SET_CLIENT=@@CHARACTER_SET_CLIENT */;
/*!40101 SET @OLD_CHARACTER_SET_RESULTS=@@CHARACTER_SET_RESULTS */;
/*!40101 SET @OLD_COLLATION_CONNECTION=@@COLLATION_CONNECTION */;
/*!40101 SET NAMES utf8mb4 */;
/*!40003 SET NAMES utf8mb4 */;
/*!40103 SET @OLD_TIME_ZONE=@@TIME_ZONE */;
/*!40103 SET TIME_ZONE= '+00:00' */;
/*!40014 SET @OLD_UNIQUE_CHECKS=@@UNIQUE_CHECKS, UNIQUE_CHECKS=0 */;
/*!40014 SET @OLD_FOREIGN_KEY_CHECKS=@@FOREIGN_KEY_CHECKS, FOREIGN_KEY_CHECKS=0 */;
/*!40101 SET @OLD_SQL_MODE=@@SQL_MODE, SQL_MODE='NO_AUTO_VALUE_ON_ZERO' */;
/*!40111 SET @OLD_SQL_NOTES=@@SQL_NOTES, SQL_NOTES=0 */;

-- Current Database: 'STUDENTS'
--

CREATE DATABASE /*!32312 IF NOT EXISTS*/ `STUDENTS` /*!1000 DEFAULT CHARACTER SET utf8mb4 COLLATE utf8mb4_0900_ai_ci */ /*180016 DEFAULT ENCRYPTION='N' */;

USE `STUDENTS`;

-- Table structure for table `students`
--

DROP TABLE IF EXISTS `students`;
/*!40101 SET @saved_cs_client      = @@character_set_client */;
/*!40101 SET character_set_client = utf8mb4 */;
CREATE TABLE `students` (
  `id` int NOT NULL AUTO_INCREMENT,
  PRIMARY KEY (`id`),
  ENGINE=InnoDB AUTO_INCREMENT=3 DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_0900_ai_ci;
)/*40101 SET character_set_client = @saved_cs_client */;

-- Dumping data for table `students`
--

LOCK TABLES `students` WRITE;
/*!40000 ALTER TABLE `students` DISABLE KEYS */;
INSERT INTO `students` VALUES (1,'Jay','1234 Elm Street Anytown, USA Postal Code: 54321','Springfield','IL','jaymor@gwu.edu','5551234567'),(2,'Emily Johnson','789 Maple Lane, Lakeside City, CA, 90210','Lakeside City','CA','emilyj@gwu.edu','5559876543');
/*!40000 ALTER TABLE `students` ENABLE KEYS */;
UNLOCK TABLES;
/*!40103 SET TIME_ZONE=@OLD_TIME_ZONE */;

/*!40101 SET SQL_MODE=@OLD_SQL_MODE */;
/*!40014 SET FOREIGN_KEY_CHECKS=@OLD_FOREIGN_KEY_CHECKS */;
/*!40014 SET UNIQUE_CHECKS=@OLD_UNIQUE_CHECKS */;
/*!40101 SET CHARACTER_SET_CLIENT=@OLD_CHARACTER_SET_CLIENT */;
/*!40101 SET CHARACTER_SET_RESULTS=@OLD_CHARACTER_SET_RESULTS */;
/*!40101 SET COLLATION_CONNECTION=@OLD_COLLATION_CONNECTION */;
/*!40111 SET SQL_NOTES=@OLD_SQL_NOTES */;

-- Dump completed on 2023-12-09 15:40:01
ubuntu@ip-10-0-0-96:~$ 

```

```

LOCK TABLES `students` WRITE;
/*!40000 ALTER TABLE `students` DISABLE KEYS */;
INSERT INTO `students` VALUES (1,'Jay','1234 Elm Street Anytown, USA Postal Code: 54321','Springfield','IL','jaymor@gwu.edu','5551234567'),(2,'Emily Johnson','789 Maple Lane, Lakeside City, CA, 90210','Lakeside City','CA','emilyj@gwu.edu','5559876543');
/*!40000 ALTER TABLE `students` ENABLE KEYS */;
UNLOCK TABLES;
/*!40103 SET TIME_ZONE=@OLD_TIME_ZONE */;

/*!40101 SET SQL_MODE=@OLD_SQL_MODE */;
/*!40014 SET FOREIGN_KEY_CHECKS=@OLD_FOREIGN_KEY_CHECKS */;
/*!40014 SET UNIQUE_CHECKS=@OLD_UNIQUE_CHECKS */;
/*!40101 SET CHARACTER_SET_CLIENT=@OLD_CHARACTER_SET_CLIENT */;
/*!40101 SET CHARACTER_SET_RESULTS=@OLD_CHARACTER_SET_RESULTS */;
/*!40101 SET COLLATION_CONNECTION=@OLD_COLLATION_CONNECTION */;
/*!40111 SET SQL_NOTES=@OLD_SQL_NOTES */;

-- Dump completed on 2023-12-09 15:40:01
ubuntu@ip-10-0-0-96:~$ 

```

```

-- Dump completed on 2023-12-05 19:46:01
ubuntu@ip-10-0-0-96:~$ sudo mysql -u root -p
Enter password:
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 14
Server version: 8.0.35-Ubuntu0.22.04.1 (Ubuntu)

Copyright (c) 2000, 2023, Oracle and/or its affiliates.

Oracle is a registered trademark of Oracle Corporation and/or its
affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> show databases;
+-----+
| Database |
+-----+
| STUDENTS |
| information_schema |
| mysql |
| performance_schema |
| sys |
+-----+
5 rows in set (0.00 sec)

mysql> use STUDENTS;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> show tables;
+-----+
| Tables_in_STUDENTS |
+-----+
| students |
+-----+
1 row in set (0.00 sec)

```

```

mysql> select * from `students`;
+----+-----+-----+-----+-----+-----+-----+
| id | name | address | city | state | email | phone |
+----+-----+-----+-----+-----+-----+-----+
| 1 | Jay | 1234 Elm Street Anytown, USA Postal Code: 54321 | Springfield | IL | jaymor@gwu.edu | 5551234567 |
| 2 | Emily Johnson | 789 Maple Lane, Lakeside City, CA, 90210 | Lakeside City | CA | emilyj@gwu.edu | 5559876543 |
+----+-----+-----+-----+-----+-----+-----+
2 rows in set (0.00 sec)

mysql>

```

```

mysql> exit;
Bye
ubuntu@ip-10-0-0-96:~$ sudo mysql -u main -p --host database-2.crgmwxusf2me.us-east-1.rds.amazonaws.com < data.sql
Enter password:
ubuntu@ip-10-0-0-96:~$ sudo mysql -u main -p --host database-2.crgmwxusf2me.us-east-1.rds.amazonaws.com
Enter password:
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 28
Server version: 8.0.33 Source distribution

Copyright (c) 2000, 2023, Oracle and/or its affiliates.

Oracle is a registered trademark of Oracle Corporation and/or its
affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> show databases;
+-----+
| Database |
+-----+
| STUDENTS |
| information_schema |
| mysql |
| performance_schema |
| sys |
+-----+
5 rows in set (0.00 sec)

mysql> use STUDENTS;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> show tables;
+-----+
| Tables_in_STUDENTS |
+-----+

```

```

Database changed
mysql> show tables;
+-----+
| Tables_in_STUDENTS |
+-----+
| students |
+-----+
1 row in set (0.00 sec)

mysql> select * from `students`;
+----+-----+-----+-----+-----+-----+
| id | name | address | city | state | email | phone |
+----+-----+-----+-----+-----+-----+
| 1 | Jay | 1234 Elm Street Anytown, USA Postal Code: 54321 | Springfield | IL | jaymor@gwu.edu | 5551234567 |
| 2 | Emily Johnson | 789 Maple Lane, Lakeside City, CA, 90210 | Lakeside City | CA | emilyj@gwu.edu | 5559876543 |
+----+-----+-----+-----+-----+-----+
2 rows in set (0.00 sec)

mysql> 

```

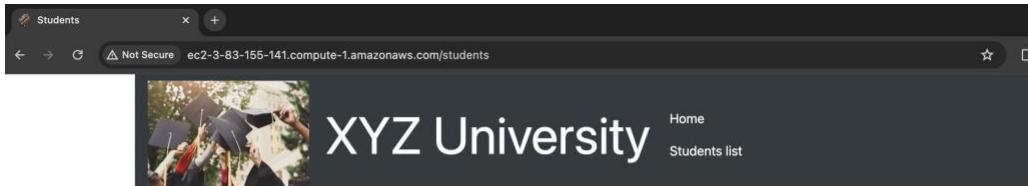
Reference

- AWS Academy Cloud Architecting – Lab: Migrating a Database to Amazon RDS

Module 5 CHALLENGE LAB

Task 7: Testing the application

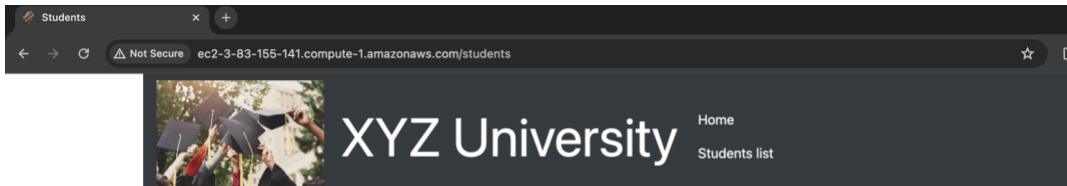
Access the application and perform a few tasks to test it. For example, view, add, delete, and modify student records.



All students

Name	Address	City	State	Email	Phone
Jay	1234 Elm Street Anytown, USA Postal Code: 54321	Springfield	IL	jaymor@gwu.edu	5551234567
Emily Johnson	789 Maple Lane, Lakeside City, CA, 90210	Lakeside City	CA	emilyj@gwu.edu	5559876543

Add a new student



All students

Name	Address	City	State	Email	Phone
Jay	1234 Elm Street Anytown, USA Postal Code: 54321	Springfield	IL	jaymor@gwu.edu	5551234567
Emily Johnson	789 Maple Lane, Lakeside City, CA, 90210	Lakeside City	CA	emilyj@gwu.edu	5559876543
Daniel Anderson	456 Pine Street	Mountainview	NY	daniela@gwu.edu	5559874637

Add a new student

The screenshot shows a web application titled "XYZ University" with a sub-page "Students". The main heading is "All students". Below it is a table with columns: Name, Address, City, State, Email, and Phone. There are four rows of data. Each row has an "edit" button. At the bottom left is a green button labeled "Add a new student".

Name	Address	City	State	Email	Phone
Jay	1234 Elm Street	Springfield	IL	jaymor@gwu.edu	5551234567
Emily Johnson	789 Maple Lane	Lakeside City	CA	emilyj@gwu.edu	5559876543
Daniel Anderson	456 Pine Street	Mountainview	NY	daniela@gwu.edu	5559874637

Phase 4: Implementing high availability and scalability

In this phase, you will complete the design and fulfill the remaining solution requirements. The objective is to use the key components that you created in earlier phases to build a scalable and highly available architecture.

Task 1: Creating an Application Load Balancer

Launch a load balancer. The endpoint will be used to access your web application.

Tip: Use a minimum of two Availability Zones.

Reference

- AWS Academy Cloud Architecting – Lab: Creating a Highly Available Environment
- Figure: Created a Load balancer: Inventory-LB

Module 9 Guided Lab

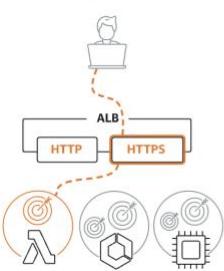
[EC2](#) > [Load balancers](#) > Compare and select load balancer type

Compare and select load balancer type

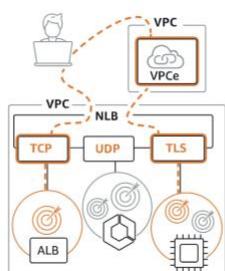
A complete feature-by-feature comparison along with detailed highlights is also available. [Learn more](#)

Load balancer types

Application Load Balancer Info



Network Load Balancer Info



Gateway Load Balancer Info



Create Application Load Balancer Info

The Application Load Balancer distributes incoming HTTP and HTTPS traffic across multiple targets such as Amazon EC2 instances, microservices, and containers, based on request attributes. When the load balancer receives a connection request, it evaluates the listener rules in priority order to determine which rule to apply, and if applicable, it selects a target from the target group for the rule action.

► How Elastic Load Balancing works

Basic configuration

Load balancer name

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

 Web-App-LB

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

Scheme Info

Scheme can't be changed after the load balancer is created.

Internet-facing

An internet-facing load balancer routes requests from clients over the internet to targets. Requires a public subnet. [Learn more](#)

Internal

An internal load balancer routes requests from clients to targets using private IP addresses.

IP address type Info

Select the type of IP addresses that your subnets use.

IPv4

Recommended for internal load balancers.

Dualstack

Includes IPv4 and IPv6 addresses.

Network mapping Info

The load balancer routes traffic to targets in the selected subnets, and in accordance with your IP address settings.

VPC Info

Select the virtual private cloud (VPC) for your targets or you can [create a new VPC](#). Only VPCs with an internet gateway are enabled for selection. The selected VPC can't be changed after the load balancer is created. To confirm the VPC for your targets, view your [target groups](#).

MyVPC

vpc-038b163a575d577e2

IPv4: 10.0.0.0/16



Mappings Info

Select at least two Availability Zones and one subnet per zone. The load balancer routes traffic to targets in these Availability Zones only. Availability Zones that are not supported by the load balancer or the VPC are not available for selection.

us-east-1a (use1-az2)

Subnet

subnet-0585160ec4da080ba

Public_Subnet_1 ▾

IPv4 address

Assigned by AWS

us-east-1b (use1-az4)

Subnet

subnet-0beb0d6f0d792588a

Public_Subnet_2 ▾

IPv4 address

Assigned by AWS

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](#).

Security groups

Select up to 5 security groups



⚠ Application Load Balancers require at least one security group. If none are selected, the VPC's default security group will be applied.

Create security group [Info](#)

A security group acts as a virtual firewall for your instance to control inbound and outbound traffic. To create a new security group, complete the fields below.

Basic details

Security group name [Info](#)

Name cannot be edited after creation.

Description [Info](#)

VPC [Info](#)

Inbound rules [Info](#)

Type [Info](#) Protocol [Info](#) Port range [Info](#) Source [Info](#) Description - optional

HTTP	TCP	80	Any... ▾	<input type="text" value="sg-0fd1403299b124d3f"/> Search	<input type="text" value="0.0.0.0 X"/>	Delete
HTTPS	TCP	443	Any... ▾	<input type="text" value="sg-0fd1403299b124d3f"/> Search	<input type="text" value="0.0.0.0 X"/>	Delete

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](#).

Security groups

Select up to 5 security groups



Web_app_LB_SG X
sg-0e1932b7395c9c3d3 VPC: vpc-038b163a575d577e2

Listeners and routing [Info](#)

A listener is a process that checks for connection requests using the port and protocol you configure. The rules that you define for a listener determine how the load balancer routes requests to its registered targets.

▼ Listener HTTP:80 Remove

Protocol	Port	Default action Info
HTTP	: 80 1-65535	Forward to <input type="text" value="Select a target group"/> ▼ Copy Create target group

Listener tags - optional
Consider adding tags to your listener. Tags enable you to categorize your AWS resources so you can more easily manage them.

Add listener tag
You can add up to 50 more tags.

Add listener

Basic configuration

Settings in this section can't be changed after the target group is created.

Choose a target type

Instances

- Supports load balancing to instances within a specific VPC.
- Facilitates the use of [Amazon EC2 Auto Scaling](#) to manage and scale your EC2 capacity.

IP addresses

- Supports load balancing to VPC and on-premises resources.
- Facilitates routing to multiple IP addresses and network interfaces on the same instance.
- Offers flexibility with microservice based architectures, simplifying inter-application communication.
- Supports IPv6 targets, enabling end-to-end IPv6 communication, and IPv4-to-IPv6 NAT.

Lambda function

- Facilitates routing to a single Lambda function.
- Accessible to Application Load Balancers only.

Application Load Balancer

- Offers the flexibility for a Network Load Balancer to accept and route TCP requests within a specific VPC.
- Facilitates using static IP addresses and PrivateLink with an Application Load Balancer.

Target group name

Web-app-LB-Target

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

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.

MyVPC

vpc-038b163a575d577e2

IPv4: 10.0.0.0/16

▼ Advanced health check settings

[Restore defaults](#)

Health check port

The port the load balancer uses when performing health checks on targets. By default, the health check port is the same as the target group's traffic port. However, you can specify a different port as an override.

Traffic port

Override

Healthy threshold

The number of consecutive health checks successes required before considering an unhealthy target healthy.

2

2-10

Unhealthy threshold

The number of consecutive health check failures required before considering a target unhealthy.

2

2-10

Timeout

The amount of time, in seconds, during which no response means a failed health check.

5 seconds

2-120

Interval

The approximate amount of time between health checks of an individual target.

10 seconds

5-300

Success codes

The HTTP codes to use when checking for a successful response from a target. You can specify multiple values (for example, "200,202") or a

EC2 > Target groups > Create target group

Step 1

[Specify group details](#)

Step 2

[Register targets](#)

Register targets

This is an optional step to create a target group. However, to ensure that your load balancer routes traffic to this target group you must register your targets.

Available instances (1/1)

Filter instances

< 1 >

<input checked="" type="checkbox"/>	Instance ID	Name	State	Security groups
<input checked="" type="checkbox"/>	i-0a7043c935570f3db	Web_App_Server	Running	Web_App_SG

⌚ Successfully created the target group: Web-app-LB-Target. Anomaly detection is automatically applied to all registered targets. Results can be viewed in the Targets tab.

EC2 > Target groups > Web-app-LB-Target

Web-app-LB-Target

[Actions ▾](#)

Introducing Automatic Target Weights (ATW) to increase application availability

Automatic Target Weights is achieved by turning on anomaly mitigation, which provides responsive, dynamic distribution of traffic to targets based on anomaly detection results. All HTTP/HTTPS target groups now include anomaly detection by default. [Learn more ↗](#)

Details

arn:aws:elasticloadbalancing:us-east-1:984309630308:targetgroup/Web-app-LB-Target/2853202b8cd1d4f

Target type
Instance

Protocol : Port
HTTP: 80

Protocol version
HTTP1

VPC
vpc-038b163a575d577e2 ↗

IP address type
IPv4

Load balancer
[None associated](#)

0
Total targets

0
Healthy

0
Unhealthy

0
Unused

0
Initial

0
Draining

0 Anomalous

Listeners and routing [Info](#)

A listener is a process that checks for connection requests using the port and protocol you configure. The rules that you define for a listener determine how the load balancer routes requests to its registered targets.

The screenshot shows the configuration for a Listener named "HTTP:80". The "Protocol" is set to "HTTP" and the "Port" is "80". The "Default action" is "Forward to" a target group named "Web-app-LB-Target". The target type is "Instance, IPv4". Below this, there is a link to "Create target group".

Listener tags - optional
Consider adding tags to your listener. Tags enable you to categorize your AWS resources so you can more easily manage them.

[Add listener tag](#)
You can add up to 50 more tags.

[Add listener](#)

The screenshot shows the "Load balancers" list with one entry: "Web-App-LB". The details page for this load balancer is also shown, displaying information such as VPC (vpc-038b163a575d577e2), IP address type (IPv4), and Availability Zones (subnet-0585160ec4da080ba, us-east-1a (use1-ac2)).

Task 2: Implementing Amazon EC2 Auto Scaling

Create a new launch template, and use an Auto Scaling group to launch the EC2 instances that host the web application.

To accomplish this, you can create an AMI from the running instance, or create a new AMI and install the necessary packages and application code. Then, configure an Auto Scaling group to use the load balancer.

Tips:

- Use a Target tracking policy.
- Set the Auto scaling group size according to your estimated requirements.
- You can use the default values (for example, for group size and CPU utilization) initially and then adjust them later as needed.

Reference

- AWS Academy Cloud Architecting – Lab: Creating a Highly Available Environment

The screenshot shows the AWS EC2 Instances page. A single instance, 'Web_App_Server' (ID: i-0a7043c935570f3db), is listed. The 'Actions' menu is open, and the 'Create image' option is highlighted. Other options in the menu include 'Connect', 'View details', 'Manage instance state', 'Instance settings', 'Networking', 'Security', 'Image and templates', and 'Monitor and troubleshoot'.

The screenshot shows the 'Create image' wizard. It has three steps: 'Select instances', 'Configure image options', and 'Review and launch'. The current step is 'Configure image options'. It displays the selected instance (i-0a7043c935570f3db), the chosen image name (Web_app_EMi), and the optional image description (Lab AMI for Web APP Server).

The screenshot shows the 'Create launch template' wizard. It has three steps: 'Select launch configuration', 'Configure launch template options', and 'Review and create'. The current step is 'Configure launch template options'. It displays the launch template name (Web-App-LT), the template version description (A prod webserver for MyApp), and the 'Auto Scaling guidance' checkbox (unchecked). Other visible sections include 'Template tags' and 'Source template'.

▼ Application and OS Images (Amazon Machine Image) [Info](#)

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. Search or Browse for AMIs if you don't see what you are looking for below

Search our full catalog including 1000s of application and OS images

Recents **My AMIs** Quick Start

Don't include in launch template Owned by me

Shared with me

 Browse more AMIs
Including AMIs from AWS, Marketplace and the Community

Amazon Machine Image (AMI)

Web_app_AMI
ami-0a190f5b278cff87d
2023-12-09T16:26:57.000Z Virtualization: hvm ENA enabled: true Root device type: ebs

Description

Lab AMI for Web APP Server

Architecture AMI ID
x86_64 ami-0a190f5b278cff87d

▼ Instance type [Info](#) | [Get advice](#) Advanced

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

All generations

[Compare instance types](#)

Additional costs apply for AMIs with pre-installed software

▼ 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

vockey

 [Create new key pair](#)

▼ Network settings [Info](#)

Subnet [Info](#)

Don't include in launch template [▼](#)

 Create new subnet [↗](#)

When you specify a subnet, a network interface is automatically added to your template.

Firewall (security groups) [Info](#)

A security group is a set of firewall rules that control the traffic for your instance. Add rules to allow specific traffic to reach your instance.

Select existing security group

Create security group

Security groups [Info](#)

Select security groups [▼](#)

 Compare security group rules

Web_app_LB_SG sg-0e1932b7395c9c3d3 [X](#)

VPC: vpc-038b163a575d577e2

► Advanced network configuration

IAM instance profile [Info](#)

LabInstanceProfile

arn:aws:iam::984309630308:instance-profile/LabInstanceProfile

[▼](#) Create new IAM profile



Hostname type [Info](#)

Don't include in launch template [▼](#)

DNS Hostname [Info](#)

Enable resource-based IPv4 (A record) DNS requests

Enable resource-based IPv6 (AAAA record) DNS requests

Instance auto-recovery [Info](#)

Don't include in launch template [▼](#)

Shutdown behavior [Info](#)

Don't include in launch template [▼](#)

Stop - Hibernate behavior [Info](#)

Don't include in launch template [▼](#)

Termination protection [Info](#)

Don't include in launch template [▼](#)

Stop protection [Info](#)

Don't include in launch template [▼](#)

Detailed CloudWatch monitoring [Info](#)

Enable [▼](#)

Figure: Created a Launch template for the auto scaling group

The screenshot shows the AWS EC2 Launch templates page. The top navigation bar includes 'EC2 > Launch templates > Web-App-LT'. The main title is 'Web-App-LT (lt-08a568b2f5991c0e9)'. On the right, there are 'Actions' and 'Delete template' buttons. Below the title, the section 'Launch template details' contains the following information:

Launch template ID	Launch template name	Default version	Owner
lt-08a568b2f5991c0e9	Web-App-LT	1	arn:aws:sts::984309630308:assumed-role/voclabs/user2378920=sowmyavara26@gwu.edu

The screenshot shows the 'Create Auto Scaling group' wizard at Step 1: 'Choose launch template'. The left sidebar lists steps: 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), Step 5 - optional (Add notifications), Step 6 - optional (Add tags), and Step 7 (Review). The main area is titled 'Choose launch template' with a 'Name' input field containing 'Web_app_ASG'. A note states: 'Specify a launch template that contains settings common to all EC2 instances that are launched by this Auto Scaling group.' Below the name input is a note: 'Must be unique to this account in the current Region and no more than 255 characters.' The next step, 'Launch template', is shown with 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.' The 'Launch template' dropdown is set to 'Web-App-LT', and there are 'Create a launch template' and 'Cancel' buttons.

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.

▼ C

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.

▼ C

us-east-1a | subnet-09481951a13efdff
(Private_Subnet_1)
10.0.2.0/24

us-east-1b | subnet-06a2a65fc34eb3034
(Private_Subnet_2)
10.0.4.0/24

[Create a subnet](#)

Configure advanced options - *optional* Info

Integrate your Auto Scaling group with other services to distribute network traffic across multiple servers using a load balancer or to establish service-to-service communications using VPC Lattice. You can also set options that give you more control over health check replacements and monitoring.

Load balancing Info

Use the options below to attach your Auto Scaling group to an existing load balancer, 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.

▼ C

Web-app-LB-Target | HTTP X

Application Load Balancer: Web-App-LB

Health checks

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.

EC2 health checks

[Always enabled](#)

Additional health check types - optional | [Info](#)

[Turn on Elastic Load Balancing health checks](#) Recommended

Elastic Load Balancing monitors whether instances are available to handle requests. When it reports an unhealthy instance, EC2 Auto Scaling can replace it on its next periodic check.

[Turn on VPC Lattice health checks](#)

VPC Lattice can monitor whether instances are available to handle requests. If it considers a target as failed a health check, EC2 Auto Scaling replaces it after its next periodic check.

Health check grace period | [Info](#)

This time period delays the first health check until your instances finish initializing. It doesn't prevent an instance from terminating when placed into a non-running state.

90 seconds

Additional settings

Monitoring | [Info](#)

[Enable group metrics collection within CloudWatch](#)

Default instance warmup | [Info](#)

The amount of time that CloudWatch metrics for new instances do not contribute to the group's aggregated instance metrics, as their usage data is not reliable yet.

[Enable default instance warmup](#)

Group size [Info](#)

Set the initial size of the Auto Scaling group. After creating the group, you can change its size to meet demand, either manually or by using automatic scaling.

Desired capacity type

Choose the unit of measurement for the desired capacity value. vCPUs and Memory(GiB) are only supported for mixed instances groups configured with a set of instance attributes.

Units (number of instances) ▾

Desired capacity

Specify your group size.

2

Scaling [Info](#)

You can resize your Auto Scaling group manually or automatically to meet changes in demand.

Scaling limits

Set limits on how much your desired capacity can be increased or decreased.

Min desired capacity

2

Equal or less than
desired capacity

Max desired capacity

2



Equal or greater than
desired capacity

Figure: Created the Auto Scaling Group: Web_app_ASG

EC2 > Auto Scaling groups

Auto Scaling groups (1/1) Info		Launch configurations	Launch templates	Actions ▾	Create Auto Scaling group
<input type="checkbox"/> Search your Auto Scaling groups ◀ 1 ▶ ⚙					
<input checked="" type="checkbox"/> Name		Launch template/configuration	Instances	Status	Desired capacity
<input checked="" type="checkbox"/> Web_app_ASG		Web-App-LT Version Default	0	Updating capacity...	2
				Min	Max
2 2					

Auto Scaling group: Web_app_ASG

[Details](#) | [Activity](#) | [Automatic scaling](#) | [Instance management](#) | [Monitoring](#) | [Instance refresh](#)

Group details				Edit
Auto Scaling group name Web_app_ASG	Desired capacity 2	Desired capacity type Units (number of instances)	Amazon Resource Name (ARN) arn:aws:autoscaling:us-east-1:984309630308:autoScalingGroup:eed8936f-6239-4865-8235-5788a085abd9:autoScalingGroupName/Web_app_ASG	
Date created Sat Dec 09 2023 11:35:42 GMT-0500 (Eastern Standard Time)	Minimum capacity 2	Status Updating capacity		
	Maximum capacity 2			

(i) Inbound security group rules successfully modified on security group (sg-0fd1403299b124d3f | Web_App_SG) X

[▶ Details](#)

[EC2](#) > [Security Groups](#) > [sg-0fd1403299b124d3f - Web_App_SG](#)

sg-0fd1403299b124d3f - Web_App_SG

[Actions](#) ▾

Details			
Security group name Web_App_SG	Security group ID sg-0fd1403299b124d3f	Description Allow HTTP	VPC ID vpc-038b163a575d577e2
Owner 984309630308	Inbound rules count 2 Permission entries	Outbound rules count 1 Permission entry	

[Inbound rules](#) | [Outbound rules](#) | [Tags](#)

Inbound rules (2)

[Manage tags](#) | [Edit inbound rules](#)

Search		C	Manage tags	Edit inbound rules		
<input type="checkbox"/>	Name	Security group rule...	IP version	Type	Protocol	Port
<input type="checkbox"/>	-	sgr-094791729c90b8...	-	HTTP	TCP	80

sg-0b820cd4584821e21 - DB_SG

Actions ▾

Details

Security group name	Security group ID	Description	VPC ID
<input type="checkbox"/> DB_SG	<input type="checkbox"/> sg-0b820cd4584821e21	<input type="checkbox"/> Database Security Group	<input type="checkbox"/> vpc-038b163a575d577e2 [2]
Owner	Inbound rules count	Outbound rules count	
<input type="checkbox"/> 984309630308	1 Permission entry	1 Permission entry	

[Inbound rules](#)[Outbound rules](#)[Tags](#)

Inbound rules (1)



Manage tags

Edit inbound rules

<input type="checkbox"/>	Name	Security group rule...	IP version	Type	Protocol	Port
<input type="checkbox"/>	-	sgr-0f7957e15c65b0a2c	-	MySQL/Aurora	TCP	3306

Web-app-LB-Target

Actions ▾



Introducing Automatic Target Weights (ATW) to increase application availability



Automatic Target Weights is achieved by turning on anomaly mitigation, which provides responsive, dynamic distribution of traffic to targets based on anomaly detection results. All HTTP/HTTPS target groups now include anomaly detection by default. [Learn more](#) [2]

Details

 arn:aws:elasticloadbalancing:us-east-1:984309630308:targetgroup/Web-app-LB-Target/2853202b8cd1d4f4

Target type Instance	Protocol : Port HTTP: 80	Protocol version HTTP1	VPC vpc-038b163a575d577e2 [2]		
IP address type IPv4	Load balancer None associated				
2 Total targets	<input checked="" type="radio"/> 2 Healthy	<input checked="" type="radio"/> 0 Unhealthy	<input type="radio"/> 0 Unused	<input type="radio"/> 0 Initial	<input type="radio"/> 0 Draining

► Distribution of targets by Availability Zone (AZ)

Select values in this table to see corresponding filters applied to the Registered targets table below.

Task 3: Accessing the application

Access the application and perform a few tasks to test it. For example, view, add, delete, and modify student records.

Task 4: Load testing the application

Perform a load test on the application to monitor scaling.

Use *Script-2* from the AWS Cloud9 Scripts file (*cloud9-scripts.yml*) to perform the load test. Recall that you used scripts from this file in previous tasks.

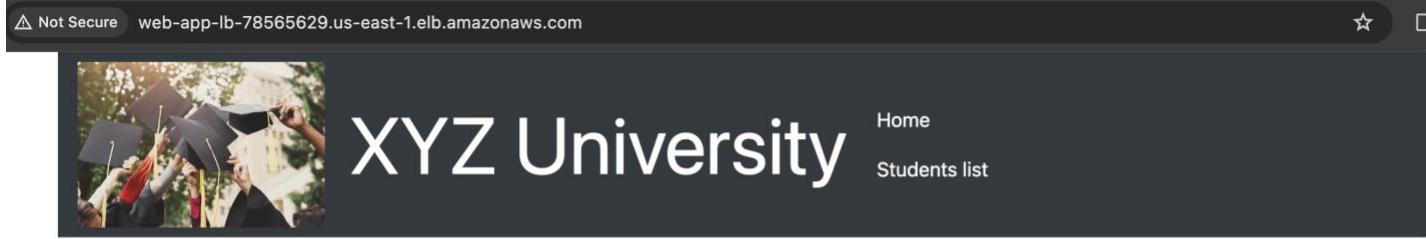
Notes:

- Access the web application from the browser by using the load balancer URL.

Figure: Inventory-LB load balancer in active state with 2 availability zones and copied the DNS

The screenshot shows the AWS Elastic Load Balancing (ELB) console. At the top, there is a navigation bar with 'EC2 > Load balancers'. Below this, a table titled 'Load balancers (1/1)' displays one entry: 'Web-App-LB'. The table includes columns for Name, DNS name, State, VPC ID, Availability Zones, and Type. The 'DNS name' column shows 'Web-App-LB-78565629.us-east-1.elb.amazonaws.com (A Record)'. The 'State' column indicates the load balancer is 'Active'. The 'Availability Zones' column shows '2 Availability Zones'. A tooltip 'DNS name copied' appears over the 'DNS name' column. At the bottom of the page, there is a summary section for 'Load balancer: Web-App-LB' with details such as Load balancer type (Application), Status (Active), VPC (vpc-038b163a575d577e2), IP address type (IPv4), Scheme (Internet-facing), Hosted zone (Z35SXDOTRQ7X7K), Availability Zones (subnet-0585160ec4da080ba, subnet-0beb0d6f0d792588a), Date created (December 9, 2023, 11:23 (UTC-05:00)), and Load balancer ARN (arn:aws:elasticloadbalancing:us-east-1:984309630308:loadbalancer/app/Web-App-LB/856631ac1aa1fea5).

Figure: Accessing the web application using the load balancer DNS.



Welcome

Use this app to keep track of your student inquiries

[List of students](#)

- Use AWS Cloud9 to run the load testing scripts against the load balancer.

Figure: On running the Script-2 for load testing using load balancer DNS

A screenshot of the AWS Cloud9 IDE terminal. The terminal window title is "Welcome" and the tab is "cloud9-scripts.yml". The terminal output shows the execution of an npm script to install loadtest, followed by the execution of the loadtest command with specific parameters. The output details the load test results, including requests per second, mean latency, and percentile response times.

```
voclabs:~/environment $ npm install -g loadtest
added 30 packages in 4s

1 package is looking for funding
  run `npm fund` for details
voclabs:~/environment $ loadtest --rps 1000 -c 500 -k http://web-app-lb-78565629.us-east-1.elb.amazonaws.com/
Requests: 4994, requests per second: 999, mean latency: 2.9 ms

Target URL:          http://web-app-lb-78565629.us-east-1.elb.amazonaws.com/
Max time (s):        10
Target rps:          1000
Concurrent clients: 32
Agent:              keepalive

Completed requests: 9998
Total errors:        0
Total time:          10 s
Mean latency:        2.4 ms
Effective rps:       1000

Percentage of requests served within a certain time
  50%      1 ms
  90%      5 ms
  95%      8 ms
  99%     16 ms
100%    58 ms (longest request)
voclabs:~/environment $
```

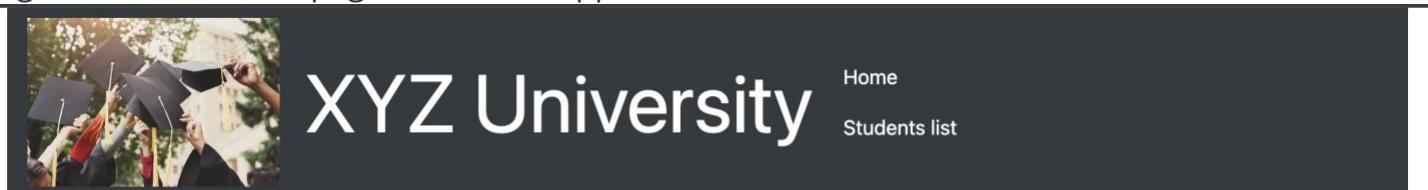
Reference

- [loadtest Tool Repository on GitHub](#)

Figure: Main Page of Web Application



Figure: Students List page of the web application



Name	Address	City	State	Email	Phone	
Jay	1234 Elm Street	Springfield	IL	jaymor@gwu.edu	5551234567	<button>edit</button>
Emily Johnson	789 Maple Lane	Lakeside City	CA	emilyj@gwu.edu	5559876543	<button>edit</button>
Daniel Anderson	456 Pine Street	Mountainview	NY	daniela@gwu.edu	5559874637	<button>edit</button>

[Add a new student](#)

Ending your session

Reminder: This is a long-lived lab environment. Data is retained until you either use the allocated budget or the course end date is reached (whichever occurs first).

To preserve your budget when you are finished for the day, or when you are finished actively working on the assignment for the time being, do the following:

1. At the top of this page, choose **End Lab**, and then choose **Yes** to confirm that you want to end the lab.

A message panel indicates that the lab is terminating.

Note: Choosing **End lab** in this lab environment will *not* delete the resource you have created. They will still be there the next time you choose Start lab (for example, on another day).

2. To close the panel, choose **Close** in the upper-right corner.

© 2023, Amazon Web Services, Inc. or its affiliates. All rights reserved.