

Digital Egypt Pioneers Initiative - DEPI

New Horizon Alex.

AWS Academy - AWS Cloud Architect

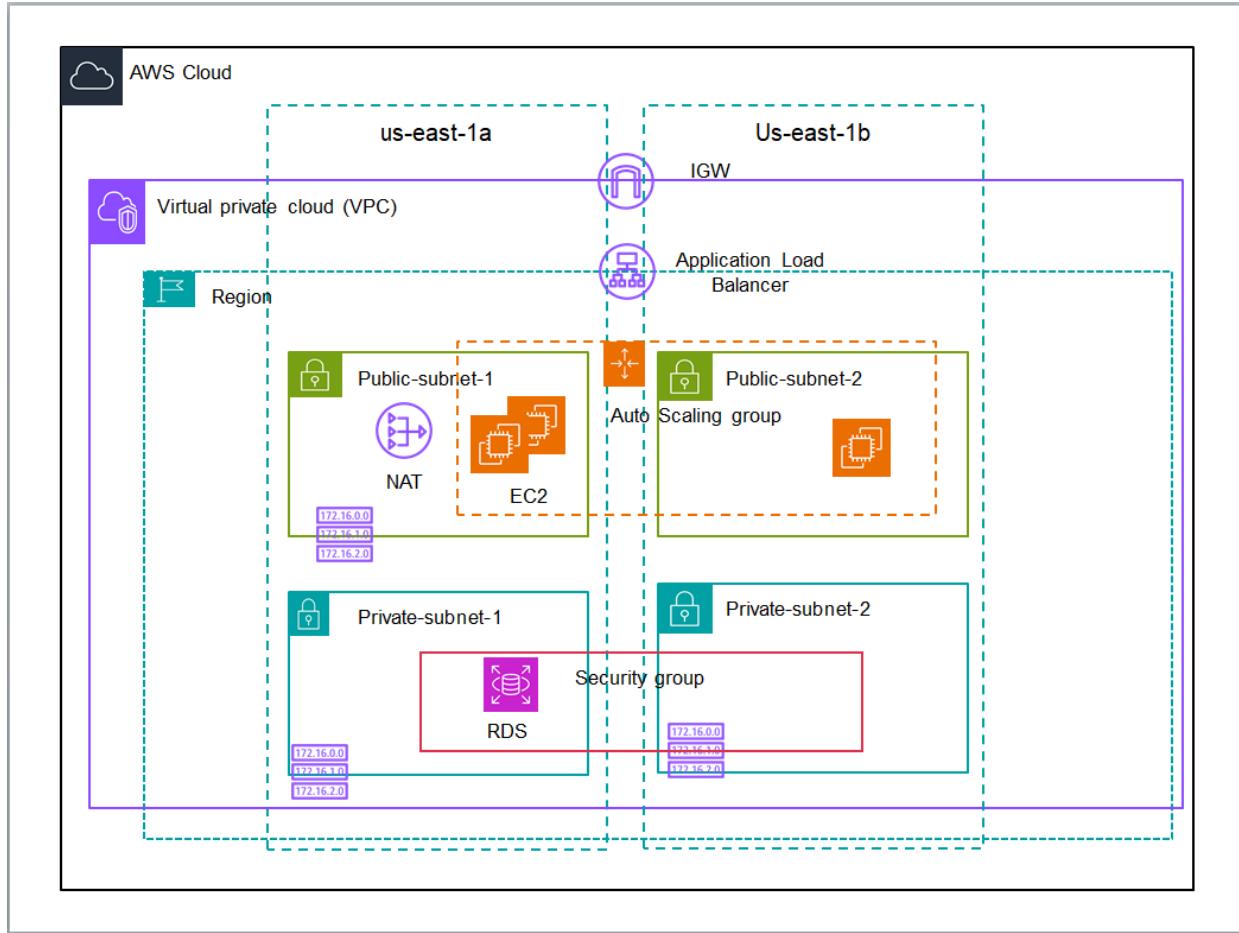
Project report

By: Hamza Shokry Warda

Building a Highly Available, Scalable Web Application

Phase 1: Planning the design and estimating cost

Task 1: Creating an architectural diagram



Task 2: Developing a cost estimate

- EC2
 - Workload: constant usage
 - Number of instances: 2
 - Payment options: EC2 instances saving plans, no upfront
 - storage: gp3, 10GB
 - data transfer: Inbound 100GB/month, Outbound 50GB/month
- RDS for MYSQL
 - Nodes: 1
 - Instance: db.t3.micro
 - deployment: single AZ
 - storage: 20GB
- VPC
 - NAT: count: 1, data 30GB/month
 - Public IPv4 in-use: 2, in-hold: 0

- Load Balancer
 - Process 20GB/month

AWS pricing calculator

[AWS Pricing Calculator](#) > [My Estimate](#) > Create estimate: Configure Amazon EC2

Feedback Language: English ▾ Contact Sales ▾ Create an AWS Account

Step 1 Add service

Description XYZ-Project price

Step 2 Configure service

Choose a location type [Info](#)

Region US East (N. Virginia)

Choose a Region

EC2 specifications [Info](#)

Tenancy Choose the tenancy type to run your Amazon EC2 instances on.

Shared Instances

Operating system Choose the operating system to run your Amazon EC2 instances on.

Ubuntu Pro

Workloads Choose the graph that best represents your monthly workload

Constant usage Daily spike traffic Weekly spike traffic Monthly spike traffic

Number of instances Please specify the total number of instances that you need each month.

2

EC2 Instances (1)

Total Upfront cost: 0.00 USD
Total Monthly cost: 18.66 USD

Show Details ▾ Cancel Save and view summary **Save and add service**

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AWS pricing calculator

[AWS Pricing Calculator](#) > [My Estimate](#) > Create estimate: Configure Amazon RDS for MySQL

Feedback Language: English ▾ Contact Sales ▾ Create an AWS Account

Step 1 Add service

Description Enter a description for your estimate

Step 2 Configure service

Choose a location type [Info](#)

Region US East (N. Virginia)

Choose a Region

MySQL instance specifications [Info](#)

Nodes Enter the number of DB instances that you need.

1

Q db.t3.micro X

Selected Instance:
db.t3.micro
vCPU: 2
Memory: 1 GiB

Utilization (On-Demand only)
With utilization, you still have to stop the instance to get the cost benefit. Utilization only affects OnDemand pricing for instances and not the storage, backups, etc.

Value Unit
24 Hours/Day

Deployment option

Total Upfront cost: 0.00 USD
Total Monthly cost: 11.06 USD

Show Details ▾ Cancel Save and view summary **Save and add service**

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AWS pricing calculator

Successfully added Amazon RDS for MySQL estimate.

AWS Pricing Calculator > My Estimate > Create estimate: Configure Amazon Virtual Private Cloud (VPC)

Create estimate: Configure Amazon Virtual Private Cloud (VPC) [Info](#)

Step 1

Add service

Description: XY2-VPC pricing

Step 2

Configure service

Choose a location type [Info](#)

Region: US East (N. Virginia)

Select VPC service(s) that you want to estimate

VPN Connection Network Address Translation (NAT) Gateway Public IPv4 Address
 Transit Gateway AWS PrivateLink Data Transfer
 Gateway Load Balancer IPAM Network Access Analyzer
 Traffic Mirroring Reachability Analyzer Cloud WAN

Network Address Translation (NAT) Gateway feature

Service settings [Info](#)

Number of NAT Gateways

Total Upfront cost: 0.00 USD Total Monthly cost: 41.50 USD

Show Details ▾

Cancel Save and view summary **Save and add service**

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AWS pricing calculator

Successfully added Elastic Load Balancing estimate.

AWS Pricing Calculator > My Estimate > Create estimate: Configure AWS Secrets Manager

Create estimate: Configure AWS Secrets Manager [Info](#)

Step 1

Add service

Description: Enter a description for your estimate

Step 2

Configure service

Choose a location type [Info](#)

Region: US East (N. Virginia)

Secrets configuration [Info](#)

Number of secrets: 1

Average duration of each secret
Validating timeframe of each secret. A secret valid for an entire month would be 730 hours or 30 days.

Value: 30 Unit: days

▶ Show calculations

API calls [Info](#)

Total Upfront cost: 0.00 USD Total Monthly cost: 0.40 USD

Show Details ▾

Cancel Save and view summary **Save and add service**

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The screenshot shows the AWS Pricing Calculator interface. In the top right corner, there are links for 'Feedback', 'Language: English', 'Contact Sales', and 'Create an AWS Account'. Below these are 'Export' and 'Share' buttons. The main title is 'My Estimate' with an 'Edit' link. On the left, under 'Estimate summary', it shows 'Upfront cost: 0.00 USD', 'Monthly cost: 88.21 USD', and 'Total 12 months cost: 1,058.52 USD' (Includes upfront cost). To the right, there's a 'Getting Started with AWS' section with 'Get started for free' and 'Contact Sales' buttons. The central part is titled 'My Estimate' with a search bar. It lists several services with their costs and details:

Service Name	Status	Upfront cost	Monthly cost	Description	Region	Config Summary
Amazon EC2	-	0.00 USD	18.66 USD	XYZ-Project price	US East (N. Virginia)	Tenancy (Shared Instances), O...
Amazon RDS for MySQL	-	0.00 USD	11.06 USD	-	US East (N. Virginia)	Storage amount (20 GB), Stor...
Amazon Virtual Private Cloud ...	-	0.00 USD	41.50 USD	XYZ-VPC pricing	US East (N. Virginia)	Number of NAT Gateways (1) ...
Elastic Load Balancing	-	0.00 USD	16.59 USD	-	US East (N. Virginia)	Number of Application Load B...
AWS Secrets Manager	-	0.00 USD	0.40 USD	-	US East (N. Virginia)	Number of secrets (1), Averag...

At the bottom, there are links for 'Privacy', 'Site terms', 'Cookie preferences', and a copyright notice: '© 2024, Amazon Web Services, Inc. or its affiliates. All rights reserved.' There is also a yellow circular icon with a question mark.

Phase 2: Creating a basic functional web application

Task 1: Creating a virtual network

The screenshot shows the AWS VPC dashboard. The left sidebar includes 'EC2 Global View', 'Virtual private cloud' (with 'Your VPCs' selected), 'Route tables', 'Internet gateways', 'Egress-only internet gateways', 'Carrier gateways', 'DHCP option sets', 'Elastic IPs', 'Managed prefix lists', 'Endpoints', 'Endpoint services', 'NAT gateways', and 'Peering connections'. Under 'Security', there are 'Network ACLs' and 'Security groups'. At the bottom, there are 'CloudShell' and 'Feedback' buttons.

The main area displays 'Your VPCs (1/2) info' with a table showing two entries:

Name	VPC ID	State	IPv4 CIDR	IPv6 CIDR	DHCP option set	Main route table
ypc-07054029235b47150	Available	172.31.0/16	-	dopt-03052252798331...	rtb-0f6b5b5...	
Project1-vpc	ypc-020cff20362965c7e	Available	10.0.0.0/16	-	dopt-03052252798331...	rtb-05cb49...

Below this, a detailed view for 'vpc-020cff20362965c7e / Project1-vpc' is shown with tabs for 'Details', 'Resource map', 'CIDRs', 'Flow logs', 'Tags', and 'Integrations'. The 'Details' tab contains the following information:

Details	Value	Details	Value
VPC ID	vpc-020cff20362965c7e	State	Available
Tenancy	Default	DHCP option set	dopt-030522527983314e5
Default VPC	No	IPv4 CIDR	10.0.0.0/16
Network Address Usage metrics	Disabled	Route 53 Resolver DNS Firewall rule groups	-
		DNS hostnames	Enabled
		Main route table	rtb-03cb49d49b71bdd2
		IPv6 pool	-
		Owner ID	601748510907
		DNS resolution	Enabled
		Main network ACL	acl-05088cf9db68be80f
		IPv6 CIDR (Network border group)	-

At the bottom, there are links for 'CloudShell', 'Feedback', and a copyright notice: '© 2024, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences'.

The screenshot shows the AWS VPC dashboard with the 'Route tables' section selected. The table lists five route tables:

Name	Route table ID	Explicit subnet associations	Edge associations	Main	VPC
-	rtb-0f6b5b5649aa4b7a	-	-	Yes	vpc-07054029235b47150
Project1-rtb-private1-us-east-1a	rtb-04904878ba4ca47362	subnet-01403f1a9daae7...	-	No	vpc-020cff20362965c7e Project1-vpc
Project1-rtb-public	rtb-0809dcf7b681cf005	2 subnets	-	No	vpc-020cff20362965c7e Project1-vpc
Project1-rtb-private2-us-east-1b	rtb-05b929139fcd5fc1	subnet-05f9d694d7766c...	-	No	vpc-020cff20362965c7e Project1-vpc
-	rtb-03ch49cd49b71bdd2	-	-	Yes	vpc-020cff20362965c7e Project1-vpc

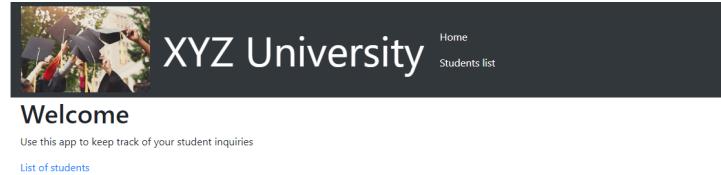
Task 2: Creating a virtual machine

The screenshot shows the AWS EC2 Instances page with one instance listed:

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS
ProjectWebapp	i-0d8669bcf96f88d26	Running	t2.micro	2/2 checks passed	View alarms +	us-east-1a	ec2-18-209-98-231.co...

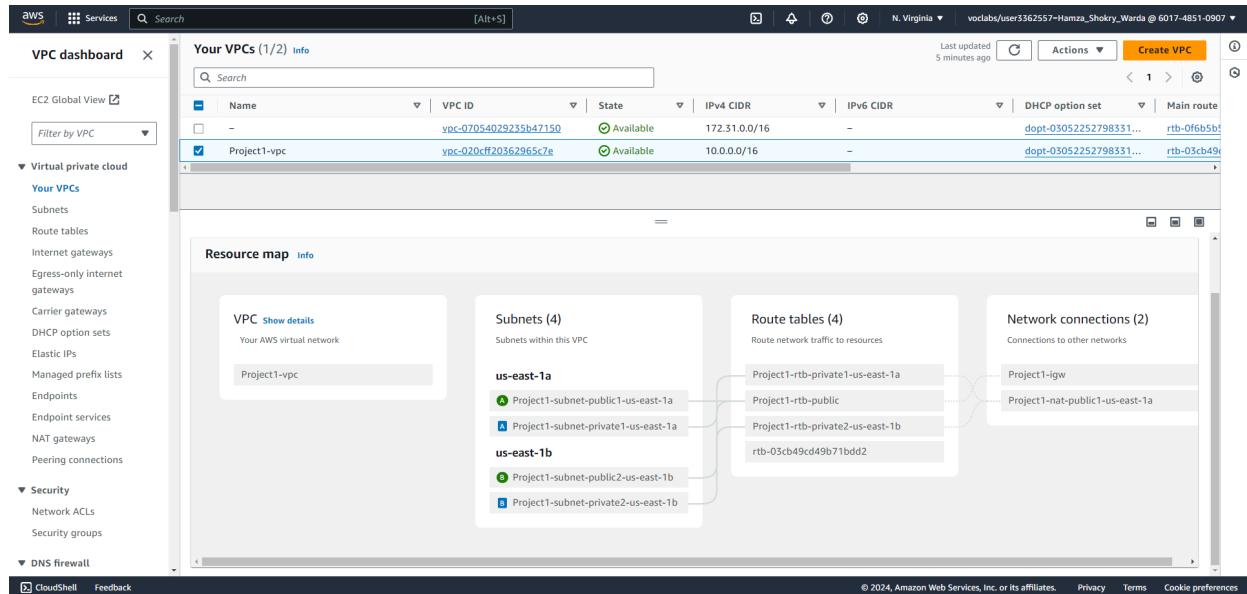
The instance details page for 'i-0d8669bcf96f88d26 (ProjectWebapp)' is shown, with tabs for Details, Status and alarms, Monitoring, Security, Networking, Storage, and Tags.

Task 3: Testing the deployment



Phase 3: Decoupling the application components

Task 1: Changing the VPC configuration

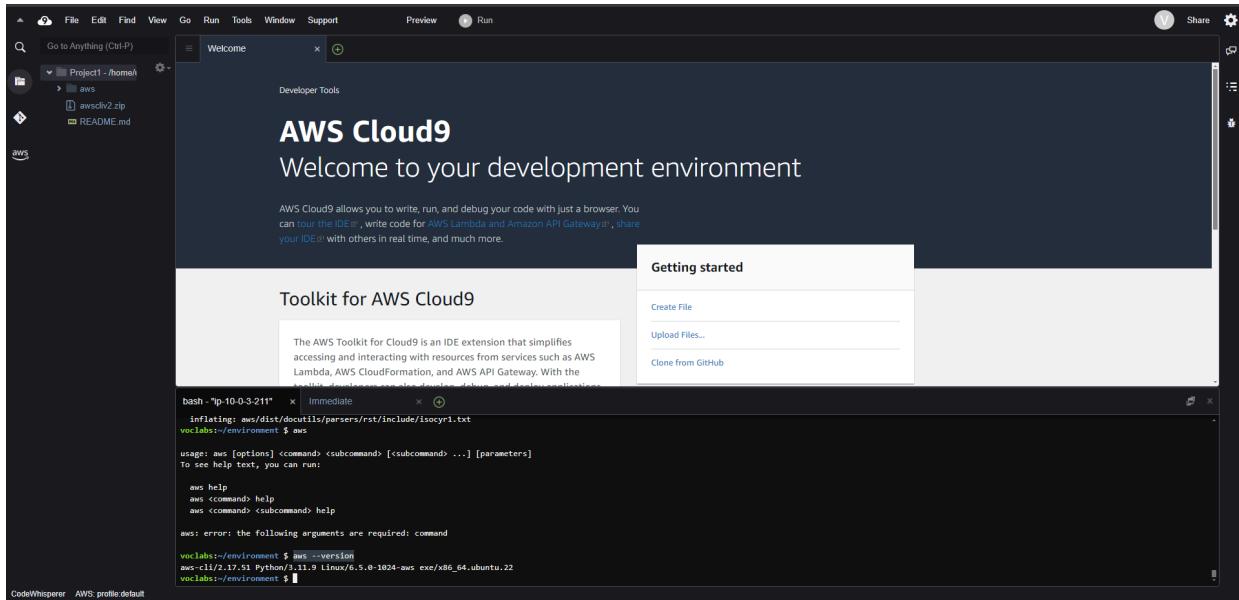


Task 2: Creating and configuring the Amazon RDS database

The screenshot shows the AWS RDS console with the database 'xyz-db' selected. The left sidebar includes links for Dashboard, Databases (selected), 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, Events, Event subscriptions, Recommendations (5), and Certificate update. The main area displays the 'Summary' tab for 'xyz-db', showing details like DB identifier, Status (Available), Role (Instance), Engine (MySQL Community), and Region & AZ (us-east-1a). Below the summary, tabs for Connectivity & security, Monitoring, Logs & events, Configuration, Zero-ETL integrations, Maintenance & backups, Tags, and Recommendations are visible. The 'Connectivity & security' tab is active, showing information about the endpoint, networking (VPC, subnet group, and subnets), and security (VPC security groups). A note indicates that publicly accessible is set to No.

Task 3: Configuring the development environment

The screenshot shows the AWS Cloud9 console. The left sidebar lists My environments, Shared with me, All account environments, and Documentation. The main area shows a success message: 'Successfully created Project1. To get the most out of your environment, see Best practices for using AWS Cloud9'. It also provides a note: 'For capabilities similar to AWS Cloud9, explore AWS Toolkits in your own IDE and AWS CloudShell in the AWS Management Console. Learn more'. The 'Environments' section shows one environment named 'Project1' with details: Cloud9 IDE (Open), Environment type (EC2 instance), Connection (Secure Shell (SSH)), Permission (Owner), and Owner ARN (arn:aws:sts::601748510907:assumed-role/voclabs/user3362557=Hamza_Shokry_Warda). Buttons for Delete, View details, Open in Cloud9, and Create environment are available.



Task 4: Provisioning Secrets Manager

The screenshot shows the AWS Secrets Manager console. At the top, it lists a secret named "Mydbsecret" with the ARN "arn:aws:secretsmanager:us-east-1:601748510907:secret:Mydbsecret-MMOH4l". Below this, there are tabs for "Overview", "Rotation", "Versions", "Replication", and "Tags". The "Overview" tab is selected.

Secret value Info
Retrieve and view the secret value.

Key/value Plaintext

Secret key	Secret value
username	admin
password	e5\$19Y0xe%_mm5-Oi?8IqJ1LDm#[
engine	mysql
host	webappdb.ceohkjmx8qw.us-east-1.rds.amazonaws.com
port	3306
dbInstanceIdentifier	webappdb

Resource permissions - optional Info
Add or edit a resource policy to access secrets across AWS accounts.

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The screenshot shows the AWS Secrets Manager interface. At the top, a green banner displays a success message: "You successfully stored the secret Mydbsecret. To show it in the list, choose Refresh. Use the sample code to update your applications to retrieve this secret." Below the banner, the navigation bar shows "AWS Secrets Manager > Secrets > Mydbsecret". The main title is "Mydbsecret". Under "Secret details", there is a table with two columns: "Encryption key" (aws/secretsmanager) and "Secret name" (Mydbsecret). The "Secret ARN" is listed as arn:aws:secretsmanager:us-east-1:601748510907:secret:Mydbsecret-MM0H4l. The "Secret description" field is empty. Below the table, tabs for "Overview", "Rotation", "Versions", "Replication", and "Tags" are visible. A "Secret value" section contains tabs for "Key/value" (selected) and "Plaintext". The "Key/value" tab shows a single entry: "Secret key" (CloudShell) and "Secret value" (Feedback). The bottom right corner includes copyright information: "© 2024, Amazon Web Services, Inc. or its affiliates." and links for "Privacy", "Terms", and "Cookie preferences".

Task 5: Provisioning a new instance for the web server

The screenshot shows the AWS EC2 Instances page. The left sidebar lists various EC2 management options like EC2 Dashboard, Instances, Instance Types, Launch Templates, etc. The main content area shows the "Instance summary for i-010d0a793da804a86 (XYZ-WebApp-Pro)". The instance is currently running. Key details include:

- Instance ID: i-010d0a793da804a86 (XYZ-WebApp-Pro)
- Public IPv4 address: 54.165.36.96 [open address]
- Private IP DNS name (IPv4 only): ip-10-0-7-225.ec2.internal
- Instance state: Running
- Instance type: t2.micro
- VPC ID: vpc-01a40544699ce26dd (XYZ-vpc)
- Subnet ID: subnet-0616c1ff4e4f05e15 (XYZ-subnet-public1-us-east-1a)
- Instance ARN: arn:aws:ec2:us-east-1:601748510907:instance/i-010d0a793da804a86
- Platform: Ubuntu (Inferred)
- AMI ID: ami-0e86e20dae9224db8

The bottom of the page shows a status bar with "Hello world from WebServer!".

Task 7: Testing the application

The screenshot shows a web application for XYZ University. At the top, there's a header with the university logo and navigation links for 'Home' and 'Students list'. Below the header, a section titled 'All students' displays a table with two rows of student data. Each row includes columns for Name, Address, City, State, Email, and Phone, along with an 'edit' button. A green button at the bottom left says 'Add a new student!'. The table has a light gray background with white text.

Name	Address	City	State	Email	Phone
Hamza Warda	Gamila Bu-Hreid	Alexandria	Alexandria	hamzashokrywarda@gmail.com	01092445261
Hamza Warda2	Gamila Bu-Hreid2	Alexandria2	Alexandria2	hamzashokrywarda@gmail.com2	010924452612

Phase 4: Implementing high availability and scalability

Task 1: Creating an Application Load Balancer

The screenshot shows the AWS CloudFront console. On the left, a sidebar lists various services like Images, AMIs, and Auto Scaling. The main area shows a distribution named 'XYZ-Dist' with a status of 'Active'. It includes sections for 'Listeners and rules', 'Network mapping', 'Resource map - new', 'Security', 'Monitoring', 'Integrations', 'Attributes', and 'Tags'. At the bottom, there are tabs for 'Listeners and rules', 'Network mapping', 'Resource map - new', 'Security', 'Monitoring', 'Integrations', 'Attributes', and 'Tags'. The 'Listeners and rules' tab is active, showing one rule with a protocol of 'HTTP' and a port of '80'. The 'Network mapping' tab shows a single origin named 'Origin 1' with an ARN of 'arn:aws:lambda:us-east-1:123456789012:function:my-lambda-function'. The 'Resource map - new' tab shows a single resource named 'Resource 1' with an ARN of 'arn:aws:cloudfront:us-east-1:123456789012:resource/12345678901234567890123456789012'. The 'Security' tab shows a security policy named 'CloudFront Default Security Policy'. The 'Monitoring' tab shows a CloudWatch Metrics stream named 'CloudFront Metrics Stream'. The 'Integrations' tab shows a Lambda function named 'CloudFront Lambda Function'. The 'Attributes' tab shows a 'Cache Behavior' with a 'Default Cache Behavior' and a 'Custom Cache Behavior'. The 'Tags' tab shows a single tag named 'Environment' with a value of 'Production'.

The screenshot shows the AWS Load Balancer Resource Map interface. At the top, it displays basic information about a load balancer: Load balancer ARN (arn:aws:elasticloadbalancing:us-east-1:601748510907:loadbalancer/app/XYZ-LB/5e3d37c2be1a8830), Subnet (Subnet-0f7eb4a8b0c98e13 us-east-1b (use1-az1)), and DNS name (info XYZ-LB-758354339.us-east-1.elb.amazonaws.com (A Record)). Below this, there are tabs for Listeners and rules, Network mapping, Resource map - new (selected), Security, Monitoring, Integrations, Attributes, and Tags.

The Resource map section is titled "Resource map - XYZ-LB". It shows the following components and their connections:

- Listeners (1):** HTTP:80 (1 rule)
- Rules (1):** Priority default: Forward to target group (Conditions (If): If no other rule applies)
- Target groups (1):** XYZ-WebApp-TG (2 targets)
 - Instance i-0a8bca427c9b01f95 (Status: 2 healthy, 0 unhealthy, 0 pending, 0 failed)
 - Instance i-0cd6685bf3a2e9eab (Status: 2 healthy, 0 unhealthy, 0 pending, 0 failed)
- Targets (2):**
 - i-0a8bca427c9b01f95 (Port 80, Status: Healthy)
 - i-0cd6685bf3a2e9eab (Port 80, Status: Healthy)

At the bottom right of the Resource map section, there are buttons for "Last fetched seconds ago", "Edit", "Export", and "Give feedback".

Task 2: Implementing Amazon EC2 Auto Scaling

The screenshot shows the AWS Auto Scaling Groups page for the group XYZ-WebApp-ASG. The left sidebar includes links for Capacity Reservations, Images, AMIs, AMI Catalog, Elastic Block Store, Network & Security, Load Balancing, and Auto Scaling.

The main content area has tabs for Details, Activity, Automatic scaling, Instance management, Monitoring, and Instance refresh. The Details tab is selected.

Group details:

Auto Scaling group name	Desired capacity	Desired capacity type	Amazon Resource Name (ARN)
XYZ-WebApp-ASG	2	Units (number of instances)	arn:aws:autoscaling:us-east-1:601748510907:autoScalingGroup:90d7a459-4a2-4e64-9776-f2b2c1fe1a8:autoScalingGroupName/XYZ-WebApp-ASG
Date created	Minimum capacity	Status	
Fri Sep 20 2024 22:31:40 GMT+0300 (Eastern European Summer Time)	1	-	
	Maximum capacity		
	3		

Launch template:

Launch template	AMI ID	Instance type	Owner
It-04384024880e9ca2 XYZ-WebApp-LT	ami-0e86e20dae9224db8	t2.micro	arn:aws:sts::601748510907:assumed-role/voclabs/user3362557:Hamza_Shokry_Warda
Version	Security groups	Security group IDs	Create time
Default	-	sg-0c1ee0f68d0e60848	Fri Sep 20 2024 22:27:21 GMT+0300 (Eastern European Summer Time)

The screenshot shows the AWS EC2 Auto Scaling Groups page for the 'XYZ-WebApp-ASG'. The left sidebar includes sections for Capacity Reservations, Images, AMIs, AMI Catalog, Elastic Block Store, Volumes, Snapshots, Lifecycle Manager, Network & Security, Security Groups, Elastic IPs, Placement Groups, Key Pairs, Network Interfaces, Load Balancing, Load Balancers, Target Groups, Trust Stores, and Auto Scaling. The main content area displays the 'Instance management' tab for the 'XYZ-WebApp-ASG'. It lists two instances: 'l-0a8bca4279b01f95' and 'l-0cd6685bf3a2e9eab', both labeled as 'InService' and 't2.micro'. The status for both instances is 'Healthy'. Below the instance table, there is a section for 'Lifecycle hooks (0)' which states 'No lifecycle hooks are currently configured.' and a 'Create lifecycle hook' button.

Task 3: Accessing the application

The screenshot shows a web browser window displaying the 'XYZ University' homepage. The URL in the address bar is 'Not secure 3.235.136.225'. The page features a dark header with the university's name and a 'Welcome' message. Below the header, there is a sub-header 'Use this app to keep track of your student inquiries' and a link 'List of students'. The browser interface includes standard navigation buttons and a toolbar at the top.