Cloud Computing CMPU3007: 2020 – 21

Assignment 2

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Contents

Introduction:

For this assignment I had to design a three-tier web application to be hosted in AWS cloud. The architecture as you can see in the figure below has a multi-AZ web server. For the assignment I started off by creating a vpc which I named project_vpc. The region I used was N. Virginia as specified in the brief. After making the vpc I made the 12 subnets needed I.e. the three public subnets in the three availability zones us-east-1a, 1b and 1c and the nine private subnets (three private web, database and app subnets each). These were also in the availability zones us-east-1a, 1b and 1c. After creating the subnets, I made two route table called 'Project public route table' and 'Project private route table'. The public route table has three subnet associations which are public subnet 1, 2 and 3. And the private route table has 9 subnet associations which are all nine private subnets.

The next thing I done was create a database subnet group called project_dp_subnet_group. This subnet group stored all three database subnets which I created earlier. After making the database subnet group I made my database. I used MySQL to make the database.

After creating my project database, I made two EC2 instance called web tier and app server I used these when I was creating my elastic load balancers. After that then I made to AMI's one for the web tier and one for the app tier. I then needed to create two load balancers one for the app tier and one for the web tier. I called these two load balancers WebELB and AppELB. After creating the two elb's I needed to make two autoscaling groups but before I could do that, I needed to make two launch configurations first, one for the web auto scaling group and one for the app autoscaling group. After making these two launch configurations I made the two autoscaling groups.

The final step for me was to test the load balancers and make sure the connection worked. Gladly it did work, and you can find the screenshots in the section titled Required Screenshots.

Three Tier Web application:
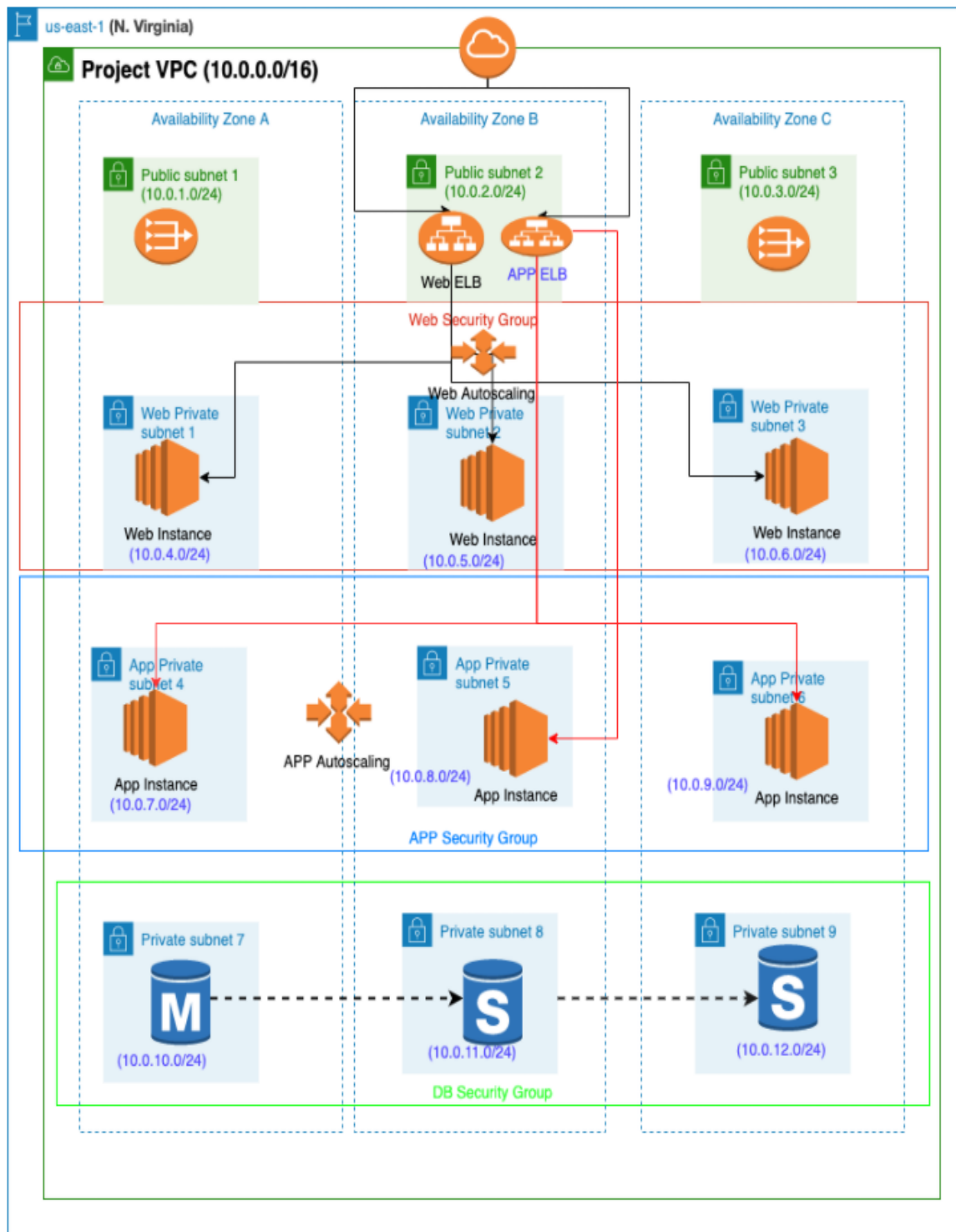
1. A VPC named (project_vpc) in the (N. Virginia)

VPC:

Figure 1: project_vpc

VPC > Your VPCs > vpc-06ac39ef8c94bfccd

vpc-06ac39ef8c94bfccd / project_vpc

Details Info

VPC ID vpc-06ac39ef8c94bfccd	**State** ⊘ Available	**DNS hostnames** Enabled	**DNS resolution** Enabled
Tenancy Default	**DHCP options set** dopt-e8dbb692	**Route table** rtb-0209838e2becd71a4	**Network ACL** acl-0ca1f9024874e28a7
Default VPC No	**IPv4 CIDR** 10.0.0.0/16	**IPv6 pool** –	**IPv6 CIDR (Network border group)** –
Owner ID 043692226793			

CIDRs | Flow logs | Tags

IPv4 CIDRs Info

CIDR	Status
10.0.0.0/16	⊘ Associated

IPv6 CIDRs Info

CIDR	Pool	Status

2. The web and app tiers are hosted in three availability zones (Create private subnets for each tier is recommended)

Subnets:

Figure 2: 12 subnets created

Subnets (18) Info

Actions ▼ | Create subnet

Name	Subnet ID	State	VPC	IPv4 CIDR	IPv6 CIDR	Available IPv4 addresses
Web Private subnet 3	subnet-0e26f7cc087ec2210	⊘ Available	vpc-06ac39ef8c94bfccd | proje...	10.0.6.0/24	–	251
Web Private subnet 2	subnet-0a6c6310f391a40c5	⊘ Available	vpc-06ac39ef8c94bfccd | proje...	10.0.5.0/24	–	251
Web Private subnet 1	subnet-05c95b97486231533	⊘ Available	vpc-06ac39ef8c94bfccd | proje...	10.0.4.0/24	–	251
Public Subnet 3	subnet-072645babe644f06d	⊘ Available	vpc-06ac39ef8c94bfccd | proje...	10.0.3.0/24	–	251
Public subnet 2	subnet-054a092a2d4a080fa	⊘ Available	vpc-06ac39ef8c94bfccd | proje...	10.0.2.0/24	–	251
Public subnet 1	subnet-036034e206a962b22	⊘ Available	vpc-06ac39ef8c94bfccd | proje...	10.0.1.0/24	–	250
DB Private subnet 9	subnet-0d29e823594c06f22	⊘ Available	vpc-06ac39ef8c94bfccd | proje...	10.0.12.0/24	–	251
DB Private subnet 8	subnet-0edf6b3e6b69f6c6d	⊘ Available	vpc-06ac39ef8c94bfccd | proje...	10.0.11.0/24	–	251
DB Private subnet 7	subnet-07dac226242f716c2	⊘ Available	vpc-06ac39ef8c94bfccd | proje...	10.0.10.0/24	–	251
App Private subnet 6	subnet-0ae33182f07c4b1d5	⊘ Available	vpc-06ac39ef8c94bfccd | proje...	10.0.9.0/24	–	251
App Private subnet 5	subnet-054806998444ab44f	⊘ Available	vpc-06ac39ef8c94bfccd | proje...	10.0.8.0/24	–	251
App Private subnet 1	subnet-01e02c4cb8d336bcf	⊘ Available	vpc-06ac39ef8c94bfccd | proje...	10.0.7.0/24	–	251
–	subnet-a185ecaf	⊘ Available	vpc-5acb0827	172.31.64.0/20	–	4091
–	subnet-f255e5ad	⊘ Available	vpc-5acb0827	172.31.32.0/20	–	4091
–	subnet-a7f84fc1	⊘ Available	vpc-5acb0827	172.31.0.0/20	–	4091
–	subnet-7cef525d	⊘ Available	vpc-5acb0827	172.31.80.0/20	–	4091
–	subnet-760c4a3b	⊘ Available	vpc-5acb0827	172.31.16.0/20	–	4091

Route Tables:

Figure 3: Project Private route table

	Name	Route Table ID	Explicit subnet association	Edge associations	Main	VPC ID	Owner
☐	Project Public route table	rtb-0c14d3f9a626ed956	3 subnets	-	No	vpc-06ac39ef8c94bfccd | ...	043692226793
☑	Project Private route table	rtb-0209838e2becd71a4	9 subnets	-	Yes	vpc-06ac39ef8c94bfccd | ...	043692226793
☐		rtb-d4f5baaa	-	-	Yes	vpc-5acb0827	043692226793

Edit subnet associations

Subnet ID	IPv4 CIDR	IPv6 CIDR
subnet-01e02c4cb8d336bcf | App Private subnet 1	10.0.7.0/24	-
subnet-0ae33182f07c4b1d5 | App Private subnet 6	10.0.9.0/24	-
subnet-0d29e823594c06f22 | DB Private subnet 9	10.0.12.0/24	-
subnet-0a6c6310f391a40c5 | Web Private subnet 2	10.0.5.0/24	-
subnet-05c95b97486231533 | Web Private subnet 1	10.0.4.0/24	-
subnet-054806998444ab44f | App Private subnet 5	10.0.8.0/24	-
subnet-07dac226242f716c2 | DB Private subnet 7	10.0.10.0/24	-
subnet-0e26f7cc087ec2210 | Web Private subnet 3	10.0.6.0/24	-
subnet-0edf6b3e6b69f6c6d | DB Private subnet 8	10.0.11.0/24	-

Figure 4: Project Public route table

Create route table   Actions ▾

Filter by tags and attributes or search by keyword

	Name	Route Table ID	Explicit subnet association	Edge associations	Main	VPC ID	Owner
☑	Project Public route table	rtb-0c14d3f9a626ed956	3 subnets	-	No	vpc-06ac39ef8c94bfccd | ...	043692226793

Route Table: rtb-0c14d3f9a626ed956

| Summary | Routes | Subnet Associations | Edge Associations | Route Propagation | Tags |

Edit subnet associations

Subnet ID	IPv4 CIDR	IPv6 CIDR
subnet-072645babe644f06d | Public Subnet 3	10.0.3.0/24	-
subnet-036034e206a962b22 | Public subnet 1	10.0.1.0/24	-
subnet-054a092a2d4a080fa | Public subnet 2	10.0.2.0/24	-

3. Host the DB in Multi AZ DB in private subnets

Database:

Figure 5: Database subnet group

RDS > Subnet groups > project_dp_subnet_group

project_dp_subnet_group

Subnet group details

VPC ID
vpc-06ac39ef8c94bfccd

ARN
arn:aws:rds:us-east-1:043692226793:subgrp:project_dp_subnet_group

Description
This subnet is for the DB Multi AZ's

Subnets (3)

Availability zone	Subnet ID	CIDR block
us-east-1c	subnet-0d29e823594c06f22	10.0.12.0/24
us-east-1a	subnet-07dac226242f716c2	10.0.10.0/24
us-east-1b	subnet-0edf6b3e6b69f6c6d	10.0.11.0/24

Figure 6: Database

RDS > Databases > project-db

project-db

Summary

DB identifier	CPU	Status	Class
project-db	0.00%	⊘ Available	db.m5.xlarge
Role	Current activity	Engine	Region & AZ
Instance	0 Connections	MySQL Community	us-east-1b

Connectivity & security | Monitoring | Logs & events | Configuration | Maintenance & backups | Tags

Connectivity & security

Endpoint & port

Endpoint
project-db.cnrauf2snrws.us-east-1.rds.amazonaws.com

Port
3306

Networking

Availability zone
us-east-1b

VPC
project_vpc (vpc-06ac39ef8c94bfccd)

Subnet group
project_dp_subnet_group

Subnets
subnet-0edf6b3e6b69f6c6d
subnet-07dac226242f716c2
subnet-0d29e823594c06f22

Security

VPC security groups
db_SecurityGroup (sg-069407e0e58fe0fd6)
(active)

Public accessibility
No

Certificate authority
rds-ca-2019

Certificate authority date
Aug 22nd, 2024

4. Use the following script for the web tier with Amazon Linux 2

EC2 Instances:
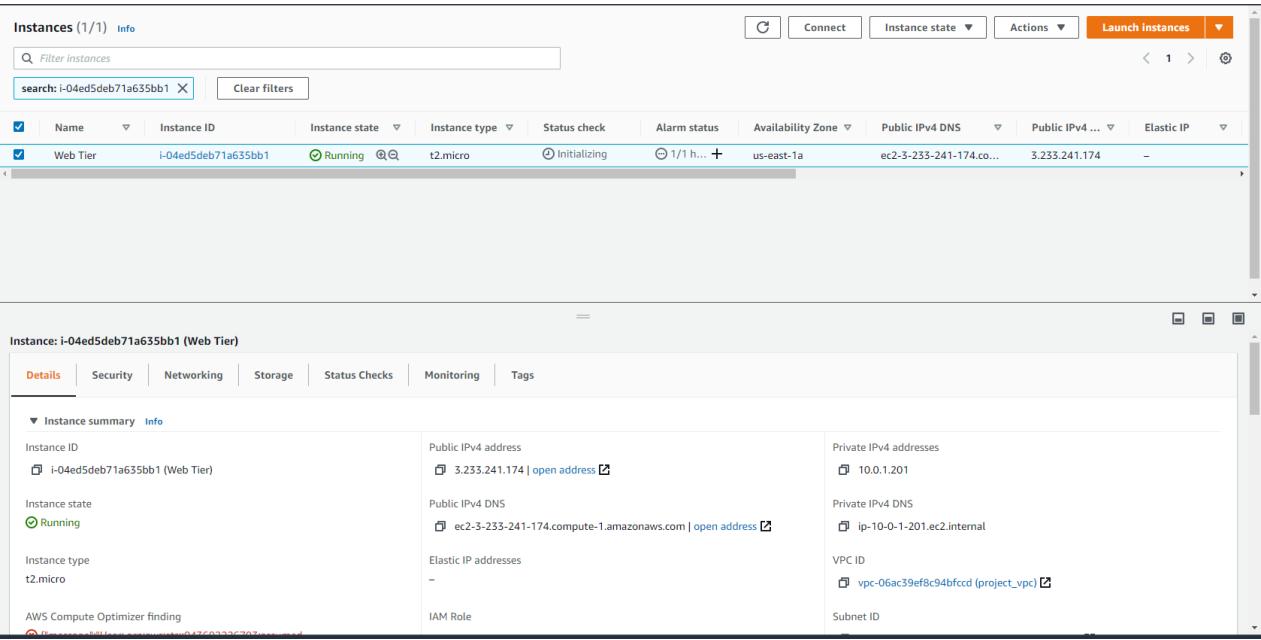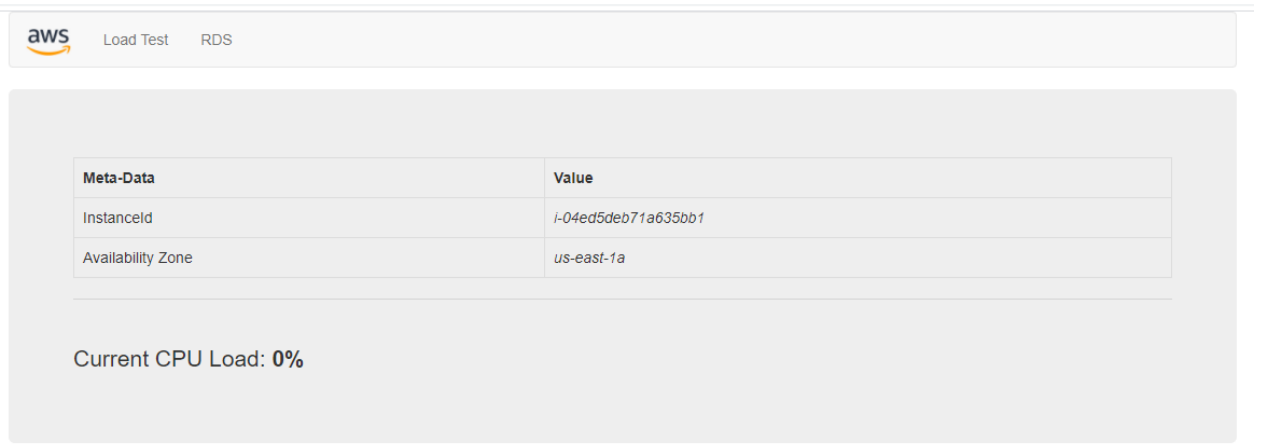
Figure 7.1: Web Tier Instance

Figure 7.2:

5. Use Amazon Linux 2 for the app tier with the following script

Figure 8.1: App Server Instance

Figure 8.2:

6. Make Sure that the web and app tier are scalable and available

Images:

Figure 9: Web Tier AMI and App Tier AMI

	Name	AMI Name	AMI ID	Source	Owner	Visibility	Status	Creation Date	Platform	Root Device	Virtualization
		APP Tier AMI	ami-0e3e71dfa0bbdce23	043692226793/...	043692226793	Private	available	December 19, 2020 at 9:49:...	Other Linux	ebs	hvm
		WebTierAMI	ami-066df4c6715f61f3f	043692226793/...	043692226793	Private	available	December 19, 2020 at 9:45:...	Other Linux	ebs	hvm

Snap Shots:

Figure 10: snapshots

	Name	Snapshot ID	Size	Description	Status	Started	Progress	Encryption
		snap-069aa0a41c6...	8 GiB	Created by CreateImage(i-005700e138c3909f1) for ami-0e3e7...	completed	December 19, 2020 at 9:51:...	available (100%)	Not Encrypted
		snap-0a521385b56...	8 GiB	Created by CreateImage(i-04ed5deb71a635bb1) for ami-066df...	completed	December 19, 2020 at 9:46:...	available (100%)	Not Encrypted

Elastic load balancers

Figure 11: Web and App ELB's

	Name	DNS name	State	VPC ID	Availability Zones	Type	Created At	Monitoring
	AppELB	AppELB-1720553169.us-eas...	provisioning	vpc-06ac39ef8c94bfccd	us-east-1a, us-east-1b,...	application	December 19, 2020 at 10:09...	
	WEBELB	WEBELB-1776923252.us-ea...	active	vpc-06ac39ef8c94bfccd	us-east-1a, us-east-1b,...	application	December 19, 2020 at 10:04:...	

Load balancer: AppELB

Description | Listeners | Monitoring | Integrated services | Tags

Basic Configuration

Name	AppELB
ARN	arn:aws:elasticloadbalancing:us-east-1:043692226793:loadbalancer/app/AppELB/9bf9874a548b9515
DNS name	AppELB-1720553169.us-east-1.elb.amazonaws.com (A Record)
State	provisioning
Type	application
Scheme	internet-facing
IP address type	ipv4

Edit IP address type

Launching configurations:

Figure 12: App Tier launch configuration and Web Tier launch configuration

Auto Scaling Groups:

Figure 13: App Tier Auto Scaling and Web Tier Auto Scaling Groups

EC2 Instances:

Figure 14: Instances after load test was done

	Name	Instance ID	Instance state		Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS	
☐	Project NAT	i-06fb774a75a20d0e6	⊘ Running	🔍🔍	t2.nano	⊘ 2/2 checks …	⊘ 1 alar… +	us-east-1a	ec2-3-221-122-16.co…	
☐	Web Tier	i-04ed5deb71a635bb1	⊖ Stopped	🔍🔍	t2.micro	–	⊖ 1/1 h… +	us-east-1a	–	
☐	App Server	i-005700e138c3909f1	⊖ Stopped	🔍🔍	t2.micro	–	⊖ 1/1 h… +	us-east-1a	–	
☐	Web Auto Scaling	i-099cfc841c2d2b2bd	⊘ Running	🔍🔍	t2.micro	⊘ 2/2 checks …	⊘ 1 alar… +	us-east-1a	–	
☐	App Auto Scaling	i-06936ccdda506f5a6	⊘ Running	🔍🔍	t2.micro	⊘ 2/2 checks …	⊘ 1 alar… +	us-east-1a	–	
☐	App Auto Scaling	i-046fed469861fb5d8	⊖ Terminated	🔍🔍	t2.micro	–	⊘ 1 alar… +	us-east-1a	–	
☐	App Auto Scaling	i-05dff3ea8f2588afc	⊖ Terminated	🔍🔍	t2.micro	–	⊘ 1 alar… +	us-east-1b	–	
☐	App Auto Scaling	i-03d1ea073640cb09c	⊖ Terminated	🔍🔍	t2.micro	–	⊘ 1 alar… +	us-east-1b	–	
☐	Web Auto Scaling	i-08ce35bbe90125702	⊘ Running	🔍🔍	t2.micro	⊘ 2/2 checks …	⊘ 1 alar… +	us-east-1c	–	
☐	App Auto Scaling	i-07b72ae68ec36336f	⊖ Terminated	🔍🔍	t2.micro	–	⊘ 1 alar… +	us-east-1c	–	
☐	App Auto Scaling	i-0923d335ae28203e0	⊘ Running	🔍🔍	t2.micro	⊘ 2/2 checks …	⊘ 1 alar… +	us-east-1c	–	

7. Required Screenshots:

Subnets:

Subnets (18) Info

	Name	Subnet ID	State	VPC	IPv4 CIDR	IPv6 CIDR	Available IPv4 addresses
	Web Private subnet 3	subnet-0e26f7cc087ec2210	⊘ Available	vpc-06ac39ef8c94bfccd	proje...	10.0.6.0/24	–	250
	Web Private subnet 2	subnet-0a6c6310f391a40c5	⊘ Available	vpc-06ac39ef8c94bfccd	proje...	10.0.5.0/24	–	251
	Web Private subnet 1	subnet-05c95b97486231533	⊘ Available	vpc-06ac39ef8c94bfccd	proje...	10.0.4.0/24	–	250
	Public Subnet 3	subnet-072645babe644f06d	⊘ Available	vpc-06ac39ef8c94bfccd	proje...	10.0.3.0/24	–	249
	Public subnet 2	subnet-054a092a2d4a080fa	⊘ Available	vpc-06ac39ef8c94bfccd	proje...	10.0.2.0/24	–	250
	Public subnet 1	subnet-036034e206a962b22	⊘ Available	vpc-06ac39ef8c94bfccd	proje...	10.0.1.0/24	–	246
	DB Private subnet 9	subnet-0d29e823594c06f22	⊘ Available	vpc-06ac39ef8c94bfccd	proje...	10.0.12.0/24	–	250
	DB Private subnet 8	subnet-0edf6b3e6b69f6c6d	⊘ Available	vpc-06ac39ef8c94bfccd	proje...	10.0.11.0/24	–	250
	DB Private subnet 7	subnet-07dac226242f716c2	⊘ Available	vpc-06ac39ef8c94bfccd	proje...	10.0.10.0/24	–	251
	App Private subnet 6	subnet-0ae33182f07c4b1d5	⊘ Available	vpc-06ac39ef8c94bfccd	proje...	10.0.9.0/24	–	250
	App Private subnet 5	subnet-054806998444ab44f	⊘ Available	vpc-06ac39ef8c94bfccd	proje...	10.0.8.0/24	–	251
	App Private subnet 1	subnet-01e02c4cb8d336bcf	⊘ Available	vpc-06ac39ef8c94bfccd	proje...	10.0.7.0/24	–	250

Load Balancers:

Create Load Balancer   Actions ▾

	Name	DNS name	State	VPC ID	Availability Zones	Type	Created At	Monitoring
	AppELB	AppELB-1720553169.us-eas...	active	vpc-06ac39ef8c94bfccd	us-east-1a, us-east-1b,...	application	December 19, 2020 at 10:09...	
	WEBELB	WEBELB-1776923252.us-ea...	active	vpc-06ac39ef8c94bfccd	us-east-1a, us-east-1b,...	application	December 19, 2020 at 10:04...	

Load balancer: WEBELB

| Description | Listeners | Monitoring | Integrated services | Tags |

Basic Configuration

Name	WEBELB
ARN	arn:aws:elasticloadbalancing:us-east-1:043692226793:loadbalancer/app/WEBELB/07bd3d391390fb96
DNS name	WEBELB-1776923252.us-east-1.elb.amazonaws.com (A Record)
State	active
Type	application
Scheme	internet-facing
IP address type	ipv4

Edit IP address type

Autoscaling Groups:

Auto Scaling groups (2)

🔄   Edit   Delete   **Create an Auto Scaling group**

🔍 Search your Auto Scaling groups

‹ 1 › ⚙

	Name	Launch template/configuration ⧉ ▽	Instances ▼	Status ▽	Desired capacity ▽	Min ▽	Max ▽	Availability Zones	▽
☐	**WebTierAutoScalingGroup**	WebTierLaunchConfig	2	-	2	2	6	us-east-1a, us-east-1b, us-east-1c	
☐	**AppTierAutoScaling**	AppTierLaunchConfig	2	-	2	2	6	us-east-1a, us-east-1b, us-east-1c	

Final Step Showing Access:

st-1.elb.amazonaws.com/load.php

aws   Load Test   RDS

Under High CPU Load! (auto refresh in 5 seconds)

Current CPU Load: **100%**

aws   Load Test   RDS

Address Book

Last name	First name	Phone	Email	Admin	
					Add Contact
Doe	Jane	010-110-1101	janed@someotheraddress.org	Edit	Remove
Johnson	Roberto	123-456-7890	robertoj@someaddress.com	Edit	Remove