

ICS 432 - 01 – Distributed and Cloud Computing Fall 2021

Assignment #2 : Load Balancing and Auto Scaling**Exercise 1:** Implementing a scalable AWS infrastructure to host a web site.**Homework report screen-shot #1:**

The screenshot shows the AWS EC2 Management Console with the URL https://console.aws.amazon.com/ec2/v2/home?region=us-east-1#SecurityGroup:group_id=sg-01526ecc2e712af5a. The left sidebar shows various AWS services like EC2 Dashboard, Global View, Events, Tags, Limits, Instances, AMIs, Elastic Block Store, Network & Security, and more. The main pane displays the details of a security group named 'danddank-ics432website-securitygroup'. Under the 'Inbound rules' tab, there are two entries:

Name	Security group rule...	IP version	Type	Protocol	Port range	Source	Description
-	sgr-03083ddff66737f662	IPv4	HTTP	TCP	80	0.0.0.0/0	-
-	sgr-02f689426de5707e6	IPv4	SSH	TCP	22	0.0.0.0/0	-

Homework report screen-shot #2:

```

ec2-user@ip-172-31-16-135:/data/www/ICS432Fall2021
ec2-user@ip-172-31-16-135 ICS432Fall2021]$ sudo nginx
[ec2-user@ip-172-31-16-135 ICS432Fall2021]$ curl http://localhost
<!DOCTYPE html>

<html>
  <head>
    <meta charset="utf-8" />
    <title>Home - ICS 432 testing Web site</title>
    <style>
      p.ex1 {
        font-size: 30px;
      }
    </style>
  </head>

  <body>
    <div style="text-align: left; text-indent: 0px; padding: 0px 0px 0px 0px; margin: 0px 0px 0px 0px;"><table width="100%" border="0" cellpadding="2" cellspacing="2" style="border-width: 0px; background-color: #fffff;"><tr align="top">
      <td colspan="2" width="523">
        <center>
          <a href="index.html">
            
          </a><br />
        </center>
      </td>
    </tr>
    <tr align="top">
      <td width="164">
        <ul>
          <li>
            <a href="index.html">Home</a>
          </li>
          <li>
            <a href="about-us.html">About Us</a>
          </li>
          <li>
            <a href="services.html">Topics Covered</a>
          </li>
        <li>

```

Homework report screen-shot #3:

My Classrooms Workbench Instance details | EC2 Manager Home - ICS 432 testing Web ...

Not Secure | 54.144.252.25/index.html

Metropolitan State University

ICS 432 Distributed and Cloud Computing Fall 2021

This is a very simple web site for testing purposes.

Cloud Computing VS *Distributed Computing*

Homework report screen-shot #4:

My Classrooms Workbench AMIs | EC2 Management Console

console.aws.amazon.com/ec2/v2/home?region=north-east-1#images:visibility=owned-by-me;sort=name

aws Services ▾

Instances Instance Types Launch Templates Spot Requests Savings Plans Reserved Instances Dedicated Hosts Scheduled Instances Capacity Reservations

Images **AMIs**

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

Auto Scaling Launch Configurations Auto Scaling Groups

Feedback English (US) ▾

Launch EC2 Image Builder Actions

Owned by me Filter by tags and attributes or search by keyword

Name	AMI Name	AMI ID	Source	Owner	Visibility	Status	Creation Date	Platform	Root Device Type	Virtualization	Deprecation Time
Danddark-ICS432-Image	ami-0358b99a865b73bf5	196580907486...	196580907486...	Private	available	October 19, 2021 at 11:55:2...	Other Linux	ebs	hvm	-	

Image: ami-0358b99a865b73bf5

Details Permissions Tags

AMI ID: ami-0358b99a865b73bf5	AMI Name: Danddark-ICS432-Image
Owner: 196580907486	Source: 196580907486/Danddark-ICS432-Image
Status: available	State Reason: -
Creation date: October 19, 2021 at 11:55:27 PM UTC-5	Platform details: Linux/UNIX
Architecture: x86_64	Usage operation: RunInstances
Image Type: machine	Virtualization type: hvm

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Homework report screen-shot #5:

Screenshot of the AWS EC2 Management Console showing the 'CreateLaunchConfiguration' page. The page is for creating a launch configuration for an Auto Scaling group. It includes fields for RAM disk ID, Metadata accessible, Metadata version, Metadata response hop limit, User data (containing a shell script to print the public IP), and IP address type (set to 'Only assign a public IP address to instances launched in a subnet with auto-assign public IP enabled (default)'). A note at the bottom states: 'Later, if you want to use a different launch configuration, you can create a new one and apply it to any Auto Scaling group. Existing launch configurations cannot be edited.'

Homework report screen-shot #6:

Screenshot of a web browser displaying a simple website for 'Metropolitan State University'. The page title is 'ICS 432 Distributed and Cloud Computing Fall 2021'. Below the title is a sub-header: 'This is a very simple web site for testing purposes.' To the left is a navigation menu with links: Home, About Us, Topics Covered, Contact Us, and Server IP. To the right is a diagram comparing 'Cloud Computing' and 'Distributed Computing'. The 'Cloud Computing' section shows a central cloud icon containing 'Storage', 'Database', 'Compute', and 'Applications', with arrows pointing from various devices (laptop, smartphone, tablet) to the cloud. The 'Distributed Computing' section shows a central node connected to multiple other nodes, with arrows labeled 'Task' and 'Result' indicating data flow between them.

My Classrooms Workbench Instances | EC2 Management Home - ICS 432 testing Web Home - ICS 432 testing Web

Not Secure | 54.196.57.121/index.html

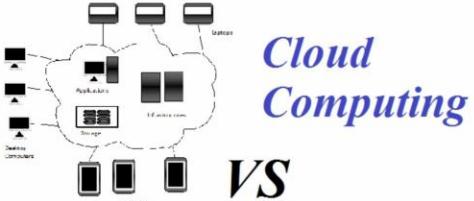
Metropolitan State University



ICS 432 Distributed and Cloud Computing Fall 2021

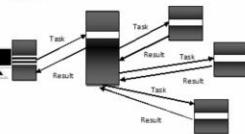
This is a very simple web site for testing purposes.

Cloud Computing



VS

Distributed Computing



Homework report screen-shot #7:

My Classrooms Workbench Instances | EC2 Management About Us - Very Simple Web Site About Us - Very Simple Web Site

Not Secure | 54.196.57.121/server-ip.html

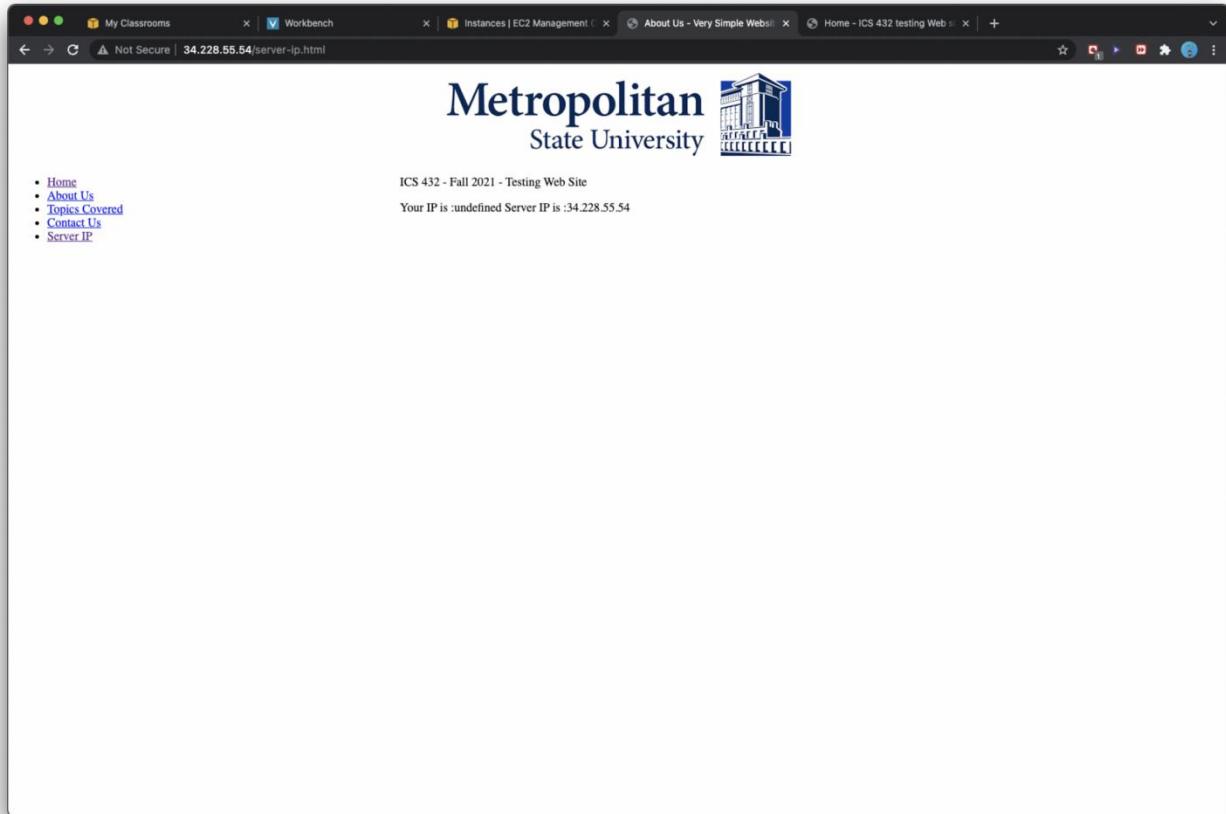
Metropolitan State University



ICS 432 - Fall 2021 - Testing Web Site

Your IP is :undefined Server IP is :54.196.57.121

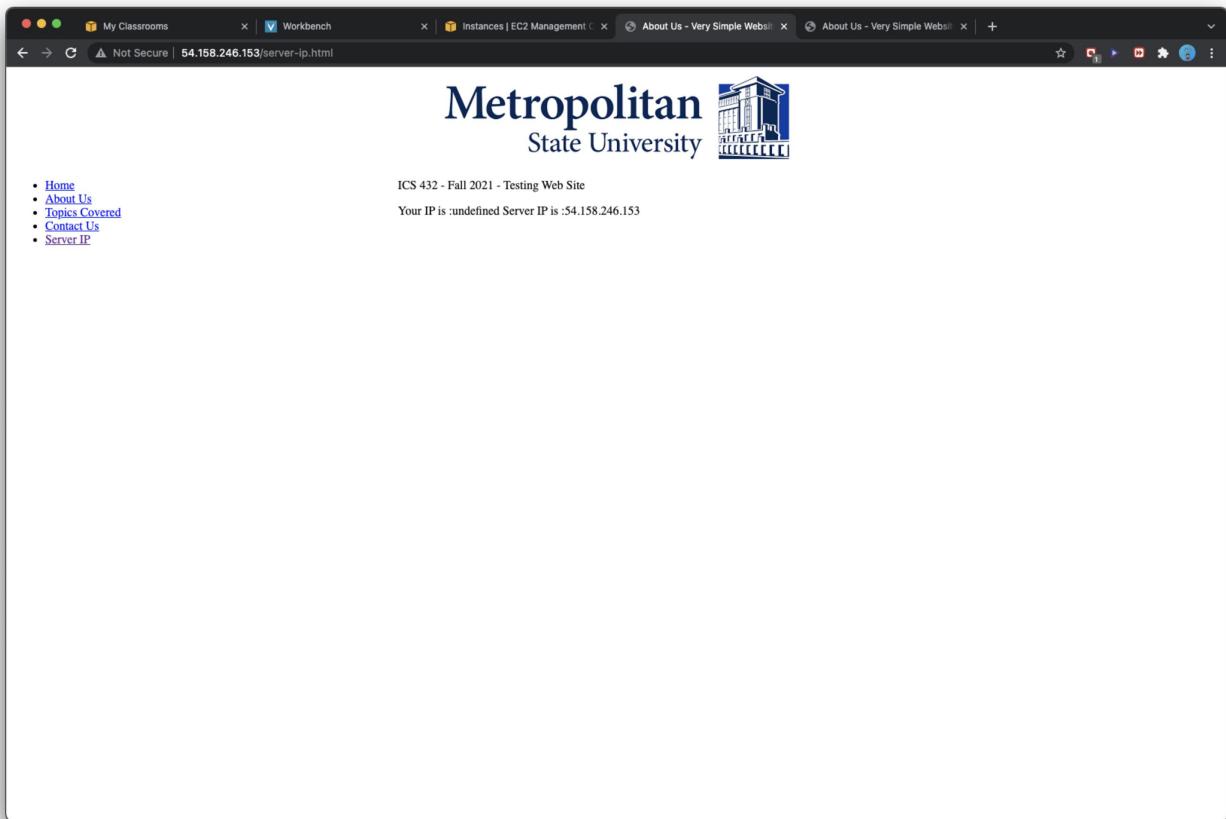
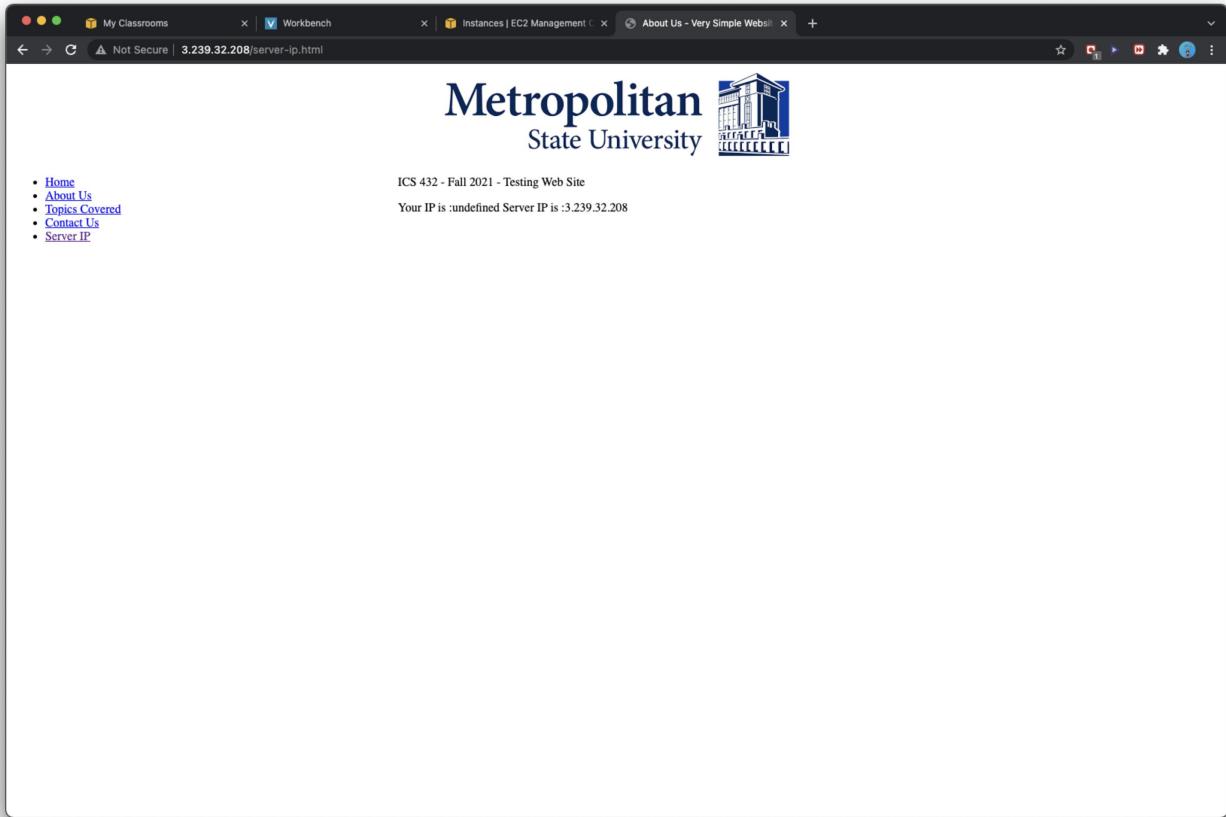
• Home
• About Us
• Topics Covered
• Contact Us
• Server IP



Homework report screen-shot #8:

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IP
run-by-auto-scaling-group2	i-0fbaf4b8b8774f270	Running	t3.micro	Initializing	No alarms	us-east-1c	ec2-5-23
Dandank Web Server	i-05a38511178bf90a0	Stopped	t2.micro	-	No alarms	us-east-1a	-
DandankLab4Instance3	i-022df32823332594e	Stopped	t2.micro	-	No alarms	us-east-1a	-
dandank-ics432website-instance	i-0a4af20a30b1214a	Running	t2.micro	2/2 checks passed	No alarms	us-east-1a	ec2-3-89
nalongson-ics432website-instance	i-04b45fe4b62fdfa45	Stopped	t2.micro	-	No alarms	us-east-1a	-
run-by-auto-scaling-group1	i-0460556cc3c152b65	Running	t3.micro	Initializing	No alarms	us-east-1a	ec2-54-1

Homework report screen-shot #9:



Homework report screen-shot #10:

Screenshot of the AWS EC2 Management Console showing the Load Balancers page.

Left Sidebar:

- Instances [New](#)
- Instance Types
- Launch Templates
- Spot Requests
- Savings Plans
- Reserved Instances [New](#)
- Dedicated Hosts
- Scheduled Instances
- Capacity Reservations
- Images
- AMIs
- Elastic Block Store
 - Volumes
 - Snapshots
 - Lifecycle Manager [New](#)
- Network & Security
 - Security Groups
 - Elastic IPs
 - Placement Groups
 - Key Pairs
 - Network Interfaces
- Load Balancing
 - Load Balancers**
 - Target Groups [New](#)
- Auto Scaling
 - Launch Configurations
 - Auto Scaling Groups

Top Bar: My Classrooms, Workbench, EC2 Management Console, Search for services, features, marketplace products, and docs [Option+5], vocstartsoft/user1564948=Nalongsone_Danddank @ 1965-8090-7486, N. Virginia, Support.

Main Content:

Create Load Balancer Actions ▾

Filter by tags and attributes or search by keyword

Name	DNS name	State	VPC ID	Availability Zones	Type
danddank-ics432web-load-b...	danddank-ics432web-load-balancer-572798612.us-east-1.elb.amazonaws.com	InService	vpc-64fa8419	us-east-1f, us-east-1e, ...	clas

Load balancer: danddank-ics432web-load-balancer

Description Instances Health check Listeners Monitoring Tags Migration

Connection Draining: Enabled, 300 seconds ([Edit](#))

Edit Instances

Instance ID	Name	Availability Zone	Status	Actions
i-0fbaf4b8b8774f270	run-by-auto-scaling-group2	us-east-1c	InService	Remove from Load Balancer
i-0460556cc3c152b65	run-by-auto-scaling-group1	us-east-1a	InService	Remove from Load Balancer

Edit Availability Zones

Availability Zone	Subnet ID	Subnet CIDR	Instance Count	Healthy?	Actions
us-east-1f	subnet-399b7c38	172.31.64.0/20	0	No (Availability Zone contains no healthy targets)	Remove from Load Balancer
us-east-1e	subnet-7c54254d	172.31.48.0/20	0	No (Availability Zone contains no healthy targets)	Remove from Load Balancer
us-east-1d	subnet-86dc4a7	172.31.80.0/20	0	No (Availability Zone contains no healthy targets)	Remove from Load Balancer
us-east-1c	subnet-15466b73	172.31.0.0/20	1	Yes	Remove from Load Balancer
us-east-1b	subnet-310b256e	172.31.32.0/20	0	No (Availability Zone contains no healthy targets)	Remove from Load Balancer
us-east-1a	subnet-9bf20fd7	172.31.16.0/20	1	Yes	Remove from Load Balancer

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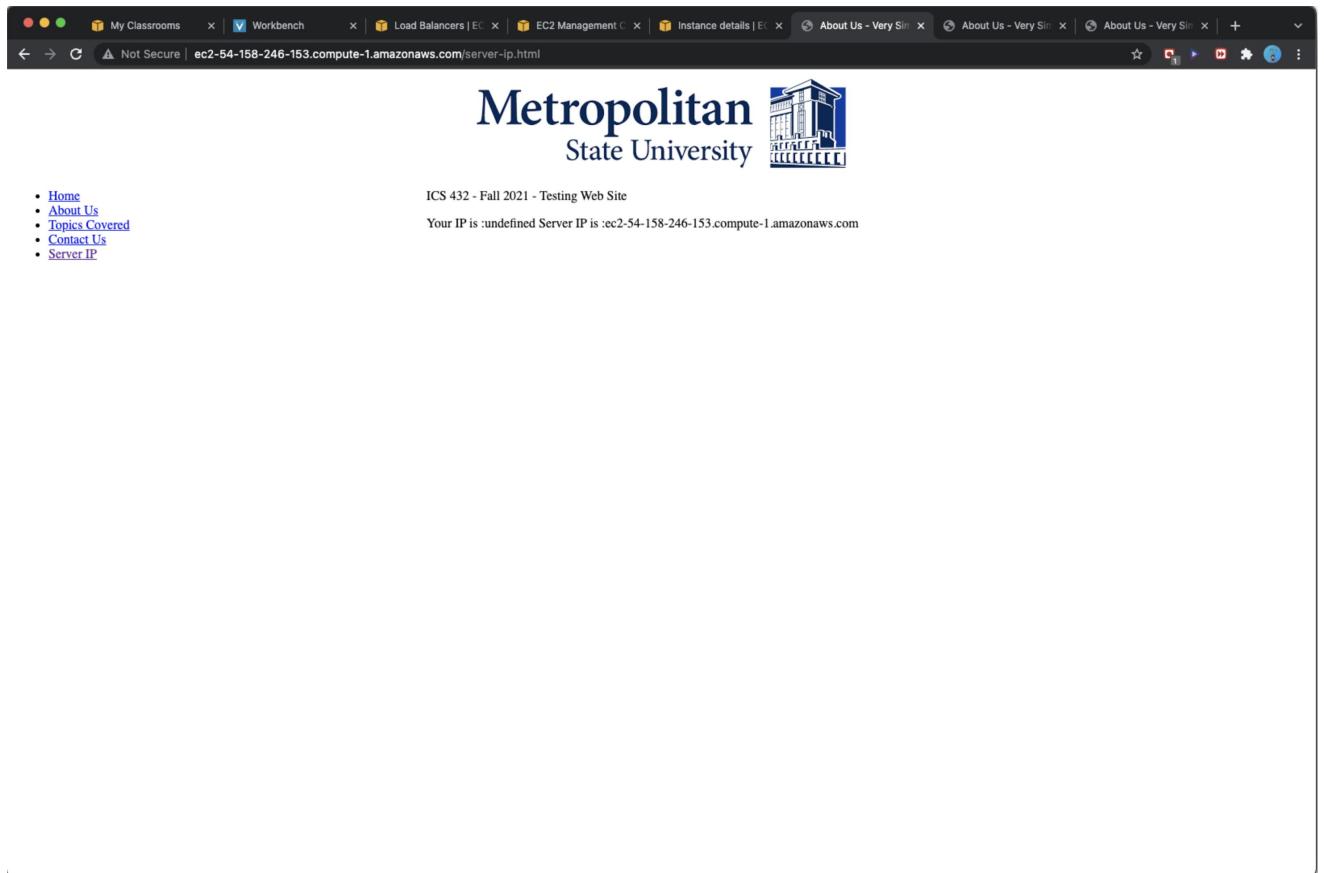
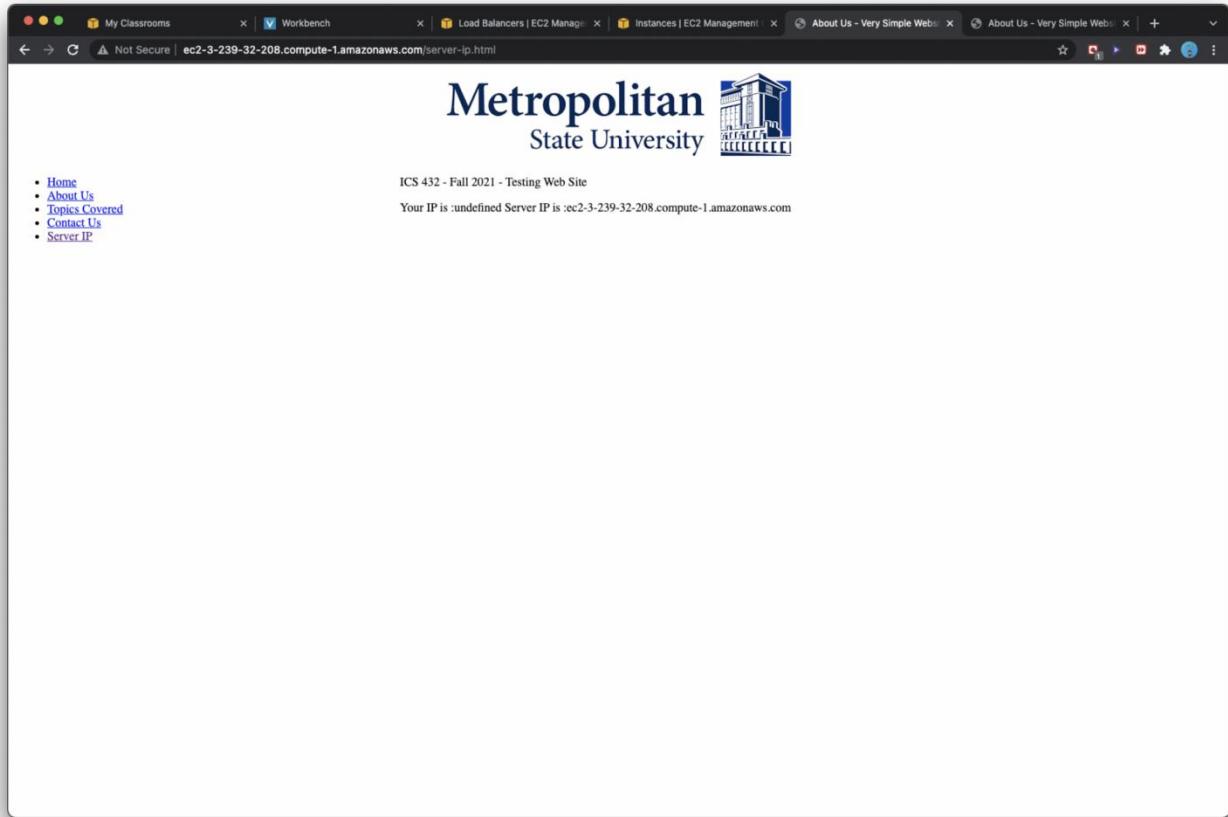
Homework report screen-shot #11:

Screenshot of a web browser displaying a simple website for Metropolitan State University.

The URL is danddank-ics432web-load-balancer-572798612.us-east-1.elb.amazonaws.com/server-ip.html.

The page content includes:

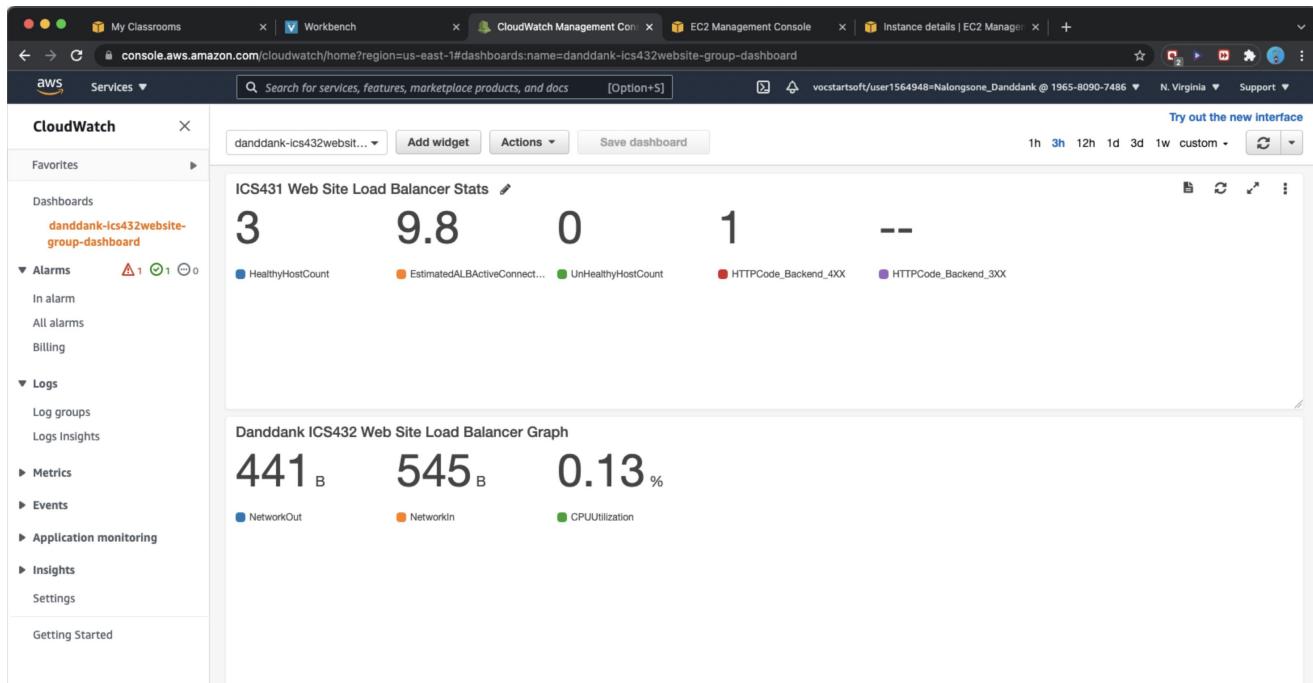
- Metropolitan State University** logo
- ICS 432 - Fall 2021 - Testing Web Site
- Your IP is :undefined Server IP is :danddank-ics432web-load-balancer-572798612.us-east-1.elb.amazonaws.com
- Navigation menu:
 - Home
 - About Us
 - Topics Covered
 - Contact Us
 - Server IP



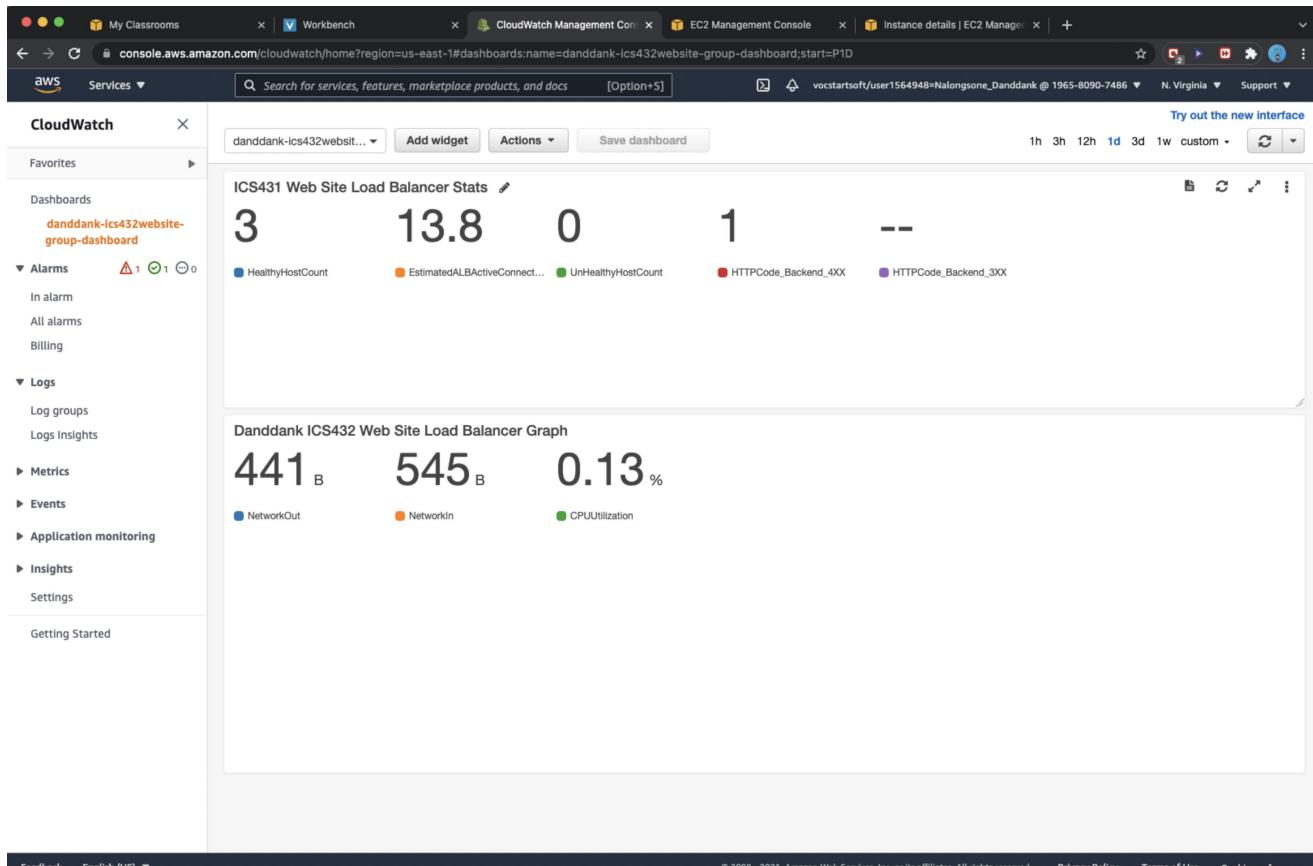
Homework report screen-shot #12:

Homework report screen-shot #13:

Homework report screen-shot #14:

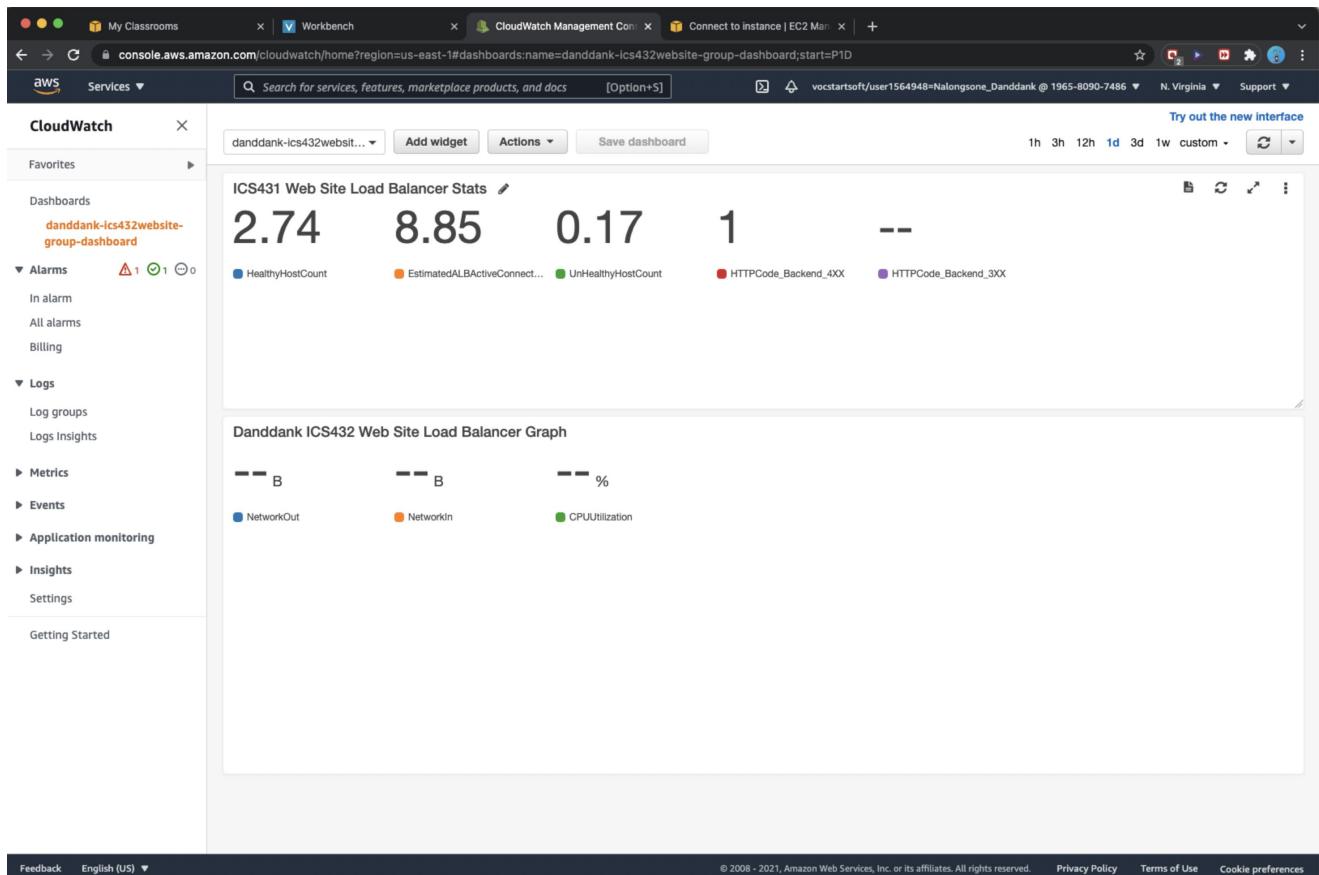


Homework report screen-shot #15:



Homework report screen-shot #16:

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Homework report screen-shot #17:

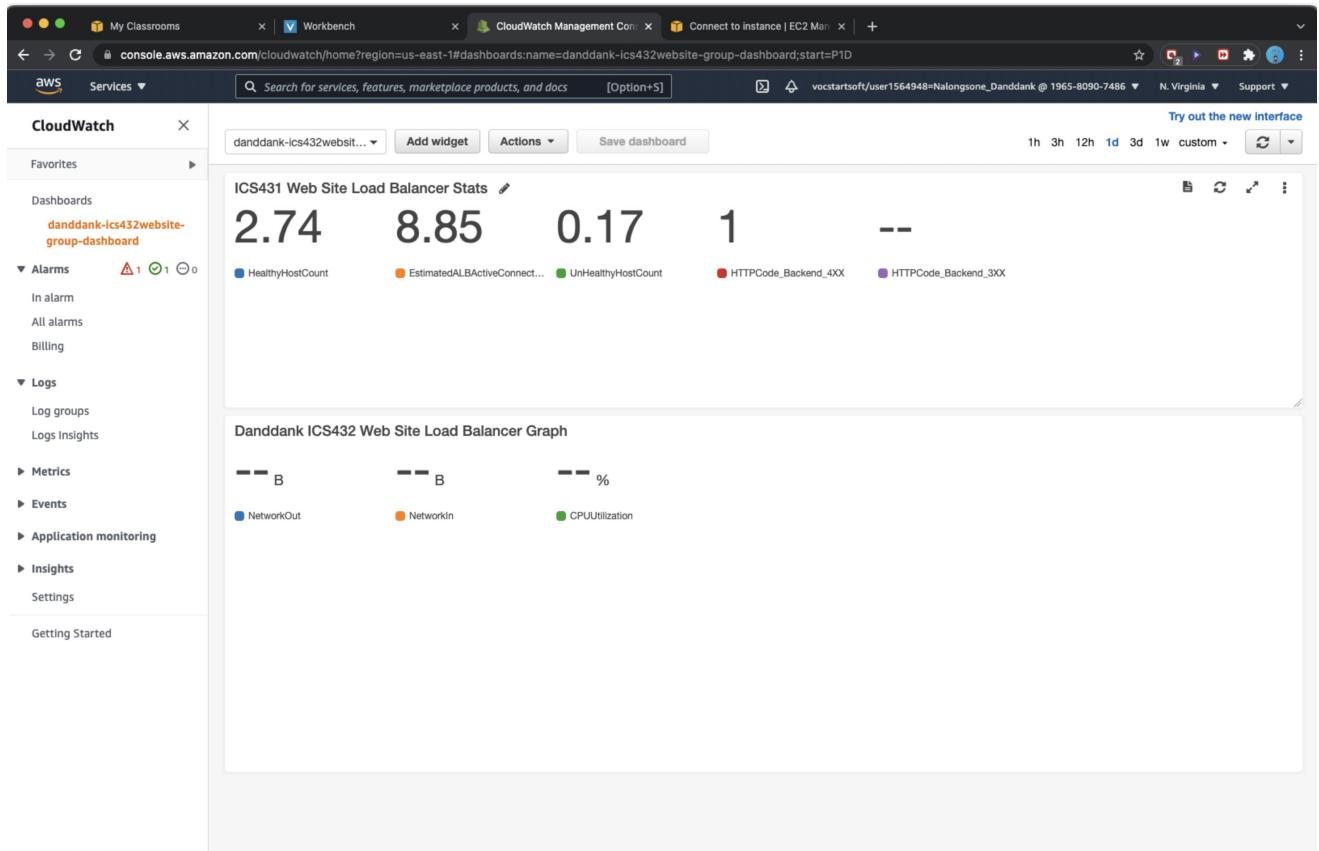
Instances (10) Info

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IP
run-by-auto-scaling-group2	i-0fbaf4fb8b8774f270	Terminated	t3.micro	-	No alarms	us-east-1c	-
-	i-08a7450946c567f46	Terminated	t3.micro	-	No alarms	us-east-1c	-
-	i-0f25f3559e1825aad	Running	t3.micro	Initializing	No alarms	us-east-1c	ec2-18-2
-	i-00962b3b2d82da2ce	Running	t3.micro	Initializing	No alarms	us-east-1c	ec2-44-1
Danddank Web Server	i-05a38511178bf90a0	Stopped	t2.micro	-	No alarms	us-east-1a	-
DanddankLab4Instance3	i-022df32823332594e	Stopped	t2.micro	-	No alarms	us-east-1a	-
danddank-ics432website-instance	i-084aff20a30b1214a	Stopped	t2.micro	-	No alarms	us-east-1a	-
nalongstone-ics432website-instance	i-04b45fe4b62fdfa45	Stopped	t2.micro	-	No alarms	us-east-1a	-
run-by-auto-scaling-group1	i-0460556cc3c152b65	Terminated	t3.micro	-	No alarms	us-east-1a	-
run-by-auto-scaling-group5	i-075fb8bf5cc6c569e	Running	t3.micro	2/2 checks passed	No alarms	us-east-1a	ec2-54-9

Select an instance above

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Homework report screen-shot #18:



Summarize your learning:

I have learned to create load balance and auto scale to launch a EC2 instance of virtual machine in AWS, and learned how to deploy a web server to run in AWS in the Linux instance which I have created by auto scale group and load balance from AMIs and Instance template. then install a nginx web server software on the EC2 instance. Then, modified the security setting of the instance to allow public access for other people can access the website that I created. Finally, stop all the EC2 instance to terminate.

The most important thing is I know how to create the load balance and auto scale increase and decrease the number of instances following the requirement of traffic internet that is every significant concept of current technology and most popular use to deploy our modern website and other applications these day.

I think the most challenge me about working with the concept of how to balance the instances that created by auto scale and how to set up the parameters for them to let them to be better perform and effective. And another thing challenge me is working with the environment system, Linux, command line and system file of Linux, that is every challenge for me in the beginning to work quickly.

Exercise 2: Implementing a scalable GCP infrastructure to host a web site.

Homework report screen-shot #19:

Setting up a network load balancer | VM instances – Compute Engine | Home - ICS 432 testing Web site | Not Secure | 34.71.199.139

Metropolitan State University

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Cloud Computing

Distributed Computing

Setting up a network load balancer | VM instances – Compute Engine | About Us - Very Simple Web Site | Not Secure | 34.71.199.139/server-ip.html

Metropolitan State University

ICS 432 - Fall 2021 - Testing Web Site
Your IP is :undefined Server IP is :34.71.199.139

Homework report screen-shot #20:

Setting up a network load balancer

Images – Compute Engine

Google Cloud Platform dandank-hw2-loadbalancing

Search products and resources

Compute Engine

Images [CREATE IMAGE] REFRESH DELETE

An image is a replica of a disk that contains the applications and operating system needed to start a VM. You can create custom images or use public images pre-configured with Linux or Windows OSes. Learn more

IMAGES IMAGE IMPORT HISTORY IMAGE EXPORT HISTORY

Filter Enter property name or value

Status	Name	Location	Archive size	Disk size	Created by	Family	Creation time	Actions
<input type="checkbox"/>	dandank-ics432website-image	us-central1	1.08 GB	20 GB	dandank-hw2-loadbalancing		Oct 20, 2021, 10:18:54 PM UTC-05:00	⋮
<input type="checkbox"/>	c0-deeplearning-common-cpu-v20211011-debian-10	asia, eu, us	—	50 GB	Debian	common-cpu-debian-10	Oct 11, 2021, 3:21:36 PM UTC-05:00	⋮
<input type="checkbox"/>	c0-deeplearning-common-cu110-v20211011-debian-10	asia, eu, us	—	50 GB	Debian	common-di-gpu-debian-10	Oct 11, 2021, 3:52:39 PM UTC-05:00	⋮
<input type="checkbox"/>	c1-deeplearning-tf1-15-cu110-v20211011-debian-10	asia, eu, us	—	50 GB	Debian	tf1-15-gpu-debian-10	Oct 11, 2021, 4:52:58 PM UTC-05:00	⋮
<input type="checkbox"/>	c1-deeplearning-tf1-15-tpu-v20211011-debian-10	asia, eu, us	—	50 GB	Debian	tf1-15-tpu-debian-10	Oct 11, 2021, 4:33:33 PM UTC-05:00	⋮
<input type="checkbox"/>	c1-deeplearning-tf2-1-cu110-v20211011-debian-10	asia, eu, us	—	50 GB	Debian	tf2-1-gpu-debian-10	Oct 11, 2021, 5:11:59 PM UTC-05:00	⋮
<input type="checkbox"/>	c1-deeplearning-tf2-1-tpu-v20211011-debian-10	asia, eu, us	—	50 GB	Debian	tf2-1-tpu-debian-10	Oct 11, 2021, 4:57:35 PM UTC-05:00	⋮
<input type="checkbox"/>	c1-deeplearning-tf2-2-tpu-v20211011-debian-10	asia, eu, us	—	50 GB	Debian	tf2-2-3-gpu-debian-10	Oct 11, 2021, 5:36:22 PM UTC-05:00	⋮
<input type="checkbox"/>	c1-deeplearning-tf2-3-tpu-v20211011-debian-10	asia, eu, us	—	50 GB	Debian	tf2-2-3-tpu-debian-10	Oct 11, 2021, 5:11:41 PM UTC-05:00	⋮
<input type="checkbox"/>	c1-deeplearning-tf2-4-cu110-v20210512-debian-10	asia, eu, us	—	50 GB	Debian	tf2-2-4-gpu-debian-10	May 12, 2021, 6:54:01 PM UTC-05:00	⋮
<input type="checkbox"/>	c1-deeplearning-tf2-4	asia, eu, us	—	50 GB	Debian	tf2-2-4-tpu-debian-10	May 12, 2021, 5:04:25 PM UTC-05:00	⋮

Show deprecated images

Select an image

PERMISSIONS LABELS

Please select at least one resource.

Homework report screen-shot #21:

Setting up a network load balancer

VM instances – Compute Engine

Home - ICS 432 testing Web

Not Secure | 35.222.179.200

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Cloud Computing

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Distributed Computing

Setting up a network load balancer | VM Instances – Compute Engine | Home – ICS 432 testing Web | +

Not Secure | 34.135.64.188/index.html

Metropolitan State University



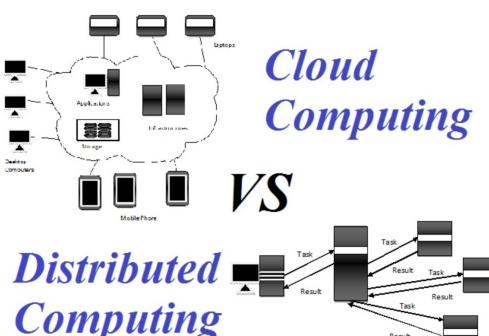
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Cloud Computing

VS

Distributed Computing

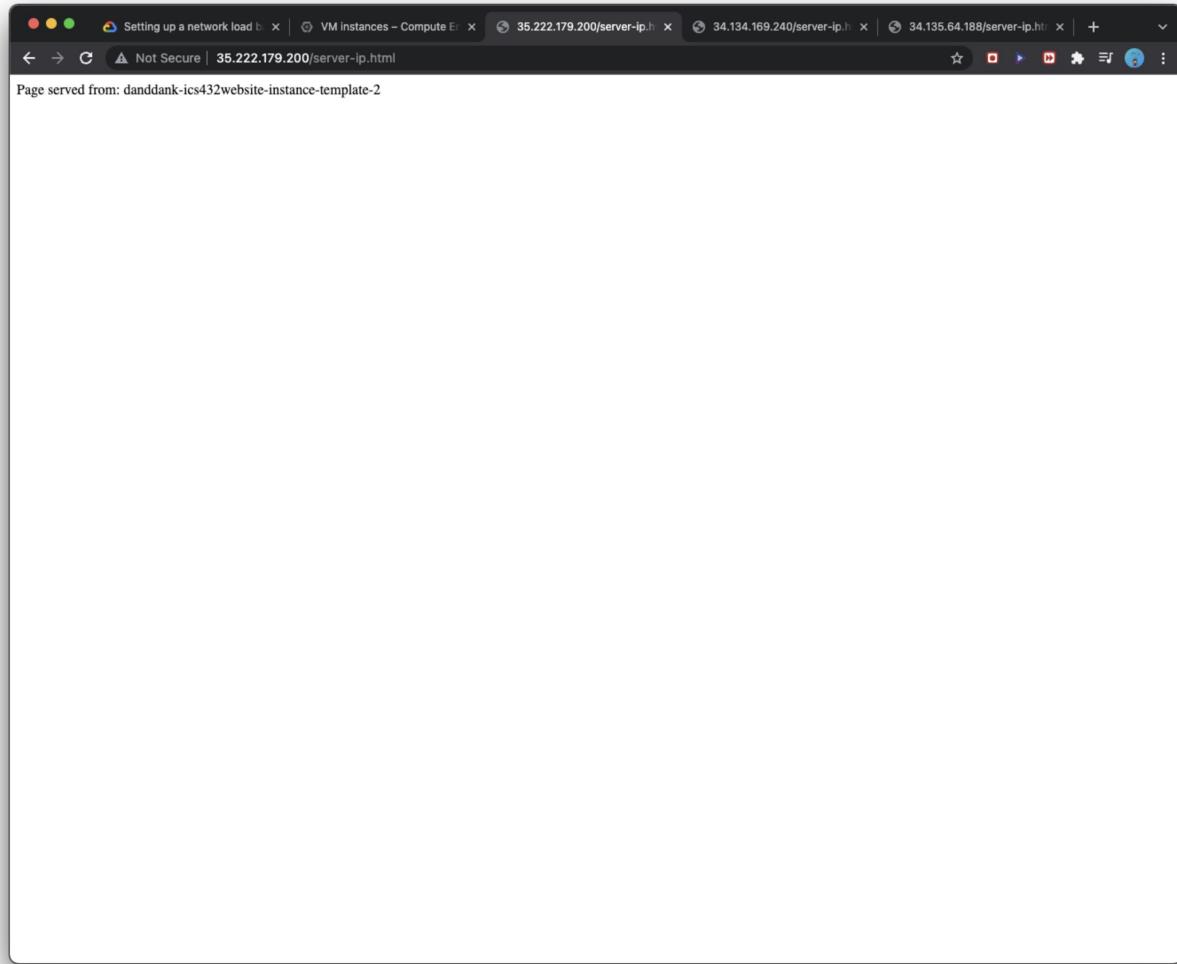


Homework report screen-shot #22:

Setting up a network load balancer | VM Instances – Compute Engine | 34.135.64.188/server-ip.html | +

Not Secure | 34.135.64.188/server-ip.html

Page served from: dandank-ics432website-instance-template-3



Homework report screen-shot #23:

Google Cloud Platform

Compute Engine

danddank-ics432website-instance-group

OVERVIEW DETAILS MONITORING ERRORS

Instances by status

Status	Count
Ready	2

Instance by health

Health	Count
Not configured	2

Autoscaling

Min	Max
On (min 2, max 4)	

Status: Ready

Creation Time: Oct 21, 2021, 2:21:56 AM UTC-05:00

Description: Number of instances: 2

Template: danddank-ics432website-instance-template

Location: us-central1-a

Instance Group Members

Status	Name	Creation Time	Template	Per instance config	Internal IP	External IP	Health	Connect
Ready	danddank-ics432website-instance-group-dkbr	Oct 21, 2021, 2:22:02 AM UTC-05:00	danddank-ics432website-instance-template		10.128.0.9 (nic0)	34.135.64.188	SSH	⋮
Ready	danddank-ics432website-instance-group-z0s4	Oct 21, 2021, 2:22:02 AM UTC-05:00	danddank-ics432website-instance-template		10.128.0.8 (nic0)	34.136.60.170	SSH	⋮

External IP address '34.135.64.188' copied.

Homework report screen-shot #24:

The screenshot shows the Google Cloud Platform Compute Engine Instance Groups page. The instance group 'danddank-ics432website-instrnace-group' contains 3 instances, all of which are ready. The page includes tabs for Overview, Details, Monitoring, and Errors. It also displays instance health status, creation time, and template information. The 'Autoscaling' section indicates it is set to 'On (min 3, max 4)'. The 'Instance Group Members' table lists the three instances with their respective internal and external IP addresses, creation times, and connection status (SSH).

Homework report screen-shot #25:

The screenshot shows the Google Cloud Platform Firewall rules page. A new firewall rule named 'fw-allow-health-check' has been successfully created. The table lists various default rules like 'default-allow-ssh' and 'default-allow-https'. The newly created rule 'fw-allow-health-check' is shown with the following details:

Name	Type	Targets	Filters	Protocols / ports	Action	Priority	Network	Logs	Hit count	Last hit	Insights
fw-allow-health-check	Ingress	allow-health-check	IP ranges: 130.211.0.0/22, 35.191.0.0/16	tcp:80	Allow	1000	default	Off	—	—	

Homework report screen-shot #26:

The screenshot shows the Google Cloud Platform VPC network External IP addresses page. A modal dialog is open on the right side with the title "lb-ipv4-ics432website". It contains a message: "Labels help organize your resources (e.g., cost_center:sales or env:prod)." Below this is a "+ ADD LABEL" button. At the bottom of the modal are "SAVE" and "DISCARD CHANGES" buttons. A success message at the bottom of the main page states: "Successfully created address 'lb-ipv4-ics432website'.".

Homework report screen-shot #27:

The screenshot shows the Google Cloud Platform Network services Load balancer details page for the load balancer "danddank-ics432website-load-balancer". The left sidebar shows other network services like Load balancing, Cloud DNS, Cloud CDN, etc. The main pane displays the load balancer configuration with tabs for DETAILS, MONITORING, and CACHING. Under the Frontend section, it shows an HTTP rule with IP:Port 34.120.169.146:80 and Network Tier Premium. The Host and path rules section shows a single unmatched host and path mapping to the backend service. The Backend section lists the "danddank-ics432website-backend-service" with its configuration: Endpoint protocol HTTP, Named port http, Timeout 30 seconds, Health check http-basic-check, and Cloud CDN Disabled. The ADVANCED CONFIGURATIONS section shows a single instance group named "danddank-ics432website-instance-group" with one instance. The right sidebar includes links for Marketplace and Release Notes.

Homework report screen-shot #28:

Setting up a network load bal... | Load balancer details – Network... | Home - ICS 432 testing Web site | +

Not Secure | 34.120.169.146

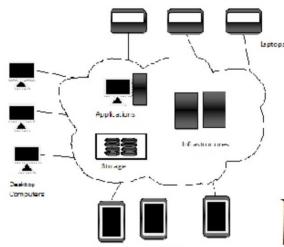
Metropolitan State University



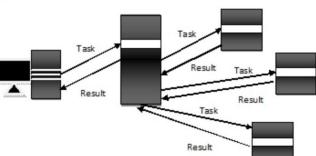
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- [Home](#)
- [About Us](#)
- [Topics Covered](#)
- [Contact Us](#)
- [Server IP](#)

 *Cloud Computing*

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Homework report screen-shot #29:

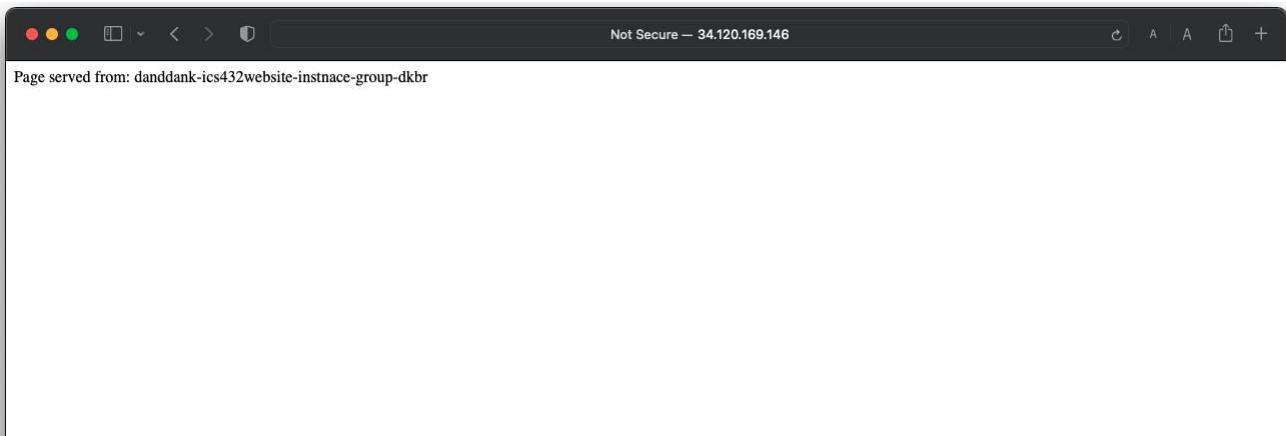
Setting up a network load bal... | Load balancer details – Network... | 34.120.169.146/server-ip.html | +

Not Secure | 34.120.169.146/server-ip.html

Page served from: danddank-ics432website-instance-group-z0s4

Not Secure — 34.120.169.146

Page served from: danddank-ics432website-instance-group-dkbr



Summarize your learning:

I have learned to create and launch VM instance by auto scale number of instance and load balancing for web page with HTTP on server of the virtual machine of Linux which I have created. Finally, I have to stop all VM instance to terminate the cost for my account bill.

The most important thing is I have familiar with how to create VM instance GCP virtual machine, then make them auto scale by load balancing that is every significant concept of current technology and most popular use to auto scale servers.

I think the most challenge me about working with GCP's load balance is working on the stable connection of internet to keep connect from my computer to a remote machine on GCP. And how to set up the parameters to build the load balancing for auto scale, that is every challenge for me in the beginning.

Purpose	AWS	GCP
Running compute resources on the cloud	Compute -> Amazon EC2	Compute -> Compute Engine -> VM instances
Creating Instance template	Compute -> Amazon EC2 -> Auto Scaling -> Launch Configurations	Compute -> Compute Engine -> Instances templates
Create Load Balancers	Compute -> Amazon EC2 -> Load Balancing -> Load Balancers	NetWorking -> Network services -> Load Balancing
Create Security Groups	Compute -> Amazon EC2 -> Network & Security -> Secutity Groups	IAM & Admin ->
Create Instance Images	Compute -> Amazon EC2 -> Images -> AMIs	Compute -> Compute Engine ->Storage -> Images
Stop compute resources on the cloud	Compute -> Amazon EC2	Compute -> Compute Engine -> VM instances
Building Monitoring Application Checking	Management & Governance -> CloudWatch	Oprations -> Monitoring