Implementing AWS WAF with ALB to block SQL Injection, Geo Location and Query string

Level: **Advanced**

Amazon EC2 Amazon Web Services Elastic Load Balancing AWS WAF

1h 59m 44s left

15 MIN

End Lab

Open Console

Validation

Lab Credentials

User Name

Whiz_User_80425.29856740

Password

bddd6310-4d44-49f9-bc41-138d172bfc69

Access Key

AKIAZ5QR5CK2XMGNWWXL

Secret Key

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

Lab Resources

No Lab Resources Found

Support Documents

No Support Documents Found

Need help?

How to use Hands on Lab

Troubleshooting Lab

FAQs

Submit Feedback | Share

Lab Overview | Lab Steps | Lab Validation

Cloud Network Engineer, Cloud Security Engineer

Security, Compute, Networking

Lab Steps

Task 1: Sign in to AWS Management Console

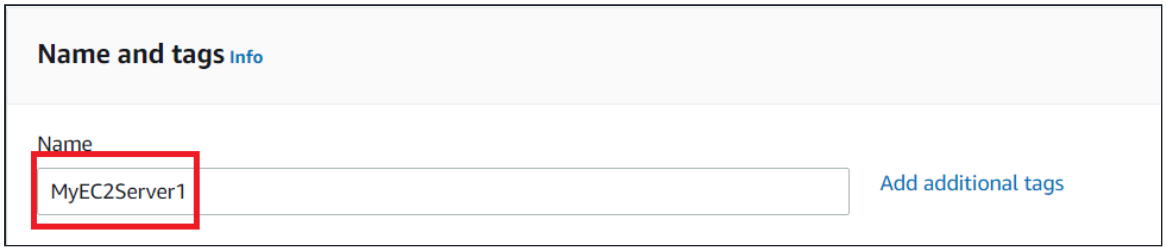
1. Click on the **Open Console** button, and you will get redirected to AWS Console in a new browser tab.
2. On the AWS sign-in page,
    - Leave the Account ID as default. Never edit/remove the 12 digit Account ID present in the AWS Console. otherwise, you cannot proceed with the lab.
    - Now copy your **User Name** and **Password** in the Lab Console to the **IAM Username and Password** in AWS Console and click on the **Sign in** button.
3. Once Signed In to the AWS Management Console, Make the default AWS Region as **US East (N. Virginia) us-east-1.**

Task 2: Launch First EC2 Instance

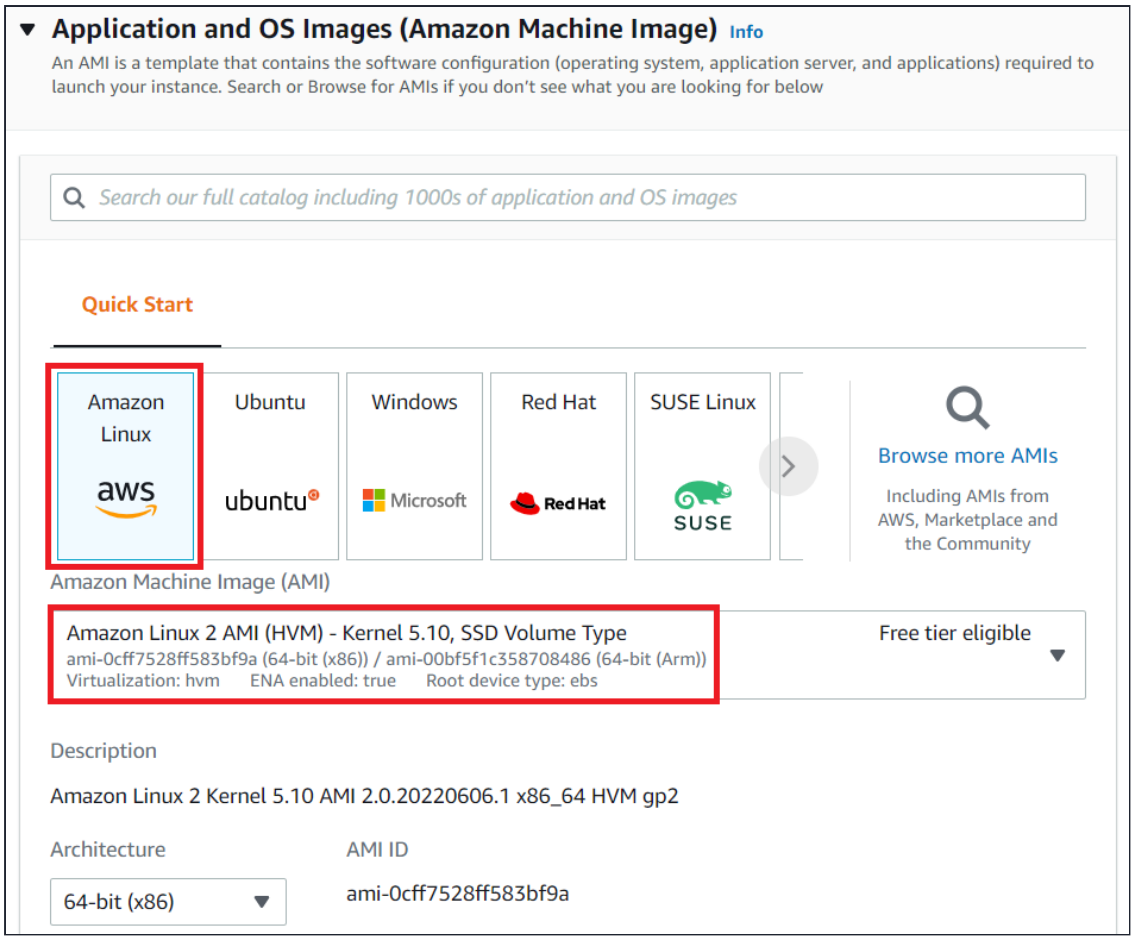
In this task, we are going to launch the first EC2 instance by providing the required configurations like name, AMI selection, security group , instance type and other settings.

Furthermore, we will provide the user data as well.

1. Make sure you are in the **N. Virginia(us-east-1)** Region.
2. Navigate to **EC2** by clicking on the **Services** menu in the top left, then click on **EC2** in the **Compute** section.
3. Navigate to **Instances** from the left side menu and click on **Launch Instances** button.
4. Under the **Name and tags** section :
   - Name : Enter ***MyEC2Server1***

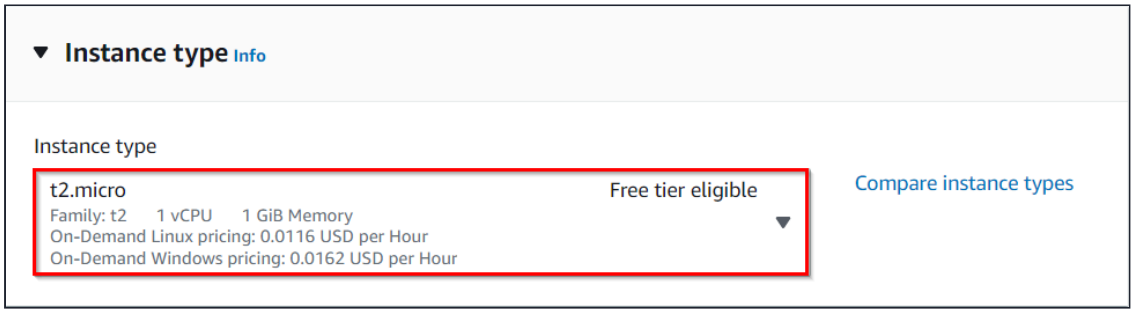


5. Under the **Application and OS Images (Amazon Machine Image)** section :
   - Select **Quick Start** tab and **Amazon Linux** under it
   - Amazon Machine Image (AMI) : select **Amazon Linux 2 AMI**
   - ***Note: if there are two AMI's present for Amazon Linux 2 AMI, choose any of them.***



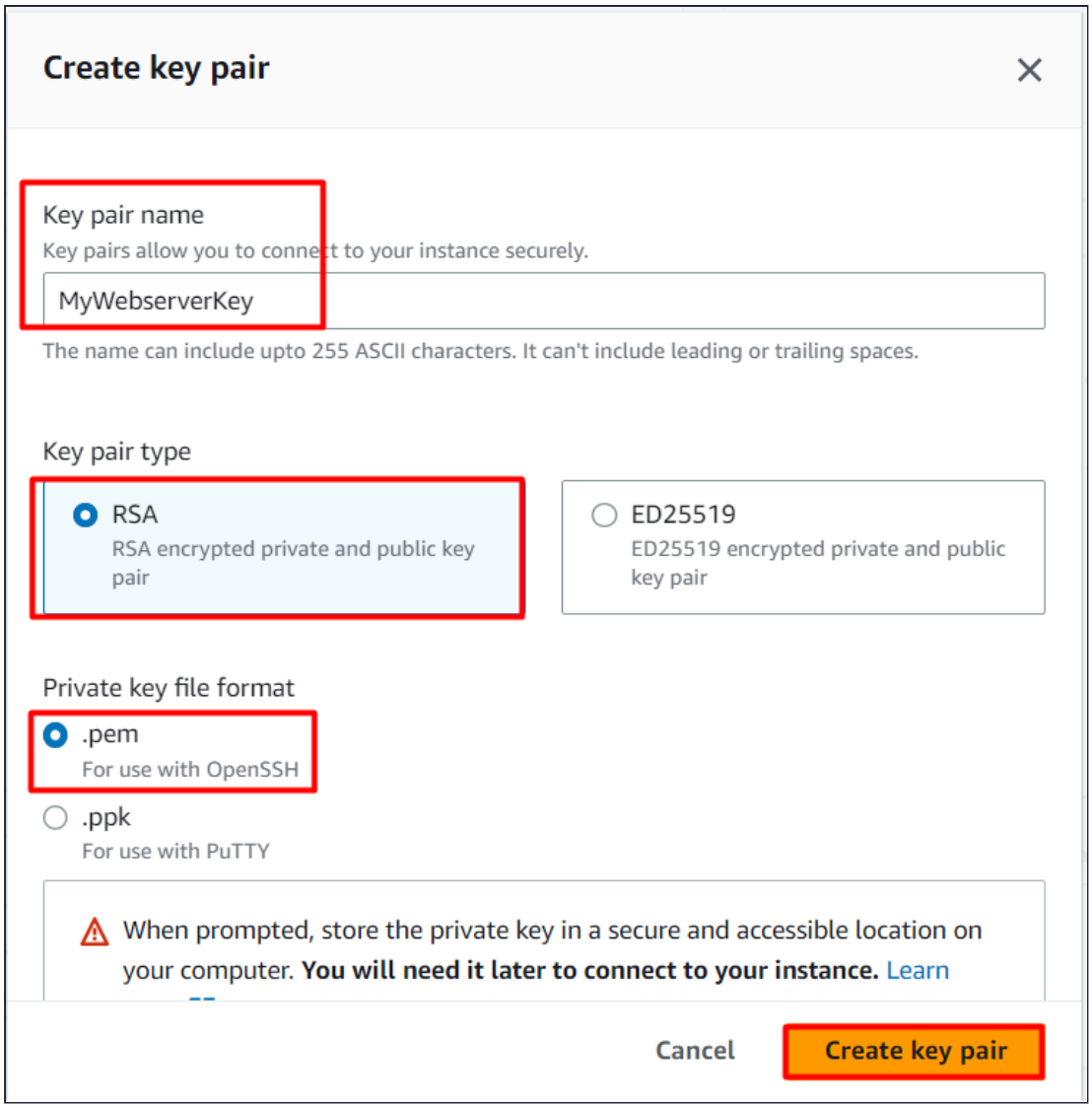
6. Under the **Instance Type** section **:**

- Instance Type : Select **t2.micro**



7. Under the **Key Pair (login)** section **:**

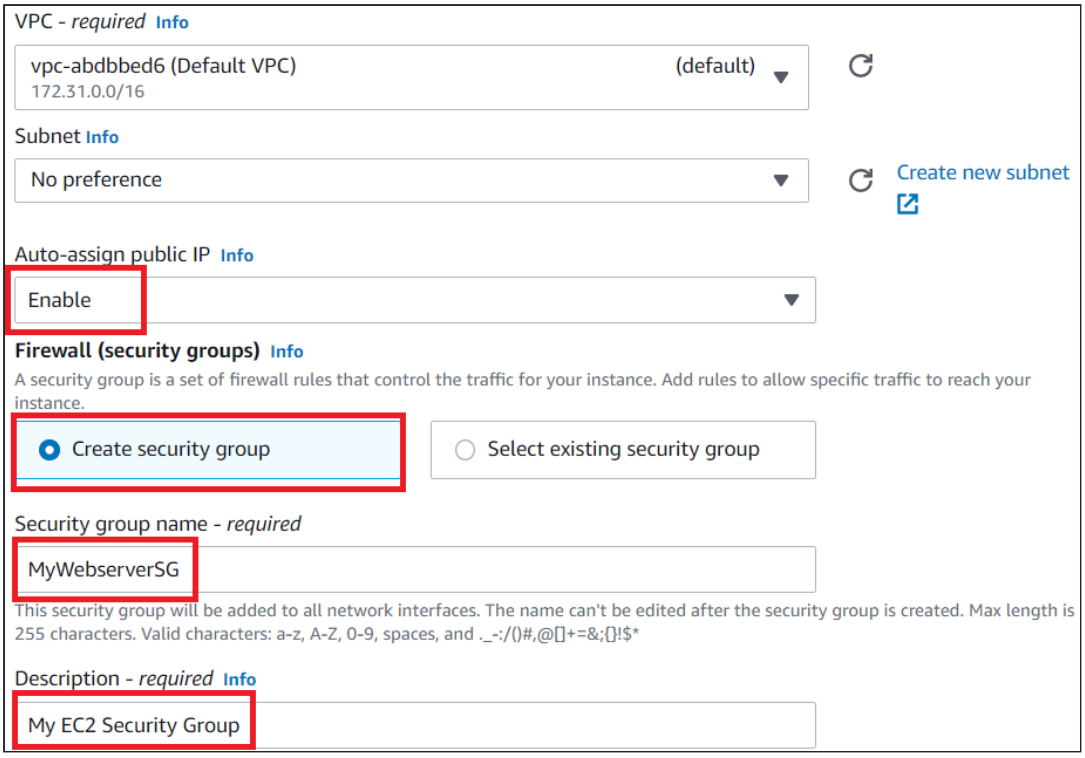
- Click on **Create new key pair** hyperlink
- Key pair name: **MyWebserverKey**
- Key pair type: **RSA**
- Private key file format: **.pem** or **.ppk**
- Click on **Create key pair** and then select the created key pair from the drop-down.

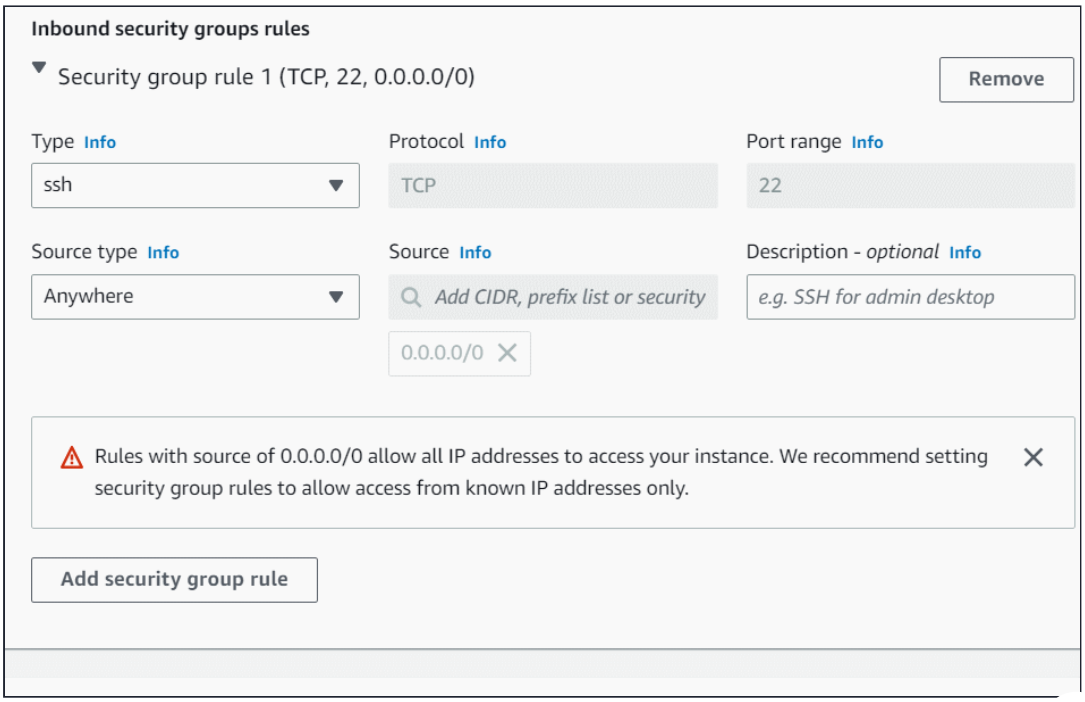


8. Under the **Network Settings** section **:**

- Click on **Edit** button
- Auto-assign public IP: select *Enable*
- Firewall (security groups) : Select **Create a new security group**
- Security group name : Enter **MyWebserverSG**
- Description : Enter **My EC2 Security Group**
- To add **SSH:**
    - Choose Type: **SSH**
    - Source: **Anywhere** (From ALL IP addresses accessible).
- For **HTTP**, click on **Add security group rule**,
    - Choose Type: **HTTP**
    - Source: **Anywhere** (From ALL IP addresses accessible).

- For **HTTPS**, click on **Add security group rule**,
  - Choose Type: **HTTPS**
  - Source: **Anywhere** (From ALL IP addresses accessible).





9. Under the **Advanced details** section **:**

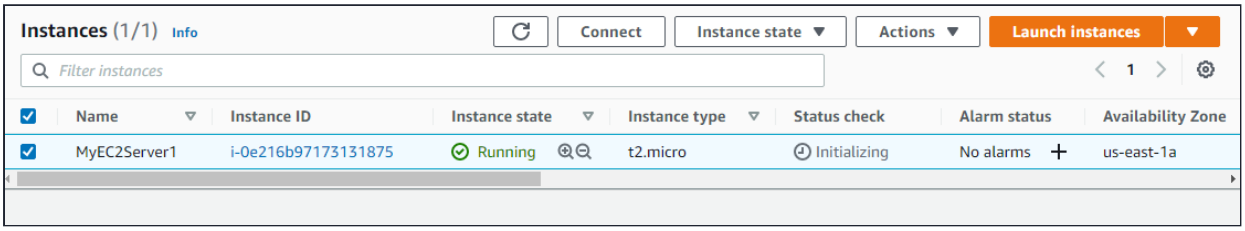
- Under the **User data:** copy and paste the following script to create an HTML page served by an Apache HTTPD web server.

```
#!/bin/bash
```

```
systemctl start httpd
systemctl enable httpd
echo "<html><h1> Welcome to Whizlabs Server 1 </h1><html>" >>
 /var/www/html/index.html
```

10. Keep everything else as default and click on the **Launch instance** button.

11. **Launch Status:** Your instance is now launching, Navigate to **Instances** page from the left menu and wait until the status of the EC2 Instance changes to **running**.



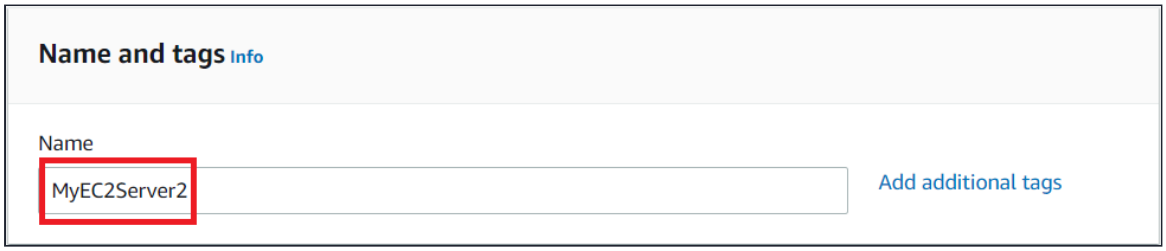
Task 3: Launch Second EC2 Instances

In this task, we are going to launch the second EC2 instance by providing the required configurations like name, AMI selection, security group , instance type and other settings. Furthermore, we will provide the user data as well.

1. Now again click on **Launch Instances** button.

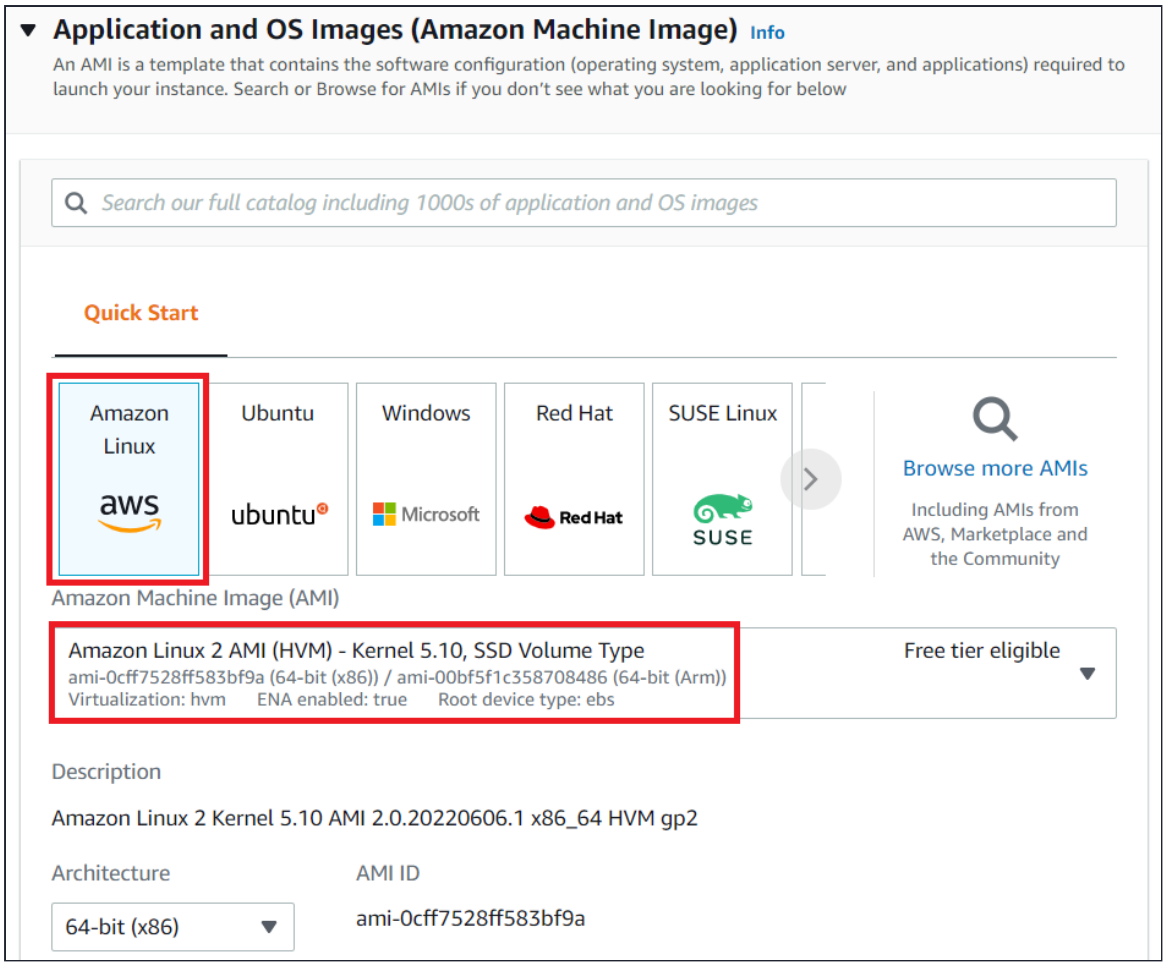
2. Under the **Name and tags** section :

   - Name : Enter ***MyEC2Server2***



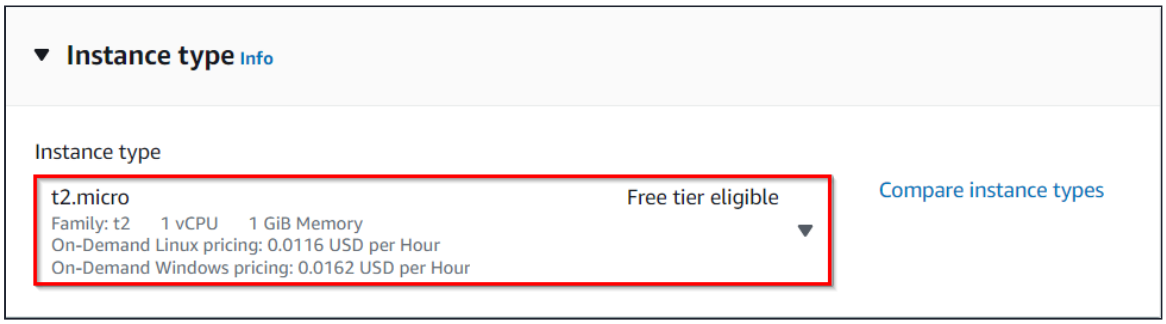
3. Under the **Application and OS Images (Amazon Machine Image)** section :

   - Select **Quick Start** tab and **Amazon Linux** under it
   - Amazon Machine Image (AMI) : select **Amazon Linux 2 AMI**
   - ***Note: if there are two AMI's present for Amazon Linux 2 AMI, choose any of them.***



4. Under the **Instance Type** section **:**

- Instance Type : Select **t2.micro**



5. Under the **Key Pair (login)** section **:**

- Select **MyWebserverKey** from the list.

6. Under the **Network Settings** section **:**

- Click on **Edit** button
- Auto-assign public IP: select **Enable**
- Firewall (security groups) : Select **Select existing security group**

- Common security groups : Select Security group with name ***MyWebserverSG***

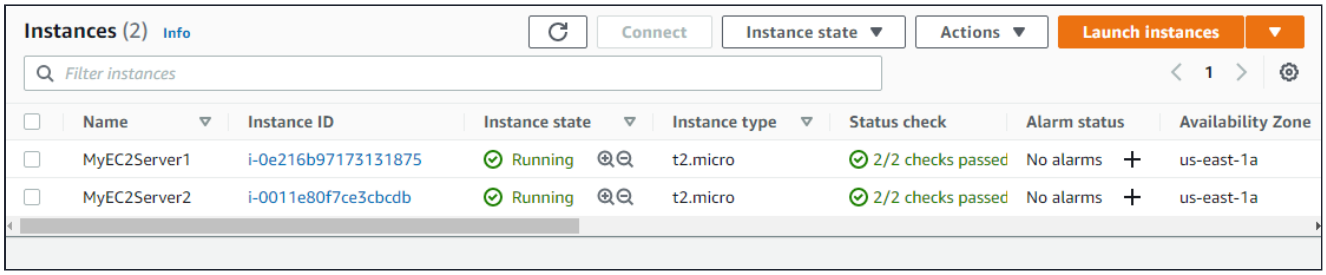
7. Under the **Advanced details** section **:**

    - Under the **User data:** copy and paste the following script to create an HTML page served by Apache httpd web server:

```
#!/bin/bash
sudo su
yum update -y
yum install httpd -y
systemctl start httpd
systemctl enable httpd
echo "<html><h1> Welcome to Whizlabs Server 2 </h1><html>" >>
 /var/www/html/index.html
```

8. Keep everything else as default and then click on the **Launch Instance** button.

9. Your instances are now launching. Navigate to the EC2 instance page and wait until the status changes to the **Running**. It will usually take 1-2 minutes.

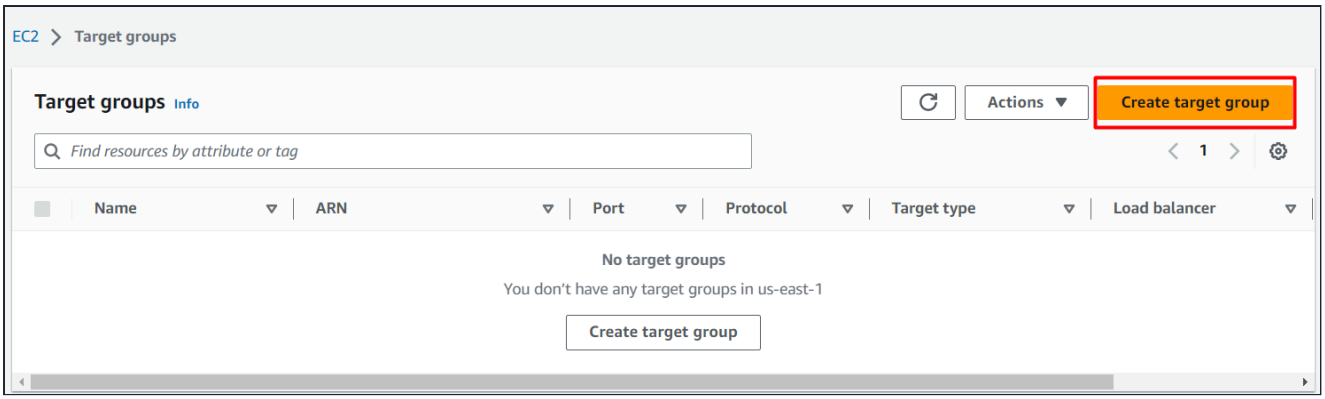


Task 4: Create a Target Group

In this task, we are going to create a target group for the load balancer and will add the target instances so that the load balancer can distribute the traffic among these instances.

1. In the EC2 console, navigate to **Target Groups** in the left-side panel under **Load Balancer** in the **Load Balancing** section.

2. Click on **Create target group** button on the top right corner.

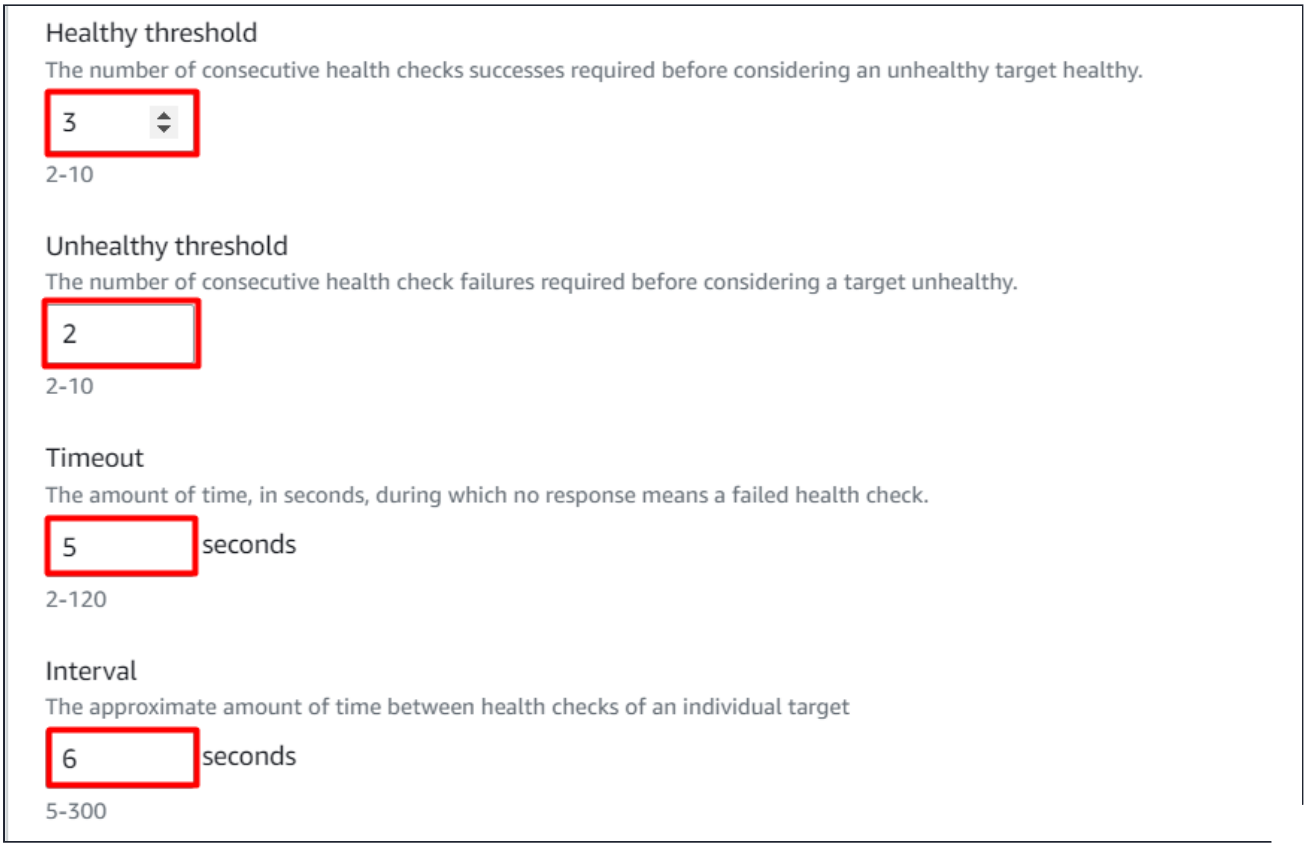


3. Basic configuration:

- Choose a target type : Select **Instances**
- Target group name : Enter ***MyWAFTargetGroup***
- Protocol : Select **HTTP**
- Port : Enter ***80***

4. Health Checks:

- Health check protocol : Select **HTTP**

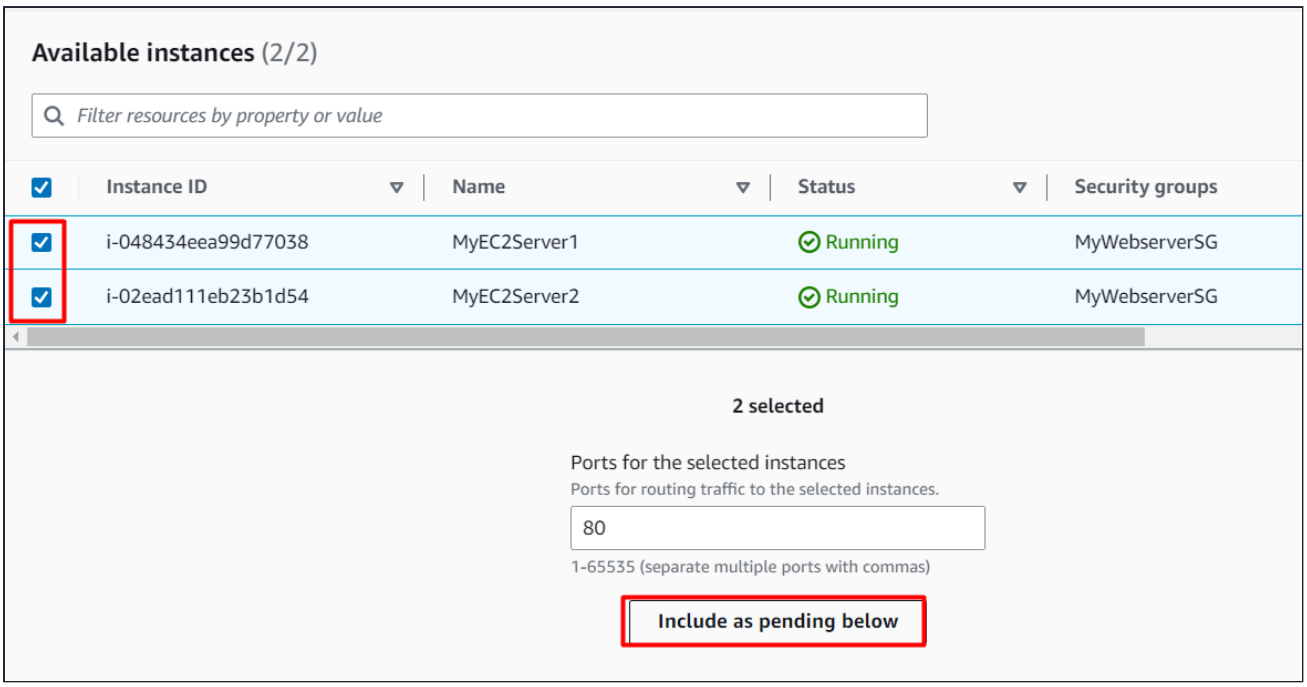


5. Leave everything as default and click on **Next** button.

6. Register targets:

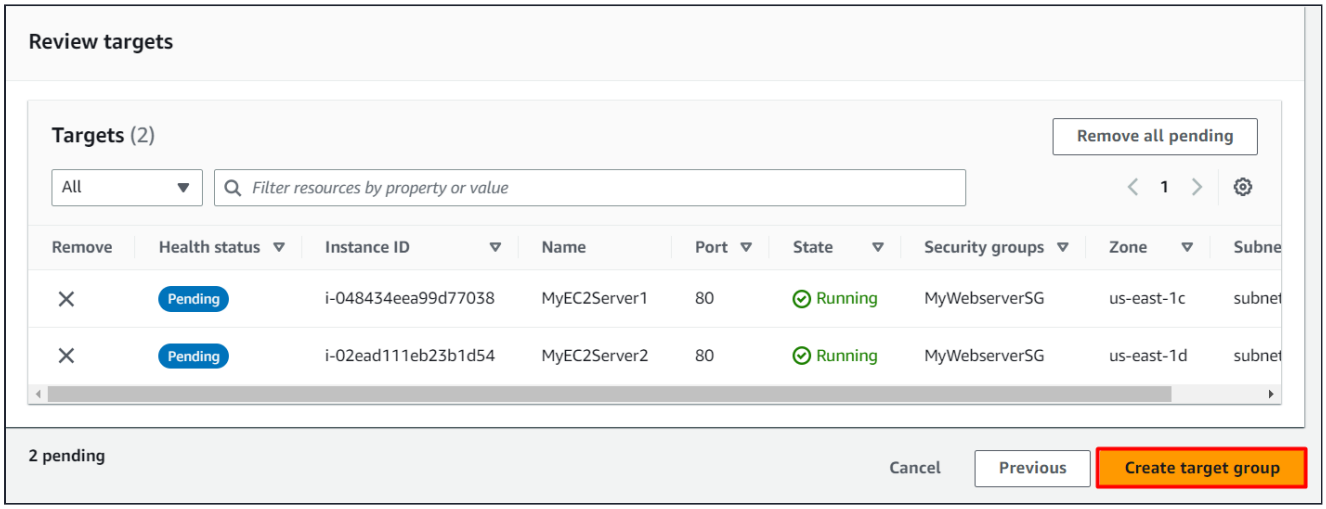
- Select the two instances we have created i.e **MyEC2Server1** and **MyEC2Server2**.

- Click on **Include as pending below** and scroll down.

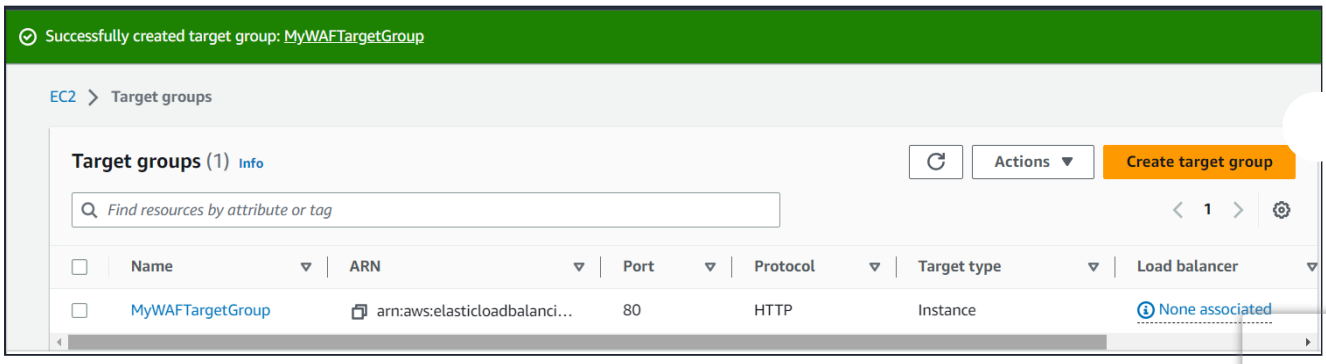


7. Review targets:

- Review the targets and click on **Create target group** button.



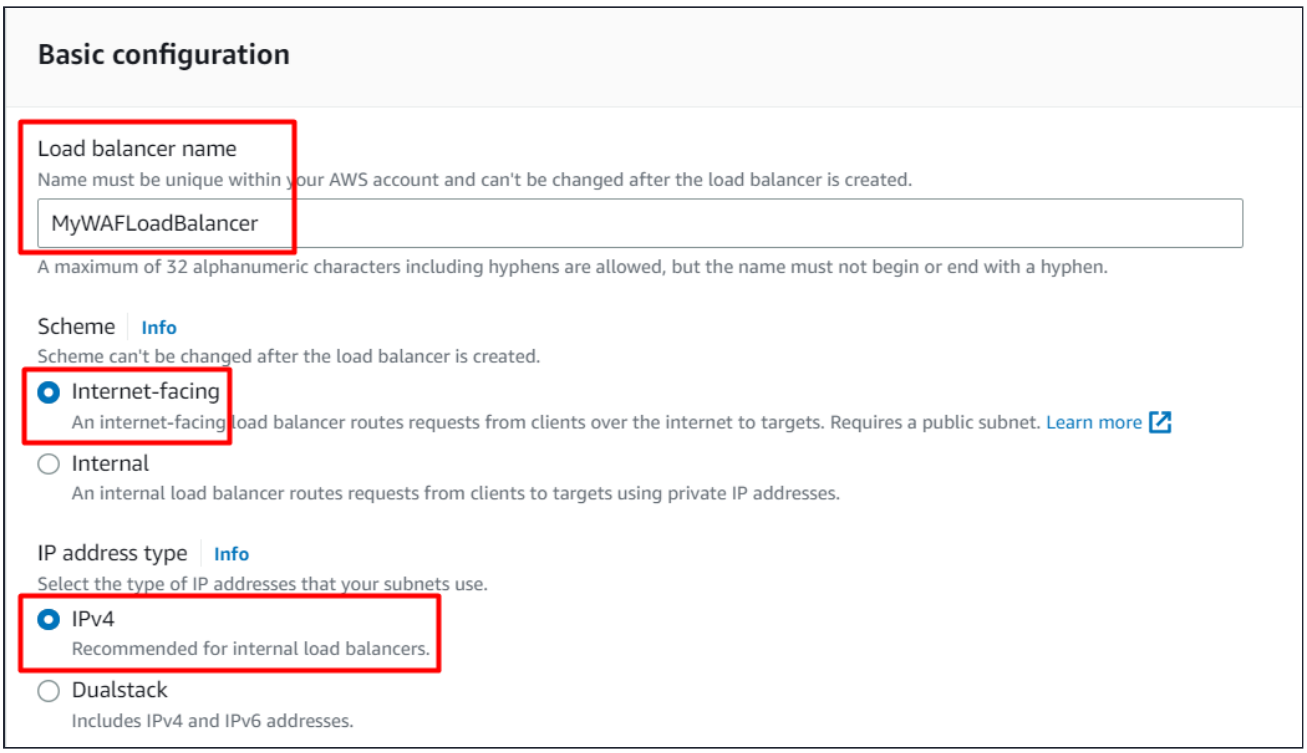
8. Your Target group has been successfully created.



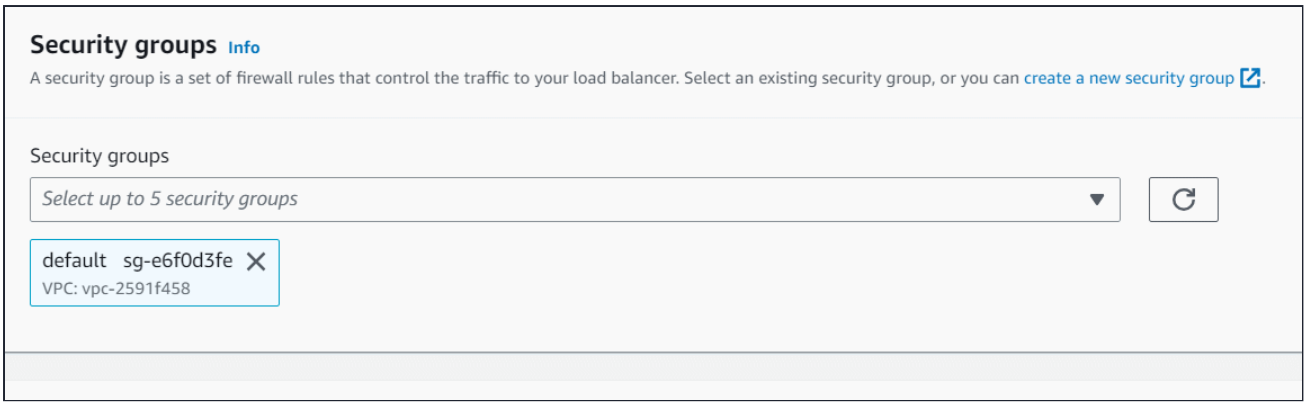
Task 5: Create an Application Load Balancer

In this task, we are going to create an Application Load balancer by providing the required configurations like name, target group etc.

1. In the EC2 console, navigate to **Load Balancers** in the left-side panel under **Load Balancing**.
2. Click on **Create Load Balancer** at the top-left to create a new load balancer for our web servers.
3. On the next screen, choose **Application Load Balancer** since we are testing the high availability of the web application and click on **Create** button.
4. Basic configuration:
    - Load balancer name: Enter ***MyWAFLoadBalancer***
    - Scheme: Select **Internet-facing**
    - Ip address type: Choose **Ipv4**

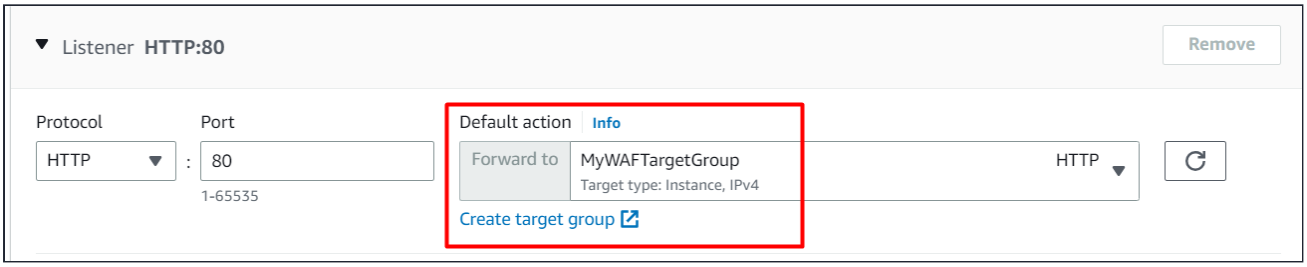


5. Network mapping:
    - VPC : Select **Default**
    - Mappings : Check **All Availability Zones**
6. Security groups:
    - Security groups : Select **an existing security group** i.e **MyWebserverSG** from the drop down menu.



7. Listeners and routing:

- Protocol : Select **HTTP**
- Port : Enter ***80***
- Default action : Select **MyWAFTargetGroup** from the drop down menu



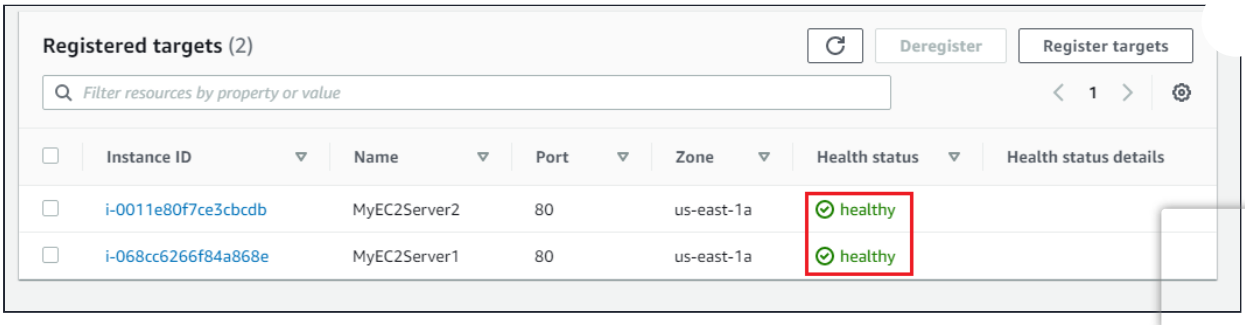
8. Leave everything as default and click on **Create load balancer** button.

9. You have successfully created Application Load Balancer.

Task 6: Test Load Balancer DNS

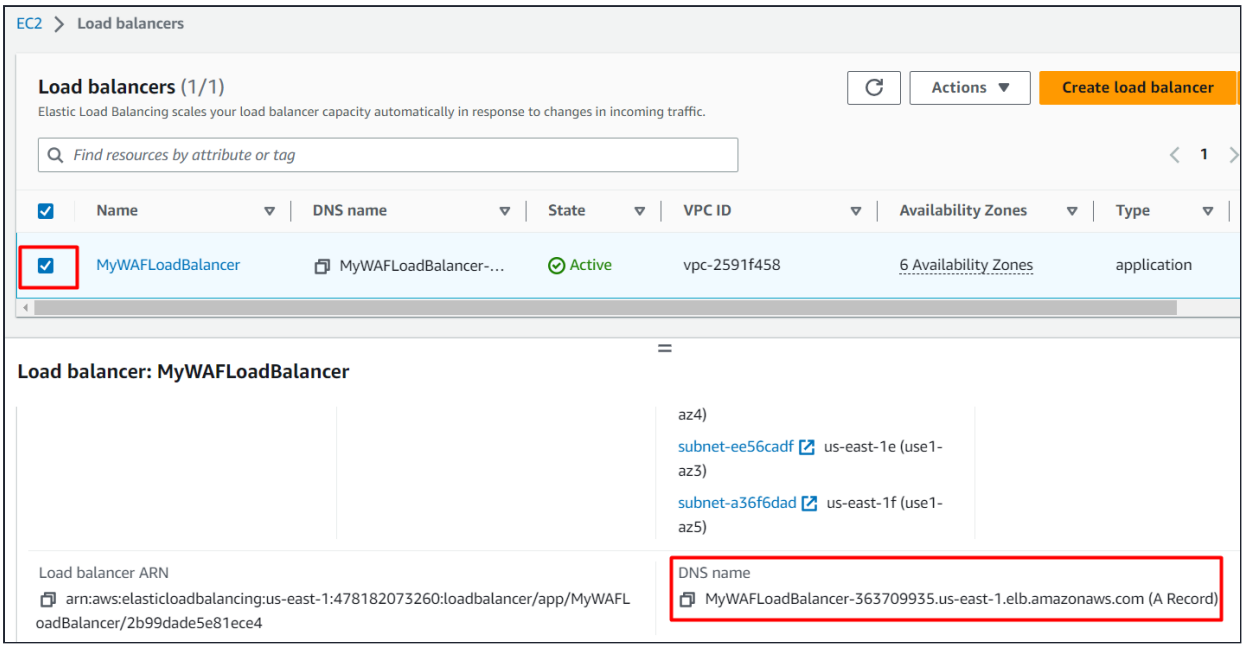
In this task, we will test the working of load balancer by copying the DNS to the browser and find out whether it is able to distribute the traffic or not.

1. Now navigate to the **Target Groups** from the left side menu under **Load balancing**.
2. Click on the **MyWAFTargetGroup** Target group name.
3. Now select the **Targets** tab and **wait till both the targets become healthy (Important)**.



4. Now again navigate to **Load Balancers** from the left side menu under **Load balancing**.

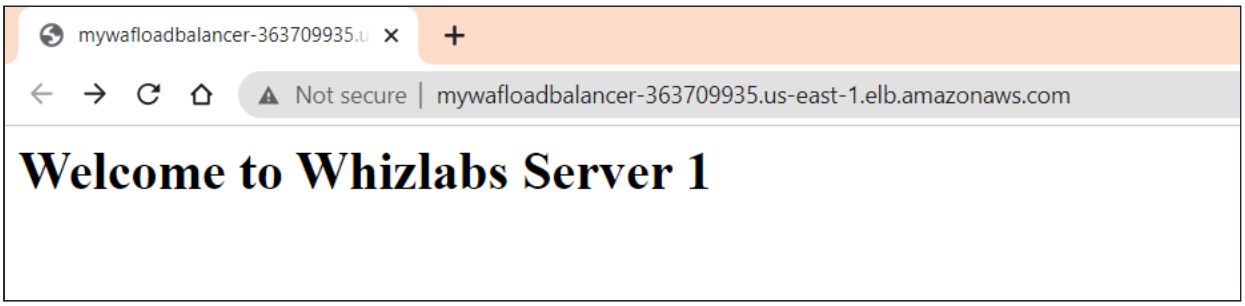
5. Select the **MyWAFLoadBalancer** Load Balancer and copy the **DNS name** under **Description** tab.



6. Copy the **DNS name** of the ELB and enter the address in the **browser**.

- **DNS Example: MyWAFLoadBalancer-2020171322.us-east-1.elb.amazonaws.com**

7. You should see the **index.html** page content of Web Server 1 or Web Server 2

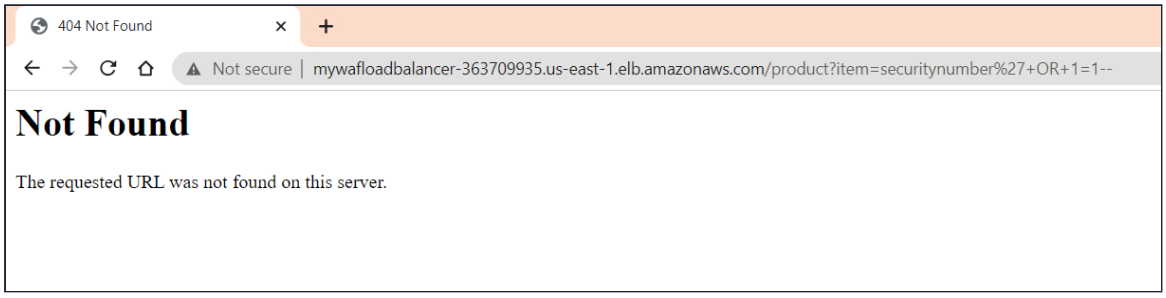


8. Now **Refresh** the page a **few times**. You will observe that the index pages change each time you refresh.

- **Note: The ELB will equally divide the incoming traffic to both servers in a Round Robin manner.**

9. Test **SQL Injection** :

- Along with the ELB DNS add the following URL parameter: ***/product?item=securitynumber'+OR+1=1--***
- Syntax : **http://<ELB DNS>/product?item=securitynumber'+OR+1=1--**
- Example : **MyWAFLoadBalancer-2020171322.us-east-1.elb.amazonaws.com/*product?item=securitynumber'+OR+1=1--***
- You will be able to see the below output.



- Here the **SQL Injection went inside the server** and since we only have an index page, the server doesn't know how to solve the URL that is why you got **Not Found** page.

10. Test Query String Parameter :

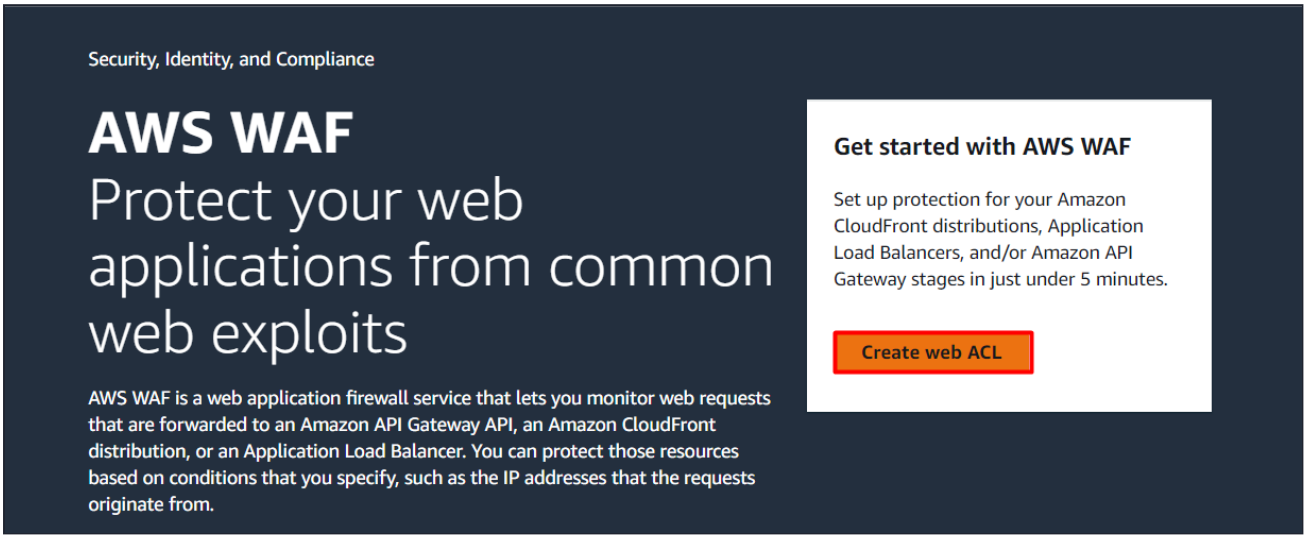
- Along with the ELB DNS add the following URL parameter: ***/?admin=123456***
- Syntax : **http://<ELB DNS>/?admin=123456**
- Example : **MyWAFLoadBalancer-2020171322.us-east-1.elb.amazonaws.com/?*admin=123456***
- You will be able to see the below output.

- Here also the **Query string went inside the server** and the server always passes the query string inside and it is resolved by the code that you write. Here the query string is passed and there is no code to resolve the this but it wont throw any error it just becames an unused value. so you got a response back.

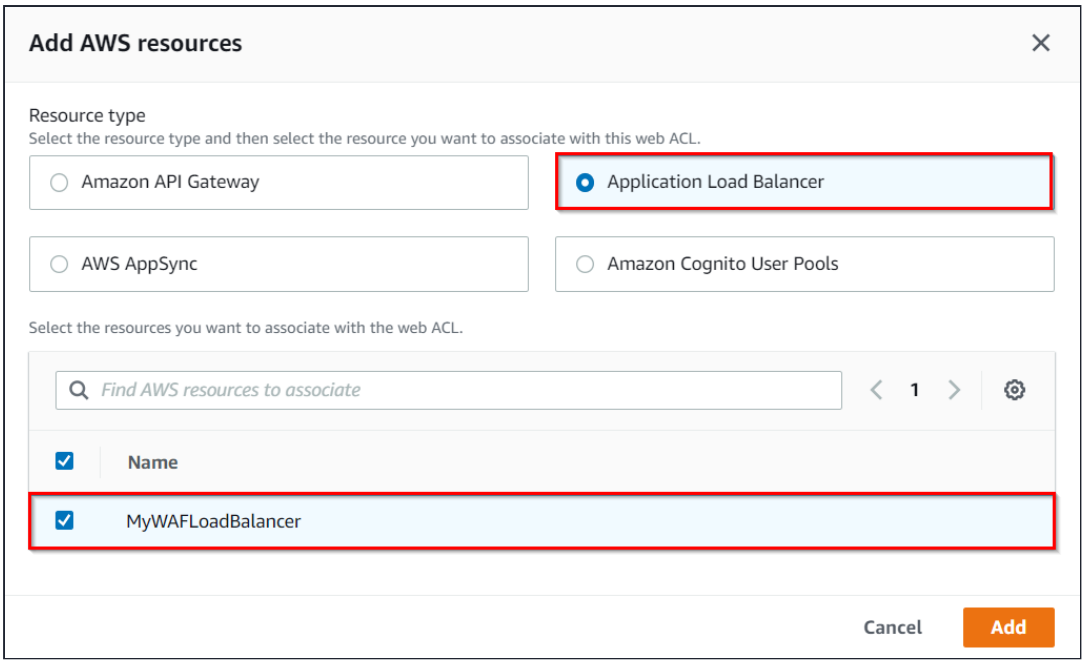
Task 7: Create AWS WAF Web ACL

In this task , we are going to create an AWS WAF Web ACL where we will add some customized rules for location restriction, query strings and

1. Navigate to **WAF** by clicking on the **Services** menu in the top, then click on **WAF & Shield** in the **Security, Identity & Compliance** section.
2. On the left side menu, select **Web ACL's** and then click on **Create web ACL** button.



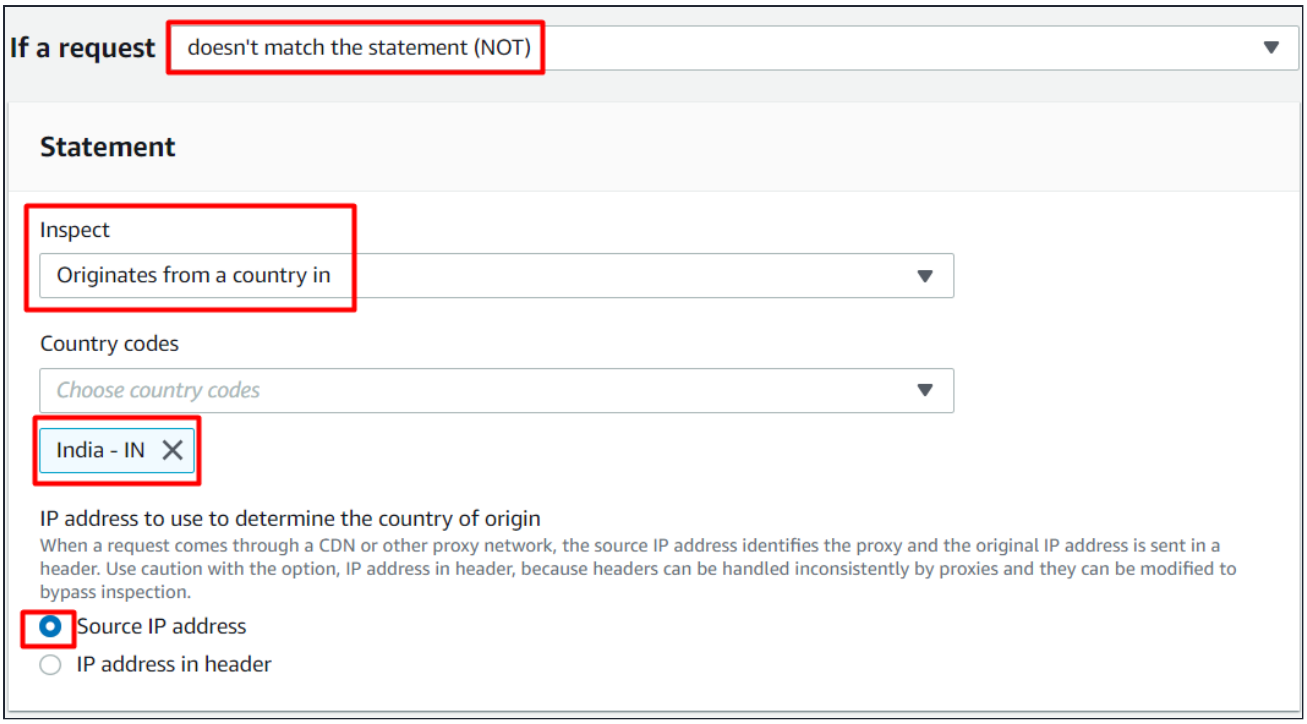
3. Describe web ACL and associate it to AWS resources :
    - Name : Enter ***MyWAFWebAcl***
    - Description : Enter ***WAF for SQL Injection, Geo location and Query String parameters***
    - CloudWatch metric name : Automatically selects the WAF name, so no changes required.
    - Resource type : Select **Regional resources**
    - Region : Select **US East (N.Virginia)** from the dropdown.
    - **Associated AWS resources** :
        - Click on the **Add AWS resources** button.
        - Resource type : Select **Application Load Balancer**
        - Select **MyWAFLoadBalancer** Load balancer from the list.



- Now click on the **Add** button.
- Click on the **Next** button.

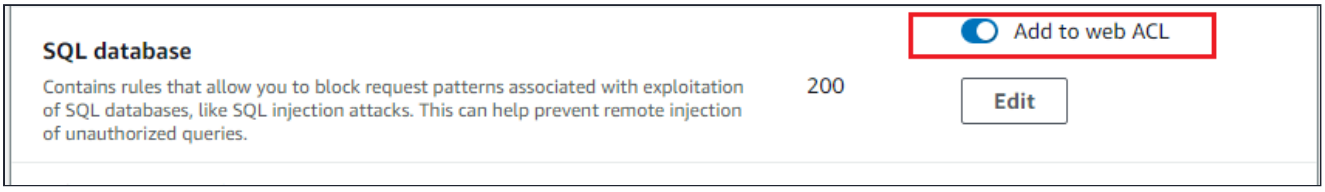
4. Add rules and rule groups :

- Under **Rules**, click on **Add rules** and then select **Add my own rules and rule groups.**
  - Rule type : Select **Rule builder**
  - Name : Enter ***GeoLocationRestriction***
  - Type : Select **Regular type**
  - If a request : Select **Doesn't match the statement (NOT)**
  - Inspect : Select **Originates from a country in**
  - Country codes : Select **<Your Country>** In this example we select **India-IN**
  - **Note** : You can also select multiple countries also.
  - IP address to use to determine the country of origin : Select **Source IP address**



- Under **Then** : **Action** Select **Block**.
- Click on **Add rule**.
- Here we are only allowing requests to come from India and all the requests that come from other countries will be blocked.
- Under **Rules**, click on **Add rules** and then select **Add my own rules and rule groups**.
    - Rule type : Select **Rule builder**
    - Name : Enter ***QueryStringRestriction***
    - Type : Select **Regular type**
    - If a request : Select **matches the statement**
    - Inspect : Select **Query string**
    - Match type : Select **Contains string**
    - String to match : Enter ***admin***
    - Text transformation : Leave as default.
    - Under **Then** : **Action** Select **Block**.
    - Click on **Add rules**.
- Anytime in the request URL contains a query string as **admin** WAF will block that request.
- Under **Rules**, click on **Add rules** and then select **Add managed rule groups**.

- It will take a few minutes to load the page. It lists all the rules which are managed by AWS.
- Click on **AWS managed rule groups**.
- Scroll down to **SQL database** and enable the corresponding **Add to web ACL** button.



- Scroll down to the end and click on **Add rules** button.
- Now you have 3 rules added.

Name	Capacity	Action
GeoLocationRestriction	1	Block
QueryStringRestriction	10	Block
AWS-AWSManagedRulesSQLiRuleSet	200	Use rule actions

- Under **Default web ACL action for requests that don't match any rules**, **Default action** Select **Allow**.
- Click on the **Next** button.

5. Set rule priority :

- No changes required, leave as default.
- **Note** : You can move the rules based on your priority.
- Click on the **Next** button.

6. Configure metrics :

- Leave it as default.
- Click on the **Next** button.

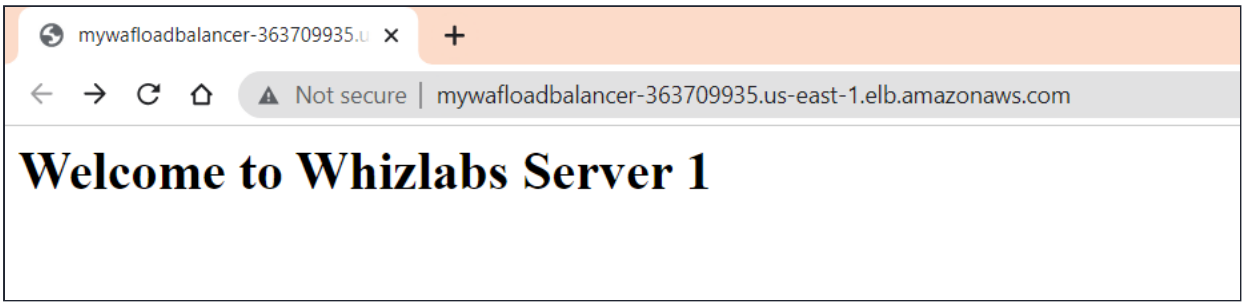
7. Review and create web ACL :

- Review the configuration done, scroll to the end and click on **Create web ACL** button.

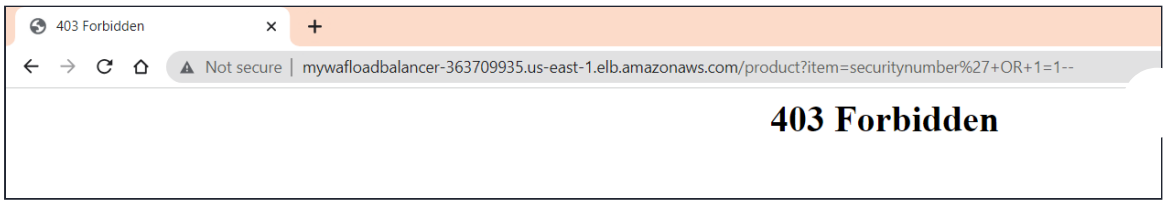
8. It will take a few seconds to create the Web ACL, so wait till its completed.

Task 8: Test Load Balancer DNS

1. Now again navigate to **Load Balancers** from the left side menu under **Load balancing**.
2. Select the **MyWAFLoadBalancer** Load Balancer and copy the **DNS name** under **Description** tab.
3. Copy the **DNS name** of the ELB and enter the address in the **browser**.
   - **DNS Example: MyWAFLoadBalancer-2020171322.us-east-1.elb.amazonaws.com**
4. You should see the **index.html** page content of Web Server 1 or Web Server 2.

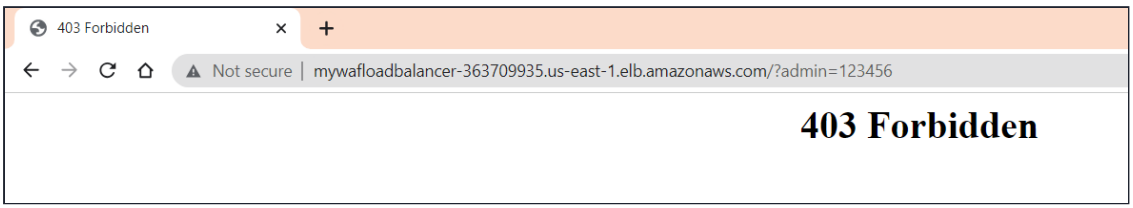


5. Now **Refresh** the page **a few times**.You will observe that the index pages change each time you refresh.
   - **Note: The ELB will equally divide the incoming traffic to both servers in a Round Robin manner**.
6. Test **SQL Injection** :
   - Along with the ELB DNS add the following URL parameter: ***/product?item=securitynumber'+OR+1=1--***
   - Syntax : **http://<ELB DNS>/product?item=securitynumber'+OR+1=1--**
   - Example : **MyWAFLoadBalancer-2020171322.us-east-1.elb.amazonaws.com/*product?item=securitynumber'+OR+1=1--***
   - You will be able to see the below output.



   - Here the **SQL Injection is blocked by WAF before it goes inside the server**.
7. Test Query String Parameter :

- Along with the ELB DNS add the following URL parameter: ***/?admin=123456***
- Syntax : **http://<ELB DNS>/?admin=123456**
- Example : **MyWAFLoadBalancer-2020171322.us-east-1.elb.amazonaws.com/?*admin=123456***
- You will be able to see the below output.



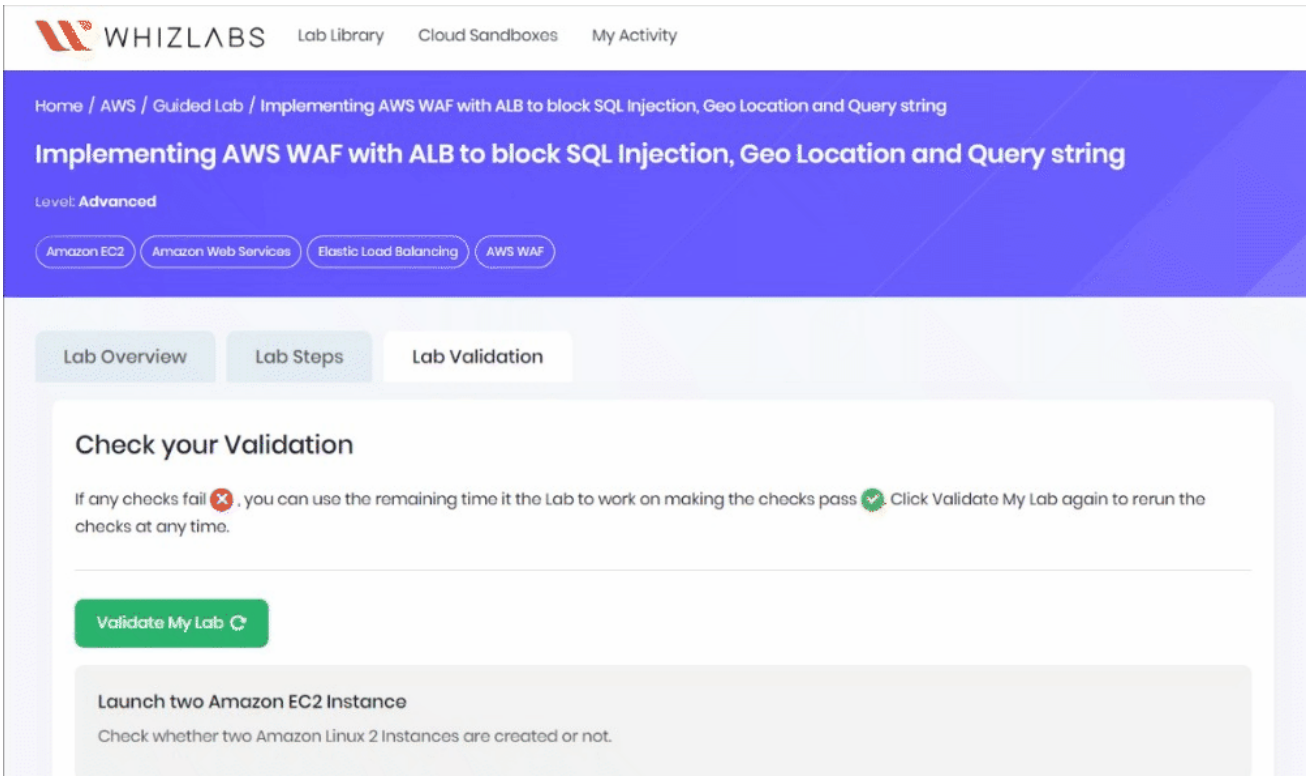
- Here also the **Query string which contains admin is blocked by WAF before it could go inside the server**.

Do you know?

WAF can offer protection against Distributed Denial of Service (DDoS) attacks by analyzing traffic patterns, detecting abnormal behavior, and mitigating the impact of such attacks.

Task 9: Validation Test

1. Once the lab steps are completed, please click on the **Validation** button on the left side panel.
2. This will validate the resources in the AWS account and displays whether you have completed this lab successfully or not.
3. Sample output :



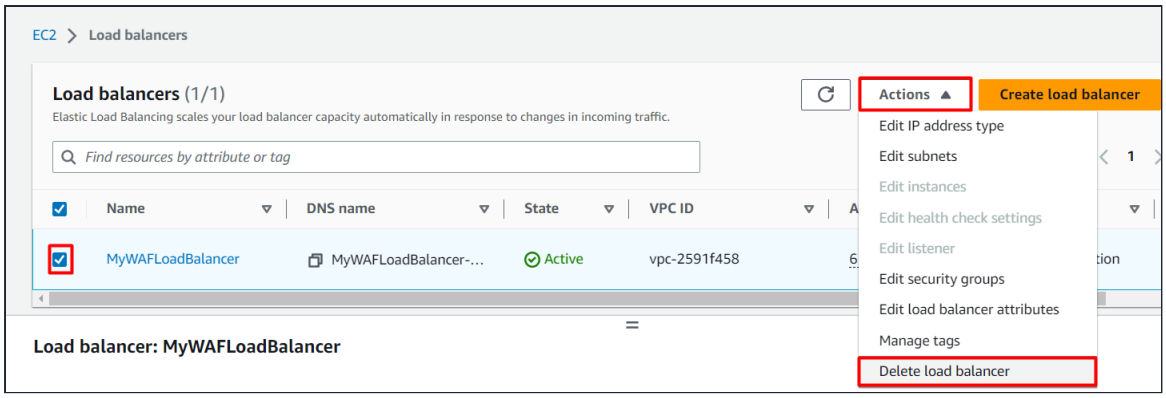
Task 10: Delete AWS Resources

10.1 Deleting an EC2 Instance

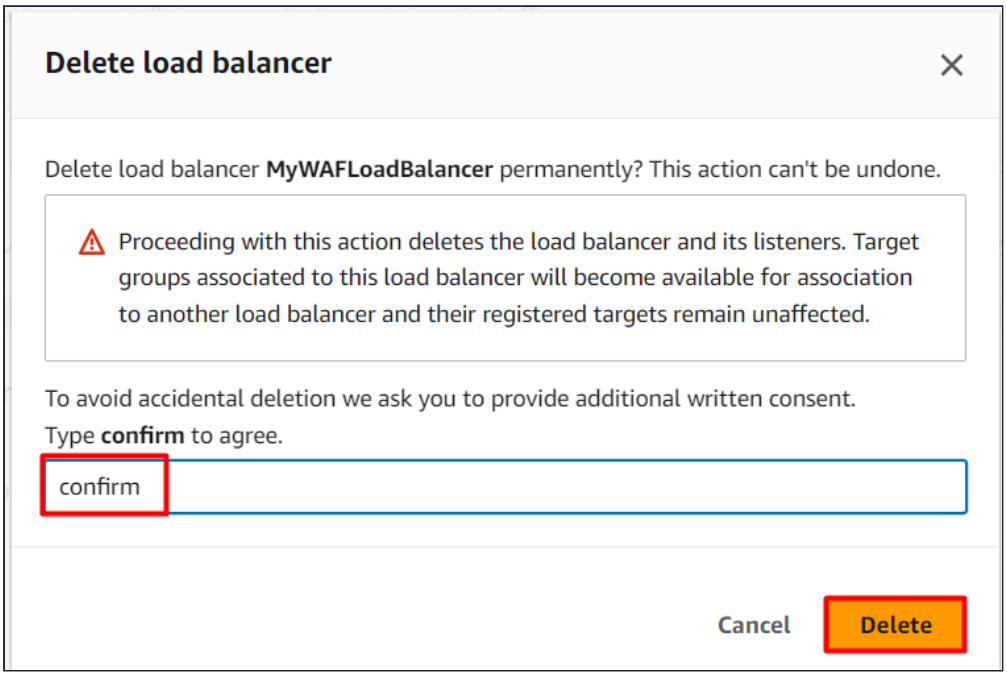
- Make sure you are in the **US East (N. Virginia) us east-1** Region.
- Navigate to **EC2** by clicking on the **Services** menu in the top, then click on **EC2** under **Compute** section.
- Now select the EC2 instance that you have created, click on the **Instance State** and click on the **Terminate** option.
- Click on **Yes,Terminate** button and your EC2 will start terminating.

10.2 Deleting Elastic LoadBalancer and Target Group

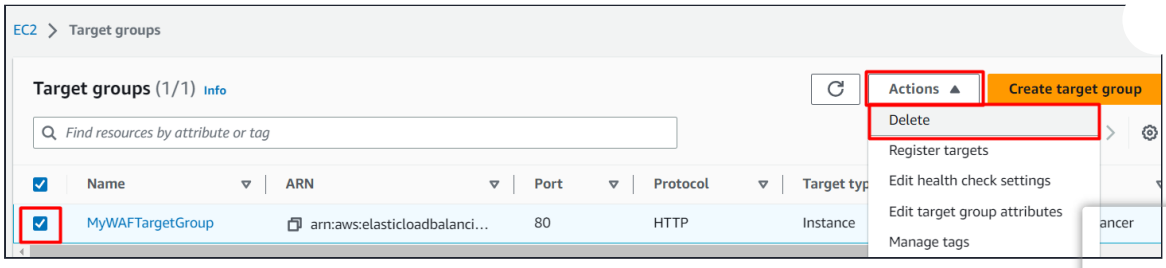
- In the EC2 console, navigate to **Load Balancer** in the left-side paneol.
- **MyWAFLoadBalancer** will be listed here.
- To **delete** the load balancer, need to perform the following actions:
    - **Select** the load balancer,
    - Click on the **Actions** button,
    - Select the **Delete** option.



- Confirm by typing **confirm** and then click on **Delete** button when a pop-up is shown.



- **MyWAFLoadBalancer** be deleted immediately.
- In the EC2 console, navigate to **Target Groups** in the left-side panel.
- **MyWAFTargetGroup** will be listed here.
- To delete the **target group**, need to perform the following actions:
    - **Select** the target group,
    - Click on the **Actions** button,
    - Select the **Delete** option.



- Now click on the **Yes, delete** button to confirm deletion.

- **MyWAFTargetGroup** will be deleted immediately.

10.3 Deleting Web ACL

- Navigate to **WAF** by clicking on the **Services** menu in the top, then click on **WAF & Shield** in the **Security, Identity & Compliance** section.
- On the left side menu, select **Web ACLs** and then click on the Web ACL name that you created, **MyWAFWebAcl**.
- Select **Associated AWS resources** tab, select the application load balancer and click on **Diassociate** button.
- In the textbox enter ***remove*** and click on **Diassociate** button.
- On the left side menu, select **Web ACLs** and then select the radio button of the Web ACL that you created, **MyWAFWebAcl**.
- Click on the **Delete** button, In the textbox enter ***delete*** and click on **Delete** button.
- Now the WAF will be successfully deleted.

Completion and Conclusion

1. You have successfully launched First EC2 Instance.
2. You have successfully launched Second EC2 Instance.
3. You have successfully created an Application Load Balancer and Target Group.
4. You have successfully tested Load Balancer DNS.
5. You have successfully created AWS WAF Web ACL.
6. You have successfully tested Load Balancer DNS.

End Lab

1. Sign out of the AWS Account.
2. You have successfully completed the lab.
3. Once you have completed the steps, click on **End Lab** from your whizlabs lab console and wait till the process gets completed.