Practical - 9: AWS Load Balancer (Step-by-Step Guide)

Objective: To configure an Application Load Balancer (ALB) to meet the specific criteria of the Practical 9 rubric. We will set up an internet-facing ALB that spans multiple Availability Zones (AZs) and routes traffic based on rules: a default rule for a primary target group and a path-based rule for a secondary target group.

Phase 1: Launch EC2 Instances (Our Web Servers)

We need four instances to demonstrate load balancing across two different groups.

1. **Navigate to EC2:** Go to the AWS Management Console -> **EC2**.
2. **Create Security Group:**
   - In the left-hand menu, go to **Network & Security** -> **Security Groups**.
   - Click **Create security group**.
   - **Name:** web-server-sg
   - **Description:** Allows HTTP and SSH for practical 9 servers
   - **VPC:** Leave as the default VPC.
   - **Inbound rules:**
     - **Rule 1:** Type: SSH, Source: My IP (or Anywhere 0.0.0.0/0 if you're unsure, but 'My IP' is safer).
     - **Rule 2:** Type: HTTP, Source: Anywhere (0.0.0.0/0). *We will restrict this later to be more secure.*
   - Click **Create security group**.
3. **Launch Instance 1 (Target Group 1, Server 1):**
   - Go to **Instances** and click **Launch instances**.
   - **Name:** instance-1
   - **AMI:** Amazon Linux 2023 (or any Amazon Linux) - t2.micro.
   - **Key pair:** Select your existing key pair.
   - **Network settings:**
     - Click **Edit**.
     - **Subnet:** Choose one in us-east-1a (or your first AZ).
     - **Firewall:** Select existing security group -> Choose web-server-sg.
   - **Advanced details** (scroll to the bottom):
   - Paste this into the **User data** box:
     ```
     #!/bin/bash
     yum update -y
     yum install -y httpd
     systemctl start httpd
     systemctl enable httpd
     echo "<h1>Response from Instance-1 (TG-1)</h1>" > /var/www/html/index.html
     ```

   - Click **Launch instance**.
4. **Launch Instance 2 (Target Group 1, Server 2):**
   - Repeat the process for instance-2.
   - **Name:** instance-2
   - **Network settings: Crucially**, for **Subnet**, choose one in us-east-1b (or your *second* AZ). This is required by the rubric.
   - **Security Group:** web-server-sg.
   - **User data:**
     ```
     #!/bin/bash
     yum update -y
     yum install -y httpd
     systemctl start httpd
     systemctl enable httpd
     echo "<h1>Response from Instance-2 (TG-1)</h1>" > /var/www/html/index.html
     ```
   - Click **Launch instance**.
5. **Launch Instance 3 (Target Group 2, Server 1):**
   - **Name:** instance-3
   - **Network settings:** Subnet in us-east-1a (your first AZ).
   - **Security Group:** web-server-sg.
   - **User data:** This script creates a special /api/ directory.
     ```
     #!/bin/bash
     yum update -y
     yum install -y httpd
     systemctl start httpd
     systemctl enable httpd
     mkdir -p /var/www/html/api
     echo "<h1>API Response from Instance-3 (TG-2)</h1>" > /var/www/html/api/index.html
     echo "Default page on Instance-3" > /var/www/html/index.html
     ```
   - Click **Launch instance**.
6. **Launch Instance 4 (Target Group 2, Server 2):**
   - **Name:** instance-4
   - **Network settings:** Subnet in us-east-1b (your second AZ).
   - **Security Group:** web-server-sg.
   - **User data:**
     ```
     #!/bin/bash
     yum update -y
     yum install -y httpd
     systemctl start httpd
     systemctl enable httpd
     ```

```
mkdir -p /var/www/html/api
echo "<h1>API Response from Instance-4 (TG-2)</h1>" >
/var/www/html/api/index.html
echo "Default page on Instance-4" > /var/www/html/index.html
```

- Click **Launch instance**.

7. **Validation:** Go to the **Instances** dashboard. Wait until all 4 instances are **Running** and **Status check** shows **2/2 checks passed**.

Phase 2: Create Target Groups (TG-1 and TG-2)

This hits the **"Core ALB & Target Group Setup"** and **"Advanced Routing"** rubric items.

1. **Navigate:** In the EC2 menu, scroll down to **Load Balancing** -> **Target Groups**.
2. **Create Target Group 1 (alb-tg-1):**
    - Click **Create target group**.
    - **Target type:** Instances.
    - **Name:** alb-tg-1 (This will be our default group).
    - **Protocol:Port:** HTTP : 80.
    - **VPC:** Your default VPC.
    - **Health check path:** /
    - Reduce the values to the minimum in the **Advanced health check settings**
    - Click **Next**.
    - **Register targets:** Select instance-1 and instance-2. Click **Include as pending below**.
    - Click **Create target group**.
3. **Create Target Group 2 (alb-tg-2):**
    - Click **Create target group** again.
    - **Target type:** Instances.
    - **Name:** alb-tg-2 (This will be our advanced routing group).
    - **Protocol:Port:** HTTP : 80.
    - **VPC:** Your default VPC.
    - **Health check path:** /api/ (This is important, as it checks the path we created).
    - Reduce the values to the minimum in the **Advanced health check settings**
    - Click **Next**.
    - **Register targets:** Select instance-3 and instance-4. Click **Include as pending below**.
    - Click **Create target group**.
4. **Validation:** Wait a few minutes. Click on alb-tg-1 and alb-tg-2. Go to the **Targets** tab for each. The **Health status** for all instances should change from unused to healthy.
    - **(Screenshot this for your report)**

Phase 3: Create the Application Load Balancer (ALB)

This hits the **"Core ALB Setup"** and **"Listener and Basic Routing"** rubric items.

1. **Navigate:** In the EC2 menu, go to **Load Balancing** -> **Load Balancers**.
2. **Create Security Group for ALB:**
   - Go to **Security Groups** -> **Create security group**.
   - **Name:** alb-sg
   - **Description:** Allows public HTTP to the ALB
   - **VPC:** Your default VPC.
   - **Inbound rules:**
     - **Rule 1:** Type: HTTP, Source: Anywhere (0.0.0.0/0).
   - Click **Create security group**.
3. **Secure Instance Security Group (Best Practice):**
   - Go back to **Security Groups**, find your web-server-sg.
   - Select it, go to the **Inbound rules** tab, and click **Edit inbound rules**.
   - Find the HTTP rule and delete it.
   - Create a new HTTP rule and add the **Source** to be your alb-sg (start typing sg- and select it).
   - Click **Save rules**. (Now, only your ALB can send HTTP traffic to your instances).
4. **Create Load Balancer:**
   - Go to **Load Balancers** -> **Create Load Balancer**.
   - **Type:** Application Load Balancer. Click **Create**.
   - **Name:** practical-9-alb
   - **Scheme:** Internet-facing (Rubric point).
   - **VPC:** Your default VPC.
   - **Mappings (CRITICAL):** You must select *at least two* Availability Zones.
     - Check the boxes for us-east-1a and us-east-1b (or the two AZs you used).
     - For each, select a *public subnet*.
   - **Security groups:** *Remove* the default group. *Add* your alb-sg.
   - **Listeners and routing (CRITICAL):**
     - This will be your **Default Action**, hitting the rubric's "Basic Routing" requirement.
     - Ensure the listener is HTTP : 80.
     - For the default action, select Forward to... and choose your alb-tg-1.
   - Click **Create load balancer**.

Phase 4: Implement Advanced Routing Rule

This hits the **"Advanced Routing Implementation"** rubric item.

1. **Wait** for your practical-9-alb state to become **Active**.
2. **Edit Listener Rules:**
   - Select the practical-9-alb.
   - Go to the **Listeners** tab.
   - Click on the HTTP : 80 listener's link.
   - This will take you to the rules page. You will see one Default rule.
   - Click the **Add rule**.
   - **Add condition:**

        - Path... -> is -> /api/* (The * is a wildcard).
    - **Add action:**
        - Forward to... -> Select alb-tg-2.
    - Set **Priority** to 1.
    - Click **Save**.
3. **Validation:** You should now see two rules: Priority 1 (Path /api/* -> alb-tg-2) and Default (all other traffic -> alb-tg-1).
    - **(Screenshot this "Rules" page for your report)**

Phase 5: Validation and Documentation

This is for the **"Validation and Documentation"** rubric points.

1. **Get DNS Name:** Go to your **Load Balancers** page, select practical-9-alb, and copy its **DNS name** (it looks like practical-9-alb-....elb.amazonaws.com).
2. **Test 1: Basic Routing (TG-1)**
    - Paste the DNS name into your browser: http://[YOUR-ALB-DNS-NAME-HERE]
    - You should see: **"Response from Instance-1 (TG-1)"**.
    - Refresh the page 5-10 times. You will see the response change to: **"Response from Instance-2 (TG-1)"**.
    - **(Screenshot both responses).** This proves your default rule and load balancing for TG-1 are working.
3. **Test 2: Advanced Routing (TG-2)**
    - Now, add /api/ to the end of your DNS name in the browser: http://[YOUR-ALB-DNS-NAME-HERE]/api/
    - You should see: **"API Response from Instance-3 (TG-2)"**.
    - Refresh this page 5-10 times. You will see the response change to: **"API Response from Instance-4 (TG-2)"**.
    - **(Screenshot both responses).** This proves your advanced path-based rule and load balancing for TG-2 are working.

Phase 6: Clean Up Resources

This is required for the final point on the rubric. **Do this in order.**

1. **Delete Load Balancer:**
    - Go to **Load Balancers** -> Select practical-9-alb -> **Actions** -> **Delete**.
2. **Delete Target Groups:**
    - Go to **Target Groups** -> Select alb-tg-1 -> **Actions** -> **Delete**.
    - Select alb-tg-2 -> **Actions** -> **Delete**.
3. **Terminate Instances:**
    - Go to **Instances** -> Select all 4 instances (instance-1 to instance-4).
    - **Instance state** -> **Terminate instance**.
4. **Delete Security Groups:**
    - Go to **Security Groups** -> Select alb-sg -> **Actions** -> **Delete security groups**.

- Select web-server-sg -> **Actions** -> **Delete security groups**.