Start Lab 01:30:00

Bot Management with Google Cloud Armor and reCAPTCHA

Lab 1 hour No cost Introductory

GSP877

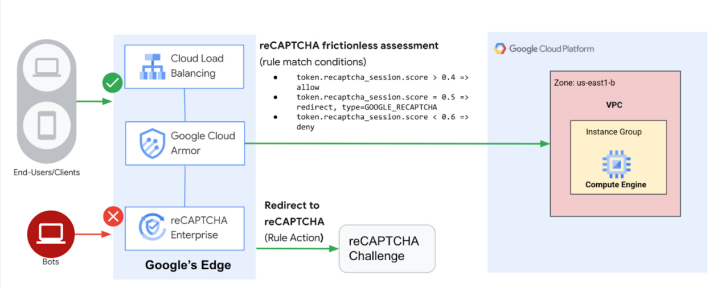
Overview

Google Cloud HTTP(S) load balancing is deployed at the edge of Google's network in Google points of presence (POP) around the world. User traffic directed to an HTTP(S) load balancer enters the POP closest to the user and is then load balanced over Google's global network to the closest backend that has sufficient capacity available.

Cloud Armor is Google's distributed denial of service and web application firewall (WAF) detection system. Cloud Armor is tightly coupled with the Google Cloud HTTP Load Balancer and safeguards applications of Google Cloud customers from attacks from the internet.

reCAPTCHA Enterprise is a service that builds on the reCAPTCHA API and protects your site from spam and abuse using advanced risk analysis techniques to tell humans and bots apart. Cloud Armor Bot Management provides an end-to-end solution integrating reCAPTCHA Enterprise bot detection and scoring with enforcement by Cloud Armor at the edge of the network to protect downstream applications.

In this lab, you configure an HTTP Load Balancer with a backend, as shown in the diagram below. You set up a reCAPTCHA session token site key and embed it in your website. You also set up redirection to reCAPTCHA Enterprise manual challenge. You then configure a Cloud Armor bot management policy to see how bot detection protects your application from malicious bot traffic.



What you'll learn

In this lab, you learn how to:

Lab instructions and tasks

- Set up a HTTP Load Balancer with appropriate health checks
- Create a reCAPTCHA WAF challenge-page site key and associated it with Cloud Armor security policy
- Create a reCAPTCHA session token site key and install it on your web pages
- Create a Cloud Armor bot management policy
- Validate that the bot management policy is handling traffic based on the rules configured

Setup and requirements

Before you click the Start Lab button

Read these instructions. Labs are timed and you cannot pause them. The timer, which starts when you click **Start Lab**, shows how long Google Cloud resources will be made available to you.

This hands-on lab lets you do the lab activities yourself in a real cloud environment, not in a simulation or demo environment. It does so by giving you new, temporary credentials that you use to sign in and access Google Cloud for the duration of the lab.

To complete this lab, you need:

- Access to a standard internet browser (Chrome browser recommended).

Note: Use an Incognito or private browser window to run this lab. This prevents any conflicts between your personal account and the Student account, which may cause extra charges incurred to your personal account.

- Time to complete the lab---remember, once you start, you cannot pause a lab.

Note: If you already have your own personal Google Cloud account or project, do not use it for this lab to avoid extra charges to your account.

How to start your lab and sign in to the Google Cloud console

1. Click the **Start Lab** button. If you need to pay for the lab, a pop-up opens for you to select your payment method. On the left is the **Lab Details** panel with the following:
    - The **Open Google Cloud console** button
    - Time remaining
    - The temporary credentials that you must use for this lab
    - Other information, if needed, to step through this lab
2. Click **Open Google Cloud console** (or right-click and select **Open Link in Incognito Window** if you are running the Chrome browser).

    The lab spins up resources, and then opens another tab that shows the **Sign in** page.

    Tip: Arrange the tabs in separate windows, side-by-side.

    Note: If you see the **Choose an account** dialog, click **Use Another Account**.

3. If necessary, copy the **Username** below and paste it into the **Sign in** dialog.

```
"Username"
```

You can also find the **Username** in the **Lab Details** panel.

4. Click **Next**.

5. Copy the **Password** below and paste it into the **Welcome** dialog.

```
"Password"
```

You can also find the **Password** in the **Lab Details** panel.

6. Click **Next**.

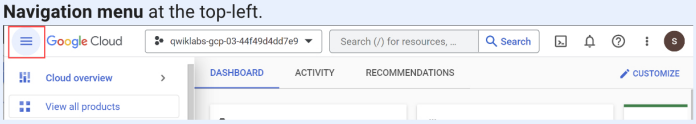
> **Important:** You must use the credentials the lab provides you. Do not use your Google Cloud account credentials.

> **Note:** Using your own Google Cloud account for this lab may incur extra charges.

7. Click through the subsequent pages:

   - Accept the terms and conditions.
   - Do not add recovery options or two-factor authentication (because this is a temporary account).
   - Do not sign up for free trials.

After a few moments, the Google Cloud console opens in this tab.

> **Note:** To view a menu with a list of Google Cloud products and services, click the **Navigation menu** at the top-left.
>
> 
>

Before you begin

- In Cloud Shell, set up your project ID:

```
export PROJECT_ID=$(gcloud config get-value project)
echo $PROJECT_ID
gcloud config set project $PROJECT_ID
```

Enable APIs

- Enable all necessary services:

```
gcloud services enable compute.googleapis.com
gcloud services enable logging.googleapis.com
gcloud services enable monitoring.googleapis.com
gcloud services enable recaptchaenterprise.googleapis.com
```

You're now set up to begin the first task.

Task 1. Configure firewall rules to allow HTTP and SSH traffic to backends

For this lab, you use the ***default*** VPC network created in your project when the lab spun up.

In this section, you configure firewall rules to allow HTTP traffic to the backends from the Google Cloud health checks and the Load Balancer. You then configure a firewall rule to allow SSH into the instances.

Create a firewall rule to allow HTTP traffic to the backends.

Health checks determine which instances of a load balancer can receive new connections. For HTTP load balancing, the health check probes to your load balanced instances come from addresses in the ranges **130.211.0.0/22 and 35.191.0.0/16**. Your VPC firewall rules must allow these connections. Also, the load balancers talk to the backend on the same IP range.

To create a firewall rule to allow HTTP traffic to the backends:

1. In the console, navigate to **Navigation menu (☰) > VPC network > Firewall**.
2. Notice the existing **ICMP**, **internal**, **RDP**, and **SSH** firewall rules. Each Google Cloud project starts with the default network and these firewall rules.
3. Click **Create Firewall Rule**.
4. Set the following values, leave all other values at their defaults:

Property	Value (type value or select option as specified)
Name	default-allow-health-check
Network	default
Targets	Specified target tags
Target tags	allow-health-check
Source filter	IPv4 Ranges
Source IPv4 ranges	130.211.0.0/22, 35.191.0.0/16
Protocols and ports	Specified protocols and ports, and then check `tcp`. Type `80` for the port number

Note: Be sure to enter the two **Source IPv4 ranges** one-by-one and press SPACE in between them.

5. Click **Create**.

Alternatively, in the gCloud command line, use the following command:

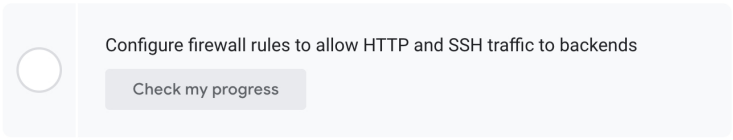
```
gcloud compute firewall-rules create default-allow-health-check
--direction=INGRESS --priority=1000 --network=default --
action=ALLOW --rules=tcp:80 --source-
ranges=130.211.0.0/22,35.191.0.0/16 --target-tags=allow-health-
check
```

6. Similarly, create a firewall rule to allow SSH-ing into the instances:

5. Similarly, create a firewall rule to allow SSH traffic into the instances.

```
gcloud compute firewall-rules create allow-ssh --
direction=INGRESS --priority=1000 --network=default --
action=ALLOW --rules=tcp:22 --source-ranges=0.0.0.0/0 --target-
tags=allow-health-check
```

Click **Check my progress** to verify the objective.



Task 2. Configure instance templates and create managed instance groups

A managed instance group uses an instance template to create a group of identical instances. Use these to create the backend of the HTTP Load Balancer.

Configure the instance templates

An instance template is a resource that you use to create VM instances and managed instance groups. Instance templates define the machine type, boot disk image, subnet, labels, and other instance properties.

To create an instance template:

1. In the console, navigate to **Navigation menu (☰) > Compute Engine > Instance templates**, and then click **Create instance template**.
2. For **Name**, type **lb-backend-template**.
3. For **Location**, Select **Global**.
4. For Series, select **N1**.
5. Click **Networking, Disks, Security, Management, Sole-Tenancy** under **Advanced options**.
6. Go to the **Management** section and insert the following script into the **Startup script** field:

```
#! /bin/bash
sudo apt-get update
sudo apt-get install apache2 -y
sudo a2ensite default-ssl
sudo a2enmod ssl
sudo su
vm_hostname="$(curl -H "Metadata-Flavor:Google" \
http://metadata.google.internal/computeMetadata/v1/instance/name)"
echo "Page served from: $vm_hostname" | \
tee /var/www/html/index.html
```

7. Click on the **Networking** tab and add the network tag: **allow-health-check**
8. Set the following values and leave all other values at their defaults:

Property	Value (type value or select option as specified)
Network (Under Network Interfaces)	default

Subnetwork (Under Network Interfaces)	default (`region`)
Network tags	allow-health-check

Note: The network tag **allow-health-check** ensures that the HTTP Health Check and SSH firewall rules apply to these instances.

9. Click **Create**.

Wait for the instance template to be created.

Create the managed instance group

To Create the managed instance group:

1. Still in **Compute Engine** page, click **Instance groups** in the left pane.
2. Click **Create instance group**.
3. Select **New managed instance group (stateless)**.
4. Set the following values, leave all other values at their defaults:

Property	Value (type value or select option as specified)
Name	lb-backend-example
Location	Single zone
Region	`region`
Zone	`zone`
Instance template	lb-backend-template
Autoscaling	Set **Autoscaling mode** to **Off: do not autoscale**
Minimum number of instance	1

5. Click **Create**.

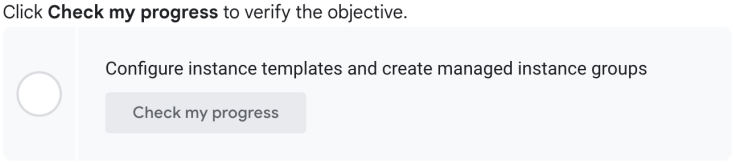
Add a named port to the instance group

- For your instance group, in Cloud Shell, define an HTTP service and map a port name to the relevant port:

```
gcloud compute instance-groups set-named-ports lb-backend-example \
--named-ports http:80 \
--zone lab_zone
```

The load balancing service forwards traffic to the named port.

Click **Check my progress** to verify the objective.



Task 3. Configure the HTTP Load Balancer

Task 3. Configure the HTTP Load Balancer

In this section, you configure the HTTP Load Balancer to send traffic to your backend **lb-backend-example**.

Start the configuration

1. In the console, click **Navigation menu** (☰) > click **Network Services** > **Load balancing**, and then click **Create load balancer**.
2. Select **Application Load Balancer (HTTP/HTTPS)** and **Next**.
3. Select **Public facing (external)** and **Next**.
4. Select **Best for global workloads** and **Next**.
5. Select **Global external Application Load Balancer** and **Next**.
6. Select **Configure**.
7. Set the **Name** to `http-lb`.

Configure the frontend

1. Click **Frontend configuration**.
2. Specify the following, leaving all other values at their defaults:

Property	Value (type value or select option as specified)
Protocol	HTTP
IP version	IPv4
IP address	Ephemeral
Port	80

3. Click **Done**.

Configure the backend

Backend services direct incoming traffic to one or more attached backends. Each backend is composed of an instance group and additional serving capacity metadata.

1. Click on **Backend configuration**.
2. For **Backend services & backend buckets**, click **Create a backend service**.
3. Set the following values, leave all other values at their defaults:

Property	Value (select option as specified)
Name	http-backend
Protocol	HTTP
Named Port	http
Instance group	lb-backend-example
Port numbers	80

4. Click **Done**.
5. For **Cloud CDN**, set the **Cache mode** to **Use origin settings based on Cache-Control headers**.
6. For **Health Check**, select **Create a health check**.

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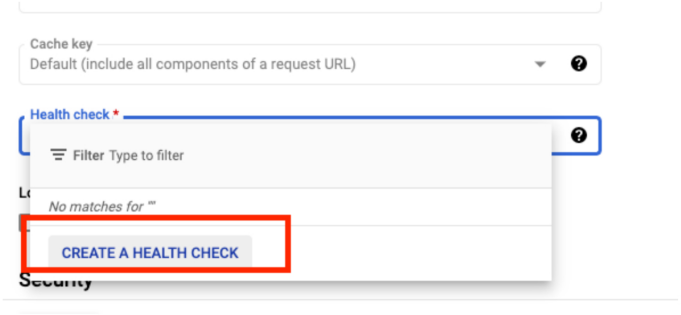


7. Set the following values, leave all other values at their defaults:

Property	Value (select option as specified)
Name	http-health-check
Protocol	TCP
Port	80

Note: Health checks determine which instances receive new connections.

This HTTP health check polls instances every 5 seconds, waits up to 5 seconds for a response and treats 2 successful or 2 failed attempts as healthy or unhealthy, respectively.

8. Click **Save**.

9. Check the **Enable Logging box**.

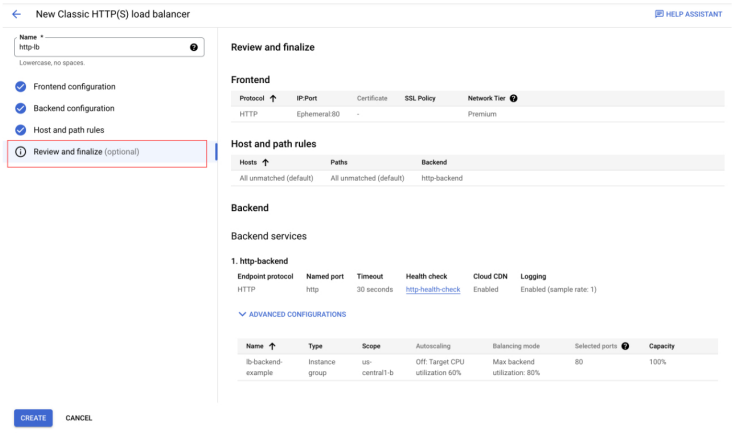
10. Set the **Sample rate** to `1`.

11. Click **Create** to create the backend service and click **ok**.

Review and create the HTTP Load Balancer

Host and path rules determine how your traffic is directed. For example, you could direct video traffic to one backend and static traffic to another backend. However, you are not configuring the Host and path rules in this lab.

1. Click on **Review and finalize**.



2. Review the **Backend services** and **Frontend**.

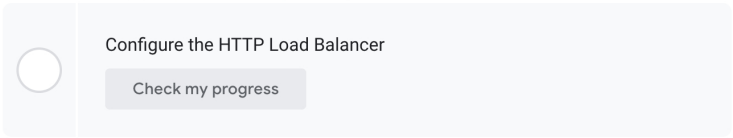
3. Click on **Create**.

Wait for the load balancer to be created.

4. Click on the name of the load balancer (**http-lb**).

5. Note the IPv4 address of the load balancer for the next task. In this lab, refer to it as `[LB_IP_v4]`.

Click **Check my progress** to verify the objective.



Test the HTTP Load Balancer

Now that you created the HTTP Load Balancer for your backends, verify that traffic is forwarded to the backend service.

- To test IPv4 access to the HTTP Load Balancer, open a new tab in your browser and navigate to **http://[LB_IP_v4]**. Be sure to replace `[LB_IP_v4]` with the IPv4 address of the load balancer.

Note: It might take up to 5 minutes to access the HTTP Load Balancer. In the meantime, you might get a 404 or 502 error. Keep trying until you see the page load.

Task 4. Create and deploy reCAPTCHA session token and challenge-page site key

reCAPTCHA Enterprise for WAF and Google Cloud Armor integration offers the following features: reCAPTCHA challenge page, reCAPTCHA action-tokens, and reCAPTCHA session-tokens. In this task, you implement the reCATCHA session token site key and reCAPTCHA WAF challenge-page site.

Create reCAPTCHA session token and WAF challenge-page site key

Before you create the session token site key and challenge page site key, double-check that you've enabled the reCAPTCHA Enterprise API as indicated in the previous *Enable API* section.

The reCAPTCHA JavaScript sets a reCAPTCHA session-token as a cookie on the end-user's browser after the assessment. The end-user's browser attaches the cookie and refreshes the cookie as long as the reCAPTCHA JavaScript remains active.

1. Create the reCAPTCHA session token site key and enable the WAF feature for the key:

```
gcloud recaptcha keys create --display-name=test-key-name \
  --web --allow-all-domains --integration-type=score --testing-
score=0.5 \
  --waf-feature=session-token --waf-service=ca
```

The output of the above command gives you the session token site key you created. Record it to use later in this task.

You also set the WAF service to Cloud Armor to enable the Cloud Armor integration.

Note: You are using the integration type **score** which is leveraged in the Cloud Armor policy. You can alternatively use **checkbox** and **invisible**.

You also set a **testing score** when you create the key to validate that the bot management policies created with Cloud Armor are working as intended. Replicating bot traffic is not easy, so this is a good way to test the feature.

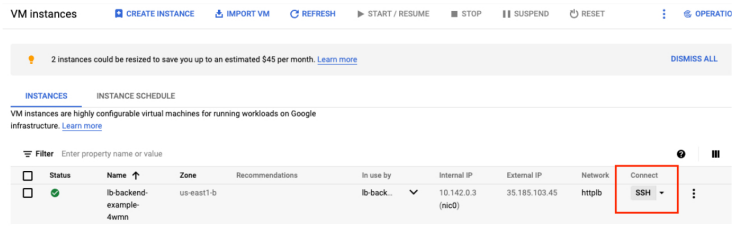
2. Create the reCAPTCHA WAF challenge-page site key and enable the WAF feature for the key. You can use the reCAPTCHA challenge page feature to redirect incoming requests to reCAPTCHA Enterprise to determine whether each request is potentially fraudulent or legitimate. Later, you associate this key with the Cloud Armor security policy to enable the manual challenge. This lab refers to this key as `CHALLENGE-PAGE-KEY` in the later steps.

```
gcloud recaptcha keys create --display-name=challenge-page-key \
--web --allow-all-domains --integration-type=INVISIBLE \
--waf-feature=challenge-page --waf-service=ca
```

3. Navigate to **Navigation menu (☰) > Security > reCAPTCHA Enterprise**. You should see the keys you created in the **Enterprise Keys** list:

Implement reCAPTCHA session token site key

1. Navigate to **Navigation menu (☰) > Compute Engine > VM Instances**. Locate the VM in your instance group and SSH to it.



2. Go to the webserver root directory and change user to root:

```
cd /var/www/html/
sudo su
```

3. Update the landing `index.html` page and embed the reCAPTCHA session token site key. The session token site key (that you recorded earlier) is set in the head section of your landing page as below:

`src="https://www.google.com/recaptcha/enterprise.js?render=<SESSION_TOKEN_SITE_KEY>&waf=session" async defer>`

Remember to replace `<SESSION_TOKEN_SITE_KEY>` with the site token before you run the following command:

```
echo '<!doctype html><html><head><title>ReCAPTCHA Session
Token</title><script
src="https://www.google.com/recaptcha/enterprise.js?render=
<SESSION_TOKEN_SITE_KEY>&waf=session" async defer></script>
</head><body><h1>Main Page</h1><p><a href="/good-
score.html">Visit allowed link</a></p><p><a href="/bad-
score.html">Visit blocked link</a></p><p><a href="/median-
score.html">Visit redirect link</a></p></body></html>' >
index.html
```

4. Create three other sample pages to test out the bot management policies:

- **good-score.html**

```
echo '<!DOCTYPE html><html><head><meta http-equiv="Content-Type"
content="text/html; charset=windows-1252"></head><body>
```

```
<h1>Congrats! You have a good score!!</h1></body></html>' >
good-score.html
```

- **bad-score.html**

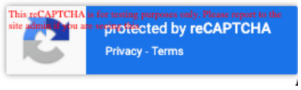
```
echo '<!DOCTYPE html><html><head><meta http-equiv="Content-Type"
content="text/html; charset=windows-1252"></head><body>
<h1>Sorry, You have a bad score!</h1></body></html>' > bad-
score.html
```

- **median-score.html**

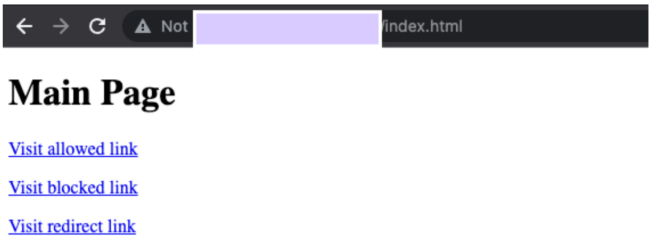
```
echo '<!DOCTYPE html><html><head><meta http-equiv="Content-Type"
content="text/html; charset=windows-1252"></head><body><h1>You
have a median score that we need a second verification.</h1>
</body></html>' > median-score.html
```

Validate that you are able to access all the webpages by opening them in your browser. Be sure to replace `[LB_IP_v4]` with the IPv4 address of the load balancer:

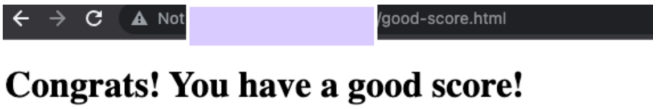
1. Open `http://[LB_IP_v4]/index.html`. You verify that the reCAPTCHA implementation is working when you see "protected by reCAPTCHA" at the bottom right corner of the page:



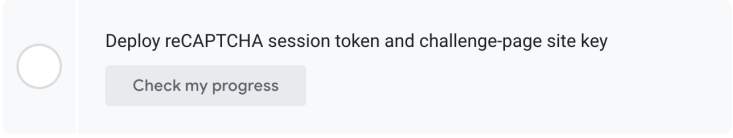
2. Click into each of the links.



3. Validate you are able to access all the pages.



Click **Check my progress** to verify the objective.



Task 5. Create Cloud Armor security policy

Task 5. Create Cloud Armor security policy rules for Bot Management

In this section, you use Cloud Armor bot management rules to allow, deny and redirect requests based on the reCAPTCHA score.

1. In Cloud Shell, create security policy via gcloud:

```
gcloud compute security-policies create recaptcha-policy \
    --description "policy for bot management"
```

2. To use reCAPTCHA Enterprise manual challenge to distinguish between human and automated clients, associate the reCAPTCHA WAF challenge site key (CHALLENGE-PAGE-KEY) you previously created for a manual challenge with the security policy. In the following script, remember to replace "CHALLENGE-PAGE-KEY" with the key you previously created:

```
gcloud compute security-policies update recaptcha-policy \
  --recaptcha-redirect-site-key "CHALLENGE-PAGE-KEY"
```

3. Add a bot management rule to allow traffic if the url path matches good-score.html and has a score greater than 0.4:

```
gcloud compute security-policies rules create 2000 \
    --security-policy recaptcha-policy\
    --expression "request.path.matches('good-score.html') &&
token.recaptcha_session.score > 0.4"\
    --action allow
```

4. Add a bot management rule to deny traffic if the url path matches bad-score.html and has a score less than 0.6:

```
gcloud compute security-policies rules create 3000 \
    --security-policy recaptcha-policy\
    --expression "request.path.matches('bad-score.html') &&
token.recaptcha_session.score < 0.6"\
    --action "deny-403"
```

5. Add a bot management rule to redirect traffic to Google reCAPTCHA if the url path matches median-score.html and has a score equal to 0.5:

```
gcloud compute security-policies rules create 1000 \
    --security-policy recaptcha-policy\
    --expression "request.path.matches('median-score.html') &&
token.recaptcha_session.score == 0.5"\
    --action redirect \
    --redirect-type google-recaptcha
```

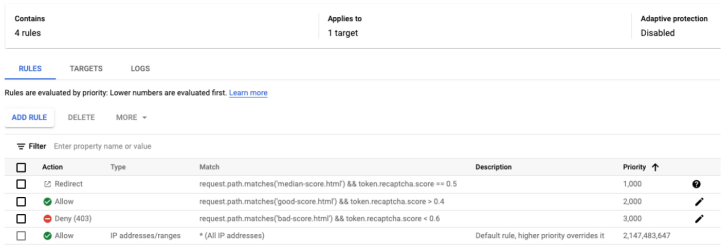
6. Attach the security policy to the backend service `http-backend`:

```
gcloud compute backend-services update http-backend \
    --security-policy recaptcha-policy --global
```

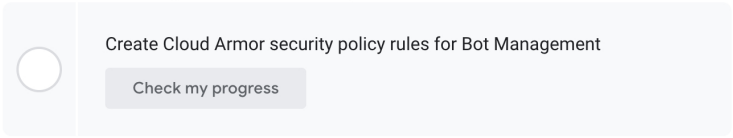
7. In the console, navigate to **Navigation menu > Network Security > Cloud Armor policies**.

8. Click `recaptcha-policy`.

Your policy should resemble the following:



Click **Check my progress** to verify the objective.



Task 6. Validate Bot Management with Cloud Armor

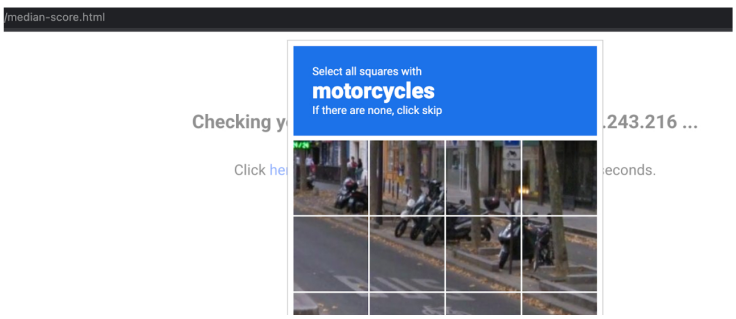
1. Open up a browser and enter the url `http://[LB_IP_v4]/index.html`. Navigate to **"Visit allow link"**.

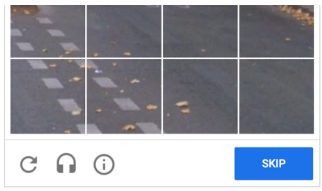
2. Open a new window in Incognito mode to ensure you have a new session.

3. Enter the url `http://[LB_IP_v4]/index.html` and navigate to **"Visit blocked link"**. You should receive a **HTTP 403** error:

4. Open a new window in Incognito mode to ensure you have a new session.

5. Enter the url `http://[LB_IP_v4]/index.html` and navigate to **"Visit redirect link"**. You should see the redirection to Google reCAPTCHA and the manual challenge page as below:





Note: If the user interaction passes the assessment, reCAPTCHA Enterprise issues an exemption cookie. The browser attaches this exemption cookie to the user's subsequent requests to the same site until the cookie expires. By default, the exemption cookie expires after three hours.

Note: To prevent automated software from participating in abusive actions on your site, reCAPTCHA uses an advanced risk analysis engine and adaptive CAPTCHAs. It accomplishes this while allowing your valid users to pass through with ease. If the algorithm believes you are a human, it will validate the reCaptcha without additional action from you. If not, it will display a variety of images that you must categorize before proceeding. Only the most suspect traffic will be requested to solve a captcha by default. If you are not served with a challenge to solve, you can still check the policy logs and verify that you were exempted from solving a challenge.

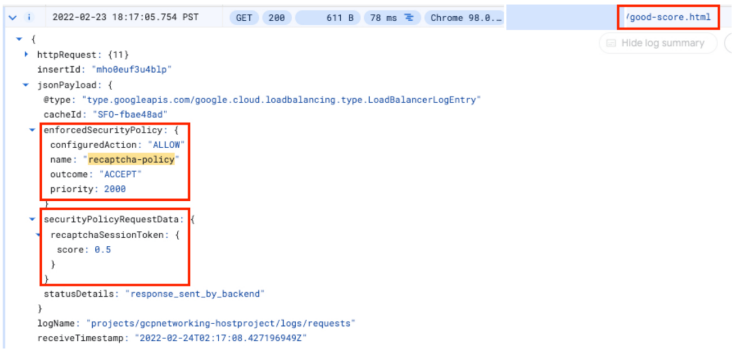
Verify Cloud Armor logs

Explore the security policy logs to validate bot management worked as expected.

1. In the console, navigate to **Navigation menu > Network Security > Cloud Armor**.
2. Click **recaptcha-policy**.
3. Click **Logs**.
4. Click **View policy logs**.
5. Below is the MQL(monitoring query language) query, copy and paste into the query editor:

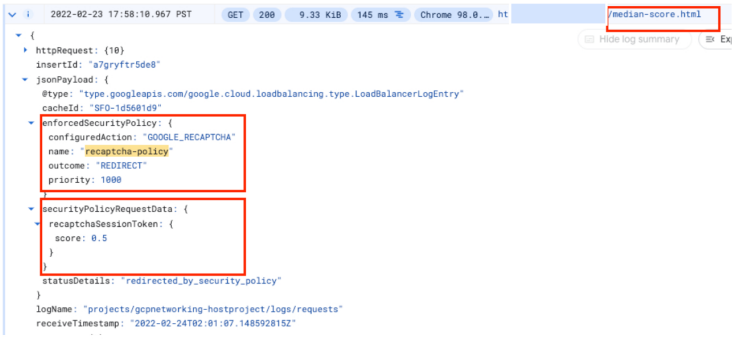
```
resource.type:(http_load_balancer) AND
jsonPayload.enforcedSecurityPolicy.name:(recaptcha-policy)
```

6. Now click **Run Query**.
7. Look for a log entry in Query results where the request is for `http://[LB_IP_v4]/good-score.html`. Expand jsonPayload.Expand enforcedSecurityPolicy.



Note: If you are not seeing log entries, wait a couple of minutes for the policy to propagate, refresh the URLs you used earlier, then check the logs again.

8. Repeat the same for `http://[LB_IP_v4]/bad-score.html` and `http://[LB_IP_v4]/median-score.html`.



Notice that the `configuredAction` is set to **ALLOW, DENY or GOOGLE_RECAPTCHA** with the name **recaptcha-policy**.

> **Note:** Cloud Armor security policies create logs that can be explored to determine when traffic is denied and when it is allowed, along with the source of the traffic.

Click **Check my progress** to verify the objective.

Validate bot management with Cloud Armor

Check my progress

Congratulations!

You successfully implemented bot management with Cloud Armor. You configured an HTTP Load Balancer. Then, you created and implemented reCAPTCHA session token site key on a webpage. You also created a challenge-page site key. You set up Cloud Armor Bot management policy and validated how they handle requests based on the rules. You explored the security policy logs to identify why the traffic was allowed, blocked or redirected.

Manual Last Updated: April 23, 2024

Lab Last Tested: April 23, 2024