

# 1 Account setup & IAM configuration

## 1.1 Enable Multi-Factor Authentication (MFA) for root account

done

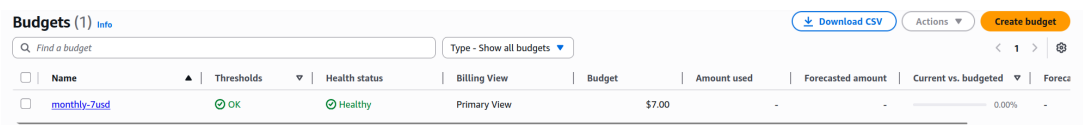
## 1.2 Create an administrative IAM user

done

## 1.3 Connect to AWS using the CLI

I configured the AWS CLI in the terminal with the command `aws configure`. After running this command, I entered my AWS Access Key ID, AWS Secret Access Key, AWS Session Token and the default region.

## 1.4 Set up billing alerts



**Budgets (1)** Info

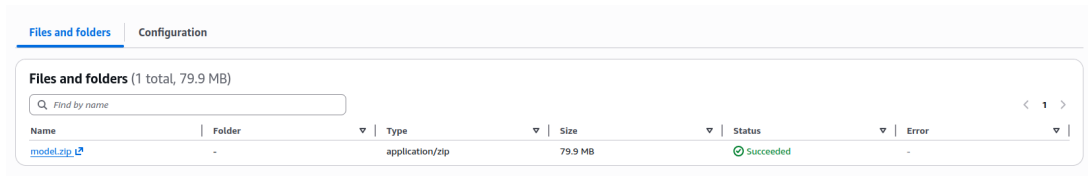
Download CSV Actions Create budget

Find a budget Type - Show all budgets

<input type="checkbox"/>	Name	Thresholds	Health status	Billing View	Budget	Amount used	Forecasted amount	Current vs. budgeted	Foreca
<input type="checkbox"/>	monthly-7usd	OK	Healthy	Primary View	\$7.00	-	-	0.00%	-

# 2 Amazon S3 setup and file management

## 2.1 Create an S3 bucket and 2.2 Upload files to S3 bucket



**Files and folders** Configuration

Files and folders (1 total, 79.9 MB)

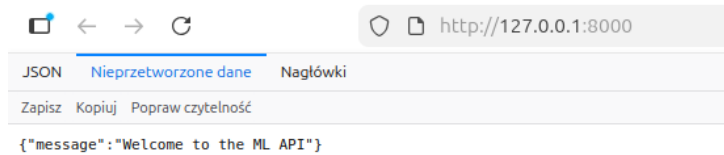
Find by name

Name	Folder	Type	Size	Status	Error
model.zip	-	application/zip	79.9 MB	Succeeded	-

## 2.3 Integrate S3 into an ML workflow

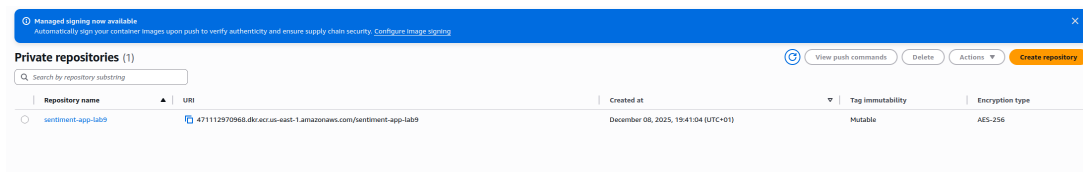
```
(lab_9MLProject) jacek-tyszkiewicz@jacek-tyszkiewicz-Mltro-AN16-41: ~/lab_9MLProject$ python downloads.py
downloading s3://mlops-lab9-jacek-01/model.zip to lab_1MLHomework/models/models/model.zip
download finished
extracting lab_1MLHomework/models/models/model.zip to lab_1MLHomework/models
extraction finished
removed ZIP file: lab_1MLHomework/models/models/model.zip
```

```
✓ lab_1mlhomework-ml-app Built
0.0s
✓ Network lab_1mlhomework_default Created
0.0s
✓ Container lab_1mlhomework-ml-app-1 Created
0.1s
Attaching to ml-app-1
ml-app-1 | Downloading mypy (13.0MiB)
ml-app-1 | Downloading ruff (13.4MiB)
ml-app-1 | Downloaded mypy
ml-app-1 | Downloaded ruff
ml-app-1 | Installed 7 packages in 65ms
ml-app-1 | INFO: Started server process [32]
ml-app-1 | INFO: Waiting for application startup.
ml-app-1 | INFO: Application startup complete.
ml-app-1 | INFO: Uvicorn running on http://0.0.0.0:8000 (Press CTRL+C to quit)
```

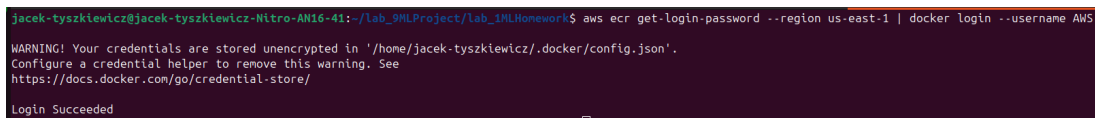


## 3 Elastic Container Registry (ECR) & Docker management

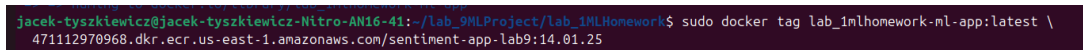
### 3.1 Create an ECR repository



### 3.2 Authenticate your Docker client to ECR



### 3.3 Build and push a Docker image to ECR





## 4.5 Set up a NAT Gateway

NAT gateways (1) [info](#)

Find NAT gateways by attribute or tag

Name	NAT gateway ID	Connectivity...	State	State message	Availability ...	Route table ID	Primary public L...	Primary private L...	Primary network...	VPC	Subnet
sentiment-app-nat-gw	<a href="#">nat-11c29e29445191816</a>	Public	Available	-	Regional	<a href="#">rtb-0e403bdf...</a>	<a href="#">18.304.20.244</a>	-	-	<a href="#">vpc-0b5ff41ef06f747d5 / senti...</a>	-

Updated routes for [rtb-077f40847f95e899f](#) / private-route-table successfully [Details](#)

### rtb-077f40847f95e899f / private-route-table [Actions](#)

**Details** [info](#)  
Route table ID  
[rtb-077f40847f95e899f](#)  
VPC  
[vpc-0b5ff41ef06f747d5](#) | [sentiment-app-vpc](#)

Main  
[No](#)  
Owner ID  
[471112970968](#)

Explicit subnet associations  
2 subnets

Edge associations  
-

Routes

Subnet associations

Edge associations

Route propagation

Tags

**Routes (2)** [Both](#) [Edit routes](#)

Filter routes

Destination	Target	Status	Propagated	Route Origin
0.0.0.0/0	<a href="#">nat-11c29e29445191816</a>	Active	No	Create Route
10.0.0.0/16	local	Active	No	Create Route Table

## 4.6 Security Groups

### sg-0e14afc3e563fa57f - sentiment-app-lb-sg [Actions](#)

**Details**  
Security group name  
[sentiment-app-lb-sg](#)  
Owner  
[471112970968](#)

Security group ID  
[sg-0e14afc3e563fa57f](#)  
Inbound rules count  
1 Permission entry

Description  
[Security group for ALB](#)  
Outbound rules count  
1 Permission entry

VPC ID  
[vpc-0b5ff41ef06f747d5](#) [L](#)

Inbound rules

Outbound rules

Sharing

VPC associations

Tags

**Inbound rules (1)** [Manage tags](#) [Edit inbound rules](#)

Search

Name	Security group rule ID	IP version	Type	Protocol	Port range	Source	Description
-	<a href="#">sgr-017d58665c5826c58</a>	IPv4	HTTP	TCP	80	0.0.0.0/0	-

### sg-0f0cf3d1477fb7c27 - sentiment-app-resources-sg [Actions](#)

**Details**  
Security group name  
[sentiment-app-resources-sg](#)  
Owner  
[471112970968](#)

Security group ID  
[sg-0f0cf3d1477fb7c27](#)  
Inbound rules count  
1 Permission entry

Description  
[Backend resources security group](#)  
Outbound rules count  
1 Permission entry

VPC ID  
[vpc-0b5ff41ef06f747d5](#) [L](#)

Inbound rules

Outbound rules

Sharing

VPC associations

Tags

**Inbound rules (1)** [Manage tags](#) [Edit inbound rules](#)

Search

Name	Security group rule ID	IP version	Type	Protocol	Port range	Source	Description
-	<a href="#">sgr-0d1da44fb3598d70b</a>	-	Custom TCP	TCP	8000	<a href="#">sg-0e14afc3e563fa57f</a> ...	-

## 4.7 Set up an Application Load Balancer (ALB)

### 4.7.1 Target Group

**sentiment-app-target-group** Actions

**Details**

aws:elasticloadbalancing:us-east-1:471112970968:targetgroup/sentiment-app-target-group/3e12a6693c229030

<b>Target type</b> IP	<b>Protocol : Port</b> HTTP: 8000	<b>Protocol version</b> HTTP1	<b>VPC</b> <a href="#">vpc-0b5ff41ef06f747d5</a>
<b>IP address type</b> IPv4	<b>Load balancer</b> <a href="#">None associated</a>		

0 Total targets	0 Healthy 0 Anomalous	0 Unhealthy	0 Unused	0 Initial	0 Draining
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**Targets** | Monitoring | Health checks | Attributes | Tags

**Registered targets (0)** Info Anomaly mitigation: Not applicable Deregister Register targets

Target groups route requests to individual registered targets using the protocol and port number specified. Health checks are performed on all registered targets according to the target group's health check settings. Anomaly detection is automatically applied to HTTP/HTTPS target groups with at least 3 healthy targets.

☐ IP address ☐ Port ☐ Zone ☐ Health status ☐ Health status details ☐ Administrative override ☐ Override ...

No registered targets  
You have not registered targets to this group yet

[Register targets](#)

### 4.7.2 Create the ALB

**Successfully created load balancer: sentiment-app-alb**  
It might take a few minutes for your load balancer to fully set up and route traffic. Targets will also take a few minutes to complete the registration process and pass initial health checks.

**Introducing ALB target optimizer**  
Target optimizer lets you enforce a maximum number of requests per target using an ALB-provided agent, improving success rates, latency, and efficiency. [Learn more](#)

**sentiment-app-alb** Actions

**Details**

<b>Load balancer type</b> Application	<b>Status</b> Provisioning	<b>VPC</b> <a href="#">vpc-0b5ff41ef06f747d5</a>	<b>Load balancer IP address type</b> IPv4
<b>Scheme</b> Internet-facing	<b>Hosted zone</b> Z35SXDOTRQ7X7K	<b>Availability Zones</b> <a href="#">subnet-0c510915184b963c3</a> us-east-1a (use1-az1) <a href="#">subnet-0638f9864dfcc6edd</a> us-east-1b (use1-az2)	<b>Date created</b> December 12, 2025, 17:16 (UTC+01:00)
<b>Load balancer ARN</b> <a href="#">arn:aws:elasticloadbalancing:us-east-1:471112970968:loadbalancer/app/sentiment-app-alb/b1a63148011bd3b4</a>		<b>DNS name info</b> <a href="#">sentiment-app-alb-2003052103.us-east-1.elb.amazonaws.com</a> (A Record)	

**Listeners and rules (1)** Info Manage rules Manage listener Add listener

A listener checks for connection requests on its configured protocol and port. Traffic received by the listener is routed according to the default action and any additional rules.

<input type="checkbox"/>	Protocol:Port	Default action	Rules	ARN	Security policy	Default SSL/TLS certificate	mTLS	Trust store
<input type="checkbox"/>	<a href="#">HTTP:80</a>	<b>Forward to target group</b> <a href="#">sentiment-app-target-group</a> : 1 (100%) Target group stickiness: Off	<a href="#">1 rule</a>	<a href="#">ARN</a>	Not applicable	Not applicable	Not applicable	Not applic

## 5 AWS Fargate deployment & CloudWatch configuration

### 5.1 Create an ECS Cluster

**Cluster sentiment-app-cluster has been created successfully.** View cluster

**Introducing Express Mode**  
Amazon ECS Express Mode provides a simplified way to quickly launch highly available, scalable containerized applications. This streamlined experience automates infrastructure setup, including a default domain for each ECS service. [Learn more](#) Try Express Mode

**Clusters (1)** Info Create cluster

**Cluster** **Services** **Tasks** **Container instances** **CloudWatch monitoring** **Capacity provider strategy**

<a href="#">sentiment-app-cluster</a>	0	No tasks running	0 EC2	Default	No default found
---------------------------------------	---	------------------	-------	---------	------------------

## 5.2 Create a Task Definition

Task definition successfully created  
sentiment-app-task-1 has been successfully created. You can use this task definition to deploy a service or run a task.

View task definition

sentiment-app-task-1

Overview

ARN: [arn:aws:ecs:us-east-1:471112970968:task-definition/sentiment-app-task-1](#)

Status: ACTIVE

Time created: December 12, 2025, 19:26 (UTC+1:00)

App environment: Fargate

Task role: [LabRole](#)

Task execution role: [LabRole](#)

Operating system/Architecture: Linux/X86\_64

Network mode: awsvpc

Fault injection: Turned off

Containers

Task size

Task CPU: 1024 units (1 vCPU)

Task CPU maximum allocation for containers

Task memory: 5072 MiB (5 GiB)

Task memory maximum allocation for container memory reservation

Container: sentiment-app-container

Image: [471112970968.dkr.ecr.us-east-1.amazonaws.com/sentiment-app-lab@sha256:a2420fa0f67ca4649b41da7551c370babdb7246aac76d09c73b64653ab802d](#)

Private registry: Turned off

Secrets Manager ARN or name: -

CPU: 0

Memory hard/soft limit: 3 GiB/-

GPU: -

Environment variables (0)

Environment files (S3 ARN)

## 5.3 Create a Service

sentiment-app-task-service-knabofgl has been deployed successfully.

View service

sentiment-app-cluster-221

Cluster overview

ARN: [arn:aws:ecs:eu-north-1:805928555002:cluster/sentiment-app-cluster-2](#)

Status: Active

CloudWatch monitoring: Default

Registered container instances: -

Services: Draining

Active: 1

Tasks: Pending

Running: 2

Services (1)

Filter services by value

Filter launch type: Any launch type

Filter scheduling strategy: Any scheduling strategy

Filter resource management type: Any resource management type

Service name: [sentiment-app-task-service-knabofgl](#)

ARN: [arn:aws:ecs:eu-north-1:805928555002:cluster/sentiment-app-cluster-2](#)

Status: Active

Scheduling strategy: REPLICA

Launch type: -

Task definition: [sentiment-app-task-1](#)

Deployments and tasks: 2/2 Tasks running

Last deployment: Completed

Created at: 6 minutes ago

## 5.4 Running the service

sentiment-app-cluster-221

Cluster overview

ARN: [arn:aws:ecs:eu-north-1:805928555002:cluster/sentiment-app-cluster-2](#)

Status: Active

CloudWatch monitoring: Default

Registered container instances: -

Services: Draining

Active: 1

Tasks: Pending

Running: 2

Services (1)

Filter services by value

Filter launch type: Any launch type

Filter scheduling strategy: Any scheduling strategy

Filter resource management type: Any resource management type

Service name: [sentiment-app-task-service-knabofgl](#)

ARN: [arn:aws:ecs:eu-north-1:805928555002:cluster/sentiment-app-cluster-2](#)

Status: Active

Scheduling strategy: REPLICA

Launch type: -

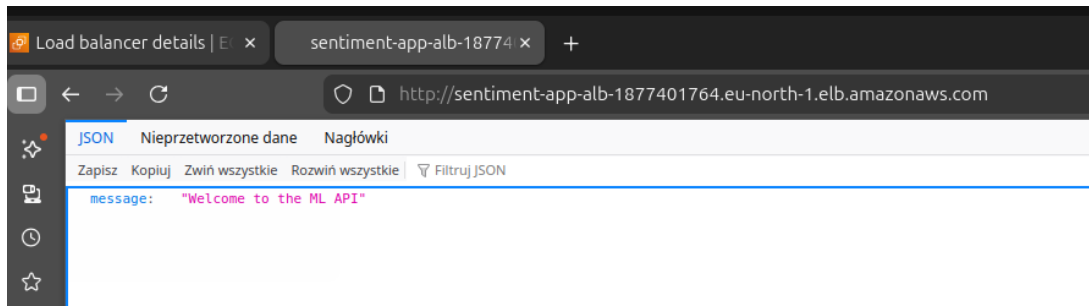
Task definition: [sentiment-app-task-1](#)

Deployments and tasks: 2/2 Tasks running

Last deployment: Completed

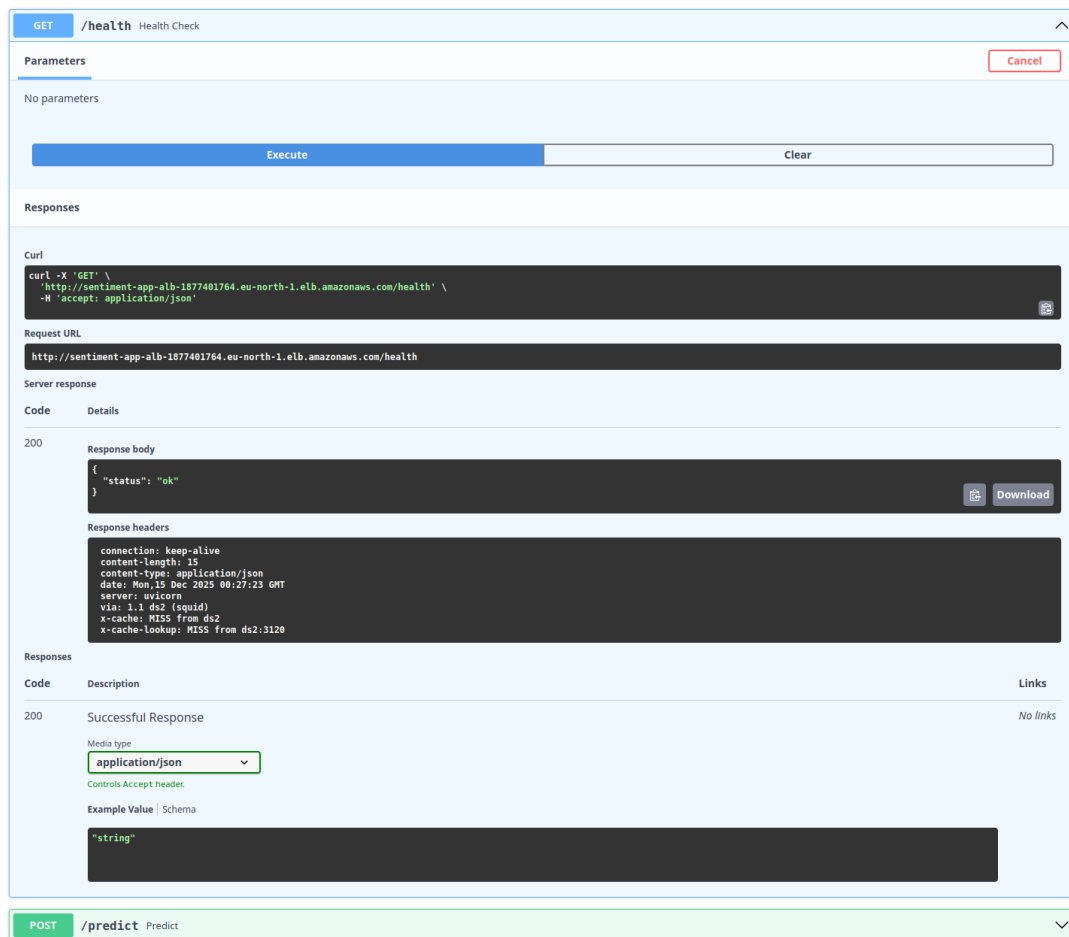
Created at: 11 minutes ago

## 5.5 Access the application



## 6 Application testing and monitoring

### 6.1 Test the application



POST

/predict Predict

⌵

Parameters

Cancel

Reset

No parameters

Request body required

application/json

Edit Value

Schema

```
{
  "text": "Lecimy z tym koxem!"
}
```

Execute

Clear

Responses

Curl

```
curl -X 'POST' \
  'http://sentiment-app-alb-1877401764.eu-north-1.elb.amazonaws.com/predict' \
  -H 'accept: application/json' \
  -H 'Content-Type: application/json' \
  -d '{
    "text": "Lecimy z tym koxem!"
  }'
```

Request URL

http://sentiment-app-alb-1877401764.eu-north-1.elb.amazonaws.com/predict

Server response

Code

Details

200

Response body

```
{
  "prediction": "neutral"
}
```

Download

Response headers

```
connection: keep-alive
content-length: 24
content-type: application/json
date: Mon, 15 Dec 2025 00:30:22 GMT
server: uvicorn
via: 1.1 ds2 (squid)
x-cache: MISS from ds2
x-cache-lookup: MISS from ds2:3120
```

Responses

Code

Description

Links

200

Successful Response

No links

Media type

application/json

Controls Accept header

Example Value

Schema

default

GET / Welcome Root

Parameters

No parameters

Execute

Clear

Responses

Curl

```
curl -X 'GET' \
  http://sentiment-app-alb-1877401764.eu-north-1.elb.amazonaws.com/ \
  -H 'accept: application/json'
```

Request URL

http://sentiment-app-alb-1877401764.eu-north-1.elb.amazonaws.com/

Server response

Code	Details
200	<div>Response body</div> <div> <pre>{   "message": "Welcome to the ML API" }</pre> </div> <div>Response headers</div> <div> <pre>connection: keep-alive content-length: 35 content-type: application/json date: Mon, 15 Dec 2025 00:33:35 GMT server: uvicorn via: 1.1 ds2 (squid) x-cache: MISS from ds2 x-cache-lookup: HIT from ds2:3120</pre> </div>

Responses

Code	Description	Links
200	Successful Response <div>Media type</div> <div>application/json</div> <div>Controls Accept header</div> <div>Example Value   Schema</div> <div>"string"</div>	No links

```
jacek-tyszkiewicz@jacek-tyszkiewicz-Nitro-AN16-41: /lab_9MLProject/lab_1MLHomework$ ALB_DNS=sentiment-app-alb-1877401764.eu-north-1.elb.amazonaws.com
jacek-tyszkiewicz@jacek-tyszkiewicz-Nitro-AN16-41: /lab_9MLProject/lab_1MLHomework$ curl -i "http://${ALB_DNS}/health"
HTTP/1.1 200 OK
Date: Mon, 15 Dec 2025 00:35:49 GMT
Content-Type: application/json
Content-Length: 15
Server: uvicorn
X-Cache: MISS from ds2
X-Cache-Lookup: HIT from ds2:3120
Via: 1.1 ds2 (squid)
Connection: keep-alive

{"status":"ok"}jacek-tyszkiewicz@jacek-tyszkiewicz-Nitro-AN16-41: /lab_9MLProject/lab_1MLHomework$ curl -i -X POST "http://${ALB_DNS}/predict" -d '{"text":"Lecimy z tym koksem!"}'
HTTP/1.1 200 OK
Date: Mon, 15 Dec 2025 00:35:57 GMT
Content-Type: application/json
Content-Length: 24
Server: uvicorn
X-Cache: MISS from ds2
X-Cache-Lookup: MISS from ds2:3120
Via: 1.1 ds2 (squid)
Connection: keep-alive

{"prediction":"neutral"}jacek-tyszkiewicz@jacek-tyszkiewicz-Nitro-AN16-41: /lab_9MLProject/lab_1MLHomework$
```

	Timestamp	Message
	2025-12-15T00:32:07.233Z	INFO: 10.0.2.187:52314 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:32:13.921Z	INFO: 10.0.1.176:54674 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:32:37.264Z	INFO: 10.0.2.187:16862 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:32:43.951Z	INFO: 10.0.1.176:26900 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:33:07.294Z	INFO: 10.0.2.187:62556 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:33:13.979Z	INFO: 10.0.1.176:5744 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:33:35.181Z	INFO: 10.0.2.187:59396 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:33:37.325Z	INFO: 10.0.2.187:12216 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:33:44.009Z	INFO: 10.0.1.176:9576 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:34:07.356Z	INFO: 10.0.2.187:9126 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:34:14.035Z	INFO: 10.0.1.176:55740 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:34:37.386Z	INFO: 10.0.2.187:13246 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:34:44.039Z	INFO: 10.0.1.176:61320 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:35:07.387Z	INFO: 10.0.2.187:34308 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:35:14.069Z	INFO: 10.0.1.176:13058 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:35:37.391Z	INFO: 10.0.2.187:63650 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:35:44.083Z	INFO: 10.0.1.176:42508 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:35:57.514Z	INFO: 10.0.1.176:11610 - "POST /predict HTTP/1.1" 200 OK
	2025-12-15T00:36:07.419Z	INFO: 10.0.2.187:4266 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:36:14.113Z	INFO: 10.0.1.176:64266 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:36:37.437Z	INFO: 10.0.2.187:62726 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:36:44.124Z	INFO: 10.0.1.176:52272 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:37:07.467Z	INFO: 10.0.2.187:46270 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:37:14.155Z	INFO: 10.0.1.176:40914 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:37:37.498Z	INFO: 10.0.2.187:17182 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:37:44.176Z	INFO: 10.0.1.176:14444 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:38:07.517Z	INFO: 10.0.2.187:61634 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:38:14.198Z	INFO: 10.0.1.176:34520 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:38:37.539Z	INFO: 10.0.2.187:63034 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:38:44.210Z	INFO: 10.0.1.176:24620 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:39:07.563Z	INFO: 10.0.2.187:47494 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:39:14.223Z	INFO: 10.0.1.176:50624 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:39:37.583Z	INFO: 10.0.2.187:41328 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:39:44.253Z	INFO: 10.0.1.176:41302 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:40:07.597Z	INFO: 10.0.2.187:7742 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:40:14.269Z	INFO: 10.0.1.176:5358 - "GET / HTTP/1.1" 200 OK
	2025-12-15T00:40:37.615Z	INFO: 10.0.2.187:3982 - "GET / HTTP/1.1" 200 OK

All > ApplicationELB > Per AppELB, per AZ, per TG Metrics
Alarm recommendations

Stockholm

Search for any metric, dimension, resource id or account id

RequestCount X Clear filters

<input type="checkbox"/> LoadBalancer 4/4	<input type="checkbox"/> AvailabilityZone	<input type="checkbox"/> TargetGroup	<input type="checkbox"/> Metric name	<input type="checkbox"/> Alarms
<input type="checkbox"/> app/sentiment-app-alb/d3d5c8f06bc9f3ed	eu-north-1a	targetgroup/sentiment-app-tg/76d194c9696f4010	RequestCount	No alarms
<input type="checkbox"/> app/sentiment-app-alb/d3d5c8f06bc9f3ed	eu-north-1b	targetgroup/sentiment-app-tg/76d194c9696f4010	RequestCount	No alarms
<input type="checkbox"/> app/sentiment-app-alb/d3d5c8f06bc9f3ed	eu-north-1b	targetgroup/sentiment-app-tg/76d194c9696f4010	RequestCountPerTarget	No alarms
<input type="checkbox"/> app/sentiment-app-alb/d3d5c8f06bc9f3ed	eu-north-1a	targetgroup/sentiment-app-tg/76d194c9696f4010	RequestCountPerTarget	No alarms

Alarms (0)

Alarm state: Any

Alarm type: Any

Actions status: Any

☐ Hide Auto Scaling alarms

Clear selection

Create composite alarm

Actions

Create alarm

Name

State

Last state update (UTC)

Conditions

Actions

No alarms

No alarms to display

[Read more about alarms](#)

Create alarm