

# **Configuration Manual**

MSc Research Project MSc Cloud Computing

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#### **MSc Project Submission Sheet**

#### School of Computing

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Programme:	Masters in Cloud Computing	Year:	2023
Module:	MSc Research Project		
Lecturer:	Rashid Mijumbi		
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Project Title:	Fault Tolerance Optimization i distributed cloud environment	n Load Balancing usi	ng Multiple APIs in
Word Count:	307 <b>Pa</b>	ge Count: 10	

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## **Configuration Manual**

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#### 1 Introduction

This manual outlines the key steps and components involved in the research on optimizing fault tolerance in load balancing within a distributed cloud environment. The document is organized into three sections: Environmental Setup and Tools Setup used in this research.

#### 2 Environmental Setup

#### 2.1 Hardware Setup for Local Environment

Processor Requirement: Intel i3 or higher Memory Requirement: 8 GB RAM

#### 2.2 Programming Setup

Python: Version 3.10 or above

#### **3** Tools Setup

There are two tools required for this project

- Anaconda Navigator: For the creation of Load Balancing and fault tolerance program
- AWS Cloud Lambda Function and Rest API (API Gateway)

#### 3.1 Installing Anaconda Navigator

Step 1: Begin by downloading Anaconda Navigator from this link. <u>https://www.anaconda.com/download</u>

Step 2: After downloading, install Anaconda Navigator on your system.



Step 3: Once installed, open Anaconda Navigator. Within Anaconda Navigator, launch Jupyter Notebook.

0.0			Anaconda Navigator			
	DA.NAVIGATOR					Connect ~
🕈 Home	All applications - on	base (1000 - ) Channels				c
Tervironments	PC	0	<b>•</b>	Jupyter	¢ IPtyt:	
🗳 Learning	PyCharm Professional	Anaconda Toolbox	Anaconda Cloud Notebooks	Notebook	Qt Console	
Community	A full fliedged IDE by JetBrains for both Scientific and Web Python development. Supports HTML, JS, and SQL	0.4.0 Anaconda Aosistant JupyterLab supercharged with a suite of Anaconda extension, starting with the Anaconda Aosistant Al charbot.	Cloud-hosted notebook service from Anaconda, Launch a preconfigured environment with hundreds of packages and store project files with persident cloud storage.	7 7.0.6 Webbased, interactive computing relationik environment, Edit and nun human-readable document describing the data analysis.	25.4.2 PyQt Gut that supports inline figures, proper multiline editing with syntax highlighting, graphical calitops, and more.	
	Install	Install	Launch	Launch	Launch	
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Step 4: You can use any browser of your choice to open and work with Jupyter Notebook.

#### 3.2 AWS Cloud

#### 3.2.1 Lambda Function

Step 1: Login in to AWS to access the service: Lambda and Rest API

Sign in		
Root user     Account owner that performs tasks requiring     unrestricted access. Learn more	aws	
O IAM user User within an account that performs daily tasks. Learn more	AWS Cloud	
Root user email address	Instituto	
balavignesh.ks.student@gmail.com	institute	
Next	Become a cloud developer in as little as 12 months	
By continuing, you agree to the AWS Customer Agreement or other agreement for AWS services, and the Privacy Notice. This site uses essential cookies. See our Cookie Notice for more information.	Enroll today >>	
New to AWS?		
Create a new AWS account		

Step 2: Search for Lambda Service in AWS



#### Step 3: After launching Lambda Create Function

Func	tions (1)						Las	st fetched now C Actions	Create function
QF	ilter by tags and	attribut	tes or search by ke	eyword					< 1 > 💿
	Function name	~	Description	~	Package type 🛛 🗢	Runtime	~	Last modified	▽
	Test2		-		Zip	Python 3.12		12 days ago	

Step 4: Write the followinng Code in the lambda Coding Platform

Co	de Test Monitor	Configuration Aliases Versions	
C	ode source Info		
<b></b>	File Edit Find View Go	Tools Window Test  Deploy	
Q	Go to Anything (Ctrl-P)	■ lambda_function × Environment Var × ⊕	
Environment	Test2 /      Iambda_function.py	<pre>1 jimport json 2 import random 3 from datetime import datetime 4 def generate_current_weather(): 6 return { 7 "location": { 8 "location": { 9 }, 10 contry": "Ireland" 9 }, 10 "date": datetime.now().strftime("%Y-%m-%d"), 11 "date": datetime.now().strftime("%Y-%m-%d"), 12 "date": datetime.now().strftime("%Y-%m-%d"), 13 "temperature": { 13 "igh": round(random.uniform(15, 25), 1), 14 "low": round(random.uniform(16, 15), 1) 15 }, 16 "humidity": random.randint(60, 80), 17 "wind_speed": round(random.uniform(5, 15), 1), 18 "condition": random.choice(["Sunny", "Cloudy", "Partly Cloudy", "Rain"]) 19 } 10 } 10 } 11 def lambda_handler(event, context): 12 weather_data = generate_current_weather() 14 "statusCode": 200, 15 "rody": weather date</pre>	

## 3.2.2 Creation of API Gateway

Step 1: Search for API Gateway

Q apig	× _	٤
	Search results for 'api'	
Services (36)	Services	See all 36 results
Features (31) Resources <b>New</b> Documentation (200,990) Knowledge Articles (227)	<ul> <li>API Gateway 公 Build, Deploy and Manage APIs</li> <li>Top features</li> </ul>	
Marketplace (4,020) Blogs (4,962) Events (140)	CloudTrail ☆ Track User Activity and API Usage	
Tutorials (25)	Securely and easily add location data to applications.	
	<b>AWS Cloud Map</b> ☆ Build a dynamic map of your cloud	

## Step 2: Create API

				C De	elete Create A
<b>Q</b> Find APIs					< 1 >
Name	▲ Description	▼   ID	▼ Protocol	▼ API endpoint type	Created
O Test2API		rb6328d058	DECT	Destand	

Step 3: Build Rest API

Lambda, HTTP, AWS Services	
	Build
REST API	
Develop a REST API where you gain complete control over the request and response capabilities.	onse along with API management
Works with the following: Lambda, HTTP, AWS Services	
	Import Build
REST API Private	
Create a REST API that is only accessible from within a VPC.	
Works with the following: Lambda, HTTP, AWS Services	

## Step 4: Give a name for the API

API details	
• New API Create a new REST API.	Clone existing API Create a copy of an API in this AWS account.
O Import API Import an API from an OpenAPI definition.	C Example API Learn about API Gateway with an example API.
API name	
My REST API	
Description - <i>optional</i>	
Regional APIs are deployed in the current AWS Region. Edge-optimi: Private APIs are only accessible from VPCs.	zed APIs route requests to the nearest CloudFront Point of Presence.

## Step 5: Create method in the new API

links		API actions V Deploy A
Create resource	Resource details	Update documentation Enable CORS
	Path	Resource ID
es /	/	0vgohoxyfa
way responses		
els	Methods (0)	Delete Create method
mentation	I Method type	Integration type v Authorization v API key
board		No methods
etungs		No methods defined.
e plans		
eys		
t certificates		
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Method type GET ntegration type		
Method type GET ntegration type Lambda function	О НТТР	Mock
Method type GET ntegration type Lambda function Integrate your API with a Lambda function.	HTTP     Integrate with an existing HTT     endpoint.	P API Gateway mappings and
Method type GET Integration type Lambda function Integrate your API with a Lambda function.	HTTP     Integrate with an existing HTT     endpoint.	P Mock Generate a response based on API Gateway mappings and transformations.
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Method type GET Integration type Lambda function Integrate your API with a Lambda function.	HTTP     Integrate with an existing HTT     endpoint.     HTTP	P Mock Generate a response based on API Gateway mappings and transformations.
Method type GET Integration type Lambda function Integrate your API with a Lambda function.	○ HTTP Integrate with an existing HTT endpoint. () VPC link	P Mock Generate a response based on API Gateway mappings and transformations.
Method type GET Integration type • Lambda function Integrate your API with a Lambda function. • AWS service Integrate with an AWS Service.	<ul> <li>HTTP Integrate with an existing HTT endpoint.</li> <li>WTTP</li> <li>VPC link Integrate with a resource that</li> </ul>	P P Mock Generate a response based on API Gateway mappings and transformations.
Method type GET Integration type C Lambda function Integrate your API with a Lambda function. C AWS service Integrate with an AWS Service.	<ul> <li>HTTP Integrate with an existing HTT endpoint.</li> <li>WTTP</li> <li>VPC link Integrate with a resource that isn't accessible over the public internet.</li> </ul>	P O Mock Generate a response based on API Gateway mappings and transformations.
Method type GET Integration type C Lambda function Integrate your API with a Lambda function. C AWS service Integrate with an AWS Service.	<ul> <li>HTTP Integrate with an existing HTT endpoint.</li> <li>WPC link Integrate with a resource that isn't accessible over the public internet.</li> </ul>	P P Mock Generate a response based on API Gateway mappings and transformations.
Method type GET Integration type Lambda function Integrate your API with a Lambda function. AWS service Integrate with an AWS Service.	<ul> <li>HTTP Integrate with an existing HTT endpoint.</li> <li>Integrate with a resource that isn't accessible over the public internet.</li> </ul>	P Mock Generate a response based on API Gateway mappings and transformations. Mock transformations.
Method type   GET   Integration type   Lambda function   Integrate your API with a Lambda function.     Integrate your API with a Lambda function.     Integrate your API with a Lambda function.     Integrate your API with a Lambda function.	<ul> <li>HTTP Integrate with an existing HTT endpoint.</li> <li>Integrate with a resource that isn't accessible over the public internet.</li> </ul>	P Mock Generate a response based on API Gateway mappings and transformations.

eu-north-1 🔻	<b>Q</b> Choose a Lambda function or enter its ARN	
Grant API Gat policy yourse	teway permission to invoke your Lambda function. To turn off, update the fun elf, or provide an invoke role that API Gateway uses to invoke your function.	ction's resource
Default timeou The default time	it neout is 29 seconds.	
<ul> <li>Method requ</li> </ul>	lest settings	
Method requ     URL query st	iest settings tring parameters	
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<ul> <li>Method requination</li> <li>URL query st</li> <li>HTTP request</li> <li>Request body</li> </ul>	iest settings tring parameters St headers	

Do the same process (3.2.1 to 3.2.2) for two more different regions.

Now the initial setup is complete.

Run the load balancer and fault tolerance function in the Jupyter notebook mentioned below. Note the api urls need to be changed to the urls of your API.

```
import requests
from prettytable import PrettyTable
import time
import itertools
from datetime import datetime
import pandas as pd
# API endpoints
apis = {
    "Stockholm": "https://q1xzknxdg0.execute-api.eu-north-1.amazonaws.com/TESTSTAGE1/",
    "Oregon": "https://rh6328d058.execute-api.us-west-2.amazonaws.com/TestStage2",
    "Ohio": "https://4ohx6p0mr9.execute-api.us-east-2.amazonaws.com/TestStage3"
# Initialize request log
request log = []
uptime = 0
downtime = 0
def get weather(api url, location):
    global uptime, downtime
    try:
        start time = datetime.now()
        response = requests.get(api_url)
        response time = (datetime.now() - start_time).total_seconds()
        if response.status code == 200:
            uptime += response time
            request_log.append({
                "Location": location
```





```
#Load balancing
try:
    while True:
        location, api_url = next(api_cycle)
        data, success, response_time = get_weather(api_url, location)
        # Fault Tolerance
        if not success:
            # Try the next API if the current one fails
            location, api_url = next(api_cycle)
            data, success, response_time = get_weather(api_url, location)
        if success:
            weather_data = {location: data['body']}
            print_weather_table(weather_data, response_time)
        else:
            print("All APIs failed to fetch weather data.")
        # Wait for a set period before calling the APIs again
        time.sleep(5) # 5 seconds
except KeyboardInterrupt:
        print_statistics()
        ovment_log to group)
```

#### 4 References

```
https://aws.amazon.com/
https://www.anaconda.com/download
```