National College of Ireland

Configuration Manual

MSc Research Project
Programme Name

Trupti Kathane
Student ID: 22216456

School of Computing
National College of Ireland

Supervisor: Sean Heeney

National College of Ireland

MSc Project Submission Sheet

School of Computing

Student Name:	Trupti Kathane……
Student ID:	22216456……..……
Programme:	MSc. In Cloud Computing…… **Year:** 2024-25…..
Module:	Research Project…….……
Lecturer:	……..……
Submission Due Date:	03/01/2025……..……
Project Title:	Investigating the Significance of Proxy-Based Connection in Hybrid Cloud Virtual Network ……
Word Count:	…… **Page Count:** ……..…….……

I hereby certify that the information contained in this (my submission) is information pertaining to research I conducted for this project. All information other than my own contribution will be fully referenced and listed in the relevant bibliography section at the rear of the project.
ALL internet material must be referenced in the bibliography section. Students are required to use the Referencing Standard specified in the report template. To use other author's written or electronic work is illegal (plagiarism) and may result in disciplinary action.

Signature: Trupti Kathane ……

Date: 03/01/2025 ……

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Configuration Manual

Trupti Kathane
Student ID: 22216456

1. Introduction:-

Hybrid cloud virtual networks integrate private and public cloud infrastructures to offer scalable, efficient, and secure IT solutions. This guide details the methodology, design, and implementation of hybrid cloud environments with a focus on proxy-based connections, including setting up AWS VPCs and VPN gateways.

2. Methodology:-

Tools and Technologies:
Python: Data analysis and simulation (libraries: Pandas, NumPy, Matplotlib, SimPy).
Jupyter Notebook: Experimentation and visualization.
Dataset: Kaggle dataset with performance metrics (CPU usage, memory usage, energy efficiency).

Experimental Approach:

- Simulated proxy-based connections to measure key metrics: latency, resource efficiency, and task completion.
- Benchmarked proxies against traditional networking solutions.

hardware_requirements:
cpu: "4 cores"
memory: "8 GB RAM"
metrics: - "Latency", "Throughput" and "Resource Utilization"

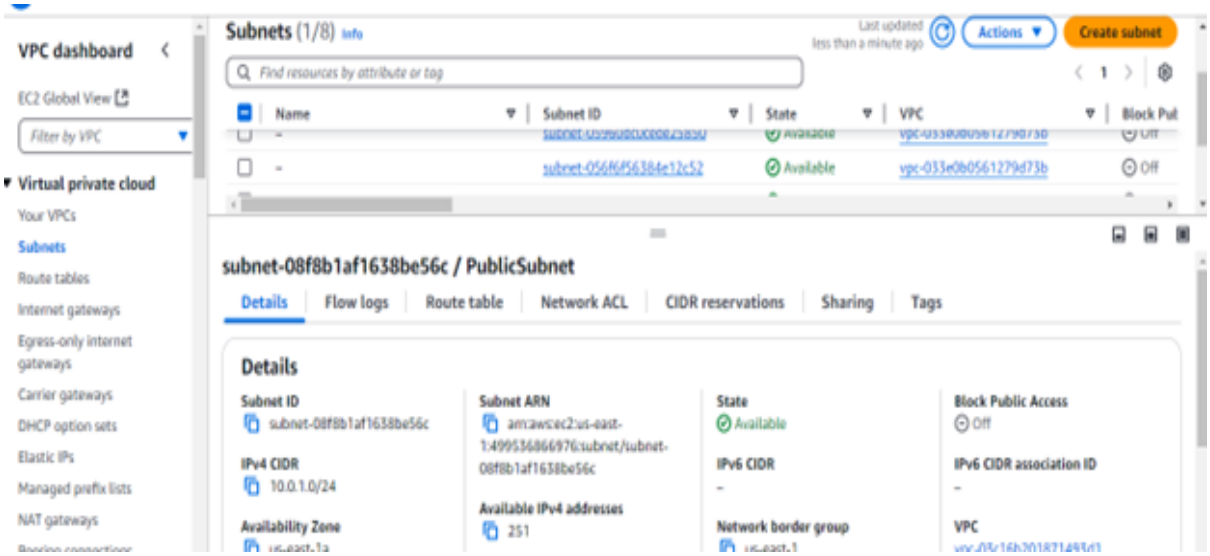
3. Implementation

1. **Data Preprocessing**:
    - Convert timestamp to datetime format.
    - Handle missing values in cpu_usage, memory_usage, network_traffic, and power_consumption using median imputation.
    - Extract hour from the timestamp for temporal analysis.
    - Split dataset into two categories: cloud and on-premises.
2. **Simulations**:
    - Create scenarios with varying task priorities and network traffic levels.
    - Use Random Forest models to predict energy efficiency based on latency and task priority.
3. **Proxies**:
    - Simulated their role in managing traffic and enforcing security policies.
    - Compared proxy performance with traditional methods under different workloads.
    -

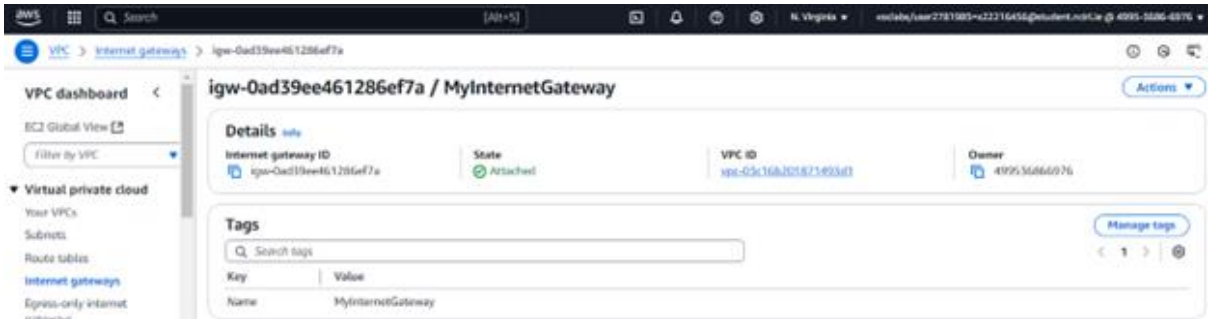
4. Cloud Infrastructure Setup:

Step1: Make sure you have an account in AWS, if not then create an account in AWS
Step2: Login to the AWS console
Step3: Search for the required services in the search section .

1. **AWS VPC Configuration**:
   - Create a VPC with CIDR block: 10.0.0.0/16.
   - Subnets:
     - Public subnet: 10.0.1.0/24 (for internet-facing services).
     - Private subnet: 10.0.2.0/24 (for sensitive resources).
   - Attach an Internet Gateway to the public subnet.
   - Configure route tables for traffic segregation.



2. **AWS VPN Gateway**:
   - Create a Virtual Private Gateway (VGW) for secure communication.
   - Configure a Customer Gateway (CGW) with a public IP address for on-premises integration.
   - Establish Site-to-Site VPN tunnels for high availability.



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5. Data Models Used

- Random Forest Regressor: Predict energy efficiency based on latency and task priority.
- Simulation Models: SimPy for evaluating network traffic and proxy impact.

6. Evaluation

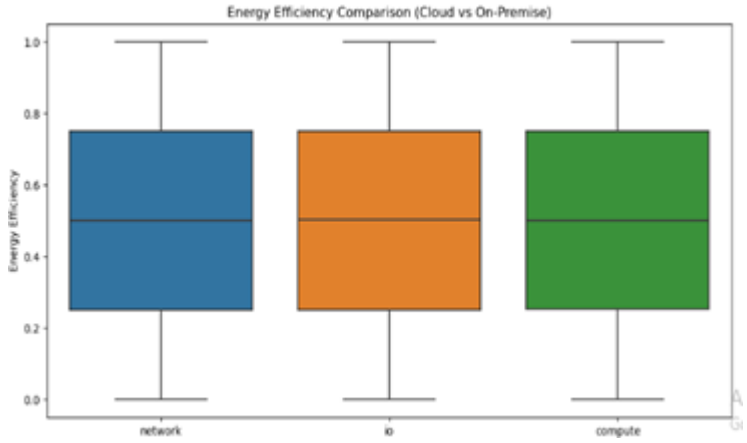
1. **Metrics Analyzed:**
    - Latency vs. Energy Efficiency.
    - CPU Usage Patterns.
    - Task Completion Times.
2. **Findings:**
    - Proxies reduced latency significantly compared to traditional methods.
    - Enhanced energy efficiency across hybrid environments.
    - Improved task prioritization and resource allocation.

	vm_id	timestamp	cpu_usage	memory_usage	network_traffic	power_consumption	num_executed_instructions	execution_time	energy_efficiency
0	c5215828-6237-4a33-9312-72c1df909881	2023-01-25 09:10:54	54.881350	78.950861	164.775973	287.808986	7527.0	69.345575	0.553589
1	29690bc6-1f34-403b-b509-a1ecb1834fb8	2023-01-26 04:46:34	71.518937	29.901883	NaN	382.273589	5348.0	41.396040	0.349856
2	2e56abc3-5bad-46cb-b445-a577f5e9bf2a	2023-01-13 23:39:47	NaN	92.709195	203.674847	231.467903	5483.0	24.602549	0.796277
3	e672e32f-c134-4fbc-992b-34eb63beff0f	2023-02-09 11:45:49	54.488318	88.100960	NaN	195.639954	5876.0	18.456870	0.529511
4	f38b8b50-6926-4533-be4f-89ad11624071	2023-06-14 08:27:26	42.365480	NaN	NaN	359.451537	3361.0	55.307992	0.351907

7.Results

- **Key Outcomes**:
    - Proxy-based connections enhanced performance, security, and scalability.
    - Achieved better load balancing and data protection in hybrid cloud systems.
- **Visualization**:
    - Boxplots and scatter plots showing efficiency trends.
    - Latency and energy efficiency correlations validated through Random Forest models.

```
# Latency vs Energy Efficiency plot (Proxy-based connection simulation)
plt.figure(figsize=(12, 6))
sns.scatterplot(x='latency', y='energy_efficiency', data=df, color='purple')
plt.title('Latency vs Energy Efficiency (Proxy Simulation)')
plt.xlabel('Latency (ms)')
plt.ylabel('Energy Efficiency')
plt.show()
```



This configuration manual aligns with the project's objectives and methodologies, ensuring a structured and reproducible setup for similar hybrid cloud systems.