

Configuration Manual

MSc Research Project
MSc. in Cloud Computing

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MSc Project Submission Sheet
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Submission

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Configuration Manual

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1 Setting up the Cloud Environment

This section provides how to configure and deploy the game on cloud environment using AWS services.

1.1 An EC2 Windows Instance Creation

1. Login to AWS Management Console
2. Go to the EC2 dashboard then click Launch Instance.

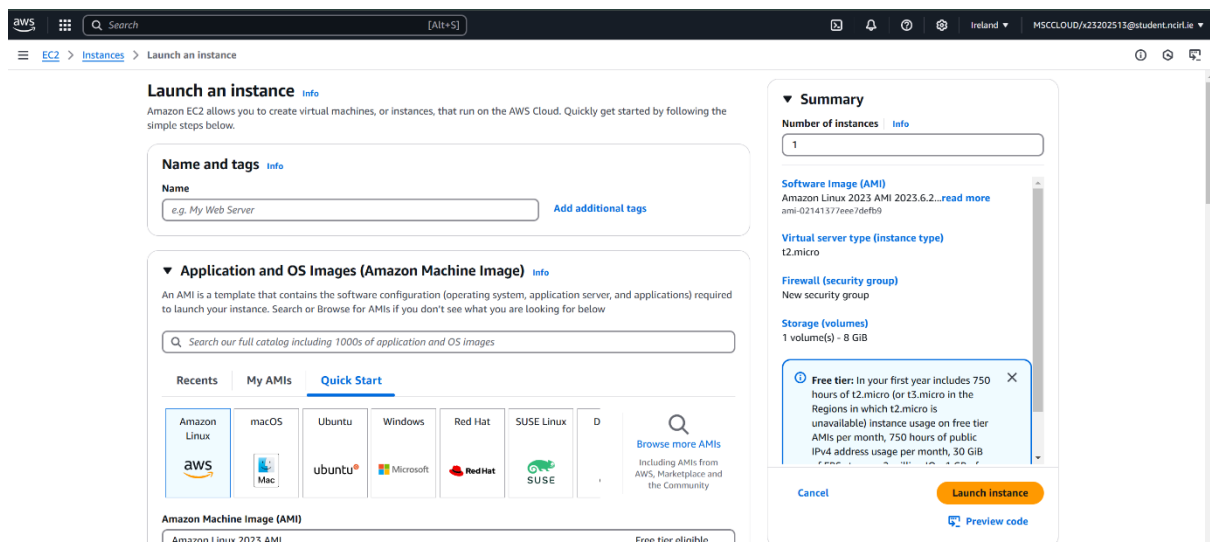


Fig.1 AWS EC2 instance Creation page

3. Select an AMI (Amazon Machine Image)
4. Pick one Windows Server AMI (like Windows Server 2019).
5. Choose Instance Type- For balanced performance select t2.xlarge.
6. Create a new Key pair
7. Change the numbers of instances to 1.
8. Enable Auto-assign Public IP for access from the external.
9. Add Storage (like 30GB).
10. Select: Create security group
11. Configure Instance Details and select “Launch Instance”
12. The key pair will be generated and will be downloaded to access the instance.
13. Once created, go to instance page and select “Security groups”

14. Add new inbound rules, allow

- RDP (port 3389)
- HTTP (port 80)
- Prometheus Server (9090)
- WMI Exporter (9182)
- Grafana (3000)

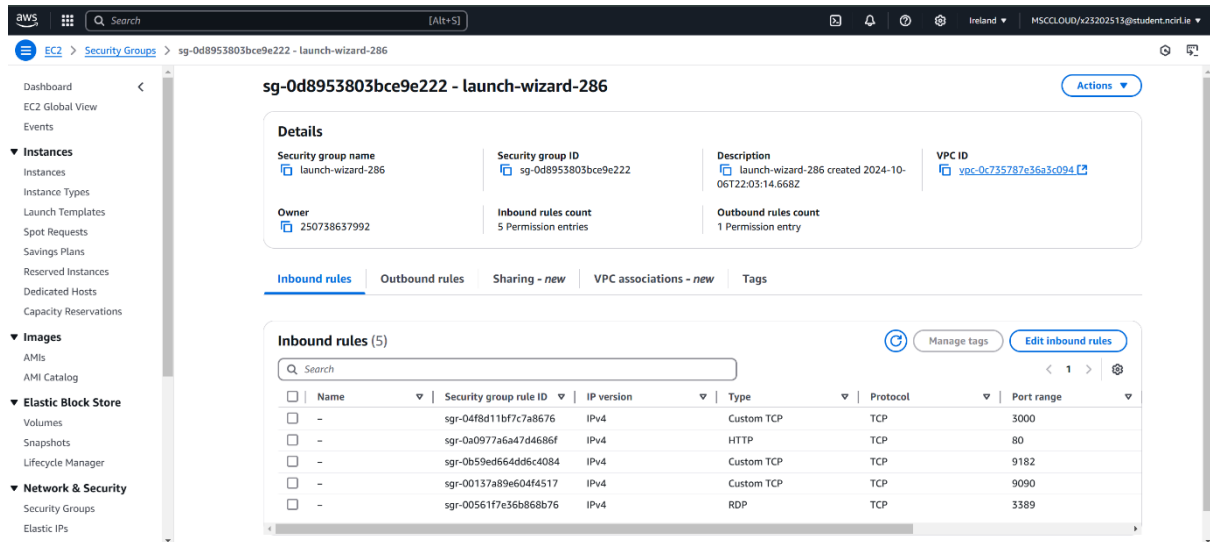


Fig.2 Added inbound Rules

15. Launch The Instance and connect to it via RDP using the generated .pem key.

2 Setting Up Hybrid Environment

2.1 Set up S3 Bucket

1. Go to AWS S3 and click on “create Bucket”
2. Give bucket a name and make sure “Block all public access” option is checked.

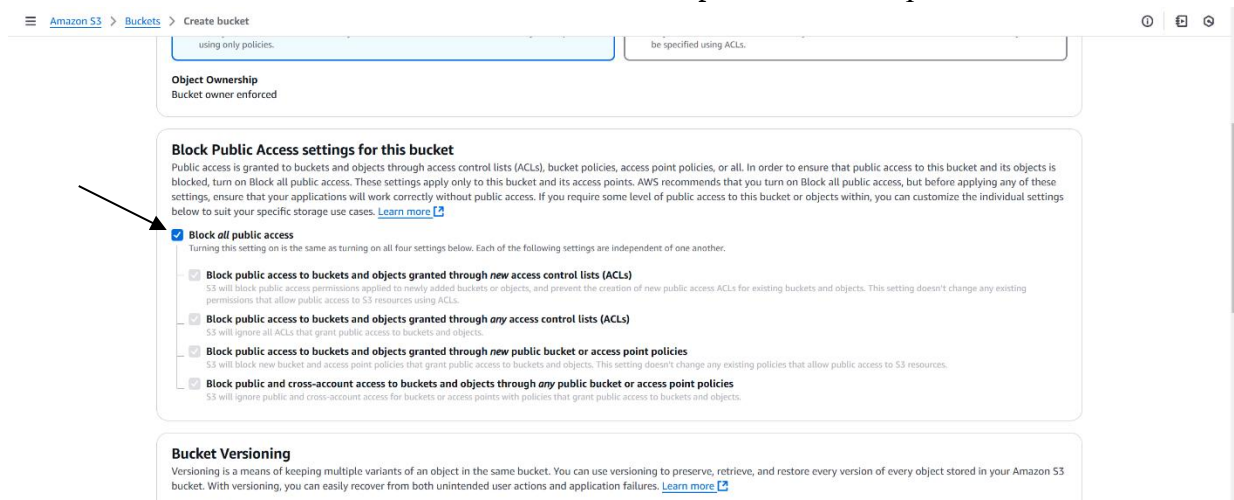


Fig.3 Making Sure Bucket is NOT Public

3. Create the bucket and upload all the files which will be served on the edge to this bucket.

2.2 Configuring CloudFront for File Delivery via Edge

1. Go to CloudFront CDN service
2. Choose Web Distribution and click Create Distribution.

Create distribution

Origin

Origin domain
Choose an AWS origin, or enter your origin's domain name. [Learn more](#)

Enter a valid DNS domain name, such as an S3 bucket, HTTP server, or VPC origin ID.

Origin path - optional
Enter a URL path to append to the origin domain name for origin requests.

Name
Enter a name for this origin.

Origin access [Info](#)

☒ **Public**
Bucket must allow public access.

☐ **Origin access control settings (recommended)**
Bucket can restrict access to only CloudFront.

☐ **Legacy access identities**
Use a CloudFront origin access identity (OAI) to access the S3 bucket.

Add custom header - optional
CloudFront includes this header in all requests that it sends to your origin.

Fig.4 Create Distribution page

3. Set Origin Settings
4. Select the S3 Bucket as the origin.
 - Caches dynamic assets (and images/sound files static assets).
5. Set allowed HTTP methods: GET, HEAD.
6. Select Cache Policy: “CachingOptimized”
7. Enable WAF security protection
8. Deploy CloudFront by clicking on “Create Distribution”
9. Go to the Distribution details page and copy the ARN of the distribution.
10. Go to S3 bucket > permissions and then edit bucket policy.

Block public access (bucket settings) [Edit](#)

Public access is granted to buckets and objects through access control lists (ACLs), bucket policies, access point policies, or all. In order to ensure that public access to all your S3 buckets and objects is blocked, turn on block all public access. These settings apply only to this bucket and its access points. AWS recommends that you turn on block all public access, but before applying any of these settings, ensure that your applications will work correctly without public access. If you require some level of public access to your buckets or objects within, you can customize the individual settings below to suit your specific storage use cases. [Learn more](#)

Block all public access

☒ On

► **Individual Block Public Access settings for this bucket**

Bucket policy [Edit](#) [Delete](#)

The bucket policy, written in JSON, provides access to the objects stored in the bucket. Bucket policies don't apply to objects owned by other accounts. [Learn more](#)

☒ **Public access is blocked because Block Public Access settings are turned on for this bucket.**
To determine which settings are turned on, check your Block Public Access settings for this bucket. [Learn more about using Amazon S3 Block Public Access](#)

[Copy](#)

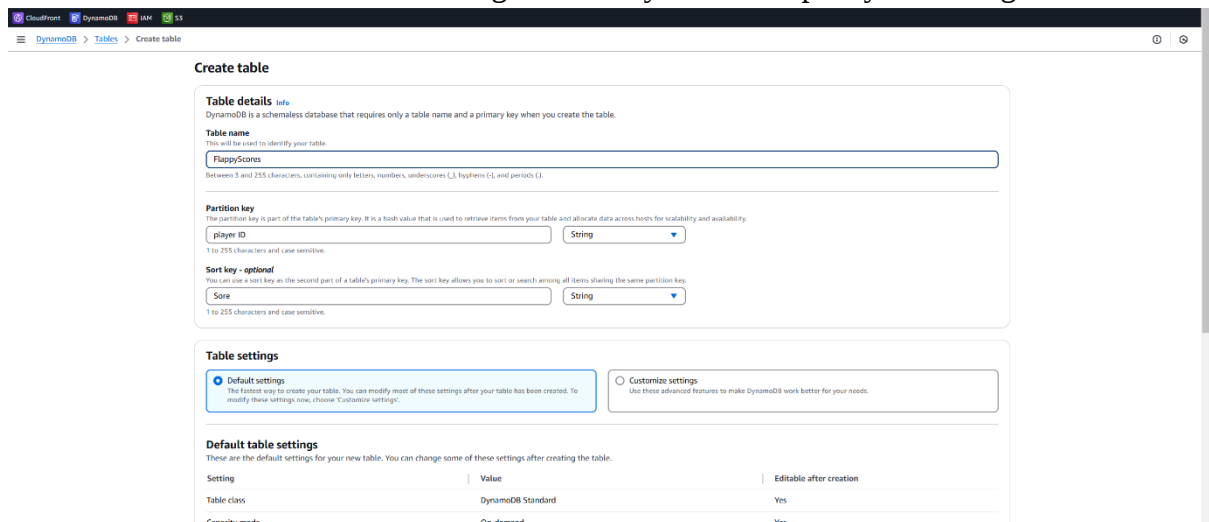
```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Deny",
      "Principal": "*",
      "Action": "s3:GetObject",
      "Resource": "arn:aws:s3:::flappy08/*",
      "Condition": {
        "StringEquals": {
          "AWS:SourceArn": "arn:aws:cloudfront::88577046019:distribution/ELSGY0W9PAPWQ"
        }
      }
    }
  ]
}
```

Fig. 5 Editing Bucket Policy to keep the files secure

11. Edit the policy to allow only specific cloudfront distribution to access the bucket.
12. CloudFront is properly set up now and is ready for use.
13. Then go back to CloudFront page and copy the provided distribution domain for integration with the game code.

2.3 Creating DynamoDB with Database of Player Scores

1. Navigate to DynamoDB dashboard and got to Create Table.
2. Define the Schema
 - Primary Key: PlayerID (string).
 - Sort Key: Score (string).
3. Enable On-Demand Mode- It brings scalability without capacity set management.



Create table

Table details info
DynamoDB is a schemaless database that requires only a table name and a primary key when you create the table.

Table name
This will be used to identify your table.
FlappyScores
Between 3 and 255 characters, containing only letters, numbers, underscores (_), hyphens (-), and periods (.).

Partition key
The partition key is part of the table's primary key. It is a hash value that is used to retrieve items from your table and allocate data across hosts for scalability and availability.
player ID
1 to 255 characters and case sensitive. String

Sort key - optional
You can use a sort key as the second part of a table's primary key. The sort key allows you to sort or search among all items sharing the same partition key.
Score
1 to 255 characters and case sensitive. String

Table settings

☒ **Default settings**
The fastest way to create your table. You can modify most of these settings after your table has been created. To modify these settings now, choose "Customize settings".

☐ **Customize settings**
Use these advanced features to make DynamoDB work better for your needs.

Default table settings
These are the default settings for your new table. You can change some of these settings after creating the table.

Setting	Value	Editable after creation
Table class	DynamoDB Standard	Yes
Capacity mode	On-demand	Yes

Fig. 6 Creating a DynamoDB Table

4. To Integrate with the Game, will require AWS “access key” and “secret access key”
5. Will save, retrieve scores using AWS SDK (boto3) written in Python

3 Setting up monitoring and visualisation tools

3.1 Installing Prometheus

1. Download the Prometheus binary from the [official site](#).
2. It must be setup on and used by all the 3 architectures (local, hybrid, cloud)
3. Configure Prometheus:
4. Open command prompt in the “Prometheus” root directory. Use following start command and pass web listen address and config file default Prometheus yml file as options.

```
prometheus.exe --config.file prometheus.yml --web.listen-address ":9090" --storage.tsdb.path "data"
```

- Prometheus is now running and can be accessed on <https://localhost:9090/targets> to check whether targets are being successfully scraped or not.

3.2 Setting Up WMI Exporter

- Download WMI Exporter from WMI Exporter GitHub
- Install WMI Exporter
- After installation, verify if Exporter is running



Fig. 7 make sure WMI Exporter is running change startup type to “automatic”

- Exporter should start exposing metrics on

<http://localhost:9182/metrics>

- Update the Prometheus.yml file with below code and restart Prometheus server:

```
- job_name: "WMI Exporter"

  # metrics_path defaults to '/metrics'
  # scheme defaults to 'http'.

  static_configs:
    - targets: ["Host_ip:9182"]
```

- Access the metrics endpoint by navigating to <EC2-Instance-IP/Private-IP>:9182/metrics in a browser.
- Now, <https://localhost:9090/targets> should show something like this

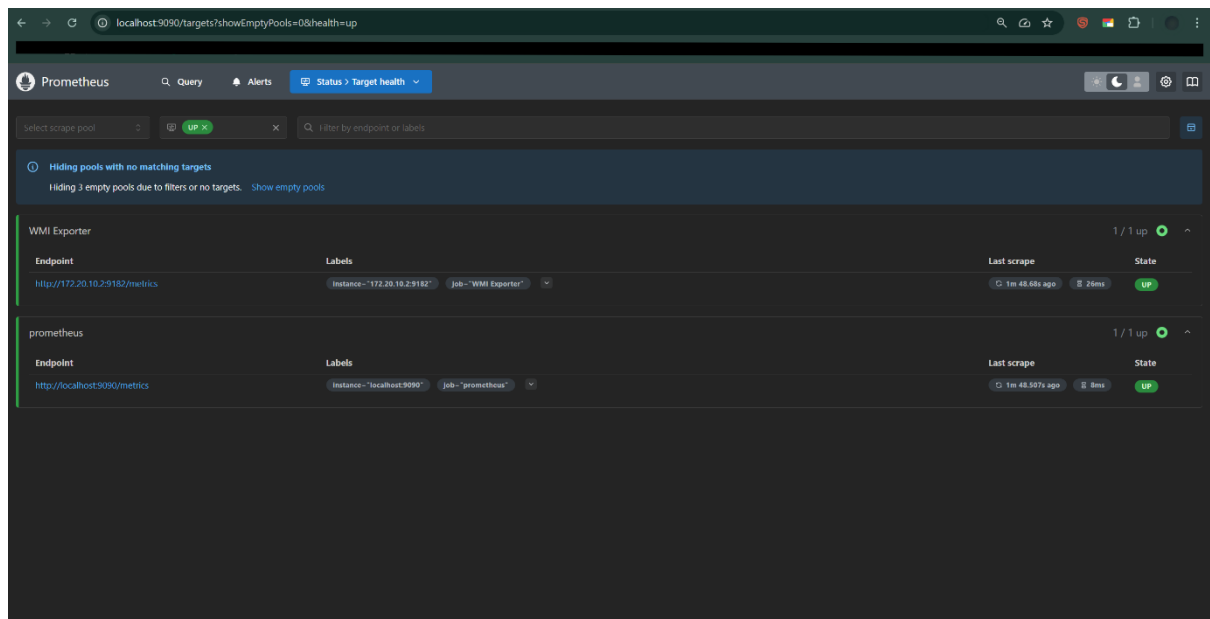


Fig. 8 WMI exporter up and running

3.3 Metrics Collection

1. In the python game code, define functions which exposes the specified metric to an endpoint. For e.g. to send network latency info :

```
Codeium: Refactor | Explain | X
async def measure_network_latency(self):
    """Measure the network latency by sending a request to a specified endpoint."""
    url = "http://localhost:8000/metrics" # Change this to your target URL

    try:
        async with aiohttp.ClientSession() as session:
            start_time = time.time() # Start the timer
            async with session.get(url) as response:
                await response.text() # Await the response to complete
                end_time = time.time() # End the timer

            # Calculate latency in milliseconds
            latency = (end_time - start_time) * 1000
            self.network_latency_metric.set(latency) # Set the Prometheus metric
    except Exception as e:
        print(f"Failed to measure network latency: {e}")
```

Fig. 9 Sending Network Latency data to be scraped

2. Update the prometheus.xml config file to this code:

```

global:
  scrape_interval: 1s
  evaluation_interval: 1s

alerting:
  alertmanagers:
    - static_configs:
      - targets: ["<alertmanager-ip>:9093"]

rule_files:
  # Define your alert rules here
  # - "alert_rules.yml"

scrape_configs:
  - job_name: "prometheus"
    static_configs:
      - targets: ["localhost:9090"]

  - job_name: "WMI Exporter"
    static_configs:
      - targets: ["172.20.10.2:9182"]

  - job_name: 'flappybird_fps'
    static_configs:
      - targets: ['172.20.10.2:8000']

  - job_name: 'flappybird_network_latency'
    static_configs:
      - targets: ['172.20.10.2:8000']

  - job_name: 'flappybird_bandwidth_usage'
    static_configs:
      - targets: ['172.20.10.2:8000']

```

Fig. 10 Prometheus Collect all data to be scraped

3. This indicates that all the game metrics are accessed by Prometheus on port:8000
4. This should how the Prometheus Dashboard should look like now

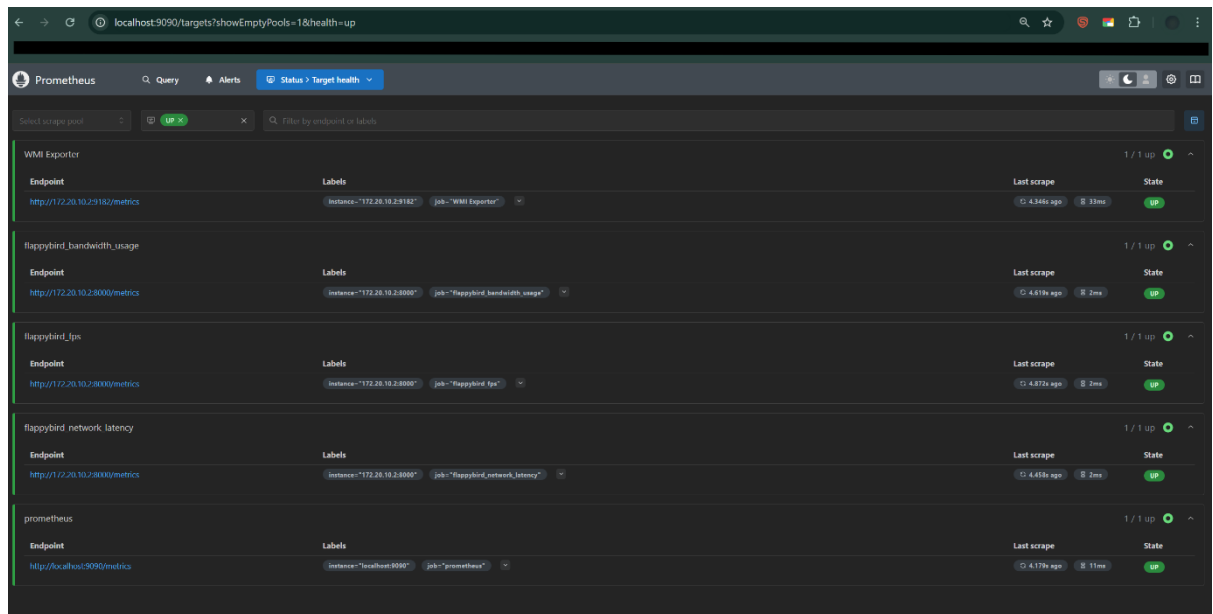


Fig. 11 All targets are in UP state and giving input to Prometheus

3.4 Configuring Grafana

1. Download Grafana from grafana.com and install it.
2. go to C: > Program Files > GrafanaLabs > Grafana > conf > defaults.ini

```
##### SMTP / Emailing #####  
[smtp]  
enabled = true
```

Change enabled = true

3. Grafana dashboard can be now accessed at <http://localhost:3000>
4. In the login Page, enter “admin” in both username and password fields
5. Go to Configuration > Data Sources > Add Data Source.
6. Select Prometheus and provide the server URL (http://<EC2-Instance-IP/ Private-IP>:9090).
7. Go to Dashboards > New Visualisation > select “Prometheus” in data source.
8. Go to the “Queries” tab > select your metric and go to “run queries”.

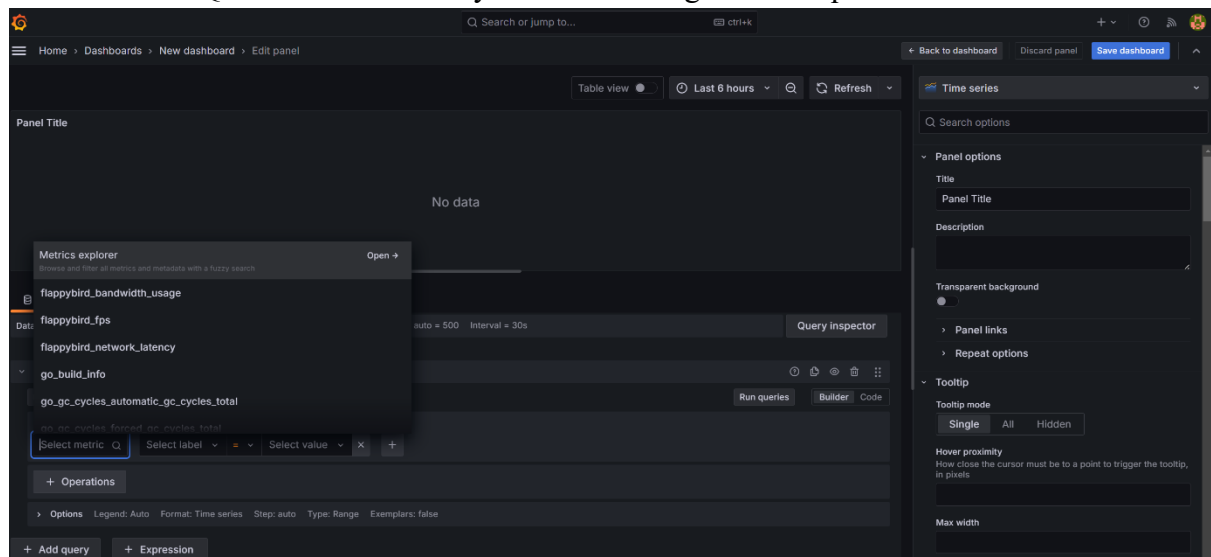


Fig.12 adding metrics for visualisation

9. Prometheus queries can add panels for latency, FPS, and bandwidth.
10. This will create a live graph that will keep updating as long as it is receiving statistics from the game.
11. After adding all the Metrics for visualisation, dashboard should look like this.

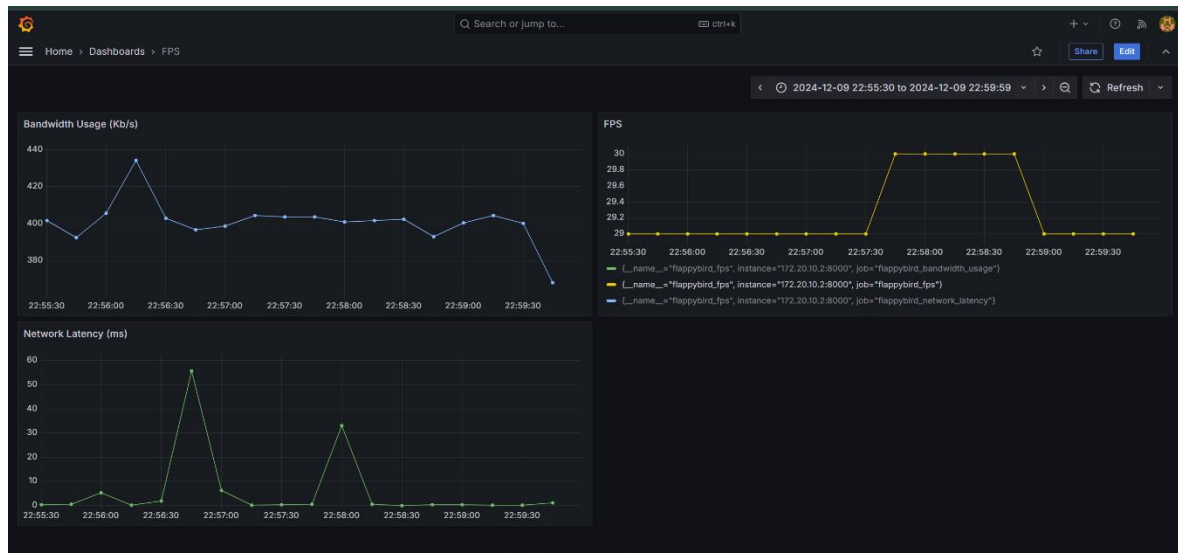


Fig. 13 live Graphs

4 Running and Monitoring the Game

4.1 Running the game on cloud

1. Deploy Game Files- Upload the game assets and code to EC2 instance.
2. Start the EC2 Game Server
3. Run the game code with Python.
4. Command: `python main.py`

4.2 Monitoring Game Performance

1. Grafana Visualizing Metrics
2. Go to Grafana dashboard.
3. See the monitor latency, FPS, and bandwidth usage in real time.
4. Grafana offers a feature to save the monitoring info in csv file format for further analysis

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