

Configuration Manual

MSc Research Project MSc. in Cloud Computing

Nipun Bakshi Student ID: X23202513

School of Computing National College of Ireland

Supervisor: Yasantha Samarawickrama

National College of Ireland

MSc Project Submission Sheet



School of Computing

Student Nipun Bakshi Name:

Student ID: X23202513

Programme: MSc. in Cloud Computing

Module: Research Project

Supervisor: Yasantha Samarawickrama

Submission Due Date: 12th Dec 2024

Project Title: Advancing the Gaming Industry through Hybrid Computational Strategies

Word Count: 1407

Page Count: 12

Year: 2024-2025

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.

<u>ALL</u> 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: Nipun Bakshi

Date: 12/12/2024

PLEASE READ THE FOLLOWING INSTRUCTIONS AND CHECKLIST

Attach a completed copy of this sheet to each project (including multiple copies)	
Attach a Moodle submission receipt of the online project	
submission to each project (including multiple conice)	
submission, to each project (including multiple copies).	
You must ensure that you retain a HARD COPY of the project,	
both for your own reference and in case a project is lost or mislaid. It is	
not sufficient to keep a copy on computer.	

Assignments that are submitted to the Programme Coordinator Office must be placed into the assignment box located outside the office.

Office Use Only

Signature:	
Date:	
Penalty Applied (if applicable):	

Configuration Manual

Nipun Bakshi Student ID: X23202513

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.

aws I ::: Q Search	[Alt+S]	D Q Ø Ireland ▼ MSCCLOUD/x23202513@student.ncirl.ie ▼
\equiv <u>EC2</u> > <u>Instances</u> >	Launch an instance	0 Q F_
	Launch an instance Info Amazon EC2 allows you to create virtual machines, or instances, that run on the AW5 Cloud. Quickly get star simple steps below.	ted by following the Variable State
	Name and tags info Name @	Software Image (AMI) Amazon Linux 2023 AMI 2023.6.2read more am-02141377ree2defb9 Virtual server type (instance type)
	Application and OS Images (Amazon Machine Image) Info An AMI is a template that contains the software configuration (operating system, application server, and to launch your instance. Search or Browse for AMIs if you don't see what you are looking for below	t2.micro Firewall (security group) New security group Storage (volumes)
	Q. Search aur full catalog including 1000s of application and OS images Recents My AMIs Quick Start	volume(s) - 8 GiB Free tier: In your first year includes 750 × hours of t2 micro (or t5 micro in the
	Amazon Linux macOS Ubuntu Windows Red Hat SUSE Linux D WS Imac ubuntu® If Microsoft Imac SUSE ,	Regions in which 12 micro is unavailable) instance usage on free tier Afforwse more AMIs Including AMIs from WS, Marketplace and the Community
	Amazon Machine Image (AMI)	Erre tier allathe

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)

EC > security Group: > sep-0d8953803bce9e222 - launch-wizard-286 Action Dathband Sg-Od8953803bce9e222 - launch-wizard-286 Action Vertis Vertis Details Security group ID Description VPC ID Instances Instances Instances Instances Instances Instances Outbound rules count Outbound rules count Petrails Spot Requests Savings Plans Inbound rules Outbound rules Tags Inbound rules Outbound rules Sharing - new VPC associations - new Tags Edit Inbound rules	2513@student.no		0 4	<u>ک</u>			Alt+S]	[Alt+			aws III Q Search
Dashbaid Sg-Od8953803bce9e222 - launch-wizard-286 Action E22 Global View Events Description VPC ID Instances isg-od8953803bce9e222 Description VPC ID Sig-od755787765816094 15 Instances isg-od8953803bce9e222 Description VPC ID Sig-od755787765816094 15 Security group name isg-od8953803bce9e222 Outbound rules count Outbound rules count Sig-od755787765816094 15 Spot Requests Savings Phas Inbound rules Sharing - new VPC associations - new Tags Indexed Hotss Capacity Reservations Inbound rules (5) @ Manage tags Edit Inbound rules Mis Savings Phas Security group rule ID ♥ IP version ♥ Type ♥ Protocol ♥ Prot range I > Mis Sapahots Sig-od4911H/72/3675 Pv4 Custom TCP TCP 3000 Supahots - sig-od49311H/72/38676 Pv4 Custom TCP TCP 9182 Lifecycle Manager - sig-od497786474646664 IPv4 HTTP TCP 9182 Lifecycle Manager - sig-od0037778647748646664 IPv4 <td< th=""><th>0</th><th></th><th></th><th></th><th></th><th></th><th></th><th>-286</th><th>unch-wizard-</th><th>sg-0d8953803bce9e222 - l</th><th>EC2 > Security Groups ></th></td<>	0							-286	unch-wizard-	sg-0d8953803bce9e222 - l	EC2 > Security Groups >
EC2 Global View Events Instances In	ns 🔻	Actions				-286	22 - launch-wizard	3bce9e222	8953803	sq-Oc	Dashboard 🔇
Events Details Instances Security group name Security group 10 Description VPC 10 Instances Isaunch-wizard-286 Security group 10 Counch-wizard-286 created 2024-10- Image: Counce of the co										- , - , - , - , - , - , - , - , - , - ,	EC2 Global View
Instances Instances Instances Instance Types Launch - wizard-286 Security group name instances Types Launch - wizard-286 Security group name instances Types Launch - wizard-286 Security group name istances Types Launch - wizard-286 Security group name 2507386537992 Inbound rules count 2507386537992 Inbound rules Comer 2507386537992 Inbound rules Sharing - new VPC ID Inbound wiles count 2507386537992 Inbound rules Sharing - new VPC associations - new Tags Inbound rules Inbound rul									ils	Det	Events
nstances nstances types aunch Templates por Requests awing: Plans tescerved Instances bedicated Hosts awing: Plans tescerved Instances bedicated Hosts awing: Plans tescerved Instances bedicated Hosts awing: Plans tescerved Instances bedicated Hosts awing: Plans tescerved Instances tescerved Instances te		VPC ID			Description	0	Security group I	le	ty group nam	Secur	nstances
stance Types auch Templates por Requests awings Plans tescrevel Instances bedicated Hosts apachy Reservations mages Mils Mil Catalog Manage tags Mils Mil Catalog Manage tags Mils Mil Catalog C Search C Search		vpc-0c735787e36a3c094	024-10-	ard-286 created 2024-	📋 launch-wizard	03bce9e222	🗖 sg-0d89538	286	unch-wizard-	6	nstances
unch Templates obr Requests wings Plans served Instances adicated Hosts apacity Reservations mages Mis Mic Catalog Latic Block Store autics Elock Store autics Star Block Store autics Block Store autics Star Star Block Store autics Star Star Star Star Star Star Star Star				8Z	06T22:03:14.668Z						stance Types
inbound rules Outbound rules Sharing - new VPC associations - new Tags inbound rules Outbound rules Sharing - new VPC associations - new Tags inbound rules Outbound rules Sharing - new VPC associations - new Tags inbound rules Outbound rules Sharing - new VPC associations - new Tags inbound rules Outbound rules Sharing - new VPC associations - new Tags inbound rules Outbound rules Sharing - new VPC associations - new Tags inbound rules Outbound rules Sharing - new VPC associations - new Tags inbound rules Outbound rules Sharing - new VPC associations - new Tags inbound rules Outbound rules Sharing - new VPC associations - new Tags inbound rules Outbound rules Sharing - new VPC associations - new Tags inbound rules Outbound rules Sharing - new VPC associations - new Tags inbound rules Security group rule ID v IP version v Type V Portcool v Port range				s count	Outbound rules co	unt	Inbound rules co		r -	Owne	unch Templates
awings Plans seaved Instances edicated Hosts sages Mis Mi Catalog Inbound rules (5) Search Se				try	1 Permission entry	ies	5 Permission entr	2	50738637992	6	pot Requests
Inbound rules Outbound rules Sharing - new VPC associations - new Tags redicated Horts pacity Reservations Inbound rules (5) Imbound ru											avings Plans
edicated Hosts apacity Reservations mages Mis Mi Catalog lastic Block Store olumes olumes sgr-04f8d11bf7c7a8676 IPv4 Custom TCP TCP 3000 con fercycle Ananger sgr-005977a64a744686f IPv4 Custom TCP TCP 9090 con con sgr-00517a89e60446517 IPv4 Custom TCP TCP 9090 con con sgr-00517a99e6046576 IPv4 Custom TCP TCP 9090 con con sgr-00517a99e604657 IPv4 Custom TCP TCP 9389					w Tags	VPC associations -	rules Sharing - new	Outbound rul	nd rules	Inbo	eserved Instances
packty Reservations nages dls dl Catalog sakit Black Store humes appacty say: Black Store lumes appactors c sgr-0.69077a6Ad74d4686f IPv4 Custom TCP c c sgr-0.69077a6Ad74d4686f IPv4 Custom TCP CP sgr-0.69077a6Ad74d4686f IPv4 Custom TCP sgr-0.0137a89e604d4c3081 IPv4 Custom TCP custom TCP sgr-0.0137a89e604d4c317 IPv4 custom TCP custom TCP custom TCP sgr-0.0137a89e604d4c3157 IPv4 custom TCP custom TCP											edicated Hosts
Inbound rules (5) C this inbound rules (5) C this inbound rule (5)											apacity Reservations
Mis Q_Storch (] Name V Security group rule ID V Type V Protocol V Port range assis Block Store - sgr-04f8d11bf7c7a8676 IPv4 Custom TCP TCP 3000 papshots - sgr-04f8d11bf7c7a8676 IPv4 HTTP TCP 80 feorycle Manager - sgr-0b59fe64dd6c4084 IPv4 Custom TCP TCP 9182 etwork & Security - sgr-00517r889e60d4f517 IPv4 Custom TCP TCP 9090 cuttor Groups - sgr-00517r889e60d4f517 IPv4 RDP TCP 3389	25	Manage tags Edit inbound rules	0	((5)	und rules	Inbo	nages
MIC catalog V Security group rule ID V IP version V Type V Protocol V Port range abasic Block Store - sgr-04f8d11bf7c7a8676 IPV4 Custom TCP TCP 3000 - sgr-04f8d11bf7c7a8676 IPV4 Custom TCP TCP 3000 - sgr-04f8d11bf7c7a8676 IPV4 Custom TCP TCP 80 - sgr-0459d564d66c4084 IPV4 Custom TCP TCP 9182 etwork & Security - sgr-00551f7e35b688b76 IPv4 RDP TCP 9090 curthy Groups - sgr-00551f7e35b688b76 IPv4 RDP TCP 3389	~		\smile \subset								MIs
Itatic Block Store Name V Security group rule ID V IP version V Vppe V Protocol V Port range blumes - Sgr-0af8d11bf7/23857 IPv4 Custom TCP TCP 3000 napshots - Sgr-0af8d11bf7/23857 IPv4 HTTP TCP 3000 ifercycle Manager - Sgr-0af9876a64/d6867 IPv4 HTTP TCP 3012 letwork & Security - - Sgr-0af9864d64617 IPv4 Custom TCP TCP 3000 curity Groups - Sgr-0af9864d64517 IPv4 Custom TCP TCP 3090	105	< 1 >							searcn	(u	MI Catalog
pagebook P sgr-04f8d11bf7r/2885r6 IPv4 Custom TCP TCP 3000 pagebook P sgr-04f8d11bf7r/2885r6 IPv4 HTTP TCP 80 pagebook P sgr-040977a647/44686f IPv4 HTTP TCP 900 feoryCle Manager P sgr-040976a647/44686f IPv4 Custom TCP TCP 9182 etwork & Security P sgr-00137a89604464517 IPv4 Custom TCP TCP 9090 etwork & Security P sgr-005917658656676 IPv4 RDP TCP 3389	~	▼ Port range	Protocol	▼ Prote	Туре	IP version	Security group rule ID 🛛	▼ S	Name		lastic Block Store
happshots Image: Constraint of the spin-0a0977a6a47d4686f IPv4 HTTP TCP 80 feoryCef Manager Image: Constraint of the spin-0a097a6a47d4686f IPv4 Custom TCP TCP 9182 etwork & Security Image: Constraint of the spin-0a073ra89e604d45517 IPv4 Custom TCP TCP 9090 etwork & Security Image: Constraint of the spin-0a073ra89e604d5517 IPv4 RDP TCP 3389		3000	TCP	TCP	Custom TCP	IPv4	sgr-04f8d11bf7c7a8676	sg	-		olumes
fecycle Manager - sgr-0b59ed564d66c408 IPv4 Custom TCP TCP 9182 etwork & Security - sgr-0b137a89e604f4517 IPv4 Custom TCP TCP 9090 custor Groups - sgr-0b51f7e36b868b76 IPv4 RDP TCP 3389		80	TCP	TCP	HTTP	IPv4	sgr-0a0977a6a47d4686f	sg	-		apshots
etwork & Security - sgr-00137a89e604f4517 IPv4 Custom TCP TCP 9090 cult/u Groups - sgr-00561f7a56b868b76 IPv4 RDP TCP 3389		9182	TCP	TCP	Custom TCP	IPv4	sgr-0b59ed664dd6c4084	sg	-		fecycle Manager
spr-00561f7e36b86b76 IPv4 RDP TCP 3389		9090	тср	TCP	Custom TCP	IPv4	sgr-00137a89e604f4517	sg	-		etwork & Security
		3389	тср	TCP	RDP	IPv4	sgr-00561f7e36b868b76	sg	-		curity Groups
			_								astic IPs

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.

Amazon S3 > Bucket	<u>is</u> > Create bucket	0 🗄 O
	using only policies. Despecified using ACLs. Diget Ownership Bucket owner enforced	
	Block Public Access settings for this bucket 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, 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 this bucket or objects within, you can customize the individual settings before that your applications will work correctly without public access. If you require some level of public access to this bucket or objects within, you can customize the individual settings before that your applications will work correctly without public access. If you require some level of public access to this bucket or objects within, you can customize the individual settings before that your applications will work correctly without public access. If you require some level of public access to this bucket or objects within, you can customize the individual settings before that your applications will work correctly without public access. If you require some level of public access to this bucket or objects within, you can customize the individual settings before that your applications will work correctly without public access. If you require some level of public access to this bucket or objects within, you can customize the individual settings before the individual settings. So lock applic access to buckets and objects granted through new access control lists (ACLS). So will have and have and buckets and objects granted through new public bucket or access point policies. So lock public access to buckets and objects granted through new public bucket or access point policies. So will puore all ACLs that you public buckets and objects granted through new public bucket or access point policis.	
	Bucket Versioning Versioning is a means of keeping multiple variants of an object in the same bucket. You can use versioning to preserve, retrieve, and restore every version of every object stored in your Amazon S3 bucket. With versioning, you can easily recover from both unintended user actions and application failures. Learn more 🖸	

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.

CloudFront	t > Distributions > Create	0 0
	Create distribution	
	Origin	
	Origin domain Choose an AWS origin, or enter your origin's domain name. Learn more 🖸	
	Q flappy08.s3.eu-west-1.amazonaws.com	
	Enter a valid DNS domain name, such as an 53 bucket, HTTP server, or VPC origin ID.	
	Origin path - optional Enter a URL path to append to the origin domain name for origin requests.	
	Enter the origin path	
	Name Enter a name for this origin.	
	flappy08.s3.eu-west-1.amazonaws.com	
	Origin access Info	
	Public Bucket must allow public access.	
	O Origin access control settings (recommended) Bucket can restrict access to only Cloudfront.	
	C 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

D CloudShell Feedback

- 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.

E Amazon S3 > Buckets > flappy08		0 🖸 O
	Block public access (bucket settings) Tele Adde server in sprande backets and dights through through across starting in the Adde to the	
	Bucket policy The bucket policy, written in 350H, provides access to the objects stored in the bucket. Bucket policies don't apply to objects owned by other accounts. Learn more [3]	
	Public access is blocked because Block Public Access settings are turned on for this backet To determine which settings are turned on, chick your Block Public Access settings for this backet. Learn more about using Amzen 33 Block Public Access [2]	
	<pre>{ 'version': 2012-10-17, 'vsterement': [(ffect: XUBuw', 'vsterement': [(ffect: XUBuw', 'vsterement': [(fector': StateROyer; 'version': StateROyer; 'version': StateROyer; 'version': " 'ssterement': ['version': " 'ssterement': ['version': " 'version': " 'version': " 'version': " 'version': " 'version: " 'version:</pre>	
CloudShell Feedback	© 2024 Amazon Web Services, Inc. or its affiliates. Privacy	Terms Cookie preferences 🚽

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.

🔞 CloudFront 📑 DynameDB 🧰 IAM 📴 S3				
				0 9
c	Create table			
	Table details info Dynamo08 is a schemaless database that requires only a table name and a Table name. Table name in to identify more table.	a primary key when you create the table.		
	FlappyScores			
	Between 3 and 255 characters, containing only letters, numbers, underscores (_), hyp	hens (-), and periods (.).		
	Partition key The partition key is part of the table's primary key. It is a hash value that is used to re	trieve items from your table and allocate data across hosts for scalability and aw	lability.	
	player ID	String 🔻		
	1 to 255 characters and case sensitive.			
	Sort key - optional You can use a sort key as the second part of a table's orimany key. The case key silver	where the source research amount all Itams sharing the same partition have		
	Sore	String		
	1 to 255 characters and case sensitive.			
	Table settings			
	Default settings The fastest way to create your table. You can modify mast of these settings and modify these settings now, choose "Custamize settings".	ter your table has been created. To	a 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"
```

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

3.2 Setting Up WMI Exporter

- 1. Download WMI Exporter from WMI Exporter GitHub
- 2. Install WMI Exporter
- 3. After installation, verify if Exporter is running

Services (Local)					
windows_exporter	Name	Description	Status	Startup Type	Log On As
	🗟 Windows Defender Antiviru	Helps prote	Running	Automatic	Local Syste
Stop the service	Windows Defender Firewall	Windows D	Running	Automatic	Local Service
Restart the service	Windows Encryption Provid	Windows E		Manual (Trig	Local Service
	Windows Error Reporting Se	Allows error		Manual (Trig	Local Syste
Description:	Windows Event Collector	This service		Manual	Network S
Exports Prometheus metrics about	Windows Event Log	This service	Running	Automatic	Local Service
the system	Windows Font Cache Service	Optimizes p	Running	Automatic	Local Service
	Windows Image Acquisitio	Provides im	-	Manual	Local Service
	Windows Insider Service	Provides inf		Disabled	Local Syste
	Windows Installer	Adds, modi	Running	Manual	Local Syste
	Windows License Manager	Provides inf	Running	Manual (Trig	Local Service
	Windows Management Inst	Provides a c	Running	Automatic	Local Syste
	Windows Media Player Net	Shares Win	-	Manual	Network S
	Windows Mobile Hotspot S	Provides th		Disabled	Local Service
	Windows Modules Installer	Enables inst	Running	Manual	Local Syste
	Windows Push Notification	This service	Running	Automatic	Local Syste
	Windows Push Notification	This service	Running	Automatic	Local Syste
	Windows PushToInstall Serv	Provides inf		Disabled	Local Syste
	Windows Remote Manage	Windows R	Running	Automatic	Network S
	Windows Search	Provides co		Disabled	Local Syste
	Windows Security Service	Windows Se		Manual	Local Syste
	🖏 Windows Time	Maintains d	Running	Automatic (T	Local Service
	Windows Update	Enables the	Running	Manual (Trig	Local Syste
	Windows Update Medic Ser	Enables rem		Manual	Local Syste
	windows_exporter	Exports Pro	Running	Automatic	Local Syste
	WinHTTP Web Proxy Auto	WinHTTP i	Running	Manual	Local Service
	🖏 Wired AutoConfia	The Wired		Manual	Local Syste

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

4. Exporter should start exposing metrics on

http://localhost:9182/metrics

5. 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"]
```

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

← → C O localhost 9090/targets?showEmptyPools=0&health=up	< < >	ම 🖬 හි 👘 💿 :
🕒 Prometheus 🔍 Query 🌲 Alerts 😰 Status > Target health		* (:@ m
Select scrape pool 0 @ UPX X Q. Hiter by endpoint or I		
Hiding pools with no matching targets Hiding 3 empty pools due to filters or no targets. Show empty pools		
WMI Exporter		1/1up 💿 🔿
Endpoint Labels	Last scrape	State
http://172.20.10.2:9182/metrics Instance="172.20.10	23182 job-"WH Exporter" Y C. 1m 44.66s.app	8 26ms
prometheus		1/1up O ^
Endpoint Labels	Last scrape	State
http://localhost:9090/metrics instance="localhost:		2 8ms UP

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 :



Fig. 9 Sending Network Latency data to be scraped

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

global:
<pre>scrape_interval: 1s</pre>
evaluation_interval: 1s
alerting:
alertmanagers:
- static_configs:
- targets: [" <alertmanager-ip>:9093"]</alertmanager-ip>
rule_files:
Define your alert rules here
<pre># - "alert_rules.yml"</pre>
scrape_configs:
- job_name: "prometheus"
static_configs:
- targets: ["localhost:9090"]
ich nome: "LUMI Expenter"
- Job_name: WHI Exponder
static_configs:
- targets. [1/2.20.10.2.9162]
- job name: 'flannyhird fns'
static configs:
- targets: ['172.20.10.2:8000']
- iob 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

← → C ③ localhost:9090/targets?showEmptyPools=1&	khealth-up	. द ☆	S =	£ ∣		
Prometheus Query Alerts 😨 Status >) Target health v				۲	ш
Select scrape pool C C C C C C C C C						
WMI Exporter					•	
Endpoint	Labels	Last scrape		State	e	
http://172.20.10.2:9182/metrics				UP	•	
flappybird bandwidth usage					•	
Enopoint		Last scrape		State		
ntp3/1/220.10/23000/metrics	ntrance" //_co.iu.covov po="teppione_benowistn_reage"	C Kolas ago			ľ	
flappybird_fps					•	
Endpoint	Labels	Last scrape		State	e	
http://172.20.10.2/8000/metrics	instance-"172.28.18.2.8000" job-"flappybird fps" ×			UP		
flappyhird network latency					•	
Endpoint	Labels	Last scrape		State	•	
http://1/220.1028000/metrics	instance="172.28.10.2:4000" job="flappybrid_network_latency" *	Ci 4,458s ago	8 2ms	UP	•	
prometheus					•	
Endpoint	Labels	Last scrape		State		
http://ocalhost:9090/metrics	(instance="localibout0000") (pit="promotions") ×	Q: 4.179s ago		UP		

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

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".

Ø				+~ 💿 🔊 😫
Home > Dashboards > New dashboard > Edit panel				Back to dashboard Discard panel Save dashboard A
		Table view • O Last 6 hours •	Q 🗘 Refresh 🗸	Time series
Panel Title				
				 Panel options Title
				Panel Title
				Description
Metrics explorer Open Browse and filter all metrics and metadata with a fuzzy search				
E flappybird_bandwidth_usage				Transparent background
Date flappybird_fps			Query inspector	> Panel links
flappybird_network_latency				Repeat options
				~ Tooltip
go_gc_cycles_automatic_gc_cycles_total		Run querie:	s Builder Code	Tooltip mode
on no. cycles forcert no. cycles total Select metric Q Select label v = v Select value v X				Single All Hidden Hover proximity Hove clean the surger must be tall a point to trianger the tealling
+ Operations				in pixels
> Options Legend: Auto Format: Time series Step: auto Type: Range Exemplars: false				Max width
+ Add query + Expression				

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

References

Mamidwar, S. and Juneja, G.D.S. (2023) Install prometheus and Grafana with WMI exporter on window server 2022 base, FOSS TechNix. Available at: https://www.fosstechnix.com/install-prometheus-and-grafana-with-wmi-exporter-onwindow-server-2022-base/ (Accessed: 10 December 2024).

Get started with Amazon EC2 - Amazon Elastic Compute Cloud. Available at: https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EC2_GetStarted.html (Accessed: 10 December 2024).

Rani, E.G. and Chetana, D.T. (2023) 'Using GitHub and Grafana tools: Data Visualization (DATA VIZ) in big data,' in Algorithms for intelligent systems, pp. 477–491. https://doi.org/10.1007/978-981-19-7892-0_38.

Singh, A.P., Rai, E.P. and Dixit, A.K., 2023, August. Web Content Distribution with Low Latency on Worldwide Using Amazon CloudFront Service. In 2023 7th International Conference On Computing, Communication, Control And Automation (ICCUBEA) (pp. 1-6). IEEE.

Setting up DynamoDB - Amazon DynamoDB (no date). https://docs.aws.amazon.com/amazondynamodb/latest/developerguide/SettingUp.html.

Getting started with Amazon S3 - Amazon Simple Storage Service (no date). https://docs.aws.amazon.com/AmazonS3/latest/userguide/GetStartedWithS3.html.

Skatteetaten (no date) GitHub - Skatteetaten/wmi_exporter: Prometheus exporter for Windows machines using WMI. <u>https://github.com/Skatteetaten/wmi_exporter</u>.

Visualization methods for game data in Python | Restackio (no date). https://www.restack.io/p/ai-for-texture-generation-in-games-answer-visualization-methodspython-cat-ai.