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Лабораторна робота №1
з дисципліни «Проектування розподілених систем»
за темою «Розгортання веб-порталу ввикористовуючи підхід IaaS»

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Тема: Розгортання веб-порталу ввикористовуючи підхід IaaS.

Завдання:

- Застосунок має бути розгорнутим в Azure Cloud або в Digital Ocean на віртуальному сервері (VPS)
- Застосунок має розгортатися за допомогою копіювання скомпільованого коду на сервер за допомогою SFTP або SSH

Хід роботи

Репозиторій: <https://github.com/JokerFunny/PRZ>.

Застосунок побудовано на .NET 6 з використанням бази даних PostgreSQL. Тому розгортання буде поділено на 2 етапа – сетап віртуальної машини («EC2») для API та налаштування БД в AWS («Amazon RDS»).

1. По-перше, була створена віртуальна машина зі стандартними налаштуваннями, використовуючи Ubuntu. Для неї був створений SSH ключ та нова Security Group з можливістю доступу по SSH:

EC2 > Instances > Launch an instance

Launch an instance [Info](#)

Amazon EC2 allows you to create virtual machines, or instances, that run on the AWS Cloud. Quickly get started by following the simple steps below.

Name and tags [Info](#)

Name

[Add additional tags](#)

▼ Application and OS Images (Amazon Machine Image) [Info](#)

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. Search or Browse for AMIs if you don't see what you are looking for below

Amazon Linux

macOS

Ubuntu

Windows

Red Hat

S

[Browse more AMIs](#)
Including AMIs from AWS, Marketplace and the Community

Amazon Machine Image (AMI)

Ubuntu Server 22.04 LTS (HVM), SSD Volume Type
ami-06ce824c157700cd2 (64-bit (x86)) / ami-0858a735e1c08e6e5 (64-bit (Arm))
Virtualization: hvm ENA enabled: true Root device type: ebs

Free tier eligible

Description

Canonical, Ubuntu, 22.04 LTS, amd64 jammy image build on 2022-12-01

Architecture

AMI ID

64-bit (x86)

ami-06ce824c157700cd2

Verified provider

▼ Summary

Number of instances [Info](#)

Software Image (AMI)

Canonical, Ubuntu, 22.04 LTS, ...[read more](#)
ami-06ce824c157700cd2

Virtual server type (instance type)

t2.micro

Firewall (security group)

New security group

Storage (volumes)

1 volume(s) - 8 GiB

Free tier: In your first year includes 750 hours of t2.micro (or t3.micro in the Regions in which t2.micro is unavailable) instance usage on free tier AMIs per month, 30 GiB of EBS storage, 2 million IOs, 1 GB of snapshots, and 100 GB of bandwidth to the internet.

×

Cancel

Launch instance

Create key pair



Key pairs allow you to connect to your instance securely.

Enter the name of the key pair below. When prompted, store the private key in a secure and accessible location on your computer. **You will need it later to connect to your instance.** [Learn more](#)

Key pair name

The name can include upto 255 ASCII characters. It can't include leading or trailing spaces.

Key pair type

☒ RSA

RSA encrypted private and public key pair

☐ ED25519

ED25519 encrypted private and public key pair (Not supported for Windows instances)

Private key file format

☐ .pem

For use with OpenSSH

☒ .ppk

For use with PuTTY

Cancel

Create key pair

▼ Instance type [Info](#)

Instance type

t2.micro

Free tier eligible

Family: t2 1 vCPU 1 GiB Memory

On-Demand Linux pricing: 0.0134 USD per Hour

On-Demand Windows pricing: 0.018 USD per Hour



[Compare instance types](#)

▼ Key pair (login) [Info](#)

You can use a key pair to securely connect to your instance. Ensure that you have access to the selected key pair before you launch the instance.

Key pair name - *required*

LabsKey



[Create new key pair](#)

▼ Network settings [Info](#)

[Edit](#)

Network [Info](#)

vpc-05b5b4786229a5f4e

Subnet [Info](#)

No preference (Default subnet in any availability zone)

Auto-assign public IP [Info](#)

Enable

Firewall (security groups) [Info](#)

A security group is a set of firewall rules that control the traffic for your instance. Add rules to allow specific traffic to reach your instance.

☒ Create security group

☐ Select existing security group

We'll create a new security group called 'launch-wizard-1' with the following rules:

☒ Allow SSH traffic from

Helps you connect to your instance

Anywhere

0.0.0.0/0



☒ Allow HTTPS traffic from the internet

To set up an endpoint, for example when creating a web server

☒ Allow HTTP traffic from the internet

To set up an endpoint, for example when creating a web server

Rules with source of 0.0.0.0/0 allow all IP addresses to access your instance. We recommend setting security group rules to allow access from known IP addresses only.

▼ **Configure storage** [Info](#) Advanced

1x GiB Root volume (Not encrypted)

i Free tier eligible customers can get up to 30 GB of EBS General Purpose (SSD) or Magnetic storage X

[Add new volume](#)

The selected AMI contains more instance store volumes than the instance allows. Only the first 0 instance store volumes from the AMI will be accessible from the instance

0 x File systems [Edit](#)

2. Дані файлу зі згенерованим SSH ключем:

```

LabsKey.ppk X
C: > Users > Danylo > Desktop > LabsKey.ppk
1 PuTTY-User-Key-File-2: ssh-rsa
2 Encryption: none
3 Comment: LabsKey
4 Public-Lines: 6
5 AAAAB3NzaC1yc2EAAAADAQABAAQACyioBkVmvB
6 SYTaaqNxdJmN4ew0L8jEsBdc+LBL6rWIiticZPE9
7 pa+HSa9um5RrUV8sj4dECtmQu5S50s7n4G0Pw9/R
8 5abD5oMTi3vuhQEfkB9YzpwiaAo+MvI0N16FiPg93
9 aIPXFJV4RGj7AHsLYVPNCo1l9aKqPRGA07qUXLhR
10 vAoS2E61U+P7vIibvXA6rPRvRHS77MVDrgX5+kjM
11 Private-Lines: 14
12 AAABADxu6v1P55m0gT00qKIb7HMZrHUWRKdh+KsY
13 1u5bvKdDmJ8X7DD603gnyJf5QhDPaXY/PnGLzMsr
14 SKm+GhuTcSAxBYorwcUwSu2AHJz19YcTS8/BuNjG
15 N6lzSffjhclqoPhljx31xuC8LNHQi167MkRGMKl
16 lx5VRUUxMgk/2g92DRrr/vvrOCdOhksaMdAa5JPS
17 IW4vF4f+r09EQx3Us6w9REBW/MEAAACBAPTfaOV/
18 HZDzl7+9mOP3TKci98hKKN6tiIr90mZftOnkDwBA
19 1thc/fdguRnf1sgSClH/Cx3sJsx0EmbEPQK5JG3R
20 0U83StjS35YHAAAAGQC15Q7pw7v96v3gVTxVb7qG
21 2s/EiKvtaHUG7jq05xahXMgZyEx9muAeXk8X02
22 /119J520F8erCFHJm2Gddd0+e1FbBtFkP9d+UdRU
23 AIEAi4hKeeRwDAppAQszo6zU5xR5G/pIXmLq+aaY
24 djj7SgaI/Np+rzK/neVSZmS19wFuPNIxB0Mx5ccD
25 XauGcRQWoISZOVU7/Uv7ZDyIEo/tgsFZhrDoCGSF
26 Private-MAC: de20d14e45be54834233e0c5106
  
```

3. Ініціалізація створення віртуальної машини:

Instances (2) Info									
<input type="text" value="Find instance by attribute or tag (case-sensitive)"/>									
<input type="checkbox"/>	Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS	Public IPv4 ...
<input type="checkbox"/>	Lab2beanstalk...	i-06ac798d703fddc60	Running	t2.micro	2/2 checks passed	No alarms	eu-central-1c	ec2-3-68-252-17.eu-ce...	3.68.252.17
<input type="checkbox"/>	lab1-vm	i-0021cef69c1221b92	Running	t2.micro	2/2 checks passed	No alarms	eu-central-1a	ec2-3-64-47-64.eu-cent...	3.64.47.64

4. Створимо базу даних. Так як наш додаток використовує PostgreSQL, будемо використовувати Amazon RDS який має підтримку PostgreSQL:

Create database

Choose a database creation method [Info](#)

- ☒ **Standard create**
You set all of the configuration options, including ones for availability, security, backups, and maintenance.

- ☐ **Easy create**
Use recommended best-practice configurations. Some configuration options can be changed after the database is created.

Engine options

Engine type [Info](#)

- ☐ Amazon Aurora



- ☐ MySQL



- ☐ MariaDB



- ☒ PostgreSQL



- ☐ Oracle

ORACLE®

- ☐ Microsoft SQL Server



Engine Version

PostgreSQL 13.7-R1



Templates

Choose a sample template to meet your use case.

- ☐ **Production**
Use defaults for high availability and fast, consistent performance.

- ☐ **Dev/Test**
This instance is intended for development use outside of a production environment.

- ☒ **Free tier**
Use RDS Free Tier to develop new applications, test existing applications, or gain hands-on experience with Amazon RDS. [Info](#)

Settings

DB instance identifier [Info](#)

Type a name for your DB instance. The name must be unique across all DB instances owned by your AWS account in the current AWS Region.

The DB instance identifier is case-insensitive, but is stored as all lowercase (as in "mydbinstance"). Constraints: 1 to 60 alphanumeric characters or hyphens. First character must be a letter. Can't contain two consecutive hyphens. Can't end with a hyphen.

▼ Credentials Settings

Master username [Info](#)

Type a login ID for the master user of your DB instance.

1 to 16 alphanumeric characters. First character must be a letter.

☐ **Manage master credentials in AWS Secrets Manager**
Manage master user credentials in Secrets Manager. RDS can generate a password for you and manage it throughout its lifecycle.

☐ **Auto generate a password**
Amazon RDS can generate a password for you, or you can specify your own password.

Master password [Info](#)

Constraints: At least 8 printable ASCII characters. Can't contain any of the following: / (slash), ' (single quote), " (double quote) and @ (at sign).

Confirm master password [Info](#)

Instance configuration

The DB instance configuration options below are limited to those supported by the engine that you selected above.

DB instance class [Info](#)

- ☐ Standard classes (includes m classes)
- ☐ Memory optimized classes (includes r and x classes)
- ☒ Burstable classes (includes t classes)

db.t3.micro

2 vCPUs 1 GiB RAM Network: 2,085 Mbps



☐ Include previous generation classes

Storage

Storage type [Info](#)

General Purpose SSD (gp2)

Baseline performance determined by volume size



Allocated storage

20

GiB

The minimum value is 20 GiB and the maximum value is 6,144 GiB

Storage autoscaling [Info](#)

Provides dynamic scaling support for your database's storage based on your application's needs.

☒ Enable storage autoscaling

Enabling this feature will allow the storage to increase after the specified threshold is exceeded.

Maximum storage threshold [Info](#)

Charges will apply when your database autoscales to the specified threshold

1000

GiB

The minimum value is 22 GiB and the maximum value is 6,144 GiB

Connectivity

Info

Compute resource

Choose whether to set up a connection to a compute resource for this database. Setting up a connection will automatically change connectivity settings so that the compute resource can connect to this database.

☒ Don't connect to an EC2 compute resource
Don't set up a connection to a compute resource for this database. You can manually set up a connection to a compute resource later.

☐ Connect to an EC2 compute resource
Set up a connection to an EC2 compute resource for this database.

Virtual private cloud (VPC)

Info

Choose the VPC. The VPC defines the virtual networking environment for this DB instance.

Default VPC (vpc-05b5b4786229a5f4e) ▼

Only VPCs with a corresponding DB subnet group are listed.

ⓘ After a database is created, you can't change its VPC.

DB Subnet group

Info

Choose the DB subnet group. The DB subnet group defines which subnets and IP ranges the DB instance can use in the VPC that you selected.

default ▼

Public access

Info

☒ Yes
RDS assigns a public IP address to the database. Amazon EC2 instances and other resources outside of the VPC can connect to your database. Resources inside the VPC can also connect to the database. Choose one or more VPC security groups that specify which resources can connect to the database.

☐ No
RDS doesn't assign a public IP address to the database. Only Amazon EC2 instances and other resources inside the VPC can connect to your database. Choose one or more VPC security groups that specify which resources can connect to the database.

Amazon RDS

Dashboard
Databases
Query Editor
Performance insights
Snapshots
Exports in Amazon S3
Automated backups
Reserved instances
Proxies
Subnet groups

RDS > Databases

Consider creating a Blue/Green Deployment to minimize downtime during upgrades
 You may want to consider using Amazon RDS Blue/Green Deployments and minimize your downtime during upgrades. A Blue/Green Deployment provides a staging environment for changes to your database.

Databases

	DB identifier	Role	Engine	Region & AZ	Size	Status
<input type="radio"/>	awsdb-e-xfmsnmgds7-stack-awsdb-rdsdatabase-t4oh4x5pgbf3	Instance	PostgreSQL	eu-central-1c	db.t4g.micro	Available
<input type="radio"/>	lab1-db	Instance	PostgreSQL	eu-central-1b	db.t3.micro	Available

Security Groups (1/1) Info

<input checked="" type="checkbox"/>	Name	Security group ID	Security group name	VPC ID	Description	Owner	Inbound rules count	Outbound rules count
<input checked="" type="checkbox"/>	default-allow-all	sg-0f47b7fdcd167991	default	vpc-05b5b4786229a5f4e	default VPC security gr...	517864397577	1 Permission entry	1 Permission entry

sg-0f47b7fdcd167991 - default

Details

Inbound rules

Outbound rules

Tags

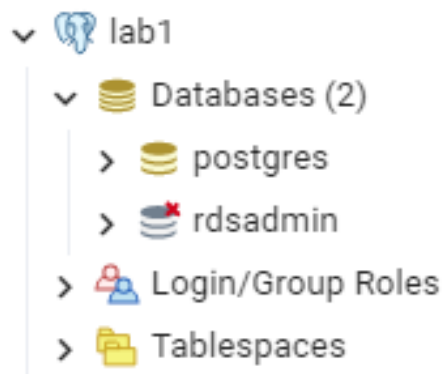
☒ You can now check network connectivity with Reachability Analyzer

Inbound rules (1/1)

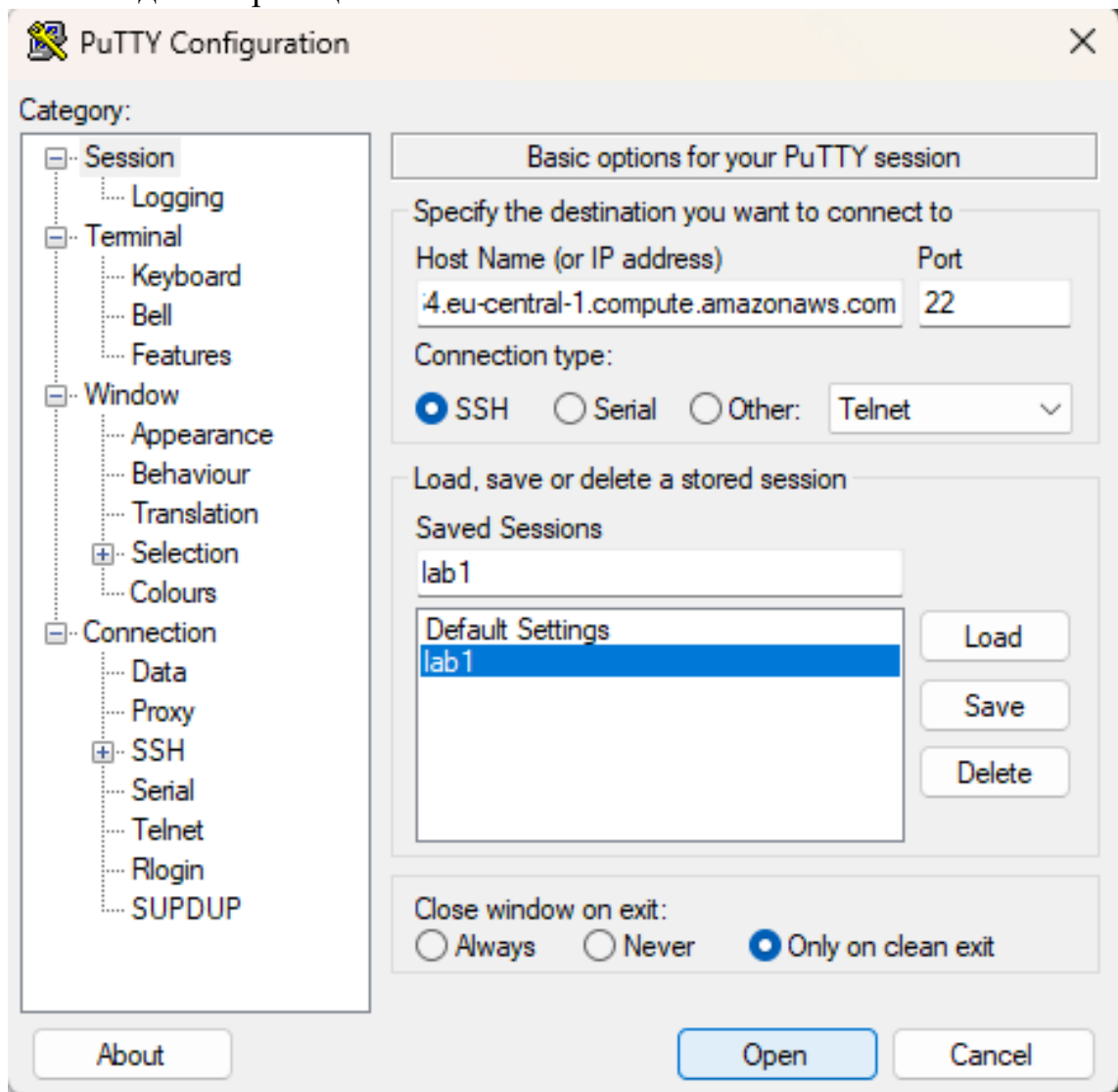
☒

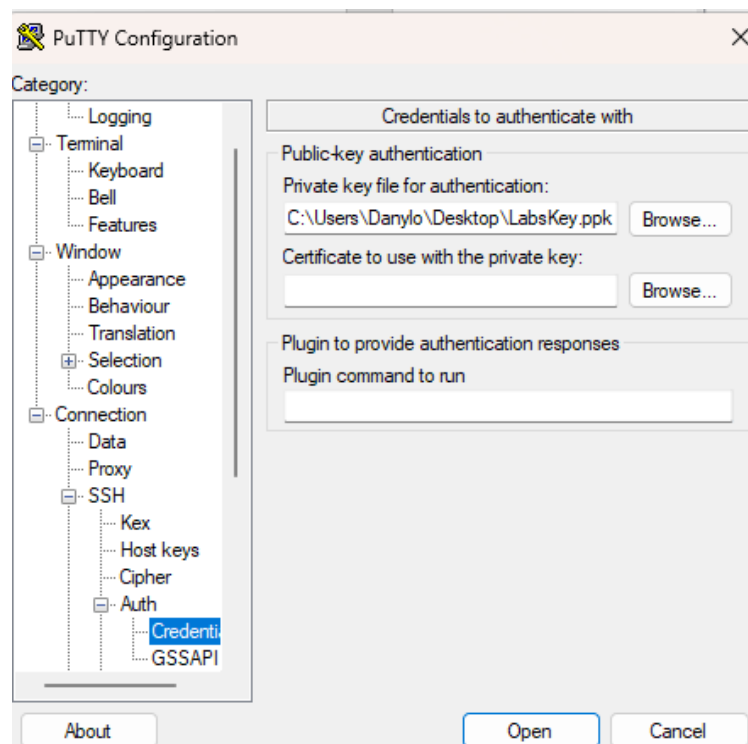
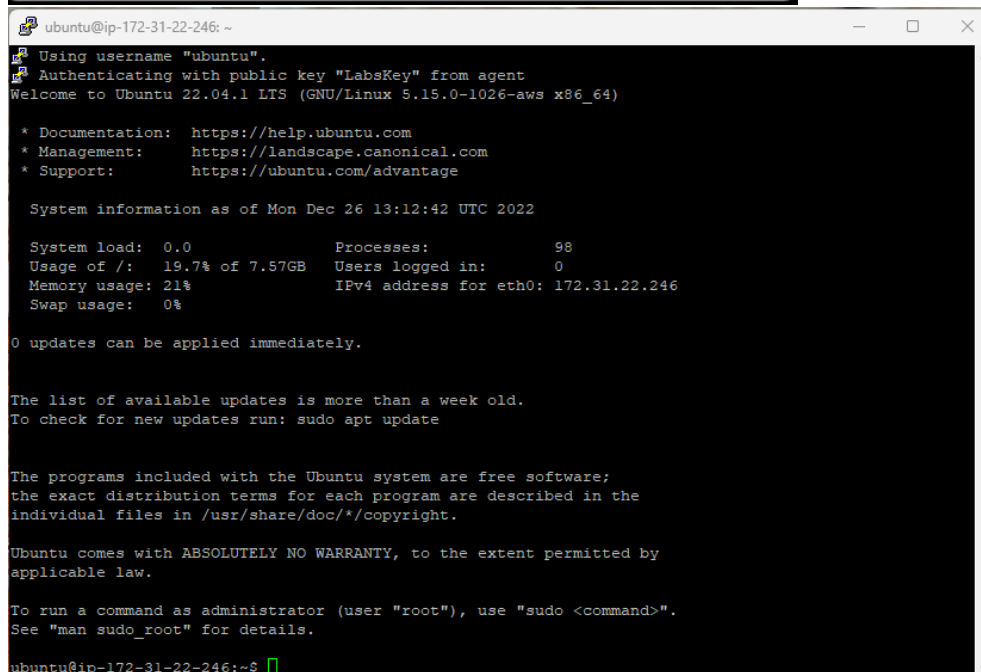
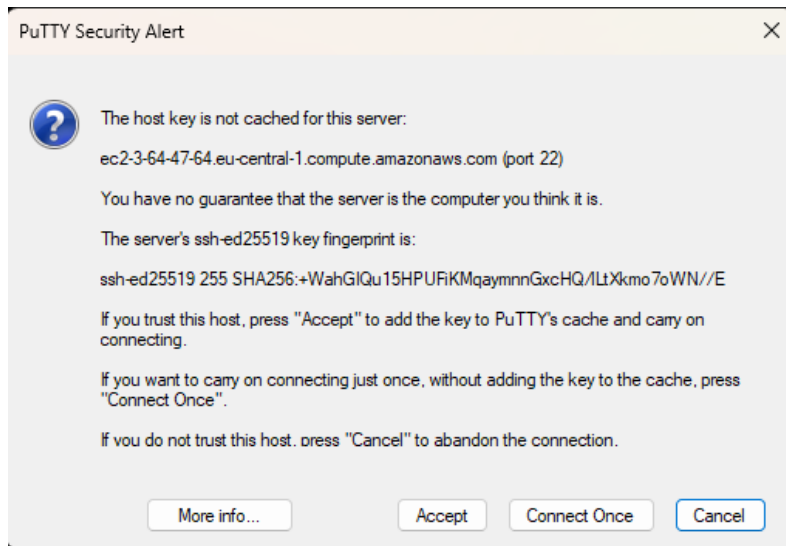
Name	Security group rule...	IP version	Type	Protocol	Port range	Source	Description
<input checked="" type="checkbox"/>	-	sg-02731c460507d9...	IPv4	All traffic	All	0.0.0.0/0	-

7. Перевіряємо що база жива та доступна:

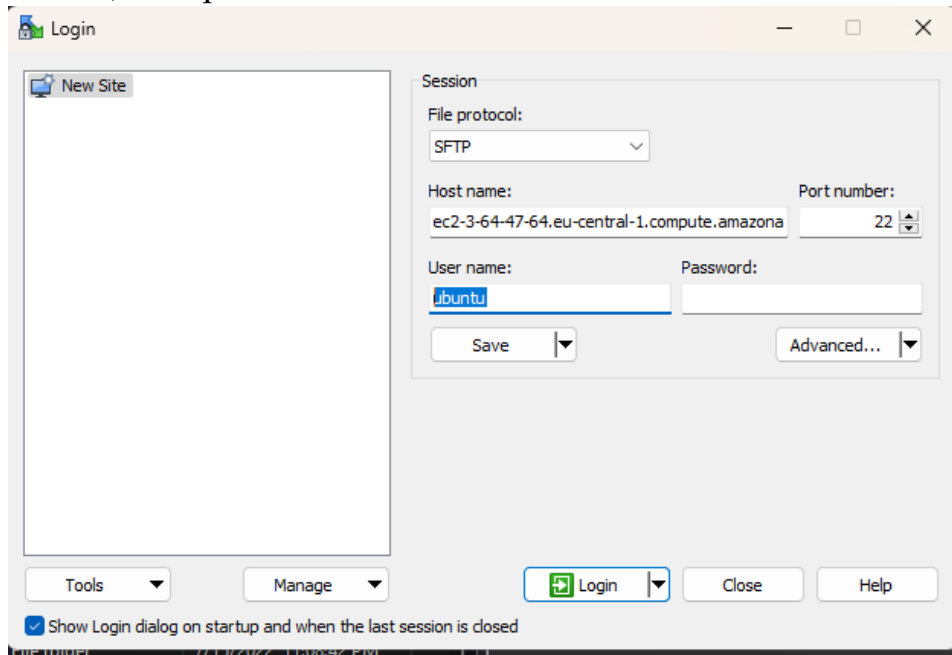


8. Використаємо Putty для підключення за SSH до EC2. Для цього, введемо IP адресу отриманої машини. Також, додамо наш отриманий файл з приватним ключем до авторизації:





9. Також, використаємо WinSCP як SFTP клієнт:



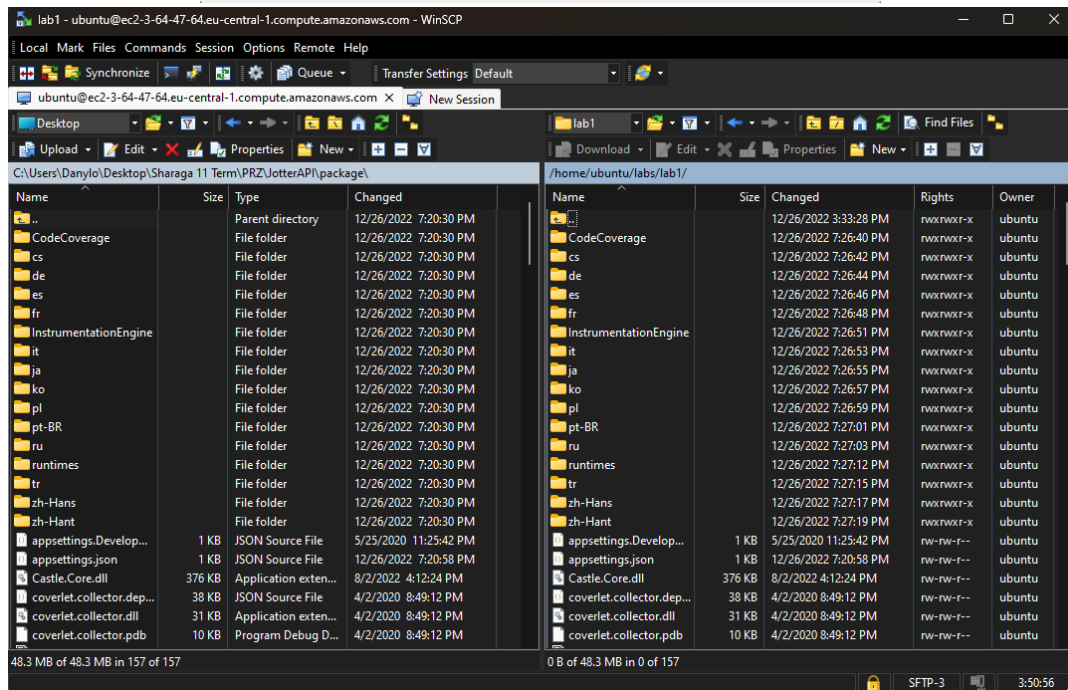
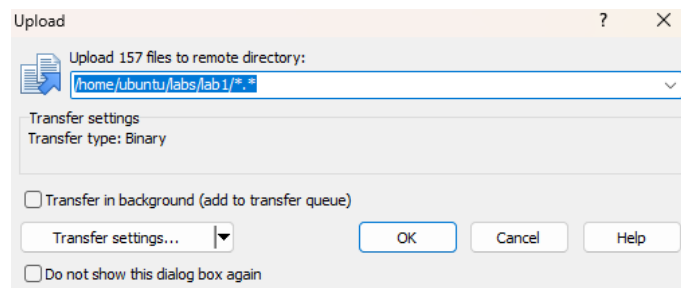
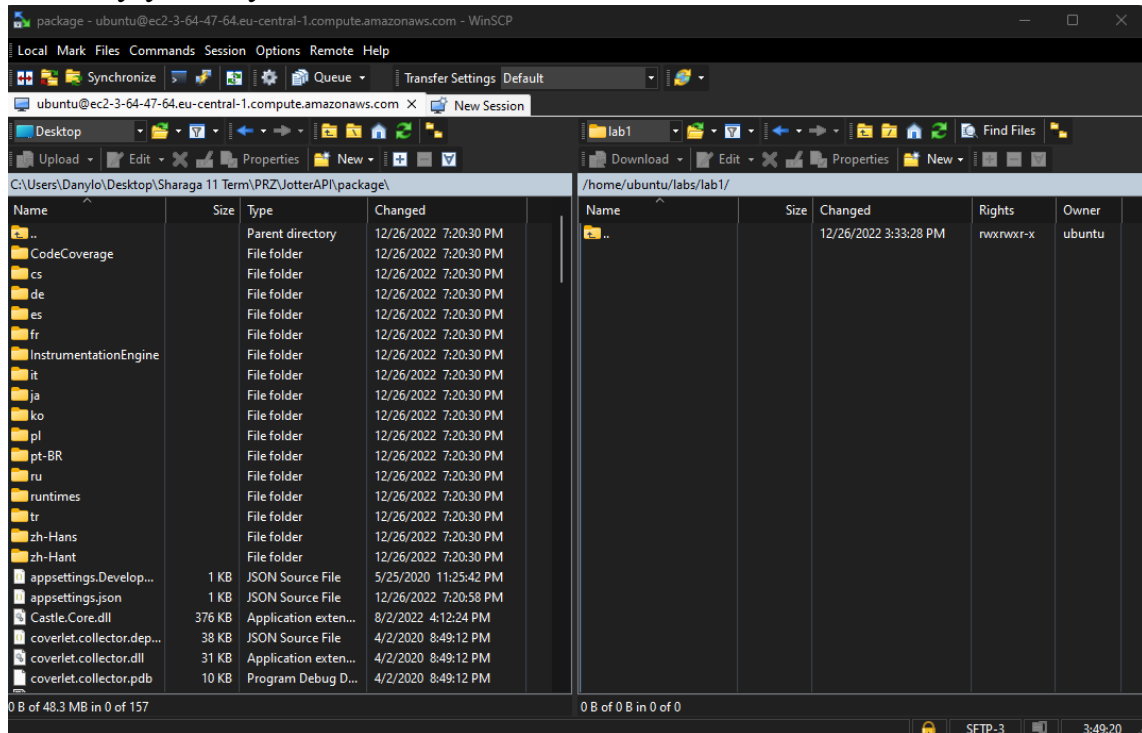
10. Після локального запуску проекту та перевірки, що все працює, запаблішимо проект у папку, в даному випадку, була використана папка package:

```
C:\Windows\System32\cmd.e  x + v
Microsoft Windows [Version 10.0.22621.963]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Danylo\Desktop\Sharaga 11 Term\PRZ\JotterAPI>dotnet publish --output package
MSBuild version 17.4.0+18d5aef85 for .NET
Determining projects to restore...
All projects are up-to-date for restore.
JotterAPI.DAL -> C:\Users\Danylo\Desktop\Sharaga 11 Term\PRZ\JotterAPI\JotterAPI.DAL\bin\Debug\net6.0\JotterAPI.DAL.dll
JotterAPI.DAL -> C:\Users\Danylo\Desktop\Sharaga 11 Term\PRZ\JotterAPI\package\
JotterAPI -> C:\Users\Danylo\Desktop\Sharaga 11 Term\PRZ\JotterAPI\JotterAPI\bin\Debug\net6.0\JotterAPI.dll
JotterAPI -> C:\Users\Danylo\Desktop\Sharaga 11 Term\PRZ\JotterAPI\package\
XUnitJotterAPITests -> C:\Users\Danylo\Desktop\Sharaga 11 Term\PRZ\JotterAPI\XUnitJotterAPITests\bin\Debug\net6.0\XUnitJotterAPITests.dll
XUnitJotterAPITests -> C:\Users\Danylo\Desktop\Sharaga 11 Term\PRZ\JotterAPI\package\

C:\Users\Danylo\Desktop\Sharaga 11 Term\PRZ\JotterAPI>
```

11. Використовуючи WinSCP клієнт, перемістимо отриманий пакет на віртуальну машину у папку Labs/lab1/:



12. Перейдемо до налаштування EC2. Для цього, встановимо .NET6 SDK:

```
Reading package lists... Done
ubuntu@ip-172-31-22-246:~/labs$ sudo apt-get install -y dotnet-sdk-6.0
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  aspnetcore-runtime-6.0 aspnetcore-targeting-pack-6.0 dotnet-apphost-pack-6.0
  dotnet-host dotnet-hostfxr-6.0 dotnet-runtime-6.0 dotnet-targeting-pack-6.0
  dotnet-templates-6.0 libltng-ust-common1 libltng-ust-ctl5 libltng-ustl1
  netstandard-targeting-pack-2.1
```

13. Перевіримо коректність встановлення, виконавши наступну команду:

```
ubuntu@ip-172-31-22-246:~/labs$ dotnet --version
6.0.111
```

14. Запустимо застосунок, перейшовши у папку Labs/lab1/ та запустивши .dll файл:

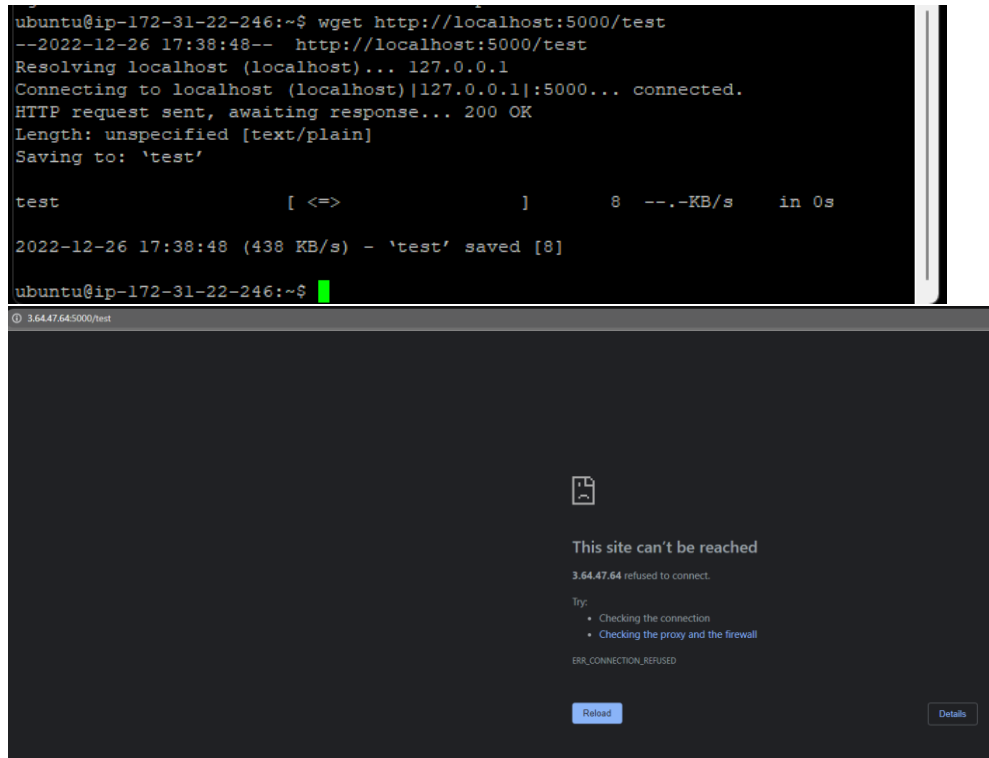
```
ubuntu@ip-172-31-22-246:~/labs/lab1$ dotnet JotterAPI.dll
warn: Microsoft.AspNetCore.DataProtection.KeyManagement.XmlKeyManager[35]
      No XML encryptor configured. Key (59ef289f-8859-4c97-ad91-a732c3deb052) may be persisted to storage in unencrypted form.
info: Microsoft.Hosting.Lifetime[14]
      Now listening on: http://localhost:5000
info: Microsoft.Hosting.Lifetime[14]
      Now listening on: https://localhost:5001
info: Microsoft.Hosting.Lifetime[0]
      Application started. Press Ctrl+C to shut down.
info: Microsoft.Hosting.Lifetime[0]
      Hosting environment: Production
info: Microsoft.Hosting.Lifetime[0]
      Content root path: /home/ubuntu/labs/lab1
```

15. Додамо «Inbound Security Rule» для порту 5000 для доступу зовні до додатку на EC2:

Security group rule ID	Type	Protocol	Port range	Source	Description - optional	
sgp-03e165528050a746	SSH	TCP	22	Custom	Q	Delete
sgp-00f515649c1f6c86e	HTTP	TCP	80	Custom	Q	Delete
sgp-07868454f1835cd72	HTTPS	TCP	443	Custom	Q	Delete
-	Custom TCP	TCP	5000	Anywhere (IPv4)	Q	Delete

Add rule

16. Перевіримо можливість отримання даних локально (на EC2) та за допомогою http запитів зі свого комп'ютера. Перший варіант у даному випадку буде працювати без проблем (використовуючи команду wget). А ось другий буде повертати помилки через неможливість з'єднання з сервером. Щоб прибрати цю помилку, додаємо строчку «.UseUrls("http://0.0.0.0:5000")» до Program.cs:



```
public static IHostBuilder CreateHostBuilder(string[] args) =>
    Host.CreateDefaultBuilder(args)
        .ConfigureWebHostDefaults(webBuilder =>
        {
            webBuilder.UseUrls("http://0.0.0.0:5000");
            webBuilder.UseStartup<Startup>();
        });
```

17. Перезапустимо застосунок та перевіримо його працездатність (`http://3.64.47.64:5000/`):

```
ubuntu@ip-172-31-22-246:~$ wget http://3.64.47.64:5000/test
--2022-12-26 17:51:38-- http://3.64.47.64:5000/test
Connecting to 3.64.47.64:5000... connected.
HTTP request sent, awaiting response... 200 OK
Length: unspecified [text/plain]
Saving to: 'test.1'

test.1          [ <=> ]      8  --.-KB/s   in 0s

2022-12-26 17:51:38 (364 KB/s) - 'test.1' saved [8]

ubuntu@ip-172-31-22-246:~$ wget http://localhost:5000/test
--2022-12-26 17:51:48-- http://localhost:5000/test
Resolving localhost (localhost)... 127.0.0.1
Connecting to localhost (localhost)|127.0.0.1|:5000... connected.
HTTP request sent, awaiting response... 200 OK
Length: unspecified [text/plain]
Saving to: 'test.2'

test.2          [ <=> ]      8  --.-KB/s   in 0s

2022-12-26 17:51:48 (793 KB/s) - 'test.2' saved [8]

ubuntu@ip-172-31-22-246:~$
```

← → ↻ 🏠 ⚠ Not secure | 3.64.47.64:5000/test

It works

⏪ ⏴ ⏵ ⏩ ⚠ Not secure | 3.64.47.64:5000/swagger/index.html

Swagger

OpenAPI Specification

Select a definitionJoggerAPI v1

Jogger API

GA52

http://3.64.47.64:5000/swagger/v1/swagger.json

Authorize

Categories

POST /Categories

GET /Categories

DELETE /Categories/{categoryId}

Files

POST /Files

GET /Files/{fileId}

DELETE /Files/{fileId}

Notes

POST /Notes

PUT /Notes

DELETE /Notes/{noteId}

GET /Notes/{noteId}

GET /Notes/category

Test

GET /Test

Users

POST /login


```
{
  "error": "string",
  "isSuccessful": true,
  "responseResult": {
    "id": "3fa85f64-5717-4562-b3fc-2c963f66afa6",
    "name": "string",
    "email": "string"
  }
}
```

18. Додаток задепложено за допомогою AWS EC2 використовуючи підхід IaaS.

Висновок:

В результаті виконання лабораторної роботи було розгорнуто застосунок на AWS EC2 за допомогою підключення через SSH для налаштування та підключення по SFTP для завантаження заздалегідь підготовленого застосунку + Amazon RDS для бази даних.