



Data Center Networking Technology

Project 1 – Amazon EC2

2022.02.22

Yu-Ho Chiang, Chieh-Ju Yu

chiang90102@gmail.com, lucy4116411.cs09@nycu.edu.tw



Outline

- Project Info
- Descriptions and Objectives
- Project Content
- Step-by-Step Instructions
- Report



Project Info

Goal:

- To understand what cloud computing is through working with Amazon Elastic Compute Cloud (Amazon EC2) which is one of the Amazon Web Service (AWS)
- In this project, student will learn how to use the Amazon EC2 API to create Virtual Machines, and run simple programs using a cluster of Virtual Machines

Project assigned: 02/22/2022
Project deadline: 03/08/2022





Descriptions and Objectives

About Amazon Elastic Compute Cloud(Amazon EC2):

- Amazon EC2 is one of web service provided by Amazon Web Service(AWS)
- Amazon EC2 offers cloud-computing services, such as IaaS
- Tenants can flexibly request their computing resources by adding or removing Virtual Machines



Project Content

1. Login AWS Academy account and learn how to use Amazon EC2
2. Create two Virtual Machines by using Amazon EC2
3. Run a TCP socket program in two Virtual Machines, one of which is the server, and the other as the client
4. Print Screen your VM terminal and put this picture in your report
5. **No demo for this project, only report**

Step-by-Step Instructions (1/26)

Step 1: Login to AWS academy

Go to https://www.awsacademy.com/LMS_Login

(Make sure you already participate in a class which is called AWS Academy Learner Lab – Foundation Services[15247], if you haven't sign up, refer to the slides “DCN Project 1 (Preparation)”)



Step-by-Step Instructions (2/26)

Step 2: Login to AWS EC2

Click the “Modules” button

The screenshot shows the AWS Academy Learner Lab - Foundation Services [15247] interface. On the left, there is a sidebar with various navigation options: Home, Modules (which is highlighted with a red circle), Discussions, Courses, Calendar, Inbox, History, and Help. The main content area displays the title "AWS Academy Learner Lab - Foundation Services [15247]" and a decorative graphic featuring clouds and the AWS logo. Below the title, there is a descriptive text block:

AWS Academy Learner Lab - Foundation Services provides a long-running sandbox environment for ad hoc exploration of AWS services. Within this class, students will have access to **a restricted set of AWS services**. Not all AWS documentation walk-through or sample labs that operate in an AWS Production account will work in the sandbox environment. You will retain access to the AWS resources set up in this environment for the duration of this course. We limit your budget (\$100), so you should exercise caution to prevent charges that will deplete your budget too quickly. If you exceed your budget, you will lose access to your environment and lose all of your work.

On the right side, there are three buttons: "View Course Stream", "View Course Calendar", and "View Course Notifications". There is also a "To Do" section which says "Nothing for now" and a "Recent Feedback" section which also says "Nothing for now".

Step-by-Step Instructions (3/26)

Step 2: Login to AWS EC2

Click the “Learner Lab - Foundational Services” button

The screenshot shows a user interface for a learning management system. On the left, there is a vertical sidebar with icons and labels for various functions: AWS logo, Account, Dashboard, Courses, Calendar, Inbox, History, and Help. The 'Modules' icon is highlighted with a vertical bar. The main content area shows the path 'ALLFv1-15247 > Modules'. Below this, there are three tabs: Home, Modules (which is selected), and Discussions. A 'Collapse All' button is located in the top right corner of the main content area. The 'Modules' section lists several items under 'Learner Lab Foundation Services': 'Learner Lab - Student Guide.pdf', 'Learner Lab - Foundational Services' (this item is circled in red), and 'End of Course Feedback Survey'.



Step-by-Step Instructions (4/26)

Step 2: Login to AWS EC2

Click the “Start Lab” button and wait until the light turns green

The screenshot shows the AWS Learner Lab interface. On the left is a sidebar with icons for Account, Dashboard, Courses, Calendar, Inbox, History, and Help. The main navigation bar at the top shows the path: ALLFv1-1... > Modules > Learner La... > Learner Lab - Foundational Services. The top right features a budget summary (Used \$0 of \$100), a timer (00:00), and several buttons: Start Lab (highlighted with a red circle), End Lab, AWS Details, Readme, Reset, and a close button. Below the navigation is a terminal window displaying a command prompt: ddd_v1_w_lcZ_1064737@runweb48601:~\$. To the right is a large panel titled "Learner Lab - Foundational Level" containing links to various resources: Environment Overview, Environment Navigation, Access the AWS Management Console, Region restriction, Service usage and other restrictions, Using the terminal in the browser, and Running AWS CLI commands.

aws

ALLFv1-1... > Modules > Learner La... > Learner Lab - Foundational Services

Home Modules Discussions

AWS

Used \$0 of \$100 00:00

▶ Start Lab End Lab AWS Details Readme Reset

ddd_v1_w_lcZ_1064737@runweb48601:~\$

EN-US -

Learner Lab - Foundational Level

[Environment Overview](#)
[Environment Navigation](#)
[Access the AWS Management Console](#)
[Region restriction](#)
[Service usage and other restrictions](#)
[Using the terminal in the browser](#)
[Running AWS CLI commands](#)



Step-by-Step Instructions (5/26)

Step 2: Login to AWS EC2

Click the “AWS” button

The screenshot shows the AWS Learner Lab interface. On the left is a dark sidebar with icons for Account, Dashboard, Courses, Calendar, Inbox, History, and Help. The main area has a breadcrumb navigation: ALLFv1-1... > Modules > Learner La... > Learner Lab - Foundational Services. A green-bordered box highlights the "AWS" button in the top right of the main content area. The content area displays a terminal window with the command "ddd_v1_w_lcZ_1064737@runweb48601:~\$". To the right is a sidebar titled "Learner Lab - Foundational Level" with links to Environment Overview, Environment Navigation, Access the AWS Management Console, Region restriction, Service usage and other restrictions, Using the terminal in the browser, and Running AWS CLI commands.

ALLFv1-1... > Modules > Learner La... > Learner Lab - Foundational Services

AWS

Used \$0 of \$100 03:59 Start Lab End Lab AWS Details Readme Reset

ddd_v1_w_lcZ_1064737@runweb48601:~\$

EN-US -

Learner Lab - Foundational Level

[Environment Overview](#)
[Environment Navigation](#)
[Access the AWS Management Console](#)
[Region restriction](#)
[Service usage and other restrictions](#)
[Using the terminal in the browser](#)
[Running AWS CLI commands](#)



Step-by-Step Instructions (6/26)

Step 3: Create VM

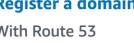
Click the “Launch a virtual machine” button at “Build a solution” area

AWS Management Console

AWS services

- ▼ Recently visited services
Your recently visited AWS services appear here.
- All services

Build a solution
Get started with simple wizards and automated workflows.

Launch a virtual machine With EC2 2-3 minutes 	Build a web app With Elastic Beanstalk 6 minutes 	Build using virtual servers With Lightsail 1-2 minutes 
Register a domain With Route 53 3 minutes 	Connect an IoT device With AWS IoT 5 minutes 	Start migrating to AWS With AWS MGN 1-2 minutes 

New AWS Console Home
See valuable insights for your account and services with the new customizable Console Home experience.
[Learn more](#) 

Switch now 

Stay connected to your AWS resources on-the-go
 AWS Console Mobile App now supports four additional regions. Download the AWS Console Mobile App to your iOS or Android mobile device. [Learn more](#) 

Explore AWS

Free AWS Training
Advance your career with AWS Cloud

Step-by-Step Instructions (7/26)

Step 3: Create VM

At this page, you can select the OS of your VM, in this project, we choose “Ubuntu Server 18.04 LTS (HVM), SSD Volume Type”

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review Cancel and Exit

Step 1: Choose an Amazon Machine Image (AMI)

SUSE Linux Enterprise Server 15 SP3 (HVM), SSD Volume Type - ami-08895422b5f3aa64a (64-bit x86) / ami-08f182b25f271ef79 (64-bit Arm) Free tier eligible Root device type: ebs Virtualization type: hvm ENA Enabled: Yes	<input checked="" type="radio"/> 64-bit (x86) <input type="radio"/> 64-bit (Arm)
Ubuntu Server 20.04 LTS (HVM), SSD Volume Type - ami-04505e74c0741db8d (64-bit x86) / ami-0b49a4a6e8e22fa16 (64-bit Arm) Free tier eligible Root device type: ebs Virtualization type: hvm ENA Enabled: Yes	<input checked="" type="radio"/> 64-bit (x86) <input type="radio"/> 64-bit (Arm)
Ubuntu Server 18.04 LTS (HVM), SSD Volume Type - ami-0e472ba40eb589f49 (64-bit x86) / ami-0a940cb939351ccca (64-bit Arm) Free tier eligible Root device type: ebs Virtualization type: hvm ENA Enabled: Yes	<input checked="" type="radio"/> 64-bit (x86) <input type="radio"/> 64-bit (Arm)
Microsoft Windows Server 2019 Base - ami-0c19f80dba70861db Free tier eligible Root device type: ebs Virtualization type: hvm ENA Enabled: Yes	<input checked="" type="radio"/> 64-bit (x86)



Step-by-Step Instructions (8/26)

Step 3: Create VM

At this page, AWS EC2 provide you some choice of computing resource (number of CPUs, size of memory.....)

In this project, you don't need to use powerful computing resource, so just use the default setting it provide to you

Click "Next" button to go to next page

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

Step 2: Choose an Instance Type

Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instances are virtual servers that can run applications. They have varying combinations of CPU, memory, storage, and networking capacity, and give you the flexibility to choose the appropriate mix of resources for your applications. [Learn more](#) about instance types and how they can meet your computing needs.

Filter by: All instance families ▾ Current generation ▾ Show/Hide Columns

Currently selected: t2.micro (- ECUs, 1 vCPUs, 2.5 GHz, -, 1 GiB memory, EBS only)

	Family	Type	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance	IPv6 Support
<input type="checkbox"/>	t2	t2.nano	1	0.5	EBS only	-	Low to Moderate	Yes
<input checked="" type="checkbox"/>	t2	t2.micro Free tier eligible	1	1	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	t2	t2.small	1	2	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	t2	t2.medium	2	4	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	t2	t2.large	2	8	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	t2	t2.xlarge	4	16	EBS only	-	Moderate	Yes
<input type="checkbox"/>	t2	t2.2xlarge	8	32	EBS only	-	Moderate	Yes
<input type="checkbox"/>	t3	t3.nano	2	0.5	EBS only	Yes	Up to 5 Gigabit	Yes
<input type="checkbox"/>	t3	t3.micro	2	1	EBS only	Yes	Up to 5 Gigabit	Yes

Cancel

Previous

Review and Launch

Next: Configure Instance Details



Step-by-Step Instructions (9/26)

Step 3: Create VM

At this page, you can set some detailed information of your VM(number of VM, network settings.....), in this project, we need two VMs to run TCP program
Change the “Number of Instances” to **2** and click the “Review and Launch” button

1. Choose AMI 2. Choose Instance Type **3. Configure Instance** 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

Step 3: Configure Instance Details
Configure the instance to suit your requirements. You can launch multiple instances from the same AMI, request Spot instances to take advantage of the lower pricing, assign an access management role to the instance, and more.

Number of instances **1.** **2** **2.**

You may want to consider launching these instances into an Auto Scaling Group to help you maintain application availability and for easy scaling in the future. [Learn how Auto Scaling can help your application stay healthy and cost effective.](#)

Purchasing option Request Spot instances

Network **vpc-907ec1ea (default)** **2.**

Subnet **No preference (default subnet in any Availability Zone)**

Auto-assign Public IP **Use subnet setting (Enable)**

Placement group Add instance to placement group

Capacity Reservation **Open**

IAM role **None** **2.**

Shutdown behavior **Stop**

Cancel **Previous** **Review and Launch** **Next: Add Storage**



Step-by-Step Instructions (10/26)

Step 3: Create VM

At this page, you can review your VMs' setting, click “Launch” button if you make sure there is no problem

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group **7. Review**

Step 7: Review Instance Launch

Please review your instance launch details. You can go back to edit changes for each section. Click **Launch** to assign a key pair to your instance and complete the launch process.

⚠ Improve your instances' security. Your security group, launch-wizard-1, is open to the world.

Your instances may be accessible from any IP address. We recommend that you update your security group rules to allow access from known IP addresses only.

You can also open additional ports in your security group to facilitate access to the application or service you're running, e.g., HTTP (80) for web servers. [Edit security groups](#)

AMI Details

[Edit AMI](#)

Ubuntu Server 16.04 LTS (HVM), SSD Volume Type - ami-0565af6e282977273

Free tier eligible Ubuntu Server 16.04 LTS (HVM),EBS General Purpose (SSD) Volume Type. Support available from Canonical (<http://www.ubuntu.com/cloud/services>).
Root Device Type: ebs Virtualization type: hvm

Instance Type

[Edit instance type](#)

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
t2.micro	Variable	1	1	EBS only	-	Low to Moderate

Security Groups

[Edit security groups](#)

Security group name launch-wizard-1
Description launch-wizard-1 created 2019-03-17T04:40:55.458+08:00

[Cancel](#) [Previous](#) **Launch**

Step-by-Step Instructions (11/26)

Step 3: Create VM

The message will show up and ask you to create a ssh key pair for login to the VM

Please choose the “Create a new key pair” option and enter the name you want to save your key pair, and then click the “Download Key Pair” button to download it

(Note: This key pair is very important, keep it cautiously)

Select an existing key pair or create a new key pair

A key pair consists of a **public key** that AWS stores, and a **private key file** that you store. Together, they allow you to connect to your instance securely. For Windows AMIs, the private key file is required to obtain the password used to log into your instance. For Linux AMIs, the private key file allows you to securely SSH into your instance. Amazon EC2 supports ED25519 and RSA key pair types.

Note: The selected key pair will be added to the set of keys authorized for this instance. Learn more about [removing existing key pairs from a public AMI](#).

Create a new key pair ← 1. Choose

RSA ED25519

Key pair name ← 2. Fill in 3.

Test

Download Key Pair

You have to download the **private key file (*.pem file)** before you can continue. **Store it in a secure and accessible location.** You will not be able to download the file again after it's created.

4.

Cancelling Launch Instances

Step-by-Step Instructions (12/26)

Step 3: Create VM

You will see the status of your VMs, the message “Your instances are now launching” means that your VMs are created successfully
Click the “View Instances” button and start to manage your VMs

Launch Status

Your instances are now launching
The following instance launches have been initiated: i-02a39a8a0b1a255b3, i-0849490b04c1312f1 [View launch log](#)

Get notified of estimated charges
Create billing alerts to get an email notification when estimated charges on your AWS bill exceed an amount you define (for example, if you exceed the free usage tier).

How to connect to your instances

Your instances are launching, and it may take a few minutes until they are in the **running** state, when they will be ready for you to use. Usage hours on your new instances will start immediately and continue to accrue until you stop or terminate your instances.

Click [View Instances](#) to monitor your instances' status. Once your instances are in the **running** state, you can [connect](#) to them from the Instances screen. [Find out](#) how to connect to your instances.

Here are some helpful resources to get you started

- How to connect to your Linux instance
- Learn about AWS Free Usage Tier
- Amazon EC2: User Guide
- Amazon EC2: Discussion Forum

While your instances are launching you can also

- Create status check alarms to be notified when these instances fail status checks. (Additional charges may apply)
- Create and attach additional EBS volumes (Additional charges may apply)
- Manage security groups

[View Instances](#)

Step-by-Step Instructions (13/26)

Step 3: Create VM

At this page, you can check the status and manage your VMs

If the field “Instance status” is “running”, it means your VM is running now

The screenshot shows the AWS EC2 Instances page with the following details:

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Put
-	i-0c363d35a974a7ac6	Running	t2.micro	Initializing	No alarms	us-east-1d	ec2
-	i-0b581ff2103a923fe	Running	t2.micro	Initializing	No alarms	us-east-1d	ec2

A red circle highlights the "Running" status for the first instance.

Step-by-Step Instructions (14/26)

Step 4: Configure Network

After creating the VMs, you need to configure the network settings so that two VMs can communicate with each other
Find the Security Group field of your VMs, and click it

The screenshot shows the AWS Management Console interface for the Instances section. On the left, there's a navigation sidebar with sections like Instances, Images, Elastic Block Store, and Network & Security. The Network & Security section has 'Security Groups' highlighted with a red circle. The main area displays a table of four instances. Two instances have their 'Security group name' column circled in red: 'comp...' and '239.co...', both of which are listed as 'launch-wizard-2'. A large red circle also highlights the 'Security group name' column header. Below the table, a section titled 'Select an instance' is visible.

	Public IPv4 ...	Elastic IP	IPv6 IPs	Monitoring	Security group name	Key name	Launch t
comp...	3.95.227.12	-	-	disabled	launch-wizard-2	Test	2022/02
239.co...	54.159.151.239	-	-	disabled	launch-wizard-2	Test	2022/02

Notice the security group name!!!

Step-by-Step Instructions (15/26)

Step 4: Configure Network

Record the Group ID, and click the “Inbound” button, and then click the “Edit” button

The screenshot shows the AWS Management Console interface for managing security groups. On the left, there's a navigation sidebar with sections like Images, Elastic Block Store, Network & Security (Security Groups selected), Load Balancing, and Auto Scaling. The main area displays a table of security groups with columns for Name, Security group ID, Security group name, VPC ID, Description, and Owner.

Step 1: A red circle highlights the "sg-0c5be386fe1a12201" row, which corresponds to the "launch-wizard-2" security group. The "Name" column shows a checkbox followed by a dash.

Step 2: Below the table, under the "Security Groups (1/3)" heading, there are tabs for "Details", "Inbound rules" (which is highlighted with a red circle), "Outbound rules", and "Tags". The "Inbound rules" tab is active, showing a single rule: "You can now check network connectivity with Reachability Analyzer".

Step 3: At the bottom of the "Inbound rules" table, there are buttons for "Manage tags" and "Edit inbound rules". A red circle highlights the "Edit inbound rules" button.

Name	Security group ID	Security group name	VPC ID	Description	Owner
-	sg-07795f713b5be9be5	default	vpc-0ab36455fe65741ab	default VPC security gr...	75648587
-	sg-0c4ee1fa1fa76b47a	launch-wizard-1	vpc-0ab36455fe65741ab	launch-wizard-1 create...	75648587
<input checked="" type="checkbox"/> -	sg-0c5be386fe1a12201	launch-wizard-2	vpc-0ab36455fe65741ab	launch-wizard-2 create...	75648587

Inbound rules (1/1)

Name	Security group rule...	IP version	Type	Protocol	Port range
-	sgr-063fc9313eda9836b	IPv4	SSH	TCP	22

Step-by-Step Instructions (16/26)

Step 4: Configure Network

The message will show up, click “Add Rule” and select “All traffic” in the Type field, and then fill in the group id you just record and finally, click the “Save” button (This configuration makes the traffic from the same security group not be blocked. Because our VMs are in the same security group, they can communicate with each other with this configuration)

EC2 > Security Groups > sg-0c5be386fe1a12201 - launch-wizard-2 > Edit inbound rules

Edit inbound rules [Info](#)

Inbound rules control the incoming traffic that's allowed to reach the instance.

Inbound rules Info	Security group rule ID	Type Info	Protocol Info	Port range Info	Source Info	Description - optional Info
	sgr-063fc9313eda9836b	SSH	TCP	22	Custom	Security Groups launch-wizard-2 sg-0c5be386fe1a12201

1. **Add rule**

2. **All traffic**

3. **Custom** **c5be386fe1a12201**

4. **Save rules**

Step-by-Step Instructions (17/26)

Step 5: Record Public IP and Private IP

Click the “Instances” button to get back to the main page

Click each instance(VM) and record the Public IP and Private IP

EC2 > Instances > i-07c7391593e2b7dc6

Instance summary for i-07c7391593e2b7dc6 Updated less than a minute ago

Record Public IP

Instance ID	Public IPv4 address 18.207.222.224 open address
IPv6 address	-
Hostname type	Instance state Running
IP name: ip-172-31-92-109.ec2.internal	Private IP DNS name (IPv4 only) ip-172-31-92-109.ec2.internal
Instance type	Elastic IP addresses -
AWS Compute Optimizer finding	IAM Role -
Opt-in to AWS Compute Optimizer for recommendations. Learn more	

Record Private IP

Private IPv4 addresses 172.31.92.109
Public IPv4 DNS ec2-18-207-222-224.compute-1.amazonaws.com open address
Answer private resource DNS name IPv4 (A)
VPC ID vpc-0ab36455fe65741ab
Subnet ID subnet-0a6704876e1172d48

Details | **Security** | **Networking** | **Storage** | **Status checks** | **Monitoring** | **Tags**



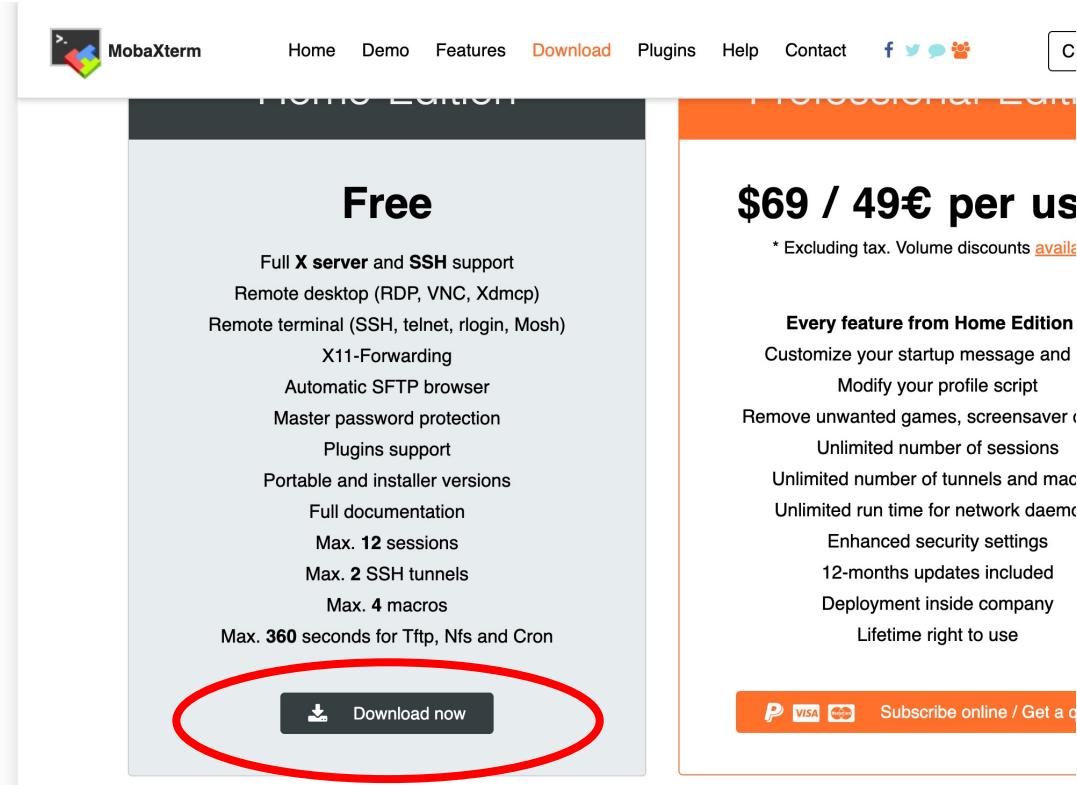
Step-by-Step Instructions (18/26)

Step 6: Login to VM

Using MobaXterm to ssh:

If the OS of your computer is windows, you can login to your VM by “MobaXterm” application

<https://mobaxterm.mobatek.net/download.html>



The screenshot shows the MobaXterm website with two main sections: "Home Edition" (free) and "Professional Edition" (paid).

Home Edition (Free):

- Free**
- Full X server and SSH support
- Remote desktop (RDP, VNC, Xdmcp)
- Remote terminal (SSH, telnet, rlogin, Mosh)
- X11-Forwarding
- Automatic SFTP browser
- Master password protection
- Plugins support
- Portable and installer versions
- Full documentation
- Max. 12 sessions
- Max. 2 SSH tunnels
- Max. 4 macros
- Max. 360 seconds for Tftp, Nfs and Cron

A red oval highlights the "Download now" button.

Professional Edition:

- \$69 / 49€ per us**
- * Excluding tax. Volume discounts [avail](#)
- Every feature from Home Edition**
- Customize your startup message and
- Modify your profile script
- Remove unwanted games, screensaver (
- Unlimited number of sessions
- Unlimited number of tunnels and mac
- Unlimited run time for network daem
- Enhanced security settings
- 12-months updates included
- Deployment inside company
- Lifetime right to use

At the bottom, there are payment icons for PayPal, VISA, and MasterCard, and a link to "Subscribe online / Get a c".

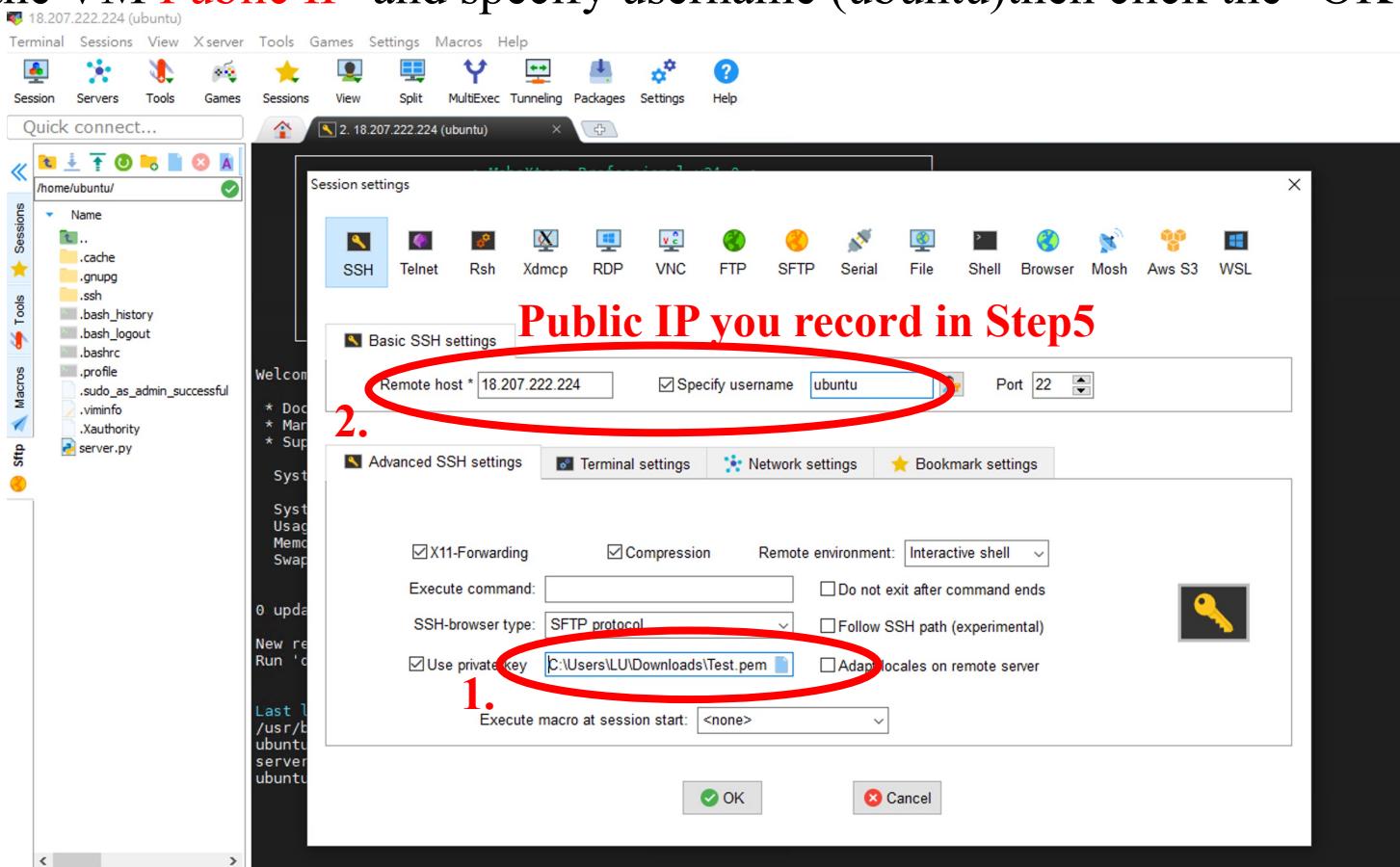


Step-by-Step Instructions (19/26)

Step 6: Login to VM

Using MobaXterm to ssh:

1. Go to [Session]>[SSH], click the Browse button to select your key
2. Enter the VM Public IP and specify username (ubuntu)then click the “OK” button



Step-by-Step Instructions (20/26)

Step 6: Login to VM

Using ssh client:

If the OS of your computer is Linux or MacOS, you can login your VM by ssh client

Open the terminal in your computer and get to the position you put your key pair

Use command: “chmod 400 xxx.pem” where xxx is the name of your key pair

```
zsh
udeMacBook-Pro ~ % cd Downloads
udeMacBook-Pro Downloads % chmod 400 Test.pem
udeMacBook-Pro Downloads % 
```

Step-by-Step Instructions (21/26)

Step 6: Login to VM

Using ssh client:

Use command: “`ssh -i xxx.pem ubuntu@yyy`” where xxx is the name of your key pair, yyy is the **Public IP** of VM, and then you can login your VM

```
to Downloads % ssh -i Test.pem ubuntu@18.207.222.224
The authenticity of host '18.207.222.224 (18.207.222.224)' can't be established.
ECDSA key fingerprint is SHA256:Qpvaaq0GRjVJzNJJZ1ftF60jD254JAI7pyiKdzzcnGyZw.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '18.207.222.224' (ECDSA) to the list of known hosts.
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-1060-aws x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

 System information as of Wed Feb 16 16:33:25 UTC 2022

 System load:  0.14           Processes:          96
 Usage of /:   14.9% of 7.69GB  Users logged in:    0
 Memory usage: 19%            IP address for eth0: 172.31.92.109
 Swap usage:   0%

 0 updates can be applied immediately.

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/*copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.
```



Step-by-Step Instructions (22/26)

Step 7: Run TCP socket program on VMs

You have to run TCP socket program on both VMs

One is TCP socket server and the other is TCP socket client

TA provide python TCP socket code in following two slides

All you need to do is put the **client.py** and **server.py** in separate VM, **modify** the red part of code, and run the code



Step-by-Step Instructions (23/26)

Step 7: Run TCP socket program on VMs

server.py

```
#!/usr/bin/env python3
import socket
HOST = '<Your server's private IP>' # Step 5; p.22
PORT = 1234
BUFFER_SIZE = 1024
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.bind((HOST, PORT))
s.listen(1)

conn, addr = s.accept()
print("connection address: " + str(addr))

while True:
    data = conn.recv(BUFFER_SIZE)
    if not data: # connection closed
        print('client closed connection.')
        break
    print('recv: ' + data.decode())
    out_data = 'echo: ' + data.decode()
    conn.send(out_data.encode())
conn.close()
```

Step-by-Step Instructions (24/26)

Step 7: Run TCP socket program on VMs

client.py

```
#!/usr/bin/env python3
import socket

HOST = '<Your server's private IP>'
PORT = 1234
BUFFER_SIZE = 1024
MESSAGE = "<Student ID>"
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.connect((HOST, PORT))

print('send: ' + MESSAGE)
s.send(MESSAGE.encode())
data = s.recv(BUFFER_SIZE)
print('recv: ' + data.decode())
s.close()
```

Step-by-Step Instructions (25/26)

Step 7: Run TCP socket program on VMs

Use “python3” command in VM to run your code, then print screen your result and put it in the report

```
ubuntu@ip-172-31-92-109:~$ python3 server.py
connection address: ('172.31.82.99', 56832)
recv: <Student ID>
client closed connection.
ubuntu@ip-172-31-92-109:~$
```

```
ubuntu@ip-172-31-82-99:~$ python3 client.py
send: <Student ID>
recv: echo: <Student ID>
ubuntu@ip-172-31-82-99:~$
```

Step-by-Step Instructions (26/26)

Step 8: Turn off VMs (optional)

Once you complete the jobs, you can turn off the VMs you create

Go to the main page of Amazon EC2, choose the instance, click the “Instance State” button and click “Terminate” button to turn off VM

(Note: The VM will be removed by Amazon EC2 if you terminate it, make sure your jobs are completed before terminating VM)

The screenshot shows the AWS EC2 Instances page with 1 instance listed. The instance is named 'i-0c363d35a974a7ac6' and is currently 'Running'. The 'Actions' dropdown menu is open, and the 'Terminate instance' option is highlighted with a red circle. Below the table, the instance ID 'i-0c363d35a974a7ac6' is displayed.

Name	Instance ID	Instance state	Instance type
-	i-09a4c153743244792	Terminated	t2.micro
-	i-03b7174181c99b730	Terminated	t2.micro
<input checked="" type="checkbox"/>	i-0c363d35a974a7ac6	Running	t2.micro
-	i-0b581ff2103a923fe	Running	t2.micro
-	i-07c7391593e2b7dc6	Running	t2.micro
-	i-086bf01f37a1a27e5	Running	t2.micro

Actions:

- Stop instance
- Start instance
- Reboot instance
- Hibernate instance
- Terminate instance

Launch instances

Instance: i-0c363d35a974a7ac6



Project Report

- Every student need to submit one report (**in PDF**)
- Report should be uploaded to new e3 platform
- Report must include:
 1. Summary of the process:
 - What is the process for you to complete this project? You explain them briefly here in 1-2 paragraph.
 - Please also include screenshots (e.g.:VM States, Network configuration, SSH terminal, Program output).
 2. Thoughts on Amazon EC2:
 - What does this project mean to you?
 - What did you do in this project?
 - How do you feel about IaaS service after using them?
- Your report should be named as “Project-1_X”, where X is your student ID
- Deadline: **03/08/2022**