

Data Center Networking Technology

Project 1 – Amazon EC2

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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

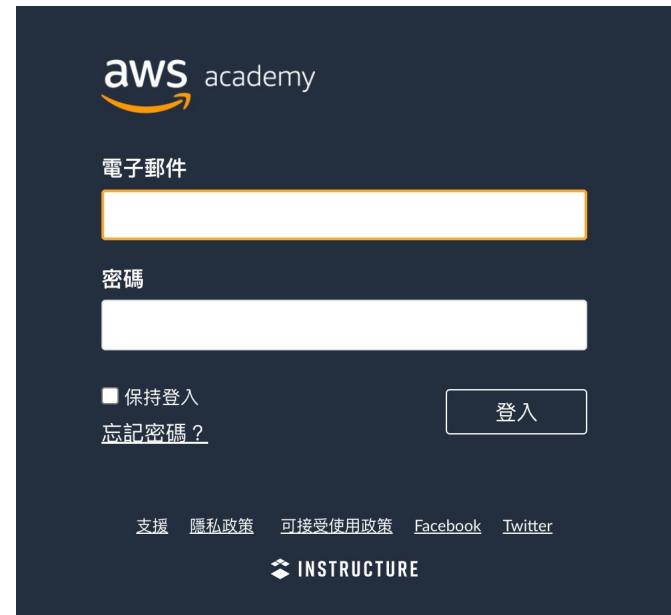
1. Login AWS Academy account and learn how to use Amazon EC2
2. Create two Virtual Machines by using Amazon EC2
3. Run a TCP socket program in two Virtual Machines, one of which is the server, and the other as the client
4. Print Screen your VM terminal and put this picture in your report
5. **No demo 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, a sidebar lists various navigation options: Account, Dashboard, Courses, Calendar, Inbox, History, and Help. The "Modules" option is highlighted with a red circle. The main content area features a banner with a classical building illustration and the AWS academy logo. Below the banner, a text block provides information about the sandbox environment.

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.

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 is a vertical sidebar with icons and labels: AWS logo, Account, Dashboard, Courses, Calendar, Inbox, History, and a question mark icon. The main area has a breadcrumb navigation bar: ALLFv1-15247 > Modules. Below this, there are three tabs: Home, Modules (which is selected and highlighted in blue), and Discussions. The 'Modules' section contains a list of 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 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 top bar includes an AWS logo, a budget of Used \$0 of \$100, a timer at 00:00, and buttons for Start Lab (circled in red), End Lab, AWS Details, Readme, Reset, and a close icon. Below the top bar is a terminal window showing a command prompt: ddd_v1_w_lcZ_1064737@runweb48601:~\$. To the right is a large panel titled "Learner Lab - Foundational Level" containing 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.

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 box highlights the "AWS" button in the top right corner of the main content area. The content area shows a terminal window with the command "ddd_v1_w_lcZ_1064737@runweb48601:~\$". To the right of the terminal is a sidebar with the title "Learner Lab - Foundational Level" and 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

The screenshot shows the AWS Management Console homepage. In the top left, there's a sidebar titled "AWS services" with sections for "Recently visited services" and "All services". The main content area has a heading "AWS Management Console". Below it, there's a "New AWS Console Home" section with a preview of the new interface and a "Switch now" button. The central part of the page is titled "Build a solution" and contains several cards with quick-start options:

- Launch a virtual machine** (With EC2, 2-3 minutes) - This option is circled in red.
- 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)

On the right side, there are two more sections: "Stay connected to your AWS resources on-the-go" (with information about the AWS Console Mobile App) and "Explore AWS" (with a "Free AWS Training" link).

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 SUSE Linux Enterprise Server 15 Service Pack 3 (HVM), EBS General Purpose (SSD) Volume Type. Amazon EC2 AMI Tools preinstalled; Apache 2.2, MySQL 5.5, PHP 5.3, and Ruby 1.8.7 available. 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 Ubuntu Server 20.04 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 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 Ubuntu Server 18.04 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 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 Windows Server 2019 Datacenter edition, [English] 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** Launch into Auto Scaling Group **i**

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 **i** Request Spot instances

Network **i** vpc-907ec1ea (default) **C** Create new VPC

Subnet **i** No preference (default subnet in any Availability Zone) **C** Create new subnet

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

Placement group **i** Add instance to placement group

Capacity Reservation **i** Open **C** Create new Capacity Reservation

IAM role **i** None **C** Create new IAM role

Shutdown behavior **i** Stop

2. **Review and Launch** **Cancel** **Previous** **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** 

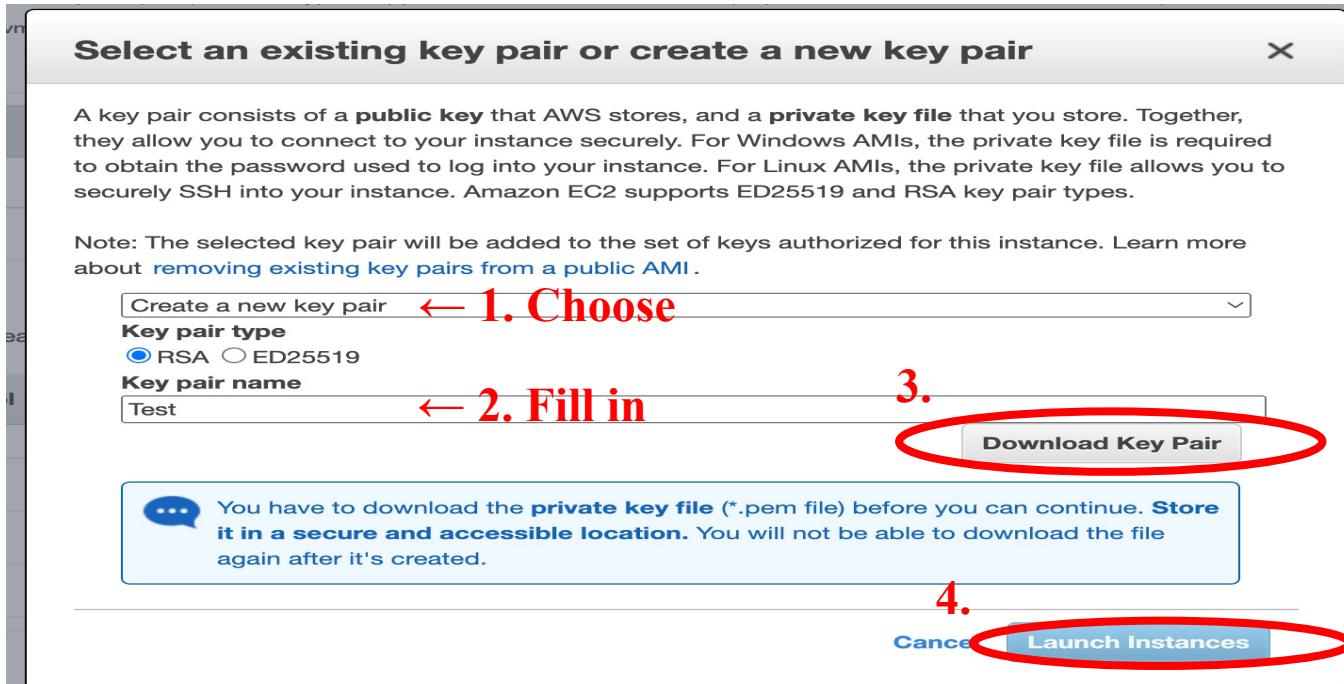
Step-by-Step Instructions (11/26)

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)



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](#)
- [Amazon EC2: User Guide](#)
- [Learn about AWS Free Usage Tier](#)
- [Amazon EC2: Discussion Forum](#)

While your instances are launching you can also

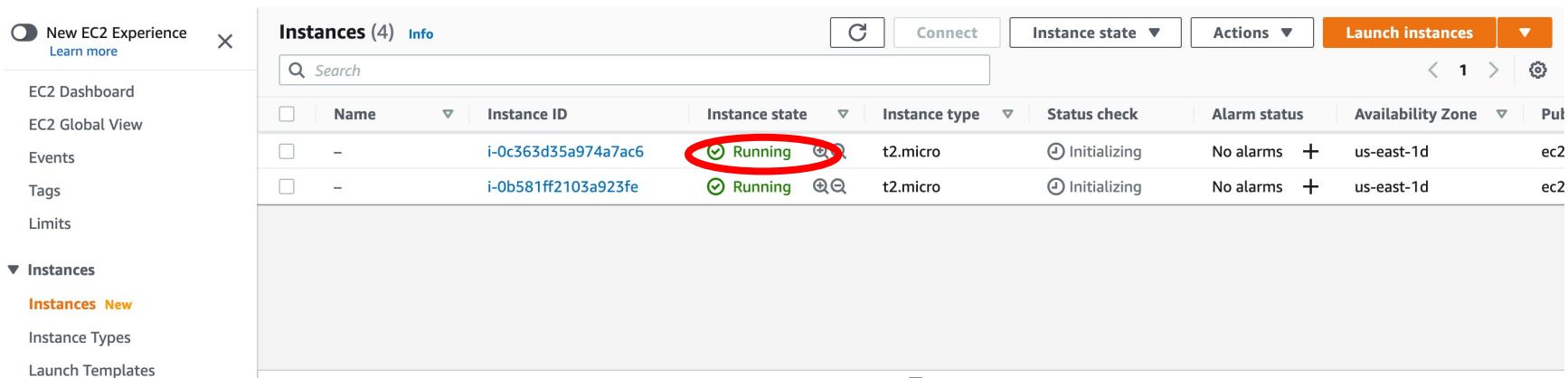
- [Create status check alarms](#) to be notified when these instances fail status checks. (Additional charges may apply)
- [Create and attach additional EBS volumes](#) (Additional charges may apply)
- [Manage security groups](#)

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. The left sidebar shows navigation links for the New EC2 Experience, EC2 Dashboard, EC2 Global View, Events, Tags, Limits, and Instances section, with Instances being the active tab.

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. 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' listed, which is circled in red. The main content area is titled 'Instances (4) Info' and shows a table with four rows of instance data. The columns include Public IPv4 Address, Elastic IP, IPv6 IPs, Monitoring, Security group name, Key name, and Launch time. The 'Security group name' column for both instances shows 'launch-wizard-2', which is also circled in red. A red box highlights this column. Below the table, a message in red text reads 'Notice the security group name!!!'.

	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 with the left navigation bar expanded. The 'Network & Security' section is selected, and the 'Security Groups' option is highlighted. The main content area displays a table of security groups:

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

Step 1. Record this id

Step 2.

Step 3.

The interface shows tabs for 'Details', 'Inbound rules' (which is highlighted with a red circle), 'Outbound rules', and 'Tags'. Below the tabs, there is a message: 'You can now check network connectivity with Reachability Analyzer' with a 'Run Reachability Analyzer' button. At the bottom, there is another table for 'Inbound rules' with one item listed:

Name	Security group rule...	IP version	Type	Protocol	Port range
<input checked="" type="checkbox"/>	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. Fill in group id 4. Save rules

Cancel [Preview changes](#) [Save rules](#)

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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

The screenshot shows the AWS EC2 Instances details page for an instance with ID i-07c7391593e2b7dc6. The Public IPv4 address is 18.207.222.224 and the Private IPv4 address is 172.31.92.109. Both addresses are circled in red.

Instance summary for i-07c7391593e2b7dc6

Updated less than a minute ago

Record Public IP

Public IPv4 address
18.207.222.224 | [open address](#)

Record Private IP

Private IPv4 addresses
172.31.92.109

Instance ID: i-07c7391593e2b7dc6

IPv6 address: -

Hostname type: IP name: ip-172-31-92-109.ec2.internal

Instance type: t2.micro

AWS Compute Optimizer finding: Opt-in to AWS Compute Optimizer for recommendations. | [Learn more](#)

Public IPv4 DNS: ec2-18-207-222-224.compute-1.amazonaws.com | [open address](#)

Private IP DNS name (IPv4 only): ip-172-31-92-109.ec2.internal

Elastic IP addresses: -

IAM Role: -

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: 'Free' and 'Professional'.

Free Edition:

- 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 at the bottom of the Free section.

Professional Edition:

- \$69 / 49€ per us**
- * Excluding tax. Volume discounts [available](#)
- 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

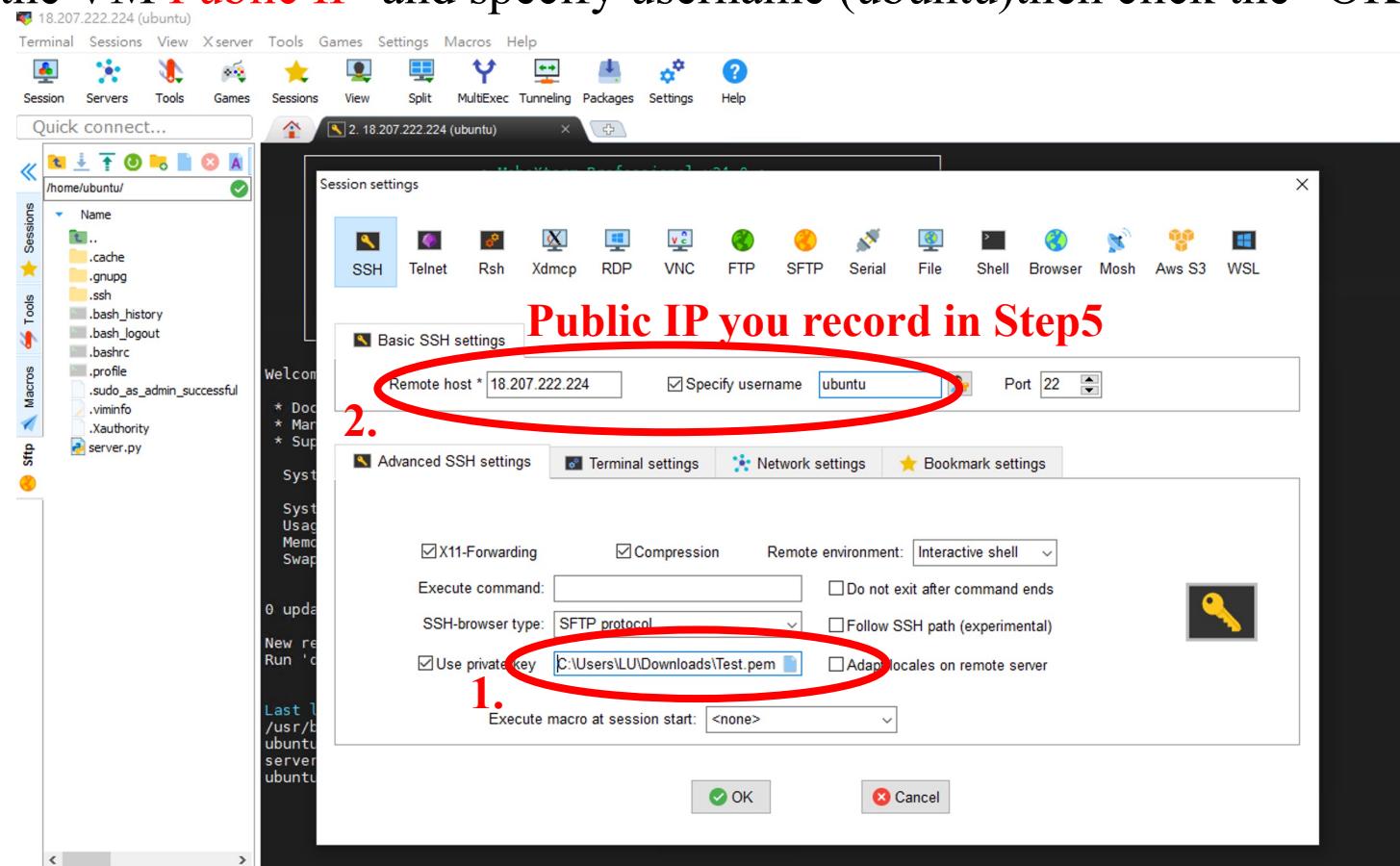
At the bottom, there are payment icons for PayPal, VISA, and MasterCard, along with a link to [Subscribe online / Get a quote](#).

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)

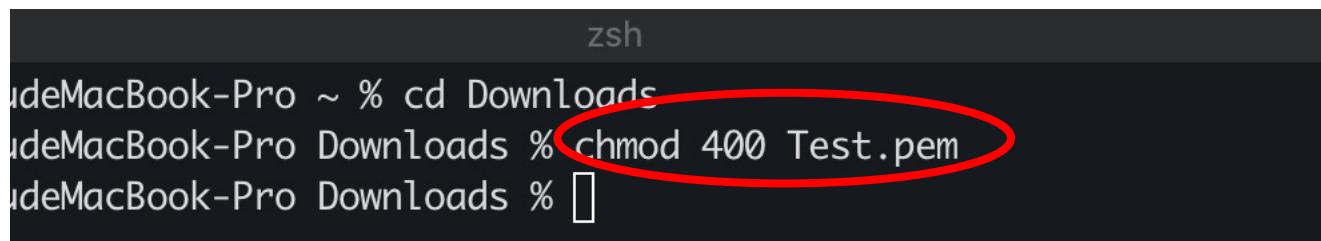
Step 6: Login to VM

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 % 
```

A screenshot of a terminal window titled "zsh". The window shows a command-line session. The user has navigated to the "Downloads" directory using the "cd" command. Then, they entered the "chmod" command followed by "400 Test.pem". The "chmod" command and its arguments are highlighted with a large red oval. The terminal prompt ends with a "%".

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%
 Swap usage:   0%
```

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%
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:~$
```

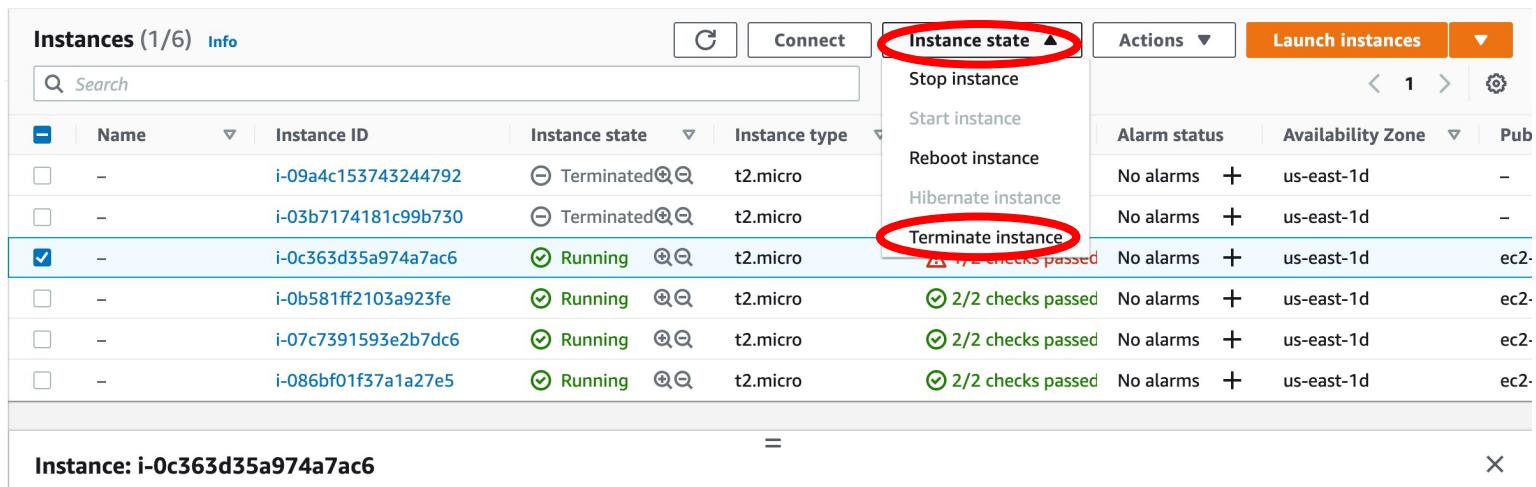
Step-by-Step Instructions (26/26)

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)



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**