

Data Center Networking Technology

Project 1 – Amazon EC2

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Timothy William

timothywilliam.cs06g@g2.nctu.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: 03/09/2021
Project deadline: 03/27/2021



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 Amazon Web Service Educate 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 (1/34)

Step 1: Login to AWS EC2

Go to <https://www.awseducate.com/signin/SiteLogin>

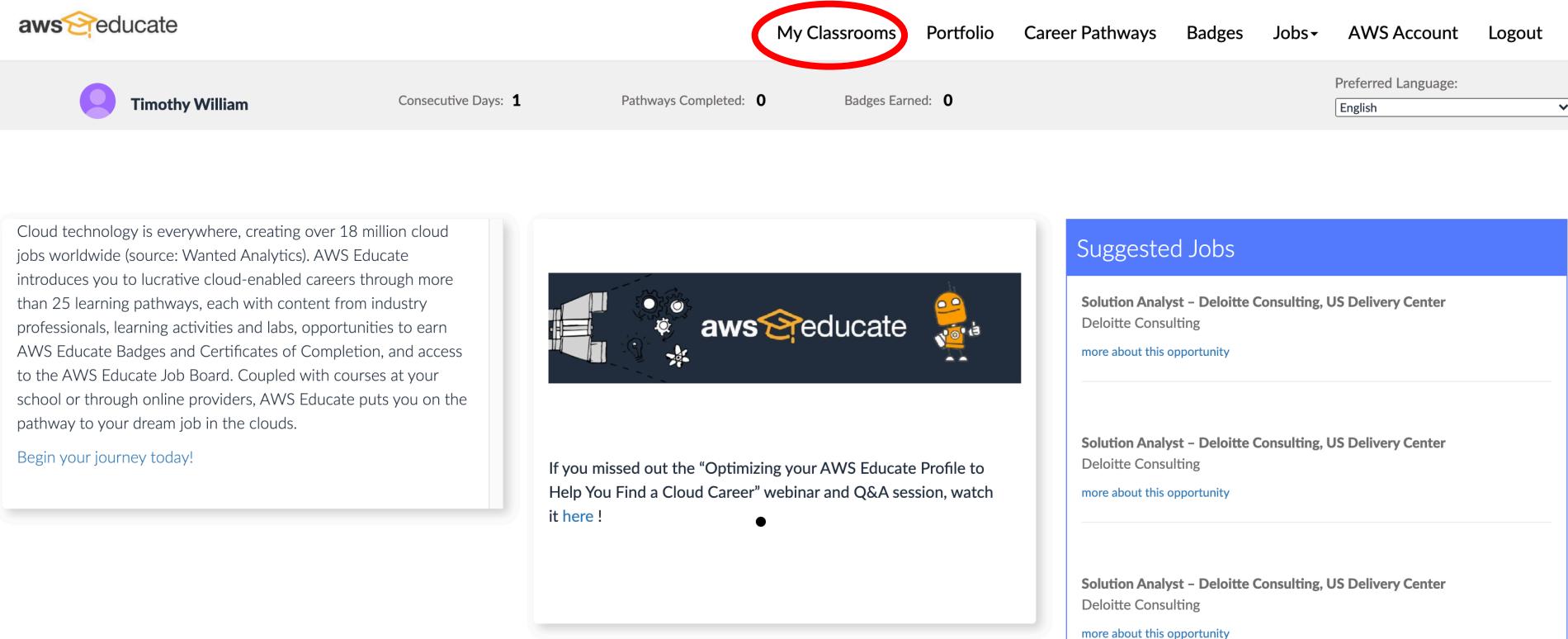
(Make sure you already sign up aws educate account, if you haven't sign up, refer to the slides “DCN Project 1 (Preparation)”) 



Step-by-Step Instructions (2/34)

Step 1: Login to AWS EC2

Click the “My Classrooms” button



The screenshot shows the AWS Educate dashboard. At the top, there's a navigation bar with links for Portfolio, Career Pathways, Badges, Jobs, AWS Account, and Logout. The "My Classrooms" link is highlighted with a red circle. Below the navigation bar, there's a user profile section for "Timothy William" showing stats: Consecutive Days: 1, Pathways Completed: 0, and Badges Earned: 0. A dropdown menu for Preferred Language is set to English. On the left, a sidebar provides information about AWS Educate, mentioning over 18 million cloud jobs worldwide, and encourages users to begin their journey. In the center, there's a banner for AWS Educate featuring a graduation cap icon and a robot. Below the banner, a message invites users to watch a webinar if they missed it. On the right, a "Suggested Jobs" section lists three job opportunities at Deloitte Consulting, each with a "more about this opportunity" link.

aws educate

My Classrooms

Portfolio Career Pathways Badges Jobs AWS Account Logout

Consecutive Days: 1 Pathways Completed: 0 Badges Earned: 0

Preferred Language: English

Cloud technology is everywhere, creating over 18 million cloud jobs worldwide (source: Wanted Analytics). AWS Educate introduces you to lucrative cloud-enabled careers through more than 25 learning pathways, each with content from industry professionals, learning activities and labs, opportunities to earn AWS Educate Badges and Certificates of Completion, and access to the AWS Educate Job Board. Coupled with courses at your school or through online providers, AWS Educate puts you on the pathway to your dream job in the clouds.

Begin your journey today!

aws educate

If you missed out the "Optimizing your AWS Educate Profile to Help You Find a Cloud Career" webinar and Q&A session, watch it [here](#) !

Suggested Jobs

Solution Analyst – Deloitte Consulting, US Delivery Center
Deloitte Consulting
[more about this opportunity](#)

Solution Analyst – Deloitte Consulting, US Delivery Center
Deloitte Consulting
[more about this opportunity](#)

Solution Analyst – Deloitte Consulting, US Delivery Center
Deloitte Consulting
[more about this opportunity](#)

Step-by-Step Instructions (3/34)

Step 1: Login to AWS EC2

Click the “Accept Invitation” button

The screenshot shows the AWS Educate platform interface. At the top, there's a navigation bar with links for "My Classrooms" (which is underlined in blue), "Portfolio", "Career Pathways", "Badges", "Jobs", and "AWS A". Below the navigation, there's a user profile section with a purple profile picture, the name "Timothy William", and stats: "Consecutive Days: 1", "Pathways Completed: 0", and "Badges Earned: 0". To the right, there's a "Preferred Language" dropdown set to "English".

The main content area is titled "My Classrooms" in orange. It contains a sub-instruction: "View your list of Classroom invitations and accept or decline the invitation. Access a Classroom by clicking Go to my classroom." Below this, there's a table listing classroom invitations. The columns are: "Course Name ↑", "Description", "Educator ↓", "Course End Date ↑", "Credit Allocated Per Student ↑", and "Status".

One specific invitation is highlighted in a light gray box. The course name is "Data Center Networking Technology". The description is: "Data center networking (DCN) has been a key infrastructure enabler for supporting cloud computing services (e.g., Amazon EC2, Microsoft Windows Azure, and Google App Engine), internet applications (e.g., web search and on-line gaming), and big data analyses. In this course, we aim at studying the DCN evolution and key technologies that can meet ever-growing performance challenges for supporting the above cloud applications and services. We will look at different DCN architectures and their pros and cons, study server and network virtualization techniques, and discuss how DCNs can be controlled and managed via the Software Define Networking (SDN) paradigm." The educator is "Maria Yuang", the course end date is "07/15/2021", and the credit allocated per student is "\$50". At the bottom right of this row, there are two buttons: a green "Accept Invitation" button with a red oval around it, and a gray "Decline" button.

Step-by-Step Instructions (4/34)

Step 1: Login to AWS EC2

After that, click the “Continue” button

The screenshot shows the AWS Educate interface. On the left, there's a sidebar with a user profile for "Timothy William" and a section titled "My Classrooms" with a link to "View your list of Classroom invitations". Below this, there's a table with columns for "Course Name" and "Description". One row in the table is for a course titled "Data Center Networking Technology" with a description mentioning "EC2, applications (e.g., web search and on-line gaming), and big data analyses". On the right side of the screen, there's a modal dialog titled "Additional Information about Joining a Classroom". The dialog contains text explaining that clicking "Continue" will lead to a site managed by a third-party provider, Vocareum. It also states that AWS Educate Terms & Conditions apply, and AWS assumes no responsibility for the provider's services. At the bottom of the dialog are two buttons: "Continue" (highlighted with a red circle) and "Cancel".

Additional Information about Joining a Classroom

Clicking "Continue" will take you to a site managed by third-party content and service provider, Vocareum ("Third-Party Content Provider").

In addition to the AWS Educate Terms & Conditions, your use of the Classroom feature is governed by the Third-Party Content Provider's terms and conditions, including its Privacy Policy. If you accept this Classroom invitation, the Third-Party Content Provider may allow your educator to view your Classroom account and activity, including the AWS console in your Classroom account, the number of EC2 instances running and any Content running in the services, and your access activity.

If you have questions regarding the Classroom feature, you should contact the Third-Party Content Provider at <https://help.vocareum.com/>.

AWS assumes no responsibility or liability and makes no representations or warranties regarding services provided by the Third-Party Content Provider.

Course Name

Description

Data Center Networking Technology

EC2, applications (e.g., web search and on-line gaming), and big data analyses. In this course, we aim at studying the DCN evolution and key technologies that can meet ever-growing performance challenges for supporting the above cloud applications and services. We will look at different DCN architectures and their pros and cons, study server and network virtualization techniques, and discuss how DCNs can be controlled and managed via the Software Define Networking (SDN) paradigm.

Continue

Cancel

Pathways Badges Jobs AW

Preferred Language: English

Credit Allocated Per Student Status

Accept Invitation

Decline

Maria Yuang 07/15/2021 \$50

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Step-by-Step Instructions (5/34)

Step 1: Login to AWS EC2

- After that, your account will be activated
- You can click “Go to classroom” button to proceed

Preferred Language:
English

Timothy William Consecutive Days: 1 Pathways Completed: 0 Badges Earned: 0

My Classrooms

View your list of Classroom invitations and accept or decline the invitation. Access a Classroom by clicking Go to my classroom.

Course Name ↑	Description	Educator ↑	Course End Date ↑	Credit Allocated Per Student ↑	Status
Data Center Networking Technology	Data center networking (DCN) has been a key infrastructure enabler for supporting cloud computing services (e.g., Amazon EC2, Microsoft Windows Azure, and Google App Engine), internet applications (e.g., web search and on-line gaming), and big data analyses. In this course, we aim at studying the DCN evolution and key technologies that can meet ever-growing performance challenges for supporting the above cloud applications and services. We will look at different DCN architectures and their pros and cons, study server and network virtualization techniques, and discuss how DCNs can be controlled and managed via the Software Define Networking (SDN) paradigm.	Maria Yuang	07/15/2021	\$50	Accepted Go to classroom

Step-by-Step Instructions (6/34)

Step 1: Login to AWS EC2

Take a look at the tip and then click the “AWS Console” button

The screenshot shows the Vocareum AWS Educate Account Status page. At the top, there's a navigation bar with the Vocareum logo, a home icon, "My Classes", "Help", and a user ID "timothywilliam.cs0..". Below the navigation, the page title is "Your AWS Account Status". It displays three key metrics: "Active" (full access), "\$50" remaining credits (estimated), and "2:57" session time. At the bottom, there are two buttons: "Account Details" and "AWS Console". The "AWS Console" button is circled in red. A red box highlights a tip at the bottom: "Please use AWS Educate Account responsibly. Remember to shut down your instances when not in use to make the best use of your credits. And, don't forget to logout once you are done with your work!".

Welcome to your AWS Educate Account

AWS Educate provides you with access to a wide variety of AWS Services for you to get your hands on and build on AWS! To get started, click on the AWS Console button to log in to your AWS console.

Please read the FAQ below to help you get started on your Starter Account.

- What are the list of services supported?
- What regions are supported with Starter Accounts or Classroom Accounts?
- I can't start any resources. What happened?
- Can I create users within my Starter or Classroom Account for others to access?

Your AWS Account Status

Active full access

\$50 remaining credits (estimated)

2:57 session time

Account Details AWS Console

Please use AWS Educate Account responsibly. Remember to shut down your instances when not in use to make the best use of your credits. And, don't forget to logout once you are done with your work!

Step-by-Step Instructions (7/34)

Step 1: Login to AWS EC2

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

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 

Connect an IoT device With AWS IoT 5 minutes 

Start a development project With CodeStar 5 minutes 

Register a domain With Route 53 3 minutes 

▶ See more

Amazon RDS
Set up, operate, and scale your relational database in the cloud. [Learn more](#) 

AWS Marketplace
Find, buy, and deploy popular software products that run on AWS. [Learn more](#) 

Run Serverless Containers with AWS Fargate
AWS Fargate runs and scales your containers without having to manage servers or clusters. [Learn more](#) 

Have feedback?
 [Submit feedback](#) to tell us about your experience with the AWS Management Console.

Learn to build
Learn to deploy your solutions through step-by-step guides, labs, and videos. [See all](#) 

Websites and Web Apps
3 videos, 3 tutorials, 3 labs

Storage
3 videos, 3 tutorials, 3 labs

Databases
3 videos, 3 tutorials, 3 labs

Step-by-Step Instructions (8/34)

Step 2: Create VM

At this page, you can select the OS of your VM, in this project, we choose “Ubuntu Server 16.04 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)

 Red Hat	Red Hat Enterprise Linux 7.6 (HVM), SSD Volume Type - ami-011b3ccf1bd6db744 (64-bit x86) / ami-0e3688b4a755ad736 (64-bit Arm)	<input type="button" value="Select"/>
 SUSE Linux	SUSE Linux Enterprise Server 15 (HVM), SSD Volume Type - ami-06ea7729e394412c8	<input type="button" value="Select"/>
 Ubuntu	Ubuntu Server 18.04 LTS (HVM), SSD Volume Type - ami-0a313d6098716f372 (64-bit x86) / ami-01ac7d9c1179d7b74 (64-bit Arm)	<input type="button" value="Select"/>
 Ubuntu	Ubuntu Server 16.04 LTS (HVM), SSD Volume Type - ami-0565af6e282977273 (64-bit x86) / ami-036ede09922dad9b (64-bit Arm)	<input type="button" value="Select"/>
 Windows	Microsoft Windows Server 2019 Base - ami-0410d3d3bd6d555f4	<input type="button" value="Select"/>

Red Hat Enterprise Linux version 7.6 (HVM), EBS General Purpose (SSD) Volume Type
Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

SUSE Linux Enterprise Server 15 (HVM), EBS General Purpose (SSD) Volume Type. Public Cloud, Advanced Systems Management, Web and Scripting, and Legacy modules enabled.
Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

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

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 ENA Enabled: Yes

Microsoft Windows 2019 Datacenter edition. [English]
Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

64-bit (x86)
 64-bit (Arm)

64-bit (x86)
 64-bit (Arm)

64-bit (x86)
 64-bit (Arm)

64-bit (x86)
 64-bit (Arm)

Step-by-Step Instructions (9/34)

Step 2: 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 types ▾ Current generation ▾ Show/Hide Columns

Currently selected: t2.micro (Variable ECUs, 1 vCPUs, 2.5 GHz, Intel Xeon Family, 1 GiB memory, EBS only)

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

Cancel

Previous

Review and Launch

Next: Configure Instance Details

Step-by-Step Instructions (10/34)

Step 2: 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.** [Launch into Auto Scaling Group](#)

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 [Create new VPC](#)

Subnet [Create new subnet](#)

Auto-assign Public IP

Placement group Add instance to placement group

Capacity Reservation [Create new Capacity Reservation](#)

IAM role [Create new IAM role](#)

Shutdown behavior

2. [Cancel](#) [Previous](#) **Review and Launch** [Next: Add Storage](#)

Step-by-Step Instructions (11/34)

Step 2: 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

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

Step-by-Step Instructions (12/34)

Step 2: 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 X

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.

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

Key pair name ← 2. Fill in

KeyPair 3. 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. Launch Instances

Cancel 17

Step-by-Step Instructions (13/34)

Step 2: 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](#)

i 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](#)

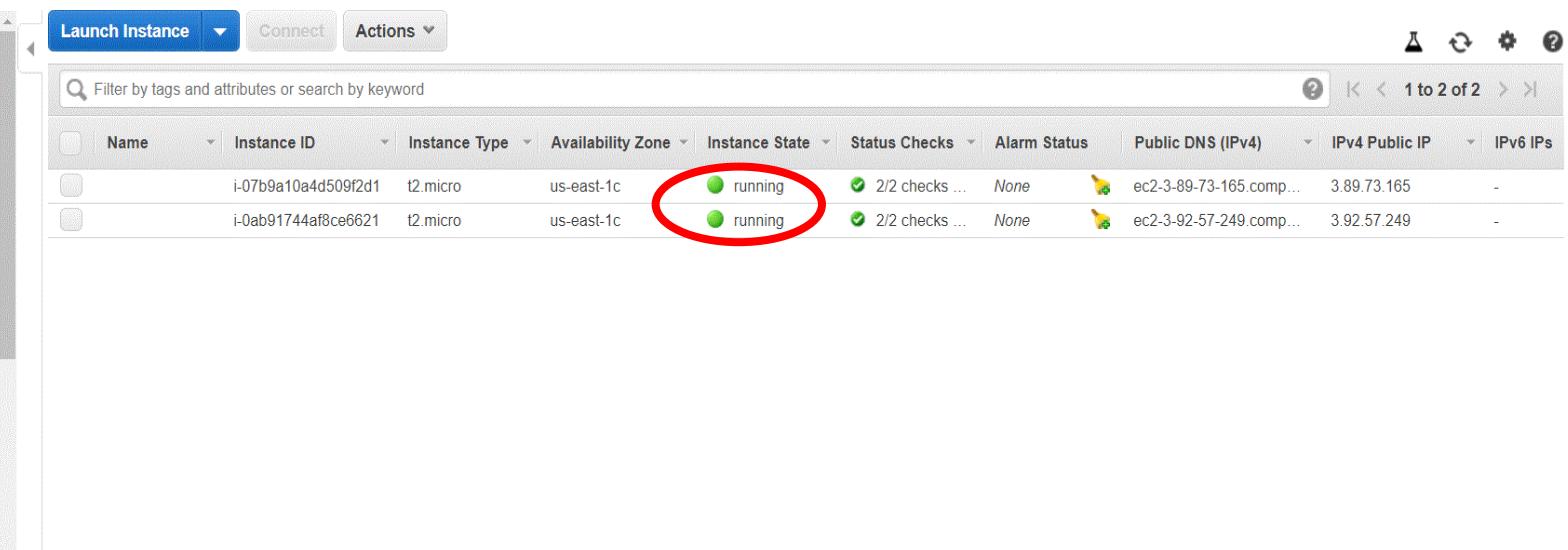
[View Instances](#)

Step-by-Step Instructions (14/34)

Step 2: 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



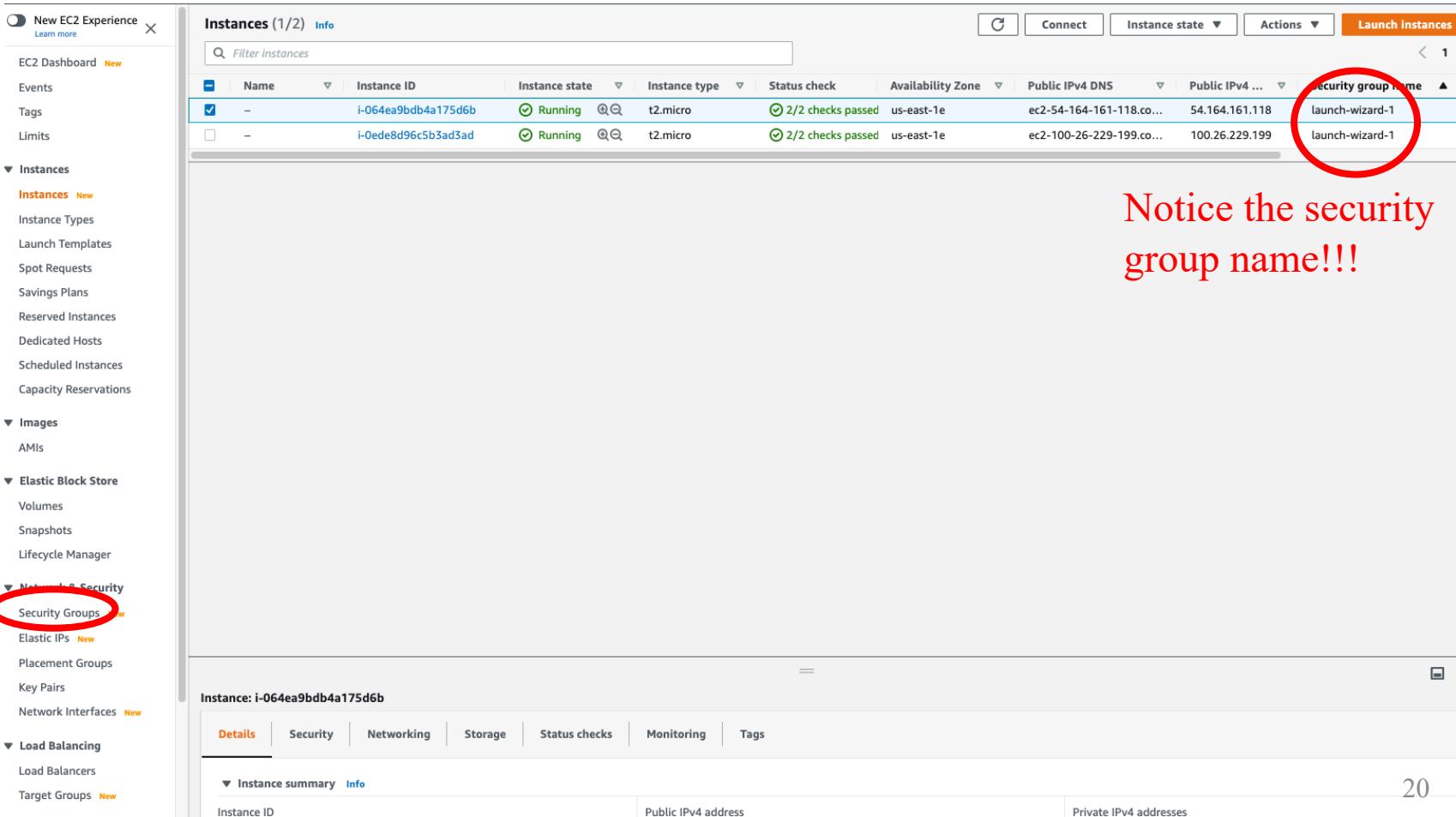
The screenshot shows the AWS EC2 Dashboard. On the left, there's a sidebar with links like EC2 Dashboard, Events, Tags, Reports, Limits, INSTANCES (with Instances selected), Launch Templates, Spot Requests, Reserved Instances, Dedicated Hosts, Scheduled Instances, Capacity Reservations, and IMAGES (with AMIs selected). The main area has tabs for Launch Instance, Connect, and Actions. Below that is a search bar and a table with two rows of instance data. The columns are: Name, Instance ID, Instance Type, Availability Zone, Instance State, Status Checks, Alarm Status, Public DNS (IPv4), IPv4 Public IP, and IPv6 IPs. The first instance has an orange circle around its 'running' status in the Instance State column. The second instance also has a green circle and the word 'running' in its Instance State column. Both instances have green checkmarks in the Status Checks column.

Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS (IPv4)	IPv4 Public IP	IPv6 IPs
	i-07b9a10a4d509f2d1	t2.micro	us-east-1c	running	2/2 checks ...	None	ec2-3-89-73-165.comp...	3.89.73.165	-
	i-0ab91744af8ce6621	t2.micro	us-east-1c	running	2/2 checks ...	None	ec2-3-92-57-249.comp...	3.92.57.249	-

Step-by-Step Instructions (15/34)

Step 3: 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 EC2 Instances page. On the left, there's a navigation sidebar with links like New EC2 Experience, EC2 Dashboard, Events, Tags, Limits, Instances (selected), Instance Types, Launch Templates, Spot Requests, Savings Plans, Reserved Instances, Dedicated Hosts, Scheduled Instances, Capacity Reservations, Images (AMIs), and Elastic Block Store (Volumes, Snapshots, Lifecycle Manager). A red circle highlights the 'Security Groups' link under 'Networking & Security'. The main content area shows 'Instances (1/2) Info' with two running t2.micro instances. The table columns include Name, Instance ID, Instance state, Instance type, Status check, Availability Zone, Public IPv4 DNS, Public IPv4 IP, and Security group name. Both instances belong to the security group 'launch-wizard-1'. A red circle highlights the 'Security group name' column header. Below the table, there's an 'Instance: i-064ea9bdb4a175d6b' details section with tabs for Details, Security, Networking, Storage, Status checks, Monitoring, and Tags. Under the Details tab, there's an 'Instance summary' section with fields for Instance ID, Public IPv4 address, and Private IPv4 addresses.

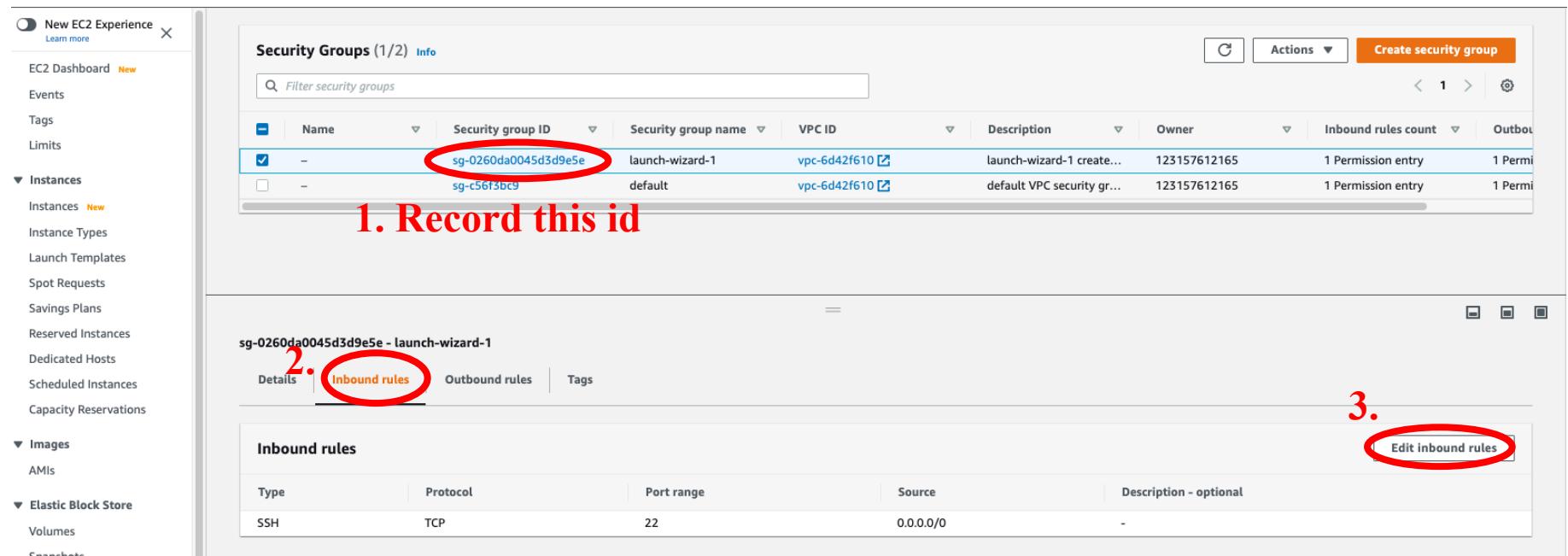
Name	Instance ID	Instance state	Instance type	Status check	Availability Zone	Public IPv4 DNS	Public IPv4 IP	Security group name
<input checked="" type="checkbox"/> -	i-064ea9bdb4a175d6b	Running	t2.micro	2/2 checks passed	us-east-1e	ec2-54-164-161-118.co...	54.164.161.118	launch-wizard-1
<input type="checkbox"/>	i-0ede8d96c5b3ad3ad	Running	t2.micro	2/2 checks passed	us-east-1e	ec2-100-26-229-199.co...	100.26.229.199	launch-wizard-1

Notice the security group name!!!

Step-by-Step Instructions (16/34)

Step 3: Configure Network

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



1. Record this id

2.

3.

The screenshot shows the AWS EC2 Security Groups page. On the left, there's a navigation sidebar with 'New EC2 Experience' and various service links like EC2 Dashboard, Instances, Images, and Elastic Block Store. The main area is titled 'Security Groups (1/2) Info'. It lists two security groups:

Name	Security group ID	Security group name	VPC ID	Description	Owner	Inbound rules count	Outbound rules count
-	sg-0260da0045d3d9e5e	launch-wizard-1	vpc-6d42f610	launch-wizard-1 create...	123157612165	1 Permission entry	1 Permission entry
-	sg-c56f3bc9	default	vpc-6d42f610	default VPC security gr...	123157612165	1 Permission entry	1 Permission entry

Below the table, a specific security group is selected: 'sg-0260da0045d3d9e5e - launch-wizard-1'. The 'Inbound rules' tab is active (circled with a red circle). The 'Edit inbound rules' button is also circled with a red circle. The 'Details' tab is visible but inactive.

Step-by-Step Instructions (17/34)

Step 3: 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)

The screenshot shows the 'Edit inbound rules' page for a specific security group. The 'Inbound rules' table has one existing row and one new row being configured. The new row is highlighted with red circles and numbered steps:

- 1. The 'Add rule' button is circled in red.
- 2. The 'Type' dropdown is set to 'All traffic' and is circled in red.
- 3. The 'Source' dropdown is set to 'Custom' and is circled in red. A search bar next to it contains the group ID 'sg-0260da0045d3d9e5e'. A tooltip for 'Security Groups' shows the selected group: 'launch-wizard-1 | sg-0260da0045d3d9e5e'.
- 4. The 'Save rules' button at the bottom right is circled in red.

A note at the bottom states: "⚠ NOTE: Any edits made on existing rules will result in the edited rule being deleted and a new rule created with the new details. This will cause traffic that depends on that rule to be dropped for a very brief period of time until the new rule can be created."

Step-by-Step Instructions (18/34)

Step 4: 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 page. On the left sidebar, under the 'INSTANCES' section, the 'Instances' option is selected. In the main content area, there are two instances listed:

Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS (IPv4)	IPv4 Public IP	IPv6 IPs
	i-07b9a10a4d509f2d1	t2.micro	us-east-1c	running	2/2 checks ...	None	ec2-3-89-73-165.comp...	3.89.73.165	-
	i-0ab91744af8ce6621	t2.micro	us-east-1c	running	2/2 checks ...	None	ec2-3-92-57-249.comp...	3.92.57.249	-

Below the table, a specific instance is selected: **Instance: i-0ab91744af8ce6621 Public DNS: ec2-3-92-57-249.compute-1.amazonaws.com**. A detailed view is shown with tabs for Description, Status Checks, Monitoring, and Tags. The Description tab displays the following details:

Instance ID	i-0ab91744af8ce6621
Instance state	running
Instance type	t2.micro
Elastic IPs	
Availability zone	us-east-1c
Security groups	launch-wizard-1, view inbound rules, view outbound rules
Scheduled events	No scheduled events
AMI ID	ubuntu/images/hvm-ssd/ubuntu-xenial-16.04-amd64-server-20190212 (ami-0565af6e282977273)

To the right of the description, there is a summary of network interfaces:

Public DNS (IPv4)	ec2-3-92-57-249.compute-1.amazonaws.com
IPv4 Public IP	3.92.57.249
IPv6 IPs	-
Private DNS	ip-172-31-36-188.ec2.internal
Private IPs	172.31.36.188
Secondary private IPs	
VPC ID	vpc-907ec1ea
Subnet ID	subnet-62c4a83e

Red circles highlight the **IPv4 Public IP** (3.92.57.249) and the **Private IPs** (172.31.36.188). Red arrows point from these highlighted areas to the text "Record Public IP" and "Record Private IP" respectively.

Step-by-Step Instructions (19/34)

Step 5: Login to VM

Using putty to ssh:

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

<https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html>

Package files

You probably want one of these. They include versions of all the PuTTY utilities.

(Not sure whether you want the 32-bit or the 64-bit version? Read the [FAQ entry](#).)

MSI (“Windows Installer”)

32-bit:	putty-0.71-installer.msi	(or by FTP)	(signature)
64-bit:	putty-64bit-0.71-installer.msi	(or by FTP)	(signature)

Unix source archive

.tar.gz:	putty-0.71.tar.gz	(or by FTP)	(signature)
----------	-----------------------------------	------------------------------	-------------------------------

Alternative binary files

The installer packages above will provide versions of all of these (except PuTTYtel), but you can download standalone binaries one by one if you prefer.

(Not sure whether you want the 32-bit or the 64-bit version? Read the [FAQ entry](#).)

putty.exe (the SSH and Telnet client itself)

32-bit:	putty.exe	(or by FTP)	(signature)
64-bit:	putty.exe	(or by FTP)	(signature)

pscp.exe (an SCP client, i.e. command-line secure file copy)

32-bit:	pscp.exe	(or by FTP)	(signature)
64-bit:	pscp.exe	(or by FTP)	(signature)

Step-by-Step Instructions (20/34)

Step 5: Login to VM

Using putty to ssh:

Besides the putty application, you also have to download putty key generator to convert the key pair you save in Step 2 into the format putty can recognize

<https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html>

The installer packages above will provide versions of all of these (except PuTTYtel), but you can download standalone binaries one by one if you prefer.

(Not sure whether you want the 32-bit or the 64-bit version? Read the [FAQ entry](#).)

putty.exe (the SSH and Telnet client itself)

32-bit:	putty.exe	(or by FTP)	(signature)
64-bit:	putty.exe	(or by FTP)	(signature)

pscp.exe (an SCP client, i.e. command-line secure file copy)

32-bit:	pscp.exe	(or by FTP)	(signature)
64-bit:	pscp.exe	(or by FTP)	(signature)

psftp.exe (an SFTP client, i.e. general file transfer sessions much like FTP)

32-bit:	psftp.exe	(or by FTP)	(signature)
64-bit:	psftp.exe	(or by FTP)	(signature)

puttytel.exe (a Telnet-only client)

32-bit:	puttytel.exe	(or by FTP)	(signature)
64-bit:	puttytel.exe	(or by FTP)	(signature)

plink.exe (a command-line interface to the PuTTY back ends)

32-bit:	plink.exe	(or by FTP)	(signature)
64-bit:	plink.exe	(or by FTP)	(signature)

pageant.exe (an SSH authentication agent for PuTTY, PSCP, PSFTP, and Plink)

32-bit:	pageant.exe	(or by FTP)	(signature)
64-bit:	pageant.exe	(or by FTP)	(signature)

puttygen.exe (a RSA and DSA key generation utility)

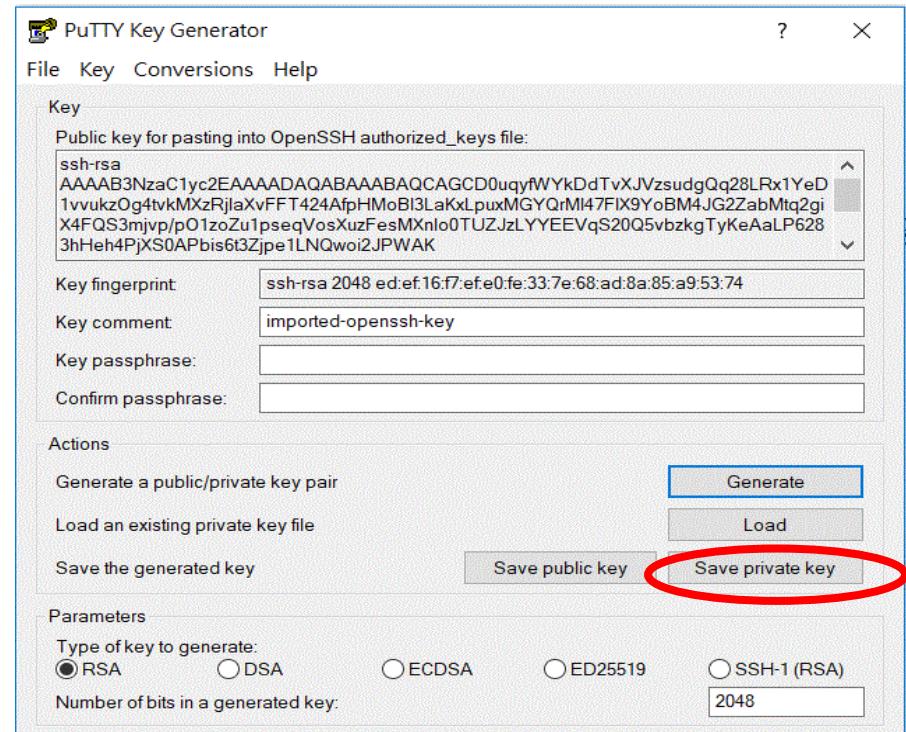
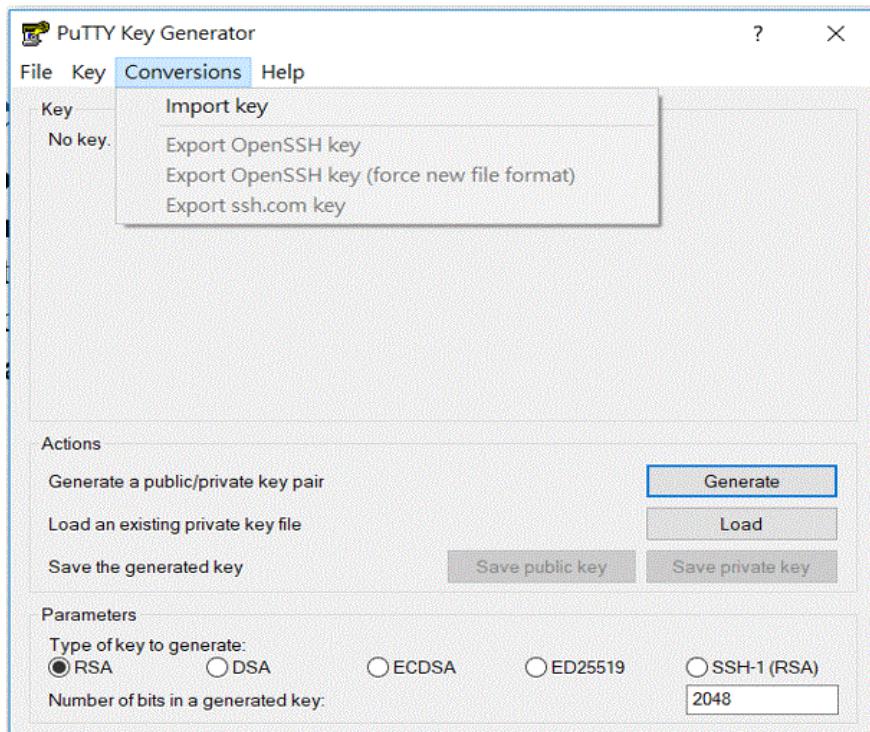
32-bit:	puttygen.exe	(or by FTP)	(signature)
64-bit:	puttygen.exe	(or by FTP)	(signature)

Step-by-Step Instructions (21/34)

Step 5: Login to VM Using putty to ssh:

Convert **.pem** file to **.ppk** file using putty generator
use the menu option Conversions > Import Key

Load the **.pem** file you downloaded and click the “Save Private Key” button

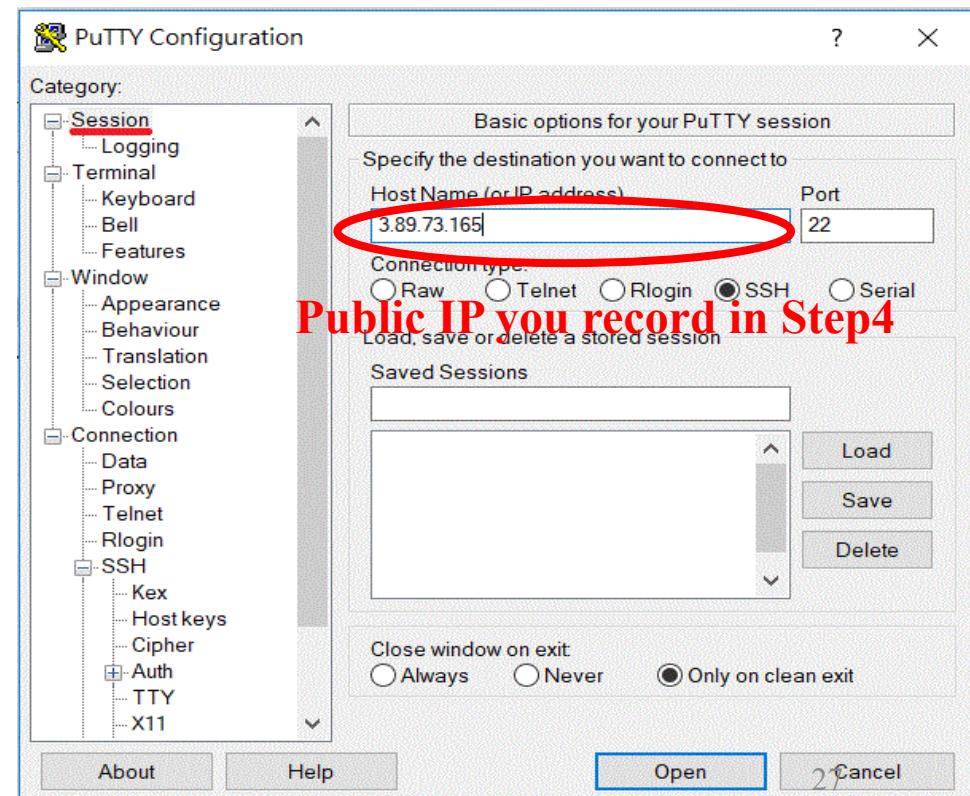
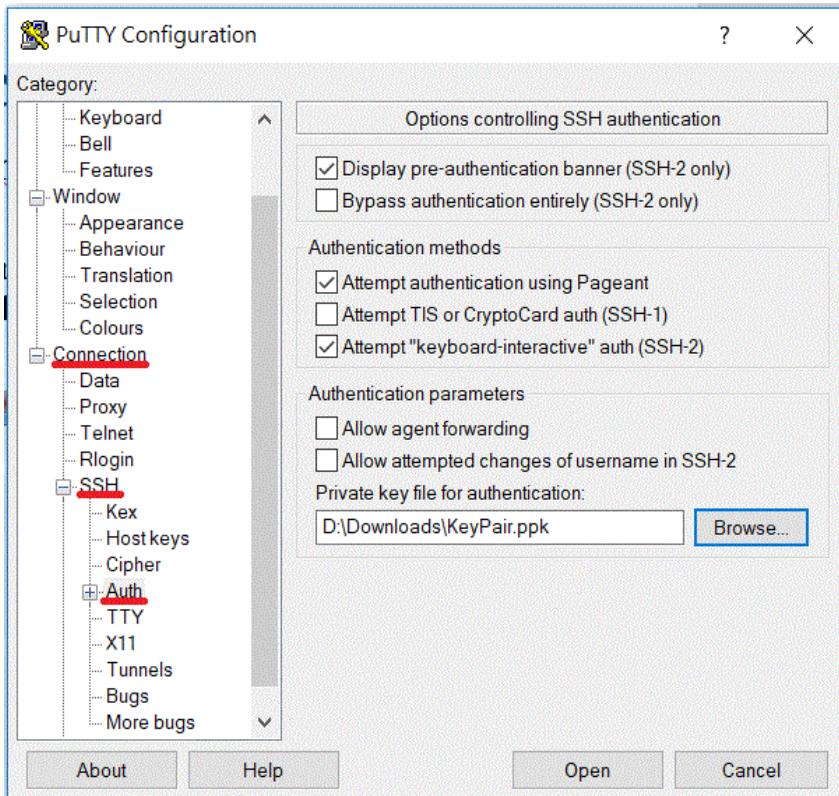


Step-by-Step Instructions (22/34)

Step 5: Login to VM

Using putty to ssh:

1. Go to [Connection]>[SSH]>[Auth], click the Browse button to select your key (.ppk file)
2. Go to [Session] and enter the VM **Public IP** then click the “Open” button



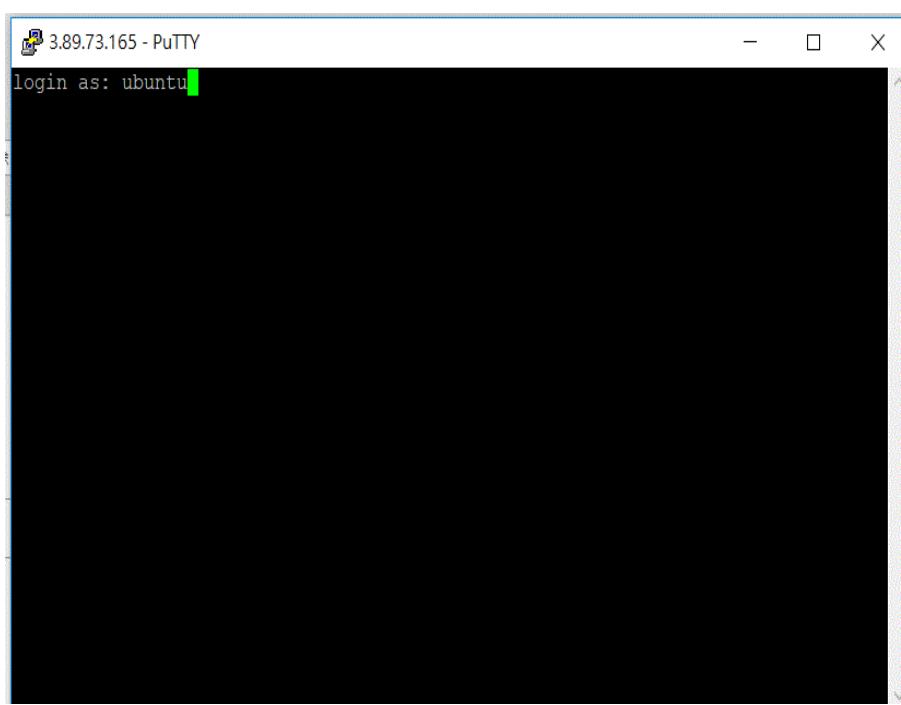
Step-by-Step Instructions (23/34)

Step 5: Login to VM

Using putty to ssh:

Username is **ubuntu**

Then you can login your VM without entering the password



```
ubuntu@ip-172-31-42-243:~$ login as: ubuntu
Authenticating with public key "imported-openssh-key"
Welcome to Ubuntu 16.04.5 LTS (GNU/Linux 4.4.0-1075-aws x86_64)

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

Get cloud support with Ubuntu Advantage Cloud Guest:
http://www.ubuntu.com/business/services/cloud

0 packages can be updated.
0 updates are security updates.

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.

ubuntu@ip-172-31-42-243:~$
```

A screenshot of a terminal window titled "ubuntu@ip-172-31-42-243:~". The window has a blue header bar with the title and standard window controls. The terminal session shows a successful SSH login for the user "ubuntu". It displays the system's welcome message for Ubuntu 16.04.5 LTS, including documentation, management, and support links. It then provides information about package updates, stating there are none available. The session ends with a copyright notice from Canonical and instructions for running commands as root using "sudo". The prompt at the bottom is "ubuntu@ip-172-31-42-243:~\$".

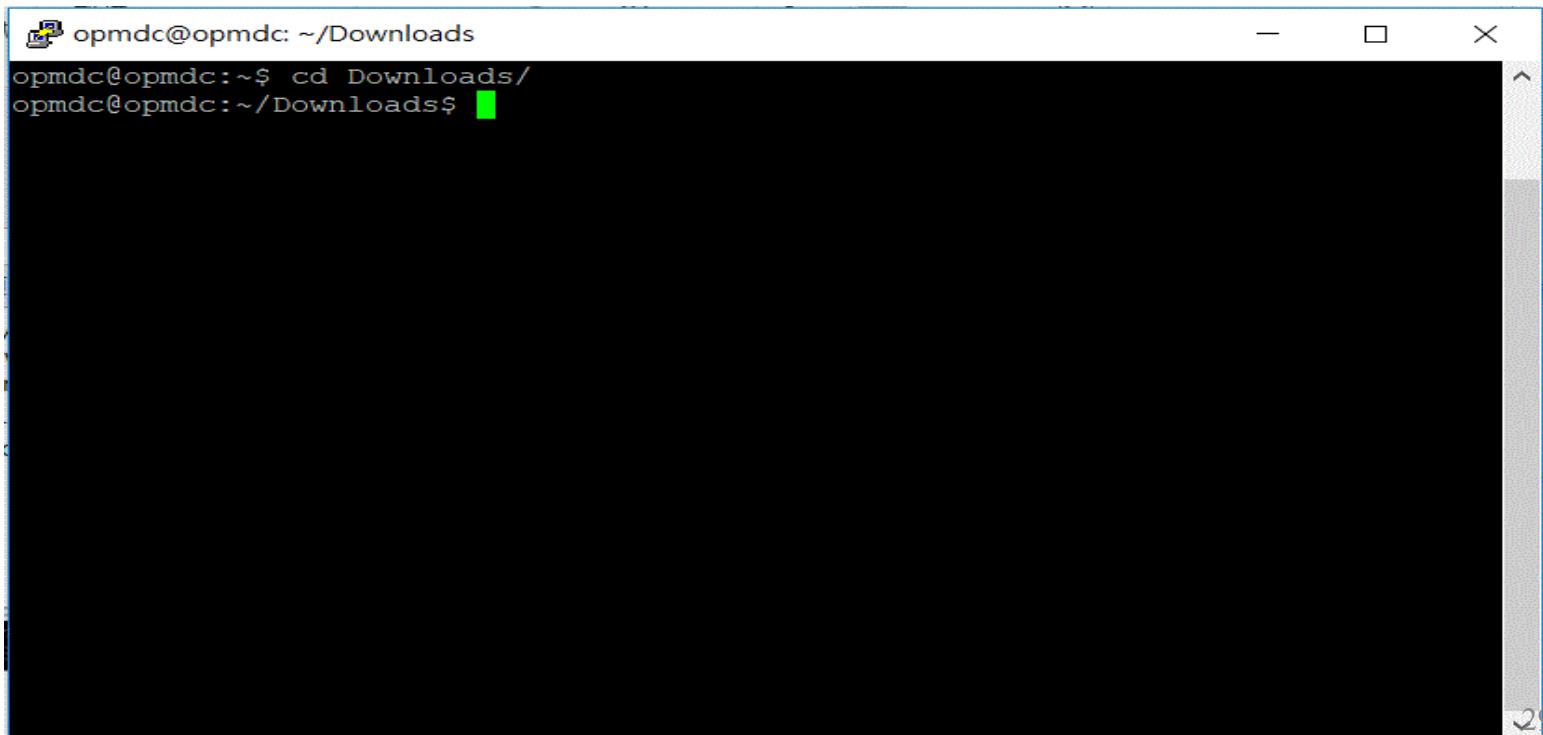
Step-by-Step Instructions (24/34)

Step 5: 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



A screenshot of a terminal window titled "opmdc@opmdc: ~/Downloads". The window shows the command "cd Downloads/" being entered at the prompt. The terminal has a dark background and light-colored text. The title bar is white with black text. There are standard window control buttons (minimize, maximize, close) in the top right corner.

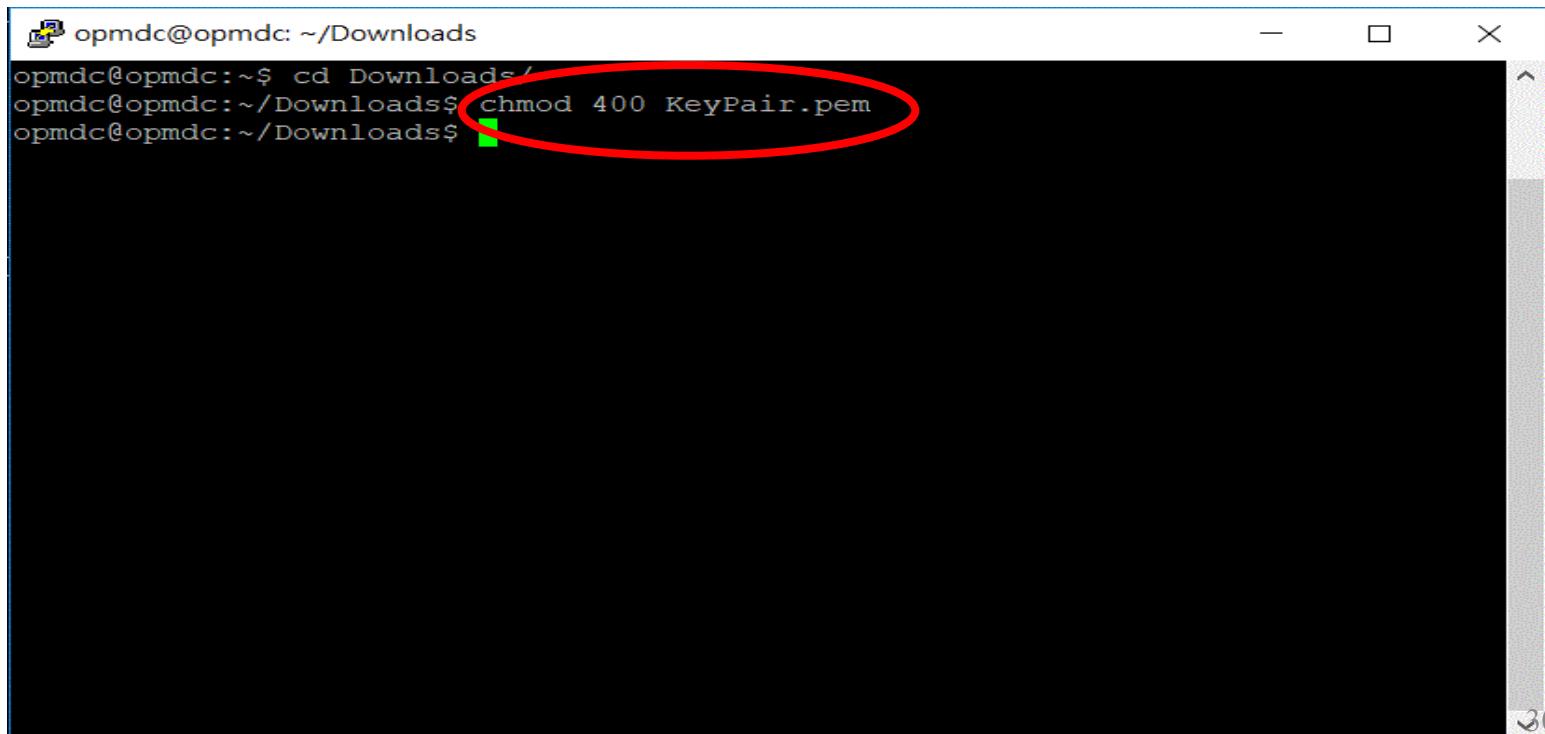
```
opmdc@opmdc:~/Downloads
opmdc@opmdc:~$ cd Downloads/
opmdc@opmdc:~/Downloads$
```

Step-by-Step Instructions (25/34)

Step 5: Login to VM

Using ssh client:

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



A screenshot of a terminal window titled "opmdc@opmdc: ~/Downloads". The window shows a command-line interface with the following text:

```
opmdc@opmdc:~/Downloads$ cd Downloads/
opmdc@opmdc:~/Downloads$ chmod 400 KeyPair.pem
opmdc@opmdc:~/Downloads$
```

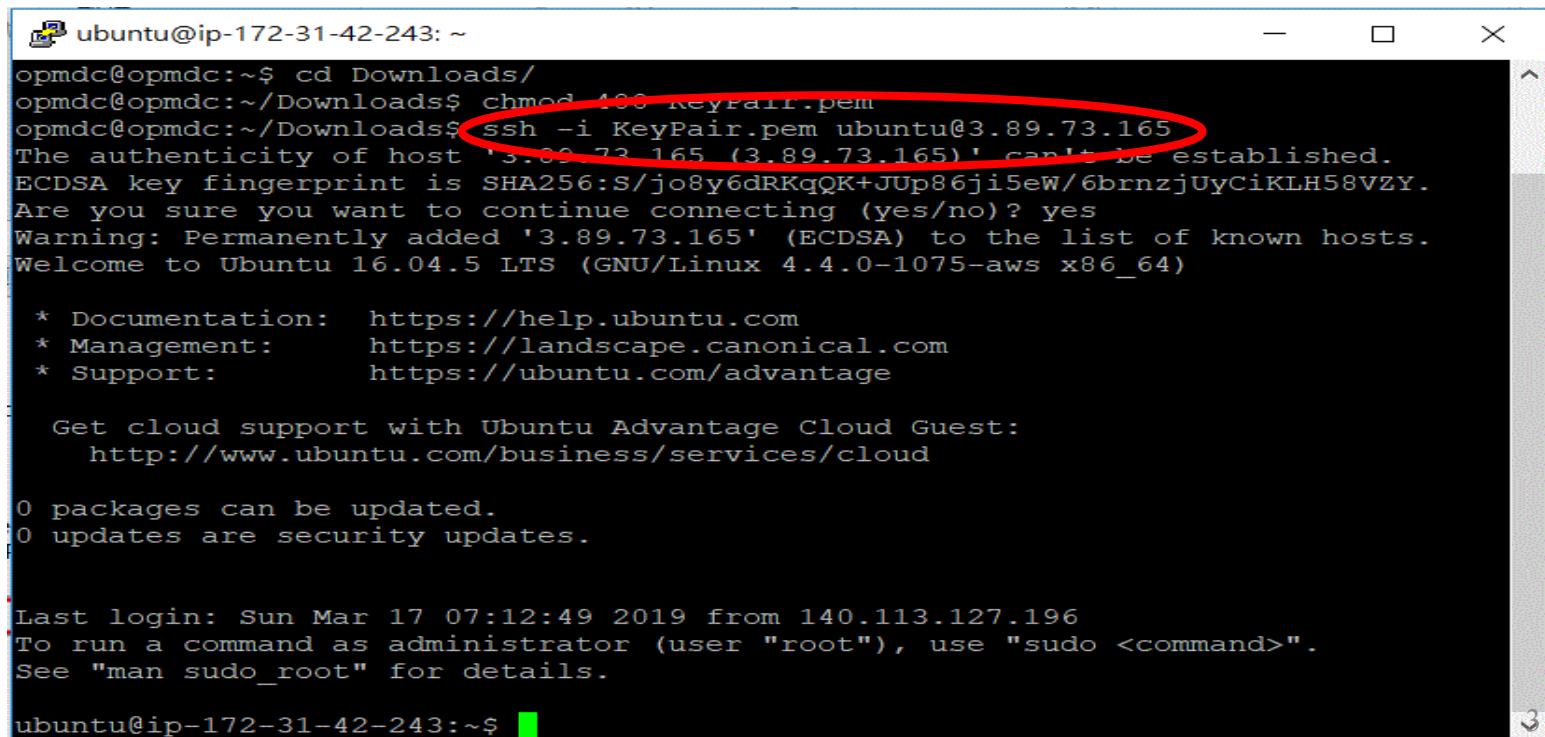
The command "chmod 400 KeyPair.pem" is highlighted with a red oval.

Step-by-Step Instructions (26/34)

Step 5: 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



The screenshot shows a terminal window titled "ubuntu@ip-172-31-42-243: ~". The user has run the command `ssh -i KeyPair.pem ubuntu@3.89.73.165`. A red oval highlights the command line. The terminal displays the following output:

```
ubuntu@ip-172-31-42-243: ~
opmdc@opmdc:~$ cd Downloads/
opmdc@opmdc:~/Downloads$ chmod 400 KeyPair.pem
opmdc@opmdc:~/Downloads$ ssh -i KeyPair.pem ubuntu@3.89.73.165
The authenticity of host '3.89.73.165 (3.89.73.165)' can't be established.
ECDSA key fingerprint is SHA256:S/jo8y6dRKqQK+JUp86ji5eW/6brnjzjUyCiKLH58VZY.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '3.89.73.165' (ECDSA) to the list of known hosts.
Welcome to Ubuntu 16.04.5 LTS (GNU/Linux 4.4.0-1075-aws x86_64)

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

 Get cloud support with Ubuntu Advantage Cloud Guest:
   http://www.ubuntu.com/business/services/cloud

0 packages can be updated.
0 updates are security updates.

Last login: Sun Mar 17 07:12:49 2019 from 140.113.127.196
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ubuntu@ip-172-31-42-243: ~$
```

Step-by-Step Instructions (27/34)

Step 6: 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 (28/34)

Step 6: Run TCP socket program on VMs

server.py

```
#!/usr/bin/env python
import socket
TCP_IP = '<server_Private_IP_address>' # Step4; pp. 23
TCP_PORT = 5005
BUFFER_SIZE = 40
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.bind((TCP_IP, TCP_PORT))
s.listen(1)
conn, addr = s.accept()
print 'Connection address:', addr
while 1:
    data = conn.recv(BUFFER_SIZE)
    if not data: break
    print "received data:", data
    conn.send(data) # echo
conn.close()
```

Step-by-Step Instructions (29/34)

Step 6: Run TCP socket program on VMs

client.py

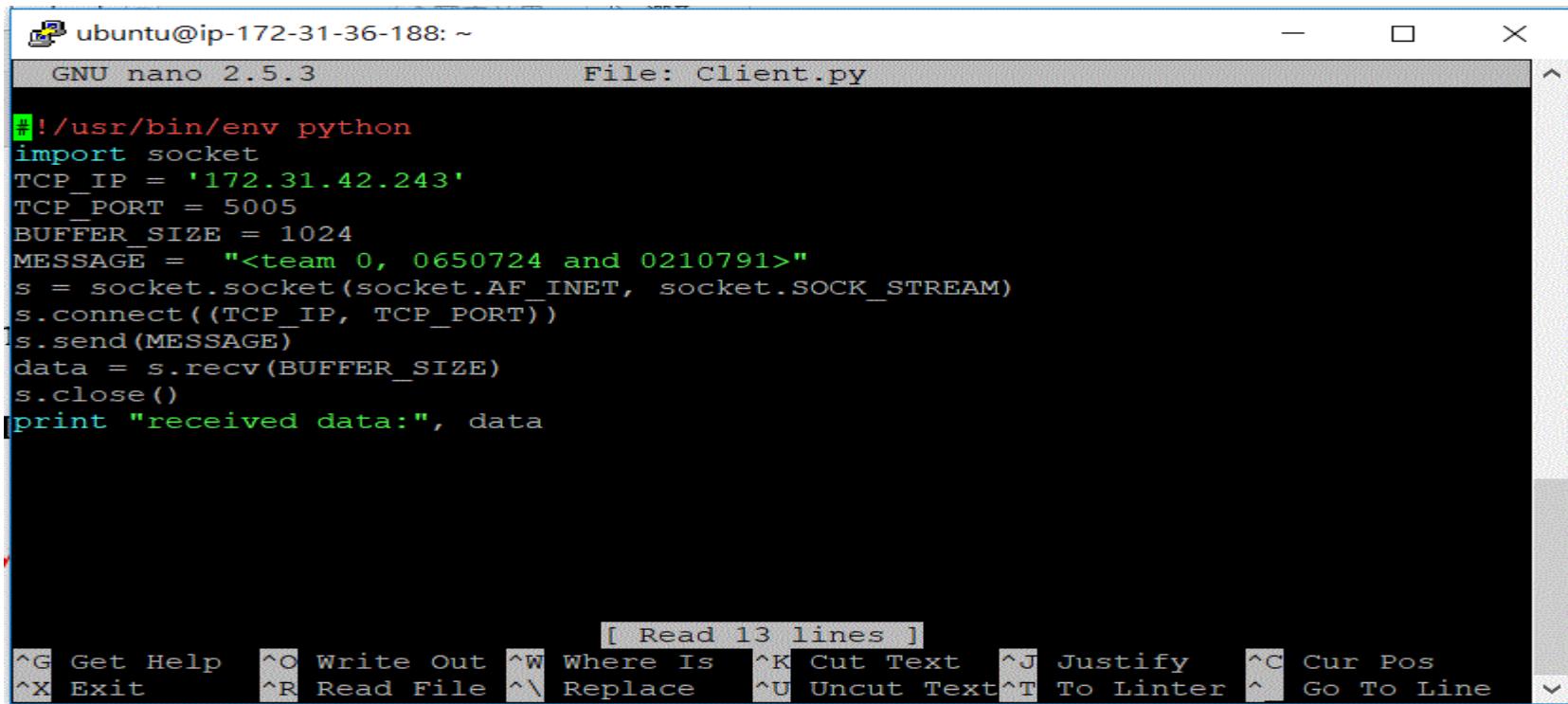
```
#!/usr/bin/env python
import socket
TCP_IP = '<server_Private_IP_address>' # Step4; pp. 23
TCP_PORT = 5005
BUFFER_SIZE = 1024
MESSAGE = "<Student ID>"
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.connect((TCP_IP, TCP_PORT))
s.send(MESSAGE)
data = s.recv(BUFFER_SIZE)
s.close()
print "received data:", data
```

Step-by-Step Instructions (30/34)

Step 6: Run TCP socket program on VMs

You can use “sudo nano” command in VM to modify your code

EX: **sudo nano client.py**



The screenshot shows a terminal window titled "ubuntu@ip-172-31-36-188: ~". The window contains the following Python code:

```
#!/usr/bin/env python
import socket
TCP_IP = '172.31.42.243'
TCP_PORT = 5005
BUFFER_SIZE = 1024
MESSAGE = "<team 0, 0650724 and 0210791>"
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.connect((TCP_IP, TCP_PORT))
s.send(MESSAGE)
data = s.recv(BUFFER_SIZE)
s.close()
print "received data:", data
```

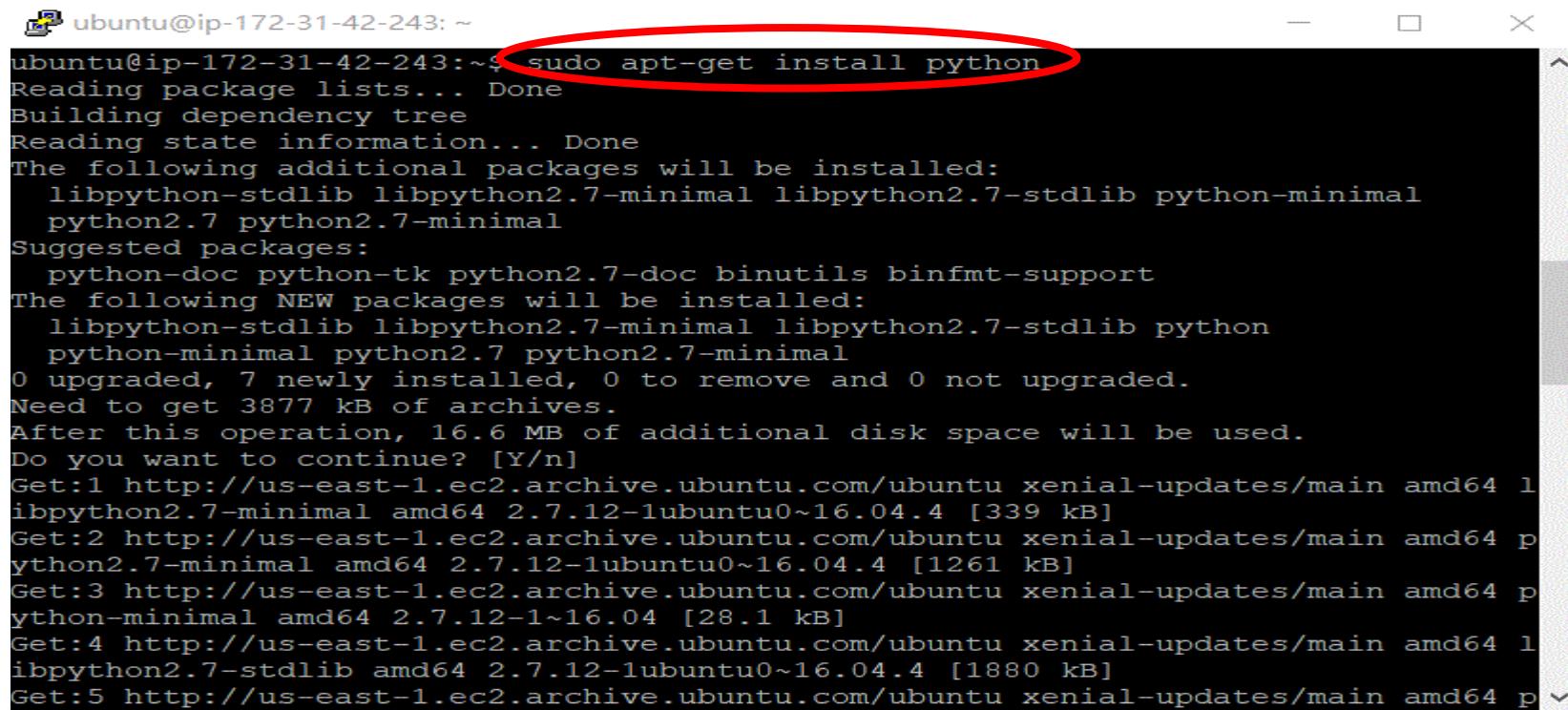
The bottom of the window shows the nano editor's command bar with various keyboard shortcuts.

Step-by-Step Instructions (31/34)

Step 6: Run TCP socket program on VMs

Install the python on both VMs:

```
$ sudo apt-get update  
$ sudo apt-get install python
```



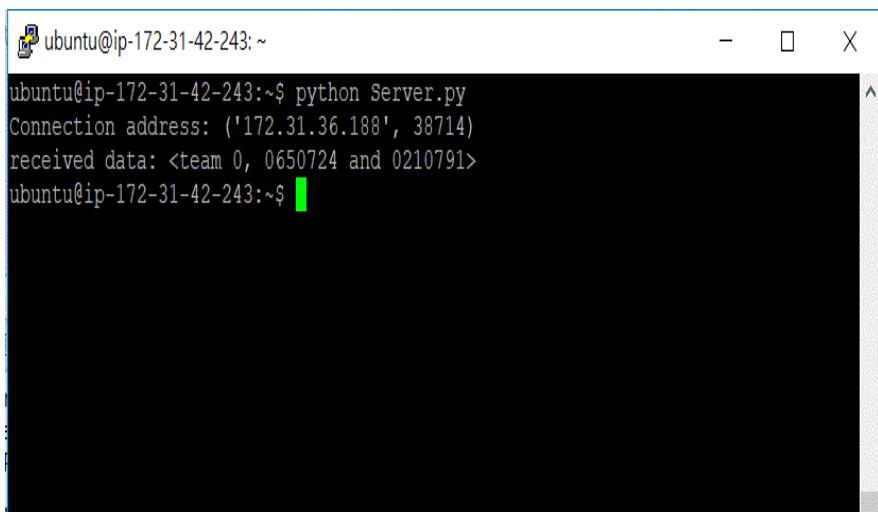
```
ubuntu@ip-172-31-42-243:~$ sudo apt-get install python  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
The following additional packages will be installed:  
  libpython-stdlib libpython2.7-minimal libpython2.7-stdlib python-minimal  
  python2.7 python2.7-minimal  
Suggested packages:  
  python-doc python-tk python2.7-doc binutils binfmt-support  
The following NEW packages will be installed:  
  libpython-stdlib libpython2.7-minimal libpython2.7-stdlib python  
  python-minimal python2.7 python2.7-minimal  
0 upgraded, 7 newly installed, 0 to remove and 0 not upgraded.  
Need to get 3877 kB of archives.  
After this operation, 16.6 MB of additional disk space will be used.  
Do you want to continue? [Y/n]  
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial-updates/main amd64 l  
ibpython2.7-minimal amd64 2.7.12-1ubuntu0~16.04.4 [339 kB]  
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial-updates/main amd64 p  
ython2.7-minimal amd64 2.7.12-1ubuntu0~16.04.4 [1261 kB]  
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial-updates/main amd64 p  
ython-minimal amd64 2.7.12-1~16.04 [28.1 kB]  
Get:4 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial-updates/main amd64 l  
ibpython2.7-stdlib amd64 2.7.12-1ubuntu0~16.04.4 [1880 kB]  
Get:5 http://us-east-1.ec2.archive.ubuntu.com/ubuntu xenial-updates/main amd64 p
```

Step-by-Step Instructions (32/34)

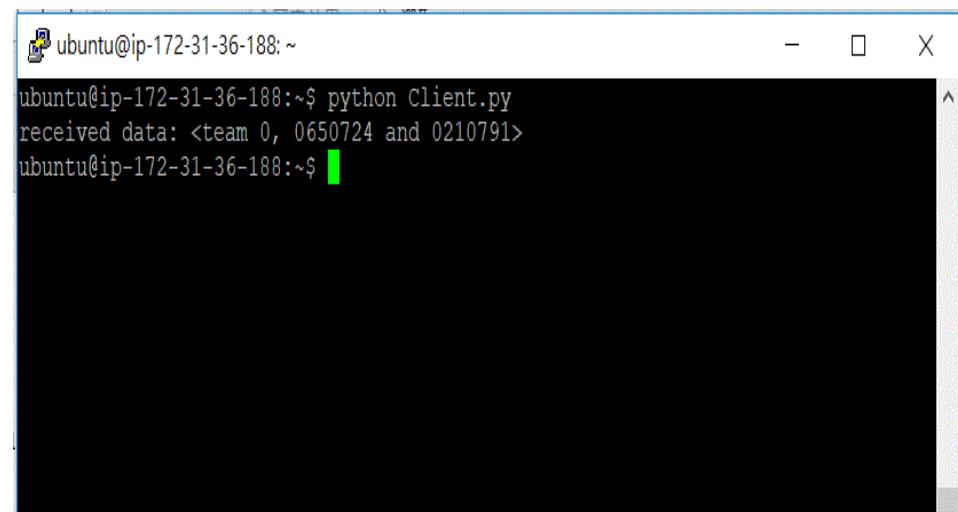
Step 6: Run TCP socket program on VMs

Use “python” command in VM to run your code

EX: **python Client.py**



```
ubuntu@ip-172-31-42-243:~$ python Server.py
Connection address: ('172.31.36.188', 38714)
received data: <team 0, 0650724 and 0210791>
ubuntu@ip-172-31-42-243:~$
```

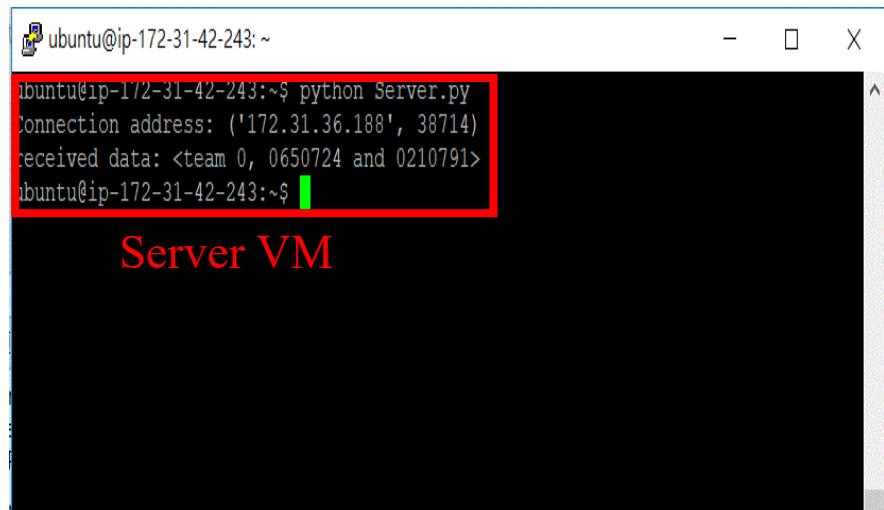


```
ubuntu@ip-172-31-36-188:~$ python Client.py
received data: <team 0, 0650724 and 0210791>
ubuntu@ip-172-31-36-188:~$
```

Step-by-Step Instructions (33/34)

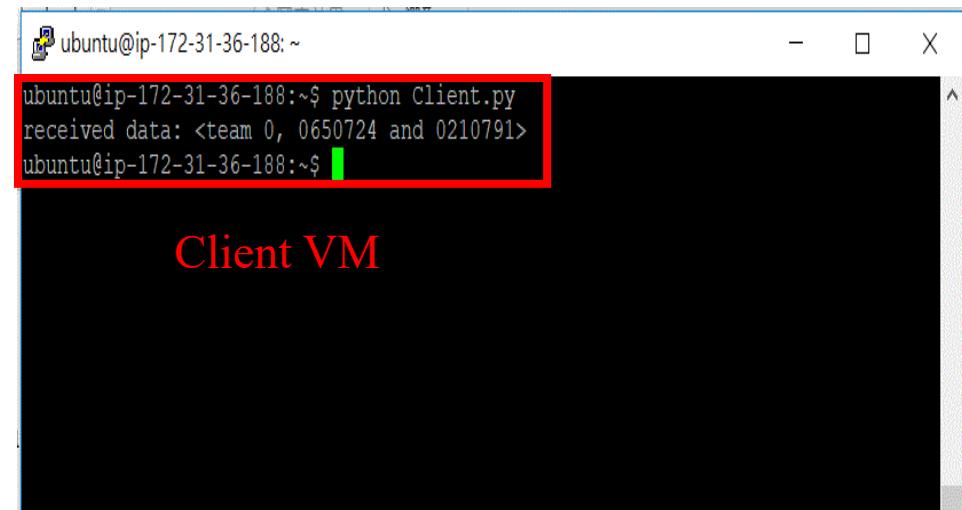
Step 6: Run TCP socket program on VMs

PrintScreen your result and put it in the report



```
ubuntu@ip-172-31-42-243:~$ python Server.py
Connection address: ('172.31.36.188', 38714)
received data: <team 0, 0650724 and 0210791>
ubuntu@ip-172-31-42-243:~$
```

Server VM



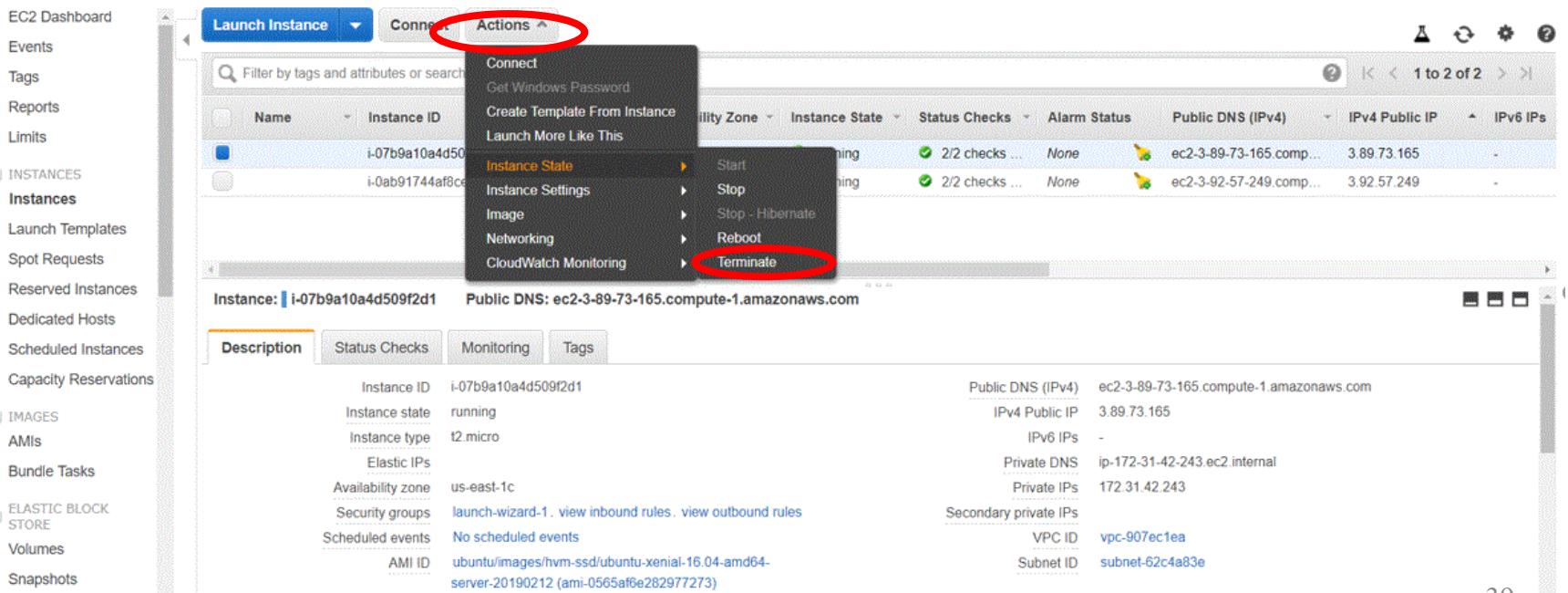
```
ubuntu@ip-172-31-36-188:~$ python Client.py
received data: <team 0, 0650724 and 0210791>
ubuntu@ip-172-31-36-188:~$
```

Client VM

Step-by-Step Instructions (34/34)

Step 7: Turn off VMs

Once you complete the jobs, do not forget to turn off the VMs you create
Go to the main page of Amazon EC2, choose the instance, click the “Actions” button, “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: **03/27/2021**