

- Created 2 VMs using Microsoft Azure Student Credit.
- Created SSH key pairs for accessing VMs.

The steps are shown below.

- Using the command `ssh-keygen -t rsa -b 4096 -C "your_email@example.com"`` we can generate a public-private keypair which is used to authenticate, connect and access our virtual machines. As the name suggests, public key is the one available to world (mostly on the VM) and private key must be stored safely.
- Since Microsoft Azure is a cloud service provider, we can rent a VM (with prices shown) by hour and use it to do our jobs. All the infrastructure is being maintained at Microsoft's Data center.
- We can now create 2 VMs (one with CentOS and the other with Ubuntu) and connect to them via SSH.
- We are choosing the cheapest option available with 1 VCPU and 1 GB memory and 30 GB of storage. It has been chosen according to the workloads that we'll be working on.

Microsoft Azure Search resources, services, and docs (G/) ≡ Cloud Shell Help Feedback User profile

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Validation passed

Basics Disks Networking Management Monitoring Advanced Tags **Review + create**

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PRODUCT DETAILS

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Name

Preferred e-mail address

Preferred phone number

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Basics

Subscription	Azure for Students
Resource group	(new) acme-corp
Virtual machine name	CentOS
Region	West US 3
Availability options	No infrastructure redundancy required
Security type	Standard
Image	CentOS-based 7.9 - Gen2
VM architecture	x64
Size	Standard B1s (1 vcpu, 1 GiB memory)
Authentication type	SSH public key
Username	mickey
Public inbound ports	SSH
Azure Spot	No

Disks

OS disk size	Default size (31 GiB)
OS disk type	Premium SSD LRS
Use managed disks	Yes
Delete OS disk with VM	Enabled
Ephemeral OS disk	No

Networking

Virtual network	(new) acme-corp-vnet
Subnet	(new) default (10.1.0.0/24)
Public IP	(new) CentOS-ip
Accelerated networking	Off
Place this virtual machine behind an existing load balancing solution?	No
Delete public IP and NIC when VM is deleted	Disabled

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Resolving host...

- We have opened port 22 on the VMs to allow access for SSH (which operates on port 22).

The screenshot shows the Microsoft Azure Deployment Overview page for a deployment named "CreateVm-OpenLogic.CentOS-7_9-gen2-20220918034637". The main message is "Your deployment is complete". Deployment details include a deployment name, start time (9/18/2022, 3:53:10 AM), subscription (Azure for Students), correlation ID (b385a7d1-06c6-4f...), and resource group (acme-corp). Below this, there are sections for "Deployment details" (Setup auto-shutdown, Monitor VM health, performance and network dependencies, Run a script inside the virtual machine) and "Next steps" (links to Go to resource and Create another VM). On the right side, there are promotional links for Cost Management, Microsoft Defender for Cloud, Free Microsoft tutorials, and Work with an expert.

Microsoft Azure | Search resources, services, and docs (G+/-)

Home > CreateVm-OpenLogic.CentOS-7_9-gen2-20220918034637 | Overview

Deployment

Search | Delete | Cancel | Redeploy | Download | Refresh

We'd love your feedback! →

Your deployment is complete

Deployment name: CreateVm-OpenLog... Start time: 9/18/2022, 3:53:10 A...
Subscription: Azure for Students Correlation ID: b385a7d1-06c6-4f...
Resource group: acme-corp

Deployment details

Next steps

Setup auto-shutdown Recommended
Monitor VM health, performance and network dependencies Recommended
Run a script inside the virtual machine Recommended

Go to resource | Create another VM

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[Home](#) > [Virtual machines](#) >

Create a virtual machine

...
[Basics](#) [Disks](#) [Networking](#) [Management](#) [Monitoring](#) [Advanced](#) [Tags](#) [Review + create](#)

Create a virtual machine that runs Linux or Windows. Select an image from Azure marketplace or use your own customized image. Complete the Basics tab then Review + create to provision a virtual machine with default parameters or review each tab for full customization. [Learn more](#)

i This subscription may not be eligible to deploy VMs of certain sizes in certain regions.

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ①	<input type="text" value="Azure for Students"/>
Resource group * ①	<input type="text" value="(New) acme-corp"/>
	Create new

Instance details

Virtual machine name * ①	<input type="text" value="CentOS"/>
Region * ①	<input type="text" value="(US) West US 3"/>
Availability options ①	<input type="text" value="No infrastructure redundancy required"/>
Security type ①	<input type="text" value="Standard"/>
Image * ①	<input type="text" value="CentOS-based 7.9 - Gen2"/>
See all images Configure VM generation	
VM architecture ①	<input type="radio"/> Arm64 <input checked="" type="radio"/> x64
Run with Azure Spot discount ①	<input type="checkbox"/>
Size * ①	<input type="text" value="Standard_B1s - 1 vcpu, 1 GiB memory (\$7.59/month)"/>
See all sizes	

Administrator account

Authentication type ①	<input checked="" type="radio"/> SSH public key <input type="radio"/> Password
<p>i Azure now automatically generates an SSH key pair for you and allows you to store it for future use. It is a fast, simple, and secure way to connect to your virtual machine.</p>	
Username * ①	<input type="text" value="mickey"/>
SSH public key source	<input type="text" value="Use existing public key"/>
SSH public key * ①	<input type="text" value="ds3QyQKRM6fblwXxvJtrW3oMctArwsO6TKIwaHw=="/> 00320381@student.nec.edu
Learn more about creating and using SSH keys in Azure	

Inbound port rules

Select which virtual machine network ports are accessible from the public internet. You can specify more limited or granular network access on the Networking tab.

Public inbound ports * ①	<input type="radio"/> None <input checked="" type="radio"/> Allow selected ports
Select inbound ports *	<input type="text" value="SSH (22)"/>

! **This will allow all IP addresses to access your virtual machine.** This is only recommended for testing. Use the Advanced controls in the Networking tab to create rules to limit inbound traffic to known IP addresses.


[Home](#) > [CreateVm-OpenLogic.CentOS-7_9-gen2-20220918034637 | Overview](#) >

Create a virtual machine

X
[Basics](#) [Disks](#) [Networking](#) [Management](#) [Monitoring](#) [Advanced](#) [Tags](#) [Review + create](#)

Create a virtual machine that runs Linux or Windows. Select an image from Azure marketplace or use your own customized image. Complete the Basics tab then Review + create to provision a virtual machine with default parameters or review each tab for full customization. [Learn more](#)

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Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ⓘ

Resource group * ⓘ

[Create new](#)

Instance details

Virtual machine name * ⓘ

Region * ⓘ

Availability options ⓘ

Security type ⓘ

Image * ⓘ

[See all images](#) | [Configure VM generation](#)

VM architecture ⓘ

Run with Azure Spot discount ⓘ

Size * ⓘ

[See all sizes](#)

Administrator account

Authentication type ⓘ

i Azure now automatically generates an SSH key pair for you and allows you to store it for future use. It is a fast, simple, and secure way to connect to your virtual machine.

Username * ⓘ

SSH public key source

SSH public key * ⓘ

[Learn more about creating and using SSH keys in Azure](#)

Inbound port rules

Select which virtual machine network ports are accessible from the public internet. You can specify more limited or granular network access on the Networking tab.

Public inbound ports * ⓘ

Select inbound ports *

! **This will allow all IP addresses to access your virtual machine.** This is only recommended for testing. Use the Advanced controls in the Networking tab to create rules to limit inbound traffic to known IP addresses.

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Create a virtual machine

Validation passed

Basics Disks Networking Management Monitoring Advanced Tags **Review + create**

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Name

Preferred e-mail address

Preferred phone number

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Basics

Subscription	Azure for Students
Resource group	acme-corp
Virtual machine name	Ubuntu
Region	West US 3
Availability options	No infrastructure redundancy required
Security type	Standard
Image	Ubuntu Server 20.04 LTS - Gen2
VM architecture	x64
Size	Standard B1s (1 vcpu, 1 GiB memory)
Authentication type	SSH public key
Username	mickey
Public inbound ports	SSH
Azure Spot	No

Disks

OS disk size	Default size (30 GiB)
OS disk type	Premium SSD LRS
Use managed disks	Yes
Delete OS disk with VM	Enabled
Ephemeral OS disk	No

Networking

Virtual network	acme-corp-vnet
Subnet	default (10.1.0.0/24)
Public IP	None
Accelerated networking	Off
Place this virtual machine behind an existing load balancing solution?	No
Delete NIC when VM is deleted	Disabled

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Home > CentOS

Virtual machine

Search

Connect Start Restart Stop Capture Delete Refresh Open in mobile CLI / PS

Overview Activity log Access control (IAM) Tags Diagnose and solve problems

Settings Networking Connect Disks Size

Microsoft Defender for Cloud Advisor recommendations Extensions + applications Continuous delivery Availability + scaling Configuration Identity Properties Locks

Operations Bastion Auto-shutdown Backup Disaster recovery Updates Inventory Change tracking Automanage (preview) Configuration management (Preview) Policies Run command

Monitoring Insights Alerts Metrics Diagnostic settings Logs Connection monitor (classic)

Essentials

Resource group (move) acme-corp

Status Running

Location West US 3

Subscription (move) Azure for Students

Subscription ID 667e1556-a57c-449d-bb90-cea18761d774

Tags (edit) Click here to add tags

Operating system Linux (centos 7.9.2009)

Size Standard B1s (1 vcpu, 1 GiB memory)

Public IP address 20.168.23.139

Virtual network/subnet acme-corp-vnet/default

DNS name Not configured

Properties Monitoring Capabilities (7) Recommendations Tutorials

Virtual machine

Computer name	CentOS	Public IP address	20.168.23.139
Health state	-	Public IP address (IPv6)	-
Operating system	Linux (centos 7.9.2009)	Private IP address	10.1.0.4
Publisher	OpenLogic	Private IP address (IPv6)	-
Offer	CentOS	Virtual network/subnet	acme-corp-vnet/default
Plan	7.9-gen2	DNS name	Configure
VM generation	V2		
VM architecture	x64		
Agent status	Ready		
Agent version	2.7.3.0		
Host group	None		
Host	-		
Proximity placement group	-		
Colocation status	N/A		
Capacity reservation group	-		

Networking

Size	Standard B1s
vCPUs	1
RAM	1 GiB

Availability + scaling

Availability zone	-
Availability set	-
Scale Set	-

Security type

Security type	Standard
---------------	----------

Extensions + applications

Extensions	-
Applications	-

Disk

OS disk	CentOS_OsDisk_1_e0c1a1d6005b4a57affbff501c79ca3d
Encryption at host	Disabled
Azure disk encryption	Not enabled
Ephemeral OS disk	N/A
Data disks	0

Azure Spot

Azure Spot	-
Azure Spot eviction policy	-

Give feedback

- Here we have successfully created a VM with CentOS whose public IP is 20.168.23.139 (required for accessing the VM via SSH).

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Home > CreateVm-canonical.0001-com-ubuntu-server-focal-2-20220918035533 | Overview ⋮ X

 Deployment

Delete Cancel Redeploy Download Refresh

Overview Inputs Outputs Template

 We'd love your feedback! →

 Your deployment is complete

 Deployment name: CreateVm-canonical.00... Start time: 9/18/2022, 3:56:3...
Subscription: Azure for Students Correlation ID: 4ce81ded-795f
Resource group: acme-corp

Deployment details Next steps

Setup auto-shutdown Recommended
Monitor VM health, performance and network dependencies Recommended
Run a script inside the virtual machine Recommended

Go to resource Create another VM

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- It takes some time to allocate resources and displays the above.

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Home > CreateVm-canonical.0001-com-ubuntu-server-focal-2-20220918035533 | Overview >

Ubuntu Virtual machine X

Search Connect Start Restart Stop Capture Delete Refresh Open in mobile CLI / PS

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Networking

Connect

Disk

Size

Microsoft Defender for Cloud

Advisor recommendations

Extensions + applications

Continuous delivery

Availability + scaling

Configuration

Identity

Properties

Locks

Operations

Bastion

Auto-shutdown

Backup

Disaster recovery

Updates

Inventory

Change tracking

Automanage (preview)

Configuration management (Preview)

Policies

Run command

Monitoring

Insights

Alerts

Metrics

Diagnostic settings

Logs

Connection monitor (classic)

Essentials

Resource group ([move](#)) **acme-corp**
Status **Running**
Location **West US 3**
Subscription ([move](#)) **Azure for Students**
Subscription ID **667e1556-a57c-449d-bb90-cea18761d774**
Tags ([edit](#)) [Click here to add tags](#)

Operating system **Linux (ubuntu 20.04)**
Size **Standard B1s (1 vcpu, 1 GiB memory)**
Public IP address **20.150.146.3**
Virtual network/subnet **acme-corp-vnet/default**
DNS name **Not configured**

Properties **Monitoring** **Capabilities (7)** **Recommendations** **Tutorials**

Virtual machine

Computer name	Ubuntu
Health state	-
Operating system	Linux (ubuntu 20.04)
Publisher	canonical
Offer	0001-com-ubuntu-server-focal
Plan	20_04-lts-gen2
VM generation	V2
VM architecture	x64
Agent status	Ready
Agent version	2.7.3.0
Host group	None
Host	-
Proximity placement group	-
Colocation status	N/A
Capacity reservation group	-

Networking

Public IP address	20.150.146.3
Public IP address (IPv6)	-
Private IP address	10.1.0.5
Private IP address (IPv6)	-
Virtual network/subnet	acme-corp-vnet/default
DNS name	Configure

Size

Size	Standard B1s
vCPUs	1
RAM	1 GiB

Disk

OS disk	Ubuntu_OsDisk_1_5ebbd3c8e3304832bf039d2d47d0949d
Encryption at host	Disabled
Azure disk encryption	Not enabled
Ephemeral OS disk	N/A
Data disks	0

Azure Spot

Azure Spot	-
Azure Spot eviction policy	-

Availability + scaling

Availability zone	-
Availability set	-
Scale Set	-

Security type

Security type	Standard
---------------	----------

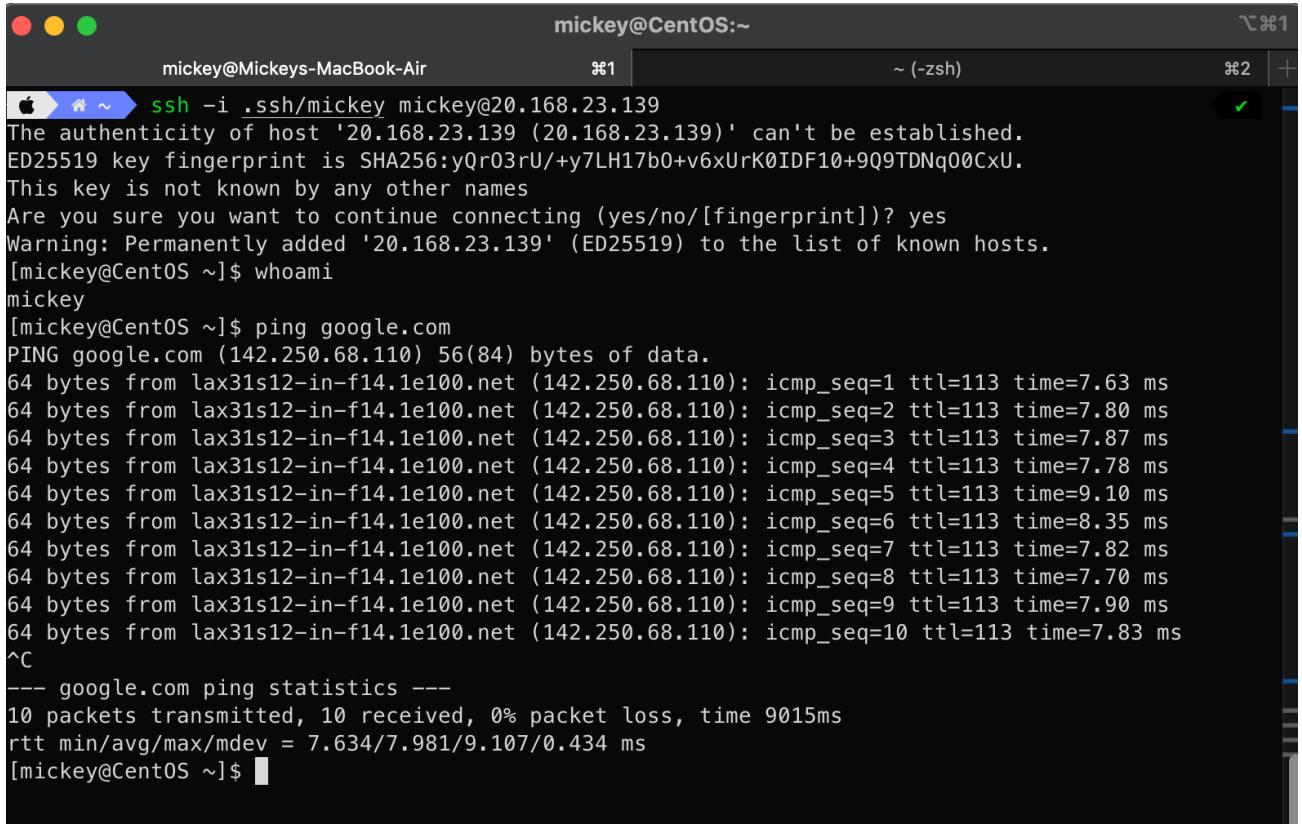
Extensions + applications

Extensions	-
Applications	-

[Give feedback](#)

- The Public IP of the Ubuntu VM is 20.150.146.3
- After the VMs are deployed I can login into the system using SSH and the private-public keypair.

- We can login to the VMs using the command `ssh -i <private key> user@hostname`.
- My private-key is present under the directory `~/.ssh/mickey`
- After logging in the successful ping to google.com suggests that both the VMs have internet access.



The screenshot shows a macOS terminal window titled "mickey@CentOS:~". It has two tabs: tab #1 is "mickey@Mickeys-MacBook-Air" and tab #2 is "~ (-zsh)". The current session is in tab #1. The terminal output is as follows:

```

mickey@Mickeys-MacBook-Air ~ % ssh -i .ssh/mickey mickey@20.168.23.139
The authenticity of host '20.168.23.139 (20.168.23.139)' can't be established.
ED25519 key fingerprint is SHA256:yQr03rU/+y7LH17b0+v6xUrK0IDF10+9Q9TDNq00CxU.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '20.168.23.139' (ED25519) to the list of known hosts.
[mickey@CentOS ~]$ whoami
mickey
[mickey@CentOS ~]$ ping google.com
PING google.com (142.250.68.110) 56(84) bytes of data.
64 bytes from lax31s12-in-f14.1e100.net (142.250.68.110): icmp_seq=1 ttl=113 time=7.63 ms
64 bytes from lax31s12-in-f14.1e100.net (142.250.68.110): icmp_seq=2 ttl=113 time=7.80 ms
64 bytes from lax31s12-in-f14.1e100.net (142.250.68.110): icmp_seq=3 ttl=113 time=7.87 ms
64 bytes from lax31s12-in-f14.1e100.net (142.250.68.110): icmp_seq=4 ttl=113 time=7.78 ms
64 bytes from lax31s12-in-f14.1e100.net (142.250.68.110): icmp_seq=5 ttl=113 time=9.10 ms
64 bytes from lax31s12-in-f14.1e100.net (142.250.68.110): icmp_seq=6 ttl=113 time=8.35 ms
64 bytes from lax31s12-in-f14.1e100.net (142.250.68.110): icmp_seq=7 ttl=113 time=7.82 ms
64 bytes from lax31s12-in-f14.1e100.net (142.250.68.110): icmp_seq=8 ttl=113 time=7.70 ms
64 bytes from lax31s12-in-f14.1e100.net (142.250.68.110): icmp_seq=9 ttl=113 time=7.90 ms
64 bytes from lax31s12-in-f14.1e100.net (142.250.68.110): icmp_seq=10 ttl=113 time=7.83 ms
^C
--- google.com ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9015ms
rtt min/avg/max/mdev = 7.634/7.981/9.107/0.434 ms
[mickey@CentOS ~]$

```

- Since we are using the same keypair we can use that private key to authenticate to one or more number of devices.
- Logging to the Ubuntu VM and ping google.com to test for internet connectivity.

```

mickey@Ubuntu: ~
mickey@Mickey's-MacBook-Air          #1
ssh -i .ssh/mickey mickey@20.150.146.3
Welcome to Ubuntu 20.04.5 LTS (GNU/Linux 5.15.0-1019-azure x86_64)

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

System information as of Sat Sep 17 22:38:49 UTC 2022

System load: 0.04           Processes:      103
Usage of /: 5.0% of 28.89GB  Users logged in:   0
Memory usage: 30%           IPv4 address for eth0: 10.1.0.5
Swap usage: 0%

0 updates can be applied immediately.

The list of available updates is more than a week old.
To check for new updates run: sudo apt update
New release '22.04.1 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Last login: Sat Sep 17 22:38:11 2022 from 23.105.134.162
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

mickey@Ubuntu:~$ ping google.com
PING google.com (142.251.40.46) 56(84) bytes of data.
64 bytes from lax17s55-in-f14.1e100.net (142.251.40.46): icmp_seq=1 ttl=54 time=7.84 ms
64 bytes from lax17s55-in-f14.1e100.net (142.251.40.46): icmp_seq=2 ttl=54 time=8.16 ms
64 bytes from lax17s55-in-f14.1e100.net (142.251.40.46): icmp_seq=3 ttl=54 time=8.04 ms
64 bytes from lax17s55-in-f14.1e100.net (142.251.40.46): icmp_seq=4 ttl=54 time=8.37 ms
64 bytes from lax17s55-in-f14.1e100.net (142.251.40.46): icmp_seq=5 ttl=54 time=8.36 ms
64 bytes from lax17s55-in-f14.1e100.net (142.251.40.46): icmp_seq=6 ttl=54 time=8.04 ms
64 bytes from lax17s55-in-f14.1e100.net (142.251.40.46): icmp_seq=7 ttl=54 time=8.36 ms
64 bytes from lax17s55-in-f14.1e100.net (142.251.40.46): icmp_seq=8 ttl=54 time=8.22 ms
64 bytes from lax17s55-in-f14.1e100.net (142.251.40.46): icmp_seq=9 ttl=54 time=8.31 ms
64 bytes from lax17s55-in-f14.1e100.net (142.251.40.46): icmp_seq=10 ttl=54 time=8.14 ms
64 bytes from lax17s55-in-f14.1e100.net (142.251.40.46): icmp_seq=11 ttl=54 time=8.28 ms
64 bytes from lax17s55-in-f14.1e100.net (142.251.40.46): icmp_seq=12 ttl=54 time=8.32 ms
^C
--- google.com ping statistics ---
12 packets transmitted, 12 received, 0% packet loss, time 11014ms
rtt min/avg/max/mdev = 7.841/8.201/8.374/0.158 ms
mickey@Ubuntu:~$ 

```

- After successful login, I can send the Assignment file - `serverSetup.pdf` to both the servers using SCP as shown below.

```

mickey@Mickey's-Macbook-Air ~ %1 | mickey@Ubuntu: ~ (ssh) %2 | -zsh %3
scp -i ~/.ssh/mickey ServerSetup.pdf mickey@20.150.146.3:/home/mickey
100% 68KB 37.8KB/s 00:01 1 x 8s ✘
mickey@Ubuntu:~% ls -al
total 100
drwxr-xr-x 4 mickey mickey 4096 Sep 17 22:44 .
drwxr-xr-x 3 root root 4096 Sep 17 22:27 ..
-rw-r--r-- 1 mickey mickey 220 Feb 25 2020 .bash_logout
-rw-r--r-- 1 mickey mickey 3771 Feb 25 2020 .bashrc
-rwx----- 2 mickey mickey 4096 Sep 17 22:38 .cache
-rw-r--r-- 1 mickey mickey 807 Feb 25 2020 .profile
-rw-r--r-- 1 mickey mickey 70135 Sep 17 22:44 ServerSetup.pdf
drwx----- 2 mickey mickey 4096 Sep 17 22:27 .ssh
mickey@Ubuntu:~%

```

- The file transfer (ServerSetup.pdf) to both the VMs are successful as shown.

```

mickey@Mickey's-Macbook-Air ~ %1 | mickey@Ubuntu: ~ (ssh) %2 | -zsh %3
scp -i ~/.ssh/mickey ServerSetup.pdf mickey@20.150.146.3:/home/mickey
100% 68KB 37.8KB/s 00:01 1 x 8s ✘
scp -i ~/.ssh/mickey ServerSetup.pdf mickey@20.168.23.139:/home/mickey
100% 68KB 10.7KB/s 00:06 14s ✘
mickey@Ubuntu:~% ls -al
total 84
drwx-----. 5 mickey mickey 126 Sep 17 22:45 .
drwxr-xr-x. 3 root root 20 Sep 17 22:24 ..
-rw-r--r--. 1 mickey mickey 18 Nov 24 2021 .bash_logout
-rw-r--r--. 1 mickey mickey 193 Nov 24 2021 .bash_profile
-rw-r--r--. 1 mickey mickey 231 Nov 24 2021 .bashrc
drwxrwxr-x. 3 mickey mickey 18 Sep 17 22:35 .cache
drwxrwxr-x. 3 mickey mickey 18 Sep 17 22:35 .config
-rw-r--r--. 1 mickey mickey 70135 Sep 17 22:45 ServerSetup.pdf
drwx----- 2 mickey mickey 29 Sep 17 22:24 .ssh
[mickey@CentOS ~]%

```

References:

- <https://docs.github.com/en/authentication/connecting-to-github-with-ssh/generating-a-new-ssh-key-and-adding-it-to-the-ssh-agent>
- <https://learn.microsoft.com/en-us/azure/virtual-machines/linux/quick-create-portal>
- <https://linuxize.com/post/how-to-use-scp-command-to-securely-transfer-files/>
- <https://linux.die.net/man/1/ssh>