

IN730 Special Topic - Network Automation

Lab1 - Setting up Ansible (Cloud Version)

The purpose of this lab is to get your cloud environment setup and working so that it can be expanded upon further in future labs.

In order to achieve this the following will be covered in this lab

- Create an Azure resource group to store the project
- Create an Azure network inside a resource group
- Create a Windows virtual machine in Azure to use as the GNS3 client
- Create a Linux virtual machine in Azure to use as the GNS3 server as well as the Ansible server
- Download and setup GNS3 on the Windows machine
- Configure a GNS3 router template
- Configure a basic ospf network in GNS3
- Connect GNS3 network to your Linux Server
- Download and configure Ansible on your Linux Server
- Create a Ansible playbook
- Deploy your Ansible playbook against your GNS3 network

Disclaimer

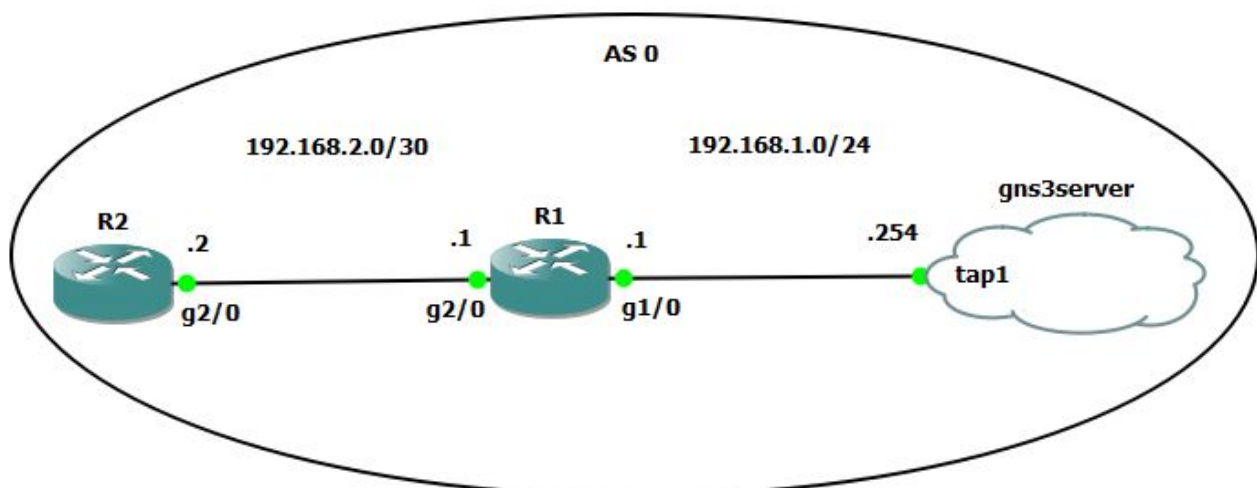
VIM is the text editor used in the following lab

The GNS3 version used at the creation of this lab was GNS3 2.2.12

Requirements

- Azure Subscription
- Terminal Emulator

Topology



Azure

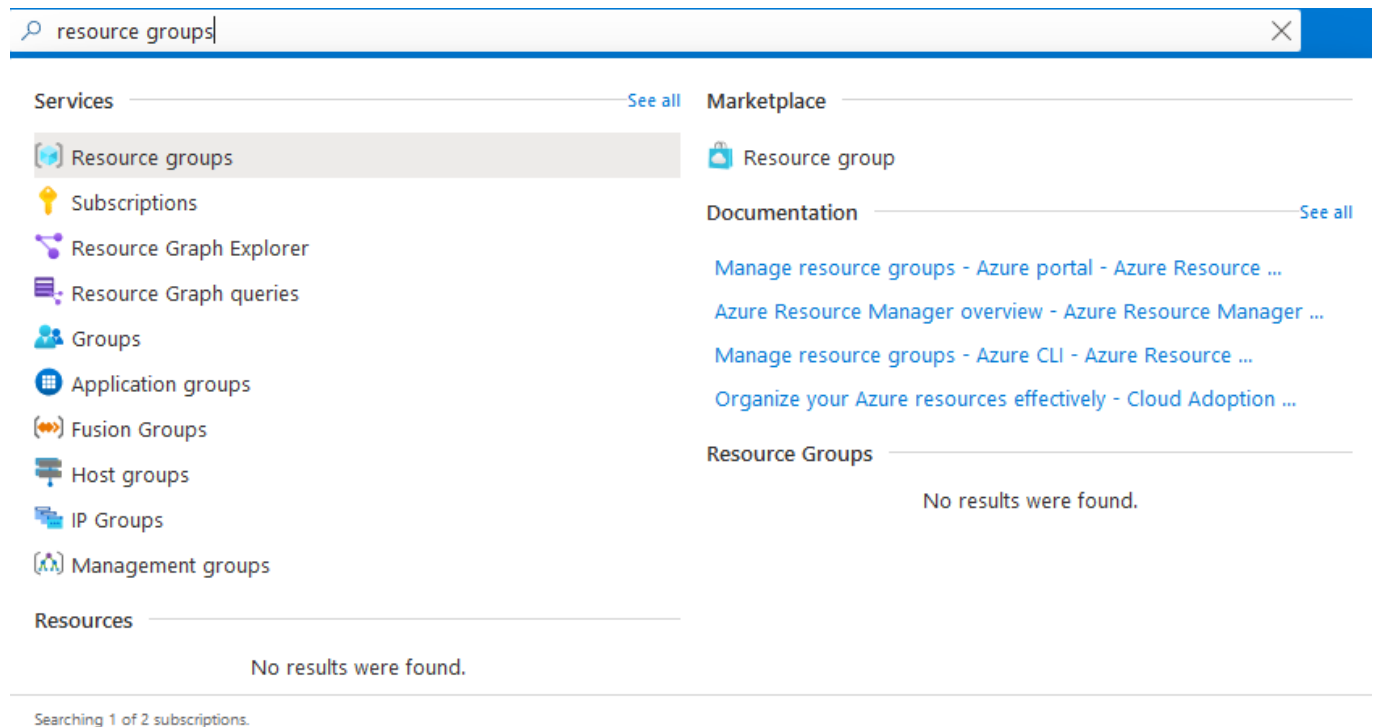
Azure portal <https://portal.azure.com/> and sign in

Lets go to our azure home <https://portal.azure.com/#home>

Resource Group

Let's create a resource group that we can use for this project

Type "resource groups" in the search bar and click on the resource groups under services



This will take you to your resource group page and display any existing resource groups that you have access to as well as allow you to create new ones

Now click add to make a new resource group

[Home](#) >

Resource groups

Otago Polytechnic


[+ Add](#) [Manage view](#) [Refresh](#) [Export to CSV](#) [Open query](#) [Assign tags](#) [Feedback](#)

Here you can name the resource group

Lets call it "ansible" for now

Create a resource group

Basics • Tags Review + create

Resource group - A container that holds related resources for an Azure solution. The resource group can include all the resources for the solution, or only those resources that you want to manage as a group. You decide how you want to allocate resources to resource groups based on what makes the most sense for your organization. [Learn more](#) 

Project details

Subscription * ⓘ

Azure School of ICT

Resource group * ⓘ

✖ Enter resource group name

Resource details

Region * ⓘ

(US) East US

You can also select the region you want your resource group in, unless you require it to be in a specific region in order to do things it is instead best to choose a region that is the closest to you

Lets select Australia East from the drop down

Now lets create our resource group

Click the review + create and confirm the creation

Network

we now need to create a virtual network that will be used *REWORD*

Go to your ansible resource group and click the add button

Go to the networking tab and select virtual network

Azure Marketplace [See all](#)

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(preview)
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Netgate pfSense® Firewall/VPN/Router

Set the name for your virtual network to ansible

Set the region for your virtual network to Australia East

Name - ansible
Region - Australia East

Instance details

Name *

Region *

Go to the IP address tab

Basics IP Addresses Security Tags Review + create

Under the ipv4 address we change it from the 10.X.X.X/16 range it gives us to a 192.168.0.0/16


IPv4 address space

192.168.0.0/16



Now we just need to create a subnet within our address range

Click the add subnet button

 Add subnet

Name this subnet ansible

Give this subnet an address range of 192.168.0.0/24

Add subnet



Subnet name *

ansible



Subnet address range * ⓘ

192.168.0.0/24



192.168.0.0 - 192.168.0.255 (251 + 5 Azure reserved addresses)



Add IPv6 address space ⓘ

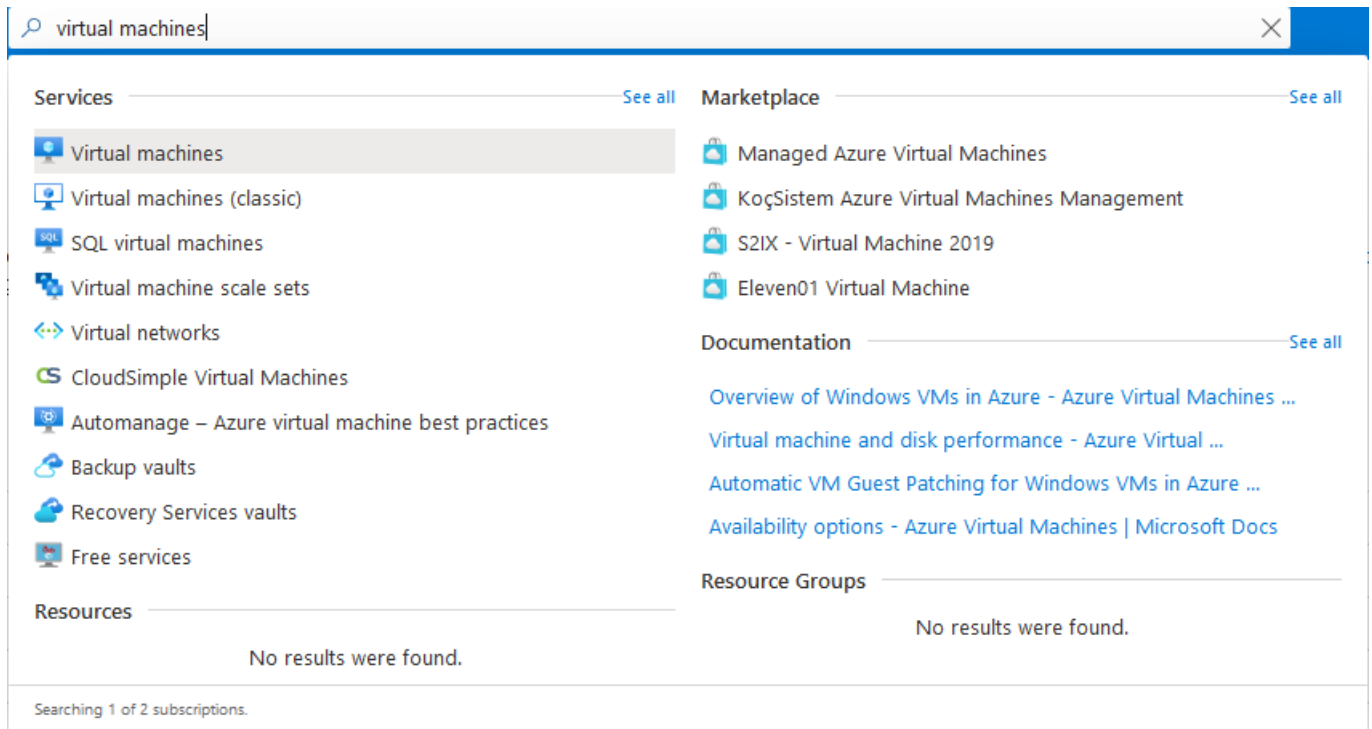
Click the review + create and double check that it is all correct

If everything is correct click the create button

VM 1 - gns3client

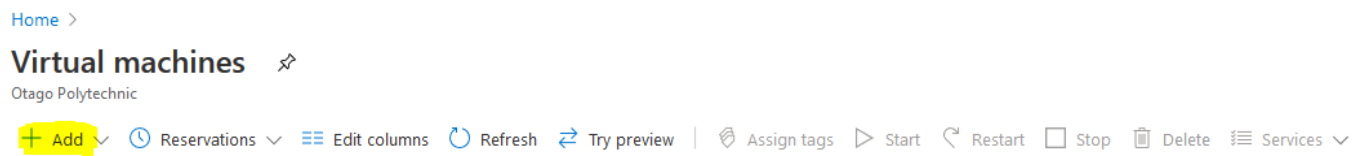
We will now create the first of 2 VM's that will be used for this lab

Type "virtual machines" in the search bar and click on the Virtual machines under services

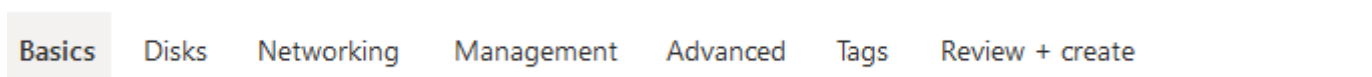


This will take you to your virtual machines page and display any existing virtual machines that you have access to as well as allow you to create new ones

Now click add to make a new virtual machine



Because the free trial has a maximum amount of vcpus that you can have allocated per region we need to make sure we divided them correctly between the ansible/gns3 server and the gns3client machine



Basics

```
Resource group - ansible
Virtual machine name - gns3client
Region - (Asia Pacific) Australia East
Image - Windows 10 Pro
Azure Spot Instance - default
Size - Standard_B2s
Username - gns3client
Password - gns3clientP@ssw0rd
Confirm Password - gns3clientP@ssw0rd
Public inbound ports - default
Select inbound ports - default
Licensing - check
```

Disks

Leave as default

Networking

Virtual network - Ansible
subnet - Ansible (192.168.0.0/24)
public ip - default
NIC network security group - none
Load balancing - default

Management

leave as defaults

Advanced

leave as defaults

Tags

leave as defaults

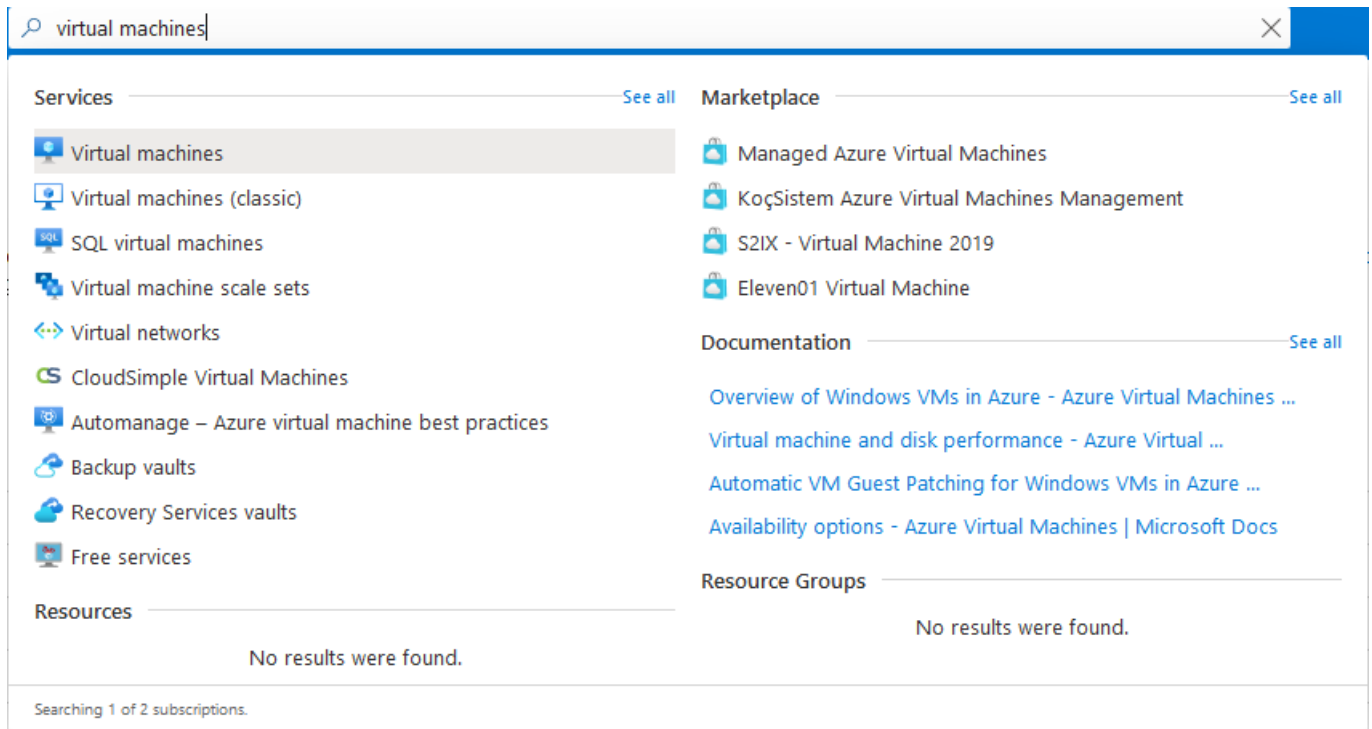
Review + create

check over and make sure you have the correct options set

VM 2 - gns3server / Ansible

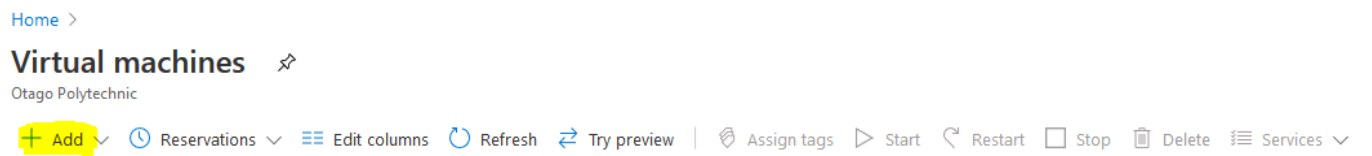
We will now create the second of the 2 VM's that will be used for this lab

Type "virtual machines" in the search bar and click on the Virtual machines under services

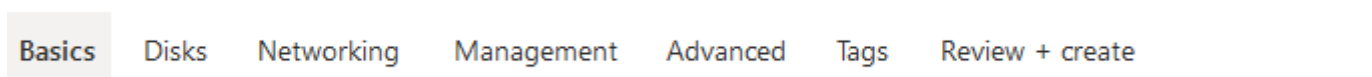


This will take you to your virtual machines page and display any existing virtual machines that you have access to as well as allow you to create new ones

Now click add to make a new virtual machine



Because the free trial has a maximum amount of vcpus that you can have allocated per region we need to make sure we divided them correctly between the ansible/gns3 server and the gns3client machine



Basics

```
Virtual machine name - gns3server
Resource Group - ansible
Region - (Asia Pacific) Australia East
Image - Ubuntu Server 18.04 LTS
Azure Spot Instance - default
Size - Standard_E2s_v3
Authentication type - Password
Username - gns3server
Password - gns3server@ssw0rd
Confirm Password - gns3server@ssw0rd
Public inbound ports - default
Select inbound ports - default
```


Disks

Leave as defaults

Networking

Virtual network - Ansible
subnet - Ansible (192.168.0.0/24)
public ip - default
NIC network security group - none
Load balancing - default

Management

Leave as defaults

Advanced

Leave as defaults

Tags

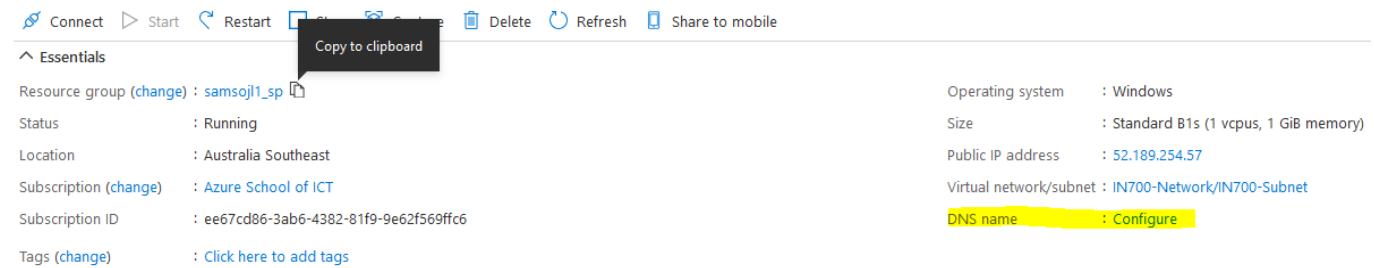
Leave as defaults

Review + create

Check over and make sure you have the correct options set

After creating our gns3server VM we will create and apply a DNS name to it so that it makes connecting to it easier

Go to your Ansible resource group and click on your gns3server VM



The screenshot shows the Azure portal interface for a virtual machine named 'gns3server'. At the top, there are action buttons: Connect, Start, Restart, Stop, Delete, Refresh, and Share to mobile. Below these is the 'Essentials' section. On the left, it lists 'Resource group (change) : samsoj1_sp', 'Status : Running', 'Location : Australia Southeast', 'Subscription (change) : Azure School of ICT', 'Subscription ID : ee67cd86-3ab6-4382-81f9-9e62f569ffc6', and 'Tags (change) : Click here to add tags'. On the right, it lists 'Operating system : Windows', 'Size : Standard B1s (1 vcpu, 1 GiB memory)', 'Public IP address : 52.189.254.57', 'Virtual network/subnet : IN700-Network/IN700-Subnet', and 'DNS name : Configure'. A 'Copy to clipboard' tooltip is visible over the 'Restart' button.

Under "DNS name label (optional)"



The screenshot shows the 'DNS name label (optional)' configuration form. At the top, there are 'Save' and 'Discard' buttons. Below them is the 'Assignment' section with 'Dynamic' selected and 'Static' as an option. The 'IP address' is '52.189.254.57'. There is a slider for 'Idle timeout (minutes)' set to 4. The 'DNS name label (optional)' field is empty, and the suffix '.australiasoutheast.cloudapp.azure.com' is shown at the bottom right.

Set the DNS name label to

gns3server

And save it

Your DNS name label will be suffixed with ".australiaeast.cloudapp.azure.com" i.e.
gns3server.australiaeast.cloudapp.azure.com

- If there are multiple people working on this you may need to tweak your name by appending a number onto the end i.e. gns3server1 etc. if you had to do this note the change for future steps

Alternatively you could also instead configure a static ip and use that in place of a DNS

Configure gns3server VM

The following occurs on our gns3server VM

After connecting to our gns3server we need to make sure that we can download the latest software

In order to do this run the following command

```
sudo apt-get update -y
```

Now we need to install the GNS3 server onto our VM so that our GNS3 client can connect to it

Run the following commands to install the GNS3 server

```
cd /tmp
curl https://raw.githubusercontent.com/GNS3/gns3-server/master/scripts/remote-
```

```
install.sh > gns3-remote-install.sh
sudo bash gns3-remote-install.sh --with-openvpn --with-iou --with-i386-repository
```

Now we need to edit our server settings so that the gns3client can connect

Run the following command

```
ip a
```

and note the ip address of eth0, we will use this in our gns3_server.conf file

```
gns3server@gns3vm:/etc/ansible$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group default qlen 1000
    link/ether 00:22:48:14:a0:82 brd ff:ff:ff:ff:ff:ff
    inet 10.10.10.5/24 brd 10.10.10.255 scope global eth0
        valid_lft forever preferred_lft forever
    inet6 fe80::222:48ff:fe14:a082/64 scope link
        valid_lft forever preferred_lft forever
```

Now let's edit our gns3_server.conf file

```
sudo vim /etc/gns3/gns3_server.conf
```

- Change the "host = " ip to that of your eth0
- Change the "port = " to 3081

Your gns3_server.conf file should look like the one in the image below

```
[Server]
host = 10.10.10.5
port = 3081
images_path = /opt/gns3/images
projects_path = /opt/gns3/projects
report_errors = True

[Qemu]
enable_kvm = True
require_kvm = True
```

After making these changes we now need to restart gns3
use the following command

```
sudo systemctl restart gns3.service
```

Now we will create a tap interface so that we can connect our virtual network that we will create in gns3 to our physical network so that it can communicate with outside devices

First we will need to download uml-utilities which will allow us to create TAP interfaces

```
sudo apt-get install uml-utilities -y
```

Now that we have uml-utilities we can go ahead and create a TAP interface

- Do note that the TAP interface and the ip associated with it are not persistent doing it the following way so you will have to run the following commands each time you shutdown or restart your VM

```
sudo tuncctl -t tap1  
sudo ifconfig tap1 192.168.1.254 netmask 255.255.255.0 up
```

To allow connection to the outside we need to configure some iptable rules

```
sudo iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE  
sudo iptables -A FORWARD -i tap1 -j ACCEPT  
sudo iptables -A INPUT -i tap1 -j ACCEPT  
sudo iptables -A FORWARD -i eth0 -j ACCEPT  
sudo iptables -A INPUT -i eth0 -j ACCEPT
```

Linux Routing

We will need to configure routes so that traffic knows where to go to get to the GNS3 routers

```
sudo ip route add 192.168.1.0/24 via 192.168.1.254 dev tap1  
sudo ip route add 192.168.2.0/30 via 192.168.1.254 dev tap1
```

Install and Setup GNS3

The following occurs on our gns3client VM

In order to download GNS3 you need to sign up to their website

- Sign up to GNS3 <https://www.gns3.com/>
- Download the windows version of GNS3 <https://www.gns3.com/software/download>

After downloading GNS3 onto our windows VM we now need to configure it so that it connects to our GNS3 Server in order to do this we need to start GNS3

- Go to the Edit tab and select preferences
- Go to the Server tab

- Change the host to gns3server.australiaeast.cloudapp.azure.com
- Set port 3081

Host:	<input type="text" value="gns3server.australiasoutheast.cloudapp.azure.com"/>
Port:	<input type="text" value="3081 TCP"/>
Auth:	<input type="checkbox"/>
User:	<input type="text" value="admin"/>
Password:	<input type="password" value="....."/>

Leave Auth unchecked

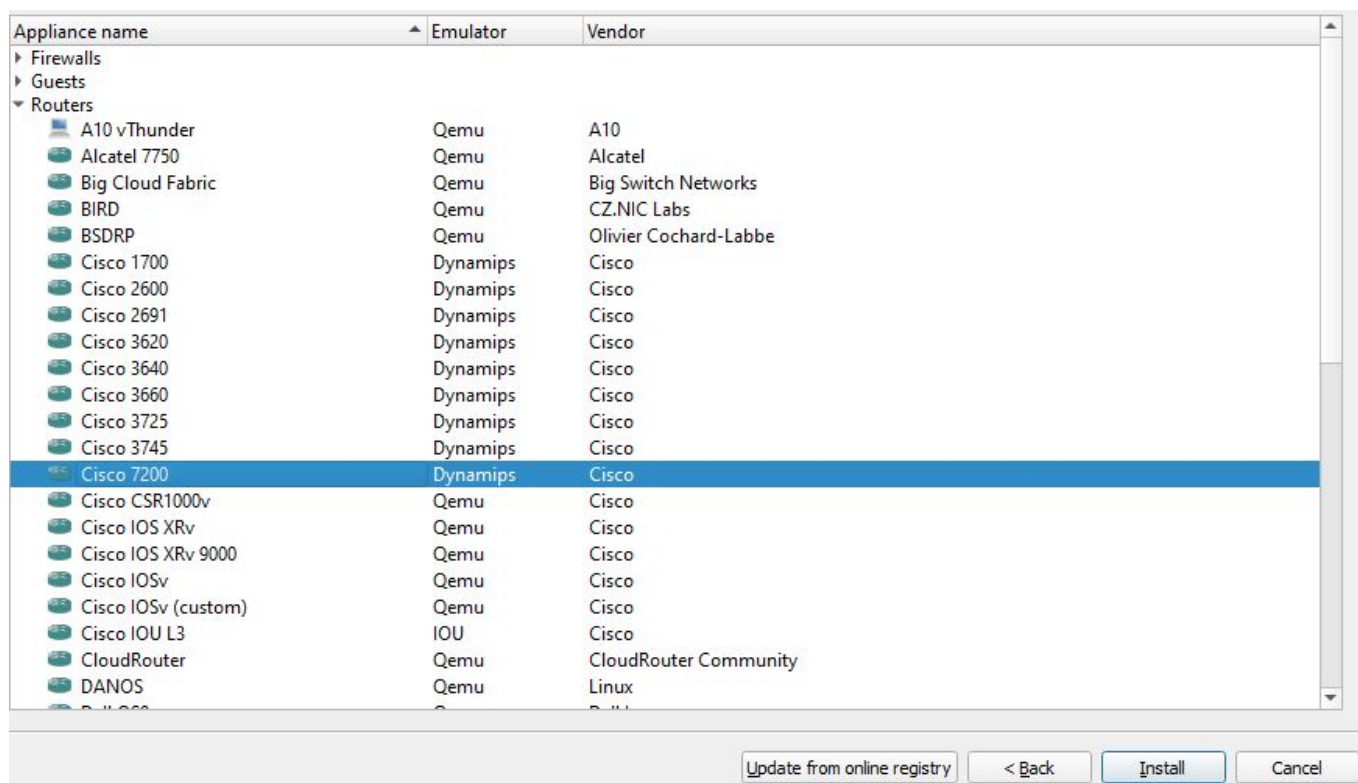
Router Template Configuration

We need to download and configure a router template that we will use within GNS3, GNS3 by default does not come with any routers that you can use.

- Download the image for the cisco 7200 router here <https://github.com/samsojl1/Otago-Polytechnic/raw/master/Special-Topic/c7200/c7200-adviservicesk9-mz.122-33.SRC2.extracted.bin>

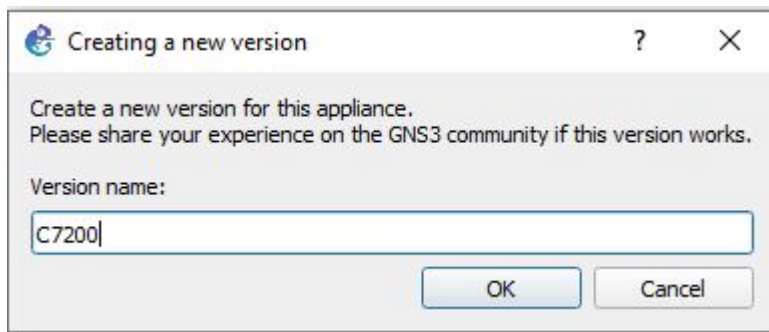
In order to create a template using the image we just downloaded we need to do the following

- In GNS3 go to File > New Template
- Install an appliance from the GNS3 server
- Then click the dropdown for the routers section and select Cisco 7200 then click install



- Install the appliance on your local computer

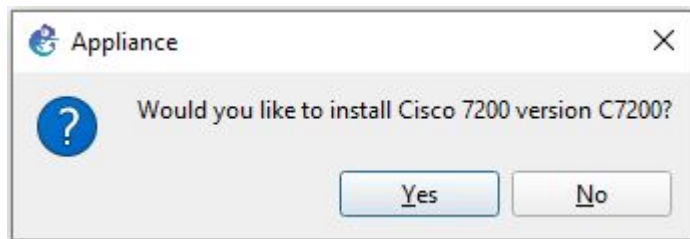
- Select Create a new version
- Name it "C7200" and select ok



- You should now see your router but with its files missing

▼ 7200 version C7200	0.0 B	Missing files
c7200-adventerprisek9-mz.C7200.image	0.0 B	Missing

- select your version from the list and click import, locate and select the c7200-advipservicesk9-mz.122-33.SRC2.extracted.bin image you downloaded
- Next
- Accept the install

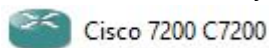


- Finish

If you click on the router icon on the left hand side

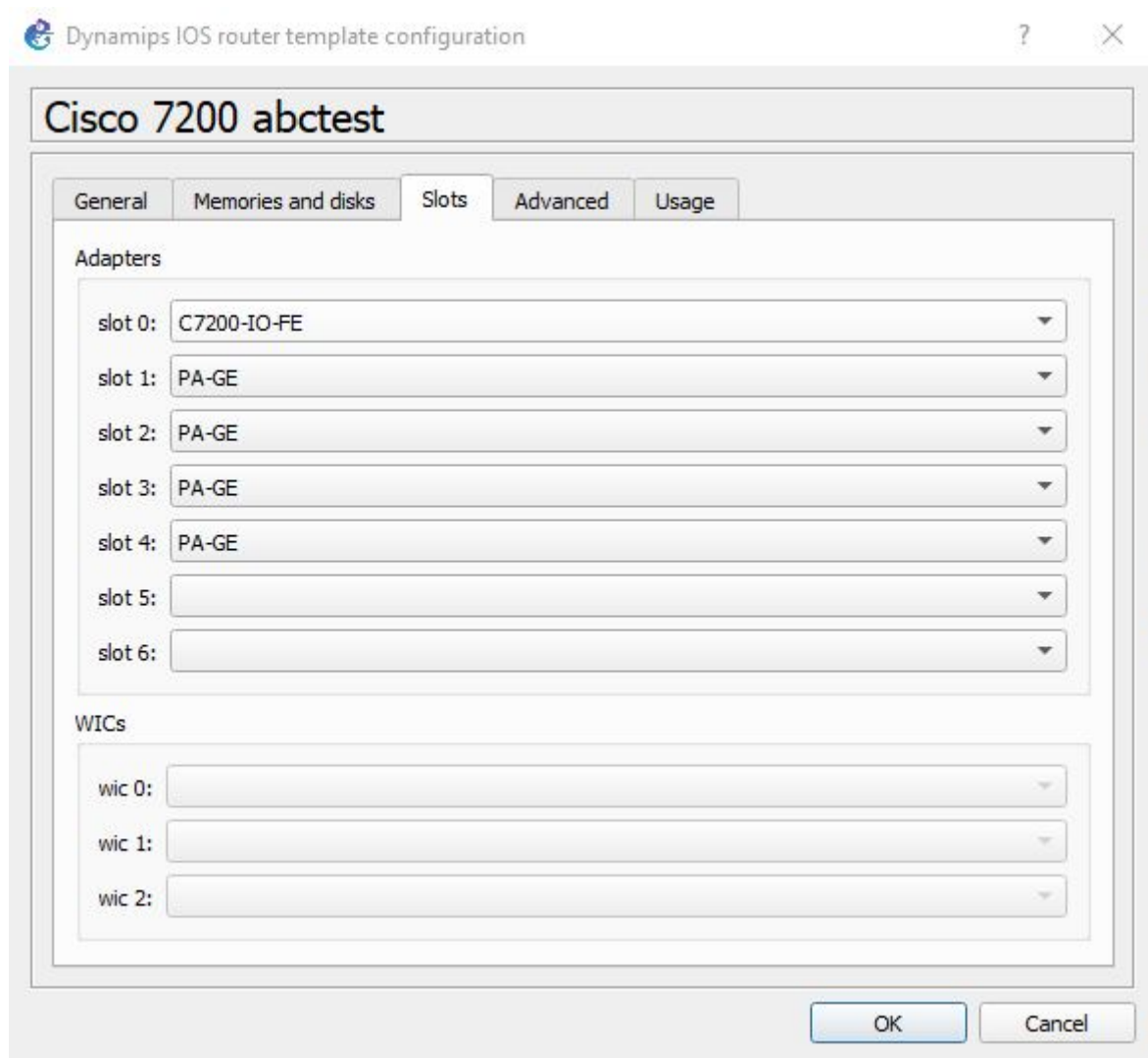


You should now see your router template you installed



We now need to make a few tweaks to our newly created template

- Right click your router template and select the configure template option

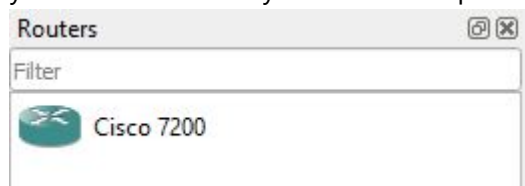


- Go to the "Slots" tab and add "PA-GE" to Adapters slots 1 through 4 this will add gigabyte interfaces to your routers when you create them

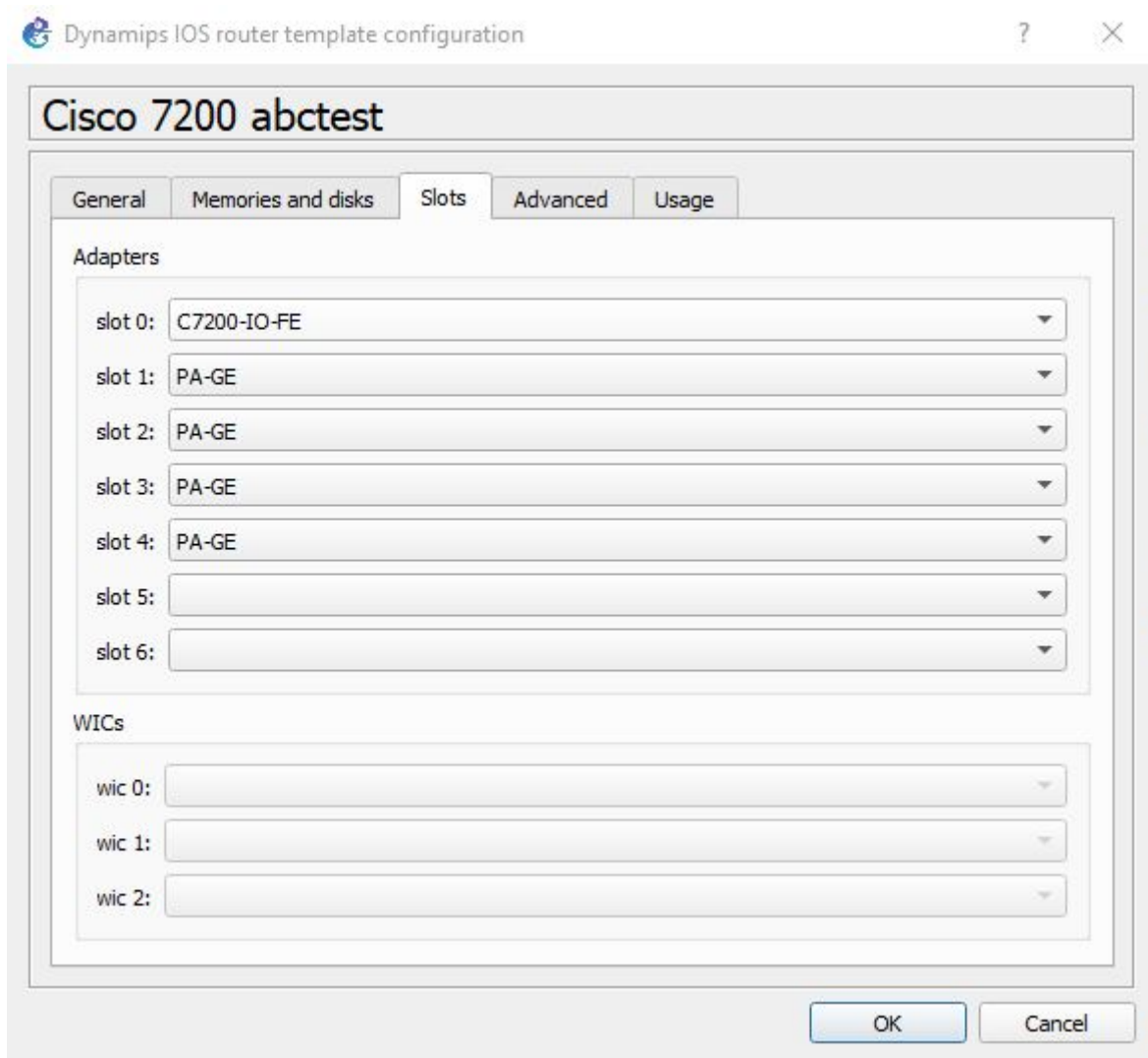
If you click on the router icon on the left-hand side



you should now see your router template you installed

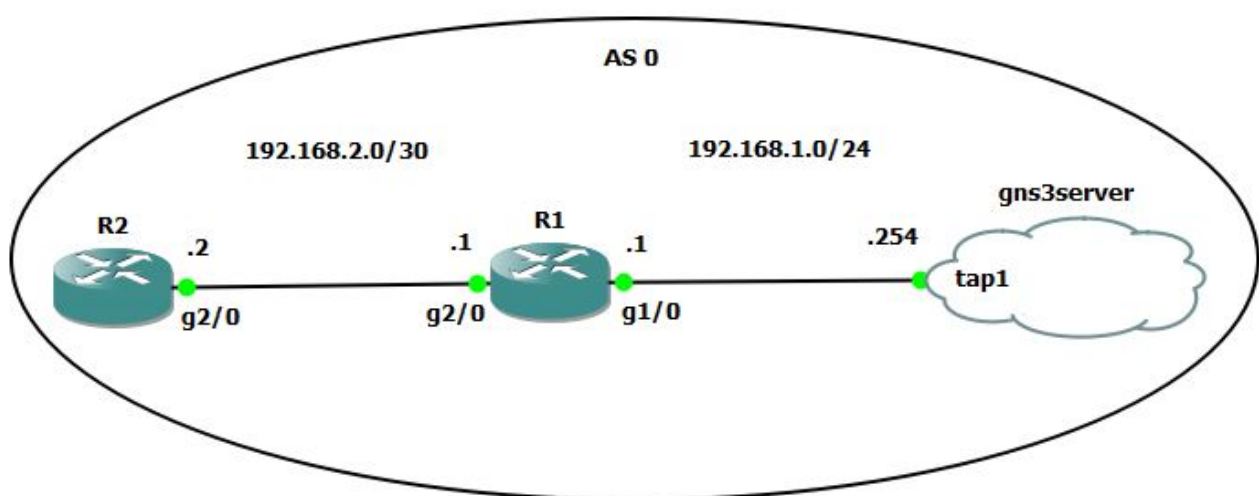


Now we need to configure our newly created router to do this right click on the newly created router and click on the configure template option



From here go to the Slots tab and add "PA-GE" to Adapters slots 1 through 4 this will add 4 gigabyte interfaces to your routers when you spawn them

Configure A Basic Network



Let's create a simple network in GNS3

- Create a new blank project

- Add 2 routers to the project
- Cable these 2 routers together according to the topology above

On R1

```
end
conf t
int g2/0
ip address 192.168.2.1 255.255.255.252
no shut
```

On R2

```
end
conf t
int g2/0
ip address 192.168.2.2 255.255.255.252
no shut
```

Verify that R1 can ping R2 and R2 can ping R1

On R1

```
end
ping 192.168.2.2
```

On R2

```
end
ping 192.168.2.1
```

Now we will add a cloud to our GNS3 project

The cloud allows the routers inside your GNS3 project to communicate with outside devices

Let's add a cloud to connect our virtual routers to our physical network

- From the browse end devices tab



- Add the cloud to your project



After adding the cloud, it is now time to configure it

- Click on the cloud and go to the "TAP Interfaces" tab
- Check that tap1 has been added
- Cable R1 to the cloud according to the topology

We will now configure R1's interface that connects with the TAP interface with an ip address

On R1

```
end
conf t
int g1/0
ip address 192.168.1.1 255.255.255.0
no shut
```

Confirm that R1 can ping the tap interface

```
end
ping 192.168.1.254
```

Confirm that the gns3server can ping R1

Configure OSPF and a static default route then redistribute that route into ospf

On R1

```
end
conf t
ip route 0.0.0.0 0.0.0.0 192.168.1.254
router ospf 1
router-id 1.1.1.1
network 192.168.1.0 0.0.0.255 area 0
network 192.168.2.0 0.0.0.3 area 0
default-information originate
```

On R2

```
end
conf t
router ospf 1
router-id 2.2.2.2
network 192.168.2.0 0.0.0.3 area 0
```

Confirm that R2 can ping tap1

```
end
ping 192.168.1.254
```

Confirm that the gns3server can ping R2

Because ansible is agentless and uses SSH to deploy playbooks, you will need to configure and enable SSH onto your GNS3 Routers, a basic configuration has been provided

```
end
conf t
ip domain-name ansible.com
crypto key generate rsa
1024
ip ssh version 2
username admin privilege 15 password 0 admin
line vty 0 4
login local
transport input ssh
exit
```

Ansible Installation And Setup

The following occurs on our gns3server VM

All that is left for us to do now is to get ansible setup and then we can run it against our gns3 topology

We now need to download and install ansible onto our server we can achieve this by using the following

```
sudo apt-get install ansible -y
```

Lets go to the ansible directory where the ansible.cfg and hosts file are stored, from this directory you can create and deploy your ansible playbooks as well as modify your host files

```
cd /etc/ansible/
```

We will disable host_key_checking in our ansible configuration file so that we don't need to ssh onto our gns3 routers first before we can deploy playbooks while this does save time it is a security risk, in order to do this we need to open our ansible configuration file in our text editor

```
sudo vim /etc/ansible/ansible.cfg
```

Go to line 62 and uncomment the following

```
#host_key_checking = False
```

Then save the file

Inside the hosts file you can define your network devices and assign them to groups an example is provided inside the file by ansible

```
# This is the default ansible 'hosts' file.
#
# It should live in /etc/ansible/hosts
#
# - Comments begin with the '#' character
# - Blank lines are ignored
# - Groups of hosts are delimited by [header] elements
# - You can enter hostnames or ip addresses
# - A hostname/ip can be a member of multiple groups
#
# Ex 1: Ungrouped hosts, specify before any group headers.
#green.example.com
#blue.example.com
#192.168.100.1
#192.168.100.10
#
# Ex 2: A collection of hosts belonging to the 'webserver' group
#[webserver]
#alpha.example.org
#beta.example.org
#192.168.1.100
#192.168.1.110
#
# If you have multiple hosts following a pattern you can specify
# them like this:
#www[001:006].example.com
#
# Ex 3: A collection of database servers in the 'dbserver' group
#[dbserver]
#
#db01.intranet.mydomain.net
#db02.intranet.mydomain.net
#10.25.1.56
#10.25.1.57
#
# Here's another example of host ranges, this time there are no
# leading 0s:
#db-[99:101]-node.example.com
[network]
192.168.1.1 ansible_network_os=ios ansible_ssh_user=admin ansible_ssh_pass=admin
192.168.2.2 ansible_network_os=ios ansible_ssh_user=admin ansible_ssh_pass=admin
```

In the hosts file you can define your environments in a few different ways you can have them ungroup or you can put them into groups, having them in groups allows you to deploy your playbooks to a set of devices which can be helpful to make sure they are all configured the same.

In the /etc/ansible/hosts file we will add the ip addresses of the devices we wish to use ansible against

```
[network]
R2 ansible_host=192.168.1.1 ansible_network_os=ios ansible_ssh_user=admin
ansible_ssh_pass=admin
R1 ansible_host=192.168.2.2 ansible_network_os=ios ansible_ssh_user=admin
ansible_ssh_pass=admin
```

- The [network] defines the name of the group this can be called whatever you wish
- R2 and R1 are the names of the hosts
- ansible_host=X.X.X.X is the ip of the host
- ansible_network_os=ios defines the network platform that the host is using
- ansible_ssh_user=admin the user account that ansible uses to connect with in this example its admin because that is what we created earlier when we setup the router configuration in gns3
- ansible_ssh_pass=admin the password of the user account that ansible is using to connect with

Let's run an ad-hoc command against the hosts we just added

The following will run the command against any host in our hosts file

```
ansible all -c network_cli -m ping
```

The following will run the command against any host in our network group

```
ansible network -c network_cli -m ping
```

Let's create a easy playbook to test if everything is working correctly ansible can be a bit pedantic with its formatting so here is a

```
sudo vim /etc/ansible/ping.yaml
```

and copy and paste the following

```
---
- name: ping
  hosts: routers
  connection: local
  gather_facts: false
  tasks:
    - ping:
```

Now that we have created our playbook it is time to run it

You can run your ansible playbooks by being located in the directory where its located by using

```
ansible-playbook ping.yaml
```

Or you can provide the path to the playbook

```
ansible-playbook /etc/ansible/ping.yaml
```

After running your playbook, the following output should occur

```
PLAY [ping] *****
TASK [ping] *****
ok: [R1]
ok: [R2]

PLAY RECAP *****
R1                : ok=1    changed=0    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
R2                : ok=1    changed=0    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
```

Congratulations you have now successfully deployed your first ansible playbook

In future labs we will cover more uses for ansible in both a local and cloud environment

Please save your work or make a script to recreate it quickly along as future labs will be built off this

Further reading:

ansible module list can be found here

- https://docs.ansible.com/ansible/latest/modules/modules_by_category.html

ansible playbooks user guide can be found here

- https://docs.ansible.com/ansible/latest/user_guide/playbooks.html