

Lab 4 Azure

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1. Azure Portal

1.1. Preparations

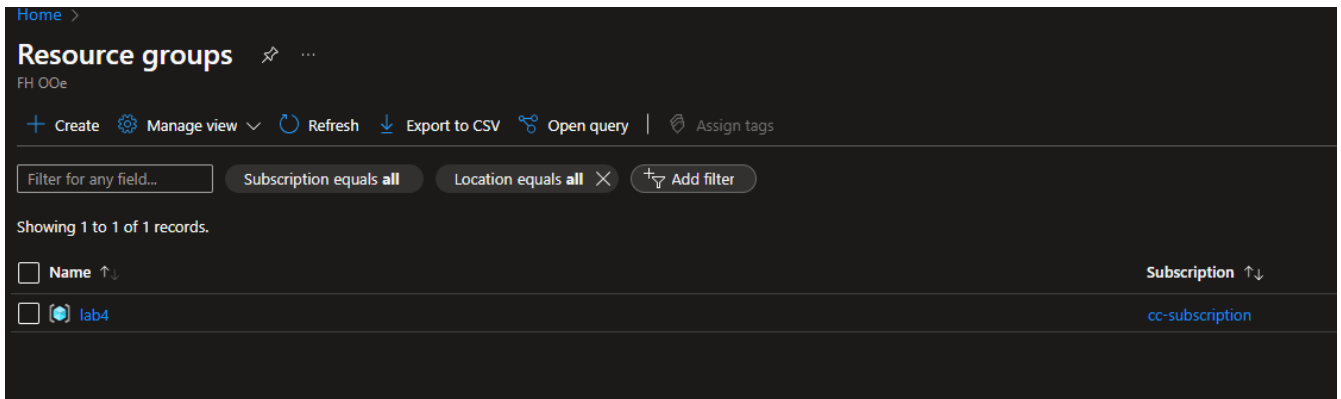


Figure 1. Ressource group for the lab

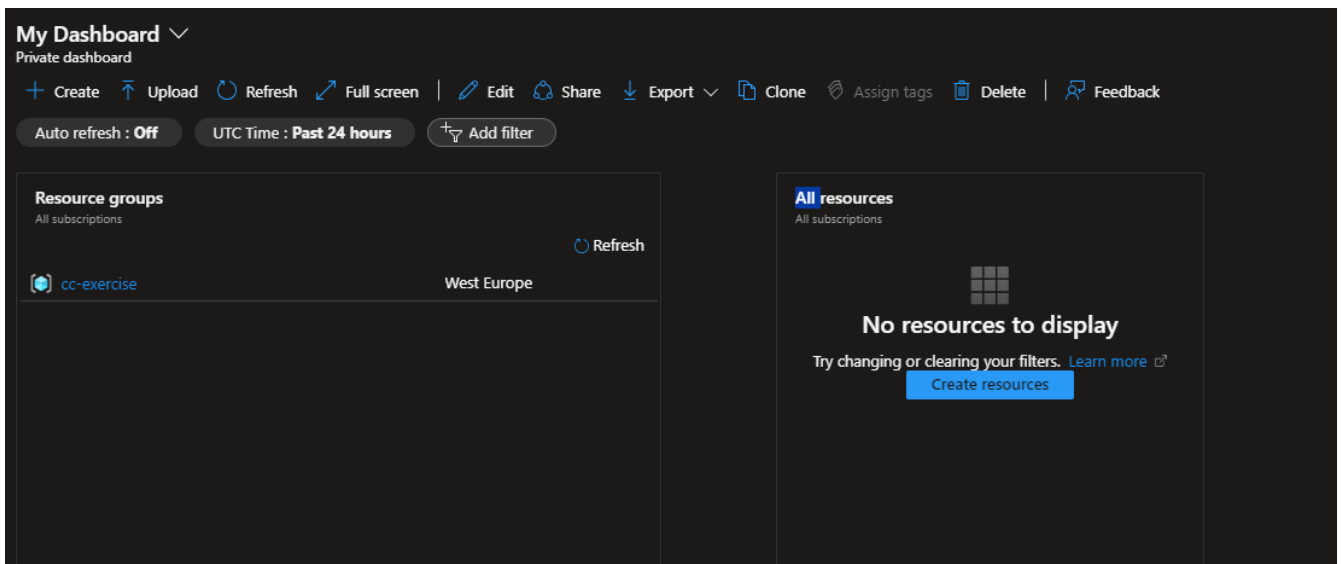


Figure 2. Updated dashboard

AWS vs Azure naming:

- EC2 instances → Virtual Machines
- Security Groups → Network Security Groups
- Volumes → Disks
- Snapshots → Snapshots
- Load Balancers → Load Balancer
- Target Groups → Network Security Group Rules

2. Azure CLI

```
PS C:\Users\Andi> az login
A web browser has been opened at https://login.microsoftonline.com/organizations/oauth2/v2.0/authorize. Please continue
the login in the web browser. If no web browser is available or if the web browser fails to open, use device code flow w
ith 'az login --use-device-code'.
[
  {
    "cloudName": "AzureCloud",
    "homeTenantId": "f88d4b73-6bb2-4b9a-abc7-eb96e5a6407c",
    "id": "cd2c233b-65a0-4ca6-81eb-198c5a8ec217",
    "isDefault": true,
    "managedByTenants": [],
    "name": "Azure for Students Starter",
    "state": "Enabled",
    "tenantId": "f88d4b73-6bb2-4b9a-abc7-eb96e5a6407c",
    "user": {
      "name": "s2210455024@fhooe.at",
      "type": "user"
    }
  }
]
```

Figure 3. Login

3. Azure Resource Manager (ARM) Templates

3.1. Creating an Initial Template

Create a virtual machine

BasicsDisksNetworkingManagementMonitoringAdvancedTagsReview + 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](#)

Project details

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

Subscription *

cc-subscription

Resource group *

lab4

Create new

Instance details

Virtual machine name *

template

Region *

(Asia Pacific) Central India

Availability options

Availability zone

Availability zone *

Zones 1


You can now select multiple zones. Selecting multiple zones will create one VM per zone. [Learn more](#)

Security type

Trusted launch virtual machines

[Configure security features](#)

Image *

 Ubuntu Server 22.04 LTS - x64 Gen2

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

VM architecture

☒ x64 ☐ Arm64

Review + create

< Previous

Next > Disks

Figure 4. Initial template

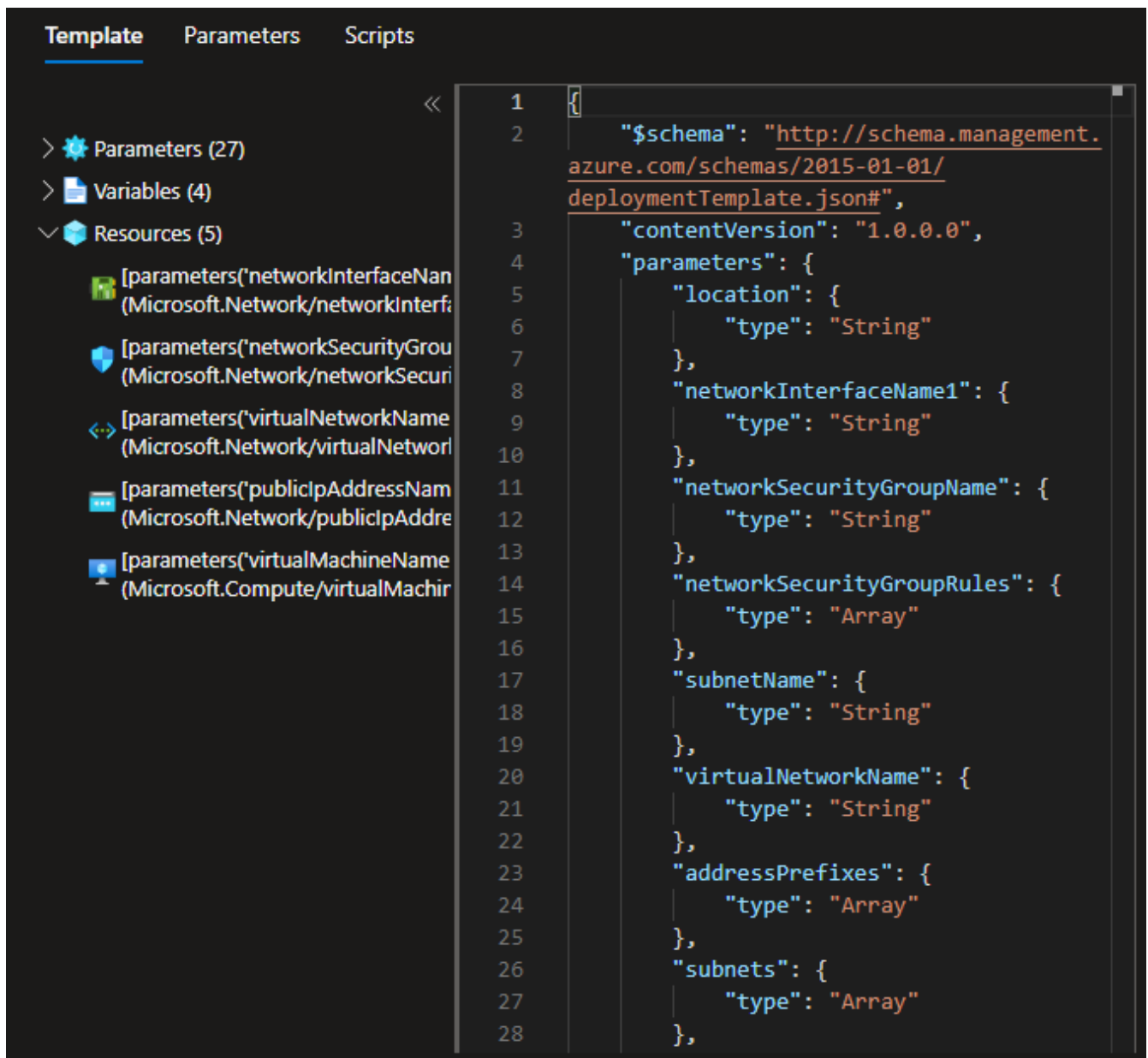


Figure 5. Template view of Azure

3.2. Analyzing an ARM Template

Parameters: Can be used to customize the deployment of the solution

Variables: Are used to simplify the template, eliminate duplication, and make the template easier to read and maintain.

Resources: Contains an array of objects, each representing a resource that you want to deploy with the template.

Outputs: Defines the values that can be returned from the ARM template after deployment. These outputs can be used to retrieve information about deploy resources, such as the the IP address of a VM.

Create a new key with `ssh-keygen -t rsa` and add it to the template.json file.

```

    "value": "azureuser"
  },
  "adminPublicKey": {
    "value": "ssh-rsa
AAAAB3NzaC1yc2EAAAADAQABAAQGDUB9R0CUbo1h8usjPCCnirVOMxbUib3GZVya6k7Jq3sdHFj205k5
qITsy+0wDrIGbgD7NbduXJZqA/5IJa3NuQJTHJ4dF52Zyc0FdqZSm3cHbx9s
+Td40wQDEh6ivNUSvdXJMCSCyAlmc+ipGfyU2Um6kWJjg
+sDCIEQnlaZLFGIshSrXzfQVFxxIfyDxpHTiq0h5EhclItfuUoCvzsEb5mDBEJRlYxm9hiwwjN0T7Ze/
h6jPeRb3NM+ruFmei8uUZqQH/cS26Pv6/KXYDUDce+zMyvRpnYm3GN/3M3vRlcyGvBOYBLcZs2U4lU/
E2fEASuvNzV7BTmb1Pm8uQqhuZO4LaswfuuBGPCJ+R2sFCAWC4zuTUwZMDddpw0y8613IHgfk/
klZSX4la5wFPdYH9J6wIRHvAzn8KheGLyNoSZ3ScGxIY6zEyc/DUuRyohePRV2zaExTv48v5nFckpPkGB
+NtjQZ3+Tqf2hHb8YTkTNSgbzdsVU0iv4ughpnzU= andi@Andi-NB"
  },
  "securityType": {
    "value": "TrustedLaunch"
  }
}

```

Figure 6. Replace public key in template.json

Now in the next step can deploy the template using the azure cli.

3.3. Creating a VM using the CLI

```
az deployment group create -g lab4 --template-file template.json --parameters parameters.json
```

Because we added a public key to the template we can now connect to the vm using ssh without using a password or key file.

Connect to the VM using SSH:

```
ssh azureuser@20.244.34.101
```

```

PS C:\Users\Andi\Documents\Github\fh-mc-cc\e04\vm1_template> ssh azureuser@20.235.247.168

Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 6.2.0-1018-azure x86_64)
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 6.2.0-1018-azure x86_64)

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

System information as of Mon Jan 15 11:35:46 UTC 2024

System load:  0.18701171875   Processes:            107
Usage of /:   5.1% of 28.89GB Users logged in:             0
Memory usage: 32%            IPv4 address for eth0: 10.0.0.4
Swap usage:   0%

```

Figure 7. Running vm deployment

List all vms with name template:

```
az vm list --query "[?name=='template']"
```

```
PS C:\Users\Andi\Documents\Github\fh-mc-cc\e04\vm1_template> az vm list --query "[?name=='template']"
[
  {
    "additionalCapabilities": {
      "hibernationEnabled": false,
      "ultraSsdEnabled": null
    },
    "applicationProfile": null,
    "availabilitySet": null,
    "billingProfile": null,
    "capacityReservation": null,
    "diagnosticsProfile": {
      "bootDiagnostics": {
        "enabled": true,

```

Figure 8. List VMs

List all vms with public ips:

`az network public-ip list`

```
PS C:\Users\Andi\Documents\Github\fh-mc-cc\e04\vm1_template> az network public-ip list
[
  {
    "etag": "W/\"63c89614-bf77-4aaf-92c5-8706fd172275\"",
    "id": "/subscriptions/18126593-4f58-4747-9e90-0fba47e7947e/resourceGroups/lab4/providers/Microsoft.Network/publicIPAddresses/template-ip",
    "idleTimeoutInMinutes": 4,
    "ipAddress": "20.235.247.168",
    "ipConfiguration": {
      "id": "/subscriptions/18126593-4f58-4747-9e90-0fba47e7947e/resourceGroups/lab4/providers/Microsoft.Network/ipConfigurations/ipconfig1",
      "resourceGroup": "lab4"
    },
    "ipTags": [],
    "location": "centralindia",
    "name": "template-ip",
    "provisioningState": "Succeeded",
    "publicIPAddressVersion": "IPv4",

```

Figure 9. VMs with public Ips

Get public ip address:

`az network public-ip show --resource-group lab4 --name template-ip --query ipAddress`

```
PS C:\Users\Andi\Documents\Github\fh-mc-cc\e04\vm1_template> az network public-ip show --resource-group lab4 --name template-ip --query ipAddress
"20.235.247.168"
```

Figure 10. Public ip address

4. Web Server Access

4.1. Installing the Web Server

Install webserver:

```
sudo apt-get install apache2
```

```
azureuser@template:~$ curl localhost:80
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
  <!--
    Modified from the Debian original for Ubuntu
    Last updated: 2022-03-22
    See: https://launchpad.net/bugs/1966004
  -->
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />
    <title>Apache2 Ubuntu Default Page: It works</title>
```

Figure 11. Check installation

4.1.1. Check accessibility

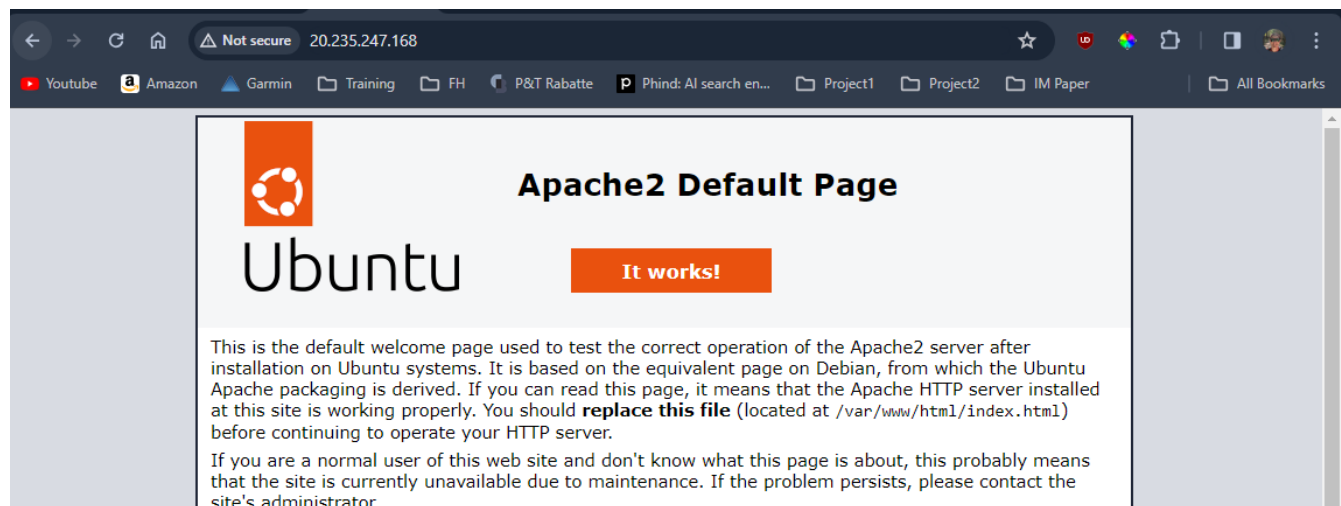


Figure 12. Accessible

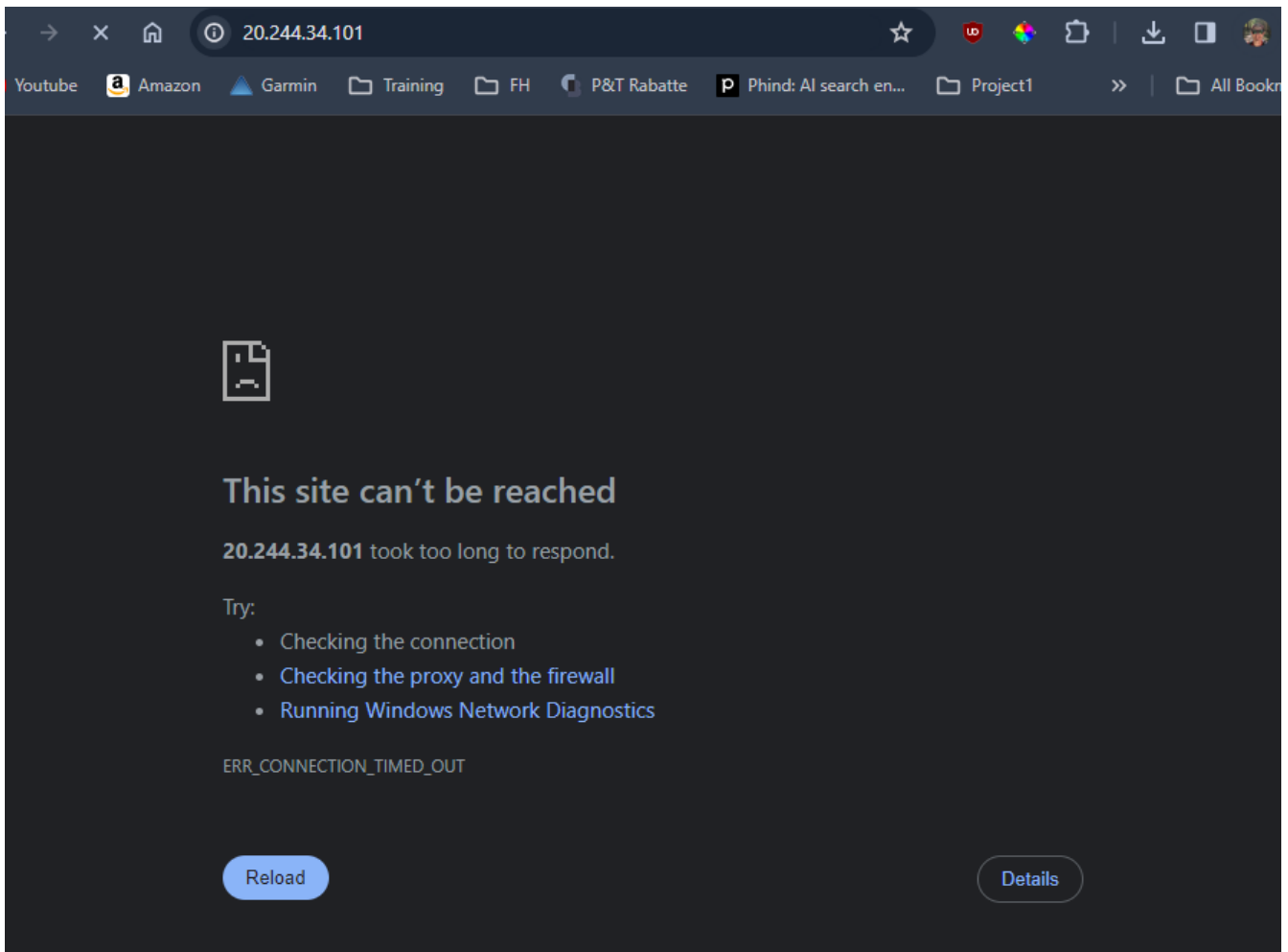


Figure 13. Not accessible

4.1.2. Add NSG rule for Web Server



Figure 14. Network security group name

List the security groups:

```
az network nsg list --query "[?name=='template-nsg']"
```

Add an nsg rule to the group to allow tcp access from port 80:

```
az network nsg rule create --resource-group lab4 --nsg-name template-nsg --name http-rule  
--protocol tcp --priority 100 --source-address-prefix '' --source-port-range '' --destination  
-address-prefix '*' --destination-port-range 80
```

4.1.3. Modifying NSG rules

Remove rule:

```
az network nsg rule delete --resource-group lab4 --nsg-name template-nsg --name http-rule
```

Allow from own ip only:

```
az network nsg rule create --resource-group lab4 --nsg-name template-nsg --name ip-rule  
--protocol tcp --priority 100 --source-address-prefix '77.220.105.192/32' --source-port-range  
' ' --destination-address-prefix ' ' --destination-port-range 80
```

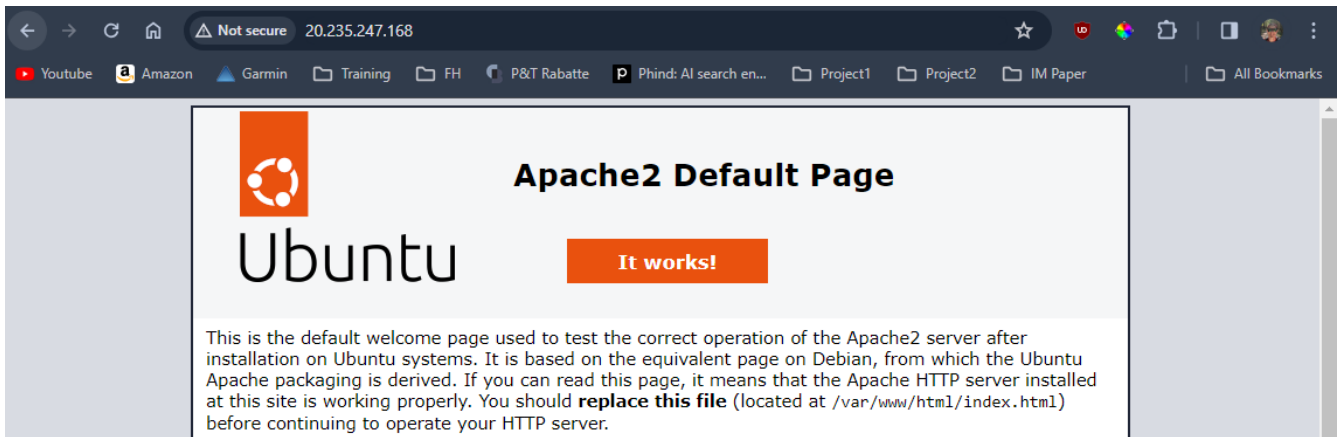


Figure 15. Works again

Remove rule:

```
az network nsg rule delete --resource-group lab4 --nsg-name template-nsg --name ip-rule
```

Allow from subnet:

```
az network nsg rule create --resource-group lab4 --nsg-name template-nsg --name subnet-rule  
--protocol tcp --priority 100 --source-address-prefix '77.220.105.0/32' --source-port-range ' '  
--destination-address-prefix ' ' --destination-port-range 80
```

Selecting a port range:

```
az network nsg rule create --resource-group lab4 --nsg-name template-nsg --name portrange-rule  
--protocol tcp --priority 100 --source-address-prefix ' ' --source-port-range ' ' --destination  
-address-prefix '*' --destination-port-range 80-443
```

5. Creating more VMs using ARM

```
    "hibernationEnabled": {  
      "value": false  
    },  
    "adminUsername": {  
      "value": "azureuser"  
    },  
    "adminPassword": {
```

Figure 16. Set password instead of public key

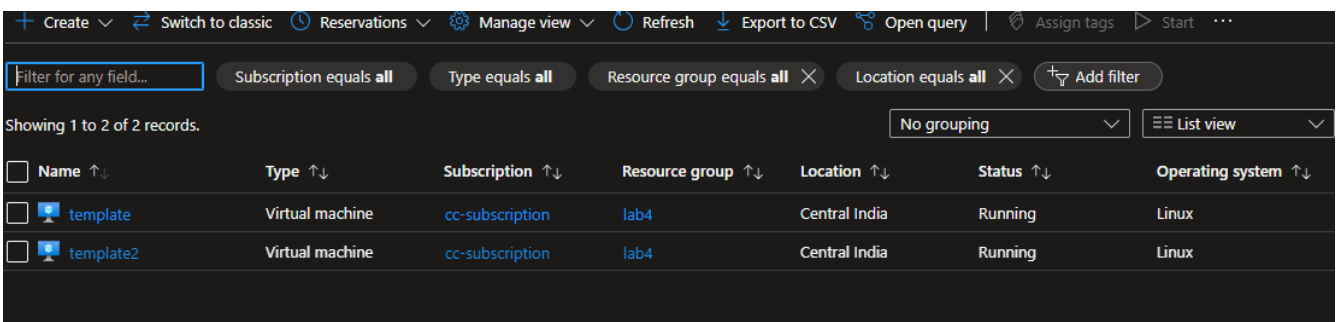
```
    },  
    "additionalCapabilities": {  
      "hibernationEnabled": false  
    },  
    "osProfile": {  
      "computerName": "[parameters('virtualMachineComputerName1')]",  
      "adminUsername": "[parameters('adminUsername')]",  
      "adminPassword": "[parameters('adminPassword')]",  
      "linuxConfiguration": {  
        "disablePasswordAuthentication": false  
      }  
    },  
    "securityProfile": {  
      "securityType": "[parameters('securityType')]",  
      "uefiSettings": {  
        "secureBootEnabled": "[parameters('secureBoot')]",  
        "vTpmEnabled": "[parameters('vTPM')]"
```

Figure 17. Allow password sign in

All public ip stuff was removed from parameters.json and template.json.

Create the vm using the cli:

```
az deployment group create -g lab4 --template-file template.json --parameters parameters.json
```



Name	Type	Subscription	Resource group	Location	Status	Operating system
template	Virtual machine	cc-subscription	lab4	Central India	Running	Linux
template2	Virtual machine	cc-subscription	lab4	Central India	Running	Linux

Figure 18. Running vm deployment

Query vm:

```
az vm list --query "[?name=='template2']"
```

```
PS C:\Users\Andi\Documents\Github\fh-mc-cc\e04\vm2_template> az vm list --query "[?name=='template2']"
[
  {
    "additionalCapabilities": {
      "hibernationEnabled": false,
      "ultraSsdEnabled": null
    },
    "applicationProfile": null,
    "availabilitySet": null,
    "billingProfile": null,
    "capacityReservation": null,
    "diagnosticsProfile": {
      "bootDiagnostics": {
        "enabled": true,
        "storageUri": null
      }
    }
  }
]
```

Figure 19. Template2 VM

Query nic list:

```
az network nic list --query "[?name=='template804_z2']"
```

```

  "id": "/subscriptions/18126593-4f58-4747-9e90-0fba47
late804_z2/ipConfigurations/ipconfig1",
  "name": "ipconfig1",
  "primary": true,
  "privateIpAddress": "10.0.0.5",
  "privateIpAddressVersion": "IPv4",
  "privateIPAllocationMethod": "Dynamic",
  "provisioningState": "Succeeded",
  "resourceGroup": "lab4",
  "subnet": {
    "id": "/subscriptions/18126593-4f58-4747-9e90-0fba
late-vnet/subnets/default",
    "resourceGroup": "lab4"
  }
}
```

Figure 20. Private ip of vm

Connect to second vm over first vm with ssh:

```

See https://ubuntu.com/esm or run: sudo pro status

Last login: Mon Jan 15 11:36:36 2024 from 77.220.105.192
azureuser@template:~$ ssh azureuser@10.0.0.5
The authenticity of host '10.0.0.5 (10.0.0.5)' can't be established.
ED25519 key fingerprint is SHA256:5eh4d89StpopmkZ0xd99g97vvzjI2X3uf5qTo27vrMo.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.0.0.5' (ED25519) to the list of known hosts.
azureuser@10.0.0.5's password:
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 6.2.0-1018-azure x86_64)

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

Figure 21. Connect to second vm

6. Disks

6.1. Creating the Disk

```
az disk create --name lab4 --sku Premium_LRS --size-gb 1024 --max-shares 2 --resource-group lab4 --location centralindia --zone 1
```

```
PS C:\Users\Andi\Documents\Github\fh-mc-cc\e04> az disk create --name lab4 --sku Premium_LRS --size-gb 1024 --max-shares 2 --resource-group lab4
{
  "burstingEnabled": null,
  "burstingEnabledTime": null,
  "completionPercent": null,
  "creationData": {
    "createOption": "Empty",
    "galleryImageReference": null,
    "imageReference": null,
    "logicalSectorSize": null,
    "performancePlus": null,
    "securityDataUri": null,
    "sourceResourceId": null,
    "sourceUniqueId": null,
  },
  "diskSizeGB": 1024,
  "diskType": "Premium_LRS",
  "location": "centralindia",
  "maxShares": 2,
  "name": "lab4",
  "osType": "Linux",
  "provisioningState": "Succeeded",
  "resourceGroup": "lab4",
  "sku": "Premium_LRS",
  "zone": 1
}
```

Create with disk template:

```
az deployment group create --resource-group lab4 --template-file template.json --parameters parameters.json
```

6.2. Attaching the Disk

First shutdown running vms:

```
az vm deallocate --name template --resource-group lab4
```

```
az vm deallocate --name template2 --resource-group lab4
```

Attach disk to both vms:

```
az vm disk attach --resource-group lab4 --vm-name template --name lab4
```

```
az vm disk attach --resource-group lab4 --vm-name template2 --name lab4
```

```
}
PS C:\Users\Andi\Documents\Github\fh-mc-cc\e04\disk_template> az vm disk attach --resource-group lab4 --vm-name template --name lab4
PS C:\Users\Andi\Documents\Github\fh-mc-cc\e04\disk_template> az vm disk attach --resource-group lab4 --vm-name template2 --name lab4
PS C:\Users\Andi\Documents\Github\fh-mc-cc\e04\disk_template> |
```

Figure 22. Connect to both disks

Create filesystem on one VM:

```

azureuser@template:~$ sudo mkfs -t ext4 /dev/sdc
mke2fs 1.46.5 (30-Dec-2021)
Discarding device blocks: done
Creating filesystem with 268435456 4k blocks and 67108864 inodes
Filesystem UUID: 2be8fd7f-f649-4c5f-b8f8-07b30456ffce
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 2654208,
    4096000, 7962624, 11239424, 20480000, 23887872, 71663616, 78675968,
    102400000, 214990848

Allocating group tables: done
Writing inode tables: done
Creating journal (262144 blocks):
done
Writing superblocks and filesystem accounting information: done

azureuser@template:~$

```

Figure 23. Create filesystem

```

azureuser@template:~$ sudo mkdir /fileserver
azureuser@template:~$ sudo mount /dev/sdc /fileserver
azureuser@template:~$ lsblk
NAME        MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
loop0        7:0      0   63.5M  1 loop /snap/core20/2015
loop1        7:1      0  111.9M  1 loop /snap/lxd/24322
loop2        7:2      0   40.9M  1 loop /snap/snapd/20290
sda          8:0       0    30G   0 disk
├─sda1       8:1       0   29.9G   0 part /
├─sda14      8:14      0     4M   0 part
└─sda15      8:15      0   106M   0 part /boot/efi
sdb          8:16      0     4G   0 disk
└─sdb1       8:17      0     4G   0 part /mnt
sdc          8:32      0    1T   0 disk /fileserver
azureuser@template:~$

```

Figure 24. Mount to folder /fileserver

Create file and unmount disk:

```

azureuser@template:~$ cd /fileserver/
azureuser@template:/fileserver$ sudo touch i-was-here
azureuser@template:/fileserver$ ls
i-was-here  lost+found
azureuser@template:/fileserver$ sudo umount /fileserver^C
azureuser@template:/fileserver$ cd /
azureuser@template:/$ sudo umount /fileserver
sudo: umount: command not found
azureuser@template:/$ sudo mount /fileserver
azureuser@template:/$ lsblk
NAME        MAJ:MIN RM   SIZE RO TYPE MOUNTPOINTS
loop0        7:0      0  63.5M  1 loop /snap/core20/2015
loop1        7:1      0 111.9M  1 loop /snap/lxd/24322
loop2        7:2      0   40.9M  1 loop /snap/snapd/20290
sda          8:0       0    30G   0 disk
├─sda1        8:1       0   29.9G   0 part /
├─sda14       8:14      0     4M   0 part
└─sda15       8:15      0   106M   0 part /boot/efi
sdb          8:16      0     4G   0 disk
└─sdb1        8:17      0     4G   0 part /mnt
sdc          8:32      0    1T   0 disk
azureuser@template:/$ |

```

Figure 25. Create file and unmount

Connect to second vm and mount disk:

```

azureuser@template2:/$ sudo mount /dev/sda /fileserver
azureuser@template2:/$ cd /fileserver/
azureuser@template2:/fileserver$ ls
i-was-here  lost+found
azureuser@template2:/fileserver$ |

```

Figure 26. Mount disk and check for file