SZABIST

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Course	Introduction to DevOps
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Lab 03 (Modules 04 and 05)

Parametrize lab02 Terraform configura6on

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Instructions:

1. Log in to Azure Portal with your credentials.
2. Paste all screenshots (highlighted in red) in a single Word document in the correct order.
3. Name the document as YourName-lab03.

Lab Objectives:

There are 5 sections in this lab. Each section has a different set of objectives:

- **Section 1:** Parametrize lab02 Terraform configuration.
- **Section 2:** Expand the parametrized Terraform configuration from Section 1 and add a Linux virtual machine to the landscape.
- **Section 3:** Expand Section 2 and define and consume local values.
- **Section 4:** Expand Section 3 and define output blocks.
- **Section 5:** Expand Section 4 and add explicit lifecycle rules and dependencies.

Section 1

Objectives:

- Move resource values to a separate file as variable blocks.
- Update main Terraform file to use variables.
- Validate, deploy, expand, analyze, and destroy infrastructure.

Part 1: Prepare for the Lab

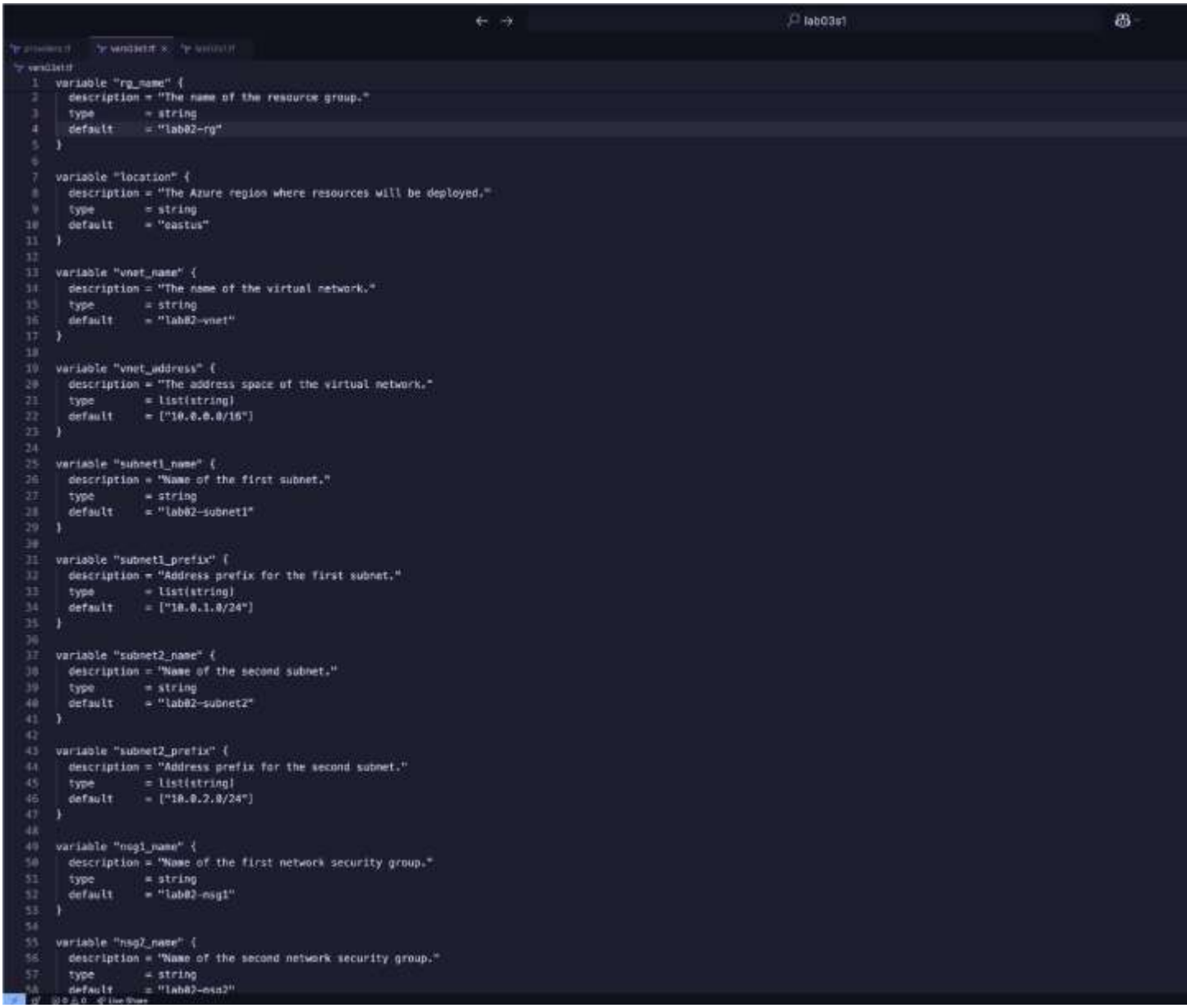
1. Open a Command Prompt or PowerShell window.
2. Create a directory called lab03s1 in your home directory.
3. Copy lab02.‘ file into lab03s1 directory.
4. Change into the lab03s1 directory.
5. Rename lab02.‘ as lab03s1.‘.
6. Create an empty file called vars03s1.‘.
7. Create an empty file called providers.‘.

Part 2: Update vars03s1.A File

8. Copy provider and Terraform blocks from lab03s1.‘ to providers.‘ (use a text editor like Notepad or VS Code).
9. Open vars03s1.‘ in a text editor and define variable blocks as follows. Enclose values in double quotation marks:
   a. One block for resource group name.
   b. One block for location.
   c. One block for virtual network name.
   d. One block for virtual network address space.
   e. Two blocks for subnet names (one per subnet).

f. Two blocks for subnet address spaces (one per address space).
g. Two blocks for network security groups (one per network security group).

Part 3: Update lab03s1.A File



```
variable "rg_name" {
  description = "The name of the resource group."
  type        = string
  default     = "lab02-rg"
}

variable "location" {
  description = "The Azure region where resources will be deployed."
  type        = string
  default     = "eastus"
}

variable "vnet_name" {
  description = "The name of the virtual network."
  type        = string
  default     = "lab02-vnet"
}

variable "vnet_address" {
  description = "The address space of the virtual network."
  type        = list(string)
  default     = ["10.0.0.0/16"]
}

variable "subnet1_name" {
  description = "Name of the first subnet."
  type        = string
  default     = "lab02-subnet1"
}

variable "subnet1_prefix" {
  description = "Address prefix for the first subnet."
  type        = list(string)
  default     = ["10.0.1.0/24"]
}

variable "subnet2_name" {
  description = "Name of the second subnet."
  type        = string
  default     = "lab02-subnet2"
}

variable "subnet2_prefix" {
  description = "Address prefix for the second subnet."
  type        = list(string)
  default     = ["10.0.2.0/24"]
}

variable "nsg1_name" {
  description = "Name of the first network security group."
  type        = string
  default     = "lab02-nsg1"
}

variable "nsg2_name" {
  description = "Name of the second network security group."
  type        = string
  default     = "lab02-nsg2"
```

10. Open lab03s1.‘ in a text editor and update as follows:
    a. Remove provider and Terraform blocks.
    b. Update all resource blocks to source values from vars03s1.‘.

```hcl
# Resource Group
resource "azurerm_resource_group" "lab02_rg" {
  name     = var.rg_name
  location = var.location
}


# Virtual Network
resource "azurerm_virtual_network" "lab02_vnet" {
  name                = var.vnet_name
  address_space       = var.vnet_address
  location            = var.location
  resource_group_name = azurerm_resource_group.lab02_rg.name
}


# Subnet to the Virtual Network
resource "azurerm_subnet" "lab02_subnet1" {
  name                 = var.subnet1_name
  resource_group_name  = azurerm_resource_group.lab02_rg.name
  virtual_network_name = azurerm_virtual_network.lab02_vnet.name
  address_prefixes     = var.subnet1_prefix
}


# Network Security Group with an inbound rule
resource "azurerm_network_security_group" "lab02_nsg1" {
  name                = var.nsg1_name
  location            = var.location
  resource_group_name = azurerm_resource_group.lab02_rg.name

  security_rule {
    name                       = "rule1"
    priority                   = 100
    direction                  = "Inbound"
    access                     = "Allow"
    protocol                   = "Tcp"
    source_port_range          = "*"
    destination_port_range     = "22"
    source_address_prefix      = "*"
    destination_address_prefix = "*"
  }
}


# Associate the NSG with the Subnet
resource "azurerm_subnet_network_security_group_association" "lab02_subnet_nsg_assoc" {
  subnet_id                 = azurerm_subnet.lab02_subnet1.id
  network_security_group_id = azurerm_network_security_group.lab02_nsg1.id
}
```

```
51
52  # Second Subnet
53  resource "azurerm_subnet" "lab02_subnet2" {
54    name                 = var.subnet2_name
55    resource_group_name  = azurerm_resource_group.lab02_rg.name
56    virtual_network_name = azurerm_virtual_network.lab02_vnet.name
57    address_prefixes     = var.subnet2_prefix
58  }
59
60
61
62  # Second NSG with two inbound rules
63  resource "azurerm_network_security_group" "lab02_nsg2" {
64  name                = var.nsg2_name
65    location            = var.location
66    resource_group_name = azurerm_resource_group.lab02_rg.name
67
68    security_rule {
69      name                       = "rule1"
70      priority                   = 100
71      direction                  = "Inbound"
72      access                     = "Allow"
73      protocol                   = "Tcp"
74      source_port_range          = "*"
75      destination_port_range     = "3389"
76      source_address_prefix      = "*"
77      destination_address_prefix = "*"
78    }
79
80    security_rule {
81      name                       = "rule2"
82      priority                   = 200
83      direction                  = "Inbound"
84      access                     = "Allow"
85      protocol                   = "Tcp"
86      source_port_range          = "*"
87      destination_port_range     = "5985"
88      source_address_prefix      = "*"
89      destination_address_prefix = "*"
90    }
91  }
92
93
94  # Associate lab02-nsg2 with lab02-subnet2
95  resource "azurerm_subnet_network_security_group_association" "lab02_subnet2_nsg_assoc" {
96    subnet_id                 = azurerm_subnet.lab02_subnet2.id
97    network_security_group_id = azurerm_network_security_group.lab02_nsg2.id
98  }
99
100
101
```

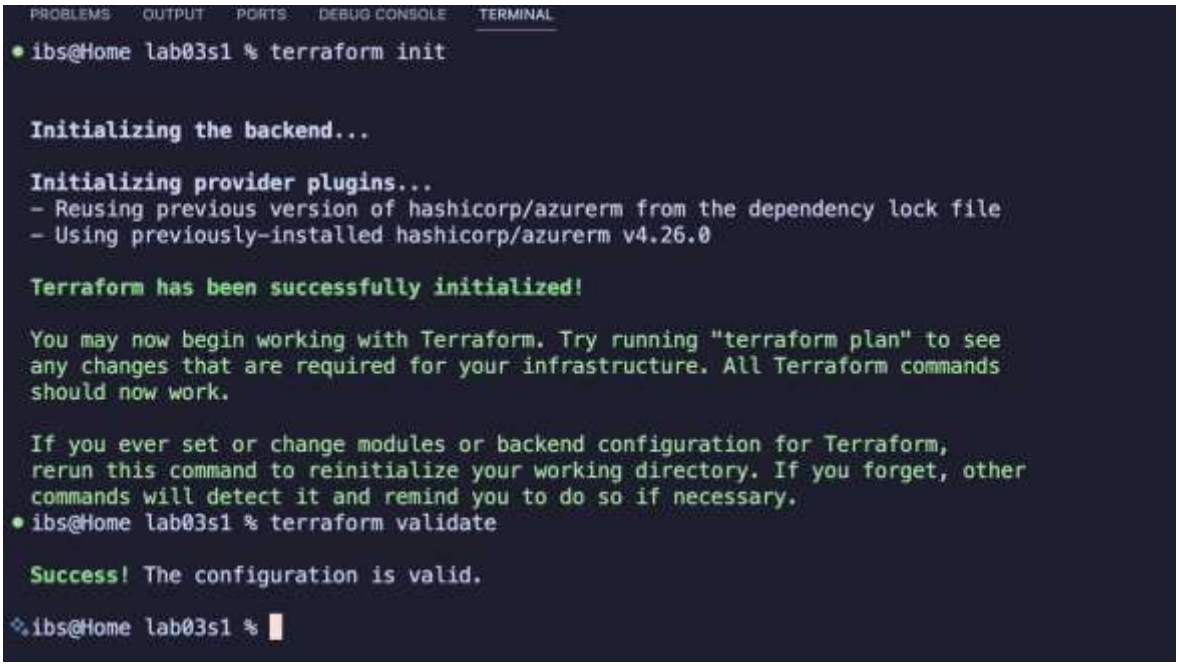
Part 4: Initialize Terraform

11. Initialize Terraform to download plug-ins as required:

Part 5: Validate Configuration

13. Validate the configuration to ensure no errors or typos:

14. Fix any issues in lab03s1.‘ and/or vars03s1.‘ files if reported (edit in your text editor).
15. Re-run validation until no errors are reported.



Part 6: Run Simulation

16. Perform a dry run:

```
terraform plan
```

17. Review output and ensure all configuration meets requirements. Observe resources with +, -, or -/+ signs.
18. Fix any issues in lab03s1.‘ and/or vars03s1.‘ files if reported.
19. Redo the dry run until no errors are reported.

Part 8: Deploy Infrastructure

20. Deploy the infrastructure and monitor progress.
    - Type yes when prompted.

Part 9: Get Information from Terraform State

22. View and analyze state information:

```
terraform state list terraform
show
```

```
ibs@Home lab03s1 % terraform state list
azurerm_network_security_group.lab02_nsg1
azurerm_network_security_group.lab02_nsg2
azurerm_resource_group.lab02_rg
azurerm_subnet.lab02_subnet1
azurerm_subnet.lab02_subnet2
azurerm_subnet_network_security_group_association.lab02_subnet2_nsg_assoc
azurerm_subnet_network_security_group_association.lab02_subnet_nsg_assoc
azurerm_virtual_network.lab02_vnet
```

Part 10: Confirm Resource Creation in Azure

23. Log in to the Azure Portal. Navigate to the resource group and confirm all resources exist as per specifications.

Part 11: Destroy All Resources and Verify

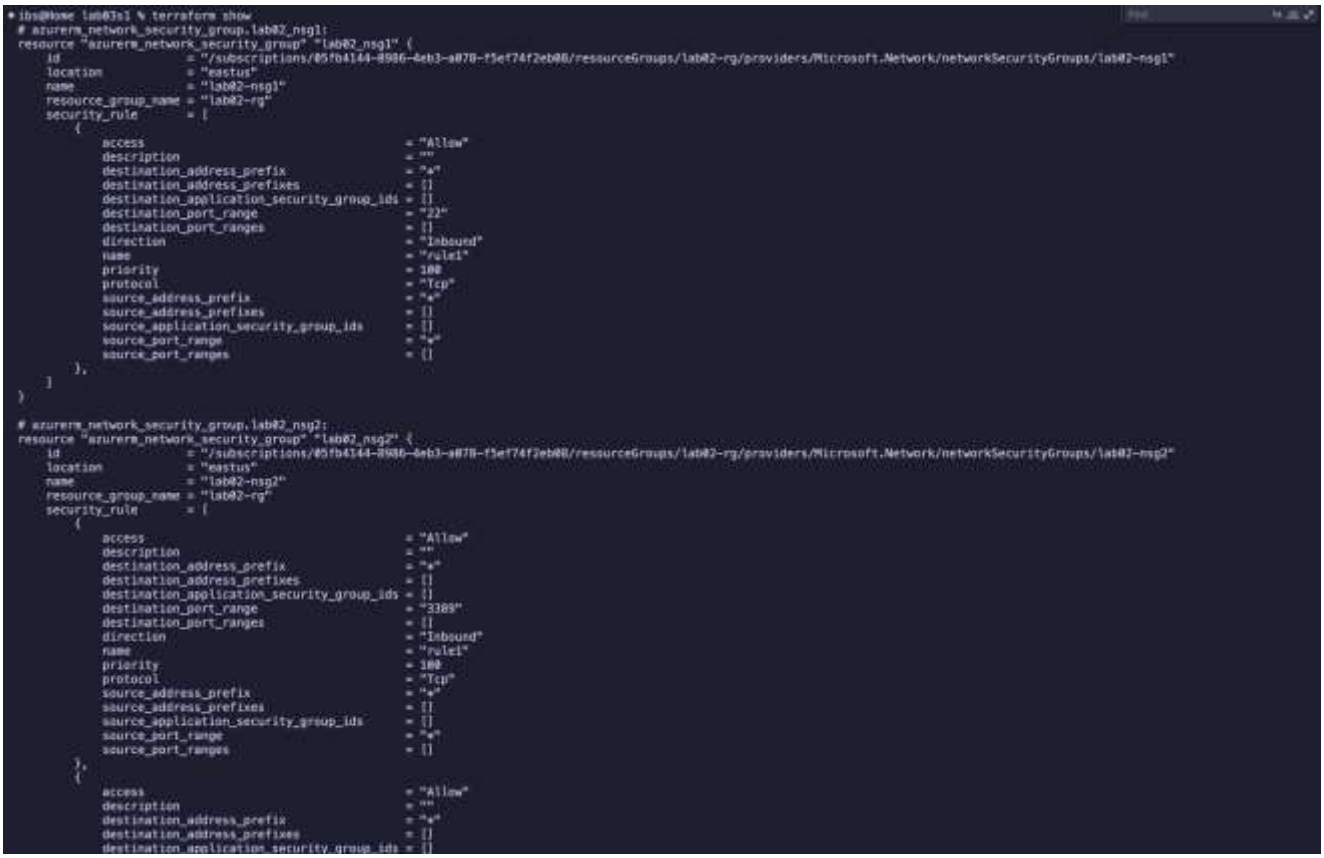
24. Destroy all resources:

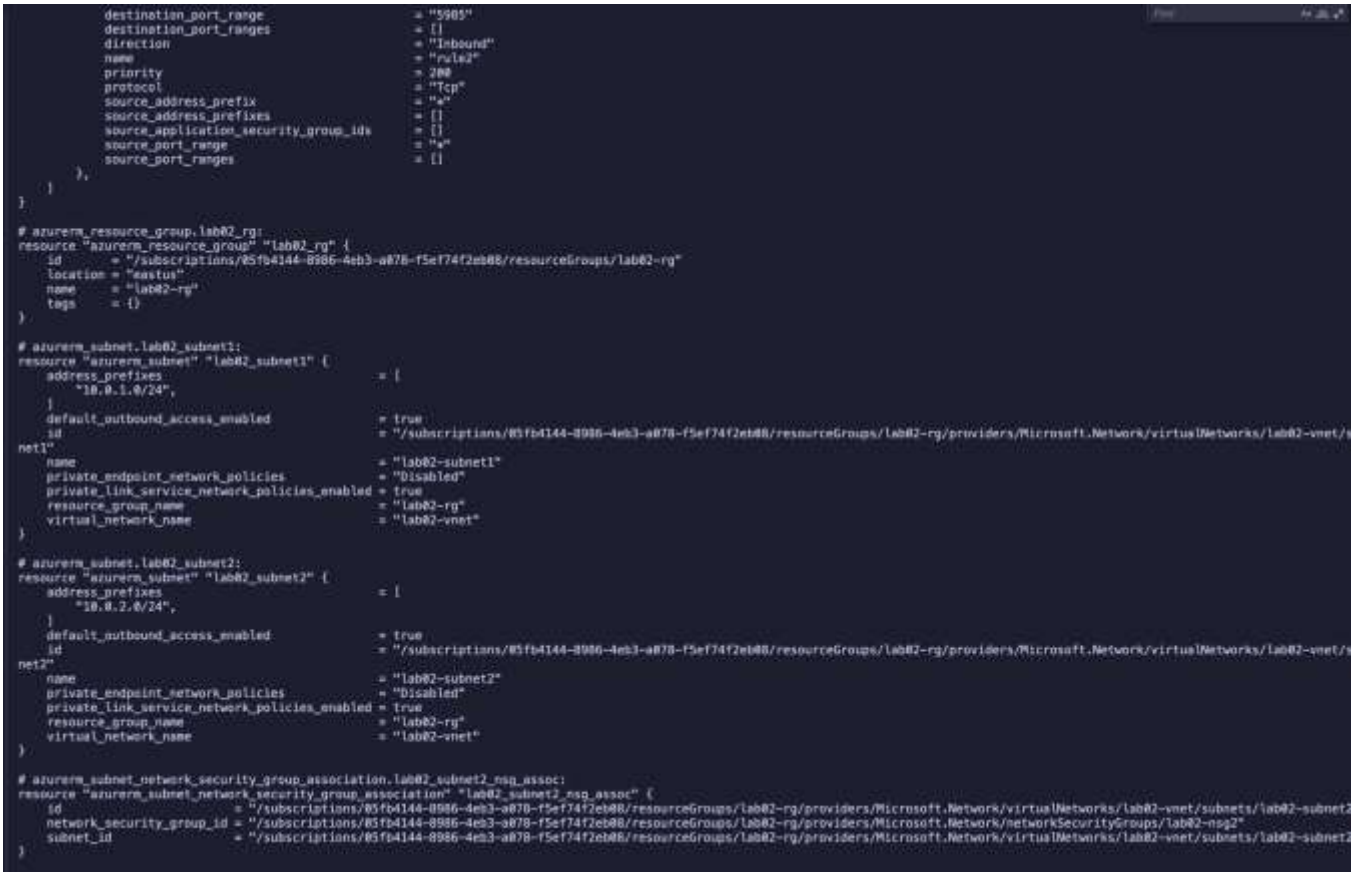
```
terraform destroy
```

    - Type yes when prompted.

25. Verify deletion:

```
terraform state list terraform

show
```





```
            destination_port_range                     = "5985"
            destination_port_ranges                    = []
            direction                                  = "Inbound"
            name                                       = "rule2"
            priority                                   = 200
            protocol                                   = "Tcp"
            source_address_prefix                      = "*"
            source_address_prefixes                    = []
            source_application_security_group_ids      = []
            source_port_range                          = "*"
            source_port_ranges                         = []
        },
    ]
}

# azurerm_resource_group.lab02_rg:
resource "azurerm_resource_group" "lab02_rg" {
    id       = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg"
    location = "eastus"
    name     = "lab02-rg"
    tags     = {}
}

# azurerm_subnet.lab02_subnet1:
resource "azurerm_subnet" "lab02_subnet1" {
    address_prefixes                          = [
        "10.0.1.0/24",
    ]
    default_outbound_access_enabled           = true
    id                                        = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/s
net1"
    name                                      = "lab02-subnet1"
    private_endpoint_network_policies         = "Disabled"
    private_link_service_network_policies_enabled = true
    resource_group_name                       = "lab02-rg"
    virtual_network_name                      = "lab02-vnet"
}

# azurerm_subnet.lab02_subnet2:
resource "azurerm_subnet" "lab02_subnet2" {
    address_prefixes                          = [
        "10.0.2.0/24",
    ]
    default_outbound_access_enabled           = true
    id                                        = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/s
net2"
    name                                      = "lab02-subnet2"
    private_endpoint_network_policies         = "Disabled"
    private_link_service_network_policies_enabled = true
    resource_group_name                       = "lab02-rg"
    virtual_network_name                      = "lab02-vnet"
}

# azurerm_subnet_network_security_group_association.lab02_subnet2_nsg_assoc:
resource "azurerm_subnet_network_security_group_association" "lab02_subnet2_nsg_assoc" {
    id                        = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subnets/lab02-subnet2
    network_security_group_id = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/networkSecurityGroups/lab02-nsg2"
    subnet_id                 = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subnets/lab02-subnet2
}
```

```
# azurerm_subnet_network_security_group_association.lab02_subnet_nsg_assoc:
resource "azurerm_subnet_network_security_group_association" "lab02_subnet_nsg_assoc" {
    id                        = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subnets/lab02-subnet1"
    network_security_group_id = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/networkSecurityGroups/lab02-nsg1"
    subnet_id                 = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subnets/lab02-subnet1"
}

# azurerm_virtual_network.lab02_vnet:
resource "azurerm_virtual_network" "lab02_vnet" {
    address_space                 = [
        "10.0.0.0/16",
    ]
    dns_servers                   = []
    flow_timeout_in_minutes       = 0
    guid                          = "dd62ea8a-79b3-4777-b1ab-45ea62ce6c9b"
    id                            = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet"
    location                      = "eastus"
    name                          = "lab02-vnet"
    private_endpoint_vnet_policies = "Disabled"
    resource_group_name           = "lab02-rg"
    subnet                        = []
}
cisco@home lab03s1 %
```

Section 2

Objectives: • Use configuration from

Section 1.

- Define resource and variable blocks for virtual machine resources. Validate, deploy, expand, analyze, and destroy infrastructure.

Part 1: Prepare for the Lab

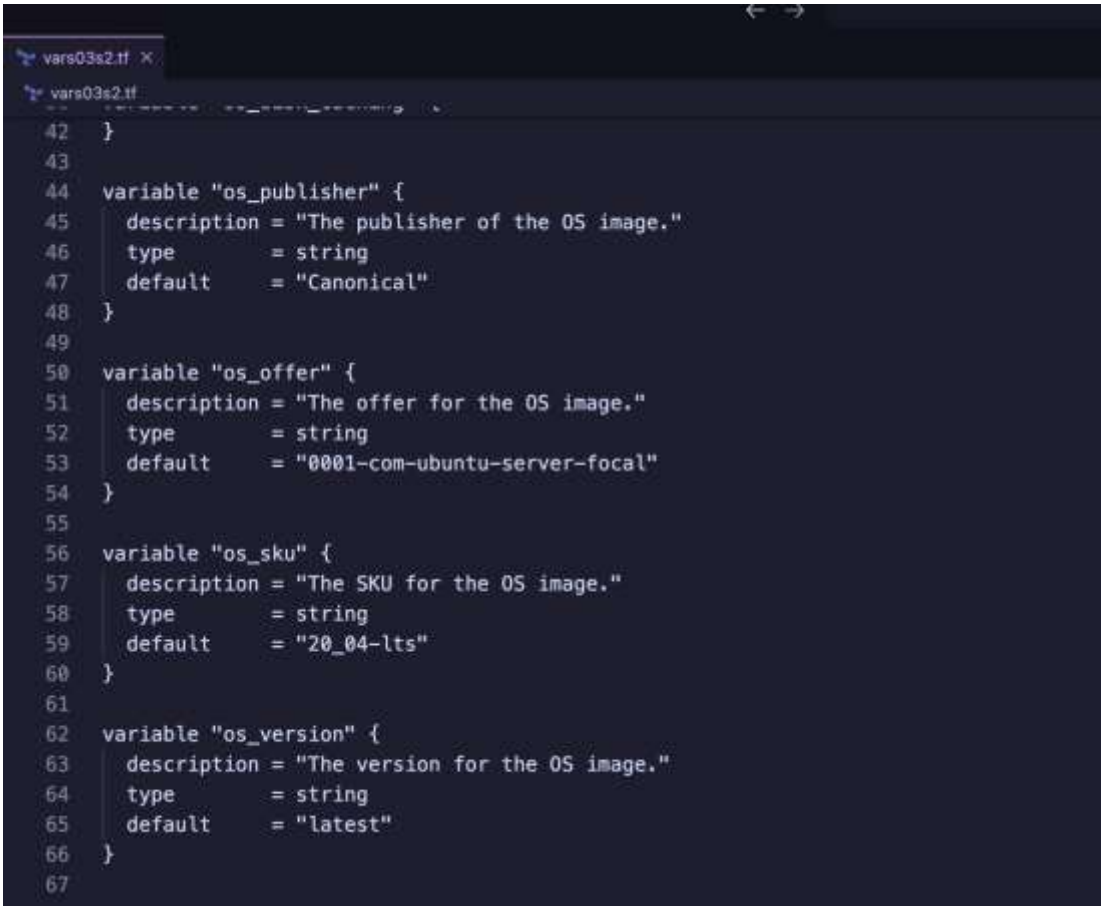
1. Create a directory called lab03s2 in your home directory:
2. Copy lab03s1.‘, vars03s1.‘, and providers.‘ into lab03s2 directory:
3. Change into the lab03s2 directory:
4. Create two empty files called lab03s2.‘ and vars03s2.‘:

Part 2: Update vars03s2.A File

5. Open vars03s2.‘ in a text editor and define variable blocks for a Linux virtual machine. Enclose values in double quotation marks:
   a. Name (e.g., linux_name): "lab03s2-db1-u-vm1".
   b. Size: "Standard_B1s".
   c. Admin user name: "<firstname-yourHumberID>" [from Lab 01].
   d. Public key: "C:\Users\<YourWindowsUsername>\.ssh\id_rsa.pub" (adjust path to your SSH public key location on Windows). e. OS disk aoributes:
   i. Storage account type: "Premium_LRS". ii.
   Disk size: "32".
   iii. Caching: "ReadWrite".
   f. Ubuntu Linux OS information:
   i. Publisher: "Canonical".
   ii. Offer: "UbuntuServer".
   iii. Sku: "19.04". iv.
   Version: "latest".

vars03s2.tf

```hcl
variable "linux_name" {
  description = "The name of the Linux virtual machine."
  type        = string
  default     = "lab03s2-db1-u-vm1"
}

variable "vm_size" {
  description = "The size of the Linux VM instance."
  type        = string
  default     = "Standard_B1s"
}

variable "admin_username" {
  description = "The admin username for the Linux VM."
  type        = string
  default     = "ibs"
}

variable "public_key_path" {
  description = "The path to the SSH public key for the Linux VM admin."
  type        = string
  default     = "/Users/ibs/.ssh/id_rsa.pub"

}

variable "os_disk_storage_type" {
  description = "The storage account type for the OS disk."
  type        = string
  default     = "Premium_LRS"
}

variable "os_disk_size" {
  description = "OS disk size in GB."
  type        = number
  default     = 32
}

variable "os_disk_caching" {
  description = "Caching mode for the OS disk."
  type        = string
  default     = "ReadWrite"
}

variable "os_publisher" {
  description = "The publisher of the OS image."
  type        = string
  default     = "Canonical"
```



Part 3: Update lab03s2.A File

6. Open lab03s2.‘ in a text editor and define resource blocks as follows:
   a. Define network interface called ${var.linux_name}-nic with IP configuration name ${var.linux_name}-ipconfig1 using azurerm_network_interface. Use Dynamic IP address allocation. b. Define public IP address called ${var.linux_name}-pip using azurerm_public_ip. Use Dynamic IP address allocation method.
   c. Define virtual machine using azurerm_linux_virtual_machine. Use ${var.linux_name}-osdisk as the OS
   disk name.

vars03s2.tf   lab03s2.tf ×

lab03s2.tf

```
# Network Interface for the Linux VM
resource "azurerm_network_interface" "linux_nic" {
  name                = "${var.linux_name}-nic"
  location            = var.location
  resource_group_name = azurerm_resource_group.lab02_rg.name

  ip_configuration {
    name                          = "${var.linux_name}-ipconfig1"
    subnet_id                     = azurerm_subnet.lab02_subnet1.id
    private_ip_address_allocation = "Dynamic"
    public_ip_address_id          = azurerm_public_ip.linux_pip.id
  }
}

# Public IP for the Linux VM
resource "azurerm_public_ip" "linux_pip" {
  name                = "${var.linux_name}-pip"
  location            = var.location
  resource_group_name = azurerm_resource_group.lab02_rg.name
  allocation_method   = "Dynamic"
  sku                 = "Basic"
}

# Linux Virtual Machine
resource "azurerm_linux_virtual_machine" "linux_vm" {
  name                = var.linux_name
  resource_group_name = azurerm_resource_group.lab02_rg.name
  location            = var.location
  size                = var.vm_size
  admin_username      = var.admin_username

  network_interface_ids = [
    azurerm_network_interface.linux_nic.id,
  ]

  admin_ssh_key {
    username   = var.admin_username
    public_key = file(var.public_key_path)
  }

  os_disk {
    caching              = var.os_disk_caching
    storage_account_type = var.os_disk_storage_type
    disk_size_gb         = var.os_disk_size
  }

```


```
  }

  os_disk {
    caching              = var.os_disk_caching
    storage_account_type = var.os_disk_storage_type
    disk_size_gb         = var.os_disk_size
  }
```


```

  source_image_reference {
    publisher = var.os_publisher
    offer     = var.os_offer
    sku       = var.os_sku
    version   = var.os_version
  }
}
```

Note: At this point, you should have 5 Terraform files—providers.<, lab03s1.<, vars03s1.<, lab03s2.<, and

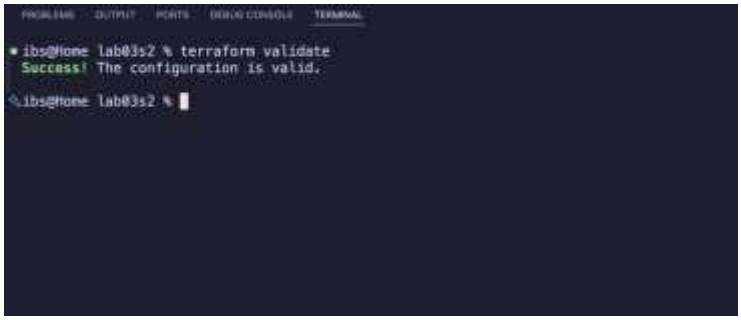
vars03s2.<—under the lab03s2 directory.

Part 4: Initialize Terraform

7. Initialize Terraform to download plug-ins as required:

Part 5: Validate Configuration

8. Validate the configuration to ensure no errors or typos:



Part 6: Run Simulation

11. Perform a dry run:

```
terraform plan
```

12. Review output and ensure all configuration meets requirements. Observe resources with +, -, or -/+ signs.
13. Fix any issues in the Terraform files if reported.
14. Redo the dry run until no errors are reported:

Part 7: Deploy Infrastructure

15. Deploy the infrastructure and monitor progress:

Part 8: Get Information from Terraform State

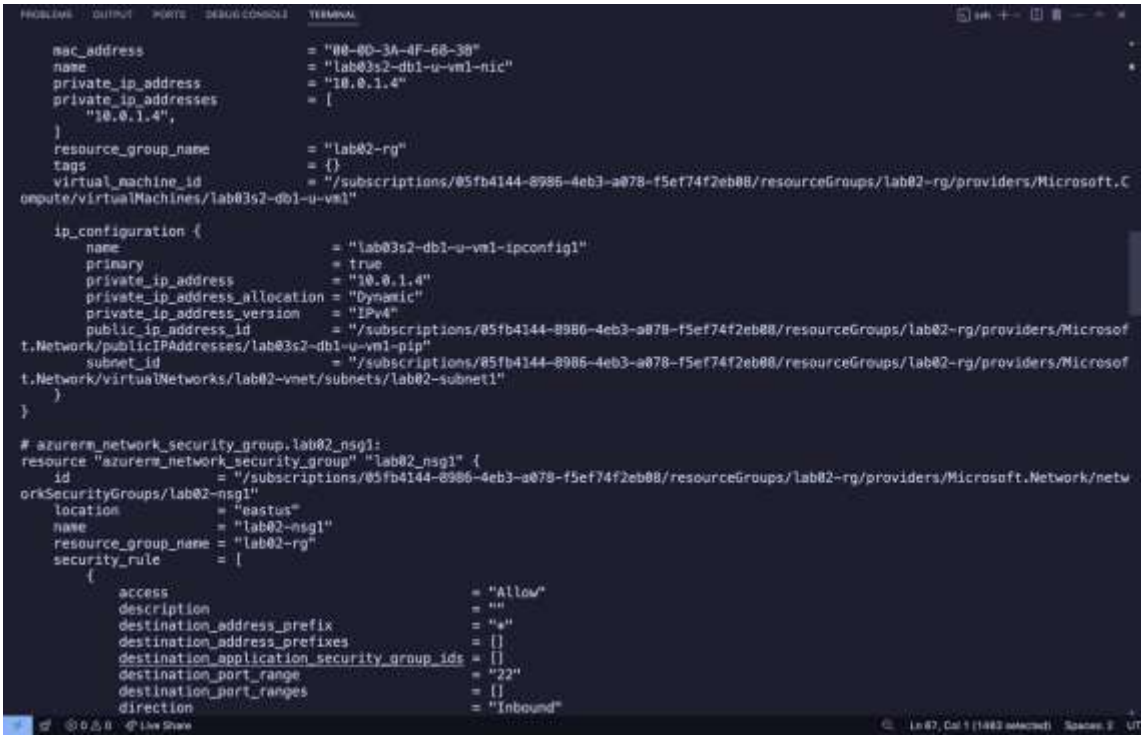
17. View and analyze state information:

```
terraform state list terraform
show
```

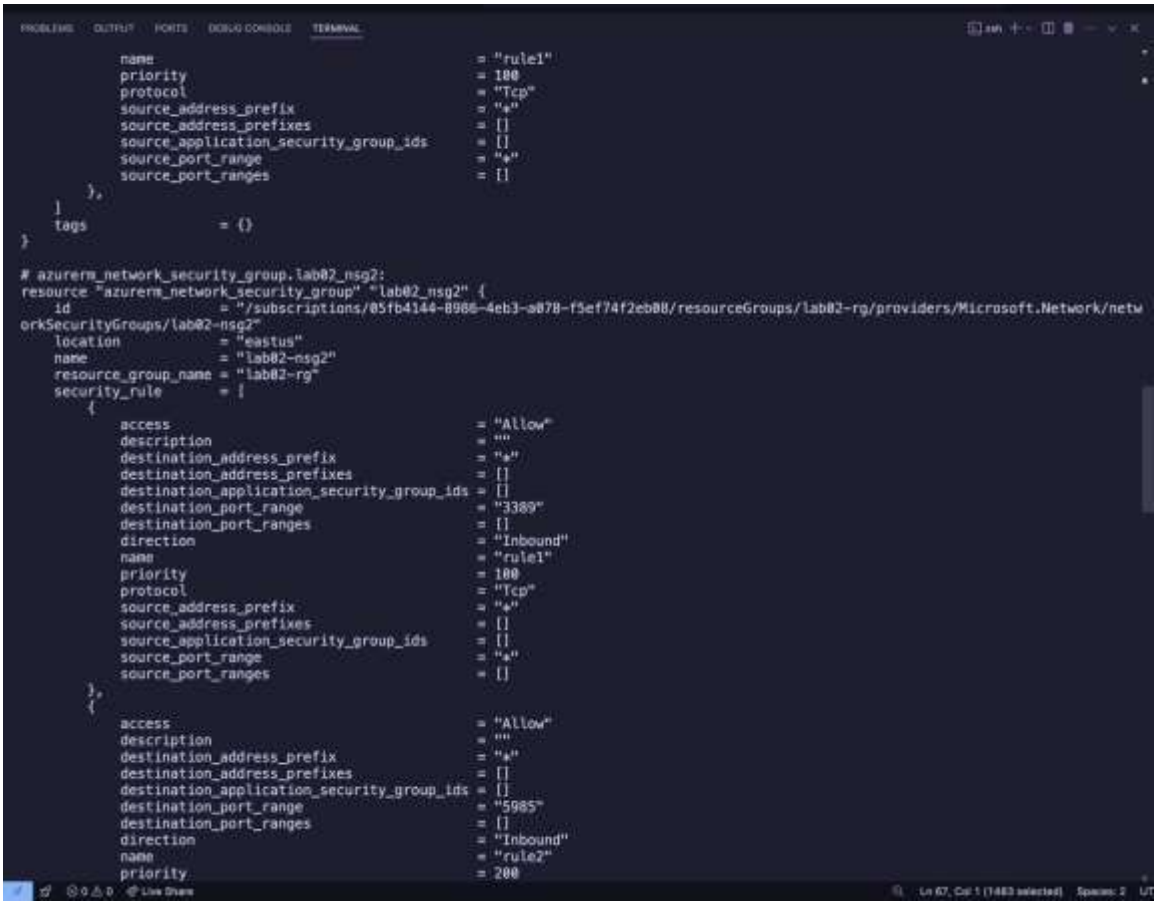
```
PROBLEMS    OUTPUT    PORTS    DEBUG CONSOLE    TERMINAL

• ibs@Home lab03s2 % terraform state list
  azurerm_linux_virtual_machine.linux_vm
  azurerm_network_interface.linux_nic
  azurerm_network_security_group.lab02_nsg1
  azurerm_network_security_group.lab02_nsg2
  azurerm_public_ip.linux_pip
  azurerm_resource_group.lab02_rg
  azurerm_subnet.lab02_subnet1
  azurerm_subnet.lab02_subnet2
  azurerm_subnet_network_security_group_association.lab02_subnet2_nsg_assoc
  azurerm_subnet_network_security_group_association.lab02_subnet_nsg_assoc
  azurerm_virtual_network.lab02_vnet
```

```
PROBLEMS    OUTPUT    PORTS    DEBUG CONSOLE    TERMINAL

• ibs@Home lab03s2 % terraform show
 # azurerm_linux_virtual_machine.linux_vm:
 resource "azurerm_linux_virtual_machine" "linux_vm" {
     admin_username                                         = "ibs"
     allow_extension_operations                             = true
     bypass_platform_safety_checks_on_user_schedule_enabled = false
     computer_name                                          = "lab03s2-db1-u-vm1"
     disable_password_authentication                        = true
     encryption_at_host_enabled                             = false
     extensions_time_budget                                 = "PT1H30M"
     id                                                     = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-
 rg/providers/Microsoft.Compute/virtualMachines/lab03s2-db1-u-vm1"
     location                                               = "eastus"
     max_bid_price                                          = -1
     name                                                   = "lab03s2-db1-u-vm1"
     network_interface_ids                                  = [
         "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/networkInterfaces/lab0
 3s2-db1-u-vm1-nic",
     ]
     patch_assessment_mode                                  = "ImageDefault"
     patch_mode                                             = "ImageDefault"
     platform_fault_domain                                  = -1
     priority                                               = "Regular"
     private_ip_address                                     = "10.0.1.4"
     private_ip_addresses                                   = [
         "10.0.1.4",
     ]
     provision_vm_agent                                     = true
     public_ip_address                                      = "172.172.226.126"
     public_ip_addresses                                    = [
         "172.172.226.126",
     ]
     resource_group_name                                    = "lab02-rg"
     secure_boot_enabled                                    = false
     size                                                   = "Standard_B1s"
     tags                                                   = {}
     virtual_machine_id                                     = "7f5231c0-c840-4d91-92b7-2ce97350670d"
     vm_agent_platform_updates_enabled                      = false
     vtpm_enabled                                           = false
```

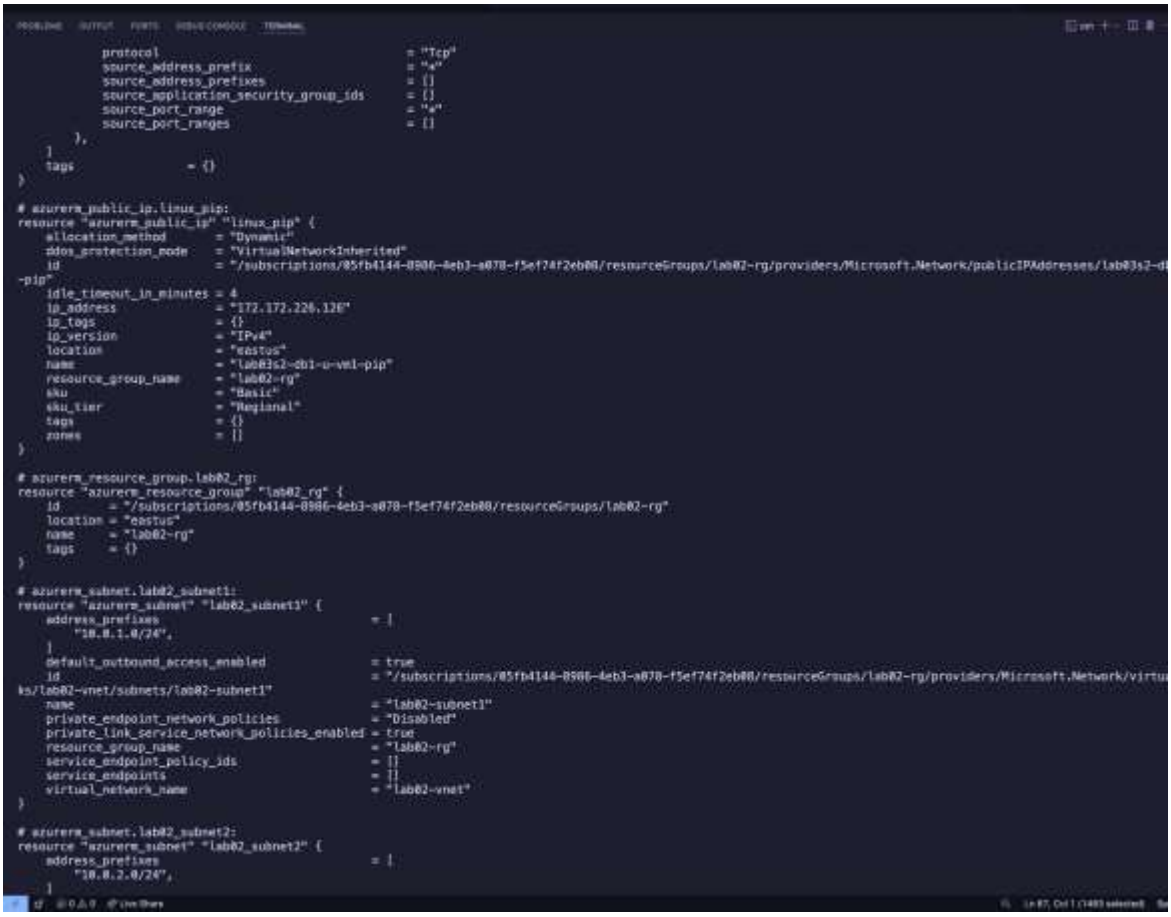
```
PROBLEMS    OUTPUT    PORTS    DEBUG CONSOLE    TERMINAL

    admin_ssh_key {
        public_key = <<-EOT
            ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAACAQDMybSuIYAUlA4wPKFcWQpLyVy2eEcbLvQdhmH/Il/hACF/Ak5gQqvbN55EXJXX1VNjX+JH1j5LNWx9dx7VwQt
Blvs2sFxFcq3dswYcWV4wF3wyHxgibKKmz4IrSiQ3ZejtyBbaZLAoPt9a5EWq0Pv+4hcwv7w0CZf4o7Q1LL6ML3vJ3Ggk6XPjECaGHNAsfQBWBvaMJkDKknVyAqiLb1r4uA0qNN
s3NeDLdpusDEU3mG+V5/J0R8/RCaR8G1QuG62ITg+C3L7dlPkgie2zJyR0ew7+uuxeYkXSMBjrMhjLf+cv+bpejPju87+/Bt8TY4y8PYclrton7H1AAAMeYTWAASkKZrE9FynAQ
cBkIZi+aiAdM5pabkFYMBFx1dhh6diSfT67StviR5GcwQ5w93/BQowkYxvWIVKcuuvKvS4+BPbpAw/FE8ED3aZO67HfRvOcDekTdjvWq1nXfa6rXkFLu1zxOa6bjp7QqsZ1toa5
V32QCj6dV5fBPnyAQR4HL0keCum6y80kUa0gAKVI67n1LnAqFik6+GSX4nl34fDDVAFV0XsnHyR4doIDmkR1NKwaTmJ0JzJ/AZj08KY7sYGdLJgnNZr0oNtOBQxZ4wgQkbPOlxK
m/0fL6LbxonxMvlJkveeoBx1ONH9o9qwDxDLh5ksb34xAJCLyMrYiRlkhhQ== ibs@Home.local
        EOT
        username   = "ibs"
    }

    os_disk {
        caching                   = "ReadWrite"
        disk_size_gb              = 32
        id                        = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Co
mpute/disks/lab03s2-db1-u-vm1_disk1_49578bdac6af44afb73189c7fd07102d"
        name                      = "lab03s2-db1-u-vm1_disk1_49578bdac6af44afb73189c7fd07102d"
        storage_account_type      = "Premium_LRS"
        write_accelerator_enabled = false
    }

    source_image_reference {
        offer     = "0001-com-ubuntu-server-focal"
        publisher = "Canonical"
        sku       = "20_04-lts"
        version   = "latest"
    }
}

# azurerm_network_interface.linux_nic:
resource "azurerm_network_interface" "linux_nic" {
    accelerated_networking_enabled = false
    applied_dns_servers            = []
    dns_servers                    = []
    id                             = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.N
etwork/networkInterfaces/lab03s2-db1-u-vm1-nic"
    internal_domain_name_suffix    = "rlvgfxntph1upmnlixvgfttmtd.bx.internal.cloudapp.net"
    ip_forwarding_enabled          = false
    location                       = "eastus"

Ln 87, Col 1 (1483 selected)   Spaces: 2
```



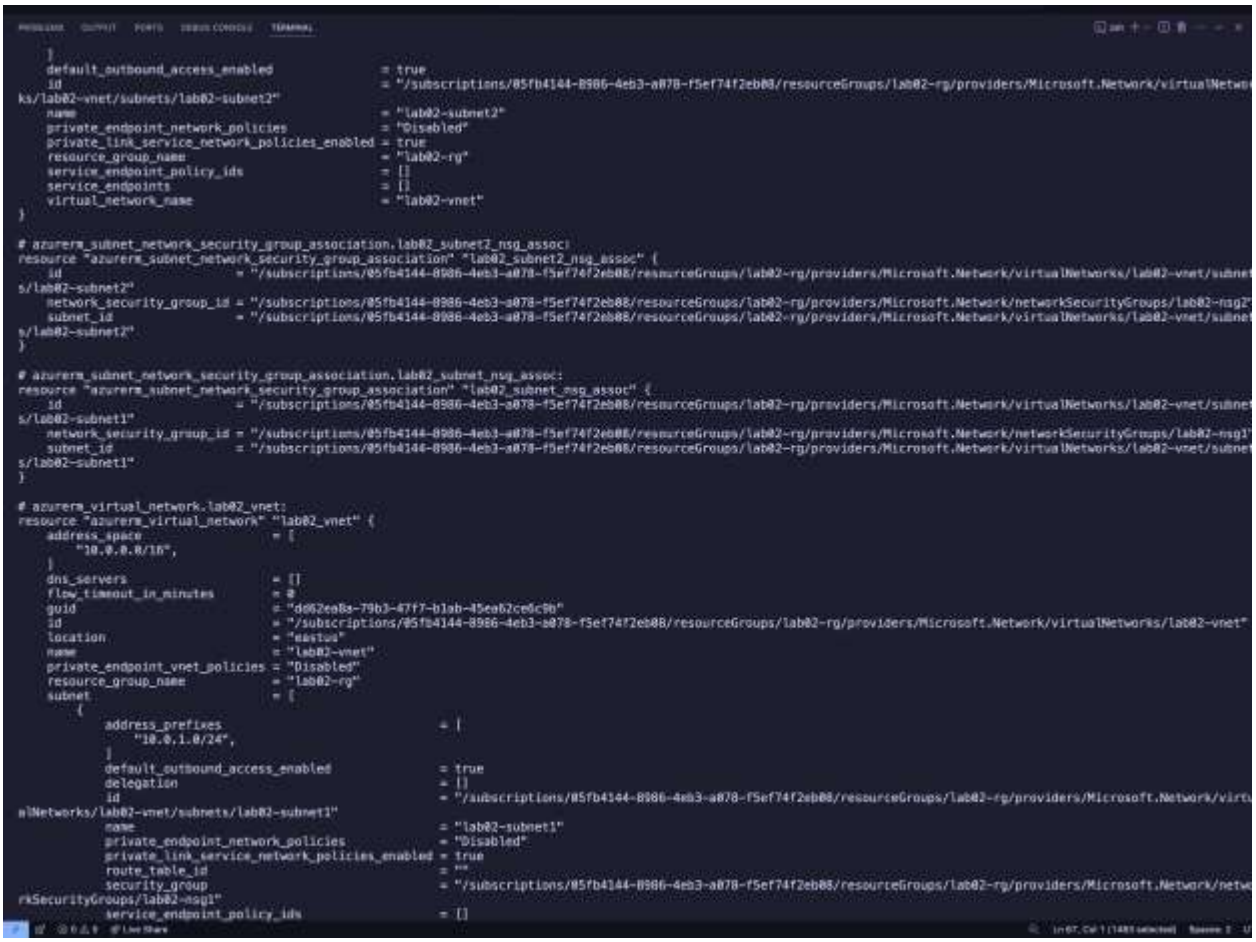
```
    mac_address                    = "00-0D-3A-4F-68-38"
    name                           = "lab03s2-db1-u-vm1-nic"
    private_ip_address             = "10.0.1.4"
    private_ip_addresses           = [
        "10.0.1.4",
    ]
    resource_group_name            = "lab02-rg"
    tags                           = {}
    virtual_machine_id             = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.C
ompute/virtualMachines/lab03s2-db1-u-vm1"

    ip_configuration {
        name                          = "lab03s2-db1-u-vm1-ipconfig1"
        primary                       = true
        private_ip_address            = "10.0.1.4"
        private_ip_address_allocation = "Dynamic"
        private_ip_address_version    = "IPv4"
        public_ip_address_id          = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsof
t.Network/publicIPAddresses/lab03s2-db1-u-vm1-pip"
        subnet_id                     = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsof
t.Network/virtualNetworks/lab02-vnet/subnets/lab02-subnet1"
    }
}

# azurerm_network_security_group.lab02_nsg1:
resource "azurerm_network_security_group" "lab02_nsg1" {
    id                  = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/netw
orkSecurityGroups/lab02-nsg1"
    location            = "eastus"
    name                = "lab02-nsg1"
    resource_group_name = "lab02-rg"
    security_rule       = [
        {
            access                                     = "Allow"
            description                                = ""
            destination_address_prefix                 = "*"
            destination_address_prefixes               = []
            destination_application_security_group_ids = []
            destination_port_range                     = "22"
            destination_port_ranges                    = []
            direction                                  = "Inbound"
```



```
            name                                       = "rule1"
            priority                                   = 100
            protocol                                   = "Tcp"
            source_address_prefix                      = "*"
            source_address_prefixes                    = []
            source_application_security_group_ids      = []
            source_port_range                          = "*"
            source_port_ranges                         = []
        },
    ]
    tags                = {}
}

# azurerm_network_security_group.lab02_nsg2:
resource "azurerm_network_security_group" "lab02_nsg2" {
    id                  = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/netw
orkSecurityGroups/lab02-nsg2"
    location            = "eastus"
    name                = "lab02-nsg2"
    resource_group_name = "lab02-rg"
    security_rule       = [
        {
            access                                     = "Allow"
            description                                = ""
            destination_address_prefix                 = "*"
            destination_address_prefixes               = []
            destination_application_security_group_ids = []
            destination_port_range                     = "3389"
            destination_port_ranges                    = []
            direction                                  = "Inbound"
            name                                       = "rule1"
            priority                                   = 100
            protocol                                   = "Tcp"
            source_address_prefix                      = "*"
            source_address_prefixes                    = []
            source_application_security_group_ids      = []
            source_port_range                          = "*"
            source_port_ranges                         = []
        },
        {
            access                                     = "Allow"
            description                                = ""
            destination_address_prefix                 = "*"
            destination_address_prefixes               = []
            destination_application_security_group_ids = []
            destination_port_range                     = "5985"
            destination_port_ranges                    = []
            direction                                  = "Inbound"
            name                                       = "rule2"
            priority                                   = 200
```



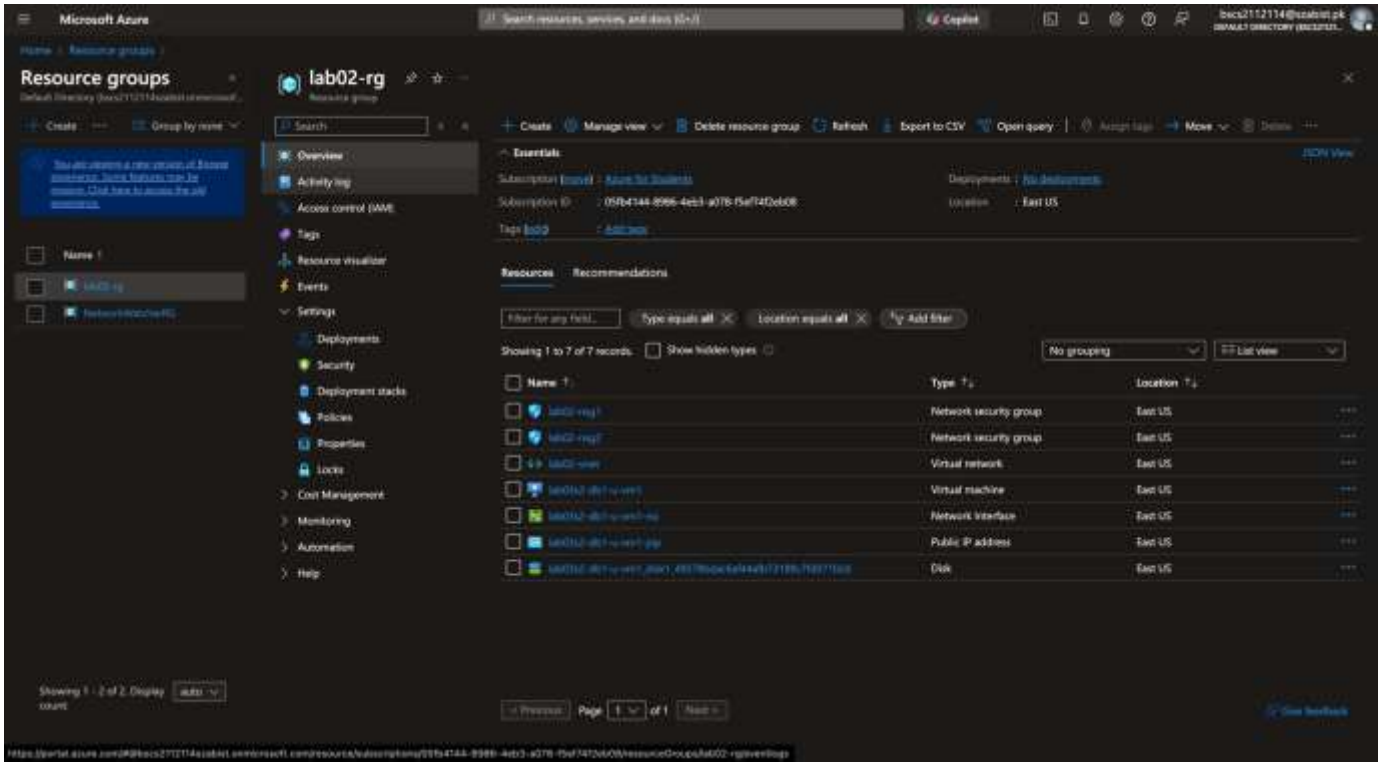
```
            protocol                                   = "Tcp"
            source_address_prefix                      = "*"
            source_address_prefixes                    = []
            source_application_security_group_ids      = []
            source_port_range                          = "*"
            source_port_ranges                         = []
        },
    ]
    tags                = {}
}

# azurerm_public_ip.linux_pip:
resource "azurerm_public_ip" "linux_pip" {
    allocation_method       = "Dynamic"
    ddos_protection_mode    = "VirtualNetworkInherited"
    id                      = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/publicIPAddresses/lab03s2-db1
-pip"
    idle_timeout_in_minutes = 4
    ip_address              = "172.172.226.128"
    ip_tags                 = {}
    ip_version              = "IPv4"
    location                = "eastus"
    name                    = "lab03s2-db1-u-vm1-pip"
    resource_group_name     = "lab02-rg"
    sku                     = "Basic"
    sku_tier                = "Regional"
    tags                    = {}
    zones                   = []
}

# azurerm_resource_group.lab02_rg:
resource "azurerm_resource_group" "lab02_rg" {
    id       = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg"
    location = "eastus"
    name     = "lab02-rg"
    tags     = {}
}

# azurerm_subnet.lab02_subnet1:
resource "azurerm_subnet" "lab02_subnet1" {
    address_prefixes                              = [
        "10.0.1.0/24",
    ]
    default_outbound_access_enabled               = true
    id                                            = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtu
ks/lab02-vnet/subnets/lab02-subnet1"
    name                                          = "lab02-subnet1"
    private_endpoint_network_policies             = "Disabled"
    private_link_service_network_policies_enabled = true
    resource_group_name                           = "lab02-rg"
    service_endpoint_policy_ids                   = []
    service_endpoints                             = []
    virtual_network_name                          = "lab02-vnet"
}

# azurerm_subnet.lab02_subnet2:
resource "azurerm_subnet" "lab02_subnet2" {
    address_prefixes                              = [
        "10.0.2.0/24",
    ]
```



```
    ]
    default_outbound_access_enabled               = true
    id                                            = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetwo
ks/lab02-vnet/subnets/lab02-subnet2"
    name                                          = "lab02-subnet2"
    private_endpoint_network_policies             = "Disabled"
    private_link_service_network_policies_enabled = true
    resource_group_name                           = "lab02-rg"
    service_endpoint_policy_ids                   = []
    service_endpoints                             = []
    virtual_network_name                          = "lab02-vnet"
}

# azurerm_subnet_network_security_group_association.lab02_subnet2_nsg_assoc:
resource "azurerm_subnet_network_security_group_association" "lab02_subnet2_nsg_assoc" {
    id                        = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subnet
s/lab02-subnet2"
    network_security_group_id = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/networkSecurityGroups/lab02-nsg2"
    subnet_id                 = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subnet
s/lab02-subnet2"
}

# azurerm_subnet_network_security_group_association.lab02_subnet_nsg_assoc:
resource "azurerm_subnet_network_security_group_association" "lab02_subnet_nsg_assoc" {
    id                        = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subnet
s/lab02-subnet1"
    network_security_group_id = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/networkSecurityGroups/lab02-nsg1"
    subnet_id                 = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subnet
s/lab02-subnet1"
}

# azurerm_virtual_network.lab02_vnet:
resource "azurerm_virtual_network" "lab02_vnet" {
    address_space                = [
        "10.0.0.0/16",
    ]
    dns_servers                  = []
    flow_timeout_in_minutes      = 0
    guid                         = "d062ea8a-79b3-47f7-b1ab-85ea62ce6c9b"
    id                           = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet"
    location                     = "eastus"
    name                         = "lab02-vnet"
    private_endpoint_vnet_policies = "Disabled"
    resource_group_name          = "lab02-rg"
    subnet                       = [
        {
            address_prefixes                          = [
                "10.0.1.0/24",
            ]
            default_outbound_access_enabled           = true
            delegation                                = []
            id                                        = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virt
ualNetworks/lab02-vnet/subnets/lab02-subnet1"
            name                                      = "lab02-subnet1"
            private_endpoint_network_policies         = "Disabled"
            private_link_service_network_policies_enabled = true
            route_table_id                            = ""
            security_group                            = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/netw
rkSecurityGroups/lab02-nsg1"
            service_endpoint_policy_ids               = []
```

Part 9: Confirm Resource Creation in Azure

18. Log in to the Azure Portal. Navigate to the resource group and confirm all resources exist as per specifications.



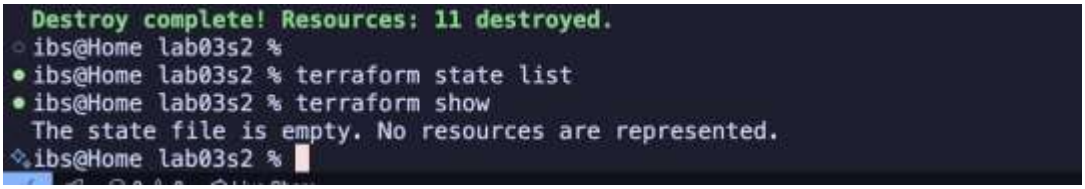
Part 10: Destroy All Resources and Verify

19. Destroy all resources:

```
terraform destroy
```

    - Type yes when prompted.
20. Verify deletion:

```
terraform state list terraform
show
```



Section 3

Objectives:

- Use configuration from Section 2.
- Define a locals block to assign tags to resources.
- Validate, deploy, expand, analyze, and destroy infrastructure.

Part 1: Prepare for the Lab

1. Create a directory called lab03s3 in your home directory:
2. Copy lab03s1.‘, vars03s1.‘, lab03s2.‘, vars03s2.‘, and providers.‘ into lab03s3 directory:
3. Change into the lab03s3 directory:
4. Rename lab03s2.‘ as lab03s3.‘ and vars03s2.‘ as vars03s3.‘:

Part 2: Update vars03s3.A File

5. Open vars03s3.‘ in a text editor and define a locals block at the beginning with the following values. Enclose values in double quotation marks:
   a. Name: "Terraform-Class".
   b. Project: "Learning".
   c. ContactEmail: "youremailaddress".
   d. Environment: "Lab".

```
locals {
  Name         = "Terraform-Class"
  Project      = "Learning"
  ContactEmail = "iqbalshahnadiri1786@gmail.com"
  Environment  = "Lab"
}


variable "linux_name" {
  description = "The name of the Linux virtual machine."
  type        = string
  default     = "lab03s2-db1-u-vm1"
}

variable "vm_size" {
  description = "The size of the Linux VM instance."
  type        = string
  default     = "Standard_B1s"
}

variable "admin_username" {
  description = "The admin username for the Linux VM."
  type        = string
  default     = "ibs"
}

variable "public_key_path" {
  description = "The path to the SSH public key for the Linux VM admin."
  type        = string
  default     = "/Users/ibs/.ssh/id_rsa.pub"

}

variable "os_disk_storage_type" {
  description = "The storage account type for the OS disk."
  type        = string
  default     = "Premium_LRS"
}

variable "os_disk_size" {
  description = "OS disk size in GB."
  type        = number
  default     = 32
}

variable "os_disk_caching" {
  description = "Caching mode for the OS disk."
  type        = string
  default     = "ReadWrite"
}

variable "os_publisher" {
  description = "The publisher of the OS image."
  type        = string
  default     = "Canonical"
}
```

Part 3: Update lab03s3.A File

6. Open lab03s3.‘ in a text editor and add tags to network interface, public IP, and virtual machine resource blocks using the locals values.

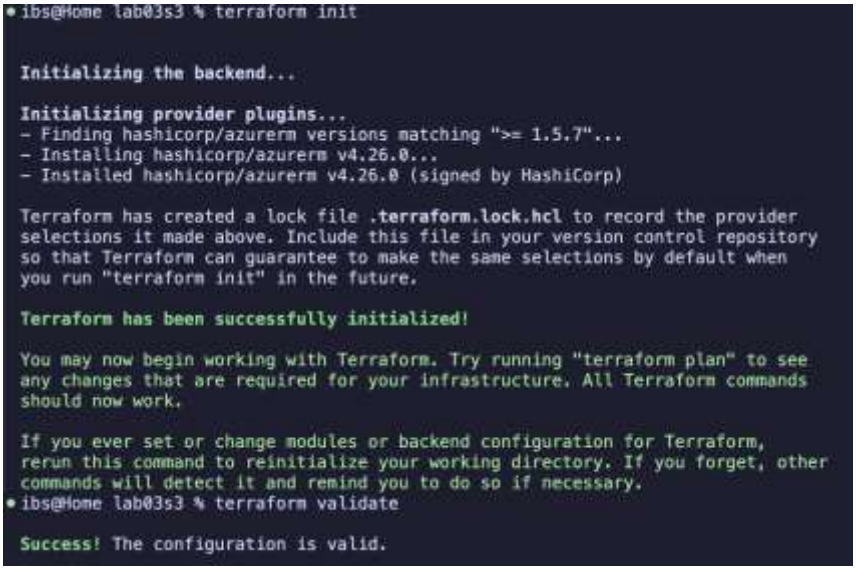
```
# Network Interface for the Linux VM
resource "azurerm_network_interface" "linux_nic" {
  name                = "${var.linux_name}-nic"
  location            = var.location
  resource_group_name = azurerm_resource_group.lab02_rg.name

  ip_configuration {
    name                          = "${var.linux_name}-ipconfig1"
    subnet_id                     = azurerm_subnet.lab02_subnet1.id
    private_ip_address_allocation = "Dynamic"
    public_ip_address_id          = azurerm_public_ip.linux_pip.id
  }

  tags = {
    Name         = local.Name
    Project      = local.Project
    ContactEmail = local.ContactEmail
    Environment  = local.Environment
  }
}

# Public IP for the Linux VM
resource "azurerm_public_ip" "linux_pip" {
  name                = "${var.linux_name}-pip"
  location            = var.location
  resource_group_name = azurerm_resource_group.lab02_rg.name
  allocation_method   = "Dynamic"
  sku                 = "Basic"

  tags = {
    Name         = local.Name
    Project      = local.Project
    ContactEmail = local.ContactEmail
    Environment  = local.Environment
  }
}

# Linux Virtual Machine
resource "azurerm_linux_virtual_machine" "linux_vm" {
  name                = var.linux_name
  resource_group_name = azurerm_resource_group.lab02_rg.name
  location            = var.location
  size                = var.vm_size
  admin_username      = var.admin_username

  network_interface_ids = [
    azurerm_network_interface.linux_nic.id,
  ]

  admin_ssh_key {
    username   = var.admin_username
    public_key = file(var.public_key_path)
  }

  os_disk {
    caching              = var.os_disk_caching
    storage_account_type = var.os_disk_storage_type
    disk_size_gb         = var.os_disk_size
  }

  source_image_reference {
    publisher = var.os_publisher
    offer     = var.os_offer
    sku       = var.os_sku
    version   = var.os_version
  }

  tags = {
    Name         = local.Name
    Project      = local.Project
    ContactEmail = local.ContactEmail
    Environment  = local.Environment
  }

}
```

Part 4: Initialize Terraform

7. Initialize Terraform to download plug-ins as required:

Part 5: Validate Configuration

8. Validate the configuration to ensure no errors or typos:
9. Fix any issues in the Terraform files if reported.
10. Re-run validation until no errors are reported:



Part 6: Run Simulation

11. Perform a dry run:

```
terraform plan
```

12. Review output and ensure all configuration meets requirements. Observe resources with +, -, or -/+ signs.
13. Fix any issues in the Terraform files if reported.
14. Redo the dry run until no errors are reported:

Part 7: Deploy Infrastructure

15. Deploy the infrastructure and monitor progress:

```
terraform apply
```

    - Type yes when prompted.

Part 8: Get Information from Terraform State

17. View and analyze state information:

```
terraform state list terraform
show
```

```
● ibs@Home lab03s3 % terraform state list
 azurerm_linux_virtual_machine.linux_vm
 azurerm_network_interface.linux_nic
 azurerm_network_security_group.lab02_nsg1
 azurerm_network_security_group.lab02_nsg2
 azurerm_public_ip.linux_pip
 azurerm_resource_group.lab02_rg
 azurerm_subnet.lab02_subnet1
 azurerm_subnet.lab02_subnet2
 azurerm_subnet_network_security_group_association.lab02_subnet2_nsg_assoc
 azurerm_subnet_network_security_group_association.lab02_subnet_nsg_assoc
 azurerm_virtual_network.lab02_vnet
● ibs@Home lab03s3 % terraform show
# azurerm_linux_virtual_machine.linux_vm:
resource "azurerm_linux_virtual_machine" "linux_vm" {
    admin_username                                         = "ibs"
    allow_extension_operations                             = true
    bypass_platform_safety_checks_on_user_schedule_enabled = false
    computer_name                                          = "lab03s2-db1-u-vm1"
    disable_password_authentication                        = true
    encryption_at_host_enabled                             = false
    extensions_time_budget                                 = "PT1H30M"
    id                                                     = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Compute/vi
rtualMachines/lab03s2-db1-u-vm1"
    location                                               = "eastus"
    max_bid_price                                          = -1
    name                                                   = "lab03s2-db1-u-vm1"
    network_interface_ids                                  = [
        "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/networkInterfaces/lab03s2-db1-u-vm1-nic",
    ]
    patch_assessment_mode                                  = "ImageDefault"
    patch_mode                                             = "ImageDefault"
    platform_fault_domain                                  = -1
    priority                                               = "Regular"
    private_ip_address                                     = "10.0.1.4"
    private_ip_addresses                                   = [
        "10.0.1.4",
    ]
    provision_vm_agent                                     = true
    public_ip_address                                      = "40.71.43.64"
    public_ip_addresses                                    = [
        "40.71.43.64",
    ]
    resource_group_name                                    = "lab02-rg"
    secure_boot_enabled                                    = false
    size                                                   = "Standard_B1s"
    tags                                                   = {
        "ContactEmail" = "iqbalshahnadiri786@gmail.com"
        "Environment"  = "Lab"
        "Name"         = "Terraform-Class"
        "Project"      = "Learning"
    }
    virtual_machine_id                                     = "2527ef77-7188-4785-b855-c80a9f5b89a1"
    vm_agent_platform_updates_enabled                      = false
    vtpm_enabled                                           = false

    admin_ssh_key {
        public_key = <<-EOT
            ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAACAQ[illegible]
[illegible]
```

```
djvWq1nXfa6rXkFLu1zxOa6bjp7QqsZ1toa5V32QCj6dV5f8PnyAQR4HL0xeCum6y88kUa0gAKVI67n1LnAqFik6+G5X4n134fDDVAFV8XsnHyR4doIDekR1NRwaTm20JzJ/A2j08KY7sYGdLJgnNZr0sNtOBQx24wgQkbPD
lxKm/0fL6LbxonxMvlJkveeoBx1DNH9o9qwDxDLhSksb34xAJCLyMrYiRlkhhQ== ibs@Home.local
        EOT
        username   = "ibs"
    }

    os_disk {
        caching                   = "ReadWrite"
        disk_size_gb              = 32
        id                        = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Compute/disks/lab03s2-db1-u-vm1_dis
k1_a96e9f45babd48e1a74a9731e0359607"
        name                      = "lab03s2-db1-u-vm1_disk1_a96e9f45babd48e1a74a9731e0359607"
        storage_account_type      = "Premium_LRS"
        write_accelerator_enabled = false
    }

    source_image_reference {
        offer     = "0001-com-ubuntu-server-focal"
        publisher = "Canonical"
        sku       = "20_04-lts"
        version   = "latest"
    }
}

# azurerm_network_interface.linux_nic:
resource "azurerm_network_interface" "linux_nic" {
    accelerated_networking_enabled = false
    applied_dns_servers            = []
    id                             = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/networkInterfaces/lab03s2-
db1-u-vm1-nic"
    internal_domain_name_suffix    = "3c5l3saz354evijbzqzrdxgmlb.bx.internal.cloudapp.net"
    ip_forwarding_enabled          = false
    location                       = "eastus"
    name                           = "lab03s2-db1-u-vm1-nic"
    private_ip_address             = "10.0.1.4"
    private_ip_addresses           = [
        "10.0.1.4",
    ]
    resource_group_name            = "lab02-rg"
    tags                           = {
        "ContactEmail" = "iqbalshahnadiri786@gmail.com"
        "Environment"  = "Lab"
        "Name"         = "Terraform-Class"
        "Project"      = "Learning"
    }

    ip_configuration {
        name                          = "lab03s2-db1-u-vm1-ipconfig1"
        primary                       = true
        private_ip_address            = "10.0.1.4"
        private_ip_address_allocation = "Dynamic"
        private_ip_address_version    = "IPv4"
        public_ip_address_id          = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/publicIPAddresses/lab03
s2-db1-u-vm1-pip"
        subnet_id                     = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-v
net/subnets/lab02-subnet1"
    }
}

# azurerm_network_security_group.lab02_nsg1:
```

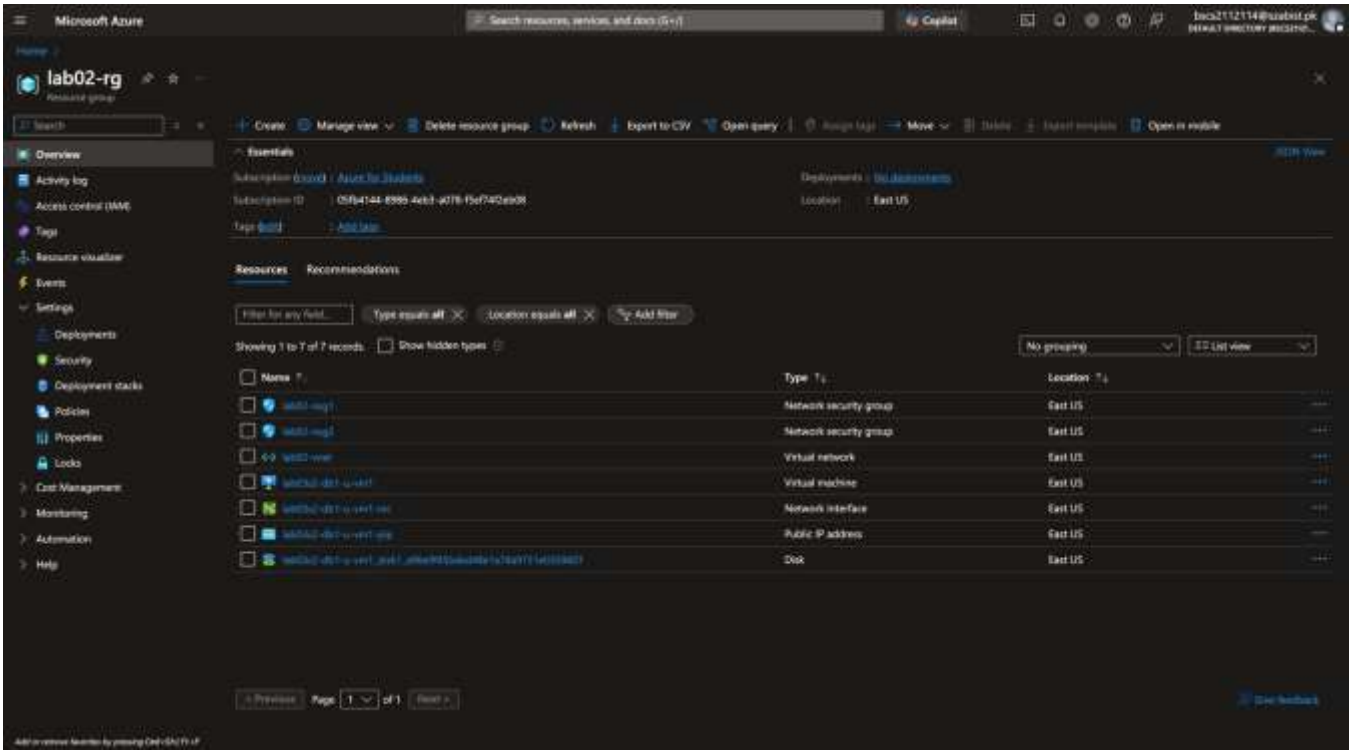
```
# azurerm_network_security_group.lab02_nsg1:
resource "azurerm_network_security_group" "lab02_nsg1" {
    id                  = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/networkSecurityGroups/lab02-nsg1"
    location            = "eastus"
    name                = "lab02-nsg1"
    resource_group_name = "lab02-rg"
    security_rule       = [
        {
            access                                     = "Allow"
            description                                = ""
            destination_address_prefix                 = "*"
            destination_address_prefixes               = []
            destination_application_security_group_ids = []
            destination_port_range                     = "22"
            destination_port_ranges                    = []
            direction                                  = "Inbound"
            name                                       = "rule1"
            priority                                   = 100
            protocol                                   = "Tcp"
            source_address_prefix                      = "*"
            source_address_prefixes                    = []
            source_application_security_group_ids      = []
            source_port_range                          = "*"
            source_port_ranges                         = []
        },
    ]
}

# azurerm_network_security_group.lab02_nsg2:
resource "azurerm_network_security_group" "lab02_nsg2" {
    id                  = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/networkSecurityGroups/lab02-nsg2"
    location            = "eastus"
    name                = "lab02-nsg2"
    resource_group_name = "lab02-rg"
    security_rule       = [
        {
            access                                     = "Allow"
            description                                = ""
            destination_address_prefix                 = "*"
            destination_address_prefixes               = []
            destination_application_security_group_ids = []
            destination_port_range                     = "1389"
            destination_port_ranges                    = []
            direction                                  = "Inbound"
            name                                       = "rule1"
            priority                                   = 100
            protocol                                   = "Tcp"
            source_address_prefix                      = "*"
            source_address_prefixes                    = []
            source_application_security_group_ids      = []
            source_port_range                          = "*"
            source_port_ranges                         = []
        },
        {
            access                                     = "Allow"
            description                                = ""
            destination_address_prefix                 = "*"
            destination_address_prefixes               = []
            destination_application_security_group_ids = []
            destination_port_range                     = "5985"
```

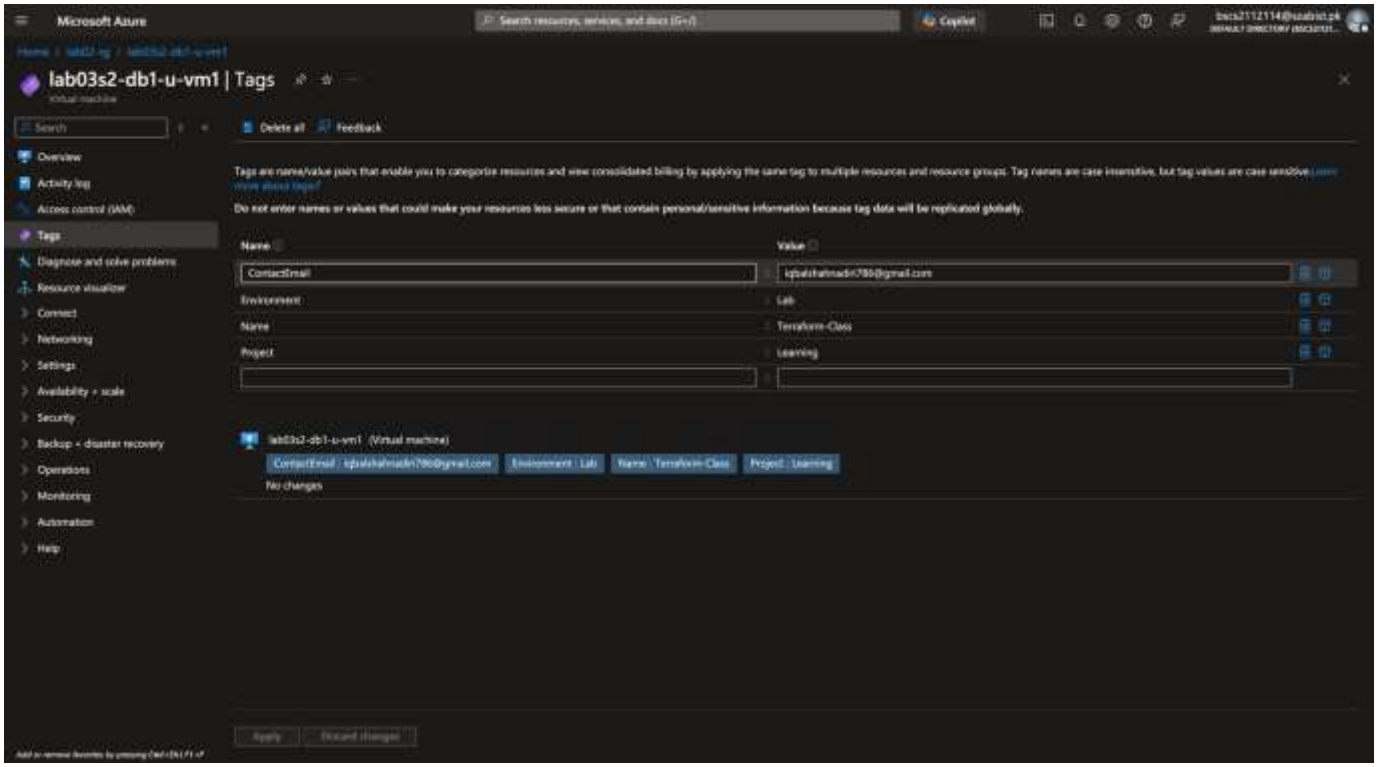
```
            source_application_security_group_ids      = []
            source_port_range                          = "*"
            source_port_ranges                         = []
        },
    ]
}

# azurerm_public_ip.linux_pip:
resource "azurerm_public_ip" "linux_pip" {
    allocation_method       = "Dynamic"
    ddos_protection_mode    = "VirtualNetworkInherited"
    id                      = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/publicIPAddresses/lab03s2-db1-u-vm1-pip"
    idle_timeout_in_minutes = 4
    ip_version              = "IPv4"
    location                = "eastus"
    name                    = "lab03s2-db1-u-vm1-pip"
    resource_group_name     = "lab02-rg"
    sku                     = "Basic"
    sku_tier                = "Regional"
    tags                    = {
        "ContactEmail" = "iqbalshahnadiri786@gmail.com"
        "Environment"  = "Lab"
        "Name"         = "Terraform-Class"
        "Project"      = "Learning"
    }
}

# azurerm_resource_group.lab02_rg:
resource "azurerm_resource_group" "lab02_rg" {
    id       = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg"
    location = "eastus"
    name     = "lab02-rg"
}

# azurerm_subnet.lab02_subnet1:
resource "azurerm_subnet" "lab02_subnet1" {
    address_prefixes                              = [
        "10.0.1.0/24",
    ]
    default_outbound_access_enabled               = true
    id                                            = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subnets/lab02-subnet1"
    name                                          = "lab02-subnet1"
    private_endpoint_network_policies             = "Disabled"
    private_link_service_network_policies_enabled = true
    resource_group_name                           = "lab02-rg"
    virtual_network_name                          = "lab02-vnet"
}

# azurerm_subnet.lab02_subnet2:
resource "azurerm_subnet" "lab02_subnet2" {
    address_prefixes                              = [
        "10.0.2.0/24",
    ]
    default_outbound_access_enabled               = true
    id                                            = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subnets/lab02-subnet2"
    name                                          = "lab02-subnet2"
    private_endpoint_network_policies             = "Disabled"
```

```
orks/lab02-vnet/subnets/lab02-subnet1"
    name                                          = "lab02-subnet1"
    private_endpoint_network_policies             = "Disabled"
    private_link_service_network_policies_enabled = true
    resource_group_name                           = "lab02-rg"
    virtual_network_name                          = "lab02-vnet"
}

# azurerm_subnet.lab02_subnet2:
resource "azurerm_subnet" "lab02_subnet2" {
    address_prefixes                              = [
        "10.0.2.0/24",
    ]
    default_outbound_access_enabled               = true
    id                                            = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetw
orks/lab02-vnet/subnets/lab02-subnet2"
    name                                          = "lab02-subnet2"
    private_endpoint_network_policies             = "Disabled"
    private_link_service_network_policies_enabled = true
    resource_group_name                           = "lab02-rg"
    virtual_network_name                          = "lab02-vnet"
}

# azurerm_subnet_network_security_group_association.lab02_subnet2_nsg_assoc:
resource "azurerm_subnet_network_security_group_association" "lab02_subnet2_nsg_assoc" {
    id                        = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subn
ets/lab02-subnet2"
    network_security_group_id = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/networkSecurityGroups/lab02-nsg
2"
    subnet_id                 = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subn
ets/lab02-subnet2"
}

# azurerm_subnet_network_security_group_association.lab02_subnet_nsg_assoc:
resource "azurerm_subnet_network_security_group_association" "lab02_subnet_nsg_assoc" {
    id                        = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subn
ets/lab02-subnet1"
    network_security_group_id = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/networkSecurityGroups/lab02-nsg
1"
    subnet_id                 = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet/subn
ets/lab02-subnet1"
}

# azurerm_virtual_network.lab02_vnet:
resource "azurerm_virtual_network" "lab02_vnet" {
    address_space                 = [
        "10.0.0.0/16",
    ]
    dns_servers                   = []
    flow_timeout_in_minutes       = 0
    guid                          = "c8bebee8-ef19-4afc-a121-cc3311dccd9"
    id                            = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/virtualNetworks/lab02-vnet
"
    location                      = "eastus"
    name                          = "lab02-vnet"
    private_endpoint_vnet_policies = "Disabled"
    resource_group_name           = "lab02-rg"
    subnet                        = []
}
\ibs@None lab03s3 %
```

Part 9: Confirm Resource Creation in Azure

18. Log in to the Azure Portal. Navigate to the resource group and confirm all resources and tags exist as per specifications.





Part 10: Destroy All Resources and Verify

19. Destroy all resources:

```
terraform destroy
```

    - Type yes when prompted.

20. Verify deletion:

```
terraform state list terraform
show
```

Section 4

Objectives:

- Use configuration from Section 3.
- Define output blocks to display values.
- Validate, deploy, expand, analyze, and destroy infrastructure.

Part 1: Prepare for the Lab

1. Copy the lab03s3 directory as lab03s4:
2. Change into the lab03s4 directory:
3. Create an empty file called outputs03s4.‘:

Part 2: Update outputs03s4.A File

4. Open outputs03s4.‘ in a text editor and define output blocks to display:
    a. VM hostname (1 block).
    b. Private IP address (1 block) and Public IP address (1 block).
    c. Virtual network name (1 block) and address space (1 block).
    d. Subnet names (2 blocks) and address spaces (2 blocks).

outputs03s4.tf

```
// a. VM hostname
output "vm_hostname" {
  description = "The hostname of the virtual machine."
  value       = azurerm_linux_virtual_machine.linux_vm.computer_name
}

// b. Private and Public IP addresses
output "vm_private_ip" {
  description = "The private IP address of the virtual machine."
  value       = azurerm_linux_virtual_machine.linux_vm.private_ip_address
}

output "vm_public_ip" {
  description = "The public IP address of the Linux VM."
  value       = azurerm_public_ip.linux_pip.ip_address
}

// c. Virtual network name and address space
output "vnet_name" {
  description = "The name of the virtual network."
  value       = azurerm_virtual_network.lab02_vnet.name
}

// Retrieve a single address space value using element()
output "vnet_address_space" {
  description = "The address space of the virtual network."
  value       = element(tolist(azurerm_virtual_network.lab02_vnet.address_space), 0)
}



// d. Subnet names and address spaces
output "subnet1_name" {
  description = "The name of the first subnet."
  value       = azurerm_subnet.lab02_subnet1.name
}

output "subnet1_address_space" {
  description = "The address space of the first subnet."
  value       = element(azurerm_subnet.lab02_subnet1.address_prefixes, 0)
}

output "subnet2_name" {
  description = "The name of the second subnet."
  value       = azurerm_subnet.lab02_subnet2.name
}
```

```

output "subnet2_address_space" {
  description = "The address space of the second subnet."
  value       = element(azurerm_subnet.lab02_subnet2.address_prefixes, 0)
}

```

Part 3: Validate Configuration

5. Validate the configuration to ensure no errors or typos:
6. Fix any issues in the Terraform files if reported.
7. Re-run validation until no errors are reported:

```
ibs@Home lab03s4 % terraform init

Initializing the backend...

Initializing provider plugins...
- Reusing previous version of hashicorp/azurerm from the dependency lock file
- Using previously-installed hashicorp/azurerm v4.26.0

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform plan" to see
any changes that are required for your infrastructure. All Terraform commands
should now work.

If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.
ibs@Home lab03s4 % terraform validate
Success! The configuration is valid.
```

Part 4: Run Simulation

8. Perform a dry run:

```
terraform plan
```

9. Review output and ensure all configuration meets requirements. Observe resources with +, -, or -/+ signs.
10. Fix any issues in the Terraform files if reported.
11. Redo the dry run until no errors are reported:

Part 5: Deploy Infrastructure

12. Deploy the infrastructure and monitor progress:

```
terraform apply
```

    - Type yes when prompted.
13. Confirm output values displayed on the screen at the end of deployment.

Part 6: Get Information from Terraform State

14. View and analyze state information:

```
terraform state list terraform
show
```

```
ibs@Home lab03s4 % terraform state list
azurerm_linux_virtual_machine.linux_vm
azurerm_network_interface.linux_nic
azurerm_network_security_group.lab02_nsg1
azurerm_network_security_group.lab02_nsg2
azurerm_public_ip.linux_pip
azurerm_resource_group.lab02_rg
azurerm_subnet.lab02_subnet1
azurerm_subnet.lab02_subnet2
azurerm_subnet_network_security_group_association.lab02_subnet2_nsg
_assoc
azurerm_subnet_network_security_group_association.lab02_subnet_nsg_
assoc
azurerm_virtual_network.lab02_vnet
```

```
ibs@Home lab03s4 % terraform show
# azurerm_linux_virtual_machine.linux_vm:
resource "azurerm_linux_virtual_machine" "linux_vm" {
    admin_username                                         = "ibs"
    allow_extension_operations                             = true
    bypass_platform_safety_checks_on_user_schedule_enabled = false
    computer_name                                          = "lab03
s2-db1-u-vm1"
    disable_password_authentication                        = true
    encryption_at_host_enabled                             = false
    extensions_time_budget                                 = "PT1H3
0M"
    id                                                     = "/subs
criptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02
-rg/providers/Microsoft.Compute/virtualMachines/lab03s2-db1-u-vm1"
    location                                               = "eastu
s"
    max_bid_price                                          = -1
    name                                                   = "lab03
s2-db1-u-vm1"
    network_interface_ids                                  = [
        "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resour
ceGroups/lab02-rg/providers/Microsoft.Network/networkInterfaces/lab
03s2-db1-u-vm1-nic",
    ]
    patch_assessment_mode                                  = "Image
Default"
    patch_mode                                             = "Image
Default"
    platform_fault_domain                                  = -1
    priority                                               = "Regul
ar"
    private_ip_address                                     = "10.0.
1.4"
    private_ip_addresses                                   = [
        "10.0.1.4",
    ]
    provision_vm_agent                                     = true
    public_ip_address                                      = "172.1
90.77.214"
    public_ip_addresses                                    = [
        "172.190.77.214",
    ]
    resource_group_name                                    = "lab02
-rg"
    secure_boot_enabled                                    = false
    size                                                   = "Stand
ard_B1s"
    tags                                                   = {
        "ContactEmail" = "iqbalshahnadiri786@gmail.com"
        "Environment"  = "Lab"
        "Name"         = "Terraform-Class"
        "Project"      = "Learning"
    }
    virtual_machine_id                                     = "7e4bb
f87-26e0-4146-b278-72b1d4155f9d"
    vm_agent_platform_updates_enabled                      = false
    vtpm_enabled                                           = false
```

```
    admin_ssh_key {
        public_key = <<-EOT
            ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAACAQDMybSuIYAUlA4wPKF
cWQpLyVy2eEcbLvQdhmH/Il/hACF/Ak5gQqvbN55EXJXX1VNjX+JH1j5LNWx9dx7VwQ
tBlvs2sFxFcq3dswYcWV4wF3wyHxgibKKmz4IrSiQ3ZejtyBbaZLAoPt9a5EWq0Pv+4
hcwv7w0CZf4o7Q1LL6ML3vJ3Ggk6XPjECaGHNAsfQBWBvaMJkDKknVyAqiLb1r4uA0q
NNs3NeDLdpusDEU3mG+V5/J0R8/RCaR8G1QuG62ITg+C3L7dlPkgie2zJyR0ew7+uux
eYkXSMBjrMhjLf+cv+bpejPjuB7+/Bt8TY4y8PYclrton7H1AAAMeYTWAASkKZrE9Fy
nAQc8kIZi+aiAdM5pabkFYMBFx1dhh6diSfT67StviR5GcwQ5w93/BQowkYxvWIVKcu
uvKvS4+BPbpAw/FE8ED3aZO67HfRvOcOekTdjvWq1nXfa6rXkFLu1zxOa6bjp7QqsZ1
toa5V32QCj6dVSfBPnyAQR4HL0keCum6y80kUa0gAKVI67n1LnAqFik6+GSX4nl34fD
DVAFV0XsnHyR4doIDmkR1NKwaTmJOJzJ/AZj08KY7sYGdLJgnNZr0oNtOBQxZ4wgQkb
POlxKm/0fL6LbxonxMvlJkveeoBx1ONH9o9qwDxDLhSksb34xAJCLyMrYiRlkhhQ==
ibs@Home.local
        EOT
        username   = "ibs"
    }

    os_disk {
        caching                   = "ReadWrite"
        disk_size_gb              = 32
        id                        = "/subscriptions/05fb4144-8986-4
eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.C
ompute/disks/lab03s2-db1-u-vm1_disk1_fc295db76f1a4ad482e791e448e354
80"
        name                      = "lab03s2-db1-u-vm1_disk1_fc295d
b76f1a4ad482e791e448e35480"
        storage_account_type      = "Premium_LRS"
        write_accelerator_enabled = false
    }

    source_image_reference {
        offer     = "0001-com-ubuntu-server-focal"
        publisher = "Canonical"
        sku       = "20_04-lts"
        version   = "latest"
    }
}

# azurerm_network_interface.linux_nic:
resource "azurerm_network_interface" "linux_nic" {
    accelerated_networking_enabled = false
    applied_dns_servers            = []
    id                             = "/subscriptions/05fb4144-8986-
4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.
Network/networkInterfaces/lab03s2-db1-u-vm1-nic"
    internal_domain_name_suffix    = "15dq1tlpoo2upjbji2oitkvboh.bx
.internal.cloudapp.net"
    ip_forwarding_enabled          = false
    location                       = "eastus"
    name                           = "lab03s2-db1-u-vm1-nic"
    private_ip_address             = "10.0.1.4"
    private_ip_addresses           = [
        "10.0.1.4",
    ]
    resource_group_name            = "lab02-rg"
    tags                           = {
        "ContactEmail" = "iqbalshahnadiri786@gmail.com"
        "Environment"  = "Lab"
        "Name"         = "Terraform-Class"
```

```
        "Project"      = "Learning"
    }

    ip_configuration {
        name                          = "lab03s2-db1-u-vm1-ipconfig
1"
        primary                       = true
        private_ip_address            = "10.0.1.4"
        private_ip_address_allocation = "Dynamic"
        private_ip_address_version    = "IPv4"
        public_ip_address_id          = "/subscriptions/05fb4144-89
86-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microso
ft.Network/publicIPAddresses/lab03s2-db1-u-vm1-pip"
        subnet_id                     = "/subscriptions/05fb4144-89
86-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microso
ft.Network/virtualNetworks/lab02-vnet/subnets/lab02-subnet1"
    }
}

# azurerm_network_security_group.lab02_nsg1:
resource "azurerm_network_security_group" "lab02_nsg1" {
    id                  = "/subscriptions/05fb4144-8986-4eb3-a078-f
5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/net
workSecurityGroups/lab02-nsg1"
    location            = "eastus"
    name                = "lab02-nsg1"
    resource_group_name = "lab02-rg"
    security_rule       = [
        {
            access                                     = "Allow"
            description                                = ""
            destination_address_prefix                 = "*"
            destination_address_prefixes               = []
            destination_application_security_group_ids = []
            destination_port_range                     = "22"
            destination_port_ranges                    = []
            direction                                  = "Inbound"
            name                                       = "rule1"
            priority                                   = 100
            protocol                                   = "Tcp"
            source_address_prefix                      = "*"
            source_address_prefixes                    = []
            source_application_security_group_ids      = []
            source_port_range                          = "*"
            source_port_ranges                         = []
        },
    ]
}

# azurerm_network_security_group.lab02_nsg2:
resource "azurerm_network_security_group" "lab02_nsg2" {
    id                  = "/subscriptions/05fb4144-8986-4eb3-a078-f
5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network/net
workSecurityGroups/lab02-nsg2"
    location            = "eastus"
    name                = "lab02-nsg2"
    resource_group_name = "lab02-rg"
    security_rule       = [
        {
            access                                     = "Allow"
```

```
            description                                = ""
            destination_address_prefix                 = "*"
            destination_address_prefixes               = []
            destination_application_security_group_ids = []
            destination_port_range                     = "3389"
            destination_port_ranges                    = []
            direction                                  = "Inbound"
            name                                       = "rule1"
            priority                                   = 100
            protocol                                   = "Tcp"
            source_address_prefix                      = "*"
            source_address_prefixes                    = []
            source_application_security_group_ids      = []
            source_port_range                          = "*"
            source_port_ranges                         = []
        },
        {
            access                                     = "Allow"
            description                                = ""
            destination_address_prefix                 = "*"
            destination_address_prefixes               = []
            destination_application_security_group_ids = []
            destination_port_range                     = "5985"
            destination_port_ranges                    = []
            direction                                  = "Inbound"
            name                                       = "rule2"
            priority                                   = 200
            protocol                                   = "Tcp"
            source_address_prefix                      = "*"
            source_address_prefixes                    = []
            source_application_security_group_ids      = []
            source_port_range                          = "*"
            source_port_ranges                         = []
        },
    ]
}

# azurerm_public_ip.linux_pip:
resource "azurerm_public_ip" "linux_pip" {
    allocation_method       = "Dynamic"
    ddos_protection_mode    = "VirtualNetworkInherited"
    id                      = "/subscriptions/05fb4144-8986-4eb3-a0
78-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Network
/publicIPAddresses/lab03s2-db1-u-vm1-pip"
    idle_timeout_in_minutes = 4
    ip_version              = "IPv4"
    location                = "eastus"
    name                    = "lab03s2-db1-u-vm1-pip"
    resource_group_name     = "lab02-rg"
    sku                     = "Basic"
    sku_tier                = "Regional"
    tags                    = {
        "ContactEmail" = "iqbalshahnadiri786@gmail.com"
        "Environment"  = "Lab"
        "Name"         = "Terraform-Class"
        "Project"      = "Learning"
    }
}

# azurerm_resource_group.lab02_rg:
```

```
# azurerm_resource_group.lab02_rg:
resource "azurerm_resource_group" "lab02_rg" {
    id       = "/subscriptions/05fb4144-8986-4eb3-a078-f5ef74f2eb08
/resourceGroups/lab02-rg"
    location = "eastus"
    name     = "lab02-rg"
}

# azurerm_subnet.lab02_subnet1:
resource "azurerm_subnet" "lab02_subnet1" {
    address_prefixes                              = [
        "10.0.1.0/24",
    ]
    default_outbound_access_enabled               = true
    id                                            = "/subscriptions
/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/provi
ders/Microsoft.Network/virtualNetworks/lab02-vnet/subnets/lab02-sub
net1"
    name                                          = "lab02-subnet1"
    private_endpoint_network_policies             = "Disabled"
    private_link_service_network_policies_enabled = true
    resource_group_name                           = "lab02-rg"
    virtual_network_name                          = "lab02-vnet"
}

# azurerm_subnet.lab02_subnet2:
resource "azurerm_subnet" "lab02_subnet2" {
    address_prefixes                              = [
        "10.0.2.0/24",
    ]
    default_outbound_access_enabled               = true
    id                                            = "/subscriptions
/05fb4144-8986-4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/provi
ders/Microsoft.Network/virtualNetworks/lab02-vnet/subnets/lab02-sub
net2"
    name                                          = "lab02-subnet2"
    private_endpoint_network_policies             = "Disabled"
    private_link_service_network_policies_enabled = true
    resource_group_name                           = "lab02-rg"
    virtual_network_name                          = "lab02-vnet"
}

# azurerm_subnet_network_security_group_association.lab02_subnet2_n
sg_assoc:
resource "azurerm_subnet_network_security_group_association" "lab02
_subnet2_nsg_assoc" {
    id                        = "/subscriptions/05fb4144-8986-4eb3-
a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Netwo
rk/virtualNetworks/lab02-vnet/subnets/lab02-subnet2"
    network_security_group_id = "/subscriptions/05fb4144-8986-4eb3-
a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Netwo
rk/networkSecurityGroups/lab02-nsg2"
    subnet_id                 = "/subscriptions/05fb4144-8986-4eb3-
a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Netwo
rk/virtualNetworks/lab02-vnet/subnets/lab02-subnet2"
}

# azurerm_subnet_network_security_group_association.lab02_subnet_ns
g_assoc:
resource "azurerm_subnet_network_security_group_association" "lab02
```

```
resource "azurerm_subnet_network_security_group_association" "lab02
_subnet2_nsg_assoc" {
    id                        = "/subscriptions/05fb4144-8986-4eb3-
a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Netwo
rk/virtualNetworks/lab02-vnet/subnets/lab02-subnet2"
    network_security_group_id = "/subscriptions/05fb4144-8986-4eb3-
a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Netwo
rk/networkSecurityGroups/lab02-nsg2"
    subnet_id                 = "/subscriptions/05fb4144-8986-4eb3-
a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Netwo
rk/virtualNetworks/lab02-vnet/subnets/lab02-subnet2"
}

# azurerm_subnet_network_security_group_association.lab02_subnet_ns
g_assoc:
resource "azurerm_subnet_network_security_group_association" "lab02
_subnet_nsg_assoc" {
    id                        = "/subscriptions/05fb4144-8986-4eb3-
a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Netwo
rk/virtualNetworks/lab02-vnet/subnets/lab02-subnet1"
    network_security_group_id = "/subscriptions/05fb4144-8986-4eb3-
a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Netwo
rk/networkSecurityGroups/lab02-nsg1"
    subnet_id                 = "/subscriptions/05fb4144-8986-4eb3-
a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.Netwo
rk/virtualNetworks/lab02-vnet/subnets/lab02-subnet1"
}

# azurerm_virtual_network.lab02_vnet:
resource "azurerm_virtual_network" "lab02_vnet" {
    address_space               = [
        "10.0.0.0/16",
    ]
    dns_servers                 = []
    flow_timeout_in_minutes     = 0
    guid                        = "cd0dc7df-736f-47b9-a429-471c8
9aaa177"
    id                          = "/subscriptions/05fb4144-8986-
4eb3-a078-f5ef74f2eb08/resourceGroups/lab02-rg/providers/Microsoft.
Network/virtualNetworks/lab02-vnet"
    location                    = "eastus"
    name                        = "lab02-vnet"
    private_endpoint_vnet_policies = "Disabled"
    resource_group_name         = "lab02-rg"
    subnet                      = []
}


Outputs:

subnet1_address_space = "10.0.1.0/24"
subnet1_name = "lab02-subnet1"
subnet2_address_space = "10.0.2.0/24"
subnet2_name = "lab02-subnet2"
vm_hostname = "lab03s2-db1-u-vm1"
vm_private_ip = "10.0.1.4"
vm_public_ip = ""
vnet_address_space = "10.0.0.0/16"
vnet_name = "lab02-vnet"
ibs@Home lab03s4 %
```

Part 7: Display Output Information

15. Display output information:

```
terraform output
```

```
ibs@Home lab03s4 % terraform output
subnet1_address_space = "10.0.1.0/24"
subnet1_name = "lab02-subnet1"
subnet2_address_space = "10.0.2.0/24"
subnet2_name = "lab02-subnet2"
vm_hostname = "lab03s2-db1-u-vm1"
vm_private_ip = "10.0.1.4"
vm_public_ip = ""
vnet_address_space = "10.0.0.0/16"
vnet_name = "lab02-vnet"
ibs@Home lab03s4 %
```

Part 8: Destroy All Resources and Verify

16. Destroy all resources:

```
terraform destroy
```

    - Type yes when prompted.

17. Verify deletion:

```
terraform state list terraform
show
```

```
ibs@Home lab03s4 % terraform state list
ibs@Home lab03s4 % terraform show
The state file is empty. No resources are represented.
ibs@Home lab03s4 %
```

Section 5

Objectives:

- Use configuration from Section 4.
- Define lifecycle rules to prevent updates and resource deletions.
- Define explicit dependency.
- Validate, deploy, expand, analyze, and destroy infrastructure.

Part 1: Prepare for the Lab

1. Copy the lab03s4 directory as lab03s5:
2. Change into the lab03s5 directory:
3. Rename lab03s3.‘ as lab03s5.‘:

Part 2: Update lab03s5.A File

4. Open lab03s5.‘ in a text editor and define an explicit dependency rule for the virtual machine to wait for the creation of the resource group.

lab03s5.tf

```
# Network Interface for the Linux VM
resource "azurerm_network_interface" "linux_nic" {
  name                = "${var.linux_name}-nic"
  location            = var.location
  resource_group_name = azurerm_resource_group.lab02_rg.name

  ip_configuration {
    name                          = "${var.linux_name}-ipconfig1"
    subnet_id                     = azurerm_subnet.lab02_subnet1.id
    private_ip_address_allocation = "Dynamic"
    public_ip_address_id          = azurerm_public_ip.linux_pip.id
  }

  tags = {
    Name         = local.Name
    Project      = local.Project
    ContactEmail = local.ContactEmail
    Environment  = local.Environment
  }
}

# Public IP for the Linux VM
resource "azurerm_public_ip" "linux_pip" {
  name                = "${var.linux_name}-pip"
  location            = var.location
  resource_group_name = azurerm_resource_group.lab02_rg.name
  allocation_method   = "Dynamic"
  sku                 = "Basic"

  tags = {
    Name         = local.Name
    Project      = local.Project
    ContactEmail = local.ContactEmail
    Environment  = local.Environment
  }
}

# Linux Virtual Machine
resource "azurerm_linux_virtual_machine" "linux_vm" {
  name                = var.linux_name
  resource_group_name = azurerm_resource_group.lab02_rg.name
  location            = var.location
  size                = var.vm_size
  admin_username      = var.admin_username
```

```
lab03s5.tf ×
lab03s5.tf
resource "azurerm_linux_virtual_machine" "linux_vm" {

  network_interface_ids = [
    azurerm_network_interface.linux_nic.id,
  ]

  admin_ssh_key {
    username   = var.admin_username
    public_key = file(var.public_key_path)
  }

  depends_on = [
    azurerm_resource_group.lab02_rg
  ]

  os_disk {
    caching              = var.os_disk_caching
    storage_account_type = var.os_disk_storage_type
    disk_size_gb         = var.os_disk_size
  }

  source_image_reference {
    publisher = var.os_publisher
    offer     = var.os_offer
    sku       = var.os_sku
    version   = var.os_version
  }

  tags = {
    Name         = local.Name
    Project      = local.Project
    ContactEmail = local.ContactEmail
    Environment  = local.Environment
  }

}

```

Part 3: Validate Configuration

5. Validate the configuration to ensure no errors or typos:
6. Fix any issues in the Terraform files if reported.
7. Re-run validation until no errors are reported:

```
ibs@Home lab03s5 % terraform init

Initializing the backend...

Initializing provider plugins...
- Reusing previous version of hashicorp/azurerm from the dependency lock file
- Using previously-installed hashicorp/azurerm v4.26.0

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform plan" to see
any changes that are required for your infrastructure. All Terraform commands
should now work.

If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.
ibs@Home lab03s5 % terraform validate
Success! The configuration is valid.
```

Part 4: Run Simulation

8. Perform a dry run:

```
terraform plan
```

9. Review output and ensure all configuration meets requirements. Observe resources with +, -, or -/+ signs.
10. Fix any issues in the Terraform files if reported.
11. Redo the dry run until no errors are reported: **Part 5: Deploy Infrastructure**

12. Deploy the infrastructure and monitor progress:

```
terraform apply
```

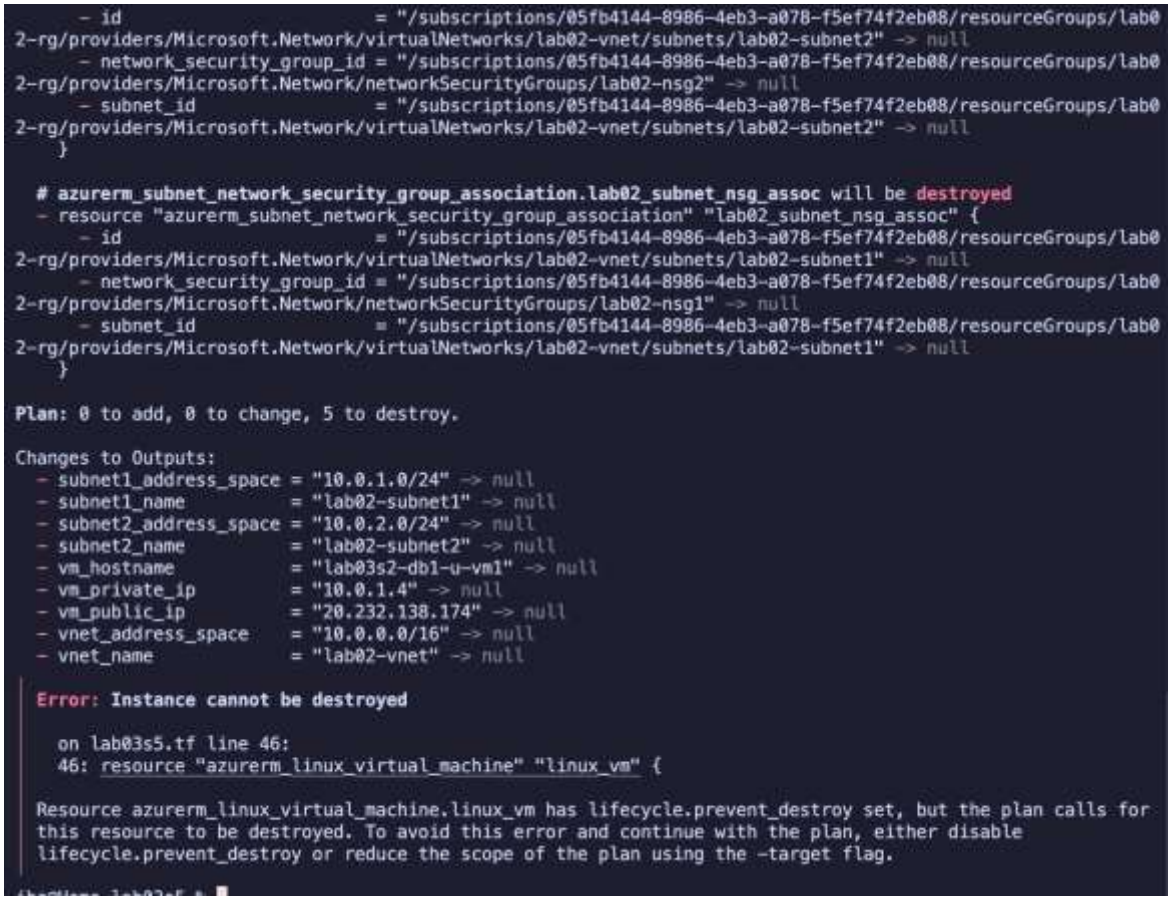
    - Type yes when prompted.
13. Confirm output values displayed on the screen at the end of deployment.

Part 6: Add and Test a Lifecycle Deletion Rule

16. Edit lab03s5.‘ in a text editor and add a rule to prevent virtual machine, public IP, and network interface resources from removal (use lifecycle { prevent_destroy = true }).
17. Run:

```
terraform destroy
```

    - Observe the error message generated.



18. Edit lab03s5.‘ again and remove the deletion rules. *Do not destroy the infrastructure yet.*

Part 7: Add and Test a Lifecycle Update Rule

19. Go to the Azure Portal and change some tag values for the virtual machine.
20. Edit lab03s5.‘ in a text editor and add a rule to prevent tag updates to the virtual machine (use lifecycle { ignore_changes = [tags] }).
21. Run:

```
terraform plan
```

    - Observe the dry run output.

22. Edit lab03s5.‘ again and remove the update rule.

Part 8: Display Dependency Graph

23. Show dependency tree:

```
terraform graph
```

```
ibs@Home lab03s5 % terraform graph
digraph {
        compound = "true"
        newrank = "true"
        subgraph "root" {
                "[root] azurerm_linux_virtual_machine.linux_vm (expand)" [label = "azurerm_linux_virtual_mac
hine.linux_vm", shape = "box"]
                "[root] azurerm_network_interface.linux_nic (expand)" [label = "azurerm_network_interface.li
nux_nic", shape = "box"]
                "[root] azurerm_network_security_group.lab02_nsg1 (expand)" [label = "azurerm_network_securi
ty_group.lab02_nsg1", shape = "box"]
                "[root] azurerm_network_security_group.lab02_nsg2 (expand)" [label = "azurerm_network_securi
ty_group.lab02_nsg2", shape = "box"]
                "[root] azurerm_public_ip.linux_pip (expand)" [label = "azurerm_public_ip.linux_pip", shape
= "box"]
                "[root] azurerm_resource_group.lab02_rg (expand)" [label = "azurerm_resource_group.lab02_rg"
, shape = "box"]
                "[root] azurerm_subnet.lab02_subnet1 (expand)" [label = "azurerm_subnet.lab02_subnet1", shap
e = "box"]
                "[root] azurerm_subnet.lab02_subnet2 (expand)" [label = "azurerm_subnet.lab02_subnet2", shap
e = "box"]
                "[root] azurerm_subnet_network_security_group_association.lab02_subnet2_nsg_assoc (expand)"
[label = "azurerm_subnet_network_security_group_association.lab02_subnet2_nsg_assoc", shape = "box"]
                "[root] azurerm_subnet_network_security_group_association.lab02_subnet_nsg_assoc (expand)" [
label = "azurerm_subnet_network_security_group_association.lab02_subnet_nsg_assoc", shape = "box"]
                "[root] azurerm_virtual_network.lab02_vnet (expand)" [label = "azurerm_virtual_network.lab02
_vnet", shape = "box"]
                "[root] provider[\"registry.terraform.io/hashicorp/azurerm\"]" [label = "provider[\"registry
.terraform.io/hashicorp/azurerm\"]", shape = "diamond"]
                "[root] var.admin_username" [label = "var.admin_username", shape = "note"]
                "[root] var.linux_name" [label = "var.linux_name", shape = "note"]
                "[root] var.location" [label = "var.location", shape = "note"]
                "[root] var.nsg1_name" [label = "var.nsg1_name", shape = "note"]
                "[root] var.nsg2_name" [label = "var.nsg2_name", shape = "note"]
                "[root] var.os_disk_caching" [label = "var.os_disk_caching", shape = "note"]
                "[root] var.os_disk_size" [label = "var.os_disk_size", shape = "note"]
                "[root] var.os_disk_storage_type" [label = "var.os_disk_storage_type", shape = "note"]
                "[root] var.os_offer" [label = "var.os_offer", shape = "note"]
                "[root] var.os_publisher" [label = "var.os_publisher", shape = "note"]
                "[root] var.os_sku" [label = "var.os_sku", shape = "note"]
                "[root] var.os_version" [label = "var.os_version", shape = "note"]
                "[root] var.public_key_path" [label = "var.public_key_path", shape = "note"]
                "[root] var.rg_name" [label = "var.rg_name", shape = "note"]
                "[root] var.subnet1_name" [label = "var.subnet1_name", shape = "note"]
                "[root] var.subnet1_prefix" [label = "var.subnet1_prefix", shape = "note"]
                "[root] var.subnet2_name" [label = "var.subnet2_name", shape = "note"]
                "[root] var.subnet2_prefix" [label = "var.subnet2_prefix", shape = "note"]
                "[root] var.vm_size" [label = "var.vm_size", shape = "note"]
                "[root] var.vnet_address" [label = "var.vnet_address", shape = "note"]
                "[root] var.vnet_name" [label = "var.vnet_name", shape = "note"]
                "[root] azurerm_linux_virtual_machine.linux_vm (expand)" -> "[root] azurerm_network_interfac
e.linux_nic (expand)"
                "[root] azurerm_linux_virtual_machine.linux_vm (expand)" -> "[root] var.admin_username"
                "[root] azurerm_linux_virtual_machine.linux_vm (expand)" -> "[root] var.os_disk_caching"
                "[root] azurerm_linux_virtual_machine.linux_vm (expand)" -> "[root] var.os_disk_size"
                "[root] azurerm_linux_virtual_machine.linux_vm (expand)" -> "[root] var.os_disk_storage_type
"
                "[root] azurerm_linux_virtual_machine.linux_vm (expand)" -> "[root] var.os_offer"
                "[root] azurerm_linux_virtual_machine.linux_vm (expand)" -> "[root] var.os_publisher"
                "[root] azurerm_linux_virtual_machine.linux_vm (expand)" -> "[root] var.os_sku"
                "[root] azurerm_linux_virtual_machine.linux_vm (expand)" -> "[root] var.os_version"
                "[root] azurerm_linux_virtual_machine.linux_vm (expand)" -> "[root] var.public_key_path"
                "[root] azurerm_linux_virtual_machine.linux_vm (expand)" -> "[root] var.vm_size"
                "[root] azurerm_network_interface.linux_nic (expand)" -> "[root] azurerm_public_ip.linux_pip
 (expand)"
                "[root] azurerm_network_interface.linux_nic (expand)" -> "[root] azurerm_subnet.lab02_subnet
1 (expand)"
                "[root] azurerm_network_security_group.lab02_nsg1 (expand)" -> "[root] azurerm_resource_grou
p.lab02_rg (expand)"
                "[root] azurerm_network_security_group.lab02_nsg1 (expand)" -> "[root] var.nsg1_name"
                "[root] azurerm_network_security_group.lab02_nsg2 (expand)" -> "[root] azurerm_resource_grou
```

Part 9: Destroy All Resources and Verify

24. Destroy all resources:

```
terraform destroy
```

    - Type yes when prompted.

25. Verify deletion:

```
terraform state list terraform

show
```


ibs@Home lab03s5 % terraform state list
ibs@Home lab03s5 % terraform show
The state file is empty. No resources are represented.
ibs@Home lab03s5 %