

# Mandatory Assignment 01 - IaC IKG3005

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- The purpose of each module
- How to use the Terraform scripts
- Any pre-requisites or dependencies

## Modules

### Network Module

The [Network Module](#) is used to provision a VNET, Subnet and Network Security Group. The module takes in the following variables:

These can also be found in the [variables.tf](#) file.

Variable	Description	Type	Default
vnet_rg_name	VNET Resource Group Name	string	vnet-rg
vnet_rg_location	VNET Resource Group Location	string	westeurope
vnet_name	VNET Name	string	vnet
vnet_address_space	VNET Address Space	list	
vnet_dns_servers	VNET DNS Servers	list	
subnet_name	Subnet Name	string	subnet
subnet_address_space	Subnet Address Space	list	
nsg_name	Network Security Group Name	string	nsg
my_ip	Your IP Address, used for NSG later	string	

### Storage Account Module

The [Storage Account Module](#) is used to create an Azure Storage Account and a Storage Container. The module takes in the following variables:

These can also be found in the [variables.tf](#) file.

Variable	Description	Type	Default
sa_base_name	Base name of the Storage Account	string	sa
sa_rg_name	Storage Account Resource Group Name	string	sa-rg
sa_location	Location of the Storage Account	string	westeurope
sa_container_name	Name of the Storage Container	string	container
sa_account_tier	Storage Account Tier	string	Standard

Variable	Description	Type	Default
sa_replication_type	Storage Account Replication Type	string	GRS

## Virtual Machine Module

The [Virtual Machine Module](#) is used to provision an Azure Virtual Machine. The module takes in the following variables:

These can also be found in the [variables.tf](#) file.

Variable	Description	Type	Default
vm_name	Virtual Machine Name	string	vm
vm_size	Virtual Machine Size	string	Standard_B2s
vm_rg_name	Virtual Machine Resource Group Name	string	vm-rg
vm_rg_location	Location of the Virtual Machine Resource Group	string	westeurope
vm_nic_name	Virtual Machine NIC Name	string	vm-nic
vm_nic_private_ip_address	Virtual Machine NIC Private IP	string	
pip_name	Public IP Name	string	vm-pip-name
vm_subnet_id	Subnet ID	string	
vm_username	Username for the Virtual Machine	string	
vm_password	Password for the Virtual Machine	string	

## Key Vault Module

The [Key Vault Module](#) is used to provision Azure Key Vault and store secret. The module takes in the following variables:

These can also be found in the [variables.tf](#) file.

Variable	Description	Type	Default
kv_rgname	Key Vault Resource Group Name	string	kv-rg
kv_location	location of the Key Vault	string	westeurope
kv_base_name	Base name of the Key Vault	string	kv
kv_sku_name	SKU of the Key Vault	string	standard
sa_access_key	Access key for the Storage Account	string	
sa_base_name	Base name of the Storage Account	string	sa
vm_password	Password for the Virtual Machine	string	
vm_username	Username for the Virtual Machine	string	

## Dependencies & Prerequisites

- [Terraform](#) >= 0.12.0
- [Azure CLI](#) >= 2.0.0
- [Azure Subscription](#)
- [Azure Service Principal](#)

## HOWTO

### Setup

1. Clone the repository
2. Create a **terraform.tfvars** file in the root of the repository and fill in the variables in the [Variables](#) section below.
3. Login to Azure using the Azure CLI
  1. Run **az login**
  2. Follow the instructions on the screen
  3. Alternatively, you can login using a Service Principal
    - Run **az login --service-principal -u -p --tenant**
4. Run **terraform init** to initialize the project
5. Run **terraform plan** to see what resources will be created
6. Run **terraform apply** to create the resources
7. Run **terraform destroy** to destroy the resources

### Terraform Plan

Used to see what resources will be created before running **terraform apply**.

Can be used in combination with **-out** to save the plan to a file, which can be used later to apply the plan.

Example: **terraform plan -var-file="terraform.tfvars" -out="terraform.tfplan"**

Using the **-var-file** flag to specify the **terraform.tfvars** file, and the **-out** flag to specify the output file.

Using plan is smart because it will show you what resources will be created, and if there are any errors in the configuration.

You can also keep track of the plan files in a version control system, and use them to apply the plan later.

Example: **terraform apply "terraform.tfplan"**

This way, you can make sure you have a plan to fall back to if something goes wrong, and you can also use the plan to apply the configuration to multiple environments.

### Terraform Apply

Used to apply the configuration to the environment.

You can specify a plan file to apply, or you can just run **terraform apply** and it will apply the configuration in the current directory.

### Terraform Destroy

Used to destroy the resources created by the configuration.

It is actually an alias for **terraform apply -destroy**, which means that it will apply the configuration, but destroy the resources instead of creating them.

Using this command will prompt you to confirm the destruction of the resources, unless you use the **-auto-**

**approve** flag.

Example: **terraform destroy -auto-approve**

The main reason for using this command is to make sure that you don't leave any resources running that you don't need.

This saves you money, as well as making sure nothing collides with the resources you create later.

It can also be used to destroy the resources created by a plan file.

## Variables

The following variables are required to run the configuration:

These can also be found in the [variables.tf](#) file. (Will repeat from the [Modules](#) section)

Variable	Description	Type	Default	Note
company	Company name	string	Company	
project	Project name	string	Project	
billing code	Billing code	string	Billing	
kv_rgname	Key Vault Resource Group Name	string	kv-rg	
kv_location	location of the Key Vault	string	westeurope	
kv_base_name	Base name of the Key Vault	string	kv	
sa_base_name	Base name of the Storage Account	string	sa	
sa_rg_name	Storage Account Resource Group Name	string	sa-rg	
sa_location	Location of the Storage Account	string	westeurope	
sa_container_name	Name of the Storage Container	string	container	
sa_account_tier	Storage Account Tier	string	Standard	
sa_replication_type	Storage Account Replication Type	string	GRS	
vnet_rg_name	VNET Resource Group Name	string	vnet-rg	
vnet_rg_location	VNET Resource Group Location	string	westeurope	
vnet_name	VNET Name	string	vnet	

Variable	Description	Type	Default	Note
vnet_address_space	VNET Address Space	list		Needs to be specified
vnet_dns_servers	VNET DNS Servers	list		Needs to be specified
subnet_name	Subnet Name	string	subnet	
subnet_address_space	Subnet Address Space	list		Needs to be specified
nsg_name	Network Security Group Name	string	nsg	
vm_name	Virtual Machine Name	string	vm	
vm_size	Virtual Machine Size	string	Standard_B2s	
vm_rg_name	Virtual Machine Resource Group Name	string	vm-rg	
vm_rg_location	Location of the Virtual Machine Resource Group	string	westeurope	
vm_nic_name	Virtual Machine NIC Name	string	vm-nic	
vm_nic_private_ip_address	Virtual Machine NIC Private IP	string		
pip_name	Public IP Name	string	vm-pip-name	
vm_subnet_id	Subnet ID	string		
vm_username	Username for the Virtual Machine	string		Needs to be specified
vm_password	Password for the Virtual Machine	string		Needs to be specified
kv_sku_name	SKU of the Key Vault	string	standard	
my_ip	Your IP Address, used for NSG later	string		Needs to be specified, or else an NSG won't work

The VM public IP address is not specified in the variables, as it is not needed, it will be created automatically and assigned to the VM.

The VM NIC private IP address is also not specified in the variables, as it is not needed, it will be created automatically and assigned to the VM NIC.

The VM subnet ID is not specified in the variables, as it is not needed, it will be created automatically and assigned to the VM.

## Screenshots of Deployment

### Terraform

After finishing the configurations and setup of the modules, and running **terraform init** i ran the following command:

**terraform plan -var-file="terraform.tfvars" -out="terraform.tfplan"**

```
# module.keyvault.azure_key_vault_secret.vm_username will be created
+ resource "azurerm_key_vault_secret" "vm_username" {
  + id            = (known after apply)
  + key_vault_id  = (known after apply)
  + name          = "vm-username"
  + value         = (sensitive value)
  + version       = (known after apply)
  + versionless_id = (known after apply)
}

# module.keyvault.azure_key_vault_secret.kv_rg will be created
+ resource "azurerm_resource_group" "kv_rg" {
  + id          = (known after apply)
  + location    = "westeurope"
  + name        = "kv-rg-consulit"
}

# module.keyvault.random_string.random_string will be created
+ resource "random_string" "random_string" {
  + id            = (known after apply)
  + length        = 12
  + lower         = true
  + min_lower     = 0
  + min_numeric   = 0
  + upper         = false
}

Plan: 21 to add, 0 to change, 0 to destroy.

Saved the plan to: terraform.tfplan
```

After running the plan, i ran the following command:

**terraform apply "terraform.tfplan"**

```
module.keyvault.azure_key_vault_secret.vm_username: Creation complete after 1s [id=https://kv-...
module.keyvault.azure_key_vault_secret.vm_password: Creation complete after 1s [id=https://kv-...
module.VirtualMachine.azure_key_vault_secret.sa_accesskey: Creation complete after 1s [id=https://kv-...
module.VirtualMachine.azure_key_vault_secret.sa_accesskey: Still creating... [10s elapsed]
module.VirtualMachine.azure_key_vault_secret.sa_accesskey: Still creating... [20s elapsed]
module.VirtualMachine.azure_key_vault_secret.sa_accesskey: Still creating... [30s elapsed]
module.VirtualMachine.azure_key_vault_secret.sa_accesskey: Still creating... [40s elapsed]
module.VirtualMachine.azure_key_vault_secret.sa_accesskey: Creation complete after 50s [id=/s...

Apply complete! Resources: 21 added, 0 changed, 0 destroyed.
PS C:\Prog\Private\IIKG3005\Mandatory Assignments\Assignment01\kristoju-oppg1>
```

### Azure Portal

After running the apply command, i went to the Azure Portal to check if the resources were created.

Resource Groups

Resource groups

tenant01ntnu

Create

Manage view

Refresh

Export to CSV

Open query

Assign tags

consult

Subscription equals all

Location equals all

Add filter

Showing 1 to 4 of 4 records.

Name	Subscription	Location
kv-rg-consulit	sub_tenant01ntnu	West Europe
sa-rg-consulit	sub_tenant01ntnu	West Europe
vm-rg-consulit	sub_tenant01ntnu	West Europe
vnet-rg-consulit	sub_tenant01ntnu	West Europe

Storage Account

Storage Account:

sa-rg-consulit

Resource group

Create

Manage view

Delete resource group

Refresh

Export to CSV

Open query

Assign tags

Move

Delete

Export template

Open in mobile

Search

Overview

Activity log

Access control (IAM)

Tags

Resource visualizer

Events

Settings

Deployments

Security

Deployment stacks

Policies

Properties

Essentials

Subscription: sub\_tenant01ntnu

Subscription ID: 5513747a-818d-4f48-83b0-da2b2f64cb97

Tags: Add tags

Deployments: No deployments

Location: West Europe

Resources

Recommendations

Filter for any field...

Type equals all

Location equals all

Add filter

Showing 1 to 1 of 1 records.

Show hidden types

No grouping

List view

Name	Type	Location
saconsulit056r6	Storage account	West Europe

Container:

saconsulit056r6 | Containers

Storage account

Container

Change access level

Restore containers

Refresh

Delete

Give feedback

Search

Overview

Activity log

Tags

Diagnose and solve problems

Access Control (IAM)

Data migration

Events

Storage browser

Storage Mover

Data storage

Containers

File shares

Search containers by prefix

Show deleted containers

Name	Last modified	Anonymous access level	Lease state
tfstate	9/28/2023, 5:29:05 PM	Private	Available

Network

vnet-rg-consulit

Resource group

Create

Manage view

Delete resource group

Refresh

Export to CSV

Open query

Assign tags

Move

Delete

Export template

Open in mobile

Search

Overview

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Access control (IAM)

Tags

Resource visualizer

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Security

Deployment stacks

Policies

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Locks

Essentials

Subscription: sub\_tenant01ntnu

Subscription ID: 5513747a-818d-4f48-83b0-da2b2f64cb97

Tags: Add tags

Deployments: No deployments

Location: West Europe

Resources

Recommendations

Filter for any field...

Type equals all

Location equals all

Add filter

Showing 1 to 2 of 2 records.

Show hidden types

No grouping

List view

Name	Type	Location
nsg-consulit	Network security group	West Europe
vnet-consulit	Virtual network	West Europe

VNET:

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Address space

Connected devices

Subnets

Search

+ Subnet + Gateway subnet Refresh Manage users Delete

Search subnets

Name	IPv4	IPv6	Available IPs	Delegated to	Security group	Route table
subnet-consulit	10.0.1.0/24	-	250	-	nsg-consulit	-

Subnet:

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Address space

Connected devices

Subnets

Search

+ Subnet + Gateway subnet Refresh Manage users Delete

Search subnets

Name	IPv4	IPv6	Available IPs	Delegated to	Security group	Route table
subnet-consulit	10.0.1.0/24	-	250	-	nsg-consulit	-

NSG:

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Inbound security rules

Outbound security rules

Network interfaces

Subnets

Properties

Locks

Monitoring

Alerts

Diagnostic settings

Logs

NSG flow logs

Automation

Search

Move Delete Refresh Give feedback

JSON View

Essentials

Resource group: vm-rg-consulit

Location: West Europe

Subscription: sub-tenant01trnu

Subscription ID: 5513747a-818d-4f48-83b0-da2b2f64cb97

Tags: Add tags

Custom security rules: 2 inbound, 0 outbound

Associated with: 1 subnets, 0 network interfaces

Filter by name Port == all Protocol == all Source == all Destination == all Action == all

Priority	Name	Port	Protocol	Source	Destination	Action
100	SSHInboundMyIP	Any	Tcp	85.252.215.82	Any	Allow
200	AllowInternalTraffic	Any	Tcp	10.0.0.0/16	Any	Allow
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowAzureLoadBalancerInBound	Any	Any	AzureLoadBalancer	Any	Allow
65500	DenyAllInBound	Any	Any	Any	Any	Deny
65000	AllowVnetOutBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowInternetOutBound	Any	Any	Any	Internet	Allow
65500	DenyAllOutBound	Any	Any	Any	Any	Deny

Virtual Machine

Overview

Activity log

Access control (IAM)

Tags

Resource visualizer

Events

Settings

Deployments

Security

Deployment stacks

Policies

Properties

Locks

Cost Management

Search

+ Create Manage view Delete resource group Refresh Export to CSV Open query Assign tags Move Delete Export template Open in mobile

Essentials

Subscription: sub-tenant01trnu

Subscription ID: 5513747a-818d-4f48-83b0-da2b2f64cb97

Tags: Add tags

Deployments: No deployments

Location: West Europe

Resources Recommendations

Filter for any field... Type equals all Location equals all Add filter

Showing 1 to 4 of 4 records. Show hidden types No grouping

Name	Type	Location
pip-consulit	Public IP address	West Europe
vm-consulit	Virtual machine	West Europe
vm-consulit_OsDisk_1_9dc5648a1f7844c8b9c52de2cb53cc98	Disk	West Europe
vm-nic-consulit	Network Interface	West Europe



VM:

vm-consulit

Virtual machine

Search

ConnectStartRestartStopCaptureDeleteRefreshOpen in mobileFeedbackCLI / PS

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Networking

Essentials

Resource group (move) : vm-rg-consulit

Status : Running

Location : West Europe

Subscription (move) : sub\_tenant01ntnu

Subscription ID : 5513747a-818d-4f48-83b0-da2b2fd4cb97

Tags (edit) : Add tags

Operating system : Linux (ubuntu 20.04)

Size : Standard B2s (2 vcpus, 4 GiB memory)

Public IP address : 20.107.38.219

Virtual network/subnet : vnet-consulit/subnet-consulit

DNS name : Not configured

Health state : -

VM Details:

PropertiesMonitoringCapabilities (7)RecommendationsTutorials

Virtual machine

Computer name : vm-consulit

Operating system : Linux (ubuntu 20.04)

Image publisher : Canonical

Image offer : 0001-com-ubuntu-server-focal

Image plan : 20\_04-lts

VM generation : V1

VM architecture : x64

Agent status : Ready

Agent version : 2.9.1.1

Host group : None

Host : -

Proximity placement group : -

Colocation status : N/A

Capacity reservation group : -

Disk controller type : -

Availability + scaling

Availability zone (edit) : -

Availability set : -

Scale Set : -

Security type

Security type : Standard

Extensions + applications

Extensions : -

Applications : -

Networking

Public IP address : 20.107.38.219 ( Network interface vm-nic-consulit )

Public IP address (IPv6) : -

Private IP address : 10.0.1.4

Private IP address (IPv6) : -

Virtual network/subnet : vnet-consulit/subnet-consulit

DNS name : Configure

Size

Size : Standard B2s

vCPUs : 2

RAM : 4 GiB

Disk

OS disk : vm-consulit\_OsDisk\_1\_9dc5648a1f7844c8b9c52de2cb53cc98

Encryption at host : Disabled

Azure disk encryption : Not enabled

Ephemeral OS disk : N/A

Data disks : 0

Auto-shutdown

Auto-shutdown : Not enabled

Scheduled shutdown : -

Azure Spot

Azure Spot : -

Azure Spot eviction policy : -

VM NIC:

vm-nic-consulit

Network interface

Search

MoveDeleteRefreshEdit accelerated networking

Overview

Activity log

Access control (IAM)

Tags

Settings

IP configurations

DNS servers

Network security group

Essentials

Resource group (move) : vm-rg-consulit

Location (move) : West Europe

Subscription (move) : sub\_tenant01ntnu

Subscription ID : 5513747a-818d-4f48-83b0-da2b2fd4cb97

Accelerated networking : Disabled

Virtual network/subnet : vnet-consulit/subnet-consulit

Tags (edit) : Add tags

Private IPv4 address : 10.0.1.4

Public IPv4 address : 20.107.38.219 (pip-consulit)

Private IPv6 address : -

Public IPv6 address : -

Attached to : vm-consulit (Virtual machine)

Type : Regular

Public IP:

pip-consulit

Public IP address

Search

Upgrade to Standard SKU - Microsoft recommends Standard SKU public IP address for production workloads

AssociateDissociateDeleteMoveRefreshOpen in mobile

Overview

Activity log

Access control (IAM)

Tags

Settings

Configuration

Properties

Locks

Monitoring

Essentials

Resource group (move) : vm-rg-consulit

Location (move) : West Europe

Subscription (move) : sub\_tenant01ntnu

Subscription ID : 5513747a-818d-4f48-83b0-da2b2fd4cb97

Taas (edit) : Add taas

SKU : Basic

Tier : Regional

IP address : 20.107.38.219

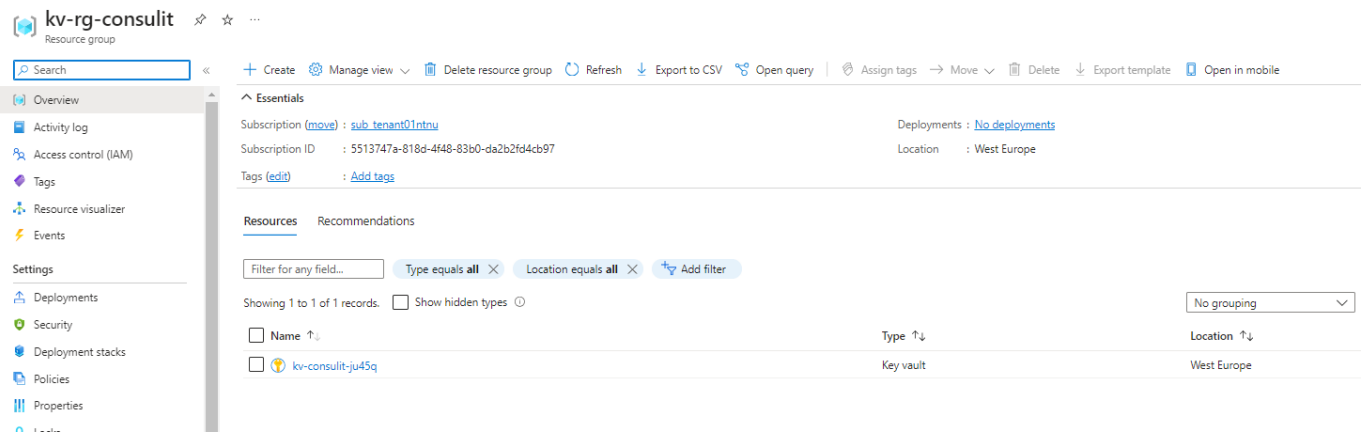
DNS name : -

Associated to : vm-nic-consulit

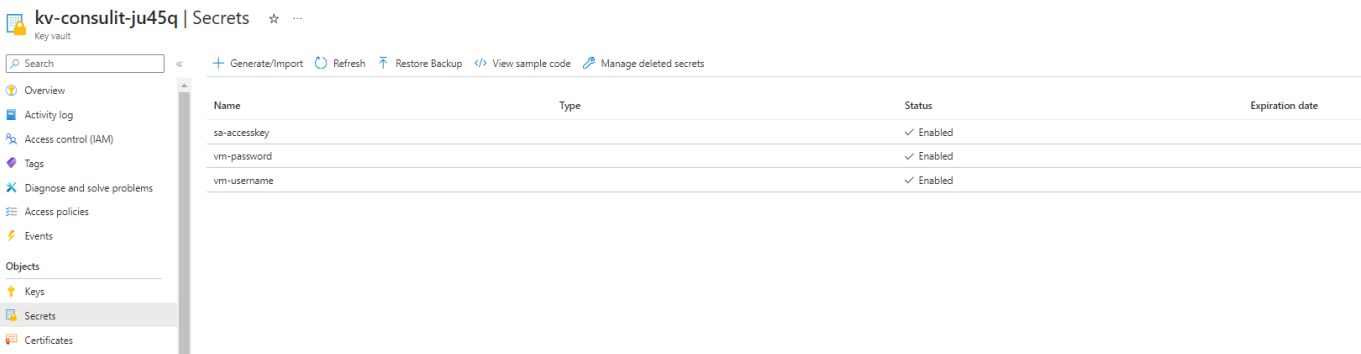
Virtual machine : vm-consulit

Routing preference : Microsoft network

Key Vault



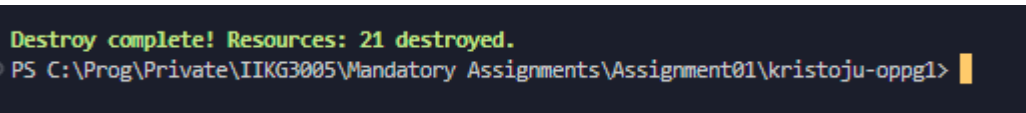
Keyvault Secrets:



**Note:** To be able to view these secrets in the Azure Portal, you need to have access to the Key Vault. By default we only allowed access for our application, so we need to add access for our user account to see it. This can be done by going to the Key Vault, and then going to **Access Policies** and adding your user account with the **Get**, and **List** permission. You will not be able to see the values directly.

Terraform

After finishing with the resources, i ran the following command:  
**terraform destroy**



After running the destroy command, i went to the Azure Portal to check if the resources were deleted.

Resource groups

tenant01ntnu

+

Create

⚙

Manage view

↺

Refresh

↓

Export to CSV

🔗

Open query

🏷

Assign tags

consultit

Subscription equals all

Location equals all

✕

+

Add filter

Showing 0 to 0 of 0 records.

Name

↑↓

Subscription

↑↓

No resource groups match your filters

Try changing or clearing your filters.

Create resource group

Clear filters

[Learn more](#)

And then we are done.