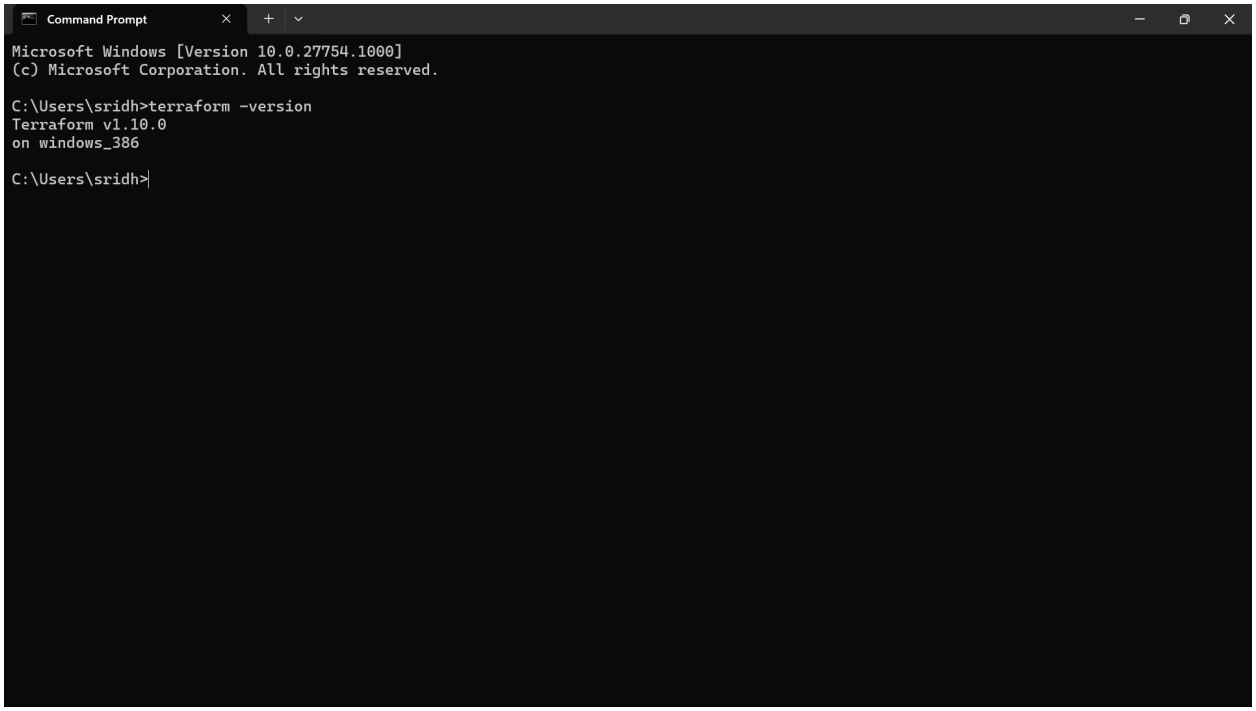
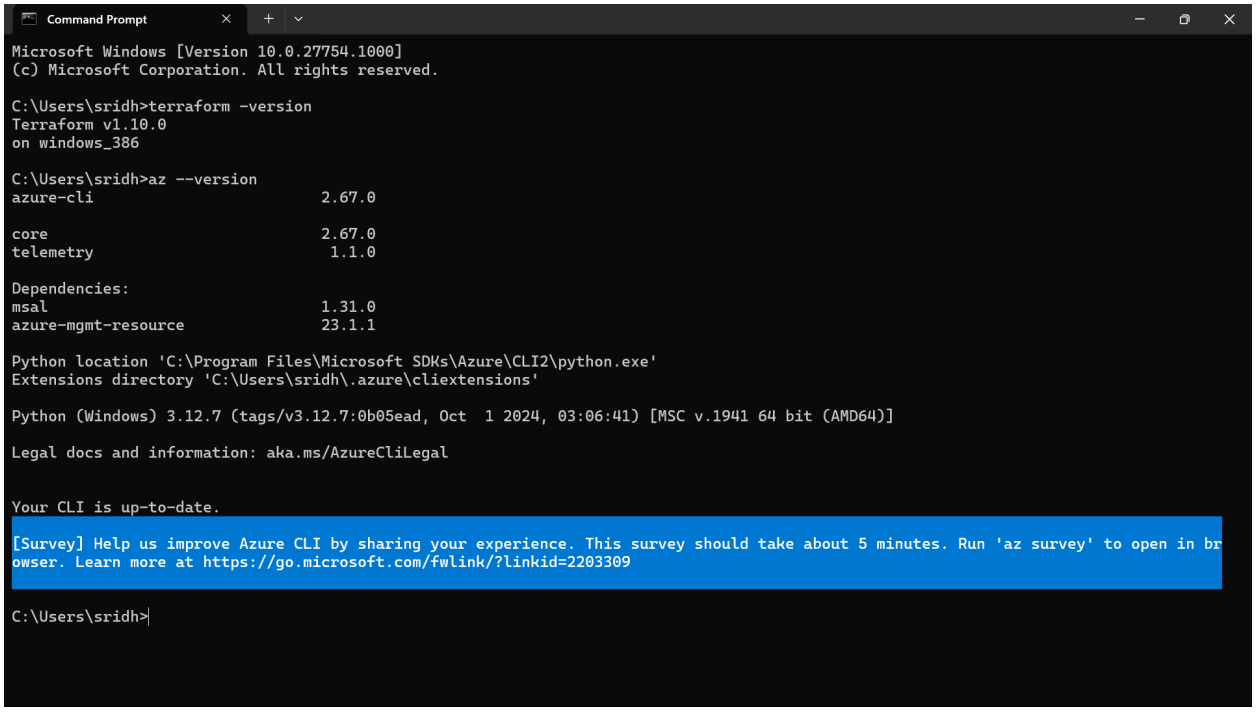
Install Terraform from the link (https://developer.hashicorp.com/terraform/install)

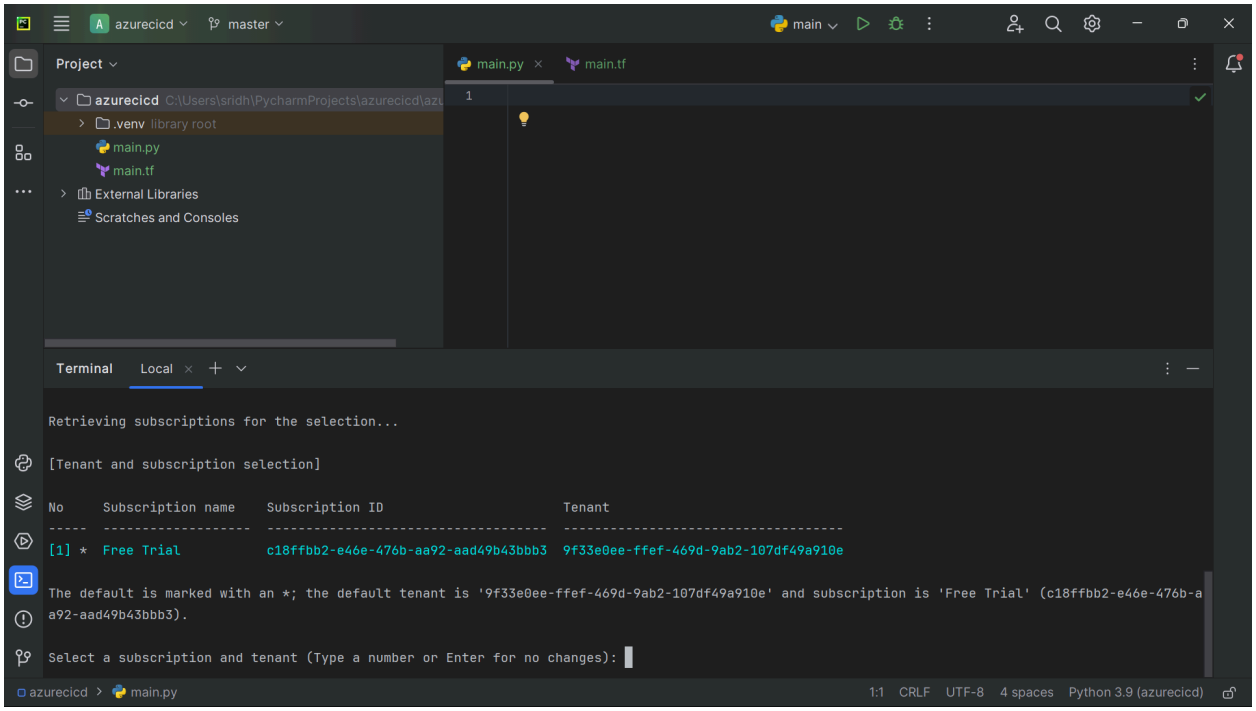


Install Azure CLI (https://learn.microsoft.com/en-us/cli/azure/install-azure-cli-windows?tabs=azure-cli#install-or-update)



I created a new project in the PyCharm IDE, Then I linked Azure CLI to the existing azure subscription (free trial), I did this by running the below commands in terminal

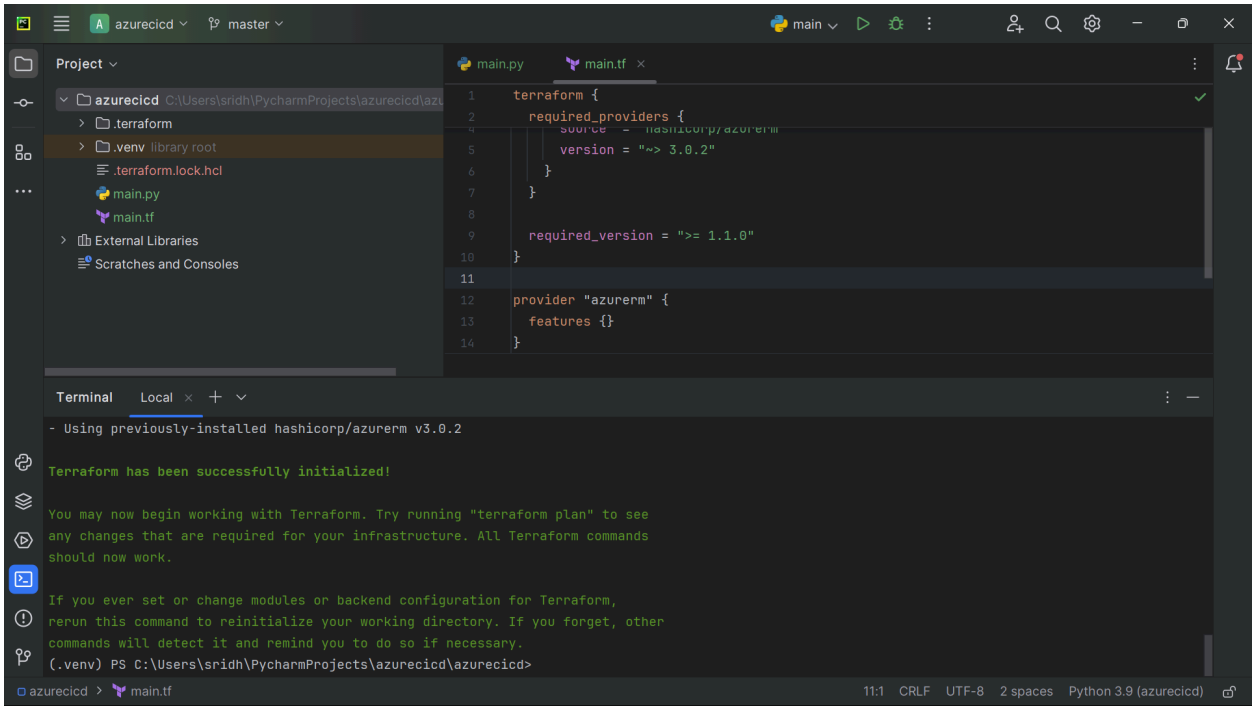
az login tenant <TENANT_ID>



Once I run terraform init by executing the below code

```
terraform {
  required_providers {
    azurerm = {
      source  = "hashicorp/azurerm"
      version = "~> 3.0.2"
    }
  }

  required_version = ">= 1.1.0"
}

provider "azurerm" {
  features {}
}
```

I can see the below screen. “Terraform init” gets the image of terraform and installs it into the system.



Code Explanation:

required_providers:

- This block specifies the providers Terraform configuration requires. Providers are plugins that allow Terraform to interact with cloud services like Azure, AWS, or GCP.
- Here, the provider is azurerm, which is the Azure Resource Manager provider.
- **source**:
  - Specifies the namespace (hashicorp) and the name (azurerm) of the provider.
  - It ensures Terraform downloads the correct provider plugin.
- **version**:
  - Specifies the version constraint for the provider.
  - ~> 3.0.2 means any version from 3.0.2 to 3.1.x (but not 4.x.x).
  - This ensures compatibility with your configuration.

required_version:

- Specifies the minimum version of Terraform required to execute this configuration.
- **>= 1.1.0** ensures that any Terraform version starting from 1.1.0 or higher is used.

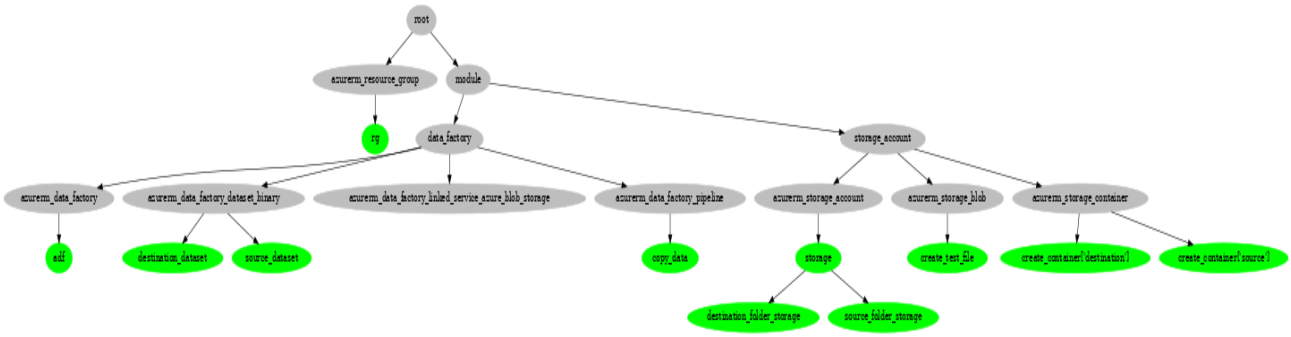
provider "azurerm":

- Declares the Azure Resource Manager provider for Terraform. This is essential to interact with Azure resources.

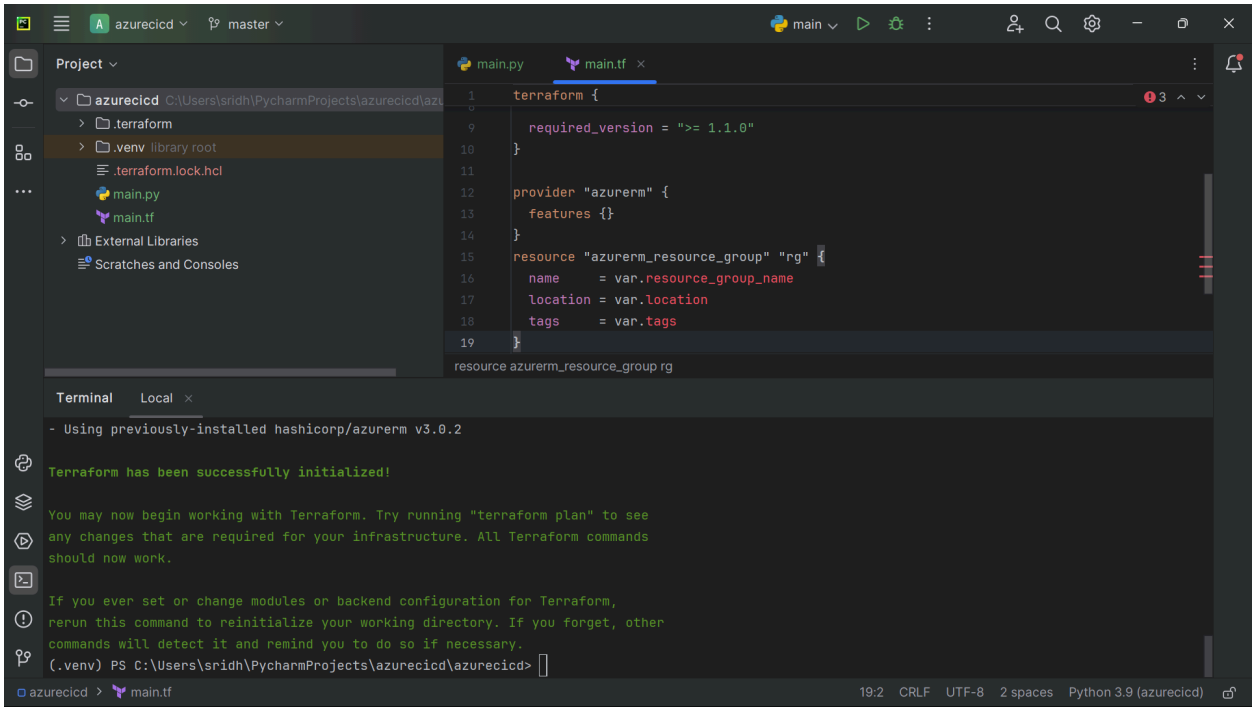
features {}:

- This is a placeholder for Azure-specific configuration settings.
- Since Terraform v2.0.0 of azurerm, this block is **mandatory**, even if it's empty.
- It's used to configure optional provider features like **resource graph** or **advanced networking features**.

System Architecture:



From the system architecture, I have a resource group and module. I will start with the resource group

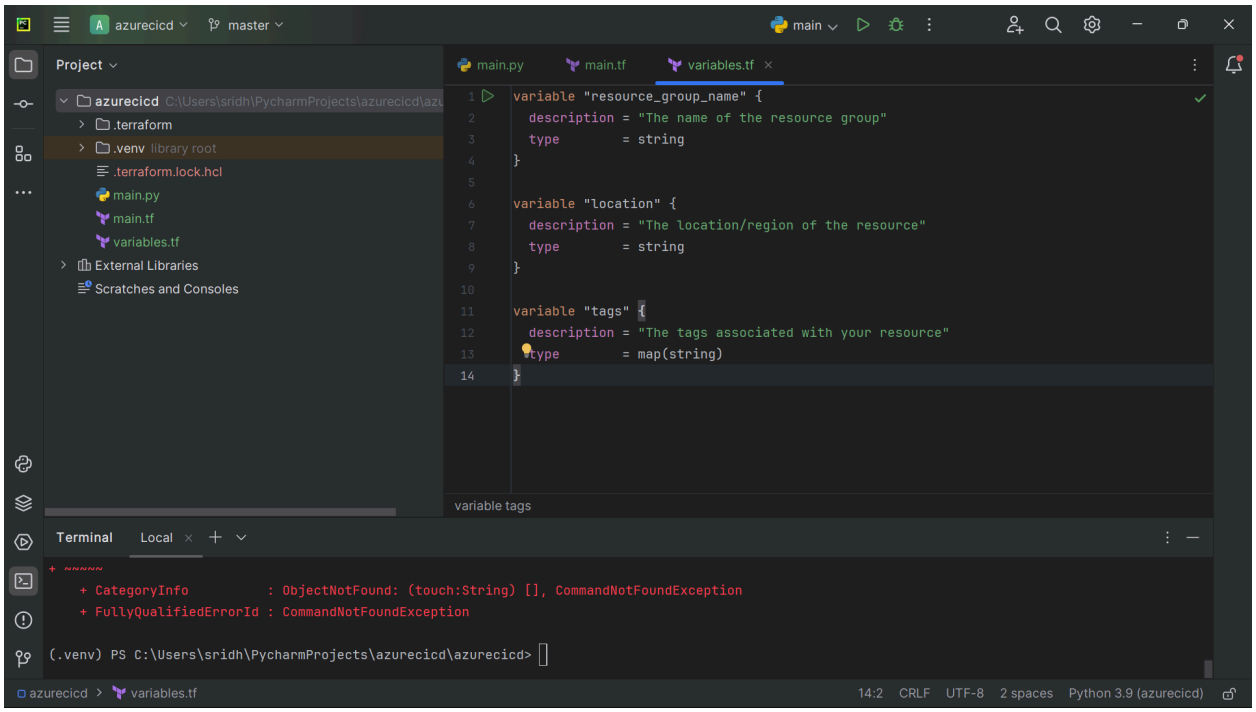


I am still seeing the errors because I don't have any variables installed. So, I created another file variables.tf as below

Code:

```
variable "resource_group_name" {
 description = "The name of the resource group"
```

```
 type        = string
}

variable "location" {
 description = "The location/region of the resource"
 type        = string
}

variable "tags" {
 description = "The tags associated with your resource"
 type        = map(string)
}
```



Code Explanation:

The code snippet defines three **input variables** in a Terraform configuration file. These variables allow you to parameterize your infrastructure configuration, making it reusable and flexible. Here's an explanation of each variable block:

1. Variable: resource_group_name

```
variable "resource_group_name" {
  description = "The name of the resource group"
  type        = string
}
```

Purpose: Defines a variable named resource_group_name to store the name of a resource group.

Key Attributes:

- description: Provides a description of what this variable represents (useful for documentation or when running terraform plan).
- type: Specifies that this variable must be a string.

Usage: This variable allows users to pass the name of the resource group as a parameter when executing the Terraform configuration.

2. Variable: location

```
variable "location" {
  description = "The location/region of the resource"
  type        = string
}
```

Purpose: Specifies the location/region where resources will be deployed.
Key Attributes:

- description: Clarifies that this variable determines the geographical region for deployment (e.g., "East US" or "West Europe").
- type: Specifies that the value for this variable must also be a string.

3. Variable: tags

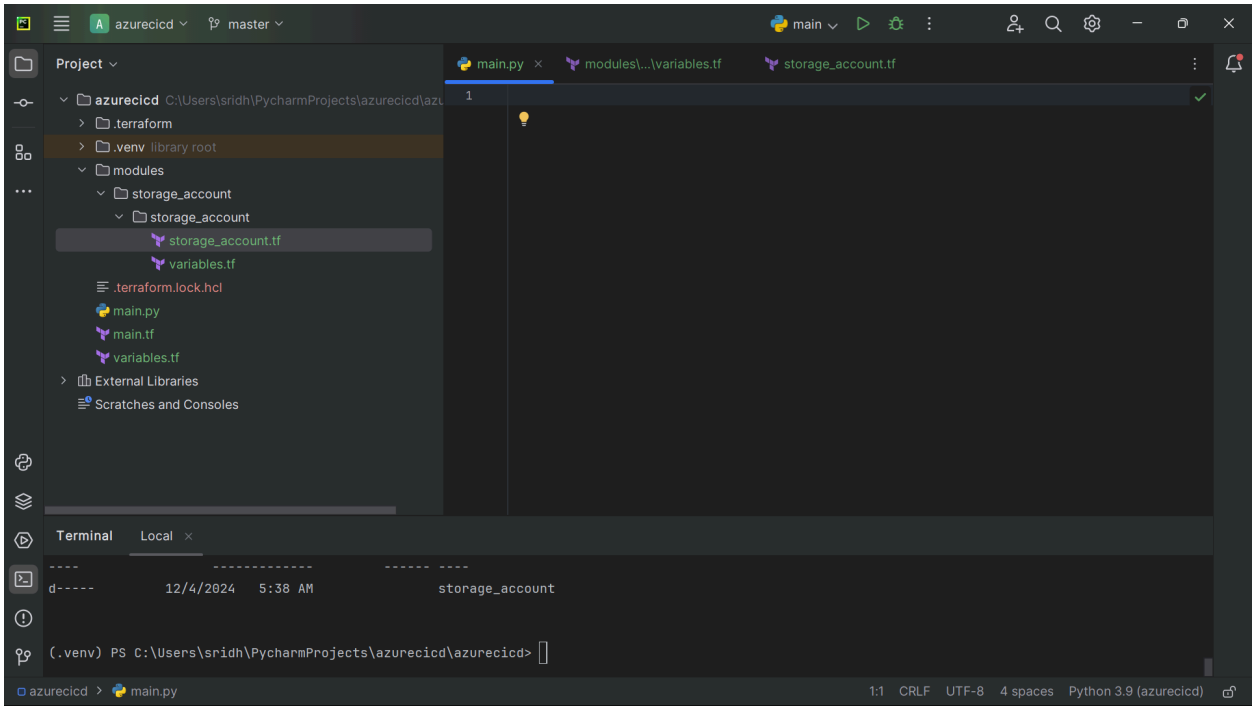
```
variable "tags" {
  description = "The tags associated with your resource"
  type        = map(string)
}
```

Purpose: Allows the definition of tags (key-value pairs) to associate metadata with resources.
Key Attributes:

- description: Explains that this variable will contain tags for resources, typically used for categorization, cost tracking, or organization.
- type: Specifies that the value should be a **map** with keys and values as strings

For the module, I have a data factory and storage account. I will start with storage account as the data factory is having dependency on storage account

I started by creating a directory for storage account in the PyCharm IDE and I created two terraform files namely storage_account.tf and variables.tf as below



From the system architecture, I have storage account, storage blob and storage container. To get these 3 into the system, I used the below code

For storage.tf file

```
resource "azurerm_storage_account" "storage" {

name = var.storage_account_name

resource_group_name = var.resource_group_name

location = var. location

account_tier = "Standard"

account_replication_type = "LRS"

tags = {

 environment = "development"

}

}

resource "azurerm_storage_container" "create_container" {

 for_each = {
```

```
   source      = var.source_folder_name,
   destination = var.destination_folder_name
 }


 name                  = each.key
 storage_account_name  = azurerm_storage_account.storage.name
 container_access_type = var.container_access_type
}


resource "azurerm_storage_blob" "create_test_file" {
 name                   = "test.txt"
 storage_account_name   = azurerm_storage_account.storage.name
 storage_container_name =
azurerm_storage_container.create_container["source"].name
 type                   = "Block"
 source_content         = "Hello Word!"
}
output "storage_account_key" {
 value = azurerm_storage_account.storage.primary_access_key
}
```

Code Explanation:

1. Azure Storage account

```
resource "azurerm_storage_account" "storage" {
  name                     = var.storage_account_name
  resource_group_name      = var.resource_group_name
  location                 = var.location
  account_tier             = "Standard"
  account_replication_type = "LRS"
```

```
  tags = {
    environment = "development"
  }
}
```

Explanation:

- Creates an Azure Storage Account.
- **`name`**: Uses the value from the `var.storage_account_name` variable to set the account name.
- **`resource_group_name`**: Specifies the Azure Resource Group in which the storage account will be created, sourced from `var.resource_group_name`.
- **`location`**: Specifies the Azure region for the storage account, sourced from `var.location`.
- **`account_tier`**: Defines the storage performance tier, here set as `"Standard"`.
- **`account_replication_type`**: Specifies the replication type. `"LRS"` (Locally Redundant Storage) keeps multiple copies of your data within a single data center.
- **`tags`**: Adds metadata tags for organization and categorization (e.g., the environment is `"development"`).

2. Azure Storage Containers

```
resource "azurerm_storage_container" "create_container" {
  for_each = {
    source      = var.source_folder_name,
    destination = var.destination_folder_name
  }

  name                  = each.key
  storage_account_name  = azurerm_storage_account.storage.name
  container_access_type = var.container_access_type
}
```

Explanation:

- **Creates multiple storage containers** dynamically using the `for_each` loop.
- **`for_each`**: Loops through a map where keys are container names (`source` and `destination` from the variable map).
- **`name`**: Each container's name is derived from the key in the map.
- **`storage_account_name`**: Links each container to the storage account created earlier (`azurerm_storage_account.storage.name`).

- **`container_access_type`**: Sets the access level for the container, defined in the `var.container_access_type` variable (e.g., `"private"` or `"blob"`).

3. Azure Storage Blob

```
resource "azurerm_storage_blob" "create_test_file" {
  name                   = "test.txt"
  storage_account_name   = azurerm_storage_account.storage.name
  storage_container_name = azurerm_storage_container.create_container["source"].name
  type                   = "Block"
  source_content         = "Hello Word!"
}
```

Explanation:

- Creates a **test file blob** (`test.txt`) inside the `"source"` storage container.
- **`name`**: Specifies the blob name, `"test.txt"`.
- **`storage_account_name`**: Links the blob to the storage account.
- **`storage_container_name`**: Specifies the container where the blob will be stored, linked dynamically to the `"source"` container from the earlier loop.
- **`type`**: Defines the blob type. `"Block"` blobs are optimized for streaming and storage of large data.
- **`source_content`**: Provides the file content, here a simple text saying `"Hello Word!"`.

4. Output the storage account key

```
output "storage_account_key" {
  value = azurerm_storage_account.storage.primary_access_key
}
```

Explanation:

- Outputs the primary access key for the storage account (`azurerm_storage_account.storage.primary_access_key`).
- This key can be used for authentication when accessing the storage account programmatically or via APIs.

To link them to the root module, I used the below code in main.tf

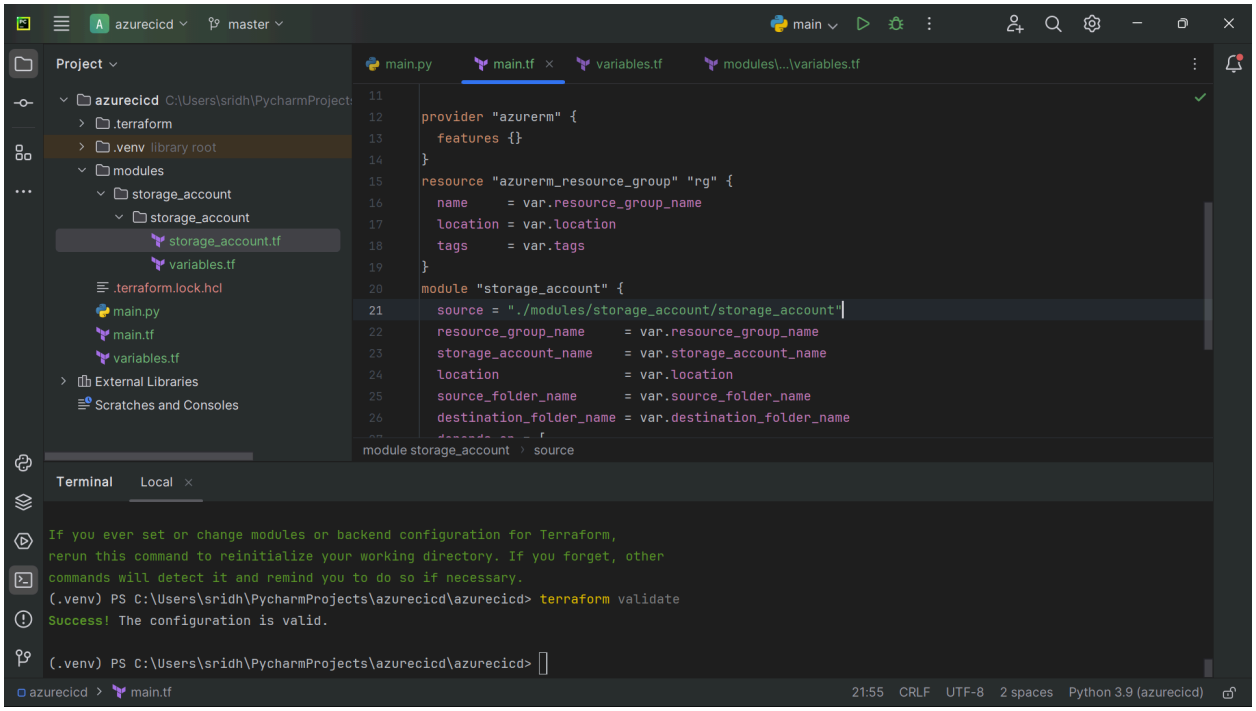
```
module "storage_account" {

 source = "./modules/storage_account/storage_account"

 resource_group_name     = var.resource_group_name

 storage_account_name    = var.storage_account_name

 location                = var.location

 source_folder_name      = var.source_folder_name

 destination_folder_name = var.destination_folder_name

 depends_on = [

   azurerm_resource_group.rg

 ]

}
```

Explanation:

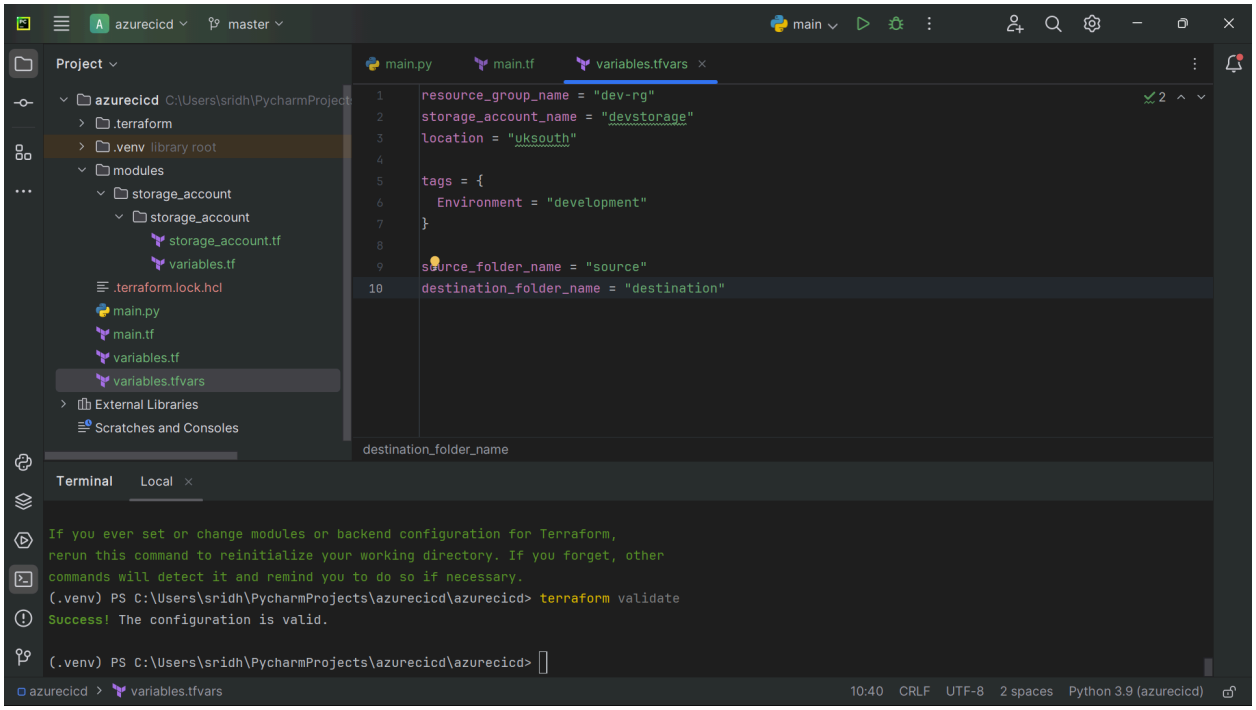
1. **module Block**:
    - The module block defines a reusable module that encapsulates the logic for creating the Azure Storage Account and related resources like containers and blobs.
    - **source**: Specifies the file path (./modules/storage_account/storage_account) where the module's code is located.
2. **Input Variables**:
    - The module is parameterized with variables to make it reusable and flexible for different configurations. These variables are passed to the module:
        - **resource_group_name**: The name of the Azure Resource Group where the storage account will reside.
        - **storage_account_name**: The name of the Azure Storage Account to be created.
        - **location**: The Azure region where the resources will be deployed.
        - **source_folder_name**: The name of the source folder (likely used in creating storage containers).
        - **destination_folder_name**: The name of the destination folder (likely used in creating storage containers).
3. **Dependency Management**:
    - **depends_on**: Ensures that the module execution waits until the azurerm_resource_group.rg resource (Azure Resource Group) has been fully

created. This is crucial for maintaining a valid dependency chain, as the storage account must be created within a resource group that already exists.

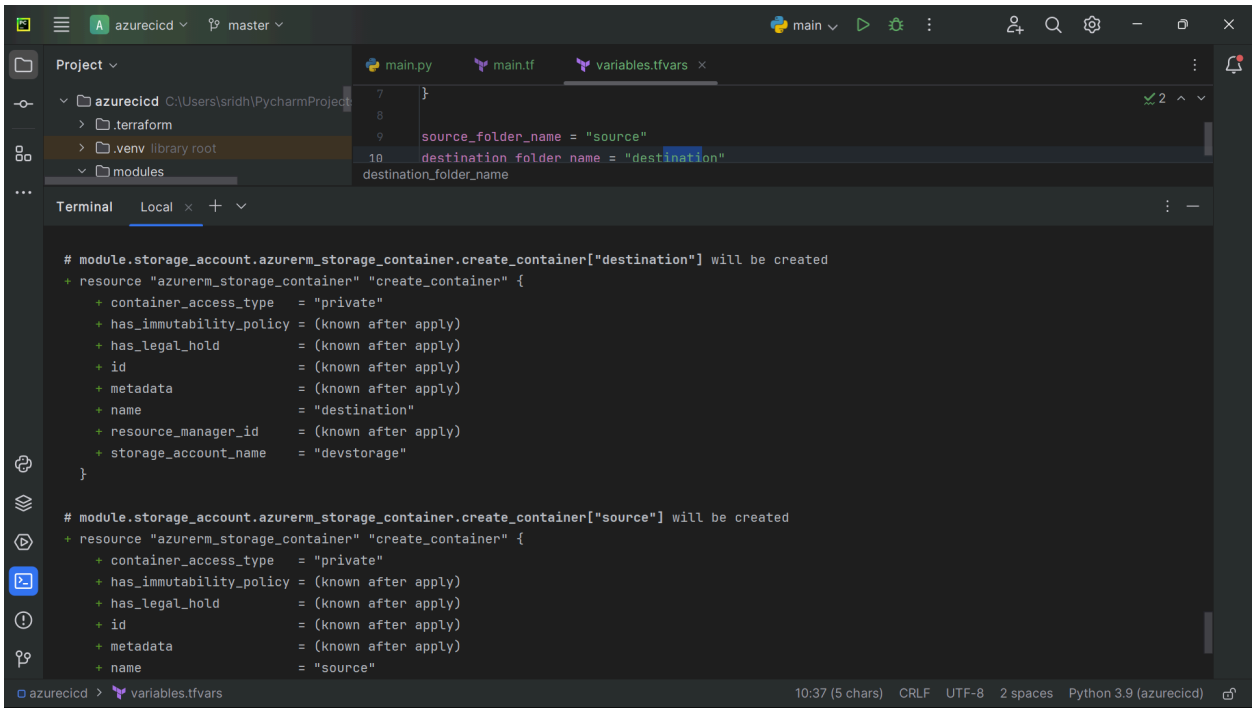
Then i initialized the terraform using “terraform init” and validated the terraform scripts using “terraform validate”, I can see the below screen

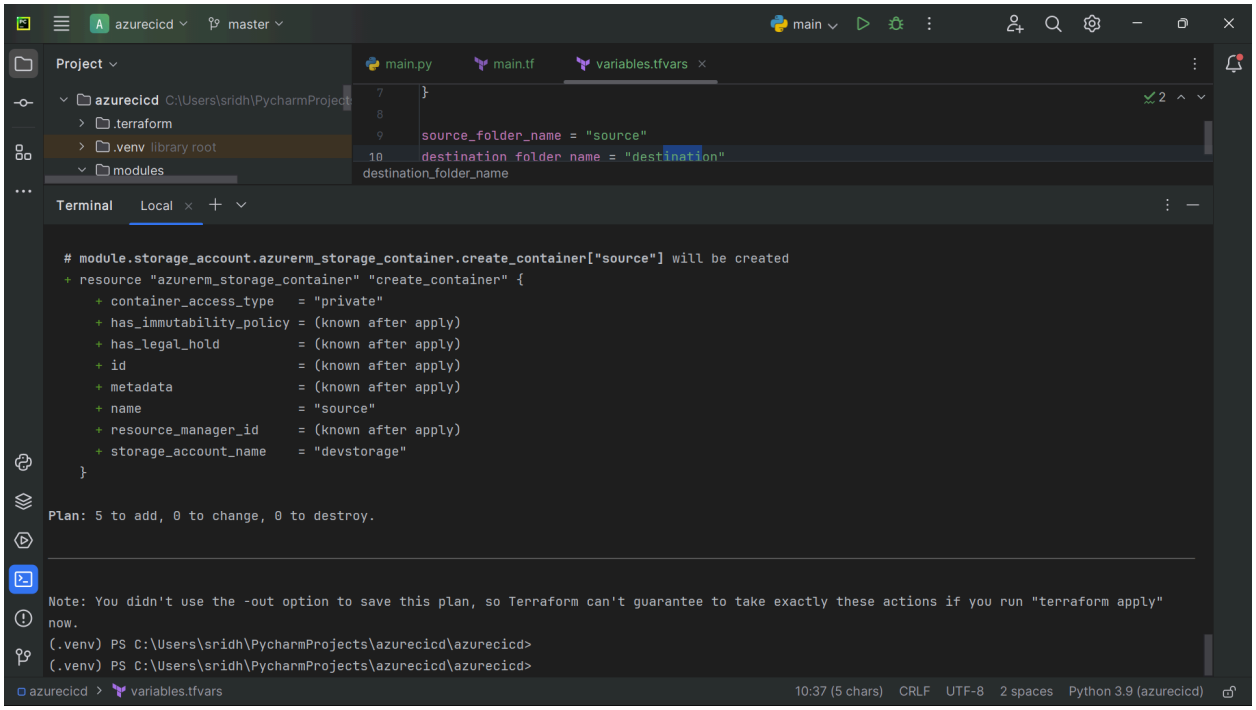


Before I perform terraform plan, I need the variables files which contains all the variables in key-value pairs, So I created another file with the name variables.tfvars with the below variables



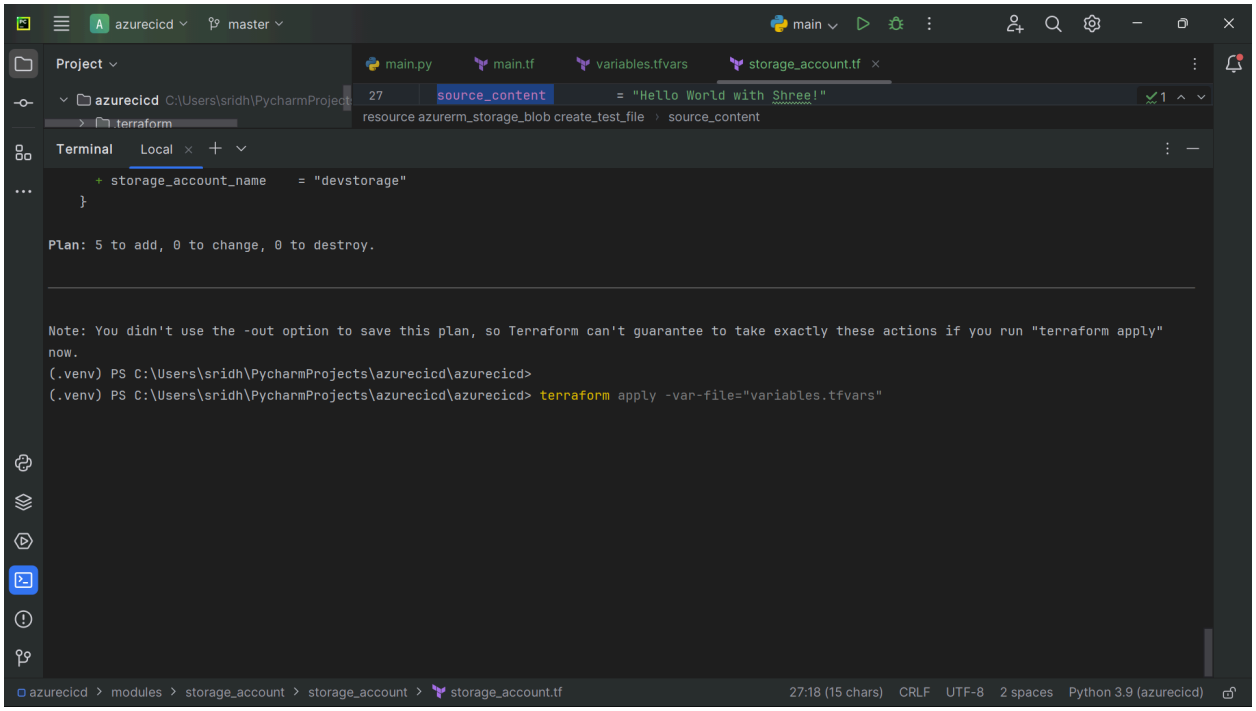
I executed “ terraform plan -var-file="variables.tfvars" ” in the terminal and I can see that resources are created



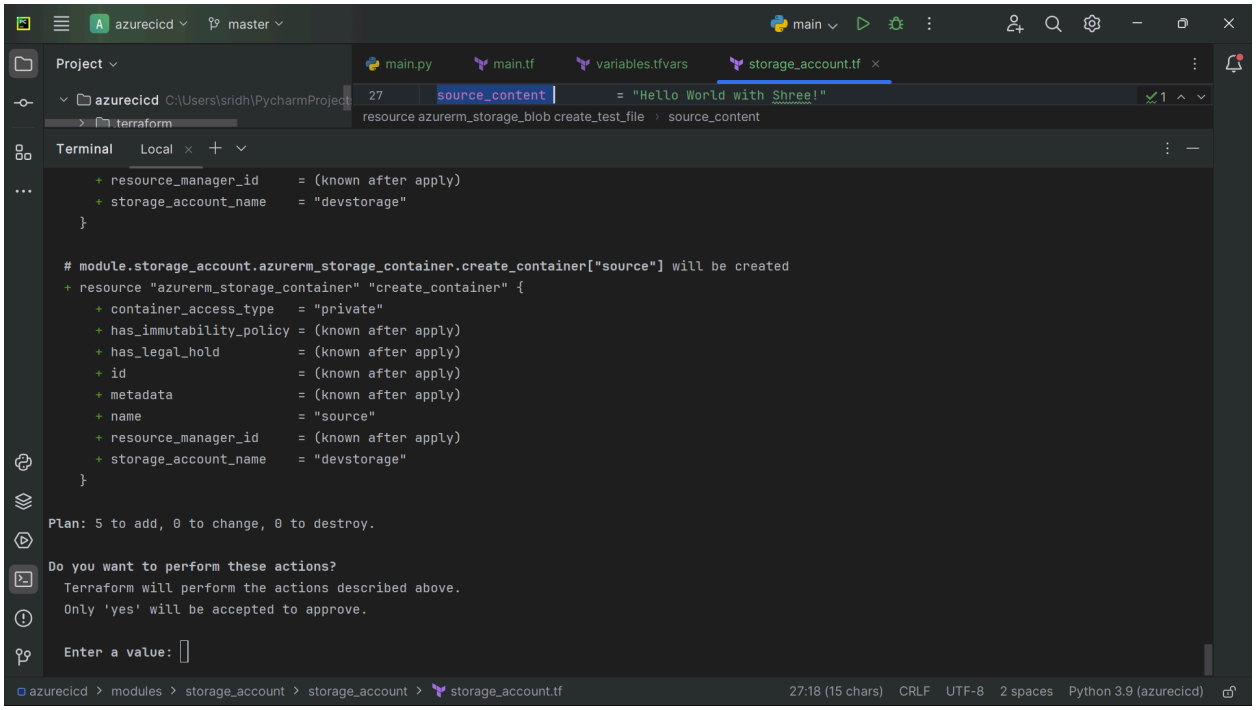


From the output, I can see that 5 resources are going to be added.

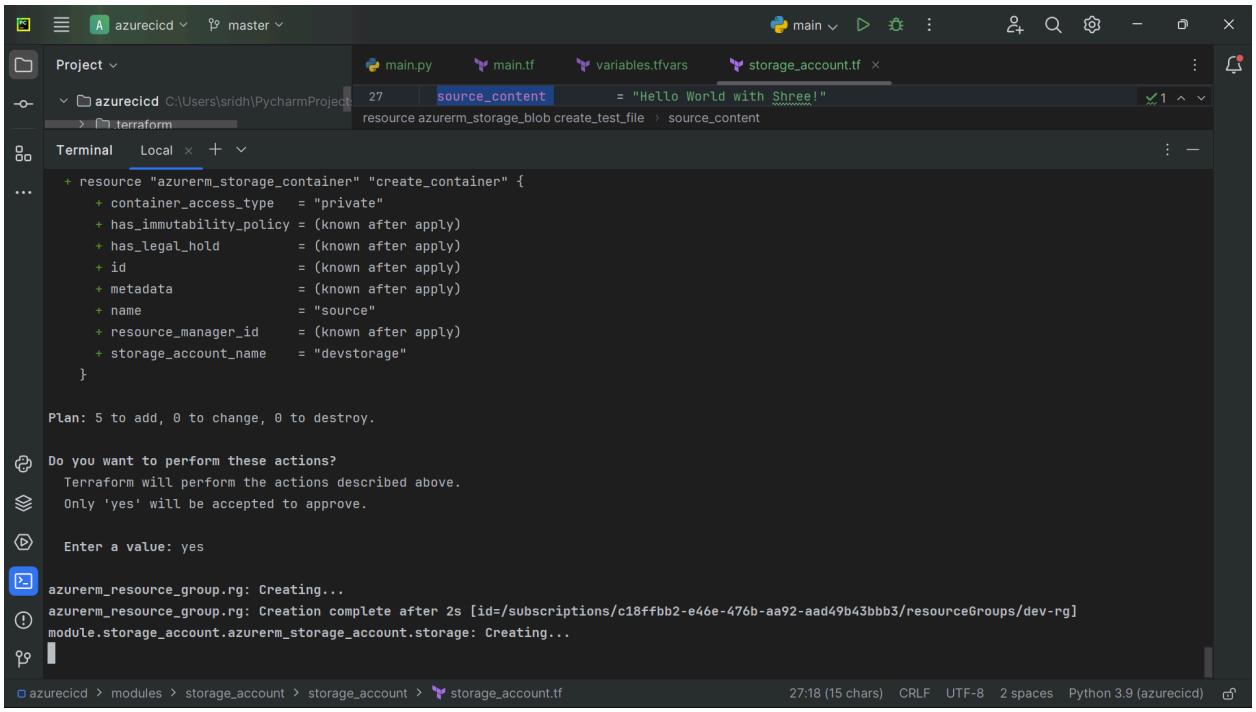
Now, If I change the "source_content" from "Hello world" to "Hello world with shree" and rerun the script using " terraform apply -var-file = variables.tfvars" as below

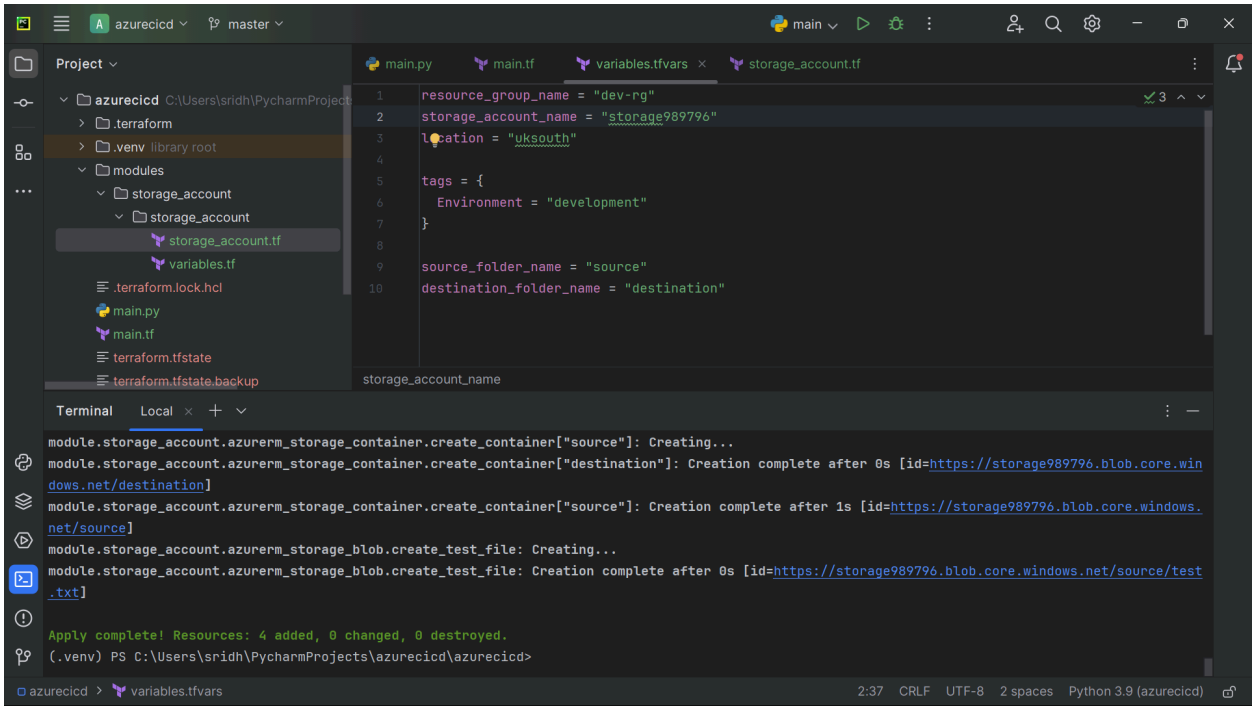


I was prompted to make a choice to create the resources in the subscription linked to azure

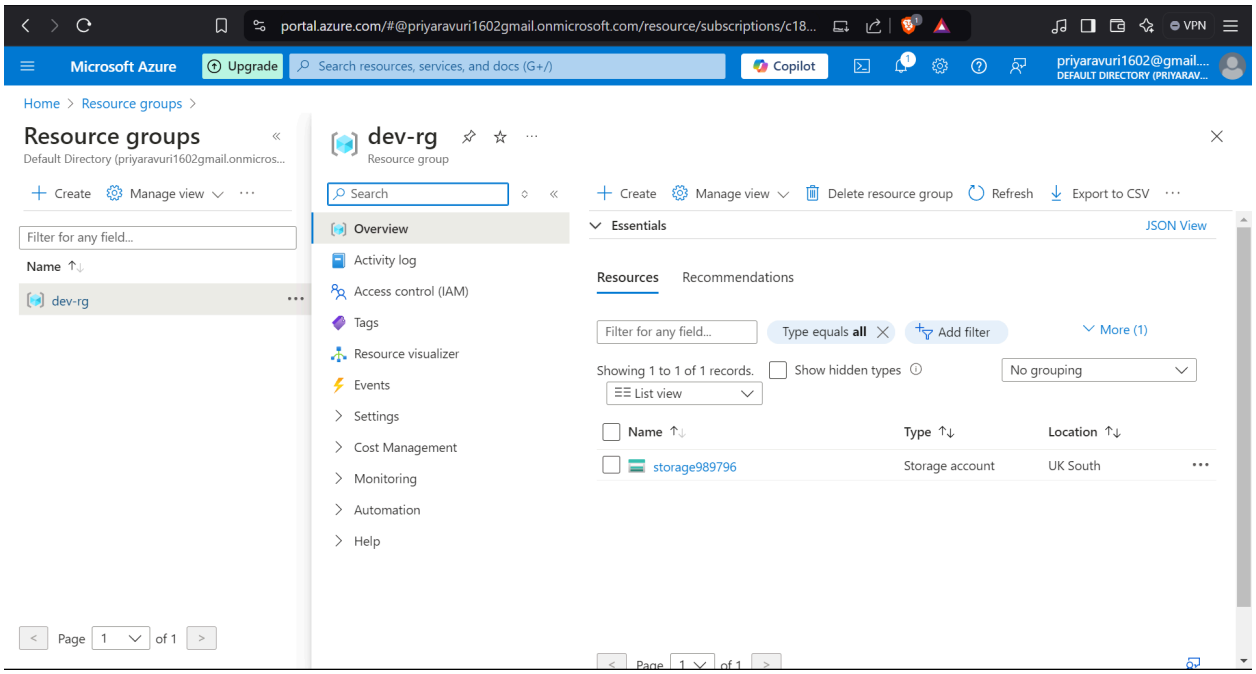


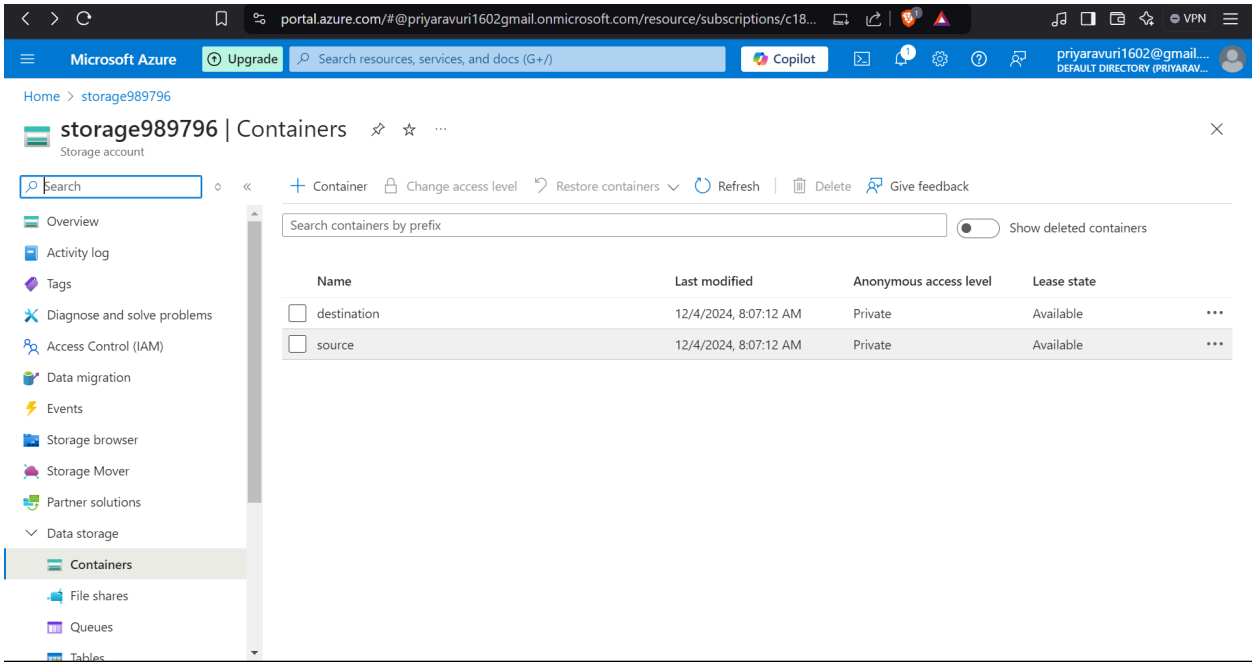
Once I approved, I can see the resources are being provisioned in azure

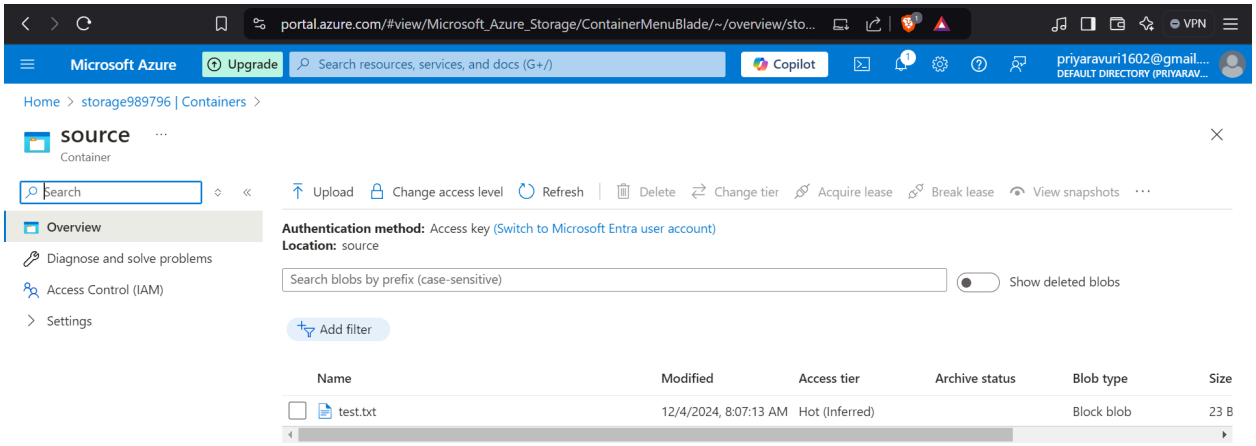




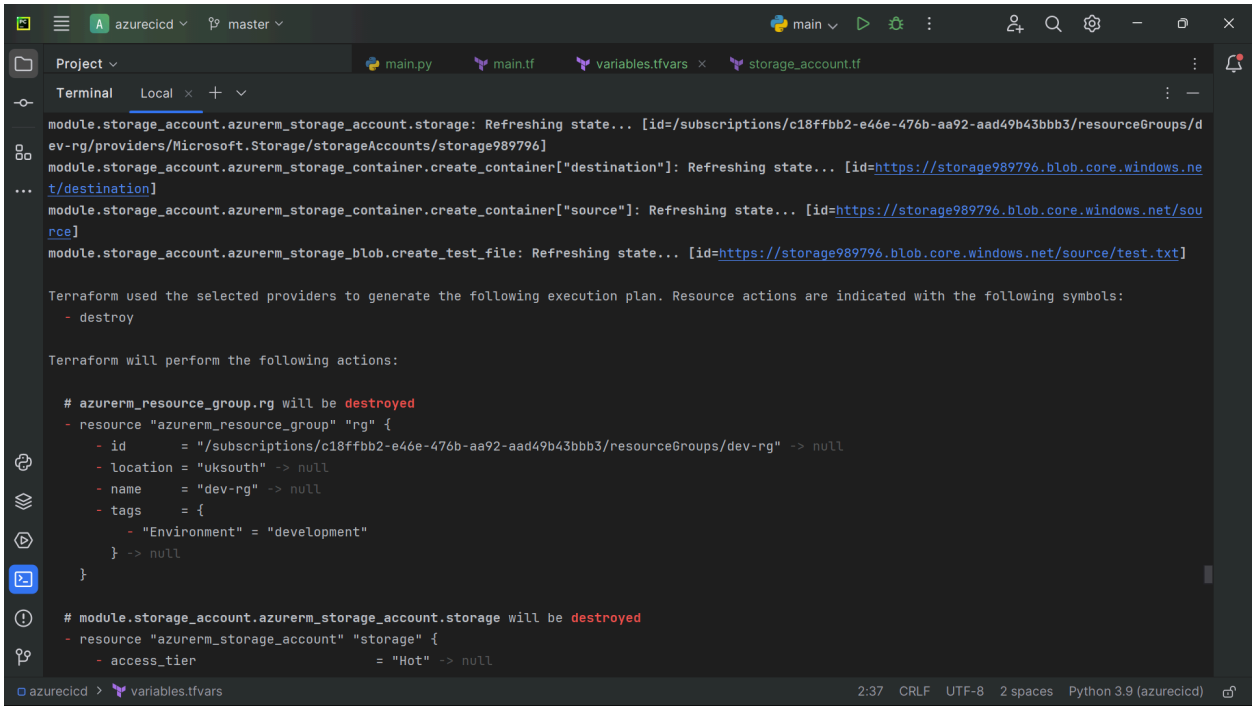
I can also verify the resources from the actual azure portal as below



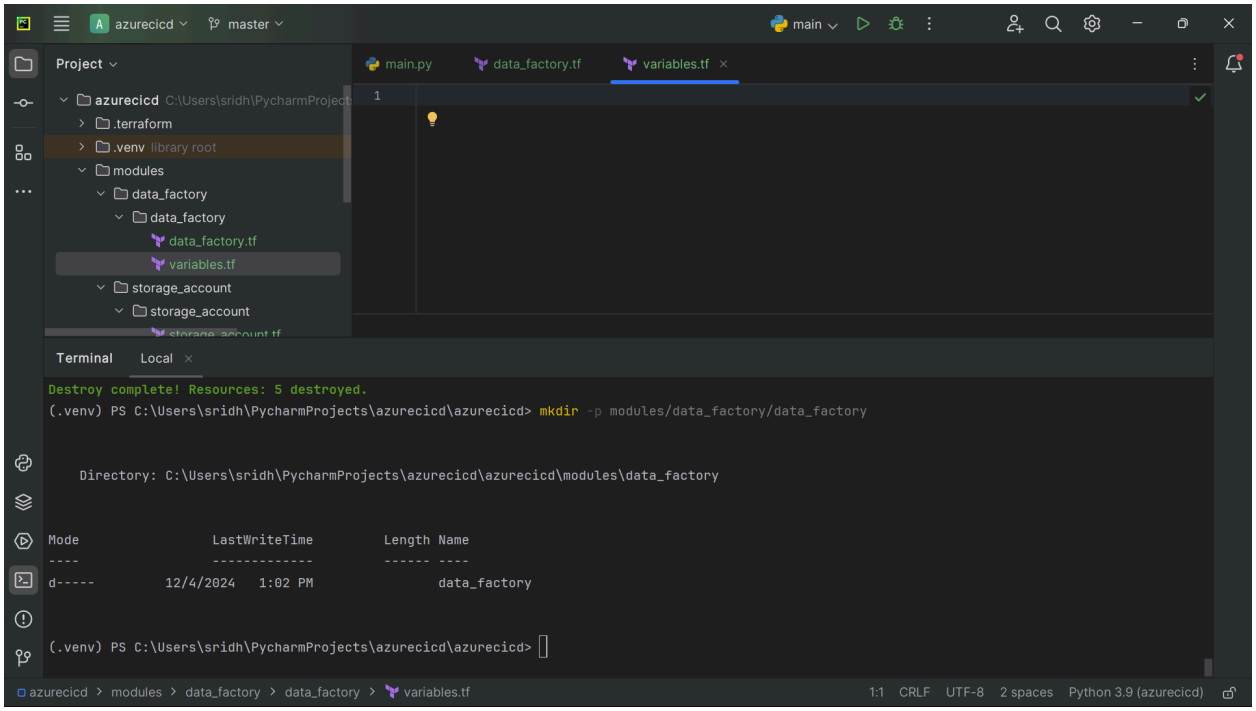




For now, I can destroy the resources as they will be created much later. I did all the above to check if my code is working as expected . I destroyed the resources by using “terraform destroy -var-file="variables.tfvars" “ in the terminal as below



From the system architecture, the next step is to create azure data factory. I created a directory with the name data_factory and two files with the names data_factory.tf and variables.tf as below



I used the below code in data_factory.tf

```
resource "azurerm_data_factory" "adf" {

 name                = var.df_name

 resource_group_name = var.resource_group_name

 location            = var.location



 identity {

   type = "SystemAssigned"

 }

}



data "azurerm_storage_account" "source_folder_storage" {

 name                = var.storage_account_name

 resource_group_name = var.resource_group_name

}



data "azurerm_storage_account" "destination_folder_storage" {

 name                = var.storage_account_name

 resource_group_name = var.resource_group_name

}



resource "azurerm_data_factory_linked_service_azure_blob_storage" "source" {

 name              = "source-storage"

 data_factory_id   = azurerm_data_factory.adf.id

 connection_string =
data.azurerm_storage_account.source_folder_storage.primary_connection_string

}
```

```
resource "azurerm_data_factory_linked_service_azure_blob_storage" "destination"
{

 name              = "destination-storage"

 data_factory_id   = azurerm_data_factory.adf.id

 connection_string =
data.azurerm_storage_account.destination_folder_storage.primary_connection_stri
ng

}



#source and sink dataset to blob storage

resource "azurerm_data_factory_dataset_binary" "source_dataset" {



 name                = "source_dataset"

 data_factory_id     = azurerm_data_factory.adf.id

 linked_service_name =
azurerm_data_factory_linked_service_azure_blob_storage.source.name



 sftp_server_location {

   filename = "test.txt"

   path     = "source"

 }

}



resource "azurerm_data_factory_dataset_binary" "destination_dataset" {



 name                = "destination_dataset"

 data_factory_id     = azurerm_data_factory.adf.id
```

```
 linked_service_name =
azurerm_data_factory_linked_service_azure_blob_storage.destination.name


 sftp_server_location {

   filename = "test-${formatdate("YYYY-MM-DD-hh-mm-ss", timestamp() )}.txt"

   path     = "destination"

 }

}


resource "azurerm_data_factory_pipeline" "copy_data" {


 name            = "copy_data_pipeline"

 data_factory_id = azurerm_data_factory.adf.id


 activities_json = <<JSON

[

 {

   "name": "CopyFromSourceToDestination",

   "type": "Copy",

   "typeProperties": {

     "source": {

       "type": "BinarySource",

       "recursive": true

     },

     "sink": {

       "type": "BinarySink"
```

```
    },
    "enableStaging": false
  },
  "policy": {
    "timeout": "7.00:00:00",
    "retry": 0,
    "retryIntervalInSeconds": 30,
    "secureInput": false,
    "secureOutput": false
  },
  "scheduler": {
    "frequency": "Day",
    "interval": 1
  },
  "external": true,
   "inputs": [
    {
      "referenceName": "source_dataset",
      "type": "DatasetReference"
    }
  ],
  "outputs": [
    {
      "referenceName": "destination_dataset",
      "type": "DatasetReference"
    }
```

```
   ]

 }

]

JSON



 depends_on = [

   azurerm_data_factory_dataset_binary.source_dataset,

   azurerm_data_factory_dataset_binary.destination_dataset,

 ]

}
```

1. **Azure Data Factory (ADF)**:
    - A Data Factory instance is created with a system-assigned managed identity for secure access.
2. **Storage Account Integration**:
    - The script retrieves existing source and destination Azure Blob Storage accounts using their names and resource groups.
    - Creates **linked services** for connecting ADF to the source and destination storage accounts via connection strings.
3. **Datasets**:
    - **Source Dataset**: Points to the source folder in the source storage, targeting the file test.txt.
    - **Destination Dataset**: Targets the destination folder in the destination storage, dynamically appending a timestamp to the file name (e.g., test-YYYY-MM-DD-hh-mm-ss.txt).
4. **Pipeline**:
    - A **Copy Activity** is defined in JSON, specifying:
        - **Source**: Reads binary data recursively from the source dataset.
        - **Sink**: Writes binary data to the destination dataset.
        - **Execution Policy**: Includes timeouts and retry intervals.
    - Scheduled to run daily, ensuring regular updates between the source and destination.
5. **Dependencies**:
    - Ensures the pipeline waits for datasets and linked services to be fully configured before execution.

The script facilitates a seamless data transfer pipeline between Azure Blob Storage containers, leveraging Azure Data Factory's capabilities for automation and scheduling. It ensures:

- **Dynamic File Naming**: Timestamped destination files for uniqueness.
- **Scalability**: Handles binary data transfers recursively.
- **Ease of Configuration**: Modular setup for storage and datasets.

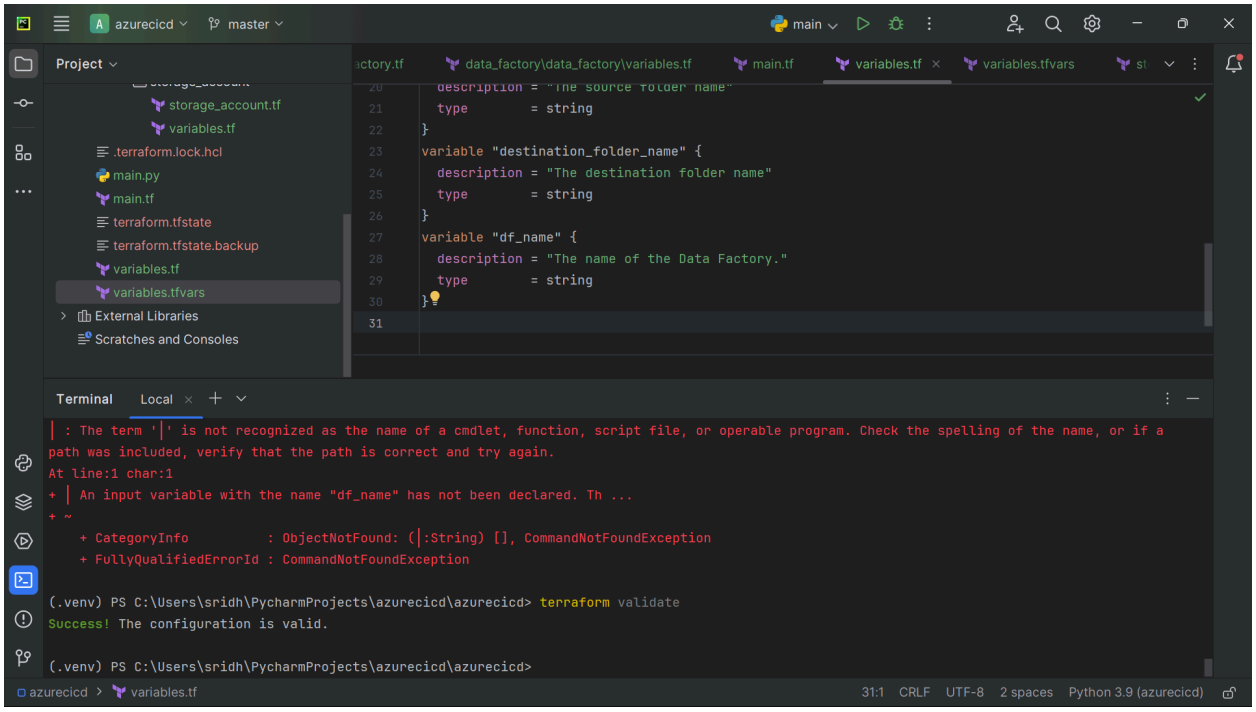
I created the following variables in variables.tf file

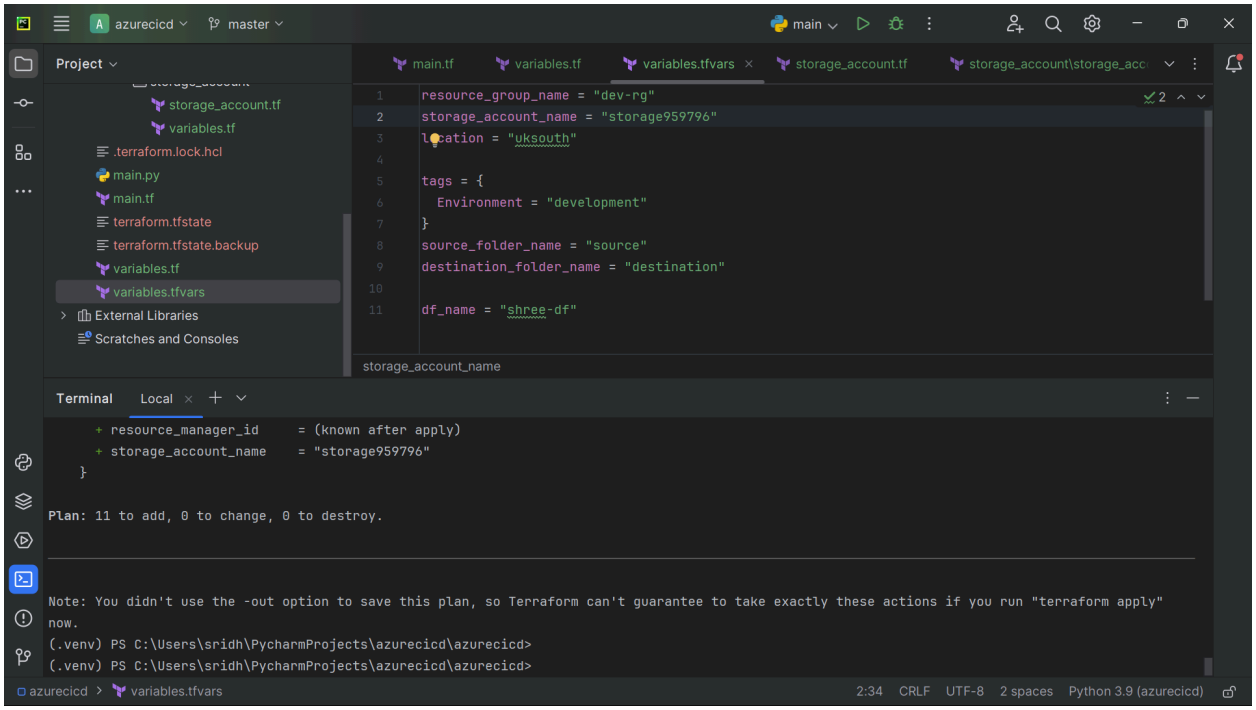
```
variable "storage_account_name" {

 description = "The storage account name"

 type        = string

}



variable "resource_group_name" {

 description = "The name of the resource group"

 type        = string

}



variable "location" {

 description = "The location/region of the resource"

 type        = string

}



variable "df_name" {

 description = "The data factory name"

 type        = string

}
```

To add the module to the root, I used the below code

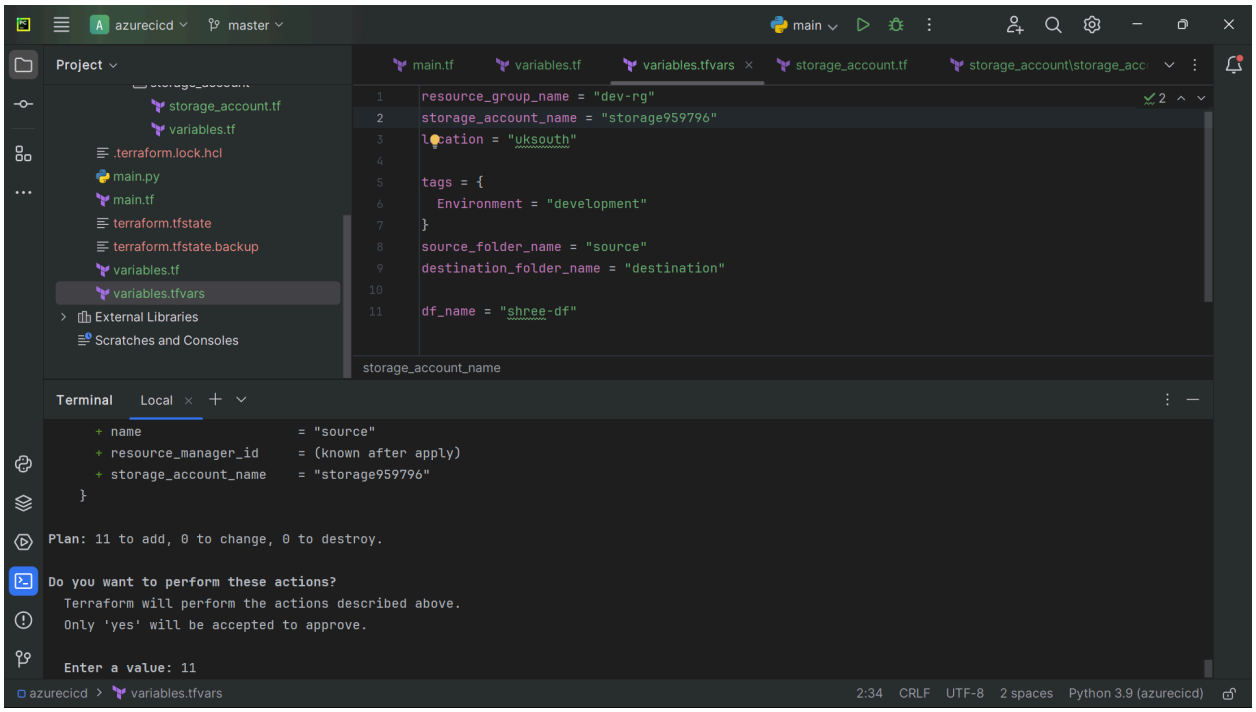
```
module "data_factory" {
  source = "./modules/data_factory/data_factory"

  df_name             = var.df_name
  location            = var.location
  resource_group_name  = var.resource_group_name
  storage_account_name = var.storage_account_name

  depends_on = [
    module.storage_account
  ]
}
```

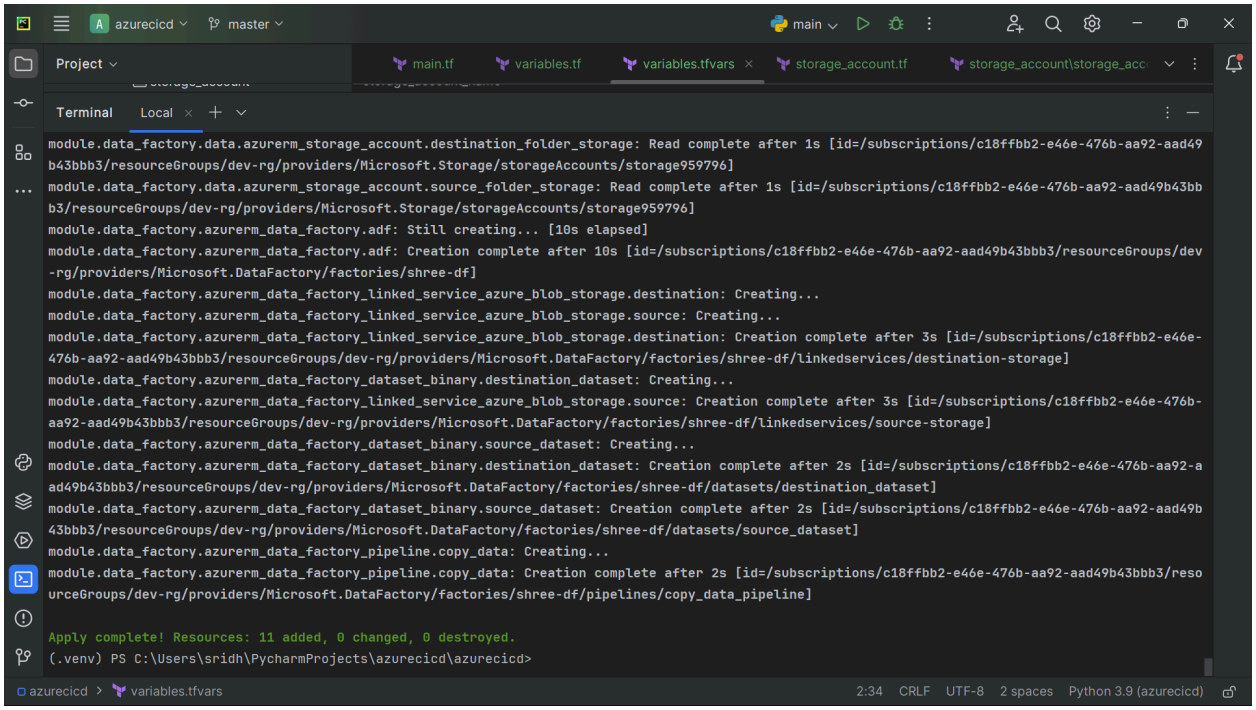
I initialized and validated the terraform script as below



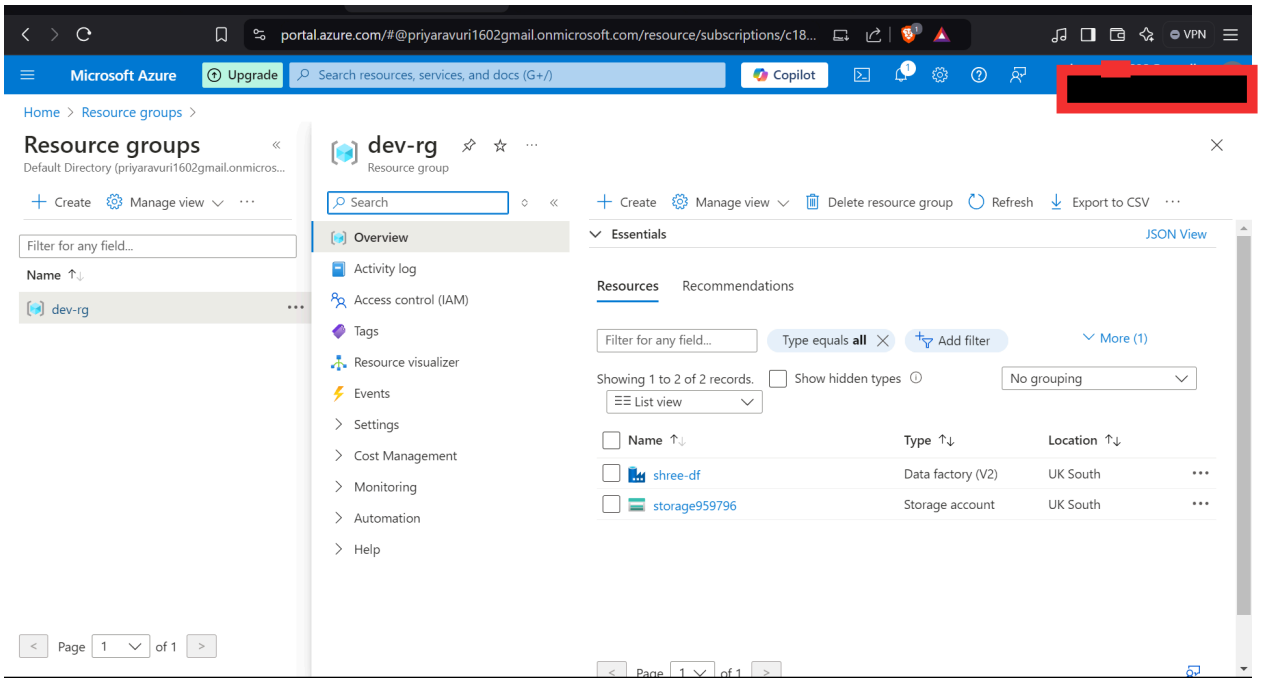


I can see that 11 resources are going to be added. Then, I applied the script

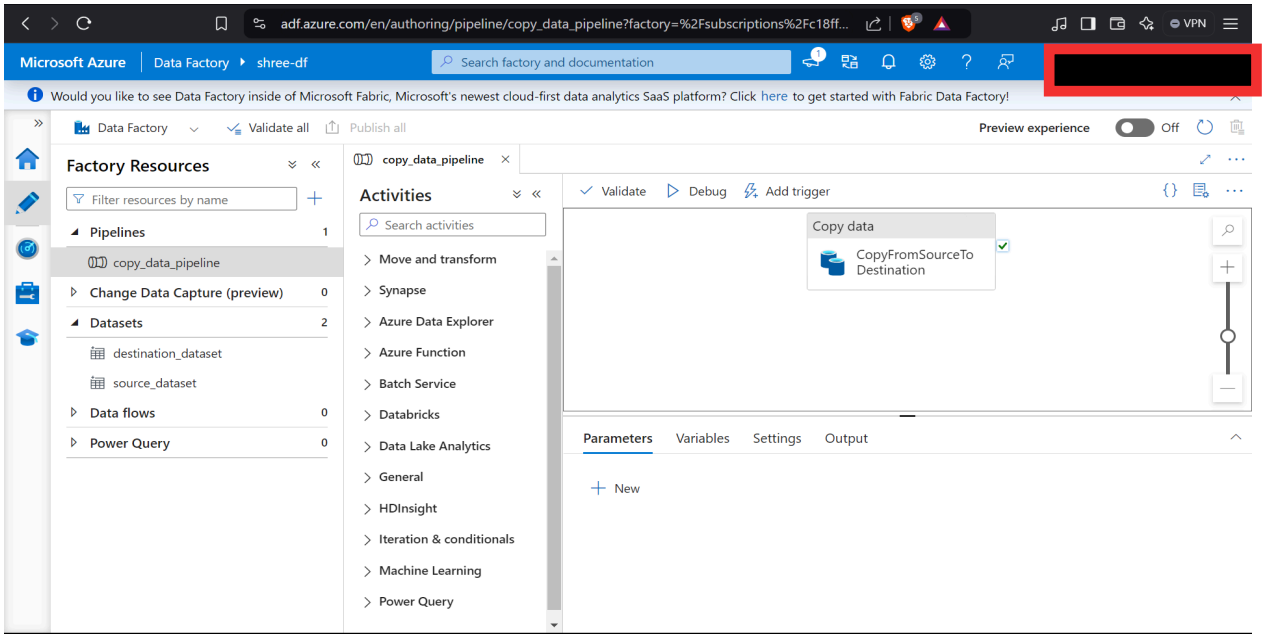




I can recheck if the resources are provisioned from Azure Portal as below. I can see both azure storage account and azure data factory



I can also see that a pipeline is created with all the source and destination datasets created as below


adf.azure.com/en/authoring/pipeline/copy_data_pipeline?factory=%2Fsubscriptions%2Fc18ff...
Microsoft Azure
Data Factory
shree-df
Search factory and documentation
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Data Factory
Validate all
Publish all
Preview experience
Off
Factory Resources
Filter resources by name
Pipelines 1
copy_data_pipeline
Change Data Capture (preview) 0
Datasets 2
destination_dataset
source_dataset
Data flows 0
Power Query 0
copy_data_pipeline
Activities
Search activities
Move and transform
Synapse
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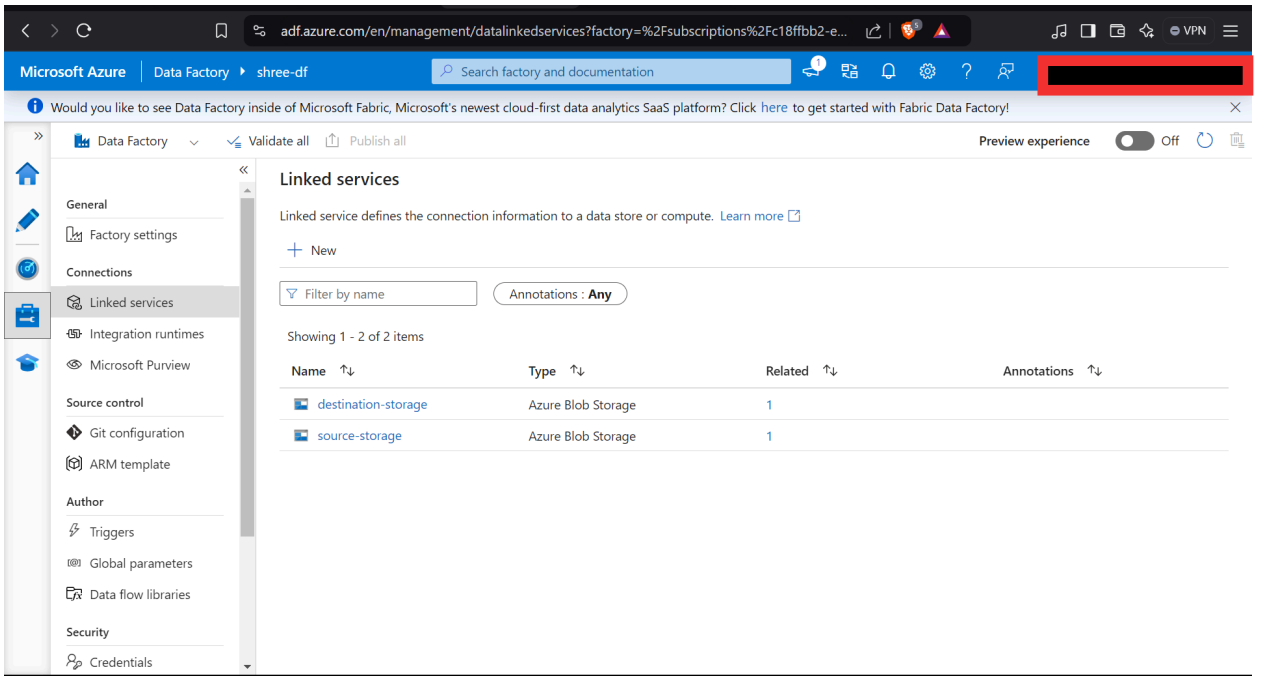
Azure Function
Batch Service
Databricks
Data Lake Analytics
General
HDInsight
Iteration & conditionals
Machine Learning
Power Query
Validate
Debug
Add trigger
Copy data
CopyFromSourceTo Destination
Parameters
Variables
Settings
Output
New


adf.azure.com/en/management/datalinkedservices?factory=%2Fsubscriptions%2Fc18ffbb2-e...
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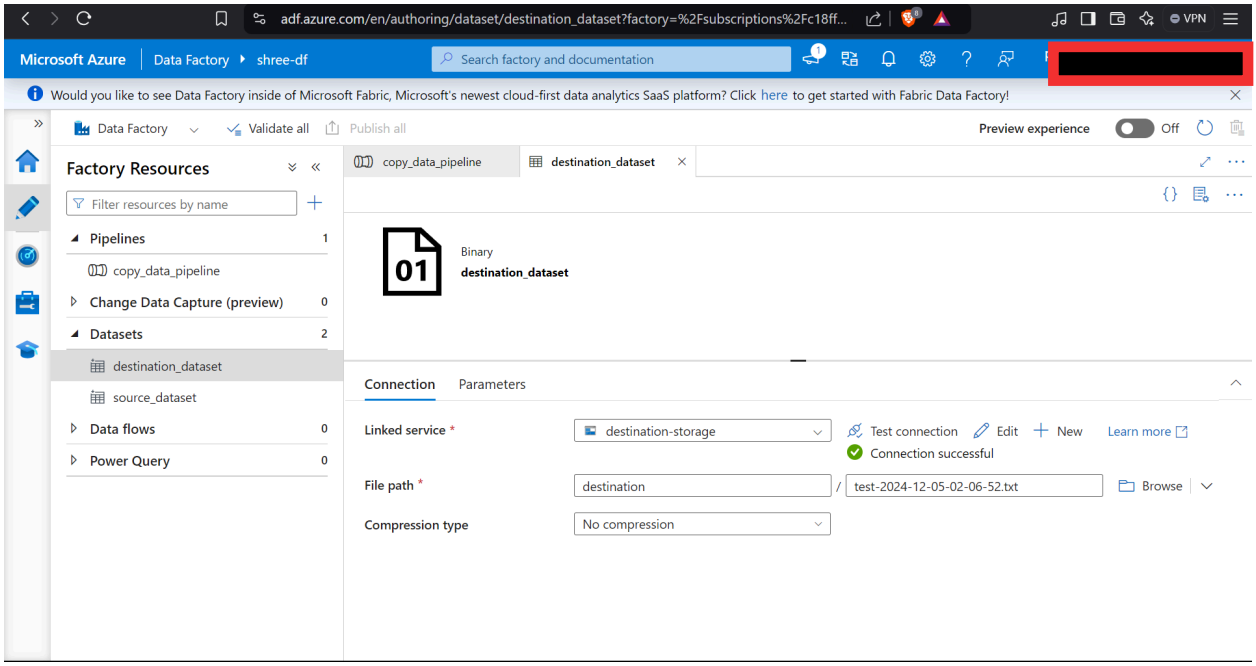
ARM template
Author
Triggers
Global parameters
Data flow libraries
Security
Credentials
Linked services
Linked service defines the connection information to a data store or compute. Learn more
New
Filter by name
Annotations : Any
Showing 1 - 2 of 2 items
Name
Type
Related
Annotations
destination-storage
Azure Blob Storage
1
source-storage
Azure Blob Storage
1


adf.azure.com/en/authoring/dataset/destination_dataset?factory=%2Fsubscriptions%2Fc18ff...
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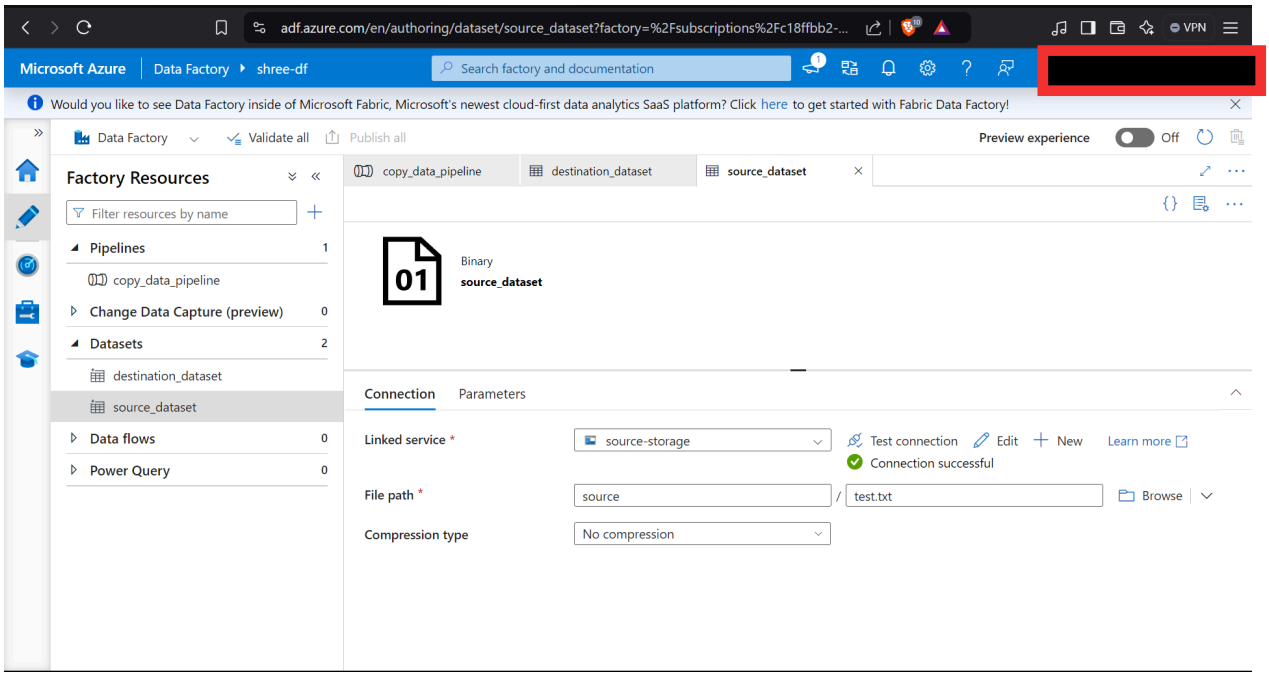
Datasets 2
destination_dataset
source_dataset
Data flows 0
Power Query 0
copy_data_pipeline
destination_dataset
Binary
destination_dataset
Connection
Parameters
Linked service *
destination-storage
Test connection
Edit
New
Learn more
Connection successful
File path *
destination
test-2024-12-05-02-06-52.txt
Browse
Compression type
No compression


adf.azure.com/en/authoring/dataset/source_dataset?factory=%2Fsubscriptions%2Fc18ffbb2-...
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destination_dataset
source_dataset
Binary
source_dataset
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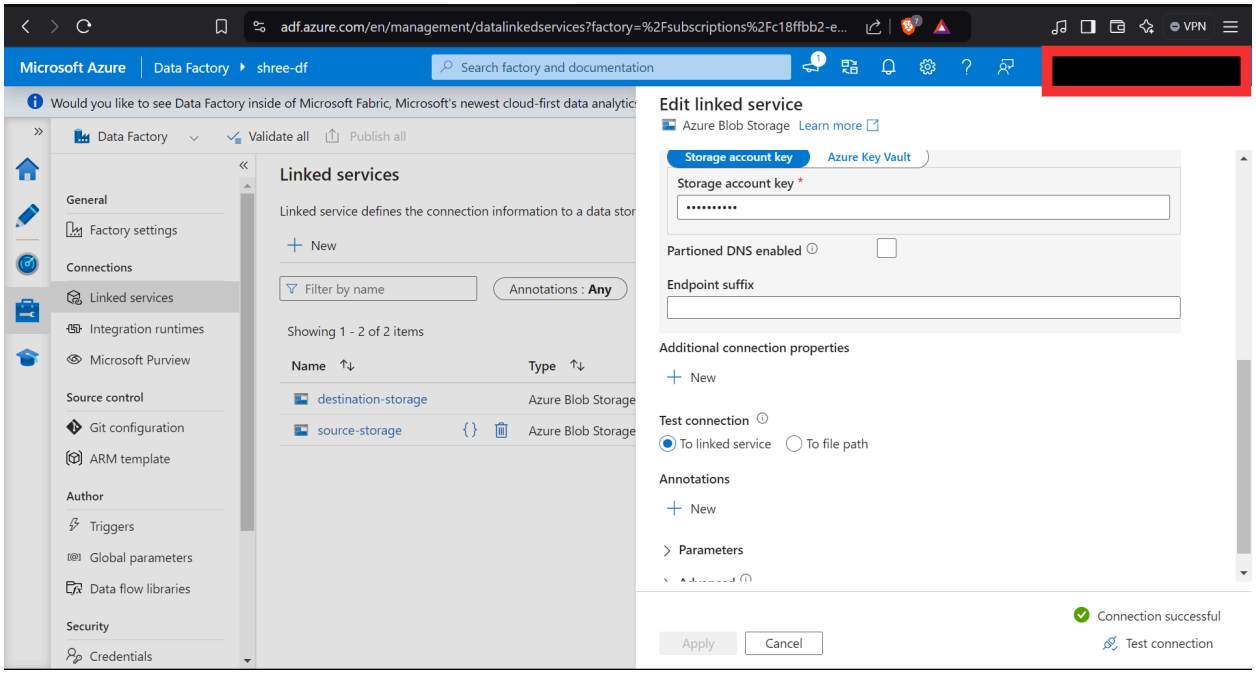
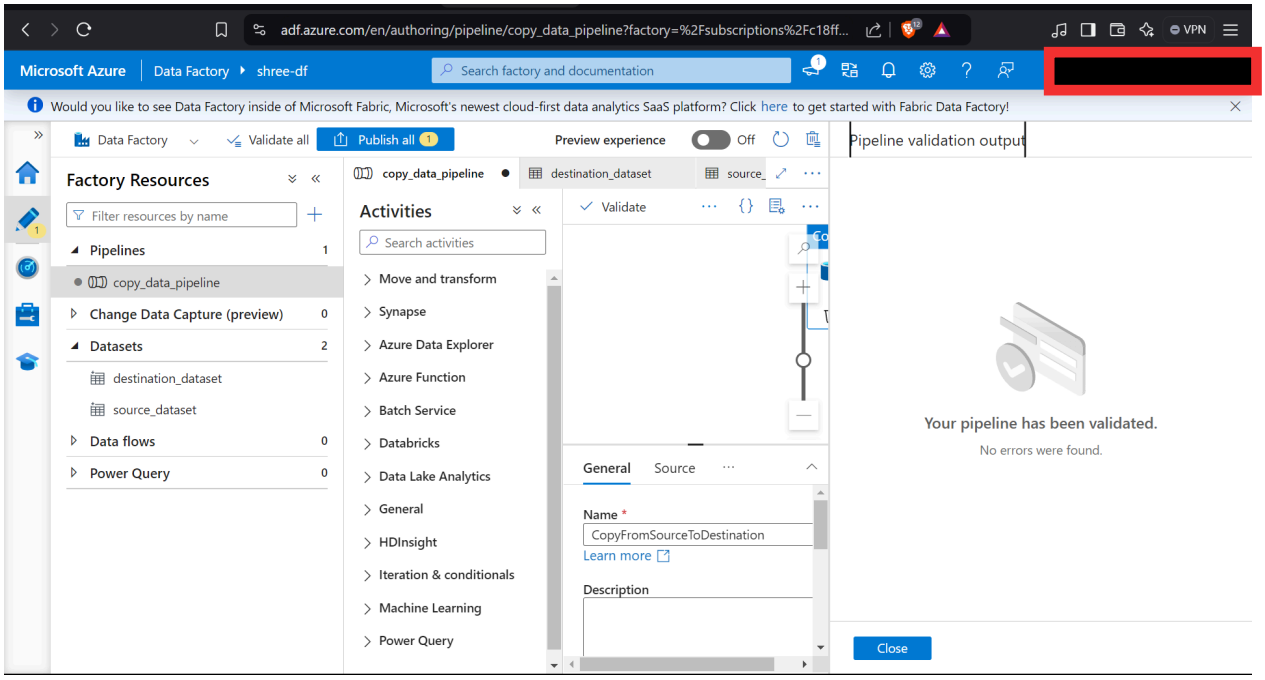
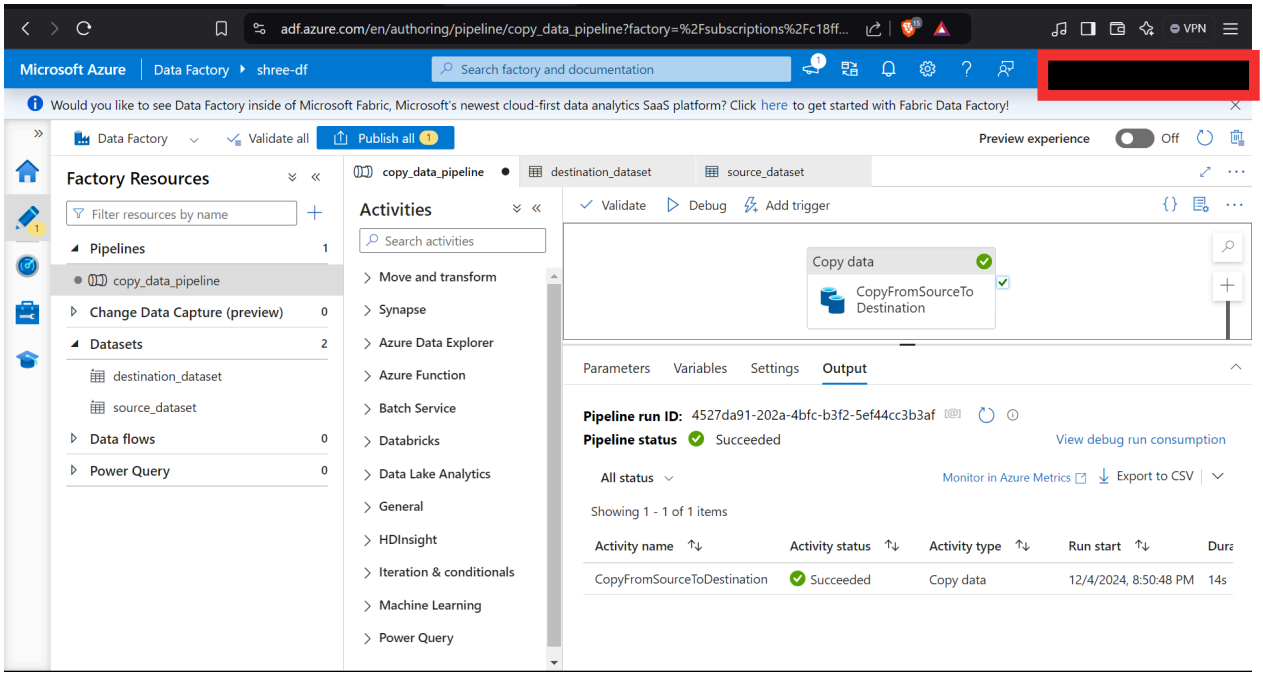
Parameters
Linked service *
source-storage
Test connection
Edit
New
Learn more
Connection successful
File path *
source
test.txt
Browse
Compression type
No compression



I can see that pipeline is validated without any errors



Next, I debugged the pipeline



Once the debug was successful, I can see the file in the destination storage container

By the above steps, I provisioned resources on Azure using Terraform which can be a simple POC for Infrastructure as code (IaaC)