CLOUD COMPUTING

LAB 10

Submitted To:

Engr. Shoaib

Submitted By:

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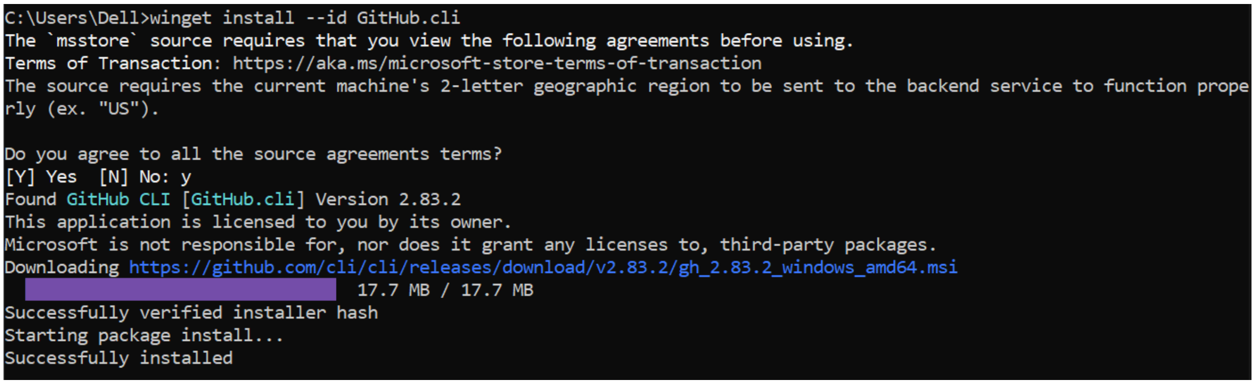
BSE V-A

2023-BSE-031

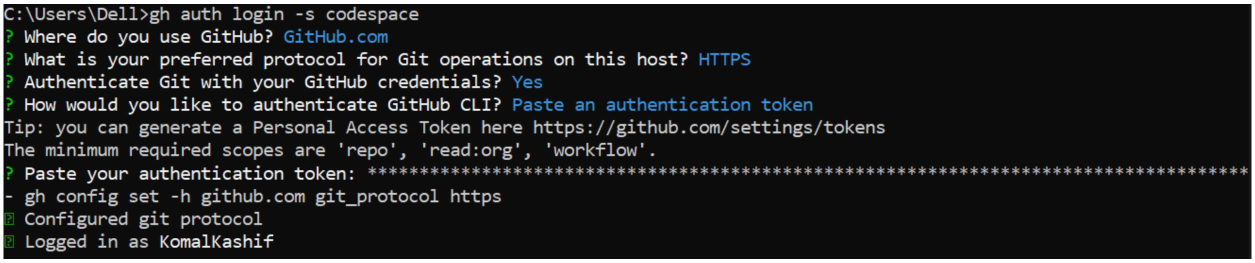
Task 1 — GitHub CLI, Codespace setup and authentication

(Local desktop) Install GitHub CLI: **`winget install --id GitHub.cli`**



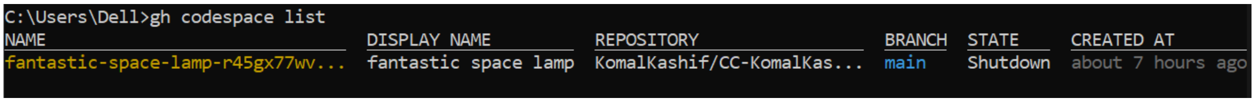
```
C:\Users\Dell>winget install --id GitHub.cli
The `msstore` source requires that you view the following agreements before using.
Terms of Transaction: https://aka.ms/microsoft-store-terms-of-transaction
The source requires the current machine's 2-letter geographic region to be sent to the backend service to function prope
rly (ex. "US").

Do you agree to all the source agreements terms?
[Y] Yes  [N] No: y
Found GitHub CLI [GitHub.cli] Version 2.83.2
This application is licensed to you by its owner.
Microsoft is not responsible for, nor does it grant any licenses to, third-party packages.
Downloading https://github.com/cli/cli/releases/download/v2.83.2/gh_2.83.2_windows_amd64.msi
                                 17.7 MB / 17.7 MB
Successfully verified installer hash
Starting package install...
Successfully installed
```

Authenticate GH CLI for Codespaces: **`gh auth login -s codespace`**



```
C:\Users\Dell>gh auth login -s codespace
? Where do you use GitHub? GitHub.com
? What is your preferred protocol for Git operations on this host? HTTPS
? Authenticate Git with your GitHub credentials? Yes
? How would you like to authenticate GitHub CLI? Paste an authentication token
Tip: you can generate a Personal Access Token here https://github.com/settings/tokens
The minimum required scopes are 'repo', 'read:org', 'workflow'.
? Paste your authentication token: *****************************************************************************************
- gh config set -h github.com git_protocol https
✓ Configured git protocol
✓ Logged in as KomalKashif
```

List available Codespaces: **`gh codespace list`**

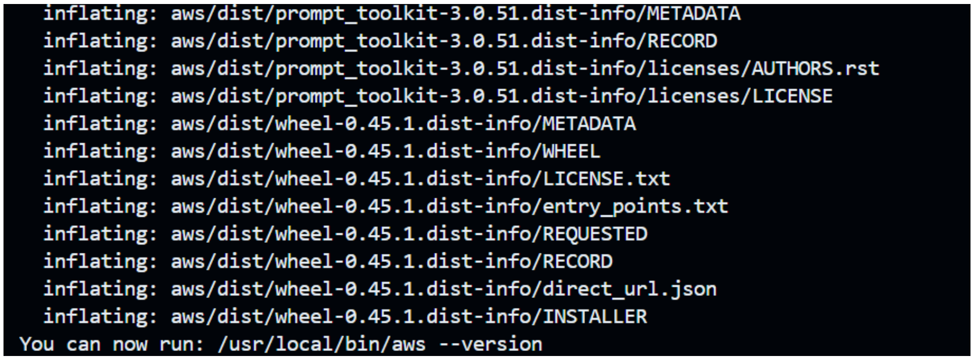


```
C:\Users\Dell>gh codespace list
NAME                             DISPLAY NAME         REPOSITORY                  BRANCH  STATE     CREATED AT
fantastic-space-lamp-r45gx77wv...  fantastic space lamp  KomalKashif/CC-KomalKas...  main    Shutdown  about 7 hours ago
```

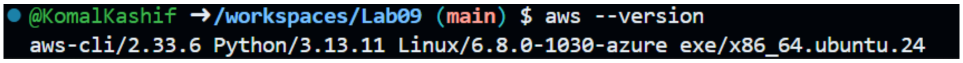
Task 2 — Install AWS CLI, Terraform CLI, Provider Setup

A. Install AWS CLI

Download and install AWS CLI:

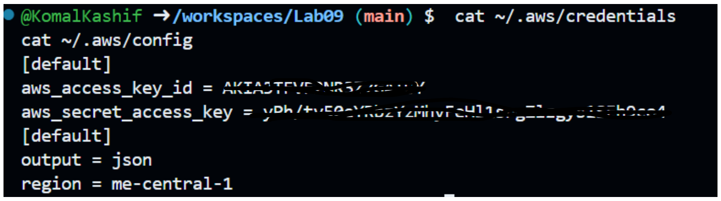


```
  inflating: aws/dist/prompt_toolkit-3.0.51.dist-info/METADATA
  inflating: aws/dist/prompt_toolkit-3.0.51.dist-info/RECORD
  inflating: aws/dist/prompt_toolkit-3.0.51.dist-info/licenses/AUTHORS.rst
  inflating: aws/dist/prompt_toolkit-3.0.51.dist-info/licenses/LICENSE
  inflating: aws/dist/wheel-0.45.1.dist-info/METADATA
  inflating: aws/dist/wheel-0.45.1.dist-info/WHEEL
  inflating: aws/dist/wheel-0.45.1.dist-info/LICENSE.txt
  inflating: aws/dist/wheel-0.45.1.dist-info/entry_points.txt
  inflating: aws/dist/wheel-0.45.1.dist-info/REQUESTED
  inflating: aws/dist/wheel-0.45.1.dist-info/RECORD
  inflating: aws/dist/wheel-0.45.1.dist-info/direct_url.json
  inflating: aws/dist/wheel-0.45.1.dist-info/INSTALLER
You can now run: /usr/local/bin/aws --version
```



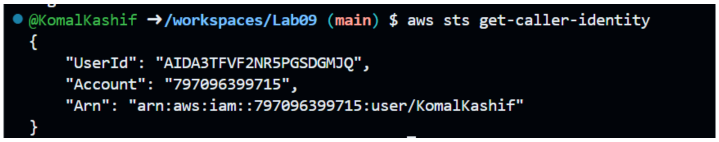
```
● @KomalKashif →/workspaces/Lab09 (main) $ aws --version
  aws-cli/2.33.6 Python/3.13.11 Linux/6.8.0-1030-azure exe/x86_64.ubuntu.24
```

Verify credentials/config files:



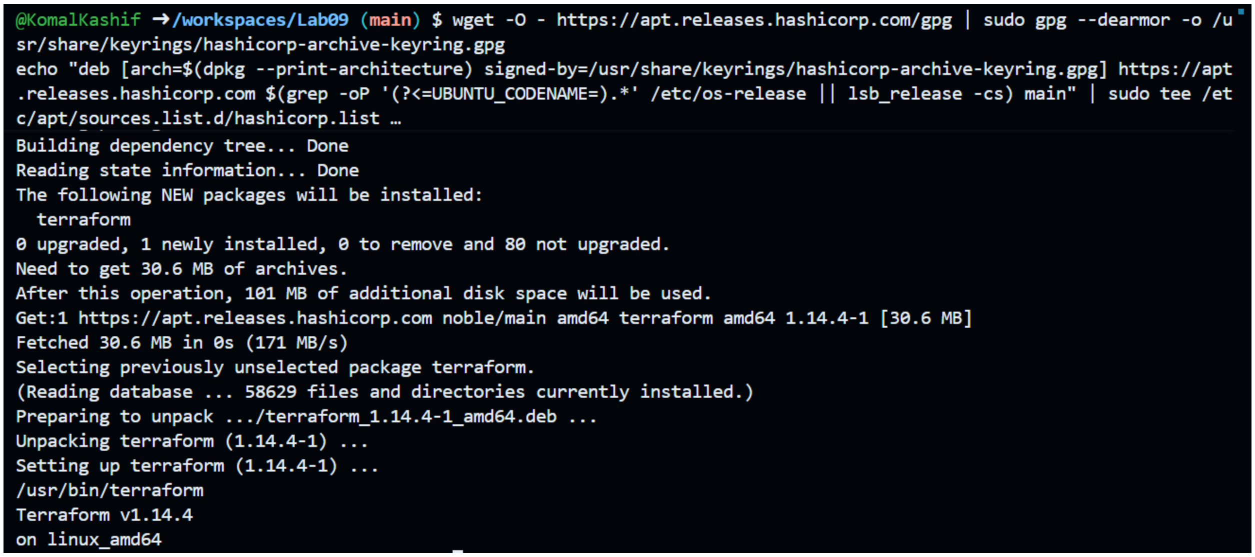
```
@KomalKashif ➜ /workspaces/Lab09 (main) $  cat ~/.aws/credentials
cat ~/.aws/config
[default]
aws_access_key_id = [redacted]
aws_secret_access_key = [redacted]
[default]
output = json
region = me-central-1
```

Verify connectivity



```
@KomalKashif ➜ /workspaces/Lab09 (main) $ aws sts get-caller-identity
{
    "UserId": "AIDA3TFVF2NR5PGSDGMJQ",
    "Account": "797096399715",
    "Arn": "arn:aws:iam::797096399715:user/KomalKashif"
}
```

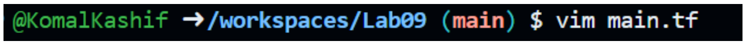
B. Install Terraform CLI



```
@KomalKashif ➜ /workspaces/Lab09 (main) $ wget -O - https://apt.releases.hashicorp.com/gpg | sudo gpg --dearmor -o /u
sr/share/keyrings/hashicorp-archive-keyring.gpg
echo "deb [arch=$(dpkg --print-architecture) signed-by=/usr/share/keyrings/hashicorp-archive-keyring.gpg] https://apt
.releases.hashicorp.com $(grep -oP '(?<=UBUNTU_CODENAME=).*' /etc/os-release || lsb_release -cs) main" | sudo tee /et
c/apt/sources.list.d/hashicorp.list …
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  terraform
0 upgraded, 1 newly installed, 0 to remove and 80 not upgraded.
Need to get 30.6 MB of archives.
After this operation, 101 MB of additional disk space will be used.
Get:1 https://apt.releases.hashicorp.com noble/main amd64 terraform amd64 1.14.4-1 [30.6 MB]
Fetched 30.6 MB in 0s (171 MB/s)
Selecting previously unselected package terraform.
(Reading database ... 58629 files and directories currently installed.)
Preparing to unpack .../terraform_1.14.4-1_amd64.deb ...
Unpacking terraform (1.14.4-1) ...
Setting up terraform (1.14.4-1) ...
/usr/bin/terraform
Terraform v1.14.4
on linux_amd64
```

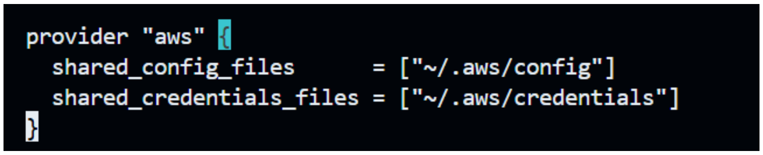
C. Provider Configuration (main.tf)

task2_terraform_install_and_version.png



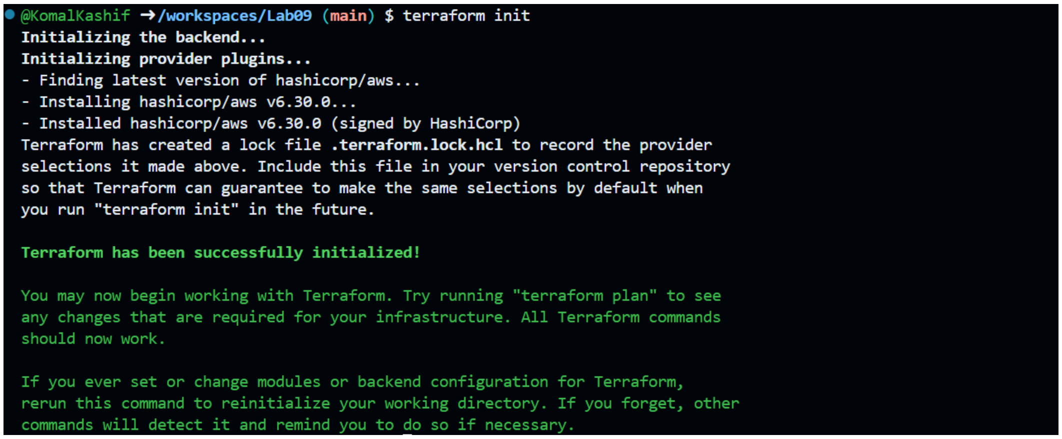
```
@KomalKashif ➜ /workspaces/Lab09 (main) $ vim main.tf
```

task2_provider_file_creation.png



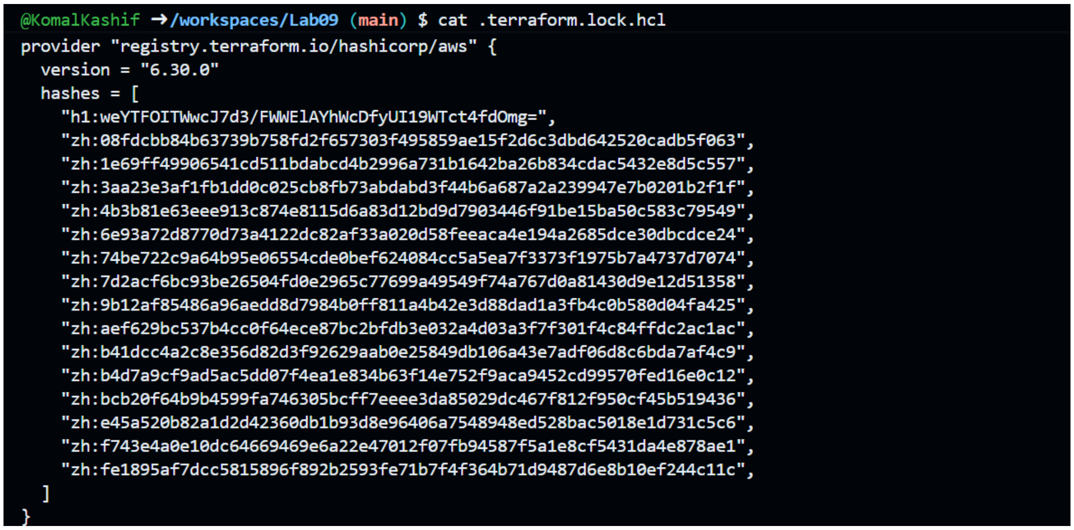
```
provider "aws" {
  shared_config_files      = ["~/.aws/config"]
  shared_credentials_files = ["~/.aws/credentials"]
}
```

task2_terraform_init_output.png



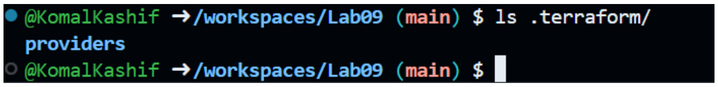
```
@KomalKashif →/workspaces/Lab09 (main) $ terraform init
Initializing the backend...
Initializing provider plugins...
- Finding latest version of hashicorp/aws...
- Installing hashicorp/aws v6.30.0...
- Installed hashicorp/aws v6.30.0 (signed by HashiCorp)
Terraform has created a lock file .terraform.lock.hcl to record the provider
selections it made above. Include this file in your version control repository
so that Terraform can guarantee to make the same selections by default when
you run "terraform init" in the future.

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.
```

task2_terraform_lock_hcl.png



```
@KomalKashif →/workspaces/Lab09 (main) $ cat .terraform.lock.hcl
provider "registry.terraform.io/hashicorp/aws" {
  version = "6.30.0"
  hashes = [
    "h1:weYTFOITWwcJ7d3/FWWElAYhWcDfyUI19WTct4fdOmg=",
    "zh:08fdcbb84b63739b758fd2f657303f495859ae15f2d6c3dbd642520cadb5f063",
    "zh:1e69ff49906541cd511bdabcd4b2996a731b1642ba26b834cdac5432e8d5c557",
    "zh:3aa23e3af1fb1dd0c025cb8fb73abdabd3f44b6a687a2a239947e7b0201b2f1f",
    "zh:4b3b81e63eee913c874e8115d6a83d12bd9d7903446f91be15ba50c583c79549",
    "zh:6e93a72d8770d73a4122dc82af33a020d58feeaca4e194a2685dce30dbcdce24",
    "zh:74be722c9a64b95e06554cde0bef624084cc5a5ea7f3373f1975b7a4737d7074",
    "zh:7d2acf6bc93be26504fd0e2965c77699a49549f74a767d0a81430d9e12d51358",
    "zh:9b12af85486a96aedd8d7984b0ff811a4b42e3d88dad1a3fb4c0b580d04fa425",
    "zh:aef629bc537b4cc0f64ece87bc2bfdb3e032a4d03a3f7f301f4c84ffdc2ac1ac",
    "zh:b41dcc4a2c8e356d82d3f92629aab0e25849db106a43e7adf06d8c6bda7af4c9",
    "zh:b4d7a9cf9ad5ac5dd07f4ea1e834b63f14e752f9aca9452cd99570fed16e0c12",
    "zh:bcb20f64b9b4599fa746305bcff7eeee3da85029dc467f812f950cf45b519436",
    "zh:e45a520b82a1d2d42360db1b93d8e96406a7548948ed528bac5018e1d731c5c6",
    "zh:f743e4a0e10dc64669469e6a22e47012f07fb94587f5a1e8cf5431da4e878ae1",
    "zh:fe1895af7dcc5815896f892b2593fe71b7f4f364b71d9487d6e8b10ef244c11c",
  ]
}
```

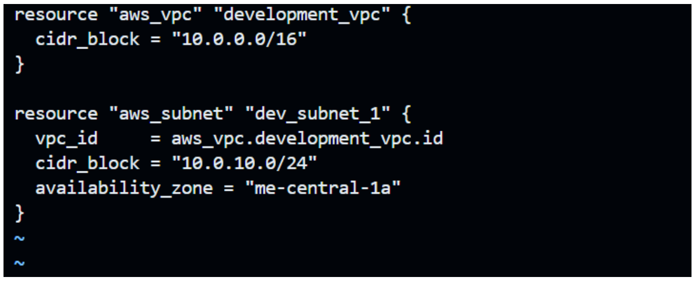
task2_terraform_dir_ls.png



```
@KomalKashif →/workspaces/Lab09 (main) $ ls .terraform/
providers
@KomalKashif →/workspaces/Lab09 (main) $
```

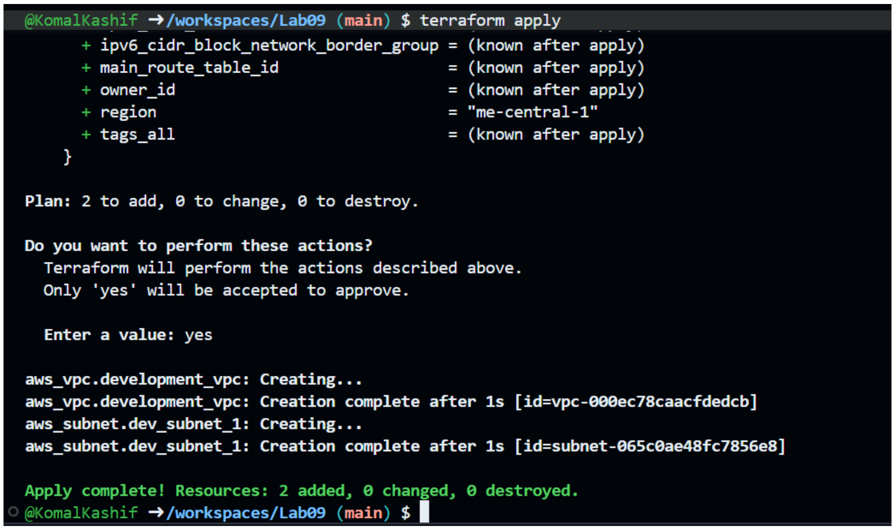
Task 3 — VPC/Subnet Creation, Initialization, Verification

task3_main_tf_resource_add.png



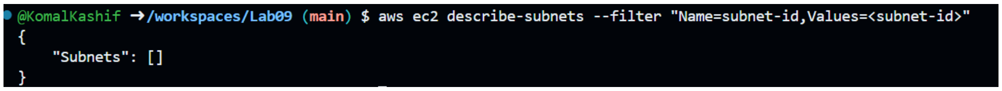
```
resource "aws_vpc" "development_vpc" {
  cidr_block = "10.0.0.0/16"
}

resource "aws_subnet" "dev_subnet_1" {
  vpc_id     = aws_vpc.development_vpc.id
  cidr_block = "10.0.10.0/24"
  availability_zone = "me-central-1a"
}
~
~
```

task3_terraform_apply_vpc_subnet.png



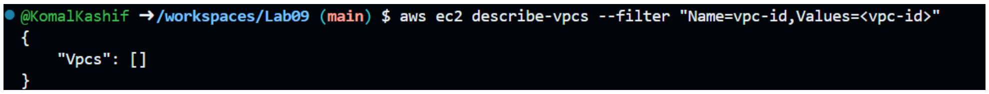
```
@KomalKashif →/workspaces/Lab09 (main) $ terraform apply
      + ipv6_cidr_block_network_border_group = (known after apply)
      + main_route_table_id                  = (known after apply)
      + owner_id                             = (known after apply)
      + region                               = "me-central-1"
      + tags_all                             = (known after apply)
    }

Plan: 2 to add, 0 to change, 0 to destroy.

Do you want to perform these actions?
  Terraform will perform the actions described above.
  Only 'yes' will be accepted to approve.

  Enter a value: yes

aws_vpc.development_vpc: Creating...
aws_vpc.development_vpc: Creation complete after 1s [id=vpc-000ec78caacfdedcb]
aws_subnet.dev_subnet_1: Creating...
aws_subnet.dev_subnet_1: Creation complete after 1s [id=subnet-065c0ae48fc7856e8]

Apply complete! Resources: 2 added, 0 changed, 0 destroyed.
@KomalKashif →/workspaces/Lab09 (main) $
```

task3_aws_cli_verify_subnet.png



```
@KomalKashif →/workspaces/Lab09 (main) $ aws ec2 describe-subnets --filter "Name=subnet-id,Values=<subnet-id>"
{
    "Subnets": []
}
```

task3_aws_cli_verify_vpc.png

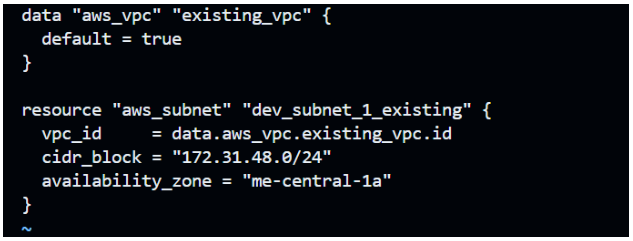


```
@KomalKashif →/workspaces/Lab09 (main) $ aws ec2 describe-vpcs --filter "Name=vpc-id,Values=<vpc-id>"
{
    "Vpcs": []
}
```

Task 4 — Data Source, Targeted Destroy, Tags

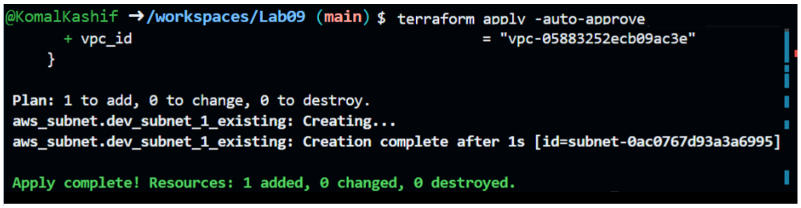
A. Data Source & Resource Creation

task4_main_tf_datasource_resource_add.png



```
data "aws_vpc" "existing_vpc" {
  default = true
}

resource "aws_subnet" "dev_subnet_1_existing" {
  vpc_id     = data.aws_vpc.existing_vpc.id
  cidr_block = "172.31.48.0/24"
  availability_zone = "me-central-1a"
}
~
```

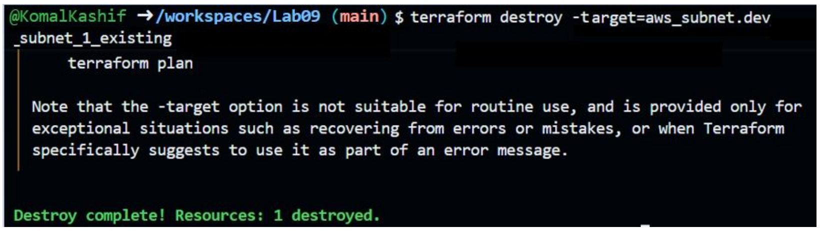
task4_terraform_apply_datasource_resource.png



```
@KomalKashif →/workspaces/Lab09 (main) $ terraform apply -auto-approve
      + vpc_id                                         = "vpc-05883252ecb09ac3e"
    }

Plan: 1 to add, 0 to change, 0 to destroy.
aws_subnet.dev_subnet_1_existing: Creating...
aws_subnet.dev_subnet_1_existing: Creation complete after 1s [id=subnet-0ac0767d93a3a6995]

Apply complete! Resources: 1 added, 0 changed, 0 destroyed.
```

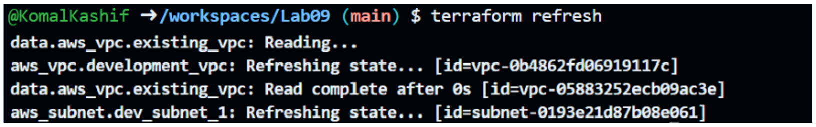
B. Targeted Destroy & Refresh

task4_terraform_destroy_targeted.png



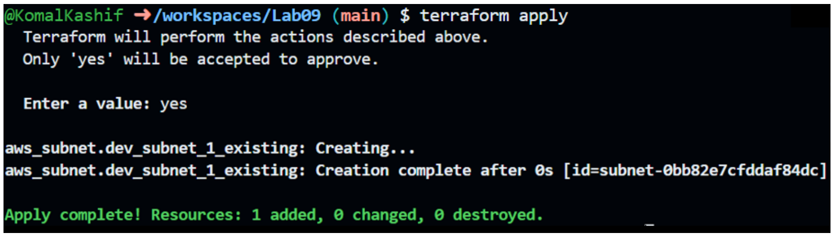
```
@KomalKashif →/workspaces/Lab09 (main) $ terraform destroy -target=aws_subnet.dev
_subnet_1_existing
│     terraform plan
│
│ Note that the -target option is not suitable for routine use, and is provided only for
│ exceptional situations such as recovering from errors or mistakes, or when Terraform
│ specifically suggests to use it as part of an error message.
│

Destroy complete! Resources: 1 destroyed.
```

task4_terraform_refresh_state.png



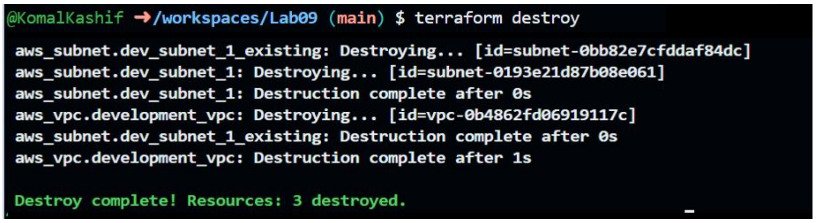
```
@KomalKashif →/workspaces/Lab09 (main) $ terraform refresh
data.aws_vpc.existing_vpc: Reading...
aws_vpc.development_vpc: Refreshing state... [id=vpc-0b4862fd06919117c]
data.aws_vpc.existing_vpc: Read complete after 0s [id=vpc-05883252ecb09ac3e]
aws_subnet.dev_subnet_1: Refreshing state... [id=subnet-0193e21d87b08e061]
```

task4_terraform_apply_after_refresh



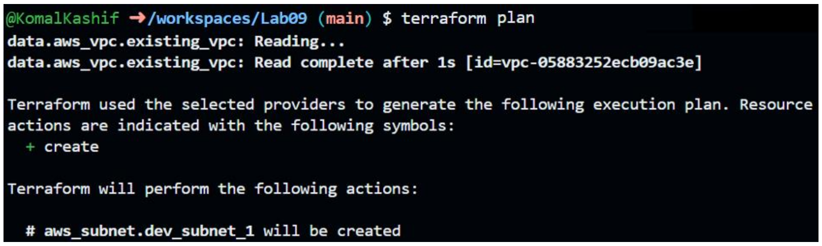
```
@KomalKashif →/workspaces/Lab09 (main) $ terraform apply
  Terraform will perform the actions described above.
  Only 'yes' will be accepted to approve.

  Enter a value: yes

aws_subnet.dev_subnet_1_existing: Creating...
aws_subnet.dev_subnet_1_existing: Creation complete after 0s [id=subnet-0bb82e7cfddaf84dc]

Apply complete! Resources: 1 added, 0 changed, 0 destroyed.
```

task4_terraform_destroy_all



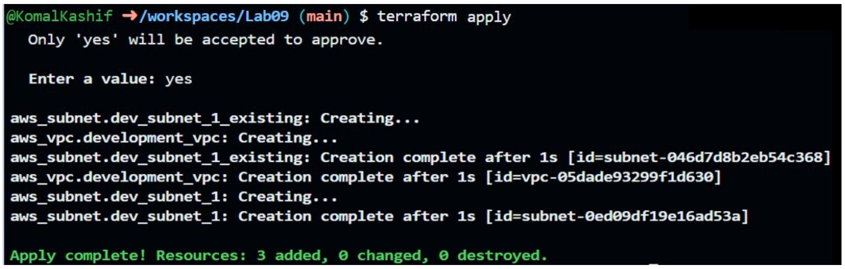
```
@KomalKashif →/workspaces/Lab09 (main) $ terraform destroy

 aws_subnet.dev_subnet_1_existing: Destroying... [id=subnet-0bb82e7cfddaf84dc]
 aws_subnet.dev_subnet_1: Destroying... [id=subnet-0193e21d87b08e061]
 aws_subnet.dev_subnet_1: Destruction complete after 0s
 aws_vpc.development_vpc: Destroying... [id=vpc-0b4862fd06919117c]
 aws_subnet.dev_subnet_1_existing: Destruction complete after 0s
 aws_vpc.development_vpc: Destruction complete after 1s

 Destroy complete! Resources: 3 destroyed.
```

task4_terraform_plan_output.png



```
@KomalKashif →/workspaces/Lab09 (main) $ terraform plan
data.aws_vpc.existing_vpc: Reading...
data.aws_vpc.existing_vpc: Read complete after 1s [id=vpc-05883252ecb09ac3e]

Terraform used the selected providers to generate the following execution plan. Resource
actions are indicated with the following symbols:
  + create

Terraform will perform the following actions:

  # aws_subnet.dev_subnet_1 will be created
```

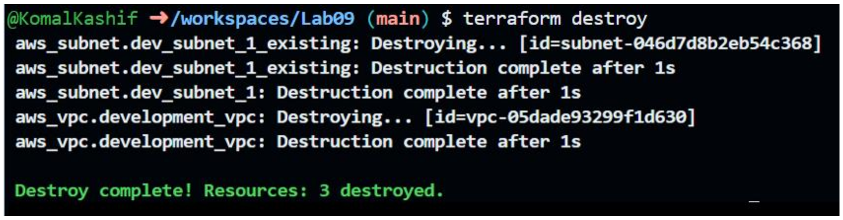
task4_terraform_apply_after_destroy.png



```
@KomalKashif ➜/workspaces/Lab09 (main) $ terraform apply
  Only 'yes' will be accepted to approve.

  Enter a value: yes

aws_subnet.dev_subnet_1_existing: Creating...
aws_vpc.development_vpc: Creating...
aws_subnet.dev_subnet_1_existing: Creation complete after 1s [id=subnet-046d7d8b2eb54c368]
aws_vpc.development_vpc: Creation complete after 1s [id=vpc-05dade93299f1d630]
aws_subnet.dev_subnet_1: Creating...
aws_subnet.dev_subnet_1: Creation complete after 1s [id=subnet-0ed09df19e16ad53a]

Apply complete! Resources: 3 added, 0 changed, 0 destroyed.
```

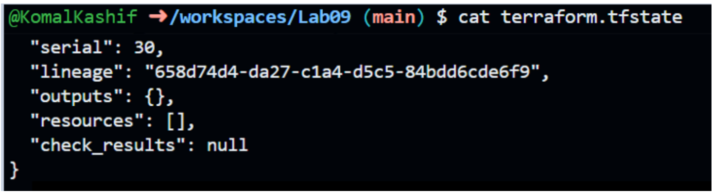
Task 5 — State File Inspection & Terraform State Commands

task5_terraform_destroy.png



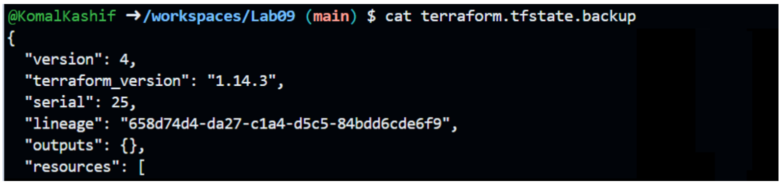
```
@KomalKashif ➜/workspaces/Lab09 (main) $ terraform destroy
 aws_subnet.dev_subnet_1_existing: Destroying... [id=subnet-046d7d8b2eb54c368]
 aws_subnet.dev_subnet_1_existing: Destruction complete after 1s
 aws_subnet.dev_subnet_1: Destruction complete after 1s
 aws_vpc.development_vpc: Destroying... [id=vpc-05dade93299f1d630]
 aws_vpc.development_vpc: Destruction complete after 1s

 Destroy complete! Resources: 3 destroyed.
```

task5_terraform_state_file_empty



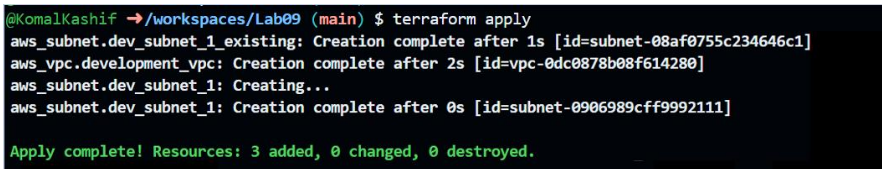
```
@KomalKashif ➜/workspaces/Lab09 (main) $ cat terraform.tfstate
  "serial": 30,
  "lineage": "658d74d4-da27-c1a4-d5c5-84bdd6cde6f9",
  "outputs": {},
  "resources": [],
  "check_results": null
}
```

task5_terraform_state_backup_prev.png



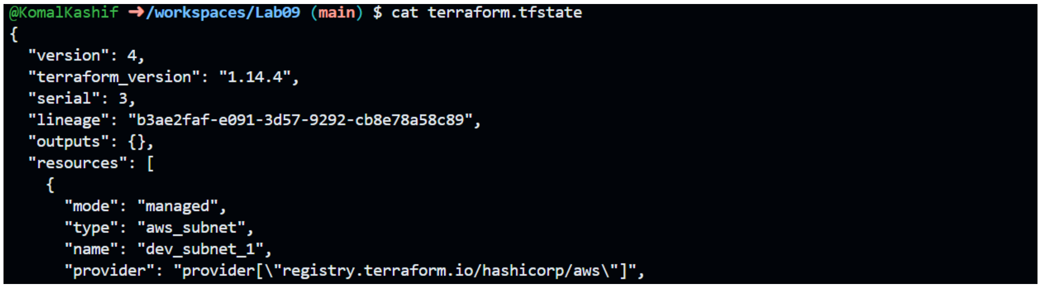
```
@KomalKashif ➜/workspaces/Lab09 (main) $ cat terraform.tfstate.backup
{
  "version": 4,
  "terraform_version": "1.14.3",
  "serial": 25,
  "lineage": "658d74d4-da27-c1a4-d5c5-84bdd6cde6f9",
  "outputs": {},
  "resources": [
```

task5_terraform_apply_recreated.png



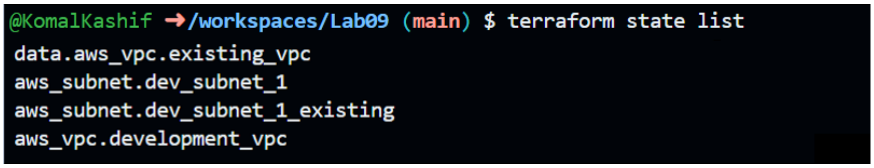
```
@KomalKashif ➜/workspaces/Lab09 (main) $ terraform apply
aws_subnet.dev_subnet_1_existing: Creation complete after 1s [id=subnet-08af0755c234646c1]
aws_vpc.development_vpc: Creation complete after 2s [id=vpc-0dc0878b08f614280]
aws_subnet.dev_subnet_1: Creating...
aws_subnet.dev_subnet_1: Creation complete after 0s [id=subnet-0906989cff9992111]

Apply complete! Resources: 3 added, 0 changed, 0 destroyed.
```

task5_terraform_state_file_populated.png



```
@KomalKashif ➜/workspaces/Lab09 (main) $ cat terraform.tfstate
{
  "version": 4,
  "terraform_version": "1.14.4",
  "serial": 3,
  "lineage": "b3ae2faf-e091-3d57-9292-cb8e78a58c89",
  "outputs": {},
  "resources": [
    {
      "mode": "managed",
      "type": "aws_subnet",
      "name": "dev_subnet_1",
      "provider": "provider[\"registry.terraform.io/hashicorp/aws\"]",
```

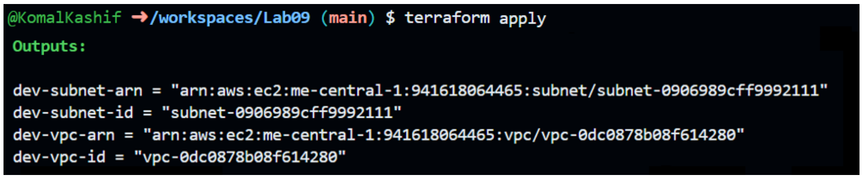
task5_terraform_state_list.png



```
@KomalKashif ➜/workspaces/Lab09 (main) $ terraform state list
data.aws_vpc.existing_vpc
aws_subnet.dev_subnet_1
aws_subnet.dev_subnet_1_existing
aws_vpc.development_vpc
```

Task 6 — Terraform Outputs & Attributes Reporting

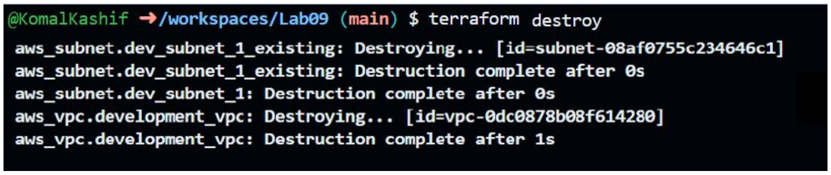
task6_terraform_outputs_basic.png



```
@KomalKashif ➜/workspaces/Lab09 (main) $ terraform apply
Outputs:

dev-subnet-arn = "arn:aws:ec2:me-central-1:941618064465:subnet/subnet-0906989cff9992111"
dev-subnet-id = "subnet-0906989cff9992111"
dev-vpc-arn = "arn:aws:ec2:me-central-1:941618064465:vpc/vpc-0dc0878b08f614280"
dev-vpc-id = "vpc-0dc0878b08f614280"
```

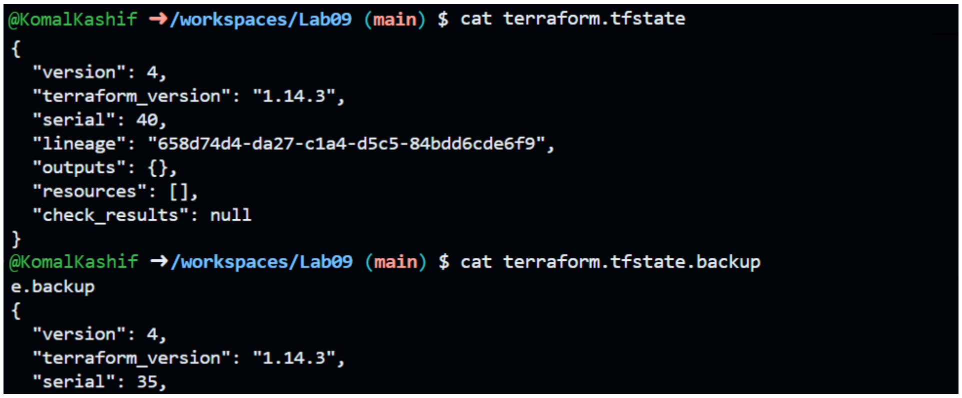
Clean up:

cleanup_destroy_resources.png



```
@KomalKashif ➜/workspaces/Lab09 (main) $ terraform destroy
aws_subnet.dev_subnet_1_existing: Destroying... [id=subnet-08af0755c234646c1]
aws_subnet.dev_subnet_1_existing: Destruction complete after 0s
aws_subnet.dev_subnet_1: Destruction complete after 0s
aws_vpc.development_vpc: Destroying... [id=vpc-0dc0878b08f614280]
aws_vpc.development_vpc: Destruction complete after 1s
```

cleanup_state_files.png



```
@KomalKashif ➜/workspaces/Lab09 (main) $ cat terraform.tfstate
{
  "version": 4,
  "terraform_version": "1.14.3",
  "serial": 40,
  "lineage": "658d74d4-da27-c1a4-d5c5-84bdd6cde6f9",
  "outputs": {},
  "resources": [],
  "check_results": null
}
@KomalKashif ➜/workspaces/Lab09 (main) $ cat terraform.tfstate.backup
e.backup
{
  "version": 4,
  "terraform_version": "1.14.3",
  "serial": 35,
```