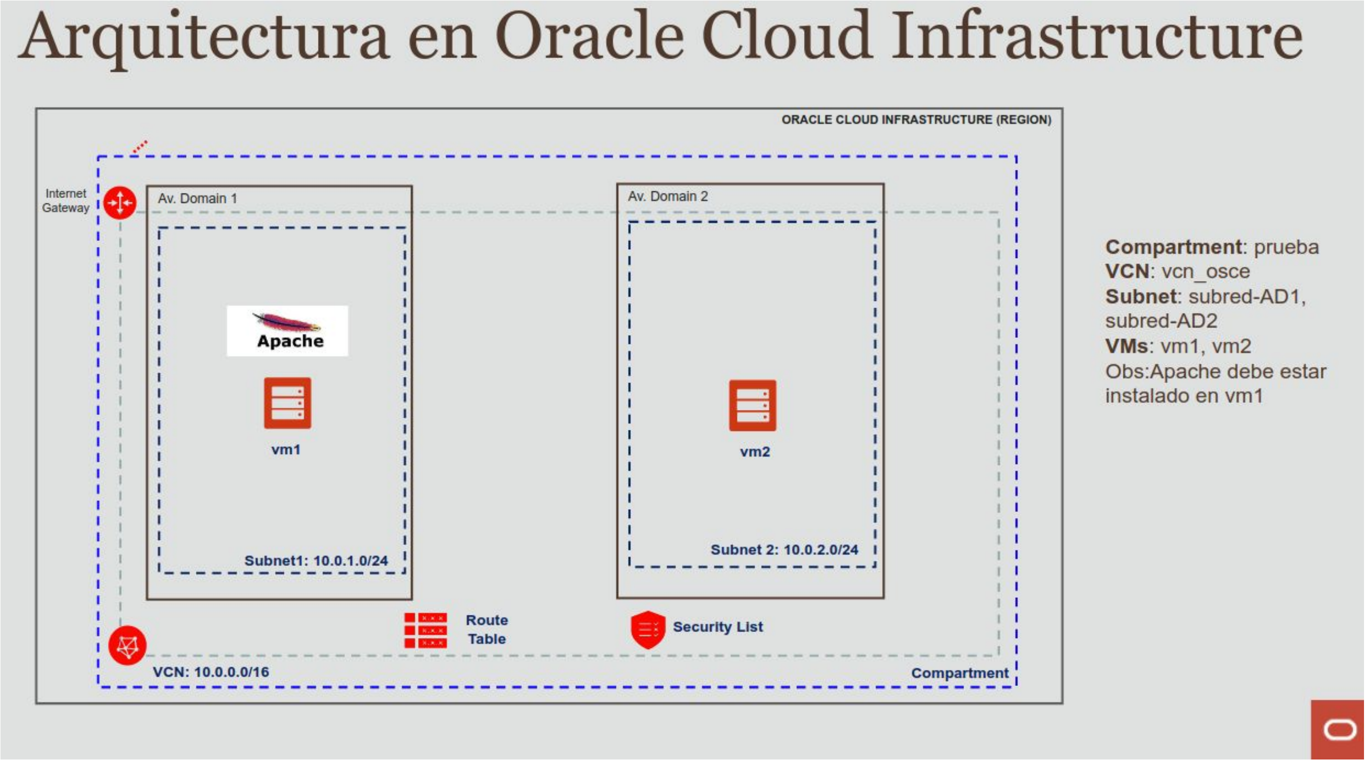
Despliegue de una arquitectura de desarrollo usando ‘Terraform’ - ‘Infrastructure as Code’ (IaC)

Introducción

‘Infrastructure as Code’ (IaC) se entiende como el concepto de despliegue de componentes de la nube (VCN, VM, storage, DB y demás servicios) a través de la ejecución de archivos (.tf), logrando así el ahorro de tiempo y disminuyendo notablemente los errores humanos al tratar de duplicar en otro arrendamiento una arquitectura previamente desplegada por consola. En la actualidad la herramienta de IaC más usada es Terraform, desarrollada por HashiCorp. Esta herramienta es compatible con las principales marcas de nube, como AWS, Azure, Google Cloud y Oracle.

Visión General

En el siguiente gráfico se puede observar la arquitectura a implementar usando la herramienta Terraform:



Todos los componentes deben ser creados en la infraestructura cloud proporcionada por Oracle.

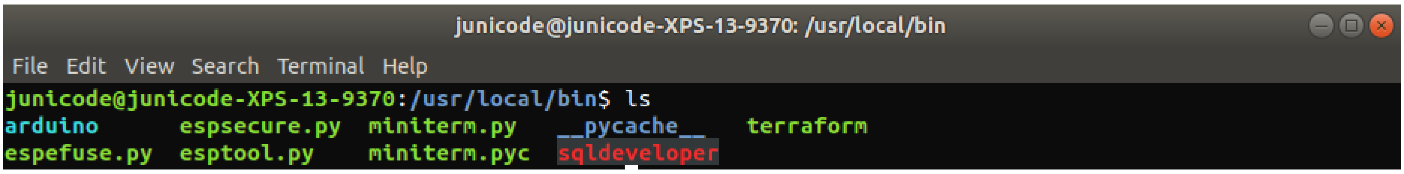
A continuación, se presentan las secciones en las que está dividido este artículo:

- **Primeros pasos con Terraform (creación de una VCN)**
- **Implementación de la Arquitectura**

Desarrollo

1. Primeros pasos con Terraform (creación de una VCN)

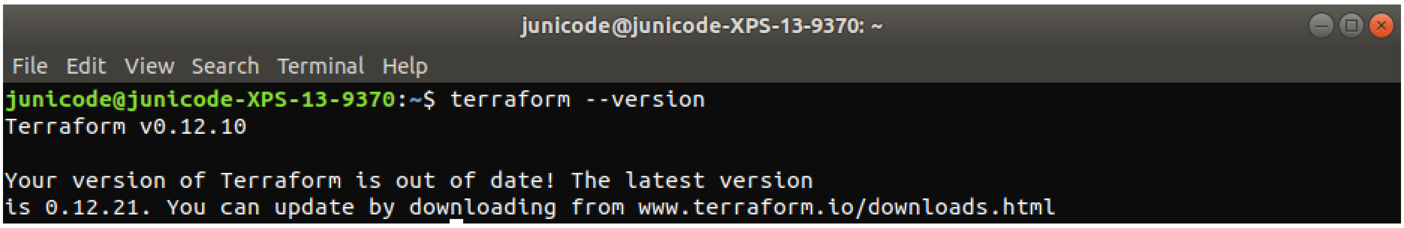
Para instalar correctamente Terraform en una máquina con sistema operativo Linux, debe ser descargado desde la página web https://www.terraform.io/downloads.html. Después, se descomprime el archivo .zip y extraer el archivo ‘terraform’. Por último, mover este archivo a la siguiente ruta: /usr/local/bin.


junicode@junicode-XPS-13-9370: /usr/local/bin
File Edit View Search Terminal Help

```
junicode@junicode-XPS-13-9370:/usr/local/bin$ ls
arduino      espsecure.py  miniterm.py   __pycache__   terraform
espefuse.py  esptool.py    miniterm.pyc  sqldeveloper
```

Se verifica que Terraform fue instalado correctamente se ejecuta el siguiente comando:

$ terraform --version

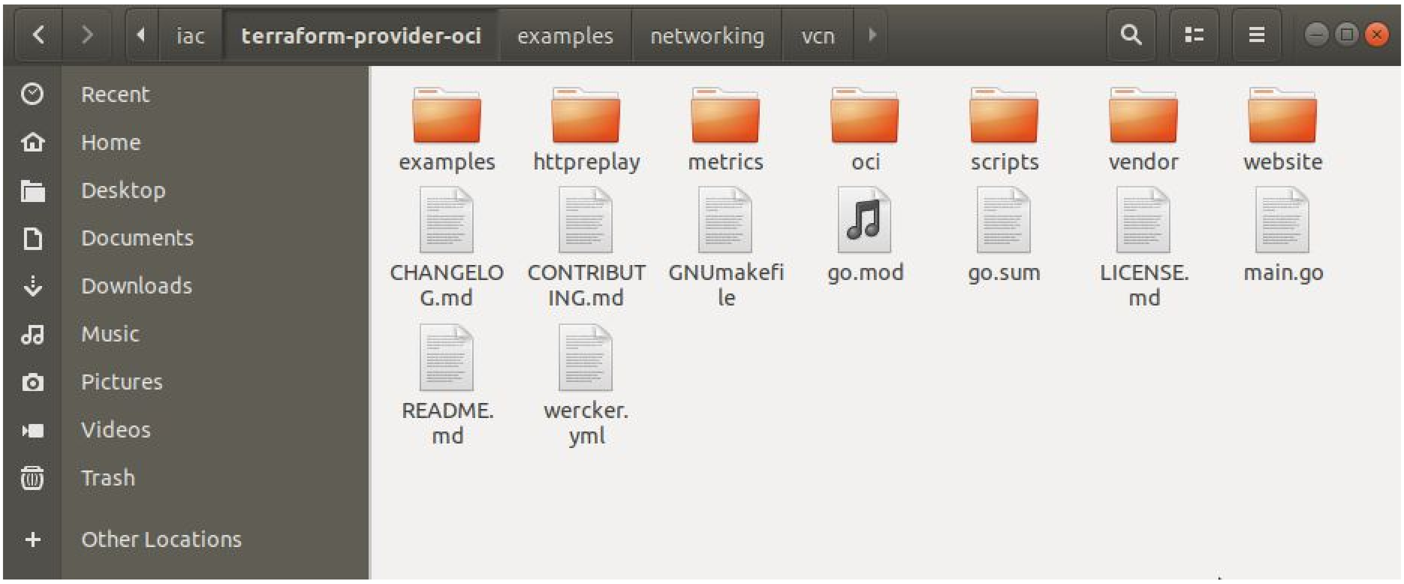

junicode@junicode-XPS-13-9370: ~
File Edit View Search Terminal Help

```
junicode@junicode-XPS-13-9370:~$ terraform --version
Terraform v0.12.10

Your version of Terraform is out of date! The latest version
is 0.12.21. You can update by downloading from www.terraform.io/downloads.html
```

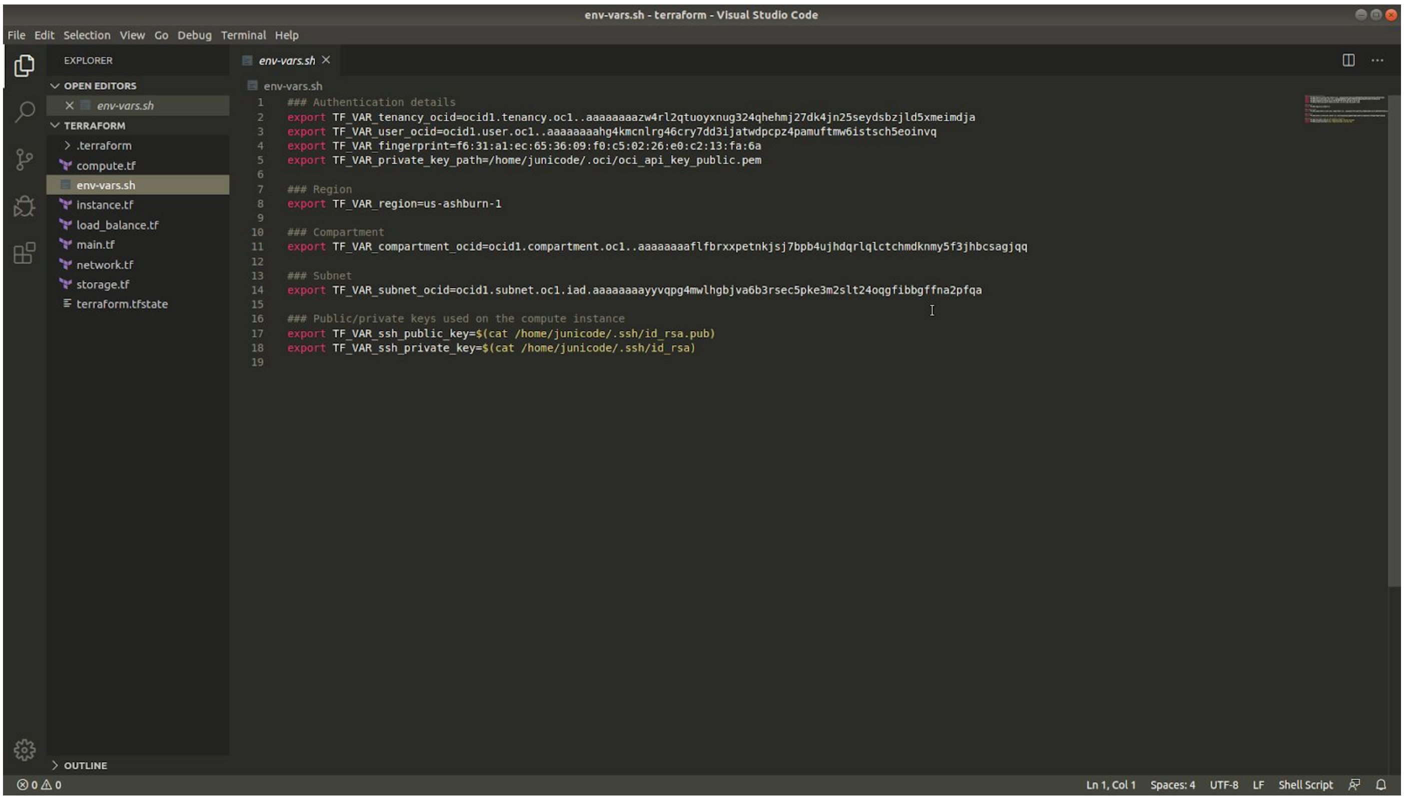
Listo. Ahora, con el fin de obtener los archivos de variables de entorno (env-vars.sh) y los que deben ser ejecutados (.tf), se descarga o clona el repositorio llamado ‘terraform-providers/terraform-provider-oci’:

$ git clone https://github.com/terraform-providers/terraform-provider-oci.git

Las carpetas y archivos que contiene el repositorio son mostrados en la siguiente imagen (se trabajará exclusivamente con la carpeta ‘examples’):



Se recomienda usar el editor de código ‘Visual Studio Code’, ya que soporta la sintaxis de Terraform.

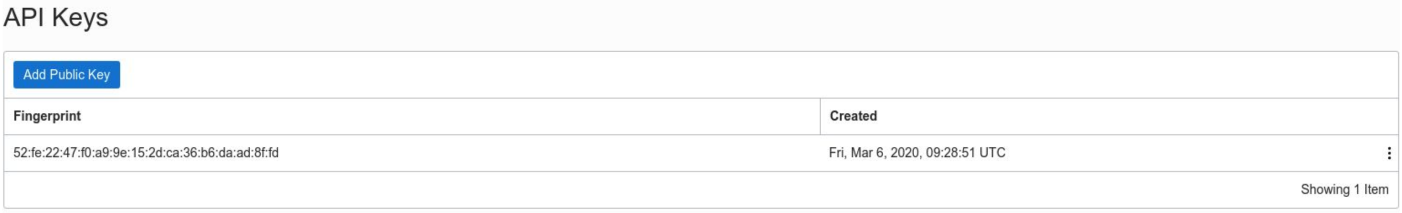


```
### Authentication details
export TF_VAR_tenancy_ocid=ocid1.tenancy.oc1..aaaaaaaazw4rl2qtuoyxnug324qhehmj27dk4jn25seydsbzjld5xmeimdja
export TF_VAR_user_ocid=ocid1.user.oc1..aaaaaaaahg4kmcnlrg46cry7dd3ijatwdpcpz4pamuftmw6istsch5eoinvq
export TF_VAR_fingerprint=f6:31:a1:ec:65:36:09:f0:c5:02:26:e0:c2:13:fa:6a
export TF_VAR_private_key_path=/home/junicode/.oci/oci_api_key_public.pem

### Region
export TF_VAR_region=us-ashburn-1

### Compartment
export TF_VAR_compartment_ocid=ocid1.compartment.oc1..aaaaaaaaflfbrxxpetnkjsj7bpb4ujhdqrlqlctchmdknmy5f3jhbcsagjqq

### Subnet
export TF_VAR_subnet_ocid=ocid1.subnet.oc1.iad.aaaaaaaayyvqpg4mwlhgbjva6b3rsec5pke3m2slt24oqgfibbgffna2pfqa

### Public/private keys used on the compute instance
export TF_VAR_ssh_public_key=$(cat /home/junicode/.ssh/id_rsa.pub)
export TF_VAR_ssh_private_key=$(cat /home/junicode/.ssh/id_rsa)

```

Ya teniendo Terraform instalado en nuestra computadora y la carpeta 'terraform' descargada, se procede a crear dos elementos básicos en la consola de OCI:

- Fingerprint del usuario (ncayllahua@ibitcore.com): 52:fe:22:47:f0:a9:9e:15:2d:ca:36:b6:da:ad:8f:fd

  Se crean las llaves .pem en la siguiente ruta: ~/.oci/
  $ openssl genrsa -des3 -out private.pem 2048
  $ openssl rsa -in private.pem -outform PEM -pubout -out public.pem ***(LLAVE PÚBLICA QUE DEBE SER AGREGADA)***

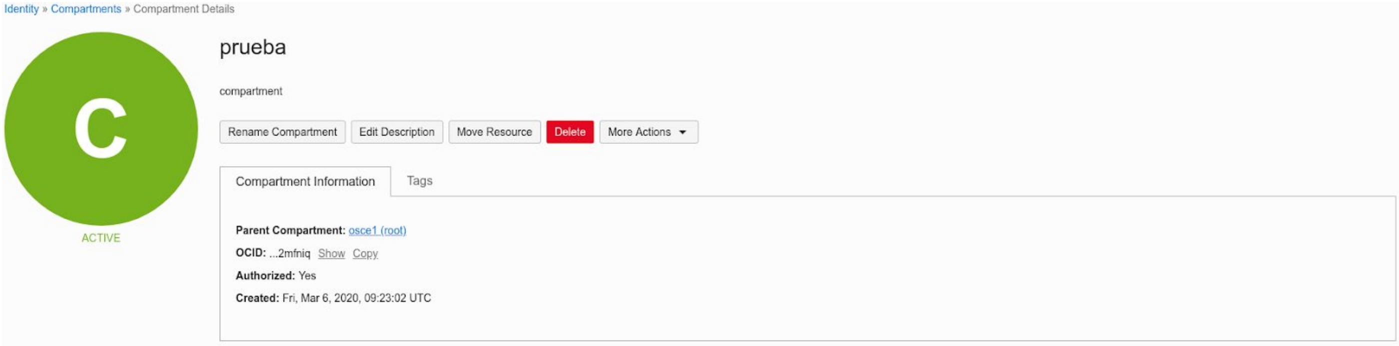


API Keys

Fingerprint	Created
52:fe:22:47:f0:a9:9e:15:2d:ca:36:b6:da:ad:8f:fd	Fri, Mar 6, 2020, 09:28:51 UTC

Showing 1 Item

- Compartimiento: prueba

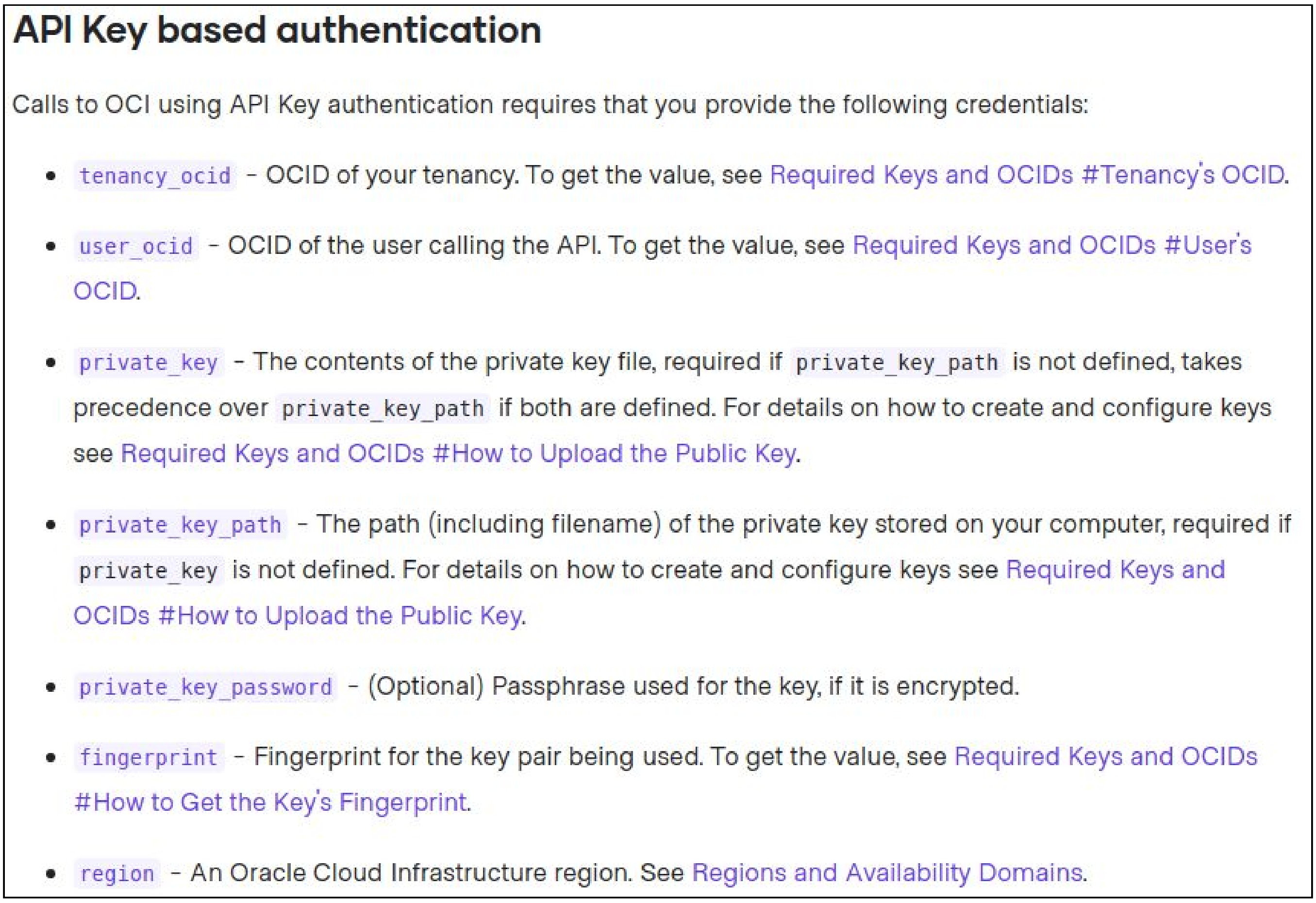


prueba

compartment

Parent Compartment: osce1 (root)
OCID: ...2mfniq Show Copy
Authorized: Yes
Created: Fri, Mar 6, 2020, 09:23:02 UTC

OCI soporta dos métodos de autenticación para Terraform: 'API Key based authentication' y 'Instance Principal based authentication'. El primero de estos dos será usado en este ejercicio.



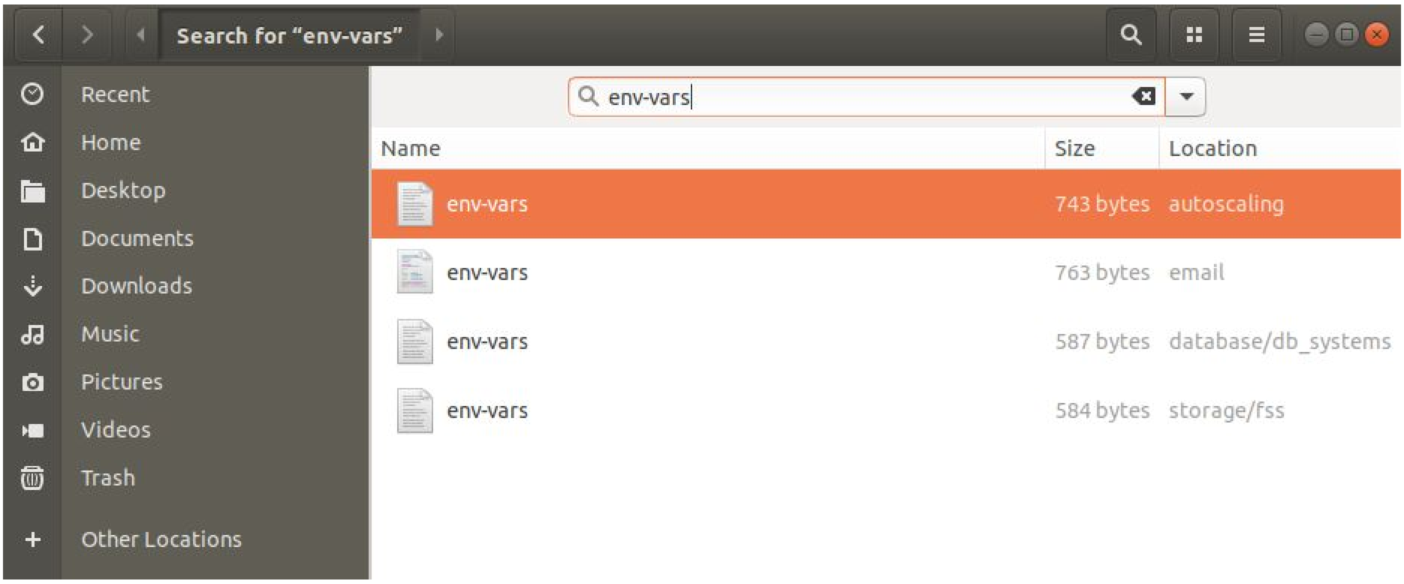
API Key based authentication

Calls to OCI using API Key authentication requires that you provide the following credentials:

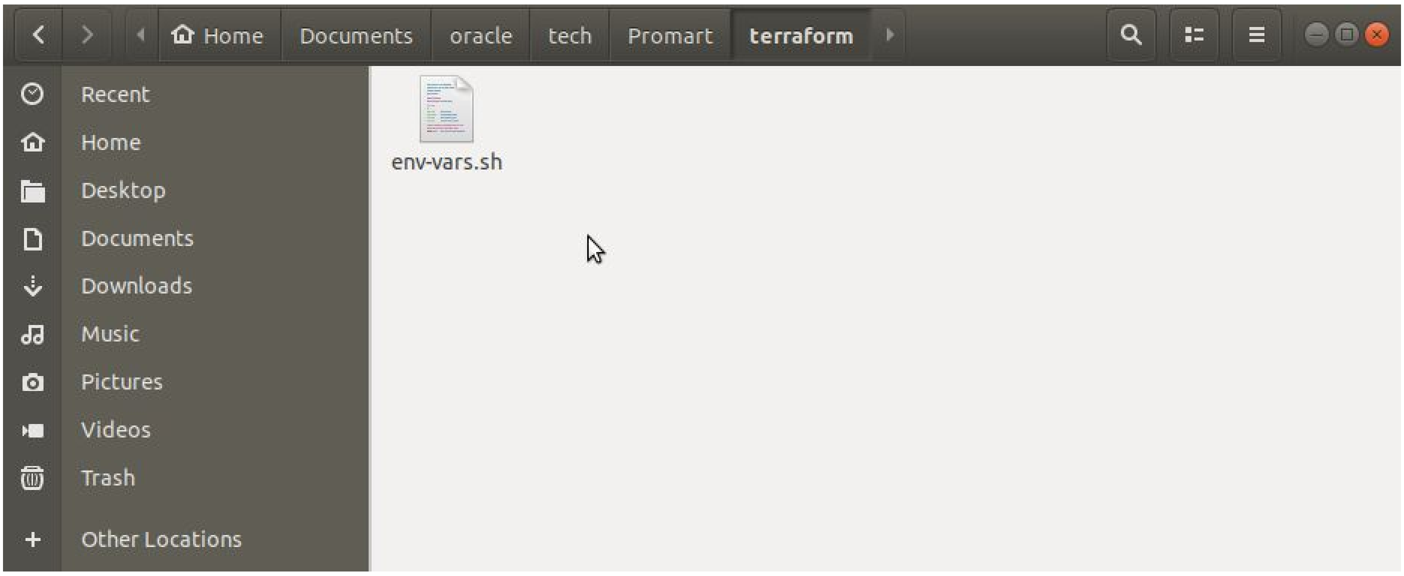
- `tenancy_ocid` - OCID of your tenancy. To get the value, see Required Keys and OCIDs #Tenancy's OCID.
- `user_ocid` - OCID of the user calling the API. To get the value, see Required Keys and OCIDs #User's OCID.
- `private_key` - The contents of the private key file, required if `private_key_path` is not defined, takes precedence over `private_key_path` if both are defined. For details on how to create and configure keys see Required Keys and OCIDs #How to Upload the Public Key.
- `private_key_path` - The path (including filename) of the private key stored on your computer, required if `private_key` is not defined. For details on how to create and configure keys see Required Keys and OCIDs #How to Upload the Public Key.
- `private_key_password` - (Optional) Passphrase used for the key, if it is encrypted.
- `fingerprint` - Fingerprint for the key pair being used. To get the value, see Required Keys and OCIDs #How to Get the Key's Fingerprint.
- `region` - An Oracle Cloud Infrastructure region. See Regions and Availability Domains.

Se procede a crear una nueva carpeta, en donde se copiará y modificará ciertos archivos de la carpeta ‘examples’, proveniente del repositorio clonado en los anteriores pasos. Esta carpeta la llamaremos ‘terraform’.

Primero, se copia algún archivo de variables de entorno (env-vars.sh).



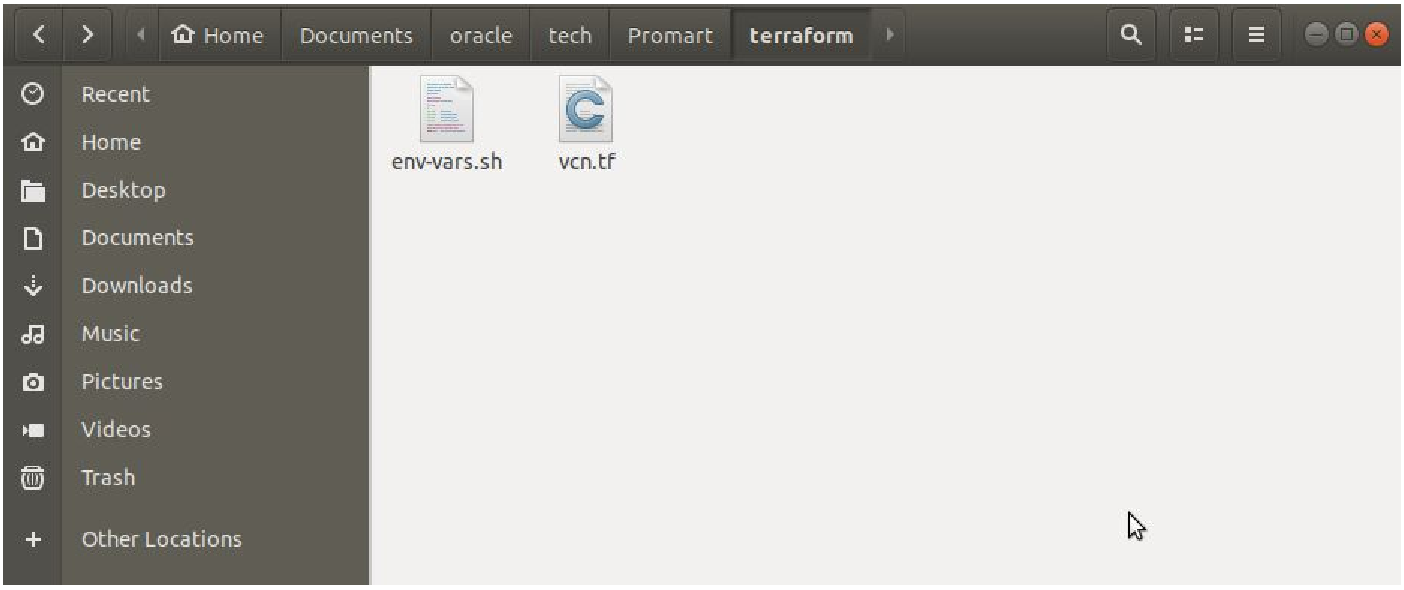
Name	Size	Location
env-vars	743 bytes	autoscaling
env-vars	763 bytes	email
env-vars	587 bytes	database/db_systems
env-vars	584 bytes	storage/fss



Seguidamente, se modifica este archivo con los datos respectivos de su cuenta OCI.

```
### Authentication details

export TF_VAR_tenancy_ocid=ocid1.tenancy.oc1..aaaaaaaatbtjah3ht6up5waoi52wiyde5gdxbdvofjzok4ruo6k4tvlnl4ia
export TF_VAR_user_ocid=ocid1.user.oc1..aaaaaaaadzczsphbzlvsqymx6kbllrfybp6wpkx6hubfbxwyfjabg7ufm5zq
export TF_VAR_fingerprint=52:fe:22:47:f0:a9:9e:15:2d:ca:36:b6:da:ad:8f:fd
export TF_VAR_private_key_path=/home/junicode/.oci/private.pem
export TF_VAR_private_key_password=private

### Region

export TF_VAR_region=us-ashburn-1

### Compartment

export TF_VAR_compartment_ocid=ocid1.compartment.oc1..aaaaaaaalxo7zindcffskunoclqhfxnvmblgpjs4r7s7li7cvx2l3p2mfniq
```

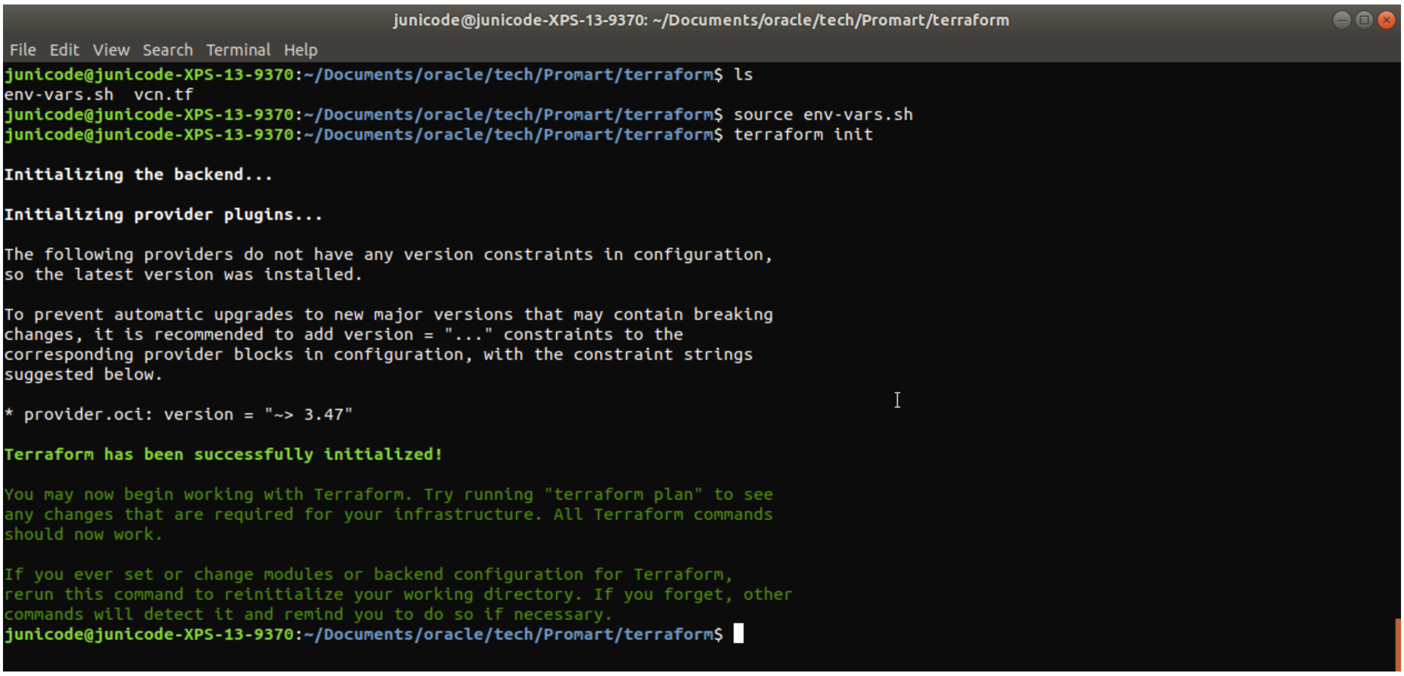
Se procede a crear la VCN, haciendo uso del archivo ‘vcn.t’. Dentro del archivo se cambia la palabra ‘vcn1’ por ‘vcn_osce’ (excepto en DNS label).



```
// Copyright (c) 2017, 2019, Oracle and/or its affiliates. All rights reserved.

variable "tenancy_ocid" {}
variable "user_ocid" {}
variable "fingerprint" {}
variable "private_key_path" {}
variable "compartment_ocid" {}
variable "region" {}

provider "oci" {
  tenancy_ocid     = "${var.tenancy_ocid}"
  user_ocid        = "${var.user_ocid}"
  fingerprint      = "${var.fingerprint}"
  private_key_path = "${var.private_key_path}"
  region           = "${var.region}"
}

resource "oci_core_vcn" "vcn_osce" {
  cidr_block     = "10.0.0.0/16"
  dns_label      = "vcn1"
  compartment_id = "${var.compartment_ocid}"
  display_name   = "vcn_osce"
}

output "vcn_id" {
  value = "${oci_core_vcn.vcn_osce.id}"
}
```

Y se ejecutan los siguientes comandos:

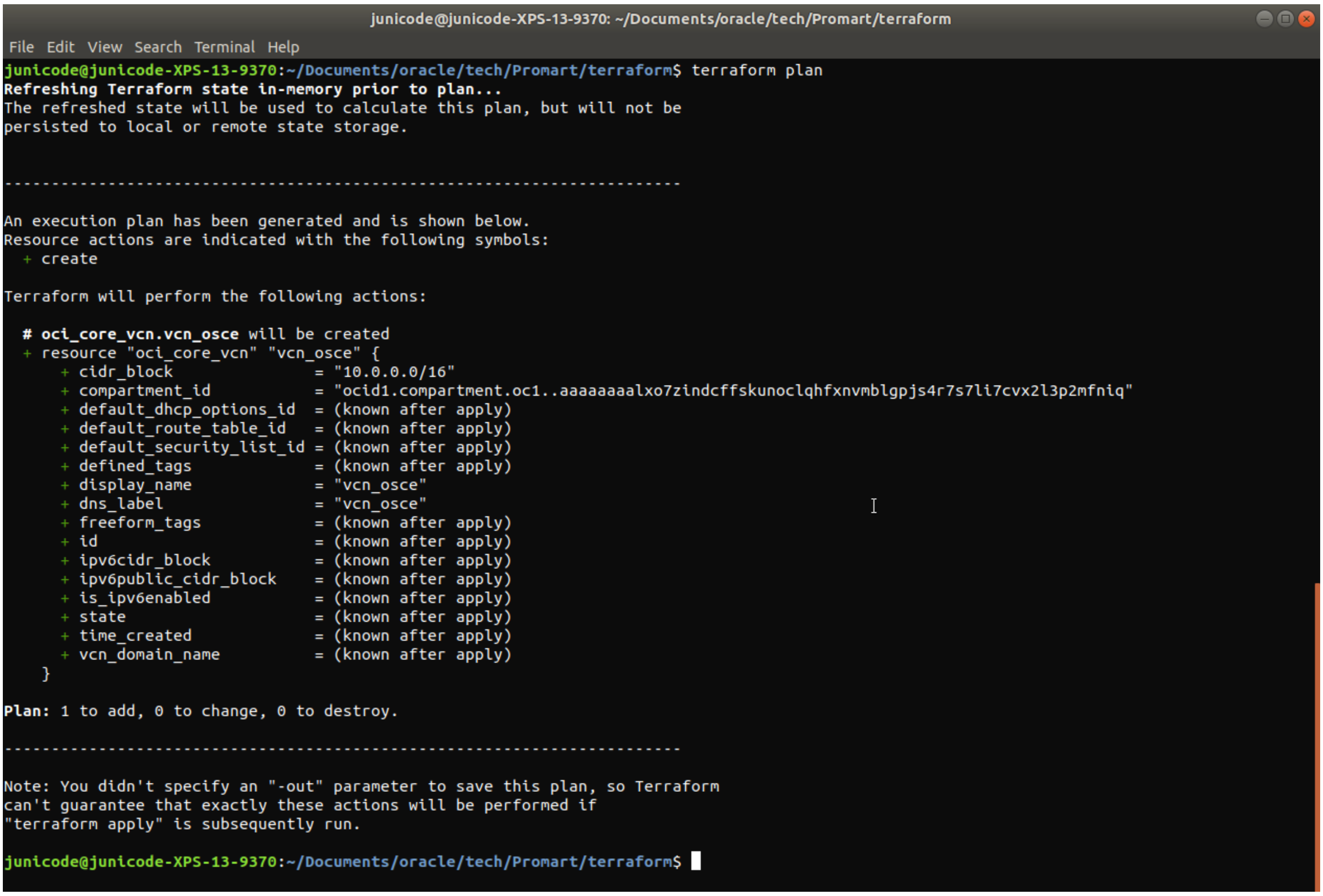
```
$ source env-vars.sh
$ terraform init
```


junicode@junicode-XPS-13-9370: ~/Documents/oracle/tech/Promart/terraform
File Edit View Search Terminal Help

```
junicode@junicode-XPS-13-9370:~/Documents/oracle/tech/Promart/terraform$ ls
env-vars.sh  vcn.tf
junicode@junicode-XPS-13-9370:~/Documents/oracle/tech/Promart/terraform$ source env-vars.sh
junicode@junicode-XPS-13-9370:~/Documents/oracle/tech/Promart/terraform$ terraform init

Initializing the backend...

Initializing provider plugins...

The following providers do not have any version constraints in configuration,
so the latest version was installed.

To prevent automatic upgrades to new major versions that may contain breaking
changes, it is recommended to add version = "..." constraints to the
corresponding provider blocks in configuration, with the constraint strings
suggested below.

* provider.oci: version = "~> 3.47"

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.
junicode@junicode-XPS-13-9370:~/Documents/oracle/tech/Promart/terraform$ 
```

Del mensaje, se corrobora que Terraform se inicializó correctamente.

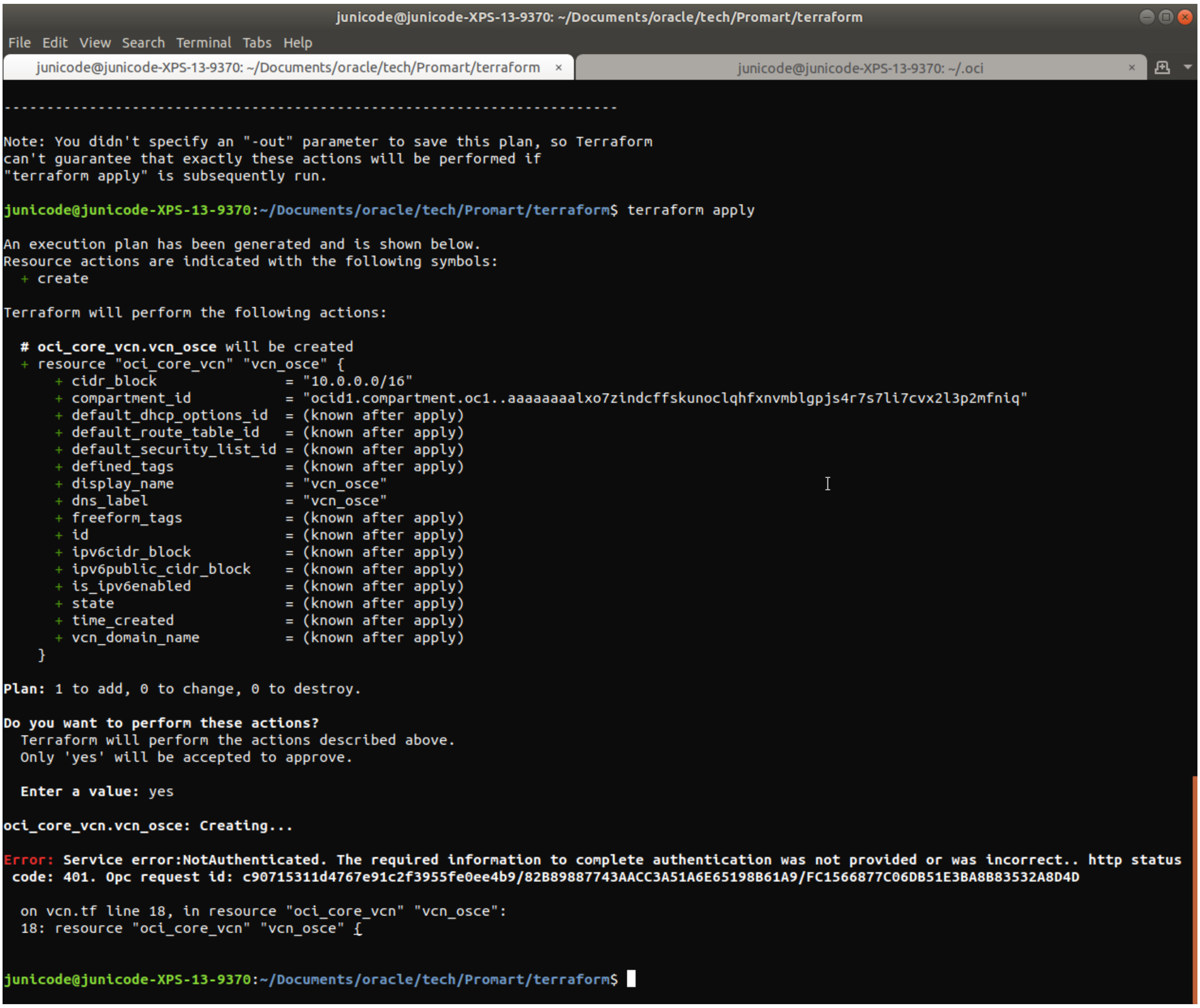
$ terraform plan


junicode@junicode-XPS-13-9370: ~/Documents/oracle/tech/Promart/terraform
File Edit View Search Terminal Help

```
junicode@junicode-XPS-13-9370:~/Documents/oracle/tech/Promart/terraform$ terraform plan
Refreshing Terraform state in-memory prior to plan...
The refreshed state will be used to calculate this plan, but will not be
persisted to local or remote state storage.


------------------------------------------------------------------------

An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbols:
  + create

Terraform will perform the following actions:

  # oci_core_vcn.vcn_osce will be created
  + resource "oci_core_vcn" "vcn_osce" {
      + cidr_block               = "10.0.0.0/16"
      + compartment_id           = "ocid1.compartment.oc1..aaaaaaaalxo7zindcffskunoclqhfxnvmblgpjs4r7s7li7cvx2l3p2mfniq"
      + default_dhcp_options_id  = (known after apply)
      + default_route_table_id   = (known after apply)
      + default_security_list_id = (known after apply)
      + defined_tags             = (known after apply)
      + display_name             = "vcn_osce"
      + dns_label                = "vcn_osce"
      + freeform_tags            = (known after apply)
      + id                       = (known after apply)
      + ipv6cidr_block           = (known after apply)
      + ipv6public_cidr_block    = (known after apply)
      + is_ipv6enabled           = (known after apply)
      + state                    = (known after apply)
      + time_created             = (known after apply)
      + vcn_domain_name          = (known after apply)
    }

Plan: 1 to add, 0 to change, 0 to destroy.

------------------------------------------------------------------------

Note: You didn't specify an "-out" parameter to save this plan, so Terraform
can't guarantee that exactly these actions will be performed if
"terraform apply" is subsequently run.

junicode@junicode-XPS-13-9370:~/Documents/oracle/tech/Promart/terraform$ 
```

Al ejecutar ‘terraform plan’, en la línea de comando se puede observar lo que Terraform llevará a cabo. Para el presente caso, la creación de una VCN.

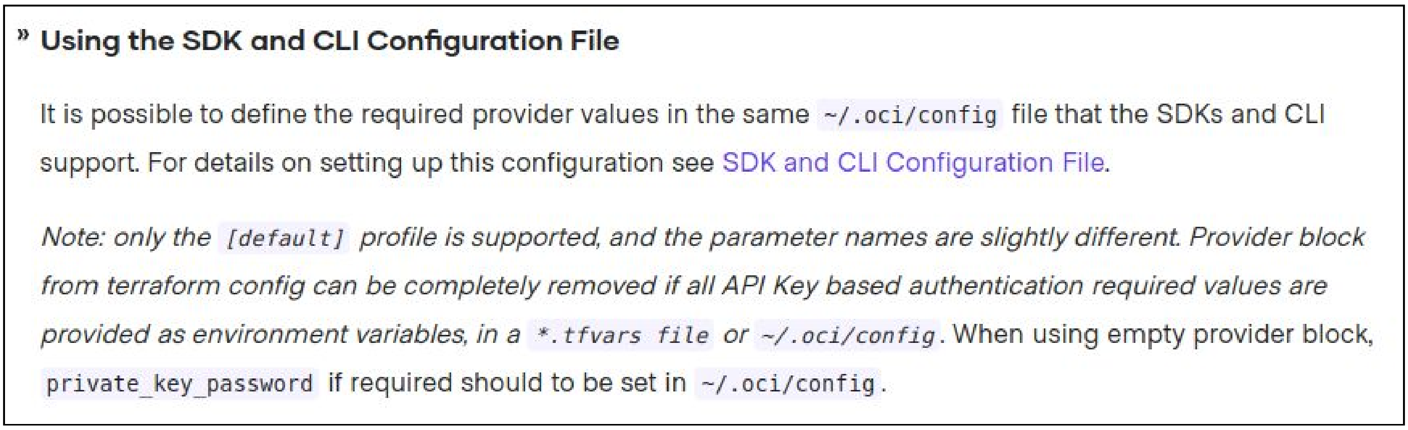
$ terraform apply



junicode@junicode-XPS-13-9370: ~/Documents/oracle/tech/Promart/terraform
File Edit View Search Terminal Tabs Help
junicode@junicode-XPS-13-9370: ~/Documents/oracle/tech/Promart/terraform
junicode@junicode-XPS-13-9370: ~/.oci

```
------------------------------------------------------------------------

Note: You didn't specify an "-out" parameter to save this plan, so Terraform
can't guarantee that exactly these actions will be performed if
"terraform apply" is subsequently run.

junicode@junicode-XPS-13-9370:~/Documents/oracle/tech/Promart/terraform$ terraform apply

An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbols:
  + create

Terraform will perform the following actions:

  # oci_core_vcn.vcn_osce will be created
  + resource "oci_core_vcn" "vcn_osce" {
      + cidr_block               = "10.0.0.0/16"
      + compartment_id           = "ocid1.compartment.oc1..aaaaaaaalxo7zindcffskunoclqhfxnvmblgpjs4r7s7li7cvx2l3p2mfniq"
      + default_dhcp_options_id  = (known after apply)
      + default_route_table_id   = (known after apply)
      + default_security_list_id = (known after apply)
      + defined_tags             = (known after apply)
      + display_name             = "vcn_osce"
      + dns_label                = "vcn_osce"
      + freeform_tags            = (known after apply)
      + id                       = (known after apply)
      + ipv6cidr_block           = (known after apply)
      + ipv6public_cidr_block    = (known after apply)
      + is_ipv6enabled           = (known after apply)
      + state                    = (known after apply)
      + time_created             = (known after apply)
      + vcn_domain_name          = (known after apply)
    }

Plan: 1 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

oci_core_vcn.vcn_osce: Creating...

Error: Service error:NotAuthenticated. The required information to complete authentication was not provided or was incorrect.. http status
 code: 401. Opc request id: c90715311d4767e91c2f3955fe0ee4b9/82B89887743AACC3A51A6E65198B61A9/FC1566877C06DB51E3BA8B83532A8D4D

  on vcn.tf line 18, in resource "oci_core_vcn" "vcn_osce":
  18: resource "oci_core_vcn" "vcn_osce" {


junicode@junicode-XPS-13-9370:~/Documents/oracle/tech/Promart/terraform$
```

El error se debe al archivo de configuración del OCI CLI (~/.oci/config).

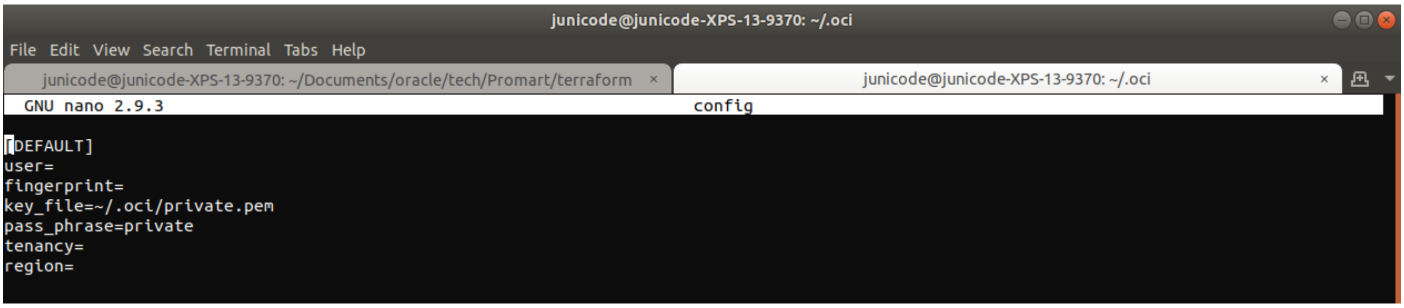


» Using the SDK and CLI Configuration File

It is possible to define the required provider values in the same `~/.oci/config` file that the SDKs and CLI support. For details on setting up this configuration see SDK and CLI Configuration File.

Note: only the `[default]` profile is supported, and the parameter names are slightly different. Provider block from terraform config can be completely removed if all API Key based authentication required values are provided as environment variables, in a `*.tfvars file` or `~/.oci/config`. When using empty provider block, `private_key_password` if required should to be set in `~/.oci/config`.

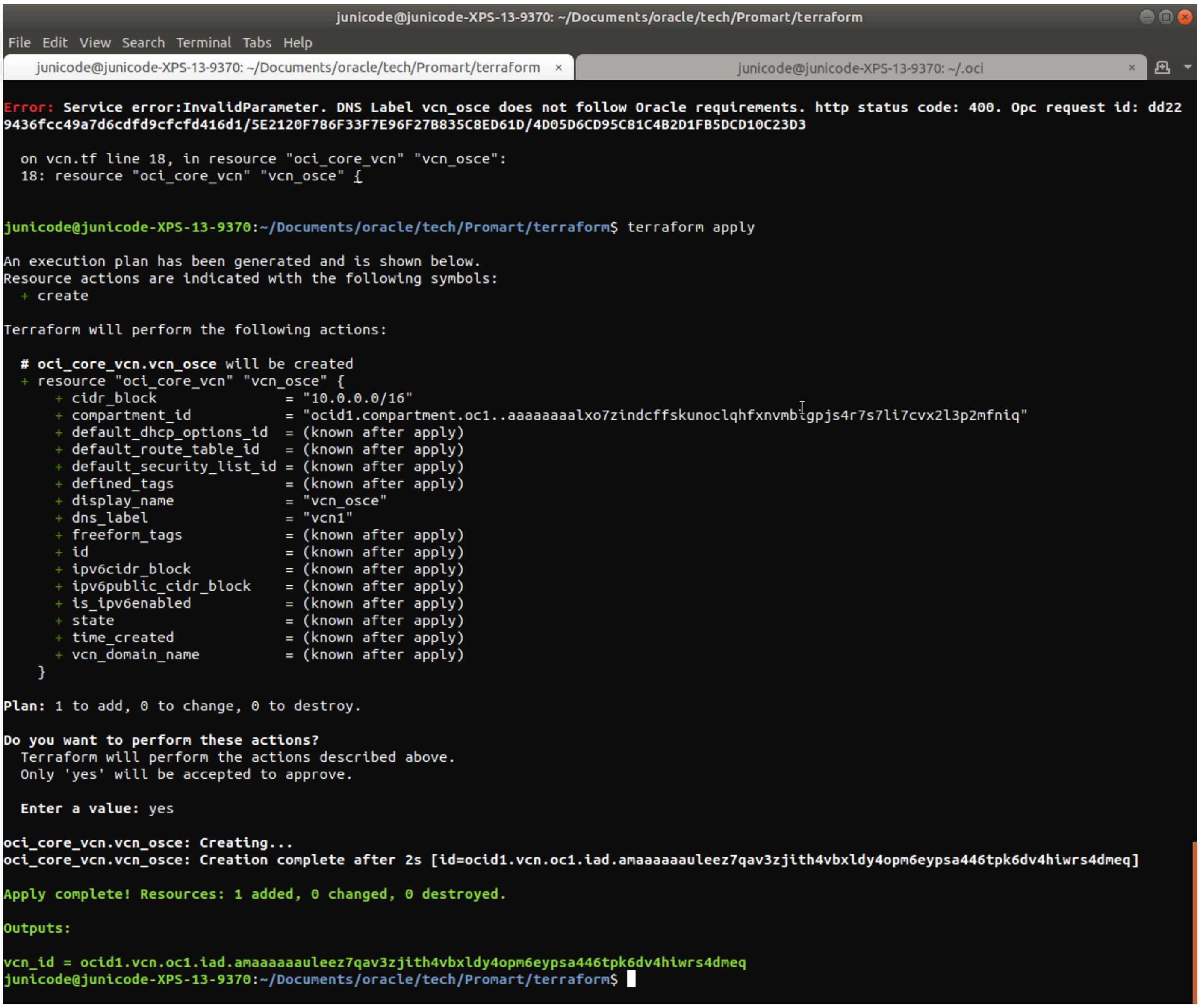
Con el objetivo de resolver el error, se debe modificar el archivo ~/oci/config, teniendo en cuenta la recomendación mencionada en la imagen de arriba.



junicode@junicode-XPS-13-9370: ~/.oci
File Edit View Search Terminal Tabs Help
junicode@junicode-XPS-13-9370: ~/Documents/oracle/tech/Promart/terraform
junicode@junicode-XPS-13-9370: ~/.oci

```
  GNU nano 2.9.3                                                  config

[DEFAULT]
user=
fingerprint=
key_file=~/.oci/private.pem
pass_phrase=private
tenancy=
region=
```

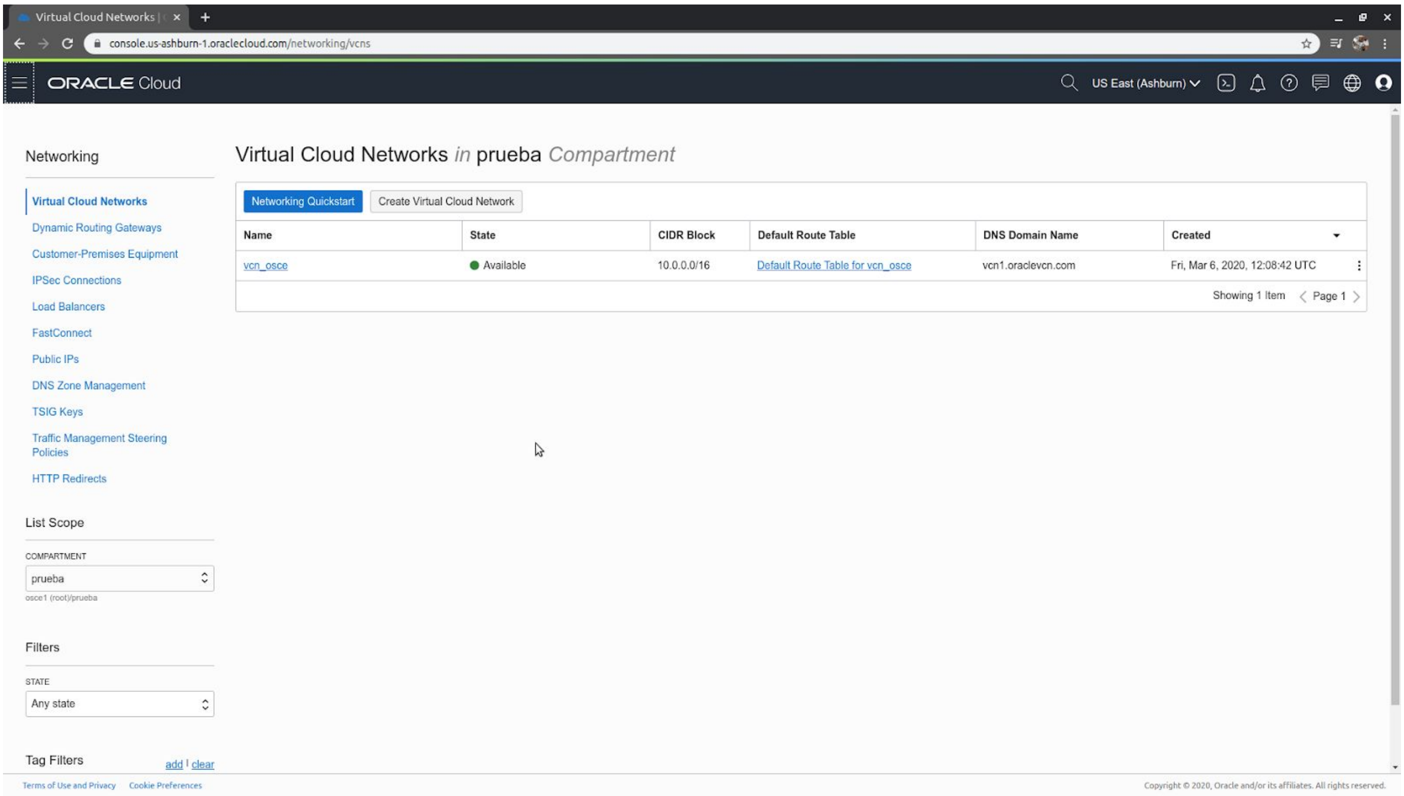
$ terraform apply



junicode@junicode-XPS-13-9370: ~/Documents/oracle/tech/Promart/terraform
File Edit View Search Terminal Tabs Help
junicode@junicode-XPS-13-9370: ~/Documents/oracle/tech/Promart/terraform
junicode@junicode-XPS-13-9370: ~/.oci

```
Error: Service error:InvalidParameter. DNS Label vcn_osce does not follow Oracle requirements. http status code: 400. Opc request id: dd22
9436fcc49a7d6cdfd9cfcfd416d1/5E2120F786F33F7E96F27B835C8ED61D/4D05D6CD95C81C4B2D1FB5DCD10C23D3

  on vcn.tf line 18, in resource "oci_core_vcn" "vcn_osce":
  18: resource "oci_core_vcn" "vcn_osce" {


junicode@junicode-XPS-13-9370:~/Documents/oracle/tech/Promart/terraform$ terraform apply

An execution plan has been generated and is shown below.
Resource actions are indicated with the following symbols:
  + create

Terraform will perform the following actions:

  # oci_core_vcn.vcn_osce will be created
  + resource "oci_core_vcn" "vcn_osce" {
      + cidr_block               = "10.0.0.0/16"
      + compartment_id           = "ocid1.compartment.oc1..aaaaaaaalxo7zindcffskunoclqhfxnvmbigpjs4r7s7li7cvx2l3p2mfniq"
      + default_dhcp_options_id  = (known after apply)
      + default_route_table_id   = (known after apply)
      + default_security_list_id = (known after apply)
      + defined_tags             = (known after apply)
      + display_name             = "vcn_osce"
      + dns_label                = "vcn1"
      + freeform_tags            = (known after apply)
      + id                       = (known after apply)
      + ipv6cidr_block           = (known after apply)
      + ipv6public_cidr_block    = (known after apply)
      + is_ipv6enabled           = (known after apply)
      + state                    = (known after apply)
      + time_created             = (known after apply)
      + vcn_domain_name          = (known after apply)
    }

Plan: 1 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

oci_core_vcn.vcn_osce: Creating...
oci_core_vcn.vcn_osce: Creation complete after 2s [id=ocid1.vcn.oc1.iad.amaaaaaauleez7qav3zjith4vbxldy4opm6eypsa446tpk6dv4hiwrs4dmeq]

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

Outputs:

vcn_id = ocid1.vcn.oc1.iad.amaaaaaauleez7qav3zjith4vbxldy4opm6eypsa446tpk6dv4hiwrs4dmeq
junicode@junicode-XPS-13-9370:~/Documents/oracle/tech/Promart/terraform$
```

Se verifica en la consola que se creó satisfactoriamente la VCN.



Virtual Cloud Networks *in* prueba *Compartment*

Name	State	CIDR Block	Default Route Table	DNS Domain Name	Created
vcn_osce	● Available	10.0.0.0/16	Default Route Table for vcn_osce	vcn1.oraclevcn.com	Fri, Mar 6, 2020, 12:08:42 UTC

COMPARTMENT: prueba

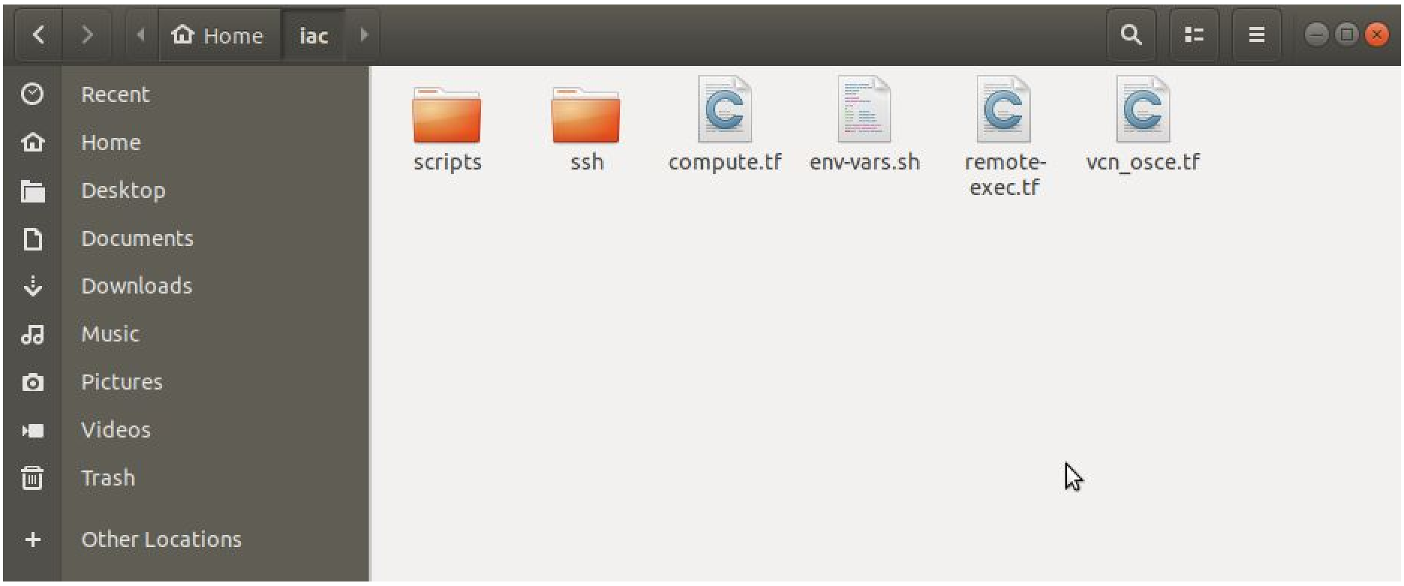
osce1 (root)/prueba

STATE: Any state

2. Implementación de la Arquitectura

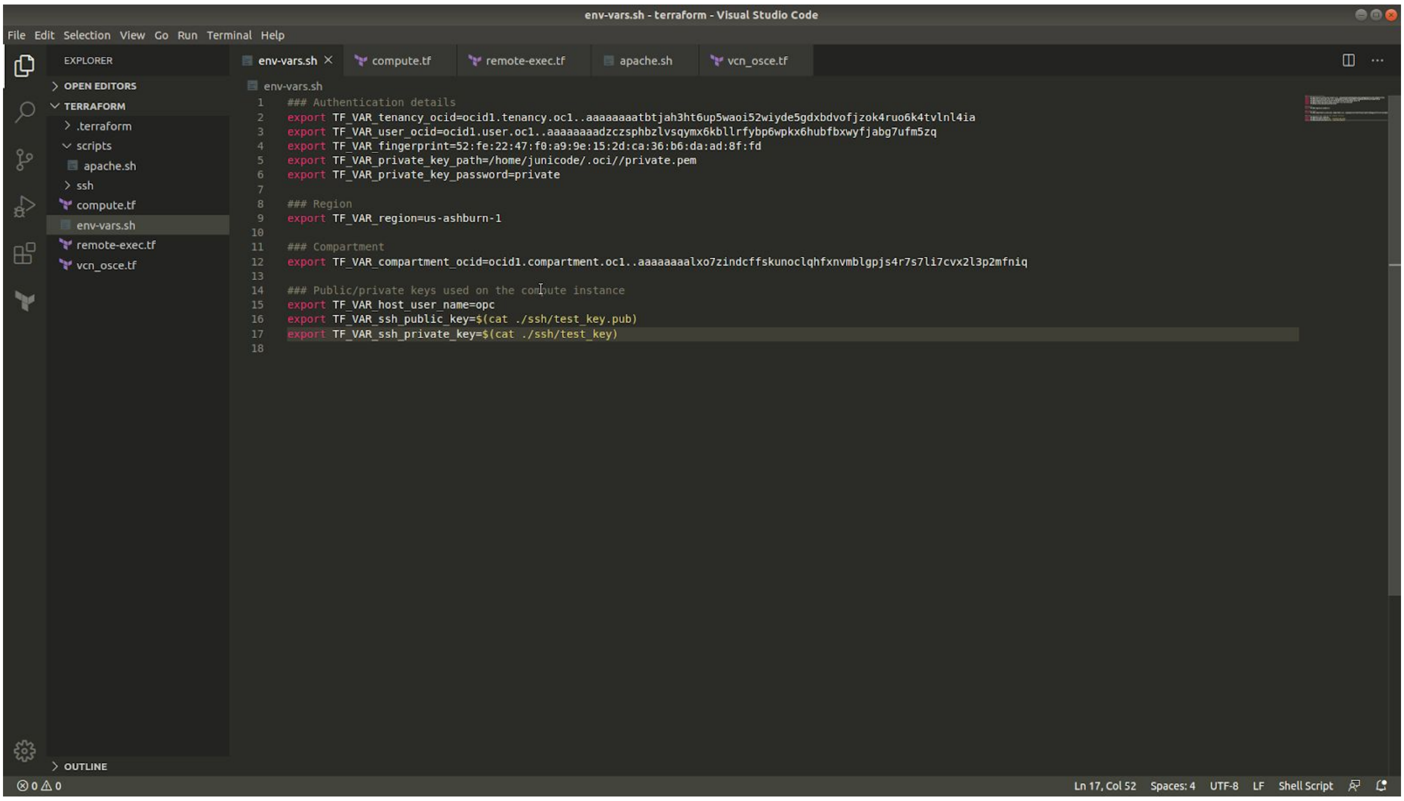
Ahora, se procede a crear la arquitectura presentada al inicio.

$ git clone https://github.com/obi10/iac.git



env-var.sh

Aquí se declaran las variables globales que serán usadas por los demás archivos.



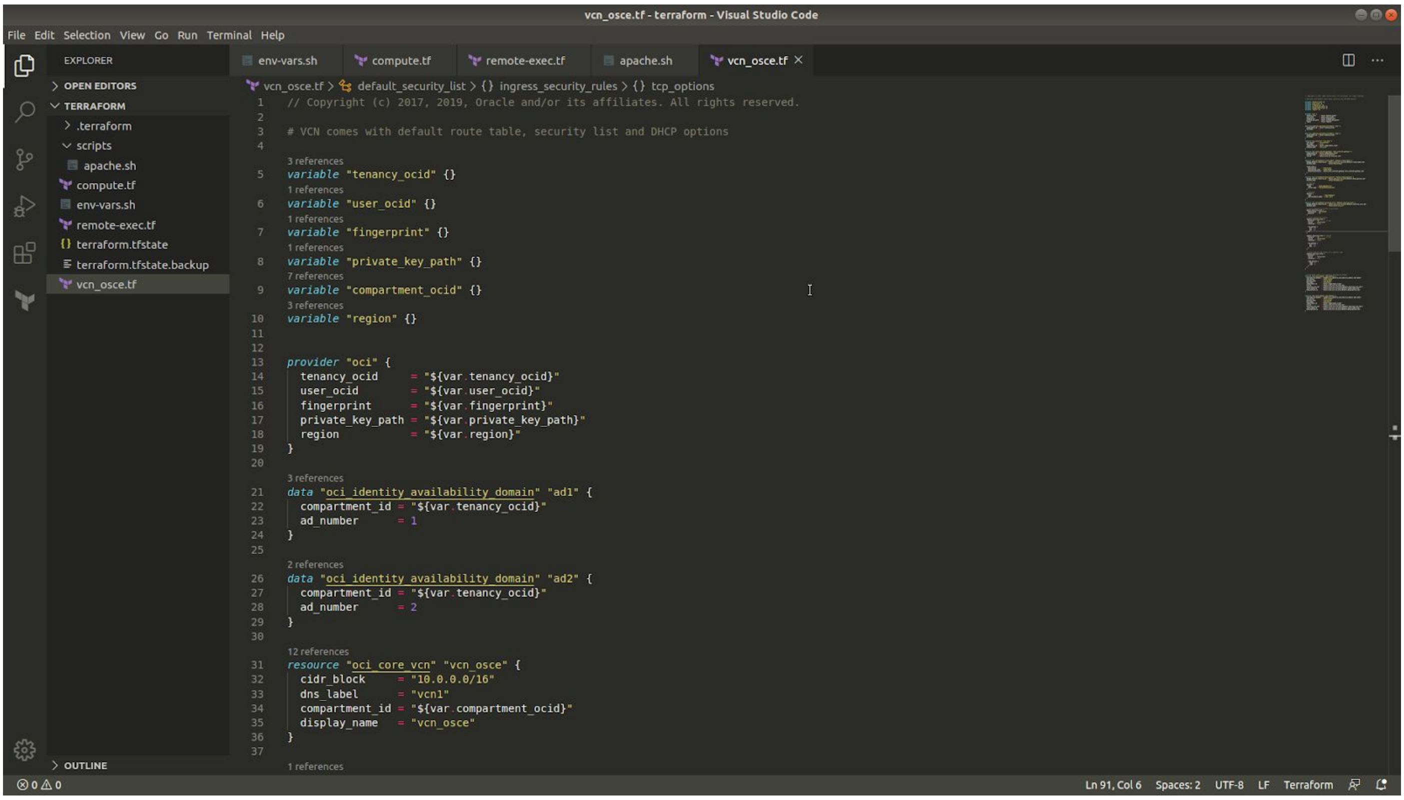
```
### Authentication details
export TF_VAR_tenancy_ocid=ocid1.tenancy.oc1..aaaaaaaatbtjah3ht6up5waoi52wiyde5gdxbdvofjzok4ruo6k4tvlnl4ia
export TF_VAR_user_ocid=ocid1.user.oc1..aaaaaaaadzczsphbzlvsqymx6kbllrfybp6wpkx6hubfbxwyfjabg7ufm5zq
export TF_VAR_fingerprint=52:fe:22:47:f0:a9:9e:15:2d:ca:36:b6:da:ad:8f:fd
export TF_VAR_private_key_path=/home/junicode/.oci//private.pem
export TF_VAR_private_key_password=private

### Region
export TF_VAR_region=us-ashburn-1

### Compartment
export TF_VAR_compartment_ocid=ocid1.compartment.oc1..aaaaaaaalxo7zindcffskunoclqhfxnvmblgpjs4r7s7li7cvx2l3p2mfniq

### Public/private keys used on the compute instance
export TF_VAR_host_user_name=opc
export TF_VAR_ssh_public_key=$(cat ./ssh/test_key.pub)
export TF_VAR_ssh_private_key=$(cat ./ssh/test_key)

```

```
### Authentication details

export TF_VAR_tenancy_ocid=ocid1.tenancy.oc1..aaaaaaaatbtjah3ht6up5waoi52wiyde5gdxbdvofjzok4ruo6k4tvlnl4ia
export TF_VAR_user_ocid=ocid1.user.oc1..aaaaaaaadzczsphbzlvsqymx6kbllrfybp6wpkx6hubfbxwyfjabg7ufm5zq
export TF_VAR_fingerprint=52:fe:22:47:f0:a9:9e:15:2d:ca:36:b6:da:ad:8f:fd
export TF_VAR_private_key_path=/home/junicode/.oci//private.pem
export TF_VAR_private_key_password=private

### Region
```

```
export TF_VAR_region=us-ashburn-1

### Compartment

export TF_VAR_compartment_ocid=ocid1.compartment.oc1..aaaaaaaalxo7zindcffskunoclqhfxnvmblgpjs4r7s7li7cvx2l3p2mfniq

### Public/private keys used on the compute instance

export TF_VAR_host_user_name=opc
export TF_VAR_ssh_public_key=$(cat ./ssh/test_key.pub)
export TF_VAR_ssh_private_key=$(cat ./ssh/test_key)
```

vcn_osce.tf

En este archivo se definen los dos dominios de disponibilidad a usar: AD1 y AD2. Asimismo, hace posible la creación de la vcn y sus componentes: internet gateway, route table, dhcp options, security list y subnets.

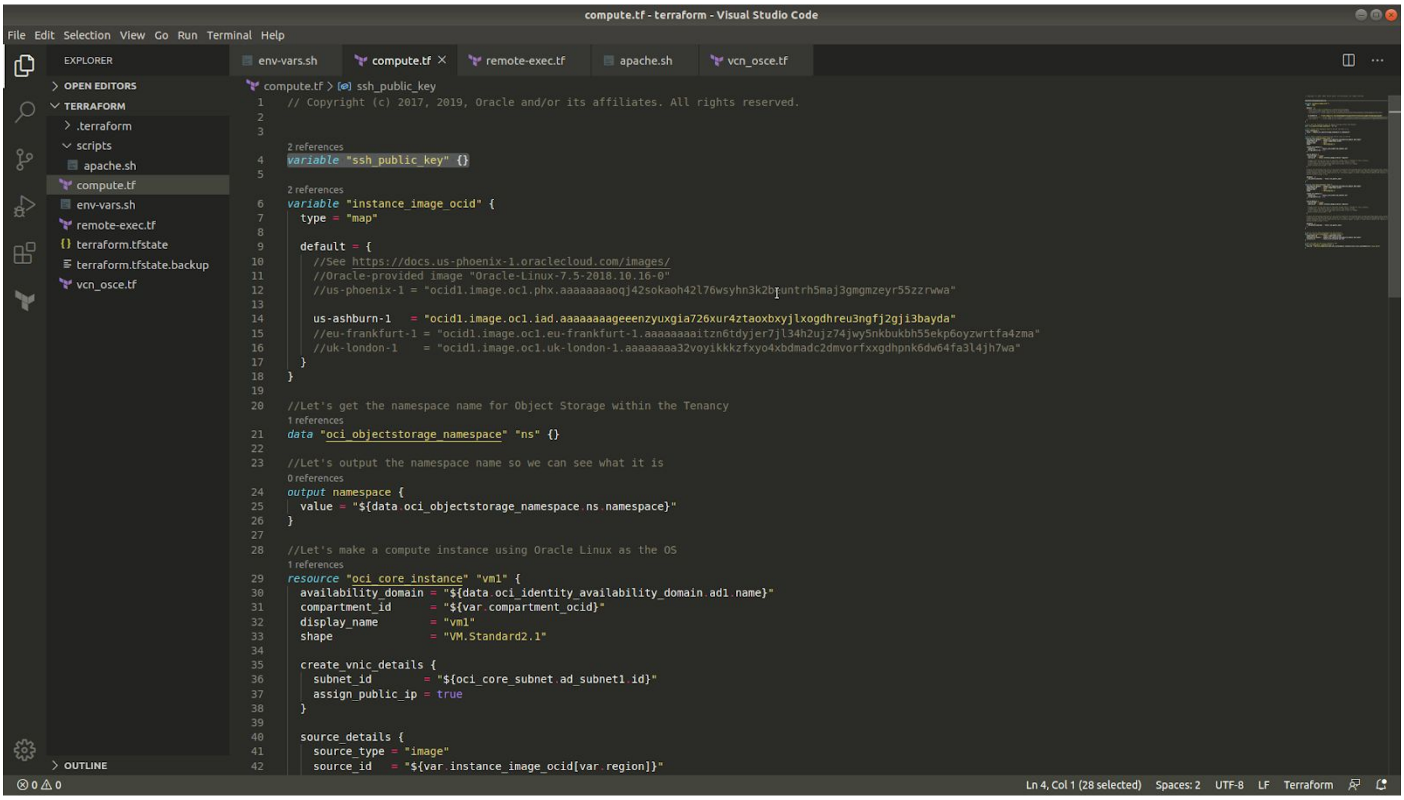


```
// Copyright (c) 2017, 2019, Oracle and/or its affiliates. All rights reserved.

# VCN comes with default route table, security list and DHCP options

3 references
variable "tenancy_ocid" {}
1 references
variable "user_ocid" {}
1 references
variable "fingerprint" {}
1 references
variable "private_key_path" {}
7 references
variable "compartment_ocid" {}
3 references
variable "region" {}


provider "oci" {
  tenancy_ocid     = "${var.tenancy_ocid}"
  user_ocid        = "${var.user_ocid}"
  fingerprint      = "${var.fingerprint}"
  private_key_path = "${var.private_key_path}"
  region           = "${var.region}"
}

3 references
data "oci_identity_availability_domain" "ad1" {
  compartment_id = "${var.tenancy_ocid}"
  ad_number      = 1
}

2 references
data "oci_identity_availability_domain" "ad2" {
  compartment_id = "${var.tenancy_ocid}"
  ad_number      = 2
}

12 references
resource "oci_core_vcn" "vcn_osce" {
  cidr_block     = "10.0.0.0/16"
  dns_label      = "vcn1"
  compartment_id = "${var.compartment_ocid}"
  display_name   = "vcn_osce"
}

1 references
```

```
// Copyright (c) 2017, 2019, Oracle and/or its affiliates. All rights reserved.

# VCN comes with default route table, security list and DHCP options

variable "tenancy_ocid" {}
variable "user_ocid" {}
variable "fingerprint" {}
variable "private_key_path" {}
variable "compartment_ocid" {}
variable "region" {}


provider "oci" {
  tenancy_ocid     = "${var.tenancy_ocid}"
  user_ocid        = "${var.user_ocid}"
  fingerprint      = "${var.fingerprint}"
  private_key_path = "${var.private_key_path}"
  region           = "${var.region}"
}

data "oci_identity_availability_domain" "ad1" {
  compartment_id = "${var.tenancy_ocid}"
  ad_number      = 1
}

data "oci_identity_availability_domain" "ad2" {
  compartment_id = "${var.tenancy_ocid}"
  ad_number      = 2
}

resource "oci_core_vcn" "vcn_osce" {
  cidr_block     = "10.0.0.0/16"
  dns_label      = "vcn1"
  compartment_id = "${var.compartment_ocid}"
  display_name   = "vcn_osce"
}

resource "oci_core_internet_gateway" "test_internet_gateway" {
  compartment_id = "${var.compartment_ocid}"
  display_name   = "testInternetGateway"
  vcn_id         = "${oci_core_vcn.vcn_osce.id}"
}

resource "oci_core_default_route_table" "default_route_table" {
  manage_default_resource_id = "${oci_core_vcn.vcn_osce.default_route_table_id}"
  display_name               = "defaultRouteTable"

  route_rules {
    destination       = "0.0.0.0/0"
    destination_type  = "CIDR_BLOCK"
    network_entity_id = "${oci_core_internet_gateway.test_internet_gateway.id}"
  }
}

resource "oci_core_default_dhcp_options" "default_dhcp_options" {
  manage_default_resource_id = "${oci_core_vcn.vcn_osce.default_dhcp_options_id}"
  display_name               = "defaultDhcpOptions"

  // required
  options {
    type        = "DomainNameServer"
    server_type = "VcnLocalPlusInternet"
  }

  // optional
  options {
    type                = "SearchDomain"
    search_domain_names = ["abc.com"]
  }
}

resource "oci_core_default_security_list" "default_security_list" {
  manage_default_resource_id = "${oci_core_vcn.vcn_osce.default_security_list_id}"
  display_name               = "defaultSecurityList"

  // allow outbound tcp traffic on all ports
  egress_security_rules {
    destination = "0.0.0.0/0"
    protocol    = "6"
  }

  // allow inbound ssh traffic
  ingress_security_rules {
    protocol  = "6"         // tcp
    source    = "0.0.0.0/0"
    stateless = false
    tcp_options {
      min = 22
      max = 22
    }
  }

  ingress_security_rules { //apache
    protocol  = "6"         // tcp
    source    = "0.0.0.0/0"
    stateless = false

    tcp_options {
      min = 80
      max = 80
    }
  }

  // allow inbound icmp traffic of a specific type
  ingress_security_rules {
    protocol  = 1
    source    = "0.0.0.0/0"
    stateless = true

    icmp_options {
      type = 3
      code = 4
    }
  }
}



// An AD based subnet will supply an Availability Domain
resource "oci_core_subnet" "ad_subnet1" {
  availability_domain = "${data.oci_identity_availability_domain.ad1.name}"
  cidr_block          = "10.0.1.0/24"
  display_name        = "subred-AD1"
  dns_label           = "ad1subnet"
  compartment_id      = "${var.compartment_ocid}"
  vcn_id              = "${oci_core_vcn.vcn_osce.id}"
  security_list_ids   = ["${oci_core_vcn.vcn_osce.default_security_list_id}"]
  route_table_id      = "${oci_core_vcn.vcn_osce.default_route_table_id}"
  dhcp_options_id     = "${oci_core_vcn.vcn_osce.default_dhcp_options_id}"
}


resource "oci_core_subnet" "ad_subnet2" {
  availability_domain = "${data.oci_identity_availability_domain.ad2.name}"
  cidr_block          = "10.0.2.0/24"
  display_name        = "subred-AD2"
  dns_label           = "ad2subnet"
  compartment_id      = "${var.compartment_ocid}"
  vcn_id              = "${oci_core_vcn.vcn_osce.id}"
  security_list_ids   = ["${oci_core_vcn.vcn_osce.default_security_list_id}"]
  route_table_id      = "${oci_core_vcn.vcn_osce.default_route_table_id}"
  dhcp_options_id     = "${oci_core_vcn.vcn_osce.default_dhcp_options_id}"
}
```

compute.tf

Este archivo permite crear las instancias de cómputo vm1 y vm2 en los dominios de disponibilidad definidos en *vcn_osce.tf*.



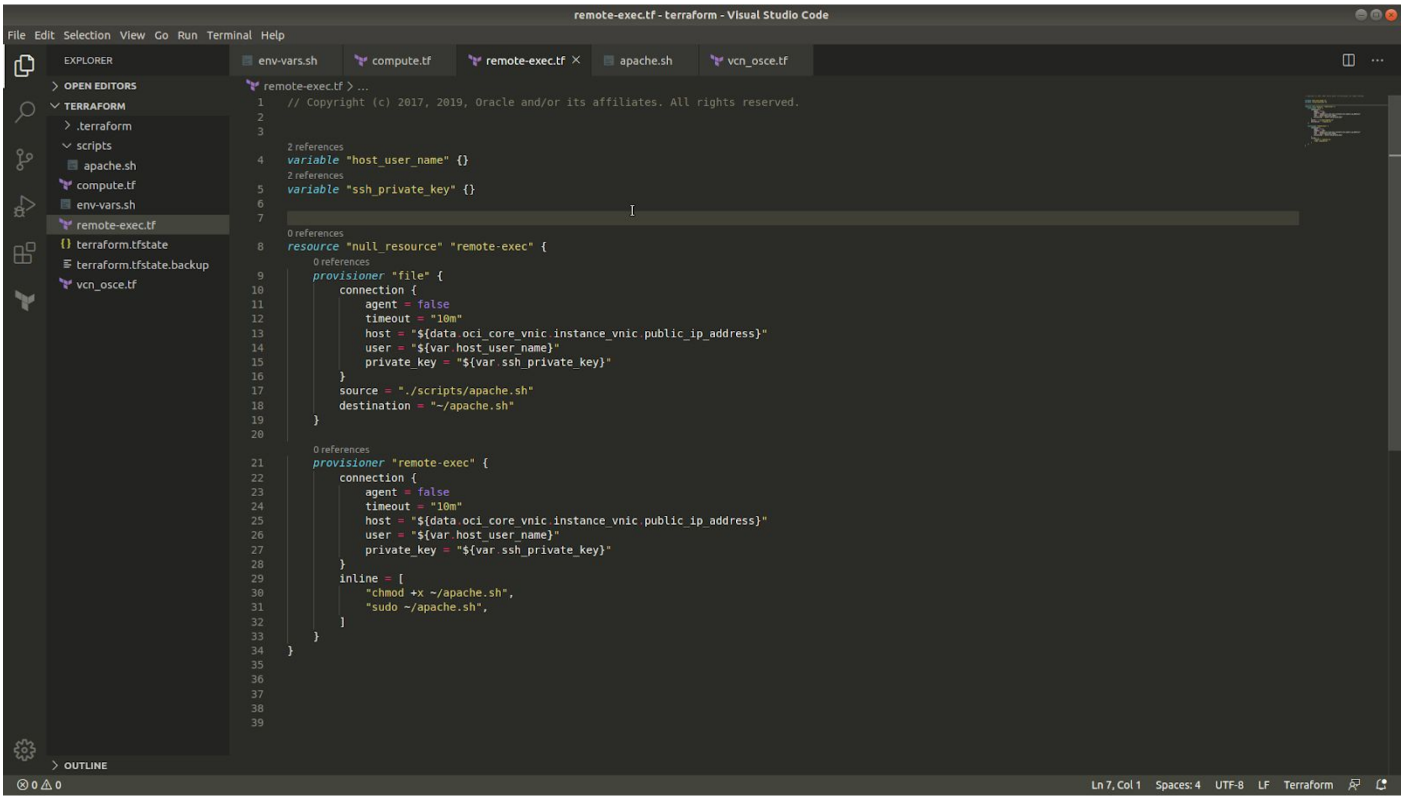
```
// Copyright (c) 2017, 2019, Oracle and/or its affiliates. All rights reserved.


variable "ssh_public_key" {}

variable "instance_image_ocid" {
  type = "map"

  default = {
    //See https://docs.us-phoenix-1.oraclecloud.com/images/
    //Oracle-provided image "Oracle-Linux-7.5-2018.10.16-0"
    //us-phoenix-1 = "ocid1.image.oc1.phx.aaaaaaaaoqj42sokaoh42l76wsyhn3k2beuntrh5maj3gmgmzeyr55zzrwwa"

    us-ashburn-1   = "ocid1.image.oc1.iad.aaaaaaaageeenzyuxgia726xur4ztaoxbxyjlxogdhreu3ngfj2gji3bayda"
    //eu-frankfurt-1 = "ocid1.image.oc1.eu-frankfurt-1.aaaaaaaaitzn6tdyjer7jl34h2ujz74jwy5nkbukbh55ekp6oyzwrtfa4zma"
    //uk-london-1    = "ocid1.image.oc1.uk-london-1.aaaaaaaa32voyikkkzfxyo4xbdmadc2dmvorfxxgdhpnk6dw64fa3l4jh7wa"
  }
}

//Let's get the namespace name for Object Storage within the Tenancy
data "oci_objectstorage_namespace" "ns" {}

//Let's output the namespace name so we can see what it is
output namespace {
  value = "${data.oci_objectstorage_namespace.ns.namespace}"
}

//Let's make a compute instance using Oracle Linux as the OS
resource "oci_core_instance" "vm1" {
  availability_domain = "${data.oci_identity_availability_domain.ad1.name}"
  compartment_id      = "${var.compartment_ocid}"
  display_name        = "vm1"
  shape               = "VM.Standard2.1"

  create_vnic_details {
    subnet_id        = "${oci_core_subnet.ad_subnet1.id}"
    assign_public_ip = true
  }

  source_details {
    source_type = "image"
    source_id   = "${var.instance_image_ocid[var.region]}"
```

```
// Copyright (c) 2017, 2019, Oracle and/or its affiliates. All rights reserved.


variable "ssh_public_key" {}

variable "instance_image_ocid" {
  type = "map"

  default = {
    //See https://docs.us-phoenix-1.oraclecloud.com/images/
    //Oracle-provided image "Oracle-Linux-7.5-2018.10.16-0"
    //us-phoenix-1 = "ocid1.image.oc1.phx.aaaaaaaaoqj42sokaoh42l76wsyhn3k2beuntrh5maj3gmgmzeyr55zzrwwa"

    us-ashburn-1   = "ocid1.image.oc1.iad.aaaaaaaageeenzyuxgia726xur4ztaoxbxyjlxogdhreu3ngfj2gji3bayda"
    //eu-frankfurt-1 = "ocid1.image.oc1.eu-frankfurt-1.aaaaaaaaitzn6tdyjer7jl34h2ujz74jwy5nkbukbh55ekp6oyzwrtfa4zma"
    //uk-london-1    = "ocid1.image.oc1.uk-london-1.aaaaaaaa32voyikkkzfxyo4xbdmadc2dmvorfxxgdhpnk6dw64fa3l4jh7wa"
  }
}

//Let's get the namespace name for Object Storage within the Tenancy
data "oci_objectstorage_namespace" "ns" {}

//Let's output the namespace name so we can see what it is
output namespace {
  value = "${data.oci_objectstorage_namespace.ns.namespace}"
}

//Let's make a compute instance using Oracle Linux as the OS
resource "oci_core_instance" "vm1" {
  availability_domain = "${data.oci_identity_availability_domain.ad1.name}"
  compartment_id      = "${var.compartment_ocid}"
  display_name        = "vm1"
  shape               = "VM.Standard2.1"

  create_vnic_details {
    subnet_id        = "${oci_core_subnet.ad_subnet1.id}"
    assign_public_ip = true
  }

  source_details {
    source_type = "image"
    source_id   = "${var.instance_image_ocid[var.region]}"

    # Apply this to set the size of the boot volume that's created for this instance.
    # Otherwise, the default boot volume size of the image is used.
    # This should only be specified when source_type is set to "image".
    #boot_volume_size_in_gbs = "60"
  }

  # Apply the following flag only if you wish to preserve the attached boot volume upon destroying this instance
  # Setting this and destroying the instance will result in a boot volume that should be managed outside of this config.
  # When changing this value, make sure to run 'terraform apply' so that it takes effect before the resource is destroyed.
  #preserve_boot_volume = true

  metadata = {
    ssh_authorized_keys = "${var.ssh_public_key}"
  }
}

resource "oci_core_instance" "vm2" {
  availability_domain = "${data.oci_identity_availability_domain.ad2.name}"
  compartment_id      = "${var.compartment_ocid}"
  display_name        = "vm2"
  shape               = "VM.Standard2.1"

  create_vnic_details {
    subnet_id        = "${oci_core_subnet.ad_subnet2.id}"
    assign_public_ip = true
  }

  source_details {
    source_type = "image"
    source_id   = "${var.instance_image_ocid[var.region]}"

    # Apply this to set the size of the boot volume that's created for this instance.
    # Otherwise, the default boot volume size of the image is used.
    # This should only be specified when source_type is set to "image".
    #boot_volume_size_in_gbs = "60"
  }

  # Apply the following flag only if you wish to preserve the attached boot volume upon destroying this instance
  # Setting this and destroying the instance will result in a boot volume that should be managed outside of this config.
  # When changing this value, make sure to run 'terraform apply' so that it takes effect before the resource is destroyed.
  #preserve_boot_volume = true

  metadata = {
    ssh_authorized_keys = "${var.ssh_public_key}"
  }
}


# Gets a list of vNIC attachments on the instance
data "oci_core_vnic_attachments" "instance_vnics" {
  compartment_id      = "${var.compartment_ocid}"
  availability_domain = "${data.oci_identity_availability_domain.ad1.name}"
  instance_id         = "${oci_core_instance.vm1.id}"
}

# Gets the OCID of the first (default) vNIC
data "oci_core_vnic" "instance_vnic" {
  vnic_id = "${lookup(data.oci_core_vnic_attachments.instance_vnics.vnic_attachments[0],"vnic_id")}"
```

```
}
```

remote-exec.tf

Este archivo permite la conexión a la instancia vm1 para ejecutar el script *apache.sh*.

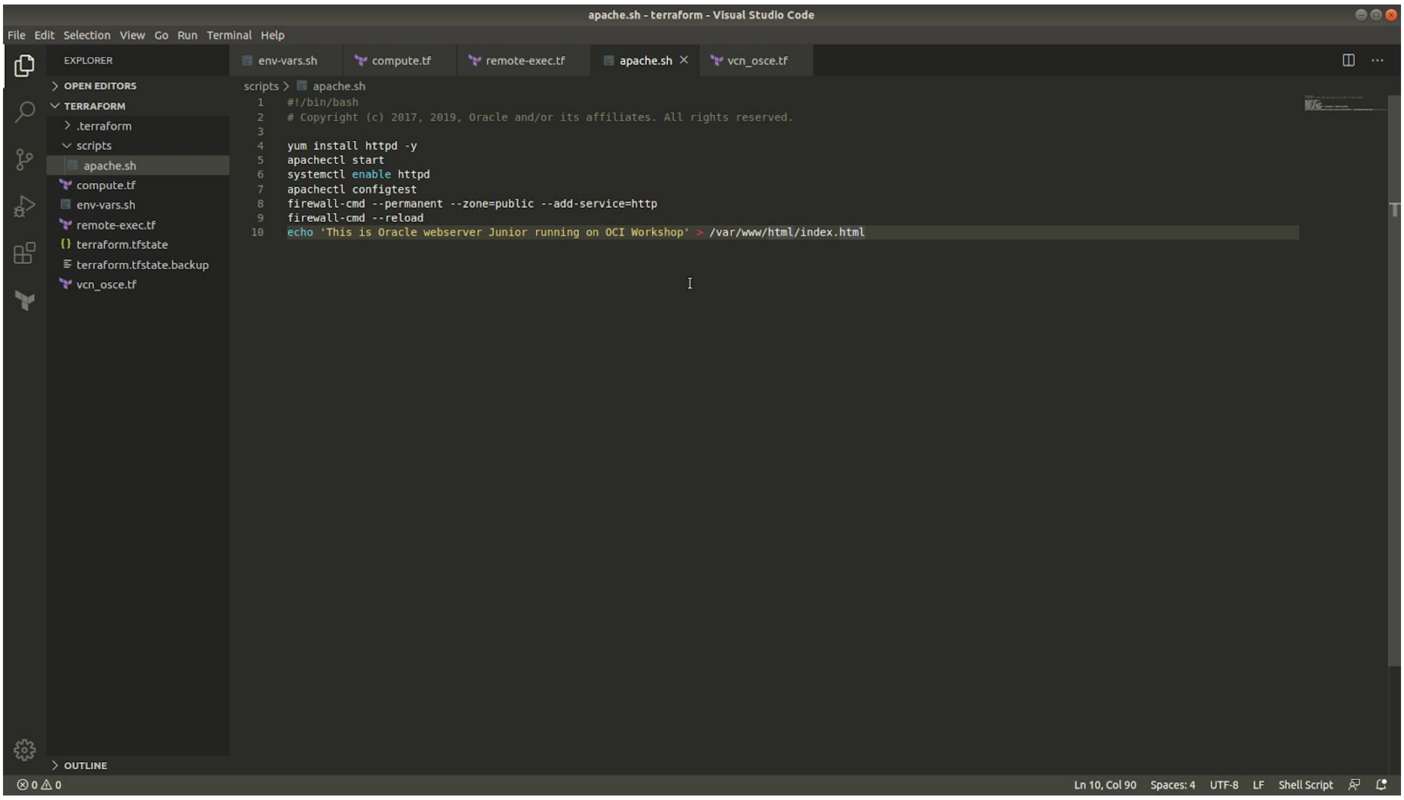


```
// Copyright (c) 2017, 2019, Oracle and/or its affiliates. All rights reserved.


variable "host_user_name" {}
variable "ssh_private_key" {}


resource "null_resource" "remote-exec" {
    provisioner "file" {
        connection {
            agent = false
            timeout = "10m"
            host = "${data.oci_core_vnic.instance_vnic.public_ip_address}"
            user = "${var.host_user_name}"
            private_key = "${var.ssh_private_key}"
        }
        source = "./scripts/apache.sh"
        destination = "~/apache.sh"
    }

    provisioner "remote-exec" {
        connection {
            agent = false
            timeout = "10m"
            host = "${data.oci_core_vnic.instance_vnic.public_ip_address}"
            user = "${var.host_user_name}"
            private_key = "${var.ssh_private_key}"
        }
        inline = [
            "chmod +x ~/apache.sh",
            "sudo ~/apache.sh",
        ]
    }
}
```

```
// Copyright (c) 2017, 2019, Oracle and/or its affiliates. All rights reserved.


variable "host_user_name" {}
variable "ssh_private_key" {}


resource "null_resource" "remote-exec" {
    provisioner "file" {
        connection {
            agent = false
            timeout = "10m"
            host = "${data.oci_core_vnic.instance_vnic.public_ip_address}"
            user = "${var.host_user_name}"
            private_key = "${var.ssh_private_key}"
        }
        source = "./scripts/apache.sh"
        destination = "~/apache.sh"
    }

    provisioner "remote-exec" {
        connection {
            agent = false
            timeout = "10m"
            host = "${data.oci_core_vnic.instance_vnic.public_ip_address}"
            user = "${var.host_user_name}"
            private_key = "${var.ssh_private_key}"
        }
        inline = [
            "chmod +x ~/apache.sh",
            "sudo ~/apache.sh",
        ]
    }
}
```

apache.sh

Script que instala apache.

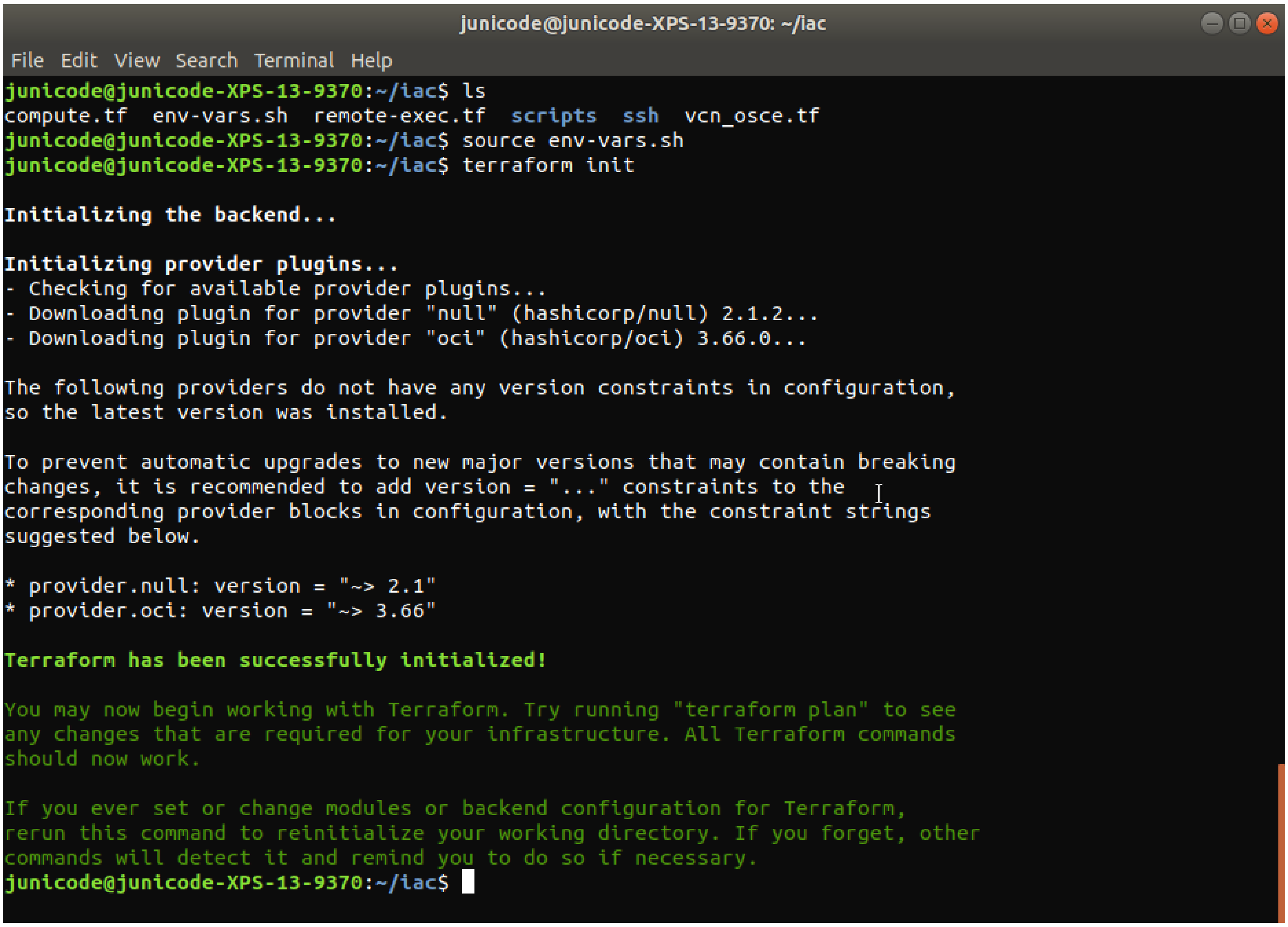


```
#!/bin/bash
# Copyright (c) 2017, 2019, Oracle and/or its affiliates. All rights reserved.

yum install httpd -y
apachectl start
systemctl enable httpd
apachectl configtest
firewall-cmd --permanent --zone=public --add-service=http
firewall-cmd --reload
echo 'This is Oracle webserver Junior running on OCI Workshop' > /var/www/html/index.html
```

```
#!/bin/bash
# Copyright (c) 2017, 2019, Oracle and/or its affiliates. All rights reserved.

yum install httpd -y
apachectl start
systemctl enable httpd
apachectl configtest
firewall-cmd --permanent --zone=public --add-service=http
firewall-cmd --reload
echo 'This is Oracle webserver Junior running on OCI Workshop' > /var/www/html/index.html
```

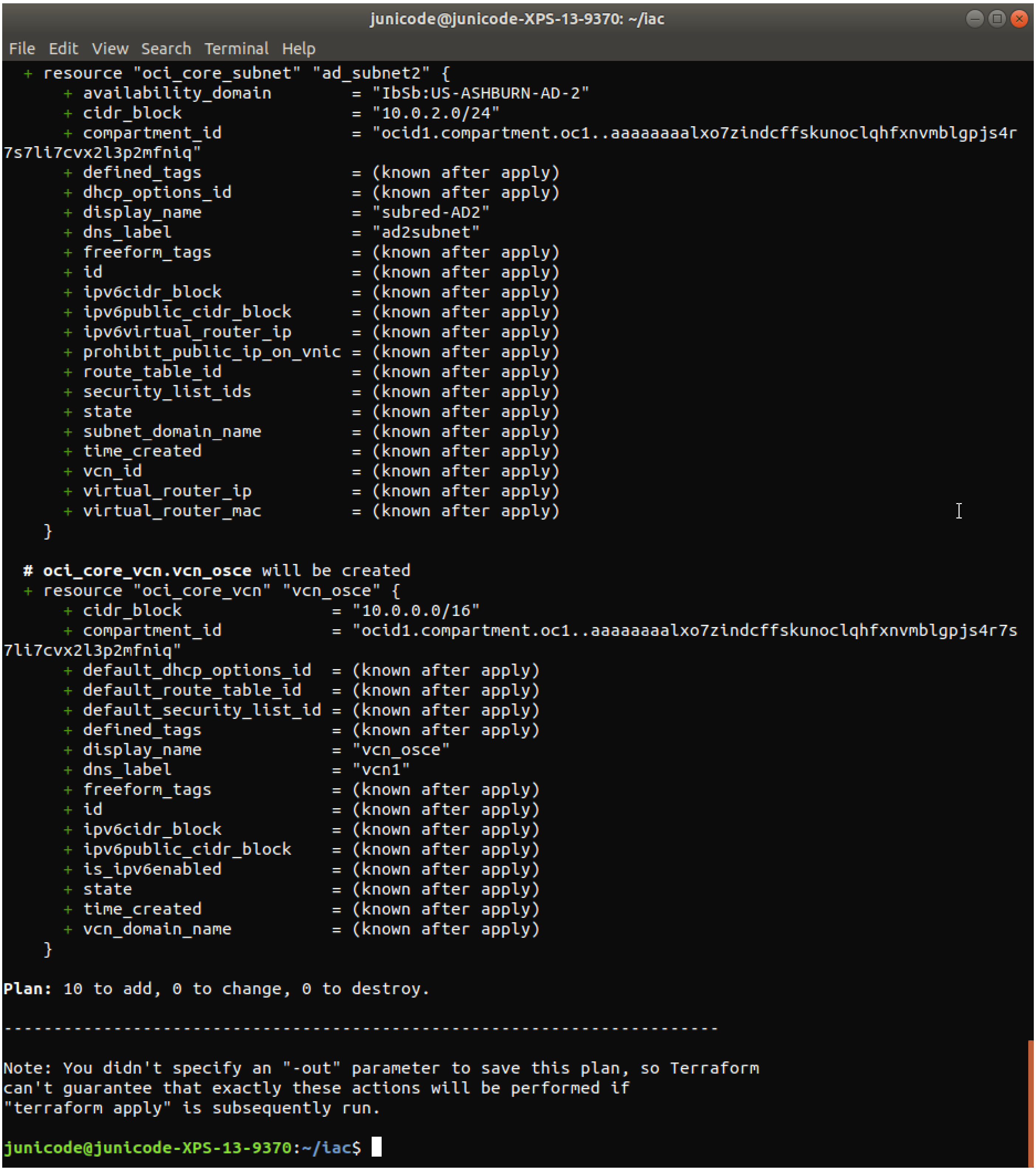
Se deben ejecutar los siguientes comandos:

$ source env-vars.sh
$ terraform init
$ terraform plan
$ terraform apply

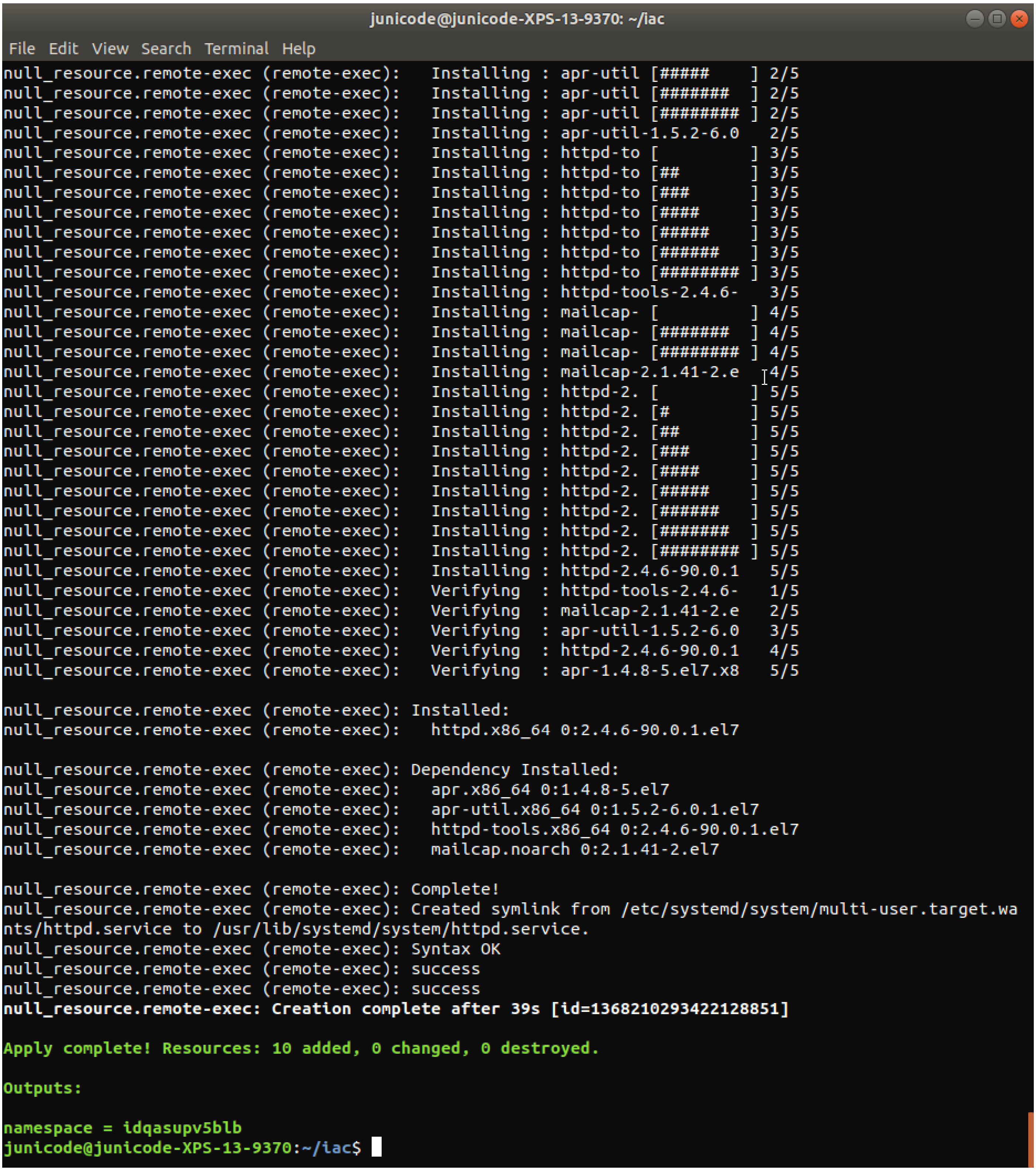


junicode@junicode-XPS-13-9370: ~/iac
File Edit View Search Terminal Help

```
junicode@junicode-XPS-13-9370:~/iac$ ls
compute.tf  env-vars.sh  remote-exec.tf  scripts  ssh  vcn_osce.tf
junicode@junicode-XPS-13-9370:~/iac$ source env-vars.sh
junicode@junicode-XPS-13-9370:~/iac$ terraform init

Initializing the backend...

Initializing provider plugins...
- Checking for available provider plugins...
- Downloading plugin for provider "null" (hashicorp/null) 2.1.2...
- Downloading plugin for provider "oci" (hashicorp/oci) 3.66.0...

The following providers do not have any version constraints in configuration,
so the latest version was installed.

To prevent automatic upgrades to new major versions that may contain breaking
changes, it is recommended to add version = "..." constraints to the
corresponding provider blocks in configuration, with the constraint strings
suggested below.

* provider.null: version = "~> 2.1"
* provider.oci: version = "~> 3.66"

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.
junicode@junicode-XPS-13-9370:~/iac$ 
```

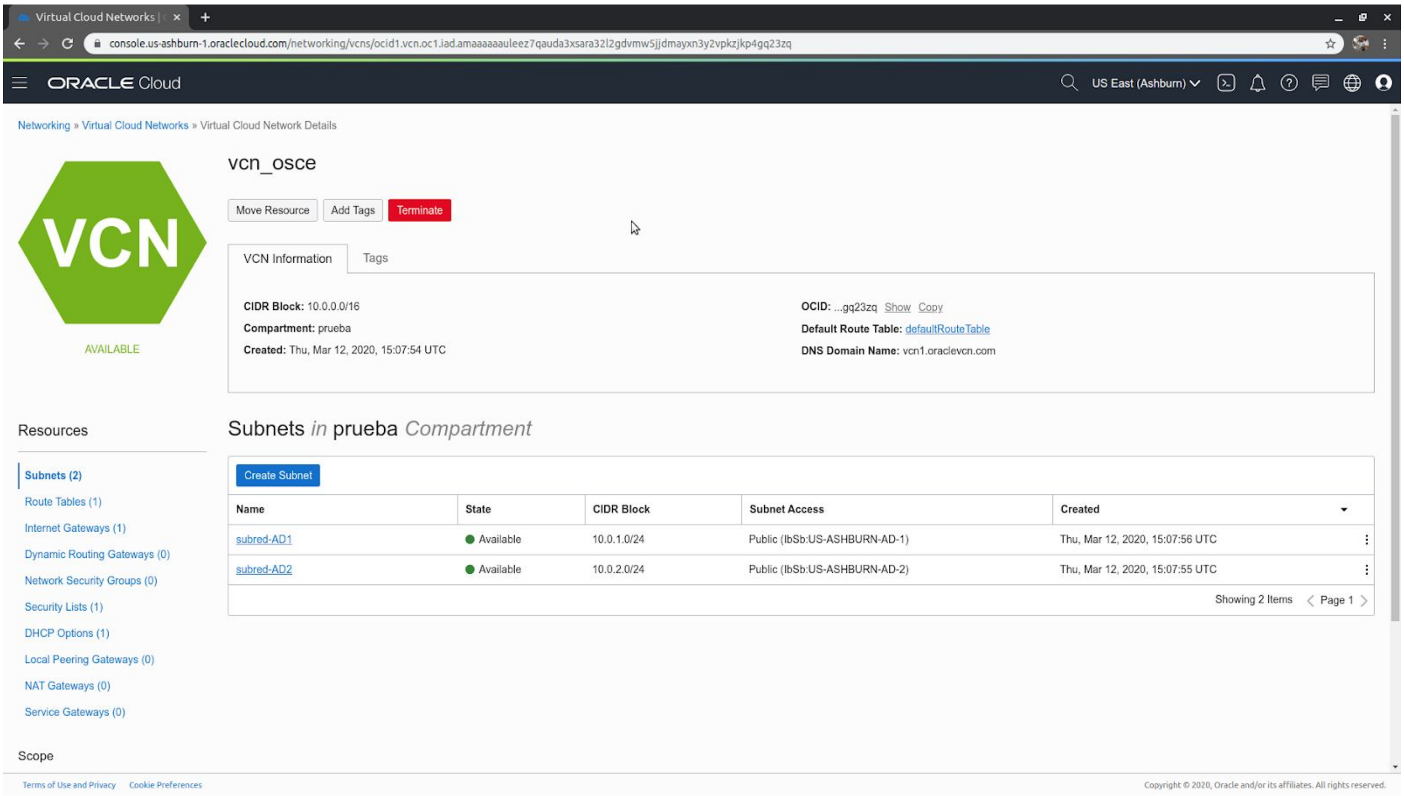


```
  + resource "oci_core_subnet" "ad_subnet2" {
      + availability_domain        = "IbSb:US-ASHBURN-AD-2"
      + cidr_block                 = "10.0.2.0/24"
      + compartment_id             = "ocid1.compartment.oc1..aaaaaaaalxo7zindcffskunoclqhfxnvmblgpjs4r
7s7li7cvx2l3p2mfniq"
      + defined_tags               = (known after apply)
      + dhcp_options_id            = (known after apply)
      + display_name               = "subred-AD2"
      + dns_label                  = "ad2subnet"
      + freeform_tags              = (known after apply)
      + id                         = (known after apply)
      + ipv6cidr_block             = (known after apply)
      + ipv6public_cidr_block      = (known after apply)
      + ipv6virtual_router_ip      = (known after apply)
      + prohibit_public_ip_on_vnic = (known after apply)
      + route_table_id             = (known after apply)
      + security_list_ids          = (known after apply)
      + state                      = (known after apply)
      + subnet_domain_name         = (known after apply)
      + time_created               = (known after apply)
      + vcn_id                     = (known after apply)
      + virtual_router_ip          = (known after apply)
      + virtual_router_mac         = (known after apply)
    }

  # oci_core_vcn.vcn_osce will be created
  + resource "oci_core_vcn" "vcn_osce" {
      + cidr_block               = "10.0.0.0/16"
      + compartment_id           = "ocid1.compartment.oc1..aaaaaaaalxo7zindcffskunoclqhfxnvmblgpjs4r7s
7li7cvx2l3p2mfniq"
      + default_dhcp_options_id  = (known after apply)
      + default_route_table_id   = (known after apply)
      + default_security_list_id = (known after apply)
      + defined_tags             = (known after apply)
      + display_name             = "vcn_osce"
      + dns_label                = "vcn1"
      + freeform_tags            = (known after apply)
      + id                       = (known after apply)
      + ipv6cidr_block           = (known after apply)
      + ipv6public_cidr_block    = (known after apply)
      + is_ipv6enabled           = (known after apply)
      + state                    = (known after apply)
      + time_created             = (known after apply)
      + vcn_domain_name          = (known after apply)
    }

Plan: 10 to add, 0 to change, 0 to destroy.

------------------------------------------------------------------------

Note: You didn't specify an "-out" parameter to save this plan, so Terraform
can't guarantee that exactly these actions will be performed if
"terraform apply" is subsequently run.

junicode@junicode-XPS-13-9370:~/iac$
```


junicode@junicode-XPS-13-9370: ~/iac
File Edit View Search Terminal Help

```
null_resource.remote-exec (remote-exec):   Installing : apr-util [#####    ] 2/5
null_resource.remote-exec (remote-exec):   Installing : apr-util [#######  ] 2/5
null_resource.remote-exec (remote-exec):   Installing : apr-util [######## ] 2/5
null_resource.remote-exec (remote-exec):   Installing : apr-util-1.5.2-6.0   2/5
null_resource.remote-exec (remote-exec):   Installing : httpd-to [         ] 3/5
null_resource.remote-exec (remote-exec):   Installing : httpd-to [##       ] 3/5
null_resource.remote-exec (remote-exec):   Installing : httpd-to [###      ] 3/5
null_resource.remote-exec (remote-exec):   Installing : httpd-to [####     ] 3/5
null_resource.remote-exec (remote-exec):   Installing : httpd-to [#####    ] 3/5
null_resource.remote-exec (remote-exec):   Installing : httpd-to [######   ] 3/5
null_resource.remote-exec (remote-exec):   Installing : httpd-to [######## ] 3/5
null_resource.remote-exec (remote-exec):   Installing : httpd-tools-2.4.6-   3/5
null_resource.remote-exec (remote-exec):   Installing : mailcap- [         ] 4/5
null_resource.remote-exec (remote-exec):   Installing : mailcap- [#######  ] 4/5
null_resource.remote-exec (remote-exec):   Installing : mailcap- [######## ] 4/5
null_resource.remote-exec (remote-exec):   Installing : mailcap-2.1.41-2.e   4/5
null_resource.remote-exec (remote-exec):   Installing : httpd-2. [         ] 5/5
null_resource.remote-exec (remote-exec):   Installing : httpd-2. [#        ] 5/5
null_resource.remote-exec (remote-exec):   Installing : httpd-2. [##       ] 5/5
null_resource.remote-exec (remote-exec):   Installing : httpd-2. [###      ] 5/5
null_resource.remote-exec (remote-exec):   Installing : httpd-2. [####     ] 5/5
null_resource.remote-exec (remote-exec):   Installing : httpd-2. [#####    ] 5/5
null_resource.remote-exec (remote-exec):   Installing : httpd-2. [######   ] 5/5
null_resource.remote-exec (remote-exec):   Installing : httpd-2. [#######  ] 5/5
null_resource.remote-exec (remote-exec):   Installing : httpd-2. [######## ] 5/5
null_resource.remote-exec (remote-exec):   Installing : httpd-2.4.6-90.0.1   5/5
null_resource.remote-exec (remote-exec):   Verifying  : httpd-tools-2.4.6-   1/5
null_resource.remote-exec (remote-exec):   Verifying  : mailcap-2.1.41-2.e   2/5
null_resource.remote-exec (remote-exec):   Verifying  : apr-util-1.5.2-6.0   3/5
null_resource.remote-exec (remote-exec):   Verifying  : httpd-2.4.6-90.0.1   4/5
null_resource.remote-exec (remote-exec):   Verifying  : apr-1.4.8-5.el7.x8   5/5

null_resource.remote-exec (remote-exec): Installed:
null_resource.remote-exec (remote-exec):   httpd.x86_64 0:2.4.6-90.0.1.el7

null_resource.remote-exec (remote-exec): Dependency Installed:
null_resource.remote-exec (remote-exec):   apr.x86_64 0:1.4.8-5.el7
null_resource.remote-exec (remote-exec):   apr-util.x86_64 0:1.5.2-6.0.1.el7
null_resource.remote-exec (remote-exec):   httpd-tools.x86_64 0:2.4.6-90.0.1.el7
null_resource.remote-exec (remote-exec):   mailcap.noarch 0:2.1.41-2.el7

null_resource.remote-exec (remote-exec): Complete!
null_resource.remote-exec (remote-exec): Created symlink from /etc/systemd/system/multi-user.target.wa
nts/httpd.service to /usr/lib/systemd/system/httpd.service.
null_resource.remote-exec (remote-exec): Syntax OK
null_resource.remote-exec (remote-exec): success
null_resource.remote-exec (remote-exec): success
null_resource.remote-exec: Creation complete after 39s [id=1368210293422128851]

Apply complete! Resources: 10 added, 0 changed, 0 destroyed.

Outputs:

namespace = idqasupv5blb
junicode@junicode-XPS-13-9370:~/iac$
```

Resultados:



console.us-ashburn-1.oraclecloud.com/networking/vcns/ocid1.vcn.oc1.iad.amaaaaaauleez7qauda3xsara32l2gdvmw5jjdmayxn3y2vpkzjkp4gq23zq

Networking » Virtual Cloud Networks » Virtual Cloud Network Details

vcn_osce

AVAILABLE

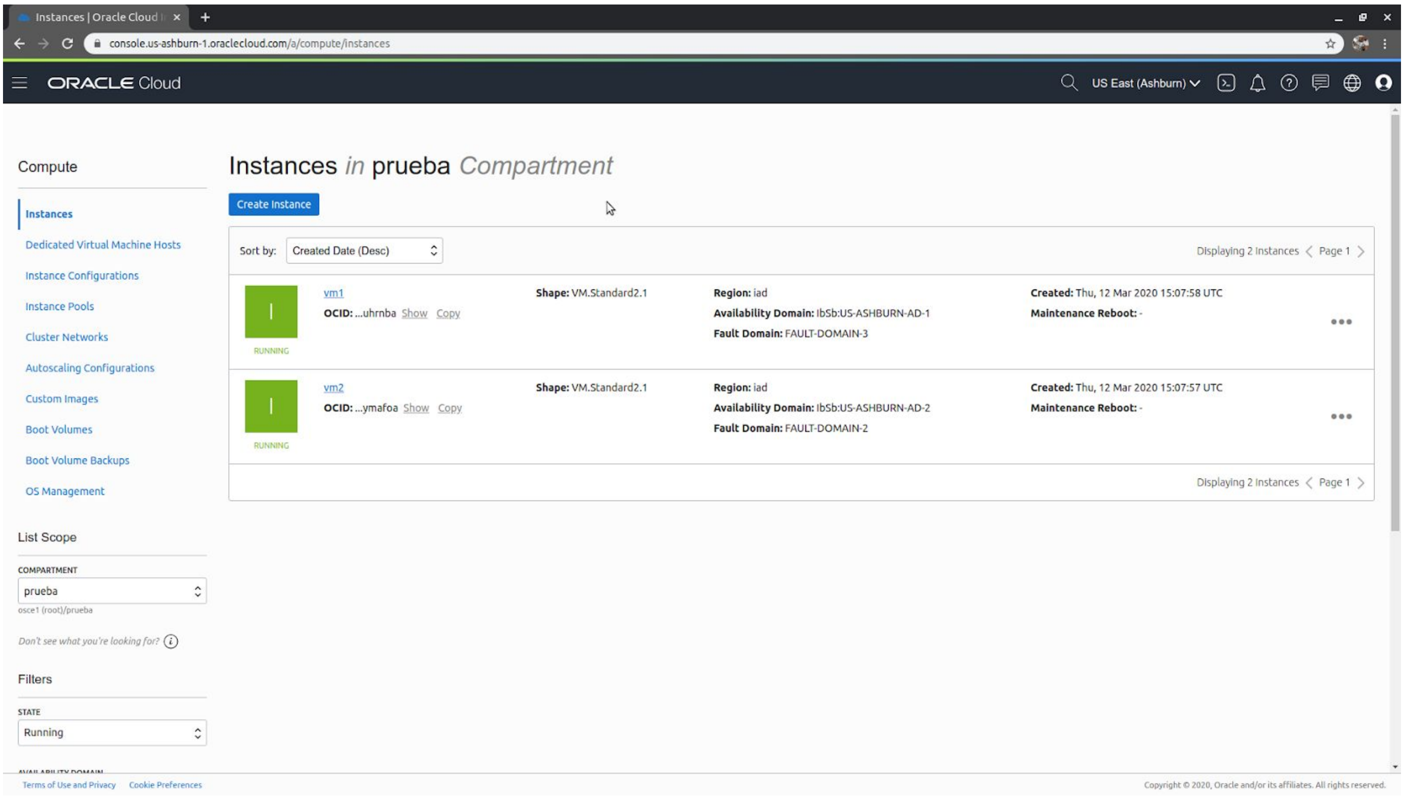
CIDR Block: 10.0.0.0/16
Compartment: prueba
Created: Thu, Mar 12, 2020, 15:07:54 UTC

OCID: ...gq23zq Show Copy
Default Route Table: defaultRouteTable
DNS Domain Name: vcn1.oraclevcn.com

Subnets *in* prueba *Compartment*

Name	State	CIDR Block	Subnet Access	Created
subred-AD1	● Available	10.0.1.0/24	Public (IbSb:US-ASHBURN-AD-1)	Thu, Mar 12, 2020, 15:07:56 UTC
subred-AD2	● Available	10.0.2.0/24	Public (IbSb:US-ASHBURN-AD-2)	Thu, Mar 12, 2020, 15:07:55 UTC

Showing 2 Items Page 1



console.us-ashburn-1.oraclecloud.com/a/compute/instances

Instances *in* prueba *Compartment*

Sort by: Created Date (Desc) Displaying 2 Instances Page 1

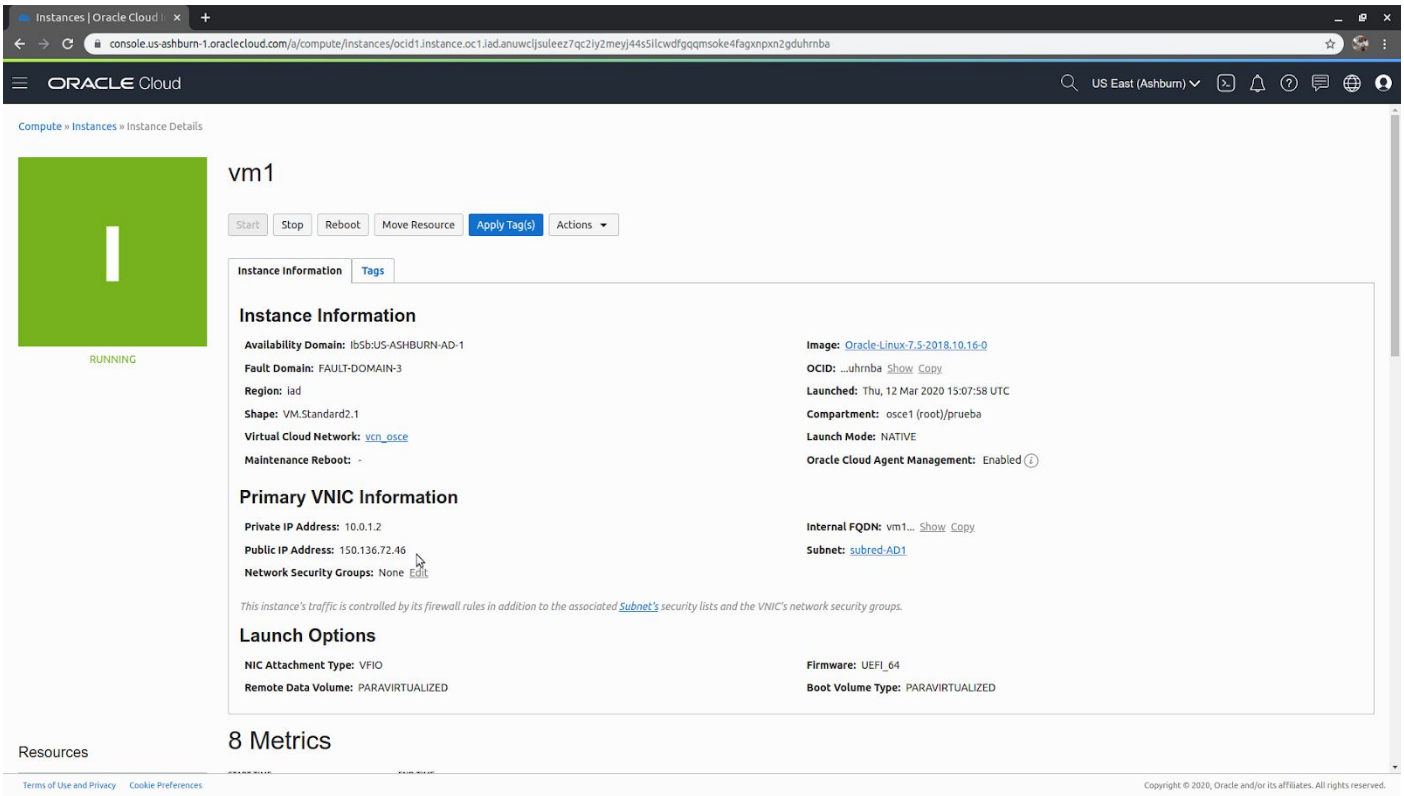
vm1
OCID: ...uhrnba Show Copy
RUNNING
Shape: VM.Standard2.1
Region: iad
Availability Domain: IbSb:US-ASHBURN-AD-1
Fault Domain: FAULT-DOMAIN-3
Created: Thu, 12 Mar 2020 15:07:58 UTC
Maintenance Reboot: -

vm2
OCID: ...ymafoa Show Copy
RUNNING
Shape: VM.Standard2.1
Region: iad
Availability Domain: IbSb:US-ASHBURN-AD-2
Fault Domain: FAULT-DOMAIN-2
Created: Thu, 12 Mar 2020 15:07:57 UTC
Maintenance Reboot: -

Displaying 2 Instances Page 1

COMPARTMENT: prueba
osce1 (root)/prueba

STATE: Running


Instances | Oracle Cloud I
console.us-ashburn-1.oraclecloud.com/a/compute/instances/ocid1.instance.oc1.iad.anuwcljsuleez7qc2iy2meyj44s5ilcwdfgqqmsoke4fagxnpxn2gduhrnba
ORACLE Cloud
US East (Ashburn)
Compute » Instances » Instance Details
I
RUNNING
Start
Stop
Reboot
Move Resource
Apply Tag(s)
Actions
Instance Information
Tags
Resources
Terms of Use and Privacy
Cookie Preferences
Copyright © 2020, Oracle and/or its affiliates. All rights reserved.

vm1

Instance Information

Availability Domain: IbSb:US-ASHBURN-AD-1
Fault Domain: FAULT-DOMAIN-3
Region: iad
Shape: VM.Standard2.1
Virtual Cloud Network: vcn_osce
Maintenance Reboot: -

Image: Oracle-Linux-7.5-2018.10.16-0
OCID: ...uhrnba Show Copy
Launched: Thu, 12 Mar 2020 15:07:58 UTC
Compartment: osce1 (root)/prueba
Launch Mode: NATIVE
Oracle Cloud Agent Management: Enabled

Primary VNIC Information

Private IP Address: 10.0.1.2
Public IP Address: 150.136.72.46
Network Security Groups: None Edit

Internal FQDN: vm1... Show Copy
Subnet: subred-AD1

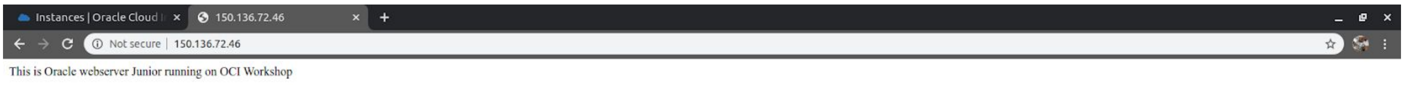
This instance's traffic is controlled by its firewall rules in addition to the associated Subnet's security lists and the VNIC's network security groups.

Launch Options

NIC Attachment Type: VFIO
Remote Data Volume: PARAVIRTUALIZED

Firmware: UEFI_64
Boot Volume Type: PARAVIRTUALIZED

8 Metrics



This is Oracle webserver Junior running on OCI Workshop

Referencias:
Terraform official web site - https://www.terraform.io/docs/providers/oci/index.html
How to use Terraform on Oracle Cloud Infrastructure (OCI) - https://www.youtube.com/watch?v=GIRjciGRDl4

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