

UNIVERSIDAD DEL VALLE DE GUATEMALA
Facultad de Ingeniería



[M1] Laboratorio 3

Uso de ANTLR para Parsear Terraform y Administrar Droplets de DigitalOcean

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Guatemala, 2025

Parte 1: Terraform

Crear con init terraform:

```
CONSOLE  PORTS  GITLENS
▼ TERMINAL
PS C:\Users\S0250\Desktop\Sofia Mishell Velásquez UVG\Cuarto Año 2025\Segundo semestre\Compis\Laboratorio_3_CC\terraform> terraform init
Initializing the backend...
Initializing provider plugins...
- Finding digitalocean/digitalocean versions matching "~> 2.0"...
- Installing digitalocean/digitalocean v2.61.0...
- Installed digitalocean/digitalocean v2.61.0 (signed by a HashiCorp partner, key ID F82037E52489C0E8)
Partner and community providers are signed by their developers.
If you'd like to know more about provider signing, you can read about it here:
https://developer.hashicorp.com/terraform/cli/plugins/signing
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.
```

Ver el plan para terraform:

```
▼ TERMINAL
PS C:\Users\S0250\Desktop\Sofia Mishell Velásquez UVG\Cuarto Año 2025\Segundo semestre\Compis\Laboratorio_3_CC\terraform> terraform plan

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:

# digitalocean_droplet.web will be created
+ resource "digitalocean_droplet" "web" {
  + backups            = false
  + created_at         = (known after apply)
  + disk               = (known after apply)
  + graceful_shutdown = false
  + id                 = (known after apply)
  + image              = "ubuntu-20-04-x64"
  + ipv4_address       = (known after apply)
  + ipv4_address_private = (known after apply)
  + ipv6               = false
  + ipv6_address       = (known after apply)
  + locked              = (known after apply)
  + locked              = (known after apply)
  + locked              = (known after apply)
  + locked              = (known after apply)
  + locked              = (known after apply)
  + locked              = (known after apply)
  + memory             = (known after apply)
  + monitoring         = false
  + name                = "example-droplet"
  + price_hourly        = (known after apply)
  + price_monthly       = (known after apply)
  + private_networking = (known after apply)
  + region              = "nyc1"
  + resize_disk         = true
  + size                = "s-1vcpu-1gb"
  + status              = (known after apply)
  + urn                 = (known after apply)
  + vcpus               = (known after apply)
  + volume_ids          = (known after apply)
  + vpc_uuid            = (known after apply)
}

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

Changes to Outputs:
+ droplet_ip = (known after apply)

Note: You didn't use the -out option to save this plan, so Terraform can't guarantee to take exactly these actions if you run "terraform apply" now.
PS C:\Users\S0250\Desktop\Sofia Mishell Velásquez UVG\Cuarto Año 2025\Segundo semestre\Compis\Laboratorio_3_CC\terraform> }
```

Apply terraform y ver la ip

```
▼ TERMINAL
PS C:\Users\S0250\Desktop\Sofia Mishell Velásquez UM6\Cuarto Año 2025\Segundo semestre\compis\Laboratorio_3_CC\terraform> terraform apply

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:

# digitalocean_droplet.web will be created
+ resource "digitalocean_droplet" "web" {
  + backups            = false
  + created_at         = (known after apply)
  + disk               = (known after apply)
  + graceful_shutdown = false
  + id                 = (known after apply)
  + image              = "ubuntu-20-04-x64"
  + ipv4_address       = (known after apply)
  + ipv4_address_private = (known after apply)
  + ipv6               = false
  + ipv6_address       = (known after apply)
  + locked              = (known after apply)
  + memory             = (known after apply)
  + monitoring          = false
  + name                = "example-droplet"
  + price_hourly        = (known after apply)
  + price_monthly       = (known after apply)
  + private_networking = (known after apply)
  + region              = "nyc1"
  + resize_disk         = true
  + size                = "5-1vcpu-1gb"
  + status              = (known after apply)
  + urn                 = (known after apply)
  + vcpus                = (known after apply)
  + volume_ids          = (known after apply)
  + vpc_uuid            = (known after apply)
}

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

Changes to Outputs:
+ droplet_ip = (known after apply)

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

digitalocean_droplet.web: Creating...
digitalocean_droplet.web: Still creating... [00m10s elapsed]
digitalocean_droplet.web: Still creating... [00m20s elapsed]
digitalocean_droplet.web: Still creating... [00m30s elapsed]
digitalocean_droplet.web: Creation complete after 33s [id=510626859]

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

Outputs:
droplet_ip = "174.138.36.166"
PS C:\Users\S0250\Desktop\Sofia Mishell Velásquez UM6\Cuarto Año 2025\Segundo semestre\compis\Laboratorio_3_CC\terraform>
```

Destruir lo creado:

```
▼ TERMINAL
PS C:\Users\S0250\Desktop\Sofia Mishell Velásquez UM6\Cuarto Año 2025\Segundo semestre\compis\Laboratorio_3_CC\terraform> terraform destroy

digitalocean_droplet.web: Refreshing state... [id=510626859]

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

Terraform will perform the following actions:

# digitalocean_droplet.web will be destroyed
- resource "digitalocean_droplet" "web" {
  - backups            = false -> null
  - created_at         = "2025-07-29T15:09:54Z" -> null
  - disk               = 25 -> null
  - graceful_shutdown = false -> null
  - id                 = "510626859" -> null
  - image              = "ubuntu-20-04-x64" -> null
  - ipv4_address       = "174.138.36.166" -> null
  - ipv4_address_private = "10.116.0.22" -> null
  - ipv6               = false -> null
  - locked              = false -> null
  - memory             = 1024 -> null
  - monitoring          = false -> null
  - name                = "example-droplet" -> null
  - price_hourly        = 0.00003 -> null
  - price_monthly       = 6 -> null
  - private_networking = true -> null
  - region              = "nyc1" -> null
  - resize_disk         = true -> null
  - size                = "5-1vcpu-1gb" -> null
  - status              = "active" -> null
  - tags                = [] -> null
  - urn                 = "do:droplet:510626859" -> null
  - private_networking = true -> null
  - region              = "nyc1" -> null
  - resize_disk         = true -> null
  - size                = "5-1vcpu-1gb" -> null
  - status              = "active" -> null
  - tags                = [] -> null
  - urn                 = "do:droplet:510626859" -> null
  - vcpus                = 1 -> null
  - volume_ids          = [] -> null
  - vpc_uuid            = "2dd24ca-204a-46fe-8b73-06ce664c2b5" -> null
  # (1 unchanged attribute hidden)
}

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

Changes to Outputs:
- droplet_ip = "174.138.36.166" -> null

Do you really want to destroy all resources?
Terraform will destroy all your managed infrastructure, as shown above.
There is no undo. Only 'yes' will be accepted to confirm.

Enter a value: yes

digitalocean_droplet.web: Destroying... [id=510626859]
digitalocean_droplet.web: Still destroying... [id=510626859, 00m10s elapsed]
digitalocean_droplet.web: Still destroying... [id=510626859, 00m20s elapsed]
digitalocean_droplet.web: Destruction complete after 22s

Destroy complete! Resources: 1 destroyed.
```

Parte 2: Bash

Construir la imagen de Docker

```
Windows PowerShell
ompose.yml: the attribute 'version' is obsolete, it will be ignored, please remove it to avoid potential confusion"
[+] Building 31.6s (11/12)                                docker:desktop-linux
[+] Building 0/1n internal] load build definition from Dockerfile
[+] Building 31.8s (13/13) FINISHED                        docker:desktop-linux
=> [digitalocean internal] load build definition from Dockerfile
=> => transferring dockerfile: 574B
=> [digitalocean internal] load metadata for docker.io/library/ubuntu:20.04
=> [digitalocean auth] library/ubuntu:pull token for registry-1.docker.io
=> [digitalocean internal] load .dockerignore
=> => transferring context: 2B
=> [digitalocean 1/6] FROM docker.io/library/ubuntu:20.04@sha256:8feb4d8ca5354def3d8fce243717141ce31e2c428701f66 4.5s
=> => resolve docker.io/library/ubuntu:20.04@sha256:8feb4d8ca5354def3d8fce243717141ce31e2c428701f6682bd2fafe1538 0.0s
=> => sha256:b7bab04fd9aa0c771e5720bf0cc7cbf993fd6946645983d9096126e5af45d713 2.30kB / 2.30kB
=> => sha256:13b7e930469f6d3575a320709035c6acf6f5485a76abcf03d1b92a64c09c2476 27.51MB / 27.51MB
=> => sha256:8feb4d8ca5354def3d8fce243717141ce31e2c428701f6682bd2fafe15388214 6.69kB / 6.69kB
=> => sha256:c664f8f86ed5a386b0a340d981b8f81714e21a8b9c73f658c4bea56aa179d54a 424B / 424B
=> => extracting sha256:13b7e930469f6d3575a320709035c6acf6f5485a76abcf03d1b92a64c09c2476 1.1s
=> [digitalocean internal] load build context
=> => transferring context: 1.70kB
=> [digitalocean 2/6] RUN apt-get update && apt-get install -y curl jq && rm -rf /var/lib/apt/lists 23.9s
=> [digitalocean 3/6] COPY create_droplet.sh /usr/local/bin/create_droplet.sh
=> [digitalocean 4/6] COPY destroy_droplet.sh /usr/local/bin/destroy_droplet.sh
=> [digitalocean 5/6] RUN chmod +x /usr/local/bin/create_droplet.sh
=> [digitalocean 6/6] RUN chmod +x /usr/local/bin/destroy_droplet.sh
=> [digitalocean] exporting to image
=> => exporting layers
=> => writing image sha256:59494972e1b86da10ed600aafdf8cacff064fe1b14010db7e85eeac19b9e7975f
[+] Building 1/1 docker.io/library/lab3-digitalocean
✔Service digitalocean Built
PS C:\Users\irvin\UVG\Octavo_Semestre\Compiladores\Lab3>
```

Ejecutar el script para crear el droplet

```
[+] Building 1/1 docker.io/library/lab3-digitalocean
✔Service digitalocean Built
PS C:\Users\irvin\UVG\Octavo_Semestre\Compiladores\Lab3> docker-compose run digitalocean /usr/local/bin/destroy_droplet.sh
time="2025-07-28T23:20:14-06:00" level=warning msg="C:\\Users\\irvin\\UVG\\Octavo_Semestre\\Compiladores\\Lab3\\docker-compose.yml: the attribute 'version' is obsolete, it will be ignored, please remove it to avoid potential confusion"
[+] Creating 1/1
✔Network lab3.default Created
cat: droplet_id.txt: No such file or directory
{"id": "Unauthorized", "message": "Unable to authenticate you" }Droplet with ID has been destroyed
PS C:\Users\irvin\UVG\Octavo_Semestre\Compiladores\Lab3>

=> => writing image sha256:4838ec7aaf028be7573de42d92daale+dd9e0c+a9a5eaea3f9bbcd33bea70a7b
[+] Building 1/1 docker.io/library/lab3-digitalocean
✔Service digitalocean Built
PS C:\Users\irvin\UVG\Octavo_Semestre\Compiladores\Lab3> docker compose run digitalocean create_droplet.sh lab3-droplet
time="2025-07-28T23:45:38-06:00" level=warning msg="C:\\Users\\irvin\\UVG\\Octavo_Semestre\\Compiladores\\Lab3\\docker-compose.yml: the attribute 'version' is obsolete, it will be ignored, please remove it to avoid potential confusion"
time="2025-07-28T23:45:38-06:00" level=warning msg="Found orphan containers ([lab3-digitalocean-run-253397ebd2b7 lab3-digitalocean-run-84b7a02c4d36 lab3-digitalocean-run-563659df927f]) for this project. If you removed or renamed this service in your compose file, you can run this command with the --remove-orphans flag to clean it up."
% Total % Received % Xferd Average Speed Time Time Time
Dload Upload Total Spent Left Speed
100 3975 100 3878 100 97 1429 35 0:00:02 0:00:02 ---:--: 1465
Droplet created with ID: 510546849
PS C:\Users\irvin\UVG\Octavo_Semestre\Compiladores\Lab3>

Droplet created with ID: 510546849
PS C:\Users\irvin\UVG\Octavo_Semestre\Compiladores\Lab3> Get-Content droplet_id.txt
510546849
PS C:\Users\irvin\UVG\Octavo_Semestre\Compiladores\Lab3>

PS C:\Users\irvin\UVG\Octavo_Semestre\Compiladores\Lab3> docker-compose run digitalocean /usr/local/bin/destroy_droplet.sh
time="2025-07-28T23:50:47-06:00" level=warning msg="C:\\Users\\irvin\\UVG\\Octavo_Semestre\\Compiladores\\Lab3\\docker-compose.yml: the attribute 'version' is obsolete, it will be ignored, please remove it to avoid potential confusion"
time="2025-07-28T23:50:47-06:00" level=warning msg="Found orphan containers ([lab3-digitalocean-run-d3821841bdc9 lab3-digitalocean-run-253397ebd2b7 lab3-digitalocean-run-84b7a02c4d36 lab3-digitalocean-run-563659df927f]) for this project. If you removed or renamed this service in your compose file, you can run this command with the --remove-orphans flag to clean it up."
Droplet with ID 510546849 has been destroyed
PS C:\Users\irvin\UVG\Octavo_Semestre\Compiladores\Lab3>
```

Parte 3: ANTLR

- Compile el archivo de Terraform en la carpeta de antlr usando el driver de Python que se proporciona y vea cómo se crea el droplet (el código imprime la IP del droplet y el ID del mismo)

```
appuser@a071e6d71c97:/program$ python3 terraform_parser.py main.tf create
[var] digitalocean_token = dop_v1_46ea0abd61861407db60b9aea7510669ae34d16b179e4bde51c76369a82d356b
[*] Creating droplet...
[+] Droplet created with ID: 510898393
[*] Waiting for droplet to become active and assigned an IP...
[+] State saved to terraform.tfstate
[✓] Droplet available at IP: 157.230.48.26
```

En efecto, esta la ip 67.205.175.202 y la id de Droplet de 510683037

- Luego de hacerlo, haga un ping a la IP y vea que si está up el recurso

```
PS C:\Users\JM\Documents\Compi2\Laboratorio_3_CC> ping 157.230.48.26
```

```
Pinging 157.230.48.26 with 32 bytes of data:
Reply from 157.230.48.26: bytes=32 time=113ms TTL=47
Reply from 157.230.48.26: bytes=32 time=95ms TTL=47
Reply from 157.230.48.26: bytes=32 time=115ms TTL=47
Reply from 157.230.48.26: bytes=32 time=101ms TTL=47

Ping statistics for 157.230.48.26:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 95ms, Maximum = 115ms, Average = 106ms
```

- Luego, haga un delete manual de este droplet usando el script de bash que usó ya anteriormente cuando creó instancias con bash y la REST API. DEBE HACER DELETE MANUAL.

Primero se importo el recurso con el droplet ID

```
PS C:\Users\JM\Documents\Compi2\Laboratorio_3_CC\bash> docker compose run digitalocean destroy_droplet.sh
time="2025-07-30T23:11:09-06:00" level=warning msg="C:\\Users\\JM\\Documents\\Compi2\\Laboratorio_3_CC\\bash\\docker-compose.yml: the attribute `version` is obsolete, it will be ignored, please remove it to avoid potential confusion"
time="2025-07-30T23:11:10-06:00" level=warning msg="Found orphan containers ([bash-digitalocean-run-9c64e08c53be bash-digitalocean-run-2863ed7a765f bash-digitalocean-run-66832a800b3d bash-digitalocean-run-758d809b48ff bash-digitalocean-run-b8ff991fa4ab bash-digitalocean-run-242927c54695 bash-digitalocean-run-a10b78116710 bash-digitalocean-run-7a4e37e053b1 bash-digitalocean-run-c175271cde4c bash-digitalocean-run-90c7947b0747 bash-digitalocean-run-bc78101208af]) for this project. If you removed or renamed this service in your compose file, you can run this command with the --remove-orphans flag to clean it up."
Droplet with ID 510898393 has been destroyed
PS C:\Users\JM\Documents\Compi2\Laboratorio_3_CC\bash> []
```

```
PS C:\Users\JM\Documents\Compi2\Laboratorio_3_CC> ping 157.230.48.26
```

```
Pinging 157.230.48.26 with 32 bytes of data:
Request timed out.
Request timed out.

Ping statistics for 157.230.48.26:
    Packets: Sent = 2, Received = 0, Lost = 2 (100% loss),
Control-C
PS C:\Users\JM\Documents\Compi2\Laboratorio_3_CC> clear
```

Para luego poder hacer terraform destroy, y podemos ver que la ip y droplet id indicadas ya fueron liberadas.

```
PS C:\Users\JM\Documents\Compi2\Laboratorio_3_CC\terraform> terraform destroy
digitalocean_droplet.web: Refreshing state... [id=510683037]

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

Terraform will perform the following actions:

# digitalocean_droplet.web will be destroyed
- resource "digitalocean_droplet" "web" {
  - backups           = false -> null
  - created_at        = "2025-07-29T23:41:06Z" -> null
  - disk              = 10 -> null
  - id                = "510683037" -> null
  - image             = "ubuntu-24-10-x64" -> null
  - ipv4_address       = "67.205.175.202" -> null
  - ipv4_address_private = "10.116.0.20" -> null
  - ipv6              = false -> null
  - locked            = false -> null
  - memory            = 512 -> null
  - monitoring        = false -> null
  - name              = "example-droplet" -> null
  - price_hourly      = 0.00595 -> null
  - price_monthly     = 4 -> null
  - private_networking = true -> null
  - region            = "nyc1" -> null
  - resize_disk       = true -> null
  - size              = "s-1vcpu-512mb-10gb" -> null
  - status            = "active" -> null
  - tags              = [] -> null
  - urn               = "do:droplet:510683037" -> null
  - vcpus             = 1 -> null
  - volume_ids        = [] -> null
  - vpc_uuid          = "2ddc24ca-204a-46fe-8b73-06ce664c2cb5" -> null
}
```

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

Changes to Outputs:

- droplet_ip = "67.205.175.202" -> null

Do you really want to destroy all resources?

Terraform will destroy all your managed infrastructure, as shown above.
There is no undo. Only 'yes' will be accepted to confirm.

Enter a value: yes

digitalocean_droplet.web: Destroying... [id=510683037]

digitalocean_droplet.web: Still destroying... [id=510683037, 00m10s elapsed]

digitalocean_droplet.web: Still destroying... [id=510683037, 00m20s elapsed]

digitalocean_droplet.web: Destruction complete after 22s

Destroy complete! Resources: 1 destroyed.

PS C:\Users\JM\Documents\Compi2\Laboratorio_3_CC\terraform> █

- Luego, deberá de completar el ecosistema de su propio Terraform, este archivo como está hace mimic de un " terraform apply-auto-approve ". Entonces lo que ahora necesito que haga, es que cree el código que soporte hacer un " terraform destroy-auto-approve ". Para lograr esto, deberá soportar parámetros en el archivo de Python. Dependiendo del flag proporcionado al cli de Python entonces ya hará un apply o destroy.

```

PS C:\Users\dgv31\OneDrive\Documents\Universidad\Semestre 8\compis\Laboratorio_3_CC\antlr> docker run --rm -it -v "${PWD}/program:/program"
lab3-image
>>
appuser@37eca842a7b3:/program$ antlr -Dlanguage = Python3 TerraformSubset.g4
error(9): invalid -Dname=value syntax: -Dlanguage
error(7): cannot find or open file: =
error(7): cannot find or open file: Python3
appuser@37eca842a7b3:/program$ antlr -Dlanguage=Python3 TerraformSubset.g4
appuser@37eca842a7b3:/program$ python3 ./terraform_parser.py ./main.tf create
python3: can't open file '/program/.terraform_parser.py': [Errno 2] No such file or directory
appuser@37eca842a7b3:/program$ python3 terraform_parser.py main.tf create
[var] digitalocean_token = dop_v1_46ea0abd61861407db60b9aea7510669ae34d16b179e4bde51c76369a82d356b
[*] Creating droplet...
[+] Droplet created with ID: 510863592
[*] Waiting for droplet to become active and assigned an IP...
[+] State saved to terraform.tfstate
[✓] Droplet available at IP: 68.183.96.87
appuser@37eca842a7b3:/program$

```

- Después, necesita crear el código para hacer un destroy, que básicamente es llamar a la REST API también. Pero para poder hacer un destroy, necesita saber el ID del droplet, entonces, deberá agregar código para crear un terraform statefile (.tfstate).

```

appuser@37eca842a7b3:/program$ python3 terraform_parser.py main.tf destroy
[var] digitalocean_token = dop_v1_46ea0abd61861407db60b9aea7510669ae34d16b179e4bde51c76369a82d356b
[+] Destroying Droplet with ID: 510863592
[+] Droplet successfully destroyed

```

- Este statefile se debe crear cuando haga un apply. Se guardará un archivo y este tendrá un json con la información correspondiente, es decir, para el droplet con este nombre proporcionado, se asocia este ID y esta IP. Ya con este archivo, cuando haga un destroy entonces ya puede mandar el ID para destruir el recurso.

antlr > program > terraform.tfstate

```
1  {
2    "id": 510863592,
3    "name": "example-droplet",
4    "region": {
5      "name": "New York 1",
6      "slug": "nyc1",
7      "features": [
8        "backups",
9        "ipv6",
10       "metadata",
11       "install_agent",
12       "storage",
13       "image_transfer"
14     ],
15     "available": true,
16     "sizes": [
17       "s-1vcpu-512mb-10gb",
18       "s-1vcpu-1gb",
19       "s-1vcpu-1gb-amd",
20       "s-1vcpu-1gb-intel",
21       "s-1vcpu-1gb-35gb-intel",
22       "s-1vcpu-2gb",
23       "s-1vcpu-2gb-amd",
24       "s-1vcpu-2gb-intel",
25       "s-1vcpu-2gb-70gb-intel",
26       "s-2vcpu-2gb",
27       "s-2vcpu-2gb-amd",
28       "s-2vcpu-2gb-intel",
29       "s-2vcpu-2gb-90gb-intel",
30       "s-2vcpu-4gb",
31       "s-2vcpu-4gb-amd",
32       "s-2vcpu-4gb-intel",
33       "s-2vcpu-4gb-120gb-intel",
34       "s-2vcpu-8gb-amd",
35       "c-2",
36       "c2-2vcpu-4gb",
37       "s-2vcpu-8gb-160gb-intel",
38       "s-4vcpu-8gb",
39       "s-4vcpu-8gb-amd",
40       "s-4vcpu-8gb-intel",
41       "s-8vcpu-8gb"
```