Laboratorio 6

Estructura del proyecto

El laboratorio tiene los archivos de patrones de diseño en la carpeta `iac_patterns/` con 5 archivos Python (singleton, factory, prototype, builder, composite). También está el script principal `generate_infra.py` que usa todos los patrones.

```
cd Laboratorio6
pwd
ls -la
/Users/melissaimannoriega/Documents/UNI/7CICLO/DS/software-development-25-2
/Users/melissaimannoriega/Documents/UNI/7CICLO/DS/software-development-25-2/Laboratorio6
total 24
drwxr-xr-x@  7 melissaimannoriega  staff   224 Oct 30 09:42 .
drwxr-xr-x  15 melissaimannoriega  staff   480 Oct 30 09:42 ..
-rw-r--r--@  1 melissaimannoriega  staff  1458 Oct 30 08:53 generate_infra.py
drwxr-xr-x@  8 melissaimannoriega  staff   256 Oct 30 08:53 iac_patterns
-rw-r--r--@  1 melissaimannoriega  staff   670 Oct 30 08:53 Instrucciones.md
drwxr-xr-x@  2 melissaimannoriega  staff    64 Oct 30 09:42 screenshots
-rw-r--r--@  1 melissaimannoriega  staff  2606 Oct 30 08:53 test_patterns.sh
```

Figure 1: Estructura del proyecto

Patrones implementados

Se implementaron 5 patrones de diseño para generar infraestructura con Terraform:

Singleton: Crea una configuración global única que se comparte en todo el sistema. Usa locks para ser thread-safe.

Factory: Genera recursos `null_resource` de Terraform con UUIDs únicos y timestamps automáticos.

Prototype: Clona recursos existentes y los modifica sin tocar el original. Usa `copy.deepcopy` para clonar.

Composite: Combina múltiples recursos en una sola estructura. Agrega todos los recursos hijos y los exporta como un JSON único.

Builder: Construye infraestructura de forma fluida. Combina los otros patrones para generar flotas de recursos con una API simple.

Generación del archivo Terraform

Se ejecutó `python3 generate_infra.py` para generar la configuración de Terraform.

El script crea el archivo `terraform/main.tf.json` que contiene 16 recursos en formato JSON.

```
 ) python3 generate_infra.py
 [Builder] Terraform JSON escrito en: terraform/main.tf.json
```

Figure 2: Generación exitosa

Contenido generado

El JSON generado tiene 16 recursos null_resource: 15 placeholders (del 0 al 14) más un recurso finalizador.

```
 ) head -n 50 terraform/main.tf.json
 {
     "resource": [
         {
             "null_resource": [
                 {
                     "placeholder_0": [
                         {
                             "triggers": {
                                 "factory_uuid": "ae5c5a1a-e7c9-457f-a562-3282424a1bd6",
                                 "timestamp": "2025-10-30T14:45:25.461323",
                                 "index": 0
                             }
                         }
                     ]
                 }
             ]
         },
         {
             "null_resource": [
                 {
                     "placeholder_1": [
                         {
                             "triggers": {
                                 "factory_uuid": "ae5c5a1a-e7c9-457f-a562-3282424a1bd6",
                                 "timestamp": "2025-10-30T14:45:25.461323",
                                 "index": 1
                             }
                         }
                     ]
                 }
             ]
         },
         {
```

Figure 3: JSON generado

Cada recurso tiene triggers con UUID único, timestamp y un índice.

Terraform plan

Se ejecutó `terraform init` para inicializar y luego `terraform plan` para ver qué recursos se van a crear.

El plan muestra los 16 recursos que se van a agregar. Cada uno con su configuración de triggers.

```
 ● ❯ 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:

   # null_resource.finalizador will be created
   + resource "null_resource" "finalizador" {
       + id       = (known after apply)
       + triggers = {
           + "factory_uuid" = "d5c9a39d-18d1-469e-a287-e796e77ed181"
           + "nota"         = "Recurso compuesto generado dinámicamente en tiempo de ejecución"
           + "timestamp"    = "2025-10-30T14:45:25.461464"
         }
     }

   # null_resource.placeholder_0 will be created
   + resource "null_resource" "placeholder_0" {
       + id       = (known after apply)
       + triggers = {
           + "factory_uuid" = "ae5c5a1a-e7c9-457f-a562-3282424a1bd6"
           + "index"        = "0"
           + "timestamp"    = "2025-10-30T14:45:25.461323"
         }
     }

   # null_resource.placeholder_1 will be created
   + resource "null_resource" "placeholder_1" {
       + id       = (known after apply)
       + triggers = {
           + "factory_uuid" = "ae5c5a1a-e7c9-457f-a562-3282424a1bd6"
           + "index"        = "1"
           + "timestamp"    = "2025-10-30T14:45:25.461323"
         }
     }

   # null_resource.placeholder_10 will be created
   + resource "null_resource" "placeholder_10" {
       + id       = (known after apply)
       + triggers = {
           + "factory_uuid" = "ae5c5a1a-e7c9-457f-a562-3282424a1bd6"
```

Figure 4: Terraform Plan

Terraform apply

Se aplicó la configuración con `terraform apply -auto-approve` para crear los recursos.

Los 16 recursos se crearon exitosamente. Terraform los crea en paralelo y asigna IDs únicos a cada uno.

Limpieza

Se ejecutó `terraform destroy -auto-approve` para eliminar los recursos creados. Los 16 recursos se destruyeron sin problemas.

```
      + triggers = {
          + "factory_uuid" = "ae5c5a1a-e7c9-457f-a562-3282424a1bd6"
          + "index"        = "9"
          + "timestamp"    = "2025-10-30T14:45:25.461323"
        }
    }

Plan: 16 to add, 0 to change, 0 to destroy.
null_resource.placeholder_1: Creating...
null_resource.placeholder_4: Creating...
null_resource.placeholder_3: Creating...
null_resource.placeholder_14: Creating...
null_resource.placeholder_12: Creating...
null_resource.placeholder_6: Creating...
null_resource.placeholder_7: Creating...
null_resource.placeholder_8: Creating...
null_resource.placeholder_5: Creating...
null_resource.placeholder_13: Creating...
null_resource.placeholder_5: Creation complete after 0s [id=6669221150644860417]
null_resource.placeholder_7: Creation complete after 0s [id=592827516577795120]
null_resource.placeholder_1: Creation complete after 0s [id=126379007614261532]
null_resource.placeholder_0: Creating...
null_resource.placeholder_13: Creation complete after 0s [id=5533909189471840923]
null_resource.placeholder_6: Creation complete after 0s [id=3700997214803362510]
null_resource.placeholder_11: Creating...
null_resource.finalizador: Creating...
null_resource.placeholder_8: Creation complete after 0s [id=5135249614550574210]
null_resource.placeholder_10: Creating...
null_resource.placeholder_2: Creating...
null_resource.placeholder_12: Creation complete after 0s [id=10489942826009751589]
null_resource.placeholder_14: Creation complete after 0s [id=8285755288050060293]
null_resource.placeholder_11: Creation complete after 0s [id=7670125101410386328]
null_resource.placeholder_0: Creation complete after 0s [id=5613171297785175335]
null_resource.finalizador: Creation complete after 0s [id=8477069365201201359]
null_resource.placeholder_3: Creation complete after 0s [id=8989309916482481714]
null_resource.placeholder_4: Creation complete after 0s [id=7201902711285904493]
null_resource.placeholder_9: Creating...
null_resource.placeholder_10: Creation complete after 0s [id=9140315801237901307]
null_resource.placeholder_2: Creation complete after 0s [id=2460346149315969436]
null_resource.placeholder_9: Creation complete after 0s [id=7554406086008533688]

Apply complete! Resources: 16 added, 0 changed, 0 destroyed.
```

Figure 5: Terraform Apply