Building GCP with Terraform

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Overview

- What is IaC?
- Declarative vs. Procedural
- What is Terraform?
- Installation
- Basics Workflow
- HCL
- Providers (Plugins)
- State File - terraform.tfstate
- Resources, Inputs
- Terraform Cloud ?

What is IaC?

- IaC = Infrastructure-as-Code
- High-level coding languages used to automate IT infrastructure builds.
- **IaC Tool Adoption**

IaC Tool	Overall	Enterprise	SMB
Terraform	36%	36%	39%
Ansible	31%	33%	29%
Chef	29%	32%	21%
Puppet	27%	26%	18%
Salt	12%	14%	10%

* Taken from Flexera 2021 State of Cloud report.

- Not an apples-for-apples comparison.
- In practice, these tools are often used together to fully-automate builds.

Procedural vs. Declarative

- IaC tools can be categorized as Procedural or Declarative.
  - Based on how the tool applies changes to the underlying target systems.
- **Procedural**
  - Think script.
  - Step-by-step tasks to automate your build.
  - Ansible & Chef are procedural - Code step-by-step tasks to achieve a desired end state.
- **Declarative**
  - Think HTML.
  - Code says what is desired, not the steps.
  - Hides the process and reveals relationships.
  - Terraform & Puppet are declarative - Code specifies your desired end state.

What is Terraform?

- Terraform is an open source IaC tool.
- Enables you to build, change, and version cloud and on-prem resources.
- Original author - Mitchell Hashimoto.
  - Maintained by Hashicorp.
- Enabled through the use of "Providers".
  - Providers = plugins which are an abstraction over an API.
  - Many providers are available through the public Terraform Registry.
  - Support for all major cloud providers.
- Modules are also available to further abstract provider interactions.
  - Public modules are available and you can also build your own.

Terraform Installation

- https://learn.hashicorp.com/tutorials/terraform/install-cli

Quick Demo

- Using Terraform's local provider:

  https://registry.terraform.io/providers/hashicorp/local

- Command line notes:

  https://github.com/netserf/netsig-presentation-building-gcp-with-terraform/terraform-cheat-sheet.txt

Basic Workflow

1. Code
   - Write your infrastructure configuration.
2. Initialize
   - Initialized providers and modules.
   - `terraform init`
3. Plan
   - Displays the difference between desired and current state.
   - Creates a plan to reconcile this gap.
   - `terraform plan`
4. Apply
   - Apply the changes to achieve the desired state.
   - `terraform apply`

HCL

- HCL = Hashicorp Configuration Language
- Toolkit for creating structured configuration languages
- Goal is to be both human- and machine-friendly
- Example:

```
default_address = "127.0.0.1"
default_message = upper("Incident: ${incident}")
default_options = {
  priority: "High",
  color: "Red"
}
```

Providers

- Provider = Terraform plugin that typically integrates with an external API.
- Acts as a translation layer
- Allows Terraform to communicate with API and build external resources
    - e.g. VMs, databases, services, etc.

State File - terraform.tfstate

- Terraform stores information about your infrastructure in a state file
  - File name: **`terraform.tfstate`**
  - State keeps track of resources modified by your IaC config
- During **`terraform plan:`**
  - Terraform compares config with state to plan changes to your infrastructure
- During **`terraform apply`**:
  - Terraform makes updates to resources and writes metadata to the state file to reflect changes
- Terraform supports a number of state file operations:
  - **`terraform show`**
  - **`terraform state list`**
  - **`terraform state -help`**

Resources

- Resources are the most important element in Terraform
- Each resource block describes one or more infrastructure objects
  - e.g. Virtual networks, VM instances, or higher-level components such as DNS records.
- Example:

```
resource "google_compute_instance" "test_instance" {
  name         = "test-instance"
  machine_type = "e2-medium"
  zone         = "northamerica-northeast1-a"

  boot_disk {
    initialize_params {
    image = "debian-cloud/debian-11"
    }
  }
```

Variables

- Variables allow for customization of Terraform modules
- Makes your module reusable
- Variables can be set using files, CLI options and/or environment variables.
- Example:

```
variable "machine_type" {
  type    = string
  default = "e2-medium"
}
```

Modules

- A module is a container for multiple resources that are used together
- Modules can abstract the underlying resource implementation
- Promotes reuse
- The .tf files in your working directory form the root module
- The root module may call other modules
- Example:

```
module "cloud-storage_simple_bucket" {
  source  = "terraform-google-modules/cloud-storage/google//modules/simple_bucket"
  version = "3.4.0"
  name = "my-bucket"
  project_id = "my-project"
  location = "northamerica-northeast1"
}
```

GCP Build Network

- Command line notes:

  https://github.com/netserf/netsig-presentation-building-gcp-with-terraform/terraform-cheat-sheet.txt

GCP Build VMs

- Command line notes:

  https://github.com/netserf/netsig-presentation-building-gcp-with-terraform/terraform-cheat-sheet.txt

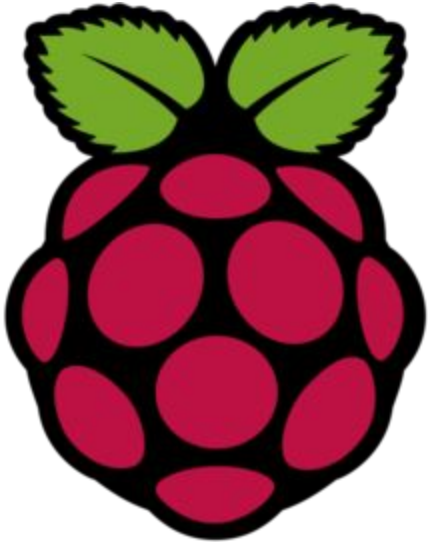
Summary

Possible Future Discussions

- Go deeper with GCP networking
  - IPv6, DNS, Load Balancing, VPNs, etc.
- Building AWS with Terraform
- Kubernetes / GKE
  - Service Mesh
- Monitoring / Log Management
  - e.g. Prometheus, Elastic Stack, etc.
- CI / CD
  - GitHub Actions
- PaaS Apps
  - e.g. GCP's AppEngine
- Other ideas welcome!

VicPiMakers and Others Slack

- Please let us know if you want an invite to this Slack group



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