class 101

Terraform: IaC

101.1 What is Terraform?

101.2 Key Features of Terraform

101.3 Pros and Cons

101.4 Providers

101.5 Basic of Infrastructure

101.6 Getting Started

Jay Kim

Nov 28, 2019

Samsung Electronics, Staff Engineer

Global Service Reliability Engineer

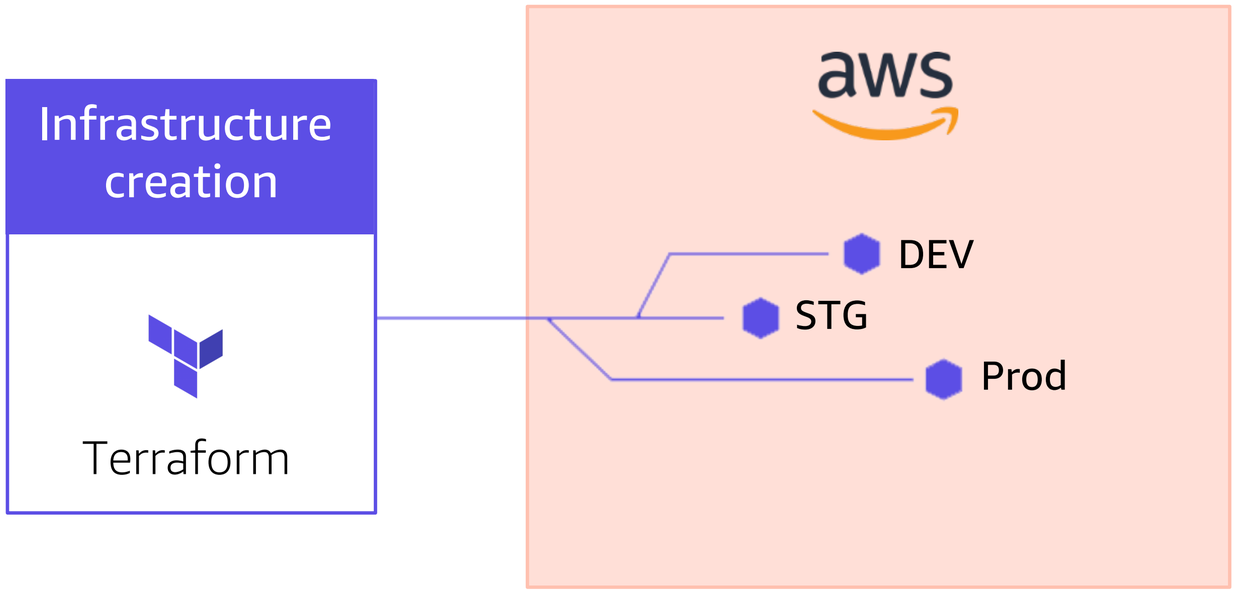
Jay Kim

101.1 What is Terraform?

Use Infrastructure as Code(IaC) to provision and manage any cloud, infrastructure, or service

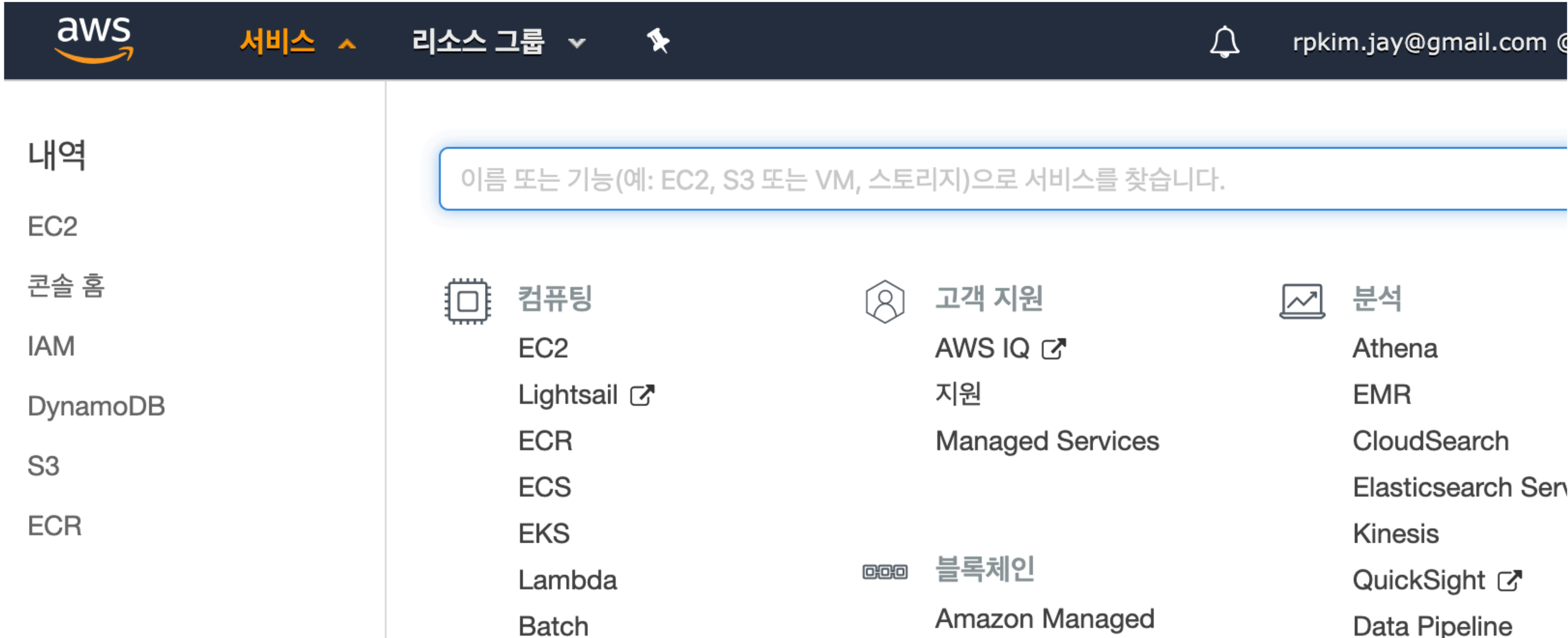
Terraform

Use Infrastructure as Code(IaC) to provision and manage any cloud, infrastructure, or service



Terraform

Use Infrastructure as Code(IaC) to provision and manage any cloud, infrastructure, or service



Use Infrastructure as Code(IaC) to provision and manage any cloud, infrastructure, or service

HCL
(Hashicorp Configuration Language (HCL))

```
resource "aws_vpc" "vpc" {
  cidr_block           = "${var.cidr_block}"
  enable_dns_hostnames = true
  enable_dns_support   = true

  tags = {
    Name      = "${var.name}"
    terraform = "true"
  }
}

resource "aws_subnet" "public" {
  count                   = "${length(var.public_subnets)}"
  map_public_ip_on_launch = true
  vpc_id                  = "${aws_vpc.vpc.id}"
  availability_zone       = "${element(var.zones, count.index)}"
  cidr_block              = "${element(var.public_subnets, count.index)}"
```


Terraform

101.1 What is Terraform?

Mitchell Hashimoto(26)
co-founder and CEO

Armon Dadgar(24)
co-founder and CTO

Terraform

HashiCorp

Mitchell Hashimoto(26)
co-founder and CEO

Armon Dadgar(24)
co-founder and CTO

PRODUCTS

- Terraform
- Vault
- Consul
- Nomad
- Vagrant
- Packer

Terraform

HashiCorp

Mitchell Hashimoto(26)
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- Terraform
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- Packer

JUNE 6, 2013

Automation Obsessed

Someone asked me recently to share some previous work I had done. As I looked back at my personal history, and reflected on what I've done successfully, it was clear to me that I'm definitely working on things I'm meant to be working on. Automation has been my passion since the very beginning.

I started programming because I wanted to cheat Neopets. I played Neopets daily, and I was frustrated that I would do the same things daily for hours for the same measly amount of Neopoints (the virtual currency used by Neopets). I learned Visual Basic with the goal of writing a program to do these tasks for me. I succeeded at this, and was soon making my measly

http://mitchellh.com/automation-obsessed

Terraform

HashiCorp

PRODUCTS

- Terraform
- Vault
- Consul
- Nomad
- Vagrant
- Packer

Mitchell Hashimoto(26)
co-founder and CEO

Recently, I started HashiCorp. And while it isn't publicly clear what I'm up to yet, and I'm not quite ready to talk about everything I'm up to, you can be sure of one thing: I'm busy automating. More specifically, I'm developing software to automate everything, and giving it to you.

http://mitchellh.com/automation-obsessed

Terraform is, the result of

“Engineering Thinking”

Do Coding For Everything

(Automation)

101.2 Key Features of Terraform

Write declarative configuration files

- Collaborate and share configurations
- Evolve and version your infrastructure
- Automate provisioning

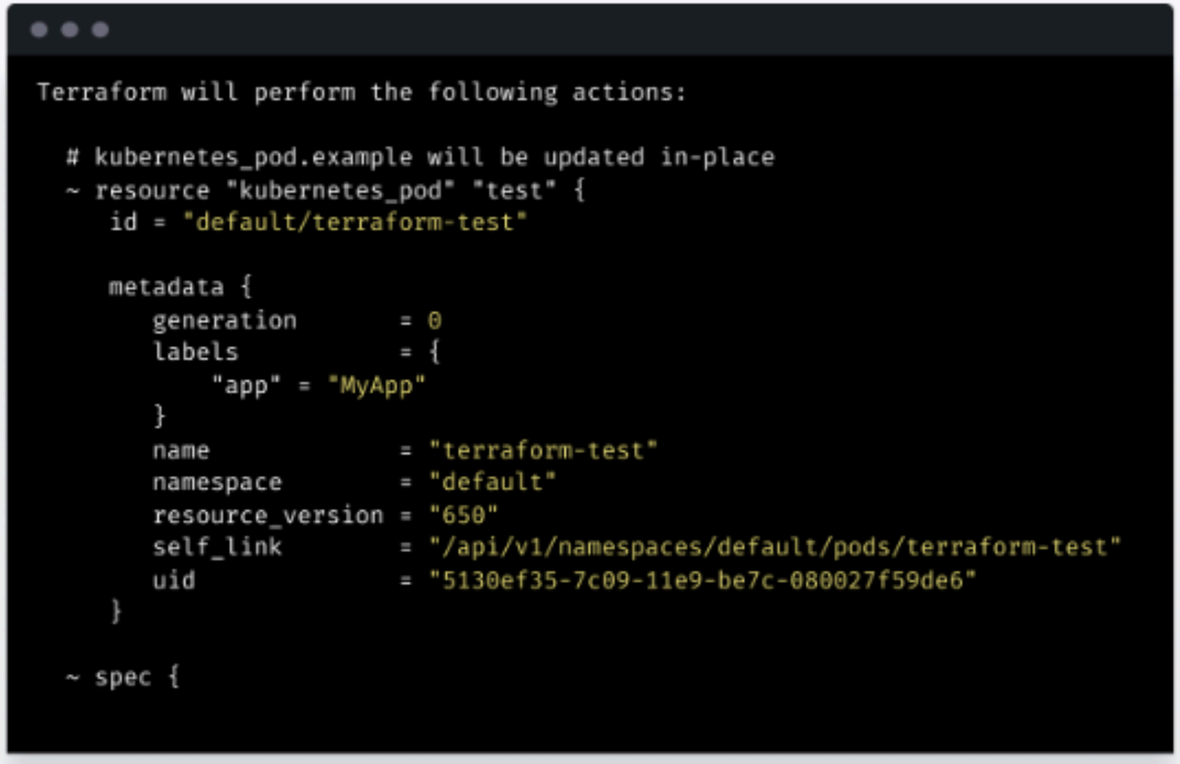
Define infrastructure as code to manage the full lifecycle — create new resources, manage existing ones, and destroy those no longer needed.

```
variable "base_network_cidr" {
  default = "10.0.0.0/8"
}

resource "google_compute_network" "example" {
  name                    = "test-network"
  auto_create_subnetworks = false
}

resource "google_compute_subnetwork" "example" {
  count = 4

  name          = "test-subnetwork"
  ip_cidr_range = cidrsubnet(var.base_network_cidr, 4, count.index)
  region        = "us-central1"
  network       = google_compute_network.custom-test.self_link
}
```



```
Terraform will perform the following actions:

  # kubernetes_pod.example will be updated in-place
  ~ resource "kubernetes_pod" "test" {
      id = "default/terraform-test"

      metadata {
          generation       = 0
          labels           = {
              "app" = "MyApp"
          }
          name             = "terraform-test"
          namespace        = "default"
          resource_version = "650"
          self_link        = "/api/v1/namespaces/default/pods/terraform-test"
          uid              = "5130ef35-7c09-11e9-be7c-080027f59de6"
      }

  ~ spec {
```

Plan and predict changes

- Clearly mapped resource dependencies
- Separation of plan and apply
- Consistent, repeatable workflow

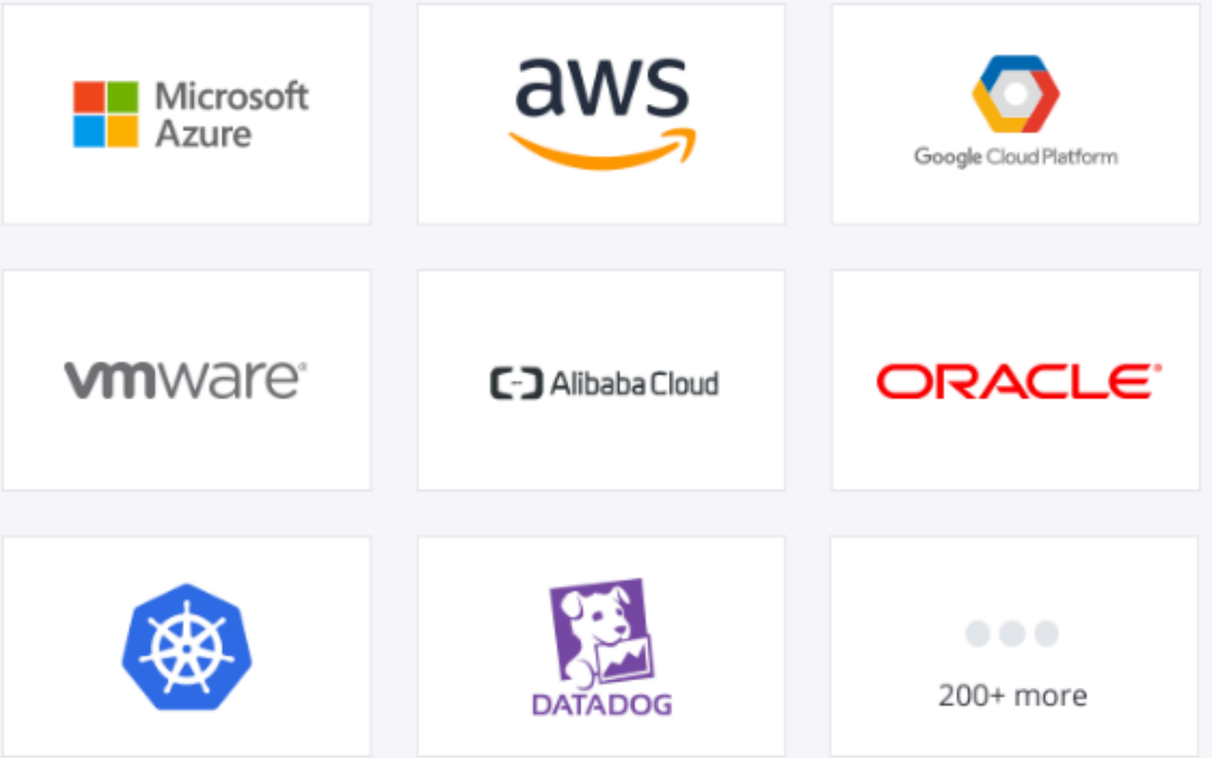
Terraform provides an elegant user experience for operators to safely and predictably make changes to infrastructure.

Create reproducible infrastructure

- Reproducible production, staging, and development environments
- Shared modules for common infrastructure patterns
- Combine multiple providers consistently

Terraform makes it easy to re-use configurations for similar infrastructure, helping you avoid mistakes and save time.

View All Providers



Modules

JUMP TO SECTION

Note: This page is about Terraform 0.12 and later. For Terraform 0.11 and earlier, see 0.11 Configuration Language: Modules.

A *module* is a container for multiple resources that are used together.

Every Terraform configuration has at least one module, known as its *root module*, which consists of the resources defined in the `.tf` files in the main working directory.

A module can call other modules, which lets you include the child module's resources into the configuration in a concise way. Modules can also be called multiple times, either within the same configuration or in separate configurations, allowing resource configurations to be packaged and re-used.

This page describes how to call one module from another. Other pages in this section of the documentation describe the different elements that make up modules, and there is further information about how modules can be used, created, and published in the dedicated *Modules* section.

Write declarative configuration files

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View All Providers

These features are very similar with [redacted]

Declarative

[redacted] makes it painless to create interactive UIs. Design simple views for each state in your application, and [redacted] will efficiently update and render just the right components when your data changes.

Declarative views make your code more predictable and easier to debug.

Component-Based

Build encapsulated components that manage their own state, then compose them to make complex UIs.

Since component logic is written in JavaScript instead of templates, you can easily pass rich data through your app and keep state out of the DOM.

Learn Once, Write Anywhere

We don't make assumptions about the rest of your technology stack, so you can develop new features in [redacted] without rewriting existing code.

[redacted] can also render on the server using Node and power mobile apps using [redacted]

These features are very similar with **React**

Declarative

React makes it painless to create interactive UIs. Design simple views for each state in your application, and React will efficiently update and render just the right components when your data changes.

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Terraform is an infrastructure provisioning tool
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*.examples of declarative

Using a Jenkinsfile

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Creating a `Jenkinsfile`, which is checked into source control [1], provides a number of immediate benefits:

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Using Helm and Kustomize to Build More Declarative Kubernetes Workloads

Argo CD - Declarative GitOps CD for Kubernetes

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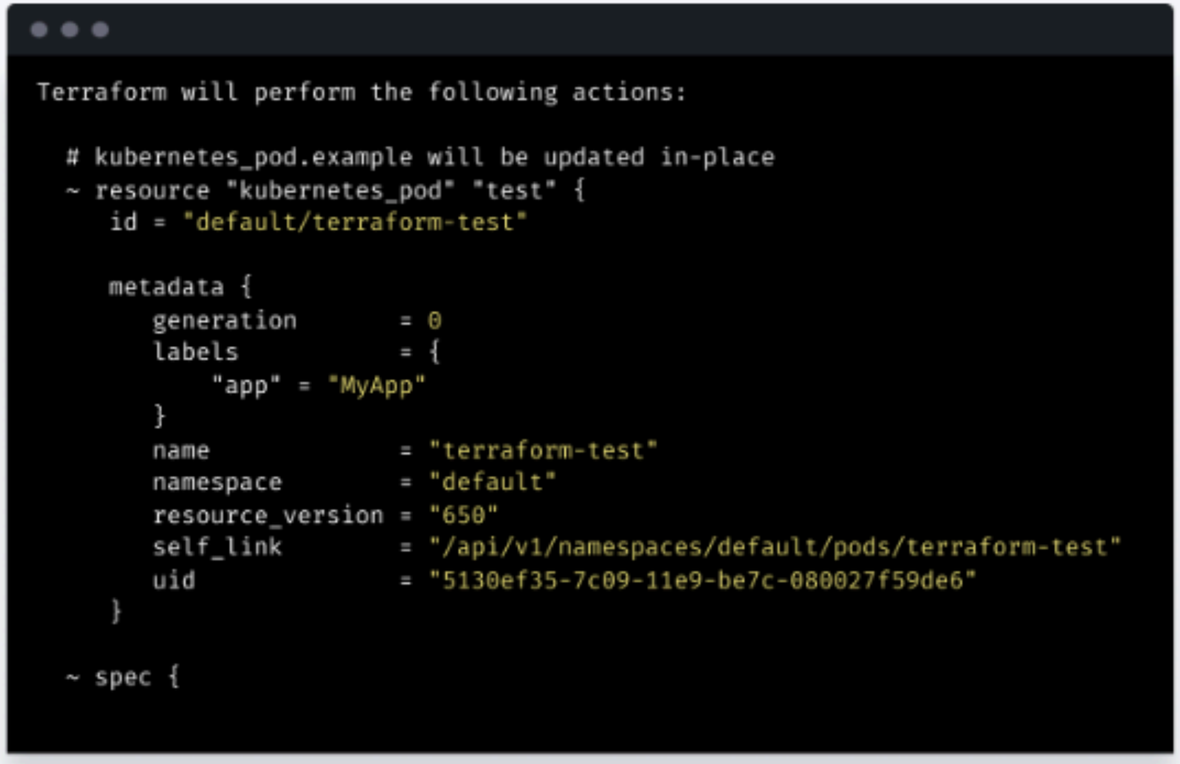

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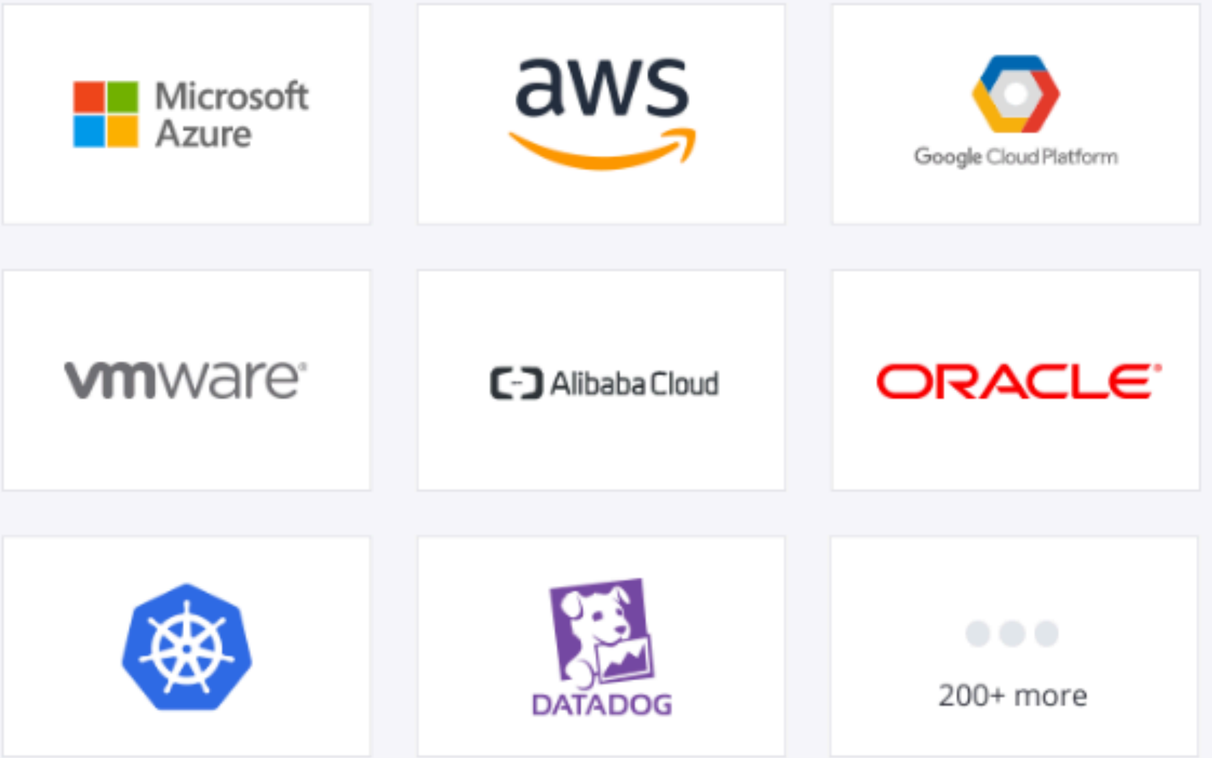

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101.3 Pros and Cons

Pros	Cons
Problem Solving w/Engineer's way	High Entry Barrier (Especially, non-coder)
Reusable Resources	Everyone Should do Terraform
Productivity	Difficult to design
Reduce Human Error	Difficult to train

101.4 Providers

major cloud

major cloud

VCS

Infrastructure Software

Monitoring & System Management

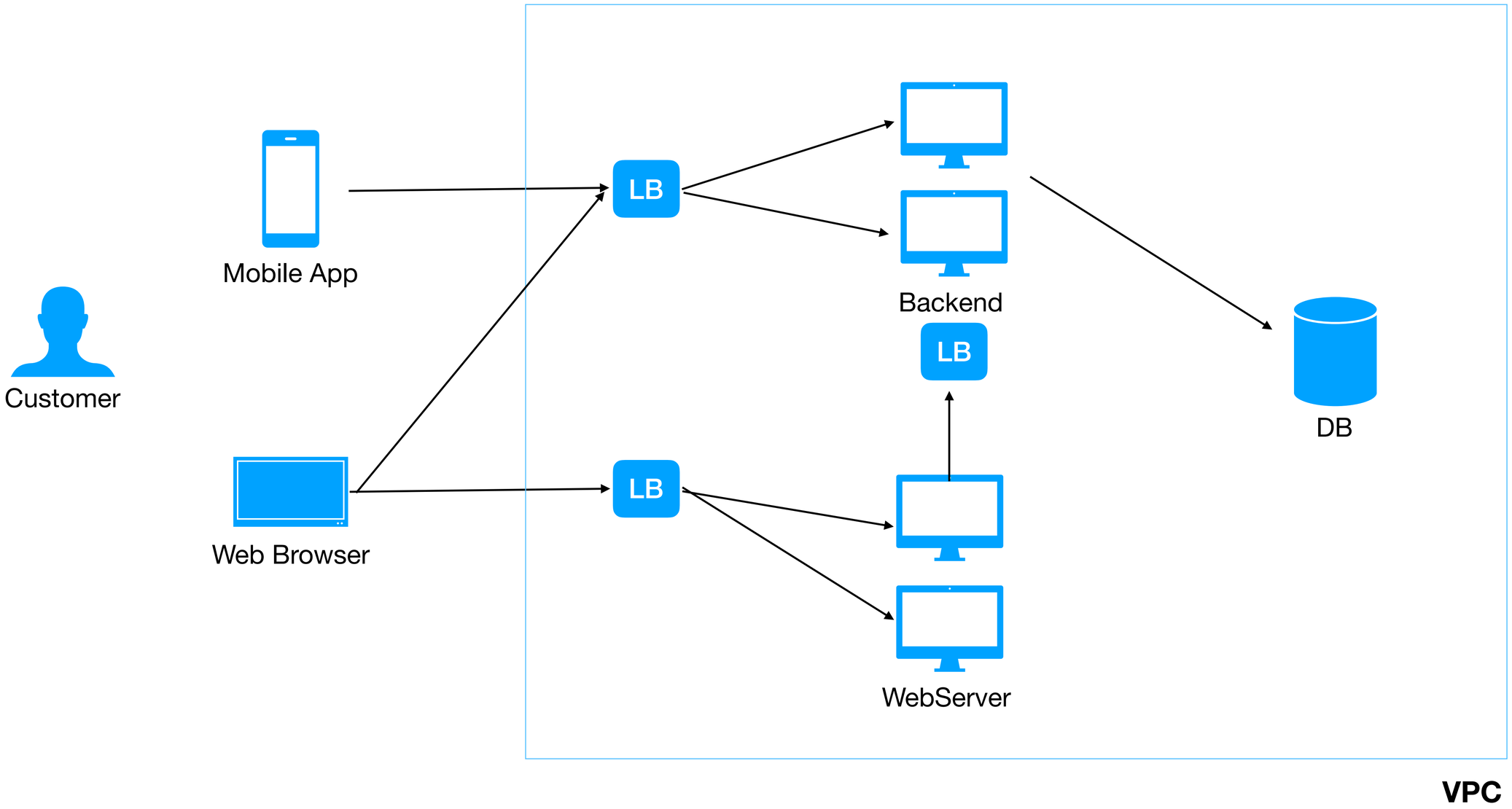
Community

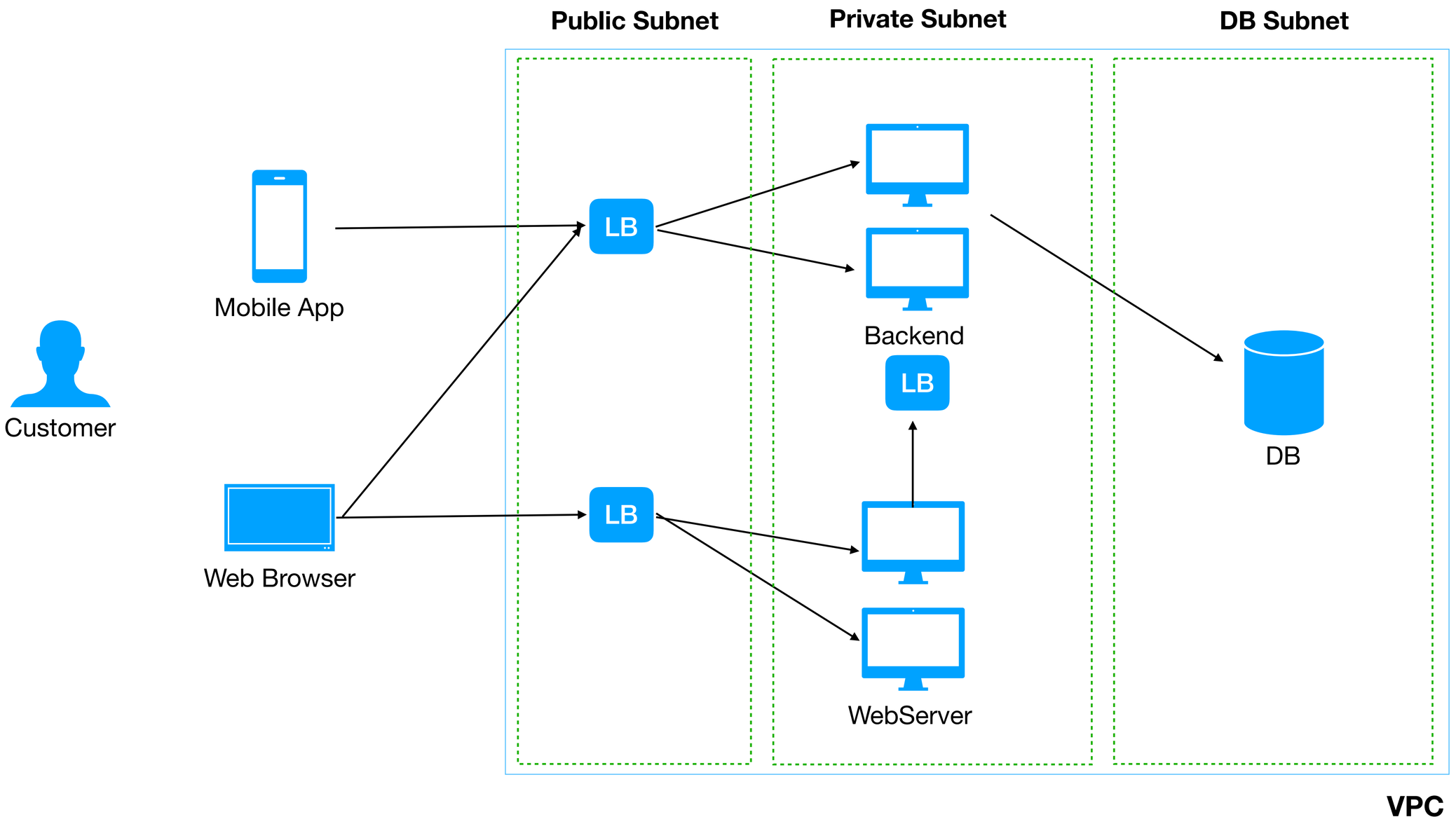
- 1Password
- Abiquo
- Active Directory - adlerrobert
- Active Directory - GSLabDev
- Aiven
- AlienVault
- AnsibleVault
- Apigee
- Artifactory
- Auth
- Citrix ADC
- Cloud Foundry
- CloudAMQP
- CloudKarafka
- CloudMQTT
- CloudPassage Halo
- CodeClimate
- Confidant
- Confluent Cloud
- Foreman
- Gandi
- Generic Rest API
- Git
- GitHub Code Owners
- GitHub File
- GitInfo
- Glue
- GoCD
- Google Calendar
- Jira (Extended)
- JumpCloud
- Kafka
- Kafka Connect
- Keboola
- Keycloak
- Keyring
- Kibana
- Kong
- OpenvCloud
- oVirt
- Pass
- PHPIPAM
- Pingdom
- Pivotal Tracker
- Proxmox
- Puppet CA
- PuppetDB
- Purestorage Flasharray
- Sewan
- Shell
- Smartronix
- Snowflake
- snowflakedb
- sops
- Spinnaker
- SQL
- Stateful
- Auth0
- Automic Continuous Delivery
- AVI
- Aviatrix
- AWX
- Azure Devops
- Bitbucket Server
- Centreon
- Checkly
- Cherry Servers
- Databricks
- Dead Man's Snitch
- Digital Rebar
- Docker Machine
- Drone
- Dropbox
- Duo Security
- EfficientIP
- Elastic Cloud Enterprise (ECE)
- Elasticsearch
- Google G Suite
- GorillaStack
- Hiera
- HPE OneView
- HTTP File Upload
- IBM Cloud
- IIJ GIO
- Infoblox
- InsightOPS
- Jira
- Manifold
- Matchbox
- MongoDB Atlas
- Nagios XI
- Name
- Nelson
- NetApp
- NSX-V
- Okta
- QingCloud
- Qiniu
- Redshift
- RKE
- Rollbar
- SakuraCloud
- SCVMM
- Sendgrid
- Sensu
- Sentry
- Updown.io
- Uptimerobot
- Vaulted
- Venafi
- vRealize Automation
- Vultr
- Wavefront
- Win DNS
- XML

Code For Everything

Not only for the infrastructure

101.5 Basic Infrastructure


Customer
Mobile App
Web Browser
LB
LB
Backend
LB
WebServer
DB
VPC


Public Subnet
Private Subnet
DB Subnet
Mobile App
Customer
Web Browser
LB
LB
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Backend
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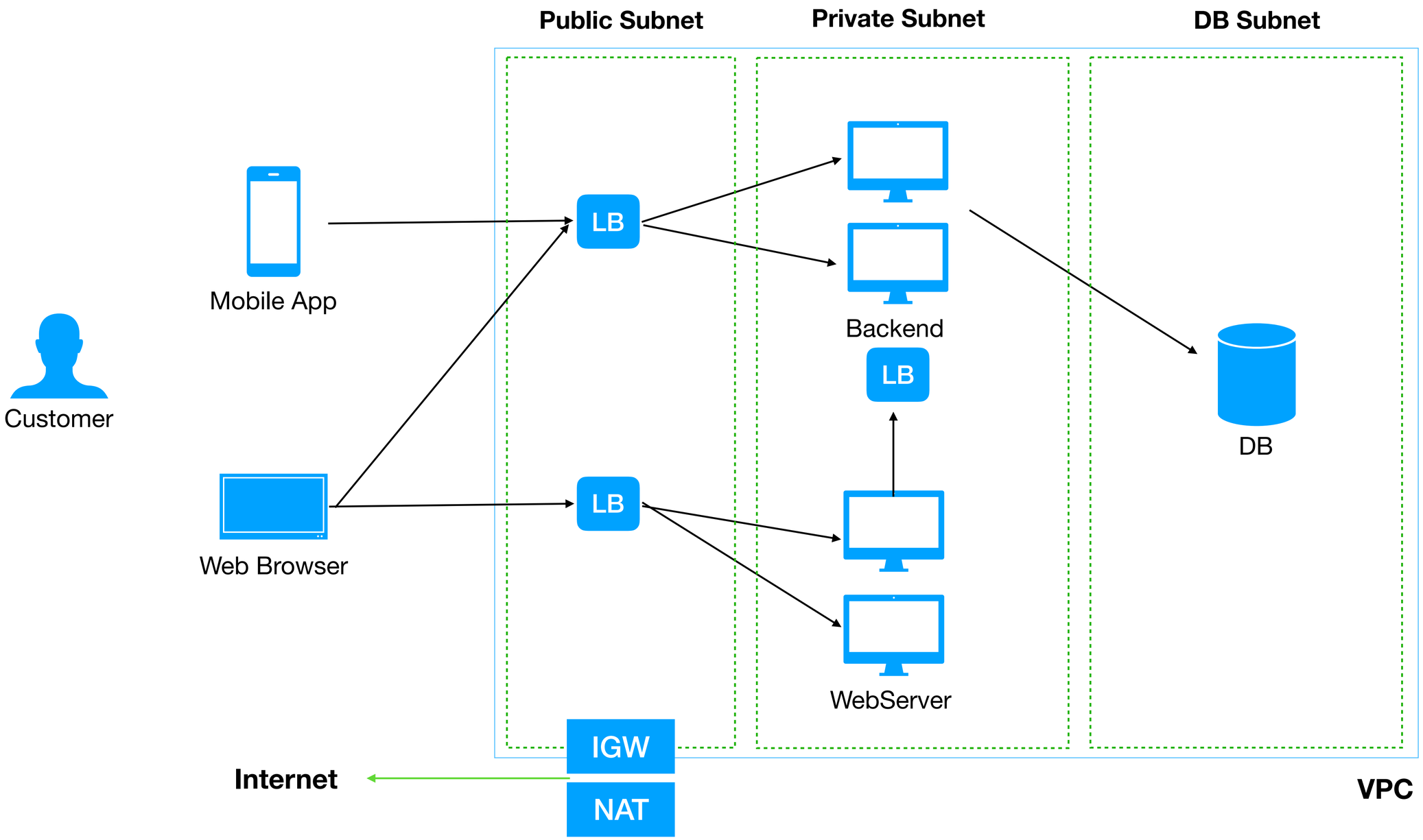
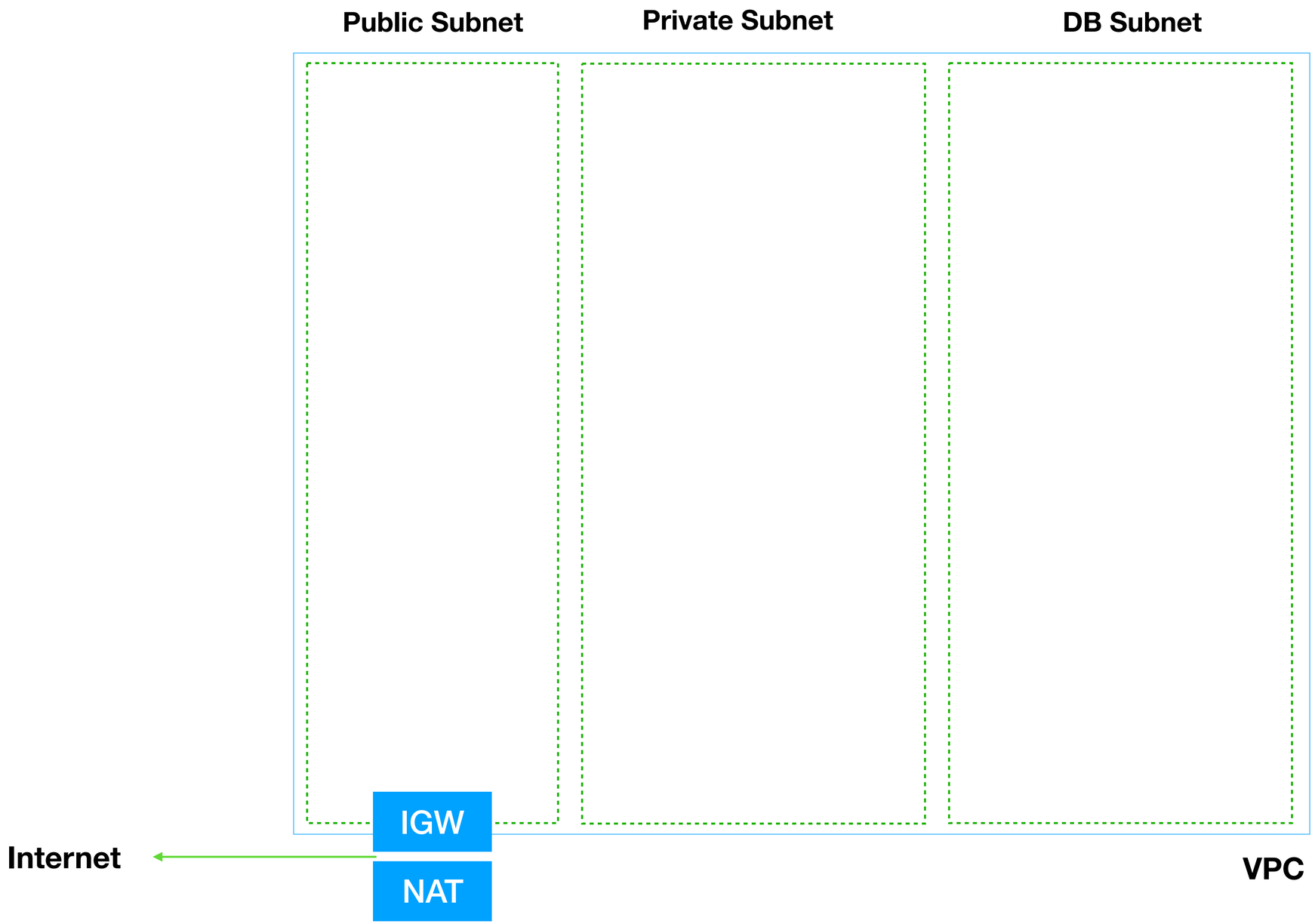

Public Subnet
Private Subnet
DB Subnet
Mobile App
Customer
Web Browser
LB
LB
LB
Backend
WebServer
DB
IGW
NAT
Internet
VPC

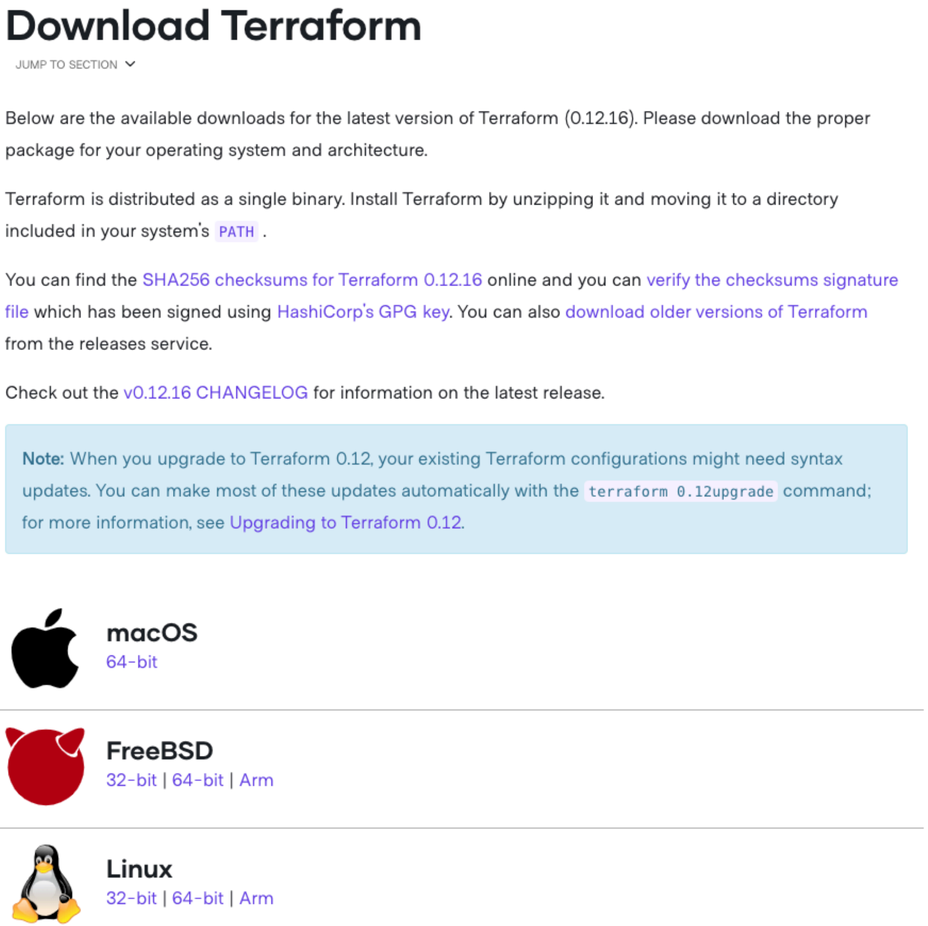
101.6 Getting Started

DEMO


Public Subnet
Private Subnet
DB Subnet
IGW
NAT
Internet
VPC

Terraform Install

https://www.terraform.io/downloads.html



After download the package,

```
$ mv terraform terraform_v0.12.0
$ mv terraform_v0.12.0 /usr/local/bin/terraform_v0.12.0
$ ln -s /usr/local/bin/terraform_v0.12.0 /usr/local/bin/tf
```

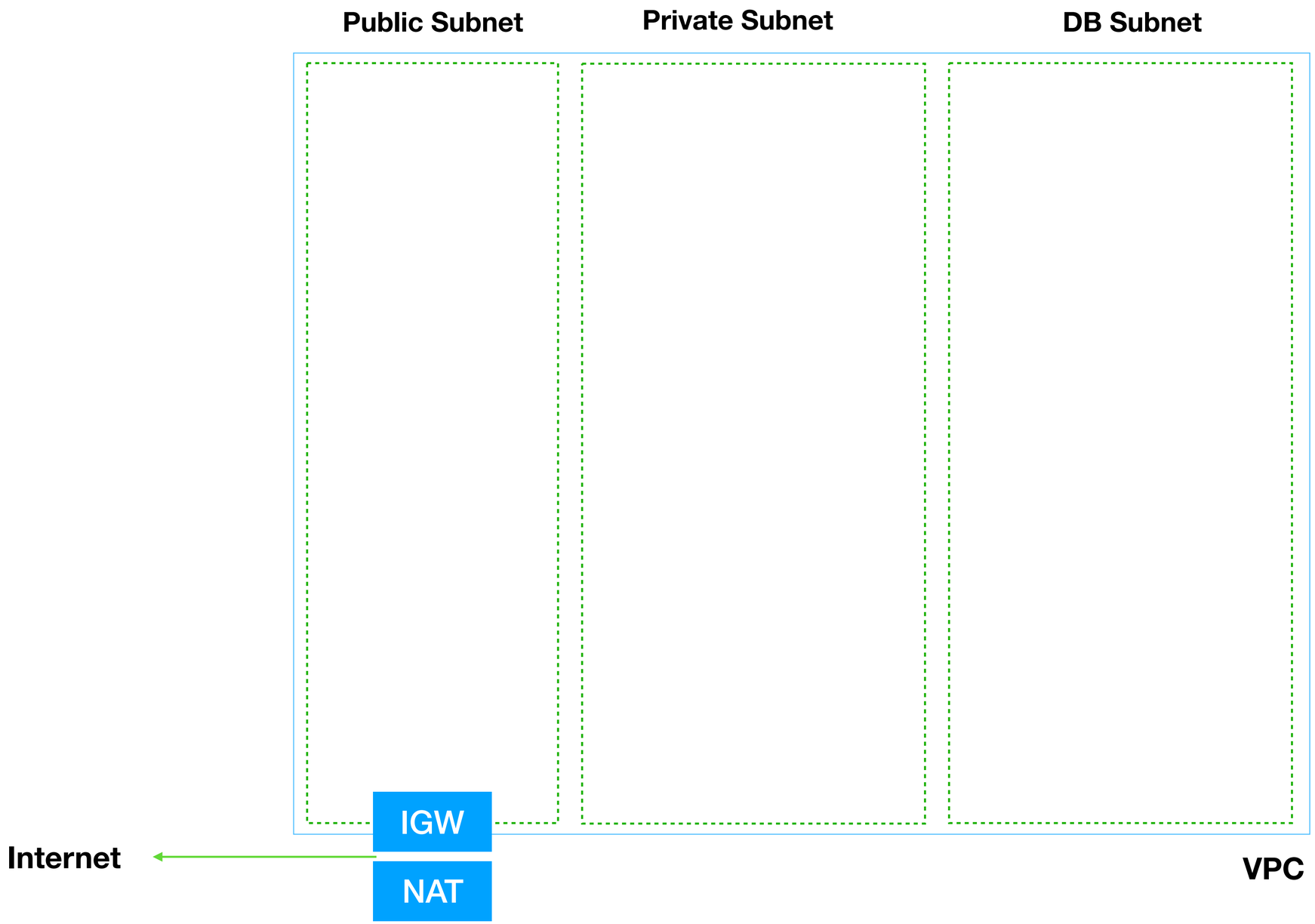
HCL(Hashicorp Configuration Language)

1. Providers
2. Resources
3. Input Variables. (TBD)
4. Output Values. (TBD)
5. Local Values
6. Modules. (TBD)
7. Data Sources (TBD)
8. Functions(Interpolation). (TBD)
9. State (TBD)
10. Backend (TBD)

Commands

1. Init
2. plan (w/target)
3. apply
4. destroy

DEMO


Public Subnet
Private Subnet
DB Subnet
IGW
NAT
Internet
VPC

DEMO

1. AWS Programmable Key Creation

AWS Admin Console -> User -> Security Credentials -> Access Keys -> Create access key

2. AWS Profile Setup

$ vi ~/.aws/credentials

```
[dev]
aws_access_key_id={{ access_key }}
aws_secret_access_key={{ secret_access_key }}
```

DEMO

3. TF Demo Folder Creation

4. aws.tf file creation

5. Search “terraform was provider” in Google

Provider: AWS - Terraform by HashiCorp
https://www.terraform.io › docs › providers › aws ▾

Example Usage

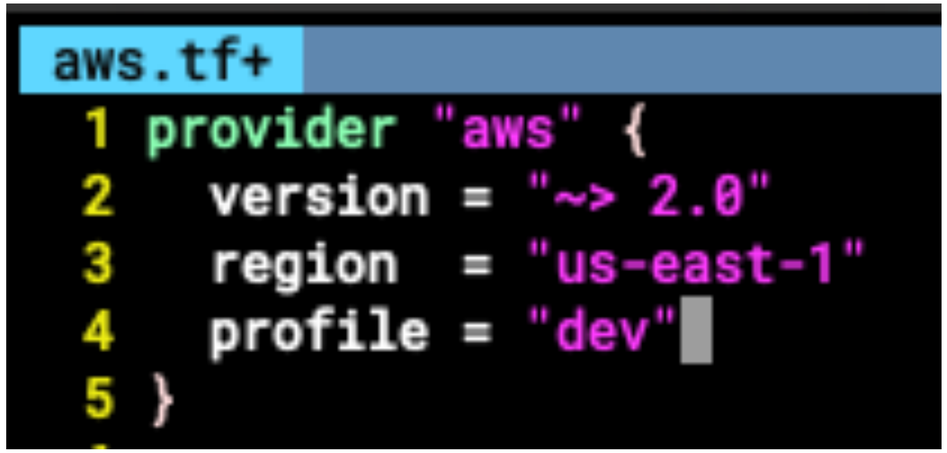
```
# Configure the AWS Provider
provider "aws" {
  version = "~> 2.0"
  region  = "us-east-1"
}

# Create a VPC
resource "aws_vpc" "example" {
  cidr_block = "10.0.0.0/16"
}
```

DEMO

6. Copy & Paste

7. Add profile = “dev"



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}
```

DEMO

8. “tf init”

```
➜  tf-demo tf init

Initializing the backend...

Initializing provider plugins...
- Checking for available provider plugins...
- Downloading plugin for provider "aws" (hashicorp/aws) 2.40.0...

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform pla
any changes that are required for your infrastructure. All Terraform
should now work.

If you ever set or change modules or backend configuration for Terra
rerun this command to reinitialize your working directory. If you fo
commands will detect it and remind you to do so if necessary.
```

DEMO

9. Search “terraform aws vpc” in google

VPC - AWS: aws_vpc - Terraform by HashiCorp
https://www.terraform.io › docs › providers › aws › vpc
cidr_block - (Required) The CIDR block for the **VPC**. instance_tenancy - (Optional) option for instances launched into the **VPC**; enable_dns_support ...
» · » Example Usage; » · » Argument Reference; » · » Attributes Reference; »

Example Usage

Basic usage:

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

Basic usage with tags:

```
resource "aws_vpc" "main" {
  cidr_block       = "10.0.0.0/16"
  instance_tenancy = "dedicated"

  tags = {
    Name = "main"
  }
}
```

DEMO

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VPC - AWS: aws_vpc - Terraform by HashiCorp
https://www.terraform.io › docs › providers › aws › vpc
cidr_block - (Required) The CIDR block for the **VPC**. instance_tenancy - (Optional) option for instances launched into the **VPC**; enable_dns_support ...
» · » Example Usage; » · » Argument Reference; » · » Attributes Reference; »

Argument Reference

The following arguments are supported:

- `cidr_block` – (Required) The CIDR block for the VPC.
- `instance_tenancy` – (Optional) A tenancy option for instances laun
- `enable_dns_support` – (Optional) A boolean flag to enable/disable
- `enable_dns_hostnames` – (Optional) A boolean flag to enable/disab Defaults false.
- `enable_classiclink` – (Optional) A boolean flag to enable/disable regions and accounts that support EC2 Classic. See the ClassicLink Defaults false.
- `enable_classiclink_dns_support` – (Optional) A boolean flag to en for the VPC. Only valid in regions and accounts that support EC2 Cl
- `assign_generated_ipv6_cidr_block` – (Optional) Requests an Ama /56 prefix length for the VPC. You cannot specify the range of IP ac Default is `false`.
- `tags` – (Optional) A mapping of tags to assign to the resource.

DEMO

9. Search “terraform aws vpc” in google

VPC - AWS: aws_vpc - Terraform by HashiCorp
https://www.terraform.io › docs › providers › aws › vpc
cidr_block - (Required) The CIDR block for the **VPC**. instance_tenancy - (Optional) option for instances launched into the **VPC**; enable_dns_support ...
» · » Example Usage; » · » Argument Reference; » · » Attributes Reference; »

Attributes Reference

In addition to all arguments above, the following attribute

- `arn` - Amazon Resource Name (ARN) of VPC
- `id` - The ID of the VPC
- `cidr_block` - The CIDR block of the VPC
- `instance_tenancy` - Tenancy of instances spin up w
- `enable_dns_support` - Whether or not the VPC has
- `enable_dns_hostnames` - Whether or not the VPC ha
- `enable_classiclink` - Whether or not the VPC has
- `main_route_table_id` - The ID of the main route tab change a VPC's main route table by using an `aws_m`
- `default_network_acl_id` - The ID of the network AC
- `default_security_group_id` - The ID of the security
- `default_route_table_id` - The ID of the route table
- `ipv6_association_id` - The association ID for the IP

DEMO

10. create “vpc.tf” file

vpc.tf+

```
1 resource "aws_vpc" "main" {
2   cidr_block       = "10.0.0.0/16"
3   instance_tenancy = "dedicated"
4
5   tags = {
6     Name = "main"
7   }
8 }
```

DEMO

11. Execute “tf plan”

```
→  tf-demo tf plan
Refreshing Terraform state in-memory prior to plan...
The refreshed state will be used to calculate this plan, but will not
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:

  # aws_vpc.main will be created
  + resource "aws_vpc" "main" {
      + arn                              = (known after apply)
      + assign_generated_ipv6_cidr_block = false
      + cidr_block                       = "10.0.0.0/16"
      + default_network_acl_id           = (known after apply)
      + default_route_table_id           = (known after apply)
      + default_security_group_id        = (known after apply)
      + dhcp_options_id                  = (known after apply)
      + enable_classiclink               = (known after apply)
      + enable_classiclink_dns_support   = (known after apply)
      + enable_dns_hostnames             = (known after apply)
      + enable_dns_support               = true
      + id                               = (known after apply)
      + instance_tenancy                 = "dedicated"
```

DEMO

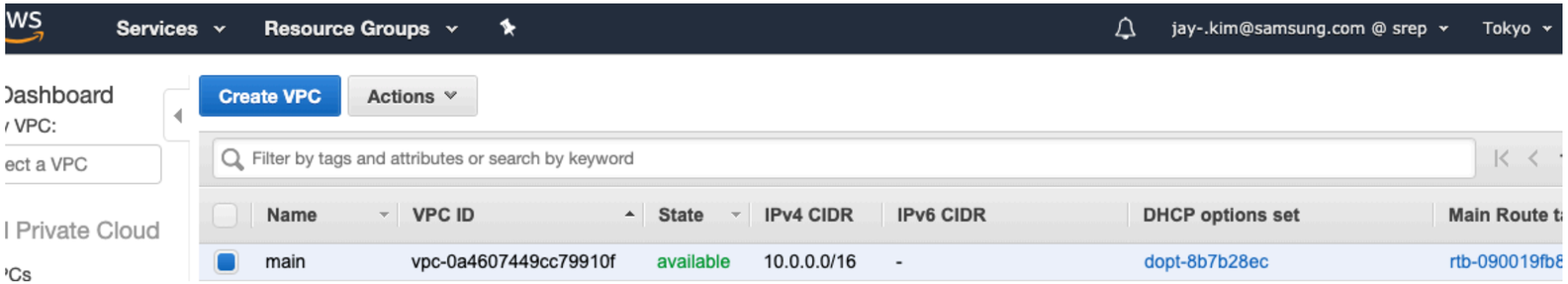
11. Execute “tf apply”

```
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
```

12. Checking “VPC Creation” in AWS Console



DEMO

13. Change “Name” Tag Value & “tf plan” & “tf apply”

14. Checking the “VPC Name Change” on AWS Console

15. Add “local” variable

vpc.tf+

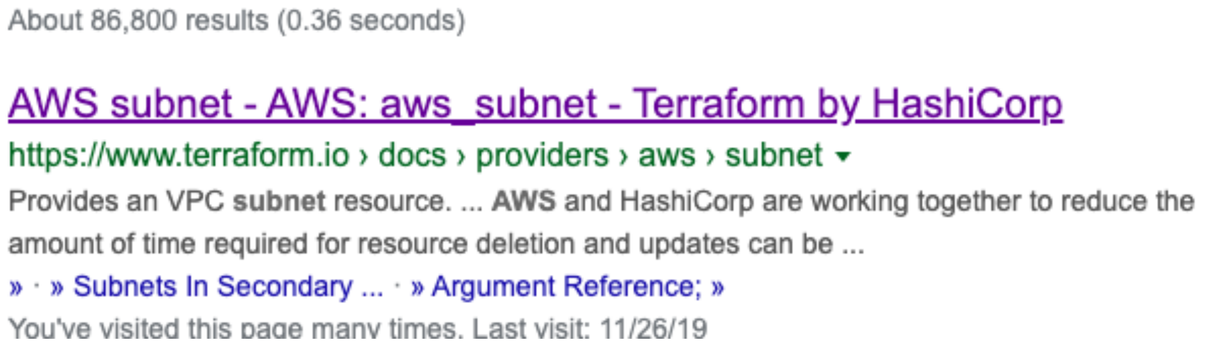
```
locals {
  name = "Terraform Testing"
  cidr_block    = "10.0.0.0/16"
  app_name      = "suite"
}

resource "aws_vpc" "main" {
  cidr_block       = local.cidr_block
  instance_tenancy = "dedicated"

  tags = {
    Name = "${local.app_name} ${local.name}"
  }
}
```

DEMO

16. Search “terraform aws subnet”



17.Add “aws_subnet” “private”, “public”, “db” with cidrs

vpc.tf+

```
locals {
  name = "Terraform Testing"
  cidr_block    = "10.0.0.0/16"
  app_name      = "suite"
  tag_name      = "${local.app_name} ${local.name}"
}
```

DEMO

17.Add “aws_subnet” “private”, “public”, “db” with cidrs

vpc.tf+

```
locals {
  name = "Terraform Testing"
  cidr_block     = "10.0.0.0/16"
  app_name       = "suite"
  tag_name       = "${local.app_name} ${local.name}"
}
```

* Interpolation Warning

Terraform Version < 0.12.x

${aws_vpc.main.id}

Terraform Version > 0.12.x

aws_vpc.main.id

18.plan / apply

```
18 resource "aws_subnet" "private" {
19   vpc_id     = aws_vpc.main.id
20   cidr_block = "10.0.1.0/24"
21
22   tags = {
23     Name = local.tag_name
24   }
25 }
26
27 resource "aws_subnet" "public" {
28   vpc_id     = aws_vpc.main.id
29   cidr_block = "10.0.2.0/24"
30
31   tags = {
32     Name = local.tag_name
33   }
34 }
35
36 resource "aws_subnet" "db" {
37   vpc_id     = aws_vpc.main.id
38   cidr_block = "10.0.3.0/24"
39
40   tags = {
41     Name = local.tag_name
42   }
43 }
```

DEMO

19. igw, route table, nat, nat_eip

```
45 resource "aws_internet_gateway" "igw" {
46   vpc_id = aws_vpc.main.id
47
48   tags = {
49     Name = local.tag_name
50   }
51 }
52
53
54 resource "aws_eip" "nat_eips" {
55   vpc    = "true"
56 }
57
58
59 resource "aws_nat_gateway" "nats" {
60   subnet_id      = aws_subnet.public.id
61   allocation_id = aws_eip.nat_eips.id
62 }
```

DEMO

19. igw, route table, nat, nat_eip

```
64 resource "aws_route_table" "private" {
65   vpc_id = aws_vpc.main.id
66
67   tags = {
68     Name = "${local.app_name} private"
69   }
70 }
71
72 resource "aws_route_table" "public" {
73   vpc_id = aws_vpc.main.id
74
75   tags = {
76     Name = "${local.app_name} public"
77   }
78 }
79
80 resource "aws_route_table" "db" {
81   vpc_id = aws_vpc.main.id
82
83   tags = {
84     Name = "${local.app_name} db"
85   }
86 }
```

```
88 resource "aws_route" "public" {
89   destination_cidr_block = "0.0.0.0/0"
90   gateway_id             = aws_internet_gateway.igw.id
91   route_table_id         = aws_route_table.public.id
92 }
93
94 resource "aws_route" "private" {
95   destination_cidr_block = "0.0.0.0/0"
96   nat_gateway_id         = aws_nat_gateway.nats.id
97   route_table_id         = aws_route_table.private.id
98 }
99
100 resource "aws_route" "db" {
101   destination_cidr_block = "0.0.0.0/0"
102   nat_gateway_id         = aws_nat_gateway.nats.id
103   route_table_id         = aws_route_table.db.id
104 }
```

```
106 resource "aws_route_table_association" "public" {
107   route_table_id = aws_route_table.public.id
108   subnet_id      = aws_subnet.public.id
109 }
110
111 resource "aws_route_table_association" "private" {
112   route_table_id = aws_route_table.private.id
113   subnet_id      = aws_subnet.private.id
114 }
115
116 resource "aws_route_table_association" "db" {
117   route_table_id = aws_route_table.db.id
118   subnet_id      = aws_subnet.db.id
119 }
```