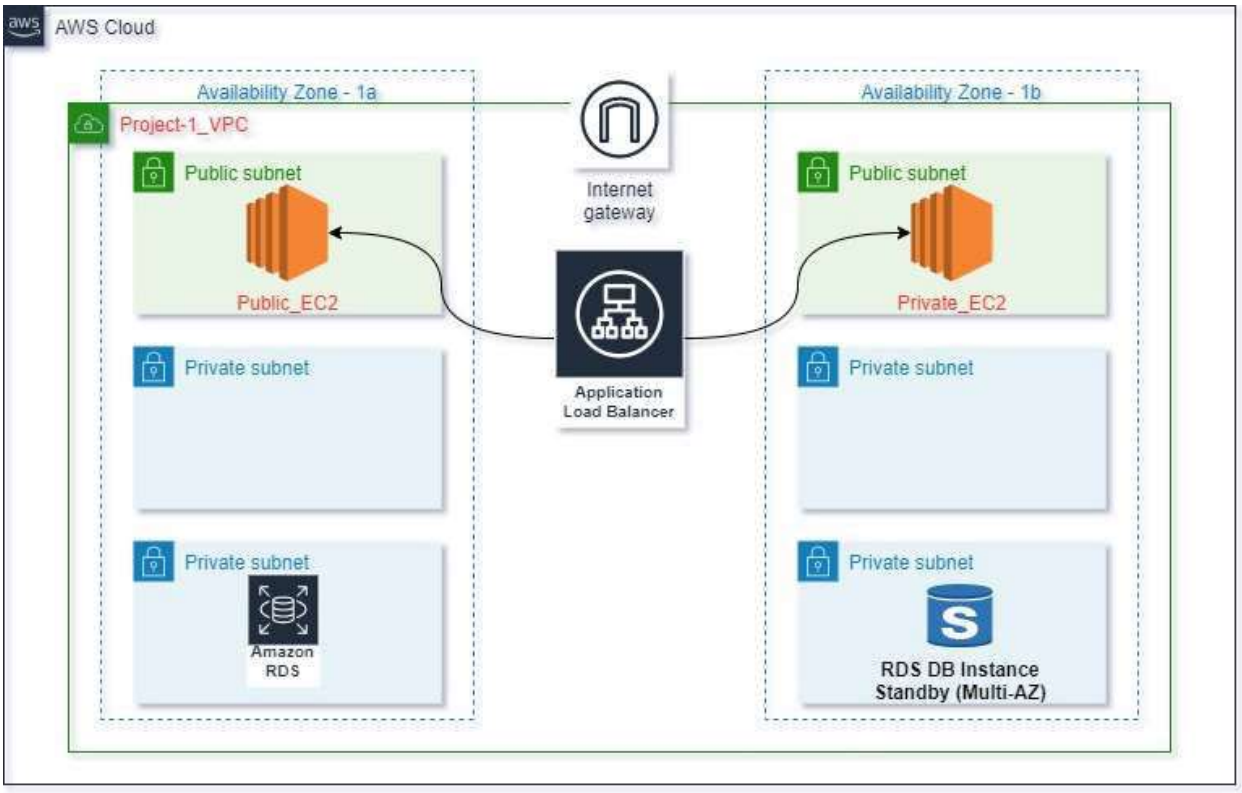
Deploy Three-Tier Architecture in AWS using Terraform

What is Terraform?

Terraform is an open-source infrastructure as a code (IAC) tool that allows to create, manage & deploy the production-ready environment. Terraform codifies cloud APIs into declarative configuration files. Terraform can manage both existing service providers and custom in-house solutions.

In this project, we will deploy a three-tier application in AWS using Terraform.



Prerequisites:

- Basic knowledge of AWS & Terraform
- AWS Account
- IAM User
- GitHub Account
- AWS Access & Secret Key

List of steps in the Pipeline:

Step 1: Create a file for the VPC

Step 2: Create a file for the Subnet

Step 3: Create a file for the Internet Gateway

Step 4: Create a file for the Route table

Step 5: Create a file for EC2 instances

Step 6: Create a file for Security Group for the Front-end tier

Step 7: Create a file for Security Group for the Database tier

Step 8: Create a file Application Load Balancer

Step 9: Create a file for the RDS instance

Step 10: Create a file for outputs

Step 11: Create a file for variable

Step 12: Create a file for user data

Step 13: Verify the resources

In this project, we will use some variables also that we will discuss here.

Step 1: Create a file for the VPC

- Create **vpc.tf** file and add the below code to it

```
# Creating VPC
resource "aws_vpc" "demovpc" {
  cidr_block       = "${var.vpc_cidr}"
  instance_tenancy = "default"
tags = {
  Name = "Demo VPC"
}
}
```

Step 2: Create a file for the Subnet

- For this project, we will create total 6 subnets for the front-end tier and back-end tier with a mixture of public & private subnet.

- Create **subnet.tf** file and add the below code to it

```
# Creating 1st web subnet
resource "aws_subnet" "public-subnet-1" {
  vpc_id                  = "${aws_vpc.demovpc.id}"
  cidr_block             = "${var.subnet_cidr}"
  map_public_ip_on_launch = true
  availability_zone = "us-east-1a"
tags = {
  Name = "Web Subnet 1"
}
}

# Creating 2nd web subnet
resource "aws_subnet" "public-subnet-2" {
  vpc_id                  = "${aws_vpc.demovpc.id}"
  cidr_block             = "${var.subnet1_cidr}"
  map_public_ip_on_launch = true
  availability_zone = "us-east-1b"
tags = {
  Name = "Web Subnet 2"
}
}

# Creating 1st application subnet
resource "aws_subnet" "application-subnet-1" {
  vpc_id                  = "${aws_vpc.demovpc.id}"
  cidr_block             = "${var.subnet2_cidr}"
  map_public_ip_on_launch = false
  availability_zone = "us-east-1a"
tags = {
  Name = "Application Subnet 1"
}
}
```

```
# Creating 2nd application subnet
resource "aws_subnet" "application-subnet-2" {
  vpc_id                  = "${aws_vpc.demovpc.id}"
  cidr_block             = "${var.subnet3_cidr}"
  map_public_ip_on_launch = false
  availability_zone = "us-east-1b"
tags = {
  Name = "Application Subnet 2"
}
}

# Create Database Private Subnet
resource "aws_subnet" "database-subnet-1" {
  vpc_id            = "${aws_vpc.demovpc.id}"
  cidr_block        = "${var.subnet4_cidr}"
  availability_zone = "us-east-1a"
tags = {
  Name = "Database Subnet 1"
}
}

# Create Database Private Subnet
resource "aws_subnet" "database-subnet-2" {
  vpc_id            = "${aws_vpc.demovpc.id}"
  cidr_block        = "${var.subnet5_cidr}"
  availability_zone = "us-east-1a"
tags = {
  Name = "Database Subnet 1"
}
}
```

Step 3: Create a file for the Internet Gateway

- Create **igw.tf** file and add the below code to it

```
# Creating Internet Gateway
resource "aws_internet_gateway" "demogateway" {
  vpc_id = "${aws_vpc.demovpc.id}"
}
```

Step 4: Create a file for the Route table

- Create **route_table_public.tf** file and add the below code to it

```
# Creating Route Table
resource "aws_route_table" "route" {
  vpc_id = "${aws_vpc.demovpc.id}"
route {
      cidr_block = "0.0.0.0/0"
      gateway_id = "${aws_internet_gateway.demogateway.id}"
  }
tags = {
      Name = "Route to internet"
  }
}
```

```
# Associating Route Table
resource "aws_route_table_association" "rt1" {
  subnet_id = "${aws_subnet.demosubnet.id}"
  route_table_id = "${aws_route_table.route.id}"
}
# Associating Route Table
resource "aws_route_table_association" "rt2" {
  subnet_id = "${aws_subnet.demosubnet1.id}"
  route_table_id = "${aws_route_table.route.id}"
}
```

- In the above code, we are creating a new route table and forwarding all the requests to the 0.0.0.0/0 CIDR block.
- we also attaching this route table to the subnet created earlier. So, it will work as the Public Subnet

Step 5: Create a file for EC2 instances

- Create **ec2.tf** file and add the below code to it

```
# Creating 1st EC2 instance in Public Subnet
resource "aws_instance" "demoinstance" {
  ami                         = "ami-087c17d1fe0178315"
  instance_type               = "t2.micro"
  count                       = 1
  key_name                    = "tests"
  vpc_security_group_ids      = ["${aws_security_group.demosg.id}"]
  subnet_id                   = "${aws_subnet.demoinstance.id}"
  associate_public_ip_address = true
  user_data                   = "${file("data.sh")}"
tags = {
  Name = "My Public Instance"
}
}

# Creating 2nd EC2 instance in Public Subnet
resource "aws_instance" "demoinstance1" {
  ami                         = "ami-087c17d1fe0178315"
  instance_type               = "t2.micro"
  count                       = 1
  key_name                    = "tests"
  vpc_security_group_ids      = ["${aws_security_group.demosg.id}"]
  subnet_id                   = "${aws_subnet.demoinstance.id}"
  associate_public_ip_address = true
  user_data                   = "${file("data.sh")}"
tags = {
  Name = "My Public Instance 2"
}
}
```

- We will use the **userdata** to configure the EC2 instance, we will discuss data.sh file later

Step 6: Create a file for Security Group for the FrontEnd tier

- Create **web_sg.tf** file and add the below code to it

```
# Creating Security Group
resource "aws_security_group" "demosg" {
  vpc_id = "${aws_vpc.demovpc.id}"

# Inbound Rules

# HTTP access from anywhere
ingress {
  from_port   = 80
  to_port     = 80
  protocol    = "tcp"
  cidr_blocks = ["0.0.0.0/0"]
}

# HTTPS access from anywhere
ingress {
  from_port   = 443
  to_port     = 443
  protocol    = "tcp"
  cidr_blocks = ["0.0.0.0/0"]
}

# SSH access from anywhere
ingress {
  from_port   = 22
  to_port     = 22
  protocol    = "tcp"
  cidr_blocks = ["0.0.0.0/0"]
}

# Outbound Rules

# Internet access to anywhere
egress {
  from_port   = 0
  to_port     = 0
  protocol    = "-1"
  cidr_blocks = ["0.0.0.0/0"]
}
tags = {
  Name = "Web SG"
}
}
```

- Here, we opened 80,443 & 22 ports for the inbound connection and we are opened all the ports for the outbound connection

Step 7: Create a file for Security Group for the Database tier

- Create **database_sg.tf** file and add the below code to it

```
# Create Database Security Group
resource "aws_security_group" "database-sg" {
  name        = "Database SG"
  description = "Allow inbound traffic from application layer"
  vpc_id      = aws_vpc.demovpc.id
ingress {
  description     = "Allow traffic from application layer"
  from_port       = 3306
  to_port         = 3306
  protocol        = "tcp"
  security_groups = [aws_security_group.demosg.id]
}
egress {
  from_port   = 32768
  to_port     = 65535
  protocol    = "tcp"
  cidr_blocks = ["0.0.0.0/0"]
}
tags = {
  Name = "Database SG"
}
}
```

- We opened 3306 ports for the inbound connection and We are opened all the ports for the outbound connection.

Step 8: Create a file Application Load Balancer

- Create **alb.tf** file and add the below code to it

```
# Creating External LoadBalancer
resource "aws_lb" "external-alb" {
  name               = "External LB"
  internal           = false
  load_balancer_type = "application"
  security_groups    = [aws_security_group.demosg.id]
  subnets            = [aws_subnet.public-subnet-1.id, aws_subnet.public-subnet-1.id]
}
resource "aws_lb_target_group" "target-elb" {
  name     = "ALB TG"
  port     = 80
  protocol = "HTTP"
  vpc_id   = aws_vpc.demovpc.id
}
resource "aws_lb_target_group_attachment" "attachment" {
  target_group_arn = aws_lb_target_group.external-alb.arn
  target_id        = aws_instance.demoinstance.id
  port             = 80
depends_on = [
  aws_instance.demoinstance,
]
}
```

```
resource "aws_lb_target_group_attachment" "attachment" {
  target_group_arn = aws_lb_target_group.external-alb.arn
  target_id        = aws_instance.demoinstance1.id
  port             = 80
depends_on = [
  aws_instance.demoinstance1,
]
}
resource "aws_lb_listener" "external-elb" {
  load_balancer_arn = aws_lb.external-alb.arn
  port              = "80"
  protocol          = "HTTP"
default_action {
  type             = "forward"
  target_group_arn = aws_lb_target_group.external-alb.arn
}
}
```

- The above load balancer is of type external
- Load balancer type is set to application
- The aws_lb_target_group_attachment resource will attach our instances to the Target Group.
- The load balancer will listen requests on port 80

Step 9: Create a file for the RDS instance

- Create a **rds.tf** file and add the below code to it

```
# Creating RDS Instance
resource "aws_db_subnet_group" "default" {
  name       = "main"
  subnet_ids = [aws_subnet.database-subnet-1.id, aws_subnet.database-subnet-1.id]
tags = {
  Name = "My DB subnet group"
}
}
resource "aws_db_instance" "default" {
  allocated_storage      = 10
  db_subnet_group_name   = aws_db_subnet_group.default.id
  engine                 = "mysql"
  engine_version         = "8.0.20"
  instance_class         = "db.t2.micro"
  multi_az               = true
  name                   = "mydb"
  username               = "username"
  password               = "password"
  skip_final_snapshot    = true
  vpc_security_group_ids = [aws_security_group.database-sg.id]
}
```

- In the above code, we need to change the value of username & password
- multi-az is set to true for the high availability

Step 10: Create a file for outputs

- Create **outputs.tf** file and add the below code to it

```
# Getting the DNS of load balancer
output "lb_dns_name" {
  description = "The DNS name of the load balancer"
  value       = "${aws_lb.external-alb.dns_name}"
}
```

- From the above code, We will get the DNS of the application load balancer.

Step 11: Create a file for variable

- Create **vars.tf** file and add the below code to it

```
# Defining CIDR Block for VPC
variable "vpc_cidr" {
  default = "10.0.0.0/16"
}

# Defining CIDR Block for 1st Subnet
variable "subnet_cidr" {
  default = "10.0.1.0/24"
}

# Defining CIDR Block for 2nd Subnet
variable "subnet1_cidr" {
  default = "10.0.2.0/24"
}

# Defining CIDR Block for 3rd Subnet
variable "subnet2_cidr" {
  default = "10.0.3.0/24"
}

# Defining CIDR Block for 3rd Subnet
variable "subnet2_cidr" {
  default = "10.0.4.0/24"
}

# Defining CIDR Block for 3rd Subnet
variable "subnet2_cidr" {
  default = "10.0.5.0/24"
}

# Defining CIDR Block for 3rd Subnet
variable "subnet2_cidr" {
  default = "10.0.6.0/24"
}
```

Step 12: Create a file for user data

- Create **data.sh** file and add the below code to it

```
#!/bin/bash
yum update -y
yum install -y httpd.x86_64
systemctl start httpd.service
systemctl enable httpd.service
echo "Hello World from $(hostname -f)" > /var/www/html/index.html
```

- The above code will install an Apache webserver in the EC2 instances

So, now our entire code is ready. We need to run the below steps to create infrastructure.

- ***terraform init*** is to initialize the working directory and downloading plugins of the provider
- ***terraform plan*** is to create the execution plan for our code
- ***terraform apply*** is to create the actual infrastructure. It will ask you to provide the Access Key and Secret Key in order to create the infrastructure. So, instead of hardcoding the Access Key and Secret Key, it is better to apply at the run time.

Step 13: Verify the resources

- Terraform will create below resources
    - VPC
    - Public & Private Subnets
    - Route Tables
    - Internet Gateway
    - EC2 instances
    - RDS instance
    - Application Load Balancer
    - Security Groups for Web & RDS instances

Once the resource creation finishes you can get the DNS of a load balancer and paste it into the browser and you can see load balancer will send the request to two instances.

That's it now, we have done the project how to create various resources in AWS using Terraform.