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Data Sources

- A data source is accessed via a special kind of resource known as a data resource, declared using a **data** block:

```
# https://registry.terraform.io/providers/hashicorp/aws/latest/docs/data-sources/availability_zones
data "aws_availability_zones" "available" {}
```

- For CLI based command:

```
aws ec2 describe-availability-zones --region us-east-1
```

- If value of the AZ is hardcoded, this is not a good practice.
- Execute **terraform console**, this command requires the details of the infra created inside the state file.

```
data.aws_availablity_zones.available
data.aws_availablity_zones.available.names
data.aws_availablity_zones.available.names[0]
exit
```

- Add network resources i.e subnets along with resource creation.

Using Count Meta Argument

- The resource block for multiple subnet creation can be added one by one, or there can be one single resource block with **count**

- Check : count
- **count.index** — The distinct index number (starting with 0)
- Add list variable types in variable declaration file.

--

```
# https://developer.hashicorp.com/terraform/language/values/variables

variable "public_cidrs" {
  type = list(string)
  default = ["172.31.3.0/24","172.31.4.0/24"]
}

variable "private_cidrs" {
  type    = list(string)
  default = ["172.31.5.0/24","172.31.6.0/24"]
}
```

```
resource "aws_subnet" "terraform_public_test_subnet" {
  count                   = 2
  //count                   = length(var.public_cidrs)
  vpc_id                  = aws_vpc.terraform_test_vpc.id
  cidr_block              = var.public_cidrs[count.index]
  map_public_ip_on_launch = true
  availability_zone       =
data.aws_availablity_zones.available.names[count.index]

  tags = {
    Name = "terraform_public_test_subnet"
  }
}
```

Launching EC2 instances inside VPC

- Current file structure can be modified as:

```
[ec2-user@ip-172-31-20-228 terraform_scripts]$ tree .
.
├── backends.tf
├── compute.tf
├── dev.tfvars
├── networking.tf
├── providers.tf
├── terraform.tfstate
├── terraform.tfstate.backup
└── variables.tf
```

- **networking.tf** : This file will contain all VPC and Networking related resource definitions.
- **compute.tf** : This file will contain all EC2 and Computing related resource definitions.
- For launching EC2 instance, there is a different AMI ID present in each region.

```
aws ec2 describe-images --image-ids IMAGE_ID --region us-east-1
```

--

- Use data source **aws_ami** to dynamically fetch the AMI Id of an Operating System

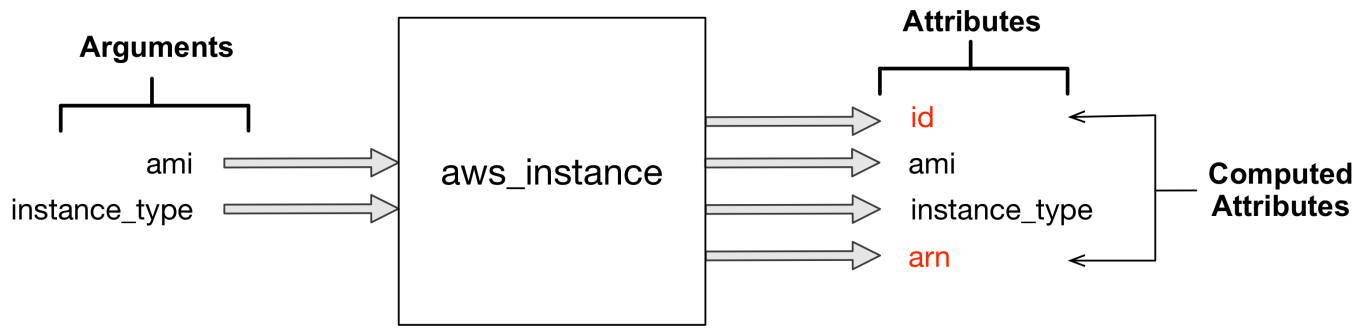
```
data "aws_ami" "server_ami" {
  most_recent = true

  owners = ["099720109477"]

  filter {
    name   = "name"
    values = ["ubuntu/images/hvm-ssd/ubuntu-focal-20.04-amd64-server-*"]
  }
}
```

--

- Use **aws_instance** as a resource type for creating an EC2 instance.



--

- Use Resource Referencing for attributes defined as below.

```
resource "aws_instance" "terraform_test_ec2" {
  count         = var.instance_count
  instance_type = var.instance_type
  ami           = data.aws_ami.server_ami.id
  key_name      = var.instance_key_name
  tags = {
    Name = "terraform_test_ec2"
  }
```

```
  vpc_security_group_ids = [aws_security_group.terraform_test_sg.id]
  subnet_id              = aws_subnet.terraform_public_test_subnet[count.index].id

  root_block_device {
    volume_size = var.vol_size
  }
}
```

Creating S3 Bucket.

- Create a new file as below for creating a S3 Bucket.
- Add Variable declaration in **variables.tf** file for bucket name and bucket acl property.
- Add the value of the same in **terraform.tfvars** file.

storage.tf

```
resource "aws_s3_bucket" "s3_bucket" {
  bucket = var.bucket_name
}

resource "aws_s3_bucket_acl" "s3_bucket_acl" {
  bucket = aws_s3_bucket.s3_bucket.id
  acl    = var.bucket_acl
}
```

Creating IAM Role and IAM Policy

- Create below .tf files as below for creating IAM Resources.

iam.tf

```
// Create a policy
//
https://registry.terraform.io/providers/hashicorp/aws/latest/docs/resources/iam_po
licy

resource "aws_iam_policy" "ec2_policy" {
  name        = "${var.cloud_env}_ec2_policy"
  path        = "/"
  description = "Policy to provide permission to EC2"
  # Terraform's "jsonencode" function converts a Terraform expression result to
valid JSON syntax.
  policy = jsonencode({
    Version = "2012-10-17"
    Statement = [
      {
```

```
        Effect = "Allow",
        Action = [
          "ec2:Describe*",
          "s3:Get*"
        ],
        Resource = "*"
      }
    ]
  })
}

// Create a role
//
https://registry.terraform.io/providers/hashicorp/aws/latest/docs/resources/iam_ro
le

resource "aws_iam_role" "ec2_access_role" {
  name               = "${var.cloud_env}_ec2_role"
  assume_role_policy = "${file("assumerolepolicy.json")}"
}

// Attach role to policy
//
https://registry.terraform.io/providers/hashicorp/aws/latest/docs/resources/iam_po
licy_attachment
resource "aws_iam_policy_attachment" "ec2_policy_role" {
  name       = "${var.cloud_env}_ec2_attachment"
  roles      = [aws_iam_role.ec2_access_role.name]
  policy_arn = aws_iam_policy.ec2_policy.arn
}

// Attach role to an instance profile
//
https://registry.terraform.io/providers/hashicorp/aws/latest/docs/resources/iam_in
stance_profile
resource "aws_iam_instance_profile" "ec2_profile" {
  name = "${var.cloud_env}_ec2_role"
  role = aws_iam_role.ec2_access_role.name
}
```

--

assumerolepolicy.tf

```
{
    "Version": "2012-10-17",
    "Statement": [
      {
        "Action": "sts:AssumeRole",
        "Principal": {
          "Service": "ec2.amazonaws.com"
```

```
        },
        "Effect": "Allow",
        "Sid": ""
      }
    ]
  }
```

> Terraform command execution environment should have access permissions to create IAM Resources in specific AWS Account.

- Add `iam_instance_profile` under compute.tf to attach this IAM Instance Profile to the EC2 instance.
- Execute the terraform plan and terraform apply command
- Validate the IAM Role, IAM Policy and IAM Trust relationship document created using above code.

Creating Multiple Environments

- Create an environment specific directory, `dev/qa/prod` and copy all TF files required for provisioning resources.
- Create **dev_tf_resources_ws**,**qa_tf_resources_ws**, **prod_tf_resources_ws** in Terraform Cloud and update the **dev/backends.tf**, **qa/backends.tf**, **prod/backends.tf** file as per workspace name.
- Modify the specific variables files i.e **.tfvars, variables.tf** as per environment specifications.
    - **dev/qa/prod** environment should be in **ap-south-1**, modify the **providers.tf** file for region specification.
    - Modify the **variables.tf** to include tags as per environment prefix.
    - Modify ec2 keypair name as per region.

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- Below will be ideal structure of all terraform Scripts.

```
├── dev
│   ├── backends.tf
│   ├── compute.tf
│   ├── dev.tfvars
│   ├── networking.tf
│   ├── providers.tf
│   └── variables.tf
├── qa
│   ├── backends.tf
│   ├── compute.tf
│   ├── qa.tfvars
│   ├── networking.tf
│   ├── providers.tf
│   └── variables.tf
├── prod
│   ├── backends.tf
│   ├── compute.tf
│   ├── prod.tfvars
│   ├── networking.tf
```

```
│   ├── providers.tf
│   └── variables.tf
```

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- Execute the **terraform init**, **terraform plan**, **terraform apply** from the specific environment directory.

```
[ec2-user@ip-172-31-20-228 terraform_scripts]$ pwd
/home/ec2-user/terraform_scripts
[ec2-user@ip-172-31-20-228 terraform_scripts]$ cd dev
[ec2-user@ip-172-31-20-228 dev]$ ls
backends.tf  compute.tf  dev.tfvars  networking.tf  providers.tf  variables.tf
[ec2-user@ip-172-31-20-228 dev]$ terraform init
[ec2-user@ip-172-31-20-228 dev]$ terraform plan

data.aws_availability_zones.available: Reading...
data.aws_ami.server_ami: Reading...
data.aws_availability_zones.available: Read complete after 0s [id=ap-south-1]
data.aws_ami.server_ami: Read complete after 0s [id=ami-0340ea71c538887c3]

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:
Plan: 17 to add, 0 to change, 0 to destroy.

[ec2-user@ip-172-31-20-228 dev]$ terraform apply --auto-approve
Plan: 17 to add, 0 to change, 0 to destroy.
aws_vpc.terraform_test_vpc: Creating...
aws_vpc.terraform_test_vpc: Still creating... [10s elapsed]
aws_vpc.terraform_test_vpc: Creation complete after 11s [id=vpc-0f3380e61f87c87d6]
aws_subnet.terraform_private_test_subnet[0]: Creating...
aws_internet_gateway.terraform_test_internet_gateway: Creating...
aws_subnet.terraform_public_test_subnet[0]: Creating...
aws_default_route_table.terraform_private_rt: Creating...
aws_route_table.terraform_public_rt: Creating...
aws_security_group.terraform_test_sg: Creating...
aws_subnet.terraform_public_test_subnet[1]: Creating...
aws_subnet.terraform_private_test_subnet[1]: Creating...
aws_default_route_table.terraform_private_rt: Creation complete after 0s [id=rtb-
07ac6cddceb1b41a1]
aws_internet_gateway.terraform_test_internet_gateway: Creation complete after 0s
[id=igw-03142eae7818d12af]
aws_route_table.terraform_public_rt: Creation complete after 0s [id=rtb-
0d7a2b55d3aedd409]
aws_route.terraform_test_route: Creating...
aws_subnet.terraform_private_test_subnet[0]: Creation complete after 0s
[id=subnet-0fe9114f4af44ee39]
aws_subnet.terraform_private_test_subnet[1]: Creation complete after 0s
```

```
[id=subnet-09369fb9540616319]
aws_route_table_association.terraform_private_subnet_association[1]: Creating...
aws_route_table_association.terraform_private_subnet_association[0]: Creating...
aws_route_table_association.terraform_private_subnet_association[0]: Creation
complete after 0s [id=rtbassoc-0a869ba078f8279bb]
aws_route_table_association.terraform_private_subnet_association[1]: Creation
complete after 0s [id=rtbassoc-090530895336b93b2]
aws_route.terraform_test_route: Creation complete after 0s [id=r-rtb-
0d7a2b55d3aedd4091080289494]
aws_security_group.terraform_test_sg: Creation complete after 1s [id=sg-
0e846c44693897ec8]
aws_security_group_rule.egress_all: Creating...
aws_security_group_rule.ingress_all: Creating...
aws_security_group_rule.ingress_all: Creation complete after 0s [id=sgrule-
3738274526]
aws_security_group_rule.egress_all: Creation complete after 1s [id=sgrule-
196345404]
aws_subnet.terraform_public_test_subnet[0]: Still creating... [10s elapsed]
aws_subnet.terraform_public_test_subnet[1]: Still creating... [10s elapsed]
aws_subnet.terraform_public_test_subnet[0]: Creation complete after 10s
[id=subnet-037fa1c9e15812346]
aws_instance.terraform_test_ec2[0]: Creating...
aws_subnet.terraform_public_test_subnet[1]: Creation complete after 10s
[id=subnet-011ec3f389244351d]
aws_route_table_association.terraform_public_subnet_association[0]: Creating...
aws_route_table_association.terraform_public_subnet_association[1]: Creating...
aws_route_table_association.terraform_public_subnet_association[0]: Creation
complete after 1s [id=rtbassoc-037be55db3bb8d313]
aws_route_table_association.terraform_public_subnet_association[1]: Creation
complete after 1s [id=rtbassoc-041092aa10d7f5f61]
aws_instance.terraform_test_ec2[0]: Still creating... [10s elapsed]
aws_instance.terraform_test_ec2[0]: Still creating... [20s elapsed]
aws_instance.terraform_test_ec2[0]: Still creating... [30s elapsed]
aws_instance.terraform_test_ec2[0]: Creation complete after 31s [id=i-
0e5f3aceb1a6765ac]
Releasing state lock. This may take a few moments...

Apply complete! Resources: 17 added, 0 changed, 0 destroyed.

# Validate all the above resources in AWS Environment.
# Navigate to AWS Account for validating the resource created by Terraform.
```

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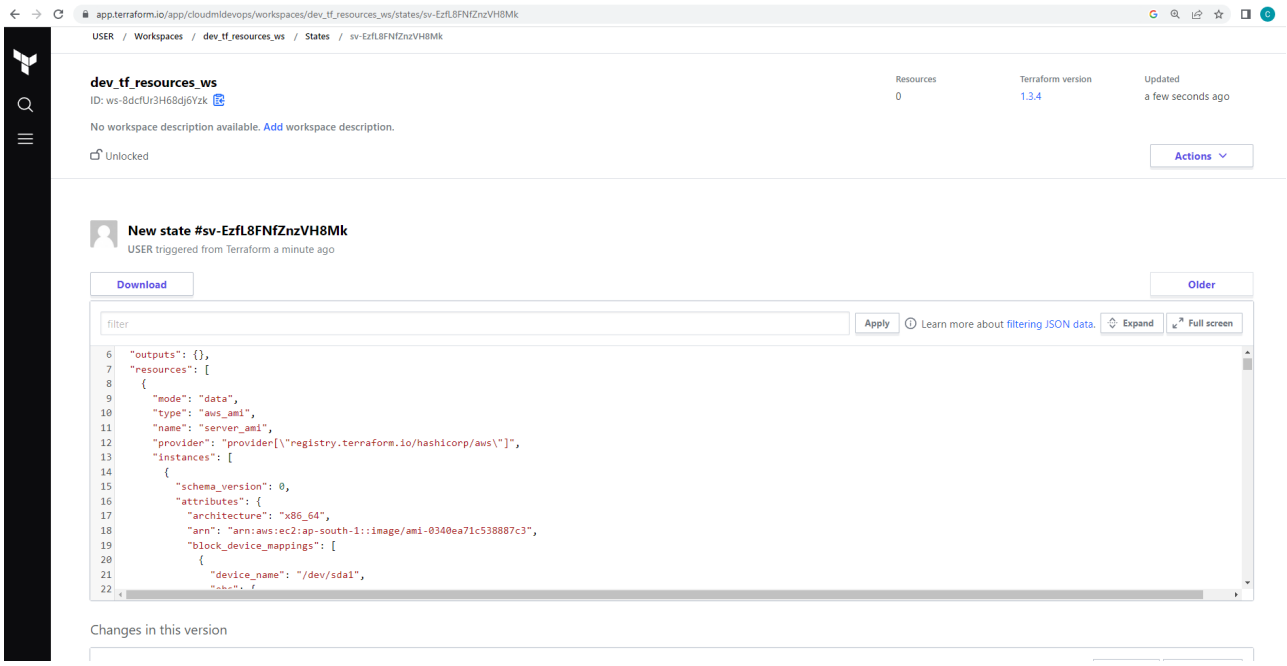
- Validate the state file in Terraform Cloud under the specific Workspace



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Changes in Multiple Environments

- Ideal steps for changing any configuration:
    - modify the dev/networking.tf -> terraform apply -> validate the create/update/destroy in console in dev environment
    - modify the qa/networking.tf -> terraform apply -> validate the create/update/destroy in console in qa environment
    - modify the prod/networking.tf -> terraform apply -> validate the create/update/destroy in console in prod environment

> Changes in the **prod** will not be done directly, changes has to be tested in lower environment first

Destroy Environments after testing

- Since there are multiple environments created, if you do not need the resources and don't want any cost implications, after trying resource creation for multiple environments, execute the **terraform destroy** command for each folder to destroy all resources.

Terraform Usage

- how-we-use-terraform-at-slack