Atgen

Terraform

Enablement Workshop

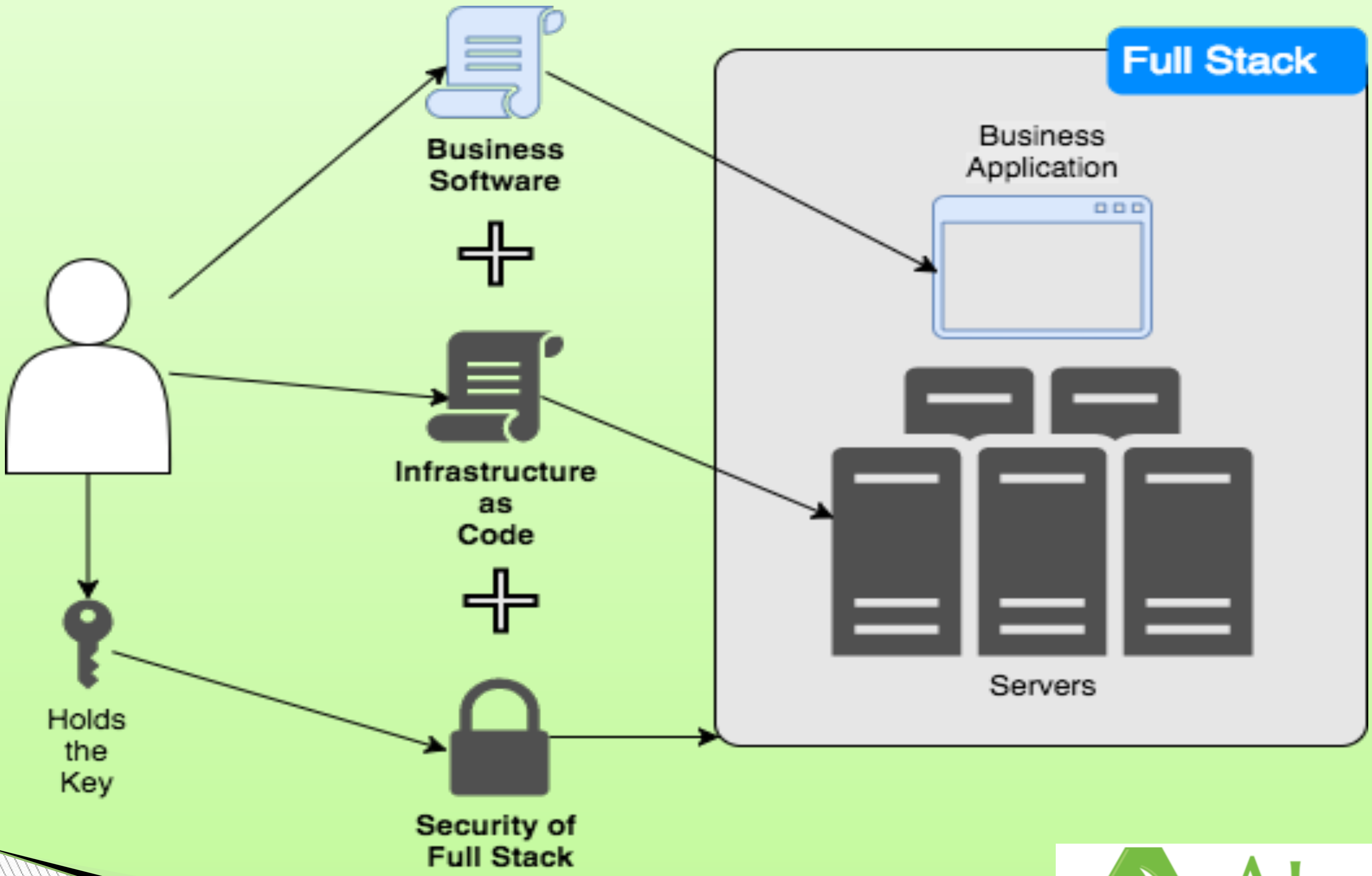
Agenda

- What is IaC?
- DevOps – Terraform
- Terraform Setup
- Terraform Configurations
- Terraform Conditional Statements
- Terraform – Templates/Modules
- Terraform - Utility Resources
- CI/CD - Terraform Cloud

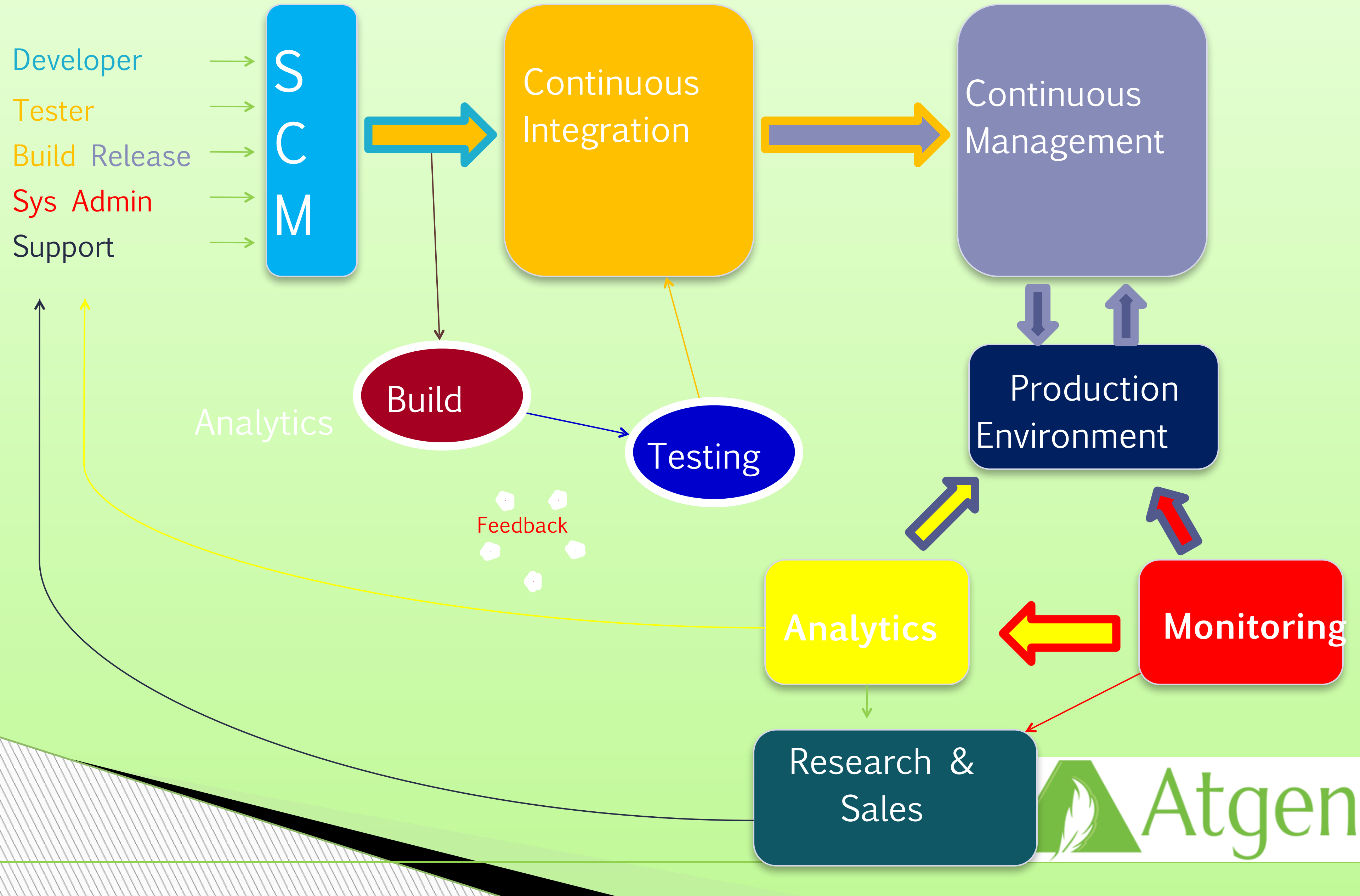
Session: 1

Infrastructure as Code

What is Business Service?



What is DevOps?



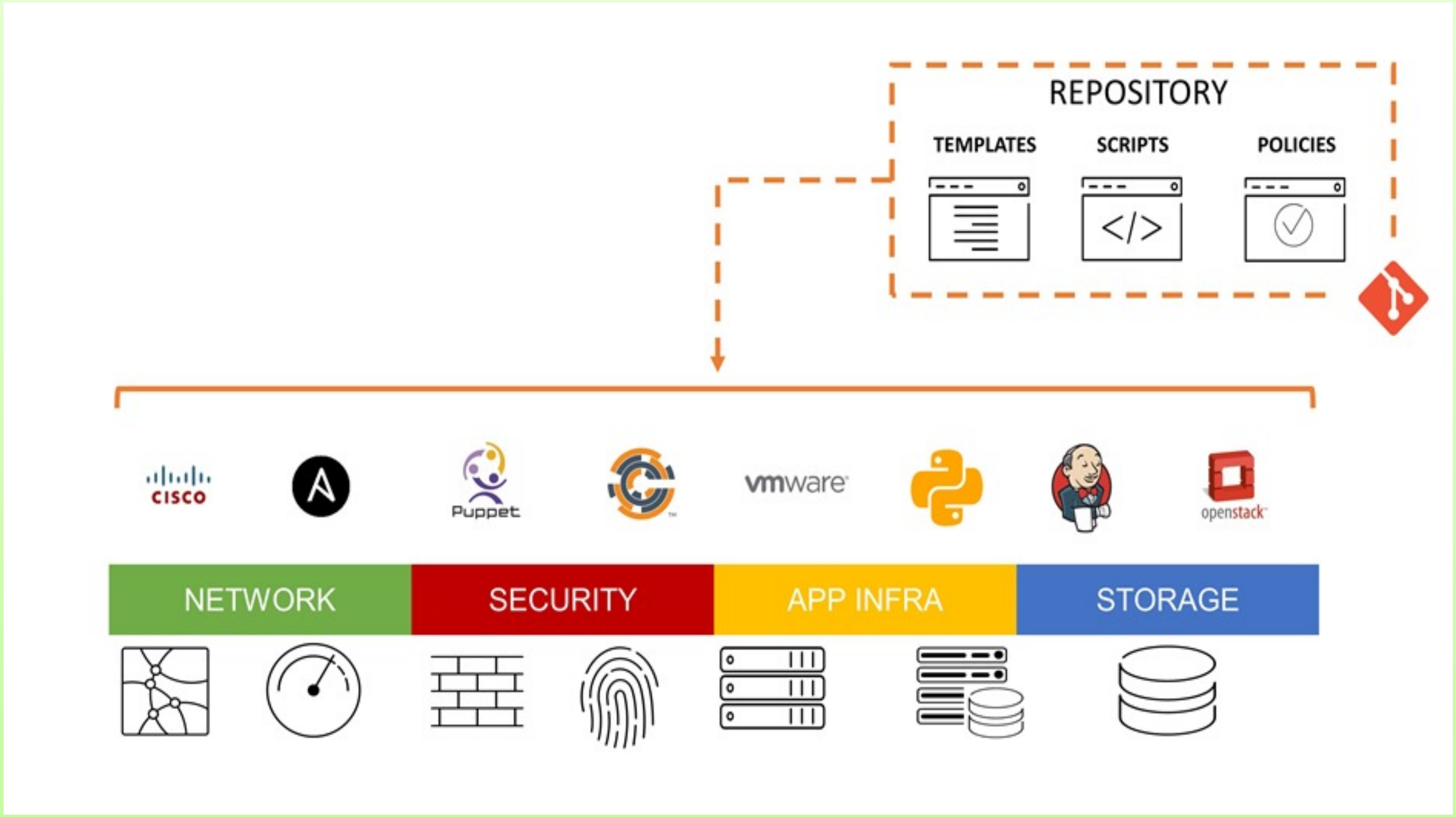
What is IaC?

- Infrastructure as code, also referred to as IaC, is a type of IT setup wherein developers or operations teams automatically manage and provision the technology stack for an application through software, rather than using a manual process to configure discrete hardware devices and operating systems.
- Infrastructure as code is sometimes referred to as programmable or software-defined infrastructure.
- The concept of infrastructure as code is similar to programming scripts, which are used to automate IT processes. However, scripts are primarily used to automate a series of static steps that must be repeated numerous times across multiple servers.

What is IaC?

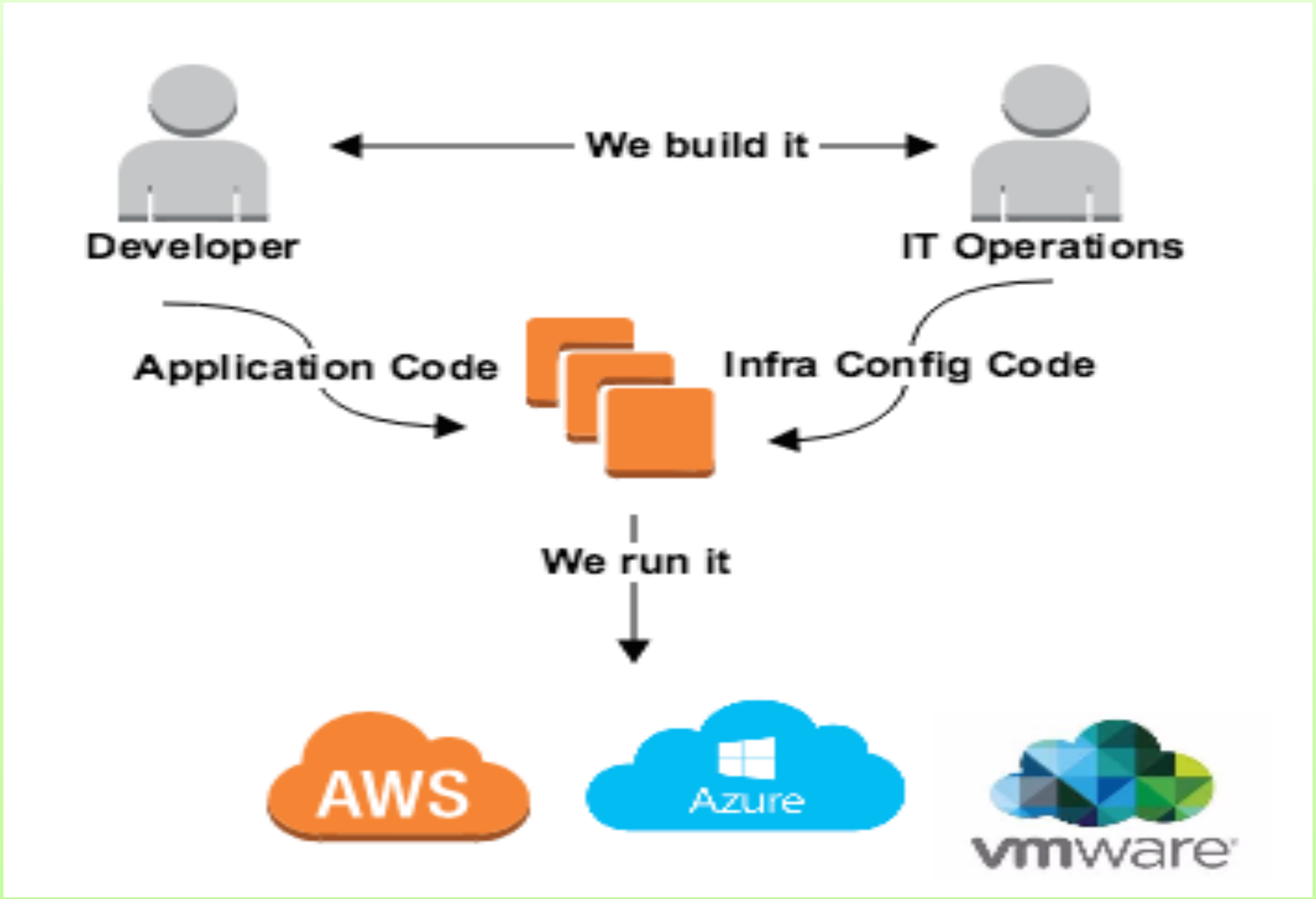
- Infrastructure as code uses higher-level or descriptive language to code more versatile and adaptive provisioning and deployment processes. For example, infrastructure-as-code capabilities included with Terraform, an IT management and configuration tool, can install WebServer, verify that WebServer is running properly, create a user account and password.
- The code-based infrastructure automation process closely resembles software design practices in which developers carefully control code versions, test iterations, and limit deployment until the software is proven and approved for production.

What is IaC?

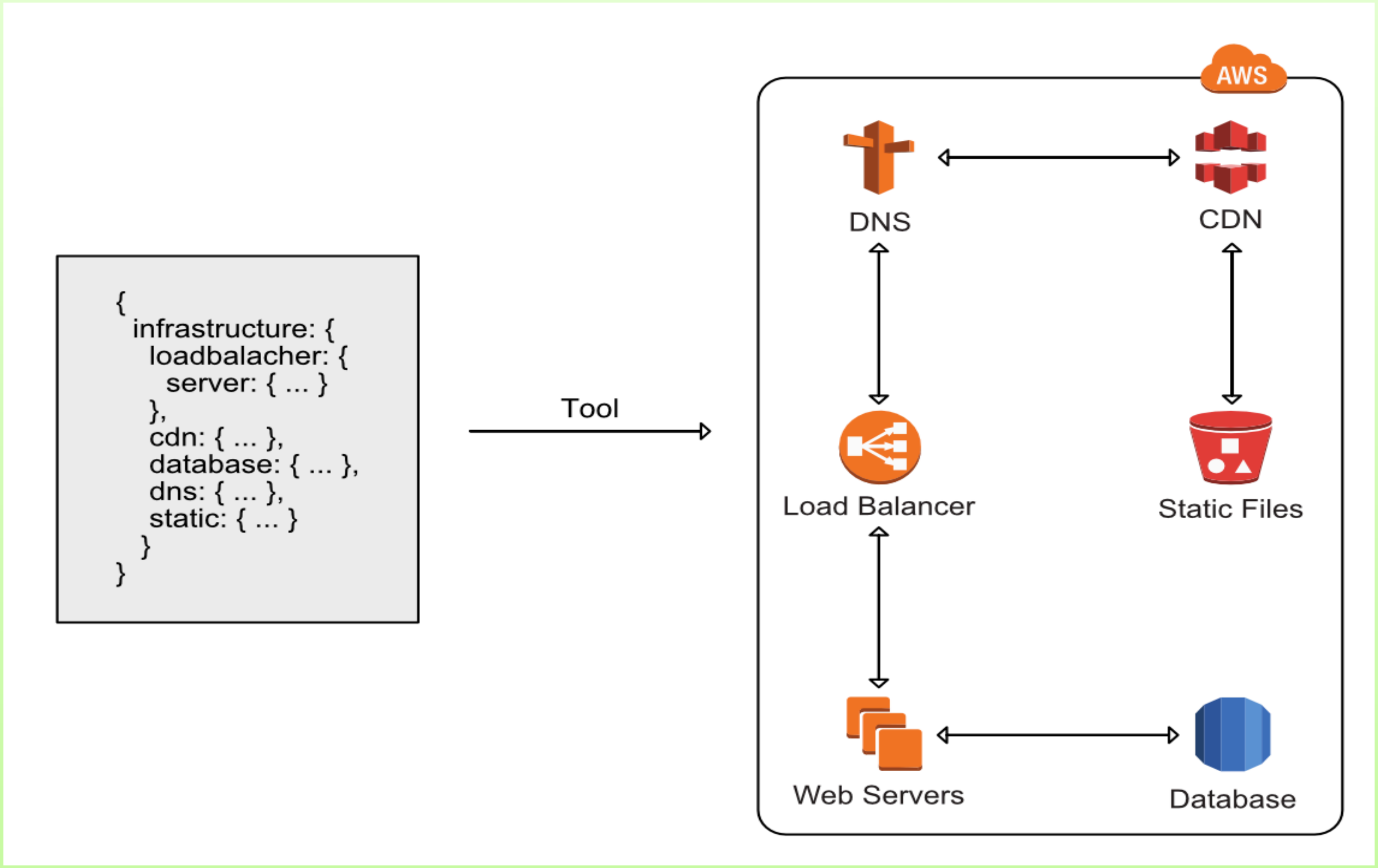


REPOSITORY
TEMPLATES
SCRIPTS
POLICIES
cisco
Puppet
vmware
openstack
NETWORK
SECURITY
APP INFRA
STORAGE

Where we stand?



IaC – Example



```
{
  infrastructure: {
    loadbalacher: {
      server: { ... }
    },
    cdn: { ... },
    database: { ... },
    dns: { ... },
    static: { ... }
  }
}
```

Benefits of IaC

- Software developers can use code to provision and deploy servers and applications, rather than rely on system administrators in a DevOps environment.
- With the infrastructure setup written as code, it can go through the same version control, automated testing, and other steps of a continuous integration and continuous delivery(CI/CD) pipeline that developers use for application code.
- Because the OS and hardware infrastructure is provisioned automatically and the application is encapsulated atop it, these technologies prove complementary for diverse deployment targets, such as test, staging and production.

Benefits of IaC

- Despite its benefits, infrastructure as code poses potential disadvantages. It requires additional tools, such as a configuration management system, that could introduce learning curves and room for error.
- If administrators change server configurations outside of the set infrastructure-as-code template, there is potential for configuration drift. It's important to fully integrate infrastructure as code into systems administration, IT operations and DevOps practices with well-documented policies and procedures.

Session: 2

DevOps - Terraform

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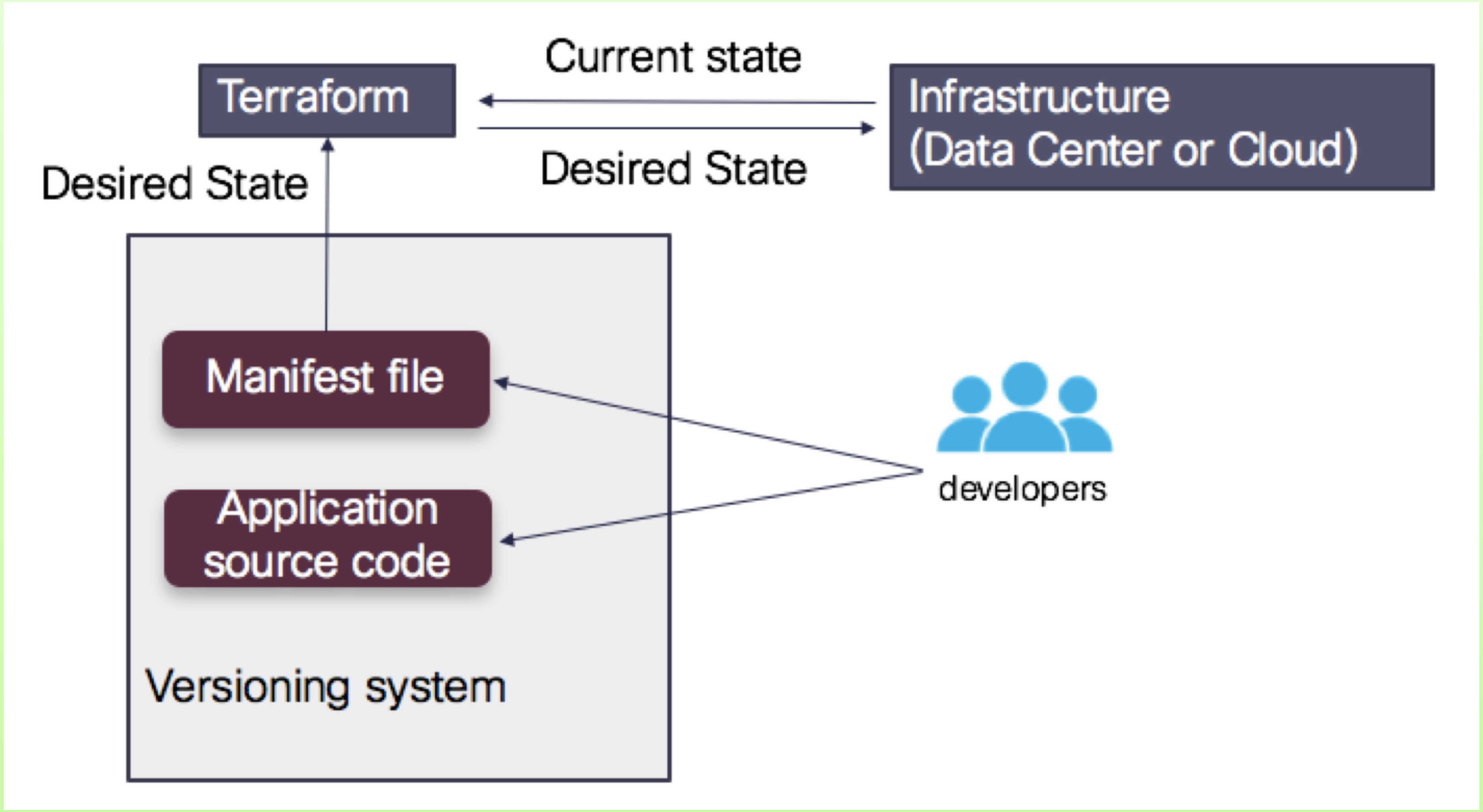
What is Terraform?

- Terraform is a tool for building, changing, and versioning infrastructure safely and efficiently.
- Configuration files describe to Terraform the components needed to run a single application or your entire datacenter.
- Terraform generates an execution plan describing what it will do to reach the desired state, and then executes it to build the described infrastructure.
- As the configuration changes, Terraform is able to determine what changed and create incremental execution plans which can be applied.
- The infrastructure Terraform can manage includes low-level components such as compute instances, storage, and networking, as well as high-level components such as DNS entries, SaaS features, etc.

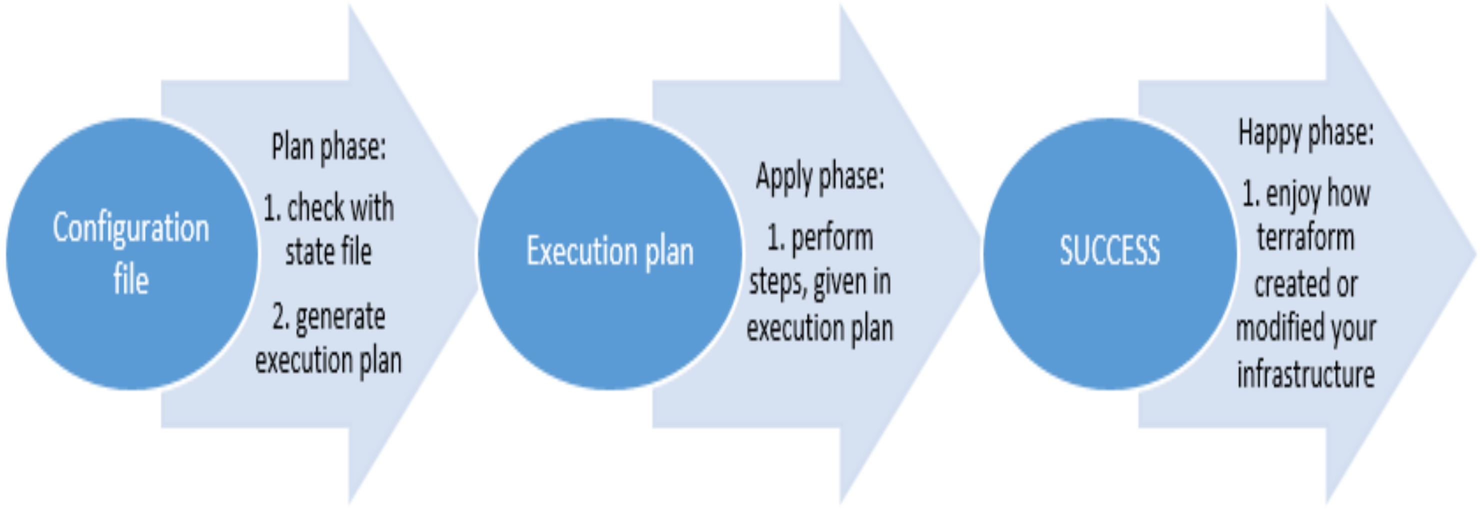
Features of Terraform

- Infrastructure as Code(IaC)
- Execution Plans
- Resource Graph
- Change Automation
- Collaboration

How Terraform works?



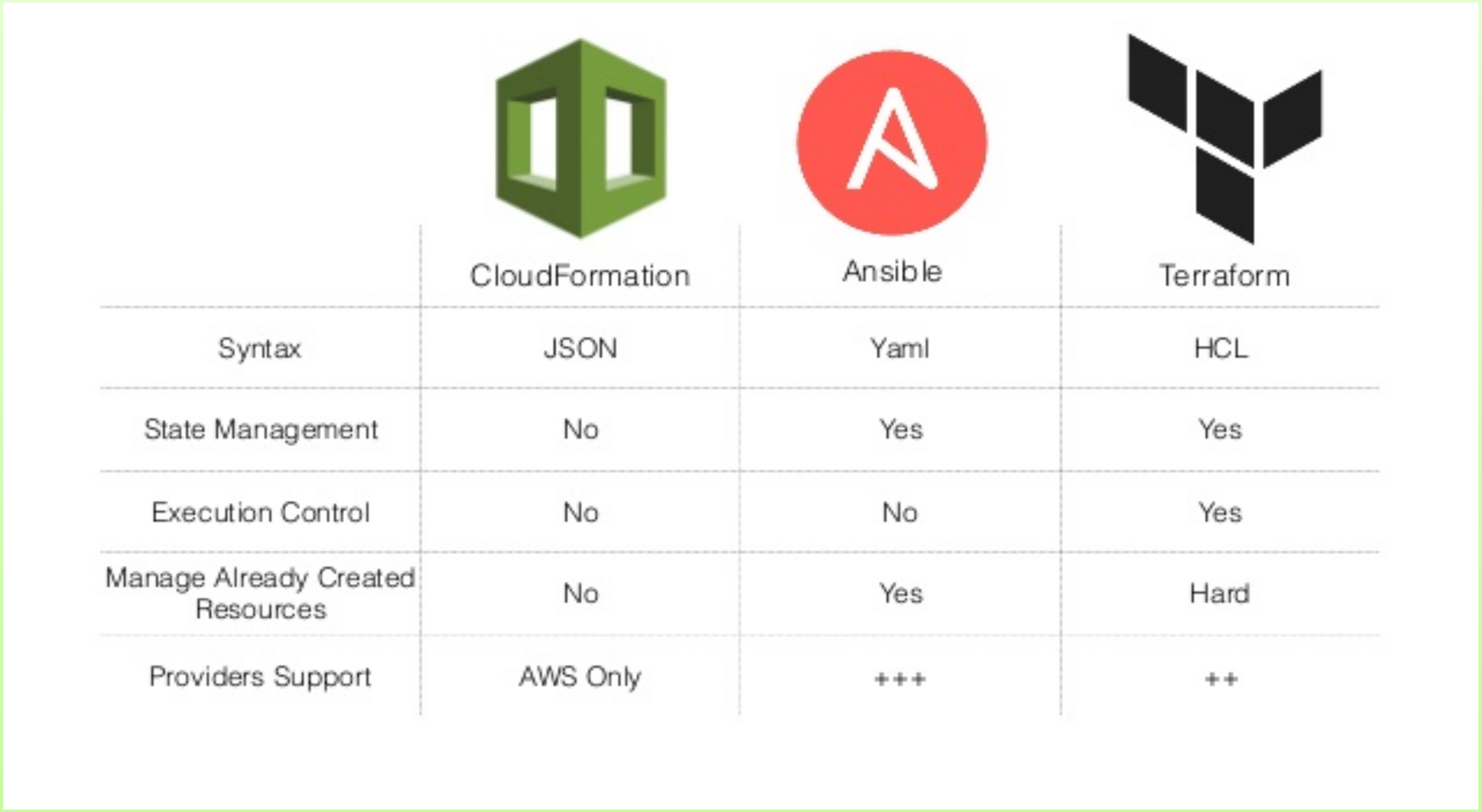
How Terraform works?


Configuration file
Plan phase:
1. check with state file
2. generate execution plan
Execution plan
Apply phase:
1. perform steps, given in execution plan
SUCCESS
Happy phase:
1. enjoy how terraform created or modified your infrastructure

Terraform vs Puppet,Chef

- Configuration management tools install and manage software on a machine that already exists.
- Terraform is not a configuration management tool, and it allows existing tooling to focus on their strengths: bootstrapping and initializing resources.
- Using provisioners, Terraform enables any configuration management tool to be used to setup a resource once it has been created.
- Terraform focuses on the higher-level abstraction of the datacenter and associated services, without sacrificing the ability to use configuration management tools to do what they do best. It also embraces the same codification that is responsible for the success of those tools, making entire infrastructure deployments easy and reliable.

Terraform vs Ansible,CF



	CloudFormation	Ansible	Terraform
Syntax	JSON	Yaml	HCL
State Management	No	Yes	Yes
Execution Control	No	No	Yes
Manage Already Created Resources	No	Yes	Hard
Providers Support	AWS Only	+++	++

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Session: 3

Classroom Environment

Terraform – Lab Setup

- Terraform will be installed for Lab Environment.
- Steps:

```
  yum install -y yum-utils
  yum-config-manager --add-repo https://rpm.releases.hashicorp.com/RHEL/hashicorp.repo
 yum -y install terraform
```

Session: 4

Terraform - Configuration

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Terraform – Configuration

- Terraform uses text files to describe infrastructure and to set variables. These text files are called Terraform *configurations* and end in .tf.
- The format of the configuration files are able to be in two formats: Terraform format and JSON.
- The Terraform format is more human-readable, supports comments, and is the generally recommended format for most Terraform files.
- The JSON format is meant for machines to create, modify, and update.

Load Order & Semantics

- When invoking any command that loads the Terraform configuration, Terraform loads all configuration files within the directory specified in alphabetical order.
- The files loaded must end in either .tf or .tf.json to specify the format that is in use. Otherwise, the files are ignored.
- Override files are the exception, as they're loaded after all non-override files, in alphabetical order.
- The configuration within the loaded files are appended to each other.
- The order of variables, resources, etc. defined within the configuration doesn't matter.

Configuration Syntax

- The syntax of Terraform configurations is called HashiCorp Configuration Language (HCL).
- It is meant to strike a balance between human readable and editable as well as being machine-friendly.
- For machine-friendliness, Terraform can also read JSON configurations.
- For general Terraform configurations, however, we recommend using the HCL Terraform syntax.

Providers

- Terraform is used to create, manage, and update infrastructure resources such as physical machines, VMs, network switches, containers, and more.
- Almost any infrastructure type can be represented as a resource in Terraform.
- A provider is responsible for understanding API interactions and exposing resources.
- Providers generally are an IaaS (e.g. AWS, GCP, Microsoft Azure, OpenStack), PaaS (e.g. Heroku), or SaaS services (e.g. Terraform Enterprise, DNSimple, CloudFlare).

Providers

- All the terraform providers can be found at:

  https://registry.terraform.io/browse/providers

Provider Configurations

- Providers are responsible in Terraform for managing the lifecycle of a resource: create, read, update, delete.
- Most providers require some sort of configuration to provide authentication information, endpoint URLs, etc.
- By default, resources are matched with provider configurations by matching the start of the resource name. For example, a resource of type vsphere_virtual_machine is associated with a provider called vsphere.

Provider Configurations - Example

- A provider configuration looks like the following:

```
provider "azurerm" {
    features {}
    client_certificate_path = "/etc/.azure/mycert.pfx"
    subscription_id = "fd2abdcd-0718-4907-abcd-5a0ab7e1c05e"
    client_id = "ab2abdcd-0718-4907-abcd-5a0ab7e1c05e"
    tenant_id = "gh2abdcd-0718-4907-abcd-5a0ab7e1c05e"
}
```

Provider Initialisations

- Each time a new provider is added to configuration, it's necessary to initialise that provider before use.
- Initialisation downloads and installs the provider's plugin and prepares it to be used.
- Provider initialisation is one of the actions of terraform init. Running this command will download and initialise any providers that are not already initialised.
- Providers downloaded by terraform init are only installed for the current working directory.
- Note that terraform init cannot automatically download providers that are not distributed by HashiCorp.

Multiple Provider Instances

- You can define multiple configurations for the same provider in order to support multiple regions, multiple hosts, etc.

```
# The default provider configuration
      provider "azurerm" {
            # …
      }
# Additional provider configuration for west coast region
      provider "azurerm" {
            alias   = "west"
            client_certificate_path = "/etc/.azure/mycert.pfx"
      }
```

Multiple Provider Instances

- Using provider in resource:

```
resource “azurerm_linux_virtual_machine" "foo" {
    provider = "azurerm.west"
     # …
}
```

Resource Configurations

- The most important thing you'll configure with Terraform are resources.
- Resources are a component of your infrastructure.
- It might be some low level component such as a physical server, virtual machine, or container. Or it can be a higher level component such as an email provider, DNS record, or database provider.
- The resource block creates a resource of the given TYPE (first parameter) and NAME (second parameter). The combination of the type and name must be unique.

Resource Configurations - Example

- A resource configuration looks like the following:

```
resource "azurerm_linux_virtual_machine" "main" {
  name                            = "myvm-vm"
  size                            = "Standard_F2"
  admin_username                  = "adminuser"
  admin_password                  = "P@ssw0rd1234!"
  disable_password_authentication = false

  source_image_reference {
    publisher = "Canonical"
    offer     = "UbuntuServer"
    sku       = "18.04-LTS"
    version   = "latest"
  }

  os_disk {
    storage_account_type = "Standard_LRS"
    caching              = "ReadWrite"
  }
}
```

Terraform Commands (CLI)

- Terraform is controlled via a very easy to use command-line interface (CLI).
- Terraform is only a single command-line application: terraform. This application then takes a subcommand such as "apply" or "plan".
- The terraform CLI is a well-behaved command line application. In erroneous cases, a non-zero exit status will be returned. It also responds to -h and --help as you'd most likely expect.

```
terraform --help
```

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Terraform Commands (CLI)

- Get Terraform plugins as per configuration:

```
terraform init
```

- Validate Terraform configurations:

```
terraform validate
```

- Validate configurations in Simulation mode:

```
terraform plan
```

- Apply Terraform configurations:

```
terraform apply
```

Terraform Commands (CLI)

- Destroy Terraform configuration:

```
terraform destroy
```

- Save a plan:

```
terraform plan -out=./plan
```

- Apply a plan:

```
terraform apply ./plan
```

- Show plan or state:

```
terraform show
```

Generate a Client Certificate

- Create CSR using openssl

```
openssl req -newkey rsa:4096 -nodes -keyout "mycert.key" -out
“mycert.csr”
```

- Signing CSR

```
openssl x509 -signkey "mycert.key" -in "mycert.csr" -req -days 365
-out “mycert.crt”
```

- Creating PFX

```
openssl pkcs12 -export -out "mycert.pfx" -inkey "mycert.key" -in
“mycert.crt"
```

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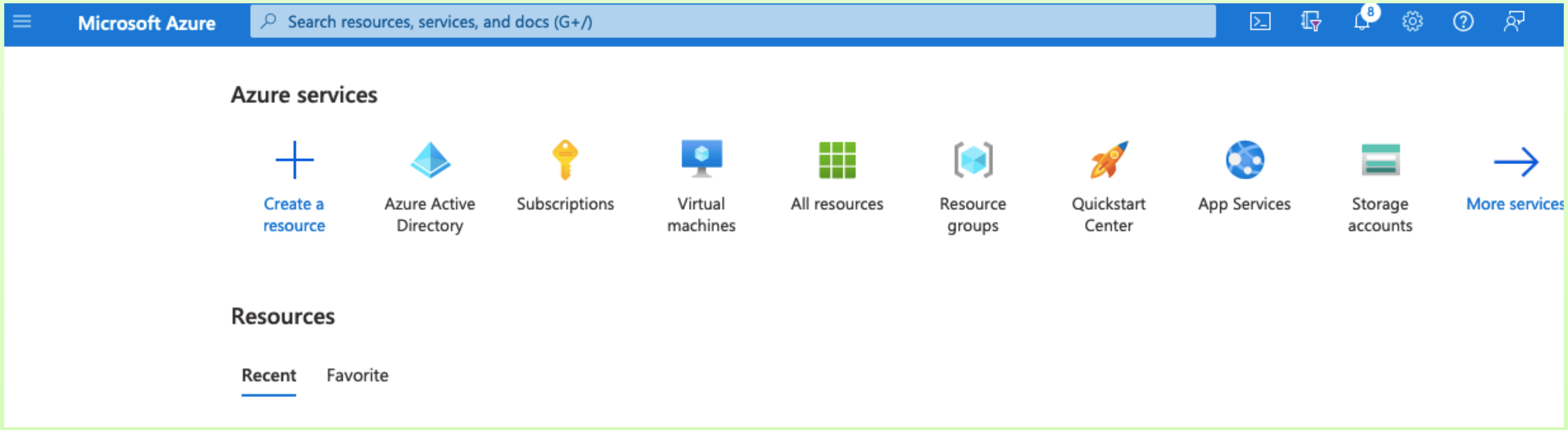
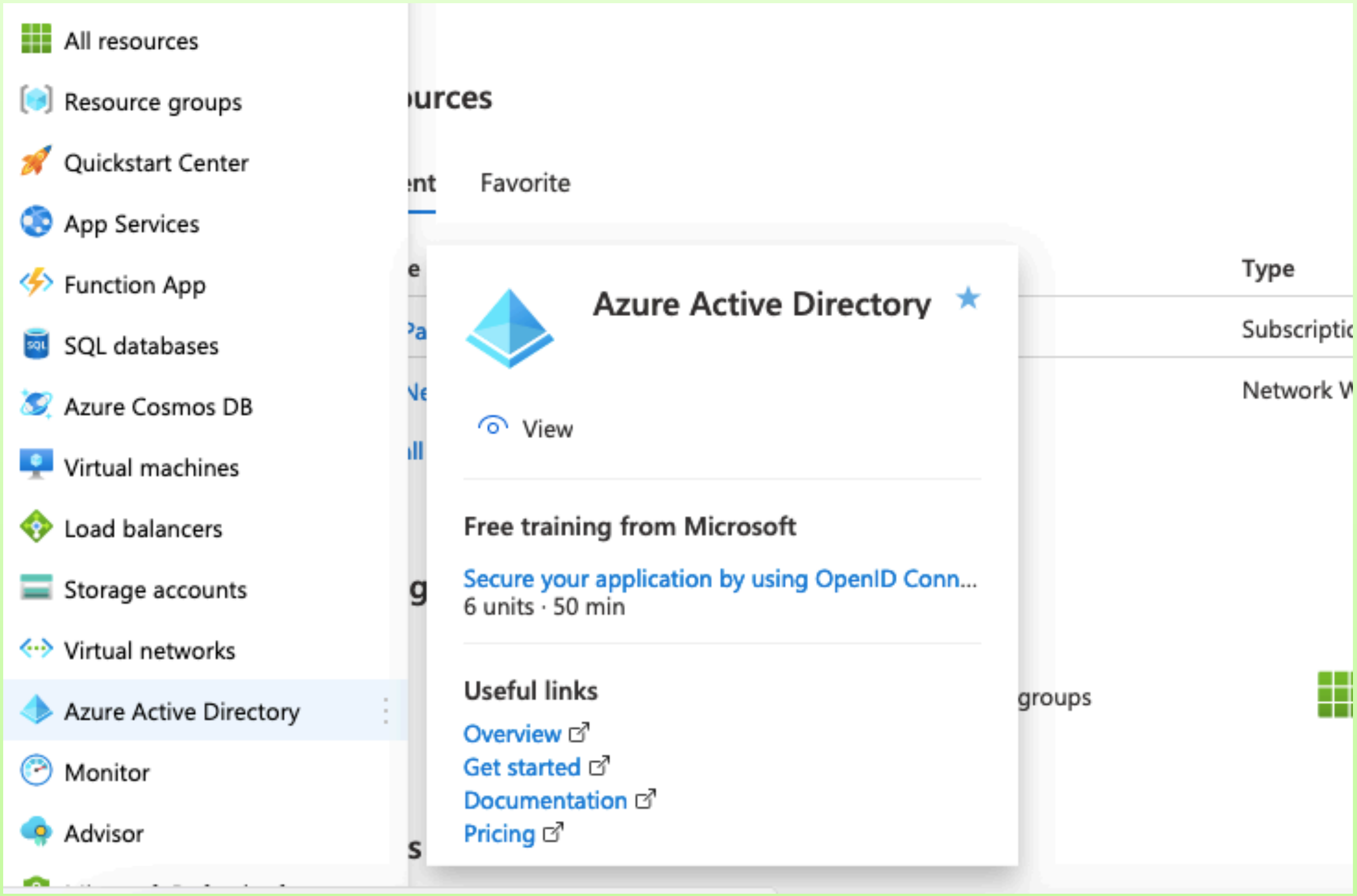
Login to Azure Portal



Go to Azure Active Directory



Azure Active Directory

View

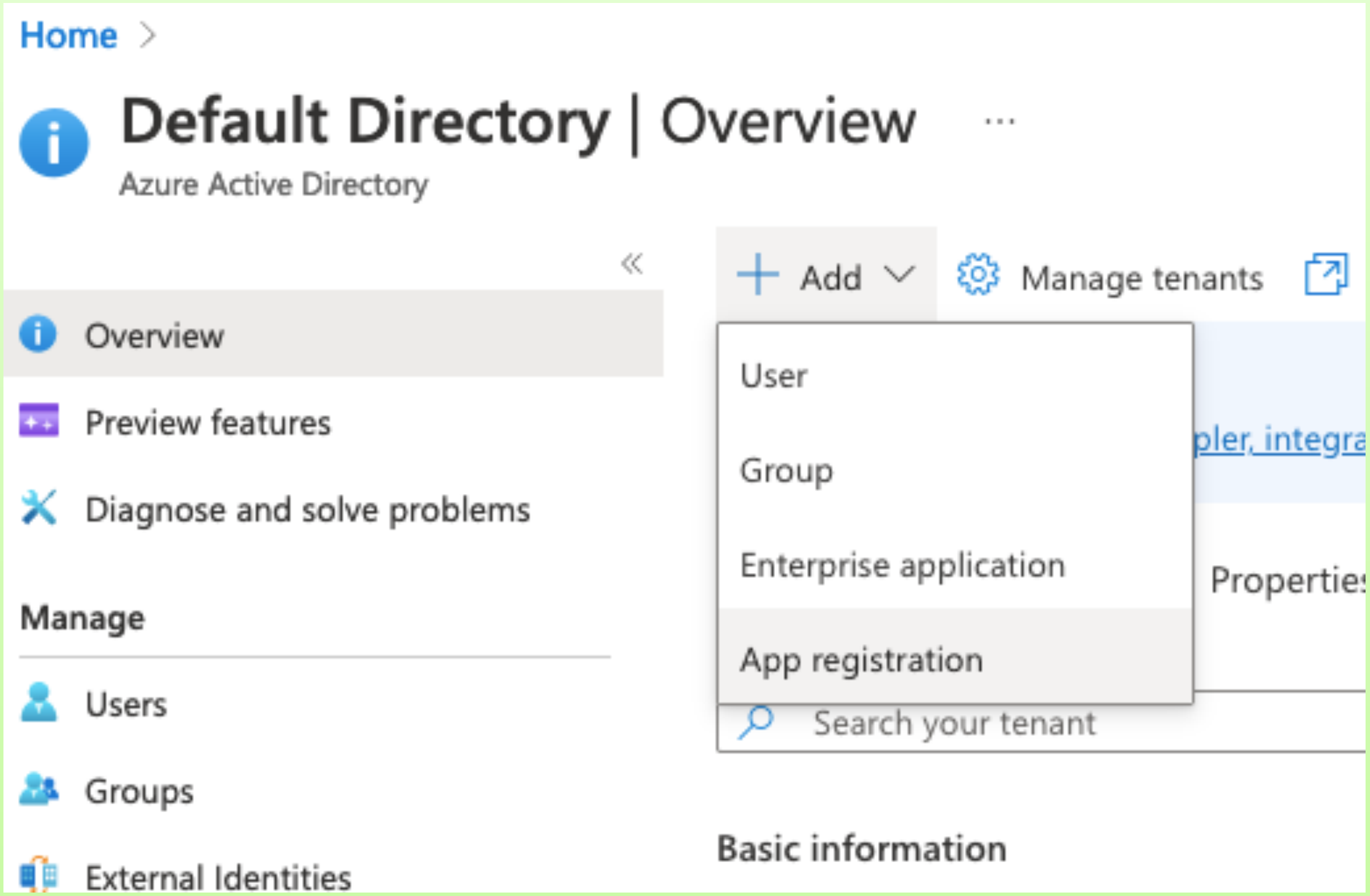
Free training from Microsoft

Secure your application by using OpenID Conn...
6 units · 50 min

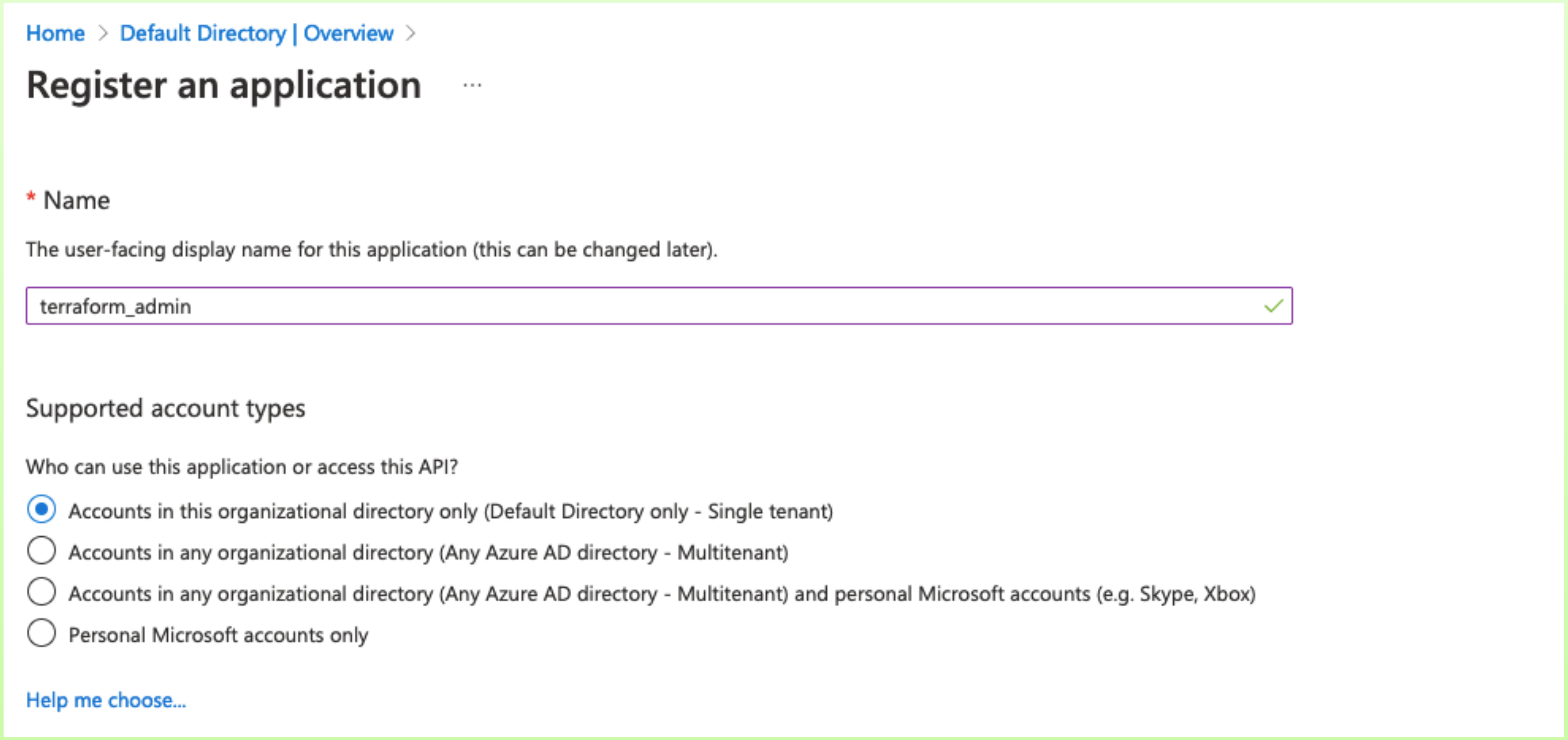
Useful links

Overview
Get started
Documentation
Pricing

Add - App registration



Enter App Name



Home > Default Directory | Overview >

Register an application ...

* Name

The user-facing display name for this application (this can be changed later).

terraform_admin ✓

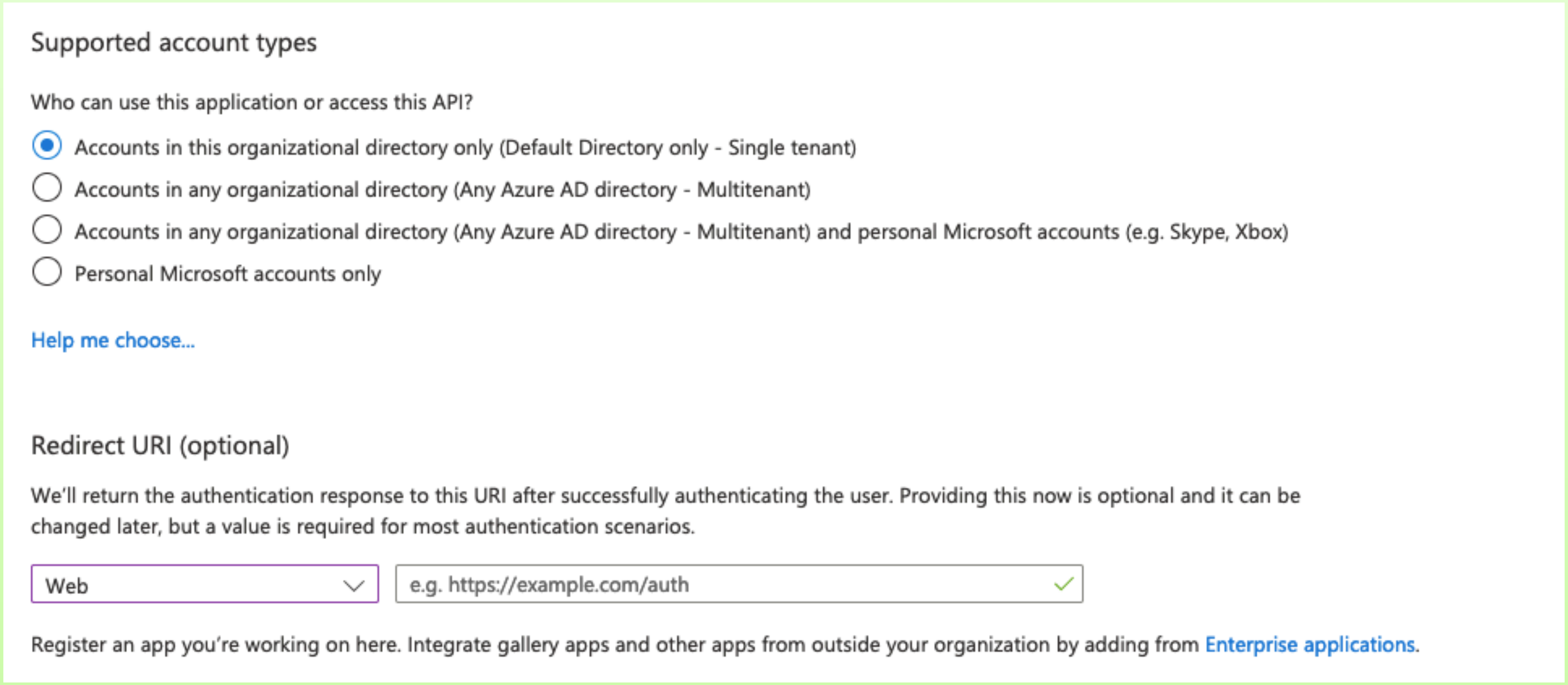
Supported account types

Who can use this application or access this API?

- ● Accounts in this organizational directory only (Default Directory only - Single tenant)
- ○ Accounts in any organizational directory (Any Azure AD directory - Multitenant)
- ○ Accounts in any organizational directory (Any Azure AD directory - Multitenant) and personal Microsoft accounts (e.g. Skype, Xbox)
- ○ Personal Microsoft accounts only

Help me choose...

Enter 'who can use' and 'Redirect URI':



Supported account types

Who can use this application or access this API?

[✓ Accounts in this organizational directory only (Default Directory only - Single tenant)]

Accounts in any organizational directory (Any Azure AD directory - Multitenant)

Accounts in any organizational directory (Any Azure AD directory - Multitenant) and personal Microsoft accounts (e.g. Skype, Xbox)

Personal Microsoft accounts only

Help me choose...

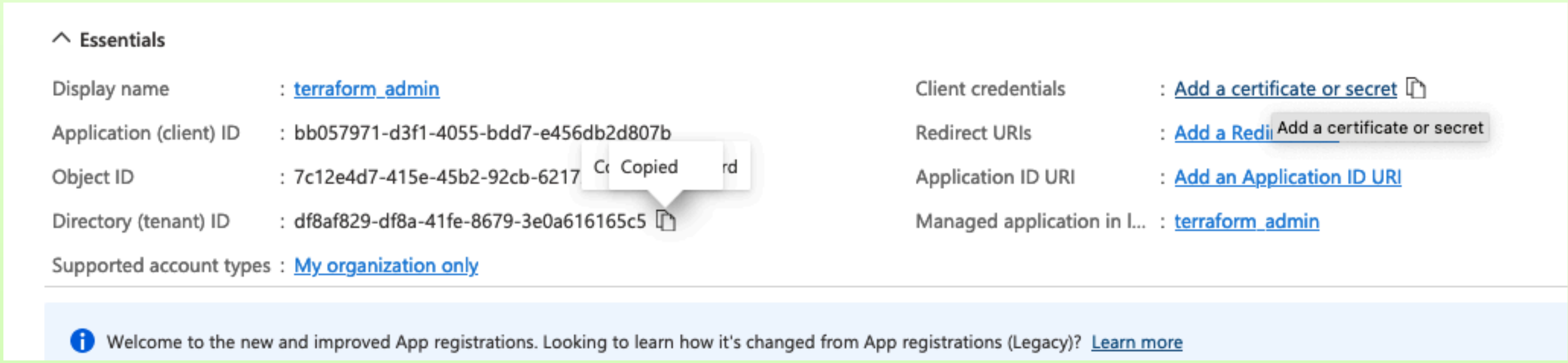
Redirect URI (optional)

We'll return the authentication response to this URI after successfully authenticating the user. Providing this now is optional and it can be changed later, but a value is required for most authentication scenarios.

Web | e.g. https://example.com/auth

Register an app you're working on here. Integrate gallery apps and other apps from outside your organization by adding from Enterprise applications.

Add Certificate to App



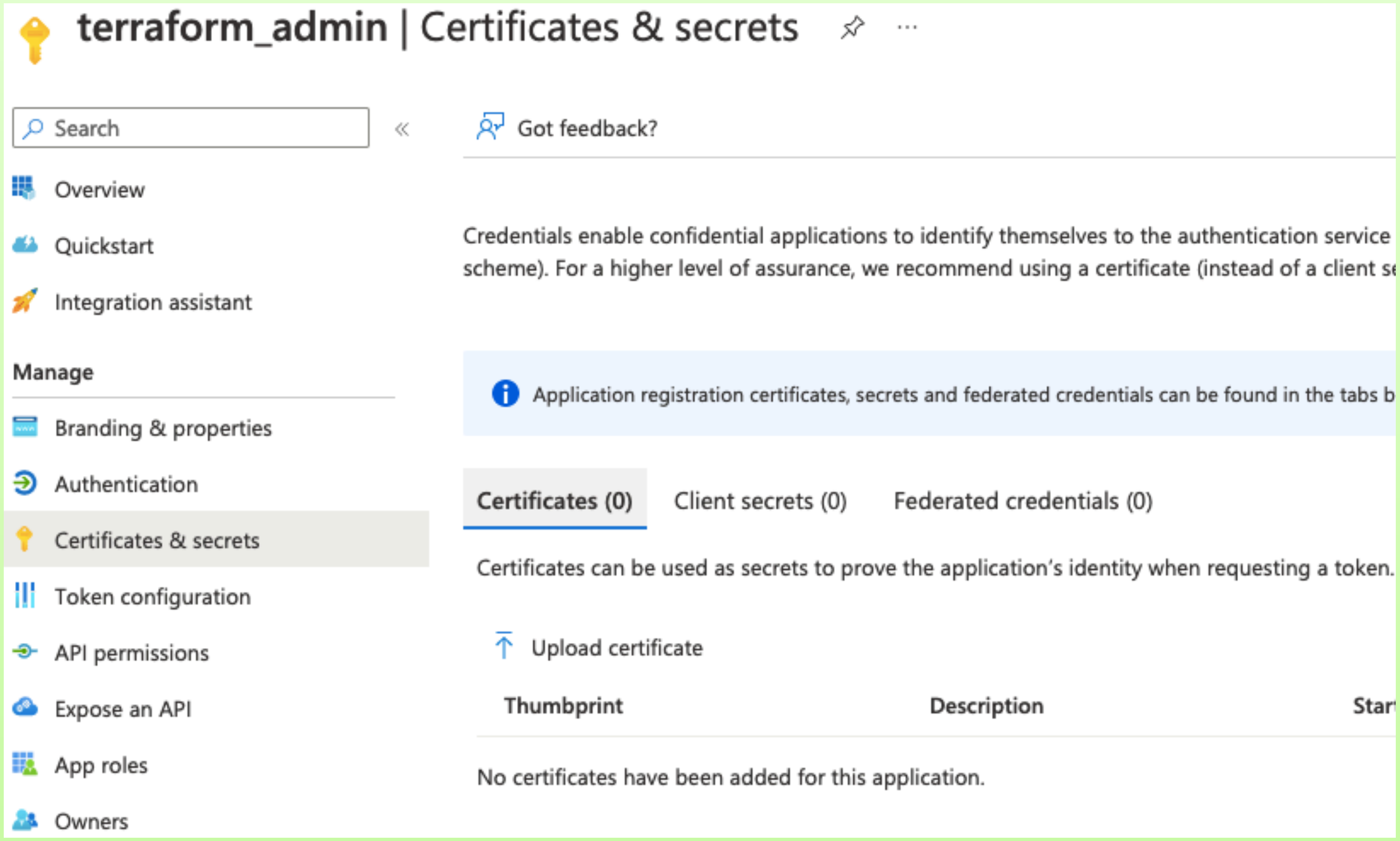
^ Essentials

Display name	: terraform_admin	Client credentials	: Add a certificate or secret
Application (client) ID	: bb057971-d3f1-4055-bdd7-e456db2d807b	Redirect URIs	: Add a Redi
Object ID	: 7c12e4d7-415e-45b2-92cb-6217	Application ID URI	: Add an Application ID URI
Directory (tenant) ID	: df8af829-df8a-41fe-8679-3e0a616165c5	Managed application in l...	: terraform_admin
Supported account types	: My organization only		

Welcome to the new and improved App registrations. Looking to learn how it's changed from App registrations (Legacy)? Learn more

Do Note Client ID & Tenant ID

Upload Certificate “*.crt”



terraform_admin | Certificates & secrets

Search

Overview
Quickstart
Integration assistant

Manage

Branding & properties
Authentication
Certificates & secrets
Token configuration
API permissions
Expose an API
App roles
Owners

Got feedback?

Credentials enable confidential applications to identify themselves to the authentication service
scheme). For a higher level of assurance, we recommend using a certificate (instead of a client se

Application registration certificates, secrets and federated credentials can be found in the tabs b

Certificates (0) | Client secrets (0) | Federated credentials (0)

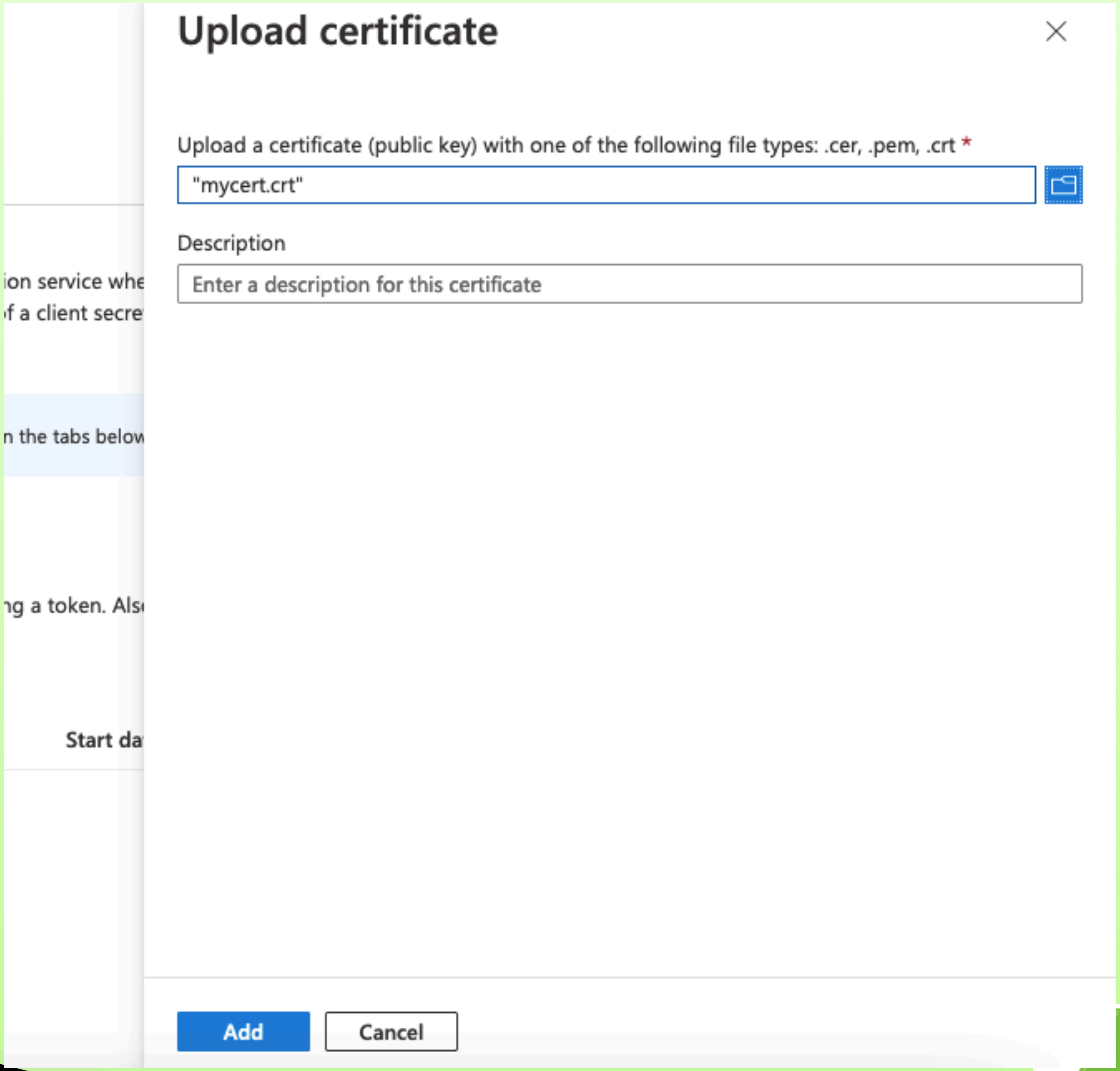
Certificates can be used as secrets to prove the application's identity when requesting a token.

Upload certificate

Thumbprint	Description	Star

No certificates have been added for this application.

Upload Certificate "*.crt"



Upload certificate

Upload a certificate (public key) with one of the following file types: .cer, .pem, .crt *

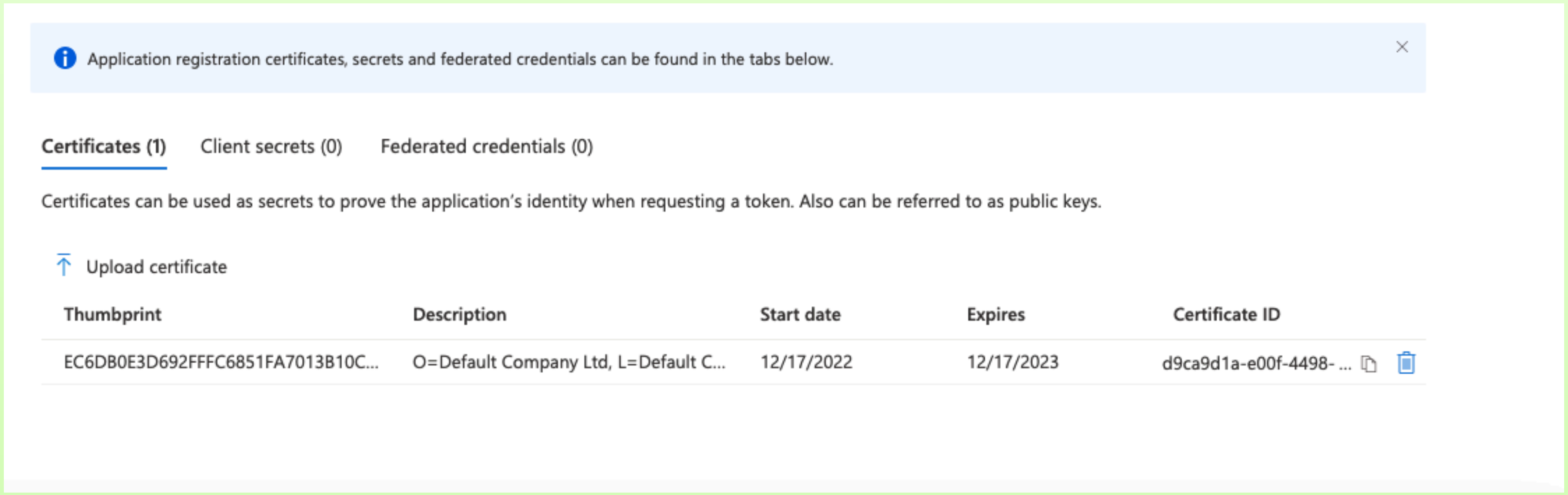
"mycert.crt"

Description

Enter a description for this certificate

ion service whe
f a client secre
n the tabs below
ng a token. Als
Start da

Upload Certificate “*.crt”

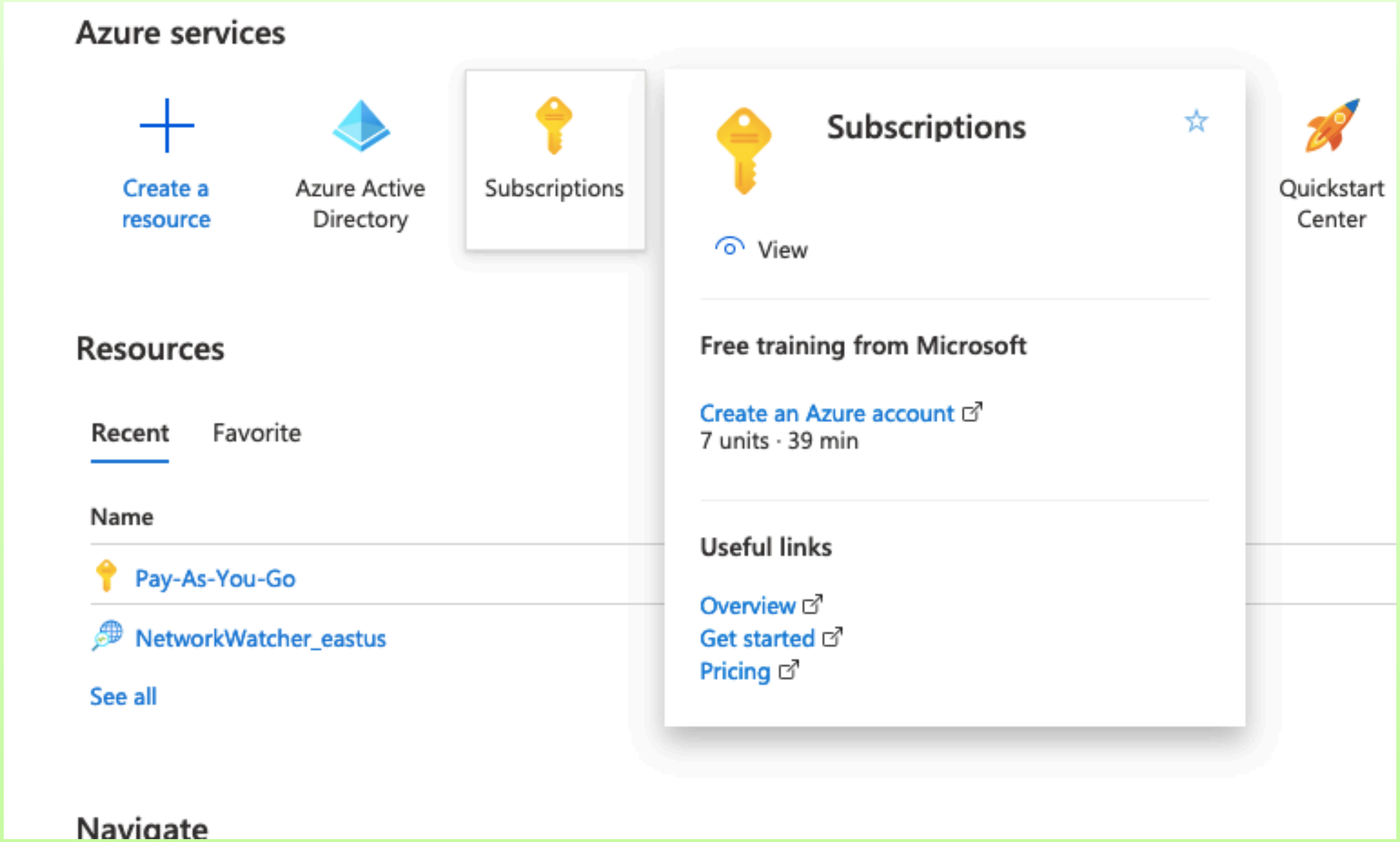


Application registration certificates, secrets and federated credentials can be found in the tabs below.

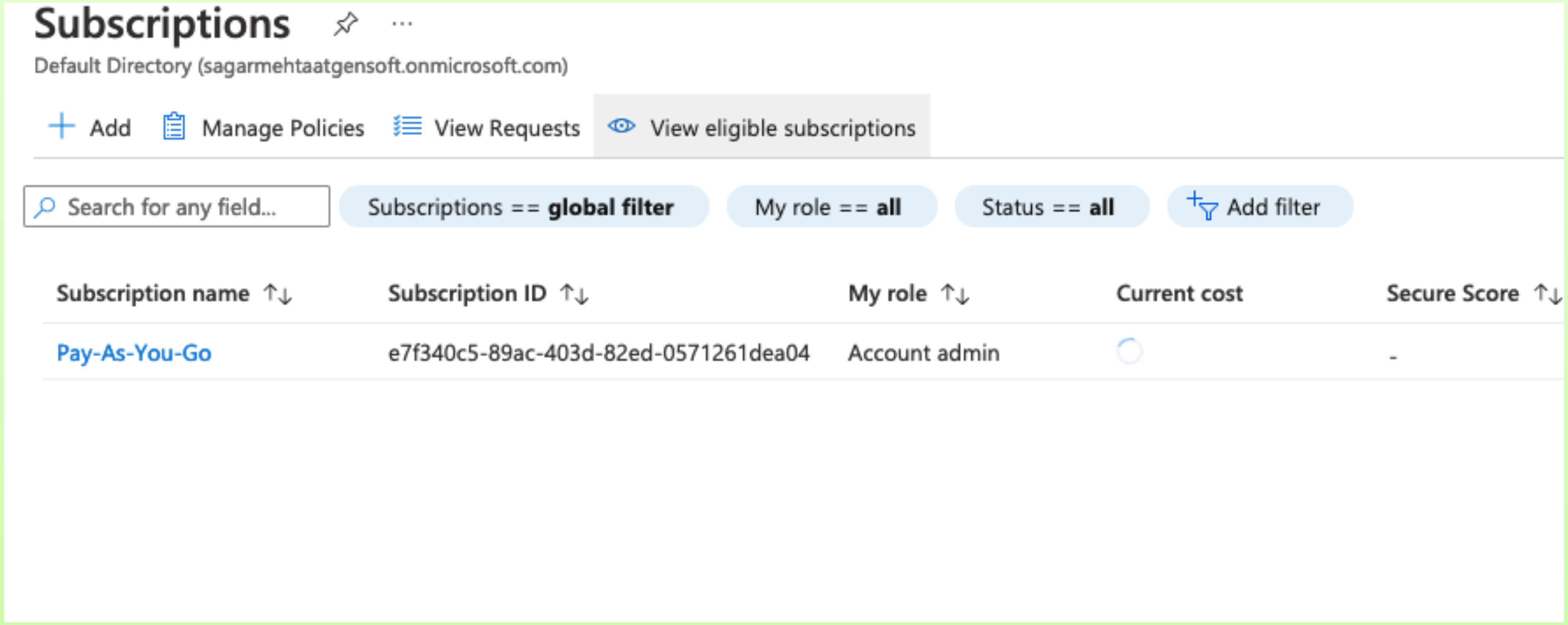
Certificates can be used as secrets to prove the application’s identity when requesting a token. Also can be referred to as public keys.

Thumbprint	Description	Start date	Expires	Certificate ID
EC6DB0E3D692FFFC6851FA7013B10C...	O=Default Company Ltd, L=Default C...	12/17/2022	12/17/2023	d9ca9d1a-e00f-4498- ...

Go to Subscriptions



Click on Subscription



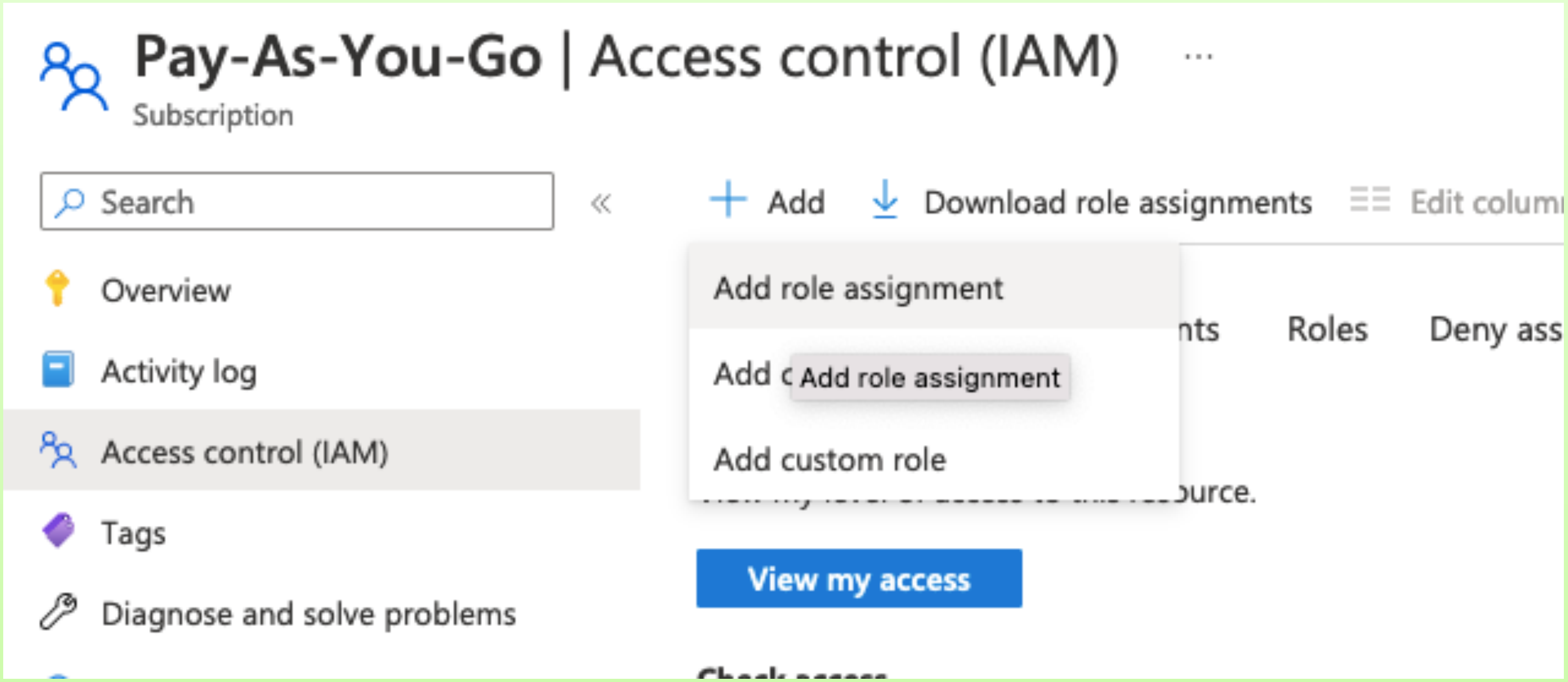
Subscriptions

Default Directory (sagarmehtaatgensoft.onmicrosoft.com)

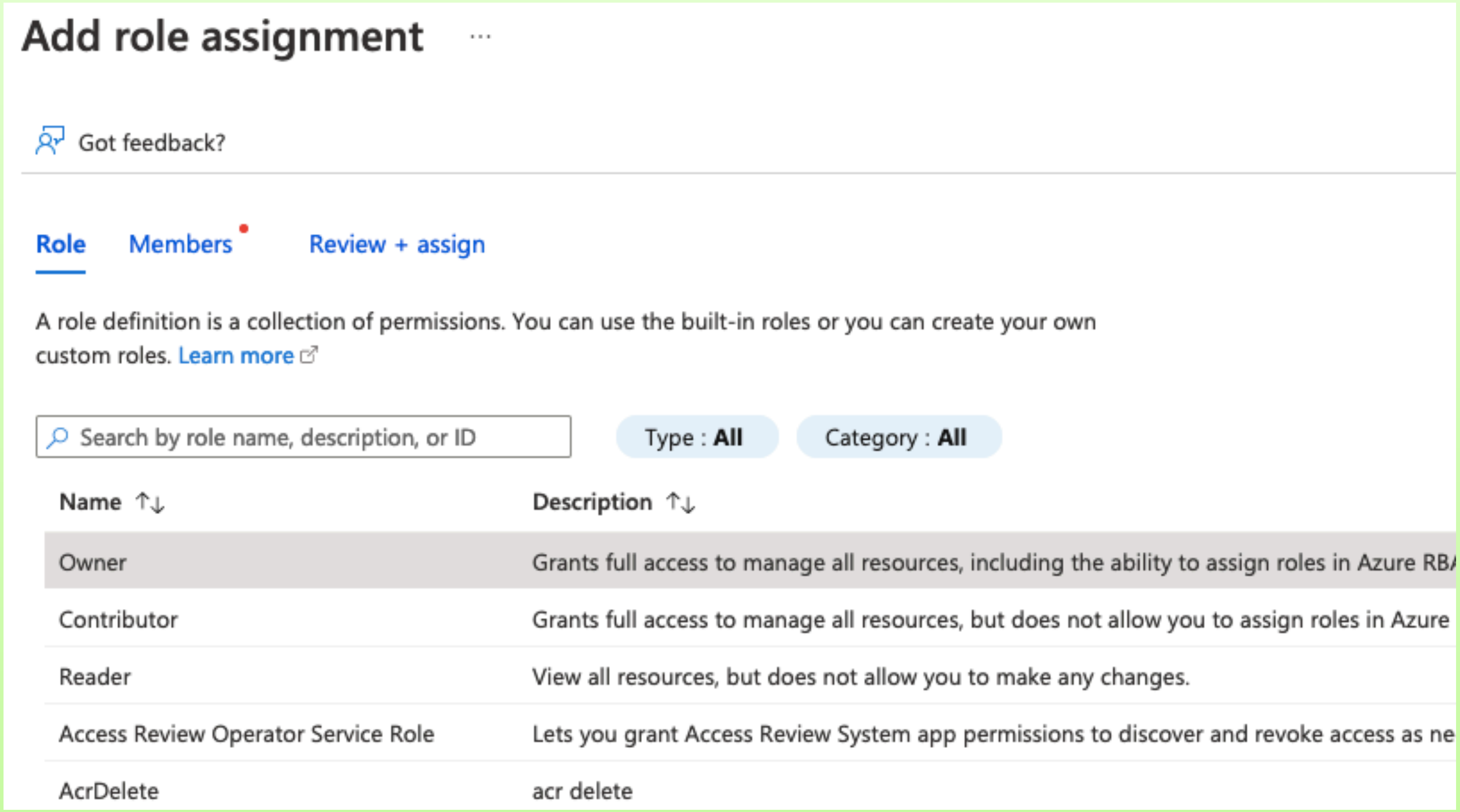
Subscription name ↑↓	Subscription ID ↑↓	My role ↑↓	Current cost	Secure Score ↑↓
Pay-As-You-Go	e7f340c5-89ac-403d-82ed-0571261dea04	Account admin		-

Do Note Subscription ID

Click IAM - Add role assignment



Select appropriate role


Add role assignment ···

Got feedback?

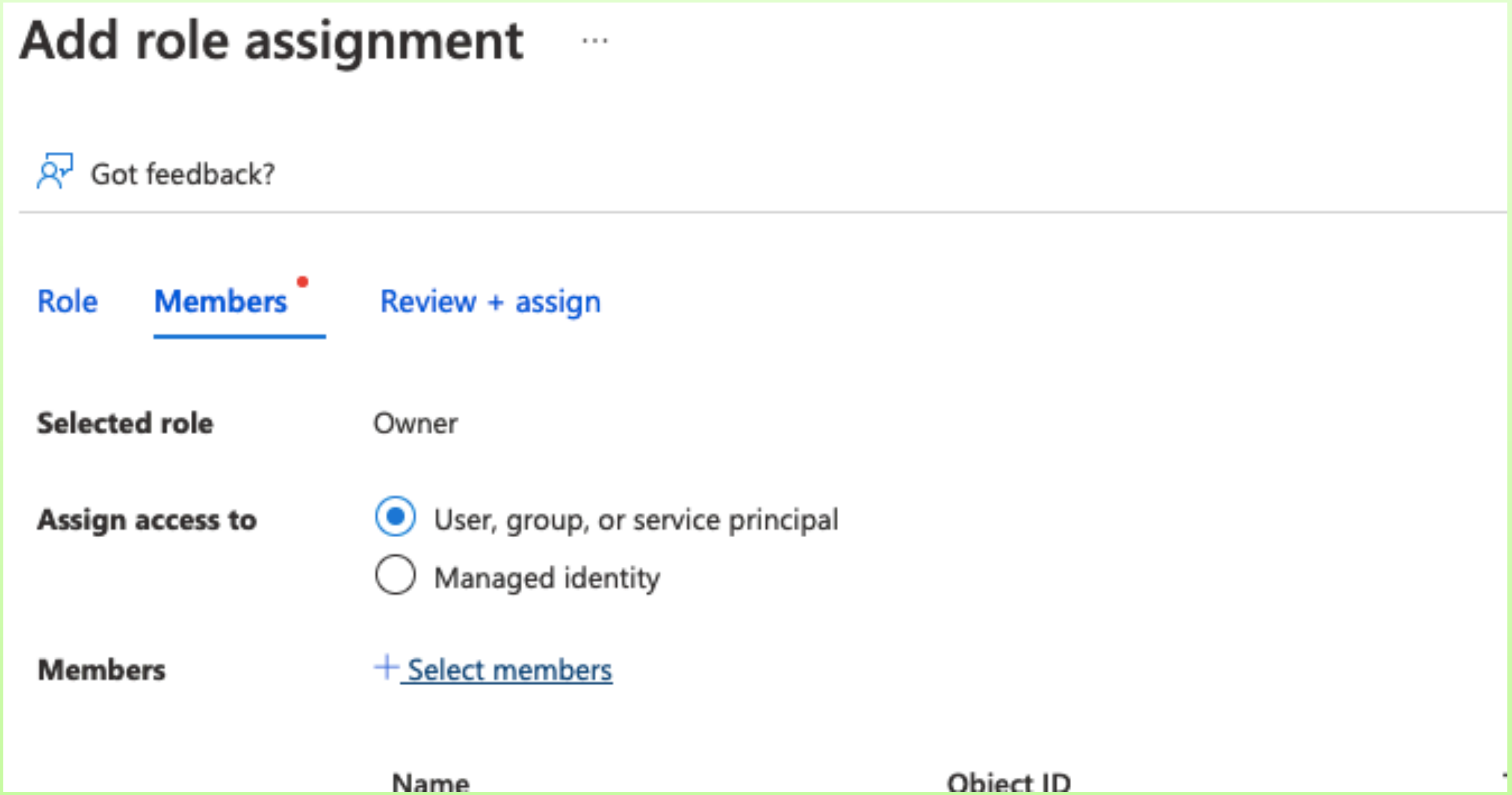
Role | Members | Review + assign

A role definition is a collection of permissions. You can use the built-in roles or you can create your own custom roles. Learn more

Search by role name, description, or ID | Type : **All** | Category : **All**

Name ↑↓	Description ↑↓
Owner	Grants full access to manage all resources, including the ability to assign roles in Azure RBA
Contributor	Grants full access to manage all resources, but does not allow you to assign roles in Azure
Reader	View all resources, but does not allow you to make any changes.
Access Review Operator Service Role	Lets you grant Access Review System app permissions to discover and revoke access as ne
AcrDelete	acr delete

Select members



Add role assignment ···

Got feedback?

Role   Members   Review + assign

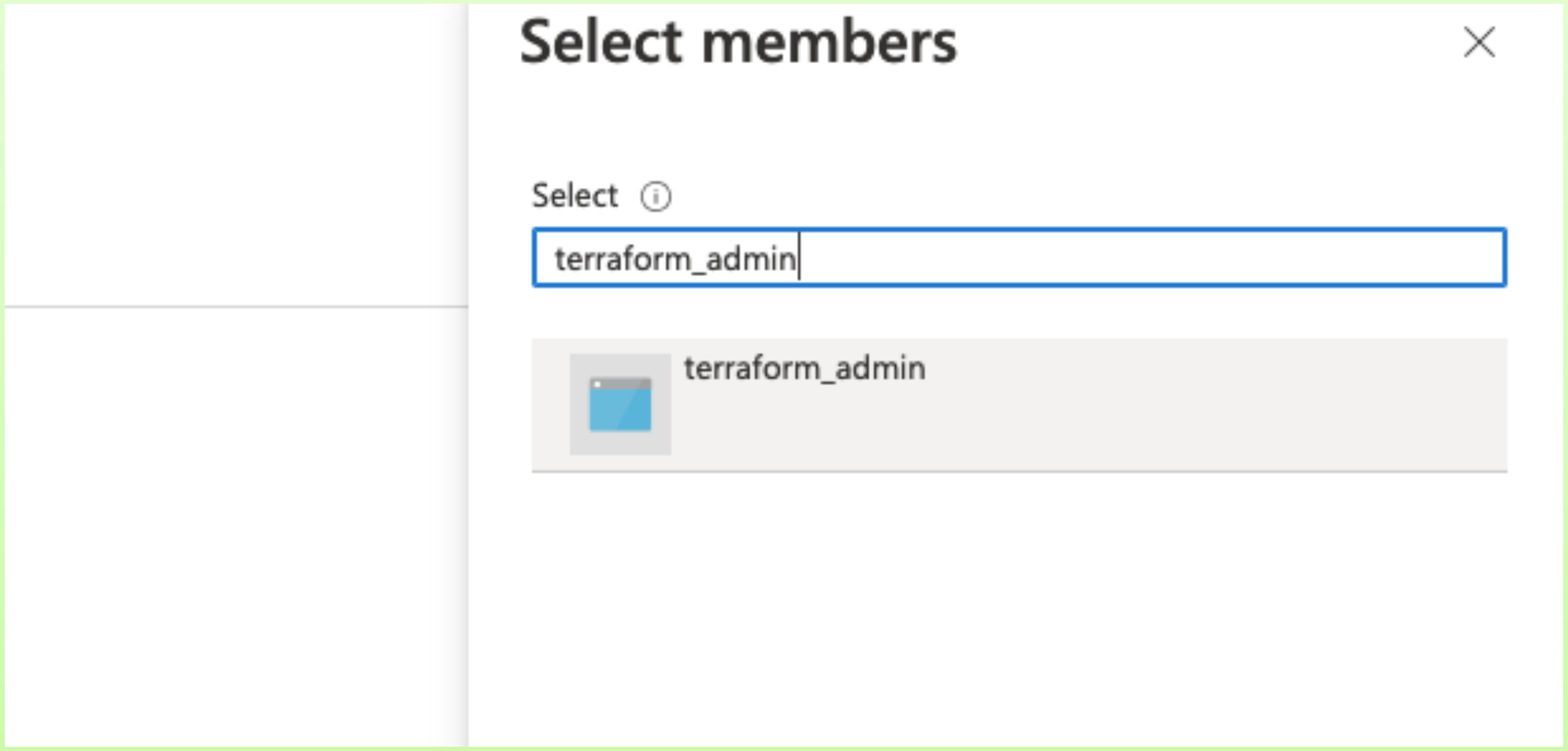
Selected role: Owner

Assign access to: [✓ User, group, or service principal] Managed identity

Members: + Select members

Name   Object ID

Select members as App Name



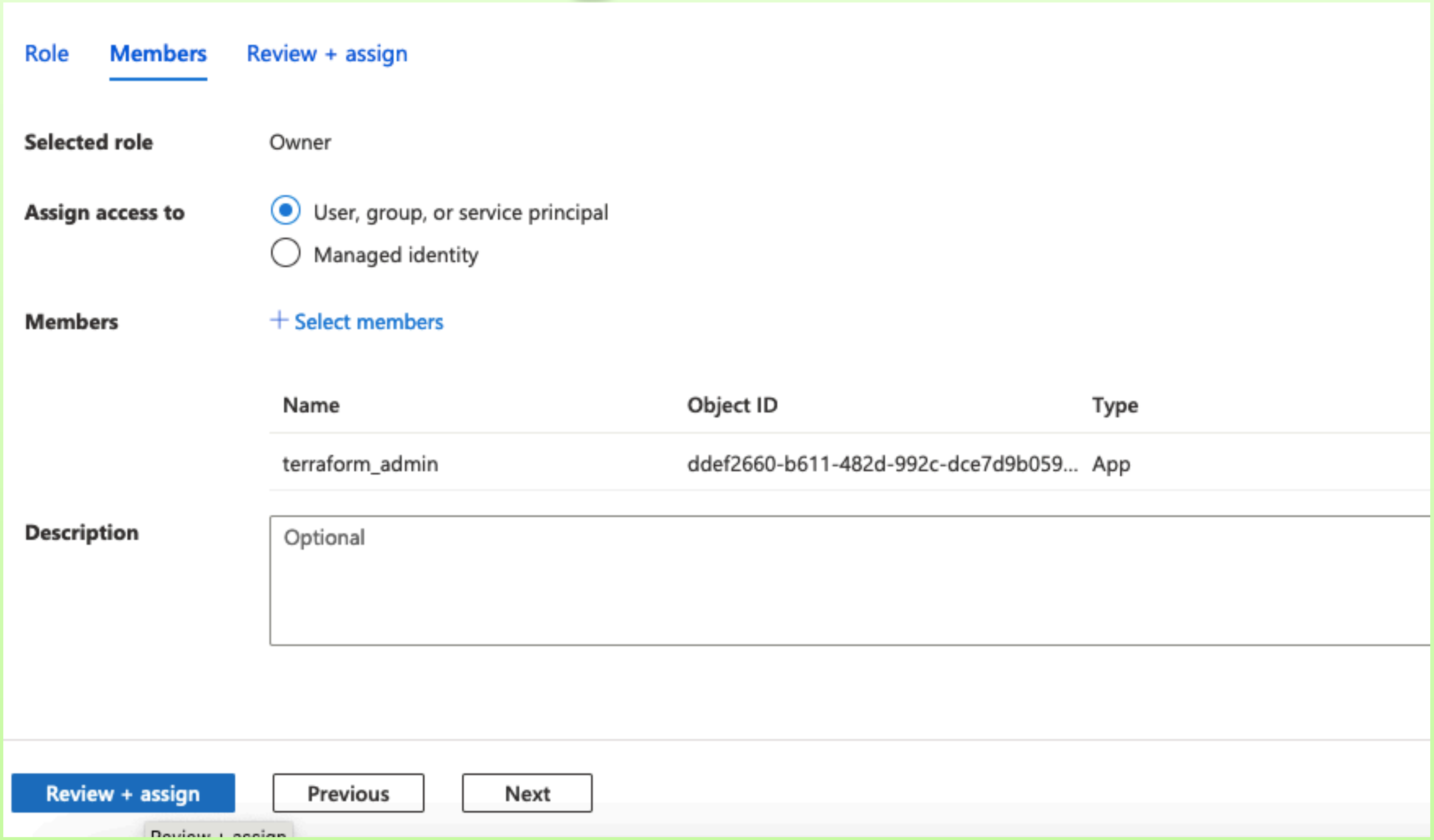
Select members

Select

terraform_admin

terraform_admin

Review + assign



Role | Members | Review + assign

Selected role: Owner

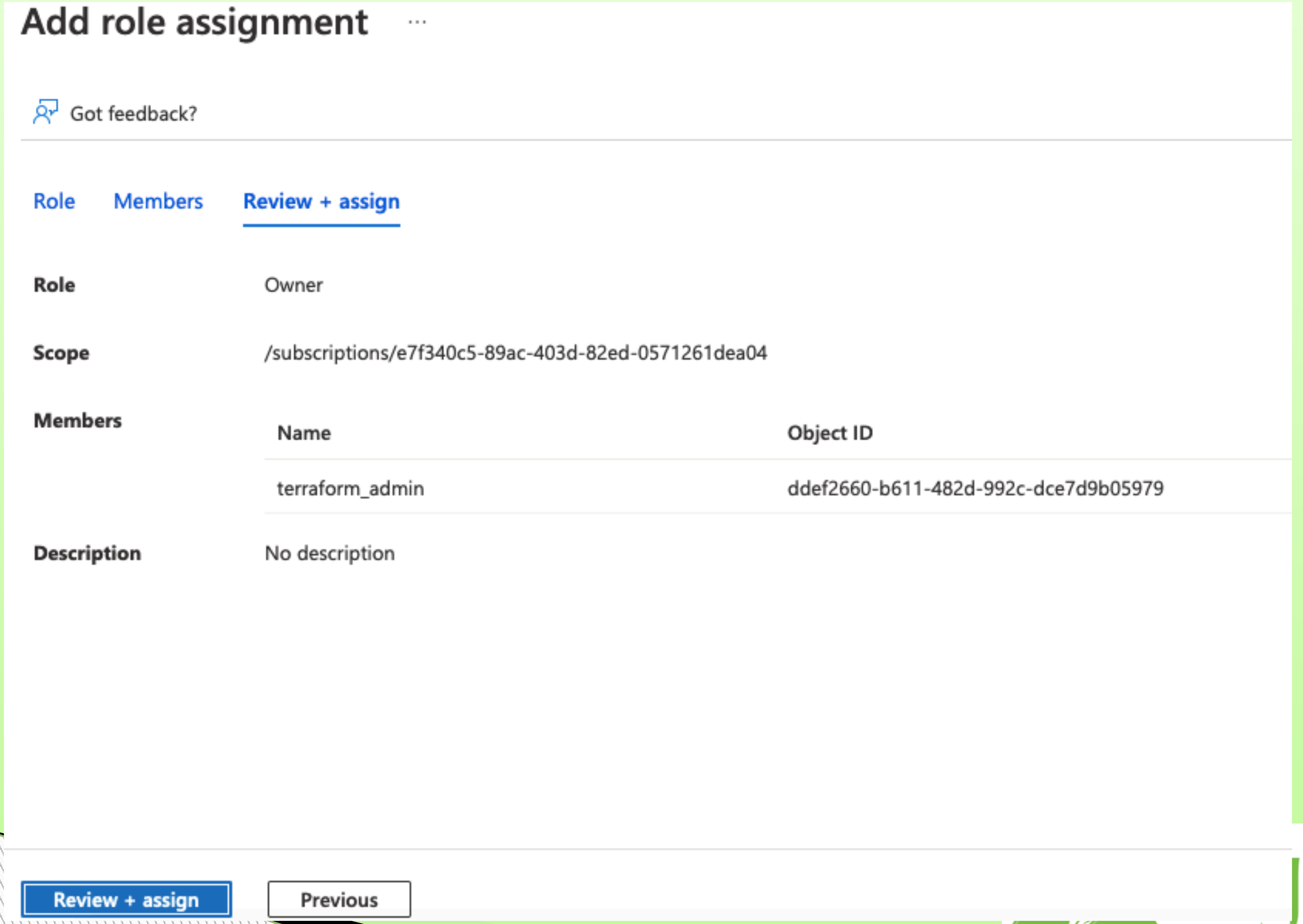
Assign access to: [✓ User, group, or service principal] Managed identity

Members: + Select members

Name	Object ID	Type
terraform_admin	ddef2660-b611-482d-992c-dce7d9b059...	App

Description: Optional

Review + assign



Add role assignment

Got feedback?

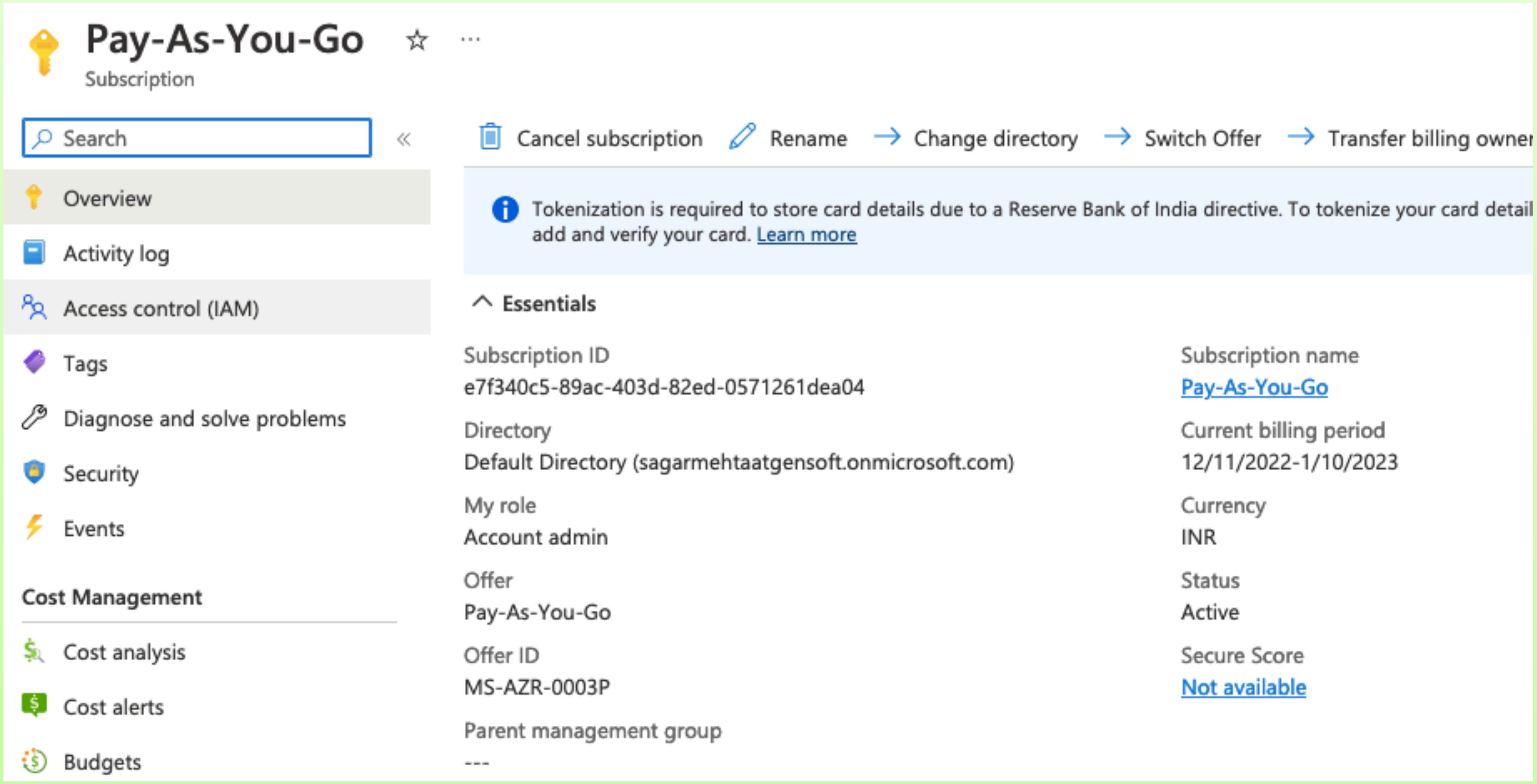
Role	Owner
Scope	/subscriptions/e7f340c5-89ac-403d-82ed-0571261dea04

Members

Name	Object ID
terraform_admin	ddef2660-b611-482d-992c-dce7d9b05979

Description No description

Generate a Client Certificate



Tokenization is required to store card details due to a Reserve Bank of India directive. To tokenize your card detail add and verify your card. Learn more

Essentials

Subscription ID	Subscription name
e7f340c5-89ac-403d-82ed-0571261dea04	Pay-As-You-Go
Directory	Current billing period
Default Directory (sagarmehtaatgensoft.onmicrosoft.com)	12/11/2022-1/10/2023
My role	Currency
Account admin	INR
Offer	Status
Pay-As-You-Go	Active
Offer ID	Secure Score
MS-AZR-0003P	Not available
Parent management group	

Installing Azure Client

- sudo rpm --import https://packages.microsoft.com/keys/microsoft.asc
- cat /etc/yum.repos.d/azure-cli.repo

```
[azure-cli]
name=Azure CLI
baseurl=https://packages.microsoft.com/yumrepos/azure-cli
enabled=1
gpgcheck=1
gpgkey=https://packages.microsoft.com/keys/microsoft.asc
```

- sudo yum install azure-cli

Installing Azure Client

- Get Locations
```
az account list-locations
```
- Get Image List
```
az vm image list
```
- Get SKU’s
```
az vm list-skus --location eastus --zone --all --output table
```

Azure Access

- https://atgensoft.com/training/terraform_azure_access_26062023.zip

Exercise

- Create an Azure Linux(Ubuntu 18.04) Machine instance using terraform.
- Region: East US

State

- Terraform must store state about your managed infrastructure and configuration.
- This state is used by Terraform to map real world resources to your configuration, keep track of metadata, and to improve performance for large infrastructures.
- This state is stored by default in a local file named "terraform.tfstate“.
- Terraform uses this local state to create plans and make changes to your infrastructure.
- Prior to any operation, Terraform does a refresh to update the state with the real infrastructure.

Variables

- Variables serve as parameters for a Terraform module.

```
variable "key" {
    type = "string"
}

variable "zones" {
    default = ["us-east-1a", "us-east-1b"]
}
```

Variables

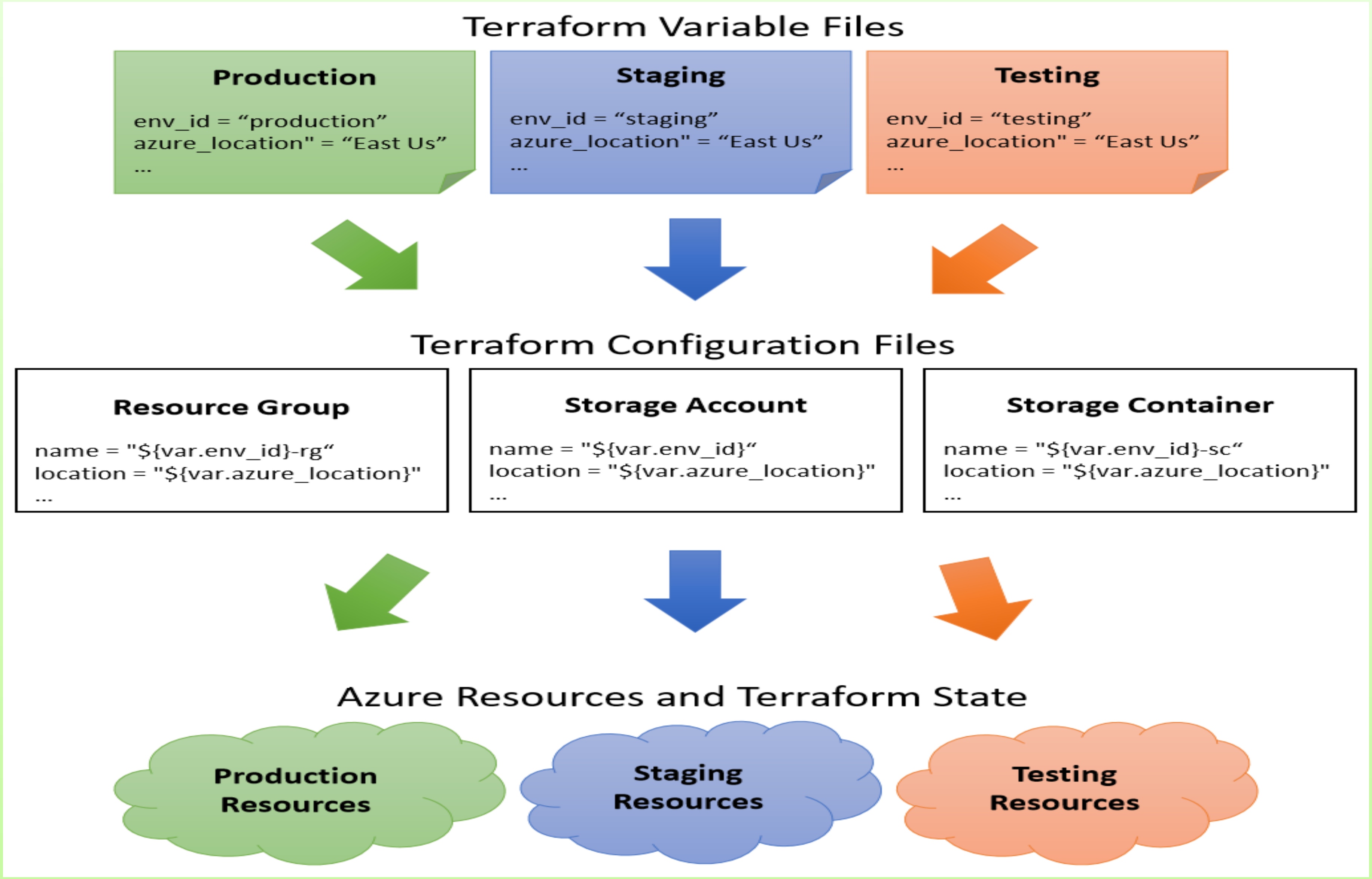
```
variable "list" {
  default = [ "1", "2", "3" ]
}

output "a" {
  value = var.list[0]
}

variable "string" {
  type = string
  default = "Hello, this is sample string"
}

output "b" {
  value = var.string
}
```

Variables

```
variable "number" {
  type = number
  default = 100
}

output "c" {
  value = var.number
}

variable "bool" {
  type = bool
  default = true
}

output "d" {
  value = var.bool
}
```

Variables

```
variable "map" {
   type = map
   default = {name = "Mabel", age = 52}
}

output "e" {
   value = var.map.name
}
```



Production

```
env_id = “production”
azure_location" = “East Us”
…
```

Staging

```
env_id = “staging”
azure_location" = “East Us”
…
```

Testing

```
env_id = “testing”
azure_location" = “East Us”
…
```

Resource Group

```
name = "${var.env_id}-rg“
location = "${var.azure_location}"
…
```

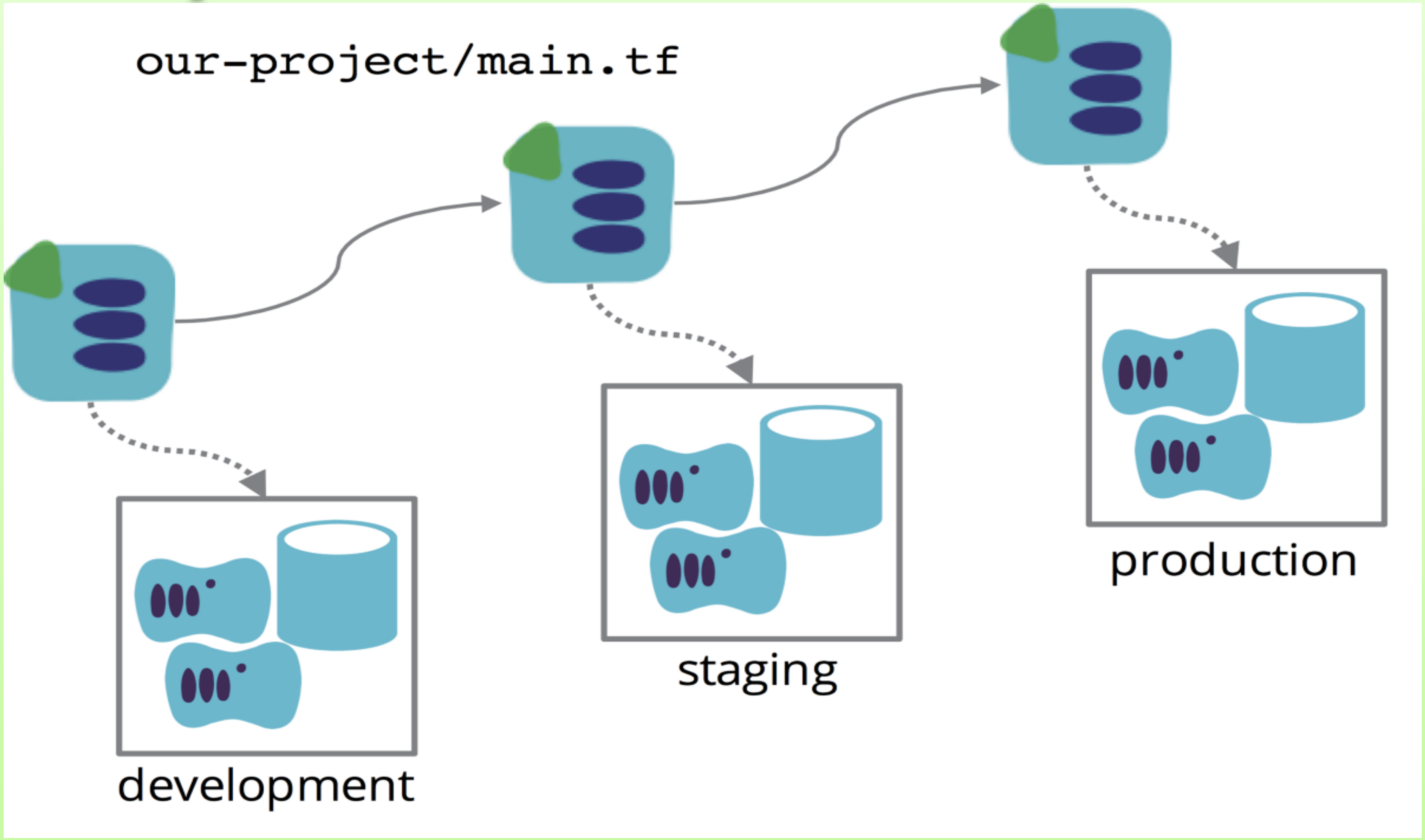
Storage Account

```
name = "${var.env_id}“
location = "${var.azure_location}"
…
```

Storage Container

```
name = "${var.env_id}-sc“
location = "${var.azure_location}"
…
```

Multiple Environments



Exercise

- Create an Azure Linux(Ubuntu 18.04) Machine instance using terraform with variables defined in variable.tf.

Output Configuration

- Outputs define values that will be highlighted to the user when Terraform applies, and can be queried easily using the output command.
- Terraform knows a lot about the infrastructure it manages. Most resources have attributes associated with them, and outputs are a way to easily extract and query that information.
- For Example,

```
output "Public_IP" {
    value = azurerm_linux_virtual_machine.main.public_ip_address
}
```

- This will output a string value corresponding to the public IP address of the Terraform-defined AWS instance named "main".

Exercise

- Create an Azure Linux(Ubuntu 18.04) Machine instance using terraform with variables defined in vars.tf and should display Public IP/Private IP as output item.

Provisioners

- Provisioners are used to execute scripts on a local or remote machine as part of resource creation or destruction.
- Provisioners can be used to bootstrap a resource, cleanup before destroy, run configuration management, etc.
- Provisioners are added directly to any resource:

```
resource "azurerm_linux_virtual_machine" "main" {
        # ...
        provisioner "local-exec" {
            command = "echo ${self.private_ip_address} > file.txt"
         }
}
```

Provisioners

- Below are type:
  - Chef
  - Connection
  - File
  - Habitat
  - Local-exec
  - Remote-exec
  - Salt-masterless

Provisioners

```
resource "azurerm_linux_virtual_machine" "main" {
 ###


  provisioner "file" {
    source = "test.sh"
    destination = "/tmp/test.sh"
    connection {
      type = "ssh"
      user = “USERNAME"
      private_key = "${file("~/.ssh/id_rsa")}"
      host = self.public_ip
    }
  }

}
```

Provisioners

```
provisioner "remote-exec" {
  inline = [
    "chmod +x /tmp/test.sh",
    "/tmp/test.sh",
  ]
  connection {
    type = "ssh"
    user = “USERNAME"
    private_key = "${file("~/.ssh/id_rsa")}"
    host = self.public_ip
  }
}
```

Exercise

- Create an Azure Linux(Ubuntu 18.04) Machine instance using terraform with variables defined in vars.tf and should display Public IP/Private IP as output item and do ssh login(using keys) to instance.

Session: 5

Conditional Statements

Loops

- To accomplish for-loop in terraform, “count” was introduced.
- For Example,

```
resource "azurerm_linux_virtual_machine" "main" {
  count = 3
  name                            = “myvm-vm-${count.index}“
  size                            = "Standard_F2"
  admin_username                  = "adminuser"
  admin_password                  = "P@ssw0rd1234!"
  disable_password_authentication = false

  source_image_reference {
    publisher = "Canonical"
    offer     = "UbuntuServer"
    sku       = "18.04-LTS"
    version   = "latest"
  }

  os_disk {
    storage_account_type = "Standard_LRS"
    caching              = "ReadWrite"
  }
}
```

Exercise

- Create a Three Azure Linux(Ubuntu 18.04) Machine instance using terraform with variables defined in vars.tf using loops.

For Each

- For Example,

```
resource "azurerm_linux_virtual_machine" "main" {
  for_each = toset( ["blr", "mum", “hyd"] )
  name                            = “myvm-vm-${each.key}“
  size                            = "Standard_F2"
  admin_username                  = "adminuser"
  admin_password                  = "P@ssw0rd1234!"
  disable_password_authentication = false

  source_image_reference {
    publisher = "Canonical"
    offer     = "UbuntuServer"
    sku       = "18.04-LTS"
    version   = "latest"
  }

  os_disk {
    storage_account_type = "Standard_LRS"
    caching              = "ReadWrite"
  }
}
```

Exercise

- Create a Two Azure Linux(Ubuntu 18.04) Machine instance using terraform with variables defined in vars.tf using for_each with sizes "Standard_F2" and "Standard_F1".

If-else

- If-else can be accomplished in terraform, using “count”.
- For Example,

```
variable "create_instance" {
        description = "Create an instance if set to True"
        default = true
}
```

If-else

```
resource "azurerm_linux_virtual_machine" "main" {
  count = "${var.create_instance == true ? 1 : 0}”
  name                            = “myvm-vm-${count.index}“
  size                            = "Standard_F2"
  admin_username                  = "adminuser"
  admin_password                  = "P@ssw0rd1234!"
  disable_password_authentication = false

  source_image_reference {
    publisher = "Canonical"
    offer     = "UbuntuServer"
    sku       = "18.04-LTS"
    version   = "latest"
  }

  os_disk {
    storage_account_type = "Standard_LRS"
    caching              = "ReadWrite"
  }
}
```

Exercise

- Create an Azure Linux(Ubuntu 18.04) Machine instance using variable values.

Session: 6

Terraform Templates

Templates

- The template provider exposes data sources to use templates to generate strings.
- Templates are helpful in scenario of managing multiple environments.

Templates

- For Example,

```
data "template_file" "user_data" {
  template = "${file("${path.module}/user_data")}"
}
```

Templates

- For Example,

```
resource "azurerm_linux_virtual_machine" "main" {
  name = “myvm-vm-${count.index}“
  size = "${trimspace(data.template_file.user_data.rendered)}"
  admin_username                  = "adminuser"
  admin_password                  = "P@ssw0rd1234!"
  disable_password_authentication = false

  source_image_reference {
    publisher = "Canonical"
    offer     = "UbuntuServer"
    sku       = "18.04-LTS"
    version   = "latest"
  }

  os_disk {
    storage_account_type = "Standard_LRS"
    caching              = "ReadWrite"
  }
}
```

Exercise

- Create Two Azure Machines(Ubuntu 18.04) instance using terraform variables defined in variable.tf and having different sizes based on environment prod and dev.

Modules

- A Terraform module is very simple: any set of Terraform configuration files in a folder is a module.
- Here are some of the ways that modules help solve the problems:
  - Organise configuration
  - Encapsulate configuration
  - Re-use configuration
  - Provide consistency

Modules

- Create directory say “terraform_modules”.
- Create Sub-directory inside it “modules/services/webserver-cluster”.
- Create below structure:

```
# tree modules/services/webserver-cluster/
modules/services/webserver-cluster/
├── main.tf
├── outputs.tf
└── vars.tf

0 directories, 3 files
```

-

Modules - Calling

- Calling Terraform modules:

```
[terraform_modules]# cat main.tf
module "webserver_cluster" {
  source = "./modules/services/webserver-cluster"
  size = "Standrad_F1"
}
```

Exercise

- Create Two Azure Machines using terraform variables defined in variable.tf and having different instance_types based on environment prod(Standard_F1) and dev(Standard_F2) using modules.

Remote State/Backend

- A backend defines where Terraform stores its state data files.
- Below are different types of Backends:
  - local
  - artifactory
  - Azurerm
  - S3
  - Kubernetes
  - http
  - Swift

Remote State/Backend

```
terraform {
   backend "local" {
      path = "relative/path/to/terraform.tfstate"
   }
}


data "terraform_remote_state" "foo" {
   backend = "local"

   config = {
      path = "${path.module}/../../terraform.tfstate"
   }
}
```

Terraform Import

- Terraform 'import' feature lets you down "tfstate" files on existing infrastructure.
- Below are steps:
  - Create "main.tf" with provider and resource to be imported
  - Initialise the plugins
  - Execute **terraform import TYPE.NAME ID**

Terraform Get Data - http

- Terraform can download data from web API as shown below:

```
data "http" "example" {
      url = “https://www.atgensoft.com"
      request_headers = {
          Accept = “application/json”
       }
  }
```

Terraform Random

- The "random" provider allows the use of randomness within Terraform configurations.
- Below is example:

```
resource "random_integer" "num" {
   min = 1
   max = 50000
}
```

- Task: Create a random string of length 16.

Terraform Local

- The "local" provider allows to manage local files.
- Below is example:

```
resource “local_file” “foo” {
  content = “foo”
  filename = “${path.module}/foo.bar”
 }
```

Terraform Taint

- The `terraform taint` command informs Terraform that a particular object has become degraded or damaged. Terraform represents this by marking the object as "tainted" in the Terraform state, and Terraform will propose to replace it in the next plan you create.

```
terraform taint <address>
```

- For example,

```
terraform taint aws_instance.foo
```

Terraform Workspaces

- Terraform starts with a single workspace named "default". This workspace is special both because it is the default and also because it cannot ever be deleted.

```
terraform workspace new dev
terraform workspace select dev
terraform workspace show
```

Exercise

- Create an Azure Machine(Ubuntu 18.04) instance using terraform variables defined in variable.tf, having output Url/IP and Port and running Web Server.
- Do set inbound/outbound rules for same.
  - Apache Web Server: **apache2**
  - Default Port: **80**
  - SSH Port: **22**

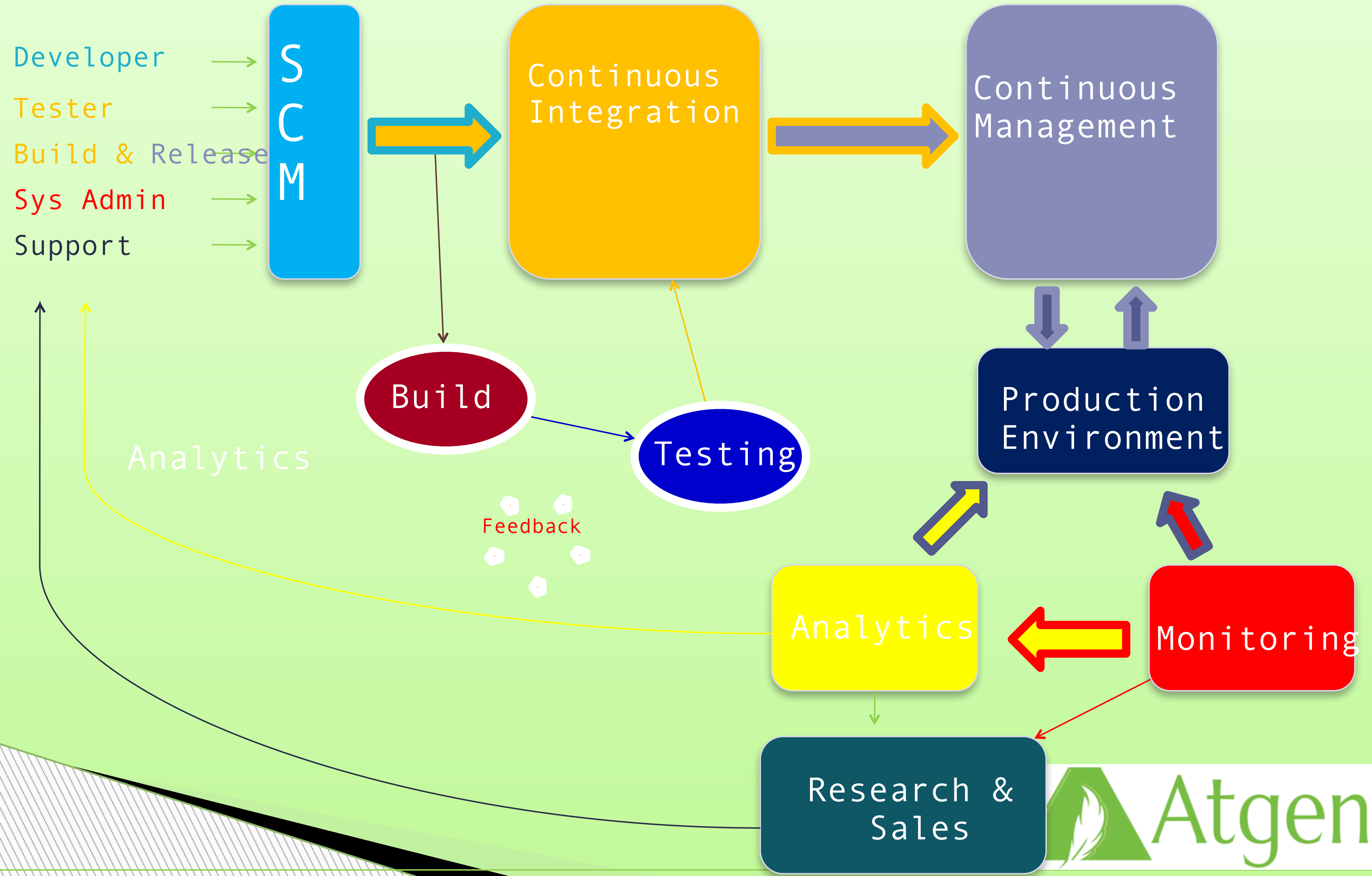
Exercise

- Create an AWS Machine(Ubuntu 20.04) instance using terraform variables defined in variable.tf, having output Url/IP and Port and running Web Server.
- Do set inbound/outbound rules for same.
  - Apache Web Server: **apache2**
  - Default Port: **80**
  - SSH Port: **22**

Session: 7

CI/CD - Terraform

What is DevOps?



Jenkins for CI

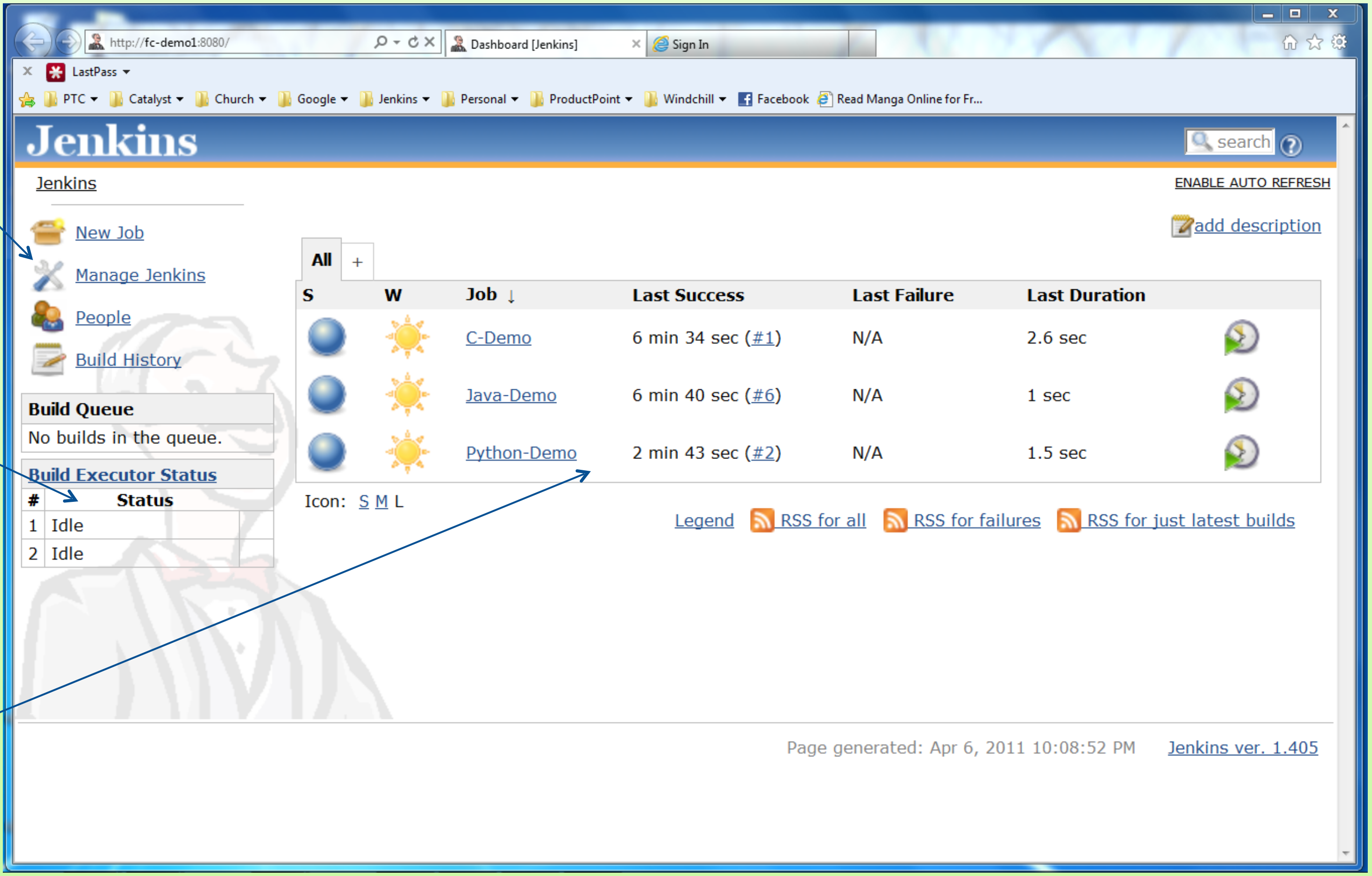
- Jenkins – open source continuous integration server
- Jenkins (http://jenkins-ci.org/) is
  - Easy to install
  - Easy to use
  - Multi-technology
  - Multi-platform
  - Widely used
  - Extensible
  - Free

Jenkins User Interface

Actions

Nodes

Jobs



Build Queue

No builds in the queue.

Build Executor Status

#	Status
1	Idle
2	Idle

S	W	Job ↓	Last Success	Last Failure	Last Duration
●	☀	C-Demo	6 min 34 sec (#1)	N/A	2.6 sec
●	☀	Java-Demo	6 min 40 sec (#6)	N/A	1 sec
●	☀	Python-Demo	2 min 43 sec (#2)	N/A	1.5 sec

Icon: S M L

Legend RSS for all RSS for failures RSS for just latest builds

Page generated: Apr 6, 2011 10:08:52 PM Jenkins ver. 1.405

More Power - Jenkins Plugins

- Jenkins has plugins for various operations like
  - Software configuration management
  - Builders
  - Test Frameworks
  - Virtual Machine Controllers
  - Notifiers
  - Static Analyzers

Jenkins - Integration

- Jenkins help your release to be
  - Faster
  - Safer
  - Easier
  - Smarter

Exercise:

- Jenkins help your release to be
  - Faster
  - Safer
  - Easier
  - Smarter

Exercise:

- Link: https://atgensoft.com/training/ibm-terraform-19062023.zip

Contact us

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Thank You !!