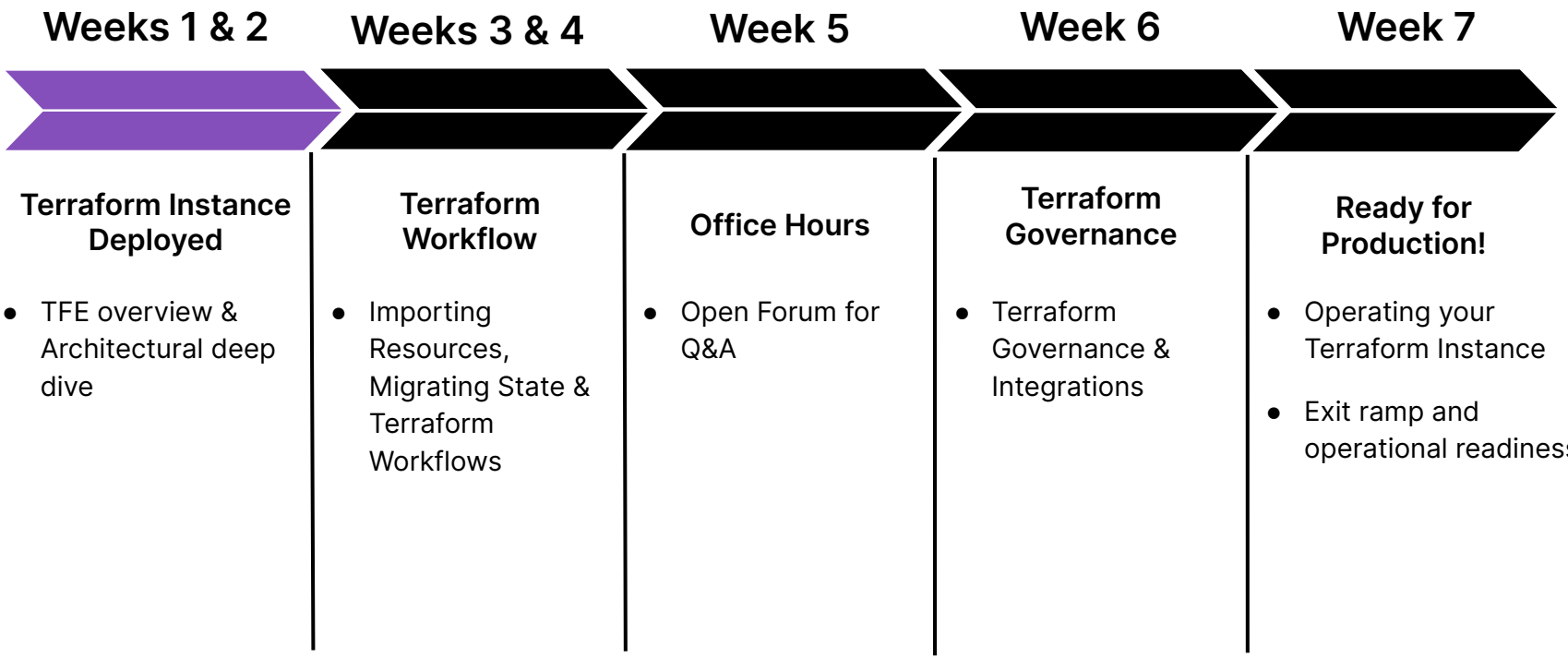
HashiCorp Terraform

Terraform Enterprise Architecture Deep Dive

TFE Path to Production



Agenda

01

Deployment

Pre-Install Checklist

Critical tasks than need completed prior to starting Terraform Enterprise installation include:

- Establish the Operational Mode - cannot be changed once TFE is operating*
- Obtain Credentials
- Prepare data storage
- Configure Linux instance(s)

Credentials

- License File
- TLS Certificate & Private Key
  - Required for the instance to operate
  - Certificate much match Terraform Enterprise’s hostname
  - Certificate must be trusted by all services TFE interfaces with
  - Key and X.509 must be PEM (base64) encoded
- Correct permissions on object storage

Amazon S3 Data Storage

- S3-compatible object storage is used to store state files (S3, GCP Cloud Storage, Azure blob)
- Bucket must be created prior to installation and is specified during the installation process
- Terraform Enterprise expects to manage all data in the object storage service
- Disable any lifecycle rules that would delete, archive, or transition objects in this bucket

PostgreSQL Data Storage

- A PostgreSQL server (Amazon RDS) or a PostgreSQL-compatible server is required
- TFE uses Postgres to store:
  - SSO Configuration
  - Terraform Organizations
  - Workspace Configuration
- Supported PostgreSQL server versions:
  - 12.x, 13.x or 14.x
  - 11.x will be deprecated in v202303-1 release
- Postgres Requirements

Replicated

- Manages licensing of Terraform Enterprise
- Used as a scheduler to manage Docker containers
- Customers should not interact with Replicated directly unless directed by support

Terraform - Services

- **tfe_nginx** - Nginx reverse proxy, facilitates access to TFE services
- **tfe_atlas** - The API and Web UI, TFE used to be known as Atlas
- **tfe_build_manager** - Manages the queue of Terraform runs
- **tfe_build_worker** - Creates workers on-demand as required by the queue, injects variables, secrets, and Terraform configuration to a temporary container
- **tfe_worker** - The ephemeral container which executes a Terraform `plan` or `apply`, can be replaced with a custom image, may be created with a randomly generated name
- List of Terraform Enterprise Containers

02

Operational Modes

Operational Modes

1. Mounted Disk
2. External Services
3. Active/Active

Mounted Disk

Production Supported
(Recommended for VMware)

- Good for Production workloads
- Long-Lived
- Single Region
- Self-contained
- Easy to set up manually
- High Availability (HA) / Disaster Recovery (DR) with cold standby
- Single Docker instance for Postgres, S3 Storage

Standalone External Services

Production Supported (Recommended for Cloud Deployments)

- Good for high Capacity Production Workloads
- Single Region
- Best done via automation for quick set up
- Uses externally running Postgres & S3 Storage
- High Availability (HA) / Disaster Recovery (DR) with cold standby

Active/Active

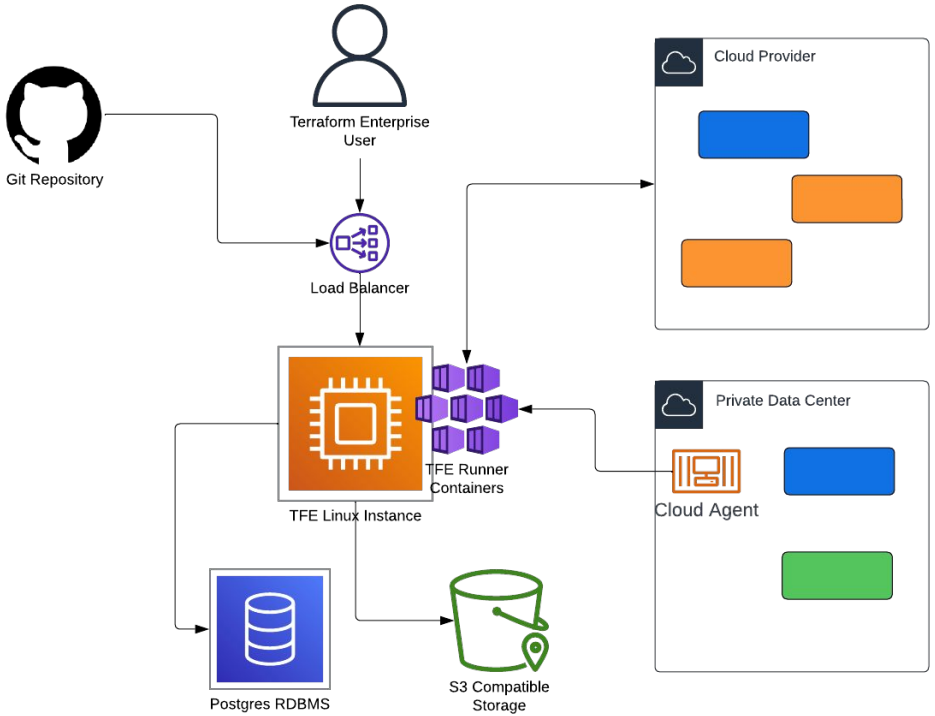
- High Availability (HA)
- Disaster Recovery (DR)
- Horizontal Scaling
- Single Region
- Requires automation for setup
- Increased operational complexity
- Uses 2X - 5X the resources of a Standalone installation
- Uses externally running Postgres, S3 Storage, and Redis

03

Reference Architecture

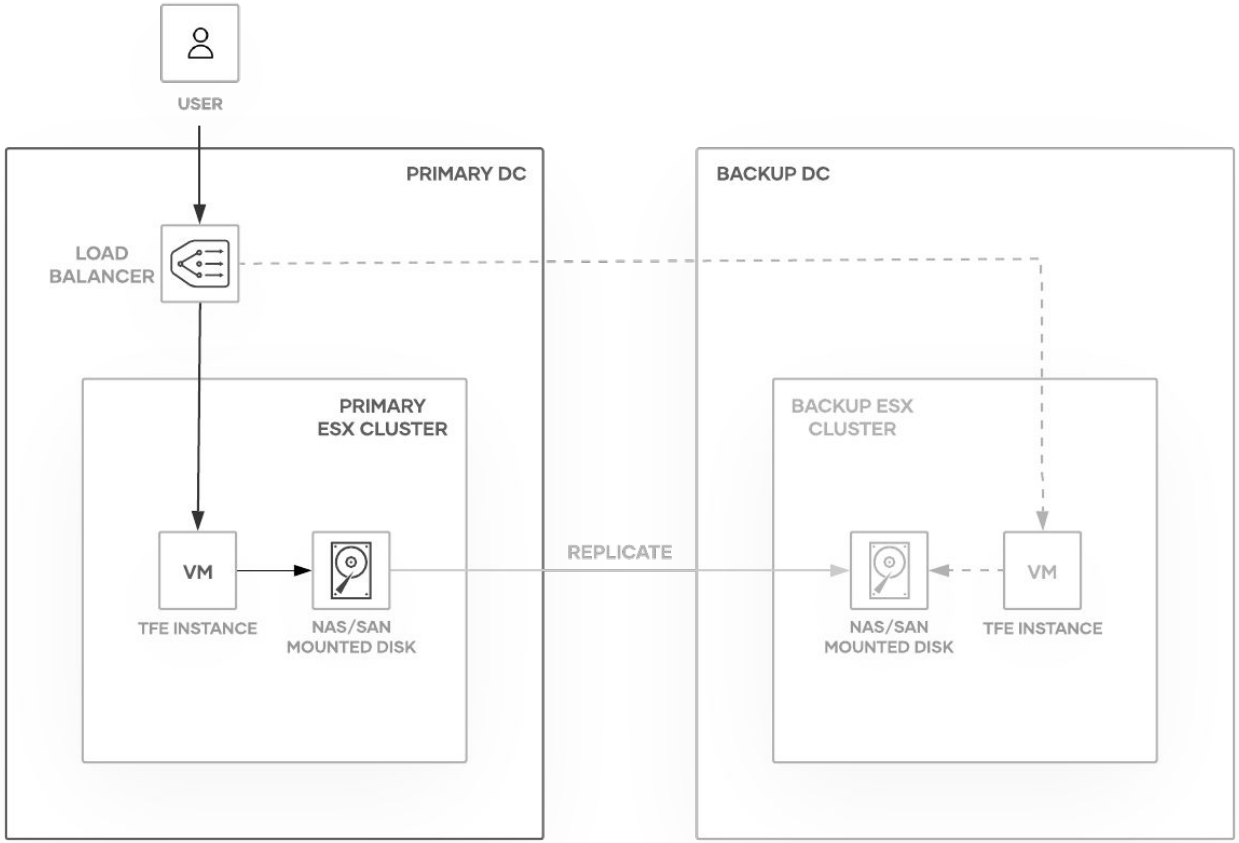
Terraform Enterprise Architecture

- TFE is a self-managed service composed of microservices runnir within Docker
- TFE uses S3-compatible storage, Postgres RDBMS, Redis, and Replicated (license management)
- The preferred installation into a **cloud provider** is a Standalone installation in **External Services** mode
- Common installation into **VMWare** is a Standalone installation in **Mounted Disk** mode



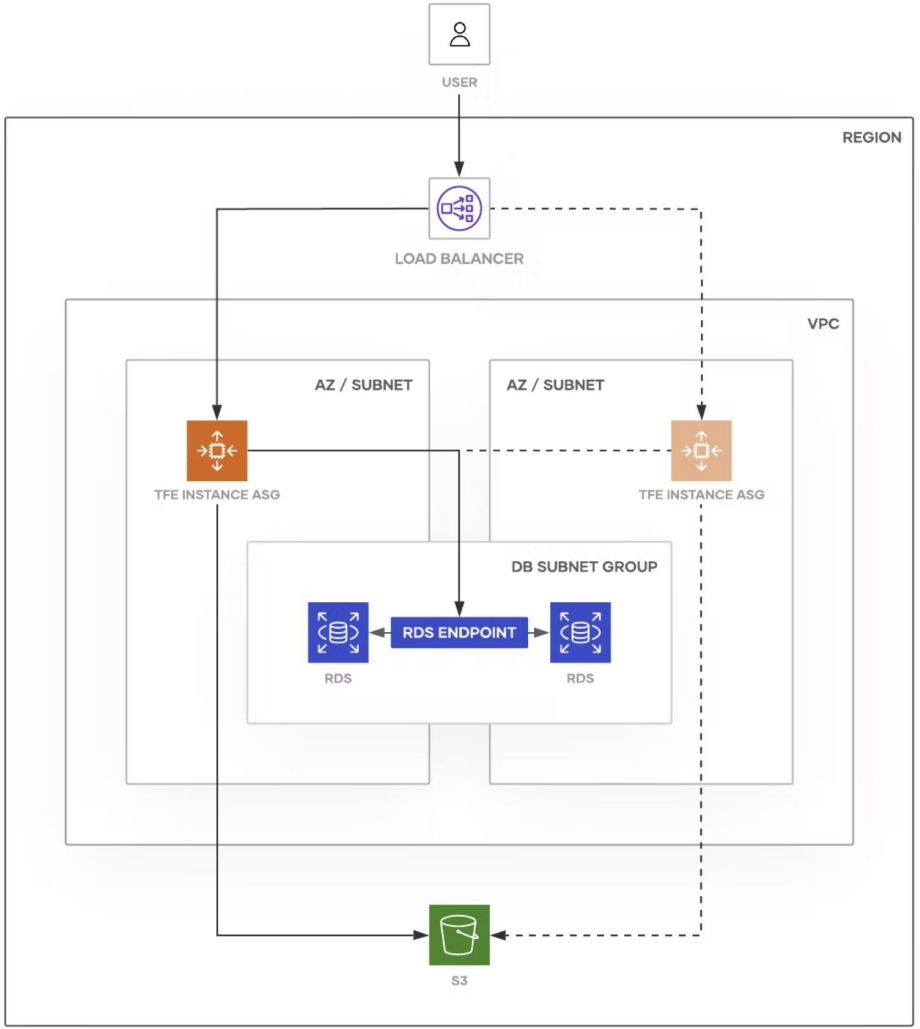
VMware Standalone

[Reference Architecture]



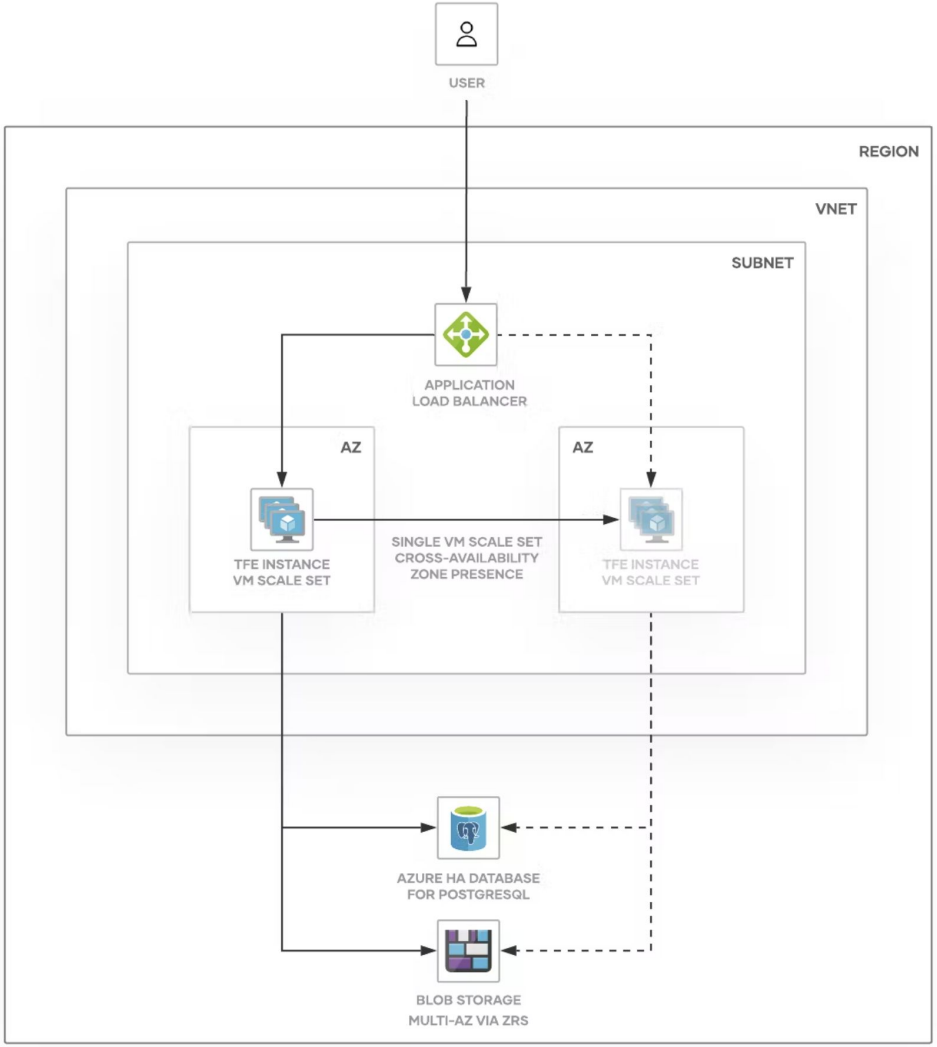
AWS Standalone

[Reference Architecture]



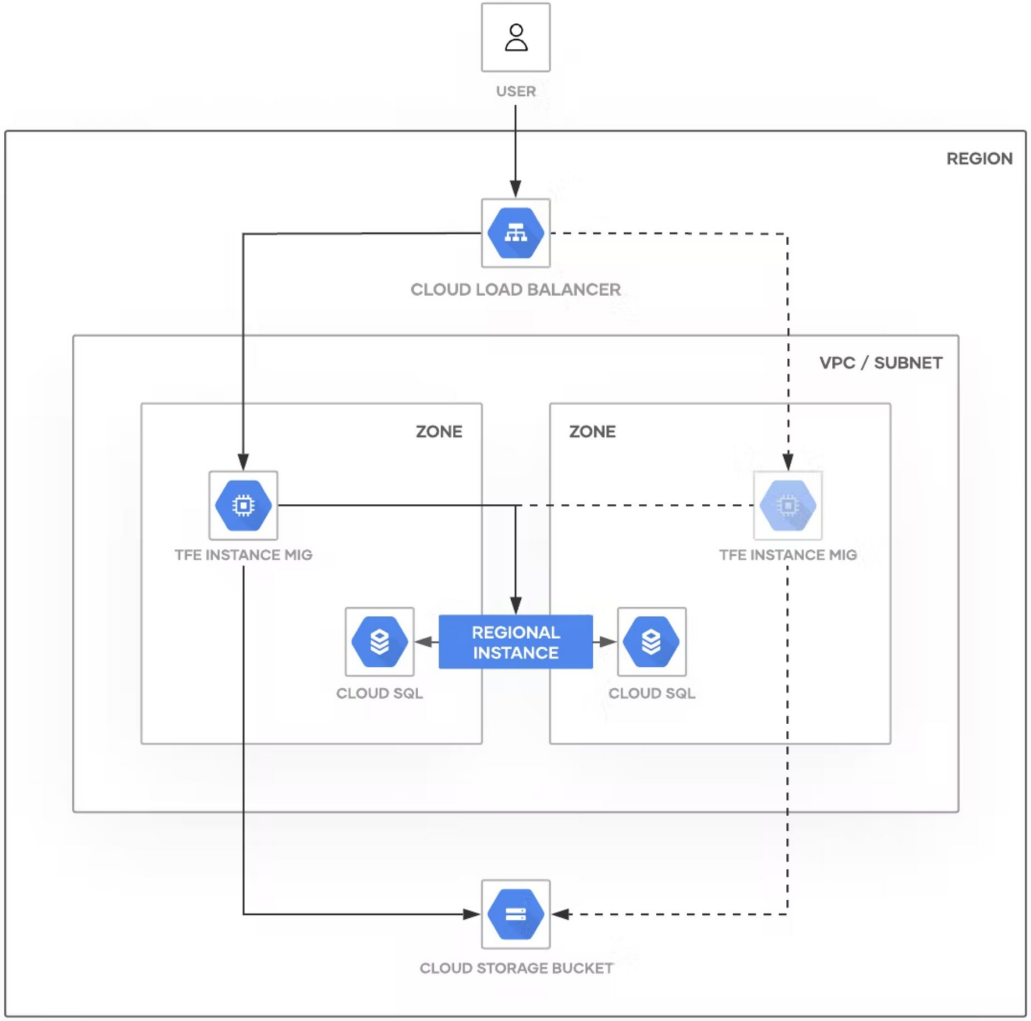
Azure Standalone

[Reference Architecture]



GCP Standalone

[Reference Architecture]



04

Dependencies

OS & Software Requirements

Operating System	
Distro	**Version**
Ubuntu	20.04, 18.04
Debian	11, 10
CentOS	8.4, 7.4 - 7.9
Oracle Linux	8.4, 7.4 - 7.9
Red Hat Enterprise Linux	8.x, 7.x
Amazon Linux	2.0

Software	
Name	**Version**
Docker CE*	20.10.x 19.03.x
containerd.io	containerd 1.4.9 containerd 1.5.5 or newer
runc	runc v1.0.0-rc93 or newer
PostgreSQL	12.x, 13.x, 14.x

Note: Docker CE is not vendor supported on Red Hat Enterprise Linux and Oracle Linux

VMware Recommended Sizing

TFE Server (vSphere and vRealize)					
Type	**CPU Sockets**	**CPU Cores**	**Memory**	**Storage**	**Storage (Mounted Disk Volume)**
Minimum	2	4	16GB RAM	40GB	200GB
Scaled	2	8	32GB RAM	40GB	200GB
PostgreSQL Database (External Services)					
Type	**CPU Sockets**	**CPU Cores**	**Memory**	**Storage**	
Minimum	2	2 cores	8GB RAM	50GB	
Scaled	2	4-8 cores	16-32GB RAM	50GB	

Cloud Recommended Sizing

TFE Server					
Type	**CPU**	**Memory**	**Storage**	**AWS**	**Azure**
Minimum	4 core	16GB RAM	50GB	m5.xlarge	Standard_D4_v4
Scaled	8 core	32GB RAM	50GB	m5.2xlarge	Standard_D8_v4
PostgreSQL Database					
Type	**CPU**	**Memory**	**Storage**	**AWS**	**Azure**
Minimum	4 core	16GB RAM	50GB	db.m4.xlarge	GP_Gen5_4
Scaled	8 core	32GB RAM	50GB	db.m4.2xlarge	GP_Gen5_8

Network Requirements - Egress

Online Installations

- *.replicated.com
- *.quay.io
- quay-registry.s3.amazonaws.com
- *.cloudfront.net
- *.docker.com
- *.docker.io
- *.terraform.io
- releases.hashicorp.com

TFE also needs Egress access to

- Any VCS servers/services that will be utilized
- Login/authentication servers if SAML will be configured (ADFS, Okta, etc)
- The various cloud API endpoints that will be managed with Terraform
- Any other third party services that will either be integrated with the TFE server or managed with it

Cost Estimation APIs

When Cost Estimation is enabled, it uses the respective cloud provider's APIs to get up-to-date pricing info

- api.pricing.us-east-1.amazonaws.com
- cloudbilling.googleapis.com
- prices.azure.com

Network Requirements – Ingress

Source - User/Client/VCS

- **80**: Terraform Enterprise application access (HTTP; redirects to HTTPS)
- **443**: Terraform Enterprise application access (HTTPS)
- VCS Web Hooks are inbound, if you intend to use VCS integration with a cloud hosted VCS, you'll need to expose TFE on the public internet

Source - Administrators

- **22**: SSH access (administration and debugging)
- **8800**: Replicated (TFE setup dashboard, HTTPS)

Network Requirements - TLS Certificates

Trusted

- Prior to installation determine the hostname and generate a certificate that will be used during installation
- Requires a FQDN to access the TFE instance, using an IP is not supported
- If using on-prem VCS, the cert could be signed by your own root authority
- If using SaaS VCS, then you'll need a publicly trusted cert

Self-signed

- Don't do it! It will be more trouble in the long run

Load Balancer / WAF: TLS Offload / Inspection

- Ensure you re-encrypt the traffic and still use a trusted cert on the origin servers

05

Installation Patterns

Installation Patterns

Online Installation

Air Gapped / Offline

Online Installation

```
$ echo "Installing with internet access"
$ curl -o install-TFE.sh
https://install.terraform.io/TFE/stable
$ sudo bash install-TFE.sh
[… time passes …]
To continue the installation, visit the following URL in
your browser:
 https://<this_server_address>:8800
```

Air Gapped Installation

Running Terraform Enterprise within an air gapped Environment includes a variety of manual configuration and management processes

```
$ echo "Installing with Airgap file"
$ apt install docker -y
$ wget https://install.terraform.io/airgap/latest.tar.gz
$ echo "SCP the .airgap file onto the machine"
$ tar xzf replicated.tar.gz
$ sudo ./install.sh airgap
[… time passes …]
To continue the installation, visit the following URL in
your browser:
 https://<this_server_address>:8800
```

Automated Installation

Replicated Settings

- Initial replicated configuration can be defined in /etc/replicated.conf
- Settings include:
  - Dashboard password
  - TLS certificates
  - License file
  - Application settings
- Replicated automatically checks this location during execution of the installer

```
{
    "DaemonAuthenticationType":     "password",
    "DaemonAuthenticationPassword": "your-password-here",
    "TlsBootstrapType":             "server-path",
    "TlsBootstrapHostname":         "server.company.com",
    "TlsBootstrapCert":             "/etc/server.crt",
    "TlsBootstrapKey":              "/etc/server.key",
    "BypassPreflightChecks":        true,
    "ImportSettingsFrom":
"/path/to/application-settings.json",
    "LicenseFileLocation":          "/path/to/license.rli"
}
```

Automated Installation

Application Settings

- Configuration of TFE can be completed by passing a JSON formatted settings file during the installation
- Online & air gapped installations are supported by this method

```
{
    "hostname": {
        "value": "terraform.example.com"
    },
    "installation_type": {
        "value": "poc"
    },
    "capacity_concurrency": {
        "value": "5"
    }
}
```

Automated Installation

Initial admin user creation

- An admin user must be created after installation to use and manage TFE
- This is typically created in the UI, the API can be leveraged for this to automate the process

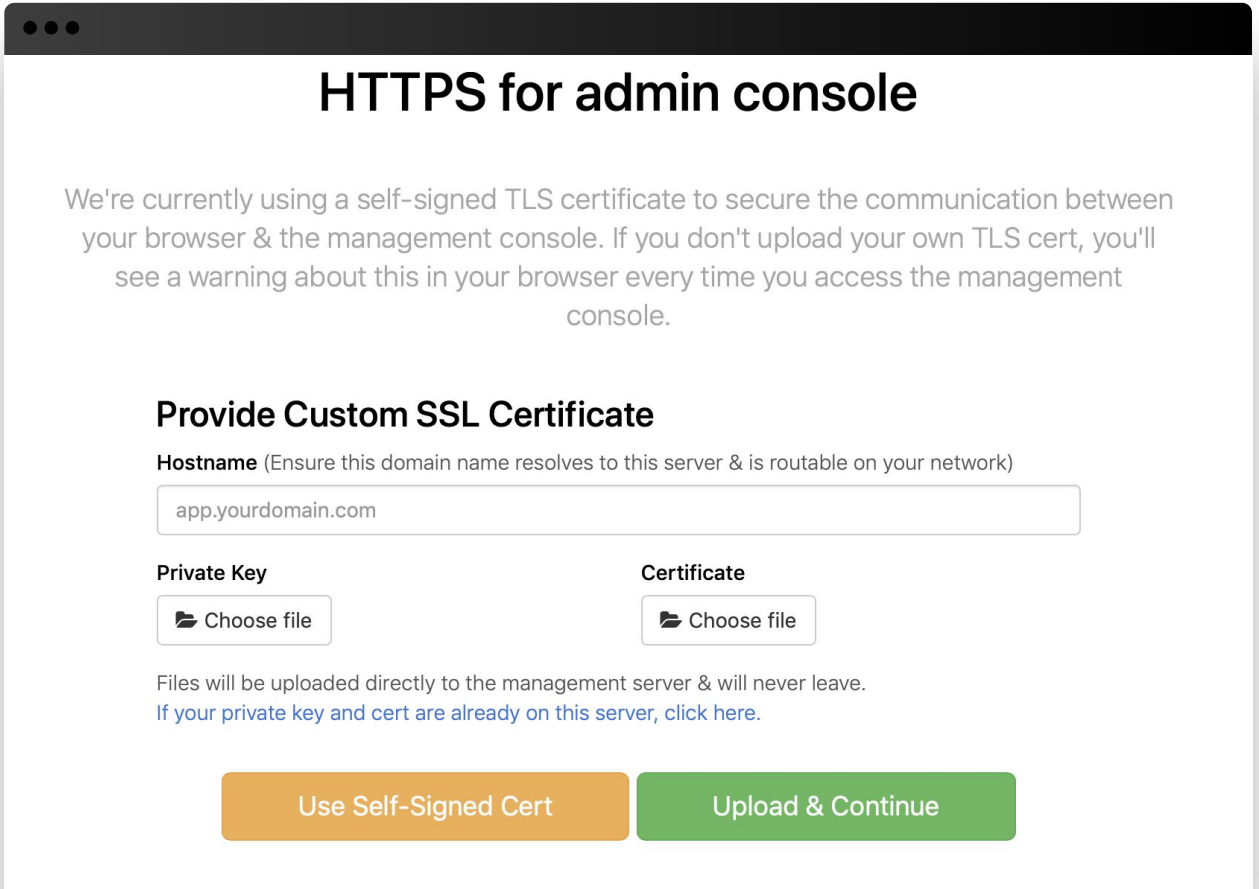
```
$ replicated admin --no-tty retrieve-iact > iact.txt
$ curl payload.json
{
  "username": "admin",
  "email": "it@mycompany.com",
  "password": "thisisabadpassword"
}
$ curl --header "Content-Type: application/json" \
  --request POST --data @payload.json \

https://TFE.company.com/admin/initial-admin-user?token=$(cat
iact.txt)
{
  "status": "created",
  "token":
"aabbccdd.v1.atlas.ddeeffgghhiijjkkllmmnnooppqqrrssttuuvvxxy
yzz"
}
```

06

Configuration

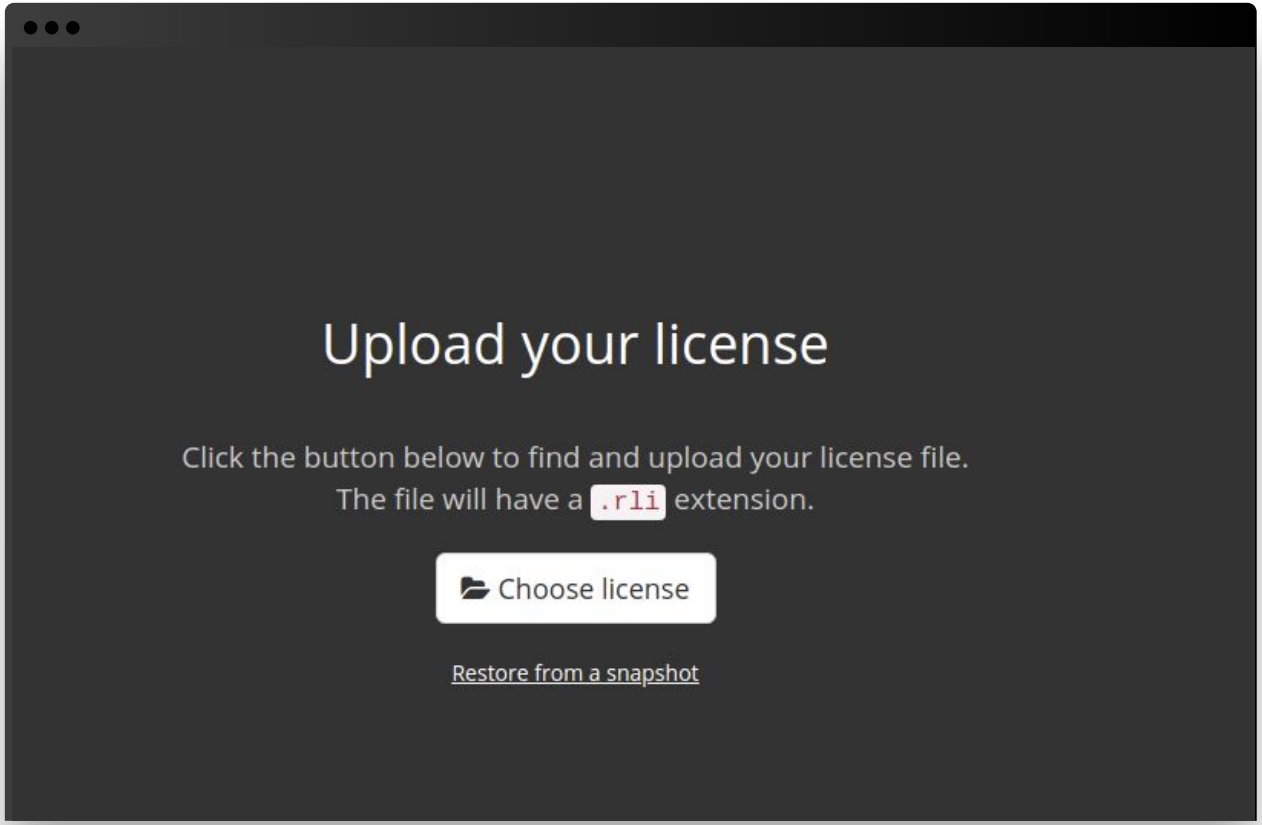
HTTPS Config

Enter hostname and upload private key and certificate



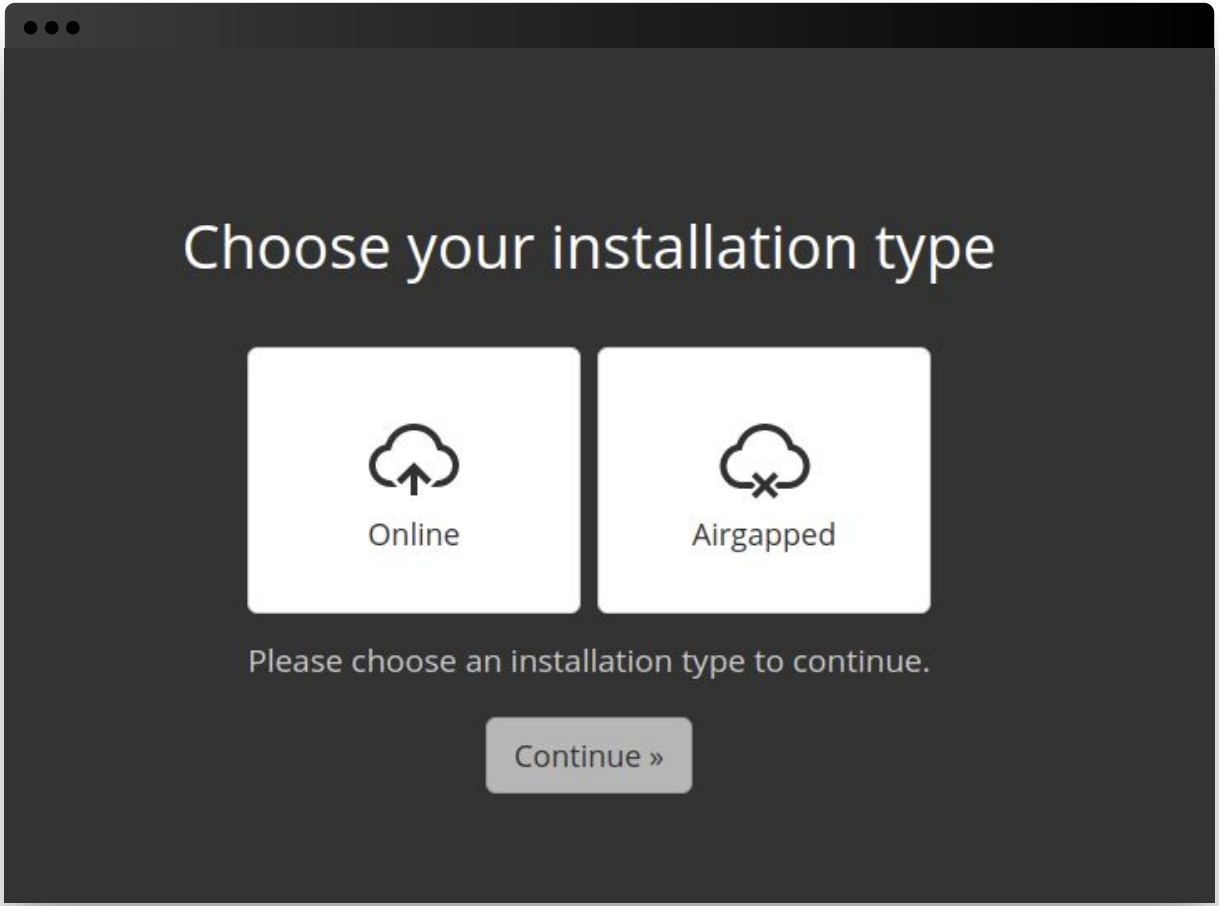
TFE Licensing

Upload .rli file provided in your welcome email



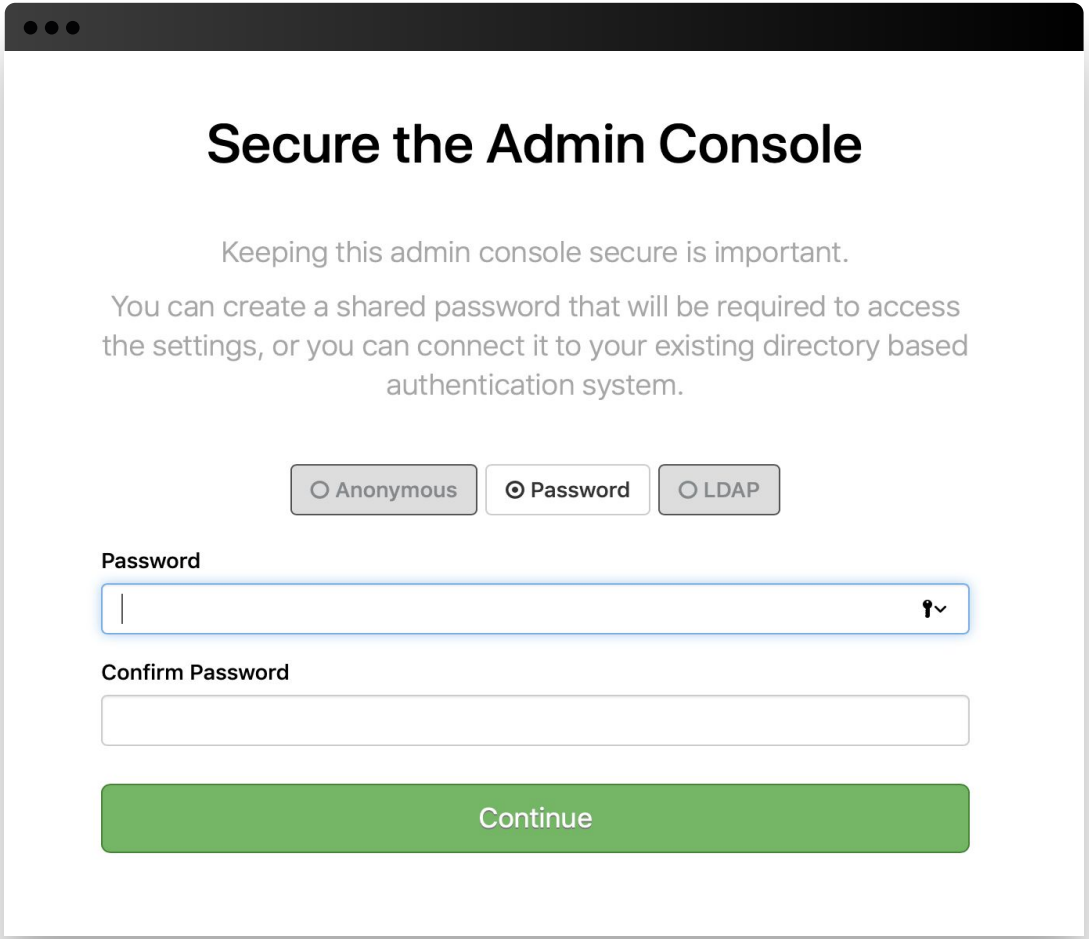
Select Installation Type

Select online or air gapped and the preflight check will begin



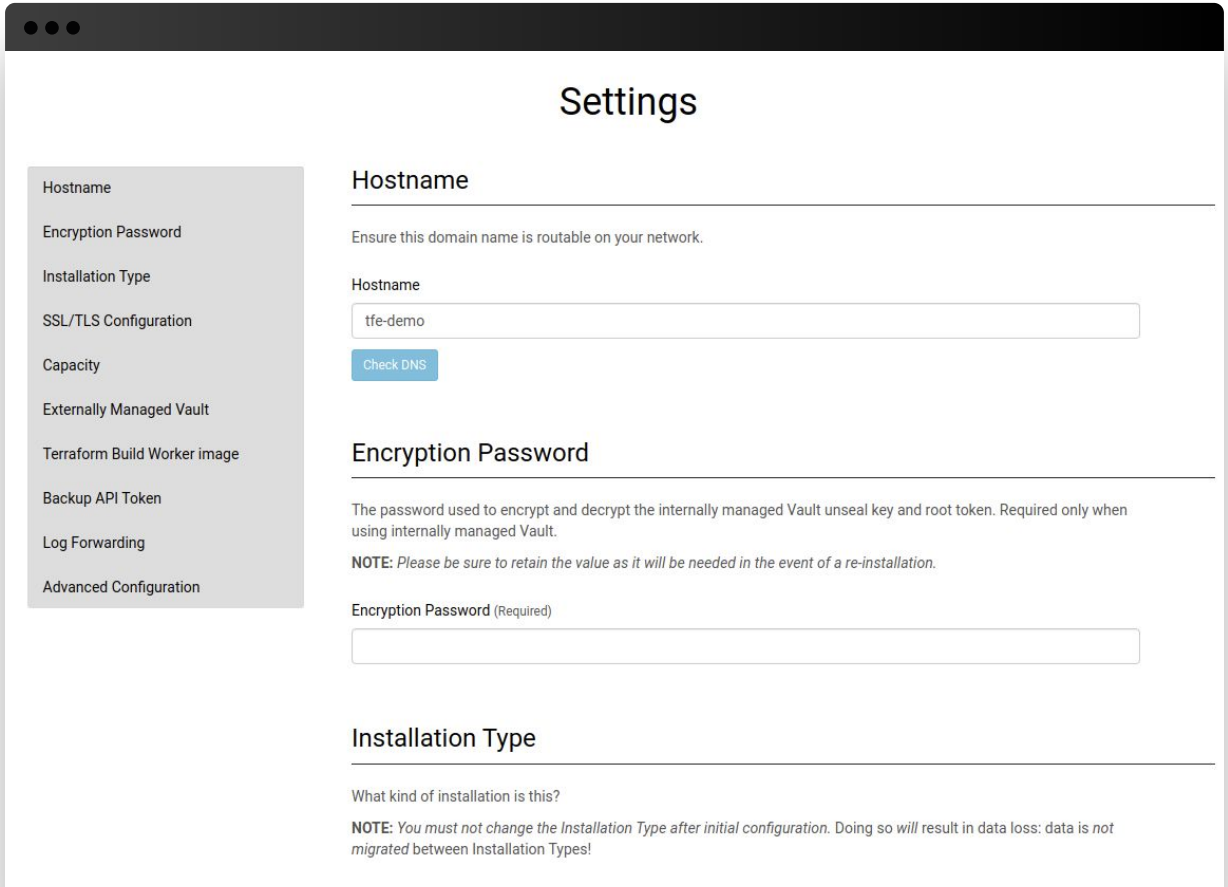
Admin Console Auth

- Create password or configure LDAP
- Anonymous is not recommended for use in production deployment



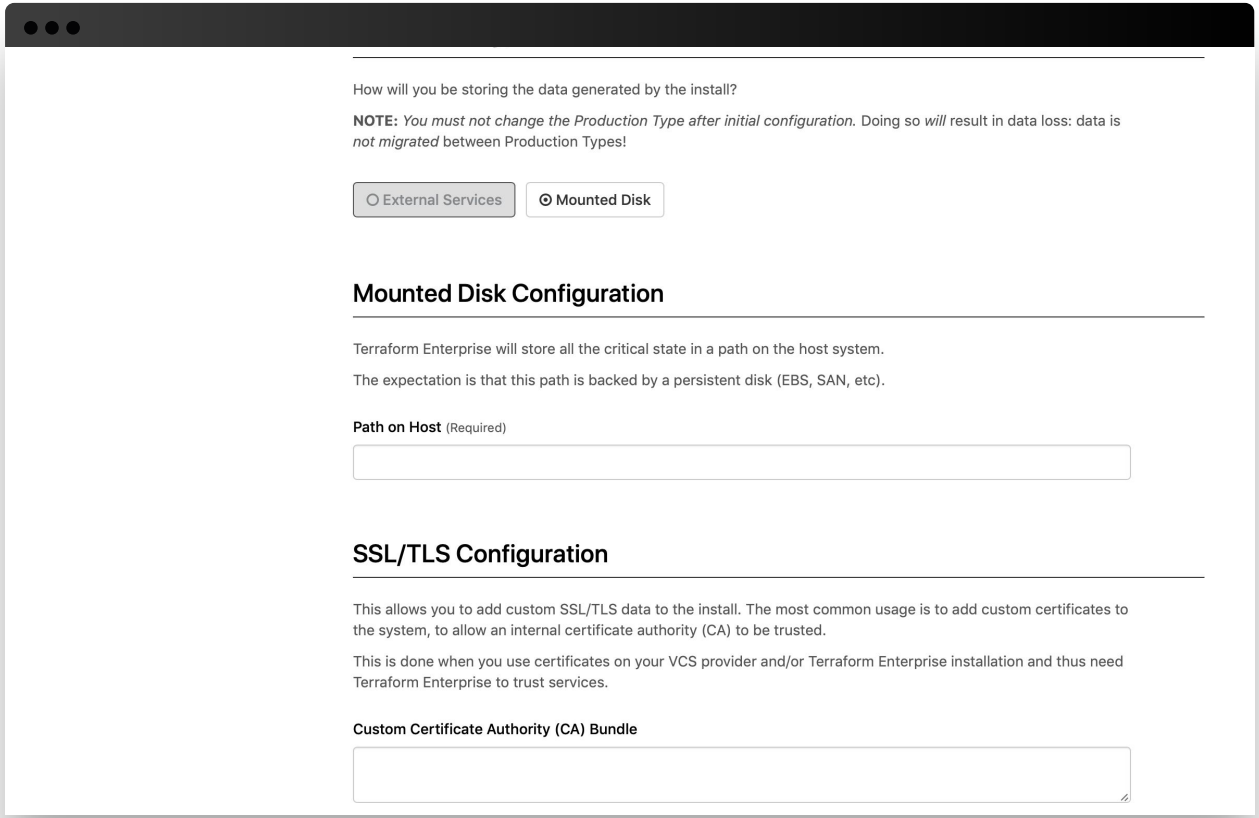
Installer Settings

Specify installation type and operation mode



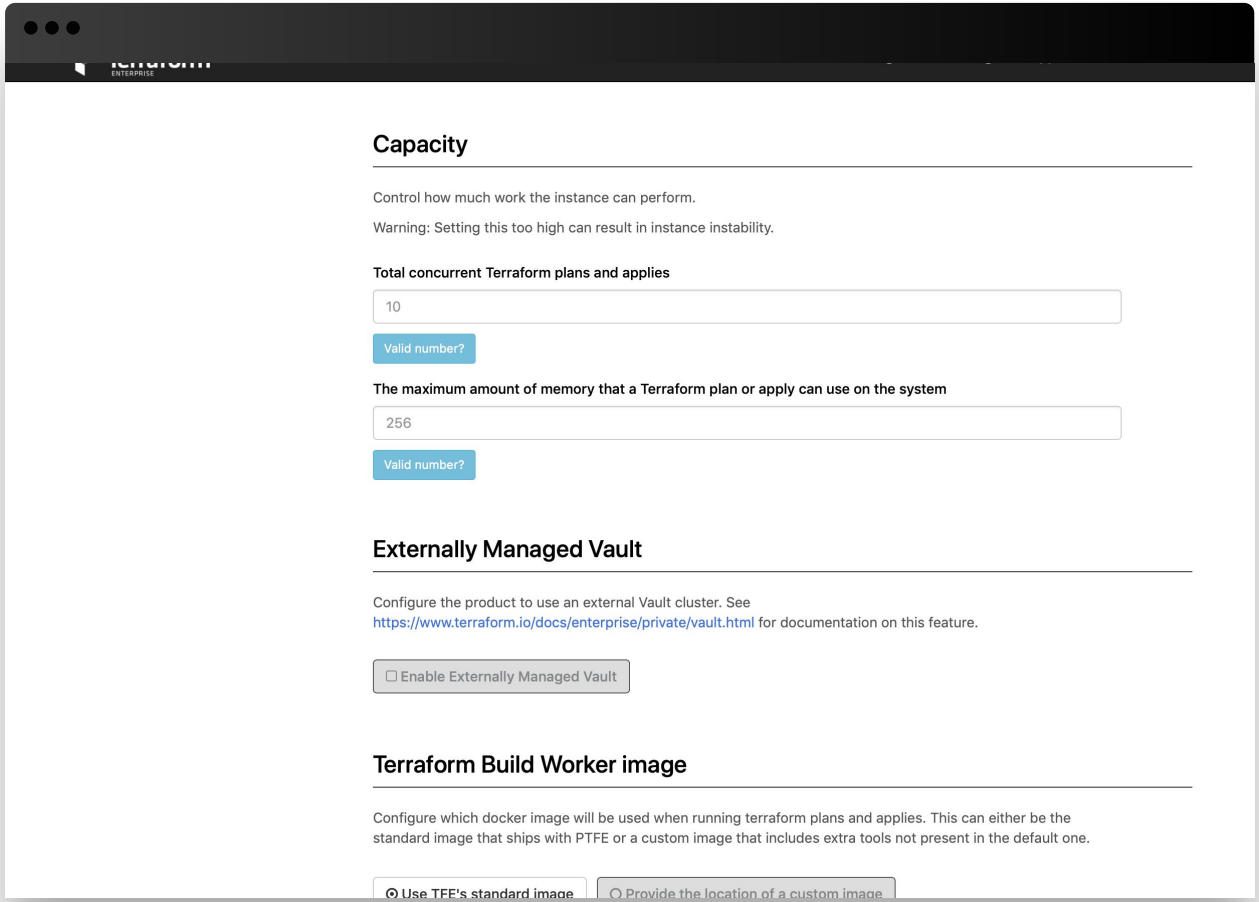
Installer Settings

Specify installation type and operation mode



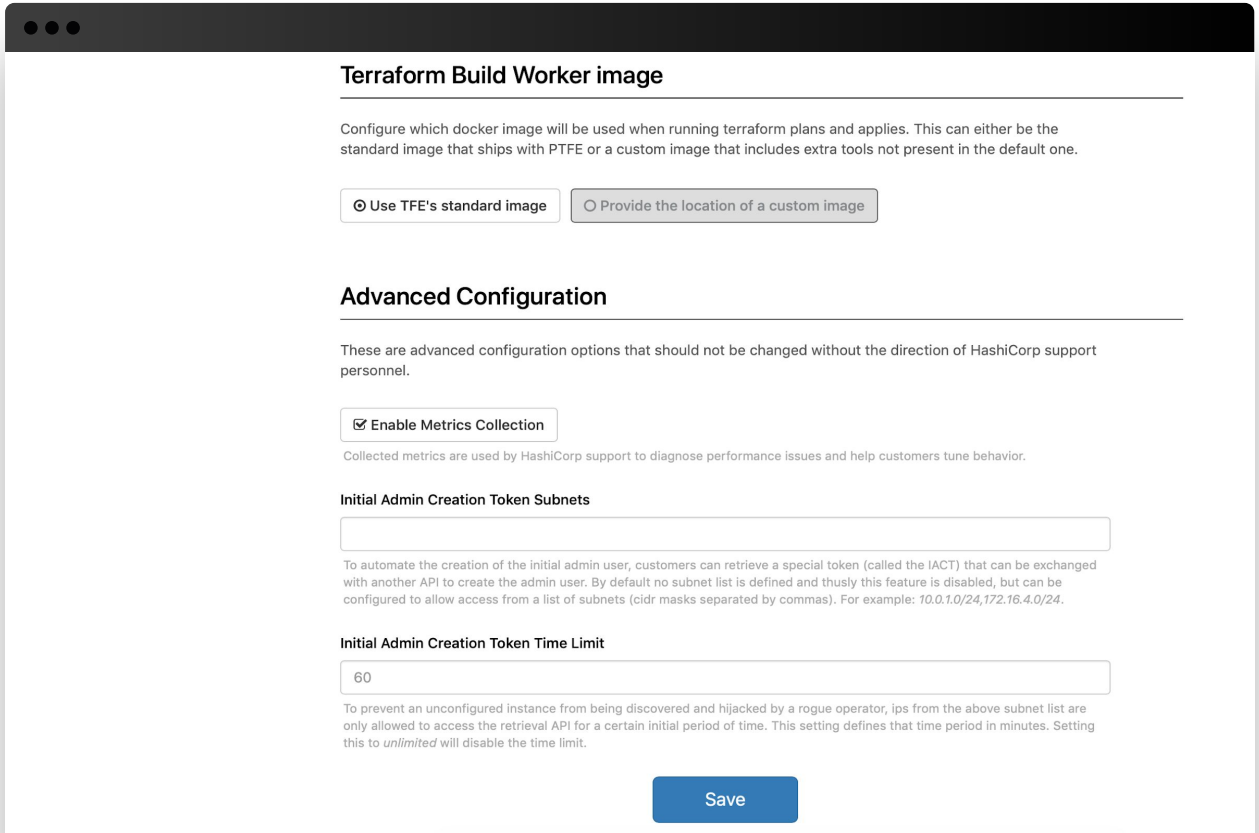
Installer Settings

Specify installation type and operation mode



Installer Settings

Click save and the installer will configure, deploy the TFE docker containers and start the app

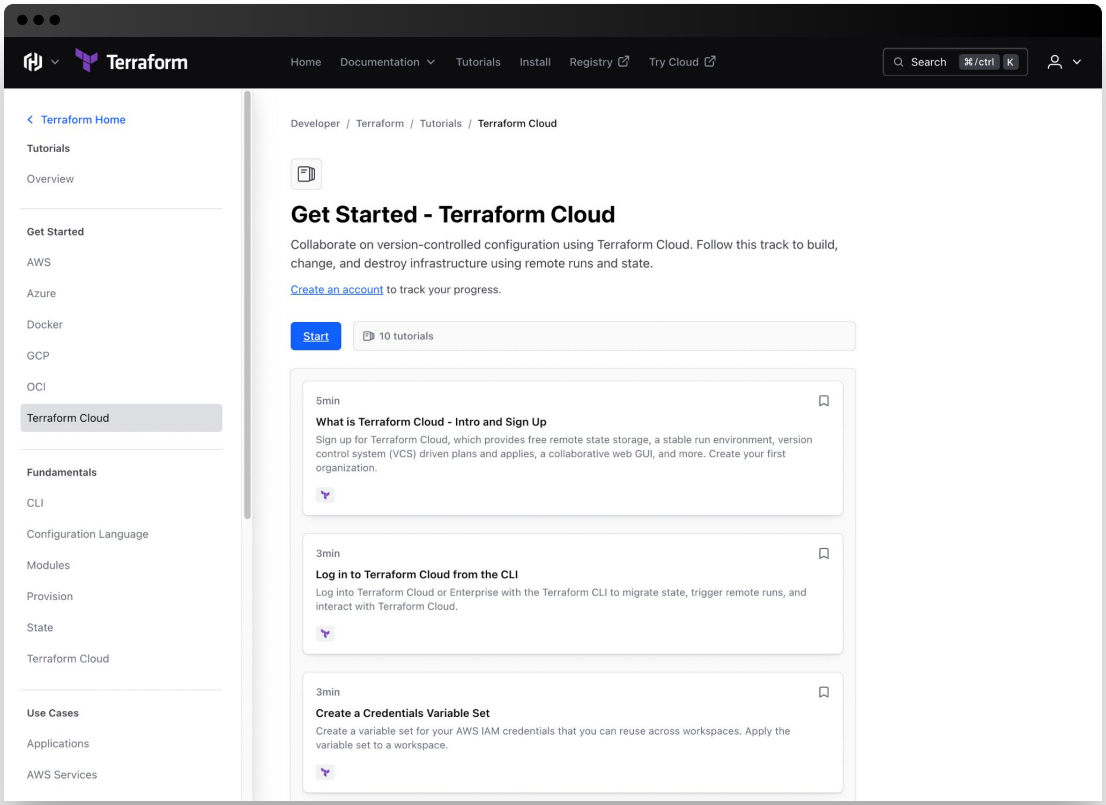


Next Steps

Tutorials

https://developer.hashicorp.com/terraform/tutorials

Step-by-step guides to accelerate deployment of Terraform Cloud



Additional Resources

- Operational Modes
- Pre-Install Checklist
- Services & Data Flow Diagram
- Terraform Enterprise Containers
- Air gapped Deployment Walkthrough
- Interactive Installation Walkthrough

- Reference Architecture
  - AWS / Azure / GCP
  - VMware
- Dependencies
  - Supported Operating Systems
  - Docker
  - Postgres
  - Network Requirements
  - Certificates

Need Additional Help?

Customer Success

Contact our Customer Success Management team with any questions. We will help coordinate the right resources for you to get your questions answered.

customer.success@hashicorp.com

Technical Support

Something not working quite right? Engage with HashiCorp Technical Support by opening a ticket for your issue at:

support.hashicorp.com.

Discuss

Engage with the HashiCorp Cloud community including HashiCorp Architects and Engineers

discuss.hashicorp.com

Upcoming Webinars

Importing Resources & Migrating State

We breakdown how to migrate your existing TF State from a local state file, remote s3 bucket, into TFE

Terraform Workflow Management

Deep dive into best practices around run workflows, workspaces, variables, modules, and Git repo structure

Office Hours

Bring your questions to Office Hours!

Action Items

- Share to customer.success@hashicorp.com
  - Authorized technical contacts for support
  - Stakeholders contact information (name and email addresses)
- Finish requirements gathering and prepare for installation
- Begin deployment of your TFE Instance

Q&A

Thank you

customer.success@hashicorp.com

www.hashicorp.com/customer-success