

# Terraform Integrations & Program Closing

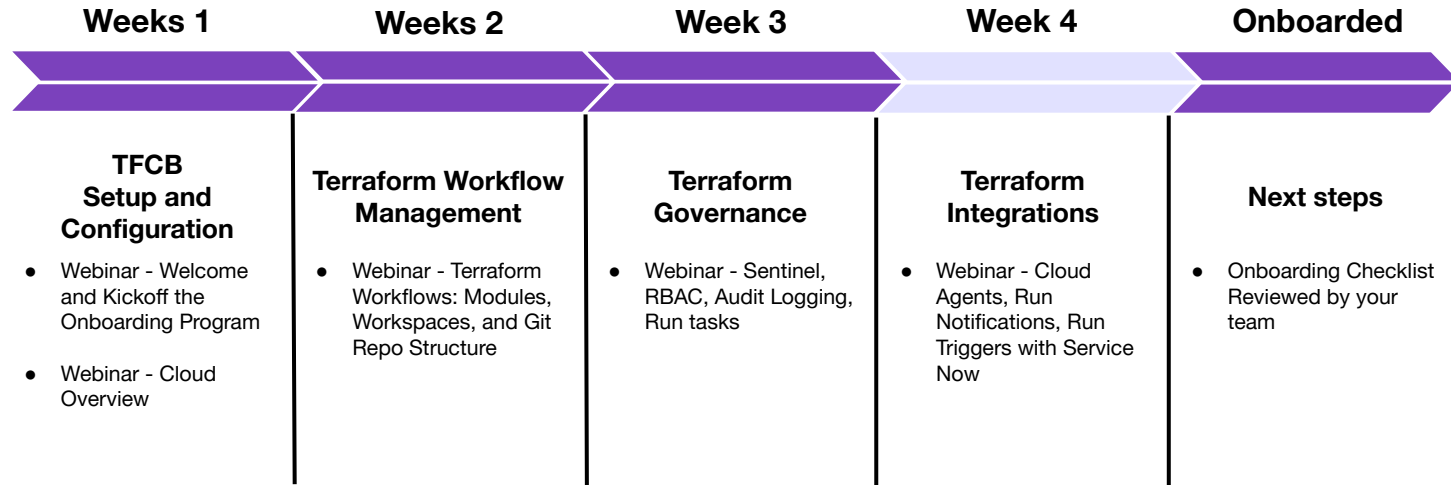


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# Agenda

1. Cloud Agents
2. TFC & Kubernetes Integration
3. TFC & ServiceNow Integration
4. TFC & Splunk Integration
5. Run Triggers
6. Run Notifications
7. Production Readiness
8. Closing Resources

# TFCB Path to Production



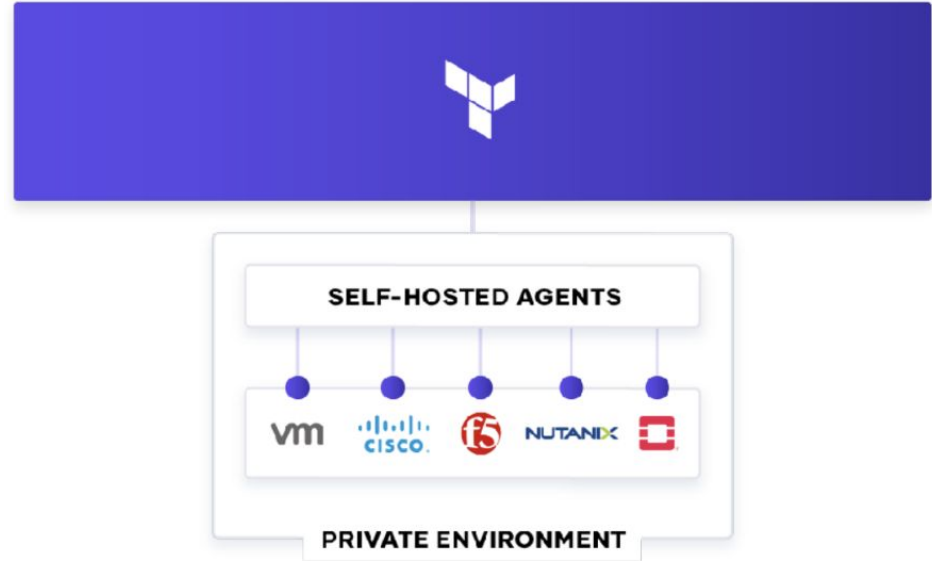
01

# Cloud Agents

# Terraform Cloud Agents



- Communicate with isolated, private, on-premises infrastructure, such as vSphere, Nutanix, & OpenStack, or across multiple cloud accounts
- The Cloud Agent is an x86-based Golang binary
- Deployable on bare metal, in a VM, as a Docker container, or in a Kubernetes cluster



# Architecture

- No inbound public internet connectivity is required
- Supports cloud provider IAM systems for security credentials on demand
- Supports multi account, multi-environment strategy

The screenshot displays the Terraform Cloud interface for a workspace named 'aws-demo-app'. The top navigation bar includes links for 'hashicorp', 'Workspaces', 'Modules', 'Usage', 'Settings', and 'HCP'. The breadcrumb trail shows the path: 'hashicorp / Workspaces / aws-demo-app / Runs / run-6x7HQ6XeVmeNDYmy'. The main content area shows a run triggered manually in Terraform Cloud. Key details include: Run ID 'run-6x7HQ6XeVmeNDYmy', Configuration from GitHub by a user, Branch 'master', Repo '...', Commit '67ba093: Update main.tf', and Trigger 'Run manually triggered'. The 'Execution Mode' is set to 'Agent'. The run status is 'Plan finished' and 'Apply finished', both completed a minute ago. The 'Agent Pool' is 'my-first-pool' and the 'Agent' is 'agent\_01'. The plan shows 1 resource to be added. The apply log shows the successful creation of a random ID resource.

aws-demo-app Runs States Variables Settings Queue plan

✓ APPLIED Queued manually in Terraform Cloud CURRENT

Run ID run-6x7HQ6XeVmeNDYmy Run Details

Configuration From GitHub by [user] Branch master Repo [repo]

Commit 67ba093: Update main.tf

Trigger Run manually triggered

Execution Mode Agent

✓ Plan finished a minute ago Resources: 1 to add, 0 to change, 0 to destroy

Started a minute ago Finished a few seconds ago

Agent Pool my-first-pool Agent agent\_01

Download Sentinel mocks Sentinel mocks can be used for testing your Sentinel policies

View raw log Top Bottom Expand Full screen

Resource actions are indicated with the following symbols:  
+ create

Terraform will perform the following actions:

```
# random_id.random will be created
+ resource "random_id" "random" {
+   b64_std = (known after apply)
+   b64_url = (known after apply)
+   byte_length = 8
+   dec = (known after apply)
+   hex = (known after apply)
+   id = (known after apply)
+   keepers = (known after apply)
}
```

Plan: 1 to add, 0 to change, 0 to destroy.

✓ Cost estimation finished a minute ago Resources: 0 of 0 estimated - \$0.00/mo - +\$0.00

✓ Apply finished a few seconds ago Resources: 1 added, 0 changed, 0 destroyed

Started a few seconds ago Finished a few seconds ago

Agent Pool my-first-pool Agent agent\_01

View raw log Top Bottom Expand Full screen

Terraform v0.13.5  
Initializing plugins and modules...  
random\_id.random: Creating...  
random\_id.random: Creation complete after 0s [id=0Vo9gb0sXT8]  
Apply complete! Resources: 1 added, 0 changed, 0 destroyed.  
Outputs:  
random = a15a3d81b42c5d3f





# Requirements

## Supported Platforms

- Baremetal
- Docker
- Kubernetes (K8S)
- VMware VM
- AWS EC2 VM, EKS, ECS, Fargate EKS, Fargate ECS
- Azure VM, Container Service, AKS
- GCP Compute Engine VM, GKE

## Hardware Requirements

- x86-based Linux host
- 2 GB of RAM
- 4 GB of disk space

## Networking Requirements

- Public Egress, outbound network connections to app.terraform.io over HTTPS (443)
- [Terraform Cloud IP Ranges](#)

# Agents

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An agent pool represents a group of agents that can be used to allow Terraform Cloud to communicate with isolated, private, or on-premises infrastructure. Each agent pool has its own set of tokens which are not shared across pools. When a workspace is configured to execute runs using agents, any available agent in that workspace's associated agent pool is eligible to complete the run.

[Read more in our documentation.](#) 

## Create your first agent pool

Agents and agent tokens are organized into agent pools, and cannot be shared among multiple agent pools. Once an agent pool is created, you can generate an agent token to allow your agents to securely communicate with Terraform Cloud.

[Create agent pool](#)

[Learn more about Terraform Agents](#) 



# Create an agent pool

## 1 Name agent pool

## 2 Token management

An agent pool represents a group of agents that can be used to allow Terraform Cloud to communicate with isolated, private, or on-premises infrastructure. When a workspace is configured to execute runs using agents, any available agent in that workspace's associated agent pool is eligible to complete the run. Learn more about [agents and agent pools](#) [↗](#)

Agent pool names must be unique, and will be used by workspace administrators when linking workspaces to a specific agent pool.

### Agent Pool Name

Dashes, underscores, and alphanumeric characters are permitted.

Cancel

Continue



# Create an agent pool



Name agent pool



Token management

## Token management

Each agent pool has its own set of tokens which are not shared across pools. These tokens allow agents to communicate securely with Terraform Cloud.

Configure your initial tokens for **test** below. Tokens can be created and revoked tokens later, as well.

### Tokens

Token description	Created	Last used
No tokens to display		

### Add a new token

Choose a description to help you identify this token later.

#### Description

Create token

Cancel

Finish



## Token created

Your new agent token, **test**, is displayed below.

U2VABqmFKk7U0w.atlasv1.4KqCoYqe5AqpDvF0TsDVPfwa0WS3x4ECsvUCKB6oyFy6KgZLW4ZD5txSae3E0mk1S3o [🔗](#)



### Warning

This token **will not be displayed again**, so make sure to save it to a safe place.

## Set up your agents

Connect to your Docker host and set the following environment variables. `TFC_AGENT_NAME` is optional.

```
$ export TFC_AGENT_TOKEN=U2VABqmFKk7U0w.atlasv1.4KqCoYqe5AqpDvF0TsDVPfwa0WS3x4ECsvUCKB6oyFy6KgZLW4ZD5txSae3E0mk1S3o
$ export TFC_AGENT_NAME=<my_agent_name>
```

[🔗](#)

Once the environment is configured, run the Docker container with the following command **or** [download the agent file](#). [🔗](#)

```
$ docker run -e TFC_AGENT_TOKEN -e TFC_AGENT_NAME hashicorp/tfc-agent:latest
```

[🔗](#)

[Read more in our documentation](#). [🔗](#)

Cancel

Finish



# Resources: Cloud Agent

- [Releases](#)
- [Docker container](#)
- [Terraform module](#) for Kubernetes deployment
- HashiCorp Blog - [Introduction to Terraform Cloud Agents](#)
- [Manage Private Environments with Terraform Cloud Agents](#)

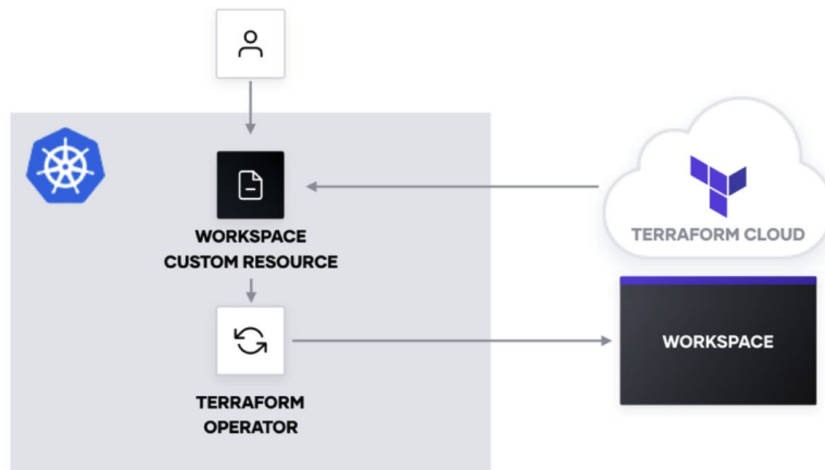
02

# Kubernetes Integration

# Terraform integration with K8s



- Terraform Cloud customers can integrate with Kubernetes to provision infrastructure directly from the K8s control plane
- Dynamically create TFC workspaces & variables directly from the K8s Control Plane using the **Terraform Cloud Operator for Kubernetes**



# Use-case



1. Manage the lifecycle of cloud and on-prem infrastructure through a single kubernetes custom resource
2. Provision and manage infra from any cloud provider and other Terraform providers to use them with your existing applications
3. Deploy and manage the Kubernetes resources in a single git repo, or directly from a module in the TF registry

# Steps to Install and Configure



1. Install terraform-k8s via Helm Chart
2. Create the namespace where you will deploy the operator, secrets and workspace resources
3. Authenticate to TFC via Team API Token and insert it as a TF credentials
4. Create K8s secret named terraformmrc in the namespace, reference the creds file in the namespace
5. It is best practice to create a separate team for the operator with “Manage Workspaces” access



# Resources: Kubernetes



- [Terraform Cloud Operator for Kubernetes](#)
- [Terraform Cloud Operator Helm Chart](#)
- [Deployment Tutorial](#)
- HashiCorp Blog - [Creating Workspaces with the Operator](#)
- [Syncing Kubernetes & Terraform Cloud Workspaces](#)

03

# ServiceNow Integration

# Terraform Integration with ServiceNow



- The Terraform ServiceNow Service Catalog integration enables end-users to provision self-serve infrastructure via ServiceNow
- Connecting ServiceNow to Terraform Cloud lets users:
  - order Service Items
  - create workspaces
  - perform Terraform runs using prepared Terraform configurations hosted in VCS repositories
- [Terraform ServiceNow Service Catalog Integration Setup Instructions](#)

# Workflow



Terraform Admin	
Prepare an organization for use with the ServiceNow Catalog	<b>ServiceNow Admin</b>
Create a team that can manage workspaces in that organization	
Create a Team API so the integration can use that team's permission	
Retrieve the oAuth token ID's and repository identifiers for TFC to identify your VCS	
	Install the Terraform Integration application from the ServiceNow App Store
	Connect the integration application with TFC
	Add the Terraform Service Catalog to ServiceNow
	Configure the VCS repositories in ServiceNow
	Configure the Variable Sets for use with the VCS

— 04

# Splunk Integration

# Splunk for Terraform



HashiCorp has an official Splunk Dashboard for ingestion of TFC Audit Logs

- Terraform Cloud retains 14 days of audit log information
- Connectivity to Splunk requires HTTPS outbound connectivity to the TFC API

## Network Requirements:

Hostname	Port/Protocol	Directionality	Purpose
app.terraform.io	tcp/443, HTTPS	Outbound	Polling for new audit log events via the TFC API

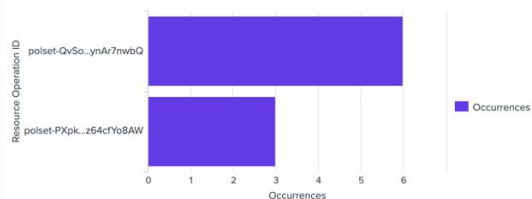
Edit Export ...

Total Workspaces Active

2

Total Workspaces Active

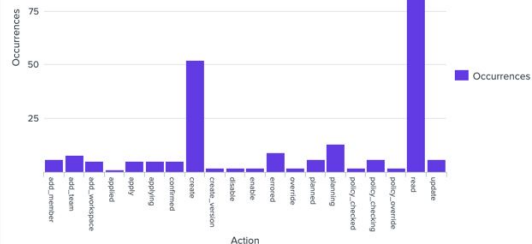
### Top 5 Policy Sets Filtered by Time



### Total Action Occurrences Filtered by Time

Total Resource Operations

## 75 \_\_\_\_\_





splunk>enterprise

App: Terraform Cloud for Splunk

Messages

Settings

Activity

Help

Find

Search

Datasets

Reports

Alerts

Dashboards

Terraform Cloud for Splunk

New Search

Save As

Close

source="terraform\_cloud" sourcetype="terraform\_cloud" resource.action="override" | table auth.description, resource.id, resource.type, resource.action, auth.type, timestamp

Last 24 hours

6 events (9/3/20 8:00:00.000 PM to 9/4/20 8:16:43.000 PM)

No Event Sampling

Job

Smart Mode

Events

Patterns

Statistics (6)

Visualization

20 Per Page

Format

Preview

auth.description	resource.id	resource.type	resource.action	auth.type	timestamp
kruddy	polchk-MQwsR84Qo61DXWFH	policy_check	override	Client	2020-09-04T14:39:13.000Z none
kruddy	polchk-MQwsR84Qo61DXWFH	policy_check	override	Client	2020-09-04T14:39:13.000Z none
kruddy	polchk-d27EuPcArUtd67Us	policy_check	override	Client	2020-09-04T14:40:52.000Z none





# Resources: Splunk

- Splunkbase: [Terraform Cloud for Splunk](#)
- HashiCorp Blog: [Audit Logging with Splunk](#)
- [Terraform Installation Documentation](#)
- [Splunk Installation Documentation](#)

05

# Run Triggers

# Run Triggers

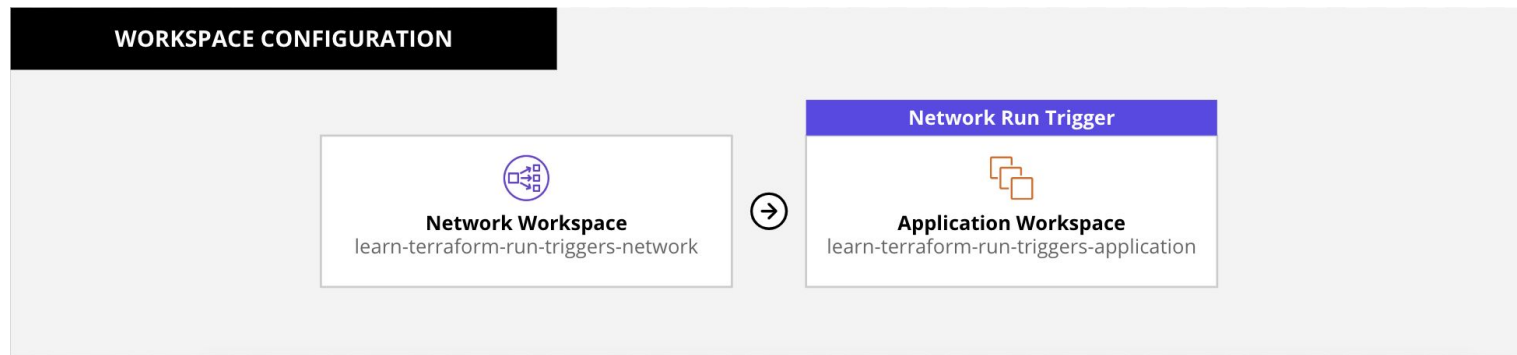


- Create infrastructure pipelines in TFCB
- Allow teams to manage complex infrastructure in TFCB by creating infrastructure pipelines between multiple workspaces
- When a source workspace is selected, multiple dependent workspaces can be linked
- When a successful apply is executed in the source workspace, the dependent workspaces have runs triggered and can be configured to auto-apply their configurations

# Use Case: Application Configuration Management



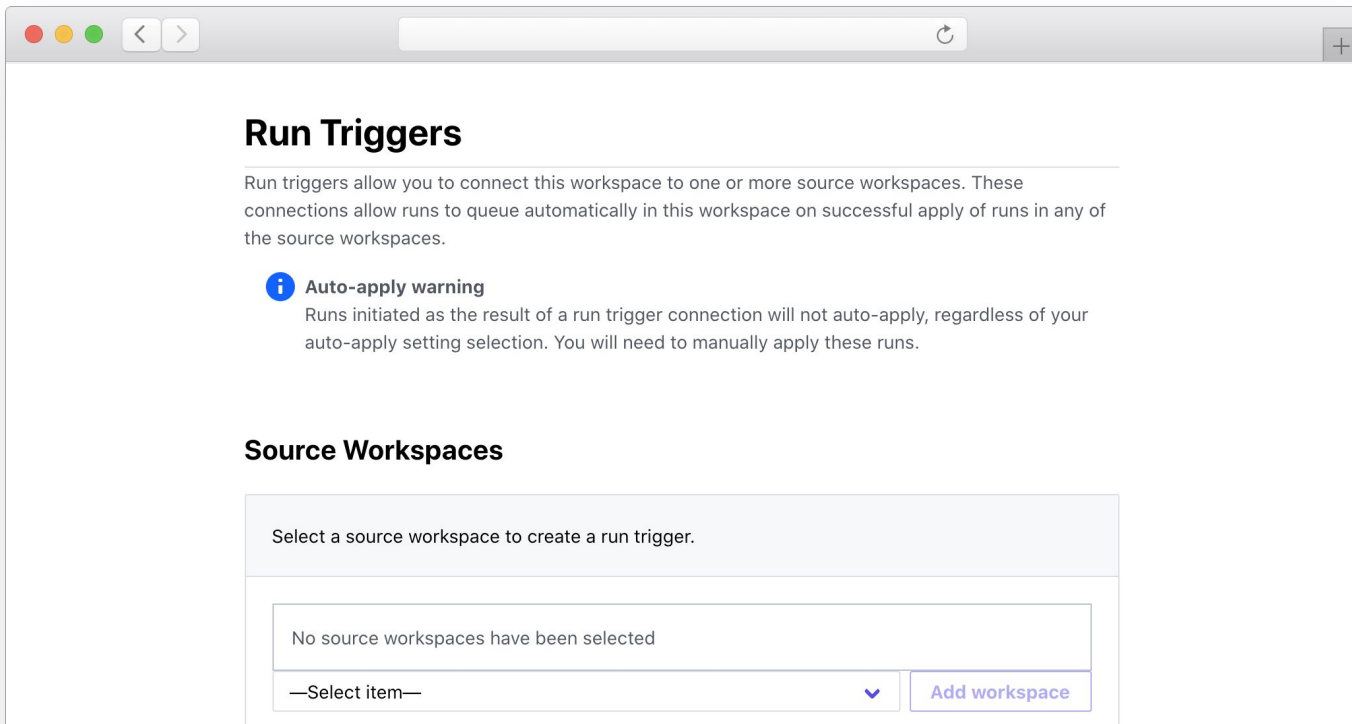
Run triggers automatically trigger updates to application configuration to rebalance servers across new subnets once they are successfully provisioned in the network workspace



# Create Run Triggers



Workspace Settings → Run Triggers → Select Source Workspace





# Resources: Run Triggers

- [Tutorial: Connect Workspaces with Run Triggers](#)
- [Run Triggers Documentation](#)
- [Terraform Registry - tfe run trigger](#)

06

# Run Notifications

# Run Notifications



- Run Notifications send updates/notifications to external services with details on run progress
- Notifications can be sent to up to 20 destinations
- Each workspace can be configured with it's own notification settings
- Can send either POST message to any URL via webhook, email message, or sent to Slack & post updates in channels



# Notification Triggers



	Trigger	Description
<b>Created</b>	“run:created”	When a run is created and enters the "Pending" state.
<b>Planning</b>	“run:planning”	When a run acquires the lock and starts to execute.
<b>Needs Attention</b>	“run:needs_attention”	Human decision required. When a plan has changes and is not auto-applied, or requires a policy override.
<b>Applying</b>	“run:applying”	When a run begins the apply stage, after a plan is confirmed or auto-applied.
<b>Completed</b>	“run:completed”	When the run has completed on a happy path and can't go any further.
<b>Errored</b>	“run:errored”	When the run has terminated early due to error or cancellation.



# Sample Notification Payload

```
CODE EDITOR

{
  "payload_version": 1,
  "notification_configuration_id": "nc-AeUQ2zfKZzW9TiGZ",
  "run_url":
  "https://app.terraform.io/app/acme-org/my-workspace/runs/run-FwnENkvDnrpyFC7M",
  "run_id": "run-FwnENkvDnrpyFC7M",
  "run_message": "Add five new queue workers",
  "run_created_at": "2019-01-25T18:34:00.000Z",
  "run_created_by": "sample-user",
  "workspace_id": "ws-XdeUVMWShTesDMME",
  "workspace_name": "my-workspace",
  "organization_name": "acme-org",
  "notifications": [
    {
      "message": "Run Canceled",
      "trigger": "run:errored",
      "run_status": "canceled",
      "run_updated_at": "2019-01-25T18:37:04.000Z",
      "run_updated_by": "sample-user"
    }
  ]
}
```



# Create Notification Trigger

Workspace → Settings → Notifications

The screenshot shows a web application interface for creating a notification trigger. The top navigation bar is blue with a logo on the left and a user profile on the right. The main navigation menu includes 'email-notifications', 'Workspaces' (highlighted with a red box), 'Modules', and 'Settings'. Below the navigation bar, the breadcrumb trail reads 'email-notifications / Workspaces / demo\_workspace / Settings / Notifications / New'. The main content area is titled 'demo\_workspace' and has tabs for 'Runs', 'States', 'Variables', and 'Settings' (highlighted with a red box). A 'Queue plan' dropdown is also visible. The 'Create a Notification' section explains that notifications allow sending messages to other applications based on Run events. Under the 'Destination' heading, there are three options: 'Webhook' (selected with a blue dot), 'Email', and 'Slack'. Each option has a description and a radio button. Below the destination selection, there are three input fields: 'Name' (with a placeholder 'e.g. My Notification'), 'Webhook URL' (with a placeholder 'https://example.com/...'), and 'Token' (with a placeholder 'Encrypted - write only'). A link to the documentation is provided at the bottom.

email-notifications / Workspaces / demo\_workspace / Settings / Notifications / New


demo\_workspace


Runs States Variables Settings Queue plan


## Create a Notification

Notifications allow you to send messages to other applications based on Run events.

**Destination**

  
**Webhook**  
POST messages to any URL  
☒

  
**Email**  
Send messages to users via Email  
☐

  
**Slack**  
Send messages to a Slack Channel  
☐

**Name**

e.g. My Notification

**Webhook URL**

https://example.com/...

**Token**

Encrypted - write only

Used to generate the HMAC on the notification request. [Read more in the documentation](#).



# Resources: Run Notifications

- [Documentation: Run Notifications](#)
- [Notification Configurations API](#)
- [Terraform Registry - tfe\\_notification\\_configuration](#)

07

# Terraform Cloud Production Readiness



# Production Readiness



Join security & vulnerability announcements list

<https://discuss.hashicorp.com/c/security/52>






Discuss

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Security ▾ Security-Vault ▾ | Latest Top

Topic		Replies	Views	Activity
<b>HCSEC-2021-34 - Vault, Consul, Boundary, and Waypoint Affected By Denial of Service in Golang's net/http (CVE-2021-44716)</b>		0	487	Dec '21
Security security-vault, security-consul, security-waypoint, security-boundary				
<b>HCSEC-2021-33 - Vault's KV Secrets Engine With Integrated Storage Exposed to Authenticated Denial of Service</b>		0	487	Dec '21
Security security-vault				
<b>HCSEC-2021-30 - Vault's Templated ACL Policies Matched First-Created Alias Per Entity and Auth Backend</b>		1	983	19d
Security security-vault				



# Production Readiness



Bookmark the Terraform Cloud Agent Changelog

<https://www.terraform.io/cloud-docs/agents/changelog>



Overview

Use Cases ▾

Editions ▾

Registry

Tutorials

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Terraform Cloud



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## Terraform Cloud Agents

Overview

Telemetry

Monitoring

Hooks

• [Changelog](#)

[Back to Cloud and Enterprise](#)

## Terraform Cloud Agent Changelog

JUMP TO SECTION ▾

These are the release notes from the Terraform Cloud Agent application. Changes within each release are categorized into one or more of the following labels:

- **FEATURES** - Used for net-new features being added to the agent.
- **BUG FIXES** - Backward-compatible fixes for buggy functionality.
- **IMPROVEMENTS** - Functional improvements to performance, efficiency, etc.
- **SECURITY FIXES** - Fixes for security-related issues.
- **BREAKING CHANGES** - Reserved for changes which break previous functionality.

Each version below corresponds to a release artifact available for download on the official [releases website](#).

### 1.2.1 (05/10/2022)

BUG FIXES:



# — Production Readiness

- Determine key workflows for teams
  - API, CLI, or VCS driven
- SSO and/or MFA configured
- VCS repo standard current and future
- Minimum Terraform code version established
- Internal consumption and training plan created



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# Post-Program Support

# TFCB Onboarding Journey Content

Date	Session & Slidedeck	Video Link & Password
Jan 25	<a href="#">Week 1 - Program Kickoff / Terraform Cloud Overview</a>	<a href="#">Terraform Cloud Onboarding Program - Jan '23 - Kickoff and Cloud Overview</a> Password: <b>C7d2gZjq39</b>
Feb 1	<a href="#">Week 2 - Terraform Workflows</a>	<a href="#">Terraform Cloud Onboarding Program - Jan '23 - Terraform Workflows</a> Password: <b>xqX6N5</b>
Feb 8	<a href="#">Week 3 - Terraform Governance</a>	<a href="#">Terraform Cloud Onboarding Program - Jan '23 - Terraform Governance</a> Password: <b>S3fgTh</b>
Feb 15	<a href="#">Week 4 - Terraform Integrations and Program Closing</a>	<a href="#">Terraform Cloud Onboarding Program - Jan '23 - Terraform Integrations and Program Closing</a> Password: <b>2ubjeH</b>

# TFCB Onboarding Journey Content

## Custom Learn Collections

- Week 1 - [Learn the Terraform Programming Language](#)
- Week 2 - [TFCB basics and an introduction to Infrastructure as Code](#)
- Week 3 - [Explore the basics of TFCB and how to collaborate on infrastructure with TFCB](#)
- Week 4 - [Use Cases](#)
- Week 5 - [Modules, Workspaces, Runs, Git Repo Structure](#)
- Week 6 - [Terraform Workspaces, VCS, and Terraform State](#)
- Week 7 - [Cloud Agents, SSO, RBAC, Sentinel, & Audit Logging](#)

# Post-program support from CS



## **Customer Success Manager (CSM)**

Account & Success Management

- Invitations to future seminars and lunch and learn sessions
- Customer advocate to connect you with internal resources at HashiCorp on any product or architectural questions
- Collaborate on pertinent adoption milestones on your post-program journey
- Partner with you on your use-cases to help you meet your production goals

## **Solution Architect (SA)**

Technical Success & Advisory

- Technical enablement through lunch and learns, tech talks, and webinars that will include enablement on technical topics, new features, and recommended patterns
- Technical advisement as-needed on topics including reference architectures, recommended patterns, and feature adoption

# Recommended additional resources



We strongly urge you to subscribe to the Terraform Cloud status web page, this can be done here

<https://status.hashicorp.com/>

Support will continue to be your resource for resolving technical challenges

[support.hashicorp.com](https://support.hashicorp.com)

# Additional Training Resources



Wanting to Learn More? A Topic Not Covered? See these



**Tutorials-** <https://developer.hashicorp.com/terraform/tutorials>

Tutorials on just about everything



**HashiCorp Events-** <https://www.hashicorp.com/events?type=all>

Great place for find HashiCorp events, conferences, webinars



**HashiCorp User Groups (HUGs)** - <https://www.meetup.com/pro/hugs/>

With over 50 countries, and 155 user groups, find a HUG located near you



**HashiCorp Terraform Certification**

Even if you don't want the certification, the [Study Guide](#) is a relevant and useful curriculum to follow especially for team members new to Terraform



**HashiCorp Instruct Labs**

Want more hands-on experience? Visit our Instruct page

<https://play.instruct.com/hashicorp>

# 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](mailto:customer.success@hashicorp.com)

## Discuss

Engage with the HashiCorp Cloud community including HashiCorp Architects and Engineers

[discuss.hashicorp.com](https://discuss.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](https://support.hashicorp.com).

## HashiCorp Academy

Terraform [Enterprise Academy](#) classes are virtual and delivered by a live instructor with in-depth Terraform knowledge and implementation expertise.

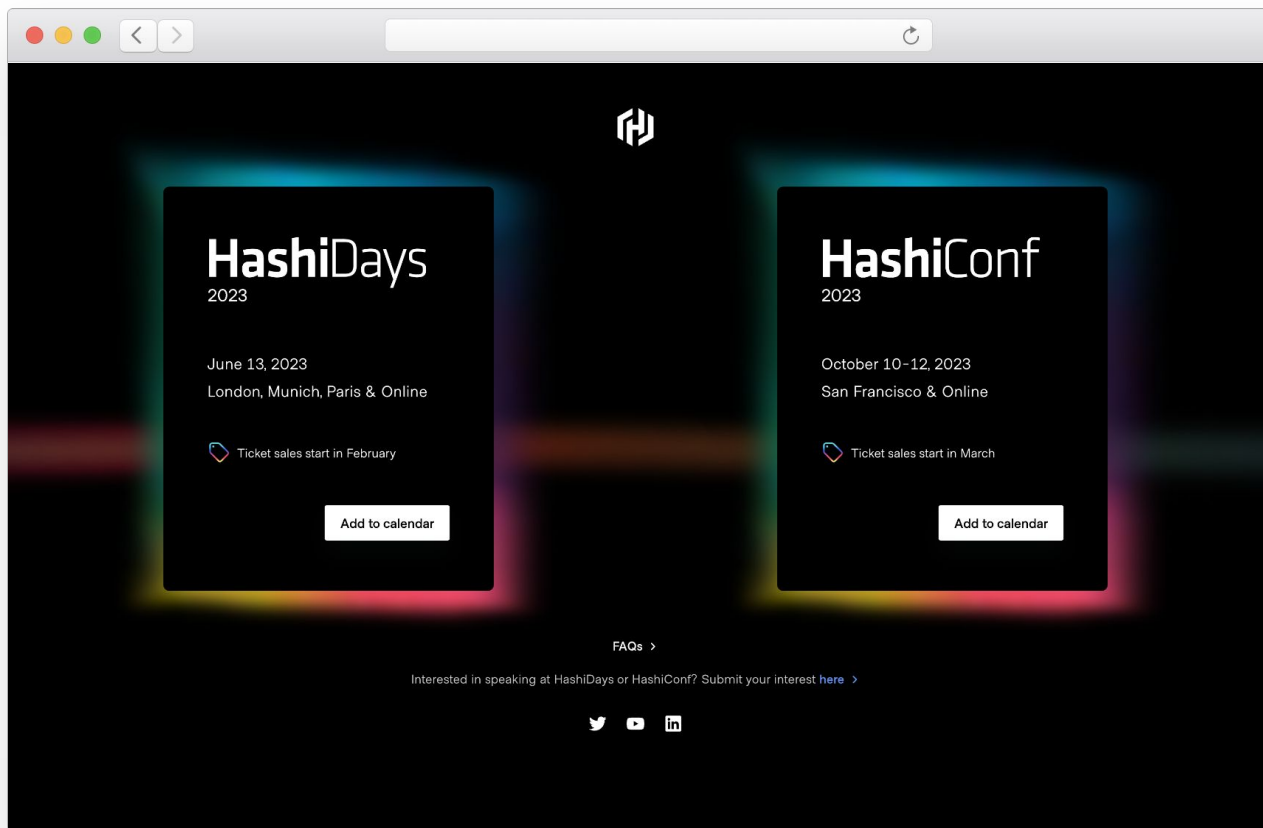
Academy courses include a sandbox environment for hand-on experience in the 10 labs throughout the 3-day course.



# HashiConf

<https://hashiconf.com>

Interested in becoming a  
HashiConf Speaker?







# Thank You

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[www.hashicorp.com/customer-success](http://www.hashicorp.com/customer-success)