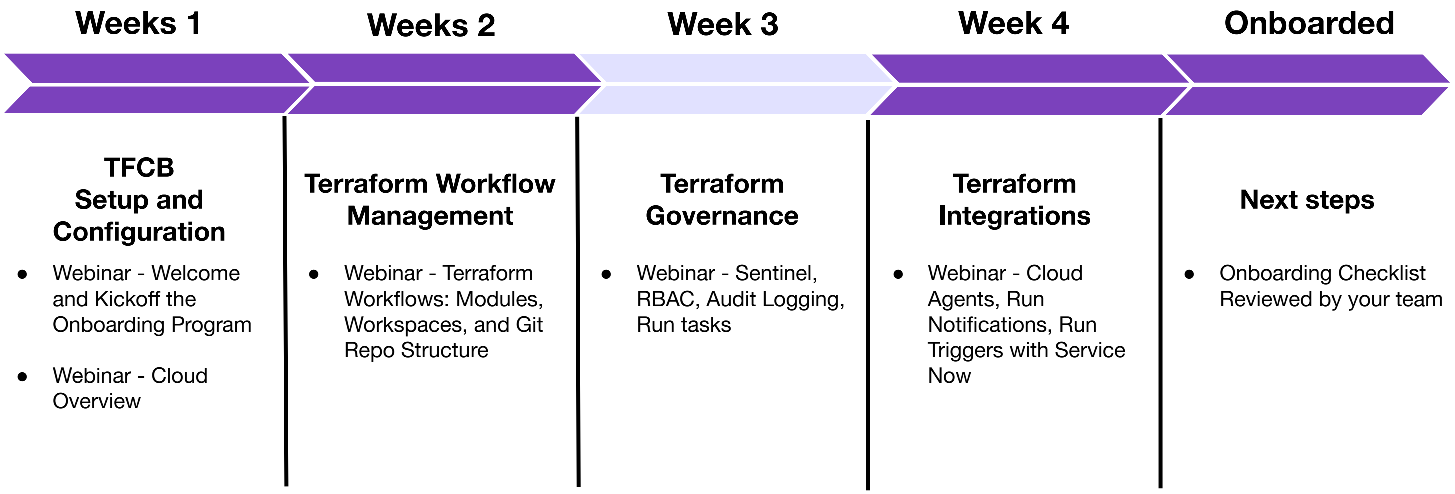
HashiCorp
Terraform

Terraform Cloud Governance

Agenda

1. Role Based Access Controls
2. Sentinel
3. Run Tasks
4. Audit Logs

TFCB Path to Production



Weeks 1

TFCB Setup and Configuration

- Webinar - Welcome and Kickoff the Onboarding Program
- Webinar - Cloud Overview

Weeks 2

Terraform Workflow Management

- Webinar - Terraform Workflows: Modules, Workspaces, and Git Repo Structure

Week 3

Terraform Governance

- Webinar - Sentinel, RBAC, Audit Logging, Run tasks

Week 4

Terraform Integrations

- Webinar - Cloud Agents, Run Notifications, Run Triggers with Service Now

Onboarded

Next steps

- Onboarding Checklist Reviewed by your team

01

Role Based Access Controls (RBAC)

Terraform Cloud RBAC Model

- Terraform Cloud's (TFCB) access model is team-based
    - Permissions are assigned at the team level
    - Users inherit permissions based upon team assignment
- TFCB's permission model is split into organization-level & workspace-level permissions
- Every Org has an "owners" team which have every available permission in that org
- Workspace permissions allow administrators to delegate access to specific collections of infrastructure

Common Scenarios

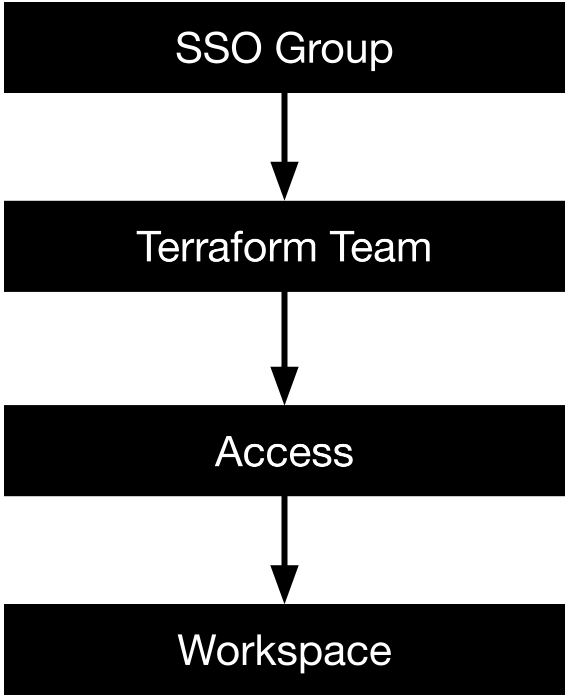
- TFC is often used by multiple Teams (i.e. *Developers, QA, Security, Operations, Networking, SQL Admins, Filestore Admins, Accounting)*

- The best approach to managing permissions is:
  a. Create Groups within your Single Sign-on (SSO) service for each team
  b. Assign each group as a TFC Team
  c. Determine how Workspaces will be divided, & assign permissions accordingly.

- Data can be dynamically shared between Workspaces as read-only by using the “**tfe_outputs**” data source

- `Terraform_remote_state` Data Source

TFCB Permissions Flow



SSO Group

Terraform Team

Access

Workspace

Workspace Permissions

There are two ways to assign permission to a TFCB team

- Custom permissions
- Fixed permission sets - bundles of specific permissions, designed for delegated access patterns

Permissions Sets

Read

- Read runs
- Read variables
- Read state versions

Plan

- Queue plans
- Read variables
- Read state versions

Write

- Lock/unlock Workspace
- Download Sentinel mocks
- Read and write Variables
- Read and write State Versions
- Approve Runs

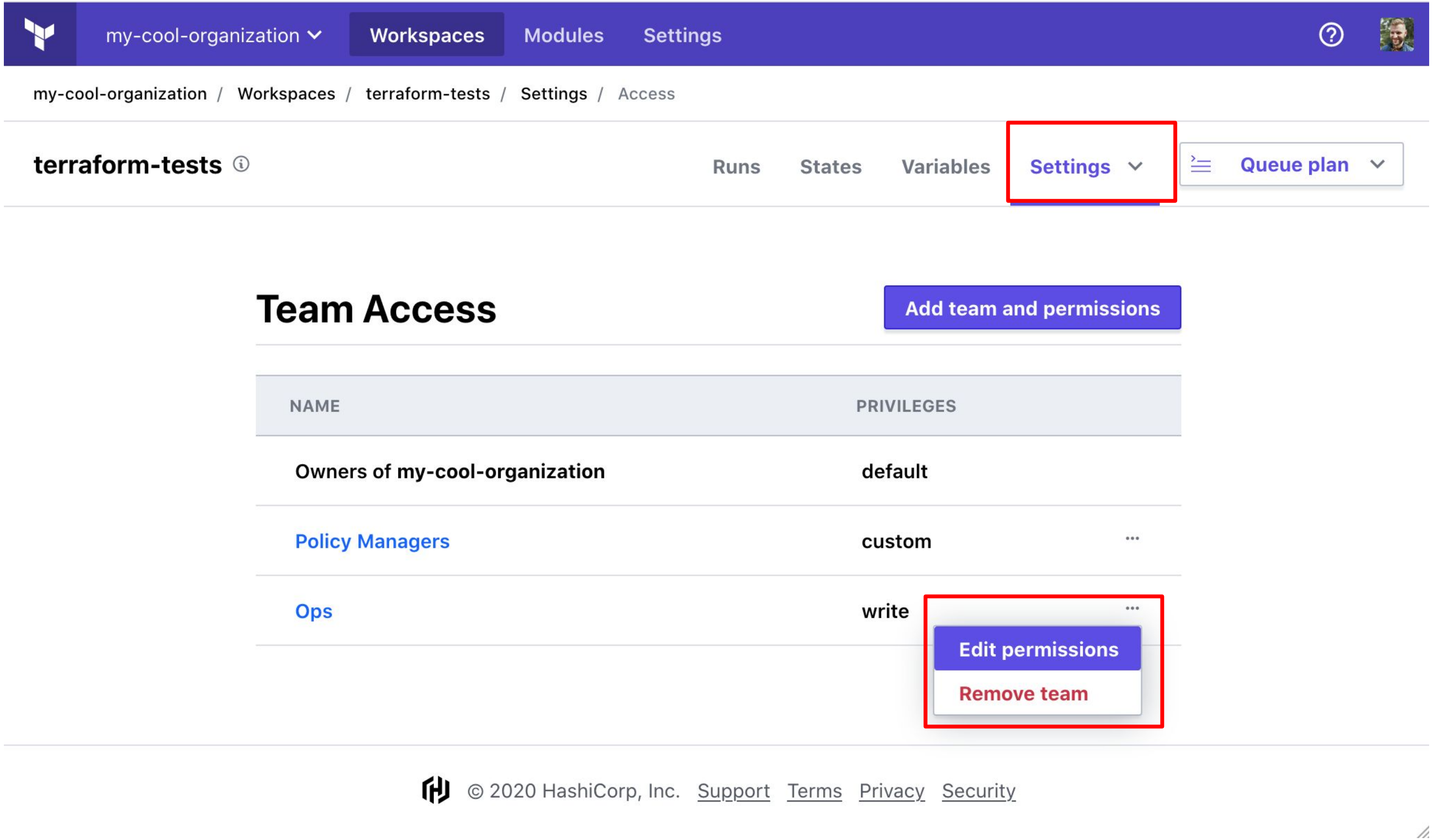
Admin

- VCS Configuration
- Manage Team Access
- Execution Mode
- Delete Workspace
- Read & write workspace settings, general settings, notification configurations, run triggers,& more

Terraform Cloud Workspace Permissions

State Files

- May contain secrets, passwords, & API Tokens
- Should be handled as sensitive material when applying RBAC permissions
- Are encrypted at rest using HashiCorp Vault
- Data can still be read at runtime or directly from the TFC UI if a User has the necessary Workspace permissions



Team Access

NAME	PRIVILEGES
Owners of my-cool-organization	default
Policy Managers	custom
Ops	write

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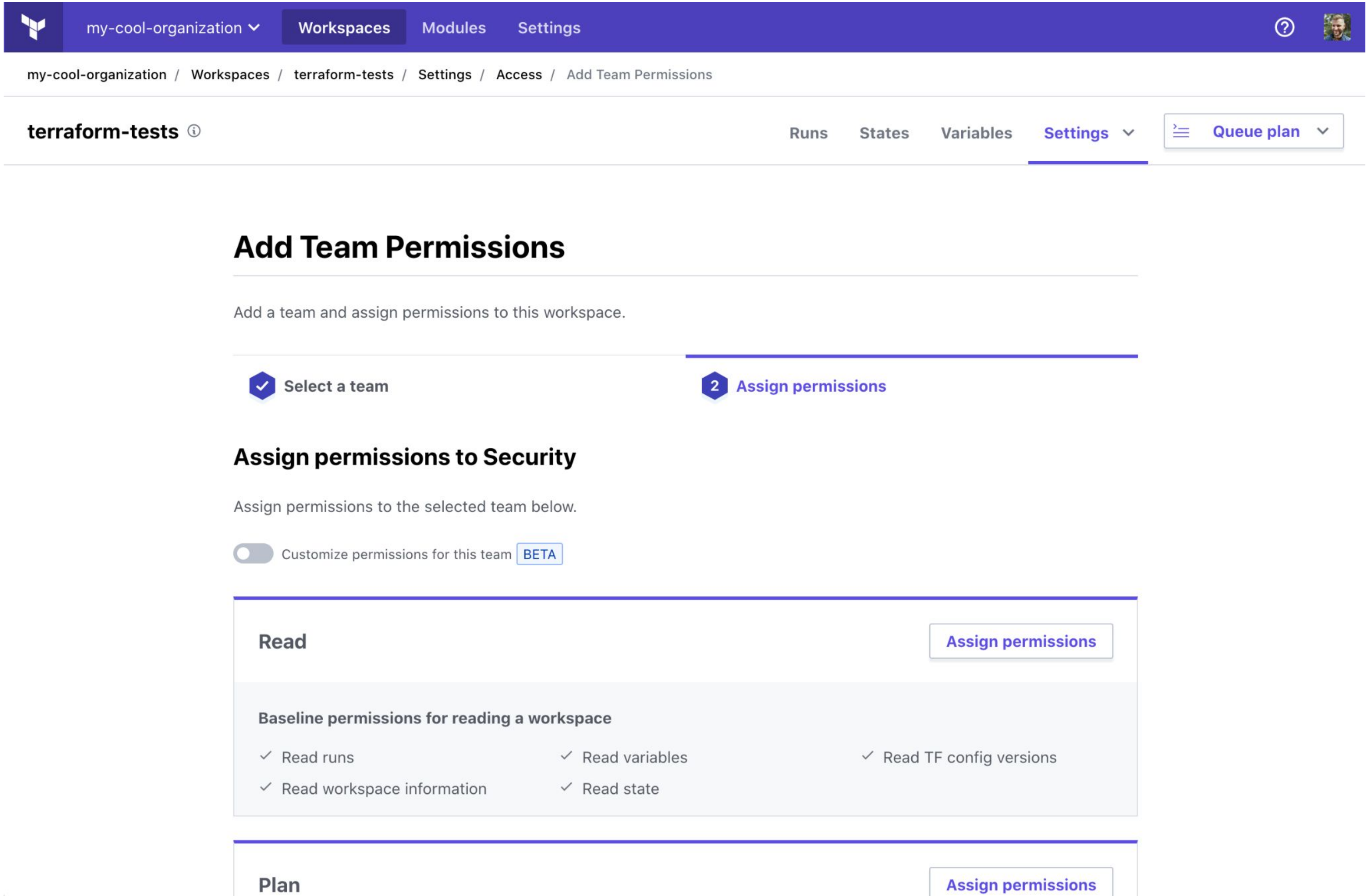


Add Team Permissions

Add a team and assign permissions to this workspace.

Assign permissions to Security

Assign permissions to the selected team below.

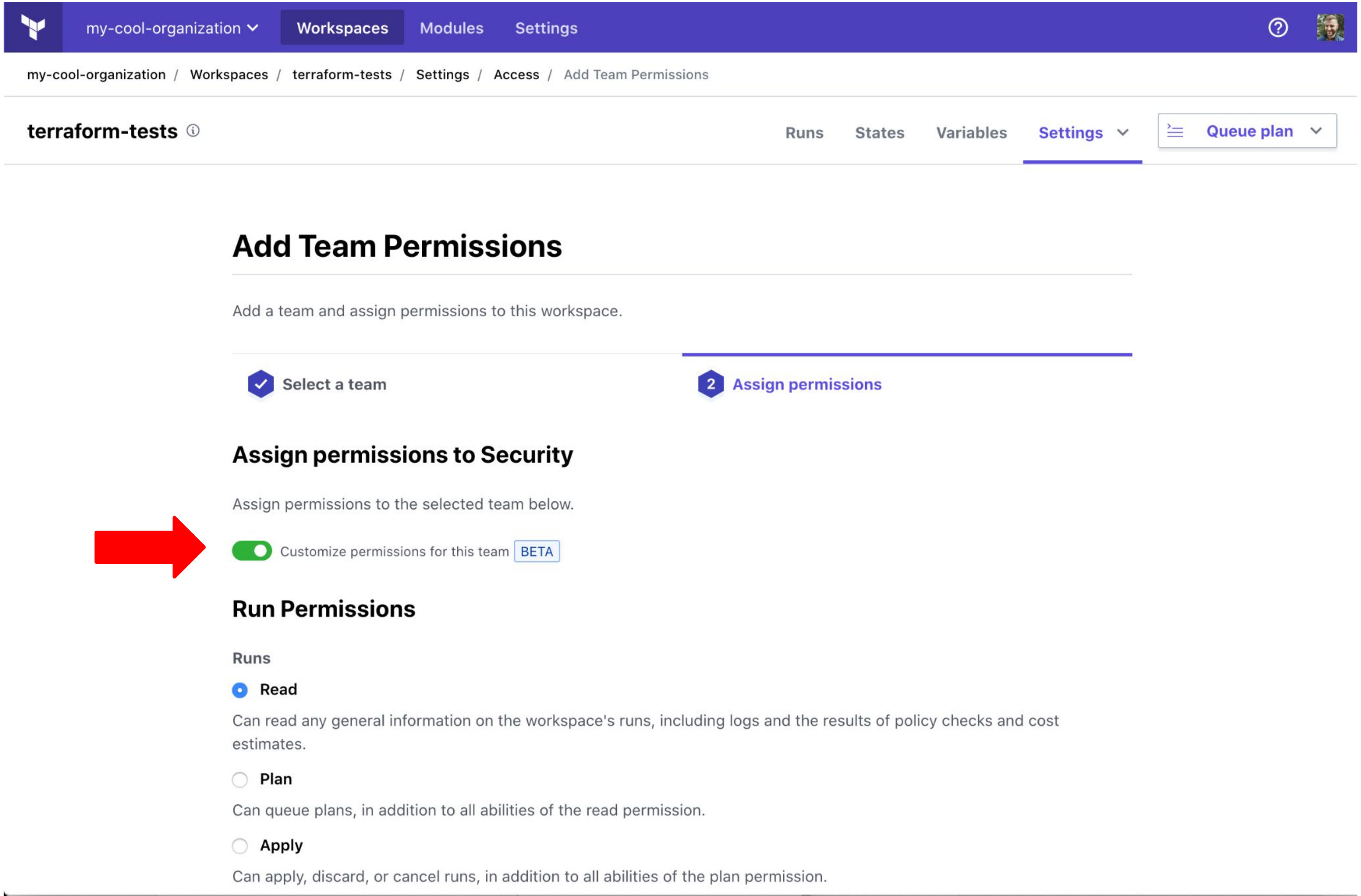
○ Customize permissions for this team BETA

Read

Baseline permissions for reading a workspace

✓ Read runs
✓ Read workspace information
✓ Read variables
✓ Read state
✓ Read TF config versions

Plan



my-cool-organization / Workspaces / terraform-tests / Settings / Access / Add Team Permissions

terraform-tests

Add Team Permissions

Add a team and assign permissions to this workspace.

✓ Select a team

2 Assign permissions

Assign permissions to Security

Assign permissions to the selected team below.

Customize permissions for this team BETA

Run Permissions

Runs

● **Read**

Can read any general information on the workspace's runs, including logs and the results of policy checks and cost estimates.

○ **Plan**

Can queue plans, in addition to all abilities of the read permission.

○ **Apply**

Can apply, discard, or cancel runs, in addition to all abilities of the plan permission.

02

Sentinel

Sentinel is “Policy / Governance / Security as Code”

Use Cases

1. Cloud Provider
2. Account ID
3. Limit regions of Availability Zones
4. Cost Estimates
5. Cost Limiting
6. Resource Tagging
7. Resource Types
8. Resource Sizes
9. Resource Configuration
10. Resource Destruction

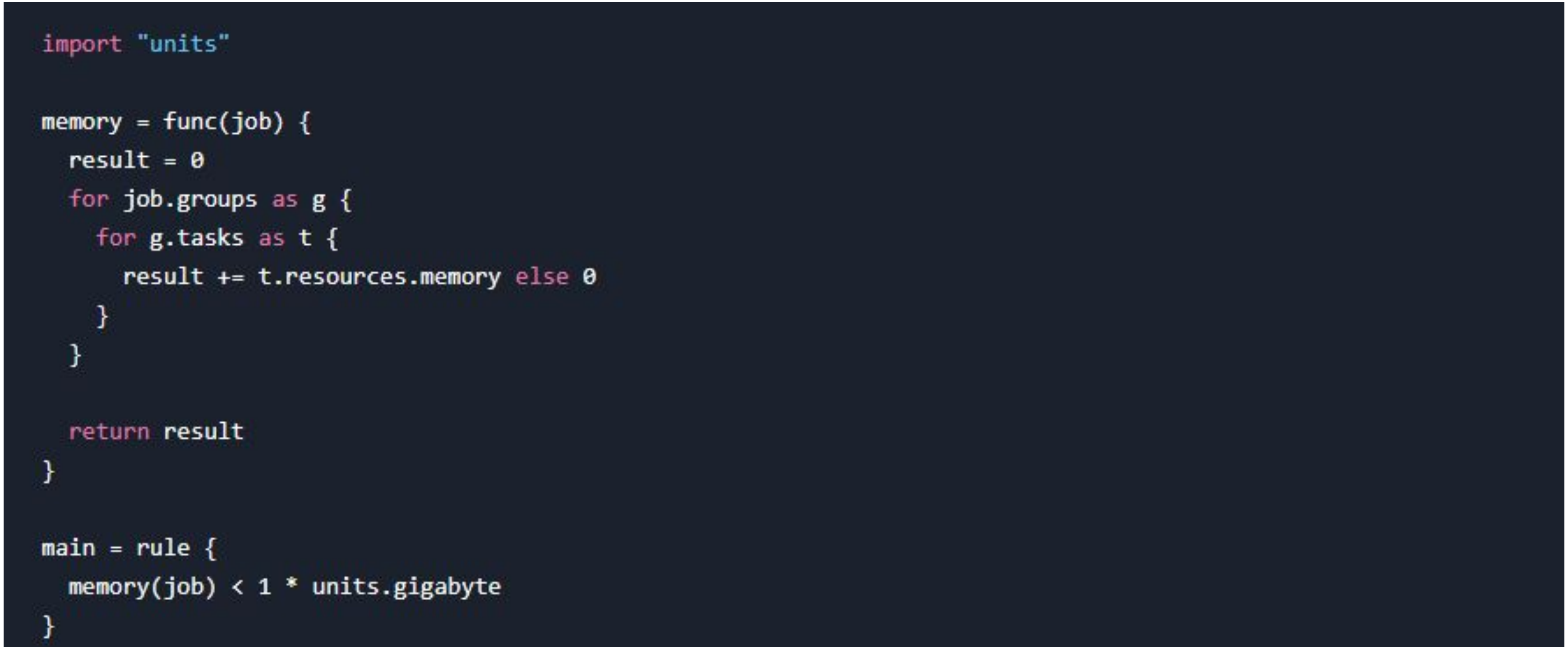
Benefits

- Enforcement
- Speed
- Reproducibility
- Reliability
- Automation
- Version Control
- Auditability

Architecture

- Variables, conditionals, loops, functions
  - Sentinel Language Reference
- Validates Config and State (Create, Edit, Destroy) of Terraform resources
- terraform plan -> sentinel check -> terraform apply
- Enforcement Levels – all are Logged
  - **Hard-mandatory**, required, cannot bypass, fail the TF RUN (prod)
  - **Soft-mandatory**, required, TF Owner can bypass with a comment in the TF UI, will halt the TF Run
  - **Advisory**, guard-rails warning, info warnings in the TF Run

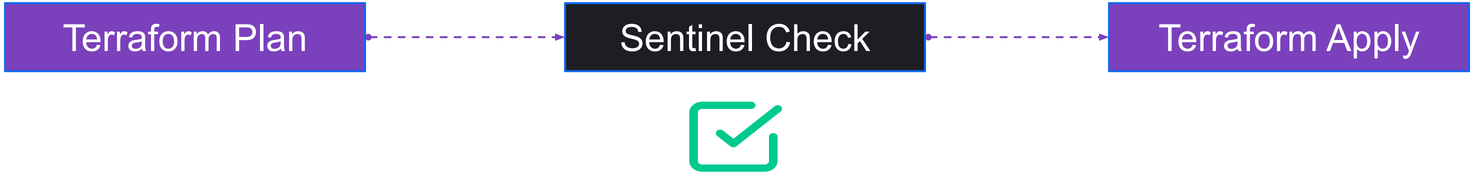
Syntax Example



```
import "units"

memory = func(job) {
  result = 0
  for job.groups as g {
    for g.tasks as t {
      result += t.resources.memory else 0
    }
  }

  return result
}

main = rule {
  memory(job) < 1 * units.gigabyte
}
```

Workflow

1. Create Terraform Workspaces
2. Create Sentinel Policies Git Repo
3. Create Policy Sets in TFC
4. Attach Policy Set to One (or more) Workspaces

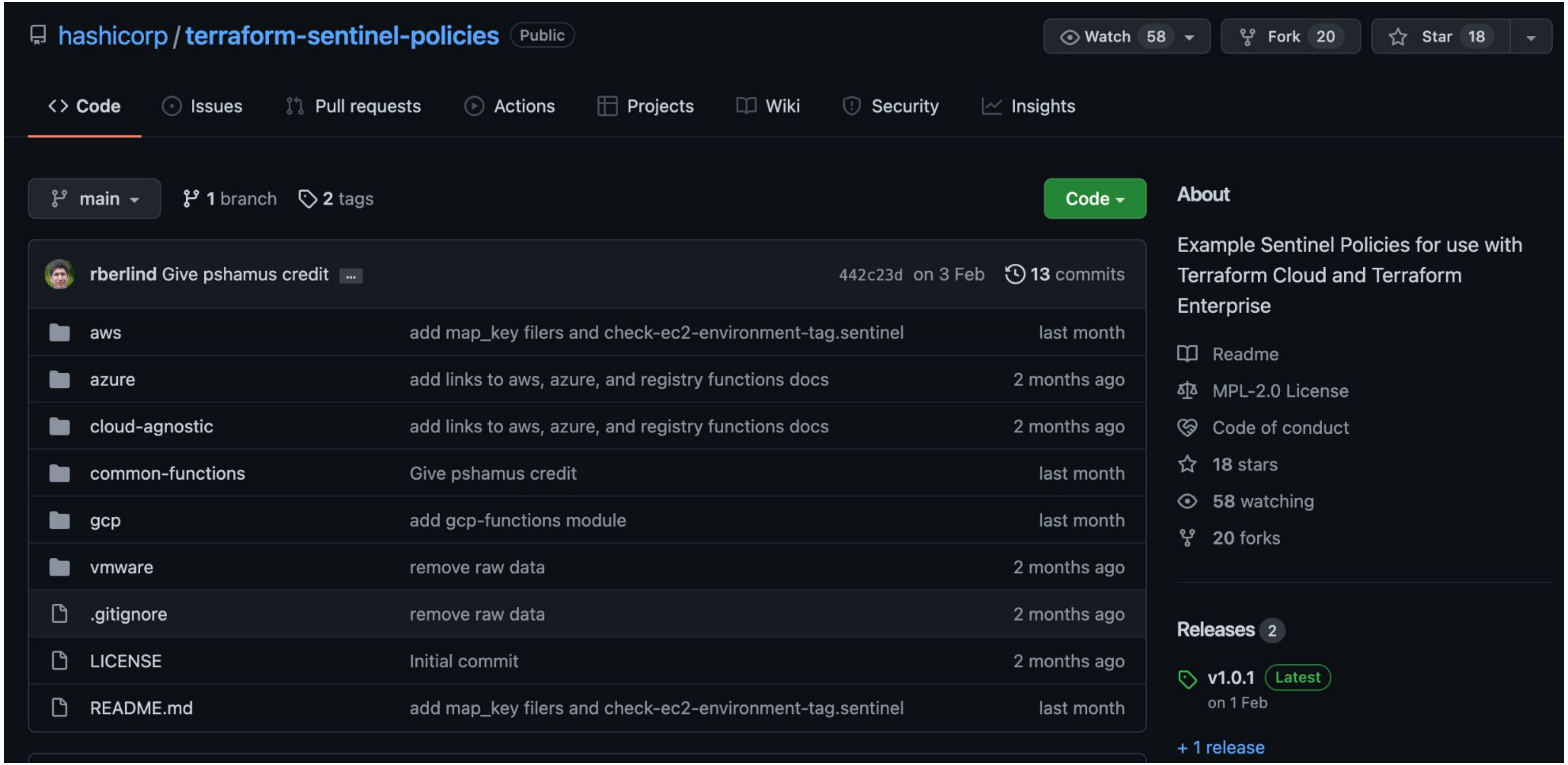


Terraform Plan

Sentinel Check

Terraform Apply

Sentinel Rule Git Repo



rberlind Give pshamus credit ... 442c23d on 3 Feb 13 commits

aws	add map_key filers and check-ec2-environment-tag.sentinel	last month
azure	add links to aws, azure, and registry functions docs	2 months ago
cloud-agnostic	add links to aws, azure, and registry functions docs	2 months ago
common-functions	Give pshamus credit	last month
gcp	add gcp-functions module	last month
vmware	remove raw data	2 months ago
.gitignore	remove raw data	2 months ago
LICENSE	Initial commit	2 months ago
README.md	add map_key filers and check-ec2-environment-tag.sentinel	last month

About

Example Sentinel Policies for use with Terraform Cloud and Terraform Enterprise

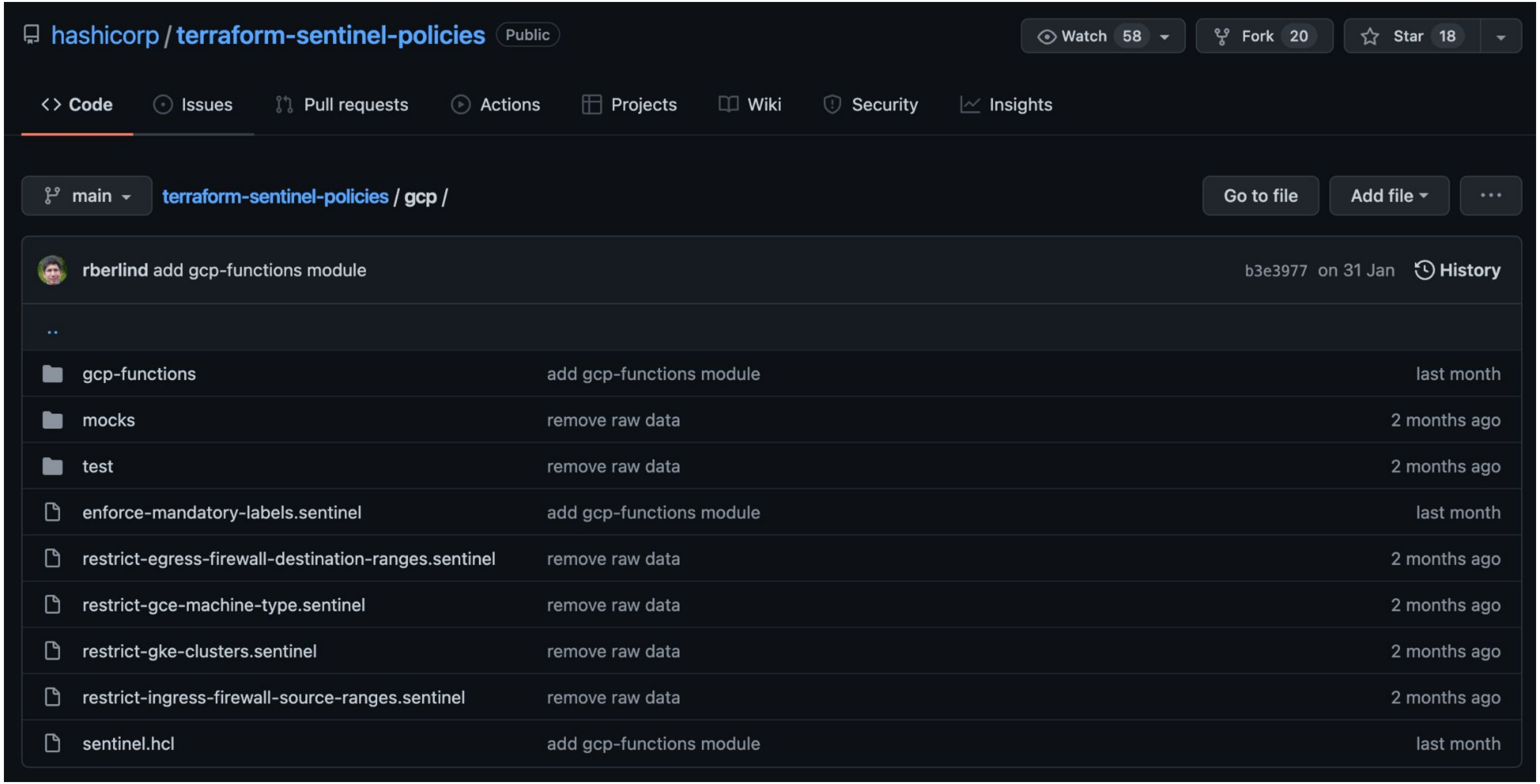
- Readme
- MPL-2.0 License
- Code of conduct
- 18 stars
- 58 watching
- 20 forks

Releases 2

v1.0.1 Latest
on 1 Feb

+ 1 release

Policy Set File Structure



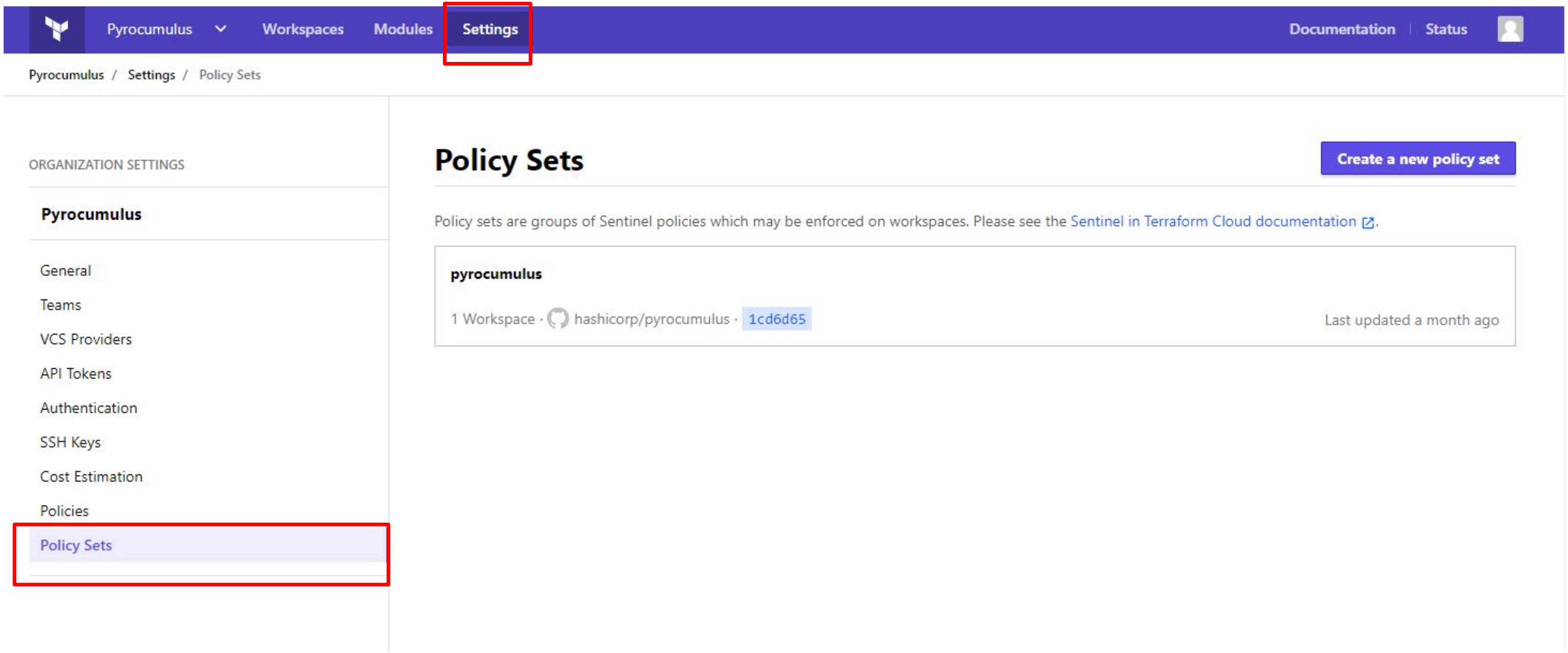
terraform-sentinel-policies / gcp /

rberlind add gcp-functions module b3e3977 on 31 Jan

..

gcp-functions	add gcp-functions module	last month
mocks	remove raw data	2 months ago
test	remove raw data	2 months ago
enforce-mandatory-labels.sentinel	add gcp-functions module	last month
restrict-egress-firewall-destination-ranges.sentinel	remove raw data	2 months ago
restrict-gce-machine-type.sentinel	remove raw data	2 months ago
restrict-gke-clusters.sentinel	remove raw data	2 months ago
restrict-ingress-firewall-source-ranges.sentinel	remove raw data	2 months ago
sentinel.hcl	add gcp-functions module	last month

Policy Sets



Pyrocumulus / Settings / Policy Sets

ORGANIZATION SETTINGS

Pyrocumulus

- General
- Teams
- VCS Providers
- API Tokens
- Authentication
- SSH Keys
- Cost Estimation
- Policies
- Policy Sets

Policy Sets

Create a new policy set

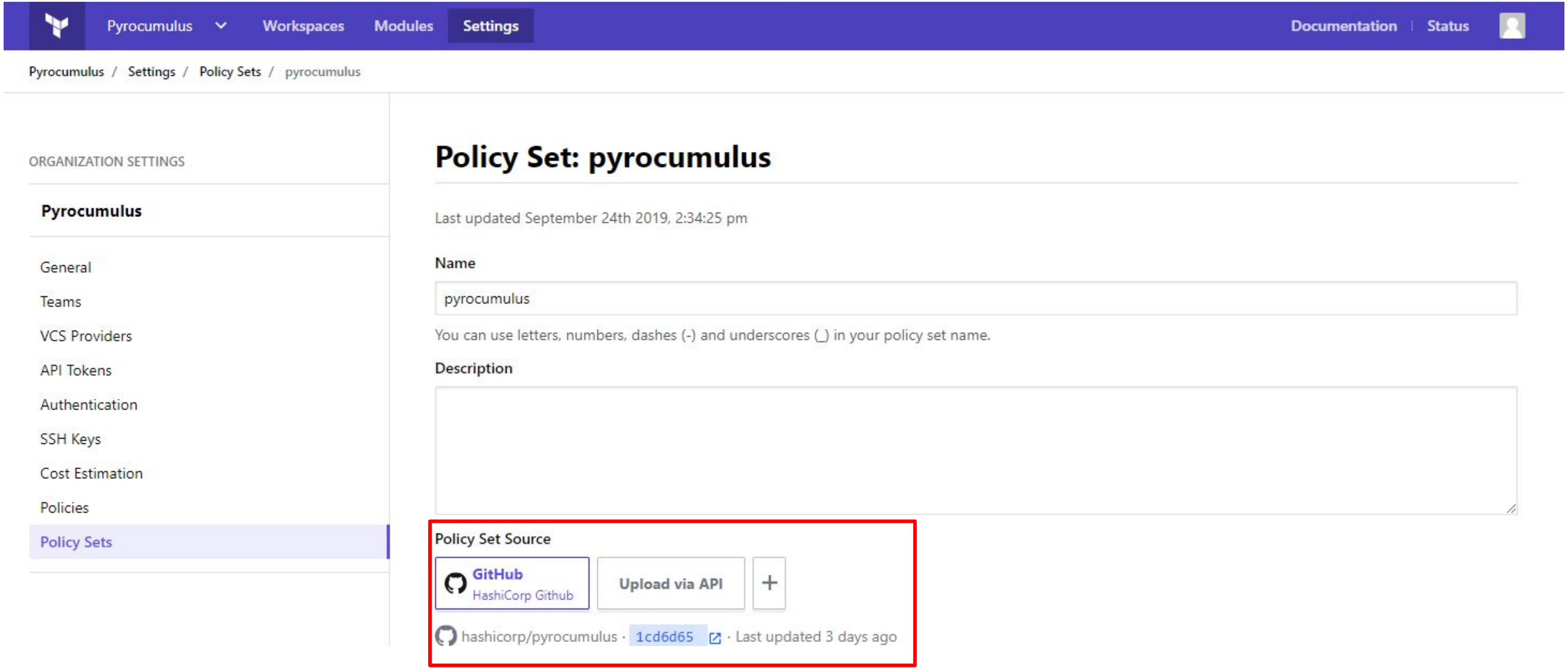
Policy sets are groups of Sentinel policies which may be enforced on workspaces. Please see the Sentinel in Terraform Cloud documentation.

pyrocumulus

1 Workspace · hashicorp/pyrocumulus · 1cd6d65

Last updated a month ago

Create Policy Set



Policy Set: pyrocumulus

Last updated September 24th 2019, 2:34:25 pm

Name

pyrocumulus

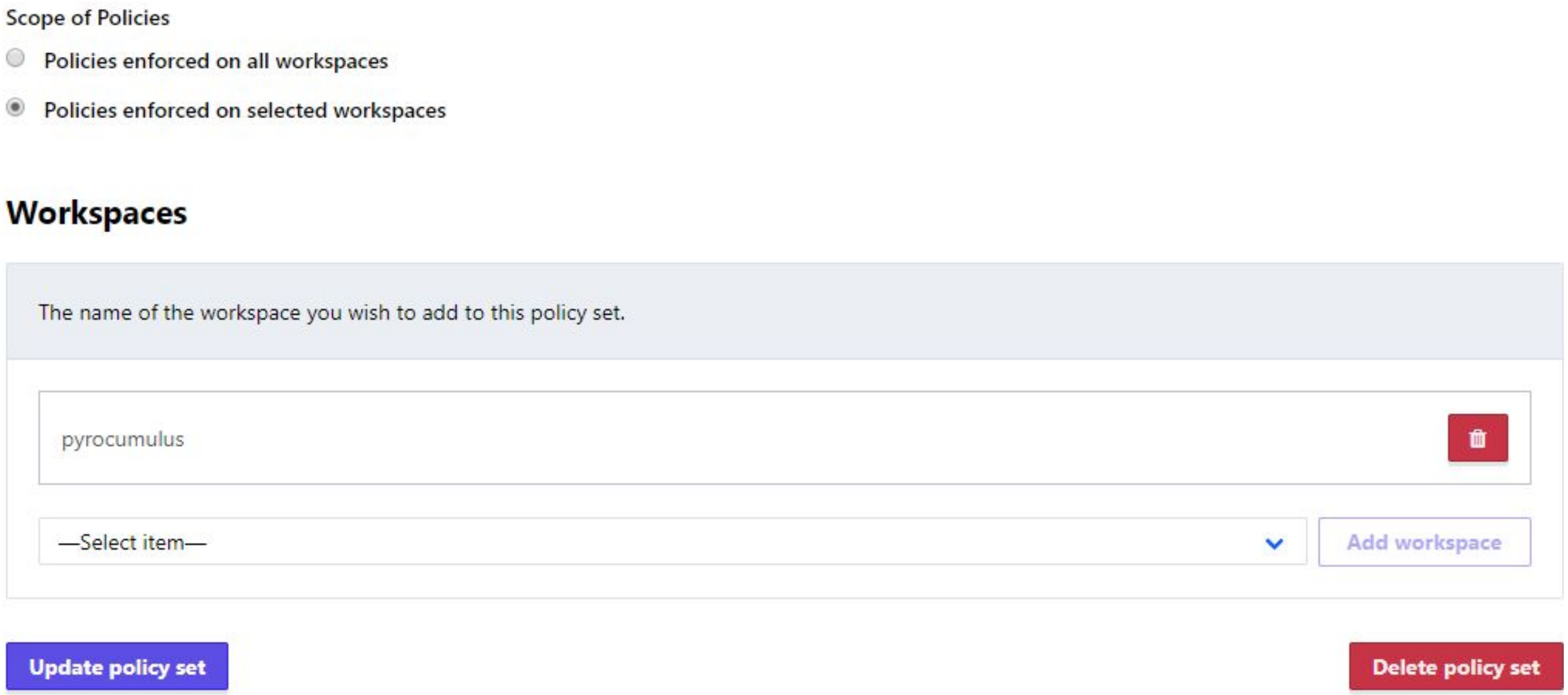
You can use letters, numbers, dashes (-) and underscores (_) in your policy set name.

Description

Policy Set Source

hashicorp/pyrocumulus · 1cd6d65 · Last updated 3 days ago

Attach Policy Set



Scope of Policies

○ Policies enforced on all workspaces

● Policies enforced on selected workspaces

Workspaces

The name of the workspace you wish to add to this policy set.

pyrocumulus

—Select item—

Automate Sentinel to Workspaces

```
# Get a list of Workspace IDs, based on matching a Regex pattern
variable "workspace_name_pattern" {
  type = string
  default = ".*_dev_vdm"
}
data "tfe_workspace_ids" "all" {
  names = ["*"]
  organization = var.tf_org_name
}
output "all_workspace_ids" { value = data.tfe_workspace_ids.all.ids }
locals {
  # filter by the Workspace Name, then return the Workspace ID, or null, then remove null entries
  filtered_workspace_ids = compact(flatten([
    for name, id in data.tfe_workspace_ids.all.ids : [
      (length(regexall(var.workspace_name_pattern, name)) > 0) ? id : null
    ]
  ]))
}
output "filtered_workspace_ids" { value = local.filtered_workspace_ids }
```

Limitations

1. Can only enforce against resources deployed & managed by Terraform
2. Cannot enforce “self-managed” services (ex: mysql on AWS EC2, Azure VM, GCP VM, VMware VM)
3. Cannot enforce against resource logs / metrics (ex: AWS CloudTrail, Azure Monitor, GCP Cloud Audit Logs)
4. Cannot continuously monitor (ex: AWS Config, Azure Policy, GCP Forseti)
5. Sentinel uses the Cloud Provider’s Cost Estimation API, which doesn’t continuously run, & does not check costs for usage-based billing (ex: AWS Athena, Azure DataBricks, GCP BigQuery, GCP Pub/Sub)

Resources: Sentinel Policies

- Example Sentinel Policies Collection
- Terraform Foundational Policies Library
- Sentinel Tutorials

03

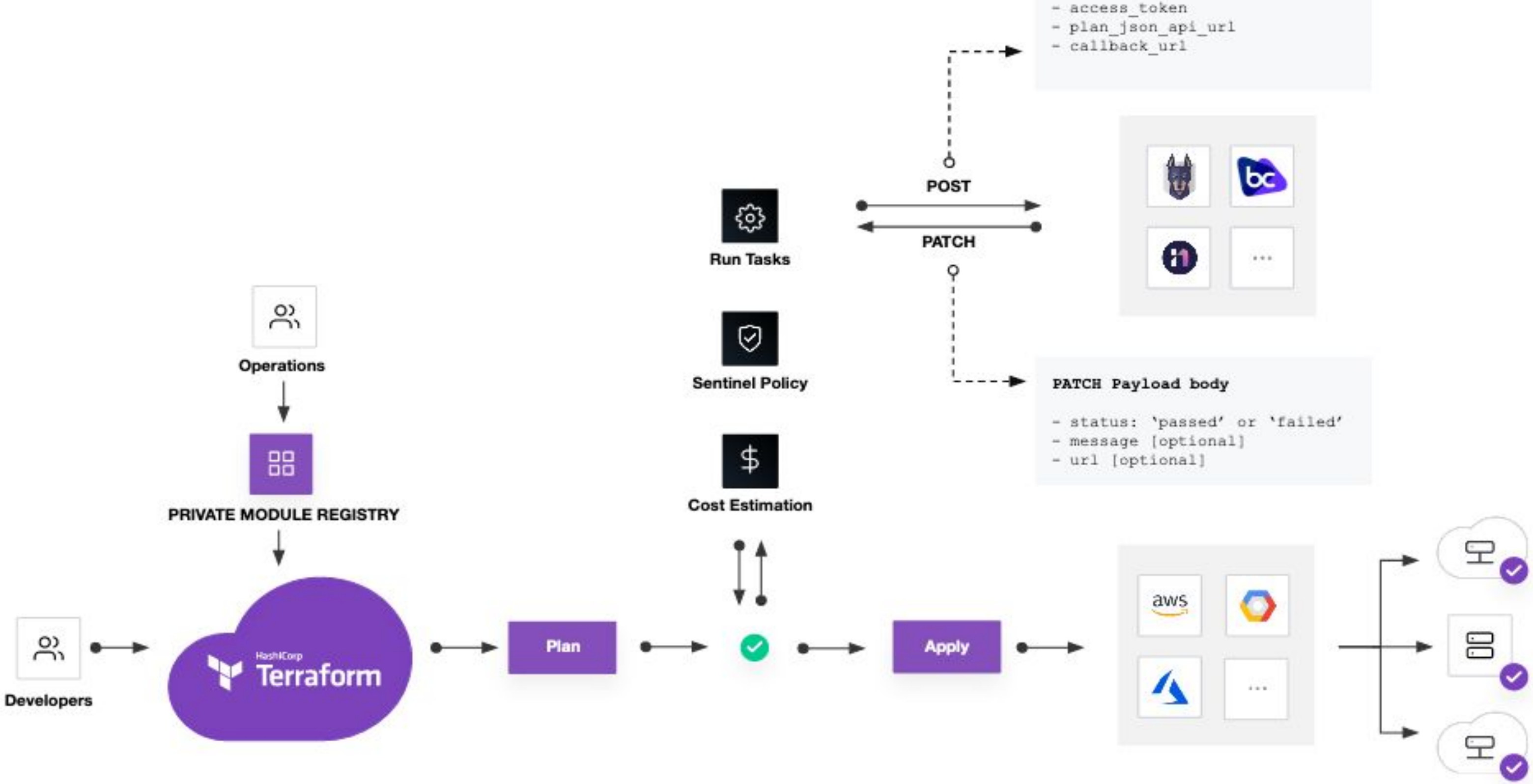
Run Tasks

Run Tasks

- Integrate 3rd-party tools into the pre-apply stage during a Terraform Cloud run
  - During pre-apply phase, an event hook is triggered & TFCB sends a payload containing run details
  - Terraform waits for the service to reply with either passed or failed status
- Supported integrations
  - Snyk, Bridgecrew, Infracost, Lightlytics, Vantage
  - HCP Packer

Architecture of Run Tasks

- access_token
- plan_json_api_url
- callback_url

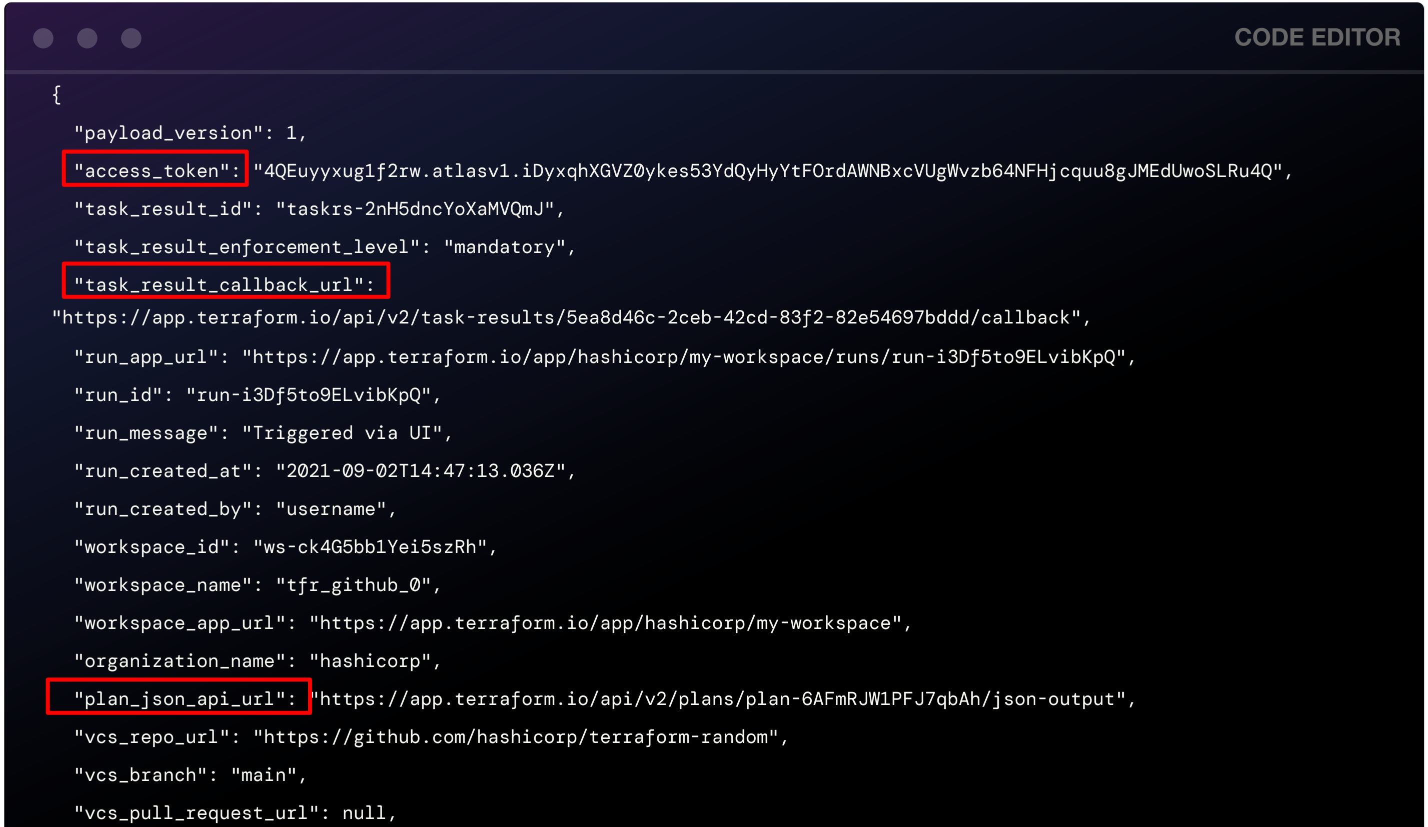


- access_token
- plan_json_api_url
- callback_url

PATCH Payload body

- status: 'passed' or 'failed'
- message [optional]
- url [optional]

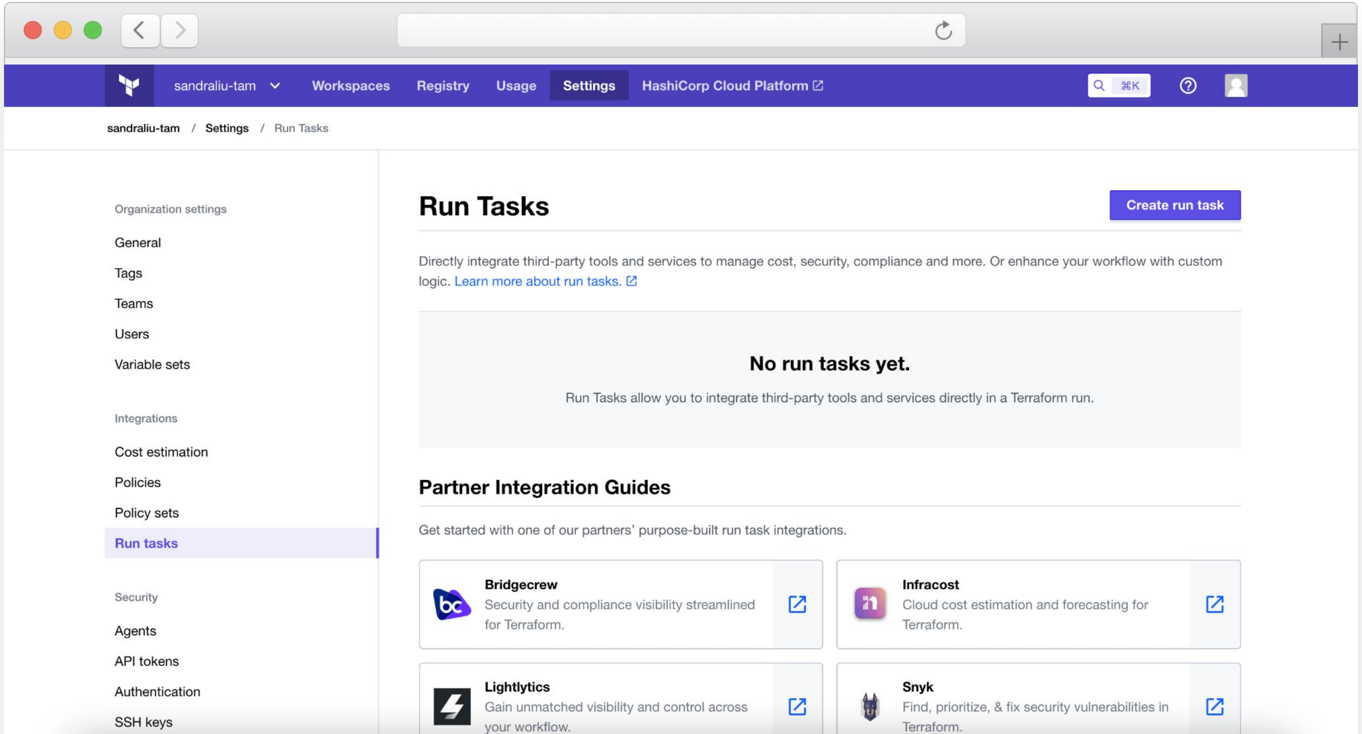
Payload from Terraform



```
{
  "payload_version": 1,
  "access_token": "4QEuyyxug1f2rw.atlasv1.iDyxqhXGVZ0ykes53YdQyHyYtFOrdAWNBxcVUgWvzb64NFHjcquu8gJMEdUwoSLRu4Q",
  "task_result_id": "taskrs-2nH5dncYoXaMVQmJ",
  "task_result_enforcement_level": "mandatory",
  "task_result_callback_url":
"https://app.terraform.io/api/v2/task-results/5ea8d46c-2ceb-42cd-83f2-82e54697bddd/callback",
  "run_app_url": "https://app.terraform.io/app/hashicorp/my-workspace/runs/run-i3Df5to9ELvibKpQ",
  "run_id": "run-i3Df5to9ELvibKpQ",
  "run_message": "Triggered via UI",
  "run_created_at": "2021-09-02T14:47:13.036Z",
  "run_created_by": "username",
  "workspace_id": "ws-ck4G5bb1Yei5szRh",
  "workspace_name": "tfr_github_0",
  "workspace_app_url": "https://app.terraform.io/app/hashicorp/my-workspace",
  "organization_name": "hashicorp",
  "plan_json_api_url": "https://app.terraform.io/api/v2/plans/plan-6AFmRJW1PFJ7qbAh/json-output",
  "vcs_repo_url": "https://github.com/hashicorp/terraform-random",
  "vcs_branch": "main",
  "vcs_pull_request_url": null,
```

Create Run Tasks

Organization Settings → Run Tasks → Create run tasks



Run Tasks

Directly integrate third-party tools and services to manage cost, security, compliance and more. Or enhance your workflow with custom logic. Learn more about run tasks.

No run tasks yet.

Run Tasks allow you to integrate third-party tools and services directly in a Terraform run.

Partner Integration Guides

Get started with one of our partners' purpose-built run task integrations.

Bridgecrew
Security and compliance visibility streamlined for Terraform.

Infracost
Cloud cost estimation and forecasting for Terraform.

Lightlytics
Gain unmatched visibility and control across your workflow.

Snyk
Find, prioritize, & fix security vulnerabilities in Terraform.

Run Task integration with HCP Packer

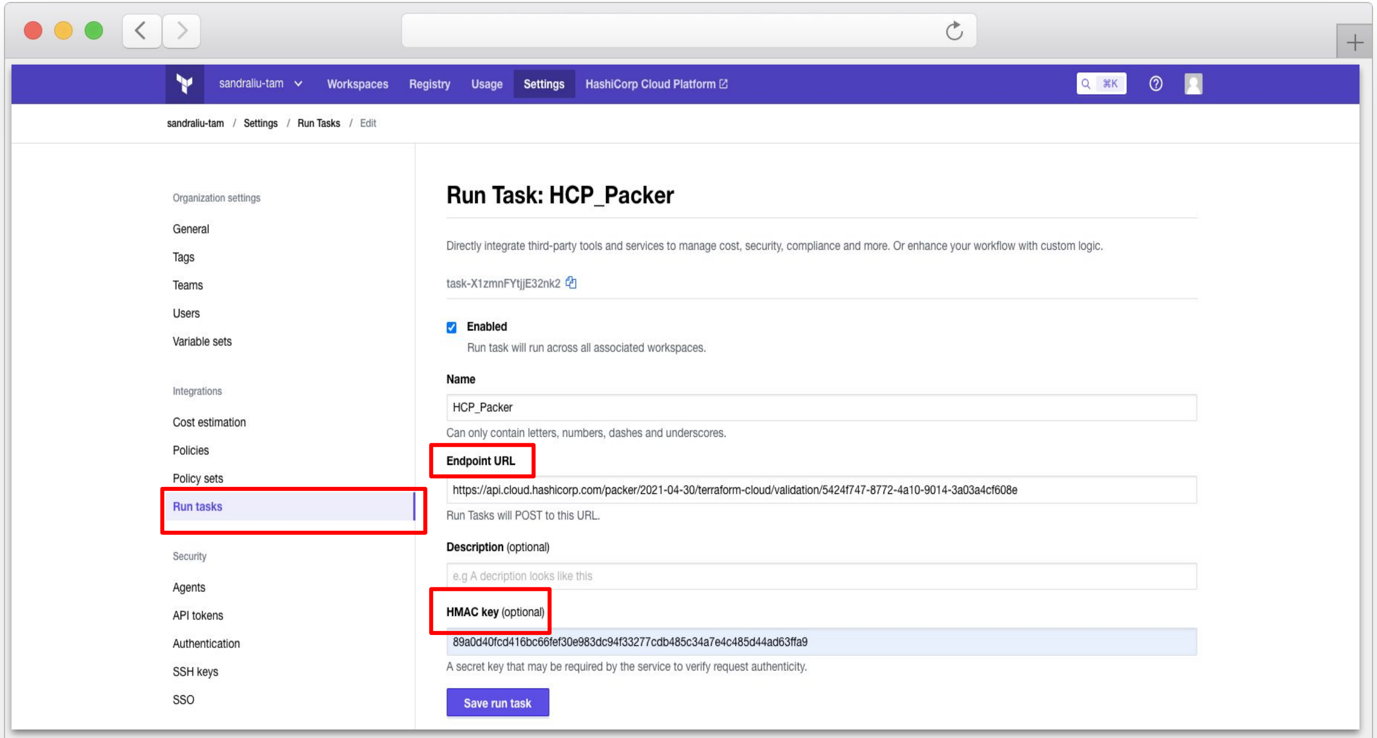
Run Task validates that machine images in your Terraform configuration are valid and haven’t been revoked for security or other reasons

Use-cases

1. Use run tasks with HCP Packer to identify compromised images with Terraform Cloud to prevent images from being outdated
2. Enforce image compliance with Terraform Cloud and let your configuration dynamically use more up to date images as you create them

Create Run Tasks with HCP Packer

Organization Settings → Run Tasks → Create run tasks



Run Task: HCP_Packer

Directly integrate third-party tools and services to manage cost, security, compliance and more. Or enhance your workflow with custom logic.

task-X1zmnFYtjjE32nk2

☑ **Enabled**

Run task will run across all associated workspaces.

Name

HCP_Packer

Can only contain letters, numbers, dashes and underscores.

Endpoint URL

https://api.cloud.hashicorp.com/packer/2021-04-30/terraform-cloud/validation/5424f747-8772-4a10-9014-3a03a4cf608e

Run Tasks will POST to this URL.

Description (optional)

e.g A decription looks like this

HMAC key (optional)

89a0d40fcd416bc66fef30e983dc94f33277cdb485c34a7e4c485d44ad63ffa9

A secret key that may be required by the service to verify request authenticity.

Technology Partners

Bridgecrew
Security and compliance errors in Terraform configurations.

cloudtamer.io
Cost savings or compliance findings.

Infracost
A cloud infrastructure costing, initiated right from a pull request or Terraform run.

Lightlytics
Security checks to any additional dependency changes.

Refactr
Allows users to build workflows for multiple use cases including but not limited to code scanning.

Snyk
find, track, and fix security misconfigurations in their cloud infrastructure as part of their SDLC

Future
An up-to-date list is available **here**.

Resources: Run Tasks

- Run Tasks Documentation
- Run Tasks Integration
- Tutorial: Configure Snyk Run Task in Terraform Cloud

04

Audit Logs

Audit Logging

- The audit trails API exposes a stream of audit events, describing changes to the application entities (workspaces, runs, etc.) for a specific TCFB Organization
- Terraform Cloud retains 14 days of audit log information
- Retentions beyond 14 days requires ingestion into an external platform or solution
- Endpoint cannot be accessed with a user token or team token, requires an organization token.

Resources: Audit Logging

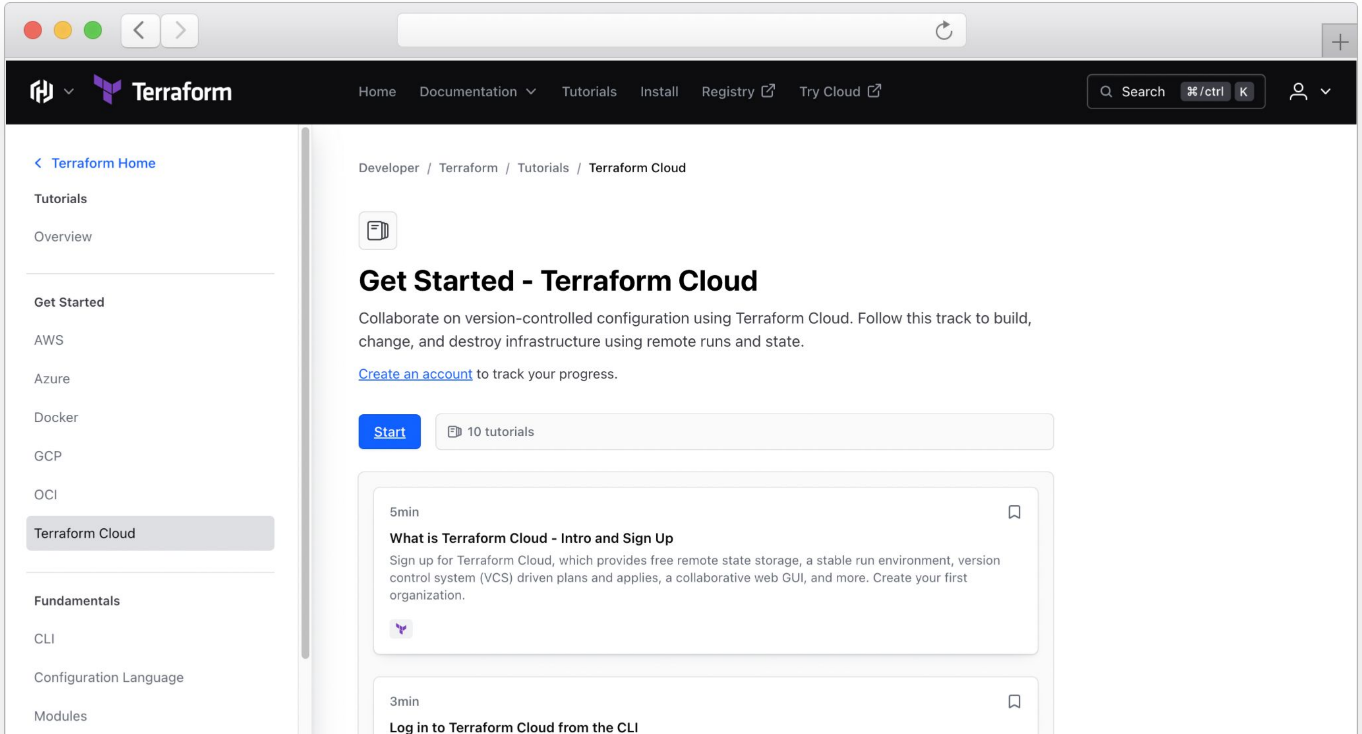
- Audit Trails API
- Blog - Cloud Compliance & Management with Terraform
- Log Forwarding
- Terraform Cloud Audit Logging with Splunk
- Medium Post - Splunk Integration with TFC

Next Steps

Tutorials

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

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



Get Started - Terraform Cloud

Collaborate on version-controlled configuration using Terraform Cloud. Follow this track to build, change, and destroy infrastructure using remote runs and state.

Create an account to track your progress.

Start | 10 tutorials

5min

What is Terraform Cloud - Intro and Sign Up

Sign up for Terraform Cloud, which provides free remote state storage, a stable run environment, version control system (VCS) driven plans and applies, a collaborative web GUI, and more. Create your first organization.

3min

Log in to Terraform Cloud from the CLI

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

Up Next

Webinar: Terraform Integrations & Program Closing

Authorized users for Support

Please email customer.success@hashicorp.com with Authorized Support Contacts

Q & A

A Q&A will be held after this session

Thank You

customer.success@hashicorp.com
www.hashicorp.com/customer-success