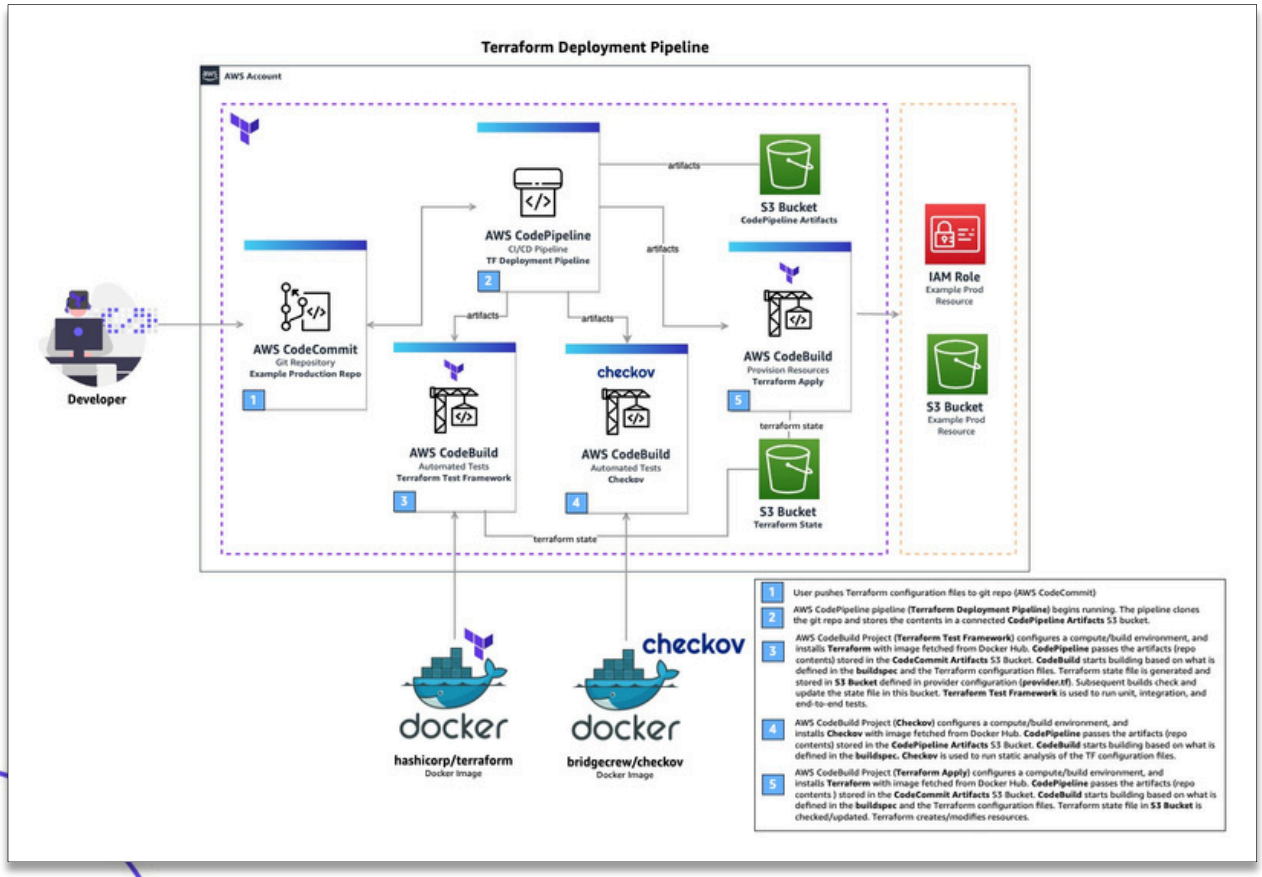
TERRAFORM CI/CD AND TESTING ON AWS

AWS Cloud Engineer



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Problem Statement

Manual Terraform deployments and lack of tes=ng increase the risk of misconfigured infrastructure, security issues, and unscalable cloud environments. This project solves that by building a CI/CD system that automates tes=ng and deployment of Terraform modules.

Business Impact

- Reduced risk of misconfigured infrastructure through automated tes=ng and valida=on
- Improved deployment speed and consistency with full CI/CD pipeline
- Strengthened security with Checkov integra=on
- Centralized Terraform state storage for team collabora=on using S3 + DynamoDB
- Eliminated manual provisioning, enabling repeatable, produc=on-ready deployments

Cloud Architecture

Services Used:

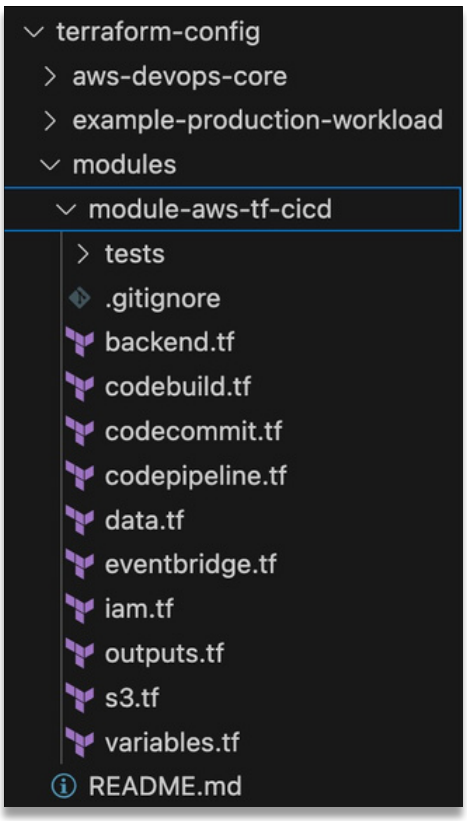
- **Terraform** – Infra automa=on, valida=on, tes=ng
- **AWS CodePipeline** – CI/CD pipeline orchestra=on
- **AWS CodeBuild** – Executes Terraform tests, Checkov scans, and apply
- **S3** – Stores ar=facts and remote backend state
- **DynamoDB** – State lock management
- **IAM** – Secure access roles and permissions
- **GitHub (via CodeStar ConnecCons)** – Source repo and trigger for pipelines

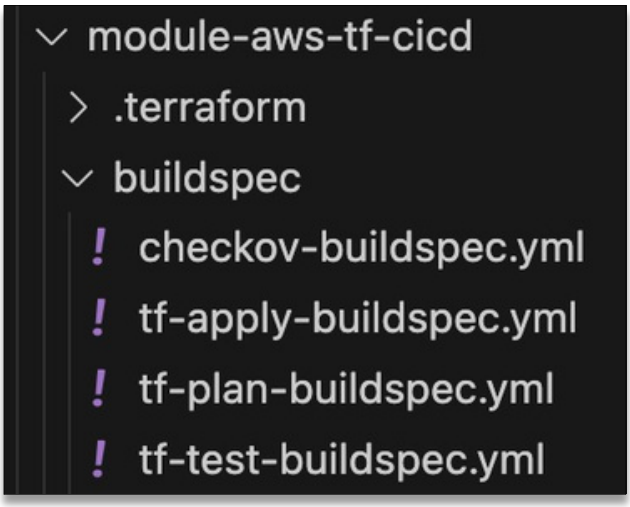
Structure:

- Tes=ng Pipeline (module valida=on)
- Deployment Pipeline (example workload)
- Remote state setup across two pipelines
- Refactored out CodeCommit, replaced with GitHub + CodeStar Connec=on

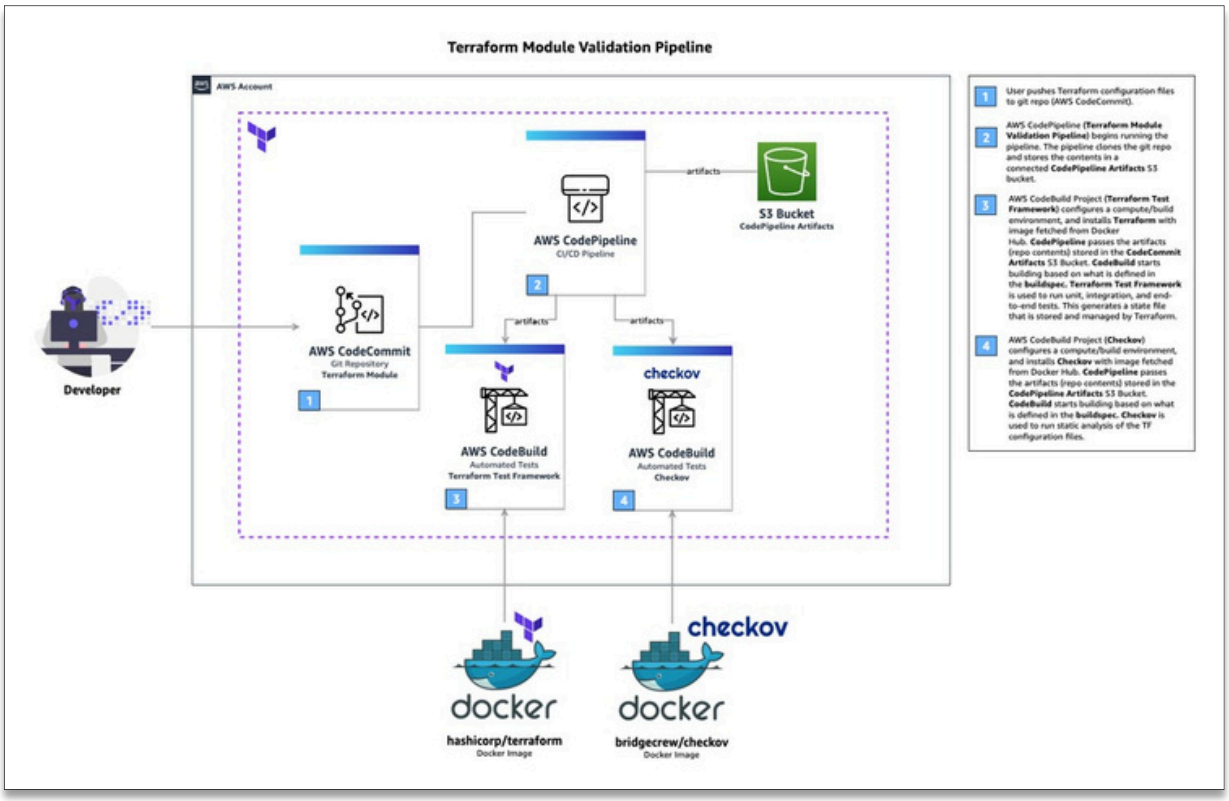
Technical Implementa?on

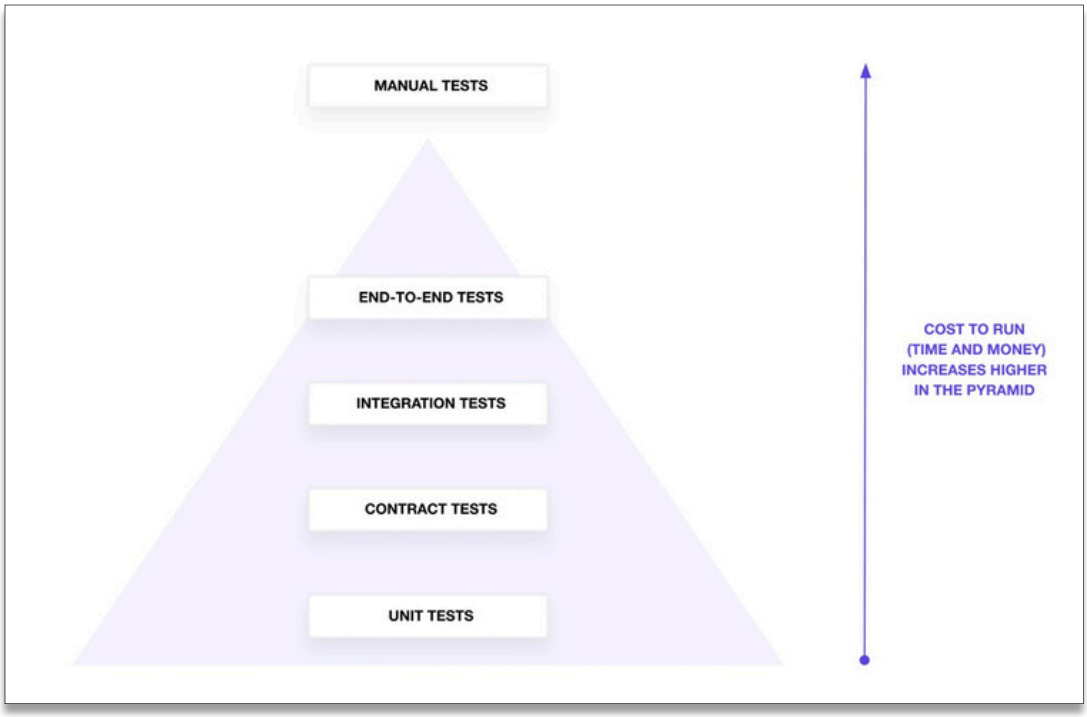
1. Developed a reusable Terraform module to provision AWS infrastructure using IaC best pracCces, including IAM roles, S3 buckets, and CodePipeline.





2. Integrated Terraform Test Framework to validate module funcConality with unit, integraCon, and end-to-end tests.






```
joeyacosta@Joeys-MacBook-Pro module-aws-tf-cicd % terraform init
Initializing the backend...
Initializing provider plugins...
- Reusing previous version of hashicorp/aws from the dependency lock file
- Reusing previous version of hashicorp/random from the dependency lock file
- Using previously-installed hashicorp/aws v5.94.1
- Using previously-installed hashicorp/random v3.7.1

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform plan" to see
any changes that are required for your infrastructure. All Terraform commands
should now work.

If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.
joeyacosta@Joeys-MacBook-Pro module-aws-tf-cicd % terraform test
tests/main.tftest.hcl... in progress
  run "input_validation"... pass
  run "e2e_test"... pass
tests/main.tftest.hcl... tearing down
tests/main.tftest.hcl... pass

Success! 2 passed, 0 failed.
```

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3. Added security scanning with Checkov and enforced linCng with TFLint to ensure clean, secure, and compliant Terraform code.

```
joeyacosta@Joeys-MacBook-Pro module-aws-tf-cicd % checkov --directory /Users/joeyacosta/
orm-config/modules/module-aws-tf-cicd
[ terraform framework ]: 100%|                    |[10/10], Current File Scanned=variabl
[ secrets framework ]: 100%|                      |[10/10], Current File Scanned=/Users/jo

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  \___|_| |_|\___|\___|_|\_\___/ \_/

By Prisma Cloud | version: 3.2.400
Update available 3.2.400 -> 3.2.403
Run pip3 install -U checkov to update


terraform scan results:

Passed checks: 94, Failed checks: 0, Skipped checks: 17

Check: CKV_AWS_93: "Ensure S3 bucket policy does not lockout all but root user. (Prevent
        PASSED for resource: aws_s3_bucket.tf_remote_state_s3_buckets
        File: /backend.tf:10-21
        Guide: https://docs.prismacloud.io/en/enterprise-edition/policy-reference/aws-po
Check: CKV_AWS_53: "Ensure S3 bucket has block public ACLS enabled"
        PASSED for resource: aws_s3_bucket_public_access_block.tf_remote_state_s3_bucket
        File: /backend.tf:31-39
        Guide: https://docs.prismacloud.io/en/enterprise-edition/policy-reference/aws-po
Check: CKV_AWS_54: "Ensure S3 bucket has block public policy enabled"
        PASSED for resource: aws_s3_bucket_public_access_block.tf_remote_state_s3_bucket
        File: /backend.tf:31-39
```

```
joeyacosta@Joeys-MacBook-Pro aws-devops-core % tflint
1 issue(s) found:

Warning: terraform "required_version" attribute is required (terraform_required_version)

  on provider.tf line 3:
   3: terraform {

Reference: https://github.com/terraform-linters/tflint-ruleset-terraform/blob/v0.11.0/doc
sion.md

joeyacosta@Joeys-MacBook-Pro aws-devops-core % terraform -version
Terraform v1.11.3
on darwin_arm64
+ provider registry.terraform.io/hashicorp/aws v5.94.1
+ provider registry.terraform.io/hashicorp/random v3.7.1
joeyacosta@Joeys-MacBook-Pro aws-devops-core % tflint
joeyacosta@Joeys-MacBook-Pro aws-devops-core %
```

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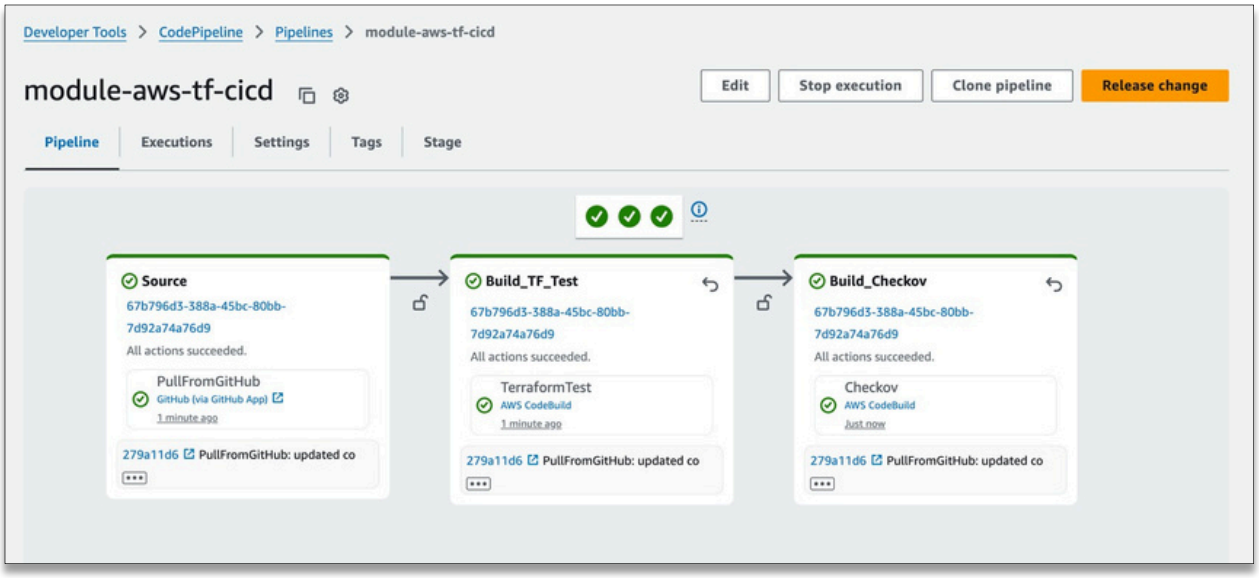
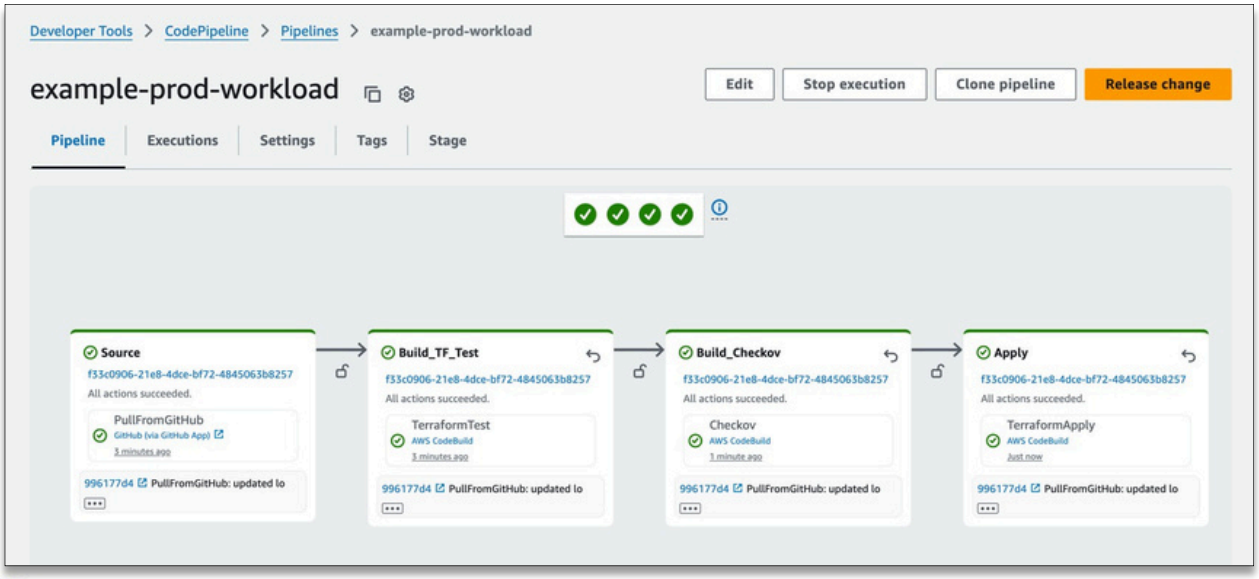
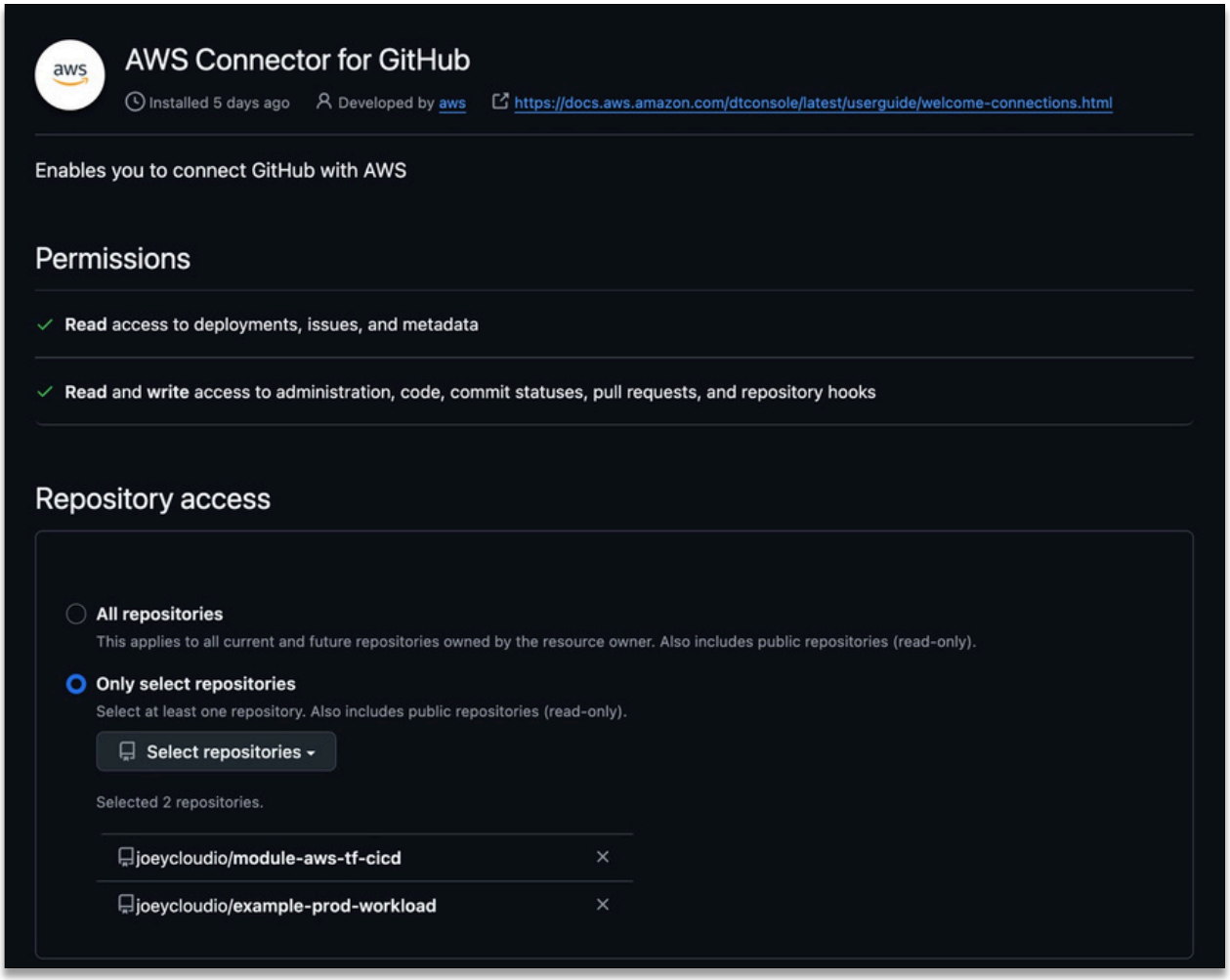
4. Built two automated CI/CD pipelines using Terraform, CodePipeline, and CodeBuild to test and deploy infrastructure triggered by GitHub commits.






AWS Connector for GitHub
Installed 5 days ago
Developed by aws
https://docs.aws.amazon.com/dtconsole/latest/userguide/welcome-connections.html
Enables you to connect GitHub with AWS
Permissions
Read access to deployments, issues, and metadata
Read and write access to administration, code, commit statuses, pull requests, and repository hooks
Repository access
All repositories
This applies to all current and future repositories owned by the resource owner. Also includes public repositories (read-only).
Only select repositories
Select at least one repository. Also includes public repositories (read-only).
Select repositories
Selected 2 repositories.
joeycloudio/module-aws-tf-cicd
joeycloudio/example-prod-workload

5. Configured S3 remote backend and DynamoDB state locking, enabling collaboraCon and safe, versioned state management.

```
joeyacosta@Joeys-MacBook-Pro aws-devops-core % terraform init
Initializing the backend...
Do you want to copy existing state to the new backend?
  Pre-existing state was found while migrating the previous "local" backend to the
  newly configured "s3" backend. No existing state was found in the newly
  configured "s3" backend. Do you want to copy this state to the new "s3"
  backend? Enter "yes" to copy and "no" to start with an empty state.

  Enter a value: yes


Successfully configured the backend "s3"! Terraform will automatically
use this backend unless the backend configuration changes.
Initializing modules...
Initializing provider plugins...
- Reusing previous version of hashicorp/aws from the dependency lock file
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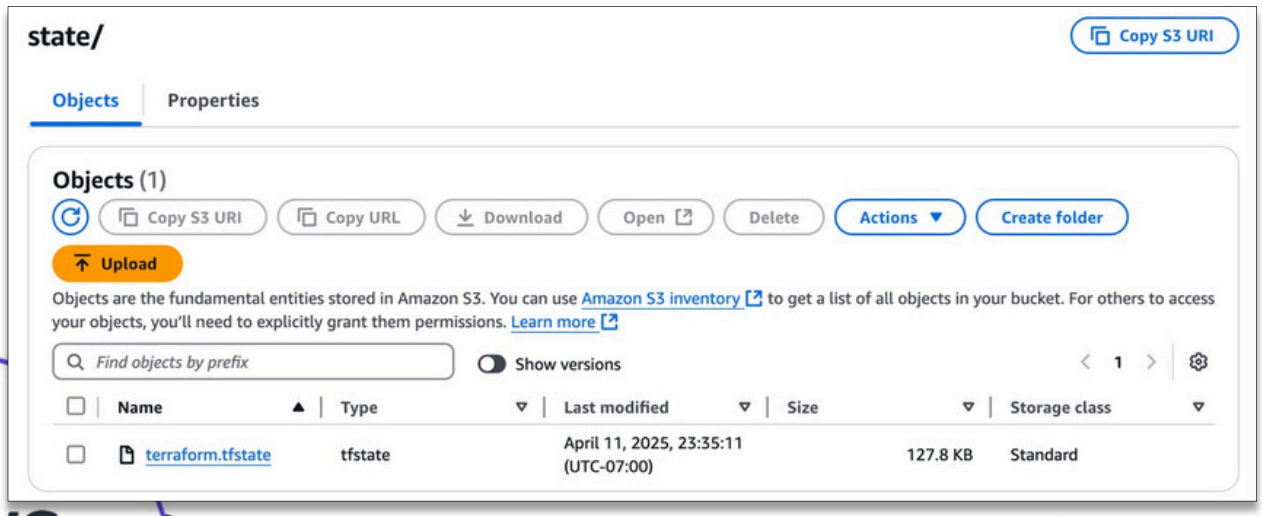

6. Refactored the project to replace AWS CodeCommit with GitHub and CodeStar ConnecCons, resolving all repo trigger issues and enabling automated pipeline execuCon.

```
variable "codestar_connection_arn" {
  description = "CodeStar Connection ARN for GitHub integration"
  type        = string
```

```
stages = [
  # Clone from GitHub, store contents in  artifacts S3 Bucket
  {
    name = "Source"
    action = [
      {
        name     = "PullFromGitHub"
        category = "Source"
        owner    = "AWS"
        provider = "CodeStarSourceConnection"
        version  = "1"
        configuration = {
          ConnectionArn     = var.codestar_connection_arn
          FullRepositoryId  = "joeycloudio/module-aws-tf-cicd"
          BranchName        = "main"
        }
        input_artifacts = []
        #  Store the output of this stage as 'source_output_arti
        output_artifacts = ["source_output_artifacts"]
        run_order        = 1
      },
    ]
  },
```

```
stages = [
  # Clone from GitHub, store contents in  artifacts S3 Bucket
  {
    name = "Source"
    action = [
      {
        name     = "PullFromGitHub"
        category = "Source"
        owner    = "AWS"
        provider = "CodeStarSourceConnection"
        version  = "1"
        configuration = {
          ConnectionArn     = var.codestar_connection_arn
          FullRepositoryId  = "joeycloudio/example-prod-workload"
          BranchName        = "main"
        }
        input_artifacts = []
        #  Store the output of this stage as 'source_output_artifac
        output_artifacts = ["source_output_artifacts"]
        run_order        = 1
      },
    ]
  },
```

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Key Accomplishments

- Replaced CodeCommit with GitHub integra=on across both pipelines
- Built modular, testable Terraform infrastructure using`terraform test framework`
- Integrated security scanning (Checkov) and lin=ng (TFLint)
- Configured and tested remote S3/DynamoDB backend
- Migrated local Terraform state to remote backend with zero dri_
- Troubleshot and resolved CodePipeline ARN issues, buildspec errors, and webhook bugs
- Successfully deployed and verified 50+ AWS resources end-to-end

Key Learnings

- Real-world Terraform debugging is o_e n reverse-engineering someone else's design
- CI/CD pipelines require precise wiring: GitHub → CodeStar → CodePipeline → CodeBuild
- Remote state config must be handled carefully, especially post-deploy
- Modular Terraform doesn't mean every folder should be a root module
- Git and Terraform interac=on (rebase, state dri_, force-unlock) mager more than tutorials admit

Why This MaCers in Produc?on

This project reflects actual prac=ces used in infrastructure teams—tes=ng Terraform modules, automa=ng secure deployments, and managing state with best prac=ces. It's built for scale, collabora=on, and real-world reliability, not just a local sandbox.

Next Steps

- Add a manual approval stage + SNS no=fica=ons (op=onal stretch goal)
- Prac=ce deploying to a second AWS account via cross-account IAM roles
- Reuse modules and pipelines for future real-world Terraform repos