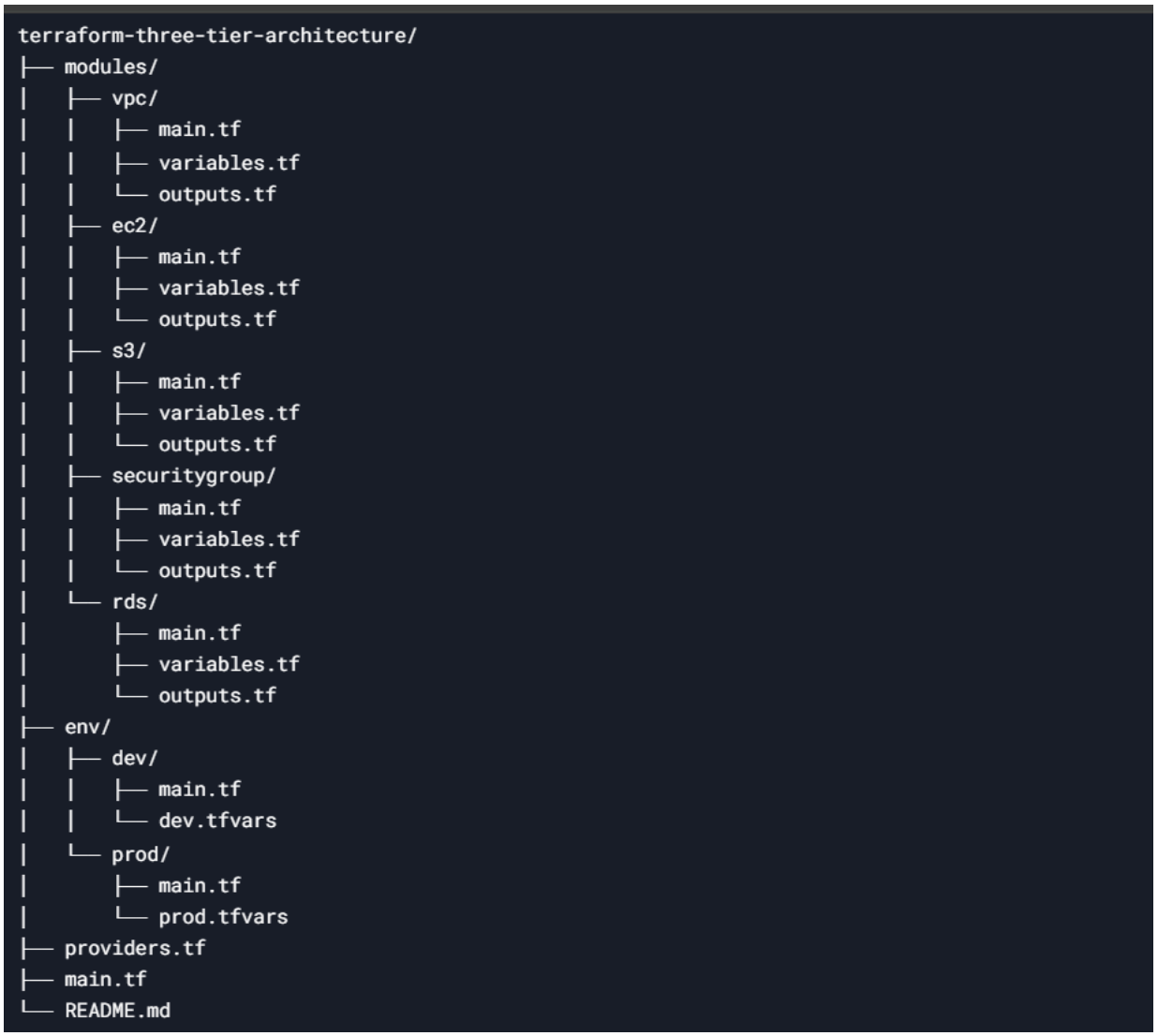
Tej Mandaliya

🚀Building a Scalable Three-Tier Architecture on AWS with Terraform



Tej Mandaliya

Introduction:

This document provides a comprehensive overview of the infrastructure setup and configuration deployed using **Terraform**. The infrastructure includes resources such as EC2 instances, RDS databases, and S3 buckets, all provisioned in a cloud environment (AWS in this case). The goal of this project is to automate and manage cloud resources efficiently and reproducibly using **Infrastructure as Code (IaC)** principles.

In this project, Terraform is used to manage the lifecycle of AWS resources, allowing for easy provisioning, management, and decommissioning of cloud resources based on the configuration.

Objective:

The main objective of this project is to:

- **Automate infrastructure provisioning**: Deploy and manage cloud resources using Terraform.
- **Ensure environment consistency**: Use workspace-specific configurations to maintain different environments (like production, staging, development).
- **Simplify resource management**: Allow dynamic configuration of resources like EC2 instances, RDS databases, and S3 buckets based on defined variables.
- **Implement best practices**: Adopt industry-standard practices for AWS infrastructure deployment.

Technologies used:

- **AWS (Amazon Web Services)**: Cloud computing platform used to deploy and manage infrastructure resources.
- **Terraform**: An open-source Infrastructure as Code (IaC) tool that allows you to define and provision data center infrastructure using a declarative configuration language.

Tej Mandaliya

How I Set Up

First Step: Setup and Configuration

I have Installed terraform

Terraform is installed on your local machine. You can download https://developer.hashicorp.com/terraform/install

AWS CLI is installed and configured with appropriate access credentials. Follow the steps here to configure AWS CLI: AWS CLI Configuration.

AWS CLI Installation

AWS CLI Configuration

Check :

```
C:\Users\tejma\Downloads>terraform --version
Terraform v1.10.4
on windows_386

Your version of Terraform is out of date! The latest version
is 1.10.5. You can update by downloading from https://www.terraform.io/downloads.html

C:\Users\tejma\Downloads>aws --version
aws-cli/2.22.20 Python/3.12.6 Windows/11 exe/AMD64

C:\Users\tejma\Downloads>aws configure
AWS Access Key ID [****************HVG6]:
AWS Secret Access Key [****************3RuW]:
Default region name [ap-south-1]:
Default output format [json]:

C:\Users\tejma\Downloads>aws s3 ls
2025-01-31 13:43:30 my-dev-terraform-bucket-dev
2025-01-31 13:13:18 my-dev-terraform-bucket-prod
```

Second Step : Creating Modules

2.1 This project follows a modular approach, making it scalable and reusable for multiple environments.

1VPC Module (modules/vpc/)

- main.tf → Defines the AWS VPC, subnets, internet gateway, and route tables.
- variables.tf → Declares input variables like CIDR blocks, subnet ranges, and availability zones.
- outputs.tf → Outputs important attributes like VPC ID and Subnet IDs for reference in other modules.

- **GitHub: VPC Code**
- 📌 *Purpose:* Provides network isolation and communication between different tiers.

2 EC2 Module (modules/ec2/)

- main.tf → Defines EC2 instances with appropriate AMI, instance type, security groups, and key pairs.
- variables.tf → Defines parameters like instance size, AMI ID, SSH key, and security group IDs.
- outputs.tf → Returns instance public IP, private IP, and instance ID.
- GitHub: EC2 code

📌 *Purpose:* Hosts the application tier by provisioning EC2 instances.

3 S3 Module (modules/s3/)

- main.tf → Creates S3 buckets.
- variables.tf → Defines bucket names, and storage settings.
- outputs.tf → Outputs the bucket name.
- GitHub: S3 code

📌 *Purpose:* Provides object storage for logs, backups, or static content.

4 Security Group Module (modules/security group/)

- main.tf → Defines security groups with rules for inbound/outbound traffic.
- variables.tf → Specifies allowed IP ranges, protocols, and ports.
- outputs.tf → Outputs security group IDs.
- GitHub: Security Code

📌 *Purpose:* Controls access between different architecture layers securely.

5 RDS Module (modules/rds/)

- main.tf → Defines RDS instances (MySQL/PostgreSQL) with multi-AZ deployment.
- variables.tf → Defines DB engine type, version, storage, and credentials.
- outputs.tf → Outputs RDS endpoint and DB name.
- GitHub: RDS code

📌 *Purpose:* Provides a managed relational database for the backend layer.

🌍 Environments (env/)

The env/ directory contains configurations for different environments:

- Development (env/dev/)
    - Uses smaller instance types and non-production settings.
    - dev.tfvars contains environment-specific variable values.
- Production (env/prod/)
    - Uses larger instances and enables high availability.
    - prod.tfvars contains environment-specific variable values.
- GitHub: [Env-terra-code]

📌 *Purpose:* Enables separation of environments with different infrastructure configurations.

⚙️ providers.tf

- Defines the AWS provider and specifies the Terraform backend (S3, DynamoDB, etc.).

📌 *Purpose:* Ensures Terraform interacts with AWS correctly.

🚀 Deployment Steps

Step 1: Initialize Terraform

- **terraform init**

  This downloads the required provider plugins and initializes the backend.

Step 2: Select or Create a Workspace

- **terraform workspace new dev # Create workspace for Dev**
- **terraform workspace select dev # Switch to Dev workspace**

For production:

- **terraform workspace new prod # Create workspace for Prod**
- **terraform workspace select prod # Switch to Prod workspace**

Step 3: Plan Infrastructure

- **terraform plan -var-file=dev.tfvars**

  This shows the execution plan for the development environment.
- **terraform plan -var-file=prod.tfvars**

  This shows the execution plan for the production environment

Step 3: Apply Changes

- **terraform apply -var-file=dev.tfvars -auto-approve**

Apply for Development it will start creating all modules.

- **terraform apply -var-file=prod.tfvars**

  Apply for Production it will start creating all modules.

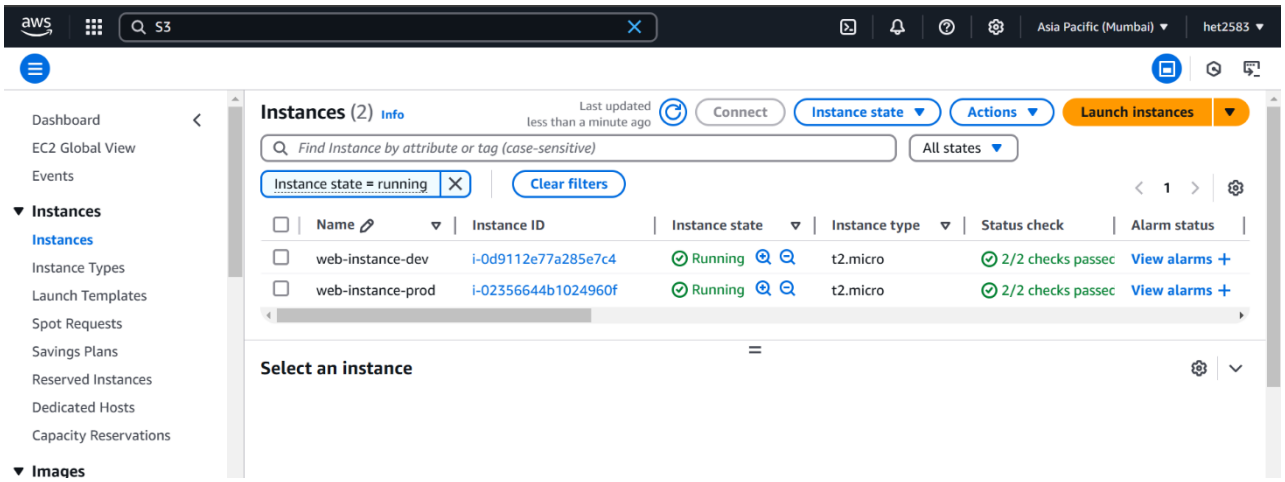
Step 4: Destroy Infrastructure (if needed)

- **terraform destroy -var-file=”dev.tfvars”**
- **terraform destroy -var-file="prod.tfvars"**

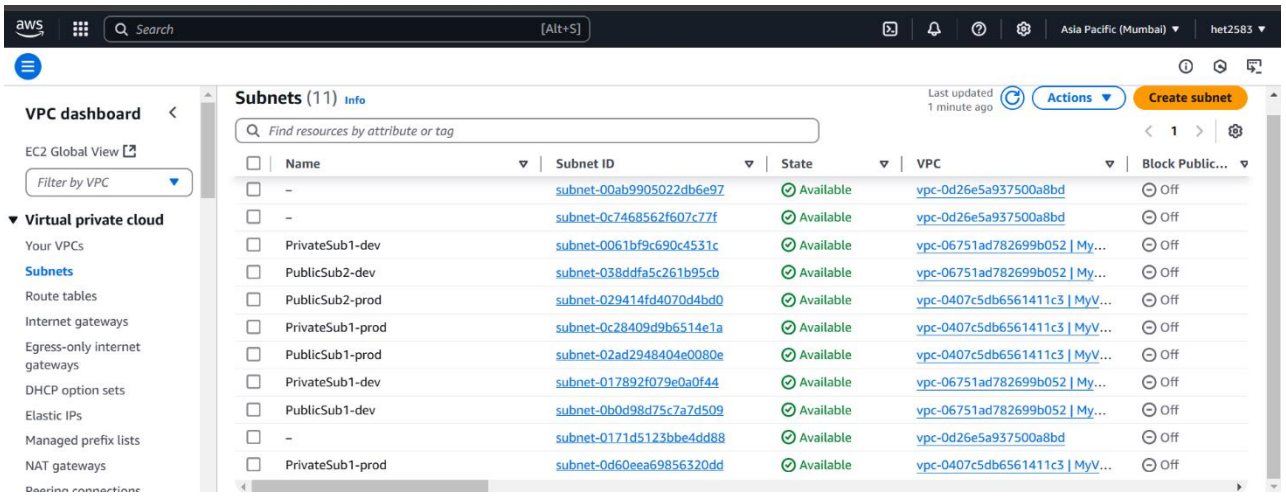
  Destroy command will delete all resource created using terraform command.

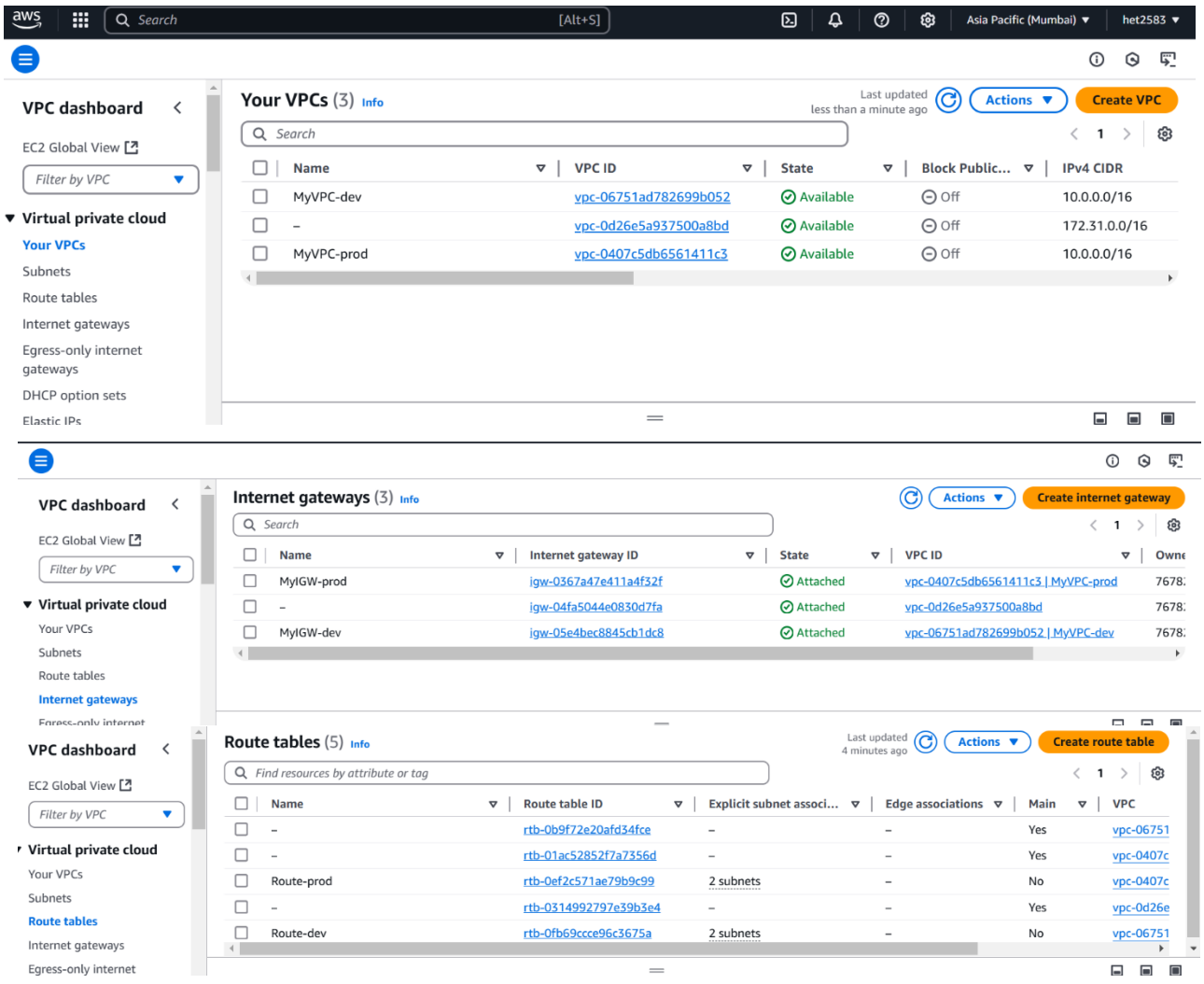
☑ Outputs:

- **EC2**

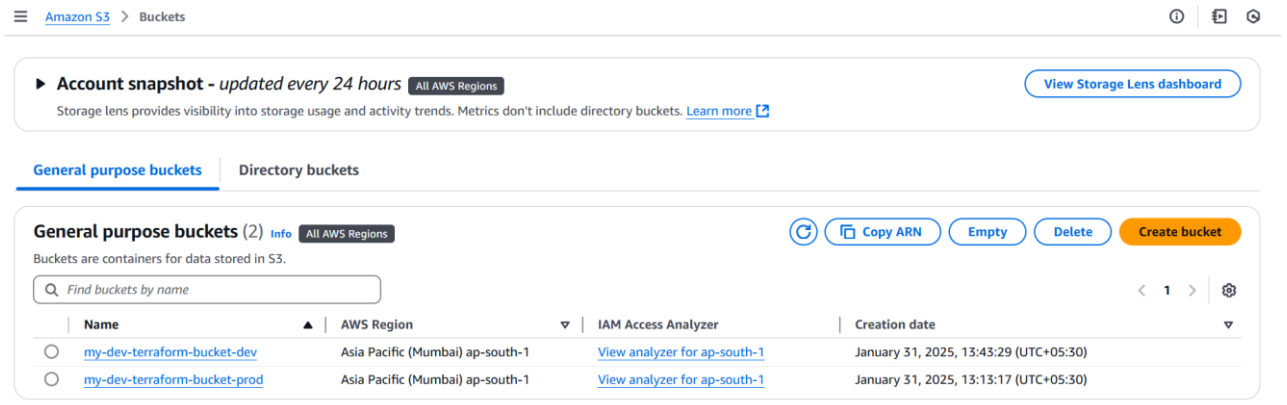


- **VPC**

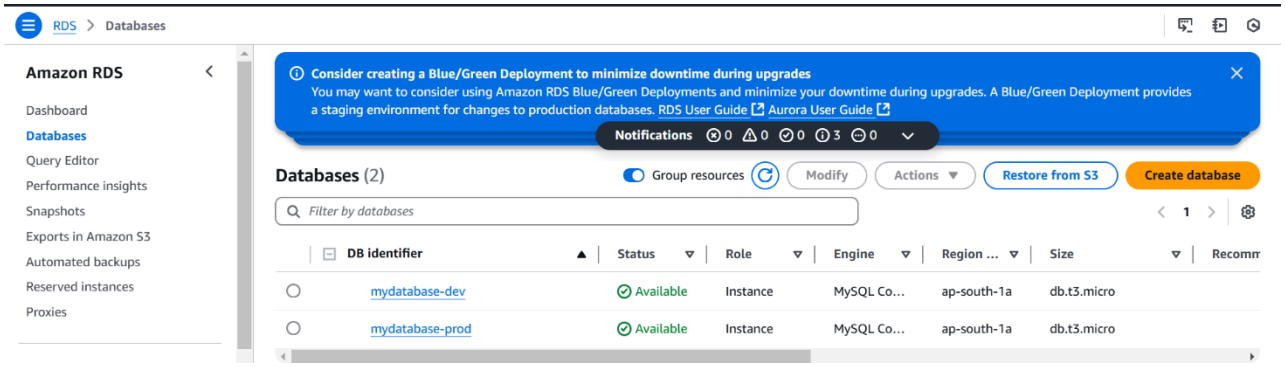



Search [Alt+S]
Asia Pacific (Mumbai)
het2583
VPC dashboard
EC2 Global View
Filter by VPC
Virtual private cloud
Your VPCs
Subnets
Route tables
Internet gateways
Egress-only internet gateways
DHCP option sets
Elastic IPs
Your VPCs (3) Info
Last updated less than a minute ago
Actions
Create VPC
Search
Name
VPC ID
State
Block Public...
IPv4 CIDR
MyVPC-dev
vpc-06751ad782699b052
Available
Off
10.0.0.0/16
–
vpc-0d26e5a937500a8bd
Available
Off
172.31.0.0/16
MyVPC-prod
vpc-0407c5db6561411c3
Available
Off
10.0.0.0/16
Internet gateways (3) Info
Actions
Create internet gateway
Search
Name
Internet gateway ID
State
VPC ID
MyIGW-prod
igw-0367a47e411a4f32f
Attached
vpc-0407c5db6561411c3 | MyVPC-prod
igw-04fa5044e0830d7fa
Attached
vpc-0d26e5a937500a8bd
MyIGW-dev
igw-05e4bec8845cb1dc8
Attached
vpc-06751ad782699b052 | MyVPC-dev
Route tables (5) Info
Last updated 4 minutes ago
Actions
Create route table
Find resources by attribute or tag
Name
Route table ID
Explicit subnet associ...
Edge associations
Main
VPC
rtb-0b9f72e20afd34fce
Yes
rtb-01ac52852f7a7356d
Yes
Route-prod
rtb-0ef2c571ae79b9c99
2 subnets
No
rtb-0314992797e39b3e4
Yes
Route-dev
rtb-0fb69ccce96c3675a
2 subnets
No

- **S3**


Amazon S3
Buckets
Account snapshot - updated every 24 hours
All AWS Regions
View Storage Lens dashboard
Storage lens provides visibility into storage usage and activity trends. Metrics don't include directory buckets. Learn more
General purpose buckets
Directory buckets
General purpose buckets (2) Info
All AWS Regions
Copy ARN
Empty
Delete
Create bucket
Buckets are containers for data stored in S3.
Find buckets by name
Name
AWS Region
IAM Access Analyzer
Creation date
my-dev-terraform-bucket-dev
Asia Pacific (Mumbai) ap-south-1
View analyzer for ap-south-1
January 31, 2025, 13:43:29 (UTC+05:30)
my-dev-terraform-bucket-prod
Asia Pacific (Mumbai) ap-south-1
View analyzer for ap-south-1
January 31, 2025, 13:13:17 (UTC+05:30)

- **RDS**



🎯 Key Features

✅ **Modular Approach → Reusable modules for efficient infrastructure management.**

✅ **Multi-Environment Support → Separate configs for dev and prod.**

✅ **Scalable Architecture → Easily extendable for additional services.**

✅ **Security Best Practices → IAM roles, security groups, and encrypted storage.**

✅ **Automation Ready → Can be integrated with CI/CD pipelines.**