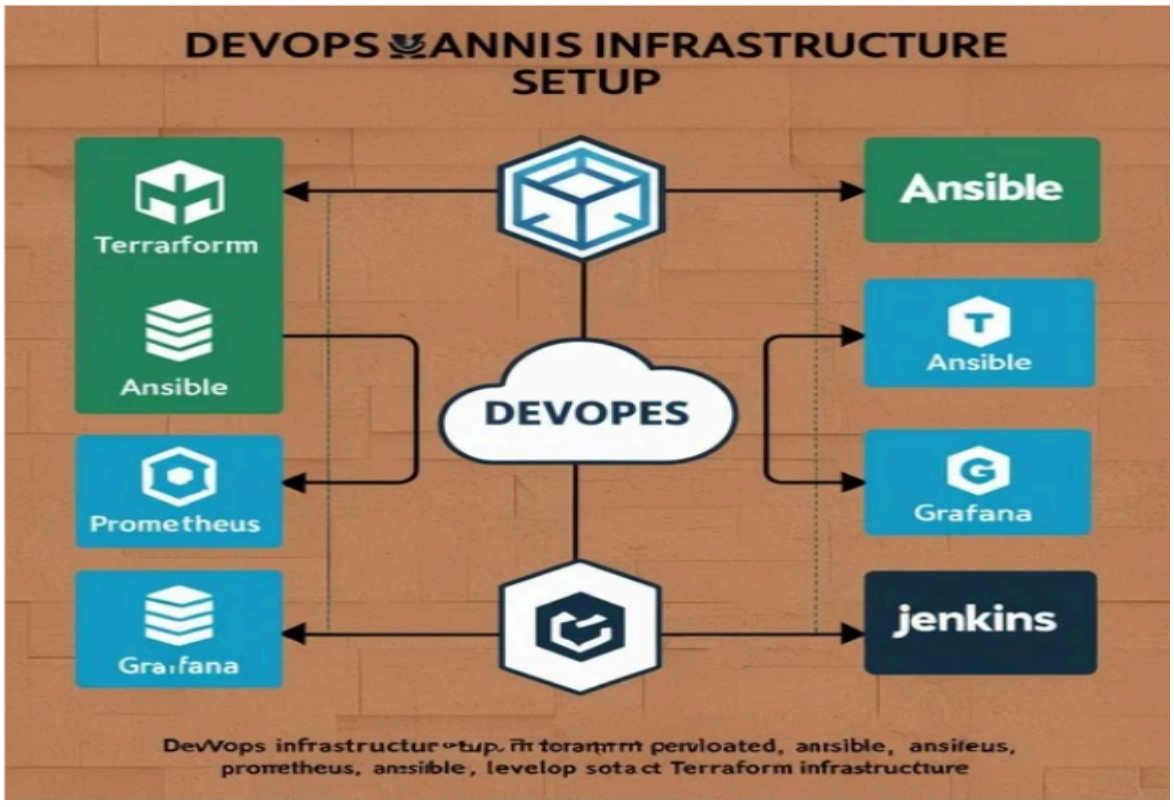
cprime

DevOps Infrastructure Setup with Terraform, Ansible, Prometheus, Grafana and Jenkins



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Introduction

Modern software development requires robust, scalable, and automated infrastructure to support continuous integration, deployment, and monitoring. This document outlines a comprehensive DevOps infrastructure built on AWS, leveraging industry-standard tools such as Terraform, Ansible, Prometheus, Grafana, and Jenkins.

The architecture presented here enables teams to automate infrastructure provisioning, configure servers consistently, implement continuous integration/continuous deployment (CI/CD) pipelines, and monitor system performance in real-time. This integrated approach helps organizations achieve faster delivery cycles, improved reliability, and better visibility into their applications and infrastructure.

Infrastructure Components

Terraform

Description: Terraform is an Infrastructure as Code (IaC) tool that allows developers to define and provision data center infrastructure using a declarative configuration language.

Role in this setup: Terraform handles the automated provisioning of AWS resources, including EC2 instances, security groups, and networking components. It ensures infrastructure can be version-controlled, reused, and consistently deployed across environments.

Key features utilized:

- AWS provider integration for resource management
- Provisioner functionality to transfer files and execute remote commands
- Output values for convenient access to infrastructure information

Ansible

Description: Ansible is an open-source automation tool that simplifies configuration management, application deployment, and task automation.

Role in this setup: Ansible serves as the configuration management system, ensuring all servers have the correct software installed and configured according to specifications. It eliminates manual server setup, reducing human error and ensuring consistency.

Key features utilized:

- Agentless architecture requiring only SSH access
- Playbooks for defining server configurations
- Inventory management to organize and control target hosts

Prometheus

Description: Prometheus is an open-source systems monitoring and alerting toolkit originally built at SoundCloud.

Role in this setup: Prometheus collects and stores metrics from configured targets, providing a powerful data source for monitoring system health, performance, and behavior over time.

Key features utilized:

- Pull-based metrics collection model
- Flexible query language (PromQL) for data analysis
- Integration with Node Exporter for system metrics

Node Exporter

Description: Node Exporter is a Prometheus exporter that collects a wide variety of hardware and kernel-related metrics.

Role in this setup: Installed on each slave instance, Node Exporter exposes system-level metrics that Prometheus scrapes, enabling visibility into server health and resource utilization.

Key features utilized:

- Comprehensive system metrics collection
- Low overhead monitoring
- Standardized Prometheus integration

Grafana

Description: Grafana is an open-source visualization and analytics platform that allows users to query, visualize, and alert on metrics data.

Role in this setup: Grafana provides customizable dashboards that visualize the metrics collected by Prometheus, offering intuitive insights into system performance and application behavior.

Key features utilized:

- Rich visualization options
- Prometheus data source integration
- Customizable dashboards for different monitoring needs

Jenkins

Description: Jenkins is an open-source automation server that enables developers to build, test, and deploy their software reliably.

Role in this setup: Jenkins manages the CI/CD pipeline, automatically building, testing, and deploying code changes as they are committed to version control.

Key features utilized:

- Multibranch pipeline support for feature branch workflows
- Declarative pipeline syntax for defining build processes
- Integration with popular development tools and platforms

Architecture in Detail

The infrastructure consists of three Amazon EC2 instances:

1. **Ansible Control Server:**
    - Hosts Ansible for configuration management
    - Runs Prometheus for metrics collection
    - Provides Grafana for metrics visualization
    - Acts as the central management node
2. **Slave Instance 1:**
    - Runs Node Exporter for system metrics
    - Hosts Jenkins for CI/CD functionality
    - Serves as a managed application server
3. **Slave Instance 2:**
    - Runs Node Exporter for system metrics
    - Serves as a managed application server

All instances operate within a shared security group that allows necessary communication between components while restricting access from the outside world. The architecture enables centralized management, monitoring, and deployment across the infrastructure.

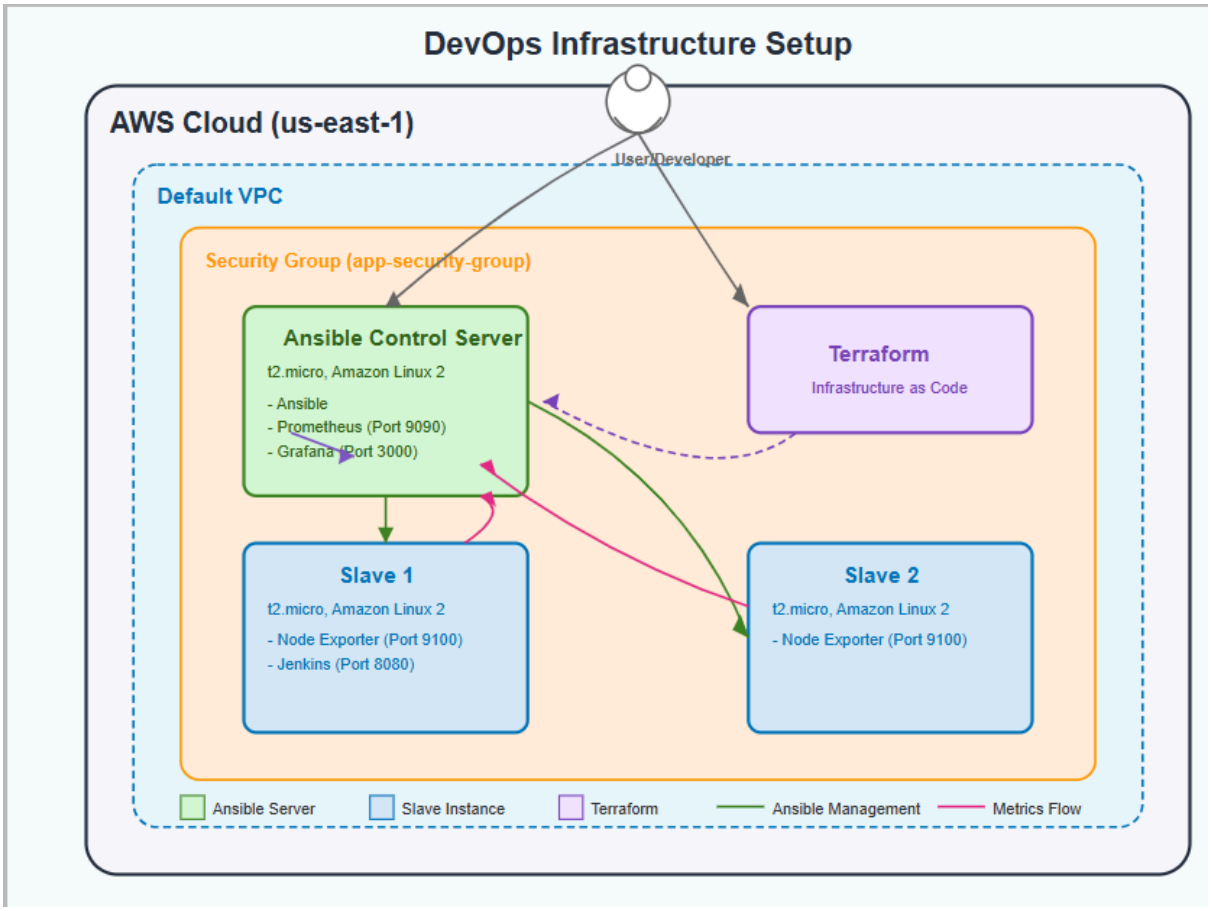
Workflow Integration

The components work together in a seamless workflow:

1. **Infrastructure Provisioning:**
    - Terraform scripts create AWS resources with appropriate configuration
    - Security groups, instances, and networking are established
2. **Configuration Management:**
    - Ansible configures all instances with required software
    - Node Exporter, Prometheus, Grafana, and Jenkins are installed and configured
3. **Monitoring Setup:**
    - Node Exporter exposes metrics on each slave
    - Prometheus collects these metrics at regular intervals
    - Grafana visualizes the collected data
4. **CI/CD Implementation:**
    - Jenkins pipelines define build, test, and deployment stages

- Code changes trigger automated workflows
- Applications are deployed to the slave instances

Architecture Overview



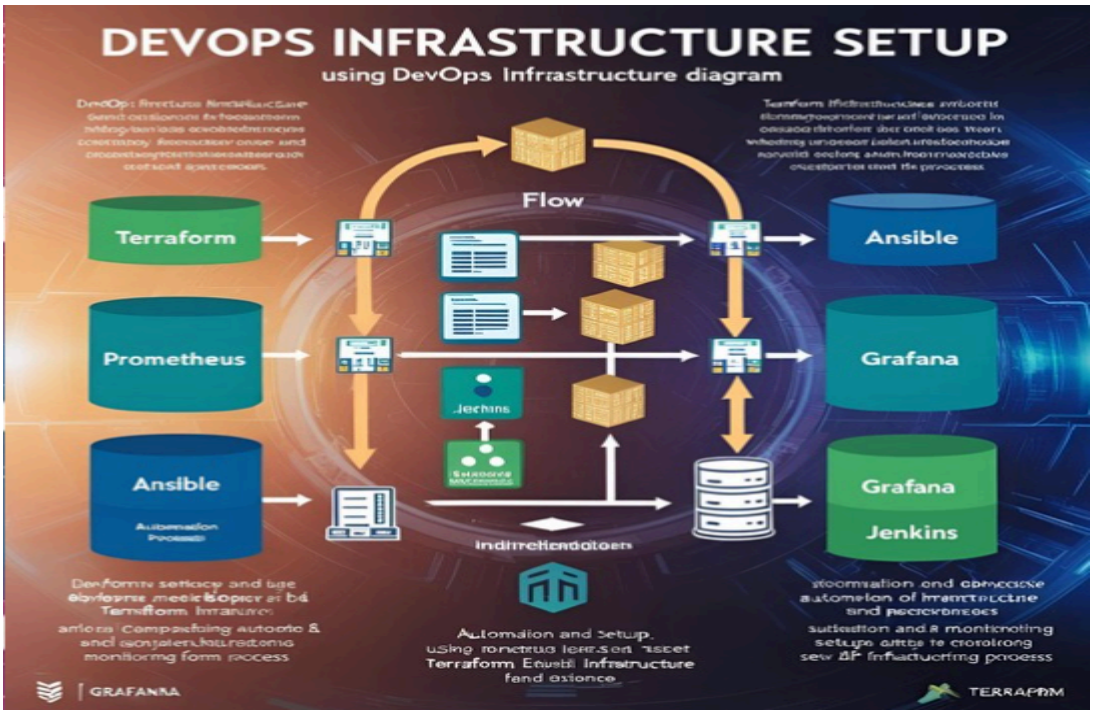
The infrastructure consists of:

1. Three EC2 instances on AWS:
   - 1 Ansible control server (which also hosts Prometheus and Grafana)
   - 2 Slave instances (monitored by Node Exporter)
2. Key components:
   - Terraform: Used for infrastructure provisioning
   - Ansible: For configuration management
   - Prometheus: For metrics collection and monitoring
   - Grafana: For metrics visualization
   - Jenkins: For CI/CD pipelines
3. Network setup:
   - Uses AWS default VPC
   - A custom security group allowing access to ports:
     - SSH (22)
     - HTTP (80)

        - Application port (4080)
        - Node Exporter (9100)
        - Prometheus (9090)
        - Grafana (3000)
4. Communication flow:
    - Ansible server manages the slave nodes
    - Node Exporter runs on all slaves to collect metrics
    - Prometheus scrapes metrics from Node Exporter endpoints
    - Grafana connects to Prometheus for visualization
    - Jenkins is set up with multibranch pipeline support

Prerequisites

- AWS Account
- Terraform installed locally
- SSH keypair named "ansible.pem"



1. Terraform Infrastructure Deployment

AWS Provider Configuration

```
provider "aws" {
  region = "us-east-1"
}
```

Explanation: This block configures Terraform to use AWS as the provider and sets the region to US East (N. Virginia). All resources will be created in this region.

VPC Configuration

```
# Fetch the default VPC
data "aws_vpc" "default" {
  default = true
}
```

Explanation: This data source retrieves the default VPC in your AWS account. Instead of creating a new VPC, we're using the existing default one for simplicity.

Security Group Configuration

```
# Create security group for our instances
resource "aws_security_group" "app_security_group" {
  name        = "app-security-group"
  description = "Security group for servers with Node Exporter and
Prometheus"
  vpc_id      = data.aws_vpc.default.id

  # SSH access from anywhere
  ingress {
    from_port   = 22
    to_port     = 22
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }

  # HTTP access
  ingress {
    from_port   = 80
    to_port     = 80
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }

  # Application port access
  ingress {
    from_port   = 4080
    to_port     = 4080
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
```

```
  }

  # Node Exporter port
  ingress {
    from_port   = 9100
    to_port     = 9100
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }

  # Prometheus port
  ingress {
    from_port   = 9090
    to_port     = 9090
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }

  # Grafana port
  ingress {
    from_port   = 3000
    to_port     = 3000
    protocol    = "tcp"
    cidr_blocks = ["0.0.0.0/0"]
  }

  # Allow all outbound traffic
  egress {
    from_port   = 0
    to_port     = 0
    protocol    = "-1"
    cidr_blocks = ["0.0.0.0/0"]
  }

  tags = {
    Name = "AppSecurityGroup"
  }
}
```

Explanation:

- This creates a security group that controls network access to our EC2 instances.
- The security group allows:
    - SSH access (port 22) for remote administration
    - HTTP access (port 80) for web services
    - Custom application port (4080)

    - Node Exporter port (9100) for metrics collection
    - Prometheus port (9090) for metrics storage and querying
    - Grafana port (3000) for visualization
- The `egress` block allows all outbound traffic from our instances.
- Using `0.0.0.0/0` allows access from any IP address, which is convenient for testing but should be restricted in production.

EC2 Instance Configuration for Slave Nodes

```
# EC2 instance for Slave1
resource "aws_instance" "slave1" {
  ami                    = "ami-0c02fb55956c7d316"  # Amazon Linux 2 AMI
  instance_type          = "t2.micro"
  key_name               = "ansible"  # Replace with your key pair
  vpc_security_group_ids = [aws_security_group.app_security_group.id]

  tags = {
    Name = "SLAVE1"
  }
}

# EC2 instance for Slave2
resource "aws_instance" "slave2" {
  ami                    = "ami-0c02fb55956c7d316"  # Amazon Linux 2 AMI
  instance_type          = "t2.micro"
  key_name               = "ansible"  # Replace with your key pair
  vpc_security_group_ids = [aws_security_group.app_security_group.id]

  tags = {
    Name = "SLAVE2"
  }
}
```

Explanation:

- These blocks create two EC2 instances that will serve as our slave nodes.
- `ami-0c02fb55956c7d316` is the ID for Amazon Linux 2 in the us-east-1 region.
- `t2.micro` is a free-tier eligible instance type suitable for lightweight workloads.
- `key_name` specifies the SSH key pair for accessing the instances.
- `vpc_security_group_ids` attaches our previously created security group.
- The `tags` block assigns a readable name to each instance for identification in the AWS console.

Ansible Server Configuration

```
# EC2 instance for Ansible Server
resource "aws_instance" "ansible_server" {
  ami                    = "ami-0c02fb55956c7d316"  # Amazon Linux 2 AMI
  instance_type          = "t2.micro"
  key_name               = "ansible"
  vpc_security_group_ids = [aws_security_group.app_security_group.id]

  depends_on = [aws_instance.slave1, aws_instance.slave2]
```

Explanation:

- This block creates the EC2 instance that will serve as our Ansible control server.
- `depends_on` ensures this instance is created after the slave instances, which is important for the provisioning steps that follow.
- The configuration is similar to the slave instances, using the same AMI and instance type.

Transferring SSH Key File

```
 # Upload the private key file to Ansible server
  provisioner "file" {
    source      = "ansible.pem"  # Your local key file
    destination = "/home/ec2-user/ansible.pem"

    connection {
      type        = "ssh"
      user        = "ec2-user"
      private_key = file("ansible.pem")
      host        = self.public_ip
    }
  }
```

Explanation:

- This `file` provisioner uploads the SSH private key to the Ansible server.
- The key is necessary for Ansible to connect to the slave nodes without password authentication.
- `source` is the local path to your key file.
- `destination` is where the key will be placed on the Ansible server.
- The `connection` block specifies how Terraform should connect to the EC2 instance:
    - Using SSH protocol
    - As the `ec2-user` user
    - Using the local private key
    - Connecting to the instance's public IP

Creating Ansible Playbook

```
 # Create the playbook file for Node Exporter deployment
  provisioner "file" {
    content     = <<-EOF
---
- hosts: all
  user: ec2-user
  become: yes
  tasks:
    - name: Install required system packages
      yum:
        name:
          - python3
          - python3-pip
          - git
        state: present

    - name: Create installation directory
      file:
        path: /opt/node_exporter
        state: directory
        mode: 0755

    - name: Download node_exporter
      get_url:
        url:
"https://github.com/prometheus/node_exporter/releases/download/v1.9.1/no
de_exporter-1.9.1.linux-amd64.tar.gz"
        dest: "/tmp/node_exporter-1.9.1.linux-amd64.tar.gz"
        mode: 0644

    - name: Extract node_exporter
      unarchive:
        src: "/tmp/node_exporter-1.9.1.linux-amd64.tar.gz"
        dest: "/opt/node_exporter"
        remote_src: yes
        extra_opts: [--strip-components=1]

    - name: Start node_exporter in background
      shell: "nohup /opt/node_exporter/node_exporter >
/opt/node_exporter/node_exporter.log 2>&1 &"
      args:
        creates: "/opt/node_exporter/node_exporter.log"

    - name: Clean up temporary files
```

```
    file:
      path: "/tmp/node_exporter-1.9.1.linux-amd64.tar.gz"
      state: absent
  EOF
  destination = "/home/ec2-user/deploy.yml"

  connection {
    type        = "ssh"
    user        = "ec2-user"
    private_key = file("ansible.pem")
    host        = self.public_ip
  }
}
```

Explanation:

- This `file` provisioner creates an Ansible playbook file on the control server.
- The playbook contains tasks to install Node Exporter on the slave instances:
  - Installing required dependencies (Python, pip, git)
  - Creating installation directory
  - Downloading Node Exporter (version 1.9.1)
  - Extracting the downloaded archive
  - Starting Node Exporter as a background process
  - Cleaning up temporary files
- The `<<-EOF ... EOF` syntax is a heredoc, allowing multi-line content in Terraform.
- The playbook will be saved as `/home/ec2-user/deploy.yml` on the Ansible server.

Server Configuration and Software Installation

```
# Install and configure Ansible, Node Exporter, Prometheus and Grafana
 provisioner "remote-exec" {
   inline = [
     # Install Ansible
     "sudo su -",
     "sudo amazon-linux-extras install ansible2 -y",
     "sudo yum install -y git",
     "chmod 400 /home/ec2-user/ansible.pem",
```

Explanation:

- The `remote-exec` provisioner runs commands directly on the EC2 instance after it's created.
- This section installs Ansible and sets proper permissions on the SSH key:

- `sudo su -` escalates to root privileges
- `amazon-linux-extras install ansible2 -y` installs Ansible from Amazon's repo
- `yum install -y git` installs Git
- `chmod 400` sets the correct permissions on the SSH key (read-only by owner)

Creating Ansible Inventory

```
    # Create inventory file
     "echo '[nodes]' > /home/ec2-user/hosts",
     "echo '${aws_instance.slave1.private_ip} ansible_user=ec2-user
ansible_ssh_private_key_file=/home/ec2-user/ansible.pem
ansible_ssh_common_args=\"-o StrictHostKeyChecking=no\"' >>
/home/ec2-user/hosts",
     "echo '${aws_instance.slave2.private_ip} ansible_user=ec2-user
ansible_ssh_private_key_file=/home/ec2-user/ansible.pem
ansible_ssh_common_args=\"-o StrictHostKeyChecking=no\"' >>
/home/ec2-user/hosts",
```

Explanation:

- These commands create an Ansible inventory file with the slave nodes:
  - First command creates the file with a `[nodes]` group header
  - Next commands add entries for each slave using their private IPs
  - Each entry includes connection parameters:
    - `ansible_user=ec2-user`: The user to connect as
    - `ansible_ssh_private_key_file`: Path to the SSH key
    - `ansible_ssh_common_args`: Additional SSH options (skipping host key verification)
- The `${aws_instance.slave1.private_ip}` syntax dynamically inserts the IP addresses of the instances created earlier.

Running Ansible Playbook

```
    # Test connection
     "ansible -i /home/ec2-user/hosts all -m ping",

     # Run the playbook to deploy Node Exporter
     "ansible-playbook -i /home/ec2-user/hosts
/home/ec2-user/deploy.yml",
```

Explanation:

- First, a simple ping test verifies connectivity to all nodes in the inventory.
- Then, the playbook is executed to deploy Node Exporter on all target hosts.
- `-i /home/ec2-user/hosts` specifies the inventory file to use.

Installing Prometheus and Grafana

```
 # Install Prometheus
      "wget
https://github.com/prometheus/prometheus/releases/download/v2.44.0/prome
theus-2.44.0.linux-amd64.tar.gz",
      "tar -xvzf prometheus-2.44.0.linux-amd64.tar.gz",
      "wget
https://dl.grafana.com/oss/release/grafana-11.6.0.linux-amd64.tar.gz",
      "tar -zxvf grafana-11.6.0.linux-amd64.tar.gz",

      "cd prometheus-2.44.0.linux-amd64",
      "sudo cp prometheus promtool /usr/local/bin/",
```

Explanation:

- These commands download and extract Prometheus and Grafana:
  - `wget` downloads the software packages directly from their official sources
  - `tar -xvzf` extracts the compressed archives
  - The Prometheus binaries are copied to `/usr/local/bin/` for system-wide access

Configuring Prometheus

```
     # Create Prometheus config
      "echo 'global:' > prometheus.yml",
      "echo '  scrape_interval: 15s' >> prometheus.yml",
      "echo '  evaluation_interval: 15s' >> prometheus.yml",
      "echo 'scrape_configs:' >> prometheus.yml",
      "echo '  - job_name: \"prometheus\"' >> prometheus.yml",
      "echo '    static_configs:' >> prometheus.yml",
      "echo '      - targets: [\"localhost:9090\"]' >> prometheus.yml",
      "echo '  - job_name: \"node_exporter\"' >> prometheus.yml",
      "echo '    static_configs:' >> prometheus.yml",
      "echo '      - targets:
[\"${aws_instance.slave1.private_ip}:9100\",
\"${aws_instance.slave2.private_ip}:9100\"]' >> prometheus.yml",
```

Explanation:

- These commands create the Prometheus configuration file line by line:
    - `scrape_interval: 15s`: How often Prometheus collects metrics
    - `evaluation_interval: 15s`: How often rules are evaluated
    - First job monitors Prometheus itself (localhost:9090)
    - Second job monitors Node Exporter on both slave instances (port 9100)
- The slave IP addresses are dynamically inserted from the Terraform state.

Starting Prometheus and Grafana

```
    # Start Prometheus
     "nohup prometheus --config.file=prometheus.yml > prometheus.log
2>&1 &",
     "cd /home/ec2-user/grafana-11.6.0/",
     "nohup ./bin/grafana-server > grafana.log 2>&1 &",
```

Explanation:

- `nohup` is used to start both services as background processes that persist after the SSH session ends.
- `> prometheus.log 2>&1 &` redirects both standard output and errors to a log file.
- Prometheus is started with our custom configuration file.
- Grafana is started from its installation directory.

Final Output Messages

```
  # Print completion message
     "echo 'Setup complete!'",
     "echo 'Prometheus URL: http://${self.public_ip}:9090'",
     "echo 'Grafana URL: http://${self.public_ip}:3000'"
    ]

    connection {
      type        = "ssh"
      user        = "ec2-user"
      private_key = file("ansible.pem")
      host        = self.public_ip
    }
  }

  tags = {
    Name = "AnsibleServer"
  }
}
```

Explanation:

- These echo commands print confirmation messages with URLs for accessing the services.
- `${self.public_ip}` dynamically inserts the public IP of the Ansible server.
- The connection block specifies how to connect to run these commands.
- The final tags block assigns a name to the instance.

Output Values

```
# Output the public IPs and URLs for easy access
output "slave1_public_ip" {
  value = aws_instance.slave1.public_ip
}

output "slave2_public_ip" {
  value = aws_instance.slave2.public_ip
}

output "ansible_server_public_ip" {
  value = aws_instance.ansible_server.public_ip
}

output "prometheus_url" {
  value = "http://${aws_instance.ansible_server.public_ip}:9090"
}

output "grafana_url" {
  value = "http://${aws_instance.ansible_server.public_ip}:3000"
}
```

Explanation:

- These output blocks define values that Terraform will display after successful deployment.
- They provide convenient access to:
    - Public IP addresses of all instances
    - URLs for accessing Prometheus and Grafana web interfaces
- These values can be used for manual access or in other automation scripts.

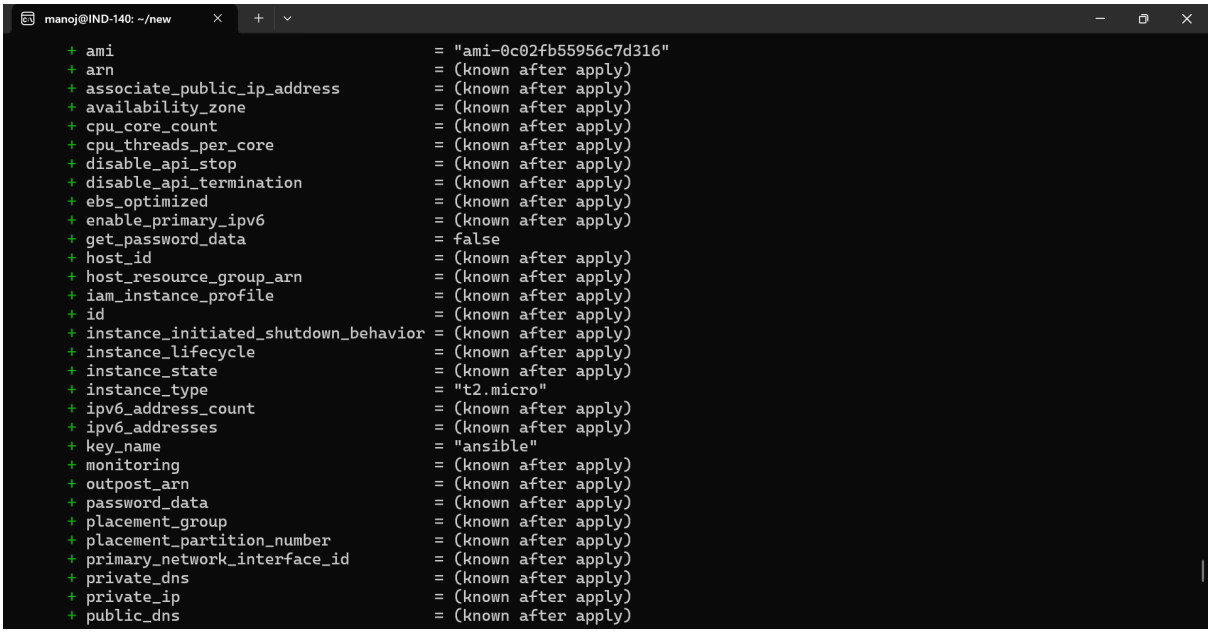
Terraform init

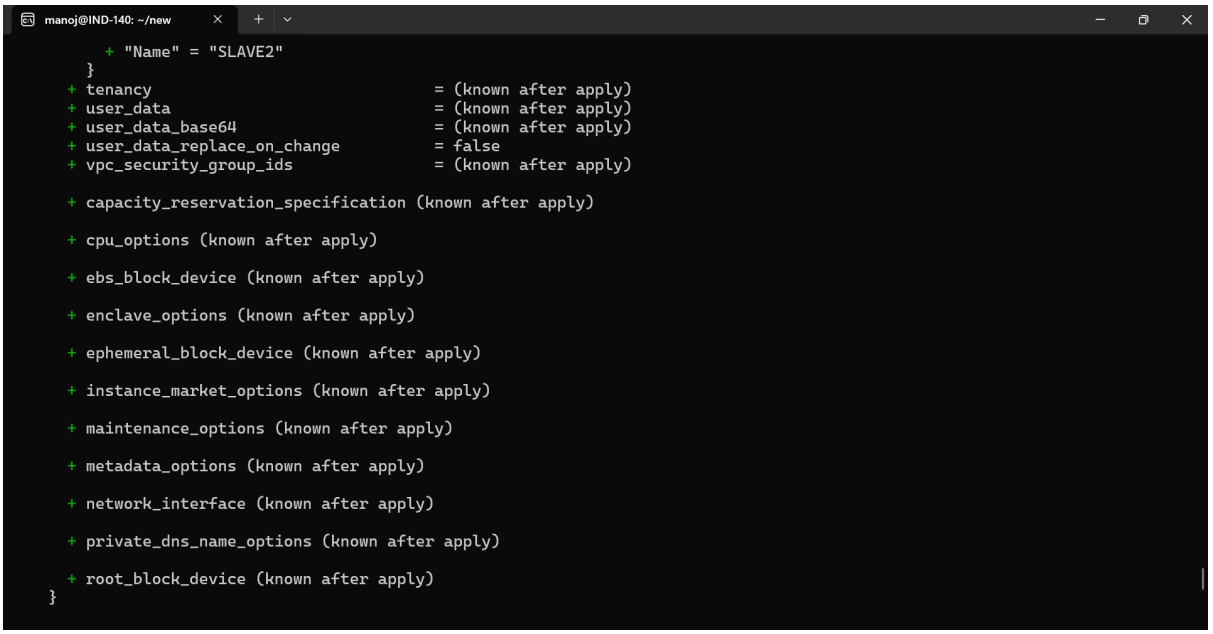
```
manoj@IND-140:~/new$ terraform init
Initializing the backend...
Initializing provider plugins...
- Reusing previous version of hashicorp/aws from the dependency lock file
- Using previously-installed hashicorp/aws v5.94.1

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.
manoj@IND-140:~/new$
```

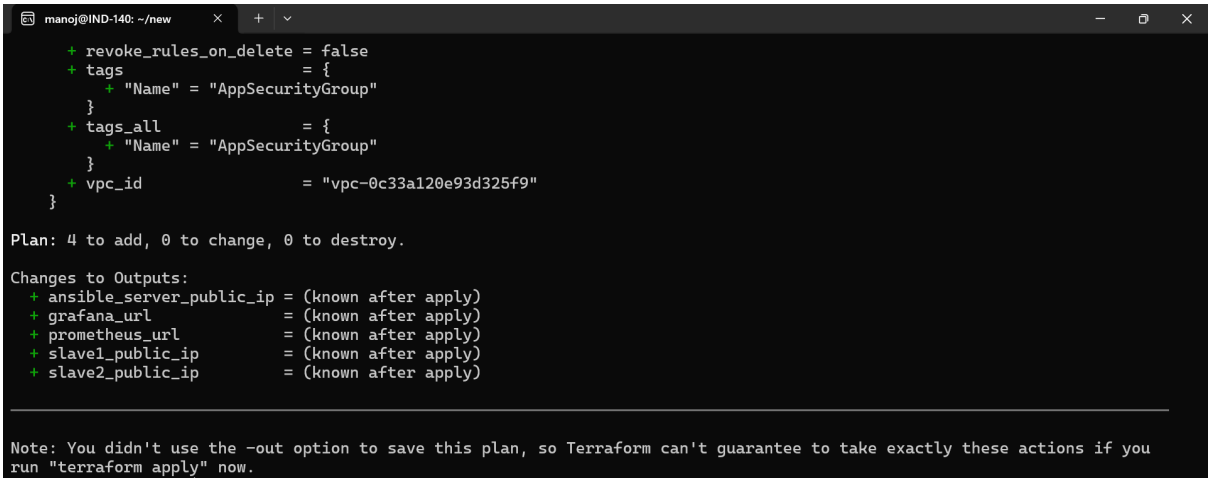
Terraform plan

```
manoj@IND-140: ~/new
manoj@IND-140:~/new$ terraform plan
data.aws_vpc.default: Reading...
data.aws_vpc.default: Read complete after 2s [id=vpc-0c33a120e93d325f9]

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the
following symbols:
  + create

Terraform will perform the following actions:

  # aws_instance.ansible_server will be created
  + resource "aws_instance" "ansible_server" {
      + ami                                  = "ami-0c02fb55956c7d316"
      + arn                                  = (known after apply)
      + associate_public_ip_address          = (known after apply)
      + availability_zone                    = (known after apply)
      + cpu_core_count                       = (known after apply)
      + cpu_threads_per_core                 = (known after apply)
      + disable_api_stop                     = (known after apply)
      + disable_api_termination              = (known after apply)
      + ebs_optimized                        = (known after apply)
      + enable_primary_ipv6                  = (known after apply)
      + get_password_data                    = false
      + host_id                              = (known after apply)
      + host_resource_group_arn              = (known after apply)
      + iam_instance_profile                 = (known after apply)
      + id                                   = (known after apply)
      + instance_initiated_shutdown_behavior = (known after apply)
      + instance_lifecycle                   = (known after apply)
      + instance_state                       = (known after apply)
      + instance_type                        = "t2.micro"
```

```
manoj@IND-140: ~/new
      + outpost_arn                          = (known after apply)
      + password_data                        = (known after apply)
      + placement_group                      = (known after apply)
      + placement_partition_number           = (known after apply)
      + primary_network_interface_id         = (known after apply)
      + private_dns                          = (known after apply)
      + private_ip                           = (known after apply)
      + public_dns                           = (known after apply)
      + public_ip                            = (known after apply)
      + secondary_private_ips                = (known after apply)
      + security_groups                      = (known after apply)
      + source_dest_check                    = true
      + spot_instance_request_id             = (known after apply)
      + subnet_id                            = (known after apply)
      + tags                                 = {
          + "Name" = "AnsibleServer"
        }
      + tags_all                             = {
          + "Name" = "AnsibleServer"
        }
      + tenancy                              = (known after apply)
      + user_data                            = (known after apply)
      + user_data_base64                     = (known after apply)
      + user_data_replace_on_change          = false
      + vpc_security_group_ids               = (known after apply)

      + capacity_reservation_specification (known after apply)

      + cpu_options (known after apply)

      + ebs_block_device (known after apply)
```


manoj@IND-140: ~/new
+ ami = "ami-0c02fb55956c7d316"
+ arn = (known after apply)
+ associate_public_ip_address = (known after apply)
+ availability_zone = (known after apply)
+ cpu_core_count = (known after apply)
+ cpu_threads_per_core = (known after apply)
+ disable_api_stop = (known after apply)
+ disable_api_termination = (known after apply)
+ ebs_optimized = (known after apply)
+ enable_primary_ipv6 = (known after apply)
+ get_password_data = false
+ host_id = (known after apply)
+ host_resource_group_arn = (known after apply)
+ iam_instance_profile = (known after apply)
+ id = (known after apply)
+ instance_initiated_shutdown_behavior = (known after apply)
+ instance_lifecycle = (known after apply)
+ instance_state = (known after apply)
+ instance_type = "t2.micro"
+ ipv6_address_count = (known after apply)
+ ipv6_addresses = (known after apply)
+ key_name = "ansible"
+ monitoring = (known after apply)
+ outpost_arn = (known after apply)
+ password_data = (known after apply)
+ placement_group = (known after apply)
+ placement_partition_number = (known after apply)
+ primary_network_interface_id = (known after apply)
+ private_dns = (known after apply)
+ private_ip = (known after apply)
+ public_dns = (known after apply)


manoj@IND-140: ~/new
+ "Name" = "SLAVE2"
}
+ tenancy = (known after apply)
+ user_data = (known after apply)
+ user_data_base64 = (known after apply)
+ user_data_replace_on_change = false
+ vpc_security_group_ids = (known after apply)
+ capacity_reservation_specification (known after apply)
+ cpu_options (known after apply)
+ ebs_block_device (known after apply)
+ enclave_options (known after apply)
+ ephemeral_block_device (known after apply)
+ instance_market_options (known after apply)
+ maintenance_options (known after apply)
+ metadata_options (known after apply)
+ network_interface (known after apply)
+ private_dns_name_options (known after apply)
+ root_block_device (known after apply)
}

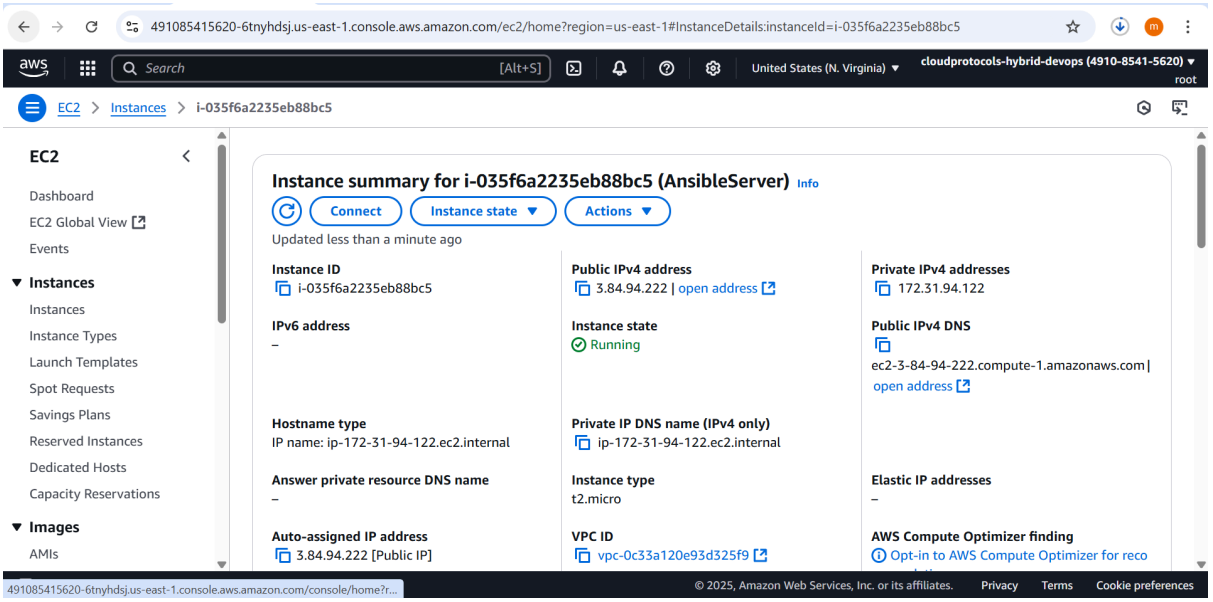

manoj@IND-140: ~/new
+ revoke_rules_on_delete = false
+ tags = {
+ "Name" = "AppSecurityGroup"
}
+ tags_all = {
+ "Name" = "AppSecurityGroup"
}
+ vpc_id = "vpc-0c33a120e93d325f9"
}
Plan: 4 to add, 0 to change, 0 to destroy.
Changes to Outputs:
+ ansible_server_public_ip = (known after apply)
+ grafana_url = (known after apply)
+ prometheus_url = (known after apply)
+ slave1_public_ip = (known after apply)
+ slave2_public_ip = (known after apply)
Note: You didn't use the -out option to save this plan, so Terraform can't guarantee to take exactly these actions if you run "terraform apply" now.

Terraform apply

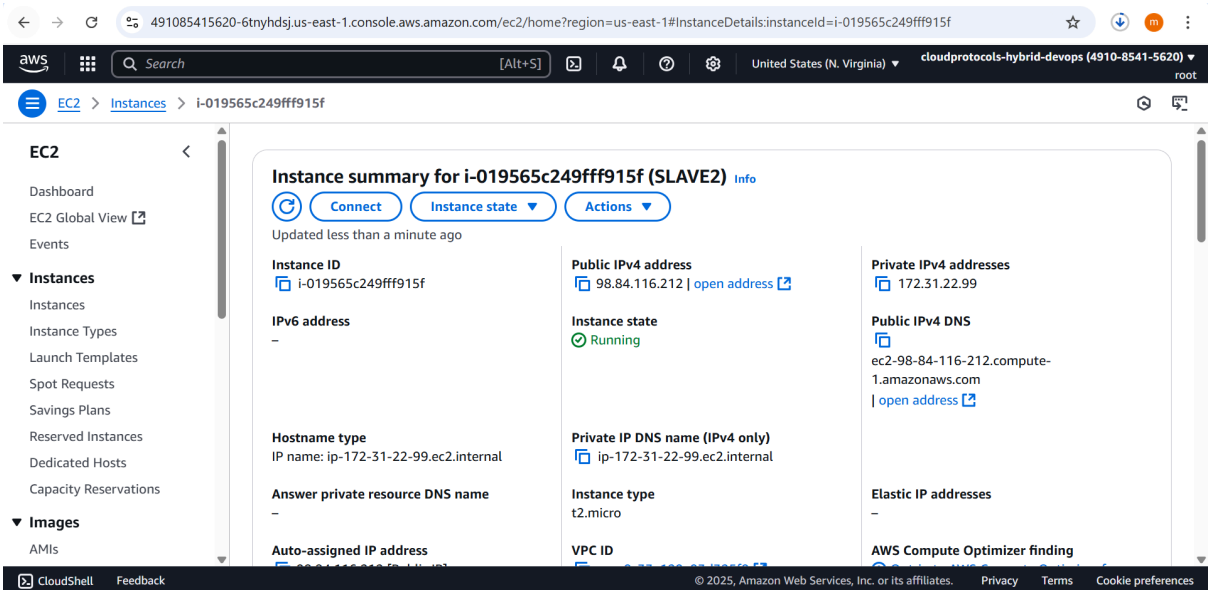
```
  + slave2_public_ip         = (known after apply)

Do you want to perform these actions?
  Terraform will perform the actions described above.
  Only 'yes' will be accepted to approve.

  Enter a value: yes
```

```
manoj@IND-140: ~/new
aws_instance.ansible_server (remote-exec):   perl-Error.noarch 1:0.17020-2.amzn2
aws_instance.ansible_server (remote-exec):   perl-Git.noarch 0:2.47.1-1.amzn2.0.2
aws_instance.ansible_server (remote-exec):   perl-TermReadKey.x86_64 0:2.30-20.amzn2.0.2

aws_instance.ansible_server (remote-exec): Complete!
aws_instance.ansible_server (remote-exec): [WARNING]: Platform linux on host 172.31.31.233 is using the discovered Python
aws_instance.ansible_server (remote-exec): interpreter at /usr/bin/python, but future installation of another Python
aws_instance.ansible_server (remote-exec): interpreter could change this. See https://docs.ansible.com/ansible/2.9/referen
aws_instance.ansible_server (remote-exec): ce_appendices/interpreter_discovery.html for more information.
aws_instance.ansible_server (remote-exec): 172.31.31.233 | SUCCESS => {
aws_instance.ansible_server (remote-exec):     "ansible_facts": {
aws_instance.ansible_server (remote-exec):         "discovered_interpreter_python": "/usr/bin/python"
aws_instance.ansible_server (remote-exec):     },
aws_instance.ansible_server (remote-exec):     "changed": false,
aws_instance.ansible_server (remote-exec):     "ping": "pong"
aws_instance.ansible_server (remote-exec): }
aws_instance.ansible_server (remote-exec): [WARNING]: Platform linux on host 172.31.17.121 is using the discovered Python
aws_instance.ansible_server (remote-exec): interpreter at /usr/bin/python, but future installation of another Python
aws_instance.ansible_server (remote-exec): interpreter could change this. See https://docs.ansible.com/ansible/2.9/referen
aws_instance.ansible_server (remote-exec): ce_appendices/interpreter_discovery.html for more information.
aws_instance.ansible_server (remote-exec): 172.31.17.121 | SUCCESS => {
aws_instance.ansible_server (remote-exec):     "ansible_facts": {
aws_instance.ansible_server (remote-exec):         "discovered_interpreter_python": "/usr/bin/python"
aws_instance.ansible_server (remote-exec):     },
aws_instance.ansible_server (remote-exec):     "changed": false,
aws_instance.ansible_server (remote-exec):     "ping": "pong"
aws_instance.ansible_server (remote-exec): }

aws_instance.ansible_server (remote-exec): PLAY [all] ***************************************************************

aws_instance.ansible_server (remote-exec): TASK [Gathering Facts] ***************************************************
```

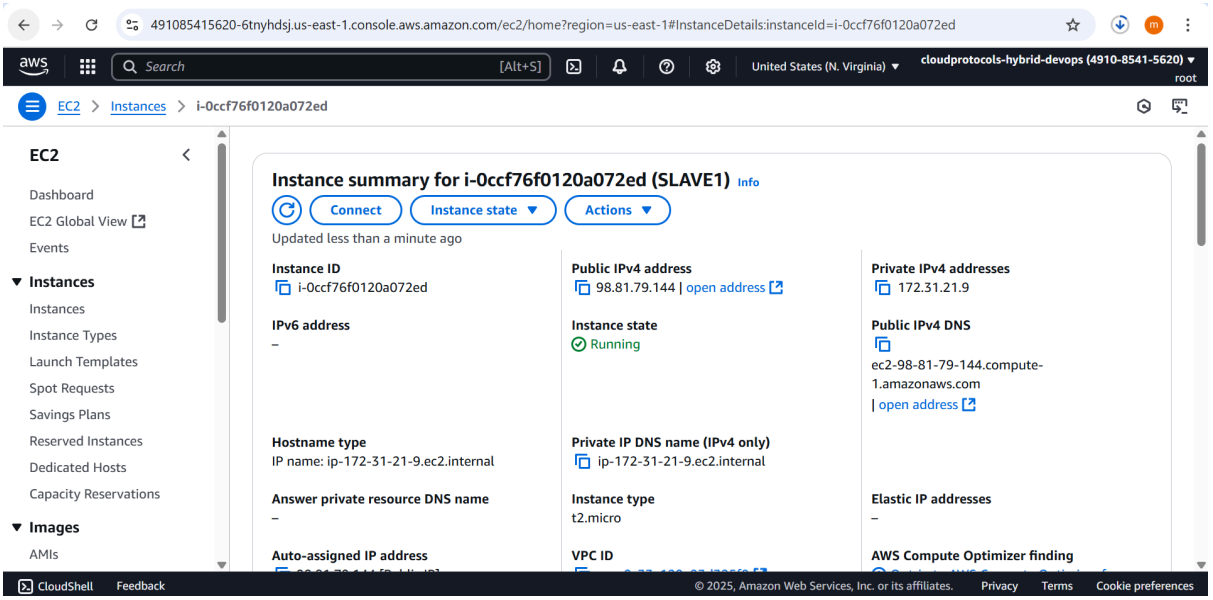
```
manoj@IND-140: ~/new
aws_instance.ansible_server (remote-exec): ● grafana.service - Grafana instance
aws_instance.ansible_server (remote-exec):    Loaded: loaded (/etc/systemd/system/grafana.service; enabled; vendor preset: d
isabled)
aws_instance.ansible_server (remote-exec):    Active: activating (auto-restart) (Result: exit-code) since Mon 2025-04-07 06:
40:42 UTC; 23ms ago
aws_instance.ansible_server (remote-exec):   Process: 7980 ExecStart=/home/ec2-user/grafana-11.6.0/bin/grafana-server --conf
ig=/home/ec2-user/grafana-11.6.0/conf/custom.ini (code=exited, status=200/CHDIR)
aws_instance.ansible_server (remote-exec):  Main PID: 7980 (code=exited, status=200/CHDIR)

aws_instance.ansible_server (remote-exec): Apr 07 06:40:42 ip-172-31-90-231.ec2.internal systemd[1]: ...
aws_instance.ansible_server (remote-exec): Apr 07 06:40:42 ip-172-31-90-231.ec2.internal systemd[1]: ...
aws_instance.ansible_server (remote-exec): Apr 07 06:40:42 ip-172-31-90-231.ec2.internal systemd[1]: ...
aws_instance.ansible_server (remote-exec): Hint: Some lines were ellipsized, use -l to show in full.
aws_instance.ansible_server (remote-exec): Setup complete!
aws_instance.ansible_server (remote-exec): Prometheus URL: http://3.83.39.181:9090
aws_instance.ansible_server (remote-exec): Grafana URL: http://3.83.39.181:3000 (default login: admin/admin)
aws_instance.ansible_server: Creation complete after 2m19s [id=i-0d06d414ca2bc5cd8]

Apply complete! Resources: 4 added, 0 changed, 0 destroyed.

Outputs:

ansible_server_public_ip = "3.83.39.181"
grafana_url = "http://3.83.39.181:3000"
prometheus_url = "http://3.83.39.181:9090"
slave1_public_ip = "44.202.97.72"
slave2_public_ip = "107.23.195.247"
manoj@IND-140:~/new$ curl 3.83.39.181:9090
<a href="/graph">Found</a>.

manoj@IND-140:~/new$ curl 3.83.39.181:9090
```



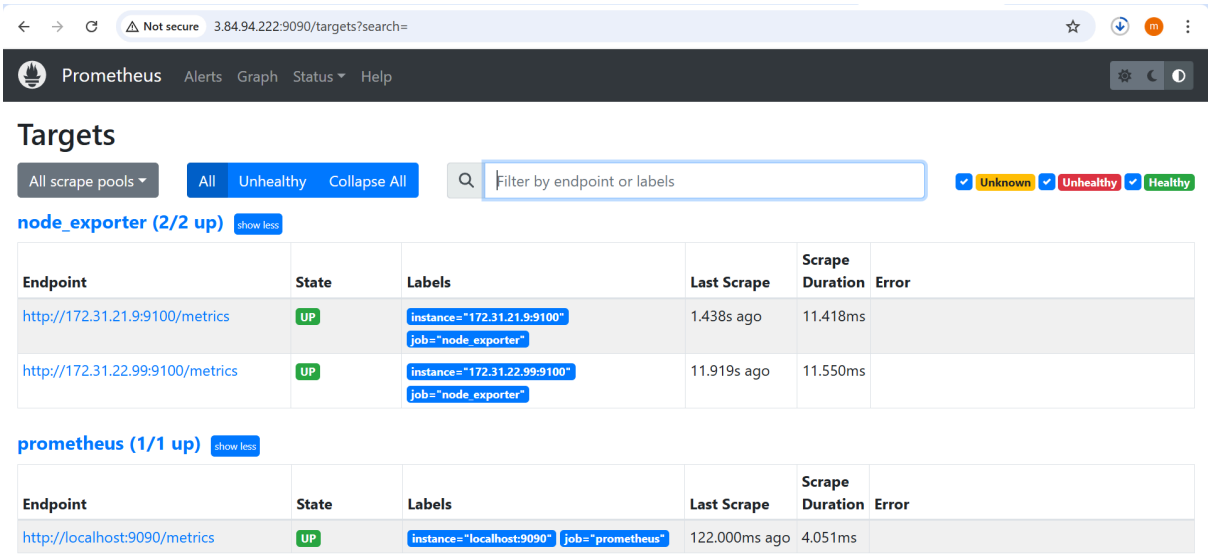
ANSIBLE SERVER



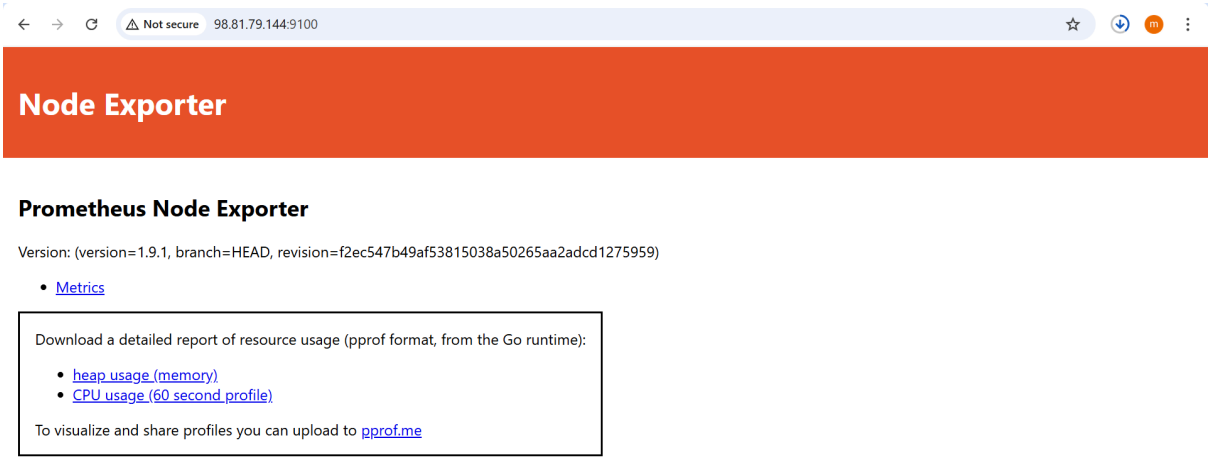
SLAVESERVER 1



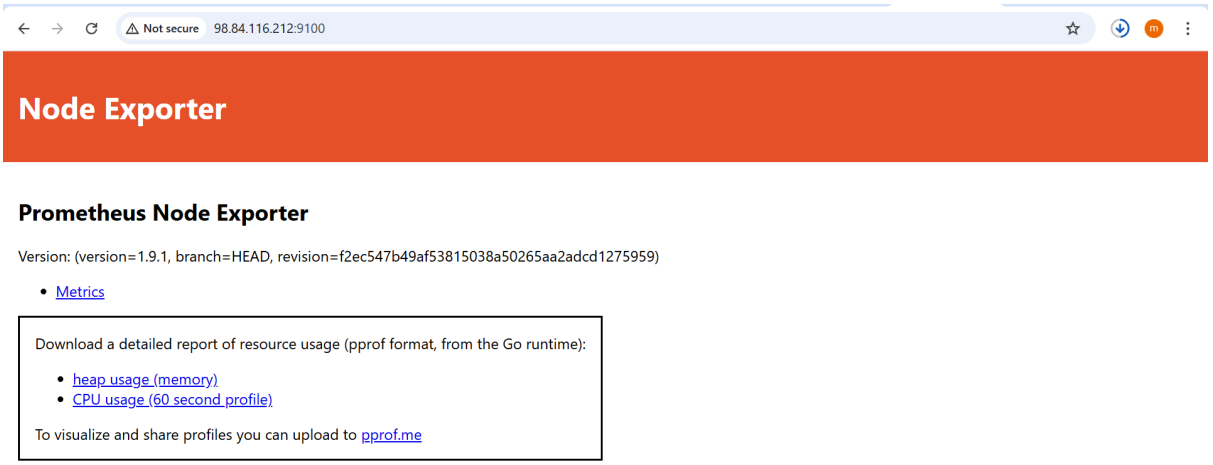
SLAVESERVER 2



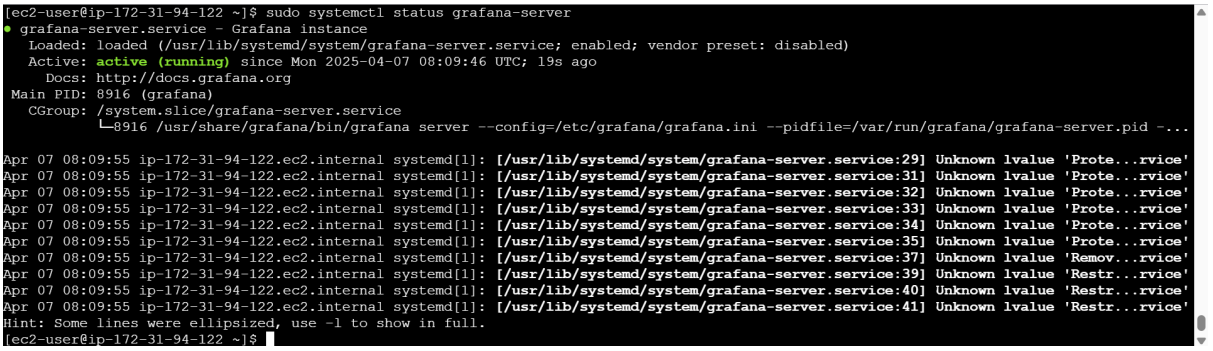
PROMETHEUS DASHBOARD



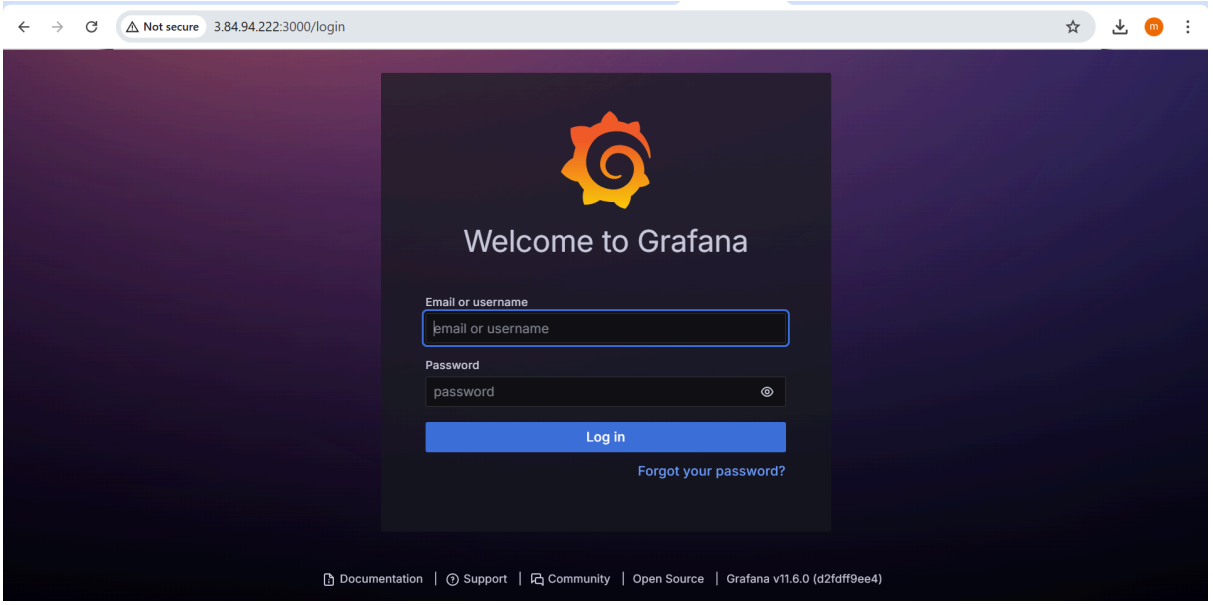
NODE EXPORTER 1



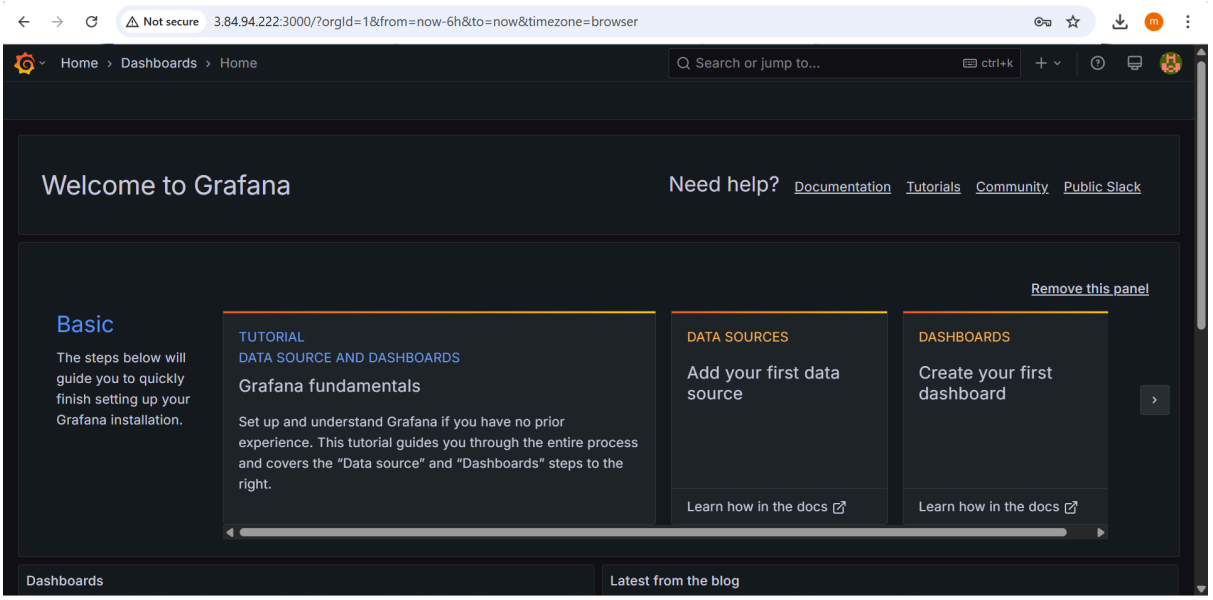
NODE EXPORTER 2



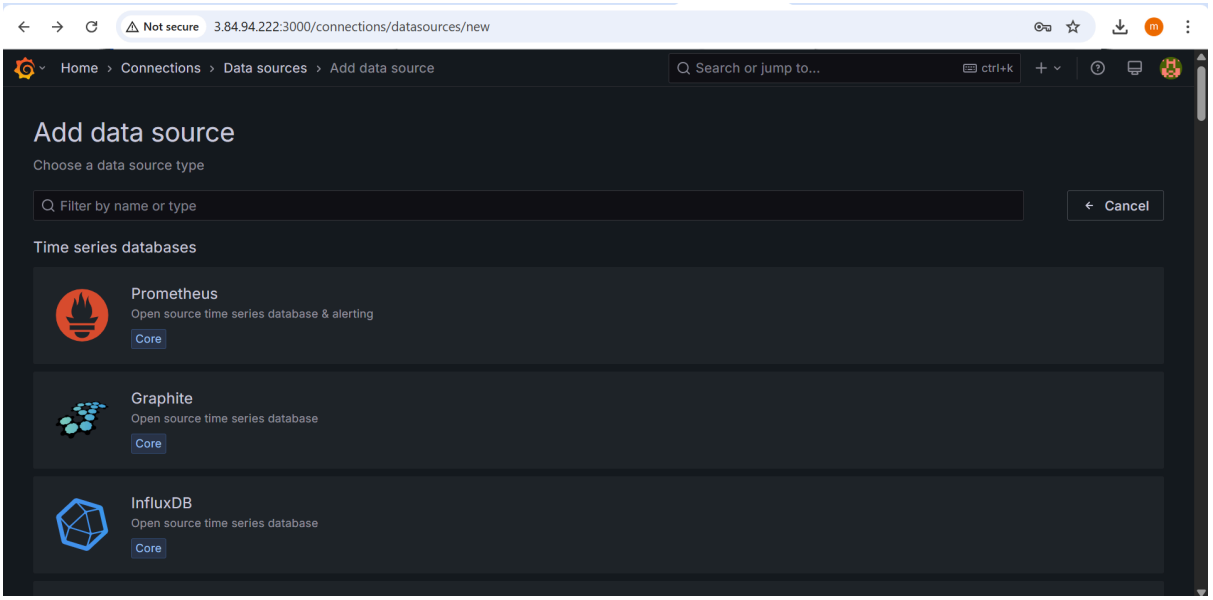
VERIFYING THE SERVICE



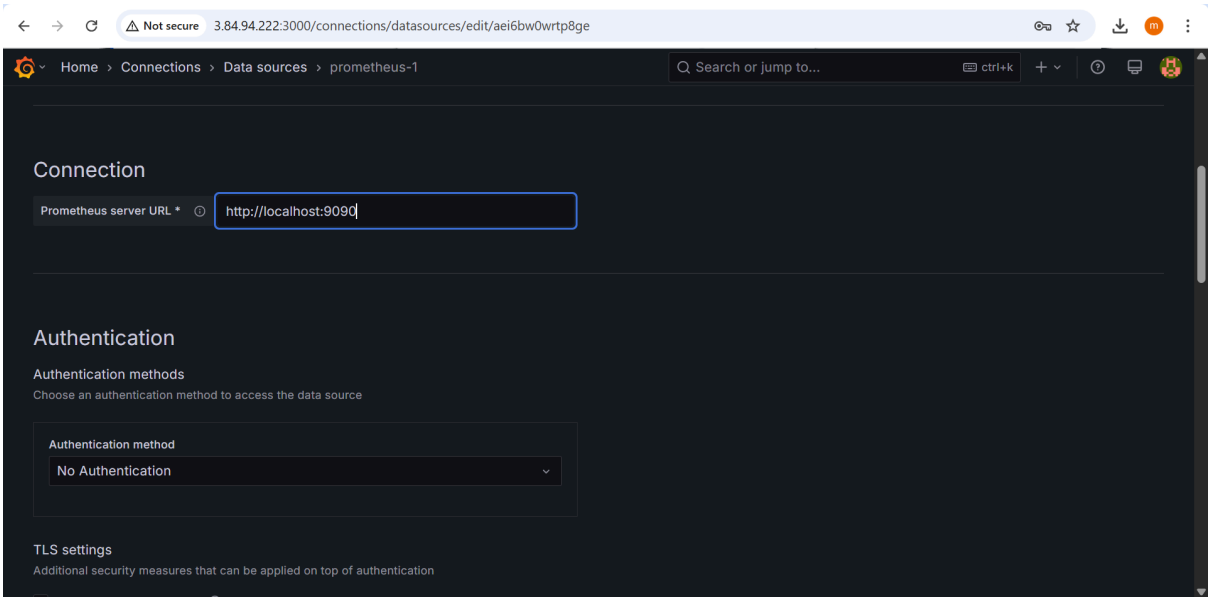
GRAFANA DASHBOARD



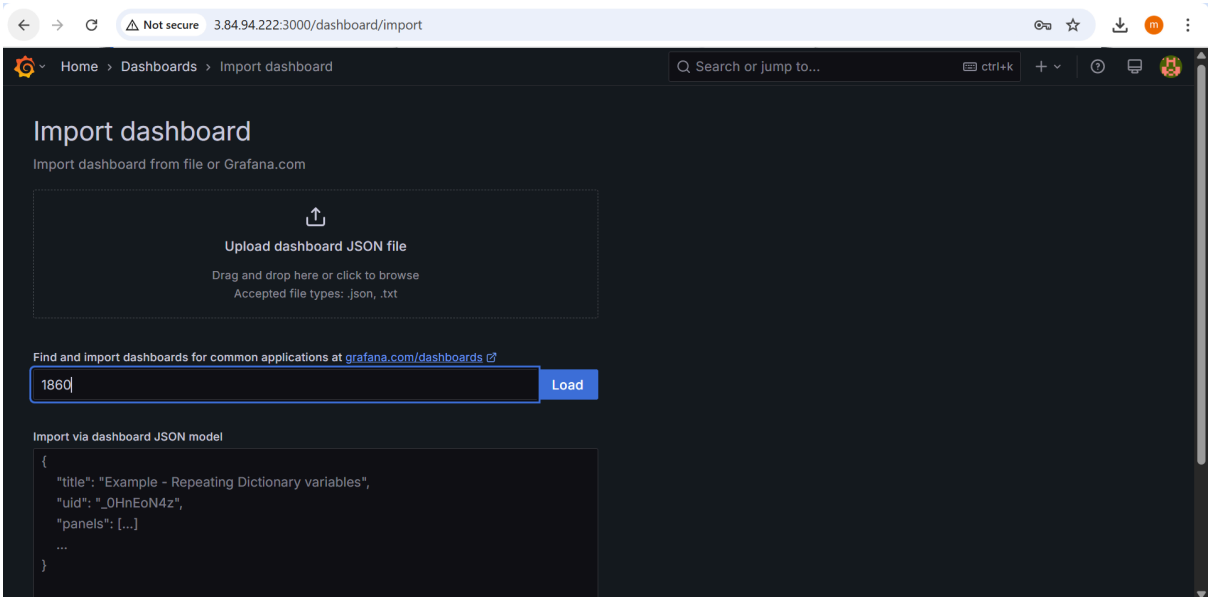
CREATION OF DASHBOARD AND ADDING DATA SOURCE

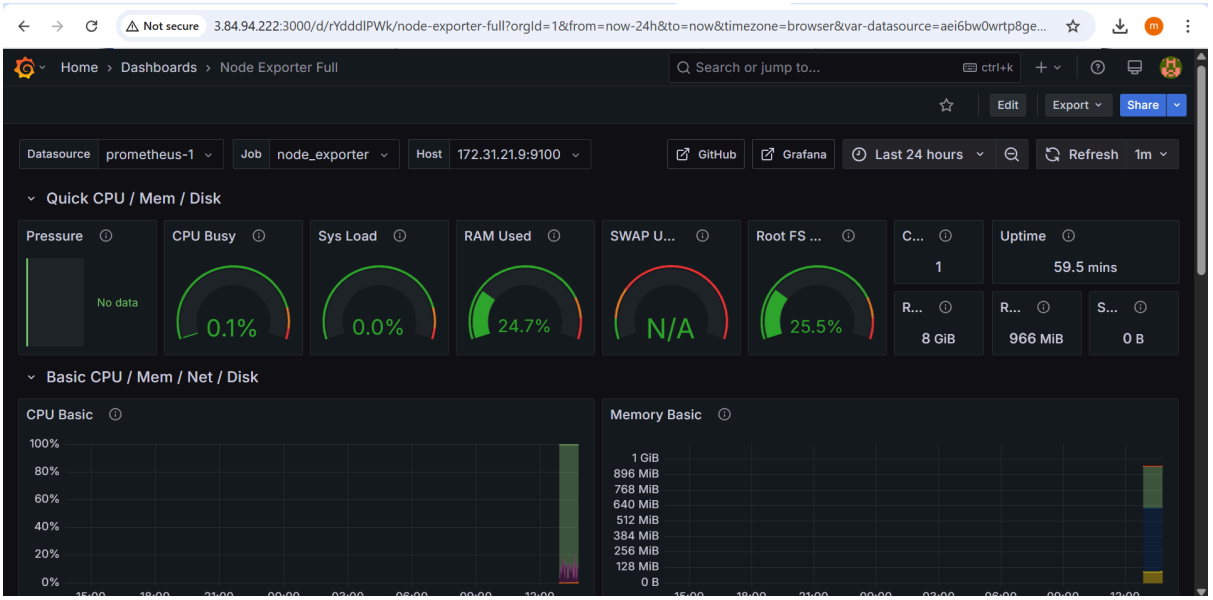


ADD PROMETHEUS AS THE DATA SOURCE



CREATION OF THE DASHBOARD





DASHBOARD OUTPUT

2. Jenkins Installation and Configuration

Jenkins Ansible Playbook Explained

```
---
- name: Playbook to Install Jenkins and Amazon Corretto JDK
  hosts: all
  become: yes
  tasks:
    - name: Install required dependencies
```

```
    yum:
      name:
        - fontconfig
        - java-17-amazon-corretto
      state: present
```

Explanation:

- The playbook header specifies it will run on all targeted hosts with elevated privileges (`become: yes`).
- The first task installs required dependencies:
    - `fontconfig`: Required by Jenkins for UI rendering
    - `java-17-amazon-corretto`: Amazon's distribution of OpenJDK, required to run Jenkins

```
- name: Add Jenkins repository
    get_url:
      url: https://pkg.jenkins.io/redhat-stable/jenkins.repo
      dest: /etc/yum.repos.d/jenkins.repo

  - name: Import Jenkins repository key
    rpm_key:
      state: present
      key: https://pkg.jenkins.io/redhat-stable/jenkins.io-2023.key

  - name: Add Amazon Corretto repository
    get_url:
      url: https://yum.corretto.aws/corretto.repo
      dest: /etc/yum.repos.d/corretto.repo
```

Explanation:

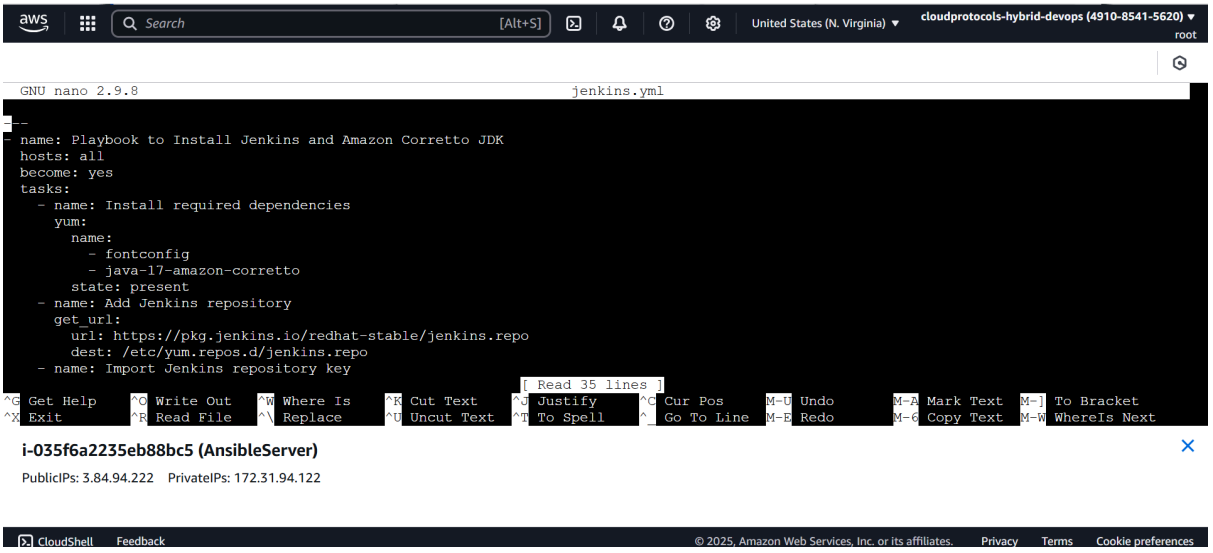
- These tasks configure the package repositories:
    - First task adds the Jenkins repository configuration
    - Second task imports the Jenkins GPG key for package verification
    - Third task adds the Amazon Corretto repository for Java

```
- name: Upgrade all packages
    yum:
      name: "*"
      state: latest
```

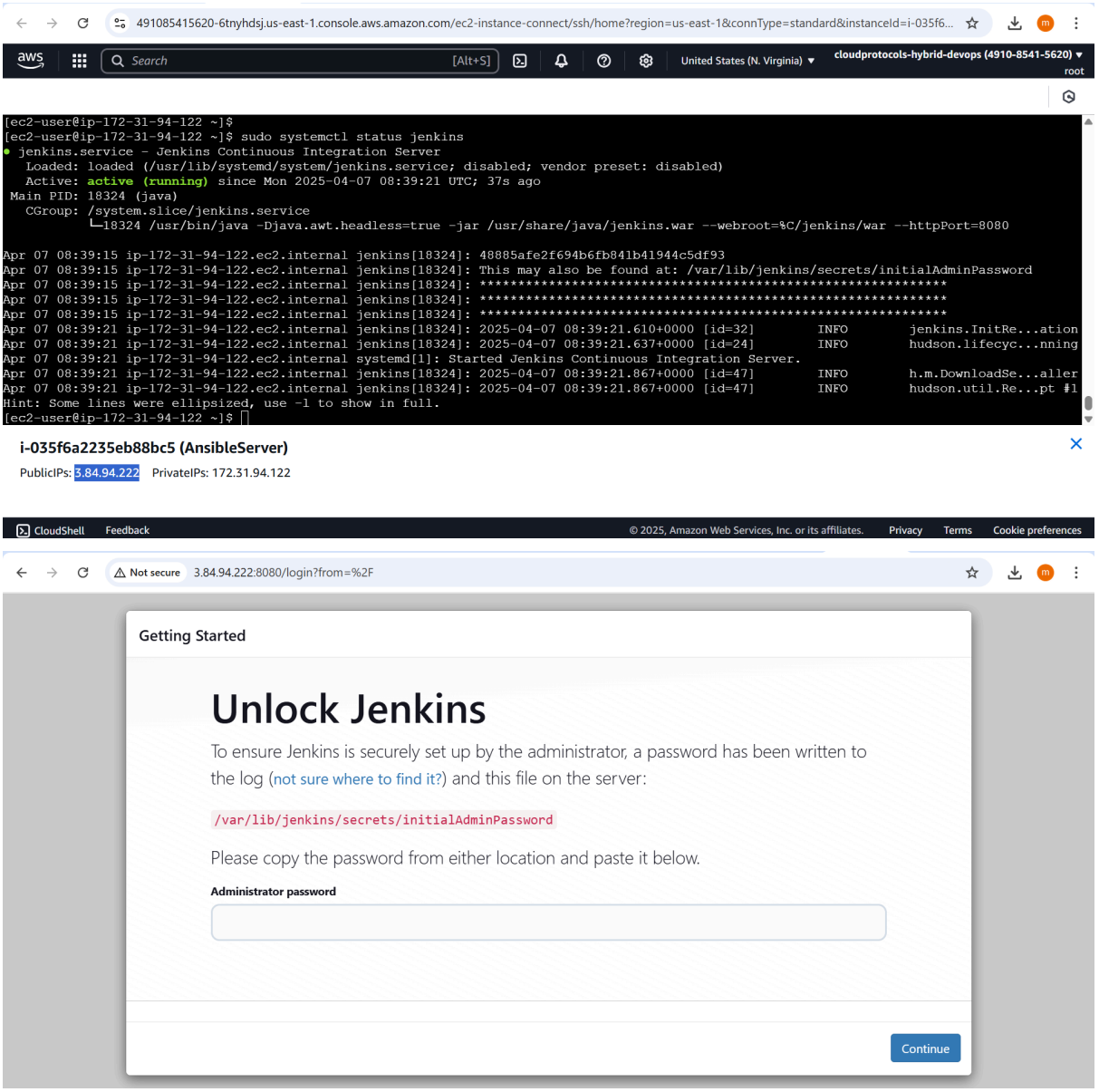
```
  - name: Install Jenkins
    yum:
      name: jenkins
      state: present

  - name: Start and enable Jenkins service
    systemd:
      name: jenkins
      state: started
      enabled: yes
      daemon_reload: yes
```

Explanation:

- The first task updates all installed packages to their latest versions.
- The second task installs Jenkins from the configured repository.
- The final task:
    - Starts the Jenkins service
    - Enables it to automatically start on boot
    - Reloads systemd configuration to recognize the new service

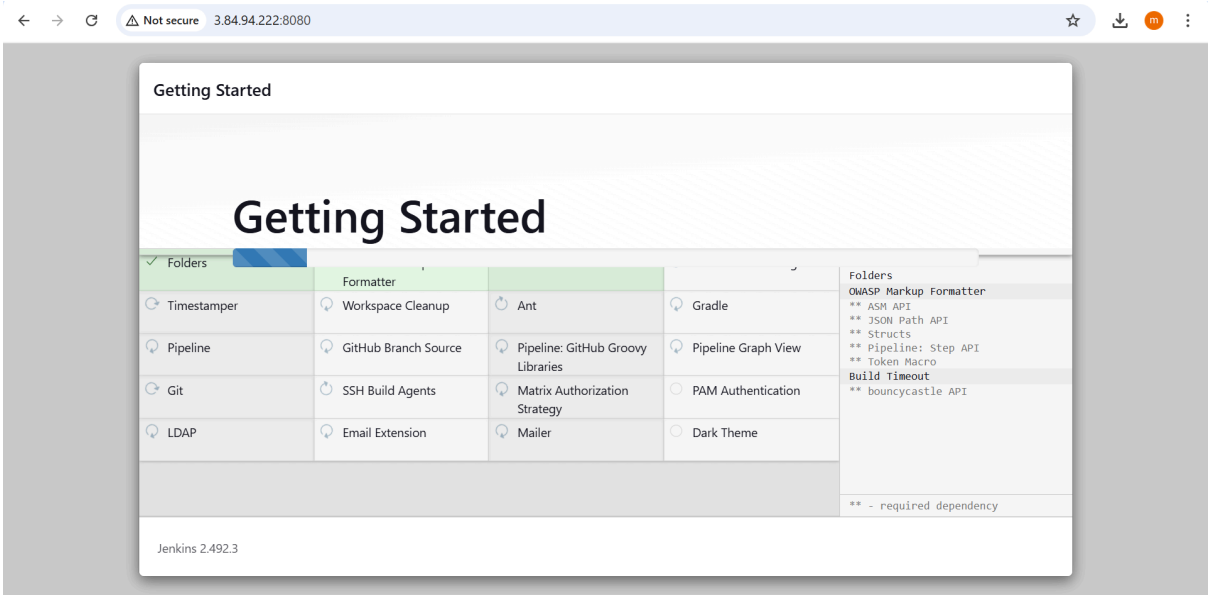


ANSIBLE YML FILE

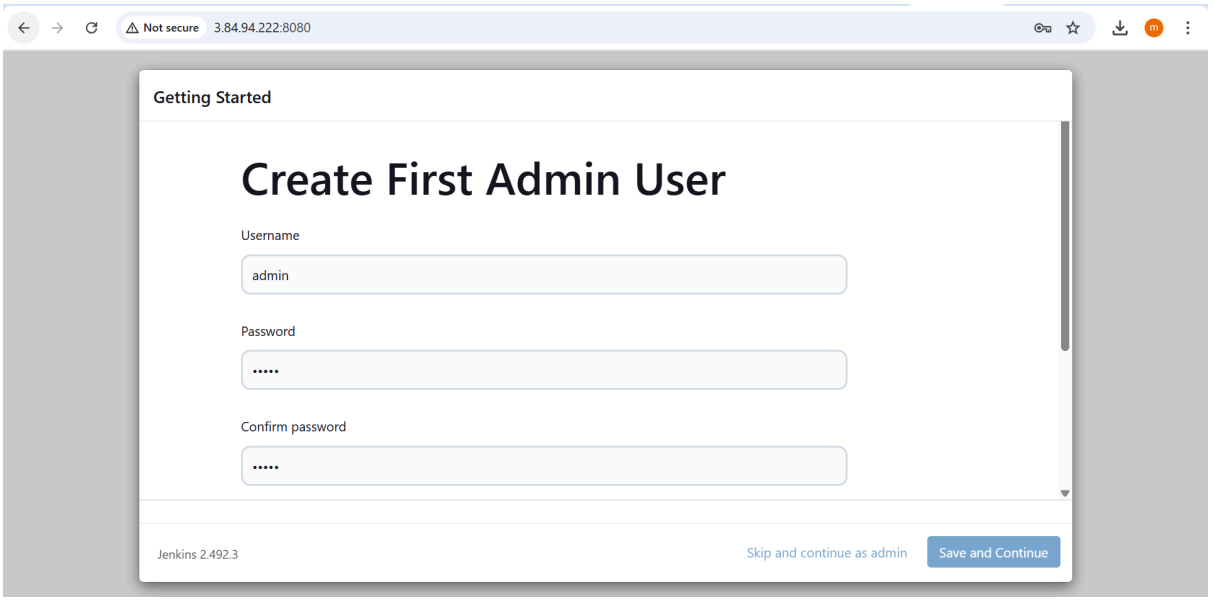

491085415620-6tnyhdsj.us-east-1.console.aws.amazon.com/ec2-instance-connect/ssh/home?region=us-east-1&connType=standard&instanceId=i-035f6...
aws
Search
[Alt+S]
United States (N. Virginia)
cloudprotocols-hybrid-devops (4910-8541-5620)
root
[ec2-user@ip-172-31-94-122 ~]$
[ec2-user@ip-172-31-94-122 ~]$ sudo systemctl status jenkins
jenkins.service - Jenkins Continuous Integration Server
Loaded: loaded (/usr/lib/systemd/system/jenkins.service; disabled; vendor preset: disabled)
Active: active (running) since Mon 2025-04-07 08:39:21 UTC; 37s ago
Main PID: 18324 (java)
CGroup: /system.slice/jenkins.service
└18324 /usr/bin/java -Djava.awt.headless=true -jar /usr/share/java/jenkins.war --webroot=%C/jenkins/war --httpPort=8080
Apr 07 08:39:15 ip-172-31-94-122.ec2.internal jenkins[18324]: 48885afe2f694b6fb841b41944c5df93
Apr 07 08:39:15 ip-172-31-94-122.ec2.internal jenkins[18324]: This may also be found at: /var/lib/jenkins/secrets/initialAdminPassword
Apr 07 08:39:15 ip-172-31-94-122.ec2.internal jenkins[18324]: **
Apr 07 08:39:15 ip-172-31-94-122.ec2.internal jenkins[18324]: **
Apr 07 08:39:15 ip-172-31-94-122.ec2.internal jenkins[18324]: **
Apr 07 08:39:21 ip-172-31-94-122.ec2.internal jenkins[18324]: 2025-04-07 08:39:21.610+0000 [id=32] INFO jenkins.InitRe...ation
Apr 07 08:39:21 ip-172-31-94-122.ec2.internal jenkins[18324]: 2025-04-07 08:39:21.637+0000 [id=24] INFO hudson.lifecyc...nning
Apr 07 08:39:21 ip-172-31-94-122.ec2.internal systemd[1]: Started Jenkins Continuous Integration Server.
Apr 07 08:39:21 ip-172-31-94-122.ec2.internal jenkins[18324]: 2025-04-07 08:39:21.867+0000 [id=47] INFO h.m.DownloadSe...aller
Apr 07 08:39:21 ip-172-31-94-122.ec2.internal jenkins[18324]: 2025-04-07 08:39:21.867+0000 [id=47] INFO hudson.util.Re...pt #1
Hint: Some lines were ellipsized, use -l to show in full.
[ec2-user@ip-172-31-94-122 ~]$
i-035f6a2235eb88bc5 (AnsibleServer)
PublicIPs: 3.84.94.222 PrivateIPs: 172.31.94.122
CloudShell
Feedback
© 2025, Amazon Web Services, Inc. or its affiliates.
Privacy
Terms
Cookie preferences

Not secure
3.84.94.222:8080/login?from=%2F
Getting Started
Unlock Jenkins
To ensure Jenkins is securely set up by the administrator, a password has been written to the log (not sure where to find it?) and this file on the server:
/var/lib/jenkins/secrets/initialAdminPassword
Please copy the password from either location and paste it below.
Administrator password
Continue

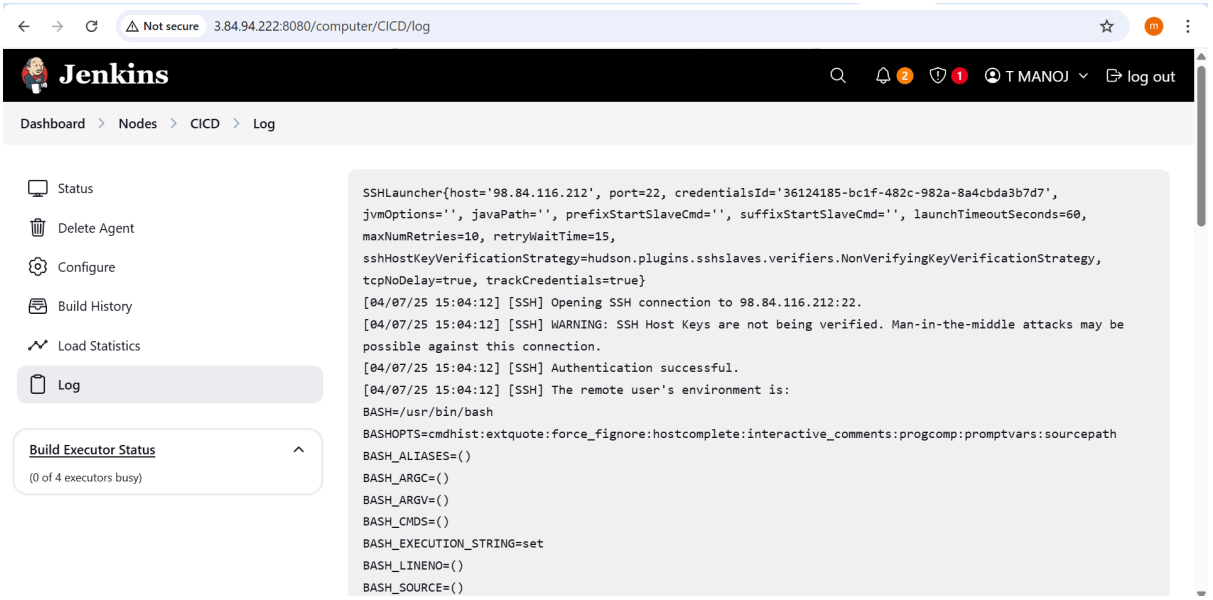
VERIFY THE JENKINS IN THE BROWSER



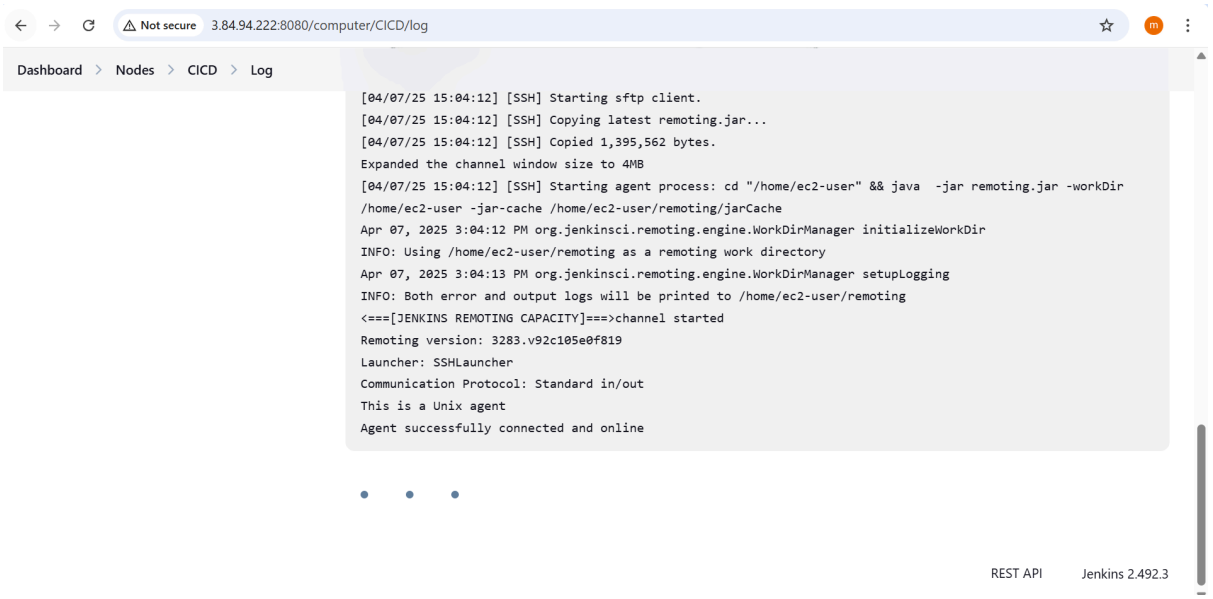
INSTALL ALL THE PLUGINS

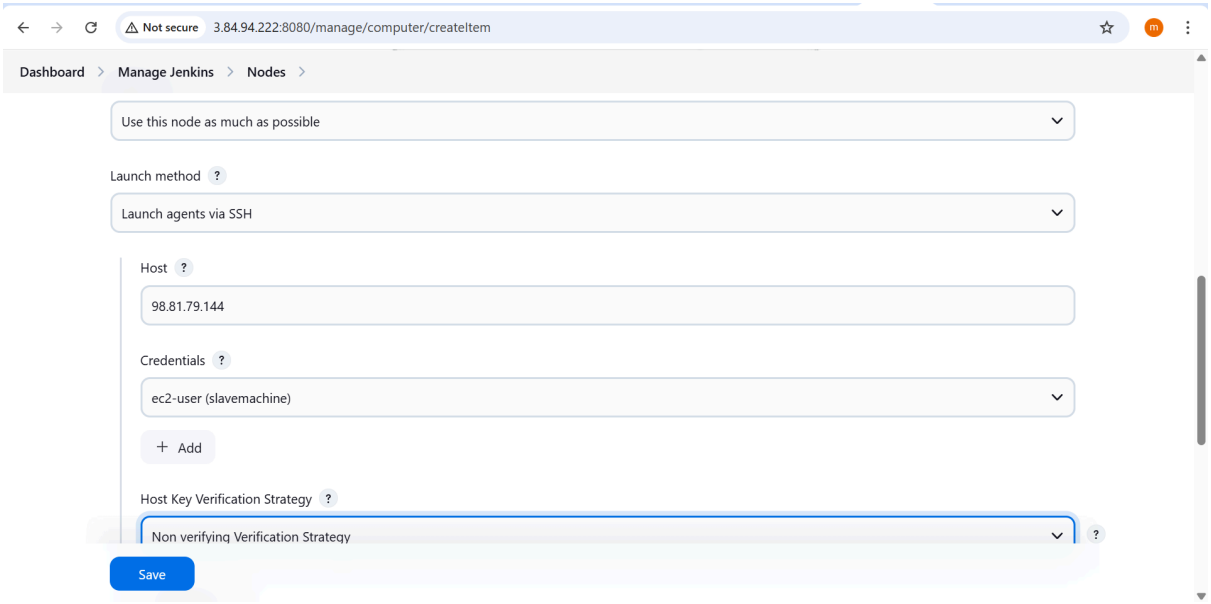


CREATION OF THE USER



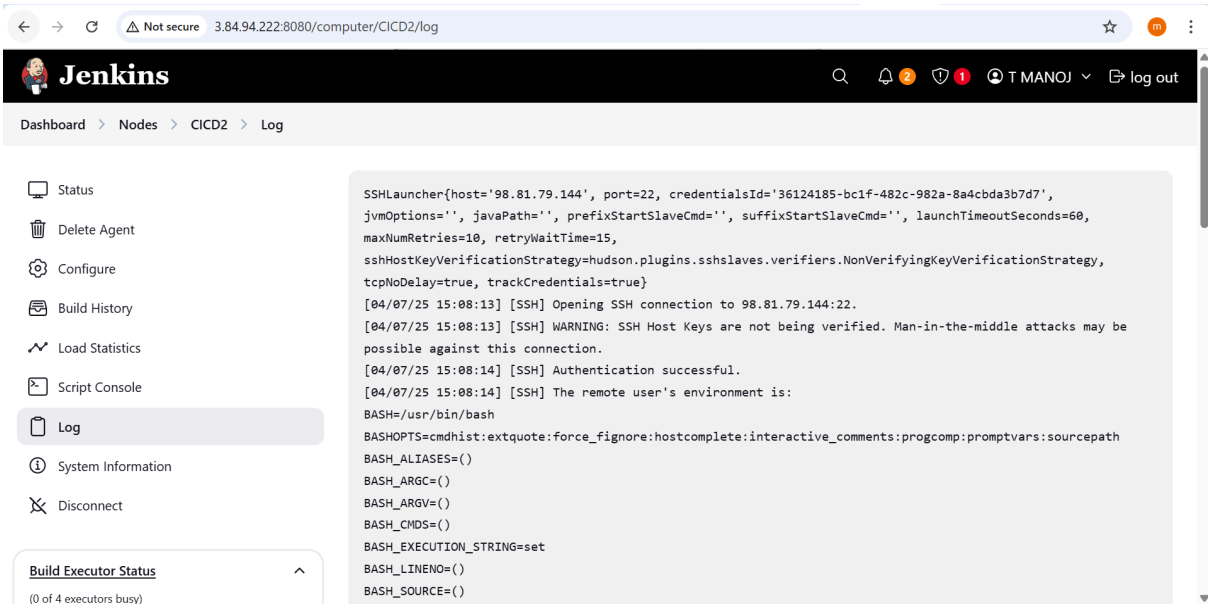
CONNECT THE MASTER WITH SLAVE AGENTS USING SSH CONNECTIONS

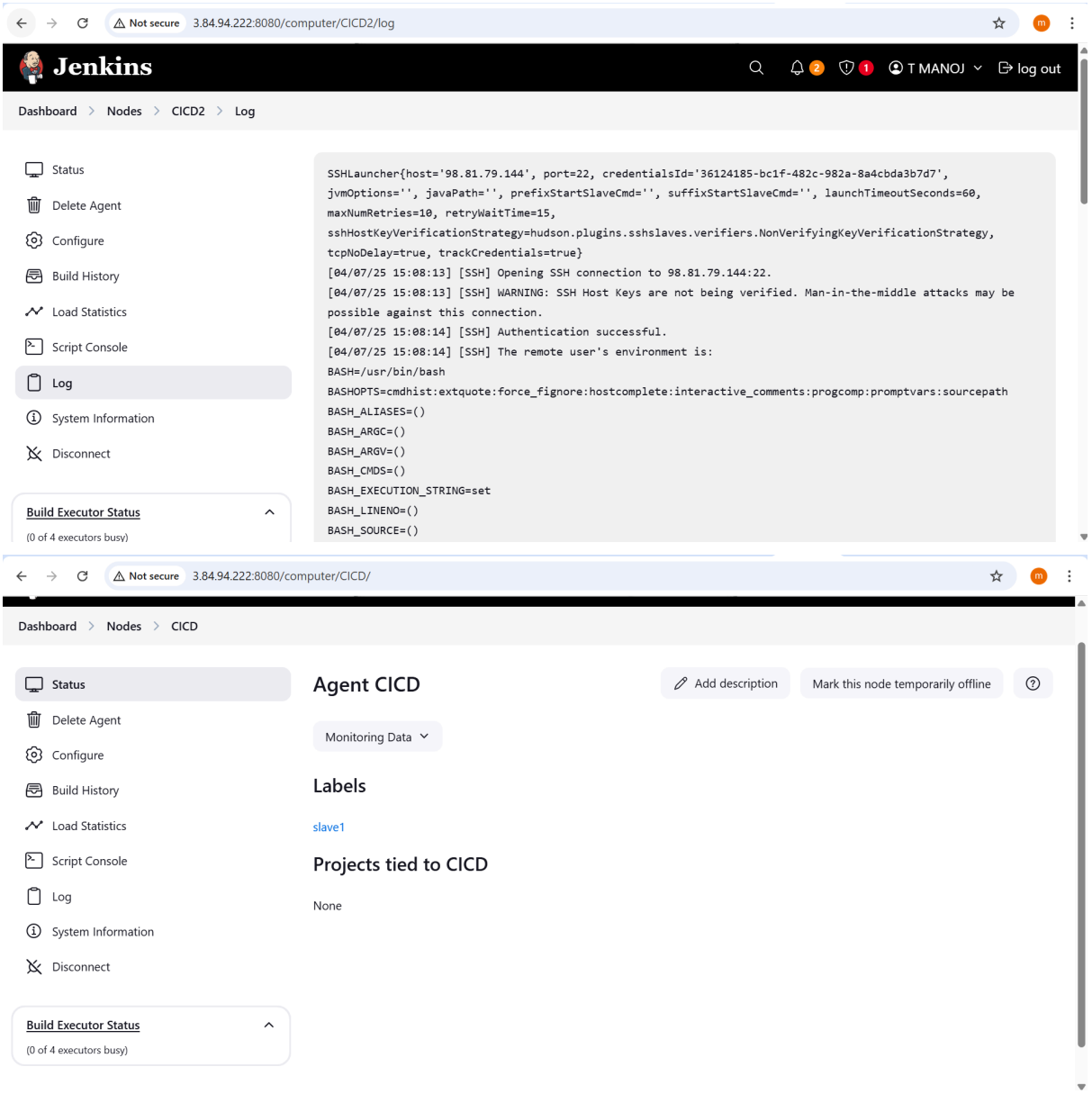




SLAVE1 CONNECTED SUCESSFULLY

CONNECT THE MASTER WITH SLAVE AGENTS USING SSH CONNECTIONS



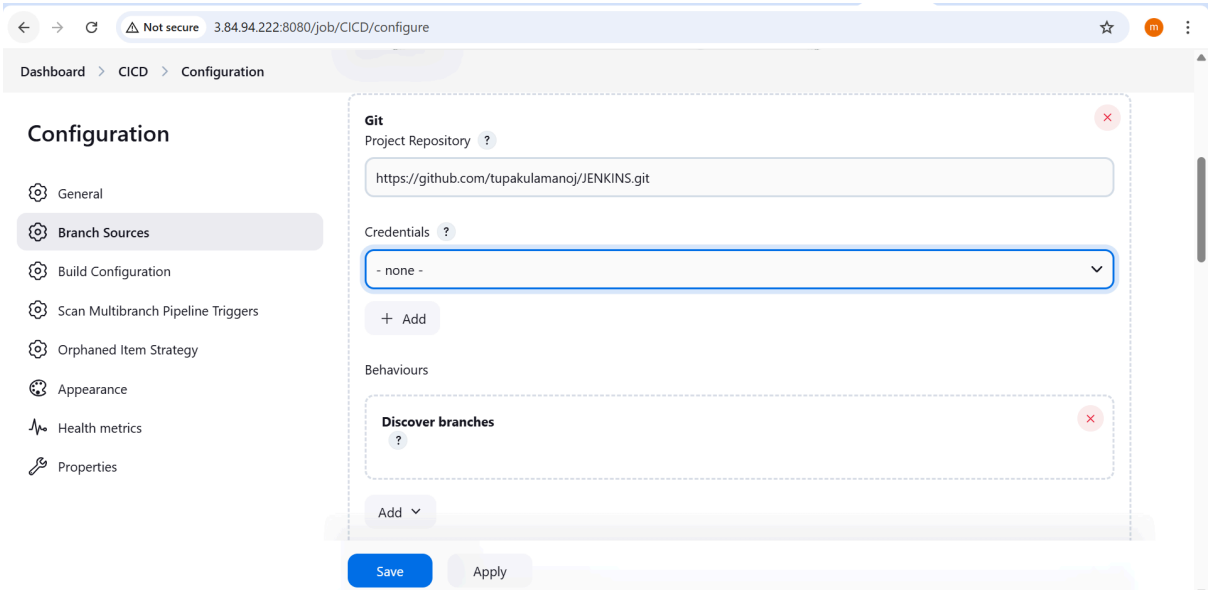


SLAVE2 CONNECTED SUCESSFULLY

3. Multibranch Pipeline Configuration

Create a Multibranch Pipeline Job

1. Go to **Jenkins Dashboard** → **New Item**.
2. Enter a **Job Name** (e.g.,CICD).
3. Select **Multibranch Pipeline** → **OK**.



---

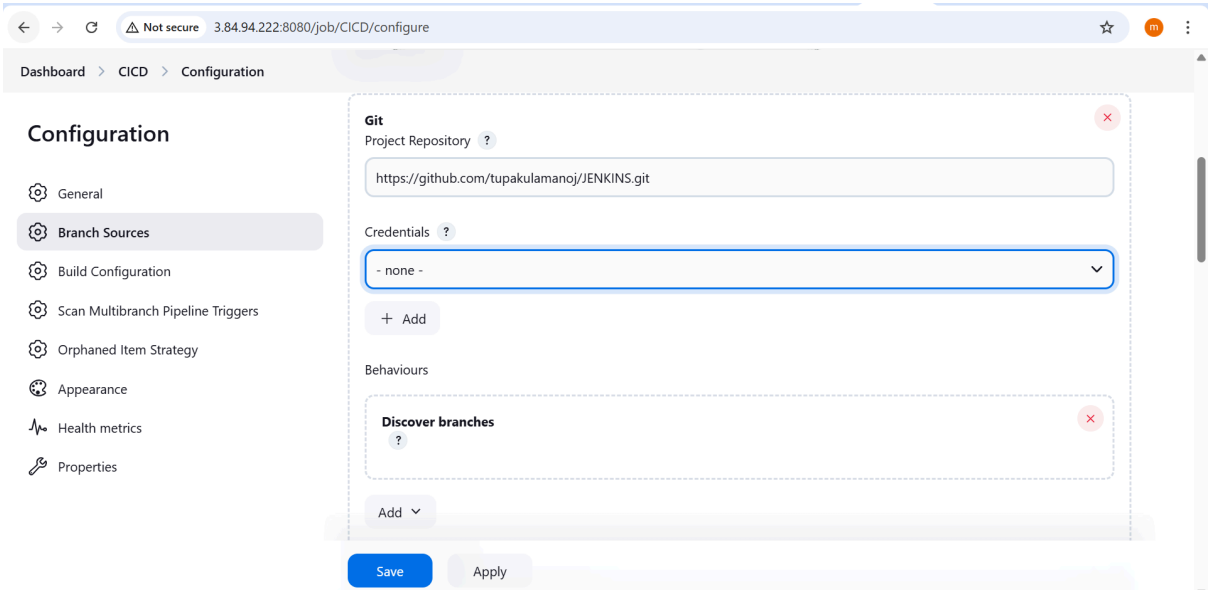
3. Configure the Multibranch Pipeline

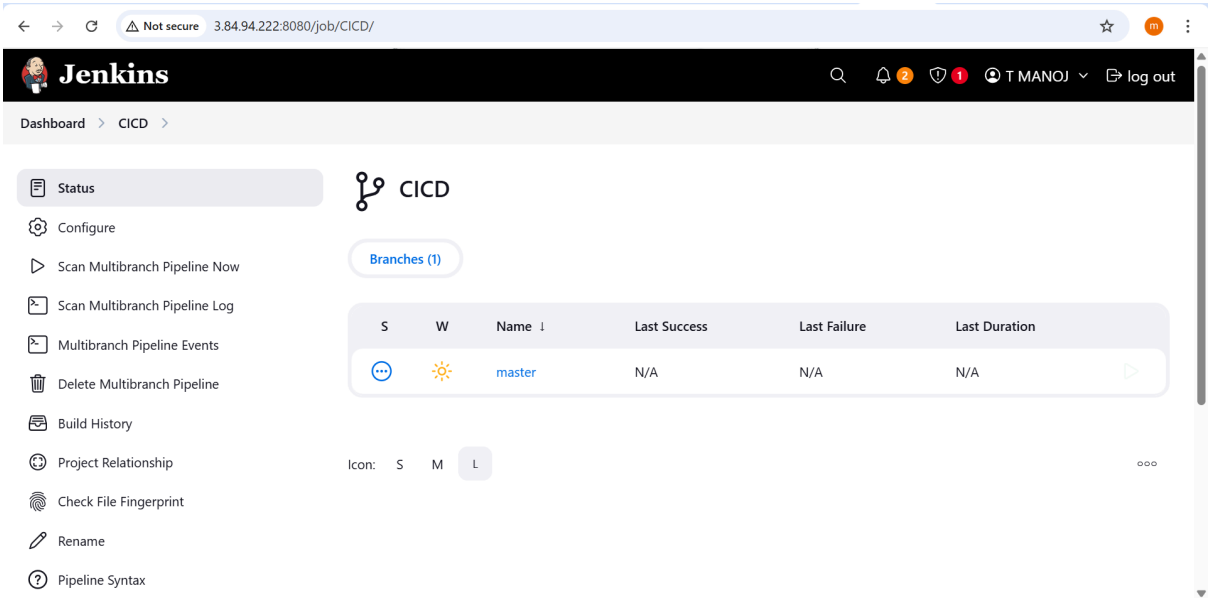
Inside your job settings:

- **Branch Sources** → **Add Source** → Choose **GitHub**.

  If you don't see GitHub option, you missed GitHub Branch Source plugin.

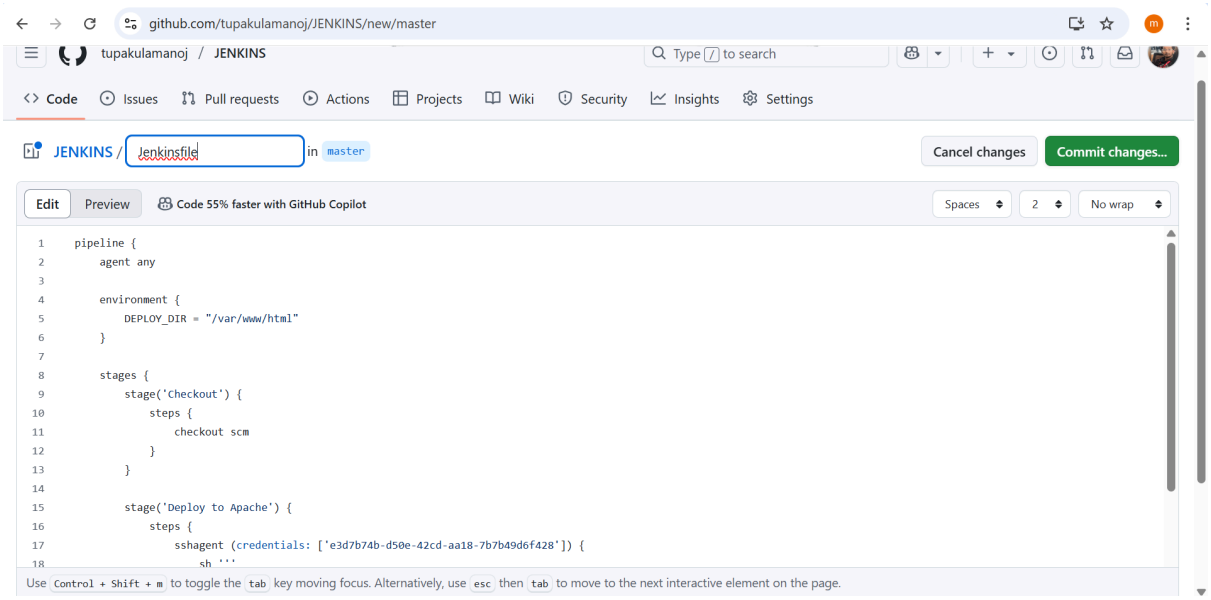
- **Credentials** → Add credentials if your repo is private (GitHub Username + Token).





4. Scan Repository

- Click **Scan Multibranch Pipeline Now**.
- Jenkins will detect all branches that have a `Jenkinsfile`.

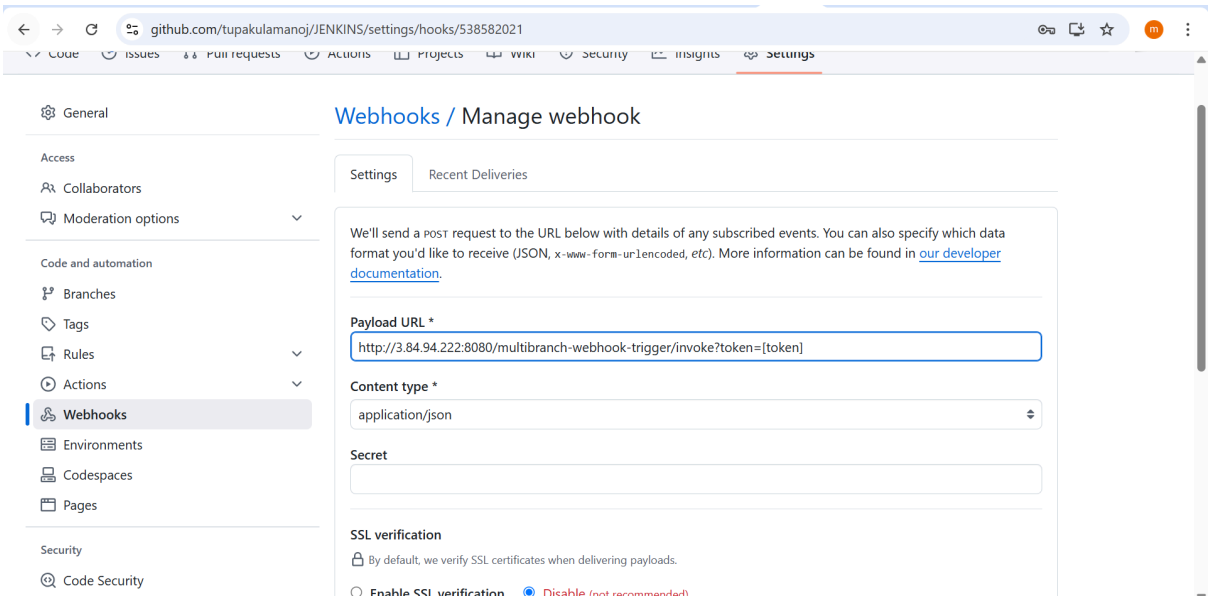


5. Add GitHub Webhook

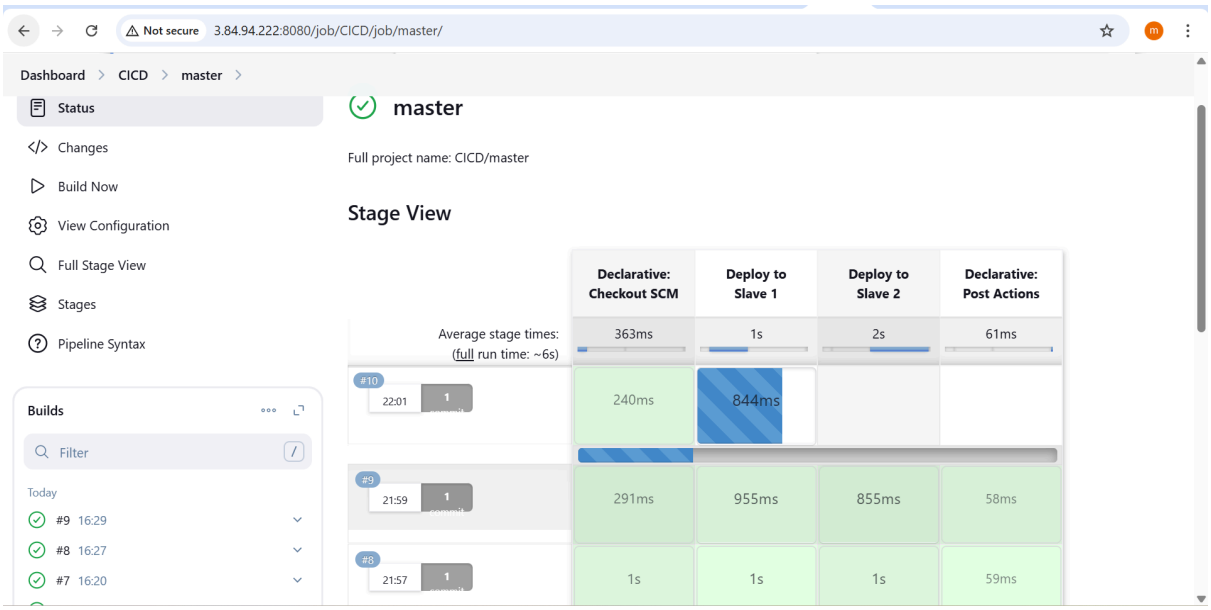
So that Jenkins builds **automatically when you push**.

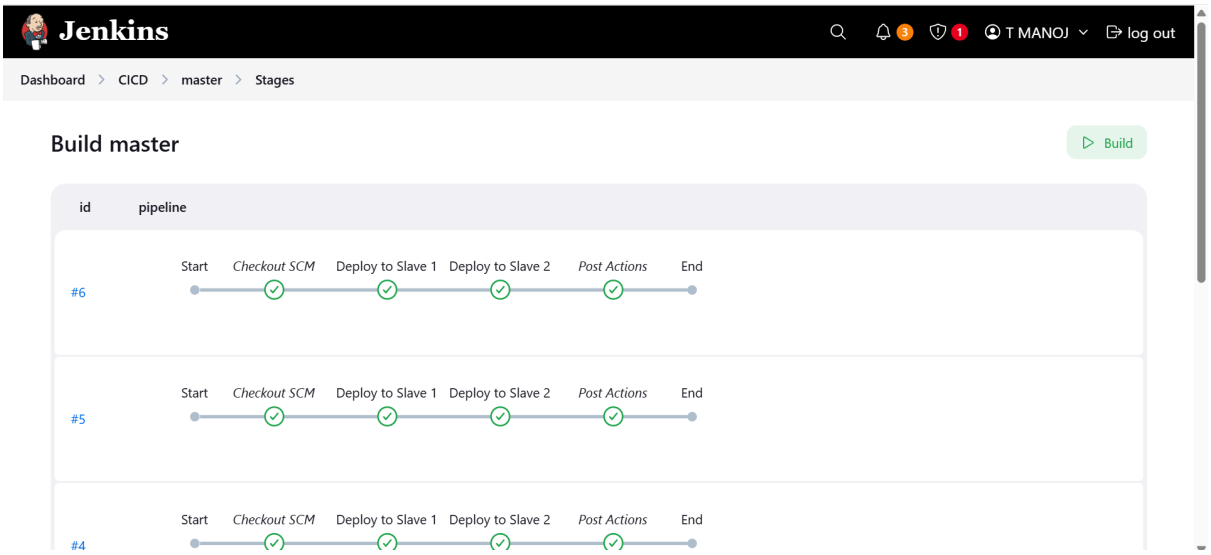
- Go to your **GitHub repository → Settings → Webhooks → Add webhook**.
- (Use public IP or domain of Jenkins, and port if needed like `8080`)

- **Content type**: `application/json`
- **Event**: Send **"Just the push event"**.
- **Save**.

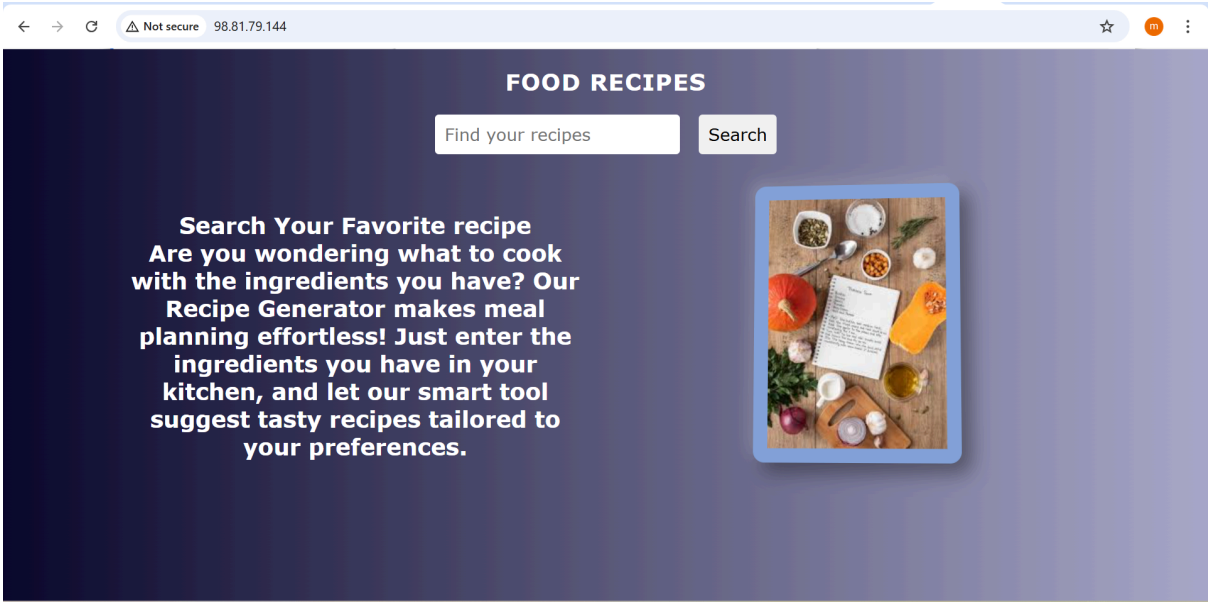


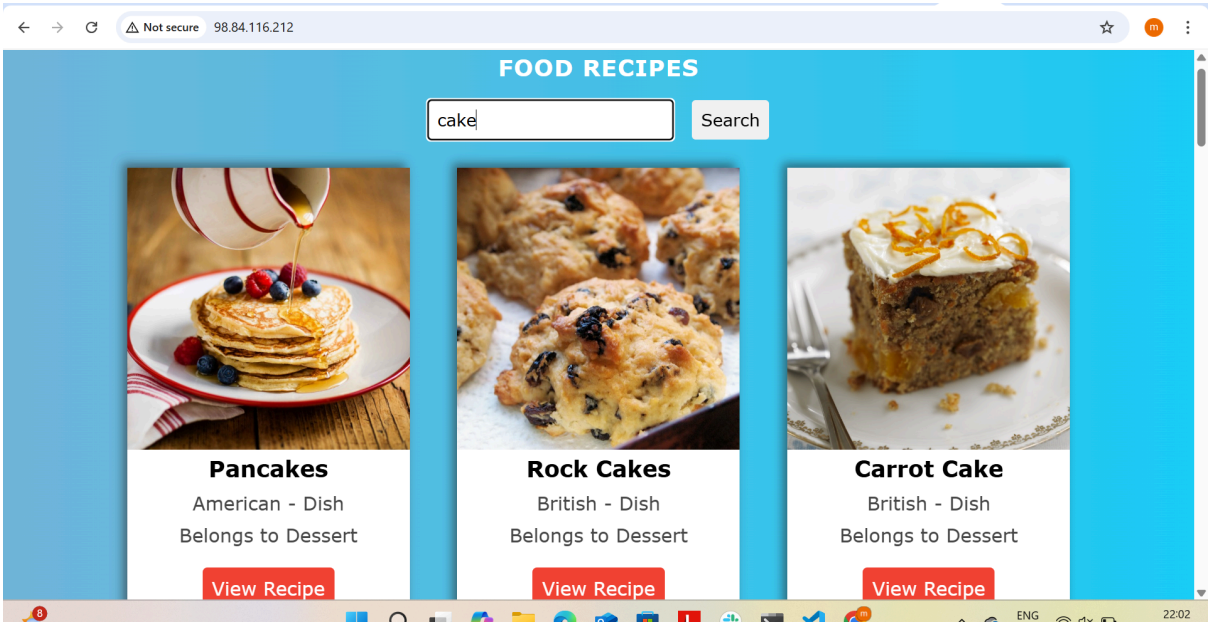
6.BUILD AND DEPLOY STAGES :



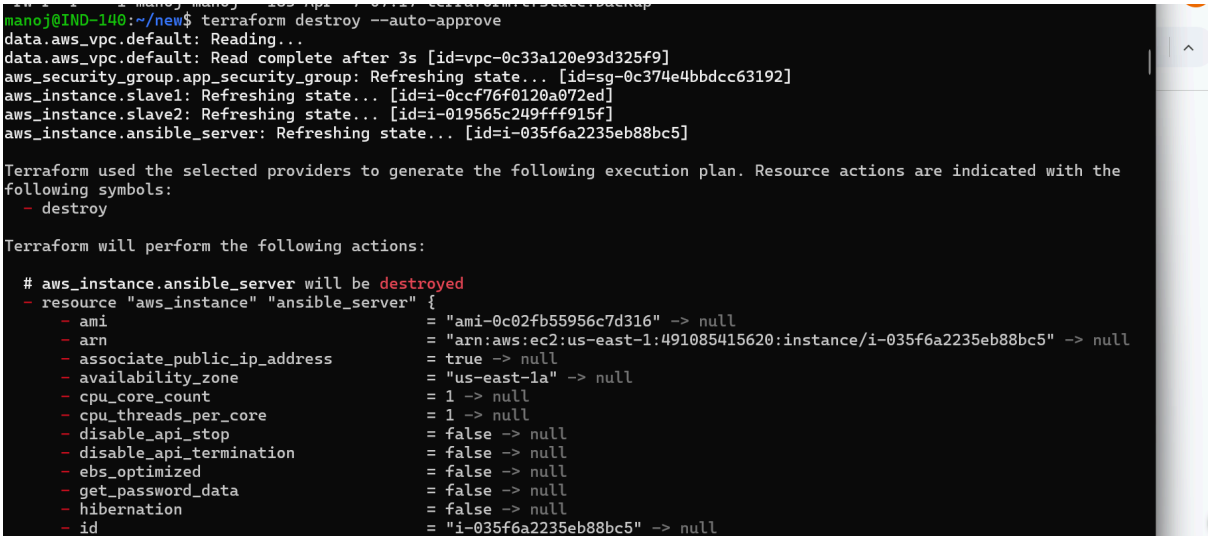


DEPLOYED IN BOTH SLAVES

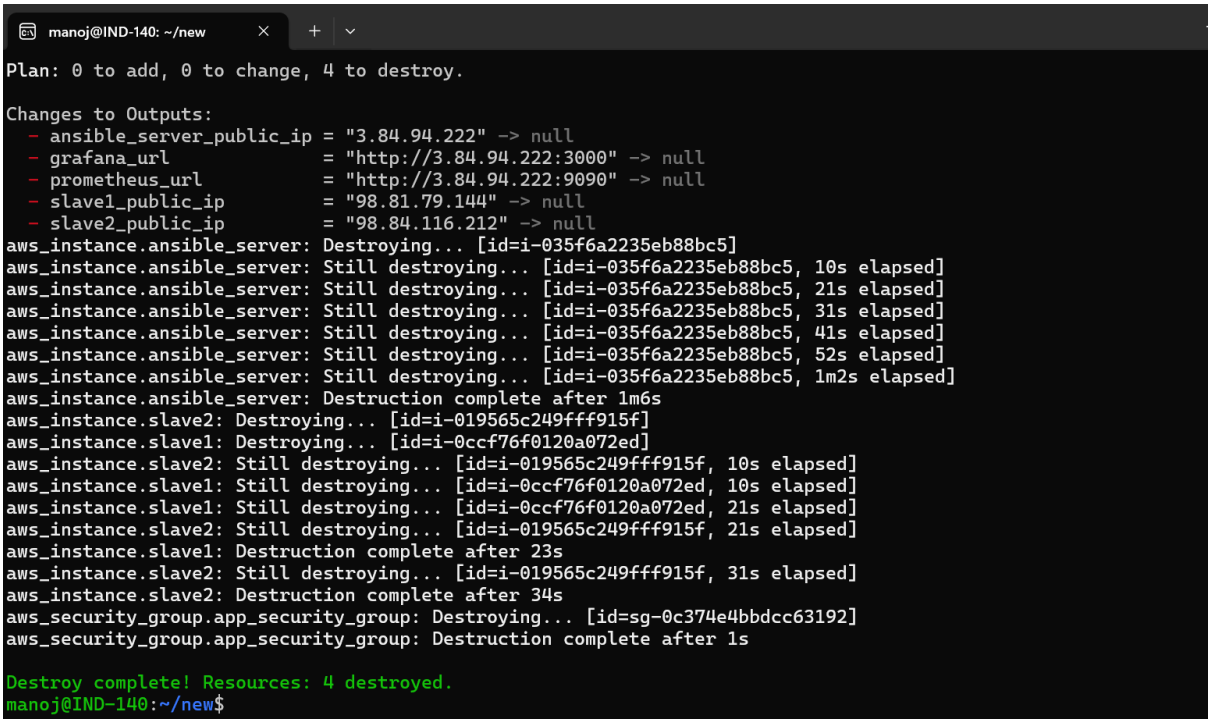




CLEANING OF RESOURCES



```
manoj@IND-140:~/new$ terraform destroy --auto-approve
data.aws_vpc.default: Reading...
data.aws_vpc.default: Read complete after 3s [id=vpc-0c33a120e93d325f9]
aws_security_group.app_security_group: Refreshing state... [id=sg-0c374e4bbdcc63192]
aws_instance.slave1: Refreshing state... [id=i-0ccf76f0120a072ed]
aws_instance.slave2: Refreshing state... [id=i-019565c249fff915f]
aws_instance.ansible_server: Refreshing state... [id=i-035f6a2235eb88bc5]

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated with the
following symbols:
  - destroy

Terraform will perform the following actions:

  # aws_instance.ansible_server will be destroyed
  - resource "aws_instance" "ansible_server" {
      - ami                                  = "ami-0c02fb55956c7d316" -> null
      - arn                                  = "arn:aws:ec2:us-east-1:491085415620:instance/i-035f6a2235eb88bc5" -> null
      - associate_public_ip_address          = true -> null
      - availability_zone                    = "us-east-1a" -> null
      - cpu_core_count                       = 1 -> null
      - cpu_threads_per_core                 = 1 -> null
      - disable_api_stop                     = false -> null
      - disable_api_termination              = false -> null
      - ebs_optimized                        = false -> null
      - get_password_data                    = false -> null
      - hibernation                          = false -> null
      - id                                   = "i-035f6a2235eb88bc5" -> null
```



Conclusion

This DevOps infrastructure provides a solid foundation for modern software development practices. By automating infrastructure provisioning with Terraform, standardizing configurations with Ansible, implementing CI/CD with Jenkins, and ensuring comprehensive monitoring with Prometheus and Grafana, organizations can achieve greater agility, reliability, and visibility. The modular nature of this architecture allows teams to adapt and extend it according to their specific needs, whether scaling to handle larger workloads, incorporating additional tools, or optimizing for particular use cases. With proper implementation and security considerations addressed, this infrastructure can support everything from small team projects to enterprise-scale applications. By embracing these DevOps practices and tools, organizations position themselves to respond more effectively to changing requirements, deliver features faster, and maintain high-quality standards throughout their development process.