

# DevOps Project 2

Using Terraform to setup the environment in Azure.

```
terraform {
  required_providers {
    azurerm = {
      source  = "hashicorp/azurerm"
      version = "=3.34.0"
    }
  }
}

provider "azurerm" {
  features {}
  subscription_id = "e9c93904-c316-4f60-a1b3-fc5ae575878f"
  tenant_id       = "624a0ea3-8660-4927-96de-a646f74ad52b"
  client_id       = "0feeb28b-8afe-4960-8e65-4c7f823bc736"
  client_secret   = "Z~r8Q~vq51LuxXDRjWnMlh9zLn6KcmZ09sH~GcA2"
}

resource "azurerm_resource_group" "devops" {
  name     = "devops-rg"
  location = "West Europe"
}

resource "azurerm_virtual_network" "devops" {
  name                = "devops-vnet"
  address_space       = ["10.0.0.0/16"]
  location             = azurerm_resource_group.devops.location
  resource_group_name = azurerm_resource_group.devops.name
}

resource "azurerm_subnet" "devops" {
  name                = "devops-subnet"
  resource_group_name = azurerm_resource_group.devops.name
  virtual_network_name = azurerm_virtual_network.devops.name
  address_prefixes     = ["10.0.9.0/24"]
}

resource "azurerm_ssh_public_key" "devops" {
  name                = "devops"
  resource_group_name = azurerm_resource_group.devops.name
  location            = azurerm_resource_group.devops.location
  public_key          = file("~/ssh/id_rsa.pub")
}

resource "azurerm_network_security_group" "devops" {
  name                = "devops-nsg"
  resource_group_name = azurerm_resource_group.devops.name
  location            = azurerm_resource_group.devops.location

  security_rule {
```

```

    name                = "SSH"
    priority             = 100
    access               = "Allow"
    direction            = "Inbound"
    protocol             = "Tcp"
    source_address_prefix = "*"
    source_port_range    = "*"
    destination_address_prefix = "*"
    destination_port_range = "22"
}
security_rule {
    name                = "HTTP"
    priority             = 101
    access               = "Allow"
    direction            = "Inbound"
    protocol             = "Tcp"
    source_address_prefix = "*"
    source_port_range    = "*"
    destination_address_prefix = "*"
    destination_port_range = "80"
}
security_rule {
    name                = "Jenkins"
    priority             = 102
    access               = "Allow"
    direction            = "Inbound"
    protocol             = "Tcp"
    source_address_prefix = "*"
    source_port_range    = "*"
    destination_address_prefix = "*"
    destination_port_range = "8080"
}
}

// Jenkins
resource "azurerm_public_ip" "jenkins" {
    name                = "jenkins-public-ip"
    location             = azurerm_resource_group.devops.location
    resource_group_name = azurerm_resource_group.devops.name
    allocation_method    = "Dynamic"
}

resource "azurerm_network_interface" "jenkins" {
    name                = "jenkins-nic"
    location             = azurerm_resource_group.devops.location
    resource_group_name = azurerm_resource_group.devops.name

    ip_configuration {
        name                = "jenkins-ip"
        subnet_id            = azurerm_subnet.devops.id
        private_ip_address_allocation = "Dynamic"
        public_ip_address_id = azurerm_public_ip.jenkins.id
    }
}

```

```

}

resource "azurerm_network_interface_security_group_association" "jenkins" {
  network_interface_id      = azurerm_network_interface.jenkins.id
  network_security_group_id = azurerm_network_security_group.devops.id
}

resource "azurerm_virtual_machine" "jenkins" {
  name                        = "Jenkins"
  location                   = azurerm_resource_group.devops.location
  resource_group_name        = azurerm_resource_group.devops.name
  vm_size                    = "Standard_D2s_v3"
  network_interface_ids      = [azurerm_network_interface.jenkins.id]
  delete_data_disks_on_termination = true
  delete_os_disk_on_termination   = true

  storage_image_reference {
    publisher = "Canonical"
    offer     = "0001-com-ubuntu-server-focal"
    sku       = "20_04-lts-gen2"
    version   = "latest"
  }

  storage_os_disk {
    name            = "jenkins-disk"
    caching          = "ReadWrite"
    create_option    = "FromImage"
    managed_disk_type = "Standard_LRS"
  }

  os_profile {
    computer_name  = "jenkins"
    admin_username = "azureuser"
    admin_password = "Password@123"
  }

  os_profile_linux_config {
    disable_password_authentication = true
    ssh_keys {
      path      = "/home/azureuser/.ssh/authorized_keys"
      key_data = azurerm_ssh_public_key.devops.public_key
    }
  }
}

// Kubernetes
resource "azurerm_public_ip" "kubernetes" {
  name            = "kubernetes-public-ip"
  location         = azurerm_resource_group.devops.location
  resource_group_name = azurerm_resource_group.devops.name
  allocation_method = "Dynamic"
}

```

```

resource "azurerm_network_interface" "kubernetes" {
  name                = "kubernetes-nic"
  location             = azurerm_resource_group.devops.location
  resource_group_name = azurerm_resource_group.devops.name

  ip_configuration {
    name                = "kubernetes-ip"
    subnet_id           = azurerm_subnet.devops.id
    private_ip_address_allocation = "Dynamic"
    public_ip_address_id = azurerm_public_ip.kubernetes.id
  }
}

resource "azurerm_network_interface_security_group_association" "kubernetes" {
  network_interface_id      = azurerm_network_interface.kubernetes.id
  network_security_group_id = azurerm_network_security_group.devops.id
}

resource "azurerm_virtual_machine" "kubernetes" {
  name                = "Kubernetes"
  location             = azurerm_resource_group.devops.location
  resource_group_name = azurerm_resource_group.devops.name
  vm_size             = "Standard_D2s_v3"
  network_interface_ids = [azurerm_network_interface.kubernetes.id]
  delete_data_disks_on_termination = true
  delete_os_disk_on_termination   = true

  storage_image_reference {
    publisher = "Canonical"
    offer     = "0001-com-ubuntu-server-focal"
    sku       = "20_04-lts-gen2"
    version   = "latest"
  }

  storage_os_disk {
    name                = "kubernetes-disk"
    caching             = "ReadWrite"
    create_option       = "FromImage"
    managed_disk_type   = "Standard_LRS"
  }

  os_profile {
    computer_name  = "kubernetes"
    admin_username = "azureuser"
    admin_password = "Password@123"
  }

  os_profile_linux_config {
    disable_password_authentication = true
    ssh_keys {
      path      = "/home/azureuser/.ssh/authorized_keys"
      key_data = azurerm_ssh_public_key.devops.public_key
    }
  }
}

```

```

}

// Slave 1
resource "azurerm_public_ip" "worker1" {
  name           = "worker1-public-ip"
  location       = azurerm_resource_group.devops.location
  resource_group_name = azurerm_resource_group.devops.name
  allocation_method = "Dynamic"
}

resource "azurerm_network_interface" "worker1" {
  name           = "worker1-nic"
  location       = azurerm_resource_group.devops.location
  resource_group_name = azurerm_resource_group.devops.name

  ip_configuration {
    name                 = "worker1-ip"
    subnet_id           = azurerm_subnet.devops.id
    private_ip_address_allocation = "Dynamic"
    public_ip_address_id = azurerm_public_ip.worker1.id
  }
}

resource "azurerm_network_interface_security_group_association" "worker1" {
  network_interface_id      = azurerm_network_interface.worker1.id
  network_security_group_id = azurerm_network_security_group.devops.id
}

resource "azurerm_virtual_machine" "worker1" {
  name                 = "Worker1"
  location             = azurerm_resource_group.devops.location
  resource_group_name = azurerm_resource_group.devops.name
  vm_size             = "Standard_D2s_v3"
  network_interface_ids = [azurerm_network_interface.worker1.id]
  delete_data_disks_on_termination = true
  delete_os_disk_on_termination   = true

  storage_image_reference {
    publisher = "Canonical"
    offer     = "0001-com-ubuntu-server-focal"
    sku       = "20_04-lts-gen2"
    version   = "latest"
  }

  storage_os_disk {
    name          = "worker1-disk"
    caching       = "ReadWrite"
    create_option = "FromImage"
    managed_disk_type = "Standard_LRS"
  }

  os_profile {
    computer_name = "worker1"
  }
}

```

```

    admin_username = "azureuser"
    admin_password = "Password@123"
}

os_profile_linux_config {
    disable_password_authentication = true
    ssh_keys {
        path      = "/home/azureuser/.ssh/authorized_keys"
        key_data = azurerm_ssh_public_key.devops.public_key
    }
}
}

// Worker 2
resource "azurerm_public_ip" "worker2" {
    name                = "worker2-public-ip"
    location             = azurerm_resource_group.devops.location
    resource_group_name = azurerm_resource_group.devops.name
    allocation_method    = "Dynamic"
}

resource "azurerm_network_interface" "worker2" {
    name                = "worker2-nic"
    location             = azurerm_resource_group.devops.location
    resource_group_name = azurerm_resource_group.devops.name

    ip_configuration {
        name                = "worker2-ip"
        subnet_id           = azurerm_subnet.devops.id
        private_ip_address_allocation = "Dynamic"
        public_ip_address_id = azurerm_public_ip.worker2.id
    }
}

resource "azurerm_network_interface_security_group_association" "worker2" {
    network_interface_id      = azurerm_network_interface.worker2.id
    network_security_group_id = azurerm_network_security_group.devops.id
}

resource "azurerm_virtual_machine" "worker2" {
    name                = "Worker2"
    location             = azurerm_resource_group.devops.location
    resource_group_name = azurerm_resource_group.devops.name
    vm_size             = "Standard_D2s_v3"
    network_interface_ids = [azurerm_network_interface.worker2.id]
    delete_data_disks_on_termination = true
    delete_os_disk_on_termination    = true

    storage_image_reference {
        publisher = "Canonical"
        offer     = "0001-com-ubuntu-server-focal"
        sku       = "20_04-lts-gen2"
        version   = "latest"
    }
}

```

```

}

storage_os_disk {
  name      = "worker2-disk"
  caching    = "ReadWrite"
  create_option = "FromImage"
  managed_disk_type = "Standard_LRS"
}

os_profile {
  computer_name  = "worker2"
  admin_username = "azureuser"
  admin_password = "Password@123"
}

os_profile_linux_config {
  disable_password_authentication = true
  ssh_keys {
    path      = "/home/azureuser/.ssh/authorized_keys"
    key_data = azurerm_ssh_public_key.devops.public_key
  }
}
}

```

\$ terraform init  
 \$ terraform plan  
 \$ terraform apply

The screenshot shows a terminal window with the following Terraform apply output:

```

azurerm_network_interface.worker1: Creating...
azurerm_network_interface.kubernetes: Creating...
azurerm_network_interface.worker2: Creating...
azurerm_network_interface.jenkins: Creation complete after 2s [id=/subscriptions/e9c93904-c316-4f60-a1b3-fc5ae575878f/resourceGroups/devops-rg/providers/Microsoft.Network/networkInterfaces/jenkins-nic]
azurerm_network_interface_security_group_association.jenkins: Creating...
azurerm_virtual_machine.jenkins: Creating...
azurerm_network_interface.worker2: Creation complete after 3s [id=/subscriptions/e9c93904-c316-4f60-a1b3-fc5ae575878f/resourceGroups/devops-rg/providers/Microsoft.Network/networkInterfaces/worker2-nic]
azurerm_network_interface_security_group_association.worker2: Creating...
azurerm_virtual_machine.worker2: Creating...
azurerm_network_interface_security_group_association.jenkins: Creation complete after 1s [id=/subscriptions/e9c93904-c316-4f60-a1b3-fc5ae575878f/resourceGroups/devops-rg/providers/Microsoft.Network/networkInterfaces/jenkins-nic]
azurerm_network_interface_security_group_association.worker2: Creation complete after 2s [id=/subscriptions/e9c93904-c316-4f60-a1b3-fc5ae575878f/resourceGroups/devops-rg/providers/Microsoft.Network/networkInterfaces/worker2-nic]
azurerm_network_interface_security_group_association.kubernetes: Creating...
azurerm_virtual_machine.kubernetes: Creating...
azurerm_network_interface_security_group_association.worker2: Creation complete after 2s [id=/subscriptions/e9c93904-c316-4f60-a1b3-fc5ae575878f/resourceGroups/devops-rg/providers/Microsoft.Network/networkInterfaces/worker2-nic]
azurerm_network_interface.jenkins: Creation complete after 6s [id=/subscriptions/e9c93904-c316-4f60-a1b3-fc5ae575878f/resourceGroups/devops-rg/providers/Microsoft.Network/networkInterfaces/jenkins-nic]
azurerm_network_interface_security_group_association.worker1: Creating...
azurerm_virtual_machine.worker1: Creating...
azurerm_network_interface_security_group_association.kubernetes: Creation complete after 2s [id=/subscriptions/e9c93904-c316-4f60-a1b3-fc5ae575878f/resourceGroups/devops-rg/providers/Microsoft.Network/networkInterfaces/kubernetes-nic]
azurerm_network_interface_security_group_association.worker1: Creation complete after 1s [id=/subscriptions/e9c93904-c316-4f60-a1b3-fc5ae575878f/resourceGroups/devops-rg/providers/Microsoft.Network/networkInterfaces/worker1-nic]
azurerm_virtual_machine.jenkins: Still creating... [10s elapsed]
azurerm_virtual_machine.worker2: Still creating... [10s elapsed]
azurerm_virtual_machine.kubernetes: Still creating... [10s elapsed]
azurerm_virtual_machine.worker1: Still creating... [10s elapsed]
azurerm_virtual_machine.jenkins: Still creating... [20s elapsed]
azurerm_virtual_machine.worker2: Still creating... [20s elapsed]
azurerm_virtual_machine.kubernetes: Still creating... [20s elapsed]
azurerm_virtual_machine.worker1: Still creating... [20s elapsed]
azurerm_virtual_machine.jenkins: Still creating... [30s elapsed]
azurerm_virtual_machine.worker2: Still creating... [30s elapsed]
azurerm_virtual_machine.kubernetes: Still creating... [31s elapsed]
azurerm_virtual_machine.worker1: Still creating... [30s elapsed]
azurerm_virtual_machine.jenkins: Still creating... [40s elapsed]
azurerm_virtual_machine.worker2: Still creating... [40s elapsed]
azurerm_virtual_machine.kubernetes: Still creating... [41s elapsed]
azurerm_virtual_machine.worker1: Still creating... [40s elapsed]
azurerm_virtual_machine.jenkins: Still creating... [50s elapsed]
azurerm_virtual_machine.worker2: Still creating... [50s elapsed]
azurerm_virtual_machine.kubernetes: Creation complete after 52s [id=/subscriptions/e9c93904-c316-4f60-a1b3-fc5ae575878f/resourceGroups/devops-rg/providers/Microsoft.Compute/virtualMachines/Jenkins]
azurerm_virtual_machine.jenkins: Creation complete after 50s [id=/subscriptions/e9c93904-c316-4f60-a1b3-fc5ae575878f/resourceGroups/devops-rg/providers/Microsoft.Compute/virtualMachines/Kubernetes]
azurerm_virtual_machine.worker2: Creation complete after 51s [id=/subscriptions/e9c93904-c316-4f60-a1b3-fc5ae575878f/resourceGroups/devops-rg/providers/Microsoft.Compute/virtualMachines/Worker2]
azurerm_virtual_machine.worker1: Creation complete after 48s [id=/subscriptions/e9c93904-c316-4f60-a1b3-fc5ae575878f/resourceGroups/devops-rg/providers/Microsoft.Compute/virtualMachines/Worker1]

```

Apply complete! Resources: 21 added, 0 changed, 0 destroyed.

Overlaid on the terminal is an Azure portal window showing the 'Resources' tab for the 'devops-rg' resource group. It displays a table with 3 resources:

Name	Type	Location
Jenkins	Microsoft.Compute/virtualMachines	West Europe
Kubernetes	Microsoft.Compute/virtualMachines	West Europe
Worker1	Microsoft.Compute/virtualMachines	West Europe

All VMs are created.

Microsoft Azure portal (PWA) - Virtual machines - Microsoft Azure

Microsoft Azure Search resources, services, and docs (G+)

Home > Virtual machines

Default Directory (dhavalgajjarlive.onmicrosoft.com)

+ Create Switch to classic Reservations Manage view Refresh Export to CSV Open query Assign tags

Filter for any field... Subscription equals all Type equals all Resource group equals all Location equals all Add filter

No grouping List view

<input type="checkbox"/>	Name ↑↓	Type ↑↓	Subscription ↑↓	Resource group ↑↓	Location ↑↓	Status ↑↓	Operating sys
<input type="checkbox"/>	Jenkins	Virtual machine	Azure Pass - Sponsors...	devops-rg	West Europe	Running	Linux
<input type="checkbox"/>	Kubernetes	Virtual machine	Azure Pass - Sponsors...	devops-rg	West Europe	Running	Linux
<input type="checkbox"/>	Worker1	Virtual machine	Azure Pass - Sponsors...	devops-rg	West Europe	Running	Linux
<input type="checkbox"/>	Worker2	Virtual machine	Azure Pass - Sponsors...	devops-rg	West Europe	Running	Linux

< Previous Page 1 of 1 Next > Showing 1 to 4 of 4 records. Give feedback

Install ansible.

```
$ sudo apt-get update
```

```
$ sudo apt install software-properties-common aptitude -y
```

```
$ sudo add-apt-repository --yes --update ppa:ansible/ansible
```

```
$ sudo aptitude install ansible -y
```

```
azureuser@jenkins: ~
$ cat www[001:004].example.com
# Ex 1: A collection of database servers in the 'dbservers' group:
# [dbservers]
#
# db01.intranet.mpldowm10.net
# db02.intranet.mpldowm10.net
# 10.23.1.56
# 10.23.1.57
#
# Here's another example of host ranges, this time there are no
# leading 0s:
# db-[00-10]-node.example.com
[jenkins]
127.0.0.1
[kubernetes]
10.0.9.6
[worker1]
10.0.9.7
[worker2]
10.0.9.5
-- INSERT --
51,9 Bot
```



Using ansible-playbook setup jenkins machine softwares.

```
---
- name: Jenkins server
  hosts: jenkins
  remote_user: root
  tasks:
    - name: Install JDK 11
      apt:
        name: openjdk-11-jdk
        update_cache: true
    - name: Get Jenkins Keyrings
      get_url:
        url: https://pkg.jenkins.io/debian-stable/jenkins.io.key
        dest: /usr/share/keyrings/jenkins-keyring.asc
    - name: Configure Jenkins Repository
      apt_repository:
        repo: deb [signed-by=/usr/share/keyrings/jenkins-keyring.asc]
https://pkg.jenkins.io/debian-stable binary/
        state: present
    - name: Install Jenkins
      apt:
        name: jenkins
        update_cache: true
    - name: Start Jenkins
      systemd:
        name: jenkins
        enabled: true
        masked: no
        daemon_reload: yes
```

Using ansible-playbook setup kubernetes machine softwares.

```
---
- name: Kubernetes server
  hosts: kubernetes
  remote_user: root
  tasks:
    - name: Install JDK 11
      apt:
        name: openjdk-11-jdk
        update_cache: true
    - name: Install prerequisites for Docker
      apt:
        pkg:
          - ca-certificates
          - curl
          - gnupg
          - lsb-release
    - name: Get Docker GPG Keyrings
      shell: curl -fsSL https://download.docker.com/linux/ubuntu/gpg | gpg --dearmor -o
/usr/share/keyrings/docker.gpg
    - name: Setup Docker Repository
```

```
    shell: echo "deb [arch=$(dpkg --print-architecture) signed-
by=/usr/share/keyrings/docker.gpg] https://download.docker.com/linux/ubuntu $(lsb_release
-cs) stable" | tee /etc/apt/sources.list.d/docker.list > /dev/null
- name: Install Docker
  apt:
    pkg:
      - docker-ce
      - docker-ce-cli
      - containerd.io
      - docker-compose-plugin
    update_cache: true
- name: Start Docker
  systemd:
    name: docker
    enabled: true
    masked: no
    daemon_reload: yes
- name: Install prerequisites for Kubernetes
  apt:
    pkg:
      - ca-certificates
      - curl
      - apt-transport-https
- name: Get Kubernetes GPG Keyrings
  shell: curl -fsSL https://packages.cloud.google.com/apt/doc/apt-key.gpg | gpg --
dearmor -o /usr/share/keyrings/kubernetes.gpg
- name: Setup Kubernetes Repository
  shell: echo "deb [signed-by=/usr/share/keyrings/kubernetes.gpg]
https://apt.kubernetes.io/ kubernetes-xenial main" | tee
/etc/apt/sources.list.d/kubernetes.list > /dev/null
- name: Install Kubernetes
  apt:
    pkg:
      - kubelet
      - kubeadm
      - kubectl
    update_cache: true
```

```
azureuser@jenkins: ~$ ansible-playbook kubernetes.yaml

PLAY [Kubernetes server] *****

TASK [Gathering Facts] *****
The authenticity of host '10.0.9.6 (10.0.9.6)' can't be established.
ECDSA key fingerprint is SHA256:M7zOqbM/kVA87zleWL/oWodFn9qtWx7oyhjQFNe9TXo.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
ok: [10.0.9.6]

TASK [Install JDK 11] *****
changed: [10.0.9.6]

TASK [Install prerequisites for Docker] *****
ok: [10.0.9.6]

TASK [Get Docker GPG Keyrings] *****
changed: [10.0.9.6]

TASK [Setup Docker Repository] *****
changed: [10.0.9.6]

TASK [Install Docker] *****
changed: [10.0.9.6]

TASK [Start Docker] *****
ok: [10.0.9.6]

TASK [Install prerequisites for Kubernetes] *****
changed: [10.0.9.6]

TASK [Get Kubernetes GPG Keyrings] *****
changed: [10.0.9.6]

TASK [Setup Kubernetes Repository] *****
changed: [10.0.9.6]

TASK [Install Kubernetes] *****
changed: [10.0.9.6]

PLAY RECAP *****
10.0.9.6      : ok=11  changed=8  unreachable=0  failed=0
kipped=0     rescued=0  ignored=0

azureuser@jenkins:~$
```

Using ansible-playbook setup worker1 machine softwares.

```
---
- name: Worker1 server
  hosts: worker1
  remote_user: root
  tasks:
    - name: Install prerequisites for Docker
      apt:
        pkg:
          - ca-certificates
          - curl
          - gnupg
          - lsb-release
    - name: Get Docker GPG Keyrings
      shell: curl -fsSL https://download.docker.com/linux/ubuntu/gpg | gpg --dearmor -o /usr/share/keyrings/docker.gpg
    - name: Setup Docker Repository
      shell: echo "deb [arch=$(dpkg --print-architecture) signed-by=/usr/share/keyrings/docker.gpg] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable" | tee /etc/apt/sources.list.d/docker.list > /dev/null
```

```
- name: Install Docker
  apt:
    pkg:
      - docker-ce
      - docker-ce-cli
      - containerd.io
      - docker-compose-plugin
    update_cache: true
- name: Start Docker
  systemd:
    name: docker
    enabled: true
    masked: no
    daemon_reload: yes
- name: Install prerequisites for Kubernetes
  apt:
    pkg:
      - ca-certificates
      - curl
      - apt-transport-https
- name: Get Kubernetes GPG Keyrings
  shell: curl -fsSL https://packages.cloud.google.com/apt/doc/apt-key.gpg | gpg --
dearmor -o /usr/share/keyrings/kubernetes.gpg
- name: Setup Kubernetes Repository
  shell: echo "deb [signed-by=/usr/share/keyrings/kubernetes.gpg]
https://apt.kubernetes.io/ kubernetes-xenial main" | tee
/etc/apt/sources.list.d/kubernetes.list > /dev/null
- name: Install Kubernetes
  apt:
    pkg:
      - kubelet
      - kubeadm
      - kubectl
    update_cache: true
```

```
azureuser@jenkins: ~  
azureuser@jenkins:~$ ansible-playbook worker1.yaml  
  
PLAY [Worker1 server] *****  
*  
  
TASK [Gathering Facts] *****  
*  
The authenticity of host '10.0.9.7 (10.0.9.7)' can't be established.  
ECDSA key fingerprint is SHA256:4qHeBYJP2lsUjAIOyxXd2EmZ+fJ0I9/fDZuDHZPwyzM.  
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes  
ok: [10.0.9.7]  
  
TASK [Install prerequisites for Docker] *****  
*  
ok: [10.0.9.7]  
  
TASK [Get Docker GPG Keyrings] *****  
*  
changed: [10.0.9.7]  
  
TASK [Setup Docker Repository] *****  
*  
changed: [10.0.9.7]  
  
TASK [Install Docker] *****  
*  
changed: [10.0.9.7]  
  
TASK [Start Docker] *****  
*  
ok: [10.0.9.7]  
  
TASK [Install prerequisites for Kubernetes] *****  
*  
changed: [10.0.9.7]  
  
TASK [Get Kubernetes GPG Keyrings] *****  
*  
changed: [10.0.9.7]  
  
TASK [Setup Kubernetes Repository] *****  
*  
changed: [10.0.9.7]  
  
TASK [Install Kubernetes] *****  
*  
changed: [10.0.9.7]  
  
PLAY RECAP *****  
*  
10.0.9.7 : ok=10 changed=7 unreachable=0 failed=0  
skipped=0 rescued=0 ignored=0  
  
azureuser@jenkins:~$
```

Using ansible-playbook setup worker2 machine softwares.

```
---  
- name: Worker2 server  
  hosts: worker2  
  remote_user: root  
  tasks:  
    - name: Install prerequisites for Docker  
      apt:  
        pkg:  
          - ca-certificates  
          - curl  
          - gnupg  
          - lsb-release  
    - name: Get Docker GPG Keyrings
```

```
    shell: curl -fsSL https://download.docker.com/linux/ubuntu/gpg | gpg --dearmor -o
/usr/share/keyrings/docker.gpg
- name: Setup Docker Repository
    shell: echo "deb [arch=$(dpkg --print-architecture) signed-
by=/usr/share/keyrings/docker.gpg] https://download.docker.com/linux/ubuntu $(lsb_release
-cs) stable" | tee /etc/apt/sources.list.d/docker.list > /dev/null
- name: Install Docker
  apt:
    pkg:
      - docker-ce
      - docker-ce-cli
      - containerd.io
      - docker-compose-plugin
    update_cache: true
- name: Start Docker
  systemd:
    name: docker
    enabled: true
    masked: no
    daemon_reload: yes
- name: Install prerequisites for Kubernetes
  apt:
    pkg:
      - ca-certificates
      - curl
      - apt-transport-https
- name: Get Kubernetes GPG Keyrings
    shell: curl -fsSL https://packages.cloud.google.com/apt/doc/apt-key.gpg | gpg --
dearmor -o /usr/share/keyrings/kubernetes.gpg
- name: Setup Kubernetes Repository
    shell: echo "deb [signed-by=/usr/share/keyrings/kubernetes.gpg]
https://apt.kubernetes.io/ kubernetes-xenial main" | tee
/etc/apt/sources.list.d/kubernetes.list > /dev/null
- name: Install Kubernetes
  apt:
    pkg:
      - kubelet
      - kubeadm
      - kubectl
    update_cache: true
```

azureuser@jenkins: ~

azureuser@jenkins:~\$ ansible-playbook worker2.yaml

PLAY [Worker2 server] \*\*\*\*\*  
\*

TASK [Gathering Facts] \*\*\*\*\*  
\*

The authenticity of host '10.0.9.5 (10.0.9.5)' can't be established.  
ECDSA key fingerprint is SHA256:eOOIL/iYqK+4cURmkUS7VfGpYep2iw6VaxHZNdlzZ9Q.  
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes  
ok: [10.0.9.5]

TASK [Install prerequisites for Docker] \*\*\*\*\*  
\*

ok: [10.0.9.5]

TASK [Get Docker GPG Keyrings] \*\*\*\*\*  
\*

changed: [10.0.9.5]

TASK [Setup Docker Repository] \*\*\*\*\*  
\*

changed: [10.0.9.5]

TASK [Install Docker] \*\*\*\*\*  
\*

changed: [10.0.9.5]

TASK [Start Docker] \*\*\*\*\*  
\*

ok: [10.0.9.5]

TASK [Install prerequisites for Kubernetes] \*\*\*\*\*  
\*

changed: [10.0.9.5]

TASK [Get Kubernetes GPG Keyrings] \*\*\*\*\*  
\*

changed: [10.0.9.5]

TASK [Setup Kubernetes Repository] \*\*\*\*\*  
\*

changed: [10.0.9.5]

TASK [Install Kubernetes] \*\*\*\*\*  
\*

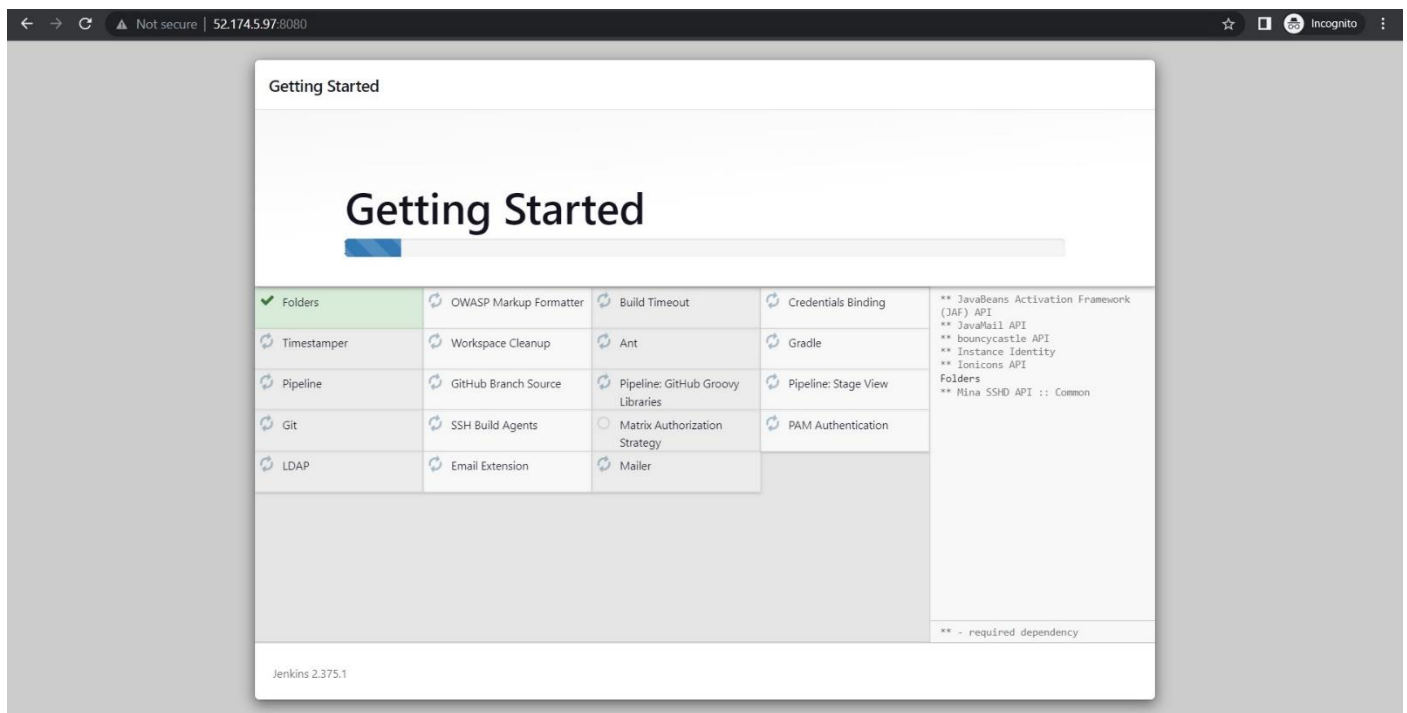
changed: [10.0.9.5]

PLAY RECAP \*\*\*\*\*  
\*

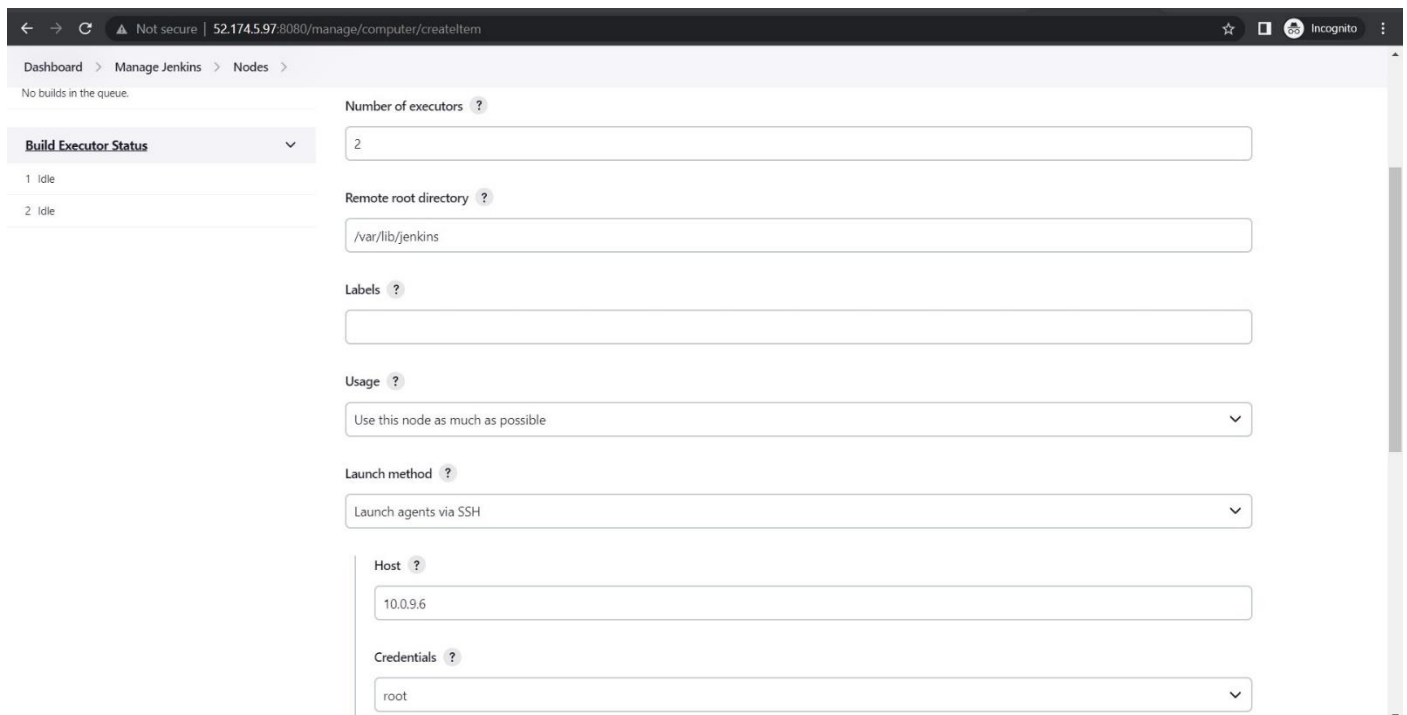
10.0.9.5 : ok=10 changed=7 unreachable=0 failed=0  
skipped=0 rescued=0 ignored=0

azureuser@jenkins:~\$

## Setup the Jenkins.



## Setup new Jenkins node for kubernetes environment.





Make sure nodes are up and online.

Jenkins

Search (CTRL+K)

☆ □ Incognito

🛡️ 1 🔒 Dhaval 🚪 log out

Dashboard > Manage Jenkins > Nodes >

+ New Node

☁ Configure Clouds

⚙ Node Monitoring

Build Queue

No builds in the queue.

Build Executor Status

Built-In Node

- 1 Idle
- 2 Idle

kubernetes

- 1 Idle
- 2 Idle

Manage nodes and clouds

Refresh status

S	Name ↓	Architecture	Clock Difference	Free Disk Space	Free Swap Space	Free Temp Space	Response Time
🖥	Built-In Node	Linux (amd64)	In sync	25.21 GB	❗ 0 B	25.21 GB	0ms ⚙
🖥	kubernetes	Linux (amd64)	In sync	25.46 GB	❗ 0 B	25.46 GB	79ms ⚙
	last checked	6.6 sec	6.6 sec	6.6 sec	6.6 sec	6.6 sec	6.6 sec

REST APIJenkins 2.375.1

Setup the initial commit to GitHub repository in the master branch.

```
D:\Azure\DevOps\Project 2\website>git init
Initialized empty Git repository in D:/Azure/DevOps/Project 2/website/.git/
```

```
D:\Azure\DevOps\Project 2\website (master)>git add -A
```

```
D:\Azure\DevOps\Project 2\website (master)>git commit -m "Initial Commit"
[master (root-commit) 3b9cb3c] Initial Commit
 2 files changed, 8 insertions(+)
 create mode 100644 images/github3.jpg
 create mode 100644 index.html
```

```
D:\Azure\DevOps\Project 2\website (master)>git remote add origin https://github.com/dhavalgajjarin/devops-proj-2.git
```

```
D:\Azure\DevOps\Project 2\website (master)>git push -u origin master
git: 'push' is not a git command. See 'git --help'.
```

The most similar command is

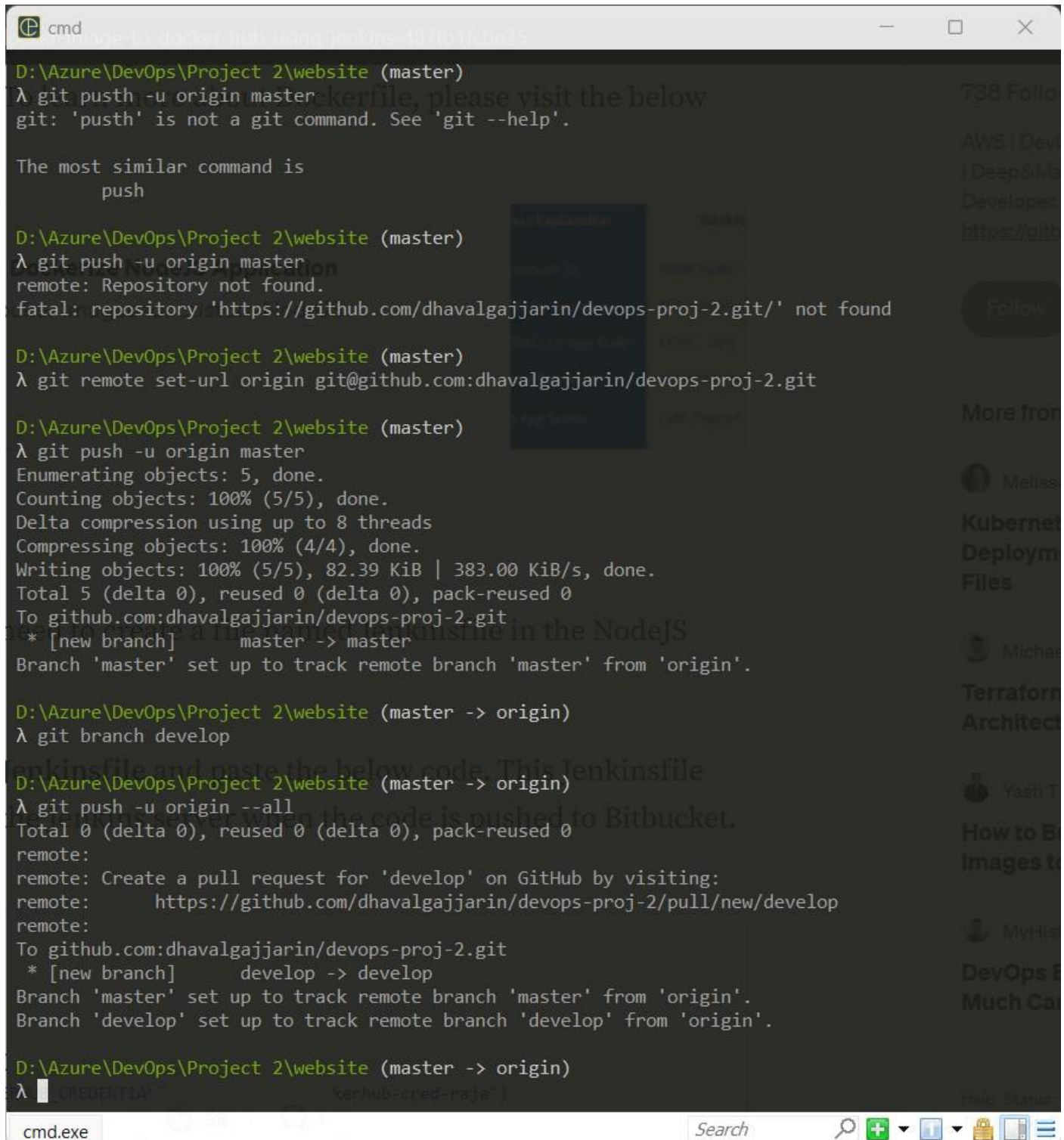
push

```
D:\Azure\DevOps\Project 2\website (master)>git push -u origin master
remote: Repository not found.
fatal: repository 'https://github.com/dhavalgajjarin/devops-proj-2.git/' not found
```

```
D:\Azure\DevOps\Project 2\website (master)>git remote set-url origin git@github.com:dhavalgajjarin/devops-proj-2.git
```

```
D:\Azure\DevOps\Project 2\website (master)>git push -u origin master
Enumerating objects: 5, done.
Counting objects: 100% (5/5), done.
Delta compression using up to 8 threads
Compressing objects: 100% (4/4), done.
Writing objects: 100% (5/5), 82.39 KiB | 383.00 KiB/s, done.
Total 5 (delta 0), reused 0 (delta 0), pack-reused 0
To github.com:dhavalgajjarin/devops-proj-2.git
 * [new branch]      master -> master
Branch 'master' set up to track remote branch 'master' from 'origin'.
```

Create GitHub workflow with creating develop branch.



```
D:\Azure\DevOps\Project 2\website (master)
λ git push -u origin master
git: 'push' is not a git command. See 'git --help'.

The most similar command is
    push

D:\Azure\DevOps\Project 2\website (master)
λ git push -u origin master
remote: Repository not found.
fatal: repository 'https://github.com/dhavalgajjarin/devops-proj-2.git/' not found

D:\Azure\DevOps\Project 2\website (master)
λ git remote set-url origin git@github.com:dhavalgajjarin/devops-proj-2.git

D:\Azure\DevOps\Project 2\website (master)
λ git push -u origin master
Enumerating objects: 5, done.
Counting objects: 100% (5/5), done.
Delta compression using up to 8 threads
Compressing objects: 100% (4/4), done.
Writing objects: 100% (5/5), 82.39 KiB | 383.00 KiB/s, done.
Total 5 (delta 0), reused 0 (delta 0), pack-reused 0
To github.com:dhavalgajjarin/devops-proj-2.git
 * [new branch]      master -> master
Branch 'master' set up to track remote branch 'master' from 'origin'.

D:\Azure\DevOps\Project 2\website (master -> origin)
λ git branch develop

D:\Azure\DevOps\Project 2\website (master -> origin)
λ git push -u origin --all
Total 0 (delta 0), reused 0 (delta 0), pack-reused 0
remote:
remote: Create a pull request for 'develop' on GitHub by visiting:
remote:   https://github.com/dhavalgajjarin/devops-proj-2/pull/new/develop
remote:
To github.com:dhavalgajjarin/devops-proj-2.git
 * [new branch]      develop -> develop
Branch 'master' set up to track remote branch 'master' from 'origin'.
Branch 'develop' set up to track remote branch 'develop' from 'origin'.

D:\Azure\DevOps\Project 2\website (master -> origin)
λ
```



Setup the Kubernetes cluster.

```
azureuser@kubernetes: ~  
azureuser@kubernetes:~$ sudo kubeadm init --pod-network-cidr=10.244.0.0/16  
[init] Using Kubernetes version: v1.26.0  
[preflight] Running pre-flight checks  
[preflight] Pulling images required for setting up a Kubernetes cluster  
[preflight] This might take a minute or two, depending on the speed of your internet connection  
[preflight] You can also perform this action in beforehand using 'kubeadm config images pull'  
[certs] Using certificateDir folder "/etc/kubernetes/pki"  
[certs] Generating "ca" certificate and key  
[certs] Generating "apiserver" certificate and key  
[certs] apiserver serving cert is signed for DNS names [kubernetes kubernetes.default kubernetes.default.svc kubernetes.default.svc.cluster.local] and IPs [10.96.0.1 10.0.9.6]  
[certs] Generating "apiserver-kubelet-client" certificate and key  
[certs] Generating "front-proxy-ca" certificate and key  
[certs] Generating "front-proxy-client" certificate and key  
[certs] Generating "etcd/ca" certificate and key  
[certs] Generating "etcd/server" certificate and key  
[certs] etcd/server serving cert is signed for DNS names [kubernetes localhost] and IPs [10.0.9.6 127.0.0.1 ::1]  
[certs] Generating "etcd/peer" certificate and key  
[certs] etcd/peer serving cert is signed for DNS names [kubernetes localhost] and IPs [10.0.9.6 127.0.0.1 ::1]  
[certs] Generating "etcd/healthcheck-client" certificate and key  
[certs] Generating "apiserver-etcd-client" certificate and key  
[certs] Generating "sa" key and public key  
[kubeconfig] Using kubeconfig folder "/etc/kubernetes"  
[kubeconfig] Writing "admin.conf" kubeconfig file  
[kubeconfig] Writing "kubelet.conf" kubeconfig file  
[kubeconfig] Writing "controller-manager.conf" kubeconfig file  
[kubeconfig] Writing "scheduler.conf" kubeconfig file  
[kubelet-start] Writing kubelet environment file with flags to file "/var/lib/kubelet/kubeadm-flags.env"  
[kubelet-start] Writing kubelet configuration to file "/var/lib/kubelet/config.yaml"  
[kubelet-start] Starting the kubelet  
[control-plane] Using manifest folder "/etc/kubernetes/manifests"  
[control-plane] Creating static Pod manifest for "kube-apiserver"  
[control-plane] Creating static Pod manifest for "kube-controller-manager"  
[control-plane] Creating static Pod manifest for "kube-scheduler"  
[etcd] Creating static Pod manifest for local etcd in "/etc/kubernetes/manifests"  
[wait-control-plane] Waiting for the kubelet to boot up the control plane as static Pods from directory "/etc/kubernetes/manifests". This can take up to 4m0s  
[apiclient] All control plane components are healthy after 10.001974 seconds  
[upload-config] Storing the configuration used in ConfigMap "kubeadm-config" in the "kube-system" Namespace
```

Join the node and setup the Kubernetes networking.

```
azureuser@kubernetes: ~  
https://kubernetes.io/docs/concepts/cluster-administration/addons/  
Then you can join any number of worker nodes by running the following on each as  
root:  
  
kubeadm join 10.0.9.6:6443 --token 4cssr6.0b7z1i2iye9efow9 \  
--discovery-token-ca-cert-hash sha256:142c4a0cc5c96d3764c2b5003df1a9ae6c  
0e491ad15af93961a8ffa4b40a8969  
azureuser@kubernetes:~$ mkdir -p $HOME/.kube  
azureuser@kubernetes:~$ sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/conf  
ig  
  
azureuser@kubernetes:~$ sudo chown $(id -u):$(id -g) $HOME/.kube/config  
azureuser@kubernetes:~$ kubectl apply -f https://raw.githubusercontent.com/flanne  
l-io/flannel/v0.20.2/Documentation/kube-flannel.yml  
namespace/kube-flannel created  
clusterrole.rbac.authorization.k8s.io/flannel created  
clusterrolebinding.rbac.authorization.k8s.io/flannel created  
serviceaccount/flannel created  
configmap/kube-flannel-cfg created  
daemonset.apps/kube-flannel-ds created  
azureuser@kubernetes:~$ kubectl get nodes  
NAME          STATUS    ROLES          AGE      VERSION  
kubernetes    Ready     control-plane   3m38s    v1.26.0  
azureuser@kubernetes:~$ kubectl get nodes  
NAME          STATUS    ROLES          AGE      VERSION  
kubernetes    Ready     control-plane   5m46s    v1.26.0  
worker1       Ready     <none>          71s      v1.26.0  
worker2       Ready     <none>          19s      v1.26.0  
azureuser@kubernetes:~$
```

Create nodeport service on port 30008.

```
---  
apiVersion: v1  
kind: Service  
metadata:  
  name: devops  
  labels:  
    app: devops  
spec:  
  type: NodePort  
  ports:  
    - port: 80  
      nodePort: 30008  
      name: http  
  selector:  
    app: devops
```

```
azureuser@kubernetes: ~  
13 updates can be applied immediately.  
13 of these updates are standard security updates.  
To see these additional updates run: apt list --upgradable  
  
New release '22.04.1 LTS' available.  
Run 'do-release-upgrade' to upgrade to it.  
  
Last login: Thu Dec 15 17:31:15 2022 from 49.206.36.205  
azureuser@kubernetes:~$ kubectl get nodes  
NAME           STATUS    ROLES           AGE      VERSION  
kubernetes     Ready    control-plane   2d18h    v1.26.0  
worker1        Ready    <none>          2d18h    v1.26.0  
worker2        Ready    <none>          2d18h    v1.26.0  
azureuser@kubernetes:~$ envsubst  
^C  
azureuser@kubernetes:~$ vi nodeport.yaml  
azureuser@kubernetes:~$ kubectl create -f nodeport.yaml  
service/devops created  
azureuser@kubernetes:~$ kubectl get svc  
NAME           TYPE           CLUSTER-IP     EXTERNAL-IP    PORT(S)          AGE  
devops          NodePort       10.97.148.98    <none>         80:30008/TCP     16s  
kubernetes     ClusterIP      10.96.0.1      <none>         443/TCP          2d18h  
azureuser@kubernetes:~$
```

Create Jenkins pipeline script job with Jenkinsfile.

Dashboard > DevOps > Configuration

### Configure

- General
- Advanced Project Options
- Pipeline**

**Pipeline**

Definition  
Pipeline script from SCM

SCM ?  
Git

Repositories ?

Repository URL ?

Credentials ?

[+ Add](#)

[Advanced...](#)

[Add Repository](#)

[Save](#) [Apply](#)

← → ↻ Not secure | 13.80.151.136:8080/job/devops/configure

Dashboard > DevOps > Configuration

## Configure

- General
- Advanced Project Options
- Pipeline**

Add Repository

Branches to build ?

Branch Specifier (blank for 'any') ?

\*/master

Add Branch

Repository browser ?

(Auto)

Additional Behaviours

Add

Script Path ?

Jenkinsfile

☒ Lightweight checkout ?

Save Apply

```
properties([pipelineTriggers([githubPush()])])

pipeline {
    agent {
        label 'kubernetes'
    }

    environment {
        DOCKERHUB_CREDENTIALS=credentials('Docker')
        REPOSITORY_TAG="dhavalgajjarin/devops:v${BUILD_NUMBER}"
    }

    stages {
        stage('Docker Build') {
            steps {
                sh 'docker build -t ${REPOSITORY_TAG} .'
            }
        }
        stage('Docker Login') {
            steps {
                sh 'echo $DOCKERHUB_CREDENTIALS_PSW | docker login -u $DOCKERHUB_CREDENTIALS_USR --password-stdin'
            }
        }
        stage('Docker Push') {
            steps {
                sh 'docker push ${REPOSITORY_TAG}'
            }
        }
        stage('Deploy to Kubernetes') {
            steps {
                sh 'envsubst < ${WORKSPACE}/deploy.yaml | kubectl apply -f -'
            }
        }
    }
}
```



```
}  
}
```

Use deploy.yaml file to deploy latest release to Kubernetes

```
---  
apiVersion: apps/v1  
kind: Deployment  
metadata:  
  name: devops  
  labels:  
    app: devops  
spec:  
  replicas: 2  
  selector:  
    matchLabels:  
      app: devops  
  template:  
    metadata:  
      labels:  
        app: devops  
    spec:  
      containers:  
        - name: devops  
          image: $REPOSITORY_TAG  
          ports:  
            - containerPort: 80
```

On git commit Jenkins will start a new build and deploy.

The screenshot shows the Jenkins web interface. The left sidebar contains navigation links: Status, Changes, Console Output (selected), View as plain text, Edit Build Information, Delete build '#7', Polling Log, Timings, Git Build Data, Restart from Stage, Replay, Pipeline Steps, Workspaces, and Previous Build. The main area is titled 'Console Output' with a green checkmark icon. The output text shows the build process starting with a GitHub push, obtaining the Jenkinsfile, and running on a Kubernetes node. It details the checkout of a specific revision, the commit message 'Removed kubernetes export', and the execution of various git commands to fetch, parse, and checkout the code. The build is currently in the 'Checkout' stage.

```
Started by Github push by dhavalgajjarin  
Obtained Jenkinsfile from git https://github.com/dhavalgajjarin/devops-proj-2.git  
[Pipeline] Start of Pipeline  
[Pipeline] properties  
[Pipeline] node  
Running on kubernetes in /var/lib/jenkins/workspace/devops  
[Pipeline] {  
[Pipeline] stage  
[Pipeline] { (Declarative: Checkout SCM)  
[Pipeline] checkout  
Selected Git installation does not exist. Using Default  
The recommended git tool is: NONE  
using credential Github  
Fetching changes from the remote Git repository  
Checking out Revision ebc3b661c3a05aac7c62c3e14ed96af89205c7ef (refs/remotes/origin/master)  
Commit message: "Removed kubernetes export"  
> git rev-parse --resolve-git-dir /var/lib/jenkins/workspace/devops/.git # timeout=10  
> git config remote.origin.url https://github.com/dhavalgajjarin/devops-proj-2.git # timeout=10  
Fetching upstream changes from https://github.com/dhavalgajjarin/devops-proj-2.git  
> git --version # timeout=10  
> git --version # 'git version 2.25.1'  
using GIT_ASKPASS to set credentials  
> git fetch --tags --force --progress -- https://github.com/dhavalgajjarin/devops-proj-2.git +refs/heads/*:refs/remotes/origin/* # timeout=10  
> git rev-parse refs/remotes/origin/master^{commit} # timeout=10  
> git config core.sparsecheckout # timeout=10  
> git checkout -f ebc3b661c3a05aac7c62c3e14ed96af89205c7ef # timeout=10  
> git rev-list --no-walk 4eaa376ace8a09c4907a98a072be66c9df8e50c2 # timeout=10  
[Pipeline] }
```



```
[Pipeline] sh
+ docker push dhavalgajjarin/devops:v7
The push refers to repository [docker.io/dhavalgajjarin/devops]
197f65f3c0fb: Preparing
dc44ed21c951: Preparing
5f0b2fe0f8eb: Preparing
6515074984c6: Preparing
dc44ed21c951: Layer already exists
6515074984c6: Layer already exists
5f0b2fe0f8eb: Layer already exists
197f65f3c0fb: Pushed
v7: digest: sha256:17c2ff2a8fcb93002ab7da00fc82974225d3b72277beadb6c4b8eafbd4321a0 size: 1163
[Pipeline] }
[Pipeline] // stage
[Pipeline] stage
[Pipeline] { (Deploy to Kubernetes)
[Pipeline] sh
+ envsubst
+ kubectl apply -f -
deployment.apps/devops configured
[Pipeline] }
[Pipeline] // stage
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] }
[Pipeline] // withCredentials
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] }
[Pipeline] // node
[Pipeline] End of Pipeline
Finished: SUCCESS
```

You can see build steps in pipeline view.

Jenkins

Search (CTRL+K)

Dhaval

log out

Dashboard > DevOps >

Status

Changes

Build Now

Configure

Delete Pipeline

Full Stage View

Rename

Pipeline Syntax

GitHub Hook Log

Build History

trend

Filter builds...

#7 18 Dec 2022, 20:36 IST

Pipeline DevOps

Project name: devops

Add description

Disable Project

Stage View

Average stage times:  
(Average full run time: ~12s)

	Declarative: Checkout SCM	Docker Build	Docker Login	Docker Push	Deploy to Kubernetes
#7 Dec 18 15:06 1 commit	2s	12s	1s	4s	542ms
#6 Dec 18 15:03 No Changes	1s	4s	1s	6s	544ms
	686ms	403ms	1s	Success Logs	981ms

Check the nodeport after deployment its working.

```
azureuser@kubernetes: ~  
azureuser@kubernetes:~$ kubectl get po  
NAME                                READY   STATUS    RESTARTS   AGE  
devops-6475946fd7-bn596             1/1     Running   0           49s  
devops-6475946fd7-qg5d4             1/1     Running   0           45s  
azureuser@kubernetes:~$ wget localhost:30008  
--2022-12-18 15:16:16--  http://localhost:30008/  
Resolving localhost (localhost)... 127.0.0.1  
Connecting to localhost (localhost)|127.0.0.1|:30008... connected.  
HTTP request sent, awaiting response... 200 OK  
Length: 185 [text/html]  
Saving to: 'index.html'  
  
index.html      100%[=====>]      185  --.-KB/s    in 0s  
  
2022-12-18 15:16:16 (29.4 MB/s) - 'index.html' saved [185/185]  
  
azureuser@kubernetes:~$ cat index.html  
<html>  
<head>  
<title> Intellipaat </title>  
</head>  
<body style = "background-image:url('images/github3.jpg'); background-size: 100%  
>  
<h2 ALIGN=CENTER>Hello world!</h2>  
</body>  
</html>  
azureuser@kubernetes:~$
```