Hands-on Final Exam	
CPE212-CPE31S2	14/11/2025
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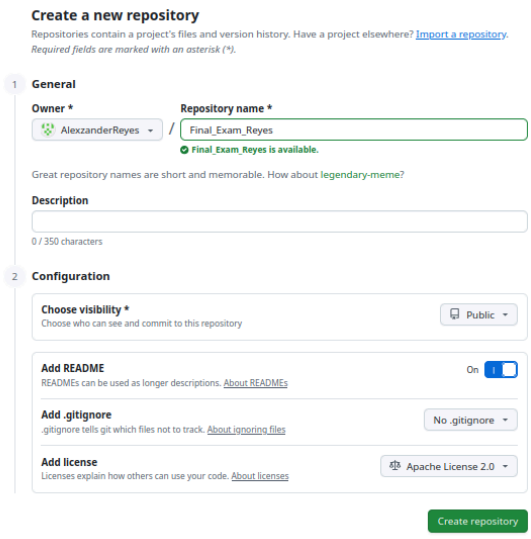
Tools Needed:

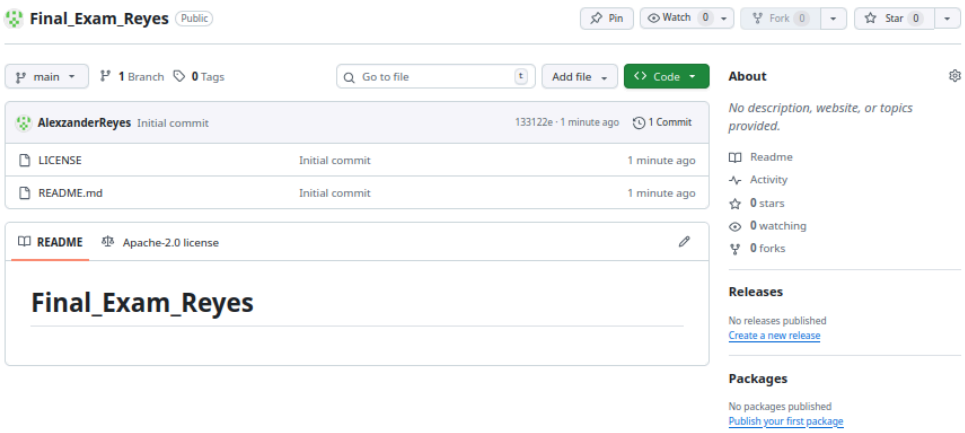
1. VM with Ubuntu, CentOS and Ansible installed

2. Web browser

Procedure:

1. Create a repository and label it as "Final_Exam_Surname"





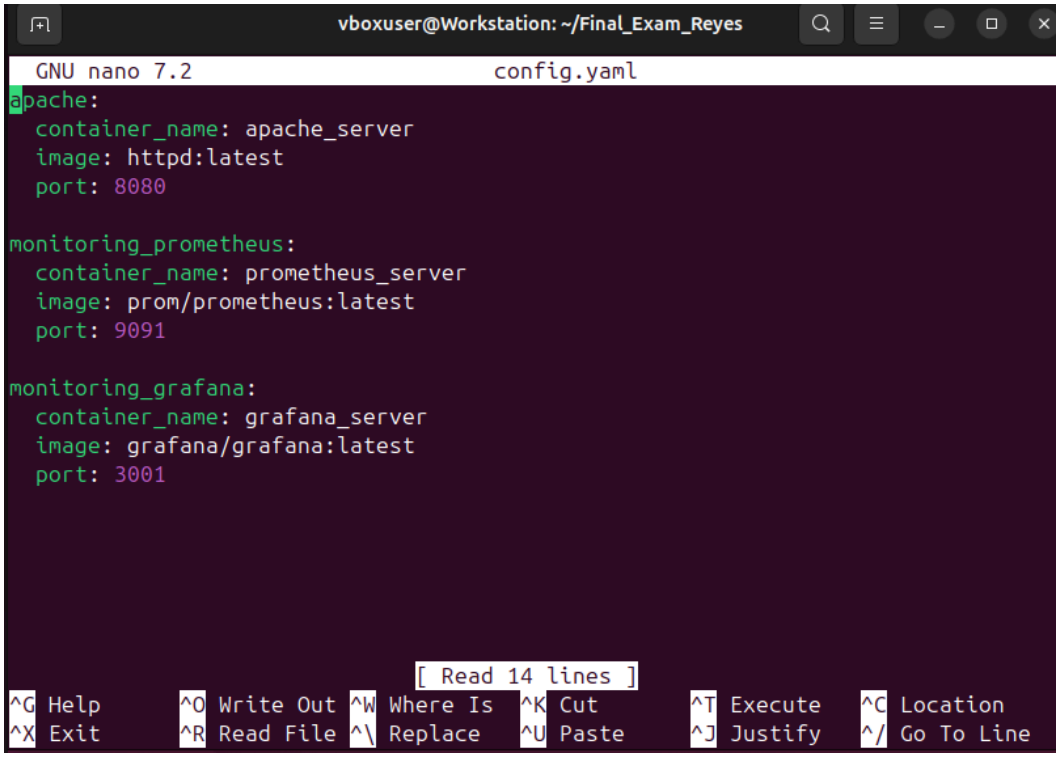
2. Clone your new repository in your VM

```
vboxuser@Workstation:~$ git clone git@github.com:AlexzanderReyes/Final_Exam_Reye
s.git
Cloning into 'Final_Exam_Reyes'...
remote: Enumerating objects: 4, done.
remote: Counting objects: 100% (4/4), done.
remote: Compressing objects: 100% (3/3), done.
Receiving objects: 100% (4/4), 4.76 KiB | 2.38 MiB/s, done.
remote: Total 4 (delta 0), reused 0 (delta 0), pack-reused 0 (from 0)
vboxuser@Workstation:~$ ls
control-node                    Desktop           hosts.ini  Reyes_PrelimExam
CPE212_CONTAINERIZATION         Documents         Music      snap
CPE212_REYES_ALEXZANDER-LAPTOP- Downloads         Pictures   Templates
CPE_MIDEXAM_REYES               Final_Exam_Reyes  Public     Videos
vboxuser@Workstation:~$ cd Final_Exam_Reyes/
vboxuser@Workstation:~/Final_Exam_Reyes$
```

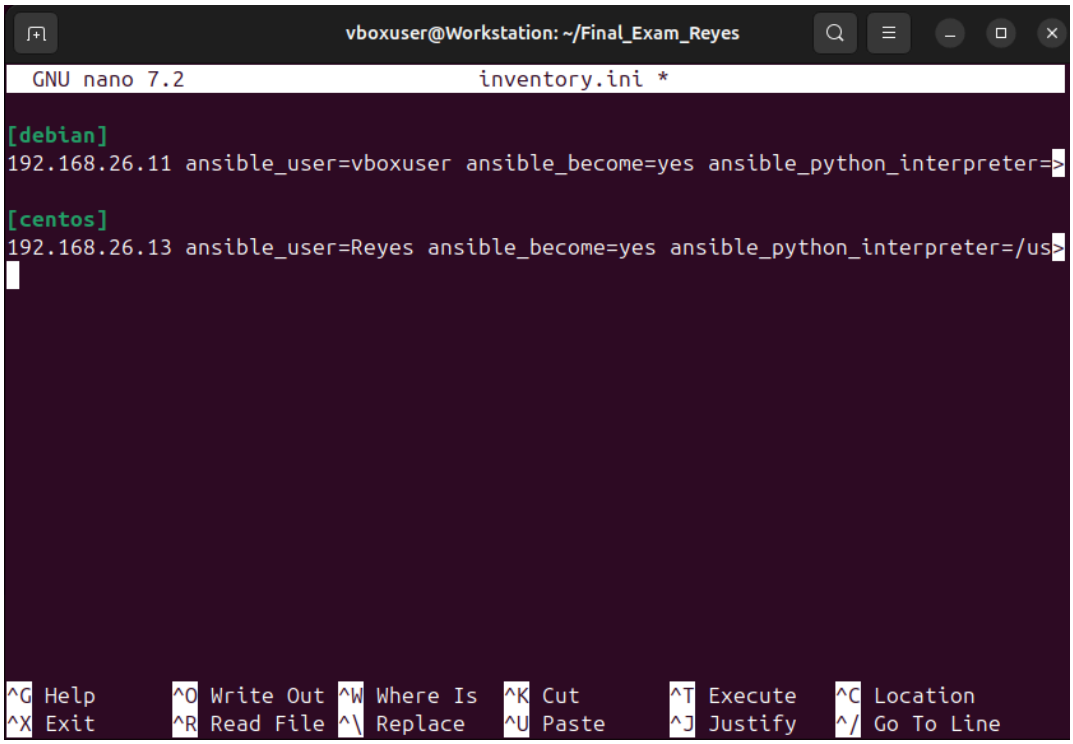
3. Create an Ansible playbook that does the following with an input of a config.yaml file and structure inventory file.

```
vboxuser@Workstation:~/Final_Exam_Reyes$ ls
config.yaml  inventory.ini  LICENSE  playbook.yml  README.md  roles
```

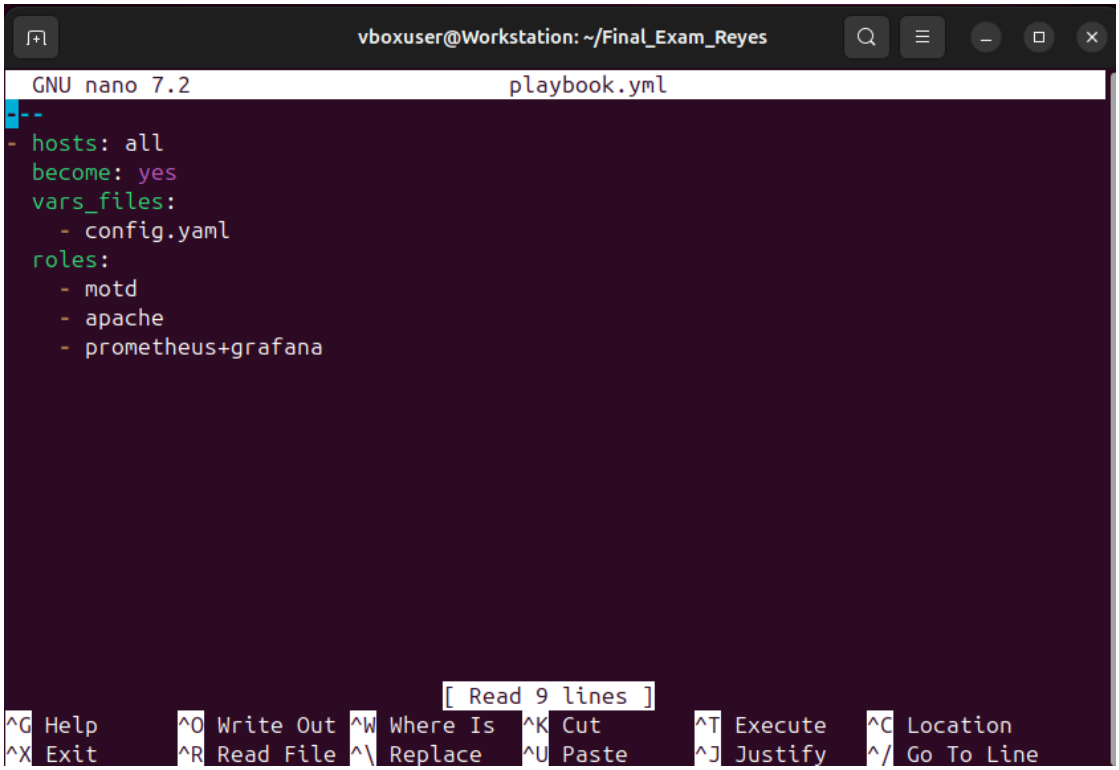
config.yaml



inventory.ini



playbook.yml



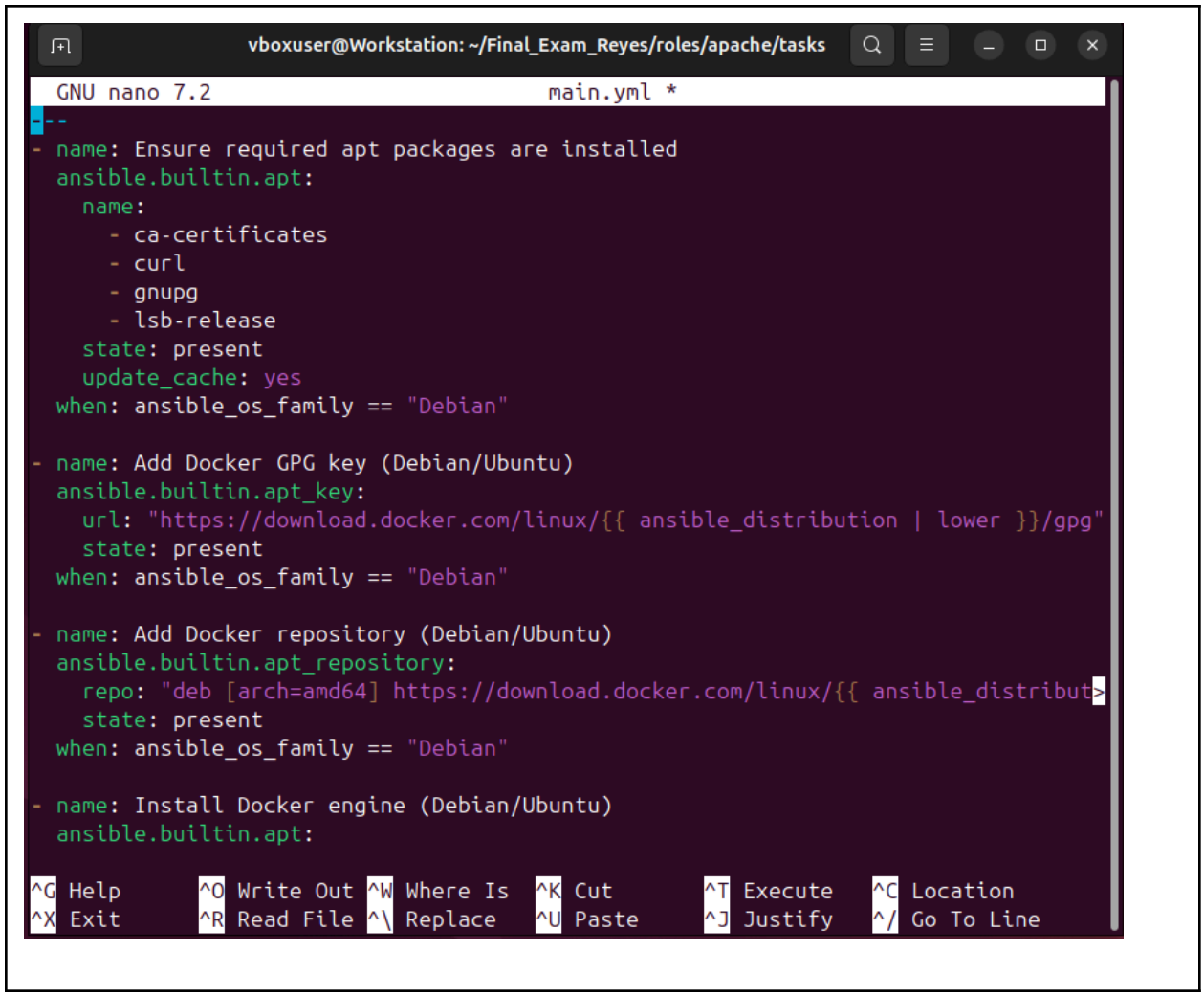
roles (directory)

```
vboxuser@Workstation:~/Final_Exam_Reyes$ ls
config.yaml  inventory.ini  LICENSE  playbook.yml  README.md  roles
vboxuser@Workstation:~/Final_Exam_Reyes$ cd roles
vboxuser@Workstation:~/Final_Exam_Reyes/roles$ ls
apache  motd  prometheus+grafana
```

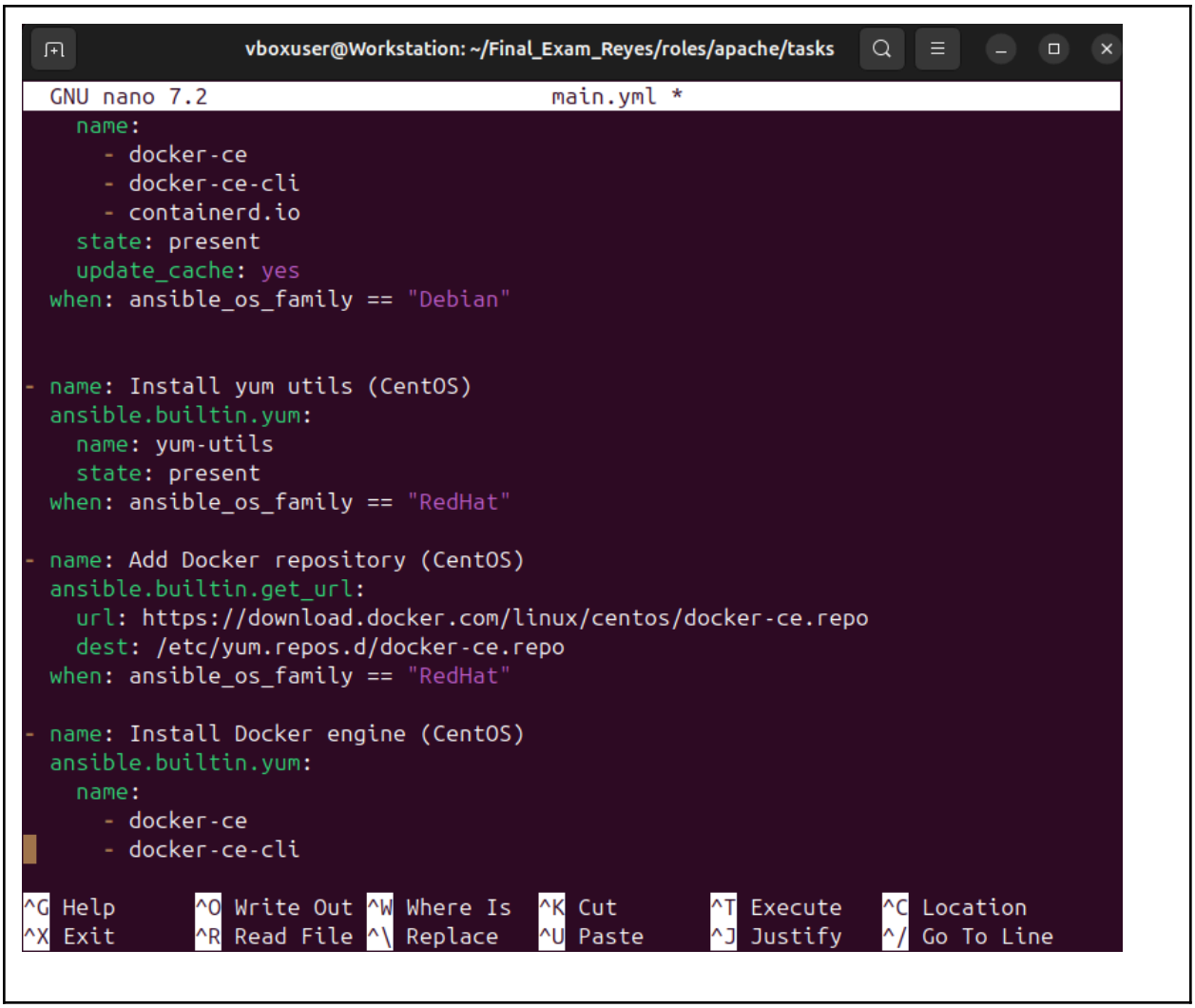
3.1 Install and configure one enterprise service that can be installed in Debian and Centos servers.

APACHE

roles/apache/tasks/main.yml


vboxuser@Workstation: ~/Final_Exam_Reyes/roles/apache/tasks
GNU nano 7.2 main.yml *

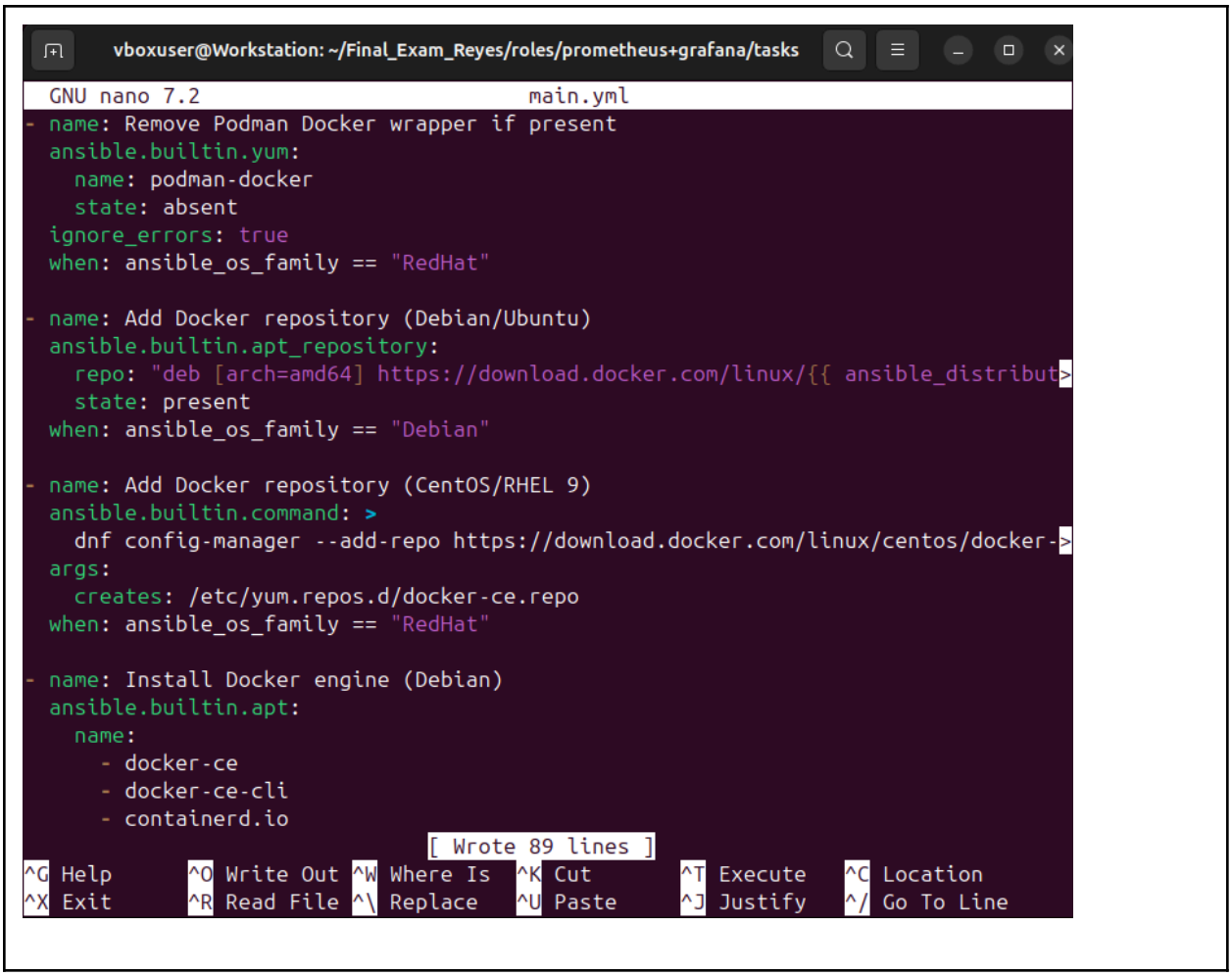
- name: Ensure required apt packages are installed
ansible.builtin.apt:
name:
- ca-certificates
- curl
- gnupg
- lsb-release
state: present
update_cache: yes
when: ansible_os_family == "Debian"
- name: Add Docker GPG key (Debian/Ubuntu)
ansible.builtin.apt_key:
url: "https://download.docker.com/linux/{{ ansible_distribution | lower }}/gpg"
state: present
when: ansible_os_family == "Debian"
- name: Add Docker repository (Debian/Ubuntu)
ansible.builtin.apt_repository:
repo: "deb [arch=amd64] https://download.docker.com/linux/{{ ansible_distribut>
state: present
when: ansible_os_family == "Debian"
- name: Install Docker engine (Debian/Ubuntu)
ansible.builtin.apt:
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^/ Go To Line

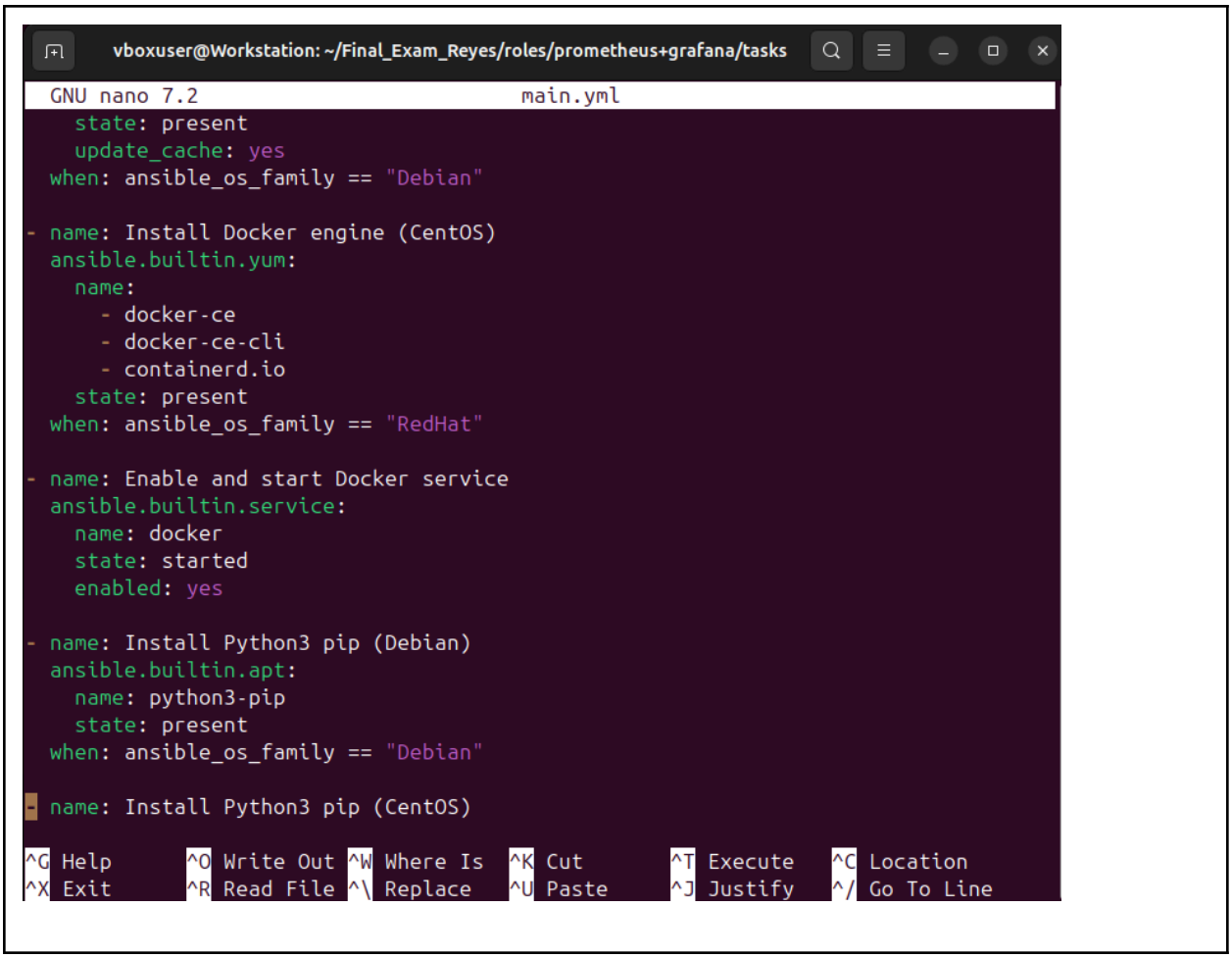

vboxuser@Workstation: ~/Final_Exam_Reyes/roles/apache/tasks
GNU nano 7.2 main.yml *
name:
- docker-ce
- docker-ce-cli
- containerd.io
state: present
update_cache: yes
when: ansible_os_family == "Debian"
- name: Install yum utils (CentOS)
ansible.builtin.yum:
name: yum-utils
state: present
when: ansible_os_family == "RedHat"
- name: Add Docker repository (CentOS)
ansible.builtin.get_url:
url: https://download.docker.com/linux/centos/docker-ce.repo
dest: /etc/yum.repos.d/docker-ce.repo
when: ansible_os_family == "RedHat"
- name: Install Docker engine (CentOS)
ansible.builtin.yum:
name:
- docker-ce
- docker-ce-cli
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^/ Go To Line

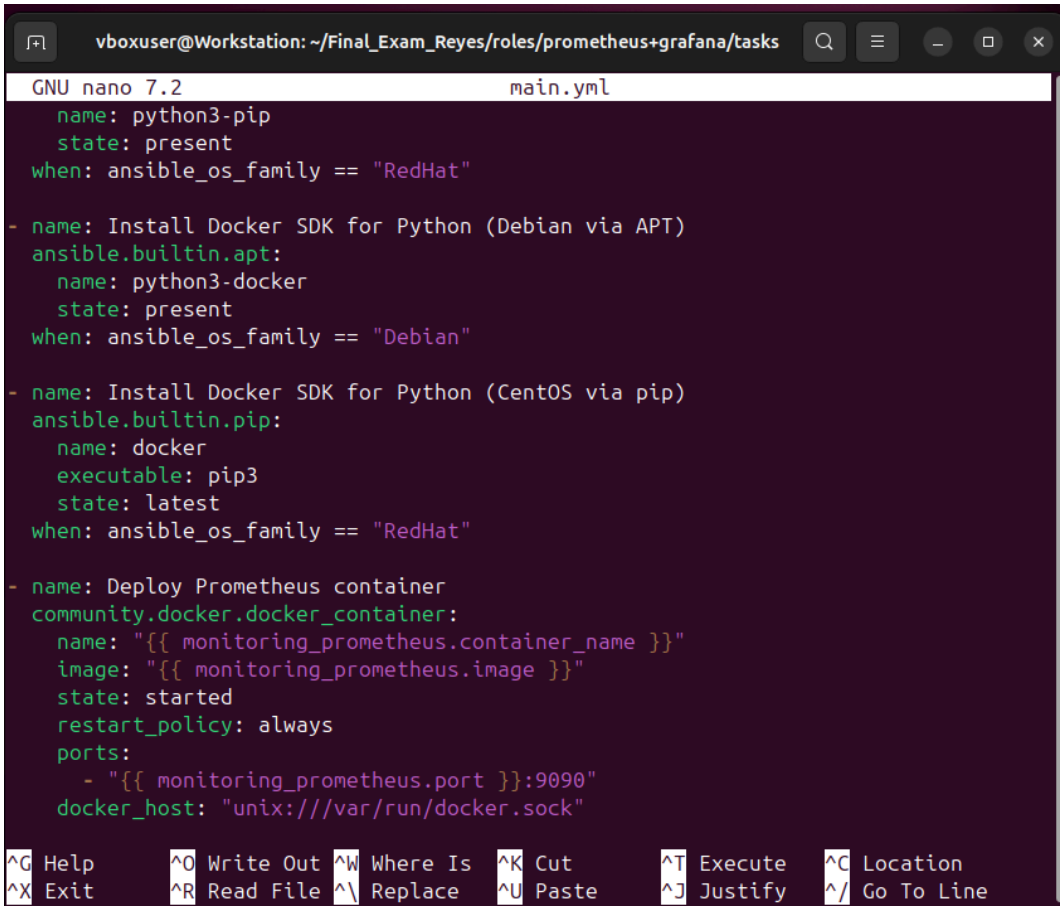
```
      - containerd.io
    state: present
  when: ansible_os_family == "RedHat"

- name: Enable and start Docker service
  ansible.builtin.service:
    name: docker
    state: started
    enabled: yes

- name: Deploy Apache container
  community.docker.docker_container:
    name: "{{ apache.container_name }}"
    image: "{{ apache.image }}"
    state: started
    restart_policy: always
    ports:
      - "{{ apache.port }}:80"
    docker_host: "unix:///var/run/docker.sock"
```

3.2 Install and configure one monitoring tool that can be installed in Debian and Centos servers (if it is a stack there should be option of different host)
PROMETHEUS & GRAFANA

roles/prometheus+grafana/tasks/main.yml


vboxuser@Workstation: ~/Final_Exam_Reyes/roles/prometheus+grafana/tasks
GNU nano 7.2 main.yml
- name: Remove Podman Docker wrapper if present
ansible.builtin.yum:
name: podman-docker
state: absent
ignore_errors: true
when: ansible_os_family == "RedHat"
- name: Add Docker repository (Debian/Ubuntu)
ansible.builtin.apt_repository:
repo: "deb [arch=amd64] https://download.docker.com/linux/{{ ansible_distribut>
state: present
when: ansible_os_family == "Debian"
- name: Add Docker repository (CentOS/RHEL 9)
ansible.builtin.command: >
dnf config-manager --add-repo https://download.docker.com/linux/centos/docker->
args:
creates: /etc/yum.repos.d/docker-ce.repo
when: ansible_os_family == "RedHat"
- name: Install Docker engine (Debian)
ansible.builtin.apt:
name:
- docker-ce
- docker-ce-cli
- containerd.io
[Wrote 89 lines]
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^/ Go To Line

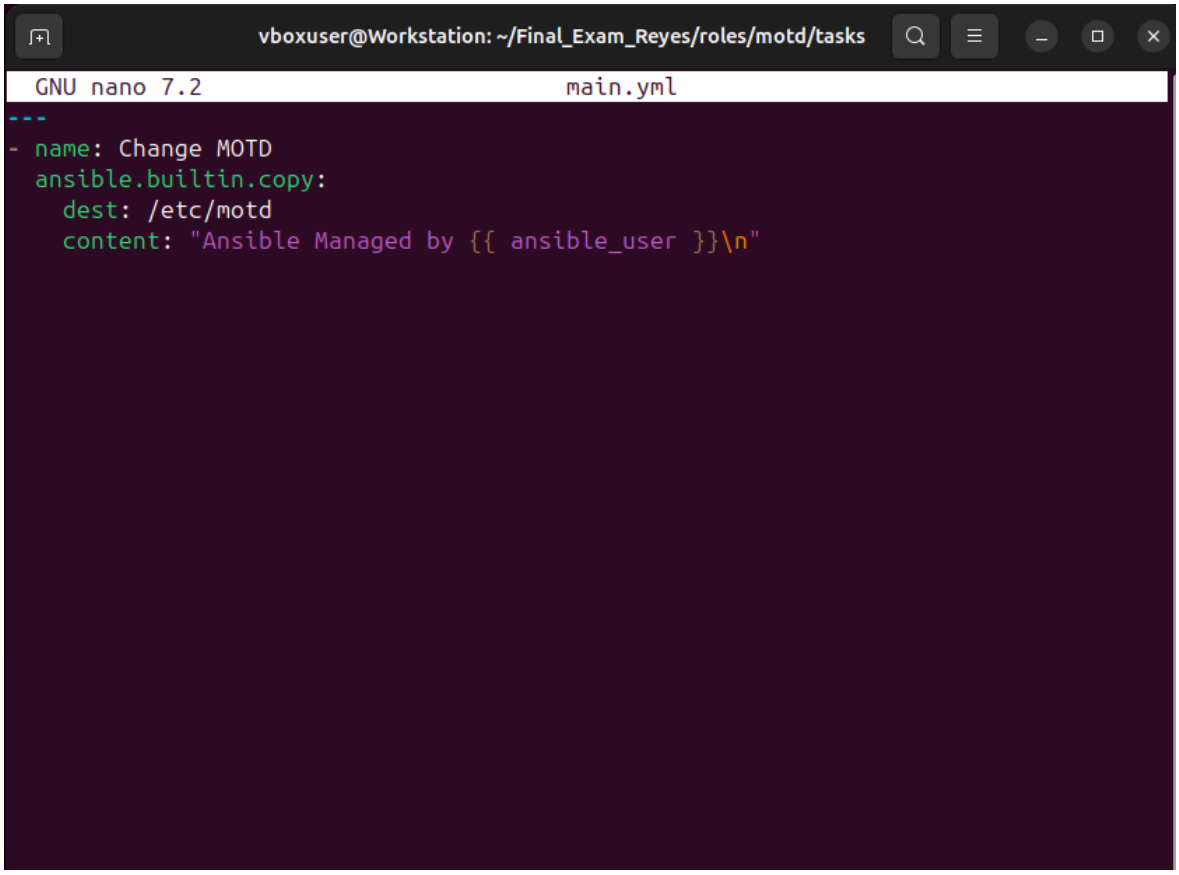

vboxuser@Workstation: ~/Final_Exam_Reyes/roles/prometheus+grafana/tasks
GNU nano 7.2 main.yml
state: present
update_cache: yes
when: ansible_os_family == "Debian"
- name: Install Docker engine (CentOS)
ansible.builtin.yum:
name:
- docker-ce
- docker-ce-cli
- containerd.io
state: present
when: ansible_os_family == "RedHat"
- name: Enable and start Docker service
ansible.builtin.service:
name: docker
state: started
enabled: yes
- name: Install Python3 pip (Debian)
ansible.builtin.apt:
name: python3-pip
state: present
when: ansible_os_family == "Debian"
- name: Install Python3 pip (CentOS)
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^/ Go To Line




```
- name: Deploy Grafana container
  community.docker.docker_container:
    name: "{{ monitoring_grafana.container_name }}"
    image: "{{ monitoring_grafana.image }}"
    state: started
    restart_policy: always
    ports:
      - "{{ monitoring_grafana.port }}:3000"
    docker_host: "unix:///var/run/docker.sock"
```

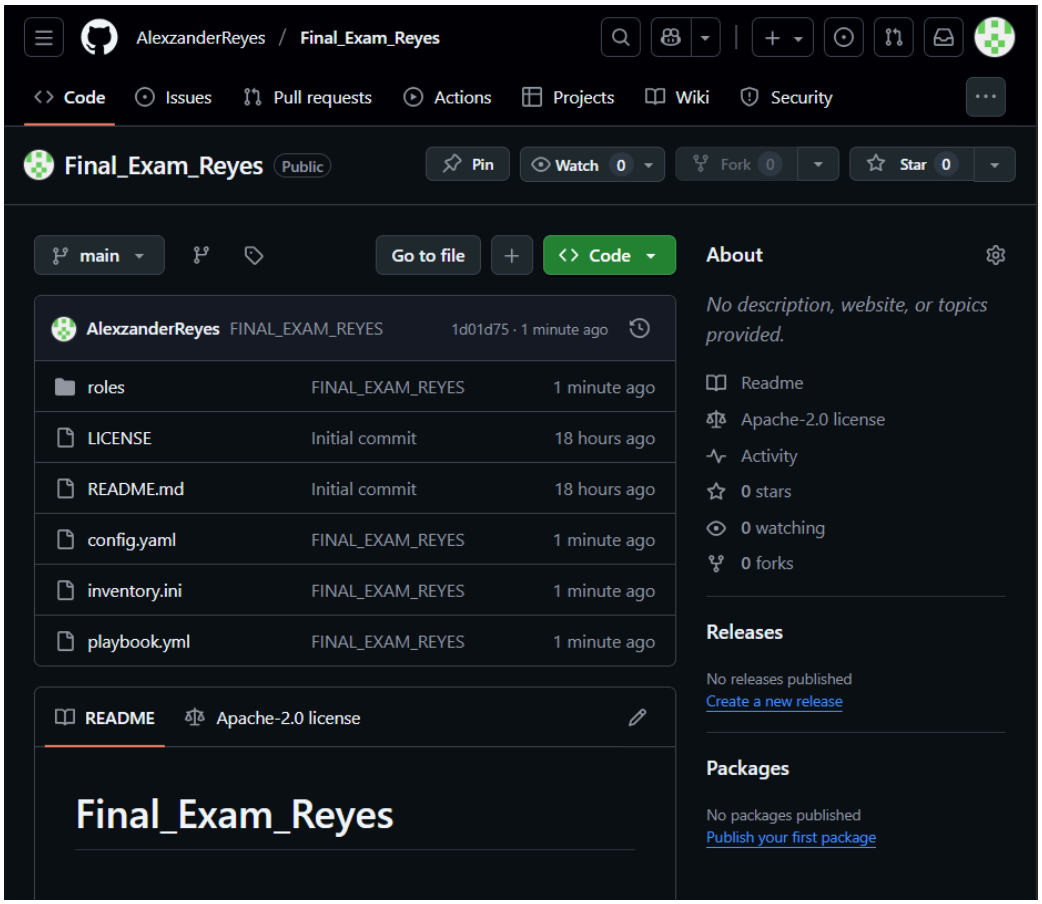
3.4 Change Motd as "Ansible Managed by <username>"

roles/motd/tasks



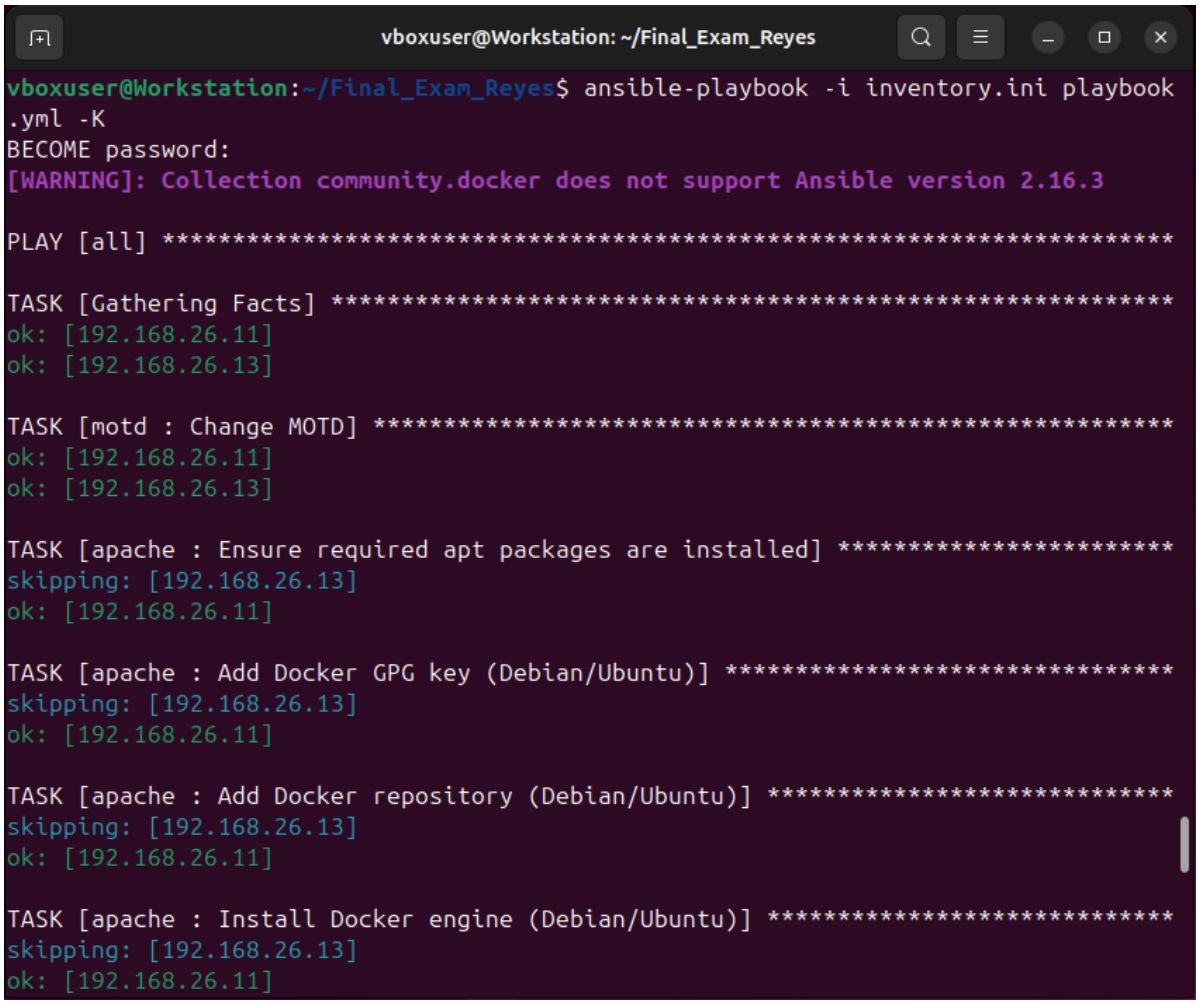
4. Push and commit your files in GitHub

```
vboxuser@Workstation:~/Final_Exam_Reyes$ ls
config.yaml  inventory.ini  LICENSE  playbook.yml  README.md  roles
vboxuser@Workstation:~/Final_Exam_Reyes$ git add .
vboxuser@Workstation:~/Final_Exam_Reyes$ git commit -m "FINAL_EXAM_REYES"
[main 1d01d75] FINAL_EXAM_REYES
 6 files changed, 195 insertions(+)
 create mode 100644 config.yaml
 create mode 100644 inventory.ini
 create mode 100644 playbook.yml
 create mode 100644 roles/apache/tasks/main.yml
 create mode 100644 roles/motd/tasks/main.yml
 create mode 100644 roles/prometheus+grafana/tasks/main.yml
vboxuser@Workstation:~/Final_Exam_Reyes$ git push
Enumerating objects: 16, done.
Counting objects: 100% (16/16), done.
Delta compression using up to 2 threads
Compressing objects: 100% (9/9), done.
Writing objects: 100% (15/15), 2.23 KiB | 761.00 KiB/s, done.
Total 15 (delta 1), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (1/1), done.
To github.com:AlexzanderReyes/Final_Exam_Reyes.git
   133122e..1d01d75  main -> main
```



5. Make sure to show evidence of input (codes) process (codes successfully running) and output (evidence of installation)

Running the playbook



```
TASK [apache : Install yum utils (CentOS)] ************************************
skipping: [192.168.26.11]
ok: [192.168.26.13]

TASK [apache : Add Docker repository (CentOS)] ********************************
skipping: [192.168.26.11]
ok: [192.168.26.13]

TASK [apache : Install Docker engine (CentOS)] ********************************
skipping: [192.168.26.11]
ok: [192.168.26.13]

TASK [apache : Enable and start Docker service] *******************************
ok: [192.168.26.11]
ok: [192.168.26.13]

TASK [apache : Deploy Apache container] ***************************************
changed: [192.168.26.13]
changed: [192.168.26.11]

TASK [prometheus+grafana : Remove Podman Docker wrapper if present] ***********
skipping: [192.168.26.11]
ok: [192.168.26.13]

TASK [prometheus+grafana : Add Docker repository (Debian/Ubuntu)] *************
skipping: [192.168.26.13]
ok: [192.168.26.11]
```

```
TASK [prometheus+grafana : Add Docker repository (CentOS/RHEL 9)] *************
skipping: [192.168.26.11]
ok: [192.168.26.13]

TASK [prometheus+grafana : Install Docker engine (Debian)] ********************
skipping: [192.168.26.13]
ok: [192.168.26.11]

TASK [prometheus+grafana : Install Docker engine (CentOS)] ********************
skipping: [192.168.26.11]
ok: [192.168.26.13]

TASK [prometheus+grafana : Enable and start Docker service] *******************
ok: [192.168.26.11]
ok: [192.168.26.13]

TASK [prometheus+grafana : Install Python3 pip (Debian)] **********************
skipping: [192.168.26.13]
ok: [192.168.26.11]

TASK [prometheus+grafana : Install Python3 pip (CentOS)] **********************
skipping: [192.168.26.11]
ok: [192.168.26.13]

TASK [prometheus+grafana : Install Docker SDK for Python (Debian via APT)] ********
skipping: [192.168.26.13]
ok: [192.168.26.11]
```

```
TASK [prometheus+grafana : Install Docker SDK for Python (CentOS via pip)] ********
skipping: [192.168.26.11]
ok: [192.168.26.13]

TASK [prometheus+grafana : Deploy Prometheus container] ***************************
changed: [192.168.26.11]
changed: [192.168.26.13]

TASK [prometheus+grafana : Deploy Grafana container] ***************************
changed: [192.168.26.13]
changed: [192.168.26.11]

PLAY RECAP *********************************************************************
192.168.26.11              : ok=15   changed=3    unreachable=0    failed=0    skip
ped=8    rescued=0    ignored=0
192.168.26.13              : ok=15   changed=3    unreachable=0    failed=0    skip
ped=8    rescued=0    ignored=0
```

MOTD IN Ubuntu (Server 1)

```
vboxuser@Workstation:~/Final_Exam_Reyes$ ssh vboxuser@server1
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-33-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

Expanded Security Maintenance for Applications is not enabled.

12 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

*** System restart required ***
Ansible Managed by vboxuser
Last login: Fri Nov 14 09:17:17 2025 from 192.168.26.10
```

MOTD IN CentOS (Reyes)

```
vboxuser@Workstation:~/Final_Exam_Reyes$ ssh Reyes@CentOS
Ansible Managed by Reyes
Activate the web console with: systemctl enable --now cockpit.socket

Last login: Fri Nov 14 17:17:18 2025 from 192.168.26.10
```

Apache and Prometheus & Grafana docker ps and docker images Ubuntu (Server 1)

Before playing the playbook

```
*** System restart required ***
Ansible Managed by vboxuser
Last login: Fri Nov 14 09:07:35 2025 from 192.168.26.10
vboxuser@Server1:~$ docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
vboxuser@Server1:~$ docker images
REPOSITORY   TAG       IMAGE ID   CREATED   SIZE
```

After playing the playbook

```
vboxuser@Server1:~$ docker ps
CONTAINER ID   IMAGE                    COMMAND                  CREATED          S
TATUS          PORTS                    NAMES
e2da3eb55f22   grafana/grafana:latest   "/run.sh"                2 minutes ago    U
p 2 minutes    0.0.0.0:3001->3000/tcp   grafana_server
b7f2563d5c88   prom/prometheus:latest   "/bin/prometheus --c…"   8 minutes ago    U
p 8 minutes    0.0.0.0:9091->9090/tcp   prometheus_server
794623cac1fc   httpd:latest             "httpd-foreground"       12 minutes ago   U
p 12 minutes   0.0.0.0:8080->80/tcp     apache_server
vboxuser@Server1:~$ docker images
REPOSITORY        TAG       IMAGE ID       CREATED       SIZE
httpd             latest    6a4fe18d08d2   10 days ago   117MB
prom/prometheus   latest    a683da769912   2 weeks ago   370MB
grafana/grafana   latest    bac4f177a0d5   3 weeks ago   730MB
```

Apache and Prometheus & Grafana docker ps and docker images CentOS (Reyes Server)

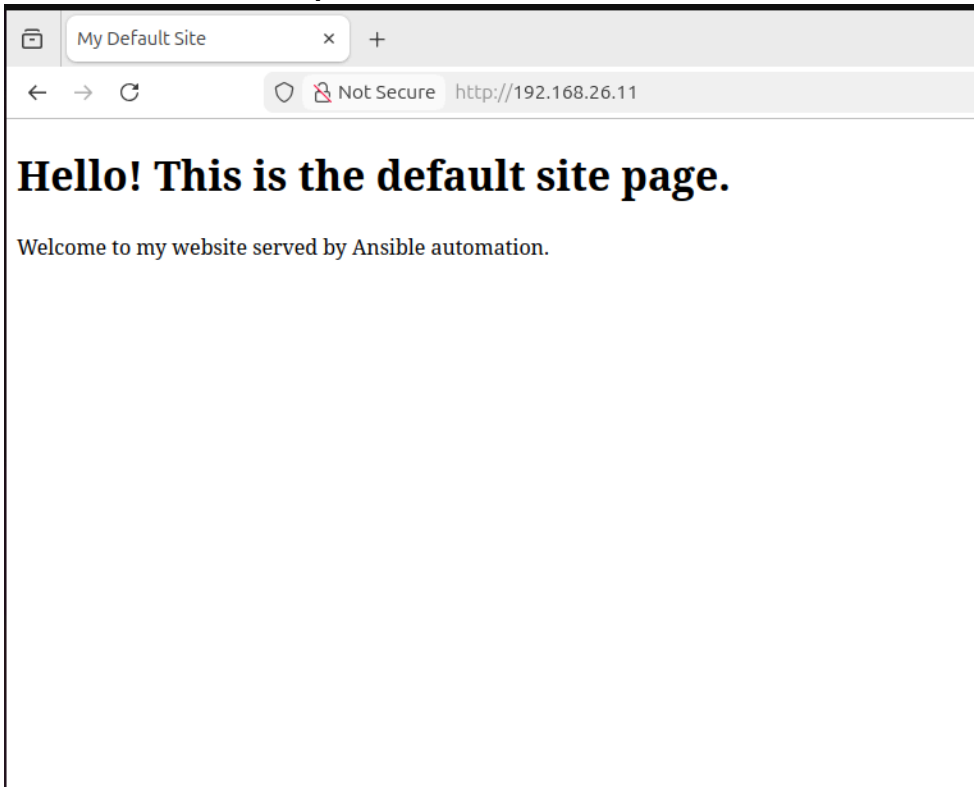
Before playing the playbook

```
vboxuser@Workstation:~/Final_Exam_Reyes$ ssh Reyes@CentOS
Ansible Managed by Reyes
Activate the web console with: systemctl enable --now cockpit.socket

Last login: Fri Nov 14 16:58:58 2025 from 192.168.26.10
[Reyes@CentOS ~]$ docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
[Reyes@CentOS ~]$ docker images
REPOSITORY   TAG       IMAGE ID   CREATED   SIZE
```

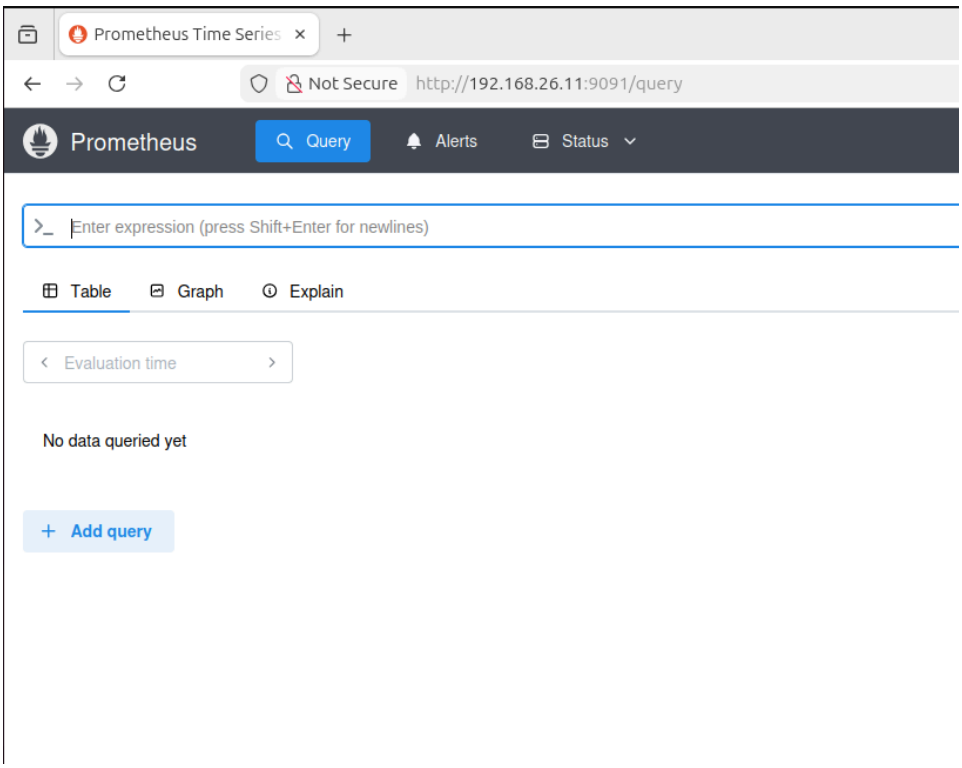
After playing the playbook

```
[Reyes@CentOS ~]$ docker ps
CONTAINER ID   IMAGE                    COMMAND                  CREATED          S
TATUS          PORTS                    NAMES
71b00a3a2127   grafana/grafana:latest   "/run.sh"                35 seconds ago   U
p 34 seconds   0.0.0.0:3001->3000/tcp   grafana_server
127096c20099   prom/prometheus:latest   "/bin/prometheus --c…"   6 minutes ago    U
p 6 minutes    0.0.0.0:9091->9090/tcp   prometheus_server
0795a8689087   httpd:latest             "httpd-foreground"       10 minutes ago   U
p 10 minutes   0.0.0.0:8080->80/tcp     apache_server
[Reyes@CentOS ~]$ docker images
REPOSITORY        TAG       IMAGE ID       CREATED       SIZE
httpd             latest    6a4fe18d08d2   10 days ago   117MB
prom/prometheus   latest    a683da769912   2 weeks ago   370MB
grafana/grafana   latest    bac4f177a0d5   3 weeks ago   730MB
```

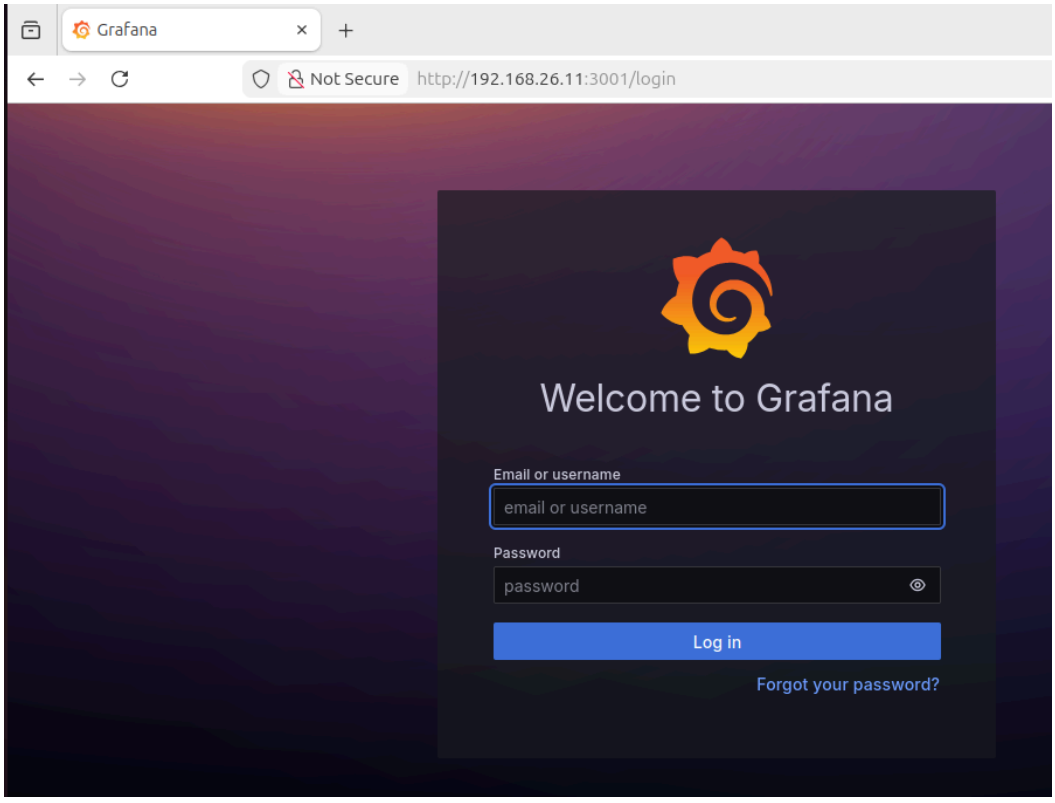
Checking Apache (Ubuntu)
Ip address = 192.168.26.11



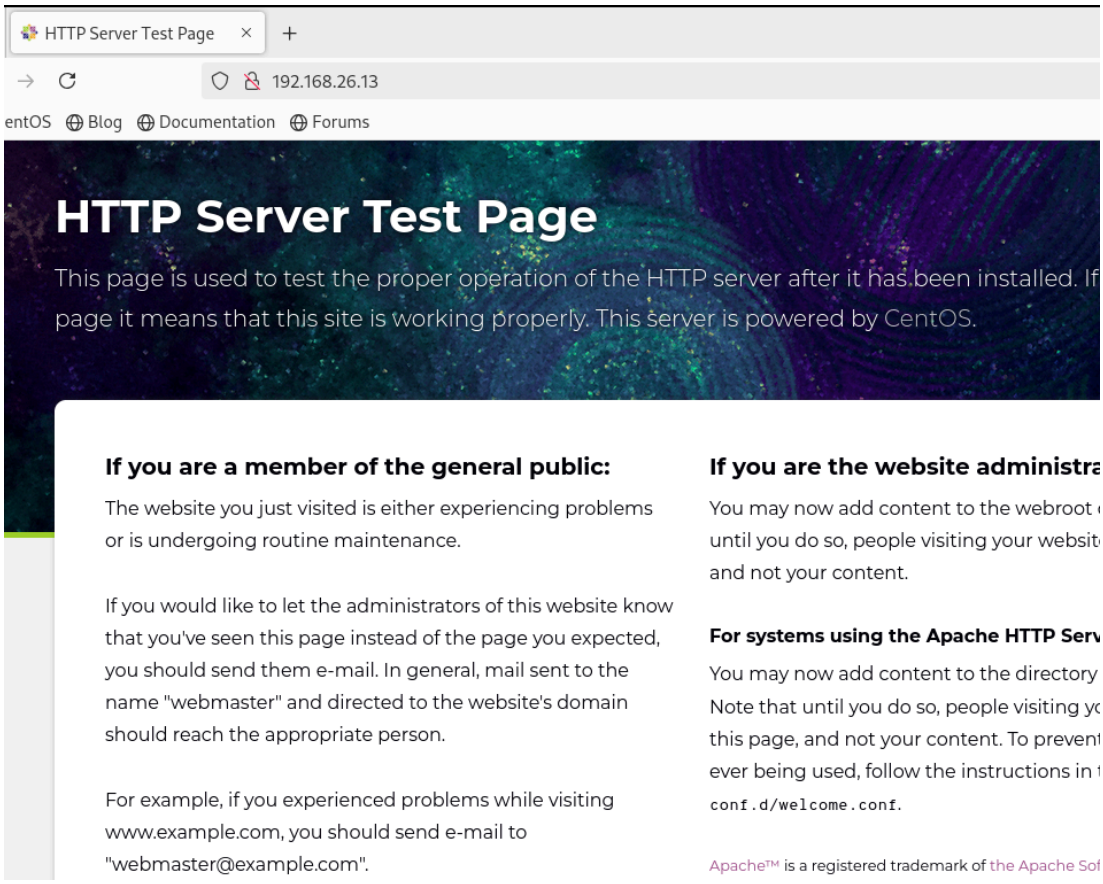
Checking Apache (Ubuntu)
Ip address = 192.168.26.11



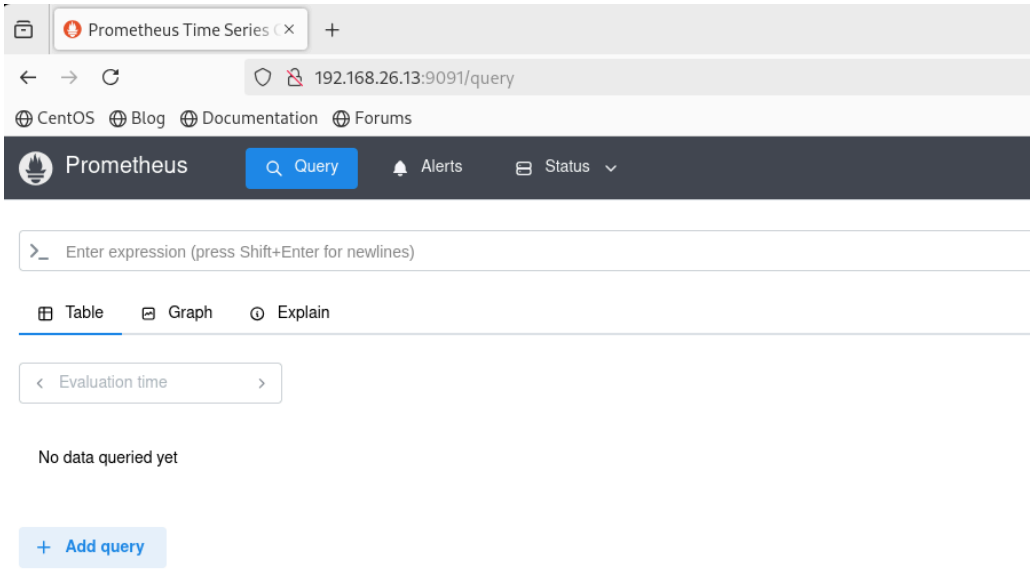
Checking Apache (Ubuntu)
Ip address = 192.168.26.11



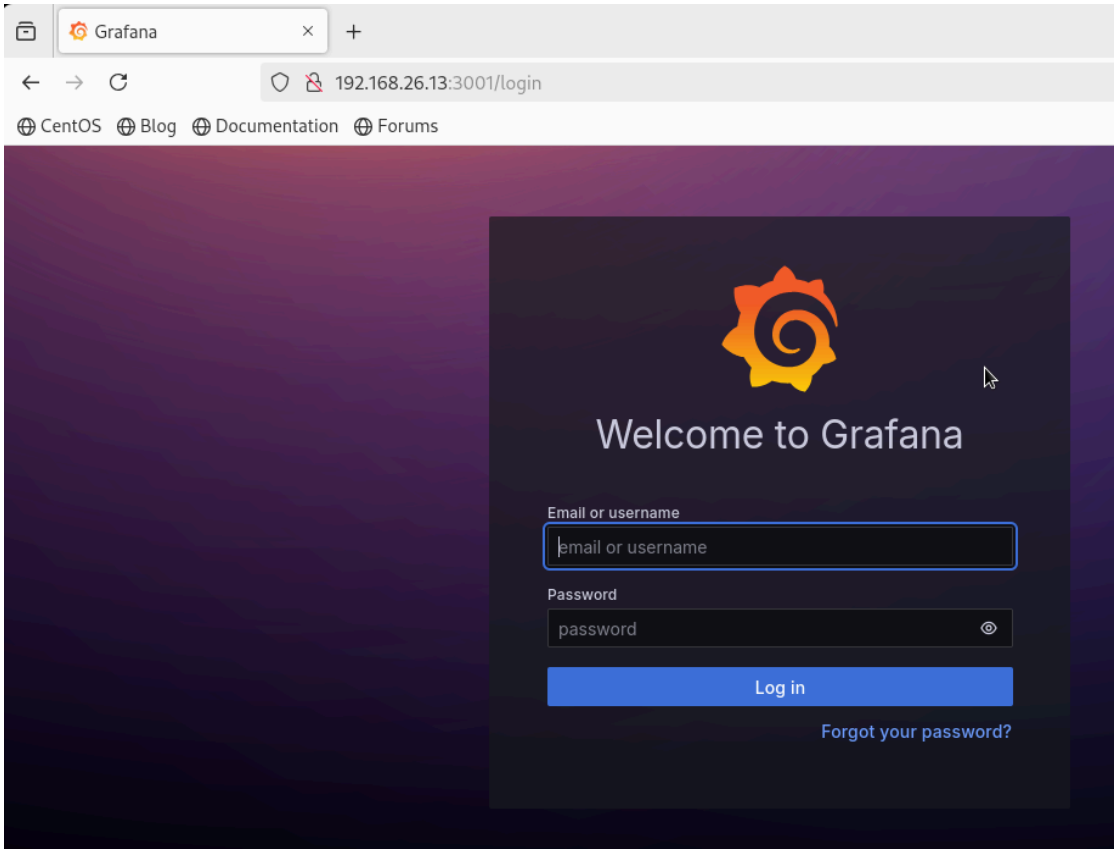
Checking Apache (CentOS)
Ip address = 192.168.26.13



Checking Prometheus (CentOS)
Ip address = 192.168.26.13:9091



Checking Grafana (CentOS)
Ip address = 192.168.26.13:3001



6. For your final exam to be counted, please paste your repository link as an answer in this exam.

- **AlexzanderReyes/Final_Exam_Reyes**

Note: Extra points if you will implement the said services via containerization.