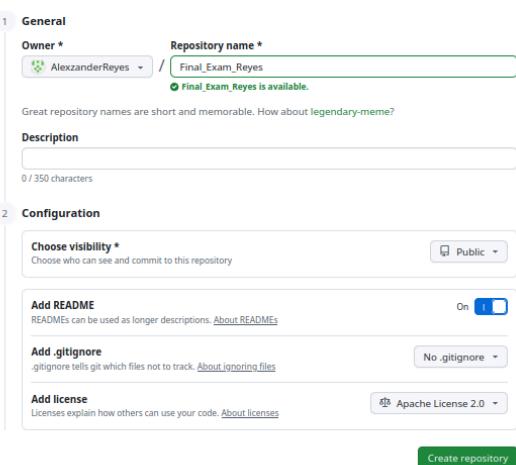
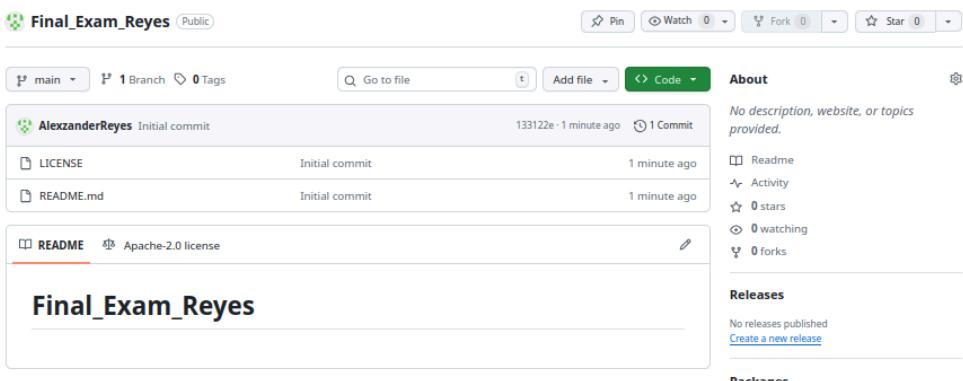


Hands-on Final Exam	
CPE212-CPE31S2	14/11/2025
Reyes, Alexzander J.	Engr. Robin Valenzuela
<b>Tools Needed:</b>	
1. VM with Ubuntu, CentOS and Ansible installed 2. Web browser	
<b>Procedure:</b>	
<b>1. Create a repository and label it as "Final_Exam_Surname"</b>	
<p><b>Create a new repository</b></p> <p>Repositories contain a project's files and version history. Have a project elsewhere? <a href="#">Import a repository</a>. Required fields are marked with an asterisk (*).</p> 	
	

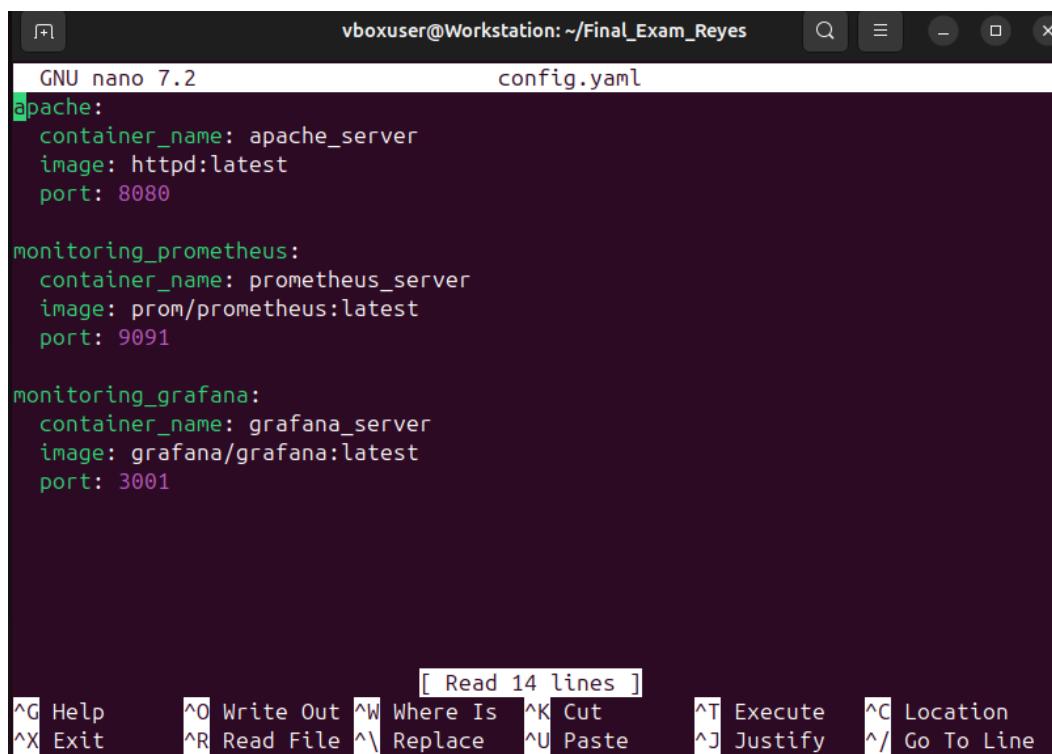
## 2. Clone your new repository in your VM

```
vboxuser@Workstation:~$ git clone git@github.com:AlexzanderReyes/Final_Exam_Reyes.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



The screenshot shows a terminal window with the title "vboxuser@Workstation: ~/Final\_Exam\_Reyes". Inside the terminal, the "nano" text editor is open, displaying the "config.yaml" file. The file contains the following YAML configuration:

```
GNU nano 7.2                                     config.yaml
apache:
  container_name: apache_server
  image: httpd:latest
  port: 8080

monitoring_prometheus:
  container_name: prometheus_server
  image: prom/prometheus:latest
  port: 9091

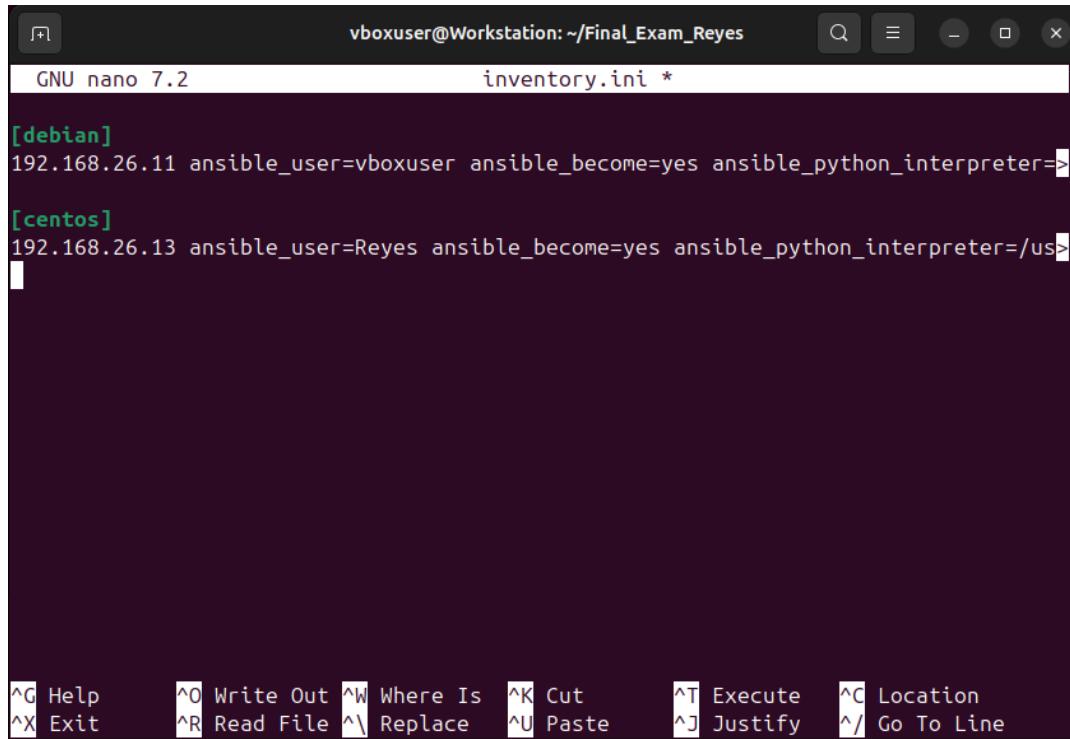
monitoring_grafana:
  container_name: grafana_server
  image: grafana/grafana:latest
  port: 3001
```

At the bottom of the terminal window, there is a menu bar with various keyboard shortcuts for navigating the nano editor. The menu bar includes the following items:

- Help (ctrl-G)
- Write Out (ctrl-O)
- Where Is (ctrl-W)
- Cut (ctrl-K)
- Execute (ctrl-T)
- Location (ctrl-C)
- Exit (ctrl-X)
- Read File (ctrl-R)
- Replace (ctrl-^)
- Paste (ctrl-U)
- Justify (ctrl-J)
- Go To Line (ctrl-/)

A status bar at the bottom right of the terminal window indicates "[ Read 14 lines ]".

## inventory.ini



The screenshot shows a terminal window titled "vboxuser@Workstation: ~/Final\_Exam Reyes" running the "nano" text editor. The file being edited is "inventory.ini". The content of the file is as follows:

```
[debian]
192.168.26.11 ansible_user=vboxuser ansible_become=yes ansible_python_interpreter=>

[centos]
192.168.26.13 ansible_user=Reyes ansible_become=yes ansible_python_interpreter=/us>
```

At the bottom of the terminal window, there is a menu of keyboard shortcuts:

- ^G Help
- ^O Write Out
- ^W Where Is
- ^K Cut
- ^T Execute
- ^C Location
- ^X Exit
- ^R Read File
- ^V Replace
- ^U Paste
- ^J Justify
- ^/ Go To Line

## playbook.yml

```
vboxuser@Workstation:~/Final_Exam_Reyes$ nano playbook.yml
GNU nano 7.2
playbook.yml
-->
hosts: all
become: yes
vars_files:
- config.yaml
roles:
- motd
- apache
- prometheus+grafana
[ Read 9 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
```

### 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**

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

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_distribution }}"
    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

```
vboxuser@Workstation: ~/Final_Exam_Reyes/roles/prometheus+grafana/tasks          main.yml
GNU nano 7.2
  name: python3-pip
  state: present
when: ansible_os_family == "RedHat"

- name: Install Docker SDK for Python (Debian via APT)
  ansible.builtin.apt:
    name: python3-docker
    state: present
when: ansible_os_family == "Debian"

- name: Install Docker SDK for Python (CentOS via pip)
  ansible.builtin.pip:
    name: docker
    executable: pip3
    state: latest
when: ansible_os_family == "RedHat"

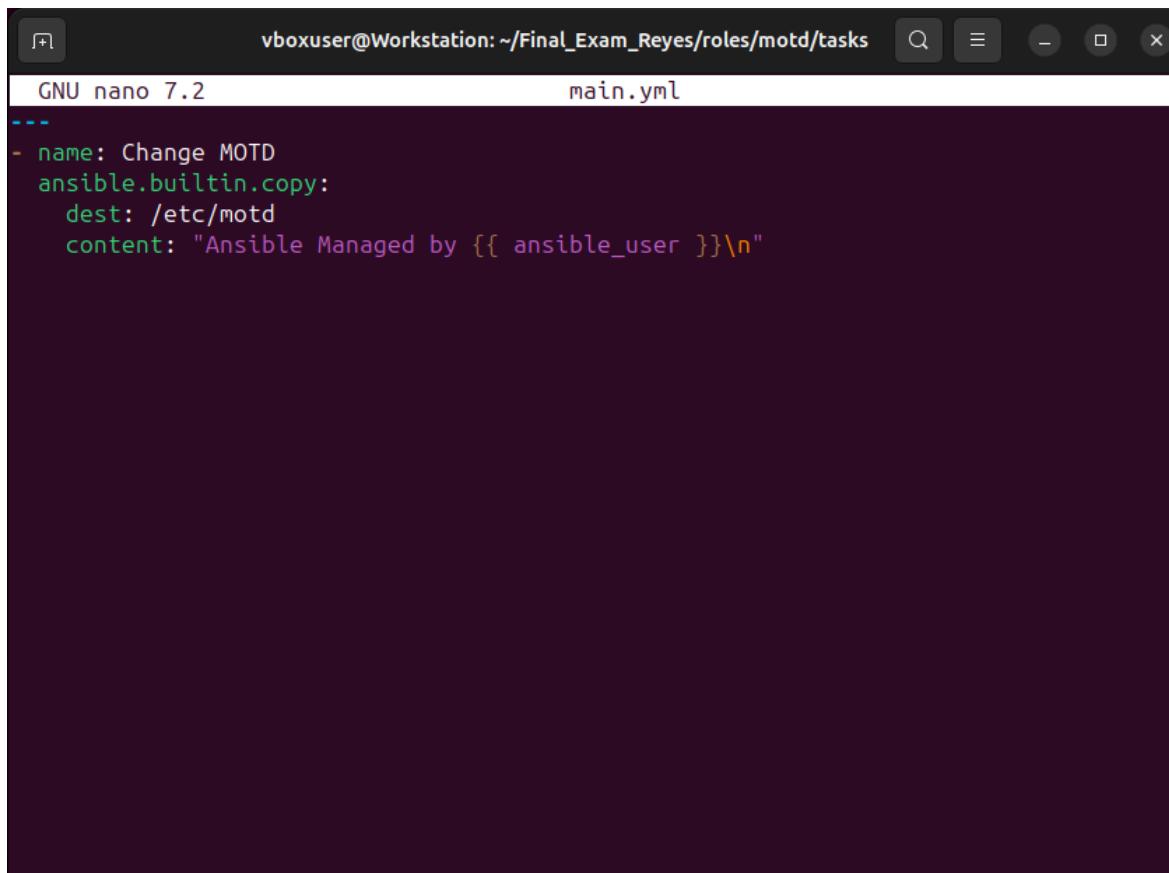
- name: Deploy Prometheus container
  community.docker.docker_container:
    name: "{{ monitoring_prometheus.container_name }}"
    image: "{{ monitoring_prometheus.image }}"
    state: started
    restart_policy: always
    ports:
      - "{{ monitoring_prometheus.port }}:9090"
    docker_host: "unix:///var/run/docker.sock"

^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



The screenshot shows a terminal window titled "vboxuser@Workstation: ~/Final\_Exam\_Reyes/roles/motd/tasks". The window is running the "GNU nano 7.2" editor on a file named "main.yml". The content of the file is:

```
---
- name: Change MOTD
  ansible.builtin.copy:
    dest: /etc/motd
    content: "Ansible Managed by {{ ansible_user }}\n"
```

**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
```

The screenshot shows a GitHub repository page for 'Final\_Exam\_Reyes'. The repository is public and was created by AlexanderReyes. It contains the following files:

- roles (1 minute ago)
- LICENSE (Initial commit, 18 hours ago)
- README.md (Initial commit, 18 hours ago)
- config.yaml (FINAL\_EXAM\_REYES, 1 minute ago)
- inventory.ini (FINAL\_EXAM\_REYES, 1 minute ago)
- playbook.yml (FINAL\_EXAM\_REYES, 1 minute ago)

The repository has 0 stars, 0 forks, and 0 watching.

**About**

No description, website, or topics provided.

**Readme**

Apache-2.0 license

**Activity**

0 stars

0 watching

0 forks

**Releases**

No releases published

[Create a new release](#)

**Packages**

No packages published

[Publish your first package](#)

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

### Running the playbook

```
vboxuser@Workstation:~/Final_Exam_Reyes$ ansible-playbook -i inventory.ini playbook
.yml -K
BECOME password:
[WARNING]: Collection community.docker does not support Ansible version 2.16.3

PLAY [all] ****
TASK [Gathering Facts] ****
ok: [192.168.26.11]
ok: [192.168.26.13]

TASK [motd : Change MOTD] ****
ok: [192.168.26.11]
ok: [192.168.26.13]

TASK [apache : Ensure required apt packages are installed] ****
skipping: [192.168.26.13]
ok: [192.168.26.11]

TASK [apache : Add Docker GPG key (Debian/Ubuntu)] ****
skipping: [192.168.26.13]
ok: [192.168.26.11]

TASK [apache : Add Docker repository (Debian/Ubuntu)] ****
skipping: [192.168.26.13]
ok: [192.168.26.11]

TASK [apache : Install Docker engine (Debian/Ubuntu)] ****
skipping: [192.168.26.13]
ok: [192.168.26.11]
```

```
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=8
192.168.26.13          : ok=15    changed=3    unreachable=0    failed=0    skip=8
```

### 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    STATUS      S
TATUS          PORTS      NAMES
e2da3eb55f22   grafana/grafana:latest   "/run.sh"        2 minutes ago   U
p 2 minutes   0.0.0.0:3001->3000/tcp
b7f2563d5c88   prom/prometheus:latest   "/bin/prometheus --c..."  8 minutes ago   U
p 8 minutes   0.0.0.0:9091->9090/tcp
794623cac1fc   httpd:latest           "httpd-foreground"  12 minutes ago   U
p 12 minutes  0.0.0.0:8080->80/tcp
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

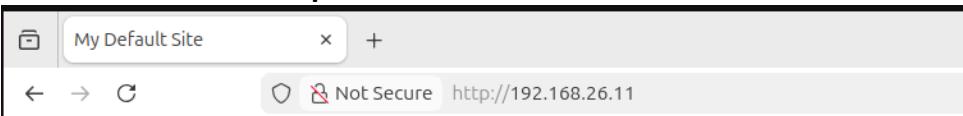
```
vboxuser@Workstation:~/Final_Exam_Reyes$ ssh Reyes@CentOS
Ansible Managed by Reyes
Activate the web console with: systemctl enable --now cockpit.socket

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            STATUS              PORTS
71b00a3a2127        grafana/grafana:latest   "/run.sh"          35 seconds ago    Up 34 seconds
127096c20099        prom/prometheus:latest   "/bin/prometheus --c..."  6 minutes ago     Up 6 minutes
0795a8689087        httpd:latest           "httpd-foreground"  10 minutes ago    Up 10 minutes
[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



**Hello! This is the default site page.**

Welcome to my website served by Ansible automation.

### Checking Apache (Ubuntu) Ip address = 192.168.26.11

Prometheus Time Series

Not Secure http://192.168.26.11:9091/query

Prometheus

Query Alerts Status

Enter expression (press Shift+Enter for newlines)

Table Graph Explain

Evaluation time

No data queried yet

+ Add query

**Checking Apache (Ubuntu)  
Ip address = 192.168.26.11**

Grafana

Not Secure http://192.168.26.11:3001/login

Welcome to Grafana

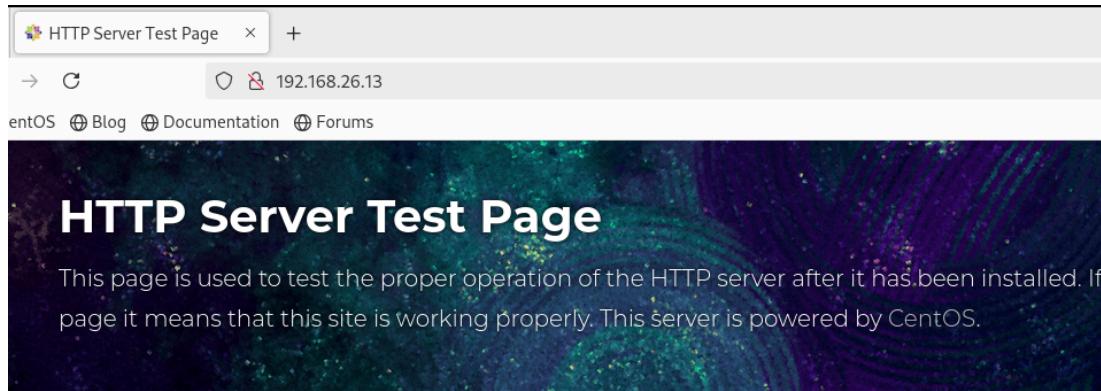
Email or username  
email or username

Password  
password

Log in

Forgot your password?

## Checking Apache (CentOS) Ip address = 192.168.26.13



### If you are a member of the general public:

The website you just visited is either experiencing problems or is undergoing routine maintenance.

If you would like to let the administrators of this website know that you've seen this page instead of the page you expected, you should send them e-mail. In general, mail sent to the name "webmaster" and directed to the website's domain should reach the appropriate person.

For example, if you experienced problems while visiting [www.example.com](http://www.example.com), you should send e-mail to "webmaster@example.com".

### If you are the website administrator:

You may now add content to the webroot directory. Note that until you do so, people visiting your website will see this page, and not your content. To prevent this page ever being used, follow the instructions in [the configuration file conf.d/welcome.conf](#).

### For systems using the Apache HTTP Server:

You may now add content to the directory /var/www/html. Note that until you do so, people visiting your website will see this page, and not your content. To prevent this page ever being used, follow the instructions in [the configuration file conf.d/welcome.conf](#).

Apache™ is a registered trademark of the Apache Software Foundation.

## Checking Prometheus (CentOS) Ip address = 192.168.26.13:9091

Prometheus Time Series

192.168.26.13:9091/query

CentOS Blog Documentation Forums

Prometheus Query Alerts Status

Enter expression (press Shift+Enter for newlines)

Table Graph Explain

Evaluation time

No data queried yet

+ Add query

### Checking Grafana (CentOS) Ip address = 192.168.26.13:3001

Grafana

192.168.26.13:3001/login

CentOS Blog Documentation Forums

Welcome to Grafana

Email or username  
email or username

Password  
password

Log in

Forgot your password?

**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.

