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Course/Section: CPE212 - CPE31S2	**Date Submitted: 10/24/2025**
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Activity 11: Containerization

1. Objectives

Create a Dockerfile and form a workflow using Ansible as Infrastructure as Code (IaC) to enable Continuous Delivery process

2. Discussion

Docker is an open platform for developing, shipping, and running applications. Docker enables you to separate your applications from your infrastructure so you can deliver software quickly. With Docker, you can manage your infrastructure in the same ways you manage your applications. By taking advantage of Docker's methodologies for shipping, testing, and deploying code quickly, you can significantly reduce the delay between writing code and running it in production.

Source: https://docs.docker.com/get-started/overview/

You may also check the difference between containers and virtual machines. Click the link given below.

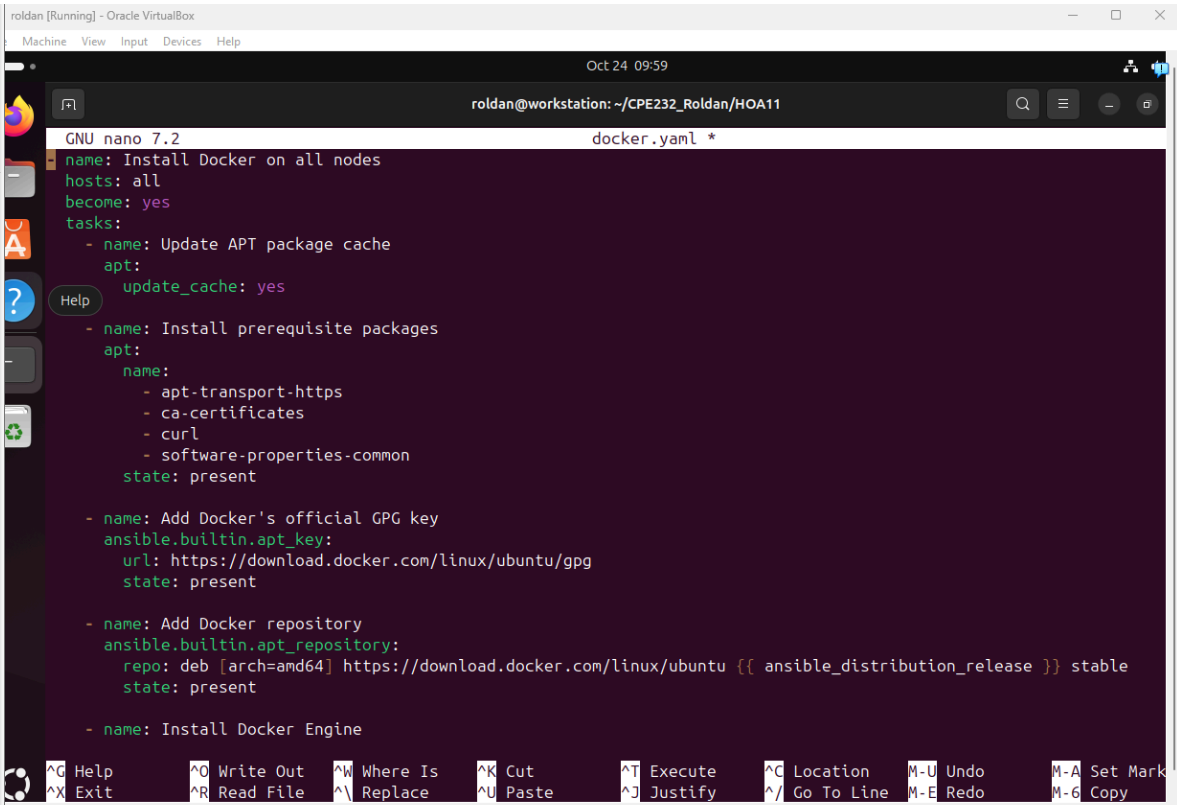
Source: https://docs.microsoft.com/en-us/virtualization/windowscontainers/about/containers-vs-vm

3. Tasks

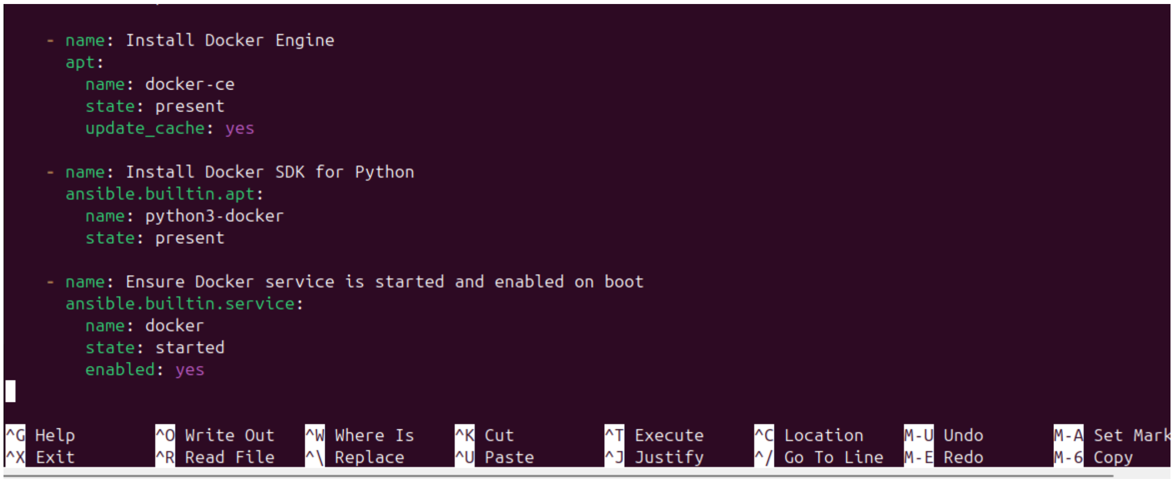
1. Create a new repository for this activity.
2. Install Docker and enable the docker socket.
3. Add to Docker group to your current user.
4. Create a Dockerfile to install web and DB server.
5. Install and build the Dockerfile using Ansible.
6. Add, commit and push it to your repository.

4. Output

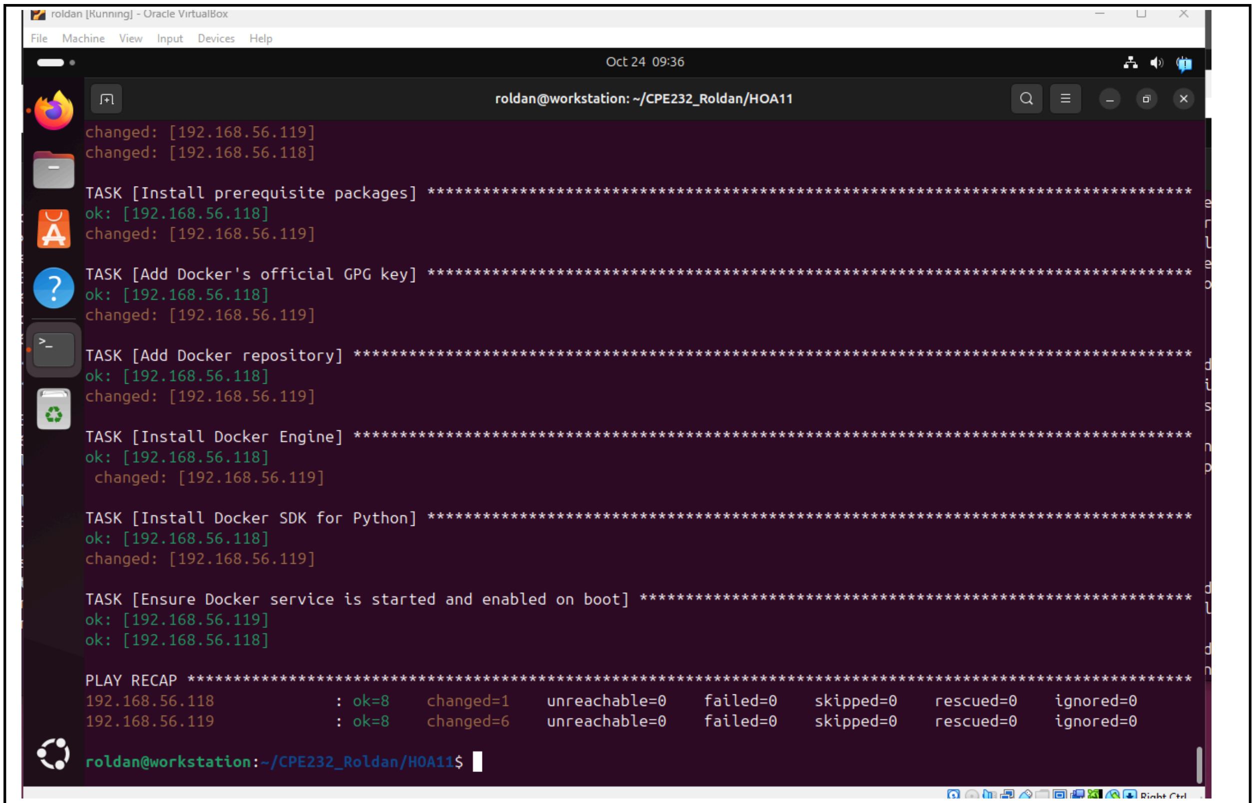
ubuntu docker


roldan [Running] - Oracle VirtualBox
Machine View Input Devices Help
Oct 24 09:59
roldan@workstation: ~/CPE232_Roldan/HOA11
Help

```
GNU nano 7.2                          docker.yaml *
- name: Install Docker on all nodes
  hosts: all
  become: yes
  tasks:
    - name: Update APT package cache
      apt:
        update_cache: yes

    - name: Install prerequisite packages
      apt:
        name:
          - apt-transport-https
          - ca-certificates
          - curl
          - software-properties-common
        state: present

    - name: Add Docker's official GPG key
      ansible.builtin.apt_key:
        url: https://download.docker.com/linux/ubuntu/gpg
        state: present

    - name: Add Docker repository
      ansible.builtin.apt_repository:
        repo: deb [arch=amd64] https://download.docker.com/linux/ubuntu {{ ansible_distribution_release }} stable
        state: present

    - name: Install Docker Engine

^G Help       ^O Write Out  ^W Where Is   ^K Cut        ^T Execute    ^C Location   M-U Undo      M-A Set Mark
^X Exit       ^R Read File  ^\ Replace    ^U Paste      ^J Justify    ^/ Go To Line M-E Redo      M-6 Copy
```

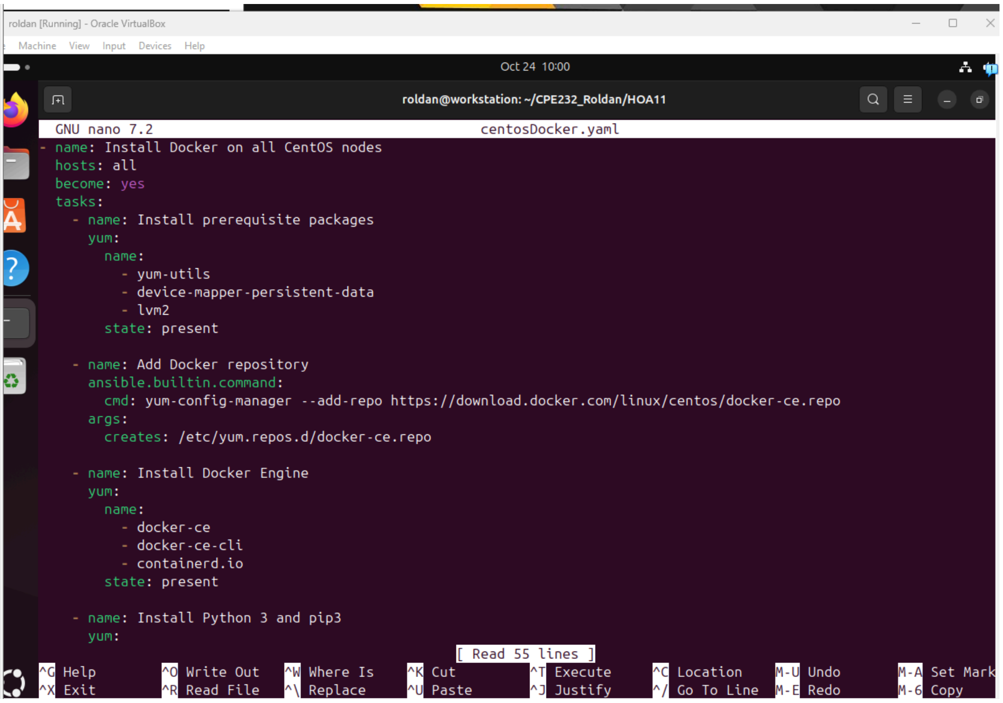


```
    - name: Install Docker Engine
      apt:
        name: docker-ce
        state: present
        update_cache: yes

    - name: Install Docker SDK for Python
      ansible.builtin.apt:
        name: python3-docker
        state: present

    - name: Ensure Docker service is started and enabled on boot
      ansible.builtin.service:
        name: docker
        state: started
        enabled: yes


^G Help       ^O Write Out  ^W Where Is   ^K Cut        ^T Execute    ^C Location   M-U Undo      M-A Set Mark
^X Exit       ^R Read File  ^\ Replace    ^U Paste      ^J Justify    ^/ Go To Line M-E Redo      M-6 Copy
```

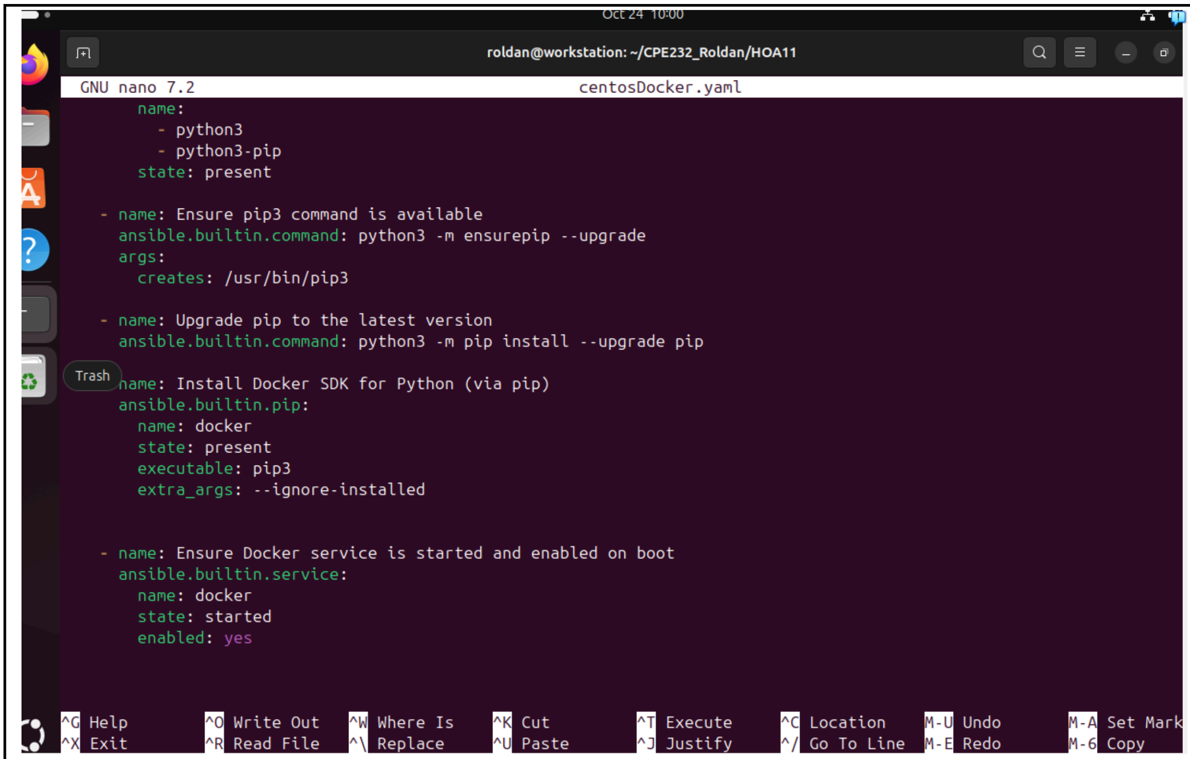

roldan [Running] - Oracle VirtualBox
File Machine View Input Devices Help
Oct 24 09:36
roldan@workstation: ~/CPE232_Roldan/HOA11

```
changed: [192.168.56.119]
changed: [192.168.56.118]

TASK [Install prerequisite packages] *****************************************************************************
ok: [192.168.56.118]
changed: [192.168.56.119]

TASK [Add Docker's official GPG key] *****************************************************************************
ok: [192.168.56.118]
changed: [192.168.56.119]

TASK [Add Docker repository] *************************************************************************************
ok: [192.168.56.118]
changed: [192.168.56.119]

TASK [Install Docker Engine] *************************************************************************************
ok: [192.168.56.118]
 changed: [192.168.56.119]

TASK [Install Docker SDK for Python] *****************************************************************************
ok: [192.168.56.118]
changed: [192.168.56.119]

TASK [Ensure Docker service is started and enabled on boot] *****************************************************
ok: [192.168.56.119]
ok: [192.168.56.118]

PLAY RECAP *******************************************************************************************************
192.168.56.118             : ok=8    changed=1    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
192.168.56.119             : ok=8    changed=6    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0

roldan@workstation:~/CPE232_Roldan/HOA11$ 
```

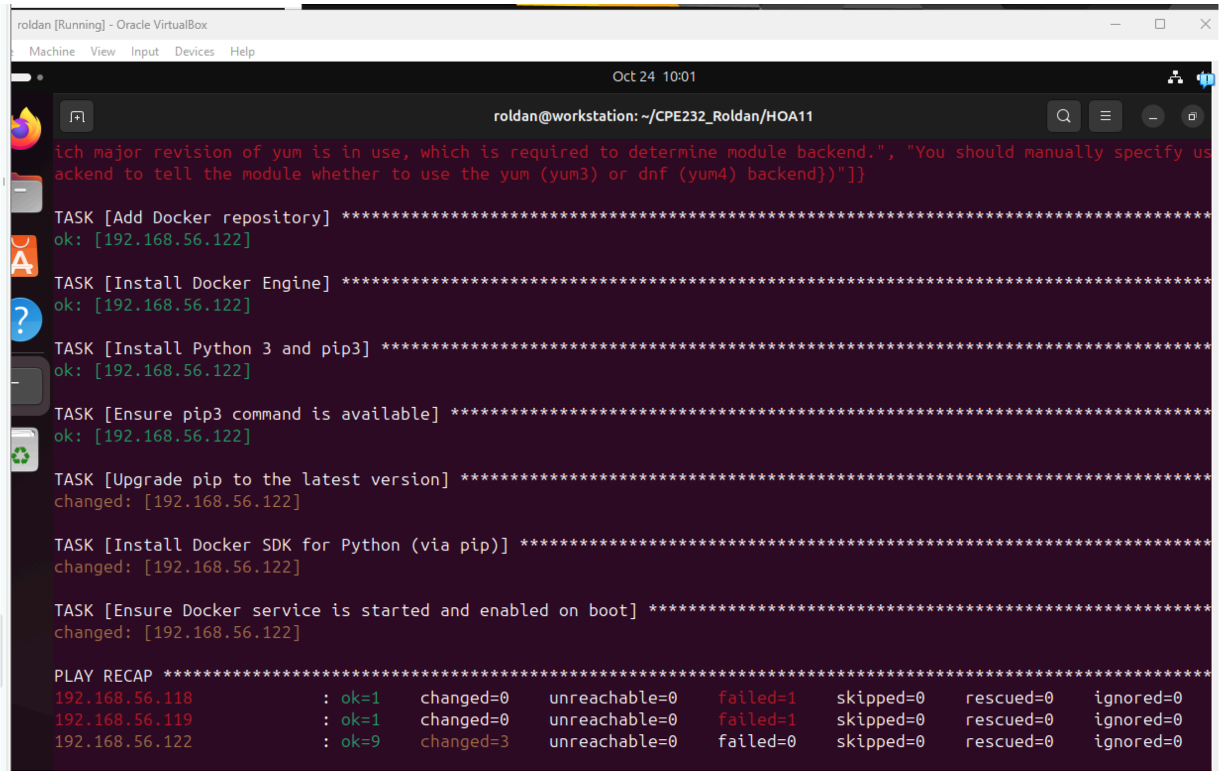
centOS Docker


roldan [Running] - Oracle VirtualBox
Machine View Input Devices Help
Oct 24 10:00
roldan@workstation: ~/CPE232_Roldan/HOA11

```
  GNU nano 7.2                                            centosDocker.yaml
- name: Install Docker on all CentOS nodes
  hosts: all
  become: yes
  tasks:
    - name: Install prerequisite packages
      yum:
        name:
          - yum-utils
          - device-mapper-persistent-data
          - lvm2
        state: present

    - name: Add Docker repository
      ansible.builtin.command:
        cmd: yum-config-manager --add-repo https://download.docker.com/linux/centos/docker-ce.repo
      args:
        creates: /etc/yum.repos.d/docker-ce.repo

    - name: Install Docker Engine
      yum:
        name:
          - docker-ce
          - docker-ce-cli
          - containerd.io
        state: present

    - name: Install Python 3 and pip3
      yum:
                                                   [ Read 55 lines ]
^G Help          ^O Write Out     ^W Where Is      ^K Cut           ^T Execute       ^C Location      M-U Undo         M-A Set Mark
^X Exit          ^R Read File     ^\ Replace       ^U Paste         ^J Justify       ^/ Go To Line    M-E Redo         M-6 Copy
```

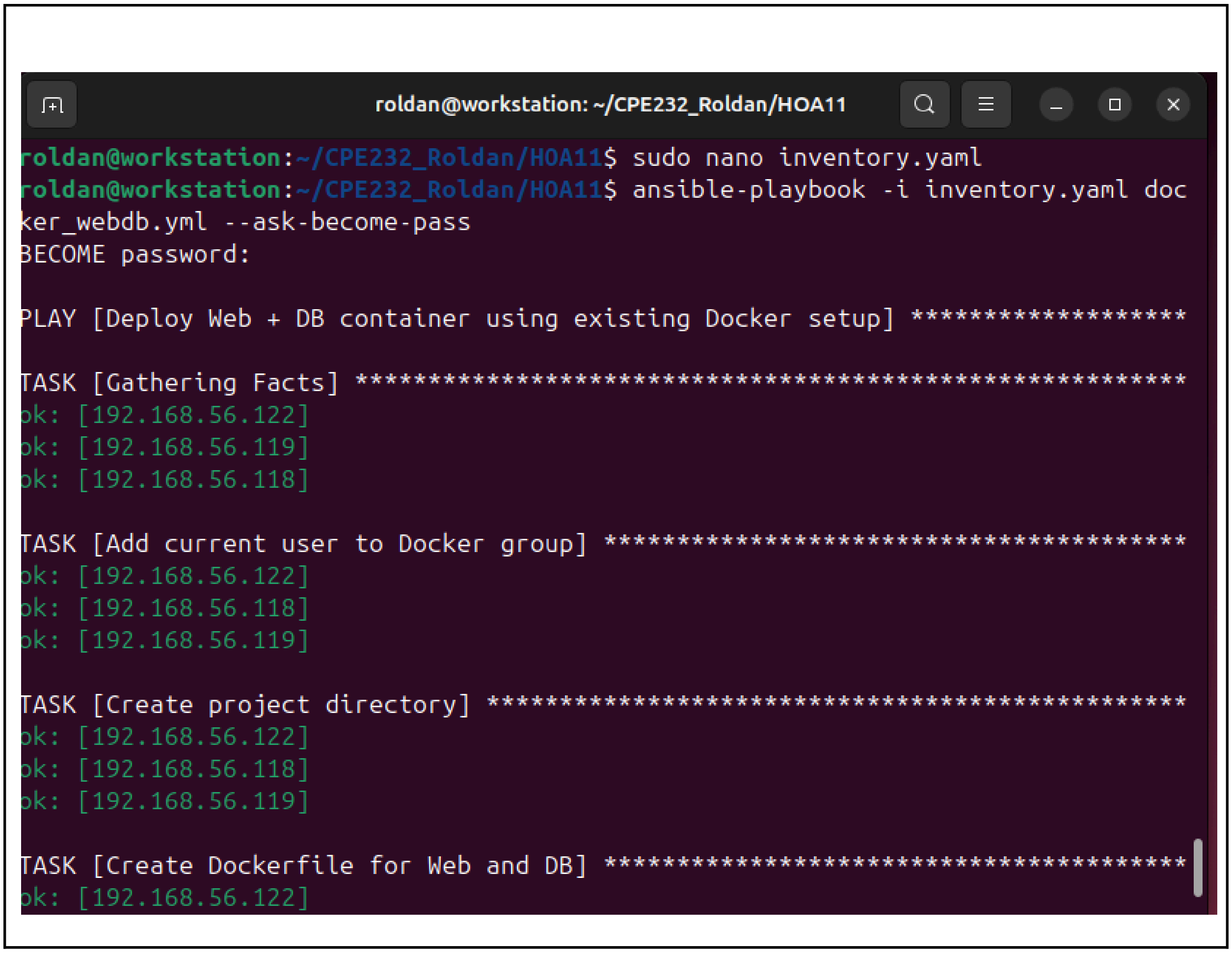


```
GNU nano 7.2                                centosDocker.yaml
      name:
        - python3
        - python3-pip
      state: present

  - name: Ensure pip3 command is available
    ansible.builtin.command: python3 -m ensurepip --upgrade
    args:
      creates: /usr/bin/pip3

  - name: Upgrade pip to the latest version
    ansible.builtin.command: python3 -m pip install --upgrade pip

  - name: Install Docker SDK for Python (via pip)
    ansible.builtin.pip:
      name: docker
      state: present
      executable: pip3
      extra_args: --ignore-installed


  - name: Ensure Docker service is started and enabled on boot
    ansible.builtin.service:
      name: docker
      state: started
      enabled: yes



^G Help        ^O Write Out   ^W Where Is    ^K Cut         ^T Execute     ^C Location    M-U Undo       M-A Set Mark
^X Exit        ^R Read File   ^\ Replace     ^U Paste       ^J Justify     ^/ Go To Line  M-E Redo       M-6 Copy
```

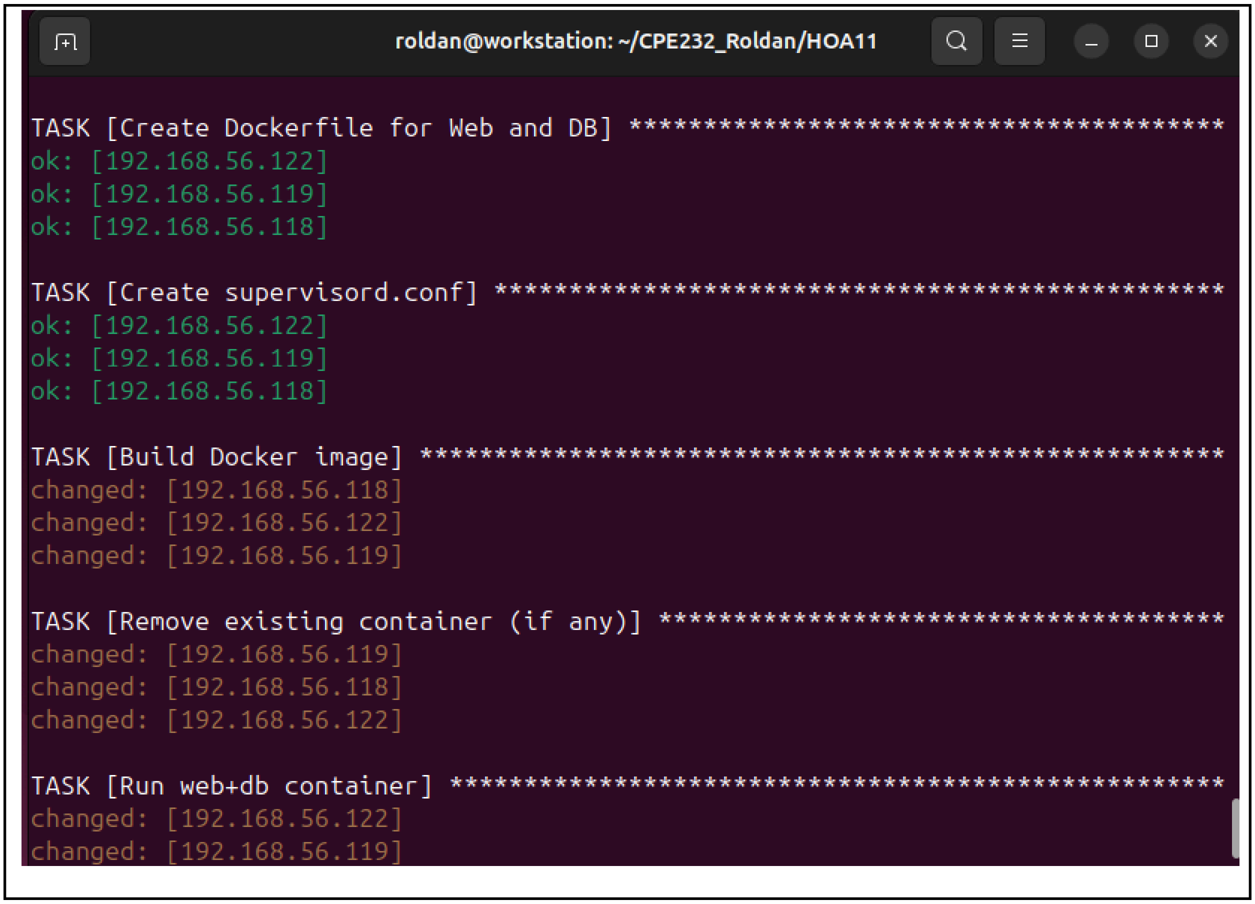

roldan [Running] - Oracle VirtualBox
Machine
View
Input
Devices
Help
Oct 24 10:01
roldan@workstation: ~/CPE232_Roldan/HOA11

```
ich major revision of yum is in use, which is required to determine module backend.", "You should manually specify us
ackend to tell the module whether to use the yum (yum3) or dnf (yum4) backend})"]}

TASK [Add Docker repository] *****************************************************************************************
ok: [192.168.56.122]

TASK [Install Docker Engine] *****************************************************************************************
ok: [192.168.56.122]

TASK [Install Python 3 and pip3] *************************************************************************************
ok: [192.168.56.122]

TASK [Ensure pip3 command is available] ******************************************************************************
ok: [192.168.56.122]

TASK [Upgrade pip to the latest version] *****************************************************************************
changed: [192.168.56.122]

TASK [Install Docker SDK for Python (via pip)] ***********************************************************************
changed: [192.168.56.122]

TASK [Ensure Docker service is started and enabled on boot] **********************************************************
changed: [192.168.56.122]

PLAY RECAP ***********************************************************************************************************
192.168.56.118             : ok=1    changed=0    unreachable=0    failed=1    skipped=0    rescued=0    ignored=0
192.168.56.119             : ok=1    changed=0    unreachable=0    failed=1    skipped=0    rescued=0    ignored=0
192.168.56.122             : ok=9    changed=3    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
```

docker web+db.yml

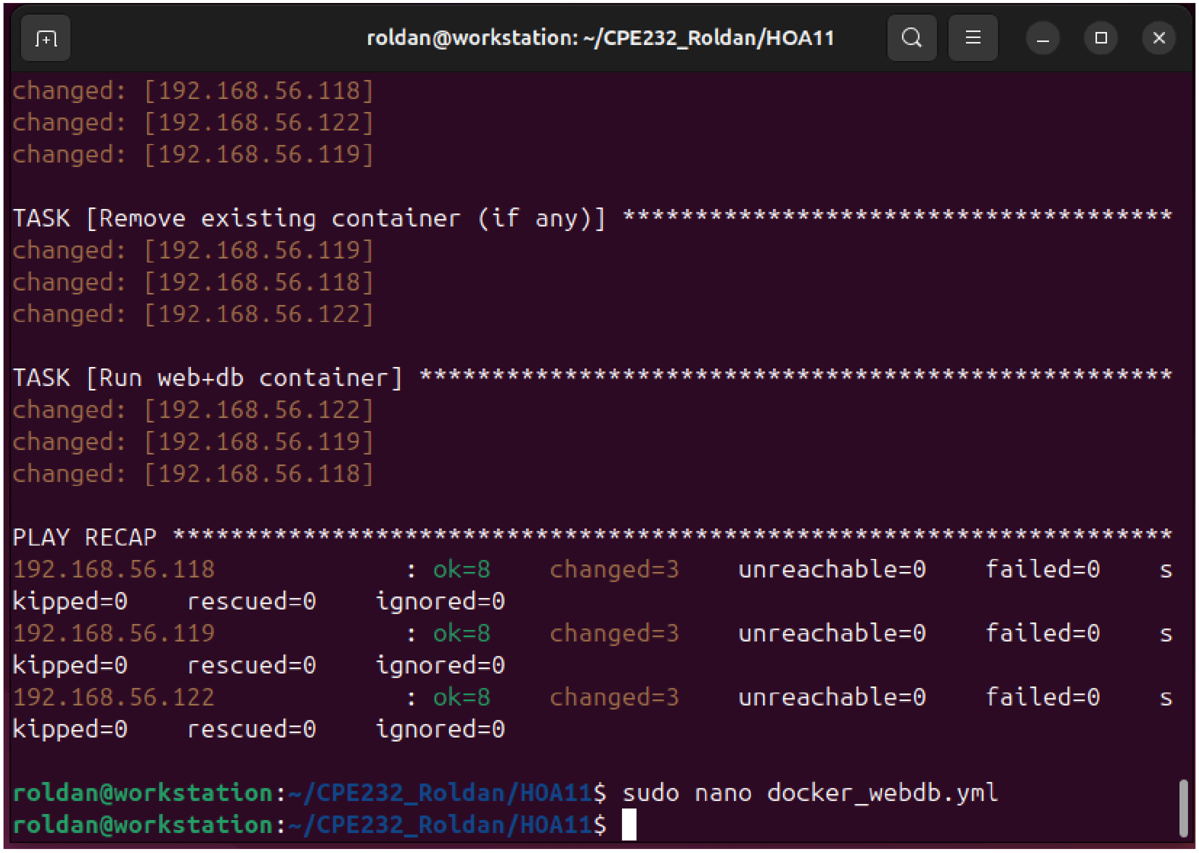


```
roldan@workstation:~/CPE232_Roldan/HOA11$ sudo nano inventory.yaml
roldan@workstation:~/CPE232_Roldan/HOA11$ ansible-playbook -i inventory.yaml doc
ker_webdb.yml --ask-become-pass
BECOME password:

PLAY [Deploy Web + DB container using existing Docker setup] *******************

TASK [Gathering Facts] *********************************************************
ok: [192.168.56.122]
ok: [192.168.56.119]
ok: [192.168.56.118]

TASK [Add current user to Docker group] ****************************************
ok: [192.168.56.122]
ok: [192.168.56.118]
ok: [192.168.56.119]

TASK [Create project directory] ************************************************
ok: [192.168.56.122]
ok: [192.168.56.118]
ok: [192.168.56.119]

TASK [Create Dockerfile for Web and DB] ****************************************
ok: [192.168.56.122]
```



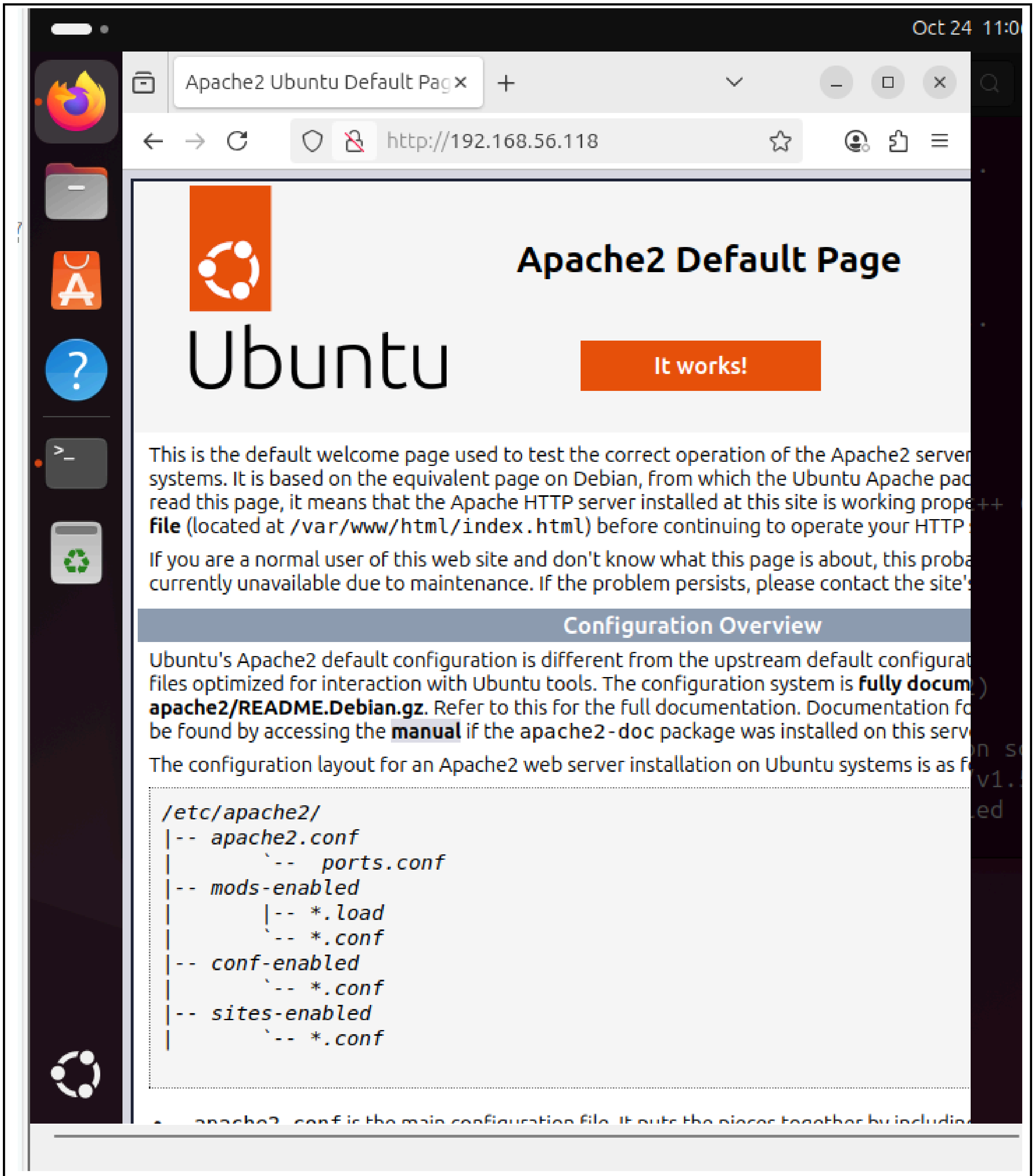
roldan@workstation: ~/CPE232_Roldan/HOA11

```
TASK [Create Dockerfile for Web and DB] *****************************************
ok: [192.168.56.122]
ok: [192.168.56.119]
ok: [192.168.56.118]

TASK [Create supervisord.conf] **************************************************
ok: [192.168.56.122]
ok: [192.168.56.119]
ok: [192.168.56.118]

TASK [Build Docker image] *******************************************************
changed: [192.168.56.118]
changed: [192.168.56.122]
changed: [192.168.56.119]

TASK [Remove existing container (if any)] ***************************************
changed: [192.168.56.119]
changed: [192.168.56.118]
changed: [192.168.56.122]

TASK [Run web+db container] *****************************************************
changed: [192.168.56.122]
changed: [192.168.56.119]
```



```
changed: [192.168.56.118]
changed: [192.168.56.122]
changed: [192.168.56.119]

TASK [Remove existing container (if any)] *************************************
changed: [192.168.56.119]
changed: [192.168.56.118]
changed: [192.168.56.122]

TASK [Run web+db container] ***************************************************
changed: [192.168.56.122]
changed: [192.168.56.119]
changed: [192.168.56.118]

PLAY RECAP ********************************************************************
192.168.56.118             : ok=8    changed=3    unreachable=0    failed=0    s
kipped=0    rescued=0    ignored=0
192.168.56.119             : ok=8    changed=3    unreachable=0    failed=0    s
kipped=0    rescued=0    ignored=0
192.168.56.122             : ok=8    changed=3    unreachable=0    failed=0    s
kipped=0    rescued=0    ignored=0

roldan@workstation:~/CPE232_Roldan/HOA11$ sudo nano docker_webdb.yml
roldan@workstation:~/CPE232_Roldan/HOA11$ 
```

manage1



Apache2 Default Page

It works!

This is the default welcome page used to test the correct operation of the Apache2 server systems. It is based on the equivalent page on Debian, from which the Ubuntu Apache pac read this page, it means that the Apache HTTP server installed at this site is working prope **file** (located at `/var/www/html/index.html`) before continuing to operate your HTTP

If you are a normal user of this web site and don't know what this page is about, this proba currently unavailable due to maintenance. If the problem persists, please contact the site'

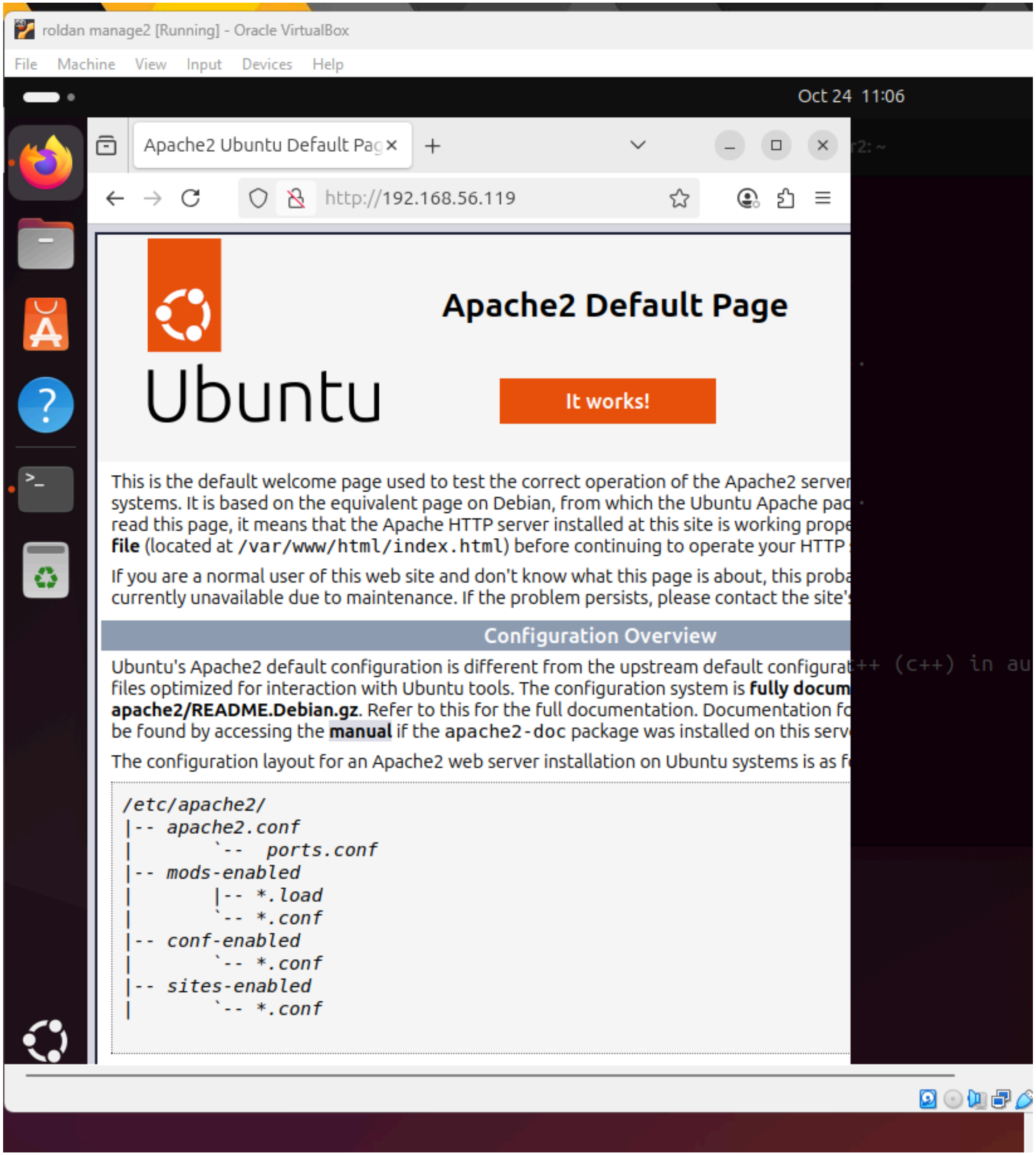
Configuration Overview

Ubuntu's Apache2 default configuration is different from the upstream default configurat files optimized for interaction with Ubuntu tools. The configuration system is **fully docum** **apache2/README.Debian.gz**. Refer to this for the full documentation. Documentation fo be found by accessing the **manual** if the `apache2-doc` package was installed on this serv

The configuration layout for an Apache2 web server installation on Ubuntu systems is as f

```
/etc/apache2/
|-- apache2.conf
|       `--  ports.conf
|-- mods-enabled
|       |-- *.load
|       `-- *.conf
|-- conf-enabled
|       `-- *.conf
|-- sites-enabled
|       `-- *.conf
```

manage2


roldan manage2 [Running] - Oracle VirtualBox
File
Machine
View
Input
Devices
Help
Oct 24 11:06
Apache2 Ubuntu Default Pag
http://192.168.56.119
Ubuntu

Apache2 Default Page

It works!

This is the default welcome page used to test the correct operation of the Apache2 server
systems. It is based on the equivalent page on Debian, from which the Ubuntu Apache pac
read this page, it means that the Apache HTTP server installed at this site is working prope
file (located at `/var/www/html/index.html`) before continuing to operate your HTTP

If you are a normal user of this web site and don't know what this page is about, this proba
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```
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|-- apache2.conf
|       `--  ports.conf
|-- mods-enabled
|       |-- *.load
|       `-- *.conf
|-- conf-enabled
|       `-- *.conf
|-- sites-enabled
|       `-- *.conf
```

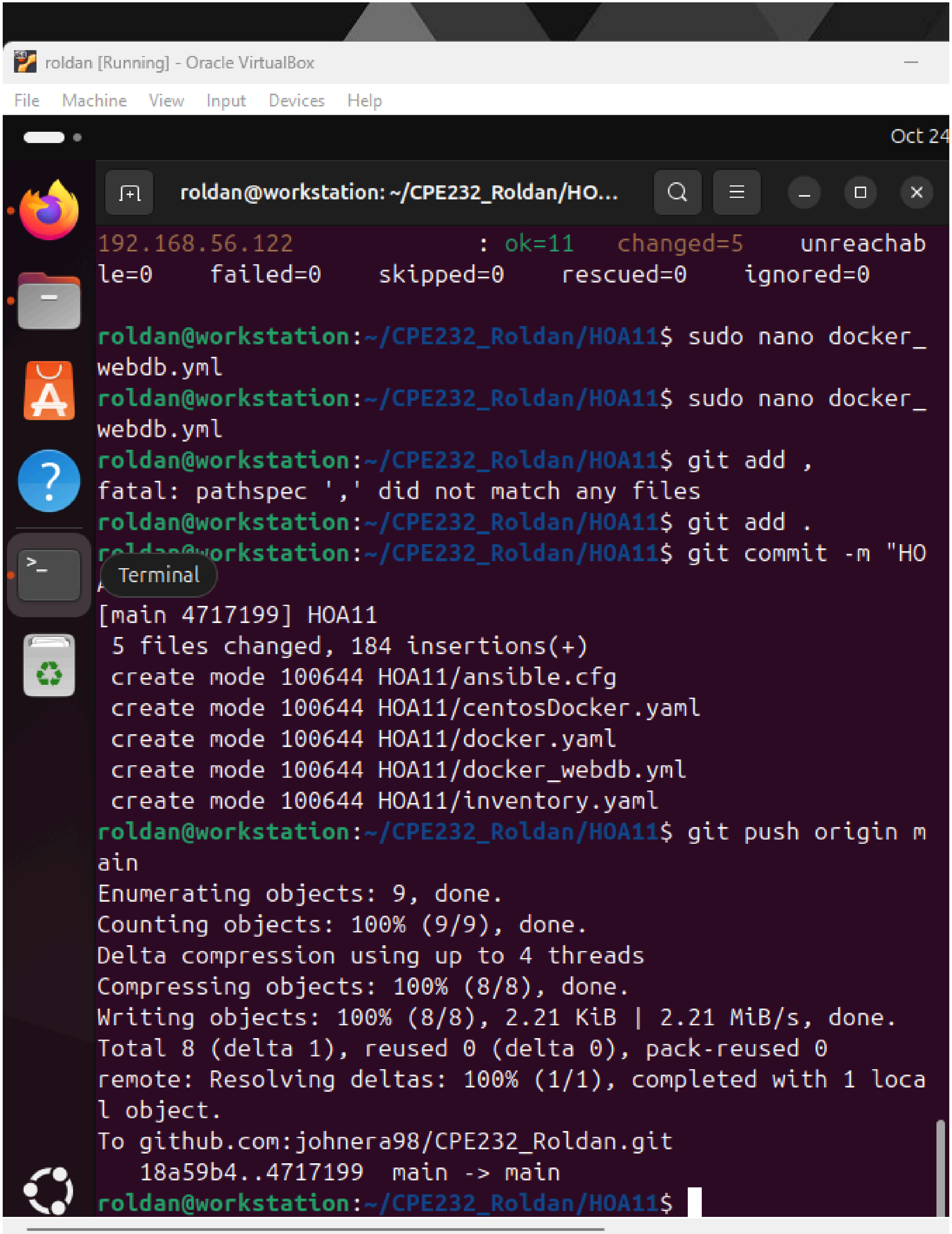
roldan [Running] - Oracle VirtualBox
File Machine View Input Devices Help
Oct 24
roldan@workstation: ~/CPE232_Roldan/HO...
Terminal

```
192.168.56.122             : ok=11    changed=5    unreachab
le=0    failed=0    skipped=0    rescued=0    ignored=0

roldan@workstation:~/CPE232_Roldan/HOA11$ sudo nano docker_
webdb.yml
roldan@workstation:~/CPE232_Roldan/HOA11$ sudo nano docker_
webdb.yml
roldan@workstation:~/CPE232_Roldan/HOA11$ git add ,
fatal: pathspec ',' did not match any files
roldan@workstation:~/CPE232_Roldan/HOA11$ git add .
roldan@workstation:~/CPE232_Roldan/HOA11$ git commit -m "HO
A
[main 4717199] HOA11
 5 files changed, 184 insertions(+)
 create mode 100644 HOA11/ansible.cfg
 create mode 100644 HOA11/centosDocker.yaml
 create mode 100644 HOA11/docker.yaml
 create mode 100644 HOA11/docker_webdb.yml
 create mode 100644 HOA11/inventory.yaml
roldan@workstation:~/CPE232_Roldan/HOA11$ git push origin m
ain
Enumerating objects: 9, done.
Counting objects: 100% (9/9), done.
Delta compression using up to 4 threads
Compressing objects: 100% (8/8), done.
Writing objects: 100% (8/8), 2.21 KiB | 2.21 MiB/s, done.
Total 8 (delta 1), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (1/1), completed with 1 loca
l object.
To github.com:johnera98/CPE232_Roldan.git
   18a59b4..4717199  main -> main
roldan@workstation:~/CPE232_Roldan/HOA11$ 
```

Reflections:

Answer the following:

1. What are the benefits of implementing containerizations?
    - Containerization makes it easier to build, run, and move apps by packaging everything they need like code, settings, and tools into one lightweight unit. This means your app works the same anywhere, whether on your laptop or in the cloud.

Conclusions:

In this activity, i learned how to use Ansible to manage and deploy Docker containers on different servers. Instead of doing everything manually, we used an Ansible playbook to automate adding users to the Docker group, creating a Dockerfile, building an image, and running web and database containers. I also solved some permission issues and made sure everything ran smoothly on each server. Overall, this activity helped us understand how automation makes managing multiple servers easier, faster, and more consistent.