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Course/Section: CPE31S4	**Date Submitted:** 11/28/2023
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Activity 13: OpenStack Prerequisite Installation

1. Objectives

Create a workflow to install OpenStack using Ansible as your Infrastructure as Code (IaC).

2. Intended Learning Outcomes

1. Analyze the advantages and disadvantages of cloud services
2. Evaluate different Cloud deployment and service models
3. Create a workflow to install and configure OpenStack base services using Ansible as documentation and execution.

3. Resources

Oracle VirtualBox (Hypervisor)

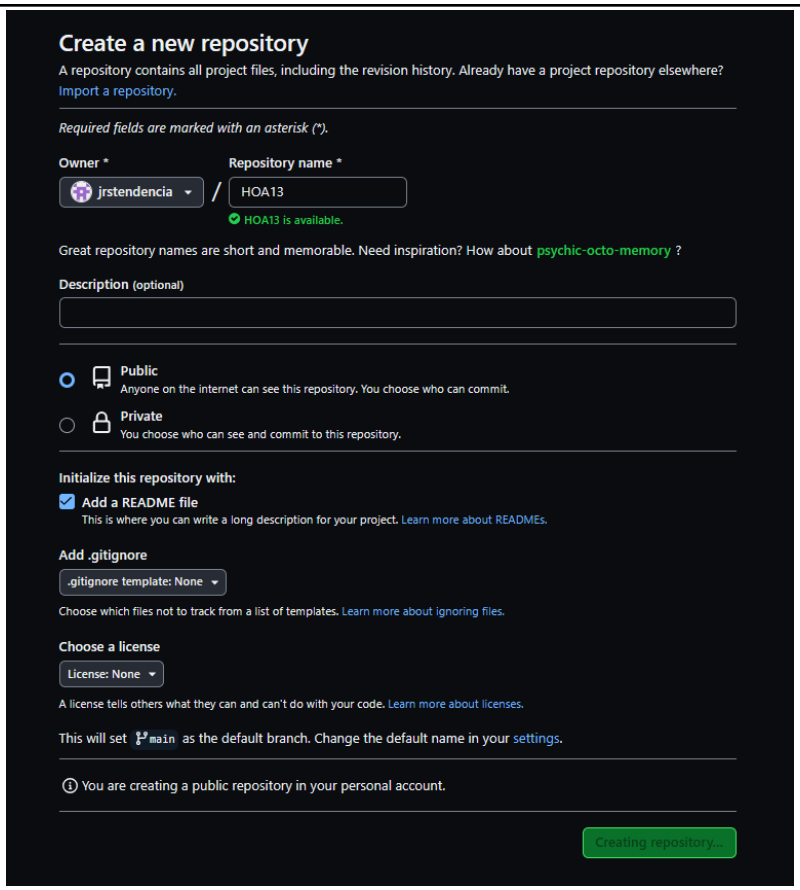
1x Ubuntu VM or Centos VM

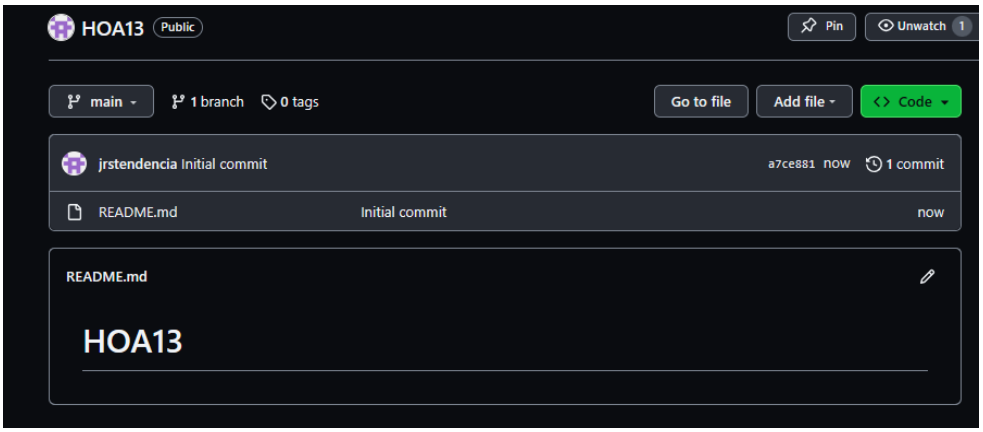
4. Tasks

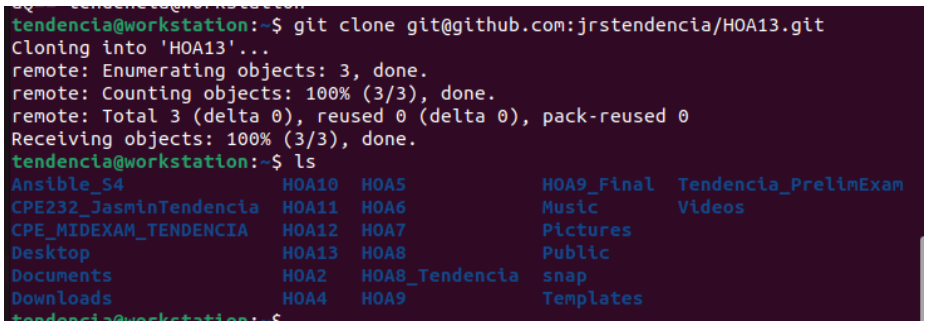
1. Create a new repository for this activity.
2. Create a playbook that converts the steps in the following items in https://docs.openstack.org/install-guide/
    a. NTP
    b. OpenStack packages
    c. SQL Database
    d. Message Queue
    e. Memcached
    f. Etcd
    g. Create different plays in installing per server type (controller, compute etc.) and identify it as a group in Inventory file.
    h. Add, commit and push it to your GitHub repo.

Output (screenshots and explanations)

1. Create a new repository for this activity.


Create a new repository
A repository contains all project files, including the revision history. Already have a project repository elsewhere?
Import a repository.
Required fields are marked with an asterisk (*).
Owner *
Repository name *
jrstendencia
HOA13
HOA13 is available.
Great repository names are short and memorable. Need inspiration? How about psychic-octo-memory ?
Description (optional)
Public
Anyone on the internet can see this repository. You choose who can commit.
Private
You choose who can see and commit to this repository.
Initialize this repository with:
Add a README file
This is where you can write a long description for your project. Learn more about READMEs.
Add .gitignore
.gitignore template: None
Choose which files not to track from a list of templates. Learn more about ignoring files.
Choose a license
License: None
A license tells others what they can and can't do with your code. Learn more about licenses.
This will set main as the default branch. Change the default name in your settings.
You are creating a public repository in your personal account.
Creating repository...


HOA13
Public
Pin
Unwatch 1
main
1 branch
0 tags
Go to file
Add file
Code
jrstendencia Initial commit
a7ce881 now
1 commit
README.md
Initial commit
now
README.md
HOA13


tendencia@workstation:~$ git clone git@github.com:jrstendencia/HOA13.git
Cloning into 'HOA13'...
remote: Enumerating objects: 3, done.
remote: Counting objects: 100% (3/3), done.
remote: Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
Receiving objects: 100% (3/3), done.
tendencia@workstation:~$ ls
Ansible_S4
CPE232_JasminTendencia
CPE_MIDEXAM_TENDENCIA
Desktop
Documents
Downloads
HOA10
HOA11
HOA12
HOA13
HOA2
HOA4
HOA5
HOA6
HOA7
HOA8
HOA8_Tendencia
HOA9
HOA9_Final
Music
Pictures
Public
snap
Templates
Tendencia_PrelimExam
Videos

2. Create different plays in installing per server type (controller, compute etc.) and identify it as a group in Inventory file.
   Inventory file:
   Ubuntu:

```
tendencia@workstation:~/HOA13/ubuntu$ cat inventory
192.168.56.103 ansible_python_interpreter=/usr/bin/python3
#192.168.56.102 ansible_python_interpreter=/usr/bin/python3
#192.168.56.104 ansible_python_interpreter=/usr/bin/python3

[controller_node]
192.168.56.103
```

   CentOS:

```
#192.168.56.101 ansible_python_interpreter=/usr/bin/python3
#192.168.56.102 ansible_python_interpreter=/usr/bin/python3
192.168.56.104 ansible_python_interpreter=/usr/bin/python

[controller_node]
192.168.56.104
```

a. NTP
   Ubuntu:

```
tendencia@workstation:~/HOA13/ubuntu/roles/ntp/files$ cat chrony.conf
# Use public servers from the pool.ntp.org project.
# Please consider joining the pool (http://www.pool.ntp.org/join.html).
server 0.centos.pool.ntp.org iburst
server 1.centos.pool.ntp.org iburst
server 2.centos.pool.ntp.org iburst
server 3.centos.pool.ntp.org iburst

# Record the rate at which the system clock gains/losses time.
driftfile /var/lib/chrony/drift

# Allow the system clock to be stepped in the first three updates
# if its offset is larger than 1 second.
makestep 1.0 3

# Enable kernel synchronization of the real-time clock (RTC).
rtcsync

# Enable hardware timestamping on all interfaces that support it.
#hwtimestamp *

# Increase the minimum number of selectable sources required to adjust
# the system clock.
#minsources 2

# Allow NTP client access from local network.
#allow 192.168.0.0/16

# Serve time even if not synchronized to a time source.
#local stratum 10

# Specify file containing keys for NTP authentication.
#keyfile /etc/chrony.keys

# Specify directory for log files.
logdir /var/log/chrony

# Select which information is logged.
#log measurements statistics tracking

allow 10.0.0.0/24

#server NTP_SERVER iburst
```

```
tendencia@workstation:~/HOA13/ubuntu/roles/ntp/handlers$ cat main.yml
- name: Restarting chrony
  service:
    name: chronyd.service
    state: restarted
    enabled: true
```

```
tendencia@workstation:~/HOA13/ubuntu/roles/ntp/tasks$ cat install.yml

- name: Installing chrony
  apt:
    name: chrony
    state: latest

- name: Starting chrony service
  service:
    name: chronyd.service
    state: started
    enabled: true

- name: Editing chrony.conf file
  copy:
    src: chrony.conf
    dest: /etc/chrony.conf
    owner: root
    group: root
    mode: 644

  notify: Restarting chrony

- block:
  - name: Verifying installation of chrony
    command: chronyd --version
    register: chrony_version

  - debug:
      msg="{{ chrony_version }}"

- block:
  - name: Verifying if chronyd is started and running in the background
    command: systemctl status chronyd
    register: chrony_service

  - debug:
      msg="{{ chrony_service }}"
tendencia@workstation:~/HOA13/ubuntu/roles/ntp/tasks$ cat main.yml

- import_tasks: install.yml
```

CentOS:

```
tendencia@workstation:~/HOA13/centos/roles/ntp/files$ cat chrony.conf
# Use public servers from the pool.ntp.org project.
# Please consider joining the pool (http://www.pool.ntp.org/join.html).
# server 0.centos.pool.ntp.org iburst
# server 1.centos.pool.ntp.org iburst
# server 2.centos.pool.ntp.org iburst
# server 3.centos.pool.ntp.org iburst

server controller iburst

# Record the rate at which the system clock gains/losses time.
driftfile /var/lib/chrony/drift

# Allow the system clock to be stepped in the first three updates
# if its offset is larger than 1 second.
makestep 1.0 3

# Enable kernel synchronization of the real-time clock (RTC).
rtcsync

# Enable hardware timestamping on all interfaces that support it.
#hwtimestamp *

# Increase the minimum number of selectable sources required to adjust
# the system clock.
#minsources 2

# Allow NTP client access from local network.
allow 192.168.56.0/24

# Serve time even if not synchronized to a time source.
#local stratum 10

# Specify file containing keys for NTP authentication.
#keyfile /etc/chrony.keys

# Specify directory for log files.
logdir /var/log/chrony

# Select which information is logged.
#log measurements statistics tracking

#server NTP_SERVER iburst
```

```
tendencia@workstation:~/HOA13/centos/roles/ntp/handlers$ cat main.yml
- name: Restarting chrony
  service:
    name: chronyd.service
    state: restarted
    enabled: true

- name: Reloading firewall
  command: firewall-cmd --reload
```

```
tendencia@workstation:~/HOA13/centos/roles/ntp/tasks$ cat configure.yml
- name: Editing chrony.conf file
  copy:
    src: chrony.conf
    dest: /etc/chrony.conf
    owner: root
    group: root
    mode: 644

  notify: Restarting chrony

- name: Adding firewall
  ansible.builtin.pip:
    name: firewall
    state: latest
  notify: Reloading firewall

- name: Adding NTP service to the firewall
  become: yes
  become_user: root
  command: "firewall-cmd --zone=public --add-service=ntp --permanent"

- name: Reloading the firewall to apply changes
  become: yes
  become_user: root
  command: "firewall-cmd --reload"
```

```
tendencia@workstation:~/HOA13/centos/roles/ntp/tasks$ cat install.yml

- name: Installing chrony
  yum:
    name: chrony
    state: latest

- name: Starting chrony service
  service:
    name: chronyd.service
    state: started
    enabled: true
tendencia@workstation:~/HOA13/centos/roles/ntp/tasks$ cat main.yml

- import_tasks: install.yml
- import_tasks: configure.yml

- block:
  - name: Verifying installation of chrony
    command: chronyd --version
    register: chrony_version

  - debug:
      msg="{{ chrony_version }}"

- block:
  - name: Verifying if chronyd is started and running in the background
    command: systemctl status chronyd
    register: chrony_service

  - debug:
      msg="{{ chrony_service }}"
```

b. OpenStack packages

Ubuntu:

```
tendencia@workstation:~/HOA13/ubuntu/roles/packages/tasks$ cat main.yml

- import_tasks: install.yml
tendencia@workstation:~/HOA13/ubuntu/roles/packages/tasks$ cat install.yml
- name: Enabling openstack repository
  community.general.zypper_repository:
    repo: 'obs://Cloud:OpenStack:Stein/openSUSE_Leap_15.0'
    name: Stein
    auto_import_keys: true
    runrefresh: true


- name: Refreshing the opensuse repository
  apt:
    update_cache: yes


- name: Installing openstackclient
  pip:
    name: python-openstackclient

- block:
  - name: Verifying installation of openstackclient
    shell: openstack --version
    register: openstack_version

  - debug:
      msg="{{ openstack_version }}"
tendencia@workstation:~/HOA13/ubuntu/roles/packages/tasks$
```

CentOS:

```
tendencia@workstation:~/HOA13/centos/roles/packages$ cat main.yml
- import_tasks: install.yml

- block:
  - name: Verifying installation of openstackclient
    shell: openstack --version
    register: openstack_version

  - debug:
      msg="{{ openstack_version }}"
tendencia@workstation:~/HOA13/centos/roles/packages$ cat install.yml
- name: Enabling openstack repository
  yum:
    name: centos-release-openstack-train
    state: latest

- name: Downloading and installing the RDO repository to enable openstack repo
sitory
  yum:
    name: https://rdoproject.org/repos/rdo-release.rpm
    state: present
  ignore_errors: true

- name: Updating repository and upgrading packages
  yum:
    name: '*'
    state: latest
    update_cache: true

- name: Installing openstack
  yum:
    name:
      - openstack-selinux
      - python-openstackclient
      - openstack-utils
```

c. SQL Database

Ubuntu:

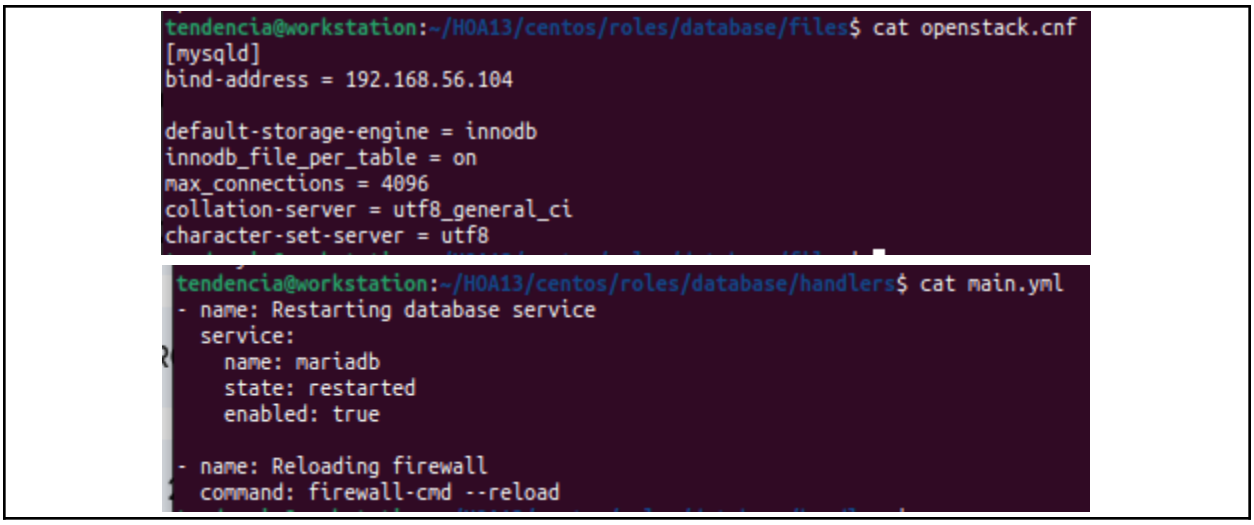
```
tendencia@workstation:~/HOA13/ubuntu/roles/database/files$ cat openstack.conf
[mysqld]
bind-address = 192.168.56.103

default-storage-engine = innodb
innodb_file_per_table = on
max_connections = 4096
collation-server = utf8_general_ci
character-set-server = utf8
```

```
tendencia@workstation:~/HOA13/ubuntu/roles/database/handlers$ cat main.yml
- name: Restarting database service
  service:
    name: mysql
    state: restarted
    enabled: true
```

```
tendencia@workstation:~/HOA13/ubuntu/roles/database/vars$ cat main.yml
---
  root_password: "server54321"
```

```
tendencia@workstation:~/HOA13/ubuntu/roles/database/tasks$ cat main.yml

- import_tasks: install.yml
tendencia@workstation:~/HOA13/ubuntu/roles/database/tasks$ cat install.yml
- name: Installing database components
  apt:
    name:
      - mariadb-client
      - mariadb-server
    state: present  # You can use 'state: present' to ensure the packages are installed

- name: Installing python-PyMySQL
  apt:
    name: python3-pymysql
    state: present

- name: Copying openstack.cnf file
  copy:
    src: openstack.cnf
    dest: /etc/my.cnf.d/openstack.cnf
    owner: root
    group: root
    mode: 644

  notify: Restarting database service

- name: Starting and enabling database service
  service:
    name: mysql
    state: started
    enabled: true

- block:
  - name: Verifying installation of mysql
    shell: mysql --version
    register: mysql_version

  - debug:
      msg="{{ mysql_version }}"

- block:
  - name: Verifying if mysql is started and running in the background
    shell: systemctl status mysql
    register: mysql_service

  - debug:
      msg="{{ mysql_service }}"
```

CentOS:


tendencia@workstation:~/HOA13/centos/roles/database/files$ cat openstack.cnf
[mysqld]
bind-address = 192.168.56.104
default-storage-engine = innodb
innodb_file_per_table = on
max_connections = 4096
collation-server = utf8_general_ci
character-set-server = utf8
tendencia@workstation:~/HOA13/centos/roles/database/handlers$ cat main.yml
- name: Restarting database service
service:
name: mariadb
state: restarted
enabled: true
- name: Reloading firewall
command: firewall-cmd --reload

```
tendencia@workstation:~/HOA13/centos/roles/database/vars$ cat main.yml
---
  mysql_root_password: "server54321"
```

```
tendencia@workstation:~/HOA13/centos/roles/database/tasks$ cat configure.yml
- name: Copying openstack.cnf file
  copy:
    src: openstack.cnf
    dest: /etc/my.cnf.d/openstack.cnf
    owner: root
    group: root
    mode: 644

  notify: Restarting database service

- name: Starting and enabling mariadb.service
  service:
    name: mariadb.service
    state: started
    enabled: true

- name: Adding MySQL service to the firewall
  become: yes
  become_user: root
  command: "firewall-cmd --zone=public --add-service=mysql --permanent"

- name: Reloading the firewall to apply changes
  become: yes
  become_user: root
  command: "firewall-cmd --reload"
tendencia@workstation:~/HOA13/centos/roles/database/tasks$ cat main.yml
- import_tasks: install.yml
- import_tasks: configure.yml

- block:
  - name: Verifying installation of MariaDB
    shell: mysql --version
    register: mysql_version

  - debug:
      msg="{{ mysql_version }}"

- block:
  - name: Verifying if MariaDB is started and running in the background
    shell: systemctl status mariadb
    register: mariadb_service

  - debug:
      msg="{{ mariadb_service }}"
tendencia@workstation:~/HOA13/centos/roles/database/tasks$ cat install.yml
- name: Installing database components
  yum:
    name:
      - mariadb
      - mariadb-server
      - python2-PyMySQL
```

d. Message Queue

Ubuntu:

```
tendencia@workstation:~/HOA13/ubuntu/roles/messageQ/handlers$ cat main.yml
- name: Configuring rabbitmq-server
  shell: |
    rabbitmqctl add_user openstack server54321
    rabbitmqctl set_permissions openstack ".*" ".*" ".*"
```

```
tendencia@workstation:~/HOA13/ubuntu/roles/messageQ/tasks$ cat install.yml

- name: Installing rabbitmq-server
  apt:
    name: rabbitmq-server
    state: latest

- name: Starting service
  service:
    name: rabbitmq-server.service
    state: started
    enabled: true

  notify: Configuring rabbitmq-server

- block:
  - name: Verifying rabbitmq-server installation
    command: rabbitmq-server --version
    register: rabbitmq_version

  - debug:
      msg="{{ rabbitmq_version }}"

- block:
  - name: Verifying rabbitmq-server installation
    command: sudo systemctl status rabbitmq-server
    register: rabbitmq_service

  - debug:
      msg="{{ rabbitmq_service }}"
tendencia@workstation:~/HOA13/ubuntu/roles/messageQ/tasks$ cat main.yml

- import_tasks: install.yml
```

CentOS:

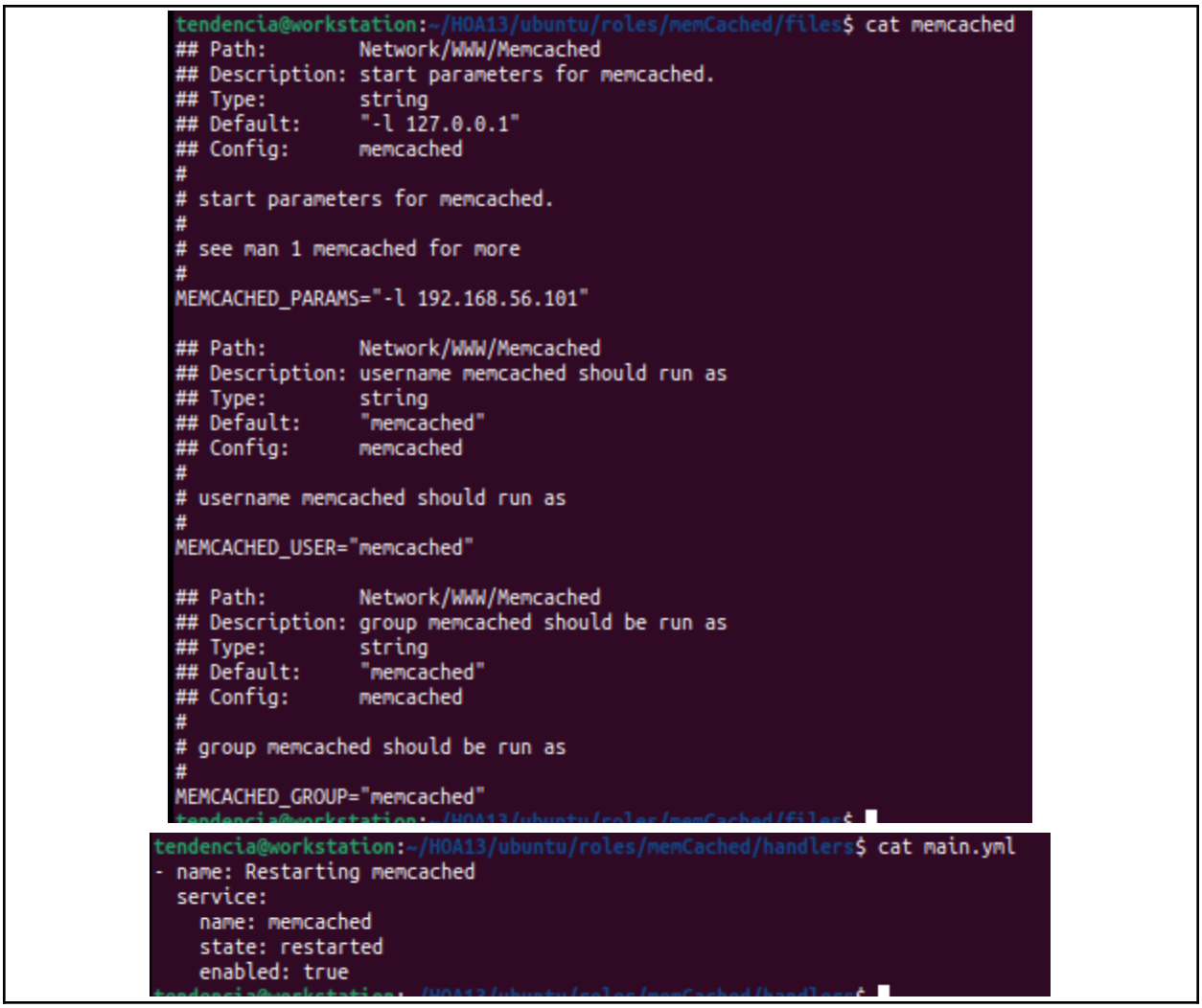
```
tendencia@workstation:~/HOA13/centos/roles/messageQ/handlers$ cat main.yml
- name: Configuring rabbitmq-server
  shell: |
    rabbitmqctl add_user openstack "{{ root_password }}"
    rabbitmqctl set_permissions openstack ".*" ".*" ".*"

- name: Reloading firewall
  command: firewall-cmd --reload
```

```
tendencia@workstation:~/HOA13/centos/roles/messageQ/tasks$ cat configure.yml
- name: Adding 11211 port to firewall
  ansible.posix.firewalld:
    port: 11211/tcp
    permanent: yes

  notify: Reloading firewall

- name: Adding 5672 port to firewall
ansible.posix.firewalld:
  port: 5672/tcp
  permanent: yes

  notify: Reloading firewall
tendencia@workstation:~/HOA13/centos/roles/messageQ/tasks$ cat main.yml
- import_tasks: install.yml

- block:
  - name: Verifying rabbitmq-server installation
    command: systemctl status rabbitmq-server
    register: rabbitmq_service

  - debug:
      msg="{{ rabbitmq_service }}"
tendencia@workstation:~/HOA13/centos/roles/messageQ/tasks$ cat install.yml
- name: Installing rabbitmq-server
  yum:
    name: rabbitmq-server
    state: latest

- name: Starting RabbitMQ service
  systemd:
    name: rabbitmq-server.service
    state: started
  async: 1200
  poll: 0
  become: true

  notify: Configuring rabbitmq-server
```

```
tendencia@workstation:~/HOA13/centos/roles/messageQ/vars$ cat main.yml
---
  root_password: "server54321"
```

e. Memcached

Ubuntu:


tendencia@workstation:~/HOA13/ubuntu/roles/memCached/files$ cat memcached
Path: Network/WWW/Memcached
Description: start parameters for memcached.
Type: string
Default: "-l 127.0.0.1"
Config: memcached
#
start parameters for memcached.
#
see man 1 memcached for more
#
MEMCACHED_PARAMS="-l 192.168.56.101"
Path: Network/WWW/Memcached
Description: username memcached should run as
Type: string
Default: "memcached"
Config: memcached
#
username memcached should run as
#
MEMCACHED_USER="memcached"
Path: Network/WWW/Memcached
Description: group memcached should be run as
Type: string
Default: "memcached"
Config: memcached
#
group memcached should be run as
#
MEMCACHED_GROUP="memcached"
tendencia@workstation:~/HOA13/ubuntu/roles/memCached/handlers$ cat main.yml
- name: Restarting memcached
service:
name: memcached
state: restarted
enabled: true

```
tendencia@workstation:~/HOA13/ubuntu/roles/memCached/tasks$ cat install.yml

- name: Installing memcached
  apt:
    name:
      - memcached
      - python3-memcache
    state: latest

- name: Ensure /etc/sysconfig directory exists
  file:
    path: /etc/sysconfig
    state: directory
    owner: root
    group: root
    mode: 0755

- name: Editing memcached.conf file
  copy:
    src: memcached
    dest: /etc/sysconfig/memcached
    owner: root
    group: root
    mode: 644

  notify: Restarting memcached

- name: Starting memcached service
  service:
    name: memcached
    state: started
    enabled: true

- block:
  - name: Verifying installation of memcached
    command: memcached --version
    register: memcached_version

  - debug:
      msg="{{ memcached_version }}"

- block:
  - name: Verifying if memcached is started and running in the background
    command: systemctl status memcached
    register: memcached_service

  - debug:
      msg="{{ memcached_service }}"
```

```
tendencia@workstation:~/HOA13/ubuntu/roles/memCached/tasks$ cat main.yml

- import_tasks: install.yml
```

CentOS:

```
tendencia@workstation:~/HOA13/centos/roles/memCached/files$ cat memcached
PORT="11211"
USER="memcached"
MAXCONN="1024"
CACHESIZE="64"
OPTIONS="-l 127.0.0.1,::1,controller"
```

```
tendencia@workstation:~/HOA13/centos/roles/memCached/handlers$ cat main.yml
- name: Restarting memcached
  service:
    name: memcached
    state: restarted
    enabled: true
```

```
tendencia@workstation:~/HOA13/centos/roles/memCached/tasks$ cat configure.yml
- name: editing memcached.conf file
  copy:
    src: memcached
    dest: /etc/sysconfig/memcached
    owner: root
    group: root
    mode: 644

  notify: Restarting memcached

- name: Starting memcached service
  service:
    name: memcached
    state: started
    enabled: true
tendencia@workstation:~/HOA13/centos/roles/memCached/tasks$ cat install.yml

- name: Installing memcached
  yum:
    name:
      - memcached
      - python-memcached
    state: latest

tendencia@workstation:~/HOA13/centos/roles/memCached/tasks$ cat main.yml
- import_tasks: install.yml
- import_tasks: configure.yml

- block:
  - name: Verifying installation of memcached
    command: memcached --version
    register: memcached_version

  - debug:
      msg="{{ memcached_version }}"

- block:
  - name: Verifying if memcached is started and running in the background
    command: systemctl status memcached
    register: memcached_service

  - debug:
      msg="{{ memcached_service }}"
```

f. **Etcd**

Ubuntu:

```
tendencia@workstation:~/HOA13/ubuntu/roles/etcd/files$ cat etcd.service
[Unit]
After=network.target
Description=etcd - highly-available key value store

[Service]
# Uncomment this on ARM64.
# Environment="ETCD_UNSUPPORTED_ARCH=arm64"
LimitNOFILE=65536
Restart=on-failure
Type=notify
ExecStart=/usr/bin/etcd --config-file /etc/etcd/etcd.conf.yml
User=etcd

[Install]
WantedBy=multi-user.target
tendencia@workstation:~/HOA13/ubuntu/roles/etcd/files$ cat etcd.conf.yml
name: controller
data-dir: /var/lib/etcd
initial-cluster-state: 'new'
initial-cluster-token: 'etcd-cluster-01'
initial-cluster: controller=http://192.168.56.101:2380
initial-advertise-peer-urls: http://192.168.56.101:2380
advertise-client-urls: http://192.168.56.101:2379
listen-peer-urls: http://0.0.0.0:2380
listen-client-urls: http://192.168.56.101:2379
```

```
tendencia@workstation:~/HOA13/ubuntu/roles/etcd/handlers$ cat main.yml
\
- name: Reloading systemd service files
  systemd:
    daemon_reload: yes
  ignore_errors: yes
```

```
tendencia@workstation:~/HOA13/ubuntu/roles/etcd/tasks$ cat main.yml

- import_tasks: install.yml
tendencia@workstation:~/HOA13/ubuntu/roles/etcd/tasks$ cat install.yml

- name: Creating etcd user
  group:
    name: etcd
    system: true
    state: present

- name: Creating user for etcd
  user:
    name: etcd
    home: "/var/lib/etcd"
    shell: /bin/false
    group: etcd
    system: true

- name: Creating /etc/etcd directory
  file:
    path: /etc/etcd
    state: directory
    owner: etcd
    group: etcd

- name: Creating /var/lib/etcd directory
  file:
    path: /var/lib/etcd
    state: directory
    owner: etcd
    group: etcd

- name: Installing etcd tarball for x86_64/amd64
  shell: |
    ETCD_VER=v3.2.7
    rm -rf /tmp/etcd && mkdir -p /tmp/etcd
    curl -L https://github.com/coreos/etcd/releases/download/${ETCD_VER}/etcd-${ETCD_VER}-linux-amd64.tar.gz -o /tmp/
etcd-${ETCD_VER}-linux-amd64.tar.gz
    tar xzvf /tmp/etcd-${ETCD_VER}-linux-amd64.tar.gz -C /tmp/etcd --strip-components=1
    cp /tmp/etcd/etcd /usr/bin/etcd
    cp /tmp/etcd/etcdctl /usr/bin/etcdctl
```

```
- name: Creating a config file for etcd
  copy:
    src: etcd.conf.yml
    dest: /etc/etcd/etcd.conf.yml
    owner: root
    group: root
    mode: 644

- name: Copying the service file for etcd
  copy:
    src: etcd.service
    dest: /usr/lib/systemd/system/etcd.service
    owner: root
    group: root
    mode: 644

  notify: Reloading systemd service files

- name: Starting and enabling service of etcd
  service:
    name: etcd
    state: started
    enabled: true

- block:
  - name: Verifying installation of etcd
    command: etcd --version
    register: etcd_version

  - debug:
      msg="{{ etcd_version }}"

- block:
  - name: Verifying if etcd is started and running in the background
    command: systemctl status etcd
    register: etcd_service

  - debug:
      msg="{{ etcd_service }}"
```

CentOS:

```
tendencia@workstation:~/HOA13/centos/roles/etcd/files$ cat etcd.conf
#[Member]
#ETCD_CORS=""
ETCD_DATA_DIR="/var/lib/etcd/default.etcd"
#ETCD_WAL_DIR=""
ETCD_LISTEN_PEER_URLS="http://192.168.56.104:2380"
ETCD_LISTEN_CLIENT_URLS="http://192.168.56.104:2379"
#ETCD_MAX_SNAPSHOTS="5"
#ETCD_MAX_WALS="5"
ETCD_NAME="controller"
#ETCD_SNAPSHOT_COUNT="100000"
#ETCD_HEARTBEAT_INTERVAL="100"
#ETCD_ELECTION_TIMEOUT="1000"
#ETCD_QUOTA_BACKEND_BYTES="0"
#ETCD_MAX_REQUEST_BYTES="1572864"
#ETCD_GRPC_KEEPALIVE_MIN_TIME="5s"
#ETCD_GRPC_KEEPALIVE_INTERVAL="2h0m0s"
#ETCD_GRPC_KEEPALIVE_TIMEOUT="20s"
#
#[Clustering]
ETCD_INITIAL_ADVERTISE_PEER_URLS="http://192.168.56.104:2380"
ETCD_ADVERTISE_CLIENT_URLS="http://192.168.56.104:2379"
#ETCD_DISCOVERY=""
#ETCD_DISCOVERY_FALLBACK="proxy"
#ETCD_DISCOVERY_PROXY=""
#ETCD_DISCOVERY_SRV=""
ETCD_INITIAL_CLUSTER="controller=http://192.168.56.104:2380"
ETCD_INITIAL_CLUSTER_TOKEN="etcd-cluster-01"
ETCD_INITIAL_CLUSTER_STATE="new"
#ETCD_STRICT_RECONFIG_CHECK="true"
#ETCD_ENABLE_V2="true"
#
#[Proxy]
#ETCD_PROXY="off"
#ETCD_PROXY_FAILURE_WAIT="5000"
#ETCD_PROXY_REFRESH_INTERVAL="30000"
#ETCD_PROXY_DIAL_TIMEOUT="1000"
#ETCD_PROXY_WRITE_TIMEOUT="5000"
#ETCD_PROXY_READ_TIMEOUT="0"
#
#[Security]
#ETCD_CERT_FILE=""
#ETCD_KEY_FILE=""
#ETCD_CLIENT_CERT_AUTH="false"
#ETCD_TRUSTED_CA_FILE=""
#ETCD_AUTO_TLS="false"
#ETCD_PEER_CERT_FILE=""
#ETCD_PEER_KEY_FILE=""
```

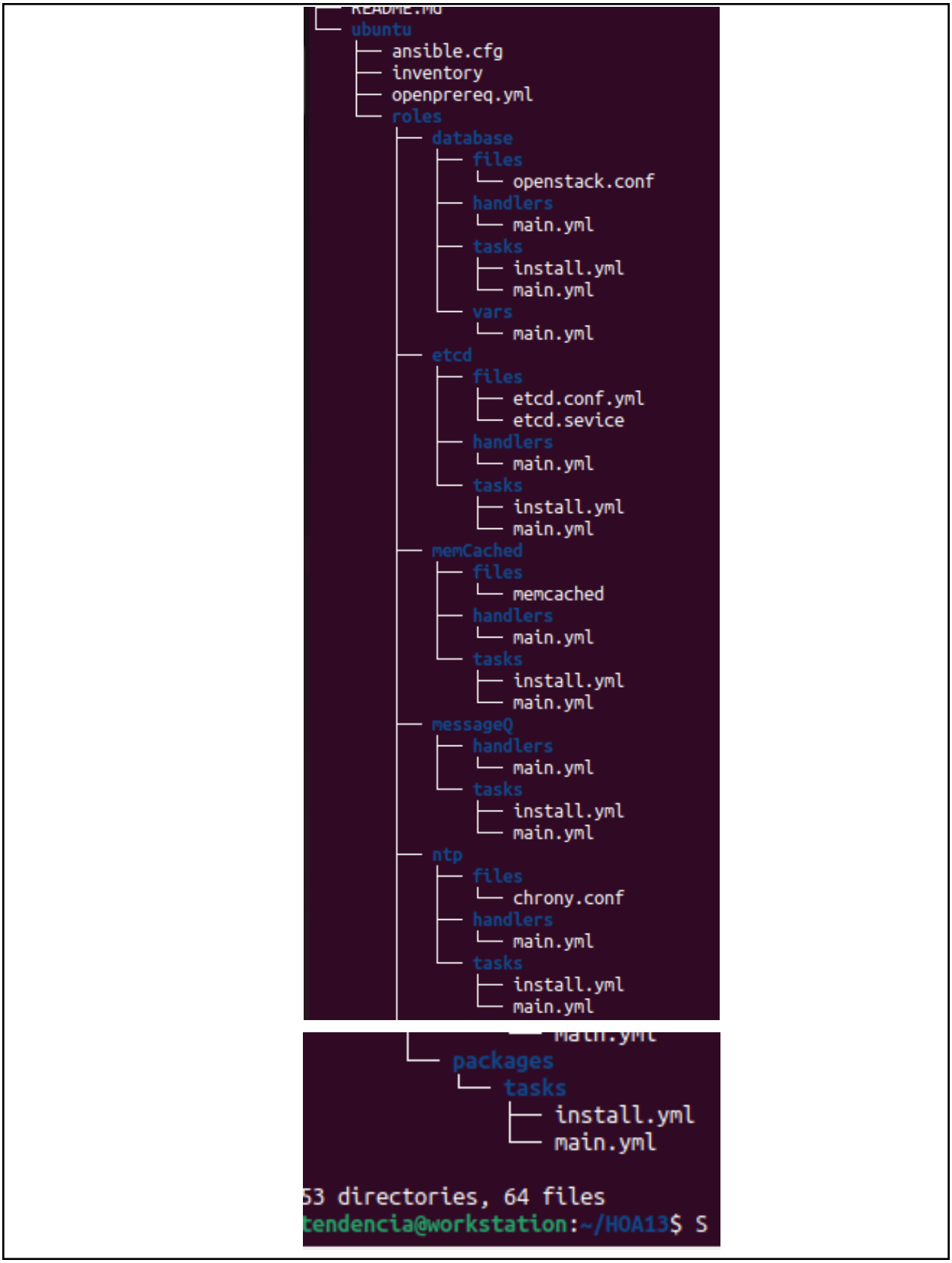
```
tendencia@workstation:~/HOA13/centos/roles/etcd/handlers$ cat main.yml

- name: Reloading systemd service files
  systemd:
    daemon_reload: yes
  ignore_errors: yes

- name: Reloading firewall
  command: firewall-cmd --reload
```

```
tendencia@workstation:~/HOA13/centos/roles/etcd/tasks$ cat configure.yml
- name: Editing etcd.conf file
  copy:
    src: etcd.conf
    dest: /etc/etcd/etcd.conf
    owner: root
    group: root
    mode: 644

- name: Adding 2380 port to firewall
  become: yes
  become_user: root
  command: "firewall-cmd --zone=public --add-port=2380/tcp --permanent"
  notify: Reloading firewall

- name: Adding 2379 port to firewall
  become: yes
  become_user: root
  command: "firewall-cmd --zone=public --add-port=2379/tcp --permanent"
  notify: Reloading firewall

- name: Reloading the firewall to apply changes
  become: yes
  become_user: root
  command: "firewall-cmd --reload"

- name: Starting etcd service
  service:
    name: etcd
    state: started
    enabled: true
```

```
tendencia@workstation:~/HOA13/centos/roles/etcd/tasks$ cat install.yml
- name: Installing etcd
  yum:
    name:
      - etcd
    state: latest
tendencia@workstation:~/HOA13/centos/roles/etcd/tasks$ cat main.yml
- import_tasks: install.yml
- import_tasks: configure.yml

- block:
  - name: Verifying installation of etcd
    command: etcd --version
    register: etcd_version

  - debug:
      msg="{{ etcd_version }}"

- block:
  - name: Verifying if etcd is started and running in the background
    command: systemctl status etcd
    register: etcd_service

  - debug:
      msg="{{ etcd_service }}"
```

3. Created roles:


tendencia@workstation:~/HOA13$ tree
.
├── centos
│   ├── ansible.cfg
│   ├── inventory
│   ├── library
│   │   └── mysql-install.py
│   ├── openprereq.yml
│   └── roles
│   ├── database
│   │   ├── files
│   │   │   └── openstack.cnf
│   │   ├── handlers
│   │   │   └── main.yml
│   │   ├── tasks
│   │   │   ├── configure.yml
│   │   │   ├── install.yml
│   │   │   └── main.yml
│   │   └── vars
│   │   └── main.yml
│   ├── etcd
│   │   ├── files
│   │   │   └── etcd.conf
│   │   ├── handlers
│   │   │   └── main.yml
│   │   └── tasks
│   │   ├── configure.yml
│   │   ├── install.yml
│   │   └── main.yml
│   ├── memCached
│   │   ├── files
│   │   │   └── memcached
│   │   ├── handlers
│   │   │   └── main.yml
│   │   └── tasks
│   │   ├── configure.yml
│   │   ├── install.yml
│   │   └── main.yml
│   ├── messageQ
│   │   ├── handlers
│   │   │   └── main.yml
│   │   ├── tasks
│   │   │   ├── configure.yml
│   │   │   ├── install.yml
│   │   │   └── main.yml
│   │   └── vars
│   │   └── main.yml
│   ├── network
│   │   ├── files
│   │   │   ├── hosts
│   │   │   └── ifcfg-enp0s8
│   │   ├── handlers
│   │   │   └── main.yml
│   │   └── tasks
│   │   ├── install.yml
│   │   └── main.yml
│   ├── ntp
│   │   ├── files
│   │   │   └── chrony.conf
│   │   ├── handlers
│   │   │   └── main.yml
│   │   └── tasks
│   │   ├── configure.yml
│   │   ├── install.yml
│   │   └── main.yml
│   └── packages
│   ├── install.yml
│   └── main.yml
└── README.md


README.md
ubuntu
ansible.cfg
inventory
openprereq.yml
roles
database
files
openstack.conf
handlers
main.yml
tasks
install.yml
main.yml
vars
main.yml
etcd
files
etcd.conf.yml
etcd.sevice
handlers
main.yml
tasks
install.yml
main.yml
memCached
files
memcached
handlers
main.yml
tasks
install.yml
main.yml
messageQ
handlers
main.yml
tasks
install.yml
main.yml
ntp
files
chrony.conf
handlers
main.yml
tasks
install.yml
main.yml
packages
tasks
install.yml
main.yml
53 directories, 64 files
tendencia@workstation:~/HOA13$ S

4. Create a main playbook that converts the steps in the following items in https://docs.openstack.org/install-guide/: NTP, OpenStack packages, SQL Database, Message Queue, Memcached, Etcd

Ubuntu:

```
 GNU nano 6.2                                          openprereq.yml
---

- hosts: all
  become: true
  pre_tasks:

  - name: Updating and upgrading the operating system
    apt:
      name: "*"
      state: latest
      update_cache: true

- hosts: controller_node
  become: true
  roles:
    - ntp
    - packages
    - database
    - messageQ
    - memCached
    - etcd
```

CentOS:

```
---

- hosts: all
  become: true
  vars:
    ansible_python_interpreter: /usr/bin/python
  pre_tasks:

  - name: Updating the repository
    yum:
      update_cache: true

- hosts: controller_node
  become: true
  roles:
    - network
    - ntp
    - packages
    - database
    - messageQ
    - memCached
    - etcd
```

5. Output of playbook:

Successful run in Ubuntu:

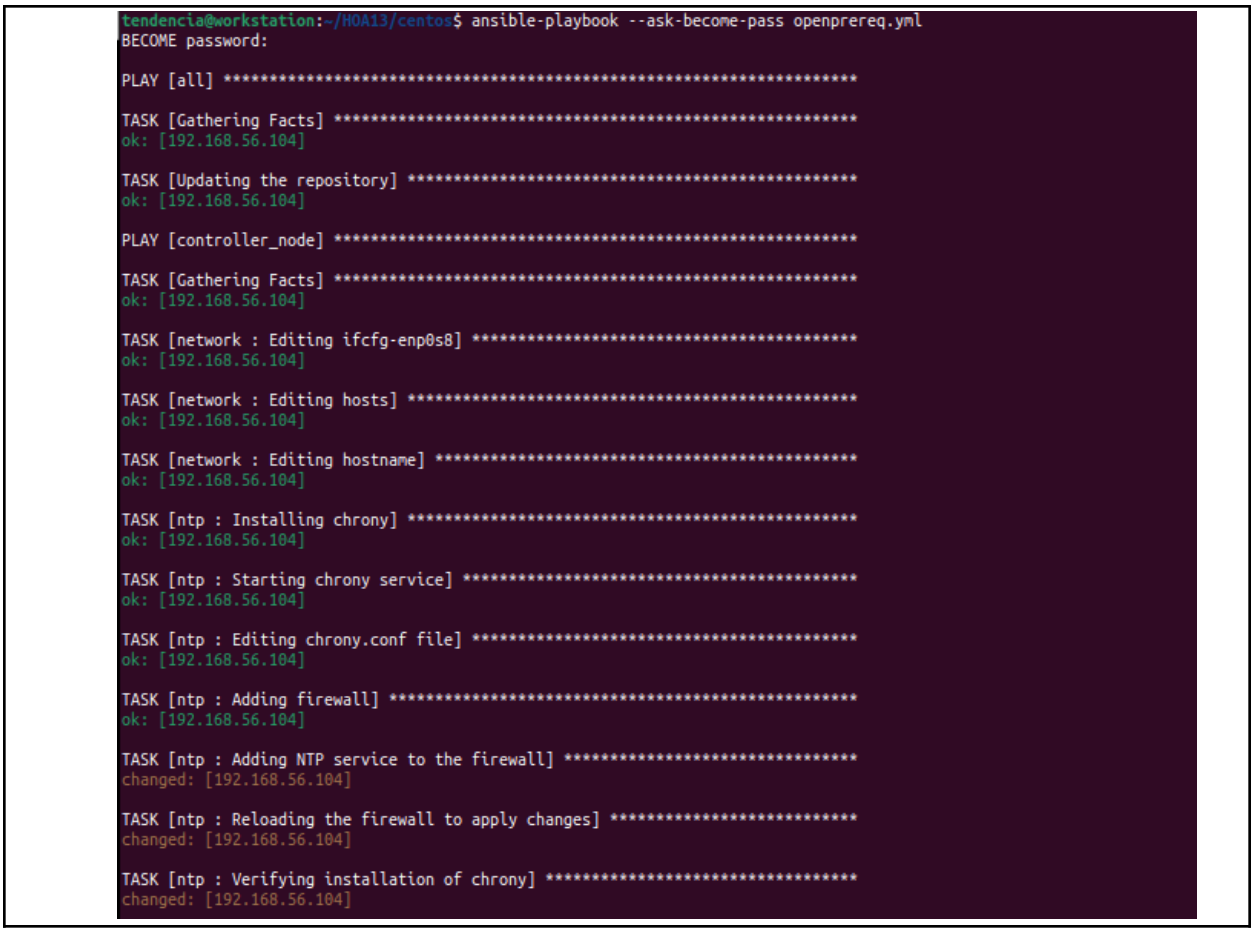
```
tendencia@workstation:~/HOA13/ubuntu$ ansible-playbook --ask-become-pass openprereq.yml
BECOME password:

PLAY [all] *********************************************************************************************************

TASK [Gathering Facts] *********************************************************************************************
ok: [192.168.56.103]

TASK [Ensure dpkg is configured] ***********************************************************************************
changed: [192.168.56.103]

TASK [Updating and upgrading the operating system] *****************************************************************
ok: [192.168.56.103]

PLAY [controller_node] *********************************************************************************************

TASK [Gathering Facts] *********************************************************************************************
ok: [192.168.56.103]

TASK [ntp : Installing chrony] *************************************************************************************
ok: [192.168.56.103]

TASK [ntp : Starting chrony service] *******************************************************************************
ok: [192.168.56.103]

TASK [ntp : Editing chrony.conf file] ******************************************************************************
ok: [192.168.56.103]

TASK [ntp : Verifying installation of chrony] **********************************************************************
changed: [192.168.56.103]

TASK [ntp : debug] *************************************************************************************************
ok: [192.168.56.103] => {
    "msg": {
        "changed": true,
        "cmd": [
            "chronyd",
            "--version"
        ],
        "delta": "0:00:00.270648",
        "end": "2023-11-28 23:47:50.932097",
        "failed": false,
        "msg": "",
        "rc": 0,
        "start": "2023-11-28 23:47:50.661449",
        "stderr": "",
        "stderr_lines": [],
        "stdout": "chronyd (chrony) version 4.2 (+CMDMON +NTP +REFCLOCK +RTC +PRIVDROP +SCFILTER +SIGND +ASYNCDNS +NTS +SECHASH +IPV6 -DEBUG)",
        "stdout_lines": [
            "chronyd (chrony) version 4.2 (+CMDMON +NTP +REFCLOCK +RTC +PRIVDROP +SCFILTER +SIGND +ASYNCDNS +NTS +SECHASH +IPV6 -DEBUG)"
        ]
    }
}
```

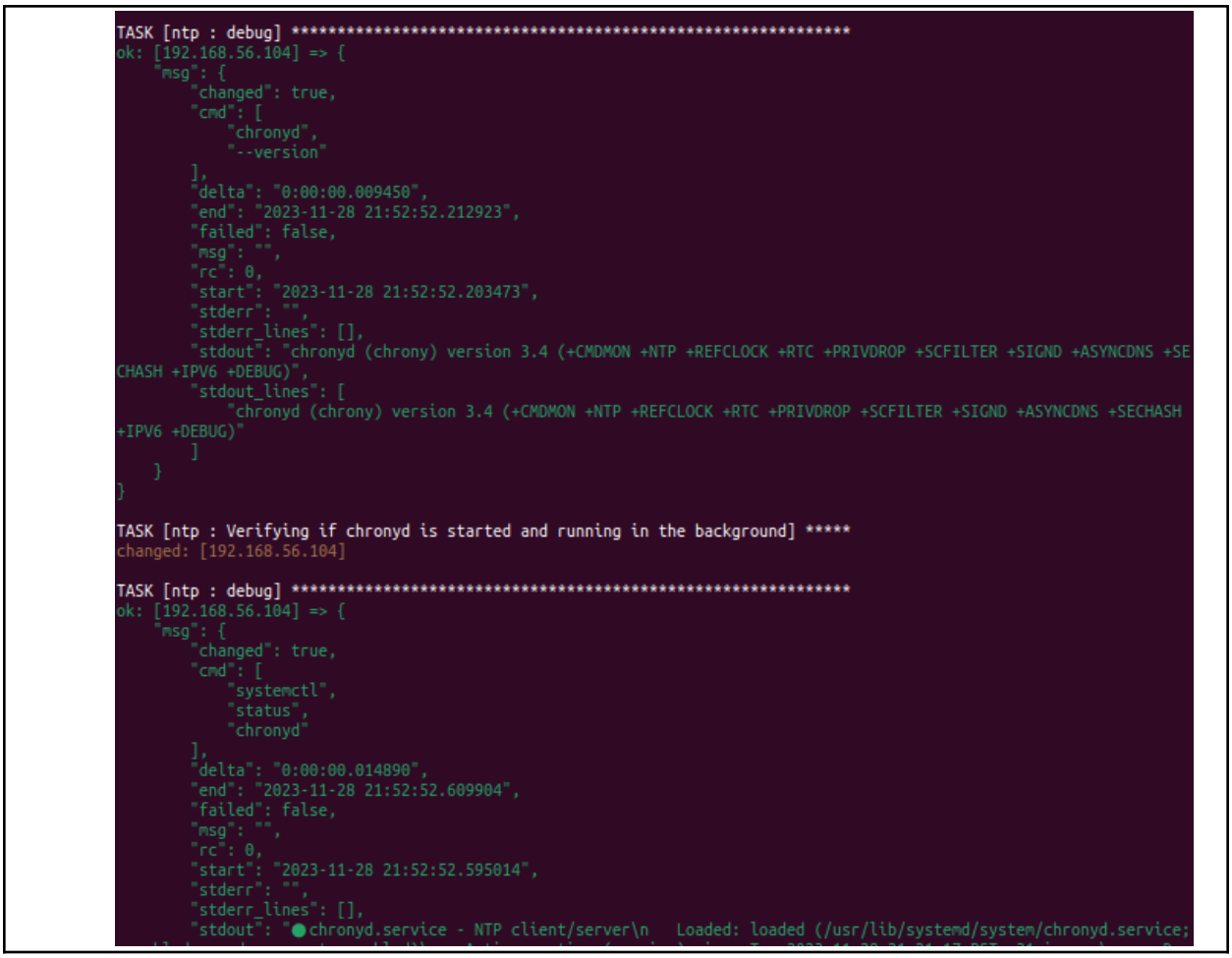
```
TASK [ntp : Verifying if chronyd is started and running in the background] *****************************************
changed: [192.168.56.103]

TASK [ntp : debug] *************************************************************************************************
ok: [192.168.56.103] => {
    "msg": {
        "changed": true,
        "cmd": [
            "systemctl",
            "status",
            "chronyd"
        ],
        "delta": "0:00:00.226909",
        "end": "2023-11-28 23:47:51.777977",
        "failed": false,
        "msg": "",
        "rc": 0,
        "start": "2023-11-28 23:47:51.551068",
        "stderr": "",
        "stderr_lines": [],
        "stdout": "● chrony.service - chrony, an NTP client/server\n     Loaded: loaded (/lib/systemd/system/chrony.service; enabled; vendor preset: enabled)\n     Active: active (running) since Tue 2023-11-28 23:13:07 PST; 34min ago\n       Docs: man:chronyd(8)\n             man:chronyc(1)\n             man:chrony.conf(5)\n    Process: 19351 ExecStart=/usr/lib/systemd/scripts/chronyd-starter.sh $DAEMON_OPTS (code=exited, status=0/SUCCESS)\n   Main PID: 19360 (chronyd)\n      Tasks: 2 (limit: 3438)\n     Memory: 1.0M\n        CPU: 645ms\n     CGroup: /system.slice/chrony.service\n             ├─19360 /usr/sbin/chronyd -F 1\n             └─19361 /usr/sbin/chronyd -F 1\n\nNov 28 23:13:07 server2 systemd[1]: Starting chrony, an NTP client/server...\nNov 28 23:13:07 server2 chronyd[19360]: chronyd version 4.2 starting (+CMDMON +NTP +REFCLOCK +RTC +PRIVDROP +SCFILTER +SIGND +ASYNCDNS +NTS +SECHASH +IPV6 -DEBUG)\nNov 28 23:13:07 server2 chronyd[19360]: Initial frequency 32.386 ppm\nNov 28 23:13:07 server2 chronyd[19360]: Using right/UTC timezone to obtain leap second data\nNov 28 23:13:07 server2 chronyd[19360]: Loaded seccomp filter (level 1)\nNov 28 23:13:07 server2 systemd[1]: Started chrony, an NTP client/server.\nNov 28 23:13:15 server2 chronyd[19360]: Selected source 185.125.190.58 (ntp.ubuntu.com)\nNov 28 23:13:15 server2 chronyd[19360]: System clock TAI offset set to 37 seconds",
        "stdout_lines": [
            "● chrony.service - chrony, an NTP client/server",
            "     Loaded: loaded (/lib/systemd/system/chrony.service; enabled; vendor preset: enabled)",
            "     Active: active (running) since Tue 2023-11-28 23:13:07 PST; 34min ago",
            "       Docs: man:chronyd(8)",
            "             man:chronyc(1)",
            "             man:chrony.conf(5)",
            "    Process: 19351 ExecStart=/usr/lib/systemd/scripts/chronyd-starter.sh $DAEMON_OPTS (code=exited, status=0/SUCCESS)",
            "   Main PID: 19360 (chronyd)",
            "      Tasks: 2 (limit: 3438)",
            "     Memory: 1.0M",
            "        CPU: 645ms",
            "     CGroup: /system.slice/chrony.service",
            "             ├─19360 /usr/sbin/chronyd -F 1",
            "             └─19361 /usr/sbin/chronyd -F 1",
            "",
            "Nov 28 23:13:07 server2 systemd[1]: Starting chrony, an NTP client/server...",
            "Nov 28 23:13:07 server2 chronyd[19360]: chronyd version 4.2 starting (+CMDMON +NTP +REFCLOCK +RTC +PRIVDROP +SCFILTER +SIGND +ASYNCDNS +NTS +SECHASH +IPV6 -DEBUG)",
            "Nov 28 23:13:07 server2 chronyd[19360]: Initial frequency 32.386 ppm",
            "Nov 28 23:13:07 server2 chronyd[19360]: Using right/UTC timezone to obtain leap second data",
            "Nov 28 23:13:07 server2 chronyd[19360]: Loaded seccomp filter (level 1)",
            "Nov 28 23:13:07 server2 systemd[1]: Started chrony, an NTP client/server.",
            "Nov 28 23:13:15 server2 chronyd[19360]: Selected source 185.125.190.58 (ntp.ubuntu.com)",
            "Nov 28 23:13:15 server2 chronyd[19360]: System clock TAI offset set to 37 seconds"
        ]
    }
}
```

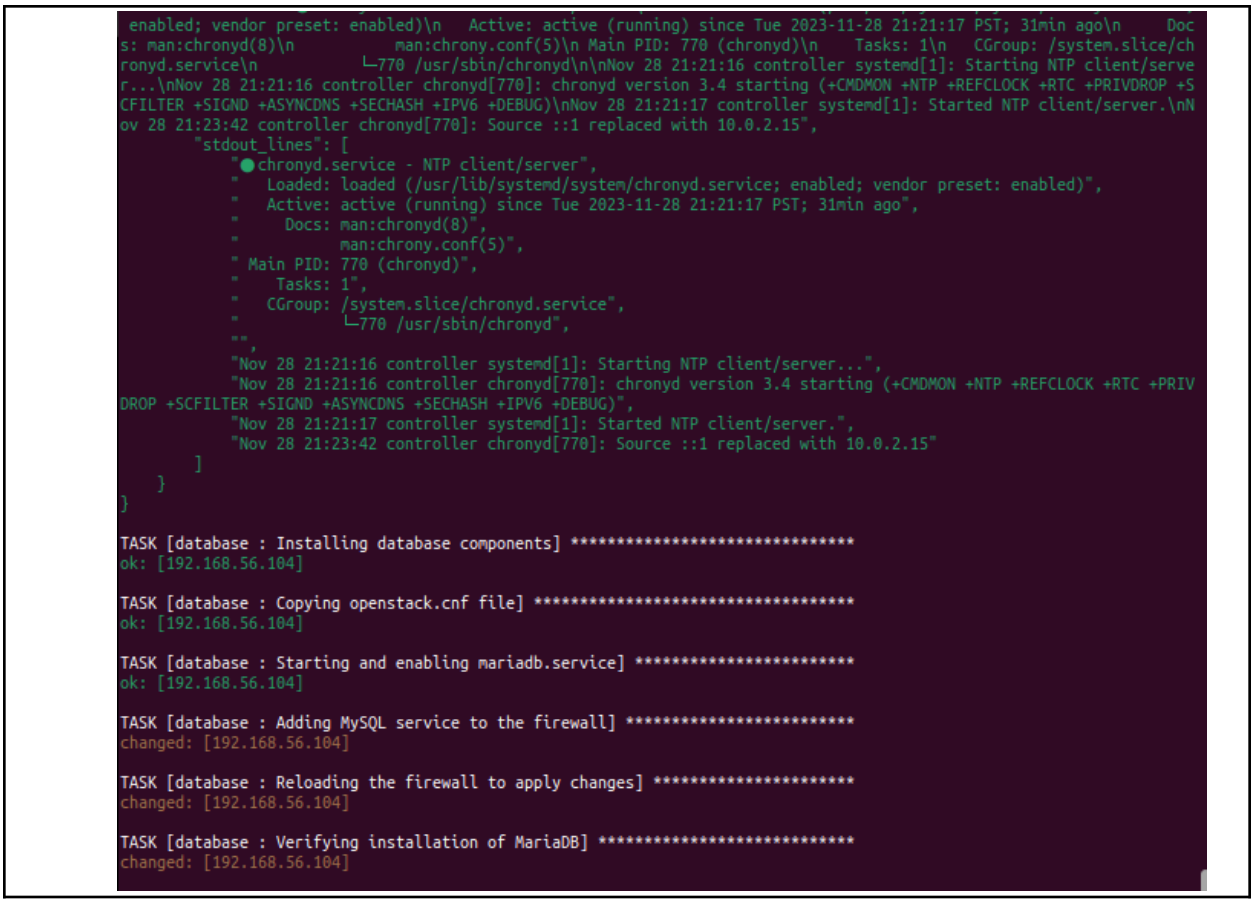
```
TASK [packages : Enabling openstack repository on openSUSE] ********************************************************
changed: [192.168.56.103]

TASK [packages : Refreshing the zypper repository] *****************************************************************
ok: [192.168.56.103]

TASK [packages : Installing Python 3 on SUSE] **********************************************************************
skipping: [192.168.56.103]
```

```
PLAY RECAP *********************************************************************************************************
192.168.56.103             : ok=13   changed=4    unreachable=0    failed=1    skipped=1    rescued=0    ignored=0
```

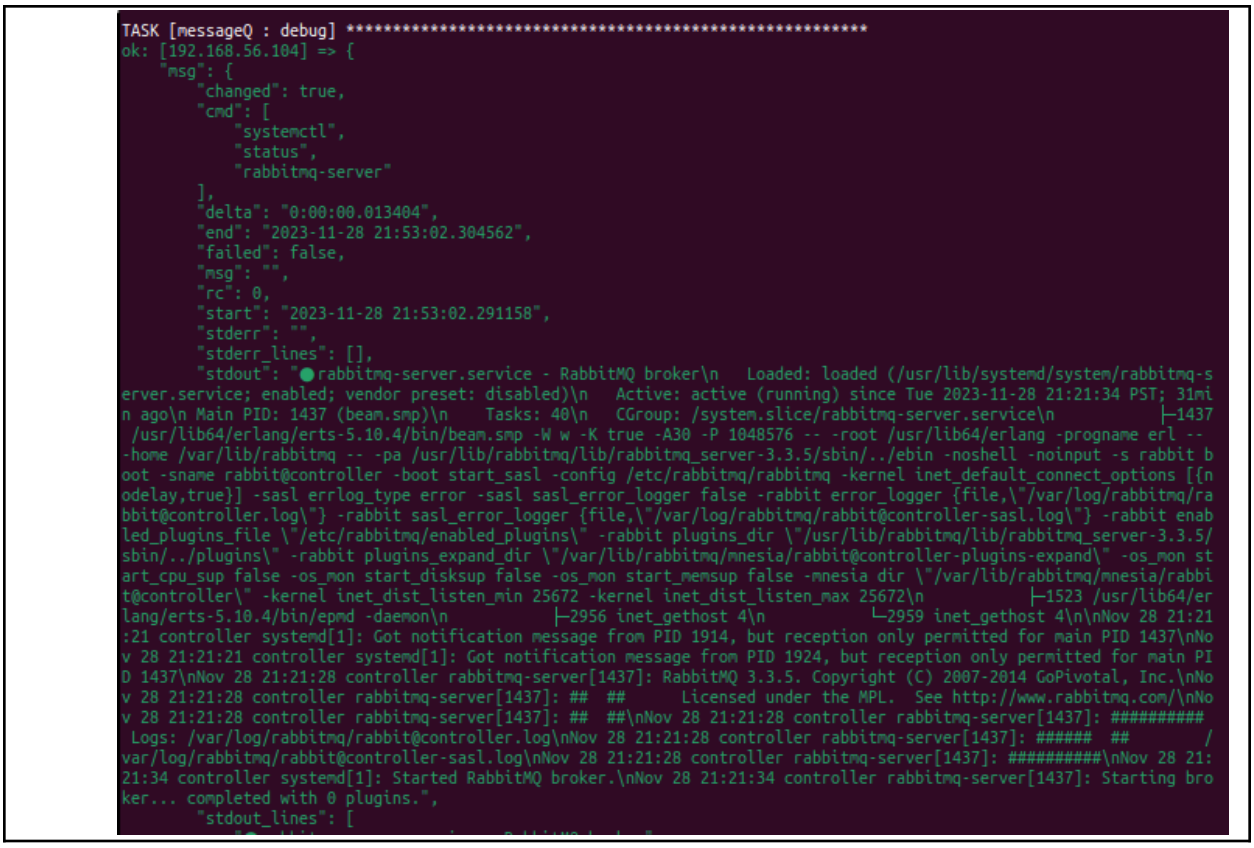
Successful run in CentOS:

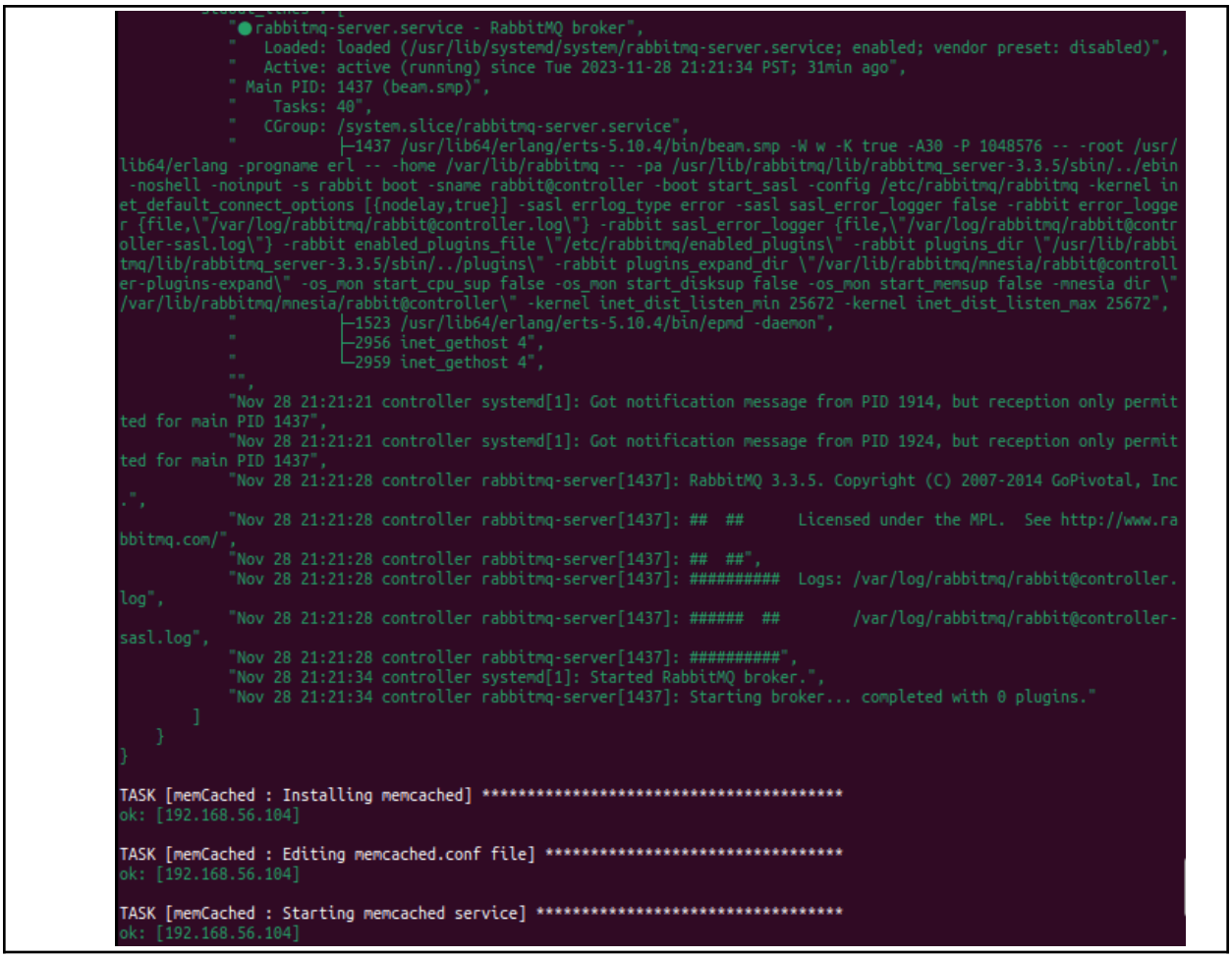

tendencia@workstation:~/HOA13/centos$ ansible-playbook --ask-become-pass openprereq.yml
BECOME password:
PLAY [all] ***
TASK [Gathering Facts] ***
ok: [192.168.56.104]
TASK [Updating the repository] ***
ok: [192.168.56.104]
PLAY [controller_node] ***
TASK [Gathering Facts] ***
ok: [192.168.56.104]
TASK [network : Editing ifcfg-enp0s8] **
ok: [192.168.56.104]
TASK [network : Editing hosts] ***
ok: [192.168.56.104]
TASK [network : Editing hostname] **
ok: [192.168.56.104]
TASK [ntp : Installing chrony] ***
ok: [192.168.56.104]
TASK [ntp : Starting chrony service] ***
ok: [192.168.56.104]
TASK [ntp : Editing chrony.conf file] **
ok: [192.168.56.104]
TASK [ntp : Adding firewall] ***
ok: [192.168.56.104]
TASK [ntp : Adding NTP service to the firewall] **********************************
changed: [192.168.56.104]
TASK [ntp : Reloading the firewall to apply changes] *****************************
changed: [192.168.56.104]
TASK [ntp : Verifying installation of chrony] ************************************
changed: [192.168.56.104]


TASK [ntp : debug] **
ok: [192.168.56.104] => {
"msg": {
"changed": true,
"cmd": [
"chronyd",
"--version"
],
"delta": "0:00:00.009450",
"end": "2023-11-28 21:52:52.212923",
"failed": false,
"msg": "",
"rc": 0,
"start": "2023-11-28 21:52:52.203473",
"stderr": "",
"stderr_lines": [],
"stdout": "chronyd (chrony) version 3.4 (+CMDMON +NTP +REFCLOCK +RTC +PRIVDROP +SCFILTER +SIGND +ASYNCDNS +SE
CHASH +IPV6 +DEBUG)",
"stdout_lines": [
"chronyd (chrony) version 3.4 (+CMDMON +NTP +REFCLOCK +RTC +PRIVDROP +SCFILTER +SIGND +ASYNCDNS +SECHASH
+IPV6 +DEBUG)"
]
}
}
TASK [ntp : Verifying if chronyd is started and running in the background] *****
changed: [192.168.56.104]
TASK [ntp : debug] **
ok: [192.168.56.104] => {
"msg": {
"changed": true,
"cmd": [
"systemctl",
"status",
"chronyd"
],
"delta": "0:00:00.014890",
"end": "2023-11-28 21:52:52.609904",
"failed": false,
"msg": "",
"rc": 0,
"start": "2023-11-28 21:52:52.595014",
"stderr": "",
"stderr_lines": [],
"stdout": "● chronyd.service - NTP client/server\n Loaded: loaded (/usr/lib/systemd/system/chronyd.service;


enabled; vendor preset: enabled)\n Active: active (running) since Tue 2023-11-28 21:21:17 PST; 31min ago\n Docs: man:chronyd(8)\n man:chrony.conf(5)\n Main PID: 770 (chronyd)\n Tasks: 1\n CGroup: /system.slice/chronyd.service\n └770 /usr/sbin/chronyd\n\nNov 28 21:21:16 controller systemd[1]: Starting NTP client/server...\nNov 28 21:21:16 controller chronyd[770]: chronyd version 3.4 starting (+CMDMON +NTP +REFCLOCK +RTC +PRIVDROP +SCFILTER +SIGND +ASYNCDNS +SECHASH +IPV6 +DEBUG)\nNov 28 21:21:17 controller systemd[1]: Started NTP client/server.\nNov 28 21:23:42 controller chronyd[770]: Source ::1 replaced with 10.0.2.15",
"stdout_lines": [
"● chronyd.service - NTP client/server",
" Loaded: loaded (/usr/lib/systemd/system/chronyd.service; enabled; vendor preset: enabled)",
" Active: active (running) since Tue 2023-11-28 21:21:17 PST; 31min ago",
" Docs: man:chronyd(8)",
" man:chrony.conf(5)",
" Main PID: 770 (chronyd)",
" Tasks: 1",
" CGroup: /system.slice/chronyd.service",
" └770 /usr/sbin/chronyd",
"",
"Nov 28 21:21:16 controller systemd[1]: Starting NTP client/server...",
"Nov 28 21:21:16 controller chronyd[770]: chronyd version 3.4 starting (+CMDMON +NTP +REFCLOCK +RTC +PRIVDROP +SCFILTER +SIGND +ASYNCDNS +SECHASH +IPV6 +DEBUG)",
"Nov 28 21:21:17 controller systemd[1]: Started NTP client/server.",
"Nov 28 21:23:42 controller chronyd[770]: Source ::1 replaced with 10.0.2.15"
]
}
}
TASK [database : Installing database components] ********************************
ok: [192.168.56.104]
TASK [database : Copying openstack.cnf file] ***********************************
ok: [192.168.56.104]
TASK [database : Starting and enabling mariadb.service] ************************
ok: [192.168.56.104]
TASK [database : Adding MySQL service to the firewall] *************************
changed: [192.168.56.104]
TASK [database : Reloading the firewall to apply changes] **********************
changed: [192.168.56.104]
TASK [database : Verifying installation of MariaDB] ****************************
changed: [192.168.56.104]

```
TASK [database : debug] ********************************************************
ok: [192.168.56.104] => {
    "msg": {
        "changed": true,
        "cmd": "mysql --version",
        "delta": "0:00:00.015722",
        "end": "2023-11-28 21:52:55.857852",
        "failed": false,
        "msg": "",
        "rc": 0,
        "start": "2023-11-28 21:52:55.842130",
        "stderr": "",
        "stderr_lines": [],
        "stdout": "mysql  Ver 15.1 Distrib 5.5.68-MariaDB, for Linux (x86_64) using readline 5.1",
        "stdout_lines": [
            "mysql  Ver 15.1 Distrib 5.5.68-MariaDB, for Linux (x86_64) using readline 5.1"
        ]
    }
}

TASK [database : Verifying if MariaDB is started and running in the background] ***
changed: [192.168.56.104]

TASK [database : debug] ********************************************************
ok: [192.168.56.104] => {
    "msg": {
        "changed": true,
        "cmd": "systemctl status mariadb",
        "delta": "0:00:00.015726",
        "end": "2023-11-28 21:52:56.296973",
        "failed": false,
        "msg": "",
        "rc": 0,
        "start": "2023-11-28 21:52:56.281247",
        "stderr": "",
        "stderr_lines": [],
        "stdout": "●mariadb.service - MariaDB database server\n   Loaded: loaded (/usr/lib/systemd/system/mariadb.se
rvice; enabled; vendor preset: disabled)\n   Active: active (running) since Tue 2023-11-28 21:21:26 PST; 31min ago\n
Main PID: 1619 (mysqld_safe)\n    Tasks: 20\n   CGroup: /system.slice/mariadb.service\n           ├─1619 /bin/sh /usr
/bin/mysqld_safe --basedir=/usr\n           └─2455 /usr/libexec/mysqld --basedir=/usr --datadir=/var/lib/mysql --plug
in-dir=/usr/lib64/mysql/plugin --log-error=/var/log/mariadb/mariadb.log --pid-file=/var/run/mariadb/mariadb.pid --soc
ket=/var/lib/mysql/mysql.sock\n\nNov 28 21:21:19 controller systemd[1]: Starting MariaDB database server...\nNov 28 2
1:21:20 controller mariadb-prepare-db-dir[1435]: Database MariaDB is probably initialized in /var/lib/mysql already,
nothing is done.\nNov 28 21:21:20 controller mariadb-prepare-db-dir[1435]: If this is not the case, make sure the /va
r/lib/mysql is empty before running mariadb-prepare-db-dir.\nNov 28 21:21:23 controller mysqld_safe[1619]: 231128 21:
21:23 mysqld_safe Logging to '/var/log/mariadb/mariadb.log'.\nNov 28 21:21:23 controller mysqld_safe[1619]: 231128 21
:21:23 mysqld_safe Starting mysqld daemon with databases from /var/lib/mysql\nNov 28 21:21:26 controller systemd[1]:
Started MariaDB database server.",
        "stdout_lines": [
            "●mariadb.service - MariaDB database server",
            "   Loaded: loaded (/usr/lib/systemd/system/mariadb.service; enabled; vendor preset: disabled)",
            "   Active: active (running) since Tue 2023-11-28 21:21:26 PST; 31min ago",
            " Main PID: 1619 (mysqld_safe)",
            "    Tasks: 20",
            "   CGroup: /system.slice/mariadb.service",
            "           ├─1619 /bin/sh /usr/bin/mysqld_safe --basedir=/usr",
            "           └─2455 /usr/libexec/mysqld --basedir=/usr --datadir=/var/lib/mysql --plugin-dir=/usr/lib64/my
sql/plugin --log-error=/var/log/mariadb/mariadb.log --pid-file=/var/run/mariadb/mariadb.pid --socket=/var/lib/mysql/m
ysql.sock",
            "",
            "Nov 28 21:21:19 controller systemd[1]: Starting MariaDB database server...",
            "Nov 28 21:21:20 controller mariadb-prepare-db-dir[1435]: Database MariaDB is probably initialized in /va
r/lib/mysql already, nothing is done.",
            "Nov 28 21:21:20 controller mariadb-prepare-db-dir[1435]: If this is not the case, make sure the /var/lib
/mysql is empty before running mariadb-prepare-db-dir.",
            "Nov 28 21:21:23 controller mysqld_safe[1619]: 231128 21:21:23 mysqld_safe Logging to '/var/log/mariadb/m
ariadb.log'.",
            "Nov 28 21:21:23 controller mysqld_safe[1619]: 231128 21:21:23 mysqld_safe Starting mysqld daemon with da
tabases from /var/lib/mysql",
            "Nov 28 21:21:26 controller systemd[1]: Started MariaDB database server."
        ]
    }
}

TASK [messageQ : Installing rabbitmq-server] ***********************************
ok: [192.168.56.104]

TASK [messageQ : Starting RabbitMQ service] ************************************
changed: [192.168.56.104]

TASK [messageQ : Verifying rabbitmq-server installation] ***********************
changed: [192.168.56.104]
```


TASK [messageQ : debug] **
ok: [192.168.56.104] => {
"msg": {
"changed": true,
"cmd": [
"systemctl",
"status",
"rabbitmq-server"
],
"delta": "0:00:00.013404",
"end": "2023-11-28 21:53:02.304562",
"failed": false,
"msg": "",
"rc": 0,
"start": "2023-11-28 21:53:02.291158",
"stderr": "",
"stderr_lines": [],
"stdout": "● rabbitmq-server.service - RabbitMQ broker\n Loaded: loaded (/usr/lib/systemd/system/rabbitmq-server.service; enabled; vendor preset: disabled)\n Active: active (running) since Tue 2023-11-28 21:21:34 PST; 31min ago\n Main PID: 1437 (beam.smp)\n Tasks: 40\n CGroup: /system.slice/rabbitmq-server.service\n ├─1437 /usr/lib64/erlang/erts-5.10.4/bin/beam.smp -W w -K true -A30 -P 1048576 -- -root /usr/lib64/erlang -progname erl -- -home /var/lib/rabbitmq -- -pa /usr/lib/rabbitmq/lib/rabbitmq_server-3.3.5/sbin/../ebin -noshell -noinput -s rabbit boot -sname rabbit@controller -boot start_sasl -config /etc/rabbitmq/rabbitmq -kernel inet_default_connect_options [{nodelay,true}] -sasl errlog_type error -sasl sasl_error_logger false -rabbit error_logger {file,\"/var/log/rabbitmq/rabbit@controller.log\"} -rabbit sasl_error_logger {file,\"/var/log/rabbitmq/rabbit@controller-sasl.log\"} -rabbit enabled_plugins_file \"/etc/rabbitmq/enabled_plugins\" -rabbit plugins_dir \"/usr/lib/rabbitmq/lib/rabbitmq_server-3.3.5/sbin/../plugins\" -rabbit plugins_expand_dir \"/var/lib/rabbitmq/mnesia/rabbit@controller-plugins-expand\" -os_mon start_cpu_sup false -os_mon start_disksup false -os_mon start_memsup false -mnesia dir \"/var/lib/rabbitmq/mnesia/rabbit@controller\" -kernel inet_dist_listen_min 25672 -kernel inet_dist_listen_max 25672\n ├─1523 /usr/lib64/erlang/erts-5.10.4/bin/epmd -daemon\n ├─2956 inet_gethost 4\n └─2959 inet_gethost 4\n\nNov 28 21:21:21 controller systemd[1]: Got notification message from PID 1914, but reception only permitted for main PID 1437\nNov 28 21:21:21 controller systemd[1]: Got notification message from PID 1924, but reception only permitted for main PID 1437\nNov 28 21:21:28 controller rabbitmq-server[1437]: RabbitMQ 3.3.5. Copyright (C) 2007-2014 GoPivotal, Inc.\nNov 28 21:21:28 controller rabbitmq-server[1437]: ## ## Licensed under the MPL. See http://www.rabbitmq.com/\nNov 28 21:21:28 controller rabbitmq-server[1437]: ## ##\nNov 28 21:21:28 controller rabbitmq-server[1437]: ##########\n Logs: /var/log/rabbitmq/rabbit@controller.log\nNov 28 21:21:28 controller rabbitmq-server[1437]: ###### ## /var/log/rabbitmq/rabbit@controller-sasl.log\nNov 28 21:21:28 controller rabbitmq-server[1437]: ##########\nNov 28 21:21:34 controller systemd[1]: Started RabbitMQ broker.\nNov 28 21:21:34 controller rabbitmq-server[1437]: Starting broker... completed with 0 plugins.",
"stdout_lines": [


"● rabbitmq-server.service - RabbitMQ broker",
"   Loaded: loaded (/usr/lib/systemd/system/rabbitmq-server.service; enabled; vendor preset: disabled)",
"   Active: active (running) since Tue 2023-11-28 21:21:34 PST; 31min ago",
" Main PID: 1437 (beam.smp)",
"   Tasks: 40",
"   CGroup: /system.slice/rabbitmq-server.service",
"   ├─1437 /usr/lib64/erlang/erts-5.10.4/bin/beam.smp -W w -K true -A30 -P 1048576 -- -root /usr/lib64/erlang -progname erl -- -home /var/lib/rabbitmq -- -pa /usr/lib/rabbitmq/lib/rabbitmq_server-3.3.5/sbin/../ebin -noshell -noinput -s rabbit boot -sname rabbit@controller -boot start_sasl -config /etc/rabbitmq/rabbitmq -kernel inet_default_connect_options [{nodelay,true}] -sasl errlog_type error -sasl sasl_error_logger false -rabbit error_logger {file,\"/var/log/rabbitmq/rabbit@controller.log\"} -rabbit sasl_error_logger {file,\"/var/log/rabbitmq/rabbit@controller-sasl.log\"} -rabbit enabled_plugins_file \"/etc/rabbitmq/enabled_plugins\" -rabbit plugins_dir \"/usr/lib/rabbitmq/lib/rabbitmq_server-3.3.5/sbin/../plugins\" -rabbit plugins_expand_dir \"/var/lib/rabbitmq/mnesia/rabbit@controller-plugins-expand\" -os_mon start_cpu_sup false -os_mon start_disksup false -os_mon start_memsup false -mnesia dir \"/var/lib/rabbitmq/mnesia/rabbit@controller\" -kernel inet_dist_listen_min 25672 -kernel inet_dist_listen_max 25672",
"   ├─1523 /usr/lib64/erlang/erts-5.10.4/bin/epmd -daemon",
"   ├─2956 inet_gethost 4",
"   └─2959 inet_gethost 4",
"",
"Nov 28 21:21:21 controller systemd[1]: Got notification message from PID 1914, but reception only permitted for main PID 1437",
"Nov 28 21:21:21 controller systemd[1]: Got notification message from PID 1924, but reception only permitted for main PID 1437",
"Nov 28 21:21:28 controller rabbitmq-server[1437]: RabbitMQ 3.3.5. Copyright (C) 2007-2014 GoPivotal, Inc.",
"Nov 28 21:21:28 controller rabbitmq-server[1437]: ## ##   Licensed under the MPL. See http://www.rabbitmq.com/",
"Nov 28 21:21:28 controller rabbitmq-server[1437]: ## ##",
"Nov 28 21:21:28 controller rabbitmq-server[1437]: ########## Logs: /var/log/rabbitmq/rabbit@controller.log",
"Nov 28 21:21:28 controller rabbitmq-server[1437]: ###### ##   /var/log/rabbitmq/rabbit@controller-sasl.log",
"Nov 28 21:21:28 controller rabbitmq-server[1437]: ##########",
"Nov 28 21:21:34 controller systemd[1]: Started RabbitMQ broker.",
"Nov 28 21:21:34 controller rabbitmq-server[1437]: Starting broker... completed with 0 plugins."
]
}
}
TASK [memCached : Installing memcached] ************************************
ok: [192.168.56.104]
TASK [memCached : Editing memcached.conf file] *********************************
ok: [192.168.56.104]
TASK [memCached : Starting memcached service] **********************************
ok: [192.168.56.104]

```
TASK [memCached : Verifying installation of memcached] ************************
changed: [192.168.56.104]

TASK [memCached : debug] *******************************************************
ok: [192.168.56.104] => {
    "msg": [
        "memcached 1.4.15",
        "-p <num>      TCP port number to listen on (default: 11211)",
        "-U <num>      UDP port number to listen on (default: 11211, 0 is off)",
        "-s <file>     UNIX socket path to listen on (disables network support)",
        "-a <mask>     access mask for UNIX socket, in octal (default: 0700)",
        "-l <addr>     interface to listen on (default: INADDR_ANY, all addresses)",
        "              <addr> may be specified as host:port. If you don't specify",
        "              a port number, the value you specified with -p or -U is",
        "              used. You may specify multiple addresses separated by comma",
        "              or by using -l multiple times",
        "-d            run as a daemon",
        "-r            maximize core file limit",
        "-u <username> assume identity of <username> (only when run as root)",
        "-m <num>      max memory to use for items in megabytes (default: 64 MB)",
        "-M            return error on memory exhausted (rather than removing items)",
        "-c <num>      max simultaneous connections (default: 1024)",
        "-k            lock down all paged memory.  Note that there is a",
        "              limit on how much memory you may lock.  Trying to",
        "              allocate more than that would fail, so be sure you",
        "              set the limit correctly for the user you started",
        "              the daemon with (not for -u <username> user;",
        "              under sh this is done with 'ulimit -S -l NUM_KB').",
        "-v            verbose (print errors/warnings while in event loop)",
        "-vv           very verbose (also print client commands/reponses)",
        "-vvv          extremely verbose (also print internal state transitions)",
        "-h            print this help and exit",
        "-i            print memcached and libevent license",
        "-P <file>     save PID in <file>, only used with -d option",
        "-f <factor>   chunk size growth factor (default: 1.25)",
        "-n <bytes>    minimum space allocated for key+value+flags (default: 48)",
        "-L            Try to use large memory pages (if available). Increasing",
        "              the memory page size could reduce the number of TLB misses",
        "              and improve the performance. In order to get large pages",
        "              from the OS, memcached will allocate the total item-cache",
        "              in one large chunk.",
        "-D <char>     Use <char> as the delimiter between key prefixes and IDs.",
        "              This is used for per-prefix stats reporting. The default is",
        "              \":\" (colon). If this option is specified, stats collection",
        "              is turned on automatically; if not, then it may be turned on",
        "              by sending the \"stats detail on\" command to the server.",
        "-t <num>      number of threads to use (default: 4)",
        "-R            Maximum number of requests per event, limits the number of",
        "              requests process for a given connection to prevent ",
        "              starvation (default: 20)",
        "-C            Disable use of CAS",
        "-b <num>      Set the backlog queue limit (default: 1024)",
        "-B            Binding protocol - one of ascii, binary, or auto (default)",
        "-I            Override the size of each slab page. Adjusts max item size",
        "              (default: 1mb, min: 1k, max: 128m)",
        "-S            Turn on Sasl authentication",
        "-o            Comma separated list of extended or experimental options",
        "              - (EXPERIMENTAL) maxconns_fast: immediately close new",
        "                connections if over maxconns limit",
        "              - hashpower: An integer multiplier for how large the hash",
        "                table should be. Can be grown at runtime if not big enough.",
        "                Set this based on \"STAT hash_power_level\" before a ",
        "                restart."
    ]
}

TASK [memCached : Verifying if memcached is started and running in the background] ***
```

```
...ignoring

TASK [memCached : debug] ***********************************************************
ok: [192.168.56.104] => {
    "msg": []
}

TASK [etcd : Installing etcd] ******************************************************
changed: [192.168.56.104]

TASK [etcd : Editing etcd.conf file] ***********************************************
changed: [192.168.56.104]

TASK [etcd : Adding 2380 port to firewall] *****************************************
changed: [192.168.56.104]

TASK [etcd : Adding 2379 port to firewall] *****************************************
changed: [192.168.56.104]

TASK [etcd : Reloading the firewall to apply changes] ******************************
changed: [192.168.56.104]

TASK [etcd : Starting etcd service] ************************************************
changed: [192.168.56.104]

TASK [etcd : Verifying installation of etcd] ***************************************
changed: [192.168.56.104]
```

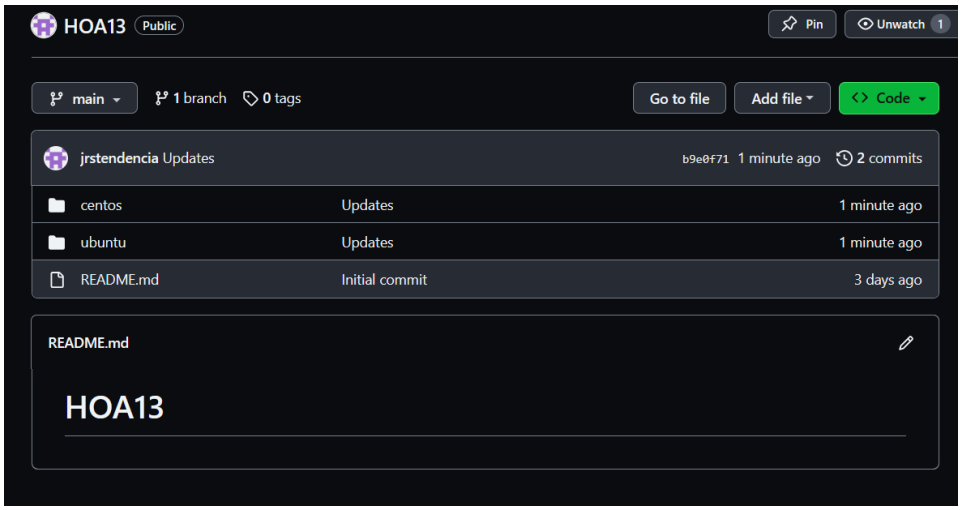
```
TASK [etcd : debug] ****************************************************************
ok: [192.168.56.104] => {
    "msg": {
        "changed": true,
        "cmd": [
            "etcd",
            "--version"
        ],
        "delta": "0:00:00.019681",
        "end": "2023-11-28 22:07:39.262747",
        "failed": false,
        "msg": "",
        "rc": 0,
        "start": "2023-11-28 22:07:39.243066",
        "stderr": "",
        "stderr_lines": [],
        "stdout": "etcd Version: 3.3.11\nGit SHA: 2cf9e51\nGo Version: go1.10.3\nGo OS/Arch: linux/amd64",
        "stdout_lines": [
            "etcd Version: 3.3.11",
            "Git SHA: 2cf9e51",
            "Go Version: go1.10.3",
            "Go OS/Arch: linux/amd64"
        ]
    }
}

TASK [etcd : Verifying if etcd is started and running in the background] *******
changed: [192.168.56.104]
```

```
TASK [etcd : debug] ************************************************************
ok: [192.168.56.104] => {
    "msg": {
        "changed": true,
        "cmd": [
            "systemctl",
            "status",
            "etcd"
        ],
        "delta": "0:00:00.014000",
        "end": "2023-11-28 22:07:39.798148",
        "failed": false,
        "msg": "",
        "rc": 0,
        "start": "2023-11-28 22:07:39.784148",
        "stderr": "",
        "stderr_lines": [],
        "stdout": "●etcd.service - Etcd Server\n   Loaded: loaded (/usr/lib/systemd/system/etcd.service; enabled; ve
ndor preset: disabled)\n   Active: active (running) since Tue 2023-11-28 22:07:38 PST; 1s ago\n Main PID: 3730 (etcd)
\n    Tasks: 9\n   CGroup: /system.slice/etcd.service\n           └─3730 /usr/bin/etcd --name=controller --data-dir=/
var/lib/etcd/default.etcd --listen-client-urls=http://192.168.56.104:2379\n\nNov 28 22:07:38 controller etcd[3730]: 3
efafda55e396efe received MsgVoteResp from 3efafda55e396efe at term 2\nNov 28 22:07:38 controller etcd[3730]: 3efafda5
5e396efe became leader at term 2\nNov 28 22:07:38 controller etcd[3730]: raft.node: 3efafda55e396efe elected leader 3
efafda55e396efe at term 2\nNov 28 22:07:38 controller etcd[3730]: setting up the initial cluster version to 3.3\nNov
28 22:07:38 controller etcd[3730]: set the initial cluster version to 3.3\nNov 28 22:07:38 controller etcd[3730]: ena
bled capabilities for version 3.3\nNov 28 22:07:38 controller etcd[3730]: published {Name:controller ClientURLs:[http
://192.168.56.104:2379]} to cluster b7c471f729e71dba\nNov 28 22:07:38 controller etcd[3730]: ready to serve client re
quests\nNov 28 22:07:38 controller etcd[3730]: serving insecure client requests on 192.168.56.104:2379, this is stron
gly discouraged!\nNov 28 22:07:38 controller systemd[1]: Started Etcd Server.",
        "stdout_lines": [
            "●etcd.service - Etcd Server",
            "   Loaded: loaded (/usr/lib/systemd/system/etcd.service; enabled; vendor preset: disabled)",
            "   Active: active (running) since Tue 2023-11-28 22:07:38 PST; 1s ago",
            " Main PID: 3730 (etcd)",
            "    Tasks: 9",
            "   CGroup: /system.slice/etcd.service",
            "           └─3730 /usr/bin/etcd --name=controller --data-dir=/var/lib/etcd/default.etcd --listen-client-
urls=http://192.168.56.104:2379",
            "",
            "Nov 28 22:07:38 controller etcd[3730]: 3efafda55e396efe received MsgVoteResp from 3efafda55e396efe at te
rm 2",
            "Nov 28 22:07:38 controller etcd[3730]: 3efafda55e396efe became leader at term 2",
            "Nov 28 22:07:38 controller etcd[3730]: raft.node: 3efafda55e396efe elected leader 3efafda55e396efe at te
rm 2",
            "Nov 28 22:07:38 controller etcd[3730]: setting up the initial cluster version to 3.3",
            "Nov 28 22:07:38 controller etcd[3730]: set the initial cluster version to 3.3",
            "Nov 28 22:07:38 controller etcd[3730]: enabled capabilities for version 3.3",
            "Nov 28 22:07:38 controller etcd[3730]: published {Name:controller ClientURLs:[http://192.168.56.104:2379
]} to cluster b7c471f729e71dba",
            "Nov 28 22:07:38 controller etcd[3730]: ready to serve client requests",
            "Nov 28 22:07:38 controller etcd[3730]: serving insecure client requests on 192.168.56.104:2379, this is
strongly discouraged!",
            "Nov 28 22:07:38 controller systemd[1]: Started Etcd Server."
        ]
    }
}

RUNNING HANDLER [messageQ : Configuring rabbitmq-server] ***********************
changed: [192.168.56.104]

RUNNING HANDLER [etcd : Reloading firewall] ************************************
changed: [192.168.56.104]

PLAY RECAP *********************************************************************
192.168.56.104             : ok=48   changed=22   unreachable=0    failed=0    skipped=0    rescued=0    ignored=1

tendencia@workstation:~/HOA13/centos$
```

6. Synch changes in GitHub repository.

```
tendencia@workstation:~/HOA13$ git add *
tendencia@workstation:~/HOA13$ git commit -m "Updates"
[main b9e0f71] Updates
 64 files changed, 1475 insertions(+)
```

```
tendencia@workstation:~/HOA13$ git push origin main
Enumerating objects: 109, done.
Counting objects: 100% (109/109), done.
Delta compression using up to 2 threads
Compressing objects: 100% (84/84), done.
Writing objects: 100% (108/108), 17.90 KiB | 352.00 KiB/s, done.
Total 108 (delta 13), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (13/13), done.
To github.com:jrstendencia/HOA13.git
   a7ce881..b9e0f71  main -> main
tendencia@workstation:~/HOA13$ git status
On branch main
Your branch is up to date with 'origin/main'.

nothing to commit, working tree clean
```



Reflections:

Answer the following:

1. What are the benefits of implementing OpenStack?
    - Implementing OpenStack offers several benefits, including enhanced flexibility and scalability in managing cloud infrastructure. It provides a unified platform for private and public cloud deployment, enabling organizations to build and customize their cloud environments according to specific needs. This open-source solution fosters interoperability among diverse components, supporting various hypervisors and storage options. With features such as self-service portals, automation, and resource orchestration. It also streamlines cloud management, reduces operational complexity, and accelerates the delivery of IT services, making it a valuable choice for organizations seeking efficient and agile cloud solutions.

Conclusions:

In conclusion, developing a workflow for OpenStack installation using Ansible as Infrastructure as Code (IaC) aligns with the outlined objectives and learning outcomes. This approach not only facilitates the efficient deployment and configuration of OpenStack services but also provides a practical demonstration of IaC principles. By leveraging Ansible, the installation process becomes automated, scalable, and repeatable, contributing to a deeper understanding of cloud services, deployment models, and the role of IaC in streamlining complex infrastructure tasks. This hands-on experience equips individuals with valuable skills to analyze the advantages and disadvantages of cloud services while enabling them to evaluate different deployment and service models within the context of OpenStack.