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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

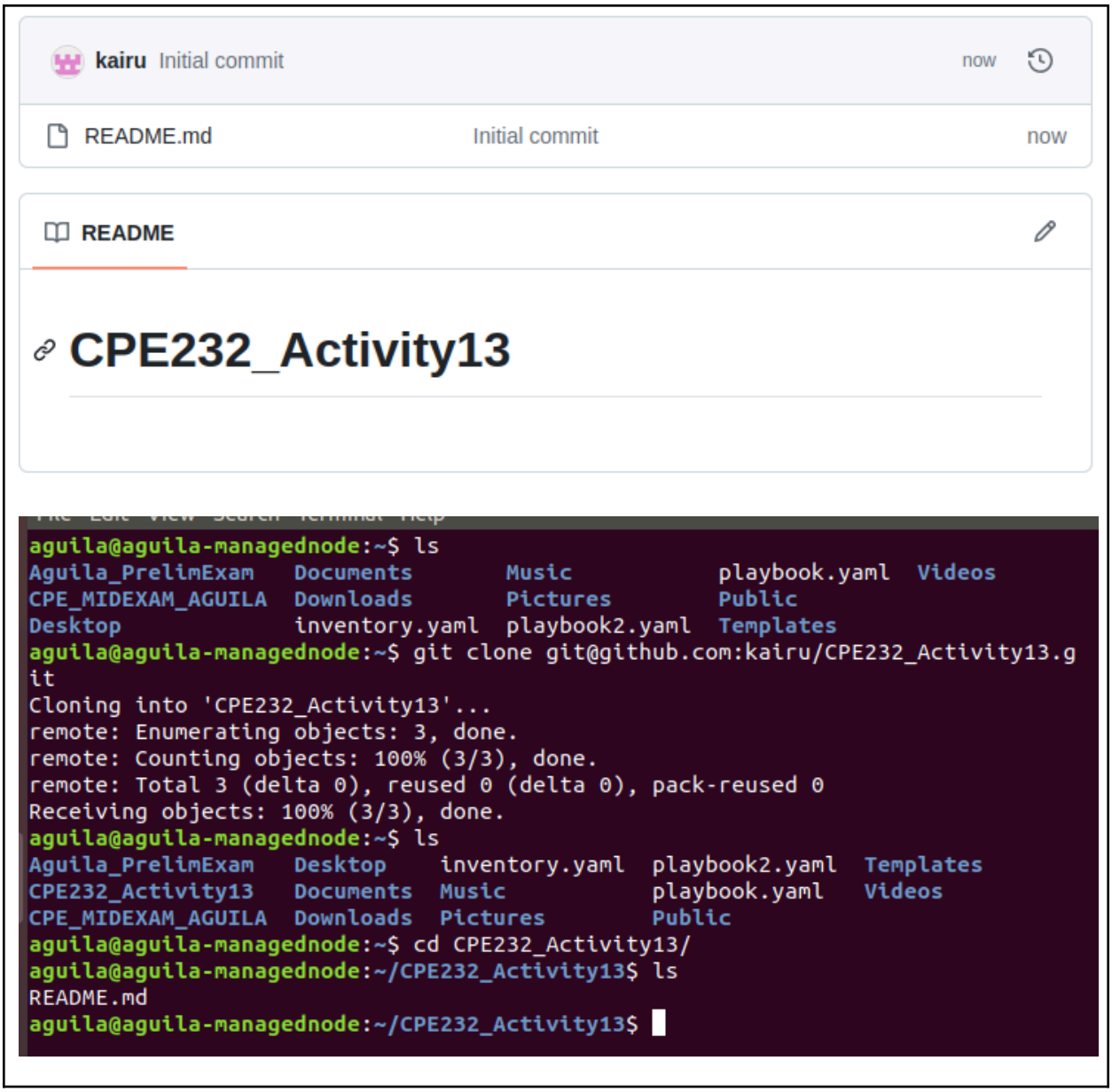
Oracle VirtualBox (Hypervisor)

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.

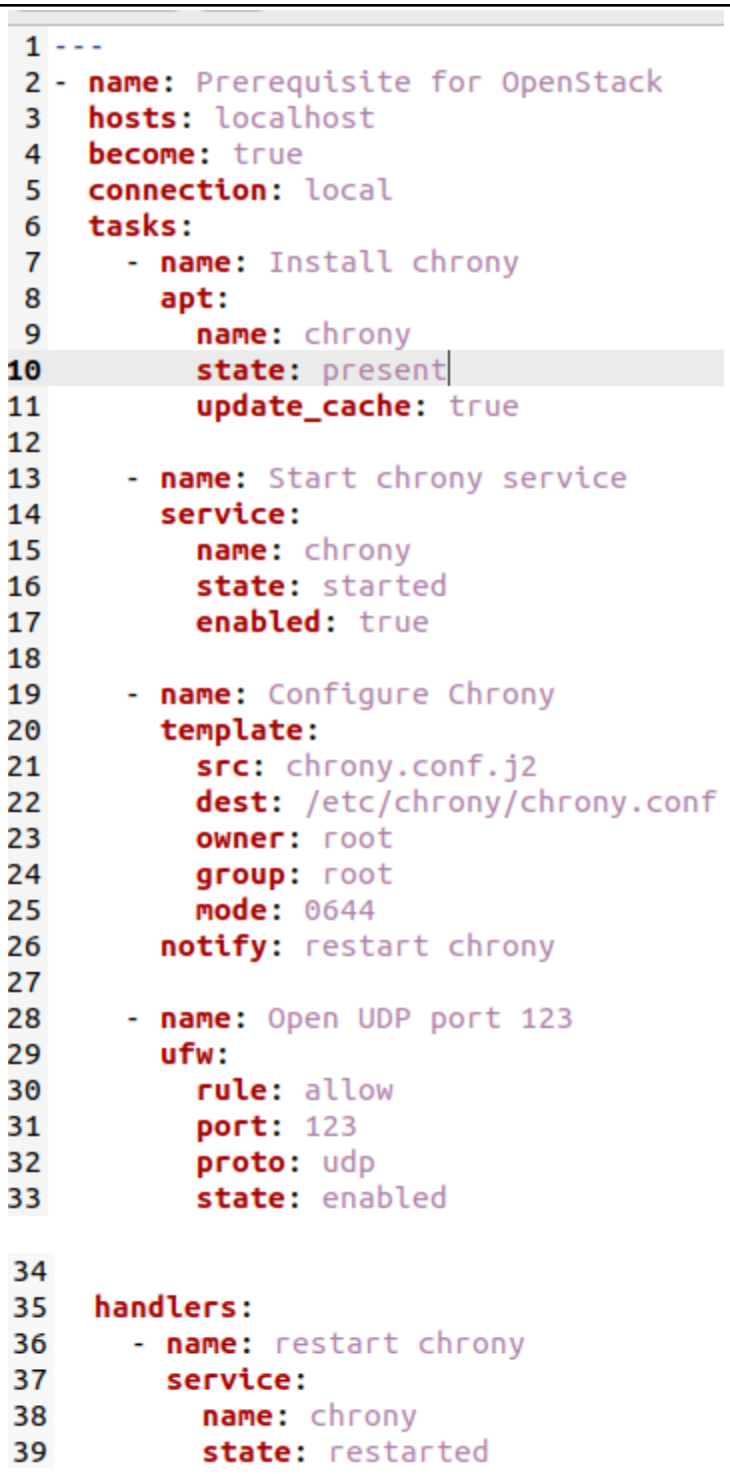
5. Output (screenshots and explanations)


kairu Initial commit
now
README.md
Initial commit
now
README
CPE232_Activity13
aguila@aguila-managednode:~$ ls
Aguila_PrelimExam Documents Music playbook.yaml Videos
CPE_MIDEXAM_AGUILA Downloads Pictures Public
Desktop inventory.yaml playbook2.yaml Templates
aguila@aguila-managednode:~$ git clone git@github.com:kairu/CPE232_Activity13.g
it
Cloning into 'CPE232_Activity13'...
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.
aguila@aguila-managednode:~$ ls
Aguila_PrelimExam Desktop inventory.yaml playbook2.yaml Templates
CPE232_Activity13 Documents Music playbook.yaml Videos
CPE_MIDEXAM_AGUILA Downloads Pictures Public
aguila@aguila-managednode:~$ cd CPE232_Activity13/
aguila@aguila-managednode:~/CPE232_Activity13$ ls
README.md
aguila@aguila-managednode:~/CPE232_Activity13$

```
aguila@aguila-ubuntu:~/CPE232_Activity13$ ansible-galaxy init NTP
- NTP was created successfully
aguila@aguila-ubuntu:~/CPE232_Activity13$ ansible-galaxy init OpenS
- OpenStack was created successfully
aguila@aguila-ubuntu:~/CPE232_Activity13$ ansible-galaxy init SQLdb
- SQLdb was created successfully
aguila@aguila-ubuntu:~/CPE232_Activity13$ ansible-galaxy init Messa
- MessageQ was created successfully
aguila@aguila-ubuntu:~/CPE232_Activity13$ ansible-galaxy init MsgQ
- MsgQ was created successfully
aguila@aguila-ubuntu:~/CPE232_Activity13$ ansible-galaxy init Mcach
- Mcache was created successfully
aguila@aguila-ubuntu:~/CPE232_Activity13$ ansible-galaxy init Etcd
- Etcd was created successfully
aguila@aguila-ubuntu:~/CPE232_Activity13$ touch inventory.ini
aguila@aguila-ubuntu:~/CPE232_Activity13$ touch playbook.yml
aguila@aguila-ubuntu:~/CPE232_Activity13$ ansible-galaxy init base
- base was created successfully
```

Create roles

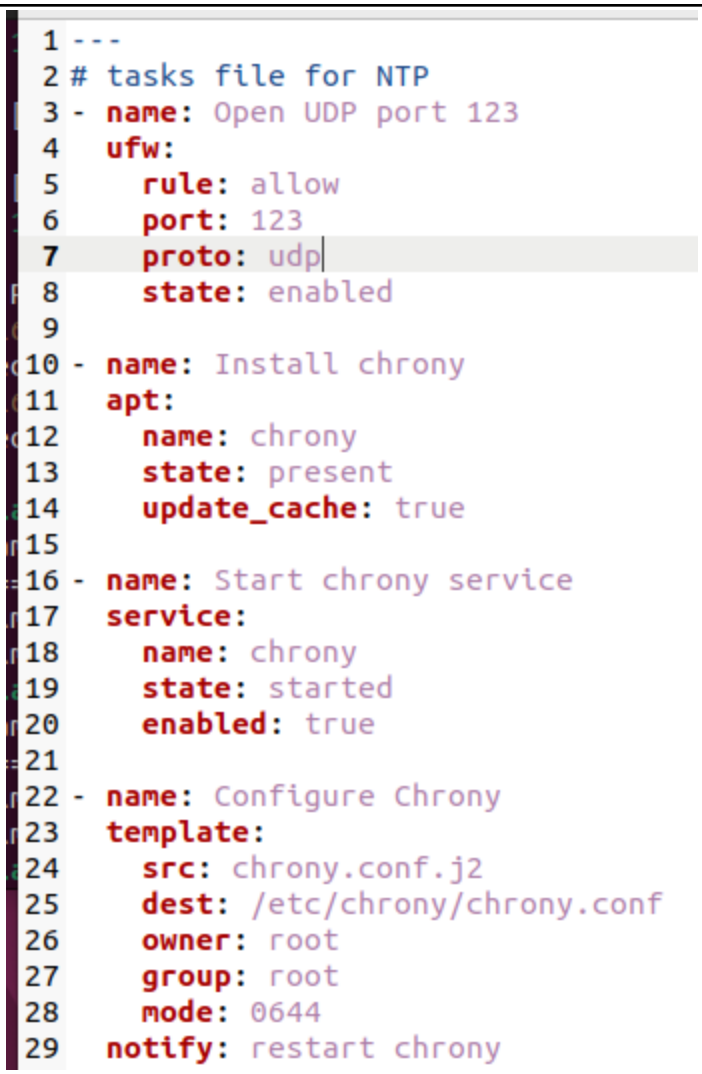
NTP:



```yaml
---
- name: Prerequisite for OpenStack
  hosts: localhost
  become: true
  connection: local
  tasks:
    - name: Install chrony
      apt:
        name: chrony
        state: present
        update_cache: true

    - name: Start chrony service
      service:
        name: chrony
        state: started
        enabled: true

    - name: Configure Chrony
      template:
        src: chrony.conf.j2
        dest: /etc/chrony/chrony.conf
        owner: root
        group: root
        mode: 0644
      notify: restart chrony

    - name: Open UDP port 123
      ufw:
        rule: allow
        port: 123
        proto: udp
        state: enabled


  handlers:
    - name: restart chrony
      service:
        name: chrony
        state: restarted
```

local playbook for controlled node

```
aguila@aguila-VirtualBox:~/CPE232_Activity13$ ansible-playbook local-playb
l -K
BECOME password:
[WARNING]: No inventory was parsed, only implicit localhost is available
[WARNING]: provided hosts list is empty, only localhost is available. Note
the implicit localhost does not match 'all'

PLAY [Prerequisite for OpenStack] ************************************

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

TASK [Install chrony] ************************************************
changed: [localhost]

TASK [Start chrony service] ******************************************
ok: [localhost]

TASK [Configure Chrony] **********************************************
changed: [localhost]

RUNNING HANDLER [restart chrony] *************************************
changed: [localhost]

PLAY RECAP ***********************************************************
localhost                  : ok=5    changed=3    unreachable=0    failed=0
kipped=0    rescued=0    ignored=0

aguila@aguila-VirtualBox:~/CPE232_Activity13$ cat /etc/chrony/chrony.conf
server 0.asia.pool.ntp.org iburst
server 1.asia.pool.ntp.org iburst

allow 255.255.255.0
```



```yaml
---
# tasks file for NTP
- name: Open UDP port 123
  ufw:
    rule: allow
    port: 123
    proto: udp
    state: enabled

- name: Install chrony
  apt:
    name: chrony
    state: present
    update_cache: true

- name: Start chrony service
  service:
    name: chrony
    state: started
    enabled: true

- name: Configure Chrony
  template:
    src: chrony.conf.j2
    dest: /etc/chrony/chrony.conf
    owner: root
    group: root
    mode: 0644
  notify: restart chrony
```

```
server 192.168.56.101 iburst
```

```
aguila@aguila-VirtualBox:~/CPE232_Activity13$ ansible-playbook -i inventory.ini
playbook.yml --limit NTP -K
BECOME password:

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

TASK [Gathering Facts] *********************************************************
ok: [192.168.56.103]
ok: [192.168.56.102]

PLAY [NTP] *********************************************************************

TASK [Gathering Facts] *********************************************************
ok: [192.168.56.103]
ok: [192.168.56.102]

TASK [NTP : Install chrony] ****************************************************
ok: [192.168.56.103]
changed: [192.168.56.102]

TASK [NTP : Start chrony service] **********************************************
ok: [192.168.56.103]
ok: [192.168.56.102]
```

```
TASK [NTP : Configure Chrony] **************************************************
ok: [192.168.56.103]
changed: [192.168.56.102]

RUNNING HANDLER [NTP : restart chrony] *****************************************
changed: [192.168.56.102]

PLAY [OpenStack] ***************************************************************

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

PLAY [SQLdb] *******************************************************************

TASK [Gathering Facts] *********************************************************
ok: [192.168.56.103]
ok: [192.168.56.102]

PLAY [MsgQ] ********************************************************************

TASK [Gathering Facts] *********************************************************
ok: [192.168.56.103]
ok: [192.168.56.102]
```

```
PLAY [Mcache] ******************************************************************

TASK [Gathering Facts] *********************************************************
ok: [192.168.56.102]

PLAY [Etcd] ********************************************************************

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

PLAY RECAP *********************************************************************
192.168.56.102             : ok=9    changed=3    unreachable=0    failed=0    s
kipped=0    rescued=0    ignored=0
192.168.56.103             : ok=9    changed=0    unreachable=0    failed=0    s
kipped=0    rescued=0    ignored=0

aguila@aguila-VirtualBox:~/CPE232_Activity13$
```

```
aguila@aguila-VirtualBox:~/CPE232_Activity13$ chronyc sources
MS Name/IP address         Stratum Poll Reach LastRx Last sample
===============================================================================
^* ns1.ads.net.id                2  10   377   122   +868us[ +888us] +/-   92ms
^+ 230.subnet-8.helium.co.id     3   9   377   381    +84us[ +110us] +/-   98ms
```

controlled node

```
guila@aguila-CN1:~$ chronyc sources
S Name/IP address         Stratum Poll Reach LastRx Last sample
===============================================================================
* 192.168.56.101                4   6    17    26  -2613ns[  -68us] +/-  108ms
guila@aguila-CN1:~$
```

managed node

Openstack packages:

```
35    - name: Add OpenStack packages repository
36      apt_repository:
37        repo: 'deb http://ubuntu-cloud.archive.canonical.com/ubuntu jammy-updates/antelope main'
38        state: present
39        update_cache: yes
40
41    - name: Install Nova Compute
42      apt:
43        name: nova-compute
44        state: present
45        update_cache: yes
46
47    - name: Install OpenStack Client
48      apt:
49        name: python3-openstackclient
50        state: present
51        update_cache: yes
52
```

local playbook

Openstack role

```yaml
---
# tasks file for OpenStack
- name: Add OpenStack packages repository
  apt_repository:
    repo: 'deb http://ubuntu-cloud.archive.canonical.com/ubuntu jammy-updates/antelope main'
    state: present
    update_cache: yes

- name: Install Nova Compute
  apt:
    name: nova-compute
    state: present
    update_cache: yes

- name: Install OpenStack Client
  apt:
    name: python3-openstackclient
    state: present
    update_cache: yes
```

```
aguila@aguila-VirtualBox:~/CPE232_Activity13$ ansible-playbook local-playbook.yml -K
BECOME password:
[WARNING]: No inventory was parsed, only implicit localhost is available
[WARNING]: provided hosts list is empty, only localhost is available. Note that the implicit localhost does not match 'all'

PLAY [Prerequisite for OpenStack] ***************************************

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

TASK [Install chrony] ***************************************************
ok: [localhost]

TASK [Start chrony service] *********************************************
ok: [localhost]

TASK [Configure Chrony] *************************************************
ok: [localhost]

TASK [Open UDP port 123] ************************************************
ok: [localhost]
```

```
TASK [Add OpenStack packages repository] ************************************
ok: [localhost]

TASK [Install Nova Compute] *************************************************
ok: [localhost]

TASK [Install OpenStack Client] *********************************************
ok: [localhost]

PLAY RECAP ******************************************************************
localhost                  : ok=8    changed=0    unreachable=0    failed=0    s
kipped=0    rescued=0    ignored=0

aguila@aguila-VirtualBox:~/CPE232_Activity13$ openstack --version
openstack 6.2.0
aguila@aguila-VirtualBox:~/CPE232_Activity13$ nova --version
nova CLI is deprecated and will be a removed in a future release
18.3.0
aguila@aguila-VirtualBox:~/CPE232_Activity13$
```

SQL Database:

```
53      - name: Install Mariadb-server
54        apt:
55          name: mariadb-server
56          state: present
57          update_cache: yes
58
59      - name: Install pymysql
60        apt:
61          name: python3-pymysql
62          state: present
63          update_cache: yes
64
65      - name: Configure MariaDB server
66        template:
67          src: mysql.conf.j2
68          dest: /etc/mysql/mariadb.conf.d/99-openstack.cnf
69        notify:
70          - restart mariadb
71
72      - name: Start MariaDB service
73        service:
74          name: mariadb
75          state: started
76          enabled: true
```

```
77
78    - name: Run mysql_secure_installation
79      command: >
80        mysql -u root -nbE
81        --execute="
82          DELETE FROM mysql.user WHERE User='';
83          DELETE FROM mysql.user WHERE User='root' AND Host NOT IN ('localhost', '127.0.0.1', '::1');
84          DROP DATABASE IF EXISTS test;
85          DELETE FROM mysql.db WHERE Db='test' OR Db='test\\_%';
86          FLUSH PRIVILEGES;
87        "
88
89  handlers:
90    - name: restart chrony
91      service:
92        name: chrony
93        state: restarted
94
95    - name: restart mariadb
96      service:
97        name: mariadb
98        state: restarted
```

```
 1 [mysqld]
 2 bind-address = 192.168.56.101
 3
 4 default-storage-engine = innodb
 5 innodb_file_per_table = on
 6 max_connections = 4096
 7 collation-server = utf8_general_ci
 8 character-set-server = utf8
 9
10 datadir=/var/lib/mysql
11 socket=/var/lib/mysql/mysql.sock
12 user=mysql
13 symbolic-links=0
14
15 [mysqld_safe]
16 log-error=/var/log/mariadb/mariadb.log
17 pid-file=/var/run/mariadb/mariadb.pid
18
19 [client]
20 default-character-set=utf8mb4
21
22 !includedir /etc/mysql/conf.d
```

```
aguila@aguila-VirtualBox:~/CPE232_Activity13$ ansible-playbook local-playbook.ym
l -K
BECOME password:
[WARNING]: No inventory was parsed, only implicit localhost is available
[WARNING]: provided hosts list is empty, only localhost is available. Note that
the implicit localhost does not match 'all'

PLAY [Prerequisite for OpenStack] **********************************************

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

TASK [Install chrony] **********************************************************
ok: [localhost]

TASK [Start chrony service] ****************************************************
ok: [localhost]

TASK [Configure Chrony] ********************************************************
ok: [localhost]

TASK [Open UDP port 123] *******************************************************
ok: [localhost]

TASK [Add OpenStack packages repository] ***************************************
ok: [localhost]

TASK [Install Nova Compute] ****************************************************
ok: [localhost]

TASK [Install OpenStack Client] ************************************************
ok: [localhost]

TASK [Install Mariadb-server] **************************************************
ok: [localhost]

TASK [Install pymysql] *********************************************************
ok: [localhost]

TASK [Configure MariaDB server] ************************************************
ok: [localhost]

TASK [Start MariaDB service] ***************************************************
ok: [localhost]

TASK [Run mysql_secure_installation] *******************************************
changed: [localhost]

PLAY RECAP *********************************************************************
localhost                  : ok=13   changed=1    unreachable=0    failed=0    s
kipped=0    rescued=0    ignored=0

aguila@aguila-VirtualBox:~/CPE232_Activity13$
```

```
aguila@aguila-VirtualBox:~$ systemctl status mysql
● mariadb.service - MariaDB 10.6.16 database server
     Loaded: loaded (/lib/systemd/system/mariadb.service; enabled; vendor preset: enabled)
     Active: active (running) since Sun 2024-04-28 15:56:09 PST; 1min 3s ago
       Docs: man:mariadbd(8)
             https://mariadb.com/kb/en/library/systemd/
    Process: 757 ExecStartPre=/usr/bin/install -m 755 -o mysql -g root -d /var/run/mysqld (code=exited, >
    Process: 780 ExecStartPre=/bin/sh -c systemctl unset-environment _WSREP_START_POSITION (code=exited,>
    Process: 810 ExecStartPre=/bin/sh -c [ ! -e /usr/bin/galera_recovery ] && VAR= ||   VAR=`cd /usr/bin>
    Process: 1301 ExecStartPost=/bin/sh -c systemctl unset-environment _WSREP_START_POSITION (code=exite>
    Process: 1334 ExecStartPost=/etc/mysql/debian-start (code=exited, status=0/SUCCESS)
   Main PID: 966 (mariadbd)
     Status: "Taking your SQL requests now..."
      Tasks: 8 (limit: 4593)
     Memory: 84.8M
        CPU: 1.185s
     CGroup: /system.slice/mariadb.service
             └─966 /usr/sbin/mariadbd

Apr 28 15:56:08 aguila-VirtualBox mariadbd[966]: 2024-04-28 15:56:08 0 [Note] Server socket created on I>
Apr 28 15:56:08 aguila-VirtualBox mariadbd[966]: 2024-04-28 15:56:08 0 [Note] InnoDB: Buffer pool(s) loa>
Apr 28 15:56:08 aguila-VirtualBox mariadbd[966]: 2024-04-28 15:56:08 0 [Note] /usr/sbin/mariadbd: ready >
Apr 28 15:56:08 aguila-VirtualBox mariadbd[966]: Version: '10.6.16-MariaDB-0ubuntu0.22.04.1'  socket: '/>
Apr 28 15:56:09 aguila-VirtualBox systemd[1]: Started MariaDB 10.6.16 database server.
Apr 28 15:56:09 aguila-VirtualBox /etc/mysql/debian-start[1350]: Looking for 'mariadb' as: /usr/bin/mari>
Apr 28 15:56:09 aguila-VirtualBox /etc/mysql/debian-start[1350]: Reading datadir from the MariaDB server>
Apr 28 15:56:09 aguila-VirtualBox /etc/mysql/debian-start[1350]: ERROR 2002 (HY000): Can't connect to lo>
Apr 28 15:56:09 aguila-VirtualBox /etc/mysql/debian-start[1350]: FATAL ERROR: Upgrade failed
Apr 28 15:56:09 aguila-VirtualBox debian-start[1433]: ERROR 2002 (HY000): Can't connect to local server >
lines 1-28/28 (END)
```

Message Queue:

```yaml
vars:
  rabbit_mq_openstack_user: openstack
  rabbit_mq_openstack_password: "password"
```

```
93      - name: Install Rabbitmq Server
94        apt:
95          name: rabbitmq-server
96          state: present
97          update_cache: yes
98
99      - name: Start RabbitMQ service
100       service:
101         name: rabbitmq-server
102         state: started
103         enabled: true
104
105     - name: Add OpenStack user
106       rabbitmq_user:
107         user: "{{ rabbit_mq_openstack_user }}"
108         password: "{{ rabbit_mq_openstack_password }}"
109         vhost: /
110         configure_priv: .*
111         read_priv: .*
112         write_priv: .*
113         state: present
```

```
aguila@aguila-VirtualBox:~/CPE232_Activity13$ ansible-playbook local-playbook.yml -K
```

```
TASK [Install Rabbitmq Server] *************************************************
ok: [localhost]

TASK [Start RabbitMQ service] **************************************************
ok: [localhost]

TASK [Add OpenStack user] ******************************************************
changed: [localhost]

PLAY RECAP *********************************************************************
localhost                  : ok=16   changed=2    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0

aguila@aguila-VirtualBox:~/CPE232_Activity13$
```

```
aguila@aguila-VirtualBox:~$ systemctl status rabbitmq-server
● rabbitmq-server.service - RabbitMQ Messaging Server
     Loaded: loaded (/lib/systemd/system/rabbitmq-server.service; enabled; vendor preset: enabled)
     Active: active (running) since Sun 2024-04-28 15:56:29 PST; 1min 20s ago
   Main PID: 765 (beam.smp)
      Tasks: 25 (limit: 4593)
     Memory: 127.4M
        CPU: 12.827s
     CGroup: /system.slice/rabbitmq-server.service
             ├─ 765 /usr/lib/erlang/erts-12.2.1/bin/beam.smp -W w -MBas ageffcbf -MHas ageffcbf -MBlmbcs>
             ├─ 892 erl_child_setup 65536
             ├─2223 inet_gethost 4
             └─2229 inet_gethost 4

Apr 28 15:56:05 aguila-VirtualBox systemd[1]: Starting RabbitMQ Messaging Server...
Apr 28 15:56:29 aguila-VirtualBox systemd[1]: Started RabbitMQ Messaging Server.
lines 1-15/15 (END)
```

Memcached:

```
115     - name: Install memcached
116       apt:
117         name: memcached
118         state: present
119         update_cache: yes
120
121     - name: Install python3 memcache
122       apt:
123         name: python3-memcache
124         state: present
125         update_cache: yes
126
127     - name: Start memcache service
128       service:
129         name: memcached
130         state: started
131         enabled: true
132
133     - name: Configure memcache
134       template:
135         src: memcached.conf.j2
136         dest: /etc/memcached.conf
137       notify:
138         - restart memcached

151   - name: restart memcached
152     service:
153       name: memcached
154       state: restarted
```

```
# memcached default config file
# 2003 - Jay Bonci <jaybonci@debian.org>
# This configuration file is read by the start-memcached script provided as
# part of the Debian GNU/Linux distribution.

# Run memcached as a daemon. This command is implied, and is not needed for the
# daemon to run. See the README.Debian that comes with this package for more
# information.
-d

# Log memcached's output to /var/log/memcached
logfile /var/log/memcached.log

# Be verbose
# -v

# Be even more verbose (print client commands as well)
# -vv

# Start with a cap of 64 megs of memory. It's reasonable, and the daemon default
# Note that the daemon will grow to this size, but does not start out holding this much
# memory
-m 64

# Default connection port is 11211
-p 11211

# Run the daemon as root. The start-memcached will default to running as root if no
# -u command is present in this config file
-u memcache

# Specify which IP address to listen on. The default is to listen on all IP addresses
# This parameter is one of the only security measures that memcached has, so make sure
# it's listening on a firewalled interface.
-l 192.168.56.101


# Limit the number of simultaneous incoming connections. The daemon default is 1024
# -c 1024

# Lock down all paged memory. Consult with the README and homepage before you do this
# -k

# Return error when memory is exhausted (rather than removing items)
# -M

# Maximize core file limit
# -r

# Use a pidfile
-P /var/run/memcached/memcached.pid
```

```
TASK [Install memcached] ********************************************************
ok: [localhost]

TASK [Install python3 memcache] *************************************************
ok: [localhost]

TASK [Start memcache service] ***************************************************
ok: [localhost]

TASK [Configure memcache] *******************************************************
changed: [localhost]

RUNNING HANDLER [restart memcached] *********************************************
changed: [localhost]

PLAY RECAP **********************************************************************
localhost                  : ok=21   changed=3    unreachable=0    failed=0    s
kipped=0    rescued=0    ignored=0

aguila@aguila-VirtualBox:~/CPE232_Activity13$
```

```
aguila@aguila-VirtualBox:~$ systemctl status memcached
● memcached.service - memcached daemon
     Loaded: loaded (/lib/systemd/system/memcached.service; enabled; vendor preset: enabled)
     Active: active (running) since Sun 2024-04-28 15:56:06 PST; 2min 9s ago
       Docs: man:memcached(1)
   Main PID: 963 (memcached)
      Tasks: 10 (limit: 4593)
     Memory: 1.7M
        CPU: 180ms
     CGroup: /system.slice/memcached.service
             └─963 /usr/bin/memcached -m 64 -p 11211 -u memcache -l 192.168.56.101 -P /var/run/memcached

Apr 28 15:56:06 aguila-VirtualBox systemd[1]: Started memcached daemon.
lines 1-12/12 (END)
```

Etcd:

```
140     - name: Install required packages for etcd
141       apt:
142         name:
143           - apt-transport-https
144           - ca-certificates
145           - curl
146           - gnupg
147           - software-properties-common
148         state: present
149         update_cache: yes
150
151     - name: Install etcd
152       apt:
153         name: etcd
154         state: present
155         update_cache: yes
156
157     - name: Start etcd service
158       service:
159         name: etcd
160         state: started
161         enabled: true
162
163     - name: Open port 2379
164       ufw:
165         rule: allow
166         port: 2379
167         proto: tcp
168
169     - name: Open port 2380
170       ufw:
171         rule: allow
172         port: 2380
173         proto: tcp
```

```
175     - name: Configure etcd
176       template:
177         src: etcd.conf.j2
178         dest: /etc/default/etcd
179         mode: 0644
180       notify:
181         - restart etcd
182
183   handlers:
184     - name: restart chrony
185       service:
186         name: chrony
187         state: restarted
188
189     - name: restart mariadb
190       service:
191         name: mariadb
192         state: restarted
193
194     - name: restart memcached
195       service:
196         name: memcached
197         state: restarted
198
199     - name: restart etcd
200       service:
201         name: etcd
202         state: restarted
```

```
1 ETCD_DATA_DIR="/var/lib/etcd"
2
3 ETCD_LISTEN_CLIENT_URLS="http://192.168.56.101:2379"
4
5 ETCD_LISTEN_PEER_URLS="http://0.0.0.0:2380"
6
7 ETCD_ADVERTISE_CLIENT_URLS="http://192.168.56.101:2379"
8
9 ETCD_INITIAL_CLUSTER_TOKEN="etcd-cluster"
10
11 ETCD_INITIAL_CLUSTER="etcd=http://192.168.56.101:2380"
12
13 ETCD_INITIAL_ADVERTISE_PEER_URLS="http://192.168.56.101:2380"
```

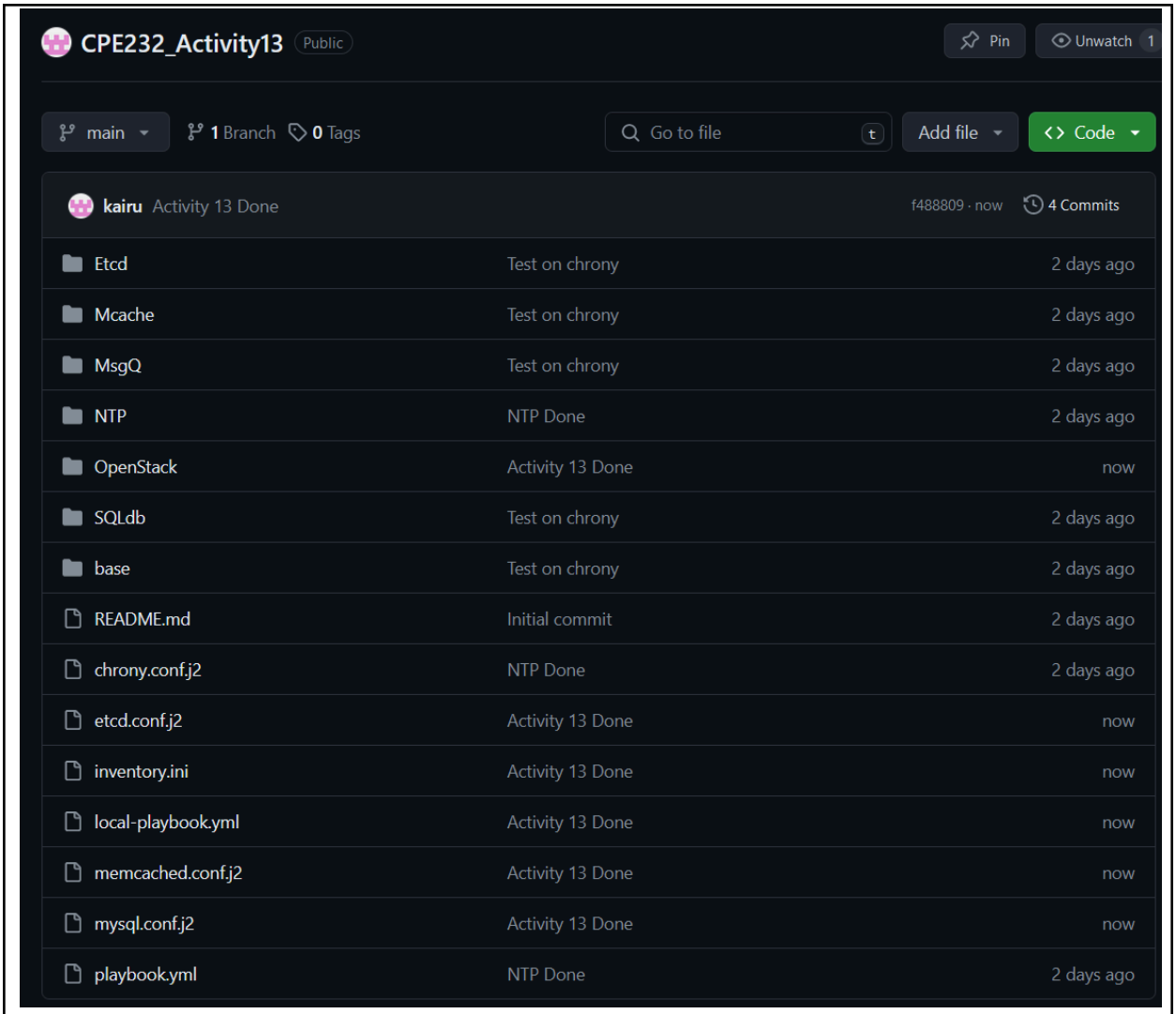
```
TASK [Install required packages for etcd] ***************************************************************
ok: [localhost]

TASK [Install etcd] *************************************************************************************
ok: [localhost]

TASK [Start etcd service] *******************************************************************************
changed: [localhost]

TASK [Open port 2379] ***********************************************************************************
ok: [localhost]

TASK [Open port 2380] ***********************************************************************************
ok: [localhost]

TASK [Configure etcd] ***********************************************************************************
changed: [localhost]

RUNNING HANDLER [restart etcd] **************************************************************************
changed: [localhost]

PLAY RECAP **********************************************************************************************
localhost                  : ok=27   changed=4    unreachable=0    failed=0    skipped=0    rescued=0    ignored
=0

aguila@aguila-VirtualBox:~/CPE232_Activity13$
```

```
aguila@aguila-VirtualBox:~$ systemctl status etcd
● etcd.service - etcd - highly-available key value store
     Loaded: loaded (/lib/systemd/system/etcd.service; enabled; vendor preset: enabled)
     Active: active (running) since Sun 2024-04-28 16:00:08 PST; 2s ago
       Docs: https://etcd.io/docs
             man:etcd
   Main PID: 3200 (etcd)
      Tasks: 8 (limit: 4593)
     Memory: 6.3M
        CPU: 285ms
     CGroup: /system.slice/etcd.service
             └─3200 /usr/bin/etcd

Apr 28 16:00:07 aguila-VirtualBox etcd[3200]: enabled capabilities for version 3.3
Apr 28 16:00:08 aguila-VirtualBox etcd[3200]: f4dcc24aca7ef1fd is starting a new election at term 3
Apr 28 16:00:08 aguila-VirtualBox etcd[3200]: f4dcc24aca7ef1fd became candidate at term 4
Apr 28 16:00:08 aguila-VirtualBox etcd[3200]: f4dcc24aca7ef1fd received MsgVoteResp from f4dcc24aca7ef1fd at term>
Apr 28 16:00:08 aguila-VirtualBox etcd[3200]: f4dcc24aca7ef1fd became leader at term 4
Apr 28 16:00:08 aguila-VirtualBox etcd[3200]: raft.node: f4dcc24aca7ef1fd elected leader f4dcc24aca7ef1fd at term>
Apr 28 16:00:08 aguila-VirtualBox etcd[3200]: published {Name:aguila-VirtualBox ClientURLs:[http://192.168.56.101>
Apr 28 16:00:08 aguila-VirtualBox etcd[3200]: ready to serve client requests
Apr 28 16:00:08 aguila-VirtualBox systemd[1]: Started etcd - highly-available key value store.
Apr 28 16:00:08 aguila-VirtualBox etcd[3200]: serving insecure client requests on 192.168.56.101:2379, this is st>
lines 1-22/22 (END)
```

github push:

```
aguila@aguila-VirtualBox:~/CPE232_Activity13$ git add .
aguila@aguila-VirtualBox:~/CPE232_Activity13$ git commit -m "Activity 13 Done"
[main f488809] Activity 13 Done
 6 files changed, 270 insertions(+), 3 deletions(-)
 rewrite OpenStack/tasks/main.yml (86%)
 create mode 100644 etcd.conf.j2
 create mode 100644 memcached.conf.j2
 create mode 100644 mysql.conf.j2
aguila@aguila-VirtualBox:~/CPE232_Activity13$ git push origin main
Enumerating objects: 16, done.
Counting objects: 100% (16/16), done.
Delta compression using up to 3 threads
Compressing objects: 100% (9/9), done.
Writing objects: 100% (10/10), 3.05 KiB | 3.05 MiB/s, done.
Total 10 (delta 3), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (3/3), completed with 3 local objects.
To github.com:kairu/CPE232_Activity13.git
   52394d0..f488809  main -> main
aguila@aguila-VirtualBox:~/CPE232_Activity13$
```

https://github.com/kairu/CPE232_Activity13



Reflections:

Answer the following:

1. What are the benefits of implementing OpenStack?
    - OpenStack is an open-source cloud platform that reduces costs, increases scalability, and prevents vendor lock-in. It provides flexibility, multi-tenancy, high availability, and integration with a variety of technologies, all supported by a strong community. Despite its complexity, its advantages make it an attractive option for businesses looking to construct their own cloud infrastructure.

Conclusions:

In sum, we feel like we've accomplished all three goals for me in this exercise. Automation in cloud infrastructure management is demonstrated by creating a workflow using Ansible to deploy and configure OpenStack base services. By acting as documentation and execution, Ansible simplifies deployment and provides an easy-to-follow blueprint for installation and upkeep. This Method

Promotes consistency and reliability in managing cloud infrastructure by increasing efficiency, decreasing human error, and creating a uniform protocol for deploying OpenStack. A fair assessment of the pros and downsides of cloud computing is essential in light of the current state of affairs. Organizations need to go through different deployment and service models to maximize productivity and dependability while using automation technologies like Ansible.