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Instructor: Dr. Jonathan V. Taylar	**Semester and SY:** 2nd 2023-2024

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)

a. Add the necessary files and its contents

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ ls
ansible.cfg  inventory  openstack-install.yml  README.md  roles
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ cat inventory
[controller]
192.168.56.128 #ManagedNode

jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ cat ansible.cfg
[defaults]
inventory = inventory
private_key_file = ~/.ssh/ansible
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ cat cat openstack-install.yml
cat: cat: No such file or directory
---
- name: Install and configure OpenStack services
  hosts: controller
  become: true

  roles:
    - base
    - ntp
    - openstack-packages
    - sql-database
    - message-queue
    - memcached
    - etcd

jonjeous@localmachine-VirtualBox:~/Recto_HOA13$
```

b. Roles

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ tree roles
roles
├── base
│   └── tasks
│       └── main.yml
├── etcd
│   ├── handlers
│   │   └── main.yml
│   ├── tasks
│   │   └── main.yml
│   └── templates
│       └── etcd.conf.j2
├── memcached
│   ├── handlers
│   │   └── main.yml
│   └── tasks
│       └── main.yml
├── message-queue
│   └── tasks
│       └── main.yml
├── ntp
│   ├── handlers
│   │   └── main.yml
│   └── tasks
│       └── main.yml
```

```
├── openstack-packages
│   └── tasks
│       └── main.yml
└── sql-database
    ├── handlers
    │   └── main.yml
    ├── tasks
    │   └── main.yml
    └── templates
        └── 99-openstack.cnf.j2

20 directories, 13 files
```

c. Tasks for each role.

1. Base

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ cat roles/base/tasks/main.yml
---
- name: install updates (Ubuntu)
  tags: always
  apt:
    update_cache: yes
  changed_when: false
  when: ansible_distribution == "Ubuntu"
  become: true
```

2. NTP

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ cat roles/ntp/tasks/main.yml
---
- name: Install NTP packages
  become: true
  package:
    name: chrony
    state: present

- name: Configure chrony
  become: true
  lineinfile:
    path: /etc/chrony/chrony.conf
    line: "{{ item }}"
    create: yes
  with_items:
    - "server NTP_SERVER iburst"
    - "allow 192.168.56.128/24"
  notify: restart chrony

- name: Ensure chrony service is enabled and started
  become: true
  systemd:
    name: chrony
    state: started
    enabled: yes
  notify: restart chrony
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$
```

3. OpenStack packages

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ cat roles/openstack-packages/tas
ks/main.yml
---
- name: Install Nova Compute and OpenStack Client
  become: true
  apt:
    name:
      - nova-compute
      - python3-openstackclient
    state: latest
```

4. SQL Database

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ cat roles/sql-database/tasks/main.yml
---
- name: Install MariaDB Server and Python MySQL library
  become: true
  apt:
    name:
      - mariadb-server
      - python3-pymysql
    state: latest

- name: Configure MariaDB
  become: true
  template:
    src: 99-openstack.cnf.j2
    dest: /etc/mysql/mariadb.conf.d/99-openstack.cnf
  notify: restart mariadb
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ cat roles/sql-database/templates/99-openstack.cnf.j2
[mysqld]
bind-address = 10.0.0.11
default-storage-engine = innodb
innodb_file_per_table = on
max_connections = 4096
collation-server = utf8_general_ci
character-set-server = utf8
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$
```

5. Message Queue

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ cat roles/message-queue/tasks/main.yml
---
- name: Install RabbitMQ Server
  become: true
  apt:
    name: rabbitmq-server
    state: present

- name: Ensure message queue service is started
  service:
    name: rabbitmq-server
    state: started
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$
```

6. Memcached

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ cat roles/memcached/tasks/main.yml
---
- name: Install Memcached and Python Memcache library
  become: true
  apt:
    name:
      - memcached
      - python3-memcache
    state: latest

- name: Configure Memcached
  become: true
  lineinfile:
    path: /etc/memcached.conf
    regexp: '^(-l\s+)'
    line: '\g<1>10.0.0.11'
  notify: restart memcached
```

7. Etcd

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ cat roles/etcd/tasks/main.yml
---
- name: Install etcd
  become: true
  apt:
    name: etcd
    state: present

- name: Configure etcd
  become: true
  template:
    src: etcd.conf.j2
    dest: /etc/default/etcd
  notify: restart etcd
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ cat roles/etcd/templates/etcd.conf.j2
ETCD_NAME="controller"
ETCD_DATA_DIR="/var/lib/etcd"
ETCD_INITIAL_CLUSTER_STATE="new"
ETCD_INITIAL_CLUSTER_TOKEN="etcd-cluster-01"
ETCD_INITIAL_CLUSTER="controller=http://10.0.0.11:2380"
ETCD_INITIAL_ADVERTISE_PEER_URLS="http://10.0.0.11:2380"
ETCD_ADVERTISE_CLIENT_URLS="http://10.0.0.11:2379"
ETCD_LISTEN_PEER_URLS="http://0.0.0.0:2380"
ETCD_LISTEN_CLIENT_URLS="http://10.0.0.11:2379"
```

d. **Run the playbook.**

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ ansible-playbook --ask-become-pass openstack-install.yml
BECOME password:

PLAY [Install and configure OpenStack services] ********************************

TASK [Gathering Facts] *********************************************************
ok: [192.168.56.128]

TASK [base : install updates (Ubuntu)] *****************************************
ok: [192.168.56.128]

TASK [ntp : Install NTP packages] **********************************************
ok: [192.168.56.128]

TASK [ntp : Configure chrony] **************************************************
ok: [192.168.56.128] => (item=server NTP_SERVER iburst)
ok: [192.168.56.128] => (item=allow 192.168.56.128/24)

TASK [ntp : Ensure chrony service is enabled and started] **********************
ok: [192.168.56.128]

TASK [openstack-packages : Install Nova Compute and OpenStack Client] **********
ok: [192.168.56.128]

TASK [sql-database : Install MariaDB Server and Python MySQL library] **********
ok: [192.168.56.128]
```

```
TASK [sql-database : Configure MariaDB] ************************************
ok: [192.168.56.128]

TASK [message-queue : Install RabbitMQ Server] *****************************
ok: [192.168.56.128]

TASK [message-queue : Ensure message queue service is started] *************
ok: [192.168.56.128]

TASK [memcached : Install Memcached and Python Memcache library] ***********
ok: [192.168.56.128]

TASK [memcached : Configure Memcached] *************************************
ok: [192.168.56.128]

TASK [etcd : Install etcd] *************************************************
ok: [192.168.56.128]

TASK [etcd : Configure etcd] ***********************************************
ok: [192.168.56.128]

PLAY RECAP *********************************************************************
192.168.56.128             : ok=14   changed=0    unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
```

e. Verify if it is installed properly

1. NTP

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ sudo systemctl status chronyd
● chrony.service - chrony, an NTP client/server
     Loaded: loaded (/lib/systemd/system/chrony.service; enabled; vendor preset:
 enabled)
     Active: active (running) since Thu 2024-04-25 16:10:34 PST; 1h 13min ago
       Docs: man:chronyd(8)
             man:chronyc(1)
             man:chrony.conf(5)
   Main PID: 1051 (chronyd)
      Tasks: 2 (limit: 4598)
     Memory: 1.4M
        CPU: 124ms
     CGroup: /system.slice/chrony.service
             ├─1051 /usr/sbin/chronyd -F 1
             └─1080 /usr/sbin/chronyd -F 1
```

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ chronyc sources
MS Name/IP address         Stratum Poll Reach LastRx Last sample
===============================================================================
^+ prod-ntp-4.ntp1.ps5.cano>     2   9   377   410   -513us[-2944us] +/-  179ms
^* alphyn.canonical.com          2   9   377   404    +23ms[  +20ms] +/-  174ms
^+ prod-ntp-3.ntp4.ps5.cano>     2   9   377   476    -12ms[  -14ms] +/-  186ms
^+ prod-ntp-5.ntp1.ps5.cano>     2   8   175   149    +19ms[  +19ms] +/-  204ms
^? 222.127.1.21                  0  10     0     -     +0ns[   +0ns] +/-    0ns
^? port.iwiphil.com              0  10     0     -     +0ns[   +0ns] +/-    0ns
^? 222.127.1.25                  0  10     0     -     +0ns[   +0ns] +/-    0ns
^? 222.127.1.27                  0  10     0     -     +0ns[   +0ns] +/-    0ns
^? 222.127.1.24                  0  10     0     -     +0ns[   +0ns] +/-    0ns
^? 222.127.1.22                  0  10     0     -     +0ns[   +0ns] +/-    0ns
^? 222.127.1.18                  0   9     0     -     +0ns[   +0ns] +/-    0ns
^? mail.fortunetobacco.com       0  10     0     -     +0ns[   +0ns] +/-    0ns
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$
```

2. OpenStack packages

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ dpkg -l | grep openstack
ii  python3-openstackclient                    5.8.0-0ubuntu1.1
                   all          OpenStack Command-line Client - Python 3.x
ii  python3-openstacksdk                       0.61.0-0ubuntu1
                   all          SDK for building applications to work with Open
Stack - Python 3.x
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ sudo systemctl status nova-compu
te
● nova-compute.service - OpenStack Compute
     Loaded: loaded (/lib/systemd/system/nova-compute.service; enabled; vendor >
     Active: active (running) since Thu 2024-04-25 16:32:07 PST; 1h 4min ago
   Main PID: 21324 (nova-compute)
      Tasks: 2 (limit: 4598)
     Memory: 141.6M
        CPU: 2.961s
     CGroup: /system.slice/nova-compute.service
             └─21324 /usr/bin/python3 /usr/bin/nova-compute --config-file=/etc/>
```

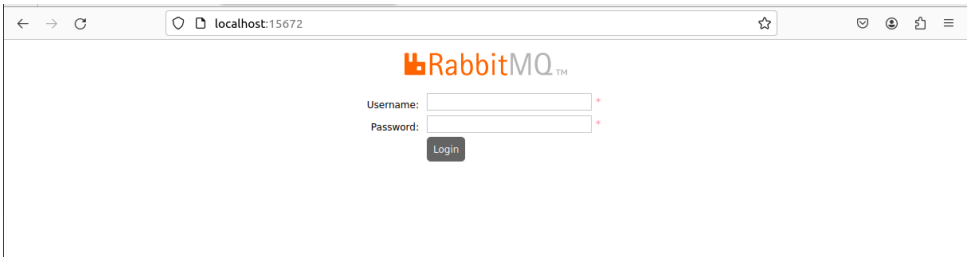
3. SQL Database

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ sudo systemctl status mariadb
● mariadb.service - MariaDB 10.6.16 database server
     Loaded: loaded (/lib/systemd/system/mariadb.service; enabled; vendor preset
: enabled)
     Active: active (running) since Thu 2024-04-25 16:12:11 PST; 1h 14min ago
       Docs: man:mariadbd(8)
             https://mariadb.com/kb/en/library/systemd/
   Main PID: 1078 (mariadbd)
     Status: "Taking your SQL requests now..."
      Tasks: 8 (limit: 4598)
     Memory: 3.4M
        CPU: 884ms
     CGroup: /system.slice/mariadb.service
             └─1078 /usr/sbin/mariadbd
```

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ sudo mysql -u root -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 32
Server version: 10.6.16-MariaDB-0ubuntu0.22.04.1 Ubuntu 22.04

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

MariaDB [(none)]>
```

4. Message Queue

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ sudo systemctl status rabbitmq-s
erver
● rabbitmq-server.service - RabbitMQ Messaging Server
     Loaded: loaded (/lib/systemd/system/rabbitmq-server.service; enabled; vendo
r preset: enabled)
     Active: active (running) since Thu 2024-04-25 16:38:10 PST; 49min ago
   Main PID: 23455 (beam.smp)
      Tasks: 23 (limit: 4598)
     Memory: 91.3M
        CPU: 21.506s
     CGroup: /system.slice/rabbitmq-server.service
             ├─23455 /usr/lib/erlang/erts-12.2.1/bin/beam.smp -W w -MBas ageffcb
f -MHas ageffcbf -MBlmbcs 512 -MHlmbcs 512 -MMmcs 3>
             ├─23466 erl_child_setup 65536
             ├─23517 inet_gethost 4
             └─23518 inet_gethost 4
```



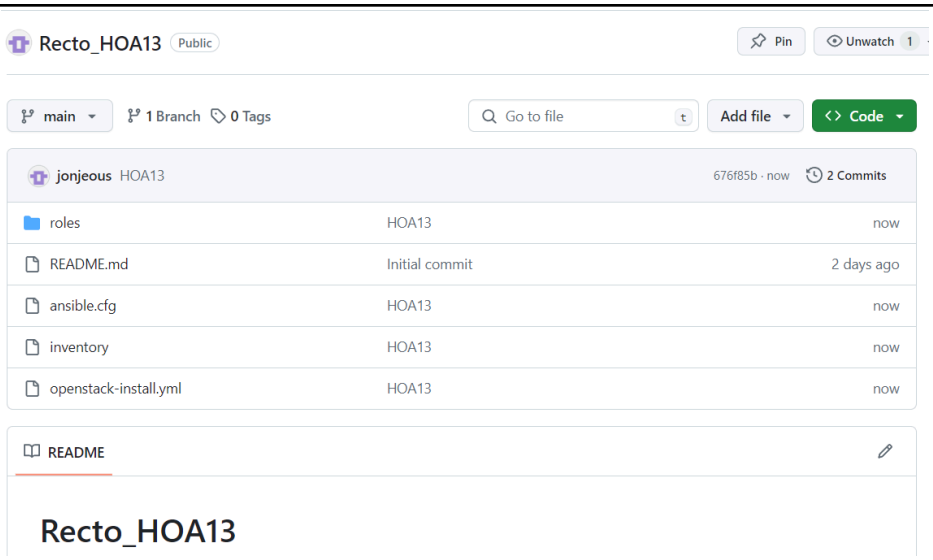
5. Memcached

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ sudo systemctl status memcached
● memcached.service - memcached daemon
     Loaded: loaded (/lib/systemd/system/memcached.service; enabled; vendor pres
et: enabled)
     Active: active (running) since Thu 2024-04-25 16:48:16 PST; 39min ago
       Docs: man:memcached(1)
   Main PID: 29344 (memcached)
      Tasks: 10 (limit: 4598)
     Memory: 2.0M
        CPU: 285ms
     CGroup: /system.slice/memcached.service
             └─29344 /usr/bin/memcached -m 64 -p 11211 -u memcache -l 127.0.0.1
-P /var/run/memcached/memcached.pid
```

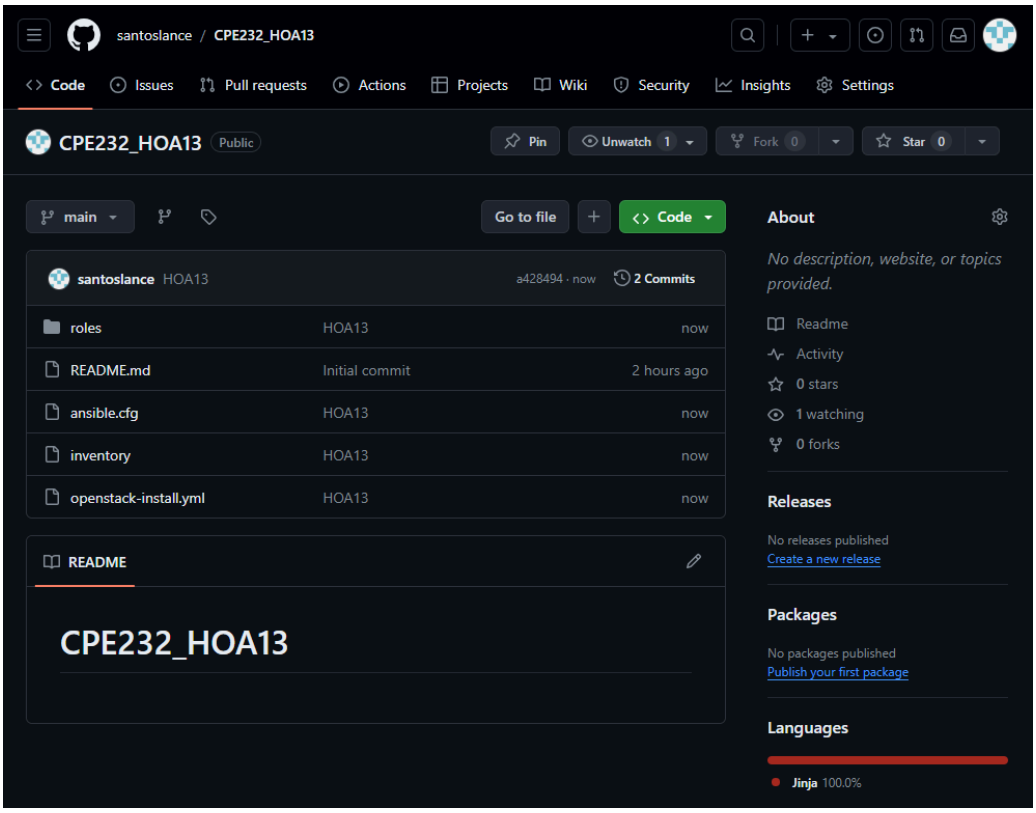
6. Etcd

```
jonjeous@localmachine-VirtualBox:~/Recto_HOA13$ sudo systemctl status etcd
● etcd.service - etcd - highly-available key value store
     Loaded: loaded (/lib/systemd/system/etcd.service; enabled; vendor preset: e
nabled)
     Active: active (running) since Thu 2024-04-25 16:51:43 PST; 35min ago
       Docs: https://etcd.io/docs
             man:etcd
   Main PID: 30785 (etcd)
      Tasks: 8 (limit: 4598)
     Memory: 6.0M
        CPU: 5.151s
     CGroup: /system.slice/etcd.service
             └─30785 /usr/bin/etcd
```

f. Commit changes to github



https://github.com/jonjeous/Recto_HOA13.git



https://github.com/santoslance/CPE232_HOA13.git

Reflections:

Answer the following:

1. What are the benefits of implementing OpenStack?

OpenStack offers a scalable and flexible cloud infrastructure solution without costly licensing fees. Its modular design enables customization to meet specific needs, while automation tools streamline operations and reduce manual errors. OpenStack promotes security with features like role-based access control and encryption, ensuring data protection. Its active community provides support and resources for successful deployment and operation, making it an attractive choice for organizations seeking cost-effective, vendor-neutral cloud solutions.

Conclusions:

In conclusion, our group worked together to set up OpenStack using Ansible. We explored the pros and cons of cloud services, assessed various deployment methods, and collaborated on installing and configuring OpenStack's core services. With Ansible's help, we automated tasks and documented our processes, improving our ability to manage cloud environments as a team. This experience enhanced our understanding of cloud infrastructure and prepared us to tackle cloud-related challenges together.