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Course/Section: CPE212 - CPE31S2	Date Submitted: 11/29/24
Instructor: Engr. Robin Valenzuela	Semester and SY: 1 st (2024 – 2025)
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	
<ol style="list-style-type: none"> 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	
<p>Oracle VirtualBox (Hypervisor)</p> <p>1x Ubuntu VM or Centos VM</p>	
4. Tasks	
<ol style="list-style-type: none"> 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/ <ol style="list-style-type: none"> 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)	

```

GNU nano 7.2                                inventory.yaml
[db_server]
192.168.56.104

[app_server]
192.168.56.106

[cache-util_server]
192.168.56.108

```

inventory.yaml file configuration

```

GNU nano 7.2                                ansible.cfg
[defaults]
inventory = ~/Activity-13/inventory.yaml
remote_user = julius-de-omampo
host_key_checking = True

```

ansible.cfg file configuration

```

GNU nano 7.2                                install.yaml
---
- hosts: all
  become: true
  pre_tasks:

    - name: Install Updates (Ubuntu)
      tags: always
      apt:
        upgrade: dist
        update_cache: yes
      when: ansible_distribution == "Ubuntu"

    - name: Install Updates (CentOS)
      tags: always
      dnf:
        update_cache: yes
      when: ansible_distribution == "CentOS"

    - name: Ensure the package manager cache is updated (CentOS)
      ansible.builtin.yum:
        name: "*"
        state: latest
      when: ansible_distribution == "CentOS"

    - name: Ensure the package manager is updated (Ubuntu)
      ansible.builtin.apt:
        update_cache: yes

```

install.yaml playbook (1)

```
when: ansible_distribution == "Ubuntu"

- hosts: db_server
  become: true
  roles:
    - Database

- hosts: app_server
  become: true
  roles:
    - Application

- hosts: cache-util_server
  become: true
  roles:
    - CacheUtility
```

install.yml playbook (2)

```
GNU nano 7.2 roles/Database/tasks/main.yml
---
- name: Install SQL Database (MySQL/MariaDB)
  ansible.builtin.package:
    name:
      - mariadb-server
    state: present
  when: ansible_os_family == "Debian"

- name: Start and enable SQL service
  ansible.builtin.service:
    name: mariadb
    state: started
    enabled: yes

- name: Install etcd
  ansible.builtin.package:
    name: etcd-server
    state: present

- name: Start and enable etcd service
  ansible.builtin.service:
    name: etcd
    state: started
    enabled: yes
```

Database server tasks

```
GNU nano 7.2 roles/Application/tasks/main.yml
---
- name: Install OpenStack (base components)
  ansible.builtin.package:
    name:
      - python3-openstackclient
    state: present
  when: ansible_os_family == "Debian"

- name: Install Message Queue (RabbitMQ)
  ansible.builtin.package:
    name: rabbitmq-server
    state: present

- name: Start and enable RabbitMQ service
  ansible.builtin.service:
    name: rabbitmq-server
    state: started
    enabled: yes
```

Application server tasks

```
GNU nano 7.2 roles/CacheUtility/tasks/main.yml
--
- name: Install NTP (chrony)
  ansible.builtin.yum:
    name: chrony
    state: present
  when: ansible_os_family == "RedHat"

- name: Start and enable NTP service
  ansible.builtin.service:
    name: chronyd
    state: started
    enabled: yes

- name: Install Memcached
  ansible.builtin.package:
    name: memcached
    state: present

- name: Start and enable Memcached service
  ansible.builtin.service:
    name: memcached
    state: started
    enabled: yes
```

Cache Utility server tasks

```
julius-de-omampo@workstation:~/Activity-13$ ansible-playbook --ask-become-pass install.yaml
BECOME password:
[WARNING]: Invalid characters were found in group names but not replaced, use -vvvv to see details

PLAY [all] *****

TASK [Gathering Facts] *****
ok: [192.168.56.104]
ok: [192.168.56.106]
ok: [192.168.56.108]

TASK [Install Updates (Ubuntu)] *****
skipping: [192.168.56.108]
ok: [192.168.56.104]
ok: [192.168.56.106]

TASK [Install Updates (CentOS)] *****
skipping: [192.168.56.104]
skipping: [192.168.56.106]
ok: [192.168.56.108]

TASK [Ensure the package manager cache is updated (CentOS)] *****
skipping: [192.168.56.104]
skipping: [192.168.56.106]
ok: [192.168.56.108]

TASK [Ensure the package manager is updated (Ubuntu)] *****
skipping: [192.168.56.108]
changed: [192.168.56.104]
changed: [192.168.56.106]
```

install.yaml playbook status (1)

```
PLAY [db_server] *****

TASK [Gathering Facts] *****
ok: [192.168.56.104]

TASK [Database : Install SQL Database (MySQL/MariaDB)] *****
ok: [192.168.56.104]

TASK [Database : Start and enable SQL service] *****
ok: [192.168.56.104]

TASK [Database : Install etcd] *****
ok: [192.168.56.104]

TASK [Database : Start and enable etcd service] *****
ok: [192.168.56.104]

PLAY [app_server] *****

TASK [Gathering Facts] *****
ok: [192.168.56.106]

TASK [Application : Install OpenStack (base components)] *****
ok: [192.168.56.106]

TASK [Application : Install Message Queue (RabbitMQ)] *****
ok: [192.168.56.106]

TASK [Application : Start and enable RabbitMQ service] *****
ok: [192.168.56.106]
```

install.yaml playbook status (2)

```
PLAY [cache-util_server] *****

TASK [Gathering Facts] *****
ok: [192.168.56.108]

TASK [CacheUtility : Install NTP (chrony)] *****
ok: [192.168.56.108]

TASK [CacheUtility : Start and enable NTP service] *****
ok: [192.168.56.108]

TASK [CacheUtility : Install Memcached] *****
changed: [192.168.56.108]

TASK [CacheUtility : Start and enable Memcached service] *****
changed: [192.168.56.108]

PLAY RECAP *****
192.168.56.104      : ok=8    changed=1    unreachable=0    failed=0    skipped=2    rescued=0    ignored=0
192.168.56.106      : ok=7    changed=1    unreachable=0    failed=0    skipped=2    rescued=0    ignored=0
192.168.56.108      : ok=8    changed=2    unreachable=0    failed=0    skipped=2    rescued=0    ignored=0
```

install.yaml playbook status (3)

Database Server:

```
julius-de-onampo@server1:~$ mariadb --version
mariadb Ver 15.1 Distrib 10.11.8-MariaDB, for debian-linux-gnu (x86_64) using EditLine wrapper
julius-de-onampo@server1:~$ systemctl status mariadb
● mariadb.service - MariaDB 10.11.8 database server
   Loaded: loaded (/usr/lib/systemd/system/mariadb.service; enabled; preset: enabled)
   Active: active (running) since Thu 2024-11-28 15:54:47 UTC; 33min ago
     Docs: man:mariadb(8)
           https://mariadb.com/kb/en/library/systemd/
   Main PID: 18824 (mariabdd)
   Status: "Taking your SQL requests now..."
     Tasks: 9 (limit: 14651)
   Memory: 79.0M (peak: 82.4M)
      CPU: 526ms
   CGroup: /system.slice/mariadb.service
           └─18824 /usr/sbin/mariabdd

Nov 28 15:54:47 server1 mariabdd[18824]: 2024-11-28 15:54:47 0 [Note] InnoDB: File './ibtmp1' size is now 12.000MiB.
Nov 28 15:54:47 server1 mariabdd[18824]: 2024-11-28 15:54:47 0 [Note] InnoDB: log sequence number 46846; transaction id 5
Nov 28 15:54:47 server1 mariabdd[18824]: 2024-11-28 15:54:47 0 [Note] Plugin 'FEEDBACK' is disabled.
Nov 28 15:54:47 server1 mariabdd[18824]: 2024-11-28 15:54:47 0 [Note] InnoDB: Loading buffer pool(s) from /var/lib/mysql/
Nov 28 15:54:47 server1 mariabdd[18824]: 2024-11-28 15:54:47 0 [Warning] You need to use --log-bin to make --expire-logs
Nov 28 15:54:47 server1 mariabdd[18824]: 2024-11-28 15:54:47 0 [Note] InnoDB: Buffer pool(s) load completed at 241128 15
Nov 28 15:54:47 server1 mariabdd[18824]: 2024-11-28 15:54:47 0 [Note] Server socket created on IP: '127.0.0.1'.
Nov 28 15:54:47 server1 mariabdd[18824]: 2024-11-28 15:54:47 0 [Note] /usr/sbin/mariabdd: ready for connections.
Nov 28 15:54:47 server1 mariabdd[18824]: Version: '10.11.8-MariaDB-0ubuntu0.24.04.1' socket: '/run/mysqld/mysqld.sock'
Nov 28 15:54:47 server1 systemd[1]: Started mariadb.service - MariaDB 10.11.8 database server.
lines 1-23/23 (END)
```

SQL Database (MariaDB) version and system status

```
julius-de-omampo@server1:~$ etcd --version
etcd Version: 3.4.30
Git SHA: Not provided (use ./build instead of go build)
Go Version: go1.22.2
Go OS/Arch: linux/amd64
julius-de-omampo@server1:~$ systemctl status etcd
● etcd.service - etcd - highly-available key value store
   Loaded: loaded (/usr/lib/systemd/system/etcd.service; enabled; preset: enabled)
   Active: active (running) since Thu 2024-11-28 15:59:27 UTC; 30min ago
     Docs: https://etcd.io/docs
           man:etcd
   Main PID: 21734 (etcd)
     Tasks: 9 (limit: 2219)
    Memory: 6.5M (peak: 7.2M)
       CPU: 6.688s
   CGroup: /system.slice/etcd.service
           └─21734 /usr/bin/etcd

Nov 28 15:59:27 server1 etcd[21734]: raft2024/11/28 15:59:27 INFO: 8e9e05c52164694d received MsgVoteResp from 8e9e05c52164694d
Nov 28 15:59:27 server1 etcd[21734]: raft2024/11/28 15:59:27 INFO: 8e9e05c52164694d became leader at term 2
Nov 28 15:59:27 server1 etcd[21734]: raft2024/11/28 15:59:27 INFO: raft.node: 8e9e05c52164694d elected leader 8e9e05c52164694d
Nov 28 15:59:27 server1 etcd[21734]: setting up the initial cluster version to 3.4
Nov 28 15:59:27 server1 etcd[21734]: ready to serve client requests
Nov 28 15:59:27 server1 etcd[21734]: published {Name:server1 ClientURLs:[http://localhost:2379]} to cluster cdf818194e3
Nov 28 15:59:27 server1 systemd[1]: Started etcd.service - etcd - highly-available key value store.
Nov 28 15:59:27 server1 etcd[21734]: serving insecure client requests on 127.0.0.1:2379, this is strongly discouraged!
Nov 28 15:59:27 server1 etcd[21734]: set the initial cluster version to 3.4
Nov 28 15:59:27 server1 etcd[21734]: enabled capabilities for version 3.4
lines 1-22/22 (END)
```

etcd version and system status

Application Server:

```
julius-de-omampo@server2:~$ openstack --version
openstack 6.6.0
julius-de-omampo@server2:~$
```

OpenStack version


```
julius-de-omampo@server2:~$ openstack
(openstack) help

Documented commands (use 'help -v' for verbose/'help <topic>' for details):
=====
alias  exit  history  quit          run_script  shell
edit   help  macro   run_pyscript  set         shortcuts

Application commands (type help <topic>):
=====
access rule delete          network set
access rule list           network show
access rule show           network subport list
access token create        network trunk create
address group create       network trunk delete
address group delete       network trunk list
address group list         network trunk set
address group set          network trunk show
address group show         network trunk unset
address group unset        network unset
address scope create       object create
address scope delete       object delete
address scope list         object list
address scope set          object save
address scope show         object set
aggregate add host         object show
aggregate cache image      object store account set
aggregate create           object store account show
aggregate delete           object store account unset
aggregate list             object unset
aggregate remove host      policy create
```

OpenStack CLI

```
julius-de-omampo@server2:~$ systemctl status rabbitmq-server
● rabbitmq-server.service - RabbitMQ Messaging Server
   Loaded: loaded (/usr/lib/systemd/system/rabbitmq-server.service; enabled; preset: enabled)
   Active: active (running) since Thu 2024-11-28 16:05:33 UTC; 29min ago
     Main PID: 21974 (beam.smp)
        Tasks: 26 (limit: 2219)
      Memory: 98.1M (peak: 128.0M)
         CPU: 13.783s
    CGroup: /system.slice/rabbitmq-server.service
            └─21974 /usr/lib/erlang/erts-13.2.2.5/bin/beam.smp -W w -MBas ageffcbf -MHAs ageffcbf -MBlmbs 512 -MHlmbcs
              └─21984 erl_child_setup 65536
                └─22041 /usr/lib/erlang/erts-13.2.2.5/bin/inet_gethost 4
                  └─22042 /usr/lib/erlang/erts-13.2.2.5/bin/inet_gethost 4
                    └─22054 /bin/sh -s rabbit_disk_monitor

Nov 28 16:05:27 server2 systemd[1]: Starting rabbitmq-server.service - RabbitMQ Messaging Server...
Nov 28 16:05:33 server2 systemd[1]: Started rabbitmq-server.service - RabbitMQ Messaging Server.
lines 1-16/16 (END)
```

RabbitMQ Server system status

Cache Utility Server:

```
[julius-de-omampo@localhost ~]$ chronyd --version
chronyd (chrony) version 4.6.1 (+CMDMON +NTP +REFCLOCK +RTC +PRIVDROP +SCFILTER +SIGND +ASYNCDNS +NTS +SECHASH +IPV6 +DEBUG)
[julius-de-omampo@localhost ~]$ systemctl status chronyd
● chronyd.service - NTP client/server
   Loaded: loaded (/usr/lib/systemd/system/chronyd.service; enabled; preset: disabled)
   Active: active (running) since Thu 2024-11-28 23:52:29 PST; 45min ago
     Docs: man:chronyd(8)
           man:chrony.conf(5)
    Main PID: 48881 (chronyd)
      Tasks: 1 (limit: 10642)
     Memory: 780.0K
        CPU: 59ms
    CGroup: /system.slice/chronyd.service
            └─48881 /usr/sbin/chronyd -F 2

Nov 28 23:52:29 localhost.localdomain systemd[1]: Starting NTP client/server...
Nov 28 23:52:29 localhost.localdomain chronyd[48881]: chronyd version 4.6.1 started
Nov 28 23:52:29 localhost.localdomain chronyd[48881]: Loaded 0 symmetric keys
Nov 28 23:52:29 localhost.localdomain chronyd[48881]: Using right/UTC timezone
Nov 28 23:52:29 localhost.localdomain chronyd[48881]: Frequency 4.993 +/- 0.644
Nov 28 23:52:29 localhost.localdomain chronyd[48881]: Loaded seccomp filter (leak)
Nov 28 23:52:29 localhost.localdomain systemd[1]: Started NTP client/server.
Nov 28 23:54:52 localhost.localdomain chronyd[48881]: Can't synchronise: no servers
Nov 28 23:54:53 localhost.localdomain chronyd[48881]: Source 222.127.1.19 replaced
lines 1-21/21 (END)
```

NTP (Chronyd) version and system status

```
[julius-de-omampo@localhost ~]$ memcached --version
memcached 1.6.9
[julius-de-omampo@localhost ~]$ systemctl status memcached
● memcached.service - memcached daemon
   Loaded: loaded (/usr/lib/systemd/system/memcached.service; enabled; preset: disabled)
   Active: active (running) since Fri 2024-11-29 00:13:50 PST; 25min ago
     Main PID: 93067 (memcached)
       Tasks: 10 (limit: 10642)
      Memory: 5.8M
         CPU: 99ms
    CGroup: /system.slice/memcached.service
            └─93067 /usr/bin/memcached -p 11211 -u memcached -m 64 -c 1024 -l 127.0.0.1,::1

Nov 29 00:13:50 localhost.localdomain systemd[1]: Started memcached daemon.
[julius-de-omampo@localhost ~]$
```

Memcached version and system status

GitHub Link:

<https://github.com/jmado-biscoff/Activity-13.git>

Reflections:

Answer the following:

1. What are the benefits of implementing OpenStack?

OpenStack is an open-source cloud computing platform that provides scalability, flexibility, and cost-effectiveness for managing virtualized resources. It enables organizations to build private or public clouds, offering self-service access to compute, storage, and networking resources. With its modular architecture, OpenStack supports diverse workloads and integrates with various technologies, ensuring adaptability. It

fosters innovation through its vibrant community, avoids vendor lock-in, and reduces infrastructure costs by leveraging commodity hardware. OpenStack's automation capabilities enhance efficiency, while its robust APIs facilitate seamless integration with existing tools and workflows.

Conclusions:

The activity demonstrated the efficient use of Ansible playbooks with roles to automate the installation of OpenStack prerequisites on both Ubuntu and CentOS managed nodes. By leveraging Ansible's flexibility and conditional tasks, the playbook ensured compatibility with the specific package managers and services of each operating system. Roles structured the configuration, improving reusability and organization. This approach not only streamlined the deployment process but also verified the proper installation and functionality of critical components such as NTP/Chrony, SQL databases, message queues, Memcached, and etcd. This automation highlights the power of Ansible in managing complex multi-OS environments with ease and consistency.