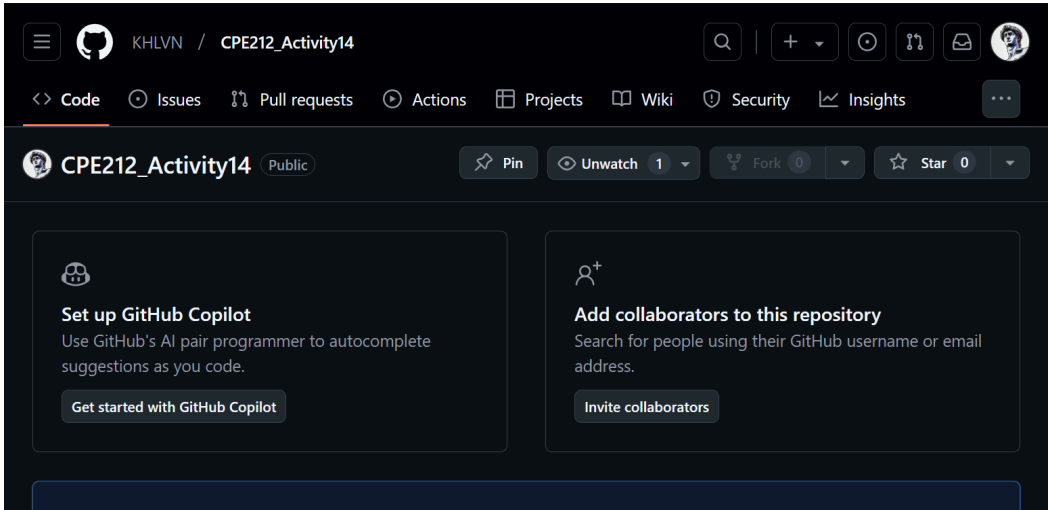


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<b>Course/Section: CPE31S2 - CPE 212</b>	<b>Date Submitted: 12/13/2024</b>
<b>Instructor: Engr. Robin Valenzuela</b>	<b>Semester and SY: 3rd Year 1st Sem</b>
<b>Activity 14: OpenStack Installation (Keystone, Glance, Nova)</b>	
<b>1. Objectives</b>	
Create a workflow to install OpenStack using Ansible as your Infrastructure as Code (IaC).	
<b>2. Intended Learning Outcomes</b>	
<ol style="list-style-type: none"> <li>1. Analyze the advantages and disadvantages of cloud services</li> <li>2. Evaluate different Cloud deployment and service models</li> <li>3. Create a workflow to install and configure OpenStack base services using Ansible as documentation and execution.</li> </ol>	
<b>3. Resources</b>	
<p>Oracle VirtualBox (Hypervisor)</p> <p>1x Ubuntu VM or Centos VM</p>	
<b>4. Tasks</b>	
<ol style="list-style-type: none"> <li>1. Create a new repository for this activity.</li> <li>2. Create a playbook that converts the steps in the following items in <a href="https://docs.openstack.org/install-guide/">https://docs.openstack.org/install-guide/</a> <ol style="list-style-type: none"> <li>a. Keystone (Identity Service)</li> <li>b. Glance (Imaging Service)</li> <li>c. Nova (Compute Service)</li> <li>d. Create different plays in installing per server type (controller, compute etc.) and identify it as a group in the Inventory file.</li> <li>e. Add, commit and push it to your GitHub repo.</li> </ol> </li> </ol>	
<b>5. Output (screenshots and explanations)</b>	
<ul style="list-style-type: none"> <li>• Create a new repository for this activity.</li> </ul>	
 <p>The screenshot shows a GitHub repository page for 'CPE212_Activity14' by user 'KHLVN'. The repository is public. The page displays navigation tabs for Code, Issues, Pull requests, Actions, Projects, Wiki, Security, and Insights. Below the repository name, there are buttons for Pin, Unwatch (1), Fork (0), and Star (0). The main content area features two cards: 'Set up GitHub Copilot' with a 'Get started with GitHub Copilot' button, and 'Add collaborators to this repository' with an 'Invite collaborators' button.</p>	

```
punopaughey@workstation:~$ git clone git@github.com:KHLVN/CPE212_Activity14.git
Cloning into 'CPE212_Activity14'...
warning: You appear to have cloned an empty repository.
```

Figure 5.1: Creating and cloning the repository

```
punopaughey@workstation:~/CPE212_Activity14$ cat inventory
[controller]
server1

[computing]
centos9  ansible_user=user_khlvn

punopaughey@workstation:~/CPE212_Activity14$
```

Figure 5.2: inside of the inventory file.

```
punopaughey@workstation:~/CPE212_Activity14$ tree .
.
├── ansible.cfg
├── group_vars
│   ├── glance.yml
│   ├── keystone.yml
│   └── nova.yml
├── install.yml
├── inventory
└── roles
    ├── glance
    │   ├── tasks
    │   │   └── main.yml
    │   └── templates
    │       ├── glance.conf.j2
    │       └── keystone.conf.j2
    ├── keystone
    │   ├── tasks
    │   │   └── main.yml
    │   └── templates
    │       └── keystone.conf.j2
    └── nova
        ├── tasks
        │   └── main.yml
        └── templates
            └── nova.conf.j2
```

Figure 5.3: contents of the roles directory, with each service corresponds to one group

- Create a playbook that converts the steps in the following items in <https://docs.openstack.org/install-guide/>
  - Keystone (Identity Service)
  - Glance (Imaging Service)

- Nova (Compute Service)
- Create different plays in installing per server type (controller, compute etc.) and identify it as a group in the Inventory file.
- Add, commit and push it to your GitHub repo.

## CODES

### install.yml

```
---
- name: keystone
  hosts: keystone
  become: yes
  roles:
    - role: keystone

- name: nova
  hosts: nova
  become: yes
  roles:
    - role: nova

- name: glance
  hosts: glance
  become: yes
  roles:
    - role: glance
```

### roles/keystone/tasks/main.yml

```
---
- name: Install OpenStack Repos (CentOS)
  package:
    name:
      - centos-release-openstack-yoga
      - python3-openstackclient
  state: present
  update_cache: yes
  when: ansible_distribution == "CentOS"

- name: Install Keystone and Dependencies (CentOS)
  package:
    name:
      - openstack-keystone
      - httpd
      - mod_wsgi
  state: present
  when: ansible_distribution == "CentOS"
```

```

- name: Install Keystone (Ubuntu)
  package:
    name: keystone
    state: present
  when: ansible_distribution == "Ubuntu"

# - name: Configure Keystone database
#   shell: |
#     mysql -uroot -p{{ mysql_root_password }} -e "
#     CREATE DATABASE keystone;
#     GRANT ALL PRIVILEGES ON keystone.* TO 'keystone'@'localhost' IDENTIFIED BY '{{
keystone_db_password }}';
#     FLUSH PRIVILEGES;"
#   creates=/var/lib/mysql/keystone

- name: Configure Keystone
  template:
    src: keystone.conf.j2
    dest: /etc/keystone/keystone.conf

- name: Enable and Start Keystone services (Ubuntu)
  systemd:
    name: apache2
    state: started
    enabled: yes
  when: ansible_distribution == "Ubuntu"

- name: Enable and Start Keystone services (CentOS)
  systemd:
    name: httpd
    state: started
    enabled: yes
  when: ansible_distribution == "CentOS"

- name: Restart Apache Service (Ubuntu)
  systemd:
    name: apache2
    enabled: yes
    state: restarted
  when: ansible_distribution == "Ubuntu"

- name: Restart Apache Service (CentOS)
  systemd:
    name: httpd
    enabled: yes
    state: restarted
  when: ansible_distribution == "CentOS"

```

---

- name: Python packages (CentOS)

yum:

name:

- python3-pip
- python3-devel
- libffi-devel
- gcc

state: present

when: ansible\_distribution == "CentOS"

- name: Install Nova packages (Ubuntu)

package:

name:

- nova-api
- nova-scheduler
- nova-conductor
- nova-compute

state: present

update\_cache: yes

when: ansible\_distribution == "Ubuntu"

- name: Install Nova packages (CentOS)

yum:

name:

- openstack-nova-api
- openstack-nova-scheduler
- openstack-nova-conductor
- python3-openstackclient

state: present

when: ansible\_distribution == "CentOS"

# - name: Configure Nova database (Control Node only)

# when: "'controller' in group\_names"

# shell: |

# mysql -uroot -p{{ mysql\_root\_password }} -e "

# CREATE DATABASE nova;

# GRANT ALL PRIVILEGES ON nova.\* TO 'nova'@'localhost' IDENTIFIED BY '{{ nova\_db\_password }}';

# FLUSH PRIVILEGES;"

# creates=/var/lib/mysql/nova

- name: Configure Nova

template:

src: nova.conf.j2

dest: /etc/nova/nova.conf

- name: Enable and Start Nova Services

systemd:

name: "{{ item }}"

state: started

```
enabled: yes
loop:
- openstack-nova-api
- openstack-nova-scheduler
- openstack-nova-conductor
when: ansible_distribution == "CentOS"
```

## roles/glance/tasks/main.yml

```
---
- name: Python packages (CentOS)
  yum:
    name:
      - python3-pip
      - python3-devel
      - libffi-devel
      - gcc
    state: present
  when: ansible_distribution == "CentOS"

- name: Install Nova packages (Ubuntu)
  package:
    name:
      - nova-api
      - nova-scheduler
      - nova-conductor
      - nova-compute
    state: present
    update_cache: yes
  when: ansible_distribution == "Ubuntu"

- name: Install Nova packages (CentOS)
  yum:
    name:
      - openstack-nova-api
      - openstack-nova-scheduler
      - openstack-nova-conductor
      - python3-openstackclient
    state: present
  when: ansible_distribution == "CentOS"

# - name: Configure Nova database (Control Node only)
#   when: "'controller' in group_names"
#   shell: |
#     mysql -uroot -p{{ mysql_root_password }} -e "
#     CREATE DATABASE nova;
#     GRANT ALL PRIVILEGES ON nova.* TO 'nova'@'localhost' IDENTIFIED BY '{{
nova_db_password }}';
#     FLUSH PRIVILEGES;"
#   creates=/var/lib/mysql/nova
```

```
- name: Configure Nova
  template:
    src: nova.conf.j2
    dest: /etc/nova/nova.conf

- name: Enable and Start Nova Services
  systemd:
    name: "{{ item }}"
    state: started
    enabled: yes
  loop:
    - openstack-nova-api
    - openstack-nova-scheduler
    - openstack-nova-conductor
  when: ansible_distribution == "CentOS"
```

## RUNNING THE PLAYBOOK

### Keystone

```
TASK [keystone : Install OpenStack Repos (CentOS)] *****
skipping: [server1]
ok: [centos9]

TASK [keystone : Install Keystone and Dependencies (CentOS)] *****
skipping: [server1]
ok: [centos9]

TASK [keystone : Install Keystone (Ubuntu)] *****
skipping: [centos9]
ok: [server1]

TASK [keystone : Configure Keystone] *****
ok: [server1]
ok: [centos9]

TASK [keystone : Enable and Start Keystone services (Ubuntu)] *****
skipping: [centos9]
ok: [server1]

TASK [keystone : Enable and Start Keystone services (CentOS)] *****
skipping: [server1]
changed: [centos9]

TASK [keystone : Restart Apache Service (Ubuntu)] *****
skipping: [centos9]
changed: [server1]

TASK [keystone : Restart Apache Service (CentOS)] *****
skipping: [server1]
changed: [centos9]
```

## Nova

```
PLAY [nova] *****

TASK [Gathering Facts] *****
ok: [server1]

TASK [nova : Python packages (CentOS)] *****
skipping: [server1]

TASK [nova : Install Nova packages (Ubuntu)] *****
ok: [server1]

TASK [nova : Install Nova packages (CentOS)] *****
skipping: [server1]

TASK [nova : Configure Nova] *****
ok: [server1]

TASK [nova : Enable and Start Nova Services] *****
skipping: [server1] => (item=openstack-nova-api)
skipping: [server1] => (item=openstack-nova-scheduler)
skipping: [server1] => (item=openstack-nova-conductor)
```

## Glance

```
TASK [glance : Install Glance packages (Ubuntu)] *****
ok: [server1]

TASK [glance : Install Glance packages (CentOS)] *****
skipping: [server1]

TASK [glance : Configure Glance] *****
ok: [server1]

TASK [glance : Enable and Start Glance services (Ubuntu)] *****
ok: [server1]

TASK [glance : Enable and Start Glance services (CentOS)] *****
skipping: [server1]
```

## VERIFYING SERVICES

### Ubuntu

#### Nova

```
punopaughey@server1:~$ sudo systemctl status nova-api
[sudo] password for punopaughey:
● nova-api.service - OpenStack Compute API
   Loaded: loaded (/lib/systemd/system/nova-api.service; enabled; vendor preset:
   Active: active (running) since Sun 2024-12-08 01:12:29 +08; 43min ago
   Main PID: 22169 (nova-api)
     Tasks: 8 (limit: 4656)
    CGroup: /system.slice/nova-api.service
            └─12307 /usr/bin/python2 /usr/bin/nova-api --config-file=/etc/nova/no
              └─12308 /usr/bin/python2 /usr/bin/nova-api --config-file=/etc/nova/no
                └─12311 /usr/bin/python2 /usr/bin/nova-api --config-file=/etc/nova/no
                  └─22169 /usr/bin/python2 /usr/bin/nova-api --config-file=/etc/nova/no

Dec 08 01:12:29 server1 systemd[1]: Started OpenStack Compute API.
```



## Keystone

```
punopaughey@server1:~$ sudo systemctl status apache2
[sudo] password for punopaughey:
● apache2.service - The Apache HTTP Server
   Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset:
  Drop-In: /lib/systemd/system/apache2.service.d
           └─apache2-systemd.conf
   Active: active (running) since Sun 2024-12-08 15:48:34 +08; 13min ago
     Process: 2063 ExecStop=/usr/sbin/apachectl stop (code=exited, status=0/SUCCESS)
     Process: 2073 ExecStart=/usr/sbin/apachectl start (code=exited, status=0/SUCCESS)
    Main PID: 2092 (apache2)
      Tasks: 26 (limit: 4653)
    CGroup: /system.slice/apache2.service
            └─2092 /usr/sbin/apache2 -k start
              2093 (wsgi:keystone-pu -k start
              2094 (wsgi:keystone-pu -k start
              2095 (wsgi:keystone-pu -k start
              2102 (wsgi:keystone-pu -k start
              2103 (wsgi:keystone-pu -k start
              2104 /usr/sbin/apache2 -k start
              2105 /usr/sbin/apache2 -k start
              2106 /usr/sbin/apache2 -k start
              2107 /usr/sbin/apache2 -k start
              2108 /usr/sbin/apache2 -k start

Dec 08 15:48:33 server1 systemd[1]: Starting The Apache HTTP Server...
```

## Glance

```
punopaughey@server1:~$ sudo systemctl status glance-api
● glance-api.service - OpenStack Image Service API
   Loaded: loaded (/lib/systemd/system/glance-api.service; enabled; vendor prese
   Active: active (running) since Sun 2024-12-08 01:15:51 +08; 40min ago
     Main PID: 25812 (glance-api)
       Tasks: 5 (limit: 4656)
    CGroup: /system.slice/glance-api.service
            └─25812 /usr/bin/python2 /usr/bin/glance-api --config-file=/etc/glanc
              25956 /usr/bin/python2 /usr/bin/glance-api --config-file=/etc/glanc
              25958 /usr/bin/python2 /usr/bin/glance-api --config-file=/etc/glanc
              25959 /usr/bin/python2 /usr/bin/glance-api --config-file=/etc/glanc
              25961 /usr/bin/python2 /usr/bin/glance-api --config-file=/etc/glanc

Dec 08 01:15:54 server1 glance-api[25812]: /usr/lib/python2.7/dist-packages/past
Dec 08 01:15:54 server1 glance-api[25812]: return pkg_resources.EntryPoint.par
Dec 08 01:15:54 server1 glance-api[25812]: /usr/lib/python2.7/dist-packages/past
Dec 08 01:15:54 server1 glance-api[25812]: return pkg_resources.EntryPoint.par
Dec 08 01:15:58 server1 glance-api[25812]: /usr/lib/python2.7/dist-packages/past
Dec 08 01:15:58 server1 glance-api[25812]: return pkg_resources.EntryPoint.par
Dec 08 01:15:58 server1 glance-api[25812]: /usr/lib/python2.7/dist-packages/past
Dec 08 01:15:58 server1 glance-api[25812]: return pkg_resources.EntryPoint.par
Dec 08 01:15:59 server1 glance-api[25812]: /usr/lib/python2.7/dist-packages/past
Dec 08 01:15:59 server1 glance-api[25812]: val = callable(*args, **kw)
```

## Nova

```

● openstack-nova-api.service - OpenStack Nova API Server
   Loaded: loaded (/usr/lib/systemd/system/openstack-nova-api.service; disabled; vendor preset: disabled)
   Active: active (running) since Fri 2024-12-06 23:19:42 PST; 52s ago
     Main PID: 56928 (nova-api)
        Tasks: 8 (limit: 23016)
      Memory: 134.2M
         CPU: 9.275s
       CGroup: /system.slice/openstack-nova-api.service
               └─56928 /usr/bin/python3 /usr/bin/nova-api

Dec 06 23:20:34 CentOS nova-api[57190]: 2024-12-06 23:20:34.093 57190 ERROR oslo
Dec 06 23:20:34 CentOS nova-api[57190]: 2024-12-06 23:20:34.093 57190 ERROR oslo
Dec 06 23:20:34 CentOS nova-api[57190]: 2024-12-06 23:20:34.093 57190 ERROR oslo
Dec 06 23:20:34 CentOS nova-api[57190]: 2024-12-06 23:20:34.093 57190 ERROR oslo

```

## Keystone

```

Activate the web console with: systemctl enable --now cockpit.socket

Last login: Sun Dec  8 15:48:17 2024 from 192.168.56.20
[user_khlvn@centos ~]$ systemctl status httpd
● httpd.service - The Apache HTTP Server
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; preset: disabled; vendor preset: disabled)
   Drop-In: /usr/lib/systemd/system/httpd.service.d
            └─php-fpm.conf
   Active: active (running) since Sun 2024-12-08 15:24:13 PST; 41min ago
     Docs: man:httpd.service(8)
    Main PID: 35000 (httpd)
   Status: "Total requests: 0; Idle/Busy workers 100/0;Requests/sec: 0; Bytes served/sec: 0.00;CPU user/elapsed system: 0% 0%/0% 0% 0%"
     Tasks: 177 (limit: 48782)
    Memory: 39.9M
       CPU: 16.857s
      CGroup: /system.slice/httpd.service
              └─35000 /usr/sbin/httpd -DFOREGROUND
                └─35001 /usr/sbin/httpd -DFOREGROUND
                  └─35002 /usr/sbin/httpd -DFOREGROUND
                    └─35003 /usr/sbin/httpd -DFOREGROUND
                      └─35004 /usr/sbin/httpd -DFOREGROUND

```

## Glance

```

● openstack-glance-api.service - OpenStack Image Service (code-named Glance) API
   Loaded: loaded (/usr/lib/systemd/system/openstack-glance-api.service; disabled; vendor preset: disabled)
   Active: active (running) since Fri 2024-12-06 22:31:20 PST; 4s ago
     Main PID: 51112 (glance-api)
        Tasks: 1 (limit: 23016)
      Memory: 52.7M
         CPU: 1.424s
       CGroup: /system.slice/openstack-glance-api.service
               └─51112 /usr/bin/python3 /usr/bin/glance-api

Dec 06 22:31:20 CentOS systemd[1]: Started OpenStack Image Service (code-named Glance) API.
Dec 06 22:31:24 CentOS glance-api[51112]: 2024-12-06 22:31:24.264 51112 INFO glance

```

## COMMITTING TO REPOSITORY:

```
punopaughey@workstation:~/CPE212_Activity14$ git add *
punopaughey@workstation:~/CPE212_Activity14$ ls
ansible.cfg  group_vars  install.yml  inventory  roles
punopaughey@workstation:~/CPE212_Activity14$ git status
On branch master

No commits yet

Changes to be committed:
  (use "git rm --cached <file>..." to unstage)

        new file:   ansible.cfg
        new file:   group_vars/glance.yml
        new file:   group_vars/keystone.yml
        new file:   group_vars/nova.yml
        new file:   install.yml
        new file:   inventory
        new file:   roles/glance/tasks/main.yml
        new file:   roles/glance/templates/glance.conf.j2
        new file:   roles/glance/templates/keystone.conf.j2
        new file:   roles/keystone/tasks/main.yml
        new file:   roles/keystone/templates/keystone.conf.j2
        new file:   roles/nova/tasks/main.yml
        new file:   roles/nova/templates/nova.conf.j2
```

Figure 5.4: Adding all files using *git add* command

```
punopaughey@workstation:~/CPE212_Activity14$ git commit -m "Activity 14"
[master (root-commit) 8467bf0] Activity 14
13 files changed, 306 insertions(+)
create mode 100644 ansible.cfg
create mode 100644 group_vars/glance.yml
create mode 100644 group_vars/keystone.yml
create mode 100644 group_vars/nova.yml
create mode 100644 install.yml
create mode 100644 inventory
create mode 100644 roles/glance/tasks/main.yml
create mode 100644 roles/glance/templates/glance.conf.j2
create mode 100644 roles/glance/templates/keystone.conf.j2
create mode 100644 roles/keystone/tasks/main.yml
create mode 100644 roles/keystone/templates/keystone.conf.j2
create mode 100644 roles/nova/tasks/main.yml
create mode 100644 roles/nova/templates/nova.conf.j2
```

Figure 5.5: Committing to remote repository

```
punopaughey@workstation:~/CPE212_Activity14$ git push
Counting objects: 25, done.
Delta compression using up to 4 threads.
Compressing objects: 100% (19/19), done.
Writing objects: 100% (25/25), 3.80 KiB | 971.00 KiB/s, done.
Total 25 (delta 2), reused 0 (delta 0)
remote: Resolving deltas: 100% (2/2), done.
To github.com:KHLVN/CPE212_Activity14.git
* [new branch]      master -> master
```

Figure 5.6: Pushing to remote repository

### Reflections:

Answer the following:

1. Describe Keystone, Glance and Nova services

- **Keystone:** Keystone is like the **gatekeeper** for OpenStack. It controls who can access the cloud and what they're allowed to do. It manages users, roles, and permissions to make sure everyone gets the right access and nothing more.
- **Glance:** Glance acts as the **library** of virtual machine images. Whenever you need a specific OS or setup to create a VM, Glance has those images ready to go, storing them so they're available when you need them.
- **Nova:** Nova is the **workhorse** of OpenStack. It takes care of running the virtual machines. It decides where and when new VMs should run, making sure there's enough compute power for all your cloud applications and services.

### Conclusions:

- This activity serves as the continuation of the previous activity where we installed the prerequisites for OpenStack (Memcached, Etcd, and etc.) in remote servers. Now this activity requires us to install three OpenStack Services namely Glance, Keystone, and Nova. The installation of these services needed configuration files in order to properly install the three services. I believe that the last three activities are somewhat a sneak peek for our next elective course that we will take after this course, related to Cloud Computing.