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Course/Section: CpE31S2	**Date Submitted:** 12-13-2024
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Activity 14: OpenStack Installation (Keystone, Glance, Nova)

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)

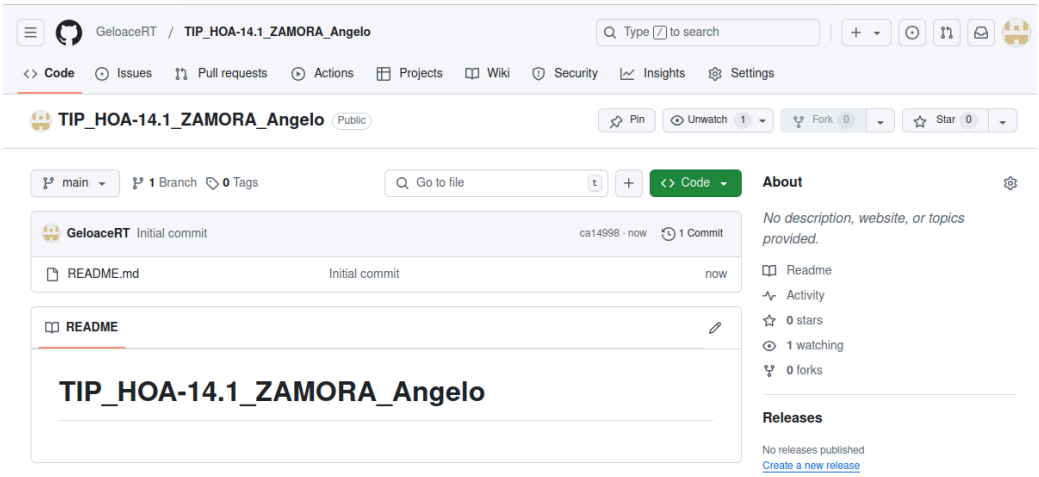
1x Ubuntu VM or Centos VM

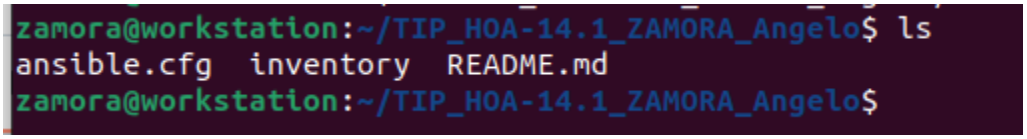
4. Tasks

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. Keystone (Identity Service)
    b. Glance (Imaging Service)
    c. Nova (Compute Service)
    d. Create different plays in installing per server type (controller, compute etc.) and identify it as a group in the Inventory file.
    e. Add, commit and push it to your GitHub repo.

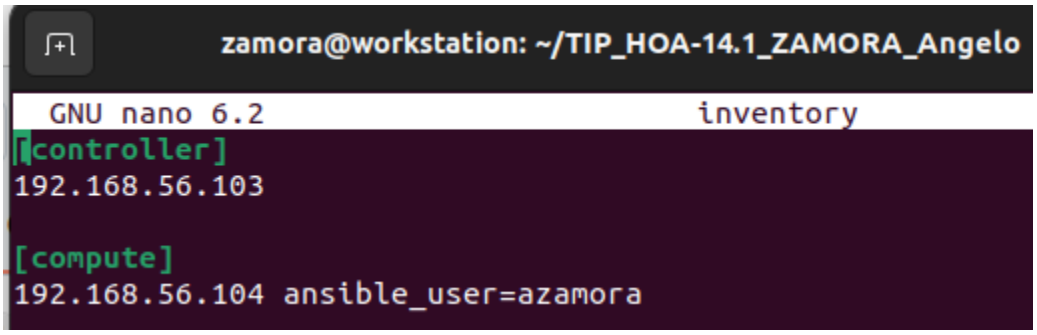
5. **Output** (screenshots and explanations)

- Create a new repository for this activity.



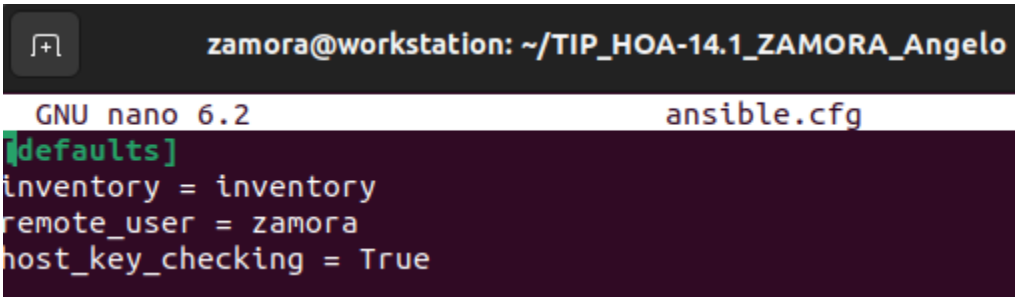


Inventory:



Controller - 192.168.56.103 Server 2
Compute - 192.168.56.104 CentOS Node 1

Ansible Config:



- Create a playbook that converts the steps in the following items in https://docs.openstack.org/install-guide/

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo$ tree roles
roles
├── glance
├── keystone
└── nova

3 directories, 0 files
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo$
```

  - Keystone (Identity Service)

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles$ tree keystone
keystone
├── files
│   └── admin-openrc
├── handlers
│   └── main.yml
└── tasks
    ├── configure.yml
    ├── install.yml
    ├── main.yml
    └── prereq.yml
```

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/keystone/tasks$ ls
configure.yml  install.yml  main.yml  prereq.yml
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/keystone/tasks$ cat prereq.yml
- name: Creating keystone database
  mysql_query:
    login_user: root
    login_password: mysqlpass
    login_unix_socket: /var/lib/mysql/mysql.sock
    query:
      - CREATE DATABASE keystone;
      - GRANT ALL PRIVILEGES ON keystone.* TO 'keystone'@'localhost' IDENTIFIED BY 'keystonepass';
      - GRANT ALL PRIVILEGES ON keystone.* TO 'keystone'@'%' IDENTIFIED BY 'keystonepass';
    single_transaction: yes
  failed_when: false
  no_log: true
  when: ansible_distribution == "CentOS"
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/keystone/tasks$
```

Note: Prerequisites to install dependencies before installing the main thing.

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/keystone/tasks$ cat install.yml
- name: Installing keystone and its prerequisites in CentOS
  yum:
    name:
      - openstack-keystone
  when: ansible_distribution == "CentOS"

- name: Install Keystone in Ubuntu
  apt:
    name:
      - keystone
      - apache2
      - php
      - libapache2-mod-php
    state: latest
    update_cache: yes
  when: ansible_distribution == "Ubuntu"
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/keystone/tasks$
```

Explanation: Main installation of the keystone.

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/keystone/tasks$ cat configure.yml
- name: Configuring the connection variable
  replace:
    path: /etc/keystone/keystone.conf
    regexp: '#connection = <None>'
    replace: 'connection = mysql+pymysql://keystone:keystonepass@controller/keystone'

- name: Configuring memcached variable
  replace:
    path: /etc/keystone/keystone.conf
    regexp: '#memcache_servers = localhost:11211'
    replace: 'memcache_servers = controller:11211'

- name: Configuring the fernet variable
  replace:
    path: /etc/keystone/keystone.conf
    regexp: '#provider = fernet'
    replace: 'provider = fernet'

- name: Initialize fernet repositories
  shell: |
    keystone-manage fernet_setup --keystone-user keystone --keystone-group keystone
    keystone-manage credential_setup --keystone-user keystone --keystone-group keystone

- name: Configuring setbools
  shell: |
    setsebool -P httpd_use_openstack on
    setsebool -P httpd_can_network_connect on
    setsebool -P httpd_can_network_connect_db on

- name: Opening firewall
  ansible.posix.firewalld:
    port: 5000/tcp
    permanent: yes
```

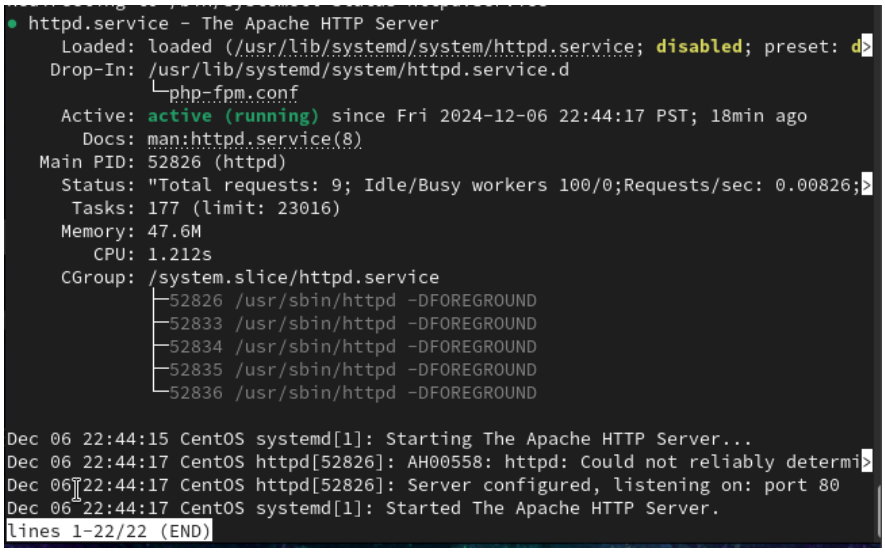
Explanation: Here is the configuration file to make sure it is properly setup

```
- name: Configuring apache
  replace:
    path: /etc/httpd/conf/httpd.conf
    regexp: '#ServerName www.example.com:80'
    replace: 'ServerName controller'

  notify: Creating link

- name: Starting and enabling service
  service:
    name: httpd
    state: started
    enabled: true

- name: Copying admin-openrc
  copy:
    src: admin-openrc
    dest: /home/cserver/
    owner: root
    group: root

- name: Changing permission
  shell: |
    sudo chmod 755 /home/cserver/admin-openrc
    source /home/cserver/admin-openrc
```

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo$ ansible-playbook --ask-become-pass test.yml
BECOME password:

PLAY [compute] *****************************************************************************

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

TASK [keystone : Creating keystone database] ***********************************************
ok: [192.168.56.104]

TASK [keystone : Installing keystone and its prerequisites in CentOS] **********************
ok: [192.168.56.104]

TASK [keystone : Install Keystone in Ubuntu] ***********************************************
skipping: [192.168.56.104]

TASK [keystone : Verifying if apache status] ***********************************************
changed: [192.168.56.104]

PLAY RECAP *********************************************************************************
192.168.56.104             : ok=4    changed=1    unreachable=0    failed=0    skipped=1    rescued=
0    ignored=0

zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo$
```

Running the playbook

Proof of installation



- Glance (Imaging Service)

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles$ tree glance/
glance/
├── files
│   └── glance-api.conf
└── tasks
    ├── configure.yml
    ├── install.yml
    └── main.yml

2 directories, 4 files
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles$
```

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/glance/tasks$ cat configure.yml
- name: Copying the config file
  copy:
    src: glance-api.conf
    dest: /etc/glance/glance-api.conf
    owner: root
    group: glance
    mode: 0640
  when: ansible_distribution == "CentOS"

- name: Populating the database
  command: su -s /bin/sh -c "glance-manage db_sync" glance
  failed_when: false
  no_log: true
  when: ansible_distribution == "CentOS"

- name: Restarting glance-api
  service:
    name: openstack-glance-api.service
    state: started
    enabled: true
  when: ansible_distribution == "CentOS"
```

Explanation: Here is the configuration file to make sure it is properly setup

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/glance/tasks$ cat install.yml
- name: Installing Glance in CentOS
  yum:
    name: openstack-glance
  when: ansible_distribution == "CentOS"

- name: Installation Glance in Ubuntu
  apt:
    name:
      - glance
    state: latest
    update_cache: yes
  when: ansible_distribution == "Ubuntu"
```

Explanation: Installation of Glance

Running the playbook

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo$ ansible-playbook --ask-become-p
ass test.yml
BECOME password:

PLAY [compute] *****************************************************************

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

TASK [glance : Installing Glance in CentOS] ************************************
ok: [192.168.56.104]

TASK [glance : Installation Glance in Ubuntu] **********************************
skipping: [192.168.56.104]

PLAY RECAP *********************************************************************
192.168.56.104             : ok=2    changed=0    unreachable=0    failed=0    s
kipped=1    rescued=0    ignored=0

zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo$
```

Proof of installation

```
[azamora@CentOS ~]$ systemctl status openstack-glance-api
● openstack-glance-api.service - OpenStack Image Service (code-named Glance) AP>
     Loaded: loaded (/usr/lib/systemd/system/openstack-glance-api.service; disa>
     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 >
Dec 06 22:31:24 CentOS glance-api[51112]: 2024-12-06 22:31:24.264 51112 INFO gl>
lines 1-12/12 (END)
```

- Nova (Compute Service)

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/nova$ tree
.
├── files
│   └── nova.conf
└── tasks
    ├── configure.yml
    ├── install.yml
    └── main.yml

2 directories, 4 files
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/nova$
```

Running the playbook

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo$ ansible-playbook --ask-become-pass test.yml
BECOME password:

PLAY [compute] *****************************************************************************************************

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

TASK [nova : Install nova and its dependencies in CentOS] **********************************************************
ok: [192.168.56.104]

TASK [nova : Installation Nova in Ubuntu] **************************************************************************
skipping: [192.168.56.104]

TASK [nova : Copying the config file] ******************************************************************************
changed: [192.168.56.104]

TASK [nova : Populating the database] ******************************************************************************
changed: [192.168.56.104]

TASK [nova : Restarting nova services] *****************************************************************************
ok: [192.168.56.104]

PLAY RECAP *********************************************************************************************************
192.168.56.104             : ok=5    changed=2    unreachable=0    failed=0    skipped=1    rescued=0    ignored=0

zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo$
```

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/nova/tasks$ cat configure.yml
- name: Copying the config file
  copy:
    src: nova.conf
    dest: /etc/nova/nova.conf
    owner: root
    group: nova
    mode: 0640

- name: Populating the database
  command:
    su -s /bin/sh -c "nova-manage api_db sync" nova
    su -s /bin/sh -c "nova-manage cell_v2 map_cell0" nova
    su -s /bin/sh -c "nova-manage cell_v2 create_cell --name=cell1 --verbose" nova
    su -s /bin/sh -c "nova-manage db sync" nova
  failed_when: false
  no_log: true

- name: Restarting nova services
  service:
    name:
      - openstack-nova-api.service
      - openstack-nova-scheduler.service
      - openstack-nova-conductor.service
      - openstack-nova-novncproxy.service
    state: started
    enabled: true
  failed_when: false
  no_log: true

zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/nova/tasks$
```

Explanation: Here is the configuration playbook for nova

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/nova/tasks$ cat install.yml
- name: Install nova and its dependencies in CentOS
  yum:
     name:
      - openstack-nova-api
      - openstack-nova-conductor
      - openstack-nova-scheduler
  when: ansible_distribution == "CentOS"

- name: Installation Nova in Ubuntu
  apt:
    name:
      - nova-compute
      - python3-openstackclient
    state: latest
    update_cache: yes
  when: ansible_distribution == "Ubuntu"
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo/roles/nova/tasks$
```

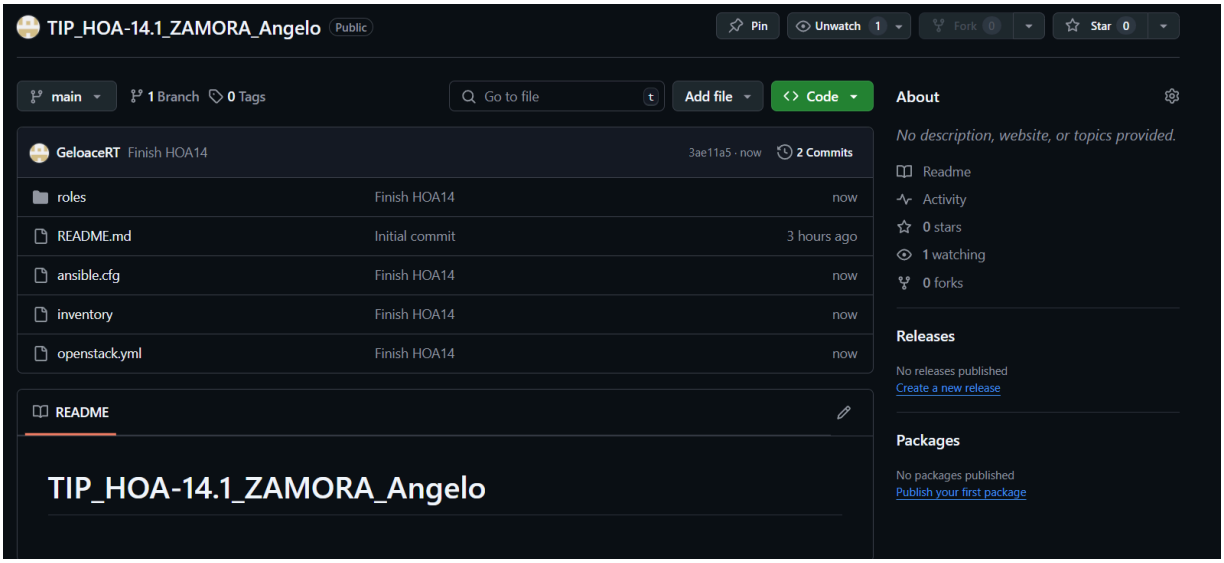
Explanation: Here is the installation playbook of nova.

Proof of installation

```
[azamora@CentOS ~]$ sudo systemctl status openstack-nova-api
● openstack-nova-api.service - OpenStack Nova API Server
     Loaded: loaded (/usr/lib/systemd/system/openstack-nova-api.service; disabl>
     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 osl>
Dec 06 23:20:34 CentOS nova-api[57190]: 2024-12-06 23:20:34.093 57190 ERROR osl>
Dec 06 23:20:34 CentOS nova-api[57190]: 2024-12-06 23:20:34.093 57190 ERROR osl>
Dec 06 23:20:34 CentOS nova-api[57190]: 2024-12-06 23:20:34.093 57190 ERROR osl>
Dec 06 23:20:34 CentOS nova-api[57190]: 2024-12-06 23:20:34.093 57190 ERROR osl>
Dec 06 23:20:34 CentOS nova-api[57190]: 2024-12-06 23:20:34.093 57190 ERROR osl>
Dec 06 23:20:34 CentOS nova-api[57190]: 2024-12-06 23:20:34.093 57190 ERROR osl>
Dec 06 23:20:34 CentOS nova-api[57190]: 2024-12-06 23:20:34.093 57190 ERROR osl>
Dec 06 23:20:34 CentOS nova-api[57190]: 2024-12-06 23:20:34.093 57190 ERROR osl>
Dec 06 23:20:34 CentOS nova-api[57190]: 2024-12-06 23:20:34.102 57190 INFO nova>
lines 1-20/20 (END)
```

- Add, commit and push it to your GitHub repo.

```
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo$ git add *
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo$ git commit -m "Finish HOA14"
[main 3ae11a5] Finish HOA14
 17 files changed, 18484 insertions(+)
 create mode 100644 ansible.cfg
 create mode 100644 inventory
 create mode 100644 openstack.yml
 create mode 100644 roles/glance/files/glance-api.conf
 create mode 100644 roles/glance/tasks/configure.yml
 create mode 100644 roles/glance/tasks/install.yml
 create mode 100644 roles/glance/tasks/main.yml
 create mode 100644 roles/keystone/files/admin-openrc
 create mode 100644 roles/keystone/handlers/main.yml
 create mode 100644 roles/keystone/tasks/configure.yml
 create mode 100644 roles/keystone/tasks/install.yml
 create mode 100644 roles/keystone/tasks/main.yml
 create mode 100644 roles/keystone/tasks/prereq.yml
 create mode 100644 roles/nova/files/nova.conf
 create mode 100644 roles/nova/tasks/configure.yml
 create mode 100644 roles/nova/tasks/install.yml
 create mode 100644 roles/nova/tasks/main.yml
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo$ git push
Enumerating objects: 31, done.
Counting objects: 100% (31/31), done.
Delta compression using up to 2 threads
Compressing objects: 100% (26/26), done.
Writing objects: 100% (30/30), 144.19 KiB | 662.00 KiB/s, done.
Total 30 (delta 1), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (1/1), done.
To github.com:GeloaceRT/TIP_HOA-14.1_ZAMORA_Angelo.git
   ca14998..3ae11a5  main -> main
zamora@workstation:~/TIP_HOA-14.1_ZAMORA_Angelo$
```



GitHub Link: https://github.com/GeloaceRT/TIP_HOA-14.1_ZAMORA_Angelo

Reflections:

Answer the following:

1. Describe Keystone, Glance and Nova services

   Keystone is OpenStack's identity service, which manages authentication, authorization, and service discovery. It serves as the primary interface for managing users, projects, and roles, ensuring safe access to OpenStack resources. Keystone supports token-based authentication and a variety of identity store backends, such as SQL databases and LDAP. It also manages the service catalog, which contains a list of all available services and their endpoints, allowing OpenStack components to connect seamlessly.

   Glance is an image service that lets you discover, register, and retrieve virtual machine images. It supports a variety of image formats, including raw, QCOW2, and VMDK, and works with storage backends such as file systems, object storage, and block storage. **Nova**, the compute service, manages the life cycle of virtual machine instances. It works with hypervisors such as KVM, Xen, and VMware to provision and manage VMs, while also coordinating with other OpenStack services such as Neutron for networking and Cinder for storage, to ensure a fully operating cloud infrastructure.

Conclusions:

When considering cloud services and deployment strategies, it is evident that cloud computing provides tremendous scalability, flexibility, and cost savings, making it an important tool for modern IT operations. However, data security, compliance, and vendor dependency remain essential factors to consider, particularly when deciding between public, private, and hybrid cloud models. The organization's demand for control, customization, and simplicity determines whether to use IaaS, PaaS, or SaaS as its cloud service model.

Using Ansible to automate the installation and configuration of OpenStack services like Keystone, Glance, and Nova speeds up deployment, minimizes manual errors, and improves repeatability. This solution ensures that infrastructure is uniformly delivered across controller and compute nodes, demonstrating Infrastructure as Code's usefulness and efficiency in handling complex cloud environments.