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Course/Section: CPE 232 - CPE31S4	Date Submitted: 11-28-2023
Instructor: Dr. Jonathan V. Taylar	Semester and SY: 1st Sem. 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	
<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)

TASK 1: PREPARATION

1. Create the repository that will be used for this activity.

Create a new repository

A repository contains all project files, including the revision history. Already have a project repository elsewhere? [Import a repository.](#)

Required fields are marked with an asterisk (*).

Owner * TuRonnDraco / Repository name * CPE232_Act13_Seruelas

✓ CPE232_Act13_Seruelas is available.

Great repository names are short and memorable. Need inspiration? How about [expert-journey](#) ?

Description (optional)

☐ **Public**
Anyone on the internet can see this repository. You choose who can commit.

☐ **Private**
You choose who can see and commit to this repository.

Initialize this repository with:

☒ **Add a README file**
This is where you can write a long description for your project. [Learn more about READMEs.](#)

Add .gitignore

.gitignore template: None

Choose which files not to track from a list of templates. [Learn more about ignoring files.](#)

Choose a license

License: None

A license tells others what they can and can't do with your code. [Learn more about licenses.](#)

This will set `main` as the default branch. Change the default name in your [settings](#).

🔔 You are creating a public repository in your personal account.

[Create repository](#)

TuRonnDraco / CPE232_Act13_Seruelas >_ + 🔍 📁 🔖 🔔

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CPE232_Act13_Seruelas Public 📌 Pin 👁 Unwatch 1 🍴 Fork 0 ★ Star 0

main 1 branch 0 tags Go to file Add file - Code

TuRonnDraco Initial commit 3fde5fa now 1 commit

README.md Initial commit now

README.md

CPE232_Act13_Seruelas

About

No description, website, or topics provided.

[Readme](#)

[Activity](#)

[0 stars](#)

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Releases

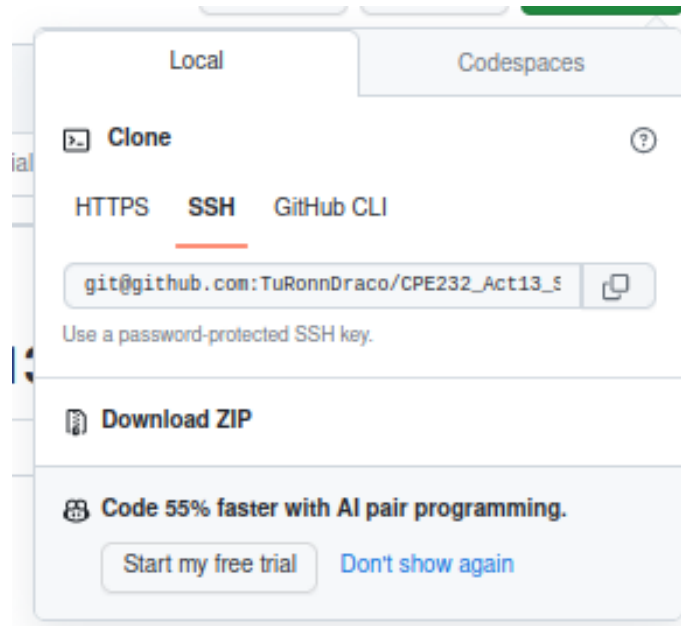
No releases published
[Create a new release](#)

Packages

No packages published
[Publish your first package](#)

Figure 1.1-2 - Creation of the repository.

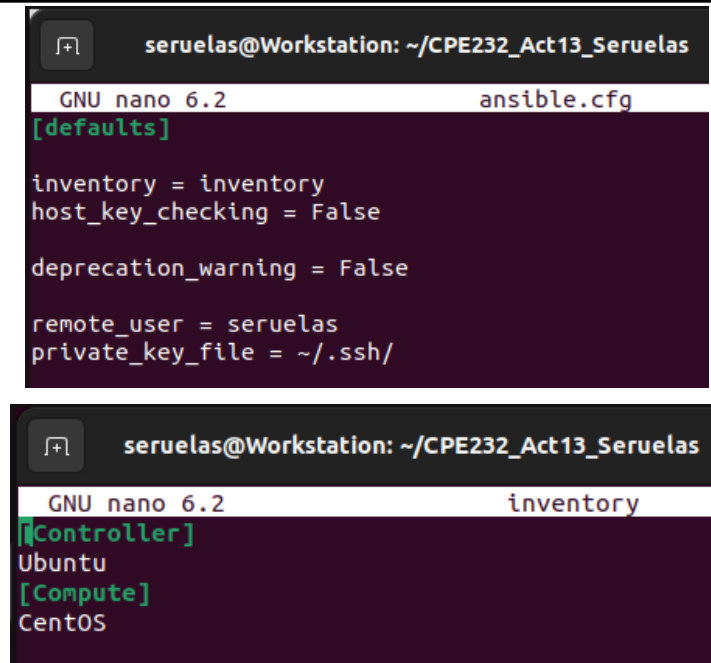
2. Clone the Github repository to the Local repository of the workstation, and setup the configuration and the inventory of the repository.



```
seruelas@Workstation: ~/CPE232_Act13_Seruelas
seruelas@Workstation:~$ git clone git@github.com:TuRonnDraco/CPE232_Act13_Seruel
as.git
Cloning into 'CPE232_Act13_Seruelas'...
The authenticity of host 'github.com (20.205.243.166)' can't be established.
ED25519 key fingerprint is SHA256:+DiY3wvV6TuJJhbpZisF/zLDA0zPMSvHdkr4UvCOQU.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'github.com' (ED25519) to the list of known hosts.
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.
seruelas@Workstation:~$ ls
CPE232_Act13_Seruelas  Documents  Music      Public  Templates
Desktop               Downloads  Pictures   snap    Videos
seruelas@Workstation:~$ cd CPE232_Act13_Seruelas
seruelas@Workstation:~/CPE232_Act13_Seruelas$ git status
On branch main
Your branch is up to date with 'origin/main'.

nothing to commit, working tree clean
```

Figure 2.1-2 - Cloning of the Github repository to the local repository of the workstation.



The figure consists of two terminal screenshots. The top screenshot shows the `ansible.cfg` file in the `~/CPE232_Act13_Seruelas` directory. It displays the `[defaults]` section with settings for `inventory`, `host_key_checking`, `deprecation_warning`, `remote_user`, and `private_key_file`. The bottom screenshot shows the `inventory` file in the same directory, listing the `[Controller]` group with `Ubuntu` and the `[Compute]` group with `CentOS`.

```
seruelas@Workstation: ~/CPE232_Act13_Seruelas
GNU nano 6.2 ansible.cfg
[defaults]

inventory = inventory
host_key_checking = False

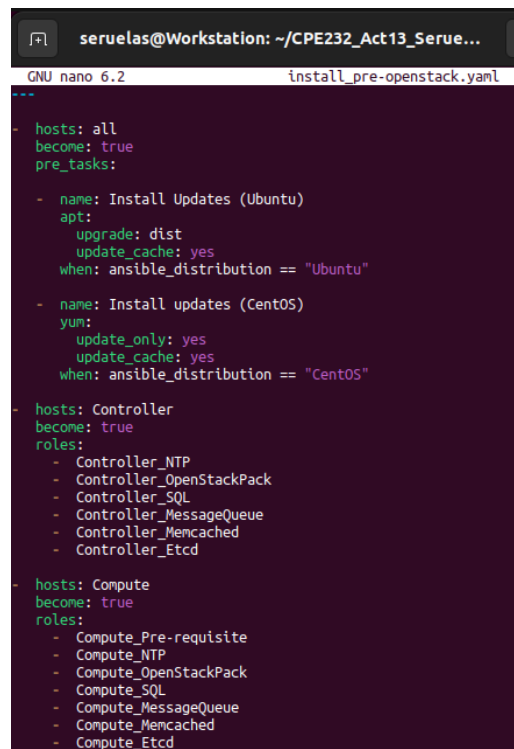
deprecation_warning = False

remote_user = seruelas
private_key_file = ~/.ssh/

seruelas@Workstation: ~/CPE232_Act13_Seruelas
GNU nano 6.2 inventory
[Controller]
Ubuntu
[Compute]
CentOS
```

Figure 2.3-4 - Configuration of the repository and its inventory.

3. Create a playbook that will contain the execution of commands from each role.



The figure shows a terminal screenshot of an Ansible playbook named `install_pre-openstack.yaml` in the `~/CPE232_Act13_Seruelles` directory. The playbook is written in YAML and includes tasks for installing updates on Ubuntu and CentOS, and roles for the Controller and Compute hosts.

```
seruelas@Workstation: ~/CPE232_Act13_Seruelles
GNU nano 6.2 install_pre-openstack.yaml
---
- hosts: all
  become: true
  pre_tasks:
    - name: Install Updates (Ubuntu)
      apt:
        upgrade: dist
        update_cache: yes
        when: ansible_distribution == "Ubuntu"
    - name: Install updates (CentOS)
      yum:
        update_only: yes
        update_cache: yes
        when: ansible_distribution == "CentOS"
- hosts: Controller
  become: true
  roles:
    - Controller_NTP
    - Controller_OpenStackPack
    - Controller_SQL
    - Controller_MessageQueue
    - Controller_Memcached
    - Controller_Etcd
- hosts: Compute
  become: true
  roles:
    - Compute_Pre-requisite
    - Compute_NTP
    - Compute_OpenStackPack
    - Compute_SQL
    - Compute_MessageQueue
    - Compute_Memcached
    - Compute_Etcd
```

Figure 3.1 - Playbook that will execute all commands from each role for each host.

```
seruelas@Workstation: ~/CPE232_Act13_Seruelas
seruelas@Workstation:~/CPE232_Act13_Seruelas$ tree roles
roles
├── Compute_Etcd
│   └── tasks
│       └── main.yml
├── Compute_Memcached
│   └── tasks
│       └── main.yml
├── Compute_MessageQueue
│   └── tasks
│       └── main.yml
├── Compute_NTP
│   └── tasks
│       └── main.yml
├── Compute_OpenStackPack
│   └── tasks
│       └── main.yml
├── Compute_Pre-requisite
│   └── tasks
│       └── main.yml
├── Compute_SQL
│   ├── tasks
│   │   └── main.yml
│   ├── templates
│   │   └── openstack.cnf.j2
│   └── openstack.cnf.j2
├── Controller_Etcd
│   ├── tasks
│   │   └── main.yml
│   ├── templates
│   │   └── etcd.conf.j2
│   └── etcd.conf.j2
├── Controller_Memcached
│   ├── tasks
│   │   └── main.yml
│   ├── templates
│   │   └── memcached.conf.j2
│   └── memcached.conf.j2
├── Controller_MessageQueue
│   └── tasks
│       └── main.yml
├── Controller_NTP
│   └── tasks
│       └── main.yml
├── Controller_OpenStackPack
│   └── tasks
│       └── main.yml
└── Controller_SQL
    └── tasks
        └── main.yml

29 directories, 16 files
```

Figure 3.2 - Tree hierarchy of the roles directory.

TASK 2: PREREQUISITE INSTALLATION FOR CONTROLLER (Ubuntu)

1. Install NTP via **Chrony**.

```
GNU nano 6.2 roles/Controller_NTP/tasks/main.yml
# Installation of NTP
- name: Install NTP (Chrony) in Controller (Ubuntu)
  apt:
    name: chrony
    state: present

- name: Enable and Start NTP in Controller (Ubuntu)
  systemd:
    name: chrony
    state: restarted
    enabled: true
```

Figure 1.1 - NTP Installation in Ubuntu.

2. Install OpenStack Packages via **python3-openstackclient**.

```
GNU nano 6.2 roles/Controller_OpenStackPack/tasks/main.yml
# Installation of OpenStack Packages
- name: Installation of OpenStack Client in Controller (Ubuntu)
  apt:
    name: python3-openstackclient
    state: present
```

Figure 2.1 - OpenStack Packages Installation.

3. Install MySQL and MariaDB and configure them accordingly.

```
GNU nano 6.2 roles/Controller_SQL/tasks/main.yml
# Installation of SQL Database
- name: Installation of MariaDB and MySQL in Controller (Ubuntu)
  apt:
    name:
      - mariadb-server
      - python3-pymysql
    state: present

- name: Creation of Configuration of MySQL for MariaDB in Controller (Ubuntu)
  file:
    path: /etc/mysql/mariadb.conf.d/99-openstack.cnf
    state: touch

- name: Configuration of MySQL for MariaDB in Controller (Ubuntu)
  copy:
    dest: /etc/mysql/mariadb.conf.d/99-openstack.cnf
    content: |
      [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

- name: Enable and Start MySQL and MariaDB in Controller (Ubuntu)
  systemd:
    name: "[[ item ]]"
    state: restarted
    enabled: true
  loop:
    - mysql
    - mariadb
```

Figure 3.1 - MySQL and MariaDB Installation.

4. Install Message Queue via RabbitMQ-Server and configure the openstack user.

```
GNU nano 6.2                                roles/Controller_MessageQueue/tasks/main.yml *
# Installation of Message Queue
- name: Installation of Message Queue (RabbitMQ-Server) in Controller (Ubuntu)
  apt:
    name: rabbitmq-server
    state: present

- name: Remove OpenStack as User for Message Queue in Controller (Ubuntu)
  command: "rabbitmqctl delete_user openstack"
  ignore_errors: yes
  changed_when: false

- name: Add OpenStack as User for Message Queue in Controller (Ubuntu)
  command: "rabbitmqctl add_user openstack RABBIT_PASS"
  ignore_errors: yes
  changed_when: false

- name: Modify Permissions for Openstack for Message Queue in Controller (Ubuntu)
  command: "rabbitmqctl set_permissions openstack '.*' '.*' '.*'"
  ignore_errors: yes
  changed_when: false
```

Figure 4.1 - Message Queue Installation and OpenStack User configuration.

5. Install Memcached and configure it.

```
GNU nano 6.2                                roles/Controller_Memcached/tasks/main.yml *
# Installation of Memcached
- name: Installation of Memcached in Controller (Ubuntu)
  apt:
    name:
      - memcached
      - python3-memcache
    state: present

- name: Creation of Configuration of Memcached in Controller (Ubuntu)
  template:
    src: roles/Controller_Memcached/templates/memcached.conf.j2
    dest: /etc/memcached.conf
    mode: 0644

- name: Enable and Start Memcached in Controller (Ubuntu)
  systemd:
    name: memcached
    state: restarted
    enabled: true
```

Figure 5.1 - Memcached Installation and Configuration.

6. Installation of ETCD and configure it.

```
GNU nano 6.2 roles/Controller_Etcd/tasks/main.yml *
# Installation of ETCD
- name: Installation of ETCD in Controller (Ubuntu)
  apt:
    name: etcd
    state: present

- name: Configuration of ETCD in Controller (Ubuntu)
  template:
    src: roles/Controller_Etcd/templates/etcd.conf.j2
    dest: /etc/default/etcd

- name: Enable and Start ETCD in Controller (Ubuntu)
  systemd:
    name: etcd
    state: restarted
    enabled: true
```

Figure 6.1 - ETCD Installation and Configuration.

TASK 3: PLAYBOOK RUN FOR INSTALLATION FOR CONTROLLER (Ubuntu)

1. Run the playbook for the installation of the Prerequisites of OpenStack. (done separately due to hardware incapability).


```
seruelas@Workstation: ~/CPE232_Act13_Seruelas
seruelas@Workstation:~/CPE232_Act13_Seruelas$ ansible-playbook --ask-become-pass install_pre-openstack.yaml
BECOME password:

PLAY [all] *****

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

TASK [Install Updates (Ubuntu)] *****
ok: [Ubuntu]

PLAY [Controller] *****

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

TASK [Controller_NTP : Install NTP (Chrony) in Controller (Ubuntu)] *****
ok: [Ubuntu]

TASK [Controller_NTP : Enable and Start NTP in Controller (Ubuntu)] *****
changed: [Ubuntu]

TASK [Controller_OpenStackPack : Installation of OpenStack Client in Controller (Ubuntu)] *****
ok: [Ubuntu]

TASK [Controller_SQL : Installation of MariaDB and MySQL in Controller (Ubuntu)] *****
ok: [Ubuntu]

TASK [Controller_SQL : Creation of Configuration of MySQL for MariaDB in Controller (Ubuntu)] *****
changed: [Ubuntu]

TASK [Controller_SQL : Configuration of MySQL for MariaDB in Controller (Ubuntu)] *****
ok: [Ubuntu]

TASK [Controller_SQL : Enable and Start MySQL and MariaDB in Controller (Ubuntu)] *****
changed: [Ubuntu] => (item=mysql)
changed: [Ubuntu] => (item=mariadb)

TASK [Controller_MessageQueue : Installation of Message Queue (RabbitMQ-Server) in Controller (Ubuntu)] *****
ok: [Ubuntu]

TASK [Controller_MessageQueue : Remove OpenStack as User for Message Queue in Controller (Ubuntu)] *****
ok: [Ubuntu]

TASK [Controller_MessageQueue : Add OpenStack as User for Message Queue in Controller (Ubuntu)] *****
ok: [Ubuntu]

TASK [Controller_MessageQueue : Modify Permissions for Openstack for Message Queue in Controller (Ubuntu)] ***
ok: [Ubuntu]

TASK [Controller_Memcached : Installation of Memcached in Controller (Ubuntu)] *****
ok: [Ubuntu]

TASK [Controller_Memcached : Creation of Configuration of Memcached in Controller (Ubuntu)] *****
ok: [Ubuntu]

TASK [Controller_Memcached : Enable and Start Memcached in Controller (Ubuntu)] *****
changed: [Ubuntu]

TASK [Controller_Etcd : Installation of ETCD in Controller (Ubuntu)] *****
ok: [Ubuntu]

TASK [Controller_Etcd : Configuration of ETCD in Controller (Ubuntu)] *****
ok: [Ubuntu]

TASK [Controller_Etcd : Enable and Start ETCD in Controller (Ubuntu)] *****
changed: [Ubuntu]

PLAY RECAP *****
Ubuntu : ok=20  changed=5  unreachable=0  failed=0  skipped=0  rescued=0  ignored=0
```

Figure 1.1 - Play recap of Playbook run for the Controller (Ubuntu).

2. Verify successful installation of NTP.

```
seruelas@Ubuntu: ~  
seruelas@Ubuntu:~$ systemctl status chrony  
● chrony.service - chrony, an NTP client/server  
   Loaded: loaded (/lib/systemd/system/chrony.service; enabled; vendor preset: enabled)  
   Active: active (running) since Mon 2023-11-27 17:19:11 +08; 7min ago  
     Docs: man:chronyd(8)  
           man:chronyc(1)  
           man:chrony.conf(5)  
  Process: 26322 ExecStart=/usr/lib/systemd/scripts/chronyd-starter.sh $DAEMON (code=exited, status=0)  
 Main PID: 26331 (chronyd)  
    Tasks: 2 (limit: 2204)  
   Memory: 1.3M  
      CPU: 85ms  
   CGroup: /system.slice/chrony.service  
           └─26331 /usr/sbin/chronyd -F 1  
             └─26332 /usr/sbin/chronyd -F 1  
lines 1-14/14 (END)
```

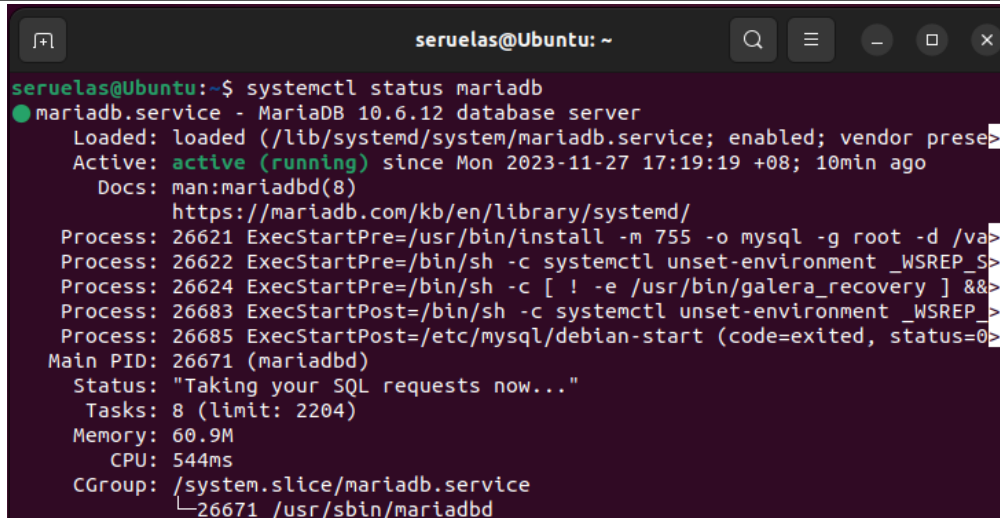
Figure 2.1 - System status of NTP (Chrony).

3. Verify successful installation of MySQL.

```
seruelas@Ubuntu: ~  
seruelas@Ubuntu:~$ systemctl status mysql  
● mariadb.service - MariaDB 10.6.12 database server  
   Loaded: loaded (/lib/systemd/system/mariadb.service; enabled; vendor preset: enabled)  
   Active: active (running) since Mon 2023-11-27 17:19:19 +08; 9min ago  
     Docs: man:mariadb(8)  
           https://mariadb.com/kb/en/library/systemd/  
  Process: 26621 ExecStartPre=/usr/bin/install -m 755 -o mysql -g root -d /var/lib/mysql (code=exited, status=0)  
  Process: 26622 ExecStartPre=/bin/sh -c systemctl unset-environment _WSREP_SSH_KEY (code=exited, status=0)  
  Process: 26624 ExecStartPre=/bin/sh -c [ ! -e /usr/bin/galera_recovery ] && mv /usr/bin/galera_recovery_recovery.sh /tmp/galera_recovery_recovery.sh; chmod 0700 /usr/bin/galera_recovery_recovery.sh; /usr/bin/galera_recovery_recovery.sh (code=exited, status=0)  
  Process: 26683 ExecStartPost=/bin/sh -c systemctl unset-environment _WSREP_SSH_KEY (code=exited, status=0)  
  Process: 26685 ExecStartPost=/etc/mysql/debian-start (code=exited, status=0)  
 Main PID: 26671 (mariabdb)  
   Status: "Taking your SQL requests now..."  
    Tasks: 8 (limit: 2204)  
   Memory: 60.9M  
      CPU: 536ms  
   CGroup: /system.slice/mariadb.service  
           └─26671 /usr/sbin/mariabdb
```

Figure 3.1 - System status of MySQL.

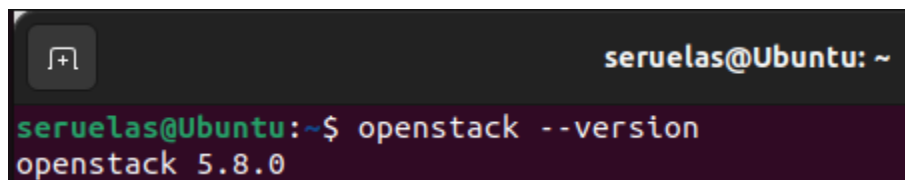
4. Verify successful installation of MariaDB.



```
seruelas@Ubuntu: ~  
seruelas@Ubuntu:~$ systemctl status mariadb  
● mariadb.service - MariaDB 10.6.12 database server  
   Loaded: loaded (/lib/systemd/system/mariadb.service; enabled; vendor prese>  
   Active: active (running) since Mon 2023-11-27 17:19:19 +08; 10min ago  
     Docs: man:mariadb(8)  
           https://mariadb.com/kb/en/library/systemd/  
 Process: 26621 ExecStartPre=/usr/bin/install -m 755 -o mysql -g root -d /va>  
 Process: 26622 ExecStartPre=/bin/sh -c systemctl unset-environment _WSREP_S>  
 Process: 26624 ExecStartPre=/bin/sh -c [ ! -e /usr/bin/galera_recovery ] &&>  
 Process: 26683 ExecStartPost=/bin/sh -c systemctl unset-environment _WSREP_>  
 Process: 26685 ExecStartPost=/etc/mysql/debian-start (code=exited, status=0>  
 Main PID: 26671 (mariabdb)  
   Status: "Taking your SQL requests now..."  
    Tasks: 8 (limit: 2204)  
  Memory: 60.9M  
     CPU: 544ms  
   CGroup: /system.slice/mariadb.service  
           └─26671 /usr/sbin/mariabdb
```

Figure 4.1 - System status of MariaDB.

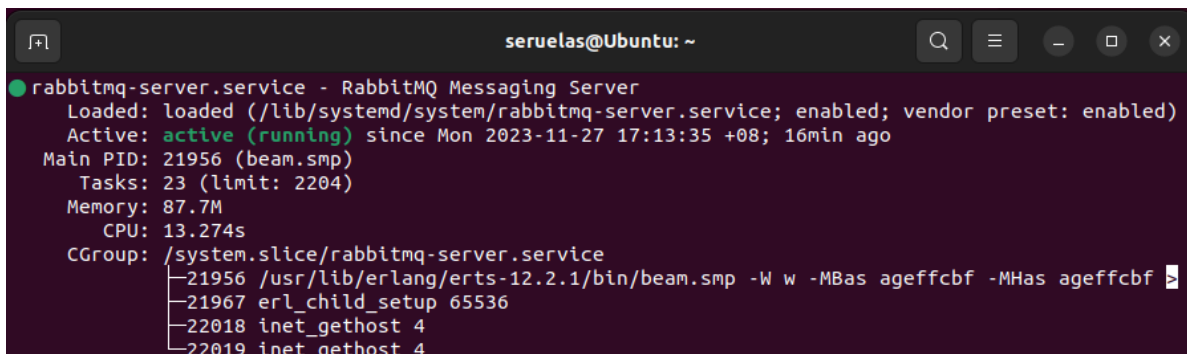
5. Verify successful installation of OpenStack Client.



```
seruelas@Ubuntu: ~  
seruelas@Ubuntu:~$ openstack --version  
openstack 5.8.0
```

Figure 5.1 - Version Number of Installed OpenStack Client.

6. Verify successful installation of Message Queue (RabbitMQ-Server).



```
seruelas@Ubuntu: ~  
● rabbitmq-server.service - RabbitMQ Messaging Server  
   Loaded: loaded (/lib/systemd/system/rabbitmq-server.service; enabled; vendor preset: enabled)  
   Active: active (running) since Mon 2023-11-27 17:13:35 +08; 16min ago  
 Main PID: 21956 (beam.smp)  
    Tasks: 23 (limit: 2204)  
  Memory: 87.7M  
     CPU: 13.274s  
   CGroup: /system.slice/rabbitmq-server.service  
           └─21956 /usr/lib/erlang/erts-12.2.1/bin/beam.smp -W w -MBas ageffcbf -MHAs ageffcbf >  
             └─21967 erl_child_setup 65536  
               └─22018 inet_gethost 4  
                 └─22019 inet_gethost 4
```

Figure 6.1 - System Status of RabbitMQ-Server.

7. Verify successful installation of Memcached.

```
seruelas@Ubuntu: ~  
● memcached.service - memcached daemon  
   Loaded: loaded (/lib/systemd/system/memcached.service; enabled; vendor preset: enable>  
   Active: active (running) since Mon 2023-11-27 17:19:28 +08; 11min ago  
     Docs: man:memcached(1)  
  Main PID: 27072 (memcached)  
    Tasks: 10 (limit: 2204)  
   Memory: 2.0M  
      CPU: 175ms  
   CGroup: /system.slice/memcached.service  
           └─27072 /usr/bin/memcached -m 64 -p 11211 -u memcache -l 127.0.0.1 -P /var/ru>  
~
```

Figure 7.1 - System Status of Memcached.

8. Verify successful installation of ETCD.

```
seruelas@Ubuntu: ~$ 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 Mon 2023-11-27 17:19:33 +08; 12min ago  
     Docs: https://etcd.io/docs  
           man:etcd  
  Main PID: 27173 (etcd)  
    Tasks: 8 (limit: 2204)  
   Memory: 6.0M  
      CPU: 3.293s  
   CGroup: /system.slice/etcd.service  
           └─27173 /usr/bin/etcd
```

TASK 4: PREREQUISITE INSTALLATION FOR COMPUTE (CentOS)

1. Install and Enable the EPEL Repository and reload the packages.

```
GNU nano 6.2                                roles/Compute_Pre-requisite/tasks/main.yml *
# Prerequisites
- name: Adding the EPEL Repository to Compute (CentOS)
  yum:
    name:
      - epel-release
      - python34
      - python-devel
      - gcc
    state: present

- name: Enabling EPEL Repository in Compute (CentOS)
  ini_file:
    dest: /etc/yum.repos.d/epel.repo
    section: epel
    option: enabled
    value: 1

- name: Reload Packages (CentOS)
  yum:
    name: "*"
    state: latest
```

Figure 1.1 - Installation and Enabling of EPEL repository and reloading the packages.

2. Install NTP via Chrony.

```
GNU nano 6.2                                roles/Compute_NTP/tasks/main.yml
# Installation of NTP
- name: Installation of NTP (Chrony) in Compute (CentOS)
  yum:
    name: chrony
    state: present

- name: Enable and Start NTP in Compute (CentOS)
  systemd:
    name: chronyd.service
    state: restarted
    enabled: true
```

Figure 2.1 - NTP Installation.

3. Install OpenStack Packages by installation the CentOS Train release, alongside the SELinux Security for the Open Stack Client.

```
GNU nano 6.2 roles/Compute_OpenStackPack/tasks/main.yml
# Installation of OpenStack Packages
- name: Installation of OpenStack Train Release in Compute (CentOS)
  yum:
    name: centos-release-openstack-train
    state: present

- name: Upgrade Packages (CentOS)
  yum:
    name: "*"
    state: latest

- name: Installation of OpenStack Client and SELinux Security in Compute (CentOS)
  yum:
    name:
      - python-openstackclient
      - openstack-selinux
    state: present
```

Figure 3.1 - Installation of OpenStack Packages.

4. Install and configure MySQL and MariaDB.

```
GNU nano 6.2 roles/Compute_SQL/tasks/main.yml *
# Installation of MySQL and MariaDB Server
- name: Installation of MySQL and MariaDB Server in Compute (CentOS)
  yum:
    name:
      - mariadb
      - mariadb-server
      - python2-PyMySQL

- name: Configuration of MySQL and MariaDB Server in Compute (CentOS)
  template:
    src: roles/Compute_SQL/templates/openstack.cnf.j2
    dest: /etc/my.cnf.d/openstack.cnf

- name: Enable and Start MySQL and MariaDB in Compute (CentOS)
  systemd:
    name: mariadb.service
    state: restarted
    enabled: true
```

Figure 4.1 - MySQL and MariaDB Installation and Configuration.

5. Install Message Queue via RabbitMQ-Server.

```
GNU nano 6.2                                roles/Compute_MessageQueue/tasks/main.yml *
# Installation of Message Queue
- name: Installation of Message Queue (RabbitMQ-Server) in Compute (CentOS)
  yum:
    name: rabbitmq-server
    state: present

- name: Remove OpenStack as User for Message Queue in Compute (CentOS)
  command: "rabbitmqctl delete_user openstack"
  ignore_errors: yes
  changed_when: false

- name: Add OpenStack as User for Message Queue in Compute (CentOS)
  command: "rabbitmqctl add_user openstack RABBIT_PASS"
  ignore_errors: yes
  changed_when: false

- name: Modify Permissions for Openstack for Message Queue in Compute (CentOS)
  command: "rabbitmqctl set_permissions openstack '.*' '.*' '.*'"
  ignore_errors: yes
  changed_when: false

- name: Enable and Start Message Queue in Compute (CentOS)
  systemd:
    name: rabbitmq-server.service
    state: restarted
    enabled: true
```

Figure 5.1 - Message Queue installation.

6. Install Memcached.

```
GNU nano 6.2                                roles/Compute_Memcached/tasks/main.yml
# Installation of Memcached
- name: Installation of Memcached in Compute (CentOS)
  yum:
    name:
      - memcached
      - python-memcached

- name: Enable and Start Memcached in Compute (CentOS)
  systemd:
    name: memcached.service
    state: restarted
    enabled: true
```

Figure 6.1 - Installation of Memcached.

7. Installation and Configuration of ETCD.

```
GNU nano 6.2                                roles/Compute_Etcd/tasks/main.yml
# Installation of ETCD
- name: Installation of ETCD in Compute (CentOS)
  yum:
    name: etcd
    state: present

- name: Configuration of ETCD in Compute (CentOS)
  blockinfile:
    path: /etc/etcd/etcd.conf
    block: |
      #[Member]
      ETCD_DATA_DIR="/var/lib/etcd/default.etcd"
      ETCD_LISTEN_PEER_URLS="http://{{ ansible_default_ipv4.address }}:2380"
      ETCD_LISTEN_CLIENT_URLS="http://{{ ansible_default_ipv4.address }}:2379"
      ETCD_NAME="controller"
      #[Clustering]
      ETCD_INITIAL_ADVERTISE_PEER_URLS="http://{{ ansible_default_ipv4.address }}:2380"
      ETCD_ADVERTISE_CLIENT_URLS="http://{{ ansible_default_ipv4.address }}:2379"
      ETCD_INITIAL_CLUSTER="controller=http://{{ ansible_default_ipv4.address }}:2380"
      ETCD_INITIAL_CLUSTER_TOKEN="etcd-cluster-01"
      ETCD_INITIAL_CLUSTER_STATE="new"

- name: Enable and Start ETCD in Compute (CentOS)
  systemd:
    name: etcd
    state: started
    enabled: true
```

Figure 7.1 - ETCD Installation and Configuration.

TASK 5: PLAYBOOK RUN FOR INSTALLATION FOR COMPUTE (CentOS)

1. Run the playbook for the installation of the Prerequisites of OpenStack. (done separately due to hardware incapacibilities).

```
seruelas@Workstation: ~/CPE232_Act13_Seruelas
seruelas@Workstation:~/CPE232_Act13_Seruela$ ansible-playbook --ask-become-pass install_pre-openstack.yml
BECOME password:

PLAY [all] *****
TASK [Gathering Facts] *****
Fatal: [Ubuntu]: UNREACHABLE! => [{"changed": false, "msg": "Failed to connect to the host via ssh: ssh: connect to host ubuntu port 22: No route to host", "unreachable": true}
ok: [CentOS]

TASK [Install updates (CentOS)] *****
ok: [CentOS]

PLAY [Compute] *****
TASK [Gathering Facts] *****
ok: [CentOS]

TASK [Compute_Pre-requisite : Adding the EPEL Repository to Compute (CentOS)] *****
ok: [CentOS]

TASK [Compute_Pre-requisite : Enabling EPEL Repository in Compute (CentOS)] *****
[WARNING]: The value "1" (type int) was converted to "u'1'" (type string). If this does not look like what you expect, quote the entire value to ensure it does not change.
ok: [CentOS]

TASK [Compute_Pre-requisite : Reload Packages (CentOS)] *****
ok: [CentOS]

TASK [Compute_NTP : Installation of NTP (Chrony) in Compute (CentOS)] *****
ok: [CentOS]

TASK [Compute_NTP : Enable and Start NTP in Compute (CentOS)] *****
changed: [CentOS]

TASK [Compute_OpenStackPack : Installation of OpenStack Train Release in Compute (CentOS)] *****
ok: [CentOS]

TASK [Compute_OpenStackPack : Upgrade Packages (CentOS)] *****
ok: [CentOS]

TASK [Compute_OpenStackPack : Installation of OpenStack Client and SELinux Security in Compute (CentOS)] *****
ok: [CentOS]

TASK [Compute_SQL : Installation of MySQL and MariaDB Server in Compute (CentOS)] *****
ok: [CentOS]

TASK [Compute_SQL : Configuration of MySQL and MariaDB Server in Compute (CentOS)] *****
ok: [CentOS]

TASK [Compute_SQL : Enable and Start MySQL and MariaDB in Compute (CentOS)] *****
changed: [CentOS]

TASK [Compute_MessageQueue : Installation of Message Queue (RabbitMQ-Server) in Compute (CentOS)] *****
ok: [CentOS]

TASK [Compute_MessageQueue : Remove OpenStack as User for Message Queue in Compute (CentOS)] *****
ok: [CentOS]

TASK [Compute_MessageQueue : Add OpenStack as User for Message Queue in Compute (CentOS)] *****
ok: [CentOS]

TASK [Compute_MessageQueue : Modify Permissions for Openstack for Message Queue in Compute (CentOS)] *****
ok: [CentOS]

TASK [Compute_MessageQueue : Enable and Start Message Queue in Compute (CentOS)] *****
changed: [CentOS]

TASK [Compute_Memcached : Installation of Memcached in Compute (CentOS)] *****
changed: [CentOS]

TASK [Compute_Memcached : Enable and Start Memcached in Compute (CentOS)] *****
changed: [CentOS]

TASK [Compute_Etcd : Installation of ETCD in Compute (CentOS)] *****
ok: [CentOS]

TASK [Compute_Etcd : Configuration of ETCD in Compute (CentOS)] *****
ok: [CentOS]

TASK [Compute_Etcd : Enable and Start ETCD in Compute (CentOS)] *****
ok: [CentOS]

PLAY RECAP *****
CentOS      : ok=24  changed=5  unreachable=0  failed=0  skipped=0  rescued=0  ignored=0
Ubuntu     : ok=0    changed=0  unreachable=1  failed=0  skipped=0  rescued=0  ignored=0
```

Figure 1.1 - Playbook Recap done for Compute (CentOS).

2. Verify the successful installation of NTP.

```
seruelas@localhost:~  
File Edit View Search Terminal Help  
[seruelas@localhost ~]$ systemctl status chronyd.service  
● chronyd.service - NTP client/server  
   Loaded: loaded (/usr/lib/systemd/system/chronyd.service; enabled; vendor preset: enabled)  
   Active: active (running) since Mon 2023-11-27 20:02:30 PST; 10min ago  
     Docs: man:chronyd(8)  
           man:chrony.conf(5)  
   Process: 2866 ExecStartPost=/usr/libexec/chrony-helper update-daemon (code=exited, status=0/SUCCESS)  
   Process: 2859 ExecStart=/usr/sbin/chronyd $OPTIONS (code=exited, status=0/SUCCESS)  
  Main PID: 2864 (chronyd)  
    Tasks: 1  
   CGroup: /system.slice/chronyd.service  
           └─2864 /usr/sbin/chronyd  
  
Nov 27 20:02:30 localhost.localdomain systemd[1]: Starting NTP client/server...  
Nov 27 20:02:30 localhost.localdomain chronyd[2864]: chronyd version 3.4 starting (...)  
Nov 27 20:02:30 localhost.localdomain chronyd[2864]: Frequency 0.000 +/- 1000000.00...t  
Nov 27 20:02:30 localhost.localdomain systemd[1]: Started NTP client/server.  
Nov 27 20:04:53 localhost.localdomain chronyd[2864]: Source 203.177.21.121 replaced...3
```

Figure 2.1 - System status of NTP (Chrony).

3. Verify the successful installation of OpenStack Packages.

```
seruelas@localhost:~  
File Edit View Search Terminal Help  
[seruelas@localhost ~]$ openstack --version  
openstack 4.0.2
```

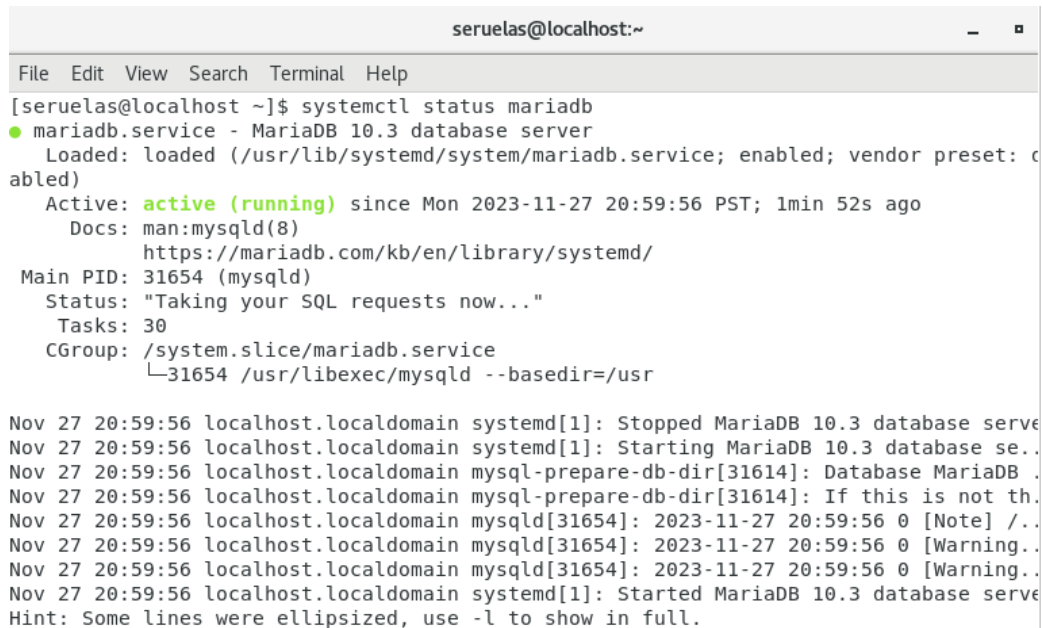
Figure 3.1 - Version of successfully installed OpenStack.

4. Verify the successful installation of MySQL.

```
seruelas@localhost:~  
File Edit View Search Terminal Help  
[seruelas@localhost ~]$ systemctl status mysql  
● mariadb.service - MariaDB 10.3 database server  
   Loaded: loaded (/usr/lib/systemd/system/mariadb.service; enabled; vendor preset: enabled)  
   Active: active (running) since Mon 2023-11-27 20:59:56 PST; 1min 32s ago  
     Docs: man:mysql(8)  
           https://mariadb.com/kb/en/library/systemd/  
  Main PID: 31654 (mysqld)  
    Status: "Taking your SQL requests now..."  
    Tasks: 30  
   CGroup: /system.slice/mariadb.service  
           └─31654 /usr/libexec/mysqld --basedir=/usr  
  
Nov 27 20:59:56 localhost.localdomain systemd[1]: Stopped MariaDB 10.3 database server.  
Nov 27 20:59:56 localhost.localdomain systemd[1]: Starting MariaDB 10.3 database server.  
Nov 27 20:59:56 localhost.localdomain mysql-prepare-db-dir[31614]: Database MariaDB .  
Nov 27 20:59:56 localhost.localdomain mysql-prepare-db-dir[31614]: If this is not th.  
Nov 27 20:59:56 localhost.localdomain mysqld[31654]: 2023-11-27 20:59:56 0 [Note] /..  
Nov 27 20:59:56 localhost.localdomain mysqld[31654]: 2023-11-27 20:59:56 0 [Warning..  
Nov 27 20:59:56 localhost.localdomain mysqld[31654]: 2023-11-27 20:59:56 0 [Warning..  
Nov 27 20:59:56 localhost.localdomain systemd[1]: Started MariaDB 10.3 database server.  
Hint: Some lines were ellipsized, use -l to show in full.
```

Figure 4.1 - System status of MySQL.

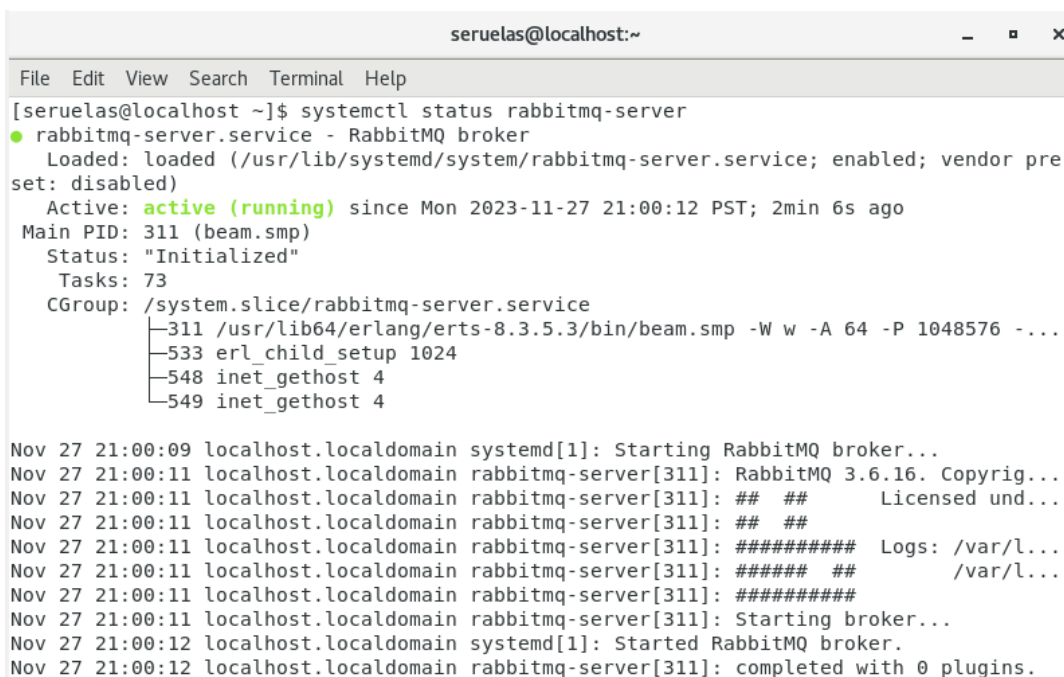
5. Verify the successful installation of MariaDB.



```
seruelas@localhost:~  
File Edit View Search Terminal Help  
[seruelas@localhost ~]$ systemctl status mariadb  
● mariadb.service - MariaDB 10.3 database server  
   Loaded: loaded (/usr/lib/systemd/system/mariadb.service; enabled; vendor preset: enabled)  
   Active: active (running) since Mon 2023-11-27 20:59:56 PST; 1min 52s ago  
     Docs: man:mysqld(8)  
           https://mariadb.com/kb/en/library/systemd/  
  Main PID: 31654 (mysqld)  
    Status: "Taking your SQL requests now..."  
     Tasks: 30  
   CGroup: /system.slice/mariadb.service  
           └─31654 /usr/libexec/mysqld --basedir=/usr  
  
Nov 27 20:59:56 localhost.localdomain systemd[1]: Stopped MariaDB 10.3 database server.  
Nov 27 20:59:56 localhost.localdomain systemd[1]: Starting MariaDB 10.3 database server.  
Nov 27 20:59:56 localhost.localdomain mysql-prepare-db-dir[31614]: Database MariaDB is not  
Nov 27 20:59:56 localhost.localdomain mysql-prepare-db-dir[31614]: If this is not the first  
Nov 27 20:59:56 localhost.localdomain mysqld[31654]: 2023-11-27 20:59:56 0 [Note] /usr/libexec/mysqld: ready for connections.  
Nov 27 20:59:56 localhost.localdomain mysqld[31654]: 2023-11-27 20:59:56 0 [Warning] InnoDB: Buffer pool(s) memory allocated  
Nov 27 20:59:56 localhost.localdomain mysqld[31654]: 2023-11-27 20:59:56 0 [Warning] InnoDB: Buffer pool(s) memory allocated  
Nov 27 20:59:56 localhost.localdomain systemd[1]: Started MariaDB 10.3 database server.  
Hint: Some lines were ellipsized, use -l to show in full.
```

Figure 5.1 - System status of MariaDB.

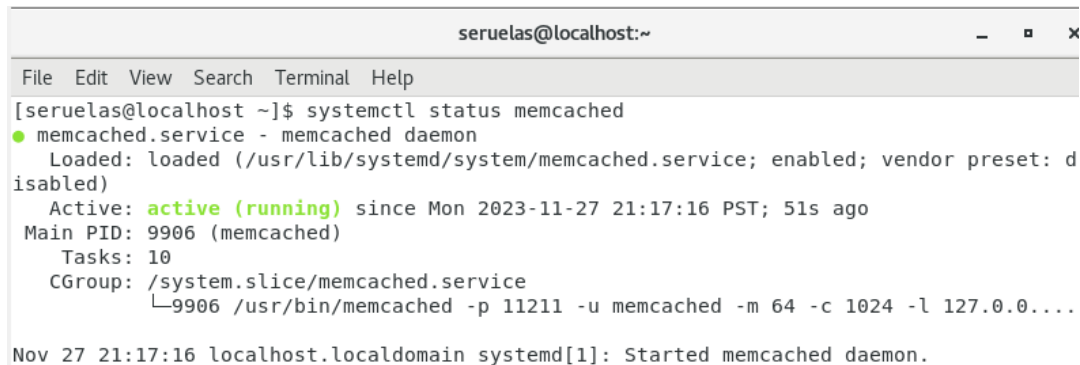
6. Verify the successful installation of Message Queue (RabbitMQ-Server).



```
seruelas@localhost:~  
File Edit View Search Terminal Help  
[seruelas@localhost ~]$ systemctl status rabbitmq-server  
● rabbitmq-server.service - RabbitMQ broker  
   Loaded: loaded (/usr/lib/systemd/system/rabbitmq-server.service; enabled; vendor preset: disabled)  
   Active: active (running) since Mon 2023-11-27 21:00:12 PST; 2min 6s ago  
 Main PID: 311 (beam.smp)  
    Status: "Initialized"  
     Tasks: 73  
   CGroup: /system.slice/rabbitmq-server.service  
           └─311 /usr/lib64/erlang/erts-8.3.5.3/bin/beam.smp -W w -A 64 -P 1048576 -...  
             └─533 erl_child_setup 1024  
               └─548 inet_gethost 4  
                 └─549 inet_gethost 4  
  
Nov 27 21:00:09 localhost.localdomain systemd[1]: Starting RabbitMQ broker...  
Nov 27 21:00:11 localhost.localdomain rabbitmq-server[311]: RabbitMQ 3.6.16. Copyright 2007-2023 RabbitMQ  
Nov 27 21:00:11 localhost.localdomain rabbitmq-server[311]: ## ## Licensed under the  
Nov 27 21:00:11 localhost.localdomain rabbitmq-server[311]: ## ##  
Nov 27 21:00:11 localhost.localdomain rabbitmq-server[311]: ##### Logs: /var/log/rabbitmq/  
Nov 27 21:00:11 localhost.localdomain rabbitmq-server[311]: ##### /var/log/rabbitmq/  
Nov 27 21:00:11 localhost.localdomain rabbitmq-server[311]: #####  
Nov 27 21:00:11 localhost.localdomain rabbitmq-server[311]: Starting broker...  
Nov 27 21:00:12 localhost.localdomain systemd[1]: Started RabbitMQ broker.  
Nov 27 21:00:12 localhost.localdomain rabbitmq-server[311]: completed with 0 plugins.
```

Figure 6.1 - System status of Message Queue (RabbitMQ-Server).

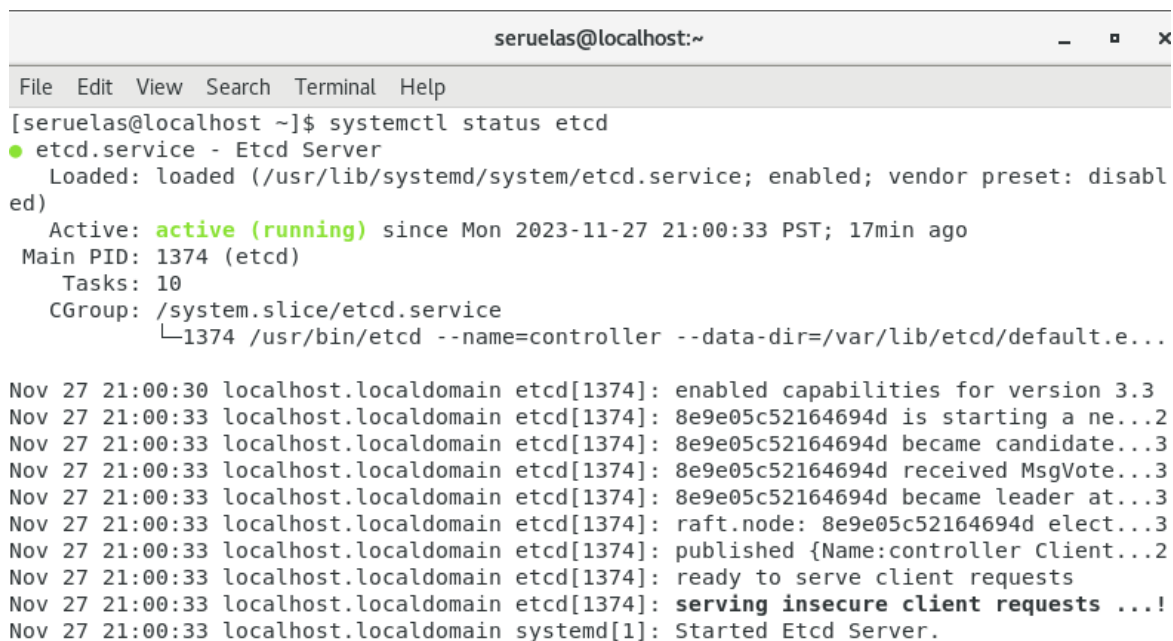
7. Verify the successful installation of Memcached.



```
seruelas@localhost:~  
File Edit View Search Terminal Help  
[seruelas@localhost ~]$ systemctl status memcached  
● memcached.service - memcached daemon  
   Loaded: loaded (/usr/lib/systemd/system/memcached.service; enabled; vendor preset: disabled)  
   Active: active (running) since Mon 2023-11-27 21:17:16 PST; 51s ago  
     Main PID: 9906 (memcached)  
        Tasks: 10  
      CGroup: /system.slice/memcached.service  
              └─9906 /usr/bin/memcached -p 11211 -u memcached -m 64 -c 1024 -l 127.0.0....  
  
Nov 27 21:17:16 localhost.localdomain systemd[1]: Started memcached daemon.
```

Figure 7.1 - System status of Memcached.

8. Verify the successful installation of ETCD.

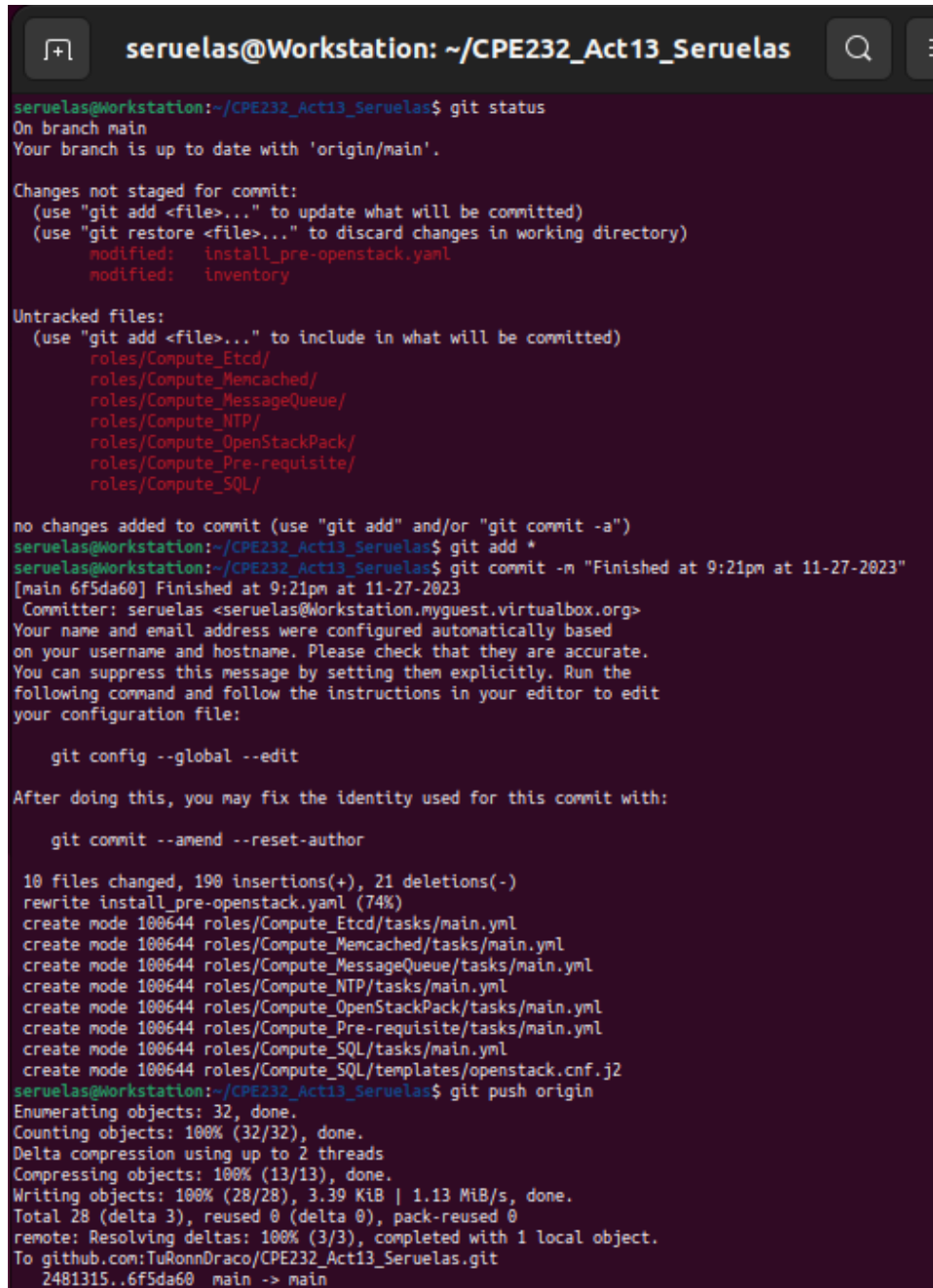


```
seruelas@localhost:~  
File Edit View Search Terminal Help  
[seruelas@localhost ~]$ systemctl status etcd  
● etcd.service - Etcd Server  
   Loaded: loaded (/usr/lib/systemd/system/etcd.service; enabled; vendor preset: disabled)  
   Active: active (running) since Mon 2023-11-27 21:00:33 PST; 17min ago  
     Main PID: 1374 (etcd)  
        Tasks: 10  
      CGroup: /system.slice/etcd.service  
              └─1374 /usr/bin/etcd --name=controller --data-dir=/var/lib/etcd/default.e...  
  
Nov 27 21:00:30 localhost.localdomain etcd[1374]: enabled capabilities for version 3.3  
Nov 27 21:00:33 localhost.localdomain etcd[1374]: 8e9e05c52164694d is starting a ne...2  
Nov 27 21:00:33 localhost.localdomain etcd[1374]: 8e9e05c52164694d became candidate...3  
Nov 27 21:00:33 localhost.localdomain etcd[1374]: 8e9e05c52164694d received MsgVote...3  
Nov 27 21:00:33 localhost.localdomain etcd[1374]: 8e9e05c52164694d became leader at...3  
Nov 27 21:00:33 localhost.localdomain etcd[1374]: raft.node: 8e9e05c52164694d elect...3  
Nov 27 21:00:33 localhost.localdomain etcd[1374]: published {Name:controller Client...2  
Nov 27 21:00:33 localhost.localdomain etcd[1374]: ready to serve client requests  
Nov 27 21:00:33 localhost.localdomain etcd[1374]: serving insecure client requests ...!  
Nov 27 21:00:33 localhost.localdomain systemd[1]: Started Etcd Server.
```

Figure 8.1 - System status of ETCD.

TASK 5: SAVING ALL CHANGES TO GITHUB

1. Add, Commit, and Push all works done to GitHub Repository.

A terminal window titled 'seruelas@Workstation: ~/CPE232_Act13_Seruelas' showing the execution of Git commands. The user runs 'git status', which shows two modified files: 'install_pre-openstack.yaml' and 'inventory'. Then, they run 'git add *' to stage all files. Next, they run 'git commit -m "Finished at 9:21pm at 11-27-2023"', which prompts for a commit message and shows the commit details. Finally, they run 'git push origin', which shows the progress of pushing the commit to the GitHub repository.

```
seruelas@Workstation:~/CPE232_Act13_Seruelas$ git status
On branch main
Your branch is up to date with 'origin/main'.

Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   install_pre-openstack.yaml
        modified:   inventory

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        roles/Compute_Etcd/
        roles/Compute_Memcached/
        roles/Compute_MessageQueue/
        roles/Compute_NTP/
        roles/Compute_OpenStackPack/
        roles/Compute_Pre-requisite/
        roles/Compute_SQL/

no changes added to commit (use "git add" and/or "git commit -a")
seruelas@Workstation:~/CPE232_Act13_Seruelas$ git add *
seruelas@Workstation:~/CPE232_Act13_Seruelas$ git commit -m "Finished at 9:21pm at 11-27-2023"
[main 6f5da60] Finished at 9:21pm at 11-27-2023
  Committer: seruelas <seruelas@Workstation.myguest.virtualbox.org>
  Your name and email address were configured automatically based
  on your username and hostname. Please check that they are accurate.
  You can suppress this message by setting them explicitly. Run the
  following command and follow the instructions in your editor to edit
  your configuration file:

    git config --global --edit

  After doing this, you may fix the identity used for this commit with:

    git commit --amend --reset-author

10 files changed, 190 insertions(+), 21 deletions(-)
rewrite install_pre-openstack.yaml (74%)
create mode 100644 roles/Compute_Etcd/tasks/main.yml
create mode 100644 roles/Compute_Memcached/tasks/main.yml
create mode 100644 roles/Compute_MessageQueue/tasks/main.yml
create mode 100644 roles/Compute_NTP/tasks/main.yml
create mode 100644 roles/Compute_OpenStackPack/tasks/main.yml
create mode 100644 roles/Compute_Pre-requisite/tasks/main.yml
create mode 100644 roles/Compute_SQL/tasks/main.yml
create mode 100644 roles/Compute_SQL/templates/openstack.cnf.j2
seruelas@Workstation:~/CPE232_Act13_Seruelas$ git push origin
Enumerating objects: 32, done.
Counting objects: 100% (32/32), done.
Delta compression using up to 2 threads
Compressing objects: 100% (13/13), done.
Writing objects: 100% (28/28), 3.39 KiB | 1.13 MiB/s, done.
Total 28 (delta 3), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (3/3), completed with 1 local object.
To github.com:TuRonnDraco/CPE232_Act13_Seruelas.git
   2481315..6f5da60  main -> main
```

Figure 1.1 - Adding, Committing, and Pushing all work to Github Repository.

2. Verifying the work done in the GitHub Repository.

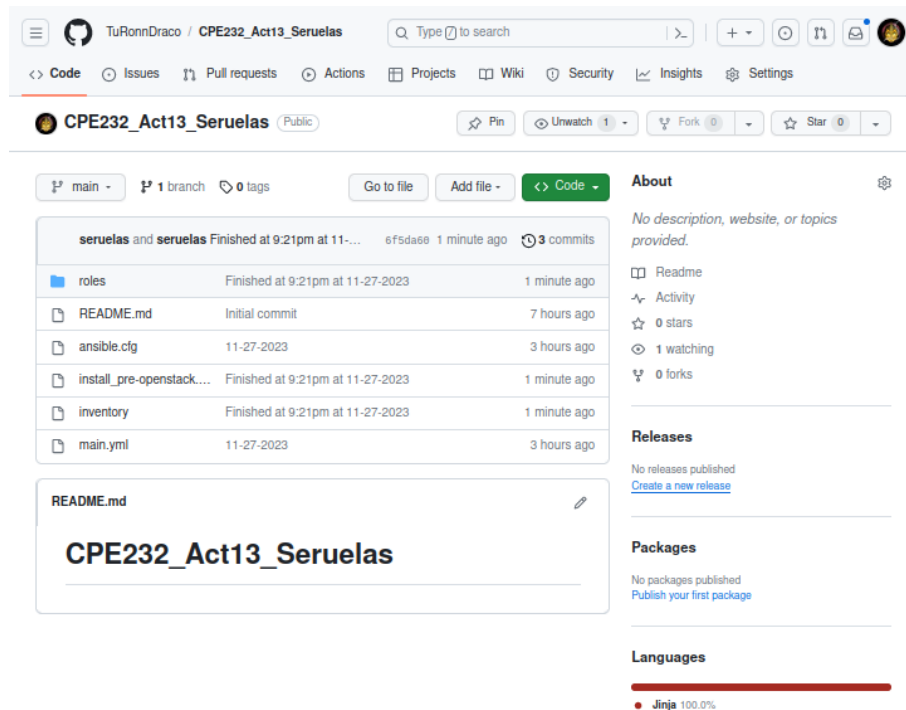


Figure 2.1 - CPE232_Act13_Seruelas at its latest state.

https://github.com/TuRonnDraco/CPE232_Act13_Seruelas

Reflections:

Answer the following:

1. What are the benefits of implementing OpenStack?

- The benefits of implementing OpenStack for our servers is that it allows us to access more infrastructures and more platforms for our servers, as it offers us more capabilities and more accessible features, such as cloud services and cloud archives, allowing us to handle data and servers more efficiently and easily. OpenStack offers us administrators an infrastructure focusing on cloud computing platforms.

Conclusions:

To conclude this activity, we were able to educate ourselves on the essential implementation of OpenStack and how we are able to install OpenStack in our servers. We were able to implement OpenStack to our servers by specifying the controller (Ubuntu Server1) and compute (CentOS) and installing and fixing specific configurations for them. Finally, we were able to successfully implement and verify our installations of OpenStack via system status verifications.