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Course/Section: CPE 232 / CPE31S22	Date Submitted: Dec 9, 2022
Instructor: Dr. Jonathan Taylar	Semester and SY: 1st Sem, 2022 - 2023
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	
<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	
Oracle VirtualBox (Hypervisor) 1x Ubuntu VM or Centos VM	
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. Keystone (Identity Service) b. Glance (Imaging Service) c. Nova (Compute Service) d. Add, commit and push it to your GitHub repo. 	
5. Output (screenshots and explanations)	

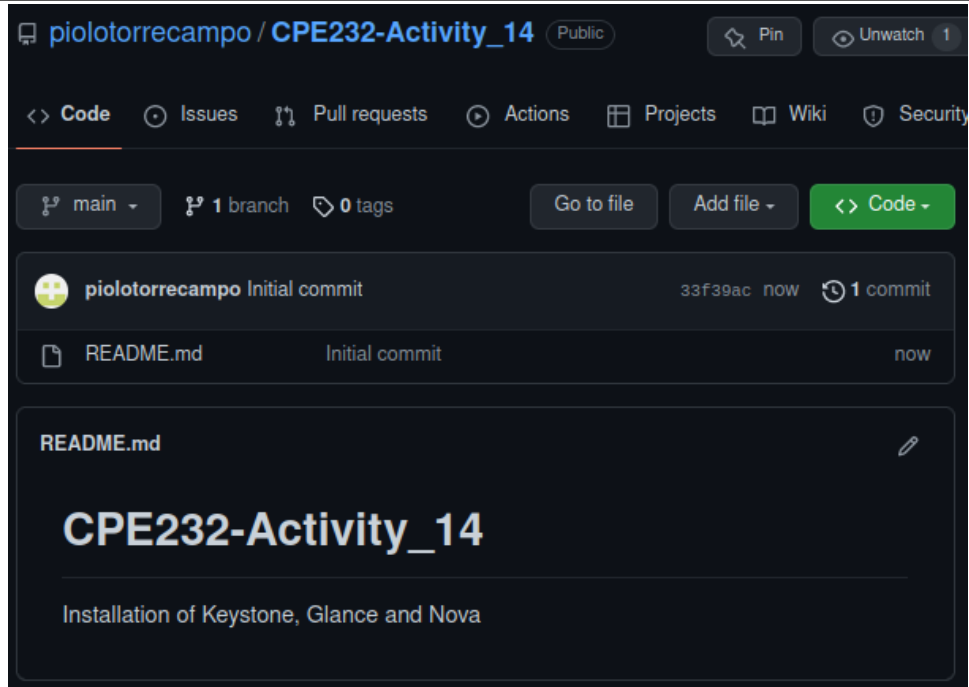


Figure 1. The image above shows the newly created page for this activity.

```
~/Documents/repos > git clone git@github.com:piolotorrecampo/CPE232-Activity_14.git
Cloning into 'CPE232-Activity_14'...
remote: Enumerating objects: 3, done.
remote: Counting objects: 100% (3/3), done.
remote: Compressing objects: 100% (2/2), done.
remote: Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
Receiving objects: 100% (3/3), done.
~/Documents/repos took 3s >
```

Figure 2. Cloning the created repository to the local machine.

```
CPE232-Activity_14 on main [?] > tree
.
├── ansible.cfg
├── install_kgn.yml
├── inventory
├── README.md
├── roles
│   ├── glance
│   │   ├── files
│   │   │   └── glance-api.conf
│   │   └── tasks
│   │       ├── configure.yml
│   │       ├── install.yml
│   │       └── main.yml
│   └── keystone
│       ├── files
│       │   └── admin-openrc
│       ├── handlers
│       └── main.yml
```



Figure 3. The picture above shows the file structure of the activity.

File Name	Ansible Script
install_kgn.yml	<pre>--- - hosts: all become: true pre_tasks: - name: Updating and upgrading the operating yum: name: "*" state: latest update_cache: true - hosts: controller_node become: true roles: - keystone - glance - nova</pre>
ansible.cfg	<pre>[defaults] inventory = inventory host_key_checking = False deprecation_warnings = False private_key_file = ~/.ssh/id_rsa</pre>
inventory	<pre>[controller_node] 192.168.30.164 ansible_user=cserver</pre>

Table 1. The table above shows the contents of install_kgn.yml, ansible.cfg, and inventory.

ROLES AND ITS CONTENTS

Keystone		
tasks	install.yml	<pre> - name: Installing keystone and its dependencies yum: name: - openstack-keystone - httpd - mod_wsgi - openstack-utils </pre>
	configuring.yml	<pre> 1 - name: Configuring the connection variable 2 replace: 3 path: /etc/keystone/keystone.conf 4 regexp: '#connection = <None>' 5 replace: 'connection = mysql+pymysql://keystone:keystonepass@controller/keystone' 6 - name: Configuring memcached variable 7 replace: 8 path: /etc/keystone/keystone.conf 9 regexp: '#memcache_servers = localhost:11211' 10 replace: 'memcache_servers = controller:11211' 11 - name: Configuring the fernet variable 12 replace: 13 path: /etc/keystone/keystone.conf 14 regexp: '#provider = fernet' 15 replace: 'provider = fernet' 16 - name: Populating the database 17 command: su -s /bin/sh -c "keystone-manage db_sync" keystone 18 - name: Initialize fernet repositories 19 shell: 20 keystone-manage fernet_setup --keystone-user keystone --keystone-group keystone 21 keystone-manage credential_setup --keystone-user keystone --keystone-group keystone 22 - name: Setting up bootstrap identity service 23 shell: 24 keystone-manage bootstrap --bootstrap-password adminpass --bootstrap-admin-url http 25 - name: Configuring setbools 26 shell: 27 setsebool -P httpd_use_openstack on 28 setsebool -P httpd_can_network_connect on 29 setsebool -P httpd_can_network_connect_db on 30 - name: Opening firewall 31 ansible.posix.firewalld: 32 port: 5000/tcp 33 permanent: yes 34 state: enabled 35 notify: Reloading firewall 36 - name: Configuring apache 37 replace: 38 path: /etc/httpd/conf/httpd.conf 39 regexp: '#ServerName www.example.com:80' 40 replace: 'ServerName controller' 41 notify: Creating link 42 - name: Starting and enabling service 43 service: 44 name: httpd 45 state: started 46 enabled: true 47 - name: Copying admin-openrc 48 copy: 49 src: admin-openrc 50 dest: /home/cserver/[...]/ 51 owner: root 52 group: root 53 - name: Changing permission 54 shell: 55 sudo chmod 755 /home/cserver/admin-openrc 56 source /home/cserver/admin-openrc </pre>

	prereq.yml	<pre> - 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 </pre>
	main.yml	<pre> - import_tasks: prereq.yml - import_tasks: install.yml - import_tasks: configure.yml - block: - name: Verifying if apache status command: systemctl status httpd register: httpd_service - debug: msg="{ httpd_service }" </pre>
handlers	main.yml	<pre> - name: Creating link command: ln -s /usr/share/keystone/wsgi-keystone.conf /etc/httpd/conf.d/ failed_when: false no_log: true - name: Reloading firewall command: firewall-cmd --reload </pre>
files	admin-openrc	<pre> export OS_USERNAME=admin export OS_PASSWORD=adminpass export OS_PROJECT_NAME=admin export OS_USER_DOMAIN_NAME=Default export OS_PROJECT_DOMAIN_NAME=Default export OS_AUTH_URL=http://controller:5000/v3 export OS_IDENTITY_API_VERSION=3 </pre>

Table 2. The table above shows the file and its contents for the keystone role.

Glance		
tasks	install.yml	<pre> - name: Intalling glance yum: name: openstack-glance </pre>

	configure.yml	<pre> - name: Copying the config file copy: src: glance-api.conf dest: /etc/glance/glance-api.conf owner: root group: glance mode: 0640 - name: Populating the database command: su -s /bin/sh -c "glance-manage db_sync" glance failed_when: false no_log: true skipped=0 rescued=0 ignored=0 - name: Restarting glance-api service: name: openstack-glance-api.service state: restarted enabled: true </pre>
	main.yml	<pre> - import_tasks: install.yml - import_tasks: configure.yml - block: - name: Verifying openstack-glance-api installation command: systemctl status openstack-glance-api register: glance_service - debug: msg="{{ glance_service }}" </pre>
files	glance-api.conf	<pre> 1 [DEFAULT] 2 # Copying the config file) 3 # From glance-api 4 # 5 # Populating the database) 6 # DEPRECATED: 7 # Set the image owner to tenant or the authenticated user. 8 # 9 # Assign a boolean value to determine the owner of an image. When set to 10 # True, the owner of the image is the tenant. When set to False, the 11 # owner of the image will be the authenticated user issuing the request. 12 # Setting it to False makes the image private to the associated user and 13 # sharing with other users within the same tenant (or "project") 14 # requires explicit image sharing via image membership. 15 # 16 # Possible values: 17 # * True 18 # * False 19 # 20 # Related options: 21 # * None 22 # * True 23 # * False 24 # This option is deprecated for removal since Rocky. 25 # Its value may be silently ignored in the future. 26 # Reason: 27 # The non-default setting for this option misaligns Glance with other 28 # OpenStack services with respect to resource ownership. Further, surveys 29 # indicate that this option is not used by operators. The option will be 30 # removed early in the 'S' development cycle following the standard OpenStack 31 # deprecation policy. As the option is not in wide use, no migration path is 32 # proposed. 33 #owner_is_tenant = true 34 </pre>

		<pre> 35 # 36 # Role used to identify an authenticated user as administrator. 37 # 38 # Provide a string value representing a Keystone role to identify an 39 # administrative user. Users with this role will be granted 40 # administrative privileges. The default value for this option is 41 # 'admin'. 42 # 43 # Possible values: (string variable) 44 # * A string value which is a valid Keystone role 45 # 46 # Related options: (string variable) 47 # * None 48 # 49 # (string value) (string variable) 50 #admin_role = admin 51 # 52 # glance-api.conf </pre>
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Table 3. The table above shows the file and its contents for the glance role.

Nova		
tasks	install.yml	<pre> - name: Install nova and its dependencies yum: name: - openstack-nova-api - openstack-nova-conductor - openstack-nova-novncproxy - openstack-nova-scheduler </pre>
	configuring.yml	<pre> - 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 </pre>
	main.yml	<pre> - import_tasks: install.yml - import_tasks: configure.yml </pre>

files	nova.conf	<pre> 1 [DEFAULT] 2 # From nova.conf 3 # 4 # 5 # 6 # Availability zone for internal services. For more information, refer to the 7 # documentation. (string value) 8 #internal_service_availability_zone=internal 9 # 10 # 11 # Default availability zone for compute services. For more information, refer to 12 # the documentation. (string value) 13 #default_availability_zone=nova 14 # 15 # 16 # Default availability zone for instances. For more information, refer to the 17 # documentation. (string value) 18 #default_schedule_zone=<None> 19 # 20 # Length of generated instance admin passwords (integer value) 21 # Minimum value: 0 22 #password_length=12 23 # 24 # 25 # Time period to generate instance usages for. It is possible to define optional 26 # offset to given period by appending @ character followed by a number defining 27 # offset. For more information, refer to the documentation. (string value) 28 #instance_usage_audit_period=month 29 # 30 # 31 # Start and use a daemon that can run the commands that need to be run with 32 # root privileges. This option is usually enabled on nodes that run nova compute 33 # processes. 34 # (boolean value) 35 #use_rootwrap_daemon=false 36 # 37 # 38 # Path to the rootwrap configuration file. For more information, refer to the 39 # documentation. (string value) 40 #rootwrap_config=/etc/nova/rootwrap.conf 41 # 42 # Explicitly specify the temporary working directory (string value) 43 #tmpdir=<None> 44 # 45 # 46 # Defines which driver to use for controlling virtualization. For more 47 # information, refer to the documentation. (string value) 48 #compute_driver=libvirt.LibvirtDriver 49 nova.conf 1,1 </pre>
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Table 4. The table above shows the file and its contents for the nova role.

<pre> CPE232-Activity_14 on ♀ main [?] took 1m9s +2 > ansible-playbook --ask-become-pass install_kgn.yml BECOME password: PLAY [all] ***** TASK [Gathering Facts] ***** ^[[ok: [192.168.30.164] TASK [Updating and upgrading the operating system] ***** ok: [192.168.30.164] PLAY [controller_node] ***** TASK [Gathering Facts] ***** ok: [192.168.30.164] TASK [keystone : Creating keystone database] ***** ok: [192.168.30.164] TASK [keystone : Installing keystone and its dependencies] ***** ok: [192.168.30.164] TASK [keystone : Configuring the connection variable] ***** ok: [192.168.30.164] TASK [keystone : Configuring memcached variable] ***** ok: [192.168.30.164] TASK [keystone : Configuring the fernet variable] ***** ok: [192.168.30.164] TASK [keystone : Populating the database] ***** changed: [192.168.30.164] </pre>		<pre> Hostname black-concept Hardware HP Notebook Kernel 6.0.10-arch2-1 Uptime 00:10:30 Total 1127 PROCESSORS CPU: 76% Core 1: 81% Core 2: 73% Core 3: 74% Core 4: 76% Temperature 80°C RAM </pre>
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```

"end": "2022-12-06 20:04:52.189928",
"failed": false,
"msg": "",
"rc": 0,
"start": "2022-12-06 20:04:51.675719",
"stderr": "",
"stderr_lines": [],
"stdout": "● httpd.service - The Apache HTTP Server\n Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; vendor preset: disabled)\n Active: active (running) since Tue 2022-12-06 14:16:58 EST; 5h 47min ago\n Docs: man:httpd(8)\n OS man:apachectl(8)\n Main PID: 1182 (httpd\n Status: \\\"Total requests: 83; Current requests/sec: 0; Current traffic: 0 B/sec\\\"\n Tasks: 27\n CGroup: /system.slice/httpd.service\n └─1182 /usr/sbin/httpd -DFOREGROUND\n └─1417 (wsgi:keystone- -DFOREGROUND\n └─1418 (wsgi:keystone- -DFOREGROUND\n └─1419 (wsgi:keystone- -DFOREGROUND\n └─1421 (wsgi:keystone- -DFOREGROUND\n └─1422 (wsgi:keystone- -DFOREGROUND\n └─1429 /usr/sbin/h\n httpd -DFOREGROUND\n └─1431 /usr/sbin/httpd -DFOREGROUND\n └─1432 /usr/sbin/httpd -DFOREGROUND\n └─1433 /usr/sbin/httpd -DFOREGROUND\n └─1436 /usr/sbin/httpd -DFOREGROUND\n └─3344 /usr/sbin/httpd -DFOREGROUND\n Dec 06 14:16:54 controller systemd[1]: Starting The Apache HTTP Server...\n Dec 06 14:16:58 controller systemd[1]: Started The Apache HTTP Server."
"stdout_lines": [
"● httpd.service - The Apache HTTP Server",
" Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; vendor preset: disabled)",
" Active: active (running) since Tue 2022-12-06 14:16:58 EST; 5h 47min ago",
" Docs: man:httpd(8)",
" man:apachectl(8)",
" Main PID: 1182 (httpd)",
" Status: \\\"Total requests: 83; Current requests/sec: 0; Current traffic: 0 B/sec\\\"",
" Tasks: 27",
" CGroup: /system.slice/httpd.service",
" └─1182 /usr/sbin/httpd -DFOREGROUND",
" └─1417 (wsgi:keystone- -DFOREGROUND",
" └─1418 (wsgi:keystone- -DFOREGROUND",
" └─1419 (wsgi:keystone- -DFOREGROUND",
" └─1421 (wsgi:keystone- -DFOREGROUND",
" └─1422 (wsgi:keystone- -DFOREGROUND",
" └─1429 /usr/sbin/httpd -DFOREGROUND",
" └─1431 /usr/sbin/httpd -DFOREGROUND",
" └─1432 /usr/sbin/httpd -DFOREGROUND",
" └─1433 /usr/sbin/httpd -DFOREGROUND",
" └─1436 /usr/sbin/httpd -DFOREGROUND",
" └─3344 /usr/sbin/httpd -DFOREGROUND",
""
"Dec 06 14:16:54 controller systemd[1]: Starting The Apache HTTP Server...",
"Dec 06 14:16:58 controller systemd[1]: Started The Apache HTTP Server."
]
}
}
}

TASK [glance : Intalling glance] *****
ok: [192.168.30.164]

TASK [glance : Copying the config file] *****
ok: [192.168.30.164]

TASK [glance : Populating the database] *****
changed: [192.168.30.164]

```

```

TASK [glance : Restarting glance-api] *****
ok: [192.168.30.164]

TASK [glance : Verifying openstack-glance-api installation] *****
changed: [192.168.30.164]

TASK [glance : debug] *****
ok: [192.168.30.164] => {
  "msg": {
    "changed": true,
    "cmd": [
      "systemctl",
      "status",
      "openstack-glance-api"
    ],
    "delta": "0:00:00.199154",
    "end": "2022-12-06 20:06:49.237923",
    "failed": false,

```

```

    "msg": "",
    "rc": 0,
    "start": "2022-12-06 20:06:49.038769",
    "stderr": "",
    "stderr_lines": [],
    "stdout": "● openstack-glance-api.service - OpenStack Image Service (code-named Glance) API server\nLoaded: loaded (/usr/lib/systemd/system/openstack-glance-api.service; enabled; vendor preset: disabled)\nActive: active (running) since Tue 2022-12-06 20:06:22 EST; 26s ago\nMain PID: 102992 (glance-api)\nTasks: 1\nCGroup: /system.slice/openstack-glance-api.service\n└─102992 /usr/bin/python2 /usr/bin/glance-api\nDec 06 20:06:22 controller systemd[1]: openstack-glance-api.service holdoff time over, scheduling restart.\nDec 06 20:06:22 controller systemd[1]: Stopped OpenStack Image Service (code-named Glance) API server.\nDec 06 20:06:22 controller systemd[1]: Started OpenStack Image Service (code-named Glance) API server.",
    "stdout_lines": [
      "● openstack-glance-api.service - OpenStack Image Service (code-named Glance) API server",
      "Loaded: loaded (/usr/lib/systemd/system/openstack-glance-api.service; enabled; vendor preset: disabled)",
      "Active: active (running) since Tue 2022-12-06 20:06:22 EST; 26s ago",
      "Main PID: 102992 (glance-api)",
      "Tasks: 1",
      "CGroup: /system.slice/openstack-glance-api.service",
      "└─102992 /usr/bin/python2 /usr/bin/glance-api",
      ""
    ]
  }
}

TASK [nova : Install nova and its dependencies] *****
ok: [192.168.30.164]

TASK [nova : Copying the config file] *****
ok: [192.168.30.164]

TASK [nova : Populating the database] *****
changed: [192.168.30.164]

TASK [nova : Restarting nova services] *****
ok: [192.168.30.164]

PLAY RECAP *****
192.168.30.164 : ok=29 changed=9 unreachable=0 failed=0 skipped=0 rescued=0 ignored=0

```

Figure 4. The screenshots above shows the output after running the ansible playbook file.

```

CPE232-Activity_14 on main [?] took 17s > git add *
CPE232-Activity_14 on main [+] > git commit -m "first commit"
[main 18c57c9] first commit
17 files changed, 18486 insertions(+)
create mode 100644 ansible.cfg
create mode 100644 install_kgn.yml
create mode 100644 inventory
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

```

service is generally used when you run network installations. For details, see the Compute Administrator Guide.

nova-compute service

A worker daemon that creates and terminates instances through hypervisor APIs. For details, see the Compute Administrator Guide.

- XenAPI for XenServer/XCP
- libvirt for KVM or QEMU
- VMwareAPI for VMware

Processing is fairly complex. Basically, nova receives requests from the queue and performs a series of steps, including launching a KVM instance and updating its metadata.

```

CPE232-Activity_14 on main [*] > git push git@github.com:school:piolotorrecampo/CPE232-Activity_14.git
Enumerating objects: 31, done.
Counting objects: 100% (31/31), done.
Delta compression using up to 4 threads
Compressing objects: 100% (26/26), done.
Writing objects: 100% (30/30), 144.12 KiB | 764.00 KiB/s, done.
Total 30 (delta 1), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (1/1), done.
To github.com:school:piolotorrecampo/CPE232-Activity_14.git
   33f39ac..18c57c9  main -> main
CPE232-Activity_14 on main [*] took 3s >

```

Takes a virtual machine instance request and determines on which compute server to place it. It is part of the **nova-conductor** module.

Mediates interactions between the **nova-api** and the **nova-compute** service. The **nova-compute** service is responsible for managing the virtual machines.

Figure 5. Pushing the repository contents in Github.

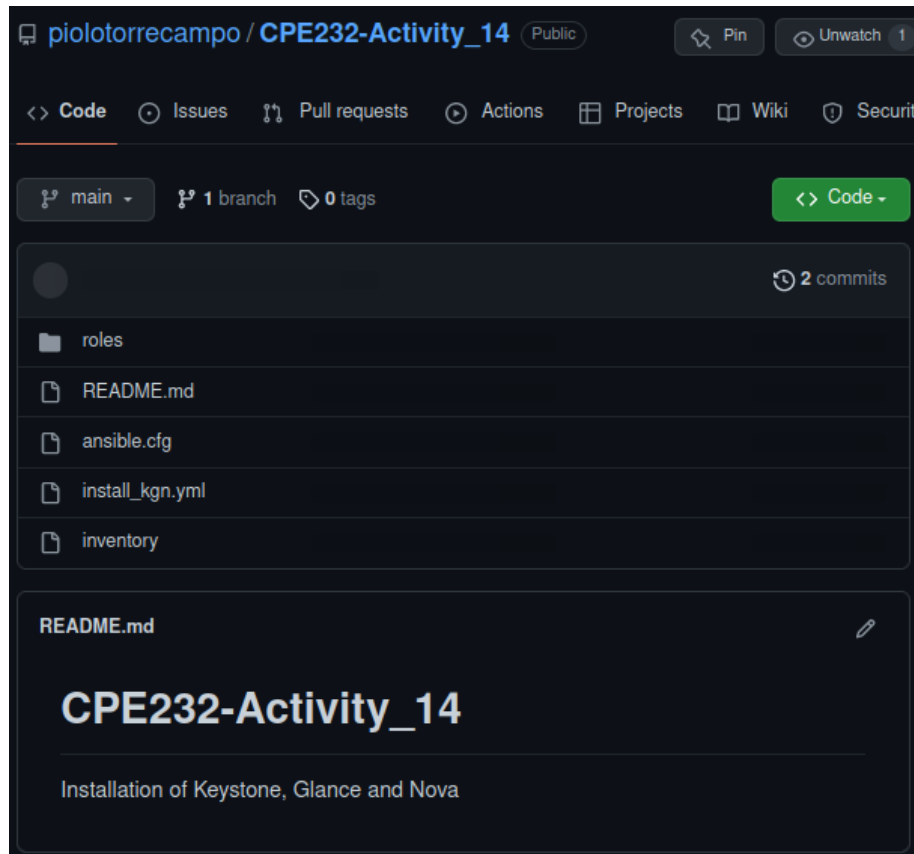


Figure 6. The image above shows the updated Github page.

Reflections:

Answer the following:

1. Describe Keystone, Glance and Nova services
 - According to the official documentation of OpenStack, Keystone is an identity service. Identity service provides a single point of integration for managing authentication, authorization and catalog of services. It is typically the first service a user interacts with. Once authenticated, an end user can use their identity to access other OpenStack services. The Glance program is a service for images. This service enables users to discover, register and retrieve virtual

machine images from its API. Lastly Nova program is a service that is used to host and manage cloud computing systems. This is the major part of the Infrastructure-as-a-Service (IaaS) system.

Conclusions:

This activity achieves its objective to introduce the tool under openstack to implement the IaaS or Infrastructure as Code. Infrastructure as Code (IaC) is a method of defining, managing, and deploying infrastructure in a repeatable and automated way. This approach allows for greater consistency, reliability, and scalability in managing complex infrastructure. Glance, Keystone, and Nova are all tools that can be used in an IaC setup to manage different aspects of a cloud computing environment. By using these tools, organizations can ensure that their infrastructure is managed in a consistent and efficient manner.

Honor Pledge:

"I affirm that I will not give or receive unauthorized help on this activity and that all will be my own."