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Activity 10: Install, Configure, and Manage Log Monitoring tools

1. Objectives

Create and design a workflow that installs, configure and manage enterprise log monitoring tools using Ansible as an Infrastructure as Code (IaC) tool.

2. Discussion

Log monitoring software scans and monitors log files generated by servers, applications, and networks. By detecting and alerting users to patterns in these log files, log monitoring software helps solve performance and security issues. System administrators use log monitoring software to detect common important events indicated by log files.

Log monitoring software helps maintain IT infrastructure performance and pinpoints issues to prevent downtime and mitigate risks. These tools will often integrate with IT alerting software, log analysis software, and other IT issue resolution products to more aptly flesh out the IT infrastructure maintenance ecosystem.

To qualify for inclusion in the Log Monitoring category, a product must:

- Monitor the log files generated by servers, applications, or networks
- Alert users when important events are detected
- Provide reporting capabilities for log files

Elastic Stack

ELK suite stands for Elasticsearch, Kibana, Beats, and Logstash (also known as the ELK Stack). Source: https://www.elastic.co/elastic-stack

The Elastic Stack is a group of open source products from Elastic designed to help users take data from any type of source and in any format, and search, analyze and visualize that data in real time. The product group was formerly known as the ELK Stack for the core products in the group -- Elasticsearch, Logstash and Kibana -- but has been rebranded as the Elastic Stack. A fourth product, Beats, was subsequently added to the stack. The Elastic Stack can be deployed on premises or made available as software as a service (SaaS). Elasticsearch supports Amazon Web Services (AWS), Google Cloud Platform and Microsoft Azure.

GrayLog

Graylog is a powerful platform that allows for easy log management of both structured and unstructured data along with debugging applications.

It is based on Elasticsearch, MongoDB, and Scala. Graylog has a main server, which receives data from its clients installed on different servers, and a web interface, which visualizes the data and allows it to work with logs aggregated by the main server.

We use Graylog primarily as the stash for the logs of the web applications we build. However, it is also effective when working with raw strings (i.e. syslog): the tool parses it into the structured data we need. It also allows advanced custom search in the logs using structured queries. In other words, when integrated properly with a web app, Graylog helps engineers to analyze the system behavior on almost per code line basis.

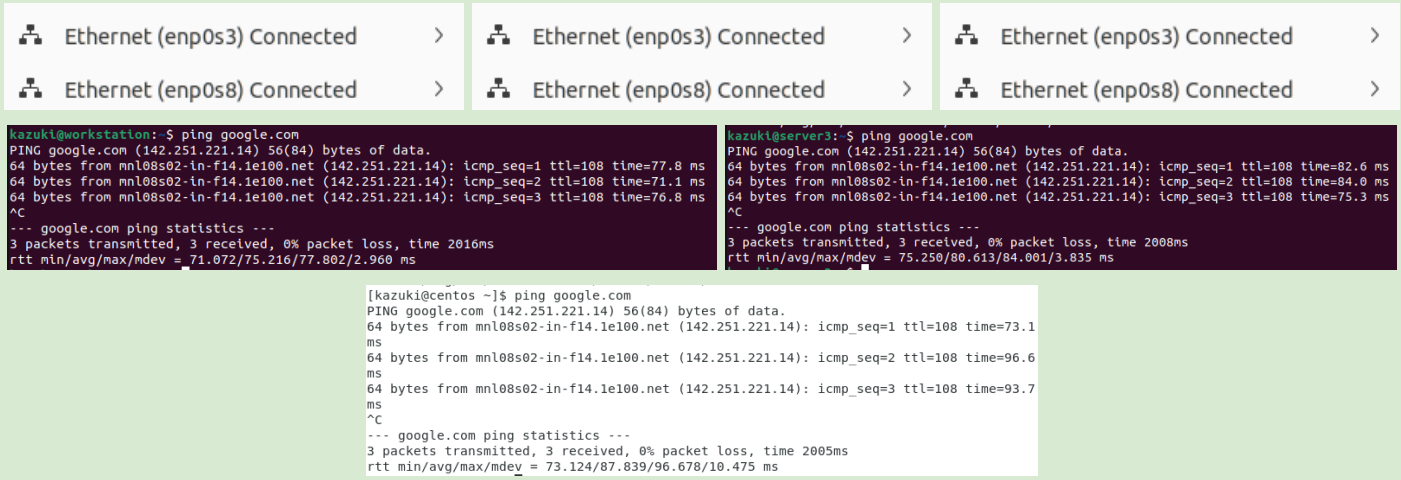
Source: https://www.graylog.org/products/open-source

3. Tasks

1. Create a playbook that:
    a. Install and configure Elastic Stack in separate hosts (Elastic Search, Kibana, Logstash)
2. Apply the concept of creating roles.
3. Describe how you did step 1. (Provide screenshots and explanations in your report. Make your report detailed such that it will look like a manual.)
4. Show an output of the installed Elastic Stack for both Ubuntu and CentOS.
5. Make sure to create a new repository in GitHub for this activity.

4. Output (screenshots and explanations)

Before starting this activity, we will be needing 3 virtual machines. 1 control node and 2 managed nodes. I used “LocalMachine_Ogata” as my control node (Ubuntu) and Ubuntu server 3 and CentOS as my managed nodes.



Check the internet connection of virtual machines. I learned my lesson from my previous activities, I started doing the activity without checking the internet connection. I used the command “ping google.com” to check the internet connection and manually checked the settings if the Ethernet enp0s3 and enp0s8 were Connected.

Check the IP Address of managed nodes. I used the command “hostname -I” to show that IP Addresses in that server. 192.168.56.125 is the IP Address of my Ubuntu Server 3. While 192.168.56.127 for my CentOS.

```
kazuki@workstation:~$ ping 192.168.56.129
PING 192.168.56.129 (192.168.56.129) 56(84) bytes of data.
64 bytes from 192.168.56.129: icmp_seq=1 ttl=64 time=1.06 ms
64 bytes from 192.168.56.129: icmp_seq=2 ttl=64 time=1.25 ms
64 bytes from 192.168.56.129: icmp_seq=3 ttl=64 time=0.961 ms
^C
--- 192.168.56.129 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2004ms
rtt min/avg/max/mdev = 0.961/1.090/1.250/0.120 ms
```

```
kazuki@workstation:~$ ping 192.168.56.127
PING 192.168.56.127 (192.168.56.127) 56(84) bytes of data.
64 bytes from 192.168.56.127: icmp_seq=1 ttl=64 time=0.828 ms
64 bytes from 192.168.56.127: icmp_seq=2 ttl=64 time=1.12 ms
64 bytes from 192.168.56.127: icmp_seq=3 ttl=64 time=0.813 ms
^C
--- 192.168.56.127 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2042ms
rtt min/avg/max/mdev = 0.813/0.921/1.124/0.143 ms
```

```
kazuki@workstation:~$ ssh kazuki@192.168.56.129
Welcome to Ubuntu 22.04.2 LTS (GNU/Linux 6.2.0-35-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

 * Introducing Expanded Security Maintenance for Applications.
   Receive updates to over 25,000 software packages with your
   Ubuntu Pro subscription. Free for personal use.

     https://ubuntu.com/pro

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

kazuki@server3:~$
```

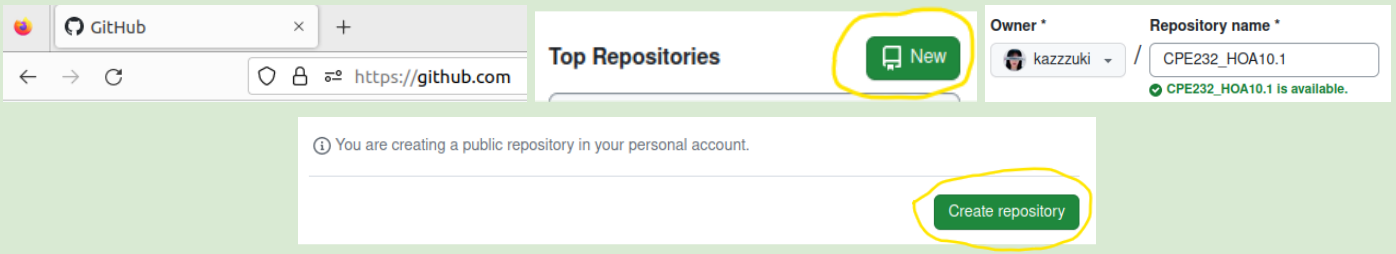
```
kazuki@workstation:~$ ssh kazuki@192.168.56.127
Last login: Fri Oct 27 21:19:14 2023 from 192.168.56.121
[kazuki@centos ~]$
```

After checking the IP address, we need to check if it has a connection to our workstation. I used the command “ping <ip add>” to check the normal connection of two machines. I used the command “ssh user@host” to check the ssh connections. When pinging, you should see a 0% packet loss, and there is no error. While in ssh connection, you should see that the hostname will change into the hostname of the hosts.

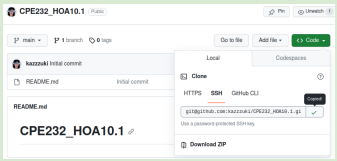
```
kazuki@workstation:~$ which git
/usr/bin/git
```

```
kazuki@workstation:~$ git --version
git version 2.34.1
```

Once we are done checking the connection of control nodes to managed nodes. We are now going to check if we have git installed in our workstation. We are checking this, since the activity requires creating a new repository on GitHub. I used the command “which git” to show any “git” related file/directory in my workstation. Then I used the command “git –version” just to make sure I have git installed in my workstation.



After installing or checking git installed in my workstation, I created a new repository named “CPE232_HOA10.1”. In creating a new repository, go to “www.github.com” create an account or sign into your account. After that, you will see a “new repository” there, just click it and then create a new repository. In this repository, I am going to save all my files that I will be creating.




```
kazuki@workstation:~$ git clone git@github.com:kazzzuki/CPE232_HOA10.1.git
Cloning into 'CPE232_HOA10.1'...
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.
```

On the GitHub repository, I clicked the “<> Code” button and went to “SSH” and copied the link there. Then, I used the command “git clone” to clone my repository in my workstation.

```
kazuki@workstation:~$ ls
CPE232_HOA10.1  CPE232_HOA9.1  Documents  Ogata_PrelimExam  snap
CPE232_HOA6.1   CPE232_KAZUKI  Downloads  Pictures          Templates
CPE232_HOA8.1   Desktop        Music      Public            Videos
```

Verify the cloned GitHub repository. I used the command “ls” to check the cloned git.

```
kazuki@workstation:~$ cd CPE232_HOA10.1
kazuki@workstation:~/CPE232_HOA10.1$
```

Go inside the cloned repository. I used the command “cd” to go inside it.

```
kazuki@workstation:~/CPE232_HOA10.1$ sudo nano inventory
kazuki@workstation:~/CPE232_HOA10.1$ cat inventory

[Hoa10_Ubuntu]
192.168.56.129  ansible_connection=ssh

[Hoa10_CentOS]
192.168.56.127  ansible_connection=ssh
```

I started by creating an inventory file. I put all the remote servers that I will be needing in this activity. I put them both in a group so it will be easy to call them in roles and playbook.

```
kazuki@workstation:~/CPE232_HOA10.1$ sudo nano ansible.cfg
kazuki@workstation:~/CPE232_HOA10.1$ cat ansible.cfg

[defaults]

inventory = inventory
```

Next is creating an ansible.cfg file, I added a default configuration that the inventory file is the inventory.

```
kazuki@workstation:~/CPE232_HOA10.1$ ansible all --list-hosts
  hosts (2):
    192.168.56.129
    192.168.56.127
kazuki@workstation:~/CPE232_HOA10.1$ ansible all -m ping
192.168.56.129 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3"
    },
    "changed": false,
    "ping": "pong"
}
192.168.56.127 | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python"
    },
    "changed": false,
    "ping": "pong"
}
```

Now that I already have inventory and ansible.cfg files, I need to check if it has a connection. I used the “ansible all –list-hosts” command to check the IP addresses of the hosts in my workstation. I also used the command “ansible all -m ping” to verify the connection of the IP addresses.

```
kazuki@workstation:~/CPE232_HOA10.1$ mkdir -p roles/Hoa10_Ubuntu/tasks
kazuki@workstation:~/CPE232_HOA10.1$ mkdir -p roles/Hoa10_CentOS/tasks
kazuki@workstation:~/CPE232_HOA10.1$ ls
ansible.cfg  inventory  README.md  roles
kazuki@workstation:~/CPE232_HOA10.1$ cd roles
kazuki@workstation:~/CPE232_HOA10.1/roles$ ls
Hoa10_CentOS  Hoa10_Ubuntu
kazuki@workstation:~/CPE232_HOA10.1/roles$ cd Hoa10_Ubuntu
kazuki@workstation:~/CPE232_HOA10.1/roles/Hoa10_Ubuntu$ ls
tasks
kazuki@workstation:~/CPE232_HOA10.1/roles/Hoa10_Ubuntu$ cd ../Hoa10_CentOS
kazuki@workstation:~/CPE232_HOA10.1/roles/Hoa10_CentOS$ ls
tasks
```

I create a directory for 2 different roles for Ubuntu and CentOS. I used the command “mkdir” in creating the directory. I used the “cd” command to go to the directory. And lastly, I used the command “ls” to show the files inside the directory.

```
kazuki@workstation:~/CPE232_HOA10.1$ sudo nano /home/kazuki/CPE232_HOA10.1/roles/Hoa10_Ubuntu/tasks/main.yml
kazuki@workstation:~/CPE232_HOA10.1$ cat /home/kazuki/CPE232_HOA10.1/roles/Hoa10_Ubuntu/tasks/main.yml

    - name: Add Elasticsearch APT repository key
      apt_key:
        url: https://packages.elastic.co/GPG-KEY-elasticsearch
      async: 3600
      poll: 0

    - name: Add Elasticsearch APT repository
      apt_repository:
        repo: "deb http://packages.elastic.co/elasticsearch/1.7/debian stable main"
      async: 3600
      poll: 0

    - name: Add Kibana APT repository
      apt_repository:
        repo: "deb https://artifacts.elastic.co/packages/7.x/apt stable main"
      async: 3600
      poll: 0

    - name: Add Logstash APT repository
      apt_repository:
        repo: "deb http://packages.elasticsearch.org/logstash/1.5/debian stable main"
      async: 3600
      poll: 0

    - name: Install Elasticsearch on Ubuntu
      apt:
        name: elasticsearch
        state: present
      async: 3600
      poll: 0

    - name: Install Kibana on Ubuntu
      apt:
        name: kibana
        state: present
      async: 3600
      poll: 0

    - name: Install Logstash on Ubuntu
      apt:
        name: logstash
        state: present
      async: 3600
      poll: 0

    - name: Enable and Start Elasticsearch, Kibana, and Logstash
      systemd:
        name: "{{ item }}"
        enabled: yes
        state: started
      loop:
        - elasticsearch
        - kibana
        - logstash
      async: 3600
      poll: 0
```

In installing Elasticsearch, Kibana, Logstash on Ubuntu, firstly, I created an APT repository key for security measurement to prevent installing malicious software. Then I added tasks that add Elasticsearch, Kibana, Logstash APT repositories. After adding repositories, I then added tasks that install each package. Lastly, I added a task that enables and starts the Elasticsearch, Kibana, and Logstash services.

```
kazuki@workstation:~/CPE232_HOA10.1$ sudo nano /home/kazuki/CPE232_HOA10.1/roles/Hoa10_CentOS/tasks/main.yml
kazuki@workstation:~/CPE232_HOA10.1$ cat /home/kazuki/CPE232_HOA10.1/roles/Hoa10_CentOS/tasks/main.yml

 - name: Add Elasticsearch YUM repository
   yum_repository:
     name: elasticsearch
     description: Elasticsearch Repository
     baseurl: https://artifacts.elastic.co/packages/7.x/yum
     gpgcheck: yes
     gpgkey: https://artifacts.elastic.co/GPG-KEY-elasticsearch
   async: 3600
   poll: 0

 - name: Add Kibana YUM repository
   yum_repository:
     name: kibana
     description: Kibana Repository
     baseurl: https://artifacts.elastic.co/packages/7.x/yum
     gpgcheck: yes
     gpgkey: https://artifacts.elastic.co/GPG-KEY-elasticsearch
   async: 3600
   poll: 0

 - name: Add Logstash YUM repository
   yum_repository:
     name: logstash
     description: Logstash Repository
     baseurl: https://artifacts.elastic.co/packages/7.x/yum
     gpgcheck: yes
     gpgkey: https://artifacts.elastic.co/GPG-KEY-elasticsearch
   async: 3600
   poll: 0
- name: Install Elasticsearch on CentOS
  dnf:
    name: elasticsearch
    use_backend: dnf
    state: present
  async: 3600
  poll: 0

- name: Install Kibana on CentOS
  dnf:
    name: kibana
    use_backend: dnf
    state: present
  async: 3600
  poll: 0

- name: Install Logstash on CentOS
  dnf:
    name: logstash
    use_backend: dnf
    state: present
  async: 3600
  poll: 0

- name: Enable and Start Elasticsearch, Kibana, and Logstash
  systemd:
    name: "{{ item }}"
    enabled: yes
    state: started
  loop:
    - elasticsearch
    - kibana
    - logstash
  async: 3600
  poll: 0
```

In installing Elasticsearch, Kibana, Logstash on Ubuntu, firstly, I added tasks that add Elasticsearch, Kibana, Logstash YUM repositories. After adding repositories, I then added tasks that install each package. Lastly, I added a task that enables and starts the Elasticsearch, Kibana, and Logstash services.

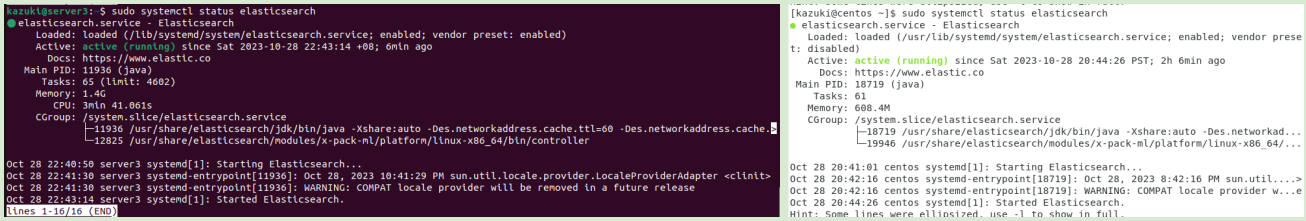
```
kazuki@workstation:~/CPE232_HOA10.1$ sudo nano install_EKL.yml
kazuki@workstation:~/CPE232_HOA10.1$ cat install_EKL.yml
---
- hosts: all
  become: true
  roles:
    - Hoa10_Ubuntu
    - Hoa10_CentOS
```

This is my main playbook, I used the “roles” command to include the directories “Hoa10_Ubuntu” and “Hoa10_VentOS” so it will run the tasks “main.yml” inside those directories.

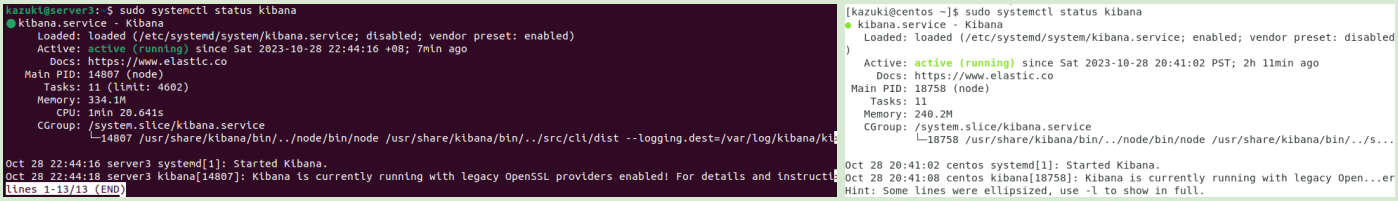
```
kazuki@workstation:~/CPE232_HOA10.1$ ansible-playbook --ask-become-pass install_EKL.yml
BECOME password:

PLAY [all] *********************************************************************************************************************

TASK [Gathering Facts] *********************************************************************************************************
ok: [192.168.56.129]
ok: [192.168.56.127]

TASK [Hoa10_Ubuntu : Add Elasticsearch APT repository key] *********************************************************************
changed: [192.168.56.129]
changed: [192.168.56.127]

TASK [Hoa10_Ubuntu : Add Elasticsearch APT repository] *************************************************************************
changed: [192.168.56.129]
changed: [192.168.56.127]

TASK [Hoa10_Ubuntu : Add Kibana APT repository] ********************************************************************************
changed: [192.168.56.129]
changed: [192.168.56.127]

TASK [Hoa10_Ubuntu : Add Logstash APT repository] ******************************************************************************
changed: [192.168.56.129]
changed: [192.168.56.127]

TASK [Hoa10_Ubuntu : Install Elasticsearch on Ubuntu] **************************************************************************
changed: [192.168.56.129]
changed: [192.168.56.127]

TASK [Hoa10_Ubuntu : Install Kibana on Ubuntu] *********************************************************************************
changed: [192.168.56.127]
changed: [192.168.56.129]

TASK [Hoa10_Ubuntu : Install Logstash on Ubuntu] *******************************************************************************
changed: [192.168.56.127]
changed: [192.168.56.129]

TASK [Hoa10_Ubuntu : Enable and Start Elasticsearch, Kibana, and Logstash] *****************************************************
changed: [192.168.56.129] => (item=elasticsearch)
changed: [192.168.56.127] => (item=elasticsearch)
changed: [192.168.56.129] => (item=kibana)
changed: [192.168.56.127] => (item=kibana)
changed: [192.168.56.129] => (item=logstash)
changed: [192.168.56.127] => (item=logstash)
```

```
TASK [Hoa10_CentOS : Add Elasticsearch YUM repository] *************************************************************************
changed: [192.168.56.127]
changed: [192.168.56.129]

TASK [Hoa10_CentOS : Add Kibana YUM repository] ********************************************************************************
changed: [192.168.56.129]
changed: [192.168.56.127]

TASK [Hoa10_CentOS : Add Logstash YUM repository] ******************************************************************************
changed: [192.168.56.129]
changed: [192.168.56.127]

TASK [Hoa10_CentOS : Install Elasticsearch on CentOS] **************************************************************************
changed: [192.168.56.129]
changed: [192.168.56.127]

TASK [Hoa10_CentOS : Install Kibana on CentOS] *********************************************************************************
changed: [192.168.56.129]
changed: [192.168.56.127]

TASK [Hoa10_CentOS : Install Logstash on CentOS] *******************************************************************************
changed: [192.168.56.129]
changed: [192.168.56.127]

TASK [Hoa10_CentOS : Enable and Start Elasticsearch, Kibana, and Logstash] *****************************************************
changed: [192.168.56.129] => (item=elasticsearch)
changed: [192.168.56.129] => (item=kibana)
changed: [192.168.56.127] => (item=elasticsearch)
changed: [192.168.56.129] => (item=logstash)
changed: [192.168.56.127] => (item=kibana)
changed: [192.168.56.127] => (item=logstash)

PLAY RECAP *********************************************************************************************************************
192.168.56.127             : ok=16   changed=15   unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
192.168.56.129             : ok=16   changed=15   unreachable=0    failed=0    skipped=0    rescued=0    ignored=0
```

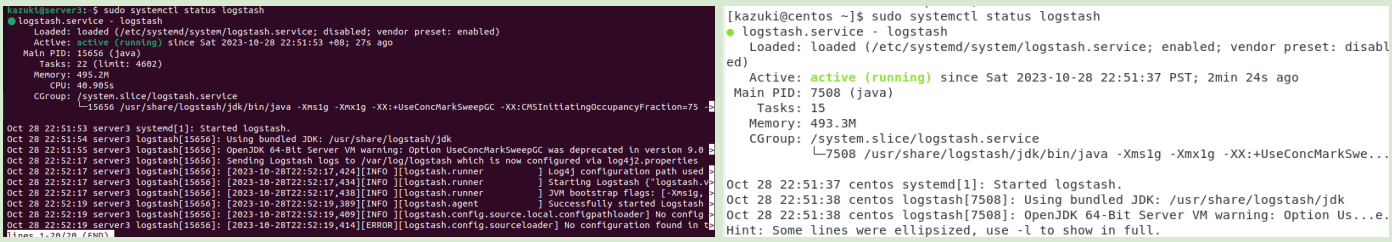
After creating roles and playbooks, I executed it using the command “ansible-playbook” and added “--ask-become-pass” so there will be no error like password error or any error. The output shows “ok” in gathering facts, meaning it successfully connects to the managed nodes. The “changed” labels shows that it changed that hosts, meaning it successfully do all the tasks inside the roles.



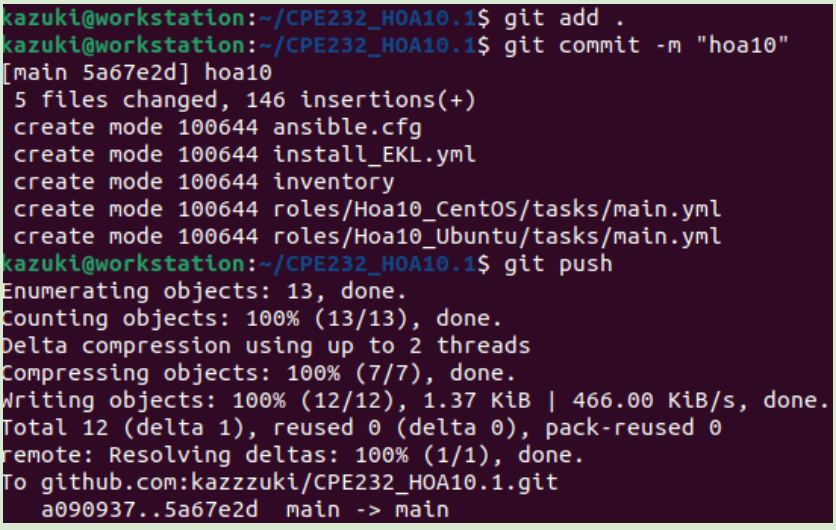
I used the command “sudo systemctl status elasticsearch” command to show if the status of elasticsearch in both my Ubuntu and CentOS are running or Active since I included in my playbook a task where it enables and starts elasticsearch service.

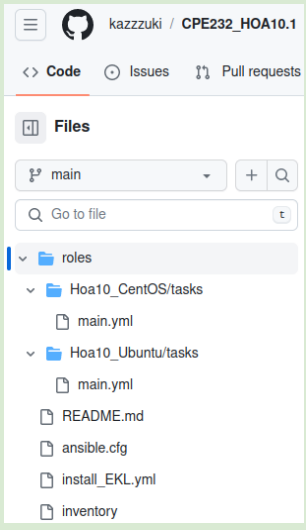


I used the command “sudo systemctl status kibana” command to show if the status of elasticsearch in both my Ubuntu and CentOS are running or Active since I included in my playbook a task where it enables and starts elasticsearch service.



I used the command “sudo systemctl status logstash” command to show if the status of elasticsearch in both my Ubuntu and CentOS are running or Active since I included in my playbook a task where it enables and starts elasticsearch service.





I used the command “git add .” to add all the files in my current directory to my GitHub repository. I used the command “git commit -m “hoa10” command to commit all changes and added a message. Lastly, I push it. GitHub link: https://github.com/kazzzuki/CPE232_HOA10.1

Reflections:
Answer the following:

1. What are the benefits of having a log monitoring tool?

    - The benefits of having a log monitoring tool are it helps us in detecting and fixing issues/problems like security breaches or any performance related problems before the problem worsens. For example, when a web server experiences multiple failed login attempts, the monitoring tool can trigger an alert in real time, notifying the system administrator, and then he/she can investigate and block in case it is a potential hacker. So in this example, monitoring tools help in preventing security issue from getting worse.

Conclusions:

In conclusion, this activity involved creating and designing a workflow that install, configure. and manage enterprise monitoring tools using Ansible as IaC tool. This activity taught me the importance of log monitoring tools in maintaining system performance and security. As a system administration student, I will keep this to my mind to always have monitoring tools on the systems I manage. In creating a playbook for installing Elasticsearch, Kibana, and Logstash, I followed all the things I learned from the past activities like using roles. Inside my playbook, I included tasks that add repositories, installing services, and starting the services. I did not encounter any error while doing this activity, the only struggle I experience is my Laptop is lagging when I execute the playbook.

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