Deploying and Automating ELK Stack on On-Premises Servers with Filebeat Integration

1. Introduction:-

The ELK Stack is a powerful set of open-source tools for collecting, processing, and visualizing logs and metrics. The core components are:

- **Elasticsearch**: The search engine for storing logs.
- **Logstash**: The data processing pipeline.
- **Kibana**: A web interface for visualizing and analyzing data.
- **Filebeat**: A lightweight shipper for forwarding and centralizing logs to Logstash or Elasticsearch**.**

2. Why We Need Log Capturing:-

2.1 Importance of Log Capturing

Logs are essential for maintaining the security, performance, and reliability of IT infrastructure. Capturing and analyzing these logs is crucial for several reasons:

1. **Security Monitoring**: Logs help detect unauthorized access, malware infections, and other security incidents in real-time.
2. **Incident Response and Troubleshooting**: Logs provide valuable insights when diagnosing issues.
3. **Compliance and Auditing**: Logs serve as an audit trail for regulatory compliance (GDPR, HIPAA, PCI-DSS).
4. **Operational Efficiency**: Analyze logs to optimize system performance.
5. **Forensic Investigations**: Logs help reconstruct events after a security breach or incident.

3. Why We Selected the ELK Stack

3.1 Advantages of the ELK Stack

The ELK Stack is chosen for its flexibility, scalability, and cost-effectiveness, with advantages such as:

1. **Open-Source**: Free and customizable without licensing costs.

2. **Real-Time Analysis**: Supports real-time data collection and analysis.
3. **Scalability**: Elasticsearch's distributed architecture enables scaling to handle large volumes of data.
4. **Search Capabilities**: Elasticsearch provides powerful search and filtering options.
5. **Data Visualization**: Kibana enables creating custom dashboards to monitor and visualize logs.
6. **Centralized Log Management**: Logs from multiple systems are managed in one place for easier analysis.

3.2 Why ELK Over Other Solutions?

Compared to Splunk: ELK is a cost-effective alternative, offering comparable functionality without licensing fees.

Compared to Graylog: ELK offers more flexibility and scalability, with better community support.

4. Installing and Configuring the ELK Stack on On-Premises Servers

Step 1: Installing Elasticsearch

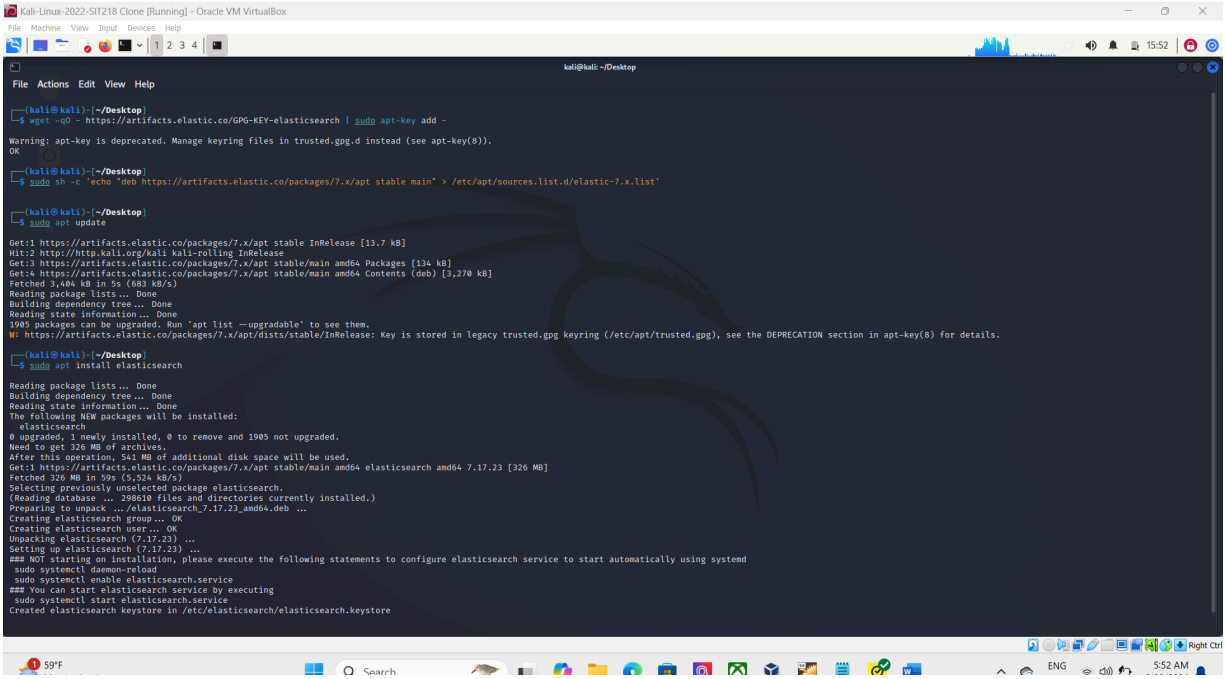
Elasticsearch is the engine that stores logs and allows you to search, analyze, and visualize data.

1. **Add the GPG Key and Repository:** This step adds the Elasticsearch repository to your system so that it can download the necessary packages.we run following commands ton do it

```
wget -qO - https://artifacts.elastic.co/GPG-KEY-elasticsearch | sudo tee /usr/share/keyrings/elasticsearch-archive-keyring.gpg > /dev/null
echo "deb [signed-by=/usr/share/keyrings/elasticsearch-archive-keyring.gpg] https://artifacts.elastic.co/packages/7.x/apt stable main" | sudo tee /etc/apt/sources.list.d/elastic-7.x.list
```

2. **Install and Start Elasticsearch:** Here, you install Elasticsearch and enable it to start on boot

```
sudo apt update
sudo apt install elasticsearch
sudo systemctl start elasticsearch
sudo systemctl enable elasticsearch
```



3.**Verify Elasticsearch Installation:** After installation, test that Elasticsearch is running by making an HTTP request to **localhost:9200**. It should return information about the Elasticsearch node.

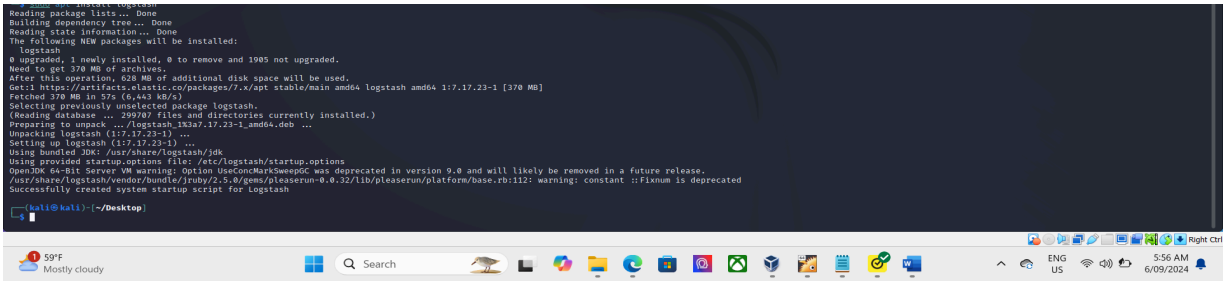
```
curl -X GET "localhost:9200/"
```

Step 2: Installing Logstash

Logstash processes logs sent by Filebeat and forwards them to Elasticsearch.

1.**Install Logstash:** This command installs Logstash on your system.

```
sudo apt install logstash
```

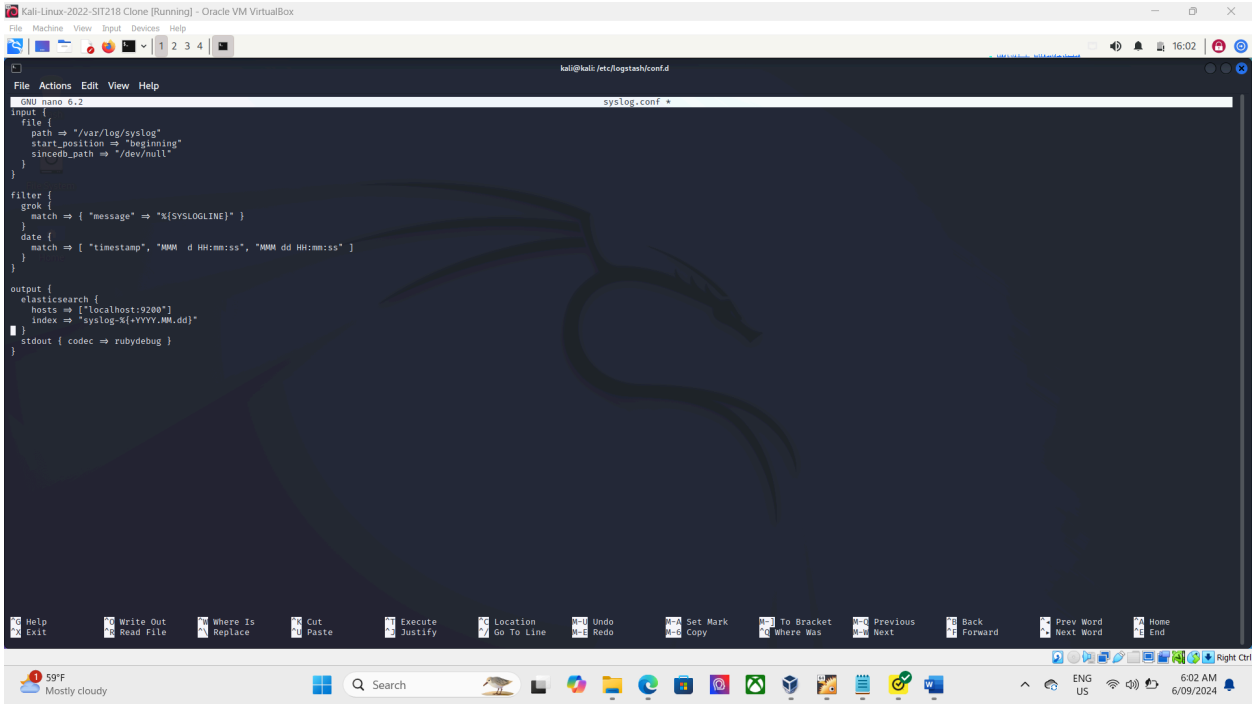


2.Configure Logstash: A configuration file (`02-beats-input.conf`) is created to specify that Logstash should listen for data on port 5044 from Filebeat. This file also defines Elasticsearch as the destination for the processed logs

```
sudo nano /etc/logstash/conf.d/02-beats-input.conf
```

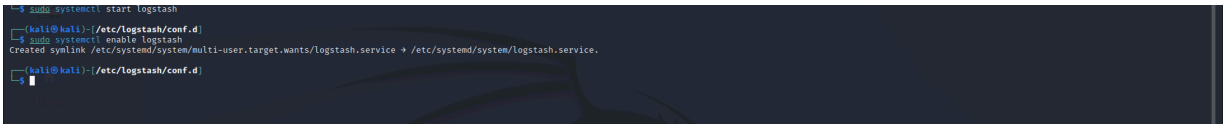
Add the following configuration:

```
input {
  beats {
    port => 5044
  }
}

output {
  elasticsearch {
    hosts => ["localhost:9200"]
    index =>
"%{[@metadata][beat]}-%{[@metadata][version]}-%{+YYYY.MM.dd}"
  }
  stdout { codec => rubydebug }
}
```



3.Start and Enable Logstash: Start Logstash and configure it to start on boot

```
sudo systemctl start logstash
sudo systemctl enable logstash
```



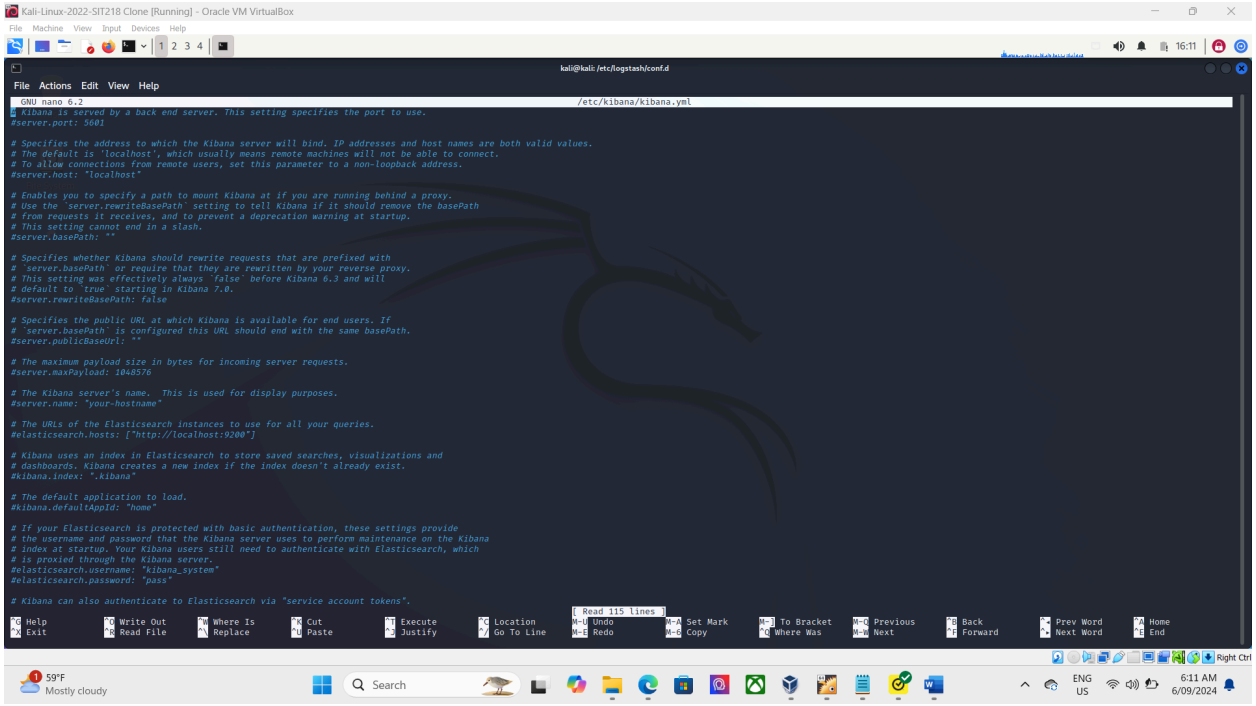
Step 3: Installing Kibana

Kibana provides the user interface to visualize and analyze data stored in Elasticsearch.

1. **Install Kibana:** Install Kibana using the package manager.

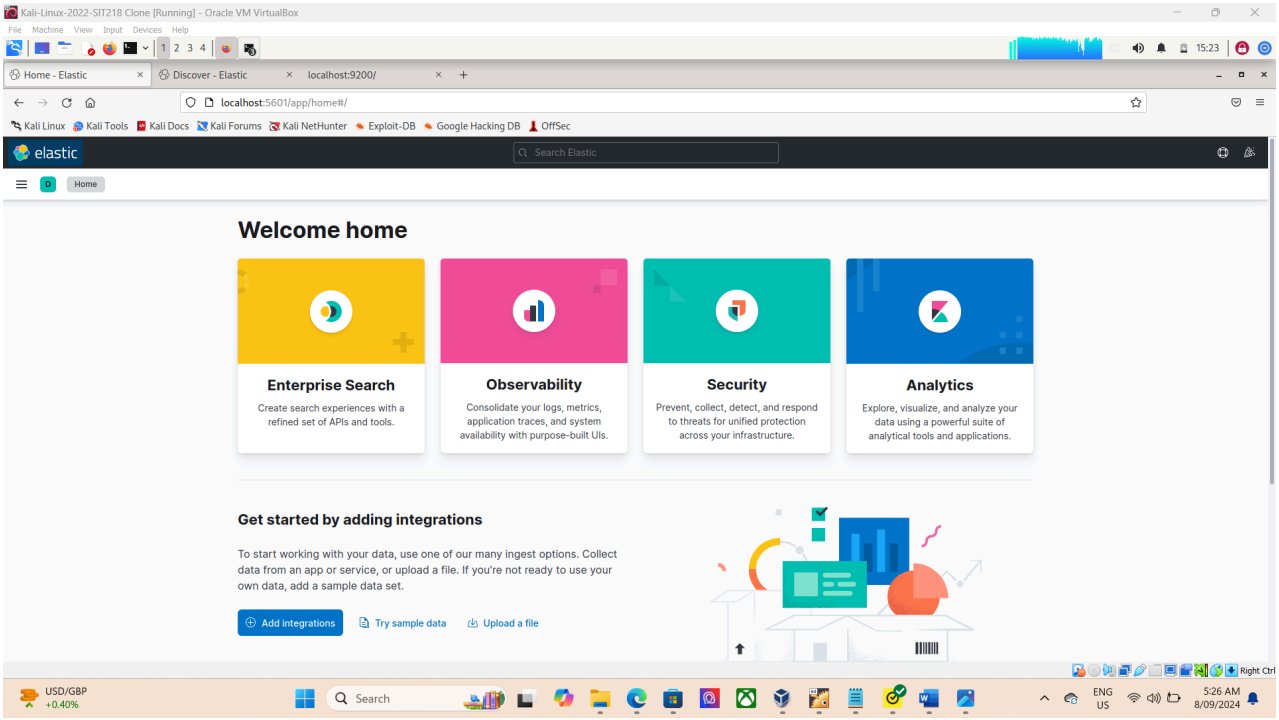
```
sudo apt install kibana
```

2. **Configure Kibana**: In Kibana's configuration file (/etc/kibana/kibana.yml), modify server.host to 0.0.0.0 to make Kibana accessible from other devices on the network.




```
sudo systemctl start kibana
sudo systemctl enable kibana
```

3. Access Kibana: You can access Kibana by opening a web browser and going to http://localhost:5601. This will bring up the Kibana dashboard.



5. Setting Up Filebeat for Log Collection

Filebeat collects and forwards logs to Logstash for processing.

1. **Install Filebeat**: Install Filebeat on your system to start shipping logs

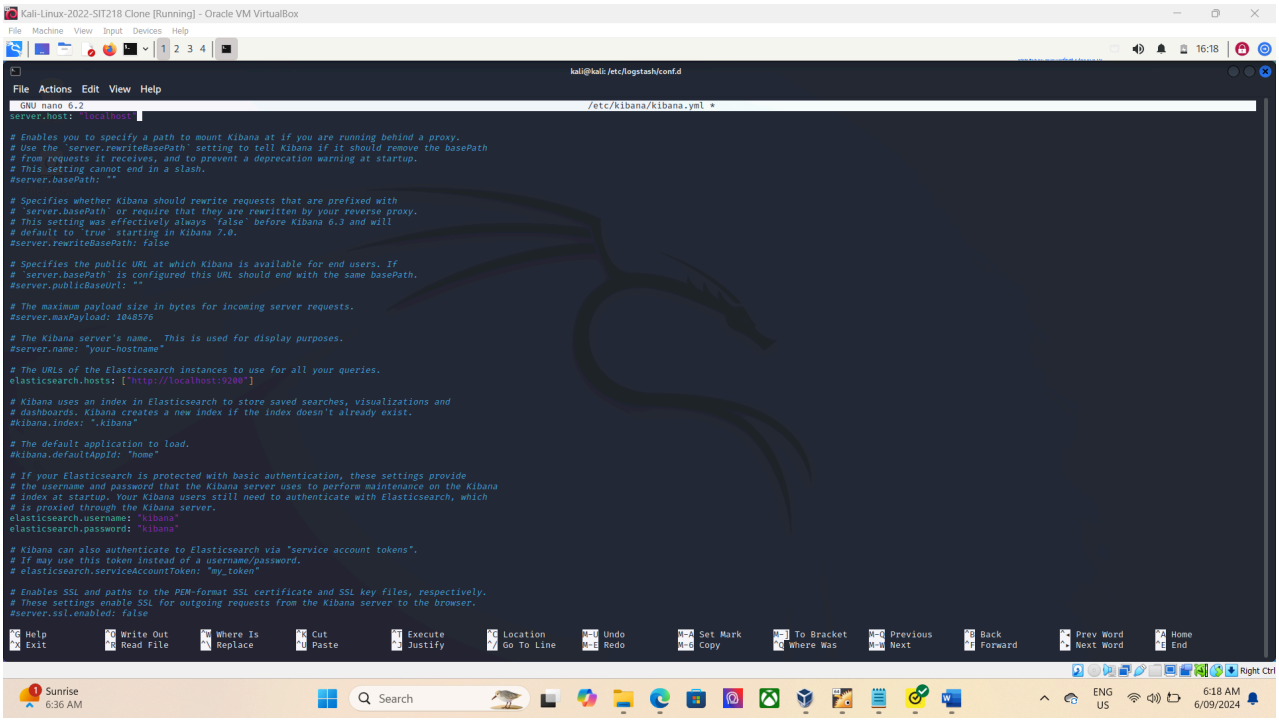
   sudo apt install filebeat

2. **Configure Filebeat:** Modify the Filebeat configuration file (/etc/filebeat/filebeat.yml) to send data to Logstash.

```
output.logstash:

  hosts: ["localhost:5044"]
```

Additionally, configure Filebeat to collect logs from `/var/log/syslog` or any other specific log file.

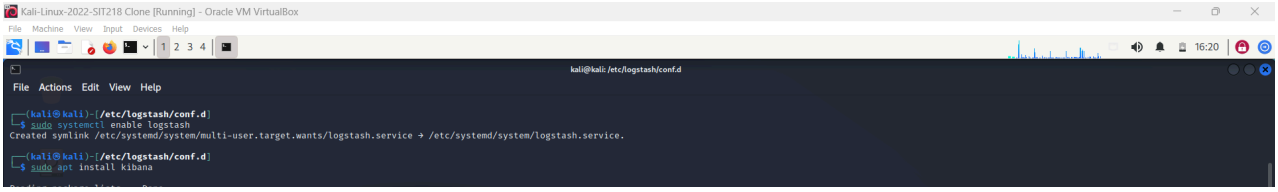
```
filebeat.inputs:

 - type: log

  enabled: true

  paths:

    - /var/log/syslog
```



3. Start Filebeat: Start Filebeat and enable it to start at boot.

sudo systemctl start filebeat

sudo systemctl enable filebeat



6. Verifying the ELK Stack Setup

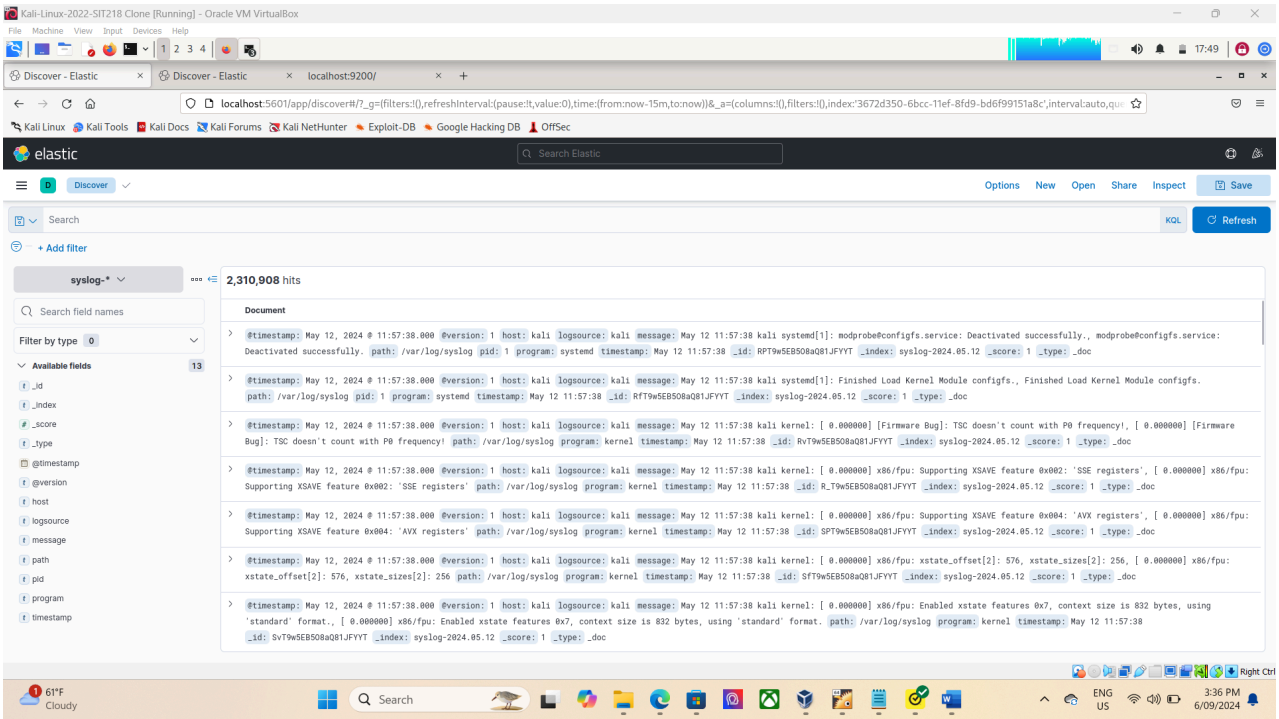
6.1 Check Elasticsearch Indices

To verify logs are being received by Elasticsearch:
curl -X GET "localhost:9200/_cat/indices?v"

Look for indices with the prefix `filebeat-*`.

6.2 Check Logs in Kibana

1. Go to **Kibana > Discover**.
2. Select the `filebeat-*` index pattern.
3. Logs should appear in Kibana if Filebeat is successfully sending logs.



7. Common Issues and Resolutions

Issue 1: Filebeat Service Fails to Start

Error: Filebeat service is inactive (dead)

Resolution:

Test the Filebeat configuration:

```
sudo filebeat test config
```

1. Test the Filebeat configuration:
2. Ensure only one output is configured (either Elasticsearch or Logstash).
3. Restart Filebeat:
   ```
   sudo systemctl restart filebeat
   ```

Issue 2: Logstash Unable to Read /var/log/syslog

Error: Permission denied - /var/log/syslog

Resolution:

Add Logstash to the adm group:
sudo usermod -a -G adm logstash

sudo systemctl restart logstash

2.Alternatively, use Filebeat to collect logs and forward them to Logstash.

Issue 3: No Data in Kibana

Symptom: No logs in the Kibana Discover tab.

Resolution:

Ensure logs are indexed by Elasticsearch:

curl -X GET "localhost:9200/filebeat*/_search?pretty"

1. Confirm Kibana's index pattern:
    - Go to **Kibana > Stack Management > Index Patterns** and ensure filebeat-* is set up.
2. Restart services if necessary:

   sudo systemctl restart elasticsearch logstash kibana

8. Automating the ELK Stack Deployment (Further Steps)

8.1 Automating ELK Deployment as a Future Enhancement

While manually installing and configuring the ELK Stack works well for initial setups, automation is a **further step** that significantly improves deployment efficiency and consistency across multiple environments.

Automation ensures repeatable processes, reducing manual errors and saving time in larger

deployments. Tools like **Ansible**, **Jenkins**, and **Docker** can be used to automate ELK Stack deployment.

Automating with Ansible

Ansible can be used to automate the ELK Stack deployment on multiple servers.