

Name: P.Aashritha

Regno:21BCE7241

CYBER PHYSICAL SYSTEMS-CSE1018 PROJECT REPORT

In the rapidly evolving environment of modern networks, maintaining robust security, optimizing performance, and gaining visibility into network activity are paramount. Network administrators and security experts rely on advanced tools and frameworks to address these challenges. One such powerful synergy results from the integration of the ELK stack (Elasticsearch, Logstash, and Kibana) with Zeek (formerly known as Bro), a high-performance network analysis framework. This integration offers a comprehensive solution for capturing, analyzing and visualizing network data, providing invaluable insights to improve network management, security and decision making.

Zeek:

Zeek, a leading network analytics framework, acts as a passive monitoring system. It dissects network traffic and transforms it into structured logs that detail a wide range of network activities, from protocol interactions to connections and data transfers. Its non-intrusive approach enables real-time analysis without disrupting normal network operations.

ELK stack:

The ELK stack consists of a trio of tools that together deal with data processing, storage and visualization:

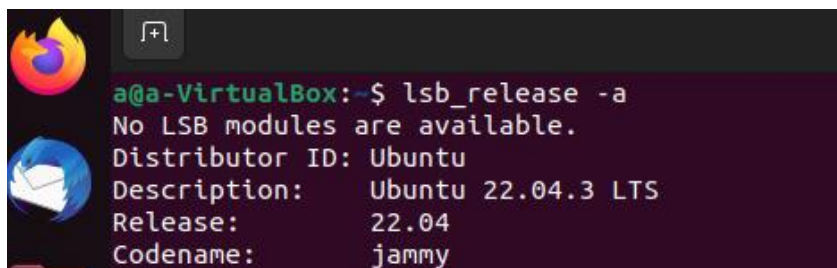
Elasticsearch: This distributed search and analytics engine excels at indexing and storing large volumes of data, enabling lightning-fast searches and comprehensive data analysis.

Logstash: As a versatile data processing pipeline, Logstash ingests, transforms and enriches data from a variety of sources and prepares it for storage and analysis.

Kibana: Kibana's powerful visualization platform works seamlessly with Elasticsearch, allowing users to create customized dashboards, reports, and visualizations that transform raw data into meaningful insights.

IMPLEMENTATION:

- Before installing ELK, set the required dependencies:
- Check current ubuntu version



```
a@a-VirtualBox:~$ lsb_release -a
No LSB modules are available.
Distributor ID: Ubuntu
Description:    Ubuntu 22.04.3 LTS
Release:        22.04
Codename:       jammy
```

- Install java Dependencies:

```

codename: jammy
a@a-VirtualBox:~$ sudo apt install default-jdk default-jre -y
[sudo] password for a:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
default-jdk is already the newest version (2:1.11-72build2).
default-jre is already the newest version (2:1.11-72build2).
0 upgraded, 0 newly installed, 0 to remove and 26 not upgraded.
a@a-VirtualBox:~$

```

- Check current java version:

```

0 upgraded, 0 newly installed, 0 to remove and 26 not upgraded
a@a-VirtualBox:~$ javac -version
javac 11.0.20
a@a-VirtualBox:~$

```

- Install curl if not installed

```

Try 'install --help' for more information.
a@a-VirtualBox:~$ sudo apt install curl
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
curl is already the newest version (7.81.0-1ubuntu1.13).
0 upgraded, 0 newly installed, 0 to remove and 26 not upgraded.
a@a-VirtualBox:~$

```

- Add elasticsearch APT repository by using below command
curl -fsSL https://artifacts.elastic.co/GPG-KEY-elasticsearch | apt-key add -

```

a@a-VirtualBox:~$ sudo -s
root@a-VirtualBox:/home/a# curl -fsSL https://artifacts.elastic.co/GPG-KEY-elasticsearch | apt-key add -
Warning: apt-key is deprecated. Manage keyring files in trusted.gpg.d instead (see apt-key(8)).
OK
root@a-VirtualBox:/home/a#

```

- Add the Elastic Search to the APT source List by using the below command

```

elastic-7.x.list: command not found
root@a-VirtualBox:/home/a# echo "deb https://artifacts.elastic.co/packages/7.x/apt stable main" >/etc/apt/sources.list.d/elastic-7.x.list
root@a-VirtualBox:/home/a#

```

Installation of elastic search:

- Apt update

```

root@an-virtualbox:/home/an# echo -deb https://artifacts.elastic.co/packages/7.x/apt/sources.list.d/
bash: /etc/apt/sources.list.d/: Is a directory
root@an-virtualbox:/home/an# apt update
Hit:1 http://in.archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://security.ubuntu.com/ubuntu jammy-security InRelease
Hit:3 http://in.archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:4 http://in.archive.ubuntu.com/ubuntu jammy-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
2 packages can be upgraded. Run 'apt list --upgradable' to see them.
root@an-virtualbox:/home/an#

```

- Install elastic search

```

root@an-virtualbox:/home/an# apt install elasticsearch -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  elasticsearch
0 upgraded, 1 newly installed, 0 to remove and 27 not upgraded.
Need to get 318 MB of archives.
After this operation, 531 MB of additional disk space will be used.
Get:1 https://artifacts.elastic.co/packages/7.x/apt/stable/main amd64 elasticsearch amd64 7.17.12 [318 MB]
Fetched 318 MB in 2min 31s (2,112 kB/s)
Selecting previously unselected package elasticsearch.
(Reading database ... 163841 files and directories currently installed.)
Preparing to unpack .../elasticsearch_7.17.12_amd64.deb ...
Creating elasticsearch group... OK
Creating elasticsearch user... OK
Unpacking elasticsearch (7.17.12) ...
Setting up elasticsearch (7.17.12) ...
### NOT starting on installation, please execute the following statements to configure elasticsearch service to start automatically using systemd
sudo systemctl daemon-reload
sudo systemctl enable elasticsearch.service
### You can start elasticsearch service by executing
sudo systemctl start elasticsearch.service
Created elasticsearch keystore in /etc/elasticsearch/elasticsearch.keystore
root@an-virtualbox:/home/an#

```

- Configure Elastic search

vim /etc/elasticsearch/elasticsearch.yml

```

#bootstrap.memory_lock: true
#
# Make sure that the heap size is set to about half the memory available
# on the system and that the owner of the process is allowed to use this
# limit.
#
# Elasticsearch performs poorly when the system is swapping the memory.
#
# ----- Network -----
#
# By default Elasticsearch is only accessible on localhost. Set a different
# address here to expose this node on the network:
#
network.host: localhost
#
# By default Elasticsearch listens for HTTP traffic on the first free port it
# finds starting at 9200. Set a specific HTTP port here:
#
http.port: 9200
#
# For more information, consult the network module documentation.
#
# ----- Discovery -----
#
# Pass an initial list of hosts to perform discovery when this node is started:
# The default list of hosts is ["127.0.0.1", "::1"]
#
#discovery.seed_hosts: ["host1", "host2"]
#
# Bootstrap the cluster using an initial set of master-eligible nodes:
#
#cluster.initial_master_nodes: ["node-1", "node-2"]
#
# For more information, consult the discovery and cluster formation module documentation.
#
# ----- Various -----

```

- Configure JVM heap
vim /etc/elasticsearch/jvm.options

Installation of logstash:

- Install logstash by below command

```
root@VirtualBox:/home/a# apt install logstash -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  logstash
0 upgraded, 1 newly installed, 0 to remove and 25 not upgraded.
Need to get 366 MB of archives.
After this operation, 623 MB of additional disk space will be used.
Get:1 https://artifacts.elastic.co/packages/7.x/apt/stable/main amd64 logstash amd64 1:7.17.12-1 [366 MB]
Fetched 366 MB in 2min 47s (2,194 kB/s)
Selecting previously unselected package logstash.
(Reading database ... 166879 files and directories currently installed.)
Preparing to unpack .../logstash_1%3a7.17.12-1_amd64.deb ...
Unpacking logstash (1:7.17.12-1) ...
Setting up logstash (1:7.17.12-1) ...
Using bundled JDK: /usr/share/logstash/jdk
Using provided startup.options file: /etc/logstash/startup.options
OpenJDK 64-Bit Server VM warning: Option UseConcMarkSweepGC was deprecated in version 9.0 and will likely be removed in a future release.
/usr/share/logstash/vendor/bundle/jruby/2.5.0/gems/pleaserun-0.0.32/lib/pleaserun/platform/base.rb:112: warning: constant ::Fixnum is deprecated
Successfully created system startup script for Logstash
root@VirtualBox:/home/a#
```

- Check its working and status

```
/usr/share/logstash/vendor/bundle/jruby/2.5.0/gems/pleaserun-0.0.32/lib/pleaserun/platform/base.rb:112: warning: constant ::Fixnum is deprecated
root@VirtualBox:/home/a# systemctl status logstash
○ logstash.service - logstash
   Loaded: loaded (/etc/systemd/system/logstash.service; disabled; vendor preset: enabled)
   Active: inactive (dead)
root@VirtualBox:/home/a#
```

Installation of kibana:

- Install kibana

```
root@VirtualBox:/home/a# apt install kibana -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  kibana
0 upgraded, 1 newly installed, 0 to remove and 25 not upgraded.
Need to get 276 MB of archives.
After this operation, 672 MB of additional disk space will be used.
Get:1 https://artifacts.elastic.co/packages/7.x/apt/stable/main amd64 kibana amd64 7.17.12 [276 MB]
Fetched 276 MB in 2min 4s (2,227 kB/s)
Selecting previously unselected package kibana.
(Reading database ... 182252 files and directories currently installed.)
Preparing to unpack .../kibana_7.17.12_amd64.deb ...
Unpacking kibana (7.17.12) ...
Setting up kibana (7.17.12) ...
Creating kibana group... OK
Creating kibana user... OK
Created Kibana keystore in /etc/kibana/kibana.keystore
root@VirtualBox:/home/a#
```

- Configure kibana
Before configuring stop kibana
systemctl stop kibana
- Open elasticsearch.yml
- sudo nano /etc/elasticsearch/elasticsearch.yml
- Add to elasticsearch.yml:
xpack.security.enabled: true
xpack.security.authc.api_key.enabled: true

```
root@a-VirtualBox: /home/a
GNU nano 6.2 /etc/elasticsearch/elasticsearch.yml
# ..... Discovery .....
# Pass an initial list of hosts to perform discovery when this node is started:
# The default list of hosts is ["127.0.0.1", "::1"]
#discovery.seed_hosts: ["host1", "host2"]
# Bootstrap the cluster using an initial set of master-eligible nodes:
#cluster.initial_master_nodes: ["node-1", "node-2"]
# For more information, consult the discovery and cluster formation module documentation.
# ..... Various .....
# Require explicit names when deleting indices:
#action.destructive_requires_name: true
# ..... Security .....
# *** WARNING ***
# Elasticsearch security features are not enabled by default.
# These features are free, but require configuration changes to enable them.
# This means that users don't have to provide credentials and can get full access
# to the cluster. Network connections are also not encrypted.
# To protect your data, we strongly encourage you to enable the Elasticsearch security features.
# Refer to the following documentation for instructions.
# https://www.elastic.co/guide/en/elasticsearch/reference/7.10/configuring-stack-security.html
xpack.security.enabled: true
xpack.security.authc.api_key.enabled: true
Help Write Out Where Is Cut Execute Location Undo Set Mark To Bracket Previous Back Prev Word
```

- Restart elasticsearch
systemctl restart elasticsearch
- Set up default password :
- cd usr/share/elasticsearch/bin
- sudo ./elasticsearch-setup-passwords auto
- Make sure you give elastic user name and password
- Open kibana.yml

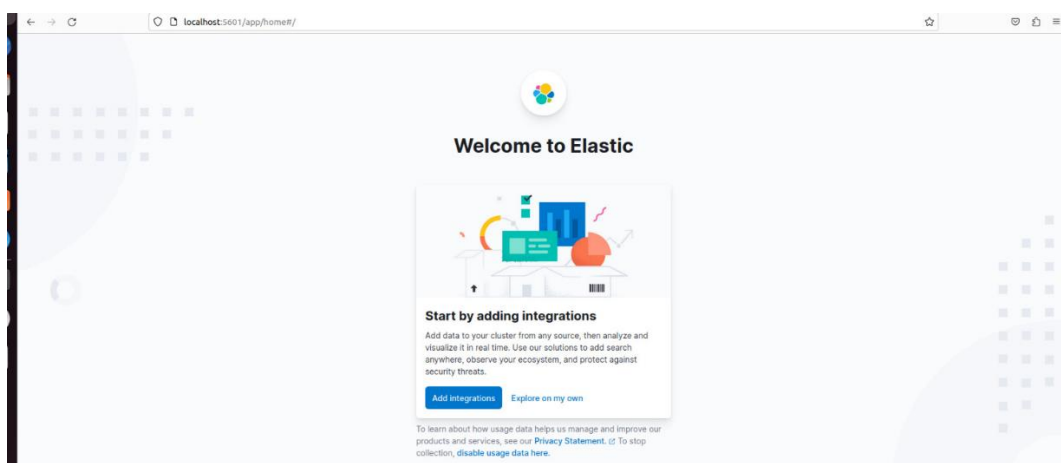
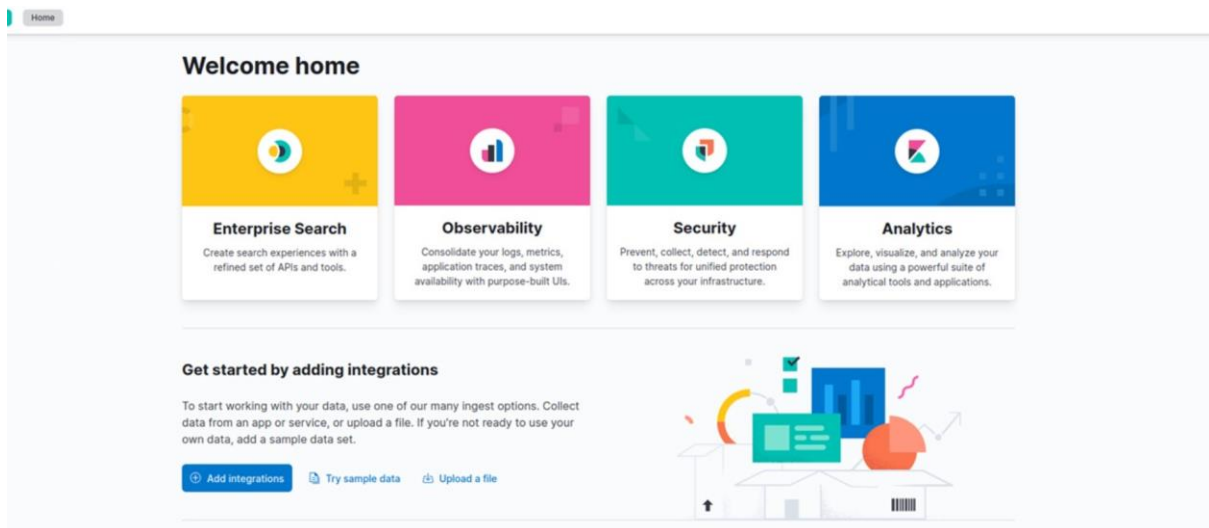
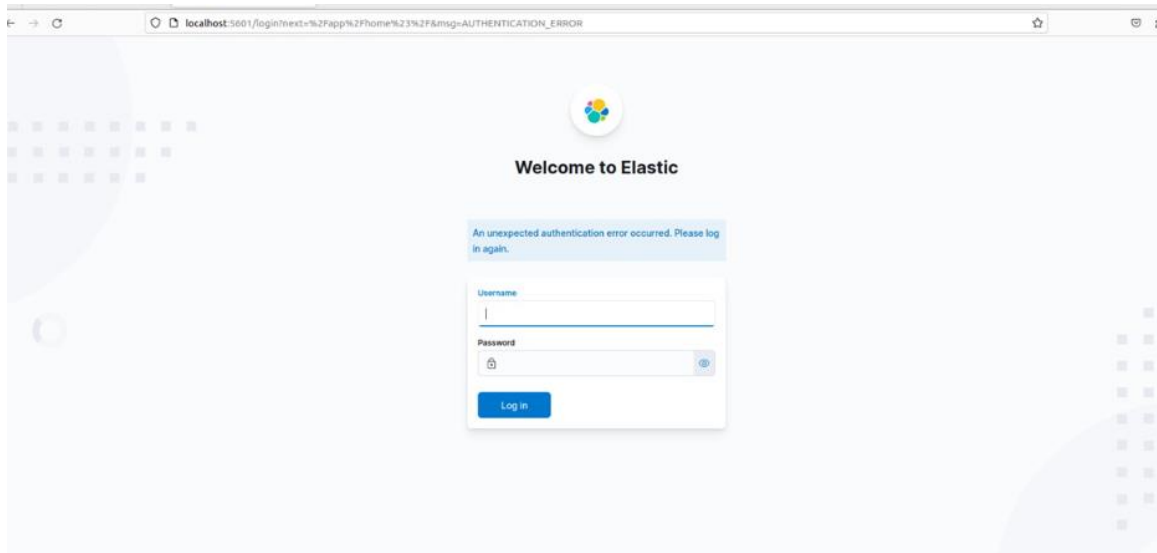
```
root@a-VirtualBox: /home/a# nano /etc/kibana/kibana.yml
root@a-VirtualBox: /home/a# nano /etc/kibana/kibana.yml
```

- Give elasticsearch username and password

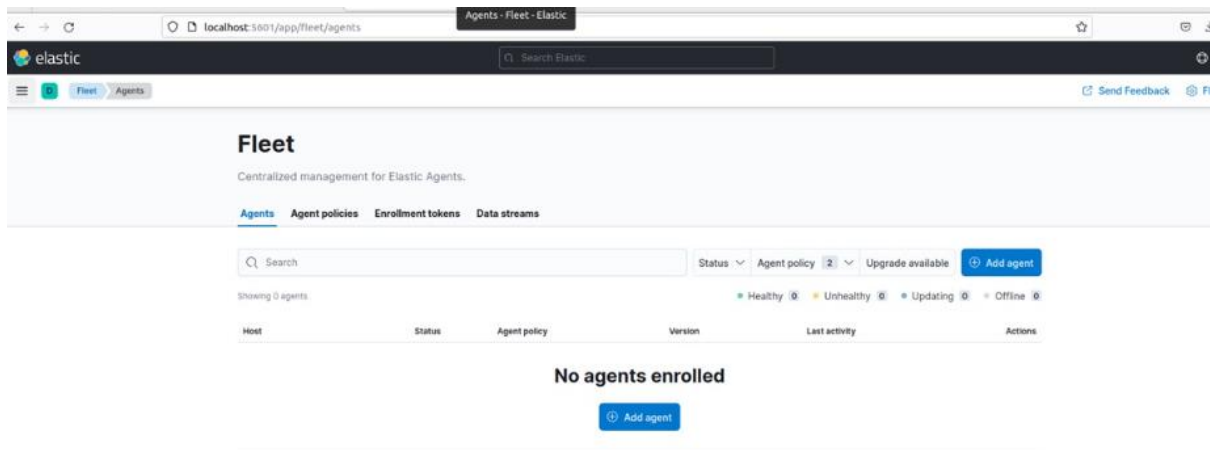
```
#Kibana.index: ".kibana"
# The default application to load.
#kibana.defaultAppId: "home"
# If your Elasticsearch is protected with basic authentication, these settings provide
# the username and password that the Kibana server uses to perform maintenance on the Kibana
# index at startup. Your Kibana users still need to authenticate with Elasticsearch, which
# is proxied through the Kibana server.
elasticsearch.username: "elasticsearch"
elasticsearch.password: "pass"
# Kibana can also authenticate to Elasticsearch via "service account tokens".
# If may use this token instead of a username/password.
# elasticsearch.serviceAccountToken: "my_token"
```

- Configure kibana uncomment server port and host

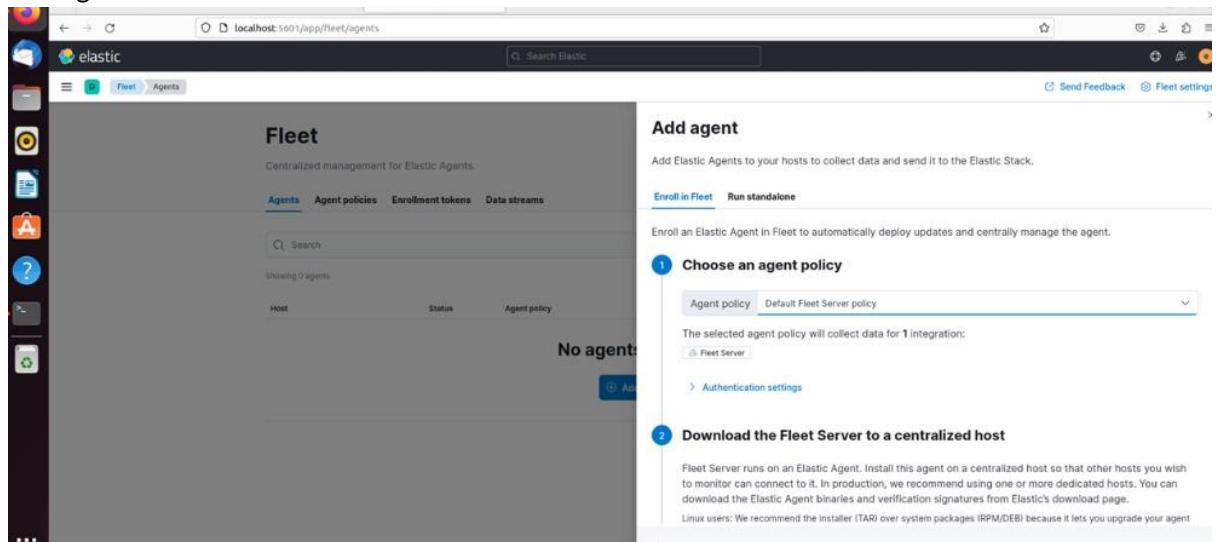
```
root@a-VirtualBox: /home/a# sudo vim /etc/kibana/kibana.yml
root@a-VirtualBox: /home/a#
```

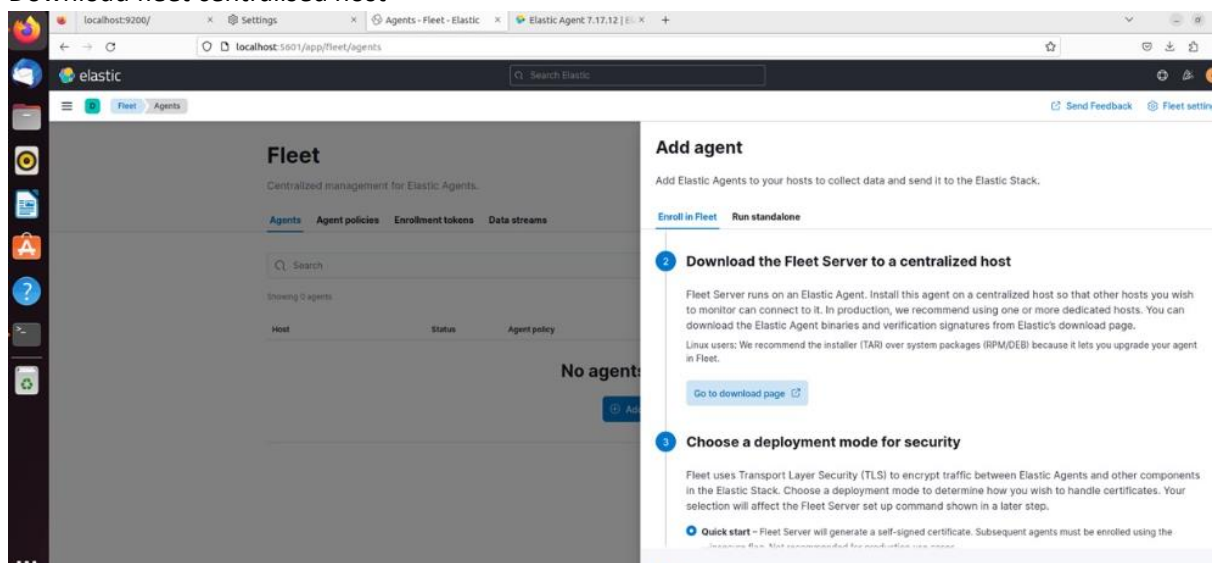
- Go to management> FLEET



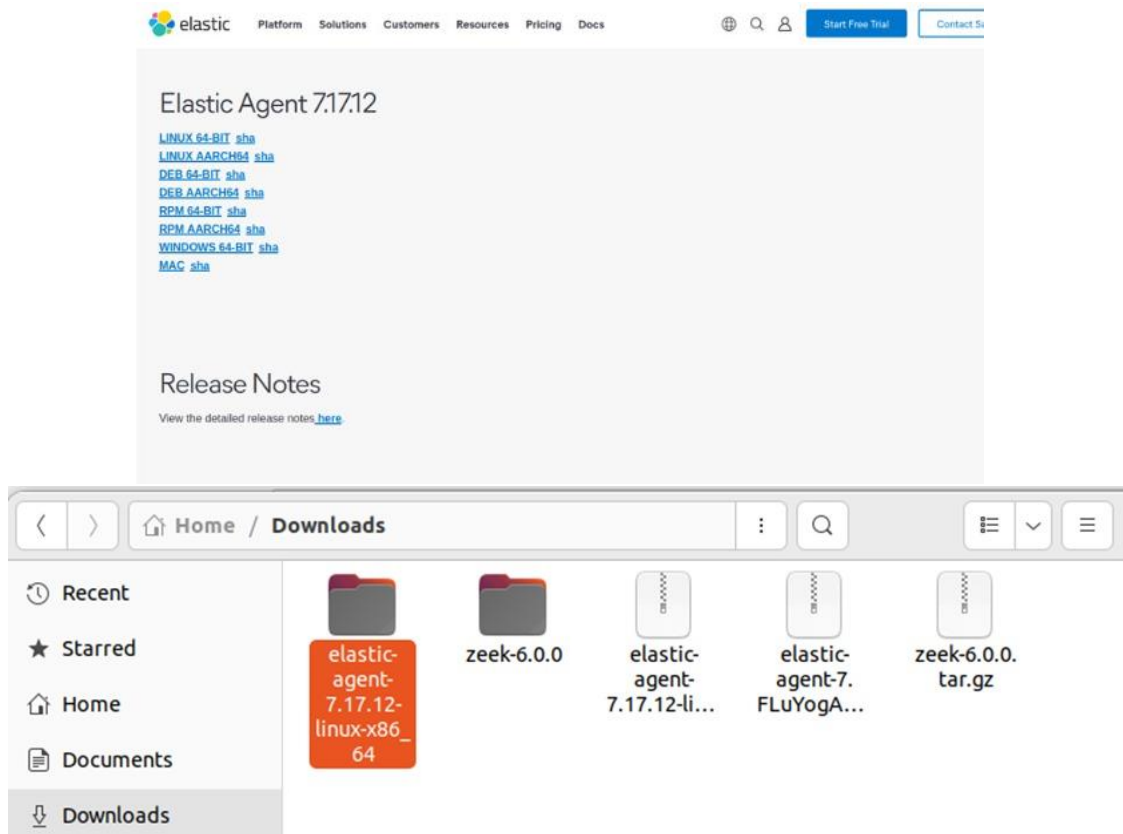
- Add agent



- Download fleet centralised host



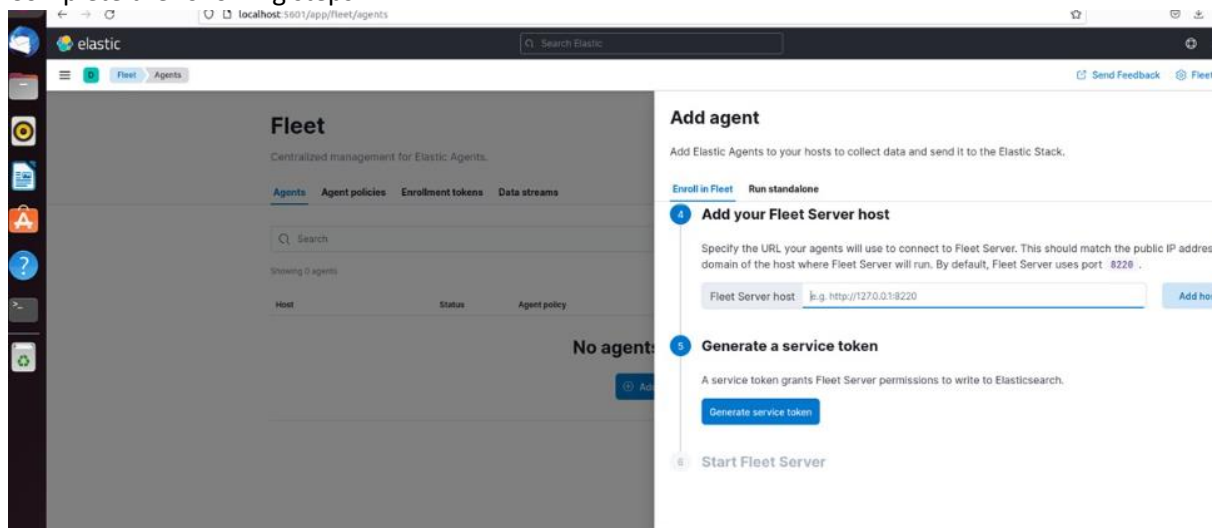
- Click download and Download

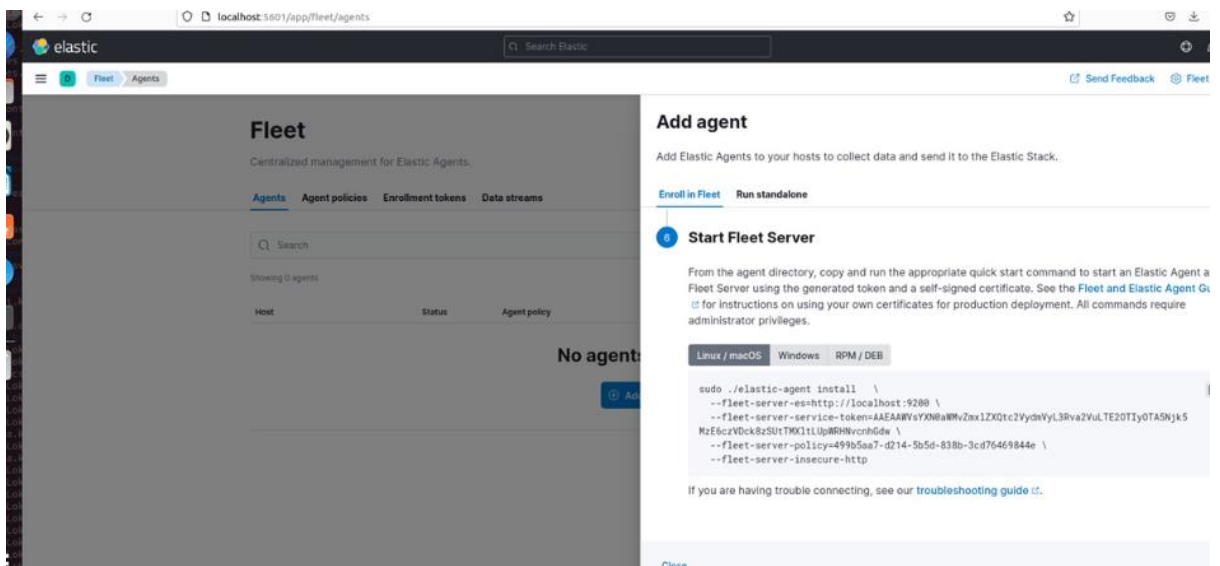
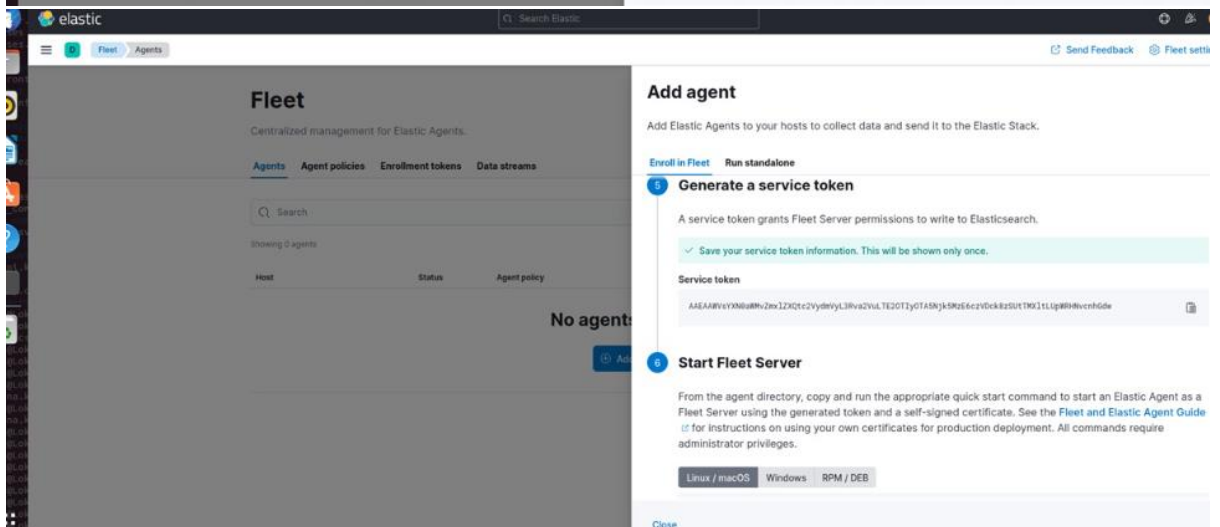
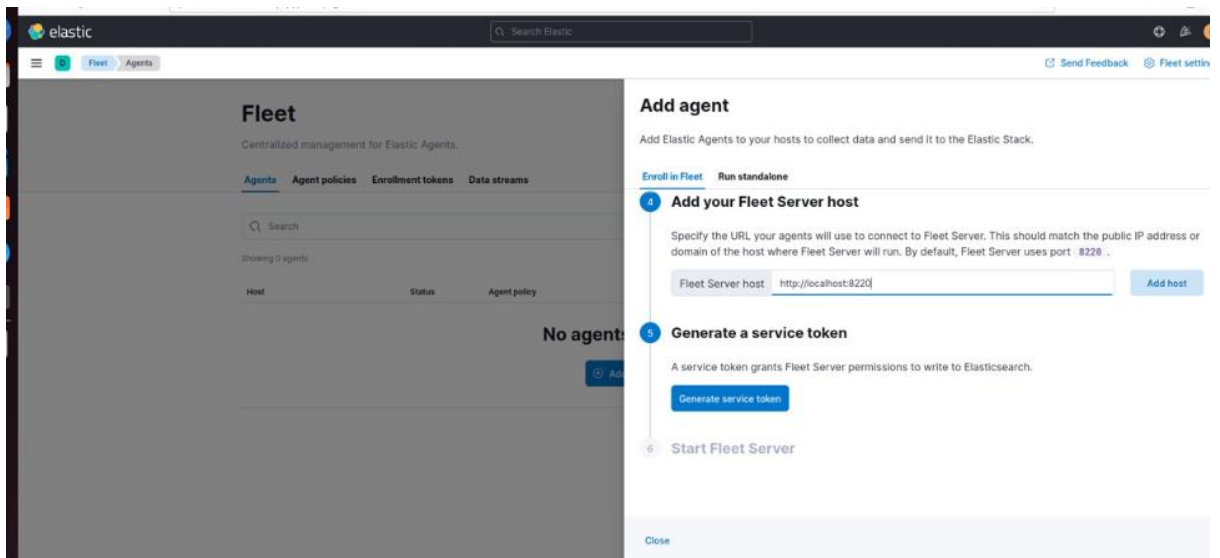


Add yours fleet host server

Fleet Server host : <http://localhost:8220> then click on add host

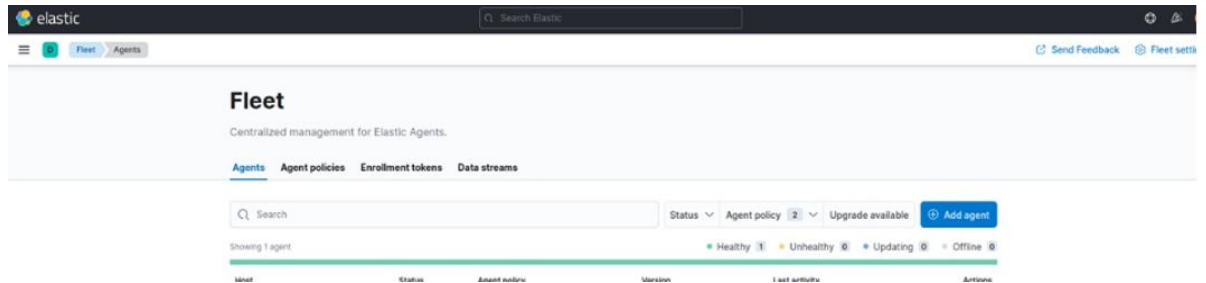
- Complete the following steps:





- Copy commands and give those command in ubuntu terminal (give commands related to which environment based elastic agent you downloaded)

- Go to the path of elastic agent and paste the fleet server commands
- Fleet server hosted



- Make sure zeek logs are running

```
[2] stopped
root@a-VirtualBox:/home/a# /opt/zeek/bin# .zeekctl deploy
checking configurations ...
installing ...
removing old policies in /opt/zeek/spool/installed-scripts-do-not-touch/site ...
removing old policies in /opt/zeek/spool/installed-scripts-do-not-touch/auto ...
creating policy directories ...
installing site policies ...
generating standalone-layout.zeek ...
generating local-networks.zeek ...
generating zeekctl-config.zeek ...
generating zeekctl-config.sh ...
stopping ...
stopping zeek ...
creating crash report for previously crashed nodes: zeek
starting ...
starting zeek ...
```

- Go to local.zeek and add a line @load policy/tuning/json_logs.zeek
- Add at the end of the file @load policy/tuning/json-logs.zeek → to solve error of getting zeek logs

```

GNU nano 0.2
@load protocols/http/detect-sqli

#### Network File Handling ####

# Enable MD5 and SHA1 hashing for all files.
@load frameworks/files/hash-all-files

# Detect SHA1 sums in Team Cymru's Malware Hash Registry.
@load frameworks/files/detect-MHR

# Extend email alerting to include hostnames
@load policy/frameworks/notice/extend-email/hostnames

# Extend the notice.log with Community ID hashes
# @load policy/frameworks/notice/community-id

# Enable logging of telemetry data into telemetry.log and
# telemetry_histogram.log.
@load frameworks/telemetry/log

# Enable metrics centralization on the manager. This opens port 9911/tcp
# on the manager node that can be readily scraped by Prometheus.
# @load frameworks/telemetry/prometheus

# Uncomment the following line to enable detection of the heartbleed attack. Enabling
# this might impact performance a bit.
# @load policy/protocols/ssl/heartbleed

# Uncomment the following line to enable logging of Community ID hashes in
# the conn.log file.
# @load policy/protocols/conn/community-id-logging

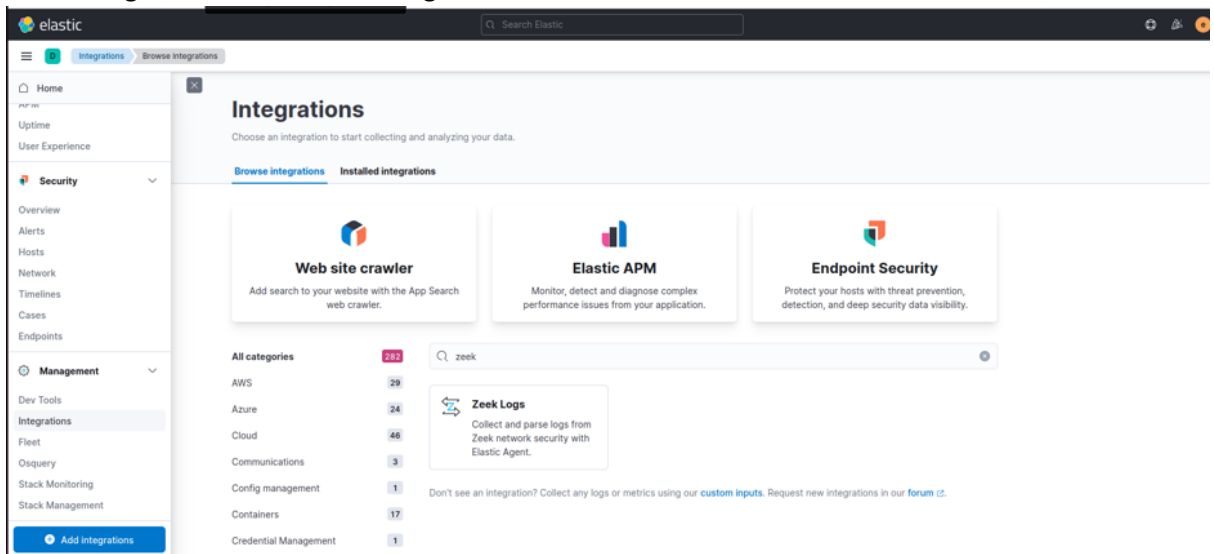
# Uncomment the following line to enable logging of connection VLANs. Enabling
# this adds two VLAN fields to the conn.log file.
# @load policy/protocols/conn/vlan-logging

# Uncomment the following line to enable logging of link-layer addresses. Enabling
# this adds the link-layer address for each connection endpoint to the conn.log file.
# @load policy/protocols/conn/mac-logging

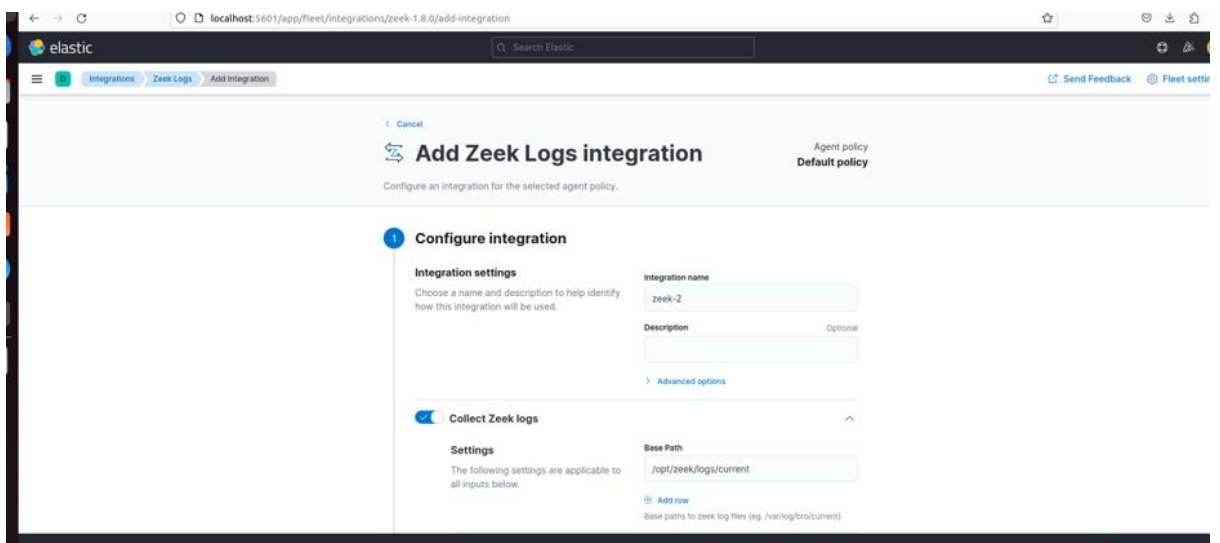
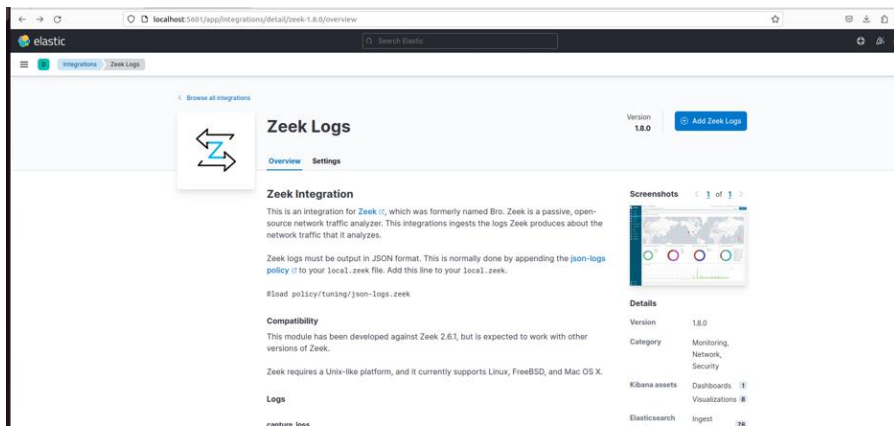
# Uncomment this to source zkg's package state
# @load packages
@load policy/tuning/ison-logs.zeek

```

- Restart zeek
- Go to integrations>> search zeek logs



- Click on zeek logs



- Give the path where zeek logs stored

```

# No such file or directory
/rtualBox:/home/a# /opt/zeel/logs/current#ls

```

```

separator \n
set separator
empty_field (empty)
unset_field
path conn
open 2023-08-15-20-00-01
fields ts uid id.orig_h id.orig_p id.resp_h id.resp_p proto tunnel_parents service duration orig_bytes resp_bytes conn_state local_orig local_resp
id_bytes history orig_pkts orig_ip_bytes resp_pkts interval count count string bool bool count string count count count set[string]
types time string addr port addr port enum string interval count count string bool bool count string count count count set[string]

```

types	time	string	addr	port	addr	port	enum	string	interval	count	count	string	bool	bool	count	string	count	count	count	set[string]
192.168.128.129	33630	192.168.128.1	53	tcp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	33630	192.168.128.1	53	tcp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	54915	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	59382	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	58498	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	48331	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	33630	192.168.128.1	53	tcp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	33630	192.168.128.1	53	tcp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	49770	192.168.128.1	53	tcp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	49770	192.168.128.1	53	tcp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	34987	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	33829	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	34753	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	42859	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	38296	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	41801	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	53672	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	49770	192.168.128.1	53	tcp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	49770	192.168.128.1	53	tcp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	40510	192.168.128.1	53	tcp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	43988	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	59767	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	44948	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	36646	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	38310	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	53275	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	51916	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0
192.168.128.129	48442	192.168.128.1	53	udp	-	-	-	-	-	-	-	-	-	-	-	OTH	T	0	C	0

localhost:5601/app/fleet/integrations/zeek-1.8.0/add-integration

elastic

IntegrationsZeek LogsAdd integration

Send Feedback

Collect Zeek logs

Settings

The following settings are applicable to all inputs below.

☒ Zeek capture_loss.log

Collect Zeek capture_loss logs

☒ Zeek conn.log

Collect Zeek connection logs

Base Path

/opt/zeek/logs/current

Add row

Base paths to zeek log files (eg. /var/log/bro/current)

Filename of capture loss log file

capture_loss.log

Add row

Preserve original event

☐ ☒

Preserves a raw copy of the original event, added to the field event.original

Advanced options

Filename of connection log

conn.log

Add row

Preserve original event

☐ ☒

localhost:5601/app/fleet/integrations/zeek-1.8.0/add-integration

elastic

IntegrationsZeek LogsAdd integration

Send FeedbackFleet settings

field event.original

Advanced options

☒ Zeek dce_rpc.log

Collect Zeek dce_rpc logs

Filename of dce_rpc log file

dce_rpc.log

Add row

Preserve original event

☐ ☒

Preserves a raw copy of the original event, added to the field event.original

Advanced options

☒ Zeek dhcp.log

Collect Zeek dhcp logs

Filename of dhcp log file

dhcp.log

Add row

Advanced options

☒ Zeek dnp3.log

Collect Zeek dnp3 logs

Filename of dnp3 log file

dnp3.log

Add row

localhost:5601/app/fleet/integrations/zeek-1.8.0/add-integration

elastic

IntegrationsZeek LogsAdd integration

Send FeedbackFleet settings

☒ Zeek dns.log

Collect Zeek dns logs

Filename of dns log file

dns.log

Add row

Preserve original event

☐ ☒

Preserves a raw copy of the original event, added to the field event.original

Advanced options

☒ Zeek dpd.log

Collect Zeek dpd logs

Filename of the dpd log file

dpd.log

Add row

Advanced options

☒ Zeek files.log

Collect Zeek files logs

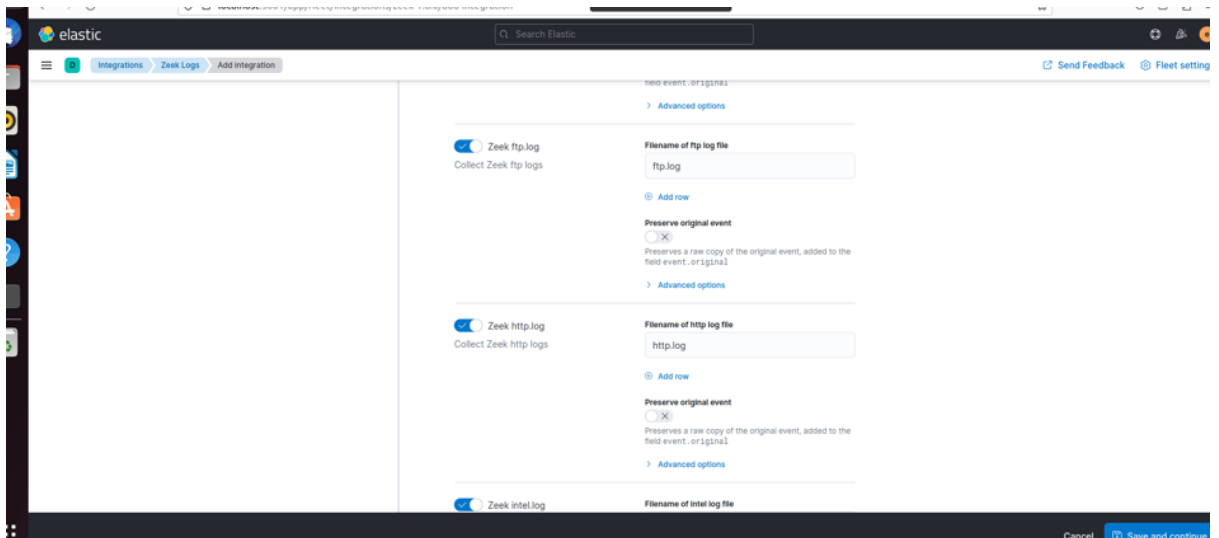
Filename of the files log file

files.log

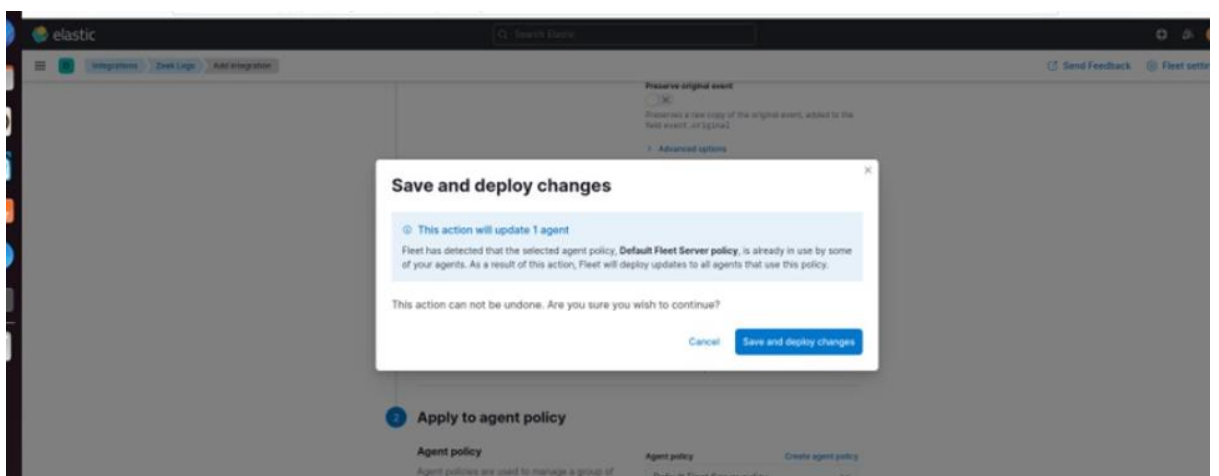
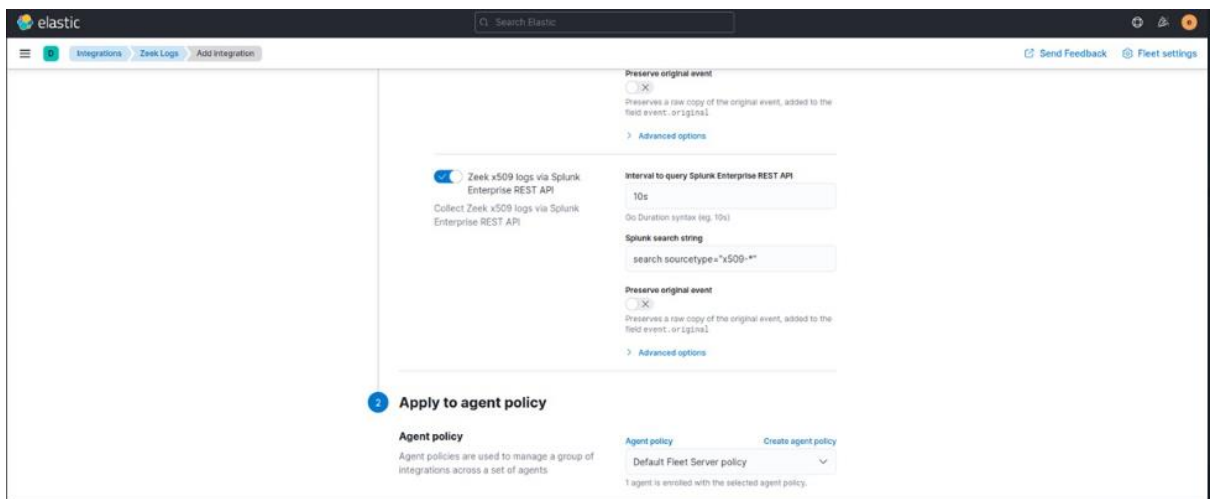
Add row

Preserve original event

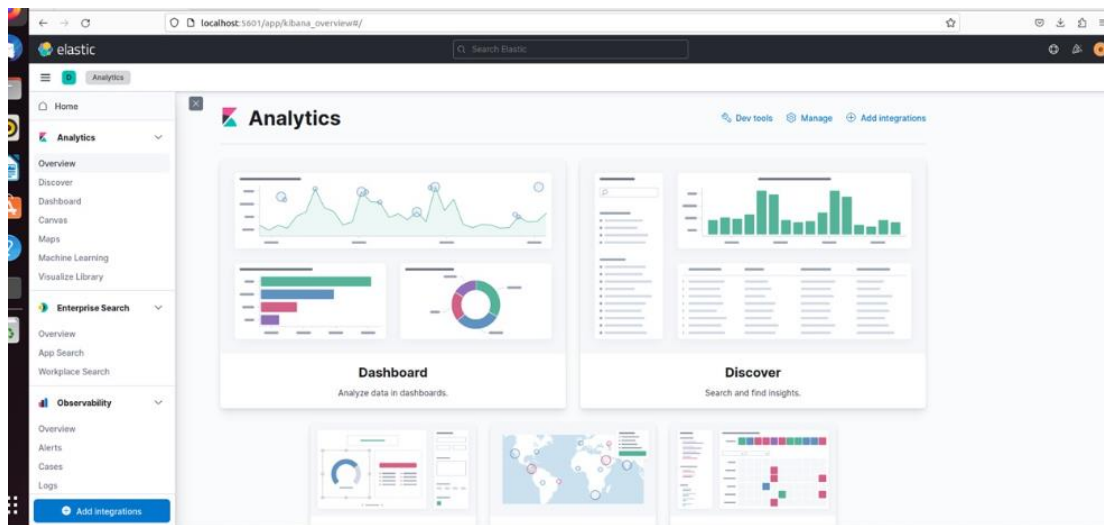
☐ ☒



- Leave all by default
- Change Agent policy



- Go to discover



- In the logs

