ANALYSE DES DONNÉES DE RÉSEAU

Elasticsearch

Logstash

Kibana

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SOMMAIRE

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INTRODUCTION

Aujourd’hui, avec la croissance exponentielle des réseaux et l’augmentation des cybermenaces, il devient essentiel pour les organisations de surveiller et analyser leur trafic réseau. Cette tâche, cependant, est complexe en raison du volume massif de données générées quotidiennement.

C’est dans ce contexte que notre projet s’inscrit. Il exploite la puissance de la stack ELK (Elasticsearch, Logstash, Kibana), une solution moderne et robuste permettant de collecter, traiter et visualiser les données réseau en temps réel.

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PROBLÉMATIQUE

Avec l'explosion des volumes de données générées par les réseaux informatiques, il devient de plus en plus difficile pour les entreprises de surveiller efficacement leur trafic, détecter les anomalies et répondre rapidement aux menaces de sécurité. Les outils classiques d’analyse sont souvent limités en termes de performances et de visualisation, rendant la prise de décision lente et peu efficace.

Comment concevoir une solution performante et accessible pour capturer, analyser et visualiser en temps réel le trafic réseau afin de renforcer la sécurité et optimiser les performances du système ?

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Objectifs du Projet

Installation et configuration de la pile ELK (Elasticsearch, Logstash, Kibana)

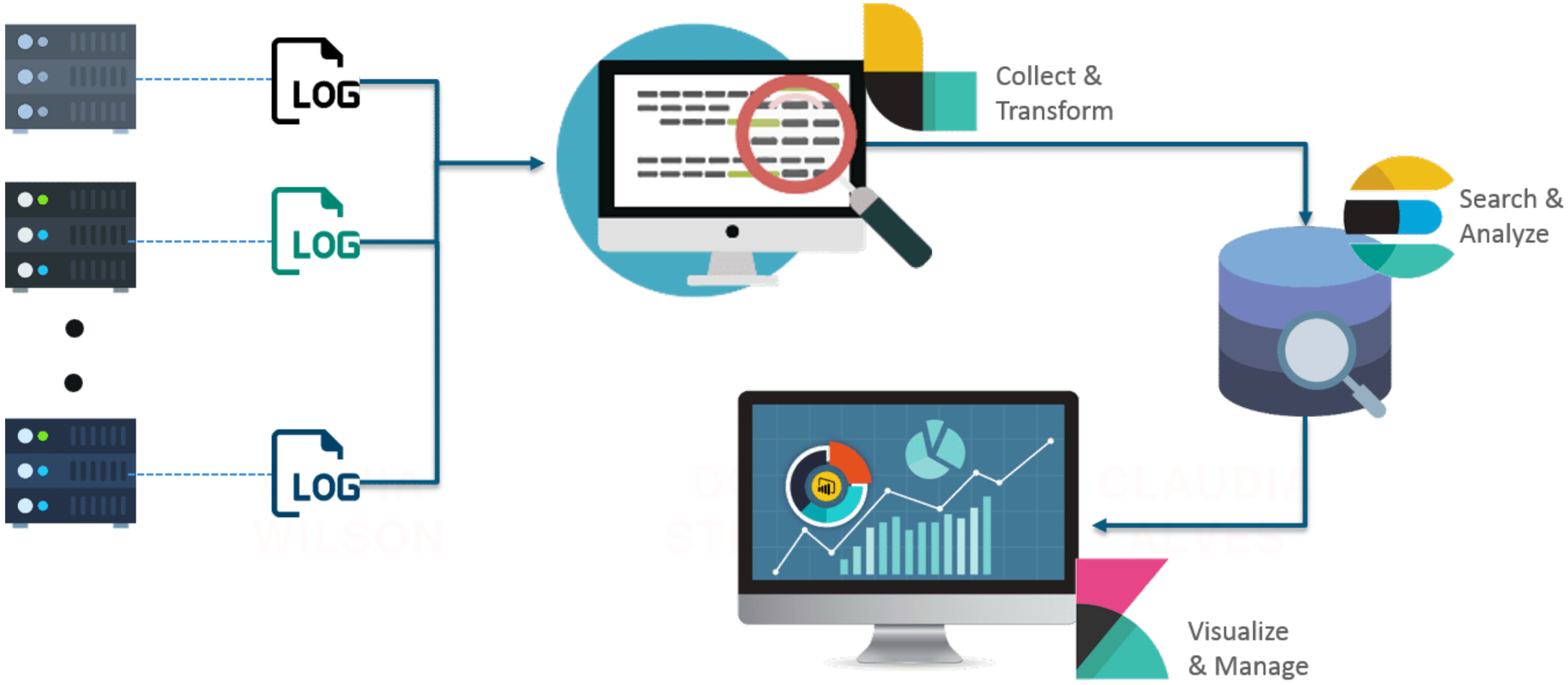
Capture et traitement des données réseau.

Automatisation l'indexation et l'analyse des données avec un script Python.

Création des tableaux de bord interactifs avec Kibana pour visualiser

- **Distribution des protocoles.**
- **IP sources principales.**
- **Chronologie du trafic réseau.**

09 ARCHITECTURE DE ELK



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ÉTAPES DE RÉALISATION

01 Préparation de l’environnement.

02 Configuration de la stack ELK (Elasticsearch, Logstash, Kibana, Filebeat)

03 Capture et transformation des données.

04 Création de visualisations interactives dans Kibana.

Configuration de Elasticsearch

```
┌──(kali㉿kali)-[~]
└─$ sudo bash -c 'cat > /etc/elasticsearch/elasticsearch.yml << EOL
cluster.name: kali-cluster
node.name: node-1
path.data: /var/lib/elasticsearch
path.logs: /var/log/elasticsearch
network.host: localhost
http.port: 9200
discovery.type: single-node
EOL'
```

```
┌──(kali㉿kali)-[~]
└─$ curl http://localhost:9200
{
  "name" : "node-1",
  "cluster_name" : "kali-cluster",
  "cluster_uuid" : "fJqWMnNUQWGtA_J3lXSYgg",
  "version" : {
    "number" : "7.17.14",
    "build_flavor" : "default",
    "build_type" : "deb",
    "build_hash" : "774e3bfa4d52e2834e4d9d8d669d77e4e5c1017f",
    "build_date" : "2023-10-05T22:17:33.780167078Z",
    "build_snapshot" : false,
    "lucene_version" : "8.11.1",
    "minimum_wire_compatibility_version" : "6.8.0",
    "minimum_index_compatibility_version" : "6.0.0-beta1"
  },
  "tagline" : "You Know, for Search"
}
```

Configuration de Logstash

```
┌──(kali㉿kali)-[~/Project_ELK]
└─$ sudo nano /etc/logstash/conf.d/network.conf
```

```
  GNU nano 8.2                                  /etc/logstash/conf.d/network.conf
# /etc/logstash/conf.d/network.conf
input {
  file {
    path => "/home/kali/Project_ELK/network_analysis/network_data.json"
    start_position => "beginning"
    sincedb_path => "/dev/null"
    codec => json
    type => "pcap"
  }
}

filter {
  if [type] == "pcap" {
    date {
      match => [ "timestamp", "ISO8601" ]
      target => "@timestamp"
    }

    geoip {
      source => "source_ip"
      target => "source_location"
    }

    # Enrichissement supplémentaire
    mutate {
      add_field => {
        "processed_by" => "logstash"
        "analysis_type" => "enhanced"
      }
    }
  }
}

output {
  elasticsearch {
    hosts => ["localhost:9200"]
    index => "network-analysis-enriched-%{+YYYY.MM.dd}"
  }
  stdout { codec => rubydebug }
}
```

Configuration de Kibana

```
┌──(kali㉿kali)-[~]
└─$ sudo apt --fix-broken install

Summary:
  Upgrading: 0, Installing: 0, Removing: 0, Not Upgrading: 34

┌──(kali㉿kali)-[~]
└─$ sudo bash -c 'cat > /etc/kibana/kibana.yml << EOL
server.port: 5601
server.host: "localhost"
elasticsearch.hosts: ["http://localhost:9200"]
EOL'
```

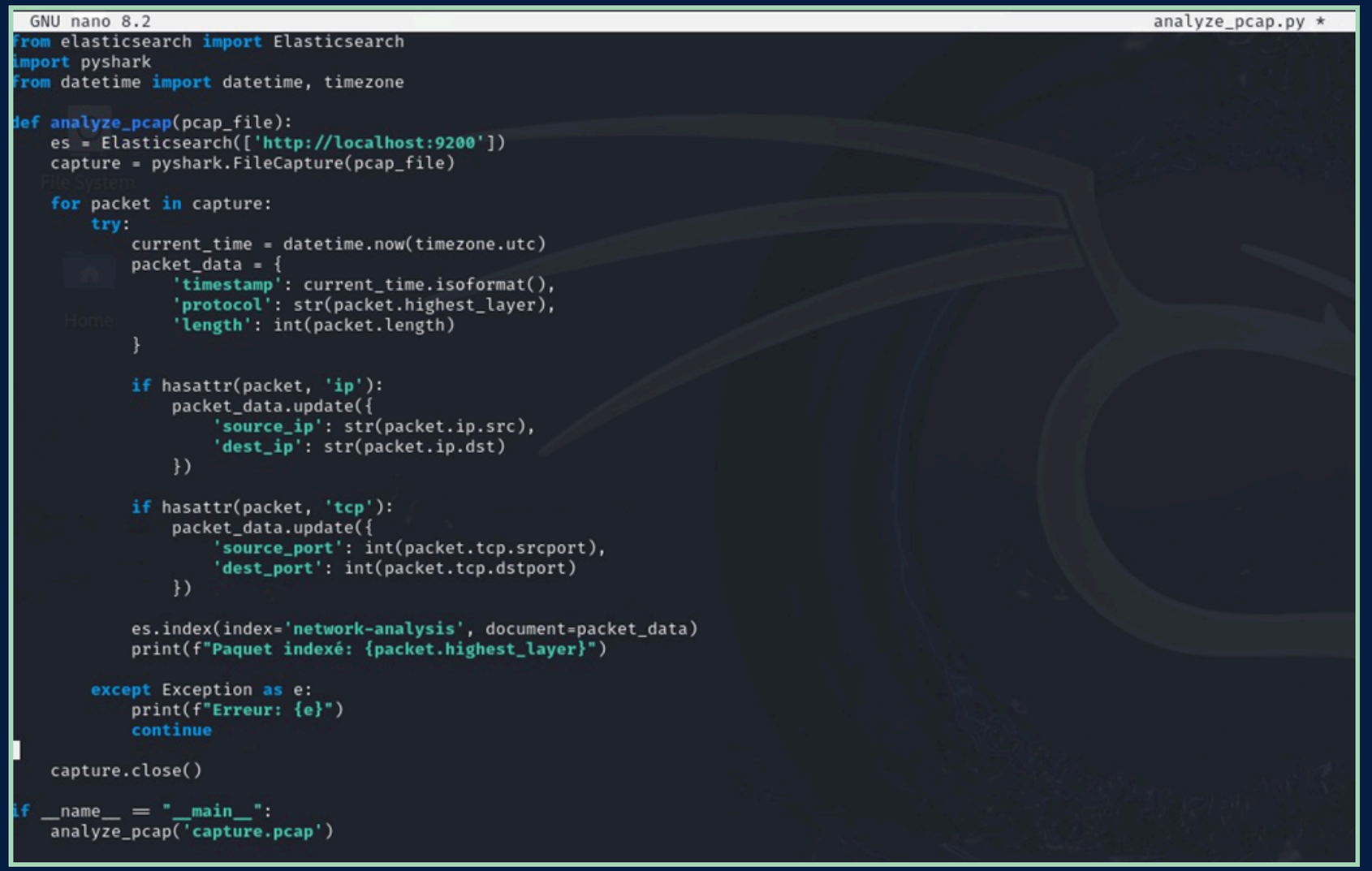
```
┌──(kali㉿kali)-[/etc/logstash/conf.d]
└─$ curl http://localhost:5601/app/home

<!DOCTYPE html><html lang="en"><head><meta charSet="utf-8"/><meta http-equiv="X-UA-Compatible" content="IE=edg
ewport" content="width=device-width"/><title>Elastic</title><style>

        @font-face {
          font-family: 'Inter';
          font-style: normal;
          font-weight: 100;
          src: url('/ui/fonts/inter/Inter-Thin.woff2') format('woff2'), url('/ui/fonts/inter/Inter-Thin.woff')
        }

        @font-face {
          font-family: 'Inter';
          font-style: italic;
          font-weight: 100;
          src: url('/ui/fonts/inter/Inter-ThinItalic.woff2') format('woff2'), url('/ui/fonts/inter/Inter-Thin
;
        }
```

Capture et analyse de trafic réseau

```
┌──(kali㉿kali)-[~/Project_ELK]
└─$ sudo tcpdump -i eth0 -w capture.pcap -G 60 -W 1
tcpdump: listening on eth0, link-type EN10MB (Ethernet), snapshot length 262144 bytes
^C29 packets captured
29 packets received by filter
0 packets dropped by kernel
```

```
┌──(kali㉿kali)-[~]
└─$ nmap localhost
Starting Nmap 7.94SVN ( https://nmap.org ) at 2024-11-12 11:51 EST
Nmap scan report for localhost (127.0.0.1)
Host is up (0.0000070s latency).
Other addresses for localhost (not scanned): ::1
Not shown: 998 closed tcp ports (reset)
PORT     STATE SERVICE
22/tcp   open  ssh
9200/tcp open  wap-wsp

Nmap done: 1 IP address (1 host up) scanned in 0.10 seconds

┌──(kali㉿kali)-[~]
└─$ ping google.com
curl example.com
PING google.com (142.250.184.174) 56(84) bytes of data.
64 bytes from mad07s23-in-f14.1e100.net (142.250.184.174): icmp_seq=1 ttl=128 time=19.6 ms
64 bytes from mad07s23-in-f14.1e100.net (142.250.184.174): icmp_seq=2 ttl=128 time=20.6 ms
64 bytes from mad07s23-in-f14.1e100.net (142.250.184.174): icmp_seq=3 ttl=128 time=19.1 ms
64 bytes from mad07s23-in-f14.1e100.net (142.250.184.174): icmp_seq=4 ttl=128 time=19.0 ms
^C
── google.com ping statistics ──
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 19.041/19.594/20.631/0.640 ms
<!doctype html>
<html>
<head>
    <title>Example Domain</title>

    <meta charset="utf-8" />
    <meta http-equiv="Content-type" content="text/html; charset=utf-8" />
    <meta name="viewport" content="width=device-width, initial-scale=1" />
    <style type="text/css">
    body {
        background-color: #f0f0f2;
        margin: 0;
        padding: 0;
        font-family: -apple-system, system-ui, BlinkMacSystemFont, "Segoe UI", "Open Sans", "Helvetica Neue", Helvetica, Arial, sans-serif;

    }
    div {
        width: 600px;
        margin: 5em auto;
        padding: 2em;
```

Capture et analyse de trafic réseau



Capture et analyse de trafic réseau

```
┌──(myenv)─(kali㉿kali)-[~/Project_ELK/network_analysis]
└─$ python3 analyze_pcap.py
/home/kali/Project_ELK/network_analysis/analyze_pcap.py:31: ElasticsearchWarning: Elasticsearch built-in security features are not enabled
See https://www.elastic.co/guide/en/elasticsearch/reference/7.17/security-minimal-setup.html to enable security.
  es.index(index='network-analysis', document=packet_data)
Paquet indexé: DNS
Paquet indexé: DNS
Paquet indexé: DNS
Paquet indexé: DNS
Paquet indexé: ICMP
Paquet indexé: ICMP
Paquet indexé: DNS
Paquet indexé: DNS
Paquet indexé: ICMP
Paquet indexé: ICMP
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Paquet indexé: ICMP
Paquet indexé: ICMP
Paquet indexé: ICMP
Paquet indexé: DNS
Paquet indexé: DNS
Paquet indexé: DNS
Paquet indexé: DNS
Paquet indexé: TCP
Paquet indexé: TCP
Paquet indexé: TCP
Paquet indexé: HTTP
Paquet indexé: TCP
Paquet indexé: DATA-TEXT-LINES
Paquet indexé: TCP
Paquet indexé: TCP
Paquet indexé: TCP
Paquet indexé: TCP
Paquet indexé: TCP
```
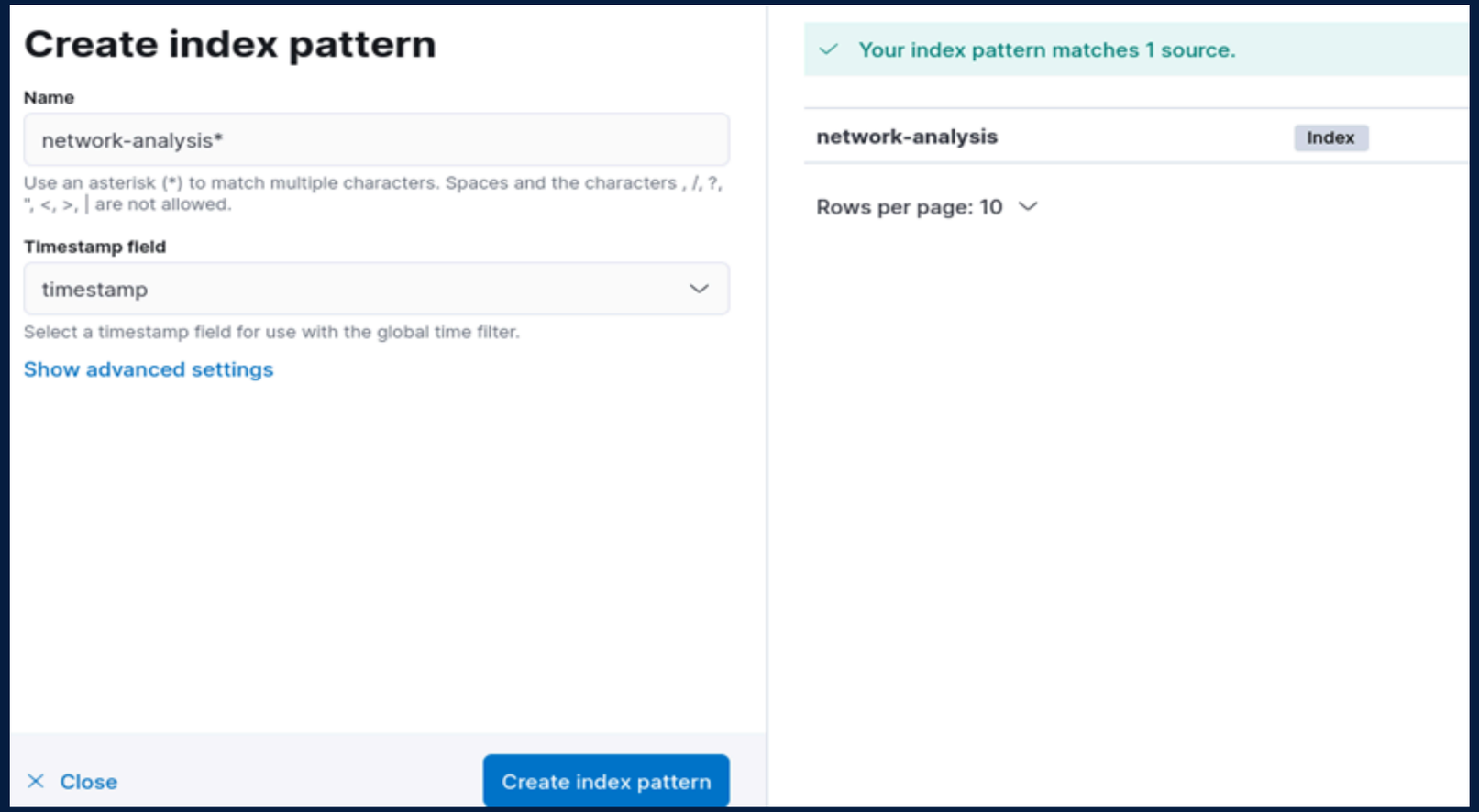
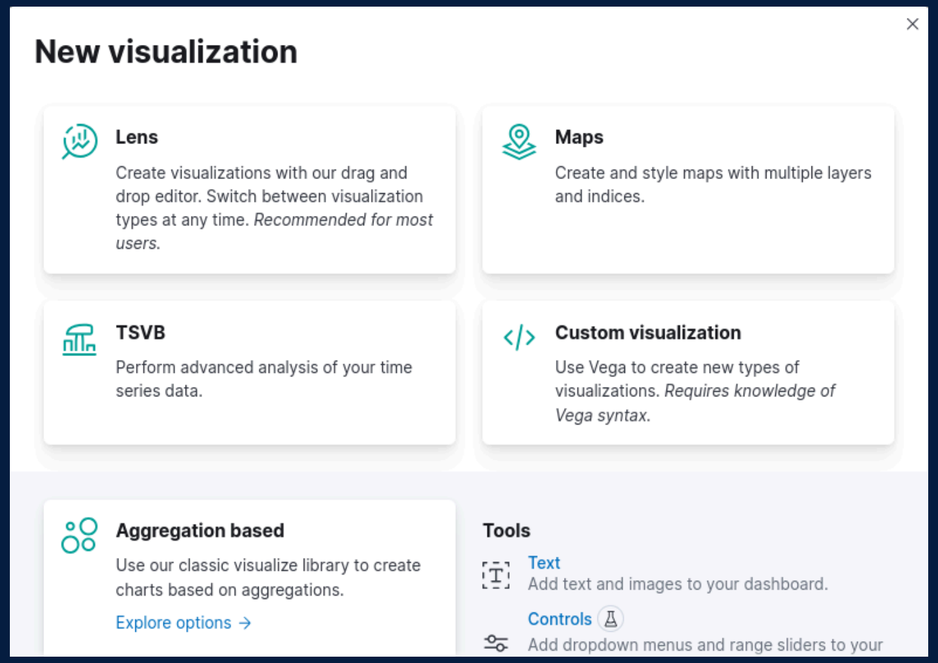

Capture et analyse de trafic réseau

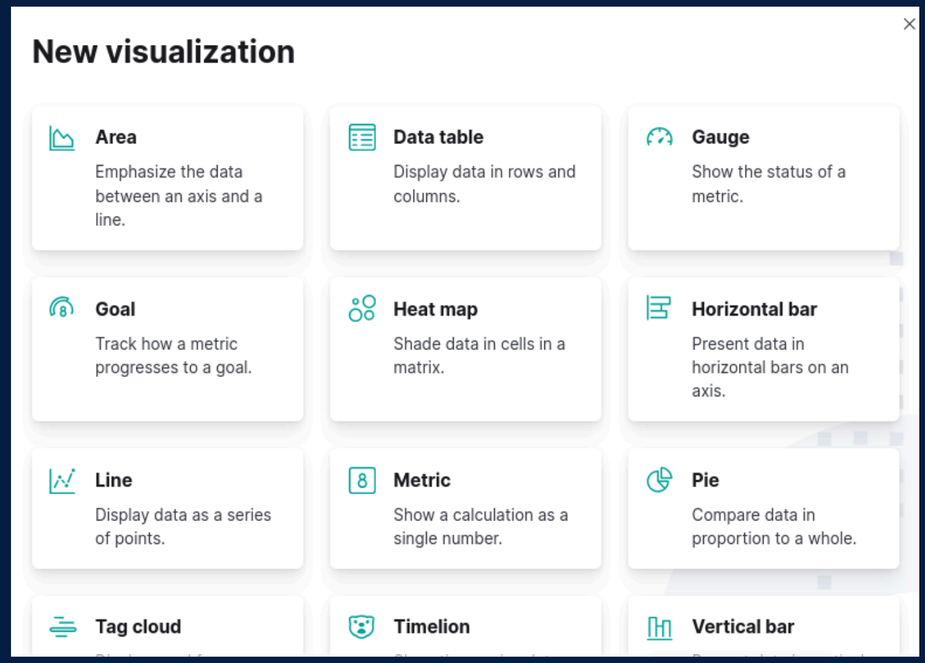
```
┌──(myenv)─(kali㉿kali)-[~/Project_ELK/network_analysis]
└─$ cat network_data.json
{"timestamp": "2024-11-12T12:39:12.838397", "protocol": "DNS", "length": 70, "source_ip": "192.168.145.128", "dest_ip": "192.168.145.2"}
{"timestamp": "2024-11-12T12:39:12.840613", "protocol": "DNS", "length": 70, "source_ip": "192.168.145.128", "dest_ip": "192.168.145.2"}
{"timestamp": "2024-11-12T12:39:12.842126", "protocol": "DNS", "length": 98, "source_ip": "192.168.145.2", "dest_ip": "192.168.145.128"}
{"timestamp": "2024-11-12T12:39:12.843370", "protocol": "DNS", "length": 86, "source_ip": "192.168.145.2", "dest_ip": "192.168.145.128"}
{"timestamp": "2024-11-12T12:39:12.844190", "protocol": "ICMP", "length": 98, "source_ip": "192.168.145.128", "dest_ip": "142.250.184.174"}
{"timestamp": "2024-11-12T12:39:12.845010", "protocol": "ICMP", "length": 98, "source_ip": "142.250.184.174", "dest_ip": "192.168.145.128"}
{"timestamp": "2024-11-12T12:39:12.845911", "protocol": "DNS", "length": 88, "source_ip": "192.168.145.128", "dest_ip": "192.168.145.2"}
{"timestamp": "2024-11-12T12:39:12.846810", "protocol": "DNS", "length": 127, "source_ip": "192.168.145.2", "dest_ip": "192.168.145.128"}
{"timestamp": "2024-11-12T12:39:12.847567", "protocol": "ICMP", "length": 98, "source_ip": "192.168.145.128", "dest_ip": "142.250.184.174"}
{"timestamp": "2024-11-12T12:39:12.848230", "protocol": "ICMP", "length": 98, "source_ip": "142.250.184.174", "dest_ip": "192.168.145.128"}
{"timestamp": "2024-11-12T12:39:12.849349", "protocol": "ICMP", "length": 98, "source_ip": "192.168.145.128", "dest_ip": "142.250.184.174"}
{"timestamp": "2024-11-12T12:39:12.850108", "protocol": "ICMP", "length": 98, "source_ip": "142.250.184.174", "dest_ip": "192.168.145.128"}
{"timestamp": "2024-11-12T12:39:12.851302", "protocol": "ICMP", "length": 98, "source_ip": "192.168.145.128", "dest_ip": "142.250.184.174"}
{"timestamp": "2024-11-12T12:39:12.852793", "protocol": "ICMP", "length": 98, "source_ip": "142.250.184.174", "dest_ip": "192.168.145.128"}
{"timestamp": "2024-11-12T12:39:12.854233", "protocol": "DNS", "length": 71, "source_ip": "192.168.145.128", "dest_ip": "192.168.145.2"}
{"timestamp": "2024-11-12T12:39:12.855355", "protocol": "DNS", "length": 71, "source_ip": "192.168.145.128", "dest_ip": "192.168.145.2"}
{"timestamp": "2024-11-12T12:39:12.856486", "protocol": "DNS", "length": 99, "source_ip": "192.168.145.2", "dest_ip": "192.168.145.128"}
{"timestamp": "2024-11-12T12:39:12.857670", "protocol": "DNS", "length": 87, "source_ip": "192.168.145.2", "dest_ip": "192.168.145.128"}
{"timestamp": "2024-11-12T12:39:12.860459", "protocol": "TCP", "length": 74, "source_ip": "192.168.145.128", "dest_ip": "93.184.215.14", "source_port": 37408, "dest_port": 80}
{"timestamp": "2024-11-12T12:39:12.865836", "protocol": "TCP", "length": 60, "source_ip": "93.184.215.14", "dest_ip": "192.168.145.128", "source_port": 80, "dest_port": 37408}
{"timestamp": "2024-11-12T12:39:12.868755", "protocol": "TCP", "length": 54, "source_ip": "192.168.145.128", "dest_ip": "93.184.215.14", "source_port": 37408, "dest_port": 80}
{"timestamp": "2024-11-12T12:39:12.871318", "protocol": "HTTP", "length": 129, "source_ip": "192.168.145.128", "dest_ip": "93.184.215.14", "source_port": 37408, "dest_port": 80}
{"timestamp": "2024-11-12T12:39:12.874737", "protocol": "TCP", "length": 60, "source_ip": "93.184.215.14", "dest_ip": "192.168.145.128", "source_port": 80, "dest_port": 37408}
{"timestamp": "2024-11-12T12:39:12.880544", "protocol": "DATA-TEXT-LINES", "length": 1652, "source_ip": "93.184.215.14", "dest_ip": "192.168.145.128", "source_port": 80, "dest_port": 37408}
{"timestamp": "2024-11-12T12:39:12.883345", "protocol": "TCP", "length": 54, "source_ip": "192.168.145.128", "dest_ip": "93.184.215.14", "source_port": 37408, "dest_port": 80}
{"timestamp": "2024-11-12T12:39:12.886491", "protocol": "TCP", "length": 54, "source_ip": "192.168.145.128", "dest_ip": "93.184.215.14", "source_port": 37408, "dest_port": 80}
{"timestamp": "2024-11-12T12:39:12.888774", "protocol": "TCP", "length": 60, "source_ip": "93.184.215.14", "dest_ip": "192.168.145.128", "source_port": 80, "dest_port": 37408}
{"timestamp": "2024-11-12T12:39:12.891146", "protocol": "TCP", "length": 60, "source_ip": "93.184.215.14", "dest_ip": "192.168.145.128", "source_port": 80, "dest_port": 37408}
{"timestamp": "2024-11-12T12:39:12.893385", "protocol": "TCP", "length": 54, "source_ip": "192.168.145.128", "dest_ip": "93.184.215.14", "source_port": 37408, "dest_port": 80}
```

Création de visualisations interactives dans Kibana.

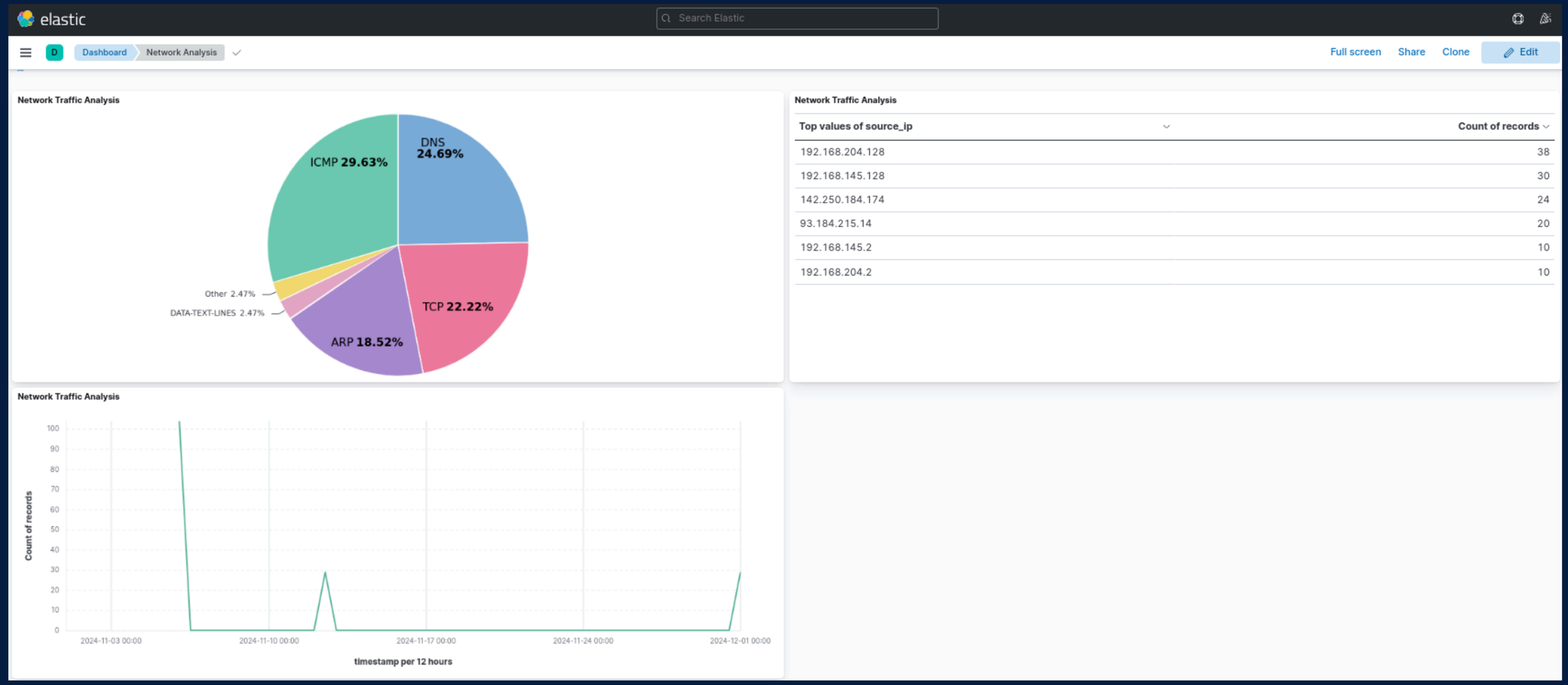


Création de visualisations interactives dans Kibana.





Création de visualisations interactives dans Kibana.



DÉFIS RENCONTRÉS

- Incompatibilités de Versions entre Elasticsearch, Logstash et Kibana
- Problèmes de Connexion sur le Port 9200 (Elasticsearch)
- Redémarrages Fréquents de la Service Elasticsearch

CONCLUSION

En conclusion, ce projet a permis de démontrer l'efficacité de la stack ELK pour l’analyse du trafic réseau en temps réel. Grâce à l’intégration de Elasticsearch, Logstash, Kibana, et Filebeat, nous avons pu collecter, traiter et visualiser les données réseau de manière fluide et performante. Bien que des défis techniques aient été rencontrés, comme les problèmes de compatibilité et de ressources, les solutions apportées ont permis d'optimiser le système. Ce projet montre l’importance des outils modernes pour une gestion proactive des réseaux, offrant ainsi une meilleure visibilité et une détection rapide des anomalies pour renforcer la sécurité et la gestion des infrastructures.

MERCI DE VOTRE ATTENTION!