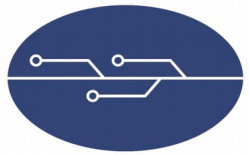
Network Telescopes Revisited

From Loads of Unwanted Traffic to Threat Intelligence

Piotr Bazydło, Adrian Korczak, Paweł Pawliński

Research and Academic Computer Network
(NASK, Poland)



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Who are we

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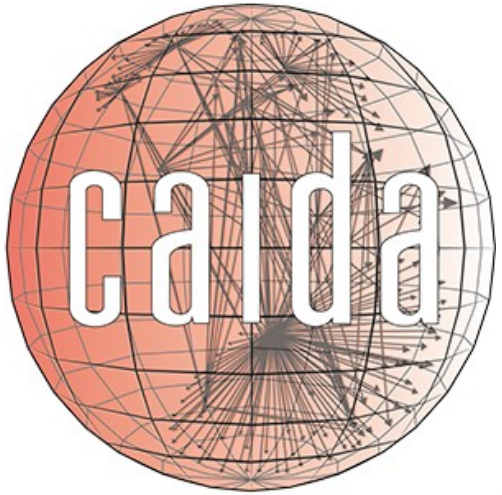
Network Telescope

- Also known as **darknet** or blackhole.
- Unused IP address space.
- No legitimate network traffic should be observed.

- First (?) & largest telescope (approx /8):



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Network Telescope

In practice, we can see a lot of different activities:

- Misconfiguration of network devices/applications.
- Scanning.
- Backscatter from DoS attacks.
- Exploitation attempts (UDP).
- Weird stuff.

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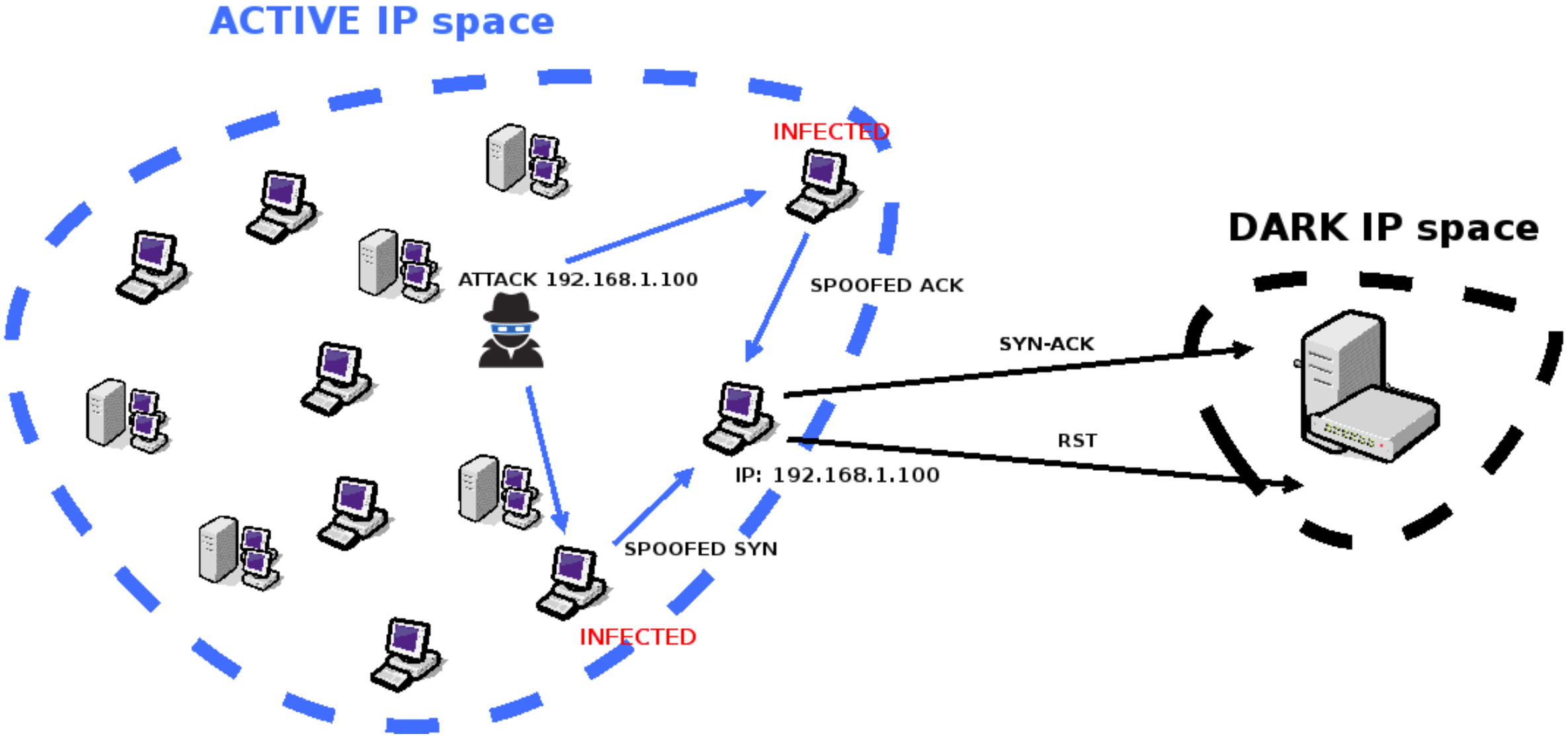
DoS attacks (backscatter)



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What we want to achieve?

- Detect large-scale malicious events (botnets, exploits).
- Detect attacks on interesting targets.
- Track activities of specific actors responsible.
- Understand the dynamics (trends).

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Problems

- How to group packets?
- How to classify them into events?
- How to find interesting events?
- How to identify actors?
- How to analyze trends?

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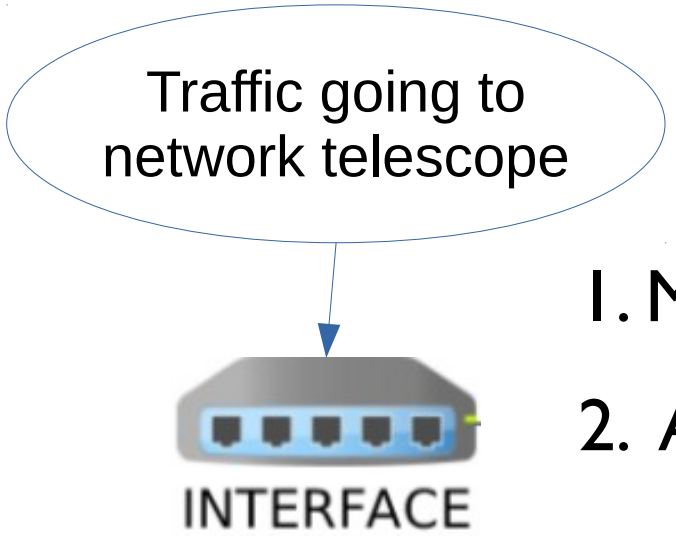
Our approach



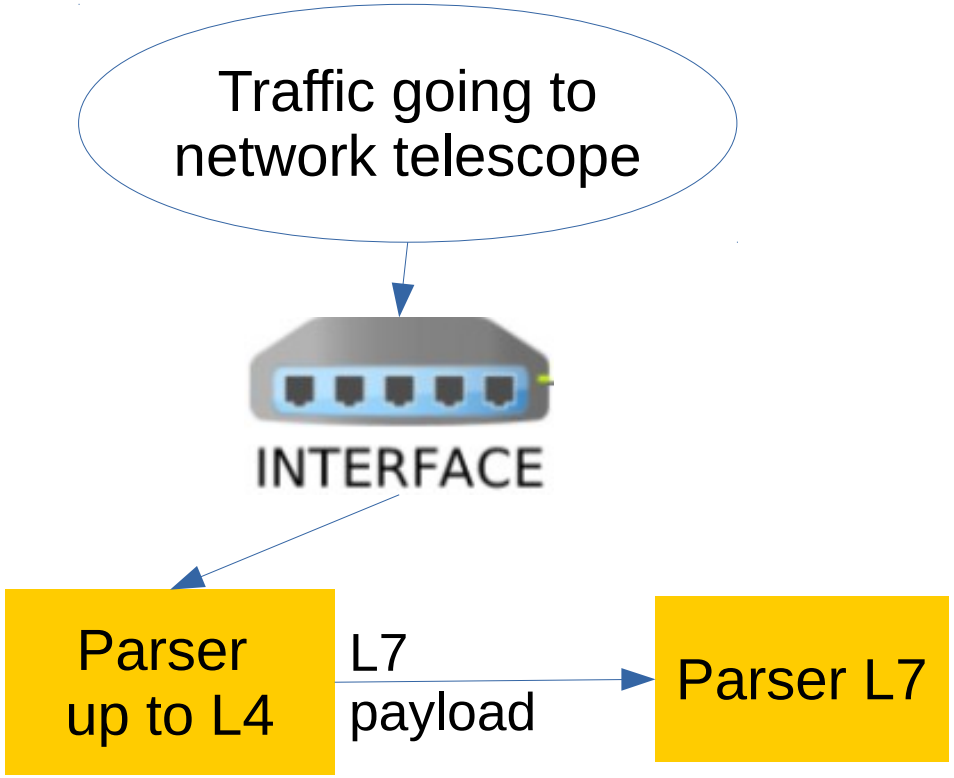
1. Monitored IPv4 space: **> 100 000** addresses
2. Analyze captured traffic every 5 minutes.

Stats:

~ 10 000 pps

~ 25 000 000 000 packets per month

80% = TCP



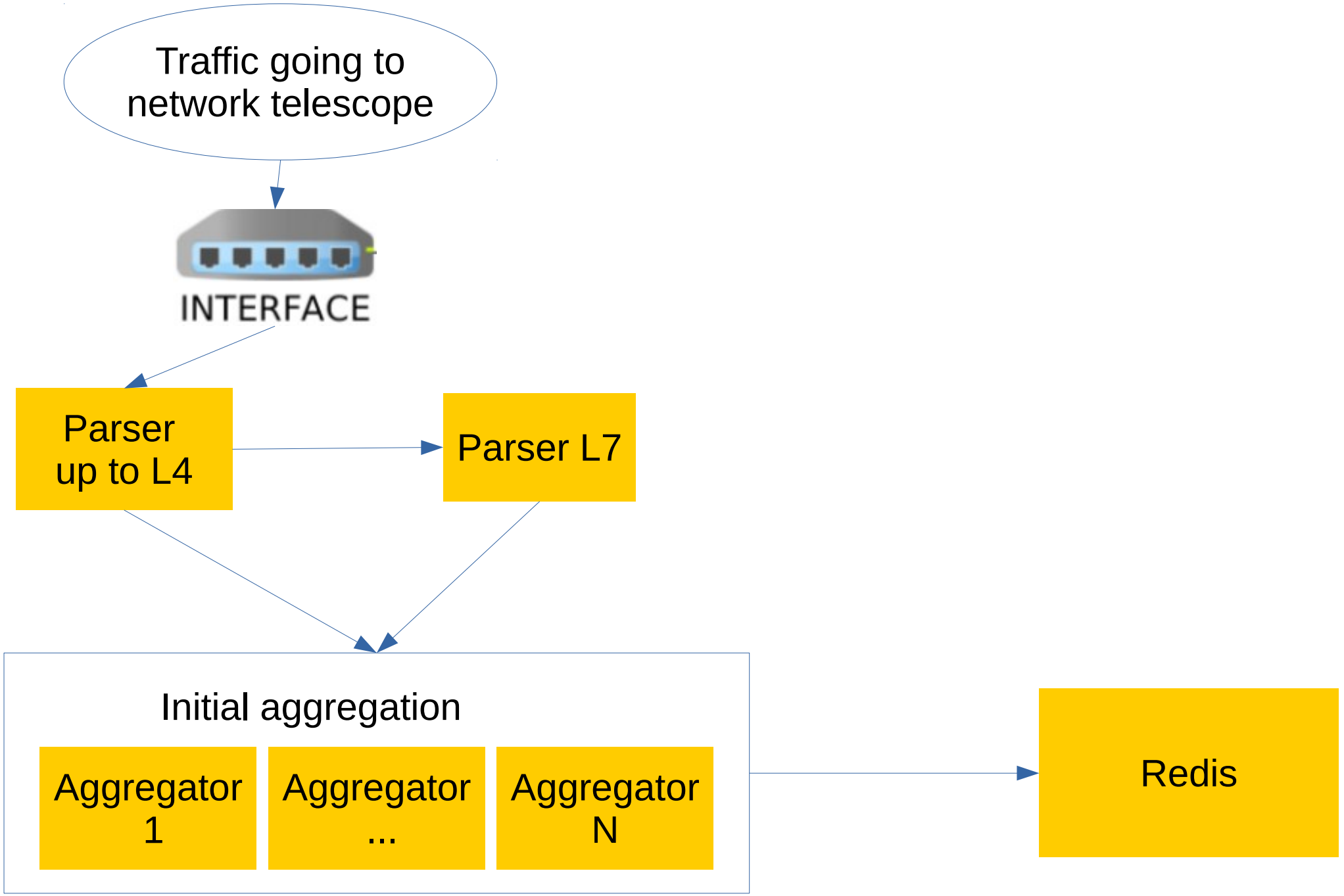
Two parsing scripts:

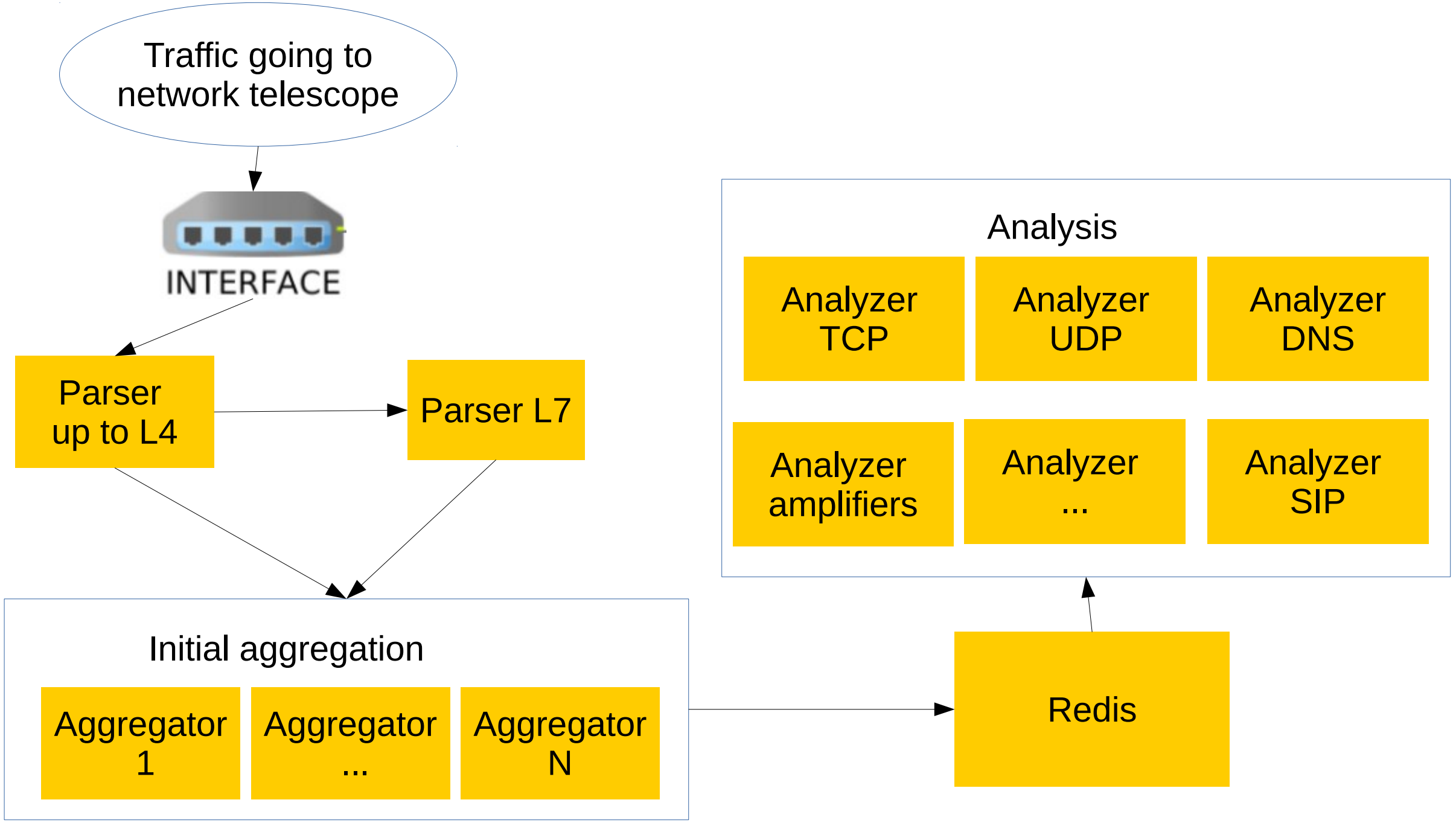
- Parser L4 – up to 4th OSI layer.

written in C++, uses libtins library.

- Parser 7 – parsing of 7th OSI layer.

written in python, uses dpkt library


Traffic going to network telescope
INTERFACE
Parser up to L4
Parser L7
Initial aggregation
Aggregator 1
Aggregator ...
Aggregator N
Redis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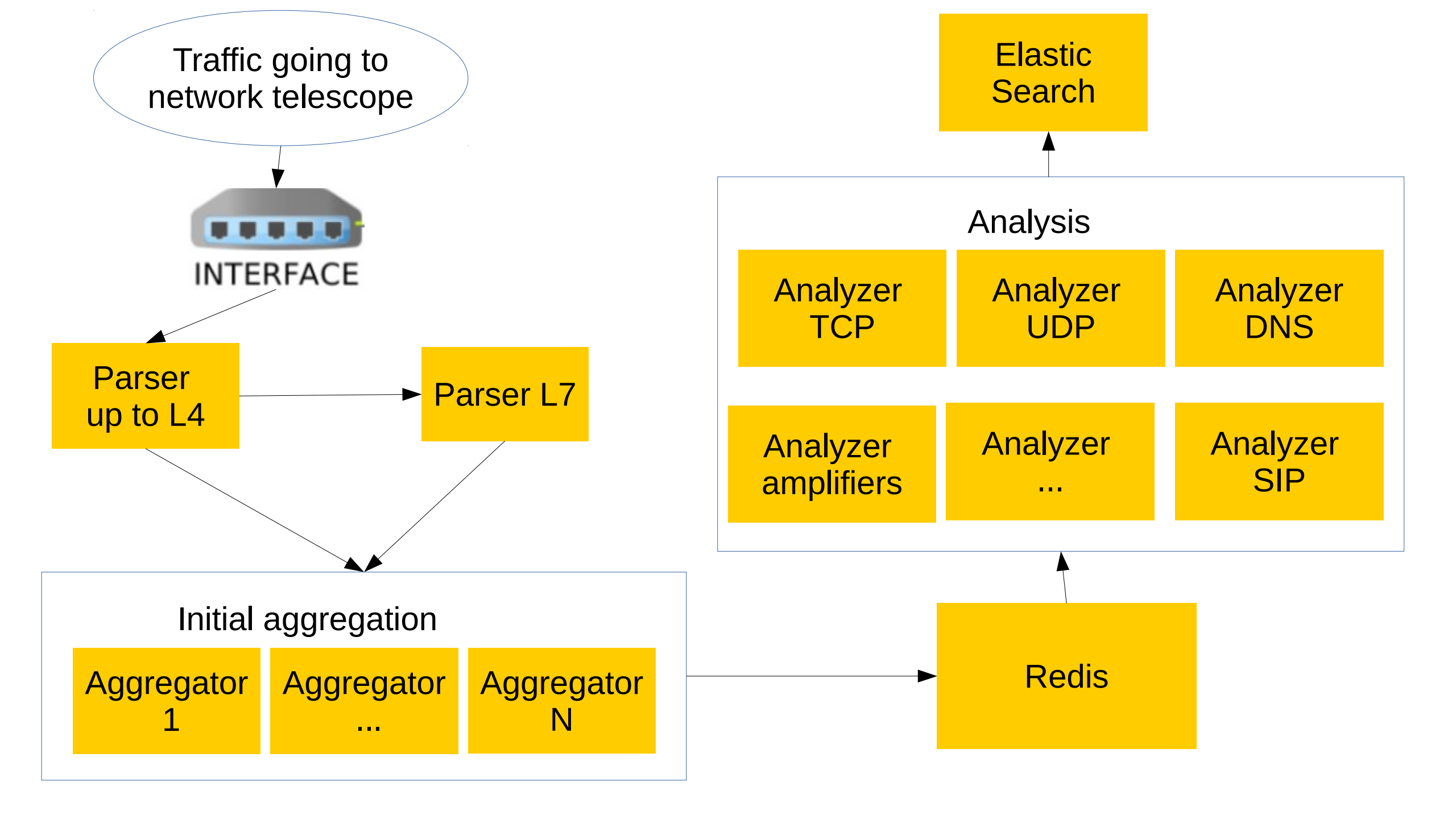
Analyzer UDP
Analyzer DNS
Analyzer amplifiers
Analyzer ...
Analyzer SIP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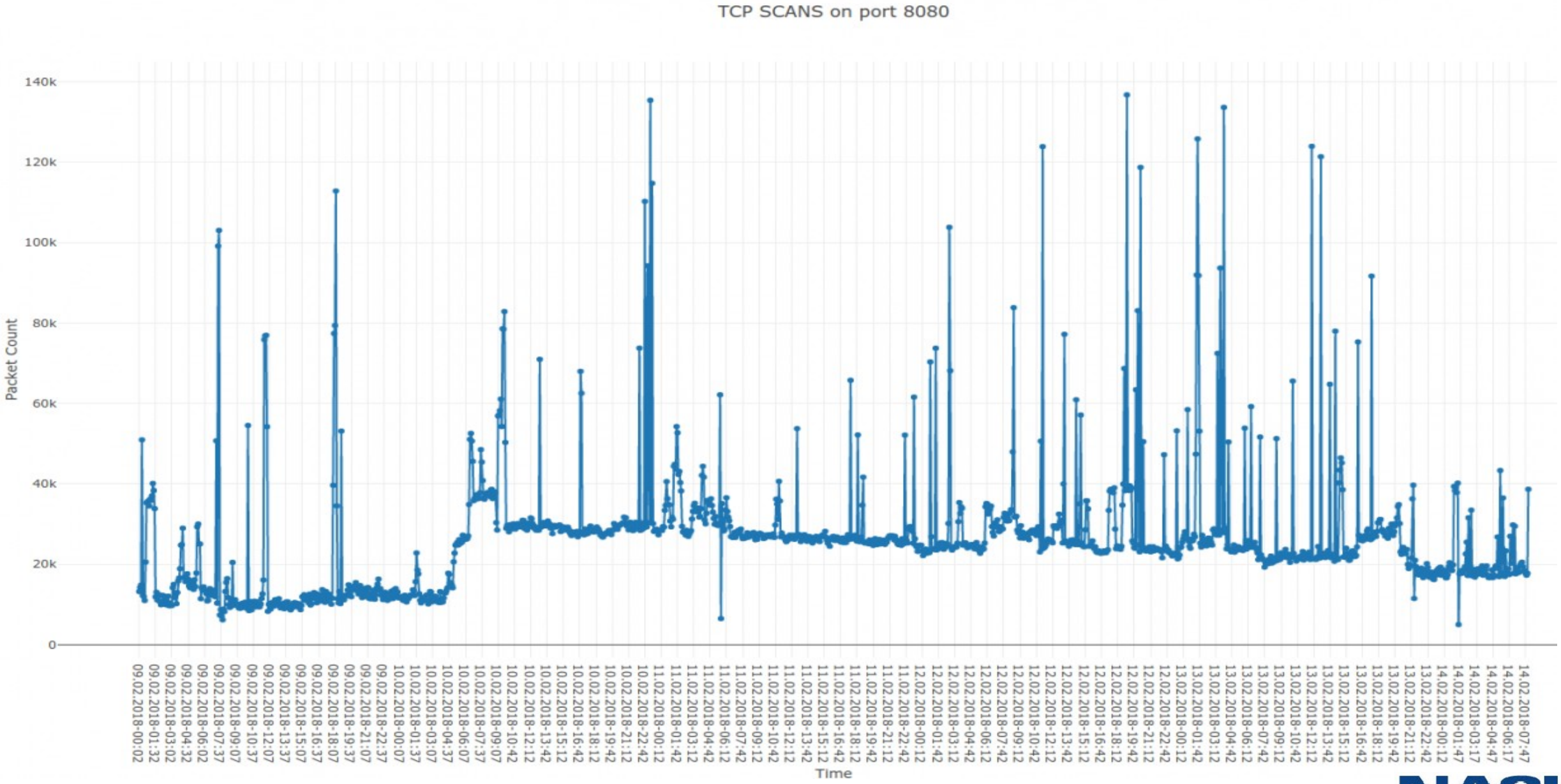
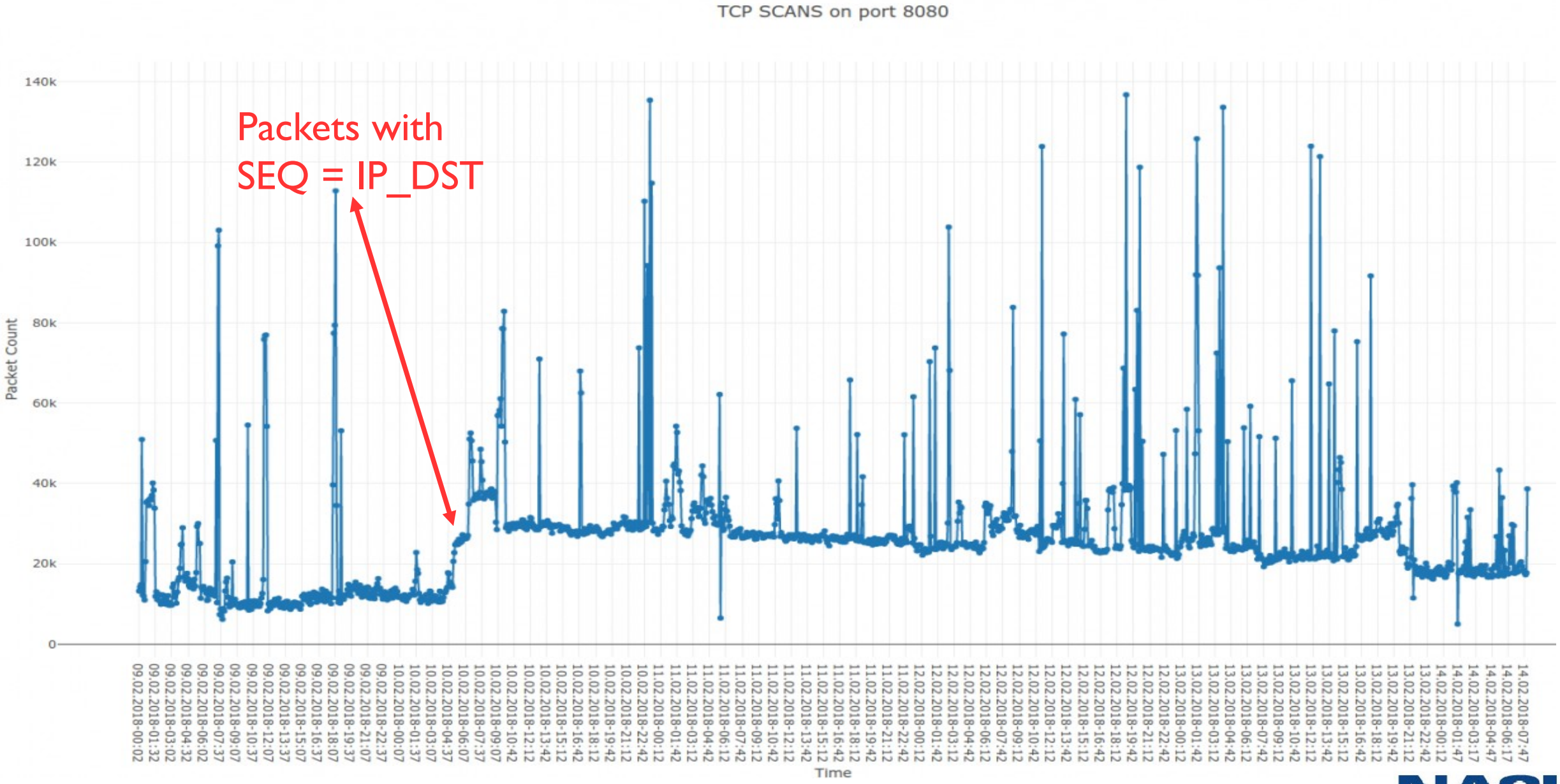
Elastic Search

Case study 1
Botnet Fingerprinting

Botnet fingerprinting



Botnet fingerprinting



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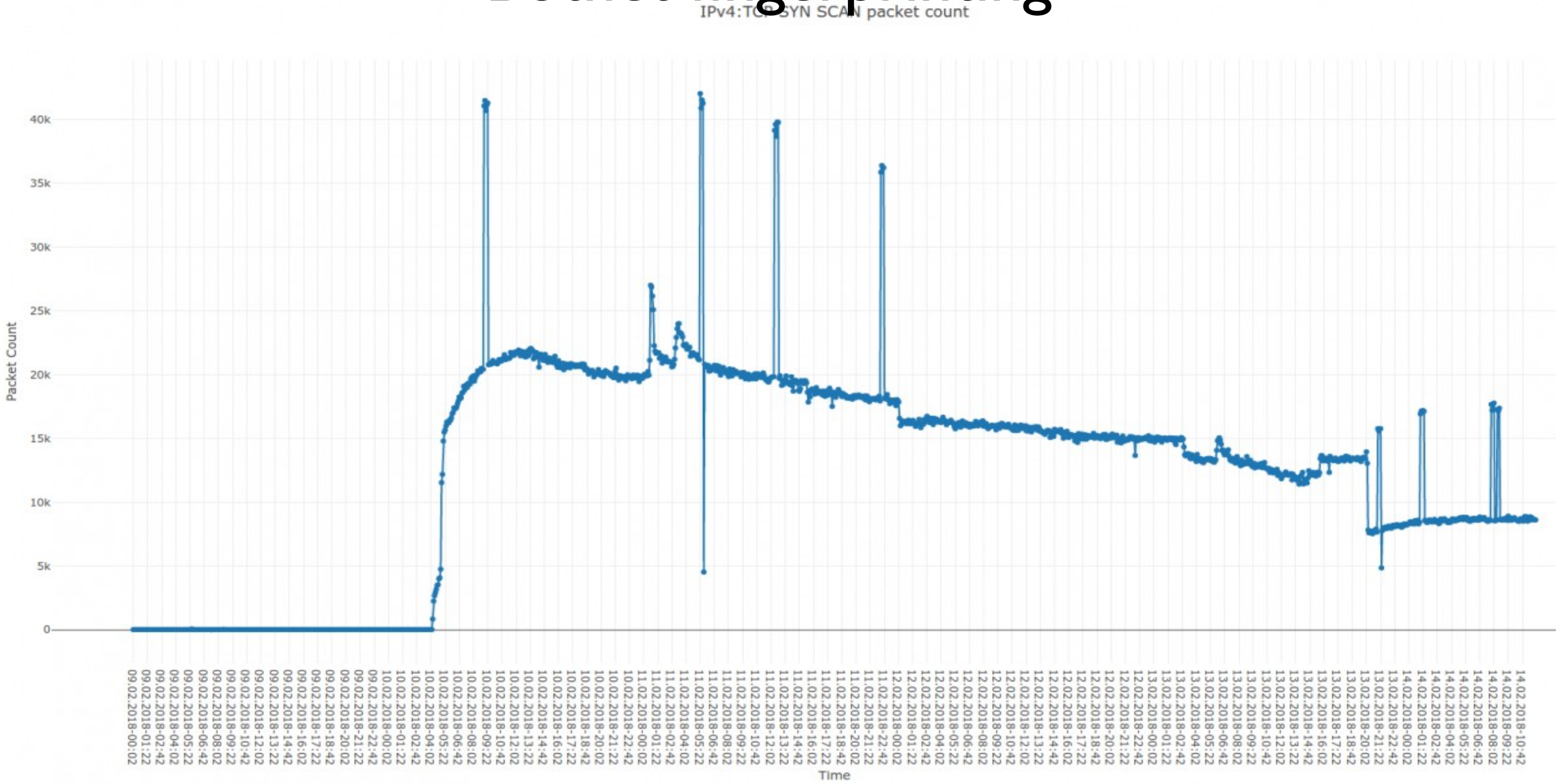
Botnet fingerprinting



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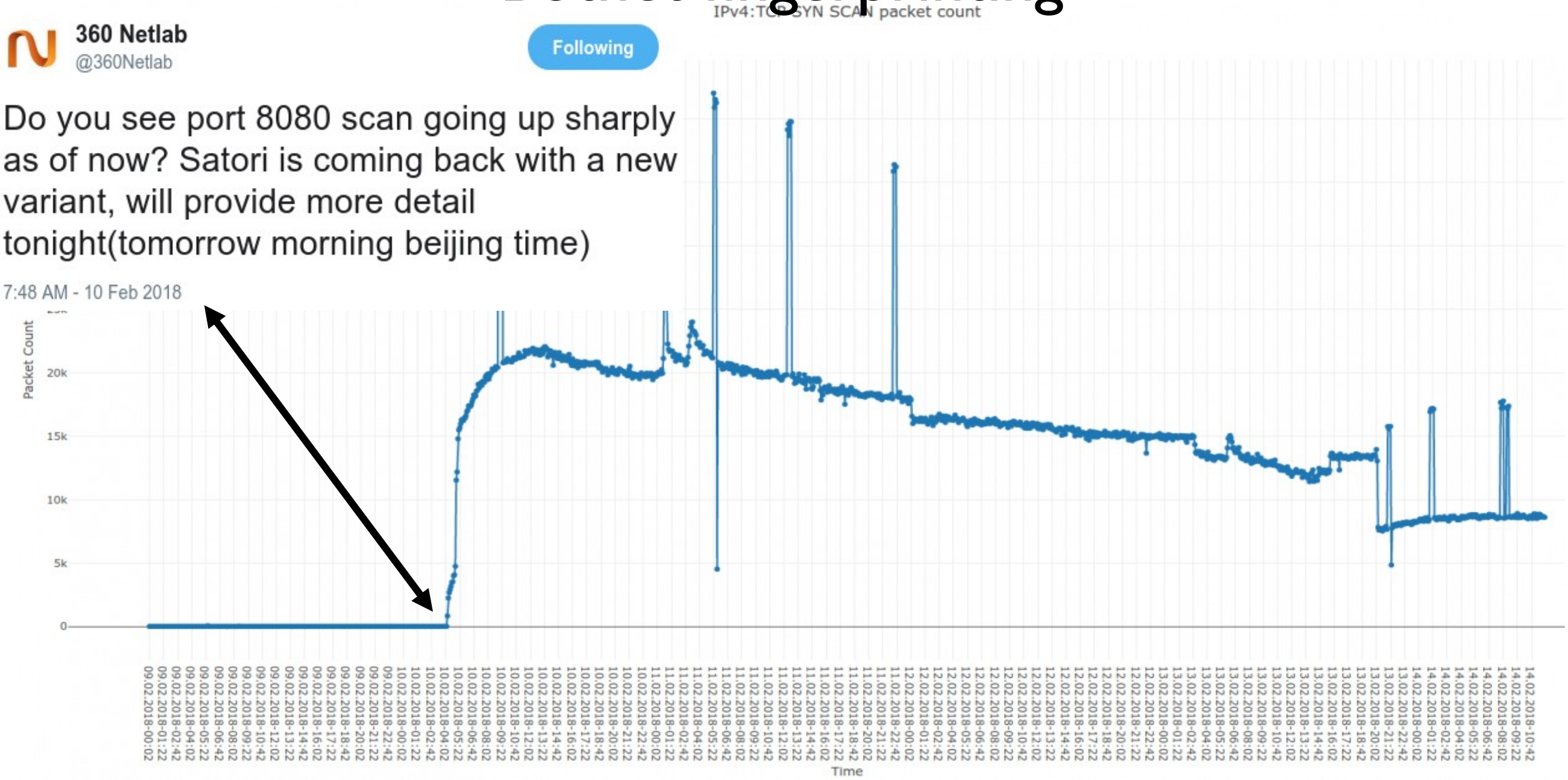
Botnet fingerprinting

360 Netlab
@360Netlab

Following

Do you see port 8080 scan going up sharply as of now? Satori is coming back with a new variant, will provide more detail tonight(tomorrow morning beijing time)

7:48 AM - 10 Feb 2018



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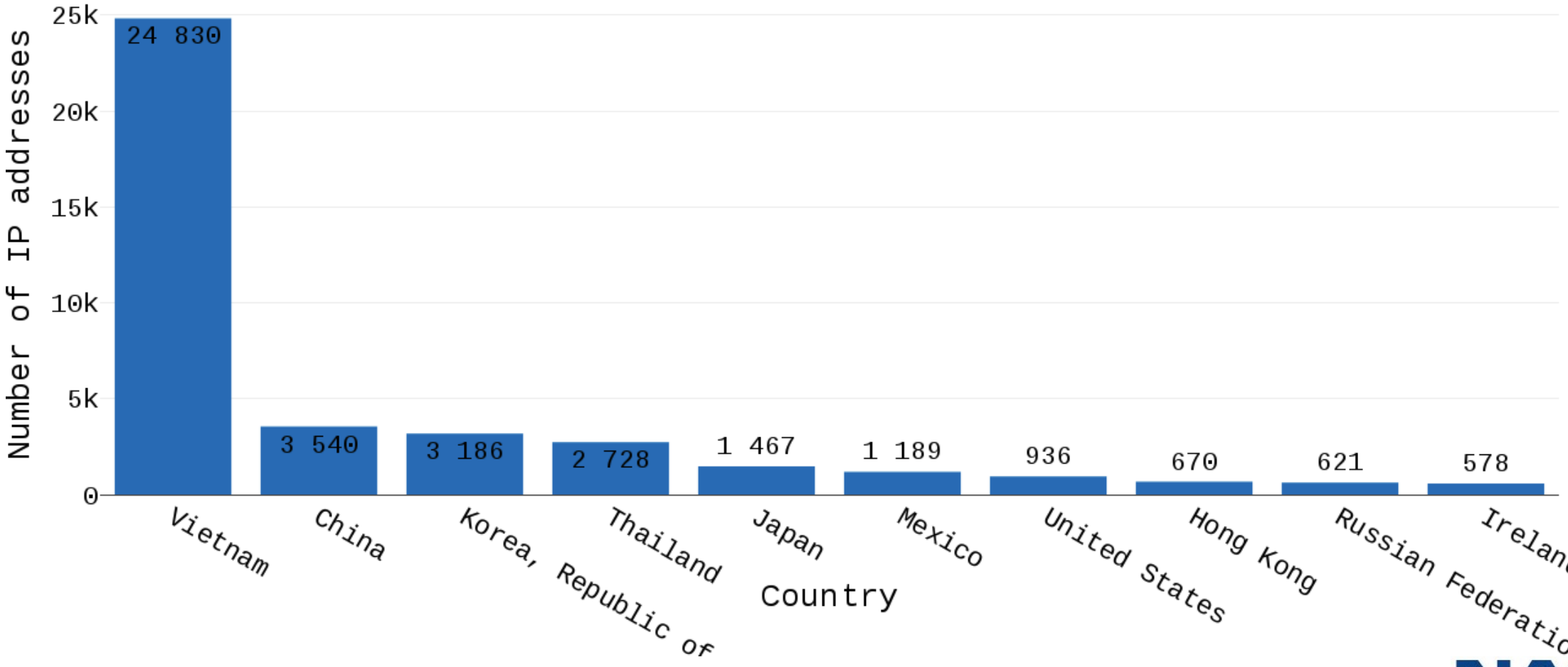
Botnet fingerprinting

In total, about 45 000 unique IP addresses were identified.

Distribution of source IPs



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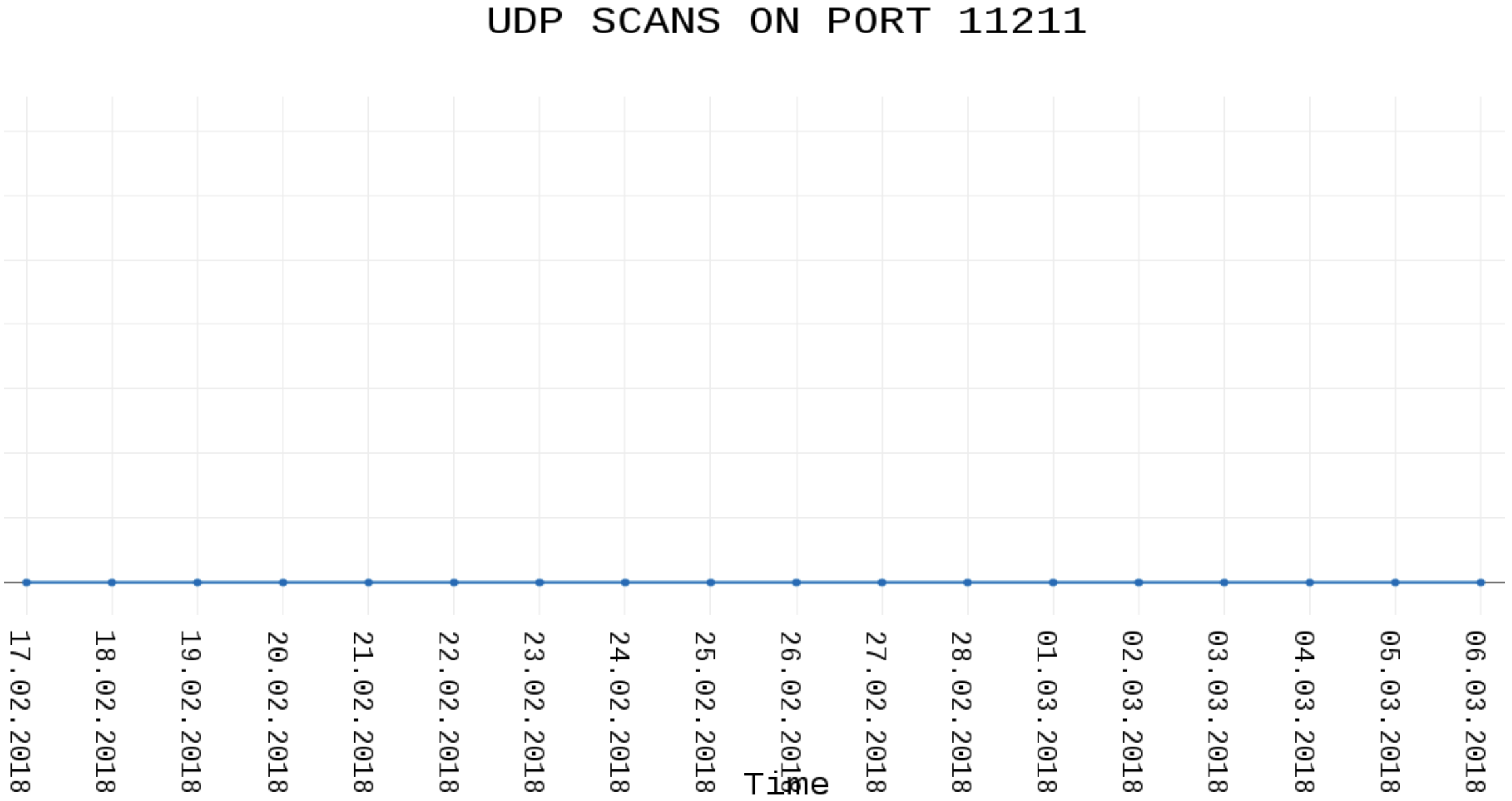
Case study 2
Memcached

Memcached



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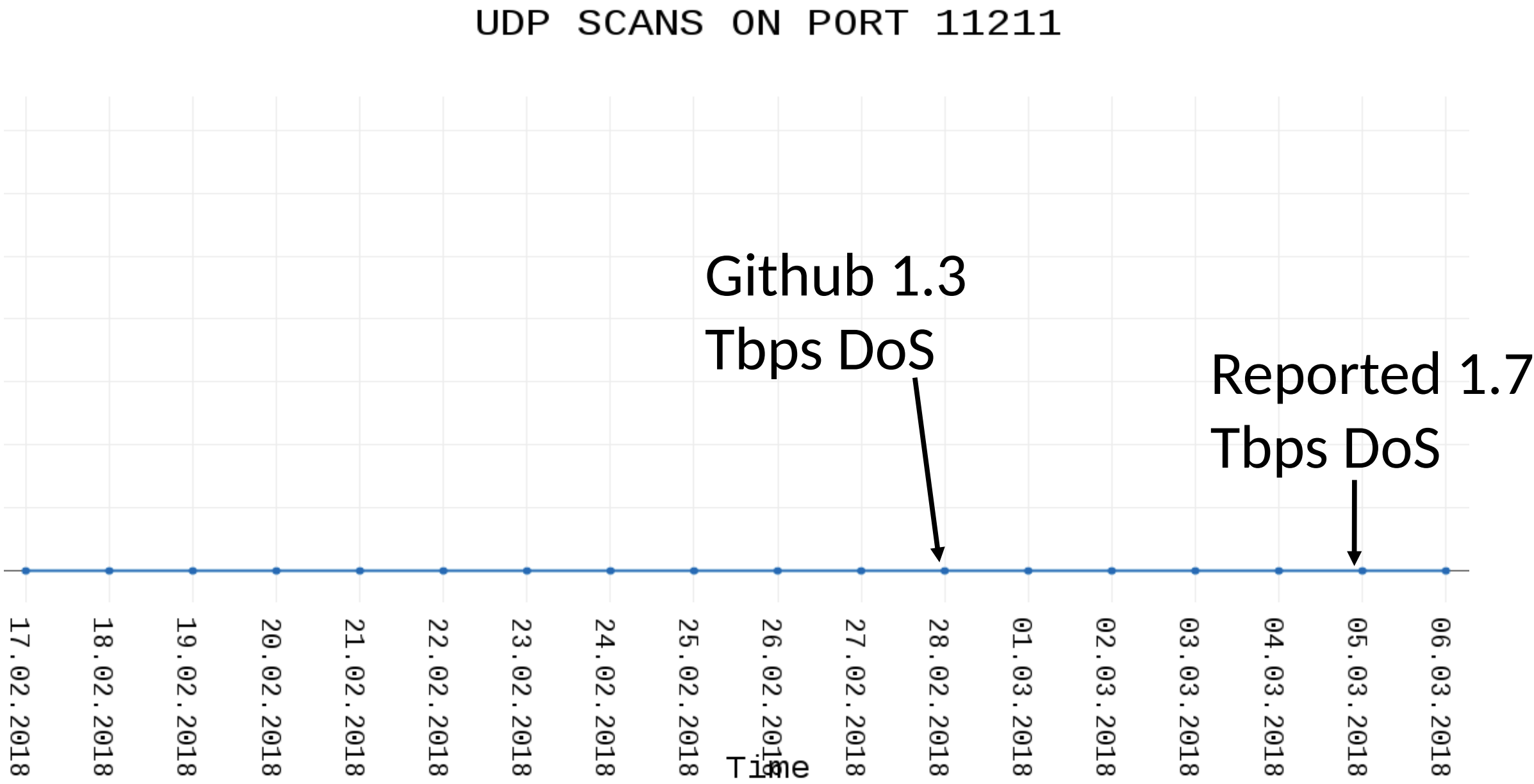
Memcached



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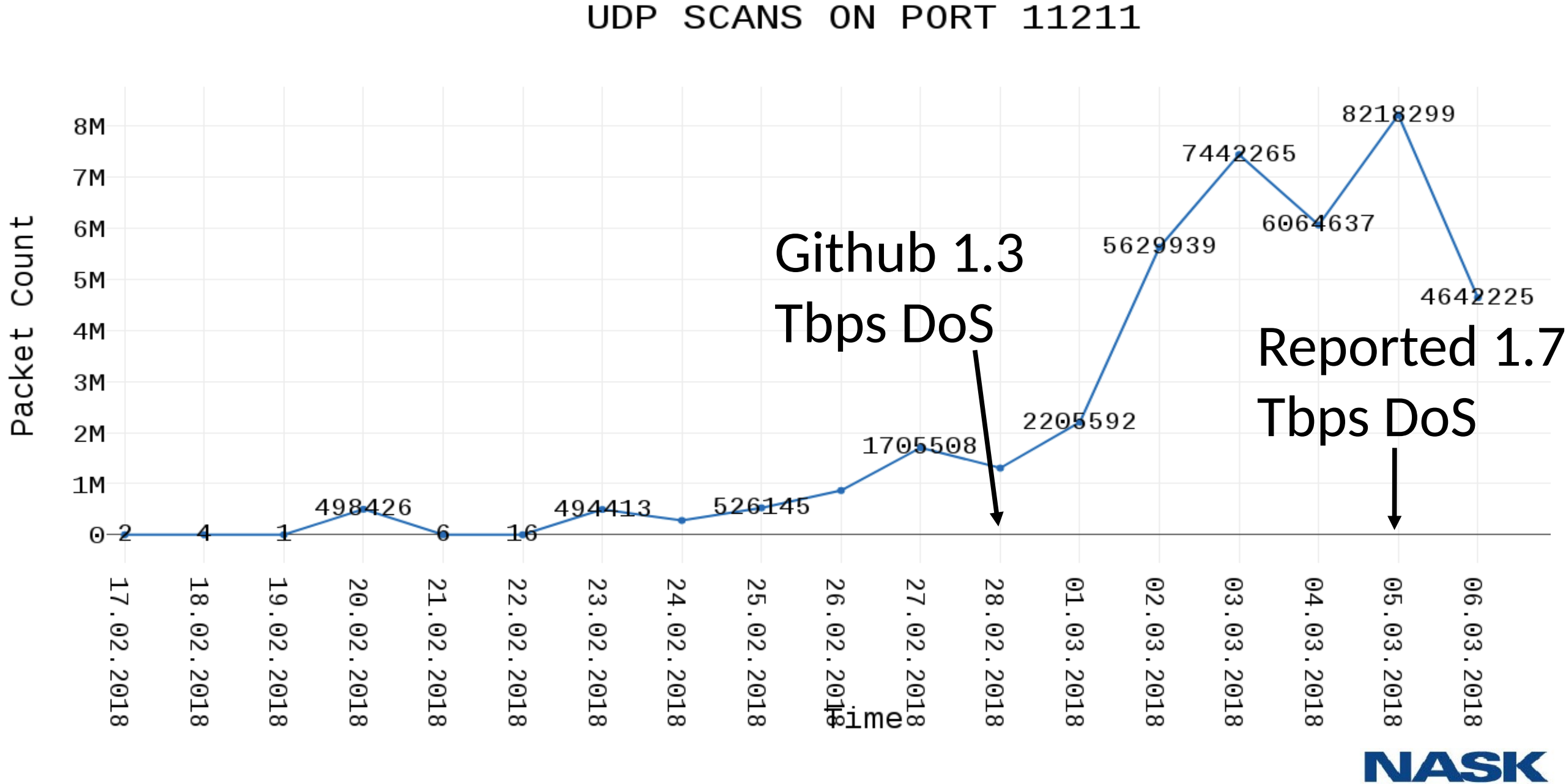
Memcached



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Day 1 – 20.02 (first scan)

- Only 4 IP addresses
- Source: DigitalOcean, UK
- Duration: 25 minutes
- Constant source port per source IP
- One payload used (memcached statistics)

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Day 5 – 24.02 (new actor)

- Only 1 IP addresses
- Source: AS 27176, DataWagon LLC, US
- Small hosting with anti-DDoS
- Randomized source ports
- New payload
- Scan lasted longer: 3 hours

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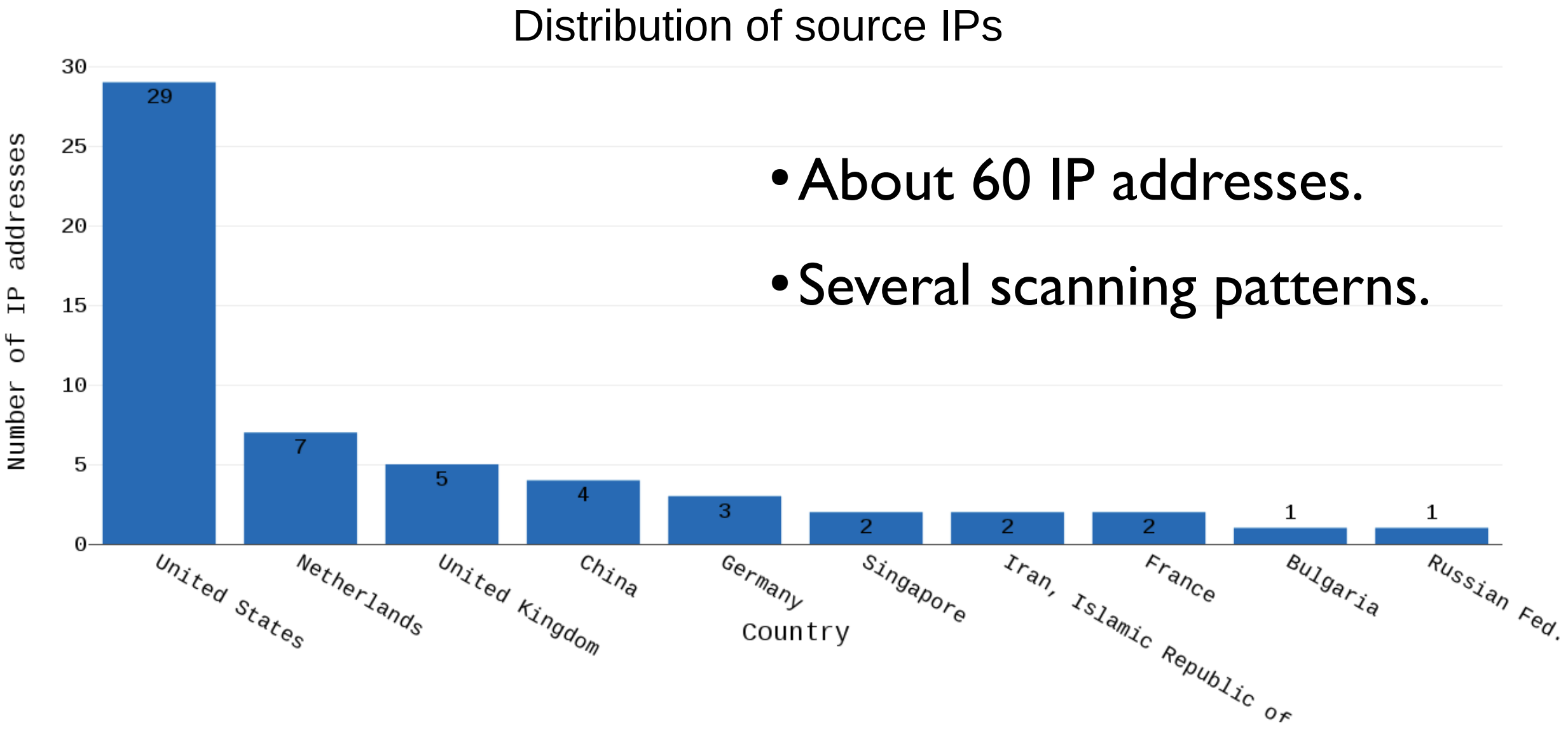
And so on… Pre-GitHub scanners



- About 60 IP addresses.
- Several scanning patterns.

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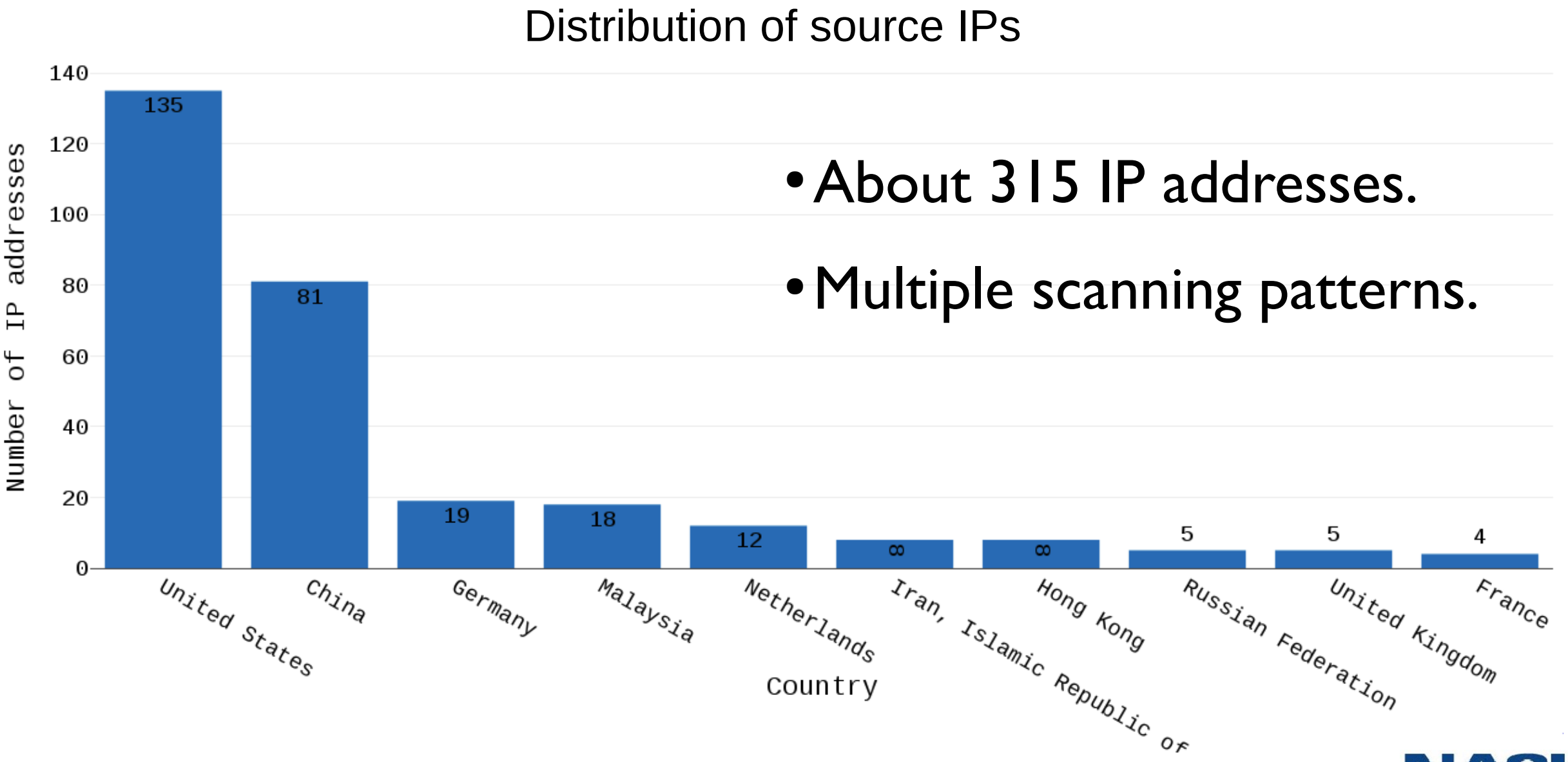
And so on… Post-GitHub scanners



- About 315 IP addresses.
- Multiple scanning patterns.

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Looking deeper into packets

PGA

- PGA = custom code to generate packets
  - *Improve DDoS Botnet Tracking with Honeypots*, Ya Liu, 360 Netlab, Botconf 4th edition, Dec 2016
- Usually simple operations, examples
  - constant values
  - byte swap
  - incrementation
- Leaves patterns that can be used for IDS
- Our tool detects patterns and creates new signatures

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PGA examples

1. Mirai:

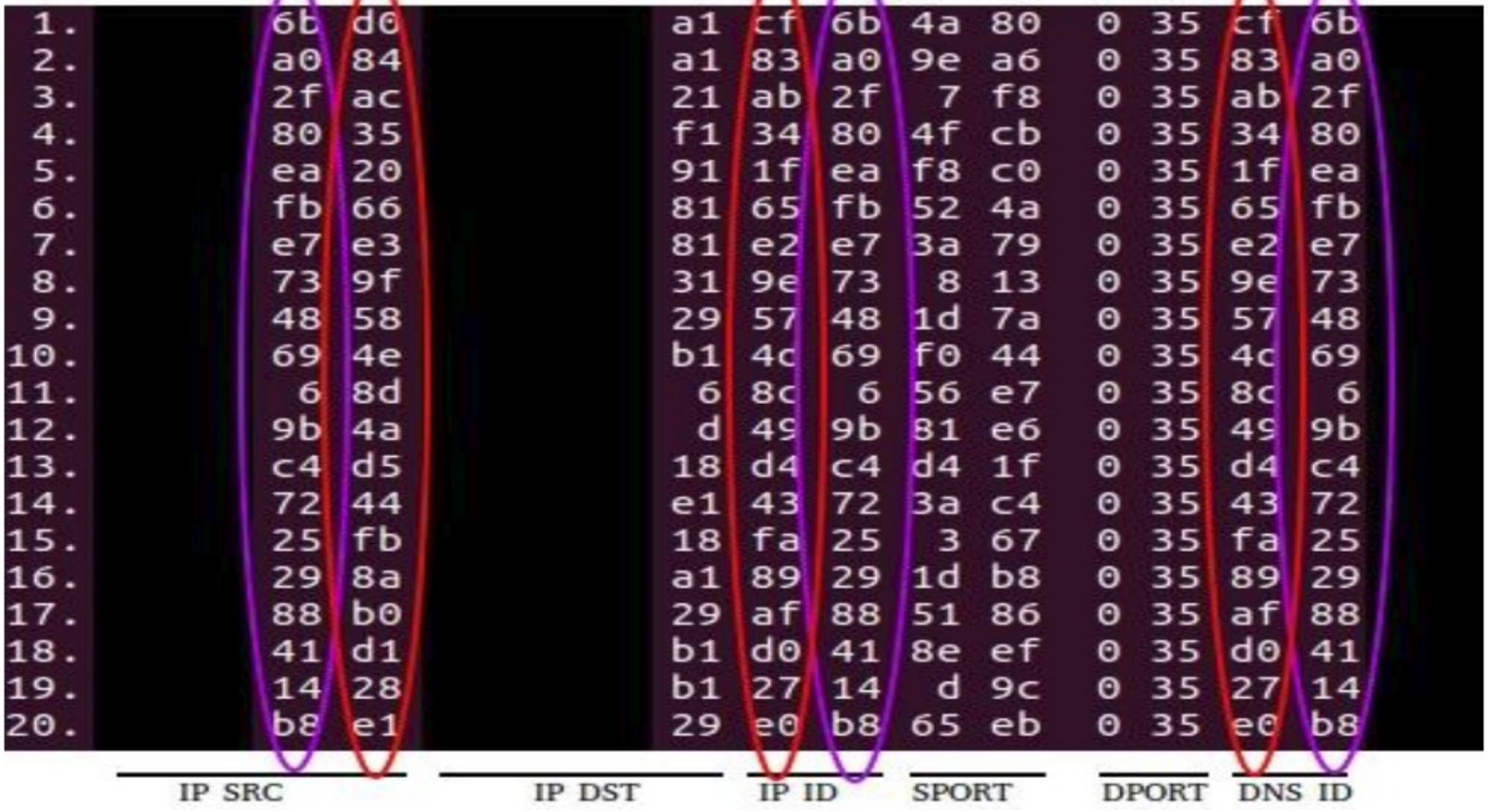
TCP_SEQ = IP_DST

2. XoR.DDoS PGA:

IP_ID = SPORT

TCP_SEQ[1:2] = IP_ID

PGA example



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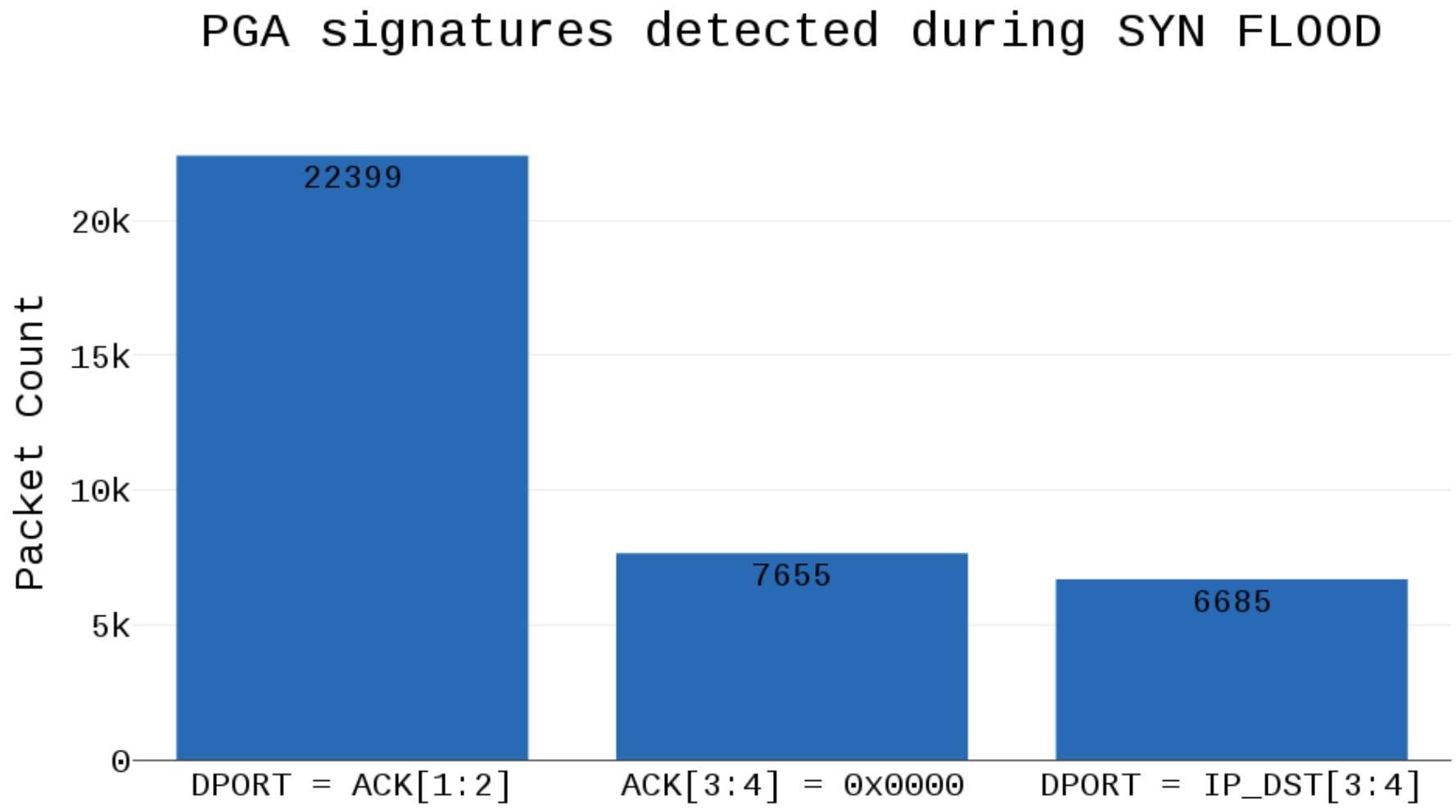
Signatures everywhere

SYN FLOOD on IP belonging to Google – full of PGA signatures.



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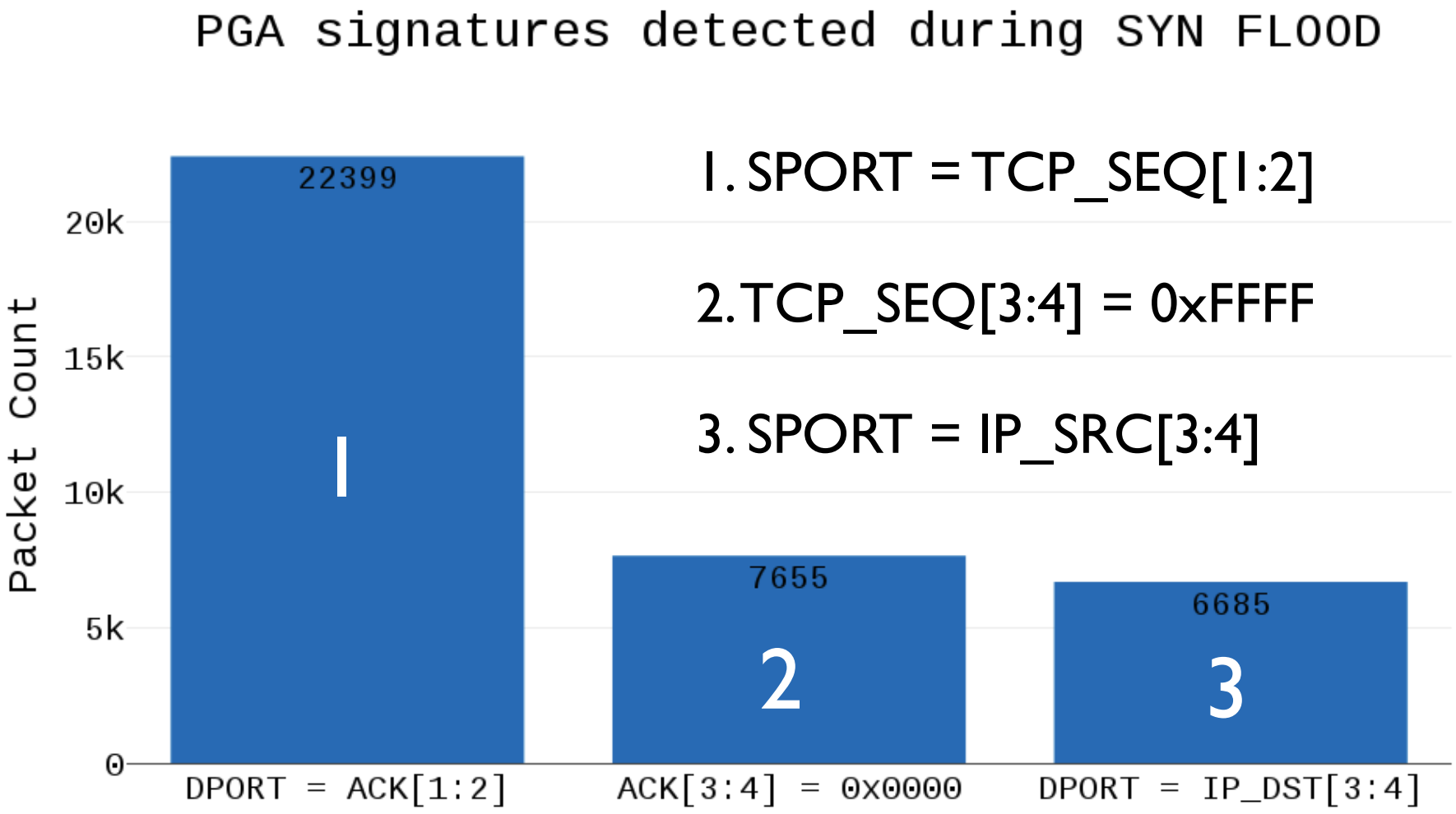

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Operations

Operational value of network telescopes

CERT.PL>_

- Raw output from analyzers is not actionable (too many events)
- **Scans** → abuse notifications (automated for high confidence events)
- **PGA fingerprinting** → Shadowserver remediation feeds
- **DoS attacks** → situational awareness & alerts
- Automated feeds provide limited "intelligence"

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DoS backscatter for the Polish IPv4 space
(color = PGA fingerprint)

Sharing threat information

- Automated distribution of abuse reports & IoCs
- Free
- > 100 active participating entities
- > 50 data sources
- Formats: JSON & CSV & more

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Interested in getting the data?

- Network owners: send an email to n6@cert.pl to sign up
- Usually working with national CSIRTs

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Aiming for actual intelligence

- In-depth analysis of events extracted from the traffic
  - insight into TTP
  - more difficult to automate
- Anomaly / trend detection:
  - forecast exploitation campaigns.
  - new campaigns
- Attribute activities to botnets / actors

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Future plans

- Combine network telescopes with other data sources

  Honeypots, sandboxes, botnet tracking

- Research collaboration:

  Looking for help in linking PGA signatures to tools / malware

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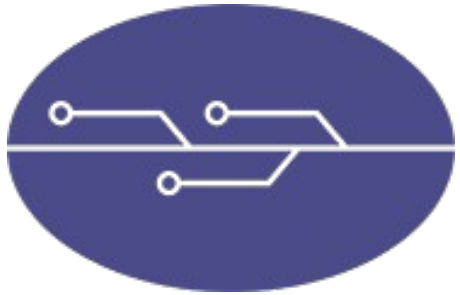

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https://sissden.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 700176.