DNSAttackStream

Investigating the Impact of DDoS Attacks on the DNS

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- Two data sources:
  1. DNS measurement data
  2. Indicators of DDoS attack activity

DNS measurement data

- **OpenINTEL** performs an **active** DNS measurement, sending a fixed set of queries for all covered names, **once every 24 hours**
- We do this **at scale**, covering over **236 million** domains per day:
  - **gTLDs**, **ccTLDs**, various **other** sources (e.g., Alexa)
- Notably provides:
  - Mapping between IP addresses to auth. nameserver infrastructure (A records)
  - Mappings between SLDs and auth. nameserver (NS records)

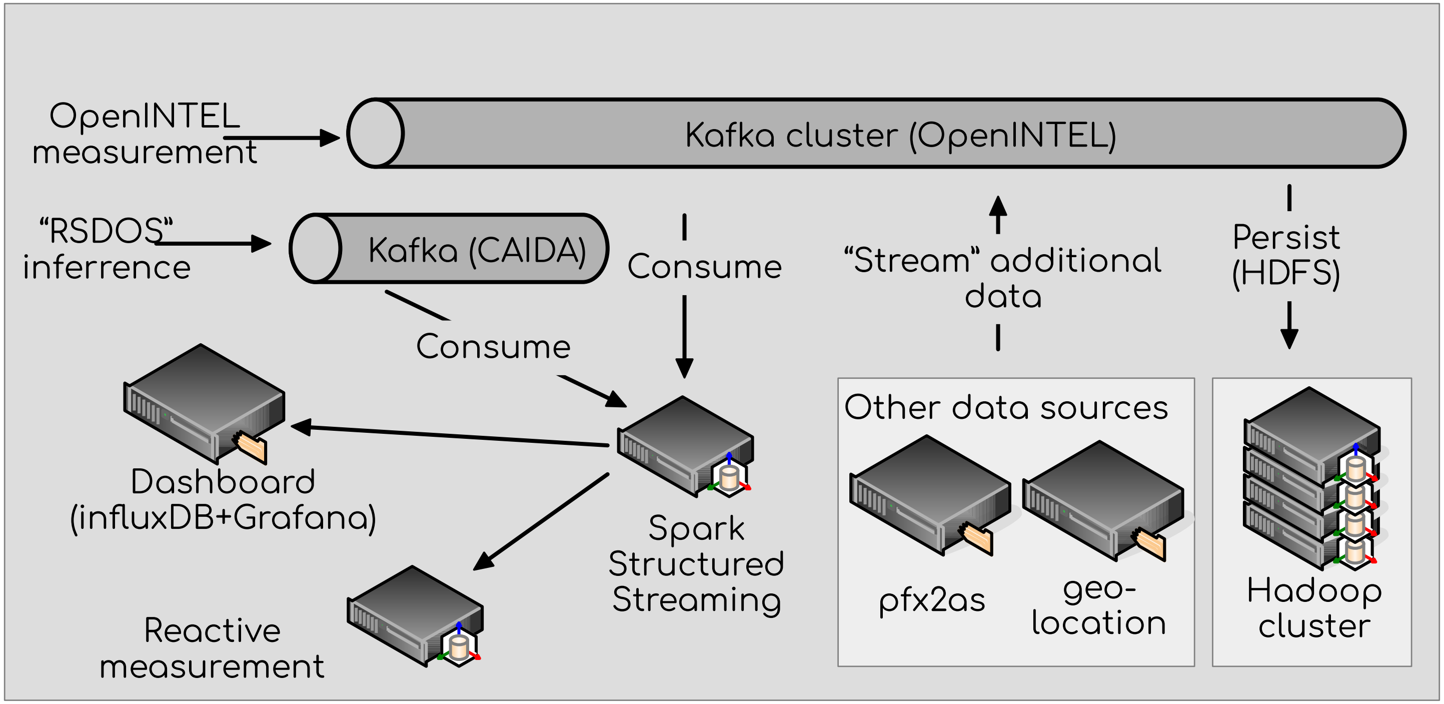
UCSD-NT

- CAIDA UCSD Network Telescope
  - Sizable IPv4 darknet
  - Receives unsolicited backscatter (from certain types of DoS attacks)
- We receive a data feed of attacks (target IP, #pkt, #byt, …)

  … and can analyze a breakdown of attack-associated “flows“ (specific ports, protocols, …)

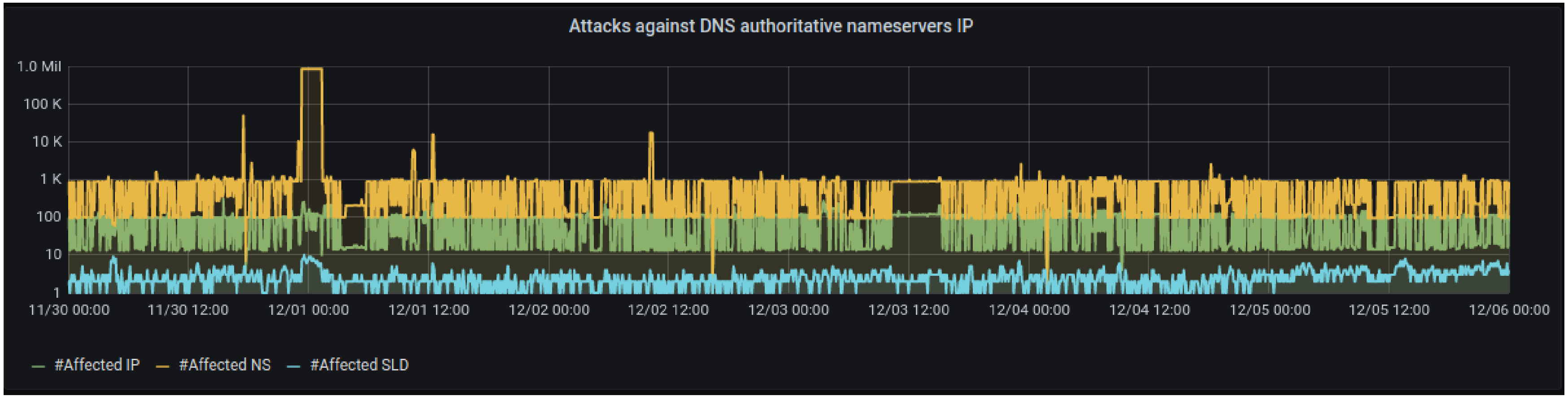
DNSAttackStream

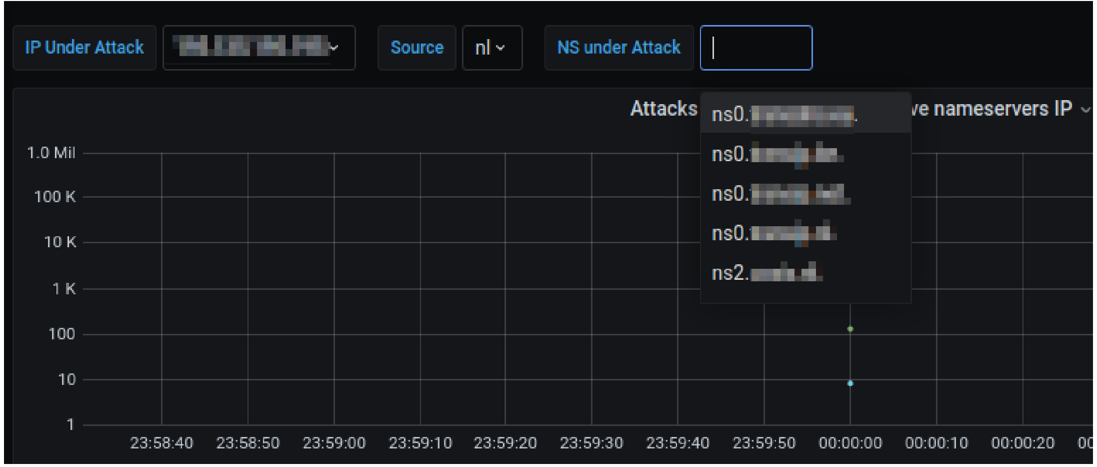
- We fuse UCSD-NT data with DNS data in near real-time
  - Yields authoritative nameservers under attack
  - Provides domain names that delegate authority to NS
  - Creates reactive measurement opportunity!



Dashboard

- Show #NS$_{IP}$, #NS$_{FQDN}$, and #SLDs (that delegate to NS) affected by attacks
- Dec ‘20 peak reveals attack on large registrar in the Netherlands (multiple of its nameservers attacked)





IP Under Attack [redacted]

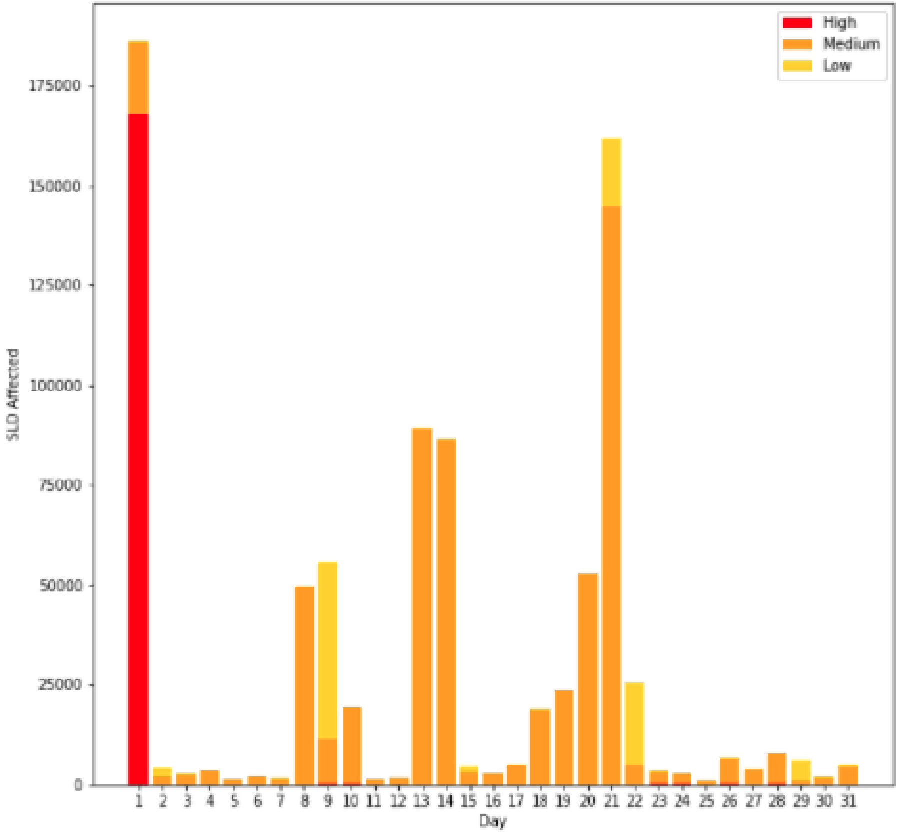
Source nl

NS under Attack

ns0.[redacted]
ns0.[redacted]
ns0.[redacted]
ns0.[redacted]
ns2.[redacted]

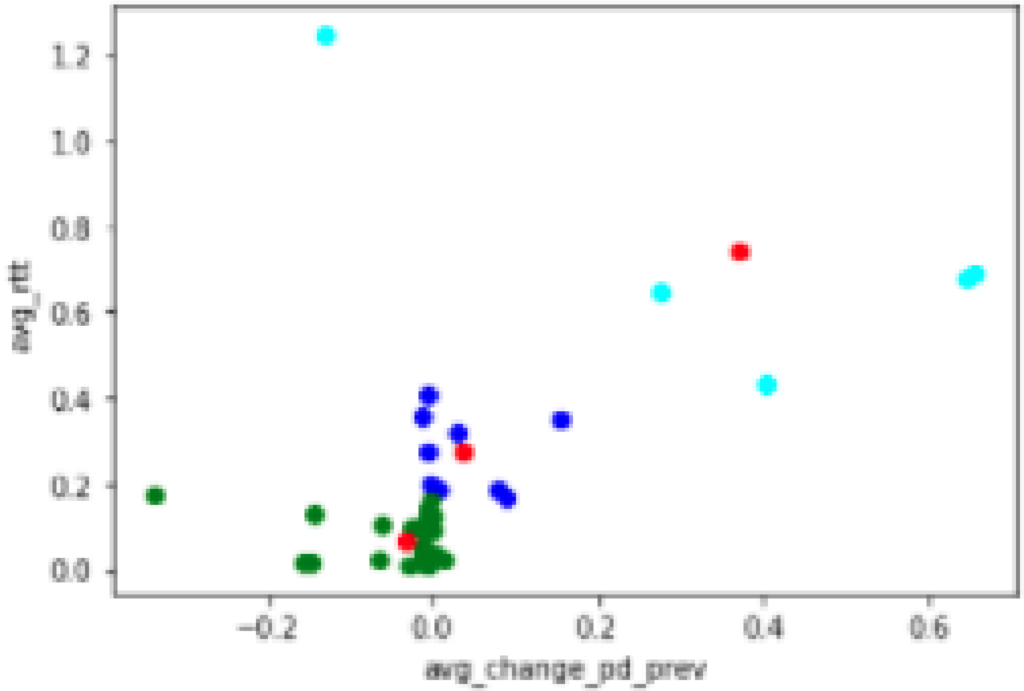
Affected domain names (potentially)

- Take SLDs that delegate authority to NS under attack
- Use RSDOS metrics (pps rate + IP count) to assign attack intensity *{low,medium,high}*
- Dec 1 attack of the high category



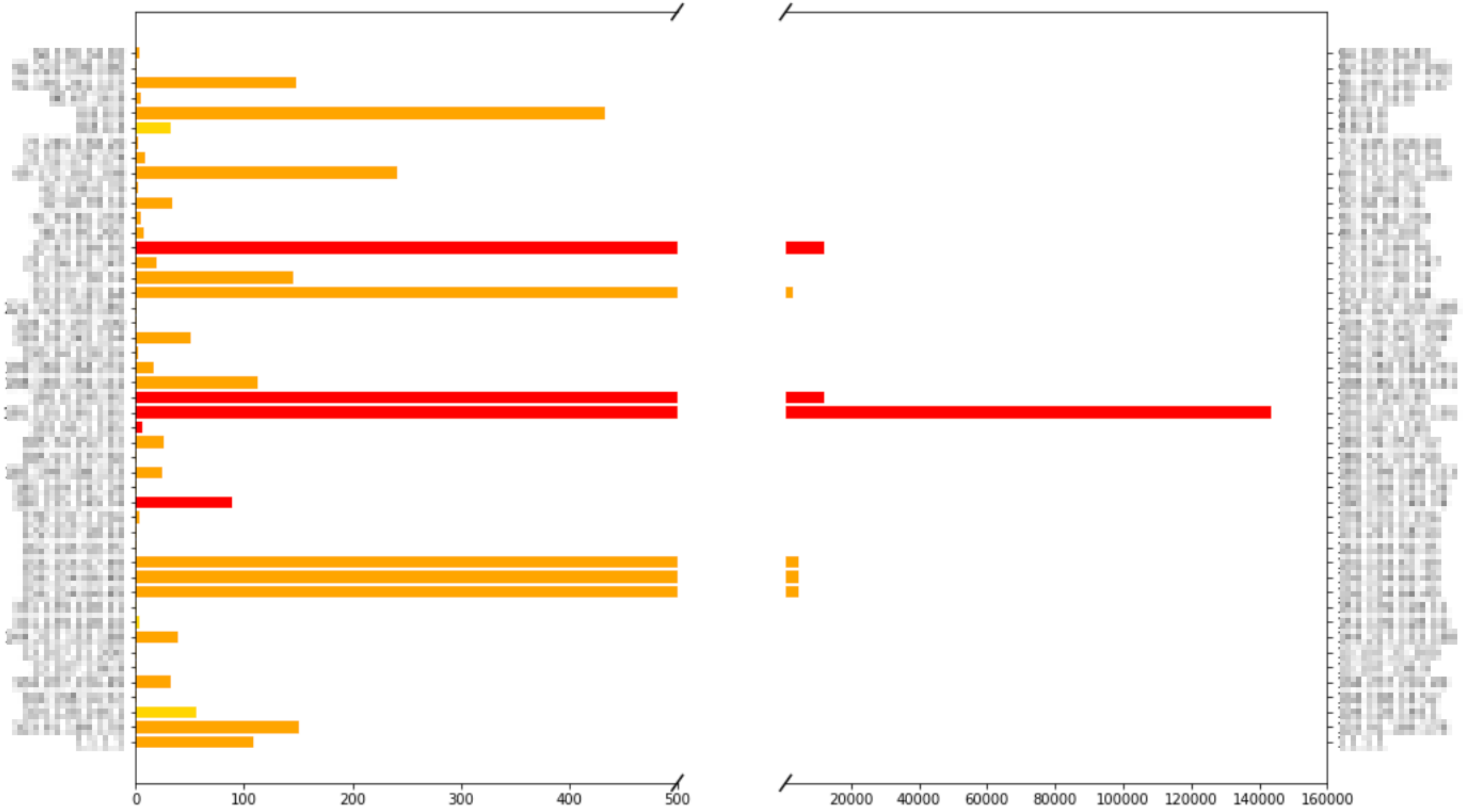
Impact assessment 1/2

- High-intensity attack, but did it have an effect on the DNS?
- We store the RTT of DNS RR resolutions
- Create metrics on day of (and adjacent to) attack (e.g., avg_rtt)
- Use PCA to identify features that explain max variance
- Use k-Means (k=3) to cluster into {low,medium,high} impact on DNS operation



Impact assessment 2/2

- #SLDs per attacked NS, with impact intensity
- DNS resolution for SLDs that delegate to various NS of the registrar under attack was adversely affected



Work in progress

- Cross-reference attack breakdown (flows) with Rapid7 data to see if ports were open/in use on/near date of attack
- **Reactive measurements** to improve attack impact assessment (closer to moment of attack)
- Fuse with **other indicators** of attack activity (e.g., reflection & amplification attacks from honeypot data)

Questions
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