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DDoS Never Dies?
An IXP Perspective on DDoS Amplification Attacks

Photo by Josep Castells

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Why more Reseach on DDoS?

Victims can’t defend themselves

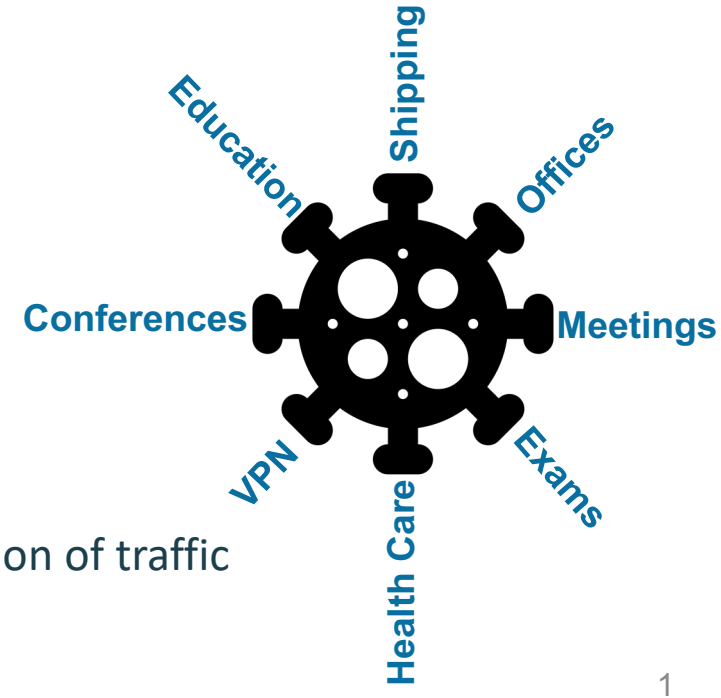
- Victims are mostly end users of the Internet → low bandwidth
- Limited view into the Internet

Targets at risk

- Gaming, e-sports, online businesses
- Finance, stock market
- Political targets and critical infrastructures

Unsolved Problems

- IP-Spoofing and security flaws → amplification of traffic



Contributions

DDoS attacks seen at a large IXP

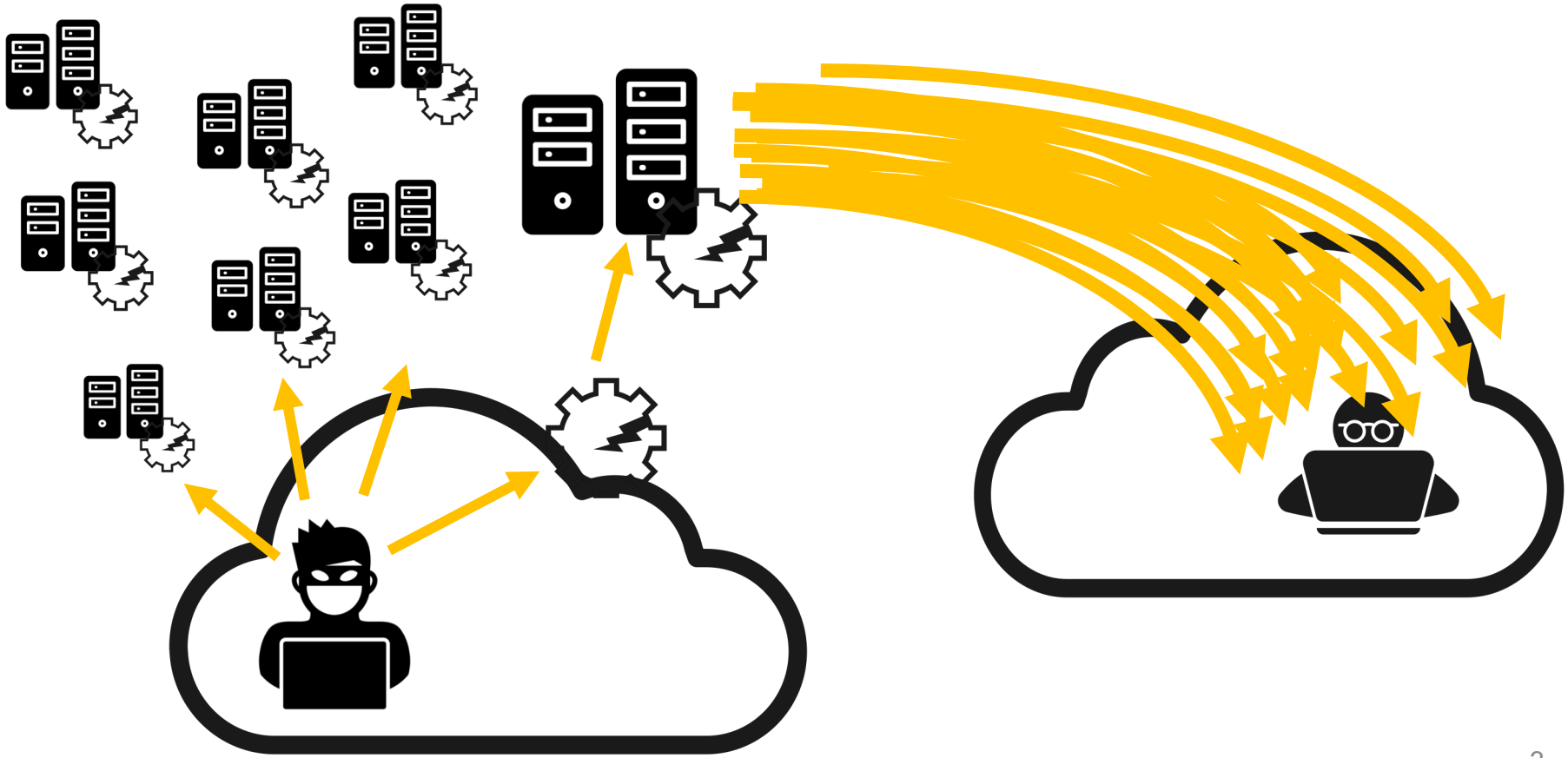
- Global visibility, focus central Europe
- > 900 connected networks

Details on amplification protocols used in the wild

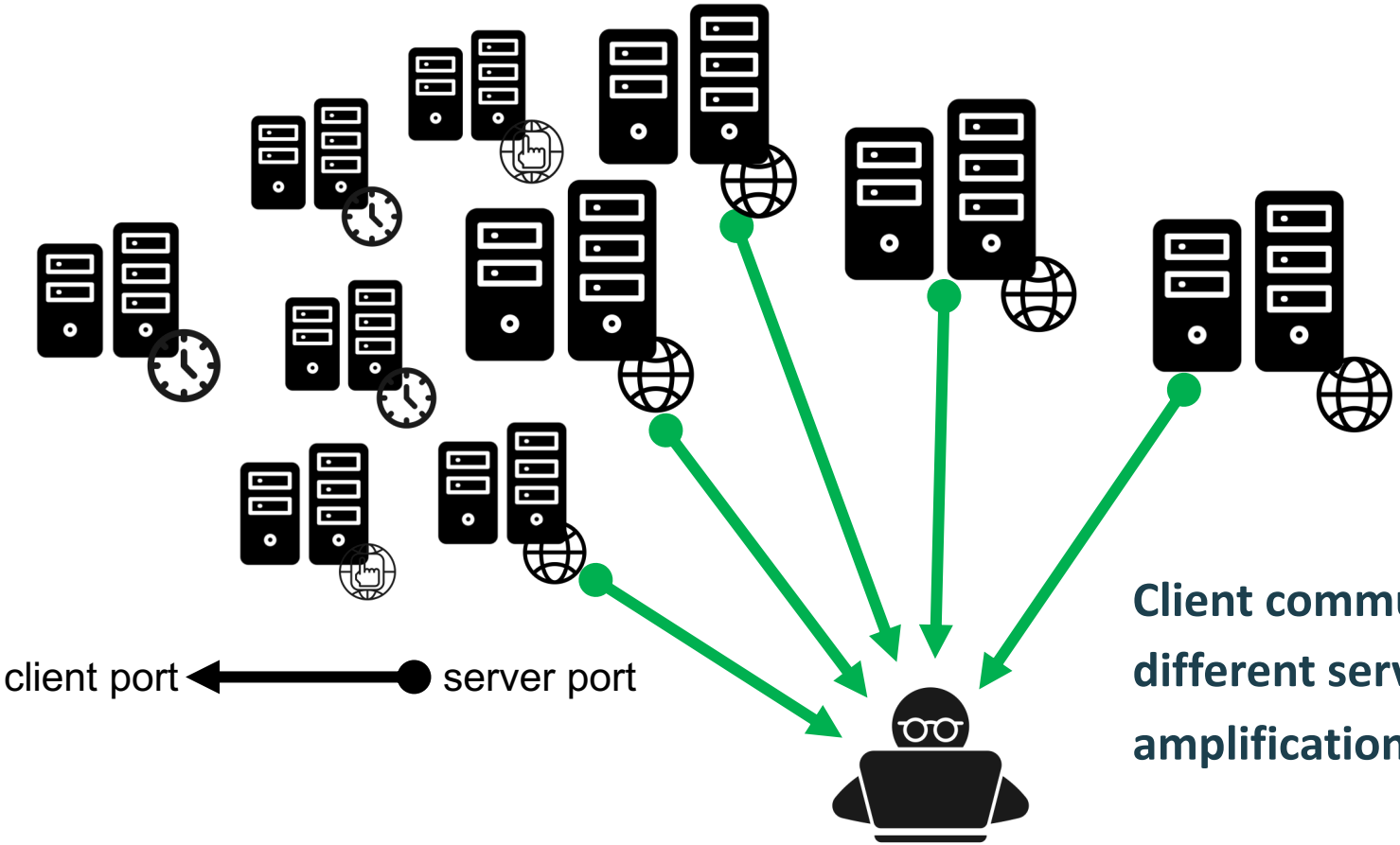
The study provides

- Infrastructure perspective
- View on targets and attack patterns
- Brief comparison of attacks seen by a honeypot
- The full paper gives more details → Table 1

Amplification DDoS Attack

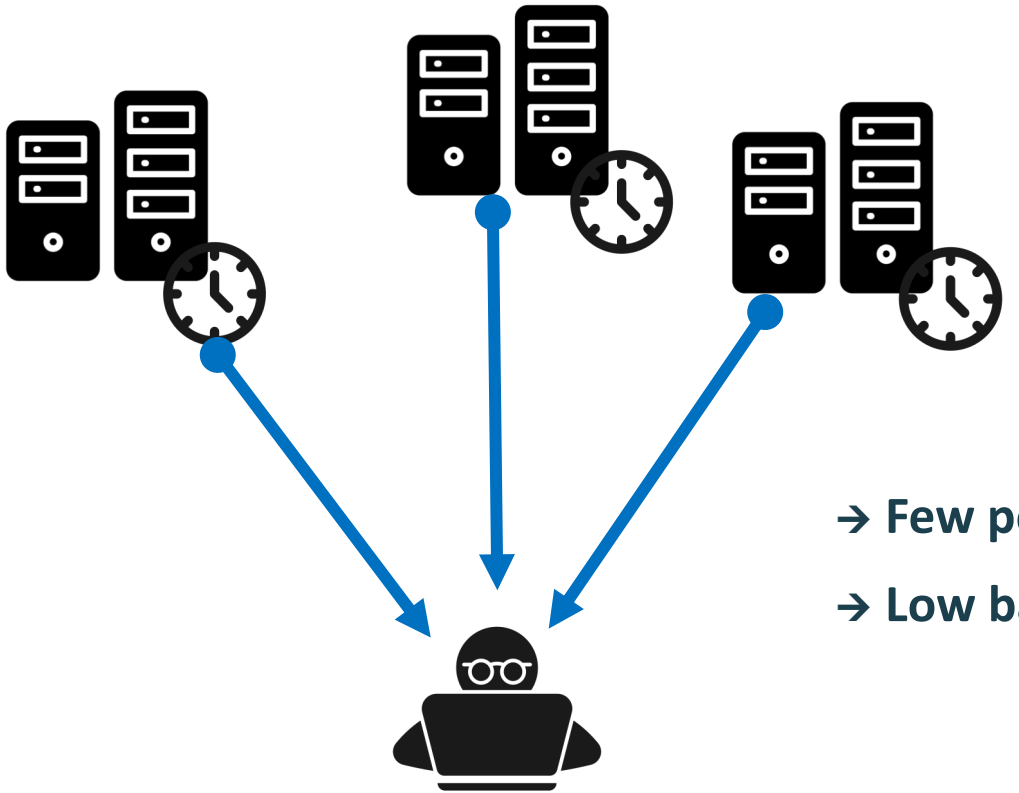


Normal Client Traffic



Client communication to different servers with non amplification protocols

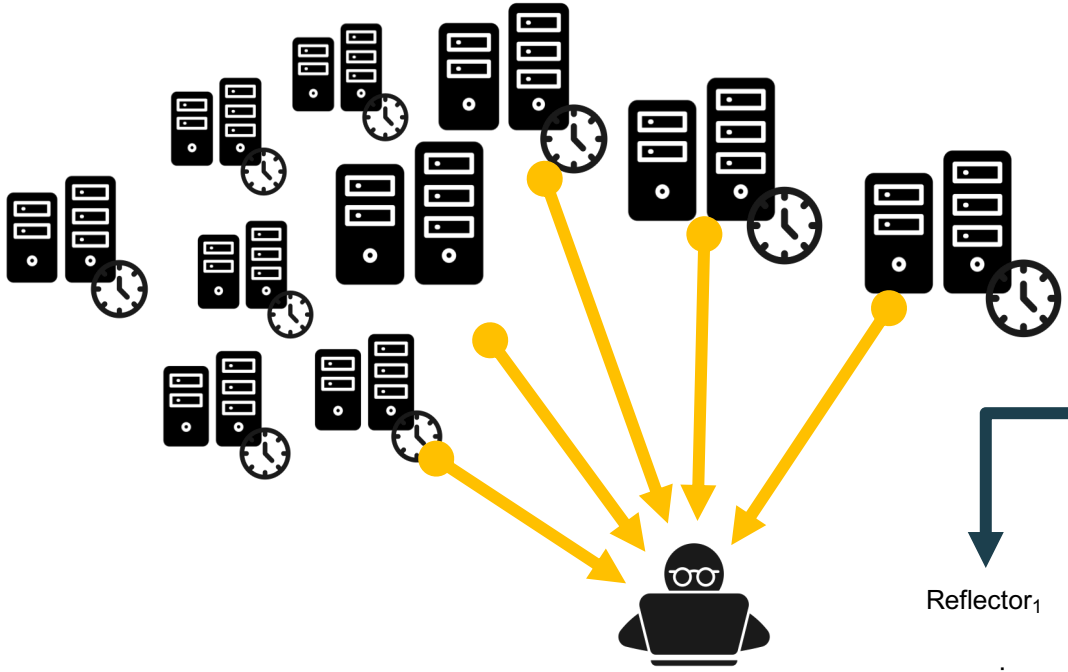
Normal NTP Traffic



→ Few potential amplification servers

→ Low bandwidth

DDoS Classification



Source port = amplification protocol

More than 10 sources

Traffic > 1 Gbps

UDP flows with src port *x* (e.g. NTP, OpenVPN, ...)

Reflector$_1$

⋮

Reflector$_k$

⋮

Reflector$_n$

∑flows > *t* Gbit/s

flow$_1$

flow$_k$

flow$_n$

Target IP

Criteria: DDoS if min *k* reflectors with > *t* Gbit/s traffic

Amplification Protocols

WS-Discovery

CLDAP

NTP

SSDP

OpenVPN

DNS

SNMP

Chargen

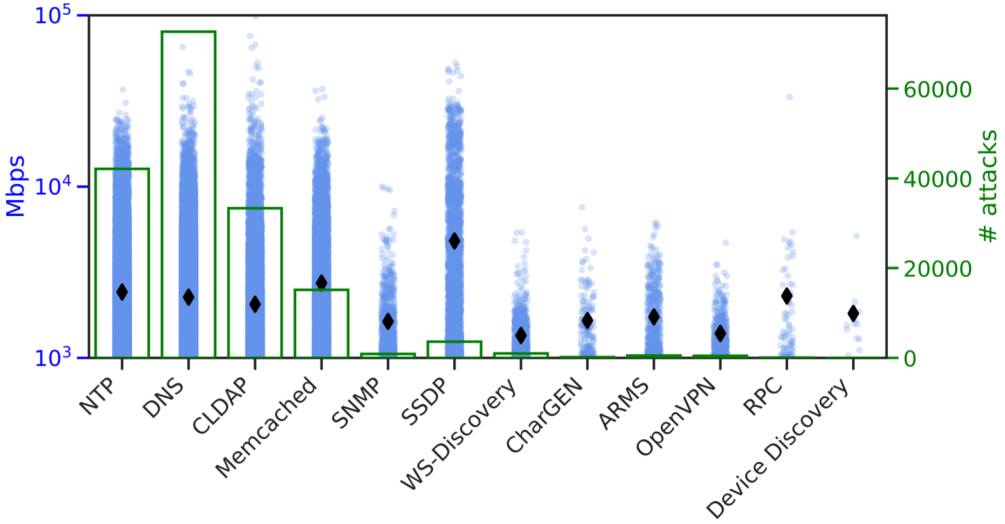
RPC

Memcached

ARMS

Device Discovery

Dataset and Results



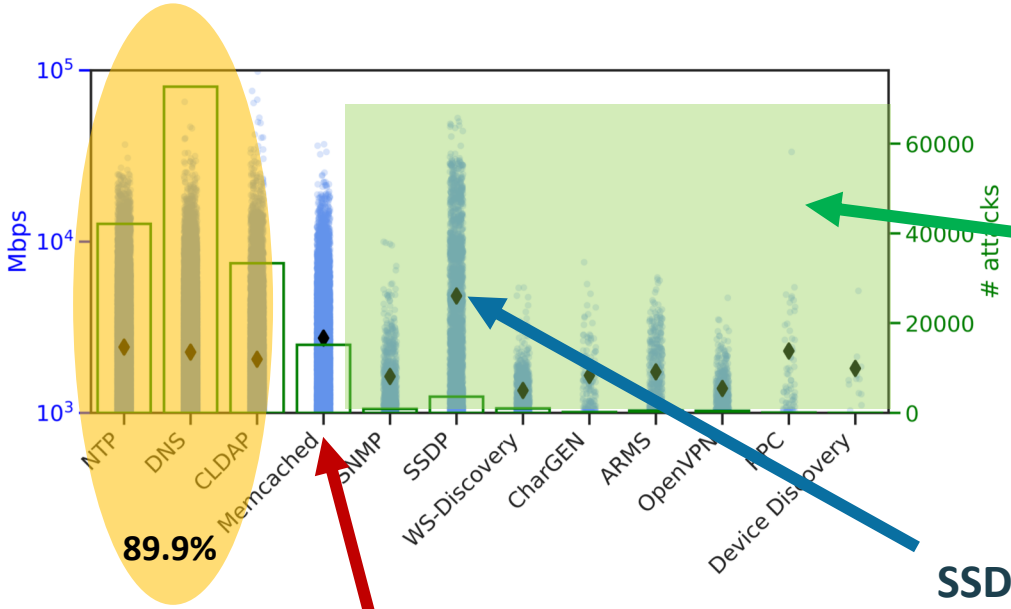
DDoS Dataset

- 58,000 attacks with at least 1 Gbps over 6 months

Validation

- Including non amplification protocols
- Potential false-positives (root DNS)
- Inspection of DDoS events with IXP

Dataset and Results



Less frequent and new protocols

- Not to be underestimated
- Generate severe traffic rates

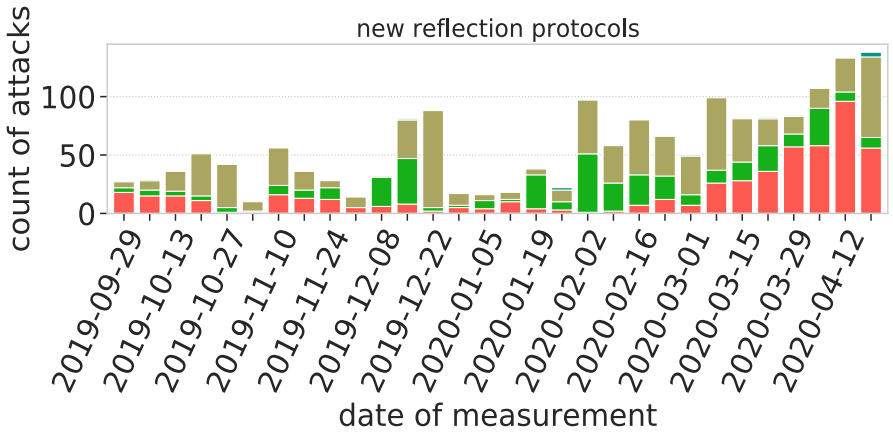
SSDP

- Used for sophisticated, long duration attacks
- High packet rates and traffic volume

Memcached

- Still a popular attack vector

Well Known Amplification Protocols

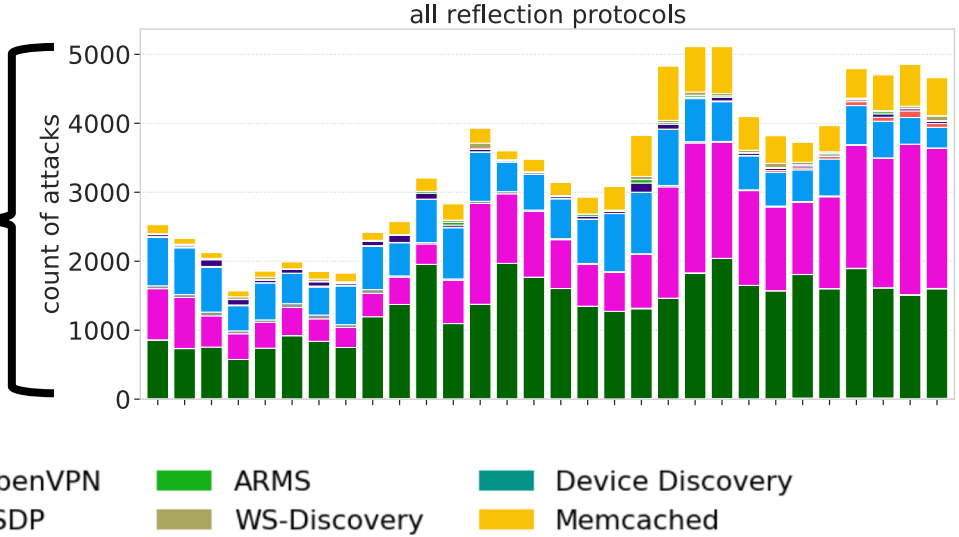


OpenVPN rose by 500%

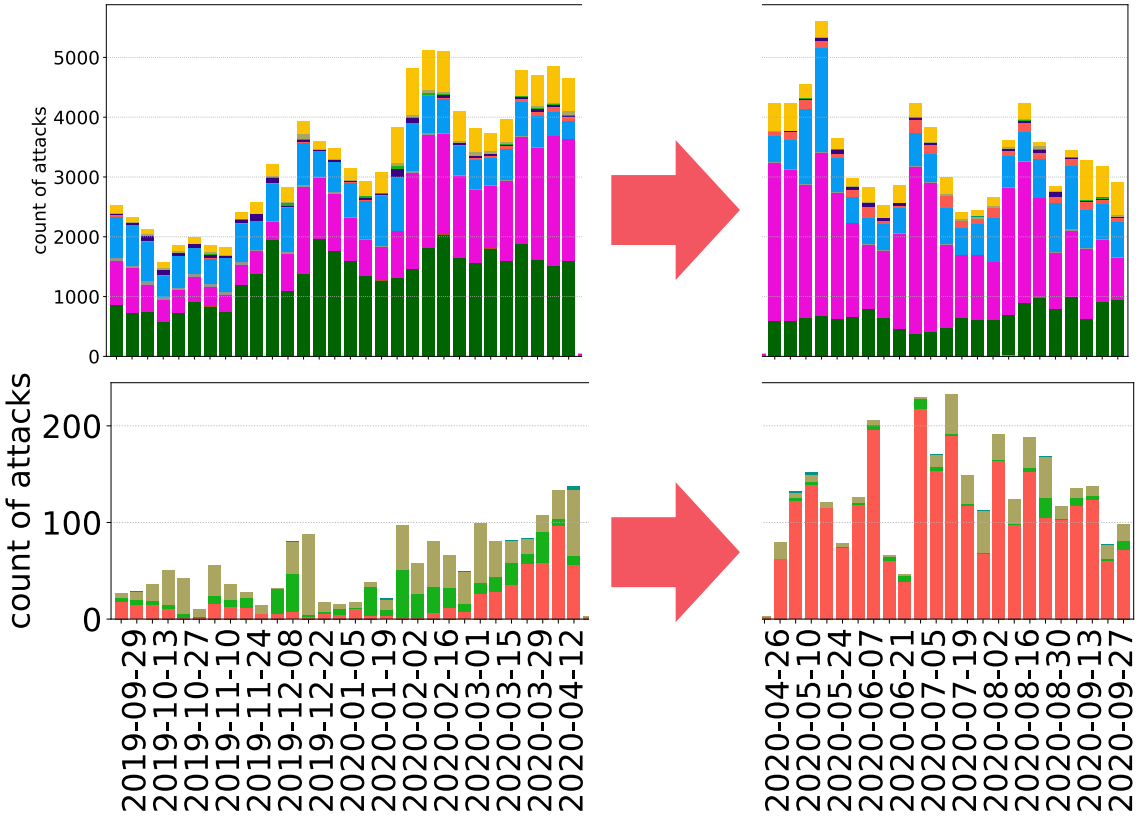
(starting from a low level)

well known protocols

weekly attacks



Amplification Protocols - Update



Traffic Volume & Packet Rate – Poll

What is of more interest to you with DDoS attacks, packet rate, traffic volume or both?

Results RIPE 82 Meeting:

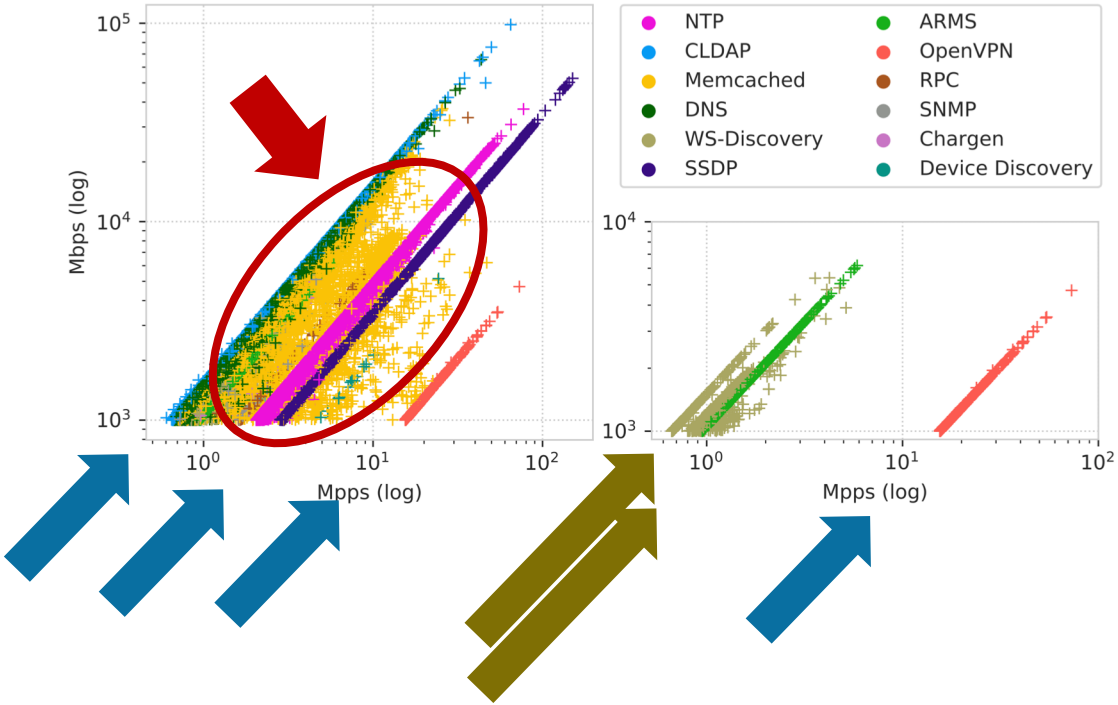
BOTH 47% (22)

TRAFFIC VOLUME 17% (8)

PACKET RATE 13% (6)

NO EXPERIENCE WITH DDoS ATTACKS 21% (10)

Traffic Volume & Packet Rate



Linear

- Stable amplification factor

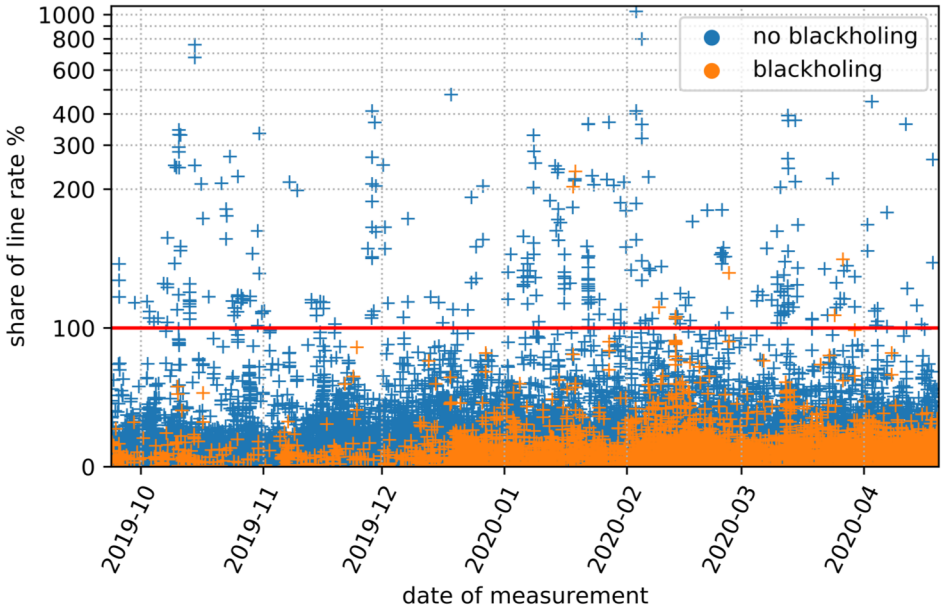
Multi linear

- Multiple amplification flaws

Non linear

- Payload of variable size

Infrastructure Perspective



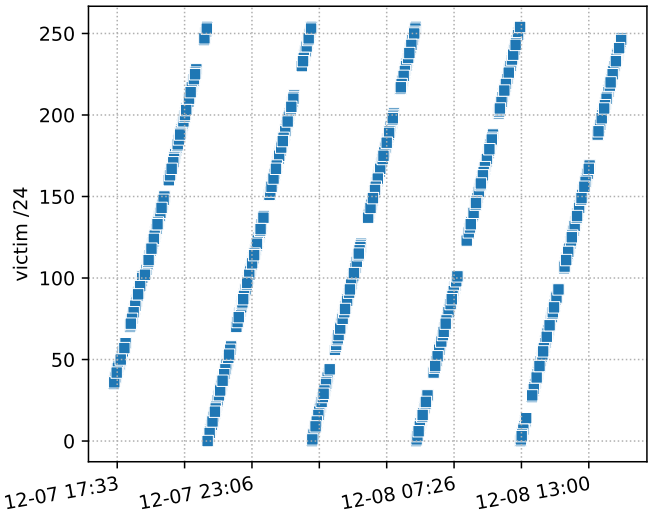
0.18% of attacks exceeded port capacity

26% of attacks at 50% of port capacity

IXP perspective

- Combined DDoS traffic was 3.6% of IXPs peak traffic

View on Targets



Temporal attack pattern

- Attach traversed /24 1 min each IP
- Probably to evade mitigation

High profile attacks

- Target 28% - 10% of announced IP space

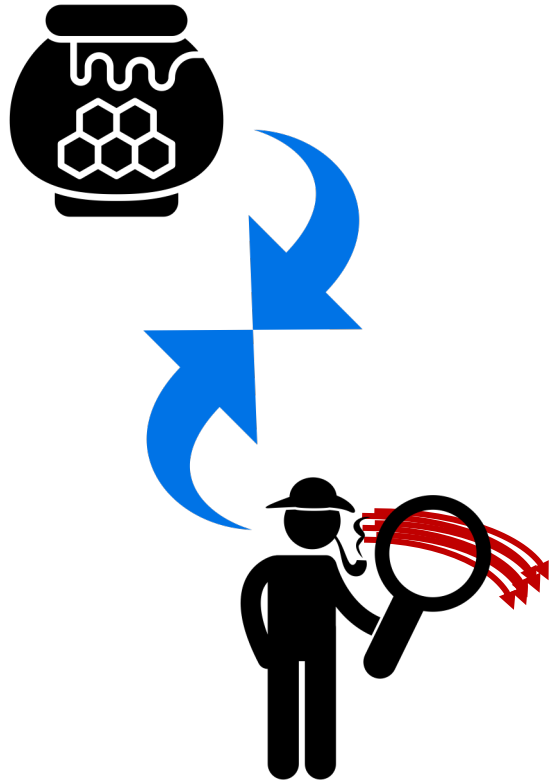
Attacks on VPN infrastructure

- 1.2M unique VPN endpoints in DNS dataset
- 39 Targets in 30 ASes

Comparison to a Honeypot

Divergent view of honeypot and IXP

- Only 8% attacks (33% targets) visible by honeypot
- 0.95% of the targets visible in IXP dataset
- High IXP threshold > 1Gbps
- Scanning events in honeypot data
- Likelihood of attack choosing honeypot
- Visibility of vantage points on the Internet



Conclusion

Updated view on amplification protocols and DDoS attacks

- Legacy protocols still heavily used
- New protocols are effective, pose an emerging threat
  - OpenVPN 500% incline (but on a low level compared to other DDoS amplification protocols)

No severe impact at core Internet infrastructures

Divergent picture of attacks observed from different sources

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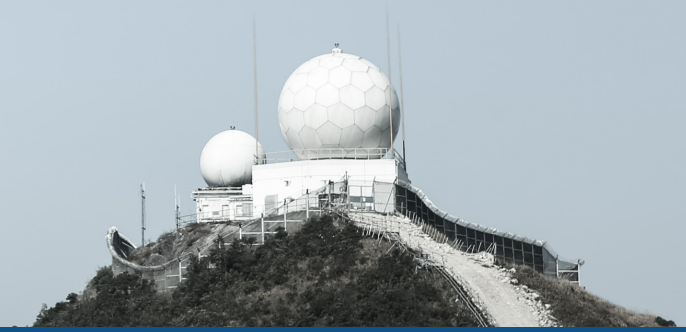

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