2019 S&T Cybersecurity and Innovation Showcase

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Homeland Security
Science and Technology

MADDVIPR: Mapping DNS DDoS Vulnerabilities to Improve Protection and Prevention

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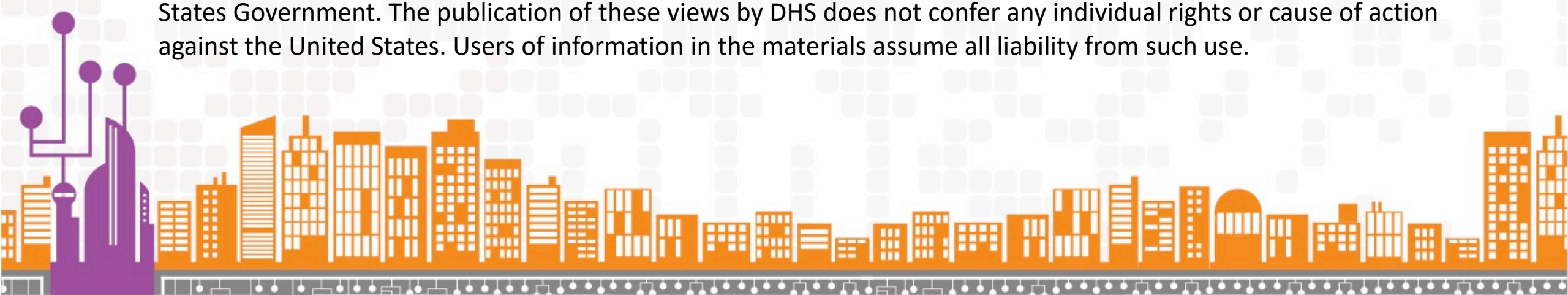


Team Profile

- PI: Dr. KC Claffy – Director
- CoPI: Dr. Alberto Dainotti – Research Scientist
- CAIDA – Center for Applied Internet Data Analysis
  University of California, San Diego

- Collaborating PIs: Dr. Anna Sperotto; Dr. Roland Rijswijk-deij
- University of Twente, NL

UNIVERSITY OF TWENTE.

Customer Need

- Protect the DNS from DDoS attacks
  - ***"If you can stop the DNS, you effectively stop most Internet communication"***

- Understanding of the DDoS ecosystem w.r.t. DNS + Systematic analysis of the resilience of the DNS against DDoS
- Tools that generate actionable intelligence to protect the DNS against DDoS attacks

- Customers: Operators and security experts that can benefit from actionable information about the DNS resilience to DDoS attacks.

Approach - Overview

1. Identify DNS single points of failure (SPoF) and vulnerabilities

   To predict how the DNS will be the target of future attacks

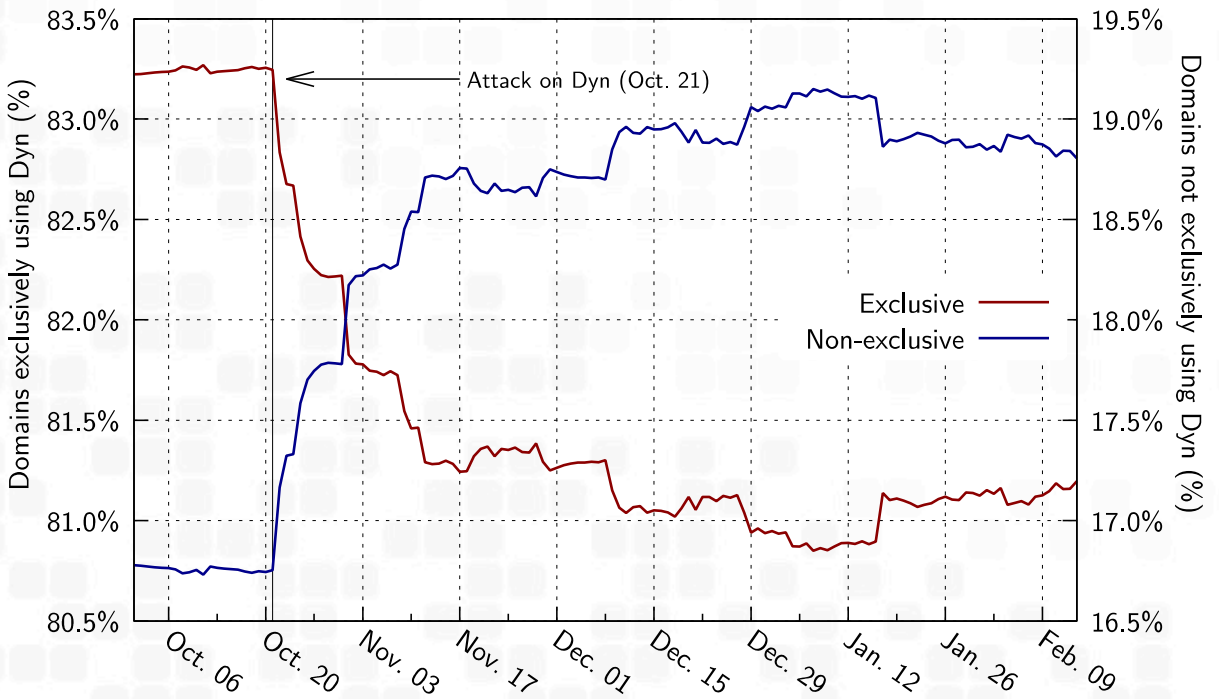
2. Analyze the DNS DDoS ecosystem

   To gain a comprehensive overview of current DDoS attacks against the DNS (attackers, attacks, and targets)

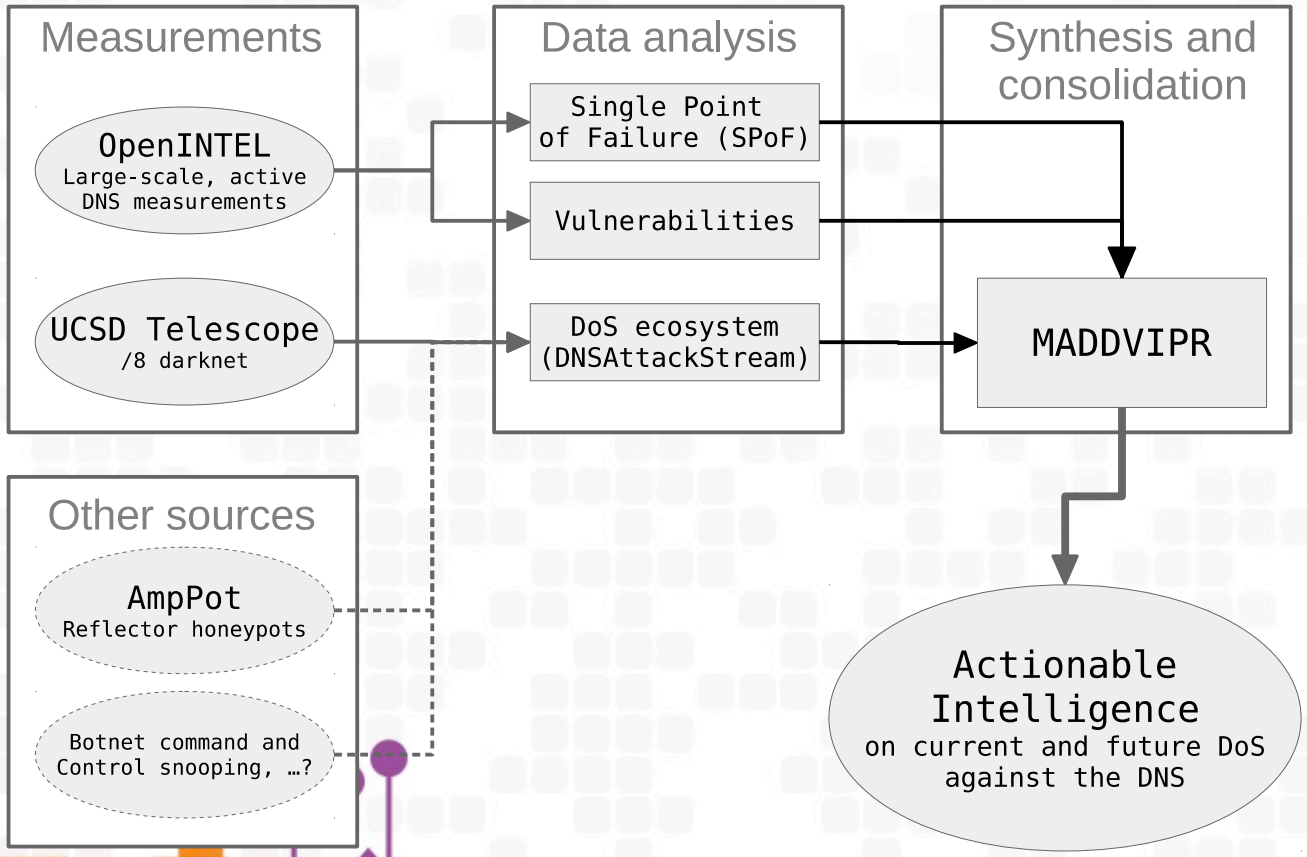
3. Synthesize results of (1) and (2) into a unified view to produce actionable information (for operators and security experts) to improve DNS resilience

Approach - Measurements

- Measurement based approach.
  Key datasets:
  - OpenINTEL project – daily active measurements of >60% of the DNS namespace *(Feb. 2015 – ongoing)*
  - UCSD Network Telescope – inference of DoS attack activity *(Jan 2010 – ongoing)*
- Auxiliary datasets: AmpPot reflection honeypot (University of Saarland), Botnet C&C, …



Approach - Architecture



Benefits

- A rigorous characterization of the DNS DDoS ecosystem and of the DNS vulnerability and misconfiguration
- Operators and security experts: access to **actionable information** in form of e.g. SPoF and misconfiguration blacklists, to improve the resilience and management of their DNS solutions

Competition/Alternatives

- Active DNS measurements
  - Other DNS measurements, e.g. netray.io (RWTH Aachen) and activednsproject.org (GeorgiaTech), exist.
    - In comparisons, OpenINTEL has more comprehensive coverage (65% of the namespace) and has been collecting data the longest (4 years)
  - Alternative: passive DNS measurements; they provide a partial view

- DoS attacks
  - UCSD-NT: unique and comprehensive global view on randomly-spoofed DoS attacks
  - Others provide information about other types of DoS attacks or partial information

Potential Transition Activities

- Open software – whenever suitable, tools will be released as open source
- Open data – a privacy-preserving form of the collected dataset will be made available to researchers
  - CAIDA's 20 years experience in providing curated Internet data
  - OpenINTEL has been awarded the 2018 Netherlands Data Prize for its commitment to making research data available.
- Interaction with operational and standardization bodies (DNS-OARC, IETF/IRTF, ICANN, NANOG, RIPE)

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