

Alexander Marder, PhD

Assistant Research Scientist

Center for Applied Internet Data Analysis (CAIDA)
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RESEARCH INTERESTS:

My research uses empirical analyses to improve the security, resilience, and performance of networked systems. I bring a unique skill set to network analysis and design, with a deep understanding of Internet topology, creative approaches to gathering data, and extensive experience measuring network properties. My data-driven approach naturally applies to a wide breadth of problems, including securing 5G communication against adversary nation-states, revealing physical resilience and security weaknesses in critical networks, and detecting performance bottlenecks that lead to broadband inequities.

EDUCATION:

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|--------------|---|---------------|
| Ph.D. | University of Pennsylvania
PhD Computer and Information Sciences
Thesis: “Sharp Snapshots of the Internet’s Graph with HONE”
Advisor: Jonathan M. Smith, PhD | December 2019 |
| M.S. | University of Pennsylvania
Computer and Information Sciences | May 2014 |
| B.S. | Brandeis University
BS Computer Science
Thesis: “Course Recommender System”
Advisor: Timothy J. Hickey | May 2012 |

FUNDING:

5G Traffic Sovereignty: Operating Through an Adversarial Internet

PI with Ricky Mok and kc claffy
NSF Convergence Accelerator 2022 Joint NSF/DOD Phase 1 for Track G, \$750,000
July 2022 – June 2023

Detection and Analysis of Infrastructure Bottlenecks in a Cloud-Centric Internet

Co-PI with Ricky Mok and kc claffy
NSF CNS Core Medium, \$1,200,000
October 2022 – September 2025

Measurement Capabilities for the Modern Internet

PI
NSF CRII, \$175,000
May 2021 – May 2023

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RESEARCH EXPERIENCE:

Assistant Research Scientist November 2020 – Present
CAIDA / UCSD, La Jolla, California

- Securing DOD communications with 5G wireless devices against nation-state adversaries
- Demonstrated the feasibility of intentional physical attacks against critical communications infrastructure
- Revealed single points of failure in Internet access networks with the potential for widespread outages
- Build measurement foundation to reveal how cloud applications route traffic to users
- Designed a machine learning approach to automatically extract information from natural language that operators use to convey information about infrastructure deployments

Postdoctoral Fellow September 2019 – October 2020
CAIDA / UCSD, La Jolla, California

Advisors: kc claffy and Alex C. Snoeren

- Designed and implemented a new technique to scaleably infer when two IP addresses belong to the same router
- Designed a technique to recognize virtual private networks
- Developed skills to conduct new large-scale Internet measurements

Research Assistant August 2014 – August 2019
University of Pennsylvania, Philadelphia, PA

Advisor: Jonathan M. Smith

- Devised and implemented two constraint satisfaction algorithms to infer network boundaries from Internet path measurements
- Released (and continue to maintain) the latter implementation; currently used for CAIDA's semi-annual Internet Topology Data Kit dataset releases
- Developed skills to process large quantities of data, along with the skills to recognize useful information and account for misleading information

PUBLICATIONS: Peer-Reviewed

Alexander Marder, Zesen Zhang, Ricky Mok, Ramakrishna Padmanabhan, Bradley Huffaker, Matthew Luckie, Alberto Dainotti, kc claffy, Alex C. Snoeren, Aaron Schulman. "Access Denied: Assessing Physical Risks to Internet Access Networks" Usenix Security. 2023

Ben Du, Gautam Akiwate, Thomas Krenc, Cecilia Testart, **Alexander Marder**, Bradley Huffaker, Alex C. Snoeren, and kc claffy. "IRR Hygiene in the RPKI Era" Passive and Active Measurement Conference. 2022.

Matthew Luckie, **Alexander Marder**, Bradley Huffaker, and kc claffy. "Learning Regexes to Extract Network Names from Hostnames" Asian Internet Engineering Conference. 2021.

Matthew Luckie, Bradley Huffaker, **Alexander Marder**, Zachary Bischof, and kc claffy. "Learning to Extract Geographic Information from Internet Router Hostnames" Conference on emerging Networking Experiments and Technologies (CoNEXT). 2021

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Zesen Zhang, **Alexander Marder**, Ricky Mok, Bradley Huffaker, Matthew Luckie, kc claffy, and Aaron Schulman. “Inferring Regional Access Network Topologies: Methods and Applications” Internet Measurement Conference. 2021. [long]

Alexander Marder, kc claffy, Alex C. Snoeren. “Inferring Cloud Interconnections: Validation, Geolocation, and Routing Behavior” Passive and Active Measurement Conference. 2021.

Matthew Luckie, **Alexander Marder**, Marianne Fletcher, Bradley Huffaker, kc claffy. “Learning to Extract and Use ASNs in Hostnames” Internet Measurement Conference. 2020. [short]

Alexander Marder. “Alias Pruning by Path Length Estimation (APPLE)” Passive and Active Measurement Conference. 2020.

Alexander Marder, Matthew Luckie, Bradley Huffaker, kc claffy. “vrfinder: Finding Outbound Addresses in Traceroute” SIGMETRICS. 2020.

Alexander Marder, Matthew Luckie, Amogh Dhamdhare, Bradley Huffaker, kc claffy, Jonathan M. Smith. “Pushing the Boundaries with bdrmapIT: Mapping Router Ownership at Internet Scale” Internet Measurement Conference. 2018. [long]

Alexander Marder, Jonathan M. Smith. “MAP-IT: Multipass Accurate Passive Inferences from Traceroute” Internet Measurement Conference. 2016. [long]

INVITED TALKS:

Alexander Marder. “How do Clouds Use IXPs?” Euro-IX Meeting. December 2020.

TEACHING EXPERIENCE:

Advisor

Visiting Student Researcher: 6 Month Internship Summer 2022 – Fall 2022
Computer Science Department, University of California, San Diego

- Worked with student to find mutually beneficial research direction
- Mentored student through a successful effort to geolocate network facilities where clouds peer with other networks

Mentor

Fall 2019 – Spring 2020

Course: Early Research Scholars Program
Computer Science Department, University of California, San Diego

- Mentored undergraduate students as part of a course designed to increase underrepresented minority completion of the computer science major
- Helped the students conduct a research project investigating allegedly stolen IP address space from African networks
- Taught students important research and Internet data science techniques

Teaching Assistant

Fall 2017 – Spring 2018

Course: Senior Project
Computer and Information Science Department, University of Pennsylvania

- Helped groups of seniors select and scope an academic yearlong project
- Met with groups regularly throughout the year to advise and assess progress

Alexander Marder, Ph.D.

- Graded projects at the end of the year and selected groups to represent the department at the School of Engineering and Applied Sciences competition

Teaching Assistant

Spring 2014

Course: Introduction to Computer Systems
Computer and Information Sciences, University of Pennsylvania

- Graded assignments and tests
- Held weekly office hours

Teaching Assistant

Fall 2013

Course: Technology and Policy
Law School and School of Engineering and Applied Sciences, University of Pennsylvania

- Graded assignments for undergraduate engineering students
- Interacted with students during weekly office hours

PROFESSIONAL SERVICE:

National Science Foundation

Proposal Review Panel

2022

Program Committee

Internet Measurement Conference

2021

Passive and Active Measurement Conference

2020