

# Ramakrishna Padmanabhan

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## Research Interests

I am primarily interested in measuring networks: their topology, connectivity, and performance.

## Education

PhD, Computer Science University of Maryland, College Park	GPA : 3.84 Advisor : Dr. Neil Spring	August 2011 - December 2018
B.Tech in Computer Science and Engg SASTRA University, Thanjavur, India	GPA : 9.2 / 10	June 2005 - May 2009

## Refereed Publications

- DynamIPs: Analyzing address assignment practices in IPv4 and IPv6  
*Ramakrishna Padmanabhan, John P. Rula, Philipp Richter, Stephen D. Strowes, Alberto Dainotti.*  
CoNEXT 2020 (Conference on emerging Networking EXperiments and Technologies)
- Trufflehunter: Cache Snooping Rare Domains at Large Public DNS Resolvers  
*Audrey Randall, Enze Liu, Gautam Akiwate, Ramakrishna Padmanabhan, Geoffrey M. Voelker, Stefan Savage, Aaron Schulman.*  
IMC 2020 (Internet Measurement Conference)
- Residential Links Under the Weather  
*Ramakrishna Padmanabhan, Aaron Schulman, Dave Levin, Neil Spring.*  
SIGCOMM 2019 (Special Interest Group on Data Communication Conference)
- Geo-locating BGP prefixes  
*Philipp Winter, Ramakrishna Padmanabhan, Alistair King, Alberto Dainotti.*  
TMA 2019 (Network Traffic Measurement and Analysis Conference)
- How to find correlated Internet failures  
*Ramakrishna Padmanabhan, Aaron Schulman, Alberto Dainotti, Dave Levin, Neil Spring.*  
PAM 2019 (Passive and Active Measurement Conference)
- Advancing the Art of Internet Edge Outage Detection  
*Philipp Richter, Ramakrishna Padmanabhan, Neil Spring, Arthur Berger, David Clark.*  
IMC 2018 (Internet Measurement Conference)
- Reasons Dynamic Addresses Change  
*Ramakrishna Padmanabhan, Amogh Dhamdhare, Emile Aben, kc claffy, Neil Spring.*  
IMC 2016 (Internet Measurement Conference)
- Timeouts: Beware Surprisingly High Delay  
*Ramakrishna Padmanabhan, Patrick Owen, Aaron Schulman, Neil Spring.*

IMC 2015 (Internet Measurement Conference)

- UAv6: Alias Resolution in IPv6 Using Unused Addresses  
*Ramakrishna Padmanabhan, Zhihao Li, Dave Levin, Neil Spring.*  
PAM 2015 (Passive and Active Measurement Conference)

## Posters and visualizations

- Measuring Last-Mile Internet Reliability During Severe Weather  
*Ramakrishna Padmanabhan, Ramakrishnan Sundara Raman, Reethika Ramesh, Aaron Schulman, Dave Levin, Neil Spring.*  
Internet Measurement Conference, 2017 (Poster)
- Live visualization of residential Internet outages detected during severe weather  
<http://bluepill.cs.umd.edu:3000/map/countymap>
- Visualization of failures that occurred during Hurricane Sandy  
<https://www.youtube.com/watch?v=pyqE87MFdqw>

## Invited blogposts

- Reasons Dynamic Addresses Change  
2016 (Nov), RIPE Labs Blog
- We can find shared IP addresses  
2018 (Mar), APNIC Blog

## Invited talks

- IPv4 vs. IPv6 address lifetimes  
NPS/CAIDA 2020 (Apr) Virtual IPv6 Workshop
- IODA-NP: Detecting outages affecting the Internet's edge  
AIMS 2019 (Mar), CAIDA, San Diego
- Measuring and Inferring Weather's Effect on Residential Link Failures  
AIMS 2018 (Mar), CAIDA, San Diego
- Analyzing static, dynamic, and gateway IPv4 addresses  
AIMS 2017 (Mar), CAIDA, San Diego
- Remote Residential Outage Detection With Active Probes  
2016 (Nov), University of Southern California, Los Angeles
- Reasons Dynamic Addresses Change  
2016 (Aug), Northeastern University, Boston

- Dynamic address durations in RIPE Atlas probes  
AIMS 2016 (Feb), CAIDA, San Diego
- UAv6: Alias Resolution in IPv6 Using Unused Addresses  
AIMS 2015 (April), CAIDA, San Diego

## Service

- TPC member, Internet Measurement Conference, 2019
- TPC member, Passive and Active Measurement Conference, 2019
- Shadow TPC member, Internet Measurement Conference, 2018
- TPC member, Passive and Active Measurement Conference, 2018

## Internships

- CAIDA: Center for Applied Internet Data Analysis, San Diego Jun 4 - Aug 26 2018
  - Worked on defining, measuring, and evaluating macroscopic Internet-edge outages
- Akamai Technologies, 150 Broadway, Cambridge, Massachusetts Jun 20 - Sep 9 2016
  - Analyzed dynamic IP address durations
  - Detected proxies and gateways using Akamai software installation logs
  - Detected and evaluated Internet outages
- CAIDA: Center for Applied Internet Data Analysis, San Diego Jun 1 - Sep 30 2015
  - Worked towards integrating UAv6 into CAIDA's Ark infrastructure
  - Began a collaboration with CAIDA on Dynamic IP address Dynamics

## Research Experience

- **When should pings time out?** With colleagues, I led an analysis of ping round-trip times (RTTs) on the Internet in an effort to determine timeouts that would capture most ping responses, using large ping datasets collected by ISI and Zmap. I found addresses that are prone to high RTTs and probed them to determine the cause of high RTTs. Our results showed that a 5 second timeout would miss 5% of pings from 5% of addresses, and in general, RTTs were higher than expected. We also showed that the primary cause of these high RTTs were cellular networks, and that high RTTs are a relatively recent phenomenon beginning in 2011.
- **Dynamic IP address Dynamics**  
Many studies assume that dynamic addresses change after certain durations without much empirical evidence. In this project, I first analyzed RIPE Atlas datasets to find patterns in how dynamic addresses change. Several ISPs in Europe and Asia periodically change addresses assigned to customer devices. Addresses are also likely to change upon Internet outages, with some ISPs changing the assigned address even upon CPE reboots. Next, I corroborated the results observed from RIPE Atlas using Akamai datasets. My eventual goal is to generate a global map of dynamic address properties that can help industry practitioners and researchers get a better sense of when addresses change and why.
- **IPv6 Topology**  
I am studying the topology of the evolving IPv6 network and developed a tool with colleagues, UAv6, that makes generated topologies more accurate. In the summer of 2015, I worked towards deploying UAv6 in the production infrastructure of CAIDA, one of the world's leading Internet measurement labs.
- **Proxy detection**  
IPv4 address scarcity has led to an increase in addresses being used as proxies, where tens to thousands of users can access the Internet using a handful of proxy addresses. Detecting proxy addresses and classifying them into different kinds (enterprise, mobile, cloud etc.) will help IP reputation systems and access-control

systems. I used Akamai datasets to detect proxy addresses, and to analyze how the behavior of such addresses changes over time.

- **Studying the effect of weather on residential Internet connectivity** With colleagues, I led an investigation into the resilience of residential Internet connections to various weather conditions by analyzing longitudinal data collected by the Thunderping tool. Thunderping pings IP addresses in U.S. counties that have ongoing active weather alerts. We analyze these pings to determine how many more outages occurred during times of active weather conditions. Our analysis of eight years' of this data revealed that a variety of weather conditions are correlated with increased probability of failure, and the increase depends upon the type of weather, link type, and geographic location.

## Teaching Experience

- Teaching Assistant for CMSC417 - Computer Networks, *with Colin Dixon.* (Spring 2016)
- Teaching Assistant for CMSC417 - Computer Networks, *with Ashok Agrawala.* (Fall 2011, Spring 2012)