

Siva Kesava Reddy KAKARLA

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Senior Researcher, Microsoft Research

Interested in researching all aspects of the design and implementation of high-performance network automation tools with insights from verification, testing, anomaly detection, algorithms, and automata theory.

Employment

Microsoft Senior Researcher Aug '22 — Present
Redmond, WA Networking Research Group • Microsoft Research (MSR)

Education

M. S., Ph. D. Computer Science Fall '17 — Spring '22
(UCLA) Advisors: [Prof. Todd Millstein](#) and [Prof. George Varghese](#)
CGPA: 4.0 / 4.0
University of California, Los Angeles • CA, USA

B. Tech. Computer Science and Engineering (with Honors) Fall '13 — Spring '17
(IIT-Kgp) CGPA: 9.67 / 10.0
Indian Institute of Technology, Kharagpur • India

Selected Awards

UCLA Outstanding Graduate Student Research Award 2022

UCLA Dissertation Year Fellowship (DYF) 2021 — 2022


Meta Facebook [PhD Fellowship](#) Award Finalist (top 3.5%) 2021


SIGCOMM Best Student Paper Award 2020


UCLA Dean's Graduate Student Research (GSR) Fellowship 2018 — 2019

UCLA Graduate Dean's Scholar Award (GDSA) 2017


Publications

NSDI '22 **SCALE: Automatically Finding RFC Compliance Bugs in DNS Nameservers.**
Invited for an article in [\(USENIX;login: Magazine\)](#)
[Siva Kesava Reddy Kakarla](#), Ryan Beckett, Todd Millstein, George Varghese.
 *Proceedings of the 19th USENIX Symposium on Networked Systems Design and Implementation, NSDI 2022, pages 307–323.*

HotNets '21 **How Complex is DNS?**
[Siva Kesava Reddy Kakarla](#), Ryan Beckett, Todd Millstein, George Varghese.
 *Proceedings of the 20th ACM Workshop on Hot Topics in Networks, HotNets 2021, pages 116–122.*

SIGCOMM '21 **CAMPION: Debugging Router Configuration Differences.**
Alan Tang, [Siva Kesava Reddy Kakarla](#), Ryan Beckett, Ennan Zhai, Matt Brown, Todd Millstein, Yuval Tamir, George Varghese.
 *Proceedings of the 2021 ACM SIGCOMM 2021 Conference, pages 748–761.*


SIGCOMM '20 **GRoot: Proactive Verification of DNS Configurations.**
[\(Best Student Paper Award\)](#)
[Siva Kesava Reddy Kakarla](#), Ryan Beckett, Behnaz Arzani, Todd Millstein, George Varghese.

 *Proceedings of the Conference of the ACM Special Interest Group on Data Communication, SIGCOMM 2020*, pages 310–328.

NSDI '20 **Finding Network Misconfigurations by Automatic Template Inference (SELFSTARTER).**
Siva Kesava Reddy Kakarla, Alan Tang, Ryan Beckett, Karthick Jayaraman, Todd Millstein, Yuval Tamir, George Varghese.

 *Proceedings of the 17th USENIX Symposium on Networked Systems Design and Implementation, NSDI 2020*, pages 999–1013.

arXiv '19 **Expect More from the Network: DDoS Mitigation by FITT in Named Data Networking.**
Zhiyi Zhang, Vishrant Vasavada, Siva Kesava Reddy Kakarla, Eric Osterweil, and Lixia Zhang.

 *CoRR*, abs-1902-09033.

GLOBECOM '17 **IEEE 802.11ac DBCA: A Tug of War between Channel Utilization and Fairness.**
Mahankali Saketh, Siva Kesava Reddy Kakarla, Raja Karmakar, Samiran Chattopadhyay, Sandip Chakraborty.

 *Proceedings of the IEEE Global Communications Conference, 2017*, pages 1–6.

Research Tools Impact

FERRET

- Performs automated testing of DNS nameserver implementations by using symbolic execution of the DNS formal model
- Scales better than symbolic testing and finds deeper (RFC violation) bugs than fuzz testing
- Found **30** bugs across 8 different open-sourced DNS implementations, including popular implementations such as Bind, PowerDNS, Knot, and Nsd, of which **20** are fixed
- Found a critical vulnerability where an attacker with little effort could **crash** Bind name-servers and resolvers remotely (High-severity rated [CVE-2021-25215](#))
- Found **4** bugs in [Amazon Route 53 DNS](#) implementation (tests now part of CI/CD pipeline)

GROOT

- Verifies efficiently that a property of interest holds for all possible DNS queries by reducing the extremely large space of possible queries to a smaller set of *query equivalence classes*
- Found multiple issues of delegation inconsistencies, cyclic zone dependencies, and rewrite blackholing in minutes in the Microsoft zone files with over 500k records
- Revealed **109** new bugs in 10 seconds in a large campus network with over a hundred thousand records
- Found around **160k** issues of blackholing in 3 minutes, which initiated a cleanup of the zone files of a large CDN with over 3.5 million records

SELFSTARTER

- Automatically finds configuration errors without a specification via a form of outlier detection on inferred templates
- Found **33** route policies with previously unknown bugs in the [Microsoft wide area network](#)
- Inferred templates provide *actionable* feedback to the operators to remediate the errors

Work Experience

Amazon Finding DNS RFC Compliance Errors in Amazon Route 53 DNS

(Intern) with John Backes, Automated Reasoning Group • Remote

Sep '21 — Dec '21

Google Finding Topology Errors by Graph Templating of Google Metro Networks

(Intern) with Jayaram Mudigonda and Anees Shaikh, NetInfra Group • Remote

Jun '20 — Sep '20

Microsoft Verification of DNS Configurations

(Part-Time Contract) with Ryan Beckett and Behnaz Arzani, MNR Group • Remote

Oct '19 — Feb '20

Microsoft Verification of DNS Configurations

(Intern) with Ryan Beckett and Behnaz Arzani, MNR Group • Redmond, WA

Jun '19 — Sep '19

UCLA CS 118 – Computer Network Fundamentals

(Teaching Assistant) with Prof. George Varghese • Los Angeles, CA

Sep '19 — Dec '19

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| UCLA (Graduate RA) | Misconfigurations by Template Inference and Formal Methods for a Robust DNS with <i>Prof. Todd Millstein and Prof. George Varghese</i> • Los Angeles, CA | Sep '17 — Jun '22 |
| IIT-Kgp (Undegraduate RA) | Does QUIC Kill Your Data Plan? A View Using YouTube Adaptive Streaming Clients with <i>Prof. Sandip Chakraborty</i> , Complex Network Research Group • India | Aug '16 — Apr '17 |
| LinkedIn (Intern) | Enhancement of LinkedIn spam detection tool with Mockito unit tests with <i>Prashanth Nimmagadda</i> , Content Filtering Team • India | May '16 — Jul '16 |
| IISc Bangalore (Intern) | Experimenting with Akka Package with <i>Prof. Komondoor V. Raghavan</i> , Compilers, PL and SE Group • India | May '15 — Jul '15 |

Academic Service

AEC Artifact Evaluation Committee Member
SIGCOMM (2021, 2022)

Selected Talks

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| Hedge Podcast | Recorded an episode for the podcast discussing the DNS complexity | Jun '22 |
| DNS-OARC 37 | Find Bugs in your DNS Zone files Before Deployment with GRoot | Feb '22 |
| UCLA Seminar | Formal Methods for a Robust DNS | Jan '22 |
| NetVerify 2021 | Exploiting Formal Methods To make The Domain Name System More Robust (Network Verification Workshop in conjunction with the 29th IEEE ICNP 2021) | Nov '21 |
| DNS-OARC 35 | “So you think your Nameservers are Correct?”: Finding Errors Automatically in Nameserver Implementations | May '21 |