Siva Kesava Reddy KAKARLA

Senior Researcher, Microsoft Research

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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. (UCLA) Computer Science — Fall '17 — Spring '22
Advisors: Prof. Todd Millstein and Prof. George Varghese
GPA: 4.0 / 4.0
University of California, Los Angeles • CA, USA

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

Selected Awards

SIGCOMM ACM SIGCOMM Dissertation Honorable Mention — 2023
Runner up of the SIGCOMM Doctoral Dissertation Award for Outstanding PhD Thesis in Computer Networking and Data Communication. "The committee found the research impressively rigorous and thorough, and of critical importance to Internet security."

ANRP IRTF/IETF Applied Networking Research Prize — 2023
For the work on checking the correctness of DNS nameservers.

UCLA Outstanding Graduate Student Research Award — 2022
One of 4 recipients across all of graduate computer science students.

UCLA Dissertation Year Fellowship (DYF) — 2021 — 2022
Awarded to students planning to teach or be in research after their graduation.

Meta Facebook PhD Fellowship Award Finalist (In top 3.5% of applicants worldwide) — 2021
"Fellowship supports exceptional PhDs in a variety of technology research domains."

SIGCOMM Best Student Paper Award — 2020
For the first work on formally modeling the Domain Name System (DNS).

UCLA Dean's Graduate Student Research (GSR) Fellowship — 2018 — 2019
Supported by UCLA graduate Dean for the 2018—2019 academic year.

UCLA Graduate Dean's Scholar Award (GDSA) — 2017
Awarded to department's top incoming PhD student. "To enhance UCLA's competitiveness for the most highly recruited doctoral students admitted to the department."

Publications

SIGCOMM '24 **Rethinking Machine Learning Collective Communication as a Multi-Commodity Flow Problem.**
Xuting Liu, Behnaz Arzani, Siva Kesava Reddy Kakarla, Liangyu Zhao, Vincent Liu, Miguel Castro, Srikanth Kandula, Luke Marshall.
(Accepted, To appear)

PLDI '24 **DIFFY: Data-driven Bug Finding for Configurations**
Siva Kesava Reddy Kakarla, Francis Y. Yan, Ryan Beckett.
Proceedings of the ACM on Programming Languages, Volume 8, Issue PLDI, Article 155.

NSDI '24 **MESSI: High-Coverage Testing for BGP Implementations.**
Rathin Singha, Rajdeep Mondal, Ryan Beckett, Siva Kesava Reddy Kakarla, Todd Millstein, George Varghese.
Proceedings of the 21st USENIX Symposium on Networked Systems Design and Implementation, NSDI 2024, pages 1009–1023.

arXiv '23 **Oracle-based Protocol Testing with Eywa.**
Siva Kesava Reddy Kakarla, Ryan Beckett.
CoRR, abs-2312-06875.

HotNets '23 **A Holistic View of AI-driven Network Incident Management.**
Pouya Hamadanian, Behnaz Arzani, Sadjad Fouladi, Siva Kesava Reddy Kakarla, Rodrigo Fonseca, Denizcan Billor, Ahmad Cheema, Edet Nkposong, Ranveer Chandra.
Proceedings of the 20th ACM Workshop on Hot Topics in Networks, HotNets 2021, pages 116-122.

NSDI '22 **SCALE: Automatically Finding RFC Compliance Bugs in DNS Nameservers.**
Invited for an article in ⟦USENIX ;login: Magazine⟧
⟦IRTF/IETF Applied Networking Research Prize (ANRP)⟧
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.

Academic Service

NSDI Program Committee Member 2025

CoNEXT	Program Committee Member	2024
ANRW	Applied Networking Research Workshop Program Committee Member	2024
SIGCOMM	Judge for the ACM SIGCOMM Student Research Competition (SRC)	2023
SIGCOMM	Poster/Demo track Program Committee Member	2023
ANRW	Applied Networking Research Workshop Program Committee Member	2023
SIGCOMM	Artifact Evaluation Committee Member	2022
SIGCOMM	Artifact Evaluation Committee Member	2021

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 nameservers 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 (Intern)	Finding DNS RFC Compliance Errors in Amazon Route 53 DNS with *John Backes*, Automated Reasoning Group • Remote	Sep '21 — Dec '21
Google (Intern)	Finding Topology Errors by Graph Templating of Google Networks with *Jayaram Mudigonda and Anees Shaikh*, NetInfra Group • Remote	Jun '20 — Sep '20
Microsoft (Part-Time Contract)	Verification of DNS Configurations with *Ryan Beckett and Behnaz Arzani*, MNR Group • Remote	Oct '19 — Feb '20
Microsoft (Intern)	Verification of DNS Configurations with *Ryan Beckett and Behnaz Arzani*, MNR Group • Redmond, WA	Jun '19 — Sep '19
UCLA (Teaching Assistant)	CS 118 – Computer Network Fundamentals with *Prof. George Varghese* • Los Angeles, CA	Sep '19 — Dec '19
UCLA (Graduate RA)	Formal Methods for a Robust DNS with *Prof. Todd Millstein and Prof. George Varghese* • Los Angeles, CA	Sep '19 — Jun '22
UCLA (Graduate RA)	Misconfigurations by Template Inference with *Prof. Todd Millstein and Prof. George Varghese* • Los Angeles, CA	Sep '17 — Jun '19
IIT-Kgp	Does QUIC Kill Your Data Plan? A View Using YouTube Adaptive Streaming Clients	

(Undegraduate RA) with *Prof. Sandip Chakraborty*, Complex Network Research Group • India — Aug '16 — Apr '17

LinkedIn (Intern) — Enhancement of LinkedIn spam detection tool with Mockito tests
with *Prashanth Nimmagadda*, Content Filtering Team • India — May '16 — Jul '16

IISc Bangalore (Intern) — Experimenting with Akka Package
with *Prof. Komondoor V. Raghavan*, Compilers, PL and SE Group • India — May '15 — Jul '15

Selected Talks

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 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