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
CGPA: 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
CGPA: 9.67 / 10.0
Indian Institute of Technology, Kharagpur • India

Selected Awards

ANRP IRTF/IETF Applied Networking Research Prize — 2023
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⟧
⟦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.

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 Metro 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 — 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

UCLA Misconfigurations by Template Inference and Formal Methods for a Robust DNS
(Graduate RA) with *Prof. Todd Millstein and Prof. George Varghese* • Los Angeles, CA — Sep '17 — Jun '22

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

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

Academic Service

AEC Artifact Evaluation Committee Member
SIGCOMM ⟨2021, 2022⟩

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 The Domain Name System More Robust — Nov '21
(Network Verification Workshop in conjunction with the 29th IEEE ICNP 2021)

DNS-OARC 35 "So you think your Nameservers are Correct?": Finding Errors Automatically in Nameserver Implementations — May '21