
Research Interests

Computer systems, formal verification, and software testing

I am a computer systems researcher with a focus on system reliability. I develop formal verification and software testing techniques to address reliability issues in cloud systems.

Education

- 2019–present **Ph.D. in Computer Science**, University of Illinois Urbana-Champaign
Advisor: Prof. Tianyin Xu
- 2015–2019 **B.Sc. in Computer Science**, Nanjing University, China

Impact

- ◇ My research has discovered over 200 bugs and led to over 120 bug fixes in mission-critical cloud systems, including Kubernetes, ZooKeeper, Hadoop, HBase, Alluxio, Orleans, and many widely-used Kubernetes controllers that manage critical cloud systems including Cassandra, Elasticsearch, Knative, MongoDB, RabbitMQ, Redis, TiDB, and ZooKeeper
- ◇ The ideas of Ctest [OSDI'20], Sieve [OSDI'22], and Acto [SOSP'23] have been followed and adopted by developers in large companies such as Anyscale ([Link1](#)), VMware ([Link2](#), [Link3](#)), and Google
- ◇ Sieve [OSDI'22], Acto [SOSP'23], and Anvil [OSDI'24] have been presented at major industrial venues including SRECon and KubeCon + CloudNativeCon
- ◇ Sieve [OSDI'22] and Acto [SOSP'23] have been used in UIUC CS523 (Advanced Operating Systems) to teach testing Kubernetes controllers
- ◇ Ctest [OSDI'20] has been used in UIUC CS527 (Topic in Software Engineering) to teach testing cloud system configurations
- ◇ *All* of my previous research projects have been open sourced to enable further research and development. For example, Sieve [OSDI'22] has received 322 stars and been forked by 20 times by Oct. 2024 ([Link](#))

Honors and Awards

- 2024 OSDI Jay Lepreau Best Paper Award
- 2024 Mavis Future Faculty Fellowship
- 2022 Yunni & Maxine Pao Memorial Fellowship
- 2020–2024 Student Travel Grants for OSDI'20, '22, '24 and NSDI'23
- 2017 Samsung Scholarship
- 2016 National Scholarship of China

Publications

Conference Papers

- EuroSys'25 Lingzhi Ouyang, **Xudong Sun**, Ruize Tang, Yu Huang, Madhav Jivrajani, Xiaoxing Ma, and Tianyin Xu. Multi-Grained Specifications for Distributed System Model Checking and Verification. To appear in *Proceedings of the 20th European Conference on Computer Systems (EuroSys'25)*, Rotterdam, The Netherlands, Apr. 2025.
- OSDI'24 **Xudong Sun**, Wenjie Ma, Jiawei Tyler Gu, Zicheng Ma, Tej Chajed, Jon Howell, Andrea Lattuada, Oded Padon, Lalith Suresh, Adriana Szekeres, and Tianyin Xu. Anvil: Verifying Liveness of Cluster Management Controllers. In *Proceedings of the 18th USENIX Symposium on Operating Systems Design and Implementation (OSDI'24)*, Santa Clara, CA, Jul. 2024.
- Jay Lepreau Best Paper Award**
- EuroSys'24 Ruize Tang, **Xudong Sun**, Yu Huang, Yuyang Wei, Lingzhi Ouyang, and Xiaoxing Ma. SandTable: Scalable Distributed System Model Checking with Specification-Level State Exploration. In *Proceedings of the 19th European Conference on Computer Systems (EuroSys'24)*, Athens, Greece, Apr. 2024.
- SOSP'23 Jiawei Tyler Gu, **Xudong Sun**, Wentao Zhang, Yuxuan Jiang, Chen Wang, Mandana Vaziri, Owolabi Legunsen, and Tianyin Xu. Acto: Automatic End-to-End Testing for Operation Correctness of Cloud System Management. In *Proceedings of the 29th ACM Symposium on Operating Systems Principles (SOSP'23)*, Koblenz, Germany, Oct. 2023.
- NSDI'23 Yinfang Chen, **Xudong Sun**, Suman Nath, Ze Yang, and Tianyin Xu. Push-Button Reliability Testing for Cloud-Backed Applications with Rainmaker. In *Proceedings of the 20th USENIX Symposium on Networked Systems Design and Implementation (NSDI'23)*, Boston, MA, April 2023.
- OSDI'22 **Xudong Sun**, Wenqing Luo, Jiawei Tyler Gu, Aishwarya Ganesan, Ramnatthan Alagappan, Michael Gasch, Lalith Suresh, and Tianyin Xu. Automatic Reliability Testing for Cluster Management Controllers. In *Proceedings of the 16th USENIX Symposium on Operating Systems Design and Implementation (OSDI'22)*, Carlsbad, CA, Jul. 2022.
- OSDI'20 **Xudong Sun***, Runxiang Cheng*, Jianyan Chen, Ran Ang, Owolabi Legunsen, and Tianyin Xu (*co-primary). Testing Configuration Changes in Context to Prevent Production Failures. In *Proceedings of the 14th USENIX Symposium on Operating Systems Design and Implementation (OSDI'20)*, Virtual Event, Nov. 2020.

Workshop Paper

- HotOS'21 **Xudong Sun**, Lalith Suresh, Aishwarya Ganesan, Ramnatthan Alagappan, Michael Gasch, Lilia Tang, and Tianyin Xu. Reasoning about modern datacenter infrastructures using partial histories. In *Proceedings of the 18th Workshop on Hot Topics in Operating Systems (HotOS-XVIII)*, Virtual Event, May 2021.

Articles

- ;login: **Xudong Sun**, Wenqing Luo, Jiawei Tyler Gu, Aishwarya Ganesan, Ramnatthan Alagappan, Michael Gasch, Lalith Suresh, and Tianyin Xu. Sieve: Chaos Testing for Kubernetes Controllers. ;login: The USENIX Magazine, Nov. 2024.

;login: Jiawei Tyler Gu, **Xudong Sun**, Zhen Tang, Chen Wang, Mandana Vaziri, Owolabi Legunsen, and Tianyin Xu Acto: Push-Button End-to-End Testing for Operation Correctness of Kubernetes Operators. ;login: The USENIX Magazine, Aug. 2024.

;login: **Xudong Sun**, Jiawei Tyler Gu, Cody Rivera, Tej Chajed, Jon Howell, Andrea Lattuada, Oded Padon, Lalith Suresh, Adriana Szekeres, and Tianyin Xu Anvil: Building Kubernetes Controllers That Do Not Break. ;login: The USENIX Magazine, Jul. 2024.

Service

2024 OSDI/ATC Reproducibility Birds-of-a-Feather Session invited presenter

2024 USENIX ATC external review committee

2024 UIUC Systems Verification Seminar co-organizer

2022 UIUC Brett Daniel Software Engineering Seminar co-organizer

2021 UIUC Systems Seminar co-organizer

2021 SOSP Hallway Discussion leader

Talks

- ◇ Testing and Verification of Cloud Infrastructure Systems
 - SOSP Doctoral Workshop, Nov. 2024, Austin, TX
- ◇ Anvil: Verifying Liveness of Cluster Management Controllers
 - ByteDance, Nov. 2024, remote
 - University of Wisconsin-Madison, Oct. 2024, Madison, WI
 - Duke University, Oct. 2024, remote
 - Microsoft Research, Aug. 2024, remote
 - VMware Research Group, Aug. 2024, remote
 - OSDI, July 2024, Santa Clara, CA
 - Verus retreat at CMU, June 2024, Pittsburgh, PA
- ◇ Push-Button Reliability Testing for Cloud-Backed Applications with Rainmaker
 - NSDI, Apr. 2023, Boston, MA
 - Pre-NSDI gathering at Boston University, Apr. 2023, Boston, MA
- ◇ Automatic Reliability Testing for Cluster Management Controllers
 - OSDI, July 2022, Carlsbad, CA
 - VMware Research Group, June 2022, Palo Alto, CA
 - KubeCon + CloudNativeCon North America, Oct. 2021, remote
- ◇ Reasoning about modern datacenter infrastructures using partial histories
 - HotOS, June 2021, remote
 - Microsoft Research, May 2021, remote
- ◇ Testing Configuration Changes in Context to Prevent Production Failures
 - UMich SRG Student Seminar, Apr. 2021, remote
 - OSDI, Nov. 2020, remote

Work Experience

Summer **Research intern**, VMware Research Group

2022 Mentors: Lalith Suresh, Adriana Szekeres, Oded Padon

- Summer **Research intern**, Microsoft Research
2021 Mentor: Suman Nath
- Summer **Research intern**, VMware Research Group
2020 Mentor: Lalith Suresh

Teaching and Mentoring

Teaching Assistant

- Fall 2020 UIUC CS523: Advanced Operating Systems (with Prof. Tianyin Xu)

Guest Lectures

- Feb. 2024 UIUC CS523: Advanced Operating Systems (hosted by Prof. Tianyin Xu)
Sep. 2023 UVA CS6501: Cloud System Reliability (hosted by Prof. Chang Lou)
Sep. 2023 UIUC CS527: Topic in Software Engineering (hosted by Prof. Darko Marinov)
Feb. 2023 UIUC CS523: Advanced Operating Systems (hosted by Prof. Tianyin Xu)
Sep. 2022 UIUC CS527: Topic in Software Engineering (hosted by Prof. Darko Marinov)
Nov. 2021 Brown University CSCI 2952: Distributed Systems at Scale: Microservices Management (hosted by Prof. Theophilus A. Benson)

Mentoring PhD Students

- 2024–now Cody Rivera on the follow-up project of Anvil [OSDI'24]
2024–now Cathy Cai on testing cluster schedulers
2021–2023 Jiawei Tyler Gu on Sieve [OSDI'22] and Acto [SOSP'23]
2021–2022 Yinfang Chen on Rainmaker [NSDI'23]
2020–2021 Lilia Tang on studying cloud infrastructure failures [HotOS'21]

Mentoring Master's Students

- 2021–2022 Wenqing Luo on Sieve [OSDI'22]
Wenqing joined Apple and is working on Apple's cloud infrastructures

Mentoring Undergraduate Students

- 2024–now Shurang Wu on testing cluster schedulers
2023 Zicheng Ma on Anvil [OSDI'24]
Zicheng joined Harvard for his master's study
2023 Wenjie Ma on Anvil [OSDI'24]
Wenjie joined UC Berkeley for her PhD study