Ting Dai

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Research Interests

My research interests are in the areas of software systems, program analysis, and cloud computing. The goal of my research is to make software systems and cloud infrastructures reliable and secure.

Education

2014–2019 **Ph.D. in Computer Science**,
North Carolina State University, USA.
GPA: 4/4
thesis A Hybrid Approach to Cloud System Performance Bug Detection, Diagnosis and Fix
advisor Professor Xiaohui (Helen) Gu

2011–2014 **Master in Computer Software and Theory**,
Nanjing University of Posts and Telecommunications, China.
GPA: 3.78/4

2007–2011 **Bachelor in Information Security**,
Nanjing University of Posts and Telecommunications, China.
GPA: 3.85/4

Publications

Refereed Journal Articles (1 total)

TPDS'19 **Ting Dai**, Daniel Dean, Peipei Wang, Xiaohui Gu, and Shan Lu. Hytrace: A Hybrid Approach to Performance Bug Diagnosis in Production Cloud Infrastructures. in *IEEE Transactions on Parallel and Distributed Systems*, vol. 30, no. 1, 2019. *Impact Factor: 4.181*

Refereed Conference Publications (8 total, 1 best paper nominee)

SoCC'20 **Ting Dai**, Alexei Karve, Grzegorz Koper, and Sai Zeng. Automatically Detecting Risky Scripts in Infrastructure Code. in *Proceedings of the 11th ACM Symposium on Cloud Computing*. Virtual Event, USA, 2020. *Acceptance Rate: 24.5%*

SoCC'20 Jingzhu He, **Ting Dai**, Xiaohui Gu, and Guoliang Jin. HangFix: Automatically Fixing Software Hang Bugs for Production Cloud Systems. in *Proceedings of the 11th ACM Symposium on Cloud Computing*. Virtual Event, USA, 2020. *Acceptance Rate: 24.5%*

DSN'19 **Ting Dai***, Hui Kang*, Nerla Jean-Louis, Shu Tao, and Xiaohui Gu. FabZK: Supporting Privacy-Preserving, Auditable Smart Contracts in Hyperledger Fabric. in *Proceedings of the 49th IEEE/IFIP International Conference on Dependable Systems and Networks*. Portland, OR, USA, 2019. *Acceptance Rate: 21.4%* (*Co-primary authors).

ICDCS'19 Jingzhu He, **Ting Dai**, and Xiaohui Gu. TFix: Automatic Timeout Bug Fixing in Production Server Systems. in *Proceedings of the 39th IEEE International Conference on Distributed Computing Systems*. Dallas, TX, USA, 2019. *Acceptance Rate: 19.6%*

IC2E'19 Olufogorehan Tunde-Onadele, Jingzhu He, **Ting Dai**, and Xiaohui Gu. A Study on Container Vulnerability Exploit Detection. in *Proceedings of the 7th IEEE International Conference on Cloud Engineering*. Prague, Czech Republic, 2019. *Acceptance Rate: 26%*

IC2E'18 **Ting Dai**, Jingzhu He, Xiaohui Gu, and Shan Lu. Understanding Real-World Timeout Problems in Cloud Server Systems. in *Proceedings of the 6th IEEE International Conference on Cloud Engineering*. Orlando, FL, USA, 2018. *Acceptance Rate: 19%* (🏅 best paper nominee)

SoCC'18 **Ting Dai**, Jingzhu He, Xiaohui Gu, Shan Lu, and Peipei Wang. DScope: Detecting Real-World Data Corruption Hang Bugs in Cloud Server Systems. in *Proceedings of the 9th ACM Symposium on Cloud Computing*. Carlsbad, CA, USA, 2018. *Acceptance Rate: 24.4%*

ICAC'18 Jingzhu He, **Ting Dai**, and Xiaohui Gu. TScope: Automatic Timeout Bug Identification for Server Systems. in *Proceedings of the 15th IEEE International Conference on Autonomic Computing*. Trento, Italy, 2018.

Refereed Poster Publications (1 total)

SoCC'17 **Ting Dai**, Daniel Dean, Peipei Wang, Xiaohui Gu, and Shan Lu. Hytrace: a hybrid approach to performance bug diagnosis in production cloud infrastructures. in *Proceedings of the 8th ACM Symposium on Cloud Computing*. Santa Clara, CA, USA, 2017.

ePrint Archive (1 total)

arXiv'21 Jingzhu He, **Ting Dai**, and Xiaohui Gu. TFix+: Self-configuring Hybrid Timeout Bug Fixing for Cloud Systems. 2021.

Submitted Work (1 total)

EuroSys'22 Bekir Turkkan, **Ting Dai**, Adithya Raman, Tevfik Kosar, Changyou Chen, Fatih Bulut, Jaroslaw Zola, and Daby Sow. GreenABR: Energy-Aware Adaptive Bitrate Streaming with Deep Reinforcement Learning. in *Proceedings of the 17th European Conference on Computer Systems*. Rennes, France, 2022.

Work Experience

Sep 2019-now **Research Staff Member**, IBM Research.

- I developed SecureCode, an analysis framework which is integrated into the DevOps pipeline deployed in IBM cloud to automatically detect risky Shell and PowerShell scripts in infrastructure code.
- I co-developed a policy-based governance, risk, and compliance system to manage VM configurations in multi-cloud environments, which is integrated with IBM AIOps.
- I co-developed an environment-aware ranking system to quantify threats, including risky configurations and security vulnerabilities.
- I designed and co-developed a risk enhancement service which periodically populates the latest weaponization metrics of the vulnerabilities to clients' data service.

2015–2019 **Research Assistant**, NC State University.

- I developed a performance bug detection and fixing system including Hytrace, DScope, and HangFix by leveraging rule-based static code analysis and ML-based anomaly detection on kernel-level syscall traces.
- I co-developed a timeout bug detection and fixing system including TScope, TFix and TFix+ by leveraging static taint analysis and adaptive self-configuration considering application workloads and runtime environment.
- I also worked on understanding real-world timeout problems and evaluating existing detection schemes on container vulnerability attacks.
- Moreover, I developed CCM, a cloud configuration management system for elastic application deployment in private clouds. CCM supports automatic component composition and instantiation, and elastic auto-scaling to handle overload conditions and resource contentions.

Summer 2018 **Graduate Intern**, IBM Research.

- I developed FabZK, a privacy-preserving and auditable blockchain system which conceals transaction amounts and participants on a shared ledger and conducts on-demand, automated auditing based only on the encrypted data.

Summer 2016 **Software Engineer Intern**, InsightFinder Inc.

- I implemented a cloud application performance analysis system, including a trace-based intelligence engine to identify performance problems using ML algorithms and a tracing agent to collect system calls from the VMs which host the cloud applications to the intelligence engine.

Teaching Experience

Spring 2019 Teaching Assistant, CSC724 - Advanced Distributed Systems, NC State

Spring 2015 Teaching Assistant, CSC226 - Discrete Math for Computer Scientists, NC State

Fall 2014 Teaching Assistant, CSC226 - Discrete Math for Computer Scientists, NC State

Mentoring Experience

Over the years I had the fantastic opportunity to work with talented students on some of the research projects that I envisioned at the time.

2nd half 2021 Bekir Turkkan [SUNY Buffalo] - Energy-efficient video streaming

Summer 2020 Sam Cheng [UIUC] - Risky script pattern discovery from open source communities

Fall 2017 Pavithra Iyer [NC State] - Software testing on data corruption hang bug detector

Honors & Awards

2021 IBM Research Accomplishment (3 nominations, results TBA)

2020 IBM First Patent Application Invention Achievement Award

2020 IBM Research Accomplishment Nomination

2018 IC2E Best Paper Nomination

2018 OSDI Travel Grant

2017, 2018 SoCC Travel Grants

2014 Outstanding Master Award

2014 Outstanding Postgraduate Dissertation Award

2013 The Winning Prize in 'Graduate Science Star' Contest in Yangtze-River-Delta Region

2012, 2013 National Scholarships for Postgraduate Students

2012, 2013 The NJUPT 'Star of the Academy' Awards
2012, 2013 Outstanding Postgraduate Student Scholarships
2012 The 2nd Prize in National Postgraduate Mathematical Contest in Modeling
2012 The 2nd Prize in National College and University Contest of Computer Coursewares
2012 The 'Hengtong Optic-electric' Scholarship
2011 The 3rd Prize in 'Challenge Cup' Science and Technology Contest in Jiangsu Province
2011 Outstanding Bachelor Award
2011 Outstanding Undergraduate Dissertation Award
2009 The Winning Prize in 'Zhongfu-Nanyou Cup' Information Security Contest
2009 The NJUPT Second-class Scholarship
2008, 2010 The NJUPT First-class Scholarships
2008–2010 Best Undergraduate Student Awards

Services

TPC Member IEEE International Conference on Cloud Computing, 2021
co-Editor Journal of Systems Research, 2021
External Reviewer IEEE International Conference on Automation and Computing, 2019
ACM Asia-Pacific Workshop on Systems, 2018
IEEE Transactions on Parallel and Distributed Systems, 2017
IEEE International Conference on Cloud Engineering, 2017

Press

2021 New service from IBM Research and X-Force Red makes vulnerability management more efficient
- [IBM Research] - [IBM MediaCenter]

2020 Kubernetes-based Control Plane to Manage Risk and Compliance for Hybrid Cloud
- [IBM Research]

2020 Software Spots and Fixes Hang Bugs in Seconds, Rather Than Weeks
- [NC State News] - [EurekAlert!] - [Tech Xplore] - [Mirage News] - [ScienceDaily]

2020 We won't leave you hanging any longer: Tool strips freeze-inducing bugs from Java bytecode while in production
- [The Register]

2020 Software program spots and fixes grasp bugs in seconds, fairly than weeks
- [News8Plus]

2020 NC State researchers develop software that fixes 'hang bugs' in seconds, rather than weeks
- [WRAL TechWire]

2020 The tool removes the bug that causes freezes from Java bytecode in production
- [Eminetra Today]

2020 Researchers develop HangFix to quickly resolve hang bugs
- [News Break] - [SD Times]