Si Liu

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Research Interests

My research interests are broadly in **formal methods**, **distributed computing**, and **programming languages**, with focus on design and analysis of scalable, reliable distributed database systems, wireless systems via formal techniques. My recent interests also include applying formal methods to blockchain and IoT systems.

Education

Ph.D. in Computer Science
University of Illinois at Urbana-Champaign 2012–present
Advisor: José Meseguer

M.S. in Software Engineering
East China Normal University 2009–2012

B.S. in Software Engineering
East China Normal Univeristy 2005–2009

Book Chapters

[B1] Rakesh Bobba, Jon Grov, Indranil Gupta, **Si Liu**, José Meseguer, Peter Csaba Ölveczky, Stephen Skeirik. Survivability: Design, Formal Modeling, and Validation of Cloud Storage Systems using Maude. 2018.

Journal Articles

[J1] **Si Liu**, Peter Csaba Ölveczky, Qi Wang, Indranil Gupta, José Meseguer. Read Atomic Transactions with Prevention of Lost Updates: ROLA and its Formal Analysis. *Formal Aspects of Computing (**FAOC**),* 2019. Conditionally Accepted.

[J2] **Si Liu**, Jatin Ganhotra, Muntasir Raihan Rahman, Son Nguyen, Indranil Gupta, José Meseguer. Quantitative Analysis of Consistency in NoSQL Key-value Stores. *Leibniz Transactions on Embedded Systems - Special Issue on Quantitative Evaluation of Systems (**LITES**),* 2017.

[J3] **Si Liu**, Peter Csaba Ölveczky and José Meseguer. Modeling and Analyzing Mobile Ad hoc Networks in Real-Time Maude. *Journal of Logical and Algebraic Methods in Programming (**JLAMP**),* 2016.

[J4] Xi Wu, Huibiao Zhu, Yongxin Zhao, Zheng Wang, **Si Liu**. Modeling and verifying the Ariadne protocol using process algebra. *Computer Science and Information Systems (**CSIS**),* 2013.

Conference Papers

[C1] **Si Liu**, Peter Csaba Ölveczky, Min Zhang, Qi Wang and José Meseguer. Automatic Analysis of Consistency Properties of Distributed Transaction Systems in Maude. ***TACAS***, 2019.

[C2] **Si Liu**, Peter Csaba Ölveczky, Keshav Santhanam, Qi Wang, Indranil Gupta, José Meseguer.

ROLA: A New Distributed Transaction Protocol and Its Formal Analysis. *International Conference on Fundamental Approaches to Software Engineering (**FASE**),* 2018. ***Invited for journal submission.***

[C3] **Si Liu**, Peter Csaba Ölveczky, Jatin Ganhotra, Indranil Gupta, José Meseguer. Exploring Design Alternatives for RAMP Transactions through Statistical Model Checking. *International Conference on Formal Engineering Methods (**ICFEM**),* 2017.

[C4] **Si Liu**, Peter Csaba Ölveczky, Muntasir Raihan Rahman, Jatin Ganhotra, Indranil Gupta, José Meseguer. Formal Modeling and Analysis of Ramp Transaction Systems. *ACM Symposium on Applied Computing (**SAC**),* 2016.

[C5] **Si Liu**, Son Nguyen, Jatin Ganhotra, Muntasir Raihan Rahman, Indranil Gupta and José Meseguer. Quantitative Analysis of Consistency in NoSQL Key-value Stores. *International Conference on Quantitative Evaluation of Systems (**QEST**),* 2015. ***Nominated for Best Paper Award. Invited for journal submission.***

[C6] **Si Liu**, Muntasir Raihan Rahman, Stephen Skeirik, Indranil Gupta and José Meseguer. Formal Modeling and Analysis of Cassandra in Maude. *International Conference on Formal Engineering Methods (**ICFEM**),* 2014.

[C7] Xi Wu, **Si Liu**, Huibiao Zhu and Yongxin Zhao. Reasoning about Group-Based Mobility in MANETs. *IEEE Pacific Rim International Symposium on Dependable Computing (**PRDC**),* 2014.

[C8] Xi Wu, **Si Liu**, Huibiao Zhu, Yongxin Zhao, Lei Chen. Modeling and Verifying the Ariadne Protocol Using CSP. *IEEE International Conference and Workshops on the Engineering of Computer Based Systems (**ECBS**),* 2012. ***Invited for journal submission.***

[C9] **Si Liu**, Yongxin Zhao, Huibiao Zhu, Qin Li. A Calculus for Mobile Ad Hoc Networks from a Group Probabilistic Perspective. *IEEE International Symposium on High-Assurance Systems Engineering (**HASE**),* 2011.

[C10] **Si Liu**, Yongxin Zhao, Huibiao Zhu, Qin Li. Towards a Probabilistic Calculus for Mobile Ad Hoc Networks. *IEEE International Symposium on Theoretical Aspects of Software Engineering (**TASE**),* 2011.

[C11] Mengying Wang, Huibiao Zhu, Yongxin Zhao, **Si Liu**. Modeling and Analyzing the μTESLA Protocol Using CSP. *IEEE International Symposium on Theoretical Aspects of Software Engineering (**TASE**),* 2011.

[C12] Yongxin Zhao, Yanhong Huang, Jifeng He, **Si Liu**. Formal Model of Interrupt Program from a Probabilistic Perspective. *IEEE International Conference on Engineering of Complex Computer Systems (**ICECCS**),* 2011.

[C13] Qin Li, Yongxin Zhao, Xiaofeng Wu, **Si Liu**. Promoting Models. *International Symposium on Unifying Theories of Programming (**UTP**),* 2010.

Workshop Papers

[W1] **Si Liu**, Peter Csaba Ölveczky, Qi Wang, José Meseguer. Formal Modeling and Analysis of the Walter Transactional Data Store. *International Workshop on Rewriting Logic and Its Applications (**WRLA**),* 2018.

[W2] **Si Liu**, Peter Csaba Ölveczky and José Meseguer. Formal analysis of Leader Election in MANETs Using Real-Time Maude. *Software, Services and Systems (**SSS**),* 2015.

[W3] **Si Liu**, Peter Csaba Ölveczky and José Meseguer. A Framework for Mobile Ad hoc Networks in Real-Time Maude. *International Workshop on Rewriting Logic and Its Applications (**WRLA**),*

2014. ***Invited for journal submission.***

[W4] **Si Liu**, Xiaofeng Wu, Qin Li, Huibiao Zhu, Qian Wang. Formal Approaches to Wireless Sensor Networks. *International Conference on Secure Software Integration and Reliability Improvement (**SSIRI**),* 2011.

[W5] Han Zhu, Huibiao Zhu, **Si Liu**, Jian Guo. Towards Denotational Semantics for Verilog in PVS. *International Conference on Secure Software Integration and Reliability Improvement (**SSIRI**),* 2011.

Under Review

[U1] Qi Wang, Wei Yang, **Si Liu**, Carl Gunter. Charting the Attack Surface of Trigger-Action IoT Platforms. 2019.

Experience

Research

Assured Cloud Computing Project — **UIUC**
Rearch Assistant under Prof. José Meseguer and Prof. Indranil Gupta — 2014–2017
Understanding, design and analysis of scalable, reliable distributed databases using formal techniques.

IDEA4CPS, Danish-Chinese Research Center — **Shanghai**
Research Assistant under Prof. Huibiao Zhu and Prof. Kim G. Larsen — 2009–2012
Modeling and analysis of mobile wireless systems using process algebra.

973 National Cyber-Physical Systems Camp — **USTC**
Research Intern with Prof. Qun Li and Prof. Xiuzhen Cheng — Summer, 2011
Understanding and addressing reliability problems in wireless systems.

Teaching

CS 425, Distributed Systems — **UIUC**
Teaching Assistant — Fall 2016

Working

Hewlett-Packard Co. Ltd. — **Shanghai**
Software Engineering Intern in Dept. of Talent House — 2008–2009
Developing and testing web applications.

Professional Activities

Grant Proposals: Hepled with preparing proposal for NSF CNS 1409416 ($584,000, 2014 - 2017), Availability-Consistency Tradeoffs in Key-Value and NoSQL Storage Systems

Subreviewer: FM'18, ICFEM'16, FASE'14, ICFEM'14, ICFEM'13, ICFEM'12, TASE'12, ICFEM'11, TASE'11, ICFEM'10

Conference Session Chair: HASE'11

Mentoring: Mentored 1 master student working on a two-year-long research project with 4 publications, and 2 undergradute students on a year-long research project with 1 publication.

Student Volunteer: ICFEM'10

Invited Talks & Presentations

- Exploring Design Alternatives for RAMP Transactions through Statistical Model Checking. ICFEM'17, Xi'an, China, 2017.

- Design, Formal Modeling, and Validation of Cloud Storage Systems using Maude. Huawei, Champaign, USA, 2017.
- Exploring Design Alternatives for the RAMP Transaction System Through Statistical Model Checking. Assured Cloud Computing Center, Champaign, USA, 2017.
- Formal Modeling and Analysis of Ramp Transaction Systems. SAC'16, Pisa, Italy, 2016.
- Formal Modeling and Analysis of Ramp Transaction Systems. Assured Cloud Computing Center, Champaign, USA, 2016.
- Quantitative Analysis of Consistency in NoSQL Key-value Stores. QEST'15, Madrid, Spain, 2015.
- Quantitative Analysis of Consistency in NoSQL Key-value Stores. Assured Cloud Computing Center, Champaign, USA, 2015.
- A Framework for Mobile Ad hoc Networks in Real-Time Maude. WRLA'14, Grenoble, France, 2014.
- Formal Modeling and Analysis of Cassandra in Maude. Assured Cloud Computing Center, Champaign, USA, 2014.
- A Calculus for Mobile Ad Hoc Networks from a Group Probabilistic Perspective. HASE'11, Boca Raton, USA, 2011.
- Towards a Probabilistic Calculus for Mobile Ad Hoc Networks. USTC, Suzhou, China, 2011.
- Towards a Probabilistic Calculus for Mobile Ad Hoc Networks. TASE'11, Xi'an, China, 2011.
- Formal Approaches to Wireless Sensor Networks. SSIRI'11, Jeju Island, Korea, 2011.

References

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