

Linh Thi Xuan Phan

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Research Interests

Cyber-physical systems; Real-time and embedded systems; Cloud computing; Internet-of-Things.

Education

- Ph.D. in Computer Science**, National University of Singapore Sep. 2009
Dissertation: “Formal Modeling and Analysis of Streaming Applications”
Advisors: P S Thiagarajan (NUS, Singapore) and Samarjit Chakraborty (TUM, Germany)
Received the Dean’s Graduate Research Excellence Award.
- B.Comp. (Honors) in Computer Science**, National University of Singapore Aug. 2003

Employment

University of Pennsylvania, Department of Computer and Information Science

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|-------------------------------------|-----------------------|
| Assistant Professor | Jul. 2016 – |
| Assistant Research Professor | Jul. 2012 – Jun. 2016 |
| Postdoctoral Researcher | Mar. 2010 – Jun. 2012 |
| Research Associate | Mar. 2009 – Feb. 2010 |

National University of Singapore, Department of Computer Science, Singapore

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| Research Assistant | Aug. 2007 – Feb. 2009 |
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ETH Zürich, Computer Engineering and Networks Laboratory, Zürich, Switzerland

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| Intern | Sep. 2006 – Apr. 2007 |
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Honors & Awards

- CAREER Award, National Science Foundation, 2018
- Outstanding Paper Award, IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS), 2018
- Member of the inaugural class of the ACM Future of Computing Academy, June 2017
ACM-FCA aims to foster the next generation of computing professionals. Its members have the privilege and responsibility to become the voice of the future of the computing field at large and of ACM.
- Best Paper Award Nominee, IEEE Real-Time Systems Symposium (RTSS), 2013
- Best Paper Award Nominee, ACM/IEEE Int. Conference on Embedded Software (EMSOFT), 2010
- Dean’s Graduate Research Excellence Award, National University of Singapore, 2009
Awarded to PhD students who have made significant research achievements during their PhD studies.
- Graduate Scholarship, National University of Singapore, 2003–2007 (four years)
- Singapore Scholarship, Singapore Ministry of Foreign Affairs, 1999–2003 (four years)
Awarded to the most outstanding students from ASEAN countries to pursue a full-time undergraduate degree in any of the top two universities in Singapore with full tuition and allowance support.

Professional Service

DEPARTMENTAL SERVICE

- Master's admissions committee, 2016 and 2017

STEERING COMMITTEES

- Executive Committee Member, IEEE Technical Committee on Real-Time Systems (TCRTS).
TCRTS serves as the steering committee of both RTSS and RTAS, the top two conferences in real-time systems.
- Diversity SubCommittee Member, TCRTS.

CONFERENCE ORGANIZATION

- Track Chair, IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS), 2018
- Publication Chair, Embedded Systems Week (ESWeek), 2017
- Topic Chair, Topic E3, Design Automation and Test in Europe (DATE) Conference, 2016
- Topic Co-Chair, Topic E3, Design Automation and Test in Europe (DATE) Conference, 2015
- Web Chair and Posters Chair, Cyber-Physical Systems Week (CPSWeek), 2013
- Work-In-Progress Chair, Euromicro Conference on Real-Time Systems (ECRTS), 2013
- Publicity Chair, IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA), 2013
- PC Chair, Compositional Theory and Technology for Real-Time Embedded Systems Workshop (CRTS), co-located with RTSS, 2011
- PC Co-Chair, Adaptive and Reconfigurable Embedded Systems Workshop (APRES), CPS Week, 2011

PROGRAM COMMITTEES (CONFERENCES)

1. IEEE Real-Time Systems Symposium (RTSS), 2012, 2013, 2015, 2016, 2017
2. IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS), 2014, 2015, 2017
3. Euromicro Conference on Real-Time Systems (ECRTS), 2013, 2015, 2016
4. Design Automation Conference (DAC), 2015, 2016
5. Design Automation and Test in Europe (DATE) Conference, 2014, 2015, 2016
6. ACM/IEEE International Conference on Embedded Software (EMSOFT), 2015, 2016
7. ACM Conf. on Languages, Compilers, Tools and Theory for Embedded Systems (LCTES), 2015
8. IEEE/ACM International Conference on Computer-Aided Design (ICCAD), 2013
9. IEEE International Conference on Industrial Informatics (INDIN), Special Session on Automotive Communication, 2016
10. IEEE Int. Conf. on Embedded and Real-Time Computing Systems and Applications (RTCSA), 2013, 2016
11. IEEE Int. Conf. on Emerging Technologies and Factory Automation (ETFA), 2011, 2012, 2013
12. IEEE Int. Conf. on Parallel and Distributed Systems (ICPADS), 2013
13. IEEE Int. Conf. on Cyber-Physical Systems, Networks, and Applications (CPSNA), 2011, 2012, 2013
14. International Conference on Embedded and Multimedia Computing (EMC), 2010, 2011

PROGRAM COMMITTEES (WORKSHOPS)

1. Workshop on Compositional Theory and Technology for RTES (CRTS), 2011, 2012, 2013, 2014, 2015
2. Workshop on Analytic Virtual Integration of Cyber-Physical Systems (AVICPS), 2013, 2014
3. Workshop on Adaptive and Reconfigurable Embedded Systems (APRES), 2012, 2013
4. Workshop on Mobile Cloud Computing in Healthcare, 2013

5. Workshop on Grid Friendly Computing, 2013
6. International Workshop on Worst-case Traverse Time, 2011, 2012
7. IEEE Real-Time Systems at Work, RTSS, 2011, 2012

PANELS AND REVIEWS

- **National Science Foundation:** CPS and NeTS panels.
- **External Grant Reviewer:** Portuguese Foundation for Science and Technology (2012); Danish National Research Foundation (2013).
- **Journal Reviewer:** Springer International Journal of Time-Critical Computing Systems; ACM Transactions on Embedded Computing Systems; IEEE Transactions on Industrial Informatics; Springer International Journal of Formal Methods and System Design; IEEE Embedded Systems Letters; European Association for Signal Processing Journal on Embedded Systems; EUROMICRO Journal of Systems Architecture; Springer Design Automation for Embedded Systems; ACM Transactions on Design Automation of Electronic Systems; IEEE Transactions on Software Engineering; IEEE Transactions on Computers.

Advising & Committees

GRADUATED DOCTORAL STUDENTS

- Jaewoo Lee (co-advise with Insup Lee; currently assistant professor at Chung-Ang University, Korea)
- Yang Li (co-advise with Boon Thau Loo and Sanjeev Khanna; currently at Facebook)

CURRENT DOCTORAL STUDENTS

- Saeed Abedi (co-advise with Boon Thau Loo)
- Max Demoulin (co-advise with Boon Thau Loo)
- Neeraj Gandhi
- Robert Gifford
- Meng Xu (co-advise with Insup Lee)

MASTER'S RESEARCH ADVISEES

- Tianyang Chen (Master's thesis; graduated May 2017, currently at Oracle)
- Shengda Ding (Master's thesis; graduated May 2015, now at Oracle)
- Meng Xu (Master's thesis; graduated May 2013, now Ph.D. candidate at Penn)
- Ruifu Zhang (Independent study, Fall 2016 and Spring 2017)
- Venkata Bharath Reddy Karnati (Research assistant, 2017)
- Sarvesh Surana (Independent study, Spring 2018)
- Animesh Shah (Independent study, Spring 2018)
- Bhairavi Mehta (Independent study, Spring 2018)
- Swachhand Lokhande (Independent study, Spring 2018)
- Tilak Raj Singh (Independent study, Spring 2018)
- Kenny Foner (Independent study, Spring 2018)

UNDERGRADUATE RESEARCH ADVISEES

- Current: Victoria Xiao, Akash Subramanian, Deepan Saravanan, Jiahui Jiao
- Previous: Razzi Abuissa, Alex Lyons, Alex Brashear, Dong Young Kim, Albert Shu, Indu Subbaraj, Thanat Owlarn, Cheng Luo.

COMMITTEES

- Ph.D dissertation: Baek-Gyu Kim (2015, now researcher at Toyota); Arpan Gujarati (2018, MPI-SWS)
- WPE-2 (chair): Andrew King (2013); Baek-Gyu Kim (2014); Jaewoo Lee (2015).
- Master's thesis: Sanchit Aggarwal (2013); Tanveer Gill (2013); Charu Jangid (2014).

ACADEMIC ADVISEES

- 2017–2018: 30 students
- 2016–2017: 19 students
- 2015–2016: 13 students
- 2014–2015: 19 students
- 2013–2014: 15 students
- 2012–2013: 14 students

Funding

Funding from NSF (CNS/SaTC, CNS/NeTS, CNS/CSR, CNS/CPS, ENG/EECS), DoD (DARPA, ONR, ARO) and Intel.

CURRENT GRANTS

- *CAREER: Resilient Execution with Bounded-Time Recovery (REBOUND).*
PI. NSF CNS SaTC CAREER. \$475K, five years (9/2018–8/2023).
- *Diagnosing Datacenter Networks with Qualitative Provenance.*
PI with co-PIs Andreas Haeberlen, Boon Thau Loo, and Wenchao Zhou.
NSF CSR: NeTS: Medium. \$1.2M, four years (9/2017–8/2021).
- *ProNet: Programmable Networks Enabled by Fast In-Path Analytics.*
Co-PI with Penn PI Jonathan Smith.
Joint project with Applied Communication Sciences and Princeton.
DARPA DCOMP. \$12.5M total (Penn: \$1.7M), four years (5/2017–4/2021).
- *Network Functions Virtualization with Timing Guarantees.*
PI with co-PIs Andreas Haeberlen and Boon Thau Loo.
NSF CSR: NeTS: Medium, \$1.1M, four years (9/2016–08/2020).
- *DeDOS: Declarative Dispersion-Oriented Software.*
Co-PI with PI Boon Thau Loo.
DARPA XD3. \$3.5M, three years (5/2016–4/2019).
- *Dynamic Real-Time Virtualization and Cloud Computing.*
Co-PI with PI Insup Lee.
ONR N00014-16-1-2195, \$750K, three years (1/2016–12/2018).
- *Security and Privacy-Aware Cyber-Physical Systems.*
Co-PI with PI Insup Lee.
NSF/Intel CPS Security, \$2.25M, three years (09/2015–08/2018).

COMPLETED GRANTS

- *Safety-Feature Modeling and Adaptive Resource Management for Mixed-Criticality CPS.*
Co-PI with PI Oleg Sokolsky.
NSF CNS CPS Synergy, \$600K, four years (09/2013–08/2017).
- *Resource Management for Real-Time Cloud Computing.*
PI with Co-PIs Boon Thau Loo and Insup Lee.
NSF CNS CSR Small, \$450K (09/2011–08/2016).

- *Co-Design of Multimodal CPS Architectures and Adaptive Controllers*.
Co-PI with PI Oleg Sokolsky.
NSF ECCS CPS Medium, \$900K (09/2011–08/2016).
- *Theory and Virtualization Platform for Compositional Real-Time Systems*.
Co-PI with PI Insup Lee.
ONR N00014-13-1-0802, \$456K (08/2013–07/2016).
- *Compositional Framework for Complex Real-time Systems on Multicore Platforms*.
Co-PI with PI Insup Lee.
ARO W911NF-11-1-0403, \$368K (09/2011–08/2014).

Teaching Experience

Instructor, University of Pennsylvania

- CIS 505: Software Systems, Spring 2018 (Enrollment: 103)
Instructor quality: N/A; Course quality: N/A.
- CIS 505: Software Systems, Fall 2017 (Enrollment: 72)
Instructor quality: 3.53/4; Course quality: 3.44/4.
- CIS 505: Software Systems, Spring 2017 (Enrollment: 87)
Instructor quality: 3.09/4; Course quality: 3.09/4.
- CIS 505: Software Systems, Fall 2016 (Enrollment: 37)
Instructor quality 3.35/4; Course quality 3.24/4.

Teaching Assistant, National University of Singapore

- Critical Systems and their Verification, 2008
- Hardware-software Co-design, 2004, 2005, and 2006
- Verification of Real-time Systems, 2002, 2004, and 2005
- Programming Methodology (Scheme), 2000 and 2001

Publications

Note: Students are underlined; acceptance rates, where available, are in parentheses.

JOURNAL PUBLICATIONS

1. J. Lee, H. S. Chwa, **L. T. X. Phan**, I. Shin, and I. Lee. *MC-ADAPT: Adaptive Task Dropping in Mixed-Criticality Scheduling*. ACM Transactions on Embedded Computing Systems (**TECS**), Oct. 2017. [**Special Issue of EMSOFT'17**]
2. D. Soudbakhsh, **L. T. X. Phan**, A. M. Annaswamy, and O. Sokolsky. *Co-Design of Arbitrated Network Control Systems with Overrun Strategies*. IEEE Transactions on Control of Network Systems (**CONES**), June 2016.
3. M. Xu, **L. T. X. Phan**, O. Sokolsky, S. Xi, C. Lu, C. Gill, and I. Lee. *Cache-Aware Compositional Analysis of Real-Time Multicore Virtualization Platforms*. Springer International Journal of Time-Critical Computing Systems, 51(6): 675-723, November 2015. [**Special Issue on Best Papers of RTSS'13**]
4. M. Anand, S. Fischmeister, I. Lee and **L. T. X. Phan**. *Analysis and Implementation of Stateful Schedules for Time-Triggered Communication*. Springer International Journal of Time-Critical Computing Systems, 2012.

REFEREED CONFERENCE PUBLICATIONS

5. J. Boudjadar, I. Lee, J. H. Kim, **L. T. X. Phan**, K. G. Larsen and U. Nyman. *Generic Formal Framework for Compositional Analysis of Hierarchical Scheduling Systems*. Proceedings of the 18th IEEE International Symposium on Object/Component/Service-Oriented Real-Time Distributed Computing (**ISORC**), Singapore, May 2018. (To appear)
6. T. Chen and **L. T. X. Phan**. *SafeMC: A system for the design and evaluation of mode change protocols*. Proceedings of the IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), Porto, Portugal, April 2018. [**Outstanding Paper Award**]
7. H. Li, M. Xu, C. Li, C. Lu, C. Gill, **L. T. X. Phan**, I. Lee, and O. Sokolsky. *Multi-Mode Virtualization for Soft Real-Time Systems*. Proceedings of the IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), Porto, Portugal, April 2018.
8. H. Nguyen, R. Ivanov, **L. T. X. Phan**, O. Sokolsky, J. Weimer and I. Lee. *LogSafe: Secure and Scalable Data Logger for IoT Devices*. Proceedings of the IEEE International Conference on Internet-of-Things Design and Implementation (**IoTDI**), Orlando, Florida, April 2018.
9. Y. Tang, N. Guan, W. Liu, **L. T. X. Phan**, and W. Yi. *Revisiting GPC and AND Connector in Real-Time Calculus*. Proceedings of the IEEE Real-Time Systems Symposium (**RTSS**), Paris, France, Dec. 2017.
10. J. Lee, H. S. Chwa, **L. T. X. Phan**, I. Shin, and I. Lee. *MC-ADAPT: Adaptive Task Dropping in Mixed-Criticality Scheduling*. Proceedings of the IEEE/ACM International Conference on Embedded Software (**EMSOFT**), Seoul, Korea, Oct. 2017.
11. M. Xu, **L. T. X. Phan**, H.-Y. Choi, and Insup Lee. *vCAT: Dynamic Cache Management using CAT Virtualization*. Proceedings of the IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), Pittsburgh, PA, April 2017.
12. D. de Niz, B. Andersson, H. Kim, M. Klein, **L. T. X. Phan**, and R. Rajkumar. *Mixed-Criticality Processing Pipelines*. Proceedings of the Design, Automation and Test in Europe (**DATE**), Lausanne, Switzerland, March 2017.
13. H. Nguyen, B. Acharya, R. Ivanov, A. Haeberlen, **L. T. X. Phan**, O. Sokolsky, J. Walker, J. Weimer, W. Hanson, and I. Lee. *Cloud-Based Secure Logger For Medical Devices*. Proceedings of the IEEE Conference on Connected Health: Applications, Systems and Engineering Technologies (**CHASE**), Washington DC, June 2016.
14. M. Xu, **L. T. X. Phan**, H.-Y. Choi, and Insup Lee. *Analysis and Implementation of Global Preemptive Fixed-Priority Scheduling with Dynamic Cache Allocation*. Proceedings of the IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), Vienna, Austria, April 2016. (27.0%).
15. Y. Li, **L. T. X. Phan**, and Boon Thau Loo. *NFV-RT: Network Function Virtualization with Soft Real-Time Guarantees*. Proceedings of the IEEE International Conference on Computer Communications (**INFOCOM**), San Francisco, CA, April 2016. (18.2%).
16. J. Ren and **L. T. X. Phan**. *Mixed-Criticality Scheduling on Multiprocessors using Task Grouping*. Proceedings of the Euromicro Conference on Real-Time Systems (**ECRTS**), Lund, Sweden, July 2015. (31%).
17. S. Xi, C. Li, C. Lu, C. Gill, M. Xu, **L. T. X. Phan**, I. Lee, and O. Sokolsky. *RT-OpenStack: CPU Resource Management for Real-Time Cloud Computing*. Proceedings of the IEEE International Conference on Cloud Computing (**CLOUD**), New York, NY, June 2015. (17%).
18. J. Boudjadar, A. David, J. H. Kim, K. G. Larsen, M. Mikucionis, U. Nyman, A. Skou, I. Lee, and **L. T. X. Phan**. *Quantitative Schedulability Analysis of Continuous Probability Tasks in a Hierarchical Context*. Proceedings of the International ACM SIGSOFT Symposium on Component-Based Software

- Engineering (CBSE), Montréal, Canada, May 2015. (33%).
19. J. Boudjadar, A. David, J. H. Kim, K. G. Larsen, M. Mikucionis, U. Nyman, A. Skou, I. Lee, and **L. T. X. Phan**. *Flexible Framework for Statistical Schedulability Analysis of Probabilistic Sporadic Tasks*. Proceedings of the 18th IEEE International Symposium on Object/Component/Service-Oriented Real-Time Distributed Computing (**ISORC**), Auckland, New Zealand, Apr. 2015. (39%).
 20. **B. Kim**, L. Feng, **L. T. X. Phan**, O. Sokolsky, and I. Lee. *Platform-Dependent Timing Verification Framework in Model-Based Implementation*. Proceedings of the Design Automation and Test in Europe (**DATE**) Conference, Grenoble, France, Mar. 2015. (22.4%).
 21. **A. Chen**, **W. B. Moore**, **H. Xiao**, A. Haerberlen, **L. T. X. Phan**, M. Sherr, and W. Zhou. *Detecting Covert Timing Channels with Time-Deterministic Replay*. Proceedings of the USENIX Symposium on Operating Systems Design and Implementation (**OSDI**), Broomfield, CO, Oct. 2014. (13.5%).
 22. **S. Xi**, **M. Xu**, C. Lu, **L. T. X. Phan**, C. Gill, O. Sokolsky and I. Lee. *Global Real-Time Multi-Core Virtual Machine Scheduling in Xen*. Proceedings of the ACM/IEEE International Conference on Embedded Software (**EMSOFT**), New Delhi, India, Oct. 2014. (25%).
 23. D. de Niz and **L. T. X. Phan**. *Partitioned Scheduling of Multi-Modal Mixed-Criticality Real-Time Systems on Multiprocessor Platforms*. Proceedings of the IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), Berlin, Germany, Apr. 2014. (20%).
 24. **M. Xu**, **L. T. X. Phan**, I. Lee, O. Sokolsky, S. Xi, C. Lu and C. Gill. *Cache-Aware Compositional Analysis of Real-Time Multicore Virtualization Platforms*. Proceedings of the IEEE Real-Time Systems Symposium (**RTSS**), Vancouver, Canada, Dec. 2013. (22%). [**Nominated for the Best Paper award**]
 25. **B. Kim**, **L. T. X. Phan**, O. Sokolsky, and I. Lee. *Platform-Dependent Code Generation for Embedded Real-Time Software*. Proceedings of the International Conference on Compilers, Architectures and Synthesis of Embedded Systems (**CASES**), Montreal, Canada, Sep. 2013. (30.8%).
 26. **D. Soudbakhsh**, **L. T. X. Phan**, O. Sokolsky, I. Lee and A. Annaswamy. *Co-design of Control and Platform with Dropped Signals*. Proceedings of the ACM/IEEE International Conference on Cyber-Physical Systems (**ICCPS**), Philadelphia, PA, Apr. 2013. (23%).
 27. **L. T. X. Phan** and I. Lee. *Improving Schedulability of Fixed-Priority Real-Time Systems using Shapers*. Proceedings of the IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), Philadelphia, PA, Apr. 2013. (29%).
 28. **L. T. X. Phan**, **M. Xu**, J. Lee, I. Lee and O. Sokolsky. *Overhead-Aware Compositional Analysis of Real-Time Systems*. Proceedings of the IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), Philadelphia, PA, Apr. 2013. (29%).
 29. **C. Lin**, M. Dinatale, H. Zeng, **L. T. X. Phan** and A. Sangiovanni-Vincentelli. *Timing Analysis of Process Graphs with Finite Communication Buffers*. Proceedings of the IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), Philadelphia, PA, Apr. 2013. (29%).
 30. **B. Kim**, **L. T. X. Phan**, I. Lee and O. Sokolsky. *A Model-Based I/O Interface Synthesis Framework for the Cross-Platform Software Model*. Proceedings of the IEEE International Symposium on Rapid System Prototyping (**RSP**), Tampere, Finland, Oct. 2012.
 31. **J. Lee**, **S. Xi**, **S. Chen**, **L. T. X. Phan**, C. Gill, I. Lee, C. Lu and O. Sokolsky. *Realizing Compositional Scheduling through Virtualization*. Proceedings of the IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), Beijing, China, Apr. 2012. (23.6%).
 32. **L. T. X. Phan**, I. Lee, and O. Sokolsky. *Compositional Analysis Framework for Real-Time Systems*. Proceedings of the International Conference on Compilers, Architectures and Synthesis of Embedded

Systems (CASES), Taipei, Taiwan, Aug. 2011.

33. D. Gangadharan, **L. T. X. Phan**, S. Chakraborty, R. Zimmermann, and I. Lee. *Video Quality Driven Buffer Sizing via Frame Drops*. Proceedings of the ACM Conference on Embedded and Real-Time Computing Systems and Applications (**RTCSA**), Toyama, Japan, Aug. 2011. (31.6%).
34. **L. T. X. Phan**, I. Lee, and O. Sokolsky. *A Semantic Framework for Multi-Mode Systems*. Proceedings of the IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), San Francisco, California, Apr. 2011. (20.8%).
35. S. Chen, **L. T. X. Phan**, J. Lee, I. Lee, and O. Sokolsky. *Removing Abstraction Overhead in the Composition of Hierarchical Real-Time Systems*. Proceedings of the IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), San Francisco, California, Apr. 2011. (20.8%).
36. Z. Zhang, **L. T. X. Phan**, G. Tan, S. Jain, H. Duong, B. T. Loo, and I. Lee. *On the Feasibility of Dynamic Rescheduling on the Intel Distributed Computing Platform*. Proceedings of the ACM/IFIP/USENIX International Conference on Middleware (**Middleware**), Bangalore, India, Nov. 2010. (15.5%).
37. **L. T. X. Phan**, R. Schneider, S. Chakraborty, and I. Lee. *Modeling Buffers with Data Refresh Semantics in Automotive Architectures*. Proceedings of the ACM/IEEE International Conference on Embedded Software (**EMSOFT**), Scottsdale, Arizona, Oct. 2010. (21.3%). [**Nominated for the Best Paper award**]
38. **L. T. X. Phan**, I. Lee and O. Sokolsky. *Compositional Analysis of Multi-Mode Systems*. Proceedings of the Euromicro Conference on Real-Time Systems (**ECRTS**), Brussels, Belgium, Jul. 2010. (24.1%).
39. **L. T. X. Phan**, S. Chakraborty and I. Lee. *Timing Analysis of Mixed Time/Event-Triggered Multi-Mode Systems*. Proceedings of the IEEE Real-Time Systems Symposium (**RTSS**), Washington DC, Dec. 2009. (22.3%).
40. A. Bouillard, **L. T. X. Phan** and S. Chakraborty. *Light-weight Modeling of Complex State Dependencies in Stream Processing Systems*. Proceedings of the IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), San Francisco, California, Apr. 2009. (25.6%).
41. **L. T. X. Phan**, S. Chakraborty and P. S. Thiagarajan. *A Multi-Mode Real-Time Calculus*. Proceedings of the IEEE Real-Time Systems Symposium (**RTSS**), Barcelona, Spain, Dec. 2008. (23.3%).
42. **L. T. X. Phan**, S. Chakraborty, P. S. Thiagarajan, and L. Thiele. *Composing Functional and State-based Performance Models for Analyzing Heterogeneous Real-Time Systems*. Proceedings of the IEEE Real-Time Systems Symposium (**RTSS**), Tucson, Arizona, Dec. 2007. (25.7%).
43. S. Chakraborty, **L. T. X. Phan**, and P. S. Thiagarajan. *Event Count Automata: A State-based Model for Stream Processing Systems*. Proceedings of the IEEE Real-Time Systems Symposium (**RTSS**), Miami, Florida, Dec. 2005. (21%). (*Authors are in alphabetical order.*)

REFEREED WORKSHOP PUBLICATIONS

44. **L. T. X. Phan**. *Real-Time Network Function Virtualization with Timing Interfaces*. Proceedings of the IEEE Workshop on Compositional Theory and Technology for Real-Time Embedded Systems (CRTS), Porto, Portugal, Nov. 2016.
45. A. Chen, A. Sriraman, T. Vaidya, Y. Zhang, A. Haeberlen, B. T. Loo, L. T. X. Phan, M. Sherr, C. Shields, and W. Zhou *Dispersing Asymmetric DDoS Attacks with SplitStack*. Proceedings of the ACM Workshop on Hot Topics in Networks (**HotNets**), Atlanta, GA, Nov. 2016.
46. **L. T. X. Phan**, M. Xu, and I. Lee. *Cache-aware Interfaces for Compositional Real-Time Systems*. Proceedings of the IEEE Workshop on Compositional Theory and Technology for Real-Time Embedded Systems (CRTS), San Antonio, Texas, Dec. 2015. [**Invited Paper**]

47. A. Chen, H. Xiao, A. Haeberlen, and **L. T. X. Phan**. *Fault Tolerance and the Five-Second Rule*. Proceedings of the 15th Workshop on Hot Topics in Operating Systems (**HotOS**), Kartause Ittingen, Switzerland, May 2015. (32.2%).
48. **L. T. X. Phan**. *Towards a Safe Compositional Scheduling Theory for Cyber-Physical Systems*. Proceedings of the Analytic Virtual Integration of Cyber-Physical Systems Workshop (**AVICPS**), Vancouver, Canada, Dec. 2013
49. Y. Li, D. Chiu, C. Liu, **L. T. X. Phan**, T. Gill, S. Aggawal, Z. Zhang, B. T. Loo and B. McManus. *Towards Dynamic Pricing-Based Collaborative Optimization for Green Data Centers*. Proceedings of the International Workshop on Data Management in the Cloud (**DMC**), Brisbane, Australia, Apr. 2013.
50. **L. T. X. Phan**, Z. Zhang, Q. Zheng, B. T. Loo and I. Lee. *An Empirical Analysis of Scheduling Techniques for Real-time Cloud-based Data Processing*. Proceedings of the IEEE International Workshop on Real-Time Service-Oriented Architectures and Applications (**RTSOAA**), UC Irvine, California, Dec. 2011.
51. **L. T. X. Phan** and I. Lee. *Towards a Compositional Multi-Modal Framework for Adaptive Cyber-Physical Systems*. Proceedings of the IEEE Workshop on Cyber-Physical Systems, Networks, and Applications (**CPSNA**), Toyama, Japan, Aug. 2011. [**Invited paper**]
52. **L. T. X. Phan**, J. Lee, A. Easwaran, V. Ramaswamy, S. Chen, I. Lee, and O. Sokolsky. *CARTS: A Tool for Compositional Analysis of Real-Time Systems*. Proceedings of the IEEE Workshop on Compositional Theory and Technology for Real-Time Embedded Systems (CRTS), San Diego, California, Nov. 2010.
53. J. Lee, **L. T. X. Phan**, S. Chen, O. Sokolsky, and I. Lee. *Improving Resource Utilization for Compositional Scheduling using DPRM Interfaces*. Proceedings of the IEEE Workshop on Compositional Theory and Technology for Real-Time Embedded Systems (CRTS), San Diego, California, Nov. 2010.
54. A. Easwaran, M. Anand, I. Lee, **L. T. X. Phan**, and O. Sokolsky. *Simulation Relations, Interface Complexity, and Resource Optimality for Real-Time Hierarchical Systems*. Proceedings of the International Workshop on Reconciling Performance with Predictability (**RePP**), Grenoble, France, Oct. 2009.
55. K. D. Nguyen, I. Cutcutache, E. Sim, **L. T. X. Phan**, N. T. T. Dang, K. Wai, Z. Sun, T. B. Tok, L. Xu, F. E. H. Tay and W.-F. Wong. *BSN Simulator: Optimizing Application Using System Level Simulation*. Proceedings of the International Workshop on Wearable and Implantable Body Sensor Networks (**BSN**), Berkeley, California, Jun. 2009.
56. K. D. Nguyen, I. Cutcutache, S. Sinnadurai, S. Liu, C. Basol, E. Sim, **L. T. X. Phan**, T. B. Tok, L. Xu, F. E. H. Tay, T. Mitra, W.-F. Wong. *Fast and Accurate Simulation of Biomonitoring Applications on a Wireless Body Area Network*. Proceedings of the International Workshop on Wearable and Implantable Body Sensor Networks (**BSN**), Hong Kong, China, Jun. 2008.

PUBLICATIONS UNDER REVIEW

57. S. Abedi, M. Demoulin, N. Gandhi, Y. Li, Y. Wu, and **L. T. X. Phan**. *RTNF: Predictable Latency for Network Function Virtualization*.
58. Y. Wu, A. Chen, and **L. T. X. Phan**. *Zeno: Diagnosing Performance Problems with Temporal Provenance*.
59. H. Demoulin, T. Vaidya, I. Pedisich, B. DiMaiolo, J. Qian, C. Shah, Y. Zhang, A. Chen, A. Haeberlen, B. T. Loo, **L. T. X. Phan**, M. Sherr, C. Shields, and W. Zhou. *DeDoS: Defusing DoS with Dispersion Oriented Software*.

60. M. Xu, **L. T. X. Phan**, H. Choi, and Y. Lin. *Holistic Resource Allocation for Multicore Real-Time Systems*.

THESES & OTHER PUBLICATIONS

61. *Formal Modeling and Analysis of Streaming Applications*. Ph.D. Thesis, 2009.
62. *Task Event Structure Scheduling in Real-Time Systems*. Bachelor Honours Year Thesis, 2003.
63. *Enhanced Route Advisory Systems*. National Undergraduate Research Opportunities Programme Congress, Singapore, 2001.
64. *Finding Gröbner Bases Visually*. National Undergraduate Research Opportunities Programme Congress, Singapore, 2000.

PATENT APPLICATIONS

65. A. Chen, H. Xiao, W. Moore, A. Haebleren, **L. T. X. Phan**, M. Sherr, and W. Zhou. *Methods, Systems, and Computer Readable Media for Detecting Covert Timing Channels*. U.S. patent application 62/059,503; filed Oct. 3, 2014. 46 pages.

Tutorials, Invited Talks & Conference Presentations

TUTORIALS

1. *Compositional Real-Time Analysis for Cyber-Physical Systems*. Given at the Cyber-Physical Systems Week, Beijing, China, Apr. 2012.
2. *Compositional Analysis Framework for Real-Time Systems*. Given at the Embedded Systems Week, Taipei, Taiwan, Aug. 2011.

GUEST LECTURES

1. CIS 441/541: Embedded Software for Life-Critical Applications, University of Pennsylvania, 2014.
2. CIS 540: Principles of Embedded Computation, University of Pennsylvania, 2012.
3. CIS 505: Software Systems, University of Pennsylvania, 2011.
4. CSE 541: Embedded and Cyber Physical Systems, University of Pennsylvania, 2010.
5. CIS 480/CIS 899: Embedded and Cyber Physical Systems, University of Pennsylvania, 2009.

INVITED TALKS

1. *Timing Guarantees for Cyber-Physical Systems*. Duke University, ECE Department, Jan 2016.
2. *Timing Guarantees for Cyber-Physical Systems*. Boston University, CS Department, Feb 2016.
3. *Timing Guarantees for Cyber-Physical Systems*. Max Planck Institute for Software Systems, Feb 2016.
4. *Timing Guarantees for Cyber-Physical Systems*. Carnegie Mellon University, Silicon Valley, Feb 2016.
5. *Timing Guarantees for Cyber-Physical Systems*. Washington University in St. Louis, CS Department, Mar. 2016.
6. *Timing Guarantees for Cyber-Physical Systems*. University of Southern California, CS Department, Mar. 2016.
7. *Timing Guarantees for Cyber-Physical Systems*. University of North Carolina at Chapel Hill, CS Department, Apr. 2016.

8. *Timing Guarantees for Cyber-Physical Systems*.
Carnegie Mellon University, ECE Department, Pittsburgh, Apr. 2016
9. *Timing Guarantees for Cyber-Physical Systems*.
University of Pennsylvania, CS Department, Apr. 2016
10. *Timing Guarantees for Cyber-Physical Systems*.
University of Maryland at College Park, joint CS/ECE talk, Apr. 2016
11. *Cache-aware Interfaces for Compositional Real-Time Systems*. IEEE Workshop on Compositional Theory and Technology for Real-Time Embedded Systems (**CRTS**), San Antonio, TX, Dec. 2015.
12. *Compositional Design and Analysis of Cyber-Physical Systems*.
Department of Computer and Information Science, Temple University, Sep. 2013.
13. *Platform Design and Compositional Analysis of Real-Time Embedded Systems*.
DREAMS Seminar, EECS Department, University of California at Berkeley, Feb. 2013.
14. *A Multi-Modal Composability Framework for Cyber-Physical Systems*.
Safe and Secure Systems and Software Symposium (S5), Beaver creek, Ohio, Jun. 2012.
15. *Compositional and Multi-Modal Analysis of Cyber-Physical Systems*.
Department of Computer and Information Science, University of Pennsylvania, Dec. 2011.
16. *Compositional Analysis of Multi-Mode Systems*.
Institut fuer Datentechnik und Kommunikationsnetze (IDA), Germany, Jul. 2010.
17. *Formal Analysis of Multi-Mode Systems*.
Max Planck Institute for Software Systems, Germany, Jul. 2010.
18. *Timing Analysis of Mixed Time/Event-Triggered Multi-Mode Systems*.
Department of Computer Science, Saarland University, Germany, Jul. 2010.
19. *Timing Analysis of Multi-Mode Systems*.
Institute for Real-Time Computer Systems, TU Munich, Germany, Mar. 2010.
20. *Formal Modeling and Analysis of Stream Processing Systems*.
Department of Electrical and Computer Engineering, University of Waterloo, Canada, Oct. 2009.
21. *Formal Analysis of Streaming Applications*.
Department of Computer Science, National University of Singapore, Feb. 2009.

CONFERENCE PRESENTATIONS

1. *Real-Time Network Function Virtualization with Timing Interfaces*. Proceedings of the IEEE Workshop on Compositional Theory and Technology for Real-Time Embedded Systems (**CRTS**), Porto, Portugal, Nov. 2016.
2. *Mixed-Criticality Scheduling on Multiprocessors using Task Grouping*. Euromicro Conference on Real-Time Systems (**ECRTS**), Lund, Sweden, July 2015.
3. *Improving Schedulability of Fixed-Priority Real-Time Systems using Shapers*. IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), Philadelphia, Apr. 2013
4. *A Multi-Modal Composability Framework for CPS*. Safe and Secure Systems and Software Symposium (S5), Beaver creek, Ohio, Jun. 2012.
5. *Video Quality Driven Buffer Sizing via Frame Drops*. ACM Conference on Embedded and Real-Time Computing Systems and Applications (**RTCSA**), Toyama, Japan, Aug. 2011
6. *Towards a Compositional Multi-Modal Framework for Adaptive Cyber-Physical Systems*. IEEE Workshop on Cyber-Physical Systems, Networks, and Applications (**CPSNA**), Toyama, Japan, Aug. 2011.
7. *An Empirical Analysis of Scheduling Techniques for Real-time Cloud-based Data Processing*. IEEE

International Workshop on Real-Time Service-Oriented Architectures and Applications (RTSOAA), UC Irvine, California, Dec. 2011.

8. *Formal Semantic Framework for Multi-Mode Systems*. IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), Chicago, Apr. 2011.
9. *CARTS: A Tool for Compositional Analysis of Real-Time Systems*. IEEE Workshop on Compositional Theory and Technology for Real-Time Embedded Systems (**CRTS**), San Diego, Nov. 2011.
10. *Modeling Buffers with Data Refresh Semantics in Automotive Architectures*. ACM/IEEE International Conference on Embedded Software (**EMSOFT**), Scottsdale, Arizona, Oct. 2010.
11. *Compositional Analysis of Multi-Mode Systems*. Euromicro Conference on Real-Time Systems (**ECRTS**), Brussels, Belgium, Jul. 2010.
12. *Timing Analysis of Mixed Time/Event-Triggered Multi-Mode Systems*. IEEE Real-Time Systems Symposium (**RTSS**), Washington D.C., Dec. 2009.
13. *Functional Modeling of Complex State Dependencies in Stream Processing Systems*. IEEE Real-Time and Embedded Technology and Applications Symposium (**RTAS**), San Francisco, California, Apr. 2009.
14. *A Multi-Mode Real-Time Calculus*. IEEE Real-Time Systems Symposium (**RTSS**), Barcelona, Spain, Dec. 2008.
15. *Composing Functional and State-based Performance Models for Analyzing Heterogeneous Real-Time Systems*. IEEE Real-Time Systems Symposium (**RTSS**), Tucson, Arizona, Dec. 2007.

Software

- **RT-Xen**: An open-source real-time virtualization platform based on Xen. Part of the VMM real-time schedulers in RT-Xen are included in the Xen 4.5 release.
<https://sites.google.com/site/realtimexen/>
<http://wiki.xenproject.org/wiki/RTDS-Based-Scheduler/>
- **CARTS**: An open-source tool for the compositional analysis of real-time embedded systems.
<http://rtg.cis.upenn.edu/carts/>
- **RADS**: A route advisory system for Singapore transportation networks.
- **BSN Simulator**: A cycle-accurate simulator for bio-monitoring applications, part of the tool chain for embedded systems and architectures, streaming applications and body area networks, jointly developed by NUS, NTU and A*STAR (Singapore).