Thomas Lin

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Education

University of Toronto

***Ph.D.** (Electrical & Computer Engineering)* *Sept. '14 – Nov. '21*

- Supervisor: Professor A. Leon-Garcia
- Thesis: *Client-centric Orchestration and Management of Distributed Applications in Multi-tier Clouds*

***M.A.Sc.** (Electrical & Computer Engineering)* *Sept. '11 – Dec. '14*

- Supervisor: Professor A. Leon-Garcia
- Thesis: *Implementation and Evaluation of an SDN Management System on the SAVI Testbed*

***B.A.Sc.** (Computer Engineering)* *Sept. '06 – Jun. '11*

- Capstone: An iPad Application in Vehicular Networks
- Specializations: Computer Networking and Software Engineering

Research Interests

Software-Defined Networking, Software-Defined Infrastructure, Cloud & Datacentre Control and Management, Virtualization of Unconventional Resources, Network Function Virtualization

Engineering Experience

***Software Developer & Avionics Software Team Lead** (SpaceRyde)* *Nov. '21 – Present*

- Represented avionics software team within a highly multi-disciplinary environment, liaising with other team leads in joint systems engineering designs of different vehicles
- Managed project timelines: reconciling milestones & objectives given constrained resources (human, time, and monetary)
- Aid the design of flight vehicle avionics, involving requirements formulation, component sourcing & validation, architectural design & layout, and integration & iterative testing
- Developed C/C++ driver suite for within embedded Linux and over the ROS2 framework
- Designed networking solution for a multi-stage vehicle stack, and for groundstation-to-vehicle tracking, telemetry, and command (TT&C)
- Implemented continuous integration pipeline for automated build & tests; defined coding standards, best practices, and test targets

***Infrastructure Testbed Developer & SysAdmin** (SAVI Network)* *May '12 – Nov. '21*

- Developing a vendor-neutral cloud infrastructure control and management applications platform based using software-defined infrastructure
- Supporting operations and management of the Canada-wide distributed applications SAVI cloud testbed
- Expanding the capabilities of OpenStack cloud computing framework to support SDI, virtualized GPUs, FPGAs, SDRs, and Wi-Fi

***Network Software Developer** (StreamWorx.AI)* *May '21 – Sept. '21*

- Collaborated with a small team, leading initial client requirements analysis, and performing exploratory research on client's tech stack to determine what is possible
- Developed a multi-layer (physical, virtual, application) network & compute telemetry framework, for a client's edge-networking product, using open-source tools
- Developed & deployed ingestion processors for real-time data pipelines and analytic dashboards

***Research Assistant** (ECE Control Group)* *May '11 – Sept. '11*

- Supervisor: Professor L. Pavel

- Verified a Python-based simulation suite (provided by Alcatel-Lucent), used to model and simulate the setup, and run-time physical behaviour of optical networks
- Documented various components of the simulation suite, their use cases, etc.
- Assess an in-lab optical network setup using optical spectral analyzers, lasers, variable optical attenuators, bandpass filters, optical couplers, and optical amplifiers

Multimedia Software Engineering Intern *(Qualcomm Canada)* *May '09 – Aug. '10*

- Developed and maintained the user-space layers for a video processing driver
- Liaised with engineers from client companies to ensure single code base can be used for a variety of smartphone operating systems
- Implemented a flexible OMX-based test application for regression testing
- Tracked and debugged build issues to ensure error-free code releases
- Supported out-of-country integration teams with any issues relating to the latest release of video driver code

Publications

Conference Papers

- **T. Lin**, W. Zhao, I. Co, A. Chen, H. Xu, A. Leon-Garcia, "PhysarumSM: P2P Service Discovery and Allocation in Dynamic Edge Networks," *IFIP/IEEE International Symposium on Integrated Network Management (IM)*, Virtual, 2021
  - Acceptance rate: 24.1%
- **T. Lin**, S. Marinova, A. Leon-Garcia, "Towards an End-to-End Network Slicing Framework in Multi-Region Infrastructures," *IEEE Conference on Network Softwarization (NetSoft)*, Virtual, 2020
  - Acceptance rate: 20.0%
- **T. Lin**, A. Leon-Garcia, "Towards a Client-Centric QoS Auto-Scaling System," *IEEE/IFIP Network Operations and Management Symposium (NOMS)*, Virtual, 2020
  - Acceptance rate: 29.6%
- L. Gavrilovska, A. Leon-Garcia, V. Rakovic, D. Denkovski, S. Marinova, V. Atanasovski, **T. Lin**, H. Bannazadeh, "Flash Crowd Management via Virtualized Network Resources (FALCON)," *NATO Science for Peace and Security (SPS) Cluster Workshop on Advanced Technologies*, Leuven, Belgium, 2019
- S. Marinova, **T. Lin**, H. Bannazadeh, A. Leon-Garcia, "End-to-end Network Slicing for 5G in Multi-Region, Multi-Tenant Cloud Platform," *3rd International Balkan Conference on Communications and Networking (BalkanCom),* Skopje, North Macedonia, 2019
- **T. Lin**, B. Park, H. Bannazadeh and A. Leon-Garcia, "Deploying a Multi-Tier Heterogeneous Cloud: Experiences and Lessons from the SAVI Testbed," *IEEE/IFIP Network Operations and Management Symposium (NOMS)*, Taipei, Taiwan, 2018
  - Acceptance rate: 29.6%
- **T. Lin**, N. Tarafdar, B. Park, P. Chow and A. Leon-Garcia, "Enabling Network Function Virtualization over Heterogeneous Resources," *19th Asia-Pacific Network Operations and Management Symposium (APNOMS)*, Seoul, South Korea, 2017
  - Acceptance rate: 36%
- N. Tarafdar, **T. Lin**, N. Eskandari, D. Lion, A. Leon-Garcia and P. Chow, "Heterogeneous Virtualized Network Function Framework for the Data Center," *27th International Conference on Field Programmable Logic and Applications (FPL)*, Ghent, Belgium, 2017
  - Acceptance rate: 24%
- P. Spachos, **T. Lin**, W. Li, M. Chignell, A. Leon-Garcia, J. Jiang and L. Zucherman, "Subjective QoE Assessment on Video Service: Laboratory Controllable Approach," *IEEE*

International Symposium on a World of Wireless Mobile and Multimedia Networks (WoWMoM), Macau, China, 2017
    - Acceptance rate: 27%
- **T. Lin**, B. Park, H. Bannazadeh and A. Leon-Garcia, “Enabling L2 Network Programmability in Multi-Tenant Clouds,” *IFIP/IEEE International Symposium on Integrated Network Management (IM)*, Lisbon, Portugal, 2017
    - Acceptance rate: 29%
- N. Tarafdar, **T. Lin**, E. Fukuda, H. Bannazadeh, A. Leon-Garcia and P. Chow, “Enabling Flexible Network FPGA Clusters in a Heterogeneous Cloud Data Center,” *ACM/SIGDA International Symposium on Field-Programmable Gate Arrays (FPGA)*, Monterey, California, USA, 2017
    - Acceptance rate: 24%
- B. Park, **T. Lin**, H. Bannazadeh and A. Leon-Garcia, "JANUS: Design of a Software-Defined Infrastructure Manager and its Network Control Architecture," *IEEE NetSoft Conference and Workshops (NetSoft)*, Seoul, South Korea, 2016
    - Acceptance rate: 19%
- **T. Lin**, B. Park, H. Bannazadeh and A. Leon-Garcia, “SAVI Testbed Architecture and Federation,” *EAI International Conference on Future Access Enablers of Ubiquitous and Intelligent Infrastructures (FABULOUS)*, Ohrid, Macedonia, 2015
- **T. Lin**, H. Bannazadeh and A. Leon-Garcia, "Introducing Wireless Access Programmability using Software-Defined Infrastructure," *IFIP/IEEE International Symposium on Integrated Network Management (IM)*, Ottawa, Canada, 2015
    - Acceptance rate: 27%
- J. M. Kang, **T. Lin**, H. Bannazadeh and A. Leon-Garcia, “Software-Defined Infrastructure and the SAVI Testbed,” EAI International Conference on Testbeds and Research Infrastructures for the Development of Networks & Communities (TRIDENTCOM), Guangzhou, PRC, 2014
    - Acceptance rate: 33%
    - Best Paper Award
- **T. Lin**, J. M. Kang, H. Bannazadeh and A. Leon-Garcia, "Enabling SDN Applications on Software-Defined Infrastructure," *IEEE Network Operations and Management Symposium (NOMS)*, Krakow, Poland, 2014
    - Acceptance rate: 29%
- J. M. Kang, H. Bannazadeh, H. Rahimi, **T. Lin**, M. Faraji and A. Leon-Garcia, "Software-Defined Infrastructure and the Future Central Office," *IEEE International Conference on Communications Workshops (ICC)*, Budapest, Hungary, 2013
    - Acceptance rate: 39%

Journals and Magazines

- S. Marinova, **T. Lin**, H. Bannazadeh, A. Leon-Garcia, “End-to-End Network Slicing for Future Wireless in Multi-Region Cloud Platforms,” in *Elsevier Computer Networks*, vol. 177, May 2020
- S. Marinova, V. Rakovic, D. Denkovski, **T. Lin**, V. Atanasovski, H. Bannazadeh, L. Gavrilovska, A. Leon-Garcia, “End-to-End Network Slicing for Flash Crowds,” in *IEEE Communications Magazine*, vol. 58, no. 4, pp. 31-37, Apr. 2020
- N. Tarafdar, N. Eskandari, **T. Lin** and P. Chow, “Designing for FPGAs in the Cloud,” *IEEE Design & Test*, vol. 35, no. 1, pp. 23-29, Feb. 2018

Book Chapters

- N. Tarafdar, **T. Lin**, D. Ly-Ma, D. Rozhko, A. Leon-Garcia and P. Chow, “Building the Infrastructure for Deploying FPGAs in the Cloud,” in *Hardware Accelerators in Data Centers*, C. Kachris, B. Falsafi, D. Soudris, Eds. Cham, Springer, 2018, pp. 9-33

Demos & Poster Presentations

- **T. Lin**, B. Park, H. Bannazadeh and A. Leon-Garcia, "*Demo Abstract: End-to-End Orchestration across SDI Smart Edges*," IEEE/ACM Symposium on Edge Computing (SEC), Washington, DC, USA, 2016
- B. Park, **T. Lin**, H. Bannazadeh and A. Leon-Garcia, “*OpenFlow Conflict Detection and Authorization in Multi-Tenant Clouds*,” 2016 SAVI AGM & Workshop
- B. Park, **T. Lin**, H. Bannazadeh and A. Leon-Garcia, “*SDI Manager Architecture and its SDN Functionalities*,” 2015 SAVI AGM & Workshop
- **T. Lin**, H. Bannazadeh and A. Leon-Garcia, “*End-to-End Traffic Control in the SAVI Testbed*,” 2014 SAVI AGM & Workshop

Invited Talks

- “*The SAVI Testbed for Software-Defined Infrastructure*,” IEEE Canadian Conference on Electrical and Computer Engineering (CCECE), Toronto, Canada, 2014

Teaching Experience

Course Development

ECE361: Computer Networks I — *Fall ’16; Summer ’19 – Winter ‘20*

- Created new set of OpenFlow-based labs, creating solutions, and thoroughly testing new lab environments prior to release to students
- Complete course re-design (lectures, tutorials, and labs) focusing on solving fundamental problems in networking
- Set of technical demos to show in tutorials and lectures to bring theory to reality

ECE1508: Network Softwarization: Technologies and Enablers — *Winter ’18, ‘19*

- Aided the design of the course syllabus and the schedule of lectures, involving instructors across 4 different universities
- Created lecture materials pertaining to SAVI, overlays, NFV, SDN, and orchestration
- Designed set of hands-on labs on SAVI related to the previous topics

APS105: Computer Fundamentals — *Winter ’16, ‘17*

- Designed, implemented, and trial-ran a new computer-based examination system
- Designed and implemented a computer-based student survey system for in-lab hours

Teaching

IEEE ComSoc Summer School — *Summer ‘17*

- Created and presented day-long series of lectures pertaining to SAVI, NFV, SDN, orchestration, monitoring, and container technology
- Created set of hands-on tutorials on SAVI related to the above topics and guided students through exercises to bring theoretical concepts to reality
- Presented set of demos to showcase SAVI SDI and use of heterogeneous resources

Teaching Assistant

ECE244: Programming Fundamentals — *Fall ’15 - ‘20*

- Supported students in creating and debugging C++-based object-oriented programs
- Marked laboratory assignments, midterms, and finals

ECE1508: Network Softwarization: Technologies and Enablers *Winter '18, '20*

- Created and presented lectures pertaining to SAVI, overlays, NFV, SDN, and orchestration methods
- Presented set of demos to showcase SAVI SDI and use of heterogeneous resources
- Provided technical advice and assistance to student projects
- Evaluated student's project presentations and reports

APS105: Computer Fundamentals *Fall '14, '15; Winter '16 - '20*

- Guided students in resolving and debugging issues regarding during lab hours
- Led tutorial sessions for groups of up to 30 students, as well as 1-on-1 sessions
- Created new lab assignments and created questions for midterm and finals
- Marked assignments, quizzes, midterms, and finals

ECE297: Communication and Design *Winter '14 - '20*

- Supervised 4 to 5 groups of students in semester-long software project
- Advised students on best approaches for tackling certain problems and suggested improvements on various aspects of their software
- Marked milestones, code reviews, technical presentations, and final pitches

ECE361: Computer Networks I *Winter '15; Fall '12, '16, '18, '19*

- Led tutorial sessions and organized weekly TA meetings
- Assisted students in resolving issues regarding labs and conducting in-lab grading

ECE1548: Advanced Network Architectures *Fall '12, '13, '15 - '17*

- Designed and implemented new cloud computing labs for the SAVI testbed, with topics on: OpenFlow, Orchestration, Monitoring, Testbed Federation
- Consulted and aided students in overcoming various issues in their final projects
- Extended and maintained capabilities of the SAVI network testbed upon which the student's final projects were deployed and tested on
- Marked laboratory assignments and provided feedback on final projects

ECE461: Internetworking *Fall '13, '14*

- Assisted students in resolving issues regarding the labs during practical hours
- Marked laboratory assignments

APS106: Fundamentals of Computer Programming *Winter '12*

- Conducted tutorials to a group of roughly 30 students
- Assisted students in resolving issues regarding labs and conducting in-lab grading

ECE466: Computer Networks II *Winter '12*

- Thoroughly tested a new lab prior to release to students
- Assisted students in resolving issues regarding the labs during practical hours

Tutoring

APS106: Fundamentals of Computer Programming *Winter '12*

- Volunteer basis
- Assessed and identified knowledge gap of the students
- Prepared customized exercises and lesson plans in 1-on-1 and small group sessions

APS105: Computer Fundamentals *Fall '11*

- Set up material review sessions with student along with sample code snippets
- Assisted student in resolving issues regarding labs

Technical Skills & Knowledge

Programming and Scripting

- C, C++, Python, Go, Node.js, Java, Matlab, CUDA-C, Obj-C, Assembly, Bash

Web Development
- HTML5 and JavaScript

Other CLI Systems and Languages
- Cisco IOS, Dell NOS, SQL

Operating Systems
- Debian and CentOS-based Linux systems, Windows

Communication Standards
- TCP/IP stack, I2C, RS-232 & 422 via UART, CAN

Volunteering Experience

Elected Residence House Representative *(New College)* *'08 – '09, '10 – '11*
- Represent the house in meetings with the campus residence council
- Liaise with other House Reps in organizing joint events, expressing the interests of the house and planned an approximate schedule for the upcoming weeks
- Created and organized an informative welcoming event for new residents

Operations Coordinator – Christmas In July Food Drive *Summer '08*
- Corresponded with various groups and companies throughout the Greater Vancouver region to inform them of the food drive
- Spread awareness of the event, advertising its purpose and goals to the public
- Collected donations from homes and groups for delivery to the local food bank

Elected Residence House Treasurer (New College) *'07 – '08*
- Managed the bank account for one of the houses on campus residence
- Collected funds, distributed reimbursements and subsidies
- Reported up to date records of expenditures and income on a ledger form