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Research Interests

Distributed systems, Programmable networking, Security, Automated reasoning, Formal methods.

Education

PhD in Computer Science	July 2015
Trinity College, University of Cambridge	
Thesis title: Higher-order proof translation	
Supervised by Prof. Lawrence Paulson, FRS	
Examiners: Prof. Mateja Jamnik, Dr. Christian Urban	
MSc in Computer Science (by research)	November 2008
University of Kent, Canterbury, UK	
Thesis title: Verification of Refactorings in Isabelle/HOL	
Supervised by Prof. Simon Thompson	
Examiners: Dr. Stefan Kahrs, Prof. Oege de Moor	
BSc in Information Technology (Honours)	December 2005
University of Malta	
Thesis title: <i>Abductive runtime verification of Lustre programs</i>	
Supervised by Mr Michael Rosner and Prof. Gordon Pace	

Experience

Fermilab (Fermi National Accelerator Laboratory) — Batavia, USA June 2023–now
Universities Research Association (URA) Visiting Scholar.
Affiliated with the Fermilab Quantum Institute and the Real-time Processing Systems Division.

Illinois Institute of Technology — Chicago, USA August 2021–now
Tenure-track Assistant Professor of Computer Science.

University of Pennsylvania — Philadelphia, USA March 2017–August 2021
Postdoctoral Researcher working on Denial-of-Service (DoS) mitigation, programmable networking and software security. I worked with several people at Penn and partner institutions on several [released systems](#) and the [publications](#) based on them.

Cambridge University March 2014–January 2017
Research Associate (post-doc) on the EPSRC-funded Network-as-a-Service project. I worked with several people at Cambridge and at partner universities on the Flick, Emu, Kneecap, and Pax [released systems](#), and the [publications](#) based on them.

Microsoft Research — Cambridge, UK November 2013–January 2014
Internship during which I wrote a model checker to analyze biological networks. I worked with Hillel Kugler, Boyan Yordanov, Yousef Hamadi, and Christoph Wintersteiger.

Open Book Publishers — Cambridge, UK March 2013–December 2016
Prototyped project ideas, wrote bespoke software, configured and maintained a multi-role server, and liaised on IT-related matters.

Microsoft Research — Cambridge, UK May–August 2012
Internship with Moritz Becker and Markulf Kohlweiss during which I implemented a logic-based authorization system that could be predicated on cryptographic primitives, and contributed to a publication.

Microsoft Research — Cambridge, UK September–November 2011
Internship with Moritz Becker during which I implemented a theorem-prover for automated reasoning on Datalog programs, and contributed to a publication.

Mathematical Institute, Ludwig Maximilian University — Munich, Germany January–August 2008
Research assistant working on constructive proof search.

Selected Publications

[Towards Practical Application-level Support for Privilege Separation](#) December 2022
N.S, H. Zhu, K. Zhong, Z. Zheng, R. Mao, D. Chauhan, J. Zhao, S. Carrasquillo, L. Shi, N. Vasilakis, B. Loo
Annual Computer Security Applications Conference (ACSAC)

[Flightplan: Dataplane Disaggregation and Placement for P4 Programs](#) April 2021
N.S, J. Sonchack, H. Giesen, I. Pedisich, Z. Han, N. Shyamkumar, S. Burad, A. DeHon, B. Loo
USENIX Symposium on Networked Systems Design and Implementation (NSDI)

[Emu: Rapid Prototyping of Networking Services](#) July 2017
N.S, S. Galea, D. Greaves, M. Wojcik, J. Shipton, R. Clegg, L. Mai, P. Bressana, R. Soulé, R. Mortier, P. Costa, P. Pietzuch, J. Crowcroft, A. Moore, N. Zilberman
USENIX Annual Technical Conference (ATC)

FLICK: Developing and Running Application-Specific Network Services

June 2016

A. Alim, R. Clegg, L. Mai, L. Rupprecht, E. Seckler, P. Costa, P. Pietzuch, A. Wolf, N.S*, J. Crowcroft, A. Madhavapeddy, A. Moore, R. Mortier, M. Koleni, L. Oviedo, D. McAuley, M. Migliavacca
USENIX Annual Technical Conference (ATC)

* Lead author from Cambridge University

Other Publications

A Domain-Specific Language for Reconfigurable, Distributed Software Architecture

May 2023

Henry Zhu, Junyong Zhao, N.S

Workshop on Advances in Parallel and Distributed Computational Models (APDCM)

Towards In-Network Semantic Analysis: A Case Study involving Spam Classification

May 2023

Cyprien Gueyraud, N.S

8th IEEE/IFIP International Workshop on Analytics for Network and Service Management (AnNet)

In-Network Fractional Calculations using P4 for Scientific Computing workloads

December 2022

Shivam Patel, Rigden Atsatsang, Kenneth Tichauer, Michael H L W Wang, James Kowalkowski, N.S

5th European P4 Workshop (EuroP4)

A Case for Remote Attestation in Programmable Dataplanes

November 2022

N.S, Deborah Shands, Vinod Yegneswaran

ACM Workshop on Hot Topics in Networks (HotNets-2022)

Demo: The Hangar environment for Teaching and Research in Programmable Networking

Oct. 2022

N.S

International Conference on Network Protocols (ICNP)

Experiment Planning for Heterogeneous Programmable Networks

June 2022

N.S

International Workshop on Test and Evaluation of Programmable Networks

Data Management and Storage over Programmable Networks

January 2022

N.S, James B. Kowalkowski, Michael H. L. S. Wang, Marc F. Paterno

ASCR Workshop on the Management and Storage of Scientific Data

IPC Evolution thru Declarative Interface Generation

December 2021

N.S, Saket, Andrew Zhao, Shubhendra Pal Singhal, Michael Kaplan, Rajesh Krishnan, Boon Thau Loo

Workshop on Descriptive Approaches to IoT Security, Network, and Application Configuration (DAI-SNAC)

Leveraging In-Network Application Awareness

August 2021

N.S

Workshop on Network-Application Integration (NAI)

Meta-level issues in Offloading: Scoping, Composition, Development, and their Automation

April 2021

André DeHon, Hans Giesen, N.S, Yuanlong Xiao

Workshop on Languages, Tools, and Techniques for Accelerator Design (LATTE)

- Debugging strongly-compartmentalized distributed systems** May 2020
Henry Zhu, N.S, Boon Thau Loo
Workshop on Advances in Parallel and Distributed Computational Models (APDCM)
- Trace-based Behaviour Analysis of Network Servers** October 2019
N.S, Achala Rao, Zihao Jin, Pardis Pashakhanloo, Henry Zhu, Vinod Yegneswaran, Boon Thau Loo
International Conference on Network and Service Management (CNSM)
- Hashtray: Turning the tables on Scalable Client Classification** April 2019
N.S, Pardis Pashakhanloo, Zihao Jin, Achala Rao, Boon Thau Loo
International Workshop on Analytics for Network and Service Management
- What we talk about when we talk about pcap expressions** February 2019
N.S
ACM Workshop on Real World Domain Specific Languages
- DoSarray: An extensible evaluation system for DoS research** January 2019
N.S, Shilip Bose, Boon Thau Loo
International Conference on COMMunication Systems & NETWORKS (COMSNETS)
- Source-level Support for Transforming Legacy Software into a Network of Tasks** October 2018
N.S, Achala Rao, Zihao Jin, Pardis Pashakhanloo, Henry Zhu, Ke Zhong, Boon Thau Loo
Workshop on Forming an Ecosystem Around Software Transformation (FEAST)
- In-network computing to the rescue of faulty links** August 2018
H. Giesen, L. Shi, J. Sonchack, A. Chelluri, N. Prabhu, N.S, L. Kant, A. McAuley, A. Poylisher, A. DeHon, B. Loo
Workshop on In-Network Computing (NetCompute)
- Report on Networking and Programming Languages 2017** October 2017
Nikolaj Bjørner, Marco Canini, N.S
Computer Communication Review, Vol. 47 No. 5
- Middleboxes for selective disclosure of network monitoring to distrusted parties** August 2016
N.S, Markulf Kohlweiss, Andrew Moore
ACM SIGCOMM Workshop on Hot Topics in Middleboxes and Network Function Virtualization (HotMiddlebox)
- Kneecap: model-based generation of network traffic** July 2016
N.S, Richard Mortier
14th International Workshop on Satisfiability Modulo Theories (SMT)
- The Higher-Order Prover LEO-II** December 2015
Christoph Benz Müller, N.S, Lawrence C. Paulson, Frank Theiss
Journal of Automated Reasoning, Vol. 55 No. 4
- Proofs and reconstructions** September 2015
N.S, Christoph Benz Müller, Lawrence C. Paulson
Frontiers in Combining Systems symposium (FroCoS)

Systematic Verification of the Modal Logic Cube in Isabelle/HOL Christoph Benz Müller, Maximilian Claus, N.S <i>Proof Exchange between Theorem Provers workshop (PxTP)</i>	August 2015
Selective Disclosure in Datalog-based Trust Management N.S, Moritz Y. Becker, Markulf Kohlweiss <i>Security and Trust Management workshop (STM)</i>	September 2013
LEO-II 1.5 (System Description) Christoph Benz Müller, N.S <i>Proof Exchange between Theorem Provers workshop (PxTP)</i>	June 2013
LEO-II and Satallax on the Sledgehammer test bench N.S, Jasmin Christian Blanchette, Lawrence C. Paulson <i>Journal of Applied Logic, Vol. 11 No. 1</i>	March 2013
Understanding LEO-II's proofs N.S, Christoph Benz Müller <i>International Workshop on the Implementation of Logics (IWIL)</i>	March 2012
Foundations of Logic-Based Trust Management Moritz Y. Becker, Alessandra Russo, N.S. <i>IEEE Symposium on Security and Privacy ("Oakland conference")</i>	May 2012
Mechanical Verification of Refactorings N.S., Simon Thompson <i>ACM SIGPLAN Symposium on Partial Evaluation and Program Manipulation (PEPM)</i>	January 2008

Selected Online Demos/Videos

Flexible Topology and Configuration Generation as a Resource for Networking Research Aishwarya Wesanekar, N.S. <i>Networking Women Professional Development Workshop (N2Women)</i>	August 2021
Demo: Disaggregated Dataplanes Heena Nagda, Rakesh Nagda, N.S, Boon Thau Loo. <i>ICDCS (International Conference on Distributed Computing Systems)</i>	July 2021
FDP: A Teaching and Demonstration Platform for Networking Heena Nagda, Rakesh Nagda, N.S, Swapneel Sheth, Boon Thau Loo. <i>SIGCSE (Computer Science Education)</i>	March 2021
FDP: A teaching and demo platform for P4-based SDN Heena Nagda, Rakesh Nagda, Isaac Pedisich, N.S, Boon Thau Loo. <i>Networking Women Professional Development Workshop (N2Women)</i>	August 2020
A Demonstration of the DeDoS Platform for Defusing Asymmetric DDoS Attacks in Data Centers by H. Demoulin, T. Vaidya, I. Pedisich, N.S, B. Wang, J. Qian, Y. Zhang, A. Chen, A. Haeberlen, B. Loo, L. Phan, M. Sherr, C. Shields, W. Zhou. <i>SIGCOMM Posters and Demos 2017</i>	August 2017

Research-related System Releases

Pitchfork Project (2022)	http://pitchfork.cs.iit.edu
(FDP) Flightplan Demo Platform (2021)	http://www.github.com/eniac/FDP
Flightplan (2020)	http://flightplan.cis.upenn.edu
Apache httpd Worker Union MPM (2019)	https://gitlab.com/DeDos/apache_httpd_workers_union
Flowdar (2019)	https://gitlab.com/DeDos/flowdar
TYM Datalog (2019)	https://github.com/niksu/tym
Caper (2019)	https://gitlab.com/niksu/caper
hashtray (2018)	https://gitlab.com/niksu/hashtray
DoSarray (2018)	https://github.com/niksu/dosarray
Pax (2016)	https://github.com/niksu/pax
Kneecap (2016)	https://github.com/niksu/kneecap
Motto (2016)	https://github.com/NaaS/motto
Counterdog (2012)	https://www.rise4fun.com/Counterdog

Selected Awards

<i>Universities Research Association's (URA) Visiting Scholars Program (VSP)</i>	April 2023
This award funded part of my collaboration with Fermilab.	

<i>Google Research Scholar award</i>	April 2022
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<i>Finalist essay in the Tipping Point Prize</i>	NESTA UK, May 2019
This competition was organized by the National Endowment for Science, Technology and the Arts (NESTA) and sought horizon-scanning essays. My essay described how bounded latency could enable more reliable Internet-carried services.	

<i>Student Bursary</i>	Summer 2016
Was awarded a grant from the Engineering and Physical Sciences Research Council that funded a 10-week research internship (UROP—Undergraduate Research Opportunities) for a student (Jonny Shipton), and for him to give a talk at the 4th South of England Regional Programming Language Seminar.	

<i>Julius Springer award</i>	September 2015
Travel grant from CADE Inc (Conference on Automated Deduction) for the presentation of my paper at the symposium on Frontiers of Combining Systems.	

<i>Conference on Automated Deduction, Automated Theorem Prover (ATP) System Competition</i>	August 2015
This is a competition in which ATPs are ranked by their ability to prove the most theorems in the least time. I helped with Satallax, the ATP that came first in the Typed Higher-order Form division.	

<i>The Observer Tech Monthly Student Essay Competition</i>	February 2014
Won two weeks work experience at The Observer for an essay on the mixed blessings of hi-tech on modern life.	

<i>German Academic Exchange Service (DAAD) study grant</i>	September–December, 2012
This grant funded a three-month research visit to the Free University of Berlin where I worked with Dr Christoph Benzmüller on extending the LEO-II theorem-prover.	

Cambridge European Trust Scholarship (Honorary)

Cambridge Trusts, 2008

External Research Scholarship

Trinity College, Cambridge, 2008

This scholarship funded my PhD work.

Marie Curie fellowship

MATHLOGAPS, 2007

MATHLOGAPS was a multi-participant Marie Curie Early Stage Research Training Site in MATHEMATICAL LOGIC and APPLICATIOnS. This fellowship funded my eight-month visit to Ludwig Maximilians Universität where I researched constructive proof search. I wrote a logic tool that was open-sourced.

Teaching

Illinois Institute of Technology

Spring 2023

CS543-1, CS543-2, ITM595-5: **Software-Defined Networking**.

Illinois Institute of Technology

Fall 2022

CS351: **Systems Programming**.

Illinois Institute of Technology

Spring 2022

CS595-1, CS595-2, ITM595-5: **Designing Large-Scale Networked Systems**.

Illinois Institute of Technology

7th October 2021

Gave guest lecture on **Large-Scale System Development + Research** as part of the Operating Systems course (CS450) taught by Prof. Francis Leung.

Illinois Institute of Technology

28th September 2021

Gave guest lecture on **Datacenter Networking and Research** as part of “Computer Networks I: Fundamentals” (CS542). The course was being taught by Prof. Edward Chlebus.

University of Pennsylvania

12th November 2019

Gave guest lecture on **Denial-of-Service attacks and mitigations** as part of “Introduction to Networks and Security” (CIS331) and formulated exam questions related to my lecture. The course was being taught by Prof. Sebastian Angel.

Cambridge University Computer Lab

Michaelmas Term 2016

Lectured the course on **Prolog** to provide sabbatical cover. This was taught as a flipped classroom. I fielded student questions in person and online, ran the exercise assessment, and wrote the exam question with Dr Alastair Beresford.

Cambridge University (various colleges)

2008–2016

Small-group teaching for the following courses:

- Compiler construction
- Computer networking
- Concepts in programming languages
- Denotational semantics
- Discrete maths
- Foundations of computer science
- Logic and proof
- Operational semantics
- Optimising compilers
- Prolog
- Software and interface design
- Specification and verification
- Unix tools

Initiatives

Networked Systems Tech Talks

Illinois Tech, 2022–now

I started a talk series that focuses on practical or applied research ideas in data networking. This series intended to be a research stimulus and to expose students to practical challenges in networking—beyond the simplified problems that are typically covered in university courses. The series of talks is carefully curated, widely advertized and it is open to all. I maintain the series' webpage: <http://www.cs.iit.edu/~nsultana1/techtalks/>
(Department of Computer Science)

Seminar on the C language

Illinois Tech, 8th September 2022

I led the preparation of this seminar, which was designed to help students with C programming. The seminar was delivered by Irina Klein who worked with me over the summer, with technical input from another student Henry Zhu and organizational assistance from ACM-W. 49 students attended this event, for which we experimented with a Jupyter-based platform for teaching.
(Department of Computer Science)

“Research Opportunities in Programmable Networking”

Illinois Tech, 4th January 2022

Gave talk at the COMSJOB event at COMSNETS 2022
(Department of Computer Science)

Q&A with Faculty for PhD applicants

Illinois Tech, 11th November 2021

(Department of Computer Science)

Service to Department/University

MS project viva of Mousam Sarkar

Illinois Tech, 14th April 2023

Advisor: Prof. Boris Glavic.
(Department of Computer Science)

PhD Oral Qualifying Exam of Nanda Velugoti

Illinois Tech, 24th February 2023

Advisor: Prof. Kyle Hale
(Department of Computer Science)

PhD Oral Qualifying Exam of Lan Nguyen

Illinois Tech, 24th February 2023

Advisor: Prof. Ioan Raicu
(Department of Computer Science)

PhD Oral Qualifying Exam of Jiya Su

Illinois Tech, 6th October 2022

Advisor: Prof. Rujia Wang
(Department of Computer Science)

PhD Oral Qualifying Exam of Jie Ye

Illinois Tech, 6th October 2022

Advisor: Prof. Xian-He Sun
(Department of Computer Science)

MS project viva of Mikel Santana

Illinois Tech, 17th August 2022

Advisor: Prof. Kyle Hale.
(Department of Computer Science)

Broadening Participation in Computing (BPC)

Illinois Tech, 2022–2023

(Department of Computer Science)

Graduate Studies Committee

Illinois Tech, 2022–2033

(Department of Computer Science)

PhD Comprehensive Exam of Yao Kang
Advisor: Prof. Zhiling Lan
(Department of Computer Science)

Illinois Tech, 21st April 2022

CS695: Doctoral Seminar

Illinois Tech, Spring 2022

Students attend talks by external speakers and by their peers, discuss research and write short summaries. This course helps student develop their communication, presentation, and critical thinking skills.
(Department of Computer Science)

MS project viva of Jorge Gonzalex Lopez

Illinois Tech, 29th November 2021

Title: "Comprehensive review and evaluation of classification networks for radar and communication signals". Advisor: Prof. Gady Agam.
(Department of Computer Science)

Undergraduate Studies Committee
(Department of Computer Science)

Illinois Tech, 2021–2022

Admissions interviews

Clare College, Cambridge. 2015, 2016

Helped with undergraduate college admission interviews for the Computer Science program.

Service to the Profession

Technical PC of **ACM SoCC** (Symposium on Cloud Computing) 2023

Reviewing for **ToN** (IEEE/ACM Transactions on Networking) 2022,2023

Technical PC of **USENIX ATC** (Annual Technical Conference) 2022,2023

Technical PC of **COMSNETS** (International Conference on COMMunication Systems & NETWORKS) 2020–2024

Panel participant for **NSF** (National Science Foundation) 2022

Contributed to drafting the workshop report for **ASCR's** (Advanced Scientific Computing Research) Workshop on the Management and Storage of Scientific Data 2022

Reviewing for **PADS** (IEEE Transactions on Parallel and Distributed Systems) 2021,2022

PC of **FEAST** (Workshop on Forming an Ecosystem Around Software Transformation) 2020

Grant reviewing for **ETH Zurich Research Commission** October 2019

PC of **SIGCOMM Posters+Demos** 2018, 2019

Reviewing for **TRETS** (ACM Transactions on Reconfigurable Technology and Systems) 2018

External reviewing for **ANCS** (ACM/IEEE Symposium on Architectures for Networking and Communications Systems) 2015

Networks and Programming Languages (NetPL) workshop 2016, 2017

Led the submission of the proposal to hold this workshop at SIGCOMM 2016, then helped with the workshop's organization when the proposal was accepted.

Posters

Compiling Natural Language Expressions to Extended BPF Programs for Stateful Network Policy Enforcement

April 2023

Mohammad Firas Sada, N.S

Symposium on the Science of Security (HotSoS)

Securing Software through Network Slicing

December 2021

Neil Dhote, N.S

SPACE 2021: Eleventh International Conference on Security, Privacy and Applied Cryptographic Engineering

The Usability of a Debugger Designed for Compartmentalized Systems

December 2020

Junyong Zhao, Henry Zhu, N.S, Boon Thau Loo

Annual Computer Security Applications Conference 2020

A Case Study of Fine-Grained Software Compartmentalization using cURL

December 2020

Stephen Carrasquillo, Junyong Zhao, Henry Zhu, N.S, Boon Thau Loo

Annual Computer Security Applications Conference 2020

FDP: A teaching and demo platform for P4-based SDN

December 2020

Heena Nagda, Rakesh Nagda, Isaac Pedisich, N.S, Boon Thau Loo.

International Conference on emerging Networking EXperiments and Technologies (CoNEXT)

Trace-based Behaviour Analysis of Network Servers

October 2019

N.S, Achala Rao, Zihao Jin, Pardis Pashakhanloo, Henry Zhu, Vinod Yegneswaran, Boon Thau Loo.

International Conference on Network and Service Management (CNSM)

Interfacing Isabelle with other systems

October 2009

Verification Technology, Systems & Applications (VSTA), INRIA Nancy, France.

Burden of Proof

June 2009

Microsoft Summer School, Microsoft Research, Cambridge.

Mechanical Validation of Refactorings

June 2007

KentPGC (Postgraduate workshop), the Computing Laboratory, University of Kent.

Technical Reports

Towards In-Network Semantic Analysis: A Case Study involving Spam Classification

March 2023

Cyprien Gueyraud, N.S.

IIT Repository, [Islandora 1012248](#)

Semantics and further Use-Cases and Evaluation of the C-Saw language

March 2023

Henry Zhu, Junyong Zhao, N.S.

IIT Repository, [Islandora 1012250](#)

Foundations of Logic-Based Trust Management

February 2012

Moritz Y. Becker, Alessandra Russo, N.S.

Microsoft Research MSR-TR-2012-10

Invited Talks

Torches on Pitchfork: Multi-feature Evaluation of a Security-oriented Programming Toolchain

Learning from Authoritative Security Experiment Results (LASER) Workshop
Austin, TX, USA

6th December 2022

A Case for Remote Attestation in Programmable Dataplanes

Computer Science Lab
SRI International

27th October 2022

Disaggregation and Placement of In-Network Programs

Hunt Group, UT Austin
NetLab, University of Kentucky
Department of Computer Science, Santa Clara University
ECE department, Illinois Institute of Technology
Software Analysis Seminar, University of Illinois in Chicago
Networked Systems Group, ETH Zurich
Data Science Research Platform seminar, University of Malta
Microsoft Research, Cambridge
SRI International
ESNet/LBL Network and Edge Reading Group
AMD Inc.
ANTLab and NECSTLab, Politecnico di Milano
Barefoot Division (BXD), Intel Inc.
CINI Cybersecurity Lab, University of Catania
Eötvös Loránd University
VMware Research
DePaul University

6th December 2022
3rd November 2022
20th October 2022
23rd September 2022
6th September 2022
23rd February 2022
23rd February 2022
22nd February 2022
17th February 2022
16th February 2022
25th January 2022
10th December 2021
9th December 2021
3rd December 2021
23rd November 2021
3rd November 2021
22nd October 2021

Experiment Planning for Heterogeneous Programmable Networks

[Focus Group on Autonomous Networks, 9th virtual meeting](#)
International Telecommunications Union

31st August 2022

Flightplan: Dataplane Disaggregation and Coordination for In-network Computing

Internet Research Task Force's "Compute in the Network" Research Group
Google

10th February 2022
12th October 2021

Research and Teaching Resources for Programmable Networking

Focus Group on Autonomous Networks, 6th virtual meeting
International Telecommunications Union

27th January 2022

Flexibility and Performance in Programmable Data Networks

Database Systems Group
University of Bozen-Bolzano

30th November 2021

Balancing Needs and Resources in Programmable Networking

[Focus Group on Autonomous Networks, 5th virtual meeting](#)
International Telecommunications Union

3rd November 2021

Disaggregation and Placement of In-Network Programs

[Focus Group on Autonomous Networks, 4th virtual meeting](#)
International Telecommunications Union

2nd September 2021

Programming for Distributed and Heterogeneous Resources CS Seminar George Mason University	1st March 2021
Flightplan: Dataplane Disaggregation and Coordination for In-network Computing Trinity College, Dublin Edinburgh University	2nd July 2019 25th June 2019
Flexible and performant network programming Programmable Storage meeting UC Santa Cruz	7th December 2018
Flightplan: Dataplane Disaggregation and Coordination for In-network Computing Distributed Systems Lab seminar, University of Pennsylvania ONF Connect 2018 CMU Silicon Valley	10th December 2018 5th December 2018 4th December 2018
High-level development and debugging of FPGA-based network programs Advanced Programming Specialist Group, British Computing Society, London Programming Languages and Systems seminar, University of Kent Systems Research Group Seminar, Cambridge University	26th January 2017 23rd January 2017 19th January 2017
Light at the Middle of the Tunnel: Middleboxes for Selective Disclosure of Network Monitoring to Distrusted Parties Constructive Security group, Microsoft Research Cambridge, UK	7th December 2016
Verification of Refactorings in Isabelle/HOL ProVal group, INRIA-Futurs, Paris Semantics and Verification Research Group, University of Malta	November 2007 October 2007

Conference/Workshop Talks

A Domain-Specific Language for Reconfigurable, Distributed Software Architecture Workshop on Advances in Parallel and Distributed Computational Models (APDCM) <i>St Petersburg (FL)</i>	8th May 2023
Towards In-Network Semantic Analysis: A Case Study involving Spam Classification 8th IEEE/IFIP International Workshop on Analytics for Network and Service Management <i>Miami</i>	15th May 2023
Towards Practical Application-level Support for Privilege Separation Symposium on the Science of Security (HotSoS) (virtual)	4th April 2023
A Case for Remote Attestation in Programmable Dataplanes Symposium on the Science of Security (HotSoS) (virtual)	4th April 2023
Towards Practical Application-level Support for Privilege Separation Annual Computer Security Applications Conference (ACSAC) Austin, TX, USA	6th December 2022

A Case for Remote Attestation in Programmable Dataplanes HotNets 2022 Austin, TX, USA	15th November 2022
The Hangar environment for Teaching and Research in Programmable Networking (Demo) International Conference on Network Protocols Lexington, KY, USA	31st Oct. 2022
Thrifty Workload Planning for Datacenter Sustainability and Efficiency OCP Future Technologies Symposium San Jose, CA, USA	19th October 2022
Experiment Planning for Heterogeneous Programmable Networks International Workshop on Test and Evaluation of Programmable Networks Marina Del Rey, LA, California	1st June 2022
Leveraging In-Network Application Awareness Workshop on Network-Application Integration (Held online)	23rd August 2021
Meta-level issues in Offloading: Scoping, Composition, Development, and their Automation Workshop on Languages, Tools, and Techniques for Accelerator Design (Held online)	15th April 2021
Flightplan: Dataplane Disaggregation and Placement for P4 Programs 18th USENIX Symposium on Networked Systems Design and Implementation (Held online)	13th April 2021
What we talk about when we talk about pcap expressions ACM Workshop on Real World Domain Specific Languages Washington, DC, USA	17th February 2019
An extensible evaluation system for DoS research 11th International Conference on COMMunication Systems & NETWORKS (COMSNETS) Bengaluru, India	10th January 2019
Making Break-ups Less Painful: Source-level Support for Transforming Legacy Software into a Network of Tasks Workshop on Forming an Ecosystem Around Software Transformation (FEAST) Toronto, Canada	19th October 2018
In-Network Computing to the Rescue of Faulty Links ACM SIGCOMM Morning Workshop on In-Network Computing (NetCompute) Budapest, Hungary	20th August 2018
Light at the Middle of the Tunnel: Middleboxes for Selective Disclosure of Network Monitoring to Distrusted Parties ACM SIGCOMM Workshop on Hot Topics in Middleboxes and Network Function Virtualization (HotMiddlebox) Florianopolis, Brazil	26th August 2016
Kneecap: Model-based Generation of Network Traffic 14th International Workshop on Satisfiability Modulo Theories (SMT) Coimbra, Portugal	1st July 2016

Proofs and reconstructions International Symposium on Frontiers of Combining Systems (FroCoS) Wroclaw, Poland	September 2015
Flick: A DSL for middleboxes Workshop on Domain-Specific Language Design and Implementation (DSLDI) Prague, Czech Republic	7th July 2015
Kneecapping considered more productive than pcapping Cosener's Workshop Abingdon, UK	2nd July 2015
Functional Programming meets Reconfigurable Hardware: Train wreck? Cosener's Workshop Abingdon, UK	10th July 2014
Selective Disclosure in Datalog-based Trust Management Security and Trust Management (STM) Egham, UK	13th September 2013
Solving trust issues using Z3 Z3 Special Interest Group Microsoft Research, Cambridge, UK	3rd November 2011
Work in progress: A prototype refactoring tool based on a mechanically-verified core 21st International Symposium on Logic-based Program Synthesis and Transformation (LOPSTR) Odense, Denmark	18th July 2011
Logic and Automation RCSU/TCSS Symposium Imperial College, London, UK	30th November 2009
Peripheral Scope of Science Science in Society Conference Cambridge, UK	5th August 2009
Logic leaps and boundaries Interdisciplinary Graduate Conference 2009 Cambridge, UK	26th June 2009
Combining proof tools Trinity College Science Symposium (TCSS) Cambridge, UK	8th March 2009
Refactoring Canterbury-Littoral Doctoral Conference Canterbury, UK	May 2007

Seminar Talks

A Case for Remote Attestation in Programmable Dataplanes Security/Privacy Seminar Georgetown University	2nd May 2023
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In-Network DAQ Functions In-Storage LDRD Weekly Meeting Fermilab	3rd February 2023
Towards Practical Application-level Support for Privilege Separation Software Analysis Seminar University of Illinois in Chicago	25th October 2022
Towards Practical Application-level Support for Privilege Separation Security Reading Group Illinois Institute of Technology	30th September 2022
Edge Computing for Big Science Argonne—Illinois Tech Spring Research Seminar Illinois Institute of Technology	30th March 2022
Outline of ongoing research CS Faculty Research Intro Workshop Illinois Institute of Technology	3rd December 2021
Flexibility and Performance in Programmable Data Networks Center for Interdisciplinary Scientific Computation Illinois Institute of Technology	23rd November 2021
FDP: a student-built learning tool for data networking Center for Learning Innovation's Virtual Faculty Lounge Illinois Institute of Technology	12th November 2021
Denial-of-Service mitigations & research ACM-W Show & Tell Event Illinois Institute of Technology	11th November 2021
Paper pitch: Distributed State and Language Primitives for Reconfigurable Software Architecture PEnn Automated Reasoning and Learning (PEARL) Group University of Pennsylvania	10th November 2021
Disaggregation and Placement of In-Network Programs PEnn Automated Reasoning and Learning (PEARL) Group University of Pennsylvania	20th October 2021
Summary of recent research Scalable Computing Software (SCS) seminar Illinois Institute of Technology	5th October 2021
What we talk about when we talk about pcap expressions Joint seminar of the Distributed Systems Lab (DSL) and Programming Languages club (PLclub) University of Pennsylvania	15th February 2019
An extensible evaluation system for DoS research Distributed Systems Lab seminar University of Pennsylvania	3rd January 2019
FLICK: Developing and Running Application-Specific Network Services Distributed Systems Lab seminar University of Pennsylvania	13th April 2017

A programming model for application-level middleboxes Networks and Operating Systems (NetOS) talklet Cambridge University Computer Lab	25th November 2014
Trip report from S-REPLS 4 Networks and Operating Systems (NetOS) talklet Cambridge University Computer Lab	11th October 2016
Light at the Middle of the Tunnel: Middleboxes for Selective Disclosure of Network Monitoring to Distrusted Parties Networks and Operating Systems (NetOS) talklet Cambridge University Computer Lab	9th August 2016
A new packet filtering technique Security Group Cambridge University Computer Lab	11th March 2016
Trip report from DSLDI Networks and Operating Systems (NetOS) talklet Cambridge University Computer Lab	14th July 2015
Interfacing and improving proof tools Automated Reasoning Group Cambridge University Computer Lab	4th March 2014
Interpreting Leo-II's proofs in Isabelle/HOL Interruption Club University of Malta	23rd October 2013
Selective Disclosure in Datalog-based Trust Management Security Group Cambridge University Computer Lab	30th August 2013
Proof Assistants Free University Berlin, Germany	12th October 2012
Selective Disclosure in Datalog-based Trust Management Microsoft Research Cambridge, UK	3rd August 2012
Isabelle and THF Technical University of Munich Munich, Germany	16th August 2011
Work in progress: A prototype refactoring tool based on a mechanically-verified core Automated Reasoning Group Cambridge University Computer Laboratory	7th June 2011
Little Languages Interruption Club University of Malta	16th May 2011
Rough-and-ready proof reconstruction Automated Reasoning Group Cambridge University Computer Lab	1st March 2011

First prototype of an Isabelle/HOL-to-LeoII interface Automated Reasoning Group Cambridge University Computer Lab	23 November 2010
Introduction to Isabelle/HOL — Minicourse Interruption Club University of Malta	14–16th April 2010
Interfacing two similar HOLs Automated Reasoning Group Cambridge University Computer Lab	9th March 2010
Solving HOL problems using FOL tools Automated Reasoning Group Cambridge University Computer Lab	2nd June 2009
Combining proof tools Interruption Club University of Malta	9th April 2009

Professional Membership

Association for Automated Reasoning
Association for Computing Machinery (ACM)
British Logic Colloquium (BLC)

Institute of Electrical and Electronic Engineering (IEEE)
Institution of Engineering and Technology (IET)
USENIX Association

Volunteering

<i>Student mentoring</i>	CoNEXT 2021
<i>Student mentoring</i>	SIGCOMM 2017, 2021
<i>Student mentoring</i>	ASPLOS 2021
<i>NetOS reading group</i> Organizer	2015–2016
<i>Debate on the Axiom of Choice</i> Organizer, in collaboration with the Trinity Mathematical Society	2012
<i>Principia Mathematica anniversary symposium</i> Organizer	2010
<i>Trinity College Science Society</i> President	2009–2010
<i>StreetBite, Cambridge</i> Volunteer	2008–2009

Outreach

ENVISION science competition Fall 2020, Spring 2022
Helped judge entries in the ENVISION science-proposal competition organized by WiSTEM (Women in STEM) for female high school students interested in STEM careers.

University of Pennsylvania Summers 2018, 2019
Gave presentation on *Denial-of-Service attacks and mitigations* as part of a varied seminar series for summer interns organized by Prof. Norm Badler at the School of Engineering and Applied Science.

Science communication inquiry April 2016
Collaborated with Dr Jat Singh and Prof. Jon Crowcroft on a [submission](#) to an inquiry by the House of Commons' Science and Technology Committee. The inquiry looked into improving trust and understanding of science by the public.

Computer Science 2008 15–17th December 2008
As a grad student I served as a “big brother” to undergrads at a student research conference. From its website: “Computer Science 2008 will be the first research conference for undergraduate students. It aims to challenge, entertain, inform and above all, to enthuse students with the excitement of research in computer science.” This event was organized by Prof. Anthony Finkelstein at Homerton College, Cambridge.

Non-academic Publications

Flightplan: Dataplane Disaggregation and Placement for P4 Programs April 2021
Wrote a post about the Flightplan paper (see above) in the [P4 blog](#).

Online revolution: Building an Internet you can rely on May 2019
This was my entry for the Tipping Point Prize, later published online by NESTA UK.

Codebreaking after the Second World War 2017
Chapter in *Codebreakers and Groundbreakers*, published by the Fitzwilliam Museum, Cambridge University. This was co-authored with Markulf Kohlweiss and Sir Tony Hoare FRS.

Hard truths about science software November 2015
Varsity

Cool Arctic squirrels may hold key to Alzheimer's cure April 2015
The Observer Tech Monthly

What we're Like January 2015
Varsity

Lab in a vat October 2014
Varsity

Ivan Oransky: Science needs a medical October 2014
Varsity

Interview with Karel Janaček May 2014
The Cambridge Student Online

Project Supervision

- BS project (CS497): “Converting between English and pcap expressions” Spring 2023
Marelle León, Illinois Tech
Code: https://gitlab.com/niksu/caper/-/merge_requests/32
★ Marelle’s project was merged into [Caper](#) and deployed on the third-party [BPF Exam](#) service.
- BS project (CS497): “Prototype of an Attesting Switch” Spring 2023
Alexander Wolosewicz, Illinois Tech
Code: <https://github.com/awolosewicz/bmv2-remote-attestation>
- BS project (CS497): “Translating pcap expressions into BPF” Spring 2023
Hyunsuk Bang, Illinois Tech
Code: https://gitlab.com/niksu/caper/-/merge_requests/31
★ Hyunsuk’s project was merged into [Caper](#) and deployed on the third-party [BPF Exam](#) service.
- BS project (CS497): “TCP session tracking in BPF” Fall 2022
Mohammad Firas Sada, Illinois Tech
Mohammad gave a presentation and demo of this project at HotSoS 2023 (the Symposium on the Science of Security).
- BS project (CS497): “Analyzing network experiments on FABRIC” Fall 2022
Sean Cummings, Illinois Tech
- MS project (CS597): “In-Network Spam Filtering with P4” Spring and Summer 2022
Cyprien Gueyraud, Illinois Tech (on exchange from EISTI-CyTech)
Cyprien presented posters on his work at Illinois Tech’s Research Showcase and at the College of Computing poster competition, both in Spring 2022.
★ This project resulted in a paper at AnNet’23, and its code was [open sourced](#).
★ Cyprien won the award for best MS poster at the College of Computing poster competition.
- MS project (CS597): “Application hand-over in Edge Computing using SDN” Spring and Summer 2022
Luis Casarrubios Elez, Illinois Tech (on exchange from Universidad Politécnica de Madrid)
Co-supervised with Dr Luis Bellido Triana (UPM).
Luis presented a poster on his work at Illinois Tech’s Research Showcase and at the College of Computing Poster competition, both in Spring 2022.
- Individual project: “Disaggregations of switch.p4” Fall 2020
Rakesh Nagda, University of Pennsylvania.
- Summer research internship: “Using C# for High Performance Network Programming” Summer 2016
Jonny Shipton, Selwyn College (Cambridge University).
Code: <https://github.com/NaaS/emu-live/tree/master/Nat>
Jonny built on this for his bachelor dissertation project—a transpiler from P4 to C#—which was supervised by Dr David Greaves: <https://github.com/TMVector/P4ToCSharp>.
- Bachelor dissertation project: “Secure tamper-evident logging” 2015–2016
Daniel Spencer, Emmanuel College (Cambridge University).
Co-supervised with Dr Richard Mortier (Cambridge University).
- Bachelor dissertation project: “Encrypted Keyword Search Using Path ORAM on MirageOS” 2015–2016
Rupert Horlick, Homerton College (Cambridge University).
Co-supervised with Dr Richard Mortier (Cambridge University).
Code: <https://github.com/ruhatch/mirage-oram>
Dissertation: <https://github.com/ruhatch/dissertation>
Rupert carried out a research internship at Microsoft Research Cambridge after his bachelors, before starting postgraduate studies.
- Bachelor dissertation project: “Investigating Resolution Provers for Propositional Logic” 2015–2016
Thomas Le Feuvre, Emmanuel College (Cambridge University).
Code: <https://github.com/thomaslefeuvre/TProver>

Research Mentoring

Sean Cummings (2023, Undergrad, Illinois Tech) developed his CS497 project further to improve workload generation, graphing and result analysis of FABRIC experiments. He was awarded a travel bursary by the FABRIC project to attend the KNIT6 workshop.

H. E. Greenblatt (2023, Undergrad, Illinois Tech) participated in the RES-MATCH program in which she improved the Python prototype that was written by Rigden in Spring 2022 for his RES-MATCH project, and started modelling the system using the SST simulator. Co-advised with Dr Claude Bajada and Dr Ken Scerri of the University of Malta.

Irina Klein (2022, Masters, Illinois Tech) prototyped a tutorial for the C language that was delivered using Jupyter and collaborated with Henry Zhu on leveraging Jupyter’s features to teach the language. Irina presented this tutorial to 49 CS students at an event organized with ACM-W at Illinois Tech in September 2022.

Simrat Kaur (2022, Masters, Illinois Tech, ECE) prototyped an FPGA design that carried out reconfigurable packet filtering.

Shivam Patel (2022, Masters, Illinois Tech) collaborated with Rigden Atsatsang to port his photon propagation model to P4, and implemented approximations of real-valued functions.

The system is open-sourced at <https://github.com/ShivamPatelShivamPatel/Photon>. Shivam gave talks about this work at a P4 developers’ meeting and at Illinois Tech’s CS Department Research Showcase, and presented posters about this work twice at the Illinois Tech Research Showcase. He carried out a summer internship at SRI International where he applied his P4 skills to develop an in-network security tool prototype for the FABRIC project.

★ Shivam contributed to a paper on this work that was accepted at EuroP4 2022 and presented it in person in Rome. He also filed a Technical Report at Illinois Tech’s library. The TR expanded on the technical content of the EuroP4 paper.

Mohammad Firas Sada (2022-2023, Masters, Illinois Tech) built a new toolchain that converts English expressions into network configuration instructions.

Mohammad presented a poster on this work at Illinois Tech’s Research Showcase and at the College of Computing poster competition, both in Spring 2022, and at the Symposium on the Science of Security (HotSoS) in April 2023.

He was awarded a travel bursary by the FABRIC project to attend the KNIT6 workshop.

Rigden Atsatsang (2022, Undergrad, Illinois Tech) developed and evaluated a model of photon propagation as a [RES-MATCH](#) project in collaboration with Shivam Patel, Nadia Netolicky, and Kenneth Tichauer (the latter two from Illinois Tech’s Department of Biomedical Engineering). Rigden presented a poster on this work at Illinois Tech’s Research Showcase and at the College of Computing poster competition, both in Spring 2022. He contributed to a paper on this work that was accepted at EuroP4 2022.

Mohamad Dib Fares (2022, Undergrad, Illinois Tech) developed a conversion between Flightplan’s configuration format and SVG (in both directions) to prototype a network configuration approach that can be provided as a visual sketch. Mohamad presented a poster on his work at Illinois Tech’s College of Computing poster competition in Spring 2022.

Neil Dhote (2021-2022, Masters, Illinois Tech) helped prototype a P4-based network slicing approach as part of the [GAPS CLOSURE](#) project. Neil presented a poster on his work at SPACE in December 2021, at Illinois Tech’s Research Showcase and at the College of Computing poster competition, the latter two in Spring 2022.

Xue Zhang (2022, Masters, Illinois Tech) implemented a prototype of a P4-based network slicing approach as part of the [GAPS CLOSURE](#) project in collaboration with Neil Dhote, and contributed to the presentation of this work at Illinois Tech's Research Showcase and at the College of Computing poster competition, both in Spring 2022.

Shubhendra Pal Singhal (2021, Masters, UPenn) improved the [GAPS CLOSURE](#) system and presented our position paper on IPC evolution at DAI-SNAC'21.

Aishwarya Wesanekar (2020–2021, Masters, UPenn) extended the topology-generation script in Flightplan to handle other types of topologies, and presented a poster at N2Women'21 on this project.

Saket (2020–2021, Masters, UPenn) extended the RPC of the [GAPS CLOSURE](#) system prototype to tolerate bounded disruption such as delays, reordering, and peer restarts.

Andrew Zhao (2020–2021, Undergrad, UPenn) extended the RPC of the [GAPS CLOSURE](#) system prototype to optimize the calling of pure cross-domain functions through memoization.

Henry Zhu (2017–2021, Undergrad then Masters, UPenn) worked on trace navigation and replay for Flowdar and on various aspects of the Pitchfork project: software compartmentalization examples, compartment-aware debugging, and de/marshalling for C.

★ Henry won an Outstanding Research award in 2020 from Penn's Computer and Information Science department for his achievements, which included writing a paper, releasing code, guiding other Research Assistants and contributing to other papers.

★ Henry joined the PhD program at UIUC in Fall 2022.

Stephen Carrasquillo (2020, Masters, UPenn) worked on demos and use-cases for software compartmentalization as part of the Pitchfork project. He presented a poster at ACSAC'20 about his work.

Junyong Zhao (2020-2021, Undergrad, UPenn) worked on the following aspects of the Pitchfork project: automatic marshalling-related memory-leak elimination for compartmentalized software; improving usability of compartment-aware debugging. He presented a poster at ACSAC'20 on his work.

★ Junyong joined the PhD program at University of Arizona in Fall 2022.

Heena Nagda (2020-2021, Masters, from Georgia Tech) worked on the online demo for Flightplan, and on the off-shoot project FDP (Flightplan Demo Platform), both of which were open-sourced. She presented posters at N2Women'20 and CoNEXT'20, and demos at SIGCSE'21 and ICDCS'21 on her projects.

★ Heena's poster at N2Women'20 won the runner-up best poster award.

★ Heena joined UPenn's PhD program in Spring 2022.

Rakesh Nagda (2020, Masters, UPenn) helped with Flightplan's code release, fixing various issues, documenting the setup and checking its reproducibility. He contributed to posters presented at N2Women'20 and CoNEXT'20, and worked on an individual project to port [switch.p4](#) from P4₁₄ to P4₁₆: https://github.com/rakeshnagda/switch_in_p4_16.

Ritvik Sadana (2020, Masters, UPenn) worked on virtualized toolchain setups and reproducible experimentation related to the CLOSURE system.

Garvit Khandelwal (2020, Masters, UPenn) worked on virtualized toolchain setups and reproducible experimentation related to the CLOSURE system.

Zhilei Zheng (2019, Undergrad, UPenn) worked on use-cases for software compartmentalization as part of the Pitchfork project.

Shivani Burad (2019, Masters, UPenn) worked on virtual network experimentation for Flightplan.

Nishanth Shyamkumar (2019, Masters, UPenn) worked on workload profiling for Flightplan.

Digvijaysinh Chauhan (2019, Masters, UPenn) worked on use-cases for de/marshalling in software compartmentalization as part of the Pitchfork project.

Ruijie Mao (2019, Undergrad, UPenn) worked on use-cases for software compartmentalization as part of the Pitchfork project.

Zhaoyang Han (2018-2019, Masters, UPenn) worked on an FPGA implementation of an in-network Memcached cache.

Ke Zhong (2018, Undergrad, visiting from Shanghai Jiao Tong University) worked on thread-oriented software splitting.

★ In 2019 Ke joined UPenn's PhD program, advised by Prof. Sebastian Angel.

Shilpi Bose (2018, Masters, UPenn) helped develop DoSarray.

Nishanth Prabhu (2018, Masters, UPenn) worked on virtual network experimentation using ns3 for datacenter-like workloads as part of our work on Wharf.

Anirudh Chelluri (2018, Masters, UPenn) worked on virtual network experimentation for network boosting research as part of our work on Wharf.

Zihao Jin (2017, Undergrad, visiting from Tsinghua University) worked on low-overhead trace generation and processing as part of Flowdar.

Achala Rao (2017, Masters, UPenn) worked on trace analysis and visualization as part of Flowdar.