[Updated: June 2024]

Eric R. Keller

https://eric-keller.github.io/

RESEARCH INTEREST

I design and build secure and reliable networked systems using a cross-layer approach that draws from networking, operating systems, distributed systems, and computer architecture. My research has been enabling and capitalizing on a more dynamic and programmable computing and network infrastructure, via such technologies as virtualization, software-defined networking, and cloud based services.

EDUCATION

Ph. D., Princeton University, Electrical Engineering, 2011

Award:	Intel PhD Fellowship (2010-2011)
Advisor:	Jennifer Rexford
Dissertation:	Refactoring Router Software to Minimize Disruption

M.S., University of Massachusetts-Amherst, Electrical and Computer Engineering, 2005

Advisor:	Russell Tessier
Thesis:	Programming Model for Network Processing on an FPGA

B.S., Virginia Tech, Computer Engineering, 1999

Work History

Stateless, Inc., Founder and CTO (2016-present).

Formed out of research at Univ. of Colorado. Raised $20M+ from investors, and received NSF SBIR Phase I ($225k), Phase II ($750k), and supplement ($690k) grants.

University of Colorado, Associate Professor (2012-2017 Assistant, 2017-present Associate)
Associate Chair of the Professional and Online Masters Programs (2024-pres)

Graduated 9 PhD students and currently advising 5 PhD students. While at CU, published at top tier networking, systems, and security conferences, such as NSDI, USENIX ATC, NDSS, Eurosys (best student paper), ACSAC, ANCS, ICDCS, and SoCC.

University of Pennsylvania, Post-doctoral researcher (2011-2012)

With Jonathan Smith.

Princeton University, Graduate researcher (2006-2011)

With Jen Rexford

Xilinx, Inc, Software Engineer (1999-2006)

Worked on advanced product development, where my team would propose new products, create prototypes, and build initial use cases. Highlights: Part of team pioneering run time reconfiguration tools – work led to productization of partial configuration by Xilinx.
Also pioneered efforts to create a Domain Specific Tool for Networking on FPGAs – work led to productization of SDNet

[Updated: June 2024]

Advising

Current (as Advisor):
Maziyar Nazari – PhD CS, expected 2024
Erika Hunhoff – PhD CS, expected 2025
Bashayer Alharbi – PhD CS, expected 2026
Shirin Ebadi – PhD ECEE, expected 2028
Dustin Hooks – PhD ECEE, expected 2028
Giulio Sidoretti – PhD (visiting from University of Rome Tor Vergata)
Tarun Annapareddy – MS CS
Rohan Eswara – MS CS
Arnib Farooqui – MS CS
Naveena Ganesan – MS CS
Pawan Muthaiah Subramanian – MS CS
Abijith Ramachandran – MS CS
Strydr Silverberg – BS (community college)
Aryan Choudhary – BS (community college)
Justin Costa - BS
Kira Cenderelli - BS
Grayson Hubbell - BS

Past (as Thesis Advisor):
PhD
Karl Olson – PhD (2024) CS, First Job: Instructor, United States Military Academy
Sepideh Goodarzy (co-advised with Rick Han) – PhD (2022) CS, First Job: Google
Greg Cusack – PhD (2022) ECEE, First Job: Solana.
Marcelo Abranches – PhD (2022) ECEE, First Job: CGU (Brazil)
Mohammad Hashemi – PhD (2021) CS, First Job: Data Scientist at Illumina
Azzam Alsaudis – PhD (2020) CS, First Job: Professor at King Saud Univ.
Oliver Michel – PhD (2019), CS, First Job: Post-doc at Univ. of Vienna
Aimee Coughlin – PhD (2018), ECEE. First Job: Security Engineer at Facebook
Murad Kablan, PhD (2017), CS, First Job: CEO and co-founder Stateless

MS
Edgar Gonzalez Quevedo, MS (2017) (visiting from UPC), First Job: Security Evaluator at Applus
Anurag Dubey, MS (2017) ECEE, First Job: Software engineer at Xilinx
Ali Ismail – M.S., (5/2015), ECEE, First Job: Embedded System Engineer at Syncroness
Ryan Hand – M.S.(4/2014), CS, First Job: Faculty at United States Military Academy
Matthew Monaco –M.S.(4/2014), CS, First Job: Google

BS
Albert Vilardell Barnosell (with Tamara Lehman) – B.S., UPC (Europe-Colorado Mobility Program) Jan-July 2022

Non-thesis
(active members of my research group, through independent studies, discovery learning apprenticeships, or other)
MS (non-thesis): , , Kelly Kaoudis (2015), Bharat Nallan (2017), Prerit Oberai (2019), Swaminathan Sriram (2022), Evan Braun (2022), George Nsude (2022). Varsha Natarajan (2022), Gaurav Roy (2022), Chethan Kavaraganahalli Prasanna (2022), Akshay Abhyankar (2022), Sreeram Ganesan (2022-23), Sachin Sharma (2022-23), Rajeev Menon (2022), Akshay Abhayankar (2023), Chethan Prasanna (2023), Varsha Natarajan (2023), Gaurav Roy (2023), Venkatesh VLNP (2023), Dwight Browne (2023)

BS (non-thesis): Alex Tsankov (AY 2014-15), Sean Lambert (AY 2015-16), Ji-hoon Kim (AY 2015-16), Yiming Wang (AY 2016-17), Jeffery Lim (AY 2016-17), Pranav Subramanian (AY 2021-22)
CS Senior Project Team in 2013-14 AY: Brian McWilliams, Scott Pledger, Alexandro Simion, Matthew Peck.
ITP Capstone Team in 2013-14 AY: Srinivas Lakshminarayan, Shankar Shivram, Siddharth Bali, Rohith Vardha

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On Committee:
PhD Acting Chair: Rahil Gandotra, ITP 2020. Dewang Gadia, ITP, 2020.
PhD Committee: Bryan Dixson (12/2012), Andy Sayler (4/2016), Ehab Ababneh (2017), Ning Gao (2018), Blake Caldwell (2018), Eric Goodman (2019), Kashyap Thimmaraju (2019 – TU Berlin), Sergey Frolov (2020), Ian Martiny (2022), Jason Schnitzer (2022), Jack Wampler (2023), Zaid Al-Ali (2023), Sandesh Sathyanarayana (2023), Ali Tariq (2024).
MS Committee: Matthew Phillips (7/2015), Andy Sayler (12/2013), Amit Gupta (4/2013), Dylan Fox (2021)
Prelim: as Chair: Aimee Coughlin (Apr 2014), Murad Kablan (Dec 2014), Oliver Michel (Dec 2016), Azzam Alsudais (April 2018), Mohammad Hashemi (April 2018), Greg Cusack (2020), Marcelo Abranches (2020), Karl Olson (2021), Maziyar Nazari (2021), Dwight Browne (2021), committee: Andy Sayler (Apr 2014), Ehab Ababneh (Oct 2014), Ning Gao (Nov, 2014), Blake Caldwell (May 2015), Zaid Al-Ali (April 2018), Jack Wampler (2021), Ali Tariq (2021).
Senior Thesis Committee: Peter Klipfel (CS) (2014), Alexey Yermakov (CS) (2023)

Funding

Title: CNS Core: Small: Transparent Network Acceleration
Source of Support: National Science Foundation
Award: $604,728.00 (PI, w/ Tamara Lehman)
Period Covered: 5/2023 - 4/2026

Title: NSF Convergence Accelerator Track G: 5G Hidden Operations through Securing Traffic (GHOST) Phase 2
Source of Support: National Science Foundation
Award: $4,983,234.00 (total), (co-PI, w/ Keith Gremban, Alexandra Siegel, Tamara Lehman, Salvador D'Itri)
Period Covered: 9/2023 – 8/2025

Title: Title: NSF Convergence: 5G Hidden Operations through Securing Traffic (GHOST)
Source of Support: National Science Foundation
Award: $749,186 (total) (co-PI, w/ Keith Gremban, Alexandra Siegel, Tamara Lehman, Salvador D'Itri)
Period Covered: 8/2022 – 7/2024

Title: "CAREER: Stateless Network Functions: Building a Better Network Through Disaggregation"
Source of Support: National Science Foundation
Award Amount: $627,999 (sole PI)
Period Covered: 7/2017 – 6/2023

Title: "SDI-CSCS: Collaborative Research: S2OS: Enabling Infrastructure-Wide Programmable Security with SDI"
Source of Support: National Science Foundation and VMWare
Award Amount: $599,489 (co-PI) (total award: $3M)
Period Covered: 9/2017 – 8/2021

Title: "I-Corps: Elastic Network Infrastructure"
Source of Support: National Science Foundation
Award Amount: $50,000 (sole PI)
Period Covered: 12/1/16 – 5/31/18

Title: "TWC: Medium: Collaborative: Active Security"
Source of Support: National Science Foundation
Award Amount: $ 746,537. (PI) (total award: $1.2M)
Period Covered: 09/01/14-08/31/18

Title: "XPS: SDA: Elasticizing the Linux Operating System for the Cloud"
Source of Support: National Science Foundation (NSF)
Award Amount: $749,992. (co-PI) (total award 749,992 – PIs all at Colorado)

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Period Covered: 09/01/13-08/31/17 (extended to 8/2019)

Title: “NeTS: Small: Liquid Networking”
Source of Support: National Science Foundation (NSF)
Award Amount: $500,000. (PI)
Period Covered: 10/01/13-9/30/16 (extended to 9/2017)

Title: gift from Xilinx
Source of Support: Xilinx
Award Amount: $15,000. (PI)
Granted: 09/2012

TEACHING

- University of Colorado: CSCI 5253 / 4253 / ECEN 7000 – Datacenter Scale Computing (Fall 2023)
- University of Colorado: ECEN 3593 / CSCI 4593 – Computer Organization (Spring 2022, Spring 2022, Spring 2023, Spring 2024)
- University of Colorado: ECEN 5033 – SpTp DevOps in the Cloud (Fall 2018, Fall 2021)
- University of Colorado: ECEN 3350 – Programming Digital Systems (Spring 2016, Spring 2017, Spring 2018, Spring 2019)
- University of Colorado: ECEN 1310 – Intro to Programming for Engineers (Spring 2015)
- University of Colorado: ECEN / CSCI SpTp - Advanced Computer and Networked System Security (Fall 2013, Fall 2014, Fall 2017).
- University of Colorado: ECEN / CSCI SpTp - Advanced Network Systems (Spring 2013, Spring 2014, Fall 2015, Fall 2016, Fall 2022).
- University of Colorado: ECEN 5013: Software-defined networking (Fall 2012)
- Teaching assistant for Princeton COS 109, “Computers in our world”
- Guest lecturer in Princeton COS 561 “Advanced computer networks”, University of Colorado ECEN5743 Software Engineering of Distributed Systems, University of Colorado CSCI 5023: Network Systems
- On-Leave from Univ. of Colorado AY 2019-2020, AY 2020-21

PUBLICATIONS

2024 **LinuxFP: Transparently Accelerating Linux Networking**
M. Abranches, E. Hunhoff, R. Eswara, O. Michel, and E. Keller.
In IEEE International Conference on Distributed Computing Systems (ICDCS), 2024 (121/552=21.9%)

2023 **Doomed to Repeat with IPv6? Characterization of NAT-centric Security in SOHO Routers**
K Olson, J Wampler, E Keller
ACM Computing Surveys, Volume 55, Issue 14s, July 2023

An Operating System for Disaggregation with Coherence
Erika Hunhoff, Gerd Zellweger, Eric Keller
(poster)USENIX Symposium on Operating Systems Design and Implementation (OSDI), June 2023

Enabling Security Research Through Efficient Partial Deployment Topology Configuration and Validation
Bashayer Alharbi, Karl Olson, Eric Keller
IEEE International Workshop on Computer and Networking Experimental Research using Testbeds (CNERT), May 2023

Capturing and Predicting User Frustration to Support a Smart Operating System
Sepideh Goodarzy, Eric Keller, Maziyar Nazari, Eric Rozner, Richard Han, Mark Dras, Young Choon Lee, Deborah Richards

Companion Proceedings of the 28th ACM International Conference on Intelligent User Interfaces (IUI), March 2023. (est. 30%)

2022 **Getting back what was lost in the era of high-speed software packet processing**
Marcelo Abranches, Oliver Michel, Eric Keller
ACM Workshop on Hot Topics in Networks (HotNets), Nov. 2022. (32/104=30%)

Detecting Unseen Anomalies in Network Systems by Leveraging Neural Networks
Mohammad J. Hashemi, Eric Keller, Saeid Tizpaz-Niari
IEEE Transactions on Network and Service Management (TNSM), Vol. 19, No. 3, Sept. 2022

Escra: Event-driven, Sub-second Container Resource Allocation
Greg Cusack, Maziyar Nazari, Sepideh Goodarzy, Erika Hunhoff, Prerit Oberai, Eric Keller, Eric Rozner, and Rick Han
IEEE International Conference on Distributed Computing Systems (ICDCS), July 2022. (114/573=19%)

2021 **Optimizing and Extending Serverless Platforms: A Survey**
Maziyar Nazari, Sepideh Goodarzy, Shivakant Mishra, Eric Rozner, Eric Keller
International Conference on Software Defined Systems (SDS). December 6-9, 2021 (est. 35%)

Efficient Network Monitoring Applications in the Kernel with eBPF and XDP
Marcelo Abranches, Oliver Michel, Eric Keller, Stefan Schmid
IEEE Conference on Network Functions Virtualization and Software-Defined Networking (IEEE NFV-SDN 2021), Nov. 2021. (Best Paper)

SmartOS: towards automated learning and user-adaptive resource allocation in operating systems Aug 2021
ACM SIGOPS Asia-Pacific Workshop on Systems (APSys), Aug 2021.
Sepideh Goodarzy, Maziyar Nazari, Richard Han, Eric Keller, Eric Rozner (20/43 = 46%)

(Poster) Federating Trust: Network Orchestration for Cross-boundary Zero Trust.
Karl Olson, Eric Keller.
In ACM SIGCOMM (Poster), Aug 2021.

Infinity: A Scalable Infrastructure for In-Network Applications
Marcelo Abranches, Karl Olson, Eric Keller
IFIP/IEEE FlexNGIA workshop (co-located with IFIP/IEEE International Symposium on Integrated Network Management (IM)), May 2021

StepNet: A Compositional Framework with Reduced Querying for Homing Complex Network Services
Azzam Alsudais A, Shankar P Narayanan, Bharath Balasubramanian, Zhe Huang , Eric Keller
IFIP/IEEE International Symposium on Integrated Network Management (IM), May 2021 (46/236 =19%)

Software Packet-Level Network Analytics at Cloud Scale
Oliver Michel, John Sonchack, Greg Cusack, Maziyar Nazari, Eric Keller, Jonathan M Smith
IEEE TRANSACTIONS ON NETWORK AND SERVICE MANAGEMENT 18(1):597-610. Mar 2021

2020 **Resource Management in Cloud Computing Using Machine Learning: A Survey**
Sepideh Goodarzy, Maziyar Nazari, Richard Han, Eric Keller, Eric Rozner
IEEE International Conference On Machine Learning And Applications. Dec., 2020. (est 25%)

General Domain Adaptation Through Proportional Progressive Pseudo Labeling
Mohammad J. Hashemi, Eric Keller
IEEE International Conference on Big Data (BigData), Dec. 2020 (83reg,88short/535=31%)

FluidMem: Full Flexible and Fast Memory Disaggregation for the Cloud
Blake Caldwell, Youngbin Im, Sepideh Goodarzy, Sangtae Ha, Richard Han, Eric Keller, Eric Rozner
IEEE International Conference on Distributed Computing Systems (ICDCS), Nov. 2020. (104/584=18%)

A Userspace Transport Stack Doesn't Have to Mean Losing Linux Processing
Marcelo Abranches, Eric Keller
IEEE Conference on Network Function Virtualization and Software Defined Networks (NFV-SDN 2020), Nov. 2020. (est 35%)

Enhancing Robustness Against Adversarial Examples in Network Intrusion Detection Systems
Mohammad J. Hashemi, Eric Keller
IEEE Conference on Network Function Virtualization and Software Defined Networks (NFV-SDN 2020), Nov. 2020. (est 35%)

2019 **Towards Evaluation of NIDSs in Adversarial Setting**
Mohammad Hashemi, Greg Cusack, Eric Keller
3rd ACM CoNEXT Workshop on Big DAta, Machine Learning and Artificial Intelligence for Data Communication Networks (Big-DAMA), Dec, 2019.

(poster) Stateless TCP
Marcelo Abranches, Eric Keller
The 15th International Conference on emerging Networking EXperiments and Technologies (CoNEXT), Dec, 2019.

(poster) Efficient Microservices with Elastic Containers
Greg Cusack, Maziyar Nazari, Sepideh Goodarzy, Prerit Oberai, Eric Rozner, Eric Keller
The 15th International Conference on emerging Networking EXperiments and Technologies (CoNEXT), Dec, 2019.

FOCUS: Scalable Search Over Highly Dynamic Geo-distributed State
Azzam Alsudais, Mohammad Hashemi, Zhe Huang, Bharath Balasubramanian, Shankaranarayanan Puzhavakath Narayanan, Eric Keller, and Kaustubh Joshi
IEEE International Conference on Distributed Computing Systems (ICDCS), July, 2019. (est 20%)

Shimmy: Shared Memory Channels for High Performance Inter-Container Communication
Marcelo Abranches, Sepideh Goodarzy, Maziyar Nazari, Shivakant Mishra, Eric Keller
USENIX Workshop on Hot Topics in Edge Computing (HotEdge), July, 2019. (22/39 = 56%)

Network Defragmentation in Virtualized Data Centers
Oliver Michel, Eric Keller, Fernando Ramos
Sixth IEEE International Conference on Software Defined Systems (SDS), June, 2019. (est 35%)

PIQ: Persistent Interactive Queries for Network Analytics
Oliver Michel, John Sonchack, Eric Keller, Jonathan M. Smith
ACM Workshop on Security in Software Defined Networks & Network Function Virtualization (SDN-NFV Sec), March, 2019.

Breaking the Trust Dependence on Third Party Processes for Reconfigurable Secure Hardware
Aimee Coughlin, Greg Cusack, Jack Wampler, Eric Keller, Eric Wustrow
ACM/SIGDA International Symposium on Field-Programmable Gate Arrays (FPGA) (full paper), Feb, 2019. (24 full + 6 short / 139 submissions= 17% full, 21% overall)

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2018 **Stochastic Substitute Training: A General Approach to Craft Adversarial Examples against Defenses which Obfuscate Gradients**
Mohammad Hashemi, Greg Cusack, Eric Keller
ACM Workshop on Artificial Intelligence and Security (AISec), Oct., 2018. **(9/32 = 28%)**

Scaling Hardware Accelerated Network Monitoring to Concurrent and Dynamic Queries With *Flow
John Sonchack, Oliver Michel, Adam J. Aviv, Eric Keller, Jonathan M. Smith
USENIX Annual Technical Conference (ATC), July, 2018 **(79/378 = 20%)**

Packet-Level Analytics in Software without Compromises
Oliver Michel, John Sonchack, Eric Keller, Jonathan M. Smith
USENIX Workshop on Hot Topics in Cloud Computing (HotCloud), July 2018 **(22/63 = 35%)**

NodeFinder: Scalable Search over Highly Dynamic Geo-distributed State
Azzam Alsudais, Zhe Huang, Bharath Balasubramanian, Shankaranarayanan Puzhavakath Narayanan, Eric Keller, Kaustubh Joshi
USENIX Workshop on Hot Topics in Cloud Computing (HotCloud), July 2018 **(22/63 = 35%)**

Making Serverless Computing More Serverless
Zaid Al-Ali, Sepideh Goodarzy, Ethan Hunter, Sangtae Ha, Richard Han, Eric Keller, Eric Rozner
International Workshop on Serverless Computing (WoSC), July, 2018

Turboflow: information rich flow record generation on commodity switches
John Sonchack, Adam J. Aviv, Eric Keller, and Jonathan M. Smith
Thirteenth EuroSys Conference (EuroSys '18), April, 2018. **(43/262 = 16%)**
(awarded best student paper)

(poster) Scalable Hardware-Accelerated Network Analytics
Oliver Michel, John Sonchack, Adam J. Aviv, Eric Keller
USENIX Symposium on Networked Systems Design and Implementation (NSDI). April, 2018

Machine Learning-Based Detection of Ransomware Using SDN
Greg Cusack, Oliver Michel, Eric Keller.
ACM International Workshop on Security in Software Defined Networks & Network Function Virtualization (SDN-NFV Sec). March, 2018 **(est. 35%)**

(poster) Machine Learning-Based Fingerprinting of Network Traffic Using Programmable Forwarding Engines
Greg Cusack, Oliver Michel, Eric Keller
Network and Distributed System Security Symposium (NDSS). February, 2018.
(won best technical poster)

2017 **Building a Security OS With Software Defined Infrastructure**
Guofei Gu, Hongxin Hu, Eric Keller, Zhiqiang Lin, Donald E. Porter
ACM Asia-Pacific Workshop on Systems (APSys). Sept. 2017

FluidMem: Memory as a Service for the Datacenter
Blake Caldwell, Youngbin Im, Sangtae Ha, Richard Han, and Eric Keller
Tech Report, arXiv:1707.07780 [cs.OS]. July 2017

Augmenting cloud architectures to support decentralized applications
Aimee Coughlin, Kelly Kaoudis, Eric Keller
IFIP/IEEE Symp. on Integrated Network and Service Management (IM), May, 2017 **(44/154 = 29%)**

SDN in Wide-Area Networks: A Survey
Oliver Michel, Eric Keller
International Conference on Software Defined Systems(SDS), May, 2017 **(est. 35%)**

Hey Network, Can You Understand Me?
Azzam Alsudais, Eric Keller
IEEE Workshop on Software-Driven Flexible and Agile Networking (SWFAN), May, 2017. **(est. 35%)**

Stateless Network Functions: Breaking the Tight Coupling of State and Processing
Murad Kablan, Azzam Alsudais, and Eric Keller, Franck Le
USENIX Symp. on Networked Systems Design and Implementation (NSDI), Mar. 2017 **(46/255 = 18%)**

(poster) TurboFlow: Accelerating Flow Collection on Commodity Switches
John Sonchack, Adam J. Aviv, Eric Keller, Jonathan M. Smith
USENIX Symposium on Networked Systems Design and Implementation (NSDI), March 2017

(poster) Colocation in Stateless Network Functions
Anurag Dubey, Murad Kablan, Eric Keller
USENIX Symposium on Networked Systems Design and Implementation (NSDI), March 2017

CommunityGuard: A Crowdsourced Home Cyber-Security System
Chase E. Steward, Anne Maria Vasu, Eric Keller
ACM International Workshop on Security in Software Defined Networks and Network Function Virtualization (SDN-NFV Security), March 2017 **(est. 35%)**

Trusted Click: Overcoming Security issues of NFV in the Cloud
Aimee Coughlin, Eric Keller, Eric Wustrow
ACM International Workshop on Security in Software Defined Networks and Network Function Virtualization (SDN-NFV Security), March 2017 **(est. 35%)**

2016 **Timing-based reconnaissance and defense in software-defined networks**
John Sonchack, Anurag Dubey, Adam J Aviv, Jonathan M Smith, Eric Keller
Proceedings of the 32nd Annual Conference on Computer Security Applications (ACSAC), Dec 2016. **(48 / 210 22%)**

Apps with hardware: enabling run-time architectural customization in smart phones
Aimee Coughlin, Ali Ismail, Eric Keller
USENIX Annual Technical Conference (USENIX ATC), June 2016. **(47 / 266 17%)**

QoX: quality of service and consumption in the cloud
Murad Kablan, Eric Keller, Hani Jamjoom
USENIX Workshop on Hot Topics in Cloud Computing (HotCloud), June 2016. **(21 / 68 30%)**

Policy Routing using Process-Level Identifiers
Oliver Michel, Eric Keller
In Proc. IEEE International Symposium on Software Defined Systems (SDS). April, 2016. **(est. 35%)**

(Poster) Defragmenting the Cloud
Oliver Michel, Eric Keller
USENIX Network System Design and Implementation (NSDI), March 2016

(Poster) CoCaching in Named Data Networking
Azzam Alsudais, Eric Keller
USENIX Network System Design and Implementation (NSDI), March 2016

(Poster) Mitigating Network Resource Abuses and DDoS attacks with Client Puzzle based Software-Defined Networks
Zhang Liu, Eric Keller, Sangtae Ha
USENIX Network System Design and Implementation (NSDI), March 2016

Timing SDN Control Planes to Infer Network Configurations
John Sonchack, Adam J. Aviv, Eric Keller
In Proc. ACM International Workshop on Security in Software Defined Networks & Network Function Virtualization (SDN-NFV Security). March, 2016. **(est. 35%)**

Taking the Surprise out of Changes to a Bro Setup
Matthew Monaco, Alexander Tsankov, Eric Keller
In Proc. ACM International Workshop on Security in Software Defined Networks & Network Function Virtualization (SDN-NFV Security). March, 2016.
(awarded best paper)

Enabling Practical Software-defined Networking Security Applications with OFX
John Sonchack, Adam J. Aviv, Eric Keller, Jonathan M. Smith
In Proc. Network and Distributed System Security Symposium (NDSS). February, 2016. **(60 / 390 = 15%)**

2015 **(Poster) OFX: Enabling OpenFlow Extensions for** Switch-Level Security Applications.
John Sonchack, Adam J. Aviv, Eric Keller, Jonathan M. Smith
In Proc. ACM SIGSAC Conference on Computer and Communications Security (CCS), 2015.

Stateless Network Functions
Murad Kablan, Blake Caldwell, Hani Jamjoon, Eric Keller
In Proc. Workshop on Hot Topics in Middleboxes and Network Function Virtualization (HotMiddlebox), Aug. 2015 (12/32, 37%)

(poster) Stateless Network Functions
Murad Kablan, Blake Caldwell, Hani Jamjoon, Eric Keller
at USENIX Symp. on Networked Systems Design and Implementation (NSDI), May., 2015.

2014 **(poster) Mobile Applications with Reconfigurable Hardware**
Aimee Coughlin, Ali Ismail, Eric Keller.
USENIX Symposium on Operating System Design and Implementation (OSDI), October 2014.

Transparent, Live Migration of a Software-Defined Network
Soudeh Ghorbani, Cole Schlesinger, Matthew Monaco, Eric Keller, Matthew Caesar, Jennifer Rexford, David Walker
ACM Symposium on Cloud Computing (SoCC). Nov., 2014 (29/119, 24%)

WASP: A Software-Defined Communication Layer for Hybrid Wireless Networks
Murad Kaplan, Chenyu Zheng, Matthew Monaco, Eric Keller, Douglas Sicker
in ACM/IEEE Symposium on Architectures for Networking and Communications Systems (ANCS). Oct., 2014 **(est. 35%)**

ClosedFlow: OpenFlow-like Control over Proprietary Devices
Ryan Hand, Eric Keller
in ACM Workshop on Hot topics in SDN (HotSDN), as Full paper. Aug., 2014 **(16 / 116 = 14%,** additional 17 accepted as short)

(poster) Extending the Software-defined Network Boundary
Oliver Michel, Aimee Coughlin, Eric Keller
at ACM SIGCOMM. Aug., 2014

(poster) Making the Live Network the Honeypot
Aimee Coughlin, Oliver Michel, Eric Keller, and Adam J. Aviv.
at USENIX Symp. on Networked Systems Design and Implementation (NSDI), Apr., 2014.

2013 **Applying Operating System Principles to SDN Controller Design**
Matthew Monaco , Oliver Michel , Eric Keller
in ACM Workshop on Hot Topics in Networks (HotNets), Nov., 2013. **(26/110 = 24%)**

Active Security
Ryan Hand , Michael Ton, Eric Keller
in ACM Workshop on Hot Topics in Networks (HotNets), Nov., 2013. **(26/110 = 24%)**

(poster/demo) Applying Operating System Principles to SDN Controller Design
Oliver Michel, Matthew Monaco, Eric Keller.
The 18th GENI Engineering Conference, Oct., 2013.

Software-Defined Energy Communication Networks: From Substation Automation to Future Smart Grids
Adam Cahn, Juan Hoyos, Matthew Hulse, Eric Keller
in IEEE Conf. on Smart Grid Communications (SmartGridComm), Oct., 2013. **(135/334 = 40%)**

Jobber: Automating Inter-Tenant Trust in The Cloud
Andy Sayler, Eric Keller , Dirk Grunwald
in Workshop on Hot Topics in Cloud Computing (HotCloud), June, 2013. **(21/74 = 28%)**

Towards Elastic Operating Systems
Amit Gupta, Ehab Ababneh, Richard Han, Eric Keller
in Hot Topics in Operating Systems (HotOS), June, 2013. **(27/92 = 29%)**

(poster) WASP: A Centrally Managed Communication Layer for Smart Phone Networks
Murad Kaplan , Chenyu Zheng, Eric Keller
in USENIX Symposium on Networked Systems Design and Implementation (NSDI), May, 2013.

(poster) yanc: Yet Another Network Controller
Matthew Monaco , Eric Keller
in USENIX Symposium on Networked Systems Design and Implementation (NSDI), May, 2013.

(poster) Jobber: Automating Inter-Tenant Trust in The Cloud
Andy Sayler, Eric Keller
in USENIX Symposium on Networked Systems Design and Implementation (NSDI), May, 2013.

Scalable Network Virtualization in Software-Defined Networks
Dmitry Drutskoy, Eric Keller , Jennifer Rexford
in IEEE Internet Computing, March/April 2013.

2012 **Live migration of an entire network (and its hosts)**
Eric Keller, Soudeh Ghorbani, Matt Caesar, Jennifer Rexford
October 2012 In Proc. HotNets. **(23/120, 19%)**

Virtual switching without a hypervisor for a more secure cloud
Xin Jin, Eric Keller, Jennifer Rexford
April 2012 Proceedings of Hot ICE. **(10/20, 50%)**

Rehoming edge links for better traffic engineering
Eric Keller, Michael Schapira, Jennifer Rexford. ACM SIGCOMM Computer Communication Review
Volume 42 Issue 2, April 2012

[Updated: June 2024]

2011 **Eliminating the Hypervisor Attack Surface for a More Secure Cloud**
Jakub Szefer, Eric Keller, Jennifer Rexford, and Ruby B. Lee
In Proc. ACM Conf. on Computer and Communications Security (CCS). Oct., 2011. **(60/429, 14%)**

2010 **NoHype: Virtualized cloud infrastructure without the virtualization**
Eric Keller, Jakub Szefer, Jennifer Rexford, and Ruby B. Lee
In Proc. International Symposium on Computer Architecture (ISCA). July, 2010. (44/245, 18%)

Seamless BGP Migration with Router Grafting
Eric Keller, Jennifer Rexford, and Jacobus van der Merwe
In Proc. Networked Systems Design and Implementation (NSDI). Apr., 2010. (29/175, 16%)

The 'Platform as a Service' model for networking
Eric Keller and Jennifer Rexford
In Proc. INM/WREN workshop. Apr., 2010.

2009 **Virtually Eliminating Router Bugs**
Eric Keller, Minlan Yu, Matthew Caesar, and Jennifer Rexford
In Proc. Conference on emerging Networking EXperiments and Technologies (CoNEXT). Dec., 2009. (29/170, 17%)

Better by a HAIR: Hardware-Amenable Internet Routing
Firat Kiyak, Brent Mochizuki, Eric Keller, and Matthew Caesar
In Proc. IEEE International Conference on Network Protocols (ICNP). Oct., 2009. (36/198, 18%)

Accountability in hosted virtual networks
Eric Keller, Ruby Lee, and Jennifer Rexford
In Proc. Workshop on Virtualized Infrastructure Systems and Architectures (VISA). Aug., 2009.

2008 **Virtual Routers on the Move: Live Router Migration as a Network-Management Primitive**
Yi Wang, Eric Keller, Brian Biskeborn, Jacobus van der Merwe, Jennifer Rexford
In Proc. ACM SIGCOMM. Aug., 2008. (35/288, 12%)

Virtualizing the Data Plane Through Source Code Merging
Eric Keller and Evan Green
In Proc. PRESTO workshop. Aug., 2008.

2004 **Programming a Hyper-Programmable Architectures for Networked Systems**
Eric Keller and Gordon Brebner
In Proc. International Conference on Field-Programmable Technology (FPT). Dec., 2004. (34/122, 27%)

Hyper-Programmable Architectures for Adaptable Networked Systems
Gordon Brebner, Phil James-Roxby, Eric Keller, Chidamber Kulkarni
In Proc. IEEE Conf. on Application-specific Systems, Architectures and Processors (ASAP). Sept., 2004.

2003 **Software Decelerators**
Eric Keller, Gordon Brebner, Phil James-Roxby
In Proc. 13th International Field Programmable Logic and Applications Conference (FPL). Sept., 2003. (~30%)

A Self-Reconfiguring Platform
Brandon Blodget, Philip James-Roxby, Eric Keller, Scott McMillan, Prasanna Sundararajaran
In Proc. 13th International Field Programmable Logic and Applications Conference (FPL). Sept., 2003. (~30%)

2002 **Gene Matching Using JBits**
Steven A. Guccione and Eric Keller
In Proc. 12th International Field-Programmable Logic and Applications Conference (FPL). Sept., 2002.
(~30%)

An FPGA Wire Data-Base for Run-Time Routers
Eric Keller and Scott McMillan
In Proc. Military and Aerospace Applications of Programmable Logic Devices (MAPLD). Sept., 2002.

2001 **Building Asynchronous Circuits With JBits**
Eric Keller
In Proc. 11th International Field-Programmable Logic and Applications Conference (FPL). Aug., 2001.
(~30%)

Run-Time Reconfigurable 2D Discrete Wavelet Transform Using JBits
Jonathan Ballagh, Peter Athanas, and Eric Keller
In Proc. Reconfigurable Technology: FPGAs for Computing and Applications II. Aug., 2001.

Java Debug Hardware Models using JBits
Jonathan Ballagh, Peter Athanas, and Eric Keller
In Proc. 8th Reconfigurable Architectures Workshop (RAW 2001). May, 2001.

2000 **Dynamic Circuit Specialization of a CORDIC Processor**
Eric Keller
In Proc. Reconfigurable Technology: FPGAs for Computing and Applications II. Nov., 2000.

JRoute: A Run-Time Routing API for FPGA Hardware
Eric Keller
In Proc. 7th Reconfigurable Architectures Workshop (RAW 2000). May, 2000.

SERVICE

Department / College:
- 2023-24 AY: (chair) Professional Masters Program and Online Committee
- 2022-23 AY: Strategic Planning Committee, Executive Committee,
  co-chair Computer Engineering Faculty Search,
  ECEE Teaching Faculty search (Spring 2022),
  Chair Tenure and Promotion ad-hoc Committee (for Eric Wustrow)
- 2021-22 AY: Strategic Planning Committee, Executive Committee.
- 2018-19 AY: CE Search Committee
- 2017-18 AY: Executive Committee (Fall) / GradComm (Spring)
- 2016-17 AY: Executive Committee (ExComm)
- 2015-16 AY: Executive Committee (ExComm)
- 2014-15 AY: Faculty Search Committee
- Spring 2014: Strategic Vision Committee

Organizing Committee:
- 2018: TPC co-Chair CNERT, Treasurer ANCS
- 2015: co-Chair CoNEXT Student Workshop, ANCS Publicity Chair

Technical Program Committee (year of conference):
- 2025: NSDI, INFOCOM
- 2024: ICNP, INFOCOMM, NOMS

2023: ICNP, NOMS
2022: ICNP, NOMS, SOSR, FFSPIN
2021: IM, ICNP, SoCC, ANCS, SPIN
2020: CoNEXT, SOSR, SPIN
2019: ICNP, ANCS, ICDCS, WoSC, SDN-NFV Security
2018: ICNP, CoNEXT, SDN-NFV Security, ANCS
2017: IM, SDN-NFV Security, ANCS, ICDCS, SOSR, ICNP, SWFAN
2016: SDN-NFV Security, NOMS, HotMiddleBox, ICNP, IEEE NFV-SDN, CAN
2015: ICNP, ANCS, EWSDN, PLVNET, IEEE NFV-SDN
2014: CNERT, ANCS, HotSDN, HotCloud, ICCCN (SDN Track), EWSDN, SDN-NGA, SIGCOMM Poster/Demo, Infocomm Poster/Demo, SDN-AA,
2013: ANCS, HotSDN, EWSDN, SIGCOMM Poster/Demo
2010: NetFPGA Developers Workshop
2009: NetFPGA Developers Workshop

Reviewer:
2023: ToN, TNSM, CSI
2022: CCR
2021: ToN
[missed tracking but reviews for several journals 2018-2020]
2017: COMNET, CSUR
2016: CCR, TNSM
2015: ToN, COSE, Sensors, CCR
2014: Internet Computing, TRETS, ToN, TNSM, CCR
2013: Internet Computing, TRETS, TNMS, ToN
2012: COMNET, ToN, CCR
2011: ToN

Panelist:
2023: NSF virtual
2022: NSF virtual (2 panels)
2021: NSF Virtual
2020: NSF virtual
2019: NSF in person
2018: NSF ad-hoc
2017: NSF in person
2016: NSF in person
2015: NSF in person, NSF virtual
2014: NSF in person, NSF ad-hoc

CSI = Computer Standards & Interfaces
SPIN = ACM SIGCOMM Workshop on Secure Programmable Network Infrastructure
Internet Computing = IEEE Internet Computing
ToN = IEEE Transactions on Networking
TRETS = ACM Transactions on Reconfigurable Technology and Systems
TNSM = IEEE Transactions on Network and Service Management
CCR = ACM SIGCOMM Computer Communication Review
COSE = Elseviewer Computers & Security Journal
Sensors = MDPI Sensors Journal
SIGCOMM = The flagship annual conference of the ACM Special Interest Group on Data Communication (SIGCOMM) on the applications, technologies, architectures, and protocols for computer communication
ICNP = IEEE International Conference on Network Protocols
ANCS = ACM/IEEE Symposium on Architectures for Networking and Communications Systems
NFV-SDN = IEEE Conference on Network Functions Virtualization and Software-defined Networking
EWSDN = European Workshop on Software Defined Networks
HotSDN = ACM SIGCOMM Workshop on Hot Topics in Software Defined Networking

HotCloud = USENIX Workshop on Hot Topics in Cloud Computing
ICCCN = IEEE International Conference on Computer Communication and Networks
CNERT = International Workshop on Computer and Networking Experimental Research using Testbeds
SDN-NGA = International Workshop on Software Defined Networks for a New Generation of Applications and Services
SDN-AA = IEEE Workshop on SDN Architecture and Applications 2014 (SDN-AA
PVLNET = workshop on PL and verification for networking
NOMS = IEEE/IFIP Network Operations and Management Symposium
IM = IFIP/IEEE International Symposium on Integrated Network Management
CAN = ACM Cloud Assisted Networking
SOSR = ACM Symposium on Software-defined Networking Research
WoSC = Workshop on Serverless Computing
SDN-NFV Security = ACM International Workshop on Security in Software Defined Networks & Network Function Virtualization

INVITED TALKS

Transparent Network Acceleration
- Google Networking Research Summit, Oct. 2023.

Event-driven, Sub-second Container Resource Allocation
- VMWare (SDI-CSCS PI Meeting), July 2021

Distributed Containers
- VMWare (SDI-CSCS PI Meeting), July 2020

Cloud-scale Packet-level Network Analytics in Software
- VMWare (SDI-CSCS PI Meeting), July 2019

From Academic to Founder Stateless
- Panel at FCCM. April 2018.

Packet-Level Network Analytics without Compromises (presented by Oliver Michel)
- work covers collaboration between Oliver Michel, Eric Keller, John Sonchack, Adam J. Aviv, and Jonathan M. Smith
- 73rd North American Network Operators Group Conference (NANOG 73), July 2018

Building a better network through disaggregation
- IETF NFVRG (2017)
- GENI Regional Workshop (KEYNOTE) (2017)

Stateless Network Functions
- Broadband Internet Technical Advisory Group (BITAG) (2016)

Software-Defined: The Power of Centralized Control
- Xilinx (2013)

CloudBase: Enabling a dynamically deployable wireless infrastructure
- Microsoft Research (2012)

Secure Virtualization for Dependable Cloud Services
- Georgetown University, University of Maryland, Boston University, University of Colorado, Indiana University, Battelle (2012)

NoHype: Virtualized Cloud Infrastructure without the Virtualization
- University of Pennsylvania (2011), IBM, (2010).

Dynamic Infrastructure for Dependable Cloud Services
- University of Maryland, Northeastern University, Bell Labs,University of Delaware (2011), Rutgers (2010)

Refactoring Router Software to Minimize Disruption
(Earlier title: Migrating and Grafting Routers to Accommodate Change)
- Georgetown University (2011), University of North Carolina, Rutgers University, University of Pennsylvania, North Carolina State University, Duke University, Bell Labs (2010)

Accountability in Hosted Virtual Networks
- Microsoft Research, AT&T Research (2009).

PATENTS

- *11,429,407* – "Apparatus, Method, And System To Dynamically Deploy Wireless Infrastructure"
- *10,425,348* – "Stateless Network Functions" Exclusive License Agreement to Stateless, Inc
- *8,806,032* – "Methods and apparatus to migrate border gateway protocol sessions between routers"
- *8,284,772* - "Method for scheduling a network packet processor"
- *8,065,135* - "Method for message processing on a programmable logic device"
- *8,032,874* – "Generation of executable threads having source code specs. that describe network packets"
- *7,990,867* – "Pipeline for processing network packets"
- *7,823,162* – "Thread circuits and a broadcast channel in programmable logic"
- *7,792,117* – "Method for simulating a processor of network packets"
- *7,788,402* – "Circuit for modification of a network packet by insertion or removal of a data segment"
- *7,784,014* – "Generation of a specification of a network packet processor"
- *7,770,179* – "Method and apparatus for multithreading on a programmable logic device"
- *7,698,449* – "Method and apparatus for configuring a processor embedded in an integrated circuit for use as a logic element"
- 7,689,726 – "Bootable integrated circuit device for readback encoding of configuration data"
- *7,653,895* – "Memory arrangement for message processing by a plurality of threads"
- *7,574,680* – "Method and apparatus for application-specific programmable memory architecture and interconnection network on a chip"
- *7,552,042* – "Method for message processing on a programmable logic device"
- *7,386,826* – "Using redundant routing to reduce susceptibility to single event upsets in PLD designs"
- *7,328,335* – "Bootable programmable logic device for internal decoding of encoded configuration data"
- *7,228,520* – "Method and apparatus for a programmable interface of a soft platform on a programmable logic device"
- *7,227,378* – "Reconfiguration of a programmable logic device using internal control"
- *7,185,309* – "Method and apparatus for application-specific programmable memory architecture and interconnection network on a chip"
- *7,131,077* – "Using an embedded processor to implement a finite state machine"
- *7,111,215* – "Methods of reducing the susceptibility of PLD designs to single event upsets"
- *7,076,596* – "Method of and apparatus for enabling a hardware module to interact with a data structure"
- *7,028,283* – "Method of using a hardware library in a programmable logic device"
- *7,010,664* – "Configurable address generator and circuit using same"
- *6,920,627* – "Reconfiguration of a programmable logic device using internal control"
- *6,883,147* – "Method and system for generating a circuit design including a peripheral component connected to a bus"

[Updated: June 2024]

- *6,725,441* – "Method and apparatus for defining and modifying connections between logic cores implemented on programmable logic devices"
- *6,487,709* – "Run-Time Routing for Programmable Logic Devices"