

# Robert Soulé - Curriculum Vitae

---

## Contact Information

Email	robert.soule@yale.edu
Web	<a href="http://www.cs.yale.edu/homes/soule/">http://www.cs.yale.edu/homes/soule/</a>
Address	Department of Computer Science Yale University 51 Prospect Street New Haven, CT, 06511, USA

## Education

09/2006 - 05/2012	<b>New York University</b> , New York, NY Ph.D. in Computer Science Thesis: <i>Reusable Software Infrastructure for Stream Processing.</i>
01/2004 - 01/2007	<b>New York University</b> , New York, NY M.Sc. in Computer Science Thesis: <i>Ensuring Content Integrity for Untrusted Peer-to-Peer Content Distribution Networks.</i>
09/1995 - 05/1999	<b>Brown University</b> , Providence, RI B.A.(s) in Computer Science, Philosophy, and Art Semiotics.

## Employment History

### Academic Positions

07/2019 - <i>present</i>	<b>Yale University</b> , Departments of Computer Science and Electrical Engineering, New Haven, CT, USA Associate Professor (7/2022 - ), Assistant Professor (7/2019 - 6/2022)
01/2014 - 07/2019	<b>Università della Svizzera italiana</b> , Department of Informatics, Lugano, Switzerland Adjunct Professor (7/2019-), Associate Professor (12/2018-7/2019), Assistant Professor (1/2014-12/2018)
06/2012 - 12/2013	<b>Cornell University</b> , Department of Computer Science, Ithaca, NY, USA Postdoctoral Associate

### Industrial Positions

02/2023 - 03/2024	<b>Moloco</b> , Machine Learning and Data Infrastructure, Redwood City, CA, USA Consultant
07/2019 - 02/2023	<b>Intel Corporation</b> , Network and Edge, Switch Fabric Group, Palo Alto, CA, USA Consultant
01/2017 - 07/2019	<b>Barefoot Networks</b> , Advanced Applications, Palo Alto, CA, USA Research Scientist
05/2008 - 05/2011	<b>IBM T. J. Watson Research Center</b> , Data Intensive Systems and Analytics, Hawthorne, NY, USA Research Co-op (part-time)
09/2005 - 09/2006	<b>Morgan Stanley</b> , Application and Data Security, New York, NY, USA Associate
06/2002 - 09/2005	<b>Bloomberg LP</b> , Equities, New York, NY, USA Technical Lead
12/2001 - 06/2002	<b>Tradeware</b> , New York, NY, USA Software Engineer
04/2000 - 10/2001	<b>LimeWire</b> , New York, NY, USA Software Engineer
06/1999 - 04/2000	<b>New Era Of Networks, Inc.</b> , New York, NY, USA Software Engineer

## Awards & Honors

### Awards and Fellowships

2022	IEEE Senior Member
2021	Intel Connectivity Group Division Recognition Award
2021	ACM Senior Member
2019	ACM SIGMETRICS Highlights Beyond Sigmetrics
2015	Google Faculty Research Award
2010	R&D 100 Award For The Most Breakthrough Innovation
2010	IBM Invention Plateau Award
2010	IBM Invention Achievement Award
2006	Henry H. MacCracken Fellowship, New York University.

### Paper Awards

2020	Best Paper Award at ACM International Conference on Emerging Networking Experiments and Technologies (CoNEXT)
2018	Best Paper Award at USENIX Symposium on Networked Systems Design and Implementation (NSDI)
2012	Best Paper Award at ACM International Conference on Distributed Event-Based Systems (DEBS)

## Research

### Research Interests:

Networking, distributed systems, databases, and programming languages.

### Grants

09/2023 - 08/2026	<i>TECAN: Telemetry-Enabled Carbon Aware Networking</i> , (PI), with Noa Zilberman. : Engineering and Physical Sciences Research Council (EPSRC) / National Science Foundation (NSF). £1,095,000 (Yale portion: \$439,999).
05/2023 - 05/2027	<i>Improved Microservice Communication through Rethought Data Center Memory Architecture</i> (PI), with Peter Alvaro. Intel Corporation. 36 months. \$225,000 (Yale portion: \$45,000).
10/2022 - 10/2026	<i>CNS Core: MEDIUM: MASON: Memory at Scale on Networks</i> , (PI), with Peter Alvaro and Avi Silberschatz. National Science Foundation. \$1,000,000 (Yale portion: \$500,000).
05/2021 - 08/2021	<i>Tools and Support Software for the Development of Applications on a P4-programmable Host Adaptor</i> , (PI), with Antonio Carzaniga. Pensando Systems. 3 months. \$16,000.
05/2021 - 05/2022	<i>Deployment of ONF's Aether Platform on Yale Campus Network</i> , (PI), Yale School of Engineering and Applied Science Dean's Initiative. 12 months. \$22,000.
05/2021 - 05/2024	<i>Network Support for Disaggregated Memory with Explicit Identifiers</i> , (PI), with Peter Alvaro and Avi Silberschatz. Intel Corporation. 36 months. \$336,000 (Yale portion: \$186,000).
03/2021 - 02/2022	<i>A Low-Cost P4 Programmable Device</i> . (PI). Network Programming Initiative. 12 months. \$25,000.
07/2020 - 07/2021	<i>Approaches to Contact Tracing and Limiting COVID-19 Outbreaks in Schools in Connecticut</i> . (Co-PI), with Xin Zhou, Marie Brault, Avi Silberschatz, Donna Spiegelman, and Sten Vermund. Yale School of Public Health COVID Rapid Response Research Fund. 12 months. \$75,000.
06/2020 - 06/2021	<i>Network Support for Storage Class Memory and Security Implications</i> , (PI), with Avi Silberschatz. Cisco Systems. 12 months. \$121,692.
06/2020 - 06/2021	<i>PMDB: A Database for Storage Class Memory</i> , (PI), with Avi Silberschatz. Western Digital. 12 months. \$70,000.
09/2020 - 09/2023	<i>ADVERT: Compositional Atomic Specifications for Distributed System Verification</i> , (Co-PI), with Zhong Shao and Ji Yong Shin. National Science Foundation. \$749,943.
06/2019 - 07/2019	<i>Incremental Programming Support</i> , (PI), with Antonio Carzaniga. Cisco Systems. 10 days. \$10,000.
01/2019 - 01/2020	<i>Debugging Programmable Data Planes</i> . (PI). Hasler Foundation. 12 months. \$48,636 CHF.
09/2017 - 09/2018	<i>Consensus for Main Memory</i> . (PI). Western Digital. 12 months. \$45,000.

01/2018 - 01/2020	<i>Research Scholarships for Visiting Masters Students.</i> (PI). Hasler Foundation. 24 months. \$50,000 CHF.
09/2017 - 09/2021	<i>Exploratory Visual Analytics for Interaction Graphs</i> , (PI), with Buğra Gedik and Michele Lanza. Swiss National Science Foundation, National Research Programme 75 Big Data. 48 months. \$569,308 CHF.
09/2016 - 09/2019	<i>Consensus Protocol Exploiting Network Co-Design</i> , (PI), with Fernando Pedone. Swiss National Science Foundation. 36 months. \$377,160 CHF.
04/2016 - 04/2018	<i>Research Scholarships for Visiting Masters Students.</i> (PI). Hasler Foundation. 24 months. \$50,000 CHF.
12/2015 - 12/2018	<i>Online Data Center Modeling</i> , (PI), with Timothy Roscoe. Swiss National Science Foundation. 36 months. \$347,014 CHF.
02/2015 - 02/2016	<i>Online Data Center Modeling</i> , (PI), with Timothy Roscoe. Google Faculty Research Award. 12 months. \$136,777.

### PhD Students

09/2023 - <i>present</i>	George Neville-Neil (Yale)
09/2023 - <i>present</i>	Stelios Kasouridis (Yale)
09/2022 - <i>present</i>	Amirmohammad Nazari (Yale)
09/2021 - <i>present</i>	Atul Pokharel (Yale)
09/2017 - <i>present</i>	Ali Fattaholmanan (USI)

### PhD Student Alumni and First Position

02/2015 - 12/2020	Daniele Rogora (USI), SoundHound
09/2016 - 07/2020	Theo Jepsen (USI), Postdoctoral Associate at Stanford University
09/2016 - 07/2020	Pietro Bressana (USI), Intel Corporation
09/2014 - 01/2019	Huynh Tu Dang (USI), Western Digital Research

### Postdoctoral Associate Alumni

05/2021 - 06/2022	Haoyu Wang (Yale), NEC Research
09/2020 - 12/2020	Vishal Shrivastav (Yale), Assistant Professor at Purdue University

### Undergraduate Independent Study or Senior Project

Spring 2024	Jack Pothier, Ali Hasnain bin Umer
Fall 2023	Cierra Ouellette, Sameer Sultan, David Cheng
Spring 2023	Ross Johnson
Fall 2022	Matthew Miller
Spring 2022	Seun Omonije, Abraham Mensah, Mohamed Shatry
Fall 2021	Seun Omonije, Aidan Evans
Spring 2021	Adam Wolnikowski, Tucker Moses
Fall 2020	Adam Wolnikowski, Sara Lewis, Tucker Moses
Spring 2020	Dylan King, Tucker Moses
Fall 2019	Seun Omonije, Harshal Sheth, Tucker Moses

### Student Awards

2022	Kaarthik Alagappan (UCF), Most Novel Non-Networking Use of P4 - Honorable Mention at P4 Workshop
2021	Daniel Bittman (UCSC), Runner-up Best Presentation Award at HotNets 2021
2021	Adam Wolnikowski (Yale), Department of Computer Science Undergraduate Prize for Research
2017	Pietro Bressana (USI), SNF Mobility Fellowship

## Teaching

### University Courses

Fall 2023	<i>CPSC 450/550, Sustainable Computing</i> , Yale University, Enrollment: TBD
Spring 2024	<i>CPSC 435/535, Building an Internet Router</i> , Yale University, Enrollment: 22
Fall 2023	<i>CPSC 440/540, Advanced Databases</i> , Yale University, Enrollment: 12
Spring 2023	<i>CPSC 440/540, Advanced Databases</i> , Yale University, Enrollment: 4
Fall 2022	<i>CPSC 435/535, Building an Internet Router</i> , Yale University, Enrollment: 7
Spring 2021	<i>CPSC 421/521, Compilers and Interpreters</i> , Yale University, Enrollment: 12
Fall 2020	<i>CPSC 435/535, Building an Internet Router</i> , Yale University, Enrollment: 7
Spring 2020	<i>CPSC 421/521, Compilers and Interpreters</i> , Yale University, Enrollment: 30
Fall 2019	<i>CPSC 634, Building an Internet Router</i> , Yale University, Enrollment: 4
Spring 2019	<i>Advanced Networking</i> , MSc, Università della Svizzera italiana
Fall 2016	<i>Advanced Networking</i> , MSc, Università della Svizzera italiana
Fall 2016	<i>Data Management</i> , BSc, Università della Svizzera italiana
Spring 2016	<i>Data Management</i> , BSc, Università della Svizzera italiana
Spring 2016	<i>Logic</i> , PhD, Università della Svizzera italiana
Fall 2015	<i>Advanced Compilers</i> , MSc, Università della Svizzera italiana
Fall 2015	<i>Network Programming Languages</i> , PhD, Università della Svizzera italiana and Politecnico di Milano
Spring 2015	<i>Data Management</i> , BSc, Università della Svizzera italiana
Fall 2014	<i>Domain Specific Languages</i> , MSc, Università della Svizzera italiana
Spring 2014	<i>Data Management</i> , BSc, Università della Svizzera italiana
Fall 2013	<i>Scripting Languages</i> , MSc, Cornell University

## Service

### Steering Committee

2022	P4 Workshop in Europe ( <b>EuroP4 '22</b> )
2021	P4 Workshop in Europe ( <b>EuroP4 '21</b> )

### General Chair

2020	P4 Workshop in Europe ( <b>EuroP4 '20</b> )
2019	P4 Workshop in Europe ( <b>EuroP4 '19</b> )

### TPC Chair

2018	P4 Workshop in Europe ( <b>EuroP4 '18</b> )
2017	P4 Developer Day Fall
2016	Workshop on Networking and Programming Languages ( <b>NetPL '16</b> )
2016	Workshop on Dependability Issues on SDN and NFV description ( <b>DISN '16</b> )
2015	Workshop on Networking and Programming Languages ( <b>NetPL '15</b> )

## TPC Member

2024	ACM SIGCOMM Conference on Applications, Technologies, Architectures, and Protocols for Computer Communications ( <b>SIGCOMM '24</b> )
2024	P4 Workshop in Europe ( <b>EuroP4 '23</b> )
2023	ACM SIGCOMM Workshop on Future of Internet Routing & Addressing ( <b>FIRA '23</b> )
2023	P4 Workshop
2022	P4 Workshop
2022	ACM SIGCOMM Conference on Applications, Technologies, Architectures, and Protocols for Computer Communications ( <b>SIGCOMM '22</b> )
2022	USENIX Symposium on Operating Systems Design and Implementation ( <b>OSDI '22</b> )
2022	Asia-Pacific Workshop on Networking ( <b>APNet'22</b> )
2021	P4 Workshop in Europe ( <b>EuroP4 '21</b> )
2021	ACM SIGCOMM Symposium on SDN Research ( <b>SOSR '21</b> )
2020	ACM SIGCOMM Workshop on Network-Application Integration/CoDesign ( <b>NAI '20</b> )
2020	P4 and Programmable Forwarding Summit
2020	Asia-Pacific Workshop on Networking ( <b>APNet'20</b> )
2020	ACM SIGCOMM Symposium on SDN Research ( <b>SOSR '20</b> )
2019	Stanford Workshop on Buffer Sizing
2019	ACM SIGCOMM Conference on Applications, Technologies, Architectures, and Protocols for Computer Communications ( <b>SIGCOMM '19</b> )
2019	Symposium on SDN Research ( <b>SOSR '19</b> )
2019	European Conference on Computer Systems ( <b>EuroSys '19</b> )
2018	ACM International Conference on Distributed and Event-Based Systems ( <b>DEBS '18</b> )
2018	ACM SIGCOMM Symposium on SDN Research ( <b>SOSR '18</b> )
2017	ACM SIGCOMM Symposium on SDN Research ( <b>SOSR '17</b> ) (Posters and Demos)
2017	ACM Symposium on Principles of Distributed Computing ( <b>PODC '17</b> )
2017	International Workshop on High Performance Computing for Big Data ( <b>HPC4BD '17</b> )
2016	International Conference on Reconfigurable Computing and FPGAs ( <b>ReConFig '16</b> )
2016	International Conference on Principles of Distributed Systems ( <b>OPODIS '16</b> )
2016	ACM SIGCOMM Conference on Applications, Technologies, Architectures, and Protocols for Computer Communications ( <b>SIGCOMM '16</b> ) (Posters and Demos)
2016	ACM International Conference on Emerging Networking Experiments and Technologies ( <b>CoNEXT '16</b> )
2016	ACM SIGPLAN Conference on Programming Language Design and Implementation ( <b>PLDI '16</b> ) (ERC)
2016	European Conference on Object-Oriented Programming ( <b>ECOOP '16</b> ) (ERC)
2016	European Conference on Computer Systems ( <b>EuroSys '16</b> ) 2016
2016	International Workshop on High Performance Computing for Big Data ( <b>HPC4BD '16</b> )
2016	ACM/IEEE Symposium on Architectures for Networking and Communications Systems ( <b>ANCS '16</b> )
2016	ACM/IFIP Middleware conference ( <b>Middleware '16</b> )
2015	ACM Conference on Object-oriented Programming, Systems, Languages, and Applications ( <b>OOPSLA '15</b> )
2015	ACM/IFIP Middleware conference ( <b>Middleware '15</b> )
2015	International Workshop on High Performance Computing for Big Data ( <b>HPC4BD '15</b> )
2014	ACM/IFIP Middleware conference ( <b>Middleware '14</b> )

## Refereed Tutorials and Hackathons

2022	Noa Zilberman, Fernando Ramos, Sándor Laki, Damu Ding, Salvatore Signorello, and Robert Soulé. P4PI Hackathon: P4 on Raspberry PI for Networking Education. In <i>2021 ACM SIGCOMM Conference on Applications, Technologies, Architectures, and Protocols for Computer Communications (SIGCOMM '22)</i> .
2022	Noa Zilberman, Robert Soulé, Fernando Ramos, and Damu Ding. P4PI: P4 on Raspberry PI for Research and Education In <i>2022 IEEE International Conference on Network Softwarization (NETSOFT '22)</i> .
2021	Sándor Laki, Noa Zilberman, and Robert Soulé. P4PI Hackathon: P4 on Raspberry PI for Networking Education. In <i>2021 ACM SIGCOMM Conference on Applications, Technologies, Architectures, and Protocols for Computer Communications (SIGCOMM '21)</i> .
2019	Noa Zilberman and Robert Soulé. Full-Day Hackathon on P4. In <i>The 16th USENIX Symposium on Networked Systems Design and Implementation (NSDI '19)</i> .
2018	Nate Foster, Noa Zilberman, and Robert Soulé. Full-Day Tutorial on Programming the Network Data Plane. In <i>2018 ACM SIGCOMM Conference on Applications, Technologies, Architectures, and Protocols for Computer Communications (SIGCOMM '18)</i> .

## Professional Activities

10/2020 - 01/2023	Member, P4 Technical Steering Team
10/2021 - present	Primary Contact for Yale, Open Networking Foundation
02/2020 - present	Primary Contact for Yale, Chips Alliance
10/2019 - present	Member, Network Programming Initiative
05/2018 - 08/2021	Chair, P4 Education Working Group
07/2007 - present	Senior Member, ACM
03/2007 - present	Member, USENIX
02/2021 - present	Senior Member, IEEE

## University Activities

2023	<i>STEM Undergraduate Fellowship Research Committee</i> , Yale University
2023	<i>STEM Undergraduate Fellowship Research Committee</i> , Yale University
2022	<i>STEM Undergraduate Fellowship Research Committee</i> , Yale University
2021	<i>STEM Undergraduate Fellowship Research Committee</i> , Yale University
2020	<i>STEM Undergraduate Fellowship Research Committee</i> , Yale University
2019 - present	<i>Fellow of Benjamin Franklin College</i> , Yale University

## Department Activities

2023 - 2024	<i>Computer Science Lecturer Review Committee</i> , Yale University
2022 - 2023	<i>Computer Science Lecturer Search Committee</i> , Yale University
2022 - 2023	<i>Computer Science Faculty Reappointment Committee</i> , Yale University
2022 - 2023	<i>Computer Science Undergraduate Class Advisor</i> , Yale University
2021 - 2022	<i>Visibility and Publicity Committee Chair</i> , Yale University
2020 - 2022	<i>Social Activities Committee Chair</i> , Yale University
2019	<i>Graduate Admission Committee</i> , Yale University

## Publications

### Journal Articles

1. Noa Zilberman, Eve Schooler, Uri Cummings, Rajit Manohar, Dawn Nafus, Robert Soulé, and Rick Taylor. Toward Carbon-Aware Networking. In *ACM SIGENERGY Energy Informatics Review (EIR)*, 3(3), October 2023.
2. Pietro Bressana, Noa Zilberman, and Robert Soulé. PTA: Finding Hard-to-Find Data Plane Bugs. In *IEEE/ACM Transactions on Networking (ToN)*, October 2022.

3. Theo Jepsen, Ali Fattaholmanan, Masoud Moshref, Nate Foster, Antonio Carzaniga, and Robert Soulé. Forwarding and Routing with Packet Subscriptions. In *IEEE/ACM Transactions on Networking (ToN)*, April 2022.
4. Sándor Laki, Radostin Stoyanov, Dávid Kis, Robert Soulé, Péter Vörös, and Noa Zilberman. P4Pi: P4 on Raspberry Pi for Networking Education. In *SIGCOMM Computer Communication Review (SIGCOMM CCR)*, 51(3), July 2021.
5. Atul Pokharel, Robert Soulé, and Avi Silberschatz. A Case for Location-based Contact Tracing. In *Health Care Management Science Special Issue on COVID-19 (HCMS)*, June 2021. Acceptance rate: 12% (12 / 100)
6. Huynh Tu Dang, Pietro Bressana, Han Wang, Ki Suh Lee, Noa Zilberman, Hakim Weatherspoon, Marco Canini, Fernando Pedone, and Robert Soulé. P4xos: Consensus as a Network Service. In *IEEE/ACM Transactions on Networking (ToN)*, 28(4), August 2020.
7. Robert Soulé, Shrutarshi Basu, Parisa Jalili Marandi, Fernando Pedone, Robert Kleinberg, Emin Gün Sirer, Nate Foster. Merlin: A Language for Provisioning Network Resources. In *IEEE/ACM Transactions on Networking (ToN)*, 26(5), October 2018.
8. Martin Hirzel, Robert Soulé, Buğra Gedik, and Scott Schneider. Stream query optimization. *Encyclopedia of Big Data Technologies*, April 2018.
9. Huynh Tu Dang, Marco Canini, Fernando Pedone, and Robert Soulé. Paxos Made Switch-y. In *SIGCOMM Computer Communication Review (SIGCOMM CCR)*, 46(2), February 2016.
10. Robert Soulé and Buğra Gedik. RailwayDB: Adaptive Storage of Interaction Graphs. In *Very Large Data Bases Journal (VLDBJ)*, 25(2), pp. 151-169 March 2016.
11. Robert Soulé, Martin Hirzel, Buğra Gedik, Robert Grimm. River: An Intermediate Language for Stream Processing. In *Software: Practice and Experience (SP&E)*, 2015.
12. Martin Hirzel, Robert Soulé, Scott Schneider, Buğra Gedik, and Robert Grimm. A Catalog of Stream Processing Optimizations. *ACM Computing Surveys (CSUR)*. 46(4), April 2014.
13. Martin Hirzel, Henrique Andrade, Buğra Gedik, Gabriela Jacques da Silva, Rohit Khandekar, Vibhor Kumar, Mark Mendell, Howard Nasgaard, Scott Schneider, Robert Soulé, Kun-Lung Wu. IBM Streams Processing Language: Analyzing Big Data in Motion. *IBM Journal on Research and Development (JRD)*, pp. 1-11, 57(3), May 2013.

### Conference Publications

14. Anita Buckley, Pavel Chuprikov, Rodrigo Otoni, Robert Soulé, Robert Rand, and Patrick Eugster. An Algebraic Language for Specifying Quantum Networks. In *Proceedings of the 2024 ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI '24)*, June 2024. Acceptance rate: % ( / ).
15. Fernando Pedone, Enrique Fynn, Robert Soulé, Zarko Milosevic, and Ethan Buchman. Robust and Fast Blockchain State Synchronization. In *Proceedings of the 26th International Conference on Principles of Distributed Systems (OPODIS '22)*, December 2022. Acceptance rate: 34% (25 / 76).
16. Ali Fattaholmanan, Mario Baldi, Antonio Carzaniga, and Robert Soulé. P4Weaver: Supporting Modular and Incremental Programming in P4. In *Proceedings of the 7th Symposium on SDN Research (SOSR '21)*, September 2021. Acceptance rate: 32% (12 / 37).
17. Theo Jepsen, Alberto Lerner, Fernando Pedone, Robert Soulé, and Philippe Cudré-Mauroux. In-Network Support for Transaction Triaging. In *Proceedings of the 47th International Conference on Very Large Data Bases (VLDB '21)*, August 2021. Acceptance rate: 23% (157 / 692).
18. Eric Campbell, William Hallahan, Priya Srikumar, Carmelo Cascone, Jed Liu, Vignesh Ramamurthy, Hossein Hojjat, Ruzica Piskac, Robert Soulé, Nate Foster. Avenir: Managing Data Plane Diversity with Control Plane Synthesis. In *Proceedings of the 18th USENIX Symposium on Networked Systems Design and Implementation (NSDI '21)*, April 2021. Acceptance rate: 16% (40 / 255).

19. Christopher Leet, Robert Soulé, Y. Richard Yang, and Ying Zhang. Flow Algebra: Towards an Efficient, Unifying Framework for Network Management Tasks. In *Proceedings of the 2021 IEEE International Conference on Computer Communications (INFOCOM '21)*, May 2021. Acceptance rate: 20% (252 / 1266).
20. Theo Jepsen, Ali Fattaholmanan, Masoud Moshref, Nate Foster, Antonio Carzaniga, and Robert Soulé. Forwarding and Routing with Packet Subscriptions. In *Proceedings of the 16th International Conference on Emerging Networking Experiments and Technologies (CoNEXT '20)*, December 2020. Acceptance rate: 24% (40 / 168). **Best Paper Award.**
21. Pietro Bressana, Noa Zilberman, and Robert Soulé. Finding Hard-to-Find Data Plane Bugs with a PTA. In *Proceedings of the 16th International Conference on Emerging Networking Experiments and Technologies (CoNEXT '20)*, December 2020. Acceptance rate: 24% (40 / 168).
22. Daniele Rogora, Antonio Carzaniga, Amer Diwan, Matthias Hauswirth, Robert Soulé. Analyzing System Performance with Probabilistic Performance Annotations. In *Proceedings of the 2020 European Conference on Computer Systems (EuroSys '20)*, April 2020. Acceptance rate: 18% (43 / 234).
23. Long Hoang Le, Enrique Fynn, Mojtaba Eslahi-Kelorazi, Robert Soulé, and Fernando Pedone. DynaStar: Optimized Dynamic Partitioning for Scalable State Machine Replication. In *Proceedings of the 39th IEEE International Conference on Distributed Computing Systems (ICDCS '19)*, July 2019. (N/A)
24. Theo Jepsen, Daniel Alvarez, Nate Foster, Changhoon Kim, Jeongkeun Lee, Masoud Moshref, and Robert Soulé. Fast String Searching on PISA. In *Proceedings of the 5th Symposium on SDN Research (SOSR '19)*, April 2019. Acceptance rate: 28% (15 / 53).
25. Yuta Tokusashi, Huynh Tu Dang, Fernando Pedone, Robert Soulé, and Noa Zilberman. The Case For In-Network Computing On Demand. In *Proceedings of the 2019 European Conference on Computer Systems (EuroSys '19)*, March 2019. Acceptance rate: 22% (45 / 121).
26. Calin Cascaval, Nate Foster, William Hallahan, Jeongkeun Lee, Jed Liu, Nick McKeown, Cole Schlesinger, Milad Sharif, Robert Soulé, and Han Wang. p4v: Practical Verification for Programmable Data Planes. In *Proceedings of the 2018 ACM SIGCOMM Conference on Applications, Technologies, Architectures, and Protocols for Computer Communications (SIGCOMM '18)*, August 2018. Acceptance rate: 18% (40 / 222).
27. Praveen Kumar, Yang Yuan, Chris Yu, Nate Foster, Robert Kleinberg, Petr Lapukhov, Chiun Lin Lim, and Robert Soulé. Semi-Oblivious Traffic Engineering: The Road Not Taken. In *Proceedings of the 15th USENIX Symposium on Networked Systems Design and Implementation (NSDI '18)*, April 2018. Acceptance rate: 16% (40 / 252).
28. Xin Jin, Xiaozhou Li, Haoyu Zhang, Nate Foster, Jeongkeun Lee, Robert Soulé, Changhoon Kim, and Ion Stoica. NetChain: Scale-Free Sub-RTT Coordination. In *Proceedings of the 15th USENIX Symposium on Networked Systems Design and Implementation (NSDI '18)*, April 2018. Acceptance rate: 16% (40 / 252). **Best Paper Award.**
29. Theo Jepsen, Masoud Moshref, Antonio Carzaniga, Nate Foster, and Robert Soulé. Life in the Fast Lane: A Line-Rate Linear Road. In *Proceedings of the 4th Symposium on SDN Research (SOSR '18)*, March 2018. Acceptance rate: 28% (18 / 63).
30. Praveen Kumar, Chris Yu, Yang Yuan, Nate Foster, Robert Kleinberg, and Robert Soulé. YATES: Rapid Prototyping for Traffic Engineering Systems. In *Proceedings of the 4th Symposium on SDN Research (SOSR '18)*, March 2018. Acceptance rate: 28% (18 / 63).
31. Xin Jin, Xiaozhou Li, Haoyu Zhang, Robert Soulé, Jeongkeun Lee, Nate Foster, Changhoon Kim, and Ion Stoica. NetCache: Balancing Key-Value Stores with Fast In-Network Caching. In *Proceedings of the 26th ACM Symposium on Operating Systems Principles (SOSP '17)*, October 2017. Acceptance rate: 17% (39 / 232).
32. Nik Sultana, Salvator Galea, David Greaves, Marcin Wojcik, Jonny Shipton, Richard Clegg, Luo Mai, Pietro Bressana, Robert Soulé, Richard Mortier, Paolo Costa, Peter Pietzuch, Jon Crowcroft, Andrew W Moore, and Noa Zilberman. Emu: Rapid Prototyping of Networking Services. In *Proceedings of the 2017 USENIX Annual Technical Conference (USENIX ATC '17)*, July 2017. Acceptance rate: 21% (60 / 283).



33. Huynh Tu Dang, Han Wang, Theo Jepsen, Gordon Brebner, Changhoon Kim, Jennifer Rexford, Robert Soulé, and Hakim Weatherspoon. Whippersnapper: A P4 Language Benchmark Suite. In *Proceedings of the 3rd ACM Sigcomm Symposium on SDN Research (SOSR '17)*, April 2017. Acceptance rate: 23% (18/77).
34. Han Wang, Robert Soulé, Huynh Tu Dang, Ki Suh Lee, Vishal Shrivastav, Nate Foster, and Hakim Weatherspoon. P4FPGA: A Rapid Prototyping Framework for P4. In *Proceedings of the 3rd ACM Sigcomm Symposium on SDN Research (SOSR '17)*, April 2017. Acceptance rate: 23% (18/77).
35. Ricardo Padilha, Enrique Fynn, Robert Soulé, and Fernando Pedone. Callinicos: Robust Transactional Storage for Distributed Data Structures. In *Proceedings of the 2016 USENIX Annual Technical Conference (USENIX ATC '16)*, June 2016. Acceptance rate: 18% (47/266).
36. Huynh Tu Dang, Daniele Sciascia, Marco Canini, Fernando Pedone, and Robert Soulé. NetPaxos: Consensus at Network Speed. In *Proceedings of the 1st ACM Sigcomm Symposium on SDN Research (SOSR '15)*, June 2015. Acceptance rate: 20% (27/137).
37. Robert Soulé, Shrutarshi Basu, Parisa Jalili Marandi, Fernando Pedone, Robert Kleinberg, Emin Gün Sirer, and Nate Foster. Merlin: A Language for Provisioning Network Resources. In *Proceedings of the 10th International Conference on Emerging Networking Experiments and Technologies (CoNEXT '14)*, December 2014. Acceptance rate: 19% (37/186).
38. Lonnie Princehouse, Rakesh Chenchu, Zhefu Jiang, Ken Birman, Nate Foster, and Robert Soulé. MiCA: A Compositional Architecture for Gossip Protocols. In *Proceedings of the 28th European Conference on Object-Oriented Programming (ECOOP '14)*, July 2014. Acceptance rate: 27% (27/101).
39. Robert Soulé, Michael I. Gordon, Saman Amarasinghe, Robert Grimm, and Martin Hirzel. Dynamic Expressivity with Static Optimization for Streaming Languages. In *Proceedings of the 7th ACM International Conference on Distributed Event-Based Systems (DEBS '13)*, July 2013. Acceptance rate: 27.5% (16/58).
40. Robert Soulé, Martin Hirzel, Buğra Gedik, and Robert Grimm. From a Calculus to an Execution Environment for Stream Processing. In *Proceedings of the 6th ACM International Conference on Distributed Event-Based Systems (DEBS '12)*, pp. 20–31, July 2012. Acceptance rate: 21% (17/79). **Best Paper Award**.
41. Giuliano Losa, Vibhore Kumar, Henrique Andrade, Buğra Gedik, Martin Hirzel, Robert Soulé, and Kun-Lung Wu. Language and System Support for Efficient State Sharing in Distributed Stream Processing Systems. In *Proceedings of the 6th ACM International Conference on Distributed Event-Based Systems (DEBS '12)* (Industrial Track), July 2012. pp. 268–277. Acceptance rate: 80% (8/10).
42. Qiong Zou, Huayong Wang, Robert Soulé, Martin Hirzel, Henrique Andrade, Buğra Gedik, and Kun-Lung Wu. From a Stream of Relational Queries to Distributed Stream Processing. In *Proceedings of the VLDB Endowment (VLDB '10)* (Industrial Track), pp. 1394–1405, volume 3, number 2, September 2010. Acceptance rate: 24% (12/51).
43. Robert Soulé, Martin Hirzel, Robert Grimm, Buğra Gedik, Henrique Andrade, Vibhore Kumar, and Kun-Lung Wu. A Universal Calculus for Stream Processing Languages. In *Proceedings of the 19th European Symposium on Programming (ESOP '10)*, pp. 507–528, volume 6012 of *Lecture Notes in Computer Science*, Springer-Verlag, March 2010. Acceptance rate: 25% (30/121).
44. Nalini Belaramani, Jiandan Zheng, Amol Nayate, Robert Soulé, Mike Dahlin, and Robert Grimm. PADS: A Policy Architecture for Distributed Storage Systems. In *Proceedings of the 6th USENIX Symposium on Networked Systems Design and Implementation (NSDI '09)*, pp. 59–73, April 2009. Acceptance rate: 20% (32/163).
45. Nikolaos Michalakis, Robert Soulé, and Robert Grimm. Ensuring content integrity for untrusted peer-to-peer content distribution networks. In *Proceedings of the 4th USENIX Symposium on Networked Systems Design and Implementation (NSDI '07)*, pp. 145–158, April 2007. Acceptance rate: 24% (27/113).

## Workshop Publications

46. Anita Buckley, Pavel Chuprikov, Rodrigo Otoni, Robert Rand, Robert Soulé, and Patrick Eugster. Towards an Algebraic Specification of Quantum Networks. In *Proceedings of the 1st SIGCOMM Workshop on Quantum Networks and Distributed Quantum Computing*. (**QuNet '23**), Sep. 2023. Acceptance rate: 92% (11/12).
47. Aidan Evans, Seun Omonije, Robert Soulé, and Robert Rand. MCBeth: A Measurement Based Quantum Programming Language. In *Proceedings of the 4th International Workshop on Quantum Software Engineering*. (**Q-SE '23**), May 2023. Acceptance rate: 50% (7/14).
48. Eve Schooler, Rick Taylor, Noa Zilberman, Robert Soulé, Dawn Nafus, Rajit Manohar, and Uri Cummings. A Perspective on Carbon-aware Networking. In *Internet Architecture Board Workshop on Environmental Impact of Internet Applications and Systems* (**e-Impact '22**), December 2022.
49. Noa Zilberman, Eve Schooler, Uri Cummings, Rajit Manohar, Dawn Nafus, Robert Soulé, and Rick Taylor. Toward Carbon-Aware Networking. In *Proceedings of the 1st Workshop on Sustainable Computer Systems Design and Implementation* (**HotCarbon '22**), July 2022. Acceptance rate: 74% (14/19).
50. Radostin Stoyanov, Adam Wolnikowski, Robert Soulé, Sándor Laki, and Noa Zilberman. Building an Internet Router with P4Pi. In *Proceedings of the 4th European P4 Workshop* (**EuroP4 '21**), December 2021. Acceptance rate: 50% (6/12).
51. Adam Wolnikowski, Stephen Ibanez, Jonathan Stone, Changhoon Kim, and Robert Soulé. Zerializer: Towards Zero-Copy Serialization. In *Proceedings of the 18th Workshop on Hot Topics in Operating Systems* (**HotOS '21**), May 2021. Acceptance rate: 27% (30/113).
52. Pietro Bressana, Noa Zilberman, Dejan Vucinic, and Robert Soulé. Trading Latency for Compute in the Network. In *Proceedings of the ACM SIGCOMM Workshop on Network-Application Integration/CoDesign* (**NAI '20**), August 2020. Acceptance rate: 55% (5/9).
53. Rajit Manohar and Robert Soulé. Buffer Sizing Problems in Networks and Asynchronous Circuits: Similarities and Differences. In *Workshop on Buffer Sizing*, December 2019. Acceptance rate: 77% (21/27).
54. Theo Jepsen, Masoud Moshref, Antonio Carzaniga, Nate Foster, and Robert Soulé. Packet Subscriptions for Programmable ASICs. In *Proceedings of the 17th ACM Workshop on Hot Topics in Networks* (**HotNets '18**), November 2018. Acceptance rate: 21% (26/125).
55. Huynh Tu Dang, Jaco Hofmann, Yang Liu, Marjan Radi, Dejan Vucinic, Fernando Pedone, Robert Soulé. Consensus for Non-Volatile Main Memory. In *Proceedings of the 1st European P4 Workshop* (**P4EU '18**), August 2018. Acceptance rate: 35% (6/17).
56. Theo Jepsen, Leandro Pacheco de Sousa, Masoud Moshref, Fernando Pedone, and Robert Soulé. Infinite Resources for Optimistic Concurrency Control. In *Proceedings of the ACM SIGCOMM 2018 Workshop on In-Network Computing* (**NetCompute '18**), August 2018. Acceptance rate: 54% (6/11).
57. Daniele Rogora, Steffen Smolka, Antonio Carzaniga, Amer Diwan, and Robert Soulé. Performance Annotations for Cloud Computing. In *Proceedings of the 9th USENIX Workshop on Hot Topics in Cloud Computing* (**HotCloud '17**), July 2017. Acceptance rate: 33% (19/58).
58. Robert Soulé, Shrutarshi Basu, Robert Kleinberg, Emin Gün Sirer, and Nate Foster. Managing the Network with Merlin. In *Proceedings of the 12th ACM Workshop on Hot Topics in Networks* (**HotNets '13**), November 2013. Acceptance rate: 24% (26/110).

## Refereed Posters and Presentations

59. Aidan Evans, Seun Omonije, Robert Soulé, and Robert Rand. MCBeth: A Measurement Based Quantum Programming Language. In *Quantum Physics and Logic* (**QPL '22**), June 2022.
60. Kaarthik Annamalai Alagappan, Paul Gazzillo, Ali Fattaholmanan, Mario Baldi, Antonio Carzaniga, and Robert Soulé. SuperP4: Preprocessor-Aware Syntax and Semantic Analysis for P4 Programs. In *P4 Workshop*, May 2022.

61. Pietro Bressana, Noa Zilberman, and Robert Soulé. A Portable Test Architecture for Finding Data Plane Bugs. In *US-Japan Workshop on Programmable Networking*, November 2020.
62. Pietro Bressana, Noa Zilberman, and Robert Soulé. A Programmable Framework for Validating Data Planes. In *Proceedings of the 2018 ACM SIGCOMM Conference on Applications, Technologies, Architectures, and Protocols for Computer Communications (SIGCOMM '18)*, August 2018. Acceptance rate: 43% (52 / 121).
63. Praveen Kumar, Yang Yuan, Chris Yu, Nate Foster, Robert Kleinberg, Petr Lapukhov, Chiun Lin Lim, and Robert Soulé. Semi-Oblivious Traffic Engineering with SMORE. In *ACM, IRTF, and, ISOC Applied Networking Research Workshop (ANRW '18)*, July 2018. Acceptance rate: 59% (33 / 56).
64. Theo Jepsen, Leandro Pacheco de Sousa, Huynh Tu Dang, Fernando Pedone, Robert Soulé. Gotthard: Network Support for Transaction Processing. In *Proceedings of the 3rd ACM Sigcomm Symposium on SDN Research (SOSR '17)*, April 2017.
65. Salvator Galea, Nik Sultana, Pietro Bressana, David Greaves, Andrew W. Moore, Robert Soulé, and Noa Zilberman. Emu: Rapid FPGA Prototyping of Network Services in C#. In *Design, Automation, and Test in Europe (DATE '17)*, March 2017.
66. Robert Soulé, Ken Birman, Nate Foster. Software Defined Networks and Gossip Protocols. In *The 8th Workshop on Large Scale Distributed Systems and Middleware (LADIS '14)*, October 2014. Acceptance rate: 81% (17 / 21).
67. Robert Soulé, Shrutarshi Basu, Robert Kleinberg, Emin Gün Sirer, Nate Foster. Merlin: Programming the Big Switch. In *The Open Networking Summit (ONS '14)*, March 2014. Acceptance rate: 50% (46 / 92).
68. Shrutarshi Basu, Robert Soulé, Robert Kleinberg, Emin Gün Sirer, Nate Foster. Merlin: Unified Management for Diverse Networks. Work-in-progress presentation and poster at the *24th ACM Symposium on Operating Systems Principles (SOSP '13)*, November 2013.
69. Robert Soulé, Martin Hirzel, Robert Grimm, Buğra Gedik. Distributed CQL Made Easy. Extended abstract and presentation at the *New England Database Summit (NEDB '11)*, January 2011. Acceptance rate: 50% (11 / 22).
70. Martin Hirzel, Henrique Andrade, Buğra Gedik, Vibhore Kumar, Giuliano Losa, Robert Soulé, Kun-Lung Wu. Spade: Opening the Levees for Stream Processing. Presentation at the *IBM Programming Languages Day*, May 2009.
71. Robert Soulé, Robert Grimm, and Petros Maniatis. Auto-Parallelization for Declarative Network Monitoring. Poster at the *21st ACM Symposium on Operating Systems Principles (SOSP '07)*, October 2007.
72. Nikolaos Michalakis, Robert Soulé, and Robert Grimm. Taking the trust out of global-scale web services. Work-in-progress presentation at the *7th USENIX Symposium on Operating Systems Design and Implementation (OSDI '06)*, November 2006.

### Select Technical Reports

73. Yanfang Le, Jeongkeun Lee, Jeremias Blendin, Jiayi Chen, Georgios Nikolaidis, Rong Pan, Robert Soulé, Aditya Akella, Pedro Yebenes Segura, Arjun Singhvi, Yuliang Li, Qingkai Meng, Changhoon Kim, and Serhat Arslan. SFC: Near-Source Congestion Signaling and Flow Control. *arXiv 2305.00538*. May 2023.
74. Aidan Evans, Seun Omonije, Robert Soulé, and Robert Rand. MCBeth: A Measurement Based Quantum Programming Language. *arXiv 2204.10784*. April 2022.
75. Huynh Tu Dang, Pietro Bressana, Han Wang, Ki Suh Lee, Noa Zilberman, Hakim Weatherspoon, Marco Canini, Fernando Pedone, and Robert Soulé. Partitioned Paxos via the Network Data Plane. *Università della Svizzera italiana Faculty of Informatics Technical Report USI-INF-TR-2019-01* January 2019.
76. Martin Hirzel, Henrique Andrade, Buğra Gedik, Vibhore Kumar, Giuliano Losa, Mark Mendell, Howard Nasgaard, Robert Soulé, Kun-Lung Wu. Streams Processing Language Specification. *IBM Research Report RC24897*, IBM T. J. Watson Research Center, November 2009. Supersedes RC24830, July 2009 and RC24760, March 2009.

## Patents Granted

1. Jeongkeun Lee, Cole Nathan Schlesinger, John Nathan Foster, Han Wang, Robert Soulé, William Hallahan, Steffen Julif Smolka, Mon Jed Liu. Data Plane Program Verification. Issued as Patent 1,188,355, in U.S.A., November 30, 2021.
2. Changhoon Kim, Jeongkeun Lee, Milad Sharif, Robert Soulé. Verification of Access Control List Rules Provided with a Message. Issued as Patent 10,826,815, in U.S.A., November 3, 2020.
3. Changhoon Kim, Jeongkeun Lee, Milad Sharif, Robert Soulé. Generation of Path Failure Message at Forwarding Element. Issued as Patent 10,764,170, in U.S.A., September 1, 2020.
4. Changhoon Kim, Jeongkeun Lee, Milad Sharif, Robert Soulé. Execution of Packet-Specified Actions at Forwarding Element. Issued as Patent 10,757,005, in U.S.A., August 25, 2020.
5. Changhoon Kim, Jeongkeun Lee, Milad Sharif, Robert Soulé. Source Routing Design with Simplified Forwarding Elements. Issued as Patent 10,700,959, in U.S.A., June 30 2020.
6. Marco Canini, Huynh Tu Dang, Fernando Pedone, Robert Soulé. Storage and Replication in Distributed Computing Environments Issued as Patent 10,248,708, in U.S.A., April 2, 2019.
7. Henrique Andrade, Buğra Gedik, Martin Hirzel, Vibhore Kumar, Giuliano Losa, Robert Soulé, and Kun-Lung Wu. Data Sharing in a Stream Processing System. Issued as Patent 8,560,602, in U.S.A., October 2013.
8. Henrique Andrade, Jim Challenger, Buğra Gedik, Robert Grimm, Martin Hirzel, Vibhore Kumar, Robert Soulé, Kun-Lung Wu. Virtual Execution Environment for Streaming Languages. Issued as Patent 8,499,292 in U.S.A., July 30, 2013.
9. Henrique Andrade, Buğra Gedik, Martin Hirzel, Robert Soulé, Huayong Wang, Kun-Lung Wu, Qiong Zou. Transforming Relational Queries Into Stream Processing. Issued as Patent 8,326,821 in U.S.A., December 4, 2012.
10. Henrique Andrade, Buğra Gedik, Martin Hirzel, Robert Soulé, Huayong Wang, Kun-Lung Wu, Qiong Zou. Proxying ODBC Calls. Issued as Patent 8,321,443 in U.S.A, November 27, 2012.
11. Henrique Andrade, Buğra Gedik, Martin Hirzel, Vibhore Kumar, Robert Soulé, Kun-Lung Wu. State Sharing in a Distributed Data Stream Processing System. Issued as Patent 8,285,780 in U.S.A., October 9, 2012.

## Patents Pending

1. Masoud Moshref Javadi, Robert Soulé, Changhoon Kim, Jeongkeun Lee, John Nathan Foster, Daniel A. Alvarez. Configuring and Performing Character Pattern Recognition in a Data Plane Circuit. US Patent Application, January 2020.
2. Robert Soulé, Rajit Manohar, Jr-Shian Tsai, Edmund Chen, Uri Cummings, Pietro Bressana, Rui Li. Object Linearization for Communications. US Patent Application, December 2022.
3. Robert Soulé, Rajit Manohar, Jr-Shian Tsai, Edmund Chen, Uri Cummings, Pietro Bressana, Rui Li. Acceleration of Communications. US Patent Application, December 2022.