

Theophilus A. Benson

Contact Info

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Employment

Assistant Professor
Brown University

Sept 2017-Present

Assistant Professor
Duke University

Jul 2013-Aug 2017

Post-Doctoral Scholar
Princeton University

Jul 2012-Jul 2013

Education

University of Wisconsin, Madison, Wisconsin USA

Ph.D., Computer Science, May 2012

M.S., Computer Science, May 2008

- Dissertation: “New Approaches for Managing Enterprise Networks”
- Advisor: Aditya Akella

Tufts University, Medford, Massachusetts USA

B.S., Computer Science, May 2004

Honors and Awards

- Best workshop paper, CoNEXT ENCP 2019.
 - Best student paper, EuroSYS 2019.
 - NSF Career, awarded 2018.
 - Google Faculty Award, awarded 2018.
 - Facebook Faculty Award, awarded 2015, 2016.
 - Yahoo FREP (Faculty Research and Engagement Program), awarded 2014, 2015.
 - Yahoo ACE (Academic Career Enhancement), awarded 2014.
 - Best paper, IMC 2010.
 - Top ranked paper (fast tracked to CCR), SIGCOMM WREN 2009.
 - IBM Research fellowship, awarded 2009-2010.
 - IBM Research PhD Assistantship, awarded 2009.
 - IBM Bravo Award, awarded 2009.
 - AOF Fellowship, Univ. of Wisconsin, awarded 2006 and 2011.
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Publications

1. **Zero Downtime Release: Disruption-free Load Balancing of a Multi-Billion User Website.**
Usama Naseer, Luca Niccolini, Udip Pant, Alan Frindell, Ranjeeth Dasineni, and Theophilus Benson
In Proc. of SIGCOMM 2020.
2. **Inspector Gadget: A Framework for Inferring TCP Congestion Control Algorithms and Protocol Configurations.**
Sishuai Gong, Usama Naseer, and Theophilus Benson
In Proc. of TMA 2020.
3. **Building and Testing Modular Programs for Programmable Data Planes.**
Peng Zheng, Theophilus Benson, and Chengchen Hu
Journal on Selected Areas in Communications, 2020.
4. **Verifying and Monitoring IoTs Network Behavior using MUD Profiles.**

- Ayyoob Hamza, Dinesha Ranathunga, Hassan Habibi Gharakheili, Theophilus Benson, Matthew Roughan and Vijay Sivaraman
Transactions of Dependable and Secure Computing, 2020.
5. **P4-InTel: Bridging the Gap between iCF Diagnosis and Functionality.**
Lucas Castanheira, Alberto Schaeffer-Filho, and Theophilus Benson
In Proc. of ENCP 2019.
 6. **Composing SDN Controller Enhancements with Mozart.**
Zhenyu Zhou, and Theophilus Benson
In Proc. of SoCC 2019.
 7. **In-Network Compute: Considered Armed and Dangerous.**
Theophilus Benson
In Proc. of HotOS 2019.
 8. **Efficient and Safe Network Updates with Suffix Causal Consistency.**
Sheng Liu, Theophilus Benson, and Michael Reiter
In Proc. of EUROSYS 2019.
 9. **Verifying and Monitoring IoTs Network Behavior using MUD Profiles.**
Ayyoob Hamza, Dinesha Ranathunga, Hassan Habibi Gharakheili, Theophilus Benson, Matthew Roughan, and Vijay Sivaraman
In Proc. of SoSR 2019.
 10. **P4Visor: Lightweight Virtualization and Composition Primitives for Building and Testing Modular Programs.**
Peng Zheng, Theophilus Benson, and Chengchen Hu
In Proc. of CoNEXT 2018.
 11. **DeepConfig: Automating Data Center Network Topologies Management with Machine Learning.**
Saim Salman, Chris Streiffer, Huan Chen, Theophilus Benson, and Asim Kadav
In Proc. of NetAI 2018.
 12. **MP-HULA: Multipath Congestion Aware Load-Balancing using Programmable Data Planes.**
Cristian Hernandez, Andreas J. Kassler, Theophilus A. Benson, and Gergely Pongrácz
In Proc. of NetCompute 2018.
 13. **InspectorGadget: Inferring Network Protocol Configuration for Web Services.**
Usama Naseer and Theophilus Benson
In Proc. of InternetQoE 2018.
 14. **Hermes: Providing Tight Control over High-Performance SDN Switches.**
Huan Chen and Theophilus Benson
In Proc. of CoNext 2017.
 15. **Sounding the Bell for Improving Internet (of Things) Security.**
Balakrishnan Chandrasekaran and Theophilus Benson
In Proc. of IoT S&P 2017.
 16. **A Call to Arms for Tackling the Unexpected Implications of SDN Controller Enhancements.**
Theophilus Benson
In Proc. of ApNet 2017.
 17. **ConfigTron: Tackling network diversity with heterogenous configurations.**
Usama Naseer and Theophilus Benson
In Proc. of HotCloud 2017.

18. **Dapper: Data Plane Performance Diagnosis of TCP.**
Mojgan Ghasemi, Theophilus Benson and Jennifer Rexford
In Proc. of SoSR 2017.
19. **The Case for Making Tight Control Plane Latency Guarantees in SDN Switches.**
Huan Chen and Theophilus Benson
In Proc. of SoSR 2017.
20. **A First Look at Bugs in OpenStack.**
Washington Garcia and Theophilus Benson
In Proc. of CAN 2016.
21. **A View from the Other Side: Understanding Mobile Phone Characteristics in the Developing World.**
Sohaib Ahmad, Abdul Lateef Haamid, Zafar Ayyub Qazi, Zhenyu Zhou,
Theophilus Benson and Ihsan Ayyub Qazi
In Proc. of IMC 2016.
22. **Performance Characterization of a Commercial Video Streaming Service.**
Mojgan Ghasemi, Partha Kanuparth, Ahmed Mansy, Theophilus Benson and Jennifer Rexford
In Proc. of IMC 2016.
23. **FOCUS: Function Offloading from a Controller to Utilize Switch Power.**
Ji Yang, Zhenyu Zhou, Theophilus Benson and Xiaowei Yang, Xin Wu and Chengchen Hu
In Proc. of NFV-SDN 2016.
24. **SFC-Checker: Checking the Correct Forwarding Behavior of Service Function Chaining.**
Brendan Tschaen, Ying Zhang, Theophilus Benson, Sujata Banerjee, Jeongkeun Lee and Joon-Myung Kang
In Proc. of NFV-SDN 2016.
25. **Picocenter: Supporting long-lived, mostly-idle applications in cloud environments.**
Liang Zhang, James Litton, Frank Cangialosi, Theophilus Benson, Dave Levin and Alan Mislove
In Proc. of EuroSys 2016.
26. **Isolating and Tolerating SDN Application Failures with LegoSDN.**
Balakrishnan Chandrasekaran, Brendan Tschaen and Theophilus Benson
In Proc. of SOSR 2016.
27. **Dynamic Prioritization of Traffic in Home Networks.**
Ilker Nadi Bozkurt, Yilun Zhou and Theophilus Benson
In Proc. of SOSR 2016.
28. **Programming Slick Network Functions.**
Bilal Anwer, Theophilus Benson, Dave Levin, and Nick Feamster
In Proc. of SOSR 2015.
29. **A Universal Approach to Data Center Network Design.**
Aditya Akella, Theophilus Benson, Balakrishnan Chandrasekaran,
Cheng Huang, Bruce Maggs, and David Maltz
In Proc. of International Conference on Distributed Computing and Networks (ICDCN) 2015.
30. **Dynamic Prioritization of Traffic in Home Networks.**
Ilker Nadi Bozkurt, Yilun Zhou and Theophilus Benson
In Proc. CoNEXT Student Workshop 2015.
31. **Destroying Networks for Fun (and Profit).**
Nick Shelly, Brendan Tschaen, Tyco-Kaus, Michael Chang, Theophilus Benson and Laurent Vanbever
In Proc. ACM Workshop on Hot Topics in Networks (HotNets) 2015.

32. **Towards a Safe Playground for HTTPS and Middleboxes with QoS2.**
Zhenyu Zhou and Theophilus Benson
In Proc. of ACM SIGCOMM Workshop on Hot Topics in Middleboxes 2015 (HotMiddleboxes) 2015.
33. **Tolerating SDN Application Failures with LegoSDN.**
Balakrishnan Chandrasekaran, Theophilus Benson
In Proc. ACM Workshop on Hot Topics in Networks (HotNets) 2014
Appeared earlier In Proc. of ACM HotSDN 2014 as a Poster
34. **ProActive Routing in Scalable Data Centers with PARIS**
Durshyant Arora, Theophilus Benson, Jennifer Rexford
In Proc. Workshop on Distributed Cloud Computing (DCC) 2014
35. **Real-time diagnosis of TCP performance in clouds**
Mojgan Ghasemi, Theophilus Benson, Jennifer Rexford
In Proc. CoNEXT Student Workshop 2013
36. **A Slick Control Plane for Network Middleboxes**
Bilal Anwer, Theophilus Benson, Nick Feamster, Dave Levin, Jennifer Rexford
In Proc. of ACM HotSDN 2013 (Poster), and In Proc. of ONS 2013
37. **HotSwap: Correct and Efficient Controller Upgrades for Software-Defined Networks**
Laurent Vanbever, Joshua Reich, Theophilus Benson, Nate Foster and Jennifer Rexford
In Proc. of ACM HotSDN 2013
38. **Challenges in Unifying Control of Middlebox Traversals and Functionality**
Aaron Gember, Theophilus Benson, and Aditya Akella.
In Proc. of LADIS 2012
39. **A First Look at Problems in the Cloud**
Theophilus Benson, Sambit Sahu, Aditya Akella and Anees Shaikh.
In Proc. of USENIX HotCloud 2010.
40. **The Case for Fine-Grained Traffic Engineering in Data Centers**
Theophilus Benson, Ashok Anand, Aditya Akella and Ming Zhang.
In Proc. of USENIX INM/WREN 2009.
41. **The Evolution of Network Configuration: A Tale of Two Campuses**
Hyojoon Kim, Theophilus Benson, Aditya Akella and Nick Feamster.
In Proc. of ACM IMC 2011.
42. **Demystifying Configuration Challenges and Trade-Offs in Network-based ISP Services**
Theophilus Benson, Aditya Akella and Aman Shaikh.
In Proc. of ACM SIGCOMM 2011.
43. **Network Traffic Characteristics of Data Centers in the Wild**
Theophilus Benson, Aditya Akella and David Maltz.
In Proc. of ACM IMC 2010.
44. **Understanding Data Center Traffic Characteristics**
Theophilus Benson, Ashok Anand, Aditya Akella and Ming Zhang.
In Proc. of IMC 2010.
45. **Mining Policies from Enterprise Network Configuration**
Theophilus Benson, Aditya Akella and David Maltz.
In Proc. of ACM IMC 2009.
46. **Unraveling the Complexity of Network Management**
Theophilus Benson, Aditya Akella and David Maltz.
In Proc. of USENIX NSDI 2009.

Posters

1. **ShadowP4: Building and Testing Modular Programs.**
Peng Zheng, Theophilus Benson and Chengchen Hu.
In Proc. of SIGCOMM 2018.
2. **Delorean: Using Time Travel to Avoid Bugs and Failures in SDN Applications.**
Zhenyu Zhou, Theophilus Benson, Marco Canini and Balakrishnan Chandrasekaran.
In Proc. of SoSR 2017.
3. **FOCUS: Function Offloading from a Controller to Utilize Switch Power.**
Ji Yang, Zhenyu Zhou, Theophilus Benson and Xiaowei Yang, Xin Wu and Chengchen Hu
In Proc. of NSDI 2016.
4. **PicoCenter: Supporting long-lived, mostly-idle applications in cloud environments.**
Liang Zhang, Frank Cangialosi, Theophilus Benson, Dave Levin and Alan Mislove.
In Proc. of SoCC 2015.
5. **Towards a Safe Playground for HTTPS and Middleboxes with QoS2.**
Zhenyu Zhou and Theophilus Benson.
In Proc. of NSDI 2015.
6. **CloudSSI: revisiting SSI in cloud era**
Mansoor Alicherry, Ashok Anand, Shoban Preeth Chandrabose and Theophilus Benson.
In Proc. of SoCC 2014.
7. **Harmony: coordinating network, compute, and storage in software-defined clouds.**
Robert Grandl, Yizheng Chen, Junaid Khalid, Suli Yang, Ashok Anand, Theophilus Benson and Aditya Akella.
In Proc. of SoCC 2013.
8. **Phoenix: A system for automatically reconfiguring networks.**
Theophilus Benson, Aditya Akella and David Maltz.
In Proc. of USENIX NSDI 2009.

Grants and Gifts

External Funded Grants:

- **2018-2023** NSF Small Award (IoT Security), co-PI, \$500K.
- **2018-2023** NSF Small Award (Data-driven Performance), PI, \$500K.
- **2018-2023** NSF CAREER Award, PI, \$500K.
- **2018-2019** Google Faculty Award, \$50K.
- **2016-2017** Facebook Faculty Award, \$30K.
- **2015-2016** Facebook Faculty Award, \$30K.
- **2015-2016** Yahoo Faculty Research Proposal, PI, \$29K.
- **2014-2015** Google Cloud Resource Usage Grant, \$10K.
- **2014-2018** NSF Medium, PI, Towards Finer-grained Cloud Computing, \$399,650K.
- **2014-2015** Yahoo Faculty Research Proposal, PI, \$30K.
- **2014** Equipment Gift from Yahoo, estimated \$50K
- **2014** Gift from Facebook, \$25K
- **2014-2015** Yahoo Academic Career Enhancement, \$10K.

Internal Funding and Gifts:

- **2018-2019** Brown Salomon, PI.
- **2014-2017** Duke Bass Connections, PI, “Distance-based, Executive- style Degree Completion Program for Ghanaian Nurse Anesthetists”, interdisciplinary team developing an online distance-based degree completion program for Ghanaian nurse anesthetists without internet connections.

- Service Activities Organizing committee member for:
- **2020:** Steering Committee CoNEXT, Tufts CS External Advisory Board (Diversity and inclusion CoChair), Organizer of NSF Workshop on Programmable Data Planes.
 - **2019:** Technical Program Chair for SIGCOMM Workshop on Networking meets ML/AI (NetAI), Steering Committee CoNEXT, Tufts CS External Advisory Board (Diversity and inclusion CoChair), URM GradCohort Steering Committee
 - **2018:** Technical Program Chair for SIGCOMM Workshop on IoT S&P, Technical Program Chair for CoNEXT, Technical Program Chair for ANCS, Technical Program Chair for HSPR, Travel Grants Chair, Technical Program Chair for SIGCOMM SecSoN Workshop, URM GradCohort Steering Committee.
 - **2017:** Technical Program Chair for CCS Workshop on IoT S&P , SoCC Poster and Demo Co-Chair, SoSR Publicity Chair.
 - **2016:** Co-Editor for IJNM (Special Issue on SDN and NFV for Flexible Management), Co-Editor for IEEE Internet Computing (NFV Special Issue).
 - **2015:** HotMiddleboxes Technical Program Chair, SIGCOMM Publicity Co-Chair, LISA Research Committee, CoNext Student Workshop Co-Chair.
 - **2014:** CoNEXT Travel Grant Co-Chair, LISA Research Committee.
 - **2013:** ITC Publicity Co-Chair.

Program committee member for:

- **2021:** NSDI.
- **2020:** HotCloud, ANRW, APNet, IMC.
- **2019:** SIGCOMM, EUROSYS, APNet, HotNets, CoNEXT, IMC, ACM COMPASS, SoSR Poster/Demo, Workshop on Harnessing the Data Revolution in Networking.
- **2018:** SIGCOMM, SoSR, ICDCS, USENIX ATC, SIGCOMM Workshop on NetCompute, APNet, ACM COMPASS.
- **2017:** SIGCOMM, IMC, HotCloud, SIGCOMM Workshop on HotContainers, ITC (Future Internet Architectures), IEEE Networking, SoCC, SoSR Poster and Demo.
- **2016:** Usenix ATC, CoNext, INFOCOM, SIGCOMM, ANCS, HotMiddleboxes, ICDCS, SoSR, IMC, Richard Tapia Scholarship Committee, CAN.
- **2015:** ANCS, SoSR, Workshop on Cross-Cloud, LISA, ICNP, ONUG Research Track, DCC.
- **2014:** NSF Cloud, IMC, CoNEXT, SOCC, HotCloud, LISA, SIGCOMM Posters/Demos, ANCS, ICWA, INFOCOM Workshop on Cross-Cloud.
- **2013:** IMC, SOCC, HotCloud, NSDI Posters/Demos, RSDA.

Tutorials:

- Configuration, Management and Enablement in a Software Defined Platform.
 - **2014:** IEEE NOMS Tutorial Session.

Duke Campus Involvement:

- **2014-Present:** Student Organization Advisor for *Duke Stop Motion*.

Mentorship Activities:

- **Summer 2015:** StreetCoders @ Facebook.
- **2014-Present:** Semester Faculty Round Tables with Delta Sigma Theta.

Invited Talks	<i>A Data-driven Approach to Speeding Up the Internet.</i>	
	● SUNY Stony Brook, Long Island, NYC.	Feb 2020
	● Tufts University, Medford, MA.	Oct 2019
	● ETH-Zurich, Zurich, Switzerland.	May 2019
	● Università della Svizzera italiana, Lugano, Italy.	May 2019
	● Brazilian Symposium on Computer Networks and Distributed Systems, Gramado, Brazil.	May 2019

<i>Systematic Approach to Managing Software Defined Networks.</i>		
• MPI, Saarbrücken, Germany.		May 2019
• TU-Darmstadt, Darmstadt, Germany.		May 2019
<i>A case for Management Abstractions for Programmable Data Planes.</i>		
• BigSwitch, Santa Clara, CA.		Jul 2018
• Huawei Data Center Summit, Madison, WI.		Jul 2018
• Huawei Resiliency Workshop, Santa Clara, WI.		Jun 2018
<i>A Data-driven Approach to Turbo Charging the Internet.</i>		
• InternetQoE, Vienna, Austria.		Jul 2018
• Facebook, Menlo Park, CA.		Jun 2018
• AT&T Research, Bedminster, NJ.		May 2018
<i>Failure as a First Class Entity of SDNs.</i>		
• IBM Research, Bangalore, India.		Jun 2016
• MSR India, Bangalore, India.		Jun 2016
• Huawei Networking Summit, Princeton, NJ.		Dec 2015
• ATT Research.		Dec 2015
• Tufts University.		Dec 2015
• University of North Carolina, Chapel Hill.		Nov 2015
<i>Commoditizing Software Defined Networks.</i>		
• VMWare Labs.		Aug 2015
• HP Labs.		Jul 2015
• ONUG - Research Track		May 2015
<i>Large Scale Systems Research from a Fish Bowl.</i>		
• Keynote ICNP Phd Forum.		Oct 2014
<i>Managing Software Defined Networks.</i>		
• IBM Research.		Jun 2014
• NEC Labs.		Jun 2014
<i>Slick: A control plane for network middleboxes.</i>		
• Raytheon BBN.		Jul 2013
<i>Demystifying and Controlling the Performance of Data Center Networks.</i>		
• CAARMS 20 (Princeton, NJ).		Jun 2014
• Yahoo! Performance Summit.		Feb 2014
• DIMACS Workshop on Algorithms for Green Data Storage.		Dec 2013
• Facebook (Hosted by Guohui Wang).		Aug 2013
• CloudTech3.		Oct 2012
• University of California, Berkeley (AMPLab Seminar).		Apr 2011
<i>Peeking into the Cloud.</i>		
• Clouds10 Workshop.		Nov 2010
Classes Taught	<ul style="list-style-type: none"> • CSCI01380: Computer Distributed Systems. • CSCI2952-F: Practical Distributed Systems at Scale. • CSCI2952-E: Topics in Network Management: Data-driven and Programmable Networks. 	<ul style="list-style-type: none"> Spr 2018-2020 Spr/Fall 2020 Spr/Fall 2018

- CPS 512/ECE 514: Computer Networks and Distributed Systems: Advanced Networking. Fall 2015
- CPS 356: Computer Network Architecture. Spr 2015
- CPS 590-04: Software Defined-Networking. Fall 2014
- CPS 512/ECE 514: Computer Networks and Distributed Systems: Advanced Networking. Spr 2014
- CPS 590-04: Rethinking Networking Paradigms for Cloud Computing and Big Data Analytics: Infrastructure for Big Data. Fall 2013

Professional
Experience

- Facebook**, Menlo Park, California USA
Web Performance Consultant; Summer **2015**
- Yahoo Research**, Sunnyvale, California USA
Data Center Performance Consultant **2014-2017**
- AT&T Research; Visiting Researcher**, Florham Park, New Jersey USA
Researcher; Spring Intern **2011**
- Microsoft Research**, Redmond, Washington USA
Researcher; Summer Intern **2008**
- IBM Research**, Hawthorne, New York USA
Researcher; Summer Intern **2007–2009**