

TRISHA BISWAS

Senior Software Engineer
Fastly, Inc.
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Research Interests

My research interests are in network protocol design, modeling multihop networks, named data networks and developing techniques that enhance the security of networks. My PhD thesis was in designing redundancy-based approaches for wireless multihop networks. In the past, I have worked in the area of software defined networking. My current work involves designing optimizations for large scalable Clos networks used in datacenters and edge cloud networks.

Education

North Carolina State University, Raleigh NC, USA May '11 - May '14
PhD in Computer Science - Computer Networking
Thesis: *Redundancy-based Approaches in Wireless Multihop Network Design*

North Carolina State University, Raleigh NC, USA Aug '08 - May '11
Master of Science in Computer Science

West Bengal University of Technology, India Aug '04 - May '08
Bachelor of Technology in Computer Science

Industry Experience

Senior Software Engineer, Fastly, Inc. April '20 - Present

- Research and development of BIRD Internet Routing Daemon used in Fastly switches and cache servers
- Design features for Border Gateway Protocol (BGP) to improve the routing performance of Fastly's network
- Develop heuristics to reduce routing convergence times after network outages
- Language/Tools used: C, Python

Software Engineer II, Amazon Web Services July '16 - April '20

- Development of the networking stack of Almach OS, the operating system used in AWS Datacenter routers
- Heuristics to improve the performance of BGP and OSPF routing protocols used in hierarchical Clos networks
- Periodic on-call support to diagnose ongoing networking issues at global AWS network and availability zones
- Language/Tools used: C, Python, IXIA

Software Defined Engineer, Aruba Networks June '14 - July '16

- Design and develop code for a Software Defined Network (SDN) controller implementation
- Develop functionality to set/overwrite action flag in an SDN flow entry
- Language/Tools used: C, XML, MongoDB

Intern, Futurewei Research Center May '12 - Aug '12

- Worked in a team to design a policy-based routing protocol for content centric networks (CCN) as an application of named data networks (NDN)
- Implemented neighbor discovery protocol over CCN framework (CCNx)
- Conducted survey on IPv6 networks versus CCN for home networking
- Language/Tools used: C, Virtual Box, Linux shell scripts

Intern, Extreme Networks May '10 - Aug '10

- Developed command line interface (CLI) for custom banner of a router
- Enhanced CLI commands related to Multiprotocol Label Switching
- Languages used: C, Tcl/Tk

Research **Research Assistant, North Carolina State University** Aug '10 - May '14

Designed a multipath routing protocol called Petal Routing, for ad hoc networks to increase end-to-end reliability while reducing wireless transmissions. Tests were carried out with OPNET simulations. Built an analytical model to predict reliability of transmissions and compared results of model with simulation. Studied latency and stability of closed-loop sensing-based security systems with the aid of hybrid control theory.

Teaching **Instructor, North Carolina State University** May '11 - Aug '11

Instructor for CSC116 - "Introduction to Computing - Java". Designed course material, schedule, assignments, projects and delivered lectures for the 10-week summer session.

Teaching Assistant, North Carolina State University Aug '08 - May '10

Held weekly office hours, graded assignments and projects, designed projects and taught lectures.

Developer Skills

Languages: Python, Java, C, C++, C#, Proto-C, nesC, Tcl/Tk, Perl
 Simulation Tools: IXIA, OPNET, Omnet++, ns-2, R, Matlab, C-PLEX
 Platforms: Linux, Android, TinyOS, Embedded systems

Professional Activities & Services

- Mentored graduate students at Gracehopper Celebration for Women in Computing (October 2017)
- Paper reviews conducted:
 - IEEE Transactions on Network & Service Management (Apr 2020, May 2020)
 - IEEE Transactions on Communications (Nov 2019)
 - Photonic Network Communications, Springer Journals (Apr 2015, Feb 2014, July 2013)
 - International Conference on Contemporary Computing, India (April 2009)
- Taught one week long summer camp on Game Design for middle school girls. Developed materials based on GameMaker software (July 2013)
- Volunteer / conference organizing: Volunteered at ACM SIGCSE 2012; Assisted with organization of STARS Celebration 2011; Helped with PhD recruiting, Department of Computer Science, NCSU (March 2012)

Professional Memberships Senior Member, Institute of Electrical and Electronics Engineers (IEEE)

Patents Ravindran, R.; Wang, G.; Zhang, X.; Chakraborti, A.; Biswas, T., "**Method and Apparatus for Policy Based Routing in Information Centric Networking Based Home Networks**", *United States US9769034B2*, Publication date September 2017

Select Publications

Biswas, T.; Dutta, R., “**Reliability Prediction of Diffused Pathset Routing in Wireless Multihop Networks**,” In *Proceedings of IEEE Global Communications Conference (GLOBECOM 2014)*, IEEE, December 2014

Biswas, T.; Lesser, K.; Dutta, R.; Oishi, M., “**Using Linear System Reliability to Obtain Theoretical Understanding of Wireless Routing**,” In *Proceedings of IEEE Global Communications Conference (GLOBECOM 2014)*, IEEE, December 2014

Biswas, T.; Lesser, K.; Dutta, R.; Oishi, M., “**Examining reliability of wireless multihop network routing with linear systems**”, In *Proceedings of the 2014 Symposium and Bootcamp on the Science of Security*, ACM, Article No. 19, April 2014

Biswas, T.; Chakraborti, A.; Ravindran, R.; Zhang, X.; Wang, G., “**Contextualized Information-Centric Home Network**,” In *Proceedings of the ACM SIGCOMM Conference (SIGCOMM 2013)*, ACM, pp. 461-462, Hong Kong, 12-15 August 2013, doi: 10.1145/2486001.2491691

Ravindran, R.; Biswas, T.; Zhang, X.; Chakraborti, A.; Wang, G., “**Information-centric Networking based Homenet**,” In *Proceedings of Integrated Network Management (IM 2013)*, IFIP/IEEE International Symposium on, vol., no., pp.1102-1108, Ghent, Belgium, 27-31 May 2013

Biswas, T.; Dutta, R., “**Spatially Diffuse Pathsets for Robust Routing in Ad Hoc Networks**,” In *Proceedings of the IEEE Global Telecommunications Conference (GLOBECOM 2011)*, IEEE, vol., no., pp.1-6, Houston TX, USA, 5-9 Dec. 2011, doi: 10.1109/GLOCOM.2011.6133499

Patel, U.; Biswas, T.; Dutta, R., “**A Routing Approach to Jamming Mitigation in Wireless Multihop Networks**,” In *Proceedings of the IEEE Local & Metropolitan Area Networks (LANMAN 2011)*, 18th IEEE Workshop on, vol., no., pp.1-6, Chapell Hill NC, USA, 13-14 Oct. 2011, doi: 10.1109/LANMAN.2011.6076932

Dissertation

Biswas, T., “**Redundancy-based Approaches in Wireless Multihop Network Design**”, *PhD Dissertation*, North Carolina State University, May 2014

Research Talks

- “Scalable Networks: how can we serve over seven billion people?”, Gracehopper Celebration of Women in Computing, October 2017
- “Scalable Networks: how can we serve over seven billion people?”, Anita Borg Institute, ABI.local, Seattle November 2017
- “Studying Closed-loop Security Systems using Hybrid Control Theory”, Science of Security Lablet Industry Meet, NCSU, March 2013
- “Introduction to Programming with Android Phones”, Conducted workshop at STARS Celebration 2012, Hampton VA, August 2012
- “Reliable Routing in Wireless Multihop Networks”, Indian Institute of Technology, Kharagpur, India, January 2012
- “Robust Routing in Ad Hoc Networks”, Gracehopper Celebration of Women in Computing India 2011, Bangalore, India, December 2011
- “Introduction to Typesetting using L^AT_EX”, Conducted workshop at STARS Celebration 2011, Raleigh NC, August 2011