

# TRISHA BISWAS

Senior Software Engineer  
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## Summary

Networking researcher with a Ph.D. in Computer Science and 9+ years of industry experience in routing protocol design, resilient Clos architectures, traffic engineering for edge cloud and wireless multihop networks. Specializing in developing scalable and efficient solutions for globally distributed systems, cloud network infrastructure and software-defined networking. Open source contributions to routing projects such as BIRD Internet Routing Daemon and FRRouting.

## Experience

- Senior Software Engineer, Fastly, Inc.** April '20 - Present
- Research and development of BIRD Internet Routing Daemon used in Fastly's routers and cache fleet worldwide
  - Design optimizations for the Border Gateway Protocol (BGP) in BIRD
  - Implement overlay for egress traffic engineering from Fastly PoPs
  - Develop an active network measurement platform to store and visualize global network data
  - Language/Tools used: C, Go, Python, Docker, ClickHouse
- Software Engineer II, Amazon Web Services** July '16 - April '20
- Develop the FRRouting networking stack used in the Almach OS operating system in AWS Datacenter routers
  - Heuristics to improve the performance of BGP and OSPF routing protocols to reduce convergence times after network outages
  - Periodic on-call support to diagnose ongoing networking issues at global AWS network and availability zones
  - Language/Tools used: C, Python, IXIA, Splunk
- Software Defined Engineer, Aruba Networks, HPE** June '14 - July '16
- Design and develop a Software Defined Networking (SDN) controller
  - Develop functionality to set/overwrite action flag in an SDN flow entry
  - Language/Tools used: C, XML, OpenFlow
- Intern, Futurewei Research Center** May '12 - Aug '12
- Design a policy-based routing protocol for content centric networks (CCN) as an application of named data networks (NDN)
  - Implement neighbor discovery protocol over CCN framework (CCNx)
  - Conduct 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
- Develop command line interface (CLI) for custom banner of a router
  - Enhance CLI commands related to Multiprotocol Label Switching (MPLS)
  - Languages used: C, Tcl/Tk

**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

**Skills**

Languages: C, C++, Go, Python, Java, Proto-C, nesC, R, Matlab  
 Protocols: BGP, OSPF, TCP/IP, DNS  
 Tools: Docker, K8s, IXIA, OPNET, Omnet++, ns-2  
 Platforms: Linux, Android, TinyOS, Embedded systems  
 Data: ClickHouse, Splunk, BigQuery

**Research**

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

Designed a multipath routing protocol called Petal Routing, for multihop ad hoc networks aimed at increasing 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.  
*Courses TA-ed:*

- Programming Concepts - Java (Spring 2010)
- Computer Networks (Fall 2009)
- Computer and Network Security (Spring 2009)
- Operating Systems and Principles (Fall 2008)

**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

**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, Chapel 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

**Open-source Contributions**

- Zajiček, O.; Biswas, T., “**Filter: Add support for setting TCP congestion control algorithm**”, *BIRD Internet Routing Daemon*, GitLab repository, February 2024
- Biswas, T., “**BGP: Add allow bgp.med option for EBGP sessions**”, *BIRD Internet Routing Daemon*, GitLab repository, April 2023
- Zajiček, O.; Biswas, T., “**Netlink: Add option to specify netlink socket receive buffer size**”, *BIRD Internet Routing Daemon*, GitLab repository, January 2022
- Biswas, T., “**Filter: Add MPLS label route attribute**”, *BIRD Internet Routing Daemon*, GitLab repository, May 2021

**Invited Talks**

- “Selectively Sharing Multipath Routes in BGP”, USENIX LISA, June 2021
- “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
- “Reliable Routing in Wireless Multihop Networks”, Indian Institute of Technology, Kharagpur, India, January 2012