

# Shihabur Rahman Chowdhury

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## Education

- 05/2012 – Present    📌 **PhD.** David R. Cheriton School of Computer Science, University of Waterloo.  
CGPA: 92.6%
- 11/2004 – 10/2009    📌 **B.Sc. (Honors) in Computer Science & Engineering.** Bangladesh University of Engineering & Technology.  
CGPA: 3.93/4.00 (Ranked 2nd in a class of 125)

## Experience

- 05/2012 – Present    📌 **Research & Teaching Assistant** University of Waterloo
- 06/2018 – 08/2018    📌 **Research Intern.** RESIST, INRIA – Nancy Grand Est, France.
- 05/2014 – 08/2014    📌 **Software Engineering Intern.** Technical Infrastructure, Google, USA
- 05/2013 – 09/2015    📌 **Research Intern.** Services Research, IBM Watson Research Center, USA
- 11/2009 – 04/2012    📌 **Lecturer.** Department of CSE, BUET, Bangladesh.

## Awards and Honors

- 📌 **Best Paper Award**, 15th IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM) 2019, Halifax, Canada.
- 📌 **Best Paper Award**, 5th IEEE Conference on Network Softwarization (NetSoft) 2019, Paris, France.
- 📌 **Best Paper Award**, 13th IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM) 2017, Tokyo, Japan.
- 📌 **Best Paper Runner-up Award**, IEEE ICDCS HotPOST Workshop 2013, Philadelphia, USA.
- 📌 **Runner-up for the Best Paper Award**, IEEE/IFIP Network Operations and Management Symposium (NOMS) 2016, Istanbul, Turkey.
- 📌 **Runner-up for the Best Paper Award**, IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM) 2013, Zurich, Switzerland.
- 📌 **MITACS Globalink Research Award**, MITACS, Canada, 2018.
- 📌 **UW International Experience Award**, University of Waterloo, 2018.
- 📌 **Best Teaching Assistant Award (Winter 2018)**, School of CS, University of Waterloo.
- 📌 **Student Travel Grant**, IEEE NetSoft 2019, IEEE/ACM/IFIP CNSM 2017, IFIP/IEEE IM 2017, IEEE/IFIP NOMS 2016/2014.
- 📌 **Ontario Graduate Scholarship**, University of Waterloo, 2015–2016, 2017–2019.
- 📌 **President's Graduate Scholarship**, University of Waterloo, 2015–2016, 2017–2019.
- 📌 **GoBell Scholarship**, University of Waterloo, 2013-2015.
- 📌 **Graduate Excellence Scholarship**, School of CS, University of Waterloo, 2017-2018.
- 📌 **University Merit Scholarship**, Bangladesh University of Engg. & Technology, 2005 - 2008
- 📌 **Dean's List Award**, Bangladesh University of Engg. & Technology, 2005 - 2009
- 📌 **6th Place**, ACM ICPC Regional Programming Contest (Dhaka site), 2007.
- 📌 **8th Place**, ACM ICPC Regional Programming Contest (Dhaka site), 2006.

## Publications

### Articles in Refereed Journals and Magazines

- 1 **Chowdhury, S. R.**, Anthony, A., Bian, H., Bai, T. & Boutaba, R. (2020). A Disaggregated Packet Processing Architecture for Network Function Virtualization. *IEEE Journal on Selected Areas in Communications*. (To appear). (Impact Factor: 9.30).
- 2 Shahriar, N., Ahmed, R., **Chowdhury, S. R.**, Khan, M. M. A., Boutaba, R., Mitra, J. & Zeng, F. (2020). Virtual Network Embedding with Guaranteed Connectivity under Multiple Substrate Link Failures. *IEEE Transactions on Communications*. (To appear). (Impact Factor: 5.69).
- 3 Bari, M. F., **Chowdhury, S. R.** & Boutaba, R. (2019). ESSO: An Energy Smart Service Function Chain Orchestrator. *IEEE Transactions on Network and Service Management*, 16(4), 1345–1359. (Impact Factor: 4.68).
- 4 **Chowdhury, S. R.**, Salahuddin, M. A., Limam, N. & Boutaba, R. (2019). Re-architecting NFV Ecosystem with Microservices: State-of-the-art and Research Challenges. *IEEE Network*, 33(3), 168–176. (Impact Factor: 7.50).
- 5 **Chowdhury, S. R.**, Ayoubi, S., Ahmed, R., Shahriar, N., Boutaba, R., Mitra, J. & Liu, L. (2018). Multi-Layer Virtual Network Embedding. *IEEE Transactions on Network and Service Management*, 15(3), 1132–1145. (Impact Factor: 4.68).
- 6 Shahriar, N., **Chowdhury, S. R.**, Ahmed, R., Khan, A., Fathi, S., Boutaba, R., Mitra, J. & Liu, L. (2018). Virtual Network Survivability Through Joint Spare Capacity Allocation and Embedding. *IEEE Journal on Selected Areas in Communications*, 36(3), 502–518. (Impact Factor: 9.30).
- 7 Shahriar, N., Ahmed, R., **Chowdhury, S. R.**, Khan, A., Boutaba, R. & Mitra, J. (2017). Generalized recovery from node failure in virtual network embedding. *IEEE Transactions on Network and Service Management*, 14(2), 261–274. (Impact Factor: 4.68).
- 8 Ahmed, R., Bari, M. F., **Chowdhury, S. R.**, Rabbani, M. G., Boutaba, R. & Mathieu, B. (2016).  $\alpha$ Route: Routing on names. *IEEE/ACM Transactions Networking*, 24(5), 3070–3083. (Impact Factor: 3.59).
- 9 Bari, M. F., **Chowdhury, S. R.**, Ahmed, R., Boutaba, R. & Duarte, O. C. M. B. (2016). Orchestrating virtualized network functions. *IEEE Transactions on Network and Service Management*, 13(4), 725–739. (Impact Factor: 4.68).
- 10 **Chowdhury, S. R.**, Ahmed, R., Khan, M. M. A., Shahriar, N., Boutaba, R., Mitra, J. & Zeng, F. (2016b). Dedicated protection for survivable virtual network embedding. *IEEE Transactions on Network and Service Management*, 13(4), 913–926. (Impact Factor: 4.68).
- 11 **Chowdhury, S. R.**, Roy, A. R., Shaikh, M. & Daudjee, K. (2015). A taxonomy of decentralized online social networks. *Peer-to-Peer Networking and Applications*, 8(3), 367–383. (Impact Factor: 2.39).
- 12 **Chowdhury, S. R.**, Hasan, M. M., Iqbal, S. & Rahman, M. S. (2014). Computing a longest common palindromic subsequence. *Fundamenta Informaticae*, 129(4), 329–340.
- 13 Bari, M. F., **Chowdhury, S. R.**, Ahmed, R., Boutaba, R. & Mathieu, B. (2012). A survey of naming and routing in information-centric networks. *IEEE Communications Magazine*, 50(12), 44–53. (Impact Factor: 10.35).

### Articles in Refereed Conference and Workshop Proceedings

- 1 Shahriar, N., Zulfiqar, M., **Chowdhury, S. R.**, Taeb, S., Tornatore, M., Boutaba, R., Mitra, J. & Hemmati, M. (2020). Disruption-minimized re-adaptation of virtual links in elastic optical networks. In *Optical Fiber Communication Conference (OFC), 2020*. Poster.

- 2 Henry, B., **Chowdhury, S. R.**, Lahmadi, A., Azais, R., François, J. & Boutaba, R. (2019). SPONGE: Software-Defined Traffic Engineering to Absorb Influx of Network Traffic. In *IEEE Conference on Local Computer Networks (LCN), 2019 (To Appear)*.
- 3 Shahriar, N., Taeb, S., **Chowdhury, S. R.**, Zulfiqar, M., Tornatore, M., Boutaba, R., Mitra, J. & Hemmati, M. (2019). Reliable Slicing of 5G Transport Networks with Dedicated Protection. In *IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM), 2019 (To appear)*.
- 4 Taeb, S., Shahriar, N., **Chowdhury, S. R.**, Tornatore, M., Boutaba, R., Mitra, J. & Hemmati, M. (2019). Virtual Network Embedding with Path-based Latency Guarantees in Elastic Optical Networks. In *IEEE International Conference on Network Protocols (ICNP), 2019 (To appear)*.
- 5 **Chowdhury, S. R.**, Anthony, A., Bian, H., Bai, T. & Boutaba, R. (2019).  $\mu$ NF: A Disaggregated Packet Processing Architecture. In *IEEE Conference on Network Softwarization (NetSoft), 2019* (pp. 342–350).
- 6 Shahriar, N., Taeb, S., **Chowdhury, S. R.**, Tornatore, M., Boutaba, R., Mitra, J. & Hemmati, M. (2019). Achieving a Fully-Flexible Virtual Network Embedding in Elastic Optical Networks. In *IEEE International Conference on Computer Communications (INFOCOM), 2019* (pp. 1756–1764).
- 7 Anthony, A., **Chowdhury, S. R.**, Bai, T., Boutaba, R. & François, J. (2018). UNiS: A User-space Non-intrusive Workflow-aware Virtual Network Function Scheduler. In *IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM), 2018* (pp. 152–160).
- 8 Ayoubi, S., **Chowdhury, S. R.** & Boutaba, R. (2018). Breaking Service Function Chains with Khaleesi. In *IFIP Networking Conference, 2018* (pp. 64–72).
- 9 **Chowdhury, S. R.**, Ahmed, R., Shahriar, N., Khan, A., Boutaba, R., Mitra, J. & Liu, L. (2017). Revine: Reallocation of virtual network embedding to eliminate substrate bottlenecks. In *IFIP/IEEE Symposium on Integrated Network and Service Management (IM), 2017* (pp. 116–124).
- 10 **Chowdhury, S. R.**, Ayoubi, S., Ahmed, R., Shahriar, N., Boutaba, R., Mitra, J. & Liu, L. (2017). MULE: multi-layer virtual network embedding. In *IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM), 2017* (pp. 1–9).
- 11 Shahriar, N., **Chowdhury, S. R.**, Ahmed, R., Khan, A., Boutaba, R., Mitra, J. & Liu, L. (2017). Joint backup capacity allocation and embedding for survivable virtual networks. In *IFIP Networking Conference, 2017* (pp. 1–9).
- 12 Shahriar, N., **Chowdhury, S. R.**, Ahmed, R., Sharmin, M., Boutaba, R. & Mathieu, B. (2017). Availability in P2P based online social networks. In *International Conference on Networking, Systems and Security, (NSysS), 2017* (pp. 1–9).
- 13 Shahriar, N., Ahmed, R., Khan, A., **Chowdhury, S. R.**, Boutaba, R. & Mitra, J. (2016). ReNoVatE: Recovery from node failure in virtual network embedding. In *IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM), 2016* (pp. 19–27).
- 14 Roy, A. R., **Chowdhury, S. R.**, Bari, M. F., Ahmed, R. & Boutaba, R. (2016). Emulating an infrastructure with EASE. In *IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM) (Mini-conference), 2016* (pp. 167–173).
- 15 Dolberg, L., François, J., **Chowdhury, S. R.**, Ahmed, R., Boutaba, R. & Engel, T. (2016). A generic framework to support application-level flow management in software-defined networks. In *IEEE Conference on Network Softwarization (NetSoft), 2016* (pp. 121–125).
- 16 Shahriar, N., Ahmed, R., **Chowdhury, S. R.**, Khan, M. M. A., Boutaba, R., Mitra, J. & Zeng, F. (2016). Connectivity-aware virtual network embedding. In *IFIP Networking Conference, 2016* (pp. 46–54).

- 17 **Chowdhury, S. R.**, Ahmed, R., Khan, M. M. A., Shahriar, N., Boutaba, R., Mitra, J. & Zeng, F. (2016a). Protecting virtual networks with DRONE. In *IEEE/IFIP Network Operations and Management Symposium (NOMS), 2016* (pp. 78–86).
- 18 Bari, M. F., **Chowdhury, S. R.**, Ahmed, R. & Boutaba, R. (2015a). nf.io: A file system abstraction for NFV orchestration. In *IEEE conference on network function virtualization and software defined networks (NFV-SDN), 2015* (pp. 135–141).
- 19 Bari, M. F., **Chowdhury, S. R.**, Ahmed, R. & Boutaba, R. (2015b). On orchestrating virtual network functions. In *IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM) (Mini-conference), 2015* (pp. 50–56).
- 20 Ahmed, R., **Chowdhury, S. R.**, Pokluda, A., Bari, M. F., Boutaba, R. & Mathieu, B. (2014). pWeb: A personal interface to the world wide web. In *IFIP Networking Conference, 2014* (pp. 1–9).
- 21 **Chowdhury, S. R.**, Adam, C., Wu, F., Rofrano, J. J. & Boutaba, R. (2014). Managing the file system from the kernel. In *IEEE/IFIP Network Operations and Management Symposium (NOMS), 2014* (pp. 1–8).
- 22 **Chowdhury, S. R.**, Bari, M. F., Ahmed, R. & Boutaba, R. (2014). PayLess: A low cost network monitoring framework for software defined networks. In *IEEE/IFIP Network Operations and Management Symposium (NOMS), 2014* (pp. 1–9).
- 23 Ahmed, R., Bari, M. F., **Chowdhury, S. R.**, Rabbani, M. G., Boutaba, R. & Mathieu, B. (2013).  $\alpha$ route: A name based routing scheme for information centric networks. In *IEEE International Conference on Computer Communications (INFOCOM) (Mini-Conference), 2013* (pp. 90–94).
- 24 Bari, M. F., **Chowdhury, S. R.**, Ahmed, R. & Boutaba, R. (2013). Policycop: An autonomic qos policy enforcement framework for software defined networks. In *IEEE SDN for future networks and services (SDN4FNS), 2013* (pp. 1–7).
- 25 Bari, M. F., Roy, A. R., **Chowdhury, S. R.**, Zhang, Q., Zhani, M. F., Ahmed, R. & Boutaba, R. (2013). Dynamic controller provisioning in software defined networks. In *IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM), 2013* (pp. 18–25).
- 26 Shahriar, N., **Chowdhury, S. R.**, Sharmin, M., Ahmed, R., Boutaba, R. & Mathieu, B. (2013). Ensuring beta-availability in P2P social networks. In *IEEE ICDCS Workshop on Hot Topics in Peer-to-Peer Networking and Online Social Networks (HotPOST), 2013* (pp. 150–155).
- 27 **Chowdhury, S. R.**, Hasan, M. M., Iqbal, S. & Rahman, M. S. (2012). Computing a longest common palindromic subsequence. In *Int. Workshop on Combinatorial Alg. (IWOCA), 2012* (pp. 219–223).
- 28 Iqbal, S., **Chowdhury, S. R.**, Hyder, C. S., Vasilakos, A. V. & Wang, C. (2009). Vehicular communication: Protocol design, testbed implementation and performance analysis. In *ACM IWCMC Workshop on Vehicular Communication Technologies (VehiCom), 2009* (pp. 410–415).

## Book Chapters

- 1 Dolberg, L., François, J., **Chowdhury, S. R.**, Ahmed, R., Boutaba, R. & Engel, T. (2015). Network configuration and flow scheduling for big data applications. In S. Yu, X. Lin, J. Misic & X. Shen (Eds.), *Networking for big data* (Chap. 7, pp. 121–138). USA: CRC Press.

## Patents

- 1 Shahriar, N., **Chowdhury, S. R.**, Boutaba, R., Mitra, J. & Hemmati, M. (2019). Method and system for latency-aware embedding of a virtual network onto a substrate optical network. US Patent Application No. 16/600,103, Filed October 2019.

- 2 Shahriar, N., **Chowdhury, S. R.**, Boutaba, R., Taeb, S., Mitra, J. & Hemmati, M. (2019). Method and system for reliability-aware embedding of a virtual network onto an elastic optical network. US Patent Application No. 16/657,635, Filed October 2019.
- 3 Ahmed, R., Mitra, J., **Chowdhury, S. R.**, Shahriar, N. & Boutaba, R. (2019). Dedicated protection for virtual network embedding. US Patent No. 10,313,195, Granted June 2019.
- 4 Ahmed, R., Mitra, J., **Chowdhury, S. R.**, Shahriar, N. & Boutaba, R. (2017). Connectivity-aware virtual network embedding. US Patent No. 9,813,287, Granted November 2017.
- 5 **Chowdhury, S. R.**, Ahmed, R., Mitra, J., Shahriar, N., Boutaba, R. & Ayoubi, S. (2017). Multi-layer virtual network embedding. US Patent Application No. 15/815,871, Filed November 2017.
- 6 Shahriar, N., Khan, A., Ahmed, R., Mitra, J., **Chowdhury, S. R.** & Boutaba, R. (2017). System and method for joint embedding and backup provisioning in virtual networks. US Patent Application No. 15/650,354. Filed: July 2017.
- 7 Shahriar, N., Mitra, J., Ahmed, R., **Chowdhury, S. R.** & Boutaba, R. (2016). Methods and systems for failure recovery in a virtual network environment. US Patent Application No. 15/267,696, Filed September 2016.

## Talks

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- SPONGE: Software-Defined Traffic Engineering to Absorb Influx of Network Traffic. *IEEE LCN, 2019, Osnabrück, Germany.*
- $\mu$ NF: A Disaggregated Packet Processing Architecture. *IEEE NetSoft, 2019, Paris, France.*
- Breaking Service Function Chains with Khaleesi. *IFIP Networking, 2018, Zurich, Switzerland.*
- MULE: Multi-Layer Virtual Network Embedding. *IEEE/ACM/IFIP CNSM, 2017, Tokyo, Japan.*
- Joint Backup Capacity Allocation and Embedding for Survivable Virtual Networks. *IFIP Networking, 2017, Stockholm, Sweden.*
- ReViNE: Reallocation of Virtual Network Embedding to Eliminate Substrate Bottlenecks. *IFIP/IEEE IM, 2017, Lisbon, Portugal.*
- Emulating an Infrastructure with EASE. *IEEE/ACM/IFIP CNSM Mini-conference, 2016, Montreal, QC, Canada.*
- Management and Orchestration of Service Function Chains in NFV. *BUET ACM Chapter Talk Series, 2015, Dhaka, Bangladesh (invited).*
- nf.io: A File System Abstraction for NFV Orchestration. *IEEE NFV-SDN Conference 2015, San Francisco, CA, USA.*
- PayLess: A Low Cost Network Monitoring Framework for Software Defined Networks. *IEEE/IFIP NOMS 2014, Krakow, Poland.*
- Managing the Filesystem from the Kernel. *IEEE/IFIP NOMS 2014, Krakow, Poland.*
- Towards Autonomic Management of File Systems. *Services Research Seminar Series, IBM T.J. Watson Research Center, Yorktown Heights, NY, USA.*
- Ensuring  $\beta$ -availability in P2P Social Networks. *IEEE ICDCS HotPOST 2013 workshop, Philadelphia, PA, USA.*
- $\alpha$ Route: A Name Based Routing Scheme for Information Centric Networks. *ICN Workshop, Orange Labs, France. June 2013.*
- $\alpha$ Route: A Name Based Routing Scheme for Information Centric Networks. *IEEE INFOCOM Mini-conference 2013, Turin, Italy.*

## Professional Activities

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- **Project Review:** FONDECYT-CHILE – National Fund for Scientific and Technological Development (Chile)
- **Technical Program Committee Member:** IEEE/IFIP NOMS 2020, IEEE NetSoft (2020, 2019)
- **Journal Review:** IEEE Journal on Selected Areas in Communications, IEEE/ACM Transactions on Networking, ACM Computing Surveys, IEEE Transactions on Parallel and Distributed Systems, IEEE Transactions on Network and Service Management, IEEE Transactions on Communications, IEEE Transactions on Cloud Computing, IEEE Communications Magazine, IEEE Network, IEEE Communication Letters, IEEE Access, Elsevier Computer Networks, Elsevier Computer Communications, Springer Journal of Network and Systems Management
- **Conference Review:** IEEE ICDCS (2016, 2019), IFIP Networking (2014, 2015, 2018, 2019), IEEE/ACM/IFIP CNSM (2015, 2017), IEEE NetSoft 2018, IEEE/IFIP IM (2017, 2019), IEEE ICC 2017, IEEE/IFIP NOMS (2014, 2016, 2018), IEEE NFV-SDN (2016, 2017), IEEE CloudNet 2017, IEEE SDN4FNS 2013, IEEE CCGrid 2014, IEEE WCNC 2018, IEEE ISNCC 2018, WALCOM 2011.