Shihabur Rahman Chowdhury

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Education

PhD (Computer Science), University of Waterloo, Canada
- Dissertation: Resource Management in Softwarized Networks. **CGPA**: **92.6%** — Sep'13 – Feb'21

MMath (Computer Science), University of Waterloo, Canada
- Fast-tracked to the PhD (Computer Science) program in Fall'13. — May'12 – Aug'13

B.Sc. Engg. (Hons), Bangladesh University of Engg. & Technology
- Major: Computer Science & Engg. **CGPA**: **3.93/4.00** (Ranked **2nd** in a class of **125**) — Dec'04 – Oct'09

Employment

- **Staff Researcher**, Distributed Sched. & Data Engine Lab, Huawei Research Canada — Feb'21 – present
- **Graduate Research Assistant**, University of Waterloo, Canada — May'12 – Feb'21
- **Summer Research Intern**, RESIST, INRIA – Nancy Grand Est, France — Jun'18 – Aug'18
- **Software Engineering Intern**, Technical Infrastructure, Google, USA — May'14 – Aug'14
- **Summer Research Intern**, Services Research, IBM Research, USA — May'13 – Sep'13
- **Lecturer**, Dept. of CSE, Bangladesh University of Engineering & Technology — Nov'09 – Apr'12

Awards and Honors

Best Paper Awards and Nominations
- **Best Paper Award**, IEEE/ACM/IFIP CNSM 2019.
- **Best Paper Award**, IEEE NetSoft 2019.
- **Best Paper Award**, IEEE/ACM/IFIP CNSM 2017.
- **Best Paper Runner-up Award**, IEEE ICDCS HotPOST Workshop 2013.
- **Runner-up for the Best Paper Award**. IEEE/ACM/IFIP CNSM 2016.
- **Runner-up for the Best Paper Award**. IEEE/IFIP NOMS 2016.
- **Runner-up for the Best Paper Award**. IEEE/ACM/IFIP CNSM 2013.

Scholarships and Grants during Graduate Studies
- **Ontario Graduate Scholarship**, University of Waterloo, 2015–2016, 2017–2020.
- **President's Graduate Scholarship**, University of Waterloo, 2015–2016, 2017–2020.
- **Ross & Muriel Cheriton Graduate Scholarship**, University of Waterloo, 2017–2018.
- **QNX Graduate Scholarship**, University of Waterloo, 2018–2019.
- **Graduate Excellence Scholarship in Computer Science**, University of Waterloo, 2016-2017.
- **GoBell Scholarship**, University of Waterloo, 2013-2015.
- **MITACS Globalink Research Award**, MITACS, Canada, 2018.
- **University of Waterloo International Experience Award**, University of Waterloo, 2018.
- **IEEE ComSoc Student Travel Grants**: IEEE NetSoft 2019, IEEE/ACM CNSM 2017, IFIP/IEEE IM 2017, and IEEE/IFIP NOMS (2016, 2014).

Service Awards
- **IEEE Transactions Outstanding Reviewer Award 2020**.
- **Winter 2018 Best TA Award**, David R. Cheriton School of Computer Science, University of Waterloo.

Awards during Undergraduate Studies
- **Dean's List Award**, Bangladesh University of Engineering & Technology, 2005 - 2009
- **University Merit Scholarship**, Bangladesh University of Engg. & Technology, 2005 - 2008
- **6th Place**, ACM ICPC Regional Programming Contest (Dhaka site), 2007.
- **8th Place**, ACM ICPC Regional Programming Contest (Dhaka site), 2006.

Publications and Patents

Book Chapter(s)

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.

Articles in Refereed Journals and Magazines

1 Shahriar, N., Zulfiqar, M., **Chowdhury**, **S. R.**, Taeb, S., Tornatore, M., Boutaba, R., Mitra, J., & Hemmati, M. (2021). Disruption Minimized Bandwidth Scaling in EON-enabled Transport Network Slices. *IEEE Journal on Selected Areas in Communications (To appear)*. (IF: 11.42).

2 Laraba, A., François, J., **Chowdhury**, **S. R.**, Chrisment, I., & Boutaba, R. (2021). Mitigating TCP Protocol Misuse with Programmable Data Planes. *IEEE Transactions on Network and Service Management*, *18*(1), 760–774. (IF: 3.878).

3 Anthony, A., **Chowdhury**, **S. R.**, Bai, T., Boutaba, R., & François, J. (2020). Non-intrusive and Workflow-aware Virtual Network Function Scheduling in User-space. *IEEE Transactions on Cloud Computing (To appear)*. (IF: 4.714).

4 **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*, *38*(6), 1075–1088. (IF: 11.42).

5 Shahriar, N., Taeb, S., **Chowdhury**, **S. R.**, Zulfiqar, M., Tornatore, M., Boutaba, R., Mitra, J., & Hemmati, M. (2020). Reliable Slicing of 5G Transport Networks with Bandwidth Squeezing and Multi-path Provisioning. *IEEE Transactions on Network and Service Management*, *17*(3), 1418–1431. (IF: 3.878).

6 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*, *68*(2), 1025–1043. (IF: 5.646).

7 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. (IF: 3.878).

8 **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. (IF: 8.80).

9 **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. (IF: 3.878).

10 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. (IF: 11.42).

11 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. (IF: 3.878).

12 Ahmed, R., Bari, M. F., **Chowdhury**, **S. R.**, Rabbani, M. G., Boutaba, R., & Mathieu, B. (2016). αRoute: Routing on names. *IEEE/ACM Transactions Networking*, *24*(5), 3070–3083. (IF: 3.31).

13 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. (IF: 3.878).

14 **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. (IF: 3.878).

15 **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. (IF: 2.79).

16 **Chowdhury**, **S. R.**, Hasan, M. M., Iqbal, S., & Rahman, M. S. (2014). Computing a longest common palindromic subsequence. *Fundamenta Informaticae*, *129*(4), 329–340.

17 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. (IF: 11.05).

Articles in Refereed Conference and Workshop Proceedings

1. **Chowdhury**, **S. R.**, Boutaba, R., & François, J. (2021). LINT: Accuracy-adaptive and Lightweight In-band Network Telemetry. In *IFIP/IEEE International Symposium on Integrated Network Management (IM) 2021*.

2. Laraba, A., François, J., Chrisment, I., **Chowdhury**, **S. R.**, & Boutaba, R. (2020). Defeating Protocol Abuse with P4: an Application to Explicit Congestion Notification. In *IFIP Networking 2020*. (Acc. Rate: 27.5%).

3. 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*. (Acc. Rate: 28.9%).

4. 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*. **Best Paper Award**. (Acc. Rate: 16.5%).

5. 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*. (Acc. Rate: 19.3%).

6. **Chowdhury**, **S. R.**, Anthony, A., Bian, H., Bai, T., & Boutaba, R. (2019). μNF: A Disaggregated Packet Processing Architecture. In *IEEE International Conference on Network Softwarization (NetSoft) 2019*. **Best Paper Award**. (Acc. Rate: 24.7%).

7. 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 Conference on Computer Communications (INFOCOM) 2019*. (Acc. Rate: 19.6%).

8. Anthony, A., **Chowdhury**, **S. R.**, Bai, T., Boutaba, R., & François, J. (2018). UN*i*S: A User-space Non-intrusive Workflow-aware Virtual Network Function Scheduler. In *IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM) 2018*. (Acc. Rate: 15.9%).

9. Ayoubi, S., **Chowdhury**, **S. R.**, & Boutaba, R. (2018). Breaking Service Function Chains with Khaleesi. In *IFIP networking 2018*. (Acc. Rate: 24.4%).

10. **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 International Symposium on Integrated Network and Service Management (IM) 2017*. (Acc. Rate: 28.6%).

11. **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*. **Best Paper Award**. (Acc. Rate: 17.6%).

12. 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 2017*. (Acc. Rate: 28.6%).

13. 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 2017*.

14. 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 International Conference on Network Softwarization (NetSoft), 2016* (pp. 121–125).

15. 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*. (Acc. Rate: 15.5%).

16. Roy, A. R., **Chowdhury**, **S. R.**, Bari, M. F., Ahmed, R., & Boutaba, R. (2016). Emulating an infrastructure with EASE. In *IEEE/ACM/IFIP CNSM Mini Conference 2016*.

17. 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 2016*. (Acc. Rate: 29%).

(18) **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*. (Acc. Rate: 25.3%).

(19) Bari, M. F., **Chowdhury**, **S. R.**, Ahmed, R., & Boutaba, R. (2015a). nf.io: A file system abstraction for NFV orchestration. In *IEEE NFV-SDN Conference 2015*.

(20) Bari, M. F., **Chowdhury**, **S. R.**, Ahmed, R., & Boutaba, R. (2015b). On orchestrating virtual network functions. In *IEEE/ACM/IFIP CNSM Mini Conference 2015*.

(21) 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 2014*. (Acc. Rate: 25%).

(22) **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*. (Acc. Rate: 28.9%).

(23) **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*. (Acc. Rate: 28.9%).

(24) Ahmed, R., Bari, M. F., **Chowdhury**, **S. R.**, Rabbani, M. G., Boutaba, R., & Mathieu, B. (2013). αRoute: A name based routing scheme for information centric networks. In *IEEE INFOCOM Mini Conference 2013*.

(25) Bari, M. F., **Chowdhury**, **S. R.**, Ahmed, R., & Boutaba, R. (2013). PolicyCop: An autonomic QoS policy enforcement framework for software defined networks. In *IEEE SDN4FNS conference 2013*.

(26) 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*. (Acc. Rate: 18.1%).

(27) Shahriar, N., **Chowdhury**, **S. R.**, Sharmin, M., Ahmed, R., Boutaba, R., & Mathieu, B. (2013). Ensuring β-availability in P2P social networks. In *IEEE ICDCS HotPOST Workshop 2013*. **Best Paper Runner-up**.

(28) **Chowdhury**, **S. R.**, Hasan, M. M., Iqbal, S., & Rahman, M. S. (2012). Computing a longest common palindromic subsequence. In *International Workshop on Combinatorial Algorithms (IWOCA) 2012*.

(29) 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 VehiCom Workshop*.

Patents Issued

(1) Shahriar, N., **Chowdhury**, **S. R.**, Boutaba, R., Taeb, S., Mitra, J., & Hemmati, M. (2020). *Method and system for reliability-aware embedding of a virtual network onto an elastic optical network*. U.S. Patent No. 10,841,183. Issued November 17, 2020.

(2) Shahriar, N., Mitra, J., Ahmed, R., **Chowdhury**, **S. R.**, & Boutaba, R. (2019). *Methods and systems for failure recovery in a virtual network environment*. U.S. Patent No. 10,505,840. Issued December 10, 2019.

(3) Ahmed, R., Mitra, J., **Chowdhury**, **S. R.**, Shahriar, N., & Boutaba, R. (2019). *Dedicated protection for virtual network embedding*. U.S. Patent No. 10,313,195. Issued June 04, 2019.

(4) Ahmed, R., Mitra, J., **Chowdhury**, **S. R.**, Shahriar, N., & Boutaba, R. (2017). *Connectivity-aware virtual network embedding*. U.S. Patent No. 9,813,287. Issued November 07, 2017.

(5) 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*. U.S. Patent No. 10,873,502. Issued December 22, 2020.

Patent Applications

(1) Shahriar, N., **Chowdhury**, **S. R.**, Boutaba, R., Zulfiqar, M., Mitra, J., & Hemmati, M. (2020). *System and method for elastic optical networks*. U.S. Patent Application No. 16/813,679. Filed March 09, 2020.

(2) 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*. U.S. Patent Application No. 16/600,103. Filed October 18, 2019.

3 **Chowdhury**, **S. R.**, Ahmed, R., Mitra, J., Shahriar, N., Boutaba, R., & Ayoubi, S. (2017). *Multi-layer virtual network embedding*. U.S. Patent Application No. 15/815,871. Filed November 17, 2017.

Demos and Posters

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. IEEE/OSA Optical Fiber Communication Conference (Poster) 2020.

2 Bari, M. F., **Chowdhury**, **S. R.**, Ahmed, R., & Boutaba, R. (2016). nf.io: A file system abstraction for NFV orchestration. NSERC SAVI-Annual General Meeting (Poster & Demo), University of Toronto.

3 Bari, M. F., **Chowdhury**, **S. R.**, Ahmed, R., & Boutaba, R. (2015c). nf.io: A file system abstraction for NFV orchestration. ACM SIGCOMM (Demo), 2015.

Talks

- SPONGE: Software-Defined Traffic Engineering to Absorb Influx of Network Traffic. *IEEE LCN 2019*.
- μNF: A Disaggregated Packet Processing Architecture. *IEEE NetSoft 2019*.
- Breaking Service Function Chains with Khaleesi. *IFIP Networking 2018*.
- MULE: Multi-Layer Virtual Network Embedding. *IEEE/ACM/IFIP CNSM 2017*.
- Joint Backup Capacity Allocation and Embedding for Survivable VNE. *IFIP Networking 2017*.
- ReViNE: Reallocation of VNE to Eliminate Substrate Bottlenecks. *IFIP/IEEE IM 2017*.
- Emulating an Infrastructure with EASE. *IEEE/ACM/IFIP CNSM Mini conference 2016*.
- Management and Orchestration of SFCs in NFV. *BUET ACM Chapter Talk Series, 2015 (invited)*.
- nf.io: A File System Abstraction for NFV Orchestration. *IEEE NFV-SDN Conference 2015*.
- PayLess: A Low Cost Network Monitoring Framework for SDNs. *IEEE/IFIP NOMS 2014*.
- Managing the Filesystem from the Kernel. *IEEE/IFIP NOMS 2014*.
- Towards Autonomic Management of File Systems. *IBM Research – Services Research Seminar Series*.
- Ensuring β-availability in P2P Social Networks. *IEEE ICDCS HotPOST 2013 workshop*.
- αRoute: A Name Based Routing Scheme for ICN. *ICN Workshop 2013, Orange Labs, France.*.
- αRoute: A Name Based Routing Scheme for ICN. *IEEE INFOCOM Mini conference 2013*.

Service

Project Review
- FONDECYT-CHILE – National Fund for Scientific and Technological Development (Chile)

Conference Technical Program Committee Member
- 2021: IEEE NetSoft
- 2020: IEEE NetSoft, IEEE/IFIP NOMS, ACM ICN (Demo and Poster)
- 2019: IEEE NetSoft

Volunteer Experience
- Project reviewer – STEM Fellowship 2020-2021 National High School Big Data Challenge.
- Judge – Kitchener-Waterloo Bilingual School Science Fair 2020

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 Communications Magazine, IEEE Network, IEEE Communication Letters, Elsevier Computer Networks, Elsevier Computer Communications, Springer Journal of Network and Systems Management

Conference Review
- IEEE Blockchain (2020), IEEE ICDCS (2019, 2016), IFIP Networking (2019, 2018, 2015, 2014), IEEE/IFIP IM (2019, 2017), IEEE NetSoft (2018), IEEE/IFIP NOMS (2018, 2016, 2014), IEEE WCNC (2018), IEEE ISNCC (2018), IEEE/ACM/IFIP CNSM (2017, 2015), IEEE ICC (2017), IEEE NFV-SDN (2017, 2016), IEEE CloudNet (2017), IEEE CCGrid (2014), IEEE SDN4FNS (2013)