Shihabur Rahman Chowdhury

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Education

PhD (Computer Science), University of Waterloo, Canada May'12 – Feb'21

🔖 Dissertation: Resource Management in Softwarized Networks. **CGPA**: **92.6%**

B.Sc. Engg. (Hons), Bangladesh University of Engineering & Technology Dec'04 – Oct'09

🔖 Major: Computer Science & Engineering. **CGPA**: **3.93/4.00** (Ranked 2nd in a class of **125**)

Professional Experience

🔖 **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/Nominations

🔖 **Best Paper Award**, IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM), Halifax, Canada, October 21 – 25, 2019.

🔖 **Best Paper Award**, IEEE International Conference on Network Softwarization (NetSoft), Paris, France, June 24 – 28, 2019.

🔖 **Best Paper Award**, IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM), Tokyo, Japan, November 26 – 30, 2017.

🔖 **Best Paper Runner-up Award**, IEEE ICDCS 5th International Workshop on Hot Topics In Peer-to-peer computing and Online Social networking (HotPOST), Philadelphia, USA, April 2013.

🔖 **Runner-up for the Best Paper Award**. IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM), Montreal, Canada, October 31 – November 4, 2016.

🔖 **Runner-up for the Best Paper Award**, IEEE/IFIP Network Operations and Management Symposium (NOMS), Istanbul, Turkey, April 19 – 25, 2016.

🔖 **Runner-up for the Best Paper Award**, IEEE/ACM/IFIP International Conference on Network and Service Management (CNSM), Zurich, Switzerland, October 14-18, 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.

Awards and Honors (continued)

- **Student Travel Grants** for attending IEEE NetSoft 2019, IEEE/ACM CNSM 2017, IFIP/IEEE IM 2017, and IEEE/IFIP NOMS (2016, 2014).

Service Awards

- **2020 Best Reviewer Award**, IEEE Transactions on Network and Service Management.
- **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

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)*. (Impact Factor: 11.42).

2. Laraba, A., François, J., **Chowdhury**, **S. R.**, Chrisment, I. & Boutaba, R. (2020). Mitigating TCP Protocol Misuse with Programmable Data Planes. *IEEE Transactions on Network and Service Management (To appear)*. (Impact Factor: 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)*. (Impact Factor: 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. (Impact Factor: 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. (Impact Factor: 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. (Impact Factor: 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. (Impact Factor: 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. (Impact Factor: 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. (Impact Factor: 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. (Impact Factor: 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. (Impact Factor: 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. (Impact Factor: 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. (Impact Factor: 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. (Impact Factor: 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. (Impact Factor: 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. (Impact Factor: 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 Conference* (pp. 431–439).

3. 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.

4. 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* (pp. 193–201).

5. 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* (pp. 1–9).

6. 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* (pp. 1–12).

7. **Chowdhury**, **S. R.**, Anthony, A., Bian, H., Bai, T. & Boutaba, R. (2019). μNF: A Disaggregated Packet Processing Architecture. In *IEEE Conference on Network Softwarization (NetSoft), 2019* (pp. 342–350).

8. 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).

(9) 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* (pp. 152–160).

(10) Ayoubi, S., **Chowdhury**, **S. R.** & Boutaba, R. (2018). Breaking Service Function Chains with Khaleesi. In *IFIP Networking 2018 Conference* (pp. 64–72).

(11) **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).

(12) **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).

(13) 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 Conference* (pp. 1–9).

(14) 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).

(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* (pp. 19–27).

(16) 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).

(17) 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).

(18) 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 Conference* (pp. 46–54).

(19) **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).

(20) 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).

(21) 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).

(22) Bari, M. F., **Chowdhury**, **S. R.**, Ahmed, R. & Boutaba, R. (2015c). nf.io: A file system abstraction for NFV orchestration. In *ACM SIGCOMM (Demo), 2015* (pp. 361–362). Demo.

(23) 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 Conference* (pp. 1–9).

(24) **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).

25 **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).

26 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 International Conference on Computer Communications (INFOCOM) (Mini-Conference), 2013* (pp. 90–94).

27 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).

28 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).

29 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).

30 **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).

31 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).

Patents

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. US Patent No. 10,841,183, **Granted November 2020**.

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

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

4 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.

5 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**.

6 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**.

7 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 No. 10,873,502, **Granted December 2020**.

Talks

- SPONGE: Software-Defined Traffic Engineering to Absorb Influx of Network Traffic. *IEEE LCN, 2019, Osnabrück, Germany*.
- μNF: A Disaggregated Packet Processing Architecture. *IEEE NetSoft, 2019, Paris, France*.
- Breaking Service Function Chains with Khaleesi. *IFIP Networking, 2018, Zurich, Switzerland*.

Talks (continued)

- 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 β-availability in P2P Social Networks. *IEEE ICDCS HotPOST 2013 workshop, Philadelphia, PA, USA.*

- αRoute: A Name Based Routing Scheme for Information Centric Networks. *ICN Workshop, Orange Labs, France. June 2013.*

- αRoute: A Name Based Routing Scheme for Information Centric Networks. *IEEE INFOCOM Mini-conference 2013, Turin, Italy.*

Professional Activities

Project Review

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

Technical Program Committee Member

- **2021:** IEEE NetSoft
- **2020:** ACM ICN (Demo/Poster), IEEE/IFIP NOMS, IEEE NetSoft
- **2019:** IEEE NetSoft

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)