

End-to-End Routing in SDN Controllers Using Max-Flow Min-Cut Route Selection Algorithm

Nada Alzaben*, Danial W. Engels**

**Computer Science, Princess Nourah Bint Abdulrahman University, Riyadh, Saudi Arabia*

***AT&T center for Virtualization, Dallas, Tx, USA*

nalzaben@pnu.edu.sa, danial.w.engels@gmail.com

Abstract—In this paper, we present a novel max-flow min-cut based algorithm to solve the flow routing problem in the Software Defined Network Controller. Routing using traditional shortest path first algorithms often results in bottlenecks that cause performance degradation including higher energy use, reduced throughput, and increased slowdown. Our algorithm uses the max-flow min-cut algorithm to identify potential bottlenecks in order to avoid them in the flow routing decisions. Our simulations show that our max-flow min-cut based algorithm improves the network performance by minimizing the mean wait time by 15.1%, minimizing the mean slowdown by 6.1 %, minimizing the maximum completion time by 9.6 %, and maximize the mean throughput by 18.3 % compared to the Shortest Path algorithm. Explicitly considering congestion in determining routes, such as with our Max-Flow Min-Cut algorithm, is necessary to maximize performance.

Keyword— end-to-end routing, Max-Flow Min-Cut, makespan, SDN controller, throughput, wait time.

Nada Alzaben. This author became a Member (M'18) of IEEE in 2018. Born in Riyadh, Saudi Arabia. received her B.S. (2001) and M.S. (2012) in computer science and information from King Saud Univ. in Riyadh, Saudi Arabia. She is currently working on her Ph.D. in computer science at Southern Methodist Univ., Dallas, TX, USA. Her research interests include network communications, routing and scheduling, network performance analysis. She is a Lecturer at Princess Nourah Bint Abdulrahman Univ., Riyadh, Saudi Arabia. Previously she worked as a senior programmer at King Saud Univ. She has 3 research publications in the field of computer networks and AI.

Dr. Daniel W. Engels is currently Head of AI, Cybersecurity Science and Analytics, at HSBC. Previously, Dr. Engels was a professor at Southern Methodist University (SMU) where he was one of the creators of, and the first Director of, the Master of Science in Data Science (MSDS) program where he grew the program from 0 students to more than 300 students in its first two years of operation. In addition to his data science expertise, Dr. Engels is an expert in security and in RFID and IoT technologies, systems, and applications. He was one of the founders of the IEEE International Conference on RFID, and he was the Chair of the IEEE Technical Committee on RFID in 2011 and in 2012. Dr. Engels is the former Director of Research of the Auto-ID Labs at MIT, where he led the development of several RFID protocols including the original "Gen2" protocol, and he is an original member of the research team that founded the Auto-ID Center at MIT and created the EPC System. Dr. Engels received his Ph.D. from the Massachusetts Institute of Technology. He has over 100 peer reviewed publications and 8 issued U.S. patents in data science, RFID, RFID applications, Internet of Things, security, embedded computing, and computer-aided design. Dr. Engels received the 2014 AIM Ted Williams Award in recognition of his contributions to the AIDC industry. Dr. Engels is a member of AIDC 100 and is a Senior Member of IEEE.