UNIVERSITY of GUELPH

COLLEGE of ENGINEERING AND PHYSICAL SCIENCES

SCHOOL OF COMPUTER SCIENCE

PhD Qualifying Examination

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The Integration of Machine Learning Probes and Frameworks into the FPGA Placement Flow

Chair: Dr. Joe Sawada
Co-Advisor: Dr. Herb Kuntz [Math & Stats]
Advisory: Dr. Denis Nikitenko
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Abstract:

Mobile Ad-hoc Networks (MANETs) are transient networks that form by a collection of self-organized and self-configured wireless mobile devices that communicate through wireless channels without relying on either pre-installed network infrastructure or centralized administrative support. As mobile ad hoc networks promise a cost-effective, flexible, and convenient way for communication and rapid and easy deployment, a wide range of applications in different sectors such as healthcare, smart cities, emergency rescue, and the military battlefield are possible.

However, highly dynamic topologies in MANETs cause routing to become one of the greatest challenges faced by scientists today to provide reliable and continuous communication between devices with considering the quality of service (QoS). Mobility causes frequent link failure and the need for frequent route discovery in MANETs. The route discovery process involves producing routing overhead which is the non-data traffic over the network. Because of limitations in network resources, routing overhead is one of the most significant performance-limiting concerns in MANETs. Furthermore, congestion is another performance-limiting factor in mobile ad hoc networks. Congestion occurs when a network node or a link carries more traffic than its capacity which causes QoS to be degraded. Congestion causes increased transmission delay and packet loss in large-scale communication scenarios. Therefore, the network performance is degraded due to congestion.

The goal of this research is to address the routing problem in MANETs by proposing a novel high quality and adaptive cross-layer routing framework to enhance the performance of the network. The framework deals with the broadcast and congestion problems by employing two modules: 1) a cross-layer hybrid route discovery with fuzzy logic, and 2) a dynamic congestion aware route selection in multi-path routing for MANETs using Q-learning algorithm. The framework will utilize Fuzzy logic and machine learning with considering required parameters to make the best routing decision on the most stable, high-quality paths with respect to the network condition.