SDN Controller Placement with Delay Overhead Balancing in Wireless Edge Networks

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Background

The bottleneck in wireless channels makes it difficult to apply SDN centralized control in edge networks. To deal with this, one approach is to place multiple controllers in the network. The locations of controllers are crucial in this context, which we model as edge controller placement problem (ECP).

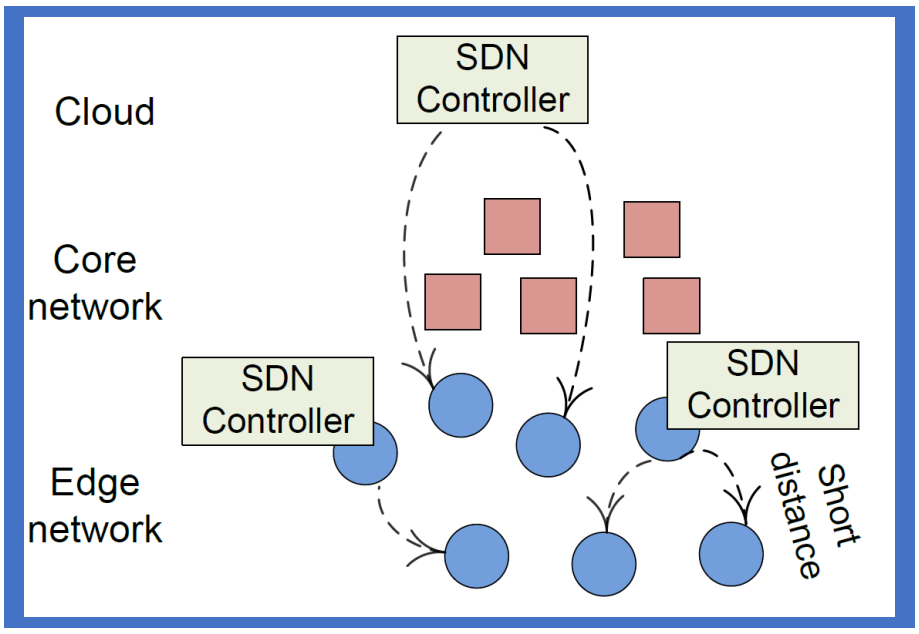


Figure 1: An edge network with multiple SDN controllers

Measurement

To capture the essence of ECP problem, we conduct measurements on following aspects:

- We use Android smartphones to show that even with limited power, mobile devices are still able to deploy SDN components, like Open vSwitch and ONOS controller.
- We deploy WiFi SDN networks to demonstrate that the **latency** of OpenFlow messages between a data plane node and its controller is highly impacted by their distance.
- Based on the cluster support of ONOS, we run large-scale emulations. We identify controller-node traffic and inter-controller traffic, then reveal that a linear amount of **overhead** when scaling up exists in both types of traffic.

Algorithm

To solve the ECP problem, we propose a scalable approximate algorithm and verify its performance by simulation, which based on real wireless network traces. Our algorithm realizes:

- Near-optimal performance, better than state-of-the-art methods;
- Multi-objective optimization with trade-off between delay and overhead costs.

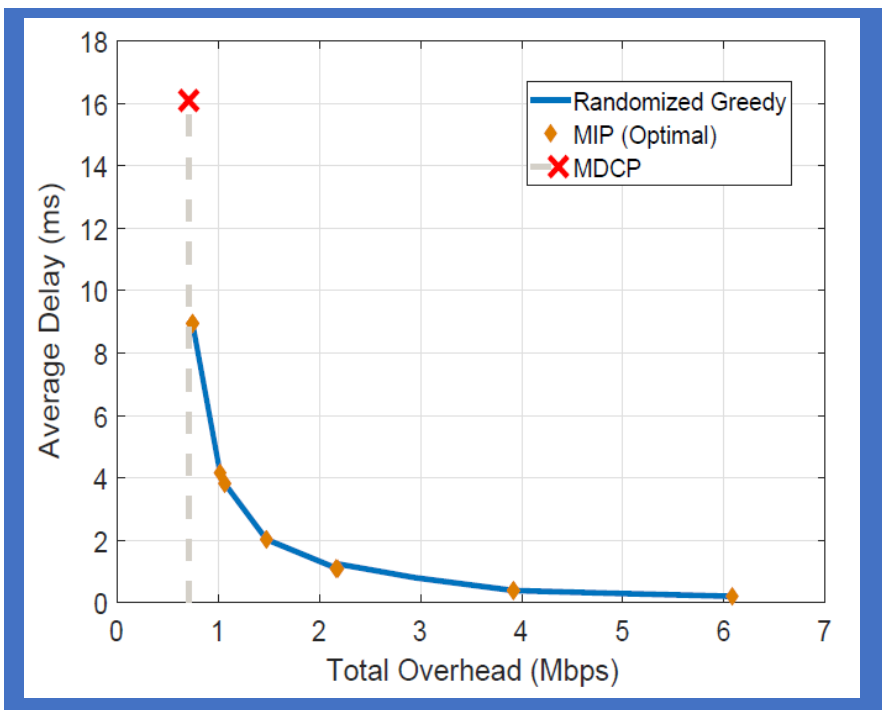
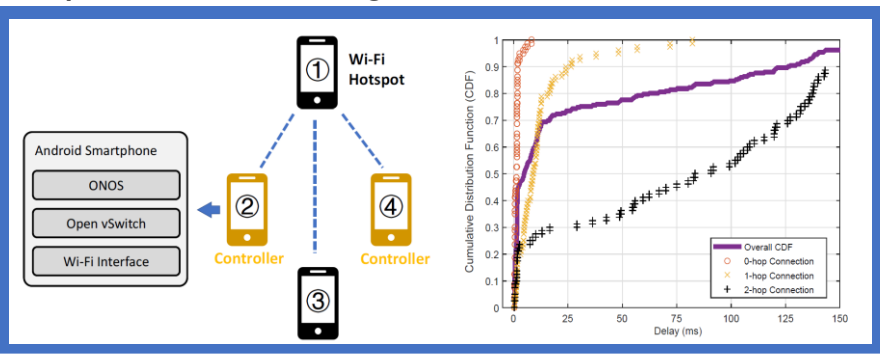
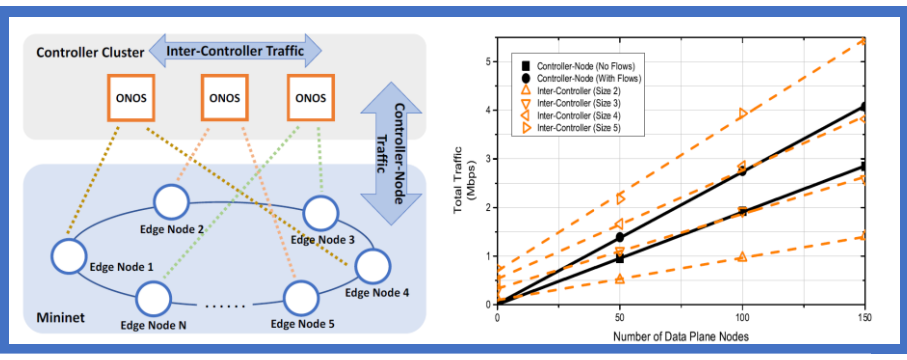


Figure 2: Optimization and trade-off between different types of costs





Q. Qin, K. Poularakis, G. Iosifidis, L. Tassiulas, “SDN Controller Placement at the Edge: Optimizing Delay and Overheads”, IEEE Infocom, 2018.

Distributed Analytics and Information Science International Technology Alliance
Annual Fall Meeting, September 2018