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1. Separation of Routing and Scheduling in Backpressure-Based Wireless Networks

Backpressure routing and scheduling, with its throughput-optimal operation guarantee, is a promising technique to improve throughput in wireless multihop networks. Although backpressure is conceptually viewed as layered, the decisions of routing and scheduling are made jointly, which imposes several challenges in practice. In this work, we present Diff-Max, an approach that separates routing and scheduling and has three strengths: 1) Diff-Max improves throughput significantly; 2) the separation of routing and scheduling makes practical implementation easier by minimizing cross-layer operations; i.e., routing is implemented in the network layer and scheduling is implemented in the link layer; and 3) the separation of routing and scheduling leads to modularity; i.e., routing and scheduling are independent modules in Diff-Max, and one can continue to operate even if the other does not. Our approach is grounded in a network utility maximization (NUM) formulation and its solution. Based on the structure of Diff-Max, we propose two practical schemes: Diff-subMax and wDiff-subMax. We demonstrate the benefits of our schemes through simulation in ns-2.