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Roh, Hee-Tae; Lee, Jang-Won

User-level satisfaction aware end-to-end rate control in communication networks.

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Summary: In this paper, we study an end-to-end rate control problem in communication networks with the network utility maximization (NUM) framework. In many cases, a communication of a user consists of two sessions: transmitting and receiving sessions, and its overall satisfaction to the communication service depends on the satisfaction to both sessions. However, in most previous approaches with the NUM framework, the utility function of a user, which represents its satisfaction to the service, is modeled considering only the satisfaction to its transmitting session through its transmitting rate. The receiving session of a user is treated independently and indirectly through the utility function of its correspondent. Hence, it is not possible to jointly consider the satisfaction of transmitting and receiving sessions of one user. To resolve this issue, in this paper, we first propose a new concept of the utility function, which is called a user-level utility function. The user-level utility function is modeled considering both transmitting and receiving sessions of a user. We then formulate an optimization problem for end-to-end rate control with user-level utility functions. Even though two users in a communication are coupled with each other through their utility functions, we developed a distributed algorithm with appropriate message exchanges. The numerical results show that our user-level utility function and algorithm can control the transmitting rate of each user more appropriately according to the type of its communication service.

Keywords: end-to-end rate control; user-level satisfaction; utility function; network utility maximization
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