

On Distributed Multimedia Scheduling with Constrained Control Channels

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Traditional multimedia scheduling approaches assume perfect control channels where each node has access to the knowledge of its neighbors. However, in practice the control channels are always constrained and nodes can only exchange limited information with their neighbors, e.g., the control packets are lost during the wireless transmission, and the node only has partial network information. In this case, existing distributed multimedia scheduling schemes cannot work efficiently. This paper investigates how imperfect neighbor information affects the multimedia scheduling, and reveals the relationship between the control gain and scheduling performance based on available network and multimedia information. This paper demonstrates that the control gain can be chosen properly such that the optimal distributed multimedia scheduling can be achieved with an exponential convergence rate. In addition, an explicit equation for asymptotic convergence rate is derived for implementation, and some practical examples are provided to show how to achieve the convergence bound.

The results in this paper have some interesting implications on the practical use of multimedia communications, i.e., multimedia sensor network is a good example. As we know, current sensor networks due to their limit transmitting and sensing capacities can hardly ensure that the perfect control channel is available. Information-limited scheduling technique is a direction to provide a satisfying multimedia service in practical large scale networks, e.g., vehicular networks, internet of things etc. Therefore, the proposed multimedia scheduling scheme for multi-hop wireless networks is eager to have large application ground. Although the results of this paper are based on the synchronized nodes and noiseless control channel, these can be easily extended to any other practical scenarios, e.g., heterogeneous networks, using the similar analysis model.

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