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授与した学位	博士
専攻分野の名称	工学
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学位授与の要件	自然科学研究科 産業創成工学専攻 (学位規則第5条第1項該当)
学位論文の題目	A Study of Performance Improvement Methods for Real-time Applications in Wireless Mesh Networks (無線メッシュネットワークにおけるリアルタイム通信の性能向上手法に関する研究)
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### 学位論文内容の要旨

In this thesis, we propose two methods, namely the *Fixed Backoff-time Switching (FBS) method* and the *TRaffic Control (TRC) method*, to improve the performance for real-time applications in the *Wireless Internet-access Mesh NETWORK (WIMNET)*.

Chapter 1 introduces the outline of WIMNET, the background and motivation for the studies, the contributions, and the contents in this thesis.

Chapter 2 briefly overviews terminologies, features, challenges, and problems in wireless mesh networks including WIMNET. Besides, this chapter introduces the Quality of Service (QoS), QualNet, Linux Wireless Networking, and Software Defined Networking as background technologies for this thesis.

Chapter 3 describes our proposal of the *FBS method* in WIMNET as the main contribution of this thesis. Then, this chapter presents the QualNet implementation of the FBS method, and show simulation results using it for evaluations.

Chapter 4 presents our design for the Linux implementation of the FBS method.

Chapter 5 describes our proposal of the *TRC method* with the consumed bandwidth estimation to afford the prioritized real-time applications in WIMNET. Then, this chapter presents the QualNet implementation of the TRC method, and show simulation results using it for evaluations.

Finally, Chapter 6 concludes this thesis with some future works.

## 論文審査結果の要旨

The applicant proposed two new methods to improve the performance for real-time applications such as IP-phones and IP-TV in Wireless Internet-access Mesh NETWORK (WIMNET). WIMNET is composed of multiple access point (APs) connected by wireless links using IEEE 802.11 standards as a flexible and cost-efficient scalable internet access network. Unfortunately, the contention resolution mechanism using a random backoff-time in the CSMA/CA protocol is not sufficient for handling real-time traffics in multihop wireless communications due to the limitation of the available bandwidth in wireless links. It may increase the network latency unacceptably in supporting real-time traffics.

In this thesis, he first proposed the Fixed Backoff-time Switching (FBS) method for the CSMA/CA protocol to improve the real-time traffic performance by giving the necessary activation chances to each link. For evaluations, he implemented it on a well-known QualNet simulator, and verified its effectiveness through simulations. In addition, he presented an implementation design of the FBS method in the Linux kernel to show its practicality and investigate the performance in a real network.

Then, he proposed the Traffic Control (TRC) method to improve the performance by prioritizing real-time traffics than others. This method is used together with the bandwidth usage estimation to estimate the consumed bandwidth by them. Less prioritized traffics are repeatedly dropped at the Internet gateway using the leaky bucket traffic shaping. For evaluations, he implemented it on the QualNet simulator, and verifies its effectiveness through simulations.

From the overall evaluation of the thesis, the applicant has satisfied the qualification condition for the doctor degree in Engineering from the Graduate School of Natural Science and Technology at Okayama University.