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授与した学位	博　士
専攻分野の名称	工　学
学位授与番号	博甲第　　　５６０８　　　号
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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４条第１項該当）
学位論文の題目	A Study of Access Point Configuration Algorithm for Elastic WLAN System and Its Implementation Using Raspberry Pi （エラスティック無線 LAN システムのアクセスポイント構成アルゴリズムとそのラズベリーパイ実装に関する研究）
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学位論文内容の概要

In this thesis, firstly, we present the concept of the elastic WLAN system that dynamically adjusts the number of active APs and changes the host associations based on traffic demands. Secondly, we formulate the AP configuration problem and propose the heuristic algorithm that is composed of seven phases for the elastic WLAN system. Thirdly, we propose the channel assignment extension for the AP configuration algorithm. Fourthly, we design and implement the elastic WLAN system in the Linux platform using Raspberry Pi. Finally, we verify the effectiveness of our proposals using the WIMNET simulator and the elastic WLAN system testbed.

Chapter 1 introduces the background and the contribution of the study in this thesis.

Chapter 2 discusses related wireless network technologies to this study, including IEEE 802.11n protocol, heterogeneous AP devices, channels in IEEE 802.11 protocols, and WLAN tools in the Linux operating system.

Chapter 3 describes the overview of the elastic WLAN system.

Chapter 4 proposes the active AP configuration algorithm for the elastic WLAN system.

Chapter 5 describes the channel assignment extension of the AP configuration algorithm.

Chapter 6 evaluates the AP configuration algorithm through simulations in several network instances using the WIMNET simulator.

Chapter 7 presents the implementation of the elastic WLAN system using Raspberry Pi and Linux PC.

Finally, Chapter 8 concludes this thesis with some future works.

In this thesis, he firstly presented the concept of the elastic WLAN system that controls the number of active APs, the operating channels of these active APs, and the host associations to the active APs in the network, so that it can save energy, reduce interferences, and improve the performance of networks.

Secondly, he presented the active AP configuration algorithm for the elastic WLAN system using heterogeneous access points (APs). These APs can contain dedicated commercial APs, mobile routers, and software APs using personal computers (PCs). For this purpose, he formulated the AP configuration problem as a combinatorial optimization problem and prove the NP-completeness of its decision problem. Then, he proposed the heuristic algorithm composed of seven phases to dynamically control the network topology by activating or deactivating APs to be matched with the traffic load in the network. He verified the effectiveness of our algorithm through extensive simulations using the WIMNET simulator.

Thirdly, he proposed the extension of the AP configuration algorithm to consider the channel assignment to the active APs under this limitation. For the proper channel assignment, AP associations of some hosts are modified here to improve the network performance by averaging loads among channels. The effectiveness of this extension was also evaluated using the WIMNET simulator.

Finally, he presented the implementation of the elastic WLAN system using the proposed algorithm. For implementation, Linux PCs were adopted for the hosts and Raspberry Pi is for the AP. Using several Linux commands, this system collects the necessary information for the AP configuration algorithm to determine the activations/deactivations of APs, the host associations, and the channels for active APs. Based on the algorithm outputs, it controls the active APs, their channels, and the associations of hosts automatically. The feasibility and performance of this elastic WLAN system implementation was verified through experiments.

From the overall evaluation of this 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.