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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5346号
学位授与の日付	平成28年 3月25日
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 Access-Point Aggregation Algorithm for Elastic Wireless Local-Area Network System and Its Implementation (エラスティック無線 LAN システムのためのアクセスポイント集約アルゴリズムとその実装に関する研究)
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学位論文内容の要旨

In this thesis, firstly, we propose the concept of an elastic WLAN system that adaptively activate/deactivate allocated APs and changes host associations for energy-saving and host performance improvement. Secondly, we describe the AP aggregation problem and its algorithm for energy-saving which is the core of the elastic WLAN system. Thirdly, we provide the extended AP aggregation algorithm for host performance improvement. Fourthly, we present the measurement results of three important parameters for algorithm inputs. Finally, we design and implement the elastic WLAN system in Linux platform.

Chapter 2 gives an overview of related wireless network technologies, such as IEEE 802.11 protocols including the IEEE 802.11n protocol, the virtual access-point, and related tools in Linux.

Chapter 3 presents the basic concept of the elastic WLAN system, the motivation, the design constraints, and the basic system flow.

Chapter 4 proposes the AP aggregation algorithm for energy-saving including the formulation of the AP aggregation problem and the algorithm procedure.

Chapter 5 describes the extended AP aggregation algorithm for host performance improvement and the modification of the algorithm to consider the host mobility.

Chapter 6 presents the measurements results of three important indices for IEEE 802.11n WLANs, and analyzes the relations among them.

Chapter 7 evaluates the proposed AP aggregation algorithm through extensive simulations using the WIMNET simulator in several network instances.

Chapter 8 presents the detailed design of the elastic WLAN system and its implementation using Linux PCs, where the operation and the performance of the implemented elastic WLAN system using a testbed are also evaluated.

Finally, Chapter 9 concludes this thesis together with some future works.

論文審査結果の要旨

In this thesis, he presented a study of the elastic WLAN system as a solution to energy and interference problems in multiple wireless local-area network (WLAN) environments. This system controls the deployed APs and the host associations to save energies, reduce interferences, and improve performances of WLANs.

Firstly, he presented an AP aggregation approach for multiple WLAN environments to aggregate deployed APs of different groups into limited ones using virtual APs. He formulated the AP aggregation problem as a combinatorial optimization problem and prove the NP-completeness of its decision problem. Then, he proposed its heuristic algorithm composed of five phases. He verified the effectiveness of this AP aggregation algorithm through extensive simulations using the WIMNET simulator.

Secondly, he presented two extensions of the AP aggregation algorithm 1) to ensure the minimum average throughput for any host by adding active APs and 2) to further optimize host associations by changing multiple hosts simultaneously in the host association finalization phase. He also verified the effectiveness of this extended algorithm through simulations in four network instances using the WIMNET simulator.

Finally, he proposed a model for the elastic WLAN system, where the number of active access points and the AP associations of hosts are controlled by the amount of hosts in the network. The key technology for this system is the use of the AP aggregation algorithm to minimize the number of active APs in the field. Then, he implemented the elastic WLAN system using Linux PCs, and evaluated the functions and the performance of this system using a simple testbed.

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.