Chapter XIII

Distributed Resources Management in Wireless LANs that Support Fault Tolerance

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ABSTRACT

This chapter introduces a new radio resource management technique based on distributed dynamic channel assignment, and sharing load among Access Points (AP). Deploying wireless LANs (WLAN) at large scale is mainly affected by reliability, availability, fairness, scalability, and performance. These parameters will be a concern for most of managers who wanted to deploy WLANs. In order to address these concerns, a new radio resource management technique can be used in a new generation of wireless LAN equipment. This technique would include distributed dynamic channel assignment, and sharing load among Access Points (AP), which improves the network availability and reliability compared to centralized management techniques. In addition, it will help in increasing network capacities and improve its performance especially in large-scale WLANs. Analysis results using normal and binomial distribution have been included which indicate an improvement of performance resulted from network balancing when implementing distributed resources management at WLANs.
INTRODUCTION

WLAN technology is rapidly becoming a crucial component of computer networks that widely used in the past few years. It provides mobility as well as essential network services where wire-line installation proved impractical. Wireless LAN technology evolved gradually during the 1990s, and the IEEE 802.11 standard was adopted in 1997 (Crow, 1997; IEEE 802.11, 1997). The inclusion of the newer IEEE 802.11g versions of the standard offers a firm basis for high performance wireless LANs. Companies and organizations are investing in wireless networks at a higher rate to take advantage of mobile, real-time access to information. While first generation IEEE 802.11 technology is adequate for residential and small office/home office (SOHO) customers, the same is not always true for enterprise customers. In fact, some chief information officers (CIOs) and information technology managers are reluctant to deploy wireless LANs. Among their concerns are security, reliability, availability, scalability, fairness, performance under heavy load, deployment, mobility, and network management. While security is often mentioned as manager's greatest worry about wireless, some of their other concerns such as, reliability, availability, performance, and deployment, can be addressed through radio resource management techniques. The use of such techniques would encourage the rapid deployment of wireless infrastructure with much greater flexibility than has previously been available. The current wireless network products do not scale as well as they might in large-scale enterprise networks. IEEE 802.11 wireless networks have become increasingly popular and more widely deployed. This put pressure to expand the functionality of wireless LAN equipment to become suitable for large scale. A Scalable Network Resource Allocation Mechanism with Bounded Efficiency Loss has been proposed by (Ramesh, 2006) to guaranty a fully efficient allocation when users are price taking. In this paper, users choose the rate at which they want to send data, and links set prices according to the marginal cost of the total rate allocated. While such a scheme is efficient when all users are price taking, there is a loss of efficiency when users are able to anticipate the effects of their choices on the link prices. Although IEEE 802.11 task groups and study groups are working to improve the standard, there is a need for lots of improvement to suit the future functionality that will be added to Wireless equipments.

Enterprise managers want to deploy wireless networks with several important qualities. These include; high security, fairness, highly reliable and available WLANs with very little downtime, and high performance (i.e., be capable of high throughput and low latency). The ideal wireless network is to have reliability, availability, and performance criteria to be similar of wired enterprise networks. In addition, it should be possible to deploy wireless networks very quickly and without the need for extensive and time-consuming site surveys. Furthermore, the networks should have the flexibility needed to support load balance and changes in the radio environment. Radio resource management (RRM) forms the basis of quality of service (QoS) provisioning for wireless networks (Kayiazakos, 2004). It is an intense research area due to the wireless medium's inherent limitations and the increasing demand for better and cheaper services. There are many benefits of RRM: timely guarantees of resources for key applications, enhanced network planning and management, and efficient bandwidth utilization. A joint scheduling, routing and congestion control mechanism for wireless networks, that asymptotically guarantees stability of the buffers and fair allocation of the network resources, has been addressed by (Atilla, 2006). Resource allocation for orthogonal frequency-division multiple-access relay network with multiple source nodes, multiple relay nodes, and a single destination node has been addressed by (Guoqing Li, 2006). However, in a practical relay system, a large number of nodes may be