

摘 要

近年来,随着无线通信技术的不断发展,无线局域网已经得到了越来越广泛的应用。许多场所都部署了无线局域网来为用户提供宽带无线接入服务,例如,办公室、学校、候机室、咖啡厅等。然而,与有线局域网相比,无线局域网所能提供的带宽是非常有限的。同时,一些研究表明无线局域网的整体性能通常是比较低的。因此,提高无线网络的整体性能已经成为一个研究的热点。本文对利用负载平衡来提高网络性能的方法进行了深入的讨论和研究,并提出了一种新的、更加有效的平衡负载在网络中分布的方法。这种方法通过将负载较重 AP 下的一些终端迁移到周围负载较轻的邻居 AP 下来调整负载分布,从而提高网络的整体性能。本论文的主要工作包括:

- (1) 讨论了通过接入控制来平衡负载分布问题以及这一问题中的几个关键点。
- (2) 提出了采用信道利用率作为 load metric 来表示 AP 的负载程度并定义:当 AP 的信道利用率超过 84% 时 AP 负载过重,负载平衡过程被触发。
- (3) 提出了一种发现终端可连接 AP 的方法。这种方法不需要终端做任何修改,对用户是完全透明的。
- (4) 提出了一种基于网络的局部移动管理机制。这种机制能减少终端切换的延时,从而降低终端切换对网络性能的影响。
- (5) 提出并实现了一种更加有效的负载平衡方法。实验结果表明这种方法能够有效地减轻 AP 的拥塞程度并提高网络的整体性能。

尽管这种负载平衡方法需要为每个 AP 增加一块网卡来获取平衡负载所需的信息,但随着网卡成本的不断降低,部署使用这种方法平衡负载分布的网络的费用也会极大地降低。另一方面,不需要对终端做任何修改的特性使得这种方法将比较利于部署和方便用户使用。

关键词: 无线局域网, 负载平衡, 信道利用率。

Research on Load Balance in Wireless LANs

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In recent years, with the development of wireless communication technologies, wireless local area networks (WLANs) have become increasingly popular and been widely used. Many areas, such as offices, campuses, airport lounges and coffee house, have deployed WLANs to provide broadband wireless access for users. However, compared with wired LANs, WLANs only can provide extremely limited bandwidth. Meanwhile, some researches have shown that the overall performance of WLANs is always quite low. Therefore, to improve the performance of networks has being a hot research topic. This paper has deep discussion and research on using load balancing scheme to improve the performance of wireless networks, and proposes a new effective scheme to balance load distribution among access points (APs) in WLANs. This scheme adjusts load distribution by forcing handoffs of some mobile stations from overloaded APs to underloaded neighboring APs in order to improve the performance. The main work of this thesis is as follows:

- (1) Using association control to balance load and some key points in this topic are investigated.
- (2) Channel utilization is used as load metric to indicate an AP's load, and we define that if the channel utilization of an AP is greater than 84% the AP is overloaded, then the overloaded AP triggers the load balance procedure.
- (3) An approach to find available APs for stations is presented. This approach does not need any modification on stations and is transparent to users.
- (4) A network-based local mobility management scheme is proposed. This scheme can reduce the handover delay and decrease the impact of handovers to the performance of the networks.
- (5) A more effective load balancing scheme is proposed and implemented. Experiments show that this scheme can indeed relieve the congestion of AP and improve the overall performance of the networks.

Although this load balancing scheme needs to add an additional wireless card for each AP to obtain necessary information for balancing load, with the cost of wireless card decreasing gradually, the cost of deploying a network using the proposed scheme to balance load distribution will also decrease. On the other hand, the property of needing no modification to stations makes this scheme easily deployed and convenient for users.

Keywords: Wireless Local Area Networks (WLANs), Load Balance, Channel Utilization.