Liang Zhao, the Degree of Doctor of Philosophy, 23 February 2011, Efficient Routing and Communication Algorithms for Wireless Mesh Networks

Abstract

There has been an increasing demand to create wireless technologies that allow people to connect their home networks together as well as to the Internet through wireless community networks (WCNs). Although several network architectures have been studied and indeed deployed in practice for WCNs due to evolving technology and locales, wireless mesh network (WMN) has been undoubtedly the most popular architecture that proved clear superiority in different roles. Indeed, there are many advantages to enabling such mesh connectivity and forming a community mesh network. This will improve quality of life, the digital engagement and partnerships of the rural and isolated communities and will promote and facilitate further the seamless economy.

The design of efficient communication is a challenging issue for the success of the next generation WMNs to handle real-time and Quality of Service sensitive applications and to satisfy both service providers and users. Unfortunately, the significant point in the literature is that today's cutting edge routing standards in WMNs are not perfectly equipped to cater to this task as these standards come with an inherent complexity and suffer from innate problems with respect to efficient communication based applications. Thus, the aim of this thesis is to enable the WMNs to handle various efficiently real-time multimedia applications, in different operating conditions. This is achieved in this thesis by making three major contributions. Firstly, a new load balancing aware multicast routing protocol is designed in order to enhance the performance of multicast communication in WMNs. Secondly, novel unicast and multicast schemes have been devised as centralized routing algorithms in WMNs. Thirdly, new cross-layer routing metrics have been proposed to further increase the efficiency of protocols in WMNs. Finally, rigorous performance analysis in different operating conditions has been conducted to confirm the superiority of the proposed solutions over well-known existing work.