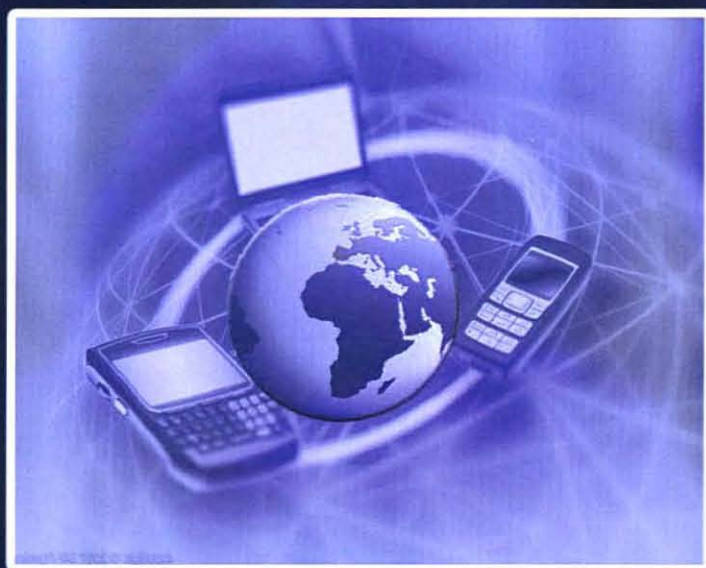


Research Issues in Wireless

Communications and Networking

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Wajdi Al-Khateeb



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Chapter 36

WiFi Network for long distances applications

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36.1 INTRODUCTION

The needs for bridging of digital divide in the rural communities and the economics of currently available broadband access technologies have motivated us for innovation and deployment of the new system designs and applications. The widely available and flexible WiFi technique meets the cost and suitability targets for the rural broadband applications. To cope with the special requirements of rural communication, amendments of 802.11 standards at the MAC protocol level has been introduced. These amendments are important due to the shortcomings of WiFi over long distances under the power constraints. This chapter proposes a new 802.11 point-to-multipoint (PMP) technique based on TDD/TDMA technique by using one of the access points in the system as centralized/gateway point to the other APs. The discussion includes the TDMA design and, architecture on top of the conventional 802.11 MAC. The protocol convergence at the gateway between the access network and the backhaul is also presented. The simulation results present the performance analysis and validate the efficiency of the proposed scheme.

The needs of Internet and e-services for rural communities and remote sites using the available broadband access technologies motivate the attempts to innovate and deploy new systems design and applications. The widely available, and highly cost-reduced, WiFi hardware meets the cost target for rural applications. However, the current 802.11 MAC protocol is not designed to cope with such system, when it is only designed for the local area network in indoor propagation environment [7]. In the long distance propagation, if the WiFi SAT sends out data, due to the propagation delay, it has to wait for an acknowledgment from the other radio station that the data has been received. If the transmitting radio doesn't receive the acknowledgment within a certain time period, it will assume that the data has been lost and it will accordingly resend the data. In such a case, using WiFi for long distance transmission needs some form of modifications in the MAC functionality. In this context, many works have been conducted using different criteria and prospective methods. In [7] and [12] Krishna et al. introduce a new design called wireless fidelity - rural extension (WiFiRe) for rural broadband voice and data access, based on the WiFi PHY and WiMAX IEEE 802.16 MAC layer, in which a single channel multi-sector TDM MAC is mobilized by employing directional antennas with simple scheduler which is developed. The combination of IEEE 802.11b PHY and IEEE 802.16 MAC was introduced in 2000 by the IEEE 802.16.3 WirelessHUMAN [5] (Wireless High-speed Unlicensed Metropolitan Area Networks) to get the advantages of the availability, low cost chipsets and license-free WiFi devices and well-designed WiMAX MAC with quality of service (QoS) [1]. WiFiRe is supported by a maximum 25Mbps data rate in the DL by using two parallel sectors transmissions. The design was tested using VOIP simultaneous calls in all STAs, the throughput was improved about 3.5 times that of the conventional IEEE 802.11b [11].

R. Patra et al. in [9] presents WiLDNet (WiFi-based Long Distance (WiLD) networks) with mesh link configuration which has the potential to provide connectivity