

Adaptive MAC Protocols for Wireless Mesh Networks Using Directional Antennas

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Abstract

Recently, Wireless Mesh Networks (WMNs) have emerged as a key technology for next-generation wireless networking. WMNs are built on a mix of fixed and mobile nodes interconnected via wireless links to form a multi-hop ad hoc network. In WMNs, wireless nodes could communicate directly with infrastructures (for example, APs); they could also use other mobile nodes as routers to relay their communications to infrastructures. Compared to WLANs, WMNs have the advantage of self-organization, self-configuration, and offering increased reliability, coverage and reduced equipment costs. Compared to another major wireless networking technology – Mobile Ad Hoc Networks (MANETs) which have attracted massive research efforts in the last decade but failed to find applications in non-military or non-emergency environments, WMN present a more pragmatic solution and can easily find numerous civilian applications. However, a key challenge in WMNs is the need for sufficient capacity and effective quality of service (QoS) support to meet the requirements of increasing multimedia applications (such as audio, video, etc.). Despite recent advances, many research issues remain in all protocol layers of WMNs.

The performance of wireless networks depends highly on how the Medium Access Control (MAC) protocol is designed, since MAC protocols directly decide how the scarce wireless resources are shared among contending nodes. The currently widely used MAC protocol in IEEE 802.11 WLANs does not work well for multi-hop networks. For example, the following are some differences that distinguish the MAC for WMNs from the MAC for classical counterparts of wireless networks: the MAC for WMNs is concerned with more than one hop communications; is distributed and cooperative and works for multipoint-to-multipoint communications; Network self-organization is needed for the MAC, etc.

The objective of this project to investigate possible solutions for designing practical and high performance MAC protocols for WMNs. In particular, we focus on WMNs using directional antennas. We believe the MAC layer of wireless networks (hereby, including WMNs) should best be ruled by adaptive protocols. In this project, we do not intend to design a totally new MAC protocol from scratch. Instead, our goal is to extend the current IEEE 802.11 MAC protocol and make it work well for WMNs.