Performance of 802.11b Mesh Network Under Channel Interference for Wireless Internet

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ABSTRACT

This article shows the performance of wireless mesh networks under channel interference for wireless Internet. The wireless mesh networks are multihop networks of wireless-router platforms. The wireless routers are typically stationary, but the clients can be mobile. A mesh network can provide multihop communication paths between wireless clients, serving as a community network or as a broadband access network for the Internet. Though no routing protocols exist for wireless mesh networks, the author has tried using AODV, which has been proved effective for wireless mesh networks. Although research is being done in revisiting the MAC and routing protocols for wireless mesh networks, one of the major problems faced in 802.11b mesh networks is channel interference. Based on the above facts, an attempt has been made to study the performance of the 802.11b mesh network under channel interference. The performance differentials are analyzed in terms of throughput, end-to-end delay, and MAC delay. The simulations are carried out in Opnet Version 11.5 simulator.

Keywords: AODV; mesh networks; Opnet

INTRODUCTION

Wireless broadband networks are being increasingly deployed in a multihop wireless mesh network (WMN) configuration (Akyildiz & Wang, 2005). These WMNs are being used on the last mile for extending or enhancing Internet connectivity for mobile clients located on the edge of the wired network. Commercial deployments of multihop WMNs are already in the works. The deployed mesh networks will provide commercial Internet access to residents and local businesses (Chaska, 2004). In WMNs, the access points or mesh routers are rarely mobile and may not have power constraints. In addition, these networks behave almost like wired networks in having infrequent topology changes, limited node failures,
and so on. Although WMNs may be self-organizing, node additions and maintenance are still rare events. In addition, since each mesh router may aggregate traffic flows for a large number of mobile clients, the aggregate traffic load of each mesh router changes frequently. Several companies such as Mesh Dynamics have recently announced the availability of multiradio mesh network technology. To make use of commodity 802.11 radios, a channel is assigned to a radio interface for an extended period as long as traffic demand or topology does not change. Bahl et al. (2004) discuss MAC protocols where each radio interface can use different channels on a fast time scale such as on a per-packet basis.

One of the major problems facing wireless networks is the capacity reduction due to interference among multiple simultaneous transmissions (Gupta & Kumar, 2000). In wireless mesh networks, mesh routers with multiple radios can greatly alleviate this problem. With multiple radios, nodes can transmit and receive simultaneously or can transmit on multiple channels simultaneously. However, due to the limited number of channels available, the interference cannot be completely eliminated, and, in addition, careful channel assignment must be done to mitigate the effects of channel interference.

With this in view, an attempt has been made to study the performance of the 802.11b mesh network under the effect of channel interference. It will be seen as to how the network performs in terms of end-to-end delay, MAC delay, and throughput under such channel interference. The remainder of this article is organized as follows. The next section discusses the wireless-mesh-network feature and its architecture. Then we talk about routing and channel interference in 802.11b mesh networks. The next section discusses the simulation platform and topology used for simulating channel interference in wireless mesh networks. This is followed by the presentation on the performance results of 802.11b network channel interference. Conclusions are given in the last section.

**WIRELESS-MESH-NETWORK FEATURES**

Wireless networking technology (Akyildiz & Wang, 2005; Chales, et al., 1999; Holt, 2005; Royer & Toh, 2004; Toh, 2004) is evolving at a rapid pace. Within the last few years, the industry has seen the highest data rates provided by products based on the 802.11 standards migrating from 2 Mbps (802.11) to 11 Mbps (802.11b) and now to 54 Mbps (802.11a/g). Currently active efforts are underway within IEEE to define the next-generation standard to be known as 802.11n that will enable rates potentially as high as 600Mbps in a 40 MHz channel. In addition, efforts are also underway to define the 802.11s standard for mesh networking. These developments as well as potential future technologies such as cooperative diversity are creating new challenges and opportunities in the design of low-power wireless LAN products.

Wireless mesh networks (WMNs) (Akyildiz & Wang, 2005) represent an effective solution to the last-mile connectivity issue. In WMNs, nodes are comprised of mesh routers and mesh clients. Each node operates not only as a host but also as a router, forwarding packets on behalf of other nodes that may not be within direct wireless-transmission range of their destinations.

A WMN is dynamically self-organized and self-configured, with the nodes in the network automatically establishing and
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