Ad Hoc Wireless Routing Schemes based on Adaptive Modulation in OFDM Broadband Networks

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Abstract

In order to facilitate communication within an ad hoc wireless network, a routing protocol is required to route data between nodes. The primary goal of such routing protocol is correct and efficient information exchange between the nodes. This paper addresses such routing issue from the Physical Layer perspective of an Orthogonal Frequency Division Multiplexing (OFDM) broadband ad hoc wireless network. Two wireless routing schemes, namely, the Adaptive-All and Adaptive-Select Routing Scheme were proposed, based on the Channel Impulse Response (CIR) of the wireless channel. Extensive simulation results show that both of the schemes are efficient in reducing the error rate and increasing the data throughput.

1. Introduction

An ad hoc network is a transient network formed dynamically by a collection of arbitrarily located wireless nodes without the use of existing network infrastructure or centralized administration [1]. Ad hoc routing protocol has become a popular yet significant research topic in the realm. The primary objective of such protocol is the correct and efficient route establishment between a pair of nodes so that message can be delivered reliably and in a timely manner [1]. In this paper, we introduce two routing schemes, namely, the Adaptive-All and Adaptive-Select Routing Scheme for Orthogonal Frequency Division Multiplexing (OFDM) broadband ad hoc wireless network. We

aimed to investigate the Physical Layer characteristic, i.e. the Channel Impulse Response (CIR) value of the wireless channel towards routing efficiency. The efficiency of the schemes is evaluated by using the Bit Error Rate (BER) and data throughput in transmission. These proposed routing schemes can be served as the component to any new ad hoc wireless routing protocol, or to be a *"plug-in"* to existing higher layer routing protocols, for formulating a cross-layer routing protocol design.

2. Background and related works

As the purpose of the research is to figure out an ad hoc wireless routing scheme, several well-known routing protocols as stated in [2], [3], [4], [5], [6] had been studied for comprehending the nature of such protocol. As stated in [2], [3], [4], [5], most of the protocols use minimum-hop-count as the metric in finding the best route. Such minimum hop-count routing algorithm may choose route that have significantly less capacity than the best path that exist in the network [7]. The fundamental property of wireless network, i.e. its time-varying channel quality has often been ignored in the design of routing protocol [7], [8], [9], [10], [11], [12].

Two adaptive-based routing protocol, namely Bandwidth-Guided Channel Adaptive (BGCA) Routing Protocol [9], [10] and Receiver-Initiated Channel Adaptive (RICA) Routing Protocol [9], [11], [12] network were also reviewed. They both exhibit the flexibility of adjusting throughput, by employing different modulation order, based on Signal-to-Noise