Performance Evaluation of Energy and Delay Aware Quality of Service (QoS) Routing Protocols in Mobile Adhoc Networks

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ABSTRACT

Mobile adhoc network (MANET) is a collection of mobile devices which form a communication network with no pre-existing wiring or infrastructure. Multiple routing protocols have been developed for MANETs. As MANETs gain popularity, their need to support real-time applications is growing as well. Quality of service (QoS) provisioning is becoming a critical issue in designing mobile adhoc networks due to the necessity of providing multimedia applications. These applications have stringent QoS requirements such as throughput, end-to-end delay, and energy. Due to dynamic topology and bandwidth constraint supporting QoS is a challenging task. QoS aware routing is an important building block for QoS support. The primary goal of the QoS aware protocol is to determine the path from source to destination that satisfies the QoS requirements. This article proposes a new energy and delay aware protocols called, energy and delay aware Adhoc On demand Distance Vector Routing (EDAODV) and energy and delay aware Dynamic Source Routing (EDDSR) based on extension of AODV and DSR. Simulation results show that the proposed protocols have a better performance than AODV and DSR in terms of energy, packet delivery ratio and end-to-end delay.

Keywords: delay; energy; mobile; quality of service; routing; wireless networks

INTRODUCTION

Wireless mobile networks and devices are becoming increasingly popular as they provide users access to information and communication anytime, anywhere. Conventional wireless mobile communication is usually supported by a wired fixed infrastructure, such as asynchronous...
transfer mode (ATM) or the Internet. The mobile devices use single-hop wireless radio communications to access a base station that connects the wired infrastructure. In contrast, the class of mobile ad hoc networks (MANETs) does not use any fixed infrastructure. The nodes of MANETs intercommunicate through single-hop and multihop paths in a peer-to-peer fashion. Intermediate nodes between a pair of communicating nodes act as routers. Thus, the nodes in MANETs operate as both hosts and routers. The nodes are mobile and so the creation of routing paths is affected by the addition and deletion of nodes. This results in the rapid change in topology of the network.

The proactive table-based routing schemes require the storage of the routing information, which is used to determine the next hop for the packet transmission to reach the destination. The protocol attempts to maintain the table information consistent by transmitting periodical updates throughout the network. These routing schemes may be flat or hierarchical in nature. Examples of flat table-based routing schemes include destination-sequence distance vector (DSDV) routing and wireless routing protocol (WRP). Flat routing schemes require maintenance of the state of the entire network at all nodes, which limits its scalability. In the hierarchical approach, the state of only a subset of the network is maintained at all nodes, and routing is facilitated through another level of state information, which is stored in fewer nodes.

In the case of on-demand source-based routing schemes, routes are created as and when necessary based on a query-reply approach. When a node needs to communicate with another node, it initiates a route discovery process. Once a route is found, it is maintained by a route maintenance procedure until the route is no longer needed. Examples of on-demand source-based routing schemes include ad hoc on-demand distance vector (AODV) routing protocol, dynamic source routing (DSR), and the temporary ordered routing algorithm (TORA) (Royer & Toh, 1999). These algorithms focus on finding the shortest path between the source and destination nodes by considering the node status and network configuration when a route is desired.

Quality of service (QoS) is usually defined as a set of service requirements that needs to be met by the network while transporting a packet stream from a source to its destination. QoS routing protocols search for routes with sufficient resources in order to satisfy the QoS requirements of a flow. The QoS routing protocol should find the path that consumes minimum resources (Prasant, Jian, & Chao, 2003). Depending on the application involved, the QoS constraints could be available bandwidth, cost, end-to-end delay, delay variation (jitter), energy, probability of packet loss, and so forth.

The rest of the article is organized as follows. In the next section, the previous work related to QoS aware routing protocols is briefly reviewed. Subsequently, energy and delay aware protocols called energy and delay aware AODV (EDAODV) and energy and delay aware DSR (EDDSR) based on extension of AODV and DSR are described. Following that, the major simulation results are shown. Finally, the result of the work done is summarized.

**RELATED WORK**

The primary goal of the QoS-aware routing protocols is to determine a path from a source to the destination that satisfies the
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N. Belala, D.E. Sadouni, R. Boukharrou, A.C. Chaouche, A. Seraoui and A. Chachoua

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