QoS-Aware Multicast Routing for Mobile Ad Hoc Networks

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ABSTRACT

Applications of ad hoc networks are increasing in recent years because of their ease of deployment. Mobile ad hoc networks multimedia applications require an efficient and effective quality of service-aware multicast routing scheme. Supporting quality of service in an ad hoc environment is a major challenge due to unpredictable and rapidly changing topology. In this article a novel cluster-based QoS aware multicast routing protocol (CQMRP) for mobile ad hoc network is presented. In this scheme the multicast routes are constructed in a distributed manner. Analysis shows that the control overhead generated by the proposed QoS aware multicast routing scheme is less than the other related schemes. The simulation result shows that the packet delivery ratio of the proposed scheme is better than HQMRP in higher mobility scenario. In addition to that it is highly adaptable to topology changes.

Keywords: clustering, mobile ad hoc network, multicast routing, quality of service

INTRODUCTION

Providing quality of service (QoS), in particular meeting the data rate and packet delay constraints of real-time data users, is one of the requirements in emerging high-speed data networks. The provision of QoS is an issue highly investigated within the Internet Engineering Task Force. However, the approaches, which have been engineered for fixed networks, are not directly applicable to mobile ad hoc networks. The continuous changes in the network topology make the end-to-end delay and available bandwidth to be continually changing. Many QoS components should work together to support QoS in ad hoc networks; a QoS model specifies which kinds of services to be included in the network; a QoS routing scheme searches a path with satisfactory resources defined by the QoS model; a
QoS MAC protocol solves the problems of medium contention; a QoS signaling protocol performs the resource reservation along the path computed by the QoS routing protocols. However, getting and managing the QoS information in mobile ad hoc network is not trivial because the quality of a wireless link changes with respect to node mobility and surrounding conditions.

Due to node mobility a route with certain capacity reserved for a particular flow may have to be re-routed. The new path to the desired location may not have the original required capacity. Therefore, re-negotiation of resources allocated to the connection is needed. At the same time, the flow (e.g., audio or video) should be transported and presented seamlessly to the destination with a smooth change of perceptual quality.

The audio and video flows are characterized by the production, transmission, and consumption of single media streams with associated QoS. For multicast flows, individual receivers may have differing capabilities. This could be due to fluctuating network resources or imposed by node mobility. The challenge is to bridge this heterogeneity gap in mobile multicast environments while simultaneously meeting the individual mobile devices QoS requirements. In order to solve these issues, we propose a new architecture and algorithm for QoS-aware multicast routing scheme.

The rest of the article is organized as follows. The second section provides an overview of related work in the area of MANET QoS routing. The QoS aware multicast routing issues are described in the third section. Fully distributed QoS-aware cluster-based algorithm is presented in the fourth section. The fifth section describes the QoS-aware multicast routing discovery scheme, and the sixth section describes the multicast path maintenance scheme. Analytical performance analysis is given in the seventh section. The next section explains the simulation results and the final section concludes the paper.

RELATED WORKS
The quality of a wireless channel is typically different for different users, and randomly changes in time on both slow and fast time scales. In addition, wireless link capacity is usually a scarce resource that needs to be used efficiently. An efficient scheduling algorithm that maximizes the throughput by utilizing asynchronous channel quality variation is presented by Matthew Andrews, Krishnan Kumaran, Kavita Ramanan, Alexander Stolyar, and Phil Whiting (2001). A fundamental problem in QoS routing is to identify a minimum cost path between a source and a destination that satisfies some delay and bandwidth constraints. Bandwidth requirements can be efficiently handled by simply pruning infeasible links. Yigal Bejerano, Yuri Breitbart, Ariel Orda, Rajeev Rastogi, and Alexander Sprintson (2003) present a polynomial solution using restricted shortest path problem. The routing algorithm uses link cost metrics to distinguish between paths of the
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