QoS Provisioning for Multicast Routing and Channel Assignment in Wireless Mesh Network

Abira Banik
https://orcid.org/0000-0001-8219-3026
Tripura University, India

Abhishek Majumder
Tripura University, India

INTRODUCTION

Wireless mesh networks (WMN) is defined by a group of nodes which uses a wireless mode of channel and form a mesh topology, where each individual node is connected to the other with a dedicated line of communication. The few distinguished features of WMN's are self-organization, spatial reuse, and fault tolerance. The ad-hoc connectivity enables the WMNs to be of low cost, ease of maintenance, reliability and robustness [Akyildiz et al., 2005]. The scope of development and research in the fields of wireless mesh network is wide open and the focus has been also widened from only effective channel assignment to channel assignment and multicast routing. An effective channel assignment algorithm in WMN maximizes the utilizationof network bandwidth. The efficiency of the network performance is generally termed as quality of service (QoS). The main term QoS defines the performance level of a service by the network to the end users. It generally is associated with the behaviour of wireless node or service, throughput sensitiveness and delay sensitiveness in multimedia applications. The QoS provisioning can be simply stated as satisfying a set of network related parameters like jitter, battery life, latency, packet loss ratio and bandwidth. The QoS imparting parameters depends upon the scenario in which it is implemented.In the context of channel assignment the QoS parameters can be signal power, bandwidth, power, etc. on the other hand the QoS parameters for multicast routing are bandwidth, delay, jitter etc. As for voice communication the parameters are battery life, for video communications buffer space, jitter delay, packet loss ratio, for military applications the parameters are strict security parameters.The various real time applications of the day to day life use multicasting such as audio/video conferencing, online gaming, remote learning, webcasting, distance learning, distribution of financial data, billing records, software, newspapers and lots more. WMNs are very much suitable for supporting such type of multicasting application.But provisioning of QoS in multicast routing as well as efficient assignment of channels is a challenging issue. For solving this problem, many techniques have been developed. This chapter presents a detailed study of the QoS provisioning in the channel assignment, multicast routing and both in a network scenario. It also classifies the techniques based on whether it is applied during channel assignment, multicast routing or during both phases. Comparison of the techniques is also presented in a tabular format.

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BACKGROUND AND CLASSIFICATION

The incorporation of the QoS provisioning in the field of channel assignment and multicast routing techniques is already implemented by a number of techniques. Based on the point where the techniques are applied, QoS provisioning techniques in WMN can be classified in three categories namely, QoS provisioning in channel assignment, QoS provisioning in multicast routing and QoS provisioning jointly in channel assignment and multicast routing.A brief discussion on the already implemented techniques for serving QoS in the channel assignment phase, in multicast routing phase and channel assignment and multicast routing phase has been presented in the joint section.

QoS Provision in Multicast Routing Algorithm

In this section a brief discussion on the techniques for QoS provisioning in multicast routing algorithm has been presented.

Gateway Cluster Based Load Balancing Multicast algorithm

Gateway cluster based Load Balancing Multicast algorithm (GLBM) [Zhao et al., 2010] provides load balancing aware multicast routing algorithm which offers QoS as well as superior performance in terms of delay, jitter and throughput. In this algorithm, the main importance has been laid on the multicast routing communication pattern, since it has a high demand on network bandwidth and also an impact on algorithm execution time. It defines the WMN network in three distinct layers – Internet Gateway layer (IGW), Mesh Router layer (MR) and Mesh Client layer. The algorithm works on the IGW layer and MR layer. As stated above, the algorithm throws light in the concept of load balancing, since the mesh routers is responsible for maintaining the traffic load of the mesh clients. Likewise the gateways maintain the traffic load of the mesh routers and internet. It works as an admin in accessing the backbone internet and maintaining the optimal load balancing. Basically for any multicast routing scheme the lowest hop count route is selected as the best route, but in this scheme the best route is selected in terms of load balancing. The steps in the algorithm are:

i. Initiating a multicast session – The source node in the multicast group initiates a multicast session to the internet, and sends a Multicast Sender Request (MSR) to its gateway to become a multicast source node. The gateway on receiving the MSR message periodically broadcasts the multicast Hello Message (HM) along with the other routing details like sequence number to other gateway nodes in the network. The gateway node on receiving the HM message, records the backward route to the source node in its multicast routing table and deletes the old entry.
ii. Receiver joins the multicast session – The receiver which aims at joining in the multicast group sends the Multicast Route Request (MRQ - J) with Join flag and destination IP address to its gateway by broadcasting the request to all the neighbouring nodes at one hop distance. The node receiving this request (MRQ - J) adds the network Interface Queue (IFQ) length to the IFQ aggregation field. The path with the lowest IFQ aggregation is chosen as the multicast path from the gateway to the receiver. The IFQ length determines how busy the network interface of the node is. The gateway checks the multicast routing table. If the IP address is already available in the table then it sends a Multicast Route Reply (MRP) to the request receiver otherwise it sends Multicast Source Reply with Error flag (MSQ-E). The MSQ-E message is to inform the non-existence of the requested multicast session.