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Multipath Multimedia Dynamic Source Routing Protocol Using Cross Layer Framework for 802.11e Wireless Network

Pawar MA* and Jadhav VS

Department of E&TC, Maharashtra Institute of Technology, Pune, India

Abstract

Presently, Multimedia services such as video-streaming applications e.g. Live streaming, video lecture are more demanded and service over wireless network (802.11e) are more used. Hence, it is necessary to provide end-to-end Quality of service (QoS) over wireless network, as it poses a challenging problem due to the transient structure of wireless networks. The weakness of Dynamic source routing with wireless system has been analyzed and work has been done to improve the Quality of service parameters such as throughput etc. MMDSR (Multipath Multimedia Dynamic Source Routing) is a multipath routing protocol DSR-based if merged with a cross-layer framework can provide enhanced QoS for multiple sources of video over IEEE 802.11e wireless networks.

Keywords: Cross-layer framework; Dynamic source routing; IEEE 802.11e; Multipath multimedia dynamic source routing; Quality of service

Introduction

Nowadays, multimedia services such as video streaming applications e.g. Live streaming is more demanded due to rapid development in the communication field. Video streaming is the transmission of multimedia from provider to the end user. Video-streaming is very useful feature for low end devices such as mobile phones, tablet, palmtop computer etc. Video-streaming faces the issues of throughput, jitter, delay, packet loss etc. because of the huge amount of the video streaming data and nature of wireless network which degrades the quality of service (QoS). There are two types of video streaming i.e., pre-stored video stream (video-on-demand) and real time video stream example live streaming online gaming, video conferencing. Distribution of video signal is done by using Real Time Control Protocol/Real Time Protocol i.e., RTCP/RTP protocol Over UDP transport protocol. Using MPEG coding video signal is encoded into set of frames. The current video frame mapping approach used in video streaming are static approach and EDCA approach but in both video frame mapping techniques cannot distinguish the frames importance, which lead towards degradation of video quality at the receiver. Cross layer approach is used to improve the video quality of service and the quality of service [1]. These video frames are transmitted over the Wireless network from source to the destination. Mobile ad hoc network (MANET) is a wireless network is a decentralized type network which does not rely on pre-existing infrastructure such as routers in wired networks or access point in wireless network. Instead each node participates in routing by forwarding the data to other node. The Cross Layer approach is used to provide end-to-end Quality of service over wireless network. In this paper we discuss the different techniques used to improve performance of quality of service in wireless environment.

Related Work

Route discovery

The main issue in wireless network is to find route from source to destination when some or all nodes are mobile. Due to mobile node it is very difficult to find route when we are considering increasing the quality of service parameter like throughput, jitter, packet delivery ratio etc. In dynamic source routing, the route discovery is done by route discovery mechanism. When source node S want to send the data packet to the destination D, source node S initiates the route discovery (Figure 1). Source node S floods the route request RREQ to its neighboring node RABK. Each node appends own identifier when forwarding RREQ. After receiving RREQ the neighboring node broadcast the route request. Node G receives the packet route request RREQ from its two neighbors which may cause collision. The process is continued until route request is reached to the destination node D. Destination node D does not forward the RREQ because Node D is the intended target of the route discovery [2,3].

Target node D returns the route reply RREP message to sender. While selecting route from source to destination parameter to considered are number of hop count and mobility of node. As it can be observed that from source to destination node D has two paths to send route reply RREP packet. As both nodes have same number of hop count, mobility is considered. Wireless nodes are mobile nodes. They are continuously moving from one point to another. So by calculating mobility we can find the lifetime of node. Node having high lifetime is less mobile compare. With less mobile node there is less chances of breaking of route. In Figure 2 the route SRMD has less mobility hence

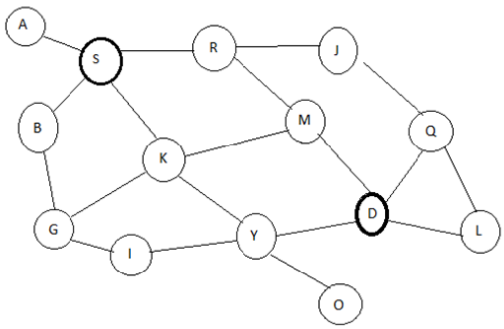

Figure 1: Route discovery.

***Corresponding author:** Pawar MA, Department of E&TC, Maharashtra Institute of Technology, Pune, India, Tel: 020 3027 3400 E-mail: maheshnamaste@gmail.com

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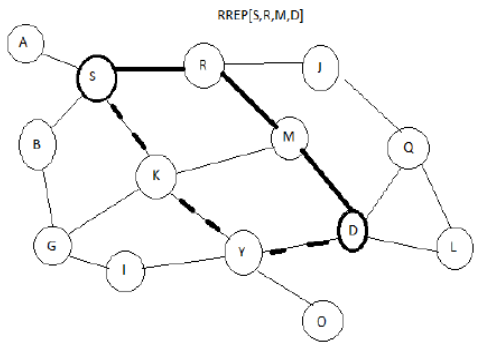

Figure 2: Route reply.

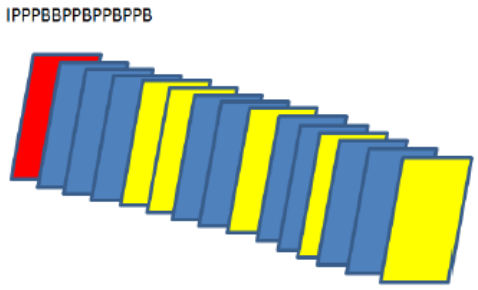

Figure 3: Group of picture.

it is selected over the route SKYD. Route maintenance is done when there is broken in link (Figure 2).

M sends the route request error to S along route M-R-S when it finds link [M-D] broken. This is done by sending route error packet RERR. Nodes hearing RERR update their route cache to remove all invalid routes related with link [M-D].

Video distribution

RTP/RTCP (Real Time Protocol/Real Time Control Protocol) is used for video distribution. The RTP/RTCP was developed for carriage of real time data over IP network. RTP is a native internet protocol, designed for and fitting well in the general suite of IP protocols. RTP makes use of an associated protocol, the RTP Control Protocol (RTCP), which provides quality of service monitoring and information used to synchronize multiple RTP streams. Layered coding allows enhanced layers of several qualities to be transmitted, given that a minimum bandwidth is guaranteed to transmit a base layer. We use layered MPEG-2 coding of the video flow [4,5].

MPEG-2 encoded video is formed by sets of frames which called as GoP (Groups of Pictures). A GoP is an encoding of sequence of frames that contain all the information that can be completely decoded within that GoP.MPEG video frames consist of three types of frames: Intra frame (I frame), Predictable frame (P frame), Bi-directional frame (B frame). For all frames within a GoP that reference other frames (such as B-frames and P-frames), the frames so referenced (I-frames and P-frames) are also included within that same GoP.

Group of Picture follows the pattern like IPPPBBPPBPPBPPB As shown in Figure 3. Group of Picture contains only one I frame, several P frame and B frame. I frame is the main frame which is responsible for regeneration of video packet at the receiver. I frame carry the most important video information for the decoding process at the receiving side. GoP could be decoded even if just I frames were present in video packet. I frame is coded independently of all other frames. Each GoP begins with I frame. I frame contain the full packet information and do not require any additional information to reconstruct even P frame and B frame are not received at the destination point.

The entire Group of picture would be lost if the corresponding I frame was not reach at destination point. The video characteristics are considered for the Quality of Service parameters.

IEEE 802.11e

The current video frame mapping approach used for video frame transmission are static video frame mapping and EDCA video frame mapping. In static video frame mapping, all packets frames i.e., I ,P and B frame are sent through single access category while in EDCA video frame mapping, GoP are send through different access category. But problem with both mapping techniques is that they don't provide priority to the access category which result into degradation of video quality and hence the Quality of Service is also degraded. The proper access mechanism in MANETs is EDCA, since no centralized access point is needed. The main difference between IEEE 80211e and other 802.11 standards is IEEE 802.11e contains four different access categories (AC). By giving different priorities to different access categories we can increase the quality of service of video frame.

Packet sizes are considered for observation. For study 20 nodes are created here for this scenario. In between these 20 nodes, nodes between source and destination are mobile or moving [6]. They are considered mobile because in the wireless communication network nodes are not fixed at size, they are moving in nature. In the study it is observed that when packet size is set minimum, Throughput and packet delivery ratio becomes maximum.

Proposed Methodology

The routing is the main issue when we are sending packet from source node to the destination node. When we are sending default video packet from source to destination, we don't know which path should be preferred over the different available path for that route discovery mechanism is used. Source node broadcast the RREQ to neighboring node and process is continued until broadcast RREQ is reached to the destination node. And then destination node sends the route through which data transmission process is going on. The parameter while selecting the route is mobility of node and minimum number of hop. Mobility is considered because by finding mobility we are to find how much node is mobile. If node is more mobile that means there are more chances of breakage of route which further increases the packet loss hence decreases the quality of service of video frame.

While transmitting default video packet we are assigning priorities to I, P, B frame through different access categories. I frame has highest priority which result into decreasing packet loss and increase in Quality of Service. By providing highest priority to I frame and including cross layer framework we are increases the quality of service parameter.

Simulation Parameters

Before application of the system in real time manner it should be studied practically because there are very large number of requirements about Throughput, Packet Delivery Ratio, Quality of Service and many more. This paper is focused to study Throughput and Packet Delivery Ratio. The system designed contains large number of nodes, hence cannot be bought individually and idea comes forward to use the

simulator. Here system is simulated using NS 2 (Network Simulator). Default video Signal frames are converted into number of packets and sent to receiver through routing protocol to study the behavior of the system in this simulator (Figures 4 and 5).

MPEG-2 format will be used for the codification and application of the system.

Simulation Results

Throughput and packet delivery ratio of the system depends mainly on the packet size. Varying packet size gives varying throughput and packet delivery ratio, hence here varying packet sizes are considered for observation. For study 20 nodes are created here for this scenario. In between these 20 nodes, nodes between source and destination are mobile or moving. They are considered mobile because in the wireless communication network nodes are not fixed at size, they are moving in nature. In the study it is observed that when packet size is set minimum, Throughput and packet delivery ratio becomes maximum.

Conclusion

This paper reviews different methods to enhance throughput and packet delivery ratio. By using cross-layer framework in the dynamic source routing protocol throughput and packet delivery ratio can be increased, as it works at different layers simultaneously overall system performance also increases.

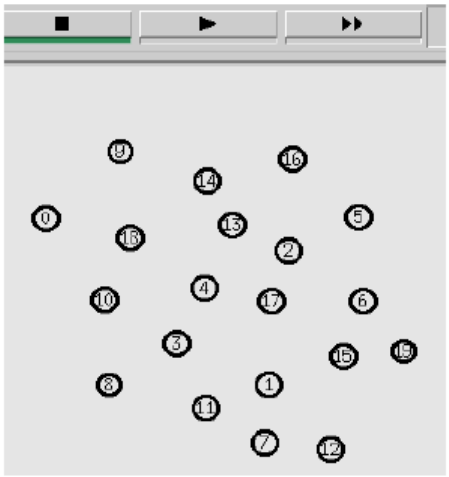

Figure 4: Wireless network with random nodes.

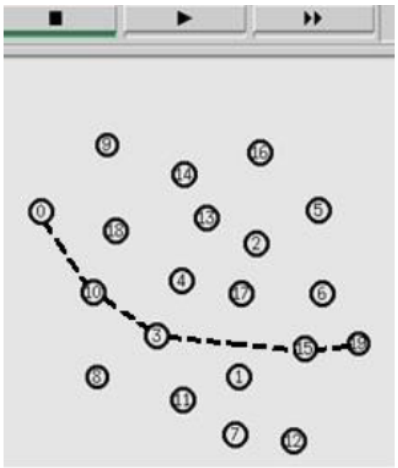

Figure 5: Random nodes sending packets in wireless network.

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