

# An Integrated Cross Layer Design to Enhance the Quality of Service of Video Streaming in Mobile Adhoc Networks

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## Article Info

### Article history:

Received Mar 6, 2018

Revised Jun 12, 2018

Accepted Jun 26, 2018

### Keyword:

Delay

Multipath transport

Multiple description coding

PSNR

Wireless networks

## ABSTRACT

The intent of this paper is to put forth a novel technique for improvising the QoS of multimedia applications in by using Modified dynamic mapping algorithm and Multipath Transport (MPT) and Multi Description Coding (MDC). The improvement is attained by applying the MDC at application layer along with UDPLite in transport layer and multipath at network layer and Modified dynamic mapping in MAC Layer. This method attains an increase of 30.84% in Peak Signal to Noise Ratio (PSNR) and 18.57% decrease in delay in contrast to the conventional methods.

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## 1. INTRODUCTION

Multimedia transmission in MANETs is used to both random and burst losses, which weakens the quality of video anticipated by the end user. Various types of solutions are available to tackle the problem out of which MDC, MPT and modified dynamic mapping is the apt scheme for video streaming in MANETs.

MDC the feasible choice for source coding is implemented in application layer. In MDC, the video folder is divided into sub-streams which has distinct significance. This division enables each received solitary description an assured ultimate level of reconstruction quality and other descriptions can rise the quality. Therefore if one description is lost it does not move to other descriptions thereby avoiding the retransmission of the description. The packets are then diffused from application layer to the transport layer. At the transport layer UDPLite is used, which increases sensitivity information to the frames, thereby reducing the chance of rising the frames and are sent to the network layer. In the network layer, a new multipath routing protocol SMMSR is proposed and implemented [1]. To avoid bottleneck in links and to expeditiously use the network properties, SMMSR creates several maximally disjoint paths.

In the SMMSR protocol, the source connects RREQ packets to regulate the routes. The destination node directs a Route Reply (RREP) back to the source node. Further RREQs are received by the destination node after waiting for a period of time. Between the received RREQs, the destination selects the path that is extremely divided into the primary responding route, carries second RREP to generate the next and in this manner four routes are created. As soon as the sender node obtains the four RREPs, four routes are produced and four video reports are relocated via through the four routes individually, these video description packets are directed from network layer to MAC layer. In MAC layer modified dynamic mapping algorithm is used to achieve low delay and good feature multimedia streaming. The approaches discussed in [2]-[31] involve the knowledge of the Networks a priori.

In the approaches [32-36] inter-packet delay is very huge. To overcome the limitations in the previous works, across layer methodology is suggested by MDC in application layer, UDPLite in the transport layer and

Split Multipath Multimedia Dynamic Source Routing (SMMDSR) in network layer and modified dynamic mapping in Medium Access Layer (MAC). In the future MDC, UDPLite and SMMDSR with dynamic cross layer mapping approach [37], [38], [39] video information from the application layer is involved to the UDP lite layer. UDP lite protocol supports the quality of video frames established from the application layer, by delivering the broken frames rather than ignoring them to the network layer. In network layer SMMDSR is used. SMMDSR is the multipath delay of DSR. In SMMDSR a set of another disconnected routes are assembled with extremely disjoint paths. SMMDSR uses Route Request (RREQ) and Route Reply (RREP) to choose dissimilar paths that are appropriate for the transmission of video descriptions, and no extra control packets were used for discovering the paths. Thus SMMDSR extracts and uses the information introduced in typical routing messages and send the packets to MAC layer. In MAC layer modified dynamic mapping algorithm is very actual than static and dynamic mapping [35], [36] in contributing less inter-packet delay and high PSNR ratio thereby creating the quality of video in end user experience.

The remainder of this paper is organized as follows: In Section 2 and 3 the proposed system and the projected multipath routing is discussed. Section 4 symbolize the system simulation model and illustrates the significance of the proposed work, while conclusions drawn are given in Section 5.

## 2. CROSS LAYER ARCHITECTURE

Provisioning Quality of Service (QoS) for multimedia applications in adhoc networks is an interesting task. The QoS provided by the MANET depends on matching the efforts from all layers. Hence, it is really appropriate to develop dynamic results based on cross layer tactics that are able to take QoS into account for the different technical terms of the TCP/IP protocol stack. This Paper aims at augmenting the quality of service of video streaming by recommending a new cross layer approach for mobile adhoc networks.

In this cross layer architecture, video streams are fed to the Application Layer. This video source file is coded into several descriptions and is reduced using the MPEG-4 standard and fed from the application layer to the transport layer. At the transport layer, UDPLite comprises sensitivity information to the frames thereby reducing the probability of dropping the frames and directs it to the Network Layer.

To deliver steady and reliable communication, multiple paths are chosen in the network layer so that the limitations due to bandwidth, time-changing nature of the topology can be overcome. The SMMDSR protocol along with modified dynamic mapping in MAC layer has been advised in this research work that affords route flexibility and a reduced end to end delay. Due to the availability of more number of paths in the network layer and the modified dynamic mapping algorithm [37], [38], [39], [40] in the MAC layer, the requirement of multimedia applications has been satisfied. Likewise, at the receiving side, the packets from numerous paths are composed in the network layer and directed to transport layer. Packets containing tainted header portion are removed and the remaining packets will be shared by merger at the application layer that combines all the received reports and sends to media player.

The framework for assessing the proposed cross layer system is shown the Figure 1. The input source for the framework is a rare video sequence in YUV CIF (176 x 144) format of size 15MB

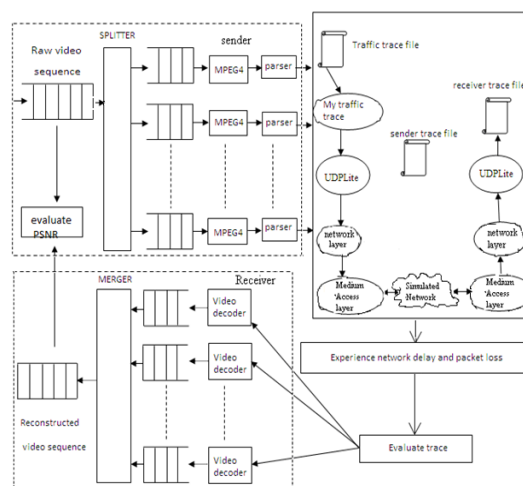


Figure 1. Framework for Cross Layer Architecture

The source file is fragmented by the splitter into 4 explanations using a frame based approach. The fragmented video sequences are MPEG-4 programmed and each compressed video sub stream is defined by the parser program. A trace file which has frame-id, frame-type and frame-size and authorized sending time is produced. Network simulator produces the packets according to the traffic trace file proceedings. According to the user specified time the generated packets are moved to the lower UDPLite Layer. The resultant file name of sender trace file is recognized by the user in UDPLite agent. The timestamp of every conveyed packet, the packet ID, packet size are also recognized by the agent.

The packets sent to the Network Layer are transmitted by SMMDSR protocol through multiple disjoint paths. Five paths are well known by this protocol and out of which four paths are used for directing the packets and one path is kept as a stand by path. The four descriptions are sent through 4 different disjoint routes. Thus additional number of packets transmitted from network layer reaches the MAC Layer. The 802.11e standard explains 4 Access Categories (ACs) AC\_VO (for voice traffic), AC\_VI (for video traffic), AC\_BE (for best effort traffic), and AC\_BK (for background traffic) that have dissimilar transmission priorities. To progress the quality of service for video streaming in Wireless Networks, 802.11e provided traffic distinction by allocating the video traffic to one access category. But the channel access method and the transmitted method do not take significant of information of the video into consideration. Therefore the features of video data content are to be altered by the transmission layer mechanism by considering the important information produced from the Application layer. So the video data has priority service since the video data are allotted to different Access categories. The video frames marked to Access Category (AC) queues as AC [0], AC [1], AC [2] relating to the video coding significance. Other traffics are allocated to AC [3] and then to the physical layer.

At the receiving side, physical layer receives the video data and it is transferred to UDPLite Sink through MAC layer and network layer. The timestamp, packet ID, size of packet that is received in user specified file are recorded by the sink agent. After the simulation the receiver trace file is valued and checked with sender trace file. From the valuation trace file, the number of packets that are sent and received become known. Moreover, the corrupted video in the form of distorted video file is formed at the receiver side.

After decoding each video file which had been received, the actual video is reframed using merger. The merger program generates the reconstructed video sequence from the decoded unclear video sequences which are fed to the merger program by the decoder. The quantity of video frames in the primitive video should be equal to total quantity of video frames in the simplified video sequence. If it is not equal, the merger program does fault suppression by copying the most recent successfully decoded frame of the sub-stream to the lost frames awaiting till correct decoded frame is identified.

### 3. MULTI PATH ROUTING

In this work five paths are selected and hence 5 paths are available always, of which one path is kept as a stand by route. The five routes are chosen in order to send the four video explanations through four routes and in case if one route fails, the stand by path can be used to send the video data so that the video is sent. In SMMDSR protocol how the five routes are chosen is described below.

In the SMMDSR protocol, the source transmits RREQ packets to discover the routes. The destination node sends a Route Reply (RREP) back to source node. More RREQs are received by the destination node after a period of time. Among the received RREQs, the destination chooses the route that is ultimate disjoint to the first responded path and transmits another RREP to make the second route and this way five routes are created. Among the five routes four routes are chosen and four video descriptions are transferred through these four routes to achieve low delay and superior quality video streaming.

In case if five routes are not available and only four routes are available, then four descriptions are sent through four routes. If Only three routes are available three descriptions will be sent through the three routes and the received quality of video will be condensed from 52dB to 49dB in PSNR and only if two routes are available then the PSNR is condensed to 47dB.

If 5 paths are not accessible to reach the destination then intermediate node sends the error message to the source node.

### 4. SIMULATION RESULTS AND DISCUSSION

On the whole, the results acquired were based on the simulation setup for MDC along with user datagram protocol lite and multipath and modified dynamic mapping scheme. The MDC along with UDPLite and SMMDSR and modified dynamic mapping system over an adhoc network is simulated using NS2 simulator and performance of the received video at the receiver has been evaluated. In the simulation, projected MDC with UDPLite, SMMDSR and modified dynamic mapping method is compared. SMMDSR with MDC,

if five paths are considered then if the four descriptions are transmitted through four paths. The video sequence “Foreman”, is at QCIF format with 400 frames. Shown in Table 1.

Table 1. Simulation Parameters for MDC with Multipath Routing and Modified Dynamic Mapping

Parameter	Value
Area	500x500m
Number of Mobile Nodes	20 nodes
Mobility Model	random waypoint model
Speed	(0<5) m/s
Routing Protocol	SMMDSR
No of routes	N=1, 2, 3,4
MAC protocol	802.11e
Video	Foreman YUV QCIF

Multiple description coding and SMMDSR notion performs well on comparing with RA MDC, other related works. In RAMDC concept, the video series is divided into double descriptions odd frames in one description, even frames into another description utilizing an MPEG-4 encoder and is transmitted via two routes. In the network model, 20 nodes are positioned in a 500x500m region. Random waypoint model has been used. IEEE 802.11b factors are utilized in MAC layer. The possibility of damaged transmitted packets is evaluated utilizing the split multipath messages. Then the evaluated damaged frame probability results are sent to application layer and mentioned frames are selected randomly in order to decrease the error propagation produced by the lost packet. In the decoder, MSVC is used. The MSVC obtains the descriptions and interprets the accurately received descriptions utilizing refined macro block re-assignment methods, lost macro blocks are hidden.

The constraint of the RAMDC technique is that the evaluation of the lost frame probability, and choosing of reference frames depending upon threshold algorithm to alleviate the error propagation involves more time. However, if both paths flops at the same time the packet damages will be more. It is detected from the Figure 2, PSNR in projected idea is higher than the RAMDC technique.

The MDC and SMMDSR technique accomplishes well when related with RAMDC.

It is noted from the Figure 2, PSNR in the projected technique is higher than the RAMDC technique. Figure 3 portays the delay attained by MDC, UDPLITE, SMMDSR and modified dynamic mapping with related methods for Foreman video.

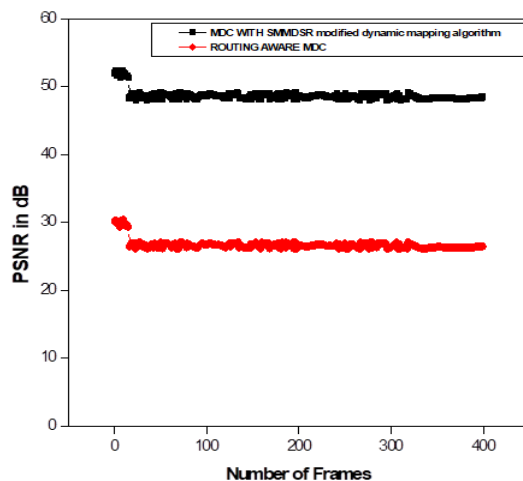


Figure 2 PSNR Attained by MDC, UDPLITE, SMMDSR and Modified Dynamic Mapping with Related Methods for Foreman Video

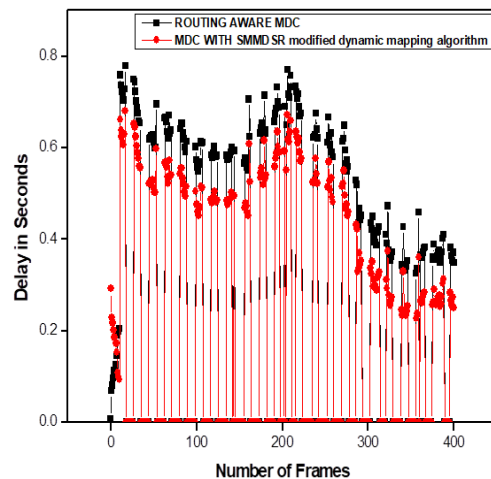


Figure 3 Delay by MDC, UDPLITE, SMMDSR and Modified Dynamic Mapping with Related Techniques for Foreman Video

## 5. CONCLUSION

The MDC, UDPLite, SMMDSR and modified dynamic mapping technique is proposed to increase the standard of video streaming over MANETS. The simulation outcomes reveals that proposed idea attains an increment of 30.84% in PSNR and 18.57% reduction in delay when compared to conventional techniques.

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