International Journal Of Engineering Research And Development
e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com
Volume 14, Issue 1 (January 2018), PP.10-13

An Improved Cross Layer Architecture to Upgrade Quality of Services in MANET

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Abstract:- The demand of multimedia application is growing day-by-day because of lots of multimedia services e.g. videos streaming. These multimedia services demands high quality of services for best user experience. In this field of commodification MANET has proved its significance. MANET is a self-organizing network which is not dependent on any infrastructure. But at the same time, because of the mobility of the nodes it suffers QoS problem that creates performance issue. In this work we have adopted optimized cross layer architecture in MANET, which works well across all networks. It gives good performance in terms of throughput and packet delay factor, which is shown in result section in the form of graphs.

Date of Submission: 20 -01-2018 Date of acceptance: 05-02 2018

Nomenclature:
MANET : Mobile ad-hoc network
FDM : Frequency Division Multiplexing
LLQ : Low Latency Queuing
PDO : Power and Delay Optimized
ADOV : Ad Hoc On-Demand Vector
QOS : Quality of Services

I. INTRODUCTION

A Mobile ad-hoc network (MANET) is a self-configuring network, where all the nodes are allowed to move independently from each-other. Generally, these nodes work on small power battery devices. All nodes of MANET can behave like a host as well as routers also. As a host it can performs like a source or destination and as a router it can act as an intermediate bridge between source and destination. As a router it has ability to store the data and forward the data across all neighbouring nodes comes in that specific network. In MANET communication can be happen between any two nodes, where one will act as a sender and other will receiver. The most important thing in MANET is the node which acts as sender or receiver, can works as a router for customized requirement of channel.

Due to large number of mobile nodes and heterogeneous network configurations it is always challenging for a wireless network to transmit the multimedia data successfully. Specially, in MANET this issue is challenging due to infrastructure less based configuration. Generally QoS is defined as the capability of a network to provide satisfactory services. This service includes high data rate of multimedia transmission or a guaranteed amount of data sending or receiving during a specific time. In a wired network, two popular service model are Differentiated Service (DiffServ) model and Integrated Service (IntServ) model. These model needs a complete information (such as topology, packet loss, packet delay and bandwidth) to provide the essential QoS.
In this work we have proposed an optimized cross layer implementation, which contains a set of protocol and controller. These protocol and controller will help the network in handling the data traffic and increase their efficiency. Due to this approach, we can overcome the previous discussed issue of MANET.

Organization: The rest of the paper is organized as follows. Section II includes the related work in the field of improving QoS in MANET. In section III the proposed system is described which comprised the set of protocols and controller. In section IV the outcomes are evaluated and presented in form of graphs. Finally section V concludes the paper.

II. Related work

A real time data transmission technique is defined in for improving quality of services in mobile ad-hoc network where multimedia transmission is managed by various control panels. Every control panel executes some part of quality of service. Classification of data traffic control is proposed in by a new MAC scheme, which supports multimedia services. This classification approach is comparable to diff-serve which incorporates the QoS mechanism. The outcome of this approach improves the multimedia traffic in a heavy traffic load. A 5G mobile technology is proposed in for a guaranteed QoS with many other services. A lot of researchers from all over the world has contributed in this advance technology of 5G. In a different QoS approach is discussed for end to end delay minimization by applying AQA-AODV where routing takes place on customized needs of network. Integer Linear Programming is also a technique applied for improving QoS in, where an optimized MANET routing technique is implemented for providing a better throughput.

III. Proposed method

While transmitting the multiple packets of data through a wireless channel, some nodes of wireless network are heavily congested and busy in processing for preparing real-time packets. Scheduling of these packets are very important and it should be forwarded from one hop to other within the deadline based on priority. In order to overcome these problems a robust architecture is presented to manage the data packets.

PDO AODV approach

This approach is useful in optimization of Power and Delay factor of the Mobile Ad-hoc network. PDO AODV is actually a protocol to enhance the method of supervision in power saving and delay optimization. This protocol is enhanced version of AODV protocol.

Internet protocol Controller

In the network layer of the MANET an improved controlling mechanism is developed. It controls the data sequence according to our proposed model and works well with different types of heterogeneous network. Handling heterogeneous network and their various formats is very challenging in point to point communication and Ethernet LAN. But our optimized approach handles all those scenario including bounded delay condition and jitter condition also.

MAC Controller

This controller is capable to manage the radio channels and the wireless medium required by the base station by applying the protocol properly. This layer comes between the physical layer and network layer, which offers interior framing by converting base station to backbone network. Challenges comes in this layer is the quality improvement of Radio Frequency. ISM band contains interference, noise and fading of spectrum signals. But the MAC layer of our proposed system controls the station problem, which may be hidden or exposed. Packet loss can occur due to the regular collision of data packets without informing the radio waves and hence, retransmission becomes necessary which can cause further degradation in energy. Therefore, to overcome from these problems various protocols can be used such as MACA and MACAW. Here, L-HCCA scheme is introduced to reduce the real-time congestion.

Real time Scheduler

Here, L-HCCA channel is utilized for broadcasting of data packets which rely upon high priority queue. The real time event driven tasks can be scheduled using real time algorithm (RTA). With this approach real-time tasks can be executed simultaneously without crossing the deadline .Task is assigned and executed based on time period of task with an intension to execute shorter task first.

L-HCCA Channel Access

It's a Low Latency Queuing (LLQ) based improved channel access algorithm, which is proposed here. It priorities the data packets based on LLQ scheduling method. Due to strict behaviour of this method, data packets related to voice and video is served first instead of other. Frequency Division Multiplexing (FDM) is used for allocation of low, medium and high priority services except video and voice packets.so, LLQ scheduling method is operated based on frequency and bandwidth.

IV. Simulation and results

In this section the experimental study analysis has performed for our proposed model. This approach is implemented in matlab environment on windows platform. Performance of proposed approach is evaluated in

terms of throughput and packet rate. Different simulation parameter, which is used in this approach, is presented in table 1.

In order to perform the simulation, a network area of size $150\ m \times 150m$ is considered and a single mobile-hop network is developed. The number of nodes are deployed randomly in this simulation network area. A network grid is developed through entire network area of size 15 m×15 m.

For a successful transmission of packets, source and destination location should be estimated first. Some data packets are generated and distributed in random order from source to destination within range of 50-199 meter. More number of channels will make a higher probability of transmission. SNR threshold is set to 10, and the corresponding transmission power is set to 1000Mw. Simulation time is considered 5 ms and packet length is taken 3.04 kb/s. In one second the number of packets supposed to be transfer is 200.

Table 1.Simulation Parameters

Network Parameter	NEEDED
Simulation Area	1
Number of Network Grid	3
Grid Area	1
Number of Frequency Channel	1
Path Loss Factor	3
Rayleigh Fading Parameter	2
SINR Threshold	2 colour
Transmission Power	$1000\ mW$
Noise Power	$10^{12}\ mW$
Slot Time Duration	$5\ ms$
Video packet Length	$3.04\ kbps$
Number of packets to be transmitted in one second	200

Figure 1 depicts the packet arrival rate across different possible throughput. The existing system packet rate is lower than the proposed model, which proves its superiority compare to other existing model.

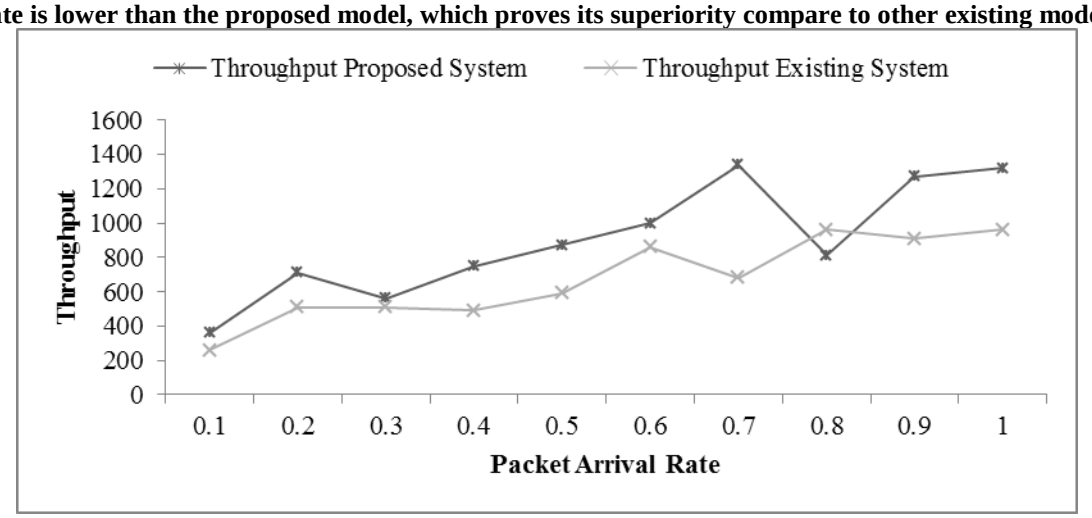

Fig .1 : Throughput Performance

Proposed model is compared with existing greedy method. This experiment is considered with various scenario where different threshold and channel is selected.

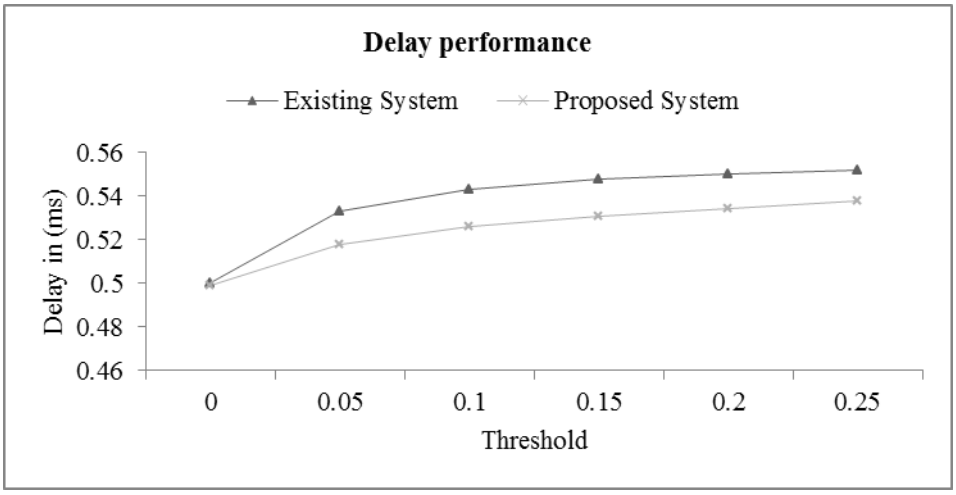

Fig. 2 : Delay performance comparison

In figure 2, we depicted the delay performance of proposed model with existing models. This delay performance is analysed across all possible threshold. Proposed model clearly outperforms better with existing models in terms of packet delay. It can be able to select the efficient channel where existing model is facing problem in finding appropriate channel.

V. CONCLUSION

The main aim of this work is to optimize the performance of multimedia services in a mobile ad-hoc network. In order to fulfil the demands of QoS, we have worked on both physical layer and MAC layer. Channel modelling is done at physical layer and buffer model is implemented with channel selection. For simulation a video distortion model is developed and the video data packet is transferred from one node to another with following the presence of proposed protocol and controller. The result is evaluated, the proposed methodology is better in comparison of other state of art QoS technique.

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Asha1. "An Improved Cross Layer Architecture to Upgrade Quality of Services in MANET, vol. 14, no. 01, 2018, pp. 10–13.