Volume 3, Issue 10, October 2013 ISSN: 2277 128X

International Journal of Advanced Research in Computer Science and Software Engineering

Research Paper

Available online at: www.ijarcsse.com

Analyzing Video Streaming Quality over Different Routing Protocols on Mobile Ad-hoc Network

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Abstract—The development of communication technology permits the people to use their mobile devices for streaming video content through wireless network. The real-time video streaming requires high band-width, minimum delay and minimum loss. Therefore it is difficult to provide the wide range of quality of services to the users. The quality of video is affected by dynamic change in the topology, multipath shadowing, collision, interference and many more. A lot of studies have been done on Mobile Ad –hoc Network to improve its performance using different protocols. In this paper, we analyze the performance of four different routing protocols namely ZRP, AODV, AOMDV, and DDIFF to improve the quality of streamed video in Mobile Ad-hoc Network .We are using an average throughput, average end-to-end delay and packet delivery fraction (PDF) with respect to varying pause time to analyze a video streaming quality over used routing protocols on MANET.

Keywords— Video streaming, MANET (Mobile Adhoc Network), ZRP (Zone Routing Protocol), AODV (Ad hoc on Demand Distance Vector), AOMDV (Adhoc on Demand Multipath Distance Vector), DDIFF (Directed Diffusion), QoS (Quality of Service), NS-2 (Network Simulator-2).

I. Introduction

Nowadays for e-learning and storing multimedia data, various mobile users utilize video streaming. The most significant problems in video conferencing are the unpredictable nature of wireless medium and mobile networks in terms of bandwidth, end-to-end delay and loss variations. Our analysis employs on four existing networking protocols in MANET with parameters of multimedia video streaming. MANET uses three types of routing protocols namely Table-driven or Proactive Protocols, On-demand or Reactive Protocols, and Hybrid Routing Protocols. Proactive routing protocols maintain up-to-date routing information between every pair of nodes in the network by propagating route updates at fixed intervals but in reactive protocols route discovery process is initiated by the source node within the network. Hybrid routing protocols overcome the disadvantage of table driven and on demand protocol and becoming first choice of most researchers [11]. In this paper, we have comparatively study and analyzed the various routing protocols in order to find a suitable routing protocol for transmitting video stream over a MANET using NS-2. In this work, we are analyzing routing protocols namely Zone Routing Protocol (ZRP), Ad-hoc On-demand Distance Vector (AODV), Adhoc On-demand Multipath Distance Vector (AOMDV), and Directed diffusion (DDIFF) protocols. We have analyzed and compared the above protocols on the basis of their performances for video streaming data by considering different Quality of Service (QoS) performance metrics such as average throughput, average end-to-end delay and packet delivery fraction (PDF).

The paper is organized as follows:

Section I discusses the introduction of video streaming over MANET. Section II provides the brief description of related works found in the literatures. Section III presents descriptions of the investigated routing protocols. Section IV presents the Simulation results. Section V presents the conclusion.

II. Related Work

In previous research works, researchers have used different layer approaches to enhance the performance of video streaming quality in MANET. In November 2005, V. C. Frias and researchers used a cross-layer QoS-provisioning mechanism to support a multipath routing scheme for video-streaming applications over ad hoc networks [1]. In year 2010,S.R. Biradar and group have compared the AODV with AOMDV protocol. The AOMDV had better efficiency in term of packets dropped and packet delivery [2]. In April 2010, Mr. A. K. Gupta with two researchers has analyzed the performance of AODV, DSR, and TORA routing protocols of MANET, with respect to the average end-to-end delay & packet delivery ratio and concluded that AODV has all round performance, while DSR has moderate and TORA is good for dense population of nodes in large mobile networks [3]. In July 2011 T. P. Singh and researchers provides the review of existing routing protocols with comparison between the protocols and giving their functionality, characteristics and limitations [4]. In May 2012 M. S. Islam with two researchers analyzed the performance of TORA, DSR, AODV, OLSR

and GRP protocols by varying the network size for 25 nodes and 85 nodes and conclude that TORA is best for video streaming[5]. In June 2012 L. Zhou and group study the quality delay tradeoff over MANET by using scheduling scheme for efficient video transmission [6]. In September 2012 Patil V. P. compare the DSDV and AODV performance with respect to the traffic effect on these protocols [7]. In February 2013 K. Tandel and R. Shelat have addressed the different issues & techniques for improving the video streaming performance over MANETs [8]. In July 2013 R. Kulkarni with two researchers have compared the AODV and DSR routing protocol over simple MANET by varying network density & network pairs. The author says that with increases the number of mobile node up to 50 and by increasing the traffic to 40%, 60% and 80%, the packet delivery fraction of AODV is better as compared to DSR [9].In January 2013 S. Sheeja and Dr. R. V. Pujeri have investigated the effective congestion avoidance schemes over MANETs which consists of effective route establishment by contention metric in the particular channel and the congestion monitoring for overall congestion status [10].

In this paper we analyzed the performance of ZRP, AODV, AOMDV and DDIFF protocols for video streaming with varying pause time.

III. Protocols Description

1. Zone routing protocol (ZRP):

The Zone Routing Protocol is a hybrid routing protocol, in this protocol the network is divided into routing zones according to the distances between nodes and the routing zone. The routing zone defines a range (in hops) that each node is required to maintain network connectivity proactively. For small number of nodes, the small routing zone is preferred because the demand of route is less; otherwise large routing zone is used due to the high demand of route. The reactive routing protocols work between the zones whereas proactive routing protocols work within the zone but the ZRP is used for both of the cases [17].

2. Ad hoc On Demand Distance Vector (AODV) routing:

The AODV is a reactive protocol is derived from Dynamic Source Routing and DSDV (Destination Sequenced Distance Vector) by combining the advantages of both the protocols [7]. AODV route discovery procedure is similar to DSR. When a node has a packet to send to a particular destination, and if it does not know a valid route, it uses route request packet, by specifying the destination address. The initial design of AODV is undertaken after the experience with DSDV routing algorithm. Like DSDV, AODV protocol provides loop free routes while repairing link breakages and DSDV, it does not require global periodic routing advertisements as in DSDV protocol [3].

3. Ad-hoc On-demand Multipath Distance Vector Routing Protocol (AOMDV):

It is an extension to the AODV protocol. The routing entries contain a list of next-hops along with the corresponding hop counts for each destination. When a route advertisement is received for a destination with a greater sequence number, the next-hop list and the advertised hop count are updated. It can be used to find node-disjoint or link-disjoint routes. The AOMDV allows intermediate nodes to reply to RREQs (Route Request), while still selecting disjoint paths. But, in AOMDV due to increased flooding it has more overheads and since it is a multipath routing protocol, the destination replies to multiple RREQs thus resulting in longer overhead [2].

4. Directed diffusion (DDIFF):

Directed diffusion consists of several elements: data messages, interests, gradients, and reinforcements. An interest message is a query which specifies what a user wants. The description of a sensing task that is supported by a sensor network for acquiring data is containing by each interest. Typically, data in sensor networks is the collected information of a physical phenomenon. Such data can be an event which is a short description of the sensed phenomenon [16].

IV. Simulation Results

In this section, we mainly are analyzing the performance of ZRP, AODV, AOMDV and DDIFF protocols for video streaming over MANET using NS-2.35. The simulation is done by using the following parameters which are listed below in Table 1.

Table 1: Simulation parameters

Parameters	Value
Simulator	NS-2.35
The Number of Nodes	25 and 75
Pause time	5, 15, 25, 35, 45, 55 (second)
MAC layer	IEEE802.11
Network layer	ZRP, AODV, AOMDV and DDIFF
Scenario size	1000m X 750m
Traffic type	TCP
Application type	Video streaming
Mobility	Random waypoint model
Simulation time	100second
Channel type	Wireless channel
Network interface type	Physical/wireless physical
Performance parameter	Average throughput, average end-to-end delay, PDF

We analyzed the performance through simulated result by using following performance matrices namely Average throughput, Average end-to-end delay, and Packet delivery fraction. The graphs for these metrics are plotted by using MATLAB R2008b as shown below.

1. Average throughput graph:

The values of all three used performance metrics are plotted separately for 25 and 75 nodes with different pause time, firstly, we have discussed about the average throughput of 25 nodes which is shown in figure (1).

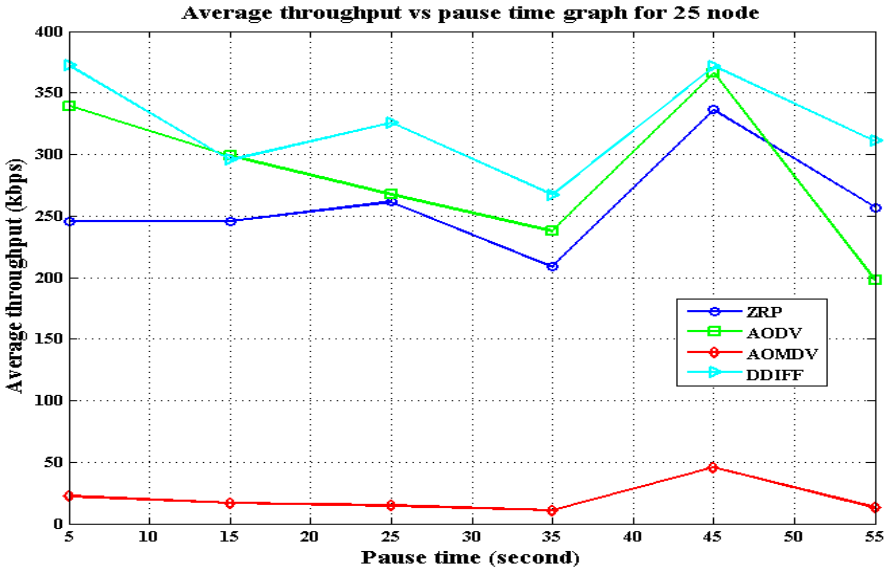

Figure (1) Average throughput for 25 nodes

It is observed from the figure 1. that for 25 node the average throughput of DDIFF is very high for all pause time whereas the AODV performance is moderate between the ZRP and DDIFF protocol but in the case of AOMDV it shows constant performance from the 5 second of pause time to 35 second of pause time and overall it is very low as compare to all other used protocols.

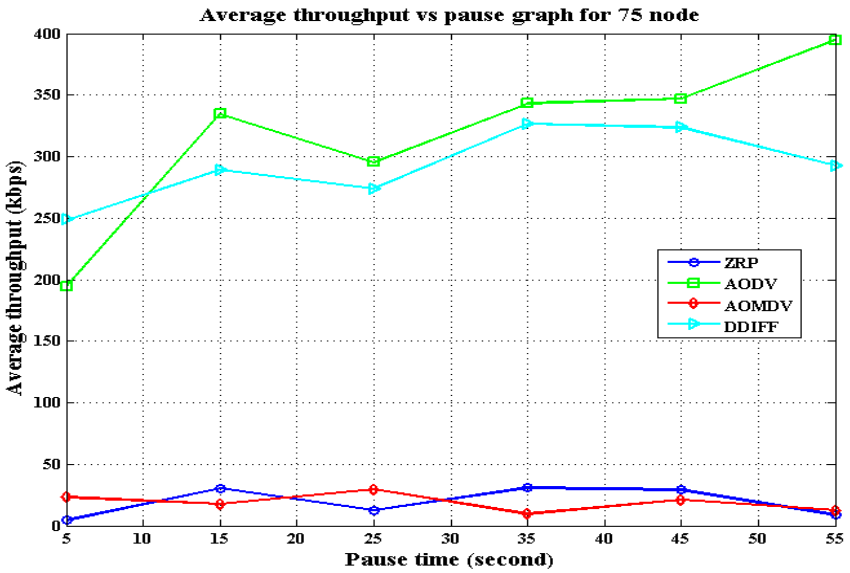

Figure (2) Average throughput for 75 nodes

In the case of 75 nodes the average throughput for AODV is different from the 25nodes. From figure (2) it is observed that the performance of AODV is very high whereas for 25 nodes it is moderate. The DDIFF and AODV throughput is high but for AOMDV and ZRP it is very low, so in the case of 75 nodes the AODV performance is better and it increases for high pause time.

2. Average end-to-end delay graph:

For 5 seconds of pause time, the AODV protocol is good but as the pause time increases the performance of ZRP is excellent with minimum delay for 15 second to 45 second of time.

The AOMDV protocol shows the worst performance for 25 nodes and the delay is very high as compare to other used protocols. The DDIFF demonstrate moderate delay and varying performance at different pause times shown in figure (3).

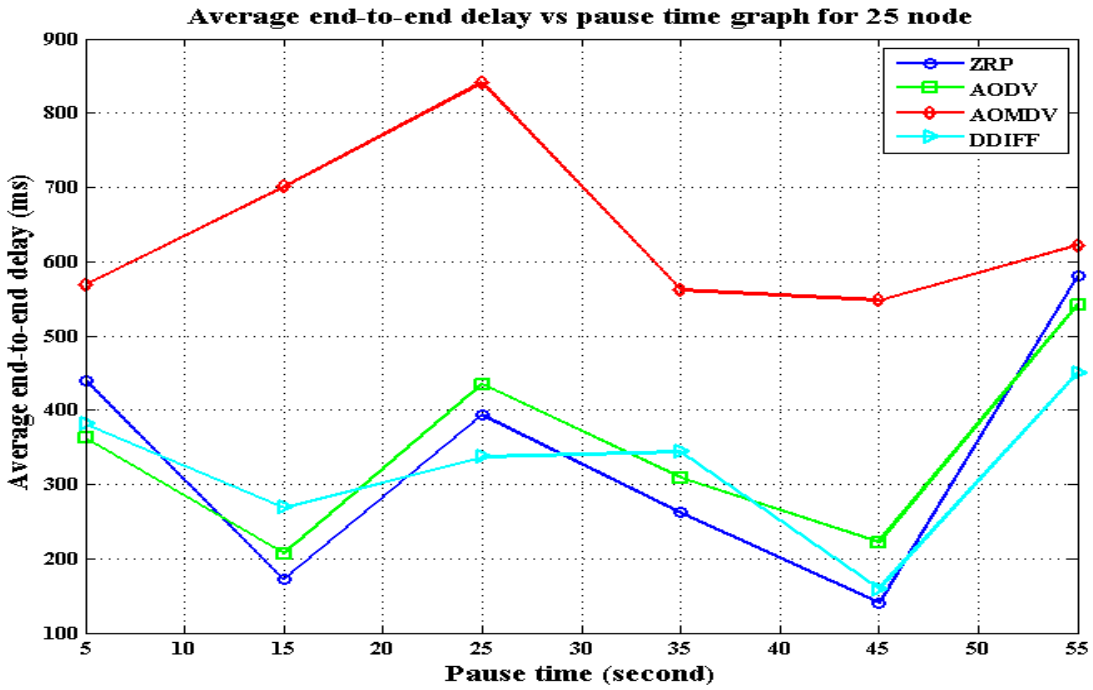

Figure (3) Average end-to-end delay for 25 nodes

In the case of 75 nodes, as shown in figure 4, the DDIFF shows better performance from the average end-to-end delay of 25 nodes. For 75 nodes the DDIFF performance is good with minimum delay. The ZRP protocol shows the highest delay while average end-to-end delay of AOMDV is high but AODV protocol shows moderate performance, so in the case of 75 nodes the overall performance of DDIFF is very good with minimum delay.

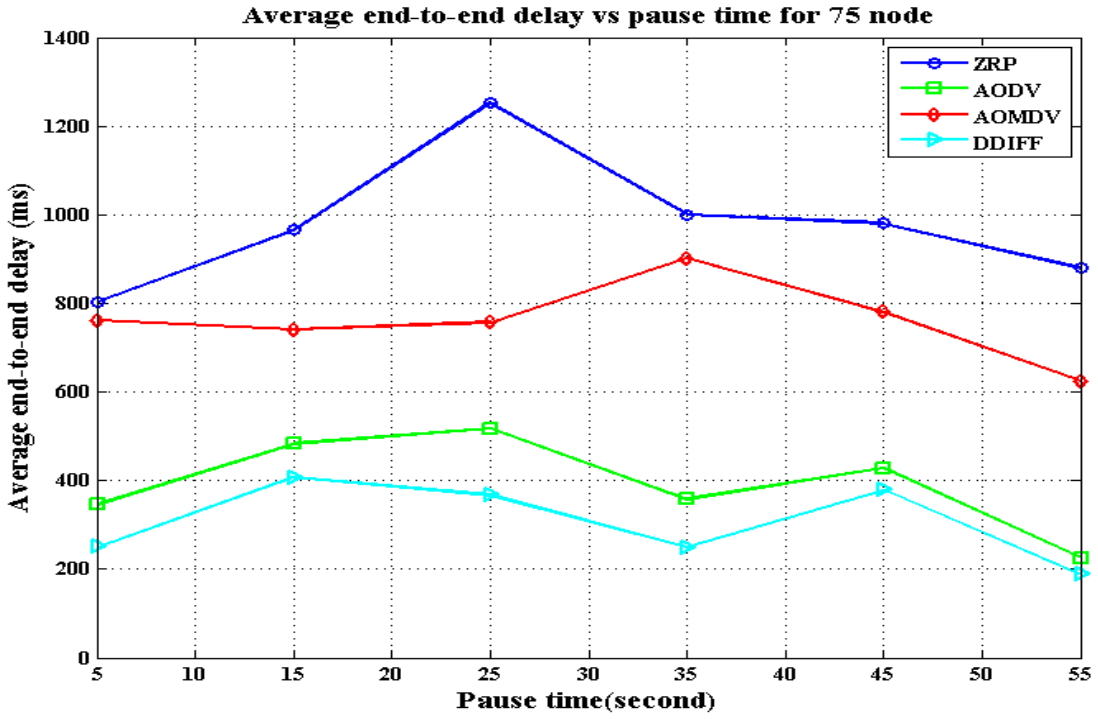

Figure (4) Average end-to-end delay for 75 nodes

3. Packet delivery fraction graph:

The packet delivery fraction graph for 25 nodes is shown in figure (5). It is clear from the graph that PDF of AODV is highest when the pause time is 5 second whereas at the end when pause time is 55 second it is moderate. From the observation we can say that the performance of ZRP and DDIFF protocol for 25 nodes is quite similar and AODV shows the moderate performance. The AOMDV protocol shows different performance at different pause time. The overall PDF of ZRP protocol is good for 25 nodes.

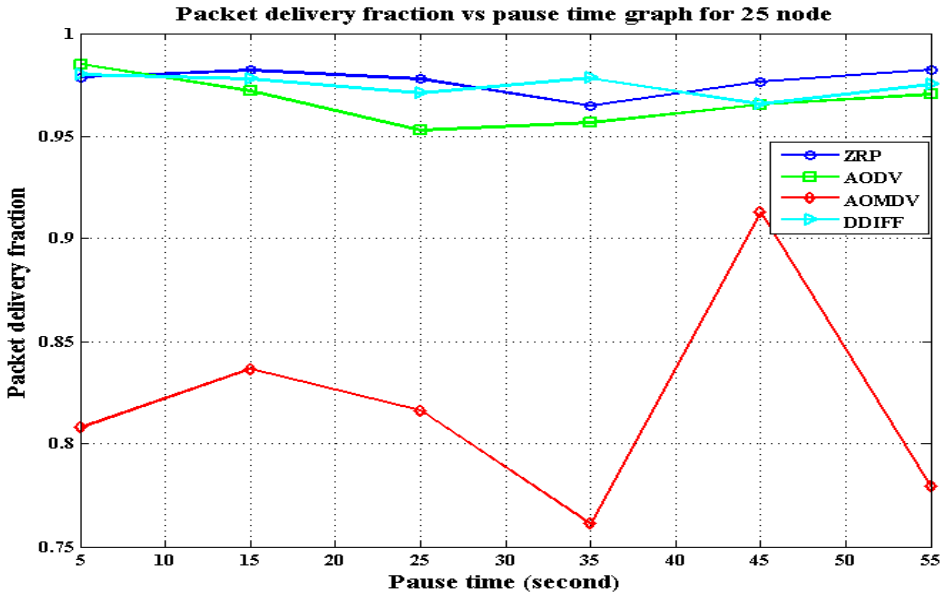

Figure (5) PDF for 25 nodes

The PDF graph for 75 nodes is shown in figure (6). ZRP performance is opposite for 75 nodes as compare to the 25 nodes performance here at the starting of simulation it is approximately equal to the zero but it increases after 15 second of pause time. Similarly, AOMDV protocol shows high variations in performance with different pause time. The PDF of DDIFF and AODV are closer to each other for 15 second, 25 second and 55 second of pause times. The DDIFF is showing highest PDF for 75 nodes scenario.

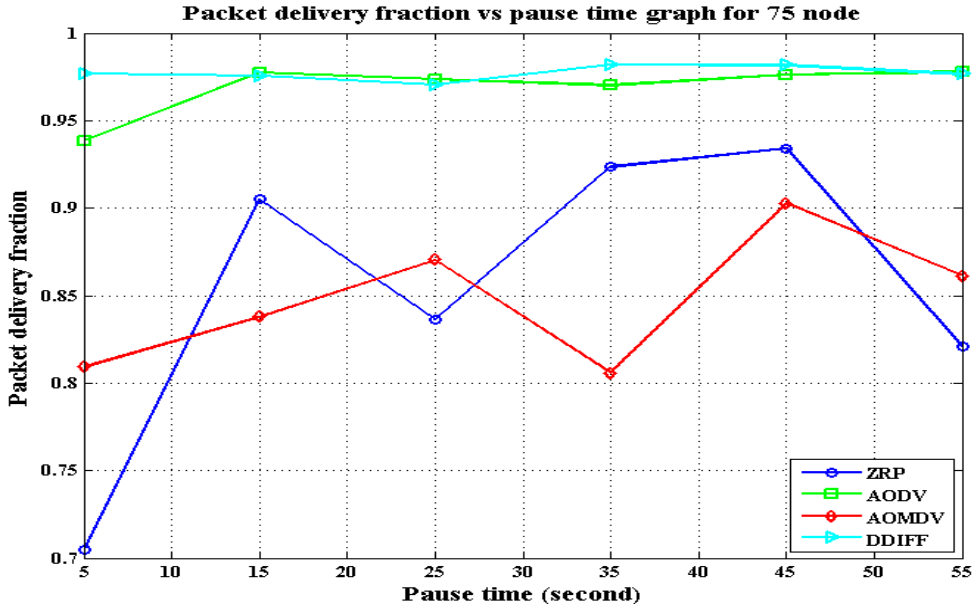

Figure (6) PDF for 75 nodes

V. Conclusion

In this paper, we have analyzed ZRP, AODV, AOMDV and DDIFF protocols on the basis of average throughput, average end-to-end delay and packet delivery fraction to propose the most suitable protocol for video streaming over MANETs. We have used 25 nodes and 75 nodes to analyze the performance of video streaming for these four routing protocols at different pause times .The overall performance of DDIFF and ZRP is better in term of packet delivery fraction as well as average end-to-end delay among other used protocols. While, in term of average throughput AODV and DDIFF has produced better results with compare to others. Finally, DDIFF is comparatively better to providing quality in video streaming over different used routing protocols on Mobile Ad-hoc Network.

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