Volume 5, Issue 5, May 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Performance Analysis of Routing Protocols for Real Time Traffic in MANET

Navneet Kumar
M. Tech, Department of CSE
IFTM University, Moradabad, India

Harpreet Chawla
Assistant Prof., Department of CSE
IFTM University, Moradabad, India

Abstract— Mobile Ad-hoc Network (MANET) is a wireless network of autonomous mobile nodes that are connected dynamically to form a random infrastructure-less topology. All the mobile nodes in MANET serves as a single entity and also serves as router by providing routes to other communicating nodes and forwarding packets allowing in establishment of temporary topology. Routing is a critical and important aspect in wireless network. Some sort of routing mechanism is needed in MANET because nodes are highly dynamic and topology is changing in timely manner i.e. routes are establishing and terminating rapidly. In this paper the performance of wireless routing protocols Dynamic Source Routing (DSR), Ad-hoc On-demand Distance Vector (AODV) and Destination Sequenced Distance Vector (DSDV) have been analysed against varying parameters for CBR traffic model. Simulation work has been completed using network simulator NS-2.35.

Keywords— AODV, DSR, DSDV, CBR, NS-2.35, MANET.

I. INTRODUCTION

A mobile ad-hoc network (MANET) is a wireless network of autonomous mobile nodes that are connected dynamically in a random way [1]. All the nodes in MANET cooperate by forwarding data packets to each other, this allow them to communicate each other and forming temporary topology without a central entity or an administrator like a base station or an access point. Each node works as a single entity and a router as well. This scheme allows to setup cost-effective network quickly, without the help of any fixed infrastructure. Due to increasing number of portable and inexpensive devices multimedia application are becoming more popular. Many of these have specific requirement to provide quality service. For this purpose routing protocols has to be deployed in such a manner that it provide certain QoS requirements. In this paper, we evaluate the performance of routing protocols against varying number of nodes, CBR links and pause time. Here we have considered CBR traffic as real-time traffic and the simulation has been done using NS2 Simulator [2]. This paper is organized as follows; Literature Review is presented in section II, a brief overview of AODV, DSR and DSDV routing protocol is given in section III, simulation model is presented in section IV, section V describes results and analysis of simulation. At last the conclusion is presented in section VI.

II. LITERATURE REVIEW

In [5] the performance of four ad-hoc routing protocols AODV, DSR, WRP and BFD is compared with respect to throughput, byte loss and collision. The result shows that AODV and DSR performs well for throughput and collision, when number of CBR links are increased then AODV again performs well. But BFD performs better for byte loss metrics. In [6] authors have compared the performance of DSR, AODV and DSDV for CBR traffic. The authors have concluded here that DSR and AODV outperformance DSDV for different mobility rates due to their reactive nature. An enhancement to the AODV protocol is proposed in [7] to provide QoS support for real time traffic. Proposed solution incorporate reservation procedure in AODV for real time traffic that assigns more bandwidth to real time traffic. This solution shows improved throughput and reduced delay. In [8] the performance of four routing protocol is compared for real time and non-real time traffic. The simulation results shows that OLSR achieved highest throughput for non-real time and real time video traffic whereas AODV for voice traffic. It has been concluded here that OLSR is best routing protocol for both real and non-real time traffic. CBR and FTP traffic has been considered in many researches [9] [10] [11] to investigate the performance of routing protocols, showing that AODV is the best protocol for CBR traffic (real-time traffic).

III. ROUTING PROTOCOLS

Many different ways have been considered to classify the protocols depending on the schemes to handle the delivery of packets in ad-hoc networks. According to the routing strategies routing protocols are divided into two classes [3] [4]: Proactive routing protocols and Reactive routing protocols. There is another class of routing protocols called hybrid routing protocol.

A. AODV Routing Protocol

AODV is a reactive routing protocol for ad hoc mobile networks [12, 13]. It establishes routes only when it is requested by source node. Route establishment is done by RREQ broadcast message. Nodes that receives RREQ can respond to the RREQ by a RREP unicast message back to the source node. This is done by all nodes whether it is destination node or other fresh node to destination. A node that forwards a RREQ packet to its neighbours, it also keep track of this packet in its routing table. This recorded information is later used to construct the reverse path for the RREP packet. In link failure case, a message packet called route error (RERR) is transmitted back to the sender and receiver node. Destination Sequence numbers is used by AODV to avoid counting to infinity, and this is one of the most important quality and feature of this routing protocol.

B. DSR Routing Protocol

Dynamic Source Routing [14] is an on-demand source routed protocol for wireless ad hoc network. Route Discovery and Route maintenance are two vital features of DSR for source routing. Route discovery process is initiated whenever a node needs to send a packet to other node. This is done by sending a route request message. A list of requests is maintained by all nodes to detect already processed route requests. . In DSR routing updates are not periodically incorporates that is it initiates source routing only when needed. Another mechanism called route maintenance, helps in detecting the failure of link among the nodes. As long as data transmission occurs the route is held using route maintenance.

C. DSDV Routing Protocol

DSDV is a proactive routing protocol in which each node maintains a routing table that contains the shortest path to each node in the ad-hoc network [15]. The routing tables are exchanged between neighbouring nodes in timely manner to keep track of topology. Each node manages a routing table containing list of the addresses of every node and the address of next hop for a packet to take in order to reach the desired node. DSDV uses sequence number, which help to apply each routing advertisement in correct order, this avoids the loops in network. Full dump is used to distribute routing information among nodes infrequently. If a node receives a new route information, then newest sequence number is used further if sequence number are same then, route with best metric is used. The entries which are not used for a long while are deleted.

IV. SIMULATION MODEL

A. Simulation Scenario

We have simulated mobile ad-hoc network for simulation time of 200 seconds and the area of 1000m×1000m. For fair comparisons between the protocols, the simulation is done under identical loads and environmental conditions. To simulate real time traffic, CBR traffic is used. In our first simulation condition we have considered varying pause time 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 seconds with 50 mobile nodes and 25 CBR links. For varying CBR links condition the number of CBR link is half to the number of mobile nodes. The maximum mobile nodes considered here are 60 nodes. In our third condition of varying nodes from 10 to 100 nodes, the CBR links are fixed to 10, to evaluate the performance of routing protocol in more populated network.

Table 1: Simulation Parameters

No. of Nodes	Up to 100
Network size	1000m×1000m.
Simulation Time	200 seconds
Routing Protocols	AODV, DSR and DSDV
Traffic Type	CBR
Packet Size	512 byte
Pause Time	10,20,30,40,50,60,70,80,90,100 seconds
Speed	15 m/sec to 20 m/sec
Mobility Model	Random Waypoint Model
Seed	1

B. Performance Metrics

To evaluate the performance of routing protocol some metrics has to be considered. These metrics shows the efficiency of a protocol. We have considered the following performance metrics:

1) Throughput

It is defines as the total number of packets received by the destination in a unit of time. Throughput is a measure of effectiveness of a protocol and it defines how fast a node can receive data in network.

2) *End-to-End Delay*

It is the average amount of time taken by the packet to propagate from source to destination. End-to-delay is an important metric because real time traffic such as video or voice applications is sensitive to the data packet delays, and needs delay as low as possible.

3) Packet Delivery Fraction

Packet delivery fraction is expressed as the ratio of data packets that has been received by all destinations to the total number of packets sent by all the sources within the period of simulation. A high PDF shows the better performance of routing protocol.

V. Results And Analysis

A. Varying Number of Nodes

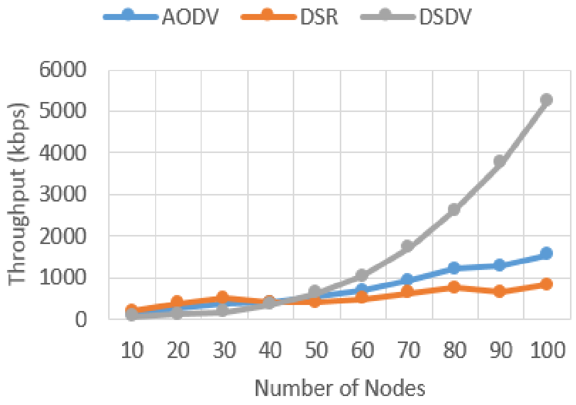

Fig. 1: Throughput v/s Number of Nodes

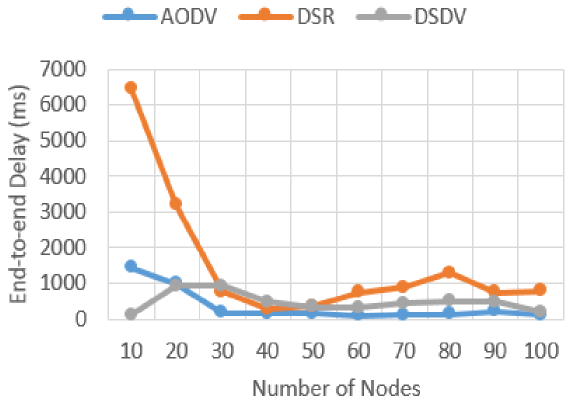

Fig. 2: End-to-end Delay v/s Number of Nodes

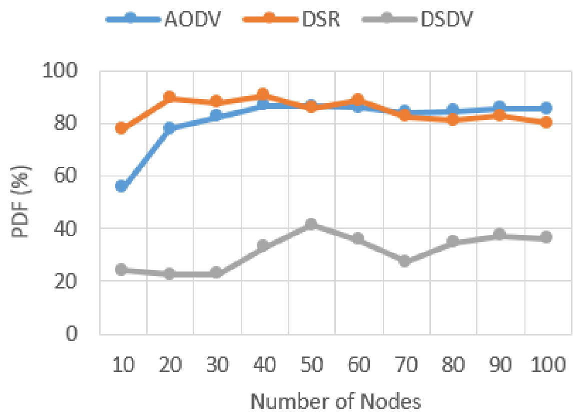

Fig. 3: PDF v/s Number of Nodes

When simulation results in figure 1, for throughput in analysed then throughput of AODV, DSDV and DSR routing protocols is approximately identical when there are 10 number of nodes having 10 links but after that the throughput of DSR improves. At 40 nodes having 10 CBR links the throughput of all the three routing protocol is again similar but from this point the DSDV protocol performs better than AODV and DSR. At this point we can also evaluate that the performance of AODV routing protocol is better than DSR protocol and it improves continuously up to 100 nodes. Figure 2 shows that initially end-to-end delay of DSR routing protocol is quite higher than AODV and DSDV routing protocols and it performs worst when the number of nodes is low. But as soon as the number of nodes is increasing the performance of the DSR protocol is also improving as the end-to-end delay is decreasing. For AODV protocol the end-to-end delay of AODV is higher than DSDV but as the number of nodes increasing the end-to-end delay is decreasing as seen in case of DSR. This shows that AODV tries to find the best route to deliver the packets to the destination as there are large number of nodes that help in finding the route.

From the simulation result in figure 3 we can see that the packet delivery fraction for DSDV is worst and it is not greater than approximately 40 %. Although the PDF between 30-50 nodes and 70-90 nodes is getting improved. When the number of nodes is low the PDF of DSR is higher than AODV and DSDV, but from 40 number of nodes the performance of DSR begins to decline.

B. Varying Pause Time

For throughput we can see in figure 4 that when the nodes are in mobile condition and having a smaller pause time. The throughput of DRS and AODV routing protocol is quite good. As the pause time is 10 seconds that is nodes are static only for few seconds, for remaining time nodes are in mobile condition and thus help in forming more route for successfully delivering the packets. As the pause time increasing the throughput of both the protocols AODV and DSR is decreasing but the overall throughput of AODV protocol is better than the DSR as well as DSDV. DSDV shows approximately same amount of throughput which is lower than AODV and DSR.

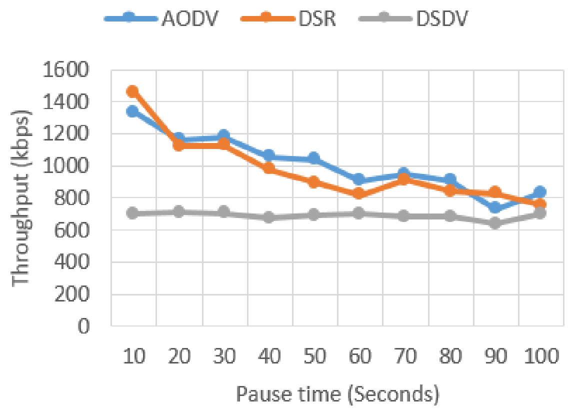

Fig. 4: Throughput v/s Pause Time

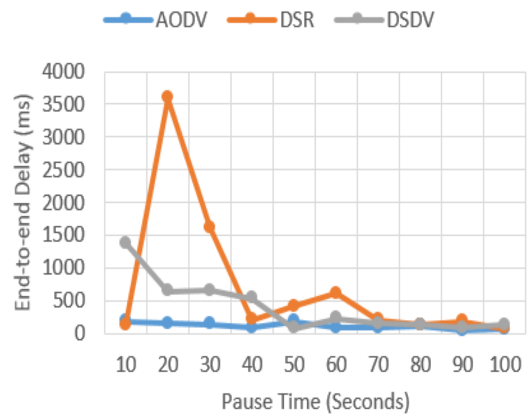

Fig. 5: End-to-end Delay v/s Pause Time

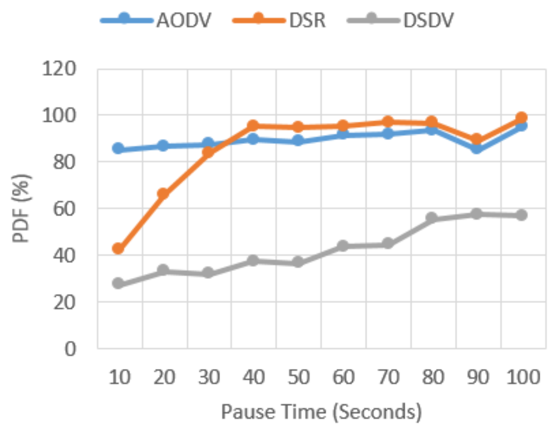

Fig. 6: PDF v/s Pause Time

Here in figure 5 the end-to-end delay of AODV is the finest then all other protocols and AODV shows similar amount of end-to-end delay at each pause time measure. AODV also shows the lowest end-to-end delay. DSR shows unusual fluctuations in end-to-end delay which is sometime lower and sometime higher unexpectedly. At 20 seconds of the pause time DSR shows highest end-to-end delay but after 20 seconds of pause time the performance begin to improve and at last it gets similar to AODV and DSR. As the pause time increases end to end delay of a body decreases and it performs quite fine then DSR but here AODV dictates.

When it comes to packet delivery fraction v/s pause time (figure 6) the performance of AODV is uniform for 80 seconds of pause time. At 90 seconds the PDF decreases but at 1000 seconds of pause time it improves again. For 35 seconds of pause time the PDF of AODV is better than DSR. After 35 seconds of pause time the PDF of DSR is parallel to AODV. DSDV shows improvement in PDF as the pause time increases but shows lower PDF than AODV and DSR routing protocols.

C. Varying Number of CBR Links

Initially the throughput of AODV, DSR and DSDV routing protocol is identical for 5 CBR links but as the number of CBR links increases the throughput of all three protocols is also increases shown in figure 7. But the throughput of AODV is much better than DSR and DSDV for higher number of links. The performance of DSDV is worst as compared to DSR. Although it performs worst but shows improvement in throughput as the number of CBR links increases. The performance of DSR is quite good, it also shows some improvement in throughput but it does not overcome the performance of AODV.

For lower number of CBR links DSR shows (figure 8) higher end-to-end delay as compared to AODV and DSR, but as the number of CBR links increases the performance of DSR improves rapidly for up to 15 CBR links and again at more than 15 CBR links the end-to-end delay increases. The end-to-end delay of AODV is higher than DSDV for 5 to 10 CBR links but after 15 CBR links the end-to-end delay begins to improve and AODV outperforms other two protocols. DSDV shows lower end-to-end delay than DSR.

It is analysed form result shown in figure 9, that PDF of DSDV is improved and uniform for varying number of CBR links but it is lower than 35 % which is not so upright. Thus the PDF of DSDV is the lowest as compared to DSR and AODV. PDF of AODV is slightly lower at 5 to 10 CBR links but as the number of CBR links increases the PDF is also improved and reaches up to 80 %. Here AODV perform better than DSR for higher number of CBR links. DSR also shows improvement up to 20 links but after this its performance degrades.

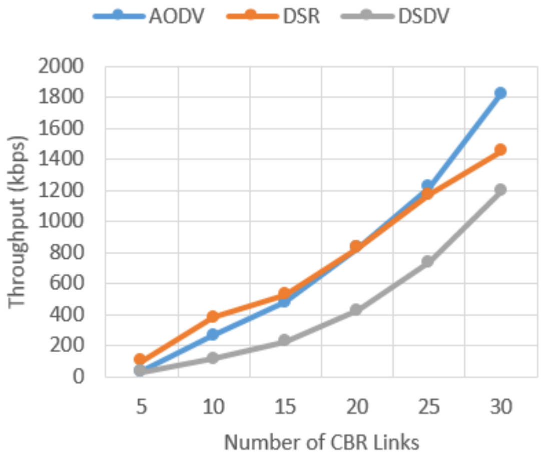

Fig. 7: Throughput v/s Number of Nodes

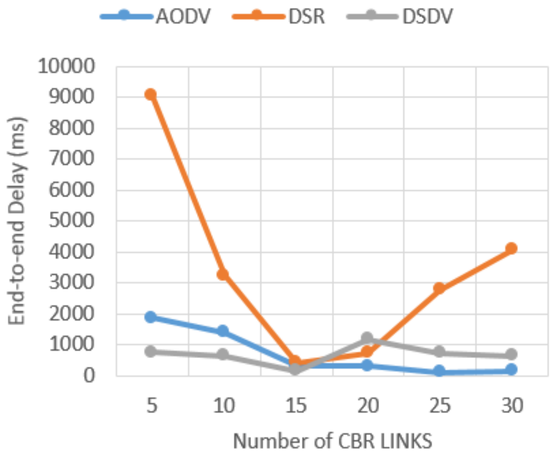

Fig. 8: End-to-end Delay v/s Number of Nodes

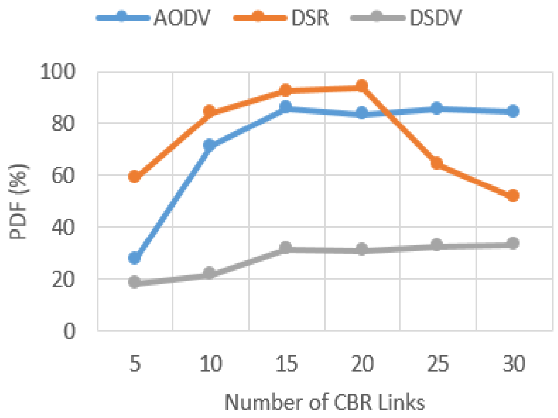

Fig. 9: PDF v/s Number of CBR Links

VI. CONCLUSION

The performance of routing protocols DSR, AODV and DSDV are compared against some performance metrics. The simulation shows that when varying number of nodes are taken than DSDV obtain the highest throughput as CBR links are low but node density is increasing due to its proactive nature. But for end-to-end delay and PDF, AODV dominates DSR and DSDV. For the condition of varying pause time the performance for throughput of DSR and AODV is decreasing and this shows that these are best suited for high mobility of nodes i.e. low pause time. In our simulation scenario we concluded that performance of AODV is best for throughput and end-to-end delay. DSR shows highest PDF when pause time if increasing. As the number of CBR links varies the performance of AODV is much better than DSR and DSDV. At last we can analyse that for high density of nodes and for higher number of CBR links AODV is best among the routing protocols simulated in this paper. So we concluded that AODV can provide the base for the protocols to be developed in future.

REFERENCES

[1] S. Corson and J. Macker, “Mobile Ad-hoc Networking (MANET), Routing Protocol Performance Issues and Evaluation Considerations,” RFC 2501, January 1999.

[2] Information Sciences Institute ISI. The Network Simulator NS-2, February 2005. http://www.isi.edu/nsnam/ns.

[3] E. M. Royer and C.-K. Toh, “A Review of Current Routing Protocols for Ad-Hoc Mobile Wireless Networks”, IEEE Personal Communications, pg. 46-55, April 1999.

[4] S.R. Das, R. Castaneda, J. Yan, and R. Sengupta, “Comparative performance evaluation of routing protocols for mobile ad hoc networks”, 7th International Conference on Computer Communications and Networks (IC3N), pg. 153–161, October 1998.

[5] Yudhvir Singh, Amit Kumar, Prabha Rani, Sunil Kumar Kaushik, “Impact of CBR Traffic on Routing Protocols in MANETs”, pg. 473-477, ICCMS, 2014.

[6] Payal, Sudesh Kr. Jakhar “CBR Traffic Based Performance Investigations of DSDV, DSR and AODV Routing Protocols for MANET Using NS2” IJSCE, Volume-3, Issue-4, 2013.

[7] Iftikhar Ahmad, Samreen Ayaz, Syed Yasser Arafat, Faisal Riaz, Humaira Jabeen “QoS Routing for Real Time Traffic in Mobile Ad hoc Network” ICUIMC (IMCOM)’13, 2013.

[8] G. A. QasMarrogy, Dr. E. S. QasMarrogy, A. Y. Ali, “Performance Analysis of Real and Non-real Time Traffic under MANET Routing Protocols” IJEDR, Volume 2, Issue 4, ISSN: 2321-9939, 2014.

[9] M. L. Sharma, Noor Fatima Rizvi, Nipun Sharma, Anu Malhan, Swati Sharma, "Performance Evaluation of MANET Routing Protocols under CBR and FTP traffic classes" IJCTA, Vol. 2 (3), pg. 392-400, 2010.

[10] Ankita Sharma, Kamal Kumar, "Performance Investigation of AODV, DSR and DSDV MANET Routing Protocols using CBR and FTP Traffic", IJCA (0975 – 8887), Volume 100– No.6, pg. 47-52, August 2014.

[11] Subodh Kumar, G. S. Agrawal, Sudhir Kumar Sharma, "Impact of CBR, FTP Traffic Patterns and Varying node density on Performance of Routing Protocols in MANETs" IJCSMC, Vol. 4, Issue. 1, ISSN 2320–088X pg.262 – 269, January 2015.

[12] Perkins, C.E., E.M. Royer and S.R. Das, "Ad hoc on-demand distance vector (AODV) routing, 2003. IETF Internet Draft - www.ietf.org/rfc/rfc3561.txt.

[13] Charles Perkins and Elizabeth Royer, "Ad hoc on demand distance vector routing", IEEE Workshop on Mobile Computing Systems and Applications, pp. 90–100, February 1999.

[14] D. Johnson, Y. Hu, D. Maltz, "The Dynamic Source Routing Protocol (DSR) for Mobile Ad Hoc Networks for Ipv4," Network Working Group, RFC 4728, 2007.

[15] Charles E. Perkins and Pravin Bhagwat, "Highly dynamic Destination-Sequenced Distance-Vector routing (DSDV) for mobile computers", SIGCOMM '94 Conference on Communications Architectures, Protocols and Applications, pp. 234-244, August 1994.

