ISSN 2229-5518

Performance comparison of role based uniform and Non uniform routing protocols in Mobile Adhoc Network

Ms.V.Savithri, Dr.A.Marimuthu

Abstract - Mobile Adhoc Network(MANET) is a dynamically forming temporary network which has a collection of mobile nodes. Routing protocols used across the network needs frequent changes in routing decision and they are of different nature. According to the role-based classification, MANET routing protocols are either uniform when all network nodes have the same role or non-uniform when the roles are different and dedicated. They are further classified as topology based, destination based, location based. This paper compares the performance of role based routing protocols and highlights the best out of them for further use over the research area. The simulation results include important Quality of Service(QoS) metrics and shows that the performance of role based reactive DSR is better than the two.

Keywords: DSR, AODV,DSDV, MANET, QoS

I. INTRODUCTION

MANET has a hostile environment supporting noise, losses and irregular connectivity. Routing packets over such an environment is tricky where the mobile nodes move independently and organize themselves to route packets and to receive packets as destination nodes. The wireless topology of the network changes rapidly and it is unpredictable.

The explosive growth of mobile devices such as Laptops, PDA's, and Cellular phones has made a revolutionary change in computer society. Hence MANET has become more popular in recent Years. QoS in MANET plays a vital in role. It is a set of service requirements that the network has to provide to all its applications. It is expected to satisfy a predefined set of qualified services such as End-End-Delay, Throughput, Packet Delivery Ratio, Jitter, Total Energy Consumption, Routing Overhead, etc.

Routing protocols play a vital role since of the nature of the environment. There are different types of routing protocols. The major classifications include proactive, reactive and hybrid. The classification is also based on the roles (ie.) how routing information is acquired and maintained by mobile nodes.

The goal of the report is to present a survey of role based routing protocols and also to present the performance of routing protocols. Section 2 presents the literature survey of the comparison of role based routing protocols. Section3 presents the taxonomy of routing protocols. Section 4 presents the simulation and performance analysis of the routing protocols. Section 5 presents the Conclusion of the article.

II. RELATED WORKS

Savithri et.al [8] presents the detailed classification of QoS metric based routing protocols as they belong to single or multiple constraints. S. A. Ade [1] presents the performance of routing protocols and concluded that AODV maintains stable connections while exchanging messages periodically and hence it is suitable for TCP based traffic pattern as the number of nodes varies. The Performance of DSR is best at all mobility rates and DSDV is more expensive for high mobility rates. AODV and DSR perform best than DSDV for large number of packets. It shows that for less number of nodes and mobility DSDV is good. Mina Vajed Khiavi et.al [2] discussed that the routing overhead of TORA is high than AODV,DSDV,DSR and the packet delivery ratio of DSR is best and in overall the performance of DSDV is best. Manjeet Gupta et.al [3] discussed that for CBR traffic pattern , the performance of AODV in terms of Throughput and PDF is best, and for End to End delay is concern TORA is taking less delay. The performance of TORA is better for dense networks. Tamilarasan et. al [4] concluded that performance of TORA is better for dense networks. The AODV is better for moderately dense networks where as the OLSR performs well in sparse networks.The AODV is discussed in [4]. Parul Sharma et.al [5] concluded that with varying pause time AODV has the best all round performance. DSR is suitable for networks with moderate mobility rate. It has low overhead that makes it suitable for low bandwidth and low power network. DSDV is suitable for operation in large mobile networks having dense population of nodes. [6] Discusses the use of Freeway Mobility Model with CBR traffic sources and concluded that AODV performs better than OLSR and DSDV, but at the cost of higher

ISSN 2229-5518

routing overhead and end-end delay. Routing overhead of DSDV is always less than AODV and OLSR. DSDV gives better throughput in CBR traffic. Throughput of OLSR is better for TCP traffic. OLSR gives better result than AODV and DSDV, but at higher routing overhead and end-end delay for TCP traffic sources. It is concluded that the above considered routing protocols perform better in TCP traffic as compared to CBR traffic.

III. PROTOCOL OVERVIEW

Uniform and Non-Uniform Protocols

Protocol taxonomy describes two types of role based routing protocols as in [7], Uniform Routing Protocols and Non-Uniform Routing Protocols. Uniform routing protocols are the protocols where all nodes follow uniform structure and there is no distinguished structure. It assumes flat network structure and no hierarchical structure. Such a structure avoids resource cost in maintaining complex structure. Non-uniform routing protocols, some of the nodes follow distinct network management and routing functions and hierarchical routing structure. They are classified into three categories: Protocol in which routing decision is based on its neighborhood, based on the topology of the network, based on the destination. Uniform and Non uniform routing protocols are further classified into proactive, reactive and hybrid. Proactive routing is also called table-driven. It evaluates routes to all nodes that are reachable from the source and has consistent and up-to date routing information. Source can get routing information faster when it needs to route packets to destination. is called On-Demand routing. These are used for highly changing MANET environment. Routing decision is taken only when the source node needs to route packets to the destination. Hybrid routing combines the merits of both proactive and reactive routing and the protocols exploit hierarchical network architecture.

Topology based routing protocols

These are the protocols that maintain large topological information and the best known example of topological based routing protocol is Link State routing protocols. Each protocol advertises its link information with their neighborhood to all other nodes in the network. Hence routing decision is based on the complete topological information. In Dynamic Source Routing (DSR) protocol all nodes follow uniform role and there is no distinguished role. Routing decision is based on the complete topological information.

Destination based routing protocols

These protocols maintain distance and vector to the destination. Distance is measured in terms of hop count or other metrics. It uses vector (hop count) to reach the destination. Distance vector protocols fall into this category. Nodes exchange their routing information with their neighbor nodes to have up to date routing information. This paper discusses on three routing protocols AODV, DSR and DSDV of which DSR is based on the topology, AODV and DSDV is based on the destination.

Dynamic Source Routing (DSR)

DSR is a uniform, topology based, reactive routing protocol. It discovers routes as follows: source sends route request packet when it has no route to the destination. When it passes over intermediate nodes, their ID's are attached to avoid duplicate route request from reaching the destination. Finally the last node that receives the route request packet is said to be the destination. Route Reply is performed in reverse manner. Source node that receives route reply catches and includes the source route in the header of each data packet. Each intermediate node extracts routes to all its down streams from the source route included in each data packet. Nodes on or near the active route stores the interesting parts of the topology of the network into their route cache and finds routes quickly and easily. Route maintenance also uses cached information to find out route error and to select alternative route.

Ad hoc On-Demand Distance Vector Routing (AODV)

AODV is a uniform, destination based, reactive routing protocol. AODV uses broadcast route discovery mechanism where it does not attempt to follow paths between nodes when one of the nodes is not on the active path. It does not exchange or maintain any routing information with that node. When a source wants to communicate to some destination, the protocol starts route discovery by sending a route request message to its all its neighbours. The neighbour node on the active path sends route reply message to the route request message initiator. A unique id is assigned, to avoid duplicate route request message. When a node receives, it will check this id and the address of the initiator and discarded the message if it had already processed that request. Node that has information about the path to the destination sends route reply message to the neighbour from which it has received route request message. When a route reply message reaches the source it can start sending data packets.

ISSN 2229-5518

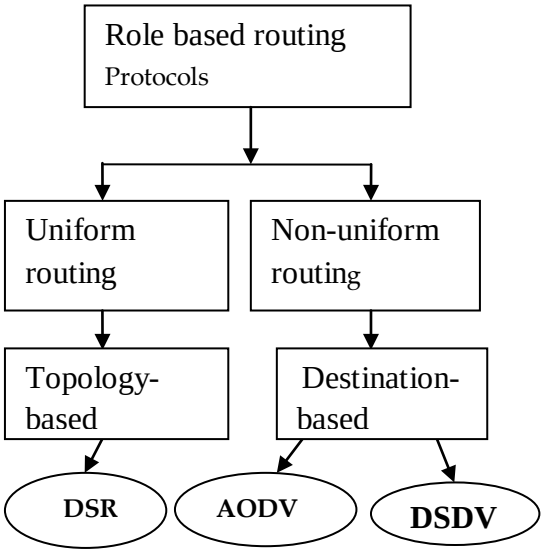

Fig 1. Taxonomy of Routing Protocols

Destination-sequenced Distance Vector (DSDV)

DSDV is a role based non-uniform and destination based unicast routing protocol. The routing updates of DSDV is either table-driven or event driven. Its routing table stores the next hop towards the destination. Each node transmits its periodic updates along with routing information to its immediate neighbor. Each entry in the routing table has sequence number which avoids the formation of loops. Sequence numbers are used to classify old routes from fresh routes. For large population of mobile nodes, adjustments will likely be needed for the time between broadcast of the routing information packets. To reduce the amount of information carried in these packets, two types of route packets are used. The first is the full dump packet which carries all available routing information and these packets are transmitted in frequently manner. The second packet is the incremental packets which are used to carry the information that has changed since the last full dump.

IV. SIMULATION AND PERFORMANCE ANALYSIS

The simulation and the Performance of AODV, DSDV, DSR is done on the basis of following QoS metrics. We simulated this network under each of routing protocols and outputs shown in Figs. 2-6 show a comparison between the routing protocols as a function of number of nodes. We have used Network Simulator (NS)-2 in our evaluation.

TABLE I. SIMULATION PARAMETERS

Parameters	Value
Routing Protocols	AODV,DSDV,DSR
MAC Layer	802.11
Packet Size	512bytes
Terrain Size	800X800
Nodes	50-100
Mobility Model	Random Waypoint model
Data Traffic	CBR,TCP
Simulation Time	100

Packet Delivery Ratio

It is the ratio of the packets received by destination to those generated by the source. CBR traffic type and TCP traffic type is used by the source. It specifies the packet loss rate, which limits the maximum throughput of the network. The routing protocol which has better PDR is more complete and correct. This reflects the usefulness of the protocol.

$$PDF = \frac{\text{Number of received packets}}{\text{Number of sent packets}}$$

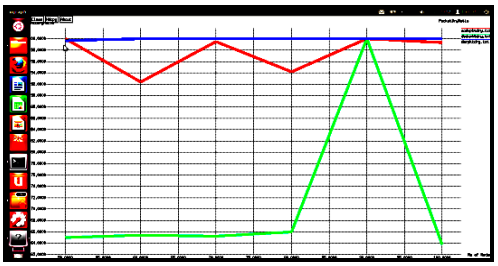

Fig 2. Packet Delivery Vs Number of Nodes

The above graph shows that the Packet Delivery Fraction of DSR is best and consistent. AODV is nearly as equal as DSR. It varies for DSDV as the number of nodes increases.

Throughput

ISSN 2229-5518

It is the number of packets passing through the network in a unit of time. It is measured in kbps. The graphical result shows that there is a variation in the throughput of AODV as the number of nodes varies. Though the throughput of AODV is slightly higher than DSR, throughput of DSR is consistent as the number of nodes varies. The throughput of DSDV varies between low and high values.

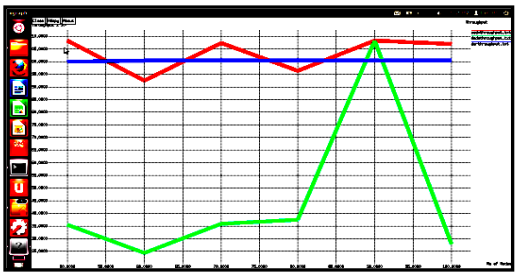

Fig 3. Throughput Vs Number of Nodes

Packet Dropping Probability

The numbers of data packets that are not successfully sent to the destination are known as dropped packets. There are various packet dropping schemes available in wired network to improvise the performance of queue management as discussed in [9]. In MANET, it is still in its early stage. In terms of dropped packets, DSDV's performance is the worst. The performance degrades as the number of nodes increases. DSR performs consistently well with increase in the number of nodes. The performance of AODV it is nearly as equal as DSR and varies as the number of nodes changes.

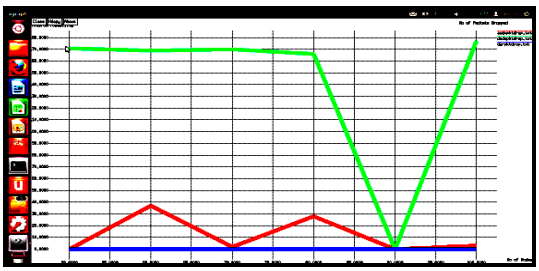

Fig 4. Packet Drop Vs Number of Nodes

Average End-End Delay

End-to-end delay is the average time delay for data packets from the source node to the destination node. To find out the End-to-end delay the time difference of packet sent and received was stored and then dividing the total time difference over the total number of packet received gives the average End-end delay for the received packets. The performance of the protocol is better when packet End-to-end delay is low.

$$AED = \frac{\sum(\text{time received} - \text{time sent})}{\text{Total data packets received}}$$

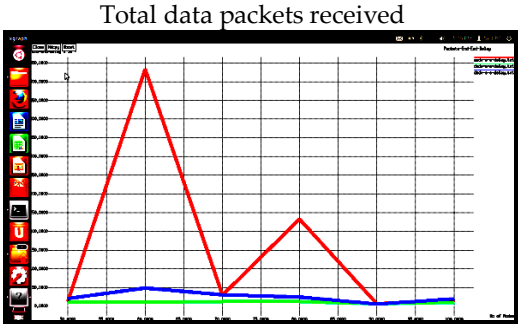

Fig 5. Average End-end-Delay Vs Number of nodes

The graphical result shows that the Average End-End-Delay of AODV is high and for DSDV and DSR it is nearly same.

Total Energy Consumption

Each node consumes energy to transmit, receive and forward packets. Minimizing routing paths reduces power needed to send a packet end-to-end. The following graph shows the total energy consumption of the above considered protocols. The graphical result shows that the energy consumption of DSDV is high. The energy consumption of AODV and DSR are slightly similar. As the number of nodes increases, the energy Consumption of DSR is low comparing to AODV and DSDV.

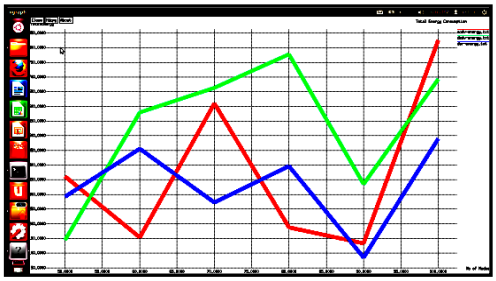

Fig 6. Total Energy Consumption Vs Number of Nodes

The following table shows the comparative study of three protocols.

TABLE II. COMPARATIVE ANALYSIS

Routing Protocols	AODV	DSR	DSDV

ISSN 2229-5518

Throughput	High-Not consistent	High-Consistent	L-H-L
End-end-delay	L-H-L	Low-nearly Consistent	Low-Consistent
Packet Dropping Probability	High-Not consistent	Low-Consistent	L-H-L
Packet Delivery Ratio	High-Not consistent	High-Consistent	L-H-L
Total Energy Consumption	L-H-L	L-H-L	High

V. CONCLUSION

In this article, we present the comparative study and performance analysis of three role based mobile ad hoc routing protocols (DSR, AODV and DSDV) on the basis of End-end delay, Packet Delivery Ratio, Throughput, Packet Dropping Probability, Total Energy Consumption. The quantitative study of these role based routing protocols shows that topology based role based routing protocol DSR is more competent in high density networks with highly sporadic traffic. It performs much better in packet delivery and packet drop, throughput, End-end-delay. Though total energy consumption is not consistent for three protocols, it is low for DSR than AODV and DSDV. Hence it has been concluded that among role based routing protocols, the performance of uniform-topology based routing protocol DSR is better for dense networks. The AODV is better for moderately dense networks where as DSDV performs well only for small networks. The future work suggested that the effort will be made to enhance mobile ad hoc network role based routing protocol by tackling core issues.

ACKNOWLEDGEMENT

I would like to express my heart felt gratitude to almighty for his endless help and blessings. I would like to thank my Guide Dr.A.Marimuthu, Associate Professor, Government Arts College, Coimbatore, for his immense help and motivation throughout the development of this article and for giving me this great opportunity. I would also like to thank the almighty for showering his blessings and showing me the right direction.

REFERENCES

[1] S. A. Ade, P.A.Tijare, "Performance Comparison of AODV, DSDV, OLSR and DSR" International Journal of Information Technology and Knowledge Management, Volume 2, No. 2, pp. 545-548, 2010.

[2] Mina Vajed Khiavi, Shahram Jamali, Sajjad Jahanbakhsh Gudakahriz , "Performance Comparison of AODV, DSDV, DSR and TORA Routing Protocols in MANETs" International Research Journal of Applied and Basic Sciences, Vol., 3 (7), 1429-1436, 2012.

[3] Manjeet Gupta,*Sonam Kaushik, " Performance Comparison Study of AODV, OLSR and TORA Routing Protocols for MANETS" , International Journal Of Computational Engineering Research(IJCER)| Vol. 2, 2250–3005, 2012.

[4] Tamilarasan-Santhamurthy," A Quantitative Study and Comparison of AODV, OLSR and TORA Routing Protocols in MANET", IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 1, No 1, January 2012.

[5] Parul Sharma, Arvind Kalia and Jawahar Thakur," Performance Analysis Of Aodv, Dsr And Dsdv Routing Protocols In Mobile Ad-Hoc Network (Manet)" ,Journal of Information Systems and Communication ISSN: 0976-8742 & E-ISSN: 0976-8750, Volume 3, Issue 1,pp.-322-326, 2012.

[6] Suman Kumari , Sunil Maakar ,Suresh Kumar, R K Rathy4 "Traffic Pattern Based Performance Comparison of AODV, DSDV & OLSR MANET Routing Protocols using Freeway Mobility Model" (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 2 (4) , 1606-1611, 2011,

[7] Laura Marie Feeney, " A Taxonomy for routing protocols in Mobile Adhoc Network", http://www.sics.se/~Imfeeney, October 1999.

[8] V.Savithri, Dr.A.Marimuthu , "A Survey on QoS Constraints based Routing Protocols in Mobile Adhoc Network", (2010) GCOMPNETS, 2nd National Conference on Green communication, Computing And Networks.

[9] V.Savithri, Dr.A.Marimuthu , "A Survey on QoS Constraints based Routing Protocols in Mobile Adhoc Network", (2012) MMASC International Conference on Mathematical Modeling and Applied Soft Computing.