Comparison of DSDV and AODV Routing Protocols for Mobile Ad-hoc Network using NS2

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Abstract— Destination Sequenced Distance Vector (DSDV) routing protocol and Ad-hoc On-demand Distance Vector (AODV) routing protocol are two routing protocols mainly designed for Mobile Ad-hoc networks (MANET). DSDV is a proactive routing protocol and AODV is a reactive routing protocol. The main purpose of this paper is to discuss about these two routing protocols and to show a comparative analysis of them in terms of their performance metrics that are Packet Delivery Ratio, Throughput and Routing Overhead by using NS2. The comparison is done by varying the number of connections and keeping the number of node constant.

Index Terms — AODV, DSDV, MANET, NS2, Packet Delivery Ratio, Routing Overhead, Throughput.

1 INTRODUCTION

A computer network is a collection of network devices and computers which shares information, application and services among each other. These networks can be wired or wireless. MANET is a temporary wireless network which does formed without the use of any existing network infrastructure and without any centralized administration. Nodes are mobile in nature in MANET, hence the topology and structure of the network changes frequently. In MANET nodes also act as a router and takes part in routing. As nodes are mobile, routing become the most important and challenging task in MANET.

MANET routing protocol can be divided into two types one is proactive or table-driven and another one is reactive or on-demand routing protocol. In the case of proactive routing protocol every nodes in the network carry the whole information about the netwok all the time and routing is done by using this information while in reactive routing protocol nodes does not carry any routing information so routes are found only when a route is required between nodes.

2 DSDV ROUTING PROTOCOL

Among the proactive routing protocols of MANET Destination Sequenced Distance Vector routing protocol is one. DSDV is somewhat same as the conventional Routing Information Protocol (RIP) and has the only difference of having additional attribute in the routing table that is the sequence number. At each node of the network the routing information which is used while routing is stored using a table known as routing table. Routing table has the attributes; all the available destinations, the sequence number assigned by the destination node and the number of hops that is needed to reach the destination node and with the help of this table, communication between nodes in the network take place.

Consistency among the routing table in the nodes is maintained by broadcasting regularly the routing information stored in the routing table to every neighbor. The broadcasted routing information contains the fields; the nodes' new sequence number, the IP address of the destination, the new sequence number assigned by the destination and the number of hops required to reach that destination. And the latest destination sequence number is used for making decisions to forward the information again or not. This latest sequence number is also updated to all the nodes which are passed by the information while transmitting within the network.

Full dump is one of the ways of broadcasting routing information and incremental dump is another way of broadcasting in the DSDV protocol. The entire routing information is broadcasted in Full dump broadcasting while only the changed information from the last full dump is broadcasted in the other way of broadcasting. Network Protocol Date Unit (NPDU) is the unit of broadcasting routing information. Incremental dump requires only one NPDU to fit in all the information while full dump requires multiple NPDU. When no movement of mobile hosts is occurring full dump can be transmitted relatively infrequently. When movement becomes frequent and the size of an incremental dump approaches the size of a NPDU, then full dump can be scheduled.

When a node receives routing information it will increments the metric and then transmits the information by broadcasting. Before transmission metric in-cremation is done because, to reach its destination incoming packets will have to travel one more hop. When mobile nodes move from one place to another then it causes broken links within the network. When a link between two nodes in the network is broken then infinity is assigned in the metric fields of the routing tables of the corresponding nodes. So, this infinity metric in the field of a routing table describe that there is no next hop for the corresponding destination. Sequence number field in routing table have an even value if it is originated by the nodes and the sequence number field have an odd number value if it is generated due to link breakage and has an infinity value metrics.

Updating of routing table of a node is done when it re-

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ceived routing information from other node and when some criteria are satisfied. The node updates its routing information in its routing table entry for the corresponding destination describe in the incoming data with the incoming routing information if:

1. Sequence number of the incoming routing information > Sequence number of the routing table entry.
2. Sequence number of the incoming routing information = Sequence number of the routing table entry AND value of metric that is the number of hop of the incoming routing information < Value of metric in the corresponding routing table entry.

The node will discard the incoming message if:

Sequence number of the incoming routing information = Sequence number of the routing table entry AND Value of metric of the incoming routing information > Value of metric in the corresponding routing table entry.

The node will then increment the value of metric by 1 only if the routing information is updated and the sequence number is also incremented by 2.

3 AODV Routing Protocol

Among the on-demand or reactive protocol of MANET AODV is the one. It is designed by using some important properties of DSR and DSDV. The route from a source node to a destination node is found only when a communication is needed between them. Just like DSDV the AODV protocol is loop-free. And it also does not face the count-to-infinity problem and this is attained by the using sequence numbers just like DSDV.

In AODV each node maintains routing table which specify the next hop to take in order to reach a particular destination. If a node wants to communicate with a certain destination and there is no routing information about this destination in the routing table then the source will broadcast a route request message. If there is a node in the path of the route request message which has up-to-date route to the destination then it will return the route information to the source node and all the nodes in the return path of the route request message will change their routing table entry for that corresponding destination with the up-to-date route information passing them. If there is no up-to-date route information for the corresponding destination in an intermediary node then it will rebroadcast the route request message. If a node receives multiple routes to a destination then it will select the route with the best metric. In AODV each routing table entry has the fields; IP Address of Destination, Sequence Number of the Destination, Hop Count, Next hop, Last Hop Count, Lifetime, Lists of Precursors and Flags.

There are many types of messages in AODV which is particularly used for routing. They are:

1. RREQ: This is the route request message which is transmitted by a node when it has to communicate with a particular destination and it does not have route information about that destination.
2. RREP: This is the route reply message which is transmitted by a node that recently received an RREQ. RREP contains the route information about the destination which is mention in RREQ. And it is transmitted to the sender of the RREQ whenever if the node receiving RREQ has route information about the particular destination for which the RREQ was generated or if the node receiving RREQ is the destination itself.
3. RERR: If a link break causes one or more destinations to become unreachable the RERR message is sent.
4. RREP-ACK: RREP-ACK is used to acknowledge the received of RREP.
5. Hello Message: Hello message is broadcasted periodically among the nodes in order to detect link break.

4 Performance Comparison of DSDV and AODV

Comparison of the performances of two routing protocols one On-Demand (Reactive) routing protocol, namely Ad-hoc On-Demand Distance Vector Routing (AODV) and another Table–driven (Proactive) routing protocol namely, Destination Sequence Distance Vector (DSDV) are done in terms of their performance metrics. The performance metrics I used here are:

1. Packet Delivery Ratio (PDR): It is the ratio of the data packets delivered to the destinations to those generated by the source.

$$PDR = \frac{Total\ Received\ Packets}{Total\ Sent\ Packets} \times 100\%$$

2. Routing Overhead (R.O): It is number of routing packets transmitted per data packet delivered at the destination.

$$Routing\ Overhead = \frac{Total\ Routing\ Signaling\ Packets}{Total\ Transmitted\ Packets}$$

3. Throughput: Throughput is the amount of data transferred to the destination through the network in a unit time expressed in kilobits per second (Kbps).

$$Throughput = \frac{Amount\ of\ Data\ Transfferd}{Total\ Simulation\ Time}(Kbps)$$

The simulation and the comparison of the two routing protocols is done by keeping 20 nodes fixed in varying numbers of connections – 5, 10, 15, 20 and 25.

TABLE 1
Scenario for Simulation of DSDV and AODV

Parameter	Value
Number of connections	5,10,15,20,25
Simulation Time	100 s
Pause Time	2 s
Environment Size	700 x 400
Packet Size	512 bytes
Maximum Speed	10 m/s
Queue Length	50
Mobility Model	Random Waypoint Mobility

5 EXPERIMENTAL RESULTS

The simulation results are shown in the tables and graphs below. The graphs are plotted showing the performance of the two routing protocols in terms of the performance metrics described above. In the graph X-axis shows the number of nodes and Y-axis shows the value of the resulted performances.

TABLE 2
Performance of DSDV Routing Protocol in various numbers of Connections with 20 Nodes fixed

No. of connections	Packet Delivery Ratio (%)	Throughput (kbps)	Routing Overhead
5	97.55	25.52	4.76
10	97.95	41.28	2.31
15	96.79	40.62	2.94
20	98.21	41.64	2.72
25	97.07	42.96	2.58

TABLE 3
Performance of AODV Routing Protocol in various numbers of Connections with 20 Nodes fixed

No. of connections	Packet Delivery Ratio (%)	Throughput (kbps)	Routing Overhead
5	99.65	20.35	2.06
10	98.68	45.12	2.00
15	97.80	50.93	2.10
20	99.18	47.74	2.19
25	98.39	50.54	2.05

FIG.10.8. PACKET DELIVERY RATIO OVER INCREASING CONNECTIONS

From the graph, the packet delivery ratio of DSDV is greater than that of AODV.

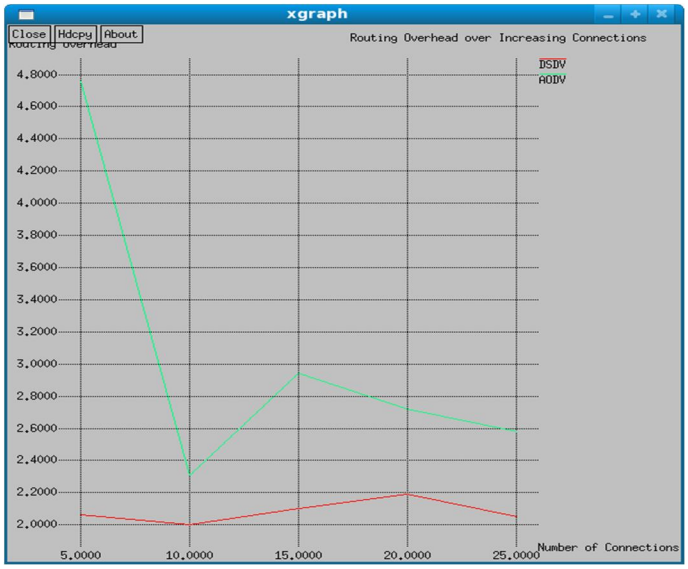

FIG.10.10. ROUTING OVERHEAD OVER INCREASING CONNECTIONS

From the graph,it can be clearly seen that the routing overhead is greater for AODV than DSDV for increasing connections.

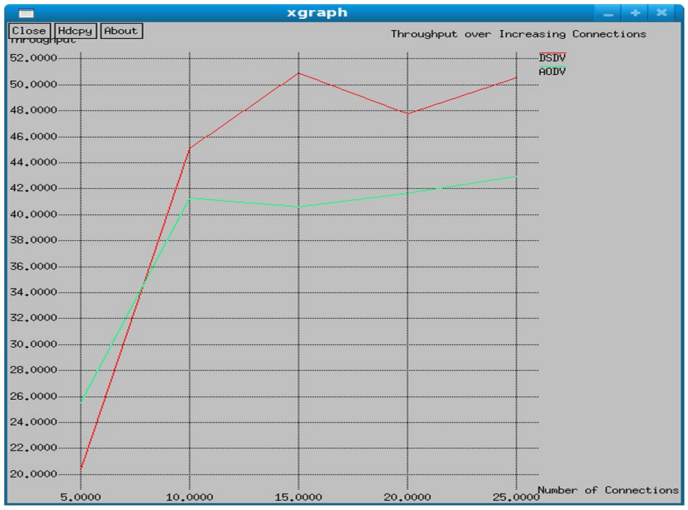

FIG.10.9. THROUGHPUT OVER INCREASING CONNECTIONS

In the graph, throughput is greater for AODV than DSDV at the start of the simulation but as the number of connection increases the throughput for DSDV is found to be more than that of AODV.

6 CONCLUSION

After reviewing the concept of wireless ad-hoc networks and two routing protocols namely, DSDV and AODV, the simulation of these protocols has been carried out using NS2. The performance analysis of both the routing protocols is done by varying the number of connections and keeping in constant the number of nodes.

The two routing protocols are compared keeping 20-nodes fixed and the number of connections is varied. From the analysis, it is found that the packet delivery ratio and throughput

of DSDV is greater than that of AODV if the number of connections is large and routing overhead is greater in AODV than in DSDV. But the performance of the routing protocols depends on the size of the network and the number of connections made between the nodes so it cannot really say which one will be best and which should be use all the time. DSDV is more preferable regarding the throughput and packet delivery ratio for size network I am using here.

7 APPENDIX

1. Ad-hoc: "For this special or temporary purpose" or "a special case without generic support".
2. AODV: Ad-hoc On-Demand Distance Vector routing protocol which is a routing protocol for MANETs.
3. DSDV: Dynamic Sequence Distance Vector routing protocol which is a routing protocol for MANETs.
4. Proactive: Maintain the routing information for the whole network all the time.
5. Reactive: Find the route only when needed.
6. RREQ: Routing Request Message used when a route is needed inside a MANET which uses AODV routing protocol.
7. RREP: Route Reply Message used by AODV routing protocol.
8. Symmetric: Transmission between two nodes have the same working in both directions

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REFERENCES

[1] Elizabeth M. Royer and C.K. Toh, *"A review of current routing protocols for Ad-Hoc Mobile Wireless Networks"*, IEEE Personal Communications, pp. 46-55, April 1999.

[2] Charles E. Perkins and Pravin Bhagwat, *"Highly dynamic Destination Sequenced Distance Vector routing DSDV for mobile computers"*, SIGCOMM Comput. Commun. Rev., Vol. 24, Nr. 4 New York, NY, USA: ACM (1994), pp. 234–244.

[3] Perkins C.E and Royer E.M, *"Ad-hoc on-demand distance vector routing"*, Proceedings of Mobile Computing Systems and Applications(HotMobile), pp. 90-100, 1999.

[4] Anurag Malik, Shivanshu Rastogi and Sajendra Kumar, *"Performance Analysis of Routing Protocol in Mobile Ad Hoc Network using NS-2"*, MIT International Journal of Computer Science & Information Technology ISSN 2230-7621(Print Version) 2230-763X(Online Version) Vol. 1 No. 1, Jan. 2011, pp. 47-50.

[5] I.Vijaya and Pinak Bhusan Mishra, *"Influence of Routing Protocols in Performance of Wireless Mobile Adhoc Network"*, IEEE Second International Conference on Emerging Applications of Information Technology, 2011, pp. 340-344.

[6] V.Ramesh, Dr.P.Subbaiah, N. Koteswar Rao and M.Janardhana Raju, *"Performance Comparison and Analysis of DSDV and AODV for MANET"*, International Journal on Computer Science and Engineering (IJCSE) ISSN 0975-3397 Vol. 02, No. 02, 2010, pp. 183-188.

[7] Sapna S. Kaushik and P.R.Deshmukh, *"Comparison of effectiveness of AODV, DSDV and DSR routing protocols in Mobile Ad-hoc Networks"*, International Journal of Information Technology and Knowledge Management July-December 2009, Volume 2, No. 2, pp. 499-502.

[8] Boukerche A, *"Performance comparison and analysis of ad hoc routing algorithms"*, IEEE International Conference on. Performance, Computing and Communications, 2001, Apr 2001, pp 171-178.