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Comparative Analysis of DSDV, AODV and DSR for Mobile Ad hoc Networks

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Abstract*— A mobile ad hoc network consists of collection of wireless nodes without any fixed infrastructure or base station. Mobile nodes are arbitrarily located due to its characteristics such as dynamic topological configuration, wireless connectivity and open medium. For optimized routing, the efficient routing protocols are essential in such type of networks. The performance of a table-driven protocol DSDV and two prominent on-demand routing protocols like AODV and DSR are compared. Even though AODV and DSR are similar in on-demand behaviour and differ in various significance factors. The simulation experiments are conducted to study the performance of DSDV with two on-demand protocols AODV and DSR.

***Keywords*— DSDV, AODV, DSR, throughput, packet loss**

I. INTRODUCTION

In Wireless Mobile Ad hoc NETwork (MANET), mobile nodes communicate with each other without the intervention of existing infrastructure or centralized access points. Dynamic topological configuration allows mobile nodes to attach and detach the network at any point of time [1]-[4]. A wireless network uses radio frequencies for data transmission instead of using any physical connections. Mobile nodes are communicated each other using multi-hop wireless links. Each node in MANET acts as a host while providing or receiving information from other nodes and as a router when discovering and maintaining routes for other nodes in its proximity area. The functionalities of MANET depend on the well cooperation between nodes.

Routing is a great concern for the dynamic topological structure; hence more efficient routing protocols are essential for the routing process [5]-[7]. However many routing protocols are existing; this proposed work only focuses on Destination Sequenced Distance Vector protocol (DSDV), Ad hoc On-demand Distance Vector (AODV) and Dynamic Source Routing protocol (DSR) for analyzing the performance. The three protocols are analyzed based on the factors such as throughput and packet loss and is presented with experimental results.

The rest of this paper is organized as follows. Considerably section II briefly describes the categories of routing protocols and functionalities of DSDV, AODV and DSR are reviewed. Section III shows the comparative analysis of three routing protocols. The simulation details and experimental results are discussed in section IV & V where the performance of routing protocols are described based on the throughput and packet loss and it is shown how protocols are efficient in various aspects.

II. MANET ROUTING PROTOCOLS

Routing protocols are classified into three categories based on updating the information in the routing table. They are proactive (or table-driven) protocols, reactive (or on-demand) protocols and hybrid routing protocols [8]. The classification of routing protocols is shown in Fig. 1.

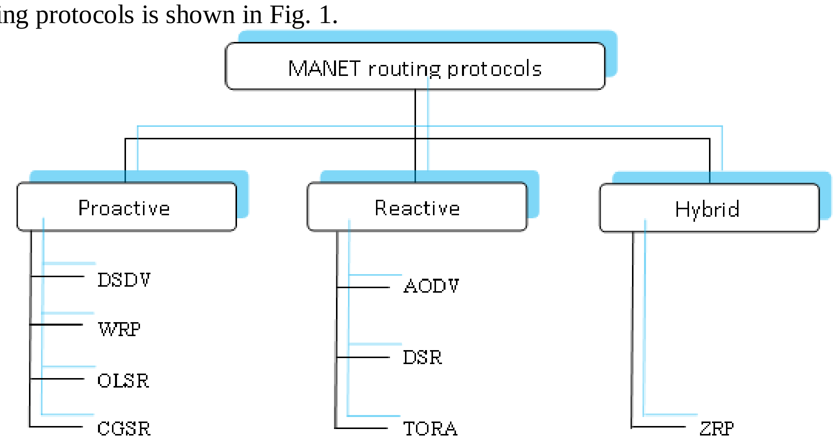

Fig. 1 Classification of routing protocols

A. Destination Sequenced Distance Vector protocol

DSDV is based on Bellman-Ford shortest path algorithm. Though it is proactive or table driven algorithm, it updates the routing table information by periodically exchanging it between nodes in the network. Each node in the network maintains a routing table which helps to find the shortest path to reach the remaining nodes in the network. Information in routing table will be periodically updated and it is informed to other nodes whenever there is a change. If nodes have received any updated information, its own routing table is updated to keep the fresh route and to find out the optimal shortest route. The main components of DSDV are route table creation, route updation and route maintenance [9]. The metric used is the hop count, is the number of intermediate hops from the source node for the packet to reach the destination. There is a problem of having routing loops because of routing updates in a table; it is prevented using sequence number. The routing table entries to reach all nodes from node S is given in Table 1 by taking the metric as hop count. Fig. 2 shows how the source node is exchanging routing table to all other nodes in the same transmission range. Each node maintains a routing table which states the list of routes to reach the remaining nodes.

Table 1 Advertised Routing Table by Node S

Destination	Next Node	Metric	Sequence Number
P	Q	2	150
Q	Q	1	176
R	Q	2	228
S	S	0	238
T	U	2	492
U	U	1	506
V	U	2	664
W	U	3	810

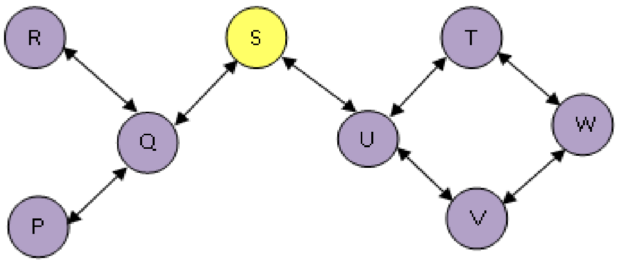

Fig. 2 Routing table exchange of node S in DSDV

B. Ad hoc On-demand Distance Vector

AODV resolves the disadvantage of DSDV where routing table entries have to be broadcasted to all the nodes in the network. Rather, in AODV routes are discovered when they are needed and maintained only as long as they are required. If route is available for transmitting packets from the source node, then it is forwarded through the next hop to reach the destination. If the path is not available in the source node routing table, the route discovery process is initiated [10]. AODV uses Route REQuest (RREQ), Route REPly (RREP) and Route ERRor (RERR) for discovering and maintaining a route.

The source node broadcasts RREQ packet to its neighbors, started its timer and wait for a reply. RREQ packet will be uniquely identified with broadcast ID and IP address together. Reverse route entry will be registered in the routing table to know the path of sending the RREP to the source node. If the route is discovered between the source node and destination node, and it is maintained till it is required by the source node. If the network link is broken, RERR message is propagated to its predecessor and it is forwarded until the source node is reached. The process RREQ and RREP is shown in Fig. 3.

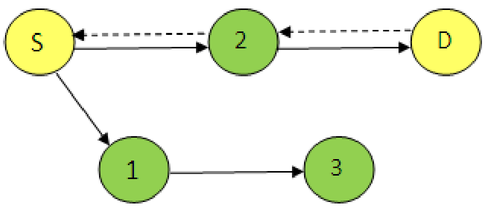

Fig. 3 Route discovery process on AODV

C. Dynamic Source Routing protocol

Dynamic Source Routing protocol is an on-demand source based routing protocol and it is source initiated. It allows the network to be fully self organized and self configured. It also consists of two phases like route discovery and route maintenance [11]. Each node has cache to store entries about the discovered paths. If the source node has the data packet for transmission, it checks the entries in cache for the path. If path is available, then it starts to transmit the packet and the source address will be added in the packet. If the path is not found in the cache or the route in cache is expired, it starts broadcasting RREQ to its neighbors. Immediately the source node starts its timer by setting TTL (Time To Live) value of RREQ to its initial start value. If the RREQ message is received by the destination node, it sends RREP towards the source node along the reverse path. If RREP reaches the source node, it begins the data packet transmission. In the route maintenance phase, link failure is persistently monitored and if so it is intimated to update the entries in route cache.

If node A wants to send data to node O, it first transmits RREQ to all its neighbors. Each neighbor checks its route cache for reaching the destination node. If entry is available in the cache list, node will send a RREP back to the sender. Otherwise, it will forward RREQ to all its neighbors. Each RREQ message uses the sequence number, it is an idea borrowed from DSDV. The node O will reply to all RREQs, hence the source node will choose the optimal path which has the lowest hop count which is shown in Fig. 4.

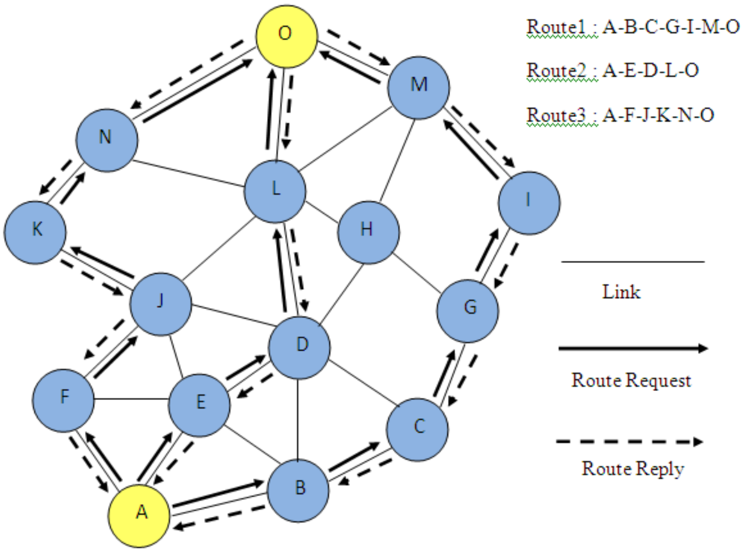

Fig. 4 Route establishment in DSR

III. THEORETICAL COMPARISON OF ROUTING PROTOCOLS

DSDV has the highest overhead compared to AODV, DSR since of routing table entries are updated through periodic and triggered updates [12]. DSDV is not suitable when the mobility of nodes is high, especially at high loads. It consumes more bandwidth due to continuous advertisement of routing information even though there is no updation in topological structure. It is not easy to maintain the routing table if the network is so large. For larger network, it incurs more bandwidth and finally it leads to more overhead. However AODV and DSR are similar in on-demand behaviour and differ in various significance factors [13]-[14]. AODV favours unicast, multicast packet transmissions and quick response if the active route is changed due to frequent topological change. It does not incur any additional overhead for data packet transmission. AODV is more vulnerable to various kinds of attacks as it is concerned that all nodes must be cooperated for establishing a route. DSR no need to maintain the routing table instead the entire route is maintained in the packet header. But it is not scalable to larger networks since it requires more number of resources and each node need more time for processing control packets even if it is not the recipient.

IV. SIMULATION PARAMETERS

The simulation experiment is carried out with Network Simulator (NS) 2.34 in LINUX Fedora 14. The proposed system is executed on a laptop with CORE^{TM}i3 CPU and 3GB RAM. In NS2.34, the configuration settings of a terrain area are taken as 500 x 500 m with 30, 40 and 50 nodes. Both the physical layer and MAC 802.11 layer are included in the wireless extension of NS2. All nodes are moved in a Random-Way Point model (RWP) with random speed between 0 and 20 m/s. In RWP all nodes move to a certain position in the network topology called waypoint, pauses for some time at that position when reached and then repeats the same pattern of pause and movement. Pause time is varied from 10s to 30s by varying the speed of nodes to measure the parameter values such as throughput and packet loss. Packets are transmitted based on User Datagram Protocol-Constant Bit Rate (UDP-CBR) traffic with a packet size of 512 B per second. RWP mobility creates different scenarios every time using setdest command in ns-2 tool. For one sample scenario of 30 number of nodes at mobility speed 10 ms the setdest command is given below,

$ ./setdest

$ ./setdest –n 30 –p 10 –s 10 –x 500 –y 500 > scenario1

V. EXPERIMENTAL RESULTS

In order to analyze the performance of the network, the following parameters are chosen,

A. Based on Throughput

It is defined as the total number of packets successfully delivered to the destination at time T. It denotes the rate at which a network sends or receives data (number of bits per second). It is observed that the throughput of AODV is better when compared to DSR while the performance of DSDV is drastically reduced. As it can be seen from the above graph

Fig. 5, throughput is varied by varying the number of nodes 30, 40, 50. Throughput is computed at destination node where AODV shows higher throughput than the DSR and DSDV. Expected throughput can be achieved in AODV than other two routing protocols. Moreover DSDV shows the lower throughput obtained among three routing protocols.

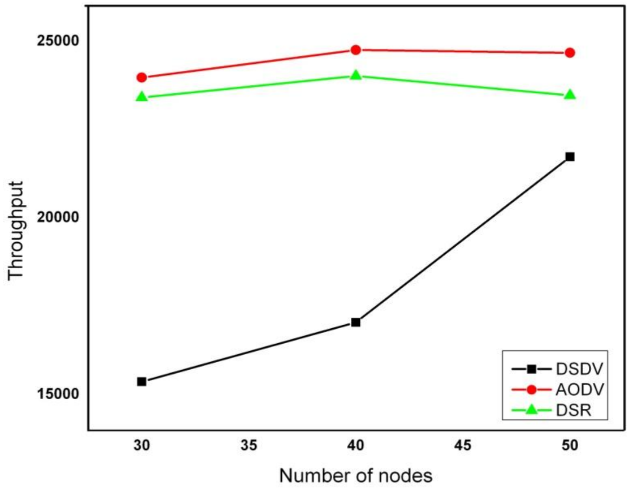

Fig. 5 Throughput comparison

B. Based on Packet loss

It is defined as the ratio that the total number of packets dropped during the simulation time. Packets may be dropped if there is no enough storage space in the buffer and if the time limit is exceeded. It may also get dropped due to network congestion, if the channel is so busy and the TTL value is expired. If the interfacing queue is full, any incoming packets will get dropped.

It is stated as the network traffic fails to reach packets its destination in a specified time interval. Packets get dropped before attaining the target point. Packet Loss (P_L) can be calculated by taking the difference between the amount of packet sent (P_S) and the amount of packet received (P_R) in the *kth* traffic. The formula is given below,

$$P_L = \sum_{i=1}^{k} P_S - P_R \qquad (1)$$

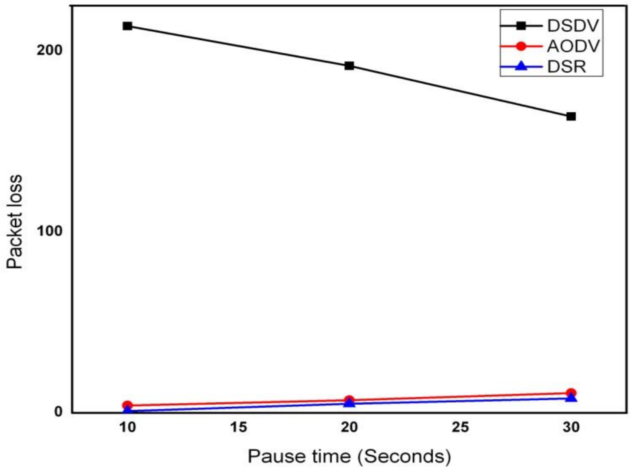

Fig. 6 Packet loss comparison

Total packet loss of AODV and DSR gradually grows with the increase of pause time from 10 to 30 seconds, as shown in the graph Fig. 6. The total packet loss of DSDV decreases with the pause time from 10 to 30 ms respectively. However DSDV increases the amount of packet loss while comparing the on-demand routing protocols.

VI. CONCLUSION

DSDV consumes more bandwidth because of frequent routing table updation. While AODV and DSR are better than DSDV as it incurs less overhead and bandwidth because of following on-demand basis. The performance of DSDV is better for smaller networks, while AODV and DSR are more suitable for networks which are more scalable. Throughput of AODV and DSR routing protocols are more stable than DSDV protocol. Packet loss is more in DSDV when compared to on-demand routing protocols AODV and DSR. By comparing these table driven and on-demand routing protocols, it is concluded that reactive topology based protocols are better than proactive based routing protocols.

REFERENCES

[1] L. Tao, S. F. Midkiff, and J. S. Park, "A framework for Wireless Ad hoc Routing Protcols", *Wireless Communications and Networking, IEEE*, vol. 2, pp. 1162-1167, 2003.

[2] C. N. Ververidis, and G. C. Plyzos, "Service discovery for mobile ad hoc networks: A survey of Issues and Techniques", *Communications Surveys and Tutorials, IEEE*, vol. 10, no. 3, pp. 30-45, 2008.

[3] H. Deng, and P. Agarwal, "Routing security in wireless ad hoc networks", *IEEE Communication Magazine*, vol. 40, pp. 70–5, 2002.

[4] L. Zhou and Z. Haas, "Securing ad hoc networks", *IEEE Network Magazine*, vol. 13, no. 6, pp. 24-30, 1999.

[5] M. Zapata, and N. Asokan, "Securing ad hoc routing protocols", *In Proc. 3rd ACM Workshop WiSE*, pp. 1-10, 2002.

[6] P. Papadimitratos and H. Haas, "Secure data transmission in mobile ad hoc networks", *In Proc. ACM Workshop WiSE*, pp. 41-50, 2003.

[7] H. Yih-Chun and A. Perrig, "A survey of secure wireless ad hoc routing", *IEEE Security Privacy*, pp. 28-39, 2004.

[8] A. Boukerche, B. Turgut, N. Aydin, M. Z. Ahmad, L. Boloni, and D.Turgut, "Routing protocols in ad hoc networks: A survey", *Computer Networks*, vol. 55, pp. 3032–3080, 2011.

[9] C. Perkins, and P. Bhagwat, "Highly dynamic Destination-Sequenced Distance-Vector routing (DSDV) for mobile computers", *ACM SIGCOMM computer communication Review*, vol. 24, no. 4, pp. 234-244, 1994.

[10] C. Perkins, E. Belding-royer, and S. Das, "Ad hoc On-Demand Distance Vector (AODV) Routing, IETF RFC 3561, 2003.

[11] Johnson, et al. The Dynamic Source Routing Protocol, RFC 4728, Feb 2007.

[12] S.Y Narendra, and R. P. Yadav, "Performance Comparison and Analysis of Table-Driven and On-Demand Routing Protocols for Mobile Ad-hoc Networks", *Interational Journal of Information and Communication Engineering*, vol. 2, no. 12, pp. 2809-2817, 2008.

[13] M. Bouhorma, H. Bentaouit and A. Boudhir, Performance comparison of Ad hoc Routing protocols AODV and DSR, IEEE ICMCS, pp. 511-514, 2009.

[14] C. Perkins, E. Royer, S. Das, and M. Marina, Performance comparison of two on-demand Routing Protocols for ad hoc networks, *IEEE Personal Communication*, vol.8, no.1, pp, 16-28, 2001.

