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Performance Evaluation of Routing Protocols for Mobile Adhoc Networks

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Abstract

Objectives: To provide characteristics of several routing algorithms by discussing the benefits and limitations in relevance to various metrics namely number of packets send, Packets dropped, delivery ratio and throughput. **Methods/Statistical analysis:** Some well known network simulators are available like Ns2 (Network Simulator 2), Ns3 (Network Simulator 3), OPNET, OMNeT++, Net Sim, REAL, Q. In order to achieve the objectives we shall be using simulator with the name of "network simulator - NS (version 2.35)" for the practical work. It is well known simulator and is an open source. So one can easily modify and add the new code according to their requirements. **Findings:** Nodes can be created in wired and wireless media using NS-2.35. These nodes can be assigned properties according to their characteristics and need of traffic. Analysis of routing algorithms has been done for 10, 30 and 40 nodes. From analysis it has been demonstrated that no. of packets dropped in AODV, DSDV, DSR and Want Net are equal to zero. No. of packets send is maximum in Want Net as compared to other routing protocols with whom the comparison has been done like AODV, DSDV and DSR. Delivery ratio is 100% in all the routing protocols AODV, DSDV, DSR and Want Net which are taken in this research paper. Throughput that represents the number of packets which are sent effectively per unit time is maximum in WAntNet as compared to other routing protocols AODV, DSDV and DSR .We have done the simulations using NS 2.35 in order to prove the benefits of WAntNet over the routing protocols that are existing in the literature. Improved performance has been attained through the WAntNet. **Application/Improvements:** MANET is infrastructure less network which is helpful in allocating information using movable devices. The various applications include Military Sector, Commercial Sector, Data Networks, Emergency Services and Sensor Networks.

Keywords: Mobile Adhoc Network, Routing Protocol

1. Introduction

Mainly there are two types of wireless networks i.e one having infrastructure and other without infrastructure. In case of networks having infrastructure the interaction between the nodes is carried out through the central agency. However for the case of networks which are not having infrastructure there is no central agency to carry out communication between nodes. Thus the network which is a set of movable nodes and function with no control is known as Mobile adhoc network[1]. The movable nodes existing in the network can come and depart the system at any instant. Direction-finding is complicated in mobile adhoc networks due to restricted bandwidth[2]. Routing overheads are more in DSR whereas it is fewer in AODV. On the similar basis caching overheads are more in case of DSR whereas it is fewer in AODV[3] Movable nodes can exchange the information if they are connected directly otherwise they exchange the information through intermediate nodes. In comparison to infrastructure networks the infrastructure less networks functions with several routing protocols.

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Routing protocols are categorized in to proactive, reactive and hybrid protocols. Wireless Routing protocol (WRP), Destination Sequenced Distance Vector (DSDV) protocol comes under the category of Proactive protocols. Ad-hoc On Demand Routing (AODV), Temporarlly Ordered Routing Algorithm (TORA), Dynamic Source Routing (DSR) and Ad-hoc On Demand Multipath Routing (AOMDV) protocols comes under the category of reactive protocols. The protocol which took the benefits of both proactive and reactive are hybrid protocols[4] Ant colony optimization technique is based on hunting for food. The main motive is to find out the smallest path from source to destination. However in case of Artificial Bee colony optimization model two different behaviors that are usually implemented are foraging and mating behavior. Different types of bees in bee colony model are female queen bee, male drone bees and worker bees. To exhibit new colony is the function of queen bee[5] Intelligent Temporally Ordered Routing Algorithm is appropriate for multimedia applications because it raises network life span, diminishes end to end delay and packet loss. In Ant colony optimization, no data regarding finding direction is conveyed to adjoining nodes. Moreover it also considers the quality of link. The various phases that are involved in this algorithm are finding a route, protection of the route and removal of route[6]

By opting the path having minimum number of hops it is possible to discover the smallest path between source and destination. Such requirement is of more importance in mobile adhoc networks as in case of MANETs the protocols requires less delays. But however in case of wireless sensor networks the quality of service is of fewer significance[7]. To decrease transmission cost for reserving energy an approach that is employed is data accumulation. While energy proficient channel is protected between source and destination the pheromone is released. For opting the best channel so as to enhance the life span of networks every node determines the remaining power and energetically compute probabilities. The acknowledgement is sent by destination to the source when packet is received by the destination. Basically this packet includes the number of hops from source to the nest[8] .The various problems that occurs in routing protocols are congestion, deadlock, livestock and faults. Deadlock occurs when more than two or just two packets wait for the resource to liberate. Another problem is the livestock in which the packet is unable to reach the target even though it is closer to the target. The reason being the channel is grasped by other packet. Further some of the faults are everlasting and some of the faults vanish after short duration of time[9]. Many researchers are also using ant colony techniques for efficient routing in MANETs[10]. For broadcasting if source and destination are chosen arbitrarily that will lead to decline the overheads during path finding process[15].

2. Routing Protocols

2.1 Dynamic-Destination-Sequenced Distance-Vector Routing Protocol (DSDV)

The routing table is kept by every movable node in case of DSDV. Every existing destination and hops that are required to reach the destination are registered in the routing table. For maintaining data regarding topology the routing tables are renewed after every instant of time. In case there occurs important alternation in routing then data is conveyed instantly. Information about routing table is broadcasted by every mobile node to the adjoining node. By this way the adjoining nodes shall be able to determine the modifications which have happened in the network. Modifications take place due to mobility of nodes[11].

2.2 Wireless Routing Protocol (WRP)

It determines the smallest path through the data about the hops from second to final to every target. Message retransmission list, link cost table, distance table and routing table are maintained by every node for determining the shortest path. After accepting renewal message from adjacent node the node will make up a decision if there is any need to renew the routing table or not. By the use of latest data the node checks for improved path. If improved path is found by the node then that data is broadcasted to the original node[11].

2.3 Dynamic source routing protocol (DSR)

In this routing protocol the bandwidth of infrastructure less networks is limited by removing the renewal messages. Entire path from source to destination is indicated by source. On the basis of the path indicated by source the packets are sent by nodes which lie in between source and target. Intermediate nodes do not found the path until it is stored in the memory. The memory includes several routes from source to destination. The error message is dispatched to starting node when the path which is in use is ruptured. That particular route is treated as unacceptable[12].

2.4 Ad-hoc On Demand Routing (AODV)

No swap of routing table takes place in this distance vector routing protocol. The paths are established when particular node is interested to exchange information with other node. Path finding is commenced when a node is desired to exchange information with the target node whose path information is not known by the source node. Main motive behind path finding is to establish path from source to target and from target to the source. Path request packet is broadcasted during path finding process. Every node who accepts the route request packet checks in the routing table. The purpose of checking in the routing table is to determine if it is meant for that particular target. Reply packet is sent to initiator if it is intended for that particular destination else it is retransmitted. In case link is not working properly then route error messages is circulated by nodes which lie on this route to all the associated nodes[13].

2.5 Temporally Ordered Routing Algorithm (TORA)

TORA which is on-demand routing protocol offers multiple paths from source node to target node. Every node shall be able to sense partitions. Simultaneous sensing of partitions leads to the routes which are non-optimal. However this routing protocol leads to minimum overheads. Mainly the functions that are performed by this routing protocol are finding a route, sustaining a route and removing a route. Whenever the source node has information packet then that packet is broadcasted to all intermediate nodes. These intermediate nodes will further transmit the packet to the destination node[14].

2.6 Want Net

It is a routing protocol which appoints forward ants for discovering dissimilar paths and to make up the data storage and make use of backward ants which gets all facts from forward ant[16]. The backward ant move back to nest by swapping information from routing table[17].

3. Major Classification of Routing and MANET

3.1 Proactive Algorithms

The nodes in case of proactive routing protocol constantly determine paths to all target nodes and keep the most recent routing information. Without any delay the source node gets the information about routing path if it requires the same. Number of hops, next hop and every destination is enlisted in the routing table.

3.2 Reactive Algorithm

The route between initial node and target is determined as per the requirement. The conservation of bandwidth occurs during the transfer of information from initial node to target. Path finding and path protection are two key components in this algorithm.

3.3 Hybrid Algorithm

For minimizing the overheads and red3ucing the latency which happens due to path finding it came in to reality. For bigger networks this algorithm is appropriate.

4. Results

To evaluate the protocols, some performance metrics were used. AODV, DSR, DSDV, WAntnet were used to evaluate the performance. The protocols were made to run with different number of nodes in the network. Performance metrics like number of packets send, delivery ratio, packet loss and throughput were considered for comparisons. The values of the QoS parameters were drawn into table and then are plotted using the graphs. So, one can easily learn from graphical as well as textual representation.

Different graphs have been plotted using varying no. of nodes. The number of nodes taken here are 10, 30 and 40. Figure 1(a) shows no. of packets dropped. Figure 1(b) shows no. of packets send. Figure 1(c) shows delivery ratio of various routing protocols. Figure 1(d) shows throughput.

Table 1 shows the analysis of routing algorithms for 10 nodes. It has been demonstrated from Table 1 that no. of packets dropped in AODV are more as compared to DSDV, DSR, WAntNet. No. of packets send are maximum in DSDV. Delivery ratio is 100% in AODV, DSR, WAntNet whereas it is 99.8 in DSDV. Throughput is maximum in DSDV.

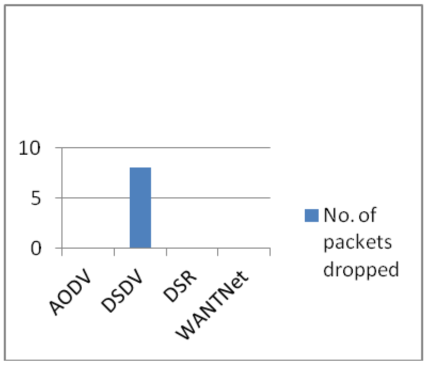

Figure 1a. No. of packets dropped.

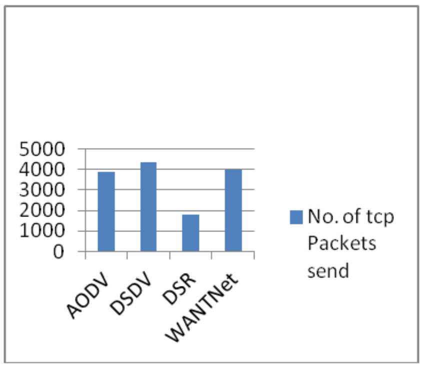

Figure 1b. No. of packets send.

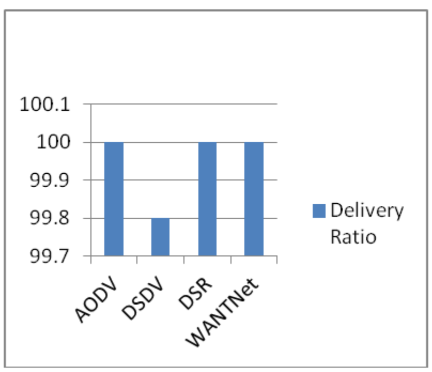

Figure 1c. Delivery Ratio.

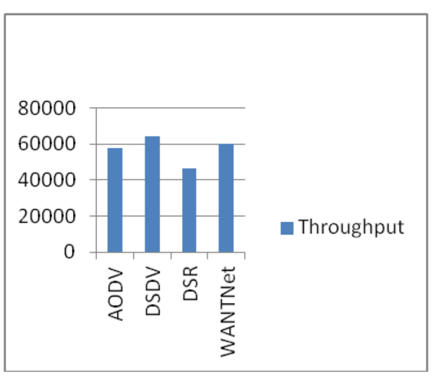

Figure 1d. Throughput.

Table 1. Analysis of routing algorithms for 10 nodes

Algorithms	AODV	DSDV	DSR	WANTNet
No. of packets dropped	0	8	0	0
No. of tcp Packets send	3884	4342	1783	4000
Delivery Ratio	100	99.8	100	100
Throughput	57676.5	64424	46308	60242

Figure 2(a) shows no. of packets dropped. Figure 2(b) shows no. of packets send. Figure 2(c) shows delivery ratio of various routing protocols. Figure 2(d) shows throughput. Table 2 shows the analysis of routing algorithms for 30 nodes. It has been demonstrated from Table 2 that no. of packets dropped in AODV, DSDV, DSR, WAntNet are equal to zero. No. of packets send are maximum in WAntNet. Delivery ratio is 100% in all the routing protocols. Throughput is maximum in WAntNet.

Table 2. Analysis of routing algorithms for 30 nodes

Algorithms	AODV	DSDV	DSR	WANTNet
No. of packets dropped	0	0	0	0
No. of tcp Packets send	4605	4613	4644	4670
Delivery Ratio	100	100	100	100
Throughput	47862	68450	68968	69735

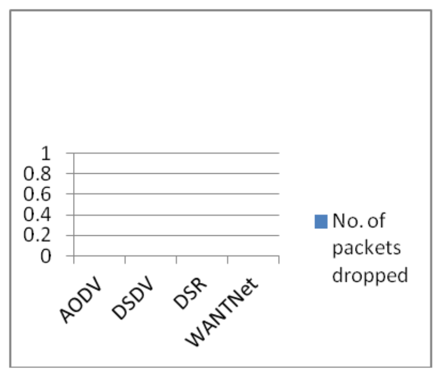

Figure 2a. No. of packets dropped.

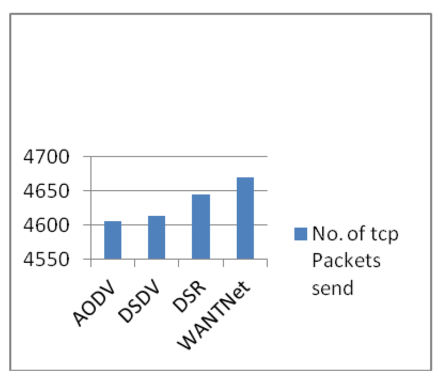

Figure 2b. No. of packets send.

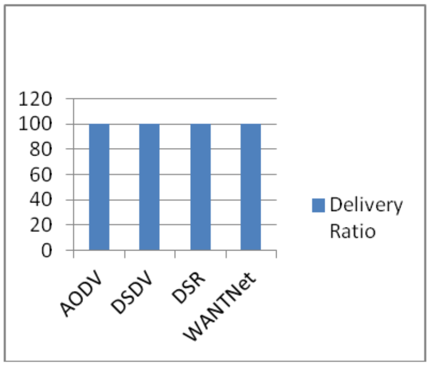

Figure 2c. Delivery Ratio.

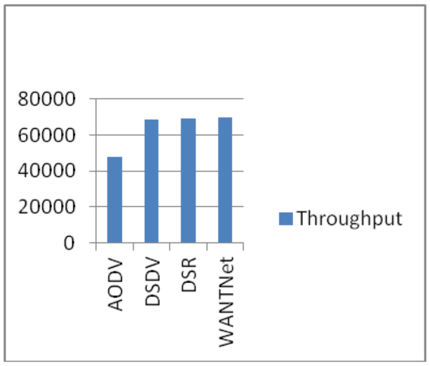

Figure 2d. Throughput.

Figure 3(a) shows no. of packets dropped. Figure 3(b) shows no. of packets send. Figure 3(c) shows delivery ratio of various routing protocols. Figure 3(d) shows throughput. Table 3 shows the analysis of routing algorithms for 40 nodes. It has been demonstrated from Table 3. that no. of packets dropped in AODV , DSDV, DSR, WAntNet are equal to zero. No. of packets send are maximum in WAntNet.. Delivery ratio is 100% in all the routing protocols. Finally throughput is maximum in WAntNet.

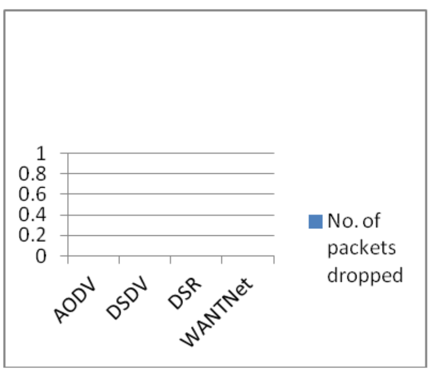

Figure 3a. No. of packets dropped.

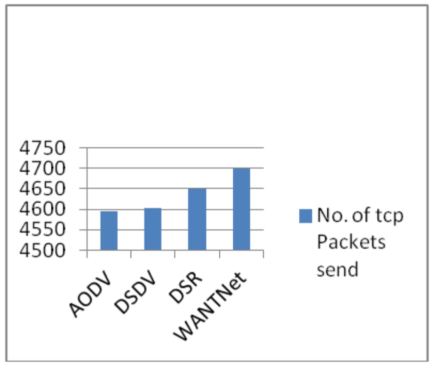

Figure 3b. No. of packets send.

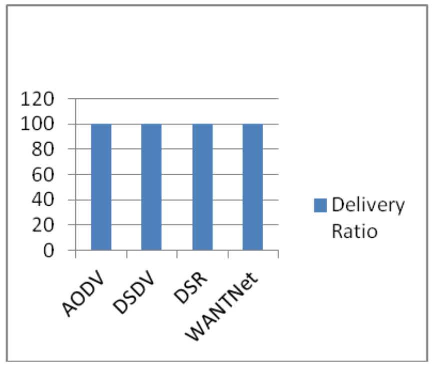

Figure 3c. Delivery Ratio.

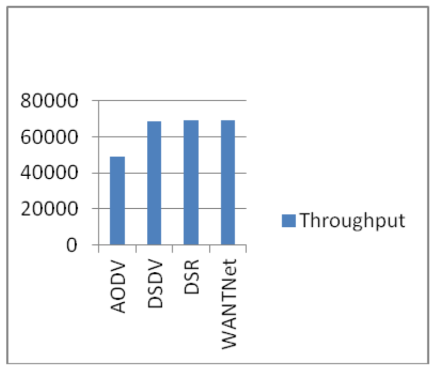

Figure 3d. Throughput.

Table 3. Analysis of routing algorithms for 40 nodes

Algorithms	AODV	DSDV	DSR	WANTNet
No. of packets dropped	0	0	0	0
No. of tcp Packets send	4596	4602	4649	4700
Delivery Ratio	100	100	100	100
Throughput	48712	68301.1	69042.2	69343

5. Conclusion

Various routing protocols namely proactive, reactive and hybrid protocols have been discussed. Infact performance of various routing protocols like Dynamic Destination-Sequenced Distance-Vector Routing Protocol (DSDV), WAntNet, Dynamic Source Routing Protocol (DSR), Adhoc on-demand Distance vector Routing protocol (AODV) has been determined. It is seen that performance of WAntNet is better as compared to DSDV, DSR and AODV routing protocols because no. of packets send and throughput are maximum in case of WAntNet.

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