Implementation DSDV routing protocol for wireless mobile *ad-hoc* network, using NS-2 simulator

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Routing in MANET is a critical task due to highly dynamic environment. A routing protocol is needed whenever a packet needs to be transmitted to destination via number of nodes and numerous routing protocols have been proposed for *ad-hoc* network. In this paper we try to judge the impact of both reactive as well proactive type protocols by increasing the density of nodes in the network, keeping source node fixed and move the destination node and lastly, keeping the destination node fixed and move source node. In all the three cases, the performance of the routing protocol have been analyzed to improve and select efficient routing protocol for network setup and its designing for practical scenario. The performance matrix includes delivery fraction, packet loss and end to end delay.

Key words: Wireless mobile, routing protocols, mobile *ad hoc* networks.

INTRODUCTION

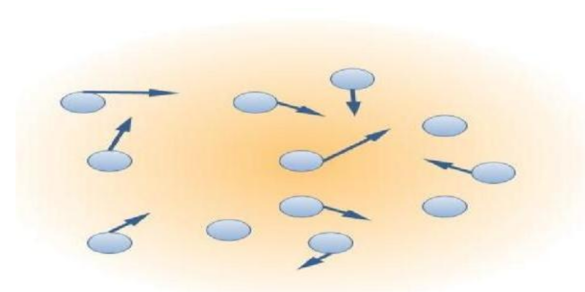
Mobile ad hoc networks (MANETs) are rapidly evolving as an important area of mobile mobility. MANETs are infrastructure less and wireless in which there are several routers which are free to move arbitrarily and can mange themselves in same manners. MANETs as shown in Figure 1 have characteristics that network topology changes very rapidly and unpredictably in which many mobile nodes moves to and from a wireless network without any fixed access point where routers and hosts move, so topology is dynamic. It has to support multihop path for mobile nodes to communicate with each other and can have multiple hops over wireless links; also connection point to the internet may also change. If mobile nodes are within the communication range of each other, then source node can send message to the destination node otherwise it can send through intermediate node.

Nowadays mobile ad hoc networks have robust and efficient operation in mobile wireless networks as it can include routing functionality into mobile nodes which is more than just mobile hosts and reduces the routing overhead and saves energy for other nodes. Hence, MANETs are very useful when infrastructure is not available (Pucha et al., 2007), impractical, or expensive because it can be rapidly deployable, without prior planning or any existing infrastructure.

And it’s an autonomous system in which mobile hosts connected by wireless links are free to be dynamic and sometimes act as routers at the same time. All nodes in a wireless ad hoc network act as a router and host as well as the network topology is in dynamically, because the connectivity between the nodes may vary with time due to some of the node departures and new node arrivals.

The special features of Mobile Ad Hoc Network (MANET) bring this technology great opportunity together with severe challenges (MANET is explained in details in

Figure 1. Mobile Ad-hoc Networks (MANETs).



Abbreviations: DSR, Dynamic source routing; **AODV,** *ad-hoc* on demand distance vector routing; **DSDV,** destination sequenced distance vector routing; **MANET,** mobile *ad hoc* networks; **NS,** network simulator.

Figure 2. Nodes move randomly in different speed and different direction rks (MANETs).

the Appendix). All the nodes or devises responsible to organize themselves dynamically the communication between the each other and to provide the necessary network functionality in the absence of fixed infrastructure or we can call it ventral administration, It implies that maintenance, routing and management, etc. have to be done between all the nodes. This case Called Peer level Multi Hopping and that is the main building block for Ad Hoc Network. In the end, conclude that the Ad Hoc Nodes or devices are difficult and more complex than other wireless networks. Therefore, Ad Hoc Networks form sort of clusters to the effective implementation of such a complex process. Figure 2 shows some nodes forming ad hoc networks, and there are some nodes more randomly in different direction and different speeds.

Reactive and proactive protocol

On demand/reactive routing protocol

On-demand routing protocols were designed to reduce the overheads in proactive protocols by maintaining information for active routes only. This means that routes are determined and maintained for nodes that require sending data to a particular destination. Route discovery usually occurs by flooding a route request packets through the network. When a node with a route to the destination (or the destination itself) is reached a route reply is sent back to the source node using link reversal if the route request has traveled through bidirectional links or by piggy-backing the route in a route reply packet via flooding. Reactive protocols can be classified into two categories: source routing and hop-by-hop routing. In source routed on-demand protocols, each data packets carry the complete source to destination address. Therefore, each intermediate node forwards these packets according to the information kept in the header of each packet. This means that the intermediate nodes do not need to maintain up-to-date routing information for each active route in order to forward the packet towards the destination. Furthermore, nodes do not need to maintain neighbor connectivity through periodic beaconing messages. The major drawback with source routing protocols is that in large networks they do not perform well. This is due to two main reasons; firstly as the number of intermediate nodes in each route grows, then so does the probability of route failure. The advantage of this strategy is that routes are adaptable to the dynamically changing environment of MANETs, since each node can update its routing table when they receiver fresher topology information and hence forward the data packets over fresher and better routes. Under this category Dynamic Source Routing (DSR) protocol requires each packet to carry the full address (every hop in the route), from source to the destination (Khatri et al., 2010).

DSR (Dynamic source routing)

DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is composed of the two main mechanisms of “Route Discovery” and “Route Maintenance”, which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network. However, this protocol has a number of advantages over routing protocols such as AODV, LMR and TORA and in small to moderately size networks (perhaps up to a few hundred nodes), this protocol may perform better. An advantage of DSR is that nodes can store multiple routes in their route cache, which means that the source node can check its route cache for a valid route before initiating route discovery and if a valid route is found there is no need for route discovery. This is very beneficial in network with low mobility. Since they routes stored in the route cache will be valid longer. Another advantage of DSR is that it does not require any periodic beaconing (or hello message exchanges), therefore nodes can enter sleep node to conserve their power. This also saves a considerable amount of bandwidth in the network (Khatri et al., 2010).

AODV (Ad-Hoc on demand distance vector routing)

AODV is a modification of the DSDV algorithm. When a source node desires to establish a communication session, it initiates a path-discovery process to locate the other node. The source node broadcasts a RREQ packet with its IP address, Broadcast ID (BrID), and the sequence number of the source and destination. While, the BrID and the IP address is used to uniquely identify each request, the sequence numbers are used to determine the timeliness of each packet. Receiving nodes set the backward pointer to the source and generates a RREP unicast packet if it is the destination or contains a route to the destination with a sequence number greater than or equal to the destination sequence number contained in the original RREQ. As the RREP is routed back to the source, forward pointers are setup by the intermediate nodes in their routing tables

The deletion of a route would occur if an entry was not used within a specified lifetime. Link failures are propagated by a RREP message with infinite metric to the source node where route discovery would again occur. An optional feature of AODV is the use of hello messages to maintain the connectivity of neighboring nodes. The hello protocol yields a greater knowledge of the network and can improve the route discovery process.

Proactive routing protocol/table driven routing protocol

It maintains the routing table using the routing information learnt from neighbors on periodic basis. Main characteristics of these protocols include: distributed, shortest-path protocols, maintains routes between every host pair at all times, based on periodic updates of routing table and high routing overhead and consumes more bandwidth (Walaia and Singh, 2011). In table driven protocols, each node maintains one or more tables containing routing information to every other node in the network. All nodes keep on updating these tables to maintain latest view of the network (Taneja and Kush, 2008).

DSDV (Destination sequenced distance vector routing)

The distance vector algorithm described is a classical Distributed Bellman-Ford (DBF) algorithm (Vetrivelan and Reddy, 2008; Basagni et al., 1998). DSDV is a distance vector algorithm which uses sequence numbers originated and updated by the destination, to avoid the looping problem caused by stale routing information. In DSDV, each node maintains a routing table which is constantly and periodically updated (not on-demand) and advertised to each of the node's current neighbors. Each entry in the routing table has the last known destination sequence number. Each node periodically transmits updates, and it does so immediately when significant new information is available. The data broadcasted by each node will contain its new sequence number and the following information for each new route: the destination's address the number of hops to reach the destination and the sequence number of the information received regarding that destination, as originally stamped by the destination. No assumptions about mobile hosts maintaining any sort of time synchronization or about the phase relationship of the update periods between the mobile nodes are made. Following the traditional distance-vector routing algorithms, these update packets contain information about which nodes are accessible from each node and the number of hops necessary to reach them. Routes with more recent sequence numbers are always the preferred basis for forwarding decisions. Of the paths with the same sequence number, those with the smallest metric (number of hops to the destination) will be used. The addresses stored in the route tables will correspond to the layer at which the DSDV protocol is operated.

METHODOLOGY

In this paper the different routing protocols have been analyzed by using simulator tool called network simulator (NS). We are using NS-2.27 for the performance analysis of these protocols. In your first scenario the total number of nodes is 10 and the source node 0 is fixed and destination node 9 is in movement while in second scenario the number of nodes is same but, here source node 0 is in mobility and destination node 9 is fixed (Figures 3, 4 and 5). The final scenario is based on increasing the density of nodes in the network and tries to judge the impact of such scenario with different simulation time 10, 50 and 100 ms. Table 1 shows the main characteristics used for scenario. The analysis result helps the network designer to choose right protocol.

Simulation tool

Software used for the performance analysis of taken protocol is based on NS-2 version 2.27. NS Simulator based on two languages: an object oriented simulator, written in C++, and a OTcl (an object oriented extension of Tcl) interpreter, use to execute users command scripts. There are two classes hierarchies: the complied C++ hierarchy and the interpreted OTcl one, with one two one correspondence between them. The complied C++ hierarchy allows us to achieve efficiency in the simulation and faster execution times. This is in particular useful for the detail definition and operation of protocols. This allows one two reduce packet and event processing time. OTcl script provided by the user, and can define a particular Network Topology, the specific protocols and applications that we wish to stimulate (who behavior is already

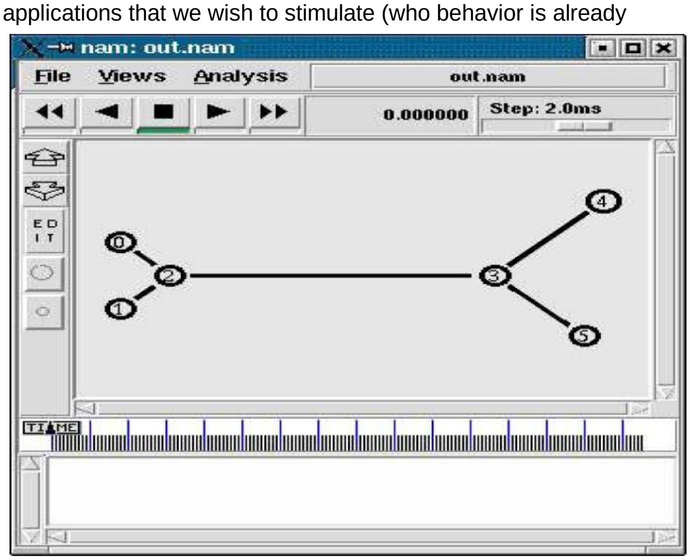


Figure 3. Example for creating file nam: nam. out.

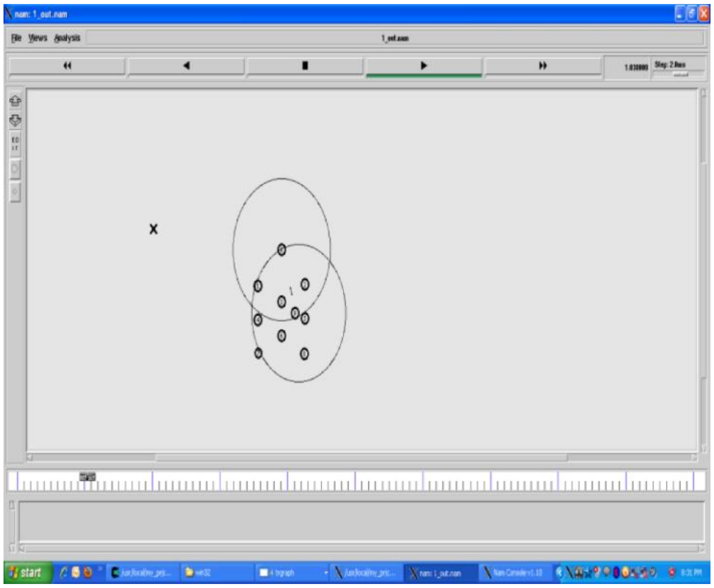


Figure 4. Scenario for source and destination variation.

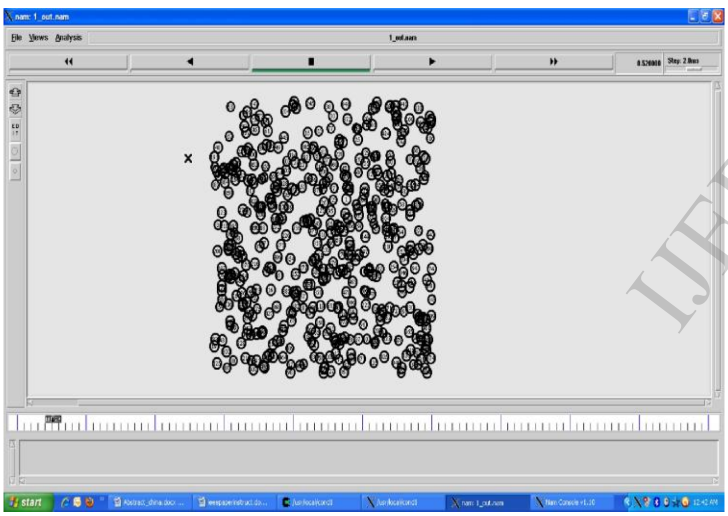


Figure 5. Scenario for node density increase.

Table 1. Main Characteristics of scenario

Statistic	Value
Simulator	NS-2.27
Protocol studied	DSR, AODV, DSDV
Scenario size	1000 × 1000 m
Number of nodes	10, 100
Node mobility (m/s)	10
Traffic type	CBR
Node movement model	Random Waypoint
Transmit power (W)	0.005
Simulation time (min)	10, 50, 100

defined in the complied hierarchy) and the form of output that we wish to obtain from the simulator. The OTcl can make use of the object complied in C++ through an OTcl linkage (done using tclCL) that creates a matching of the OTcl objects for each of the C++. NS is a discrete event simulator, where the advance of time depends on the timing of events which are maintained by a scheduler. An event is an object in the C++ hierarchy with a unique, a scheduled time and the pointer to an object that handles the events.

The schedulers keeps an ordered data structure (there are four, but by default NS use a simple linked- list) with the events to be executed and fires them one by one, invoking the handler of the event. The otcl script used in this simulator is defined in the following manner:

Otcl Script:

#Create a simulator object
set ns [new Simulator]
#Open the trace file(s)
set nf [open out.nam w]

$ns namtrace-all $nf
#Define a 'finish' procedure
proc finish {} {
global ns nf
$ns flush-trace
close $nf; #Close the trace file
exec nam out.nam & #Execute nam on the trace file
#(optional)
exit 0
}

.nam file is generated by.tcl file and we can visualize the network scenario by this.

RESULTS

The calculated result will be in the form of trace file and it

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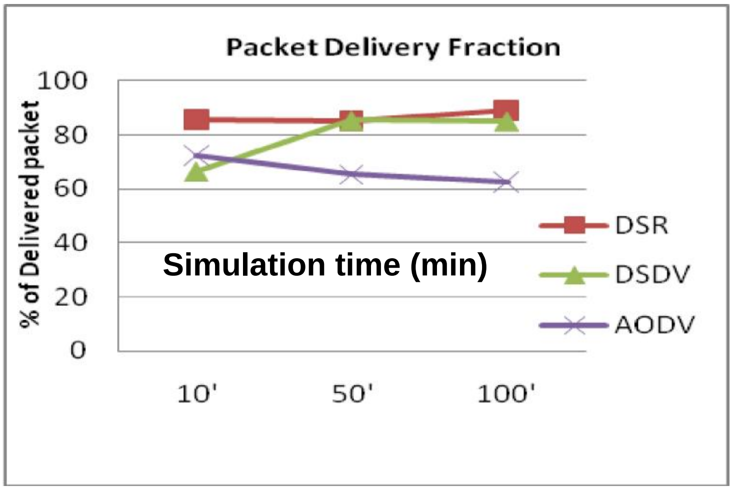


Figure 6. Packet Delivery Fraction.

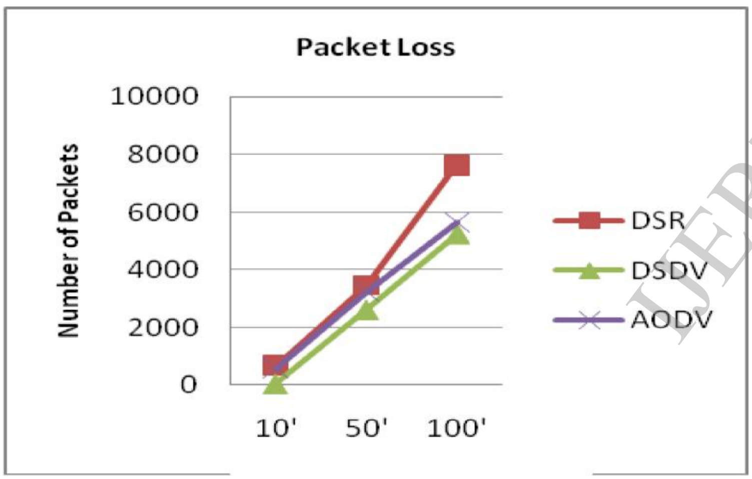


Figure 7. Packet loss.

is plotted with the help of Microsoft Excel 2007 tool. Figures 6, 7 and 8 shown result of the network when the source node 0 is fixed at one place and destination node 10 is in movement. The analysis results are shown in Figures 6, 7 and 8.

The result plotted for the three routing protocols DSR, DSDV and DSR respectively for the first scenario having 10 nodes.

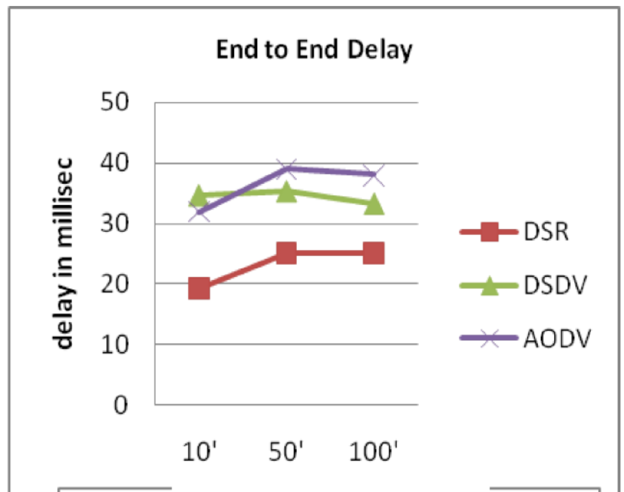
The simulated result is of second scenario when the source node 0 is in movement and destination node 9 is fixed or constant in the network. The analysis result is shown in Figures 9, 10 and 11. The result plotted for the three routing protocols DSR, DSDV and AODV respectively for the second scenario having 10 nodes.

The simulated result is of third and final scenario of node density increase shown in Figures 12, 13 and 14.

Conclusion

This paper does the realistic comparison of three routing protocols DSR, AODV and DSDV in node mobility and node density increase in the network. In first scenario keeping source node fixed and destination node variation.

Figure 8. End to End Delay



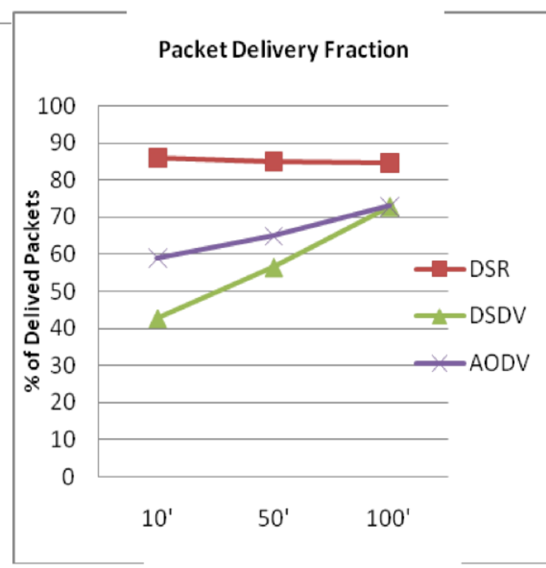


Figure 9. Packet delivery fraction

DSR routing protocol performance is quite well compared to AODV and DSDV. While keeping the destination node fixed and source node variation we again conclude that DSR performance improves much better compared to AODV as well as DSDV routing so, in second scenario DSR performs efficient for the network. And the loss would be much in DSDV routing protocol. Finally, in the last scenario of your work when the node density increases then DSDV performance deteriorate poorly and it goes nearly to zero value. Also, here the performance of DSR routing protocol is much better than AODV and DSDV. So, under high traffic condition DSR performs well and is good for engineers while designing any ad-hoc real scenario network.

Simulation time (min)

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