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Review Paper on AODV & DSR Routing Protocol

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Abstract— *Mobile Ad hoc network is network where nodes communicate without any central administration or network infrastructure. They are connected via wireless channels and can use multiple hops to exchange data. Routing protocols are needed for communication in such Ad hoc networks, where it targets for efficient and timely delivery of message. There are various performance metrics to compare Ad hoc routing protocols. In this paper, a step by step procedure is stated to compare two popular routing protocols, DSR, AODV based on performance metrics Packet Delivery Fraction (Pdf), End to end delay and Normalized Routing load while varying the number of nodes, speed and Pause time. It also provides a step by step approach based on assumption on how to carry out such a comparative study, which could be used for future research.*

Keywords— *AODV, DSR.*

I. INTRODUCTION

In MANET mobile nodes communicate with each other using multi hop wireless links without infrastructure .Every node in the network act as a router as well as packet forwarding agency for other nodes. A central challenge in the design of MANET is the development of dynamic routing protocols that can efficiently find routes between two communicating nodes. In MANET nodes moves randomly, therefore the network may experience sudden and unpredictable change in topology. Nodes in MANET normally have limited transmission ranges, therefore some nodes cannot communicate directly to other nodes and those are beyond the limit of range of mobile node. So many protocols have been proposed MANETs for achieving the efficient routing. Every protocol uses a new searching methodology for new route or modifying a known route, when hosts move. Energy consumptions in MANET are very critical issue. Because mobile devices have limited battery power and processing power. So routing protocols is very important for path selection and route recovery in MANET.

II. AODV ROUTING PROTOCOL DESCRIPTION

Ad hoc On Demand Distance Vector (AODV) is a reactive routing protocol which initiates a route discovery process only when it has data packets to transmit and it does not have any route.path towards the destination node, that is, route discovery in AODV is called as on-demand. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to avoid the routing loops that may occur during the routing calculation process. All routing packets carry these sequence numbers.

Route Discovery Process

During a route discovery process, the source node broadcasts a route query packet to its neighbors. If any of the neighbors has a route to the destination, it replies to the query with a route reply packet; otherwise, the neighbors rebroadcast the route query packet. Finally, some query packets reach to the destination.

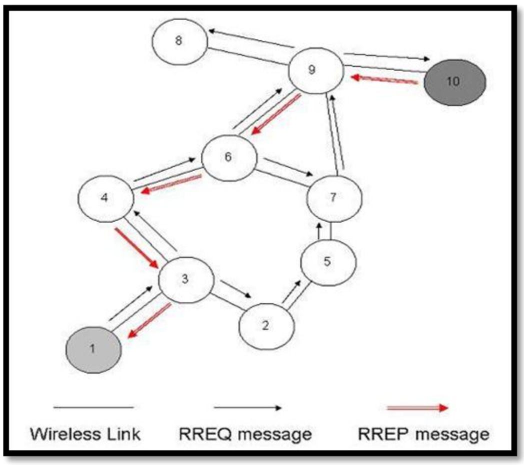

Fig. 1.1. AODV route discovery process.

Figure 1.1 shows the route discovery process from source node 1 to destination node 10. At that time, a reply packet is produced and transmitted tracing back the route traversed by the query packet as shown in figure 1.1

AODV Route Message Generation

The route maintenance process in AODV is very simple. When the link in the communication path between node 1 and node 10 breaks the upstream node that is affected by the break, in this case node 4 generates and broadcasts a RERR message. The RERR message eventually ends up in source node 1. After receiving the RERR message, node 1 will generate a new RREQ message shown in figure 1.2.

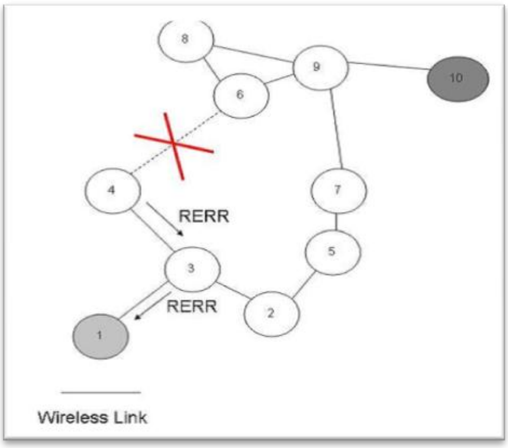

Fig. 1.2. AODV route message generation.

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Finally, if node 2 already has a route to node 10, it will generate a RREP message, as indicated in figure 1.3. Otherwise, it will re-broadcast the RREQ from source node 1 to destination node 10 as shown in figure 1.3.

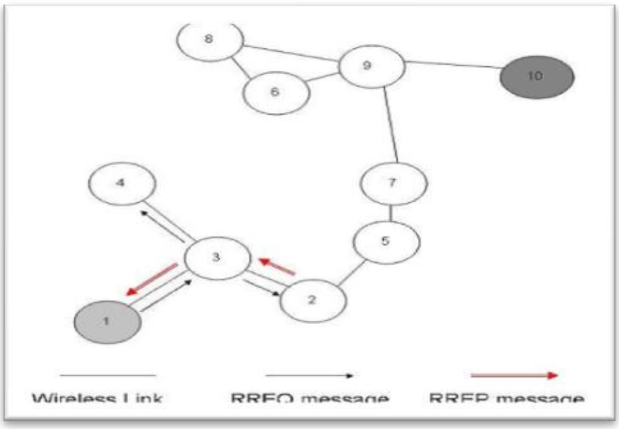

Fig. 1.3. AODV route maintenance process.

III. DSR Routing Protocol Description

The Dynamic Source Routing (DSR) protocol is a reactive routing protocol based on source routing. In the source routing, a source determines the perfect sequence of nodes with which it propagate a packet towards the destination. The list of intermediate nodes for routing is explicitly stored in the packet's header .In DSR, every mobile node needs to maintain a route cache where it caches source routes. When a source node wants to send a packet to some other intermediate node, it first checks its route cache for a source route to the destination for successful delivery of data packets. In this case if a route is found, the source node uses this route to propagate the data packet otherwise it initiates the route discovery process. Route discovery and route maintenance are the two main features of the DSR protocol.

Route Discovery

For route discovery, the source node starts by broadcasting a route request packet that can be received by all neighbor nodes within its wireless transmission range. The route request contains the address of the destination host, referred to as the target of the route discovery, the source's address, a route record field and a unique identification number (Figure 4). At the end, the source node should receive a route reply packet with a list of network nodes through which it should transmit the data packets that is supposed the route discovery process was successful During the route discovery process, the route record field is used to contain the sequence of hops which already taken. At start, all senders initiate the route record as a list with a single node containing itself. The next intermediate node attaches itself to the list and so on. Each route request packet also contains a unique identification number called as request_id which is a simple counter increased whenever a new route request packet is being sent by the source node. So each route request packet can be uniquely identified through its initiator's address and request_id. When a node receives a route request packet, it is important to process the request in the following given order. This way we can make sure that no loops will occur during the broadcasting of the packets.

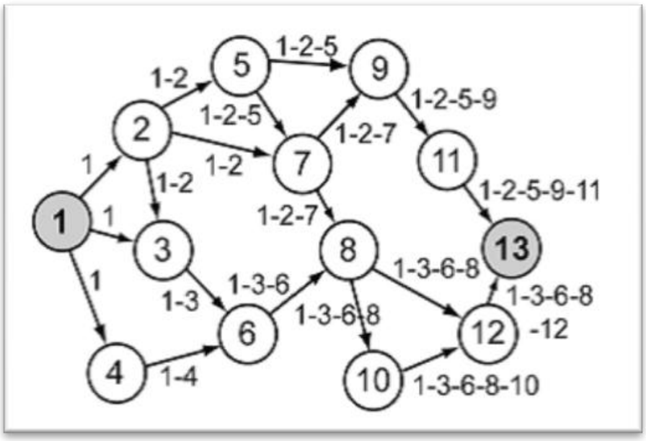

Fig. 2.1. Building of the record during route discovery in DSR.

1) If the pair < source node address, request_id > is found in the list of recent route requests, the packet is discarded.
2) If the host's address is already listed in the request's route record, the packet is also discarded. This indicates removal same request that arrive by using a loop.
3) If the destination address in the route request matches the host's address, the route record field contains the route by which the request reached this host from the source node. A route reply packet is sent back to the source node with a copy of this route.
4) Otherwise, add this node's address to the route record field and re-broadcast this packet .A route reply is sent back either if the request packet reaches the destination node itself, or if the request reaches an intermediate node which has an active route 4 to the destination in its route cache. The route record field in the request packet indicates the sequence of hops which was considered. If the destination node generating the route reply, it just takes the route record field of the route request and puts it into the route reply. If the responding node is an intermediate node, it attaches the cached route to the route record and then generates the route reply

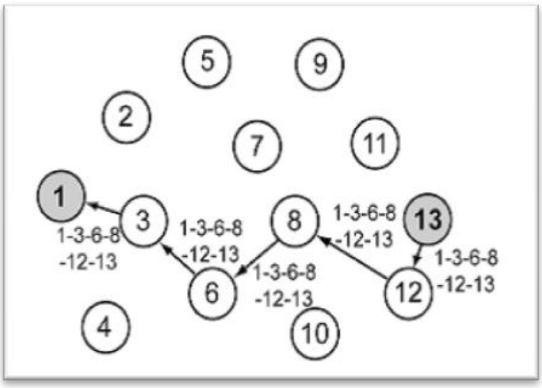

Fig. 2.2. Propagation of the route reply in DSR.

Sending back route replies can be processed with two different ways: DSR may use symmetric links. In the case of symmetric links, the node generating the route reply just uses the reverse route of the route record. When using asymmetric links, the node needs to initiate its own route discovery process and back the route reply on the new route request.

Route Maintenance

Route maintenance can be accomplished by two different processes:

- Hop-by-hop acknowledgement at the data link layer
- End-to-end acknowledgements

Hop-by-hop acknowledgement is the process at the data link layer which allows an early detection and re-transmission of lost packets. If the data link layer determines a fatal transmission error, a route error packet is being sent back to the sender of the packet. The route error packet contains the information about the address of the node detecting the error and the host's address which was trying to transmit the packet. Whenever a node receives a route error packet, the hop is removed from the route cache and all routes containing this hop are truncated at that point. When wireless transmission between two hosts does not process equally well in both directions, end-to-end acknowledgement may be used. As long as a route exists, the two end nodes are able to communicate and route maintenance is possible. In this case, acknowledgements or replies on the transport layer used to indicate the status of the route from one host to another. However, with end-to-end acknowledgement it is not possible to find out the hop which has been in error.

IV. COMPARISON OF AODV AND DSR ROUTING PROTOCOLS

In reactive routing protocols, a route is discovered only when needed. A source node initiates route discovery by broadcasting route query or request messages into the network. All nodes maintain the discovered routes in their routing tables. However, only valid routes are kept and old routes are deleted after an active route timeout. The scheme improves network routing efficiency preventing the use of stale routes. A serious issue for MANETs arises when link failure occur due to high mobility. At the same time new links may also be established between previously distant nodes. This significantly increases the network broadcast traffic with rapid link/break effect of intermediate nodes. Therefore, reactive routing protocols are subjected to an increase in network control overhead. The following sections discuss some of the reactive ad hoc routing protocols.

V. NS-2 SIMULATION ENVIRONMENT

Simulation Model

Here we give the significance for the evaluation of performance of Ad hoc routing protocol with varying the number of mobile nodes. The network simulations have been done using network simulator NS-2.the network simulator NS-2 discrete event simulation software for network simulations which means it simulates events such as sending, receiving, forwarding and dropping packets. The latest version, ns all-in one-2.35, supports simulation for routing protocols for ad hoc wireless networks such as AODV, DSR.NS2 is an object oriented simulator, written in C++, with an OTcl interpreter as a front-end. This means that most of the simulation scripts are created in Tcl (Tool Command language).If the components have to be developed for ns2, and then both tcl and C++ have to be used. To run simulation with NS-2.35, the user must write the OTCL simulation script. We get the simulation results in an output trace file and here we analyzed the experimental results by using the awk command. The performance parameters are graphically visualized in GRAPH.NS-2 also offers a visual representation of the simulated network by tracing nodes movements and events writing them in a network animator (NAM).

Simulation Parameters

In our work, the performance of routing protocols AODV and DSR is evaluated by varying the network size (number of nodes).here below mentioned table shows the simulation parameters used in NS 2 simulation.

TABLE I. Simulation parameters.

PARAMETERS NAME	*DSR*	*AODV*
NS version	NS 2-34	NS 2-34
Channel type	Wireless channel	Wireless channel
Mac protocol	Mac/802.11	Mac/802.11
Radio propagation	Two ray ground	Two ray ground
Antenna type	Omni antenna	Omni antenna
Mobility model	Random way point	Random way point
Mobility	60 m/s	60 m/s
Ifq	Queue/drop tail/priqueue	Queue/drop tail/priqueue
Ifqlen	50	50
Packet size	512 bytes	512 bytes
Number of nodes	30,40,50.60.70	30,40,50.60.70
Routing protocol	DSR	AODV
Area	200*200	200*200
Transmission range	250 m	250 m
Simulation time	1500 sec	1500 sec
Topology	Hybrid topology	Hybrid topology
Traffic type	CBR(DSR)	CBR(AODV)
Link layer type	LL	LL

A. *Performance Metrics*

While analyzed the AODV and DSR protocols, we focused on four performance metrics for evaluation which are Packet Delivery Fraction (PDF), Average End-to-End Delay, Normalized Routing Load (NRL) and Throughput.

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B. Packet delivery fraction

Packet delivery fraction (PDF) is the fraction of all the received data packets successfully at the destinations over the number of data packets sent by the CBR sources.

C. Average End to end delay

It is the average time from the transmission of a data packet at a source node until packet delivery to a destination which includes all possible delays caused by buffering during route discovery process, retransmission delays, queuing at the interface queue, propagation and
transfer times of data packets.

D. Normalized Routing Load

The normalized routing load (NRL) nodes to the number of received data packets at the

E. Throughput

It is the average number of messages successfully delivered per unit time number of bits delivered per second.

VI. RESULT AND OBSERVATIONS

Figure 3.1 and figure 3.2 shows the screenshot of AODV and DSR Tcl script. The results after simulation are viewed in the form of line graphs. The performance of AODV and DSR based on the varying n/w size.

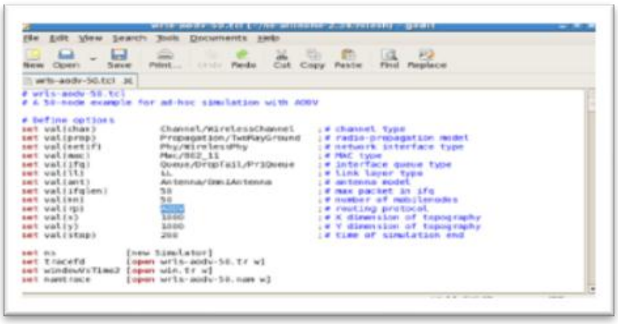

Fig. 3.1. Screenshot of AODV Tcl script.

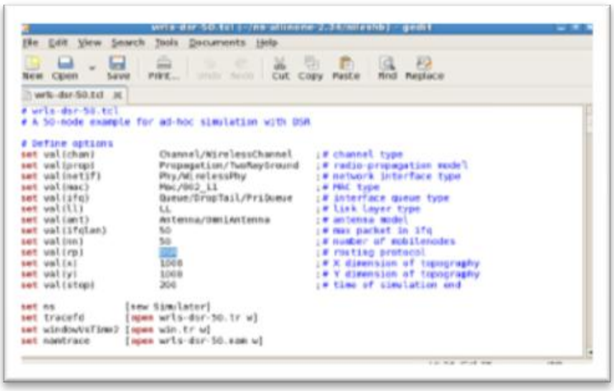

Fig. 3.2. Screenshot of DSR Tcl script.

Figure 3.3 and figure 3.4 shows the creation of clusters with 50 mobile nodes for AODV and DSR respectively as it is shown in NAM console which is a built-in program in NS-2.

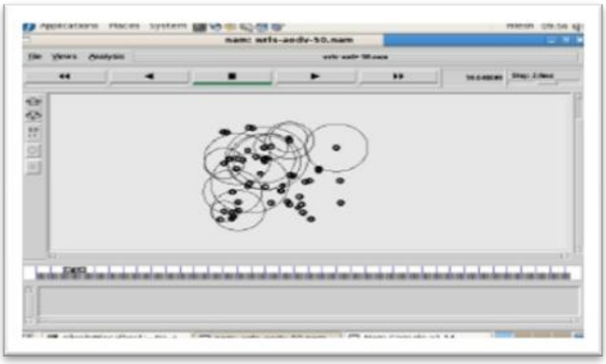

Fig. 3.3. AODV with 50 nodes: Route Discovery.

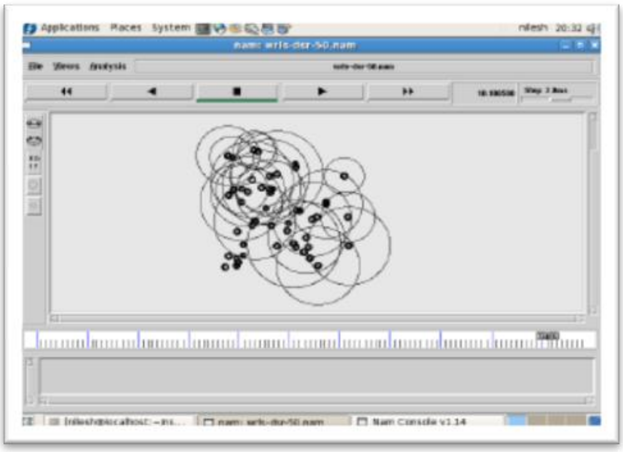

Fig. 3.4. DSR with 50 nodes: Route discovery.

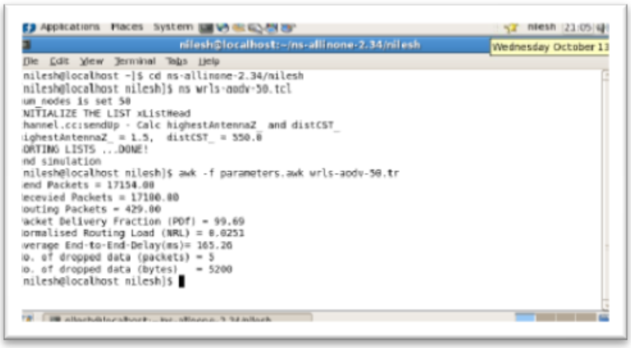

Fig. 3.5. Screenshot of the results of performance metrics for AODV simulation.

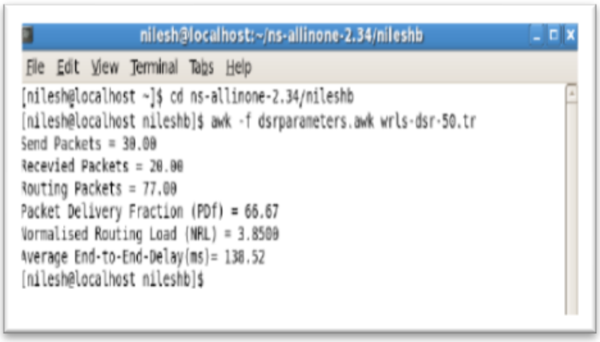

Fig. 3.6. Screenshot of the results of performance metrics for DSR simulation.

Figure 3.5 and figure 3.6 shows the calculation of sent packets, received packet, packet delivery fraction, average end-to-end delay, normalized routing load etc.

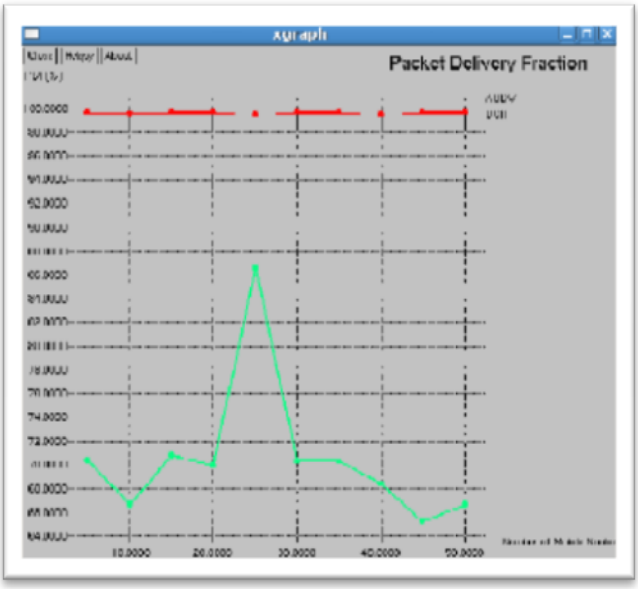

Fig. 3.7. Screenshot of the results of performance metrics for verify no. of mobile nodes.

From figure 3.7 it is clear that average delay of AODV is higher than DSR. The performance of AODV is almost uniform except for 40 nodes.

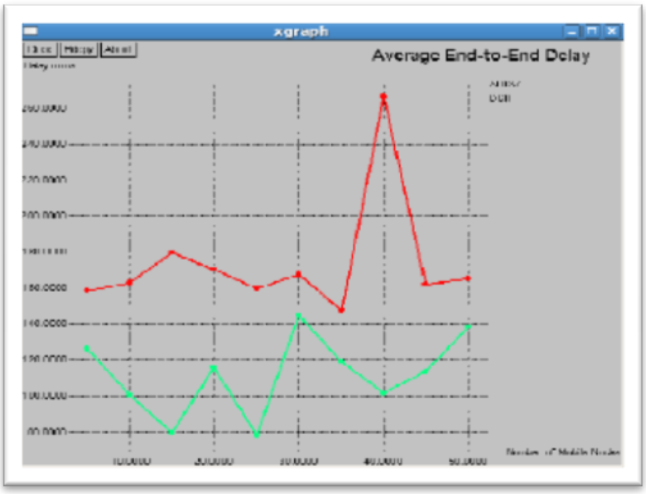

Fig. 3.8. Average End-to-End Delay for AODV and DSR with varying no. of mobile nodes.

From figure 3.8 we can observe that AODV demonstrate significantly lower routing load than DSR. It is almost consistent.

In the AODV routing protocol, when the no. of nodes increases, initially throughput increases due to availability of large no. of routes but after a certain limit throughput becomes nearly stable as shown in figure 3.9.

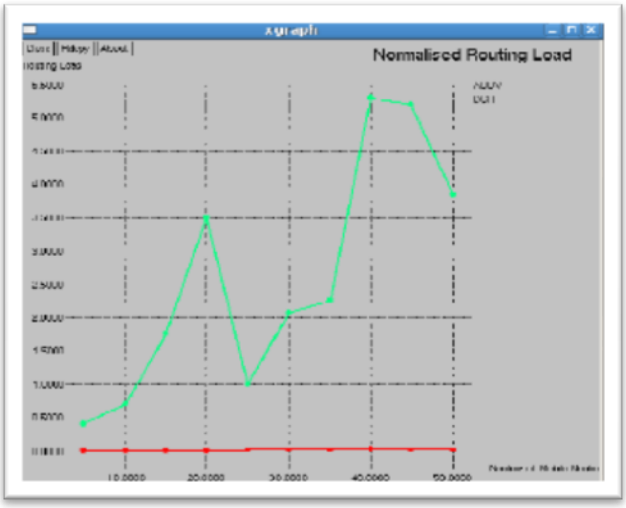

Fig. 3.9. Normalized routing load for AODV and DSR with verifying no. of mobile nodes.

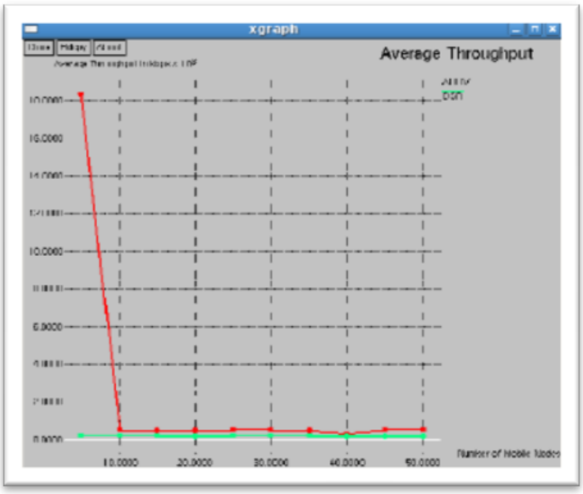

Fig. 3.10. Throughput for AODV and DSR with varying no. of mobile nodes.

VII. Conclusion

In this our simulation work, the routing protocols: AODV and DSR are evaluated for the application oriented performance metrics like packet delivery fraction, average end-to-end delay, throughput and normalized routing load with increasing the ten number of mobile nodes up to 50. As we increase the number of nodes for performing the simulation of AODV and DSR routing protocols, number of sent, routing and delivered packets changes, hence the performance parameters changes. As a result of our studies, we concluded that AODV exhibits a better performance in terms of packet delivery fraction and throughput with increasing number of mobile nodes due to its on demand characteristics to determine the freshness of the routes. It is proved that the AODV has slightly higher average end-to-end delay than DSR. Our result also indicates that as the number of nodes in the network increases AODV and DSR gives nearly constant throughput. Considering the overall performance, AODV performs well with varying network size.

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