# Evaluation of the Performance Comparison of DSR and AODV Routing Protocols in Mobile Ad Hoc Networks

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*Abstract* — **Mobile Ad hoc network is a set of mobile nodes without any physical infrastructure and centralized administration. Several reactive routing protocols like Dynamic Source Routing, Ad Hoc on-Demand Distance Vector Routing, Destination-Sequenced Distance-Vector and several other protocols have been implemented. In this paper, it is evaluated and compared the performance of two reactive routing protocols for mobile ad hoc networks: DSR and AODV. In this simulation AODV gives better performance than the DSR. In this performance evaluation, it is used different parameters like network load, mobility, and network size.**

*Index Terms*—**Mobile Ad hoc Networks (MANETs), Dynamic Source Routing (DSR), Ad hoc On –Demand Distance Vector Routing (AODV), Packet Delivery Fraction (PDF).**

## I. INTRODUCTION

Mobile computers such as notebooks, palmtops computers, with powerful central processing units, large memories, gigabytes of disk space and multimedia capability are easily available & affordable and becoming very common in daily life. At the same time, network connectivity option for use with mobile hosts has increased dramatically. With this type of mobile computing, there is a natural desire and ability to share information between mobile users. For example, employee may find themselves together in a meeting room or a collection of researchers may gather in a room for a workshop or conference. These kinds of networks of mobile computers have become known as mobile ad hoc networks as shown in figure 1.

An Ad hoc network is a collection of mobile nodes dynamically forming a temporary network without the use of any existing network infrastructure or centralized administrator.

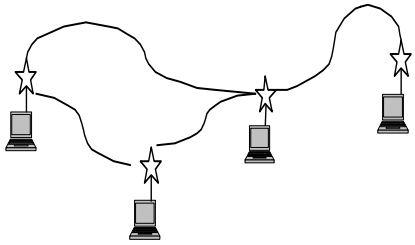

**Fig. 1. Mobile Ad hoc Network**

The main characteristics can be summarized as follows:

- The topology is highly dynamic and frequent changes in the topology may be hard to predict.
- Mobile ad hoc network are based on wireless links, which will continue to have a significantly lower capacity than their wired counterparts.
- Physical security is limited due to the wireless transmission.
- Mobile ad hoc networks are affected by higher loss rates and can experience higher delay than fixed networks due to the wireless transmission.
- Mobile ad hoc network nodes rely on batteries or other exhaustible power supplies for their energy. So energy saving are an important system design

## II. ROUTING IN MOBILE AD HOC NETWORKS

The maturity of wireless transmission has made the dream of communication anytime and anywhere possible. User can move around, while at the same time still connected with the rest of the world. We call this mobile computing or nomadic computing which has received intensive attention recently.

Due to the concerns such as radio power limitations and channel utilization, a mobile host may not be able to communicate directly with other host in a single hop fashion. In this case, multi-hop situation occurs, in which the packets sent by the source host must be relayed by several intermediate host before reaching the destination node. Thus each mobile node in mobile ad hoc network serves as a router. Figure 2 shows ad hoc network of three mobile nodes.

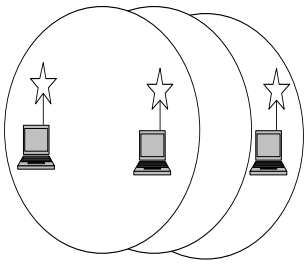

**Fig. 2.Ad hoc network of three mobile nodes**

Mobile node M3 is not within the range of mobile node M1 if mobile node M1 and M3 wish to communicate or exchange information with each other than they have to utilize the services of mobile node M2 to forward information to them. The maximum number of network hops needed to reach another mobile node in mobile adhoc network is likely to be small, but may often be greater than one as shown here. The routing problem in a mobile adhoc network may be even more complicated than this example, since any or all nodes involved may move at any time.



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## III. ROUTING SOLUTION

As given in characteristics of mobile ad hoc network the topology of mobile ad hoc network is highly dynamic and hard to predict. Due to unpredictable changes of network topology, adds difficulty and complexity to routing among the mobile nodes. A preliminary classification of the routing protocols can be done via the type of cast property, i.e. whether they use a uni-cast, geo-cast, and multicast or broadcast routing. In the broadcast forwarding the message transmitted on a wireless channel is generally received by all neighbors located within one hop from the sender. But in the broadcast forwarding, due to redundant re-broadcast the broadcast storm problem may arise.

### *A. Uni- cast Routing*

In uni-cast forwarding means one to one communications, it means one source (mobile node) sends data or information to a single destination (mobile node). This is the largest cast of routing protocols found in ad hoc networks.

### *B. Multi – cast Routing*

In this scheme, when a mobile node of MANET sends data or information packet to multiple destinations. Geo-cast routing is a special case of multicast routing that is used to send information packet to a group of mobile node exists in a specified geographical area. In multicast or geo-cast any mobile node may leave or join at any time. From an implementation point of view geo-cast is applicable in restricted geographical area. It means the infrastructure packet may be broadcast only to those nodes, which are available in the specified region. This can be achieved by routing packets from the source to a node inside the given region than this particular node applies broadcast transmission with in the specified region.

Mobile ad hoc network routing protocols are subdivided into two categories:

- Proactive routing protocols
- Reactive On demand routing Protocols

Proactive routing protocols or table driven routing protocols, the main characteristics of these protocols is the constant maintenance of a route table by each node exist in MANET. The route creation and maintenance are performed through both periodic and event driven messages. Proactive routing protocols are derived from Internet distance vector and link state protocol. They attempt to maintain updated routing information for every pair of network nodes by propagating proactively routes update at fixed time intervals.

As the routing information usually maintained in tables, these protocols are sometime referred as table driven protocols. Reactive On demand routing protocol, on other hand, establishes the route to a destination only when there is demand for it. The use of route through route discovery process usually initiates the route requested, once a route has been established, it is maintained until the route expired.

### *C. Conventional Routing Solutions*

A natural method for trying to provide routing in an ad hoc network is to simply treat each mobile host as a router and to run a routing protocol between them.

In distance vector routing, each router (node) maintains a table giving the distance from itself to all possible destinations (Mobile nodes). Each router periodically broadcasts this information to each of its neighbors; a router can determine which of its neighborsis the correct "next hop" on the shortest path towards each destination. When presented a packet for forwarding to some destination, each router simply forwards the packet to the correct next hop router.

In link state routing, each router maintains a complete picture of the topology of the entire network. Each router maintains the cost of the line to each of its neighbor router and periodically update and broadcast this information to all other routers (mobile nodes) in the network.

### *D. Route Discovery and Route Maintenance*

Reactive Routing Protocol is derived from the concept of source routing.Route Discovery describes how to request for routes and respond to such requests. Route discovery is used when one node required sending a packet to other node and the route of that node is not known. When one route is discovered, in this process, more than one route is got and kept those routes in the cache of that node from which route discovery initiated. These cached routes are useful when the originally found route failed. In this situation those cached routes are retried and there is no requirement of route discovery again.

Route Maintenance explains how route problems (such as link breakage) are reported and recovered. When a node say S (Source node) wants to send a packet to a node D (Destination node) then it uses the route stored in S's routing table, but it may be possible that the node D have changed its current position and due to that there may be the change in topology also. In this situation, the node S has to use some other route stored in its route cache. If no valid route is found then node S have to initiate again route discovery and find the new route to D and update the routing table at that node S. This updating of routing table is known as route maintenance.

### *E. Dynamic Source Routing (DSR)*

The key distinguishing feature of DSR is the use of source routing. That is, the sender knows the complete hop-by-hop route to the destination. These routes are stored in a route cache. The data packets carry the source route in the packet header. When a node in the ad hoc network attempts to send a data packet to a destination for which it does not already know the route, it uses a route discovery process to dynamically determine such a route. Route discovery works by flooding the network with route request (RREQ) packets. Each node receiving an RREQ rebroadcasts it, unless it is the destination or it has a route to the destination in its route cache. Such a node replies to the RREQ with a route reply (RREP) packet that is routed back to the original source. RREQ and RREP packets are also source routed. The RREQ builds up the path traversed across the network. The RREP routes itself back to

the source by traversing this path backward. The route carried back by the RREP packet is cached at the source for future use. If any link on a source route is broken, the source node is notified using a route error (RERR) packet. The source removes any route using this link from its cache. A new route discovery process must be initiated by the source if this route is still needed. DSR makes very aggressive use of source routing and route caching. No special mechanism to detect routing loops is needed. Also, any forwarding node caches the source route in a packet it forwards for possible future use.

### *F. Ad Hoc On – Demand Distance Vector Routing (AODV)*

AODV shares DSR's on-demand characteristics in that it also discovers routes on an as needed basis via a similar route discovery process. However, AODV adopts a very different mechanism to maintain routing information. It uses traditional routing tables, one entry per destination. This is in contrast to DSR, which can maintain multiple route cache entries for each destination. Without source routing, AODV relies on routing table entries to propagate an RREP back to the source and, subsequently, to route data packets to the destination. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to prevent routing loops. All routing packets carry these sequence numbers.

An important feature of AODV is the maintenance of timer-based states in each node, regarding utilization of individual routing table entries. A routing table entry is expired if not used recently. A set of predecessor nodes is maintained for each routing table entry, indicating the set of neighboring nodes which use that entry to route data packets. These nodes are notified with RERR packets when the next-hop link breaks. Each predecessor node, in turn, forwards the RERR to its own set of predecessors, thus effectively erasing all routes using the broken link. In contrast to DSR, It uses a link when a failure occurs. Route error propagation in AODV can be visualized conceptually as a tree whose root is the node at the point of failure and all sources using the failed link as the leaves.

### *G. The Traffic and Mobility Models*

Continuous bit rate (CBR) traffic sources are used. The source-destination pairs are spread randomly over the network. 1000-byte data packets are used. The number of source-destination pairs and the packet-sending rate in each pair is varied to change the offered load in the network. The mobility model uses the random waypoint model in a rectangular field. The field configurations used is: 1800 m x 100 m field with 20 nodes. It is possible to increase the no. of nodes (upto 50 - 60). Since infrastructure uses event driven sequences for NS-2 simulation, the existing machine will use the limited memory capacity due to stochastic property beyond 100 nodes. Here, each packet starts its journey from a random location to a random destination with a randomly chosen speed (uniformly distributed at 5 km/hr.). Once the destination is reached, another random destination is targeted after a pause. The pause time, which affects the relative speeds of the mobiles, is varied. Simulations are run for 25 simulated seconds. In transmitter/receiver of 151/151 packets, 6 packets/second (i.e. total no. of packets/simulation time = 151/25 = 6) will be transmitted. IEEE 802.11 MAC layer with 2.4 GHz and bandwidth of 11 Mbps with 11 channels are used.

### *H. Performance Metrics*

#### *H.1. Packet Delivery Fraction (PDF)*

The ratio of the data packets delivered to the destinations to those generated by the CBR sources. That is almost same (i.e. almost unity) in both AODV & DSR. But packet drops are almost negligible.

#### *H.2. Average End – to – End Delay Data Packets*

This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times. However in this case, End- to – End delay is not considered in account of CBR. But in case of VBR (Variable Bit Rate), it can be considered.

## IV. RESULTS AND CONCLUSION

For the evaluation of performance of the routing protocols, a model is developed for simulating multi-hop wireless networks complete with physical, data link, and medium access control (MAC) layer models based on ns-2 software.

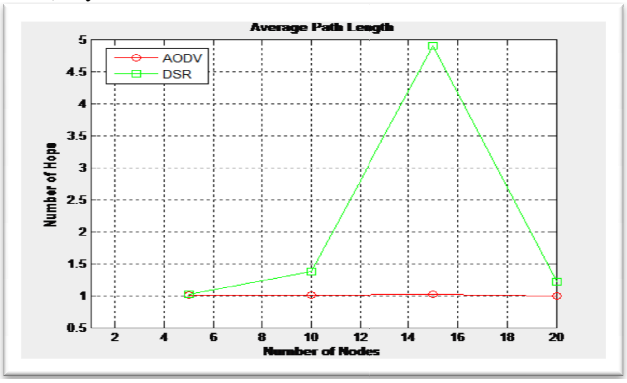


**Fig. 3.Average Path Length**

InGraph (1)ofAverage Path Length**,**

- Single hop transmission
- By increasing no. of nodes, AODV remains almost same whereas DSR shoots up.
- So, the performance of AODV is better.



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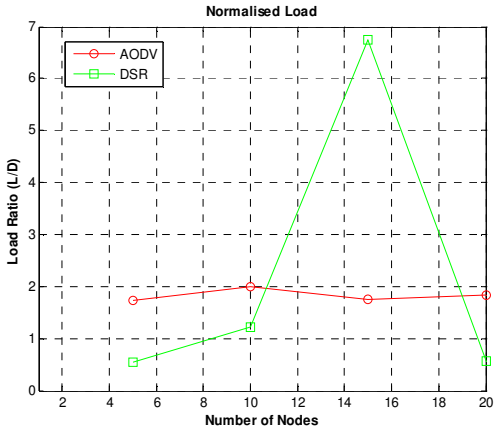


**Fig. 4.Normalized Load**

InGraph (2)ofNormalized Load**,**

- By increasing the no. of nodes, In AODV Protocol (On Demand Routing Protocol), every time routing table updating is initiated whereas in DSR Protocol (Table Driven Routing Protocol), routing table updating is not required every time.
- So, DSR performance is better.
- Depending on the network scenario, AODV gives better performance in high mobility whereas DSR provides better performance in low mobility.

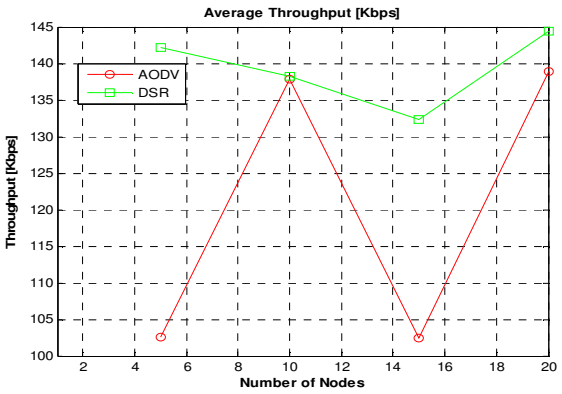


**Fig. 5.Average Throughput (Kbps)**

InGraph (3) of **Average Throughput (Kbps),**

- Performance of both AODV & DSR Protocols are similar because by adjusting DSR, it shows almost the same shape of AODV.

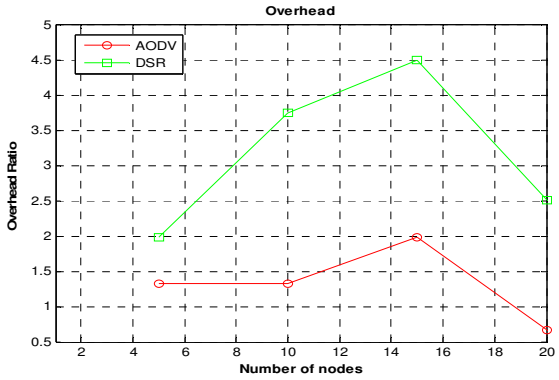


**Fig. 6.Overhead**

InGraph (4)of**Overhead,**

- DSR provides more overhead for Overload than AODV because of load traffic and link broken of path tes.
- But in Under load, low Overhead is required and AODV performance is better.

Overall, performance of AODV Protocol is better than DSR Protocol.

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