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Some Ad Hoc Network Characteristics Effects on the Performance of On-Demand Routing Protocols

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Abstract: A Mobile Ad-Hoc Network (MANET) is a collection of wireless nodes that can be setup dynamically anywhere and anytime without using any pre-existing network infrastructure. Each node can communicate with another node that is immediately within their radio range. Traditionally Ad-Hoc routing protocols are typically used to deal with the dynamic nature of these networks and can survive rapid changes in the network topology. These protocols typically suffer from a number of shortcomings, such as high routing overhead and limited scalability. This motivates the work presented in this paper, which provides a comparison of AODV and DSR protocols in Mobile Ad-Hoc network. Our experimental results show that the routing path is changed by using the Critical Transmission Range. A comparison analysis of the topology changes, transmission range and hop count is presented.

Keywords: Mobile Ad-Hoc Networks, routing, AODV, DSR.

1 Introduction

Routing support for mobile hosts is presently being formulated as "mobile IP" technology [3]. When the mobile agent moves from its home network to a foreign (visited) network, the mobile agent tells a home agent on the home network to which foreign agent their packets should be forward. In addition, the mobile agent registers itself with that foreign agent on us, the foreign networks. Thus, all packets intended for the mobile agent on the foreign networks.

Thus, all packets intended for the mobile agent are forwarded by the home agent to the foreign agent who sends them to the mobile agent on the foreign network; it informs both agents (home and foreign) that the original configuration has been restored. No one on the outside networks need to know that the mobile agent moved [3].

But in Ad-Hoc networks there is no concept of home agent as itself may be "moving". supporting mobile IP from of host mobility (or named city) required address management, protocols inter operability and enhancements and the like, but core network function such as hope by hope routing still presently relay upon pre existing routing protocols operating with in the fixed network[4].

2 Routing Protocols

Routing support for mobile hosts is presently being formulated as "mobile IP" technology [3]. When the mobile agent moves from its home network to a foreign (visited) network, the mobile agent tells a home agent on the home network to which foreign agent their packets should be forward. In addition, the mobile agent registers itself with that foreign agent on us, the foreign networks.

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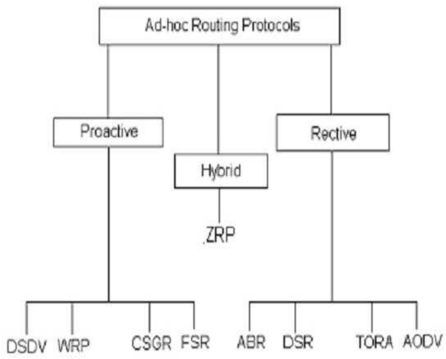

Figure 1: Figure 1: Categorization of Ad-Hoc Routing Protocols.

3 AODV (AD-HOC ON DEMAND DISTANCE VECTOR)

Ad hoc On-Demand Distance Vector, (AODV) is a distance vector routing protocol that is reactive. The reactive property of the routing protocol implies that it only requests a route when it needs one and does not require that the mobile nodes maintain routes to destination that are not communicating [5]. AODV guarantees loop-free routes by using sequences number that indicate how new, or fresh, a route is [6]. AODV requires each node to maintain a routing table containing one route entry for each destination that the node is communicating with [4]. Each route entry keeps track of certain fields. Some of these fields are: **Destination IP Address**: The IP address of the destination for which a route is supplied. Destination sequences number: The destination sequences number associated to the route. **Next Hop**: either the destination itself or an intermediate node designated to forward packets to the destination. **Hob Count**: The number of hops from the originator IP Address to the Destination IP Address Lifetimes: the time in milliseconds for which nodes receiving the RREP consider the route to be valid routing flags the state of the route; up (valid), down (not valid)or in repair[2].

4 DSR (DYNAMIC SOURCE ROUTING)

TDynamic Source Routing (DSR) is a reactive routing protocol that uses source routing to send packets. It is reactive like AODV which mean that it only requests a route when it needs one and does not require that the nodes maintain routes to destinations that are not communicating. It uses source routing which means that the source must know the complete hop sequence to destination [5]. Each node maintains a route cache, where all routes it knows are stored the route discovery process is initiated only if the desired route cannot be found in the route cache. to limit the number of route requests propagated, a node process the route request message only if it has not already received the message and its address is not presented in the route record of the message [4]. As mentioned before, DSR uses source routing, i.e. the source determines the complete sequence of hops that each packet should traverse. This requires that the sequences of hops is included in each packets‘s header. A negative consequence of this is the routing overhead every packet has to carry. However, one big advantage is that intermediate nodes can learn routes from the source routes in the packets they receive. Since finding a route is generally a costly operation in term of times, bandwidth and energy, this is a strong argument for using source routing. Another advantage of source routing is that it avoids the need for up-to-date routing information in the intermediate is included in the packets. Finally, it avoids routing loops easily because the complete route is determined by a single node instead of making the decision hop-by-hop [2].

5 Experimental Results

Our experimental focus on Hui Li and Dan Yu model [7] and the extension in [8] and [9] for investigating two important properties of ad hoc network, the average of neighbor nodes and number of nodes. The coverage shape is perfect circle that nodes move in it. this shape exactly the transmission area that could be calculating from the following equation. *transmission_area = (average network degree * network area)/(N-1)* by using this equation we can calculate the radius R of this circle shape as following

$$R = \sqrt{\frac{tramsmission\_area}{\pi}}$$

We focus on the topological shape effects and transmission range effects on reactive routing ad hoc network algorithms. We present a number of characteristics like transmission range, area of ad hoc network and node density. We study the effects of three different shapes topology (such circle , square and rectangle area) on two different algorithms our comparison use the hop count and path cost parameter through ad hoc networks. The CTR (critical transmission range) it's the minimum transmitting range that produce a connected communication graph and may lead to save the energy of network devices. If the CTR is less than the minimum value, then the graph will be disconnected. If the transmission range increased, the path may be different from the path of the CTR state and the graph will be strong connected. **In DSR state:** When the CTR is equal to 5 in the network with 10 nodes the path from node 1 to node 10 is 1 - 2 – 6 – 8 – 10. After increasing the R (transmission range) the path is 1- 2 – 8 – 10 and the network is strong connected. **In AODV state:** When the CTR is equal to 5 the network with 10 nodes the path from node 1 to node 10 is 1 – 2 – 3 – 4 – 5 – 8 – 10 and

Table 1: network area changes effects on the hop count and path distance

Network area	AODV		DSR	
	Hop count	Path distance	Hop count	Path distance
141.3	6	21.7722	4	14.5708
200	6	21.7722	3	13.9031
250	6	25.6927	3	12.6056
300	4	20.2059	3	14.2854
350	4	20.2059	3	14.2854

Table 2: average number of neighbor nodes on the hop count and path distance

Average number of neighbor node	AODV		DSR	
	Hop count	Path distance	Hop count	Path distance
5	6	21.7722	3	13.9031
10	4	20.2059	3	14.2854
15	4	20.2059	1	9.0554
25	4	20.2059	1	9.0554
30	4	20.2059	1	9.0554

the network is connected. When the R increasing (the transmission range increasing) the path is 1 – 2 – 8 – 9 – 10. Both of the state of DSR and AODV the path route is changed with the CTR and this lead us that the CTR has clear effects on the network connectivity and the path routing.

Circle area The circle topological shape with transmission range, average number of neighbor node and node density (number of nodes) changes effects on the hop count and path distance.

Table 3: The node density effects of hop count and path distance

N(number of nodes)	AODV		DSR	
	Hop count	Path distance	Hop count	Path distance
5	4	20.2059	1	9.0554
10	4	20.2059	3	14.2854
15	6	21.7722	3	13.9031
20	6	21.7722	4	14.5708

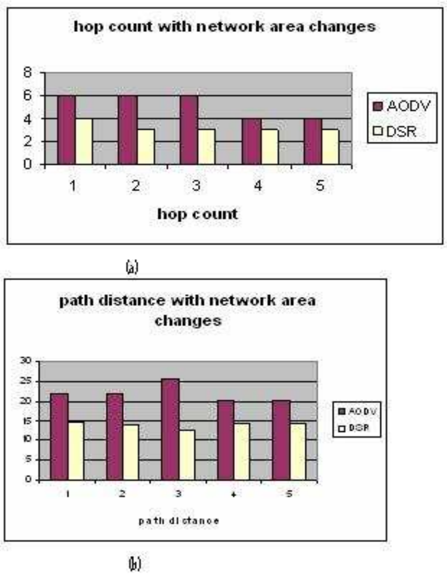

Figure 2: shows the effects of network area changes on (a) the hop count (b) path distance

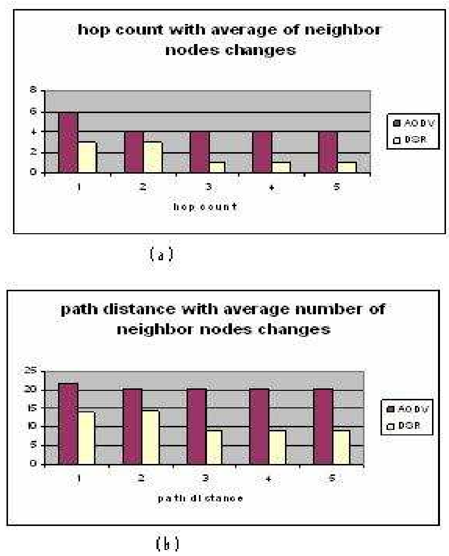

Figure 3: shows the effects of average number of neighbor nodes on (a) the hop count (b) path distance

Table 4: network area changes effects on hop count and path distance

Network area	AODV		DSR	
	Hop count	Path distance	Hop count	Path distance
141.3	6	21.7722	4	14.5708
225	6	25.6925	3	12.6056
400	4	20.2059	3	14.2854
625	4	20.2059	1	9.0554
900	4	20.2059	1	9.0554

Table 5: average number of neighbor node effects on hop count and path distance

Average number of neighbor node	AODV		DSR	
	Hop count	Path distance	Hop count	Path distance
5	6	25.6927	3	12.6056
10	4	20.2059	2	12.6671
15	4	20.2059	1	9.0554
25	4	20.2059	1	9.0554
30	4	20.2059	1	9.0554

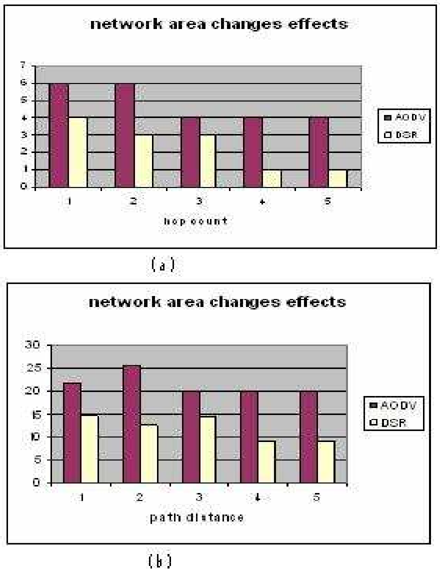

Figure 5: shows the topology of network area changes effects on (a) hop count (b) path distance

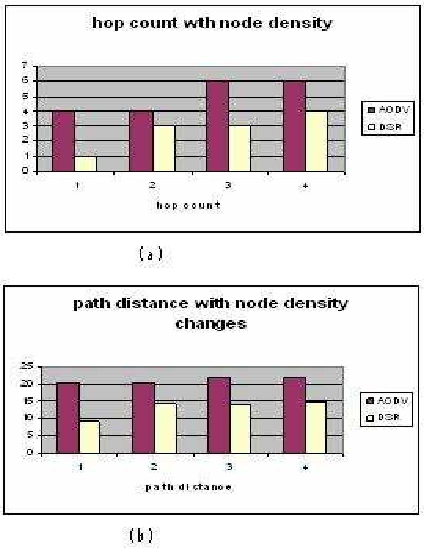

Figure 4: depicts the effects of node density (number of nodes) on (a) hop count (b) path distance

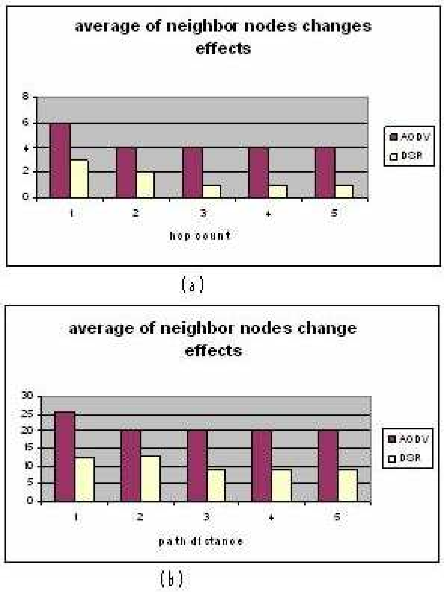

Figure 6: depicts the average of neighbor nodes changes effects on (a) hop count (b) path distance

Square area The square topological shape with transmission range, average number of neighbor node and node density (number of nodes) changes effects on hop count and path distance.

Table 6: node density (number of nodes) on hop count and path distance

N number of nodes	AODV		DSR	
	Hop count	Path distance	Hop count	Path distance
5	4	15.4477	1	7.0711
10	6	25.6927	3	12.8056
15	6	21.7722	4	14.5708
20	6	20.6588	4	14.5708

Table 7: network area changes with hop count and path distance

Network area	AODV		DSR	
	Hop count	Path distance	Hop count	Path distance
100	6	20.6588	4	14.5708
150	6	21.7722	4	14.5708
300	4	20.2059	3	14.2854
375	4	20.2059	3	14.2854
600	4	20.2059	1	9.0554

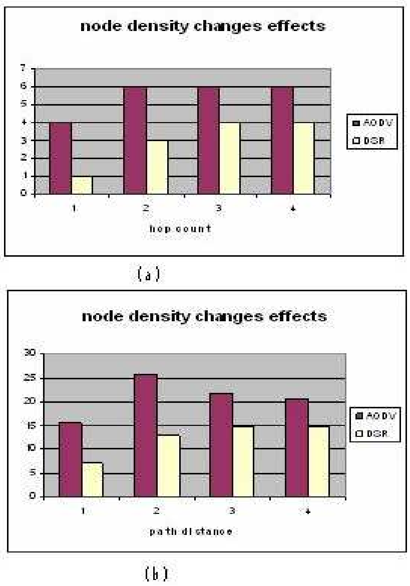

Figure 7: shows the effects of node density on (a) hop count (b) path distance.

Rectangle area The rectangle topological shape with transmission range, average number of neighbor nodes and node density changes effects on hop count and path distance.

Table 8: average number of neighbor nodes on hop count and path distance

Average number of neighbor node	AODV		DSR	
	Hop count	Path distance	Hop count	Path distance
5	4	20.2059	3	14.2854
10	4	20.2059	1	9.0554
15	4	20.2059	1	9.0554
25	4	20.2059	1	9.0554
30	4	20.2059	1	9.0554

Table 9: node density (number of nodes) on the hop count and path distance

N number of nodes	AODV		DSR	
	Ho count	Path distance	Hop count	Path distance
5	4	20.2059	1	9.0554
10	4	20.2059	3	14.2834
15	6	21.7722	3	13.9031
20	6	21.7722	4	14.5708

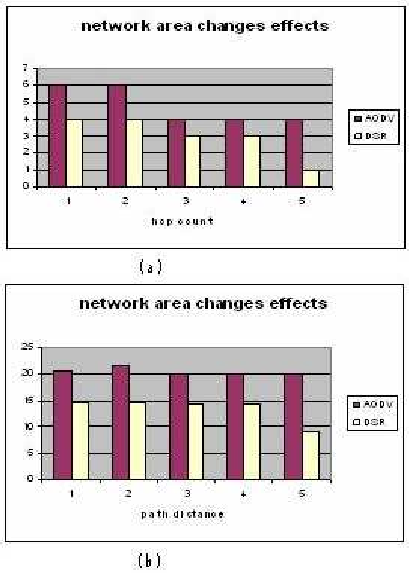

Figure 8: shows the network area topology changes effects on (a) hop count (b) path distance

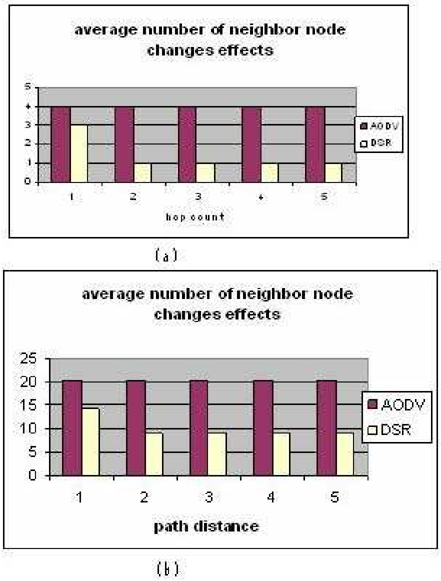

Figure 9: depicts the average of neighbor node changes effects on (a) hop count (b) path distance

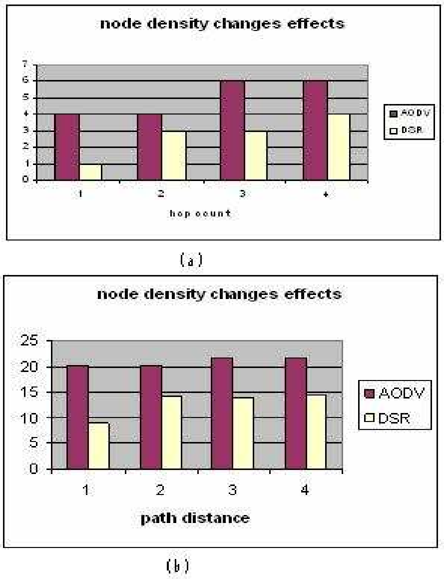

Figure 10: depicts the effects of node density on (a) hop count (b) path distance

Result and analysis The Satveer Kaur paper [2] proved that the DSR give better performance than AODV through. It studied the mobility changed through path random direction, packet loss, packet delivery ratio. First both DSR and AODV give the same performance in packet loss. In packet delivery ratio the DSR gives better performance than AODV. Second in through put DSR gives better performance instead of AODV. In metric aggregate good put DSR successfully submit the more number of bits into the network. the Satveer Kaur paper conclude that the DSR gives better performance than AODV.

In this paper we study new parameters like node density, average number of neighbor nodes and topology changes on the hop count and path distance with changing the transmission area and area of network. Area of network changed with three topological shapes (circle, square and rectangle). First in circle topological shape figure 2 (a) and (b) DSR is more accurate than AODV. figure 3 depicts that (a) both AODV and DSR is the same behavior (b) AODV is more stable than DSR. Figure 4 shows that (a) DSR is more accurate than AODV (b) AODV is more stable than DSR.

Second in the square topological shape figure 5 (a) DSR is best performance than AODV (b) AODV is more stable. Figure 6 (a) and (b) both DSR and AODV have the same behavior. In figure 7 (a) and (b) DSR is more stable than AODV.

Third in the rectangle area figure 8 (a) DSR is more accurate than AODV but (b) the AODV is more stable than DSR. In figure 9 (a) and (b) AODV is more stable than DSR. in figure 10 both (a) AODV and DSR has the same behavior (b) DSR is more accurate performance than AODV. Also we can conclude that DSR gives better performance than AODV.

6 conclusion

The study in this paper evaluates two of MANET routing protocols which are AODV and DSR. these routing protocols are compared in term of topology changes , transmission range, average number of neighbor nodes and node density of two parameter hop cont and path cost. Performance of each routing protocol has been analyzed and evaluated according the different transmission changes and different topological shape with effects on the hop count and path cost. This study can be used as reference for the future work.

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