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Efficiency Evaluation of DSR and AODV On-demand protocols in Wireless MANETs

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Abstract: Mobile Ad hoc Networks (MANETs) are becoming indispensable and ubiquitous in future due to proliferation of laptops and mobile phones. These short lived networks are an effective solution in emergency conditions. These networks can be created anytime, everywhere by portable wireless devices such as smart phones and laptops without any installation and infrastructure cost. Distant mobile nodes communicate with each other with cooperation of other nodes which relays communication packets by acting as routers. Due to freely movement of mobile nodes independently in any direction, routing is a challenging issue in ad-hoc network. Different routing protocols have been introduced for discovering and maintaining a route in ad hoc network. These routing protocols are of three categories viz. table driven, reactive and hybrid protocols. In our paper, we have used AODV and DSR routing protocol to find efficient and shortest route in MANET. Our simulation results demonstrate that AODV routing protocol outperforms DSR routing protocol in terms of packet delivery ratio and throughput.

Keywords: AODV, DSR, Ad-hoc Networks, Reactive, Routing Protocol

I. INTRODUCTION

A Mobile Adhoc Network (MANET) [1, 2] is a wireless type of network which can be made quickly at any location and anytime without any predefined setup of infrastructure. It has mobile nodes which will configure network automatically and are changing its locations dynamically. MANET comes under category of infrastructure free, multi hop networks having special features limited bandwidth, memory, unreliable and weak commutation wireless medium, constantly changing topologies. MANETs can be easily deployed with these features; they are having a routing issue due to infrastructure free nature. These networks are useful in applications such as rescue operation in emergency situation, military battlefield applications, resource sharing for personal use. Each mobile node of MANET acts as transceiver which can send and receive data at single

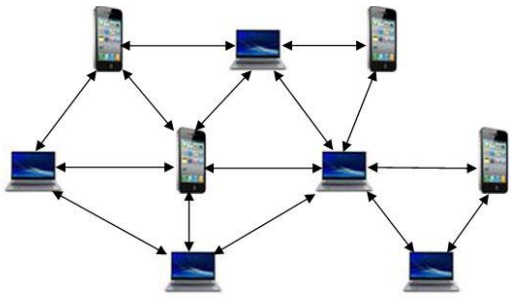

Fig. 1: Mobile Ad-Hoc Network with 9 nodes

frequency. Every node in MANET can freely move in any direction and change their links with other mobile nodes very frequently. A lot of research has been done to make a comparison of various MANET protocols under different conditions to evaluate various routing protocols [4], [5], [6]. Fig.1 shows a MANET network of 9 nodes.

II. ROUTING PROTOCOLS

Routing mechanism in MANET is given by routing protocols [3, 16] and these protocols controls routing of data packets in these networks. In MANET, initially both communicating nodes does not know network topology; routing protocol will discover route for data packets from source to destination. An ad-hoc routing protocol can be divided into three categories viz. on-demand (reactive) protocol [4,5], table-driven (proactive) protocol, hybrid routing protocol. Fig. 2 shows different types of protocols.

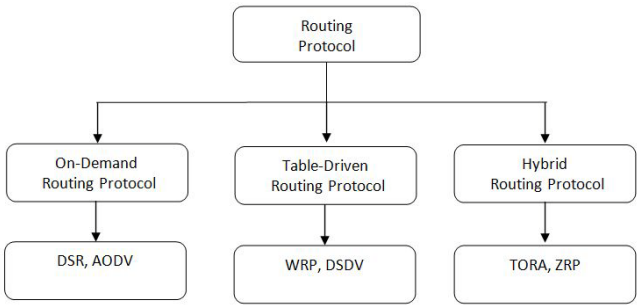

Fig 2 Types of Routing Protocols

A. Table Driven (proactive) Routing Protocol

Table driven protocols come under category of proactive routing. In proactive routing, mobile nodes broadcast routing information to all neighboring nodes. Every mobile node of

network has to maintain information of routing table which contains number of hops to needed for reachable node, neighboring nodes, and reachable mobile nodes. All mobile nodes have to find their neighbors when network topology changes. When network size increases, overhead of control messages also increases in proactive routing. DSDV (Destination Sequence Distance Vector) is a familiar proactive protocol.

A.1 Destination Sequence Distance Vector Routing Protocol

DSDV [13] routing protocol is a modified version of DBF (Distributed Bellman Ford) routing protocol. In DSDV protocol, every mobile node transmits routing update control messages to all its neighbors along with a sequence number which is updated by two after some period.

***B.** On-Demand (Reactive) Routing Protocol*

Reactive routing protocols are bandwidth efficient protocols for mobile networks which finds path by using request of route (RREQ) message. Two main roles of this protocol are path discovery mechanism and repair route mechanism. Path discovery mechanism decides discovery of new path for communicating mobile nodes and Repair route mechanism to detect breakage in existing path as well as repair of existing path. Reactive protocols discovers path on requirement of route between mobile nodes if no path exists already. Reactive routing does not require distributing routing information to all mobile nodes. These types of protocols do not store routing information permanently, but routes are discovered by originating mobile node on requirement. AODV and DSR are popular protocols under reactive routing.

C. Hybrid Routing protocol

These protocols contain features of proactive routing as well as reactive routing. TORA [14] and ZRP are popular hybrid routing protocols [15].

III. RELATED WORK

A. AODV Routing Protocol :

AODV [9] is a reactive strategy based routing protocol that will set up a path at start of communication between two communicating node and uses it until path breaks, after that AODV initiates set up of new path. It uses two stages to find route of communicating nodes (a) Discover route between originating node and receiving node (b) Repair route between communicating nodes. Routing Protocol employs Request of path (RREQ) and Reply of Path to find best possible route between originating node and receiving node and Error of Path (RERR) message to repair the path in case of breakage of path between communicating nodes. It employs different strategy for maintenance of routing information and makes use of routing table one entry for each destination of MANET. AODV uses entries of routing table to send reply of route (RREP) back to originating node and, then originating node sends data packets to receiving node. AODV uses sequence numbers originated by destination for freshness of path and to avoid routing loops. An entry for destination in routing table will be expired after a particular time based on timer value. For each entry of routing table, a collection of nodes known as neighboring nodes are maintained. These neighboring nodes are informed in case of route error (RERR) whenever link of next hop breaks. Each neighboring node deletes all paths containing this broken link. Fig.3 shows path discovery mechanism in AODV using request of route (RREQ) and reply of route (RREP) messages. Here, source node S sends request of route (RREQ) message to discover path to receiver D and gets route of reply (RREP) message to find path between originating node and receiver as shown in Fig.3.

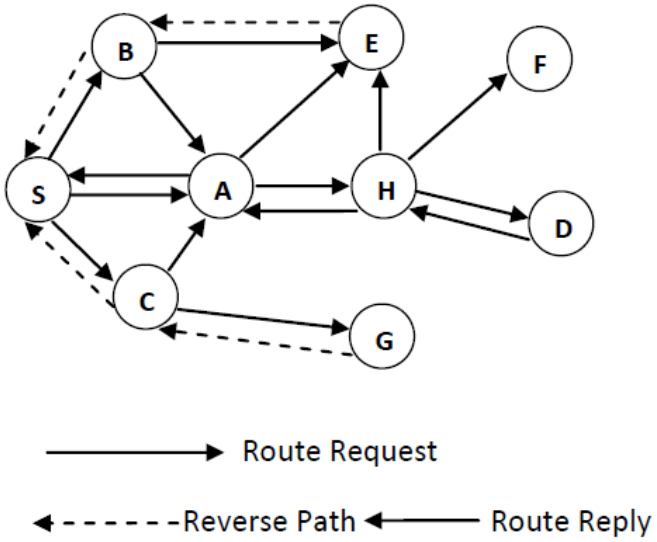

Fig. 3: Path discovery in AODV

B. Dynamic Source Routing Protocol (DSR) :

DSR [7, 8] routing protocol makes use of source routing for communication with destination. Here, originating node knows complete path to receiving node. As compare to AODV which uses routing table information for every destination, this protocol uses route cache memory to store routes. DSR protocol can store many routes to a particular destination. Data packets contain source path it its packet header. If a node in MANET does not have a path to particular destination, it uses path discovery mechanism to dynamically finding the route. DSR protocol floods request of route (RREQ) message in whole network to find shortest route to receiving node. Every

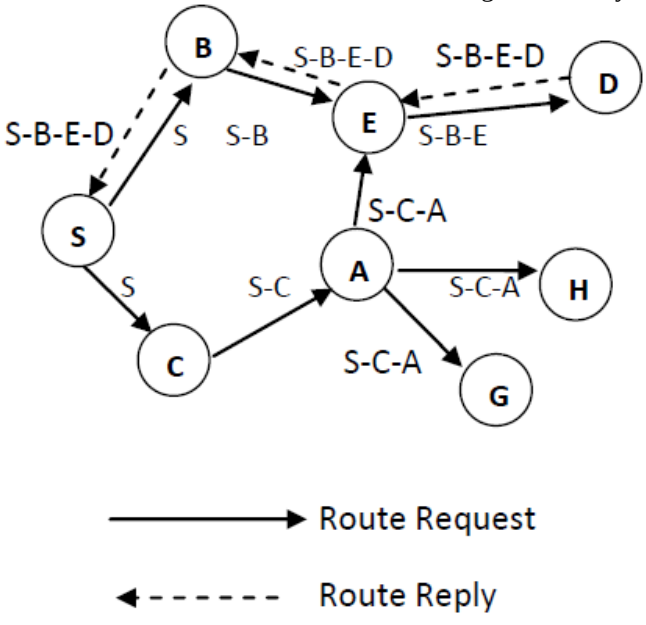

Fig.4: Path discovery in DSR

node of network rebroadcasts request of route message unless its route cache contain route to destination node. If any

receiving node has a route to receiving node, it sends reply of route (RREP) message back to originating node which starts route discovery mechanism. In this way, route of request (RREQ) message builds path between communicating nodes across ad hoc network. The path made by route of reply message is stored in route cache of originating node. If any link in this path is broken, then originating node is informed with error of route (RERR) packet. Originating nodes deletes route containing broken link. Now, originating node reinitiates route finding mechanism by flooding route of request (RREQ) message again, if this path still required by originating node. Fig 4 shows route of request (RREQ) and route of reply (RREP) message communication in DSR to find route between originating node S and receiving node D. Here, RREP also contains route from originating node S to receiving node D.

IV. SIMULATION ENVIRONMENT

The recorded values in tables are taken by optimum value over multiple runs for 30, 40, 50, 60, 70, 80 nodes respectively. Every mobile node of network has a range of 250m and at network layer, we have used DSR and AODV protocols under similar simulator conditions. In present environment of simulation, all the simulations have been done in flat area of 1000m by 1000m to see the impact of increasing number of nodes from 30 to 80 nodes by increasing 10 nodes each time to see performance of AODV protocol as well as DSR protocol using simulator NS2[10,11,12]. We have used IEEE 802.11 protocol at MAC layer. Table 1 shows values of simulation parameters.

TABLE 1: Simulation Parameters

Simulator	NS2 (Ver, 2.34)
Number of Mobile Nodes	30 ,40,50,60,70,80
Simulation Time	100 seconds
Topology	1000m * 1000m
Radio Propagation Range	250m
MAC Protocol	IEEE 802.11
Propagation	Two Ray Ground
Mobility Model	Random Way Point
Packet Size	512 bytes
Routing Protocol	AODV, DSR
Antenna Type	Omni directional
Channel Type	Wireless Channel

V. SIMULATION RESULTS AND PERFORMANCE ANALYSIS

We have used two quality metrics Packet Delivery ratio and throughput for evaluating performance of two reactive protocols for simulation experiments.

A. Throughput

Throughput performance parameter can be defined as amount of data originating mobile node transfers to destination node per unit time. We have observed simulation experiments at mobile nodes 30, 40, 50, 60, 70, 80 as shown in Table 2 to see performance of DSR protocol as well as AODV protocol. Throughput results obtained from considered MANET routing protocols AODV and DSR are shown in Table 2 and Fig. 5. It can be observed from Fig.5 that AODV protocol has improved and more throughput as compare to DSR protocol.

TABLE 2: Number of Nodes and Throughput

Number of Nodes	Throughput DSR	Throughput AODV
30	5506	9664
40	9185	15250
50	8224	13377
60	6711	12351
70	9104	11850
80	4831	16662

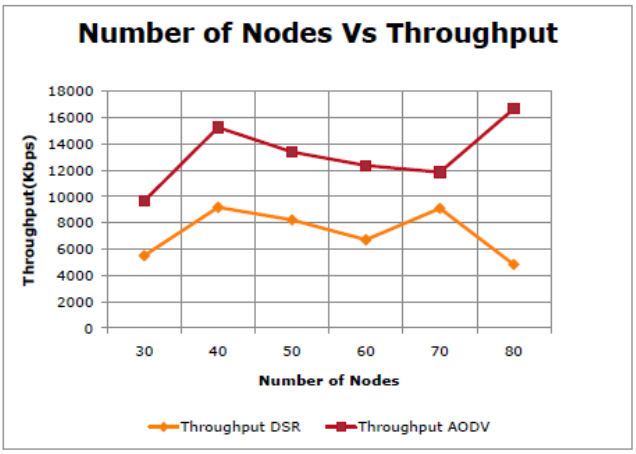

Fig. 5: Throughput Vs Number of Nodes

B. Packet Delivery Ratio :

Packet delivery ratio is defined as data received at destination mobile node to data transferred by originating node. It can be noticed from Table 3 and Fig. 6 that AODV protocol has higher packet delivery ratio as compare to DSR protocol.

TABLE 3: Number of Nodes and PDR

Number of Nodes	PDR DSR	PDR AODV
30	0.9939	0.9973
40	0.9951	0.9958
50	0.9967	0.998
60	0.9957	0.998
70	0.9944	0.9952
80	0.995	0.9979

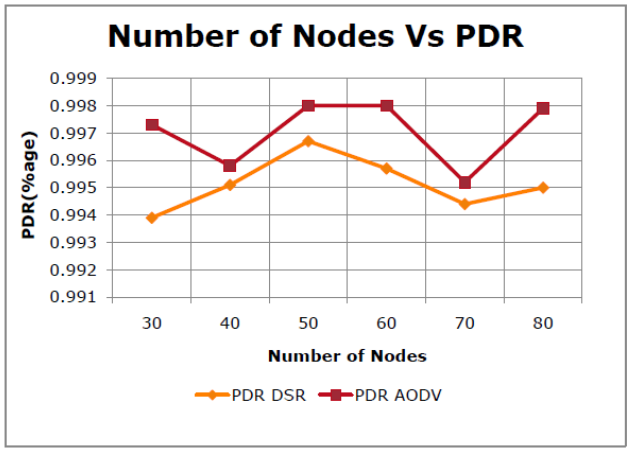

Fig. 6: PDR Vs Number of Nodes

VI. CONCLUSION

MANET is a set of autonomous mobile nodes which makes temporary network without any fixed infrastructure. In our paper, we have made a comparison of AODV and DSR reactive routing protocols which are used for routing in mobile ad-hoc short lived network. Packet Delivery Ratio and Throughput qualitative metrics compares performance of AODV and DSR routing protocol. AODV protocol outperforms DSR routing protocol. We have compared these routing protocols by increasing the network size of nodes 30, 40, 50, 60, 70, 80 with rectangular area size 1000 * 1000 m^2. From simulations, we have observed that AODV protocol has improved packet delivery ratio and throughput than DSR. In future, we can compare performance metrics by adding other MANET routing protocols.

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