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FP-AODV Forwarding in Mobile Adhoc Network

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***Abstract*-In this paper, we focus upon the increase the throughput of an on-demand distance vector routing (AODV) protocol for mobile and wireless ad hoc networks. We propose to FP-AODV protocol increases the packet delivery ratio, throughput better than other protocols. And decrease the end to end delay and packet dropping. AODV protocol is extended with a plunge factor that induces a randomness feature to result in Finest Path Selection Ad-Hoc On-Demand Routing (FP-AODV) protocol.**

Keywords-fpaodv, aodv, dsr.

I. INTRODUCTION

A MANET is a collection of mobile nodes sharing a wireless channel without any centralized control communication backbone. MANET has dynamic topology and each mobile node has limited resources such as battery, processing power and on-board memory MANETs mobile nodes communicate with each other in a multi-hop fashion. That means a mobile node sends a packet to a destination through intermediate nodes and each node can act as an end system and also can act as a router. Routing protocols are classified as a two category. That's for proactive and reactive protocols.

-Proactive: Proactive means mobile nodes periodically update their information in routing tables (DSDV).

-Reactive: Reactive means route is required when find the route (AODV, DSR).

II. AD HOC ON-DEMAND DISTANCE VECTOR ROUTING

The Ad hoc On-Demand Distance Vector (AODV) algorithm enables dynamic, self-starting, multi hop routing between participating mobile nodes wishing to establish and maintain an ad hoc network. AODV allows mobile nodes to obtain routes quickly for new destinations, and does not require nodes to maintain routes to destinations that are not in active communication. AODV allows mobile nodes to respond to link breakages and changes in network topology in a timely manner. The operation of AODV is loop-free, and by avoiding the Bellman-Ford "counting to infinity" problem offers quick convergence when the adhoc network topology changes (typically, when a node moves in the network). When links break, AODV causes the affected set of nodes to be notified so that they are able to invalidate the routes using the lost link. Route Requests (RREQs), Route Replies (RREPs) and Route Errors (RERRs) are message types defined by AODV

A. Route Discovery

The route discovery process is initiated when a source needs a route to a destination and it does not have a route in its routing table. To initiate route discovery, the source floods the network with a RREQ packet specifying the destination for which the route is requested. When a node receives an RREQ packet, it checks to see whether it is the destination or whether it has a route to the destination. If either case is true, the node generates an RREP packet, which is sent back to the source along the reverse path. Each node along the reverse path sets up a forward pointer to the node it received the RREP from. This sets up a forward path from the source to the destination. If the node is not the destination and does not have a route to the destination, it rebroadcasts the RREQ packet. At intermediate nodes duplicate RREQ packets are discarded.

B. Route Maintenance

When a node detects a broken link while attempting to forward a packet to the next hop, it generates a RERR packet that is sent to all sources using the broken link. The RERR packet erases all routes using the link along the way. If a source receives a RERR packet and a route to the destination is still required, it initiates a new route discovery process. Routes are also deleted from the routing table if they are unused for a certain amount of time.

C. Data Packet Forwarding

After the reply packet returns from the destination, the source can begin sending out the packet to the destination via the new discovery path, or the node can forward any en queued packets to a destination if a reverse path is set up and the destination of the reverse path is the destination of the path.

D. Dealing with the broken links

If a link breaks while the route is active the packets that are flowing in that path can be dropped and an error message is sent to the source or a local repair routine will take over. If the node holding the packets is close to the destination, this node invokes a local repair route. It en queues the packet and finds a new path from this node to the destination. Otherwise, the packets are dropped, and the node upstream of the break propagates a route error message to the source node to inform it of the now unreachable destination(s). After receiving the route error, if the source node still desires the route, it can re-initiate a route discovery mechanism. However, we can add a preemptive protocol to AODV and initiate a rediscovery routine before the current routes goes down. In the next section, we will discuss this preemptive approach in more detail.

III. DYNAMIC SOURCE ROUTING PROTOCOL

DSR protocol is a distance-vector routing protocol for MANETs. When a node generates a packet to a certain destination and it does not have a known route to that destination, this node starts a route discovery procedure. Therefore, DSR is a reactive protocol. One advantage of DSR is that no periodic routing packets are required. DSR also has the capability to handle bidirectional links. Since DSR discovers routes on-demand, it may have poor performance in terms of control overhead in networks with high mobility and heavy traffic loads. Scalability is said to be another disadvantage of DSR because DSR relies on blind broadcasts to discover routes.

That protocol contain for two major phases: that's for route discovery and route maintenance. When a mobile node has a packet to send to some destination, it first consults its route cache to determine whether it already has a route to the destination. If it has an unexpired route destination, it will use this route to send the packet. On other hand, if the node does not have such route, it initiates route discovery by broadcasting a route request packet. This route request contains the address of the destination, along with the source node address and a unique identification number. Each node receiving the packet and check whether it knows of a route to the destination. If it does not, it adds its own address to the route record of the packet and then forwards the packet along its outgoing links.

A. Route Discovery

If the source does not have a route to the destination in its route cache, it broadcasts a route request (RREQ) message specifying the destination node for which the route is requested. The RREQ message includes a route record which specifies the sequence of nodes traversed by the message. When an intermediate node receives a RREQ, it checks to see if it is already in the route record. If it is, it drops the message. This is done to prevent routing loops. If the intermediate node had received the RREQ before, then it also drops the message. The intermediate node forwards the RREQ to the next hop according to the route specified in the header. When the destination receives the RREQ, it sends back a route reply message. If the destination has a route to the source in its route cache, then it can send a route response (RREP) message along this route. Otherwise, the RREP message can be sent along the reverse route back to the source. Intermediate nodes may also use their route cache to reply to RREQs. If an intermediate node has a route to the destination in its cache, then it can append the route to the route record in the RREQ, and send an RREP back to the source containing this route. This can help limit flooding of the RREQ. However, if the cached route is out-of-date, it can result in the source receiving stale routes.

B. Route Maintenance

When a node detects a broken link while trying to forward a packet to the next hop, it sends a route error (RERR) message back to the source containing the link in error. When an RERR message is received, all routes containing the link in error are deleted at that node.

IV. FINEST PATH SELECTION AODV (FP-AODV) PROTOCOL

The objective of packet forwarding in AODV protocol design is to consuming the packet sending and receiving capacity of each node in transmission range, while minimizing the packet loss rate of the mobile nodes. Before preceding the implementation process, the proposed work will required a mobility and distance to each neighboring nodes.

AODV protocol is extended with a drop factor that induces a randomness feature to result in finest path Ad-Hoc On-Demand Routing (FP-AODV) protocol. During the route discovery process, every intermediary or router nodes between the source and the destination nodes makes a decision to either broadcast/forward the RREQ packet further towards the destination or drop it. Before forwarding a RREQ packet, every node computes the drop factor which is a function of the inverse of the number of hop counts traversed by the RREQ packet. This drop factor lies in the range of 0 to 1. Also, the node generates a random number from 0 to 1. If this random number is higher than the drop factor, the node forwards the RREQ packet. Otherwise, the RREQ packet is dropped. Dropping of RREQ packets does not necessarily result in a new route discovery process by the source node. This is due to the fact that the original broadcast by the source node results in multiple RREQ packets via the neighbors and this diffusing wave results quickly in a large number of RREQ packets traversing the network in search of the destination. A major proportion of these packets are redundant due to the fact that in the ideal case, a single RREQ packet can find the best route. Also, a number of these packets diffusing in directions away from the destination shall eventually timeout. Hence, in FP-AODV, the aim is to minimize on these redundant RREQ packets, or alternatively, drop as much as possible of these redundant RREQ packets. The drop policy is conservative and its value becomes lesser with higher number of hops. As RREQ packets get near the destination node, the chances of survival of RREQ packets are higher. Hence, the first phase of the route discovering process, that is, finding the destination node, is completed as soon as possible and a RREP packet can be transmitted

In FP-AODV, the dropping of redundant RREQ packets reduces a proportion of RREQ packets that shall never reach the destination node, resulting in a decrease of network congestion. Hence, the ratio of the number of packets received by the nodes to the number of packets sent by the nodes, namely, throughput, should be higher in FP-AODVcompared to AODV. The following algorithm is used in the decision making process of whether to drop the RREQ packets by the intermediary or routing nodes.

Algorithm: FP-AODV

Step 1: Set the Source and Destination
Step 2: Initialize the packet size and send a Broadcast Message.
Step 3: Calculate Drop Factor
Drop factor = (1/ (Hop count of RREQ packet + 1))
Step 4: Calculate a Random Value in the Range Of 0 To 1.
Step 5: If (random value > drop factor) then forward packet
Else drop RREQ packet
Step 6: end

A. Send on RREQ Packet

Before send a RREQ packet, every node computes the plunge factor which is a function of the inverse of the number of hop counts traversed by the RREQ packet. This plunge factor lies in the range of 0 to 1. Also, the node generates a random number from 0 to 1. If this random number is higher than the plunge factor, the node forwards the RREQ packet. Otherwise, the RREQ packet is dropped. Dropping of RREQ packets does not necessarily result in a new route discovery process by the source node. This is due to the fact that the original broadcast by the source node results in multiple RREQ packets via the neighbors and this diffusing wave results quickly in a large number of RREQ packets traversing the network in search of the destination. A major proportion of these packets are redundant due to the fact that in the ideal case, a single RREQ packet can find the best route. Also, a number of these packets diffusing in directions away from the destination shall eventually timeout.

B. Drop Policy

Hence, in *FP-AODV*, the aim is to minimize on these redundant RREQ packets, or alternatively, drop as much as possible of these redundant RREQ packets. The drop policy is conservative and its value becomes lesser with higher number of hops. As RREQ packets get near the destination node, the chance of survival of RREQ packets is higher. Hence, the first phase of the route discovering process, that is, finding the destination node, is completed as soon as possible and a RREP packet can be transmitted from the destination node back to the source node.In *FP-AODV*, the dropping of redundant RREQ packets reduces a proportion of RREQ packets that shall never reach the destination node, resulting in a decrease of network blocking. Hence, the ratio of the number of packets received by the nodes to the number of packets sent by the nodes, namely, throughput, should be higher in *FP-AODV*compared to AODV and DSR. The following algorithm is used in the decision making process of whether to drop the RREQ packets by the intermediary or routing nodes.

IV. SIMULATION EXPERIMENTS

We have implemented FP-AODVand AODV and DSR protocols using ns-2, version 2.34. The mobility model used is Random Way point Model the traffic sources are CBR (continuous bit –rate), the source-destination pairs are spread randomly over the network in a rectangular filed of 500m x 500m. During the simulation, each node starts its journey from a random spot to a random chosen destination. Once the destination is reached, the node takes a rest period of time in second and another random destination is chosen after that pause time. This process repeats throughout the simulation, causing continuous changes in the topology of the underlying network. The simulation time is 180 m seconds and maximum speed of nodes is 10 m/s.

In order to evaluate the performance of FP-AODV and AODV ad hoc routing protocols, we chose the following metrics:

– Throughput: (i.e., packet delivered ratio) is a ratio of the data packets delivered to the destination to those generated by the CBR sources.In communication networks, such as Ethernet or packet delivery radio throughput or network throughput is the rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. The throughput is usually measured in bits per second (bps), and sometimes in data packets per second or data packets per time slot.

– end to end delay: 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 time.

– Packet received: this is the number of packets that are successfully transferred to the destination.

–End-to-end delay: refers to the time taken for a packet to be transmitted across a network from source to destination.

A. Simulation consequences

In this section, the proposed work presents simulation results of the several scenarios. We have used to evaluate the performance of the FP-AODV, and then compared with AODV and DSR and the preventive ad hoc routing protocols

Recollect the plunge factor in FP-AODV a dropping packets of some forwarding packets but the drop rate is conservative enough not to let the source node to result in a loop of initiation of route discoveries. The routing packet throughput is illustrated in Fig5.1. Represents the simulation performance of the FP-AODV, AODV and DSR packet throughput. This figure shows throughput is better in FP-AODV compared to AODV and DSR on an average. That given figure contain x axis are packet size and y axis are throughput values. Better percentage was observed with a better field. This is mainly due to the induction of the plunge factor in FP-AODV to reduce the node blocking.

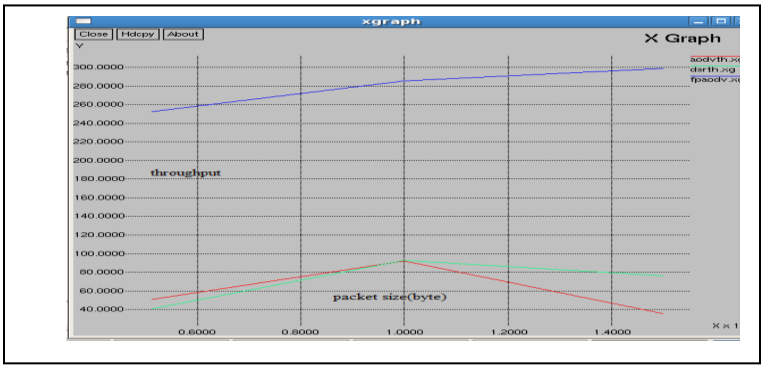

Figure 1. Throughput

A Fig 2 represents the comparison of AODV with FP-AODV on number of packets sends to the source node in minimum delay. It is observe that the routing packet sending to the source node better then to AODV and DSR. This is due to the induction of the plunge factor in FP-AODV to decrease node blocking. A Fig 5.3 shows the comparison of AODV and DSR with FP-AODV on number of packets delivery ratio to the destination node.

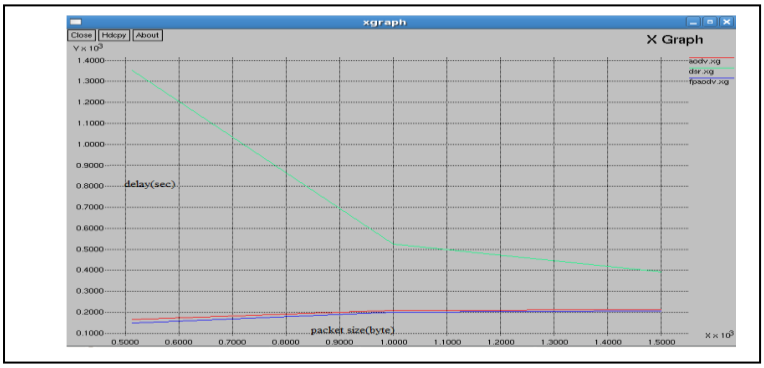

Figure 2. End to End Delay

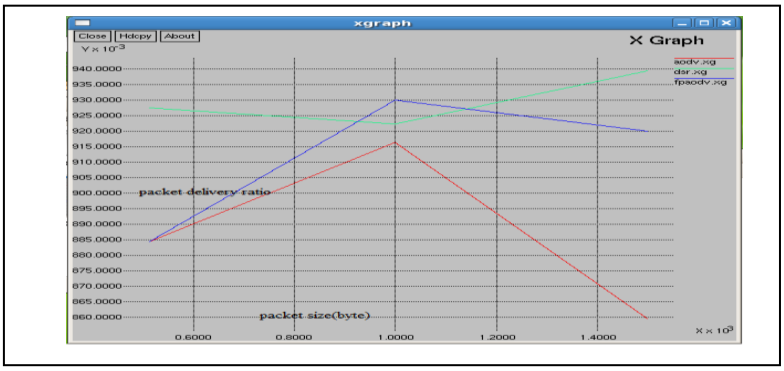

Figure 3. Packet Delivery Ratio

A Fig 3 shows the comparison of AODV and DSR with FP-AODV on number of packets delivery ratio to the destination node. It is observed that the routing packet receiving to the destination node better in FP-AODV compared to AODV and DSR averages. A Fig 4 represents the packets loss. That for packet dropped in the network That FP-AODV contains minimum dropping packets comparatively then AODV and DSR. This implies that for more stable networks, wherein the nodes are static for higher quantum of time, the latency in finding a route to a node is relatively less.

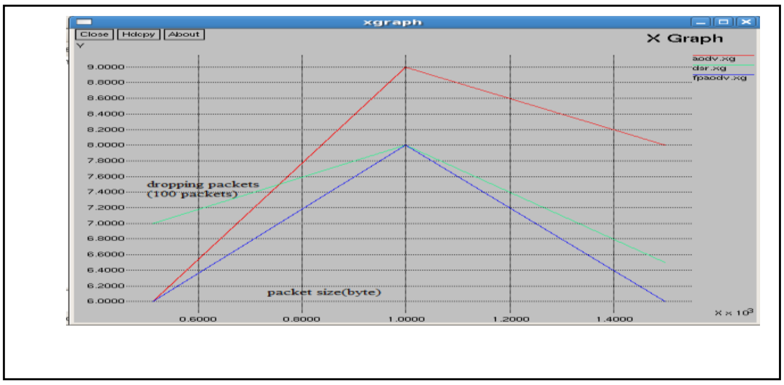

Figure 4. Packet Dropping Ratio

Overall, since throughput is higher for FP-AODV, lesser number of packets that were sent out by the nodes in the network was lost during the route discovery process, thus reducing network blocking in FP-AODV when compared to AODV. Especially, for larger number of packets to be sends in the network compared to AODV and DSR.

A main reason attributed to this observation is that as node mobility decrease the route update interval increases since low node mobility results in less route updates. That given table 1 shows the simulation parameter. That given Table 2, Table 3, Table 4 shows the simulation results. That Table 2 contains the simulation results for FP-AODV, AODV, and DSR.

This table contains for the details about the throughput, delay, packet delivery ratio, packet dropped. That all are values compute packet size for 512 bytes. That table shows the FPAODV has a better performance values compared with other two protocols. That is throughput, end to end delay and packet delivery ratio is better than AODV and throughput is better than DSR.

That Table 3 shows the FPAODV is better performance values compared with other two protocols. That is throughput, end to end delay and packet delivery ratio is better than AODV and throughput is better than DSR. That table 4 shows the FPAODV has a better performance values compare other two protocols. That is throughput, end to end delay and packet delivery ratio is better than AODV and throughput is better than DSR. That Table 3 shows the FPAODV is better performance values compare other two protocols.

TABLE I. SIMULATION RESULTS 512 BYTES

Protocols	Packet size			
	End to End Delay (ms)	***Throughput (ms)***	***Packet Delivery Ratio (%)***	***Dropped Packets (%)***
AODV	207.929	92.45	0.8844	6
DSR	526.534	72.90	0.9275	9
FPAODV	199.29	285.49	0.8944	8

TABLE II. SIMULATION RESULTS 1000 BYTES

Protocols	Packet size			
	End to End Delay (ms)	***Throughput (ms)***	***Packet Delivery Ratio (%)***	***Dropped Packets (%)***
AODV	211.651	35.60	0.8596	6
DSR	393.824	76.05	0.9394	8
FPAODV	205.54	298.86	0.9462	6.5

TABLE III. SIMULATION RESULTS 1500 BYTES

Protocols	Packet size			
	End to End Delay (ms)	***Throughput (ms)***	***Packet Delivery Ratio (%)***	***Dropped Packets (%)***
AODV	211.651	35.60	0.8596	6
DSR	393.824	76.05	0.9394	8
FPAODV	205.54	298.86	0.9462	6.5

V. CONCLUSION

In this paper, we discuss on the increase the throughput of an on-demand distance vector routing (AODV) protocol for mobile and wireless ad hoc networks. We propose to FP-AODV protocol increases the packet generating, packet sending, and packet receiving better than other protocols. And decrease the end to end delay. AODV protocol is extended with a plunge factor that induces a randomness feature to result in Finest Path Selection Ad-Hoc On-Demand Routing (FP-AODV) protocol. We have also reported a set of simulation experiments to evaluate their performance when compared to the original AODV on-demand routing protocol.

Our results indicate that FP-AODV, AODV and DSR protocols are easy to scale, the number of mobile nodes does not affect their performance. And the traffic is quite well balanced among the available paths in the network. While ourresults indicate that both protocols increase the number of arrival packets within the same simulation time, they decrease the delay per packet when compared to the original AODV and DSR scheme

Several additional issues related to the design and evaluation of the FP-AODV protocol requires further investigation. First, the protocol can be improved to effectively deal with the packet sending, receiving an end to end delay source-destination. Second, improve the plunge factor that can improve FP-AODV performance.

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