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An Enhanced QoS Based Hybrid Source Routing Protocol for MANETs

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ABSTRACT

The network layer has received a great deal of attention in the research on MANETs. As a result, abundant routing protocols in this network with differing objectives and for various specific needs have been proposed. Proactive source routing (PSR) protocol facilitates opportunistic data forwarding in MANETs. In PSR, each node maintains a breadth-first search spanning tree of the network rooted at itself. This information is periodically exchanged among neighboring nodes for updated network topology information. Thus, PSR allows a node to have full-path information to all other nodes in the network, although the communication cost is only linear to the number of the nodes. This allows it to support both source routing and conventional IP forwarding. PSR is a proactive protocol which has lower overhead when compared to other protocols like OLSR, DSDV etc., But it has the disadvantage of routing overhead in case when the number of nodes in the network increases. A hybrid source routing protocol is proposed which is particularly designed with optimal scalability performance. It uses the advantages of both reactive and proactive protocols and eliminates their disadvantages. It combines a AOMDV protocol with PSR. The proposed protocol is to efficiently make use of all the location information available, to minimize the routing overhead, and to gracefully exit to reactive routing as the location information degrades.

Key Words : AOMDV, HSRP , PSR , Proactive, Reactive

1. INTRODUCTION

An ad-hoc (or "spontaneous") network is a local area network or any other small network, especially one with wireless or temporary plug-in connections, in which some of the network devices are part of the network only for the duration of a communication session, whereas in the case of mobile or portable devices it is part of the network when in some close proximity to the rest of the network. Ad Hoc Networks are future alternative to the current trend of connections among wireless devices via fixed infrastructure-based service. With changing technology mobile devices getting smaller, cheaper, more convenient, and more powerful, they also run more applications and network services. All of these factors are supporting the explosive growth of the mobile computing equipment market seen today. New alternative ways to deliver connectivity have been gaining increased attention in recent years. These are focused around having mobile devices within the transmission range connect to each other through automatic configuration, setting up an ad hoc mobile network that is both flexible and powerful. By this way, mobile nodes communicate with each other and receive Internet services through an Internet gateway node, effectively extending both network and Internet services to non infrastructure [1, 2]. Characteristics of ad hoc networks include resource-poor devices, limited bandwidth, high error rates, and a continually changing topology. Among the available resources, battery power is typically the most constraining. Hence, routing protocol must have Minimal control overhead, Minimal processing overhead, Multi-hop routing capability, Dynamic topology maintenance and Loop prevention. Many proactive and reactive routing are already in existence [3].

2. RELATED WORK

In this paper [4], author propose such a complete solution, called Geo DTN+Nav, that includes a greedy mode, a perimeter mode, and DTN mode. In order to know when to use each of these modes, a network partition method is proposed that evaluates for each packet the correct forwarding method to use in order to guarantee a high packet delivery even in sparse or partitioned networks. Various works related to topology control in MANETs are carried out to control the dynamic topology. Cooperative communication typically refers to a system where users share and coordinate their resources to enhance the information transmission quality. It is a generalization of the relay communication, in which multiple sources also serve as relays for each other. Capacity optimized cooperative (COCO) topology control scheme [5] is used to improve network capability in MANETs Through simulations, proposed topology control scheme to improve network capacity in cooperative MANETs. There are two types of routing in MANETS: proactive and reactive. In this paper [6], a protocol called lightweight proactive source routing (PSR) is proposed. PSR can maintain more network topology information than distance vector (DV) routing to facilitate source routing, although it has much smaller overhead than traditional DV-based protocols e.g., destination-sequenced DV (DSDV), link state (LS)-based routing e.g., optimized link state routing (OLSR), and reactive source routine e.g., dynamic source routing(DSR). Reactive protocol uses on demand route discovery approach. Ad-hoc On Demand Distance Vector Routing (AODV) [6], a novel algorithm for the operation of such ad-hoc networks. Each Mobile Host operates as a

specialized router, and routes are obtained as needed (i.e., on-demand) with little or no reliance on periodic advertisements.

AODV is an on demand routing protocol in which routes are established on demand and destination sequence numbers are used to find the latest route to the destination. The connection setup delay is less. The HELLO messages supporting the routes maintenance are range-limited, so they do not cause unnecessary overhead in the network but the intermediate nodes can lead to inconsistent routes if the source sequence number is very old and the intermediate nodes have a higher but not the latest destination sequence number, thereby having stale entries.

Section 3 summarizes the existing PSR protocol. Section 4 deals with the proposed hybrid source routing protocol. Section 5 evaluates the performance of AODV, AOMDV and hybrid source routing protocol for the QoS parameters through xgraph.

3. REVIEW OF PROACTIVE SOURCE ROUTING PROTOCOL

3.1. Design Of Proactive Source Routing

The functions of PSR are:

- Route Update
- Neighborhood Trimming
- Streamlined Differential Update

3.2 . Route Update

Due to the proactive nature of PSR, The update operation of PSR is iterative and distributed among all nodes in the network. Each node updates its own BFST based on the recent information received from its neighbors. Communication overhead is not increased as one routing message is sent per update interval.

3.3. Neighborhood Trimming

When a neighbor is lost, its contribution to the network connectivity should be removed. Neighborhood trimming takes place under the following conditions:

1) No routing update or data packet has been received from the lost neighbor for a given period of time

2) A data transmission to the lost node have failed, as reported by the link layer

3.4. Streamlined Differential Update

Full dump messages are interleaved using differential updates.The idea is to send the full update messages less frequently than shorter messages containing the difference between the current and previous knowledge of a node's routing module. First, we use a compact tree representation in full-dump and differential update messages to halve the size of these messages. Second, every node attempts to maintain an updated BFST as the network changes so that the differential update messages are even shorter.

4. HYBRID SOURCE ROUTING PROTOCOL

The existing system uses proactive source routing approach. In source routing, nodes can explicitly decide the best forwarder to forward the data. Proactive source routing offers the advantage of maintaining updated routing table information. Exchanging the node information periodically results in overhead especially when the number of nodes in the network increases. Hence in these cases reactive routing is preferable. But reactive routing follows on demand approach, where route is established when a node needs to transfer data. Comparatively reactive routing has more advantages than proactive routing protocols. The proposed approach uses hybrid source routing where it combines PSR and AOMDV [7] protocol. It combines the advantages of both the protocols and based on the network conditions it switches over to use the best one. Figure 1 shows the data flow diagram of HSRP.

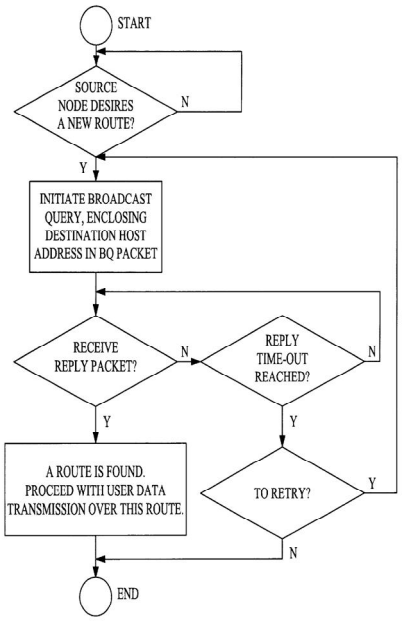

Figure 1: Data Flow Diagram for proposed protocol

- HELLO messages are broadcasted by the sender to all its neighboring nodes.
- Based on the received responses the routing table is updated.
- Routing table is managed by routing manager.
- Each node has the capability to decide the next hop on receiving a packet.

- The shortest route to the destination is always selected to minimize wastage of bandwidth.

4.1. Design Of HSRP

HSR is composed of the following components:

- Route discovery
  -Route request
  -Route reply
- Hybrid model routing
- Local repair

4.2. Route Discovery

If the source node has no route to the destination node , then source node initiates the route discovery in an on-demand fashion . After generating RREQ, node looks up its own neighbor table to find if it has any closer neighbor nodes toward the destination nodes . If a closer neighbor nodes is available, the RREQ packet is forwarded to that node . If no closer neighbor nodes are available the RREQ packet is flooded to all neighbor nodes . A destination node replies to a received RREQ packet with a route reply (RREP) packet in only the following three cases:

1) if the RREQ packet is the first to be received from this source nodes

2) if the RREQ packet contains a higher source sequence number than the RREQ packet previously responded to by the destination nodes

3) if the RREQ packet contains the same source sequence number as the RREQ packet previously responded to by the destination nodes , but the new packet indicates that a better quality route is available.

4.3. Hybrid Routing

This type of protocol combines the advantages of proactive and of reactive routing. The routing is initially established with some proactively predicted routes and then serves the demand from additionally activated nodes through reactive flooding.

4.4. Local Repair

Node mobility will cause the communication links between nodes to frequently be broken. A local repair will, in general, also cost less power consumption relative to reestablishing a new source-to-destination route. Intermediate nodes that participate in exchanging data traffic are allowed to locally repair broken routes through a route repair (RRP) packet instead of just reporting a broken route to its source nodes . Once an intermediate node recognizes a broken link to a certain destination node , it buffers the received data packets for that destination nodes . Then, the intermediate node looks up its own neighbor table to find if it has any neighbor nodes closer to the intended destination node . If a closer neighbor node is available, data packets are forwarded to that nodes after the intermediate nodes has updated its own neighbor table.

5. PERFORMANCE EVALUATION

The performance of hybrid source routing protocol is evaluated using network simulator (ns-2.34). QoS parameters like packet delivery ratio, delay and throughput are analysed. These parameters are analysed for the proposed hybrid protocol. The obtained results are compared with PSR and AOMDV. Minimisation in the routing overhead is shown through simulation results. The following Figure 2 and Figure 3 demonstrates the the QoS parameters like PDF and delay among three protocols namely AODV,AOMDV and HSRP.

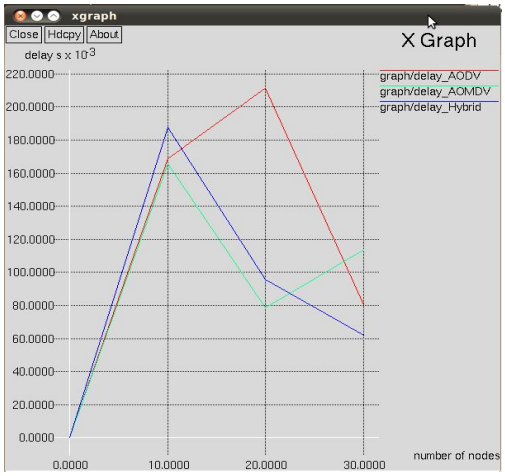

Figure 2: Comparison graph for delay

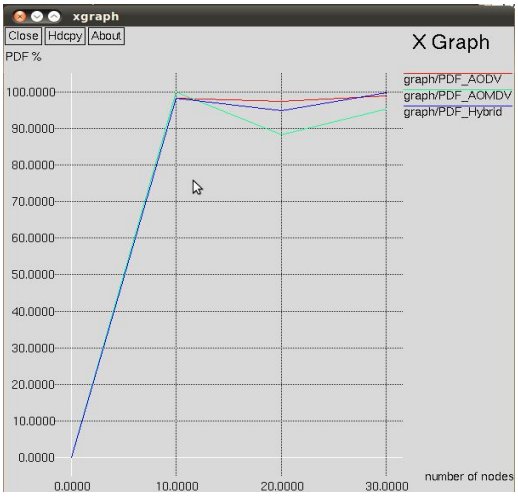

Figure 3: Comparison graph for packet delivery fraction

Comparatively hybrid source routing protocol has less delay and increased PDF. The following Figure 4 and Figure 5 depicts the throughput and routing overhead of the three protocols namely AODV, AOMDV and hybrid source routing protocol (HSRP).

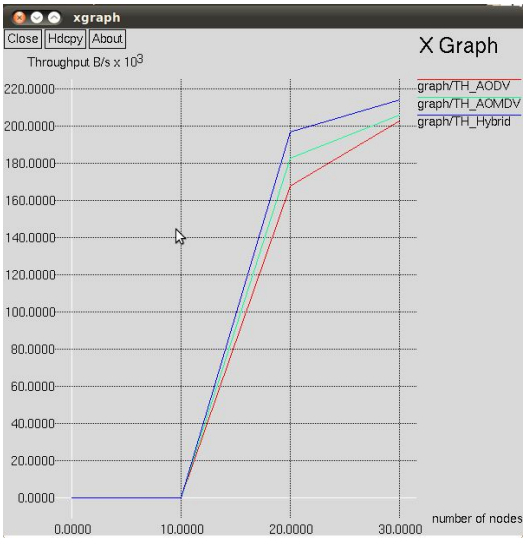

Figure 4: Comparison graph for throughput

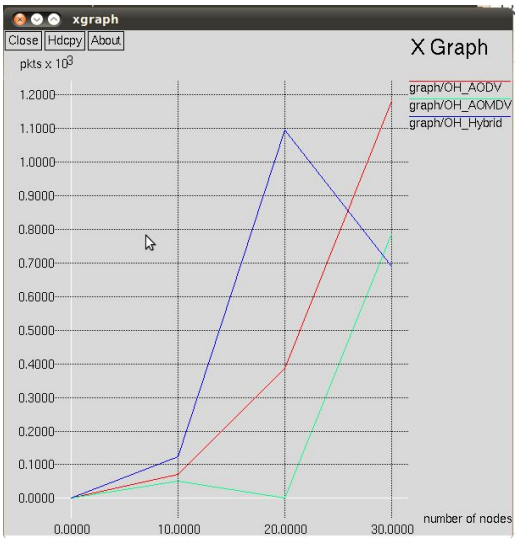

Figure 5: Comparison graph for routing overhead

6. CONCLUSION AND FUTURE WORK

PSR and AOMDV protocol are combined to provide optimal scalability performance. Advantages of both the protocols are utilized. When route information is already present in the routing table proactive approach is used. Otherwise on demand (reactive) routing is carried out. It is shown through both analysis and simulations, that a significant reduction in the routing overhead can be achieved in HSRP compared to standard reactive and proactive routing protocols. And it is demonstrated that how such a performance improvement leads to a scalable routing solution in the context of MANET environments. Moreover, most of current routing protocols assume homogeneous networking conditions where all nodes have the same capabilities and resources. Although homogenous networks are easy to model and analysis, they exhibits poor scalability compared with heterogeneous networks that consist of different nodes with different resources. Therefore, heterogeneity of nodes is another issue that needs to be considered in constructing and developing routing protocols for MANETs. Possibility of implementation in heterogeneous MANETs with better scalability is considered as the future work.

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