APPLYING HEURISTIC TECHNIQUE TO AD-HOC ON DEMAND DSTANCE VECTOR ROUTING TO REDUCE BROADCAST

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ABSTRACT:

In this paper we propose an approach to improve the performance of existing flood based routing algorithm Ad-hoc on demand Distance Vector Routing [2] for mobile Ad-hoc wireless networks based on heuristic searching technique. Flooding technique is often used for route discovery in on demand mechanism in MANET such as AODV, DSR. To avoid the problem of wireless broadcast storm, the heuristic searching approach was introduced in the process of finding route from source node to destination node. Heuristic function considers the characteristics of MANET (Bandwidth, number of nodes in the given range). If a node S wants to send a packet to D in the flooding method S sends packet to all its neighbor nodes, but in the proposed scheme tries to reduce broadcasting by finding heuristic measures of the neighbors of S. The heuristic measures are evaluated by applying a function to all neighbors.

1 Introduction:

Multi - hop ad hoc networks (MANETs) have recently been the subject of active research because of their unique advantages. MANETs are self-creating, self-organizing and self-administrating without deploying any kind of infrastructure. They offer special benefits and versatility for wide applications in military [5] (e.g. battlefields, sensor networks etc.), commercial (e.g., distributed mobile computing, disaster discovery systems, etc.), and educational environments (e.g., conferences. conventions, etc.) where fixed infrastructure is not easily acquired. With the absence of pre-established infrastructure (e.g., no router, no access point, etc.) two nodes communicate with one another in a peer-to-peer fashion. Two nodes communicate directly if they are in the transmission range of each other. Otherwise, nodes can communicate via a multi-hop route with the cooperation of other nodes, each MANET node widely uses flooding or broadcast. Many ad-hoc routing protocols, multi cast schemes or service discovery programs depend on massive flooding

In flooding [1], a node transmits a message to all of its neighbors. The neighbors in turn rely to their neighbors and so on until the message has been propagated to the entire network. We call such flooding as blind flooding. As the neighbor degree gets higher, the blind flooding suffers from the increase of redundant and superfluous packets, the probability of collision, and congestion of wireless medium. Performance of blind

flooding is severely impaired especially in large and dense networks

When topology or neighborhood information is available, only a subset of neighbors is required to participate in flooding to guarantee the complete flooding. We call such flooding efficient flooding [7]. The characteristics of MANET's are node mobility, the limited bandwidth and resource; however, make collecting topological information is very difficult. It generally needs huge extra overhead due to the periodic message exchanges or event driven updates with optional deployment of GPS (Global Positioning System) like system. For that reason many on-demand ad-hoc routing schemes and services discovery protocols simply use blind flooding. With periodic route table exchanges, proactive ad hoc routing schemes, unlike on demand routing methods, can gather topological information with out big extra overhead (through piggybacking topology information or learning neighbors).Thus, a few proactive ad hoc routing mechanisms proposed route aggregated by only a subset of nodes in the network

2 Heuristic Search:

A heuristic is a technique that improves the efficiency of a search process, possibly by sacrificing claims of completeness. They are good to the extent that they point in generally interesting directions; they are bad to the extent that they miss point in generally interesting directions. Some heuristics help to guide a search process without sacrificing any claims to completeness that the process might previously have bad. Others (in fact, many of the best ones) may occasionally cause an excellent path to be overlooked. But, on the average, they improve the quality of the paths that are explored. Using good heuristic, we can hope to get good (through possibly non optimal) results.

2.1 The Ad-hoc On-demand Distance Vector Algorithm

Our basic proposal can be called a pure on-demand vector route acquisition system nodes that do not lie on active paths neither maintain any routing information nor participate in any periodic routing table exchanges. Further a node does not have

ISBN:978-988-98671-2-6

to discover and maintain a route to another node until the two nodes to communicate, unless the former node is offering its services as an intermediates forwarding station connectivity between two other nodes.

When the local connectivity of the mobile node is of interest , each mobile node can become aware of the other nodes in its neighborhood by the use of several techniques, including local (not system-wide) broadcast known as hello message. The routing tables of the nodes within neighborhood are organized to optimize response time to local movements and provide quick response time for requests for establishment of new routes. The algorithm’s primary objectives are:

1) To broadcast discovery packets only when necessary

2) To distinguish between local connectivity management (neighborhood detection) and general topology maintenance

3) To disseminate information about changes in local connectivity to those neighboring mobile node that are likely to need the information

AODV uses a broadcast route discovery mechanism [3], as also used (with modifications) in the Dynamic Source Routing (DSR) algorithm [9, 10]. Instead of source routing, however, AODV relies on dynamically establishing route table entries at intermediate nodes. This difference pays off in network with many nodes, where a larger overhead is incurred by carrying source routes in each data packet. In order to maintain the most recent routing information between nodes. We borrow the concept of destination sequence numbers from DSDV[13].Unlike in DSDV however each ad-hoc node maintains monotonically increasing sequence number counter which is used bandwidth efficiently(by minimizing the network load for control and data traffic), is responsive to changes in topology , and ensures loop-free routing. In the existing AODV protocol broad cast route discovery (RREQ) packet only when necessary. In the proposed protocol try to reduce broadcast by applying heuristic search method.

2.2 Active set construction:

Packet sending node calculates the active set it is proper subset of neighbor set. Heuristic function is applied to each neighbor node those nodes heuristic function value is greater than some pre defined threshold value all such nodes included in active set

In the Fig 1 node n apply heuristic function on each and every neighbor node $h(n_i)$ where n_i is neighbor node of n.If $h(n_i)$ > M
(where M is threshold value) then n_i is belongs to active set of node n. In the above example n1, n3, n5 heuristic function values are greater than threshold value M

3 Heuristic path discovery :

The path discovery process is initiated whenever a source node needs to communicate with another node for which it has no routing information in its table. Before applying any RREQ first it evaluates the heuristic function values at that node. Every node maintains two separate counters: a node sequence number and a broadcast_id. The source node initiate path discovery by broadcasting a route request (RREQ) packet to its active set of neighbors based on heuristic threshold value. The RREQ contains the following fields

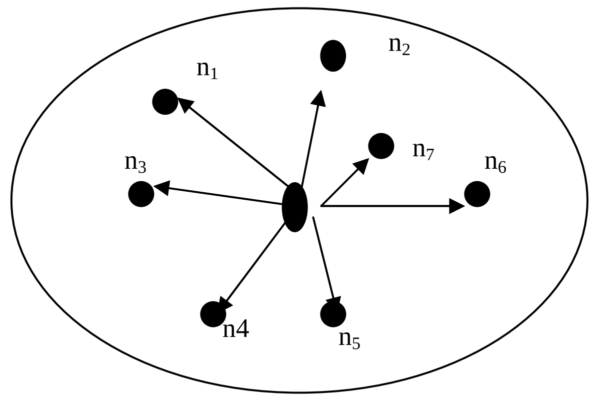

Fig 1

< source_addr, source sequence_#, broadcast_id, dest_addr, dest_seqence_#, hop count > Heuristic function is defined from node to any positive integer
H: N $\rightarrow$ Z^+ here N is any node and Z^+ is a positive integer.

The pair < source_addr, broadcast_id > uniquely identifies a RREQ broadcast_id is incremented whenever the source issues a new RREQ each neighbor either satisfies the RREQ by sending a route reply (RREP) back to the source or rebroadcasts the RREQ to its own active set of neighbors after increasing the hop_count.Notice that a node may receive multiple copies of the same route broadcast packet from various neighbors. When an intermediate node receives a RREQ, if it has already received a RREQ with the same broadcast_id and source address, it drops the redundant RREQ. It keeps track of the following information in order to implement the reverse path setup, as well as the forward path setup that will accompany the transmission of the eventual RREP:

Destination IP address
Source IP address
Broadcast_id
Expiration time for reverse path route entry
Source node sequence number

There are two sequences numbers (in addition to the broadcast_id) included in a RREQ: the source sequence number and the last destination sequence number known to the source.

The source sequence number is used to maintain freshness information about the reverse route to the source, and the destination sequence number specifies how fresh a route to the destination must before it can be accepted by the source

As the RREQ travels from a source to various destinations, it automatically sets up the reverse path from all nodes back to the source. To set up a reverse path a node records the address of the neighbor from which it received the first copy of the RREQ.These reverse path route entries are maintained for at least enough time for the RREQ to traverse the network and produce a reply to the sender.

3.1 Forward path setup:

Eventually, a RREQ will arrive at a node (possibly the destination itself) that posse a current route to the destination. The receiving node first checks that there was received over a bi-directional link. If an intermediate node has a route entry for the desired destination, it determines whether the route is current by comparing the destination sequence number in its own route entry to the destination sequence number in the RREQ. If the RREQ's sequence number for the destination is greater than that recorded by the intermediate node, the intermediate node must not use its recorded route to respond to the RREQ. Instead, the intermediate node rebroadcasts the RREQ. The intermediate node can reply only when it has a route with sequence number that is greater than or equal to that contained in the RREQ. If it does have a current route to the destination, and if the RREQ has not been processed previously, the node then unicast a route reply packet (RREP) back to its neighbor from which it received the RREQ. A RREP contains the following information:

<Source_addr, dest_addr, dest_seq_#, hop count, lifetime >

4 Performance Evaluation

Simulation Environment

To compare the performance of proposed with AODV [1], we simulated both protocols in Glomosim version 2.03. GloMosim [14] is a scalable wireless simulator developed at UCLA. 100 nodes were placed uniformly at random in area 2000 X 600 sqm. Nodes follow random way point mobility and communicate using 802.11 MAC layer with a radio transmission range of 250 meters

Mobility Speed

Each node moved constantly with the predefined speed. Moving directions of each node were selected randomly, and when node reached the simulation terrain boundary, they bounced back and continued to move. The node movement speed was varied from 0 km/hr to 72 km/hr. In the mobility experiment.

Simulation Results:

The performance measures monitored in this study are packet delivery ratio with number of nodes and RREQ packets with number of nodes. In Fig 1 shown the relation ship between

numbers of nodes with packet delivery ratio. In Fig 2 shown the relation ship between number of nodes with RREQ packets.

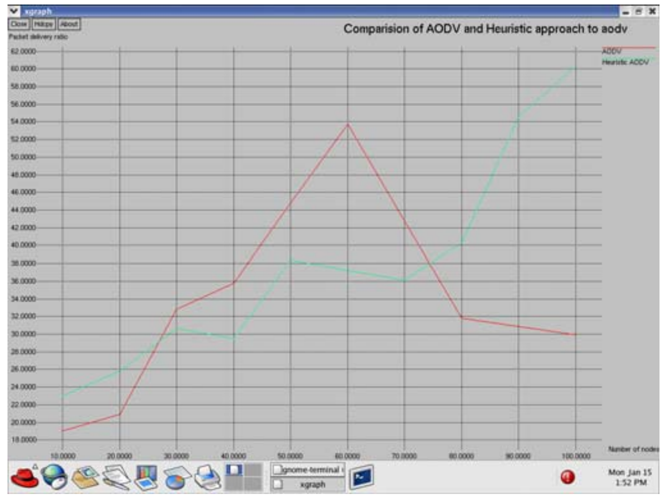

Fig 1. Packet delivery ratio vs number of nodes

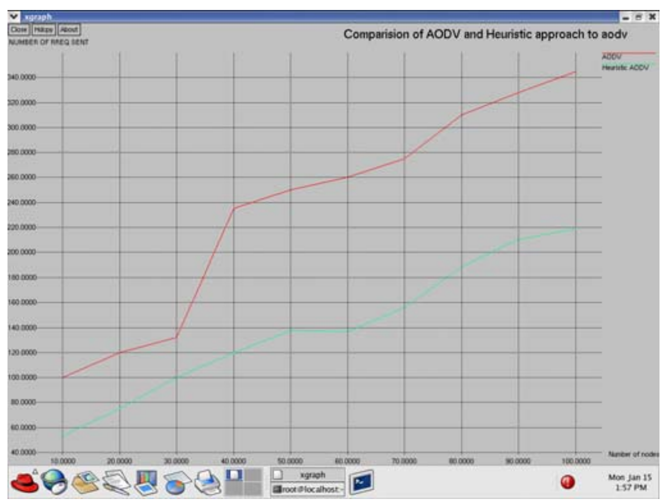

Fig 2 Number of nodes vs. RREQ packets

Conclusions:

We have introduced a novel routing with heuristic technique approach for ad-hoc networks this leads to a reduction of redundant broadcasting resulting in higher throughput and multicast efficiency. The proposed protocol show very better performance in dense networks than in a normal network.

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