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New Framework for Routing in MANET Right Angled and Ant Search Protocol (RAAA)

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Abstract

There is always a continuous development in mobile technology. Considering the recent advance development in mobile technology and mobile devices, mobile computing was playing an important role in our everyday life. People are using wireless networks for their day–to–day work for the following usage (i) whether it is making a phone call, (ii) to download news to see, listen and (iii) only listen to their favorite song from various multimedia servers with the help of various devices such as mobile phones. PDAs or a laptop. In this paper, we tried in introducing a new routing method for the mobile ad hoc networks. The approach proposed in this paper takes advantage in the mobility of mobile nodes and the stability of link to establish a robust and long-lived route between sources and destination, which in addition to reducing the flooding and overhead effects and minimizing the rate of breakage of links in the established paths. In the proposed approach, selecting nodes to forward packets between the source and destination is based on Biased Geographical Routing (BGR) and Ant Search Method and we named the protocol as RAAA (Right Angled And Ant Search Protocol

Keywords: MANET, AODV, AOMDV, DSR, Biased geographical routing, congestion, distance, angle(bias) and pause time.

Introduction

In mobile ad hoc networks, several routing protocols have been proposed to solve the critical problems such as mobility effects in multi-hop communication and routing overhead. This let to the significant control overhead and interference to ongoing traffic, which is often not acceptable. There will be a excessive redundancy, contention, broken links and collision due to flooding techniques. This outcome is notorious as the “broadcast storm problem”.

A scheme to reduce the overhead involved in the discovery of a route to the end node during overhead and flooding order to reduce the overhead and flooding. This is done by forwarding packets to certain nodes, which fall within a determined direction. These intermediate nodes are selected according to their location and that of the final destination node. However, the method fails to account for the lifetime of the links between neighboring nodes, which would be the most necessary thing to establish long-lived routes and guarantee selection of the optimal path.

In this paper, we analyze the benefits of optimal multipath routing, to improve fairness and increase throughput in wireless networks with location information, in a bandwidth limited mobile ad hoc network. In such environments the actions of each node can potentially impact the overall network connections. Wireless embedded processors contained in mobile phones, handheld devices or weaved into the environment as sensors, is likely to become the main part of the future internet. Further, it is expected that location information will be widely available for such processing, to enhance context-aware types of interactions. The prospect of having ad hoc wireless networks composed of numerous location-aware nodes spread in the surrounding environment poses new interesting challenges to the research community. Congestion in wireless networks has already been explored by other research, observing its impact on performance: a drastic decrease in throughput, and increased per-packet energy consumption. On the other hand, computing is moving to an era where applications require large and stable bandwidths to perform their tasks. Such applications include multimedia applications, high frequency sensing applications, file transfer, and so forth. If devices enabling these applications are going to become an integral part of tomorrow's networks, solutions to reduce the effects of congestion in wireless networks are required.

A promising approach for routing in such networks is geographical routing, an algorithm that leverages location information to route messages in a hop-by-hop, greedy manner. Assuming that a coordinate system is in place, this scheme is scalable, has low computational overhead and requires minimum routing information to be maintained by node.

However, shortest path routing schemes in general, and geographical routing in particular, amplify the effects of congestion: in a random communication pattern, the nodes in the centre of the network carry a disproportionately large amount of the entire traffic, drastically decreasing the throughput of the flows they forward. This affects most long-range flows, as they have a higher probability of interesting in the central hotspot.

Taking into above considerations in mind, we propose a new method of multipath routing a solution that seeks to utilize idle or under-loaded nodes to reduce the effects of congestion. To achieve this goal, we enhance geographic routing to allow a source to select different paths towards the destination, named Right Angled Biased Geographical Routing (RABGR) and ANT search, which routes the packets from the source to destination through the angle 90° (between the intermediate nodes also). While multi-path solutions for geographic routing have been proposed before, they have either limited effectiveness (e.g., waypoint routing), or they exhibit a high overhead.

Routing in MANETs

A routing protocol [RAS96] is the mechanism by which user traffic is directed and transported through the network from the source node to the destination node. Objectives include maximizing network performance from the application point of view – application requirements – while minimizing the cost of network itself in accordance with its capacity. The application requirements are hop count, packet delay, throughput, loss rate, stability, jitter, cost; and the network capacity is a function of available resources that reside at each node and number of nodes in the network as well as it density, frequency of end-to-end connection, frequency of topology changes.

The following are the important basic routing functionalities of mobile ad hoc networks;

Path generation: this generates path according to the assembled and distributed state information of the network and of the applications; assembling and distributing network and user traffic state information.

Path selection: this selects appropriate paths based on networks and application state information.

Data Forwarding : this forwards user traffic along the select route forwarding user traffic along the selected route.

Path Maintenance : this functionality is mainly used in maintaining of the selected route.

Inspite of the above functionality, basically the routing techniques is bounded by the following terms;

- **Traffic requirement**
- **Network capacity**
- **Security requirement**

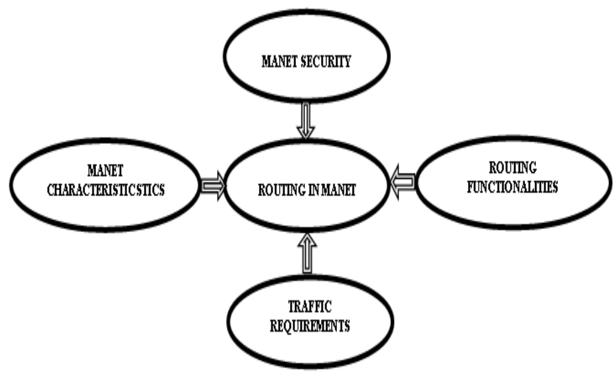


Figure 1. Routing in MANET

Routing protocols between any pair of node within ad hoc network can be difficult because the nodes can move randomly and can also join or leave the network. This means that an optimal route at a certain time may not work seconds later.

Network Simulator 2

The Network Simulator (NS) is an event driven network simulator developed at UC Berkeley that simulates variety of IP networks. It implements network protocols such as Transmission Control Protocol and User Datagram Protocol, traffic source behavior such as File Transfer Protocol, Telnet, Web, Constant Bit Rate and Variable Bit Rate, queue management mechanism, routing algorithms and more. The very important features of NS are, it also implements multicasting and some of the MAC layer protocols for LAN simulations. Current version of ns is ns2 written in C++ and OTcl (Tcl Script

Language with Object-oriented extensions developed at MIT).

Right Angled Biased Geographical Routing and Ant Search protocol

This section presents the operation of the proposed RAAA protocol, an enhancement over the multipath protocols based on on-demand routing scheme. We added important features to the RAAA protocol overcome the disadvantages of multipath protocol and improve it performance, providing stability and availability required to guarantee the selection of the best path and to reduce the congestion effects, the occurrence of broken links and dropped packets

- Each node in the network is able to find its neighboring nodes according to the 90° angle. The 90° angles are selected according to the strongest link stability, and so increase availability in the network.
- Each node in the network has a counter for the link stability (LS) to it neighboring nodes. The LS indicates which nodes are active in the network and this will automatically improve the performance of the network and increase the likelihood of selecting the best or optimal path.
- This RAAA protocol is based on the time and acknowledgement message in order to guarantee the selection of the path and link stability
- Each node will send acknowledgement message after receiving an RREQ and forwarding it, so the acknowledgement message should provide information on which nodes have problems and have been unable to forward RREQ.
- The source node should resend the RREQ whenever the time elapses before receiving the error message, in order to make the use of the full lifetime of the links.

RAAA in an on-demand routing protocol. To reduce the congestion during transmission of packets; we used the congestion control mechanisms BPNS and NNPS that highly enhance RAAA protocol.

Biased Node Packet Scatter (BNPS) is a very light weight method mechanism that partially aims to transient congestion by locally splitting the traffic along multiple paths to avoid congested hotspots.

Node-to-Node Packet Scatter (NNPS) is also a mechanism but aim to transmit packets to longer term congestion, when BPNS fails.

New Algorithm OF Right Angled And Ant Search Method

```
int I, Currentadd;
Algorithm FindPath(Nodesaddr, n, Sourceadd)
begin
        int FinalPath[100];
        int j;
        Currentadd = Sourceadd;
        FinalPath[j] = Sourceadd;
        For i = 1 to n-1
        begin
                If(NNPS(Currentadd) = true) then
                begin
                        j = j+ 1;
                        FinalPath[j] = Currentadd;
                end
                else if(BNPS(Currentadd) = true) then
                begin
                        j = j + 1;
                FinalPath[j] = Currentadd;
                end
        next i
        for i = 1 to j
                print(FinalPath[i]);
        next i
end
Algorithm boolean NNPS(Currentadd)
Begin
        int f = 0;
        for k = i to n-1
                int angle = acos(Currentadd,
Nodeaddr[i])
                if (angle = 90) then
                begin
                        Currentadd = Nodeadd[i];
                        f = 1;
                        break;
                end
        next k
        if (f = 1) then
                return true;
        else
                return false;
end

Algorithm boolean BNPS(Currentadd)
begin
        int f = 0;
        int dist = sqrt((xaxis(Nodeaddr[i+1]-
xaxis(Currentadd))-(yaxis(Nodeaddr[i+1]-
yaxis(Currentadd)));
        int mindist = dist;
        for k = i+1 to n-1
                dist = sqrt((xaxis(Nodeaddr[k+1]-
xaxis(Currentadd))-(yaxis(Nodeaddr[k+1]-
yaxis(Currentadd)));
```

```
                    if(dist < mindist) then
                    begin
                    Currentadd = Nodeaddr[k+1];
                              f = 1;
                    end
          next k
          if (f = 1) then
                    return (true);
          else
                    return(false);
end
```

The performance of the above two mechanism had been evaluated in term RAAA by using a high-level simulator, a packet-level simulator (NS-2). The results show that RAAA is a practical and efficient multipath routing protocol. We have evaluated BNPS and NNPS using NS2.

Formula Specification RAAA

a) To find the distance between any two nodes in the network.

Using the facts and Pythagoras' Theorem, we can now find the length of any interval.

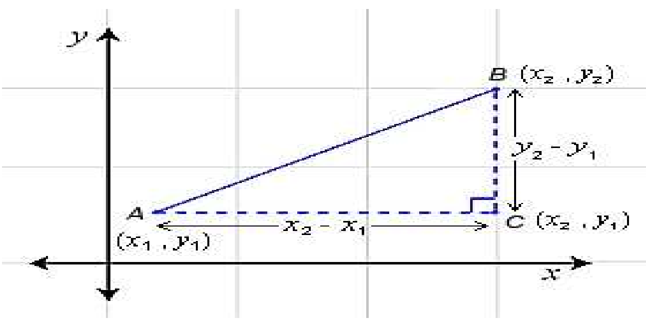
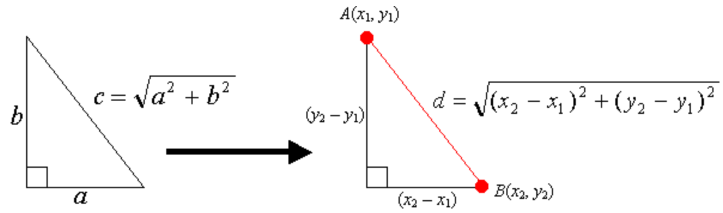


Figure 2. Co-ordinates axes

AC is parallel to the *x*-axis, it is part of the line $y = y_1$, so the *y*-coordinate of ***C*** is y_1.
BC is parallel to the *y*-axis, it is part of the line $x = x_2$, so the *x*-coordinate of ***C*** isx_2.
AC is perpendicular to ***BC*** so $\angle$***ACB*** is a right angle.
Since ***ABC*** is a right-angled triangle,
$AB^2 = AC^2 + BC^2$ (Pythagoras)
Now, ***AC*** is a horizontal line so
$AC = x_2 - x_1$
BC is a vertical line so $BC = y_2 - y_1$
Thus $AB^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$
Hence the length of ***AB*** is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
What this means is that The distance formula

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

If the coordinates of two points are $(x1, y_1)$ and $(x2, y_2)$, then the distance, *d*, between the two points is given by the following formula *(Distance Formula).*



FigureDistance Calculation Diagram

b) To find the axis angle between any two nodes in the network.

If $X_1$and X_2 are normalized, so that $|X_1|=|X_2|=1$, then, angle = acos(X_1 * X_2)where X_1 and X_2 are the coordinates of the axis.

angle (degrees)	sin(angle)	cos(angle)	v1•v2	v1 x v2
0	0	1	1	0,0,0
90	1	0	0	unit len
180	0	-1	-1	0,0,0
270	-1	0	0	unit len

Table1. Determination of Axis Angle between the Nodes

Parameter Values

In the simulation model, the number of mobile nodes ranges from 10 to 50, placed randomly within the simulation area. Each simulation was executed for 100 seconds and the network space for each simulation was 1000 m x 1000 m. The table provides a summary of the simulation parameters.

Scenario Name	**Mobility Scenario**	**Speed Scenario**	**Network Size Scenario**
Pause Time (s)	0,1,2,3,4,5	10	25
Max Node Speed (m/s)	10	20,40,60,80	25
Number of mobile Nodes	25	10	5,10,15,20
Simulation Time (s)	100	100	100
Network Space	1000 m x 1000 m	1000 m x 1000 m	1000 m x 1000 m
Radio Range	IEEE 802.11	IEEE 802.11	IEEE 802.11

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MAC protocol	Free space / two-ray	Free space / two-ray	Free space / two-ray
Antenna Model	Omni Antenna	Omni Antenna	Omni Antenna
Maximum number of connections	25	25	25
Traffic Pattern	CBR	CBR	CBR

Table 2. Simulation Parameters of RAAA Protocol

Evaluation of a RAAA protocol

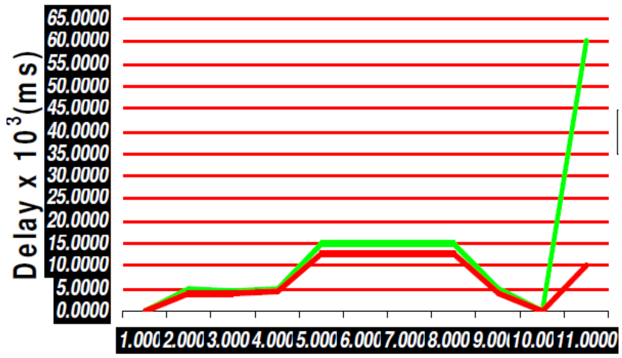
The performance of RAAA protocol is tested with the following performance measurements while routing. In the below X-graph results **the pause time is taken along x-axis.**

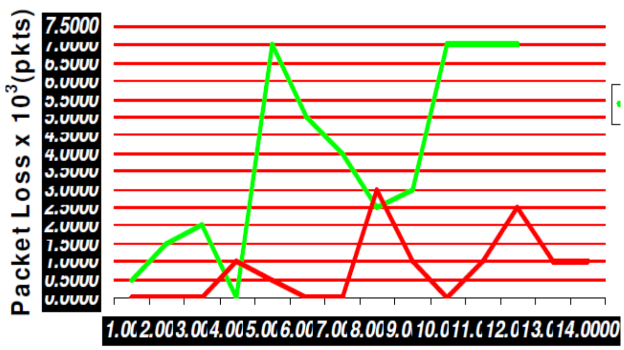
i. Average End to End Delay of Data Packets: The average time from the beginning of a packet transmission at a source node until packet delivery to a destination. This includes delays caused by buffering of data packets during rout discovery, queuing at the interface queue, retransmission delays at a MAC, and propagation and transfer times. Calculate the send (S) time (t) and Receive (R) Time (T) and average it.

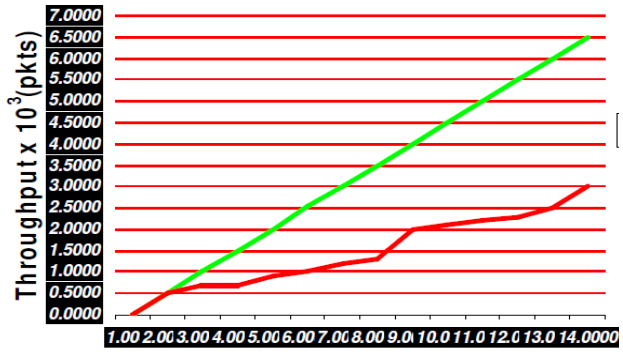
ii. Packet Loss: It is a measure of the number of packets by the routers due to various reasons. The reason we have considered for evaluation are Collisions, Time outs, Looping, Errors.

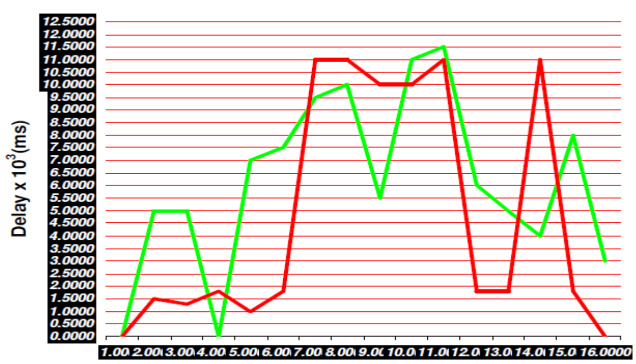
iii. Throughput: It is the number of packets received successfully. In communication networks, such as Ethernet or packet radio, throughput or network throughput is the average rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot.

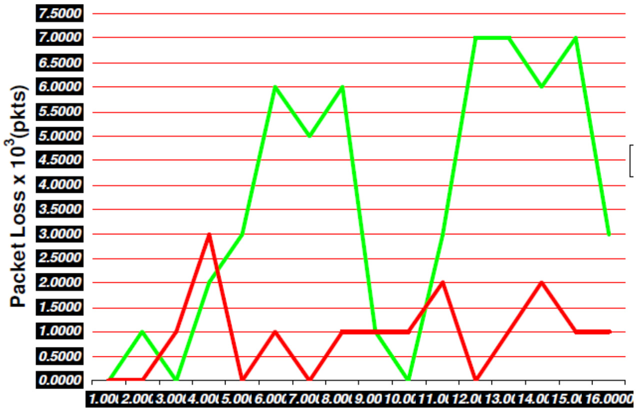
Simulation Results











Conclusions

In the proposed RAAA protocol, the use of RABGR and Ant Search method to select the most robust and long-lived link between each two communicating nodes is investigated. In addition the RAOA considers that the mobile ad hoc networks lack any external source of routing information. Therefore, RAAA can be considered as solution to handle the frequent changes in the network topology due to mobility and to maintain the long-lived multi-hop paths between two communicating node. The proposed multipath routing protocol attains confidentiality of packets in both routing and link layers of MANETs. This paper does the realistic comparison of three protocols namely AODV (unipath routing) and AOMDV (multipath routing) with our newly proposed Reactive (on-demand) multipath routing protocol RAAA. The significant observation is, simulation results agree with expected results based on theoretical analysis. As we expected, our routing protocol RAAA performance is the best considering its ability to maintain connection by periodic exchange of information, which is required for TCP, based traffic. As we know, routing protocol in grid environment is a rather hot concept in computer communications. In future, the RAAA protocol is tested by adding security to it and compared with some other secured protocols in MANET. Also we planned to implement this right angled biased geographical routing method using swarm and honey bee optimization method.

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