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A Proactive QoS Routing Protocol for wireless Ad Hoc Networks

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Abstract: wireless ad-hoc network in case of Multimedia communication retaining demanding quality of services and multimedia applications. These nodes are needded to be synchronization properly for efficient data transmission. Our proposed work focused on QoS routing based proactive rating protocol that deals high rate multimedia services with proper synchronization delay and convergence time measurement. It establish a path in the network that meets QoS requirement by considering the power condition prior to the determination path, delay & convergence time measurements. Simulation results shows that with the propose Proactive or NFPQR protocol provide an efficient synchronization, power & end to end delay along with B.W improvements.

Keywords: QoS routing, NFPQR, delay, convergence time.

I. INTRODUCTION

Wireless ad hoc networks, also called wireless multi-hop networks, are formed by multiple nodes, each possessing a wireless transceiver, communicating amongst them selves. An ad hoc network can be used to exchange information between the nodes and to allow nodes to communicate with remote sites that they otherwise would not have the capability to reach. Wireless ad hoc networks can be either static, e. g. sensor networks, or mobile, e. g. Unmanned Aerial Vehicle (UAV) networks. The most important design criterion for any type of networks is for guaranteeing Quality of Service.

Through puts reached today by Mobile Ad hoc Networks (MANET) [1] enable the execution of complex applications such as multimedia applications (video conference, videophony, etc.). However, these applications consume significant amounts of resources and can suffer from an inefficient and an unfair use of the wireless channel when they coexist with bursty data services. A lot of work has been done to support QoS on the Internet. However, none of these works can be directly used in MANET due to their specifics QoS has become an important issue in various kinds of data networks as some users are no longer satisfied with resource allocation based on service provisioning. QoS measures include bandwidth, delay , delivery guarantee & convergence time. Different classes of traffic (e.g. voice, data, image, video, etc.) have different bandwidth and delay requirements. Many issues of resource allocation for QoS provisioning are discussed in [2],[3]. Therefore, new specific QoS solutions need to be developed taking into account the dynamic nature of ad hoc networks. Since ad hoc networks should deal with the limited radio range and mobility of their nodes, we believe that the best way to offer QoS is to integrate it in routing protocols. Such protocols will have to take into consideration QoS requirements, such as delay or bandwidth constraints, in order to select the adequate routes.

In this paper, we present a complete solution to the QoS routing problem based on a newly designed Proactive QoS routing protocol. This solution consists of tracing routes in a reactive way by taking into account the QoS requirements in terms of power, delay and convergence time associated with each flow.

The rest of the paper is organized as follows: In Section II we briefly describe about routing issue, Section III overall about Proactive routing protocol Section IV routing algorithms Section V simulation result Section VI for conclusion.

II. ROUTING PROTOCOLS

In recent years, the progress of communication technology has made wireless device smaller, less expensive and more powerful. Such rapid technology advance has promoted great growth in mobile devices connected to the Internet. There are two variations of wireless networks: infrastructure networks (as shown in Fig. 1) and ad-hoc networks (as shown in Fig. 2). In infrastructure wireless network, there exists a base station (BS) or an access point (AP) to be the portal of wireless devices. Ad-hoc network [3,5,15] is a self organized, dynamically changing multi-hop network. All mobile nodes in an ad-hoc network are capable of communicating with each other without the aid of any established infrastructure or centralized controller. Each mobile station has a function for routing messages. The routing protocols supported in infrastructure wireless networks are suitable for one-hop wireless transmission.
Many of them cannot be applied directly to the communication in ad-hoc networks because of the characteristics of wireless communication, such as the mobility of wireless nodes. The mobility of wireless nodes will cause the change of network topology. Routing protocols for ad hoc networks can be classified into two categories: (1) Table-driven; and (2) Source initiated on-demand. Table-driven protocols attempt to maintain consistent, up-to-date routing information among all nodes in the network. Table-driven algorithms require periodic route-update messages to propagate throughout the network. This can cause substantial overhead (due to the "route information" traffic) affecting bandwidth utilization, throughput as well as power usage. The advantage is that routes to any destination are always available without the

overhead of a route discovery. In contrast, in On-demand routing, the source must wait until a route has been discovered, but the traffic overhead is less than Table-driven algorithms where many of the updates are for unused paths. Thus, there is a tradeoff between the overhead for maintaining paths and the time for establishing and mending paths.

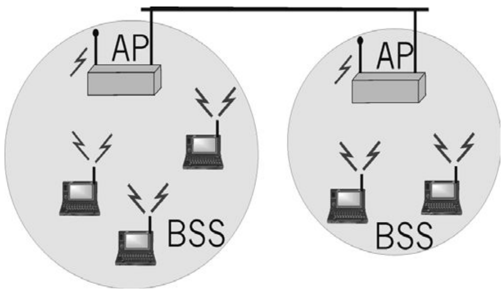


Fig. 1. Infrastructure network

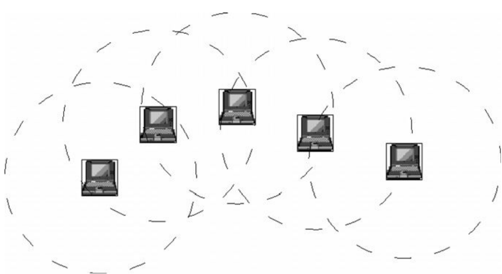


Fig. 2. An ad-hoc network.

A. Routing in Mobile Ad hoc Networks

Routing in mobile ad hoc networks faces additional problems and challenges when compared to routing in traditional wired networks with fixed infrastructure. There are several well-known protocols in the literature that have been specifically developed to cope with the limitations imposed by ad hoc networking environments. The problem of routing in such environments is aggravated by limiting factors such as rapidly changing topologies, high power consumption, low bandwidth and high error rates [2]. Most of the existing routing protocols follow two different design approaches to confront the inherent characteristics of ad hoc networks, namely the *table-driven* and the *source-initiated on-demand* approaches. The following sections analyze in more detail these two design approaches, and briefly present example protocols that are based on them. Such an introduction is necessary since most of the secure protocols presented in Section 4 are built on top of existing ad hoc routing protocols.

III. PROPOSED ROUTING PROTOCOL FOR AD HOC NETWORK

."**Reactive Routing**" is any scheme where routing information is gathered only on demand. In such schemes, a route is discovered only when needed, and thus routing management traffic is kept to its bare minimum. Reactive schemes have been most popular to date, since they minimize the route management traffic
Overheads.

Proactive Routing" is any scheme which continuously monitors the topology and maintains current routing tables regardless of instantaneous demand. DV and LS schemes fall into this category. While routing information is always available for a sender, the network is being continuously flooded with routing management traffic, much of which is unused

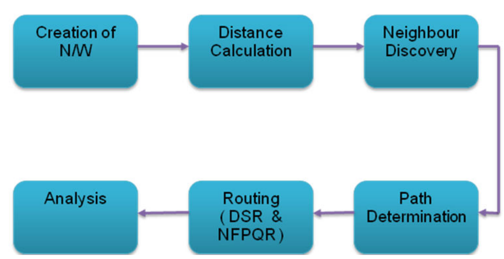
In general there may be several different routes from one node to another node.
If a node receives a packet address to a directly connected node it will simply pass it to appropriate link to driver software. If a node receives a packet addressed to a node that it has no direct connection it must solve the "routing problem" to determine which node to send it to.

ROUTING PRINCIPLE

- The network layer must determine the path, that the packets are to follow.
- Whether the network layer provides the datagram service all packets between given source and destination
- In the above network node A may route a packet address to Y to either node B or to node D.
- The selection of which node to route the packet to is the routing decision.

The routing decision is incorporated by the algorithm used in packet switching exchange (pse) software.

IMPLEMENTATION



BLOCK DIAGRAM

DISCRIMINATION

- CREATION OF THE NETWORK
- DISTANCE CALCULATION
- NEIBHOUR DISCOVERY
- PATH DETERMINATION
- ROUTING (DSR&NFPQR)
- ANALYSIS

A. Creation of the Network

- Creating a network by entering the number of nodes.
- we use a random permutation to generate x and y coordinates of each node.
- We also assign the id numbers and power levels for each node which can be used future applications

B. Distance Calculation

- we find the distance between each node to all other nodes by using
  Euclidean distance method
  d=sqrt ((x1-x2)^2+(y1-y2)^2).
- Then a Distance matrix is formed
  ex:

1	3	2
2	1	3
3	2	1

C. Neighbor Discover

- In order to maximize the quality of service, we use the threshold value in order to find the neighbour list of each node.
- We group all these neighbouring lists into a cell matrix which can be used for path determination.
  ex:[1 4 5]

D. Path Determination

We use the neighboring list in order to find the path between each source and destination using

1. DSR routing protocols
2. NFPQR routing protocols.

In DSR it takes distance metric into consideration to find the optimal path.

In NFPQR routing protocol which predicts whether a node will be failed in the near future or not. Based on this an optimal path can be found.

E. Routing (DSR&NFPQR)

1. *DSR ROUTING PROTOCOLS:* This function is used to determine the path in Dynamic Source Routing algorithm. Here its checks for the best optimal path from the various paths obtained in the evaluation of route.
2. *NFPQR ROUTING PROTOCOLS:* This function is used to determine the path in Node Failure Prediction QoS Routing algorithm.

Here the optimal path which satisfies the power conditions is selected from the various paths obtained in the evaluation of route.

IV. ALGORITHM FOR NFPQR

NODE FAILURE PREDICTION QoS ROUTING PROTOCOL

NFPQR calculates the future condition of a node to make it as next relay node in the path discovery. The estimation of future condition of a node depends on the power level of the node at a particular time.

In order to solve the problem due to node failure and to support QoS, we propose a new method, which predicts whether a node will be failed in near future or not. Before the up stream node is selected as a router to forward the packets, the downstream node predicts whether the upstream node will be failed in the near future or not. The heuristic we use here is based on the power levels in the battery power are consumed during communication and processing or computing. Communication power is much higher than the computing power.

In Communication , the transmission power & the power needed to transmit a packet is much higher than others like receiving power, idle power etc. If transmission power is Ct and overhead energy is C0, then the total power needed to transmit the entire buffer is

(Bf* Ct/Ps)+C0

Here Bf is buffer capacity and Ps is packet size.

The threshold power level is based on the packet size, buffer capacity and the packet transfer rate of the node. If t1 is the present time, than the maximum power consumption at a particular node after time t2 is given as

P12= (t2-t1). (tr .Ct+C0)

Here tr is the maximum packet transfer rate of a node.

If Tp is the total battery power to the node initially than our experimental results show that the threshold value about 0:1xTp is desirable that is the down speed node checks whether the up stream node is having power level at least 10% of the total battery power. If the node is having power level more than the threshold, than it is selected as a router otherwise the down stream node will not select this node as a router and the process is repeated with other neighbor nodes. This method also increases the life of the network.

When node j receives a route request message (RREQ in AODV) from node i, than node j predicts its future conditions by considering power level of node j. If its power level is above the threshold, that is the power level is above the initial power given (0:1xTr) than the node j will forward this RREQ to next hop, otherwise it will drop the route request message. The same procedure is repeater for all the nodes till the destination node is reached.

In NFPQR algorithm, more stable paths are found during route discovery. Here the stable path means the packets, which traverse on these paths, will not experience long delays and improves the delivery ratio also. NFPQR increases the network life time of the MANET.

V. SIMULATION ANALYSIS RESULTS

An analysis is made by comparing both the DSR and NFPQR routing protocols

1. Convergence time,
2. Delay
3. Power levels at each node

NFPQR has an advantage of

1. Good convergence time,
2. Less delay
3. Better node power levels
4. Hop-node performance than DSR

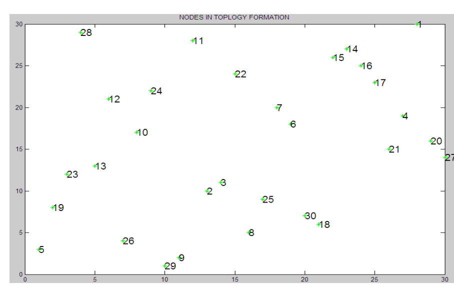


Fig3: Creation Of The Random Ad hoc network

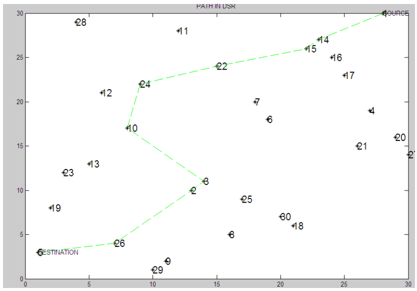


Fig4: Selecting The route according to DSR protocol

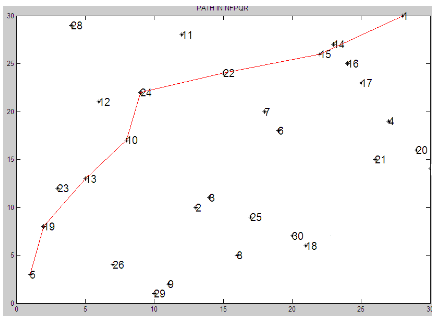


Fig5: Route of low power nodes by using NFPQR protocol

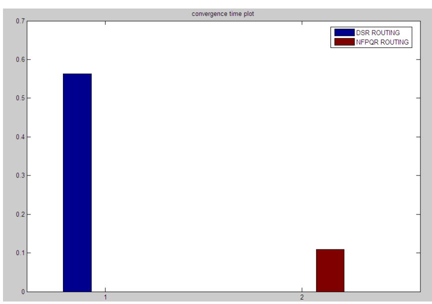


Fig6: Analysis between the DSR and NFPQR routing protocol

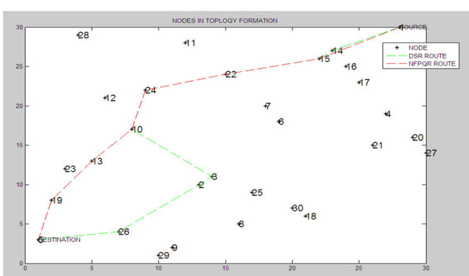


Fig7: NFPQR & DSR protocol applied on the random network for route selection

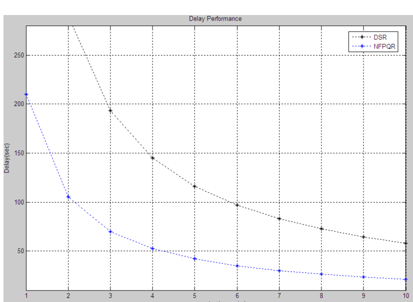


Fig8: Graph between Communication VS delay

VI. CONCLUSION

In this paper we have proposed NFPQR protocol for random Ad hoc network has been evaluated and compared for QoS parameters such as power consumption, convergence time. To analyze the performance and average load density random Ad hoc network with 30 nodes is considered for simulations. The power level of each node and respective geographical position is randomly defined in the network. Simulations have been run for 3 seconds considering almost no mobility of nodes during routing and communication.

Rout selection and communication has been performed by all the protocols individually in accordance with the respective algorithms. Our proposed protocol after evolution of simulation result shows better QoS routing provided through NFPQR protocol in terms of synchronization delay and convergence time measurement.

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