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IMPROVED NODE FAILURE PREDICTION QOS ROUTING PROTOCOL WITH CLASSIFIED POWER LEVELS

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ABSTRACT
The nodes in ad hoc wireless networks or sensor networks have limited power capabilities and are prone to failure due to lack of battery power leading to frequent path breaks ,network partitions & packet losses thereby resulting in the decrease of network throughput. In this paper , we propose a new routing algorithm called node failure prediction QoS routing with classified power level(NFPQRCL) protocol, which improves the different QoS parameters such as end-to-end packet delay and the packet loss along the path. The algorithm NFPQRCL predicts the future state of a node based on its power level to decide whether the node is a good selection as a router or not .Power considerations at each of the network nodes helps in efficient utilization and saving of battery power. In this algorithm, more stable paths are selected during the route discovery process and hence QoS routing parameter could be satisfied.

Key words: protocol, QoS, wireless network.

INTRODUCTION

Mobile ad hoc networks (MANETs) consist of wireless hosts that communicate with each other in the absence of fixed infrastructure. Mobile ad hoc networks present many application areas such as military, environment, health, home, and commercial applications. Most of these applications require different levels of quality and place additional demands on the network. The resource, power limitations and variability further add to the need for QoS provisioning in MANETs. The resource, power limitations and variability further add to the need for QoS provisioning in MANETs .The important QoS parameters are bandwidth, delay, jitter and packet loss.

The node failure in the network leads to different problems such as network topology changes, network partitions, possibly packet losses and low signal quality. The nodes in ad hoc wireless network do not have any restrictions on mobility, which will make the topology of the network changes frequently and unpredictably. A limited bandwidth resource is usually shared among adjacent nodes due to the wireless medium. Hence the admitted QoS sessions may suffer due to frequent path breaks

Design of routing protocol is crucial problem in mobile ad hoc networks and several routing algorithms have been developed. Most of the proposed routing protocols differ in approach used for searching a new route and/or modifying a new route with no attempt to provide any quality of service (QoS) requirement. Routing messages in such routes may not be adequate for application that requires QoS support for routes with sufficient resources in order to satisfy the QoS requirements of flow. The primary goal of the QoS aware routing protocols is to determine a path from source to the destination that satisfies the needs of the desired QoS. The QoS aware path is determined with the constraints such as end-to -end delay, available bandwidth, probabilty of packet loss, etc. When a node has failed or has insufficient battery power levels, the established routes are susceptible to the link failures or decrease of throughput. Therefore, throughput or delay bounds are hard to guarantee .Some researchers have proposed the notion of soft QoS. Soft QoS means that after the connection is setup, there may exist transient periods of time when QoS specification is not honored.

In wireless ad hoc network the devices are dependent on finite battery sources. Once the battery power is consumed, the device will go down i.e the device is considered as under-failure. A prediction on node failure helps us in providing better QoS routing for ad hoc and/or sensor networks.

RELATED WORK

Quality of Service is a set of service requirements provided to certain traffic by the network to meet the satisfaction of the user of that traffic. It has been studied and investigated by different researchers and several proposals have been published to address how the QoS can be supported in MANETs. Nevertheless, QoS routing support in MANET still remains as an open problem. In this section, we discuss about the related work and compare them with our work .The dynamic nature of mobile ad hoc network, not only makes the routing fundamentally different from fixed networks, but also its QoS support.

NFPQR algorithm proposed as a QoS routing protocol deals with the prediction of node failure by estimating the future power level of a node but does not accounts for the specific power level at each of the node & has no provision for reactivating the nodes. Ignoring these factors might result in the decrease of network lifetime .This paper addresses a new algorithm called Node Failure prediction QoS routing protocol with classified power levels(NFPQRCL) that predicts the future state of a node with special considerations for power levels. This can guarantee selection of more stable paths during route discovery & ultimately increase in the network lifetime.

NFPQRCL

NFPQRCL 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. This method selects a path such that the nodes with depleted energy will not lie on the path. It also increases the network lifetime. This approximation may not be applicable for all the cases. The node failure may occur due to some other reasons like environmental influences, unexpected accidental events etc which are not considered here.

A. POWER LEVELS

Power is consumed during communication and processing or computing.

Communication power is much higher than computing power.

Communication power: - includes transmission and receiving power. The transmission power, the power needed to transmit a packet is much higher than receiving power. The total power needed to transmit the entire buffer is

$$P=(B_f.C_t/P_s)+C_0$$

B_f : Buffer capacity

P_s:packet size

C_t:transmission power

C_o:Overhead energy(the energy dissipated during transfer at each node)

Computing power: If t_1 is the present time,then the maximum power consumption at a particular node after time t_2 is

$$P_{12}=(t_2-t_1).(t_r.C_t+C_o)$$

t_r:maximum packet transfer rate of a node

THRESHOLD LEVEL

The threshold power level is based on the packet size,buffer capacity and the packet transfer rate of the node.

The threshold level for each of the following nodes is :

Source: power needed at the source node is

$$P(source)=Tr+cal_s$$

Tr=transmission power

cal_s=processing power at the source node

Destination: $P(dest)=Rr+cal_D$

Rr=receiving power

cal_D=processing power at the destination node

Intermediate:$P(intm)=Tr+Rr+cal_{in}$

Cal_{in}=processing power at the intermediate node

It can be inferred that $cal_{in}>cal_s$ or cal_D

If Tp is the total battery power given to the node initially then a threshold value of 0.1*Tp is desirable for intermediate nodes and 0.07*Tp is desirable for source and destination nodes.

B. NFPQRCL algorithm

When node j receives a route request message (RREQ in AODV) from node i, then node i predicts the future condition of node j by considering power level of node j. If its power level is above threshold then node i will forward this RREQ to j otherwise node i will not select this node as a router and the process is repeated with other neighboring nodes.

The number of nodes whose power is below threshold are considered as inactive or dump nodes. If A is the average number of dump nodes and B denotes the number of nodes that were reactivated either by recharging or replacing or replenishing (through solar energy etc) the battery. Then B must always be greater than A.

The algorithm also determines the percentage number of reactivated nodes based on the probability of recharging the node.

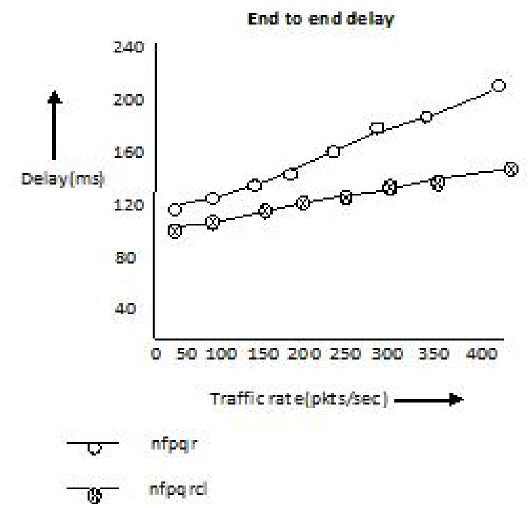
In NFPQRCL algorithm more stable paths are found during route discovery. Here stable path means the packets which traverse on these paths will not experience long delays and improves the delivery ratio.

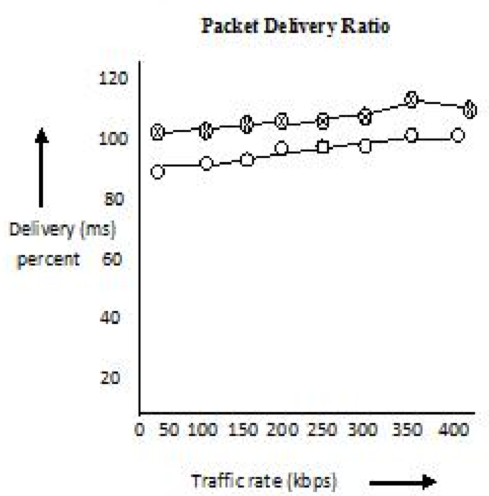
SIMULATION

We evaluate the proposed NFPQRCL algorithm through simulation experiments in comparison with the NFPQR protocol.Network simulator (version ns-3) is used to simulate the proposed algorithm. The constants and parameters of the simulation are given in the Table. The performance of NFPQRCL is compared with the NFPQR using the simulator trace outputs. The end to end delay, packet delivery ratio metrics have been considered to evaluate the performance of NFPQRCL. As shown in the fig. the proposed algorithm has greater packet delivery ratio compared to NFPQR because NFPQRCL finds stable paths which do not contain weak links between the nodes and each node is able to provide sufficient signal power for the communication during data transmission.

Simulation Parameters

Field Space	800*800
Number of nodes	50
Max node speed	1-8m/s
Node mobility	Random way point
Simulation time	250
CBR packet delivery ratio	50/s to 500/s
MAC layer type	IEEE 802.11
Transmission range	200m
CBR packet size	256 bytes
Initial power	100





RESULT

Simulation results show the efficiency of the proposed algorithm. The QoS routing is ensured particularly in terms of end to end delay and packet loss. The end to end delay is achieved through the more stable paths selected during the route discovery. The proposed algorithm has greater packet delivery ratio compared to NFPQR because NFPQRCL finds stable paths which do not contain weak links between the nodes.

CONCLUSION

In this paper we discussed the need for future state prediction of nodes to provide better QoS routing. This prediction heuristic is used to select a node as the next relay node during the route discovery process. The QoS routing is ensured particularly in terms of end to end delay and packet loss. The end to end delay is achieved through the more stable paths selected during the route discovery. NFPQRCL not only selects stable paths but also distributes load sharing and increases network lifetime.

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