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ANALYZING THE PERFORMANCE OF MANET ROUTING PROTOCOLS BASED ON EVALUATION OF DIFFERENT PARAMETERS

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ABSTRACT

Manet is a self-configuring network with set of independent nodes. Since the wireless network interfaces are limited by its transmission range, multiple hops are needed to transmit data within the network for which a routing protocol is needed. Efficient route establishment is the primary goal of such routing protocols. The main contribution of this paper is to examine two mobile ad-hoc networks reactive routing protocols NCPR and the proposed LPNS and evaluate them based on packet delivery ratio and delay in varying network size, mobility speed and packet size. The simulation is performed using the Network Simulator (NS-2).

KEYWORDS: *Manet Routing, NCPR, LPNS, Delay, Packet Delivery Ratio, Mobility Speed*

INTRODUCTION

Nodes in MANET communicate with each other without any fixed infra structure [6]. They have the capability of entering or leaving the network at any time [1]. Due to such wireless nature, routing protocol should be designed in such a way that it should be more efficient and reliable. The proposed LPNS protocol which enhanced the selection of loyal neighbour node to construct the stable path and to reduce the retransmission of packets has been compared with NCPR protocol. LPNS improves the life time of the network by stable path construction and reduction of overhead and delay. With the idea of Zhang et. Al [2] who proposed neighbourhood transmission based probabilistic re-transmission protocol, the transmission delay is also considered which forms as a base for LPNS protocol. Also considering the remaining energy in the proposed work ensures the increase in network life time.

ROUTING PROTOCOLS UNDER CONSIDERATION

Neighbour Coverage Based Probabilistic Rebroadcast (NCPR) Protocol

In NCPR Protocol, rebroadcast delay which is used to determine the forwarding order is calculated. The node has lower delay, if it has more common neighbours with the previous node [3]. If the node with lower rebroadcast delay rebroadcasts a packet, it's reached to more neighbours which tend to be the key success for the proposed LPNS Protocol [4]. It also considers connectivity metric, uncovered neighbours, local node density. Here the additional coverage ratio which is ratio between the numbers of nodes that should be covered by a single broadcast to the total number of neighbours is calculated. Also, the relationship between the network connectivity and the neighbours of a node is represented by connectivity factor. Based on additional coverage ratio and connectivity factor, rebroadcast probability is calculated. Here the number of retransmission is reduced which improves the routing performance [5].

Loyalty Pair Neighbor Selection based Adaptive Routing Retransmission (LPNS) Protocol

In the proposed LPNS protocol, the routes are established through a set of loyal pairs. Here each node has info list which maintains the current queue (Q_s) and residual energy (E_r) values of the neighbor node by exchanging hello message. The initial values of E_r and Q_s are empty. The nodes in the network renew its info list during every RREQ packet. Next, the power value is calculated through which remaining power is achieved. Based on the threshold value, the nodes are classified in to low power nodes and high power nodes. The nodes with high power and more queue size is considered as loyal pair to form neighbor set[5]. Next the loyal pair set is revised and sorted by considering the angle, direction and mobility, difference in receiving signal strength of those nodes. Now RREQ Packet is transmitted by enclosing the loyal neighbours in it. Then the retransmission delay and retransmission probability which decides the order of transmission is calculated for those sorted nodes. Because of the fact that transmission of RREQ updates neighbours till the data packets are delivered, LPNS do not use repeated hello packets. After receiving RREP from destination, routing table is being updated.

SIMULATION ENVIRONMENT

Our proposed LPNS protocol is evaluated against NCPR protocol on NS2, popular simulator software that simulates both wired and wireless network systems. Table 1 shows the simulation parameters. The performances of both the routing protocols are evaluated under the various mobility speeds, increase in network size and various packet sizes.

Table 1: Simulation Parameters

Simulation Parameter	Value
Simulator	NS-2.34
Topology size	500 m X 500 m
Number of Nodes	50,60,70,80,90,100
Mobility	Random way point
Transmission range	250 m
Bandwidth	2 Mbps
Interface queue length	50
Traffic type	CBR
Number of CBR Traffic	2,4,6,8,10
Packet Size	512 bytes
Node speed	1,2,3,4,5

PERFORMANCE METRICS

The following most important performance metrics are evaluated.

***End-End Delay*:** The delay of a packet is nothing but the time taken by the packet to reach the destination after it is generated at the source.

***Packet Delivery Ratio*:** It is nothing but the ratio between the packets received at the destination and the packets generated by the source.

SIMULATION RESULTS

The graphs that are shown below is the comparison of existing NCPR protocol with the proposed LPNS protocol. It brings out certain characteristic differences between them.

Performance with Varying Network Size

Table 2 shows the packet delivery ratio and delay for varying nodes. Here the nodes are varied from 50 to 100. Fig (1) clearly shows that LPNS probably delivers 98% to 100 % of packets at all cases but NCPR does poorly at certain cases. Fig (2) gives a clear picture to decide that LPNS has less delay than NCPR.

Table 2: PDR and Delay for Varying Network Size

Nodes	PDR (%)		Delay(s)	
	LPNS	NCPR	LPNS	NCPR
50	99.6700	97.1212	0.04487	1.02635
60	97.9412	91.4706	0.09789	1.72907
70	99.2000	98.6000	0.8096	1.85941
80	99.0000	95.8000	0.05219	1.6725
90	99.8148	97.7778	0.15256	1.93327
100	99.2481	95.4887	0.6864	1.62184

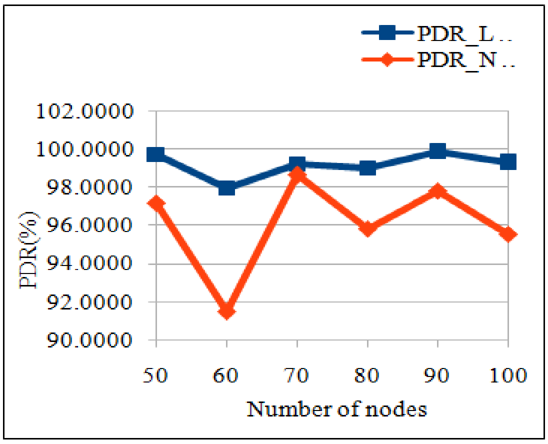

Figure 1: Number of Nodes vs PDR

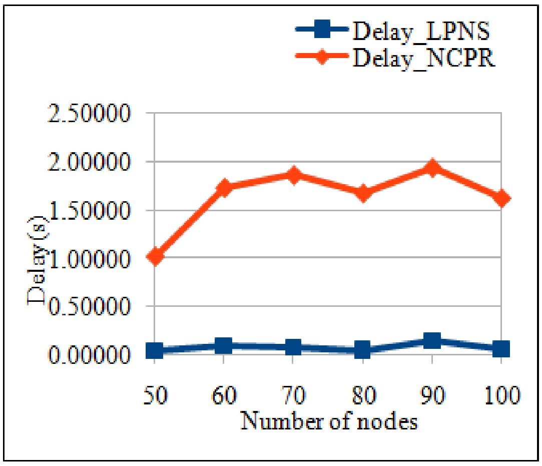

Figure 2: Number of Nodes vs Delay

Performance with Varying Mobility Speed

Table 3 shows the packet delivery ratio and delay for varying mobility speed. According to the given movement in the scenario, all nodes move till the simulation time ends. The simulation result in Fig (3) delivers that even when the mobility of node increases LPNS achieves 99 – 100 % of PDR which is not in the case of NCPR. Fig (4) clearly concludes that LPNS has delay than NCPR.

Table 3: PDR and Delay for Varying Mobility Speed

Speed (m/s)	PDR (%)		Delay(s)	
	LPNS	NCPR	LPNS	NCPR
1	99.6241	91.9173	0.05848	2.04965
2	99.4361	98.1203	0.09631	1.58254
3	99.7312	97.5806	0.5273	1.65959
4	99.4361	98.3083	0.07519	1.69426
5	98.9899	97.5564	0.06342	0.88856

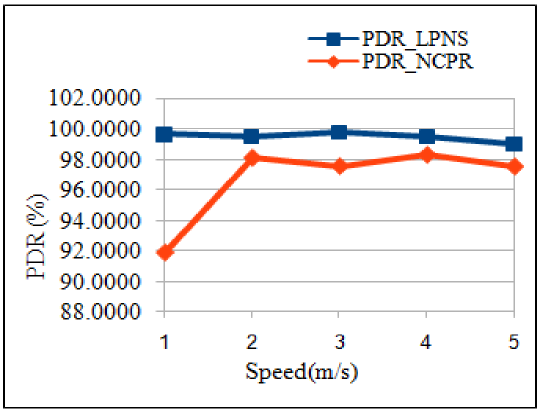

Figure 3: Speed vs PDR

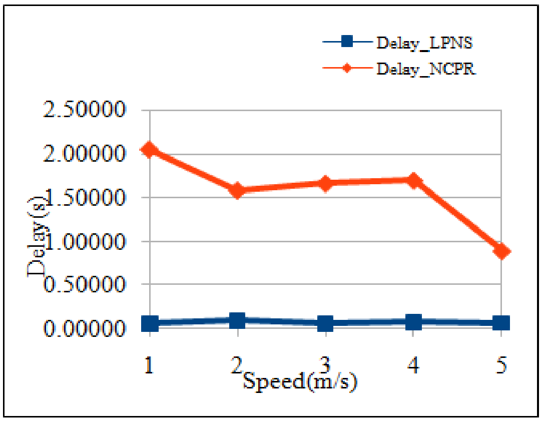

Figure 4: Speed vs Delay

Performance with Varying Packet Size

Table 4 shows the packet delivery ratio for varying packet size. Fig (3) carves out a clear conclusion that even in increase in packet size, PDR is high in LPNS than NCPR.

Table 4: PDR and Delay for Varying Packet Size

Packet Size (Bytes)	PDR (%)		Delay(s)	
	LPNS	NCPR	LPNS	NCPR
600	99.8788	98.5455	0.04885	1.02012
800	98.4979	97.3333	0.7718	0.97479
1000	99.7433	97.3333	0.6169	1.04666
1200	99.7576	97.8182	0.06082	1.11141

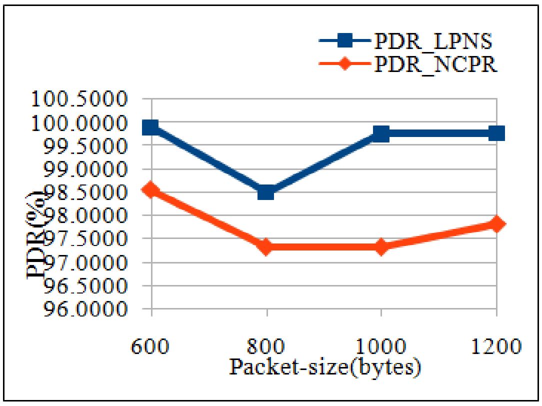

Figure 5: Packet Size vs PDR

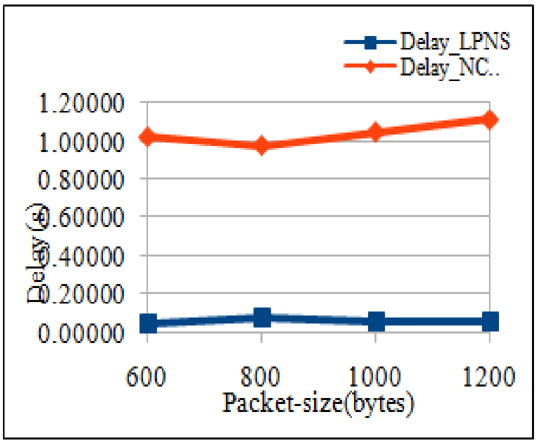

Figure 6: Packet Size vs Delay

CONCLUSIONS AND FUTURE WORK

It can be summarized that there is no single protocol that performs superior in all cases. The choice of choosing an appropriate protocol depends on the intention of the research work to be done. Here NCPR is considered, because the neighbour coverage matters a lot which indeed forms as a base for the proposed LPNS. After evaluating the two Manet routing protocols NCPR and LPNS, from the above table and graph, we clearly conclude that LPNS outperforms NCPR in the PDR and delay. The proposed work results only in minimizing the impact of network topology and control overhead. Here, the power reduction or energy improvement techniques are not taken into account. The future work is to enhance the proposed LPNS protocol's loyal neighbour selection by cuckoo search algorithm [7].

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