# Minimizing End to End Delay by Power Aware Routing in Wireless Mobile Adhoc Network

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**Abstract-** In this paper, we proposed an algorithm for joint power control and routing, along with cross layer interactions in wireless ad-hoc networks. The performance analysis expects that there will be a better improvement in end to end delay with this algorithm compared to existing DSR algorithm. To use congestion information in routing protocol DSR, we can modify the Routing Discovery mechanism. When an intermediate node receives a Route Request packet that is not directed to it, it then checks the congestion metrics. If the congestion metrics are higher than some thresholds, that indicates high level congestion around the node. The cross-layer design approach is the most relevant concept in wireless mobile ad hoc networks which is adopted to solve several open issue.

***Keywords*** -- Cross Layer, End to End delay, path loss, DSR

## I. INTRODUCTION

In a Multihop wireless ad hoc network, mobile nodes cooperate to form a network without the use of any infrastructure such as access points or base stations. The mobile nodes, instead, forward packets for each other, allowing nodes beyond direct wireless transmission range of each other to communicate.

The mobility of the nodes and the fundamentally limited capacity of the wireless medium, together with wireless transmission effects such as attenuation, multipath propagation, and interference, combine to create significant challenges for network protocols operating in an ad hoc network. It is observed that it is also possible to provide an awareness of congestion at each node in order to avoid bottleneck regions with high link utilizations[1].The Cross-layer design [3], approaches the most relevant concept in wireless mobile ad hoc networks which is adopted to solve several open issues. Further many Ad hoc wireless nodes are powered by batteries with limited life time. Power constraints impact the signal processing and transmission of all nodes as well as network life time. So power conservation is the key requirement in the design of ad hoc network. Power conservation requires a cross layer design and power control has significant impact up on the protocol above the Physical layer. Therefore power control will play a key role in the development of efficient cross layer networking protocols. Thus, it makes sense to devise metrics that account for congestion, and power control in a combined manner.

## II ESTIMATIMG PROBABILITY OF CONTENTION

The bandwidth measurement technique [11] is triggered by the source node by sending a search packet to the destination, there by starting the measurement process. On receiving the search packet sent by the source, the destination will send a series of back to back search packets on all paths to the source node.. These packets which are transmitted along all paths from the sender to receiver will produce gaps between them. These gaps are measured at the receiver side. When sending search packets from a sender to receiver, some packets will be dropped if the medium is congested or busy. So at the receiver side, some search packets may not be received thus varying the gaps between the packets. By sending multiple search packets simultaneously, the receiver node can produce the raw gaps between the received packets, though some search packets are lost. Moreover the information about the lost search packets will be used for the process of bandwidth estimation.

## III. ESTIMATION OF BANDWIDTH IN 802.11

In the rate-based congestion control algorithm [2],[8],. the sender has to send the RTS packet to the next hop, to successfully send the first search packet p1 . When a node receives the RTS packet, it will reply with the CTS to the sender. The sender will then send the search packet and the next hop node will send the ACK to acknowledge that the search packet has been received successfully [12]. The second search packet p2 is sent followed by a delay Tdelay1, represented in terms of the channel busyness ratio (Rb) [9]. Channel busyness ratio (Rb) is the channel busyness ratio which represents the interference level. It is defined as the ratio of time intervals when the channel is busy due to successful transmission or collision to the total time. (ie) Tdelay1 = Rb, So the gap between p1 and p2 at hop1 is calculated as

G1 = Trts + Tcts + Ts + Tack + Tdelay1 (1)

Where Trts ,Tcts , Ts and Tack are the time to transmit the RTS,CTS, Search and ACK packets respectively. Tdelay1 is the channel busyness ratio athop 1. In the best case scenario, where there is no contention at the medium,. Tdelay1 = 0 So (1) can be modified as

Gb = Trts + Tcts + Ts + Tack (2)

If Tdelay1 is high, then the available bandwidth for sender node is small and if Tdelay1 is low, then the available bandwidth is more.
The probe packets are forwarded by all the intermediate nodes towards the receiver.
The gap between the search packets p1 and p2 is calculated at hop2 as

G2 = Trts + Tcts + Ts + Tack + (Tdelay1 + Tdelay2) (3)

Where Tdelay2 is the contention at hop 2.
Similarly the gap can be calculated for all the hops.
At the receiver, the gap is measured as

Gr = Trts + Tcts + Ts+ Tack + (Tdelay1 + Tdelay2 +….+ Tdelayr −1) (4)

Now the available bandwidth Abw is calculated as

Abw = (Gb /Gr ) B (5)

Where B is the maximum bandwidth available

The bandwidth measurement technique is implemented on any multi path routing protocol, which establishes multiple disjoint paths between a source and destination. We have used the Adhoc On demand PDSR (Power DSR) protocol as the multipath on demand routing protocol [10 ].
Let P1, P2 ,… Pn be the multiple disjoint paths established by the routing protocol. Then using the bandwidth estimation method described in the previous section, the available bandwidth Abw1, Abw2 ,.., Abwn can be calculated by the source, for each path P1, P2 ,L, Pn , respectively. Then the source selects the paths Pj ( j < n), such that Abwj > Rbw, where Rbw is the requested bandwidth.

## IV. POWER DSR ROUTING PROTOCOL

A new Power controlled DSR (PDSR) is proposed by modifying the existing DSR protocol [10] The changes are needed in the route discovery phase of DSR algorithm [6],[7]. The RREP packet is send to the particular source with the transmission power in its header along with the route. Upon receiving the RREP packet, the source node measures the received power of the RREP packet and collects the transmitted power of the RREP packet that is piggybacked in the same packet. Then the source node calculates the pathloss of the RREP packet and calculates its required minimum transmission power using the receiver threshold (minimum power required for the receiver to detect the signal). The receiver threshold along with the path loss gives the optimum power required for transmission at MAC layer.

### Algorithm

The RREP packet is sent to a particular source with the transmission power in its header along with the route. Upon receiving the RREP packet and if the node is intended source-

1. Received power of the RREP packet is measured.

2. The transmitted power of the RREP packet that is piggybacked in the same packet is collected

3. Then the node calculates the pathloss of the packet using: Pathloss = Tx power – Rx power.

4. Then the node calculates its required minimum transmission power using the receiver threshold. The receiver threshold along with the path loss gives the optimum power required for transmission at MAC layer. Required Min Tx Power = Path loss + Receiver Threshold

5. This Min Tx Power calculated at routing layer is directly passed to MAC layer where the node can transmit control packets (RPTS/APTS) and data packets to the destination with this reduced Tx Power.

## V. CONCLUSION

In this paper, we proposed an algorithm for joint power control and routing, PDSR, along with cross layer interactions in wireless ad-hoc networks. The performance analysis expects that there is a better improvement with this algorithm compared to existing DSR algorithm.

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