An Efficient Design of Cross Layer Design for Power Control andLink Availability

Bagadi Siddarth[1]

[1] Lecturer in CSE Dept, JNTU-Hyderabad ,Telangana, India.

Abstract: Basic alterations in network topology due to mobility and constrained the battery power of the mobile devices are the key challenges within the mobile ad-hoc networks. The depletion of the power supply may rationale early unavailability of nodes and therefore links in the network. The mobility of nodes factors, general route breaks and adversely impacts the specified performance of the applications. We've got to proposea cross-layer design for power control and link availability prediction (DPCPLP) in mobilead-hoc networks that provide a mixed solution for energy conservation as well as link availability. The simulation results show that the proposed cross-layer design improves the throughput, packet delivery ratio by means of prior prediction of link breaks and initiating the route restore. It also reduces usual communication interruption time, routing overheads, end-to-end delay, and energy consumption. For that reason, this suggests that the proposed cross-layer design raises network and nodes' lifetime and ability.

Keywords-cross-layer, routing, AODV, MANET

I. INTRODUCTION

A mobile ad-hoc network (MANET) is a self-configuringinfrastructure-much less network of cellular devices linkedby means of wireless hyperlinks. Ad-hoc is Latin and method "for thispurpose". Mobile ad Hoc Networks (MANETs) hasmerged as one of the vital everyday areas of study in therecent years on the grounds that of the challenges it poses to theassociated protocols. MANET is the new emerging technology, which makes it possible for customers to keep up a correspondence withoutany bodily infrastructure in spite of their geographicalplace, that's why it's oftentimes referred to as an"infrastructure much less" community.

In mobile adhoc networks the nodes in addition contribute in routing distribution belong to other nodes of thenetwork. These two-way environments of the network have many merits in addition to demerits also. The on themobility of the nodes, not approximating other networks in a way which is exposed between any dispatcher andreceiver may or possibly will not be existing after positive occasion which causes an association crash among anytwo nodes. Because of the association of any node, the particular node will not be in attendance in the reporting of a forward node which causes link failure.

The attendance of connection collapse will not be known to the sender node and the sender will decide the path and forward the communication.At one stage there will be association failure and the forward node tries todiscover a few other ways. Otherwise, it will be acknowledged to the dispatcher as not available; at this timethe foundations have to procedure route particular again and process the similar again and again. Severaldirection-finding protocol studies are based on node lifetime and link lifetime.

II. BACKGROUND WORK

With the intention beingmobile, untethered connectivity using wireless interfaces needs to be a present with each node within the network. In general, mobile nodes are determined by battery energy for their operations. It is fascinating to cut back the energy consumption in these nodes. Further, this difficulty is foremost as-as soon as the battery of the node is exhausted, it cannot transmit as well as acquire any information. It has died to outcome in an influence on network connectivity considering that in ad-hoc networks, even intermediate nodes are important to maintain connectivity. As quickly as some of the intermediate nodes die, the entire link must be formed again. This leads to a large quantity of delay, waste of uncommon node resources like battery power, thereby obstructing the throughput of the whole approach. Extra, mobility grants the challenges in the form of always variable topology and as a result requiring an intricate and energy efficient routing mechanism. Wireless networks might be used typically via personal conversation instruments which humans can lift with them. These small, at all times linked personal devices will result in new functions. For jogging a lot of these applications on resource-constrained instruments, one wishes efficient networking stack in the mobile devices. Conventionally, to simplify the complex mission of handling community connectivity, layered architecture had been used. To further strengthen the performance, the inspiration of layered software, accessories is now being broken through also enabling lawyers to entry data constructions of non-instantaneous layers. This method is popularly referred to as move-layer optimization. Exceptions of service in MANETs will indicate assured the supply of packets similar to the distinct flows at the greater precedence to be able to satisfy loss and delay performance necessities. In MANETs, node capabilities utilizing ultimate battery energy, availability of which can range broadly throughout the nodes. The nodes may be mobile, for that reason the links in the most fulfilling courses from the source to the destination could wreck either due to mobility or much less battery power. Therefore delivering QoS guarantees with highly unreliable links, want speedy and even proactive routing recovery, along with transport and application layer optimization, which can even earlier than the cross link failure in the end happens. For this reason, the measurements at the data link layer and MAC layer have got to be used on the network, transport and application layers to restrict wastage of transmitting power as a result of transmission of data frames which are no need due to link failure.

III. METHDOLOGY OF DESIGN FOR POWER CONTROL ANDLINK AVAILABILITY

We simulated an AODV routing protocol, AODV with link prediction (AODVLP) anddynamic power control protocol with link prediction (DPCPLP) using NS-2. In thesimulations, There is a variation in the 3 parameters – node velocity, network load (rate ofgeneration of packets) and number of nodes in a given area. The complete simulationparameters are mentioned in Table.1. Numerous simulations were run with the same parameters and average of observed values was taken to decrease the estimation error.The DPCPLP algorithm is the set of power levels used for the transmission,where L is an integer varies from 1 to 7. The transmit power is the maximum powerlevel and the number of power levels in the set is 7.

Figure.1 shows cross layer relations used in DPCPLP are between physicaland network layers. The received signal strength is used by the network layer to recreatethe process to find the new route.

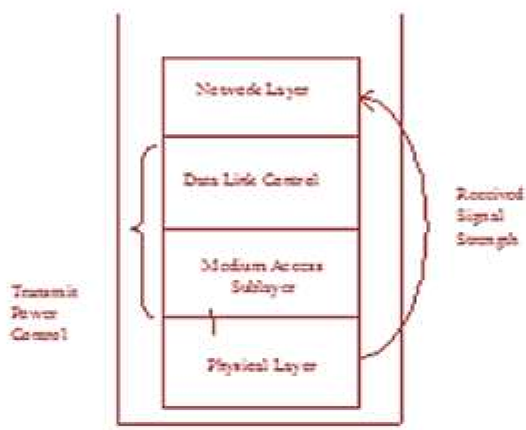

Figure.1: Cross layer interactions at node

Cross layer-centered approach for hyperlink availability prediction (DPCPLP) raisesnetworks and nodes' lifetime and capability by way of combining the outcomes of ultimate transmit power in transmitting RTS, CTS, knowledge and ACK packets and estimation of the hyperlinkavailability time and additional, formation of the trail prior to the hyperlink ruin to support the quality of service (QoS) standards of functions

A. Transmitter:

1. Let,
2. Check the optimum power table at the transmitter node for the receiver node addressand its stored optimum transmit power value ,
3. If node entry is available, then else ,
4. Add this power value in RTS header and send RTS with this power level,
5. Receive a CTS packet, observe its received power and extract transmit power. Thenode calculates optimum transmit power for a DATA packet,
6. Update optimum power table,
7. Add the power level in the DATA packet header and send the DATA packet atoptimum transmit power level,
8. Receive ACK,
9. End

1. For each neighbor,
2. On receipt of a packet,
3. Update record of (received power, time) for last three packets,
4. If and then Prediction (),
5. Prediction ()
6. {
7. Estimate and update the and update the, when a node enters into a critical state,prior to link break
8. }
9. If (current time >=)
10. {
11. Sent a warning message to the upstream node,
12. Sleep for fixed duration.
13. }
14. On receipt of repair message,
15. Set the route, and link status as soon-to-be-broken,
16. Local route repair().
17. Local route repair()
18. {
19. Find path to next node n_j;
20. If (found a path in k hops within time)
21. Use this path for rerouting.
22. Else
23. Find path to destination D;
24. If (path is found)
25. {
26. Route the packet through new path,
27.Send message to sources to find the shortest path.
29. }
30. }

1. At source:

2. {
3. New path discovers message received,
4. Discover new path,
5. Redirect traffic through new path.
6. }

Table .1 Simulation parameters for DPCPLP

Traffic Pattern	Constant Bit Rate
Simulation Time	900 seconds
Total Connections	20, 25, 30, 35, 40, 45 and 50
Packet size	512 Bytes
Velocity	5, 10, 15, 20, 25 and 30 meters/second
Pause Time	10 seconds
Simulation Area	1500m by 300m
Total Nodes	25, 50, 75, 100 and 125

Simulation Parameters: Two-ray radio propagation model is used. We have used seven transmit powerlevels. Three parameters viz. node velocity, network load and node density were varied inthe simulations. Network load is the rate of generation of packets in the network.

The performance of protocols has been evaluated in terms of average interruptiontime, overhead packets, energy consumption, throughput, packet delivery ratio and end-to end delay as a function of node mobility, packet generation rate and node density.

Constantbit rate (CBR)sources are assumed in the simulation.

Average interruption time is the time during which ongoing communications areinterrupted.

Routing overhead is the number of routing overhead packets that are generated inthe network to transfer the data packets.

Throughput is the number of kilobytes transferred successfully from the sender tothe receiver successfully.

The ***packet delivery ratio*** is the ratio of the data packets delivered to the destination tothose generated by the CBR sources. The higher the value better is the performance.

Average end-to-end delay of data packets includes all possible delays caused bybuffering during route discovery, queuing at interface queue, retransmission delays at the MAC layer, propagation and transfer time.

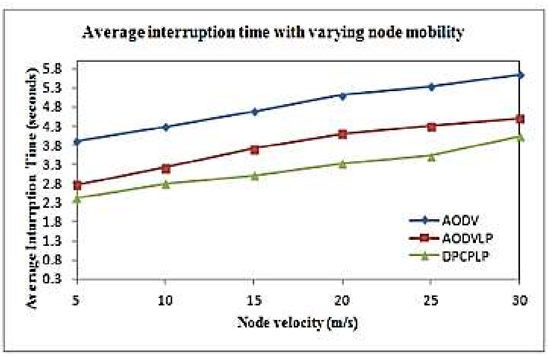

Figure.2 Average interruption time vs node velocity

Figure.2 shows the contrast of the average interruption time in DPCPLP, AODVLP and AODVschemes. It displays that DPCPLP displays least average interruption time as compared toAODVLP and AODV. This is for the reason that DPCPLP uses a smaller transmission range, thus concurrent transmission of packets as well as uses backup path in case of route failures forrenovation of paths, thus results in lowest interruption time as compared to AODVLP andAODV. However, AODV, AODVLP and DPCPLP give increasing average interruptiontime to increase in node velocity because faster mobility of nodes causes more routeunapproachability. Additional, more route unreachability result in higher interruption time.

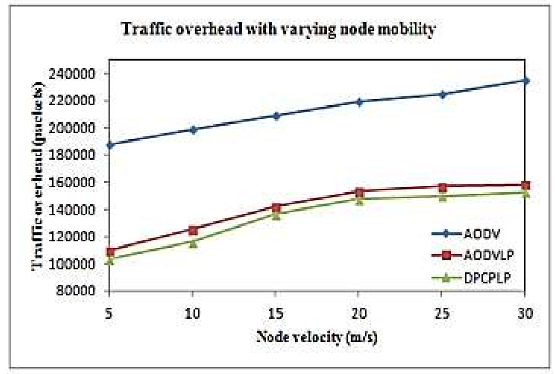

Figure.3 Routing overhead vs node velocity

Figure.3 shows that the overhead packets are least in DPCPLP as compared toAODVLP and AODV, because more packets are transferred simultaneously due to a smaller carrier sensing range in addition to availability of alternate routes in case of route failurescaused due to higher node mobility. However, in DPCPLP, AODVLP and AODVschemes, the routing overhead packets increase with increase in node velocity. Thishappens because the increase in node velocity increases more route unavailability for fastmoving nodes. Therefore, overheads of new route discovery lead to increase in the routing overhead packets.

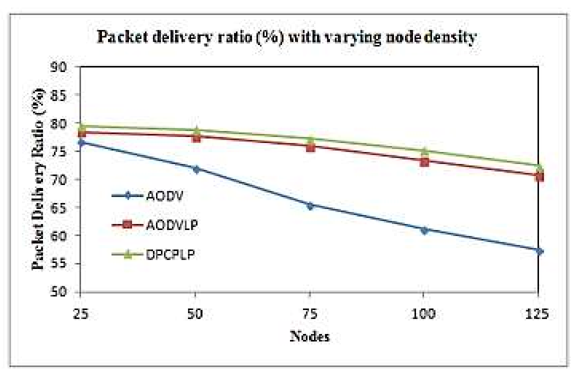

Figure.4 Delivery of packets vs no. of nodes

Figure.4 shows the variation of the packet delivery ratio with increasing node density.Results show that packet delivery ratio is best DPCPLP as compared to AODVLP andAODV. It happens because in DPCPLP, concurrent transmission takes place due to the spatial reuse of the channel, resulting from lower transmit power of the packets, in addition toDPCPLP and AODVLP schemes discovers alternative routes before the route failures, andmore data is successfully delivered to the destination. However, DPCPLP, AODVLP andAODV give decreasing delivery ratio as node density increases, since it causes morecontentions and collision due to more neighboring nodes in the vicinity and therefore,decreases delivery ratio by retransmitting the packets more than once.

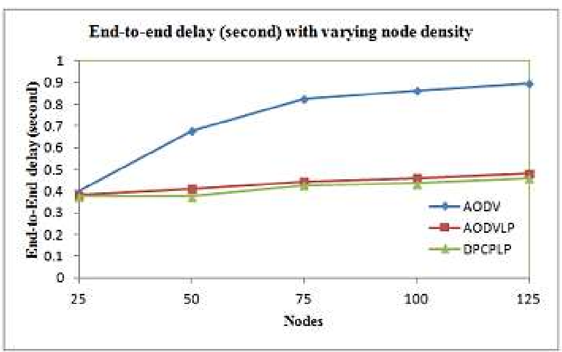

Figure .5 End-to-end delay vs no. of nodes

The end-to-end delay is an average of the difference between the time a data packet isoriginated by an application and the time the data packet is received at its destination.Figure 5.12 shows lowest end-to-end delay in DPCPLP as compared to AODVLP andAODV because DPCPLP takes care of concurrent transmission of packets due to lowertransmit power for RTS, CTS, DATA and ACK in addition to prior route discovery in caseof route failures. The end-to-end delay is lower in AODVLP as compared to AODV due to the prior route discovery in case of route failures. At low density, the delay is low in all.

IV. CONCLUSION

In this paper, we have proposed cross layer design to provide a combined solutionfor link availability management and power conservation (DPCPLP) in ad-hoc networks.This extension is the addition of power control at MAC layer that minimizes powerconsumption, thus yields longer battery life alongwith the prediction function predicts linkbreaks and proactively repairs, it before breaks at the network layer, based on received signalpower of the three consecutive received packets and threshold signal power strength. Usingthe MAC layer RTS, CTS, DATA and ACK packet exchange, the optimum transmitpower can be dynamically estimated based on ongoing transmission and accordingly thesender and receiver can adjust its transmitting power in sending RTS, CTS, DATA andACK packets at optimum power, which is lower than maximum transmit power to conserve its energy sources.

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BIODATA