ANALYSIS OF MODIFIED COOPERATIVE TRANSMISSION ROUTING PROTOCOL IN MANET

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ABSTRACT

The major problems faced by wireless communication in real time environment are that of interference and un-reliable communication links. A lot of research work has been done to overcome this using various techniques. Two of the techniques that help in reducing interference and communication link failures are co-operative communication and transmission side diversity in the network. In this work, we propose a new type of protocol that proactively selects a group of forwarding nodes that work co-operatively in forwarding the packet towards the destination. Multiple nodes are selected so as to co-ordinate their transmission to achieve transmission side diversity. In this network nodes are equipped with Omni-directional antenna to achieve transmission side diversity. We have also proposed a new technique to find the optimum route between the source and destination that incurs the minimum cost in terms of energy, no. of hops, available bandwidth and link quality (SNR). We have done extensive simulation based studies to verify the proposed techniques and find that our technique gives better results in terms of throughput, end-to-end delay and energy consumption than existing non-cooperative protocols.

Index Terms— Cooperative transmission, energy efficiency, network reliability, outage probability, routing, wireless networks.

I INTRODUCTION:

In this project, we analyze the joint problem of optimum route selection and transmission side diversity that should result in optimum route selection and also minimum energy consumption. It is a well known fact that in MANET, the nodes are small and lose their energy mainly during transmission of packets [1]. This resulted in lot of research being done in energy efficient communication techniques. This problem can be approached either by energy-efficient routing protocols and network layer or by new efficient communication techniques at physical layer. But a cross-layer approach between network and physical layer may result in a better solution. the flexibility in the network configurations whereby the number of cooperating nodes can be changed according to a specified system performance criterion;– the relaying strategy can be adapted to fit various scenarios;– the coverage is expected to be better since users will always find relaying nodes close by even if they are at the far end of their cell; and – a consequence of this is an increased user capacity since the user transmitted power can be better controlled which in turn controls the level of multiple access interference at the access point.

In diversity techniques, information is transmitted over channels that are affected by uncorrelated fading and noise processes. This effect may be achieved by separating the channels in frequency, time, or space. These techniques are reviewed in detail in [7]. Space diversity is usually achieved by employing multiple transmitting and/or multiple receiving antennas. Multiple antennas, on the transmitter or on the receiver side, must be about 0:4¸ apart, a few inches at the typical carrier frequencies, to achieve the desired effect of uncorrelated channels. However, in some cases, the use of multiple transmitters or receivers may be impractical, infeasible, or too costly. It is well known that transmission and receiver space diversity can result in lower error probability or higher transmission capacity [6]-[8]. In this paper we propose a new way of achieving space diversity by allowing cooperation among nodes for routing purposes, in effect creating a virtual antenna array.(to be re-written). The problem of transmission diversity is discussed in [4].

When the omni-directional antenna is used a single is transmitted and it is received by all receiver at a particular distance radius[7] .The following simple example best illustrates the potential benefits of this approach.

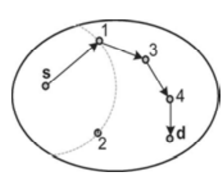

Fig. 1. Multihop routing and WBA

Above figure 1 depicts a simple 4-node wireless network, where s and d are the source and the destination nodes, respectively. We assume that the minimum energy path from s to d is through node 1, i.e. s -> 1 ->d. In this case, node 2, which is also located within the transmission radius of s to 1, receives the information transmitted from s at no additional cost. This property of wireless medium is usually referred to as Wireless Broadcast Advantage (WBA) [5]. Cooperation between nodes 1 and 2 in the second hop will create transmission-side diversity and may result in a lower energy route from s to d. Under this setting, each node can participate in cooperative transmission after it has completely received the information. For this reason, the problem of finding the optimal path is a multi-stage decision making problem, where at each stage a set of nodes may cooperate to relay the information to a chosen node. Thus the minimum energy cooperative route may be viewed as a sequence of sets of cooperating nodes along with an appropriate allocation of transmission powers. The tradeoff is between spending more energy in each transmission slot to reach a larger set of nodes, and the potential savings in energy in subsequent transmission slots due to cooperation. Nodes are capable of cooperatively *beamforming* to a receiver is presented in [5]and [8]

In this paper, we develop a new technique that in cooperates this benefit of cooperation among forwarding nodes and develop a new algorithm of finding an optimal route. To our knowledge very little research has been done in this area. The idea of wireless broadcast advantage was first introduced in [7]. The problem of finding the optimal multi-cast and broadcast tree in a wireless network and the added complexity due to WBA has been studied extensively in [7] and [8]. This problem is shown to be NP-Complete in [9] and [10]. The same problem, under the assumption that nodes can collect power in different transmission slots, was studied in [11].

Our contributions can be summarized as follows:

1) We formulate Minimum Energy Cooperative routing on individual node transmission power and achievable end-to-end throughput.

2) We formulate optimal power allocation for a cooperative link between a set of transmitters and a set of receivers

3) We develop cooperative routing algorithms, and evaluate their performance using simulations.

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II SYSTEM MODEL

A.Channel model: Consider a set of transmitting node *ti*, and a receiving node r_j where i=1…m and j=1…n. Let x_i and y_j denote the transmitted and received signals at nodes t_i and r_j , respectively. Without loss of generality, we assume that *xi* has unit power and that transmitter *ti* is able to control its power p_i in arbitrarily small steps up to some limit Pmax. Let η_j denotes the additive white Gaussian noise with power density P_η and other interferences received at each nodes r_j is expressed as follows

$$y_j = \sum_{t_i \in T} \sqrt{\frac{p_i}{d_{ij}^{\alpha}}} h_{ij}\, x_i + \eta_j,$$

where, d_{ij} is the distance between the transmitting and the receiving nodes t_i and r_j , α is the path loss exponent. The path loss α_{ij} is proportional to $1/d_{ij}^2$, assumed to be constant for the whole transmission. The power of the received signal is attenuated proportional to $1/d_{ij}^4$.Fading in the transmission medium is one of the major limiting factors in wireless communication, resulting in transmission loss. We assume the received information can be decoded without loss of generality and amplify to describe how the received data is processed at the relay station before the data is sent to the destination. This method is often used when the relay has only limited computing time/power available or the time delay, when an analogue signal is transmitted a DAF protocol can not be used[13]. Selection is performed before transmission, relying on clear-to-send (CTS) and ready-to-send (RTS) messages. The diversity achieved by this scheme is $M+1$ where M is the number of available relays. It also achieves the same diversity-rate multiplexing tradeoff achieved by the space-time coding scheme proposed in [laneman03] .

B.**Receiver Model:** The receiver detects the received signal symbol by symbol. In the case of a BPSK modulated signal the symbol/bit is detected as

$$Yj[n] = +1 \quad Re[yj] \geq 0$$

$$Yi[n] = -1 \quad Re[yi] < 0$$

III.COOPERATIVE ROUTE SELECTION

In the proposed algorithm Opportunistic Minimum Energy Cooperative transmission Shortest Path Algorithms (OMCTSP) the routing protocol AODV is to be modified to implement the routing. In that every step of cooperative routing, all nodes can be *overhearing* when source nodes sending the route request pkt. After the transmission to the next node along the non-cooperative shortest path all the nodes that are not in outage, available Bandwidth, size of the packet, residual power available, number of hops will be added to the transmitting set for the next step of the routing.

Steps to forward the packet using OMCTSP

1. First modify the MAC layer protocol 802.11 to include SNR calculation

2. Next modify the routing protocol AODV to implement the routing algorithm proposed.

3. Network is deployed with defined no of nodes with specified initial energy

4. SNR value is estimated based on receiving power and distance, while receiving the hello message and SNR value is stored in snr table.

5. Unit variance model estimates expected value for channel gain for each slot index. Once the square of expected value is 1 then outage probability is estimated.
6. Every node goes for calculating available bandwidth.
7. The number of hops for each path is also calculated.
8. The source node when sending the route request pkt, will include outage probability, residual power available and available bandwidth, sizeofthepkt.
9 .Intermediate nodes updates the link cost based on point to point connection, and push into request packet along with available bandwidth information.
10.All the forwarding nodes will calculate SNR value of its received pkt, its available bandwidth, residual energy. These values with number of hops are also included in the route request pkt.
11. When the destination node receives the route request packet ,it selects the best path based on four parameters.
12. Generate route reply msg to source nod in the reverse path.
13. Once a best path is selected, the destination node sends a route reply pkt to the source node.
14.This calculation goes on for all the pkts forwarded towards the receiver. So that whenever the receiver finds a better path, it discards the old path and picks up the new path for data communication.
15. In future diversity techniques also going to add it shows more energy saving and it will reduces the outage probability also.

IV SIMULATION RESULT

PDR without outage

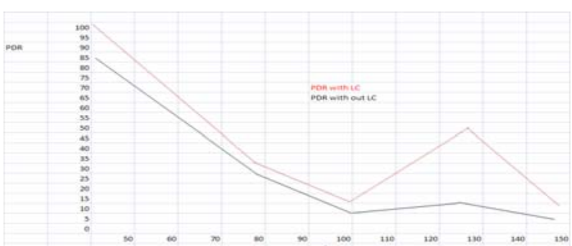

Fig1: shows comparison packet delivery ratio Vs Nodes

When the number of node is 130 more Packets is delivered compared to without LC but this is less compare to with outage estimation

PDR with outage

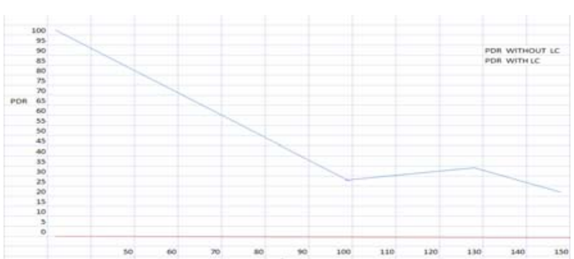

Fig2: shows comparison packet delivery ratio Vs Nodes with outage

With outage more packet is delivered compare to Packet delivery with LC

Throughput without outage

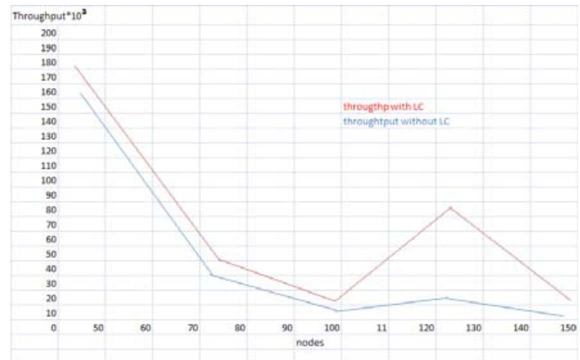

Fig3: Throughput Vs Nodes

Fig3: shows that Throughput without LC is less as compared to with LC when the number of nodes are increase

Average consumed energy without outage

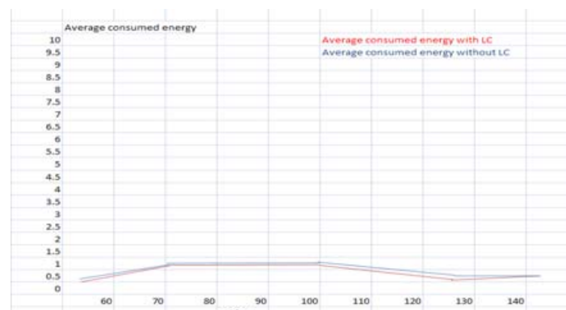

Fig 4: shows Average consumed energy Vs Nodes

As number of nodes increase, the energy consumed with LC is more or less same as compare to without LC

Average consumed energy with outage

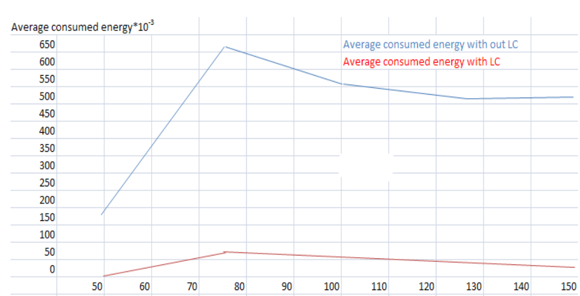

Fig 5 shows Average consumed energy Vs Nodes

As number of nodes increase, the energy consumed with LC is less as compare to without outage .it can be seen that more than 90% of energy is getting saved As number of nodes increase, the energy consumed with LC is less as compare to without outage ie it shows that more than 50%is saving than the other route selection methodology

Total consumed energy without outage

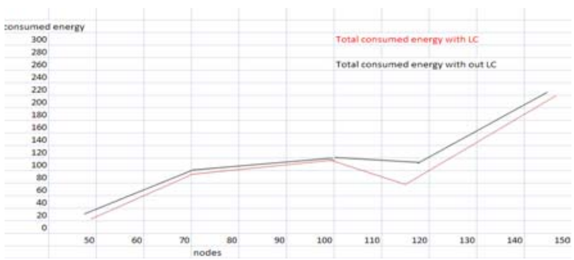

Fig 6 shows Total consumed energy Vs Nodes

As number of nodes increase, the energy consumed with LC is less as compare to without LC

Total consumed energy with outage

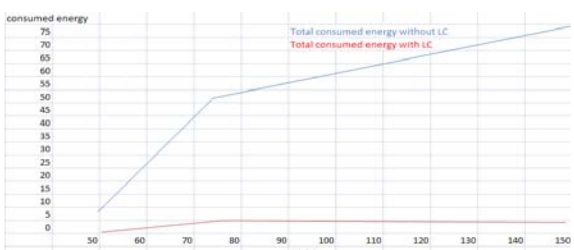

Fig 7 shows Total consumed energy Vs Nodes

Compared to without outage , the cooperative with outage consume less energy

V CONCLUSION

In this paper our proposed algorithm OMCTSP is better than other protocol like AODV because it consumes more average power ie more than 70%

VI Future work

Here using OMCTSP algorithm the energy saved is more than 80% compared to other routing algorithms. In future diversity is going to add to prove the outage probability is less hence it consumes more power.

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