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ANALYSIS OF COOPERATIVE TRANSMISSION MODIFIED ROUTING PROTOCOL IN MANETS

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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.

Key Words: *Cooperative Transmission, Energy Efficiency, Network Reliability, Outage Probability, Routing and Wireless Networks*

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 (Feeney and Nilsson, 2001).

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 (Alamouti, 1988). 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 (Royer and Chai-Keong 1999; Alamouti, 1988; Gesbert *et al.*, 2003). 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

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antenna array.(to be re-written). The problem of transmission diversity is discussed in (Derryberry *et al.*, 2002).

When the omni-directional antenna is used a single is transmitted and it is received by all receiver at a particular distance radius (Alamouti, 1988). The following simple example best illustrates the potential benefits of this approach.

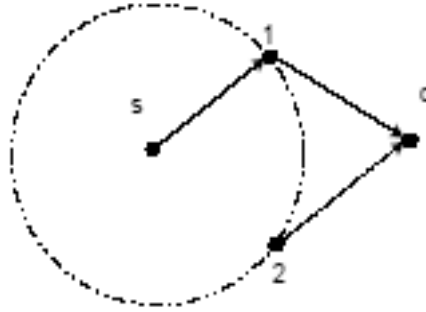


Figure 1: Multihop routing and WBA

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. $s \rightarrow 1 \rightarrow d$. 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) (Khandani *et al.*, 2007). 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 *beam forming* to a receiver is presented in ((Khandani *et al.*, 2007 and Gesbert *et al.*, 2003).

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 (Alamouti, 1988). 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 (Alamouti, 1988 and Gesbert *et al.*, 2003). This problem is shown to be NP-Complete in (Zheng and Tse, 2003 and Wieselthier *et al.*, 1999). The same problem, under the assumption that nodes can collect power in different transmission slots, was studied in (Zhang and Zhang, 2008).

SYSTEM MODEL

Channel Model

Consider a set of transmitting node t_i , and a receiving node r_j where $i=1 \dots m$ and $j=1 \dots n$. 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 x_i has unit power and that transmitter t_i is able to control its power p_i in arbitrarily small steps up to some limit P_{max} . Let η_j denotes the additive white Gaussian noise with power density P_η and other interferences received at each node r_j is expressed as follows

$$y_j = \sum_{t_i \in T} \sqrt{\frac{p_i}{d_{ij}^\alpha}} h_{ij} x_i + \eta_j, \quad (1)$$

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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 cannot be used (Ashwinder, 2002). 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].

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

$$\begin{aligned} Y_j[n] &= +1 \quad \text{Re}[y_j] \geq 0 \\ Y_j[n] &= -1 \quad \text{Re}[y_j] < 0 \end{aligned} \quad (2)$$

OPPORTUNISTIC COOPERATIVE TRANSMISSION SHORTEST PATH GORITHMS (OCTSP)

In the OCTSP 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 OCTSP

1. To form a routing path the initial energy is given to every node in the network.
2. The source nodes sending the route request packet can be overhearing will include outage probability, residual power available and available bandwidth, size of the pkt, number of packets.
3. The available bandwidth > packet size and rate of communication the packet will be forwarded if not.
4. It can calculate Power availability in that particular path by using Threshold value P_{max} . The calculated power $P = \{p_i | p_i \leq P_{max}\}$,
Where power allocation vectors p , where p_i is the power allocated to transmitter.
5. Also calculate the outage probability and residual energy.
6. Finally it can calculate number of hops.
7. When the destination node receives the route request packet, it selects the best path based on these four parameters. Power availability in that particular path, Outage probability, Number of hops, Available bandwidth in that particular path.
8. Once a best path is selected based on minimum power consumption. The destination node sends a route reply packet to the source node.
9. This step will continue till all the packets 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 another data communication. All the forwarding nodes which can hear/receive the packet (SNR calculation); having the required bandwidth, outage probability will forward the request.

RESULTS

Figure 2 shows the packet delivery ratio% of the protocols. The packet delivered using proposed algorithm AODV and DSR almost delivered all the packets than DSDV.

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Figure 3 shows that end-end delay for various numbers of nodes. When the number of nodes is less (i.e.) up to 50 numbers the delay is more whereas the number of nodes is more the delay is getting reduced. Therefore we are taking large number of nodes.

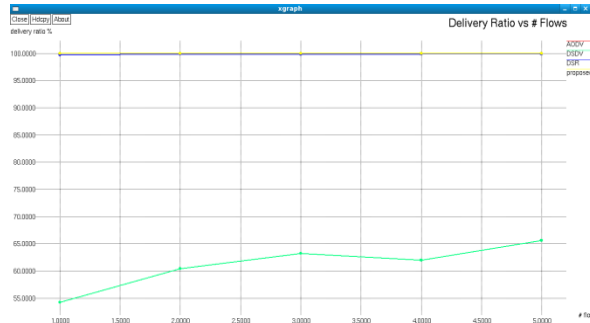


Figure 2: Shows Comparison Packet Delivery Ratio Vs Flows

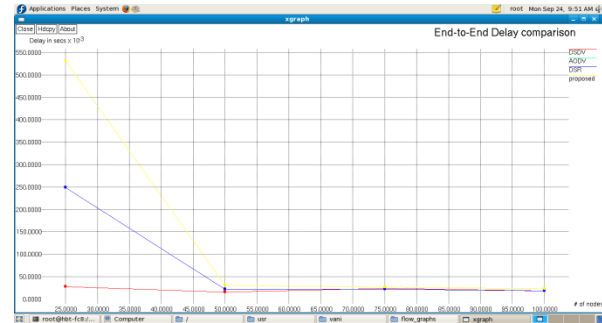


Figure 3: End-End Delay Comparison

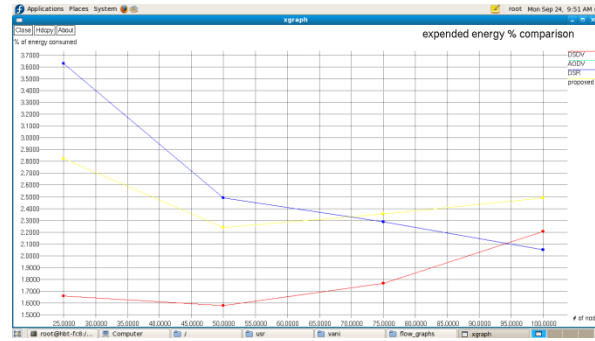


Figure 4: Energy Comparison

Figure 4 shows that energy comparison of different protocols if the number of nodes is more enough all three protocols consumes same amount of energy(i.e) in the fig at number of nodes is 100.

CONCLUSION

In this paper all four different protocols DSR, DSDV, AODV and Proposed algorithm have been compared with different parameters such as energy comparison, End-End Delay comparison and packet delivery ratio. Except DSDV all three falls under the category of reactive protocols. AODV and Proposed algorithm consumed more or less same amount of energy. But in case of DSDV end-end delay and packet drop are more. Therefore our proposed algorithm is better than other protocols.

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