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Energy Efficiency In Ad-hoc Wireless Network Using Topology Control

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Abstract -When energy efficiency is considered then cooperative communications may not be responding since it involves multiple nodes in network. Use of distributed user Cooperation is necessary in cooperative wireless ad hoc networks (WANETs),Here we propose a Energy-Aware Reliable Routing (EARR) algorithm in topology control system to improve energy efficiency in the network. Here we jointly consider coalition of network using coalition formation algorithm which gives stable coalition(topology) structure and selecting particular path by comparing their energy consumption in bits per joule using their relay nodes in network. Simulation results show the performance which is improvement of EARR in energy efficiency compared to the existing topology controlling algorithm.

1 INTRODUCTION

With the increasing demand in the use of wireless applications, more users need to share the same network,which motivates cooperative communications as effective ways to improve information transmission quality on the unreliable wireless channel. To improve transmission performance is challenging task in cooperative communication technology.Forming coalition and selecting specific transmission pattern is considered [1] which gives particular topology for achieving energy efficiency. Cooperative relaying isa typical cooperative communication technology that exploitsuser diversity by decoding the combined signals direct from source to destination and from relayed node or assistantrelays [2]. Again, interference cancellation (IC) as another cooperative communication scheme has been proposed to furtherimprove the network capacity by allowing parallel transmissions between multiple source-destinationpairsand cancelling interference[3]. Cooperative communication using relay scheduling has been used to reduce interference to achieve higher network capacity [4].Other than network capacity, energy efficiency is alsoan important in wireless ad hoc networks(WANETs) which is to be consider in increasingly rigid environmental standards [5]. When considering energy efficiency,cooperative communication may not be always responding. Thereason behind this is cooperative communication often involves theparticipation of multiple nodes to deliver information, and the increased data rate of one user comes at the price of the energyconsumed by other users acting as relays [6].Network capacity is different issue than energy efficiency which is considered in the existing topology control schemes, [7]–[9]. A cooperation manner selection in topology control with cooperative communications is considered in [8].

Inthis paper, we propose a Energy-Aware Reliable Routing(EARR) topology control scheme by taking intoaccount both network capacity and energy efficiency. EARR provides a distributed user cooperation mechanism to exploitthe advantages of cooperative communications including cooperative relaying and transmission pattern.

2 SYSTEM MODEL

Wireless network can be modelled as a directed graph G(N, E), where the set N includes all the n nodes in the network and E is the the wireless links set. Let Ti be a transmission from the source node S_i to the destination node D_i. The transmission $T_i$can be achieved through different transmission patterns with or without the help of relay nodes, leading to different diversity. However, a transmission can only be carried out in any one transmission pattern, resulting in selective diversity. To interpret the transmission clearly, a definition for transmission pattern is introduced as follows:

Definition 1-Transmission pattern: For a transmission Ti,transmission pattern is $g(T_i) = (R, h(R))$ where R is the relay nodes set and h(R) is the way these relay nodes work.

In this paper, we will study four transmission patterns with different cooperation diversities as shown in Fig.1.

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1. Direct transmission (DT): DT transmission is a singlehop transmission. Si transmits directly to Di using one slot and no relay node is involved. Therefore, R = Ø, h(R) = DT.

2.Two-hop transmission (TT): TT transmission is one type of multi-hop forwarding and used here as a representative. In TT transmission, Si transmits a packet to intermediate node R as a relay in the first slot, which decodes the packet and forwards it to Di in the second slot. Di decodes the signals only from the relay. Therefore, R = {R}, h(R) = TT.

3.Decode-and-forward relay transmission (DF): In DF transmission, Si transmits signals to intermediate node R as a relay in the first slot, which decodes the received signals and forwards them to Di in the second slot. The combined signals received from the source Si and from the relay R are decoded at Di jointly. Therefore, R = {R}, h(R) = DF.

4.IC cooperative transmission (IC-based): There is a cooperative transmission Tj and three assisting relays R1,R2,R3. In the transmission, Si and Sj broadcast their packets to the three relays concurrently in the fist slot. In the second slot, each relay scales the received signals and forwards them to the destination concurrently [3]. Therefore, we have R = {R_1,R_2,R_3}, h(R) = IC.

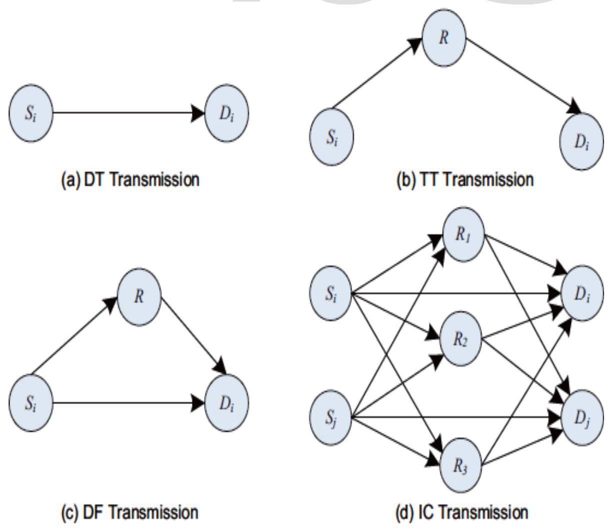

Fig. 1. Transmission patterns.

The main focus of this paper is to form an energy-efficientnetwork topology via the selection of transmission patterns.The metric of energy efficiency is discussed in the following.

Definition 2-Energy efficiency: Energy efficiency refersto the achievable information transmission per Joule energyconsumption with bits per Joule as the unit, i.e.

$$E_{g(T_i)} = \frac{C_{g(Ti)}}{P_{g(Ti)}}$$

Where Pg(Ti) and Cg(Ti) are the total power consumptionand the achievable throughput in a transmission Ti withtransmission pattern g(Ti).

3 AODV : FOR FINDING SHORTEST PATH

The AODV (Ad-Hoc On-Demand Distance Vector) routing protocol is a reactive routing protocol that uses some characteristics of proactive routing protocols. Routes are established on-demand, as they are needed. However, once established a route is maintained as long as it is needed. Reactive (or on-demand) routing protocols find a path between the source and the destination only when the path is needed (i.e., if there are data to be exchanged between the source and the destination). An advantage of this approach is that the routing overhead is greatly reduced. A disadvantage is a possible large delay from the moment the route is needed (a packet is ready to be sent) until the time the route is actually acquired. In AODV, the network is silent until a connection is needed. At that point the network node that needs a connection broadcasts a request for connection. Other AODV nodes forward this message, and record the node that they heard it from, creating an explosion of temporary routes back to the needy node. When a node receives such a message and already has a route to the desired node, it sends a message backwards through a temporary route to the requesting node. The needy node then begins using the route that has the least number of hops through other nodes. Unused entries in the routing tables are recycled after a time.

4 ENERGY-AWARE RELIABLE ROUTING ALGORITHM

In this work, we are considering wireless ad-hoc network, Direct transmission (DT), Two-hop transmission (TT), Decode-and-forward relay transmission (DF), IC cooperative transmission (IC-based). This may be used only in very few scenarios, whereas, in most cases, data packets have to travel more hops to reach destination. We study such scenario as our proposed work. In such case, if source node transmits data packets to destination, via more than one relay node, then we need to study the efficient routing based on energy. So best energy nodes can be taken as relay nodes to choose particular destination.

ALGORITHM

Step 1: Deploy 'N' number of nodes in the wireless mesh network

Step 2: Choose source node 'S' and destination node 'D'

Step 3: Create TCP/UDP connection among the nodes

Step 4: Declare energy value 'E' for all nodes in the network

Step 5: Create Routing Table, one- hop neighbour for all nodes deployed in Wireless network

Step 6: Create Routing path

For Node (i=0, i<=n)

If {

If energy <threshold;
//Check Energy;

Assign the node to routing table *Rt*

}

Return Rt

Step 7: Start the packet delivery by using the router derived above

Step 8: Destination receives packet from source using multi-hop routing mode

5 Result and Analysis

In this work, we will generally present our work in NS2where simulation is running. It will be an easy way to presentthe important details by the perspective of packet-flow. Bypresenting the operations on packets, the protocols stack thatis implemented in *ns*2 will be presented. Meanwhile, we willbriefly introduce important classes and files in *ns*2, especiallythe relationships between these classes.

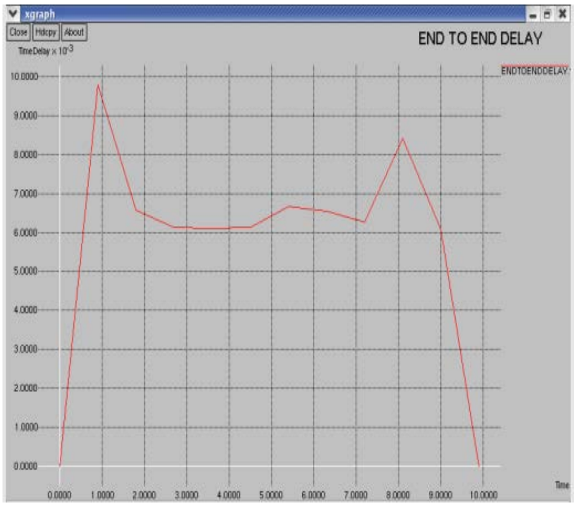

Fig:1 Shows End to End Delay From Source to Destination

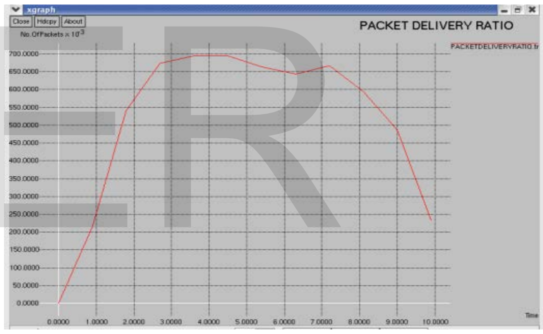

Fig:2 Packet Delivery Ratio by Each Node in route

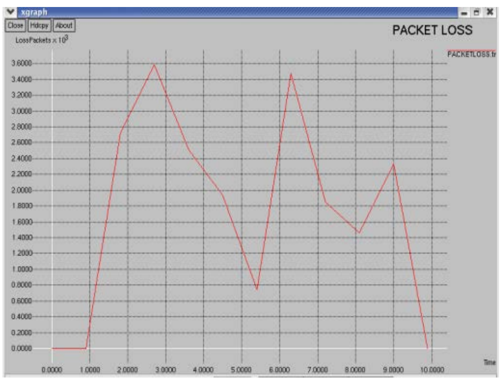

Fig:3 Packet loss in network

6 Conclusion

In this paper, we have proposed a Energy-Aware Reliable Routing (EARR) based topology control scheme for cooperative wireless ad hoc networks. We exploit distributed user cooperation in selecting energy-efficient transmission patterns, which leads to selecting particular node using algorithm. EARR is formulated into a coalition game and energy comparing algorithm is developed to form energy-efficient transmission coalitions considering energy of each node.

REFERENCES

[1] Bingyi Guo, Quansheng Guan, F. Richard Yu, Shengming Jiang, and Victor C. M. Leung " Energy-Efficient Topology Control with Selective Diversity in Cooperative Wireless Ad Hoc Networks," IEEE ICC 2014 - Ad-hoc and Sensor Networking Symposium.

[2] C. Hoymann, W. Chen, J. Montojo, A. Golitschek, C. Koutsimanis, andX. Shen, "Relaying operation in 3GPP LTE: challenges and solutions,"IEEE Communication. Mag., vol. 50, pp. 156 –162, Feb. 2012.

[3] L. Li, Y. Jing, and H. Jafarkhani, "Interference cancellation at the relay for multi-user wireless cooperative networks," IEEE Trans. Wirelesscommunication, vol. 10, no. 3, pp. 930–939, 2011.

[4] H. Li, N. Jaggi, and B. Sikdar, "Relay scheduling for cooperative communications in sensor networks with energy harvesting," IEEE Trans. Wireless Communication., vol. 10, no. 9, pp. 2918–2928, 2011.

[5] F.R. Yu, X. Zhang, and V.C.M. Leung, Green Communications andNetworking. New York: CRC Press, 2012.

[6] O.Amin and L. Lampe, "Opportunistic energy efficient cooperativecommunication," IEEE Wireless Communication. Letters, vol. 1, pp. 412 –415,Oct. 2012.

[7] Y. Zhu, M. Huang, S. Chen, and Y. Wang, +"Energy-efficient topologycontrol in cooperative ad hoc networks," IEEE Trans. Parallel andDistributed Systems, vol. 23, no. 8, pp. 1480–1491, 2012.

[8] Q. Guan, F. Yu, S. Jiang, and V. Leung, "Capacity-optimized topologycontrol for manets with cooperative communications," IEEE Trans.Wireless Communication., vol. 10, no. 7, pp. 2162–2170, 2011.

[9] Q. Guan, F. R. Yu, S. Jiang,and V. Leung,"Joint topology controland authentication design in mobile ad hoc networks with cooperativecommunications," IEEE Trans. Veh. Tech., vol. 61, pp. 2674 –2685, July 2012.

[10] Q. Guan, F. R. Yu, S. Jiang, V. Leung, and H. Mehrvar, "Topologycontrol in mobile ad hoc networks with cooperative communications,"IEEE Wireless Comm., vol. 19, no. 2, pp. 74–79, Apr. 2012.