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Residual Energy in Wireless Ad-Hoc Network Using ERCIM

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ABSTRACT

A wireless ad hoc network is a collection of nodes exchanging information through radio or infrared wireless adapters. Such a network functions without an established infrastructure. Each node communicates directly with destinations within wireless transmission range and indirectly with all other destinations, relying on its peers to forward traffic on its behalf. In this networks are generally characterized by bandwidth-constrained, variable-capacity links and an unpredictable, dynamic topology. Because the nodes of an ad hoc network are usually small, battery powered devices, energy management is a critical issue for practical deployment of these networks. In this paper, I introduced an Enhanced Receiver Centric Interference model (ERCIM) with PNCC algorithm to calculate the residual energy in during transmission. This algorithm proves the guarantees to build a valid topology for transfer data between source and destination.

Keywords: Bandwidth, PNCC, Interference, Residual, Topology.

I. INTRODUCTION

An ad hoc wireless network is a special type of wireless network that does not have a wired infrastructure to support communication among the wireless nodes. In multi-hop ad hoc networks, communication between two nodes that are not direct neighbors requires the relay of messages by the intermediate nodes between them. Each node acts as a router, as well as a communication end-point. In Latin, ad hoc literally means “for this” further meaning “for this purpose only and thus usually temporary proposed in [2]. Ad hoc networks represent composite distributed systems that comprise wireless mobile nodes that can freely and dynamically self-organize into arbitrary and temporary, ad hoc network topologies, allowing people and devices to seamlessly inter network in areas with no pre-existing communication infrastructure. Ad hoc networks are a major goal towards the evolution of 4G devices. In the nodes of the Ad hoc networks, computing power and network connectivity are rooted in virtually every device to bring computation to users, no matter where they are, or under what circumstances they work. Node mobility in an ad hoc network causes recurrent changes of the network topology [2] and [7]. Communication from a node *s* to another node *t* may established either directly if the two nodes are close enough and node *s* uses adequate transmitting power, or by using intermediate nodes described in Fig. 1.

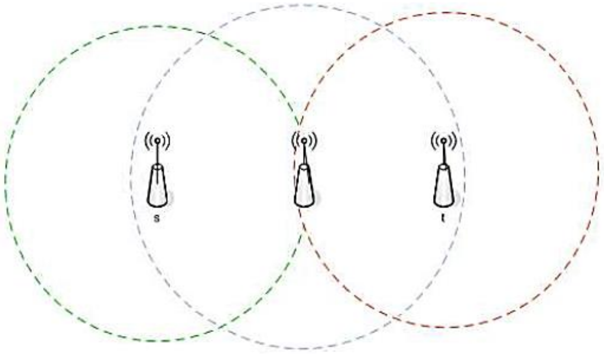

Figure 1. Communication between three nodes

An ad hoc wireless network is usually modeled as a complete directed graph G=(V,E), with a non-negative edge cost function $c: E \rightarrow R^{+}$ Intuitively, V is the set of stations or nodes, the edges in E correspond to potential direct links, and the function c denotes the minimum energy required for establishing a direct link between any possible transmitter-receiver pair. Usually, the edge cost function is symmetric (i.e., c(u,v)=c(v,u)). An important special case, which usually reflects the real-world situation, henceforth called geometric case, is when nodes of G are points in a Euclidean space and the cost of an edge (u,v) is define as the Euclidean distance between u and v raised to a fixed power α ie. $c(u,v) = d(u,v)^{\alpha}$. Asymmetric edge cost functions can be used to model medium abnormalities or batteries with different energy levels proposed in [7].

Topology control and management is to determine the transmission power of each node so as to maintain network connectivity while consuming the minimum possible power has emerged to be one of more important issues in wireless multi-hop networks proposed in [1]. Recent research results address topology control and routing. The importance of topology control lies in the fact that it critically affects the system performance in several ways. For one, as show in [3], it affects network spatial reuse and hence the traffic carrying capacity. Choosing too large power level results in excessive interference, while choosing too small power level results in a disconnected network. Topology control aims at constructing sparse network topologies that guarantee particular properties, like short paths, low energy consumption, planarity, etc preserving network connectivity. Topology control can be considered a trade -off between energy conservation, interference reduction and connectivity.

Power control also affects the energy usage of communication, thus impacts on battery life, a critical resource in many mobile applications. Several topology control algorithm [4]-[6] have been proposed to create a power –efficient network topology in wireless multi-hop networks with limited mobility. In this paper, I propose a Proposed Nearest Component Connector (PNCC) algorithm using Enhanced Receiver Centric Interference Model (ERCIM).

II. METHODS AND MATERIAL

1. Nearest Component Connector (NCC) algorithm

The nearest component connector algorithm generates a subgraph via connecting the components to their nearest neighbors. A component is a sing or group node. The algorithm constructs a tree toward sink in several rounds. This algorithm based on the receiver-centric perspective proposed in [8]. In Fig. 2 shows the receiver-centric interference model. The values of vertices indicate the number of disks that include the corresponding nodes. This model proved that the receiver-centric perspective generates lower interference optimal topologies than do the sender-centric perspective. In the sender-centric perspective, the topology control algorithms compute the subgraph regarding the coverage of a certain communication link, but in the receiver-centric perspective the goal is to minimize the interference at each possible receiver. The interference of node s is then defined as the number of other nodes that affect the message reception at node s.

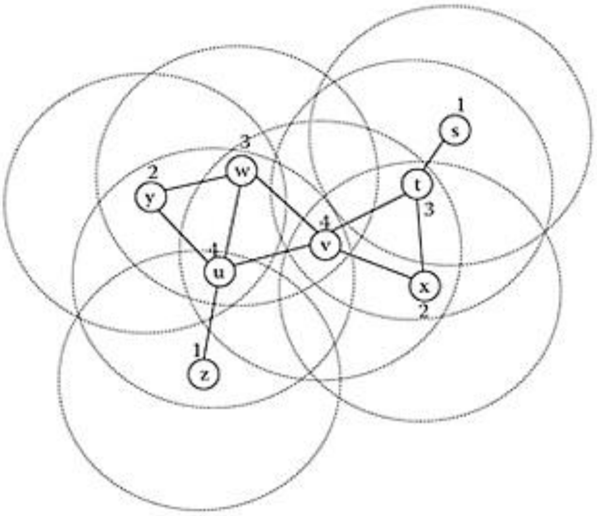

Figure 2. Receiver-centric Interference model [8]

NCC algorithm, as described in [8] builds valid topologies with interference O(logn) in ad hoc sensor networks, but can be generalized to apply to ad hoc wireless networks by eliminating the directional-edges requirement.

2. AODV

AODV is an Ad hoc on demand protocol as it finds the routes only when required by the source node for transmitting the data. AODV has two phases, the route construction phase and route maintenance phase. In the route construction phase a route must be created from source node to destination node. While in the maintenance is to rebuild a route between source and destination since the previous by found route may be broken due to the nodes movement.

AODV is a relative of the Bellman-Ford distant vector algorithm, but is adapted to work in a mobile environment. AODV determines a route to a destination only when a node wants to send a packet to that destination. Routes are maintained as long as they are needed by the source. Sequence numbers ensure the freshness of routes and guarantee the loop-free routing. Each routing table entry contains the following information: destination, next hop, number of hops, destination sequence number, and active neighbors for this route and expiration time for this route table entry. Expiration time, also called lifetime, is reset each time the route has been used. The new expiration time is the sum of the current time and a parameter called active route timeout. This parameter, also called route caching timeout. Ad hoc On-demand Distance Vector(AODV) routing scheme, the second solution can verify 75% to 98% of the route to the destination depending on the pause time sat a minimum cost of the delay in the networks.

3. Proposed Model

The proposed model is Enhanced Receiver Centric Interference Model (ERCIM) focuses on energy consumption of a set of nodes in wireless ad hoc network.

In wireless ad hoc network modeled as a graph G (V, E) with the vertices V representing network nodes, and the edges E representing communication links. Wireless ad hoc network topology with more number of nodes and ERCIM with proposed nearest component connector algorithm which asymptotically matches the lower bound, guarantees to build a valid topology and transfer data from source to end. ERCIM is robust with respect to addition or removal of single network nodes and transfer packet from starting node to ending node. This model consumes less energy with no collision. The proposed algorithm is to connect components to their nearest neighbors. Each node in the given ad hoc network forms a component of its own. It is also be suited for MPLS networks suggested in [10].

The Proposed Nearest Component Connector (PNCC) algorithm shows the nodes in Component Connector (CC) with nearest neighbor. It is based on the broadcasting a beacon and jitter value. Neighbor Discovery Agent (NDA) updates the neighbor nodes in run time. If the node timeouts for the transmission data, it removes arc from the graph. This protocol update is suggested at inter and intra zone levels to achieve the less energy consumption in the network. The n lists of sorted neighbors can be constructed in time n_nlog(n) proposed in [9]. The 'n' value represent the sorted neighbors and nlog(n) represent the NCC algorithm for achieving the transmission of the packets from source to destination with residual energy is more in this model. In Fig. 3 shows the flowchart for the proposed algorithm.

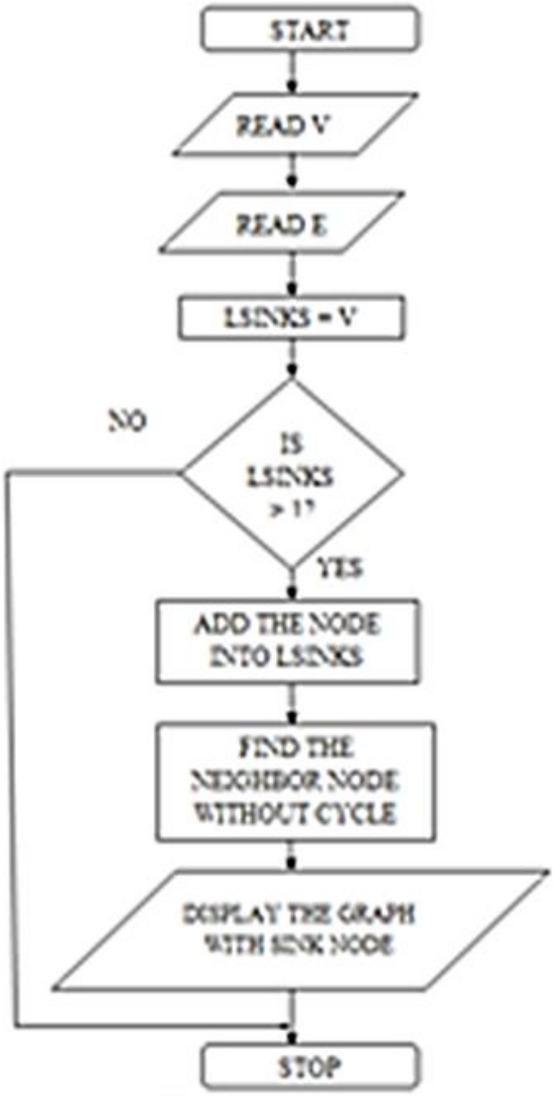

Figure 3. Flow chart for the proposed algorithm

III. RESULTS AND DISCUSSION

Implementation and Experimental Results

I have implemented algorithm proposed nearest component connector in wireless ad hoc network. I have experimentally compared existing and proposed nearest component connector algorithm. In Fig. 4 shows the animated graph for the transmission of packets between the nodes with energy level. The horizontal line shows the time in seconds and vertical line shows the energy value in joules.

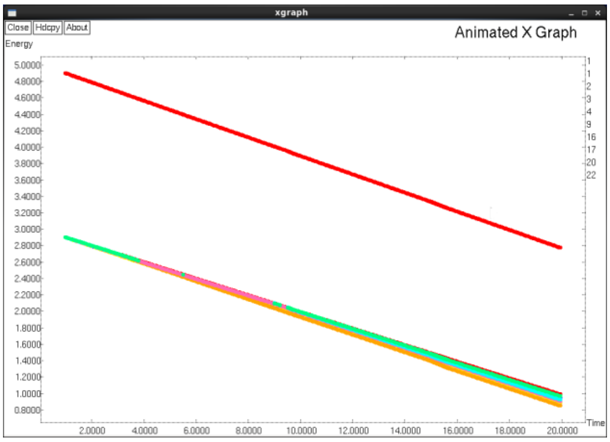

Figure 4. Animated graph using ERCIM model

The Table 1 shows the residual energy for existing and proposed NCC algorithm. In this table, the values for left over energy in the wireless ad hoc network for given number of the nodes are analyzed. The PNCC algorithm achieves the saving of energy in wireless ad hoc network. The residual energy is more about by 1.3 to 10 joules in PNCC. Due to this residual energy, to increase the life time of nodes in wireless ad hoc network. Hence, PNCC manages the energy in efficient manner in wireless ad hoc network.

Table 1. Residual energy values for existing and proposed algorithm

Simulation time (Seconds)	Residual energy existing NCC(J)	Residual energy PNCC(J)
10	71.6518	81.6518
20	38.3702	46.3702
30	2.06072	6.06072
40	1.99259	5.99259
50	1.99259	5.99259
60	1.99259	3.33499

Fig. 5 shows the comparison graph for residual energy variation considering the simulation time in seconds. Proposed algorithm has shown that the residual energy remain steady after time t=30 seconds. But existing algorithm utilize the more energy while transferring packets from source to destination. The proposed algorithm accomplishes energy saving during transmission in wireless ad hoc network

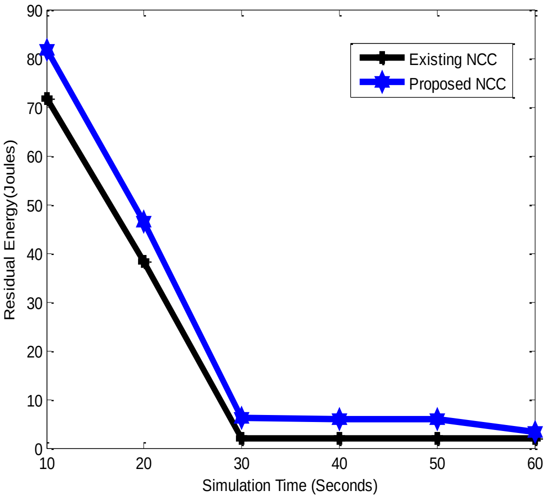

Figure 5. Residual energy comparison between existing and proposed NCC algorithm

IV. CONCLUSION

The lifetime of a wireless network operating on energy is critical to its usefulness. Network lifetime can be increased by efficiently managing the energy consumption in each individual node belonging to the network. In this paper I proved the residual energy is better than existing nearest component connector algorithm. The enhanced the life time of the network is major goal in wireless ad hoc network. This goal is achieved in this paper. These observations prove that PNCC terminates in polynomial time. Future work includes the development of ERCIM that residual energy while increasing spatial reuse to a certain scope keeps time.

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