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DBET: Demand Based Energy efficient Topology for MANET with Security

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---**ABSTRACT**---
*Deman Based Energy efficient topology as the name itself suggests saves the energy efficiently by dynamically adjusting the totpology of the network. Network is a wireless network of mobile devices also called as MANETs. The main goal is to save Energy Cunsumption and Power Consumption because these factors are also , important in determining the performance of the network. Efficiency in Ad-hoc networks can be achieved mainly in two different ways. In the first method,network maintains a small number of nodes to form connected backbone and the remaining nodes sleep to conserve energy. This method is effective for low traffic networks. Energy efficiency in the second method is achieved by power control technique. This technique is effective in high traffic conditions. The first method is not effective in high traffic conditions. Similarly, the second method is not effective in low traffic networks. So, in this paper we propose a Demand Based Energy efficient Topology (DBET) to reduce the energy consumption for mobile ad hoc network, by dynamically adjusting the topology for various network traffic conditions. We have simulated our proposed protocol DBET by using **AODV** [8] as routing protocol in network simulator ns2.33 [1] and compared with **AODV** an SPAN [3]. The simulation studies revealed that the proposed scheme perform better in terms of **Energy, Delay, and Delivery ratio**. Also in this paper newly we are implementing the security factor while sending the packets. For that we are using RSA algorithm.*

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I. INTRODUCTION

In this paper, we present a demand based energy efficient topology (DBET) that dynamically adjust network topology for various network traffic conditions. Here we are using two methods for two different traffic conditions. In the first method a small lnumber of nodes awake to maintain the network connectivity and remaining nodes go into sleep state to conserve energy.This method is effective in low traffic conditions, because the power consumption to keep nodes awake dominates the power consumption in data transfer.

In the second method, topology is controlled by keeping lesser cost links in the network.An energy efficient dynamic path is maintained to send data from source to destination for MANET, Due to mobility existing paths may not be energy efficient. So, each node in a data path Dynamically updates the path by adjusting its transmission power. Each node in the networks determines its power for data transmission and control packets transmission according to the received beacon messages from its neighbors. In dynamic path optimization technique protocols dynamically select energy efficient path as per the requirement of dynamic topological changes in the network [4].

Working: BET can be divided into four phases. The first phase selects a small set of nodes that constitutes a independent set of the network. The second phase is responsible for electing more nodes to ensure that the selected nodes form a connected backbone. Remaining nodes go to sleep to conserve energy. Active node withdraw process is implement in the third phase to remove redundant nodes in each region. To improve the performance along the high traffic path we use the route optimization with power control technique in the fourth phase. In this technique, we change topology dynamically to connect more nodes, around the routing path to minimize the total power consumption.

A. Phase I: Independent set formation

The first phase selects a minimal set of nodes that constitute a minimal independent set of a connected backbone of the network. This selection is done in a distributed and localized manner using neighbor information available with the network layer. Let *ni* be the total number of nodes surrounding a node *i* and let *nai* be the number of additional nodes among these neighbors, which are connected, if node *i* becomes a coordinator to the forward packets. The following heuristic is used in this phase:

• **Stability factor** (denoted by *S*): Nodes that are relatively more stable as compared to the others in the localities are given more preference. The node's stability is measured as the ratio of number of link failures (*fi*) and new connection established (*ci*) per unit time to the total number of nodes surrounding that node (*ni*). Therefore,stability of a node *i* is *ci*+*fini*. As the values of *ci* and *fi*increase, the stability of the node decreases.
• **Utility factor** (denoted by U): Nodes that have higher number of neighbors without an active neighbor are given more preference. This heuristic is derived from the fact that such nodes, if elected, can help a larger number of other nodes, which can then be put to sleep state. Thus,

the utility factor *Ui* of a node *i* is calculate as: $\frac{n_i - n_{a_i}}{n_i}$.
• **Energy factor** (denoted by E): Nodes that have higher amounts of percentage remaining power are given more preference over others to be elected as active nodes. This introduces fairness in the protocol by ensuring proper rotation in the selection of active nodes. Let *E*0*i* denote the initial node's energy and *Eti* be the amount of energy of a node at time *t*. So the energy factor *Ei* of the node *i* is calculate as *E*0*i*−*Eti E*0*i*.Thus, the above discussion suggests that the coordinator selection factor for *phase* − *I* can be the sum of all these factors:

$$C_i = S_i + U_i + E_i = \frac{c_i + f_i}{n_i} + \frac{n_i - n_{a_i}}{n_i} + \frac{E_{0_i} - E_{t_i}}{E_{0_i}}$$

B. Phase II: Connecting the Independent Set

Nodes selected in the first phase are not connected. This is because there is only one active node in a given locality. In this phase more nodes are elected to ensure that the selected nodes form a connected network.All nodes that have two or more active nodes as neighbors, which are not connected directly or through one or two active nodes, are eligible to become active in this phase. Preference is given to the nodes satisfying the following criteria:

• Nodes having higher amount of remaining energy.
• Nodes having higher stability. This can be measured similar to the one used in the first phase.
• Nodes having more number of active nodes in the 1-hop neighborhood.

The stability and energy factors of this phase is very much similar with 1*stphase*. But the utility factor is depends upon the 1*stphase*'s black active nodes. Let *nbi* be the number of active nodes of the 1*stphase* in 1 − *hop* neighborhood of a node *i*. If nodes with high *nbi* become the coordinators in this phase, fewer coordinators in total may be needed in order to make sure every node can talk to a coordinator. Thus a node with a high *nbi* should volunteer more quickly than one with smaller value. Thus, the coordinator selection factor for 2^{nd} *phase* is the sum of all these factors:

$$C_i = S_i + U_i + E_i = \frac{c_i + f_i}{n_i} + \frac{n_i - n_{a_i}}{n_i} + \frac{E_{0_i} - E_{t_i}}{E_{0_i}}$$

The contention if any is also resolved using the back off mechanism like in the first phase.

C. Phase III: Coordinator Withdraw

Every active node periodically checks if it should goto sleep state or not. The need for a node to be an active may also cease to exist due to the dynamics of the system. More explicitly,this may happen due to one of the following reasons. If first phase active nodes may move into a region that already has another first phase active node so that the region now has more than one first phase active nodes.These active nodes recognize this situation and one of them withdraws.
• If the withdrawal of a first phase active node may mean that the second phase active nodes in the locality no longer serve their purpose and hence withdraw.

D. Phase IV: Local route customization with Power control technique

The energy consumption per data packet form source todestination is high when each node uses full transmission power. This can be reduced by chooses a lower energy cost path. The minimum transmission power *Pt*(*d*) = *adk* + *c* is required to send data to a node at a distance *d*, where 2 < *k* < 4 and for some constants *a* and *c*. The receiving power *Pr* = *PtGtGrht*2*hr*2/*d*4 = *PtKd*4 by surface reflection model, where *ht*, *Gt*, *hr*, and *Gr* are respectively antenna height and gain of sending and receiving nodes [10]. Theactual power
ξI,J = *K PtPr*+*X*, required for sending data froma node *I* to the node *J* at a distance *d*, where *X* represents the energy consumed by receiving node.

The proposed DBET can be integrated with any routing protocol. In this section, we discusses the process of integration with AODV. In our approach all control packets and data packets are transmit on low traffic path with full transmission power and data packets on high traffic path with minimum required energy.

CONCLUSIONS

In this paper, we proposed a demand based energy efficient topology that dynamically adjusts its topology for various network traffic conditions. We have simulated our proposed protocol DBET and compared with AODV and AODV with SPAN. The simulation studies revealed that the proposed scheme perform better in terms of energy, delay, and delivery ratio. It would be interesting to investigate the use of directional antenna to further reduce the energy consumption.

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