

EDBAT: Efficient Demand Based Energy Allocation Topology for Mobile Ad Hoc Networks

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Abstract- Cellular Ad Hoc Networks (MANET) will be the group of mobile nodes with no centralized infrastructure. The underlying premise is the fact that the intermediate nodes cooperate in forwarding packets. Mobile nodes gather the route information through overhearing and store these information in route caches by means of Dynamic Source Routing (DSR) Process. These nodes use up electricity needlessly because of overhearing the transmissions of their neighbors. Due to this, the community performance is improved but more power consumption occurs unnecessarily. The main goal of the task is to reduce the effect of overhearing utilizing the Efficient Demand Based Energy Allocation Topology (EDBAT) criteria. The freedom of the nodes ends in stagnant routes, due to the lack of course cache updating. For that, a cross layer framework is implemented in addition to the EDBAT to improve path cache performance in DSR. Using the cache time-out policy we can very quickly avoid old routes from used. The cache time-out of personal links are found by Receiving Signal Strength Indication (RSSI) advice. By simulation results the proposed algorithm achieves better performance compared to the present procedures.

Keywords - MANET, DSR, Stale route , Cache timeout policy and RSSI.

1. INTRODUCTION

1.1. Mobile Ad Hoc Networks (MANET)

In MANETs, a network is formed dynamically through the alliance of an arbitrary set of separate nodes. There is absolutely no prearrangement regarding the specific role each node should assume. Instead, each node makes its decision individually, grounded on the network situation, without using a preexisting community facilities. Random networks have the features including dynamically changing topology, weak physical safety of nodes, the lack of centralized administration and high dependence on inherent node cooperation. These sites do not have a well-defined border and hence network-based access control mechanism for example firewalls are not directly relevant, if the topology keeps changing. The key concern in MANET could be the first law of thermodynamics because of the limited lifetime of mobile devices.

1.2. Dynamic Source Routing (DSR) Protocol

DSR [1] is a resource routing method. In DSR the source node begins and takes cost of computing the paths. When a node S would like to deliver emails to node N, it firstly shows a course request (RREQ) which features the destination and source node's details. When S sends data packets, it provides the path to the packet's headers and starts stateless forwarding. During route maintenance, S registers the link problems over the trail. If it occurs, it fixes the broken links. Otherwise, if the source path is totally broken, S will restart a brand new finding.

1.3. Overhearing in MANET

Overhearing [2] signifies a node picks up packets that are meant for other nodes. Wifi nodes will consume electricity needlessly as a result of overhearing transmissions of their nearby nodes. Wifi nodes consume electricity needlessly as a result of overhearing the transmissions of the neighbours. This is often true in a normal broadcast environment. For example, whilst the IEEE 802.11 wireless protocol identifies, receivers stay on and track the typical channel constantly. Thus the cell nodes receive all packages that struck their receiver antenna. Such plan ends in considerable power consumption because just a small amount of the received packets are destined to the receiver or would have to be forwarded by the receiver. DSR gathers the path information through overhearing. Overhearing enhances the routing effectiveness in DSR by eavesdropping additional communications to gather course info but it spends a significant amount of energy.

1.4. Stale Route links Problem in DSR

The wireless connection is damaged thanks to node mobility and upstream node propagates a RERR box to eliminate stale route information from route caches of the nodes. Sometimes route caches normally comprise stagnant route information for a thorough time period. Today, overhearing could make the situation even worse. This is only because more RREP packets are generated by the Dynamic Source Routing (DSR) for a route finding to provide alternate paths in addition to the main one. Alternate paths may remain in route cache unchecked also once they become stale, as the main route is

examined for its quality during the connection between the origin and also the destination. This applies additionally for all their neighbors since they discovered and held them in the form of unconditional overhearing which is node S transmits packets to node D via a precomputed routing path with three advanced nodes but in this case each node overhears the transmission which results within the energy usage together with less network lifetime.

2. PREVIOUS WORK

Hu C et.al [4] developed the 802.11 Power Saving Mode (PSM) applicable in multihop. The downside in integrating the DSR process with 802.11 PSM comes from unnecessary or unintended overhearing and DSR depends upon broadcast flood of control packages.

Ashish K et.al [12] & Charles E Perkins et.al [13] proposed the on-demand routing protocols Course servicing is invoked when node registers link failure. To be able to prevent route discovery for every single packet, cache routes are utilized by on-demand routing protocols previously learned.

Lim S et.al [11] explored a mechanism called DBET mechanism. Besides the energy usage, overhearing brings in several undesirable consequences. It could worsen the old path difficulty, the chief cause of that will be node mobility. Sree Ranga Raju [14] proposed a traditional way of gather course info. It doesn't allow overhearing and removes existing route information using time-out. This needs more RREQ messages which in turn results in more management expenses in routing. Ashish Shukla [3] suggested a cache time-out policy to predict path cache life time, and also to expunge old route cache entries, which are timed out. Several techniques are proposed for path cache organization and its impact to the performance of on demand routing methods. But, the concentration of cache timeout policy is very less.

It is used in route cache implementation to stop stagnant route from being used. So, a method for reducing the unintentional overhearing of neighboring nodes is completed with the help of DBET mechanism and for avoidance of old route difficulty, a cross-level cache time-out policy is applied. Time out policy derives cache time-outs of individual hyperlinks that are found in route cache by utilizing Received Signal Strength Indication (RSSI) information. So to satisfy the target and to defeat the drawbacks, a message overhearing and forwarding system called DBET [11] is chosen making a prudent balance between power and network performance.

The paper is structured as follows. The Area 2 describes with summary of DSR protocol. Part 3 addresses the rates of old and overhearing route problem in DSR. Section 4 is devoted for the execution of cross level framework. Section 5 explains the performance evaluation and the last section concludes the task.

3. IMPLEMENTATION OF CROSS-LAYER APPROACH WITH EDBAT ALGORITHM

Our planned work influenced by the DBET [11] and the look is carried out predicated on EDBAT - Cross Layer Approach.

A node within an ad-hoc network learns routing information by overhearing or forwarding packets to other nodes and keeps the discovered routes within the route caches. We have used the body format of DBET for both unicast and broadcast packages has been mentioned below

3.1. The Modified ATIM frame

The mechanism enables a transmitter to decide no, overhearing for its neighbors', particular in the ATIM frame and is accessible to its neighboring nodes.

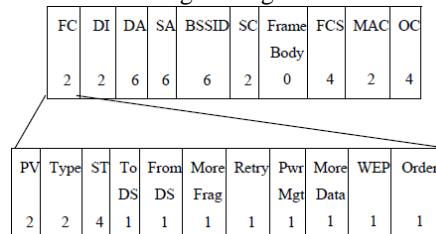


Fig.1.Modified Frame Format

For practicality, it is implemented in the context of IEEE ATIM frame is really a management frame (type 002) and its own sub-type is 10012 based on the 802.11 regular. The DBET protocol uses two unused sub-types, 11012 and 11102, to specify randomized and no overhearing, respectively. An ATIM frame together with the original sub-type 10012 is considered as unconditional overhearing and so conforms to the typical. It receives an ATIM frame or a unicast packet, when a node (its MAC address MA) wakes up in the start of a beacon interval. The ATIM frame comprises the receiver address (DA) and subtype (ID). The node determines whether or not to receive / overhear the publicized packet in the following data-transmission interval according to DA and ID. MAC is useful for obtaining the medium. OC means Overhearing Count, which is used for calculating the overhearing in the source to destination node. It might remain awoken to get it if one of the following conditions is satisfied:

1. The receiving node is the anticipated destination.
2. If the node is not the destination and unconditional overhearing is opted.
3. If the node is not the destination, the randomized overhearing is opted.

For each of the unicast packets, DSR uses the following overhearing mechanism, they are as follows,

- a. Randomized overhearing for RREP packets
- b. Randomized overhearing for data packets
- c. Unconditional overhearing for RERR packets

3.2 An Overhearing and Forwarding Mechanism for Broadcasting Packets

This forwarding and overhearing mechanism may be put on the broadcast packages such as RREQ to allow randomized overhearing; this avoids redundant rebroadcast of the exact same package in dense mobile networks. To the other hand, the re-broadcast decision must certainly be made conservatively. This is because a transmission packet may not be sent to any or all nodes within the network when depending rebroadcast can be used. The probability (PF) is set greater than overhearing probability (PR). In overhearing,

different transmission packets are offered, they truly are as follows

- i. Randomized rebroadcast for RREQ packets
- ii. Unconditional rebroadcast for ARP (address resolution protocol) request

Despite the fact that DBET reduces energy consumption by allowing the sender to establish the desired level of overhearing, the issue arises because of node mobility since the node mobility results in stale routes in course caches. This stale path issue will again be considered a reason for energy consumption. To create the DBET mechanism more effective rancid route avoidance is needed and this is achieved by employing the cross layer framework which is dependent on cache timeout policy.

3.3 Stale Route Avoidance in DSR by Cache Timeout Policy

Nodes motions result stagnant path cache entries. Cache staleness is a big problem in link cache system where individual hyperlinks are combined to seek out best route between source and location. A cache timeout policy is required to end a route cache entry, when it truly is more likely to become stagnant. DSR makes usage of course cache to avoid route discovery. The operation of DSR greatly depends upon successful execution of route cache. Inside this, a new cross-layer approach for forecasting the route cache lifetime is presented. This process assigns timeouts of individual links in route cache by utilising Received Signal Strength Indicator (RSSI) values received from wifi network interface card.

4. EFFICIENT DEMAND BASED ENERGY ALLOCATION

TOPOLOGY (EDBAT) - CROSS LAYER APPROACH

In our planned Efficient Demand Based Energy Allocation Topology (EDBAT), the topology is changed dynamically based on the network traffic requirements. EDBAT is integrated with the cross level method [3] to forecast the route cache life and get the old route information. Initially a little set of nodes is calculated which form a joined set, while the other nodes are positioned off to save electricity. This set can be useful for routing the packets under low network load. The dynamically changes along the route between these nodes to reduce the power consumption, if bulk data is transmitted between a pair of nodes.

Actions involved in the modified EDBAT - Cross layer approach as follows:

Step 1:

The first phase chooses a small set of nodes that constitutes independent set of the network. Here , we have considered 3 factors like energy factor, mobility factor, utility factor.

In energy factor, Let E_0 denote the initial node's energy and E_t be the amount of energy of a node at time t. So the energy factor E_i of the node i is calculated as

$$\frac{E_0 - E_t}{E_0}$$

Mobility factor (M_i) can be derived as the ratio of Received signal strength and Probability of overhearing rate to the energy consumption at the source to be transmitted.

Utility factor is derived as nodes that have a large number of neighbour nodes which have less conditional overhearing. It is denoted as U_i

By forming these three factors within the limitation of region R, the node moves independently with the reducible amount of overhearing.

Step 2:

The second phase is electing more nodes to ensure that the selected nodes form a connected set. Remaining other nodes go to sleep to conserve energy.

Step 3:

In the third phase, the redundant nodes are removed in each region R.

Step 4:

In fourth phase, the topology is dynamically changed with the use of power control technique to minimize the total power consumption. In this technique, all nodes consume more power when it receives full transmission power. This can be reduced by choosing low energy cost path. The minimum receiving power is calculated as

$$P_r = \frac{P_t G_t G_r h_t^2 h_r^2}{d^4}$$

h_t, h_r, G_t, G_r Antenna height and gain of the transmitter and receiver. d is the distance between transmitter and receiver. The actual power is given as,

$$\xi p, q = K \frac{P_t}{P_r} + W$$

K is function of h_t, h_r & d . W is the energy consumed by each receiving node. In EDBAT algorithm, the energy consumption is minimized along the routing path using the power control technique during the transmission.

Step 5:

The steps for removing stale route information is as follows

1. RREQ packet will be broadcasted to all the nodes.
2. The overhearing level will be set in the frame type field of ATIM for RREP and RERR packets.
3. Nodes in the network may overhear the RREP and able to stores the route information in route caches.
4. If there is any link break, RERR is propagated to the source node by an upstream node, so that it can be deleted these stale route from route cache.
5. The stale route information will be present in some of the neighboring nodes due to the overhearing of RREPs.
6. Route cache is updated based on RSS by cache timeout policy to remove stale routes from the neighboring nodes.

5. PERFORMANCE ANALYSIS

We use NS2 to mimic our proposed criteria. Inside our simulation, 101 cell nodes move in a 1000 meter x 1000 meter rectangular area for 50 seconds simulator time. All nodes have the same transmission range of 100 meters. The simulated traffic is Continuous Bit Rate (CBR). Our simulation configurations and variables are described in table 1

No. of Nodes	100
Area Size	1000 X 1000
Mac	802.11
Radio Range	100m
Simulation Time	50 sec
Traffic Source	CBR
Packet Size	80 bytes
Mobility Model	Random Way Point

5.1 Performance Metrics

We assess mainly the operation according to the following measurements.

Control overhead: The control overhead means the total number of routing control packets normalized by the complete amount of received information packets.

End-to-end delay: The end-to-end delay is averaged over-all enduring data packets from the resources to the destinations.

Packet Delivery Ratio: It's the proportion of the quantity of boxes received successfully as well as the absolute number of packets sent.

Fig. 2, presents the energy consumption. The Comparison of energy consumption for EDBAT, DBET and 802.11 PSM. It is clearly seen that energy consumed by EDBAT-CLA is less compared to DBET and 802.11PSM.

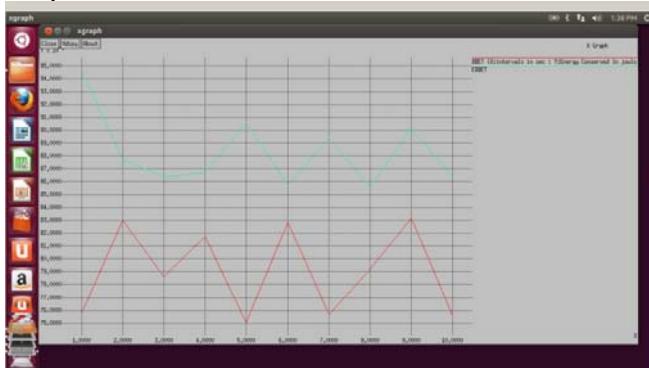


Fig. 2. No.of Nodes Vs Energy Consumption

6. CONCLUSION

On account of that, more energy is consumed by the node unnecessarily. Within this document, we've created a need established energy effective with cross level approach which reaches minimal energy intake to the mobile nodes. Within the first period of the plan, minimum energy consumption is realized using EDBAT formula. It uses three variables called power factor, power factor, flexibility factor to prefer package

forwarding by keeping minimum energy consumption for every node. In first stage, each of the redundant nodes are removed. We've shown the energy estimate of each node. In second period, the stele path problems are avoided utilizing the Cross layer strategy. By simulation results, we have shown that the EDBAT - CLA achieves good packet delivery ratio while attaining low delay, overhead, minimal power consumption in relation to the existing strategies DBET and 802.11 PSM while different the amount of nodes and freedom.

REFERENCES

- [1] P Narayan, V R. Syrotiuk, "Evaluation of the AODV and DSR Routing Protocols Using the MERIT Tool", In In proceeding or ADHOC-NOW 2004, pp. 25-36.
- [2] Fang Liu, Kai Xing, Xiuzhen Cheng, Shmuel Rotenstreich , "Energy-efficient MAC layer protocols in ad hoc networks" Resource Management in Wireless Networking, Kluwer Academic Publishers, 2004, pp.1- 42.
- [3] Hu C and Hou J, "A Link-Indexed Statistical Traffic Prediction Approach to Improving IEEE 802.11 PSM," J. Ad Hoc Networks, Vol. 3, No. 5, pp. 529-545, 2005.
- [4] Ashish K. Shukla and Neeraj Tyagi, "A New Route Maintenance in Dynamic Source Routing Protocol," International Symposium on Wireless Pervasive Computing, Phuket, 2006.
- [5] Charles E. Perkins and Elizabeth M. Royer, "Ad-Hoc On- Demand Distance Vector Routing," In Second IEEE Workshop on Mobile Computing Systems and Applications, pages 90-100, February 1999.
- [6] Sunho Lim, Chansu Yu,Chita, R.Das, "Random Cast: An Energy-Efficient Communication Scheme For Mobile Ad Hoc Networks," IEEE Transactions on Mobile Computing, Vol 8, No. 8, Aug 2009.
- [7] Sree Ranga Raju, Kiran Runkana and Jitendranath Mungara, "ZRP versus AODV and DSR: A comprehensive study on ZRP performance," International Journal of Computer Applications, Vol. 1, No. 12, pp. 1-6, 2010.
- [8] Ashish Shukla, "Ensuring Cache Freshness in On- demand Routing Protocols for Mobile Ad Hoc Network: A Cross-layer Framework " IEEE CCNC, 2007.
- [9] S. Agarwal, S.V. Krishnamurthy, R.H. Katz, and S.K. Dao, "Distributed Power Control in Ad-Hoc Wireless Networks," Proc.IEEE Int'l Symp. Personal, Indoor and Mobile Radio Comm. (PIMRC '01), pp. 59-66, 2001.
- [10] Johnson D and Maltz D, "Dynamic Source Routing in Ad Hoc Wireless Networks," Mobile Computing, pp. 153-181, 1996.
- [11] Jung E and Vaidya N, "A Power Control MAC Protocol for Ad Hoc Networks," Proc. ACM MobiCom, pp. 36-47, 2002.
- [12] Kawadia V and Kumar P, "Power Control and Clustering in Ad Hoc Networks," Proc. IEEE INFOCOM, pp. 459-469, 2003.
- [13] Kravets R, Kravets K and Krishnan P, "Power Management Techniques for Mobile Communication," Proc. ACM MobiCom, pp. 157-168, 1998.
- [14] Kyasanur P, Choudhury R. and Gupta I, "Smart Gossip: An Adaptive Gossip-Based Broadcasting Service for Sensor Networks," Proc. Second IEEE Int'l Conf. Mobile Ad Hoc and Sensor Systems, pp. 91-100, 2006.
- [15] Li Z and Li B, (2005) "Probabilistic Power Management for Wireless Ad Hoc Networks," Mobile Networks and Applications, Vol. 10, No. 5, pp. 771-782, 2005.
- [16] Lim S, Yu C and Das C, "Reast: A Randomized Communication Scheme for Improving Energy Efficiency in Mobile Ad Hoc Networks," Proc. 25th IEEE Int'l Conf. Distributed Computing Systems, pp. 123-132, 2005.
- [17] Hari Prasad Gupta, S.V.Rao, " DBET: Demand Based Energy Efficient Topology for MANETs", IEEE Conferences, 2011, pp.1-5.