Energy Efficient Approaches: Altruist Energy Efficient Approach is the Best

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ABSTRACT- This paper presents the energy efficient approaches and the importance of Altruistic approach in the absence of nearest neighboring nodes to the receiver. Two energy-efficient approaches have been proposed one is in-situ energy efficient approach, and the other is altruistic energy efficient approach. In the first approach existing nodes in network are only used and in second approach additional nodes called altruists are used. Generally comparison is done with five protocols with respect to these approaches and identifies altruistic DISH to be the right choice since it conserves 40-80 percent of energy, maintains the throughput advantage, and the cost efficiency compared to protocols without this approach is two times more. Our study also shows that an in-situ energy efficient approach is suitable only in certain confined scenarios. When transmit-receive pair wishes to initiate communication, neighboring nodes share their knowledge of channel usage. This helps to considerably reduce collisions and increases throughput significantly. However, it comes at the cost of increased energy consumption since idle nodes have to stay awake to overhear and acquire channel usage information. In fact this can be as high as 264% of a power-saving protocol without cooperation. The core idea is to introduce specialized nodes called altruists in the network whose only role is to acquire and share channel usage information. All other nodes, termed peers, go in to the sleep mode when idle due to this power consumption will be less. This altruistic approach seems to be complicated because it needs additional nodes to be deployed.

Keywords- Cooperation, Energy Efficiency, MAC Protocol, Multi-Channel, in-situ energy conscious DISH, wireless ad hoc networks Design, Performance

I. INTRODUCTION

The main challenge to multi-channel MAC protocol design for ad hoc networks is a multi-channel coordination problem. It consists of a channel conflict problem, caused by a node selecting a busy channel for data transmission, and a deaf terminal problem, caused by a node initiating communication with another node which is however on a different channel. The first sub problem results in packet collision and the second leads to unneeded retransmissions. The mainstream of proposed solutions uses either multiple transceivers or time synchronization to address the problem, but it clearly increases cost, overhead and complexity. Recently, introduced a new notion of cooperation and thereby propose a cooperative multi-channel MAC protocol called CAM-MAC (Cooperative Asynchronous Multi-Channel MAC). Disparate in usual MAC protocols nodes making decisions independently, in CAM-MAC idle neighbors actively aid transmit-receive pairs in selecting correct channels and interception insensitive terminals. The protocol uses a single transceiver and is fully asynchronous, and demonstrates notable throughput advantages. In particular, it substantially outperforms three recent and representative multi-channel MAC protocols, MMAC, SSCH, and AMCP. However, we point out that the performance gain comes at the cost of significant energy consumption. In order to cooperate, nodes have to stay awake during idle periods in order to gather and share channel usage information, which prevents them from sleeping to save energy. We evaluated this via simulations in a single-hop network, comparing it with a power-saving protocol without cooperation. We found that, when there are 40 nodes forming 20 disjoint source destination pairs and each source generates traffic at 160kbps, the cooperative protocol consumes energy as high as 264% of the power-saving uncooperative protocol. This motivates the need of designing energy efficient strategies for cooperative protocols, however it is even more difficult than for traditional protocols, because (i) the prerequisite of cooperation is information gathering which can be done only when nodes are awake, and (ii) extra energy has to be spent on transmitting/receiving cooperative messages. In this paper, an approach called altruistic cooperation is explained which is a simple solution to this challenging problem. The key idea is to introduce additional nodes called altruists that are used only to cooperate but not carry traffic. These altruists always stay awake so that existing nodes can sleep when idle. This strategy seems naive since it uses additional resources to improve performance. In fact it is unclear whether (i) the total energy can be conserved, (ii) throughput will be compromised, and (iii) the increased network cost will pay off that is the if the transmission is more reliable then it affords the cost at the same time to meet the needs.

II. MEDIA ACCESS CONTROL

Media access control is an essential part of the wireless communication stack and it has obtained intensive research attention. More recently, to achieve higher communication throughput, multi-channel MAC has been studied. This paper focuses on how to incorporate both the advantages of multiple channels and TDMA into the MAC design with low overhead, when each node in the network is only equipped with a single half-duplex radio transceiver. Such hardware can not transmit and receive at the same time, but it can switch its frequency dynamically.

Many of the previous multi-channel MAC designs require multiple radio transceivers. Multiple radios not only result in higher product prices, but also consume more power from energy-constrained devices. Plus, most current IEEE 802.11 devices are equipped with a single half-duplex radio transceiver. Therefore, it is important to devise an energy efficient multi-channel MAC protocol based on a single half-duplex transceiver. In this single transceiver context, conventional multichannel MAC designs adopt explicit frequency negotiation, through certain kinds of control messages.

III. ENERGY-EFFICIENT APPROACHS

The main challenge to achieving energy efficiency for DISH is that a requisite of information sharing is information gathering initially, a process that requires nodes to stay awake for overhearing, which presents a challenge for nodes to switch off radio when idle. The strategies we elaborate below meet this challenge.

In-Situ Energy Efficient Approaches

In this approach, all the existing nodes rotate the responsibility of information sharing (i.e., cooperation) such that nodes without the responsibility can sleep when idle. There are two methods to implement this strategy:

Probabilistic method: According to a (static or dynamic) probability each node decides whether to cooperate or not. This is uniformly to probabilistic flooding, and probabilistic routing in ad hoc networks, and cluster-head rotating algorithms (e.g., LEACH and HEED) in sensor networks.
Voting method: Nodes periodically vote or elect a subset of nodes to team up. This resembles to GAF, Span, PANEL, and VCA. A visible importance of the in-situ strategy is it does not require any additional nodes. On the other hand, a runtime probabilistic or voting mechanism must be introduced and must be 1) distributed, 2) fair (in terms of energy consumption), and 3) adaptive (to network dynamics such as traffic and energy drainage). These would introduce considerable complexity and overhead. In addition, it has to consider other factors as listed below. Broadcasts might be reduced or avoided by determining cooperative nodes based on geographic information. However, this requires expensive GPS support or a distributed localization algorithm which introduces additional overhead and complexity to those incurred by rotation itself. Second, rotating the responsibility of cooperation also involves other resource-consuming factors including two-hop neighbor discovery and the assessment of dynamic information (such as energy and traffic. Third, how to integrate a probabilistic or voting mechanism into a legacy DISH protocol is a nontrivial problem and a viable solution is yet to be found. In summary, the complexity, overhead, and unreliability of in-situ energy conscious DISH would consume considerable resource and eventually negate its possible performance gain.

Altruistic Energy Efficient Approaches

In this strategy, additional nodes called altruists are deployed to take over the responsibility of information sharing from the existing nodes, which we call peers to distinguish from altruists, so that peers can sleep when idle. Altruists are the same as peers in terms of hardware, but are different in terms of software: they solely cooperate (do not carry data traffic) and always stay awake. An apparent drawback of this strategy is that it requires additional nodes. However, this is offset by substantive advantages. First, it is very simple to implement the strategy: one only needs to introduce a Boolean flag to disable data related functions on altruists and cooperation related functions on peers. Equally importantly, there is no additional runtime mechanism and hence runtime overhead. Second, unlike the in-situ strategy, this strategy does not have the multichannel broadcasting problem. Altruists always stay on the same channel (control channel) and send/receive packets only on the control channel. Third, this strategy is robust to network dynamics (such as traffic and residual energy). Every altruist is cooperative and will react to every MCC problem that it identifies; they do not need to adjust any parameter on the fly. In fact, even the deployment of altruists, which is an offline process, can be done with a constant number for any given peer density since peers only carry data traffic and need not to cooperate, they are like nodes in traditional (non-DISH) networks and thus can adopt a legacy sleep-wake scheduling algorithm, where a lot of choices are available. Finally, unlike the in-situ strategy and the original DISH where cooperation is provided in an opportunistic manner—meaning that cooperative nodes are not always available, altruistic DISH provides cooperation in a guaranteed manner. The cooperation among nodes is definite among the nodes for the successful transfer of file or message. Compare to in-situ energy efficiency our survey identified altruistic energy efficient approach as the best one by considering many aspects like energy conservation, reliable message or file transfer etc.

IV. INTRODUCTION TO DISH

Various design approaches have been proposed in the last decade or so, but most of them require either multiple radios or time synchronization. Recently, proposed a distinct approach called Distributed Information SHaring (DISH), in which a single radio is used but operates asynchronously. The authors designed a DISH-based protocol called CAM-MAC, in which neighboring nodes share control information with each sender-receiver pair to facilitate it to choose collision-free channels or to avoid busy receivers. DISH is essentially a form of node cooperation, but the key difference is that, in traditional cooperation, intermediate nodes help relay data for source and destination nodes, but DISH, on the other hand, only requires control information to be sent. Therefore, the former can be called data-plane cooperation and the latter can be called control-plane cooperation.

V. EXSISTING SYSTEM

Distributed Information SHaring (DISH) uses a single radio but operates asynchronously. Various design approaches have been proposed previously but most of them require either multiple radios or time synchronization. DISH-based protocol called CAM-MAC.DISH is essentially a form of node cooperation.

In existing system the generation of additional nodes is not possible however the generation of additional nodes is not easy task it is complex to show practically. Sender sends message through available shortest path to receiver. If receiver is free to accept the message sent by sender accepts and sends acknowledgement. But if receiver is busy then the problem arises to send the message again by sender. This process consumes both power and time. As mobile devices are battery powered the main task is to eliminate regular battery charge so to aim this objective instead of sending the message again when the receiver comes to active it is better to make use of neighboring nodes. If the message is sent to nearest node of receiver then the receiver could easily get the message that is sent by sender and when receiver comes to active. This entire process is shown in Figure 1. By storing the message in nearest neighboring nodes also reduces burden on sender that is energy consumption will be reduced.

The drawback with this existing system is if the node that is nearer to receiver is not in available due to improper functioning or due to power loss a question arises where to store the message sent by sender until the receiver comes to active state? The solution for this drawback will be given in our studied proposed system.

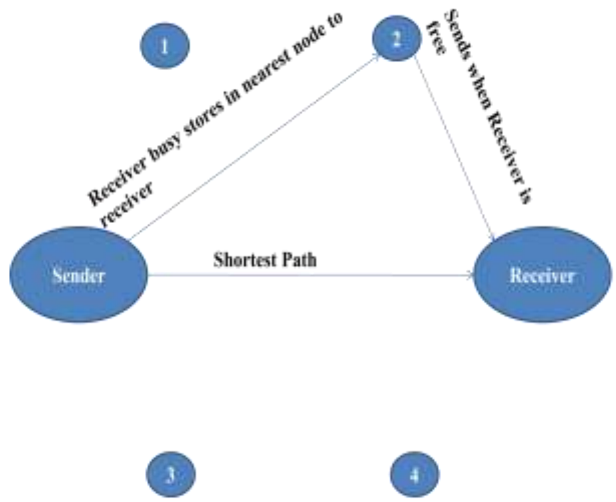

Fig 1: Traditional approach to transfer message from neighboring node

VI. PROPOSED SYSTEM

The proposed system overcomes all the drawbacks of existing system. This proposed system makes use of altruistic energy efficient approach and based on additional nodes generation procedure. But the demonstration of this additional node is difficult task so we are showing them with the node evaluation to identify suitable available nodes for the transmission of message sent by sender.

The Figure 2 shows the work flow of our proposed system that we studied. There are two processes in proposed system. The first process is a front end process and the second process is back end processes.

At the frontend processes the user interface firstly estimates the distance to the sender and evaluates nodes and through that selected nodes only message will be sent. The energy consumption will be based on selected nodes and receiver gets the message (or) file through that selected nodes. The nodes that are utilized for transfer only consumes energy and the rest will be in idle state. Energy consumption, Nodes choosing and saving of energy all comes under backend process.

The advantage of this proposed system is that the energy consumed by the nodes that are used for the transmission of the message is saved that is the lost energy is saved. The energy loss is only for the nodes that involve in transmission not all the available nodes only nodes that are efficient and effective in the transmission participation.

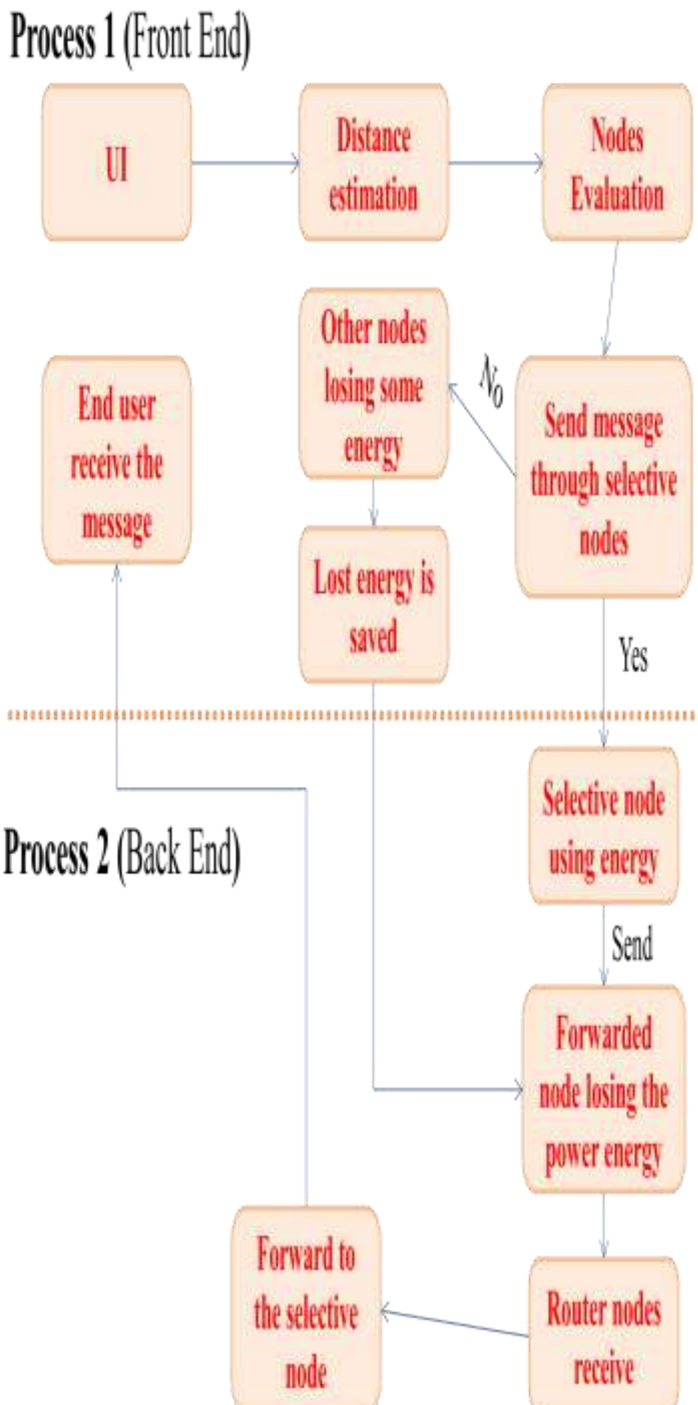

Fig 2: Work Flow in Proposed System

VII. SCREEN SHOTS

Figure: This is source node page with a message to destination node

Description:

In the source node page of this windows based application either a sample simple text is typed in the text box provided or a file from the computer can be browsed that is to be sent via routers. The content of the file browsed will be displayed in the text box. On clicking "Submit" button the browsed file will be sent. In the above screen shot the message a simple message is typed for the transmission.

Figure: This is router page which is showing the path of transfer of message sent

Description:

The routers page of this windows based application shows the route of the file transfer to the destination. In the above page there are overall 9 routers through which the file has to transfer. Mostly the choosing of routers will be based on the routers availability, efficiency and the shortest possible path. In the above screen shot the route of the sent message is displayed through the differentiation made by the routers colors.

Figure: This is destination node page that displays sent message

Description:

In the destination page of this windows based application, the sent file from the source travels through the available best routers and reaches the destination. The file that has been browed in source page gets displayed on the textbox provided in the destination node page. In the above screen shot the sent message from source node gets displayed at the destination node and the message gets displayed in the textbox provided.

VIII. CONCLUSION

Distributed information sharing can significantly boost the system throughput (performance) for multichannel MAC protocols, but it also heightens the energy consumption due to its information sharing component (which subsumes information gathering). In this paper, we propose two energy-efficient strategies and conduct a comparative study on five protocols that differ in the usage of DISH and the strategies.

This paper explains the effective energy conservation by the proposed two effective energy approaches: in-situ energy efficient approach, which uses existing nodes only, and altruistic energy efficient approach, which requires additional nodes called altruists. But with the energy conservation the cost is increasing by 2 times and there is a scope to reduce the cost.

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BIOGRAPHY

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