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Improving the Network Period of Time of MANETS through Cooperative Raincoat Protocol Style

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Abstract:

Our ultimate aim is to implement a high energy efficient data transmission protocol for Mobile ad-hoc network. We have selected our research domain energy management system in MANET. Cooperative communication is a hopeful technique for saving the energy consumption in MANETs. CC is not always energy efficient compared to direct transmission. To deal with the tangled medium access interactions induced by relaying and hold the benefits of such cooperation, an efficient Cooperative Medium Access Control protocol is needed. The existing CMAC protocols mainly focus on the throughput enhancement while fault to investigate the energy efficiency or network lifetime. We propose DEL-CMAC that basis on the network lifetime extension, which is a less traverse aspect in the related work, by considering the energy consumption on both transmitter and receiver.

Keywords:

MANET, CSMA/CA, CMAC, Energy efficiency.

1. Introduction:

A Mobile Ad-hoc Network (MANET) is a self-configured network of mobile terminals connected by wireless links. Mobile terminals such as cell phones, portable gaming devices, personal digital assistants, (PDAs) and tablets all have wireless networking capabilities.

By participating in MANETs, these terminals may reach the Interne when they are not in the range of Wi-Fi access points or cellular base stations, or communicate with each other when no networking infrastructure is available. One primary issue with continuous participation in MANETs is the network lifetime, because the aforementioned wireless terminals are battery powered, and energy is a scarce resource. Cooperative communication (CC) [2] is a promising technique for conserving the energy consumption in MANETs. The broadcast nature of the wireless medium (The so-called wireless broadcast advantage) is exploited in cooperative fashion. The wireless transmission between a pair of terminals can be received and processed at other terminals for performance gain, rather than be considered as an interference traditionally. CC can provide gains in terms of the required transmitting power due to the spatial diversity achieved via user cooperation. However, if we take into account the extra processing and receiving energy consumption required for cooperation, CC is not always energy efficient compared to direct transmission. There is a tradeoff between the gains in transmitting power and the losses in extra energy consumption overhead.

2. Related Work:

Space, or multiple-antenna, diversity techniques are particularly attractive as they can be readily combined

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with other forms of diversity, e.g., time and frequency diversity, and still offer dramatic performance gains when other forms of diversity are unavailable. Authors developed and analyze low-complexity cooperative diversity protocols that combat fading induced by multipath propagation in wireless networks. The underlying techniques exploit space diversity available through cooperating terminals' relaying signals for one another.

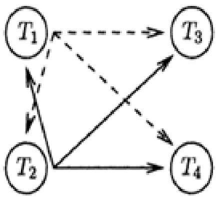
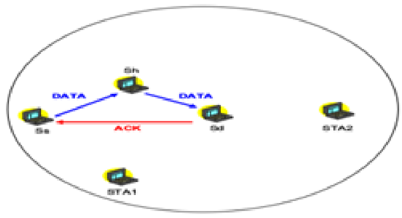


Fig. 1. Illustration of radio signal paths in an example wireless network with terminals T_1 and T_2 transmitting information to terminals T_3 and T_4, respectively.

[1] Paper technique improved the quality of service in network performance, and it makes effective relaying in signal transmission. And disadvantage is not concentrating on the energy efficient transmission in wireless network. Wireless networks [2] that provide multi-rate support give the stations the ability to adapt their transmission rate to the link quality in order to make their transmissions more reliable. Thus, stations that experience poor channel conditions tend to use lower transmission rates and vice versa. The basic functionality of the proposed protocol is illustrated in Fig. 2. In this figure, S is the source station; S d is the destination station and S h a potential helper. The potential helper is an intermediate station between the source and the destination that is able to exchange data with the source and the destination at rates higher than the rate of the direct link between them. As authors can see in the figure, the source station, instead of sending its data directly to the destination using a Cooperative regions for Cooperative MAC low data rate transmission, transmits the data in a two-hop manner using the station S h as a helper. The advantage of the two-hop transmission is that the two links that are used are fast and thus the overall time for the transmission from the source to the destination is reduced.

When the helper receives the frame from the source, it retransmits it to the destination after a SIFS time, and thus avoids the need to contend for the medium. After the reception of the frame from the helper, the destination station sends a direct ACK to the source, acknowledging the reception. [2] Paper also mainly concentrating on the QoS improvement not on the energy efficiency



Exchange of data-ACK frames for Cooperative MAC

Fig.2: Exchange of data-ACK frames for Cooperative MAC protocol

[3] Cooperative communication, which can achieve spatial diversity by exploiting distributed virtual antennas of cooperative nodes, has attracted much attention recently due to its ability to mitigate fading in wireless networks. The main feature of cooperative communication is the involvement of neighboring nodes in data transmissions. The novel aspect and core idea of author's proposal is a cross-layer adaptive data transmission algorithm considering both the length of data frame at the MAC layer and instantaneous wireless channel conditions. Under this algorithm, direct transmission mode or proper cooperative transmission mode will be adaptively selected for data packets according to both MAC layer and physical layer information.

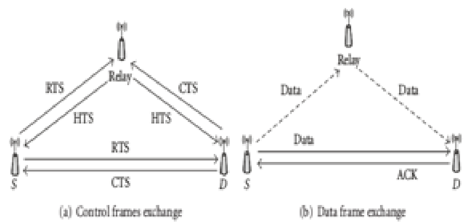


Fig.3: Physical Layer Information

When the length of a data frame is less than the RTS threshold, the source will transmit it directly to the destination by the basic access scheme of IEEE 802.11 DCF, which brings down the overhead in the network; otherwise, the source will send an RTS frame and wait for a CTS frame from the destination. If the source receives a CTS frame but does not receive any HTS frame from neighbor nodes in a certain interval, it will transmit the data packet by RTS/CTS direct transmission scheme. If both CTS and HTS frames are received in sequence, the source transmits the data packet according to the “transfer mode” piggybacked in the HTS frame. If an ACK is not received after an ACK timeout, the source should perform random back off; otherwise, the source will handle the next data packet in its queue. If the destination receives an RTS frame from the source, it sends a CTS frame including the measured channel conditions information between source and destination and waits for HTS frames from neighbor nodes. If any HTS frame is not received before receiving data packet, indicating that the source transmits data packet by RTS/CTS direct transmission scheme, the destination processes the unique data packet.

If the destination receives an HTS frame before receiving data packet, it will process the received data packet according to the “transfer mode” piggybacked in HTS and then sends an ACK to the source. The neighbor node judges whether itself is a candidate relay node for a given source-destination pair. If it is, it will wait for the timer T r to expire and then broadcasts an HTS frame to declare itself; if it receives an HTS frame before the timer reaches zero meaning it is not the best relay node for the given source-destination pair, the neighbor node should backoff. When overhearing a data packet, a candidate relay node extracts the “relay address” information to judge whether it is the relay node for the given source-destination pair. If it is, the node will decode and forward the data packet to the destination.

It [3] can avoid extra overhead, and this technique can improve the throughput by using the MAC and physical layer configuration. It cannot select the optimal relay, this technique not concentrating on the optimal relay selection process and power saving process. Wireless [4] ad hoc networks are increasingly deployed for various applications. This wide application requires ad hoc networks to support different types of service ranging from slow rate data transmission to multimedia and real-time services. An effective solution to this problem is to use cooperative communications as it can exploit the spatial diversity from relaying paths via relaying nodes to increase the transmission reliability, enhance the network throughput, as well as reduce the transmission latency. [5] Paper considers the design of a cross-layer medium access control protocol for wireless ad hoc cooperative networks.

Authors proposed an improved cross-layer cooperative MAC protocol. Author’s idea is to simplify the signal message exchange process to reduce the protocol overhead. Specifically, instead of using a control frame to inform the source, authors use a helper response pulse signal with shorter length (up to two mini-slots in IEEE 802.11 DCF). [5] The shortened length of the HRP signal helps to reduce the protocol overhead, and thus improves the path throughput. The HRP signal with shorter length is transmitted more reliably over erroneous channels leading to higher cooperative opportunity. In author’s protocol, only one HRP signal is used at the k th randomly picked up mini-slot to inform the source even if there are more than one optimal helper. This design allows the protocol to switch from the unsuccessful cooperative mode to the direct transmission faster.

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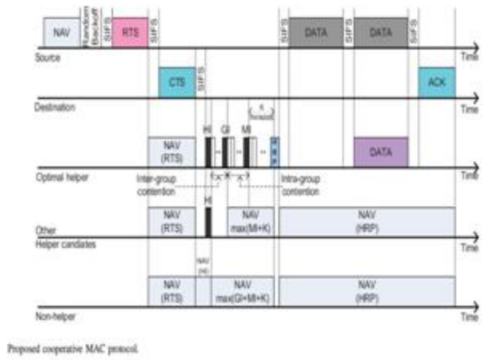

Fig.4: Proposed Cooperative MAC protocol

This technique only concentrates on QoS parameters such as overhead and throughput. Spatial diversity has been extensively studied in the context of Multiple-Input-Multiple-Output (MIMO) systems to combat the effects of multipath fading. However, in wireless networks, especially sensor networks, it might not be feasible to install more than one antenna on the wireless terminal because of space limitations or the required simplicity in implementation. To solve such problems, cooperative diversity has been introduced. The analytical and numerical results reveal that for small distance separation between the source and destination, direct transmission is more energy efficient than relaying. The results also reveal that equal power allocation performs as well as optimal power allocation for some scenarios. Authors compare the performance of two communication scenarios. In the first scenario only direct transmission between the source and destination nodes is allowed, and this accounts for conventional direct transmission. In the second communication scenario, authors consider a two-phase cooperation protocol. In the first phase, the source transmits a signal to the destination, and due to the broadcast nature of the wireless medium the relay can overhear this signal. If the destination receives the packet from this phase correctly, then it sends back an acknowledgement (ACK) and the relay just idles. On the other hand, if the destination cannot decode the received packet correctly, then it sends back a negative acknowledgement (NACK).

In this case, if the relay was able to receive the packet correctly in the first phase, then it forwards it to the destination. The source node transmits its packets to the destination and the relays try to decode this packet. If the destination does not decode the packet correctly, it sends a NACK that can be heard by the relays. If the first relay is able to decode the packet correctly, it forwards the packet with power P 1 to the destination. If the destination does not receive correctly again, then it sends a NACK and the second candidate relay, if it received the packet correctly, forwards the source's packet to the destination with power P 2. [5] Paper effectively describes about the necessary of cooperative communication in wireless sensor network when the direct communication fails. And it provides another best solution to improve the power saving by using the power allocation method. [5] paper mainly suitable for wireless sensor network with different fixed power levels, and further improvement is needed with this concept for mobile ad-hoc network.

2.1. Existing work summary:

In this paper, we propose an improved cross-layer cooperative MAC protocol. Our idea is to simplify the signal message exchange process to reduce the protocol overhead. Specifically, this protocol can switch from the unsuccessful cooperative mode to the direct transmission faster. The existing CMAC protocols mainly focus on the throughput enhancement while failing to investigate the energy efficiency or network lifetime.

3. Proposed system:

We propose a technique with the objective of prolonging the network lifetime and increasing the energy efficiency, we present a novel CMAC protocol, namely DEL-CMAC, for multi-hop MANETs. We also address the issue of effective coordination over multiple concurrent cooperative connections with dynamical transmitting power. A distributed energy-aware location-based best relay selection strategy is incorporated in our proposed system.

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In this section, with the objective of prolonging the network lifetime and increasing the energy efficiency, we present a novel CMAC protocol, namely DEL-CMAC, for multi-hop MANETs. When cooperative relaying is involved, the channel reservation needs to be extended in both space and time in order to coordinate transmissions at the relay. To deal with the relaying and dynamic transmitting power, besides the conventional control frames RTS, CTS and ACK, additional control frames are required. DEL-CMAC introduces two new control frames to facilitate the cooperation, i.e., Eager-To-Help (ETH) and Interference-Indicator (II). The ETH frame is used for selecting the best relay in a distributed and lightweight manner, which is sent by the winning relay to inform the source, destination and lost relays.In this paper, the best relay is defined as the relay that has the maximum residual energy and requires the minimum transmitting power among the capable relay candidates. The II frame is utilized to reconfirm the interference range of allocated transmitting power at the winning relay, in order to enhance the spatial reuse. Among all the frames, RTS, CTS, ETH and ACK are transmitted by fixed power. And the transmitting power for the II frame and data packet is dynamically allocated. We denote the time durations for the transmission of RTS, CTS, ETH, ACK and II frames by T_{rts}, T_{cts}, T_{eth}, T_{ack}, and T_{ii}, respectively.

3.1. Enhancement:

It uses the formula to choose the optimum route. The formula is predicated on the hop count and also the minimum residual energy and the cooperative communication. There is no discussion about security issues in MANET. In our enhancement work we propose a solution to address the energy based attack. In mobile ad-hoc network, one of the main problem is energy saving. The attackers mainly focusing on node energy level, and reduce energy level of intermediate node. So in our proposed solution we are introducing the energy trust management system with network layer.

3.2. Algorithm:

1) If node has data
a. If Medium free
i. Send RTS
ii. Set medium NAV_
2) If pkt recv in j
a. If pkt $=$ RTS
i. Store Src $\rightarrow$ $Help_{src}$
ii. If j == dst
1. Send CTS
iii. Wait for CTS
1. If not
a. Go to sleep
b. If pkt $=$ CTS
i. If $Help_{src}$ $=$ dst
1. Send ETH
2. Wait
a. Send II
ii. Else if j $=$ dst
1. Wait for ETH
a. If not
i. Direct transmission
iii. Else
1. Go toSleep
c. If pkt $=$ ETH
i. Send Data to helper
ii. Go to sleep
d. If (pkt $=$ data) & $Helper$
i. Forward to receiver

Outputs:

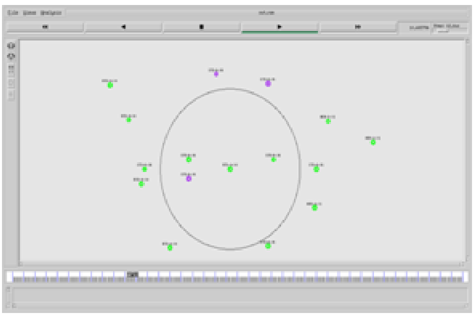

Fig.5: Proposed System

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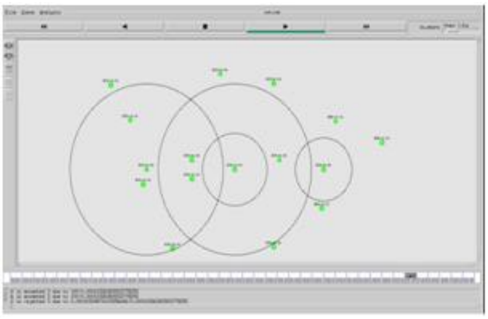

Fig.6: Enhancement

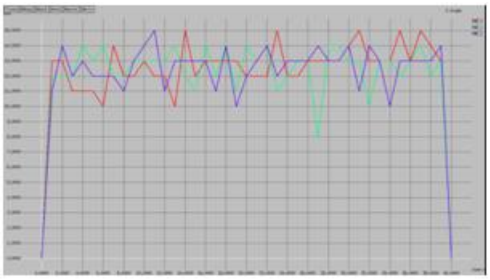

Fig.7:Comparision1.

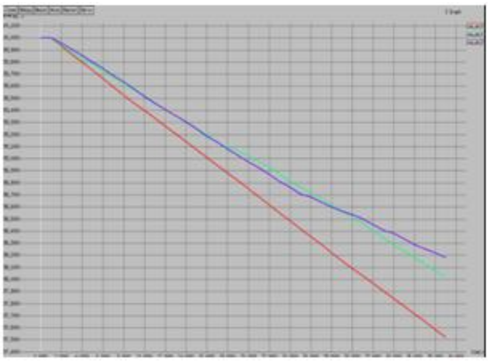

Fig.8: Comparision 2

4. Requirements:

To implement this technique we used the hardware single PC with 20 Gb Hard disc space and 1Gb RAM. And software is Linux OS (Ubuntu 10.04) and NS2.34. We used the programming languages TCL (Front end type project only) and C++

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