Volume 3, No. 9, September 2012
Journal of Global Research in Computer Science
RESEARCH PAPER
Available Online at www.jgrcs.info
ISSN-2229-371X

A NOVEL APPROACH FOR IMPROVING PERFORMANCE OF WSN USING R-MAC SCHEDULE

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Abstract- MAC protocols employ identical schedules for both unicast and broadcast packet transmissions, and modify their "unicast schedule" to work with broadcast packets. For instance, IEEE 802.11 cannot perform an RTS / CTS handshake for broadcast packets, and thus only utilizes CSMA for broadcast packets, regardless of the impact on life or contention. The MAC schedule should be chosen to maximize the life of the network, which includes reducing contention. MAC schedule to node and network conditions to improve performance under a wide range of conditions and for both unicast and broadcast packets the "transmit / receive schedule" to synchronize nodes on a slowly changing path so that throughput and delay are further reduced, at no cost of overhead in most cases. the transmit / receive schedule to automatically synchronize the nodes can reduce packet delivery delays, providing an efficiency and throughput will increases. The Route-MAC (R-MAC) or SP-MAC-D schedules perform differently depending on the network scenario and application requirements. R-MAC attempts to pick the MAC schedule that yields the best operating points by adapting the MAC schedule, based on a look-up table. Thus, this research work must populate this adaptation table and find the appropriate switching thresholds. As discussed next, this research work begin this evaluation with the simulation of an analytical model, and verify it with a Matlab implementation.

Keywords- Wireless sensor networks (WSNs), Transmit, Receive Schedule, MAC Schedule , Efficiency and Throughput, IEEE 802.11, unicast and broadcast packet, network.

INTRODUCTION

Energy efficiency is crucial in wireless sensor networks. To this end, many energy-efficient wireless MAC protocols (e.g., [1] have been proposed that utilize duty cycling, a technique in which each sensor node alternates between active and sleeping states, turning its radio on only periodically; the percentage of time a node is awake is referred to as the node's duty cycle. Duty cycling aids in energy efficiency by reducing idle listening and overhearing, two of the most significant causes of unnecessary energy consumption in wireless sensor networks. Idle listening refers to a node listening to a wireless channel when there is nothing on the channel to receive, and overhearing refers to a node hearing packets not intended for this node.

The Wireless sensor networks (WSNs) have been used for many applications, including environmental monitoring, health monitoring, security and surveillance [2]. As new sensor platforms have appeared on the market, a simple observation was made that idle listening, far from being negligible, was a major source of energy consumption [3] [4] [5]. A MAC protocol may reduce energy consumption for unicast packets, it may at the same time waste energy when applied to broadcast packets. Such inefficiencies become significant as broadcast packets make up a larger percentage of the total packets sent on a network—for example, in the case of a room monitoring application at night when no events are reported and only protocol administration packets are exchanged. Until now, protocol designers have only adapted their unicast MAC schedules to function in a broadcast configuration without concern for other design considerations. Instead, this research work propose adopting the transmission schedule that yields the best life taken from a pool of compatible protocols.

A sensor networks make the best possible use of their initial energy resources, by constantly adapting their protocols to the changing conditions in the network. Both protocol-specific and cross-layer schemes have offered a plethora of energy reducing techniques. In particular, there are also some other protocols that focus on reducing energy at the data link / MAC layer, which constitutes the scope of this work. In this paper discusses MAC schedules to adopt the most throughput efficient pattern of packet transmissions and receptions. Because different areas in the network experience different and changing loads of traffic, the MAC protocol should utilize the schedule most economical for the local conditions. This research work also try to synchronize nodes so as to reduce transmission time and thus throughput decreases and packet delivery delays.x

Technique controls the inter-listening time to conditions in the network and is exposed in [6]. As new sensor network platforms have appeared on the market, a simple observation was made that idle listening, far from being negligible, was a major source of energy and time consumption [3]. the sending node occupies the medium for long intervals to signal its imminent packet transmission. Receiving nodes are thus allowed to sleep for at most the duration of this preamble and they must stay awake when they sense a busy medium until the packet transfer is complete. (although many of our results can be transposed to other MAC protocols), and this research work define) MAC schedule" as the pattern of packet transmissions occurring within the interval. Our Solution to modify the MAC schedule of X-MAC by repeating the data packet and waiting for ACK frames between transmissions. A received ACK signifies that the data packet has been correctly received and stops the transmission flow of data packets. This renders the MAC protocol immune to false positive packet receptions. For broadcast packets, the flow of data packets is still interleaved with periods of listening for acknowledgments. Consequently, multiple receivers of the same packet may wake up, stay in Rx mode until the full reception of a packet, and go back to sleep.

In the initial part of this work, this research work prove that while the MAC protocols generally throughput consumption without resorting to explicit exchange of active / inactive schedules between nodes, low duty cycles drastically favor receiving nodes over mostly sending nodes and induce higher delays and contention.

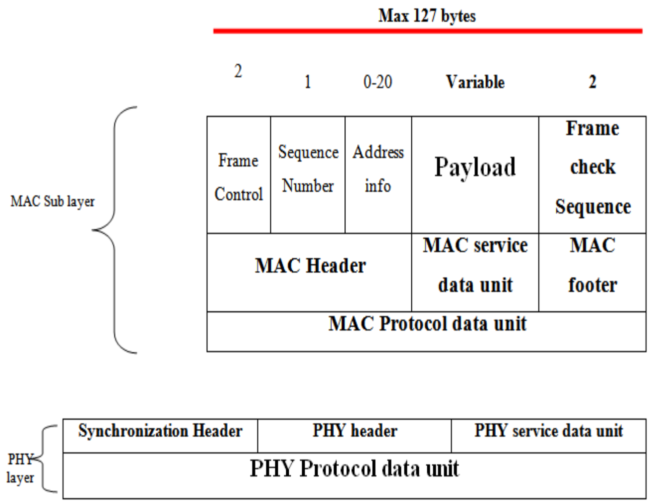

Figure: 1 shows the construction of the data frame, also called a *data packet*.

Switching MAC schedules from a pool of MAC protocols at the transmitter to minimize energy consumption based on parameters such as packet size, whether the packet is broadcast or unicast, and the estimated ratio of transmit to receive packets in the local neighborhood. The protocols are "compatible" because they are interchangeable: the receiver does not need to know what specific schedule is being used, it simply wakes up and senses the channel every seconds and sends an ACK frame when required by the received packet.

Also to synchronize nodes along a slowly changing routing path so as to minimize error and packet delay, without explicit scheduling between nodes or overhead of any sort. For unicast packets, the sender stops its stream of advertisement data MX-MAC packets after receiving an acknowledgement frame. Sender and receiver can then be synchronized to wake-up sequentially within a short interval. Conversely, Speck MAC, which cannot be interrupted, needs explicit notification within nodes to synchronize.

LITERATURE SURVEY

In this research work [7], traditional wireless sensor network (WSN) applications, energy efficiency may be considered to be the most important concern whereas utilizing bandwidth and maximizing throughput are of secondary importance. However, recent applications, such as structural health monitoring, require high amounts of data to be collected at a faster rate. This research work present a multi-channel MAC protocol, MC-LMAC, designed with the objective of maximizing the throughput of WSNs by coordinating transmissions over multiple frequency channels.

MC-LMAC takes advantage of interference and contention-free parallel transmissions on different channels. It is based on scheduled access which eases the coordination of nodes, dynamically switching their interfaces between channels and makes the protocol operate effectively with no collisions during peak traffic. Time is slotted and each node is assigned the control over a time slot to transmit on a particular channel. This research work analyze the performance of MC-LMAC with extensive simulations in Glomosim. MC-LMAC exhibits significant bandwidth utilization and high throughput while ensuring an energy-efficient operation. Moreover, MC-LMAC outperforms the contention-based multi-channel MMSN protocol, a cluster-based channel assignment method, and the single-channel CSMA in terms of data delivery ratio and throughput for high data rate, moderate-size networks of 100 nodes at different densities.

A MAC protocol that reduces the preamble length before sending a data packet by exchanging wake-up schedules between neighbors. However, Wise MAC (like B-MAC) cannot be implemented on 802.15.4 radios. It also requires fine time synchronization between nodes, and at a cost that may be difficult to quantify. For these reasons, it was not included as such in our study. Moreover, other work [8] shows that implicit synchronization can be achieved between nodes running some of the protocols studied here, reducing the need for synchronization overhead.

In [9], Wong and Arvind also propose Speck MAC-B, which is compared, along with Speck MAC-D, to B-MAC. The Speck MAC protocol family is intended for miniature motes called specks. Speck MAC-B stands for Back off and replaces the long preamble with a sequence of wake up packets containing the destination target and the time when the data packet will be sent. This allows receiving nodes to sleep for the remainder of ti and activate just in time for data reception. However, this scheduling supposes fine time synchronization between nodes. The authors thoroughly compare B-MAC to SMAC [4] and T-MAC [5]. To curb limitations imposed on the receiving node to stay awake for the time of the preamble, Polastre et al. propose sending packets with half-sized preambles. Post-B-MAC protocols include X-MAC [10] and Speck MAC-D [9]. Both protocols are of the channel-probing family and tried to improve the scheme presented by B-MAC. Although more recent, C-MAC [11] uses the same schedule as X-MAC and is therefore included in our work under the same principles that govern X-MAC.

Existing MAC protocols employ identical schedules for both unicast and broadcast packet transmissions or, when impossible, simply modify their "unicast schedule" to work with broadcast packets

PROPOSED TECHNIQUE

X-MAC Schedule Under the X-MAC [12] schedule, a sender repeats the transmission of an advertisement packet containing the address of the intended receiver. Upon hearing the advertisement packet, the receiver replies with an ACK, which is followed by the transmission of the data packet by the sender. Figure 1 illustrates this process.

Research work know to Modified X-MAC for Broadcast Transmissions In [12], Buettner et al. make a convincing case for the energy and latency gains achieved by their proposed X-MAC protocol. Although efficient for unicast packets, this simple scheme is not well suited for broadcast transmissions. A additional drawback to X-MAC is its sensitivity to the hidden node problem and the persistence of a high risk of false positive packet reception acknowledgements. Indeed, early ACKs are sent and received before the data packet is transmitted, which does not guarantee successful reception of the packet.

This research work propose to modify the MAC schedule of X-MAC by R-Mac repeating the data packet and waiting for ACK frames between transmissions. A received ACK signifies that the data packet has been correctly received and stops the transmission flow of data packets. This renders the MAC protocol immune to false positive packet receptions.

To detect an ongoing transmission, of R-Mac are usually sufficient and they are provided separated by the correct time.

During our experiments, this research work strove to minimize the time separating two R-Mac in order to not expend energy, as simulations have shown that medium probes account for most of the energy consumption for low traffic patterns and short Tx values. This research work also noticed that for a value of 500 µs between R-Mac the delivery reliability of the MAC did not always increase for smaller packets. The reason is that the second R-Mac would “overshoot” the packet transmission and not bring any advantage. the packet delivery ratios for two nodes randomly sending 100 packets to each other, including collisions, missed packets, bad radio states, etc. As the packet size increases, it is generally easier for a receiver to hear a transmission. The dotted line shows a value for t2 R-Mac that was not retained because of poor reliability. For R-MAC, which must use compatible parameters for all MAC schedules, this research work set t2CCAs to 512 µs for all protocols.

The X-MAC Design and Choice of Advertisement Packet Size are proposed, the packet delivery ratio for 11B (no payload) packets is only 67% for X-MAC. This prompted the choice of larger advertisement packets (35B), as is supposed by C-MAC [12]. In order to remain compatible with the other protocols, this research work considered all 35B long packets to be advertisements. The receiver, upon reading a 35B packet from its RXFIFO stays on to receive the subsequent data packet. In other words, when a MAC protocol needs to send a 35B packet, it has to use the X-MAC schedule.

Throughput:

In order to evaluate the throughput of the MAC protocols, this research work let one node send 100 packets to three different neighbors. For R-MAC and X-MAC, a failed packet transmission was followed by two subsequent attempts to send after 200ms. Speck MAC does not provide any retransmission mechanism. the number of correct bits transmitted in one second. For smaller values of Tx (not shown), X-MAC has the highest throughput. With larger values of Tx and for larger than 20B packets.

This is because R-MAC is capable of staggering packet transmissions, which compensates for retransmissions. As the packet size increases, fewer retransmissions occur, which increases the throughput by up to 76%. When Tx is too small, R-MAC cannot fit more transmissions.

Proposed Algorithm:

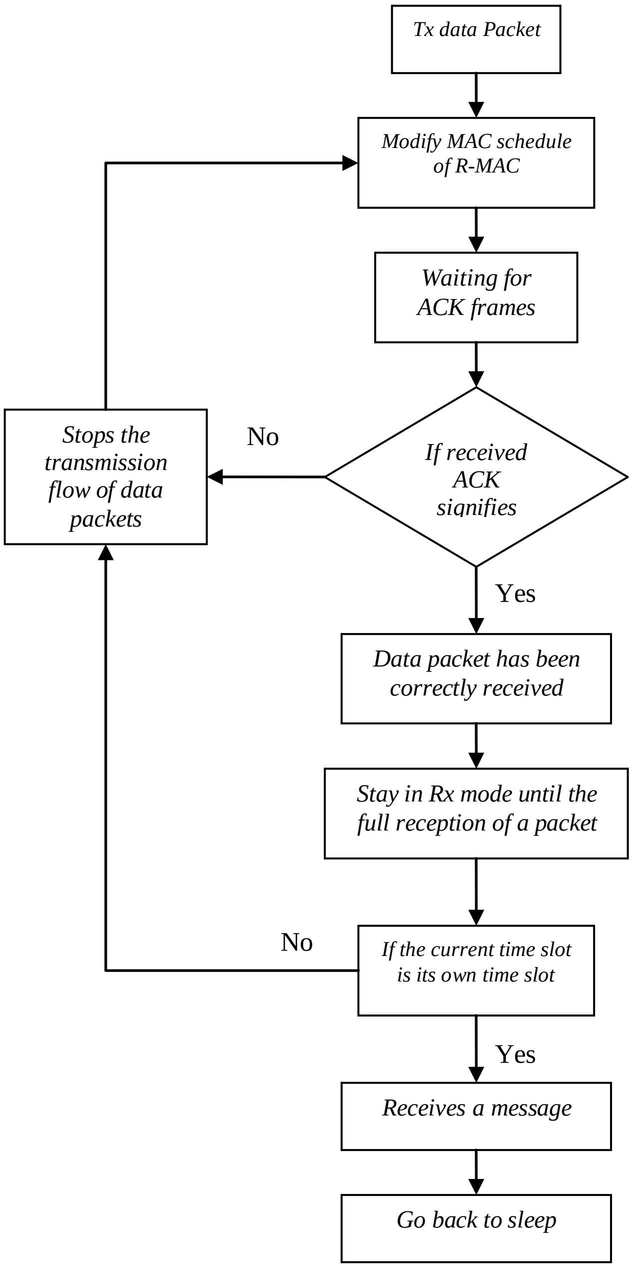

Figure: 2 Proposed Algorithm of R-MAC

This research work measured the throughput and time spent probing the medium, starting a transmission, sending one packet and switching the radio back to Tx mode, stopping a transmission after a successful and failed transmission, and receiving a packet. Every scenario is then reconstructed with Matlab by adding the energy expended during each operation. Moreover, our measurements allow us to determine the radio switch time Selecting a MAC protocol supposes a compromise between excellent performance under certain circumstances (hoped to be the common case), and suboptimal operation otherwise. Various protocols may perform differently according to the broadcast / unicast nature of the packets, This research work give solution creating a pool of MAC protocols that are compatible with one another: while the sender may decide which schedule to follow based on the parameters mentioned above, the receiver need not be informed of the changes in MAC Protocals. For instance, a sender choosing a certain MAC Protocals may expect an ACK frame between packet transmissions; it will thus stay in receiving mode for a given time before it returns to transmitting mode. At the other end of the communication, a receiver simply wakes up periodically, and occasionally receives packets. If a received packet is marked with an acknowledgment request, it immediately sends an ACK frame. Switching between interchangeable MAC Protocals guarantees that gains in energy and latency are achieved without any overhead save the computation required to determine the best Protocals to use.

Existing MAC protocols were included as part of the pool of compatible MAC schedules: X-MAC [8] and Speck MAC-D [9], which were introduced around the same time. However, this research work also add a novel MAC schedule based on a modified version of X-MAC. Proposed Algorithm:-

TEST RESULTS AND ANALYSIS

MAC schedule may be adapted to conditions in the network to increase life or throughput. Matlab implementation will demonstrate the feasibility of compatible MAC schedules and the benefit of switching between them. On top of the gains obtained through MAC schedule, this research work also propose a simple approach to synchronizing nodes on a temporarily-fixed path for the sub-family of protocols. Through analysis, this research work proved that the path is automatically synchronized after n = h packets have been sent from node 0 (the farthest) to node n. In other words, the requirement to have a fixed path is a weak one since it needs to be constant for only h packets. Since

R-MAC uses fixed sized advertisement packets, its throughput increases linearly with the data packet size. For a different reason, Speck MAC based schedules are also linear: Speck MAC can send only one packet per Tx time period. When the packet size increases, so does the throughput. These results teach us that R-MAC can select the MAC schedule that will yield the best throughput for a certain packet size and Tx value. The results will suggest that for Tx= 1 s, the X-MAC schedule yields the best throughput for small packets (less than 35B), while the R-MAC schedule has the best performance for larger packets.

Synchronization of transmit / receive schedules has several benefits: it drastically reduces the packet delay, and it reduces the energy use at every node by a factor of about ti/2tS , removing the limit standing in the way of lower duty cycles. In some strategies to increase the packet rate and further reduce the packet delay. Pipelining packets over synchronized paths doubles the packet rate. Urgent packets are delivered almost immediately, taking the delay. Although MAC and node synchronization may be implemented without the benefit of the other, their combined impact on node life and packet delivery delay exceeds that of each approach independently. This is because MAC may select the most reliable MAC schedule, which in turns greatly facilitates node synchronization.

CONCLUSION

This research paper give a solution for MAC schedule to node and network conditions to improve performance under a wide range of conditions and for both unicast and broadcast packets. the number of parameters and metrics to switch MAC schedules. MAC can significantly increase per-node life and that node synchronization is both possible and practical. Packet delivery ratio shows that the Speck MAC-D schedule is more reliable. And for unicast packets, the main difference between simulation and implementation results stems from the size of the advertisement packets sent by X-MAC. This research paper observe that the optimal Tx time value decreases with an increase in packet transmissions.

The improvements on the node life and packet delays require no overhead or cost in most WSN cases: nodes do not need to exchange On / Off schedules with their neighbors, and in the unidirectional case, no explicit synchronization phase or messages are required. the nodes organize themselves automatically. This research work will implement and test in matlab.

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