IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 3, March 2016

RGSP for Energy Efficient MAC Cross-layer in WSN

Vidyashree BN[1], V Shivakumar[2]

PG student, CSE Dept. Rao Bahadur Y Mahabaleswarappa Engineering College, Ballari, Karnataka[1]

Asst. Professor, CSE Dept. Rao Bahadur Y Mahabaleswarappa Engineering College, Ballari, Karnataka[2]

Abstract: This article presents RGSP (for "Rest Gather and Send Protocol") for remote sensor arranges, a system MAC cross layer outline that determines the intrinsic clash between vitality effectiveness and throughput. The convention utilizes as a part of its MAC layer another worldview that we call "rest, gather and send". The thought of RGSP is that a router dozes for a given measure of time, awakens and gathers information from its kids and different routers and afterward send them into a burst amid a timeframe that we call transmission period. In its network layer, the protocol used is LEACH and it's a hierarchical routing protocol. LEACH also increases the lifetime of the network. RGSP does not require synchronization in the middle of switches and progressively ascertains the rest and gather periods as indicated by the measure of approaching movement.

Keywords: RGSP, MAC, Cross-layer, LEACH, Lifetime.

I. INTRODUCTION

Numerous remote sensor systems (WSN) applications such as timberland reconnaissance are sent for long stretches with as it were batteries as principle force supply. With a specific end goal to make note of vitality productivity, MAC convention outlines use obligation cycling instruments in which hubs occasionally switch between rest (low-power) and dynamic modes. Notwithstanding, including rest periods corrupt system throughput which is a crucial parameter for a few applications and circumstances. For instance, when a flame is identified in the woods, a major number of messages will be produced in this way focusing on the high throughput usefulness of the MAC convention. Subsequently, hubs in WSN must be equipped for accomplishing high throughput rates while minimizing vitality utilization. At the point when a pressing occasion happens, there is no requirement for vitality sparing any longer. Henceforth, we require an element adjustment component of rest and dynamic periods.

II. RELATED WORK

[1]In this paper, we have developed Adaptive Coordinated Medium Access Control (AC-MAC), a contention-based Medium Access Control protocol for wireless sensor networks. To handle the load variations in some real-time sensor applications, ACMAC introduces the adaptive duty cycle scheme within the framework of sensor-MAC (S-MAC). The novelty of this protocol is that it improves latency and throughput under a wide range of traffic loads while remaining as energy-efficient as S-MAC.

[2]We propose B-MAC, a carrier sense media access protocol for wireless sensor networks that provides a flexible interface to obtain ultra low power operation, effective collision avoidance, and high channel utilization. To achieve low power operation, B-MAC employs an adaptive preamble sampling scheme to reduce duty cycle and minimize idle listening. B-MAC supports on-the-fly reconfiguration and provides bidirectional interfaces for system services to optimize performance, whether it be for throughput, latency, or power conservation. We build an analytical model of a class of sensor network applications. We use the model to show the effect of changing B-MAC's parameters and predict the behavior of sensor network applications. By comparing B-MAC to conventional 802.11- inspired protocols, specifically S-MAC, we develop an experimental characterization of B-MAC over a wide range of network conditions. We show that B-MAC's flexibility results in better packet delivery rates, throughput, latency, and energy consumption than S-MAC. By deploying a real world monitoring application with multihop networking, we validate our protocol design and model. Our results illustrate the need for flexible protocols to effectively realize energy efficient sensor network applications.

[3]Wireless personal area networks (WPANs) are used to convey information over relatively short distances. Unlike wireless local area networks (WLANs), connections effected via WPANs involve little or no infrastructure. This feature allows small, power-efficient, inexpensive solutions to be implemented for a wide range of devices.

[4]While the IEEE 802.15.4/Zigbee protocol stack is being considered as a promising technology for low-cost low-power Wireless Sensor Networks (WSNs), several issues in their specifications are still open. One of those ambiguous issues is how to build a synchronized cluster-tree network, which is quite suitable for ensuring QoS support in WSNs. In fact, the current IEEE 802.15.4/Zigbee specifications restrict the synchronization in the beacon-enabled mode (by the generation of periodic beacon frames) to star-based networks, while they support multi-hop networking using the peer-to-peer mesh

topology, but with no synchronization. Even though both specifications mention the possible use of cluster-tree topologies, which combine multi-hop and synchronization features, the description on how to effectively construct such a network topology is missing. This paper tackles this problem, unveiling the ambiguities regarding the use of the cluster-tree topology and proposing a synchronization mechanism based on Time Division Beacon Scheduling to construct cluster-tree WSNs. We also propose a methodology for an efficient duty-cycle management in each router (cluster-head) of a cluster-tree WSN that ensures the fairest use of bandwidth resources. The feasibility of the proposal is clearly demonstrated through an experimental test bed based on our own implementation of the IEEE 802.15.4/Zigbee protocols.

[5]Cross-layer design with respect to a reference layered architecture is the design of algorithms, protocols, or architectures that exploit or provide a set of interlayer interactions that is a superset of the standard interfaces provided by the reference layered architecture.

The interlayer interactions fall into one of two broad categories:

1. **Information sharing**: Adjacent or non-adjacent communication layers can share information through new interfaces that are either unidirectional or bidirectional. Alternatively, cross-layer architecture may support comprehensive state variables that are accessible to all communication
2. **Design Coupling**: Design of new protocols or algorithms may try to exploit the features or avoid the weaknesses of existing mechanisms. More extreme cross layer approaches can partially or completely integrate the functionality of adjacent layers

III. ENERGY-EFFICIENCY PROTOCOL AND RGSP DESIGN

Low-energy adaptive clustering hierarchy (LEACH) is a new communication protocol that tries to distribute the energy load evenly among the net-work nodes by randomly rotating the cluster head among the sensors.

[6]The life cycle of LEACH is divided into rounds with two phases in each round. The round starts with set-up phase. It is the phase where the clusters for the current round are formed. By the end of this phase, each cluster contains a cluster-head, members, and transmission schedule.

The second phase is called the steady-state. In the latter phase, the data get transferred across the network. The network continues to change from one phase to the second until it runs out of energy.

The set-up phase starts with a node contest for cluster-heads of the current round. Every eligible node participates in the self-election process by generating a random number between 0 and 1. Then, the generated number is compared with a threshold value T(n); if the random number is less than a threshold value, the node gets elected as a cluster-head. The threshold is set as:

$$T(n) = \begin{cases} \frac{P}{1-P*(r \bmod \frac{1}{P})} & if\ n \in G \\ 0 & otherwise \end{cases}$$

Where P is the desired percentage of cluster-heads in each round, r is the current round, and G is a set of all eligible nodes that participate in the election. The G set contains all the nodes who have not became a cluster-heads in the last 1/ P rounds. The set members reset every 1/ P rounds to contain all alive nodes. At the first round of any 1/P rounds, all nodes start with the same probability to be a cluster-head. Moreover, at the last round of the current 1/ P rounds T(n) equals 1; therefore, all remaining nodes in G will be elected as cluster-heads.

Once a node becomes a cluster-head it informs other nodes about its new status. The elected cluster-heads broadcast an advertisement message to the entire network, and then they keep their receivers on. At the same time, all non-cluster-head nodes keep their receivers on to receive the advertisement messages. These messages identify the available clusters in current round. Upon receiving all cluster-heads' advertisements, non-cluster nodes select the closest cluster-head and request to join it. Every non-cluster-head node compares the received signal strength of each collected advertisement and selects the highest as the nearest cluster-head. After that, the node sends a join request to the selected cluster-head, and keeps its receivers on while waiting for a confirmation from the cluster-head. At this stage, all cluster-heads keep gathering join requests from surrounding nodes. Each cluster-head considers the received join requests then it generates and distributes a TDMA schedule. The cluster-heads generates a TDMA schedule including all join requesting nodes; the schedule indicates the cluster-members' access time. Then the schedule is sent to all cluster-members. By receiving the TDMA schedules the cluster membership has been confirmed, and the cluster has been formed. This indicates the end of set-up phase beginning of steady-state phase.

In the steady-state phase, the sensed data are transferred to the sink according to the cluster TDMA schedule. This phase is divided into frames. Each cluster-member has at most a single time slot in each frame. Each member keeps the transceiver off until its time slot. Each node sends the collected data in its designated time to the cluster-head. The cluster-head aggregates all received data into one message and send it to the sink. This procedure continues during the steady-state. The steady-state phase lasts for a predefined period of time before the start of new election round. When the predefined time has elapsed, all clusters get dissociated. The status of all network nodes resets to a normal node. This way, they become ready to participate in the next election. This concludes a single round. The duration of steady-state is set to be longer than the duration of set-up phase. The reason behind that is that the energy consumption the in set-up phase, according to the type of exchanged messaging, is higher than in steady-state. Therefore, by having a longer steady-state phase the overhead on the network is reduced.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 3, March 2016

[7]Compressive sensing (CS) can reduce the number of data transmissions and balance the traffic load throughout networks. However, the total number of transmissions for data collection by using pure CS is still large. The sensor nodes are organized into clusters. Within a cluster, nodes transmit data to cluster head (CH) without using CS. CHs use CS to transmit data to sink.

Some of the advantages of LEACH protocol are:

- Scalability.
- Aggregates Data.
- Single-hop routing.
- Distributed property
- Lifetime network is increased.
- Dynamic clustering approach

Disadvantages of LEACH protocol are:

- Relies on CH's rather than on cluster members.
- Additional overhead.
- No inter-cluster communication
- Not uniformly distributed.
- Security.

A. General parameters of RGSP Design

We consider a wireless network composed of simple nodes and router nodes (named router in the rest of the document). A simple node is a device that generally has measurement sensors built in and has limited routing decisions capabilities. A router is a device that implements full routing and network management protocols. However, it can act like a simple device when its routing and management capabilities are disabled.

B. Channel Access Protocol

[8]When a node starts, it executes the association procedure to integrate the network. For a router, once the association is successfully completed, it starts sending beacon frames to provide useful information to its neighbors (including its children) and synchronization to its children. Routers use a superframe structure, defined as the time between two successive beacon frames. The superframe is divided into three periods; Sleep Period (SP), Waiting Period (WP) and Transmission Period (TP). We call the sum of SP and WP a subframe. During the SP, the router enters into sleep mode. When the SP expires, the router becomes active.

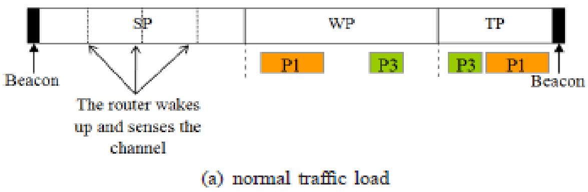

Figure 3.1 Subframe structure

However it does not transmit packets one by one upon their arrival. Instead, it goes to reception state and collects data from its neighbors (simple nodes or routers) during the WP. After the end of the WP, the router starts transmitting all packets queued in its buffer in a single burst. This is done in the TP. Finally, at the end of the TP, the router sends the next beacon and starts another cycle. The super frame structure is illustrated in Fig. 1(a). Simple nodes are always in sleep mode unless they receive a packet to transmit from the higher layer.

Waiting period: The WP depends on the amount of incoming traffic; the higher the traffic volume, the longer the WP duration.

Transmission period: The collected data during the waiting period are transmitted in a burst. At the beginning of the TP, the router sends a preamble frame; its duration is superior to the wake up period of routers. This way, all neighbor routers will wake up. However, if the network is configured to stay active all the time, preamble transmission is disabled.

Sleep period: During the SP, the router goes to sleep.

However it periodically wakes up and senses the channel. If the channel is free it goes back again to sleep, otherwise it remains active as far as it receives data from the medium. The router goes back to sleep if the SP did not expire yet.

IV. SIMULATION RESULTS

We present in this section a simulation study of SCSP which we implemented in Ns2 [9]. We analyze the energy consumption and end to end delay with different network conditions and protocol parameters. The Simulation results describe as: With compressing and without compressing the data packets using Leach protocol. The parameters used for simulation are number of transmissions and end-to-end delay.

A. Compressing the data packets

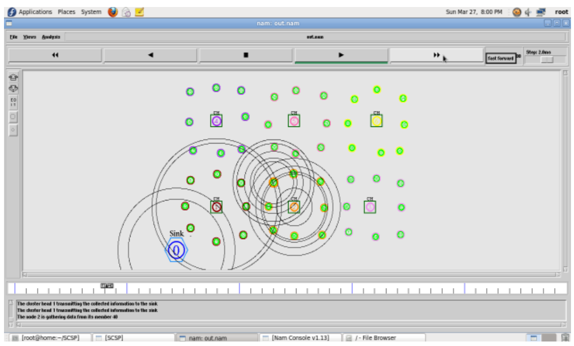

Figure 4.1 Data packets transmission with compression ratio.

Figure 4.2 Number of transmissions

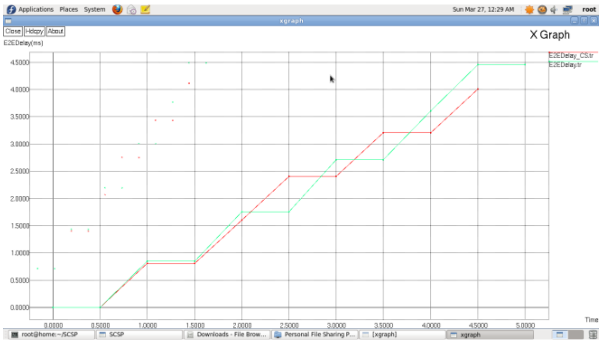

Figure 4.3 End-to-End delay

B. Without compressing the data packets

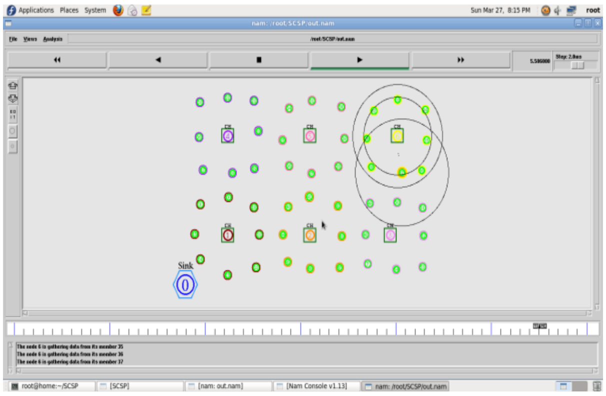

Figure 4.4 Data packets transmission without compression ratio.

Figure 4.5 Number of transmissions

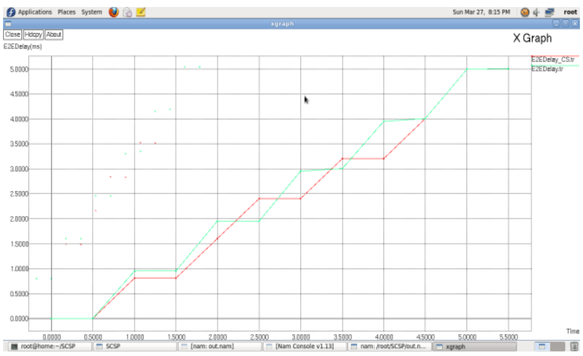

Figure 4.6 End-to-End delay

V. CONCLUSION

This paper presents RGSP, a system MAC cross-layer plan which improves vitality utilization by exchanging in the middle of dynamic and rest periods and powerfully adjusting them as per the measure of got activity. The convention utilizes a straightforward yet proficient directing convention that does not require course upkeep or revelation and works mutually with the Macintosh layer to improve its adaptation to internal failure properties. Reproduction results demonstrate that RGSP amplifies the system lifetime and network in examination with IEEE 802.15.4 MAC. And also the LEACH protocol which is a hierarchical routing protocol, its an energy efficiency protocol which works on clustering methodology.
Future work can be carried out on implementing the other parameters of LEACH protocol by using improved versions or advanced LEACH protocols.

ACKNOWLEDGEMENT

This work was supported in part by our institution to bring up the ideas and develop our project. The authors would like to thank the Almighty God and their Parents, Head of the Department, Principal, Staffs, and the administration and also like to thank the anonymous reviewers for their constructive comments which greatly improved the quality of this work.

REFERENCES

1. Ye, W., Heidemann, J., and Estrin, D. 2004. Medium access control with coordinated adaptive sleeping for wireless sensor networks. IEEE/ACM Trans. Netw. 12, 3 (Jun. 2004), 493-506. DOI=http://dx.doi.org/10.1109/TNET.2004. 828953.
2. Polastre, J., Hill, J., and Culler, D. 2004. Versatile low power media access for wireless sensor networks. In Proceedings of the 2nd international Conference on Embedded Networked Sensor Systems (Baltimore, MD, USA, November 03-05, 2004). SenSys '04. ACM, New York, NY, 95-107. (Pubitemid 41563352)
3. IEEE-TG15.4 (2003). Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) specifications for low-rate Wireless Personal Area Networks (LR-WPANs). IEEE standard for information technology.
4. Koubaa, A., Cunha, A., and Alves, M. 2007. A Time Division Beacon Scheduling Mechanism for IEEE 802.15.4/Zigbee Cluster-Tree Wireless Sensor Networks. In Proceedings of the 19th Euromicro Conference on Real-Time Systems (July 04-06, 2007). ECRTS. IEEE Computer Society, Washington, DC, 125-135. DOI=http://dx.doi.org/10.1109/ECRTS.2007.82 (Pubitemid 47591693)
5. Raja Jurdak , Wireless Ad Hoc and Sensor Networks A Cross-Layer Design Perspective.
6. An evaluation study of leach protocol under different scenarios .Mohammed Almeer*, Ivica Kostanic Electrical and Computer Engineering, Florida Institute of Technology, Melbourne, FL USA
7. Transmission-Efficient Clustering Method for Wireless Sensor Networks Using Compressive Sensing Ruitao Xie and Xiaohua Jia, Fellow, IEEE, Computer Society.
8. SCSP : an Energy Efficient Network-MAC Cross-layer design for wireless Sensor Networks
9. nile.wpi.edu/NS/