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SMAC and GMAC : A Comparison for Wireless Sensor Networks' Channel Access Control

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Abstract—

This paper proposes the GMAC (Group - Medium Access Protocol) protocol, which involves organizing nodes into groups for the purpose of data transmission from one group to another while keeping unused groups in an idle state and having each group keep a table for routing updating between inter-group and intra-group nodes. Comparisons of energy consumption, throughput, and delay show that the proposed GMAC is superior to SMAC (Sleep MAC). NS2.35 simulations have been used to generate these results.

Keywords—GMAC, SMAC, Throughput, Delay component;

I. INTRODUCTION TO WIRELESS SENSOR NETWORKS

When data is collected by a wireless sensor network, it is transmitted via wireless link to the base station and then to the sink node. In the fields of disaster management, biomedicine, the military, and many others, this Network is indispensable. The advantages of sensor nodes are their low price, low power consumption, small size, ease of deployment, and ability to organise themselves. Emphasis is placed on CAC protocol design for WSNs[1, 2].

SIMULATION PROCEDURE

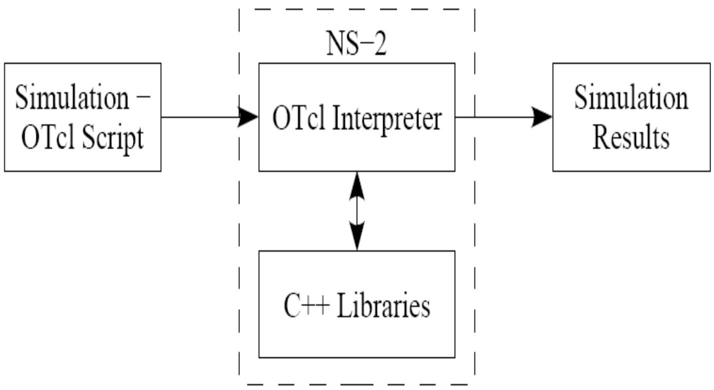

Fig.1: NS 2 Block diagram

The proposed approach can be included in the OTCL scripting and then executed using NS2.35 and checking the results as shown in Fig 1.

II. MAC PROTOCOLS CLASSIFICATION:

The MAC Protocols are of two types SMAC and GMAC such as

2.1 **Introduction to SMAC** :

The acronym SMAC means "Sensor MAC." The goal of this protocol is to lessen the power consumed by accidental transmissions, idle listening, and collisions. Each node in this protocol can be in one of two states: sleep or active. SMAC, in contrast to STEM, does not rely on a bilateral communication system. During a node's listen phase, it is able to both receive and send information. The SMAC system utilises a periodic wake up strategy. SMAC makes an effort to coordinate the listen times of nearby nodes[3, 4]. The following diagram illustrates the three stages that make up a node's listen time. A node is only active during its listen period and is asleep throughout the rest of the time. There are set durations for both the listen and sleep phases in the S-MAC.
There are three distinct listening stages: During the "sync" phase, neighboring nodes coordinate their listen times and update a table with information about their neighbors' schedules; during the "RTS" phase, all nodes interested in communicating with a specific node send RTS in CSMA mode with additional back off; and during the "CTS" phase, the targeted node acknowledges a specific RTS and communication between the two nodes begins and continues even during the targeted nodes' sleep times. Every so often, the neighbors become in sync[6].

The SYNC packet is used to regularly synchronise. Sender information, including future sleep time, is included in the SYNC packet. After receiving the SYNC packet and updating the neighbor's schedule, the receiver will set its timers to the next sleep time specified by the sender. With the use of SMAC, lengthy data messages can be transferred from sender to receiver without losing any information. If a fragment is not acknowledged by the receiver, it is resent. In this case, one CTS and RTS message is used for a sequence of fragments. Sending and receiving messages describes this process. Similar to S-MAC, the proposed T-MAC protocol allows for adaptable Listen and Sleep intervals that can be fine-tuned to the current network load[7]. The key idea behind SMAC is that adjacent nodes should create virtual clusters and coordinate their rest and communication cycles. They talk to one another during their listen times, and sleep during their sleep times. While some nodes are sending and others are receiving, their close neighbours rest. When sending a lengthy message, it is more efficient to break it up into smaller chunks and send them all at once[8].

S-contributions MAC's include a decrease in idle listening (due to nodes sleeping instead of staying in an idle state), protection against collisions and overhearing through the use of RTS and CTS, and the conservation of resources (time and energy) through the transmission of message fragments in batches rather than individually.

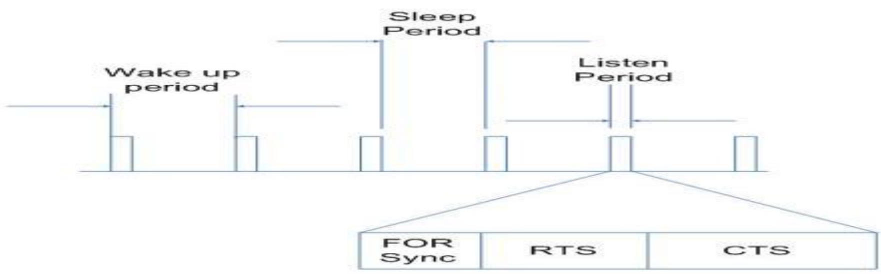

Fig 2.1 SMAC Protocol Architecture

2.2 **Introduction to GMAC :**

Grouping MAC (GMAC). GMAC can drastically cut down on collisions, hence extending the life of the network. Based on five cycles that control information flow between sensors and cluster head and between cluster head and sink, GMAC was designed. These two steps in interaction save wasted energy during packet transmission. In addition, GMAC is a grouping-aware protocol because it features slot decomposition and assignment depending on node priority. In order to reduce power consumption caused by node overhearing of control packets during the contention phase, the pipeline approach is utilized, and for data transmission, multiple group tables are used for nodes that belong to different groups. The proposed solution minimizes the contention problem in various groups, which helps address the problems of power consumption and delayed transmission. Thus, when a node makes a choice based on a group table, it sends data to its neighbours[9].

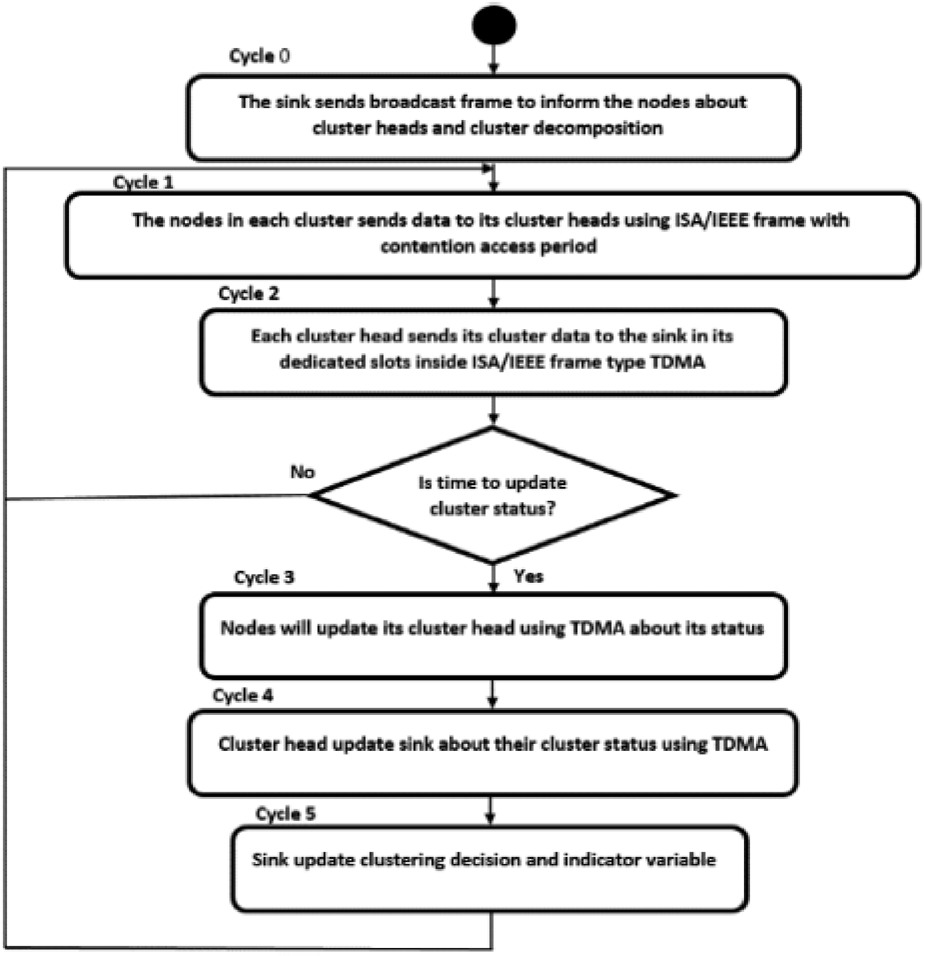

Fig 2.2 GMAC working flow

III. PERFORMANCE ANALYSIS OF GMAC OVER SMAC PROTOCOL FOR WSN

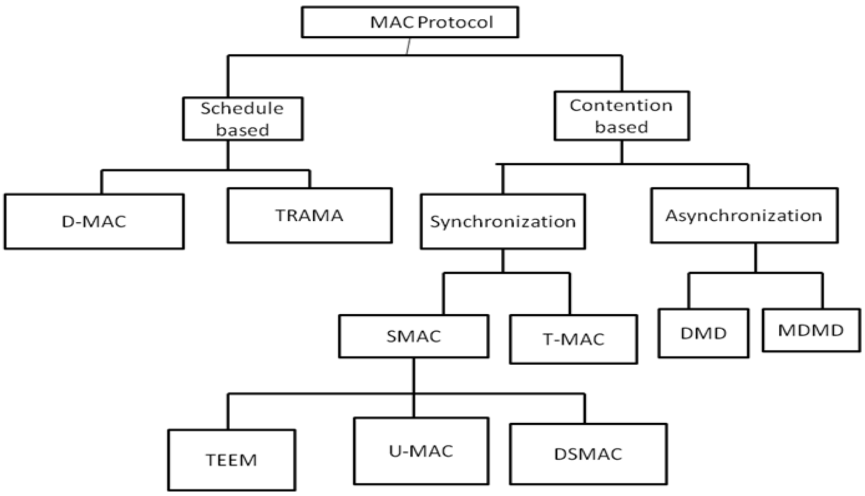

Fig 3.1 Classification of MAC Protocols

IV. **RESULTS & DISCUSSION**

A. Simulation Parameters :

In our simulation, 50 sensor nodes are created in 500*500 m^2 area. The node transmission range is 150 meters. Thus, the sensor node has 15 adjacent hop points in the average. From Fig 4.1-4.5 shows the GMAC gives better throughput, lowers the delay and also reduces the energy consumption than SMAC respectively.

Fig 4.1 shows that throughput of GMAC outperforms the SMAC ,When no. of nodes are Increases

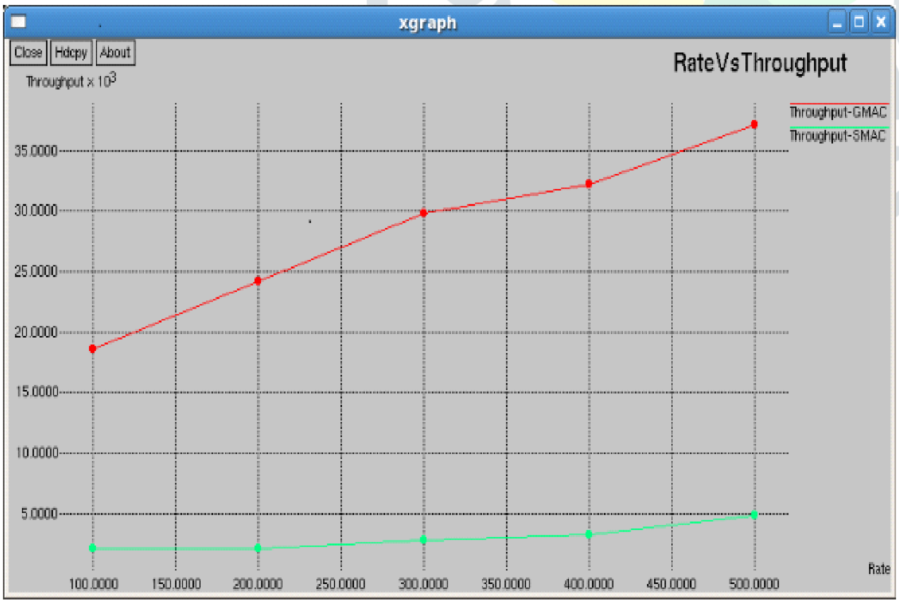

Fig 4.1. Throughput vs Nodes

Fig 4.2 shows that Delay is very low in GMAC compared to SMAC ,When no. of nodes are Increases.

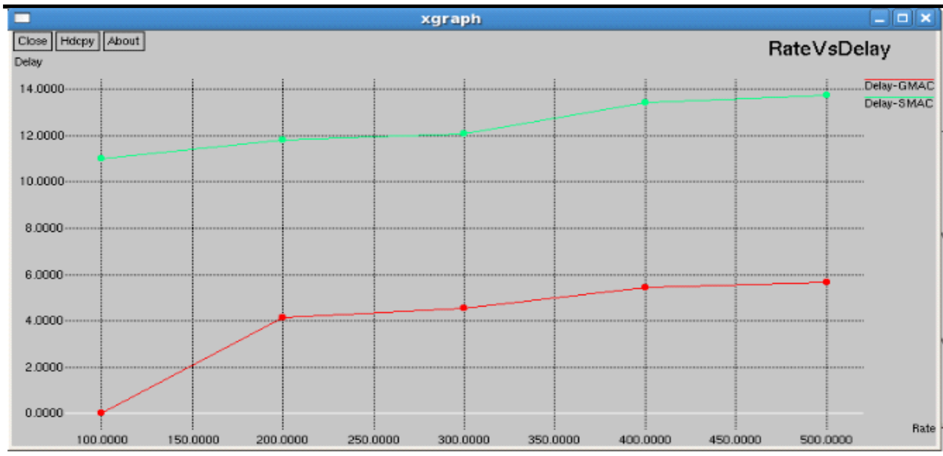

Fig 4.2 Delay vs Nodes

Fig 4.3 shows that Energy Consumption is very low in GMAC compared to SMAC,When no. of nodes are Increases.

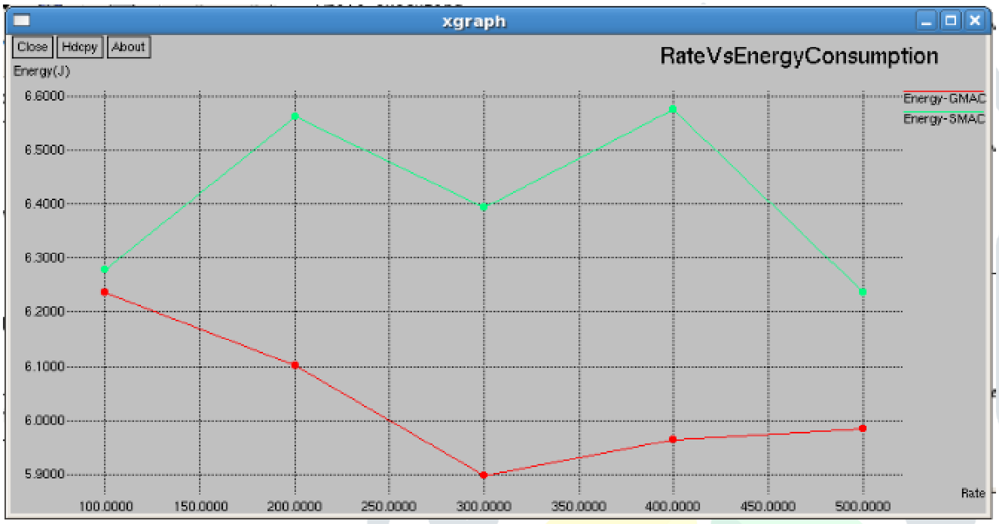

Fig 4.3. Energy vs Nodes consumption

V. CONCLUSION

The proposed GMAC uses node organizing method to improve throughput, reduce energy wastage and pipelining method used to minimize Contention and delay than SMAC (Sleep MAC). These results are developed using NS2.35 simulator for better performance.

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