International Journal of Computer Science
Oddity...Probe...Reviste...
http://www.ijcsjournal.com Volume 1, Issue 1, No 1, 2013. ISSN: 2348-6600
Reference ID: IJCS-004 PAGE NO: 019-023

EVALUATION OF SLEEP SCHEDULING AND TOPOLOGY CONTROL (CDS)

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Abstract— ***Wireless sensor networks (WSN) have recently used in many applications like surveillance, military applications, etc. In such applications, the sensor nodes are expected to be work long period of time without recharging their batteries. To extend the network lifetime, some sleep scheduling techniques always used, which may cause communication delay in large scale WSNs. In this paper, Although the existing system avoids delay there are still few challenges. So the proposed topology of a wireless network should be efficiently designed to achieve high network performance. Thus remove useless topology information such as collision, redundancy and transmission delay from a network to dramatically improve a network's broadband utilization, delivery ratio, network lifetime and packet retransmission. This is called as topology control management. Thus Connected Dominating Set (CDS) is regarded as an effective approach to hierarchical topology organization.***

Keywords:- sleep scheduling, wake-up pattern

I. INTRODUCTION

In wireless sensor network, large numbers of sensor nodes are deployed in a wide range of areas to detect and report mission critical information to the end-users. When a critical event occurs such as gas leak in factory or fire in the forest is detected by a sensor node, an alarm needs to be broadcast to the other nodes as soon as possible. Sleep scheduling method is always used during the monitoring process to reduce the energy consumption so that the sensor nodes for event monitoring in wireless sensor networks are expected to work for a long time without recharging their batteries. In sleep scheduling, sender nodes should wait until receiver nodes are active and ready to receive the message. Sleep scheduling should increase the network life time but it could cause transmission delay. Whenever the network scale increases, the broadcasting delays also increase. So, delay efficient sleep scheduling methods are needs to be designed to provide low broadcasting delay from any node in the WSN. Most of sleep scheduling methods in focus to minimize the energy consumption. To minimize the broadcasting delay in WSN, the time wasted for waiting during the broadcasting needs to be minimized. So there is a need for balance both energy consumption and broadcasting delay in wireless sensor network. The destination node wakes up immediately when the source nodes obtain the broadcasting packets. Here, the broadcasting delay is reduced.

II. KEY CONCEPTS

A. Sleep Scheduling

Wireless sensor networking is always worked with sleep scheduling which is used to reduce the energy consumption. Sleep scheduling is probably the most efficient mechanism to increase the lifetime of energy constrained sensor networks. Sleep scheduling can be classified into two types such as, synchronized sleep wake scheduling protocol and asynchronized sleep wake scheduling protocol. In synchronized sleep wake scheduling, each node knows exactly when its neighbour nodes will wake up. Then each node in wireless sensor network needs to exchange synchronization message with other nodes. It causes the additional communication overhead. In asynchronized sleep wake scheduling, each sensor nodes wake-up independently. Each sensor node can only estimate when its neighbour nodes will wake up. It could result in a large delay than in the synchronized scheduling.

B. Wake-up Pattern

In sleep scheduling, most of the time nodes stay in low-power or sleep modes. But periodically waking up to check or monitor for activity. This increased longevity, however, comes at the cost of increased message delivery latency since a forwarding node has to wait until its next-hop neighbour awakens and is ready to receive the message. Current wake-up methods can be divided into two main categories:

1) Scheduled wakeups: In this class, the nodes follow possibly random wakeup patterns. Time synchronization among the sensor nodes in the wireless sensor network is generally assumed. However, asynchronous wakeup mechanisms which do not require synchronization among the different nodes are also categorized in this class. Although asynchronous methods are simpler to implement, they are not as efficient as synchronous schemes, and in the worst case their guaranteed delay can be very long.

2) Wakeup on-demand: It is assumed that the nodes can be notified and awakened at any point of time and then a message is sent to the node. This is usually implemented by employing two wireless interfaces. The first radio is used for data communication and is triggered by the second ultra low-power radio which is used only for paging and signalling.

C. Level-by-Level Offset

All nodes have a periodic receive-transmit sleep scheduling with *level-by-level offset*, which means that all nodes wake up when their source nodes have just gotten data packets, and go to sleep as soon as possible they transmit packets to their neighbour nodes. The idea of *level-by-level offset schedule* can achieve much lower transmission delay in one traffic direction but it is not efficient when bidirectional delay guarantee is required.

D. MAC Protocol

We expect sensor network to be deployed in ad-hoc fashion, with individual nodes remaining largely inactive for long periods of time but then becoming suddenly active when something is detected. These characteristics of sensor networ and application motivate MAC that is different from traditional wireless MAC such as IEEE 802.11. Energy consumption and self configuration are primary goals.

III. Related Work

A centralized gateway node collects all transmission requirements during a contention period and then schedules the distributions according to the reservation path. An energy-adaptive MAC protocol, Gateway MAC (G-MAC) implements a new cluster-centric paradigm to effectively distribute cluster energy resources and extend network lifetime. Concentrating the transmissions into a smaller active period reduces idle listening, but it also increases the probability of collisions. Receiving and discarding messages intended for other nodes, or message overhearing, is commonly employed in non-energy constrained networks to increase throughput and high delay.

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Continuous monitoring applications are an important class of wireless sensor application. These application require periodic refreshed data information at the sink nodes. The need of the sensor node was to transmit continuously in periodic fashion to the sink nodes it leads to excessive energy consumption. DMAC protocol specifically design for the wireless sensor network, where the communication pattern is restricted to an established unidirectional data gathering tree. Here, all nodes having a periodic receive– transmit sleep cycle with level-by-level offset schedule ,which means that all nodes wake up when the source node have just gotten a data packets, and go to the sleep as soon as they transmit packets to the destination nodes. The level-by-level offset schedule in DMAC can achieve much lower transmission delay in one traffic direction. it is not efficient in bidirectional delay guarantee . The authors presented several sleep scheduling patterns that adhere to the bidirectional end-to-end delay constraints, such as shifted even and odd pattern, ladder pattern, two-ladder pattern and crossed-ladders pattern. However, the patterns are not suitable to alarm broadcasting in the WSN, because the traffic discussed is just a single flow. If the sink node broadcasts packets according to the patterns, there will be serious collision in the network. In this query based sensor network a node cannot voluntary send data packets that they sensed to the sink node, unless the sink node sends them queries, these queries are very complex. Hence the sink node needs to predict the data arrival time for each destination nodes. Collecting information from the environment by keeping all the nodes active and transmitting to the sink is energy expensive. Therefore, the scheme is not suitable to alarm broadcasting in the WSN for critical event detection. ADB is based on asynchronous wake-up. It exploits some information contained in data packets and ACK, so to arrange the transmission among nodes. When sensor nodes take prior knowledge of all the link quality, packet broadcasting in ADB actually follows a determined broadcasting tree in the network. Furthermore, as sensor nodes with ADB wake up asynchronously, collision can almost be avoided.

IV. PROPOSED WORK

The topology of a wireless network should be efficiently designed to achieve high network performance. Thus remove useless topology information such as collision, redundancy and transmission delay from a network to dramatically improve a network's broadband utilization, delivery ratio, network lifetime and packet retransmission. This is called as topology control management. Thus Connected Dominating Set (CDS) is regarded as an effective approach to hierarchical topology organization.

Topology control includes power control and hierarchical topology organization. The target of power control is to adjust nodes' transmission range to achieve balanced connectivity while hierarchical topology organization aims to find a communication backbone from the original network in charge of all forwarding's in the network. Routing information is only kept in the virtual backbone, so that routing path search time and communication cost will decrease greatly.

Connected Dominating Set (CDS):

A network can be modeled as a bidirectional graph denoted as G= (V, E) where V represents the set of nodes in the network while E represents the set of all links. When CDS is constructed, only nodes in CDS may forward data whereas broadcasting nodes in CDS can help spread data to the whole network. In routing, data will be sent to CDS and be delivered via nodes in CDS.

Published by SK Research Group of Companies (SKRGC).

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Larger CDS, increases redundancy and interference. On the other hand smaller CDS some characteristics in original networks may be missing. In Fig. 1a, nodes (D, E, F) construct a minimum CDS. The shortest path between A and C in the original network is $\mathbf{p}_{AC}$= {A, B, C} of length 2. However, routing path between A and C through the minimum CDS will become $\mathbf{p'}_{AC}$= {A, D, E, F, C} of length 4 which is twice as that of $\mathbf{p}_{AC}$. Hence $\mathbf{p}_{AC}$ is used for routing between A and C.

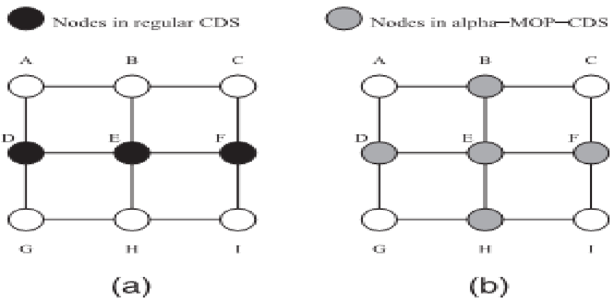

Fig1: (a) A minimum Regular CDS. (b) A minimum 1-MOC-CDS.

Efficient broadcasting and routing:

CDS's size should be as small as possible while the routing paths' length does not increase a lot through the nodes in CDSs. The concept of diameter was defined to evaluate the length of the longest shortest path between any pair of nodes in a network. A special CDS named as _-Minimum rOuting Cost-Connected Dominating Set **(_-MOC-CDS)**.

(_-MOC-CDS) has a special constraint—for any pair of nodes, there is at least one path all intermediate nodes on which belong to **(_-MOC-CDS)** and the number of the intermediate nodes is smaller than __times of that on the shortest path in the original network. Thus, routing hops will not increase too much.

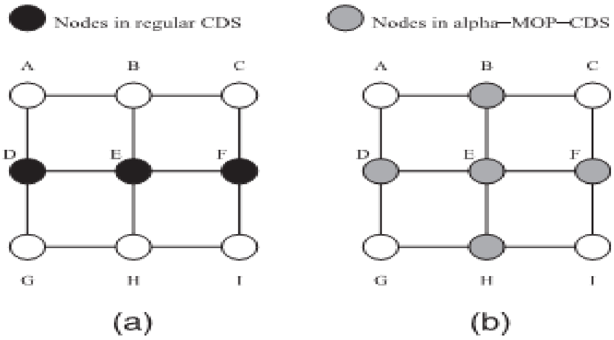
Fig1: (a) A minimum Regular CDS. (b) A minimum 1-MOC-CDS.

Heuristic localized algorithm is proposed to construct **_-2hop-DS which is equivalent to (_-MOC-CDS)**. A network can be modeled as a bidirectional graph denoted as G= (V, E) where V represents the set of nodes in the network while E represents the set of all links. The path between any pair of nodes u and v as **p (u, v)** = (**u,** w1, w2,… wk, **v**) where $\mathbf{W_i}$ (1_ i _k) represents the intermediate node on p (u, v). The shortest path between u and v is the path with the smallest number of intermediate nodes, represented by $\mathbf{p}_{\mathbf{shortest}}$ **(u, v)** and the distance between u and v is equal to the hop count on the shortest path between u and v, denoted as **Dist (u, v) = | p** $_{\mathbf{shortest}}$ **(u, v) | - 1** If the distance between the source and the destination is 1, then the messages can be delivered directly. To simplify the problem of _-MOC-CDS**,** an equivalent problem of _-2hop-DS is defined. It is used where the intermediate nodes distance is 2.

Proposed system

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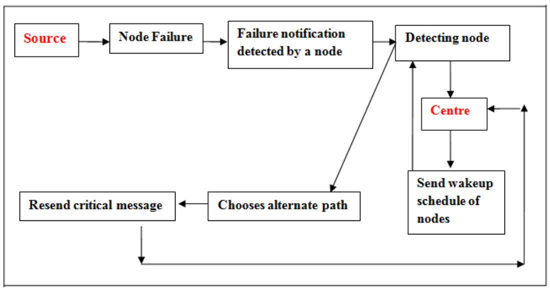

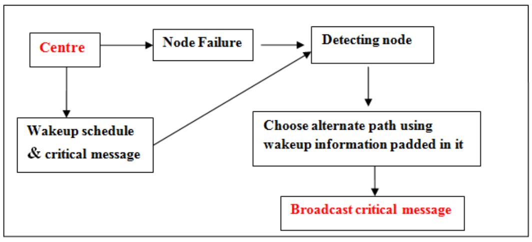

CONCLUSION

The sleep schedule scheme could essentially decrease the delay of alarm broadcasting from any node in WSN. Moreover, the alarm broadcasting delay is independent of the density of nodes in WSN. The topology influences the performance of the network in terms of broadcasting, scheduling of transmission and routing. When a critical event occurs, an alarm message should broadcast to the entire network as soon as possible. If such topology construction is poorly designed causes transmissions delay. To achieve efficient routing, minimum routing cost preserving CDS is proposed. Hence we can achieve efficient routing even through CDS. The new techniques and new algorithms can be implemented to improve the efficiency of the proposed system. The malicious node identification and removal helps in reliable transmission.

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