Certain Investigations on Delay Guaranteed Routing Protocols for WSN - A Survey

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Abstract

One of the main issue in the designing of routing protocols for Wireless sensor networks is delay efficiency due to the deficient energy resources of sensors. Behind the routing protocol design is to keep the sensors operating for as long as possible beyond the network lifetime. The delay consumption of the sensors is overhang by data transmission and reception. Therefore, routing protocols designed for WSNs should be as delay efficient as possible to prolong the lifetime of individual sensors, and hence the network lifetime. In this paper, we have observed a sample of routing protocols by taking into account to overcome delay based on several taxonomy criteria, including location information, network layering and data centricity. . For each of these categories, we have analyze a few example protocols to face the drawbacks to be overcome in the wireless sensor networks.

***Keywords** — WSN, Delay Guaranteed, Data centricity, path redundancy*

I INTRODUCTION

Wireless sensor networks are also called wireless sensor and actuator networks (WSAN), are spatially designed to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. to coordinately pass their data through the network to a desired location. The more modern networks are also enables control of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on. The WSN comprises of several hundreds or even thousands of nodes, where each node is connected to sensors which has typically several parts: a radio transceiver ,a microcontroller, an electronic circuit for interfacing with the sensors and an energy source for energy harvesting. A sensor node might vary in size from small to grain of dust and cost of sensor nodes is similarly variable depending on the complexity of the individual sensor nodes. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network.

ROUTING CHALLENGES IN WSN

Recent advancement in the sensor network has led to its use in wide range of applications. Also it has several restrictions like limited power supply, computing power also limited amount of bandwidth as the device can connect to the sensors. Some of the factors that affect the routing protocols are:

1. **Node deployment:** It is an application dependent in WSNs which affects the performance of the routing protocol. The deployment can be either deterministic or randomized. Optimal clustering becomes necessary to allow connectivity and enable energy efficient network operation.
2. **Energy consumption:** For the transmission of the signal multi hop routing will be more significance as it consumes less power than normal communication. Main factors that affect the sensor networks is the low power availability which depends upon the battery life time of sensors.
3. **Network designing**: The sensors are connected through a wireless connection it is necessary to identify the network topology and desired routing to be used for proper message traffic in order to avoid instability of the system if more traffic is present at similar node.
4. **Data transfer:** The proper transfer of data from the sensors to the connected device without much wastage of energy and it should also maintain route stability can be done only when a proper routing is applied among the network.
5. **Tolerance and scalability**: The routing scheme must be scalable to respond to the events, if any sensor or node gets failure due to loss in power should not affect the entire network as this may lead to total malfunction.

II RELATED WORK

In Wireless Sensor networks, a new contention-free TDMA based MAC and routing protocol, which can provide deterministic delay guarantee. It includes Protocol design of time slot assignment, transmission and reception cycle of nodes. It may also possible to calculate the worst case delay analysis of Delay Guaranteed routing. The simulation results validated that the actual delay is always less than the analytical delay bound for which protocol is designed. Thus, Delay guaranteed routing protocol can be used for hard real time applications such as bio-hazard detection, radioactive emission control etc. It is designed to handle inter- event time less than the worst case delay. We also learn that as long as the inter-event time at each node is less than the maximum allowable delay, the energy consumption of the network remains almost constant. This characteristic of DGRAM can be exploited while choosing various operating parameters of the protocol.

III ROUTING PROTOCOLS IN WSNS

To concurrently improve the fidelity for high-integrity applications and decrease the point to point holdup for delay-sensitive, when the network is congested. We use the concept of Data-centric Routing Protocols which differ from traditional address-centric protocols in which the data is sent from source sensors to the sink. In address-centric protocols, each source sensor that has the appropriate data responds by sending its data to the sink independently of all other sensors. However, in data-centric protocols, when the source sensors send their data to the sink, intermediate sensors performs some aggregation on the data originating from multiple source sensors and send the aggregated data toward the sink. This result in energy savings because of less transmission required to send the data from the sources to the sink. In this section, we review some of the data-centric routing protocols for WSNs.

1 DIRECTED DIFFUSION (DD):

Direct diffusion is a data centric query based and application-aware protocol where data aggregation is carried out at each node in the network. The nodes will not broadcast the sensed data until a request is made by the BS, and all the data generated by sensor node is named by attribute-value pairs. The node which receives the events information from the source attempts to find a matching entry in its interest cache. All sensor nodes in a directed-diffusion-based network are application-aware, which enables diffusion to achieve energy savings by selecting empirically good paths, and by caching and processing data in the network. Caching can increase the efficiency, robustness, and scalability of coordination between sensor nodes, which is the essence of the data diffusion paradigm.

2 RUMOR ROUTING (RR):

Rumor routing is another variation of Directed Diffusion and is mainly intended for geographic routing criteria are not applicable. Generally Directed Diffusion floods the query to the entire network when there is no geographic criterion to diffuse tasks. An alternative approach is to flood the events if number of events is small and number of queries is large. Rumor routing is between event flooding and query flooding. The idea is to route the queries to the nodes that have observed a particular event rather than flooding the entire network to retrieve information about the occurring events. In order to flood events through the network, the rumor routing algorithm employs long-lived packets, called agents. When a node detects an event, it adds such event to its local table and generates an agent. Agents travel the network in order to propagate information about local events to distant nodes. When a node generates a query for an event, the nodes that know the route, can respond to the query by referring its event table. Hence, the cost of flooding the whole network is avoided. Rumor routing maintains only one path between source and destination as opposed to Directed Diffusion where data can be sent through multiple paths at low rates.

3 COUGAR:

A data-centric protocol that views the network as a huge distributed database system. The main idea is to use declarative queries in order to abstract query processing from the network layer functions such as selection of relevant sensors etc. and utilize in-network data aggregation to save energy. The abstraction is supported through a new query layer between the network and application layers. COUGAR proposes architecture for the sensor database system where sensor nodes select a leader node to perform aggregation and transmit the data to the gateway (sink).The gateway is responsible for generating a query plan, which specifies the necessary information about the data flow and in-network computation for the incoming query and send it to the relevant nodes. The query plan also describes how to select a leader for the query. The architecture provides in-network computation ability for all the sensor nodes. Such ability ensures energy efficiency especially when the number of sensors generating and sending data to the leader is huge. Although COUGAR provides a network-layer independent solution for querying the sensors, it has some drawbacks: First of all, introducing additional query layer on each sensor node will bring extra overhead to sensor nodes in terms of energy consumption and storage. Second, in network data computation from several nodes will require synchronization, i.e. a relaying node should wait every packet from each incoming source, before sending the data to the leader node. Third, the leader nodes should be dynamically maintained to prevent them from failure.

4 ACTIVE QUERY FORWARDING IN SENSOR NETWORKS *(ACQUIRE):*

ACQUIRE is another data centric querying mechanism used for querying named data. It provides superior query optimization to answer specific types of queries, called one-shot complex queries for replicated data. ACQUIRE query (i.e., interest for named data) consists of several sub queries for which several simple responses are provided by several relevant sensors. Each sub-query is answered based on the currently stored data at its relevant sensor. ACQUIRE allows a sensor to inject an active query in a network following either a random or a specified trajectory until the query gets answered by some sensors on the path using a localized update mechanism. Unlike other query techniques, ACQUIRE allows the queries to inject a complex query into the network to be forwarded stepwise through a sequence of sensors.

5 DRUG:

This protocol introduces a novel adaptive approach to find an optimal routing path from source to sink when the sensor nodes are deployed randomly deployed in a restricted service area with single sink. This also aggregates the data in intermediate node to reduce the duplicate data. Data centric protocols more focus on data rather than the address of the destination. Here our approach focuses on both data as well as the destination address. DRUG protocol uses three types of messages to communicate between different nodes as shown in Figure 1, such as:

(i) **ADV**: new data advertisement. When a sensor node has data to share, it can advertise this fact by transmitting an ADV message containing meta-data.

(ii) **ACK**: request for data. A SPIN node sends an ACK message when it wishes to receive data.

(iii) **DATA**: data message. DATA messages contain actual sensor data with a meta-data header. ADV and ACK messages contain only meta-data. In networks where the cost of sending and receiving a message is largely determined by the messages size, ADV and ACK messages will therefore be cheaper to transmit and receive than their corresponding DATA messages. DRUG protocol is efficient than both spin and flooding. The pictorial representation of the DRUG protocol is as follows

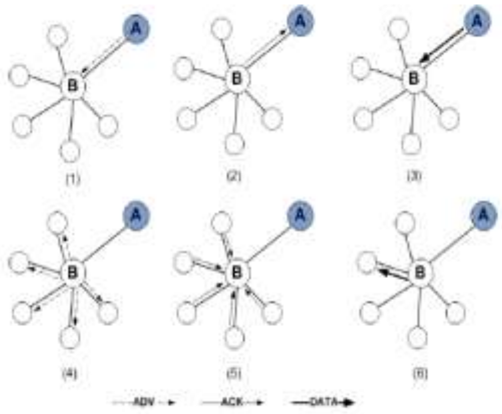

FIG 1: DRUG PROTOCOL

IV CONCLUSION

Routing in sensor networks is a new area of research, with a limited, but rapidly growing set of research results. In this paper, we investigated a comprehensive list of Delay sensitive guaranteed routing based on data-centric protocols. There are many issues need to be addressed by researchers to improve energy efficiency and life time. The best algorithm which an implement this idea and to be strongly recommended to be used in future. The future work could be extended by conducting a experiments on data centric protocol in a hardware testbed for WSNs this will allows to evaluating the protocol's performance in a more realistic environment and able to check the energy efficiency of real sensors. And also make the technique more efficient in terms of throughput and packet delivery ratio.

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