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Issues in Development of Routing Techniques in Wireless Sensor Networks

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ABSTRACT
A wireless sensor network subsists of a number of sensors spread across a geographical area. The wireless sensor network consists of very low configuration nodes running over the battery power, which mean they are having the limited lifetime due to the energy constraint. Sensor networks got all the basic features of ad hoc networks but with different standards – such as much lower mobility and much more stringent energy requirements. By analyzing the current state of research I have evaluated open issues in development of routing techniques in wireless sensor networks.

Keywords:- Sensor Network, Mobility

I. INTRODUCTION

Over the last half a centenary, computers have exponentially enhanced in processing power and at the same time curtail in both size and cost. These swift advancements led to a very rapid market in which computers would engage in more and more of our society's everyday liveliness. In modernistic years, one such transformation has been taking place, where computers are becoming so small and so nominal, that single-purpose computers with embedded sensors are almost pragmatic from both economical and theoretical points of view. Wireless sensor networks are commencing to become a reality, and therefore some of the long overlooked drawbacks have become an prominent area of research [1].

The first major issue is to implement an ad hoc network containing sensors or pods, which can monitor wind, shower, temperature, light and humidity, and which can be used for determining structural or temporal impressions in the environment of the plant being studied.

The sensor nodes are battery powered, so the first networking objection in beginning is to get data back with minimal energy, based on some energy-efficient paths and by minimizing the routing overhead too.

The second challenge is to provide and maintain better connectivity in those cases where sensors are moved to a different location or they fail to connect due to the lack of power.

The third challenge is that sensor networks are expected to grow to as many as number of nodes, so we have to make sure that any algorithm which is going to be used in these networks ought to be extensible. Finally, these networks should use numerous routes whenever possible, both for redundancy and to deliver the energy consumption of forwarding packets. These requirements differentiate ad-hoc wireless sensor networks from mobile ad-hoc networks (MANETs).

A lot of research has been going on in wireless routing protocols. Existing protocols give different tradeoffs among the following desirable characteristics such as fault tolerance, distributed computation, strength, scalability, and authenticity. Wireless protocols suggested so far for wireless sensor networks are very limited, generally concentrate on communication to a single base station or on merging sensor data. This paper explores the use of protocols developed for MANETs to contribute more

general communication among nodes in a sensor network.

II. INFRASTRUCTURE AND INFRASTRUCTURE LESS

A mobile ad hoc network is a heap of wireless nodes that can dynamically be set up at any place and anytime without using any pre-existing network support. These are Infrastructure less networks. Mainly two schemes are used to layout a wireless sensor network, the address centric scheme as well as data centric scheme. The address centric scheme has been used by various routing protocols such as LAR, GSPR, and DREAM etc [2]. In address centric scheme IP addresses are assigned to each sensor node, simplifying the technique of routing. This concept is similar to that of simple wired networks. A unique IP address will help the source sensor node to know the sensor node to which data must be routed. The mechanism and target of self-configuration in these networks is different from those of the address centric scheme.

III. MULTIPATH DESIRABILITY

Macker and Corson [9] listed qualitative and quantitative independent metrics to judge the performance of mobile ad hoc network routing protocols. One of these qualitative metrics was route strategy. There are a number of different route strategies. One that is very common is shortest route where a copy of the message is in the network at any time. At the other end is the flooding based approach [10, 11, and 12] where the message is flooded over the whole network area. A good example of this approach is the Multi-path On-demand Routing (MOR) Protocol [10] which is a on-demand, load balancing routing protocol designed for the PODS project at the University of Hawaii at Manoa. MOR may need as little as one network flood to create necessary routes and its energy efficient and robust in low mobility energy networks such as PODS. Broadcasting normally solves the routing in highly mobile conditions but considering our need for a general sensor network for PODS this is undesirable. The compromise between these two approaches is a multipath technique, where data packets are routed through a few distinct routes and successive packets follow different routes whenever possible. It is not only provides robustness to the network using multiple routes but also helps in distribution of the energy needs of the network evenly across the network. M.R Perlman et al., demonstrate [12] that multipath routing can balance loads. They propose a diversity injection method to find more node-disjoint paths compared to DSR. However, their work is based on multiple channel networks, which are contention free but may not be present in some applications. [10] Applies the multipath strategy to DSR's source routing technique and achieves some scalability under mobile conditions. However the energy distribution component of the multipath technique has not been adequately explored in the paper.

IV. SCALABILITY

Scalability is capacity of a network, process and system to handle a growing amount of work in a capable manner. It is ability to be extended to accommodate that expansion.

There are two interpretation of scalability: asymptotic scalability and in-practice scalability. First is asymptotic scalability in which most of the work along the lines and refers to the order of expansion in the limit of some metric as a function of size. Second is in-practice scalability as the number of nodes outside which a network will not work adequately. The asymptotic scalability is unqualified and in-practice scalability is qualified [12].

The best way to provide scalability is using geographic knowledge. Using hierarchy to provide scalability is the most extensively deployed approach to scale routing as the number of destinations burgeons. Two main strategies used to merge nodes location and hierarchical network structures are the Zone Based Routing and the Dominating Set Routing. Zone Based Routing such as Online power-aware routing routing [28] schemes dominating set routing such as GRID

Beside methods mentioned above another method which is used to provide scalability is caching. Caching is becoming a extensively deployed technique for scaling ad hoc routing protocols in MANET [7, 8]. Caching reduces the routing protocols message load with two methods: It ignore pushing topological information where the forwarding load does not need it (like ideal routers) and it often curtails the number of hops between the router that has topological knowledge and the router that requires it.

The last and most often used technique to provide scalability in ad hoc routing protocols is to use the

geographic location information. This technique considers that all wireless nodes know their positions and links are bi-directional. This technique has been adapted in GPSR, GEAR and gradient routing.

V. CONCLUSION

In this paper the imperative features of the routing protocols are evaluated for general wireless sensor network. Modern research into routing protocols for MANETs and ad hoc sensor networks tend to make many tradeoffs in various significant features and are generally tested in a regulated environment. As seen from the paper that the requirements of routing protocols for general ad hoc sensor networks is very unique as compared to routing protocols for MANETs and other sensor networks. Hence, there is a need for more research into this new field as it poses some of its unique challenges and we will be continuing our research in this area in future.

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Table 1: Comparison among features of MANETs and Ad Hoc Sensor Networks.

Features	MANET	Ad Hoc Sensor Networks
Decentralized control	Yes	Yes
Bandwidth deficient	Yes	Sometimes
Energy deficient	Yes. But this is of secondary importance as battery packs can be replaced	Yes, it is of primary importance
Mobility	Varies (slow to fast)	Limited
Traffic	Multimedia rich	Statistical and Multimedia
Data rate	High	Low [1-1000 Kbps]
Flow of data	Bi-directional	Mostly uni-directional [sensor to sink]
Redundancy in data	No	Sometimes
Main Goal	To optimize QoS and high bandwidth efficiency	Prolonging the life of the network through aggressive energy management, to prevent connectivity degradation.
Fault tolerance	Needed as mobility increases	Needed only if nodes exhaust available energy or are moved
Basic features of routing protocol	Loop free, energy and bandwidth efficient, secure, provides QoS, fault tolerant and reactive instead of proactive, and distributed in nature	Most of the same features as for MANETs, but with less emphasis on mobility and more emphasis on energy efficiency, scalability, and multipath connectivity.