Mechanisms Supporting Mobility in WSNs

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Abstract. Applications of todays world require to have dynamic features like mobility support,In this paper we proposed and evaluated a comprehensive set of mechanisms essential to assure the support of mobility in WSNs,by providing energy efficiency mechanism for a node and a mechanism for soft handoff,based on link quality.

1 Introduction

wsns are viewed with an angle to suite the most basic requriments suitable for various applications.

In this paper we propose a set of mechanisms to turn sensor networks into an adaptable and flexible solutions,so as to provide solution to most applications .Here we basically focus on node mobility which is categorized based on whether the node is moving within the same network domain or whether it is moving between domains. Based on the specific properties of WSNs, the requirements of Mobility and the demand for critical applications, we propose a model for the support and deployment of mobility-aware wireless sensor networks.

2 Related Work

So far we have seen S-MAC and WiseMAC which use different duty cycles.some of the ideas which could be used for adapting neighbor discovery protocol to WSNs.

Load adhoc routing[1]- defines a method called LOAD to provide route discovery,for maintaining data structures and maintaining local connections.

Hierarchial routing[2]- introduces issue of dynamic address assignment with self configuration.

lowPAN neighbor discovery extension[3]-proposes optimized methods,minimizing the multicast of router solicitations.

[4]-neglects unnecessary information of global address,instead previous L2 address is replaced with (RA)router advertisement.

[5]-this new mechanism allows the use of stateless address assignment,neighbor discovery proxy,and optimization of RA also introducing concept of (RE),router edge per network.

To support mobility in WSNs it was need to combine a method for node discovery with a method for handoff management [9].

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Wireless communication consumes more energy,especially in broadcast,which is unavoidable since broadcasting helps in establishing a network,node discovery,access points and neighbours,looking above protocol for neighbor discovery is presented where in a periodic broadcast of of router advertisements messages to present an overview of the complete protocol.

When a new node is deployed, it broadcasts a Router Solicitation. Then, all sinks in the area answer with a Router Advertisement, and the node selects the best one to connect based on the Received Signal Strength Indication (RSSI) value. The selection is confirmed by a accept message. After receiving the accept message,the Sink Node computes a Time-to-Live value. Then, it sends this value to the mote, which, in turn, confirms the procedure with an acknowledgement. During the Registration procedure, the ack message contains the list of supported services in the data field.

While performing this procedure, the Sink Node saves all information in a local database, so that it can be made available to applications if needed. In turn, when it receives the TTL value, the mote self configures its address with the network prefix. This means that a force is made to use global addresses based on Router Advertisements. This procedure does not require an additional message to announce it. Once registered in a network, it must guarantee the connections even for high mobility motes.

mobility is crucial to apply WSN in the most critical and demanded environments. Mobile nodes should not be physical constrained and we must assume the possibility to occur not only intra-mobility, but also inter-mobility where motes must reboot the transceiver during the handoff process. To control the communication during the handoff, including latencies and packet losses. To do so, it needed to provide a mechanism to detect on time if the mote is moving away or if it is arriving. In order to detect movement, a study based on the RSSI value, which is the link metric [7] provided by

IEEE802.15.4 to detect when the mote is moving by comparing the RSSI of the exchanged messages. In [6] it concluded that independently of the environment conditions and the achieved distance, the lowest acceptable RSSI value is -88dBm. After that point the connection is lost. Therefore, it defined this point as the rupture point, Rpoint. However, nodes must connect to another Sink before reaching that point, at a point that we call the critical point,C-point. Naturally, the difference between C and R – which we denote Δc – depends on the average time taken by the handoff process and on the rate of RSSI degradation experienced by the mote. If the sensor node is experiencing a decrease in RSSI of Ei dB during a time interval T and it takes an average t seconds to perform the handoff procedures, then:

$$\Delta c = k \times t \times Ei / T \quad (1)$$

Where k is a constant used to adjust the handoff policy. Naturally, Δc is always an estimation, as there is no way to determine future RSSI values. A conservative approach would use $k > 1$, and an optimistic approach would use $k < 1$. Based on the above formula, nodes, or any other responsible entity, can decide if and when to handoff, according to their movement. Once detected that the mote is within the critical area Δc, the handoff process must start.

Based on mobility model, nodes were able to determine when they should look for another sink. In addition, nodes were enabled with the proposed soft handoff capabilities. following experiments measured the elapsed time from the moment the node detects a bad connection until the moment the node connects to a new parent and reports that to the Home Agent via a Binding Update. To perform this evaluation a scenario was implemented with two Sink Nodes, each one in a different domain, programmed with the NoDiS server module, and one mobile node, programmed with NoDiS mote module. The applications were developed in C and nesC respectively, as extensions to the ones used in the previous experiments. To force the handoff, a micaZ was installed on a radio-controlled model car moving along the corridor at a constant speed of 1.5 m/s.

According to the experiments[ ], the time it takes since the node detects a bad connection until it connects to a new Sink and sends the Care-of Address, through the Binding Update, to the Home Agent, is approximately 2.106 seconds. For handoff time this is a considerable long period, in which several packets might be lost. Therefore, even considering soft-handoff mechanisms, we must improve this value.

3 Proposed Model

By analyzing previous papers we found that the relay nodes are selected randomly. But there may be a situation that randomly selected relay node may be overloaded or it can be moving, leading to data loss and repeated retransmissions. So it is necessary to develop an efficient technique for relay node selection.

Hence we propose an optimal load and mobility aware MAC protocol with efficient relay node selection, for wireless sensor network.

Mobility prediction

Each node measures the received signal strength (RSS) from the receiver by monitoring the acknowledgement (ACK) packets and based on the RSS value the link quality and mobility of the node can be predicted. When the link quality is below a minimum value, then relay node selection (RNS) is done.

Relay node selection

The node broadcasts RNS request message to all its neighbors at time T1. Upon receiving the RNS message, the nodes recovers from sleep state to awake mode and it compute their current load. Within the time T2, each neighbor should reply back with RNS reply message along with its load value. On receiving the RNS reply message from its neighbors, the source node computes the RSS of nodes. When more than one RNS reply are received, the node with minimum load and best RSS is chosen as relay node. This procedure reduces the packet drop due to overloading and weak link quality. When no RNS reply is received within T2, source node enters into sleep state in order to avoid inefficient communication and to save energy.

Through this approach, the frequent link failure can be avoided thus reducing packet drop. Further the proposed technique minimizes the energy consumption.

4 Conclusions

Hence a dynamic frame time ,that is inversely proportional to level of mobility is required to cope with these problems we introduce a mobility-adaptive frame time that enables the protocol to dynamically adapt to changes in mobility patterns,making it suitable for sensor environments with both high and low mobility. the above presented mechanisms,though assure mobility support,we aim to improve them,in order to optimize the handoff time so as to control latencies and packet losses.

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