A Review on Energy Efficient PRP Protocol for WSN

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Abstract— *Large scale wireless sensor networks may be one of the best examples in which the pervasiveness of energy efficient design criteria is desirable, due to the inherent resource limitation, which makes energy the most valuable resource. Progress in battery technology and energy harvesting techniques falls behind the much faster growing need of energy need for embedded components – this requires reconsideration of systems architectures to better address the need for energy-efficiency. In our approach efficiency is considered a vertical parameter and influences all layers of the system: from distributed applications all the way to digital / analog co-design.*

Keywords— WSN, Energy Efficient PRP Protocol

I. INTRODUCTION

Wireless communication techniques should provide communication capabilities that are sufficient, depending on time and place, as efficiently as possible. In traditional networks, functionalities are often separated by assigning them to different layers in the protocol stack. A common practice is to try and optimize layers individually in order to implement as efficiently as possible the functionalities assigned to each one of them. An opportunity that should be exploited is the possibility to jointly optimize adjacent layers (and, ultimately, the whole protocol stack) in such a way that the resulting cross-layer optimization is significantly better than what can be achieved by workMin To enable the provision of optimized seamless services, co-operation of networks is inevitable. This cooperation concerns various types of wireless access networks (providing access to fixed networks) and wireless ad-hoc networks. On the one hand, these networks jointly provided connectivity and communication capabilities. On the other hand, they compete for the same scarce resources, e.g. radio spectrum. This requires mechanisms for efficient resource allocation (e.g. by a common resource management) and optimized usage of available bandwidth. Scheduling techniques have to be proposed such that the system can efficiently provide the services needed. Optimization issues and methods play a crucial role in order to achieve an appropriate quality in heterogeneous wireless networks. E.g. resource management and allocation as well as clustering ask for fast and efficient distributed approaches. These approaches have to take care of various aspects like the heterogeneity of the network, the mobility, the transmission range, the scarce resources, and the run-time environment.

Ad-hoc networking will be one of the major enablers to an architecture and underlying framework for large scale wireless sensor networks. Ad-hoc networks utilizing wireless technology are considered as a means of communications among embedded devices that temporarily meet, where distance and time come close, yet connection to a network infrastructure is not easily possible. One of the major requirements when meaningful applications are to be supported by deeply g on single layers. embedded sensor networks is that these networks should be dependable and trusted. Wireless networks are fundamentally different from their well-studied wired cousins due to their absence of the design constraints on processing and communication.

II. SCALABILITY & ADAPTABILITY

The challenges in developing new technologies for large-scale wireless and sensor networks are the need for the devices to be smart, self-configurable, capable of networking together, and the inherent resource lean properties of the devices themselves. These devices need to be able to operate in environments that can change drastically in short term as well as long term in available resources and available services. The same applies at the network level, where the network as a whole has to adapt to changes in its environment, mobility or malfunctioning of devices, etc. Moreover, the system must configure, install, diagnose, maintain, and improve itself. Current systems are not able to cope well with these requirements, or are far too complex or resource demanding. In this program we plan to design and implement efficient reconfigurable processing platforms and adaptive protocols and algorithms for large-scale wireless and sensor networks. A promising technique in this respect is model-based adaptivity, in which adaptivity is governed by an underlying mathematical system model.

The large number of entities that make up large scale sensor systems implies that access to resources will be extremely competitive. Hence, these systems will have to embody adaptability on an entirely new scale. For example, communication will need to become adaptive to sustain high densities of devices, and computations may need to split and migrate to adapt to available energy and communication.

Research in WiSe is typically multi-disciplinary and application-oriented. Therefore it is necessary to create a forum in which different disciples can cooperate and which stimulates this cooperation. Secondly, because of the application-oriented nature of wireless sensor networks research, a good and intensive contact with industrial partners is required. WiSe provides such a forum, stimulates the contacts with industry and is a clear and transparent interface between the industry and the research activities at the University of Twente. Examples of applications that we currently work on are: entertainment (NXP, Philips), logistics (IBM) and medical (Philips Medical Systems). For the applications there is also a relation with other SRO's like ASSIST and IE&ICT. Other applications that can be addressed in cooperation with other SRO's are:

- Fitness and medical applications: transmission of the body parameters such as blood pressure, pulse rate, body temperature, transmission of parameters of body implants, digital spectacles, hearing aides, emergency support, speech control and data.
- Business: to support production and maintenance, as well as personification and access/identification through

authentication of individual objects, guidance and assistance in logistic operations.

- Learning: to augment learning environments, but also to make learning more ubiquitous; to support explicit learning and training, but also to support communities around learning and provide seamlessness e.g. between learning in school, excursions, homework and between planned and spontaneous learning activity.
- Security and safety: Security systems melt into the environment with the goal to increase the safety in public areas (streets, airports, train stations, etc.). Monitoring human activities. Automated assessment of situations and alarm generation; personal security; safety-critical services; crisis detection; smart alarms; secure operation of dangerous devices; location- and context-based security.
- Leisure: music entertainment, navigation support in cars and on foot, museum and city guide, pulse rate monitoring in sports, monitoring of babies, wireless cash card: display of recent transactions and checking of balance.
- Transport and mobility: enhancement of traffic safety and efficiency, and reduction of emissions, by utilizing vehicle-to-vehicle or vehicle to infrastructure communication.

III. LITERATURE REVIEW & PROBLEM IDENTIFICATION

The main operational sustainability concern in WSN is its energy resource constraint. This brings along in recent years that a great number of energy efficient routing protocols have been proposed for WSNs based on the network organization and the routing protocol operations. Some of these focused on minimizing the communication distance to reduce the energy consumption and a handful of them focused on fair energy distribution to avoid the routing hole (hot spot) problems. The routing hole issue was described and addressed in by utilizing mobility based energy efficient routing protocols. These protocols are suitable in certain situations; however they may not be applicable in cases where mobility is not feasible such as earthquake, forest fire, and disaster management. Mobility techniques do have other challenges like increased energy overhead owing to frequent network topology changes and data packet drops due to high latency. Various other research papers focusing on energy efficiency routing protocols can be found in. Many researchers pay attention to the WSN energy issue by designing different routing techniques and MAC-layer protocols to raise the energy level in WSN. Our literature review reveals that a range of different energy efficient routing protocols in the recent past were designed mostly based on the network structure such as hierarchical routing, location routing, and flat based routing. Our extensive literature review also reveals that the existing routing protocols are still facing energy efficiency limitation issues. Critical analyses of some of the popular existing energy efficient routing protocols are presented in this section.

Hierarchal routing protocols are considered more energy efficient when compared with flat and location based routing protocols.

The literature review refers to the fact that the main advantage of hierarchal approach is to control the data duplication and is best suited for data aggregation. With this format, nodes are not allowed to communicate with the sink directly that they must go through a cluster head for communication purposes, while the cluster head collects the data from different nodes within a specific cluster area, and then it sends the collected data either to another cluster head or directly to the sink. This approach is more balanced and energy efficient comparable to flat and location based routing protocols.

However, the disadvantage of this approach is that it results in quick energy drain of the cluster head nodes as most of the time they are involved in sending and receiving the data packets. Rotation of cluster heads is possible but it also brings along an issue related to the loss of the energy resource.

A number of different protocols have been proposed for WSN node localization or location based routing. These literatures referred to the fact that the main advantage of these protocols is the ability to identify the correct location of the sensor node within the sensor network. Node localization is directly linked to energy efficiency of WSN. It saves energy resources of WSN. However in most cases these protocols resulted in energy loss due to its geographical topology and node distribution in the WSN. There is thus still a gap in energy efficient routing protocol design and solutions for this class of routing.

A good number of flat based routing protocols have been studied such as,

The literature review referred to the fact that the main advantage of flat based routing protocol is its simplicity in operation and it had a direct communication mechanism with the base station in which all nodes are allowed to participate during the routing operation. For its simplicity, the nodes only need information about their closest neighbors. However, the major disadvantage is that nodes spread out in a flat manner and all nodes are attempting to participate equally thus causing the nodes closer to the sink to deplete their power sooner than those located further away from the sink. This is mainly due to the heavy data transmission load. This is badly affecting the nodes closer to the sink for keeping them alive longer. Therefore the nodes further away may be unable to communicate with the base station after some time due to network isolated segmentation problem in the WSN. Consequently many of the nodes are not able to participate in routing thus not utilizing their entire energy effectively. More research works are deemed necessary to address the WSN energy efficiency in this aspect. In addition, flat routing is still having issues in data collision overhead, links formed on the fly without synchronization, energy dissipation depending on traffic patterns, and fairness being not guaranteed.

IV. METHODOLOGY

This research is aimed to design a new energy efficient routing protocol, namely, Position Responsive Routing Protocol (PRRP), to address the energy issues in WSN and specifically to enhance the energy efficiency in WSN. The main contribution of PRRP is the novel way of selecting the cluster head (CH) in WSN. In comparing to the existing protocols such as LEACH and CELRP whereby the CHs are chosen randomly among all nodes based on their respective residual energy, in PRRP we considered different parameters such as distance from the sink, energy level, and the average distance of neighboring nodes from the candidate CH node.

V. EXPECTED OUTCOMES

PRRP differs from existing protocols such as LEACH and CELRP in many ways. This research assumes that nodes are aware of their geographical locations in WSNs using GPS or some other cost effective location surveys. Each node is able to use different frequencies for transmitting and receiving as it is assumed that sensor node has a multichannel transceiver. It is assumed that each node can transmit its data to the sink as node has ability to transmit for longer distance. All nodes have homogeneous energy level at initial stage and this assumption is widely used in literature. Sensor nodes are distributed in the grid format with a uniform random fashion and the sink is placed in the center of sensor network. This assumption is particularly relevant for forest fire surveillance systems and disaster management systems.

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