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A Review of Cluster Heads Selection in WSN

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Abstract: In recent years there has been a growing interest in Wireless Sensor Networks (WSN). Recent advancements in the field of sensing, computing and communications have attracted research efforts and huge investments from various quarters in the field of WSN. Also sensing networks will reveal previously unobserved phenomena. Network's lifetime depends on energy efficiency and load balancing of wireless sensor network. The main aim of clustering is to provide the scalability and reduce energy consumption. Cluster head consume more energy as compare to non cluster head nodes. Proper selection of cluster head increases the network lifetime and energy efficiency. This paper provides an overview of clustering, cluster head election mechanisms and LEACH protocol.

Key words: *Wireless Sensor Networks Clustering Cluster head LEACH*

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I. Introduction

A **wireless sensor network (WSN)** consists of spatially distributed autonomous sensors to *monitor* physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling *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 is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

II. Literature Survey

A coordinated data collection approach: Design, evaluation, and comparison: W. C. Cheng, C. Chou, L. Golubchik, S. Khuller, and Y. C. Wan

We consider the problem of collecting a large amount of data from several different hosts to a single destination in a wide-area network. This problem is important since improvements in data collection times in many applications such as wide-area upload applications, high-performance computing applications, and data mining applications are crucial to performance of those applications. Often, due to congestion conditions, the paths chosen by the network may have poor throughput. By choosing an alternate route at the application level, we may be able to obtain substantially faster completion time. This data collection problem is a nontrivial one because the issue is not only to avoid congested link(s), but to devise a coordinated transfer schedule which would afford maximum possible utilization of available network resources. Our approach for computing coordinated data collection schedules makes no assumptions about knowledge of the topology of the network or the capacity available on individual links of the network. This approach provides significant performance improvements under various degrees and types of network congestions. To show this, we give a comprehensive comparison study of the various approaches to the data collection problem which considers performance, robustness, and adaptation characteristics of the different data collection methods. The adaptation to network conditions characteristics are important as the above applications are long lasting, i.e., it is likely changes in network conditions will occur during the data transfer process. In general, our approach can be used for solving arbitrary data movement problems over the

Internet. We use the Bistro platform to illustrate one application of our techniques.

Relay node deployment strategies in heterogeneous wireless sensor networks: K. Xu, H. Hassanein, G. Takahara, and Q. Wang

In a heterogeneous wireless sensor network (WSN), relay nodes (RNs) are adopted to relay data packets from sensor nodes (SNs) to the base station (BS). The deployment of the RNs can have a significant impact on connectivity and lifetime of a WSN system. This paper studies the effects of random deployment strategies. We first discuss the biased energy consumption rate problem associated with uniform random deployment. This problem leads to insufficient energy utilization and shortened network lifetime. To overcome this problem, we propose two new random deployment strategies, namely, the lifetime-oriented deployment and hybrid deployment. The former solely aims at balancing the energy consumption rates of RNs across the network, thus extending the system lifetime. However, this deployment scheme may not provide sufficient connectivity to SNs when the given number of RNs is relatively small. The latter reconciles the concerns of connectivity and lifetime extension. Both single-hop and multihop communication models are considered in this paper. With a combination of theoretical analysis and simulated evaluation, this study explores the trade-off between connectivity and lifetime extension in the problem of RN deployment. It also provides a guideline for efficient deployment of RNs in a large-scale heterogeneous WSN.

3) **Collection tree protocol:** O. Gnawali, R. Fonseca, K. Jamieson, D. Moss, and P. Levis

Most sensor networks are used to collect information from the physical world. Examples include sensor networks deployed to monitor micro-climates in agriculture farms and deployments that measure energy consumption in office or residential buildings. The nodes in these networks collect information about the physical world using their sensors and relay the sensor readings to a central base station or server using multi-hop wireless communication.

Collecting information reliably and efficiently from the nodes in a sensor network is a challenging problem, particularly due to the wireless dynamics. Multihop routing in a dynamic wireless environment requires that a protocol can adapt quickly to the changes in the network (agility) while the energy-constrains of sensor networks dictate that such mechanisms not require too much communication among the nodes (efficiency). CTP is a collection routing protocol, that achieves both agility and efficiency, while offering highly reliable data delivery in sensor networks. CTP has been used in research, teaching, and in commercial products. Experiences with CTP has also informed the design of the IPv6 Routing Protocol for Low power and Lossy Networks (RPL).

Data gathering mechanism with local sink in geographic routing for wireless sensor networks: E. Lee, S. Park, F. Yu, and S.-H. Kim

Most existing geographic routing protocols on sensor networks concentrates on finding ways to guarantee data forwarding from the source to the destination, and not many protocols have been done on gathering and aggregating data of sources in a local and adjacent region. However, data generated from the sources in the region are often redundant and highly correlated. Accordingly, gathering and aggregating data from the region in the sensor networks is important and necessary to save the energy and wireless resources of sensor nodes. We introduce the concept of a local sink to address this issue in geographic routing. The local sink is a sensor node in the region, in which the sensor node is temporarily selected by a global sink for gathering and aggregating data from sources in the region and delivering the aggregated data to the global sink. We next design a Single Local Sink Model for determining optimal location of single local sink. Because the buffer size of a local sink is limited and the deadline of data is constrained, single local sink is capable of carrying out many sources in a large-scale local and adjacent region. Hence, we also extend the Single Local Sink Model to a Multiple Local Sinks Model. We next propose a data gathering mechanism that gathers data in the region through the local sink and delivers the aggregated data to the global sink. Simulation results show that the proposed mechanism is more efficient in terms of the energy consumption, the data delivery ratio, and the deadline miss ratio than the existing mechanisms.

Constructing maximum-lifetime data-gathering forests in sensor networks:: Y. Wu, Z. Mao, S. Fahmy, and N. Shroff

Energy efficiency is critical for wireless sensor networks. The data-gathering process must be carefully designed to conserve energy and extend network lifetime. For applications where each sensor continuously monitors the environment and periodically reports to a base station, a tree-based topology is often used to collect data from sensor nodes. In this work, we first study the construction of a data-gathering tree when there is a single base station in the network. The objective is to maximize the network lifetime, which is defined as the time until the first node depletes its energy. The problem is shown to be NP-complete. We design an algorithm that starts from an arbitrary tree and iteratively reduces the load on bottleneck nodes (nodes

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likely to soon deplete their energy due to high degree or low remaining energy). We then extend our work to the case when there are multiple base stations and study the construction of a maximum-lifetime data-gathering forest. We show that both the tree and forest construction algorithms terminate in polynomial time and are provably near optimal. We then verify the efficacy of our algorithms via numerical comparisons.

III. CONCLUSION

Clustering based techniques plays an important role for network scalability, energy efficiency and reducingoverheads. Cluster head selection is major challenge toprolong energy efficiency and network's lifetime.Researchers have proposed different mechanisms toselect cluster head but still it open research problem forprolonging network's lifetime. This paper focused onclustering importance and cluster head selectionmechanisms.

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