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The Effects of Physical and Mac Parameters on the Routing by Cross-Layers Interaction Approach

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ABSTRACT

Wireless sensor networks (WSN) are an ad hoc network consisting of miniaturized autonomous sensors that communicate with each other over a radio link. In this paper, the authors' contribution is a cross-layer approach. To achieve this approach, the authors proposed in the first part an improvement of LEACH algorithm named WEIGHTED_LEACH. This algorithm is an enhancement of LEACH by inserting novel factors in the threshold equation in order to choose the best node to be CH by competitiveness strategy. In the second part, the authors propose a new adaptable cross-layer design realized by proposed algorithm and AODV protocol with cross layer interaction algorithm. This is an improvement by the control of data fusion in the network using multi-hop routing based on weight metric deducts from relative parameters of node such RSSI, SINR, residual energy, and distance. A comparative analysis between WEIGHTED_LEACH and LEACH, shown for different configurations the efficiency of the proposition in terms of energy saving and life time of WSN cluster, are evaluate under the NS2 simulator.

KEYWORDS

AODV, Distance, Energy, Leach, Ns2.35, RSSI, SINR, WSN

INTRODUCTION

In recent years, with the rapid development of communication and sensor technologies, Wireless Sensor Networks (WSN) are emerging in many industrial and consumer area.

(WSN) is a group of static sensor nodes which gather information and deliver to the base station. In WSN sensor nodes deployed to monitor various physical and environmental parameters. Due to fast development in mobile Internet technology, mobile wireless sensor network (MWSN) has become a popular field of research and replacement of static WSN.

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MWSN is a collection of mobile sensor nodes that aim to sense data from the environment and effectively deliver the base station.

MWSN can be classified into three types, which are as follows:

- Mobile base station and mobile sensor;
- Mobile base station and static sensor;
- Static base station and mobile sensor.

BACKGROUND

Wireless Sensor Environments

Wireless sensor network (WSN) is a developing technology that improves the resource utilization in various fields such as home automation, e-health, smart grid, precision agriculture etc. It consists of sensor devices, which works autonomously with its sensing, communication and computation capabilities. In most of the sensor network applications the nodes will be deployed in remote areas, so replacing the battery often is impossible in many WSN scenarios. Hence energy is considered as a valuable resource in resource constrained wireless sensor networks.

WSN communication suffers from various problems with Self-organization nodes, and environment obstacles. To ensure the best performance of network it is necessary to try to solve the problems of unreliability of links, and to avoid successive retransmission of packet in order to reduce the energy consumption at each node to its task of routing in other words minimizing the route failed re-selection.

Consequently, the evaluation specifies the quality of link, minimize the errors and make the interchangeability between nodes more effective to solve the problems imposed by the unreliability of links. To overcome these problems of layers modules, most researchers proposed cross layer design.

The aim of Cross-layer design is to improve the performance of all layers and share key parameters between these layers.

Whole system performance can be improved if the MAC can get parameter from the PHY about when and how the noise level is changing, as a result the MAC can schedule transmission during the periods of time in which noise levels are lower.

All protocols proposed in WSN have to take in their account the basic inherent characteristics of the network which are: dynamic topology, variable link capacity and bandwidth constraints, energy constraints nodes and multi-hop communications. All these characteristics are seriously challenged the OSI layer design which is characterized by the modularity (Kawadia & Kumar,2005), and permit to create a new methodology named Cross-layer. Cross-layer design refers to an optimized approach design done by allowing layers to exchange state parameter in order to obtain performance gains. The sharing of parameter enables each layer to have global pictures of the constraints and characteristics of the network. Basically, the cross-layer design enables the network protocols and the applications to observe and respond to the changing networks and channel conditions (*Rappaport & al,2002)*.

We can classify the shared parameter of layers as:

- **Physical Layer Parameters (PLPs):** By focusing on the effects of link quality, power control, a harmonization between Mac and physical layer is investigated. For example, given the current channel state condition, the MAC protocol may adjust some parameters in order to reduce the energy consumption.
- **Mac Layer Parameters (MLPs):** The link layer has notification mechanisms in case of absence of the acknowledge packet or the clear to send (CTS) packet which permit the network protocols to research newer routes and update their routing table.