

# Review on Low Energy Adaptive Clustering Hierarchy (LEACH) Protocol for Wireless Sensor Networks

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**Abstract:** The routing protocol for Wireless Sensor Networks (WSNs) is defined as the manner of data dispersal from source to the destination. This review paper focuses on the basic features of the Low Energy Adaptive Clustering Hierarchy (LEACH) protocol performance.

**Key Words:** Wireless Sensor Network, LEACH protocol.

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## I. Introduction

There are many ways in which the properties of a sensor network can be evaluated-

- 1 Ease of deployment- Sensor networks can be easily deployed in inaccessible and perilous locations.
- 2 Network lifetime- The networks should function as long as possible so as to gather more data and also due to unavailability of recharge methods unless solar cells are deployed.
- 3 Latency- The time sensitivity of data from sensor nodes must not be disturbed.
- 4 Quality- The quality of aggregate data must be useful to the end user.

LEACH employs randomized, adaptive, self- configuring cluster formation and localized control for data transfers using medium access control (MAC) and also performs data compression which enables efficient data transfer from source to destination.

## II. Architecture

The operation of LEACH can be studied by considering a round of data transfer from sensor nodes to base station as comprised of setup phase which includes cluster head selection and cluster formation and steady state phase.

### A. CLUSTER HEAD SELECTION AND CLUSTER FORMATION PHASE

The application of a wireless sensor network is in monitoring a remote location for temperature, location etc. For efficient data transfer to the destination, the nodes arrange themselves in clusters and a cluster head is chosen.

In LEACH the cluster head selection is a dynamic process i.e. different cluster heads are chosen for different rounds of information being transmitted. Initially, all nodes are assumed to have equal energy, and if nodes have different amounts of energy then the nodes with more energy are chosen as cluster heads so as to maximize the network lifetime.

Each cluster head node broadcasts a declaration message using a non-persistent carrier-sense multiple access (CSMA) MAC protocol. This is a small message containing the node's identity (ID) and a header that distinguishes this message as a declaration message Each non-cluster head node determines its cluster for a round by choosing the cluster head that requires the minimum energy, based on the received signal strength of the advertisement from each cluster head i.e. the node which requires minimum amount of energy to communicate is chosen as cluster head.

Since there may be correlation in data between the nodes close to each other so data compression is also performed in order to transmit effective data to the destination. The node chosen as cluster head performs the function of data compression and transmitting it to the destination. Destination is a base station which requires data for monitoring. Data compression also leads to reduction in energy consumption during transmission of data from cluster head to base station.

### B. STEADY STATE PHASE

The steady-state operation is broken into frames, where nodes send their data to the cluster head at most once per frame during their allocated transmission slot. The duration of the slot in which a sensor node transmits data to the cluster head is constant, so the time to send a frame of data depends on the number of nodes in the cluster.

Each non-cluster head node also has a power control mechanism using which it can set the transmit energy limit based on the distance of cluster head node from it. A Time Division Multiple Access (TDMA) schedule is also set up to maximize the use of available bandwidth thus providing both energy efficient and bandwidth efficient data transfer from non-cluster head node to cluster head node.

Spread spectrum techniques are also used to reduce inter-cluster interference by providing each cluster head and the members of a cluster a unique spreading code. Thus all the nodes in a cluster transmit data to cluster head node using a fixed spreading code

Data is sent from cluster head node to base station using CSMA and fixed spreading code. Thus, if the channel is sensed to be free, then data is transmitted or fixed spreading code can also be used.

### **III. Conclusion**

Thus, while designing protocol architectures for sensor network certain features must be taken care of as the function to be performed, ease of deployment, and energy constraints of the nodes. These features led to design of LEACH, which reduces the amount of transmitted data, and operation is done using local control i.e. via cluster heads, and media access control (MAC) and routing protocols enable low-energy networking.

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