LEACH PROTOCOL

Wireless Sensor Networks

LEACH

The LEACH protocol **(Low-energy Adaptive Clustering Hierarchy)** presented by **Heinzelman et al.** assumes a dense sensor network of homogeneous, energy-constrained nodes, which shall report their data to a sink node. In LEACH, a TDMA-based MAC Protocol is integrated with clustering and a simple “routing” protocol.

LEACH

LEACH partitions the nodes into **clusters** and in each cluster a dedicated node, the **cluster-head**, is responsible for creating and maintaining a TDMA schedule, all the other nodes of a cluster are member nodes.

To all member nodes, **TDMA slots are assigned**, which can be used to exchange data between the member and the cluster-head.

LEACH

- There is **no peer-to-peer** communication.
- The cluster-head **aggregates** the data of its members and transmits it to the sink node.
- It **minimizes** the energy consumption in wireless sensor networks.

Purpose of LEACH

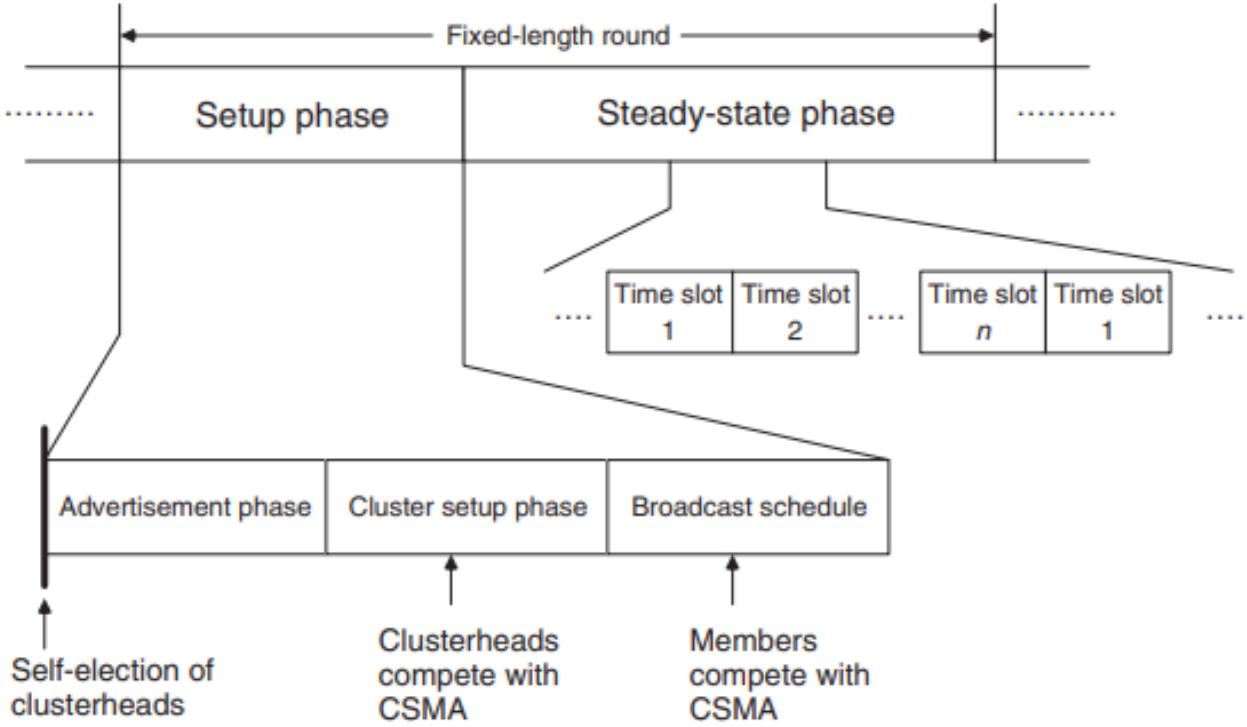
- Cluster based protocol that **minimize energy consumption** in Wireless Sensor Networks.
- Randomly Select sensor nodes as Cluster-head so that higher energy dissipation in communicating base stations spread to all sensor nodes in sensor nodes

Phases

The protocol is organized in rounds and each round is subdivided into:

- Setup phase
- Steady-state phase

Organization of LEACH rounds



Setup phase

1. Cluster-Head Selection **2. Cluster Formation**

- ✓ The setup phase starts with the **self-election of nodes** to cluster-heads.
- ✓ In the beginning of each round, each node advertises its probability to become a cluster head, depending upon its energy.
- ✓ In **advertisement phase**, the cluster-heads informs their neighborhood with an advertisement packet.

Setup phase

- ✓ Higher probability chosen as cluster head.
- ✓ Cluster-head broadcasts message using CSMA
- ✓ Based on signal strength member nodes are selected as cluster head for round.

Aim:

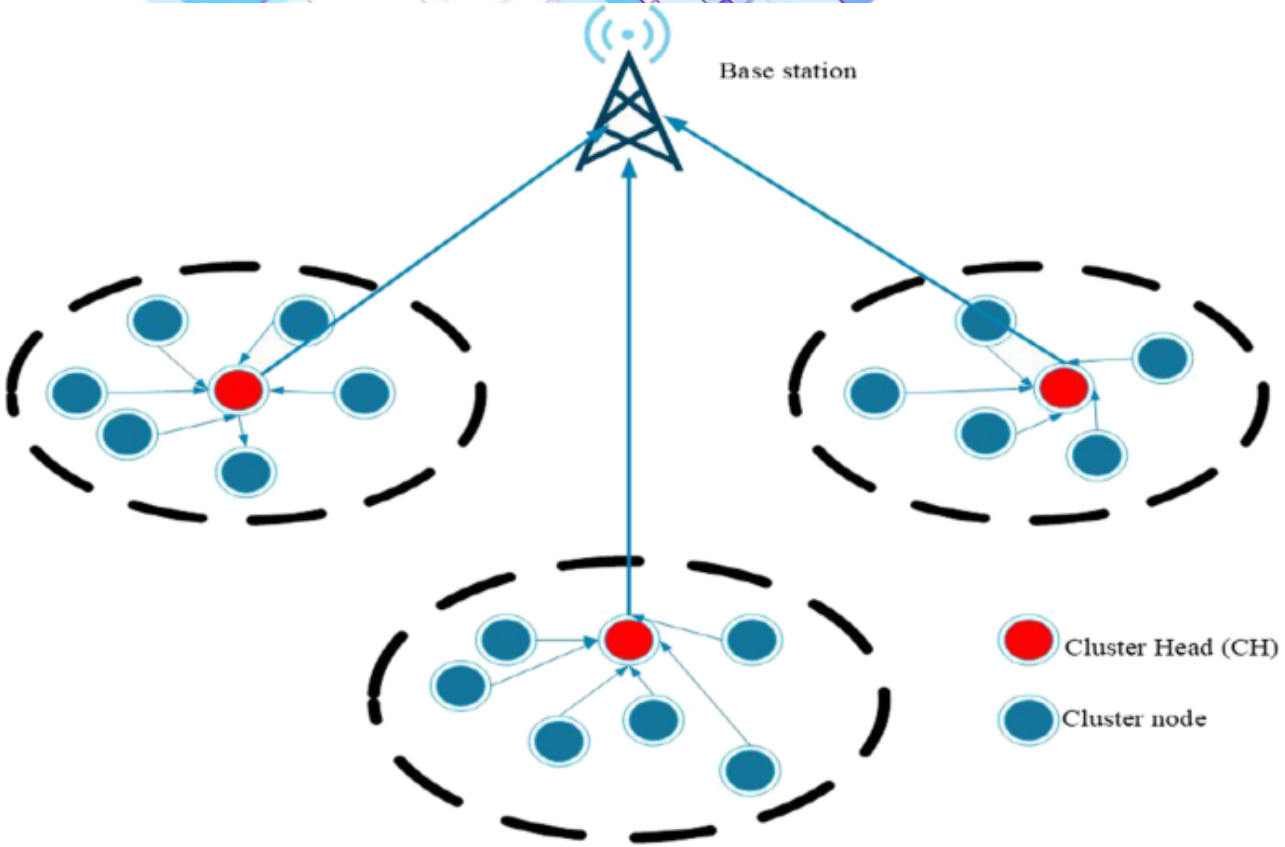
Setup phase aims to prolong the network lifetime by rotating the role of cluster-head among sensor nodes.

Steady-state Phase

- In the Steady State Phase of LEACH, the network operates in a stable and predictable manner.
- Sensor nodes collect and transmit data to cluster heads, which aggregate and forward it to the base station.
- Cluster heads, acting as intermediaries, play a key role in data aggregation and communication with the central collection point.

Steady-state Phase

- Continuous monitoring and adjustments in the steady state phase maintain optimal network performance and adapt to changing conditions.
- The emphasis during this phase is on energy efficiency, extending the overall lifetime of the wireless sensor network.
- The organized clustering structure established in the setup phase persists, contributing to the stability and efficiency of data transmission.


Base station
Cluster Head (CH)
Cluster node