SNS COLLEGE OF TECHNOLOGY

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Coimbatore-35

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT308-WIRELESS TECHNOLOGIES FOR IoT

III YEAR/ VI SEMESTER

UNIT 5 WPN &WSN

TOPIC – ROUTING TECHNIQUES IN WIRELESS SENSOR NETWORKS

OUTLINE

- Challenges in WSNs

- Categorization based on Network Structure

- Flat-Based Routing

- Hierarchical-Based Routing

- Location-Based Routing

- Categorization based on Protocol Operation

- Summary

CHALLENGES IN WSNS

- No global ID addressing

- IP-based protocols do not apply

- Stationary nodes

- Constraints on energy, storage and processing capacity

- High redundancy in different sensors' data

NETWORK STRUCTURE CATEGORIZATION

NETWORK STRUCTURE CATEGORIZATION

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                    │  Routing Protocols  │
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Flat-Based	Hierarchical-Based	Location-Based
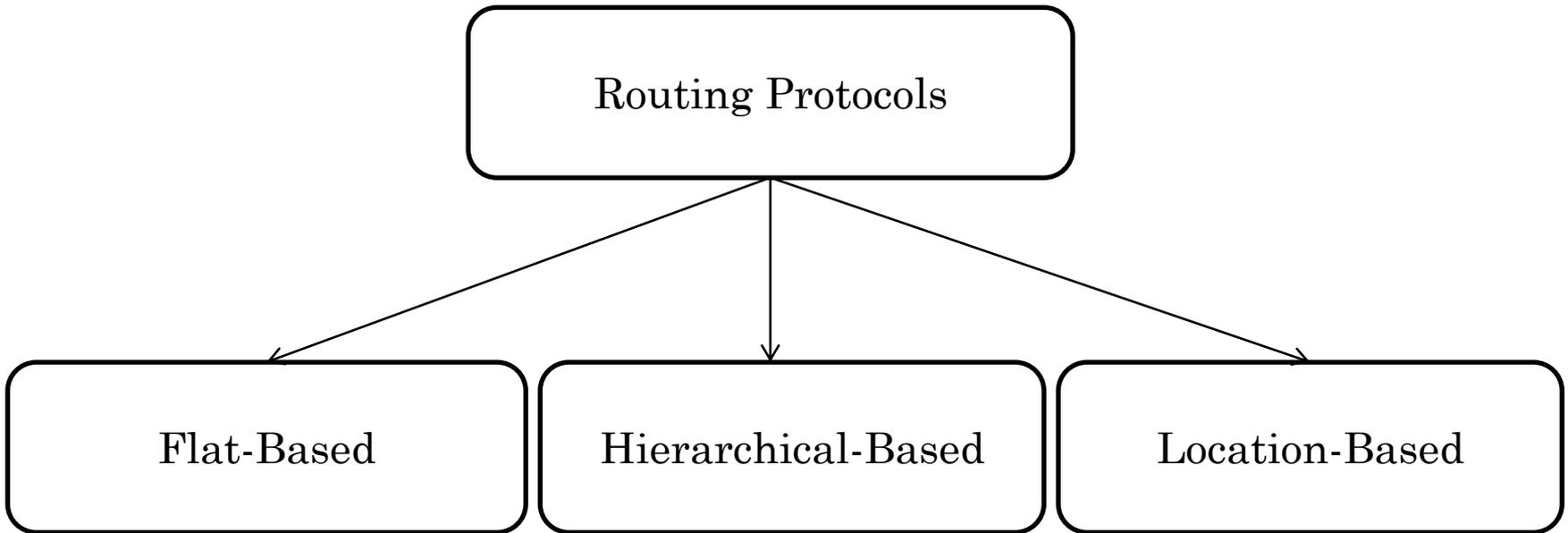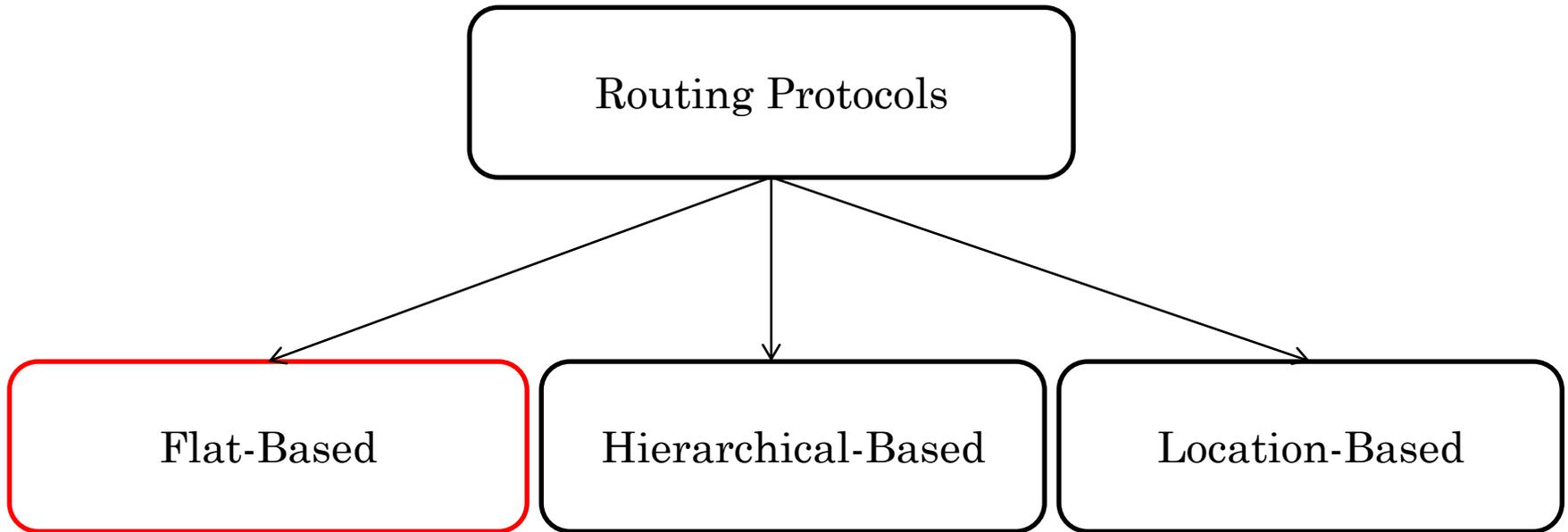
- All the nodes are treated equally and have the same functionality

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FLAT-BASED ROUTING PROTOCOLS

1. Sensor Protocol for Information Negotiation (SPIN):

- Sending meta-data to neighboring nodes, instead of data
- Requesting for the desired data
- ❖ Avoid redundant data transmission
- ❖ Adaptation to remaining energy ➡ increase network lifetime

2. Directed Diffusion:

- BS continuously sends query to the neighboring nodes
- Node with the desired data transmit all the way back to BS
- ❖ Saving energy by selecting the optimal return path
- ❖ Not practical for continuous data demand cases

FLAT-BASED ROUTING PROTOCOLS

3. Rumor Routing:

Variation of Directed Diffusion

Each node has an event table

Event agent flooding instead of query flooding

Significant energy saving

Good for when number of events is less than queries
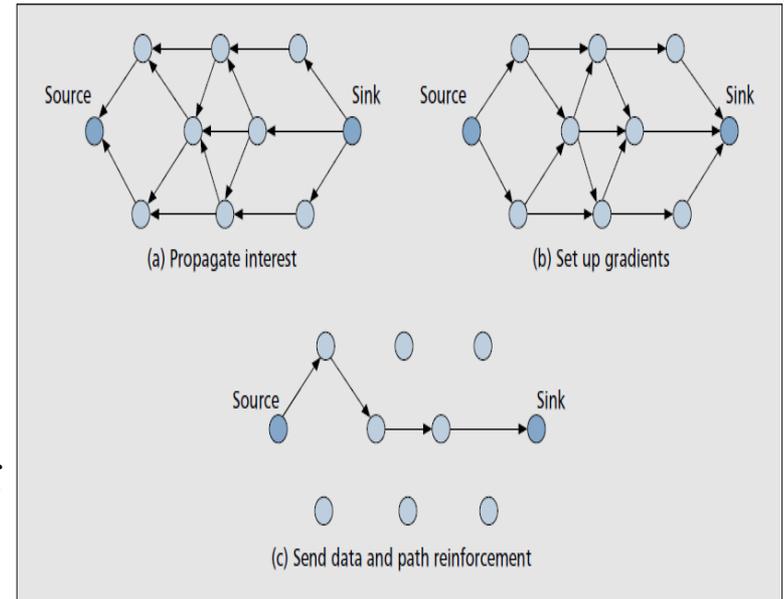
4. Minimum Cost Forwarding Algorithm (MCFA):

• Each node knows the least cost path between itself and BS

• Least cost path can be acquired via initialization

❖ Saving energy by selecting the optimal return path

❖ Good for small networks

NETWORK STRUCTURE CATEGORIZATION

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        ┌─────────────────────┐
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Flat-Based	Hierarchical-Based	Location-Based
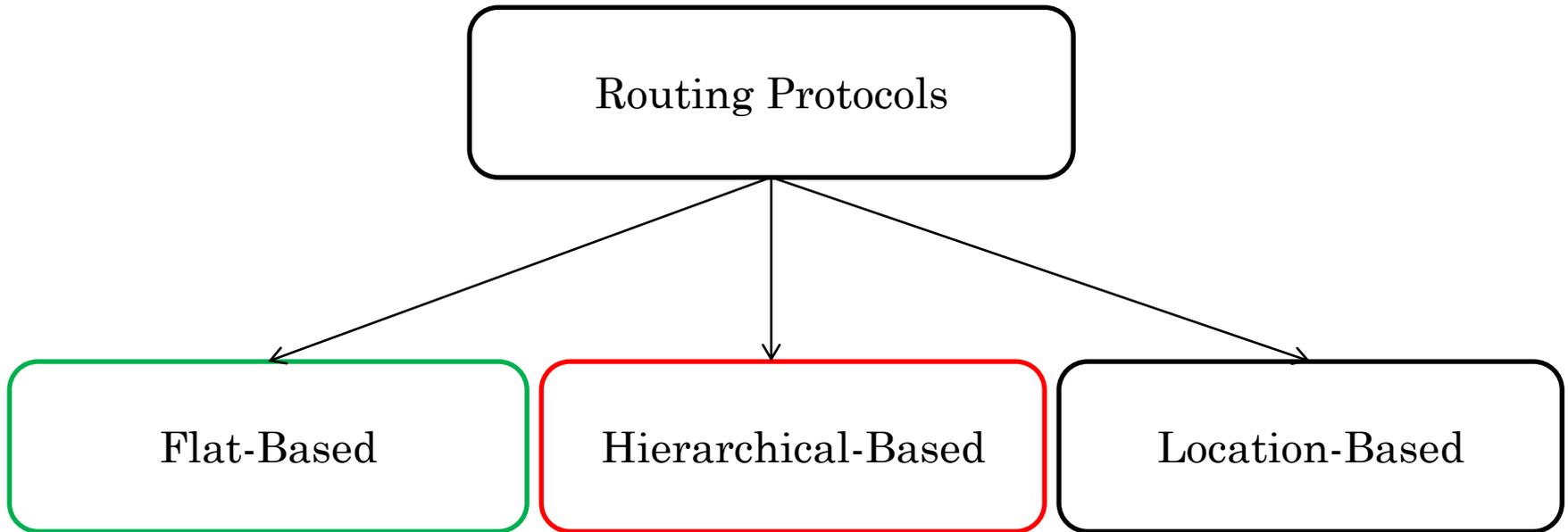
- Higher energy nodes for transmission, lower energy nodes for sensing
- Two layer routing
- Increasing the life time

HIERARCHICAL ROUTING

1. Low Energy Adaptive Clustering Hierarchy(LEACH):

- Random and variation Cluster Head (CH) selection
- Compression and transmission of arriving data at CHs
- ❖ Constant monitoring applications
- ❖ Good for small networks
- ❖ Extra overhead because of clustering

2. Self Organizing Protocol (SOP):

- Mobile sensors to probe the environment
- Stationary nodes as the routers
- Local Markov loop (LML) algorithm for routing
- ❖ Energy consumption is less than SPIN

HIERARCHICAL ROUTING

3. Virtual Grid Architecture

- Symmetric, non-overlapping clusters with optimal CH
- Local and global data aggregation
- ❖ NP-hard to find the optimal global aggregators

4. Hierarchical power-aware routing

- Proximate nodes form zones
- Routes through the zones which has maximum minimum residual energy
- ❖ Dijkstra algorithm can be exploited

○ Sensor node   ● Local aggregator node
◉ Master aggregator node

NETWORK STRUCTURE CATEGORIZATION

Routing Protocols

Flat-Based

Hierarchical-Based
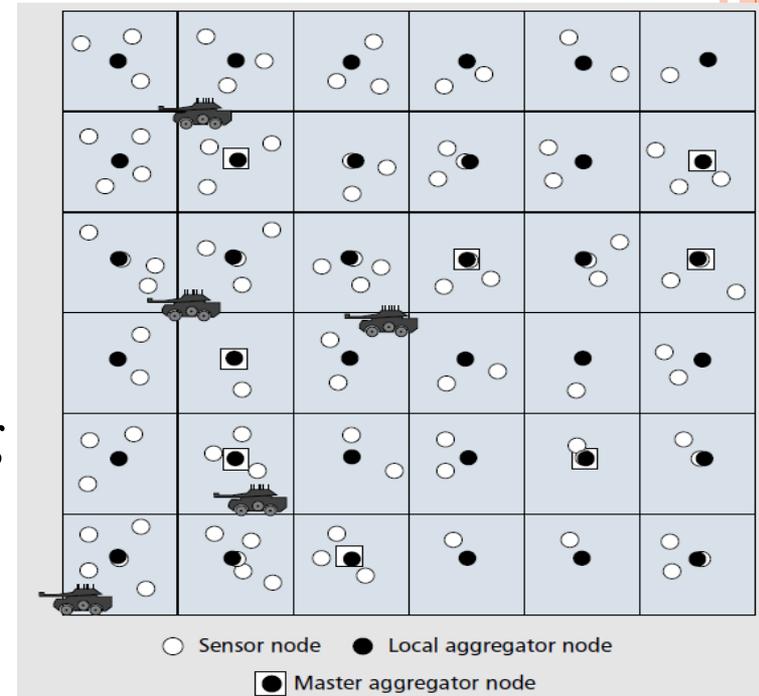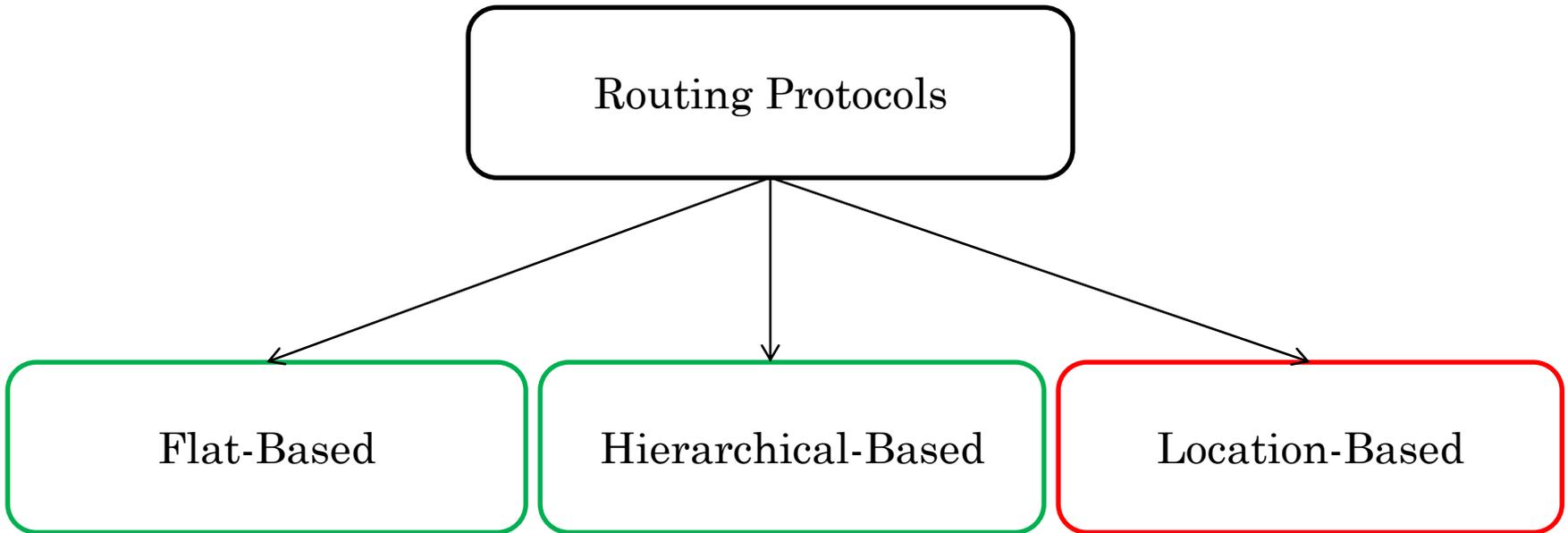
Location-Based

- Sensor nodes are addressed based on their location
- Location are acquired by GPS or via coordination among nodes

LOCATION-BASED ROUTING

1. Geographical Adaptive Fidelity (GAF):

- Network divided into zones
- Only one node is awake in each zone, the rest sleep
- ❖ Conserves energy by turning off unnecessary nodes
- ❖ Increases the network life time

2. SPAN:

- Some nodes are selected as coordinators based on their positions
- Enough coordinators such that network is three-hop reachable
- ❖ Not energy efficient as the others

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ROUTING PROTOCOLS BASED ON PROTOCOL OPERATION

1. Multipath routing
- Increases fault tolerance
- Sophisticated case: have back up paths

2. Query-based routing
- Query transmitted and the date is sent back

3. Negotiation-based routing
- High-level data description
- Elimination of redundant data transmission

4. QoS-baed routing
- Balance between data quality and energy consumption

SUMMARY

- WSNs needs have specific characteristics.

- WSNs need specific routing algorithm.

- Large number of algorithms has been designed, but no optimal one!

- Based on the network structure, routing algorithms can be categorized into 3 main groups.

- We briefly discussed some examples of each group.

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