

Wireless Sensor Network Routing Protocols

Outline

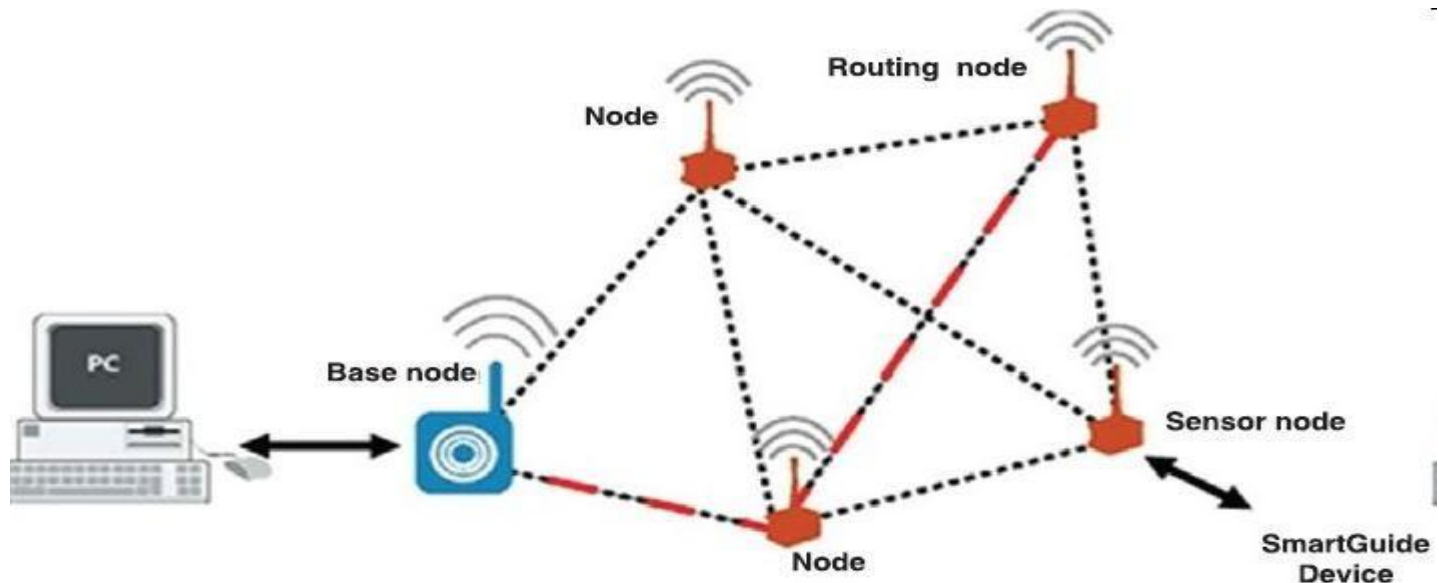
- Introduction of WSN.
- Design Challenges.
- Application of WSN.
- Different Types of Routing Protocols.
- Comparison (Spin,Leach,DD).
- Comprehensive survey .
- Objective .
- References.

Introduction of WSN

- Wireless Sensor networks are a particular type of adhoc network.
- WSN formed by a large no of nodes.
- Nodes: "physical device monitoring a set of physical variables" ,communicates via a redio channel.
- Nodes: Internally protocol stack controls communications.
- WSN can be considered as a particular type of MOBILE AD-HOC NETWORK(MANET).

Introduction of WSN(Cont'd)

- Architecture of WSN....



Design challenges

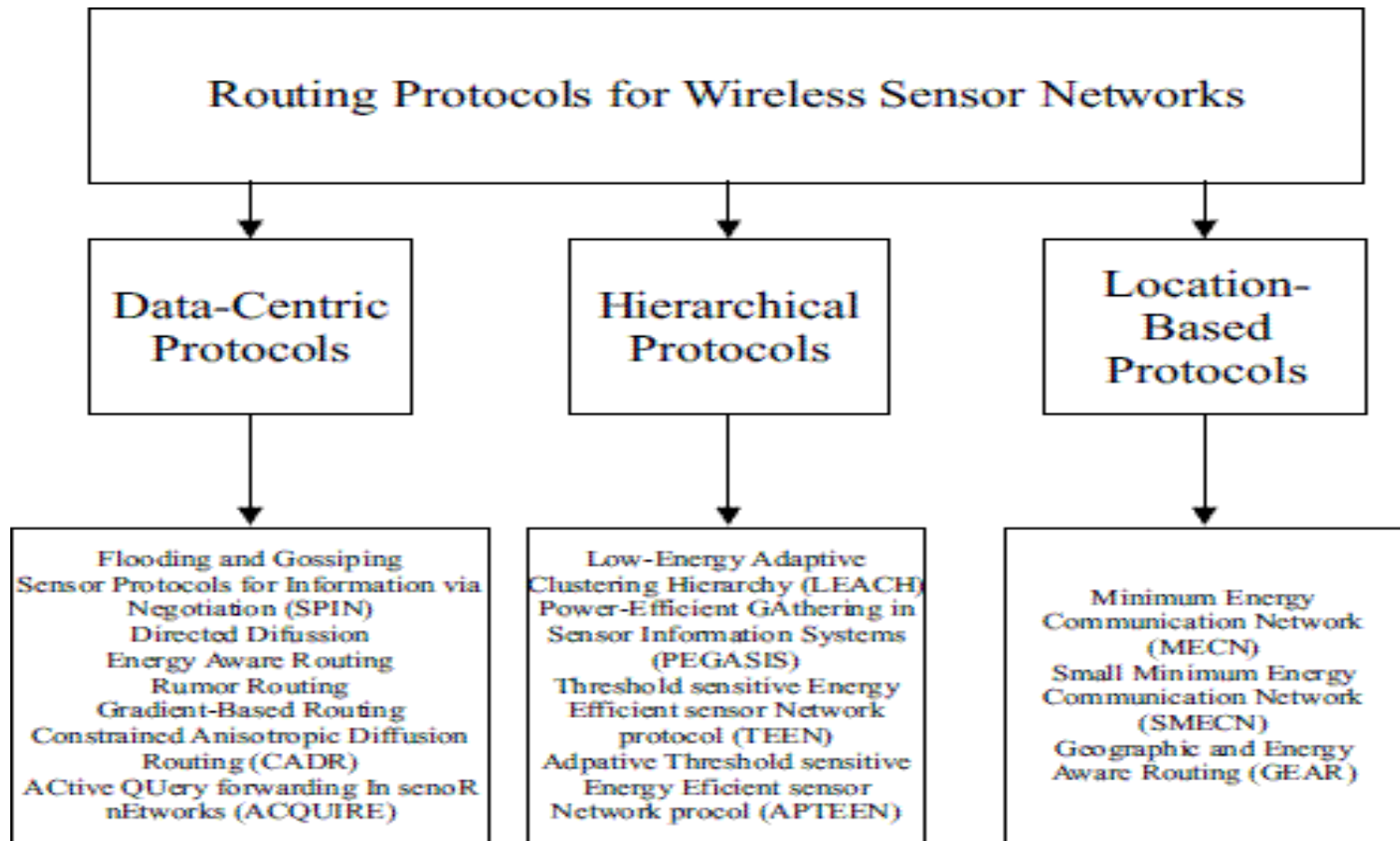
- Energy conservation.
- Unstructured and/or time-varying network topology.
- Low quality communications.
- Resource-constrained computation:

Protocols for ad-hoc networks must strive to provide the desired performance level in spite of the few available resources.

Application of WSN....

- Ocean temperature monitoring for improved weather forecast .
- Intrusion detection .
- Avalanche prediction .
- Emergency situation.
- Industrial application.
- Automotive.

Routing Protocol In WSN



Hierarchical Protocol

- Cluster-based routing.
- Higher energy nodes can be used to process and send information and low energy nodes can be used to perform sending.
- Low energy consumption within a cluster by data aggregation and fusion to decrease the number of transmitted messages.

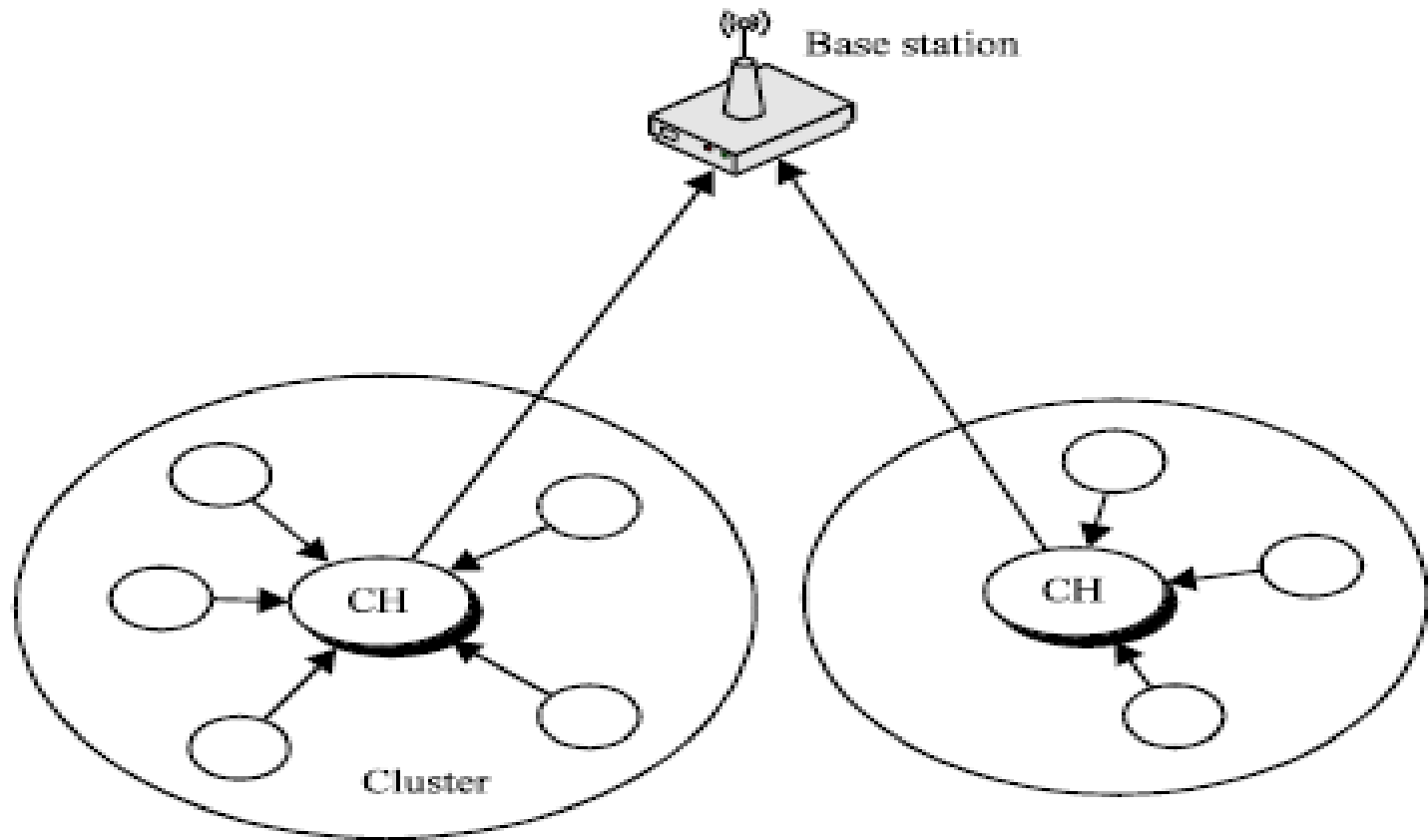
LEACH (low energy adaptive clustering hierarchy)

- It is a self organizing adaptive clustering protocol.
- Randomly select sensor nodes as cluster heads .
- Uses randomization for distributing energy load among the sensors in the networks.
- Set up phase & Steady Phase .

LEACH(Cont'd)

- Assumption made in the leach protocol.
 - a) Nodes transmit enough power to reach base station.
 - b) Each node has enough computational power.
 - c) Nodes located close to each other have correlated data.

LEACH (Diagram)



Flat Routing

- Each node plays the same role & sensors nodes collaborate together to perform the sensing task.
 - 1) Spin.
 - 2) Direct Diffusion.
- Use data centric routing ,the sink sends request and waits for data from sensor nodes.

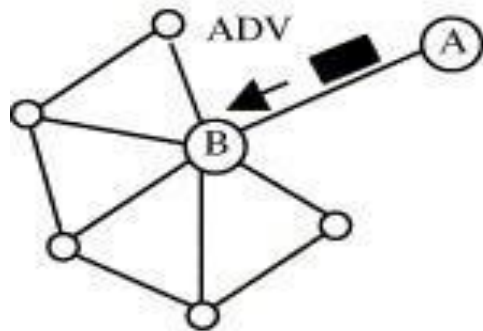
SPIN (Sensor protocols for information via negotiation)

- SPIN , A data centric routing protocol .
- It assumes all nodes in the network are base station.
- Nodes in close proximity have similar data.

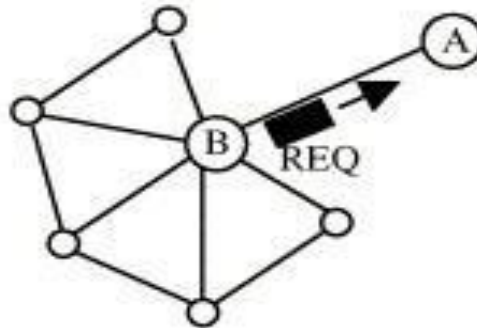
SPIN(Cont,d)

- The key character of SPIN protocol.
- All nodes can be assumed as base station and all information is broadcast to each node in network.
- User can query to any node and can get the information immediately.
- Nodes in the network use a high level name to describe their collected data call meta data.

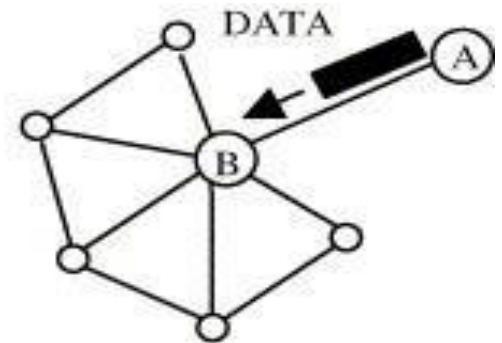
SPIN (Diagram)



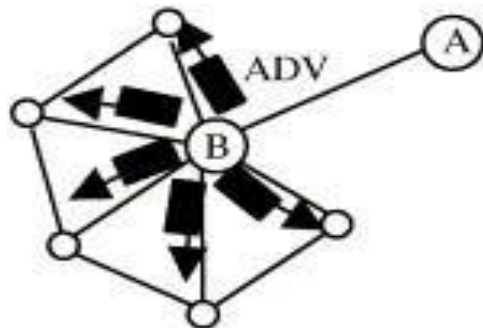
(a)



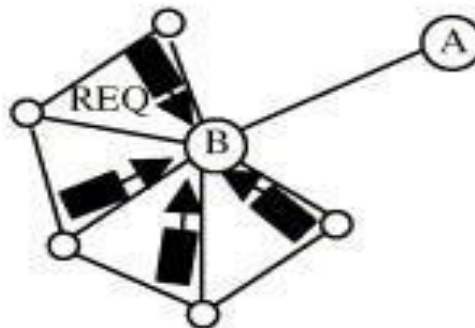
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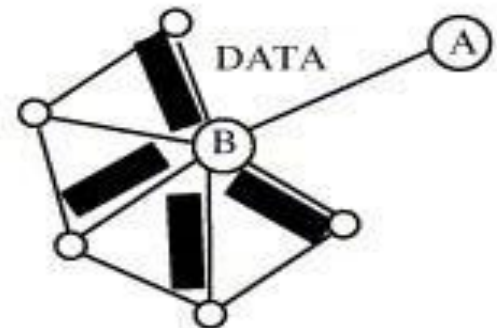
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(d)



(e)



(f)

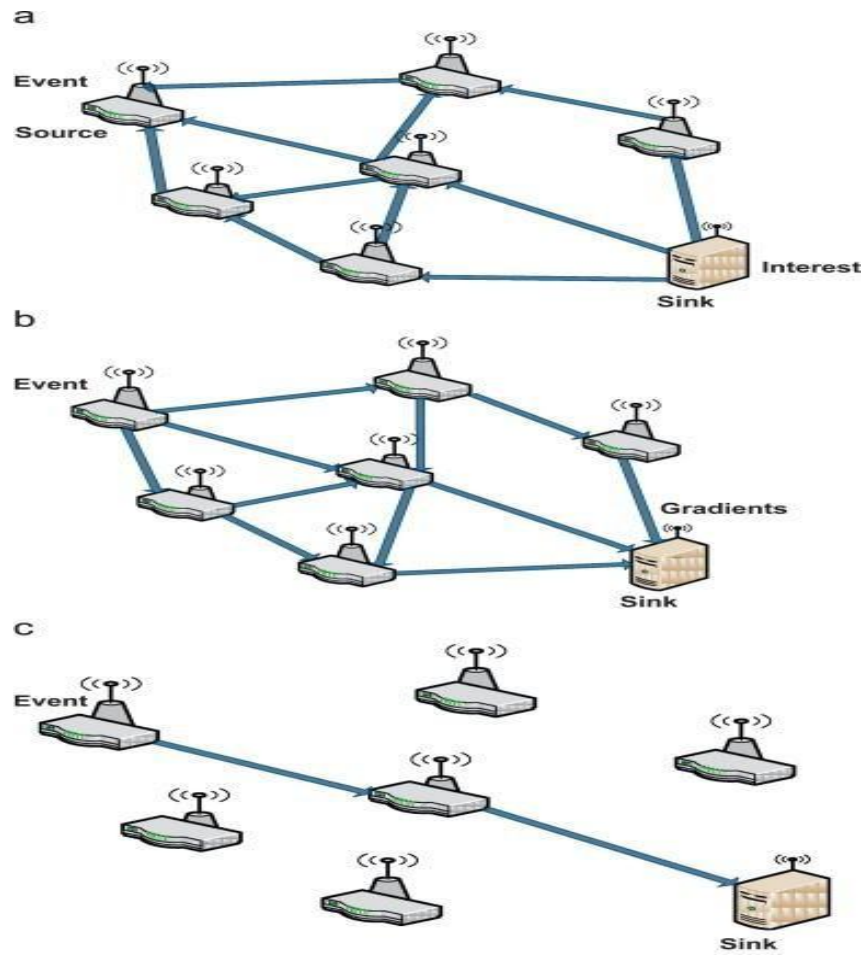
DD(Direct Diffusion)

- Direct Diffusion is a Data Centric and application aware protocol .
- Data is generated by sensor nodes is names bt attribute value.
- It represents distributed wireless sensor network application .

Direct Diffusion(Cont'd)

- Elements of DD algorithms.
 - a) Data is named as attribute value pair.
 - b) Sink sends interests are disseminated through out the wsn.
 - c) Dissemination sets up gradients .
 - d) Data delivery.

Direct Diffusion(Diagram)



Rumor Routing

- Rumor Routing is a kind of Direct Diffusion .
- It is used for application where geographic route is not feasible .
- It combines query flooding and event flooding in a random way .

Rumor Routing(Cont'd)

- Assumptions
 - a) This network is composed of densely distributed nodes.
 - b) Only bi-directional links exists.
 - c) Only short distance transmission are allowed
 - d) Fixed infrastructure.

Heirarchical vs Flat Routing

Table 2: Hierarchical vs. flat topologies routing

Hierarchical routing	Flat routing
Reservation-based scheduling	Contention-based scheduling
Collisions avoided	Collision overhead present
Reduced duty cycle due to periodic sleeping	Variable duty cycle by controlling sleep time of nodes
Data aggregation by clusterhead	node on multihop path aggregates incoming data from neighbors
Simple but non-optimal routing	Routing can be made optimal but with an added complexity.
Requires global and local synchronization	Links formed on the fly without synchronization
Overhead of cluster formation throughout the network	Routes formed only in regions that have data for transmission
Lower latency as multiple hops network formed by clusterheads always available	Latency in waking up intermediate nodes and setting up the multipath
Energy dissipation is uniform	Energy dissipation depends on traffic patterns
Energy dissipation cannot be controlled	Energy dissipation adapts to traffic pattern
Fair channel allocation	Fairness not guaranteed

Comprehensive Study Of Routing protocol

	Classification	Mobility	Position Awareness	Power Usage	Negotiation based	Data Aggregation	Localization	QoS	State Complexity	Scalability	Multipath	Query based
SPIN	Flat	Possible	No	Limited	Yes	Yes	No	No	Low	Limited	Yes	Yes
Directed Diffusion	Flat	Limited	No	Limited	Yes	Yes	Yes	No	Low	Limited	Yes	Yes
Rumor Routing	Flat	Very Limited	No	N/A	No	Yes	No	No	Low	Good	No	Yes
GBR	Flat	Limited	No	N/A	No	Yes	No	No	Low	Limited	No	Yes
MCFA	Flat	No	No	N/A	No	No	No	No	Low	Good	No	No
CADR	Flat	No	No	Limited	No	Yes	No	No	Low	Limited	No	No
COUGAR	Flat	No	No	Limited	No	Yes	No	No	Low	Limited	No	Yes
ACQUIRE	Flat	Limited	No	N/A	No	Yes	No	No	Low	Limited	No	Yes
EAR	Flat	Limited	No	N/A	No	No		No	Low	Limited	No	Yes
LEACH	Hierarchical	Fixed BS	No	Maximum	No	Yes	Yes	No	CHs	Good	No	No
TEEN & APTEEN	Hierarchical	Fixed BS	No	Maximum	No	Yes	Yes	No	CHs	Good	No	No
PEGASIS	Hierarchical	Fixed BS	No	Maximum	No	No	Yes	No	Low	Good	No	No
MECN & SMECN	Hierarchical	No	No	Maximum	No	No	No	No	Low	Low	No	No
SOP	Hierarchical	No	No	N/A	No	No	No	No	Low	Low	No	No
HPAR	Hierarchical	No	No	N/A	No	No	No	No	Low	Good	No	No
VGA	Hierarchical	No	No	N/A	Yes	Yes	Yes	No	CHs	Good	Yes	No
Sensor aggregate	Hierarchical	Limited	No	N/A	No	Yes	No	No	Low	Good	No	Possible
TTDD	Hierarchical	Yes	Yes	Limited	No	No	No	No	Moderate	Low	Possible	Possible
GAF	Location	Limited	No	Limited	No	No	No	No	Low	Good	No	No
GEAR	Location	Limited	No	Limited	No	No	No	No	Low	Limited	No	No
SPAN	Location	Limited	No	N/A	Yes	No	No	No	Low	Limited	No	No
MFR, GEDIR	Location	No	No	N/A	No	No	No	No	Low	Limited	No	No
GOAFR	Location	No	No	N/A	No	No	No		Low	Good	No	No
SAR	QoS	No	No	N/A	Yes	Yes	No	Yes	Moderate	Limited	No	Yes
SPEED	QoS	No	No	N/A	No	No	No	Yes	moderate	Limited	No	Yes

References.....

- **Heizelman , W,; chandrakasan, A .; Balakrishnan , H. Energy efficient communication protocol.**
- **Lewis , F.L wireless sensor network.**

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THANKING YOU