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Survey on Routing Protocols of Wireless Sensor Network

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Abstract—

A device network is associate infrastructure comprised of sensing (measuring), computing, and communication components that provides an administrator the flexibility to instrument, observe, and react to events and phenomena in a as surroundings. though WSNs share several commonalities with wired and ad hoc networks, they also exhibit variety of distinctive characteristics that set them except existing networks. These distinctive characteristics bring back sharp focus new routing style necessities that transcend those usually encountered in wired and wireless accidental networks. Meeting these style necessities presents a particular and unique set of challenges. These challenges will be attributed to multiple factors, together with severe energy constraints, restricted computing and communication capabilities, the dynamically dynamic surroundings inside that sensors are deployed, and distinctive knowledge traffic models and application-level quality of service necessities. As the WSN is having limitation to the energy constraints, the routing protocols in the multihop technology used should be adequate to the energy constraint. For that different routing protocols used are flooding, LEACH, SPIN, PEGASIS, Directed Diffusion etc.

Keywords*— *WSN, Routing protocols of WSN

I. INTRODUCTION

Sensor nodes operate with limited computing, storage, and communication capabilities under severe energy constraints, Due to the large number of conceivable sensor-based applications, the densities of the WSNs may vary widely, ranging from very sparse to very dense. Furthermore, in many applications, the sensor nodes, in some cases numbering in the hundreds if not thousands, are deployed in an ad hoc and often unsupervised manner over wide coverage areas. In these networks, the behavior of sensor nodes is dynamic and highly adaptive, as the need to self-organize and conserve energy forces sensor nodes to adjust their behaviour constantly in response to their current level of activity or the lack thereof. Furthermore, sensor nodes may be required to adjust their behaviour in response to the erratic and unpredictable behavior of wireless connections caused by high noise levels and radio-frequency interference, to prevent severe performance degradation of the application supported.

Resource Constraints, Sensor Applications Data Models, Network Scale and Time-Varying Characteristics.

II. WSN ROUTING PROTOCOLS

1. Flooding:

Flooding is used for path discovery and information dissemination (Sending and receiving packets but not given acknowledgement) Flooding uses reactive (on demand) approach. In flooding received packet is sent to all its neighbors. Unless the network disconnected the packet is received by the receiver. To prevent sending packet indefinitely the approaches used are

1.Hop count is given in the packet which gives exactly diameter of the network. Hop count is decremented at each intermediate node. Once hop count reaches zero, packet is discarded.

2.Time to live (ttl) parameter also have same effect as like hop count.

3.Data packet is identified uniquely. Is same identification is detected then packet is not forwarded packet is not sent again. For the data packet identification history should be maintained for at least recent sent packet.

Drawbacks:-

Traffic Implosion- Duplicate control or date packets sent repeatedly to the same node

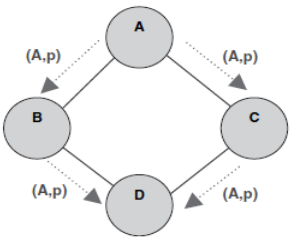

Fig 1. Traffic Implosion

Overlapping- In overlapping two nodes send the same similar packet to the same node covering the same region.

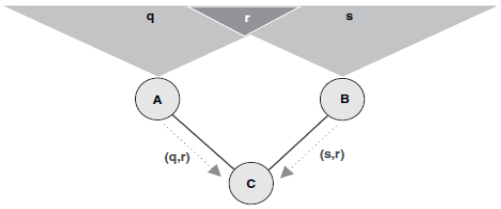

Fig. 2 Overlapping

Resource blindness- does not take energy constraints into consideration.
GOSSIPING- Gossiping is the extended version of flooding. In gossiping each node sends the incoming packet to a randomly selected neighbor. The process continues until the packet reaches to the intended destination or the maximum hop count or ttl exceeded. Gossiping avoids implosion.

2. Sensor Protocols for Information via Negotiation (SPIN)

In the SPIN protocol nodes learns about the content of data before transmitting in the network.
SPIN uses three types of messages
ADV- is used to advertise new data among nodes. A node which wants to share its data to other in the network, can advertise its data by first transmitting an ADV message containing metadata describing the data.
REQ-is used to request an advertised data of interest.
DATA-contains the actual data collected by a sensor, along with metadata header.

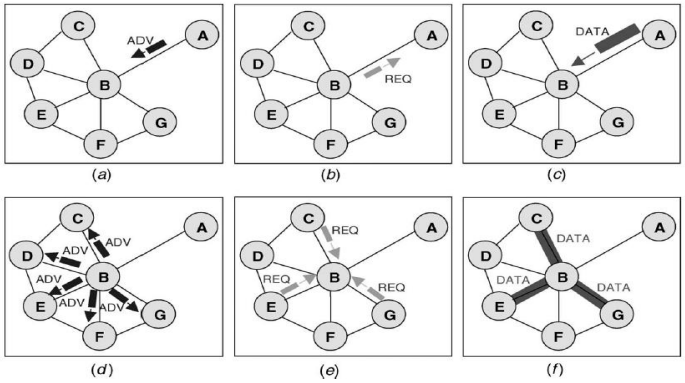

Fig 3 SPIN protocol operation

In diagram sensor node A advertises its data to its immediate neighbor, sensor node B, by sending an ADV message containing the metadata describing its data. Node B gives interest by sending REQ messages to A. Upon receiving the data, node B sends an ADV message to advertise the newly received data to its neighbor. Only C,E and G shows the interest by sending REQ.

ADV and REQ are small packets. Simulation shows that protocol reduces energy consumption.

Drawback- : SPIN's data advertisement mechanism cannot guarantee delivery of data.

3. Low-Energy Adaptive Clustering Hierarchy (LEACH)-

Mainly LEACH is used for data aggregation to reduce number of communication messages. LEACH uses hierarchical approach to organize the network in to a set of clusters. Cluster Head manages the cluster.
The cluster head manages several tasks, the first task is periodic collection of data from the member of clusters. Upon gathering the dta cluster head aggregates for removal of redundancy. Second task is to transmit the aggregated data directly to the base station. The third task of the cluster head is to create a TDMA- based schedule whereby each node of the cluster is assigned a time slot that it can use for transmission.

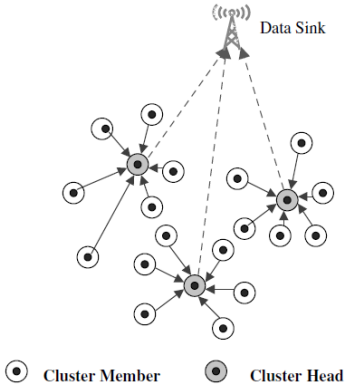

Fig. 4 LEACH network model

LEACH is having two phases, Setup phase and Steady-state phase.
Setup phase consists of two steps, cluster-head selection and cluster formation. Steady state phase does data collection, data aggregation and delivery to the base station.

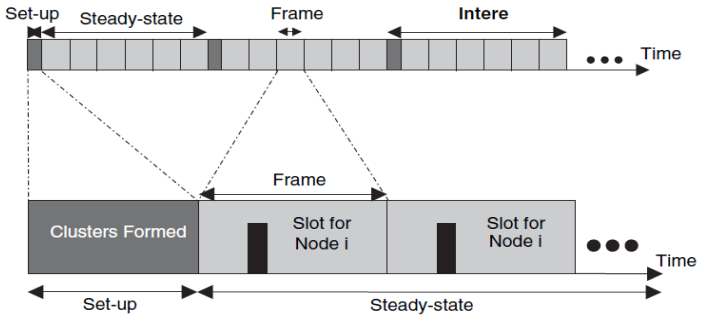

Fig 5 LEACH phases

Drawbacks
It is not applicable to networks deployed in large regions
The idea of dynamic clustering brings extra overhead
The protocol assumes that all nodes begin with the same amount of energy capacity in each election round, assuming that being a CH consumes approximately the same amount of energy for each node

4. Power-Efficient Gathering in Sensor Information Systems (PEGASIS)

Main objectives of PEGASIS are, uniform energy consumption across the network and to reduce the delay to reach to the sink by data.

I The main plan in PEGASIS is for every node to receive from and transmit to close neighbors and take turns being the leader for transmission to the bs. Nodes take turns sending to the bs, and that we can use node range i mod N (N represents the quantity of nodes) to transmit to the bs in spherical it is assumed that nodes take turns in sending to the base station such node i mod N, wherever N represents the full range of nodes, is answerable for sending the aggregate data to the base station in spherical i. based on this assignment, node 3, in position three within the chain, is that the leader in round three. All nodes in an even position should send their data to their neighbor to the proper. At the next level, node three remains in an odd position. Consequently, all nodes in an even position aggregate their data and transmit them to their right neighbours. At the third level, node three {is no|is not any|isn't any} longer in an odd position. Node 7, the only node beside node three to rise to the present level, aggregates its data and sends them to node three. Node 3, in turn, aggregates the data received with
its own data and sends them to the base station.n PEGASIS chain of nodes is formed by the nodes itself. The chain is formed by greedy algorithm. When a node dies, the chain is reconstructed in the same manner to bypass the dead node

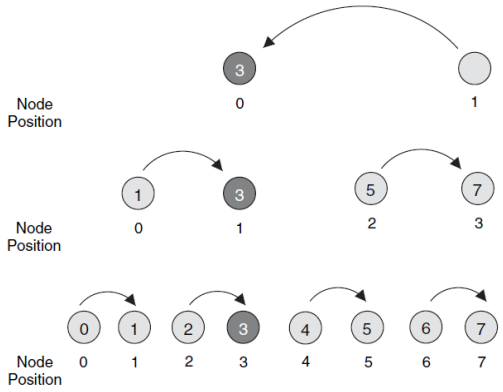

Fig 6 Chain-based data gathering and aggregation scheme

5. Directed Diffusion

Directed diffusion is a data-centric routing protocol for information gathering and dissemination in WSNs. The main objective of the protocol is to reduce the energy used by the sensor nodes in there operation.
Main elements of the Directed Diffusion are, interests, data messages, gradients and reinforcements.
Interest- Interest is what the inquirer wants. Data sinks broadcast the interest message to each neighbour. All the nodes maintain the interest cache, each entry corresponds to different interests. Cache entry contains timestamp i.e. last matching interest received, multiple gradient fields. Gradient can be thought of as a reply link pointing toward the neighbouring node from which the interest is received.

For each active sensing task, data sink sporadically broadcasts an interest message to every neighbour. The message propagates throughout the sensing element network as an interest for named data. A sensing element node that detects an event searches its interest cache for an entry matching the interest. If a match is found, the node initial computes the best event rate requested among all its outgoing gradients. It then sets its sensing system to sample the events at this highest

rate. The node then sends out an event description to every neighbour that it's a gradient. A neighbouring node that receives a data searches for an identical interest entry in its cache. If no match is found, the node drops the data message with no additional action. If such a match exists, and also the data message received doesn't have an identical data cache entry, the node adds the message to the data cache and sends the data message to the near nodes. Upon receiving AN interest, a node checks its interest cache to work out if AN entry exists in its cache for this interest. If such AN entry doesn't exist, the receiving node creates a replacement cache entry. The node then uses the data contained within the interest to instantiate the parameters of the fresh created interest field. What is more, the entry is about to contain one gradient field, with the event rate mere, inform toward the near node from that the interest is received. If a match exists between the interest received and a cache entry, the node updates the timestamp and length fields of the matching entry. If the entry contains no gradient for the sender of the interest, the node adds a gradient with the worth per the interest message. If the matching interest entry contains a gradient for the interest sender, the node simply updates the timestamp and length fields. A gradient is far away from its interest entry once it expires.

Link failure detected by reduced rate, data loss

III. CONCLUSION

WSN is having wide range of applications, but the limitation to WSN is battery as well as storage constraints. To come over on these limitations the study on the routing protocols is necessary because the optimal routing protocol can make the usage to battery as well as storage effectively. The routing protocols like flooding, LEACH, PEGASIS etc. shows the variations in the utilization of battery and storage constraints.

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