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* what is Routing protocol ?

⇒ A routing protocol Specifies how routers communicate with each other distributing information that enables them to select routes between any two nodes on a Computer network.

Routing algorithm determines the specific choice of route.

Routing in WSN

* Routing protocol
There are different types of routing protocols.

1) Proactive
2) Reactive
3) flat
4) Hierarchical

1) Proactive :-
proactive protocols attempt to continuously evaluate the routes within the network so that all routes are computed before they are needed.
In other words, when a Packet needs to be forwarded, the route is already available and can be immediately adopted.
All routes are predefined well in advance.
In proactive there will be no delay as its defined in advance so it is good for real time application.

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- Proactive routing Schemas are not appropriate for the adhoc networks environment whereas network topology changes fast and constantly.
- When there is a large area network at that time this Schema will not working properly.

★ Reactive Routing :-
Reactive protocols invokes a route determination procedure only on demand.

- In reactive Schemas some sort of search procedure has to be employed to identify a route prior to data forwarding.
- It is a kind of communication protocol.
- The main purpose of it is to react based only "On the

demand". It is just like saying, "when you need me, tell me".

- It works in adhoc WSN network or dynamic WSN networks.
- The advantage of reactive routing is, it doesn't consume any memory as it is calculated at runtime.

→ Reactive approach is not good for real world applications.

→ In reactive routing, as the routes are defined runtime, the problem is that the wireless network is dynamic having no fix topology, then may be route will not working properly at the runtime.

★ flat :-

- Every node is having equal

roles and functionality which are typically assigned to each node.

- flat routing protocols distribute information as needed to any node

* Hierarchical Routing :-
  In this routing schemas extra responsibility is given to some nodes to form the hierarchy.

- Hierarchical routing protocols often group nodes together by function into a hierarchy or cluster.

- By assigning different roles to different types of nodes or performing traffic aggregation to reduce redundancy, a hierarchical protocol allows WSN to make best use of the mixed nodes' capability.

The clusters (group) of network are formed and the clusters have a cluster head.

The cluster head has the responsibility to collect all the data and forward it to the node.

Hierarchical routing protocols are often better suited to large WSN, due to their scalability.

Maintaining the hierarchy or cluster can be costly in terms of energy consumption for small sized WSN.

In that case, the flat schemas are favorable.

Congestion (Network traffic) redundancy, wasting of energy (more battery consumed) are disadvantages of the float approach

- These all are resolved in hierarchical approach.

☆ Routing Protocol methods :-

1) Flooding :-
flooding is a classical and straightforward mechanism to broadcast the data in WSNs, which takes advantage of the broadcasting nature of the wireless medium.

- To deliever a particular packet from the source to the destination node with flooding the source node broadcasts the data to all the neighbours.

- As the neighbour will receive the data it will do the same recursion.

- This process continues until the packet arrives at destination

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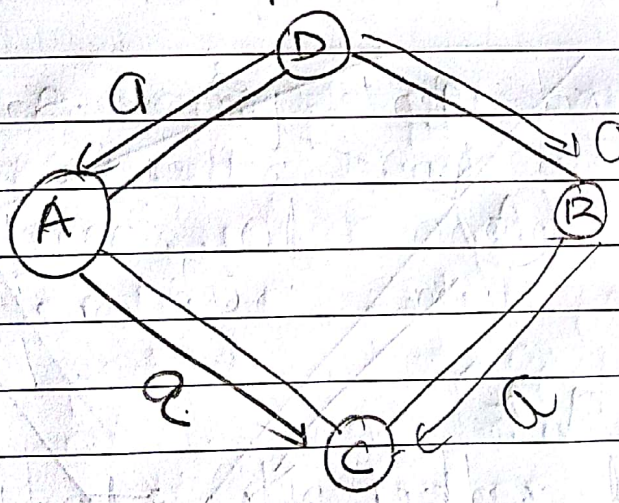
Flooding is very easy to implement but it has a major drawback of increasing the network load with redundant traffic.

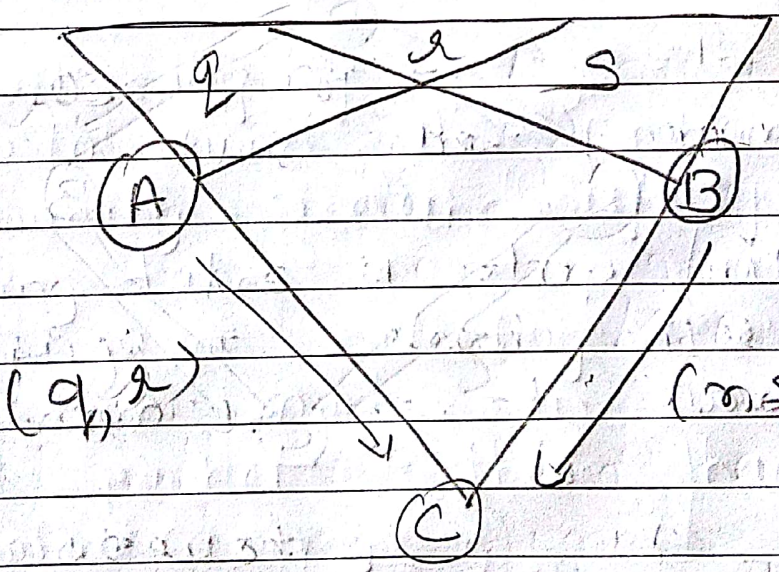
- In classical flooding, a node may blindly broadcast whatever it receives regardless of whether or not the neighbour has already received a copy from other source. This is called implosion problem.



This figure shows implosion problem where same message goes to node C from nodes A and B that creates redundancy.

The implosion results in multiple copies of the same data. Packet floating around the network and a node may receive multiple copies of the data.

The sensed data received by the neighbours of the node would contain some part of the data that is redundant is known as overlap.



The above figure shows an example of the overlapping issues.

⇒ Node A sense the data in the regions q and r. Similarly node B sense the data in the region r and s. Assume that the data sensed in the region q and r is (q, r) and the data sensed in the region r and s is (r, s). After sensing the data the nodes A and B send the data (q, r) and (r, s) to node e.

Here the redundant copy of data (r) received at the destination node C is unnecessary.

- The implosion and overlap issues load to additional traffic in the network.
- In flooding process the limited resources such as energy and bandwidth are wasted.

- Packet ID is one technique which is used to control the redundancy generated from the flooding process.
- In this a unique ID is assigned for the packet. After assigning ID, a node can remember the IDs for the packet it broadcast earlier. Then the node ignore the packet when it see the same Packet ID again.

* Gossiping :-
  To avoid the problem of flooding redundancy, gossiping takes a stop further by just selecting one random node to forward the packet rather than broadcasting.

- In gossiping the receiving node sends the packet to a randomly selected neighbour.

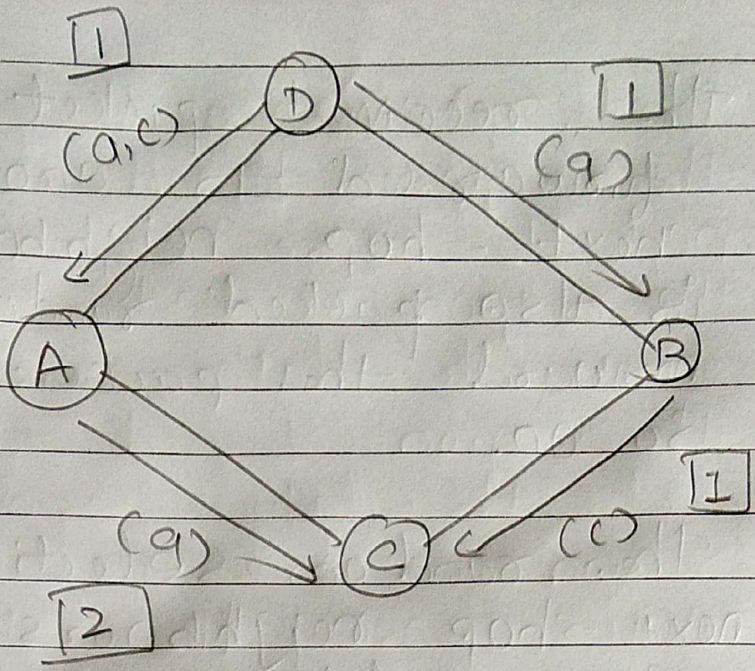
→ The received packet is forwarded to another next-hop neighbour which is also packed randomly to forword the packet and so on.

→ The random selection of next-hop neighbours can cause delay on the propogation of data through the networks.

* Idle Dissemination (broad-casting)

It is a phenomenon by which in wireless sensor networks the intended nodes receives each piece of distinct data only once.

It is not working fine in a real distributed ad-hoc sensor network.



- Ideal dissemination does not waste energy on transmitting and receiving useless data.

★ Issues in designing the wireless sensor network routing protocols.

→ Limited Resources in WSNs
→ fault Tolerance
→ Data Reporting and Aggregation
→ Node Deployment
→ Scalability and Coverage
→ Network Dynamics & Heterogeneity