

IoT Sensor Networks – Routing Protocols

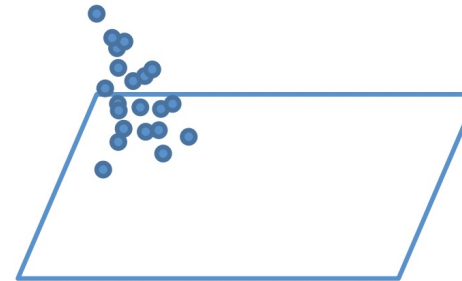
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CS698T, Lecture 9

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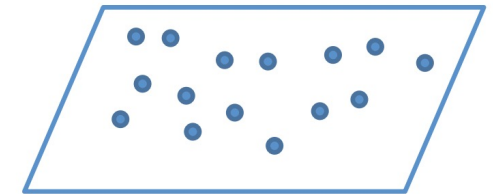
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Organizing process of WSNs

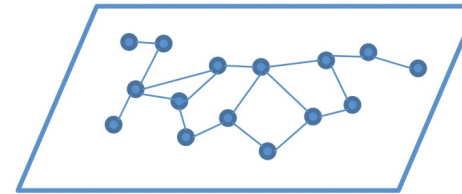
- Sensor nodes broadcasts their status and receive status from neighbors
- Use of different topologies to organize the sensor nodes in WSNs
- Find suitable paths to connect nodes for data transmission
- Data forwarding to increase the network coverage
- Features
 - Self organizing networks
 - low cost communication
 - Self-adaptive flow control



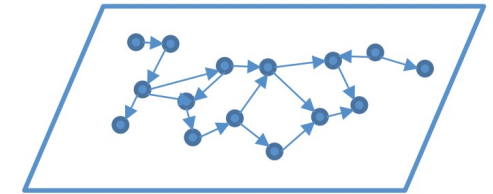
Placing sensors



Waking up and detecting



Connecting into a network

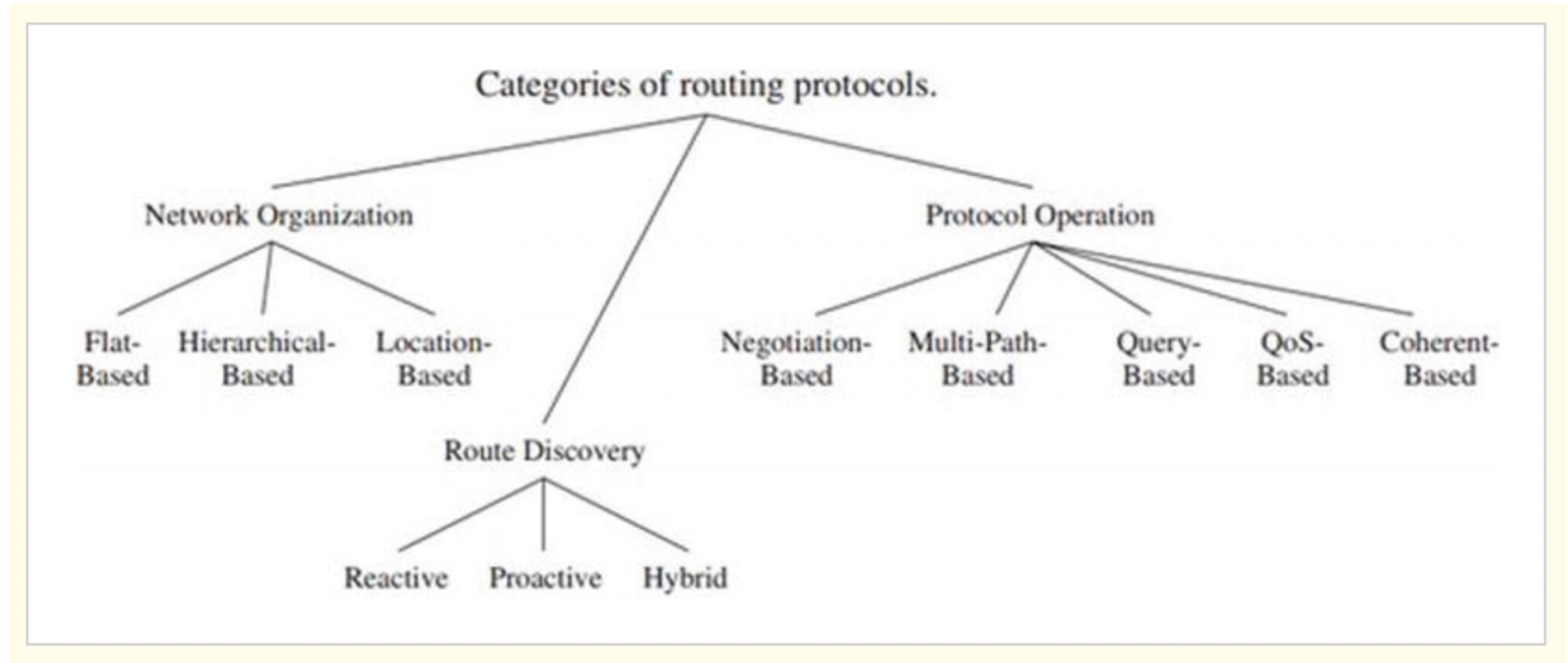


Routing and transmission

WSN Routing Protocols

- Focused on sending data from a sensor node to a base station or sink node
- Design requirements of WSN routing protocols
 - **Energy efficiency** - power and resource limitations of the network nodes
 - **Scalability**
 - **Minimize delay**
 - **Robustness**-
 - time-varying quality of the wireless channel for moving sensor nodes
 - possibility for packet loss and delay
 - **Sensor Location**
 - With GPS
 - GPS-free

Classification of WSN routing protocols



Network Structure – Flat Network Architecture


- all sensor nodes are peers
 - treats all node equally
 - All participating nodes are homogeneous – same characteristics and functionality
 - Does not maintain global id for all sensors
 - Data centric routing
 - base station queries certain region to collect sensor data
 - uses attribute-based naming
 - queries to relative to specific attributes
 - Different strategies can be used to query sensor nodes, including broadcasting, attribute-based multicasting, geo-casting, and any casting.
- Advantages:
 - minimal overhead to maintain the infrastructure
 - the potential for the discovery of multiple routes between communicating nodes for fault tolerance.

Hierarchical based routing

- Structural network architecture to achieve energy efficiency, stability, and scalability
 - network nodes are organized in clusters
 - Cluster head
 - Node with higher residual energy
 - Responsible for coordinating activities within the cluster and forwarding information between clusters.
 - Reduces energy consumption and extend the lifetime of the network



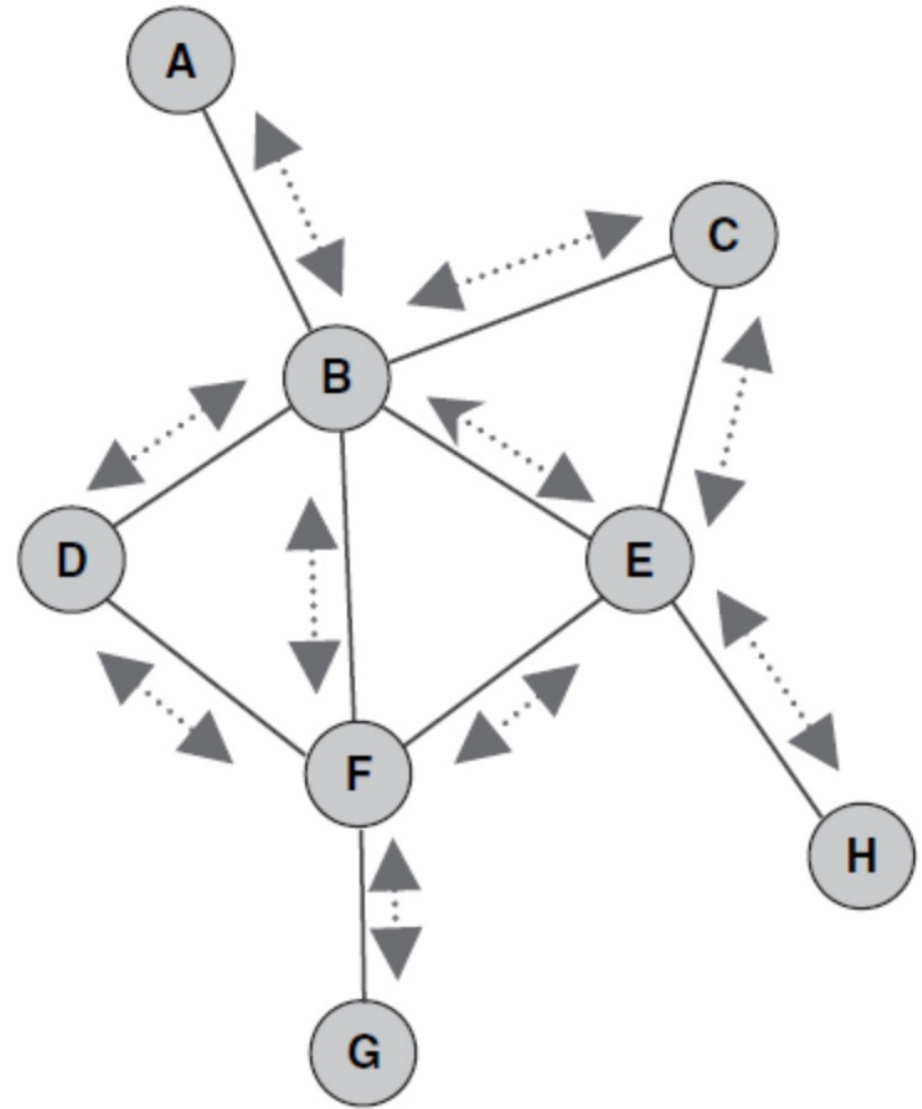
Location-based routing

- Useful in applications where the position of the node within the geographical coverage of the.
- With GPS 
- GPS free
- Queries in a specific area where a phenomenon of interest may occur or the vicinity to a specific point in the network environment



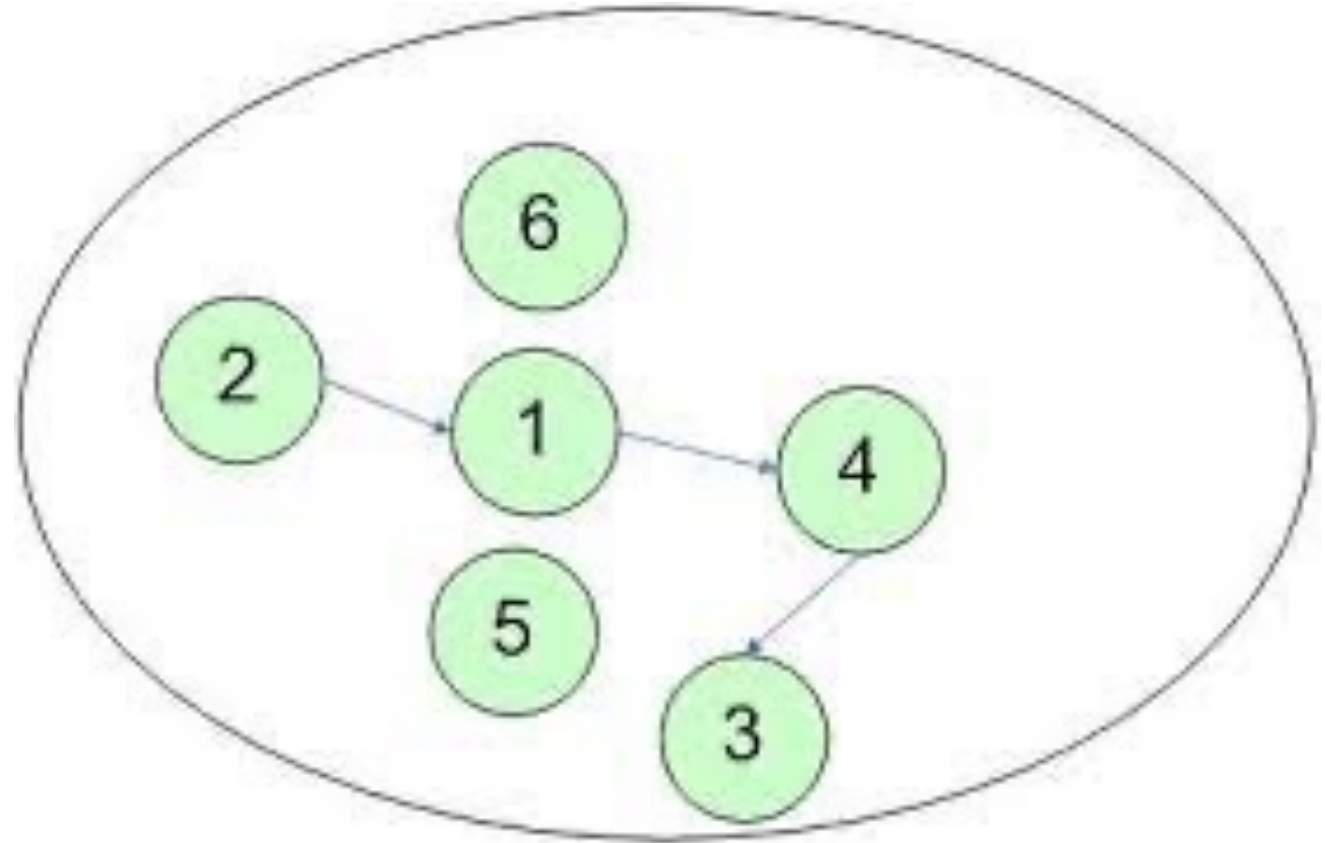
Network Structure – Flat Network Architecture [1]

- Flooding
 - Each sensor node sends data to all neighboring sensor nodes
 - Packet follows all possible paths
 - Packet follows new paths when the network topology changes



Network Structure – Flat Network Architecture [1]

- Gossiping
 - Uses a simple forwarding rule similar to flooding
 - Sends data packet randomly selected node
 - The process continues until data reaches the base station or the network runs out of maximum hops
- Shortcomings
 - Takes longer time to reach base station
 - No guarantee of data reception



Reading Material

- <https://www.intechopen.com/chapters/38793>
- https://storage-iecwebsite-prd-iec-ch.s3.eu-west-1.amazonaws.com/2019-09/content/media/files/iec_wp_internet_of_things_en.pdf
- Routing Techniques in Wireless Sensor Networks: A Survey
<https://www.ece.iastate.edu/~kamal/Docs/kk04.pdf>

Questions?

