

Routing protocol:

A routing protocol specifies how routers communicate with each other to distribute information that enables them to select routes between nodes on a computer network.

Routers perform the traffic directing functions on the internet; data packets are forwarded through the networks of the internet from router to router until they reach their destination computers. Routing algorithm determines the specific choice of route.

Classification of Routing protocol:

1) Multi path routing protocol:

Multi path routing protocols provide multiple paths for data to reach the destination providing load balancing, low delay and improved network performance as result. The multiple routing protocol also provide alternate path in case of any failure path. Multipath routing protocols are

* Multi path and multi speed

* Sensor protocols for information via negotiation.

2) Query based routing protocol:

These type of routing protocols are mostly receiver-initiated. The sensor nodes will only send data in response to queries generated by the destination node. The destination node sends query of interest for receiving some information through the network and the target node sense the information and send back to the node that has initiated the request.

Ex:

* Directed Diffusion

* COUGAR

3) Negotiation based routing protocols.

In these type of protocols to keep the redundant data transmission level at minimum, the sensor nodes negotiate with the other nodes and share their information with the neighboring nodes about the resources available and data transmission decision are made after the negotiation process

Eg:

- * Sequential assignment routing (SAR)
- * Directed diffusion (DD)
- * Sensor protocols for information via negotiation (SPAN)

4) QoS based routing protocols:

To get good Quality of Service these protocols are used. QoS aware protocols try to discover path from source to sink that satisfies the level of metrics related to good QoS like throughput, data delivery, energy and delay, but also making the optimum use of the network resources.

Eg:

- * Sequential assignment routing (SAR)
- * SPEED

5) Coherent data processing routing protocol:

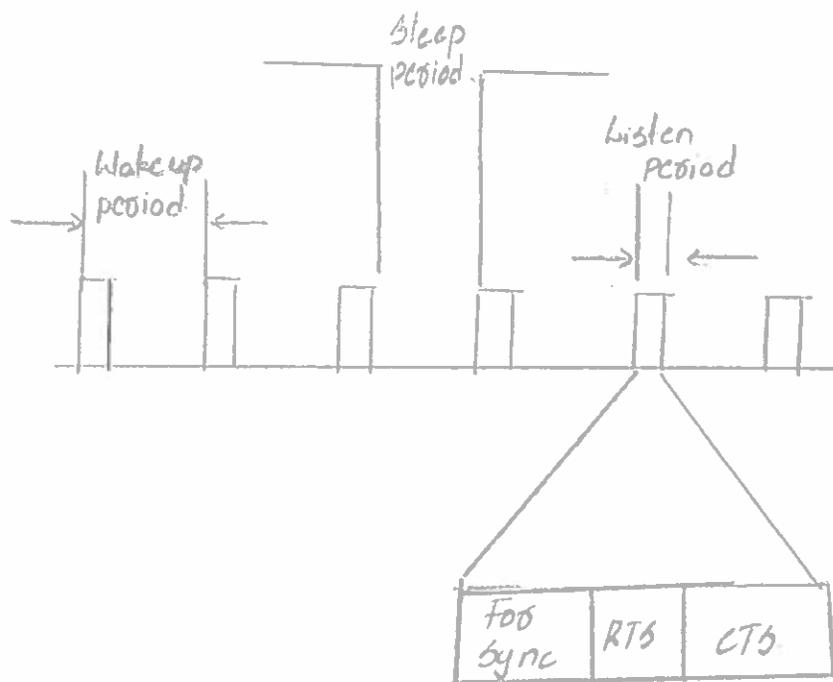
In this protocol the nodes perform minimum processing on the data before transmitting it towards the other sensor nodes or aggregators. Aggregator performs aggregation of data from different nodes and then passes to the sink node.

SMAC protocol:

SMAC stands for Sensor Medium Access Control protocol, which is designed on the basis of periodic listen sleep mechanism of nodes of WSN for avoiding energy wastage because of idle listening. SMAC reduces energy consumption because of collision, overhearing, control packet overhead and idle listening. Wireless sensor networks use battery operated computing and sensing devices.

In this protocol also every node has two states, sleep state and active state. Unlike STEM , SMAC does not use two channels. A node can receive and transmit data during its listen period.

SMAC adopts a periodic wake up scheme. SMAC tries to synchronize the listen periods of neighboring nodes. The listen period of a node is divided into three phases. The listen period is the time during which a node is awake, rest of the time node is sleeping. The listen and sleep periods in the S-MAC are fixed intervals.



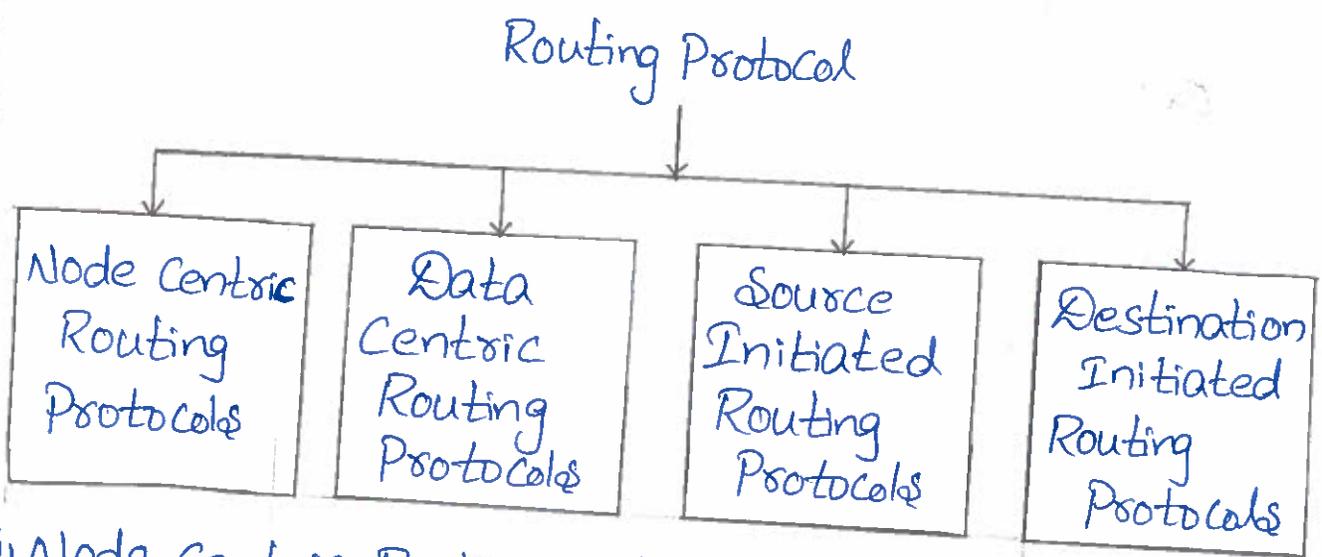
Unit - II

Routing Protocols :

Routing protocol is a process to select suitable path for the data to travel from source to destination.

The routing protocols define how nodes will communicate with each other and how the information will be disseminated to the network.

→ Classification of Routing Protocols :



i) Node Centric Routing protocols :-

In node centric protocols the destination node is specified with some numeric identifier and this is not expected type of communication to wireless sensor networks.

Ex: Low energy adaptive clustering hierarchy (LEACH)

In Leach routing protocol several clusters are produced of sensor nodes and one node defined as clusterhead and acting as routing node for all the other nodes in the cluster.

ii) Data Centric Routing protocols :-

In WSN the sensed data or information is more valuable than the actual node itself. Therefore, the data centric routing techniques the protocol focus is on the transmission of information specified by certain attributes rather than collecting data from certain nodes.

Ex: Sensor Protocols for Information via Negotiation (SPIN)

SPIN:

This protocol is defined to use to remove the deficiency like flooding. The main idea is that sharing of data, which is sensed by the node, might take more resources as compared to the meta data which is just a description about the data sensed by the node.

iii) Source Initiated Routing Protocol :-

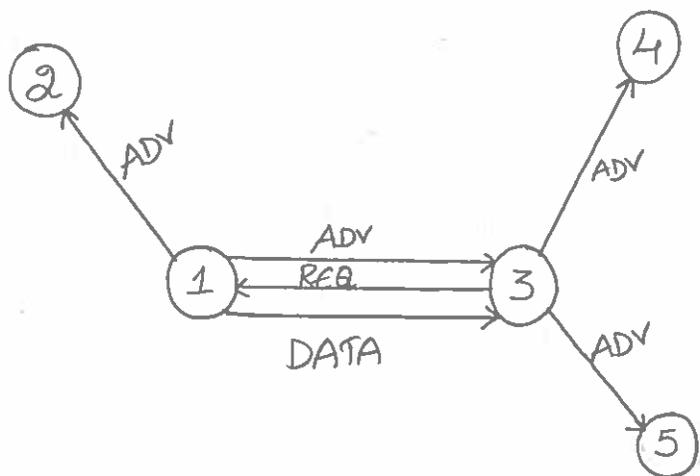
This type of protocols, the source node advertisement when it has data to share and then the route is generated from the source side to the destination.

Ex: SPIN protocol

iv) Destination Initiated Routing Protocols :-

The destination initiated protocols when the path setup generation originates from the destination node.

Directed diffused (DD) and LEACH

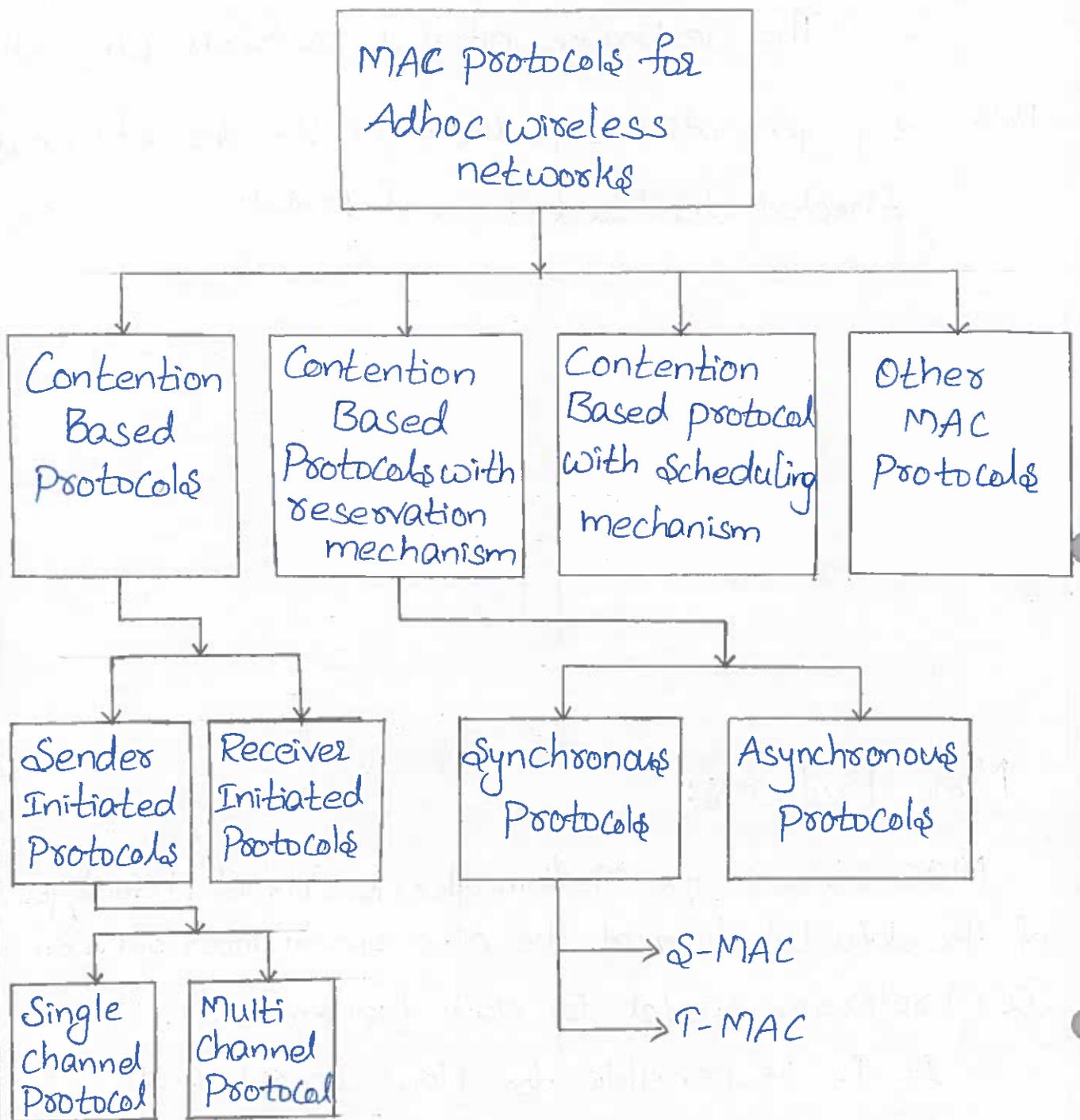


MAC Protocols:

MAC stands for Medium Access Control. A sublayer of the data link layer of the open system interconnections (OSI) reference model for data transmission.

It is responsible for flow control and multiplexing for transmission medium. It controls the transmission of data packets via remotely shared channels.

Classification of MAC Protocols



1. Contention-based protocols:

- * Bandwidth are not reserved
- * No guarantees

⇒ Sender-initiated protocols:-

The transmission of packets are initiated by the sender node

- * Single-channel sender initiated. For example, MACAW, FAMA

* Multiple-channel sender initiated protocols. For example, BTMA, DBTMA, ICSMA.

⇒ Receiver-initiated protocols:

The connection is initiated by the receiver node.

For example, RI-BTMA, MACA-BI, MARCH

2. Contention-based protocols with reservation mechanism:-

⇒ Synchronous protocols:

All nodes are kept synchronized. For example, D-PRMA,

CATA, HRMA, SRMA/PA, FPRP.

⇒ Asynchronous protocols:

Relative time information is used to achieve effecting reservations. For example, MACA/PR, RTMAC...

3. Contention-based protocols with scheduling mechanisms:-

All the nodes are treated equally and no node is get deprived of bandwidth. For example, Eg. DPS, DWOP, DLPS.

4. Other protocols :-

These MAC protocols do not strictly fall into any above category.

For example, NMAC, MCSMA, PCM, RBAR

S-MAC Protocol:-

Sensor Media Access Control is a network protocol for sensor networks. Sensor networks consist of tiny, wirelessly communicating computers (sensor nodes),

which are deployed in large numbers in an area to network independently and as long as monitor their surroundings in group work with sensors, to their energy reserves are depleted.

A special form of ad-hoc network, they make entirely different demands on a network protocol and therefore require network protocols specially build for them (SMAC).

Sensor Media Access Control specifies in detail how the nodes of a sensor network exchange data, controls the Media Access Control (MAC) to access the shared communication medium of the network, regulates the structure of the network topology, and provides a method for synchronizing.

S-MAC was a significant step in sensor network research and inspired many subsequent network protocols.

B-MAC Protocol :-

Berkeley MAC is a carrier sense media access protocol for wireless sensor networks that provides a flexible interface to obtain ultra low power operation, effective collision avoidance, and high channel utilization.

To achieve low power operation, B-MAC employs an adaptive preamble sampling scheme to reduce duty cycle and minimize idle listening.

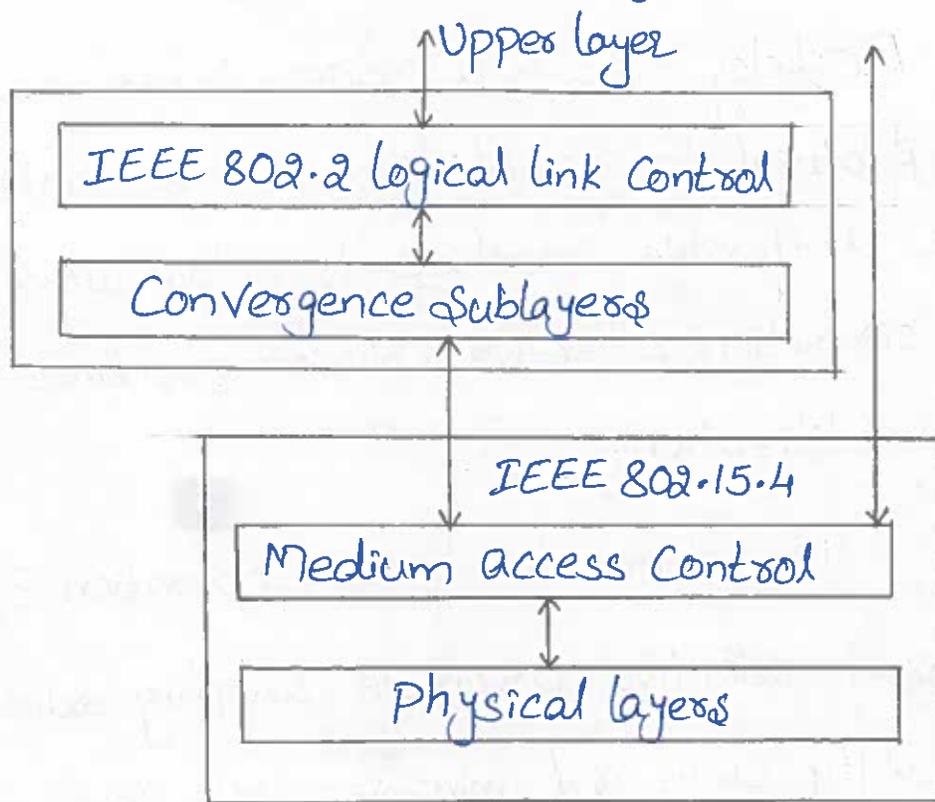
B-MAC is designed for low traffic, low power communication, and is one of the most widely used protocols. The B-MAC module type implements the B-MAC protocol.

Bmac Interface is a wireless interface with the MAC type set to Bmac.

It is classified into four categories. They are

- i) Contention based
- ii) Scheduling based
- iii) Channel polling based
- iv) hybrid protocols.

IEEE 802.15.4 Standard and ZigBee :-



Four is a technical standard which defines the operation of a low-rate wireless personal area network (LR-WPAN).

It specifies the physical layer and media access control for LR-WPANs, and is maintained by the IEEE 802.15 working group, which defined the standard in 2003. It is the basis for the Zigbee, ISA100, WirelessHART, MiWi, 6LoWPAN, ANT (network), Thread and SNAP specifications, each of which further extends the standard by developing the upper layers which are not defined in IEEE 802.15.4

Advantages of IEEE 802.15.4 :-

- Cheap Cost
- Long battery life
- Quick Installation
- Simple
- Extensible protocol stack.

Disadvantages of IEEE 802.15.4 :-

- Interference and multipath fading
- Unbounded latency
- Interference Susceptibility
- Does not employ a frequency hopping approach.

Applications of IEEE 802.15.4 :-

- Building & Home automation
- Wireless Sensor Network in the Industry.
- Automotive Networks.

IEEE 802.15 protocol stacks :-

- Zigbee
- 6 low PAN
- Zigbee IP

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