SNS COLLEGE OF ENGINEERING

Coimbatore-35

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19EC701- **AdHoc Networks**

IV ECE / VII SEMESTER

UNIT 2 –ISSUES IN MAC PROTOCOL

ISSUES IN AD HOC WIRELESS NETWORKS

Medium Access Control

Medium Access Control

- The major issues that affect the **design, deployment, & performance** of an ad hoc wireless network system are
- Medium Access Control (MAC)

- The primary responsibility of a Medium Access Control (MAC) protocol in ad hoc wireless networks is the distributed arbitration for the shared channel for transmission of packets.

- The major issues to be considered in designing a MAC protocol for ad hoc wireless networks are as follows :

ISSUES IN
AD HOC WIRELESS NETWORKS

1. **Distributed Operation**
2. **Synchronization**
3. **Hidden Terminals**
4. **Exposed terminals**
5. **Throughput**
6. **Access delay**
7. **Fairness**
8. **Real-time Traffic support**
9. **Resource reservation**
10. **Ability to measure resource availability**
11. **Capability for power control**
12. **Adaptive rate control**
13. **Use of directional antennas**

ISSUES IN
AD HOC WIRELESS NETWORKS

Distributed Operation

- Ad hoc wireless network do not have central coordinator to distribute bandwidth fairly among nodes.

- Therefore nodes must be scheduled in a distributed fashion for gaining access to the channel and for this exchange of control information among nodes is required.

- Therefore the MAC protocol design should be fully distributed and must make sure that the additional overhead incurred due to this control information exchange is not Elevated.

ISSUES IN AD HOC WIRELESS NETWORKS

Distributed Operation
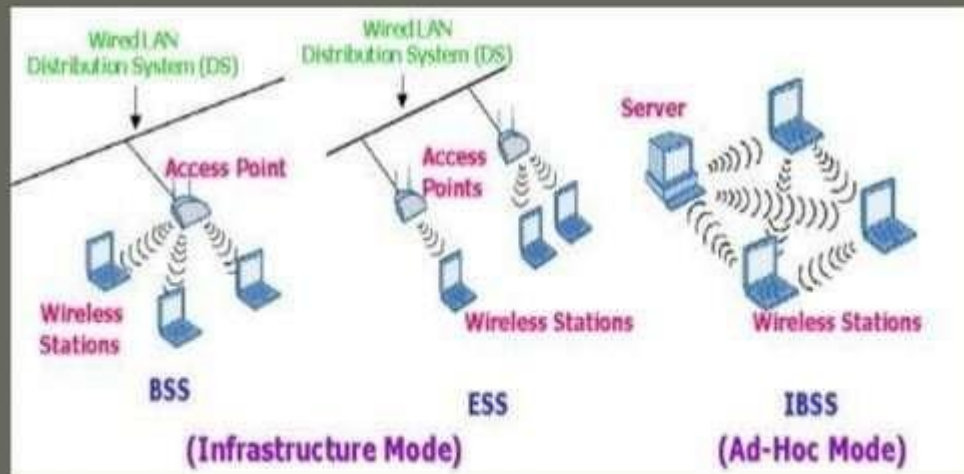
ISSUES IN
AD HOC WIRELESS NETWORKS

Synchronization

- Synchronization is very important for bandwidth reservations by nodes.
- The MAC protocol must take into consideration the synchronization between nodes in the network.
- The MAC protocol design should take into account the requirement of time synchronization. Synchronization is mandatory for TDMA-based systems for management of
- transmission and reception slots. Synchronization involves usage of scarce resources such as bandwidth and battery power.
- The control packets used for synchronization can also increase collisions in the network.

ISSUES IN AD HOC WIRELESS NETWORKS

Time Synchronization

Wireless Network

Wireless Network

Nodes

Nodes

MEDIUM ACCESS CONTROL

ISSUES IN
AD HOC WIRELESS NETWORKS

Hidden Terminals

- Hidden terminals are nodes that are hidden(or not reachable) from the sender of a data transmission session, but are reachable to the receiver of the session.
- In such cases, the hidden terminal can cause collisions at the receiver node. The presence of hidden terminals can significantly reduce the throughput of a MAC protocol used in ad hoc wireless networks.

Exposed terminals

- Exposed terminals, the nodes that are in the transmission range of the sender of an on –going session, are prevented from making a transmission.
- In order to improve the efficiency of the MAC protocol, the exposed nodes should be allowed to transmit in a controlled fashion without causing collision to the on-going data transfer.
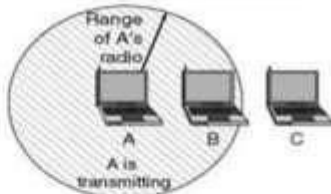
ISSUES IN AD HOC WIRELESS NETWORKS

Hidden & exposed terminal problem
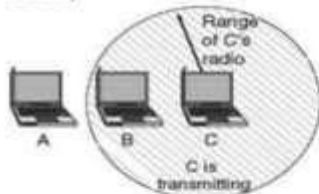

A)THE HIDDEN STATION PROBLEM. (B) THE EXPOSED STATION PROBLEM.

ISSUES IN AD HOC WIRELESS NETWORKS

Throughput

- The MAC protocol employed in ad hoc wireless networks should attempt to maximize the throughput of the system.

- The important considerations for throughput enhancement are
- Minimizing the occurrence of collisions.
- Maximizing channel utilization and Minimizing control overhead.
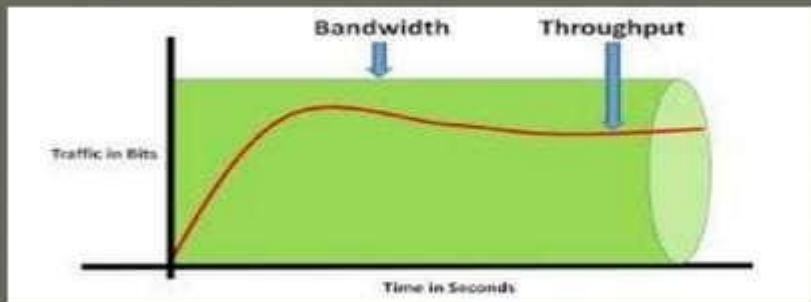
ISSUES IN
AD HOC WIRELESS NETWORKS

Access delay

- The average delay that any packet experiences to get transmitted. The MAC protocol should attempt to minimize the delay.

Fairness

- Fairness refers to the ability of the MAC protocols to provide an equivalent share or weighted share of the bandwidth to all competing nodes.
- Fairness can be either node-based or flow based.

- The former attempts to provide an equal bandwidth to all competing nodes where the later provides an equal share for competing data transfer session.

ISSUES IN
AD HOC WIRELESS NETWORKS

- In ad hoc wireless network fairness is important due to the multi-hop relying done by the node.

Fairness Distribution
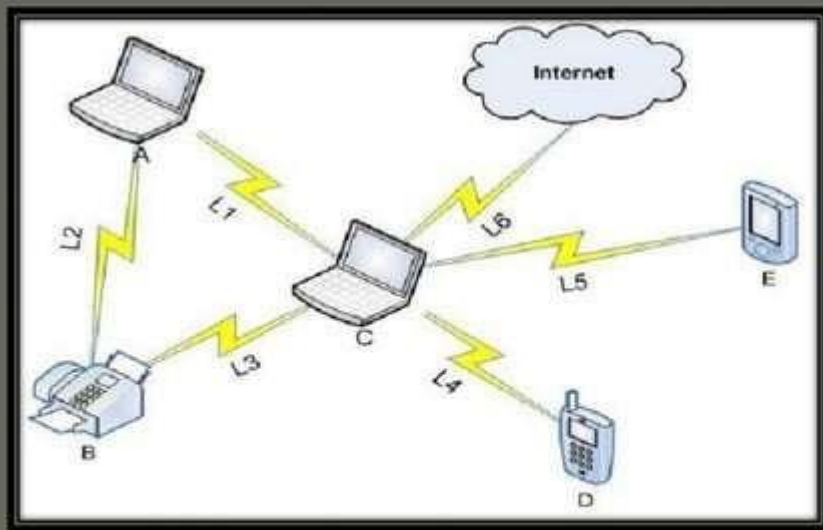
ISSUES IN
# AD HOC WIRELESS NETWORKS

⊙ *Real-time Traffic support*

⊙ In a contention-based channel access environment, without any
central coordination, with limited bandwidth, and with location-
dependent contention, supporting time- sensitive traffic such as
voice, video, and real-time data requires explicit support from the
MAC protocol.

⊙ *Resource reservation*

⊙ The provisioning of QoS defined by parameters such as
bandwidth, delay, and jitter requires reservation of resources such
as *bandwidth, buffer space, and processing power.*

ISSUES IN
AD HOC WIRELESS NETWORKS
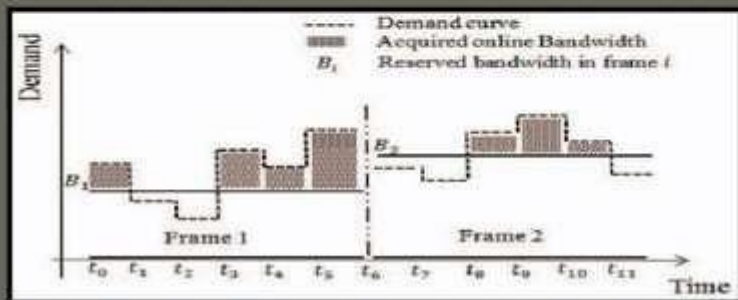
Ability to measure resource availability

- In order to handle the resources such as bandwidth efficiently and perform call admission control based on their availability, the MAC protocol should be able to provide an estimation of resource availability at every node.
- This can also be used for making *congestion control decisions*.

ISSUES IN
# AD HOC WIRELESS NETWORKS

◉ *Capability for power control*

- ◉ The transmission power control reduces the energy consumption at the nodes, causes a decrease in interference at neighboring nodes, and increases frequency reuse.
- ◉ Support for power control at the MAC layer is very important in the ad hoc wireless environment.

◉ *Adaptive rate control*

- ◉ This refers to the variation in the data bit rate achieved over a channel.
- ◉ A MAC protocol that has adaptive rate control can make use of a high data rate when the sender and receiver are nearby & adaptively reduce the data rate as they move away from each other.

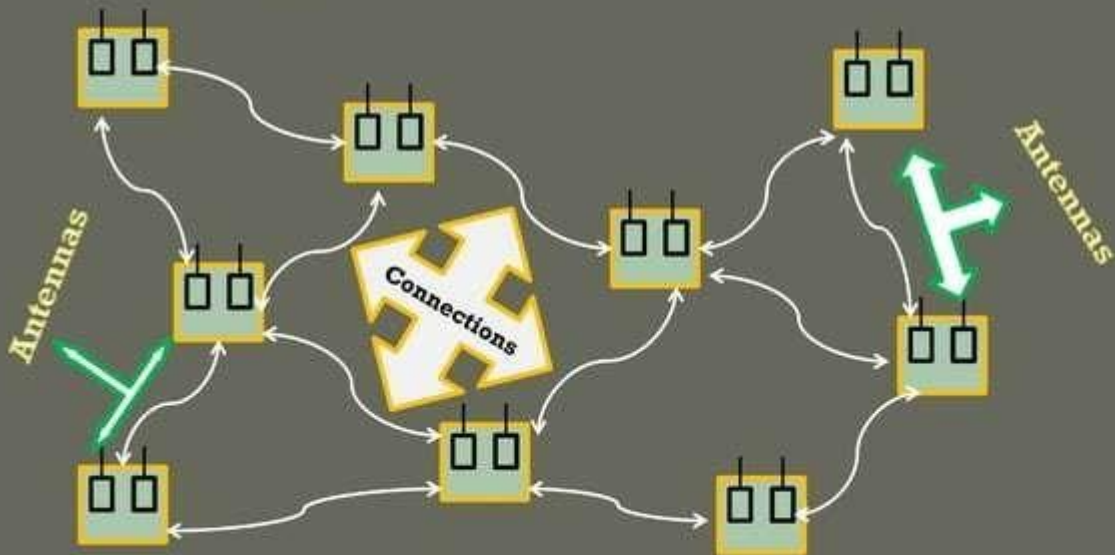# ISSUES IN
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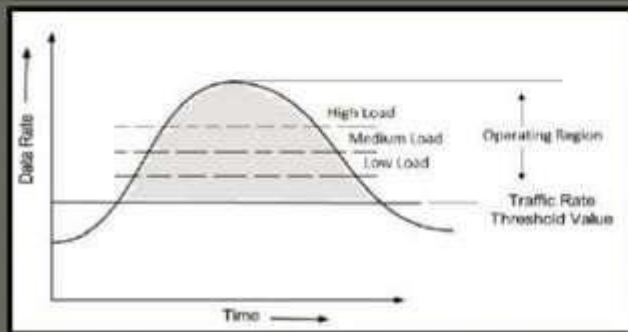
Adaptive Rate Control

⊙ *Use of directional antennas*

- This has many advantages that include increased spectrum reuse, Reduction in interference and Reduced power consumption.
- MAC protocols that use omni directional antennas do not work with directional antennas.

ISSUES IN AD HOC WIRELESS NETWORKS

Topology control with Directional Antennas

THANK YOU