Online-Class-1

27-01-22

WLAN

- Wifi is ~~a form~~ the commercial name of WLAN.

→ New node comes and waits for beacon is A Passive Scanning.

→ New node /station pushes AP to send a beacon. AP replies with a prob response. This is Active Scanning. → (prob)

⊛ Beacon is used ~~for~~ time synchronization.

priority ↑
1) Audio
2) Video → ~~Second Priority~~
3) Text → ~~Highest Priority~~

But ⊛ DCF can not ensure quality of service as the backoff time for all 3 stations are random.

*2

Medium Access Control with QoS

DCF → General Service
→ Simplicity
] (Sender initiated but no QoS) ⊛

PCF → [Receiver initiated protocal] Challenge

As receiver doesn't know who has data it might create inefficiency.

Solution - 802.11e (ensures QoS)

HCF (hybrid co-ordination function)

Channel Access
- Contention based [EDCA] ≈ better DCF
- Controlled channel Access (HCCA)

EDCA
→ Simplicity, sender initiated
→ QoS

QBSS: A BSS where all nodes have 802.11e.

HC: The PC in a QBSS.

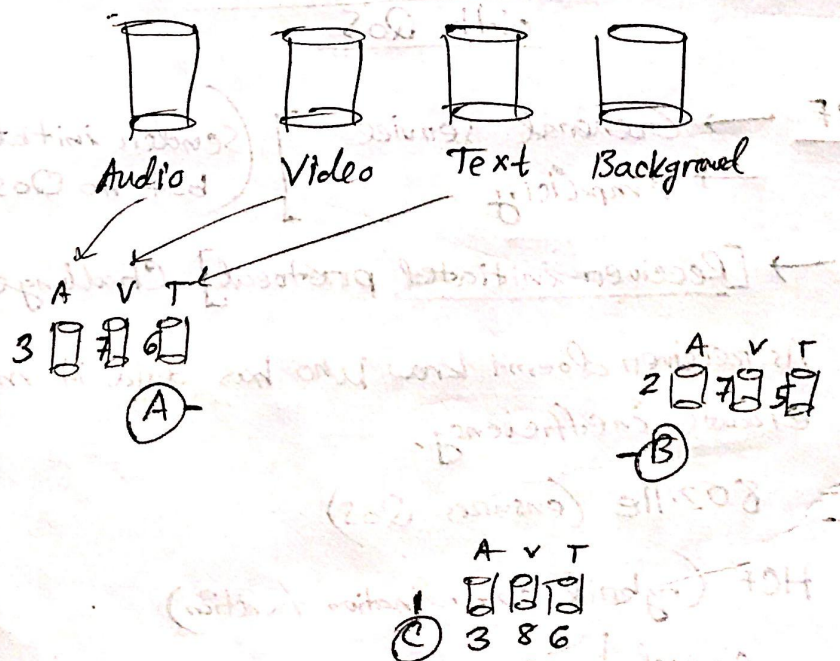
TXOP — Transmission Opportunity

↳ The duration for which a station who got won channel access can use the channel.

Ex- If TXOP is 1 sec and station-A won it, then station-A can transmit back to back for 1 second.

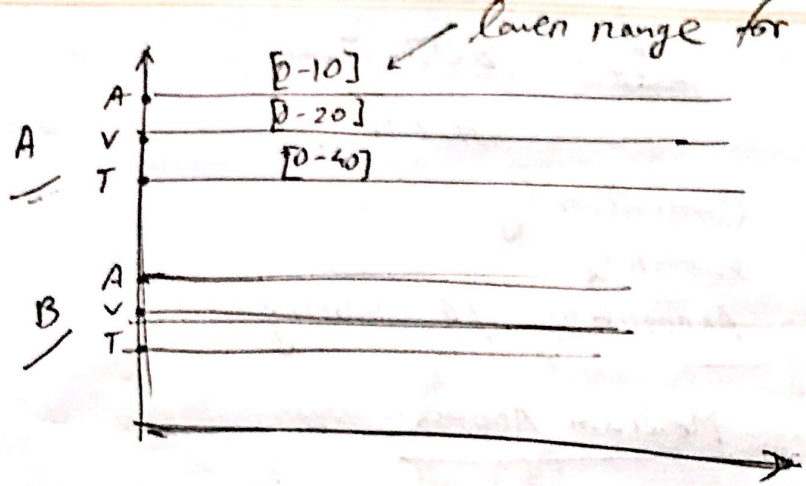
→ How is QoS ensured?

(*) Firstly you should have seperate queues in MAC layer for seperate catagories of data.



(*) Each queue will have seperate backoff entities.

How to prioritize?



$m = 0$
$m = 1$

(i) → How do we select backoff values? (i.e the range)

- Audio should have lower range as it has higher priority.

$$CW_n[AC] = \min\left[\{2^n (CW_{min}[AC] + 1)\} - 1,\ CW_{max}[AC]\right]$$

$CW_n[AC]$ → Access Category (like audio, video)

1 = audio, 2

For example, if, $CW_{min}[1] = 4$

$CW_{max}[1] = 20$

---

then, $CW_n[1] = \min\left[2^1(4+1) - 1,\ 20\right]$

↓ no. of attempts = 1

$= \min(2 \times 5 - 1, 20)$

$= \min(9, 20)$

$CW_1[\text{Audio}] = 9$

(ii) AIFS[AC] → ~~Arbitration Space~~

Arbitration Interframe Space for an Access Category.

- AIFS[Audio] < AIFS[video]

(more ~~priority~~ priority has less IFS if there's a tie between backoff time, Audio will be prioritized).

IEEE 802.15.4

WPAN

Confidentiality
Integrity
Accessibility / Availability

Medium Access

- Random Access
  - ~~CSMA/CA~~
    - DCF
    - EDCA
- Multiple Access
  - ~~FDMA~~
  - TDMA
    - distributed scheduling
  - ~~CDMA~~

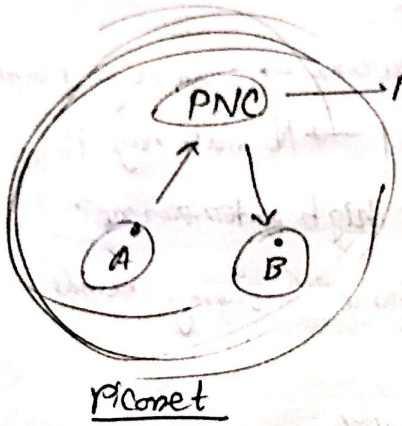
#3

Personal Area Network

03-03-22
Friday

802.15.4 → Zigbee (Commercial Name)

WPAN



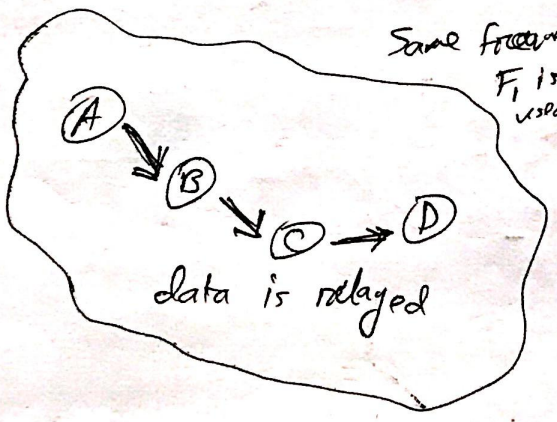
PicoNet Co-ordinator

Adhoc Network
(Infrastructure-less Network)

Piconet

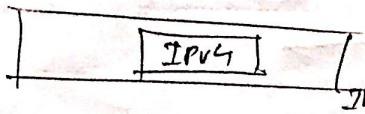
DLP – 802.11
↳ Direct Link Protocol

(A → AP → B) is repeated multiple times
(A → B) direct permission will be granted.



Same frequency F_1 is used

Heterogenous network – different access protocols
Ex –
Wifi → Wimax - Wifi



Encapsulation.

Mobile Ad-Hoc Network (MANET)

→ Adhoc network ~~with more flexibility~~ where the nodes are mobile (moving).

Cellular Network → Stationary Point (BTS)

Manet → No stationary Point.

Q: Why manet has high interferance?

→ It has same frequency bands

~~Manet~~

Manet vs Cellular Net

↳ Weaker quicker network

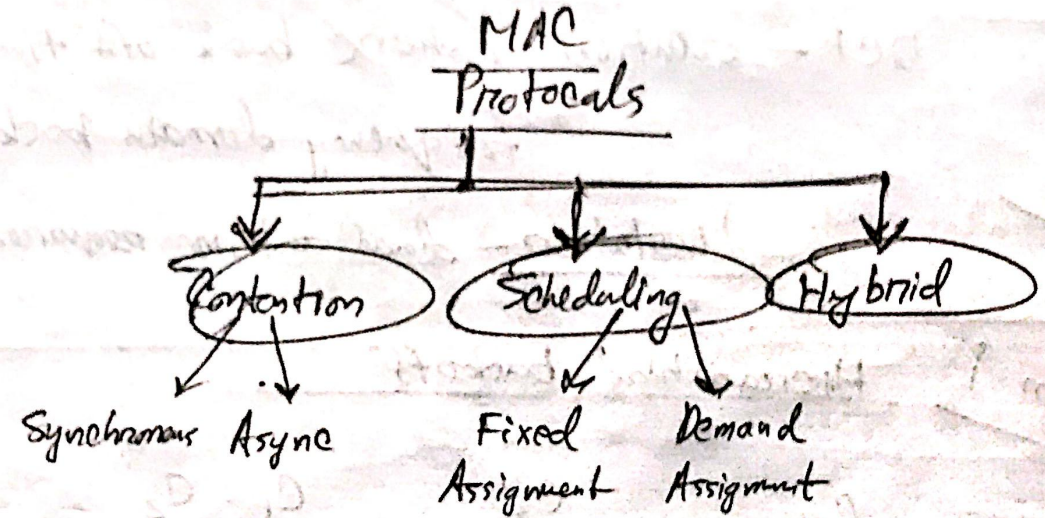
DTN

Delay Tolerant Network

Overhearing → Listening when you are not intended to listen

↓overhearing = ↑ efficiency.

Overheads → RTS, CTS ..... which don't contribute to data transfer.



Scheduling → Centralized

~~Distributed~~

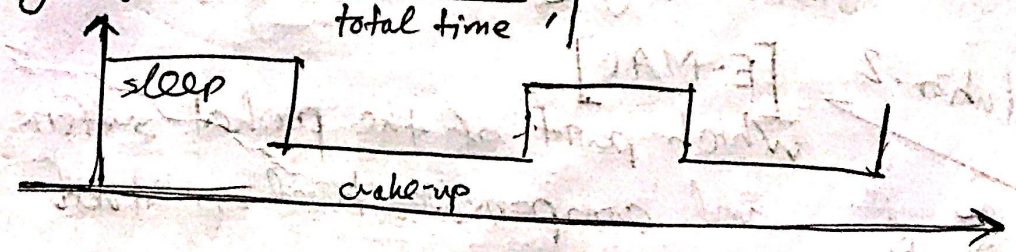
Decentralized

(preferred) [because less dependency]

~~Tdma~~

WSN-MAC

* Duty cycle = $\frac{\text{wake-up}}{\text{total time}}$



S-MAC / Sensor MAC

→ They will maintain synchronization

[New nodes shall synchronize with previous nodes duty cycle]

(*) During active time if all the nodes try to communicate, then there will be collision.

Limitation : collision

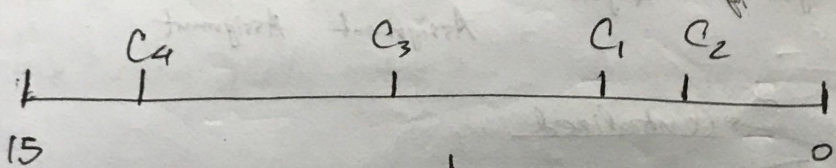
DCF – solution (share back-off time)

frequency domain backoff

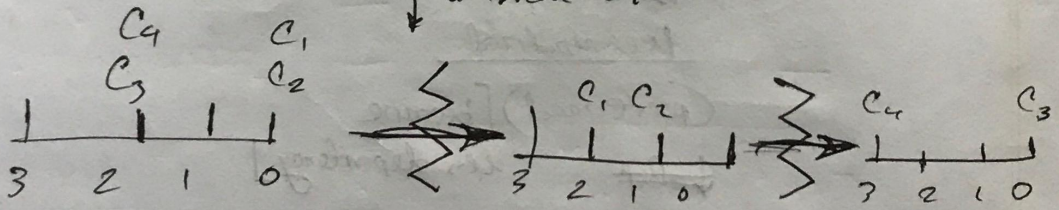
OFDM

Limitation – dual antenna required. X

Solution-1 Hierarchical backoff



improvement



[Pick R.N from a small range]

C_2 first

C_1 second

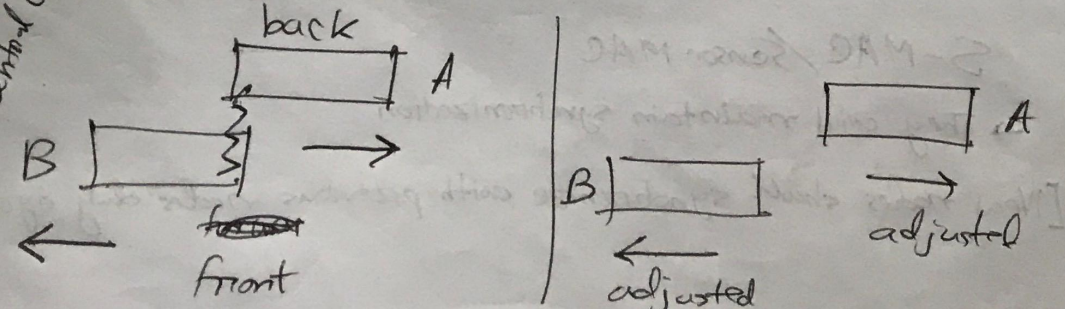
C_3 ~~third~~ third

C_4 fourth

Channel utilization ↑ improves DCF by tuning backoff

Solution-2 [E-MAC]

which part of the packet suffers collision and compensate based on that



Scalable to Network size

Quickly lead to convergence

Doesn't require central co-ord.

(*) Adjusts the next transmission based on which part

TOD (Transmission Order Reducing)

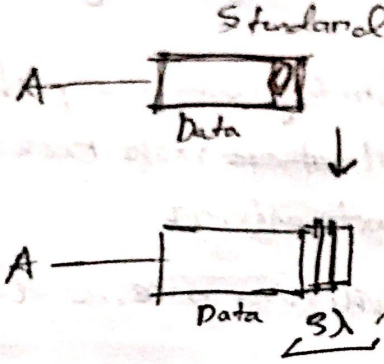
Solution 3

Freq-domain Backoff [Starting the backoff]

- ⊛ Implicitly determines transmission order.
- ⊛ Round Robin which minimizes idle slot time.

Pros:
→ Decentralized

Cons:
→ Higher Convergence Time



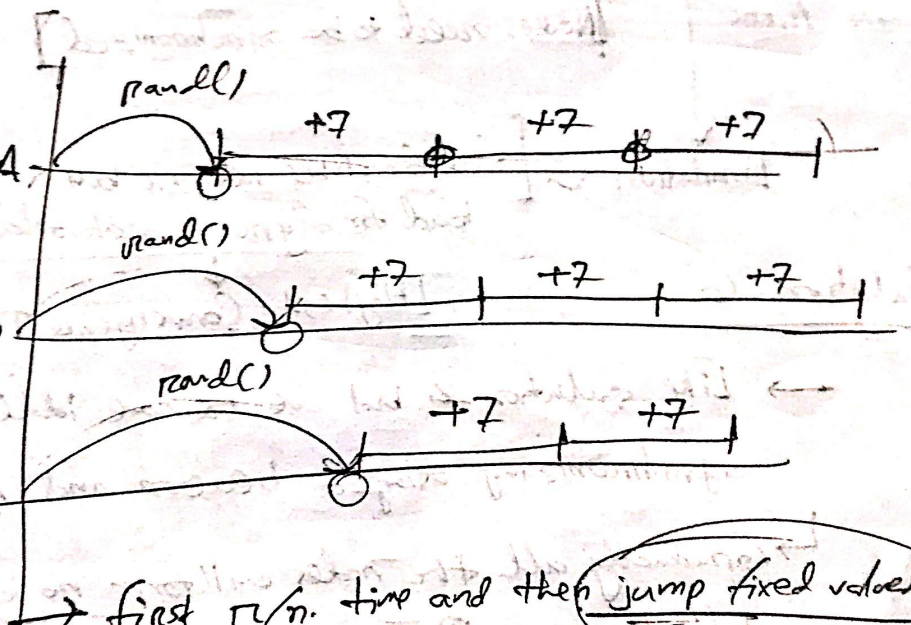
This is the random no. for the next packet.

The other nodes will listen and understand the backoff time of node A for next transmission.

Solution-4

Pros: → Simplicity

Cons: → Takes time to converge
→ Idle slots [Inefficient]



→ first r/n. time and then jump fixed values.

random + deterministic backoff

[if collision → rand()
else → deterministic]

Solution-4 : Ensures gradual collission-free medium access.

Initially there might be collission but it is soon avoided ~~often~~ gradually.

schedule-based / non-schedule-based [slight modification] → Initially when a packet experiences collission, it will ~~not try~~ make back-to-back transmissions on its next attempt.

Solution-5 → Collission free, no idle period.

- Learning to win
- ~~Rectifying the count~~
- Learning the losers

→ Scheduling phase to prepare the transmission order

[Nodes need to be synchronized]

for static network

Limitation ~ [Good for stable network but bad for dynamic networks]

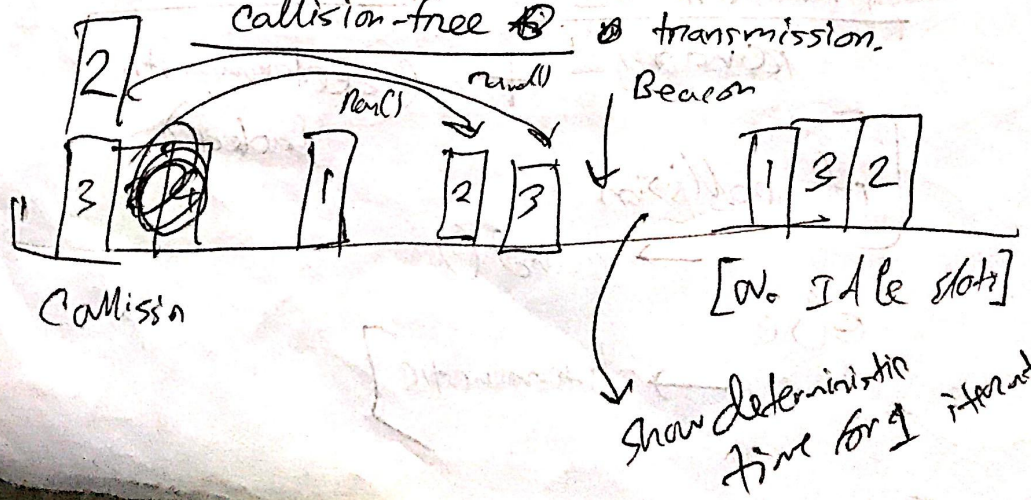
[Highest Convergence Time]

Solution-6

Cons: i) Centralized Synchronization
ii)

→ Like solution-4 but we remove idle times by synchronizing using a beacon and AP.

↳ Gradually all the nodes will form no idle slot collision-free ~~B~~ transmission.



Show deterministic time for 1 iteration