Page-01 SMCN

from last class

speed of IEEE 802.11 (FH+55)2 (DS55)
— 1 or 2 Mbps.

(c) IEEE 802.11a Physical WLAN

(i) 5 GHz band.

(ii) speed of transmission 54 Mbps.

(iii) OFDM (orthogonal Frequency Division Multiplexing modulation scheme.

(iv)
- efficient spectrum utilization
- Multipath fading does not effect here
- data sent over 52 subchannels parallel
  - 48 data
  - 4 synchronous
- 8 different data rates 6 to 54 Mbps

(d) IEEE 802.11b

(i) — started after 802.11a but completed before 802.11a implemented

(ii) Uses spread spectrum method - DSSS (Barker sequence)

(iii) Data rate 1, 2, 5.5 & 11 Mbps.

(iii) 2.64 GHz band.

(iv) Uses BPSK 1 Mbps rate (1 bit / 11 chips) Barker sequence

(v) Uses QPSK 2 Mbps rate (2 bits / 11 chips) (Barker sequence)

(vi) User CCSK (Complementary Code keying)

for

chip code one of 8 chips

— 5.5 Mbps speed 4 bit in every 8 chip code

— 11 Mbps speed: 8 bit in every 8 chip Code (both cases chip code is of 8 chips)

(e) 802.11g

— OFDM like 802.11a.
— But uses 2.4 GHz band
(compatible with 802.11b)
— Rate same as that of 802.11a — 6 to 54 Mbps

(f) IEEE 802.11n

— (i) 5 GHz band.
(ii) speed 100 Mbps
(iii) speed boosting done by MIMO (Multiple Input Multiple output) Antenna system.

a CSMA/CA (Carrier Sense Multiple Access with collision avoidance

(1) Definitions:

(i) DCF – Distributed co-ordination function

(ii) NAV – Network allocation Vector

(iii) IFS – Inter Frame space

(iv) SIFS – Short Inter Frame Space

(v) DIFS – DCF IFS (Time Interval)

(vi) Slot time – The CSMA/CA protocol is allotted in time (δ)

δ → slot time (10 ms)

(vii) DIFS = SIFS + 2δ

(viii) If SIFS = 15 ms
Then DIFS = 15 + 20 = 35 ms.

(IX) Carrier ⇒ Medium (here the wireless channel)

(X) Carrier free: when nobody is transmitting in the carrier

(XI) Carrier Busy: When one or more stations are sending in the carrier.

(XII) Mobile stations: Smart Phones, Laptops, PDF, and even the desktops with Antena and wifi ports.

2. (i) Carrier sensing is not possible in CSMA/CD

(ii) Also collision detection is also not possible due to Hindden terminal problem (both for (i) & (ii).

(iii) Hidden terminal Problem —

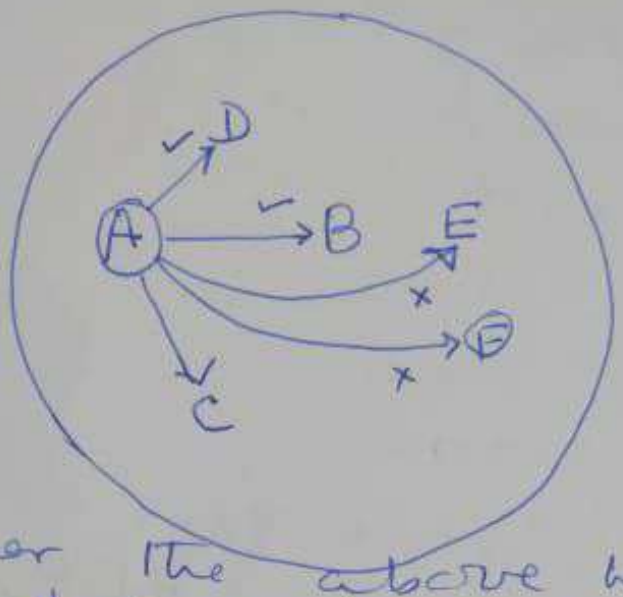


Fig - 1

Consider the above WLAN with ~~five~~ four stations A, B, C, D, E.

- Here signal from A reaches B, C, D. So B, C, D are non-hidden terminal w.r.t A
- Signal from (A) does not reach station E & F.

So E, & F are known as the hidden terminal w.r.t A.

2 (i) Carrier sensing not possible

Assume in figure 1, only A is willing to transmit at the moment to B and others are silent

— If A senses the corner, it will find it free and transmit in the channel
— A's transmission reaches B, C, D but not E and F
— Suppose now E is also willing to transmit to B
— E will also senses the corner and will find it free, as A's signal does not reach to E.
— Now both A and E's signal will collide At B.
— So corner sensing is not possible
— Now A's signal shall not reach E. So E shall not perceive multiple transmission
— So E shall not be able to detect collision
— Similarly E's signal shall not reach A and A shall not be able to Detect collision.
— So Corner sensing & collision Detection not possible.

08

LCSMA/CA Protocol

(i) CS - carrier sensing is not successful for hidden terminal. But it is successful for non-hidden terminal. So carrier sensing (CS) is kept.

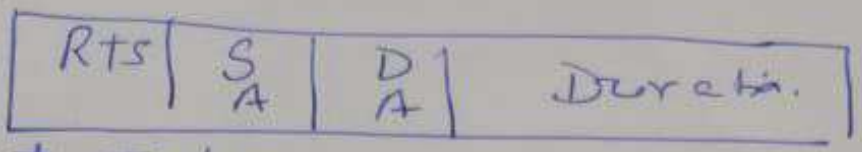
(ii) MA → Multiple Access - as there are many stations to compete for channel.

(iv) CA → Collision Avoidance is done by exchange of RTS/CTS frame which is discussed.

(v) RTS frame: Request to SEND
CTS → Control to Send
ACK → Acknowledgement frame.

09

(v) (a) Frame format RTS

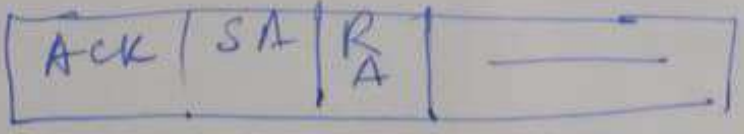


RTS → Type
SA → Sender's Address
DA → Destination Address
Duration: duration of frame exchange (RTS)

(b) CTS

Duration is the duration of ~~CTS~~ frame exchange (CTS)

(c) ACK



(10)

Frame exchange sequence :