WIFI

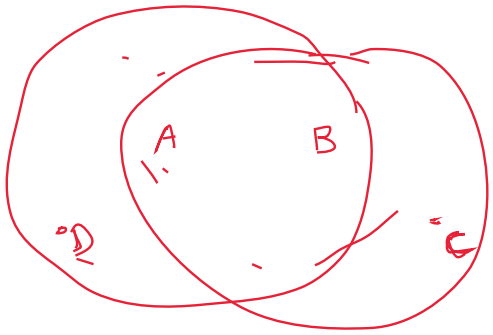
CSMA-CD

ACK, RTS-CTS

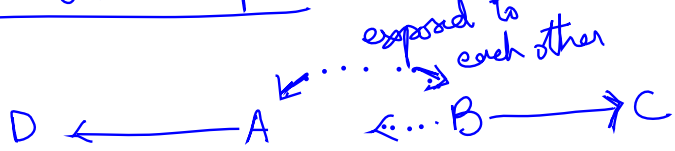
VIRTUAL C.S.

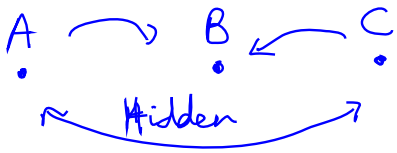
CSMA-CA

collision avoidance



Exposed terminal problem



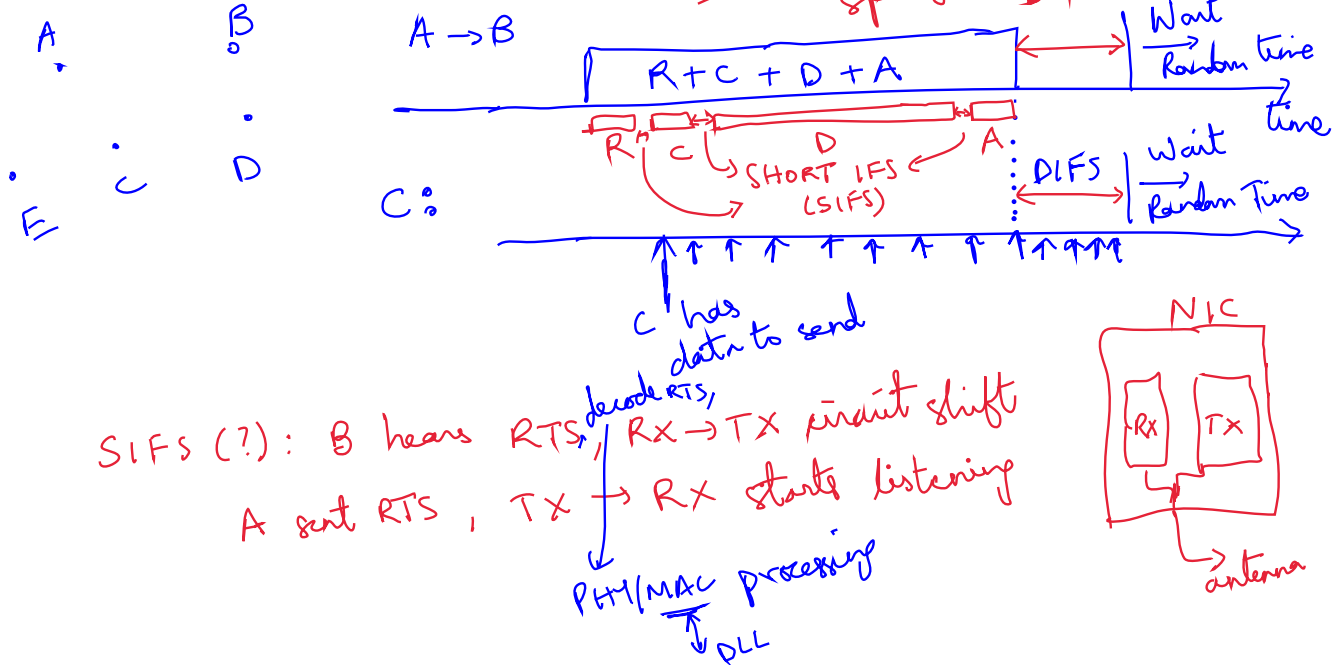


D can receive from A simultaneously (in theory)

C —"— B

However, if A → D then B remains silent due to C.S.

Contention Window (CW)



SIFS (?): B hears RTS, decode RTS, Rx → Tx circuit shift

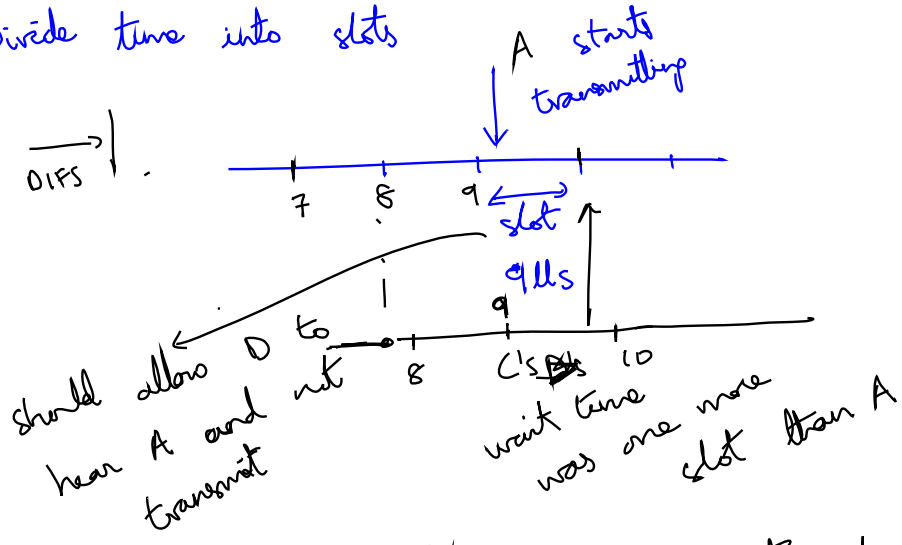
A sent RTS, Tx → Rx starts listening

PHY/MAC processing

DLL

DIFS > SIFS

Divide time into slots



(prop delay + possible offset (starting time for measuring slots) + time to C.S)

C must hear A + carrier sense it → if A was transmitting

prop delay; C.S. time

+ RX→TX → No one else was transmitting

switch from RX→TX

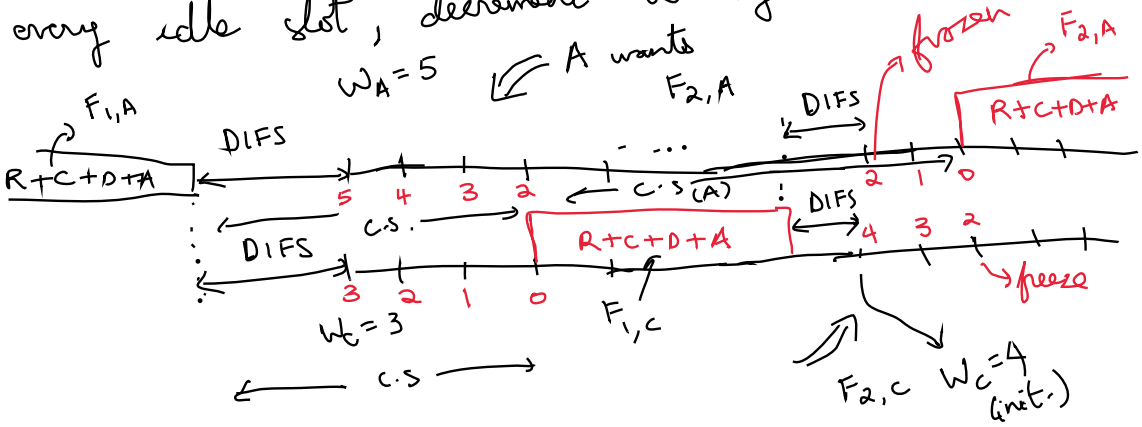
+

How long to wait?

Remaining Waiting time W

Initialize $W \in \text{Unif.}(0, CW_{max})$

For every idle slot, decrement W by 1



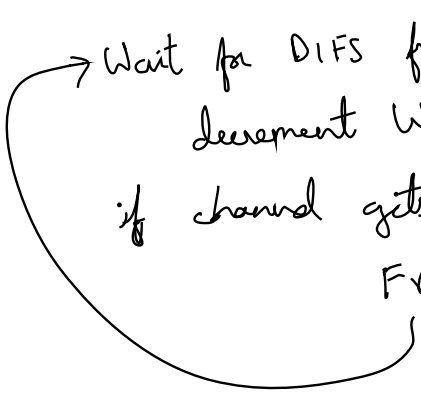
Collision: sent RTS, no CTS

sent DATA, no ACK

$CW_{max} = CW_{max} \times 2$ → on collision

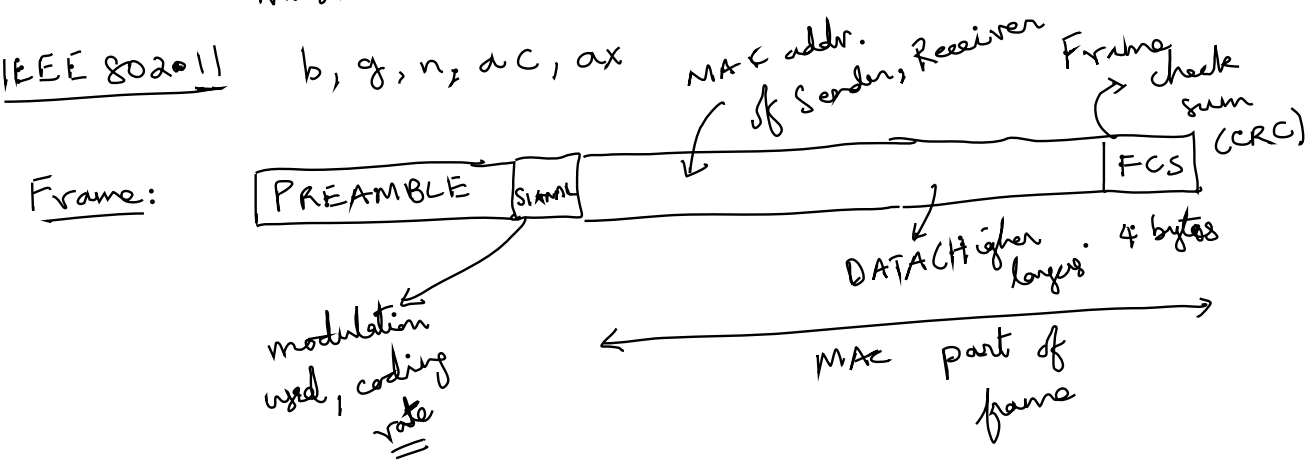
$CW_{max} = \max(CW_{max}, \text{max. allowed value})$

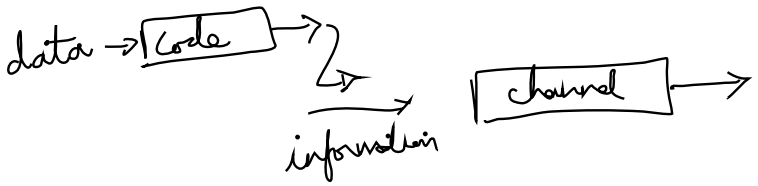
repeat procedure $W \in Unif(0, CW_{max})$



Transmits when $W = 0$

IEEE 802.11 b, g, n, ac, ax





rate 3/4: Send N bits, $\frac{3}{4}N$ information bits

5/6: — " — $\frac{5}{6}N$ information bits

802.11 g → 64-QAM, rate 3/4 (54 Mbps) → bit rate

Chl width (MHz)

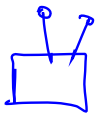
11 n → —11—, 5/6 (150 Mbps) ; 20 → 40

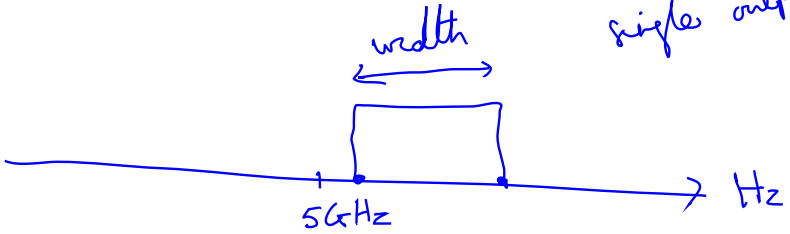
11 ac → 256-QAM, rate 3/4, 5/6 (866 Mbps) ; upto 160

11 ax → 1024-QAM ; rate - , 5/6 → 1to MHz (1.2 Gbps)

MIMO
Multiple input multiple output

SISO
(single input, single output)

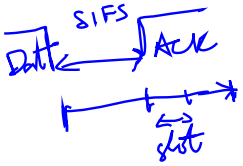




DIFS > SIFS

DIFS = SIFS + 2 × slot_time

PIFS = SIFS + slot_time
↳ Point Coordination function (PCF)

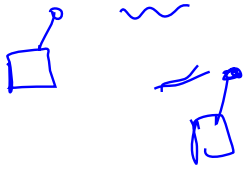


SIFS = 10 Ms 11g, 11n

Max. Retries if collisions and then give up.

Distributed CF

QoS



A.P.

$W \in [0, CW_{max}]$

Higher Priority Possible?

802.11e

	CWmax	Initial	Max Value
Voice	3	7	Need cross-layer interaction
Video	7	15	
other	15	1023	