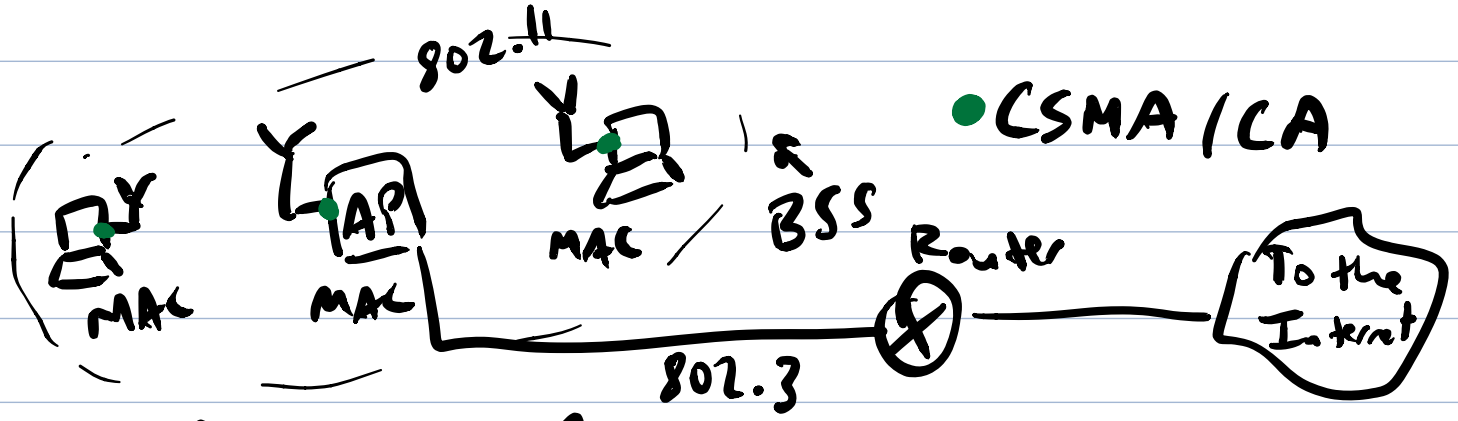
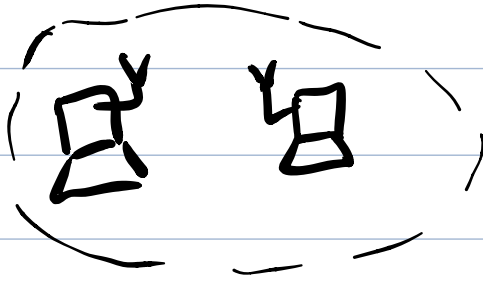
WiFi → IEEE 802.11 (link layer protocol)



- CSMA/CA

BSS → 1 AP + 1+ wireless stations

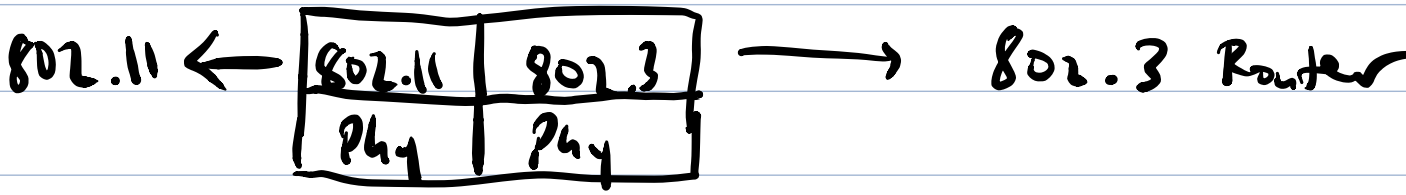
BSS ID = MAC addr of AP



No infrastructure
Ad-hoc network
(only wireless stations)

e.g. exchange messages between cars
→ vehicular ad-hoc networks (VANET)
increase safety between cars (e.g. merge safely)

App
Transport
Network
802.11 ←?→ Network
Phy Ethernet 802.3
Phy

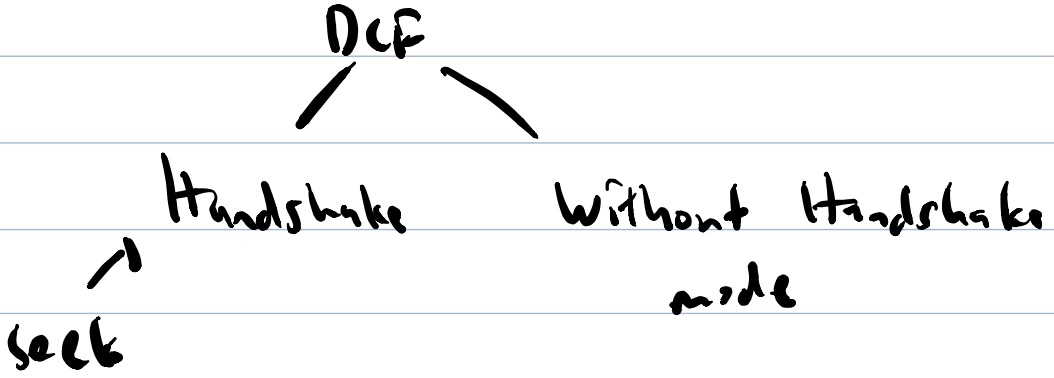


Mapping
Wi-Fi frames ↔ Eth frames

Modes of Operation

Distributed Coordination Function (DCF) Mode:
no need for an AP, AP behaves as ordinary nodes, nodes decide to Tx

Point Coordination Function (PCF) mode: AP decides who tx and when (master/slave BDSM)



PCF Mode (optional): AP operates as Central Controller. Decides who and when tx
no contention for medium access
Can Allocate slots using round-robin policy

- wastes b/w if scheduled node has no traffic
- based on polling (taking-turns MAC)

DCF (is a must)
AP → normal node
- provides Internet connectivity
- will be medium contention to access the channels
- MAC protocol → CSMA/CA

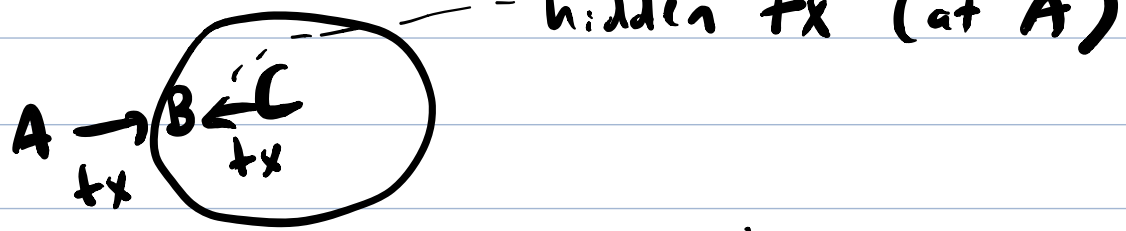
AP tells all when to enter PCF mode and DCF mode. Sends beacon
most common is DCF
how do I know when to use handshake and when not to?

Handshaking in DCF: each node maintains an integer counter called dot RTS threshold. Frame size > dot RTS threshold
⇒ With handshaking
else, node decides

handshaking uses <u>control frames</u>

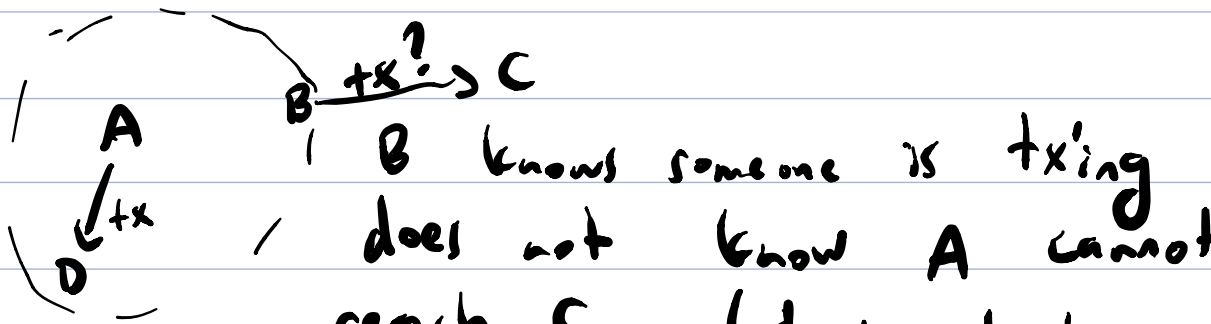
RTS: request to send
CTS: clear to send
receiver not obligated to send CTS
rdt b2 of ACK control frames

Hidden Terminal Problem



A's frame collides with C's at B
C is hidden from A → collision (far away)
solution exists: CSMA/CA

Exposed Terminal Problem



B knows someone is tx'ing
does not know A cannot reach C. (does not know physical location)
→ No solution exists so far

WLAN MAC: CSMA/CA

RTS and CTS frames, ACK, and 1 data frame

RTS	Frame Ctrl	Duration	RA (B)	TA (A)	FCS	
20 bytes:	2	2	6	6	4	bytes

Frame Control: FCS Frame Check Seq (CRC)

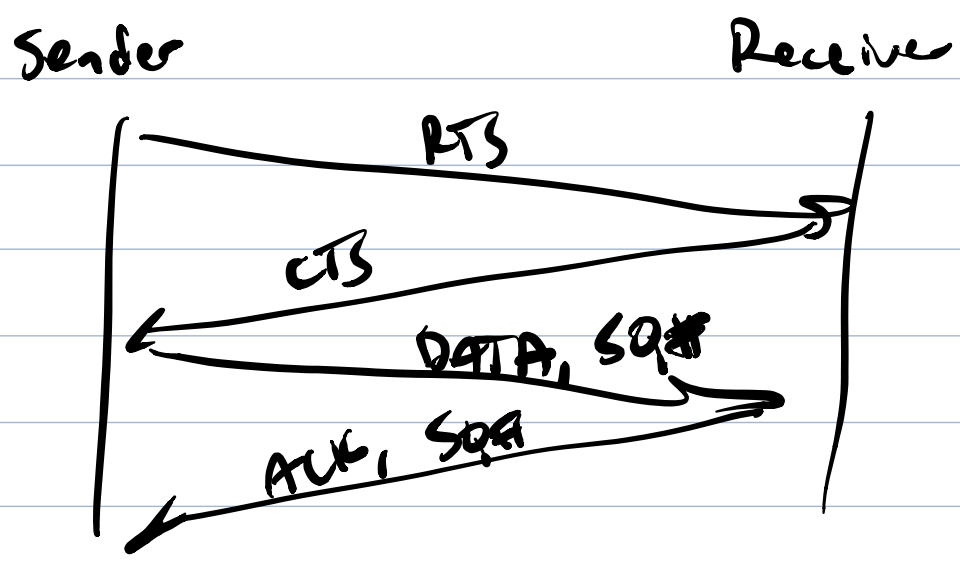
CTS/ACK:	Frame Control	Duration	RA	FCS
14 bytes:	2	2	6	4

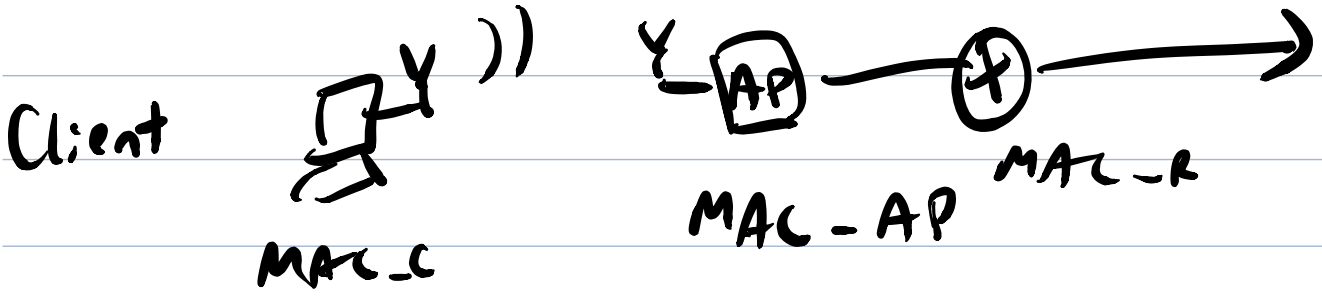
DATA Frame

Frame Control	Duration	A1 RA	A2 TA	A3	Seq Ctrl	A4
2	2	6	6	6	2	6

Frame Body (Datagram)	FCS
	4

Overhead = 34 By. total





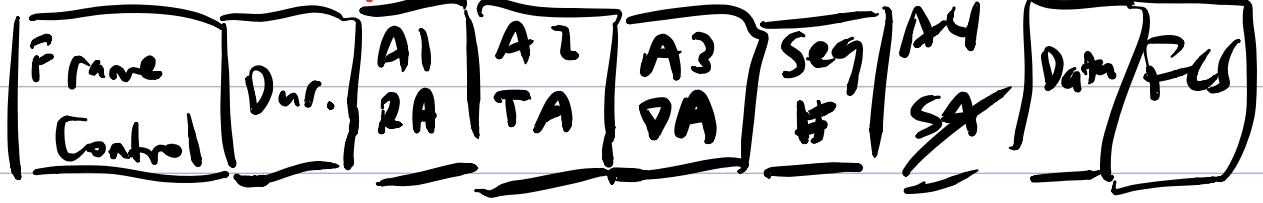
SA: MAC addr of node generating the frame
TA: MAC addr of the wireless transmitter
RA: MAC addr of wireless receiver
DA: MAC addr of destination (1 hop away)

Case 1: Client sends IP packet to first hop router

Case 2: First hop router sends IP packet to client

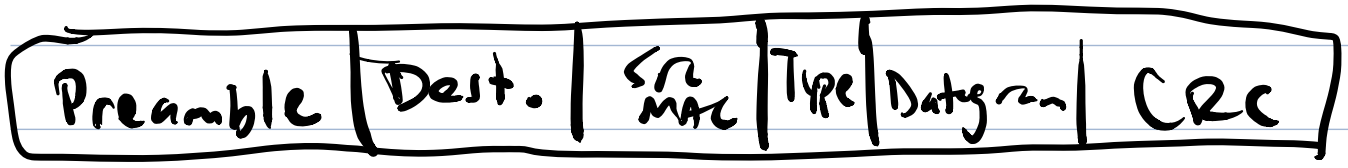
Case 1

SA: MAC_C RA: MAC_AP
TA: MAC_C DA: MAC_R



MAC_C

AP



MAC_R MAC_C

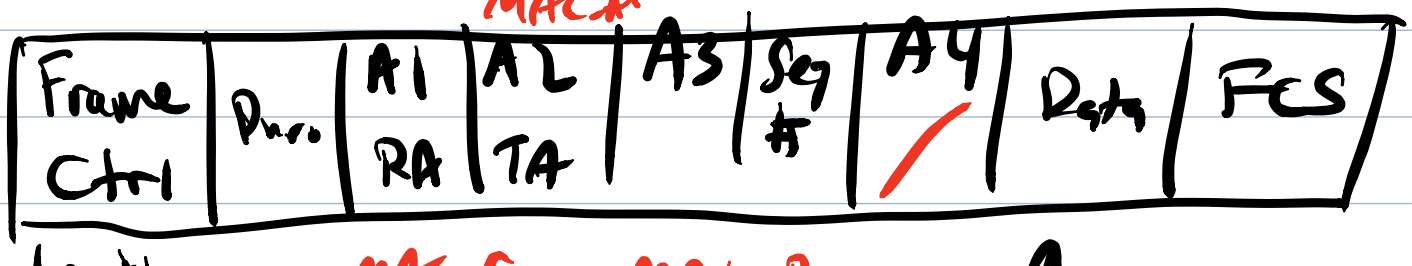
MAC_AP dropped

Case 2: Router to Client

SA: MAC_R RA: MAC_C

TA: MAC_AP DA: MAC_C

MAC_AP

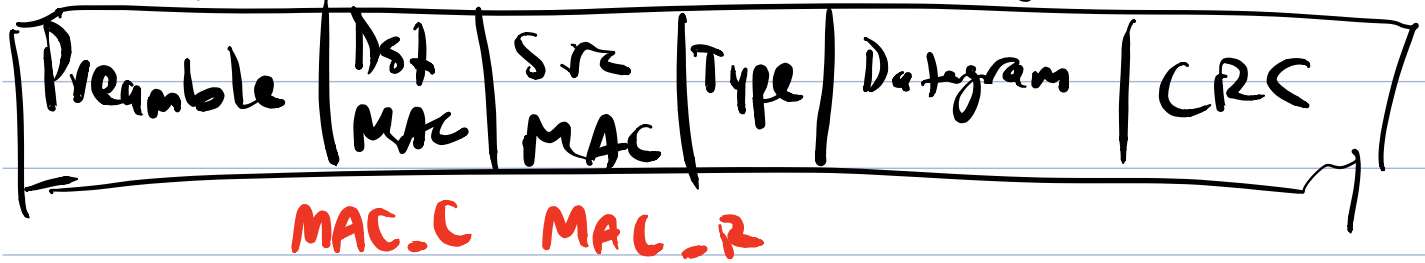


Length MAC_C MAC_R

AP

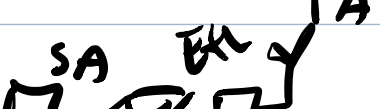
equal!

DA SA



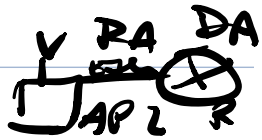
MAC_C MAC_R

TA | RA always dropped in Eth frame



2 APs between station & router

Frame from Client's AP to router AP



Frame Ctrl	Dur.	A1 RA	A2 TA	A3 DA	Seq. Ctrl	A4 SA	Frame Body	FCS

AP2 AP1 R C

Dst MAC	Src MAC

MAC-2 MAC-C