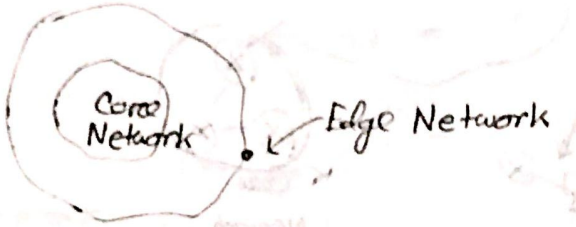
Internet and Access Networks

25-11-21

Access Networks → Used to access edge devices



neighboring cells shall have different frequencies

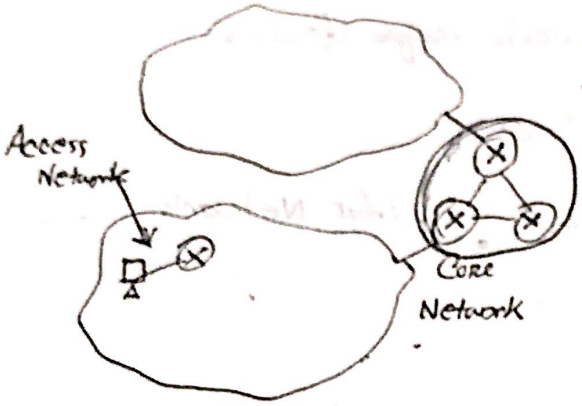
Interference Range → Upto which the signal exists. → (Transmission Range)
(Much larger than the cell's boundary)

⊛ → Close transmitting devices must have different frequencies [difference must be high] or else there will be collision. [at receiver's side]

Single Antenna — either send/receive
(devices switch this mode automatically)

#2

26-11-21
Friday



PAN → WSN (Wireless Sensor Network), Bluetooth, WiFi Direct

Access Network – LAN/WLAN → Ethernet, ~~Coffee~~ Wifi

MAN/WMAN → WiMax

WAN/WWAN → ~~WiMax~~

Cellular Network

Wired → Low Flexibility, High performance

Wireless → High Flexibility, Low performance

Challenge Network – DTN

(Delay Tolerant Network)

[Has no end-to-end connectivity]

→ Stores data packets and sends the bundle of data packets when end-to-end connectivity is possible

[Covered upto Section-1.3]

⊛ Simulator → Imitates Real World, event-driven clock

⊛ Emulator → Same as simulator but,

with real-@time clock → (continuous)

→ can work in real world

→ imports real image,

hence behaviour closer to real world.

Command to assign IP

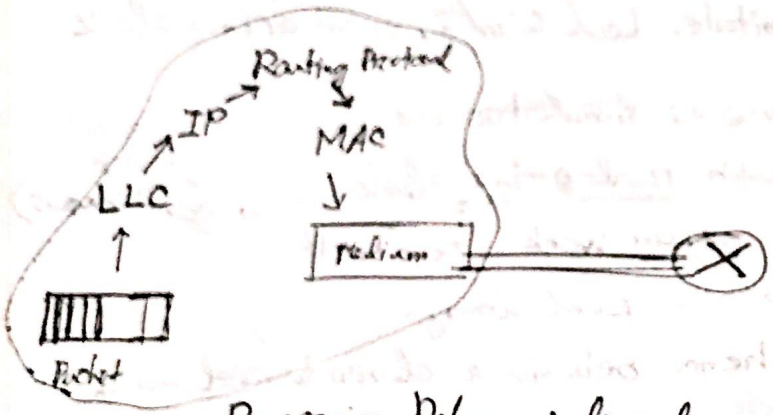
ip <ip_address> <subnet_mask> <default_domain>

gateway router

Choose Routers that support the WIC card.

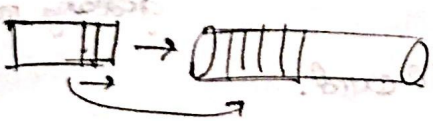
#3

Trans delay



i) • Processing Delay → depends on processing capability ~~power~~ of the router.

ii) • Queuing Delay → depends on network traffic intensity.



To push the whole packet / transmit the whole packet in the channel is called transmission delay.

If the channel rate is R bits/s

and, length of packet is L.

iii) • Transmission Delay = $\frac{\text{Packet Size}}{\text{Link Data Rate}} = \frac{L}{R}$

Propagation Delay →

Time required to deliver the packet through the channel

iv) • Propagation Delay ~~—~~ $\propto$ Physical medium of the link

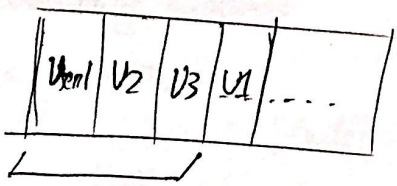
(How fast packet travels through medium)

Total Nodal Delay = Processing Delay
+ Queing Delay (usually absent in circuit switching)
+ Transmission Dday
+ Propagation Delay

Many Users have to share single channels → Multiplexing

- FDM (Frequency Division Multiplexing)
- TDM (Time Division Multiplexing)

TDM



Here, only 3 people can be served

Frame in 1 second

Packet Switch

#4

⊛ Multiplexing → FDM (neighboring frequencies can not be used together)
→ TDM
→ CDM

OFDM → neighboring frequencies can be used together but must be orthogonal to each other.

SDM → Space Division Multiplexing.

⊛ Multiple Access →

⊛ Modulation → [techniques to convert Binary to Digital]
(Physical Layer)

#5

IEEE 802 Wireless Systems
[Ch-5]

23-Dec-21
~~Wednesday~~
Thursday

IEEE 802 systems work on top of OSI models,
OSI is the basic building block of wireless systems.

(i) 802.11 → Wireless LAN
[Redefines Layer-1 and Layer-2] of OSI

Co-ordination Function → Point C.F.
→ Distributed C.F.
[No central co-ordinator]

#6

→ Basic Service Set (BSS) is controlled by co-ordination function.
Multiple Basic Service Set is ~~connd~~ connected by a Distributed System (DS).
which is not necessarily wireless.

Architectures → i) BSS
ii) IBSS [Independent BSS]
iii) EBSS

IBSS has no hierarchy among end nodes, and hence uses D.C.F. only.

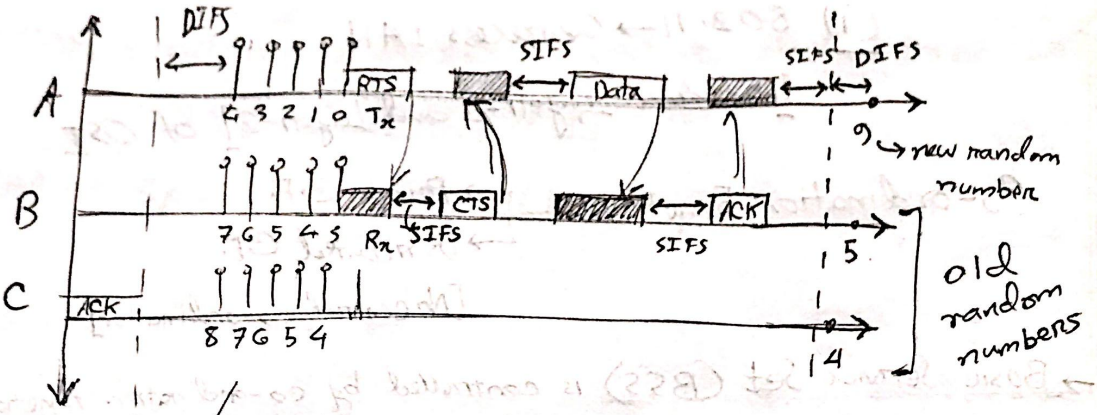
Each basic service set uses different ~~frequency~~ for wireless communication.
The time between sending an RTS and a CTS, a time called Short Interframe Space (SIFS) is given.

#7

Basic Service Set (BSS)

30-Dec-21
Thursday

Distributed Co-ordination Function → Compete among themselves for medium access with no co-ordinator.



They counted for a random number (4, 7 and 8). Each time, it counts down, the medium is sensed.

Why SIFS?

→ To switch from R_x and T_x.
→ Process the received data

DIFS → 34 μs
SIFS → 16 μs

RTS callission?

If both send RTS at the same time, it results in timeout.

✱ [SIFS + 2 slot time = DIFS] After DIFS time, random numbers are picked.

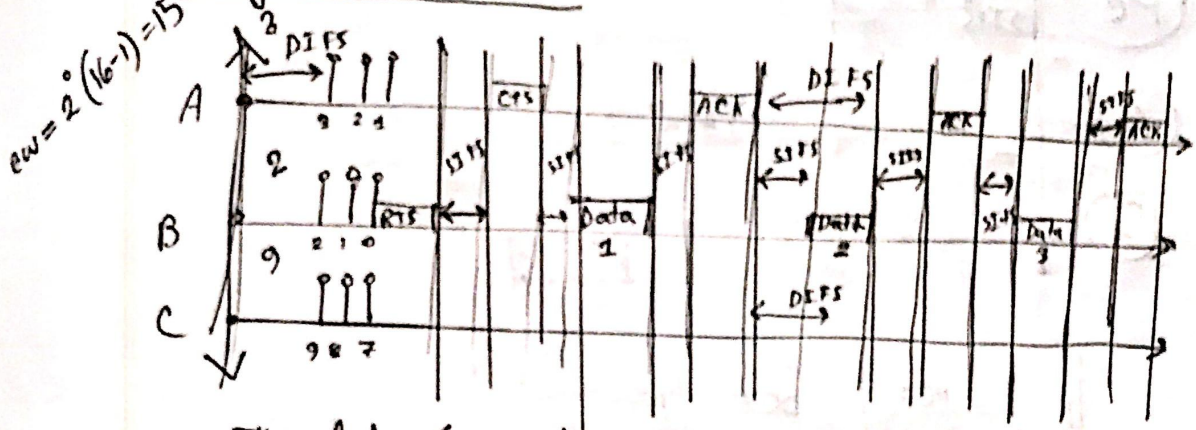
→ After RTS callision range of r.n. generator is increased. Why?

A: To avoid callission by the RTS senders again, a largen range will make it less possible for the packets to callide again.

#8

04-01-2022
Tuesday

Fragmented Packets

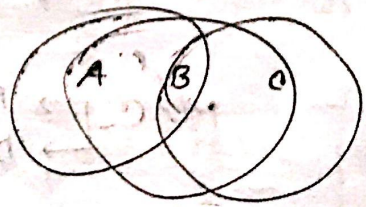


Timeline Diagram

The data fragments are sent right after another within SIFS time.

Hidden Station

[→ Wireless networks
→ Multi-hop (AND)] Applicable for



Solution → (RTS - CTS) Handshaking

i) RTS informs the neighbors of senders
ii) CTS informs the neighbors of receivers

⊛ Retransmission limit

→ No. of times a packet can be retransmitted due to RTS collission.
(Depends on priority of packet)

How to pick R.N.P? → Retransmission No.

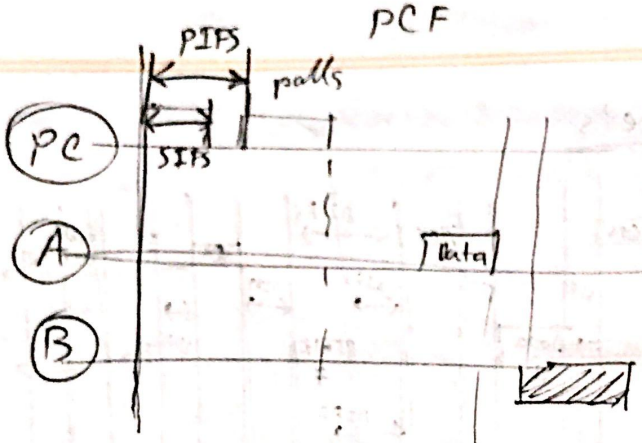
→ $0 \sim 2^{n-1}(C.W._{min} - 1)$ (usually 16)

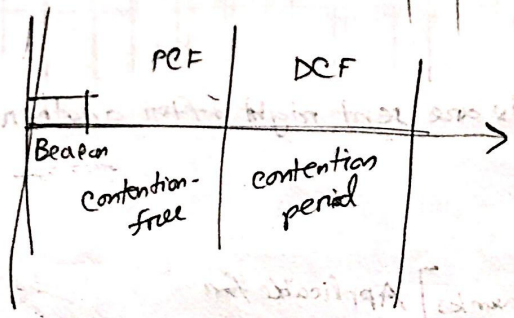
⊛ Post-backoff

[SIFS + 1 slot time = PIFS
SIFS + 2 " " = DIFS] → (for priority access, a station can wait PIFS instead of DIFS)

PIFS = SIFS + One Slot-time

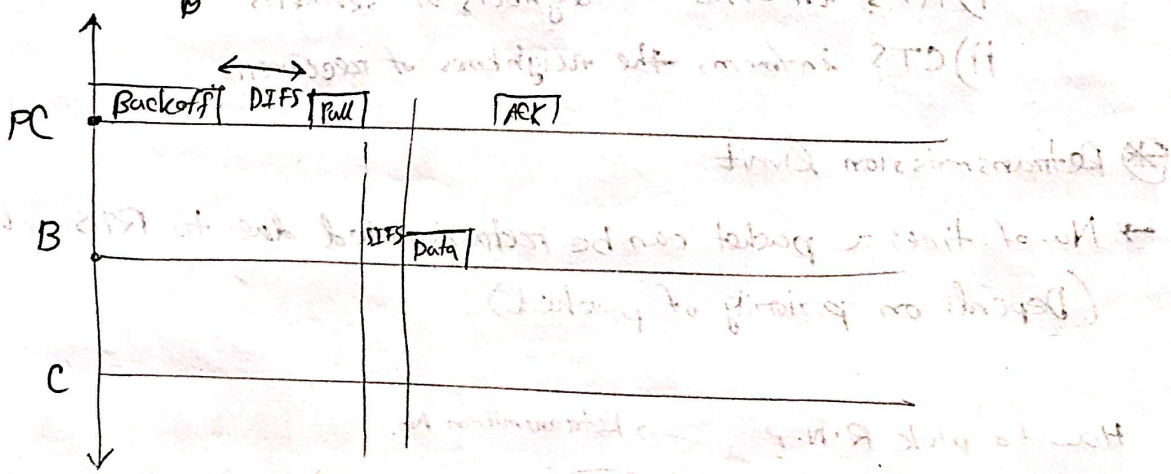
PCF

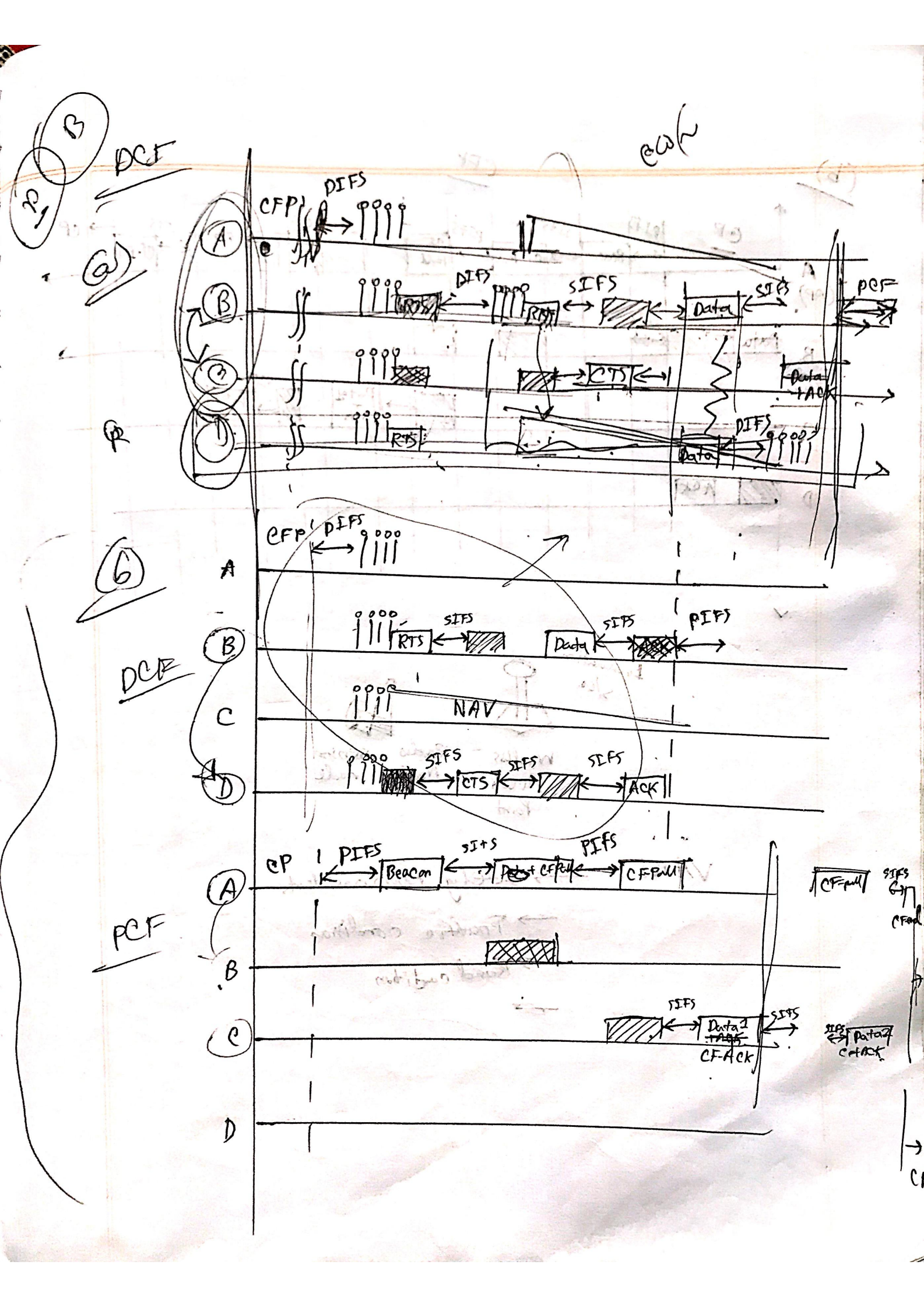




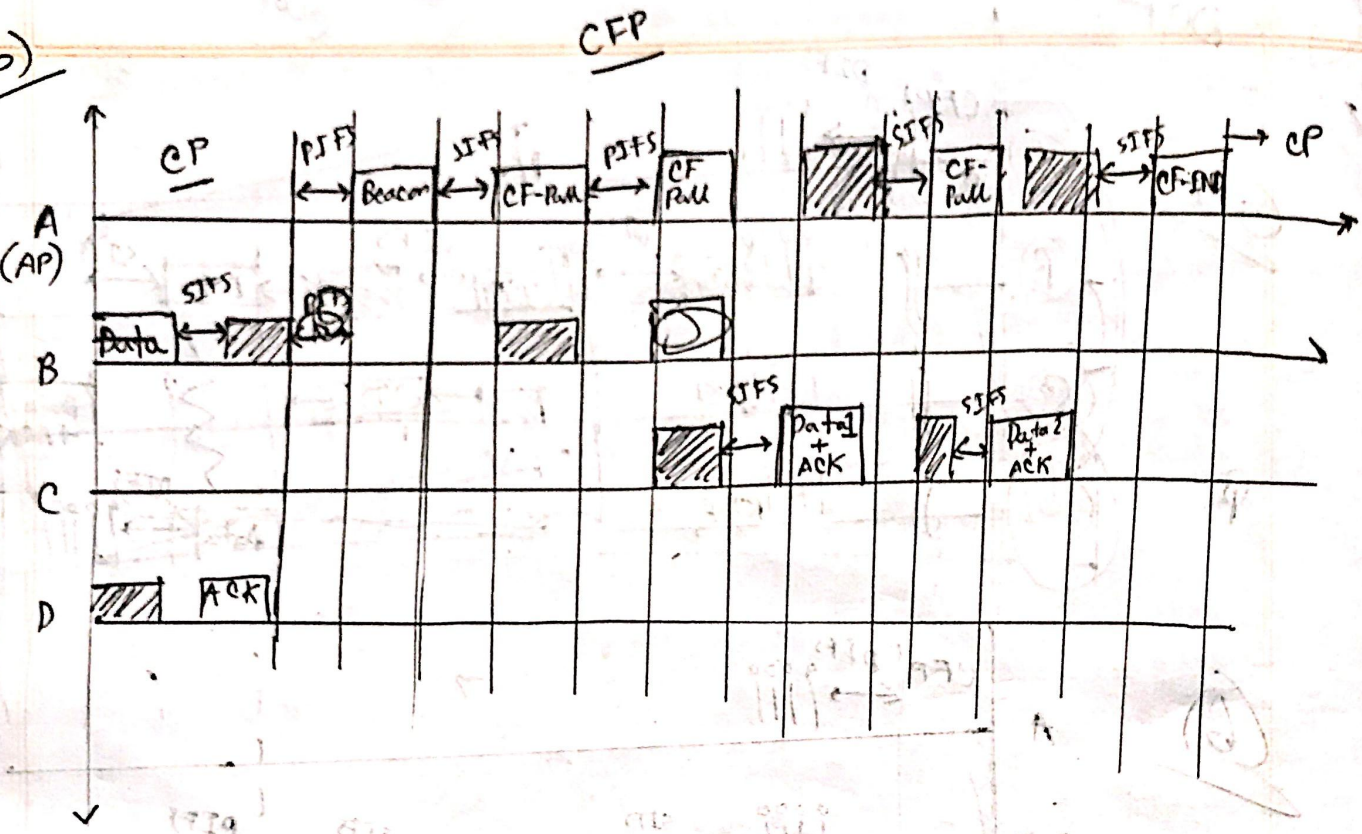
MAC → PCF (QoS/Special service)
→ DCF

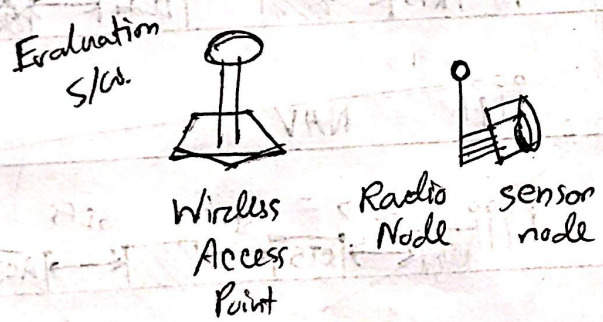
TBTT (Beacon Initiation)




DCF
PCF
CFP
DIFS
SIFS
PIFS
RTS
CTS
Data
Data+ACK
ACK
NAV
Beacon
CF-Poll
CF-Ack
A
B
C
D

(b)





VANET → Safety from accidents

→ Traffic condition

→ Road condition