Interference Suppression Article

Ver : 1.0

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2016/09/07

An 802.11 STA has to check two condition before being able to transmit frames at wifi network.

1- Clear channel assessment (CCA) (listen to the channel , if it considered occupied then CCA indicate a state of Busy and whenever it is clear , CCA indicate a state of Idle).

CCA divided to TWO process :

Energy detection(when energy level is detected on specific threshold (20db more than minimum MCS sensitivity (-82 – 20 => -62dbm)
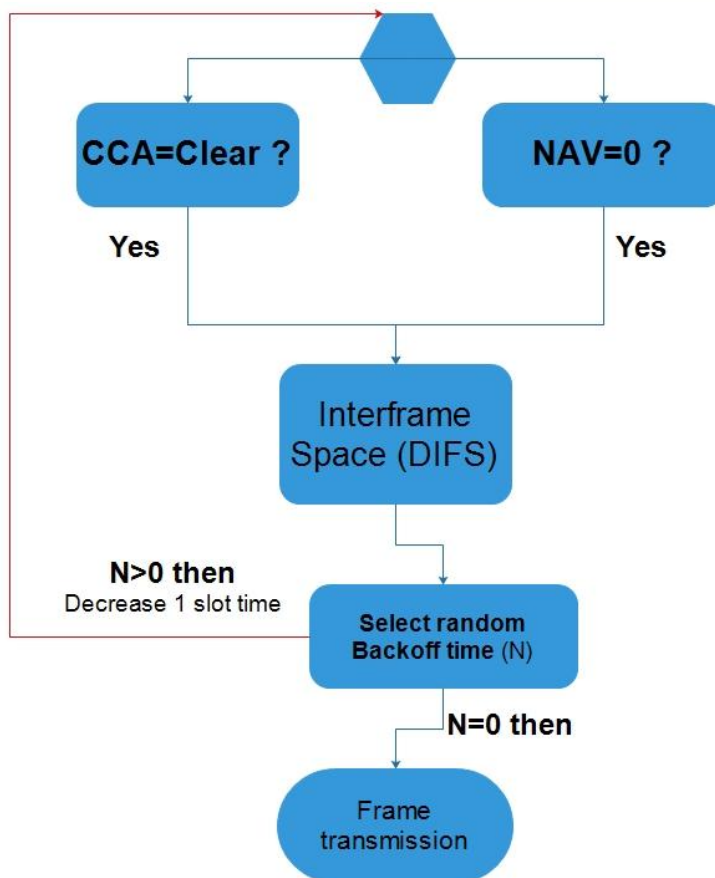
Carrier sense : when valid 802.11 ofdm transmission (with preamble) is detected , then CCA is triggered.
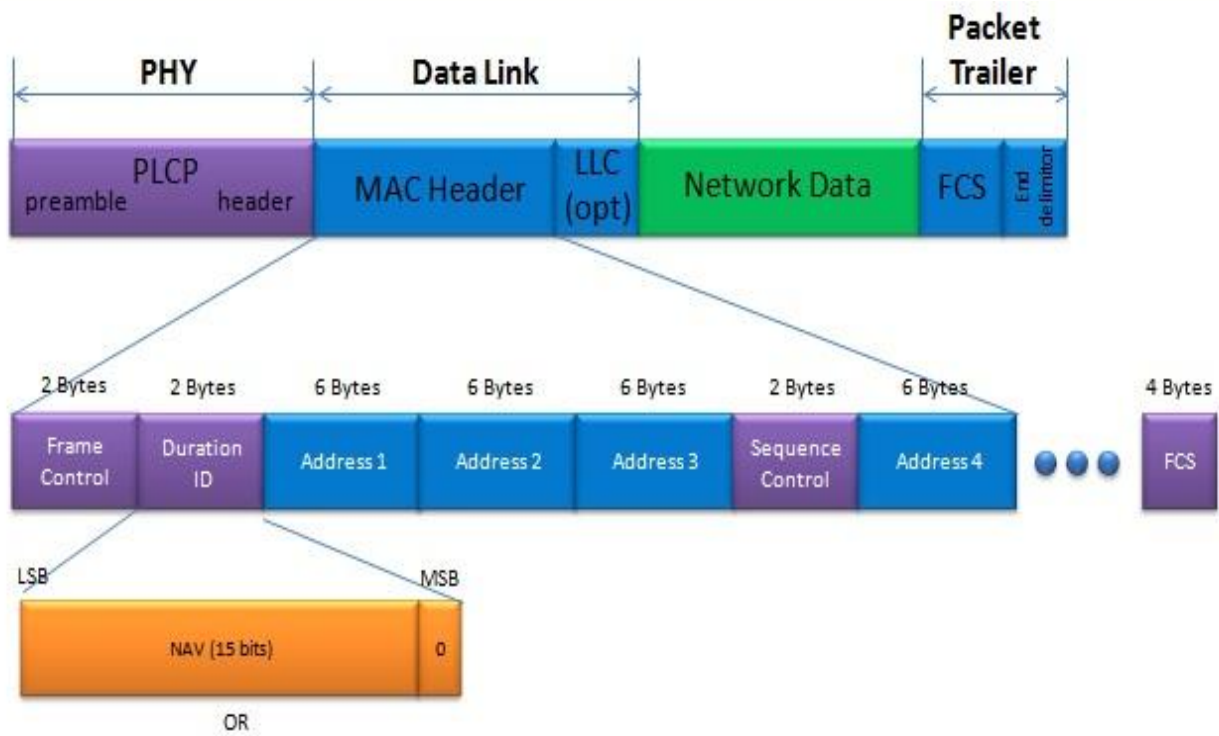
2- <u>Network allocation vector (NAV)</u> :

Each 802.11 frame has a NAV value to reserve medium for a period of time. All the stations on the channel can read this field and leverage for medium reserving.

I think if we be able to control NAV timers of all stations on the channel , we would be able to control CCA too.

And we have more clear channel in result.

CCA=Clear ?

Yes

NAV=0 ?

Yes

Interframe Space (DIFS)

N>0 then
Decrease 1 slot time

Select random Backoff time (N)

N=0 then

Frame transmission

All stations should content for the medium access , but on Ultra-Noisy environment like we have to find a new and unique way to dominate the noises to have the better chance for medium access.

PHY		Data Link				Packet Trailer					
PLCP preamble / header	MAC Header	LLC (opt)	Network Data	FCS	End delimitor						

2 Bytes	2 Bytes	6 Bytes	6 Bytes	6 Bytes	2 Bytes	6 Bytes		4 Bytes
Frame Control	Duration ID	Address 1	Address 2	Address 3	Sequence Control	Address 4	•••	FCS

LSB   MSB

NAV (15 bits)	0

OR

RTS/CTS and CTS-to-Self are not suitable for such conditions , because :

1- We need to access to the medium on a normal fashion and it's may only help for hidden node problem.
2- All other interferer AP's may use this way.
3- We have equal chance for gaining access to the medium , like other STA's .

Octets: 2	2	6	6	4
Frame Control	Duration	RA	TA	FCS

MAC Header
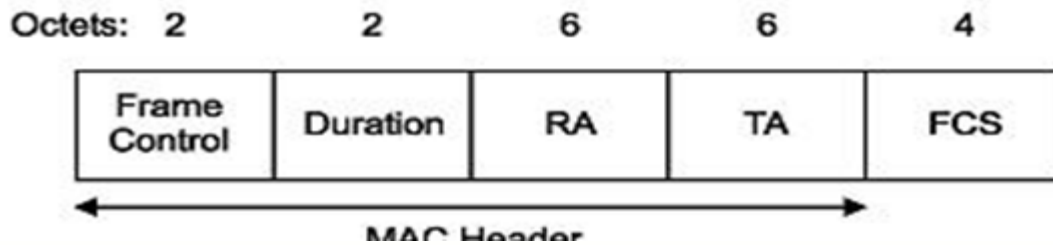
Solution :

We need to an Access point with a special firmware and capability to clear channel for other STA's.(we've noted this AP as Channel-Cleaner AP (CC-AP) on this article).

What is the main duty on CC-AP ?

The CC-AP should send Fake-NAV (Fake RTS) without normal medium contention (CCA and NAV) and also with :

1- minimum inter-frame space ,SIFS or RIFS. (to reduce the likelihood of occupying channel by other STA's).
2- minimum back-off timer ($1 < CW < 4$) .

As I know , for a simple data frame to be send , we need approximately 100 to 300 microsecond , so it's better to propagate the Fake-NAV (Fake-RTS) timers with value of 300 microsecond.

This solution only works for downlink and is used whenever the AP contains queued frames for STA's.
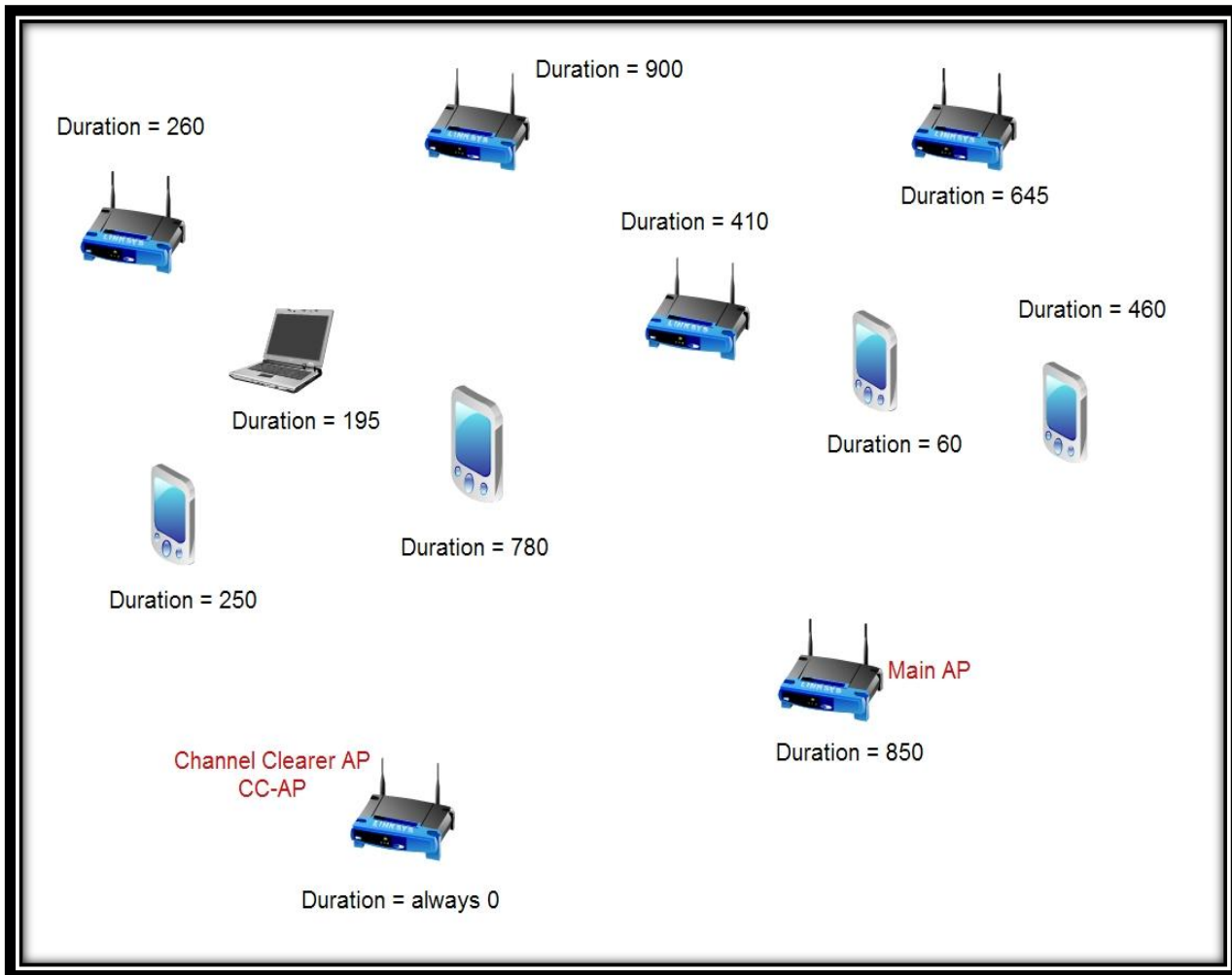
Fig 1 : simple crowded Wifi network :
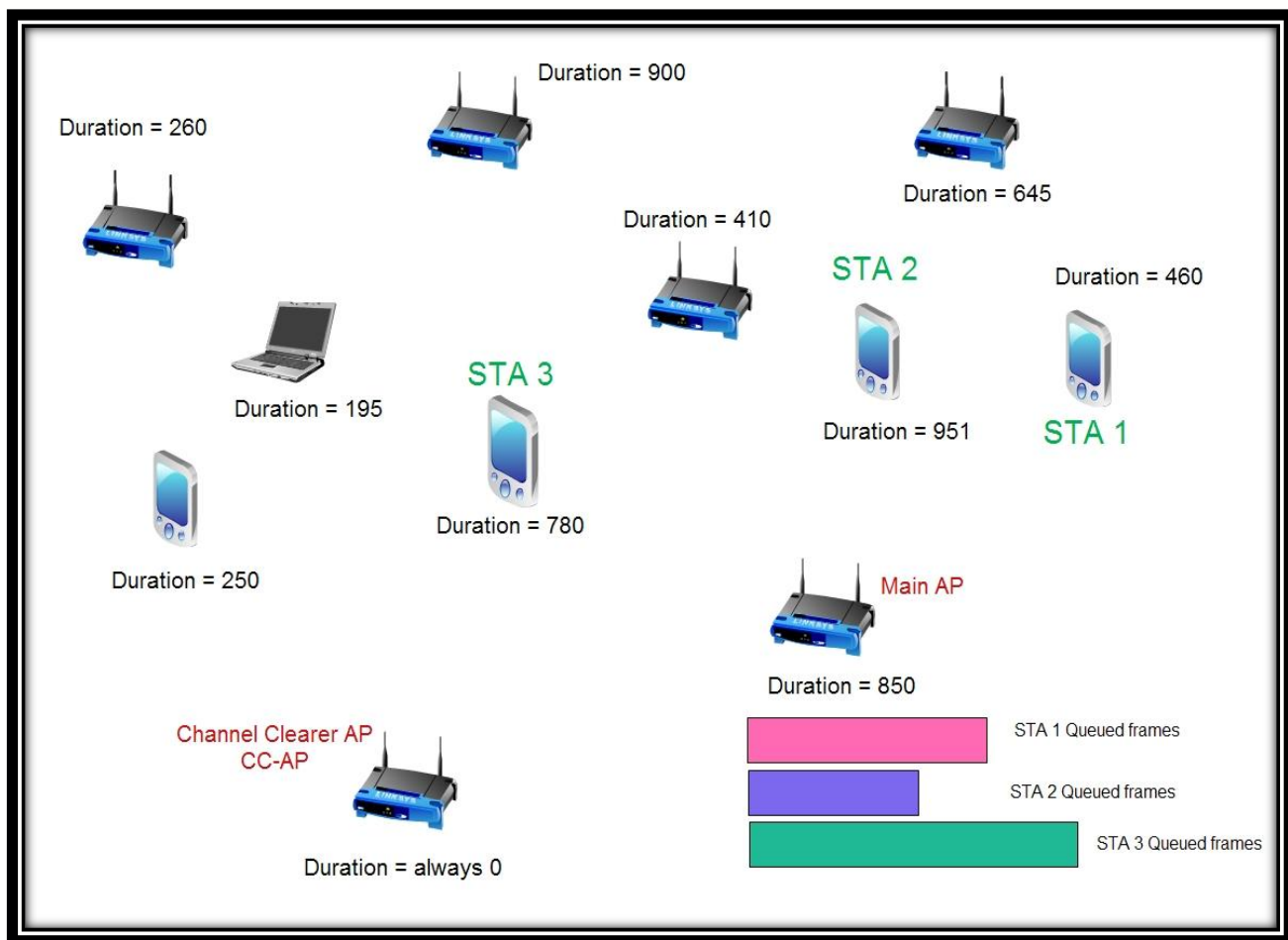
Fig 2 : Channel-clearer AP and main AP (three STA's with queued frame on the AP):

Fig 3 : Clearing channel operation:

Duration = 900+300

Duration = 260+300

Duration = 645+300

Duration = 410+300

STA 2

Duration = 460+300

STA 3

Duration = 195+300

Duration = 951+300   STA 1

Duration = 780+300

Duration = 250 +300

3 CC-AP resets All sta's NAV timer +300

1 Main AP sends Channel 6 clearing request to the CC-AP

Main AP

4 NAV timer has been resseting duration field - now duration value = 0 so AP starts transmitting

2 CC-AP receives the channel clearing request and starts Fake-NAV sending

Channel Clearer AP CC-AP

Duration = 300

STA 1's Queued frames

STA 2's Queued frames

STA 3's Queued frames