

WLAN TROUBLESHOOTING

LAYER 2 retransmissions:

- occur at the MAC sublayer
- caused when the ACK for a packet doesn't reach the sender.
- **ADVERSE EFFECTS:**
 - Increase overhead
 - Decrease throughput
 - latency and jitter issues for latency-critical service like VoWiFi ..
- Wi-Fi can handle L2 re-trans up to 10% without any noticeable effects
- for VoWiFi -> **2%** higher packet loss, **5%** L2 packet loss tolerable.
- **CAUSES**
 - Layer 1 causes
 - Adjacent Cell interference
 - Refers to interference caused by overlapping frequency space, thanks to bad design.
 - This is caused when overlapping cells (needed for roaming) have overlapping frequencies.
 - in 2.4 Ghz ISM : 1,6,11 are the best non-overlapping channels
 - 5 Ghz UNII : 23 non-overlapping channels.
 - Multipath
 - Can cause ISI (inter symbol interference)
 - Delay spread (def is known)
 - in site surveys one must look out for the number of L2 retransmissions.
 - They can be usually solved by using "Antenna Diversity". Metals also cause Antenna Diversity.
 - Using a Unidirectional Antenna reduces Multipath
 - OFDM technology is more resilient to multipath, so it's good to use it.
 - User MIMO, it takes advantage of Multipath.
 - Low SNR
 - The difference between the signal level received and the minimum discernable signal level is known as the **"FADE MARGIN"**.
 - Data transmission corrupted with low SNR.
 - SNR > **25 db** = a good quality signal
 - SNR < **10 db** = a poor quality signal
 - industry standards : **18 db for data and 25 db for voice**
 - RF interference
 - **ADVERSE EFFECTS**
 - The interfering device might be heard by a legit device during its "CCA" and it might not transfer
 - There might be corruption of the data
 - Excessive retransmissions
 - Types of RF interference
 - Narrowband interference : deadly
 - Wideband interference : Harder to achieve and not so deadly. But still possible.

- All-band interference : FHSS interfering with HR-DSSS and/or ERP-OFDM channel comm at 2.4 Ghz. Frames might get corrupted. Highly depends on the dwell time and the hop time of the FHSS signal.
 - Devices which cause this : Microwaves, video camers , Bluetooth,
 - Other causes
 - hidden node
 - the problem starts when a node cannot hear the transmission by all the nodes when perform it's CCA.
 - This results in transmission plus collisions.
 - This can cause a **15-20%** decrease in throughput..
 - They can also occur if the stations are at opposite ends of the ccoverage cell and they can't hear one another.
 - This can be detected, if using a protocol analyzer, we can see that only one station's frame retransmission rate is higher than other client stations.
 - Therefore, by **disabling 1, 2 Mbps speeds**, we can limit the stations from roaming to the very edges of the cell.
 - A Distributed Antenna system can also cause this.
 - Another temporary solution is to use RTS/CTS
 - If after implementing RTS/CTS , the throughput increases, then the problem is definitely hidden node.
 - Ways to fix this are :
 - RTS/CTS
 - Increase power to all stations and check.
 - Remove obstacles.
 - Move the hidden station
 - Add another AP.
 - near/far
 - A low powered client far away is unheard if a high-powered station is very close to the AP.
 - This is because the high powered client increases the "floor noise" level, which is high above the signal level received from the far-away client.
 - it's usally solved by CSMA/CA.
 - mismatched power settings
 - Usually happens when the client's power settngs are lower than that of the AP.
 - Client can hear the AP, but not vice-versa.
 - Solution:all the client transmit power = AP's transmit power.
 - During protocol analysis, if the frames are corruped near the AP , but are ok near the client, then this problem exists.
 - Note : always increase the antenna gain, not the IR!!!
 - The 802.11k ratification makes it possible for an AP to inform it's clients to use their Trasmit power control (TPC_) capabilities to change their transmit amplitude dynamically to match the AP's power.
 - adjacent cell interference

802.11 Coverage Considerations

- As stations move away from the AP, they will shift their b/w to lower speeds by using **Dynamic Rate Shifting (DRS)**
- This shifting to be done is decided by using various parameters, like quality of the signal, SNR , RSSI , packet error rates.

- Different vendors do the rate shifting differently.
- It's also good to disable the 1 , 2 mbps speeds, because the clients operating at that speed occupy the channel for longer.

Roaming

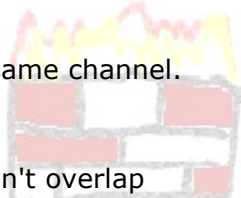
- Roaming behaviour is again proprietary - so watch out for problems
- It starts the roaming by sending a Re-association request to the new AP.
- 802.11r defines faster handoffs in a Robust Security Network (RSN).
- 15-25 % overlap is ideal for roaming.
- Too little overlap is bad, so is too much overlap. (ping-pong effect).
- Another issue is the 802.1x reauthentication that has to take place everytime during reassociation.
- Average time for reass using 802.1x -> **700ms**. But VoWifi needs **150ms** during roaming.
- so a FSR (fast secure roaming) solution is needed. (Proprietary). 802.11i defines optional FSR. 802.11r ratified FSR

Layer 3 Roaming

- Roaming across different subnets
- client loses connection and has to re-connect.
- ways to solve this
 - Mobile IP
 - a device will always have only 1 IP
 - proprietary L3 roaming solution.
 - Maybe some tunneling is involved.

Co-Channel Interference

- Configuring multiple AP's all on the same channel.



MCA

- Make sure that adjacent channels don't overlap
- in 2.4 Ghz, we use only 1,6,11 for non-overlapping channels
- in 5 Ghz we can use 23 channels, but it's good practice to use the channel with is 2 channels away from the previous one.
- It's good practice to perform a 5 Ghz planning first and then 2.4 Ghz, because 5 ghz attenuate faster and have smaller coverage cells.

SCA

- All AP's are transmitting on the same channel and using the same BSSID.
- This is achieved using a virtual BSSID.
- great for VoWifi and 802.1x authentication deployments.
- Controller takes care of all roaming needs.
- No adjacent cell interference.

During desing try and place your AP's atleast 5 meters apart from each other. To prevent sideband signal interference.

Colocation design usually occurs in a MCA environment, but if it's used in a SCA = **Channel Stacking**. Each later of multiple AP's on a signal channel and using the same virtual BSSID is called **channel blanket or channel span**.