ET4394 Wireless Networking

Experimental Evaluation of Interference Impact on WiFi Packet corruption

by

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1. Theory

Cyclic Redundancy Check (CRC) is used to indicate whether the received data is valid or not. In our project we have used Field Check Sum (FCS), which is the data link layer implementation of CRC. The errors on the receiver side packets are generally indicated by a term called bit error rate(BER), which defines the number of errors in our data packets(headers inclusive), hence implying the probability of having error bits in received packets. BER improves depending on the coding used. In case of CRC,

$BER_{CRC8} > BER_{CRC16} > BER_{CRC32} > BER_{CRC64}$

In all the readings that have been taken, CRC32 is used(infered from the 32bit hex FCS field). This can be seen in Fig. 1,

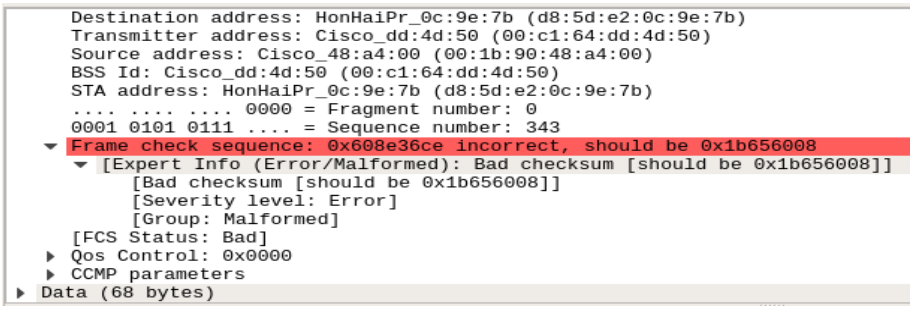


Figure 1: CRC Length

It should also be noted that the obtained values and the obtainable values will strictly depend on the Network Interface Card being used.

2. Objectives

The aim of this project is to show the inter relation between interference and packet corruption of WiFi packets in real life scenarios. To fulfill this purpose, wireshark, tshark are used for packet sniffing. Bash script is used for automating the whole process of packet collection and processing. MATLAB has been used for processing the data obtained into meaningful insights.
The Fig.2 shows a bad FCS packet with relevant information such as Signal strength(RSSI),

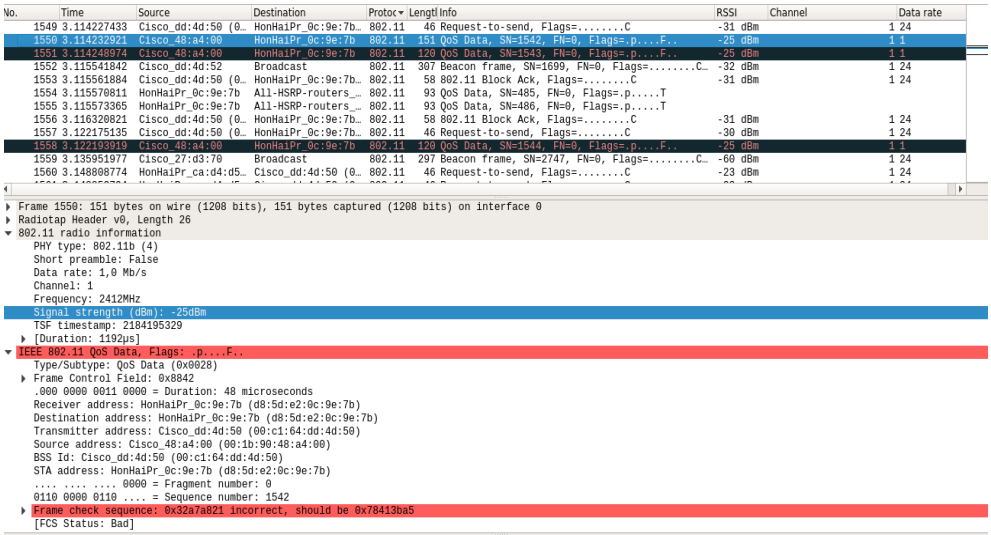


Figure 2: Wireshark GUI with error packet selected

3. Relating RSSI and CRC errors

RSSI - Received Signal Strength indicator($Signallevel + Noiselevel$) represents the signal strength calculated by the network card at particular frequency band. In our analysis we use RSSI values as representation of interference in the specific frequency band. We represent the corrupted packets whose FCS is corrupted.

4. Results

4.1. CASE 1:

Case 1 shows the results of experimentation conducted at home and Delft station (at night).
This case represents two scenarios with low interference.In fig.3 (blue - good packets, Red - corrupted Packets), the plots show the corruption of packets w.r.t to RSSI over 15 minutes time period. Both the plots indicate that the chances of packet loss increases with increase in RSSI values i.e increase in interference, while in the second plot the interference leads to packet corruption (red marks) in the beginning. This is being caused by us with the help of a mobile which is later removed(WiFi switched off on mobile) and the effect is seen with improve in good packets (blue marks).

4.2. CASE 2:

Case 2 shows the results of experimentation conducted at Aula centre TU Delft in evening when there are lots of people nearby, leading to high interference. Hence, with increasing interference (increasing RSSI), the probability or the chances of packet being corrupted increases(BER will increase) which can be clearly seen in the stacked bar graph of fig.4 and fig.5 . Both the figures represent the same scenario but the network cards used for reception of WiFi signals are different, which causes varied results.

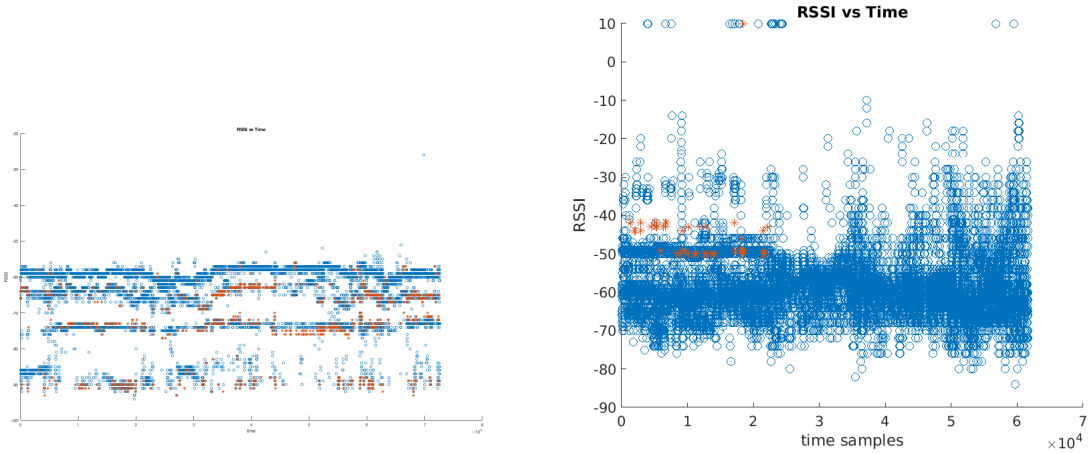
4.3. CASE 3:

Case 3 shows the results of experimentation conducted at study centre. In the beginning there are few students but later on lots of students enter the area, leading to high increase in interfernce levels. This can be seen in fig.6.

5. Conclusion

The above results clearly show the relation between Chances of Packet corruption w.r.t interference indicating that the chances of a WiFi packet being corrupted increases with increase in RSSI levels.

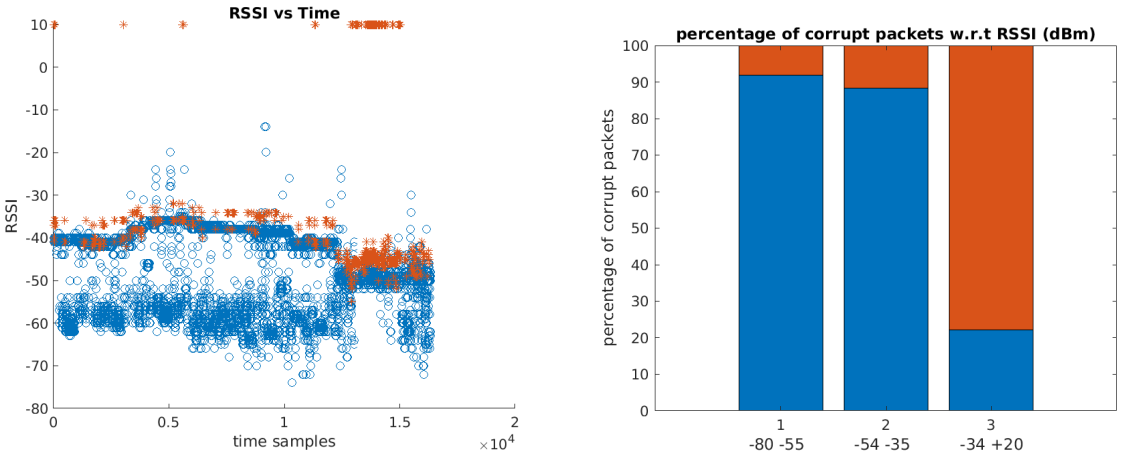
6. Figures



(a) Home

(b) Train station

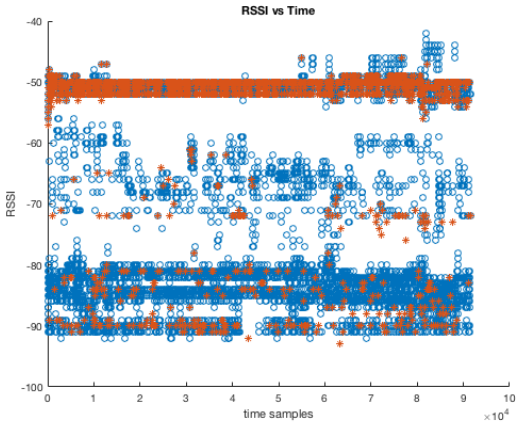
Figure 3: Scenario: Home(AirPort) and Train Station(RTL8723BE)



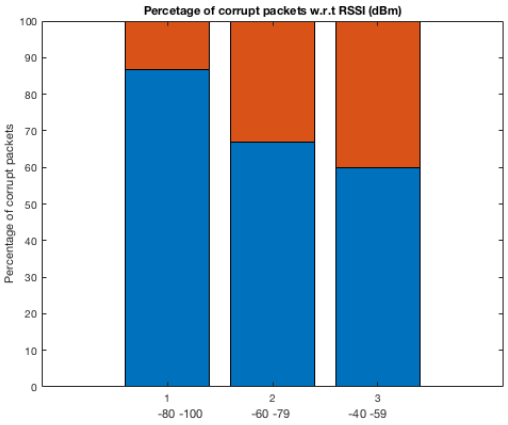
(a) Aula Evening RSSI vs time

(b) Aula Evening (percentage of corrupt packets w.r.t. RSSI)

Figure 4: Scenario: Aula Evening (RTL8723BE)

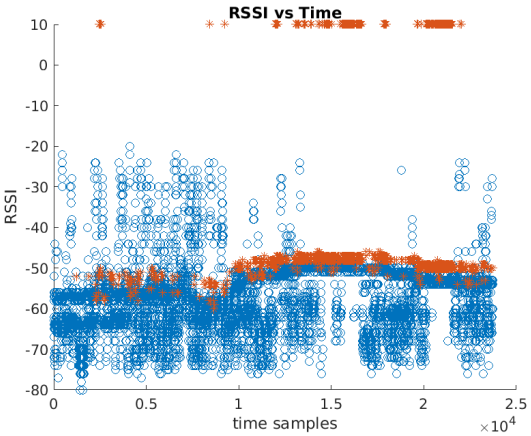


(a) Aula Evening RSSI vs time

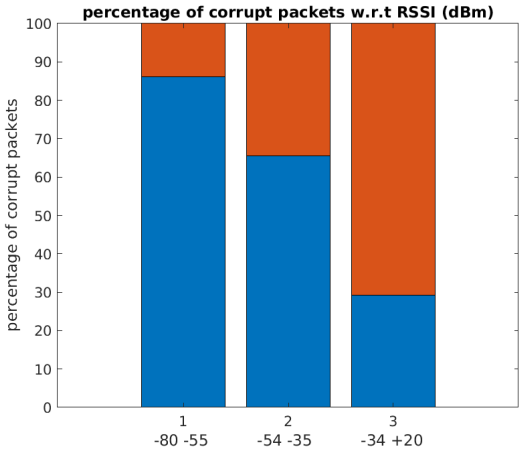


(b) Aula Evening (percentage of corrupt packets w.r.t. RSSI)

Figure 5: Scenario: Aula Evening (AirPort)



(a) Two People RSSI vs time



(b) Two People (percentage of corrupt packets w.r.t. RSSI)

Figure 6: Scenario: Two People (RTL8723BE)