IEEE P802.11
Wireless LANs

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| Proposed FD-TIG report text on system efficiency improvement using FD based collision detection  |
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Abstract

This document provides the proposed text on system level simulation results to contribute to Sections 6.1.3 and 6.2.2 in the FD TIF report framework [1]. The proposed text is mainly based on the FD TIG presentation [2].

# FD Benefits and Challenges

### 6.1.3 System level simulation for throughput gains

Simulation procedures and results are shown in [2] for comparison among three scenarios: 1) EDCA transmission without FD capabilities; 2) Symmetric FD transmission assuming both AP and STA have FD capability and 3) Symmetric FD transmission assuming that only AP has the FD capability. Throughput gain, which is defined as: throughput gain = (FD throughput – EDCA throughput)/EDCA throughput, is used as the criterion for comparison.

The simulation assumptions are summarized in the following table.

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| --- | --- |
| Number of APs | 1, 4 |
| Number of STAs per BSS | 10 |
| BSS Range | 10m |
| Bandwidth | 20MHz @ 2.4GHz |
| Self interference cancelation | 80dB~120dB |
| Traffic model | full buffer |
| Packet size | 1500 bytes |
| Data MCS | link adaptation |
| Antenna Number | AP 1, STA 1 |
| STA position | random (uniform distribution) within a certain BSS range |

The following figures illustrate the throughput gain of FD compared with EDCA. As shown in Figure 1 and Figure 2, in the single-BSS scenario, the throughput gain of symmetric FD can reach 125% when the SIC is higher than 110dB, and in the multi-BSS scenario, the throughput gain can be up to 194%. Please refer to [2] for more detailed description.



Figure 1 Symmetric FD simulation result (AP number = 1, STA number = 10)



Figure 2 Symmetric FD simulation result (AP number = 4, STA number = 10)

Figure 3 and Figure 4 show the throughput gain of the asymmetric FD. In the two-STA scenario, we assume two STAs stay on the left and right side of the AP, which is the typical relay scenario. In this case, the asymmetric FD can bring 27%~44% throughput gain compared with EDCA. In the random deployment scenario (STA number = 10), the throughput gain can be up to 27%.



Figure 3 Asymmetric FD simulation result (AP number = 1, STA number = 2)



Figure 4 Asymmetric FD simulation result (AP number = 1, STA number = 10)

### 6.2.2 System level simulation for latency enhancement

In the case of delay evaluation, we assume that a fixed amount of data packets are put into the queues of the AP and the STAs at the beginning of the simulation, and the latency for each packet is measured as: Delay = the time that the packet is successfully received by the receiver – the time that the packet is put into the queue of the transmitter. To evaluate the gain of full duplex on the latency performance, we define the latency gain with FD as: Latency gain = (EDCA latency – FD Latency)/EDCA latency.

The following figures show that up to 43% latency gain can be obtained in the symmetric FD case, and 8%~22% latency gain is achievable in the asymmetric FD case. Please see [2] for more details.



Figure 5 Symmetric FD simulation result for latency



Figure 6 Asymmetric FD simulation result for latency

# References

[1] 11-18-0498-00-00fd-framework-fd-tig-report

[2] 11-18-1222-01-00fd-system-level-simulation-results-of-full-duplex-transmission