

Cisco/UDel Meeting Minutes
June 17, 2016

Attendees: Jim Seymour, Len Cimini, Chien-Chung Shen, Li Li
Minutes Taken By: Li Li

A. Review slides

Slides #4 – Simulation results with lambda of 2.5. Last time, some of the results looks weird due to insufficient simulations.

Slides #6 – Simulation results with 4 subchannels and lambda of 10.

- Len: These are the average numbers, CDF would be a better way to see what is happening. For the two tables, the results are similar.
- Li: In this case, both WiFi and LAA will only transmit with 80 MHz or nothing even though channel bonding and carrier aggregation are adopted. Therefore, the results should be similar.

Slides #7 – Simulations with mixed traffic, and primary channels for all transmitters are the same.

- Jim: LAA's performance is a bit better than that of WiFi.
- Li: This is because the advantage of LAA and the setting of the LAA ED. If I decrease LAAED, LAA's performance

Slides #8 – Simulations with mixed traffic, and primary channels for all transmitters are different, (1,2,3,4) and (1,3,1,3).

- Li: In the case of (1,2,3,4). First of all, WiFi's overall performance is decreasing, and LAA's overall performance is improving. Also, two WiFi transmitters have similar performance.
- Li: WiFi's performance decreases. Since WiFi has to use certain patterns for channel bonding, they transmit with a single 20 MHz at most of time, which is also shown in the results.
- Li: WiFi #1 and WiFi #3 have similar performance, this is because they are using different channels as primary channels, and they transmit with a single 20 MHz at most of time, there will be no competitions among transmitters.
- Jim: Due to the flexibility of carrier aggregation, it is expected that LAA's performance is better than that of WiFi.
- Jim: Now the question is that, though LAA has some advantages in carrier aggregation, can we lower LAA's ED thresholds so that we can achieve fairness among WiFi and LAA?

Slides #9 – Simulations with 8 subchannels, and primary channels for all transmitters are different (1,4,5,8). In the first case, one LAA transmitter chooses 3 subchannels randomly, not matter they are idle or not. In the second case, a LAA transmitter will always try to occupy idle subchannels (at most 3).

- Jim: It is important to see whether LAA and WiFi can achieve fairness. Since WiFi community claims that LAA are occupying channel non-contiguously, it will degrade WiFi's performance. WiFi uses channel bonding other than carrier aggregation may have something to do with complexity. But if we can come up with some schemes to ensure fairness between WiFi and LAA, even though one is using carrier aggregation and the other is using channel bonding, that would be interesting. Then, we do not need to say that LAA has to use same techniques as WiFi does.

Slides #10/11 Simulations with 8 subchannels, and primary channels for all transmitters are different (1,2,5,6) and (1,1,5,5).

- Li: In the case of (1,2,5,6), since LAA's primary channels are adjacent to WiFi's primary channels. The probability of transmitting with 40 MHz decreases a lot for WiFi, so WiFi's performance decreases.
- Li: In the case of (1,1,5,5), WiFi #1 will compete with LAA #2 for primary channel 1, and WiFi #3 will compete with LAA #4 for primary channel 5. However, there are no competitions among WiFi transmitters. So, in the first table (LAA choose subchannels randomly), WiFi even outperforms LAA due to LAA #2 and LAA #4 may happen to choose the same channel. In the second table, LAA and WiFi have similar performance, but the overall performance is decreased.

Slides #12 Discussion

- Jim: I will take a look at some proposals to see what will be a good and typical band for LAA/802.11ac.
- Chien-Chung: I think maybe the channel bonding is even more restricted. If you look at the figures about channel bonding, they all start from one side.

Actions Items:

- **Adapting LAA's energy detection threshold to see whether LAA and WiFi can achieve fairness.**
- **Check the typical band for LAA, and check the channel bonding patterns for 802.11ac**
- **Work on the channel selection problem.**

Next meeting: Friday July 1st 1:15 - 2:15 pm (EST)