IEEE P802.11 Wireless LANs

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| Comments on Proposal of Relayed CCA mechanism |
| Date: 2021-03-01 |
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Abstract

This document proposes the Relayed CCA mechanism in TGbb.

# 1. Relayed Uplink CCA

The mandatory mode of operation is an FDD system with slotted ALOHA on the uplink. This means that we can expect the maximum uplink throughput to peak at about 18% of the uplink bandwidth, and actually drop if the offered load increases beyond that. To address this problem, the mandatory mode requires the use of a RTS/CTS mechanism, where STAs contend to send an uplink RTS, and the AP responds with a CTS that includes a NAV update. Since each LC STA is half duplex, and further could potentially implement a DRX mechanism when it is not transmitting, the CTS could be missed. The Relayed Uplink CCA can address this performance issue.

This document provides my Track Changes comments to Document 11-21/280r1.

[HB: I think this section should focus on modifying the RTS/CTS mechanism to address two use cases. In the first use case, we need to allow a STA to send an RTS on the uplink, and to receive a Relayed Uplink CCA on the downlink from the AP. What appears below is for the second use case, where an unsolicited Uplink CCA from the AP when a STA transmits a packet without a preceding RTS.]

For the Relayed Uplink CCA, the LC STA and LC AP operate in a full-duplex, FDD deployment. On the downlink, the CCA mechanism described in 17.3.6 cannot be used to prevent downlink collisions caused by simultaneous transmissions from neighboring LC APs. Such downlink collisions can be avoided by a dynamic resource allocation of the downlink resources in neighboring APs that is outside the scope of this standard. On the uplink, the legacy CCA mechanism of 802.11-2020 cannot prevent uplink collisions, because the LC STAs cannot receive uplink transmissions.

This uplink CCA problem can be addressed if the AP can relay an indication of an uplink channel busy condition to all STAs . In general, the AP could detect the transmission from any STA as described in 32.3.2.3.5.2 CCA requirements. Then, the AP may transmit multiple Uplink CTS frames to the LC STAs within its coverage whenever an LC STA is actively transmitting on the uplink. [HB: we should consider how we could indicate a detected collision to solve the hidden node problem]

When the AP receives a transmission from a STA or transmissions from multiple STAs, it may retransmit the received packet [why not simply send an Uplink CTS frame to all STAs on the downlink. This is a normal CTS frame, where the source address field contains the address of the AP and the destination address field contains the address of STA1. STA1 receives this frame while transmitting on the uplink to confirm it has access to the medium. Other STAs receive this frame to determine the uplink channel is now busy.]. The Duration field of this frame contains the content of the Duration field of the uplink packet, so all STAs can update their uplink NAV] [HB: we could possibly indicate a collision if the Uplink CTS frame destination address is the broadcast address]. if it does not have any packet in its queue. The retransmission would be a broadcast to all the STAs within its range, so that the STAs may be able to obtain the occupation status of the uplink channel from the assistance of the AP. STAs that successfully receive the retransmission from the AP would mark the medium ‘busy’ as in the CCA mechanism, except the sender(s) who are using the uplink channel.

When the AP has a packet to transmit, it stops the retransmission in the relayed CCA mechanism, and switches to the transmission of the new packet immediately.

[HB: we should update Figure 1 to show the uplink ACK appearing on the downlink]. Figure 1 illustrates an example of channel access with relayed CCA mechanism. The AP may retransmit packet received from STA1 and STA2 on the downlink channel. Other STAs could mark the uplink channel as ‘busy’ in the CCA.indication in order to avoid the collisions on the uplink channel. The AP could switch from retransmission of received packet to its own queue as shown in the example of Packet 3 and 4’s switch.

[HB: we need a Figure 2 to show what happens if the AP is in the middle of a downlink transmission when STA1 sends an uplink transmission. In this case, the Uplink CTS frame is delayed.]

Packet 4

**AP**

**STA1**

**STA2**

Packet 1

Retransmission

Packet 1

Backoff

Relayed CCA Busy

Packet 2

Packet 3

Retransmission Packet 3

Relayed CCA Busy

Delay (ns)

Delay (ns)

Delay (ns)

Figure 1 An example of channel access with relayed CCA mechanism