IEEE P802.11
Wireless LANs

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| EDCA and HCCA |
| Date: July 10, 2020 |
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Abstract

This document contains a proposed resolution for the following CIDs:

1. 4444

The baseline for this document is Draft P802.11REVmd D3.0.

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| --- | --- | --- | --- |
| **CID Identifiers** | **Comment** | **Proposed Change** | **Proposed Resolution** |
| CID 444410.23.3.2.21001.3Rison, Mark | "When the HC needs access to the WM to start a TXOP, the HC shall sense the WM. When the WM is determined to be idle at the TxPIFS slot boundary as defined in 10.3.7 (DCF timing relations), the HC shall transmit the first frame of any permitted frame exchange sequence, with the duration value set to cover the TXOP."This seems to allow any AP that claims to support HCCA to always transmit after PIFS, even if the access is not for HCCA. The permission to use PIFS should be constrained to HCCA contexts" | As it says in the comment | Revised - implement changes in <this document> under CID 4444, which makes changes in the direction suggested by the commenter by separating the EDCA HCCA sections. |

The comment requests that an EDCA AP does not use PIFS access by claiming it is an HC.

The proposed resolution attempts to facilitate this by separating the EDCA and HCCA sections, so that EDCA no longer falls under the HCF umbrella.

The changes are mostly editorial in nature, except for a few locations where HC is changed to the more generic term AP, to make the related text also apply for EDCA. Examples are the TS management interface and the QoS Control field.

The changes are intended to be orthogonal to the changes proposed for CID 4444 by Graham Smith in document 11-20/367r7.

Some examples of what the proposed changes would accomplish:

Clause 10.23 (HCF) currently has the following clauses (not exhaustive):

10.23 HCF

10.23.1 General

10.23.2 HCF contention based channel access (EDCA)

10.23.3 HCF controlled channel access (HCCA)

which would become:

10.23 EDCA and HCCA

10.23.1 General

10.23.2 Enhanced Distributed Channel Access (EDCA)

10.23.3 HCF Controlled Channel Access (HCCA)

There are currently two types of admission control that fall under a single main clause 10.23.24 (Admission control at the HC):

10.23.4 Admission control at the HC

10.23.4.2 Contention based admission control procedures

10.23.4.3 Controlled-access admission control

which would become:

10.23.4 Admission control

10.23.4.2 EDCA admission control

10.23.4.3 HCCA admission control

In 10.23.4.2 (EDCA admission control) two changes are made to locations where HC is referenced.

To indicate HCCA support, we may consider repurposing the QoS subfield (B9) of the Capability Information field to indicate only HCCA, rather than EDCA or HCCA:





B9 is currently not used to indicate EDCA support.

Changes to the QoS bit in the Capability Information field are not included in this document yet.

We may need to redefine dot11QoSOptionImplemented, which may need to be split also.

**----- Start of proposed changes ----**

(Note: references are not changed, assuming they will be updated automatically when a clause title is changed.)

**3.2 Definitions specific to IEEE Std 802.11**

179.49 change as shown

**controlled access phase (CAP):** A time period during which the hybrid coordinator (HC) maintains control of the medium using the hybrid coordination function (HCF) controlled channel access (HCCA) procedure. It might span multiple consecutive transmission opportunities (TXOPs) and can contain polled TXOPs.

186.27 change as shown

**hybrid coordination function (HCF):** A coordination function that provides contention free access to provide quality-of-service (QoS) stations (STAs) with prioritized and parameterized QoS access to the wireless medium (WM), while continuing to support non-QoS STAs for best-effort transfer. The HCF is based on the functionality provided by HCF controlled channel access (HCCA).

186.39 change as shown

**hybrid coordinator (HC)**: A type of coordinator, defined as part of the quality-of-service (QoS) facility, that implements the frame exchange sequences and medium access control (MAC) service data unit (MSDU) handling rules defined by the hybrid coordination function (HCF) controlled channel access (HCCA).

**6.3.25 TS management interface**

425.23, in Table 6-1 (Supported TS management primitives) change "HC" to "AP" (2x).

**9.2.4.5 QoS Control field**

796.50 change as shown

When not transmitted within a DMG PPDU, each QoS Control field comprises five or eight subfields, as defined for the particular sender (AP or non-AP STA) and frame type and subtype. The usage of these subfields and the various possible layouts of the QoS Control field are described in 9.2.4.5.2 (TID subfield) to 9.2.4.5.12 (Receiver Service Period Initiated (RSPI) subfield) and shown in Table 9-10 (QoS Control field).

797.15, in Table 9-10 (QoS Control field), change "HC" to "AP".

797.18, in Table 9-10 (QoS Control field), change "HC" to "AP".

**9.2.4.5.3 EOSP (end of service period) subfield**

798.46 change as shown

The EOSP subfield is 1 bit in length and is used by the AP to indicate the end of the current service period (SP) and by a DMG STA to indicate the end of the current SP or the end of the current allocated CBAP with a destination AID that is not the broadcast AID. The AP sets the EOSP subfield to 1 in its transmission and retransmissions of the SP’s final frame to end an SP and sets it to 0 otherwise. To end an SP allocation or a CBAP allocation with a destination AID that is not the broadcast AID, the DMG STA sets the EOSP subfield to 1 in its final frame transmission and retransmissions within the allocation; otherwise, the DMG STA sets the EOSP subfield to 0.

The mesh STA uses the EOSP subfield to indicate the end of the current mesh peer service period in which it operates as the owner. The mesh STA sets the EOSP subfield to 1 in its transmission and retransmissions of the mesh peer service period’s final frame to end a mesh peer service period, and sets it to 0 otherwise. See 14.14.9.4 (Termination of a mesh peer service period) for details.

If dot11RobustAVStreamingImplemented is true, then the AP sets the EOSP subfield to 1 in a GCR-SP group addressed frame in order to indicate that no more GCR-SP frames of that group address are to be transmitted by the AP until the next scheduled SP for this GCR-SP stream.

**10. MAC sublayer functional description**

**10.1 Introduction**

1714.7 change as shown

The MAC functional description is presented in this clause. The architecture of the MAC sublayer, including the distributed coordination function (DCF), Enhanced Distributed Channel Access (EDCA), HCF Coordinated Channel Access (HCCA), the mesh coordination function (MCF), and their coexistence in an IEEE 802.11 LAN are introduced in 10.2 (MAC architecture). These functions are expanded on in 10.3 (DCF), 10.23 (HCF), and 10.24 (Mesh coordination function (MCF)).

**10.2 MAC architecture**

**10.2.1 General**

**Figure 10-1—Non-DMG non-CMMG non-S1G STA MAC architecture**

1714.42 delete "HCF" and the associated accolade

1714.44 change "HCF Contention Access (EDCA)" to "Enhanced Distributed Channel Access (EDCA)"

1714.42 change "Used for Contention Services, basis for HCF and MCF" to "Basis for EDCA, HCCA, and MCF"

**Figure 10-2—S1G STA MAC architecture**

1715.6 delete "Hybrid Coordination Function (HCF)" and the associated accolade

1715.13 change "HCF Contention Access (EDCA)" to "EDCA"

1717.15 change as shown

**10.2.3 QoS facility**

**10.2.3.1 General**

The QoS facility includes additional coordination functions called EDCA and HCCA that are usable only in QoS network configurations. EDCA and HCCA shall be implemented in all QoS STAs except mesh STAs. Instead, mesh STAs implement the MCF. EDCA and HCCA combine functions from the DCF with some enhanced, QoS-specific mechanisms and frame subtypes to allow a uniform set of frame exchange sequences to be used for QoS data transfers. EDCA uses a contention based channel access method, for contention based transfer. HCCA uses a controlled channel access method, for contention free transfer.

1717.43 change as shown

**10.2.3.2 Ehanced distributed channel access (EDCA)**

1718.26 change as shown

The following rules apply for Enhanced distributed channel access (EDCA):

1720.29 change as shown

The operation rules of Enhanced distributed channel access (EDCA) are defined in 10.23.2 (HCF contention based channel access (EDCA)).

1721.40 change as shown

**10.2.5 Combined use of DCF, EDCA and HCCA**

The DCF, EDCA and HCCA are defined so they may operate within the same BSS. EDCA and HCCA operate sequentially. Sequential operation allows the polled and contention based access methods to alternate, within intervals as short as the time to transmit a frame exchange sequence, under rules defined in 10.23 (HCF).

1825.43 change as shown

**10.23 EDCA and HCCA**

**10.23.1 General**

Under EDCA and HCCA, the basic unit of allocation of the right to transmit onto the WM is the TXOP. Each TXOP is defined by a starting time and a defined maximum length. In a non-DMG BSS, the TXOP may be obtained by a STA winning an instance of EDCA contention (see 10.23.2 (HCF contention based channel access (EDCA))) or by a STA receiving a QoS (+)CF-Poll frame (see 10.23.3 (HCF controlled channel access (HCCA))). The former is called EDCA TXOP, while the latter is called HCCA TXOP or polled TXOP.

In a DMG BSS, the EDCAF operates only during CBAPs. Operation of the EDCAF is suspended at the end of a CBAP and is resumed at the beginning of the following CBAP. See 10.39.5 (Contention based access period (CBAP) transmission rules) and 10.39.5 (Contention based access period (CBAP) transmission rules) for additional rules regarding contention based access in DMG BSSs.

HCCA is not used by either DMG or S1G STAs.

**10.23.2 Enhanced Distributed Channel Access (EDCA)**

**10.23.2.1 Reference model**

The EDCA channel access protocol is derived from the DCF procedures described in 10.3 (DCF) by adding four independent enhanced distributed channel access functions (EDCAFs) to provide differentiated priorities to transmitted traffic, through the use of four different access categories (ACs).

**10.23.3.2 HCCA procedure**

**10.23.3.2.1 General**

1845.1 change as shown

The HC gains control of the WM as needed to send QoS traffic and to issue QoS (+)CF-Poll frames to STAs by waiting a shorter time between transmissions than the STAs using the EDCA procedures. The duration values used in QoS frame exchange sequences reserve the medium to permit completion of the current sequence. TXOPs started using the HCCA procedure occur during a CAP.

1844.28

**10.23.3 HCF Controlled Channel Access (HCCA)**

1851.1 change as shown

**10.23.4 Admission control**

**10.23.4.1 General**

An IEEE 802.11 network may use admission control to administer policy or regulate the available bandwidth resources. Admission control is used to attempt to provide a guarantee of the amount of time that a STA has available to access the channel. The AP or HC is used to administer admission control in the network. As the QoS facility supports two access mechanisms, there are two distinct admission control mechanisms: one for contention based access and another for controlled access.

Admission control in an HC depends on vendors’ implementation of the scheduler, available channel capacity, link conditions, retransmission limits, and the scheduling requirements of a given stream. All of these criteria affect the admissibility of a given stream. If the HC has admitted no streams that require polling, it might not find it necessary to perform the scheduler or related HC functions.

1851.18 change as shown

**10.23.4.2 EDCA admission control**

**10.23.4.2.1 General**

1851.47 change as shown

A STA shall transmit an ADDTS Request frame to the AP in order to request admission of traffic in any direction (i.e., uplink, downlink, direct, or bidirectional) employing an AC that requires admission control. The ADDTS Request frame shall contain the UP associated with the traffic and shall indicate EDCA as the access policy. The AP shall associate the received UP of the ADDTS Request frame with the appropriate AC per the UP-to-AC mappings described in 10.2.3.2 (HCF contention based channel access (EDCA)).

The AP when dot11SSPNInterfaceActivated is true shall admit a non-AP STA’s request based on dot11NonAPStationAuthAccessCategories stored in that non-AP STA’s dot11InterworkingEntry, which is part of the dot11InterworkingTable. The dot11InterworkingEntry specifies the EDCA access classes and throughput limitations on each access class for which a non-AP STA is permitted to transmit.

1853.20 change as shown

**10.23.4.3 HCCA admission control**

**10.24.2 MCF contention based channel access**

1863.8 change as shown

MCF implements EDCA (see 10.23.2 (HCF contention based channel access (EDCA))).

2109.31 change as shown

The SO-Backoff function begins or resumes when the SO condition is confirmed. The SO-Backoff function is independent of all other backoff functions but follows the EDCA procedure as defined in 10.23.2 (Enhanced Distributed Channel Access (EDCA)).

**11.2.3.5 Power management with APSD**

**11.2.3.5.1 Power management with APSD procedures**

2183.33 change as shown

e) If the SI is nonzero, a STA using scheduled SP shall first wake up at the service start time to receive downlink individually addressed and/or GCR-SP group addressed BUs buffered and/or to receive polls from the AP or HC. The STA shall wake up subsequently at a fixed time interval equal to the SI.

<no change was needed here, because the text already cites "AP or HC">

**11.4 TS operation**

**11.4.1 Introduction**

2246.9 change as shown

There are three types of traffic specifications: the TSPEC, the DMG TSPEC, and the PTP TSPEC.

A TSPEC describes the traffic characteristics and the QoS requirements of a TS. The main purpose of the TSPEC is to reserve resources within the AP or HC and, in the case of HCCA and HEMM access policies, to modify the HC’s scheduling behavior. It also allows other parameters to be specified that are associated with the TS, such as a traffic classifier and ack policy.

Editor: Throughout 11.4 (TS operation), replace "HC" with "AP or HC" similar to the above change.

**11.23.5.3 Reporting and session control with SSPN**

2435.20 change "HC" to "AP"

2435.27 change "HC" to "AP"

2435.35 change "HC" to "AP"

2435.42 change "HC" to "AP"

(At 2435.50 HC is specifically related to HCCA, so no change is needed.)

**B.2.2 General abbreviations for Item and Support columns**

3575.31

QD quality-of-service (QoS) enhanced distributed channel access (EDCA)??

QP quality-of-service (QoS) hybrid coordination function (HCF) controlled channel access (HCCA)??

**Annex C**

**(normative)**

**ASN.1 encoding of the MAC and PHY MIB**

4271.47 change as shown

It is written after the AP transmits an ADDTS Response

frame to the non-AP STA or after the AP includes a RIC element in a

Reassociation Response frame.

**Annex G**

4396.50 change "hcf-sequence" to "qos-sequence"

4397.4 change "hcf-sequence" to "qos-sequence"

4397.7 change "hcf-sequence" to "qos-sequence"

4631.47 change as shown

**T.3.2 AP or HC with admission control mandatory**

If no “empty” channels are available, then an AP with the ACM (admission control mandatory) bit in the EDCA Parameter Set element set for AC\_VI or AC\_VO should implement a channel selection procedure to share with one or more APs, in the following preference order:

a) Non-QoS AP where the EDCA Parameter Set element is not present in the Beacon frame

b) QoS AP with the ACM bit set for AC\_VI or AC\_VO and with an indication of support for QLoad reporting (i.e., the QLoad Report field equal to 1 in the Extended Capabilities element)

c) HC with an indication of support for QLoad reporting (i.e., the QLoad Report field equal to 1 in the Extended Capabilities element)

d) HC with no indication of support for QLoad reporting

f) QoS AP where the EDCA Parameter Set element is present in the Beacon frame and the ACM bit is not set for AC\_VI or AC\_VO

**T.3.3 HC**

If no “empty” channels are available, then an HC should implement a channel selection procedure to share with one or more APs, in the following preference order:

a) Non-QoS AP where the EDCA Parameter Set element is not present in the Beacon frame

b) QoS AP where the EDCA Parameter Set element is present in the Beacon frame and the ACM bit is not set for AC\_VI or AC\_VO

c) QoS AP with the ACM bit set for AC\_VI or AC\_VO and with an indication of support for QLoad reporting (i.e., the QLoad Report field equal to 1 in the Extended Capabilities element)

d) HC with an indication of support for QLoad reporting (i.e., the QLoad Report field equal to 1 in the Extended Capabilities element)

e) QoS AP with the ACM bit set for AC\_VI or AC\_VO and with no indication of support for QLoad reporting

f) HC with no indication of support for QLoad reporting

**T.3.4 Channel selection procedures**

4633.9 modify as shown

3) If this list contains more than one channel, filter the list for the minimum count of HCs with no indication of support for QLoad reporting.

4) If this list contains more than one channel, filter the list for the minimum count of HCs with an indication of support for QLoad reporting (i.e., the QLoad Report field equal to 1 in the Extended Capabilities element).

5) If this list contains more than one channel, filter the list for the minimum count of QoS APs with the ACM bit set for AC\_VI or AC\_VO and with an indication of support for QLoad reporting (i.e., the QLoad Report field equal to 1 in the Extended Capabilities element).

i) If this list contains more than one channel and for an HC:

1) Filter the list for the minimum count of HCs with no indication of support for QLoad reporting.

2) If this list contains more than one channel, filter the list for the minimum count of QoS APs with the ACM bit set for AC\_VI or AC\_VO and with no indication of support for QLoad reporting.

3) If this list contains more than one channel, filter the list for the minimum count of HCs with an indication of support for QLoad reporting (i.e., the QLoad Report field equal to 1 in the Extended Capabilities element).

**--- End of proposed changes ---**