IEEE P802.11
Wireless LANs

|  |
| --- |
| CC36 CR on 5196 and 7620 |
| Date: 2021-11-27 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Guogang Huang | Huawei |  |  | huangguogang1@huawei.com |
| Ming Gan |  |  |  |
| Yuchen Guo |  |  |  |
| Yunbo Li |  |  |  |
| Yiqing Li |  |  |  |
| Zhenguo Du |  |  |  |
| Rob Sun |  |  |  |
| Mengyao Ma |  |  |  |

Abstract

This submission contains proposed comment resolutions to comments on P802.11be D1.0.

CID 5196 and 7620 are resolved.

Revisions:

* Rev 0: Initial version of the document.
* Rev 1-3: Editorial changes
* Rev 4: Define a new SCSID subelement instead of restricting the SCSID value

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| CID | Page.Line | Clause Number | Comment | Proposed Change | Resolution |
| 5196 | 297.62 | 35.6 | need to define a QoS report for the low-latency traffic stream, maybe we can reuse the existing measurement report, e.g. Transmit Stream/Category Measurement Request/Report | As in comment | REVISEDAgreed in principle. The current Transmit Stream/Category Measurement Request/Report is modified to address the measurement for the low-latency traffic stream.Instructions to the editor:Please make the changes to the spec as shown in 11/21-1273r5 |
| 7620 |  |  | The MAC needs to be able to measure the delay of data delivery, from the time when data is passed from the upper layer till successful delivery at the peer MAC. This is fundamental to see if there is improvement in delay. | As in comment. | REVISEDAgreed in principle. The current Transmit Stream/Category Measurement Request/Report is modified to address the measurement for the low-latency traffic stream.Instructions to the editor:Please make the changes to the spec as shown in 11/21-1273r5 |

**Discussion:**

We have agreed that the SCS mechanisim is used by a STA to inform the AP of the QoS requirement of a low-latency traffic flow.

For a low-latency traffic identified by the SCSID, one important QoS parameter is the MSDU delivery ratio given the delay bound. In order to try to meet the QoS requirement, a corresponding measurement report needs to be defined. Thus the AP or AP MLD can take actions to improve the experienced QoS according to the received measurement report.

For simplicity, we prefer to reuse the current Transmit Stream/Category Measurement Request/Report to realize it.

Q&A:

Q: why do we need to define a new trigger condition for the QoS measurement of the delay-sensitive traffic, i.e. MSDU delivery ratio?

A: For the 802.11 media, the problem (i.e. how to meet the QoS requirement of the delay-sensitive traffic) is not as “guaranteed latency” and “guaranteed zero congestion” (black-and-white), but as, “a particular loss rate within a particular delay bound” (a gray scale). For the details, please refer to doc.802.11-19/1266r0.

***TGbe editor: modify the following subclause after 9.4.2.20.11 of Draft REVme 1.0 as:***

9.4.2.20.11 Transmit Stream/Category Measurement Request

The Transmit Stream/Category Measurement applies to TIDs for traffic streams associated with TSPECs, to TIDs for traffic categories for QoS traffic without TSPECs and also to SCSIDs for SCS streams with QoS Characteristics elements. The Measurement Request field corresponding to a Transmit Stream/Category Measurement request is shown in Figure 9-252 (Measurement Request field format for Transmit Stream/Category Measurement Request).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Randomization Interval | Measurement Duration | Peer STA Address | Traffic Identifier | Bin 0 Range | Optional Subelements |
| Octets: | 2 | 2 | 6 | 1 | 1 | variable |

**Figure 9-252 Measurement Request field format**

The Randomization Interval field is set to the maximum random delay in the measurement start time, in units of TUs. The use of the Randomization Interval field is described in 11.10.3 (Measurement start time). When requesting a triggered Transmit Stream/Category Measurement, the randomization interval is not used and the Randomization Interval field is reserved. See 11.10.9.8 (Transmit Stream/Category Measurement report).

The Measurement Duration is set to the duration of the requested measurement, in units of TUs except when setting up a triggered QoS measurement, when it is not used and is set to 0.

The Peer STA Address contains a MAC address indicating the RA in the MSDUs to be measured.

The Traffic Identifier field contains the TID subfield as shown in Figure 9-253 (Traffic Identifier field format).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 | B3 | B4 | B7 |
|  | Reserved  | TID |
| Bits: | 4 | 4 |
| * Traffic Identifier field format
 |

The TID subfield indicates the TC or TS for which traffic is to be measured.

Bin 0 Range indicates the delay range of the first bin (Bin 0) of the Transmit Delay Histogram, in units of TUs. The Bin 0 Range value is used to calculate the delay ranges of the other 5 bins making up the histogram. The delay range for each bin increases in a binary exponential fashion as described in 9.4.2.21.11 (Transmit Stream/Category Measurement report).

The Optional Subelements field contains zero or more subelements. The subelement format and ordering of subelements are defined in 9.4.3 (Subelements).

The Subelement ID field values for the defined subelements are shown in Table 9-148 (Optional subelement IDs for Transmit Stream/Category Measurement Request).

|  |
| --- |
| * Optional subelement IDs for Transmit Stream/Category Measurement Request
 |
| Subelement ID | Name | Extensible |
| 0 | Reserved |  |
| 1 | Triggered Reporting | Yes |
| 2 | SCSID | No |
| 3–220 | Reserved |  |
| 221 | Vendor Specific | Vendor defined |
| 222–255 | Reserved |  |

The Subelement ID field is defined in Table 9-148 (Optional subelement IDs for Transmit Stream/Category Measurement Request).

The Triggered Reporting subelement is used to specify measurement trigger thresholds. It is present only if requesting triggered transmit stream/category measurement reporting. The Triggered Reporting subelement format is shown in Figure 9-254 (Triggered Reporting subelement format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Subelement ID | Length | Triggered Reporting |
| Octets: | 1 | 1 | 6 |
| * Triggered Reporting subelement format
 |

The Subelement ID field is defined in Table 9-148 (Optional subelement IDs for Transmit Stream/Category Measurement Request).

The Length field is defined in 9.4.3 (Subelements).

The Triggered Reporting field is as shown in Figure 9-255 (Triggered Reporting field format).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Trigger Conditions | Average Error Threshold | Consecutive Error Threshold | Delay Threshold | Measurement Count | Trigger Timeout |
| Octets: | 1 | 1 | 1 | 1 | 1 | 1 |
| * Triggered Reporting field format
 |

Trigger Conditions is a bit-field that specifies reporting triggers when requesting a triggered transmit stream/category measurement. The format of the Trigger Conditions bit-field is shown in Figure 9-256 (Trigger Conditions bit-field format).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 B7 |
|  | Average | Consecutive | Delay | MSDU Delivery Ratio | Reserved |
| Bits: | 1 | 1 | 1 | 1 | 4 |

**Figure 9-256 Trigger Condition bit-field format**

* The Average bit is set to 1 to request that a Transmit Stream/Category Measurement report be generated when the number of MSDUs for the TC or TS given by the TID that are discarded out of the number of preceding MSDUs specified in Measurement Count is greater than or equal to the value given in Average Error Threshold. MSDUs discarded due to the number of transmit attempts exceeding dot11ShortRetryLimit, or due to the MSDU lifetime having been reached, are counted.
* The Consecutive bit is set to 1 to request that a Transmit Stream/Category Measurement report be generated when the number of MSDUs for the TC or TS given by the TID that are discarded in succession is greater than or equal to the value given in Consecutive Error Threshold. MSDUs discarded due to the number of transmit attempts exceeding dot11ShortRetryLimit, or due to the MSDU lifetime having been reached, are counted.
* The Delay bit is set to 1 to request that a Transmit Stream/Category Measurement report be generated when the number of consecutive MSDUs for the TC or TS given by the TID that experience a transmit delay greater than or equal to the value specified in the Delay Threshold subfield is greater than or equal to the value given in Delayed MSDU Count. Delay is measured from the time the MSDU is passed to the MAC until the point at which the entire MSDU has been successfully transmitted, including receipt of the final Ack frame from the peer STA if the QoSAck service class is being used.

The MSDU Delivery Ratio bit is set to 1 to request that a Transmit Stream/Category Measurement report be generated when the experienced MSDU delivery ratio for the SCS stream given by the SCSID being lower than the value specified in the MSDU Delivery Ratio field in the QoS Characteristics element.

The Average Error Threshold field contains a value representing the number of discarded MSDUs to be used as the threshold value for the average trigger condition(#291). The field is reserved if the Average Error Threshold subfield of the Trigger Conditions (#291)subfield is 0.

The Consecutive Error Threshold field contains a value representing the number of discarded MSDUs to be used as the threshold value for the consecutive trigger condition. The field is reserved if the Consecutive Error Threshold subfield of the Trigger Conditions (#291)subfield is 0.

The Delay Threshold field contains two subfields as shown in Figure 9-257 (Delay Threshold subfield format). The Delay Threshold field is reserved if the Delay Threshold subfield of the Trigger Conditions (#291)subfield is 0.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B7 |
|  | Delayed MSDU Range  | Delayed MSDU Count |
| Bits: | 2 | 6 |
| * Delay Threshold subfield format
 |

The Delayed MSDU Range field contains a value representing the MSDU transmit delay at or above which an MSDU is counted toward the Delayed MSDU Count threshold. The Delayed MSDU Range field is encoded as a value representing the lower bound of a bin in the Transmit Delay Histogram as shown in Table 9-149 (Delayed MSDU Range Definitions). The Transmit Delay Histogram is defined in 9.4.2.21.11 (Transmit Stream/Category Measurement report).

|  |
| --- |
| * Delayed MSDU Range Definitions
 |
| Delayed MSDU Range | Condition |
| 0 | Transmit Delay = Lower Bound of Bin 2 |
| 1 | Transmit Delay = Lower Bound of Bin 3 |
| 2 | Transmit Delay = Lower Bound of Bin 4 |
| 3 | Transmit Delay = Lower Bound of Bin 5 |

The Delayed MSDU Count field contains a value representing the number of MSDUs to be used as the threshold value for the delay trigger condition.

The Measurement Count field contains a number of MSDUs. This value is used to calculate an average discard count for the average trigger condition and the MSDU delivery ratio trigger condition. It is also used in place of measurement duration in determining the scope of the reported results when a report is triggered; see 11.10.9.8 (Transmit Stream/Category Measurement report).

The Trigger Timeout field contains a value, in units of 100 TU, during which a measuring STA does not generate further triggered transmit stream/category measurement reports after a trigger condition has been met. See 11.10.9.8 (Transmit Stream/Category Measurement report).

The SCSID subelement contains a SCSID field as shown in Figure 9-xxx (SCSID subelement format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Subelement ID | Length | SCSID |
| Octets: | 1 | 1 | 1 |
| Figure 9-xxx SCSID subelement format |

The SCSID field indicates the SCSID for which SCS stream with the TID specified in the Traffic Identifier field is to be measured.

The Vendor Specific subelement has the same format as the Vendor Specific element (see 9.4.2.25 (Vendor Specific element)). Zero or more Vendor Specific subelements are included in the list of optional subelements.

***TGbe editor: modify the following subclause after 9.4.2.21.11 of Draft REVme 1.0 as:***

9.4.2.21.11 Transmit Stream/Category Measurement Report

The Transmit Stream/Category Measurement report applies to TIDs for Traffic Streams associated with TSPECs , to TIDs for Traffic Categories for QoS traffic without TSPECs and also to SCSIDs for SCS streams with QoS Characteristics elements. The format of the Measurement Report field corresponding to a Transmit Stream/Category Measurement report is shown in Figure 9-310 (Measurement Report field format for Transmit Stream/Category Measurement report).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Actual Measurement Start Time | Measurement Duration | Peer STA Address | Traffic Identifier | Reporting Reason | Transmitted MSDU Count |
| Octets: | 8 | 2 | 6 | 1 | 1 | 4 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | MSDU Discarded Count | MSDU Failed Count | MSDU Multiple Retry Count | QoS CF-Polls Lost Count | Average Queue Delay | Average Transmit Delay |
| Octets: | 4 | 4 | 4 | 4 | 4 | 4 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Bin 0 Range | Bin 0 | Bin 1 | Bin 2 | Bin 3 | Bin 4 | Bin 5 | Optional Subelements |
| Octets: | 1 | 4 | 4 | 4 | 4 | 4 | 4 | variable |

**Figure 9-310 Measurement Report field format for Transmit Stream/Category Measurement report**

The Actual Measurement Start Time field is set to the TSF at the time at which the measurement started, or for a triggered Transmit Stream/Category Measurement report, the TSF value at the reporting QoS STA when the trigger condition was met.

The Measurement Duration field is set to the duration over which the Transmit Stream/Category Measurement report was measured, in units of TUs. In a triggered Transmit Stream/Category Measurement report, metrics are reported over a number of transmitted MSDUs rather than a duration; hence Measurement Duration is set to 0; see 11.10.9.8 (Transmit Stream/Category Measurement report).

The Peer STA Address field contains a MAC address indicating the RA for the measured frames.

The Traffic Identifier field contains the TID subfield as shown in Figure 9-204 (Measurement Request field format for Transmit Stream/Category Measurement Request). The TID subfield indicates the TC or TS for which traffic was measured.

The Reporting Reason field is a bit field indicating the reason that the measuring QoS STA sent the transmit stream/category measurement report. The Reporting Reason field is shown in Figure 9-311 (Reporting Reason field format).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3 | B4 B7 |
|  | Average Trigger | Consecutive Trigger | Delay Trigger | MSDU Delivery Ratio Trigger | Reserved |
| Bits: | 1 | 1 | 1 | 1 | 4 |

**Figure 9-311 Reporting Reason field format**

* The Average Trigger bit set to 1 indicates that the Transmit Stream/Category Measurement report was generated as a triggered report due to the Average Error trigger.
* The Consecutive Trigger bit set to 1 indicates that the Transmit Stream/Category Measurement report was generated as a triggered report due to the Consecutive Error trigger.
* The Delay Trigger bit set to 1 indicates that the Transmit Stream/Category Measurement report was generated as a triggered report due to the delay exceeding the Delay Threshold.
* The MSDU Delivery Ratio Trigger bit set to 1 indicates that the Transmit Stream/Category Measurement report was generated as a triggered report due to the MSDU delivery ratio for the SCS stream given by the SCSID being lower than the value specified in the MSDU Delivery Ratio field in the QoS Characteristics element.

When a Transmit Stream/Category Measurement report is sent as a direct response to a Transmit Stream/Category Measurement request and not as a triggered Transmit Stream/Category Measurement report, all bit fields in the Reporting Reason field are set to 0. This is termed a requested Transmit Stream/Category Measurement report. Within a triggered Transmit Stream/Category Measurement report, more than one bit field in the Reporting Reason field might be set to 1 if more than one trigger condition was met.

The Transmitted MSDU Count, MSDU Failed Count, MSDU Discarded Count, MSDU Multiple Retry Count, QoS CF-Polls Lost Count, Average Queue Delay, Average Transmit Delay, and delay histogram fields relate to transmissions to the QoS STA given in the Peer STA Address field. Metrics are reported over the Measurement Duration, or for triggered transmit stream/category measurements, over the Measurement Count. Any counter that increments to a value of $2^{31}-1$ terminates the measurement.

The Transmitted MSDU Count field contains the number of MSDUs for the TC or the TS specified by the TID that were successfully transmittedt. The Transmitted MSDU Count field contains the number of MSDUs for the SCS stream specified by the SCSID that were successfully transmitted within the delay bound specified in the Delay Bound field in the relevant QoS Characteristics elemen.

The MSDU Discarded Count field contains the number of MSDUs for the TC or the TS specified by the TID that were discarded due either to the number of transmit attempts exceeding dot11ShortRetryLimit, or due to the MSDU lifetime having been reached. The MSDU Discarded Count field contains the number of MSDUs for the SCS stream specified by the SCSID that were discarded due to the number of transmit attempts exceeding QSRC[AC], the MSDU lifetime, or the MSDU delay bound having been reached.

The MSDU Failed Count field contains the number of MSDUs for the TC or the TS specified by the TID that were discarded due to the number of transmit attempts exceeding dot11ShortRetryLimit. The MSDU Failed Count field contains the number of MSDUs for the SCS stream specified by the SCSID that were discarded due to the number of transmit attempts exceeding QSRC[AC].

The MSDU Multiple Retry Count field contains the number of MSDUs for the TC or the TS specified by the TID that were successfully transmitted after more than one retransmission attempt. The MSDU Multiple Retry Count field contains the number of MSDUs for the SCS stream specified by the SCSID that were successfully transmitted after more than one retransmission attempt.

The QoS CF-Polls Lost Count field contains the number of QoS (+)CF-Poll frames that were transmitted where there was no response from the QoS STA. QoS CF-Polls Lost Count are returned only if the reporting QoS STA is contained within an AP and the TID is for a TS. This field is set to 0 when QoS CF-Polls Lost Count is not returned.

The Average Queue Delay field is the average queuing delay of the frames (MSDUs) that are passed to the MAC for the indicated peer STA address and the indicated traffic identifier. Queue Delay is expressed in TUs and is measured from the time the MSDU is passed to the MAC until the point at which the first or only corresponding MPDU begins transmission.

The Average Transmit Delay field is the average delay of the frames (MSDUs) that are successfully transmitted for the indicated Peer STA Address and TID or SCSID. Average Transmit Delay is measured from the time the MSDU is passed to the MAC until the point at which the entire MSDU has been successfully transmitted, including receipt of the final Ack frame from the peer STA if the QoSAck service class is being used. Average Transmit delay is expressed in units of TUs.

The Bin 0 Range field value indicates the delay range of the first bin (Bin 0) of the Transmit Delay Histogram, in units of TUs. It is also used to calculate the delay ranges of the other five bins making up the histogram. The delay range for each bin increases in a binary exponential fashion as follows:

For example, if the Bin 0 Range field value is 10 TUs, the bin delay ranges are as defined in Table 9-171 (Delay definitions for a Transmit Stream/Category Measurement report for a Bin 0 Range field value of 10 TU).

|  |
| --- |
| * Delay definitions for a Transmit Stream/Category Measurement report for a Bin 0 Range field value of 10 TU
 |
| Bin  | Measured MSDU Transmit Delay (TUs) |
| 0 | Delay < 10 |
| 1 | 10  Delay < 20 |
| 2 | 20  Delay < 40 |
| 3 | 40  Delay < 80 |
| 4 | 80  Delay < 160 |
| 5 | 160  Delay  |

To compute the value reported in Bin *i* (i.e., *Bi* for *i* = 0, 1...5 of the Transmit Delay Histogram), the STA initializes all bin values to 0. For each MSDU successfully transmitted, the measured MSDU Transmit Delay determines the bin to be incremented. If the measured delay has a duration *t* within Bin *i*, then Bin *i* is increased by one. MSDU Transmit Delay is measured from the time the MSDU is passed to the MAC until the point at which the entire MSDU has been successfully transmitted, including receipt of the final Ack frame from the peer STA if the QoSAck service class is being used. The sum of the values in all six bins is equal to the value reported in the Transmitted MSDU Count.

The Optional Subelements field contains zero or more subelements. The subelement format and ordering of subelements are defined in 9.4.3 (Subelements).

The Subelement ID field values for the defined subelements are shown in Table 9-172 (Optional subelement IDs for Transmit Stream/Category Measurement report).

|  |
| --- |
| * Optional subelement IDs for Transmit Stream/Category Measurement report
 |
| Subelement ID | Name | Extensible |
| 0 | Reserved |  |
| 1 | SCSID | No |
| 2-220 | Reserved |  |
| 221 | Vendor Specific | Vendor defined |
| 222–255 | Reserved |  |

The SCSID subelement contains a SCSID field as shown in Figure 9-xxx (SCSID subelement format).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Subelement ID | Length | SCSID |
| Octets: | 1 | 1 | 1 |
| Figure 9-xxx SCSID subelement format |

The SCSID field indicates the SCSID for which SCS stream with the TID specified in the Traffic Identifier field is to be measured. The Vendor Specific subelements have the same format as their corresponding elements (see 9.4.2.25 (Vendor Specific element)). Zero or more Vendor Specific subelements are included in the list of optional subelements.

***TGbe editor: modify the following subclause after subclause 35.3.23 Multi-link MSCS procedure as:***

35.3.24 SCS stream measurement Report

The Transmit Stream/Category Measurement applies to SCSIDs for SCS streams associated with QoS Characteristics element.

If dot11RMTransmitStreamCategoryMeasurementActivated is true and has no resource constraint that prevents it from being able to make the requested measurement for a given a SCS stream specified by the SCSID, a QoS EHT STA receiving a Transmit Stream/Category Measurement request shall respond with a Radio Measurement Report frame containing one Measurement (Transmit Stream/Category Measurement) Report element. If the SCS stream that is corresponding to the SCSID is removed, the EHT STA shall cease sending Radio Measurement Reports.