IEEE P802.11
Wireless LANs

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| LB 271 CR for 9.4.2.316 QoS Characteristics element (Part 2) |
| Date: July, 2023 |
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 Abstract

This submission proposes resolutions for following CIDs received for TGbe LB271:

17638, 18015, 17640, 17642, 17641, 18016, 18044, 17643, 17645, 16297, 16298, 16693, 17644, 17647, 17639, 18335

**Revisions:**

* Rev 0: Initial version of the document.
* Rev 1: added the CID list at the end of the doc
* Rev 2:
	+ Deferred CIDs 16693, 17645, and 18335 for further discussion
	+ CID17643 -> need to present the proposed text change
	+ CID17638 -> limit the STA to send an SCS Request only with an updated SST value (and not the other QoS parameters) to simplify the protocol.
	+ CID17644 -> accepting the CID is fine because D3.2 has expanded the “MSDU Delivery Ratio” field to represent the % of packets delivered for non-low-latency traffic flow that does NOT have a delay bound specified. Note D3.2 clearly says if a delay bound is included, the MSDU Deliver Ratio computation will take the delay into account just like how the “MSDU Delivery Ratio” was originally defined.

***TGbe editor: The baseline for this document is 11be D3.0***

Interpretation of a Motion to Adopt

A motion to approve this submission means that the editing instructions and any changed or added material are actioned in the TGbe Draft. This introduction is not part of the adopted material.

***Editing instructions formatted like this are intended to be copied into the TGbe Draft (i.e., they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGbe Editor: Editing instructions preceded by “TGbe Editor” are instructions to the TGbe editor to modify existing material in the TGbe draft. As a result of adopting the changes, the TGbe editor will execute the instructions rather than copy them to the TGbe Draft.***

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| **CID** | **Commenter** | **Clause** | **Pg/Ln** | **Comment** | **Proposed Change** | **Resolution** |
| **Min/Max Service Interval field** |
| 17638 | Brian Hart | 9.4.2.316 | 297.19 | Also L23/35/39. Min/Max SI needs to support predictable traffic (e.g. 802.1Qbv, VR/XR) with regular interval and consistent known start time. This may be implied if MinSI==MaxSI (no jitter) but doesn't allow for deviation in source MSDU delivery. If the flow is generated by a codec, typically a frame of data is available to be sourced encoded at a regular interval and consistent start time, although the codec's first and last MSDU outputs might occur at variable delays. As well, any downlink traffic might be subject to variable networking delays. Nonetheless, there is a set of use cases where the traffic arrival is akin to the TBTT sequence - i.e., known offset, known period. For lowest latency, this traffic should be scheduled as soon as it is known to be available; and then in these (mostly UL) cases it is desirable for the non-AP STA to inform the AP scheduler of this characteristic. However, this current Qos Characteristics encoding relates to time between start of \*adjacent\* service periods, so is very "jittery" and provides no information about the long term predictable insight as to when the flow's traffic is ready to be UL triggered/DL transmitted. Accordingly the AP scheduler might blindly and unnecessarily delay the traffic, ready for transmission, by up to max service interval. Or a SP might have no data to send (it was sent in the previous SP) or 2x traffic to send (the previous SP was too early for the last two codec bursts).As a related note, as per D3.0 35.17 (line 30) there is the notion of the AP synchronizing to a long-term average period between SI min and SI max BUT the actual period isn't specified (e.g. (Min\_SI+Max\_SI)/2=35ms) and neither is any jitter offset specified around this period. | All of the following:0) Define new predictable min/max SI encoding i.e. non-consecutive/ drifiting with desired period = e.g. (maxSI+minSI)/2 or e.g. abs\_period+deviation1) Keep the current encoding, especially for DL traffic. Especially for UL traffic, allow another encoding that precisely specifies when the last MSDU in a burst should be available for transmission (e.g., UL triggering): e.g., if max SI = min SI, then assume this encoding. Here min SI = max SI ~ 1/codecRate (according to TSF of AP with specified linkId). Assume target burst transmit time is Service Start Time + n\*SI. Here SST needs to be defined carefully to be 99.99th percentile (or application-relevant alternative) for when the codec generates the last MSDU + jitter delay from other sources.2) If the codec is generating more data per burst than fits into a single 2-3 msec TXOP, then the AP might use multiple TXOPs to retrieve all the data in the burst. For this scenario it is also helpful for the AP to learn when the codec generates the earlier MSDUs. Accordingly, this element would benefit from other flavors of SST: e.g. as well "99.99th" percentile of last MSDU plus other jitter delay of the first burst, also something like "99.99th" percentile of middle MSDU plus other jitter delay of the first burst, or the duraiotn of the window during wihich MSDUs are generate, or similar.3) And there should be a way to alert the AP to tiny drifts over time, via this mechanism or another: e.g. the codec and TSF clocks are not locked, and anyway the codec rate is a rounded-off integer (consider a codec rate of 72 Hz, then 1/72 = 13888.888 microseconds, which is not the same as 13888 or 13889usec) | Revised.Re 0) and 1), propose to add a note to clarify for periodic traffic, the min SI and max SI should be set to the same value (see resolution of CID 18015).Note the AP does not know the exact moment UL packets/burst are ready to be transmitted, the AP can only take the exact SST value indicated by the STA and tx an UL trigger to enable UL tx starting at the SST. Therefore, the STA should request a proper SST value such that most or all of its expected UL packet(s)/burst would have arrived before the SST.Re 3), note the tiny drift over time can be corrected by an updated QoS characteristics element included in a new SCS Request to modify the SCS session (i.e., sending an SCS Descriptor with the same SCSID and with SCS Request Type = Change) .**Proposed resolution:** Add a note after the Maximum Service Interval field to mention for periodic traffic min/max SI might be set to the same value. Also add a note in the EHT SCS procedure to say “the STA might send an updated QoS char element using the SCS Req to update the QoS parameters from time to timeif the true period is not a nice multiples of microseconds.**TGbe editor, please make the changes tagged as 17638 as shown below in this document.** |
| 18015 | Duncan Ho | 9.4.2.316 | 297.50 | For periodic traffic, the STA should set the min service interval and max service interval to be the same value, which should be as close to the periodic as possible (as close as possible because some periods are not nice integers of microseconds - e.g., 1/60 seconds) | Add a note after the Maximum Service Interval field reflecting what's stated in the comment. | Revised.Same resolution as 17638**TGbe editor, please make the changes tagged as 17638 as shown below in this document.** |
| **Burst Size field** |
| 17640 | Brian Hart | 9.4.2.316 | 298.08 | Burst Size and Delay Bound don't seem strongly correlated. First, the latter applies to any single MSDU or A-MSDU (??) not a burst of an arbitrary # of MSDUs and secondly they aren't really mathematically related e.g. Voice delay budget could be 200ms but the burst size (per 20ms period) could be 1x100B MSDU. One doesn't contrain the other naturally. | Remove line | Revised.This issue has been discussed many times before and the group converged on the current definition, and it continues to hold that this is the most useful definition since it is aligned with 5G. Some codecs might not deliver very localized individual bursts as expected by the commenter.**Proposed resolution:**Change the name of the field to “Delay bounded Burst Size” to reflect that the computation of this field uses a time window that is the same as the delay bound.**TGbe editor, please make the changes tagged as 17640 as shown below in this document.** |
| 17642 | Brian Hart | 9.4.2.316 | 298.31 | Burst Size and Delay Bound seem unrelated from a traffic spec POV | Suggested change "within a time duration specified in the Delay Bound field" to "within a time duration specified by Burst Window parameter. If absent, the Burst Window is set to the minimum interval between SPs (2\*MaxSI-MinSI)" | Revised.This issue has been discussed many times before and the group converged on the current definition, and it continues to hold that this is the most useful definition since it is aligned with 5G.Same resolution as 17640.**TGbe editor, please make the changes tagged as 17640 as shown below in this document.** |
| **Service Start Time field** |
| 17641 | Brian Hart | 9.4.2.316 | 298.16 | "traffic starts" seems ambiguous from an 802.11 POV. We presume this is ALL MSDUs in a burst (of size Burst Size) arrive at the MAC SAP at this time. | All of the folowing-Define Start time to be the point at which all MSDUs are expected to arrive (in a burst of max Burst Size) for the specified TID for the first SP-Clarify that during subsequent SPs (i.e. Start\_Time + n \* MaxSI) we expect the same (all MSDUs in a burst are expected to arrive) | Revised.Add a note to clarify the STA takes into account when its UL MSDUs or burst is ready for transmission.**TGbe editor, please make the changes tagged as #17641 in this document.** |
| 18016 | Duncan Ho | 9.4.2.316 | 298.14 | It's not clear if the Service Start Time indicates the time for which the traffic starts at the upper layers (e.g., traffic output of a codec) or it is the time for which the traffic is available for transmission by the MAC layer | Modify the field description as follows:"The Service Start Time field contains an unsigned integer that specifies the anticipated time, in microseconds, when the traffic starts for the associated TID and the UL traffic is ready for transmission at the local MAC sublayer…." | Revised.Use the same resolution as CID 17641.**TGbe editor, please make the changes tagged as #17641 in this document.** |
| 18044 | Binita Gupta | 9.4.2.316 | 298.15 | The Service Start Time should refer to the anticipated time when the traffic starts for the traffic flow described by this element, not necessarily for the associated TID, because a TID can have multiple traffic flows mapped to it. | Modify the paragraph to reflect that Service Start Time is for the traffic flow described by this element. | Revised.Modify the paragraph to reflect that Service Start Time is for the traffic flow described by this element.**TGbe editor, please make the changes tagged as #18044 in this document.** |
| **MSDU Lifetime field** |
| 17643 | Brian Hart | 9.4.2.316 | 298.36 | What, if any, is the distinct value of MSDU Lifetime wrt Delay Bound? They seem essentially identical | Redefine the Delay Bound to be linked to the Deliver Ratio explicitly (e.g. 99% of MSDUs should be delivered within the Delay Bound) or if not present we assume the target is 100%. Define the MSDU Lifetime to be the 100%-ile delivery target (i.e. worst case) and thus the MSDU (and containing A-MSDSU) are discard eligible. Add a figure explaining the inter-relationship of hte parameters. | Revised.There are applications that benefit from receiving packets that are delayed more than the delay bound but less than the MSDU Lifetime, and packets that are delayed beyond the MSDU Lifetime will be safe to be discarded.With the clarification of CID17643 that the “Delay bound” field is a target with the probability specified the Packet Delivery Ratio (<100%), it’s clear there could be packets that exceed this delay bound and still could be delivered. However, if these packets also exceed the MDSU Lifetime, they will not be useful to the receiver anymore (so the transmitter is free to discard them).**TGbe editor, please make the changes tagged as #17643 in this document.** |
| **Medium Time** |
| 17645 | Brian Hart | 9.4.2.316 | 299.41 | Medium Time can apply to BSS and non-BSS/P2P traffic equally. In particular, any service based on 802.1Qbv (TSN) will be descibed in terms of medium-time as opposed to bytes since the AP is simply one node in a broader TSN network. | Remove last sentence | Rejected.The model of UL/DL cases is the STA indicates the QoS requirements and the AP sets up the proper resource to satisfy the QoS demand. Medium time is one of the resources that the AP will compute.The Medium time is needed in the p2p case is because the AP does not know the condition of the p2p link and the capabilities of the peer STA on the far end so the AP will not be able to come up with a proper medium time. |
| **Miscellaneous/New features** |
| 16297 | Pascal VIGER | 9.4.2.316 | 295.03 | In order to better support P2P traffic, there is a need to update QoS Characteristics element format by specific information related to P2P (e.g. for TXS) such as the STA AID of P2P recipient STA. By knowing recipient P2P STA's AID, AP can invite it to join a same TWT session so STA is awake at SP | As per comment | Rejected.Such coordination is not needed because usually the high layers p2p protocols will coordinate the peers so they could go to power save mode to conserve power. |
| 16298 | Pascal VIGER | 9.4.2.316 | 295.03 | For direct link traffic, the information of the receiving peer STA could be valuable to help the AP in its scheduling and for instance to avoid multiple communication to the same STA (P2P and DL) | Add an information to inform the AP of the peer receiver STA in case of direct link communication. | Rejected.Such coordination is not needed because usually the high layers p2p protocols will coordinate the peers so they could go to power save mode to conserve power. |
| 16693 | Yonggang Fang | 9.4.2.316 | 295.43 | The QoS characteristics define the characteristics and QoS expectations of a traffic flow at MLD level. It needs to clarify that in the text. | Suggest to revise the sentence as "The QoS Characteristics element contains a set of parameters that define the characteristics and QoS expectations of a traffic flow at MLD level, in the context of a particular non-AP EHT STA, for use by the EHT AP and the non-AP EHT STA in support of QoS traffic transfer using the procedures defined in 11.25.2 (SCS procedures) and 35.8 (Restricted TWT (R-TWT))." | Rejected.The traffic flow described by the QoS characteristics element is at the MLD level for both UL and DL cases. However, for direction link (p2p) case, it is at the link level since the spec currently only allows a single link in the p2p case. Also, the p2p peer may not even be an MLD. It could be just a legacy STA. |
| 17644 | Brian Hart | 9.4.2.316 | 299.36 | Non-delay bounded flows have reliability targets hence this is unwarranted | Remove | Accepted. |
| 17647 | Brian Hart | 9.4.2.316 | 298.11 | Definition of Max MSDU Size constrains a burst size (n MSDUs in an A-MSDU) | Reword last sentence to "an MSDU belonging to the traffic flow described by this element" | Accepted. |
| 17639 | Brian Hart | 9.4.2.316 | 297.10 | Why should this be invalid if direction != P2P (e.g. up/downlink) ?If SCS can be used to specify a Link ID then it should apply equally to non-P2P. We presume SCS is compatible with all TID-to-link variants (i.e. honor link-preferences, etc the STA might have) but an SCS (flow) driven link preference makes sense, | 1) Remove language that LinkId only applies to P2P traffic, 2) Assign a currently-reserved bit from Control Info field, call it e.g. LinkId Significance, and use LinkId Significance as a modifier for LinkID field. If LinkId Significance = 0, LinkId is reserved for non-P2P; if LinkId Significance = 1, LinkId is the preferred Link for the indicated flow. | Rejected.Currently the TID-to-link mapping already provides the links(s) for which the traffic from this TID is allowed. It’s not clear what the benefits are to indicate a preferred link. |
| 18335 | Peshal Nayak | 9.4.2.316 | 295.43 | A mechanism is needed to enable the STA to inform the AP about the urgency for traffic transmission (e.g., delay deadline, time before the packet will be dropped, etc.). The AP can use this information to prioritize those STAs with urgent traffic transmission needs via TXOP sharing | Define a mechanism by which the STA can provide a traffic urgency indication to the AP | Rejected.Insufficient details were given in the proposed resolution. |

**TGbe editor, for CID 17638, please make the following changes:**

**Add the following note right after the Maximum Service Internal field description.**

(#17638)NOTE - Periodic traffic can be indicated by setting the Minimum Service Interval field and Maximum Service Interval field to the same value.

**Add the following note right after section 35.17 EHT SCS Procedure Pg 654/line 64.**

(#17638)NOTE - For periodic traffic, where a non-AP MLD sets the Minimum Service Interval field and Maximum Service Interval field to the same value, and where the exact period of the traffic cannot be exactly indicated by these fields (e.g., a period of 1/60 seconds cannot be expressed in integer multiple of microseconds), then the non-AP MLD might intermittently send a QoS Characteristics element with an updated service start time using the SCS Request (e.g., using the same SCSID with the SCS Request Type set to “Change”).

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**TGbe editor, for CID 17640, please make the following changes:**

To editor: please replace all occurrences of “Burst Size” with “Delay Bounded Burst Size” within 9.4.2.316.

(#17640)The Delay Bounded Burst Size field is 4 octets long and contains an unsigned integer that specifies the maximum burst, in octets, of the MSDUs or A-MSDUs belonging to the traffic flow that arrive at the MAC SAP within any time duration equal to the value specified in the Delay Bound field. (e.g., if the delay bound is 10ms and a burst of x octets arrive within the first 1ms within the SP followed by no more traffic after that within the SP, the STA reports the burst as x)

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**TGbe editor, for CID 17641, please make the following changes:**

The Service Start Time field contains an unsigned integer that specifies the anticipated time, in microseconds, when the traffic starts for the associated TID. The Service Start Time indicates to the AP the time when the STA expects to exchange frames corresponding to the TID specified in this element. The field represents the four lower order octets of the TSF timer associated to the link specified in the LinkID field at the start of the anticipated SP.

(#17641)NOTE – For an UL traffic flow, the STA takes into account when it expects the UL traffic, if known (e.g., a burst of MSDUs from a codec has arrived), for an SP to be ready for transmission.

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**TGbe editor, for CID 18044, please make the following changes:**

(#18044)The Service Start Time field contains an unsigned integer that specifies the anticipated time, in microsec­onds, when the STA is ready to exchange frames corresponding to the traffic flow described by this element. The field rep­resents the four lower order octets of the TSF timer associated to the link specified in the Service Start Time LinkID field at the start of the anticipated SP.

**TGbe editor, for CID 17643, please make the following changes:**

(#17643)The Delay Bound field contains an unsigned integer that specifies the maximum amount of time, in microseconds, targeted (see the MSDU Delivery Ratio field for more details on the delay and the targeted deliver ratio) to transport an MSDU or A-MSDU belonging to the traffic flow described by this element, measured between the time marking the arrival of the MSDU, or the first MSDU of the MSDUs constituting an A-MSDU, at the local MAC sublayer from the local MAC SAP and the time of completion of the successful (re)transmission of the MPDU containing the MSDU to the destination. The completion time of the MSDU or A-MSDU transmission includes the corresponding acknowledgment frame transmission time, if present.

Do you agree to the resolution provided in doc 11-23/0801r0 for the following CIDs?

17638, 18015, 17640, 17642, 17641, 18016, 18044, 17643, ~~17645~~, 16297, 16298, ~~16693~~, 17644, 17647, 17639, ~~18335~~