IEEE P802.11
Wireless LANs

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| SCS Procedure for EHT |
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Abstract

This submission resolves the following CID: 1977.

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| **CID** | **Page** | **Line** | **Clause** | **Comment** | **Proposed Change** | **Resolution** |
| 1977 | 146 | 46 | 35.4.1 | There are complaints on UL MU operation for 11ax in the field, especially for the latency-sensive applications. It is beneficial to further enhance the MU operation in 11be. There is pratice in the industry in this direction. It is beneficial to bring the similar mechanisms for the whole industry by standarizing it at IEEE. | Refer to https://www.youtube.com/watch?v=uYlHpgZ6XTM; and DCN1006-r3 | **Revised.**We added TSPEC based signaling to provide parameters that describe traffic characteristics within the SCS procedure. With this addition the SCS protocol can be used by a non-AP STA to signal traffic flow QoS requirements (esp. the low latency parameters) which allows the AP to create an optimal schedule to meet those requirements. TGbe editor to make the changes with the CID tag (#1977) in doc.: IEEE 802.11-21/0340r3 |

**Discussion:**

To meet the low latency requirements in EHT as well as to increase the efficiency of the UL MU operation, what we need is a light-weight mechanism for a STA to inform the AP of its QoS requirements. There are quite a few procedures already defined in 802.11 that allow STAs to exchange QoS requirements. Among them the SCS mechanism provides an extremely light-weight way for a STA to inform the AP about what UP and EDCA transmit queue to be used for certain DL flows. What’s missing in SCS though is a way to provide detailed characteristics of a QoS traffic flow. As such in this document we propose to extend SCS to meet EHT QoS requirements as follows:

1. Include TSPEC in the SCS Request/Response frames to allow exchange of detailed traffic description in DL or UL and bidirectional flows.
2. Clarify that the traffic description is at MLD-level for DL and UL flows.

***TGbe editor: Revise the definition of service period in P196L7 of draft REVme 0.0 as:***

**service period (SP):** A period of time during which one or more downlink individually addressed frames
are transmitted to a quality-of-service (QoS) station (STA) and/or one or more (portions of) transmission opportunities
(TXOPs) are granted or allocated to the same STA. SPs are either scheduled or unscheduled.
NOTE—A non-access-point (non-AP) STA can have at most one nongroupcast with retries SP (non-GCR-SP) active at
any time

***TGbe editor: Revise the text in 6.3.82.3.2 of draft REVme 0.0 as:***

**6.3.82.3 MLME-SCS.confirm**

**6.3.82.3.2 Semantics of the service primitive** (#1977)

The primitive parameters are as follows:

MLME-SCS.confirm(

 PeerSTAAddress,

 DialogToken,

 SCSID,

 Status,

 SCS Descriptor,

 VendorSpecific Info)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| PeerSTAAddress | MAC address | Any valid individual MAC address | Specifies the address of thepeer MAC entity withwhich to perform the SCSprocess |
| Dialog Token | Integer | 1-255 | The dialog token to identifythe SCS request andresponse transaction |
| SCSID | Integer | 1–255 | Identifies the SCS streamthat is being classified |
| Status | Enumeration | See Table 9-50 (Statuscodes) | Indicates the result responseof the requested SCSID. SeeTable 9-50 (Status codes). |
| SCS Descriptor | SCS Descriptor element | SCS Descriptor | SCS Descriptor |
| VendorSpecificInfo | A set of elements | As defined in 9.4.2.25(Vendor Specific element) | Zero or more elements. |

***TGbe editor: Revise the text in 6.3.82.5.2 of draft REVme 0.0 as:***

**6.3.82.5 MLME-SCS.response**

**6.3.82.5.2 Semantics of the service primitive** (#1977)

The primitive parameters are as follows:

MLME-SCS.response(

PeerSTAAddress,

DialogToken,

SCSID,

Status,

 SCS Descriptor,

 VendorSpecificInfo

 )

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| PeerSTAAddress | MAC address | Any valid individual MAC address | Specifies the address of thepeer MAC entity withwhich to perform the SCSprocess |
| Dialog Token | Integer | 1-255 | The dialog token to identifythe SCS request andresponse transaction |
| SCSID | Integer | 1–255 | Identifies the SCS streamthat is being classified |
| Status | Enumeration | See Table 9-50 (Statuscodes) | Indicates the result responseof the requested SCSID. SeeTable 9-50 (Status codes). |
| SCS Descriptor | SCS Descriptor element | SCS Descriptor | SCS Descriptor |
| VendorSpecificInfo | A set of elements | As defined in 9.4.2.25(Vendor Specific element) | Zero or more elements. |

***TGbe editor: Revise Figure 9-541 in 9.4.2.121 of draft REVme 0.0 as:***

**9.4.2.121 SCS Descriptor element** (#1977)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Element ID | Length | SCSID | Request Type | Intra-Access Category Priority element (optional)  | TCLAS Elements (optional) | TCLAS Processing Element (optional) | TSPEC Element (optional) | Optional Subelements |

Octets: 1 1 1 1 0 or 3 variable 0 or 3 0 or 57 variable

 **Figure 9-541—SCS Descriptor element format**

***TGbe editor: Add the following paragraph in 9.4.2.121 P1274L48 of draft REVme 0.0:***

The TSPEC Element field contains zero or one TSPEC element to describe the traffic characteristics and QoS expectations of traffic flows that belong to this SCS stream, as defined in 9.4.2.29 (TSPEC element). Zero or one TSPEC element is present when the Request Type field is equal to “Add” or “Change” and no TSPEC element is present when the Request Type field is equal to “Remove”.

***TGbe editor: Revise Figure 9-555 in 9.6.18.3 of draft REVme 0.0 as:***

**9.6.18.3 SCS Response frame format** (#1977)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Category | Robust Action | Dialog Token | SCS Status List | SCS Descriptor List |

Octets: 1 1 1 variable variable

 **Figure 9-955—SCS Response frame Action field format**

***TGbe editor: Add the following paragraph in 9. 6.18.3 P1624L21 of draft REVme 0.0:***

The SCS Descriptor List field contains zero or more SCS Descriptor elements, as defined in 9.4.2.121 (SCS
Descriptor element). If included, each SCS Descriptor element contains a TSPEC element to describe the traffic characteristics and QoS expectations of traffic flows that belong to this SCS stream. Zero or more SCS Descriptor elements are present when the Status Code field value is equal to “Success” and no SCS Descriptor element is

present otherwise.

* EHT MAC Capabilities Information field (#1126)

The format of the EHT MAC Capabilities Information field is defined in Figure 9-788em (EHT MAC Capabilities Information field format).

TGbe editor: change Table 9-788em (EHT MAC Capabilities Information field format) as follows. Please note that bit order can be adjusted to accommodate subfields defined in other PDTs.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| B0 | B1 | B2 | B3 | TBD |
| NSEP Priority Access Supported | EHT OM Control Support | Triggered TXOP Sharing Support | SCS Traffic Description Support | TBD |
| 1 | 1 | 1 | 1 | TBD |
| * **EHT MAC Capabilities Information field format**
 |

***TGbe editor: insert the following row after the last row of Table 9-322ao (Subfields of the EHT MAC Capabilities Information field)***

|  |  |  |
| --- | --- | --- |
| SCS Traffic Description Support | Indicates support for transmission and reception of SCS Descriptor elements containing a TSPEC subelement.  | Set to 1 by an EHT AP that supports transmission of SCS Response frames containing SCS Descriptor element with a TSPEC subelement and dot11SCSActivated is true.Set to 1 by a non-AP EHT STA that supports transmission of SCS Request frames containing SCS Descriptor element with a TSPEC subelement and dot11SCSActivated is true.Set to 0 otherwise.  |

**9.4.2.29 TSPEC element**

***TGbe editor: Revise the text in 11.25.2 of draft REVme 0.0 as:***

**11.25.2 SCS procedures** (#1977)

The stream classification service (SCS) is a service that may be provided by an AP to its associated STAs that support SCS. In SCS, the AP classifies incoming (M101) individually addressed MSDUs based upon parameters provided by the non-AP STA.

The classification allows the UP, drop eligibility, and EDCA transmit queue to be selected for all MSDUs

matching the classification.

Implementation of SCS is optional for a STA. A STA that implements SCS shall set its dot11SCSImplemented to true. (#1121) A STA with dot11SCSActivated equal to true shall support stream classification and shall set to 1 the SCS field of the Extended Capabilities elements that it transmits. If dot11SCSActivated is true, dot11SCSImplemented shall be true.

A non-AP STA that supports SCS may request use of SCS by sending an SCS Request frame that includes an

SCS Descriptor element with the Request Type field set to “Add” or “Change.” The SCS Descriptor List field

in the SCS Descriptor element identifies how MSDUs are classified and the priority to assign to MSDUs that

match this classification. If the TCLAS Processing element is present in an SCS Descriptor element, the

Processing subfield shall have a value of 0 or 1. An AP shall decline any SCS Request frame where a TCLAS

Processing element is present, and the Processing subfield does not have a value of 0 or 1.

Each SCS stream is identified by an SCSID. The SCSID is used by a non-AP STA to request creation,

modification, or deletion of an SCS stream. The SCSID is used by an AP to identify an SCS stream in SCS

responses.

Upon receipt of an SCS Request frame from an associated non-AP STA, the AP shall respond with a corresponding SCS Response frame. A value of (#4282)SUCCESS shall be set in the corresponding Status field of the SCS Status duple in the SCS Response frame when the AP accepts the SCS request for the requested SCSID. A value of REQUEST\_DECLINED, REQUESTED\_TCLAS\_NOT\_SUPPORTED\_BY\_AP, or INSUFFICIENT\_TCLAS\_PROCESSING\_RESOURCES shall be set in the corresponding SCS Status field of

the SCS Status duple in the SCS Response frame when a non-EHT AP denies the SCS request for the requested SCSID.

If the AP declines a request to change a previously accepted SCSID, the previously accepted classification for

this SCSID continues to operate.

If the requested SCS is accepted by a non-EHT AP the AP shall process subsequent incoming (M101)individually addressed MSDUs from the DS or WM that match the TCLAS elements and optional TCLAS Processing element classifier specified in the SCS Descriptor element.

A match of the classifier is defined as follows:

— When the Processing subfield of the TCLAS Processing element is 0, the classifier matches all of the parameters in the TCLAS elements in the SCS Descriptor element.

— When the Processing subfield of the TCLAS Processing element is 1 or the TCLAS Processing element is not present, the classifier matches if the parameters match at least one of the TCLAS elements in the SCS Descriptor element.

The processing of matching MSDUs depends upon the access policy assigned to the MSDU:

— For matching MSDUs that are not part of a TS (as described in 11.4 (TS operation)), the User

Priority subfield of the Intra-Access Category Priority element is used as the UP of these MSDUs.

— For matching MSDUs that are part of a TS (as described in 11.4 (TS operation)), the TID and UP

classification of these MSDUs shall follow the rules specified in 11.4.8 (Data transfer).

— If dot11AlternateEDCAActivated is true, for matching MSDUs that are not part of a TS (as

described in 11.4 (TS operation)) or for MSDUs that are part of a TS that uses EDCA or HEMM as

the access policy, the Alternate Queue subfield of the Intra-Access Category Priority element is used

to select whether the primary EDCA transmit queue or alternate EDCA transmit queue is used for

these MSDUs.

— All matching MSDUs have their DEI set using the value from the Drop Eligibility subfield of the

Intra-Access Category Priority element in the DEI subfield of the HT Control field, as defined in

9.2.4.6 (HT Control field).

A non-AP STA may request the termination of an accepted SCS stream by sending an SCS Request frame with

the Request Type field set to “Remove” and the requested SCSIDs in the SCS Descriptor element. The Length

field of the SCS Descriptor element is set to 0; and no Intra-Access Priority, TCLAS, or TCLAS Processing

elements shall be included in the SCS Descriptor element.

Upon reception of a request to terminate a previously accepted SCS stream, the AP shall cease to apply the

classifier related to this SCSID. The AP shall send an SCS Response frame to confirm the termination of the

SCS stream identified by the SCSID, by including the SCSID and a value of “Terminate” in the Status field of

an SCS Status duple in an SCS Response frame and the dialog token in the SCS Response frame set to the

value from the SCS Request frame that requested termination.

The AP may send an unsolicited SCS Response frame at any time to cancel a granted SCS stream identified by

the SCSID, by including the SCSID and a value of “Terminate” in the Status field of an SCS Status duple in an

SCS Response frame and the dialog token in the SCS Response frame set to 0.

***TGbe editor: Add the following subclause to the end of 35.3 Multi-link operation in draft 1.0 as:***

**35.3.19 Multi-link SCS procedure**

An EHT STA establishes SCS stream with an EHT AP, as defined in 11.25.2 (SCS procedures), subject to the additional rules and restrictions defined in this clause.

The SCS procedure can be used by a non-AP EHT STA to describe its traffic characteristics to an EHT AP.

A non-AP EHT STA with dot11SCSActivated equal to true that supports transmission of SCS Request frames containing SCS Descriptor element with a TSPEC subelement shall set the SCS Traffic Description Support subfield value in the EHT Capabilities element that it transmits to 1. An EHT AP with dot11SCSActivated equal to true that supports transmission of SCS Response frames containing SCS Descriptor element with a TSPEC subelement shall set the SCS Traffic Description Support field value in the EHT Capabilities element that it transmits to 1. All STAs affiliated with an MLD shall set the SCS Traffic Description Support subfield of the EHT Capabilities element that they transmit to the same value.

A non-AP EHT STA may transmit an SCS Request frame with SCS Descriptor element(s) containing a TSPEC element with the Request Type field set to “Add” or “Change”. The TSPEC element describes the traffic characteristics of the requested SCS stream. A non-AP EHT STA shall not transmit an SCS Request frame with SCS Descriptor element(s) containing a TSPEC element to an AP from which it has not received an EHT Capabilities element with the SCS Traffic Description Support field equal to 1.

~~A non-AP EHT STA shall not transmit an SCS Request frame with SCS Descriptor element(s) containing a TSPEC element to an AP in which the Direction subfield is equal to 3 (i.e., Bidirectional link).~~

 The MLDs maintain SCSIDs at MLD level, i.e. the SCSID used by a STA affiliated with a non-AP MLD in an SCS Request frame transmitted to an AP affiliated with an AP MLD is unique across the non-AP MLD.

All STAs affiliated with an MLD shall set the SCS field of the Extended Capabilities element that they transmit to the same value. The SCSID is used by a non-AP MLD to request creation, modification, or deletion of an SCS stream. The SCSID is used by an AP MLD to identify an SCS stream in SCS responses.

An SCS Request frame sent by a non-AP STA affiliated with a non-AP MLD to the AP of an AP MLD that contains a TSPEC element in which the Direction subfield is set to uplink or downlink or bidirectional link is interpreted as a request for creation of an SCS stream that applies at the MLD level.

If the SCS Descriptor element contains a TSPEC element in which the Direction subfield is equal to downlink or bidirectional link then the TCLAS Elements field shall be included in the SCS Descriptor and the TCLAS Processing Element field may be included in the SCS Descriptor. The TCLAS Elements and the Processing Element, if present, describe the the traffic classification the non-AP STA requests the AP to apply to the corresponding stream.

An SCS Descriptor element contained in an SCS Request frame in which the TSPEC subelement is present and the Direction subfield in the TSPEC element is equal to direct link or uplink shall not contain the TCLAS

Elements and TCLAS Processing Element fields.

A value of REQUEST\_DECLINED, REQUESTED\_TCLAS\_NOT\_SUPPORTED\_BY\_AP, REJECTED\_WITH\_SUGGESTED\_CHANGES, or INSUFFICIENT\_TCLAS\_PROCESSING\_RESOURCES shall be set in the corresponding SCS Status field of the SCS Status duple in the SCS Response frame when an EHT AP denies the SCS request for the requested SCSID.

If the requested SCS is rejected by an EHT AP by setting the Status field value to REJECTED\_WITH\_SUGGESTED\_
CHANGES, the AP shall include an SCS Descriptor element containing a TSPEC element in the SCS Response frame signaling the suggested TSPEC parameters for this SCS stream. The SCS Descriptor element shall not contain any Intra-Access Category Priority element, TCLAS Elements or TCLAS Processing Element. The Request Type field value in the SCS Descriptor element is reserved. An AP shall not set the Status field value in an SCS Response frame to REJECTED\_WITH\_SUGGESTED\_CHANGES if the corresponding SCS Descriptor element in the corresponding SCS Request frame did not contain a TSPEC element.

NOTE- A TSPEC provided by a non-AP EHT STA is used by a receiving EHT AP to facilitate the creation of a schedule for contention based channel access (EDCA) or MU operation. How the AP uses the information provided by the non-AP STA is beyond the scope of the specification.

If the requested SCS is accepted by an EHT AP and the SCS Descriptor element either did not contain a TSPEC element or contained a TSPEC element in which the Direction subfield is equal to downlink or bidirectional link, the AP shall process subsequent incoming (M101) individually addressed MSDUs from the DS or WM that match the TCLAS elements and optional TCLAS Processing element classifier specified in the SCS Descriptor element as described in 11.25.2.

An SCS Response frame transmitted by an EHT AP that contains a value of “Terminate” in the Status field of

an SCS Status duple shall not contain a TSPEC element.