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 light-weight SCS protocol can be used by a non-AP STA to inform its UL 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 802.11-21/0340r1Dibakar Das, Intel |

**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 text in 6.3.82.3.2 of draft REVmd 5.0 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 Descriptorelement, as defined in9.4.2.121 (SCSDescriptor element) | Specifies parameters for the accepted SCS stream.  |
| 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 REVmd 5.0 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 Descriptorelement, as defined in9.4.2.121 (SCSDescriptor element) | Specifies parameters for the accepted SCS stream.  |
| 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 REVmd 5.0 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 P1291L16 of draft REVmd 5.0:***

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 Request Type field is equal to “Add” or “Change” and no TSPEC element is present when Request Type field is equal to “Remove”.

***TGbe editor: Revise Figure 9-555 in 9.6.18.3 of draft REVmd 5.0 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**

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 codes field value is equal to “Success” and no SCS Descriptor element is

present otherwise.

***TGbe editor: Revise the text in 11.25.2 of draft REVmd 5.0 as:***

**11.25.2 SCS procedures** (#1977)

The stream classification service (SCS) is a service that may be provided either by a non-EHT AP to its associated STAs that support SCS or by an AP MLD to non-AP MLDs that support SCS with which it has successfully performed multi-link setup. 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. All STAs affiliated with an MLD shall set the SCS field of the Extended Capabilities element that it transmits to the same value.

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.

A non-AP 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.

An SCS Request frame sent by a non-AP STA affiliated with an MLD to the AP of an AP MLD that does not contain a TSPEC element in which the Direction subfield is set to 1 (Direct Link) is interpreted as a request for creation of an SCS stream that applies at the MLD level.

Each SCS stream is identified by an SCSID. This 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.

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 (i.e., no two STAs affiliated with the same MLD can use the same SCSID to request creation, modification, or deletion of two different SCS streams).

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 the 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 the AP and the SCS Descriptor element did not contain a TSPEC element in which the Direction subfield is set to either 0 (i.e., Uplink) or 1 (Direct 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.

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).

If the requested SCS is accepted by an AP MLD and the SCS Descriptor element in the corresponding SCS Request frame contained a TSPEC element, an AP of the AP MLD shall include an SCS Descriptor element containing a TSPEC element in the SCS Response frame signaling the accepted 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.

If the requested SCS is accepted by the AP of an AP MLD and the SCS Descriptor element in the corresponding SCS Request frame contains a TSPEC element in which the Direction subfield is set to 0 (i.e., Uplink), the AP MLD should configure EDCA, schedule MU operation or configure Restricted TWT service periods (R-TWT) on its enabled links to the meet the QoS requirements described in the TSPEC element sent in the SCS Response frame.

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 SCS Response frame shall not contain any TSPEC element.

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. The SCS Response frame shall not contain any TSPEC element.

The AP may send an unsolicited SCS Response frame at any time to update the QoS parameters for a granted SCS stream identified by the SCSID, by including the SCSID and a value of “Success” in the Status field of an SCS Status duple in an SCS Response frame. The SCS Response frame shall contain a TSPEC element and the Dialog Token field shall be set to 0.