###  **IEEE P802.11Wireless LANs**

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| MIB fixes |
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**Abstract**

This submission proposes resolutions for following CIDs received for TGbe D6.0:

23146, 23147, 23148, 23164, 23165

**Revisions:**

* Rev 0: Initial version of the document (See also 24/1051)

**Discussion**

There is one MLME MIB per MLME (i.e., per affiliated STA). However, certain MIB variables make sense at the MLD level, and so need to be synchronized across the MIBs (i.e., a “shall”); however 802.11 cannot apply “shall”s to the SME. Other parameters need to be synchronized between affiliated STAs (802.11 state variable, block ack parameters etc etc). However, there is no SME interface defined whereby the SME can get or set these parameters; and where these parameters are exchanged with the SME it is in the *reverse* direction only.

A common mental model is that the functionality of an 802.11 module (peripheral) maps to the 802.11 standard whereas the functionality of the SME maps to the enclosing device (and typically its OS). Given the 802.11 module is responsible for MLO, therefore it is most natural if an internal 802.11 interface provides MIB and state synchronization between affiliated STAs.

Furthermore, since it is expected that the 802.11 module performing MLO is developed by a single vendor (and typically a single team, with a MAC+processor skillset, implements all of: MLO sync, MLO upper MAC and affiliated MAC functionality), then there is no requirement for the internal 802.11 interface to provide MIB and state synchronization in any real detail: simply stating the architectural requirements suffices.

Accordingly we propose to evolve the architecture such that synchronization component of the coordination of affiliated STAs is define via an unspecified synchronization interface subject to a minimal set of requirements.

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| 23146 | Brian Hart | - | 00.00 | This is an evolution of CID 22293 which was disposed of under the invalid reasoning that "However, performing all these changes does not fix any technical inconsistency since these [MIB variables] are internal variables and need not be exposed" which will come as a major surprise to the users of STAs that do expose these MIB variables (for decades). The STA statistics (under Dot11CountersEntry and Dot11QosCountersEntry) related to MSDUs, and arguably to MPDUs too, are defined at the link level but some parameters don't make sense at the link level - like dot11FrameDuplicateCount, dot11QosFailedCount, dot11QosRetryCount, dot11QosFrameDuplicateCount, dot11QosDiscardedFrameCount etc. | Address this inconsistency: e.g., a) redefine meaning to be at MLD layer in a non-AP MLO (but this solution is insufficient for an AP MLD due to legacy clents(?)), or b) create new MLD-level MIB variables for these kinds of parameters and then defined a new Measurement Req/Rep of type STA Statistics Report for MLD-level MIB variables. | **Revised.**See changes under CID 23146 in 24/1252r<motionedRevision> that substantially address the commenter’s concern using a method substantially aligned with the commenter’s proposed resolution.  |
| 23147 | Brian Hart | 35.3.14.1 | 580.16 | This is an evolution of CID 22293 which was disposed of under the invalid reasoning that "However, performing all these changes does not fix any technical inconsistency since these [MIB variables] are internal variables and need not be exposed" which will come as a major surprise to the users of STAs that do expose these MIB variables (for decades). This bulleted list specifically calls out frames that operate at the MLD level, but there is no such list for MIB variables | Create a centralized list of MIB variables that operate at the MIB level, including where the MIB dependency might be non-obvious (e.g., P222L21/27/33 …P223L8/13/18, P571L62,P580L4/6, P682L56, P683L7). If other comments related to MLD Sublayer Management Entity are adopted, mention that as the transport mechanism for the MIB-to-MIB synchronization function. Convert existing normative text to "as defined in <section where this new content is hosted> | **Revised.**See changes under CID 23147 in 24/1252r<motionedRevision> that substantially address the commenter’s concern using a method substantially aligned with the commenter’s proposed resolution.  |
| 23148 | Brian Hart | C.1 | 16.77 | This is an evolution of CID 22293 which was disposed of under the invalid reasoning that "However, performing all these changes does not fix any technical inconsistency since these [MIB variables] are internal variables and need not be exposed" which will come as a major surprise to the users of STAs that do expose these MIB variables (for decades). MLO requires specialized MIB behavior (i.e., synchronization between MIBs) that is not called out | After the following sentence from the baseline "The MAC and PHY MIBs are described in Abstract Syntax Notation One (ASN.1), defined in ISO/IEC 8824-1:1995, ISO/IEC 8824-2:1995, ISO/IEC 8824-3:1995 and ISO/IEC 8824-4:1995, (#4112)and as adapted per Structure of Management Information Version 2 (SMIv2) specified in IETF RFC 2578" append the following "where the MAC MIB in an MLD is subject to further constraints (see xxx ... akin to the list at P580L16 but for MIB variables)". | **Revised.**See changes under CID 23148 in 24/1252r<motionedRevision> that substantially address the commenter’s concern using a method substantially aligned with the commenter’s proposed resolution.  |
| 23164 | Brian Hart | 4.9.6 | 77.38 | This is an evolution of CID 22291 that only partially addressed the concerns raised. From 11.3.1 in the baseline, "A STA (local) for which dot11OCBActivated is false keeps an enumerated state variable for each STA (remote) with which direct communication via the WM is needed." and this knowledge is needed for frame filtering (11.3.3) etc. But here we have "The SME maintains the authentication and association states." In the non-MLO world the STA can snoop MLME-ASSOCIATE.resp/.conf function to maintain knowledge of that state, but snooping is no longer sufficient in the MLO world since these functions might be exchanged by a different MLME with the SME. | Define a new primitive whereby the SME can report a STA's state to each MLME. Or, since this inter-MLME coordination issue might come up more than just here, define a new MLD Sublayer Management Entity that acts as a conduit of information between MLMEs whereby the conduit (unlike the MLME-SAP) does not require explicit standardization. See MIB-related comments also. | **Revised.**See changes under CID 23164 in 24/1252r<motionedRevision> that substantially address the commenter’s concern using a method substantially aligned with the commenter’s proposed resolution.  |
| 23165 | Brian Hart | 6.1 | 87.01 | This is an evolution of CID 22293 which was disposed of under the invalid reasoning that "However, performing all these changes does not fix any technical inconsistency since these [MIB variables] are internal variables and need not be exposed" which will come as a major surprise to the users of STAs that do expose these MIB variables (for decades). Fig 6-1 in the baseline expresses where the MAC MIB resides, but how that applies to the MLO arch is unclear. | Provide a companion figure to 6-1 for MLO that shows the two (or N) MLMEs (for two or N links). I believe there is one MIB per MLME(?) so this figure should show two (or N) MIBs. As well, MLO-level MIB variables need to be the same in each MIB, so the figure should describe a synchronization function between the two or N MIBs. This synchronization function could be subsumed into a new MLD Sublayer Management Entity that acts as a conduit of information between MLMEs whereby the conduit (unlike the MLME-SAP) does not require explicit standardization. See other related MIB comments also | **Revised.**See changes under CID 23165 in 24/1252r<motionedRevision> that substantially address the commenter’s concern using a method substantially aligned with the commenter’s proposed resolution.  |

***Changes indicated via Word track changes***

4.9.6 Reference model for multi-link operation (MLO)

(23164)An MLD supports multiple MAC functions, with synchronization across the MAC functions as needed via the MLD synchronization service (see 35.3.24a (MLD Synchronization Service)) and otherwise coordinated by the SME.

(23164)35.3.24a MLD Synchronization Service

The MLD synchronization service enables various parameters to be distributed and coordinated among an MLD and its affiliated STAs, including:

* MIB variables or characteristics of the MIB variables (see 35.3.24b (Operation of MAC MIBs in an MLD))
* Capability variables not related to a MIB variable
* Other variables such as the state variable and parameters related to agreements

NOTE – Respective examples where the MLD synchronization service is invoked are:

* To ensure that the instances of dot11RSNAConfigPasswordValueTable across affiliated STAs consistently all have no password identifiers for any passwords, at least one password has a password identifier or every password has a password identifier (see the SAE Password Identifiers In Use and SAE Password Identifiers Used Exclusively fields in 9.4.2.25 (Extended Capabilities element))
* To ensure that the Local MAC Address Policy field of the Extended Capabilities field is the same across affiliated STAs.
* To notify an affiliated STA to perform Block Ack scoreboarding once a Block Ack agreement is established at the MLD level (see Figure 5-2a (MAC data plane architecture (MLO) for individually addressed Data frames))

9.4.2.25 Extended Capabilities element

Table 9-192—Extended Capabilities field

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| 12 | Proxy ARP Service | ~~The~~An AP sets the Proxy ARP Service field to 1 when dot11ProxyARPActivated is true, and sets it to 0 otherwise. See 11.21.14 (Proxy ARP service). A non-AP STA sets the Proxy ARP Service field to 0. All STAs affiliated with an MLD set (23147)dot11ProxyARPActivated to the same value (see 35.3.24b (Operation of MAC MIBs in an MLD)). |
| 17 | WNM Sleep Mode | ~~The~~A STA sets the WNM Sleep Mode field to 1 when dot11WNMSleepModeActivated is true, and sets it to 0 otherwise. All STAs affiliated with an MLD set (23147)dot11WNMSleepModeActivated to the same value. See 11.2.3.15 (WNM sleep mode) and 35.3.24b (Operation of MAC MIBs in an MLD). |
| 49 | QMFActivated | The STA sets the QMFActivated field to 1 when dot11QMFActivated is true and sets it to 0 otherwise. See 11.24 (Quality-of-service Management frame (QMF)). All STAs affiliated with an MLD set (23147)dot11QMFActivated to the same value (see 35.3.24b (Operation of MAC MIBs in an MLD)).  |
| 50 | QMFReconfigurationActivated | The STA sets the QMFReconfigurationActivated field to 1 when dot11QMFReconfigurationActivated is true and sets it to 0 otherwise. See 11.24 (Quality-of-service Management frame (QMF)). All STAs affiliated with an MLD set (23147)dot11QMFReconfigurationActivated to the same value (see 35.3.24b (Operation of MAC MIBs in an MLD)). |
| 84 | Beacon Protection Enabled | ~~The~~An AP sets the Beacon Protection Enabled field to 1 when dot11BeaconProtectionEnabled is true. Otherwise, it is set to 0. All APs affiliated with an AP MLD set (23147)dot11BeaconProtectionEnabled to the same value (see 35.3.24b (Operation of MAC MIBs in an MLD)). This field is reserved for a non-AP STA. See 11.52 (Beacon frame protection procedures). |
| 85 | Mirrored SCS | ~~The~~A STA sets the Mirrored SCS field to 1 when dot11MSCSActivated is true and sets it to 0 otherwise. All STAs affiliated with an MLD set (23147)dot11MSCSActivated to the same value (see 35.3.24b (Operation of MAC MIBs in an MLD)). |
| 103 | ~~Reserved~~Local MAC Address Policy | All STAs affiliated with an MLD set the Local MAC Address Policy subfield to the same value (23147)via the MLD synchronization service. |

35.3.12.2 Basic BSS operation

(23147)Via the MLD synchronization service, all non-AP STAs affiliated with a non-AP MLD shall set each of the ACs U-APSD Flag subfields in the QoS Info field to the same value across all setup links (see 35.3.5 (ML (re)setup)).

35.17 EHT SCS procedure

A non-AP EHT STA with dot11SCSActivated equal to true that supports transmission of SCS Request

frames containing an SCS Descriptor element with a QoS Characteristics element 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 an SCS

Descriptor element with a QoS Characteristics element shall set the SCS Traffic Description Support

subfield value in the EHT Capabilities element that it transmits to 1. (23147)Via the MLD synchronization service, 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.

(23147)All STAs affiliated with an MLD set the SCS field of the Extended Capabilities element that they

transmit to the same value (see 9.4.2.25 (Extended Capabilities element)). 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.

9.4.2.25 Extended Capabilities element

Table 9-192—Extended Capabilities field

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| Bit | Information | Notes |
| 54 | SCS | The STA sets the SCS field to 1 when dot11SCSActivated is true and sets it to 0otherwise. See 11.25.2 (SCS procedures). (23147)All STAs affiliated with an MLD set dot11SCSActivated to the same value (see 35.3.24b (Operation of MAC MIBs in an MLD)). |

35.3.14.2 QMF

All affiliated STAs of an MLD are set dot11QMFActivated to the same value (23147)(see 35.3.24b (Operation of MAC MIBs in an MLD)).

All affiliated STAs of an MLD are set dot11QMFReconfigurationActivated to the same value (23147)(see 35.3.24b (Operation of MAC MIBs in an MLD)).

(23147)35.3.24b Operation of MAC MIBs in an MLD

(23147)Given that an MLD contains one MAC MIB per affiliated STA, yet certain MIB variables operate at the MLD level, then the MLD ensures that these MIB variables are synchronized using the MLD synchronization service defined in 35.3.24a and related mechanisms.

(23147)The following MIB variables shall be identical in the MAC MIBs of affiliated STAs:

* dot11ExtendedChannelSwitchActivated
* dot11MultiDomainCapabilityActivated
* dot11OperatingClassesRequired
* dot11ProxyARPActivated
* dot11WNMSleepModeActivated
* dot11QMFActivated
* dot11QMFReconfigurationActivated
* dot11BeaconProtectionEnabled (in an AP)
* dot11MSCSActivated
* dot11SCSActivated
* dot11QMFActivated
* dot11QMFReconfigurationActivated
* dot11AMSDUFragmentationOptionImplemented
* dot11SPPAMSDUCapable
* dot11SPPAMSDURequired
* dot11MaxTransmitMSDULifetime
* dot11EDCATableMSDULifetime
* dot11QAPEDCATableMSDULifetime

(23147)In each MAC MIB, the following MIB variables shall be the same or higher than indicated to peer STAs:

* dot11MaxMSDULength
* dot11MaxAMSDULength

(23146)The following MIB variables cumulate results from all peers. For an AP, the increment operation related to MLO STAs shall be synchronized before the MIB variables are updated, but the increment operation for non-MLO STAs shall be localized to each affiliated AP:

* dot11TransmittedFrameCount
* dot11FailedCount
* dot11RetryCount
* dot11MultipleRetryCount
* dot11QosCountersIndex for corresponding entries in the QoSCounters Table
* dot11QosFailedCount for corresponding entries in the QoSCounters Table
* dot11QosRetryCount for corresponding entries in the QoSCounters Table
* dot11QosMultipleRetryCount for corresponding entries in the QoSCounters Table
* dot11QosDiscardedFrameCount for corresponding entries in the QoSCounters Table
* dot11TransmittedAMSDUCount
* dot11FailedAMSDUCount
* dot11RetryAMSDUCount
* dot11MultipleRetryAMSDUCount
* dot11TransmittedOctetsInAMSDUCount
* dot11ReceivedAMSDUCount
* dot11ReceivedOctetsInAMSDUCount
* dot11TransmittedMSDUOctetsCount
* dot11ReceivedMSDUOctetsCount

(23146)For the MIB variables under Dot11InterworkingEntry for peer MLO STAs, the increment operation for the counter MIB variables is synchronized, and the other MIB variables are synchronized, except dot11NonAPStationBroadcastCipherSuite, dot11NonAPStationAuthMaxSourceMulticastRate and dot11NonAPStationPowerManagementMode are reserved and set to 0 for peer MLO non-AP STAs.

***TGbe editor, add the 6.1 header from the baseline insert the following at the end of the section***

6.1 Overview of management model

(23165)NOTE – The MAC MIBs in an MLD are subject to synchronization requirements as defined in 35.3.24b (Operation of MAC MIBs in an MLD).

C.1 General

(23148)NOTE 3 – The MAC MIBs in an MLD are subject to synchronization requirements as defined in 35.3.24b (Operation of MAC MIBs in an MLD).