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

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| PDT MAC Coex clause6 for CID 2190 |
| Date: 2025-05-05 |
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**Abstract**

CID 2190

**Revisions:**

* Rev 0: Initial version of the document.

***TGme editor: Please note Baseline is 11bn D0.2. Edits are expressed via Word track changes:***

***Comment:***

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| --- | --- | --- | --- | --- | --- |
| 2190 | 6.4 | 25.33 | STA can never report unavailability since there is no interface defined for this. (See 24/1817 for some extra details.) | Add an MLME primitive for receiving real-time DUO/PUO unavailability reports from other in-device radios, including with priority information. Ditto add an MLME primitive for sending real-time unavailability reports to other in-device radios, including with priority information. | Revised: In general agreement with commenter. Editor please implement changes under CID 2190 in 25/0920<motionedRevision> that substantially address the issue raised by the commenter.  |

***Discussion***

This is a longstanding omission.

As the underlying architecture, assume that:

* an in-device coexistence (IDC) policy and arbitration engine resides in the SME. This determines which wireless interfaces need to become unavailable, when and for how long.
* via prior engineering (or in-service measurements), the SME is aware of which wireless interfaces can transmit and/or receive at the same time, and at what maximum PPDU duration / maximum MCS / whether LDPC is supported / whether immediate acknowledgements are supported / what punctured bandwidth modes are available
* each wireless interface reports upcoming IDC-related communications to the SME engine (typically limited to where not already known by the SME):
	+ either (e.g., more typical for PUO or both PUO+DUO)
		- identifier
		- operator: add/change/delete (where change and delete use the same identifier as is sent with the add)
	+ or (e.g., more typical for DUO)
		- nothing (each new report overrides all previous reports)
	+ transmit / receive / a mix of both
	+ start time
	+ duration (if known)
	+ period (if periodic)
	+ priority information (e.g., TID, where TID = 15 is given special meaning to signal absolute priority)
	+ expiry information (e.g., time to expiry or expiry deadline)
	+ whether deferrable (e.g. initiator with random backoff) or not (e.g., immediate responder)
* the SME makes unavailability or lowered operational mode demands to wireless interfaces:
	+ either (e.g., more typical for PUO or both PUO+DUO)
		- identifier
		- operator: add/change/delete (where change and delete use the same identifier as is sent with the add)
	+ or (e.g., more typical for DUO)
		- nothing (each new report overrides all previous reports)
	+ transmit / receive / a mix of both
	+ start time
	+ duration (if known)
	+ period (if periodic)
	+ what maximum PPDU duration / maximum MCS / whether LDPC is supported / whether immediate acknowledgements are supported / what punctured bandwidth modes are available
	+ under what circumstances an unavailability window might be deferred or cancelled (e.g., TID, where TID = 15 is assigned special meaning to indicate that no deferral or cancellation is possible)

To realize this arch, we need to define:

* How SME obtains information for
	+ PUO: periodic flows, over the 802.11 wireless interface, comprising bursts where the variability related to the amount of offered traffic, the arrival time of the offered traffic and related channel access delays for each burst **can** be reasonably bounded.

How this information reaches the SME is never explicit in SCS(QC) and RTWT. Worse, there is no defined interface for the SME to snoop the 802.11 data-plane. Could be:

* + - detected at MAC, then sent to SME // would need a new MLME SAP interface (11mf work)
		- detected by upper layers in the network stack or at the application layer, then sent to SME // out of scope of 802.11
	+ else DUO:
		- periodic flows comprising bursts where the variability related to the amount of offered traffic, the arrival time of the offered traffic and related channel access delays for each burst **cannot** be reasonably bounded, and
		- aperiodic traffic

How this information reaches the SME is not explicit in the currently accepted DUO draft text. As before, there is no defined interface for the SME to snoop the 802.11 data-plane, and worse, given that buffering and channel access delays are only known at MAC for these types of traffic, we cannot assume that upper layers have sufficient information. **An 802.11 MLME SAP is required.**

* // How the SME acquires information for traffic over a non-802.11 interface is out of scope of the 802.11 standard but the 802.11 MLME SAP might be used as a template by non-802.11 systems
* How the SME creates PUO agreements for 802.11

Should consider the CHANNELUSAGE type 1 MLME primitive. The CHANNELUSAGE primitive is for the Channel Usage feature which contains multiple sub-features, most of which do not relate to PUO (and the Channel Usage feature lacks some PUO behavior defined in 37.12.3). **An 802.11 MLME SAP is preferred.**

* How the SME makes DUO demands for 802.11 MACs
	+ How this happens is currently undefined. **An 802.11 MLME SAP is required.**
* // How the SME creates PUO agreements/DUO demands for traffic over a non-802.11 interface is out of scope of the 802.11 standard but the 802.11 MLME SAP might be used as a template by such non-802.11 systems

Finally, there is one important detail: for the start time parameters, the SME and MLME must exchange timestamps in a way that is mutually understood. Several possibilities exist that require no change to the MAC-SAP:

* Given that the clause 6 MLME SAP interface is instantaneous, the start time might be encoded as the number of microseconds between the MLME primitive issuance and the start of the indicated event. Here the primitive recipient might *instantaneously* convert this relative time to an absolute time (i.e., MLME might convert the signaled relative time to microseconds and add this value to the current TSF value).
* The SME and MLE might have clocks that increment according to a common oscillator (i.e., locked clocks). Then the signaled start time might be the time from an agreed event (e.g., the first or most recent MLME-RESET or MLME-JOIN) until the start of the indicated event
* The SME might regularly publish its clock to the MLME (e.g., via an undocumented vendor specific MLME primitive)

***Proposed changes under CID 2190, assuming 11bnD0.2 as the baseline, using Word track changes and instructions to the 11bn editor***:

6.4 Table of MLME SAP interfaces

Table 6-1— MLME SAP interface

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Service Name | MLME-XXX | Type | References | Comments |
| Unavailability reporting and parameter updates | UNAVAILABILITY- DUO-SESSION | 1 | 37.12.2 (Dynamic Unavailability Operation (DUO) mode) |  |
| UNAVAILABILITY- DUO | 3 | 37.12.2 (Dynamic Unavailability Operation (DUO) mode) |  |
| UNAVAILABILITY- PUO-AGREEMENT | 1 | 37.12.3 (Non-AP STA periodic unavailability operation (PUO) mode) |  |
| UNAVAILABILITY- PUO-AP | 2 | 37.12.4 (AP PUO mode) |  |
| UNAVAILABILITY- LOM | 1 | 37.12.5 (Non-AP STA Parameter Update mechanism) |  |
| UNAVAILABILITY-NOTIFY | 7 | 37.12.5a (SME Informational Interface)  |  |

37.12.2 Dynamic Unavailability Operation (DUO) mode

Given receipt of an MLME-UNAVAILABILITY- DUO.request primitive, a DUO non-AP STA that is operating in the DUO mode and that is a TXOP responder may indicate, in a response Multi-STA BlockAck frame, whether the non-AP STA will be unavailable after a specific point in time and, if known, for how long, by including a Per-AID TID Info field that contains an Unavailability Target Start Time and Unavailability Duration (see 9.3.1.8.6 (Multi-STA BlockAck variant)).

Given receipt of an MLME-UNAVAILABILITY- DUO.request primitive, a DUO non-AP STA that is operating in the DUO mode and that is a TXOP holder may indicate in a BSRP Trigger frame whether the non-AP STA will be unavailable after a specific point in time, and, if known, for how long, by including a TBD User Info field that contains an Unavailability Target Start Time and Unavailability Duration (see 9.3.1.22 (Trigger frame format)). The DUO non-AP STA may transmit this BSRP Trigger frame only if certain TBD conditions are true. The response frame to such a BSRP Trigger frame is a Multi-STA BlockAck frame in non-HT (duplicate) PPDU format.

Parameters of the UNAVAILABILITY-WINDOW.request primitive shall include start time and duration (if known) (see 9.3.1.22 (Trigger frame format) and 9.3.1.8.6 (Multi-STA BlockAck variant)) and may include identifier, operator (add / change / delete), direction (transmit / receive / both), priority information, expiry information, and identification of the circumstances, if any, under which the unavailability is deferrable.

***TGbn editor: add the following as new subclause after 37.12.5***

37.12.5a SME Informational Interface

For the SME of a STA in a device performing a PUO session or is operating in DUO mode (or equivalent) on another collocated wireless interface, the STA may report its own activity via the MLME-UNAVAILABILITY-NOTIFY.indication primitive. Parameters of the primitive shall include start time and duration (if known) (see 9.3.1.22 (Trigger frame format) and 9.3.1.8.6 (Multi-STA BlockAck variant)) and may include identifier, operator (add / change / delete), direction (transmit / receive / both), period (if periodic), priority information, expiry information, identification of the circumstances, if any, under which the unavailability is deferrable, and parameters related to limited operation mode.