IEEE P802.11
Wireless LANs

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| 11be Spec text for motion 137, SP244 related to WNM Sleep Procedure |
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Abstract

We propose the draft text related to a motion related to power-save (Motion 137, #SP244) to help the creation of TGbe draft D0.4.

Revisions:

* Rev 0: Initial version of the document.
* Rev 1:
	+ Live changes when the doc was discussed on 1/25/21 11be MAC telco
	+ The group keys for AP(s) of an MLD is carried as a sub-element in the Key Data field of the WNM Sleep Response frame.
		- Removed text on carrying group keys in ML IE.
	+ Incorporates offline feedback from Mark R., Rojan, and Edward
* Rev 2:
	+ Updates based on feedback from Rojan and Mark R.
* Rev 3:
	+ Additional updates based on feedback from Mark R.

**The proposed texts is based on the following motion:**

In R1, the WNM sleep interval of a non-AP MLD is applied at the MLD level and not at the link level.

**[Motion 137, #SP244]**

**Proposed spec text:**

The baseline for this text is 802.11 REVmd draft D5.0 and 802.11be D0.3.

* Definitions specific to IEEE Std 802.11

***TGbe editor: please add a NOTE after the following definition in this subclause as shown below:***

**wireless network management (WNM) sleep mode:** An extended power save mode for non-access-point (non-AP) stations (STAs) and non-AP multi-link devices (MLDs) whereby a non-AP STA or STAs affiliated with a non-AP MLD need not listen for every delivery traffic indication map (DTIM) Beacon frame and does not perform group temporal key/integrity group temporal key/beacon integrity group temporal key (GTK/IGTK/BIGTK) updates.

* WNM sleep mode

***TGbe editor: please update the following paragraph in this subclause as shown below:***

WNM sleep mode is an extended power save mode in which a non-AP STA or STAs affiliated with a non-AP MLD need not listen for every DTIM Beacon frame, and need not perform GTK/IGTK/BIGTK updates. For an association that is not a multi-link setup, WNM sleep mode enables a non-AP STA to signal to an AP that it might sleep for a specified length of time. For an association that is a multi-link setup between an AP MLD and a non-AP MLD, WNM sleep mode enables a STA affiliated with the non-AP MLD to signal to an AP affiliated with the AP MLD that all the STAs affiliated with the non-AP MLD might sleep for a specified length of time. This enables a non-AP STA or a non-AP MLD to reduce power consumption and remain associated while the non-AP STA or non-AP MLD has no traffic to send to or receive from the AP or AP MLD.

* WNM Sleep Mode Response frame format

***TGbe editor: please update the 5th paragraph and Table 9-429 in this subclause as shown below:***

The Key Data field contains zero or more subelements that provide the current GTK, IGTK and BIGTK to the STA. The format of these subelements is shown in Figure 9-939 (WNM Sleep Mode GTK subelement format), Figure 9-940 (WNM Sleep Mode IGTK subelement format), Figure 9-941 (WNM Sleep Mode BIGTK subelement format), Figure 9-941a (WNM Sleep Mode MLO GTK subelement format), Figure 9-941c (WNM Sleep Mode MLO IGTK subelement format), and Figure 9-941d (WNM Sleep Mode MLO BIGTK subelement format). The subelement IDs for these subelements are defined in Table 9-429 (Optional subelement IDs for WNM Sleep Mode parameters). When management frame protection is not used, the Key Data field is not present.

|  |
| --- |
| * Optional subelement IDs for WNM Sleep Mode parameters
 |
| Value | Contents of subelement |
| 0 | GTK |
| 1 | IGTK |
| 2 | BIGTK |
| 3 | MLO GTK |
| 4 | MLO IGTK |
| 5 | MLO BIGTK |
| 6–255 | Reserved |

***TGbe editor: please insert the following before the paragraph starting “The WNM Sleep Mode Element field contains …” as shown below:***

The MLO GTK subelement contains the GTK for the AP operating on the link identified by the Link ID subfield carried in the subelement. The format of the MLO GTK subelement is shown in Figure 9-941a (WNM Sleep Mode MLO GTK subelement format).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Subelement ID | Length | Link Info | Key Info | Key Length | RSC | Key |
| Octets: | 1 | 1 | 1 | 2 | 1 | 8 | 5 to 32 |
|  | **Figure 9-941a – WNM Sleep Mode MLO GTK subelement format** |

The Length field is defined in 9.4.3 (Subelements).

The format of the Link Info field is shown in Figure 9-941b (Link Info field format).

|  |  |  |
| --- | --- | --- |
|  |  B0 B3 |  B4 B7 |
|  | Link ID | Reserved |
| Bits: | 4 | 4 |
| Figure 9-941b – Link Info field format |

The Link ID subfield identifies the link of the AP MLD.

The Key Info, Key Length and RSC fields are as defined for GTK subelement.

The Key field is the GTK being distributed for the AP operating on the link identified by the Link ID subfield.

The MLO IGTK subelement contains the IGTK for the AP operating on the link identified by the Link ID subfield carried in the subelement. The format of the MLO IGTK subelement is shown in Figure 9-941b (WNM Sleep Mode MLO IGTK subelement format).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Subelement ID | Length | Link Info | Key ID | PN | Key |
| Octets: | 1 | 1 | 1 | 2 | 6 | 16 |
|  | **Figure 9-941c – WNM Sleep Mode MLO IGTK subelement format** |

The Length field is defined in 9.4.3 (Subelements).

The format of the Link Info field is shown in Figure 9-941b (Link Info field format).

The Key ID and PN fields as defined for IGTK subelement.

The Key field is the IGTK being distributed for the AP operating on the link identified by the Link ID subfield.

The MLO BIGTK subelement contains the BIGTK for the AP operating on the link identified by the Link ID subfield carried in the subelement. The format of the MLO BIGTK subelement is shown in Figure 9-941 (WNM Sleep Mode MLO BIGTK subelement format).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Subelement ID | Length | Link Info | Key ID | BIPN | Key |
| Octets: | 1 | 1 | 1 | 2 | 6 | 16 or 32 |
|  | **Figure 9-941d – WNM Sleep Mode MLO BIGTK subelement format** |

The Length field is defined in 9.4.3 (Subelements).

The format of the Link Info field is shown in Figure 9-941b (Link Info field format).

The Key ID and BIPN fields are as defined for the BIGTK subelement.

The Key field is the BIGTK being distributed for the AP operating on the link identified by the Link ID subfield.

NOTE 1—There might be multiple MLO GTK, multiple MLO IGTK, and multiple MLO BIGTK subelements if a group rekeying is in process for one or more links when the non-AP MLD wakes up from WNM sleep mode. The Subelement ID field and Link ID subfield identifies the key type and the link to which the key(s) apply.

NOTE 2—Management frame protection is used to provide confidentiality, replay, and integrity protection for MLO GTK/IGTK/BIGTK update in WNM Sleep Mode Response frames.

* Multi-link power management

***TGbe editor: please add a new subclause under this clause as shown below:***

* + - 1. WNM sleep mode in multi-link operation

An MLD that implements WNM sleep mode shall indicate its capability by setting the WNM Sleep Mode field to 1 in the Extended Capabilities element that is transmitted by its affiliated STAs.

A STA affiliated with a non-AP MLD may transmit a WNM Sleep Mode Request frame (see 9.6.13.19 (WNM Sleep Mode Request frame format)) to an AP affiliated with an AP MLD that has indicated support for WNM sleep mode capability.

All STAs of an MLD shall advertise the same WNM Sleep Mode capability.

An AP of an AP MLD shall send a WNM Sleep Mode Response frame in response to a WNM Sleep Mode Request frame received from a STA of a non-AP MLD. An AP of an AP MLD may send this frame without solicitation upon the AP MLD’s deletion of all traffic filter sets established according to the traffic filtering agreement between the AP MLD and the non-AP MLD (see 9.6.13.20 (WNM Sleep Mode Response frame format)).

The WNM sleep state is maintained at the MLD level and WNM sleep mode procedures defined in 11.2.3 (Power management in a non-DMG infrastructure network) and 11.2.3.16 (WNM sleep mode) are performed at the MLD level and apply to all the STAs affiliated with the MLD.

* Power management in a non-DMG infrastructure network
* General

***TGbe editor: Please update the following paragraph in this subclause as follows:***

WNM sleep mode enables an extended power save mode in which a non-AP STA need not listen for every DTIM Beacon frame, and need not perform GTK/IGTK/BIGTK updates. A STA in WNM sleep mode can wake up as infrequently as once every WNM sleep interval to check whether its corresponding TIM bit is set or group addressed traffic is pending. The WNM sleep interval advertised by a STA of a non-AP MLD is applied at the MLD level and the WNM procedures described in this subclause and in 11.2.3.16 (WNM sleep mode) are are performed at the MLD level and apply to all the STAs affiliated with the MLD.

NOTE—A STA may use both WNM sleep mode and PS mode simultaneously.

* + - * 1. WNM sleep mode non-AP STA operation

***TGbe editor: Please add the following as the last paragraph in this subclause:***

A non-AP MLD identifies the link to which the GTK/IGTK/BIGTK belongs based on the Link ID subfield carried in the corresponding subelement of the Key Data field.

* WNM sleep mode AP operation

***TGbe editor: Please update the following paragraph in this subclause as follows:***

When the association is not a multi-link setup:

* If RSN is used with management frame protection and a valid PTK is configured for the STA, the current GTK, IGTK, and BIGTK shall be included in the WNM Sleep Mode Response frame.
* If a GTK/IGTK/BIGTK update is in progress, the pending GTK, IGTK, and BIGTK shall be included in the WNM Sleep Mode Response frame.
* If RSN is used without management frame protection and a valid PTK is configured for the STA, the current GTK shall be sent to the STA using a group key handshake (see 12.7.7 (Group key handshake)) immediately following the WNM Sleep Mode Response frame.

When the association is a multi-link setup:

* If RSN is used with management frame protection and a valid PTK is configured between the MLDs, the current GTK, IGTK, and BIGTK for each the links shall be included in the WNM Sleep Mode Response frame.
* If a GTK/IGTK/BIGTK update is in progress for one or more links, the pending GTK(s), IGTK(s), and BIGTK(s) for the affected link(s) shall be included in the WNM Sleep Mode Response frame.
* If RSN is used without management frame protection and a valid PTK is configured for the STA, the current GTK for all the links shall be sent to the STA using a group key handshake (see 12.7.7 (Group key handshake)) immediately following the WNM Sleep Mode Response frame.
* Extended Capabilities element

***TGbe editor: Please update the following entry in Table 9-153 as follows:***

|  |
| --- |
| * Extended Capabilities field
 |
| Bit | Information | Notes |
| 17 | WNM Sleep Mode | A non-AP STA or a STA of a non-AP MLD sets the WNM Sleep Mode field to 1 when dot11WNMSleepModeActivated is true, and sets it to 0 otherwise. See 11.2.3.16 (WNM sleep mode). |

**C.3 MIB detail**

***TGbe editor: Please update the following entry in this subclause as follows:***

dot11WNMSleepModeImplemented OBJECT-TYPE

 SYNTAX TruthValue

 MAX-ACCESS read-only

 STATUS current

 DESCRIPTION

 "This is a capability variable.

 Its value is determined by device capabilities.

 This attribute, when true, indicates that the station or non-AP MLD implementation is capable of supporting WNM sleep mode when dot11WirelessManagementImplemented is equal to true."

 ::= { dot11WirelessMgmtOptionsEntry 10 }