IEEE P802.11
Wireless LANs

|  |
| --- |
| TDD time synchronization clarifications |
| Date: 2019-05-15 |
| Author(s): |
| Name | Affiliation | Address | Phone | Email |
| Payam Torab  | Facebook |  |  | ptorab@fb.com |
|  |  |  |  |  |

Abstract

We clarify the TDD Synchronization element definition and usage.

Addressed CIDs: 4415

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Page** | **Line** | **Comment** | **Proposed Change** |
| 4415 | 11.1.7 | 348 | 16 | TDD time synchronization mode is missing details, not using clockQuality.dot11DMGSyncModeActivated = false means STA (AP, non-AP, ..) will ignore any timestamp from peers.dot11DMGSyncModeActivated = true means STA (AP, non-AP, ...) may sync to peer's clock based on a hierarchical comparison of local and peer clock. | - Add the following fields to TDD Synchronization element, in this order: Priority 1 (8 bits), Clock Class (8 bits), Clock Accuracy (8 bits), Offset Scaled Log Variance (16 bits), and Priority 2.- Remove ClockQuality and sync Mode fields from TDD Synchronization element; first one is a concatenation of [Clock Class, Clock Accuracy and Offset Scaled Log Variance] fields, which now are explicitly added. SyncMode field is unnecessary; it is equivalent to {- Deciding whether peer clock is "better" than local is based on this hierarchy, but decision is ultimately implementation specific, that is a better clock may still be ignored if it falls within a threshold- priority1 higher (numerically lower)- clockClass better- clockAccuracy better- offsetScaledLogVariance better- priority2 higher (numerically lower)[As a practical implementation note, clock class will be 6, 7 and 52 for a device with access to GNSS that, respectively (1) has reception, (2) has lost reception but is in holdover mode, and (3) has lost reception and out go holdover mode. |

**Resolution:** Revised.

**Discussion:** The TDD time synchronization framework allows a STA to synchronize its TSF timer to a source of timing such as GNSS, locally available to the STA. In the absence of, or when losing access to, the external source of timing, STA can synchronize its TSF timer to that of its peer(s) – independent of the STA role in the BSS (AP, non-AP). Not limiting the source of timing to AP/PCP means that the STA can receive multiple Timestamp field values from different peers. We clarify that the Clock Quality metric in the TDD Synchronization element can be used to decide the best clock among the peers in this case.

***>>> (Editorial) Rename dot11DMGSyncModeActivated to dot11DMGTDDLocalClockModeActivated***

**9.4.2.271 TDD Synchronization element**

The TDD Synchronization element contains the information needed for clock synchronization during TDD SPs. The format of the element is shown in Figure 102.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Element ID Extension | Clock Attributes | Time Source | Sync Mode |
| Octets: | 1 | 1 | 1 |  15 | 1 | 1 |

**Figure 102 —TDD Synchronization element format**

The Element ID, Length, and Element ID Extension fields are defined in 9.4.2.1.

The Clock Attributes field is defined in Figure X.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Priority 1 | Clock Class | Clock Accuracy | Offset Scaled Log Variance | Priority 2 | Clock Identity |
| Octets: | 1 | 1 | 1 | 2 | 1 | 8 |

**Figure X —Clock Attributes field**

The Priority 1, Clock Class, Clock Accuracy, Offset Scaled Log Variance, Priority 2 and Clock Identity subfields indicate attributes of the source of timing locally available to the STA that transmits the element, and are defined the same as priority1, clockClass, clockAccuracy, offsetSceledLogVariance, priority2 and clockIdentity attributes defined in IEEE Std 802.1AS-Rev/D8.0, Section 8.6.2 (PTP Instance attributes).

The Time Source field is an information only field that indicates the type of clock available to the STA transmitting the element. It is defined the same as the timeSource attribute IEEE Std 802.1AS-Rev/D8.0, Section 8.6.2 (PTP Instance attributes).

NOTE 1—The Clock Attributes field is defined similar to the 802.1AS systemIdentity attribute, as a metric to compare the local clock available to a STA and the clock available to the peer STA that transmits the TDD Clock Attributes element. While the comparison metric and logic are defined the same as 802.1AS for flexibility, using the 802.1AS protocol for TDD time synchronization is not required and is outside the scope of tis standard.

NOTE 2—DMG STAs that support TDD channel access can use external timing sources such as GNSS for accurate Clock Attributes. For example, for a STA with access to a clock that is synchronized to a primary reference time source such as GNSS (i.e., clockClass of 0x06), and has a precision of ±500 ps (i.e., clockAccuracy 0f 0x23) and a clock variance of 1.497e-22 s2 (i.e., offsetScaledLogVariance 0x3780), the Clock Class, Clock Accuracy and Offset Scaled Log Variance fields are respectively set to 0x06, 0x23 and 0x3780. Refer to IEEE Std 802.1AS for details.

The Sync Mode field indicates access to a local source of timing (e.g., GNSS). The Sync Mode field is set to 1 to indicate that the STA does not have access to a local source of timing at the time of sending the element. The Sync Mode field is set to 0 to indicate that the local clock is used by the STA at the time of sending the element.

***>>> Edit Section 11.1.7 (P348L16) as follows:***

**11.1.7 TDD time synchronization**

This section applies to DMG STAs that are operating under TDD channel access (see 10.40.6.2.2) and have set the TDD Synchronization Mode subfield in their DMG Capabilities element to 1.

All STAs shall include a TDD Synchronization element, at least once per beacon interval, in the Announce frames they transmit. An AP or PCP may include a TDD Synchronization element in DMG Beacon frames.

NOTE—STA is not required to transmit the TDD Synchronization element during a beacon interval where it does not have transmit opportunity, subject to TDD channel access rules, to transmit an Announce frame.

A STA with dot11DMGTDDLocalClockModeActivated set to true shall not update its TSF timer based on the Timestamp field of a received DMG Beacon or Announce frame.

A STA with dot11DMGTDDLocalClockModeActivated set to false shall update its TSF timer based on the Timestamp field of each received DMG Beacon or Announce frame that includes a TDD Synchronization element with the Sync Mode field set to 0, unless (1) the last frame the STA used to update its TSF timer was a frame received in the same beacon interval as the new frame, and (2) the Clock Attributes field in the TDD Synchronization element of that frame scores better than the Clock Attributes field in the TDD Synchronization element of the new frame. The logic to compare two Clock Attributes field values is the same as the logic to compare two 802.1AS systemIdentity attributes, as defined in IEEE Std 802.1AS-Rev/D8.0, Section 8.6.2 (PTP Instance attributes).

NOTE—While the comparison metric and logic are defined the same as 802.1AS for flexibility, using the 802.1AS protocol for TDD time synchronization is not required and is outside the scope of this standard. The logic to compare two Clock Attributes field values is a hierarchical comparison of the Clock Attributes subfields in this order: Priority 1, Clock Class, Clock Accuracy, Offset Scaled Log Variance, and Priority 2, with a lower numerical value for each subfield indicating a better clock.

The SME of a STA with dot11DMGTDDLocalClockModeActivated set to false shall issue an MLME-DISASSOCIATE.request primitive with ReasonCode parameter set to TIME\_SYNC\_LOST and PeerSTAAddress parameter set to the TA of the last received Announce frame that has the Sync Mode field in the TDD Synchronization element equal to 1.

***>>> Revise the dot11DMGTDDLocalClockModeActivated definition in Annex C:***

dot11DMGTDDLocalClockModeActivated OBJECT-TYPE 17

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a control variable.

It is written by the SME or an external management entity.

Changes take effect as soon as practical in the implementation.

This attribute, when true, indicates that TSF timer is synchronizing to a local source of timing."

DEFVAL { false }

::= { dot11DMGSTAConfigEntry 8 }