IEEE P802.11  
Wireless LANs

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##### Baseline is 11mc D2.7. Changes indicated by a mixture of Word track-changes and instructions. For equation changes, Tex notation is sometimes used. E.g. a\_{xyz}^b denotes axyzb . Yellow highlighting means “look at the highlighted text more closely”.

Overview of changes

* FTM Range report capability in RM enabled capabilities element
* Neighbor report includes reporting AP when location is reported
* Extra detail for Clause 6
* 1 bit in Z to indicate better loc post assoc.
* In FTM Range request, limit Count to 1-15 neighboring APs (not up to 255)
* In FTM Range request, add a Maximum Age subelement

***Change*:**

**6.3.32.2.2 Semantics of the service primitive**

The primitive parameters are as follows:

MLME-NEIGHBORREPREQ.request(

DialogToken,

SSID,

LCI Measurement Request,

Location Civic Measurement Request,

VendorSpecificInfo

)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| SSID | As defined in the SSID element | As defined in the SSID element | Optional SSID element to request a neighbor list for a specific SSID. |
| LCI Measurement Request | As defined in 8.6.7.6 (Neighbor Report Request frame format) | As defined in 8.6.7.6 (Neighbor Report Request frame format) | Optional element included to request LCI information in Neighbor Report elements |
| Location Civic Measurement Request | As defined in 8.6.7.6 (Neighbor Report Request frame format) | As defined in 8.6.7.6 (Neighbor Report Request frame format) | Optional element included to request Location Civic information in Neighbor Report elements |
| Vendor-SpecificInfo | A set of elements | As defined in 8.4.2.25 (Vendor Specific element) | Zero or more elements. |

**6.3.32.3.2 Semantics of the service primitive**

The primitive parameters are as follows:

MLME-NEIGHBORREPREQ.indication(

PeerSTAAddress,

DialogToken,

SSID,

LCI Measurement Request,

Location Civic Measurement Request,

VendorSpecificInfo

)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| SSID | As defined in the SSID element | As defined in the SSID element | Optional SSID element to request a neighbor list for a specific SSID. |
| LCI Measurement Request | As defined in 8.6.7.6 (Neighbor Report Request frame format) | As defined in 8.6.7.6 (Neighbor Report Request frame format) | Optional element included to request LCI information in Neighbor Report elements |
| Location Civic Measurement Request | As defined in 8.6.7.6 (Neighbor Report Request frame format) | As defined in 8.6.7.6 (Neighbor Report Request frame format) | Optional element included to request Location Civic information in Neighbor Report elements |
| Vendor-SpecificInfo | A set of elements | As defined in 8.4.2.25 (Vendor Specific element) | Zero or more elements. |

**6.3.58.2.2 Semantics of the service primitive**

The primitive parameters are as follows:

MLME-FINETIMINGMSMT.request(

Peer MAC Address,

Dialog Token,

Follow Up Dialog Token,

t1,

Max t1 Error,

t4,

Max t4 Error,

LCI Report,

Location Civic Report.

Fine Timing Measurement Parameter,

VendorSpecific

)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| Max t4 Error | Integer | 0–32 767(#2164) | Maximum error in t4 value expressed in 0.1 ns(#2164) units. A value of 0 indicates that the upper bound on the error is unknown. A value of 32 767 (#2164) indicates that the upper bound on the error is greater than or equal to 3.2767 μs. |
| LCI Report | As defined in 8.6.8.35 (Fine Timing Measurement frame format) | As defined in 8.6.8.35 (Fine Timing Measurement frame format) | Optional element to report LCI information of sender |
| Location Civic Report | As defined in 8.6.8.35 (Fine Timing Measurement frame format) | As defined in 8.6.8.35 (Fine Timing Measurement frame format) | Optional element to report Location Civic information of sender |
| Fine Timing Measurement Parameter | As defined in 8.4.2.166 (Fine Timing Measurement Parameter element) | As defined in 8.4.2.166 (Fine Timing Measurement Parameter element) | Optional element containing the proposed fine timing measurement configuration |
| VendorSpecific | A set of information elements | As defined in 8.4.2.25 (Vendor Specific element) | Zero or more elements |

**6.3.58.3.2 Semantics of the service primitive**

The primitive parameters are as follows:

MLME-FINETIMINGMSMT.confirm(

Peer MAC Address,

Dialog Token,

t1,

Max t1 Error,

t4,

Max t4 Error(#1015),

LCI Report,

Location Civic Report.

Fine Timing Measurement Parameter,

VendorSpecific

)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| Max t4 Error | Integer | 0–32 767(#2164) | Maximum error in t4 value expressed in 0.1 ns(#2164) units. A value of 0 indicates that the upper bound on the error is unknown. A value of 32 767 (#2164) indicates that the upper bound on the error is greater than or equal to 3.2767 μs. |
| LCI Report | As defined in 8.6.8.35 (Fine Timing Measurement frame format) | As defined in 8.6.8.35 (Fine Timing Measurement frame format) | Optional element to report LCI information of sender |
| Location Civic Report | As defined in 8.6.8.35 (Fine Timing Measurement frame format) | As defined in 8.6.8.35 (Fine Timing Measurement frame format) | Optional element to report Location Civic information of sender |
| Fine Timing Measurement Parameter | As defined in 8.4.2.166 (Fine Timing Measurement Parameter element) | As defined in 8.4.2.166 (Fine Timing Measurement Parameter element) | Optional element containing the proposed fine timing measurement configuration |
| VendorSpecific | A set of information elements | As defined in 8.4.2.25 (Vendor Specific element) | Zero or more elements |

**6.3.70.2.2 Semantics of the service primitive**

The primitive parameters are as follows:

MLME-FINETIMINGMSMTRQ.request(

Peer MAC Address,

Trigger,

LCI Request,

Locaton Civic Request,

Fine Timing Measurement Parameter,Vendor Specific

)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| Trigger | Integer | 0–1 | The trigger to identify the action. |
| LCI Request | As defined in 8.6.8.34 (Fine Timing Measurement Request frame format) | As defined in 8.6.8.34 (Fine Timing Measurement Request frame format) | Optional element to request LCI information of sender |
| Location Civic Request | As defined in 8.6.8.34 (Fine Timing Measurement Request frame format) | As defined in 8.6.8.34 (Fine Timing Measurement Request frame format) | Optional element to request Location Civic information of sender |
| Fine Timing Measurement Parameter | As defined in 8.4.2.166 (Fine Timing Measurement Parameter element) | As defined in 8.4.2.166 (Fine Timing Measurement Parameter element) | Optional element containing the desired fine timing measurement configuration |
| VendorSpecific | A set of elements | As defined by 8.4.2.25 (Vendor Specific element) | Zero or more elements |

**6.3.70.3.2 Semantics of the service primitive**

The primitive parameters are as follows:

MLME-FINETIMINGMSMTRQ.indication(

Peer MAC Address,

Trigger,

LCI Request,

Locaton Civic Request,

Fine Timing Measurement Parameter,

Vendor Specific

)

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| Trigger | Integer | 0–1 | The trigger to identify the action. |
| LCI Request | As defined in 8.6.8.34 (Fine Timing Measurement Request frame format) | As defined in 8.6.8.34 (Fine Timing Measurement Request frame format) | Optional element to request LCI information of sender |
| Location Civic Request | As defined in 8.6.8.34 (Fine Timing Measurement Request frame format) | As defined in 8.6.8.34 (Fine Timing Measurement Request frame format) | Optional element to request Location Civic information of sender |
| Fine Timing Measurement Parameter | As defined in 8.4.2.166 (Fine Timing Measurement Parameter element) | As defined in 8.4.2.166 (Fine Timing Measurement Parameter element) | Optional element containing the desired fine timing measurement configuration |
| VendorSpecific | A set of elements | As defined by 8.4.2.25 (Vendor Specific element) | Zero or more elements |

**8.4.2.21.10 Location Configuration Information (#1294)report**

The format of the STA Floor Info field is defined in Figure 8-213 (Z subelement format(#2403)).(#2403).

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 | B1 B14 | B15 |
|  | Expected to Move | STA Floor Number | STA Location Policy |
| Bits: | 1 | 14 | 1 |

**Figure 8-214—STA Floor Info field format**

***11mc editor: Insert the new parapgraph (2 paragraphs below) immediately after the existing paragraph (immediately below)***

If the STA Height Above Floor field indicates an unknown STA height above floor, the STA Height Above Floor Uncertainty field is set to 0. (#2403)

The STA Location Policy field indicates whether additional STA or neighboring STA location information is available if the additional information can be transferred more securely. The security of the transfer is (from lowest to highest): unassociated, associated without RSNA established, associated with RSNA established but without management frame protection negotiated, and associated with both RSNA established and management frame protection negotiated. The additional information might be one or more of: 1) the STA’s location with reduced uncertainty and 2) the location of additional neighbor APs, if the STA Location Policy field is carried within a Neighbor Report Response frame. A value of 1 indicates additional STA or neighboring STA location information is available. A value of 0 indicates no additional STA or neighboring STA location information is available.

**8.4.2.44 RM Enabled Capabilities element**

**Table 8-161—RM Enabled Capabilities definition**

|  |  |  |
| --- | --- | --- |
| **Bit position in the RM Enabled Capabilities field** | **Field name** | **Notes** |
| 34 | FTM Range Report Capability Enabled | ASTA sets FTM Range Report Capability Enabled field to 1 when dot11RMFineTimingMsmtRangeRepActivated is true, and sets it to 0 otherwise. |
| 35-39 | Reserved |  |

**8.4.2.20.19 Fine Timing Measurement Range request(#2403)**

The Minimum AP Count field specifies the minimum number of fine timing measurement ranges between the requested STA and the APs listed in the Neighbor Report Subelements field that are requested. The value 0 and values above 15 are reserved.

The Optional Subelements field format contains zero or more subelements, each consisting of a 1-octet

Subelement ID field, a 1-octet Length field, and a variable-length Data field, as shown in Figure 8-575

(Subelement format). Any optional subelements are ordered by nondecreasing Subelement ID. Optional subelements are listed in Table 8-9999.

Table 8-9999—Optional subelement IDs for Fine Timing Measurement Rangerequest (#1294)(#1429)

|  |  |  |
| --- | --- | --- |
| Subelement ID | Name | Extensible |
| 0-3 | Reserved |  |
| 4 | Maximum Age | Yes |
| 5–220 | Reserved |  |
| 221 | Vendor Specific |  |
| 222-255 | Reserved |  |

The Maximum Age subelement indicates the maximum age of the requested Fine Timing Measurement ranges. The format of the Maximum Age subelement is defined in Figure 8-9999. The absence of a Maximum Age subelement indicates that Fine Timing Measurement ranges determined at or after the Fine Timing Measurement range request is received are requested.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Subelement ID | Length | Maximum Age |
| Octets | 1 | 1 | 2 |

Figure 8-9999: Format of Maximum Age subelement

The Subelement ID field is set to the value for Maximum Age in Table 8-79 (Optional subelement

IDs for LCI request).

The Length field is defined in 8.4.3 (Information Subelements).

The Maximum Age field of a Maximum Age subelement indicates the maximum elapsed time between when Fine Timing Measurement ranges are determined and when a Fine Timing Measurement range request is received, within which the Fine Timing Measurement ranges satisfy the Fine Timing Measurement range request. The Maximum Age field is encoded as an unsigned integer with units of 0.1 seconds. The value of 0 is reserved. The value of 65535 indicates that Fine Timing Measurement ranges determined at any time are acceptable.

The Vendor Specific subelements have the same format as their corresponding elements (see 8.4.2.25

(Vendor Specific element)). Multiple Vendor Specific subelements can be included in the list of Optional Subelements.

**10.11.9.11 Fine Timing Measurement Range report(#2403)**

The Fine Timing Measurement Range report provides a means for a requesting STA to request a responding STA that advertises ~~Fine Timing Measurement~~FTM Range Report Capability Enabled equal to true in the RM Enabled Capabilities element to measure and report the ranges between the responding STA and other nearby APs where the ranges are determined using the fine timing measurement procedure (see 10.24.6 (fine timing measurement procedure(#46))).

***Note to reader, not for inclusion in the draft, insert the following sentence only if Carlos Aldana’s document 14/525 is adopted***

If dot11RMFineTimingMsmtRangeRepActivated is set to true, dot11MgmtOptionFineTimingMsmtInitActivated shall be set to true also.

If a responding STA with dot11RMFineTimingMsmtRangeRepActivated equal to true accepts a Fine Timing Measurement Range request, then

* if the request includes a Maximum Age subelement, and the STA has already determined Fine Timing Measurement ranges to C APs listed in the Neighbor Report subelements field in the Measurement Request field within the indicated Maximum Age, then the STA may use these ranges instead of initiating new fine timing measurement procedures with the C APs
* considering the remaining listed APs in the Neighbor Report subelements field in the Measurement Request field, if Minimum AP Count exceeds C, the responding STA shall wait a random delay up to Randomization Interval in the Measurement Request element (see 10.11.3 (Measurement start time)) then initiate the fine timing measurement procedure with at least Minimum AP Count – C remaining listed APs. The responding STA should initiate the fine timing measurement procedure with the remaining listed APs until either the responding STA has successfully measured the range between the responding STA with at least Minimum AP Count –C APs or has attempted the fine timing measurement procedure with all remaining listed APs. For each fine timing measurement procedure that is attempted with a remaining listed AP without success, the responding STA shall record an error entry.

***11mc editor. Note indent for the next two paragraphs to be aligned with the second bullet (they are all conditioned on “for other requested ranges”***

For procedures related to the remaining listed APs that operate on non-operating channels, see 10.11.2 (Measurement on operating and nonoperating channels).

The responding STA shall transform the measurements obtained from each fine timing measurement procedure with an AP into a range and a maximum error between itself and the AP, while accounting for any clock offsets between the responding STA and the AP.

At the completion of all the fine timing measurement procedures and transformations, the responding STA shall send the all computed range information between itself and other APs, and all error entries, to the requesting STA using a Measurement Report element with Measurement Type set to Fine Timing

Measurement range in a Measurement Report frame.

A requesting STA may request a single set of range measurements by setting the Number of Repetitions field to 0 in the Measurement Request frame, or request a regular sequence of range measurements by

— setting the Number of Repetitions field greater than 0 in the Measurement Request frame, and

— including a Measurement Request element with Measurement Type equal to Fine Timing

Measurement range request and a Measurement Request element with Measurement Type equal to Measurement pause request (see 10.11.9.7 (Measurement pause)).

If dot11RMFineTimingMsmtRangeRepActivated is false, a STA shall reject any Fine Timing Measurement Range request and shall respond with a Radio Measurement Report frame including a Measurement Report element with the Incapable field set to 1.

10.11.10.3 Receiving a neighbor report

***Note to reader, not for inclusion in the draft, in the bulleted language below, use dot11FineTimingMsmtRespActivated only if Carlos Aldana’s document 14/525 is adopted; else use dot11FineTimingMsmtActivated(two times***

When (#2403)

— an AP that has both dot11FineTimingMsmtRespActivated and dot11RMLCIMeasurementActivated equal to true receives a Measurement Request element with Measurement Type equal to LCI request, or

— an AP that has both dot11FineTimingMsmtRespActivated and dot11RMCivicMeasurementActivated equal to true receives a Measurement Request element with Measurement Type equal to Location Civic request

within a Neighbor Report Request frame then the AP shall include a Neighbor Report element for the AP’s own BSSID.

When (#2403)

— an AP that has both dot11FineTimingMsmtActivated and dot11RMLCIMeasurementActivated equal to true receives a Measurement Request element with Measurement Type equal to LCI request within a Neighbor Report Request frame, or

— an AP that has dot11LciCivicInNeighborReport and dot11RMLCIMeasurementActivated equal to true receives a Neighbor Report Request frame,

then the AP shall include a Measurement Report subelement with Measurement Type equal to LCI report in each Neighbor Report element in the Neighbor Report response frame. If the maximum horizontal or vertical location error of a neighboring AP relative to a reference AP is known to the AP and this relative error is smaller than the absolute error indicated in the LCI subelement, then the AP may include a Relative Location Error subfield in the Measurement Report field. If the Measurement Report subelement is included but the LCI information of the neighbor is unknown, the AP shall indicate an unknown LCI for the neighbor following the format defined in 8.4.2.20.10 (Location Configuration (#136)Request).(#2403)

When (#2403)

— an AP that has at least one of dot11FineTimingMsmtActivated and dot11RMLCIMeasurementActivated equal to false receives a Measurement Request element with Measurement Type equal to LCI request within a Neighbor Report Request frame, and

— an AP that has at least one of dot11LciCivicInNeighborReport and

dot11RMLCIMeasurementActivated equal to false receives a Neighbor Report Request frame,

then the AP shall include a Measurement Report subelement with the Incapable field set to 1 in each Neighbor Report element in the Neighbor Report response frame. (#2403)

When (#2403)

— an AP that has dot11FineTimingMsmtActivated and dot11RMCivicMeasurementActivated equal to true receives a Measurement Request element with Measurement Type equal to Location Civic request within a Neighbor Report Request frame, or

— an AP that has dot11LciCivicInNeighborReport and dot11RMCivicMeasurementActivated equal to true receives a Neighbor Report Request frame,

then the AP shall include a Measurement Report subelement with Measurement Type equal to Location Civic report in each Neighbor Report element in the Neighbor Report response frame. If the Measurement Report subelement is included but the Location Civic information of the neighbor is unknown, the AP shall indicate an unknown Civic address following the format defined in 8.4.2.21.13 (Location Civic (#1294)report).(#2403)

When (#2403)

— an AP that has at least one of dot11FineTimingMsmtActivated and dot11RMCivicMeasurementActivated equal to false receives a Measurement Request element with Measurement Type equal to Location Civic request within a Neighbor Report Request frame, and

— an AP that has at leasr one of dot11LciCivicInNeighborReport and dot11RMCivicMeasurementActivated equal to false receives a Neighbor Report Request frame,

then the AP shall include a Measurement Report subelement with the Incapable field set to 1 in each Neighbor Report element in the Neighbor Report response frame.(#2403)

Each Measurement Report subelement returned shall have the same Measurement Token as in the corresponding Measurement Request element, or, if there is no corresponding Measurement Request then the Measurement Token shall be set to 0. (#2403)

If an AP determines that the LCI and/or Civic location of a neighboring AP changes, the AP may send an unsolicited Neighbor Report Response frame containing complete neighbor information including the updated neighboring AP location information. The Dialog Token field is set to 0 as defined in 8.6.7.7 (Neighbor Report Response frame format).(#2403)

A STA that receives an LCI report that contains a Usage Rules subelement shall process the LCI information in compliance with the retransmission and retention permissions in the Usage-rules subelement.(#2403)

Annex C

Dot11WirelessMgmtOptionsEntry ::=

SEQUENCE {

dot11(#1676)LocationActivated TruthValue,

dot11(#1676)FMSImplemented TruthValue,

dot11(#1676)FMSActivated TruthValue,

dot11(#1676)EventsActivated TruthValue,

dot11(#1676)DiagnosticsActivated TruthValue,

dot11(#1676)MultiBSSIDImplemented TruthValue,

dot11(#1676)MultiBSSIDActivated TruthValue,

dot11(#1676)TFSImplemented TruthValue,

dot11(#1676)TFSActivated TruthValue,

dot11(#1676)WNMSleepModeImplemented TruthValue,

dot11(#1676)WNMSleepModeActivated TruthValue,

dot11(#1676)TIMBroadcastImplemented TruthValue,

dot11(#1676)TIMBroadcastActivated TruthValue,

dot11(#1676)ProxyARPImplemented TruthValue,

dot11(#1676)ProxyARPActivated TruthValue,

dot11(#1676)BSSTransitionImplemented TruthValue,

dot11(#1676)BSSTransitionActivated TruthValue,

dot11(#1676)QoSTrafficCapabilityImplemented TruthValue,

dot11(#1676)QoSTrafficCapabilityActivated TruthValue,

dot11(#1676)ACStationCountImplemented TruthValue,

dot11(#1676)ACStationCountActivated TruthValue,

dot11(#1676)CoLocIntfReportingImplemented TruthValue,

dot11(#1676)CoLocIntfReportingActivated TruthValue,

dot11(#1676)MotionDetectionImplemented TruthValue,

dot11(#1676)MotionDetectionActivated TruthValue,

dot11(#1676)TODImplemented TruthValue,

dot11(#1676)TODActivated TruthValue,

dot11(#1676)TimingMsmtImplemented TruthValue,

dot11(#1676)TimingMsmtActivated TruthValue,

dot11(#1676)ChannelUsageImplemented TruthValue,

dot11(#1676)ChannelUsageActivated TruthValue,

dot11(#1676)TriggerSTAStatisticsActivated TruthValue,

dot11(#1676)SSIDListImplemented TruthValue,

dot11(#1676)SSIDListActivated TruthValue,

dot11(#1676)MulticastDiagnosticsActivated TruthValue,

dot11(#1676)LocationTrackingImplemented TruthValue,

dot11(#1676)LocationTrackingActivated TruthValue,

dot11(#1676)DMSImplemented TruthValue,

dot11(#1676)DMSActivated TruthValue,

dot11(#1676)UAPSDCoexistenceImplemented TruthValue,

dot11(#1676)UAPSDCoexistenceActivated TruthValue,

dot11(#1676)WNMNotificationImplemented TruthValue,

dot11(#1676)WNMNotificationActivated TruthValue,

dot11(#1676)UTCTSFOffsetImplemented TruthValue,

dot11(#1676)UTCTSFOffsetActivated TruthValue,

dot11(#1676)FineTimingMsmtImplemented TruthValue,(#46)

dot11(#1676)FineTimingMsmtActivated TruthValue,(#46)

dot11LciCivicInNeighborReport TruthValue,(#2403)

dot11RMFineTimingMsmtRangeRepImplemented TruthValue,

dot11RMFineTimingMsmtRangeRepActivated TruthValue}

dot11RMFineTimingMsmtRangeRepImplemented 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 implementation is capable of supporting Fine Timing Measurement Range reporting."

::= { dot11WirelessMgmtOptionsEntry 49}

dot11RMFineTimingMsmtRangeRepActivated OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-write

STATUS current

DESCRIPTION

"This is a control variable.

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

Changes take effect as soon as practical in the implementation.

This attribute, when true, indicates that Fine Timing Measurement Range reporting is enabled at the station. The capability is disabled, otherwise."

DEFVAL { false}

::= { dot11WirelessMgmtOptionsEntry 50}