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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Location Comment Resolutions | | | | |
| Date: 2023-06-11 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | Email |
| Brian Hart | Cisco Systems |  |  | brianh@cisco.com |
|  |  |  |  |  |
|  |  |  |  |  |

**Abstract**

CIDs 4198, 4312

**Revisions:**

* Rev 0: Initial version of the document.
* Rev 1: Applied feedback from 11me meeting and other offline feedback (mainly converting the map’s URL query parameters to a new subelement)
* Rev 2: Addressing other offline feedback editorials plus allowing X Max to be assigned to NAN as padding.
* Rev 3: Addressed comments on call (Not extensible, etc)

***TGme editor: Please note Baseline is 11me D3.0. Edits are expressed via Word track changes:***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 4312 | Location Reference subelement was deleted under CID 3225, but there are still some references to it | 2605 | 9.4.2. 20.13 | 63 | Delete from 4.3.21.10 Location services, 947.61, p. 948 (6x), 953.2, 2519.49 [needs discussion | Revised. See changes under CID4198 in 23/0929<motionedRevision> that actually fix various location-related issues  TGme Editor: no further changes beyond those defined for CID4198 |
| 4198 | Multiple issues with civic location: \* 4.3.21.10 Location services's claim that "The location reference is a URL that defines from where the location value is retrieved." \* Which field is being referred to in "The Civic Location Type field contains the format of location information in the Civic Location field" in 9.4.2.21.13 Location Civic report \* Which field is being referred to in "The Civic Location field follows the little-endian octet ordering" in 9.4.2.21.13 Location Civic report \* Which field is being referred to in "If the Location Civic report contains the Location Reference and Location Shape subelements, the receiving STA may use the information specified in those subelements in combination with the Civic Location field value for additional granularity on the position reported in the Civic Location field." in 11.10.9.9 Location Civic report \* "When the Civic Location Type field is IETF RFC 4776, the list of optional subelements optionally includes the Location Reference, Location Shape, Map Image, and Vendor Specific subelements as defined in Table 9-175 (Subelement IDs for Location Civic report)." in 9.4.2.21.13 Location Civic report is not clear: is it trying to say that no other optional subelements are allowed? \* Dependencies between subelements, e.g.: o Location Shape depends on the presence of Location Reference, which in turn depends on this being Civic Location. o Map Image depends on this being Civic Location. \* ... or maybe: o Location Shape depends on the presence of non-empty Location Reference, which in turn depends on this being Civic Location. o Location Reference if absent/empty, depends on the presence of Map Image which in turn depends on this being Civic Location. \* ... or even: o Location Shape depends on the presence of Location Reference which in turn depends on the presence of a Map Image which in turn depends on this being Civic Location (seems to be implicit in "of the floor plan on which the Location Shape is defined") \* Whether if you don't have a non-empty Location Reference it should be "... indicates that the position of the Location Shape is the south west corner (i.e., 0,0) of the lowest (or only) floor in the floor plan on which the Location Shape is defined." \* The axes of the coordinate system are undefined. We probably should require that a map is a prereq for locshape |  | 9.4.2. 21.13 |  | As it says in the comment [big item; needs discussion] | Revised. See changes under CID4198 in 23/0929<motionedRevision> that actually fix various location-related issues |

***Discussion and Intermingled text changes***

**Location Reference subelement was deleted under CID 3225, but there are still some references to it**

*Looking back at 3225, the string reference doesn’t have to be computable. Putting a blue dot/ellipse/etc on a map via them belonging to the same coordinate system suffices. Here, the string reference*

* *could be used for debugging.*
* *could be displayed on the map as a location marker (“bottom left of building”) akin to how Google maps shows (a few) markers on the map for (paying) venues.*

*Then revert 3225, with the presumed acquiescence of the ANA:*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Table 9-175—Subelement IDs for Location Civic report   |  |  |  | | --- | --- | --- | | Subelement ID | Name | Extensible | | <ANA>3 | Location Reference | No |   The Target MAC Address subelement contains the MAC address of the STA whose Location Information was requested and it is present whenever the Location Subject field in the corresponding Location Civic request was set to 2. The format of the Target MAC Address subelement is shown in Figure 9-250 (Target MAC Address subelement format).  The format of the Location Reference subelement is shown in Figure 9-xx (Location Reference subelement format).  A screenshot of a computer  Description automatically generated  xx  The Location Reference field is an ASCII string that defines a position on a floor from which the relative location contained in the Location Shape subelement is offset. A Location Reference subelement set to 0 indicates that the position of the Location Shape is top north west corner (i.e., 0,0) of the floor plan on which the Location Shape is defined. |

**\* 4.3.21.10 Location services's claim that "The location reference is a URL that defines from where the location value is retrieved."**

*Rather, “Location Reference” in clause 4.3.21.10 was intended to point to Location Identifier (9.4.2.20.14 (Location Identifier report)), so rewrite the text to clarify this intent.*

|  |
| --- |
| 4.3.21.10 Location services  Location Configuration Request and Response frames enable STAs to configure a collection of location related parameters for Location Track Notification frames. The AP can indicate that it can provide location data to support applications such as emergency services. Location services also provide the ability for STAs to exchange location information using Radio Measurement Request and Radio Measurement Report frames. The protocol supports exchange-by-value and exchange-by-reference mechanisms. Exchange-by-value can be performed in geospatial (LCI) and civic formats. Exchange-by-reference can be performed using a URL that defines from where the location value is retrieved (in a Location Identifier report). |

**\* Which field is being referred to in "The Civic Location Type field contains the format of location information in the Civic Location field" in 9.4.2.21.13 Location Civic report**

|  |
| --- |
| 9.4.2.20.13 Location Civic report    The Civic Location Type field contains the format of location information in the Location Civic Subelement field, as indicated in Table 9-152 (Civic Location Type field values). |

**\* Which field is being referred to in "The Civic Location field follows the little-endian octet ordering" in 9.4.2.21.13 Location Civic report**

|  |
| --- |
| 9.4.2.20.13 Location Civic report    The Location Civic field contains the location information in the format as indicated in the Civic Location Type field. When the Civic Location Type field is IETF RFC 4776:   * The Location Civic field is formatted according to IETF RFC 4776 starting at the country code field (i.e., excluding the GEOCONF\_CIVIC/ OPTION\_GEOCONF\_CIVIC, N/option-len and what fields) * An unknown civic location is indicated by(#3216)a zero-length Location Civic field * The Location Civic field follows the little-endian octet ordering |

**\* Which field is being referred to in "If the Location Civic report contains the Location Reference and Location Shape subelements, the receiving STA may use the information specified in those subelements in combination with the Civic Location field value for additional granularity on the position reported in the Civic Location field." in 11.10.9.9 Location Civic report**

|  |
| --- |
| 11.10.9.9 Location Civic report  If the Location Civic report contains the Location Reference and Location Shape subelements, the receiving STA may use the information specified in those subelements in combination with the Location Civic field value for additional granularity on the position reported in the Location Civic field. |

**\* The axes of the coordinate system are undefined. We probably should require that a map is a prereq for locshape**

*It turns out that the axes of a coordinate system are always defined; see:*

|  |
| --- |
| 9.4.2.20.13 Location Civic report  The Location Shape subelement defines the position in meters, including uncertainty, of the entity being  located. A Shape is specified with respect to either a 2-Dimensional or 3-Dimensional Coordinate Reference System where each point in the shape defines the direction from the Location Reference value’s starting point. **A positive X-axis value corresponds to an easterly direction relative to the Location Reference value’s starting point; a negative X-axis value corresponds to a westerly direction relative to the Location Reference value’s starting point; a positive Y-axis value corresponds to a northerly direction relative to the Location Reference value’s starting point; a negative Y-axis value corresponds to a southerly direction relative to the Location Reference value’s starting point and the Z-axis value corresponds to the altitude above the horizontal plane at the Location Reference value’s starting point.** |

**\* Whether if you don’t have a non-empty Location Reference it should be “... indicates that the position of the Location Shape is the south west corner (i.e., 0,0) of the lowest (or only) floor in the floor plan on which the Location Shape is defined.”**

*For backwards compatibility issues, leave this as north west. However, clean up the text, and address the following issues:*

* *Length field = 0 implies we use the north west corner of the floor map – aka the Map Image. So we need a Map Image if Length field = 0*
* *Given map images support svg/dwf/dxf, the following floor map is possible. Then, is the north west corner point A, B, or C? If we were to make the perimeter more and more complicated, the only stable reference is A, so our definition should be clear enough to express this.*



* *The axes of the Coordinate system are defined in the Location Shape subelement, but that makes reference to “starting point” which is ambiguous – what is the “starting point” of “Lobby”? – so clean that text up.*
* *“Floor plan” is rally just “floor map”.*

|  |
| --- |
| ***TGme editor: For the change text below, the reversion of CID3225 defined above is treated as baseline text. The changes herein are changes upon those earlier changes.***  9.4.2.20.13 Location Civic report  The Location Shape subelement defines the position in meters, including uncertainty, of the entity being located. A Shape is specified with respect to either a 2-dimensional or 3-dimensional coordinate reference system where each point in the shape defines the direction from the point indicated by the Location Reference field. A positive X-axis value corresponds to an easterly direction relative to the point indicated by the Location Reference field; a negative X-axis value corresponds to a westerly direction relative to the point indicated by the Location Reference field; a positive Y-axis value corresponds to a northerly direction relative to the point indicated by the Location Reference field; a negative Y-axis value corresponds to a southerly direction relative to the point indicated by the Location Reference field and the Z-axis value corresponds to the altitude above the horizontal plane at the point indicated by the Location Reference field.  …  The Location Reference field is an ASCII string that defines the origin of the coordinate reference system and is used for the relative locations and offsets contained in the Location Shape subelement and in the Map Registration subelement. A Location Reference subelement with Length field set to 0 indicates that the origin is the point with the same X-coordinate as the most western feature in the floor map, with the same Y-coordinate as the most northern feature in the floor map, and with the same Z-coordinate as the feature with lowest altitude in the floor map.  NOTE – The floor map is identified by the Map Image subelement.  11.10.9.9 Location Civic report  If the Location Civic report contains the Map Image subelement, the receiving STA’s SME can retrieve the  floor map specified by the Map URL field. The method to retrieve the floor map specified by the Map URL  field is out of scope of this document. |

The text Is unclear how to register the map Image to the coordinate reference system. Given that the Location Reference (if Length > 0) defines the origin which could be anywhere on the map, therefore it is natural to register the 4 edges of a raster map to the coordinate system. But also svg/dwg/dxf files are defined that enable complicated vector perimeters and dwg/dxf file further support 3D vector floor maps. Expressing this requires new work. A building with a *very* large footprint is the Boeing Everett factory, and (with annex buildings) is almost 1.1 km wide, and campuses / ports / oil & gas fields have much larger footprints; meanwhile 1 meter resolution (and even 0.1 meters) can be quite coarse for certain applications. So integers quickly run of out precision and dynamic range. Therefore, in the following, the map registration parameters are encoded as single-precision floating point, which is also the same encoding used for the parameters of the Location Shape subelement.

A picture containing map, text, screenshot, graphics software

Description automatically generated

As well, many map types (svg, dxf, dwg) have their own scale information, so need an origin defined but extra scale information might just repeat the same information as is already contained in the floor map (but would need to be maintained if/when the floor map changed). Even certain image files can contain scaling parameters: consider "Resolution" in tiff, "XResolution" and "YResolution" in png etc. Therefore provide the ability to scale the X/Y/Z extent of the floor plan, but make scaling optional if determined as needed by the transmitter.

***TGme editor; after ANA signs a value (e.g., 8), redefine the Reserved row – e.g., to 9-220.***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table 9-175—Subelement IDs for Location Civic report   |  |  |  | | --- | --- | --- | | Subelement ID | Name | Extensible | | <ANA> | Map Registration | No | | 8-220 | Reserved |  |   The Map URL field is a variable length field formatted in accordance with IETF RFC 3986 and provides the location of the floor map.  The (#2210)Colocated BSSID List subelement is used to report the list of BSSIDs of the BSSs sharing the same antenna connector with the reporting STA if the subelement is contained within a Fine Time Measurement frame, otherwise the BSSs that are (#2210)colocated within the same physical device as the reporting STA. The (#2210)Colocated BSSID List subelement is described in 9.4.2.20.10 (LCI report (Location configuration information report)).  The Map Registration subelement reports the registration of the floor map to the coordinate reference system.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | Subelement ID | Length | X Min | Y Min | Z Min | X Max (optional) | Y Max (optional) | Z Max (optional) | | Octets | 1 | 1 | 4 | 4 | 4 | 0 or 4 | 0 or 4 | 0 or 4 |   The Subelement ID is equal to Map Registration as defined in Table 9-175 (Subelement IDs for Location Civic report).  The X Min, Y Min, Z Min, X Max, Y Max and Z Max fields, when present, contain floating point values represented by binary32 floating point values as defined in IEEE Std 754-2008, with the least significant bit of the fraction occurring in bit 0 of the field. These fields have units of meters and are defined with respect to the Location Reference subelement. For a rasterized floor map, these fields indicate the outermost edge (rather than the center) of the outermost pixels in the specified X or Y direction.  The X Min field is the X-coordinate of the most western feature in the floor map.  The Y Min field is the Y-coordinate of the most southern feature in the floor map.  The Z Min field is the Z-coordinate of the lowest feature in the floor map.  The X Max field, if other than NAN, is the X-coordinate of the most eastern feature in the floor map. The X Max field is optionally present. When present and other than NAN, the X Max field, together with the X Min field, is used to scale the floor map along the X-axis. When present and set to NAN, the X Max field is a padding field.  The Y Max field is the Y-coordinate of the most northern feature in the floor map. The Y Max field is optionally present. When present, the Y Max field, together with the Y Min field, is used to scale the floor map along the Y axis. If the Y Max field is present, then the X Max field is also present.  The Z Max field is the Z-coordinate of the highest feature in the floor map. The Z Max field is optionally present. When present, the Z Max field, together with the Z Min field, is used to scale the floor map along the Z-axis. If the Z Max field is present, then the X Max and Y Max fields are also present. For a 2-dimensional floor map, the Z Max field is not present or set to the Z Min field.  If the Length field of the Location Reference subelement contained in the Location Civic report is equal to 0 then the X Min and Z Min fields are equal to 0 and the Y Max field is present and equal to 0.  NOTE – In this case, the X Max field is present and might be set to NAN or another value. |

**\* "When the Civic Location Type field is IETF RFC 4776, the list of optional subelements optionally includes the Location Reference, Location Shape, Map Image, and Vendor Specific subelements as defined in Table 9-175 (Subelement IDs for Location Civic report)." in 9.4.2.21.13 Location Civic report is not clear: is it trying to say that no other optional subelements are allowed?**

From context, these subelements are specifically relevant to IETF RFC 4776 (and might not be relevant to other Civic types; though only IETF RFC 4776 and VS is defined). Given that we really only have IETF RFC 4776, the other subelements (Originator Requesting STA MAC Address, Target MAC Address, Colocated BSSID List) are surely allowed (and do seem reasonable).

As well, for VS, all of these subelements seem allowable and don’t need to be excluded.

Then really we just have some optional subelements that are optional. Therefore omit this text. (And promote the introduction of the optional subelements) (see below).

**\* Dependencies between subelements, e.g.:**

**o Location Shape depends on the presence of Location Reference, which in turn depends on this being Civic Location.**

**o Map Image depends on this being Civic Location.**

**\* ... or maybe:**

**o Location Shape depends on the presence of non-empty Location Reference, which in turn depends on this being Civic Location.**

**o Location Reference if absent/empty, depends on the presence of Map Image which in turn depends on this being Civic Location.**

**\* ... or even:**

**o Location Shape depends on the presence of Location Reference which in turn depends on the presence of a Map Image which in turn depends on this being Civic Location (seems to be implicit in "of the floor plan on which the Location Shape is defined")**

*Dependencies should be explicitly expressed:*

* *Location Shape is defined in terms of Location Reference:*

|  |
| --- |
| The Location Shape subelement defines the position in meters, including uncertainty, of the entity being located. A Shape is specified with respect to either a 2-Dimensional or 3-Dimensional Coordinate Reference System where each point in the shape defines the direction from the Location Reference value’s starting point. |

* *From the change text above, if the Location Reference Length = 0 then the Location Reference is defined in turn in terms of the Map Image subelement*
* *As well, Map Image is defined in terms of Location Reference (with Length > 0) and Location Shape subelements (and now, if the Location Reference subelement Length field is non-zero then in terms of the Map Registration subelement too)*

|  |
| --- |
| The Map Image subelement contains a map reference that is used in combination with the Location Reference and Location Shape subelements. |

|  |
| --- |
| 9.4.2.20.13 Location Civic report    The Optional Subelements field contains zero or more subelements with subelement ID greater than or equal to 1 as listed in Table 9-175 (Subelement IDs for Location Civic report). The subelement format and ordering of subelements are defined in 9.4.3 (Subelements). The Optional Subelements field includes zero or one of each subelement, except the Optional Subelements field includes zero or more Vendor Specific subelements.  If the Civic Location Type field is IETF RFC 4776, and the Optional Subelements field includes:   * a Map Image subelement, then the Optional Subelements field also includes a Location Shape subelement * a Location Shape subelement, then the Optional Subelements field also includes a Location Reference subelement * both a Map Image subelement and a Location Reference subelement with nonzero Length field, then the Optional Subelements field also includes a Map Registration subelement * a Location Reference subelement with Length field equal to 0, then the Optional Subelements field also includes a Map Image subelement and optionally includes a Map Registration subelement   If the Civic Location Type field value is Vendor Specific, the Optional Subelements field includes at least ne Vendor Specific subelement that identifies the Organization Identifier corresponding to the Civic Location Type field. |

|  |
| --- |
| *As well, a worked example is probably worthwhile:****TGme editor: At the end of 11.10.9.9 Location Civic report, insert:***  For example, if the response to a Location Civic request with Location Subject field equal to Location Subject Local is a Location Civic report containing a Location Reference field equal to “Lobby Entrance”, a Location Shape ID field equal to 2-Dimension Point, a Location Shape Value field equal to (0, -1.5), a Map Type field equal to png, a Map URL field equal to “http://www.example.com/maps/exampleBuilding/lobbyLevel.png” and a Map Registration subelement containing X Min = -50, Y Min = -100, Z Min = 0, X Max = 49.9, Y Max = 0, then a process related to the user interface might retrieve the map image and display it from (-50, -100) to (49.9, 0) meters, place a pin at (0, 0) meters labelled “Lobby Entrance” and place a second pin at (0, -1.5) meters labelled “You Are Here”. |