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

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| Map Registration Comment Resolution | | | | |
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**Abstract**

CIDs 6068

**Revisions:**

* Rev 0: Initial version of the document.

***TGme editor: Please note Baseline is 11me D4.1. Edits are expressed via Word track changes:***

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| 6068 | Orr, Stephen | 9.4.2.20.13 | 953 | 5 | Final set of location changes to finish off the earlier related changes in REVme: 1) Define a URL-only method of map registration (e.g., for geo coordinates when single precision (float) is insufficient) 2) Allow either the Map Registration subelement or the URL-only method or both. 3) And modify the subelement dependencies to account for this | An 802.11 WG member will bring a proposal | Revised.  Substantially agree with commenter. Make changes in 23/2143 <motionedRevision>. |

***Discussion***

Civic location and map registration were substantially improved in the previous letter ballot with a new subelement for map registration, which is compact, natively internationalized and suitable for a local coordinate system. At the same time it was reported that there was also a desire expressed to allow the map to be **geo**registered via URL parameters (query string) since:

* This is a scheme used in the wild
  + See for instance <https://developers.google.com/maps/documentation/android-sdk/groundoverlay>
* Since the map types include kml and gml, which use (latitude, longitutde) as their coordinate system, the single precision floating point values used in the Map Registration subelement provide a worst case longitude error at the equator of 2^-23 \* 179.99999/360 \* 2\*pi\*6378000 = 2.39 meters, which is higher than desired in many use cases. Text parameters in a URL do not suffer from any resolution issue – e.g., if rounding to 7 decimal places then the worst-case error is 0.5e-7/360 \* 2\*pi\*6378000 which is under 1 cm.

Related: the Location Shape would still use single-precision floats, so if we just fix the map registration, we could register the map “perfectly” but a perfectly known blue-dot location at 179.99999deg longitude and non-zero lat actually needs to be presented as a blue 2.39m-wide rectangle. So, providing precise map registration with the Location Shape doesn’t seem to be worth much. Instead, the *useful* path seems to be LCI (for the latitude/longitude location + uncertainty) + precisely georeferenced map (which implies a basic Location Civic also).

Proposal: define URL parameters for floor map georegistration and, if present, disallow the Location Shape subelement (i.e., use LCI instead).

One alternate / complementary option is to define hi-res Location Shape (and optionally hi-res Map Registration subelements too) that use double precision floating point values, but this approach does not address the desire for a solution that uses URL parameters. Also, many implementations may not be able to easily consume double precision floating point values and this option does not seem to be as important / valuable as a solution that uses URL query parameters.

Another alternate / complementary option is to define URL parameters for map georegistration and, if present, *still* allow the Location Shape subelement. Since the Location Shape subelement is wrt the Location Reference subelement and its Location Reference field is a string for (0,0) then we would need to define a special Location Reference string such as “0Lat0Lng” to use in this scenario. Of course, we haven’t fixed the need for a blue 2.39m-wide rectangle so it’s not clear this direction is worth the effort either.

So we propose to add georegistration of the floor map only via URL parameters.

Given the element length constraints, compact URL parameters are desirable yet “longitude” and “latitude” are quite long strings, so we propose to use the more compact “lat” and “lng”, as per many programming languages (lat, lng in Java, LatLng in [Android](https://developers.google.com/android/reference/com/google/android/gms/maps/model/LatLng), etc); and also this avoids the use of the substring “long” which can mean “long int” in some programming languages, leading to a desire to avoid that substring entirely.

***Proposed Text Changes***

9.4.2.20.13 Location Civic report

(#4198)If the Civic Location Type field is IETF RFC 4776 and the Optional Subelements field includes

* a Map Image subelement wherein the Map URL field does not include floor map georegistration parameters, 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 wherein the Map URL field does not include floor map georegistration parameters 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 wherein the Map URL field does not include floor map georegistration parameters and optionally includes a Map Registration subelement.
* a Map Image subelement wherein the Map URL field does include floor map georegistration parameters, then the Optional Subelements field does not include a Location Shape subelement, a Location Reference subelement or a Map Registration subelement.

***TGme editor to renumber the NOTEs accordingly.***

NOTE 0.9 – In the case of a Map Image subelement wherein the Map URL field does include floor map georegistration parameters, a precise location can be conveyed separately via a Measurement Report element with the Measurement Type field set to LCI.

The Map Image subelement contains a map reference that is used in combination with the Location Reference and Location Shape subelements. The format of the Map Image subelement is shown in Figure 9-334 (Map Image subelement format).

The Map URL field is a variable length field formatted in accordance with IETF RFC 3986 and provides the retrieval location of (#4198)the floor map. The Map URL field optionally includes floor map georegistration parameters as query parameters in the URL’s query string, where each of the following query parameters define string representations of numbers, with units of degrees:

* s\_lat: the most southern feature in the floor map
* w\_lng: the most western feature in the floor map
* n\_lat: the most northern feature in the floor map
* e\_lng: the most eastern feature in the floor map

***TGme editor to renumber the NOTEs accordingly.***

NOTE 3.1— Seven decimal places of latitude and longitude provide sufficient resolution to achieve under 0.01 meters of latitude error and longitude error throughout the globe. Considering the sizes of devices whose positions are being estimated and the use cases for the estimated positions, an AP geolocation error of under 0.01 meters is generally regarded as sufficient to avoid compromise of the estimated positions.

***Note to reader, not for inclusion in the draft: the following example using the Sydney Opera House and corresponding polygonal coordinates is also used in 9.4.2.20.10 (LCI report)***

NOTE 3.2— Consider a floor map of the Sydney Opera House where the floor map is cropped to the minimal rectangle that encloses the building perimeter, and the building perimeter is described by a polygon with vertices having the following (latitude, longitude) coordinates:

(–33.856 625 0°, +151.215 906 0°)

(–33.856 299 0°, +151.215 343 0°)

(–33.856 326 0°, +151.214 731 0°)

(–33.857 533 0°, +151.214 495 0°)

(–33.857 720 0°, +151.214 613 0°)

(–33.857 369 0°, +151.215 375 0°)

Then, if the retrieval location for the floor map is http://www.example.com/floorMapImages/floorMapImage.png then the Map URL field that includes the floor map georegistration parameters is http://www.example.com/floorMapImages/floorMapImage.png?s\_lat=-33.8577200&w\_lng=151.2144950&n\_lat=-33.8562990&e\_lng=151.2159060.

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 (#4198)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. If the URL includes the floor map georegistration parameters s\_lat, w\_lng, n\_lat and e\_lng as query parameters then the receiving STA’s SME can georeference the floor map.

(#4198)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” (i.e., without floor map georegistration parameters) 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”.