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A Link-Format Attribute for Locating Things
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Abstract

This memo proposes a new CoAP link format attribute, "geo", that can be used to associate positioning metadata to a CoAP resource. An extension to the link format query syntax is also defined to allow the discovery of resources based on their geo location.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

The ability for a client application to access positioning information about a sensing resource is crucial in a number of use cases, e.g. those in which one or more sensor networks provide input to an emergency handling service (fire, flood, etc.).

This memo proposes a new CoAP link-format attribute, "geo", that can be used to associate positioning metadata to a CoAP resource, and make this information available to other endpoints that, directly or indirectly, participate to CoAP link-format discovery [RFC6690].

This spec reuses the geo URI syntax [RFC5870], which is capable of describing physical locations in two or three dimensions (also supporting underground and underwater localisation using negative numbers) in a simple, reasonably compact, and human readable way.

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

2. Use Cases

Location-aware applications and location-based services like rescue systems in devastated areas, seismic networks, gas pipeline monitoring deployments, fire or flood detection systems, etc., need to precisely locate the source of sensed stimulus in order to react in a suitable way. Smart city scenarios, e.g. street lights control, emergency services, often have similar needs.

3. The geo Link Format Attribute

This section defines a new Web Linking [RFC5988] link-param, "geo", to be used within the [RFC6690] framework, having the following syntax:

```
link-extension  = "geo" "=" geo-path
geo-path          ; defined in Section 3.3. of RFC 5870
```

The geo attribute MUST NOT appear more than once in a link.

4. Examples

- A sensor exposing an explicit location resource:

```
REQ: GET /.well-known/core?geo=*

RES: 2.05 Content
</loc>;geo="52.2047, 0.1368"
```

- A fire detector somewhere in the Pollino National Park (approx. 10cm accuracy, enough to distinguish trees from each other):

```
REQ: GET /.well-known/core?geo=*

RES: 2.05 Content
</fire>;ct=0;if="sensor";geo="40.00201,16.34007"
```

- An underwater current sampler in the sea between Ithaki and Kefallonia bearing explicit accuracy information (10m):

```
REQ: GET /.well-known/core?geo=*

RES: 2.05 Content
</water>;ct=0;if="sensor";geo="38.2953,20.6426,-20;u=10"
```

5. Encoding Considerations

This specification allows only one CRS, which is WGS-84. There is no need to set an explicit crslabel when encoding a geo link-format attribute, since the default value wgs84 applies anyway.

For further encoding consideration, see Section 3.5. of [RFC5870].

6. Extended Geo Queries

The "extended" geo query (xgeo) format allows a client application to select a capture area, and let endpoints advertise their presence -- by replying to the link-format query -- if they are located within the specified area.

6.1. Syntax

The syntax for describing the query capture area is based on the "WGS 84 bounding box" defined in section 10.2.2 of [OGC-WSC].

The WGS 84 bounding box is a specialisation of the more general bounding box concept for use with the WGS 84 geodetic datum, with latitude and longitude expressed as decimal degrees.

A bounding box is a rectangular area identified by its lower and upper corners, i.e. the points within the bounding box at which the value of each coordinate is the algebraic minimum and maximum, respectively.

For consistency with the geo URI definition, the latitude and longitude attributes of the upper and lower corners have been swapped, while the optional ’crs’ and ’dimensions’ parameters are not used (their default values are implicitly assumed), which leads to the following ABNF:

```
ext-geo-query = "?xgeo=" bounding-box
bounding-box  = lower-corner "-" upper-corner
lower-corner  = latitude "," longitude
upper-corner  = latitude "," longitude
```

For simplicity, xgeo allows a single bounding box per link-format query. Therefore, when a search is logically made of multiple boxes (e.g. at a discontinuity point, or for more complex tessellations), the querying client shall split it into the appropriate number of xgeo queries and send them out individually.

6.2. Filtering Rules

An endpoint which understands xgeo MUST respond to the query if and only if its latitude and longitude values fall within the bounding box specified in the query string.

When running the match algorithm, the queried endpoint MUST take into consideration any accuracy/uncertainty associated with its current position. Any uncertainty information MUST be returned in a response if it has been used to compute a positive answer to the corresponding xgeo query.

6.3. Examples

- An example capture area that would match (among the other) the "/water" resource in Section 4:

```
REQ: GET /.well-known/core?xgeo=38.2900,20.6400-38.3000,20.6500

RES[0]: 2.05 Content
</water>;geo="38.2953,20.6426,-20;u=10"

RES[1]: 2.05 Content
</pos>;geo="38.2908,20.6451"

RES[2]: [...]
```

7. Acknowledgements

Thanks to Keith Drage and Carl Reed for comments and discussions that have helped shaping this document.

8. IANA Considerations

No formal request at present. However, there is a plan to add a registry for the namespace of link parameters as part of [RFC5988] update.

9. Security Considerations

The "geo" link-format attribute shares the same security issues as any other attribute involved in the discovery process described in [RFC6690].

Further to that, the privacy considerations regarding distribution, protection, usage, retention, and storage of the location information of the target resource found in [RFC6280] fully apply.

10. Normative References

[OGC-WSC] Whiteside, A. and J. Greenwood, "OGC Web Service Common Implementation Specification (Version 2.0.0)", April 2010, <http://http://www.opengeospatial.org/standards/common>.

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[RFC5870] Mayrhofer, A. and C. Spanring, "A Uniform Resource Identifier for Geographic Locations (’geo’ URI)", RFC 5870, June 2010.

[RFC5988] Nottingham, M., "Web Linking", RFC 5988, October 2010.

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