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LISP Geo-Coordinate Use-Cases
draft-farinacci-lisp-geo-01

Abstract

This draft describes how Geo-Coordinates can be used in the LISP Architecture and Protocols.

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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This Internet-Draft will expire on April 15, 2017.

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1. Introduction

The LISP architecture and protocols [RFC6830] introduces two new numbering spaces, Endpoint Identifiers (EIDs) and Routing Locators (RLOCs) which are intended to replace most use of IP addresses on the Internet. To provide flexibility for current and future applications, these values can be encoded in LISP control messages using a general syntax that includes Address Family Identifier (AFI) [RFC1700].

This specification introduces the use of Geo-Coordinates that can be used in EID-records and RLOC-records of LISP control messages. The encoding format is specified in [LCAF] as the "Geo-Coordinates LCAF Type".

2. Definition of Terms

Geo-Point is a Geo-Coordinate according to [GEO] that defines a point from parameters Latitude, Longitude, and Altitude.

Geo-Prefix forms a circle of a geographic area made up of a Geo-Point and a Radius. A Geo-Point is known to be "more-specific" than a Geo-Prefix when its physical location is within the geographic circle.

3. Geo-Points in RLOC-records

Geo-Points can accompany an RLOC-record to determine the physical location of an ETR or RTR. This can aid in determining geographical distance when topological distance is inaccurate or hidden. When Geo-Points are encoded in RLOC-records with RLOC addresses the LCAF AFI-List Type should be used.

Geo-Points can be used as the sole piece of information in an RLOC-record when an EID maps to a Geo-Coordinate. If it is desirable to find the geographical location of any EID, this method can be convienent.

Here is a high-level use-case where an EID that maps to a Geo-Coordinate can be used. Lets say that am EID is assigned to a physical shipping package by a package delivery company. And the EID is encoded as an IPv6 address where the tracking number is embedded in an IPv6 EID. The network has LISP nodes deployed in many locations that are configured with their respective Geo-Coordinates. As the package roams, the LISP node that discovers the EID, registers it to the LISP mapping system. The EID-to-RLOC mapping is EID=IPv6 and RLOC=Geo-Coordinate. If someone does a mapping database lookup on the IPv6 EID, what is returned is the Geo-Coordinate. As the EID roams, new registrations with different Geo-Coordinates are stored, allowing the physical tracking of the package.

4. Geo-Prefixes in EID-records and RLOC-records

A Geo-Prefix is defined to be a Geo-Coordinate point and a Radius. This allows a circle to be drawn on a geographic map. The Geo-Prefix can describe a coarse physical location for an RLOC when encoded in an RLOC-record. So an RLOC could be registered in the mapping database indicating it is in a city or country versus the exact location where a Geo-Point would locate it.

A Geo-Prefix could allow a Distinguished-Name [DIST-NAME] to be registered as an EID with an RLOC that contains a Geo-Prefix. For example EID="San Francisco", with RLOC=geo-prefix could be stored in the mapping system.

A Geo-Prefix, when encoded in an EID-record, could be registered as an EID-prefix and when a Geo-Point is used as an EID lookup key, a sort of longest match could be looked up. If the Geo-Point is in the Circle described by the Geo-Prefix, an entry is returned to the Map-Requestor.

You could take a combination of mappings from the above examples to ask the question: "Is the package in San Francisco"? This could be done with two lookups to the mapping system:

```
Contents of Mapping Database:
  EID=<dist-name="san francisco">
  RLOC=<geo-prefix-of-60-mile-radius-of-sf>

  EID=<ipv6-package-tracking-number>
  RLOC=<geo-point-of-current-location>

  EID=<geo-prefix-of-60-mile-radius-of-sf>
  RLOC=<dist-name="san francisco">

Map-Request for package:
  EID=<ipv6-package-tracking-number>
Mapping system returns:
  RLOC=<geo-point-of-current-location>

Map-Request for geo-point:
  EID=<geo-point-of-current-location>
Mapping system longest-match lookup returns:
  EID=<geo-prefix-of-60-mile-radius-of-sf>
  RLOC=<dist-name="san francisco">
```

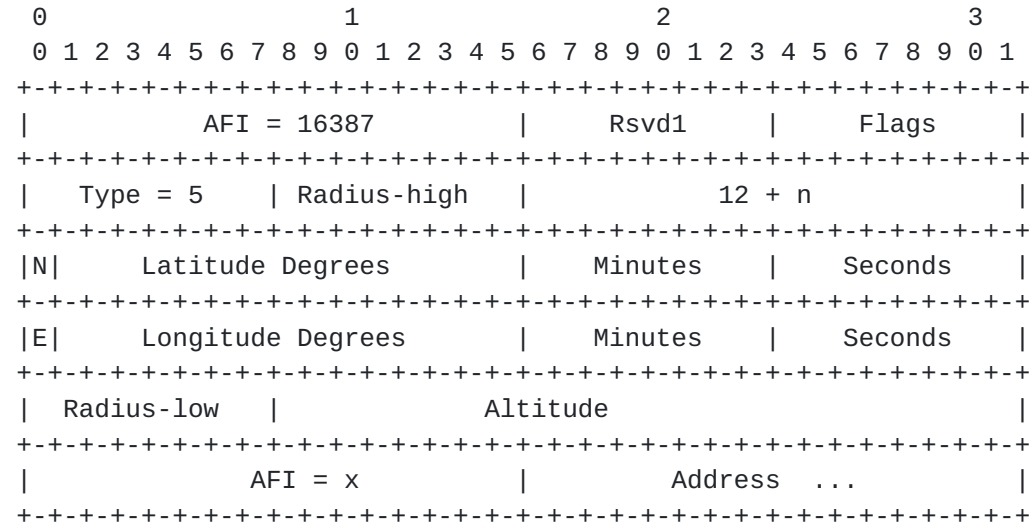
If the package was not in San Francisco, the second mapping table lookup would fail.

Another application is concentric rings of WiFi access-points. The radius of each ring corresponds to the Wifi signal strength. An EID could be located in any on the inner rings but possibly on the edge of a ring. A WiFi access-point RLOC can be selected to encapsulate packets to because it will have better signal to the current EID location. And when there are intersecting circles, it can be determined that when the EID is in the intersection of the circles, it would be a good time to transition radios to closer APs or base stations.

When assigning EIDs to vehicles [V2I], a Geo-Prefix could be used to create a "reachability set" of Road-Side-Units (RSUs). So an ITR could encapsulate to multiple RLOCs in the Geo-Prefix to try to create connectivity to the vehicle while roaming. This makes use of predictive RLOCs that can be used when the direction of the roaming EID is known (a train track or single direction road, but not a flight path of a plane).

5. Geo-Prefix and Geo-Point Encodings

When a Geo-Prefix or a Geo-Point are encoded in an EID-record, it is encoded solely with the Geo-Coordinates LCAF Type format when VPNs are not in use. When VPNs are used, the Geo-Coordinate LCAF Type is encoded within an Instance-ID LCAF Type.



This draft proposes to change the "Rsvd2" field from [LCAF] to "Radius-high" and take 8 bits from "Altitude" for Radius-low to make up a 16-bit value. When "Radius" is 0 the Geo-Coordinate encoding is a Geo-Point. When non-zero, it is the radius of the circle in kilometers. The maximum value is 65535 kilometers which is almost twice the distance of the earth's circumference.

The Altitude field in [LCAF] indicates that a value of 0x7fffffff is set when there is no Altitude encoded. Since the width of the Altitude field is shortened in this document, the value 0x7fffff is set to indicate no Altitude is encoded.

6. Security Considerations

The use of Geo-Coordinates in any application must be considered carefully to not violate and privacy concerns about physical location.

7. IANA Considerations

At this time there are no specific requests for IANA.

8. References

8.1. Normative References

[GEO] Geodesy and Geophysics Department, DoD., "World Geodetic System 1984", NIMA TR8350.2, January 2000, <http://earth-info.nga.mil/GandG/publications/tr8350.2/wgs84fin.pdf>.

[LCAF] Farinacci, D., Meyer, D., and J. Snijders, "LISP Canonical Address Format", draft-ietf-lisp-lcaf-12.txt (work in progress).

[RFC1700] Reynolds, J. and J. Postel, "Assigned Numbers", RFC 1700, DOI 10.17487/RFC1700, October 1994, <http://www.rfc-editor.org/info/rfc1700>.

[RFC6830] Farinacci, D., Fuller, V., Meyer, D., and D. Lewis, "The Locator/ID Separation Protocol (LISP)", RFC 6830, DOI 10.17487/RFC6830, January 2013, <http://www.rfc-editor.org/info/rfc6830>.

8.2. Informative References

[DIST-NAME] Farinacci, D., "LISP Distinguished Name Encoding", draft-farinacci-lisp-name-encoding-00.txt (work in progress).

[V2I] Jeong, J. and T. Oh, "Problem Statement for Vehicle-to-Infrastructure Networking", draft-jeong-its-v2i-problem-statement-00 (work in progress).

Appendix A. Acknowledgments

The author would like to thank the LISP WG for their review and acceptance of this draft.

Appendix B. Document Change Log

[RFC Editor: Please delete this section on publication as RFC.]

B.1. Changes to draft-farinacci-lisp-geo--01.txt

- Posted October 2016.
- Clarify that the Geo-Coordinates LCAF type should be encoded inside an Instance-ID LCAF type when VPNs are used.

- Indiate what the value of the Altitude field is when not included in a message. Since this draft shortens the field, a new value is specified in this draft for not conveying an Altitude value in a message.

B.2. Changes to draft-farinacci-lisp-geo--00.txt

- Initial draft posted April 2016.

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