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N. Shen, Ed.  
E. Chen  
A. Lindem  
Cisco Systems  
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Carrying Geo Coordinates Information In IS-IS  
draft-shen-isis-geo-coordinates-04

Abstract

This document defines a new IS-IS TLV which carries the Geo Coordinates information of the system. The Geo Coordinates information can be used by IS-IS routing or by an application.

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## 1. Introduction

The IS-IS routing protocol defined by [ISO10589] has been widely deployed. The Geo Coordinates information can be useful, particularly within the wide area networks for numerous applications. Similar to the Dynamic Hostname defined in [RFC5301], the Geo Coordinates can also be used for network management purposes.

The Geo coordinate information can be retrieve using a variety of means (e.g., SNMP, CLI) without requiring advertising it in an IGP. Nevertheless, announcing the information in IGP allows for new applications and use cases that are elaborated hereafter.

The following provides a non-exhaustive list of sample use cases.

In the case of IGP point-to-multiple operations [I-D.lamparter-isis-p2mp], [RFC6845], the local system configuration can be greatly simplified if the outbound metric to remote neighbors can be generated automatically based on the Geo Location of the IGP neighbors.

In the application where IS-IS neighbors are on the same "sub-net", but over the WAN network, the Geo Location information may be used for equal-cost or unequal-cost load sharing on the local system. This enables location based operation on anycast IP prefixes and DMZ gateways across the WAN environment.

For the traffic matrix using the Geo Coordinates within the routing domain, instead of a collection of IP nexthops which might be translated into locations, this enables automatic region to region traffic pattern aggregation. In particular, introducing new nodes or withdrawing existing ones will be automatically reflected by the application responsible for region to region traffic aggregation. Advanced traffic engineering policies may also be enforced to avoid some nodes located on a specific region under some conditions. Such advanced TE policies are not discussed in this document.

This document describes the IS-IS protocol extension for carrying the Geo Coordinates information. A new TLV is defined for this purpose. This TLV can be distributed within the node's LSP or inside the IIH PDU. The exact mechanism an application uses the information carried in this TLV is outside the scope of this document.

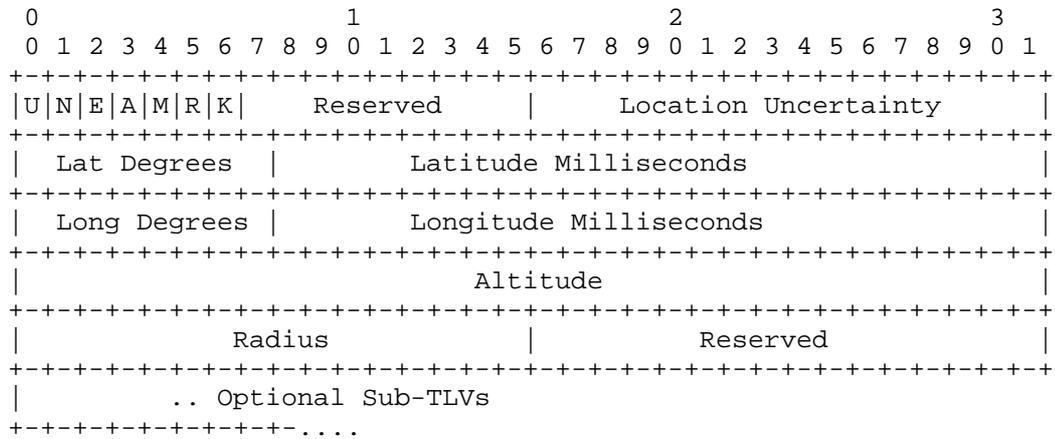
Further, it is out of scope of this document to specify how a node is provided with the information to be included in the TLV. This document does not assume whether the information included in the TLV is static or not. This is deployment-specific. Typically, this information can be used within a mobile network (trains, for example) that is grafted to a global network.

### 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 RFC 2119 [RFC2119].

## 2. Packet Encoding

This Geo Coordinates extension introduces one TLV for IS-IS LSP PDU and for Hello (IIH) PDU. The code of the TLV is described in Section 4. The fields specify the location of the system using WGS-84 (World Geodetic System) reference coordinate system [WGS84]. The value of the Geo Coordinates TLV consists of the following fields:



- Type: TBD. 8 bits value, to be assigned by IANA.
- Length: Variable. 8 bits value. The mandatory part is 16 octets.
- U-bit: If the U-bit is set, it indicates that the "Location Uncertainty" field is specified. If the U-bit is clear, it indicates the "Location Uncertainty" field is unspecified.
- N-bit: If the N-bit is set, it indicates the Latitude is north relative to the Equator. If the N-bit is clear, it indicates the Latitude is south of the Equator.
- E-bit: If the E-bit is set, it indicates the Longitude is east of the Prime Meridian. If the E-bit is clear, it indicates the Longitude is west of the Prime Meridian.
- A-bit: If the A-bit is set, it indicates the "Altitude" field is specified. If the A-bit is clear, it indicates the "Altitude" field is unspecified.
- M-bit: If the M-bit is set, it indicates the "Altitude" is specified in meters. If the M-bit is clear, it indicates the "Altitude" is in centimeters.
- R-bit: If the R-bit is set, it indicates the "Radius" field is specified and the encoding is for a circular area. If the R-bit is clear, it indicates the "Radius" field is unspecified and the encoding is for a single point.
- K-bit: If the K-bit is set, it indicates the "Radius" is specified in kilometers. If the K-bit is clear, it indicates the "Radius" is in meters.

Reserved: These bits are reserved. They SHOULD be set to 0 when sending protocol packets and MUST be ignored when receiving protocol packets.

Location Uncertainty: Unsigned 16-bit integer indicating the number of centimeters of uncertainty for the location.

Latitude Degrees: Unsigned 8-bit integer with a range of 0 - 90 degrees north or south of the Equator (northern or southern hemisphere, respectively).

Latitude Milliseconds: Unsigned 24-bit integer with a range of 0 - 3,599,999 (i.e., less than 60 minutes).

Longitude Degrees: Unsigned 8-bit integer with a range of 0 - 180 degrees east or west of the Prime Meridian.

Longitude Milliseconds: Unsigned 24-bit integer with a range of 0 - 3,599,999 (i.e., less than 60 minutes).

Altitude: Signed 32-bit integer containing the Height relative to sea level in centimeters or meters. A negative height indicates that the location is below sea level.

Radius: Unsigned 16-bit integer containing the radius of a circle centered at the specified coordinates. The radius is specified in meters unless the K-bit is specified indicating specification in kilometers. If the radius is specified, the geo-coordinates specify the entire area of the circle defined by the radius and center point. While the use cases herein do not make use of this field, future use cases may.

Optional Sub-TLV: Not defined in this document, for future extension related to the Geo Coordinates information.

### 3. Operations

The IS-IS Geo Coordinates TLV may be included in the node's LSP, and it is recommended to be in the LSP fragment zero. This TLV can also be optionally included in the IIH PDU. This can be useful when the application is setting the outbound p2mp circuit metric based on the neighbor's location. This can also be used in the Spine-Leaf extension [I-D.shen-isis-spine-leaf-ext] where there is no LSP being flooded into the leaf nodes.

The Geo location information can be provisioned on the system, or it can be dynamically acquired from the GPS capable device on the system.

Further, this specification assumes that the Geo Location coordinates MUST NOT be included by default. An explicit configuration parameter is required to instruct an IS-IS node to include this TLV in its announcement. If a node is instructed to include the TLV, but no value is provided, the TLV MUST NOT be announced.

#### 4. IANA Considerations

A new TLV codepoint is defined in this document and needs to be assigned by IANA from the "IS-IS TLV Codepoints" registry. It is referred to as the Geo Coordinates TLV. This TLV is only to be optionally inserted in the LSP PDU and the IIH PDU. This document does not propose any sub-TLV out of this Geo Coordinates TLV.

Value	Name	IIH	LSP	SNP	Purge
TBD	Geo Coordinates	y	y	n	n

#### 5. Security Considerations

Since the Geo Location coordinates may provide the exact location of the routing devices, disclosure may make the IS-IS devices more susceptible to physical attacks if such IS-IS messages are advertised outside an administrative domain. In situations where this is a concern (e.g., in military applications, or the topology of the network is considered proprietary information), the implementation MUST allow the Geo Location extension to be removed from the IS-IS advertisement. As mentioned in Section 3, the TLV is not included by default. Doing so, allow to avoid misuses of the TLV in the contexts that are not requiring such TLV to be advertised.

Security concerns for the base IS-IS are addressed in [ISO10589], [RFC5304], [RFC5310], and [RFC7602].

#### 6. Privacy Considerations

If the location of an IS-IS router advertising Geo Location coordinates as described herein can be directly correlated to an individual, individuals, or an organization, the location of that router should be considered sensitive and IS-IS LSP containing such geo coordinates should be advertised confidentially as described in Section 5. Additionally, IS-IS network management facilities may require added authorization to view the contents of IS-IS LSPs containing geo-Location TLVs. Refer to [RFC6973] for more information.

The Uncertainty and Confidence metrics for geo-location information as described in [RFC7459] are not included in the Geo Coordinates

TLV. In a future document, these may be considered for inclusion with additional Geo Location Sub-TLVs dependent on both on requirements and adoption of [RFC7459].

## 7. Acknowledgments

The encoding of the Geo location is adapted from the "Geo Coordinate LISP Canonical Address Format" specified in the "LISP Canonical Address Format (LCAF)". We would like to thank the authors of that Document and particularly Dino Farinacci for subsequent discussions.

Thanks to Mohamed Boucadair, Les Ginsberg, Yi Yang, and Joe Hildebrand for commenting and discussions of Geo Coordinates precision encoding. Thanks to David Ward for commenting on attack vector in relation to this new capability of IS-IS.

## 8. Document Change Log

### 8.1. Changes to draft-shen-isis-geo-coordinates-04.txt

- o Clarification and more precise descriptions throughout the document thanks to the detailed comments from Mohamed Boucadair.

### 8.2. Changes to draft-shen-isis-geo-coordinates-03.txt

- o The 03 version submitted in April 2017 without content change.

### 8.3. Changes to draft-shen-isis-geo-coordinates-02.txt

- o The 02 version submitted in October 2016.
- o Changed the format of Geo Location encoding to have Radius field and flags to be compatible with LISP [LISP-GEO].
- o Added the privacy section.

### 8.4. Changes to draft-shen-isis-geo-coordinates-01.txt

- o The 01 version submitted in February 2016.
- o Change Geo Location encoding to have better precision and to include uncertainty information.
- o Added the discussion in security section for the awareness of increased probability in attack vector.

## 8.5. Changes to draft-shen-isis-geo-coordinates-00.txt

- o Initial version of the draft is published in February 2016.

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## Authors' Addresses

Naiming Shen (editor)  
Cisco Systems  
560 McCarthy Blvd.  
Milpitas, CA 95035  
US

Email: [naiming@cisco.com](mailto:naiming@cisco.com)

Enke Chen  
Cisco Systems  
560 McCarthy Blvd.  
Milpitas, CA 95035  
US

Email: enkechen@cisco.com

Acee Linden  
Cisco Systems  
301 Midenhall Way  
Cary, NC 27513  
US

Email: acee@cisco.com