Networking Working Group   N. Shen, Ed.
Internet-Draft   E. Chen
Intended status: Standards Track   A. Lindem
Expires: April 21, 2018   Cisco Systems
                                                   October 18, 2017

               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.

Status of This Memo

Copyright Notice

Table of Contents

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:

```
      0                   1                   2                   3
      0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |U|N|E|A|M|R|K|    Reserved       |      Location Uncertainty    |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     | Lat Degrees  |        Latitude Milliseconds                   |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     | Long Degrees |        Longitude Milliseconds                  |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |                            Altitude                           |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |            Radius             |           Reserved            |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |            .. Optional Sub-TLVs
     +-+-+-+-+-+-+-+-+-....
```

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.

9. References

9.1. Normative References

   [ISO10589]
              ISO "International Organization for Standardization",
              "Intermediate system to Intermediate system intra-domain
              routeing information exchange protocol for use in
              conjunction with the protocol for providing the
              connectionless-mode Network Service (ISO 8473), ISO/IEC
              10589:2002, Second Edition.", Nov 2002.

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119,
              DOI 10.17487/RFC2119, March 1997, <https://www.rfc-
              editor.org/info/rfc2119>.

   [RFC5301] McPherson, D. and N. Shen, "Dynamic Hostname Exchange
              Mechanism for IS-IS", RFC 5301, DOI 10.17487/RFC5301,
              October 2008, <https://www.rfc-editor.org/info/rfc5301>.

   [RFC5304] Li, T. and R. Atkinson, "IS-IS Cryptographic
              Authentication", RFC 5304, DOI 10.17487/RFC5304, October
              2008, <https://www.rfc-editor.org/info/rfc5304>.

   [RFC5310] Bhatia, M., Manral, V., Li, T., Atkinson, R., White, R.,
              and M. Fanto, "IS-IS Generic Cryptographic
              Authentication", RFC 5310, DOI 10.17487/RFC5310, February
              2009, <https://www.rfc-editor.org/info/rfc5310>.

   [RFC6845] Sheth, N., Wang, L., and J. Zhang, "OSPF Hybrid Broadcast
              and Point-to-Multipoint Interface Type", RFC 6845,
              DOI 10.17487/RFC6845, January 2013, <https://www.rfc-
              editor.org/info/rfc6845>.

   [RFC7602] Chunduri, U., Lu, W., Tian, A., and N. Shen, "IS-IS
              Extended Sequence Number TLV", RFC 7602,
              DOI 10.17487/RFC7602, July 2015, <https://www.rfc-
              editor.org/info/rfc7602>.

9.2. Informative References

   [I-D.lamparter-isis-p2mp]
              Franke, C., Lamparter, D., and C. Hopps, "IS-IS Point-to-
              Multipoint operation", draft-lamparter-isis-p2mp-01 (work
              in progress), October 2015.

   [I-D.shen-isis-spine-leaf-ext]
              Shen, N., Ginsberg, L., and S. Thyamagundalu, "IS-IS
              Routing for Spine-Leaf Topology", draft-shen-isis-spine-
              leaf-ext-03 (work in progress), March 2017.

   [LISP-GEO]
              Farinacci, D., "LISP Geo-Coordinate Use-Cases", draft-
              farinacci-lisp-geo-02 (work in progress), 2016.

   [RFC6973] Cooper, A., Tschofenig, H., Aboba, B., Peterson, J.,
              Morris, J., Hansen, M., and R. Smith, "Privacy
              Considerations for Internet Protocols", RFC 6973,
              DOI 10.17487/RFC6973, July 2013, <https://www.rfc-
              editor.org/info/rfc6973>.

   [RFC7459] Thomson, M. and J. Winterbottom, "Representation of
              Uncertainty and Confidence in the Presence Information
              Data Format Location Object (PIDF-LO)", RFC 7459,
              DOI 10.17487/RFC7459, February 2015, <https://www.rfc-
              editor.org/info/rfc7459>.

   [WGS84]   National Imagery and Mapping Agency, "Department of
              Defense World Geodetic System 1984, Third Edition",
              NIMA TR8350.2, January 2000.

Authors' Addresses

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

   Email: 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