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**OSPF Extensions for Advertising/Signaling Geo Location Information
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Abstract

This document specifies an OSPF Router Information (RI) TLV to advertise the current Geo Coordinates of the OSPF router. For Point-to-Point (P2P) and Point-to-Multi-Point (P2MP) networks, the Geo Coordinates can be used to dynamically computing the cost to neighbors. This is useful both from the standpoint of auto-configuration and situations where the OSPF routers are moving. The Geo Coordinates are also useful for other applications such as Traffic Engineering (TE) and network management.

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[1.](#) Introduction

This document specifies an OSPF Router Information (RI) [[OSPF-RI](#)] TLV to advertise the current Geo Coordinates of the OSPF router. For Point-to-Point (P2P) and Point-to-Multi-Point (P2MP) networks, the Geo Coordinates can be used to dynamically computing the cost to neighbors. This is useful both from the standpoint of auto-configuration and situations where the OSPF routers are moving. The Geo Coordinates are also useful for other applications such as Traffic Engineering (TE) and network management.

[1.1.](#) Requirements Notation

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-KEYWORDS](#)].

[2.](#) OSPF Geo Coordinates TLV

The Geo Coordinates TLV can be used to advertise the current location of an OSPFv2 [[OSPF](#)] or OSPFv3 [[OSPFV3](#)] router using the OSPF Router Information LSA [[OSPF-RI](#)]. The OSPF Router Information LSA can be advertised in both link-scoped and area or AS scoped RI LSAs. 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|      Reserved      |  Location Uncertainty  |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|Latitude Degr. |      Latitude Milliseconds      |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|Longitude Degr.|      Longitude Milliseconds      |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     Altitude         |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|          .. Optional Sub-TLVs
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

Where:

- 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.
- 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.

Optional Sub-TLVs: No additional Sub-TLVs are defined in this document.

OSPF Geo Coordinates TLV

3. Link Advertisement of the OSPF Geo-Coordinates

When the Geo Coordinates are used for cost computation, the coordinates need to be advertised on the link using the encoding specified in [Section 2](#). For this application, a link-scoped OSPF Router Information (RI) [[OSPF-RI](#)] is advertised on each link where geo-location cost computation is utilized.

When an OSPF router receives the Geo Coordinates TLV in a link-scoped OSPF RI LSA from an adjacent neighbor, it can be used to calculate the physical distance to neighbor. For P2P and P2MP networks, this distance can be used to dynamically compute the cost of the link to that neighbor. The mapping of the distance to advertised cost is not specified in this document. However, all OSPF routers in the domain SHOULD use the same algorithm. Computation of cost based on physical distance can be useful both for autoconfiguration of these networks types and dynamic cost computation when the routers are moving.

The Geo location information can be statically provisioned or dynamically acquired from a GPS capable device on the OSPF Router.

4. OSPFv2 Router Information (RI) Opaque LSA

The OSPF Geo Coordinates TLV may optionally be advertised in the OSPF Router Information (RI) LSA [[OSPF-RI](#)]. It then may be used for applications such as traffic engineering (TE) and network management (e.g., the Find-My-Router application). The details of such applications are beyond the scope of this document.

5. Security Considerations

Since the Geo Location coordinates provide the exact location of the OSPF router, disclosure will make the OSPF router more susceptible to physical attacks. In situations where this is a concern (e.g., military applications), confidentiality should be provided either through a secure tunnel (e.g., [[IP-ESP](#)]) or protocol encryption [[OSPFV3-AUTH](#)].

Additionally, in some situations, the topology of the network is considered proprietary information. With the Geo Location coordinates, the physical topology, as well as the IP topology, can be discerned from the OSPF Router Information (RI) LSA. In these situations, confidentiality should be assured.

Security considerations for the base OSPF protocol are covered in [[OSPF](#)] and [[OSPFV3](#)].

6. Privacy Considerations

If the location of an OSPF 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 OSPF RI LSAs containing such geo coordinates should be advertised confidentially as described in [Section 5](#). Additionally, OSPF network management facilities may require added authorization to view the contents of OSPF RI LSAs containing geo-Location TLVs. Refer to [[PRIVACY](#)] for more information.

The Uncertainty and Confidence metrics for geo-location information as described in [[GEO-PIDF-LO](#)] 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 [[GEO-PIDF-LO](#)].

7. IANA Considerations

The document will require the following IANA actions:

1. A Router Information TLV type for the Geo Location TLV will be allocated from the OSPF Router Information (RI) TLVs registry.

8. References

8.1. Normative References

- [OSPF] Moy, J., "OSPF Version 2", STD 54, [RFC 2328](#), April 1998.
- [OSPF-RI] Lindem, A., Shen, N., Vasseur, J., Aggarwal, R., and S. Shaffer, "Extensions to OSPF for Advertising Optional Router Capabilities", [RFC 7770](#), January 2016.
- [OSPFV3] Coltun, R., Ferguson, D., Moy, J., and A. Lindem, "OSPF for IPv6", [RFC 5340](#), July 2008.
- [RFC-KEYWORDS]
Bradner, S., "Key words for use in RFC's to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.

8.2. Informative References

- [GEO-PIDF-L0]
Thomson, M. and J. Winterbottom, "Representation of Uncertainty and Confidence in the Presence Information Data Location Object (PIDF-L0)", [RFC 7459](#), February 2015.
- [IP-ESP] Kent, S., "IP Encapsulation Security Payload (ESP)", [RFC 4303](#), December 2005.
- [OSPFV3-AUTH]
Gupta, M. and S. Melam, "Authentication/Confidentiality for OSPFv3", [RFC 4552](#), June 2006.
- [PRIVACY] Cooper, A., Tschofenig, H., Aboba, B., Peterson, J., Morris, J., Hansen, M., and R. Smith, "Privacy Considerations", [RFC 6973](#), July 2013.

[Appendix A](#). Acknowledgments

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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.

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