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Carrying Geo Coordinates in BGP
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Abstract

In this document we specify a new BGP capability - the Geo Coordinate Capability, and a new BGP attribute - the Geo Coordinate Attribute, for carrying the Geo Coordinate information in BGP.

[1.](#) Introduction

There are several potential applications as described hereby for the physical location information of BGP speakers [[RFC4271](#)] in a network.

In an "overlay network" without IGPs or where the "underlay network" belongs to a different administrative domain (e.g., using the BGP Tunnel Encapsulation Attribute [[I-D.ietf-idr-tunnel-encaps](#)]), the geographical location of the BGP speaker that sources the route in the network can be used to derive some rough sense of "distance" as a parameter in lieu of the IGP-metric in BGP path selection.

In the applications of "Service Function Chaining" [[RFC7665](#)], the Geo location information of the Service Function Forwarders or the Service Nodes, can help the design of Service Function Paths with better traffic pattern and a lower latency.

The knowledge of the physical location of BGP speakers can also be used to simplify the operational procedures for setting the outbound "MED" value in route advertisement.

In this document we specify a new BGP capability - the Geo Coordinate Capability, and a new BGP attribute - the Geo Coordinate Attribute, for carrying the Geo Coordinate information in BGP.

[1.1.](#) Specification of Requirements

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. The Geo Coordinate Capability

The Geo Coordinate Capability is a new BGP capability [[RFC5492](#)]. The Capability Code for this capability is specified in the "IANA Considerations" section of this document. The Capability Length is 16 octets. The Capability Value consists of the following fields that specify the location of the speaker using the WGS-84 (World Geodetic System) reference coordinate system [[WGS-84](#)]:

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																													

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

Diagram illustrating the structure of an IPv4 address, showing four octets (0, 1, 2, 3) and their corresponding bit positions (0 to 31). The address is represented as a horizontal line with vertical tick marks for each bit. The octets are labeled 0, 1, 2, and 3 above the line. The bit positions are labeled 0 through 31 below the line. The text "AS Number" is centered below the line.

```

+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     BGP Identifier                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|U|N|E|M|      Reserved      |      Location Uncertainty      |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|Latitude Degr. |      Latitude Milliseconds      |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|Longitude Degr.|      Longitude Milliseconds      |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                                     Altitude                                     |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

where the "AS number" and the "BGP Identifier" fields contain the AS number and the BGP Identifier [RFC4271, [RFC6286](#)] of the BGP speaker that sources or advertises the route, and the remaining fields specify the location of the speaker using the WGS-84 (World Geodetic System) reference coordinate system [[WGS-84](#)]. These location related fields are hereby given the same description as the ones in the "Geo

Coordinate Capability" section.

[4. Operations](#)

The Geo Coordinate Capability may be used by a BGP speaker to advertise its physical location to its neighbor. When an IGP (such as OSPF or ISIS) is involved and accessible, it could be advantageous for the Geo Coordinates to be carried in the IGP instead of in the OPEN for internal BGP ("IBGP") sessions.

When a BGP speakers receives the Geo Coordinate Capability in the OPEN message from a neighbor, it is up to the speaker and its local policy to decide how the information would be used.

The Geo Coordinate Attribute may be used by a BGP speaker to encode the physical location of the speaker in an UPDATE message. In the case that a route already contains the attribute, the speaker MAY prepend its AS number, its BGP Identifier, and the Geo coordinate information in the value field of the attribute, and adjust the attribute length accordingly. Depending on local policy, the speaker MAY also override the existing Geo Coordinate Attribute with its own

information in route advertisement.

When a BGP speakers receives the Geo Coordinate Attribute in an UPDATE message from a neighbor, it is up to the speaker and the local policy to decide how this attribute would be handled and used.

The Geo Coordinate Capability in an OPEN message does not have any impact on how the Geo Coordinate Attribute in an UPDATE message (carried over the same session) would be handled.

[5.](#) Error Handling

The Geo Coordinate Attribute in an UPDATE message is considered malformed if the attribute length is not a non-zero multiple of 24.

An UPDATE message with a malformed Geo Coordinate Attribute SHALL be handled using the approach of "attribute discard" [[RFC7606](#)].

[6.](#) IANA Considerations

This documents specifies a BGP capability, the Geo Coordinate Capability. The capability type needs to be allocated by IANA.

This documents specifies a BGP attribute, the Geo Coordinate Attribute. The attribute type needs to be allocated by IANA.

[7.](#) Security Considerations

The underlying security issues for BGP are discussed in [[RFC4271](#)].

Since the Geo coordinates provide the exact location of the routing devices, disclosure may make the routing devices more susceptible to

physical attacks. 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 BGP's OPEN and UPDATE messages.

8. 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 Yi Yang for review and discussions of the Geo Coordinate encoding.

9. References

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