                   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
20 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|R|K|   Reserved-1   |     Location Uncertainty      |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |  Lat Degrees  |        Latitude Milliseconds                 |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |  Long Degrees |        Longitude Milliseconds                |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                             Altitude                         |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |            Radius             |         Reserved-2           |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
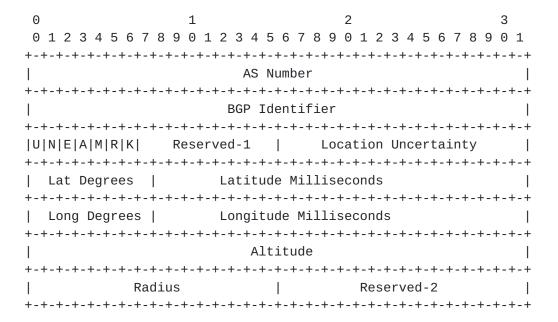
where:

  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.

  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-1: These bits are reserved. They SHOULD be set to zero by
the sender and MUST be ignored by the receiver.

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.

Reserved-2: The 16-bit field is reserved. It SHOULD be set to zero
by the sender and MUST be ignored by the receiver.

3. **The Geo Coordinate Attribute**

   The Geo Coordinate Attribute is an optional, transitive BGP attribute
   [RFC4271]. The type of the attribute is described in the IANA
   Considerations section, and the value of the attribute consists of
   one or more of the tuple encoded as shown below:

```
    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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                         AS Number                             |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                        BGP Identifier                         |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |U|N|E|A|M|R|K|   Reserved-1   |      Location Uncertainty      |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   | Lat Degrees  |        Latitude Milliseconds                   |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   | Long Degrees |        Longitude Milliseconds                  |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                          Altitude                             |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |          Radius           |          Reserved-2               |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   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 28.

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. Privacy Considerations

   TBD.

9. 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 and Acee Lindem for review and discussions of the
   Geo Coordinate encoding.

10. References

10.1. Normative References

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

   [RFC4271]   Rekhter, Y., Ed., Li, T., Ed., and S. Hares, Ed., "A
               Border Gateway Protocol 4 (BGP-4)", RFC 4271,
               DOI 10.17487/RFC4271, January 2006,
               <http://www.rfc-editor.org/info/rfc4271>.

   [RFC5492]   Scudder, J. and R. Chandra, "Capabilities Advertisement
               with BGP-4", RFC 5492, DOI 10.17487/RFC5492, February
               2009, <http://www.rfc-editor.org/info/rfc5492>.

   [RFC6286]   Chen, E., and J. Yuan, "Autonomous-System-Wide Unique BGP
               Identifier for BGP-4", RFC 6286, DOI 10.17487/RFC6286,
               June 2011, <http://www.rfc-editor.org/info/rfc6286>.

   [RFC7606]   Chen, E., Ed., Scudder, J., Ed., Mohapatra, P., and K.
               Patel, "Revised Error Handling for BGP UPDATE Messages",
               RFC 7606, DOI 10.17487/RFC7606, August 2015,
               <http://www.rfc-editor.org/info/rfc7606>.

   [WGS-84]   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>.

10.2. Informative References

   [I-D.ietf-idr-tunnel-encaps]
              Rosen, E., Patel, K., and G. Velde, "The BGP Tunnel
              Encapsulation Attribute", draft-ietf-idr-tunnel-encaps-01
              (work in progress), December 2015.

   [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,
              <http://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,
              <http://www.rfc-editor.org/info/rfc7459>.

   [RFC7665] Halpern, J., Ed., and C. Pignataro, Ed., "Service Function
              Chaining (SFC) Architecture", RFC 7665,
              DOI 10.17487/RFC7665, October 2015,
              <http://www.rfc-editor.org/info/rfc7665>.

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