       Advertising Per-node Admin Tags in BGP Link-State Advertisements
            draft-psarkar-idr-bgp-ls-node-admin-tag-extension-03

Abstract

   This document describes the protocol extensions to collect per-node
   administrative tags adevertised in IGP Link State advertisements and
   disseminate the same in BGP Link-State advertisement protocol, to
   facilitate inter-AS TE applications that may need the same per-node
   administrative tags to associate a subset of network devices spanning
   across more than one AS with a specific functionality.

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].

Status of This Memo

   This Internet-Draft is submitted in full conformance with the
   provisions of BCP 78 and BCP 79.

   Internet-Drafts are working documents of the Internet Engineering
   Task Force (IETF). Note that other groups may also distribute
   working documents as Internet-Drafts. The list of current Internet-
   Drafts is at http://datatracker.ietf.org/drafts/current/.

   Internet-Drafts are draft documents valid for a maximum of six months
   and may be updated, replaced, or obsoleted by other documents at any
   time. It is inappropriate to use Internet-Drafts as reference
   material or to cite them other than as "work in progress."

   This Internet-Draft will expire on May 13, 2016.

Copyright Notice

Table of Contents

1. Introduction

   Advertising Per-node Administrative Tags in Link State protocols like
   IS-IS [I-D.ietf-isis-node-admin-tag] and OSPF
   [I-D.ietf-ospf-node-admin-tag] allows adding an optional operational
   capability, that allows tagging and grouping of the nodes in a IGP
   domain. This, among other applications, allows simple management and
   easy control over route and path selection, based on local configured
   policies. However per-node administrative tags advertised in IGP
   advertisements let network operators associate nodes within a single
   AS (if not a single area). This limits the use of such per-node
   administrative tags and applications that need to associate a subset
   of network devices spanning across multiple AS with a specific
   functionality cannot use them.

   To address the need for applications that require visibility into
   LSDB across IGP areas, or even across ASes, the BGP-LS address-

family/sub-address-family have been defined that allows BGP to carry
LSDB information. The BGP Network Layer Reachability Information
(NLRI) encoding format for BGP-LS and a new BGP Path Attribute called
BGP-LS attribute are defined in [I-D.ietf-idr-ls-distribution]. The
identifying key of each LSDB object, namely a node, a link or a
prefix, is encoded in the NLRI and the properties of the object are
encoded in the BGP-LS attribute. Figure 1 describes a typical
deployment scenario. In each IGP area, one or more nodes are
configured with BGP-LS. These BGP speakers form an IBGP mesh by
connecting to one or more route-reflectors. This way, all BGP
speakers - specifically the route-reflectors - obtain LSDB
information from all IGP areas (and from other ASes from EBGP peers).
An external component connects to the route-reflector to obtain this
information (perhaps moderated by a policy regarding what information
is sent to the external component, and what information isn't).

```
                          +------------+
                          |  Consumer  |
                          +------------+
                                ^
                                |
                                v
              +------------------+
              |   BGP Speaker    |          +-----------+
              | (Route-Reflector)|          |  Consumer |
              +------------------+          +-----------+
                   ^    ^    ^                     ^
                   |    |    |                     |
         +---------------+   |   +---------------------+   |
         |               |   |                       |   |
         v               v                           v   v
    +-----------+   +-----------+             +-----------+
    |    BGP    |   |    BGP    |             |    BGP    |
    |  Speaker  |   |  Speaker  |    . . .    |  Speaker  |
    +-----------+   +-----------+             +-----------+
         ^               ^                         ^
         |               |                         |
        IGP             IGP                       IGP
```
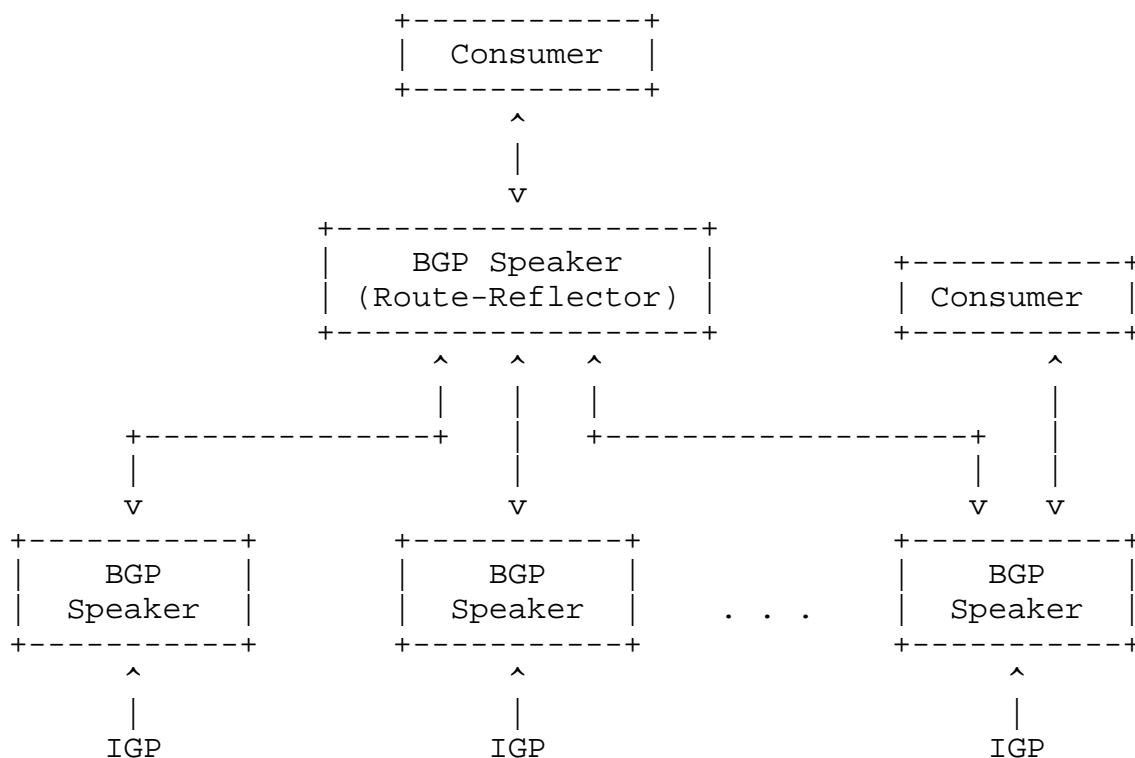
Figure 1: Link State info collection

For the purpose of advertising per-node administrative tags within
BGP Link-State advertisements, a new Node Attribute TLV to be carried
in the corresponding BGP-LS Node NLRI is proposed. For more details
on the Node Attribute TLVs please refer to section 3.3.1 in
[I-D.ietf-idr-ls-distribution]

2. Per-Node Administrative Tag

   An administrative Tag is a 32-bit integer value that can be used to
   identify a group of nodes in the entire routing domain. The new sub-
   TLV specifies one or more administrative tag values. A BGP Link-
   State speaker that also participates in the IGP link state
   advertisements exchange may learn one or more per-node administrative
   tags advertised by another router in the same IGP domain. Such BGP-
   LS speaker shall encode the same set of per-node administrative tags
   in the corresponding Node Attribute TLV representing the network
   device that originated the per-node administrative tags.

   The per-node administrative tags advertised in IGP link state
   advertisements will have either per-area(or levels in IS-IS)scope or
   'global' scope. Operator may choose to a set of per-node
   administrative tags across areas (or levels in IS-IS) and another
   advertise set of per-node administrative tags within the specific
   area (or level). But evidently two areas within the same AS or two
   different may use the same per-node administrative tag for different
   purposes. In such case applications will need to distinguish between
   the per-area(or level) scoped administrative tags originated from a
   specific node against those originated from the same node with
   'global' scope.

   A BGP-LS router in a given AS while copying the per-node
   administrative tags learnt from IGP link-state advertisements, MUST
   also copy the scope associated with the per-node administrative tags.
   Refer to Section 3.1 for how to encode the associated scope of a per-
   node administrative tags as well.

   To be able to distinguish between the significance of a per-area(or
   level) administrative tag learnt in one area, from that advertised in
   another area, or another AS, any applications receiving such a BGP-LS
   advertisements MUST consider the scope associated with each per-node
   administrative tag with 'per-area (or per-level) along with the
   area(or level in IS-IS) associated with corresponding IGP link state
   advertisement and the AS number associated with the originating node.
   The area(or level) associated with corresponding IGP link state
   advertisement and the AS number associated with the originating node
   can be derived from appropriate node attributes (already defined in
   BGP-LS [I-D.ietf-idr-ls-distribution]) attached with the
   corresponding Node NLRI.

3. BGP-LS Extensions for Per-Node Administrative Tags

   The BGP-LS NLRI can be a node NLRI, a link NLRI or a prefix NLRI.
   The corresponding BGP-LS attribute is a node attribute, a link
   attribute or a prefix attribute. BGP-LS

[I-D.ietf-idr-ls-distribution] defines the TLVs that map link-state
information to BGP-LS NLRI and BGP-LS attribute. This document adds
an new Node Attribute TLV called 'Node Admin Tag TLV' to encode per-
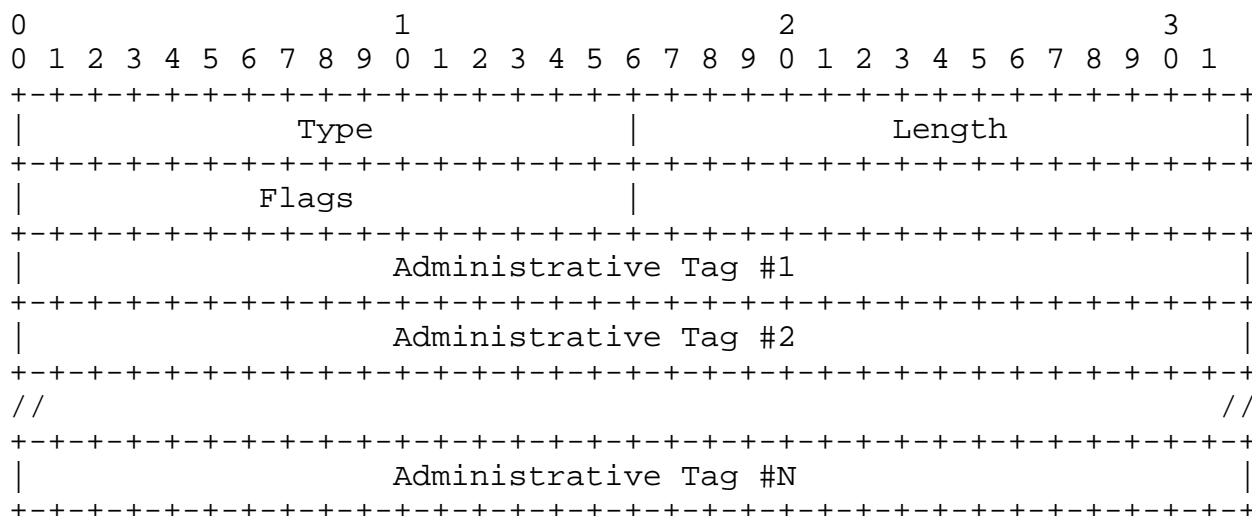node administrative tags information.

[I-D.ietf-isis-node-admin-tag] defines the 'Per-node Admin Tag' sub-
TLV in the Router Capability TLV (type 242) in IS-IS Link State PDUs
to encode per-node administrative tags. Similarly
[I-D.ietf-isis-node-admin-tag] defines the 'Per-node Administrative
Tag' TLV in OSPF Router Information LSAs to encode per-node
administrative tags in OSPF Link State update packets. The per-node
administrative tags TLVs learnt from the IGP link state
advertisements of a specific node will all be inserted in a new Node
Admin Tag TLV and added to the corresponding Node are mapped to the
corresponding BGP-LS Node NLRI. Per-node administrative tags from
IGP advertisements are mapped to the corresponding Node Admin Tag TLV
in the following way.

TLV Code Point	Description	Length	IS-IS TLV /sub-TLV	OSPF LSA/TLV
TBD	Node Admin Tag TLV	Variable	242/TBD [1]	RI-LSA/TBD [2]

Table 1: Node Admin Tag TLV Mapping from IGP

3.1. Node Admin Tag TLV

The new Node Administrative Tag TLV, like other BGP-LS Node Attribute
TLVs, is formatted as Type/Length/Value (TLV)triplets. Figure 2
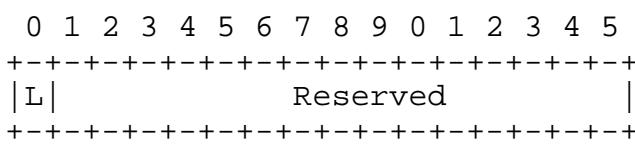below shows the format of the new TLV.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Type                 |              Length           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Flags                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   Administrative Tag #1                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   Administrative Tag #2                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
//                                                             //
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   Administrative Tag #N                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Type : A 2-octet field specifiying code-point of the new
           sub-TLV type. Code-point: TBA (suggested 1040)

   Length: A 2-octet field that indicates the length of the value
           portion in octets and will be a multiple of 4 octets
           dependent on the number of tags advertised.

   Value: A 2-octet 'Flags' field, followed by a sequence of multiple
           4 octets defining the administrative tags.

   Flags: A 2-octet field that carries flags associated with
           all the administrative flags encoded in this TLV.
           Following is the format of this field.

```
            0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
           +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
           |L|              Reserved        |
           +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

           The following bit flags are defined:

           L bit : If the L bit is set (1), it signifies that
                   all administrative flags encoded in this
                   TLV has per-area(or level in IS-IS) scope,
                   and should not be mixed with ones with same
                   value but with 'global' scope (L bit reset
                   to 0).

            Figure 2: BGP Link-State Node Administrative Tag TLV

This new type of 'Node Admin Tag' TLVs can ONLY be added to the Node
Attribute associated with the Node NLRI that originates the
corresponding per-node administrative tags in IGP domain.

All the per-node administrative tags with 'per-area' (or per-level)
scope, originated by a single node in IGP domain SHALL be re-
originated in a single 'Node Admin Tag' TLV and inserted in the Node
NLRI generated for the same node. Similarly, all the per-node
administrative tags with 'global' scope originated by the same node
in IGP domain SHALL be re-originated in another 'Node Admin Tag' TLV
and inserted in the same Node NLRI generated for the originating
node. Multiple instances of a TLV may be generated by the BGP-lS
router for a given node in the IGP domain. This MAY happen if the
original node's link state advertisement carries more than 16383 per-
node administrative groups and a single TLV does not provide
sufficient space. As such multiple occurence of the 'Node Admin Tag'
TLVs under a single BGP LS NLRI is cumulative.

While copying per-node administrative tags from IGP link-state
advertisements to corresponding BGP-LS advertisements, the said BGP-
LS speaker MAY run all the per-node administrative flags through a
locally configured policy that selects which ones should be exported
and which ones not. And then the per-node administrative tag is
copied to the BGP-LS advertisement if it is permitted to do so by the
said policy.

4. Elements of Procedure

   Meaning of the Per-node administrative tags is generally opaque to
   BGP Link-State protocol. Router advertising the per-node
   administrative tag (or tags) may be configured to do so without
   knowing (or even explicitly supporting) functionality implied by the
   tag.

   Interpretation of tag values is specific to the administrative domain
   of a particular network operator. The meaning of a per-node
   administrative tag is defined by the network local policy and is
   controlled via the configuration. However multiple administrative
   domain owners may agree on a common meaning implied by a
   administrative tag for mutual benefit.

   The semantics of the tag order has no meaning. There is no implied
   meaning to the ordering of the tags that indicates a certain
   operation or set of operations that need to be performed based on the
   ordering.

   Each tag SHOULD be treated as an independent identifier that MAY be
   used in policy to perform a policy action. Per-node administrative

tags carried by the Node Admin Tag TLV SHOULD be used to indicate a independent characteristics of the node in IGP domain that originated it. The TLV SHOULD be considered as an unordered list. Whilst policies may be implemented based on the presence of multiple tags (e.g., if tag A AND tag B are present), they MUST NOT be reliant upon the order of the tags (i.e., all policies should be considered commutative operations, such that tag A preceding or following tag B does not change their outcome).

For more details on guidance on usage of per-node administrative tags please refer to section 4 [3] in [I-D.ietf-isis-node-admin-tag].

5. Applications

   [I-D.ietf-isis-node-admin-tag] and [I-D.ietf-ospf-node-admin-tag] present some applications of node administrative tags.

   The policy-based Explicit routing use case can be extended to inter-area or inter-AS scenarios where an end to end path needs to avoid or include nodes that have particular properties. Following are some examples.

   1. Geopolitical routing : preventing traffic from country A to country B to cross country C. In this case, we may use node administrative tags to encode geographical information (country). Path computation will be required to take into account node administrative tag to permit avoidance of nodes belonging to country C.

   2. Legacy node avoidance : in some specific cases, it is interesting for service-provider to force some traffic to avoid legacy nodes in the network. For example, legacy nodes may not be carrier class (no high availability), and service provider wants to ensure that critical traffic only uses nodes that are providing high availability.

   In case of inter-AS Traffic-Engineering applications, different ASes SHOULD share their admin tag policies. They MAY also need to agree upon some common tagging policy for specific applications.

   For more details on some possible applications with per-node administrative tags please refer to section 5 [4] in [I-D.ietf-isis-node-admin-tag].

6. IANA Considerations

   This document requests assigning code-points from the registry for
   BGP-LS attribute TLVs based on table Table 2.

7. Manageability Considerations

   This section is structured as recommended in [RFC5706].

7.1. Operational Considerations

7.1.1. Operations

   Existing BGP and BGP-LS operational procedures apply. No new
   operation procedures are defined in this document.

8. TLV/Sub-TLV Code Points Summary

   This section contains the global table of all TLVs/Sub-TLVs defined
   in this document.

```
+---------------+---------------+----------+
| TLV Code Point | Description   |  Length  |
+---------------+---------------+----------+
|     1040       | Node Admin Tag | variable |
+---------------+---------------+----------+
```

           Table 2: Summary Table of TLV/Sub-TLV Codepoints

9. Security Considerations

   Procedures and protocol extensions defined in this document do not
   affect the BGP security model. See the 'Security Considerations'
   section of [RFC4271] for a discussion of BGP security. Also refer to
   [RFC4272] and [RFC6952] for analysis of security issues for BGP.

10. Acknowledgements

   TBD.

11. References

11.1. Normative References

[I-D.ietf-idr-ls-distribution]
          Gredler, H., Medved, J., Previdi, S., Farrel, A., and S.
          Ray, "North-Bound Distribution of Link-State and TE
          Information using BGP", draft-ietf-idr-ls-distribution-13
          (work in progress), October 2015.

[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>.

11.2. Informative References

[I-D.ietf-isis-node-admin-tag]
          Sarkar, P., Gredler, H., Hegde, S., Litkowski, S.,
          Decraene, B., Li, Z., Aries, E., Rodriguez, R., and H.
          Raghuveer, "Advertising Per-node Admin Tags in IS-IS",
          draft-ietf-isis-node-admin-tag-00 (work in progress),
          December 2014.

[I-D.ietf-ospf-node-admin-tag]
          Hegde, S., Raghuveer, H., Gredler, H., Shakir, R.,
          Smirnov, A., Li, Z., and B. Decraene, "Advertising per-
          node administrative tags in OSPF", draft-ietf-ospf-node-
          admin-tag-00 (work in progress), October 2014.

[RFC4272] Murphy, S., "BGP Security Vulnerabilities Analysis",
          RFC 4272, DOI 10.17487/RFC4272, January 2006,
          <http://www.rfc-editor.org/info/rfc4272>.

[RFC5706] Harrington, D., "Guidelines for Considering Operations and
          Management of New Protocols and Protocol Extensions",
          RFC 5706, DOI 10.17487/RFC5706, November 2009,
          <http://www.rfc-editor.org/info/rfc5706>.

[RFC6952] Jethanandani, M., Patel, K., and L. Zheng, "Analysis of
          BGP, LDP, PCEP, and MSDP Issues According to the Keying
          and Authentication for Routing Protocols (KARP) Design
          Guide", RFC 6952, DOI 10.17487/RFC6952, May 2013,
          <http://www.rfc-editor.org/info/rfc6952>.

11.3. URIs

   [1] http://tools.ietf.org/html/draft-ietf-isis-node-admin-tag-
       00#section-3.1

   [2] http://tools.ietf.org/html/draft-ietf-ospf-node-admin-tag-
       00#section-4.1

   [3] http://tools.ietf.org/html/draft-ietf-isis-node-admin-tag-
       00#section-4

   [4] http://tools.ietf.org/html/draft-ietf-isis-node-admin-tag-
       00#section-5

Authors' Addresses

   Pushpasis Sarkar (editor)
   Juniper Networks, Inc.
   Electra, Exora Business Park
   Bangalore, KA 560103
   India

   Email: psarkar@juniper.net; pushpasis.ietf@gmail.com

   Hannes Gredler
   Juniper Networks, Inc.
   1194 N. Mathilda Ave.
   Sunnyvale, CA 94089
   US

   Email: hannes@gredler.at

   Stephane Litkowski
   Orange

   Email: stephane.litkowski@orange.com