        Export of MPLS Segment Routing Label Type Information in IP Flow
                          Information Export (IPFIX)

Abstract

   This document introduces new IP Flow Information Export (IPFIX) code
   points to identify which traffic is being forwarded based on which
   MPLS control plane protocol is used within a Segment Routing domain.
   In particular, this document defines five code points for the IPFIX
   mplsTopLabelType Information Element for Path Computation Element
   (PCE), IS-IS, OSPFv2, OSPFv3, and BGP MPLS Segment Routing
   extensions.

Status of This Memo

Copyright Notice

Table of Contents

1. Introduction

    Four routing protocol extensions -- OSPFv2 Extensions [RFC8665],
    OSPFv3 Extensions [RFC8666], IS-IS Extensions [RFC8667], and BGP
    Prefix Segment Identifiers (Prefix-SIDs) [RFC8669] -- and one Path
    Computation Element Communication Protocol (PCEP) Extension [RFC8664]
    have been defined to be able to propagate Segment Routing (SR) labels
    for the MPLS data plane [RFC8660].

    Also, [SR-Traffic-Accounting] describes how IP Flow Information
    Export (IPFIX) [RFC7012] can be leveraged in dimensional data
    modeling to account for traffic to MPLS SR label dimensions within a
    Segment Routing domain.

    In [RFC7012], the Information Element (IE) mplsTopLabelType(46)
    identifies which MPLS control plane protocol allocated the top-of-
    stack label in the MPLS label stack. Per Section 7.2 of [RFC7012],
    the "IPFIX MPLS label type (Value 46)" subregistry [IANA-IPFIX] was
    created, where new MPLS label type entries should be added. This
    document defines new code points to address typical use cases that
    are discussed in Section 2.

2. MPLS Segment Routing Top Label Type

    By introducing five new code points to the IPFIX IE
    mplsTopLabelType(46) for Path Computation Element (PCE), IS-IS,
    OSPFv2, OSPFv3, and BGP Prefix-SIDs, it is possible to identify which
    traffic is being forwarded based upon which MPLS SR control plane
    protocol is in use.

    A typical use case is to monitor MPLS control plane migrations from
    LDP to IS-IS or OSPF Segment Routing. Such a migration can be done
    node by node as described in Appendix A of [RFC8661].

    Another use case is to monitor MPLS control plane migrations from
    dynamic BGP labels [RFC8277] to BGP Prefix-SIDs [RFC8669]. For
    example, the motivation for, and benefits of, such a migration in
    large-scale data centers are described in [RFC8670].

    Both use cases can be verified by using mplsTopLabelType(46),
    mplsTopLabelIPv4Address(47), mplsTopLabelIPv6Address(140),
    mplsTopLabelStackSection(70), and forwardingStatus(89) IEs to infer

    * how many packets are forwarded or dropped

    * if packets are dropped, for which reasons, and

    * the MPLS provider edge loopback address and label protocol

By looking at the MPLS label value itself, it is not always clear to which label protocol it belongs. This is because they may share the same label allocation range. This is, for example, the case for IGP-Adjacency SIDs, LDP, and dynamic BGP labels.

3. IANA Considerations

IANA has allocated the following code points in the "IPFIX MPLS label type (Value 46)" subregistry within the "IPFIX Information Elements" registry [RFC7012]. See [IANA-IPFIX].

Value	Description	Reference
=======	=============================	=====================
6	Path Computation Element	RFC 9160, RFC 8664
7	OSPFv2 Segment Routing	RFC 9160, RFC 8665
8	OSPFv3 Segment Routing	RFC 9160, RFC 8666
9	IS-IS Segment Routing	RFC 9160, RFC 8667
10	BGP Segment Routing Prefix-SID	RFC 9160, RFC 8669

Table 1: Updates to "IPFIX MPLS label type (Value 46)" Subregistry

References to RFCs 4364, 4271, and 5036 have been added to the "Reference" column in the "IPFIX MPLS label type (Value 46)" subregistry [IANA-IPFIX] for code points 3, 4, and 5, respectively. Previously, these references appeared in the "Additional Information" column for mplsTopLabelType(46) in the "IPFIX Information Elements" registry [IANA-IPFIX].

4. Operational Considerations

In the IE mplsTopLabelType(46), BGP code point 4 refers to the label value in the MP_REACH_NLRI path attribute described in Section 2 of [RFC8277], while BGP Segment Routing Prefix-SID code point 10 corresponds to the label index value in the Label-Index TLV described in Section 3.1 of [RFC8669]. These values are thus used for those distinct purposes.

5. Security Considerations

There exist no significant extra security considerations regarding the allocation of these new IPFIX IEs as compared to [RFC7012].

6. References

6.1. Normative References

[RFC7012] Claise, B., Ed. and B. Trammell, Ed., "Information Model for IP Flow Information Export (IPFIX)", RFC 7012, DOI 10.17487/RFC7012, September 2013,

              <https://www.rfc-editor.org/info/rfc7012>.

6.2. Informative References

   [IANA-IPFIX]
              IANA, "IPFIX MPLS label type (Value 46)",
              <https://www.iana.org/assignments/ipfix/>.

   [RFC8277] Rosen, E., "Using BGP to Bind MPLS Labels to Address
              Prefixes", RFC 8277, DOI 10.17487/RFC8277, October 2017,
              <https://www.rfc-editor.org/info/rfc8277>.

   [RFC8660] Bashandy, A., Ed., Filsfils, C., Ed., Previdi, S.,
              Decraene, B., Litkowski, S., and R. Shakir, "Segment
              Routing with the MPLS Data Plane", RFC 8660,
              DOI 10.17487/RFC8660, December 2019,
              <https://www.rfc-editor.org/info/rfc8660>.

   [RFC8661] Bashandy, A., Ed., Filsfils, C., Ed., Previdi, S.,
              Decraene, B., and S. Litkowski, "Segment Routing MPLS
              Interworking with LDP", RFC 8661, DOI 10.17487/RFC8661,
              December 2019, <https://www.rfc-editor.org/info/rfc8661>.

   [RFC8664] Sivabalan, S., Filsfils, C., Tantsura, J., Henderickx, W.,
              and J. Hardwick, "Path Computation Element Communication
              Protocol (PCEP) Extensions for Segment Routing", RFC 8664,
              DOI 10.17487/RFC8664, December 2019,
              <https://www.rfc-editor.org/info/rfc8664>.

   [RFC8665] Psenak, P., Ed., Previdi, S., Ed., Filsfils, C., Gredler,
              H., Shakir, R., Henderickx, W., and J. Tantsura, "OSPF
              Extensions for Segment Routing", RFC 8665,
              DOI 10.17487/RFC8665, December 2019,
              <https://www.rfc-editor.org/info/rfc8665>.

   [RFC8666] Psenak, P., Ed. and S. Previdi, Ed., "OSPFv3 Extensions
              for Segment Routing", RFC 8666, DOI 10.17487/RFC8666,
              December 2019, <https://www.rfc-editor.org/info/rfc8666>.

   [RFC8667] Previdi, S., Ed., Ginsberg, L., Ed., Filsfils, C.,
              Bashandy, A., Gredler, H., and B. Decraene, "IS-IS
              Extensions for Segment Routing", RFC 8667,
              DOI 10.17487/RFC8667, December 2019,
              <https://www.rfc-editor.org/info/rfc8667>.

   [RFC8669] Previdi, S., Filsfils, C., Lindem, A., Ed., Sreekantiah,
              A., and H. Gredler, "Segment Routing Prefix Segment
              Identifier Extensions for BGP", RFC 8669,
              DOI 10.17487/RFC8669, December 2019,
              <https://www.rfc-editor.org/info/rfc8669>.

   [RFC8670] Filsfils, C., Ed., Previdi, S., Dawra, G., Aries, E., and
              P. Lapukhov, "BGP Prefix Segment in Large-Scale Data
              Centers", RFC 8670, DOI 10.17487/RFC8670, December 2019,
              <https://www.rfc-editor.org/info/rfc8670>.

[SR-Traffic-Accounting]
            Ali, Z., Filsfils, C., Talaulikar, K., Sivabalan, S.,
            Horneffer, M., Raszuk, R., Litkowski, S., Voyer, D.,
            Morton, R., and G. Dawra, "Traffic Accounting in Segment
            Routing Networks", Work in Progress, Internet-Draft,
            draft-ali-spring-sr-traffic-accounting-06, 13 November
            2021, <https://datatracker.ietf.org/doc/html/draft-ali-
            spring-sr-traffic-accounting-06>.

Acknowledgements

Author's Address

Thomas Graf
Swisscom
Binzring 17
CH-8045 Zürich
Switzerland

Email: thomas.graf@swisscom.com