      A Policy Control Mechanism in IS-IS Using Administrative Tags

Status of This Memo

   This document specifies an Internet standards track protocol for the
   Internet community, and requests discussion and suggestions for
   improvements. Please refer to the current edition of the "Internet
   Official Protocol Standards" (STD 1) for the standardization state
   and status of this protocol. Distribution of this memo is unlimited.

Abstract

   This document describes an extension to the IS-IS protocol to add
   operational capabilities that allow for ease of management and
   control over IP prefix distribution within an IS-IS domain. This
   document enhances the IS-IS protocol by extending the information
   that an Intermediate System (IS) router can place in Link State
   Protocol (LSP) Data Units for policy use. This extension will
   provide operators with a mechanism to control IP prefix distribution
   throughout multi-level IS-IS domains.

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1. Introduction

   As defined in [RFC1195] and extended in [RFC3784], the IS-IS protocol
   [ISO10589] may be used to distribute IPv4 prefix reachability
   information throughout an IS-IS domain. In addition, thanks to
   extensions made in [RFC5120] and [ISIS-IPv6], IS-IS may be used to
   distribute IPv6 reachability information.

   The IPv4 prefix information is encoded as TLV type 128 and 130 in
   [RFC1195], with additional information carried in TLV 135 as
   specified in [RFC3784] and TLV 235 as defined in [RFC5120]. In
   particular, the extended IP Reachability TLV (TLV 135) contains
   support for a larger metric space, an up/down bit to indicate
   redistribution between different levels in the hierarchy, an IP
   prefix, and one or more sub-TLVs that can be used to carry specific
   information about the prefix. TLV 235 is a derivative of TLV 135,
   with the addition of Multi-Topology membership information [RFC5120].
   The IPv6 prefix information is encoded as TLV 236 in [ISIS-IPv6], and
   TLV 237 in [RFC5120].

   This document defines 2 new sub-TLVs for TLV 135, TLV 235, TLV 236
   and TLV 237 that may be used to carry administrative information
   about an IP prefix.

2. Conventions Used in This Document

   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 BCP 14, [RFC2119].

3. Sub-TLV Additions

   This document creates 2 new "Administrative Tag" sub-TLVs to be added
   to TLV 135, TLV 235, TLV 236 and TLV 237. These TLVs specify one or
   more 32- or 64-bit unsigned integers that may be associated with an
   IP prefix. Example uses of these tags include carrying BGP standard
   (or extended) communities and controlling redistribution between
   levels and areas, different routing protocols, or multiple instances
   of IS-IS running on the same router.

   The methods for which their use is employed is beyond the scope of
   this document and left to the implementer and/or operator.

   The encoding of the sub-TLV(s) is discussed in the following
   subsections.

3.1. 32-bit Administrative Tag Sub-TLV 1

   The Administrative Tag SHALL be encoded as one or more 4-octet
   unsigned integers using Sub-TLV 1 in TLV 135 [RFC3784], TLV 235
   [RFC5120], TLV 236 [ISIS-IPv6], and TLV 237 [RFC5120]. The
   Administrative Tag Sub-TLV has following structure:

   o 1 octet of type (value: 1)

   o 1 octet of length (value: multiple of 4)

   o one or more instances of 4 octets of administrative tag

   On receipt, an implementation MAY consider only one encoded tag, in
   which case, the first encoded tag MUST be considered and any
   additional tags ignored. A tag value of zero is reserved and SHOULD
   be treated as "no tag".

3.2. 64-bit Administrative Tag Sub-TLV 2

   The Administrative Tag SHALL be encoded as one or more 8-octet
   unsigned integers using Sub-TLV 2 in TLV 135 [RFC3784], TLV 235
   [RFC5120], TLV 236 [ISIS-IPv6], and TLV 237 [RFC5120]. The 64-bit
   Administrative Tag Sub-TLV has following structure:

   o 1 octet of type (value: 2)

   o 1 octet of length (value: multiple of 8)

   o one or more instances of 8 octets of administrative tag

   On receipt, an implementation MAY consider only one encoded tag; in
   which case, the first encoded tag MUST be considered and any
   additional tags ignored. A tag value of zero is reserved and SHOULD
   be treated as "no tag".

4. Ordering of Tags

   The semantics of the tag order are implementation-dependent. That
   is, there is no implied meaning to the ordering of the tags that
   indicates a certain operation or set of operations need be performed
   based on the order of the tags. Each tag SHOULD be treated as an
   autonomous identifier that MAY be used in policy to perform a policy
   action. Whether or not tag A precedes or succeeds tag B SHOULD not
   change the meaning of the tag set. However, when propagating TLVs
   that contain multiple tags between levels, an implementation SHOULD

preserve the ordering such that the first tag remains the first tag,
so that implementations that only recognize a single tag will have a
consistent view across levels.

Each IS that receives an LSP with TLV(s) 135 and/or 235 and/or 236
and/or 237, that have associated sub-TLV(s) 1 and/or 2, MAY operate
on the tag values as warranted by the implementation. If an
implementation needs to change tag values, for example, when
propagating TLVs between levels at an area boundary, then the TLV(s)
SHOULD be copied to the newly generated Level-1 or Level-2 LSP. At
that point, the contents of the sub-TLV(s) MAY change as dictated by
the policy action. In the event that no change is required, the sub-
TLV(s) SHOULD be copied in order into the new LSP, such that ordering
is preserved.

5. Compliance

   A compliant IS-IS implementation MUST be able to assign one tag to
   any IP prefix in any of the following TLVs: TLV 135, TLV 235, TLV
   236, TLV 237. It MUST be able to interpret a single tag present in
   the sub-TLV, or the first tag where there is more than one tag
   present in the sub-TLV.

   A compliant IS-IS implementation MAY be able to assign more than one
   tag to any IP prefix in any of the following TLVs: TLV 135, TLV 235,
   TLV 236, TLV 237. It MAY be able to interpret the second and
   subsequent tags where more than one tag is present in the sub-TLV.

   When propagating TLVs between levels, a compliant IS-IS
   implementation MAY be able to rewrite or remove one or more tags
   associated with a prefix in any of the following TLVs: TLV 135, TLV
   235, TLV 236, TLV 237.

6. Operations

   An administrator associates an Administrative Tag value with some
   interesting property. When IS-IS advertises reachability for some IP
   prefix that has that property, it adds the Administrative Tag to the
   IP reachability information TLV for that prefix, and the tag "sticks"
   to the prefix as it is flooded throughout the routing domain.

   Consider the network in Figure 1. We wish to "leak" L1 prefixes
   [RFC2966] with some property, A, from L2 to the L1 router R1.
   Without policy groups, there is no way for R2 to know property A
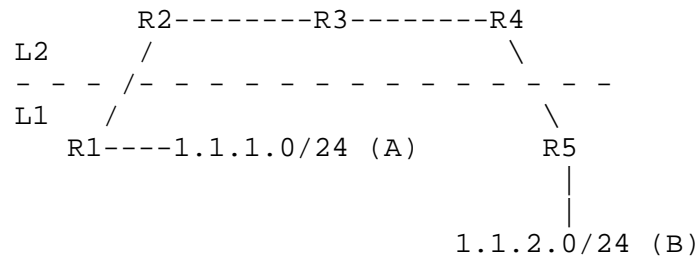   prefixes from property B prefixes.

```
              R2--------R3--------R4
        L2      /                    \
        - - - /- - - - - - - - - - - - - - -
        L1   /                          \
          R1----1.1.1.0/24 (A)        R5
                                       |
                                       |
                             1.1.2.0/24 (B)
```

                    Figure 1: Example of usage

   We associate Administrative Tag 100 with property A, and have R5
   attach that value to the IP extended reachability information TLV for
   prefix 1.1.2.0/24. R2 has a policy in place to "match prefixes with
   Administrative Tag 100, and leak to L1".

   The previous example is rather simplistic; it seems that it would be
   just as easy for R2 simply to match the prefix 1.1.2.0/24. However,
   if there are a large number of routers that need to apply some policy
   according to property A and a large number of "A" prefixes, this
   mechanism can be quite helpful.

   Implementations that support only a single tag and those that support
   multiple tags may coexist in the same IS-IS domain. An
   implementation supporting multiple tags SHOULD therefore assign any
   tag that is required to be interpreted by all systems as the first
   tag in any set of multiple tags.

7. Security Considerations

   This document raises no new security issues for IS-IS, as any
   annotations to IP prefixes should not pass outside the administrative
   control of the network operator of the IS-IS domain. Such an
   allowance would violate the spirit of Interior Gateway Protocols in
   general and IS-IS in particular.

8. IANA Considerations

   IANA has assigned "1" as the type code of the 32-bit Administrative
   Tag Sub-TLV and "2" as the type code of the 64-bit Administrative Tag
   Sub-TLV.

9. Manageability Considerations

   These extensions have been designed, developed, and deployed for many
   years and do not have any new impact on management and operation of
   the IS-IS protocol via this standardization process.

10. Acknowledgements

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   place to describe this new information, Tony Li and Tony Przygienda
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11. Contributors

   Brad Neal contributed portions of this document.

12. References

12.1. Normative References

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