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RSVP-TE Extensions for Collecting SRLG Information
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Abstract

   This document provides extensions for the Resource ReserVation
   Protocol-Traffic Engineering (RSVP-TE) to support automatic
   collection of Shared Risk Link Group (SRLG) Information for the TE
   link formed by a LSP.

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1. Introduction

   It is important to understand which TE links in the network might be
   at risk from the same failures. In this sense, a set of links may
   constitute a 'shared risk link group' (SRLG) if they share a resource
   whose failure may affect all links in the set [RFC4202].

   On the other hand, as described in [RFC4206] and [RFC6107], H-LSP
   (Hierarchical LSP) or S-LSP (stitched LSP) can be used for carrying
   one or more other LSPs. Both of the H-LSP and S-LSP can be formed as
   a TE link. In such cases, it is important to know the SRLG
   information of the LSPs that will be used to carry further LSPs.

   This document provides an automatic mechanism to collect the SRLG for
   the TE link formed by a LSP. Note that how to use the collected SRLG
   information is out of scope of this document

2. RSVP-TE Requirements

2.1. SRLG Collection Indication

   The head nodes of the LSP must be capable of indicating whether the
   SRLG information of the LSP should be collected during the signaling
   procedure of setting up an LSP. SRLG information should not be
   collected without an explicit request for it being made by the head
   node.

2.2. SRLG Collection

   If requested, the SRLG information should be collected during the
   setup of an LSP. The endpoints of the LSP may use the collected SRLG
   information and use it for routing, sharing and TE link configuration
   purposes.

2.3. SRLG Update

   When the SRLG information of an existing LSP for which SRLG
   information was collected during signaling changes, the relevant
   nodes of the LSP must be capable of updating the SRLG information of
   the LSP. This means that that the signaling procedure must be
   capable of updating the new SRLG information.

3. RSVP-TE Extensions (Encoding)

3.1. **SRLG Collection Flag**

   In order to indicate nodes that SRLG collection is desired, this
   document defines a new flag in the Attribute Flags TLV, which is
   carried in an LSP_REQUIRED_ATTRIBUTES or LSP_ATTRIBUTE Object:

   o Bit Number (to be assigned by IANA, recommended bit 12): SRLG
      Collection flag

   The SRLG Collection flag is meaningful on a Path message. If the
   SRLG Collection flag is set to 1, it means that the SRLG information
   should be reported to the head and tail node along the setup of the
   LSP.

   The rules of the processing of the Attribute Flags TLV are not
   changed.

3.2. **SRLG sub-object**

   This document defines a new RRO sub-object (ROUTE_RECORD sub-object)
   to record the SRLG information of the LSP. Its format is modeled on
   the RRO sub-objects defined in RFC 3209 [RFC3209].

```
        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     |    Reserved    |    Flags     |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                   SRLG ID 1 (4 bytes)                         |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   ~                       ......                                  ~
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                   SRLG ID n (4 bytes)                         |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Type

   The type of the sub-object, to be assigned by IANA, which is
   recommended 34.

   Length

   The Length contains the total length of the sub-object in bytes,
   including the Type and Length fields. The Length depends on the
   number of SRLG IDs.

   Flags

The Flags are used to indicate properties of the SRLG-list contained
in the sub-object.

    0x01 = SRLG-list edited

    If set, this flag indicates that the SRLG-list contained in the
    RRO sub-object has been edited in some way by a node during
    signaling in accordance with that node's policy.

    0x02 = Partial SRLG-list

    If set, this flag indicates that the SRLG-list contained in this
    RRO sub-object is known to be incomplete.

SRLG Id

The 32-bit identifier of the SRLG.

Reserved

This field is reserved. It SHOULD be set to zero on transmission and
MUST be ignored on receipt.

The rules of the processing of the LSP_REQUIRED_ATTRIBUTES,
LSP_ATTRIBUTE and ROUTE_RECORD Objects are not changed.

4. Signaling Procedures

4.1. SRLG Collection

Typically, the head node gets the route information of an LSP by
adding a RRO which contains the sender's IP addresses in the Path
message. If a head node also desires SRLG recording, it sets the
SRLG Collection Flag in the Attribute Flags TLV which can be carried
either in an LSP_REQUIRED_ATTRIBUTES Object if the collection is
mandatory, or in an LSP_ATTRIBUTES Object if the collection is
desired, but not mandatory

When a node receives a Path message which carries an
LSP_REQUIRED_ATTRIBUTES Object and the SRLG Collection Flag is set,
if local policy determines that the SRLG information should not be
provided to the endpoints, it MUST return a PathErr message with
Error Code 2 (policy) and Error subcode "SRLG Recording Rejected"
(value to be assigned by IANA, suggest value 108) to reject the Path
message.

When a node receives a Path message which carries an LSP_ATTRIBUTES

Object and the SRLG Collection Flag is set, if local policy
determines that the SRLG information should not be provided to the
endpoints, the Path message SHOULD NOT be rejected due to SRLG
recording restriction and the Path message SHOULD be forwarded
without the SRLG sub-object(s) in the Path RRO.

If local policy permits the recording of the SRLG information, the
processing node SHOULD add an SRLG sub-object to the RRO to carry the
local SRLG information. It then forwards the Path message to the
next node in the downstream direction.

Following the steps described above, the intermediate nodes of the
LSP can collect the SRLG information in the RRO during the forwarding
of the Path message hop by hop. When the Path message arrives at the
tail node, the tail node can get the SRLG information from the RRO.

Before the Resv message is sent to the upstream node, the tail node
adds the SRLG subobject with the SRLG value(s) associated with the
local hop to the Resv RRO in a similar manner to that specified above
for the addition of Path RRO sub-objects by midpoint nodes.

When a node receives a Resv message for an LSP for which SRLG
Collection is specified, if local policy determines that the SRLG
information should not be provided to the endpoints, if the SRLG-
recording request was in a LSP_REQUIRED_ATTRIBUTES object, then a
ResvErr with Error code 2 (policy) and Error subcode "SRLG Recording
Rejected" (value to be assigned by IANA, suggest value 108) MUST be
sent. If the request was in a LSP_ATTRIBUTES object, then a ResvErr
SHOULD NOT be generated, but SRLG information must not be added in
the RRO. Otherwise, if local policy allows to provide the SRLG
informatin, it MUST add an SRLG sub-object to the RRO to carry the
SRLG information in the upstream direction. When the Resv message
arrives at the head node, the head node can get the SRLG information
from the RRO in the same way as the tail node.

Note that a link's SRLG information for the upstream direction cannot
be assumed to be the same as that in the downstream.

o For Path and Resv messages for a unidirectional LSP, a node SHOULD
   include SRLG sub-objects in the RRO for the downstream data link
   only.

o For Path and Resv messages for a bidirectional LSP, a node SHOULD
   include SRLG sub-objects in the RRO for both the upstream data
   link and the downstream data link from the local node. In this
   case, the node MUST include the information in the same order for
   both Path messages and Resv messages. That is, the SRLG sub-
   object for the upstream link is added to the RRO before the SRLG

sub-object for the downstream link.

Based on the above procedure, the endpoints can get the SRLG
information automatically. Then the endpoints can for instance
advertise it as a TE link to the routing instance based on the
procedure described in [RFC6107] and configure the SRLG information
of the FA automatically.

It is noted that a node (e.g. the edge node of a domain) may edit the
RRO to remove the route information (e.g. node, interface identifier
information) before forwarding it due to some reasons
(e.g.confidentiality or reduce the size of RRO). A node MAY edit
SRLG information within the RRO of a Path or Resv message if dictated
by its local policy. If a node makes such an alteration to an
existing RRO object, it SHOULD set the "SRLG-list edited" flag in the
edited RRO sub-object to indicate to other nodes that this has been
done.

4.2. SRLG Update

When the SRLG information of a link is changed, the LSPs using that
link should be aware of the changes. The procedures defined in
Section 4.4.3 of RFC 3209 [RFC3209] MUST be used to refresh the SRLG
information if the SRLG change is to be communicated to other nodes
according to the local node's policy. If local policy is that the
SRLG change should be suppressed or would result in no change to the
previously signaled SRLG-list, the node need not send an update

5. Manageability Considerations

5.1. Policy Configuration

In a border node of inter-domain or inter-layer network, the
following SRLG processing policy should be capable of being
configured:

o Whether the SRLG IDs of the domain or specific layer network can
   be exposed to the nodes outside the domain or layer network, or
   whether they should be summarized or removed entirely.

o If SRLGs are summarized or removed, whether the "SRLG-list edited"
   flag is set in affected SRLG RRO-sub-objects and .

o If SRLGs are summarized or removed, whether the "SRLG-list edited"
   and "Partial SRLG-list" flags are set in affected SRLG RRO-sub-
   objects.

5.2. Coherent SRLG IDs

   In a multi-layer multi-domain scenario, SRLG ids may be configured by
   different management entities in each layer/domain. In such
   scenarios, maintaining a coherent set of SRLG IDs is a key
   requirement in order to be able to use the SRLG information properly.
   Thus, SRLG IDs must be unique. Note that current procedure is
   targeted towards a scenario where the different layers and domains
   belong to the same operator, or to several coordinated administrative
   groups. Ensuring the aforementioned coherence of SRLG IDs is beyond
   the scope of this documen

   Further scenarios, where coherence in the SRLG IDs cannot be
   guaranteed are out of the scope of the present document and are left
   for further study.

6. Security Considerations

   This document does not introduce any additional security issues above
   those identified in [RFC5920][RFC3209][RFC3473]

7. IANA Considerations

7.1. RSVP Attribute Bit Flags

   IANA has created a registry and manages the space of attributes bit
   flags of Attribute Flags TLV as described in section 11.3 of
   [RFC5420]. It is requested that IANA makes assignments from the
   Attribute Bit Flags.

   This document introduces a new Attribute Bit Flag:

   o Bit number: TBD (12)

   o Defining RFC: this I-D

   o Name of bit: SRLG Collection Flag

   o The meaning of the Attribute Flags TLV on a Path is defined in
      this I-D

7.2. ROUTE_RECORD Object

   IANA has made the following assignments in the "Class Names, Class
   Numbers, and Class Types" section of the "RSVP PARAMETERS" registry
   located at http://www.iana.org/assignments/rsvp-parameters. We

request that IANA make assignments from the ROUTE_RECORD RFC 3209
[RFC3209] portions of this registry.

This document introduces a new RRO sub-object:

```
     Type        Name                     Reference
     ---------   ----------------------   ---------
     TBD (34)    SRLG sub-object          This I-D
```

7.2.1. SRLG sub-object Flags

It is requested that the IANA ceates a registry to manage the space
of bit flags of the SRLG sub-object defined in this document. It is
requested that IANA makes assignments from the SRLG sub-object Flags.

This document introduces two new SRLG sub-object Flags.

```
     +------------+------------------+---------------+
     | Bit Number |       Name       |   Reference   |
     +------------+------------------+---------------+
     |      1     |  SRLG-list edited | This document |
     |      2     | Partial SRLG-list | This document |
     +------------+------------------+---------------+
```

7.3. Policy Control Failure Error subcodes

IANA has made the following assignments in the "Error Codes and
Globally-Defined Error Value Sub-Codes" section of the "RSVP
PARAMETERS" registry located at
http://www.iana.org/assignments/rsvp-parameters. We request that
IANA make assignments from the Policy Control Failure Sub-Codes
registry.

This document introduces a new Policy Control Failure Error sub-code:

o Error sub-code: TBD (108)

o Defining RFC: this I-D

o Name of error sub-code: SRLG Recording Rejected

o The meaning of the SRLG Recording Rejected error sub-code is
   defined in this I-D

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