Compressed Routing Header (CRH) Helper Option
draft-bonica-6man-crh-helper-opt-00

Abstract

   This document defines the IPv6 CRH Helper option. When an SRm6
   ingress node originates a packet, it can use the IPv6 CRH Helper
   option to provide SID Forwarding Information Base (SFIB) information
   to downstream nodes that do not maintain a complete SFIB.

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   This Internet-Draft will expire on May 3, 2020.

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1. Introduction

   SRm6 [I-D.bonica-spring-srv6-plus] leverages two new IPv6 [RFC8200]
   Routing types. Generically, they are called the Compressed Routing
   Header (CRH) [I-D.bonica-6man-comp-rtg-hdr]. More specifically, the
   16-bit version of the CRH is called the CRH-16, while the 32-bit
   version of the CRH is called the CRH-32.

   Both CRH versions contain the following fields:

   o Next Header - Identifies the header immediately following the CRH.

   o Hdr Ext Len - Length of the CRH.

   o Routing Type - Identifies the Routing header variant (i.e., CRH-16
      or CRH-32).

   o Segments Left - The number of segments still to be traversed
      before reaching the SRm6 path egress node.

   o Segment Identifier (SID) List - Represents the SRm6 path as an
      ordered list of Segment Identifiers (SID). SIDs are listed in
      reverse order, with SID[0] representing the final segment, SID[1]
      representing the penultimate segment, and so forth. SIDs are
      listed in reverse order so that Segments Left can be used as an
      index to the SID List. The SID indexed by Segments Left is called
      the current SID.

   As per [RFC8200], when an IPv6 node receives a packet, it examines
   the packet's destination address. If the destination address

represents an interface belonging to the node, the node processes the next header. If the node encounters and recognizes the CRH, it processes the CRH as follows:

o If Segments Left equal 0, skip over the CRH and process the next header in the packet.

o Decrement Segments Left.

o Query a local data structure, called the SID Forwarding Information Base (SFIB), searching for an entry that is indexed by the current SID.

o If the above-mentioned query returns an SFIB entry, update the packet's IPv6 Destination Address and forward the packet.

In a typical SRm6 deployment, every segment ingress node maintains a complete SFIB and the above-mentioned query returns an SFIB entry. However, in some SRm6 deployments, some segment ingress nodes maintain a complete SFIB while others do not. The following are reasons why a segment ingress node might not maintain a complete SFIB:

o the node is a Network Interface Card (NIC) in a data center. Although it originates many segments, it does not participate in the SRm6 control plane [I-D.bonica-lsr-crh-isis-extensions].

o the node resides in another autonomous system and does not participate in the SRm6 control plane.

This document defines the IPv6 CRH Helper option. When an SRm6 path ingress node originates a packet, it can use the IPv6 CRH Helper option to provide SFIB information to downstream nodes that do not maintain a complete SFIB.

If a segment ingress node queries its SFIB, searching for an entry that is indexed by the current SID, and that query returns nothing, the segment ingress node can obtain the required SFIB information from the IPv6 CRH Helper option. If the segment ingress node cannot obtain the required SFIB information from either source, it discards the packet sends an ICMPv6 [I-D.bonica-lsr-crh-isis-extensions] Parameter Problem message to the source node.

2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP

14 [RFC2119] [RFC8174] when, and only when, they appear in all
capitals, as shown here.

3. Option Format

The CRH Helper option contains the following fields:

o Option Type - (8-bits) CRH Helper option. Value TBD by IANA.
   (Suggested value: 0x11). See Note below.

o Opt Data Len - (8-bits) Length of the option, in octets, excluding
   the Option Type and Option Length fields.

o SFIB Helper (SFIBH) List - (Variable length) A list of SFIBHs.

Each SFIBH contains the following fields:

o SFIBH Length - (8-bits) Length of the SFIBH, in octets, excluding
   SFIBH Length. Value MUST be greater than 2 and less than 19.

o Low SID - (8-bits) Index to the CRH SID List. References the
   first member of the SID List to which this SFIBH applies.

o High SID - (8-bits) Index to the CRH SID List. References the
   last member of the SID List to which this SFIBH applies.

o Prefix field (variable length): An IPv6 Prefix.

NOTE : The highest-order two bits of the Option Type (i.e., the "act"
bits) are 00. These bits specify the action taken by a destination
node that does not recognize the option. The required action is to
skip over this option and continue processing the header.

The third highest-order bit of the Option Type (i.e., the "chg" bit)
is 0. This indicates that Option Data cannot be modified along the
path between the packet's source and its destination.

4. Option Processing

When a segment endpoint node processes a CRH, it attempts to resolve
the SID using information contained by its SFIB. If it cannot
resolve the SID using SFIB, it attempts to resolve the SID using
information received in an applicable SFIBH. If no SFIBH applies to
the current SID, the processing node discards the packet and sends an
ICMPv6 Parameter Problem message to the source node.

When the processing node uses an SFIBH to resolve a SID, it executes
the following procedure:

o Set the IPv6 Destination Address to 0::

o Overwrite the low order bits of the IPv6 Destination Address with
   the current SID found in the CRH

o Overwrite the high order bits of the IPv6 Destination Address with
   the prefix found in the applicable SFIBH

If the prefix found in the applicable SFIBH is 16 bytes long, it
overwrites the entire IPv6 Destination Address.

The CRH Helper option MAY occur in a Destination Options header that
precedes a CRH. It SHOULD NOT occur in a Hop-by-hop options header
or in a Destination Options header that precedes an upper-layer
header.

When a segment ingress node resolves a SID using information obtained
from the CRH helper option, the SID is understood to be a prefix SID.
Therefore, the packet is forwarded to its destination via the least
cost path.

Information obtained from the CRH Helper option is transient. It is
discarded as soon as the packet that carried it has been processed.

5. Security Considerations

When a segment endpoint node processes a CRH, it attempts to resolve
the SID using information contained by its SFIB. If it can resolve
the SID using SFIB, it MUST ignore the CRH Helper option, even if it
contains an applicable SFIBH.

6. IANA Considerations

IANA is requested to allocate a code point from the Destination
Options and Hop-by-hop Options registry
(https://www.iana.org/assignments/ipv6-parameters/
ipv6-parameters.xhtml#ipv6-parameters-2). This option is called "CRH
Helper Option". The "act" bits are 00 and the "chg" bit is 0.
(Suggested value: 0x11).

7. Acknowledgements

Thanks to TBD for their careful review of this document.

8. References

8.1. Normative References

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