Transparent Interconnection of Lots of Links (TRILL): Vendor-Specific RBridge Channel Protocol

Abstract

   The IETF TRILL (Transparent Interconnection of Lots of Links)
   protocol is implemented by devices called TRILL switches or RBridges
   (Routing Bridges). TRILL includes a general mechanism, called an
   RBridge Channel, for the transmission of typed messages between
   RBridges in the same campus and between RBridges and end stations on
   the same link. This document specifies a method to send vendor-
   specific messages over the RBridge Channel facility.

Status of This Memo

   This is an Internet Standards Track document.

   This document is a product of the Internet Engineering Task Force
   (IETF). It represents the consensus of the IETF community. It has
   received public review and has been approved for publication by the
   Internet Engineering Steering Group (IESG). Further information on
   Internet Standards is available in Section 2 of RFC 7841.

   Information about the current status of this document, any errata,
   and how to provide feedback on it may be obtained at
   https://www.rfc-editor.org/info/rfc8381.

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1. Introduction

   The IETF TRILL (Transparent Interconnection of Lots of Links)
   protocol [RFC6325] [RFC7780] is implemented by devices called TRILL
   switches or RBridges (Routing Bridges). It provides efficient least-
   cost transparent routing in multi-hop networks with arbitrary
   topologies and link technologies, using link-state routing and a hop
   count.

   The TRILL protocol includes an RBridge Channel facility [RFC7178] to
   support typed message transmission between RBridges in the same
   campus and between RBridges and end stations on the same link. This
   document specifies a method of sending messages specified by a
   particular organization, indicated by OUI (Organizationally Unique
   Identifier) [RFC7042] or CID (Company Identifier) [802], over the
   RBridge Channel facility. Such organization-specific messages could,
   for example, be used for vendor-specific diagnostic or control
   messages.

However, note that a range of RBridge Channel protocol numbers are
available based on RFC publication. Those intending to use the
RBridge Channel facility are encouraged to document their use in an
RFC and to use RBridge Channel protocol numbers based on such RFC
publication.

1.1. Terminology and Acronyms

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.

This document uses the acronyms defined in [RFC6325] supplemented by
the following additional acronyms:

CID - Company Identifier [802]

FGL - Fine-Grained Labeling

OUI - Organizationally Unique Identifier [RFC7042]

TRILL switch - An alternative term for an RBridge

2. Vendor Channel Packet Format

The general structure of an RBridge Channel packet on a link between
TRILL switches (RBridges) is shown in Figure 1 below. When an
RBridge Channel message is sent between an RBridge and an end station
on the same link, in either direction, it is called a Native RBridge
Channel message and the TRILL Header (including the Inner Ethernet
Addresses and Data Label area) is omitted as shown in Figure 2. The
type of RBridge Channel packet is given by a Protocol field in the
RBridge Channel Header that indicates how to interpret the Channel-
Protocol-Specific Payload. See [RFC7178].
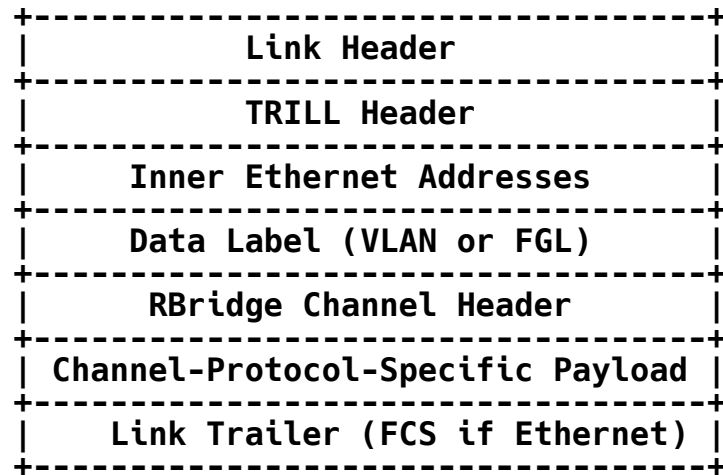
                         Packet Structure

```
              +------------------------------------+
              |            Link Header              |
              +------------------------------------+
              |           TRILL Header             |
              +------------------------------------+
              |      Inner Ethernet Addresses      |
              +------------------------------------+
              |      Data Label (VLAN or FGL)      |
              +------------------------------------+
              |       RBridge Channel Header       |
              +------------------------------------+
              | Channel-Protocol-Specific Payload  |
              +------------------------------------+
              |    Link Trailer (FCS if Ethernet)  |
              +------------------------------------+
```

          Figure 1: RBridge Channel Packet Structure

                        Message Structure

```
              +------------------------------------+
              |            Link Header              |
              +------------------------------------+
              |       RBridge Channel Header       |
              +------------------------------------+
              | Channel Protocol Specific Payload  |
              +------------------------------------+
              |    Link Trailer (FCS if Ethernet)  |
              +------------------------------------+
```
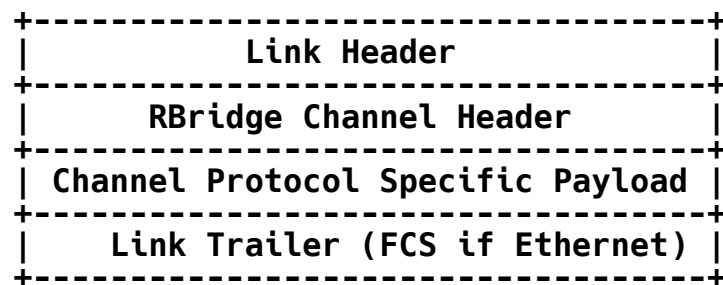
         Figure 2: Native RBridge Channel Message Structure

   Figure 3 below expands the RBridge Channel Header and Channel
   Protocol Specific Payload above for the case of the Vendor-Specific
   RBridge Channel Tunnel Protocol. 0x8946 is the Ethertype [RFC7042]
   assigned by the IEEE for the RBridge Channel protocol.

```
                          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
      RBridge Channel Header:
         +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
         |     RBridge-Channel (0x8946)  | 0x0   | Channel Protocol=0x008|
         +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
         |          Flags                | ERR   |
         +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
      RBridge Channel Protocol Specific:
                                         +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                                         |        Vendor ID = OUI/CID    |
         +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
         |OUI/CID (cont.)|    VERR       | Sub-Protocol  | Sub-Version   |
         +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
         |          Vendor-Protocol-Specific Data
         |
         | ...
```
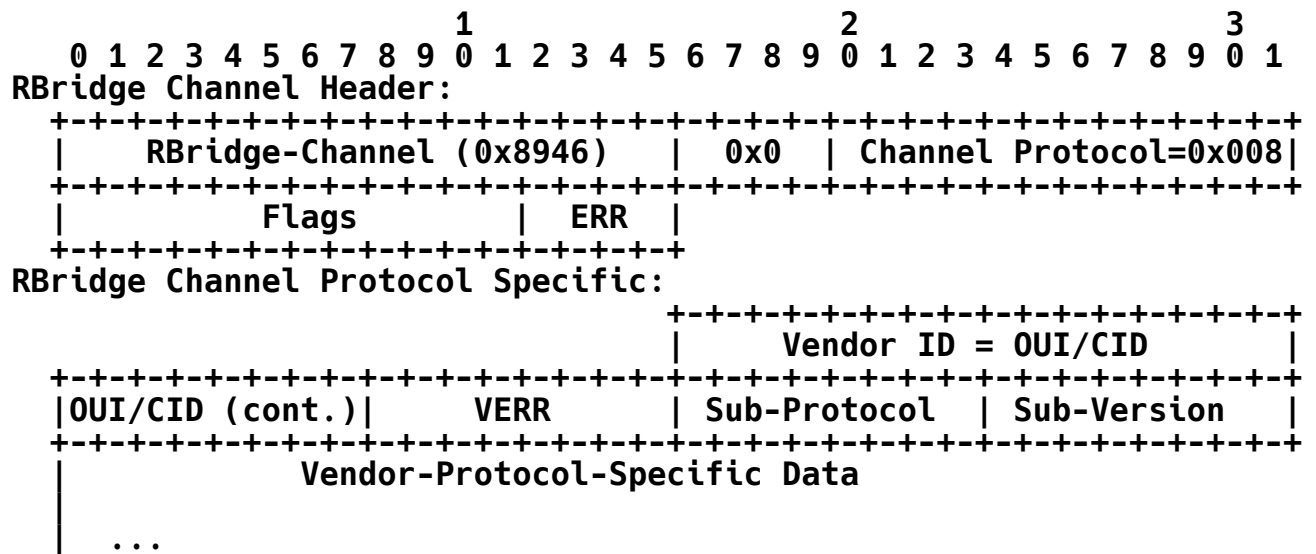
                Figure 3: Channel Tunnel Message Structure

   The fields in Figure 3 related to the Vendor RBridge Channel Protocol
   are as follows:

      Channel Protocol: The RBridge Channel Protocol value allocated
         for the Vendor Channel (see Section 4).

      Vendor ID: This field indicates the vendor specifying the
         particular use or uses of the Vendor Channel. The vendor to
         whom the OUI or CID in this field has been allocated is in
         charge of specifying Vendor Channel messages using their
         identifier. Depending on the first byte of this field as
         follows:

         OUI: When the bottom two bits of the first byte of the Vendor
            ID are zero (that is, the first byte is 0bXXXXXX00), the
            Vendor ID is an OUI.

         CID: When the bottom two bits of the first byte are a one
            followed by a zero (that is, the first byte is 0bXXXXXX10),
            the Vendor ID is a CID.

         Other: Other values of the bottom two bits of the first byte of
            the Vendor ID are invalid, and a VERR of 2 MUST be returned,
            subject to possible rate limiting (see Section 3).

      VERR: Vendor Channel Error. See Section 3.

Sub-Protocol: Actually, the vendor specifying their use of the
    Vendor Channel can do whatever they want with the bits after
    the VERR field. But it is strongly RECOMMENDED that they use
    the sub-protocol / sub-version fields indicated so that
    multiple and evolving uses can be specified based on a single
    OUI.

Sub-Version: See explanation above of the Sub-Protocol field.
    This field is provided to indicate the version of the
    particular vendor's Sub-Protocol.

3. Vendor Channel Errors

The VERR field values from 0x0 through 0x0F (inclusive) and the value
0xFF are reserved for specification by the IETF. See Section 4. All
other values of VERR are available for whatever use the vendor
specifies, except that a Vendor Channel implementation MUST NOT send
a Vendor Channel Error in response to a Vendor Channel message with a
nonzero VERR.

The VERR values thus far specified by the IETF are as follows:

0. The VERR field is zero in Vendor Channel messages unless the
    Vendor Channel packet is reporting an error.

1. The value one indicates that the length of the RBridge-Channel-
    Specific Data is less than 4 bytes. This means that at least the
    VERR byte and possibly part or all of the OUI is truncated. If
    an RBridge that implements the Vendor Channel facility receives
    such a Vendor Channel message, it MUST expand it to extend
    through the VERR field, set that field to one, and return the
    packet as described in Section 3.1.

2. The OUI/CID field value is unknown. If an RBridge implements the
    Vendor Channel facility and receives a Vendor Channel packet with
    a zero VERR field and an OUI/CID field it does not recognize and
    the SL flag is zero in the RBridge Channel Header, it MUST set
    the VERR field to the value two and return the packet as
    described in Section 3.1.

   3.   The value 3 indicates that the Sub-Protocol field value is
        unknown. An RBridge SHOULD set the VERR field to 3 and return
        the packet as described in Section 3.1 if it implements the
        Vendor Channel facility and it receives a Vendor Channel packet
        meeting the following conditions:
        (a) a zero VERR field in the RBridge Channel Header,
        (b) a zero SL flag in the RBridge Channel Header,
        (c) an OUI/CID that it implements, and
        (d) a Sub-Protocol field value it does not recognize even though
            it implements and uses the Sub-Protocol field.

   4.   The value 4 indicates that the Sub-Version field value is
        unknown. An RBridge SHOULD set the VERR field to 4 and return
        the packet as described in Section 3.1 if it implements the
        Vendor RBridge Channel facility and it receives a Vendor Channel
        packet meeting the following conditions:
        (a) a zero VERR field in the RBridge Channel Header,
        (b) a zero SL flag in the RBridge Channel Header,
        (c) an OUI/CID and Sub-Protocol that it implements, and
        (d) a Sub-Version field value it does not recognize even though
            it implements and uses the Sub-Version field.

   Uniform error handling is generally advisable for the sake of
   maintenance and understandability; however, "SHOULD" is chosen for
   errors 3 and 4 above because, as long as each message is
   distinguished by a vendor's OUI/CID, it is up to that vendor to
   decide between standard and nonstandard error handling.

3.1. Sending an Error Response

   The IETF-specified Vendor Channel errors are sent in response to a
   received RBridge Channel packet by setting the VERR field as
   specified above and modifying the packet as specified below. (The
   ERR field will be zero because, if it were nonzero, the packet would
   have been handled at the general RBridge Channel level rather than
   being passed down to the Vendor Channel level.)

   The RBridge Channel Header is modified by setting the SL flag. (The
   flags in the Channel Header and the semantics of the SL flag are
   specified in [RFC7178].)

   o If an error 1 is being generated because of truncation, the
      RBridge-Channel-Specific Data area is extended to include the VERR
      byte.

o If a Vendor Channel message was sent between RBridges, the TRILL
   Header is modified by (1) clearing the M bit, (2) setting the
   egress nickname to the ingress nickname as received, (3) setting
   the ingress nickname to a nickname held by the TRILL switch
   sending the error packet, and (4) setting the hop count to the
   usual value on TRILL Data packets used by the TRILL switch sending
   the error packet.

o If a Vendor Channel message was sent between an RBridge and an end
   station in either direction, the outer MAC addresses are modified
   by (1) setting the Outer.MacDA to the Outer.MacSA as received and
   (2) setting the Outer.MacSA to the MAC address of the port of the
   TRILL switch or end station sending the error packet.

o The priority of the error response message MAY be reduced from the
   priority of the Vendor Chanel message causing the error, unless it
   was already minimum priority, and the Drop Eligibility Indicator
   bit MAY be set in an error response. (See Section 4.1.1 of
   [RFC6325].)

o Vendor Channel error responses MAY be rate-limited.

It is generally anticipated that the entire packet in which an error
was detected would be sent back, modified as above, as the protocol
specific payload, so that, for example, error responses could more
easily be matched with messages sent; however, except for errors 1
and 2, this is up to the vendor specifying how their Vendor RBridge
Channel messages are to be used.

Note that if you receive a Vendor Channel error message with error 1,
indicating a truncation error, you cannot trust the apparent
"OUI/CID" in that Vendor Channel error message.

4. IANA Considerations

   IANA has allocated 0x008 for the Vendor-Specific RBridge Channel
   Protocol from the range of RBridge Channel protocols allocated by
   Standards Action.

   IANA has established a subregistry as follows in the TRILL Parameters
   registry (indented under "RBridge Channel Error Codes" after "RBridge
   Channel SubError Codes"):

   Registry: Vendor RBridge Channel Error Codes
   Registration Procedures: Standards Action
   Reference: RFC 8381

Code	Description	Reference
0x00	No error	RFC 8381
0x01	Message too short	RFC 8381
0x02	Unknown OUI/CID	RFC 8381
0x03	Unknown Sub-Protocol	RFC 8381
0x04	Unknown Sub-Version	RFC 8381
0x05-0x0F	Unassigned	-
0x10-0xFE	Reserved for vendor use	RFC 8381
0xFF	Reserved	RFC 8381

5. Security Considerations

   See [RFC6325] for general TRILL Security Considerations.

   See [RFC7178] for general RBridge Channel Security Considerations.

   Neither the Vendor-Specific RBridge Channel Protocol nor the basic
   RBridge Channel Protocol [RFC7178] provide any security assurances or
   features. (The basic RBridge Channel Protocol's first use was as an
   envelope for Bidirectional Forwarding Detection (BFD) messages
   [RFC7175], which provide their own security.) Any needed security
   can be provided by fields or processing within the Vendor-Protocol-
   Specific Data, which is outside the scope of this document.
   Alternatively or in addition, use of a Vendor Channel MAY be nested
   inside the RBridge Channel Header Extension Protocol [RFC7978]; this
   can provide some security services.

6. References

6.1. Normative References

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