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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

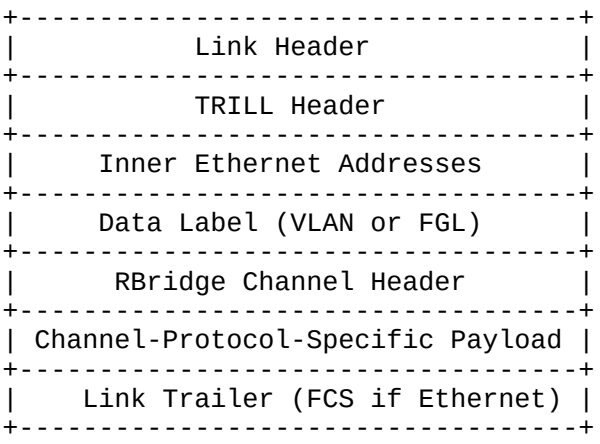

Figure 1: RBridge Channel Packet Structure

Message Structure

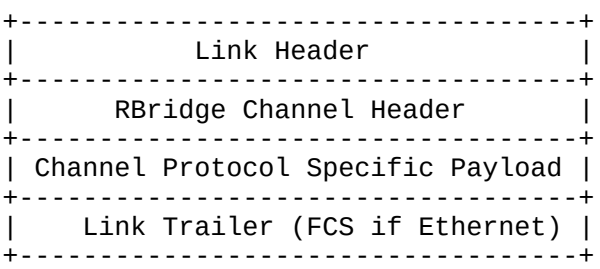

Figure 2: Native RBridge Channel Message Structure

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.

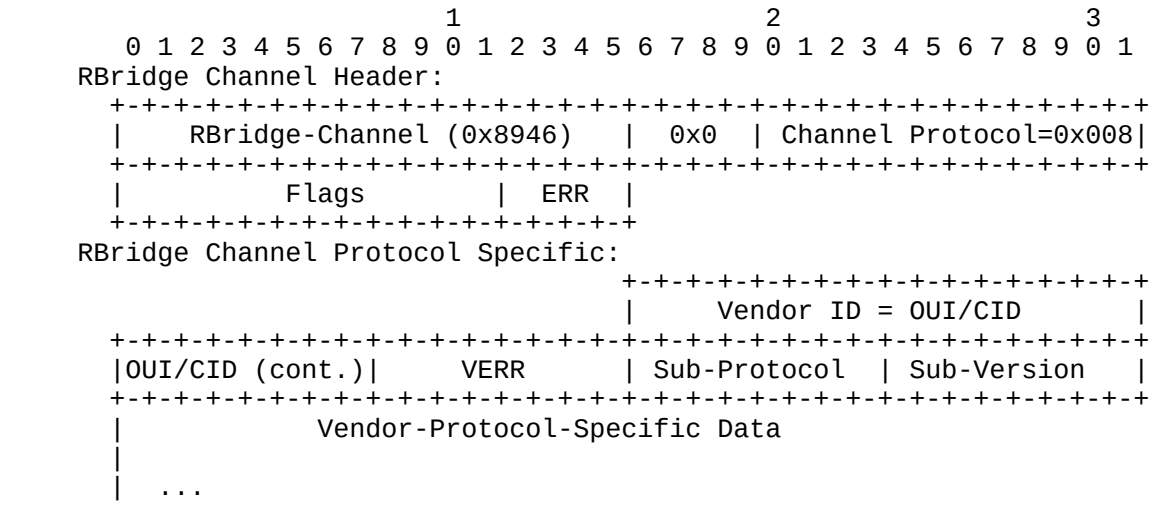

Figure 3: Channel Tunnel Message Structure

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].)

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

- 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.

- 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.

- 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].)

- 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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6.2. Informative References

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[RFC7978] Eastlake 3rd, D., Umair, M., and Y. Li, "Transparent Interconnection of Lots of Links (TRILL): RBridge Channel Header Extension", RFC 7978, DOI 10.17487/RFC7978, September 2016, <https://www.rfc-editor.org/info/rfc7978>.

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