

Network Working Group
INTERNET-DRAFT
Intended status: Proposed Standard

Donald Eastlake 3rd
Eastlake Enterprises
Radia Perlman
Sun Microsystems
Dinesh Dutt
Cisco
November 3, 2008

Expires: May 2, 2009

RBridges: Use of IS-IS

<[draft-eastlake-trill-rbridge-isis-02.txt](#)>

Status of This Document

By submitting this Internet-Draft, each author represents that any applicable patent or other IPR claims of which he or she is aware have been or will be disclosed, and any of which he or she becomes aware will be disclosed, in accordance with [Section 6 of BCP 79](#).

Distribution of this document is unlimited. Comments should be sent to the TRILL Working Group <rbridge@postel.org>.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/1id-abstracts.txt>

The list of Internet-Draft Shadow Directories can be accessed at <http://www.ietf.org/shadow.html>.

Abstract

RBridges implement the TRILL protocol, which in turn makes use of an extended version of the IS-IS (Intermediate System to Intermediate System) routing protocol to determine topology and frame forwarding and for the distribution and synchronization of data. RBridges provide optimal pair-wise forwarding with zero configuration, safe forwarding even during periods of temporary loops, and multipathing for both unicast and multicast traffic. Rbridges also support VLANs. This document specifies some details of IS-IS PDUs used in TRILL.

Table of Contents

Status of This Document.....	1
Abstract.....	1
1 . Introduction.....	3
1.1 Terminology.....	3
1.2 Acknowledgements.....	3
2 . Separation of IS-IS Instances.....	4
3 . TRILL IS-IS PDU Details.....	6
3.1 Hello PDUs.....	6
3.2 LSP PDUs.....	8
3.2.1 Core TRILL IS-IS LSP.....	8
3.2.2 TRILL ESADI LSP.....	12
3.3 CSNP/PSNP and MGROUP CSNP/PSNP PDUs.....	13
3.4 MGROUP PDUs.....	13
4 . TRILL IS-IS TLVs.....	14
4.1 Port Capability TLV.....	14
4.2 Area Address.....	14
4.3 Protocols Supported.....	14
5 . Bridged LAN Link Costs.....	15
6 . IANA Considerations.....	16
7 . Security Considerations.....	16
8 . Normative References.....	17
9 . Informative References.....	17
Disclaimer.....	18
Additional IPR Provisions.....	18
Author's Address.....	19
Expiration and File Name.....	19

1. Introduction

[RBRIDGE] specifies the TRILL base protocol which provides optimal pair-wise forwarding with zero configuration, safe forwarding even during periods of temporary loops, and multipathing for both unicast and multicast traffic. Rbridges also support VLANs. The TRILL protocol, in turn, makes use of the IS-IS [[ISIS](#)] protocol with certain extensions. [[ISIS-L2](#)] is intended to specify general [[ISIS](#)] facilities to provide true link state routing to any protocol running directly over Layer-2.

This is a specification of details of TRILL use of IS-IS concentrating on IS-IS PDU content in TRILL. It makes use of the Router Capabilities TLV [[RFC4971](#)]. It also adds a new Port Capabilities TLV used only within Hello PDUs.

[RBRIDGE] specifies the TRILL handling and flow of IS-IS PDUs, along with the determination of the Designated RBridges (DRB, equivalent to the DIS (Designated Intermediate System)) on a link and the like.

{{Comments in double curly braces relate to version -03 of [ISIS-L2].}}

1.1 Terminology

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 [RFC 2119](#).

The same acronyms and terminology are used in this document as in [[RBRIDGE](#)].

1.2 Acknowledgements

The comments of Ayan Banerjee are gratefully acknowledged.

2. Separation of IS-IS Instances

TRILL implements separate IS-IS instances from those used by Layer 3, that is, different from the one used by IP routers. It is important that these be distinguishable to avoid possible confusion that would occur if an IS-IS instance attempted to process IS-IS PDUs intended for a different instance.

TRILL implements multiple instances of IS-IS for its own use. One mandatory instance includes information such as basic connectivity between RBridges, VLAN attachment, location of IP multicast routers, and the like. RBridges also optionally implement TRILL ESADIs (End Station Address Distribution Instances) of IS-IS, to carry information about attached end nodes.

This section explains how TRILL encodes IS-IS frames for its instances to ensure that there is no confusion between TRILL instances of IS-IS and Layer-3 instances of IS-IS or between the mandatory core instance of TRILL IS-IS and TRILL ESADIs.

The first level of discrimination is based on the destination address of IS-IS frames as follows:

1. Layer 3 IS-IS frames have a destination multicast MAC address of AllL1ISs or AllL2ISs. (Proposals are under consideration which would add other multicast addresses to this list but they would not in duplicate)
2. TRILL IS-IS frames are used for the core instance which all RBridges MUST participate in. They have the multicast destination address All-IS-IS-RBridges.
3. TRILL ESADI frames are used for the optional per VLAN instances. An RBridge which is an appointed forwarder for a link in VLAN-x MAY participate in the ESADI for VLAN-x if the ESADI feature is implemented in that RBridge and it is configured to so participate. TRILL ESADI frames will never have the outer MAC destination addresses listed in items 1 and 2 above. They look just like TRILL data frames and have an outer TRILL Ethertype, but the encapsulated IS-IS PDU has a destination MAC multicast address of All-ESADI-RBridges. Thus TRILL ESADI frames are transparently tunneled thorough non-participating RBridges exactly as if they were TRILL data frames. The VLAN to which they apply is indicated by the encapsulated frames VLAN tag.

In addition, TRILL uses a distinct, constant IS-IS Area Address that would not appear as a real Layer-3 IS-IS area address. This Area Address is the value zero. (See [Section 4.2.](#))

The multiple instance mechanism described in [[ISIS-MI](#)] is not used to

distinguish these TRILL IS-IS instances, although TRILL IS-IS PDUs for the mandatory core instance MAY include the MI TLV with the instance number of zero. In order to facilitate the optional RBridge VLAN mapping feature, TRILL ESADI frames MUST NOT contain an instance identifier. The instance identifier TLV is type #7.

3. TRILL IS-IS PDU Details

[[ISIS](#)], as extended by [[ISIS-L2](#)], supports 7 types of PDUs: Hello, LSP, CSNP, PSNP, MGROUP, MGROUP CSNP, and MGROUP PSNP. TRILL aspects of the contents of each of the PDU types are specified in this Section. Some individual TLVs types are discussed in [Section 4](#) below.

All RBridges have a 6-octet System ID that is conveyed in the header of every TRILL IS-IS PDU they produce, just as in Layer-3 IS-IS. The Maximum Area Addresses octet in the common fixed header is set to 0x01. An RBridge campus is always a single Level 1 IS-IS Area.

Where some IS-IS TLVs assume a unique 32-bit Router ID, in TRILL IS-IS this field is zero

All TRILL IS-IS PDUs MAY contain an Authentication TLV (Type #10) [[RFC5304](#)].

3.1 Hello PDUs

Hellos are only used in the core instance of TRILL IS-IS. (The core instance link state contains enough information that the DRB, adjacencies, and holding time for any ESADI can be determined without Hellos. See Section 4.2.4.1 of [[RBRIDGE](#)].)

All TRILL Hello PDUs contain the TRILL Area Address TLV (see [Section 4.2](#)). The Circuit Type two bit field of TRILL IS-IS Hello PDUs MUST be set to 0b01 indicating Level 1 only.

An IS Neighbor TLV (Type #6) MUST be included in a TRILL Hello if the Hello is sent on the Designated VLAN and MAY be included if it is sent on any other VLAN. (See Section 4.2.3 of [[RBRIDGE](#)].)

Core IS-IS instance Hello PDUs MUST include one or more Port Capability TLVs (Type #<tb4.1>). The following TRILL related subTLVs can appear within a Port Capability TLV:

1. Special VLANs and Flags (subTLV Type #10). This subTLV MUST appear exactly once in a Port Information TLV in every TRILL Hello PDU. The length of the value is four octets.

0	1	2	3	4 - 15	16 - 19	20 - 31
+-----+-----+-----+-----+-----+-----+-----+						
AF	AC	VM	R	Outer.VLAN	Reserved	Desig.VLAN
+-----+-----+-----+-----+-----+-----+-----+						

The first and second octets have a copy of the Outer.VLAN ID

associated with the Hello frame when it was sent. The lower 4

bits of the first octet give the upper ID bits of the VLAN ID and the second octet gives the lower VLAN ID bits.

The upper 4 bits of the first octet are flag bits as shown. The AF bit, if one, indicates that the sending RBridge believes it is Appointed Forwarder for the VLAN and port on which the Hellos was sent. The AC bit, if one, indicates that the sending port is configured as an access port. The VM flag, if a one, indicates that the sending RBridge has detected VLAN mapping within the link. The R bit is reserved and MUST be sent as zero and ignored on receipt.

The third and forth octets give the Designated VLAN for the link. The lower 4 bits of the third octet give the upper ID bits of the Designated VLAN and the forth octet gives the lower VLAN ID bits. The upper 4 bits of the third octet are reserved and MUST be sent as zero and ignored on receipt.

2. Enabled VLANs (subTLV Type #11). Specifies the VLANs enabled for end station service at the port on which the Hello was sent. The minimum size of the value is 3 octets. The third and subsequent octets provide a bit map of enabled VLANs starting at the VLAN ID indicated in the first two octets. The lower order four bits of the first octet give the upper bits of the starting VLAN ID and the second octet gives the lower bits of that VLAN ID. The upper four bits of the first octet are reserved and MUST be sent as zero and ignored on receipt. The highest order bit of the third octet indicates the VLAN equal to the starting ID while the lowest order bit of the third octet indicated that ID plus 7. For example, VLANs 1 and 14 being enabled for end station service could be encoded in 4-octets value 0x00 0x01 0x80 0x04 or, alternatively, as 0x00 0x00 0x40 0x02.

This subTLV may occur more than once in a TRILL Hello and a VLAN is enabled for end station service on the port where the Hellos was sent if this is indicated by any occurrence in the Hello. For example, a receiver could allocate a 512-octet buffer and, with appropriate shifting operations, OR in the enabled bits for each subTLV of this type it finds in a Hello to derive the complete bit map of these VLANs.

3. Appointed Forwarders (subTLV Type #12). This subTLV provides the mechanism by which the DRB can inform other RBridges on the link that they are the designated VLAN-x forwarder for that link for one or more ranges of VLAN IDs. The size of the value is 6*n octets where there are n appointments. Each 6 octet part of the value is formatted as follows:

octet 1 - 2	octet 3	octet 4	octet 5	octet 6
Appointee Nick	Res	Start VLAN ID	Res	End VLAN ID

The appointed forwarder RBridge is specified by its nickname in the first two octets.

The "Res" fields of 4 bits each are reserved and MUST be sent as zero and ignored on receipt.

The VLAN range given is inclusive. To specify a single VLAN, that VLAN ID appears as both the start and end VLAN. The RBridge whose nickname is given is appointed forwarder for those VLANs for which it has end station service enabled (see item 2 above) in the inclusive range. For example, assume an RBridge with end station service enabled on VLANs 100, 101, 199, and 200 (and possibly other VLANs less than 100 or greater than 200), but not enabled for VLANs 102 through 198. It could be appointed forwarder for these four VLANs through either (1) a single 6-octet value sequence with start and end VLAN IDs of 100 and 200, or (2) a 12-octet value sequence with start and end VLAN IDs of 100 and 101 in the first part and 199 and 200 in the second part.

An RBridge's nickname may occur as appointed forwarder for multiple VLAN ranges within the same or different Port Capability TLVs within a DRB's Hello. In the absence of appointed forwarder subTLVs referring to a VLAN, the DRB acts as the appointed forwarder for that VLAN if end station service is enabled.

3.2 LSP PDUs

The TLVs to be included in TRILL LSP PDUs are different for the mandatory core TRILL IS-IS instance of a campus, discussed in [Section 3.2.1](#) below, and in the optional TRILL ESADIs, discussed in [section 3.2.2](#) below.

All TRILL LSP PDUs contain the TRILL Area Address TLV (see [Section 4.2](#)). In addition, in the LSP header, the P Flag and Att flags MUST be zero and the IS type two bit field MUST be set to 0b01 indicating Level 1.

3.2.1 Core TRILL IS-IS LSP

The content of core TRILL IS-IS instance LSP PDUs includes:

1. Information on reachable RBridge neighbors and the cost of the hop via the Extended IS Reachability TLV (Type #22) [[RFC5305](#)] (wide metric). TRILL IS-IS does not use the IS Reachability TLV (Type #2) (narrow metric).
2. The RBridge flags, nickname, VLANs, and other information via one or more Router Capability TLVs [[RFC4971](#)] (Type #242). The D and S flags in the Router Capability TLV MUST be zero. Other information is included by instances of the following TRILL related Router Capability TLV subTLVs:

- 2.a TRILL Flags (subTLV Type #<td3.2.1a>). Exactly one TRILL Flags subTLV must occur in the link state of every RBridge. The length of the value of this subTLV is variable with a minimum size of 1 octet. The top four bits of the first octet are defined as below. Additional bits may be specified in the future and those bits may extend into subsequence octets. The value of all bits in any octets not present is assumed by a receiver to be zero.

```

      first octet
      0      1      2      3      4 - 7
+----+----+----+----+-----+----+
| V0 | V1 | V2 | V3 | reserved |
+----+----+----+----+-----+----+

```

V0 through V4 indicate support of TRILL Header Versions 0 through 4. The remaining bits of the first octet (and all bits of subsequent octets if present) are reserved and MUST be zero when sent and ignored on receipt.

- 2.b Nickname and Tree Root (subTLV Type #<td3.2.1b>). If an RBridge is to be able to act as an ingress, egress, or tree root, it must have a nickname. The value is 7 octets in length. The first octet is the RBridge's nickname priority, the second and third octets are its nickname. Octets 4 and 5 are the RBridge's priority to be a tree root as an unsigned 16-bit integer. Octets 6 and 7 are an unsigned 16-bit integer that gives the number of additional trees every RBridge in the campus is to compute if the RBridge in whose link state this occurs is the highest priority tree root. (See [[RBRIDGE Section 4.3](#)].)

{{While the Device ID subTLV in [[ISIS-L2](#)] could be used for Nickname, putting the Nickname priority in 8 of the Options bits, the Root Priority subTLV and Root Identity subTLV in [[ISIS-L2](#)] does not correspond and never has corresponded with how with how TRILL determines distribution tree roots or

multi-path multi-destination frames.}}

2.c Distribution Tree Roots (subTLV Type #<tb3.2.1c>). The value is a variable length array of the nicknames of the RBridges from which the originating RBridge must pick the root of the distribution tree for multi-destination traffic for which it is the ingress RBridge. If the list is empty or this subTLV is not provided, the originating RBridge can only select the highest priority tree root (see [RBRIDGE] [Section 4.3](#)).

2.d VLANs and Bridge Roots (subTLV Type #<tb3.2.1d>). The value of this subTLV consists of a VLAN range, flags, and a variable length list of spanning tree root bridge IDs. This subTLV may appear zero, one, or many times. The union of the VLAN ranges in all occurrences MUST be precisely the set of VLANs for which the originating RBridge is appointed forwarder on at least one port and the VLAN ranges in multiple VLANs subTLVs for an RBridge MUST NOT overlap. That is, the intersection of the VLAN ranges for any pair of these subTLVs originated by an RBridge must be null. The value length is $4 + 6 * n$ where n is the number of root bridge IDs. The initial 4 octets of value are as follows:

0	1	2	3	4 - 15	16 - 19	20 - 31
+-----+-----+-----+-----+-----+-----+-----+						
M4	M6	OM	R	VLAN start	Reserved	VLAN end
+-----+-----+-----+-----+-----+-----+-----+						

The M4 bit indicates that there is an IPv4 multicast router on a link for which the originating RBridge is appointed forwarder for every VLAN in the indicated range. The M6 bit indicates the same for an IPv6 multicast router. The OM bit indicates that this RBridge requests that all non-IP derived multicast traffic in the indicated VLAN range be sent to it. The R and Reserved bits MUST be sent as zero and are ignored on receipt.

The VLAN start and end IDs are inclusive. A range of one VLAN ID is indicated by setting them both to that VLAN ID value.

The list of zero or more spanning tree root bridge IDs is the set of root bridge IDs seen for all ports for which the RBridge is appointed forwarder for the VLANs in the range. This information is learned from BPDUs heard by the RBridge. If MSTP is in use on a link, the root bridge referred to is the CIST (common and internal spanning tree) root bridge. (While, of course, only one spanning tree root should be seen on any particular port, there may be multiple ports in the same VLAN connected to different bridged LANs with different spanning tree roots.) If no spanning tree roots can be seen on

any of the links in any of the VLANs in the range indicated
for which the RBridge is appointed forwarder (for example all

such links are point-to-point links to other RBridges or to end stations so no BPDUs are received) then the listed set of spanning tree root IDs will be null.

If there are any two VLANs in the range indicated for which the value of the M4, M6, or OM bits are different, the subTLV is incorrect and must be split into multiple subTLVs each indicating only VLANs with the same M4, M6, and OM values. If there are any two VLANs in the range indicated for which the set of root bridge IDs seen on all links for which the RBridge is appointed forwarder for the VLAN are not the same, the subTLV is incorrect and must be split into multiple subTLVs each indicating only VLANs with the same set of DRB seen root bridge IDs. It is always safe to use subTLVs with a "range" of one VLAN ID but this may be too verbose.

- 2.e ESADI Participation (subTLV Type #<tb3.2.1e>). The value of this optional subTLV is 6*N octets where N is the number of VLAN ranges given. The presence of this subTLV in the LSP for an RBridge constitutes the ESADI participation flag for the VLANs in the range or ranges given. An RBridge which does not implement the ESADI feature may ignore this subTLV. Each 6 octets of value is structured as follows:

0	1-7	8-11	12-23	24-27	28-39	40-47
R Priority	Res	VLAN start	Res	VLAN end	Holding Time	

The R bit and the two "Res" fields are reserved and MUST be sent as zero and ignored on receipt. The Priority field gives the RBridge's priority for being DRB on the TRILL ESADI virtual links for the VLAN or VLANs indicated while the Holding Time field gives its holding time if it is DRB. The VLAN start and end values give the inclusive range of VLAN IDs for which the RBridge wishes to participate in a TRILL ESADI. A range of one VLAN is specified by making the start and end IDs equal.

- 2.f VLAN Groups (subTLV Type #<tb3.2.1f>). The value of this optional subTLV consists of two or more 16-bit fields each of which has a VLAN ID in the low order 12 bits. The top 4 bits MUST be sent as zero and ignored on receipt. The first such VLAN ID is the primary, or may be zero if there is no primary. Address learning is shared between the listed VLANs at the originating RBridges as described in Section 4.6.3 of [\[RBRIDGE\]](#). This subTLV may appear zero, one, or many times.

2.g VLAN Mapping (subTLV Type #<tbd3.2.1g>). The value of this optional subTLV consists of $6*N$ octets where N is the number

of VLAN mappings occurring at the cut set RBridge originating the LSP [[VLANmapping](#)]. Each 6 octet subpart of the value is structured as follows:

```

      0-7      |8-11| 12-23  | 24-31  |32-35| 36-47  |
+-+-----+---+-----+-----+-----+-----+
| 1st Domain |Res | 1st VLAN | 2nd Domain | Res | 2nd VLAN |
+-+-----+---+-----+-----+-----+-----+

```

The numbering of the parts of the IETF compus (Domains) between which VLAN mapping is occurring must be done consistently by the administrator. The value indicates that the 1st VLAN's ID in the 1st domain is being mapped to the 2nd VLAN's ID in the 2nd domain. Since these mappings must be symmetric, this implies that the 2nd VLAN's ID in the 2nd domain is also being mapped to the 1st VLAN's ID in the 1st domain. In other words, it makes no difference if the first 3 and last 3 octets in each 6-octet substring of the value are swapped. This subTLV may appear zero, one, or many times.

Note: See [Section 3.4](#) below for multicast groups.

[3.2.2](#) TRILL ESADI LSP

The information in TRILL ESADI LSP PDUs consists of one or more MAC Reachability (MAC-RI) TLVs [[ISIS-L2](#)] (Type #139). These TLVs contain one or more unicast MAC addresses of end stations that are both on a port and in a VLAN for which the originating RBridge is appointed forwarder, along with the one octet unsigned Confidence in this information with a value in the range 0-254.

In order to support VLAN mapping, the TRILL ESADI LSP and any TLVs in it, including the MAC-RI TLV MUST NOT contain the VLAN ID. The VLAN to which the TRILL ESADI LSP applies is indicated only by the VLAN tag in the encapsulated TRILL ESADI IS-IS frame.

{{There is no place in the current MAC-Reachability TLV for the confidence level. It could go where the VLAN ID currently is as the VLAN ID is not needed for the TRILL use and, in fact, can't be used if you want VLAN mapping to be practical. Alternatively, some option bits and the confidence could be inserted before or after the VLAN ID and the VLAN ID always set to zero.}}

3.3 CSNP/PSNP and MGROUP CSNP/PSNP PDUs

CSNP stands for Complete Sequence Number Packet and PSNP for Partial Sequence Number Packet. These relate to the IS-IS link state flooding algorithm and link state sequence numbers. There is no change from typical Layer-3 sequence number IS-IS PDUs except for the addition of MGROUP CSNP and PSNP PDUs. TRILL IS-IS uses only Level 1 sequence number packets.

3.4 MGROUP PDUs

MGROUP PDUs [[ISIS-L2](#)] are only sent as part of the core TRILL IS-IS instance. They contain one or more Group Address (GADDR) TLVs each of which, in turn, contains one or more Group MAC Address (GMAC-ADDR) sub-TLVs. Those GMAC-ADDR sub-TLVs specify the VLAN involved and list the IP-derived multicast addresses for which there are listeners on links for which the originating RBridge is appointed forwarder.

(MGROUP PDUs must be in the core TRILL IS-IS, even if an optional TRILL ESADI is in use for the relevant VLAN, so that transit RBridges can properly prune the distribution of multicast frames.)

All TRILL MGROUP PDUs contain the TRILL Area Address TLV (see [Section 4.2](#)).

4. TRILL IS-IS TLVs

This section describes particular TLVs included or not included in TRILL IS-IS PDUs.

4.1 Port Capability TLV

The Port Capability TLV is used in TRILL IS-IS Hellos to announce a variety of information specific to the port on which the Hello is sent. It is TLV Type #tbd4.1. It's content is structured as subTLVs in the same manner as in [[RFC5305](#)].

The Port Capability TLV appears only in IS-IS Hello PDUs

4.2 Area Address

The TRILL zero Area Address TLV is encoded as follows:

```

+-----+-----+
| 0x01 (Area Address Type) | 0x02 (Length of Value) |
+-----+-----+
| 0x01 (Length of Address) | 0x00 (zero Area Address) |
+-----+-----+
```

4.3 Protocols Supported

Since no NLPID (Network Layer Protocol Identifier) has been allocated by the ISO/IEC TR 9577 Registry for the Ethernet protocol or MAC-48 address type or TRILL, there is no way to indicate support of IS-IS routing for these in a Protocols Supported TLV (TLV #129).

5. Bridged LAN Link Costs

RBridges use IS-IS to support TRILL and may be interconnected by direct links such as 802.3, or by bridged LANs. If there an intervening bridge or bridges, the link is really multiple bridged physical links. RBridges can automatically detect this condition under some circumstances.

For loop avoidance purposes RBridges listen for BPDUs and keep track of the most recent announced root bridge on a link [[RBRIDGE](#)], if any. This bridge, or the fact that no BPDUs have been received, is reported in the link state database as described in [Section 3.2.1](#) above. It is still possible for RBridges to be connected by a bridged LAN where the bridge ports to which they are connected have been configured not to emit BPDUs. On the other hand, if any RBridge connected to a link is seeing BPDUs, it is likely that there are one or more intervening bridges between it and any RBridge on the link to which it appears to be adjacent.

When a link is a bridged LAN, transit traffic will experience at least two bridged physical links and possibly many more. To account for this, RBridges SHOULD assume, for IS-IS routing purpose, that the default metric for traversing such a link is $2 * C + 1$, where C is the Layer-3 IS-IS default metric (usually auto-configured from port speed).

More precise link cost can be asserted by management configuration.

6. IANA Considerations

IANA will allocate a TLV number for the new Port Capability TLV and create a registry for subTLVs under the Port Capabilities TLV.

The Port Capabilities TLV is generally described in [Section 4.1](#). Its TLV number is <tb4.1>(suggest 243). IANA Considerations for the allocation of additional subTLVs under the Port Capability TLV are Expert Approval except that subTLV Types 0 and 0xFF are Reserved and require an IETF Standards Action for allocation.

In addition, seven new subTLVs will be allocated under the Router Capabilities TLV as listed in [Section 3.2.1](#) and listed below.

Port Capabilities	
subTLV Name	Value
-----	-----
Special VLANs and Flags	10
Enabled VLANs	11
Appointed Forwarders	12
Router Capabilities	
subTLV Name	Value
-----	-----
TRILL Flags	<tb3.2.1a>(suggest 21)
Nickname and Tree Root	<tb3.2.1b>(suggest 22)
Distribution Tree Roots	<tb3.2.1c>(suggest 23)
VLANs	<tb3.2.1d>(suggest 24)
ESADI Participation	<tb3.2.1e>(suggest 25)
VLAN Groups	<tb3.2.1f>(suggest 26)
VLAN Mapping	<tb3.2.1g>(suggest 27)

7. Security Considerations

This document raises no new security issues for IS-IS. IS-IS security may be used to secure the IS-IS messages discussed here. See [\[RFC5304\]](#). See [\[RBRIDGE\]](#) for TRILL Security Considerations.

8. Normative References

- [ISIS] "Intermediate system to Intermediate system routing information exchange protocol for use in conjunction with the Protocol for providing the Connectionless-mode Network Service (ISO 8473)", ISO, ISO/IEC 10589:1992.
- [ISIS-L2] D. Ward et. al, "Carrying Attached Addresses in IS-IS", [draft-ward-l2isis-03.txt](#), work in progress, May 2008.
- [RBRIDGE] R. Perlman et. al., "Rbridges: Base Protocol Specification", [draft-ietf-trill-rbridge-protocol-10.txt](#), work in progress, July 2008.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC4971] Vasseur, JP., Ed., Shen, N., Ed., and R. Aggarwal, Ed., "Intermediate System to Intermediate System (IS-IS) Extensions for Advertising Router Information", [RFC 4971](#), July 2007.
- [RFC5305] Li, T. and H. Smit, "IS-IS Extensions for Traffic Engineering", [RFC 5305](#), October 2008.
- [VLANmapping] R. Perlman et al., "RBridge VLAN Mapping", [draft-perlman-trill-rbridge-vlan-mapping-00.txt](#), work in progress, October 2008.

9. Informative References

- [ISIS-MI] S. Previd et. al., "IS-IS Multi-instance", [draft-ietf-isis-mi-01.txt](#), work in progress, February 2008.
- [RFC5304] Li, T. and R. Atkinson, "IS-IS Cryptographic Authentication", [RFC 5304](#), October 2008..

Disclaimer

This document and the information contained herein are provided on an "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE/SHE REPRESENTS OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY, THE IETF TRUST AND THE INTERNET ENGINEERING TASK FORCE DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Additional IPR Provisions

The IETF takes no position regarding the validity or scope of any Intellectual Property Rights or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; nor does it represent that it has made any independent effort to identify any such rights. Information on the procedures with respect to rights in RFC documents can be found in [BCP 78](#) and [BCP 79](#).

Copies of IPR disclosures made to the IETF Secretariat and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this specification can be obtained from the IETF on-line IPR repository at <http://www.ietf.org/ipr>.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to implement this standard. Please address the information to the IETF at ietf-ipr@ietf.org.

Copyright (C) The IETF Trust 2008. This document is subject to the rights, licenses and restrictions contained in [BCP 78](#), and except as set forth therein, the authors retain all their rights.

Author's Address

Donald E. Eastlake 3rd
Eastlake Enterprises
155 Beaver Street
Milford, MA 01757 USA

Phone: +1-508-634-2066
email: d3e3e3@gmail.com

Radia Perlman
Sun Microsystems
16 Network Circle
Menlo Park, CA 94025

Phone: +1-650-960-1300
Email: Radia.Perlman@sun.com

Dinesh G. Dutt
Cisco Systems
170 Tasman Drive
San Jose, CA 95134-1706 USA

Phone: +1-408-527-0955
email: ddutt@cisco.com

Expiration and File Name

This draft expires in May 2009.

Its file name is <[draft-eastlake-trill-rbridge-isis-02.txt](#)>.

