                        STP Application of ICCP
                    draft-zhang-pwe3-iccp-stp-00.txt

Abstract

   Inter-Chassis Communication Protocol (ICCP) supports the inter-
   chassis redundancy mechanism which achieves high network
   availability.

   In this document, the PEs in a Redundant Group (RG) running ICCP are
   used to offer multi-homed connectivity to Spanning Tree Protocol
   (STP) networks. The ICCP TLVs for the STP application are defined,
   therefore PEs from the RG can make use of these TLVs to synchronize
   the state and configuration data.

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Table of Contents

1. Introduction

   Inter-Chassis Communication Protocol (ICCP) specifies a multi-chassis
   redundant mechanism, which enables PEs located in multi-chassis to
   act as a single Redundant Group (RG).

   When a bridge network running Spanning Tree Protocol (STP) is
   connected to a RG, the RG members should pretend to be a single root
   bridge to participate the operations of the STP. STP relevant
   information need be exchanged and synchronized among the RG members.
   ICCP TLVs for the Spanning Tree Protocol application are specified
   for this purpose.

1.1. Conventions used in this document

   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 [RFC2119].

1.2. Terminology

   STP: Spanning Tree Protocol
   MSTP: Multiple Spanning Tree Protocol
   DSLAM: Digital Subscriber Line Access Multiplexer
   MST: Multiple Spanning Trees
   CIST: Common and Internal Spanning Tree
   MSTI: Multiple Spanning Tree Instance
   BPDU: Bridge Protocol Data Unit

   In this document, unless otherwise explicitly noted, when the term
   STP is used, it also covers MSTP.

2. The Use Case Scenario

   It is a common case that an RG is connected to a bridge network where
   STP is running. For example, geographically dispersed DSLAMs of a
   Broadband Network may be connected by an RG. These DSLAMs constitute
   a typical STP network. For the sake of network resilience, it is
   reasonable to connect each RG member to this bridge network. The
   scenario in Figure 2.1 illustrates this kind of connection.

```
         +-------------+       +============+
         |             |       |            |
         |             |       |            |
         |     +---+   |       |   +-----+  |
         | +---+CE1+-- |-------|--+ PE1 |   |
         | |   +---+   |       |   +-----+  |
         | +-+-+       |       |     ||     |
         | |CE3|       |       |     ||  ICCP |
         | +-+-+       |       |     ||     |
         | |   +---+   |       |   +-----+  |
         | +---+CE2+-- |-------|--+ PE2 |   |
         |     +---+   |       |   +-----+  |
         |             |       |            |
         | Multi-homed |       | Redundancy |
         | STP Network |       |   Group    |
         +-------------+       +============+
```
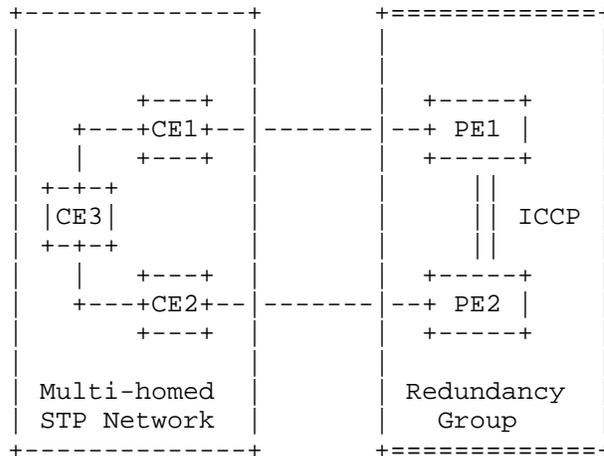
        Figure 2.1: A STP network is multi-homed to an Redundant Group.

2.1. Virtual Root Bridge

   With ICCP, the whole RG will be virtualized to be a single bridge.
   The RG pretends that the ports connected to the STP network are from
   the same bridge. All these ports emit configuration BPDU with the
   highest root priority to trigger the construction of the spanning
   tree. In this way, the STP will always broken a loop within the
   multi-homed STP network.

   Each RG member has its BridgeIdentifier (the MAC address). The least
   significant one is elected as the BridgeIdentifier of the 'vitualized
   root bridge'.

3. Spanning Tree Protocol Application TLVs

   This section discusses the ICCP TLVs for the Spanning Tree Protocol
   application.

3.1. STP Connect TLV

   This TLV is included in the RG Connect message to signal the
   establishment of STP application connection.

```
    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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |U|F|    Type=TBD              |            Length               |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |       Protocol Version       |A|          Reserved             |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                     Optional Sub-TLVs                          |
   ~                                                                ~
   |                                                                |
   +                          +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |           ...            |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
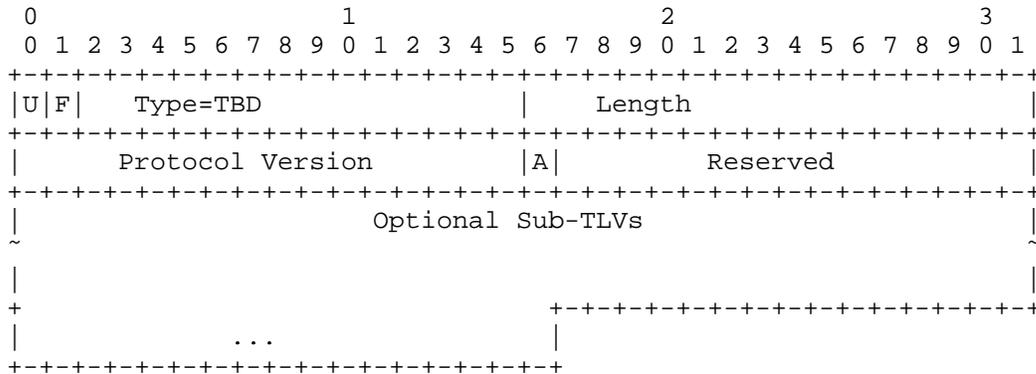
       - U and F Bits

         Both are set to 0.

       - Type

         set to TBD for "STP Connect TLV"

       - Length

         Length of the TLV in octets excluding the U-bit, F-bit, Type,
         and Length fields.

       - Protocol Version

         The version of this particular protocol for the purposes of
         ICCP. This is set to 0x0001.

       - A bit

         Acknowledgement Bit. Set to 1 if the sender has received a STP
         Connect TLV from the recipient. Otherwise, set to 0.

       - Reserved

         Reserved for future use.

       - Optional Sub-TLVs

         There are no optional Sub-TLVs defined for this version of the
         protocol.

3.2. STP Disconnect TLV

This TLV is used in an RG Disconnect Message to indicate that the
connection for the STP application is to be terminated.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|U|F|   Type=TBD              |           Length               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Optional Sub-TLVs                       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
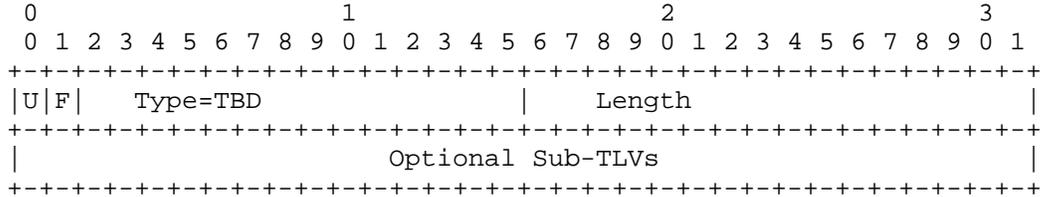
   - U and F Bits

     Both are set to 0.

   - Type

     set to TBD for "STP Disconnect TLV"

   - Length

     Length of the TLV in octets excluding the U-bit, F-bit, Type,
     and Length fields.

   - Optional Sub-TLVs

     The only optional Sub-TLV defined for this version of the
     protocol is the "STP Disconnect Cause" TLV defined next:

3.2.1. STP Disconnect Cause TLV

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|U|F|   Type=TBD              |           Length               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Disconnect Cause String                  |
~                                                              ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
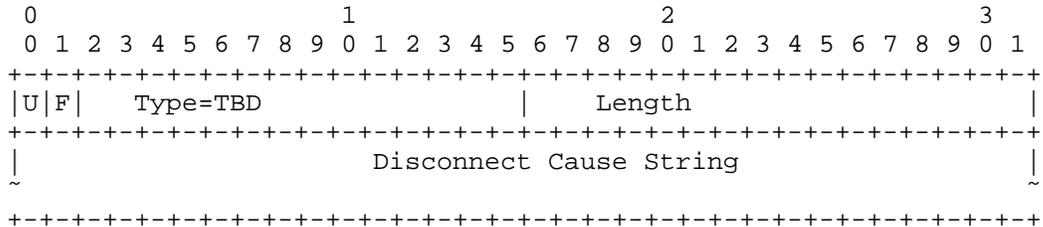
   - U and F Bits

     Both are set to 0.

   - Type

     set to TBD for "STP Disconnect Cause TLV"

- Length

  Length of the TLV in octets excluding the U-bit, F-bit, Type,
 and Length fields.

- Disconnect Cause String

  Variable length string specifying the reason for the disconnect.
  Used for network management.

3.3. STP Config TLVs

The STP Config TLVs are sent in the RG Application Data message. When
a STP Config TLV is received by a peering RB member, it SHOULD
synchronize the configuration information contained in the TLV. TLVs
specified from section 3.3.1 through section 3.3.9 contains such kind
of configuration information.

3.3.1. STP System Config

This TLV announces the local node's STP System Parameters to the RG
peers.

```
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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|U|F|    Type=TBD               |            Length             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                             ROID                              |
+                                                              +
|                                                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          MAC Address                          |
+                         +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
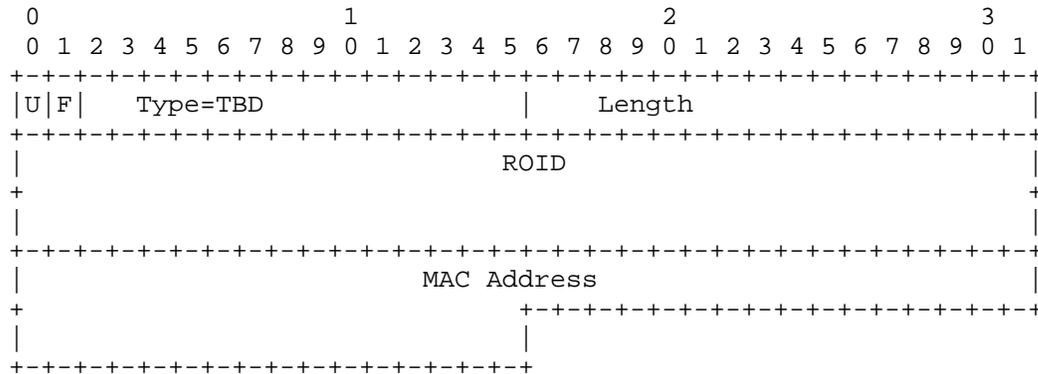
- U and F Bits

  Both are set to 0.

- Type

  set to TBD for "STP System Config"

- Length

  Length of the MAC address, which is 6 octets.

      -ROID

        As defined in the ROID section of [ICCP].

      - MAC Address

        The MAC address of the sender. This MAC address is set to the
        BridgeIdentifier of the sender, as defined in [802.1q] section
        13.23.2. The the least significant unsigned BridgeIdentifier is
        used as the MAC address of the Virtual Root Bridge mentioned in
        Section 2.1.

3.3.2. STP Topology Changed Instances

   This TLV is used to report the Topology Changed Instances to other
   members in the RG. The receiver RG member SHOULD enforce the Topology
   Change to its port connected to the STP network, including the flush
   out of MAC addresses relevant to the instances listed in this TLV.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|U|F|   Type=TBD              |          Length                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      InstanceID List                         |
~                                                              ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
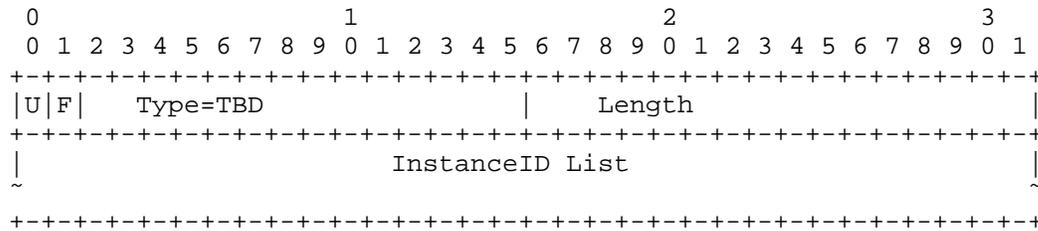
      - U and F Bits

        Both are set to 0.

      - Type

        set to TBD for "STP Topology Changed Instances"

      - Length

        Length of the TLV in octets excluding the U-bit, F-bit, Type,
        and Length fields.

      - InstanceID List

        The list of the instances whose topology is changed as indicated
        by the Topology Change Notification (TCN) Messages as specified
        in [802.1q] section 13.14.

3.3.3. STP CIST Root Time

This TLV is used to report the Value of CIST Root Time to other members in the RG.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|U|F|    Type=TBD           |           Length                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    MaxAge      |   MessageAge  |   FwdDelay    |   HelloTime   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| RemainingHops |
+-+-+-+-+-+-+-+-+
```
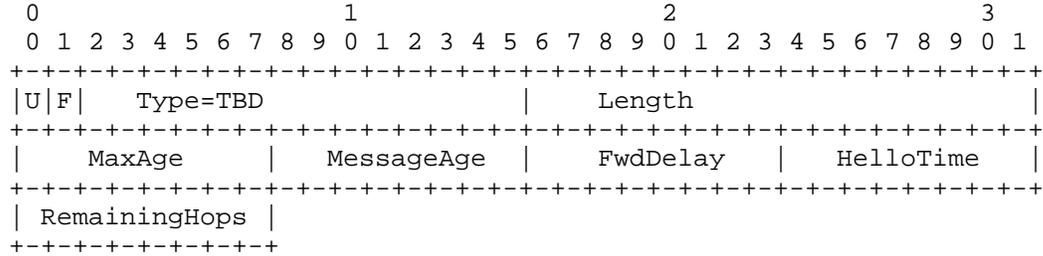
   - U and F Bits

      Both are set to 0.

   - Type

      set to TBD for "STP CIST Root Time"

   - Length

      Length of the TLV in octets excluding the U-bit, F-bit, Type, and Length fields.

   - MaxAge

      The Maximum Age of this TLV.

   - MessageAge

      The actual age of this TLV.

   - FwdDelay

      The delay before the port enters the forwarding status.

   - HelloTime

      The interval between two continuous configuration BPDUs.

   - RemainingHops

      The remaining hops of this TLV

3.3.4. STP MSTI Root Time

This TLV is used to report the Value of MSTI Root Time to other
members in the RG.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|U|F|    Type=TBD           |            Length                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          InstanceID       |  RemainingHops |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
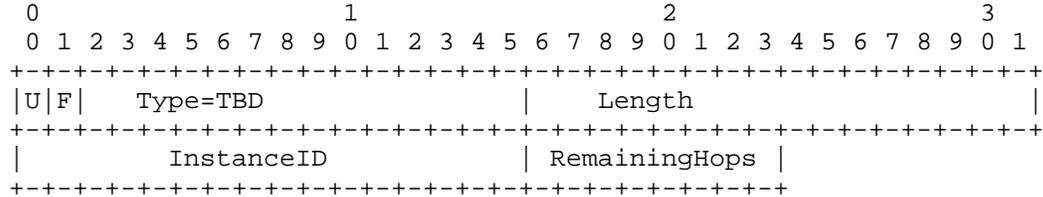
   - U and F Bits

     Both are set to 0.

   - Type

     set to TBD for "STP MSTI Root Time"

   - Length

     Length of the TLV in octets excluding the U-bit, F-bit, Type,
     and Length fields.

   - InstanceID

     The instance identification number of the MSTI.

   - remainingHops

     The remaining hops of this TLV

3.3.5. STP Region Name

This TLV is used to report the Value of Region Name to other members
in the RG.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|U|F|    Type=TBD           |            Length                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                         Region Name                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
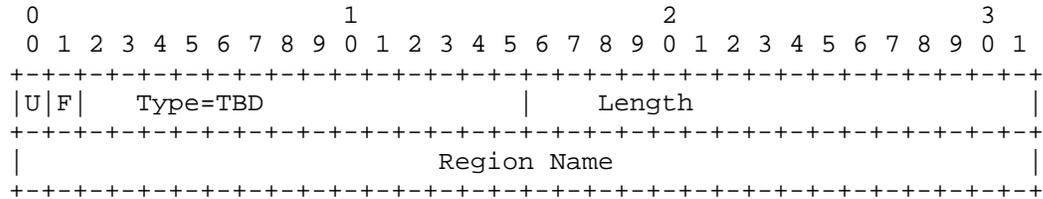
   - U and F Bits

     Both are set to 0.

        - Type

          set to TBD for "STP Region Name"

        - Length

   Length of the TLV in octets excluding the U-bit, F-bit, Type,
          and Length fields.

        - Region Name

          The Name of the MST Region.

3.3.6. STP Revision Level

   This TLV is used to report the Value of Revision Level to other
   members in the RG.

```
    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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |U|F|    Type=TBD              |        Length                 |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |        Revision Level         |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
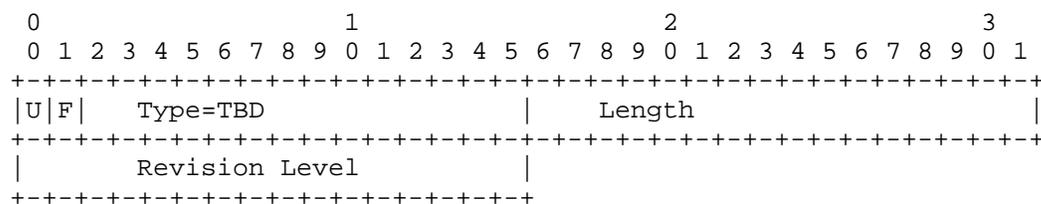
        - U and F Bits

          Both are set to 0.

        - Type

          set to TBD for "STP Revision Level"

        - Length

          Length of the TLV in octets excluding the U-bit, F-bit, Type,
          and Length fields.

        - Revision Level

          The Revision Level as specified in [802.1q] section 3.21;

3.3.7. STP Instance Priority

   This TLV is used to report the Value of Instance Priority to other
   members in the RG.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|U|F|    Type=TBD            |            Length               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Pri  |      InstanceID      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
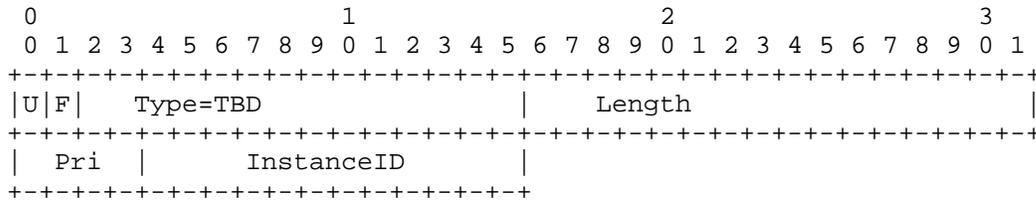
   - U and F Bits

     Both are set to 0.

   - Type

     set to TBD for "STP Instance Priority"

   - Length

     Length of the TLV in octets excluding the U-bit, F-bit, Type,
   and Length fields.

   - Pri

     The Instance Priority

   - InstanceID

     The instance identification number of the MSTI.

3.3.8. STP Configuration Digest

   This TLV is used to report the Value of STP VLAN Instance Mapping to
   other members in the RG.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|U|F|    Type=TBD            |            Length               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Configuration Digest                      |
~                                                              ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
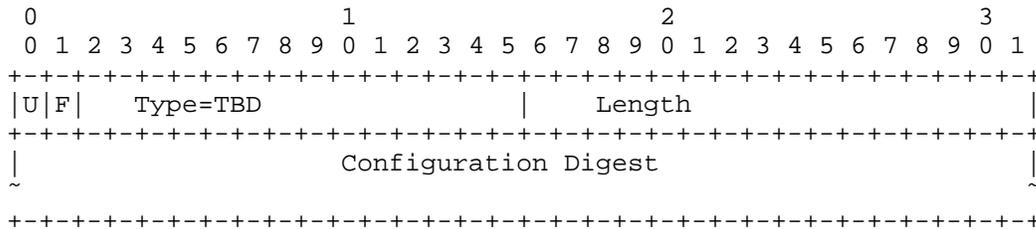
   - U and F Bits

     Both are set to 0.

   - Type

        set to TBD for "STP Configuration Digest"

    - Length

      Length of the STP Configuration Digest which is 16 octets.

   - Configuration Digest

      As specified in [802.1q] section 13.7.

3.4. STP Synchronization Request TLV

   The STP Synchronization Request TLV is used in the RG Application
   Data message. This TLV is used by a device to request from its peer
   to re-transmit configuration or operational state. The following
   information can be requested:

     - system configuration and/or state
     - configuration and/or state for a specific port
      The format of the TLV is as follows:
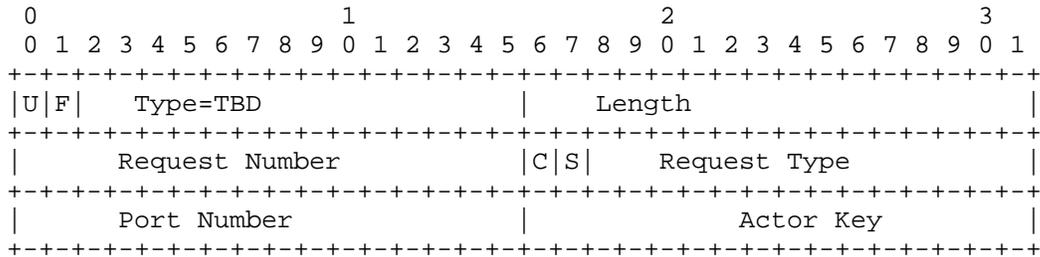
```
0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|U|F|   Type=TBD              |          Length                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Request Number         |C|S|      Request Type           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Port Number            |            Actor Key            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

    - U and F Bits

      Both are set to 0.

    - Type

      set to TBD for "STP Synchronization Data TLV"

    - Length

      Length of the TLV in octets excluding the U-bit, F-bit, Type,
      and Length fields.

    - Request Number

      2 octets. Unsigned integer uniquely identifying the request.
      Used to match the request with a response. The value of 0 is

reserved for unsolicited synchronization, and MUST NOT be used
in the STP Synchronization Request TLV.

- C Bit

  Set to 1 if request is for configuration data. Otherwise, set to
  0.

- S Bit

  Set to 1 if request is for running state data. Otherwise, set to
  0.

- Request Type

  14-bits specifying the request type, encoded as follows:

      0x00   Request System Data
      0x01   Request Port Data
      0x3FFF Request All Data

- Port Number

  2 octets. When Request Type field is set to 'Request Port Data',
  this field encodes the STP Port Number for the requested port.
  When the value of this field is 0, it denotes that all ports,
  whose STP Key is specified in the "Actor Key" field, are being
  requested.

- Actor Key

  2 octets. STP Actor key for the corresponding port. When the
  value of this field is 0 (and the Port Number field is 0 as
  well), it denotes that information for all ports in the system
  is being requested.

3.5. STP Synchronization Data TLV

   The STP Synchronization Data TLV is used in the RG Application Data
   message. A pair of these TLVs is used by a device to delimit a set of
   TLVs that are being transmitted in response to an STP Synchronization
   Request TLV. The delimiting TLVs signal the start and end of the
   synchronization data, and associate the response with its
   corresponding request via the 'Request Number' field.

   The STP Synchronization Data TLVs are also used for unsolicited
   advertisements of complete STP configuration and operational state
   data. The 'Request Number' field MUST be set to 0 in this case.

This TLV has the following format:

   - U and F Bits

     Both are set to 0.

   - Type

     set to TBD for "STP Synchronization Data TLV"

   - Length

     Length of the TLV in octets excluding the U-bit, F-bit, Type,
     and Length fields.

     - Request Number

     2 octets. Unsigned integer identifying the Request Number from
     the "STP Synchronization Request TLV" which solicited this
     synchronization data response.

   - Flags

     2 octets, response flags encoded as follows:

        0x00 Synchronization Data Start
        0x01 Synchronization Data End

4. Security Considerations

   This document raises no new security issues.

5. IANA Considerations

   The types used by the application TLVs defined in Section 3 should be
   assigned.

6. References

6.1. Normative References

   [ICCP] L. Martini, S. Salam, et al, "Inter-Chassis Communication
        Protocol for L2VPN PE Redundancy", draft-ietf-pwe3-iccp-11.txt,
        work in progress.

6.2. Informative References

   [802.1q] "IEEE Standard for Local and Metropolitan Area Networks---

Virtual Bridged Local Area Networks.". IEEE Std 802.1 Q-2005, May 19, 2006.

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