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                  ICCP extension for the MSP application
                draft-hao-pwe3-iccp-extension-for-msp-00

Abstract

   This document presents some extensions on the Inter-Chassis
   Communication Protocol(ICCP) to support the application of multiplex
   section protection(MSP) that is described in the G.841. Linear
   multiplex section protection(MSP) is used to protect the Synchronous
   Digital Hierarchy (SDH) network. In the case of inter-chassis linear
   MSP, it needs a mechanism to synchronize the state and configuration
   data between the two chassis. The ICCP is appropriate for that.

Status of this Memo

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1. Introduction

   Linear multiplex section protection switching can be a dedicated or
   shared protection mechanism. It protects the multiplex section
   layer, and applies to point-to-point physical networks. One
   protection multiplex section can be used to protect the normal
   traffic from a number(N) of working multiplex sections. It can
   operate in a unidirectional or bidirectional manner, and it can carry
   extra traffic on the protection multiplex section in bidirectional
   operation. It is used widely in the SDH networks.

   MSP has been extended to support inter-chassis linear MSP. It means
   that the MSP can be used for point-to-multipoint physical networks.
   The two chassis form a inter-chassis protect group. They runs the
   protocol to protect the work link and protect link as a chassis
   running. So the state and configuration data need to be synchronized
   between the two chassises.

   As defined in the [I-D:ietf-pwe3-iccp], it specifies an inter-chassis
   communication protocol that enables Provider Edge (PE) device
   redundancy for Virtual Private Wire Service (VPWS) and Virtual
   Private LAN Service (VPLS) applications. The protocol runs within a
   set of two or more PEs, forming a redundancy group(RG), for the
   purpose of synchronizing data amongst the systems. In the ICCP
   draft, it specifies the ICCP's TLVs for the Pseudowire Redundancy
   application and the multi-chassis LACP(mLACP) application.

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 [RFC2119].

2. Terminology

   o ICCP:Inter-Chassis Communication Protocol

   o MSP: Multiplex Section Protection

   o SDH: Synchronous Digital Hierarchy

   o RG: redundancy group

   o PW: Pseudowire

   o LACP: Link Aggregation Control Protocol

3. ICCP extension requirements

3.1.   Multi-chassis MSP Protection Model

```
                                    +----+
                 <---Pseudowire--->|PE1 |
                                   |    |\
                                    +----+  \
                                    |        \
                                    |         \
                                    |          \+----+
                                    |           | CE |
                                    |           |    |
                                    |          /+----+
                                    |         /
                  +----+   /
                  |PE2 |/
                 <---Pseudowire--->|    |
                                    +----+
```
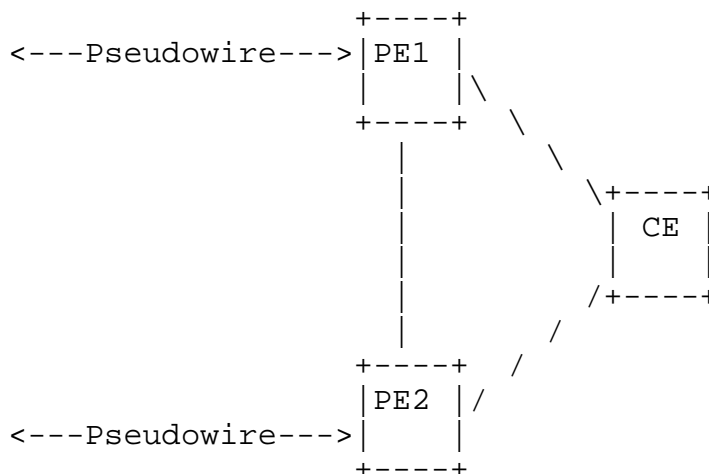
          Figure 1: Generic Multi-chassis MSP Protection Model

   Figure 1 describes the multi-chassis MSP reference model. The node
   PE1 and PE2 form an inter-chassis linear multiplex section protection
   group A. The node CE established a multiplex section protection group
   B. The links between PE1 and CE, PE2 and CE are SDH links. The link
   PE1-CE is called work link and the link PE2-CE is called protect
   link. When the node PE1 finds the link to CE is failed, the node PE1
   should transfer the state of link to the PE2 by the synchronize link
   (PE1 to PE2) for running the protocol of MSP. The node PE2 receives
   the link fault message, and then it will switch the services to the
   protect link and notify the result to the group B by K value defined
   in G.841. After that, it send the result to the node PE1 to
   synchronize the state of group A by the synchronize link. When the
   node PE1 is configured the switch command, it also transfer the
   command to the PE2 by the synchronize link for running the protocol
   of MSP. Therefore a mechanism is required to insure the
   synchronization between the members of the protect group A.

3.2.   ICCP extension precondition

   ICCP is specified in the [I-D:ietf-pwe3-iccp]. It allows
   synchronization of state and configuration data between a set of two
   or more PEs forming a RG. ICCP provides reliable message transport
   and in-order delivery between nodes in a RG with secure
   authentication mechanisms built into the protocol. Furthermore, it
   provides a common set of procedures by which applications on one PE
   can connect to their counterparts on another PE, for purpose of
   inter-chassis communication in the context of a given RG. The

prerequisite for establishing an application connection is to have an
operational ICCP RG connection between the two endpoints. When an
application has information to transfer over ICCP, it triggers the
transmission of an Application Data message.For the moment, the draft
has specified the ICCP's TLVs for the Pseudowire Redundancy
application and the multi-chassis LACP(mLACP) application.

The PEs in an RG offer multi-homed connectivity to either individual
devices or entire networks. The generic multi-chassis redundancy
model is depicted in the [I-D:ietf-pwe3-iccp]. When the access
network is SDH network, it is just the applied field of inter-chassis
linear MSP. But the ICCP draft does not specify ICCP's TLVs for the
MSP application.

As mentioned in the preceding part of this document, the ICCP is
appropriate for the inter-chassis linear MSP. The ICCP just need to
extend its TLVs for the MSP application. Then it will be achieved
the synchronization between the members of the protect group.

4. ICCP TLV extensions for MSP

The ICCP can achieve the synchronization of state and configuration
data between the members of the inter-chassis linear MSP group by
extending the TLVs.Now we will expatiate the detail of MSP
application TLV's format.

4.1. MSP connect TLV

This TLV is included in the RG Connect message to signal the
establishment of MSP 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=0x3E00       |             Length              |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |       Protocol Version          |A|           Reserved       |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                    Optional Sub-TLVs                         |
   ~                                                              ~
   |                                                              |
   +                          +-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |              ...   ...                                        |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
```
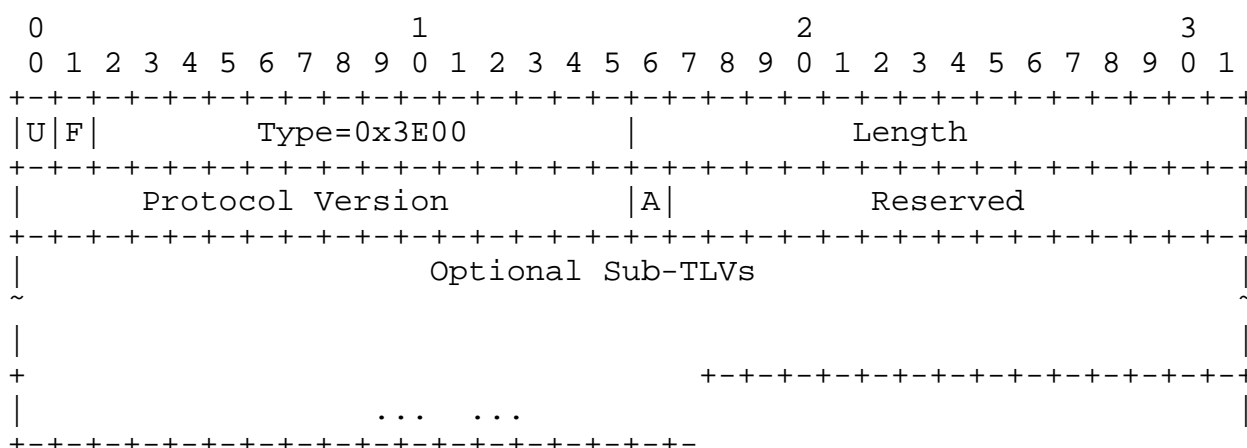
Figure 2: MSP connect TLV

   - U and F Bits
   Both are set to 0.

   - Type
   Set temporarily to 0x3E00 for "MSP 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 MSP
   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.

4.2. MSP disconnect TLV

   This TLV is used in an RG Disconnect Message to indicate that the
   connection for the MSP 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=0x3E01          |             Length           |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                      Optional Sub-TLVs                        |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
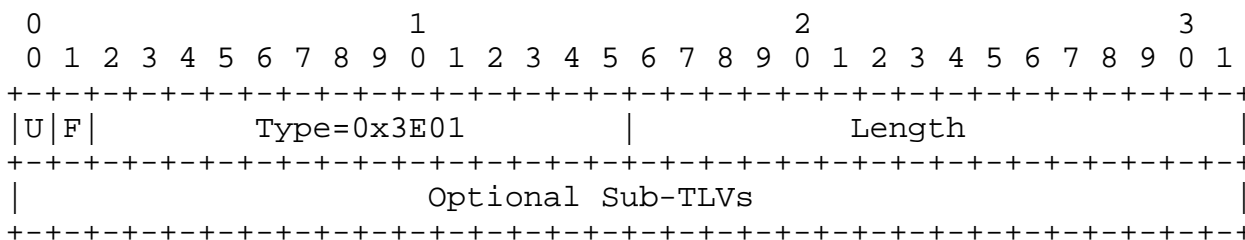
                    Figure 3: MSP disconnect TLV

   - U and F Bits
   Both are set to 0.

   - Type
   Set temporarily to 0x3E01 for "MSP disconnect TLV"

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

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

4.2.1. MSP disconnect cause TLV

This TLV is used in an RG Disconnect Message to indicate the cause of
disconnect.

```
 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=0x3E09               |           Length            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Disconnect Cause String                   |
~                                                               ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 4: MSP disconnect TLV

- U and F Bits
Both are set to 0.

- Type
Set temporarily to 0x3E09 for "MSP 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.

4.3. MSP group config TLV

The MSP configuration TLV is sent in the RG application data message.
This TLV is used to notify RG peers about the local configuration of
protect group.

```
      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=0x3E02         |              Length           |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |          Group ID             | Protect Type  |   Direction   |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     | Protect Mode  |     Flags     |             WTR Time          |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
     |           WTR Time            |                               |
     +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

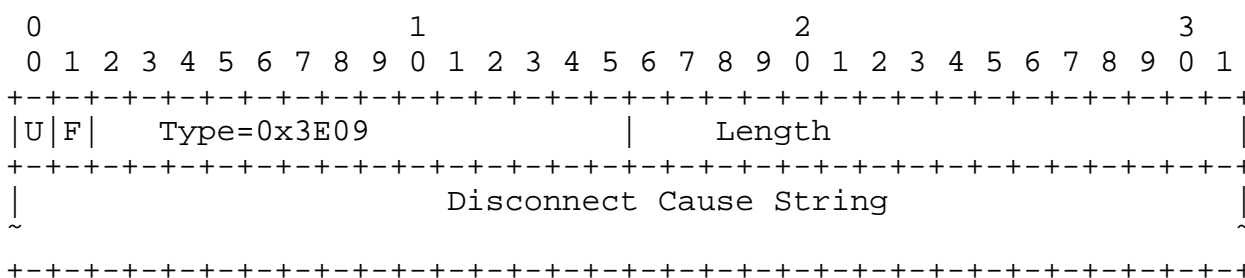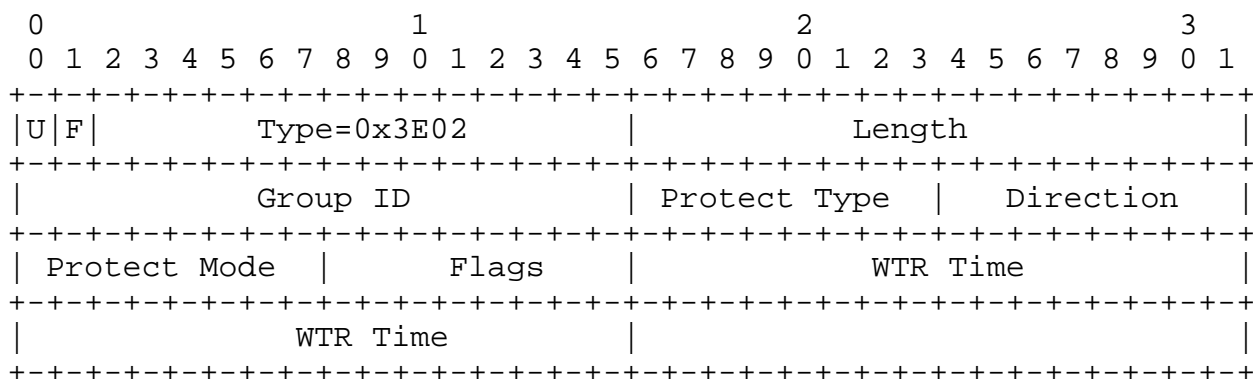   Figure 5: MSP group config TLV

    - U and F Bits
    Both are set to 0.

    - Type
    Set temporarily to 0x3E02 for "MSP group config TLV"

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

    - Group ID
    Two octets. Unsigned integer uniquely identifying the protect group.

    - Protect Type
    One octet encoding the protect type of the MSP protect group as
    follows:
    0x00 1+1
    0x01 1:1
    0x02-0xFF reserved

    - Direction
    One octet encoding the architecture of the network as follows:
    0x00 unidirectional
    0x01 bidirectional

    - Protect Mode
    One octet encoding the mode of operation as follows:
    0x00 non-revertive operation
    0x01 revertive operation

    - Flags
    One octet. Valid values are:
    -i Synchronized (0x01)

Indicates that the sender has concluded transmitting all group
configuration information.
-ii Purge Configuration (0x02)
Indicates that the group is no longer configured for MSP operation.

- WTR Time
Four octets. The time of waiting to restore, is used in the
revertive mode of operation.

4.4. MSP port config TLV

The MSP port configuration TLV is sent in the RG application data
message. This TLV is used to notify RG peers about the local port
configuration.

```
     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=0x3E03         |              Length          |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |             Group ID          |     Role      |     Flags     |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    | Port Name Len |                Port Name                      |
    +-+-+-+-+-+-+-+-+                                               +
    ~                                                               ~
    |                              ...                              |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
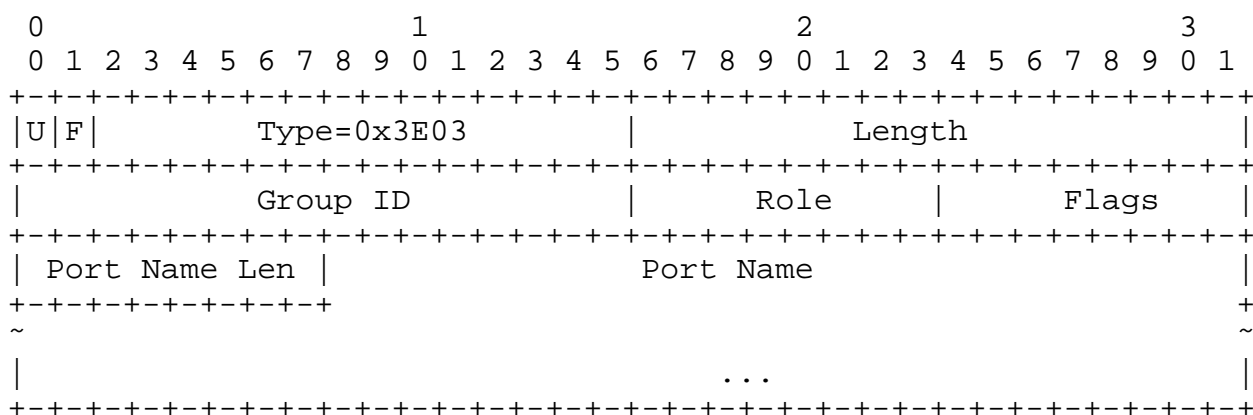
                    Figure 6: MSP port config TLV

- U and F Bits
Both are set to 0.

- Type
Set temporarily to 0x3E03 for "MSP group config TLV"

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

- Group ID
Two octets. Unsigned integer uniquely identifying the protect group.

- Role
One octet encoding the role of the node as follows:
0x00 master

0x01 backup

- Flags
One octet. Valid values are:
-i Synchronized (0x01)
Indicates that the sender has concluded transmitting all group
configuration information.
-ii Purge Configuration (0x02)
Indicates that the group is no longer configured for MSP operation.

- Port Name Len
One octet, length of the "Port Name" field in octets.

- Port Name
Port name encoded in UTF-8 format, up to a maximum of 32 characters.

4.5. MSP link state TLV

The MSP link state TLV is sent in the RG application data message.
This TLV announces the local node's link state 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=0x3E04        |              Length             |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |         Group ID           | Link State   |                  |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
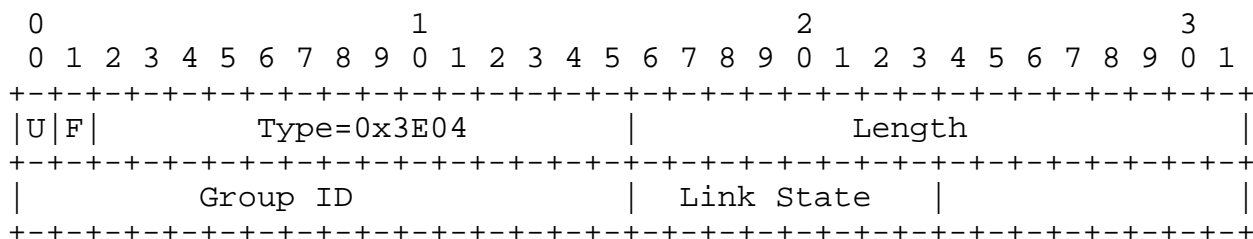
Figure 7: MSP link state TLV

- U and F Bits
Both are set to 0.

- Type
Set temporarily to 0x3E04 for "MSP link state TLV"

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

- Group ID
Two octets. Unsigned integer uniquely identifying the protect group.

- Link State
One octet encoding the link state as follows:

```
   0x00 the signal is ok
   0x01 signal failure(SF)
   0x02 signal degradation(SD)
```

4.6. MSP switch command TLV

The MSP configuration TLV is sent in the RG application data message.
This TLV is used to notify RG peers about the local configuration of
protect group.

```
    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=0x3E05          |             Length          |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |           Group ID              |  Request Cmd  |             |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
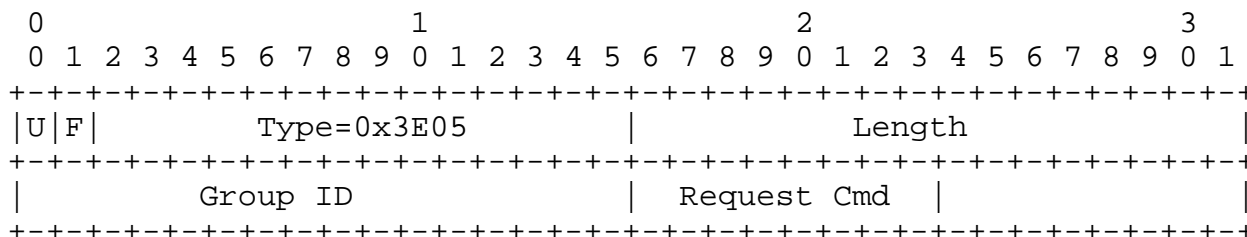
                   Figure 8: MSP switch command TLV

- U and F Bits
Both are set to 0.

- Type
Set temporarily to 0x3E05 for "MSP switch command TLV"

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

- Group ID
Two octets. Unsigned integer uniquely identifying the protect group.

- Request Cmd
One octet.The switch command issued at the MSP APS controller
interface. The following are the possible values, in order of
priority from highest to lowest:
(1111) Clear
(1101) Lockout of protection(LP)
(1011) Forced switch(FS)
(0111) Manual switch(MS)
(0100) Exercise

4.7. MSP group state TLV

The MSP group state TLV is sent in the RG application data message.
This TLV is used to report its state of protect group to the 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=0x3E06          |               Length          |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |           Group ID              | Group State  |     Path      |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
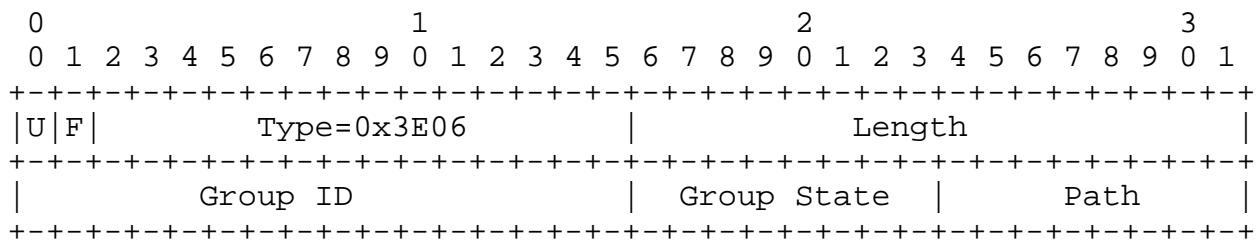
                      Figure 9: MSP group state TLV

   - U and F Bits
   Both are set to 0.

   - Type
   Set temporarily to 0x3E06 for "MSP group state TLV"

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

   - Group ID
   Two octets. Unsigned integer uniquely identifying the protect group.

   - Group State
   One octet encoding the current state of the MSP protect group as
   follows:
   0x00 No request
   0x01 Do not revert
   0x02 Reverse request
   0x03 Unused
   0x04 Exercise
   0x05 Unused
   0x06 Wait-to restore
   0x07 Unused
   0x08 Manual switch
   0x09 Unused
   0x0A Signal degrade low priority
   0x0B Signal degrade high priority
   0x0C Signal fail low priority
   0x0D Signal fail high priority
   0x0E Forced switch
   0x0F Lockout of protection

   - Path

One octet encoding the active path of the MSP protect group as
follows:
0x00 the active path is the working link
0x01 the active path is the protection link

4.8. MSP Synchronization Request TLV

The MSP 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.

```
   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=0x3E07        |              Length            |
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  |         Request Number        |C|S|         Request Type       |
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  |            Group ID           |                               |
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
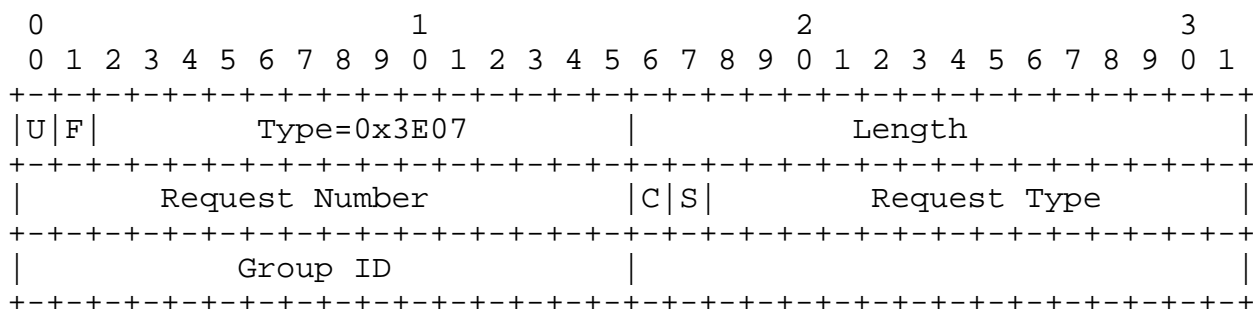
Figure 10: MSP Synchronization Request TLV

- U and F Bits
Both are set to 0.

- Type
Set temporarily to 0x3E07 for "MSP Synchronization Request TLV"

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

- Request Number
Two octets. Unsigned integer uniquely identifying the request. Be
used to match the request with a response. The value of 0 is
reserved for unsolicited synchronization, and MUST NOT be used in the
MSP 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 Data for specified protect group
0x01 Request Data for all groups in specified service(s)

- Group ID
Two octets. When Request Type field is set to (0x00), this field
encodes the group ID for the requested group. When the Request Type
field is set to (0x01), this field must be empty.

4.9. MSP Synchronization Data TLV

The meaning of MSP Synchronization Data TLV is similar with the PW-
RED Synchronization Data TLV defined in the [I-D:ietf-pwe3-iccp]. It
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 sent in response
to a MSP 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 MSP Synchronization Data TLVs are also used for unsolicited
advertisements of complete MSP configuration and operational state
data. In this case, the Request Number field MUST be set to 0.

```
 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=0x3E08        |              Length            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         Request Number       |              Flags             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
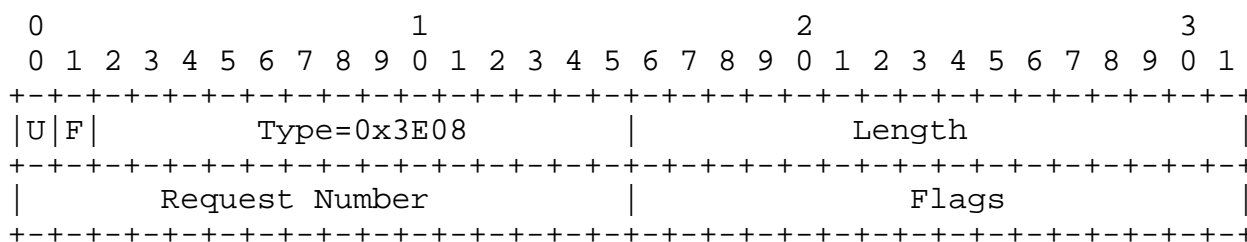
Figure 11: MSP group notify TLV

- U and F Bits
Both are set to 0.

- Type
Set temporarily to 0x3E08 for "MSP Synchronization Data TLV"

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

- Request Number
Two octets. Unsigned integer is identifying the Request Number from
the "MSP Synchronization Request TLV" which solicited this

synchronization data response.

- Flags
Two octets, response flags encoded as follows:
0x00 Synchronization Data Start
0x01 Synchronization Data End

5. Security Considerations

   The extensions of this document are based on ICCP, only some TLVs are
   added which will not change the security of existing network.

6. IANA Consideration

   TBD.

7. References

7.1. Normative References

   [RFC2119]   Bradner, S., "Key words for use in RFCs to Indicate
               Requirement Levels", BCP 14, RFC 2119, March 1997.

7.2. Informative References

   [G.841]   ITU-T Recommendation G.841, "Types and characteristics of
               SDH network protection architectures", 1998.

   [I-D:ietf-pwe3-iccp]
               Luca Martini,Samer Salam,Ali Sajassi, "Inter-Chassis
               Communication Protocol for L2VPN PE Redundancy",
               draft-ietf-pwe3-iccp-05 .

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