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MPLS LSP PW status refresh reduction for Static Pseudowires

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Abstract

This document describes a method for generating an aggregated pseudowire status message on Multi-Protocol Label Switching (MPLS) network Label Switched Path (LSP).

The method for transmitting the pseudowire (PW) status information is not new, however this protocol extension allows a Service Provider (SP) to reliably monitor the individual PW status while not overwhelming the network of multiple periodic status messages. This

is achieved by sending a single cumulative summary status verification message for all the PWs grouped in the same LSP.

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1. Introduction

When PWs use a Multi Protocol Label Switched (MPLS) network as the Packet Switched Network (PSN), they are setup according to [RFC4447] static configuration mode and the PW status information is propagated using the method described in [PW-STATUS]. There are 2 basic modes of operation described in [PW-STATUS] section 5.3: Periodic retransmission of non-zero status messages, and a simple acknowledge of PW status (sec 5.3.1 of [PW-STATUS]). The LSP level protocol described below applies to the case when PW status is acknowledged immediately with a requested refresh value of zero (no refresh). In this case the PW status refresh reduction protocol is necessary for several reasons, such as:

-i. Greatly increase the scalability of the PW status protocol by reducing the amount of messages that a PE needs to periodically send to it's neighbors.
-ii. Detect a remote PE restart.
-iii. If the local state is lost for some reason, the PE needs to be able to request a status refresh reduction from the remote PE
-iv. Optionally detect a remote PE provisioning change.

1.1. Requirements Language

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].

1.2. Terminology

FEC: Forwarding Equivalence Class

LDP: Label Distribution Protocol

LSP: Label Switching Path

MS-PW: Multi-Segment Pseudowire

PE: Provider Edge

PW: Pseudowire

SS-PW: Single-Segment Pseudowire

S-PE: Switching Provider Edge Node of MS-PW

T-PE: Terminating Provider Edge Node of MS-PW

1.3. Notational Conventions in Backus-Naur Form

All multiple-word atomic identifiers use underscores (_) between the words to join the words. Many of the identifiers are composed of a concatenation of other identifiers. These are expressed using Backus-Naur Form (using double-colon - "::" - notation).

Where the same identifier type is used multiple times in a concatenation, they are qualified by a prefix joined to the identifier by a dash (-). For example Src-Node_ID is the Node_ID of a node referred to as Src (where "Src" is short for "source" in this example).

The notation does not define an implicit ordering of the information elements involved in a concatenated identifier.

2. PW status refresh reduction protocol

PW status refresh reduction protocol consists of a simple message that is sent at the LSP level using the MPLS Generic Associated Channel.

A PE using the PW status refresh reduction protocol MUST send the PW status refresh reduction Message as soon as a PW is configured on a particular LSP. The message is then re-transmitted at a locally configured interval indicated in the refresh timer field. If no acknowledgment is received, the protocol does not reach active state, and the PE SHOULD NOT send any PW status messages with a refresh timer of zero as described in [PW-STATUS] section 5.3.1.

It is worth noting that no relationship is existing between the locally configured timer for the refresh reduction protocol and the PW individual status refresh timers.

2.1. Protocol states

The protocol can be in 3 possible states: INACTIVE, STARTUP, and ACTIVE.

2.1.1. INACTIVE

This state is entered when the protocol is turned off. This state is also entered if all PW on a specific LSP are unprovisioned, or the feature is unprovisioned.

2.1.2. STARTUP

In this state the PE transmits periodic PW status refresh reduction messages, with the Ack Session ID set to 0. The PE remains in this state until a PW status refresh message is received with the correct local session ID in the Ack Session ID Field. This state can be exited to the ACTIVE or INACTIVE state.

2.1.3. ACTIVE

This state is entered once the PE receives a PW status refresh reduction message with the correct local session ID in the Ack Session ID Field within 3.5 times the refresh timer field value of the last PW status refresh reduction message transmitted. This state is immediately exited as follows:

-i. A valid PW status refresh reduction message is not received within 3.5 times the current refresh timer field value. (assuming a timer transition procedure is not in progress) New state: STARTUP

-ii. A PW status refresh reduction message is received with the wrong, or a zero, Ack Session ID field value. New state: STARTUP

-iii. All PWs using the particular LSP are unprovisioned, or the protocol is disabled. New state: INACTIVE

2.2. Timer value change transition procedure

If a PE needs to change the refresh timer value field while the PW refresh reduction protocol is in the ACTIVE state, the following procedure must be followed:

-i. A PW status refresh reduction message is transmitted with the new timer value.

-ii. If the new value is greater then the original one the PE will operate on the new timer value immediately.

-iii. If the new value is smaller then the original one, the PE will operate according to the original timer value for a period 3.5 times the original timer value, or until the first valid PW status refresh reduction message is received.

A PE receiving a PW status refresh reduction message with a new timer value, will immediately transmit an acknowledge PW status refresh reduction message, and start operating according to the new timer value.

3. PW status refresh reduction procedure

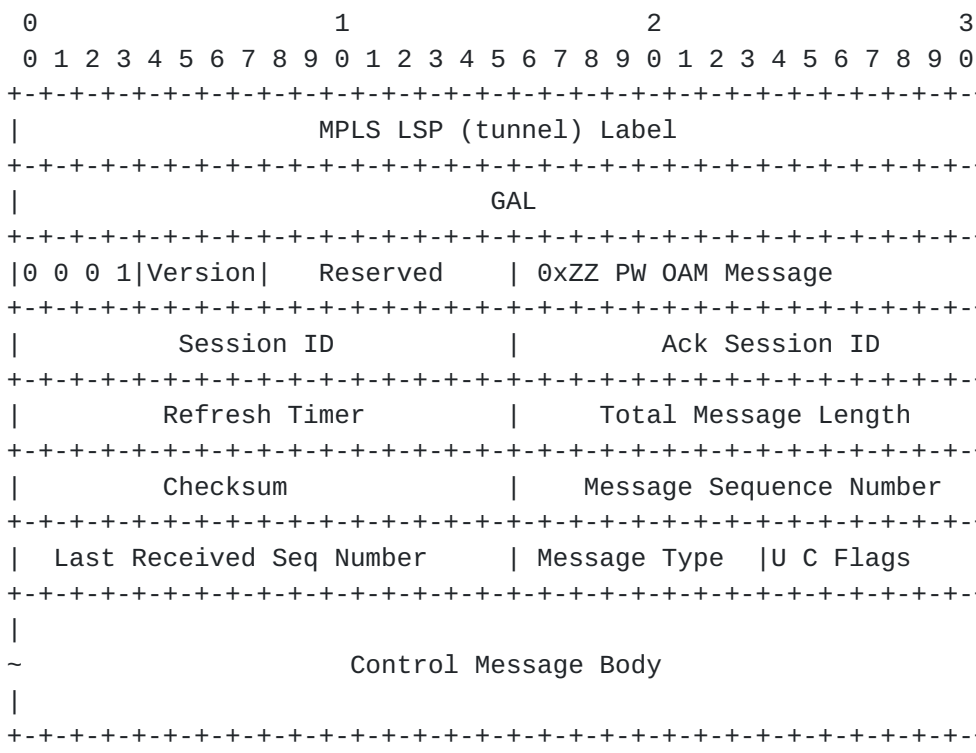
When the refresh reduction protocol, on a particular LSP, is in the ACTIVE state, the PE can send all PW status messages, for PWs on that LSP, with a refresh timer value of zero. This greatly decreases the amount of messages that the PE needs to transmit to the remote PE because once the PW status message for a particular PW is acknowledged, further repetitions of that message are no longer necessary.

To further mitigate the amount of possible messages when an LSP starts forwarding traffic, care should be taken to permit the PW refresh reduction protocol to reach the ACTIVE state quickly, and before the the first PW status refresh timer expires. This can be achieved by using a PW status refresh reduction Message refresh timer value that is much smaller then the PW status message refresh timer value in use. (sec 5.3.1 of [PW-STATUS])

If the refresh reduction protocol session is terminated by entering the INACTIVE or STARTUP states, the PE MUST immediately re-send all the previously sent PW status messages for that particular LSP for which the session terminated. In this case the refresh timer value MUST NOT be set to zero, and MUST be set according to the local policy of the PE router.

4. PW status refresh reduction Message Encoding

The packet containing the refresh reduction message is encoded as follows: (omitting link layer information)



This message contains the following fields:

* PW OAM Message.

  This field indicates the generic associated channel type in the GACH header as defined in [RFC5586].

  Note: Channel type 0xZZ pending IANA allocation.

* Session ID

  A non-zero, locally selected session number that is not preserved if the local PE restarts.

  In order to get a locally unique session ID, the recommended choice is to perform a CRC-16 giving as input the following data

  |Y|Y|M|M|D|D|H|H|M|M|S|S|L|L|L|

  Where: YY: are the decimal two last digit of the current year MM: are the decimal two digit of the current month DD: are the decimal two digit of the current day HHMMSSLLL: are the decimal digits of the current time expressed in (hour, minutes, seconds, milliseconds)

* Ack Session ID

  The Acknowledgment Session ID received from the remote PE.

* Refresh Timer.

  A non zero unsigned 16 bit integer value greater or equal to 10, in milliseconds, that indicates the desired refresh interval. The default value of 30000 is RECOMENDED.

* Total Message Length

  Total length in octets of the Checksum, Message Type, Flags, Message Sequence Number, and control message body. A value of zero means that no control message is present, and therefore that no Checksum, and following fields are present either.

* Checksum

  A 16 bit field containing the one's complement of the one's complement sum of the entire message (including the GACH header), with the checksum field replaced by zero for the purpose of computing the checksum. An all-zero value means that no checksum was transmitted. Note that when the checksum is not computed, the header of the bundle message will not be covered by any checksum.

* Message Sequence Number

  A unsigned 16 bit integer number that is started from 1 when the protocol enters ACTIVE state. The sequence numbers wraps back to 1 when the maximum value is reached. The value of zero is reserved and MUST NOT be used.

* Last Received Message Sequence Number

  The sequence number of the last message received. In no message has yet been received during this session, this field is set to zero.

* Message Type

  The Type of the control message that follows. Control message types are allocated in this document, and by IANA.

* (U) Unknown flag bit.

  Upon receipt of an unknown message, if U is clear (=0), the keepalive session MUST be terminated by entering STARTUP state;

if U is set (=1), the unknown message MUST be acknowledge and silently ignored and the following messages, if any, processed as if the unknown message did not exist.

* (C) Configuration flag bit. The C Bit is used to signal the end of PW configuration transmission. If it is set, the sending PE has finished sending all it's current configuration information.

* Flags (Reserved)

  7 bits of flags reserved for future use, they MUST be set to 0 on transmission, and ignored on reception.

* Control Message Body

  The Control Message body is defined in a section below, and is specific to the type of message.

It should be noted that the Checksum, Message Sequence Number, Last Received Message Sequence Number, Message Type, Flags, and control message body are OPTIONAL.

5. PW status refresh reduction Control Messages

PW status refresh reduction Control messages consist of the Checksum, Message Sequence Number, Last Received Message Sequence Number, Message Type, Flags, and control message body.

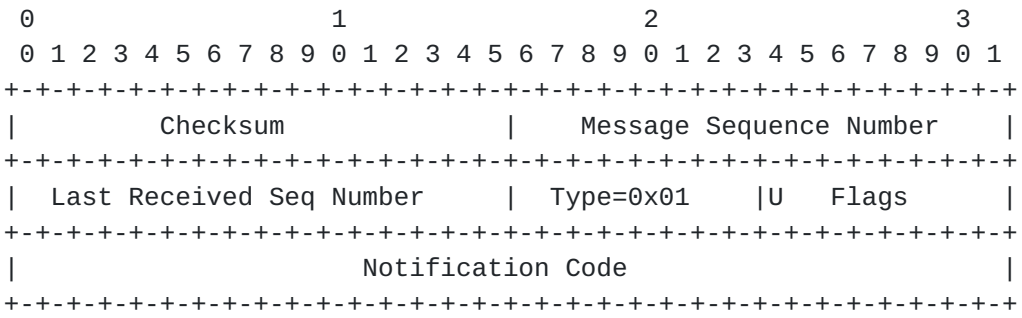
When there is the need to send a PW status refresh reduction Control Messages, the system can attach it to a scheduled PW status refresh reduction or send one ahead of time. In any case PW status refresh reduction Control Messages always piggy back on normal messages.

There can only be one control message construct per PW status refresh reduction Message. If the U bit is set, and a PE receiving the PW status refresh reduction Message does not understand the control message, the control message MUST be silently ignored. However the control message sequence number MUST still be acknowledged by sending a null message back with the appropriate value in the Last Message Received Field. If a control message is not acknowledged, after 3.5 times the value of the Refresh Timer, a fatal notification "unacknowledged control message" MUST be sent, and the PW refresh reduction session MUST be terminated.

If a PE does not want or need to send a control message, the Checksum, and all following fields MUST NOT be sent, and the Total Message Length field is then set to zero.

5.0.1. Notification message

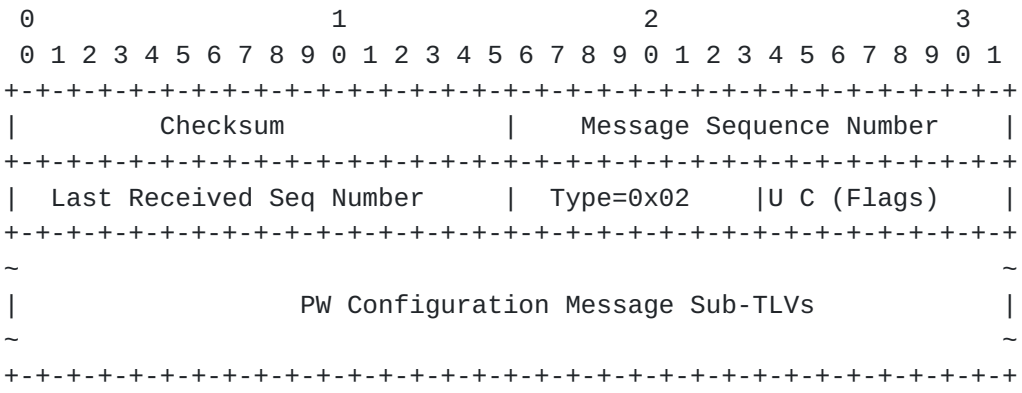
The most common use of the Notification Message is to acknowledge the reception of a message by indicating the received message sequence number in the "Last Received Sequence Number" field. The notification message is encoded as follows:



The message type is set to 0x01, and the U bit is treated as described in the above section. The Notification Codes are a 32 bit quantity assigned by IANA. (see IANA consideration section) Notification codes are either considered "Error codes" or simple notifications. If the Notification code is an Error code as indicated in the IANA allocation registry, the keepalive session MUST be terminated by entering STARTUP state.

5.0.2. PW Configuration Message

The PW status refresh reduction TLVs are informational TLVs, that allow the remote PE to verify certain provisioning information. This message contain a series of sub-TLVs in no particular order, that contain PW and LSP configuration information. The message has no preset length limit, however its total length will be limited by the transport network Maximum Transmit Unit (MTU).



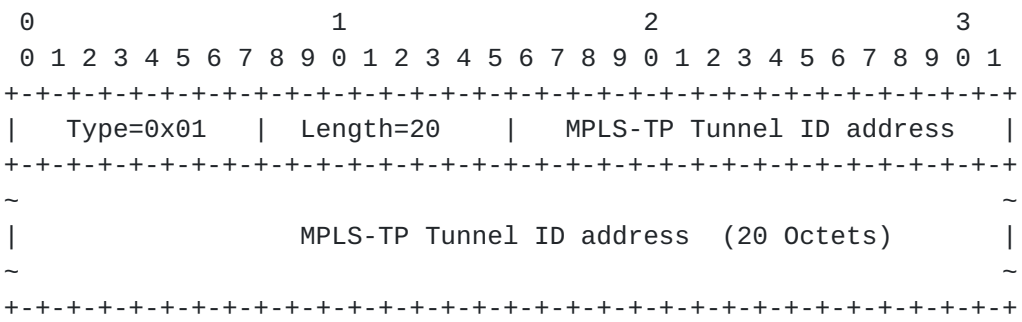
The PW Configuration Message type is set to 0x02. For this message the U-bit is set to 1 as processing of these messages is OPTIONAL.

The C Bit is used to signal the end of PW configuration transmission. If it is set, the sending PE has finished sending all its current configuration information. The PE transmitting the configuration MUST set the C bit on the last PW configuration message when all current PW configuration has been sent.

5.0.2.1. MPLS-TP Tunnel ID

This TLV contains the address of the MPLS-TP tunnel ID. When the configuration message is used for a particular keepalive session the MPLS-TP Tunnel ID sub-TLV MUST be sent at least once.

The MPLS-TP Tunnel ID address is encoded as follows:



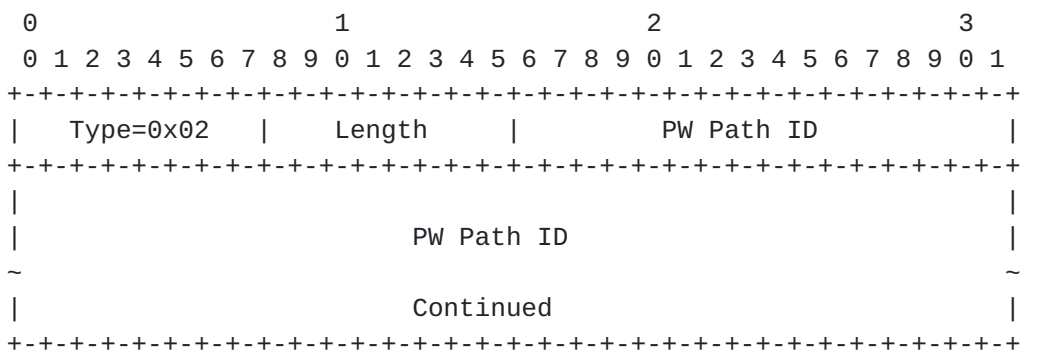
The MPLS-TP point to point tunnel ID is defined in [IDENTIFIER] as follows:

Src-Global_Node_ID::Src-Tunnel_Num::Dst-Global_Node_ID::Dst-Tunnel_Num

Note that a single address is enough to identify the tunnel, and the source end of the message.

5.0.2.2. PW ID configured List

This OPTIONAL TLV contains a list of the provisioned PWs on the LSP.

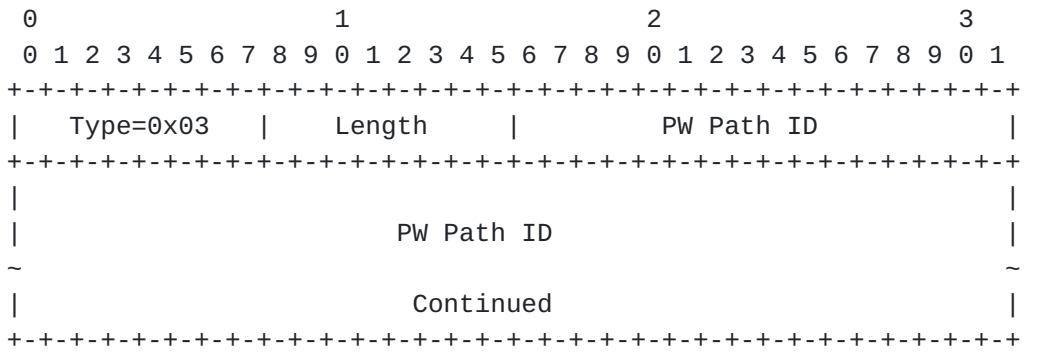


The PW Path ID is a 32 octet pseudowire path identifier specified in [IDENTIFIER] as follows: AGI::Src-Global_ID::Src-Node_ID::Src-AC_ID:: Dst-Global_ID::Dst-Node_ID::Dst-AC_ID

The number of PW Path IDs in the TLV will be inferred by the length of the TLV up to a maximum of 8. The procedure for processing this TLV will be described in a section below.

5.0.2.3. PW ID unconfigured List

This OPTIONAL TLV contains a list of the PWs that have been unprovisioned on the LSP. Note that it is a fatal session error to send the same PW address in both the configured list TLV , and the unconfigured list TLV in the same configuration message.



The PW Path ID is a 32 octet pseudowire path identifier specified in [IDENTIFIER] as follows: AGI::Src-Global_ID::Src-Node_ID::Src-AC_ID:: Dst-Global_ID::Dst-Node_ID::Dst-AC_ID

The number of PW Path IDs in the TLV will be inferred by the length of the TLV up to a maximum of 8.

6. PW provisioning verification procedure

This procedure and the advertisement of the PW configuration message are OPTIONAL.

A PE that desires to use the PW configuration message to verify the configuration of PWs on a particular LSP, should advertise its PW configuration to the remote PE on LSPs that have active keepalive sessions. When a PE receives PW configuration information using this protocol and it not supporting or not willing to use the information, it MUST acknowledge all the PW configuration messages with a notification of "PW configuration not supported". In this case, the information in the control messages is silently ignored. If a PE receives such a notification it should stop sending PW configuration control messages for the duration of the PW refresh reduction keepalive session.

If PW configuration information is received, it is used to verify the accuracy of the local configuration information against the remote PE's configuration information. If a configuration mismatch is detected, where a particular PW is configured locally but not on the remote PE, the following action SHOULD be taken:

-i. The local PW MUST be considered in "Not Forwarding" State.

-ii. The PW Attachment Circuit status is set to reflect the PW fault.

-iii. An Alarm MAY be raised to a network management system.

6.1. PW ID List advertising and processing

When configuration messages are advertised along a particular LSP, the PE sending the messages needs to check point the configuration information sent by setting the C bit when all currently known configuration information has been sent. This process allows the receiving PE to immediately proceed to verify all the currently configured PWs on that LSP, eliminating the need for a long waiting period.

If a new PW is added to a particular LSP, the PE MUST place the configuration verification of this PW on hold for a period of at least 10 seconds. This is necessary to prevent false positive events of mis-configuration due to the ends of the PW being slightly out of sync.

7. Security Considerations

Section to be completed in a later version of the document.

8. IANA Considerations

8.1. PW Status Refresh Reduction Message Types

IANA needs to set up a registry of "PW status refresh reduction Control Messages". These are 8-bit values. Type value 1 through 2 are defined in this document. Type values 3 through 64 are to be assigned by IANA using the "Expert Review" policy defined in RFC5226. Type values 65 through 127, 0 and 255 are to be allocated using the IETF consensus policy defined in [RFC5226]. Type values 128 through 254 are reserved for vendor proprietary extensions and are to be assigned by IANA, using the "First Come First Served" policy defined in RFC5226.

The Type Values are assigned as follows:

Type	Message Description
0x01	Notification message
0x02	PW Configuration Message

8.2. PW Configuration Message Sub-TLVs

IANA needs to set up a registry of "PW status refresh reduction Configuration Message Sub-TLVs". These are 8-bit values. Type value 1 through 2 are defined in this document. Type values 3 through 64 are to be assigned by IANA using the "Expert Review" policy defined in RFC5226. Type values 65 through 127, 0 and 255 are to be allocated using the IETF consensus policy defined in [RFC5226]. Type values 128 through 254 are reserved for vendor proprietary extensions and are to be assigned by IANA, using the "First Come First Served" policy defined in RFC5226.

The Type Values are assigned as follows:

sub-TLV type	Description
0x01	MPLS-TP Tunnel ID address.
0x02	PW ID configured List.
0x03	PW ID unconfigured List.

8.3. PW Status Refresh Reduction Notification Codes

IANA needs to set up a registry of "PW status refresh reduction Notification Codes". These are 32-bit values. Type value 1 through 7 are defined in this document. Type values 8 through 65536 are to be assigned by IANA using the "Expert Review" policy defined in RFC5226. Type values 65536 through 134,217,728, 0 and 4,294,967,295 are to be allocated using the IETF consensus policy defined in [RFC5226]. Type values 134,217,729 through 4,294,967,294 are reserved for vendor proprietary extensions and are to be assigned by IANA, using the "First Come First Served" policy defined in RFC5226.

The Type Values are assigned as follows:

Code	Error?	Description
0x00000000	No	Null Notification.
0x00000001	No	PW configuration rejected.
0x00000002	Yes	PW Configuration TLV conflict.
0x00000003	No	Unknown TLV (U-bit=1)
0x00000004	Yes	Unknown TLV (U-bit=0)
0x00000005	No	Unknown Message Type
0x00000006	No	PW configuration not supported.
0x00000007	Yes	Unacknowledged control message.

9. References

9.1. Normative References

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

[RFC4447] "Transport of Layer 2 Frames Over MPLS", Martini, L., et al., rfc4447 April 2006.

[PW-STATUS] L. Martini, G. Swallow, G. Heron, M. Bocci "Pseudowire Status for Static Pseudowires", draft-ietf-pwe3-static-pw-status-06.txt, (work in progress), July 2011

[IDENTIFIER] M. Bocci, G. Swallow, E. Gray "MPLS-TP Identifiers" draft-ietf-mpls-tp-identifiers-07.txt, IETF Work in Progress, july 2011

[RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations section in RFCs", BCP 26, RFC 5226, May 2008

9.2. Informative References

[RFC5586] M. Bocci, Ed., M. Vigoureux, Ed., S. Bryant, Ed.,
"MPLS Generic Associated Channel", rfc5586, June 2009

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