

PWE3 Working Group
Internet Draft
Intended Status: Standards Track
Expiration Date: August 5, 2012

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February 6, 2012

LDP Typed Wildcard FEC for PwId and Generalized PwId
FEC Elements

[draft-ietf-pwe3-pw-typed-wc-fec-03.txt](#)

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Abstract

The "Typed Wildcard Forwarding Equivalence Class (FEC) Element" defines an extension to the Label Distribution Protocol (LDP) that can be used when it is desired to request or withdraw or release all label bindings for a given FEC Element type. However, a typed wildcard FEC element must be individually defined for each FEC element type. This specification defines the typed wildcard FEC elements for the PWid (0x80) and Generalized PWid (0x81) FEC element types.

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](#)].

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1. Introduction

An extension [[RFC5918](#)] to the Label Distribution Protocol (LDP) [[RFC5036](#)] defines the general notion of a "Typed Wildcard Forwarding Equivalence Class (FEC) Element". This can be used when it is desired to request all label bindings for a given type of FEC Element, or to release or withdraw all label bindings for a given type of FEC element. However, a typed wildcard FEC element must be individually defined for each type of FEC element.

[RFC4447] defines the "PWid FEC Element" and "Generalized PWid FEC Element", but does not specify the Typed Wildcard format for these elements. This document specifies the format of the Typed Wildcard FEC Element for the "PWid FEC Element" and "Generalized PWid FEC Element". The procedures for Typed Wildcard processing for PWid and Generalized PWid FEC Elements are same as described in [[RFC5918](#)] for any typed wildcard FEC Element type.

2. Typed Wildcard for PW FEC Elements

The format of the Typed Wildcard FEC Element for PWid and Generalized PWid is specified as:

```

      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
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Typed Wcard=0x5 | Type=PW FEC   | Len = 2   | R | PW type   |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|   . . .       |
+---+---+---+---+---+---+

```

Figure 1: Format of Typed Wildcard FEC Element for PW FEC Element Types

Where:

Typed Wcard (one octet): Typed Wildcard FEC element type (0x05)
as specified in [[RFC5918](#)]

[FEC Element] Type (one octet): PW FEC Element type:

PWid: (type 0x80 [[RFC4447](#)])

Generalized PWid: (type 0x81 [[RFC4447](#)])

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Len [FEC Type Info] (one octet): Two. (i.e. there is additional FEC info to scope the Typed Wildcard)

R bit (Reserved bit): Must be set to ZERO on transmit and ignored on receipt.

PW type (15-bits): PW type as specified in [[RFC4447](#)]. This field is used to scope the wildcard FEC operation to limit to all PWs of a given type. This MUST be set to "Wildcard" type (0x7FFF), as defined in [[IANA-PWE3](#)], when referring PWs of all types (see [Section 4](#) for its usage).

[RFC4447] defines "PW Grouping ID TLV" that can be used for wildcard withdrawal or status messages related to Generalized PWid FECs. When Typed Wildcard FEC for Generalized PWid FEC element is in use, "PW Grouping ID TLV" MUST NOT be present in the same message. If found present, the receiving LSR MUST ignore this TLV silently, and process the rest of the message.

[3.](#) Applicability Statement

The Typed wildcard FEC Elements defined in this document for the PWid and Generalized PWid FEC Elements provide a finer degree of granularity when compared to the wildcard FEC mechanics defined in [[RFC5036](#)].

The PWid FEC Element as defined in [[RFC4447](#)] contains a Group ID field. This field is defined as an arbitrary 32-bit value that represents a group of PWs, and is used to create groups in the PW space, including potentially a single group of all PWs for a given FEC Element type. This grouping enables an LSR to send "wildcard" label withdrawals and/or status notification messages corresponding to a PW group upon physical port failures. Similarly, [[RFC4447](#)] defines the "PW Grouping ID TLV" used in the same fashion for the Generalized PWid FEC Element.

The PW Typed Wildcard FEC elements defined in this document help us achieve the similar functionality as "Group ID" field or "PW Grouping ID TLV" for label withdrawal and status notification messages; Additionally, the Typed Wildcard procedures [[RFC5918](#)] also provide more generalized and comprehensive solution by allowing:

1. Typed-Wildcard Label Request messages

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2. Label TLV in label messages to further constraint the wildcard to all FECs of the specified FEC type [and its specific filter] that are also bound to the specified label.

This document allows the use of Typed Wildcard PW FEC Element in any LDP message that specifies a FEC TLV as mandatory or optional parameter of the message. In addition to LDP label messages, this also applies to Notification messages (containing PW Status) and Address Withdraw (for MAC address withdrawal [[RFC4762](#)]) in the context of LDP PW signaling. When a Typed Wildcard PW FEC element is used in a Address Withdraw message for VPLS MAC address withdrawal, the MAC List TLV MUST contain an empty list.

[4.](#) Operation

The use of Typed Wildcard FEC elements for PW can be useful under several scenarios. This section describes some use cases to illustrate their usage. The following use cases consider two LSR nodes, A and B, with LDP session between them to exchange L2VPN PW bindings.

[4.1.](#) PW Consistency Check

A user may request a control plane consistency check at LSR A for the Generalized PWid FEC bindings that it had learnt from LSR B over LDP session. To perform this consistency check, LSR A marks all its learnt Generalized PWid FEC bindings from LSR B as stale, and then sends a Label Request message towards LSR B for Typed Wildcard FEC element for Generalized PWid FEC element type with PW type set to "Wildcard" (0x7FFF). Upon receipt of such request, LSR B replays its database related to Generalized PWid FEC element using one or more Label Mapping messages. As a PW binding is received at LSR A, the

associated binding state is marked as refreshed (no stale). When replay completes for Generalized PWid FEC type, LSR B marks end of its replay by sending End-of-LIB notification [[RFC5919](#)] corresponding to Generalized PWid FEC element type. Upon receipt of this notification at LSR A, any remaining stale PW binding of Generalized PWid FEC type learnt from the peer LSR B, is cleaned up and removed from the database. This completes consistency check with LSR B at LSR A for Generalized PWid FEC type.

[4.2.](#) PW Graceful Shutdown

It may be desirable to perform shutdown/removal of existing PW bindings advertised towards a peer in a graceful manner - i.e. all

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advertised PW bindings to be removed from a peer without session flap. For example, to request a graceful delete of the PWid FEC and Generalized PWid FEC bindings at LSR A learnt from LSR B, LSR A would send a Label Withdraw message towards LSR B with Typed Wildcard FEC elements pertaining to PWid FEC element (with PW type set to 0x7FFF) and Generalized PWid FEC element (with PW type set to 0x7FFF). Upon receipt of such message, LSR B will delete all PWid and Generalized PWid bindings learnt from LSR A. Afterwards, LSR B would send Label Release messages corresponding to received Label Withdraw messages with Typed FEC element.

[4.3.](#) Wildcard PW Status

The Typed Wildcard FEC Elements for PW FECs can be very useful when used to convey PW status amongst LSRs. The PE devices can send "PW Status TLV" in an LDP Notification message to indicate PW status (i.e., a Pseudowire Status Code denoting for example a particular fault) to their remote peers [[RFC4447](#)]. In case of a global failure affecting all PWs, an LSR typically sends one PW Status LDP Notification message per PW. This per PW Status message has scalability implications in a large-scale network with large number of PWs.

Using Typed Wildcard FEC Element for given type of PW FEC Element, the LSR will need to send only one PW Status Notification message with Typed Wildcard PW FEC specified to notify about the common status applicable to all PWs as scoped by the PW Typed Wildcard FEC.

[4.4.](#) Typed Wildcard MAC Withdrawal in VPLS

[RFC4762] defines a pseudowire based solution to implement Virtual Private LAN Service (VPLS). [Section 6.2 of RFC-4762](#) describes MAC Withdrawal procedures and extensions in an VPLS environment. These procedures use LDP Address Withdraw message containing FEC TLV (with PW FEC element corresponding to the VPLS instance) and MAC List TLV (to specify addresses to be withdrawn). [RFC-4762](#) procedures also allow MAC addresses withdrawal wildcarding for a given VPLS instance.

Using [RFC-4762](#) procedures, a PE LSR can withdraw all MAC addresses for a given VPLS instance by sending an Address Withdraw message with VPLS instance corresponding PW FEC element in a FEC TLV, and MAC List TLV with an empty list of addresses. If there are more than one VPLS instance on a given PE LSR node, separate Address Withdraw messages

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will need to be sent by PE LSR if it wishes to withdraw MAC addresses for all or subset of VPLS instances upon some global failure or configuration. This per PW (VPLS instance) MAC Withdraw messages may have some scalability implications in large-scale network.

As stated in [section 3](#), this document allows use of Typed Wildcard PW FEC in Address Withdraw messages corresponding to VPLS MAC Withdrawal. The usage of PW Typed Wildcard FEC enhances the scope of MAC withdrawal beyond just a single VPLS instance, and allows a PE node to wildcard withdraw all MAC addresses for:

- o all VPLS instances; or
- o all VPLS instances corresponding to a given PW type.

[5.](#) Security Considerations

No new security considerations beyond that apply to the base LDP specification [[RFC5036](#)], [[RFC4447](#)], [[RFC4762](#)], and [[RFC5920](#)] apply to the use of the PW Typed Wildcard FEC Element types described in this document.

[6.](#) IANA Considerations

None.

[7.](#) Acknowledgments

The authors would like to thank Eric Rosen, Reshad Rahman, Siva

Sivabalan, and Zafar Ali for their review and valuable comments. We also acknowledge Daniel Cohn for suggesting the use of Typed Wildcard PW FEC for VPLS MAC withdrawal.

This document was prepared using 2-Word-v2.0 template.dot.

[8.](#) References

[8.1.](#) Normative References

- [RFC5036] L. Andersson, I. Minei, and B. Thomas, "LDP Specification", [RFC 5036](#), September 2007.

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- [RFC5918] R. Asati, I. Minei, and B. Thomas, "LDP Typed Wildcard Forwarding Equivalence Class", [RFC 5918](#), August 2010.
- [RFC5919] R. Asati, P. Mohapatra, E. Chen, and B. Thomas, "Signaling LDP Label Advertisement Completion", [RFC 5919](#), August 2009.
- [RFC4447] L. Martini, E. Rosen, El-Aawar, T. Smith, and G. Heron, "Pseudowire Setup and Maintenance using the Label Distribution Protocol", [RFC 4447](#), April 2006.
- [RFC4762] M. Lasserre, and V. Kompella, "Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling", [RFC 4762](#), January 2007.
- [RFC2119] S. Bradner, "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC2119](#), March 1997.

[8.2.](#) Informative References

- [RFC5920] L. Fang (Editor), et al., "Security Framework for MPLS and GMPLS Networks", [RFC 5920](#), July 2010.
- [IANA-PWE3] Internet Assigned Numbers Authority, "Pseudo Wires Name Spaces (PWE3)", <http://www.iana.org/assignments/pwe3-parameters>, May 2011.

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