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## LDP Typed Wildcard FEC for the PW FEC Elements

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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), Generalized PWid (0x81), and P2MP PW (0x82) FEC element types.

## Conventions used in this document

The keywords "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](#)].

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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", and [[P2MP-PW](#)] defines the "P2MP PW FEC Element". These specifications, however, do 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", "Generalized Pwid FEC Element", and "P2MP FEC Element". The procedures for Typed Wildcard processing for Pwid, Generalized Pwid, and P2MP 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, Generalized Pwid, and P2MP PW FEC Elements 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 Elements

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](#)])  
P2MP PW: (type 0x82, [[P2MP-PW](#)])

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

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 PWid wildcard FEC operation to limit to all PWs of a given type. This MUST be set to 0x7FFF (Wildcard PW [[IANA-PWE3](#)]) when referring PWs of all types (see [Section 7](#)).

[RFC4447] defines "PW Grouping ID TLV" that can be used for wildcard withdrawal or status messages related to Generalized PWid and P2MP PW FECs. When Typed Wildcard FEC for Generalized PWid or P2MP PW FEC element is in use, "PW Grouping ID TLV" MUST NOT be present in the same message. If found present, receiving LSR MUST silently ignore Grouping ID TLV and process rest of the message.

### [3](#). Applicability Statement

The Typed wildcard FEC Elements defined in this document for the PWid, Generalized PWid, and P2MP PW 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. 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 and P2MP PW FEC Elements.

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 message

2. Label TLV 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.

#### [4. Operation](#)

The use of Typed Wildcard FEC elements for PW can be useful under several scenarios. This section describes two 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 PWid FEC and 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 PW bindings from LSR B as stale, and then send a Label Request message towards LSR B with Typed Wildcard FEC element for PWid FEC element (PW type = 0x7FFF) and Generalized PWid FEC element (PW type = 0x7FFF). Upon receipt of such request, LSR B replays its database related to PWid FEC elements and Generalized PWid FEC element in Label Mapping message. As a PW binding is received at LSR A, the associated binding state is marked as refreshed (no stale). When replay completes for a given type of FEC, LSR B sends End-of-LIB Notification [[RFC5919](#)] to mark the end of update for the given FEC type. Upon receipt of this Notification at LSR A, any remaining stale PW binding of given 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 given 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 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 (PW type = 0x7FFF) and Generalized PWid FEC element (PW type = 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 message corresponding to received Label Withdraw 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 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 Notification message per PW. 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.

#### [5.](#) Security Considerations

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

#### [6.](#) IANA Considerations

None.

#### [7.](#) Acknowledgments

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