

Network Working Group  
Internet Draft  
Expiration Date: November 2007

Bob Thomas  
Cisco Systems, Inc.

Ina Minei  
Juniper Networks

May 2007

## **LDP Typed Wildcard FEC**

[draft-ietf-mpls-ldp-typed-wildcard-01.txt](#)

### Status of this Memo

By submitting this Internet-Draft, each author represents that any applicable patent or other IPR claims of which he or she is aware have been or will be disclosed, and any of which he or she becomes aware will be disclosed, in accordance with [Section 6 of BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/1id-abstracts.txt>

The list of Internet-Draft Shadow Directories can be accessed at <http://www.ietf.org/shadow.html>.

### Copyright Notice

Copyright (C) The IETF TRUST (2007).

### Abstract

The LDP specification [[RFC3036](#)] for the Wildcard FEC element has several deficiencies. This document corrects those deficiencies. In addition, it specifies the Typed Wildcard FEC for the Prefix FEC Element Type defined in [RFC3036](#).

## Table of Contents

<a href="#">1</a>	Introduction .....	<a href="#">2</a>
<a href="#">2</a>	Specification Language .....	<a href="#">3</a>
<a href="#">3</a>	The Typed Wildcard FEC Element .....	<a href="#">3</a>
<a href="#">4</a>	Procedures for the Typed Wildcard FEC Element .....	<a href="#">4</a>
5	Typed Wildcard FEC Element for <a href="#">RFC3036</a> Prefix FEC Element	5
<a href="#">6</a>	<a href="#">RFC3036</a> Host and Wildcard FEC Elements .....	<a href="#">5</a>
<a href="#">7</a>	IANA Considerations .....	<a href="#">5</a>
<a href="#">8</a>	Security Considerations .....	<a href="#">6</a>
<a href="#">9</a>	Acknowledgements .....	<a href="#">6</a>
<a href="#">10</a>	References .....	<a href="#">6</a>
<a href="#">11</a>	Author Information .....	<a href="#">7</a>
<a href="#">12</a>	Intellectual Property Statement .....	<a href="#">7</a>
<a href="#">13</a>	Full Copyright Statement .....	<a href="#">8</a>

## [1](#). Introduction

LDP [[RFC3036](#)] distributes labels for Forwarding Equivalence Classes (FECs). LDP uses FEC TLVs in LDP messages to specify FECs. An LDP FEC TLV includes 1 or more FEC Elements. A FEC element includes a FEC type and an optional type-dependent value.

[RFC3036](#) specifies two FEC types (Wildcard and Prefix), and other documents specify additional FEC types; e.g., see [[PWE3](#)] [[MLDP](#)].

As specified in [RFC3036](#) the Wildcard FEC Element refers to all FECs relative to an optional constraint. The only constraint [RFC3036](#) specifies is one that limits the scope of the Wildcard FEC Element to "all FECs bound to a given label".

The [RFC3036](#) specification of the Wildcard FEC Element has the following deficiencies which limit its utility:

1. The Wildcard FEC Element is untyped. There are situations where it would be useful to be able to refer to all FECs of a given type.
2. Use of the Wildcard FEC Element is limited to Label Withdraw and Label Release messages only. There are situations where it would be useful in Label Request messages.



This document addresses these deficiencies by defining a Typed Wildcard FEC Element and procedures for its use. Note that this document does not change procedures specified for the LDP Wildcard FEC Element by [RFC3036](#).

## 2. Specification 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 [\[RFC2119\]](#).

## 3. The Typed Wildcard FEC Element

The Typed Wildcard FEC Element refers to all FECs of a given type relative to an optional constraint. The constraint, if present, is determined from the context in which the Typed Wildcard FEC Element appears.

The format of the Typed Wildcard FEC Element is:

```

      0               1               2
      0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3
+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Typed (IANA) | FEC Element | Len FEC Type |           |
| Wildcard    | Type       | Info         |           |
+---+---+---+---+---+---+---+---+---+---+---+---+---+
|
|           Additional FEC Type-specific Information
|
|                                     +---+---+---+---+---+
+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

where:

**Typed Wildcard:** One octet FEC Element type to be assigned by IANA.

**FEC Element Type:** One octet FEC Element Type that specifies the FEC Element Type to be wildcarded.

**Len FEC Type Info:** One octet that specifies the length of the FEC Type Specific information field. MUST be 0 if there is no Additional FEC Type-specific Information.

**Additional FEC Type-specific Information:** Additional information specific to the FEC Element Type required to fully specify the Typed Wildcard.



Specification of the length and format of Additional FEC Type Specific Information for particular FEC Element Types is outside of the scope of this document.

#### **4. Procedures for the Typed Wildcard FEC Element**

It is the responsibility of the designer of the FEC Element Type to specify whether typed wildcarding is required for the FEC Element Type. When typed wildcarding is supported for a FEC Element Type it is the responsibility of the designer to specify the length and format of any Additional FEC Type Specific Information.

When a FEC TLV contains a Typed Wildcard FEC Element the Typed Wildcard FEC Element MUST be the only FEC Element in the TLV.

An LDP implementation that supports the Typed Wildcard FEC Element MUST support its use in Label Request, Label Withdraw and Label Release messages.

Receipt of a Label Request message with a FEC TLV containing a Typed Wildcard FEC Element is interpreted as a request to send a Label Mapping for all FECs of the type specified by the FEC Element type field in the Typed Wildcard FEC Element encoding.

An LDP implementation that supports the Typed Wildcard FEC Element MUST support the following constraints whenever a Typed Wildcard FEC appears in a Label Withdraw or Label Release message:

1. If the message carries an optional Label TLV the Typed Wildcard FEC Element refers to all FECs of the specified FEC type bound to the specified label.
2. If the message has no Label TLV the Typed Wildcard FEC Element refers to all FECs of the specified FEC type.

Backwards compatibility with a router not supporting the Typed Wildcard FEC element is ensured by the FEC procedures defined in [RFC3036](#). Quoting from [RFC3036](#):

"If it" [an LSR] "encounters a FEC Element type it cannot decode, it SHOULD stop decoding the FEC TLV, abort processing the message containing the TLV, and send an "Unknown FEC" Notification message to its LDP peer signaling an error."

A router receiving a FEC TLV containing a Typed Wildcard FEC element for a FEC Element Type that it either doesn't support or for a FEC Element Type that doesn't support the use of wildcarding MUST stop



decoding the FEC TLV, abort processing the message containing the TLV, and send an "Unknown FEC" Notification message to its LDP peer signaling an error.

## 5. Typed Wildcard FEC Element for [RFC3036](#) Prefix FEC Element

[RFC3036](#) defines the Prefix FEC Element but it does not specify a Typed Wildcard for it. This section specifies the Typed Wildcard FEC Element for [RFC3036](#) Prefix Elements.

The format of the Prefix FEC Typed Wildcard FEC ("Prefix FEC Wildcard" for short) is:

```

      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 | Prefix (2) | 2 | Address... |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| ...Family |
+---+---+---+---+---+---+

```

Address Family: Two octet quantity containing a value from ADDRESS FAMILY NUMBERS in [[IANA-AF](#)].

The procedures of [Section 4](#) apply to the Prefix FEC Wildcard.

## 6. [RFC3036](#) Host and Wildcard FEC Elements

There is no need to specify Typed Wildcard FEC Elements for the Host and Wildcard FEC Elements specified by [RFC3036](#). The [RFC3036](#) Host FEC Element has been removed from rfc3036bis [[RFC3036bis](#)], and the Wildcard FEC Element is untyped by definition.

## 7. IANA Considerations

The Typed Wildcard FEC Element requires a code point from the LDP FEC Type Name Space. IANA manages the FEC TYPE name space as recommended by the following from [[RFC3036](#)]:

"FEC Type Name Space

The range for FEC types is 0 - 255.

Following the policies outlined in [[RFC3036](#)], FEC types in the range 0 - 127 are allocated through an IETF Consensus action, types in the range 128 - 191 are allocated as First Come First





Served, and types in the range 192 - 255 are reserved for Private Use."

The authors recommend that the code point 0x05 from the IETF Consensus range be assigned to the Typed Wildcard FEC Element.

## **8. Security Considerations**

No security considerations beyond those that apply to the base LDP specification and described in [RFC3036] apply to use of the Typed Wildcard FEC Element defined in this document.

## **9. Acknowledgements**

The authors wish to thank Yakov Rehkter for suggesting that the deficiencies of the Wildcard FEC be addressed.

## **10. References**

### Normative References

[RFC3036] Andersson, L., Doolan, P., Feldman, N., Fredette, A. and Thomas, B., "LDP Specification", [RFC 3036](#), January 2001.

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

[IANA-AF] <http://www.iana.org/assignments/address-family-numbers>

### Informative References

[PWE3] Martini, L., Editor, "Pseudowire Setup and Maintenance Using the Label Distribution Protocol (LDP)", [RFC 4447](#), April 2006.

[MLDP] Minei, I., Wijnands, I., Editors, "Label Distribution Protocol Extensions for Point-to-Multipoint and Multipoint-to-Multipoint Label Switched Paths", [draft-ietf-mpls-ldp-p2mp-02.txt](#), Work in Progress, October 2006.

[RFC3036bis] Andersson, L., Minei, I., Thomas, B., Editors, "LDP Specification", [draft-ietf-mpls-rfc3036bis-04.txt](#), Work in Progress, September 2006.



## **11. Author Information**

Bob Thomas  
Cisco Systems, Inc.  
1414 Massachusetts Ave.  
Boxborough MA 01719  
Email: [rhthomas@cisco.com](mailto:rhthomas@cisco.com)

Ina Minei  
Juniper Networks  
1194 North Mathilda Ave.  
Sunnyvale, CA 94089  
Email: [ina@juniper.net](mailto:ina@juniper.net)

## **12. Intellectual Property Statement**

The IETF takes no position regarding the validity or scope of any Intellectual Property Rights or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; nor does it represent that it has made any independent effort to identify any such rights. Information on the procedures with respect to rights in RFC documents can be found in [BCP 78](#) and [BCP 79](#).

Copies of IPR disclosures made to the IETF Secretariat and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this specification can be obtained from the IETF on-line IPR repository at <http://www.ietf.org/ipr>.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to implement this standard. Please address the information to the IETF at [ietf-ipr@ietf.org](mailto:ietf-ipr@ietf.org).



### **13. Full Copyright Statement**

Copyright (C) The IETF Trust (2007).

This document is subject to the rights, licenses and restrictions contained in [BCP 78](#), and except as set forth therein, the authors retain all their rights.

This document and the information contained herein are provided on an "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE/SHE REPRESENTS OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY, THE IETF TRUST AND THE INTERNET ENGINEERING TASK FORCE DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

