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Rajiv Asati  
Cisco Systems

Ina Minei  
Juniper Networks

Bob Thomas

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**Label Distribution Protocol (LDP) 'Typed Wildcard' Forward  
Equivalence Class (FEC)  
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## Abstract

The Label Distribution Protocol (LDP) specification for the Wildcard Forward Equivalence Class (FEC) element has several limitations. This document addresses those limitations by defining a Typed Wildcard FEC element and associated procedures. In addition, it defines a new LDP capability to address backward compatibility.

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## 1. Introduction

LDP [[RFC5036](#)] 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.

[RFC5036](#) specifies two FEC types (Prefix and Wildcard), and other documents specify additional FEC types; e.g., see [[RFC4447](#)] [[MLDP](#)].

As specified by [RFC5036](#), the Wildcard FEC Element refers to all FECs relative to an optional constraint. The only constraint [RFC5036](#) specifies is one that limits the scope of the Wildcard FEC Element to "all FECs bound to a given label".

The [RFC5036](#) 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 (as another constraint).
- 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 to have Wildcard FEC Element, with type constraint, in Label Request messages.

This document:

- Addresses the above limitations by defining a Typed Wildcard FEC Element and procedures for its use.
- Specifies use of the LDP capability mechanism [[RFC5561](#)] at session establishment time for informing a peer that an LDP speaker is capable of handling the Typed Wildcard FEC.
- Specifies use of Typed Wildcard FEC Element in Label Request message.
- Specifies the Typed Wildcard FEC Element for the Prefix FEC Element specified by [RFC5036](#).

Note that this document does not change procedures specified for the LDP Wildcard FEC Element by [RFC5036](#).



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

LDP - Label Distribution Protocol

FEC - Forwarding Equivalence Class

TLV - Type Length Value

LSR - Label Switch Router

## 3. The Typed Wildcard FEC Element

The Typed Wildcard FEC Element refers to all FECs of the specified type that meet the constraint. It specifies a 'FEC Element Type' and an optional constraint, which is intended to provide additional information.

The format of the Typed Wildcard FEC Element is:

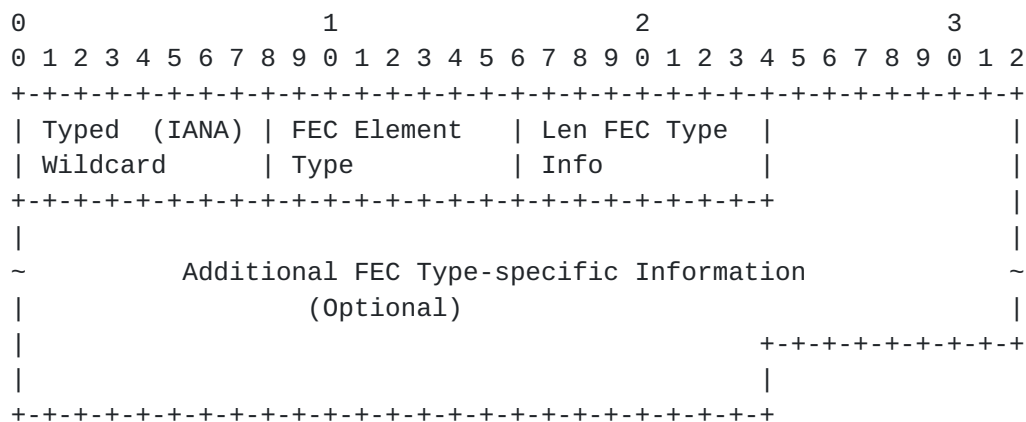


Figure 1 Typed Wildcard FEC Element

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. Please see [section 3.4.1 of RFC5036](#).

Any (future) document specifying new FEC Element Type (not defined in [RFC5630](#)) should prescribe whether typed wildcarding is needed for that FEC Element Type.

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

Additional FEC Type-specific Information: (Optional) Additional information specific to the FEC Element Type required to fully specify the Typed Wildcard. If this field is absent, then all FECs of the specified FEC Type would be matched.

Any (future) document specifying Typed wildcarding for any FEC Element Type should also specify the length and format of Additional FEC Type Specific Information, if included.

This document specifies one FEC Element Type instance (e.g. Prefix FEC) for the 'Typed Wildcard FEC Element' in [section 6](#).

#### **[4. Procedures for the Typed Wildcard FEC Element](#)**

When a FEC TLV contains a Typed Wildcard FEC Element, the Typed Wildcard FEC Element MUST be the only FEC Element in the TLV. If an LDP speaker receives a FEC TLV containing Typed Wildcard FEC Element and any other FEC Elements, then the LDP speaker should ignore the other FEC Elements and continue processing as if the message had contained only the Typed Wildcard FEC Element.

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

An LDP implementation that supports the Typed Wildcard FEC Element MUST support it for every FEC Element Type implemented for which it is defined.



Receipt of a Label Request message with a FEC TLV containing a Typed Wildcard FEC Element is interpreted as a request to send one or more Label Mappings 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 [RFC5036](#). Quoting from [RFC5036](#):

"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 Capability**

As noted above, [RFC5056](#) FEC procedures provide for backward compatibility with an LSR not supporting the Typed Wildcard FEC Element. However, they don't provide means for LSR wishing to use the Typed Wildcard FEC Element to determine whether a peer supports it other than to send a message that uses the FEC Element and to wait and see how the peer responds.

An LDP speaker that supports the Typed Wildcard FEC Element MUST inform its peers of the support by including a Typed Wildcard FEC Element Capability Parameter [[RFC5561](#)] in its Initialization messages.





The Capability Parameter for the Typed Wildcard FEC capability is a TLV with the following format:

```

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| Typed WCard FEC Cap (IANA)|                               Length                               |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|S| Reserved                    |
+---+---+---+---+---+---+---+

```

Figure 2 Typed Wildcard FEC Capability format

Where:

U and F bits : MUST be 1 and 0 respectively as per [section 3](#) of LDP Capabilities [[RFC5561](#)].

Typed WCard FEC Cap : TLV code point to be assigned by IANA.

S-bit : MUST be 1 (indicates that capability is being advertised).

## 6. Typed Wildcard FEC Element for Prefix FEC Element

[RFC5036](#) defines the Prefix FEC Element but it does not specify a Typed Wildcard for it. This section specifies the Typed Wildcard FEC Element for Prefix FEC Elements.

The format of the Prefix FEC Typed Wildcard FEC Element ("Prefix FEC Wildcard" for short), based on Figure 1, 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 2
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Typed Wcard | Type = Prefix | Len = 2 | Address... |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| ...Family   |
+---+---+---+---+---+---+---+

```

Figure 3 Format of Prefix FEC Element using Typed Wildcard

Where:

FEC Element Type : "Prefix" FEC Element (0x02, per [RFC5036](#)).

Len FEC Type Info : Two octets (=0x02).

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

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

## **7. Typed Wildcard FEC Element for Host and Wildcard FEC Elements**

There is no need to specify Typed Wildcard FEC Elements for the Host FEC Element specified by [[RFC3036](#)], nor for the Wildcard FEC Element specified by [RFC5036](#). The [[RFC3036](#)] Host FEC Element has been removed from [RFC5036](#), and the Wildcard FEC Element is untyped by definition.

In other words, the 'FEC Element Type' field in 'Typed Wildcard FEC Element' MUST NOT be 0x01.

## **8. IANA Considerations**

This draft introduces a new LDP FEC Element Type and a new LDP Capability both of which require IANA assignment -

The 'Typed Wildcard' FEC Element requires a code point from the LDP FEC Type Name Space. [[RFC5036](#)] partitions the FEC Type Name Space into 3 regions: IETF Consensus region, First Come First Served region, and Private Use region. The authors recommend that the code point 0x05 from the IETF Consensus range be assigned to the 'Typed Wildcard' FEC Element.

The 'Typed Wildcard FEC' Capability requires a code point from the TLV Type name space. [[RFC5036](#)] partitions the TLV TYPE name space into 3 regions: IETF Consensus region, Vendor Private Use region, and Experimental Use region. The authors recommend that a code point from the IETF Consensus range be assigned to the 'Typed Wildcard FEC' Capability.

## **9. Security Considerations**

No security considerations beyond those that apply to the base LDP specification [[RFC5036](#)] and further described in [[MPLSsec](#)] apply to use of the Typed Wildcard FEC Elements as described in this document.

One could deduce that the security exposure is reduced by this document, since an LDP speaker using Typed Wildcard FEC Element could use a single message to request, withdraw or release all the label mappings of a particular type (a particular AFI, for example), whereas an LDP speaker using Wildcard FEC Element, as defined in based LDP specification [[RFC5036](#)], could use a single message to request, withdraw or release all the label mappings of all types (all AFIs, for example).

## **10. Acknowledgments**

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

## **11. References**

### **11.1. Normative References**

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC5036] Andersson, L., Minei, I., and Thomas, B., "LDP Specification", [RFC 5036](#), October 2007.
- [RFC5561] Thomas, B., Aggarwal, S., Aggarwal, R., Le Roux, J.L., "LDP Capabilities", [RFC5561](#), May 2007.

### **11.2. Informative References**

- [RFC3036] Andersson, L., Doolan, P., Feldman, N., Fredette, A. and Thomas, B., "LDP Specification", [RFC 3036](#), January 2001.
- [RFC4447] Martini, L., Editor, "Pseudowire Setup and Maintenance Using the label Distribution Protocol (LDP)", [RFC4447](#), 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-08.txt](#), Work in Progress, Oct 2009.
- [MPLSsec] Fang, L., "Security Framework for MPLS and GMPLS Networks", [draft-ietf-mpls-mpls-and-gmpls-security-framework-07](#), Work in Progress, Oct 2009.
- [IANA-AF] <http://www.iana.org/assignments/address-family-numbers>.

Author's Addresses

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

Bob Thomas  
Email: [bobthomas@alum.mit.edu](mailto:bobthomas@alum.mit.edu)

Rajiv Asati  
Cisco Systems,  
7025-6 Kit Creek Rd, RTP, NC, 27709-4987  
Email: [rajiva@cisco.com](mailto:rajiva@cisco.com)