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                 Signaling LDP Label Advertisement Completion
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Abstract

There are situations following Label Distribution Protocol (LDP)
session establishment where it would be useful for an LDP speaker to
know when its peer has advertised all of its labels. The LDP
specification provides no mechanism for an LDP speaker to notify a
peer when it has completed its initial label advertisements to that
peer. This document specifies means for an LDP speaker to signal
completion of its initial label advertisements following session
establishment.

Table of Contents

1. Introduction

   There are situations following LDP session establishment where it
   would be useful for an LDP speaker to know when its peer has
   advertised all of the labels from its Label Information Base (LIB).
   For example, when an LDP speaker is using LDP-IGP synchronization
   procedures [RFC5443], it would be useful for the speaker to know when
   its peer has completed advertisement of its IP label bindings.
   Similarly, after an LDP session is re-established when LDP Graceful
   Restart [RFC3478] is in effect, it would be helpful for each peer to
   signal the other after it has advertised all its label bindings.

   The LDP specification [RFC5036] provides no mechanism for an LDP
   speaker to notify a peer when it has completed its initial label
   advertisements to that peer.

   This document specifies use of a Notification message with the "End-
   of-LIB" Status Code for an LDP speaker to signal completion of its
   label advertisements following session establishment.

   RFC5036 implicitly assumes that new Status Codes will be defined over
   the course of time. However, it does not explicitly define the
   behavior of an LDP speaker which does not understand the Status Code
   in a Notification message. To avoid backward compatibility issues
   this document specifies use of the LDP capability mechanism [RFC5561]
   at session establishment time for informing a peer that an LDP
   speaker is capable of handling a Notification message that carries an
   unrecognized Status Code.

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. Unrecognized Notification Capability

An LDP speaker MAY include a Capability Parameter [RFC5561] in the
Initialization message to inform a peer that it ignores Notification
Messages that carry a Status Type-Length-Value (TLV) with a non-fatal
Status Code unknown to it.

The Capability Parameter for the Unrecognized Notification 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| Unrecog Notif (IANA)      |            Length             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|S| Reserved    |
+-+-+-+-+-+-+-+-+
```

Figure 1 Unrecognized Notification Capability format

Where:

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

   Unrecog Notif: TLV code point to be assigned by IANA.

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

Upon receiving a Notification with an unrecognized Status Code an LDP
speaker MAY generate a console or system log message for trouble
shooting purposes.

4. Signaling Completion of Label Advertisement

An LDP speaker that conforms to this specification SHOULD signal
completion of its label advertisements to a peer by means of a
Notification message, if its peer has advertised the Unrecognized
Notification capability during session establishment. The LDP speaker

SHOULD send the Notification message (per Forwarding Equivalence
Class (FEC) Type) to a peer even if the LDP speaker had zero Label
bindings to advertise to that peer.

Such a Notification message MUST carry:

   - A status TLV (with TLV E- and F-bits set to zero) that carries
     an "End-of-LIB" Status Code (value to be assigned by IANA).

   - A FEC TLV with the Typed Wildcard FEC Element [TypedWC] that
     identifies the FEC type for which initial label advertisements
     have been completed. In terms of Section 3.5.1 of RFC5036,
     this TLV is an "Optional Parameter" of the Notification
     message.

An LDP speaker MUST NOT send a Notification which carries a Status
TLV with the End-of-LIB Status Code to a peer unless the peer had
advertised the Unrecognized Notification capability during session
establishment.

This applies to any LDP peers discovered via either basic discovery
or extended discovery mechanism (per section 2.4 of [RFC5036]).

4.1. Missing Expected End-of-LIB Notifications

There is no guarantee that an LDP speaker will receive (or send) End-
of-LIB Notification from (or to) a peer even if the LDP speaker has
signaled the 'Unrecognized Notification' capability (section 3).

  Although it is expected that an LDP speaker supporting Unrecognized
  Notification Capability would support sending and receiving End-of-
  LIB Notication, it is not mandatory by definition.

  Please note that this is not a concern since the LDP speaker would
  simply ignore the received Notification with End-of-LIB status code
  (or any status code) that is not recognized or supported, by
  definition.

To deal with the possibility of missing End-of-LIB Notifications
after the LDP session establishment, an LDP speaker MAY time out
receipt of an expected End-of-LIB Notification. An LDP speaker SHOULD
start a per-peer internal timer, called 'EOL Notification' timer (the
default value of 60 seconds is RECOMMENDED, though the value of this
timer SHOULD be configurable) immediately following the LDP session
establishment.

This timer is reset by the subsequent label advertisement, and
stopped by the End-of-LIB Notification message. Lacking any label
advertisement from the peer, the timer would expire, resulting in the
LDP speaker to behave as if it had received the End-of-LIB
notification from the peer.

If the End-of-LIB Notification message is received after the timer
expires, then the message SHOULD be ignored.

5. Usage Guidelines

The FECs known to an LDP speaker and the labels the speaker has bound
to those FECs may change over the course of time. This makes
determining when an LDP speaker has advertised "all" of its label
bindings for a given FEC type an issue. Ultimately, this
determination is a judgment call the LDP speaker makes. The
following guidelines may be useful.

An LDP speaker is assumed to "know" a set of FECs. Depending on a
variety of criteria, such as:

   - The label distribution control mode in use (Independent or
     Ordered);

   - The set of FEC's to which the speaker has bound local labels;

   - Configuration settings which may constrain which label bindings
     the speaker may advertise to peers;

the speaker can determine the set of bindings for a given FEC type
that it is permitted to advertise to a given peer.

LDP-IGP Sync, LDP Graceful Restart, and the response to a Wildcard
Label Request [TypedWC] are situations that would benefit from End-
of-LIB Notification. In these situations, after an LDP speaker
completes its label binding advertisements to a peer, sending an End-
of-LIB Notification to the peer makes their outcome deterministic.
The following subsections further explain each of these situations
one by one.

5.1. **LDP-IGP Sync**

   The LDP-IGP Synchronization [RFC5443] specifies a mechanism by which
   directly connected LDP speakers may delay the use of the link between
   them, for transit IP traffic forwarding until the labels required to
   support IP over MPLS traffic forwarding have been distributed and
   installed.

   Without an End-of-LIB Notification, the speaker must rely on some
   heuristic to determine when it has received all of its peer's label
   bindings. The heuristic chosen could cause LDP to signal the IGP too
   soon in which case the likelihood that traffic will be dropped
   increases, or too late in which case traffic is kept on sub-optimal
   paths longer than necessary.

   Following session establishment, with a directly connected peer that
   has advertised the Unrecognized Notification capability, an LDP
   speaker using LDP-IGP Sync may send the peer an End-of-LIB
   Notification after it completes advertisement of its IP label
   bindings to the peer. Similarly, the LDP speaker may use the End-of-
   LIB Notification received from a directly connected peer to determine
   when the peer has completed advertisement of its label bindings for
   IP prefixes. After receiving the notification, the LDP speaker
   should consider LDP to be fully operational for the link and signal
   the IGP to start advertising the link with normal cost.

5.2. **LDP Graceful Restart**

   LDP Graceful Restart [RFC3478] helps to reduce the loss of MPLS
   traffic caused by the restart of a router's LDP component. It
   defines procedures that allow routers capable of preserving MPLS
   forwarding state across the restart to continue forwarding MPLS
   traffic using forwarding state installed prior to the restart for a
   configured time period.

   The current behavior without End-of-LIB Notification is as follows:
   the restarting router and its peers consider the preserved forwarding
   state to be usable but stale until it is refreshed by receipt of new
   label advertisements following re-establishment of new LDP sessions
   or until the time period expires. When the time period expires, any
   remaining stale forwarding state is removed by the router.

   Receiving End-of-LIB Notification from a peer in an LDP Graceful
   Restart scenario enables an LDP speaker to stop using stale
   forwarding information learned from that peer and to recover the

resources it requires without having to wait until the time period
expiry. The time period expiry can still be used if the End-of-LIB-
Notification message is not received.

5.3. Wildcard Label Request

When an LDP speaker receives a Label Request message for a Typed
Wildcard FEC (e.g. a particular FEC element type) from a peer it
determines the set of bindings, it is permitted to advertise the peer
for the FEC type specified by the request. Assuming the peer had
advertised the Unrecognized Notification capability at session
initialization time, the speaker should send the peer an End-of-LIB
Notification for the FEC type when it completes advertisement of the
permitted bindings.

As in the previous applications, receipt of the Notification
eliminates uncertainty as to when the peer has completed its
advertisements of label bindings for the requested Wildcard FEC
Element Type.

6. Security Considerations

No security considerations beyond those that apply to the base LDP
specification [RFC5036] and further described in [MPLSsec] apply to
signaling the End-of-LIB condition as described in this document.

7. IANA Considerations

This draft introduces a new LDP Status Code and a new LDP Capability
both of which require IANA assignment -

   The 'End-of-LIB' status code requires a code point from the Status
   Code Name Space. [RFC5036] partitions the Status Code Name Space
   into 3 regions: IETF Consensus region, First Come First Served
   region, and Private Use region. The authors recommend that a code
   point from the IETF Consensus range be assigned to the 'End-of-
   LIB' status code.

   The 'Unrecognized Notification' Capability requires a code point
   from the TLV Type name space. [RFC5036] partitions the TLV TYPE
   name space into 3 regions: IETF Consensus region, First Come

First Served region, and Private Use region. The authors
recommend that a code point from the IETF Consensus range be
assigned to the 'Unrecognized Notification' Capability.

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9. References

9.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
          Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC5036] Andersson, L., Doolan, P., Feldman, N., Fredette, A. and
          Thomas, B., "LDP Specification", RFC 5036, January 2001.

[RFC5561] Thomas, B., Aggarwal, S., Aggarwal, R., Le Roux, J.L., "LDP
          Capabilities", RFC5561, May 2007.

[TypedWC] Thomas, B., Minei, I., "LDP Typed Wildcard FEC", draft-
          ietf-mpls-ldp-typed-wildcard-03, Work in Progress, March
          2008.

9.2. Informative References

[RFC5443] Jork, M., Atlas, A., Fang, L., "LDP IGP Synchronization",
          RFC5443, Dec 2007.

[RFC3478] Leelanivas, M., Rekhter, Y., Aggarwal, R., "Graceful
          Restart Mechanism for Label Distribution Protocol",
          February 2003.

[MPLSsec] Fang, L., "Security Framework for MPLS and GMPLS Networks",
          draft-ietf-mpls-mpls-and-gmpls-security-framework-06, Work
          in Progress, July 13 2009.

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