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                            LDP End-of-LIB

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Abstract

    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 its labels. These include session establishment
    when LDP-IGP sync is in use and session re-establishment following
    loss of an LDP session when LDP graceful restart is in use. 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.

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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 its labels. For example, when an LDP speaker is
using LDP-IGP synchronization procedures [LDPSynch] 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 [LDPCap]
at session establishment time for informing a peer that an LDP
speaker is capable of handling Notification messages that carry
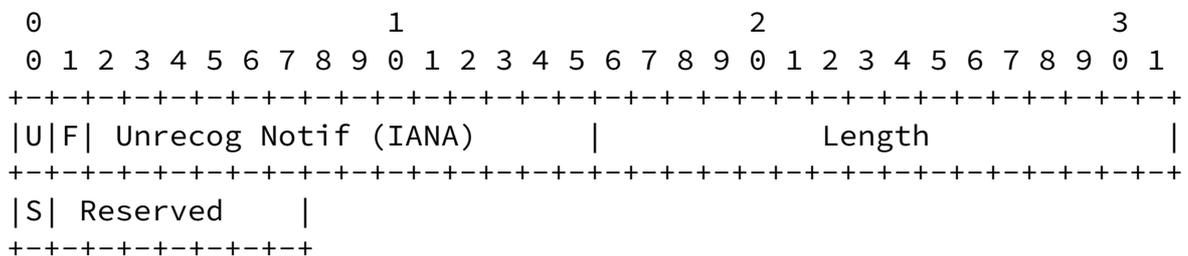unrecognized Status Codes.

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 [LDPCap] in an
   Initialization message to inform a peer that it ignores Notification
   Messages that carry a Status 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     |
   +-+-+-+-+-+-+-+-+-+
```

   where:

     U and F bits: As specified by RFC5036.

     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 MAY signal completion of its label advertisements to a
   peer by means of a Notification message if its peer had advertised
   the Unrecognized Notification capability during session
   establishment.

   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. End-of-LIB is a new Status Code.

     - 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 unless its peer had advertised
   the Unrecognized Notification capability during session
   establishment.

5. Usage Guidelines

   The FEC's known to an LDP speaker and the labels the speaker has
   bound to those FEC's 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 judgement call the LDP speaker makes. The
   following guidelines may be useful.

   An LDP speaker is assumed to "know" a set of FEC's. 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.

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 it should send the peer an
End-of-LIB Notification. The following considers each of these
situations in turn.

5.1. IGP-Sync

LDP-IGP Sync is a mechanism directly connected LDP speakers may use
to delay using the link connecting them for IP traffic until the
labels required to support IP over MPLS traffic on the link have been
learned.

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

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Notification after it completes advertisement of its IP label
bindings to the peer. The LDP speaker may use an End-of-LIB
Notification from a directly connected peer to determine when the
peer has completed its label advertisements for IP prefixes. After
the speaker has exchanged End-of-LIB Notifications with the peer the
speaker should consider LDP to be fully operational for the link to
the peer and should signal the IGP to start advertising the link with
normal cost.

5.2. LDP Graceful Restart

LDP Graceful Restart helps 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 for a pre-agreed upon
period using forwarding state installed prior to the restart.

During that period 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. When the period elapses any
remaining stale forwarding state is removed by the router.

Receipt of the 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 timeout
occurs.

5.3. Wildcard Label Request

When an LDP speaker receives a Label Request message for a Typed
Wildcard FEC 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.

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5.4. Missing Expected End-of-LIB Notifications

There is no guarantee that an LDP speaker will receive End-of-LIB
Notifications from a peer in a situation where it may be used.

Therefore, in situations where the End-of-LIB Notification may be
used an implementation SHOULD NOT depend on the receipt of the
notification.

To deal with the possibility of missing notifications an LDP speaker
may time out receipt of an expected End-of-LIB Notification, and if
the timeout occurs may behave as if it had received the notification.

6. IANA Considerations

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

7. Security Considerations

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

8. References

Normative References

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