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Experience with the Label Distribution Protocol (LDP)

Status of This Memo

Abstract

The purpose of this memo is to document how some of the requirements specified in RFC 1264 for advancing protocols developed by working groups within the IETF Routing Area to Draft Standard have been satisfied by LDP (Label Distribution Protocol). Specifically, this report documents operational experience with LDP, requirement 5 of section 5.0 in RFC 1264.

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1. Introduction

The purpose of this memo is to document how some of the requirements specified in [RFC1264] for advancing protocols developed by working groups within the IETF Routing Area to Draft Standard have been satisfied by LDP. Specifically, this report documents operational experience with LDP, requirement 5 of section 5.0 in RFC 1264.

LDP was originally published as [RFC3036] in January 2001. It was produced by the MPLS Working Group of the IETF and was jointly authored by Loa Andersson, Paul Doolan, Nancy Feldman, Andre Fredette, and Bob Thomas. It has since been obsoleted by [RFC5036].

2. Operational Experience

This section discusses operational experience with the protocol. The information is based on a survey sent to the MPLS Working Group in October 2004. The questionnaire can be found in the MPLS Working Group mail archives for October 2004.

11 responses were received, all but 2 requesting confidentiality. The survey results are summarized to maintain confidentiality. The networks surveyed span different geographic locations: US, Europe, and Asia. Both academic and commercial networks responded to the survey.

2.1. Environment and Duration

The size of the deployments ranges from less than 20 Label Switching Routers (LSRs) to over 1000 LSRs. Eight out of the 11 deployments use LDP in the edge and the core, two on the edge only, and one in the core only.

Sessions exist to peers discovered via both the basic and the extended discovery mechanisms. In half the cases, more than one adjacency (and as many as four adjacencies) are maintained per session. The average number of LDP sessions on an LSR ranges from under 10 to just over 80. The responses are spread out as follows: under 10: 4 responses, 20-50: 4 responses, and over 80: 1 response.

In the surveyed networks, the time LDP has been deployed ranges from under 1 year to over 4 years. The responses are spread out as follows: under 1 year: 3 responses, 2 years: 2 responses, 3 years: 3 responses, and over 4 years: 3 responses.

2.2. Applications and Motivation

Nine of the 11 responses list Layer 3 Virtual Private Networks (L3VPNs) as the application driving the LDP deployment in the network.

The list of applications is as follows: L3VPNs: 9, pseudowires: 4 current (and one planned deployment), L2VPNs: 4, forwarding based on labels: 2, and BGP-free core: 1.

There are two major options for label distribution protocols, LDP and Resource Reservation Protocol-Traffic Engineering (RSVP-TE). One of the key differences between the two is that RSVP-TE has support for traffic engineering, while LDP does not. The reasons cited for picking LDP as the label distribution protocol are:

- The deployment does not require traffic engineering - 6
- Inter-operability concerns if a different protocol is used - 5
- Equipment vendor only supports LDP - 5
- Ease of configuration - 4
- Ease of management - 3
- Scalability concerns with other protocols - 3
- Required for a service offering of the service provider - 1

2.3. Protocol Features

All deployments surveyed use the Downstream Unsolicited Label Distribution mode. All but one deployment use Liberal Label retention (one uses conservative).

LSP setup is established with both independent and Ordered Control. Five of the deployments use both control modes in the same network.

The number of LDP Forwarding Equivalence Classes (FECs) advertised and LDP routes installed falls in one of two categories: 1) roughly the same as the number of LSRs in the network and 2) roughly the same as the number of IGP routes in the network. Of the 8 responses that were received, 6 were in the first category and 2 in the second.

2.4. Security Concerns

A security concern was raised by one of the operators with respect to the lack of a mechanism for securing LDP Hellos.

2.5. Implementations and Inter-Operability

Eight of the 11 responses state that more than one implementation (and as many as four different ones) are deployed in the same network.

The consensus is that although implementations differ, no inter-operability issues exist. The challenges listed by providers running multiple implementations are:

- Different flexibility in picking for which FECs to advertise labels.
- Different flexibility in setting transport and LDP router-id addresses.
- Different default utilization of LDP labels for traffic resolution. Some vendors use LDP for both VPN and IPv4 traffic forwarding, while other vendors allow only VPN traffic to resolve via LDP. The challenge is to restrict the utilization of LDP labels to VPN traffic in a mixed-vendor environment.
- Understanding the differences in the implementations.

2.6. Operational Experience

In general, operators reported stable implementations and steady improvement in resiliency to failure and convergence times over the years. Some operators reported that no issues were found with the protocol since deploying.

The operational issues reported fall in three categories:

1. Configuration issues. Both the session and adjacency endpoints must be allowed by the firewall filters. Misconfiguration of the filters causes sessions to drop (if already established) or not to establish.
2. Vendor bugs. These include traffic blackholing, unnecessary label withdrawals and changes, session resets, and problems migrating from older versions of the technology. Most reports stated that the problems reported occurred in early versions of the implementations.

3. Protocol issues.

   - The synchronization required between LDP and the IGP was listed as the main protocol issue. Two issues were reported: 1) slow convergence, due to the fact that LDP convergence time is tied to the IGP convergence time, and 2) traffic blackholing on a link-up event. When an interface comes up, the LDP session may come up slower than the IGP session. This results in dropping MPLS traffic for a link-up event (not a failure but a restoration). This issue is described in more detail in [LDP-SYNC].

   - Silent failures. Failure not being propagated to the head end of the LSP when setting up LSPs using independent control.

3. Security Considerations

This document is a survey of experiences from deployment of LDP implementations; it does not specify any protocol behavior. Thus, security issues introduced by the document are not discussed.

4. Acknowledgments

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5. References

5.1. Normative References

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