

Network Working Group  
Request for Comments: 3213  
Category: Informational

J. Ash  
AT&T  
M. Girish  
Atoga Systems  
E. Gray  
Sandburst  
B. Jamoussi  
G. Wright  
Nortel Networks Corp.  
January 2002

## Applicability Statement for CR-LDP

### Status of this Memo

This memo provides information for the Internet community. It does not specify an Internet standard of any kind. Distribution of this memo is unlimited.

### Copyright Notice

Copyright (C) The Internet Society (2002). All Rights Reserved.

### Abstract

This document discusses the applicability of Constraint-Based LSP Setup using LDP. It discusses possible network applications, extensions to Label Distribution Protocol (LDP) required to implement constraint-based routing, guidelines for deployment and known limitations of the protocol. This document is a prerequisite to advancing CR-LDP on the standards track.

## 1. Introduction

As the Internet evolves, additional capabilities are required to ensure proper treatment of data [3], voice, video and other delay sensitive traffic [4]. MPLS enhances source routing and allows for certain techniques, used in circuit switching, in IP networks. This permits a scalable approach to handling these diverse transmission requirements. CR-LDP [1] is a simple, scalable, open, non-proprietary, traffic engineering signaling protocol for MPLS IP networks.

CR-LDP provides mechanisms for establishing explicitly routed Label Switched Paths (LSPs). These mechanisms are defined as extensions to LDP [2]. Because LDP is a peer-to-peer protocol based on the

establishment and maintenance of TCP sessions, the following natural benefits exist:

CR-LDP messages are reliably delivered by the underlying TCP, and State information associated with explicitly routed LSPs does not require periodic refresh.

CR-LDP messages are flow controlled (throttled) through TCP.

CR-LDP is defined for the specific purpose of establishing and maintaining explicitly routed LSPs. Additional optional capabilities included have minimal impact on system performance and requirements when not in use for a specific explicitly routed LSP. Optional capabilities provide for negotiation of LSP services and traffic management parameters over and above best-effort packet delivery including bandwidth allocation, setup and holding priorities. CR-LDP optionally allows these parameters to be dynamically modified without disruption of the operational (in-service) LSP [4].

CR-LDP allows the specification of a set of parameters to be signaled along with the LSP setup request. Moreover, the network can be provisioned with a set of edge traffic conditioning functions (which could include marking, metering, policing and shaping). This set of parameters along with the specification of edge conditioning functions can be shown to be adequate and powerful enough to describe, characterize and parameterize a wide variety of QoS scenarios and services including IP differentiated services [5], integrated services [6], ATM service classes [7], and frame relay [8].

CR-LDP is designed to adequately support the various media types that MPLS was designed to support (ATM, FR, Ethernet, PPP, etc.). Hence, it will work equally well for Multi-service switched networks, router networks, or hybrid networks.

This applicability statement does not preclude the use of other signaling and label distribution protocols for the traffic engineering application in MPLS based networks. Service providers are free to deploy whatever signaling protocol meets their needs.

In particular CR-LDP and RSVP-TE [9] are two signaling protocols that perform similar functions in MPLS networks. There is currently no consensus on which protocol is technically superior. Therefore, network administrators should make a choice between the two based upon their needs and particular situation. Applicability of RSVP-TE is described in [10].

## 2. Applicability of extensions to LDP

To provide support of additional LSP services, CR-LDP extensions are defined in such a way as to be directly translatable to objects and messages used in other protocols defined to provide similar services [9]. Implementations can take advantage of this fact to:

Setup LSPs for provision of an aggregate service associated with the services being provided via these other protocols.

Directly translate protocol messages to provide services defined in a non-CR-LDP portion of the network.

Describe, characterize and parameterize a wide variety of QoS scenarios and services including IP differentiated services, integrated services, ATM service classes, and frame relay.

Steady state information required for proper maintenance of an LSP may be as little as 200 bytes or less. It is not unreasonable to anticipate that CR-LDP implementations may support in excess of one hundred thousand or one million LSPs switched through a single Label Switching Router (LSR) under fairly stable conditions.

Because CR-LDP provides for low overhead per LSP - both in terms of needed state information and control traffic - CR-LDP is applicable in those portions of the Internet where very large numbers of LSPs may need to be switched at each LSR. An example of this would be large backbone networks using MPLS exclusively to transport very large numbers of traffic streams between a moderately large number of MPLS edge nodes.

CR-LDP may also be applicable as a mediating service between networks providing similar service extensions using widely varying signaling models.

## 3. Implementation and deployment considerations in relation to LDP

LDP specifies the following label distribution and management modes (which can be combined in various logical ways described in LDP):

- . Downstream On Demand label distribution
- . Downstream Unsolicited label distribution
- . Independent Label Distribution Control
- . Ordered Label Distribution Control
- . Conservative Label Retention Mode
- . Liberal Label Retention Mode

The applicability of LDP is described in [11].

In networks where only Traffic Engineered LSPs are required, the CR-LDP implementation and deployment does NOT require all the functionality defined in the LDP specification. The basic Discovery, Session, and Notification messages are required. However, CR-LDP requires one specific combination of the label distribution modes:

- . Downstream On Demand Ordered label distribution and conservative Label Retention Mode

Although CR-LDP is defined as an extension to LDP, support for Downstream Unsolicited Label Advertisement and Independent Control modes is not required for support of Strict Explicit Routes. In addition, implementations of CR-LDP MAY be able to support Loose Explicit Routes via the use of 'Abstract Nodes' and/or 'Hierarchical Explicit Routing', without using LDP for hop-by-hop LSP setup.

CR-LDP also includes support for loose explicit routes. Use of this capability allows the network operator to define an 'explicit path' through portions of their network with imperfect knowledge of the entire network topology. Proper use of this capability may also allow CR-LDP implementations to inter-operate with 'vanilla' LDP implementations - particularly if it is desired to set up an explicitly routed LSP for best-effort packet delivery via a loosely defined path.

Finally, in networks where both Routing Protocol-driven LSPs (a.k.a. hop-by-hop LSPs) and Traffic Engineered LSPs are required, a single protocol (LDP, with the extensions defined in CR-LDP) can be used for both TE and Hop-by-Hop LSPs. New protocols do not have to be introduced in the network to provide TE-LSP signaling.

#### 4. Limitations

CR-LDP specification only supports point-to-point LSPs. Multi-point-to-point and point-to-multi-point are for further study (FFS).

CR-LDP specification only supports unidirectional LSP setup. Bi-directional LSP setup is FFS.

CR-LDP specification only supports a unique label allocation per LSP setup. Multiple label allocations per LSP setup are FFS.

#### 5. Security Considerations

No additional security issues are introduced in this document. As an extension to LDP, CR-LDP shares the security concerns associated with LDP.

## 6. Acknowledgements

The authors would like to thank the following people for their careful review of the document and their comments: Loa Andersson, Peter Ashwood-Smith, Anoop Ghanwani, Juha Heinanen, Jon Weil and Adrian Farrel.

## 7. References

- [1] Jamoussi, B., Andersson, L., Callon, R., Dantu, R., Wu, L., Doolan, P., Worster, T., Feldman, N., Fredette, A., Girish, M., Gray, E., Heinanen, J., Kilty, T. and A. Malis, "Constraint-based LSP Setup Using LDP", RFC 3212, January 2002.
- [2] Andersson, L., Doolan, P., Feldman, N., Fredette, A. and B. Thomas, "LDP Specification", RFC 3036, January 2001.
- [3] Awduche, D., Malcolm, J., Agogbua, J., O'Dell, M. and J. McManus, "Requirements for Traffic Engineering Over MPLS", RFC 2702, September 1999.
- [4] Ash, B., Lee, Y., Ashwood-Smith, P., Jamoussi, B., Fedyk, D., Skalecki, D. and L. Li, "LSP Modification using CR-LDP", RFC 3214, January 2002.
- [5] Blake S., Black, D., Carlson, M., Davies, E., Wang, Z. and W. Weiss, "An Architecture for Differentiated Services", RFC 2475, December 1998.
- [6] Shenker, S. and J. Wroclawski, "General Characterization Parameters for Integrated Service Network Elements", RFC 2215, September 1997.
- [7] ATM Forum Traffic Management Specification Version 4.1 (AF-TM-0121.000), March 1999.
- [8] CONGESTION MANAGEMENT FOR THE ISDN FRAME RELAYING BEARER SERVICE, ITU (CCITT) Recommendation I.370, 1991.
- [9] Awduche, D., Berger, L., Gan, D., Li, T., Srinivasan, V. and G. Swallow, "RSVP-TE: Extensions to RSVP for LSP Tunnels", RFC 3209, December 2001.
- [10] Awduche, D., Hannan, A. and X. Xiao, "Applicability Statement for Extensions to RSVP for LSP-Tunnels", RFC 3210, December 2001.

[11] Thomas, B. and E. Gray, "LDP Applicability", RFC 3037, January 2001.

## 8. Author's Addresses

Gerald R. Ash  
AT&T  
Room MT D5-2A01  
200 Laurel Avenue  
Middletown, NJ 07748  
USA  
Phone: 732-420-4578  
Fax: 732-368-8659  
EMail: gash@att.com

Eric Gray  
Sandburst  
600 Federal Drive  
Andover, MA 01810  
Phone: (978) 689-1610  
EMail: eric.gray@sandburst.com

Gregory Wright  
Nortel Networks Corp.  
P O Box 3511 Station C  
Ottawa, ON K1Y 4H7  
Canada  
Phone: +1 613 765-7912  
EMail: gwright@nortelnetworks.com

M. K. Girish  
Atoga Systems  
49026 Milmont Drive  
Fremont, CA 94538  
EMail: muckai@atoga.com

Bilel Jamoussi  
Nortel Networks Corp.  
600 Technology Park Drive  
Billerica, MA 01821  
USA  
phone: +1 978-288-4506  
EMail: Jamoussi@nortelnetworks.com

## 9. Full Copyright Statement

Copyright (C) The Internet Society (2002). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS 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.

## Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.

