                 Applicability Statement for CR-LDP

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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.

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