MPLS Working Group
Internet-Draft
Intended status: Informational
Expires: September 2, 2018

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March 1, 2018

Deprecating MD5 for LDP
draft-nslag-ietf-deprecate-md5-00.txt

Abstract

When the MPLS Label Distribution Protocol (LDP) was specified circa 1999, there were very strong requirements that LDP should use a cryptographic hash function to sign LDP protocol messages. MD5 was widely used at that time, and was the obvious choices.

However, even when this decision was being taken there were concerns as to whether MD5 was a strong enough signing option. This discussion was briefly reflected in section 5.1 of RFC 5036 [RFC5036] (and also in RFC 3036 [RFC3036]).

Over time it has been shown that MD5 can be compromised. Thus, there is a concern shared in the security community and the working groups responsible for the development of the LDP protocol that LDP is no longer adequately secured.

This document deprecates MD5 as the signing method for LDP messages. The document also selects a future method to secure LDP messages - the choice is TCP-AO. In addition, we specify that the TBD cryptographic mechanism is to be the default TCP-AO security method.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at https://datatracker.ietf.org/drafts/current/.

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1. Introduction

RFC 3036 was published in January 2001 as a Proposed Standard, and it was replaced by RFC 5035, which is a Draft Standard, in October 2007. Two decades after LDP was originally specified there is a concern shared by the security community and the IETF working groups that develop the LDP protocol that LDP is no longer adequately secured.

LDP currently uses MD5 to cryptographically sign its messages for security security purposes. However, MD5 is a hash function that is no longer considered adequate to meet current security requirements.

1.1. Requirement Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

2. Background

2.1. LDP in RFC 5036

In Section 5.1 "Spoofing" of RFC 5036 [RFC5036], in list item 2 "Session communication carried by TCP" the following statements are made:

> LDP specifies use of the TCP MD5 Signature Option to provide for the authenticity and integrity of session messages.
>
> RFC 2385 [RFC2385] asserts that MD5 authentication is now considered by some to be too weak for this application. It also points out that a similar TCP option with a stronger hashing algorithm (it cites SHA-1 as an example) could be deployed. To our knowledge, no such TCP option has been defined and deployed. However, we note that LDP can use whatever TCP message digest techniques are available, and when one stronger than MD5 is specified and implemented, upgrading LDP to use it would be relatively straightforward.

2.2. MD5 in BGP

There has been a similar discussion among working groups developing the BGP protocol. BGP has already replaced MD5 with TCP-AO. This was specified in RFC 7454 [RFC7454].

To secure LDP the same approach will be followed, TCP-AO will be used for LDP also.

As far as we are able to ascertain, there is currently no recommended, mandatory to implement, cryptographic function specified. We are concerned that without such a mandatory function, implementations will simply fall back to MD5 and nothing will really be changed. The MPLS working group will need the expertise of the

security community to specify a viable security function that is suitable for wide scale deployment on existing network platforms.

2.3. Prior Art

RFC 6952 [RFC6952] dicusses a set of routing protocols that all are using TCP for transport of protocol messages, according to guidelines set forth in Section 4.2 of "Keying and Authentication for Routing Protocols Design Guidelines", RFC 6518 [RFC6518].

RFC 6952 takes a much broader approach than this document, it discusses several protcols and also securing the LDP session initialization. This document has a narrower scope, securing LDP session messages only. LDP in initialization mode is addressed in RFC 7349 [RFC7349].

RFC 6952 and this document, basically suggest the same thing, move to TCP-AO and deploy a strong cryotoigraphic algorithm.

All the protcols discuseed in RFC 6952 should adopt the approach to securing protocol messages over TCP.

3. Securing LDP

Implementations conforming to this RFC MUST implement TCP-AO to secure the TCP sessions carrying LDP in addition to the currently required TCP MD5 Signature Option.

A TBD cryptographic mechanism must be implemented and provided to TCP-AO to secure LDP messages.

The TBD mechanism is the preferred option, and MD5 SHOULD only to be used when TBD is unavailable.

Note: The authors are not experts on this part of the stack, but it seems that TCP security negotiation is still work in progress. If we are wrong, then we need to include a requirement that such negotiation is also required. In the absence of a negotiation protocol, however, we need to leave this as a configuration process until such time as the negotiation protocol work is complete. On completion of a suitable negotiation protocol we need to issue a further update requiring its use.

Cryptographic mechanisms do not have an indefinite lifetime, the IETF hence anticipates updating default cryptographic mechanisms over time.

The TBD default security function will need to be chosen such that it can reasonably be implemented on a typical router route processor, and which will provide adequate security without significantly degrading the convergence time of a Label Switching Router (LSR).

Without a function that does not significantly impact router convergence we simply close one vulnerability and open another.

Note: As experts on the LDP protocol, but not on security mechanisms, we need to ask the security area for a review of our proposed approach, and help correcting any misunderstanding of the security issues or our misunderstanding of the existing security mechanisms. We also need a recommendation on a suitable security function (TBD in the above text).

4. Security Considerations

This document is entirely about LDP operational security. It describes best practices that one should adopt to secure LDP messages and the TCP based LDP sessions between LSRs.

This document does not aim to describe existing LDP implementations, their potential vulnerabilities, or ways they handle errors. It does not detail how protection could be enforced against attack techniques using crafted packets.

5. IANA Considerations

There are no requests for IANA actions in this document.

Note to the RFC Editor - this section can be removed before publication.

6. Acknowledgements

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7. References

7.1. Normative References

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