

Expiration Date: September 2004

March 2004

Standards Maturity Variance Regarding the TCP MD5 Signature Option ([RFC 2385](#)) and the BGP-4 Specification

[draft-iesg-tcpmd5app-00.txt](#)

Status of this Memo

This document is an Internet-Draft and is in full conformance with all provisions of [Section 10 of RFC2026](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/1id-abstracts.txt>

The list of Internet-Draft Shadow Directories can be accessed at <http://www.ietf.org/shadow.html>.

Abstract

The IETF Standards Process requires that all normative references for a document be at the same or higher level of standardization. [RFC 2026 section 9.1](#) allows the IESG to grant a variance to the standard practices of the IETF. This document explains why the IESG is considering doing so for the revised version of the BGP-4 specification, which refers normatively to [RFC 2385](#), "Protection of BGP Sessions via the TCP MD5 Signature Option". [RFC 2385](#) will remain at the Proposed Standard level.

1. Introduction

The IETF Standards Process [[RFC2026](#)] requires that all normative references for a document be at the same or higher level of standardization. [RFC 2026 section 9.1](#) allows the IESG to grant a variance to the standard practices of the IETF. Pursuant to that, it is considering publishing the updated BGP-4 specification [[RLH](#)] as Draft Standard, despite the normative reference to [[RFC2385](#)], "Protection of BGP Sessions via the TCP MD5 Signature Option"; that protocol will remain a Proposed Standard.

[[RFC2385](#)], which is widely implemented, is the only transmission security mechanism defined for BGP-4. Other possible mechanisms, such as IPsec [[RFC2401](#)] and TLS [[RFC2246](#)], are rarely, if ever, used for this purpose. Given the long-standing requirement for security features in protocols, it is not possible to advance BGP-4 with no mandated security mechanism.

The conflict of maturity levels between specifications would normally be resolved by advancing the specification being referred to along the standards track to the level of maturity that the referring specification needs to achieve. However, in the particular case considered here, the IESG believes that [[RFC2385](#)], though adequate for BGP deployments at this moment, is not strong enough for general use, and thus should not be progressed along the standards track. In this situation, the IESG believes that variance procedure should be used to allow the updated BGP-4 specification to be published as Draft Standard.

The following sections of the document give detailed explanations of the statements above.

2. Draft Standard Requirements

The requirements for Proposed Standards and Draft Standards are given in [[RFC2026](#)]. For Proposed Standards, [[RFC2026](#)] warns that:

Implementors should treat Proposed Standards as immature specifications. It is desirable to implement them in order to gain experience and to validate, test, and clarify the specification. However, since the content of Proposed Standards may be changed if problems are found or better solutions are identified, deploying implementations of such standards into a disruption-sensitive environment is not recommended.

In other words, it is considered reasonable for flaws to be discovered in Proposed Standards.

The requirements for Draft Standards are higher:

A Draft Standard must be well-understood and known to be quite stable, both in its semantics and as a basis for developing an implementation.

In other words, any document that has known deficiencies should not be promoted to Draft Standard.

3. The TCP MD5 Signature Option

[[RFC2385](#)], despite its 1998 publication date, describes a Message Authentication Code (MAC) that is considerably older. It utilizes a technique known as a "keyed hash function", using MD5 [[RFC1321](#)] as the hash function. At the time the original code was developed, this was believed to be a reasonable technique, especially if the key was appended to the data being protected, rather than being prepended. But cryptographic hash functions were never intended for use as MACs, and later cryptanalytic results showed that the construct was not as strong as was originally believed [[PV1](#),[PV2](#)]. Worse yet, the underlying hash function, MD5, has shown signs of weakness [[Dobbertin](#)]. Accordingly, the IETF community has adopted HMAC [[RFC2104](#)], a scheme with provable security properties, as its standard MAC.

Beyond that, [[RFC2385](#)] does not include any sort of key management technique. Common practice is to use a password as a shared secret between pairs of sites. This is not a good idea [[RFC3562](#)].

Other problems are documented in [[RFC2385](#)] itself, including the lack of a type code or version number, and the inability of systems using this scheme to accept certain TCP resets.

Despite the widespread deployment of [[RFC2385](#)] in BGP deployments, the IESG has thus concluded that it is not appropriate for use in other contexts. [[RFC2385](#)] is not suitable for advancement to Draft Standard.

4. Usage Patterns for [RFC 2385](#)

Given the above analysis, it is reasonable to ask why [\[RFC2385\]](#) is still used for BGP. The answer lies in the deployment patterns peculiar to BGP.

BGP connections inherently tend to travel over short paths. Indeed, most external BGP links are one hop. Furthermore, though internal BGP sessions are usually multi-hop, the links involved are generally inhabited only by routers rather than general-purpose computers; general-purpose computers are easier for attackers to use as TCP hijacking tools [\[Joncheray\]](#).

It is also the case that BGP peering associations tend to be long-lived and static. By contrast, many other security situations are more dynamic.

This is not to say that such attacks cannot happen. (If they couldn't happen at all, there would be no point to any security measures.) Attackers could divert links at layers 1 or 2, or they could (in some situations) use ARP-spoofing at Ethernet-based exchange points. Still, on balance, BGP is employed in an environment that is less susceptible to this sort of attack.

There is another class of attack against which BGP is extremely vulnerable: false route advertisements from more than one autonomous system (AS) hop away. However, neither [\[RFC2385\]](#) nor any other transmission security mechanism can block such attacks. Rather, a scheme such as S-BGP [\[Kent\]](#) would be needed.

5. LDP

The Label Distribution Protocol (LDP) [\[RFC3036\]](#) also uses [\[RFC2385\]](#). Since LDP connections are always between routers and are always one hop long, the threat environment is similar to BGP's. Accordingly, we are not deprecating [\[RFC2385\]](#) for use with LDP.

6. Security Considerations

The IESG believes that the variance described here will not affect the security of the Internet.

7. Conclusions

Given the above analysis, the IESG is persuaded that waiving the prerequisite requirement is the appropriate thing to do. [[RFC2385](#)] is clearly not suitable for Draft Standard. Other existing mechanisms, such as IPsec, would do its job better. However, given the current operational practices in service provider networks at the moment -- and in particular the common use of long-lived standard keys, [[RFC3562](#)] notwithstanding -- the marginal benefit of such schemes in this situation would be low, and not worth the transition effort. We would prefer to wait for a security mechanism tailored towards the major threat environment for BGP.

8. References

- [Dobbertin] H. Dobbertin, "The Status of MD5 After a Recent Attack", RSA Labs' CryptoBytes, Vol. 2 No. 2, Summer 1996.
- [Joncheray] Joncheray, L. "A Simple Active Attack Against TCP." Proceedings of the Fifth Usenix Unix Security Symposium, 1995.
- [Kent] Kent, S., C. Lynn, and K. Seo. "Secure Border Gateway Protocol (Secure-BGP)." IEEE Journal on Selected Areas in Communications, vol. 18, no. 4, April, 2000, pp. 582-592.
- [RFC3562] Leech, M. "Key Management Considerations for the TCP MD5 Signature Option". [RFC 3562](#). July 2003.
- [PV1] B. Preneel and P. van Oorschot, "MD-x MAC and building fast MACs from hash functions," Advances in Cryptology --- Crypto 95 Proceedings, Lecture Notes in Computer Science Vol. 963, D. Coppersmith, ed., Springer-Verlag, 1995.
- [PV2] B. Preneel and P. van Oorschot, "On the security of two MAC algorithms," Advances in Cryptology --- Eurocrypt 96 Proceedings, Lecture Notes in Computer Science, U. Maurer, ed., Springer-Verlag, 1996.

- [RFC1321] Rivest, R. "The MD5 Message-Digest Algorithm." [RFC 1321](#). April, 1992.
- [RFC2026] Bradner, S. "The Internet Standards Process -- Revision 3." [RFC 2026](#). October 1996.
- [RFC2104] Krawczyk, H., M. Bellare, and R. Canetti, "HMAC: Keyed-Hashing for Message Authentication." [RFC 2104](#). February 1997.
- [RFC2246] Dierks, T. and C. Allen. "The TLS Protocol Version 1.0." [RFC 2246](#). January, 1999.
- [RFC2385] Heffernan, A. "Protection of BGP Sessions via the TCP MD5 Signature Option." [RFC 2385](#). August, 1998.
- [RFC2401] Kent, S. and R. Atkinson. "Security Architecture for the Internet Protocol." [RFC 2401](#). November, 1998.
- [RFC3036] Andersson, L., P. Doolan, N. Feldman, A. Fredette, and B. Thomas. "LDP Specification." [RFC 3036](#), January 2001.
- [RLH] Rekhter, Y., T. Li, and S. Hares. "A Border Gateway Protocol 4 (BGP-4)." [draft-ietf-idr-bgp4](#), December 2003, work in progress.

[9. Author Information](#)

Steven M. Bellovin
AT&T Labs Research
Shannon Laboratory
[180 Park Avenue](#)
Florham Park, NJ 07932
Phone: +1 973-360-8656
email: bellovin@acm.org

IPR Disclosure Acknowledgement

By submitting this Internet-Draft, I certify that any applicable patent or other IPR claims of which I am aware have been disclosed, and any of which I become aware will be disclosed, in accordance with [RFC 3668](#).

Copyright Notice

Copyright (C) The Internet Society (2004). This document is subject to the rights, licenses and restrictions contained in [BCP 78](#), and except as set forth therein, the authors retain all their rights.

Disclaimer

This document and the information contained herein are provided on an "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE/SHE REPRESENTS OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIM 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.

