

Internet Engineering Task Force
Internet-Draft
Intended status: Standards Track
Expires: May 2, 2017

H. Stenn
D. Mayer
Network Time Foundation
October 29, 2016

Network Time Protocol MAC/Last Extension Fields
draft-stenn-ntp-mac-last-ef-00

Abstract

NTPv4 is defined by RFC 5905 [RFC5905], and it and earlier versions of the NTP Protocol have supported symmetric private key Message Authentication Code (MAC) authentication. MACs were first described in Appendix C of RFC 1305 [RFC1305] and are further described in RFC 5905 [RFC5905]. As the number of Extension Fields grows there is an increasing chance of a parsing ambiguity when deciding if the "next" set of data is an Extension Field or a legacy MAC. This proposal defines two new Extension Fields to avoid this ambiguity. One is used to signify that it is the last Extension Field in the packet. If present, any subsequent data MUST be considered to be a legacy MAC. The other allows one or more MACs to be encapsulated in an Extension Field. If all parties in an association support MAC-EF, the use of a legacy MAC may be avoided.

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 <http://datatracker.ietf.org/drafts/current/>.

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."

This Internet-Draft will expire on May 2, 2017.

Copyright Notice

Copyright (c) 2016 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1. Introduction	2
1.1. Requirements Language	2
2. The Last Extension Field Extension Field	3
3. MAC Extension Field	4
4. Acknowledgements	5
5. IANA Considerations	5
6. Security Considerations	6
7. Normative References	6
Authors' Addresses	6

1. Introduction

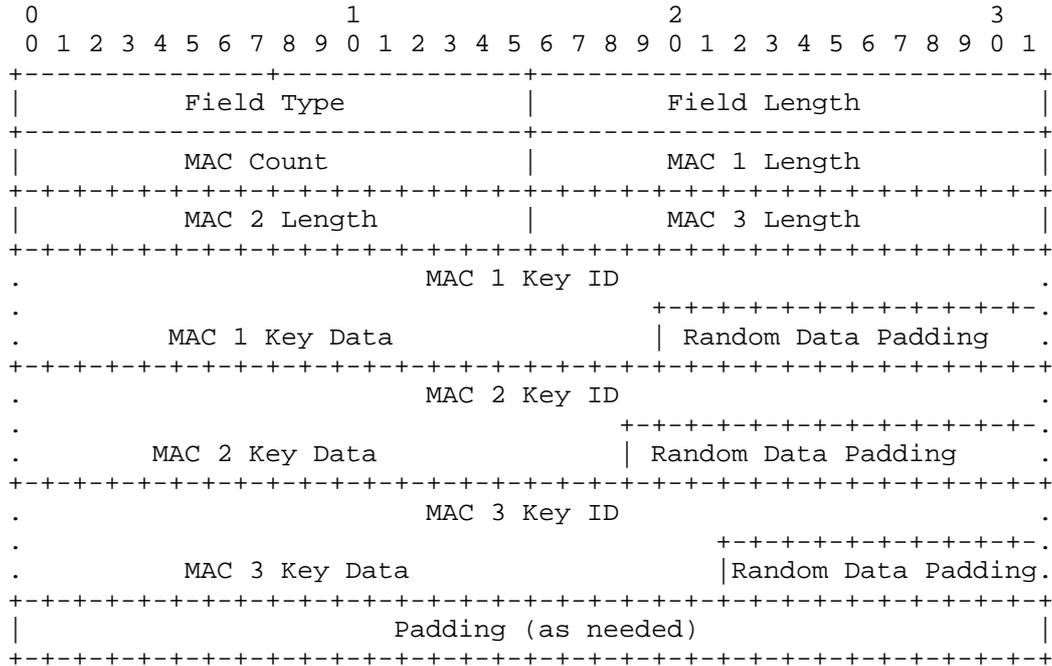
NTPv4 is defined by RFC 5905 [RFC5905], and it and earlier versions of the NTP Protocol have supported symmetric private key Message Authentication Code (MAC) authentication. MACs were first described in Appendix C of RFC 1305 [RFC1305] and are further described in RFC 5905 [RFC5905]. As the number of Extension Fields grows there is an increasing chance of a parsing ambiguity when deciding if the "next" set of data is an Extension Field or a legacy MAC. This proposal defines two new Extension Fields to avoid this ambiguity. One is used to signify that it is the last Extension Field in the packet. If present, any subsequent data MUST be considered to be a legacy MAC. The other allows one or more MACs to be encapsulated in an Extension Field. If all parties in an association support MAC-EF, the use of a legacy MAC may be avoided.

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

3. MAC Extension Field

Now that multiple extension fields are a possibility, there is a chance that additional packet data could be either an Extension Field or a legacy MAC. There is benefit to encapsulating the MAC in an extension field. By encapsulating the MAC in an EF, we also have the option to include multiple MACs in a packet, which may be of use in broadcast scenarios, for example.



NTP Extension Field: MAC EF Format

Field Type: TBD (Recommendation for IANA: 0x1003 (MAC-EF, MAC INCLUDED), 0x3003 (MAC-EF, MAC OPTIONAL, MAC INCLUDED))

Field Length: As needed

Payload: As described.

A Field Type of 0 and a Length of 0 means this extension field is a CRYPTO-NAK, as defined by RFC5905. Otherwise, a Field Type value of TBD (0x1003 is suggested) identifies this extension field as a MAC Extension field. The MAC Count is an unsigned 16-bit field, as is each MAC length field. If there are an even number of MACs specified there is an unused 16-bit field which SHOULD be 0x0000 at the end of

the set of MAC length values so that the subsequent MAC data is longword (4-octet) aligned. Each MAC SHALL be padded so that any subsequent MAC starts on a 4-octet boundary.

A MAC SHOULD not be present if there is a crypto-NAK present in the packet.

Each MAC within the extension field consists of a 32-bit key identifier which SHOULD be unique to the set of key identifiers in this MAC extension field followed by ((MAC Length) - 4) octets of data, optionally followed by random octets to pad the key data to the length specified earlier in the extension field. That key identifier is a shared secret which defines the algorithm to be used and a cookie or secret to be used in generating the digest. The MAC digest is produced by hashing the data from the beginning of the NTP packet up to but not including the start of the MAC extension field. The calculation of the digest SHOULD be a hash of this data concatenated with the 32-bit keyid (in network-order), and the key. When sending or receiving a key identifier each side needs to agree on the key identifier, algorithm and the cookie or secret used to produce the digest along with the digest lengths. Note that the sender may send more bytes than are required by the digest algorithm. This would be done to make it more difficult for a casual observer to identify the algorithm being used based on the length of the data. The digest data begins immediately after the key ID, and any padding octets SHOULD be random.

4. Acknowledgements

MAC-EF: The authors gratefully acknowledge Dave Mills for his insightful comments.

5. IANA Considerations

This memo requests IANA to allocate NTP Extension Field Types:

0x0000 CRYPTO-NAK

0x1003 MAC-EF, MAC INCLUDED

0x3003 MAC-EF, MAC OPTIONAL, MAC INCLUDED

0x0008 LAST-EF

0x2008 LAST-EF, MAC OPTIONAL

6. Security Considerations

The security considerations of time protocols in general are discussed in RFC7384 [RFC7384], and the security considerations of NTP are discussed in [RFC5905].

Digests MD5, DES and SHA-1 are considered compromised and should not be used [COMP].

If possible each MAC length should be at least 68 octets long to allow for 4 octets of key ID and at least 64 octets of digest and random padding. This means that for SHA-256 digests there are 4 octets of key ID, 32 bytes digest and 32 random octets of padding. Using larger minimum MAC lengths makes it difficult for an attacker to know which digest algorithms are used.

7. Normative References

- [RFC1305] Mills, D., "Network Time Protocol (Version 3) Specification, Implementation and Analysis", RFC 1305, DOI 10.17487/RFC1305, March 1992, <<http://www.rfc-editor.org/info/rfc1305>>.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <<http://www.rfc-editor.org/info/rfc2119>>.
- [RFC5905] Mills, D., Martin, J., Ed., Burbank, J., and W. Kasch, "Network Time Protocol Version 4: Protocol and Algorithms Specification", RFC 5905, DOI 10.17487/RFC5905, June 2010, <<http://www.rfc-editor.org/info/rfc5905>>.
- [RFC7384] Mizrahi, T., "Security Requirements of Time Protocols in Packet Switched Networks", RFC 7384, DOI 10.17487/RFC7384, October 2014, <<http://www.rfc-editor.org/info/rfc7384>>.

Authors' Addresses

Harlan Stenn
Network Time Foundation
P.O. Box 918
Talent, OR 97540
US

Email: stenn@nwttime.org

Danny Mayer
Network Time Foundation
P.O. Box 918
Talent, OR 97540
US

Email: mayer@ntp.org