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Internet Engineering Task Force (IETF)
Request for Comments: 8954
Updates: 6960
Category: Standards Track
ISSN: 2070-1721

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November 2020

Online Certificate Status Protocol (OCSP) Nonce Extension

Abstract

This document specifies the updated format of the Nonce extension in the Online Certificate Status Protocol (OCSP) request and response messages. OCSP is used to check the status of a certificate, and the Nonce extension is used to cryptographically bind an OCSP response message to a particular OCSP request message. This document updates RFC 6960.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at https://www.rfc-editor.org/info/rfc8954.

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1. Introduction

This document updates the usage and format of the Nonce extension in OCSP request and response messages. This extension was previously defined in Section 4.4.1 of [RFC6960]. [RFC6960] does not mention any minimum or maximum length of the nonce in the Nonce extension. Lacking limits on the length of the nonce in the Nonce extension, OCSP responders that follow [RFC6960] may be vulnerable to various attacks, like Denial-of-Service attacks [RFC4732] or chosen-prefix attacks (to get a desired signature), and possible evasions using the Nonce extension data. This document specifies a lower limit of 1 and an upper limit of 32 for the length of the nonce in the Nonce extension. This document updates [RFC6960].

1.1. Terminology

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. OCSP Extensions

The message formats for OCSP requests and responses are defined in [RFC6960]. [RFC6960] also defines the standard extensions for OCSP messages based on the extension model employed in X.509 version 3 certificates (see [RFC5280]). This document only specifies the new format for the Nonce extension and does not change the specifications of any of the other standard extensions defined in [RFC6960].

2.1. Nonce Extension

This section replaces the entirety of Section 4.4.1 of [RFC6960], which describes the OCSP Nonce extension.

The nonce cryptographically binds a request and a response to prevent replay attacks. The nonce is included as one of the requestExtensions in requests; in responses, it would be included as one of the responseExtensions. In both the request and the response, the nonce will be identified by the object identifier id-pkix-ocsp-nonce, while the extnValue is the value of the nonce. If the Nonce extension is present, then the length of the nonce MUST be at least 1 octet and can be up to 32 octets.

A server MUST reject any OCSP request that has a nonce in the Nonce extension with a length of either 0 octets or more than 32 octets with the malformedRequest OCSPResponseStatus, as described in Section 4.2.1 of [RFC6960].

The value of the nonce MUST be generated using a cryptographically strong pseudorandom number generator (see [RFC4086]). The minimum nonce length of 1 octet is defined to provide backward compatibility with older clients that follow [RFC6960]. Newer OCSP clients that support this document MUST use a length of 32 octets for the nonce in the Nonce extension. OCSP responders MUST accept lengths of at least 16 octets and MAY choose to ignore the Nonce extension for requests where the length of the nonce is less than 16 octets.

```
id-pkix-ocsp           OBJECT IDENTIFIER ::= { id-ad-ocsp }
id-pkix-ocsp-nonce     OBJECT IDENTIFIER ::= { id-pkix-ocsp 2 }

Nonce ::= OCTET STRING(SIZE(1..32))
```

3. Security Considerations

The security considerations of OCSP, in general, are described in [RFC6960]. During the interval in which the previous OCSP response for a certificate is not expired but the responder has a changed status for that certificate, a copy of that OCSP response can be used to indicate that the status of the certificate is still valid. Including a client's nonce value in the OCSP response makes sure that the response is the latest response from the server and not an old

copy.

3.1. Replay Attack

The Nonce extension is used to avoid replay attacks. Since the OCSP responder may choose not to send the Nonce extension in the OCSP response even if the client has sent the Nonce extension in the request [RFC5019], an on-path attacker can intercept the OCSP request and respond with an earlier response from the server without the Nonce extension. This can be mitigated by configuring the server to use a short time interval between the thisUpdate and nextUpdate fields in the OCSP response.

3.2. Nonce Collision

If the value of the nonce used by a client in the OCSP request is predictable, then an attacker may prefetch responses with the predicted nonce and can replay them, thus defeating the purpose of using the nonce. Therefore, the value of the Nonce extension in the OCSP request MUST contain cryptographically strong randomness and MUST be freshly generated at the time of the creation of the OCSP request. Also, if the length of the nonce is too small (e.g., 1 octet), then an on-path attacker can prefetch responses with all the possible values of the nonce and replay a matching nonce.

4. IANA Considerations

This document has no IANA actions.

5. Changes to Appendix B of RFC 6960

This section updates the ASN.1 definitions of the OCSP Nonce extension in Appendices B.1 and B.2 of [RFC6960]. Appendix B.1 defines OCSP using ASN.1 - 1998 Syntax; Appendix B.2 defines OCSP using ASN.1 - 2008 Syntax.

5.1. Changes to Appendix B.1 OCSP in ASN.1 - 1998 Syntax

OLD Syntax:

The definition of OCSP Nonce extension is not provided in Appendix B.1 of [RFC6960] for the ASN.1 - 1998 Syntax.

NEW Syntax:

```
Nonce ::= OCTET STRING(SIZE(1..32))
```

5.2. Changes to Appendix B.2 OCSP in ASN.1 - 2008 Syntax

OLD Syntax:

```
re-ocsp-nonce EXTENSION ::= { SYNTAX OCTET STRING IDENTIFIED
    BY id-pkix-ocsp-nonce }
```

NEW Syntax:

```
re-ocsp-nonce EXTENSION ::= { SYNTAX OCTET STRING(SIZE(1..32))
    IDENTIFIED BY id-pkix-ocsp-nonce }
```

6. References

6.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <https://www.rfc-editor.org/info/rfc2119>.

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(CRL) Profile", RFC 5280, DOI 10.17487/RFC5280, May 2008, <https://www.rfc-editor.org/info/rfc5280>.

[RFC6960] Santesson, S., Myers, M., Ankney, R., Malpani, A., Galperin, S., and C. Adams, "X.509 Internet Public Key Infrastructure Online Certificate Status Protocol - OCSP", RFC 6960, DOI 10.17487/RFC6960, June 2013, <https://www.rfc-editor.org/info/rfc6960>.

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6.2. Informative References

[RFC4086] Eastlake 3rd, D., Schiller, J., and S. Crocker, "Randomness Requirements for Security", BCP 106, RFC 4086, DOI 10.17487/RFC4086, June 2005, <https://www.rfc-editor.org/info/rfc4086>.

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[RFC5019] Deacon, A. and R. Hurst, "The Lightweight Online Certificate Status Protocol (OCSP) Profile for High-Volume Environments", RFC 5019, DOI 10.17487/RFC5019, September 2007, <https://www.rfc-editor.org/info/rfc5019>.

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