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Channel Bindings for TLS 1.3

Abstract

This document defines a channel binding type, tls-exporter, that is compatible with TLS 1.3 in accordance with RFC 5056, On Channel Binding. Furthermore it updates the "default" channel binding to the new binding for versions of TLS greater than 1.2. This document updates RFC5801, RFC5802, RFC5929, RFC7677, and RFC8446.

Status of This Memo

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

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This Internet-Draft will expire on 28 April 2022.

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1. Introduction

The "tls-unique" channel binding type defined in [RFC5929] was found to be vulnerable to the "triple handshake vulnerability" [TRIPLE-HANDSHAKE] without the extended master secret extension defined in [RFC7627]. While TLS 1.3 uses a complete transcript hash akin to the extended master secret procedures, the safety of channel bindings with TLS 1.3 was not analyzed as part of the core protocol work, and so the specification of channel bindings for TLS 1.3 was deferred. [RFC8446] section C.5 notes the lack of channel bindings for TLS 1.3; as this document defines such channel bindings, it updates [RFC8446] to note that this gap has been filled. Furthermore, this document updates [RFC5929] by adding an additional unique channel binding type, "tls-exporter", that replaces some usage of "tls-unique".

1.1. Conventions and Terminology

Throughout this document the acronym "EKM" is used to refer to Exported Keying Material as defined in [RFC5705].

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. The 'tls-exporter' Channel Binding Type

Channel binding mechanisms are not useful until TLS implementations expose the required data. To facilitate this, "tls-exporter" uses

exported keying material (EKM) which is already widely exposed by TLS implementations. The EKM is obtained using the keying material exporters for TLS as defined in [RFC5705] and [RFC8446] section 7.5 by supplying the following inputs:

Label: The ASCII string "EXPORTER-Channel-Binding" with no terminating NUL.

Context value: Zero-length string.

Length: 32 bytes.

This channel binding mechanism is defined only when TLS cipher negotiation results in unique master secrets, which is true of TLS 1.3 which always behaves as if it were using the extended master secret fix required by previous versions of TLS (see [RFC8446] appendix D).

3. TLS 1.3 with SCRAM or GSS-API over SASL

SCRAM ([RFC5802], and [RFC7677]) and GSS-API over SASL [RFC5801] define "tls-unique" as the default channel binding to use over TLS. As "tls-unique" is not defined for TLS 1.3 (and greater), this document updates [RFC5801], [RFC5802], and [RFC7677] to use "tls-exporter" as the default channel binding over TLS 1.3 (and greater). Note that this document does not change the default channel binding for SCRAM mechanisms over TLS 1.2 [RFC5246], which is still "tls-unique".

4. Security Considerations

The channel binding type defined in this document is constructed so that disclosure of the channel binding data does not leak secret information about the TLS channel and does not affect the security of the TLS channel.

The Security Considerations sections of [RFC5056], [RFC5705], and [RFC8446] apply to this document.

4.1. Use with Legacy TLS

While it is possible to use this channel binding mechanism with TLS versions below 1.3, extra precaution must be taken to ensure that the chosen cipher suites always result in unique master secrets. For more information see [RFC7627] and the Security Considerations section of [RFC5705].

When TLS renegotiation is enabled on a connection the "tls-exporter" channel binding type is not defined for that connection and implementations **MUST NOT** support it.

In general, users wishing to take advantage of channel binding should upgrade to TLS 1.3 or later.

The derived data **MUST NOT** be used for any purpose other than channel bindings as described in [RFC5056]. In particular, implementations MUST NOT use channel binding as a secret key to protect privileged information.

5. IANA Considerations

5.1. Registration of Channel Binding Type

This document adds the following registration in the "Channel-Binding Types" registry:

Subject: Registration of channel binding tls-exporter

Channel binding unique prefix: tls-exporter

Channel binding type: unique

Channel type: TLS [RFC8446]

Published specification: draft-ietf-kitten-tls-channel-bindings-for-tls13-12

Channel binding is secret: no

Description: The EKM value obtained from the current TLS connection.

Intended usage: COMMON

Person and email address to contact for further information: Sam Whited <sam@samwhited.com>.

Owner/Change controller name and email address: IESG.

Expert reviewer name and contact information: IETF KITTEN or TLS WG (kitten@ietf.org or tls@ietf.org, failing that, ietf@ietf.org).

Note: See the published specification for advice on the applicability of this channel binding type.

5.2. Registration of Channel Binding TLS Exporter Label

This document adds the following registration in the "TLS Exporter Labels" registry:

Value: EXPORTER-Channel-Binding

DTLS-OK:
Y

Recommended: Y

Reference: This document

6. References

6.1. Normative References

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[RFC5705] Rescorla, E., "Keying Material Exporters for Transport Layer Security (TLS)", RFC 5705, DOI 10.17487/RFC5705, March 2010, <https://www.rfc-editor.org/info/rfc5705>.

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6.2. Informative References

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[RFC5801] Josefsson, S. and N. Williams, "Using Generic Security Service Application Program Interface (GSS-API) Mechanisms in Simple Authentication and Security Layer (SASL): The GS2 Mechanism Family", RFC 5801, DOI 10.17487/RFC5801, July 2010, <https://www.rfc-editor.org/info/rfc5801>.

[RFC5802] Newman, C., Menon-Sen, A., Melnikov, A., and N. Williams, "Salted Challenge Response Authentication Mechanism (SCRAM) SASL and GSS-API Mechanisms", RFC 5802, DOI 10.17487/RFC5802, July 2010, <https://www.rfc-editor.org/info/rfc5802>.

[RFC5929] Altman, J., Williams, N., and L. Zhu, "Channel Bindings for TLS", RFC 5929, DOI 10.17487/RFC5929, July 2010, <https://www.rfc-editor.org/info/rfc5929>.

[RFC7627] Bhargavan, K., Ed., Delignat-Lavaud, A., Pironti, A., Langley, A., and M. Ray, "Transport Layer Security (TLS) Session Hash and Extended Master Secret Extension", RFC 7627, DOI 10.17487/RFC7627, September 2015, <https://www.rfc-editor.org/info/rfc7627>.

[TRIPLE-HANDSHAKE] Bhargavan, K., Delignat-Lavaud, A., Fournet, C., Pironti, A., and P. Strub, "Password Storage", March 2014, <https://www.mitls.org/pages/attacks/3SHAKE>.

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