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Prohibiting RC4 Cipher Suites
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Abstract

This document requires that Transport Layer Security (TLS) clients and servers never negotiate the use of RC4 cipher suites when they establish connections.

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[1.](#) Introduction

RC4 is a stream cipher described in [[SCH](#)], which is widely supported, and often preferred, by TLS servers. However, RC4 has long been known to have a variety of cryptographic weaknesses, e.g. [[PAU](#)], [[MAN](#)], [[FLU](#)]. Recent cryptanalysis results [[ALF](#)] exploit biases in the RC4 keystream to recover repeatedly encrypted plaintexts.

These recent results are on the verge of becoming practically exploitable; currently they require 2^{26} sessions or 13×2^{30} encryptions. As a result, RC4 can no longer be seen as providing a sufficient level of security for TLS sessions.

This document requires that TLS ([[RFC5246](#)], [[RFC4346](#)], [[RFC2246](#)]) clients and servers never negotiate the use of RC4 cipher suites.

[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 [[RFC2119](#)].

[2.](#) Changes to TLS

Because of the deficiencies noted in [Section 1](#):

- o TLS clients MUST NOT include RC4 cipher suites in the ClientHello message.

- o TLS servers MUST NOT select an RC4 cipher suite when a TLS client sends such a cipher suite in the ClientHello message.

- o If the TLS client only offers RC4 cipher suites, the TLS server MUST terminate the handshake. The TLS server MAY send the `insufficient_security` fatal alert in this case.

[Appendix A](#) lists the RC4 cipher suites defined for TLS.

[3.](#) Acknowledgements

This document was inspired by discussions with Magnus Nystrom, Eric Rescorla, Joseph Salowey, Yaron Sheffer, Nagendra Modadugu and others on the TLS mailing list.

[4.](#) IANA Considerations

This memo includes no request to IANA.

[5.](#) Security Considerations

This document helps maintain the security guarantees of the TLS protocol by prohibiting the use of the RC4-based cipher suites (listed in [Appendix A](#)), which do not provide a sufficiently high level of security.

[6.](#) References

[6.1.](#) Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC2246] Dierks, T. and C. Allen, "The TLS Protocol Version 1.0", [RFC 2246](#), January 1999.
- [RFC4346] Dierks, T. and E. Rescorla, "The Transport Layer Security (TLS) Protocol Version 1.1", [RFC 4346](#), April 2006.

[RFC5246] Dierks, T. and E. Rescorla, "The Transport Layer Security (TLS) Protocol Version 1.2", [RFC 5246](#), August 2008.

[6.2.](#) Informative References

[ALF] AlFardan, N., Bernstein, D., Paterson, K., Poettering, B., and J. Schuldt, "On the security of RC4 in TLS and WPA. USENIX Security Symposium.", 2013, <<https://www.usenix.org/conference/usenixsecurity13/security-rc4-tls>>.

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[FLU] Fluhrer, S., Mantin, I., and A. Shamir, "Weaknesses in the Key Scheduling Algorithm of RC4. Selected Areas in Cryptography, pp. 1-24", 2001.

[MAN] Mantin, I. and A. Shamir, "A Practical Attack on Broadcast RC4. FSE, pp. 152-164.", 2001.

[PAU] Paul, G. and S. Maitra, "Permutation after RC4 Key Scheduling Reveals the Secret Key. In Proceedings of the 14th Workshop on Selected Areas in Cryptography (SAC), pp. 360-377, vol. 4876, LNCS, Springer.", 2007.

[SCH] Schneier, B., "Applied Cryptography: Protocols, Algorithms, and Source Code in C, 2nd ed.", 1996.

[Appendix A.](#) RC4 Cipher Suites

The following cipher suites defined for TLS use RC4:

- o TLS_RSA_EXPORT_WITH_RC4_40_MD5>
- o TLS_RSA_WITH_RC4_128_MD5
- o TLS_RSA_WITH_RC4_128_SHA
- o TLS_DH_anon_EXPORT_WITH_RC4_40_MD5
- o TLS_DH_anon_WITH_RC4_128_MD5

- o TLS_KRB5_WITH_RC4_128_SHA>
- o TLS_KRB5_WITH_RC4_128_MD5>
- o TLS_KRB5_EXPORT_WITH_RC4_40_SHA
- o TLS_KRB5_EXPORT_WITH_RC4_40_MD5
- o TLS_PSK_WITH_RC4_128_SHA
- o TLS_DHE_PSK_WITH_RC4_128_SHA
- o TLS_RSA_PSK_WITH_RC4_128_SHA
- o TLS_ECDH_ECDSA_WITH_RC4_128_SHA
- o TLS_ECDHE_ECDSA_WITH_RC4_128_SHA
- o TLS_ECDH_RSA_WITH_RC4_128_SHA

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- o TLS_ECDHE_RSA_WITH_RC4_128_SHA
- o TLS_ECDH_anon_WITH_RC4_128_SHA
- o TLS_ECDHE_PSK_WITH_RC4_128_SHA

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