Internet Engineering Task Force
Internet-Draft
Updates: 4253, 4432 (if approved)
Intended status: Standards Track
Expires: September 7, 2017

M. Baushke
Juniper Networks, Inc.

March 6, 2017

More Modular Exponential (MODP) Diffie-Hellman (DH) Key Exchange (KEX) Groups for Secure Shell (SSH)
draft-ietf-curdle-ssh-modp-dh-sha2-02

Abstract

This document defines added Modular Exponential (MODP) Groups for the Secure Shell (SSH) protocol using SHA-2 hashes.

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 September 7, 2017.

Copyright Notice

1. Overview and Rationale

Secure Shell (SSH) is a common protocol for secure communication on the Internet. Due to recent security concerns with SHA-1 [RFC6194] and with MODP groups with less than 2048 bits [NIST-SP-800-131Ar1] implementer and users request support for larger Diffie Hellman (DH) MODP group sizes with data integrity verification using the SHA-2 family of secure hash algorithms as well as MODP groups providing more security.

The United States Information Assurance Directorate at the National Security Agency has published a FAQ [MFQ-U-OO-815099-15] suggesting both: a) DH groups using less than 3072-bits, and b) the use of SHA-2 based hashes less than SHA2-384, are no longer sufficient for transport of Top Secret information. For this reason, the new MODP groups are being introduced starting with the MODP 3072-bit group 15 are all using SHA2-512 as the hash algorithm.

The DH 2048-bit MODP group 14 is already present in most SSH implementations and most implementations already have a SHA2-256 implementation, so diffie-hellman-group14-sha256 is provided as an easy to implement and faster to use key exchange for small embedded applications.

Please send comments on this draft to ietf-ssh@NetBSD.org and ietf-curdle@ietf.org.

2. 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].

3. Key Exchange Algorithms

This memo adopts the style and conventions of [RFC4253] in specifying how the use of new data key exchange is indicated in SSH.

The following new key exchange algorithms are defined:

Key Exchange Method Name
diffie-hellman-group14-sha256
diffie-hellman-group15-sha512

```
diffie-hellman-group16-sha512
diffie-hellman-group17-sha512
diffie-hellman-group18-sha512
```

Figure 1

The SHA-2 family of secure hash algorithms are defined in [FIPS-180-4].

The method of key exchange used for the name "diffie-hellman-group14-sha256" is the same as that for "diffie-hellman-group14-sha1" except that the SHA2-256 hash algorithm is used.

The method of key exchange used for the name "gss-group14-sha256-*" is the same as that for "gss-group14-sha1-*" except that the SHA2-256 hash algorithm is used.

The group15 through group18 names are the same as those specified in [RFC3526] 3071-bit MODP Group 15, 4096-bit MODP Group 16, 6144-bit MODP Group 17, and 8192-bit MODP Group 18.

The SHA2-512 algorithm is to be used when "sha512" is specified as a part of the key exchange method name.

4. IANA Considerations

This document augments the Key Exchange Method Names in [RFC4253].

IANA is requested to add to the Key Exchange Method Names algorithm registry with the following entries:

Key Exchange Method Name	Reference
diffie-hellman-group14-sha256	This Draft
diffie-hellman-group15-sha512	This Draft
diffie-hellman-group16-sha512	This Draft
diffie-hellman-group17-sha512	This Draft
diffie-hellman-group18-sha512	This Draft

[TO BE REMOVED: This registration should take place at the following location: <http://www.iana.org/assignments/ssh-parameters/ssh-parameters.xhtml#ssh-parameters-16>]

5. Security Considerations

The security considerations of [RFC4253] apply to this document.

The security considerations of [RFC3526] suggest that these MODP groups have security strengths given in this table. They are based on [RFC3766] Determining Strengths For Public Keys Used For Exchanging Symmetric Keys.

Group modulus security strength estimates (RFC3526)

Group	Modulus	Strength Estimate 1		Strength Estimate 2	
		in bits	exponent size	in bits	exponent size
14	2048-bit	110	220-	160	320-
15	3072-bit	130	260-	210	420-
16	4096-bit	150	300-	240	480-
17	6144-bit	170	340-	270	540-
18	8192-bit	190	380-	310	620-

Figure 2

Many users seem to be interested in the perceived safety of using larger MODP groups and hashing with SHA2-based algorithms.

6. References

6.1. Normative References

[FIPS-180-4]
National Institute of Standards and Technology, "Secure Hash Standard (SHS)", FIPS PUB 180-4, August 2015, <http://nvlpubs.nist.gov/nistpubs/FIPS/NIST.FIPS.180-4.pdf>.

[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>.

[RFC3526] Kivinen, T. and M. Kojo, "More Modular Exponential (MODP) Diffie-Hellman groups for Internet Key Exchange (IKE)", RFC 3526, DOI 10.17487/RFC3526, May 2003, <http://www.rfc-editor.org/info/rfc3526>.

[RFC4253] Ylonen, T. and C. Lonvick, Ed., "The Secure Shell (SSH) Transport Layer Protocol", RFC 4253, DOI 10.17487/RFC4253, January 2006, <http://www.rfc-editor.org/info/rfc4253>.

6.2. Informative References

[MFQ-U-OO-815099-15]
"National Security Agency/Central Security Service", "CNSA Suite and Quantum Computing FAQ", January 2016, <https://www.iad.gov/iad/library/ia-guidance/ia-solutions-for-classified/algorithm-guidance/cnsa-suite-and-quantum-computing-faq.cfm>.

[NIST-SP-800-131Ar1]
Barker, and Roginsky, "Transitions: Recommendation for the Transitioning of the Use of Cryptographic Algorithms and Key Lengths", NIST Special Publication 800-131A Revision 1, November 2015, <http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-131Ar1.pdf>.

[RFC3766] Orman, H. and P. Hoffman, "Determining Strengths For Public Keys Used For Exchanging Symmetric Keys", BCP 86, RFC 3766, DOI 10.17487/RFC3766, April 2004, <http://www.rfc-editor.org/info/rfc3766>.

[RFC6194] Polk, T., Chen, L., Turner, S., and P. Hoffman, "Security Considerations for the SHA-0 and SHA-1 Message-Digest Algorithms", RFC 6194, DOI 10.17487/RFC6194, March 2011, <http://www.rfc-editor.org/info/rfc6194>.

Author's Address

Mark D. Baushke
Juniper Networks, Inc.
1133 Innovation Way
Sunnyvale, CA 94089-1228
US

Phone: +1 408 745 2952
Email: mdb@juniper.net
URI: http://www.juniper.net/