

Secure Shell Working Group
Internet-Draft
Expires: September 2, 2006

J. Galbraith
VanDyke Software
R. Thayer
The Tilleran Group
March 1, 2006

SSH Public Key File Format
draft-ietf-secsh-publickeyfile-12.txt

Status of this Memo

By submitting this Internet-Draft, each author represents that any applicable patent or other IPR claims of which he or she is aware have been or will be disclosed, and any of which he or she becomes aware will be disclosed, in accordance with [Section 6 of BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

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."

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/lid-abstracts.txt>.

The list of Internet-Draft Shadow Directories can be accessed at <http://www.ietf.org/shadow.html>.

This Internet-Draft will expire on September 2, 2006.

Copyright Notice

Copyright (C) The Internet Society (2006).

Abstract

This document formally documents an existing public key file format in use for exchanging public keys between different SSH implementations.

In addition, this document defines a standard textual representation for SSH public key fingerprints.

Internet-Draft

SSH Public Key File Format

March 2006

Table of Contents

1.	Conventions used in this document	3
2.	Introduction	4
3.	Key File Format	5
3.1.	Line Termination Characters	5
3.2.	Begin and End Markers	5
3.3.	Key File Header	5
3.3.1.	Subject Header	6
3.3.2.	Comment Header	6
3.3.3.	Private Use Headers	6
3.4.	Public Key File Body	6
3.5.	Differences with RFC1421 PEM formats	7
3.6.	Examples	7
4.	Public Key Fingerprints	9
5.	IANA Considerations	10
6.	Security Considerations	11
7.	References	12
7.1.	Normative References	12
7.2.	Informative References	12
	Authors' Addresses	13
	Intellectual Property and Copyright Statements	14

1. Conventions used in this document

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.](#) Introduction

The SSH protocol supports the use of public/private key pairs in order to perform authentication based on public-key cryptography. However, in order to use public-key authentication in the SSH protocol, public keys must first be exchanged between client and server.

This document formally describes an existing public-key file format which can be used with any of the common existing file transfer mechanisms in order to exchange public keys.

The SSH protocol also uses public/private key pairs to authenticate the server. In this scenario, it is important to verify that the public key provided by the server is indeed the server's public-key. This document describes a mechanism for creating a short text string that uniquely represents a particular public key, called fingerprinting.

[3.](#) Key File Format

In order to implement public key authentication, SSH implementations must share public key files between the client and the server in order to interoperate.

A key file is a text file, containing a sequence of lines. Each line in the file **MUST NOT** be longer than 72 8-bit bytes excluding line termination characters.

[3.1.](#) Line Termination Characters

Implementations **SHOULD** generate public key files using their system's local text file representation.

In the event that public key files are not transferred as text files, implementations **SHOULD** be prepared to read files using any of the common line termination sequence, <CR>, <LF> or <CR><LF>.

[3.2.](#) Begin and End Markers

The first line of a conforming key file **MUST** be a begin marker, which

is the literal text:

```
---- BEGIN SSH2 PUBLIC KEY ----
```

The last line of a conforming key file MUST be an end marker, which is the literal text:

```
---- END SSH2 PUBLIC KEY ----
```

[3.3.](#) Key File Header

The key file header section consists of multiple [RFC822](#)-style header fields. Each field is a line of the following format:

```
Header-tag ':' ' ' Header-value
```

The Header-tag MUST NOT be more than 64 8-bit bytes, and is case-insensitive. The Header-value MUST NOT be more than 1024 8-bit bytes. Each line in the header MUST NOT be more than 72 8-bit bytes.

A line is continued if the last character in the line is a '\\'. If the last character of a line is a '\\', then the logical contents of the line is formed by removing the '\\' and the line termination characters, and appending the contents of the next line.

The Header-tag MUST be encoded in US-ASCII. The Header-value MUST be

encoded in UTF-8. [[RFC3629](#)]

A line that is not a continuation line that has no ':' in it is the first line of the base 64 encoded body (See [Section 3.4.](#))

The space of header-tags is managed as described in [Section 5.](#)

Compliant implementations MUST ignore headers with unrecognized header-tags. Implementations SHOULD preserve such unrecognized headers when manipulating the key file.

[3.3.1.](#) Subject Header

This field is used to store the login-name that the key was generated under. For example:

Subject: user

[3.3.2.](#) Comment Header

The comment header contains a user specified comment. The comment SHOULD be displayed when using the key.

It is suggested that this field default to user@hostname for the user and machine used to generate the key. For example:

```
Comment: user@example.com
```

Currently, common practice is to quote the Header-value of the Comment by prefixing and suffixing it with '"' characters, and some existing implementations fail if these quotation marks are omitted.

Compliant implementations MUST function correctly if the quotation marks are omitted.

Implementations MAY include the quotation marks. If the first and last characters of the Header-value are matching quotation marks, implementations SHOULD remove them before using the value.

[3.3.3.](#) Private Use Headers

Headers with header-tags beginning with "x-" are reserved for private use.

[3.4.](#) Public Key File Body

The body of a public-key file is the base64 encoded ([\[RFC2045\]](#)) public-key data as specified by [\[RFC4253\], section 6.6](#):

```
string    certificate or public key format identifier  
byte[n]  key/certificate data
```

As with all other lines, each line in the body MUST NOT be longer than 72 8-bit bytes excluding line termination characters.

[3.5.](#) Differences with [RFC1421](#) PEM formats

Implementers should take care to notice that while the format is superficially similar to those specified by PEM [[RFC1421](#)] and OpenPGP [[RFC2440](#)], it is not identical; most notably:

- o The other specifications use different BEGIN/END delimiters (five dashes, no space rather than four dashes and a space).
- o There is no blank line before the start of the base64-encoded contents.
- o There is no CRC at the end of the base64-encoded block.
- o Header continuation uses a backslash at the end of the continued line rather than whitespace at the start of the next line.

[3.6.](#) Examples

The following are some example public key files that are compliant (note that the examples all wrap before 72 bytes to meet ietf document requirements; however, they are still compliant.)

```
----- BEGIN SSH2 PUBLIC KEY -----  
Comment: "1024-bit RSA, converted from OpenSSH by me@example.com"  
x-command: /home/galb/bin/lock-in-guest.sh  
AAAAB3NzaC1yc2EAAAABIwAAAIEA1on8gxCGJJWSRT4uOrR13mUaUk0hRf4RzxSZ1zRb  
YYFw8pfGesIFoEuVth4HKyF8k1y4mRUUnYHP1XNMNMJl1JcEArC2asV8sHf6zSPVffozZ  
5TT4SfsUu/iKy9lUcCfXzwre4WWZSXXcPff+EhtWshahu3WzBdnGxm5Xoi89zcE=  
----- END SSH2 PUBLIC KEY -----
```

```
----- BEGIN SSH2 PUBLIC KEY -----
```

Comment: This is my public key for use on \ servers which I don't like.

```
AAAAB3NzaC1kc3MAAACBAPY8Z0HY2yFSJA6XYC9HRwNHxaehvx5w0J0rzZdzoS0XxbET
W6ToHv8D1UJ/z+zHo9Fiko5XybZnDIaBDHtblQ+Yp7StxyltHnXF1YLfKD1G4T6JYrdH
YI140m1eg9e4NnCRleaqqZPF3UGfZia6bXrGTQf3gJq2e7Yisk/gF+1VAAAAAFQDb8D5c
vwHWTZDPfX0D2s9Rd7NBvQAAAIEALN92+Bb7D4KLYk3IwRbXblwXdkPggA4pfdtW9vGf
J0/RHd+NjB4eo1D+0dix6tXwYGN7PKS5R/FXPNwxHPapcj9uL1Jn2AWQ2dsknf+i/FAA
vioUPkmdMc0zuWoS0EsSNhVDtX3WdvVcGcBq9cetzrtOKW0ocJmJ80qadxTRHtUAAACB
AN7CY+KKv1gHpRzFwdQm7HK9bb1LAo2KwaoXnadFgeptNBQeSXG1v0+JsvphVMBJc9HS
n24VYtYtsMu74qXviYjziVucWKjjKEb11juqnF0GDlB3VVmxHLmxnAz643WK42Z7dLM5
sY29ouezv4Xz2PuMch5VGPP+CDqzCM4loWgV
```

----- END SSH2 PUBLIC KEY -----

----- BEGIN SSH2 PUBLIC KEY -----

Comment: DSA Public Key for use with MyIsp

```
AAAAB3NzaC1kc3MAAACBAPY8Z0HY2yFSJA6XYC9HRwNHxaehvx5w0J0rzZdzoS0XxbET
W6ToHv8D1UJ/z+zHo9Fiko5XybZnDIaBDHtblQ+Yp7StxyltHnXF1YLfKD1G4T6JYrdH
YI140m1eg9e4NnCRleaqqZPF3UGfZia6bXrGTQf3gJq2e7Yisk/gF+1VAAAAAFQDb8D5c
vwHWTZDPfX0D2s9Rd7NBvQAAAIEALN92+Bb7D4KLYk3IwRbXblwXdkPggA4pfdtW9vGf
J0/RHd+NjB4eo1D+0dix6tXwYGN7PKS5R/FXPNwxHPapcj9uL1Jn2AWQ2dsknf+i/FAA
vioUPkmdMc0zuWoS0EsSNhVDtX3WdvVcGcBq9cetzrtOKW0ocJmJ80qadxTRHtUAAACB
AN7CY+KKv1gHpRzFwdQm7HK9bb1LAo2KwaoXnadFgeptNBQeSXG1v0+JsvphVMBJc9HS
n24VYtYtsMu74qXviYjziVucWKjjKEb11juqnF0GDlB3VVmxHLmxnAz643WK42Z7dLM5
sY29ouezv4Xz2PuMch5VGPP+CDqzCM4loWgV
```

----- END SSH2 PUBLIC KEY -----

----- BEGIN SSH2 PUBLIC KEY -----

Subject: galb

Comment: 1024-bit rsa, created by me@example.com Mon Jan 15 08:31:24 2001

```
AAAAB3NzaC1yc2EAAAABJQAAAIEAIPWx6WM4lhHNedGfBpPJNPPz7yKu+dnn1SJejgt4
596k6YjzGGphH2TUxwKzxcKDKKewkpfnxPkSMkuEspGRt/aZZ9wa++0i7Qkr8prgHc4
soW6NUlfDzpvZK2H5E7eQaSeP3SAwGmQKUFHCddNaP0L+hM7zhFNzjFvpaMgJw0=
```

----- END SSH2 PUBLIC KEY -----

4. Public Key Fingerprints

The security of the SSH protocols relies on the verification of public host keys. Since public keys tend to be very large, it is difficult for a human to verify an entire host key. Even with a PKI in place, it is useful to have a standard for exchanging short fingerprints of public keys.

This section formally describes the method of generating public key fingerprints that is in common use in the SSH community.

The fingerprint of a public key consists of the output of the MD5 message-digest algorithm [[RFC1321](#)]. The input to the algorithm is the public-key data as specified by [[RFC4253](#)]. (This is the same data that is base64 encoded to form the body of the public-key file.)

The output of the algorithm is presented to the user as a sequence of 16 octets printed as hexadecimal with lowercase letters and separated by colons.

For example: "c1:b1:30:29:d7:b8:de:6c:97:77:10:d7:46:41:63:87"

5. IANA Considerations

[Section 3.3](#) defines a new namespace of "Header-tags". These are US-ASCII strings of maximum length 64 characters, and are case-insensitive.

The following header-tags are defined by this document:

subject

comment

In addition, all header-tags beginning with "x-" are reserved for Private Use, as defined in [\[RFC2434\]](#).

Further allocations are to be made by IETF Consensus, as defined in [\[RFC2434\]](#).

6. Security Considerations

The file format described by this document provides no mechanism to verify the integrity or otherwise detect tampering with the data stored in such files. Given the potential of an adversarial tampering with this data, system-specific measures (e.g. Access Control Lists, UNIX permissions, other Discretionary and/or Mandatory Access Controls) SHOULD be used to protect these files. Also, if the contents of these files are transferred it SHOULD be done over a trusted channel.

The header data allowed by this file format could contain an unlimited range of information. While in many environments the information conveyed by this header data may be considered innocuous public information, it may constitute a channel through which information about a user, a key or its use may be disclosed intentionally or otherwise (e.g. "Comment: Mary E. Jones, 123 Main St, Home Phone:..."). The presence and use of this header data SHOULD be reviewed by sites that deploy this file format.

The public-key fingerprint method presented here relies on the MD5 one-way hash function, which is known to have certain weaknesses regarding its collision resistance; however, the particular use made of MD5 here depends solely on its 2nd-preimage resistance, not on its collision resistance.

MD5 is used here for historical reasons.

[7.](#) References

[7.1.](#) Normative References

- [RFC1321] Rivest, R., "The MD5 Message-Digest Algorithm", [RFC 1321](#), April 1992.
- [RFC2045] Freed, N. and N. Borenstein, "Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies", [RFC 2045](#), November 1996.
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC3629] Yergeau, F., "UTF-8, a transformation format of ISO 10646", STD 63, [RFC 3629](#), November 2003.
- [RFC4253] Ylonen, T. and C. Lonvick, "The Secure Shell (SSH) Transport Layer Protocol", [RFC 4253](#), January 2006.

[7.2.](#) Informative References

- [RFC1421] Linn, J., "Privacy Enhancement for Internet Electronic Mail: Part I: Message Encryption and Authentication Procedures", [RFC 1421](#), February 1993.

- [RFC2434] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", [BCP 26](#), [RFC 2434](#), October 1998.
- [RFC2440] Callas, J., Donnerhackle, L., Finney, H., and R. Thayer, "OpenPGP Message Format", [RFC 2440](#), November 1998.

Galbraith & Thayer

Expires September 2, 2006

[Page 12]

Internet-Draft

SSH Public Key File Format

March 2006

Authors' Addresses

Joseph Galbraith
VanDyke Software
4848 Tramway Ridge Blvd
Suite 101
Albuquerque, NM 87111
US

Phone: +1 505 332 5700
Email: galb-list@vandyke.com

Rodney Thayer
The Tillerman Group
370 Altair Way, PMB 321
Sunnyvale, CA 94086

Phone: +1 408 757 9693
Email: rodney@tillerman.to

Galbraith & Thayer Expires September 2, 2006 [Page 13]

Internet-Draft SSH Public Key File Format March 2006

Intellectual Property Statement

The IETF takes no position regarding the validity or scope of any Intellectual Property Rights or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; nor does it represent that it has made any independent effort to identify any such rights. Information on the procedures with respect to rights in RFC documents can be found in [BCP 78](#) and [BCP 79](#).

Copies of IPR disclosures made to the IETF Secretariat and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this specification can be obtained from the IETF on-line IPR repository at <http://www.ietf.org/ipr>.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to implement this standard. Please address the information to the IETF at ietf-ipr@ietf.org.

Disclaimer of Validity

This document and the information contained herein are provided on an "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE/SHE REPRESENTS OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Copyright Statement

Copyright (C) The Internet Society (2006). This document is subject to the rights, licenses and restrictions contained in [BCP 78](#), and except as set forth therein, the authors retain all their rights.

Acknowledgment

Funding for the RFC Editor function is currently provided by the Internet Society.