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Test Vectors for Session Traversal Utilities for NAT (STUN)

Abstract

The Session Traversal Utilities for NAT (STUN) protocol defines several STUN attributes. The content of some of these -- FINGERPRINT, MESSAGE-INTEGRITY, and XOR-MAPPED-ADDRESS -- involve binary-logical operations (hashing, xor). This document provides test vectors for those attributes.

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1. Introduction

The Session Traversal Utilities for NAT (STUN)[RFC5389] protocol defines two different hashes that may be included in messages exchanged by peers implementing that protocol:

FINGERPRINT attribute: a 32-bit Cyclic Redundancy Check.

MESSAGE-INTEGRITY attribute: an HMAC-SHA1 [RFC2104] authentication code.

This document provides samples of properly formatted STUN messages including these hashes, for the sake of testing implementations of the STUN protocol.

2. Test Vectors

All included vectors are represented as a series of hexadecimal values in network byte order. Each pair of hexadecimal digits represents one byte.

Messages follow the Interactive Connectivity Establishment (ICE) Connectivity Checks use case of STUN (see [RFC5245]). These messages include FINGERPRINT, MESSAGE-INTEGRITY, and XOR-MAPPED-ADDRESS STUN attributes. These attributes are considered to be most prone to implementation errors. An additional message is provided to test STUN authentication with long-term credentials (which is not used by ICE).

In the following sample messages, two types of plain UTF-8 text attributes are included. The values of certain of these attributes were purposely sized to require padding. Non-ASCII characters are represented as <U+xxxx> where xxxx is the hexadecimal number of their Unicode code point.

In this document, ASCII white spaces (U+0020) are used for padding within the first three messages - this is arbitrary. Similarly, the last message uses nul bytes for padding. As per [RFC5389], padding bytes may take any value.

2.1. Sample Request

This request uses the following parameters:

Software name: "STUN test client" (without quotes)

Username: "evtj:h6vY" (without quotes)

Password: "V0kJxbRl1RmTxUk/WvJxBt" (without quotes)

00 01 00 58		Request type and message length
21 12 a4 42		Magic cookie
b7 e7 a7 01	}	
bc 34 d6 86	}	Transaction ID
fa 87 df ae	}	
80 22 00 10		SOFTWARE attribute header
53 54 55 4e	}	
20 74 65 73	}	User-agent...
74 20 63 6c	}	...name
69 65 6e 74	}	
00 24 00 04		PRIORITY attribute header
6e 00 01 ff		ICE priority value
80 29 00 08		ICE-CONTROLLED attribute header
93 2f f9 b1	}	Pseudo-random tie breaker...
51 26 3b 36	}	...for ICE control
00 06 00 09		USERNAME attribute header
65 76 74 6a	}	
3a 68 36 76	}	Username (9 bytes) and padding (3 bytes)
59 20 20 20	}	
00 08 00 14		MESSAGE-INTEGRITY attribute header
9a ea a7 0c	}	
bf d8 cb 56	}	
78 1e f2 b5	}	HMAC-SHA1 fingerprint
b2 d3 f2 49	}	
c1 b5 71 a2	}	
80 28 00 04		FINGERPRINT attribute header
e5 7a 3b cf		CRC32 fingerprint

2.2. Sample IPv4 Response

This response uses the following parameter:

Password: "V0kJxbRl1RmTxUk/WvJxBt" (without quotes)

Software name: "test vector" (without quotes)

Mapped address: 192.0.2.1 port 32853

01 01 00 3c		Response type and message length
21 12 a4 42		Magic cookie
b7 e7 a7 01	}	
bc 34 d6 86	}	Transaction ID
fa 87 df ae	}	
80 22 00 0b		SOFTWARE attribute header
74 65 73 74	}	
20 76 65 63	}	UTF-8 server name
74 6f 72 20	}	
00 20 00 08		XOR-MAPPED-ADDRESS attribute header
00 01 a1 47		Address family (IPv4) and xor'd mapped port number
e1 12 a6 43		Xor'd mapped IPv4 address
00 08 00 14		MESSAGE-INTEGRITY attribute header
2b 91 f5 99	}	
fd 9e 90 c3	}	
8c 74 89 f9	}	HMAC-SHA1 fingerprint
2a f9 ba 53	}	
f0 6b e7 d7	}	
80 28 00 04		FINGERPRINT attribute header
c0 7d 4c 96		CRC32 fingerprint

2.3. Sample IPv6 Response

This response uses the following parameter:

Password: "V0kJxbRl1RmTxUk/WvJxBt" (without quotes)

Software name: "test vector" (without quotes)

Mapped address: 2001:db8:1234:5678:11:2233:4455:6677 port 32853

01 01 00 48		Response type and message length
21 12 a4 42		Magic cookie
b7 e7 a7 01	}	
bc 34 d6 86	}	Transaction ID
fa 87 df ae	}	
80 22 00 0b		SOFTWARE attribute header
74 65 73 74	}	
20 76 65 63	}	UTF-8 server name
74 6f 72 20	}	
00 20 00 14		XOR-MAPPED-ADDRESS attribute header
00 02 a1 47		Address family (IPv6) and xor'd mapped port number
01 13 a9 fa	}	
a5 d3 f1 79	}	Xor'd mapped IPv6 address
bc 25 f4 b5	}	
be d2 b9 d9	}	
00 08 00 14		MESSAGE-INTEGRITY attribute header
a3 82 95 4e	}	
4b e6 7b f1	}	
17 84 c9 7c	}	HMAC-SHA1 fingerprint
82 92 c2 75	}	
bf e3 ed 41	}	
80 28 00 04		FINGERPRINT attribute header
c8 fb 0b 4c		CRC32 fingerprint

2.4. Sample Request with Long-Term Authentication

This request uses the following parameters:

Username: "<U+30DE><U+30C8><U+30EA><U+30C3><U+30AF><U+30B9>"
(without quotes) unaffected by SASLprep [RFC4013] processing

Password: "The<U+00AD>M<U+00AA>tr<U+2168>" and "TheMatrIX" (without
quotes) respectively before and after SASLprep processing

Nonce: "f//499k954d60L34oL9FSTvy64sA" (without quotes)

Realm: "example.org" (without quotes)

00 01 00 60	Request type and message length
21 12 a4 42	Magic cookie
78 ad 34 33 }	
c6 ad 72 c0 }	Transaction ID
29 da 41 2e }	
00 06 00 12	USERNAME attribute header
e3 83 9e e3 }	
83 88 e3 83 }	
aa e3 83 83 }	Username value (18 bytes) and padding (2 bytes)
e3 82 af e3 }	
82 b9 00 00 }	
00 15 00 1c	NONCE attribute header
66 2f 2f 34 }	
39 39 6b 39 }	
35 34 64 36 }	
4f 4c 33 34 }	Nonce value
6f 4c 39 46 }	
53 54 76 79 }	
36 34 73 41 }	
00 14 00 0b	REALM attribute header
65 78 61 6d }	
70 6c 65 2e }	Realm value (11 bytes) and padding (1 byte)
6f 72 67 00 }	
00 08 00 14	MESSAGE-INTEGRITY attribute header
f6 70 24 65 }	
6d d6 4a 3e }	
02 b8 e0 71 }	HMAC-SHA1 fingerprint
2e 85 c9 a2 }	
8c a8 96 66 }	

3. Security Considerations

There are no security considerations.

4. Acknowledgments

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5. References

5.1. Normative References

- [RFC5389] Rosenberg, J., Mahy, R., Matthews, P., and D. Wing, "Session Traversal Utilities for NAT (STUN)", RFC 5389, October 2008.
- [RFC5245] Rosenberg, J., "Interactive Connectivity Establishment (ICE): A Protocol for Network Address Translator (NAT) Traversal for Offer/Answer Protocols", RFC 5245, April 2010.

5.2. Informative References

- [RFC2104] Krawczyk, H., Bellare, M., and R. Canetti, "HMAC: Keyed-Hashing for Message Authentication", RFC 2104, February 1997.
- [RFC4013] Zeilenga, K., "SASLprep: Stringprep Profile for User Names and Passwords", RFC 4013, February 2005.

Appendix A. Source Code for Test Vectors

```
const unsigned char req[] =  
  "\x00\x01\x00\x58"  
  "\x21\x12\xa4\x42"  
  "\xb7\xe7\xa7\x01\xbc\x34\xd6\x86\xfa\x87\xdf\xae"  
  "\x80\x22\x00\x10"  
  "STUN test client"  
  "\x00\x24\x00\x04"  
  "\x6e\x00\x01\xff"  
  "\x80\x29\x00\x08"  
  "\x93\x2f\xf9\xb1\x51\x26\x3b\x36"  
  "\x00\x06\x00\x09"  
  "\x65\x76\x74\x6a\x3a\x68\x36\x76\x59\x20\x20\x20"  
  "\x00\x08\x00\x14"  
  "\x9a\xea\xa7\x0c\xbf\xd8\xcb\x56\x78\x1e\xf2\xb5"  
  "\xb2\xd3\xf2\x49\xc1\xb5\x71\xa2"  
  "\x80\x28\x00\x04"  
  "\xe5\x7a\x3b\xcf";
```

Request message

```
const unsigned char respv4[] =  
  "\x01\x01\x00\x3c"  
  "\x21\x12\xa4\x42"  
  "\xb7\xe7\xa7\x01\xbc\x34\xd6\x86\xfa\x87\xdf\xae"  
  "\x80\x22\x00\x0b"  
  "\x74\x65\x73\x74\x20\x76\x65\x63\x74\x6f\x72\x20"  
  "\x00\x20\x00\x08"  
  "\x00\x01\xa1\x47\xe1\x12\xa6\x43"  
  "\x00\x08\x00\x14"  
  "\x2b\x91\xf5\x99\xfd\x9e\x90\xc3\x8c\x74\x89\xf9"  
  "\x2a\xf9\xba\x53\xf0\x6b\xe7\xd7"  
  "\x80\x28\x00\x04"  
  "\xc0\x7d\x4c\x96";
```

IPv4 response message

```
const unsigned char respv6[] =  
  "\x01\x01\x00\x48"  
  "\x21\x12\xa4\x42"  
  "\xb7\xe7\xa7\x01\xbc\x34\xd6\x86\xfa\x87\xdf\xae"  
  "\x80\x22\x00\x0b"  
  "\x74\x65\x73\x74\x20\x76\x65\x63\x74\x6f\x72\x20"  
  "\x00\x20\x00\x14"  
  "\x00\x02\xa1\x47"  
  "\x01\x13\xa9\xfa\xa5\xd3\xf1\x79"  
  "\xbc\x25\xf4\xb5\xbe\xd2\xb9\xd9"  
  "\x00\x08\x00\x14"  
  "\xa3\x82\x95\x4e\x4b\xe6\x7b\xf1\x17\x84\xc9\x7c"  
  "\x82\x92\xc2\x75\xbf\xe3\xed\x41"  
  "\x80\x28\x00\x04"  
  "\xc8\xfb\x0b\x4c";
```

IPv6 response message

```
const unsigned char reqltc[] =
  "\x00\x01\x00\x60"
  "\x21\x12\xa4\x42"
  "\x78\xad\x34\x33\xc6\xad\x72\xc0\x29\xda\x41\xe"
  "\x00\x06\x00\x12"
  "\xe3\x83\x9e\xe3\x83\x88\xe3\x83\xaa\xe3\x83\x83"
  "\xe3\x82\xaf\xe3\x82\xb9\x00\x00"
  "\x00\x15\x00\x1c"
  "\x66\x2f\x2f\x34\x39\x39\x6b\x39\x35\x34\x64\x36"
  "\x4f\x4c\x33\x34\x6f\x4c\x39\x46\x53\x54\x76\x79"
  "\x36\x34\x73\x41"
  "\x00\x14\x00\x0b"
  "\x65\x78\x61\x6d\x70\x6c\x65\x2e\x6f\x72\x67\x00"
  "\x00\x08\x00\x14"
  "\xf6\x70\x24\x65\x6d\xd6\x4a\x3e\x02\xb8\xe0\x71"
  "\x2e\x85\xc9\xa2\x8c\xa8\x96\x66";
```

Request with long-term credentials

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