NSS Cryptographic Module Freebl Version 3.12.4

FIPS 140-2 Non-Proprietary Security Policy

Level 1 Validation

Red Hat, Inc.

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Introduction

A security policy includes the precise specification of the security rules under which the cryptographic module **must** operate, including rules derived from the security requirements of the FIPS PUB 140-2 standard, and the additional security rules listed below. The rules of operation of the cryptographic module that define within which role(s), and under what circumstances (when performing which services), an operator is allowed to maintain or disclose each security relevant data item of the cryptographic module.

There are three major reasons for developing and following a precise cryptographic module security policy:

- To induce the cryptographic module vendor to think carefully and precisely about who they want to access the cryptographic module, the way different system elements can be accessed, and which system elements to protect.
- To provide a precise specification of the cryptographic security to allow individuals and organizations (e.g., validators) to determine whether the cryptographic module, as implemented, does obey (satisfy) a stated security policy.
- To describe to the cryptographic module user (organization, or individual operator) the capabilities, protections, and access rights they will have when using the cryptographic module.

The NSS Freebl cryptographic module is an open-source, general-purpose cryptographic hash library. It is available for free under the Mozilla Public License, the GNU General Public License, and the GNU Lesser General Public License. The NSS Freebl cryptographic module is jointly developed by Red Hat and Sun engineers and is used in the GNU glibcrypt library.

The NSS cryptographic module has two modes of operation: the *FIPS Approved* mode and *non-FIPS Approved* mode. By default, the module operates in the non-FIPS Approved mode. To operate the module in the FIPS Approved mode, an application must adhere to the security rules in the **Security Rules** section, initialize the module properly with the fips_enabled flag in the Linux kernel set to true.

In addition the operating system must be configured in a single operator mode of operation by removing all other user accounts and turning off all remote login and access services.

This module is a multi-chip standalone module, and no components in the module are excluded from FIPS 140-2 security requirements.

Platform List

FIPS 140-2 conformance testing of the NSS Freebl cryptographic module was performed on the following platforms listed below.

- Security Level 1
  - `64-bit binary on IBM System x3550 running Red Hat Enterprise Linux v5`
  - `32-bit binary on HP ProLiant DL145 running Red Hat Enterprise Linux v5`

The NSS Freebl cryptographic module supports many other platforms. If you would like to have the module validated on other platforms, please contact us.

Security Rules

The following list specifies the security rules that the NSS Freebl cryptographic module and each product using the module shall adhere to:

1. The NSS Freebl cryptographic module shall consist of software libraries compiled for each supported platform.
2. The cryptographic module shall rely on the underlying operating system to ensure the integrity of the cryptographic module loaded into memory. A cryptographic module user shall have access to **all** the services provided by the cryptographic module.
3. Message digesting services are public only since CSPs are not accessed.
4. In the FIPS Approved mode of operation, the cryptographic module shall enforce rules specific to FIPS 140-2 requirements.
5. In the FIPS Approved mode of operation the cryptographic module shall not allow critical errors to compromise security. Whenever a critical error (e.g., a self-test failure) is encountered, the cryptographic module shall enter an error state and the library shall need to be reinitialized to resume normal operation. Reinitialization is accomplished by calling `NSSLOW_Shutdown` followed by `NSSLOW_Init`.
6. Resetting and restarting the NSS Freebl cryptographic module with the `NSSLOW_Reset` and `NSSLOW_Init` functions shall execute the same power-up self-tests detailed above when initializing the module library for the FIPS Approved mode. This allows a user to execute these power-up self-tests on demand as defined in Section 4.9.1 of FIPS 140-2.
7. The FIPS 140-2 cipher suite shall consist solely of Secure Hash Standard (SHA-1, SHA-256, SHA-384, and SHA-512) (FIPS 180-2) for hashing.

Algorithm validation certificates:

Algorithm	Cert#	Description
SHS	1048	SHA-1 (BYTE-only) SHA-256 (BYTE-only) SHA-384 (BYTE-only) SHA-512 (BYTE-only)
DSA	366	DSA 1024 used internally for integrity checking

The NSS Freebl cryptographic module implements the following non-Approved algorithms, which shall not be used in the FIPS Approved mode of operation:

- MD2 or MD5 for hashing.

8. Once the FIPS Approved mode of operation has been selected, SHA-1, SHA-256, SHA-386, and SHA-512 shall be the only algorithms used to perform one-way hashes of data.
9. The NSS Freebl cryptographic module consists of the following shared libraries/DLLs and the associated `.chk` files:

- Red Hat Enterprise Linux 5 x86, and Red Hat Enterprise Linux 5 x86_64
  - `libfreebl3.so`
  - `libfreebl3.chk`

The installation instructions are:

Step 1: Install the shared libraries/DLLs and the associated `.chk` files in a directory on the shared library/DLL search path, which could be a system library directory (`/usr/lib` on Unix/Linux) or a directory specified in the following environment variable:

- Linux: `LD_LIBRARY_PATH`

Step 2: Use the `chmod` utility to set the file mode bits of the shared libraries/DLLs to **0755** so that all users can execute the library files, but only the files' owner can modify (i.e., write, replace, and delete) the files. For example, on most Unix and Linux platforms,

```
$ chmod 0755 llibfreebl3.so
```

The discretionary access control protects the binaries stored on disk from being tampered with.

Step 3: Use the `chmod` utility to set the file mode bits of the associated `.chk` files to **0644**. For example, on most Unix and Linux platforms,

```
$ chmod 0644 libfreebl3.chk
```

Step 4: The kernel fip_enable flag must be set to '1'. The NSS Freebl cryptographic module detects this by reading /proc/sys/crypto/fips_enabled.

(End of Security Rules)

Authentication Policy

Specification of Roles

The NSS Freebl cryptographic module supports two authorized roles for operators.

- The NSS User role provides access to all module services specified in the 'Specfication of Services' table on page 11.
- The Crypto Officer role is supported for the installation and initialization of the module. The Crypto Officer must control the access to the module both before and after installation. Control consists of management of physical access to the computer executing the NSS Freebl cryptographic module code as well as management of the security facilities provided by the operating system.

The NSS Freebl cryptographic module does not have a maintenance role. The roles are implicitly-assumed, as the module does not implement any authentication.

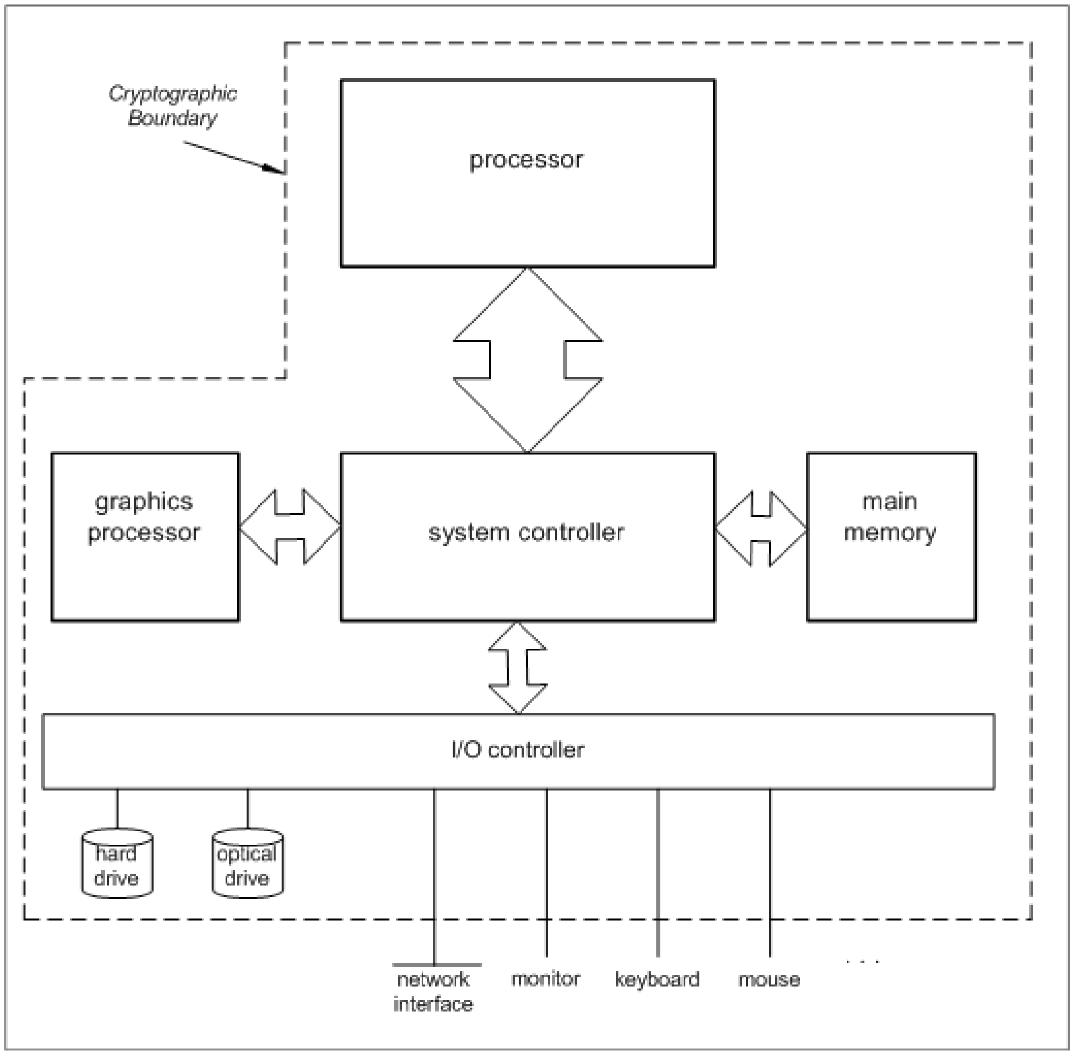
Multiple Concurrent Operators

The NSS Freebl cryptographic module doesn't allow concurrent operators.

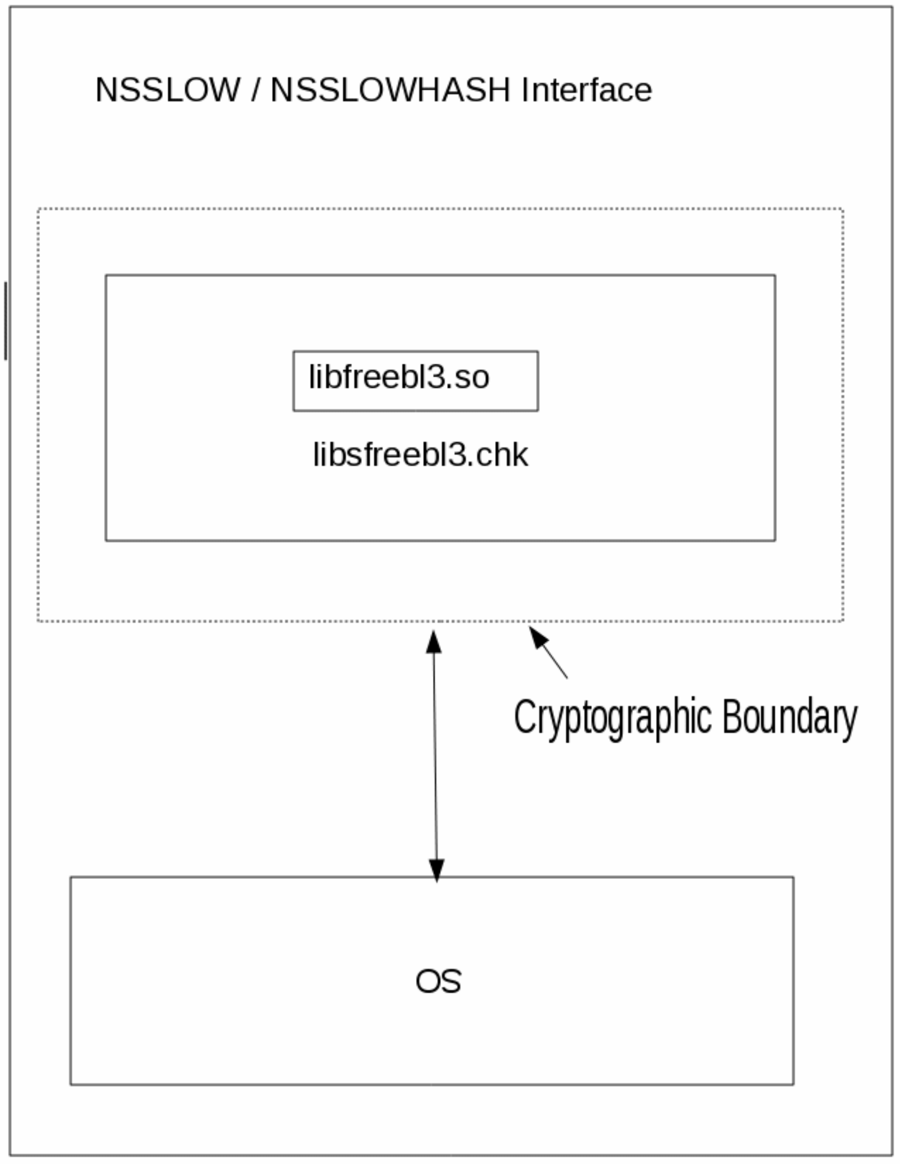
- The operating system has been restricted to a single operator mode of operation, so concurrent operators are explicitly excluded (FIPS 140-2 Section 4.6.1).

Module Ports and Interfaces

Physical Cryptographic Boundary


Cryptographic Boundary
processor
graphics processor
system controller
main memory
I/O controller
hard drive
optical drive
network interface
monitor
keyboard
mouse
. . .

Logical Cryptographic Boundary



Logical Interfaces

The following four logical interfaces have been designed within the NSS Freebl cryptographic module.

1. Data input interface: function input arguments that specify plaintext data; and hash data that are to be input to and processed by the NSS Freebl cryptographic module.
2. Data output interface: function output arguments that receive plaintext data; and hash data from the NSS Freebl cryptographic module.
3. Control input interface: function calls, or input arguments that specify commands and control data (e.g., algorithms, algorithm modes, or module settings) used to control the operation of the NSS Freebl cryptographic module
4. Status output interface: function return codes, error codes, or output arguments that receive status information used to indicate the status of the NSS Freebl cryptographic module

The NSS Freebl cryptographic module uses different function arguments for input and output to distinguish between data and control for input and data and status for output, and to disconnect the logical paths followed by data/control entering the module and data/status exiting the module. The NSS Freebl cryptographic module doesn't use the same buffer for input and output. After the NSS Freebl cryptographic module is done with an input buffer that holds security-related information, it always zeroizes the buffer so that if the memory is later reused as an output buffer, no sensitive information may be inadvertently leaked.

Access Control Policy

This section identifies the cryptographic keys and CSPs that the user has access to while performing a service, and the type of access the user has to the CSPs. The NSS Freebl cryptographic module does not access CPSs.

Security-Relevant Information

Self-Tests

In the FIPS Approved mode of operation the cryptographic module does not allow critical errors to compromise security. Whenever a critical error (e.g., a self-test failure) is encountered, the cryptographic module enters an error state and the library needs to be reinitialized to resume normal operation. Reinitialization is accomplished by calling `NSSLOW_Shutdown` followed by `NSSLOW_Init`.

Upon initialization of the cryptographic module library for the FIPS Approved mode of operation, the following power-up self-tests shall be performed:

a) SHA-1 hash,
b) SHA-256 hash,
c) SHA-384 hash,
d) SHA-512 hash,
e) DSA signature verification integrity check

Resetting and restarting the NSS cryptographic module with the `NSSLOW_Reset` and `NSSLOW_Init` functions shall execute the same power-up self-tests detailed above when initializing the module library for the FIPS Approved mode. This allows a user to execute these power-up self-tests on demand as defined in Section 4.9.1 of FIPS 140-2.

On success NSSLOW_Init will return an init context required by NSSLOW_Reset, NSSLOW_Shutdown and NSSLOWHASH_CreateContext. On failure NSSLOW_Init will return NULL.

Specification of Services

Cryptographic module consists solely of public services which require no user authentication.

Service Category	Role	Function Name	Description	Cryptographic Keys and CSPs Accessed	Access type, RWZ
General purpose	User	NSSLOW_Init	initializes the module library, checks for the FIPS Approved mode of operation. This function provides the power-up self-test service and the Show Status service.	none	-
	User	NSSLOW_Shutdown	finalizes (shuts down) the module library	none	Z
	User	NSSLOW_Reset	resets the power on self-test flag	none	-
Message digesting	User	NSSLOWHASH_NewContext	Create a hashing context to be used by NSSLOWHASH_Begin, NSSLOWHASH_Update, NSSLOWHASH_Destroy, and NSSLOWHASH_Length	none	
	User	NSSLOWHASH_Begin	initializes a message-digesting operation	none	-
	User	NSSLOWHASH_Update	continues a multiple-part digesting operation	none	-
	User	NSSLOWHASH_Destroy	finishes a multiple-part digesting operation	none	-
	User	NSSLOWHASH_Length	Returns the length of the selected hash	none	-

Sample Cryptographic Module Initialization Code

```
#include <stdio.h>
#include <nspr4/prtypes.h>
#include <nss3/hasht.h>
#include "nsslowhash.h"

  /* SHA-256 Known Digest Message (256-bits). */
    static const unsigned char sha256_known_digest[] = {
        0x38,0xa9,0xc1,0xf0,0x35,0xf6,0x5d,0x61,
        0x11,0xd4,0x0b,0xdc,0xce,0x35,0x14,0x8d,
        0xf2,0xdd,0xaf,0xaf,0xcf,0xb7,0x87,0xe9,
        0x96,0xa5,0xd2,0x83,0x62,0x46,0x56,0x79};

/* Known Hash Message (512-bits).  Used for all hashes (incl. SHA-N
[N>1]). */
static const unsigned char known_hash_message[] = {
  "The test message for the MD2, MD5, and SHA-1 hashing algorithms." };



main(int argc, char **argv)
{
    NSSLOWInitContext *initCtx;
    NSSLOWHASHContext *ctx;
    unsigned char results_buf[64];
    int len;

   initCtx = NSSLOW_Init();
   if (initCtx == NULL) {
        printf("Couldn't init hash\n");
        return 1;
   }
   ctx = NSSLOWHASH_NewContext(initCtx, HASH_AlgSHA256);
   if (ctx == NULL) {
        printf("Couldn't get hash context\n");
        return 1;
   }
   NSSLOWHASH_Begin(ctx);
   NSSLOWHASH_Update(ctx, known_hash_message, 64);
   NSSLOWHASH_End(ctx, results_buf, &len, sizeof(results_buf));
   NSSLOWHASH_Destroy(ctx);
   NSSLOW_Shutdown(initCtx);

   if (len != sizeof(sha256_known_digest)) {
        printf("Hash result lengths do not match (%d != %d)\n",
                        len, sizeof(sha256_known_digest));
        return 2;
   }
   if (memcmp(sha256_known_digest, results_buf, len) != 0) {
        printf("Hash result not match\n");
        return 3;
   }
   printf(" hash completed and OK \n" );


   return 0;
}
```

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