Xceedium

FIPS 140-2 Non-Proprietary Security Policy

for the

Xceedium GateKeeper™
Hardware Version 5 or 5a
Firmware Version 5.2.1

Level 2 Validation

Document Version: Version 3.5

April 20, 2011

REVISION HISTORY

The table below provides revision history of this document.

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1.0	March 2, 2007	Apex Assurance Group	Initial Draft for submission to EWA
1.1	April 16, 2007	Apex Assurance Group	Revise with comments from EWA
1.2	July 12, 2007	Apex Assurance Group	Address comments from NIST
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2.2	August 18, 2009	Ryan Maple, Xceedium Dave Olander, Xceedium	Revise with comments from EWA
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3.3	January 26, 2011	Ryan Maple, Xceedium	Updates for GateKeeper 5.2.1
3.4	February 14, 2011	Ryan Maple., Xceedium	Added CAVP certificate numbers and deprecation statement.
3.5	April 20, 2011	Ryan Maple, Xceedium	Revise with comments from the CMVP.

Table 1 - Security Policy Revision History

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INTRODUCTION

Background

Federal Information Processing Standards Publication 140-2 — Security Requirements for Cryptographic Modules specifies requirements for cryptographic products to be deployed in a Sensitive but Unclassified environment. More information about the FIPS 140-2 standard and validation program is available on the NIST website at http://csrc.nist.gov/groups/STM/cmvp/index.html .

This non-proprietary Cryptographic Module Security Policy for the GateKeeper from Xceedium provides an overview of the product and a high-level description of how it meets the security requirements of FIPS 140-2. This document contains details on the module's cryptographic keys and critical security parameters. This Security Policy concludes with instructions and guidance on running the module in a FIPS 140-2 mode of operation.

External Resources

The Xceedium website (http://www.xceedium.com) contains information on the full line of products from Xceedium, including a detailed overview of the GateKeeper solution. The NIST Cryptographic Module Validation Program website (http://csrc.ncsl.nist.gov/groups/STM/cmvp/index.html) contains Xceedium contact information for answers to technical or sales-related questions.

Notices

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XCEEDIUM GATEKEEPER

Product Overview

The Xceedium GateKeeper™, which may also be referred to simply as GateKeeper, provides many of the required day-to-day IT functions for organizations in a 1U, rack-mountable appliance. It provides TLS-secured, in-band and out-of-band management and monitoring of networking equipment, UNIX, Linux, Mac OS and Windows servers and workstations, as well as remote power-management to either turn on, turn off, or reboot any attached device. The GateKeeper offers the following functions:

- All-in-one web-based remote in-band access,
- Web-enabled serial console for remote out-of-band access,
- Web-based Virtual Desktop to bring secure remote management of your UNIX (X-Windows and CDE), Windows, Linux, and Macintosh desktops right to any web-browser without the need to install processor intensive, bandwidth hungry, large applications from other vendors on every desktop and server,
- Web-based Secure Shell (SSH) and Telnet access to all computer desktops and workstations as well as network devices and terminal servers,
- Encrypted connectivity without Virtual Private Networks (VPN) – No expensive VPN tunnels to worry about everywhere your support staff travels – lowers total cost of ownership, and
- Multi-level Authentication.

The GateKeeper features include:
- Web-based access to establish telnet, SSH, and standard operating system specific GUI sessions to devices over TCP/IP,
- IPsec and SSL-VPN support,
- Remote power management – allowing you to turn attached devices on or off, and
- External LCD display for entering initial host connection information without needing access to a laptop of other terminal, as well as checking on system configuration.
- The ability for multiple concurrent operators to be logged in at the same time.

Cryptographic Module Specification

The module is the Xceedium GateKeeper, running firmware version 5.2.1 on either hardware version 5 or 5a. The module is classified as a multi-chip standalone cryptographic module. The physical cryptographic boundary is defined as the module's case and all components within the case. The BIOS is excluded from the requirements of FIPS 140-2. The physical boundary is pictured in the image below:

Figure 1 – Physical Boundary

Validation Level

The following table lists the level of validation for each area in FIPS 140-2.

FIPS 140-2 DTR Section	Section Title	Module Validation Level
1	Cryptographic Module Specification	2
2	Cryptographic Module Ports and Interfaces	2
3	Roles, Services, and Authentication	3
4	Finite State Model	2
5	Physical Security	2
6	Operational Environment	N/A
7	Cryptographic Key Management	2
8	Electromagnetic Interference / Electromagnetic Compatibility	2
9	Self-Tests	2
10	Design Assurance	3
11	Mitigation of Other Attacks	N/A

Table 2 – Validation Level by DTR Section

Module Interfaces

The interfaces for the cryptographic boundary include physical and logical interfaces. The physical interfaces provided by the module are mapped to four FIPS 140-2 defined logical interfaces: Data Input, Data Output, Control Input, and Status Output. The mapping of logical interfaces to module physical interfaces is provided in the following table:

FIPS 140-2 Logical Interface	Module Physical Interface
Data Input	6 Gigabit Ethernet Interfaces
Data Output	6 Gigabit Ethernet Interfaces
Control Input	6 Gigabit Ethernet Interfaces On/Off Switch Reset Switch

FIPS 140-2 Logical Interface	Module Physical Interface
Status Output	6 Gigabit Ethernet Interfaces LCD Panel LEDs RJ-45 RS-232 Serial Interface
Power	Power Plug
Unused Interface	2 USB Interfaces*

Table 3 – Logical Interface / Physical Interface Mapping

* The USB interfaces are wired; however, the Xceedium software does not allow any communications through these interfaces. Driver support for the USB interfaces is not compiled into the shipping image, and it is disabled at the BIOS level.

Roles and Services

In the FIPS-approved mode of operation, the module is accessed via a Web browser over HTTPS/TLS (see Secure Operation of the GateKeeper section of this document for more details). As required by FIPS 140-2, there are two roles (a Crypto Officer role and User role) in the module that operators may assume. The module supports identity-based authentication, and the respective services for each role are described in the following sections.

The module supports basic management via the LCD panel. This unauthenticated service is used to define basic network configuration, reset to factory defaults, reboot or shut down the GateKeeper, or to initialize the module for FIPS mode of operation. When in FIPS mode, the LCD Management is completely disabled.

Additionally, the power-up self-tests that are run when FIPS mode is enabled are an unauthenticated service.

Crypto Officer Role

The Crypto Officer role is responsible for the configuration and maintenance of the module and authenticates via Web browser over HTTPS/TLS[1]. The Crypto Officer services consist of the following FIPS services:

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[1] Except for the initial configuration for FIPS mode of operation, where the Crypto Officer will first use the LCD panel (see *Secure Operation of the GateKeeper* section of this document for more details)

Service	Description
Authenticate	Allows the Crypto Officer to authenticate to access the services available to the role.
Sessions	Utilize administrative features such as viewing active logins, sessions, logs, and reporting.
Config	Utilize the configuration features such as setting system parameters, conducting maintenance tasks, and uploading new firmware.
Services	Create custom access methods to run either local clients or launch a URL
Users	Utilize user management features, such as create, update, and delete.
Devices	Utilize device management features, such as create, update, and delete.
Policy	Utilize policy association management features, such as create, update, and delete.
Access	A default setting allowing the user to utilize the assigned access methods. This also allows the KVM and power management features to be available for the user.
Monitoring	A default setting allowing the user to utilize the monitoring feature.
User Account Management	Allows the user to view and change their password and contact information
Global Settings	Utilize the global settings feature to enable customization of policies for passwords, timeouts, services, and user warnings.

Table 4 – Crypto Officer Services and Descriptions

The Crypto Officer Role may perform zeroization of all the CSPs listed in Table 7 and may also check the status of the module.

Note that all services are invoked via HTTPS session using the following algorithms in the TLS protocol:
- FIPS-approved PRNG for generation of Diffie Hellman Private Component
- Diffie Hellman for key agreement with encryption strength of 80-bits, 96-bits, or 112-bits
- RSA for:
    - Digital signature generation and verification for self-signing of certificates using 1024-bit and 2048-bit key lengths
    - Key transport with encryption strength of 80-bits, 96-bits, 112-bits, 128-bits, or 160-bits
- HMAC SHA (all variants) for message integrity checking
- AES or TDES for data encryption encrypted via symmetric encryption algorithm (AES or TDES).

User Role

The User Role authenticates via Web browser over HTTPS/TLS. The User services available in the module consist of the following FIPS services:

Service	Description
Access	A default setting allowing the user to utilize the assigned access methods. This also allows the KVM and power management features to be available for the user.
Monitoring	A default setting allowing the user to utilize the monitoring feature.
Authenticate	Allows the user to authenticate to access the services available to the role.
User Account Management	Allows the user to view and change their password and contact information.

Table 5 – User Services and Descriptions

The User Role may only perform zeroization of User Passwords.

Note that all services are invoked via HTTPS session using the following algorithms in the TLS protocol:
- FIPS-approved PRNG for generation of Diffie Hellman Private Component
- Diffie Hellman for key agreement with encryption strength of 80-bits, 96-bits, or 112-bits

- RSA for:
  - o Digital signature generation and verification for self-signing of certificates using 1024-bit and 2048-bit key lengths
  - o Key transport with encryption strength of 80-bits, 96-bits, 112-bits, 128-bits, or 160-bits
- HMAC SHA (all variants) for message integrity checking
- AES or TDES for data encryption encrypted via symmetric encryption algorithm (AES or TDES).

The services accessing the Critical Security Parameters (CSP)s, the type of access and the role accessing the CSPs are listed in Table 8 – Role and Service Access to Security Relevant Data Items.

Authentication

The module supports either a username and password or digital certificates for authenticating operators. The table below provides estimated strength of the authentication mechanisms:

Authentication Type	Strength
Username and Password mechanism	Passwords must be a minimum of 6 characters and a maximum of 15 characters (see Secure Operation section of this document). The password can consist of alphanumeric values, [a-zA-Z0-9], yielding 62 choices per character. The probability of a successful random attempt is $1/62^6$, which is less than 1/1,000,000. For the Super and Config accounts, assuming 10 attempts per second via a scripted or automatic attack, the probability of a success with multiple attempts in a one minute period is $600/62^6$, which is less than 1/100,000. For accounts other than the Super account, the module will lock an account after 3 failed authentication attempts; thus, the maximum number of attempts in one minute is 3. Therefore, the probability of a success with multiple consecutive attempts in a one minute period is $3/62^6$ which is less than 1/100,000.
Certificate-based authentication	The module supports a public key based authentication with 512, 768, 1024, and 2048 (for RSA) bit keys[2]. A 1024-bit RSA key has at least 80-bits of equivalent strength. The probability of a successful random attempt is $1/2^{80}$, which is less than 1/1,000,000. Assuming the module can support 60 authentication attempts in one minute, the probability of a success with multiple consecutive attempts in a one minute period is $60/2^{80}$ which is less than 1/100,000. A 2048-bit RSA key has at least 112-bits of equivalent strength. The probability of a successful random attempt is $1/2^{112}$, which is less than 1/1,000,000. Assuming the module can support 60 authentication attempts in one minute, the probability of a success with multiple consecutive attempts in a one minute period is $60/2^{112}$ which is less than 1/100,000.

Table 6 – Estimated Strength of Authentication Mechanisms

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[2] As described in the *Secure Operation of the GateKeeper* section, 512-bit and 768-bit RSA keys must not be used in FIPS mode of operation.

To authenticate to the module for management purposes (i.e., accessing available services defined in the Crypto Officer Role and User Role sections), an operator must connect to the module via a supported, Java-enabled, Web browser and provide either a username and password or a valid digital certificate. A valid user name and password or a digital certificate is required for all services accessed through a browser.

Note that all services are available when accessing the module via certificate-based authentication.

Cryptographic Key Management

Table 7 provides a complete list of critical security parameters[3] used within the module:

IDENTIFIER	KEY / CSP NAME	DESCRIPTION	STORAGE (FORMAT)	DELETION
1	PRNG Seed and Seed Key	Generated from non-FIPS approved PRNG in OpenSSL code implemented in module; used in ANSI X9.31 Appendix A.2.4 FIPS-approved PRNG (using AES)	RAM (plaintext)	Generating a new seed
2	Public keys	Public keys of peers	RAM (plaintext)	Resetting or rebooting the module
3	RSA public/private keys	Identity certificates for the module itself and also used in TLS negotiations. The module supports 1024 and 2048 bit key sizes.	NVRAM (plaintext)	Deleting the certificate or certificate request; The keys are overwritten with dashes via command sent by the Crypto Officer over the web interface.
4	TLS Traffic Keys	Used in HTTPS connections	RAM (plaintext)	Resetting or rebooting the module
5	User Passwords	Secret	NVRAM/Flash Memory (plaintext) and RAM (plaintext)	Overwriting the passwords with new ones
6	Crypto Officer Passwords	Secret	NVRAM/Flash Memory (plaintext) and RAM (plaintext)	Overwriting the passwords with new ones
7	Xceedium default certificate and private key	Used in HTTPS connections	NVRAM (plaintext)	Deleting the certificate or certificate request; The private key is overwritten with dashes via command sent by the Crypto Officer over the web interface.
8	Diffie-Hellman Key Pairs[4]	Key agreement for TLS sessions	RAM (plaintext)	Resetting or rebooting the module
9	IPsec Traffic Keys	Used to encrypt IPsec sessions	RAM (plaintext)	Resetting or rebooting the module
10	Client Certificates	Authenticate PKI peers	RAM (plaintext)	Resetting or rebooting the module
11	HMAC firmware load key	Used to validate firmware upgrade patches	NVRAM (plaintext)	Application of patch (see Crypto Officer Guidance)

Table 7 – Critical Security Parameters

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[3] Public keys are not considered to be critical security parameters.
[4] DH groups 2 (1024 bits), 5 (1536 bits) and 7 (2048 bits) are supported.

The services accessing the Critical Security Parameters (CSP)s, the type of access and the role accessing the CSPs are listed in the following table:

Identifier Services by Role	1	2	3	4	5	6	7	8	9	10	11
User Role											
Access				R			R W		R	R W	
Authenticate		R W	R	R W	R		R	R W	R W	R	
Monitoring				R					R		
User Account Management					R W D						
Crypto Officer Role											
Access				R			R W		R	R W	
Monitoring				R					R		
Authenticate		R W	R	R W		R	R	R W	R W	R	
Sessions				R					R		
Config	R W D	R W D	R W D	R W D	D	R W D	R W D	R W D	R W D	R W D	R W D
Services				R					R		
Users				R	W D	R W D	R W		R	R W	
Devices				R					R		
Associations				R					R		
LCD Management											
Global Settings											

R = Read   W = Write   D = Delete

Table 8 – Role and Service Access to Security Relevant Data Items

The module does support entry of usernames and passwords for authentication, but these parameters are not distributed outside the cryptographic boundary. The module supports electronic key entry; the Crypto Officer may load RSA private keys and certificates to replace the default Xceedium private key and certificate for the module identity. The parameters are loaded via the secured Web interface. The private key and public key certificate associated with the default Xceedium certificate may be output by the Crypto Officer via the secure Web interface in the non-FIPS approved mode of operation.

To zeroize all keys, the Crypto Officer may reset GateKeeper to "factory defaults" by performing a reset of the system database.

Self-Tests

The module includes an array of self-tests that are run during startup and periodically during operations to prevent any secure data from being released and to ensure all components are functioning correctly. The module supports OpenSSL for all IPsec and SSL-VPN operations as well as HTTPS communications. The following sections discuss the module's self-tests in more detail:

Power-On Self-Tests

The module implements the following power-on self test:
- Module integrity check via SHA-1

The module implements the following power-on self-tests for the OpenSSL algorithm implementations:

- RSA KAT (signing and signature verification)
- AES KAT (encryption and decryption)
- Triple DES KAT (encryption and decryption)
- SHA-1 KAT
- HMAC SHA-1 KAT
- HMAC SHA-224 KAT
- HMAC SHA-256 KAT
- HMAC SHA-384 KAT
- HMAC SHA-512 KAT
- PRNG KAT

The module implements the following power-on self-tests for the Linux IPsec Kernel Module algorithm implementations:

- AES KAT (encryption and decryption)
- Triple DES KAT (encryption and decryption)
- SHA-1 KAT
- HMAC SHA-1 KAT
- HMAC SHA-224 KAT
- HMAC SHA-256 KAT
- HMAC SHA-384 KAT
- HMAC SHA-512 KAT

The module performs all power-on self-tests automatically at boot when FIPS mode is enabled. All power-on self-tests must be passed before a User/Crypto Officer can perform services. The power-on self-tests are performed after the cryptographic systems are initialized but prior to the initialization of the Gigabit Ethernet ports, which prevents the module from passing any data during a power-on self-test failure.

An operator can discern that all power-on self-tests have passed via normal operation of the module, which is indicated with the following text on the LCD panel:

```
""""""""""""
GateKeeper
In FIPS mode
""""""""""""
```

For OpenSSL self-test failure: *spfd*[5] will not run, and an error status is sent by *spfd* to the log table. When *spfd* stops, there will be no connections to the module because no process is listening on port 443 (Port 443 is the only way to connect to the module). The module will also provide the following indication of a self-test failure via the LCD: `FIPS mode failed / System halted`, and the user will reboot manually. When rebooted, the module is not running in FIPS mode, and `Network Setup` is displayed on the LCD panel.

The module will indicate a failure of the integrity test via the LCD; the message `GK SI failure / System halted` is displayed on the LCD. The module writes a log entry to the log table only if the database is initialized prior to the failure.

Conditional Self-Tests

The module performs the following conditional self-tests:

- Pairwise consistency test for RSA
- Continuous Random Number Generator Test for the FIPS-approved PRNG
- Continuous Random Number Generator Test for the non-approved PRNG in the OpenSSL code portion of the cryptographic module
- Firmware load test

The module will provide the following indication of a conditional self-test failure via the LCD: `FIPS mode failed / System halted`, and the user will reboot manually. A log entry is written to the module database.

The module does not support a bypass function because it only transmits encrypted data.

Mitigation of Other Attacks

The module does not mitigate other attacks in a FIPS-approved mode of operation.

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[5] *spfd* is the GateKeeper Secure Port Forwarder Daemon.

SECURE OPERATION OF THE GATEKEEPER

This section describes how to configure the module for FIPS-approved mode of operation. Operating the module without maintaining the following settings will remove the module from the FIPS-approved mode of operation.

Crypto Officer Guidance

Module Initialization and Configuration

Crypto Officer must configure and enforce the following initialization procedures:

1. Verify that the firmware version is 5.2.1.

2. Configure the minimum password length for all accounts to 6 characters.

   > Note: Stronger, more secure passwords should have a combination of letters and numbers and should not contain any recognizable words that may be found in a dictionary. The module does not enforce this; the Crypto Officer must follow their organization's systems security policies and adhere to the password policies set forth therein.

3. Change the default password of the Crypto Officer.

4. Ensure that neither 512-bit or 768-bit RSA keys are used in FIPS mode of operation.

5. Ensure that RADIUS and RSA SecureID authentication mechanisms are not used in FIPS mode of operation.

6. Ensure that DSA is not used in FIPS mode of operation.

7. Configure the Password Failures Limit to 3. This ensures that accounts are locked after 3 unsuccessful authentication attempts.

8. Turn on FIPS mode via the Web interface or LCD panel.

9. Reboot the module.

The GateKeeper should be configured such that plaintext data (e.g. recorded session data) is not output via the same port (physical interface) that is used for ciphertext data.

The Crypto Officer should consider replacing the default Xceedium certificate with another certificate. Additionally, the Crypto Officer must not disclose passwords and must store passwords in a safe location and according to their organization's systems security policies for password storage.

The GateKeeper supports the loading of new firmware if the given firmware is intended to be ran in a FIPS-approved mode of operation. FIPS-approved firmware upgrades issued by Xceedium are cryptographically signed and, should an error occur during upgrade, the GateKeeper will be put into a halted state until a Crypto Officer can clear the error. The firmware upgrade mechanism has an integrity check which uses an

HMAC to verify the integrity of the new firmware. The Crypto Officer may zeroize the HMAC firmware load key by uploading a special patch (FIPS_ZEROIZE_FUHMAC.521.01.p.bin) provided by Xceedium.

Physical Security and Tamper Evidence

The enclosure cover of the GateKeeper is secured to the rear of the chassis with two (2) Torx T10 screws. A single, serialized, tamper evidence label is placed on the GateKeeper at the time of manufacture covering one of these Torx T10 screws while the other screw is directly to the right. This security label is very fragile and cannot be removed without clear signs of damage to the label; any attempt to open the device will damage the tamper evidence label or the material of the module cover. The label is placed on the back of the module, as shown in Figure 2 – Tamper Evidence Label Placement below:

Figure 2 – Tamper Evidence Label Placement

The Crypto Officer should record the serial number of the tamper evident label. The Crypto Officer should inspect the tamper evidence label periodically according to their organization's systems security policies to verify it is not damaged and to verify that the serial number on the tamper evident label matches the recorded value as a means of confirming that the label has not been replaced by a different label.

User Guidance

1. The User must not disclose passwords and must store passwords in a safe location and according to their organization's systems security policies for password storage.

Approved Cryptographic Algorithms

In FIPS mode of operation, only the following FIPS approved algorithms are to be used:

- AES encryption/decryption: Validation #1151 and #1572
- Triple DES encryption/decryption: Validation #833 and #1029
- RSA signing and verifying: Validation #765
- SHA-1, SHA-224, SHA-256, SHA-384, SHA-512 hashing: Validation #1065 and #1392
- HMAC SHA-1, HMAC SHA-224, HMAC SHA-256, HMAC SHA-384, and HMAC SHA-512 for hashed message authentication: Validation #654 and #919
- ANSI X9.31 Appendix A.2.4 for PRNG: Validation #846

Non-FIPS Approved Algorithms

The module implements the following non-FIPS-approved cryptographic algorithms:

- Diffie-Hellman (allowed for use in FIPS mode / key establishment methodology provides 80-bits, 96-bits, or 112-bits of encryption strength)
- DSA (non-compliant): Validation #483
- RSA encryption/decryption (allowed for key transport in FIPS mode / key establishment methodology provides 80-bits, 96-bits, 112-bits, 128-bits, or 160-bits of encryption strength; non-compliant less than 80-bits of encryption strength)
- PRNG included in the OpenSSL code for the cryptographic module

Algorithm Deprecation Statements

As of January 2011 the following algorithms are restricted or deprecated:

- 2-key Triple DES
- 1024 bit RSA
- 1024 bit DSA
- ANSI X9.31 RNG
- SHA-1
- Diffie-Hellman

Please refer to NIST Special Publication 800-131A for more information.

ACRONYM LIST

AES	Advanced Encryption Standard
ANSI	American National Standards Institute
CAC	Common Access Card
CBC	Cipher Block Chaining
CFB	Cipher Feedback
CSP	Critical Security Parameter
DES	Data Encryption Standard
DH	Diffie-Hellman
DSA	Digital Signature Algorithm
DTR	Derived Test Requirements
ECB	Electronic Codebook
FIPS	Federal Information Processing Standard
GUI	Graphical User Interface
HMAC	Hashed Message Authentication Code
HTTPS	Secure Hypertext Transfer Protocol
IP	Internet Protocol
KAT	Known Answer Test
KVM	Keyboard, Video, Mouse
LCD	Liquid Crystal Display
MAC	Message Authentication Code
NIST	National Institute of Standards and Technology
NVRAM	Non-Volatile Random Access Memory
OFB	Output Feedback
PKI	Public Key Infrastructure
PRNG	Pseudo-Random Number Generator
RADIUS	Remote Authentication Dial In User Service
RAM	Random Access Memory
RNG	Random Number Generator
RSA	Rivest, Shamir, Adleman
SHA	Secure Hash Algorithm
SPFD	Sender Policy Framework Daemon
SSH	Secure Shell
SSL	Secure Sockets Layer
TCP	Transmission Control Protocol
TDES	Triple DES
TLS	Transport Layer Security
VPN	Virtual Private Network