Cisco ASA Service Module (SM)

FIPS 140-2 Non Proprietary Security Policy

Level 1 Validation

Version 0.2

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1 Introduction

1.1 Purpose

This is a non-proprietary Cryptographic Module Security Policy for the Cisco ASA Service Module (SM), henceforth referred to as ASA-SM, running Firmware 9.6. This security policy describes how the module meets the security requirements of FIPS 140-2 Level 1 and how to run the module in a FIPS 140-2 mode of operation and may be freely distributed.

FIPS 140-2 (Federal Information Processing Standards Publication 140-2 — *Security Requirements for Cryptographic Modules*) details the U.S. Government requirements for cryptographic modules. More information about the FIPS 140-2 standard and validation program is available on the NIST website at http://csrc.nist.gov/groups/STM/index.html.

1.2 Module Validation Level

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

No.	Area Title	Level
1	Cryptographic Module Specification	1
2	Cryptographic Module Ports and Interfaces	1
3	Roles, Services, and Authentication	3
4	Finite State Model	1
5	Physical Security	1
6	Operational Environment	N/A
7	Cryptographic Key management	1
8	Electromagnetic Interface/Electromagnetic Compatibility	1
9	Self-Tests	1
10	Design Assurance	2
11	Mitigation of Other Attacks	N/A
	Overall module validation level	**1**

Table 1 Module Validation Level

1.3 References

This document deals only with the operations and capabilities of the Cisco ASA-SM blade listed in section 1.2 above as it relates to the technical terms of a FIPS 140-2 cryptographic module security policy. More information is available from the following sources:

The Cisco Systems website contains information on the full line of Cisco Systems security. Please refer to the following website:

http://www.cisco.com/en/US/products/ps11621/index.html

http://www.cisco.com/c/en/us/td/docs/security/asa/quick_start/module/asa_sm_qsg.html?referring_site=RE&pos=2&page=http://www.cisco.com/c/en/us/products/collateral/interfaces-modules/catalyst-6500-series-7600-series-asa-services-module/qa_c67-662207.html

For answers to technical or sales related questions please refer to the contacts listed on the Cisco Systems website at www.cisco.com.

The NIST Validated Modules website (http://csrc.nist.gov/groups/STM/cmvp/validation.html) contains contact information for answers to technical or sales-related questions for the module.

1.4 Terminology

In this document, the Cisco ASA-SM identified above is referred to as ASA-SM Security Blade, Blade, Module or the System.

1.5 Document Organization

The Security Policy document is part of the FIPS 140-2 Submission Package. In addition to this document, the Submission Package contains:

Vendor Evidence document
Finite State Machine
Other supporting documentation as additional references

This document provides an overview of the Cisco ASA-SM Blade model identified in section 1.2 above and explains the secure configuration and operation of the module. This introduction section is followed by Section 2, which details the general features and functionality of the blades. Section 3 specifically addresses the required configuration for the FIPS-mode of operation.

With the exception of this Non-Proprietary Security Policy, the FIPS 140-2 Validation Submission Documentation is Cisco-proprietary and is releasable only under appropriate non-disclosure agreements. For access to these documents, please contact Cisco Systems.

2 Cisco ASA-SM Blade

Image 1: ASA-SM into any of the CAT6K slots

The ASA-SM, part number WS-SVC-ASA-SM1-K9, is a high performance security service module (SM) housed in the Catalyst 6500 chassis. It will serve as the next generation for the existing Firewall Service Module (FWSM).

The following Cisco Catalyst 6500 Series chassis support the ASA Service Module:

- WS-C6503-E: 3-slot chassis
- WS-C6504-E: 4-slot chassis
- WS-C6506-E: 6-slot chassis
- WS-C6509-E: 9-slot chassis
- WS-C6509-VE: 9-slot chassis
- WS-C6513-E: 13-slot chassis

The ASA-SM firmware is based on normal ASA code, the behavior and commands follow ASA as opposed to FWSM. The firmware version on ASA-SM is 9.6. Cisco ASA-SM blades integrate world-class firewall and Secure Sockets Layer/IP Security (SSL/IPsec) VPN.

The following subsections describe the physical and security characteristics of the ASA-SM blade.

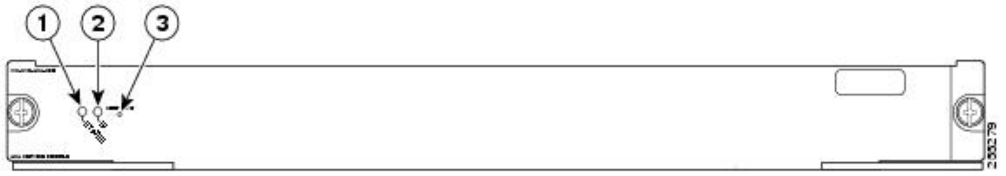
2.1 Cryptographic Module Physical Characteristics

Cisco ASA Service Module (SM) is a high-speed, integrated network security module housed in Catalyst 6500 providing enhanced security, reliability, and performance. Delivering industry-leading firewall data rates, this module provides exceptional scalability to meet the needs of today's dynamic organizations - in a single blade architecture. With twice the performance and four times the session count of competitive network security modules, it supports up to:

- 20 Gbps maximum firewall throughput (max)
- 16 Gbps of maximum firewall throughput (multi-protocol)
- 300,000 connections per second
- 10 million concurrent connections
- 250 security contexts
- 1,000 VLANs

Its advanced features help reduce costs and operational complexity, while allowing management of multiple firewalls from the same platform. In addition, up to four ASA Services Module blades can be installed in the Catalyst 6500, providing scalability to 64 Gbps.

The ASA Services Module makes it easy to add full firewall capabilities to an existing infrastructure by sliding a blade into an empty slot in an existing Catalyst 6500 - no additional rack space, cabling, power, or physical interface is required. It also works in tandem with other modules in the chassis to deliver robust security throughout the entire chassis, effectively making every port a security port. This module is used to support TLSv1, TLSv1.1, TLSv1.2, SSHv2, IKEv2, Remote Access VPN [With TLSv1 and IKEv2/ ESPv3] and Suite B.



1	Status LED	2	ID LED	3	Reset Switch

Figure 1: ASA-SM Front Panel

All other sides are contained within the Catalyst 6500 Series. As such they are not visible unless the blade is removed from the Catalyst 6500 Series.

2.2 Cryptographic Boundary

The Cisco ASA-SM contains a multiple-chip embedded cryptographic module with the cryptographic boundary defined as just the blade.

2.3 Module Interfaces

The module provides a number of physical and logical interfaces to the device, and the physical interfaces provided by the module are mapped to the following FIPS 140-2 defined logical interfaces: data input, data output, control input and status output. The module provides no power to external devices and takes in its own power through a normal power input interface. The logical interfaces and their mapping are described in the following tables:

FIPS 140-2 Logical Interface	ASA SM Physical Interface
Data Input Interface	VLAN
Data Output Interface	VLAN
Control Input Interface	VLAN Reset Switch
Status Output Interface	VLAN Status LED ID LED

Table 2: Interface diagram

Please note that the module’s VLAN interface listed in Table 2 above can be accessed in one of the following ways:

- Console Port (via the Catalyst 6k console port)
- Telnet over IPsec (via the Catalyst 6k Ethernet ports)
- SSH v2 (via the Catalyst 6k Ethernet ports)
- ASDM via HTTPS/TLS (via the Catalyst 6k Ethernet ports)

2.4 Roles and Services

Authentication is identity-based. Each user is authenticated by the module upon initial access to the module. As required by FIPS 140-2, there are two roles in the security blades that operators may assume: Crypto Officer role and User role. The administrator of the security blades assumes the Crypto Officer role in order to configure and maintain the module using Crypto Officer services, while the Users exercise only the basic User services. The module also supports RADIUS and TACACS+ as another means of authentication, allowing the storage of usernames and passwords on an external server as opposed to using the module’s internal database for storage.

The User and Crypto Officer passwords and all shared secrets must each be at a minimum eight (8) characters long. There must be at least one special character and at least one number character (enforced procedurally) along with six additional characters taken from the 26 upper case, 26 lower case, 10 number and 32 special characters.   If six (6) special/alpha/number characters, one (1) special character and one (1) number are used without repetition for an eight (8) digit value, the probability of randomly guessing the correct sequence is one (1) in

187,595,543,116,800. This is calculated by performing 94 x 93 x 92 x 91 x 90 x 89 x 32 x 10. In order to successfully guess the sequence in one minute would require the ability to make over 3,126,592,385,280 guesses per second, which far exceeds the operational capabilities of the module.

Additionally, when using RSA based authentication, RSA key pair has a modulus size of 2048 bits, thus providing 112 bits of strength. Assuming the low end of that range, an attacker would have a 1 in 2^{112} chance of randomly obtaining the key, which is much stronger than the one in a million chance required by FIPS 140-2. To exceed a one in 100,000 probability of a successful random key guess in one minute, an attacker would have to be capable of approximately $8.65x10^{31}$ attempts per second, which far exceeds the operational capabilities of the module to support.

User Services

A User enters the system by accessing the console port with a terminal program or via IPsec protected telnet or SSH session to an Ethernet port or ASDM via HTTPS/TLS. The module prompts the User for username and password. If the password is correct, the User is allowed entry to the module management functionality. The other means of accessing the console is via an IPsec session. This session is authenticated either using a shared secret or RSA digital signature authentication mechanism. The services available to the User role accessing the CSPs, the type of access – read (r), write (w) and zeroize/delete (d) – and which role accesses the CSPs are listed below:

Services	Description	Keys and CSPs Access
Status Functions	View state of interfaces and protocols, version of firmware currently running.	Operator password (r)
Terminal Functions	Adjust the terminal session (e.g., lock the terminal, adjust flow control).	Operator password (r)
Directory Services	Display directory of files kept in flash memory.	Operator password (r)
Self-Tests	Execute the FIPS 140 start-up tests on demand.	N/A
IPsec VPN	Negotiation and encrypted data transport via IPSec VPN.	Operator password, skeyid, skeyid_d, SKEYSEED, IKE session encrypt key, IKE session authentication key, ISAKMP preshared, IKE authentication private Key, IKE authentication public key, IPsec encryption key and IPsec authentication key (r, w, d)
SSH Functions	Negotiation and encrypted data transport via SSH.	Operator password, SSH Traffic Keys (r, w, d)
HTTPS Functions (TLS)	Negotiation and encrypted data transport via HTTPS.	Operator password, TLS pre-master secret, TLS Traffic Keys (r, w, d)

Table 3 - User Services

Crypto Officer Services

The Crypto Officer role is responsible for the configuration and maintenance of the security appliances and authenticates from the **enable** command (for local authentication) or the **login c**ommand (for AAA authentication) from the user services. The Crypto Officer services consist of the following:

The Crypto Officer role is responsible for the configuration of the module. The services available to the User role accessing the CSPs, the type of access – read (r), write (w) and zeroized/delete (d) – and which role accesses the CSPs are listed below:

Services	Description	Keys and CSPs Access
Configure the Security Blade	Define network interfaces and settings, create command aliases, set the protocols the module will support, enable interfaces and network services, set system date and time, and load authentication information.	ISAKMP preshared, Operator password, Enable password, IKE session encrypt key, IKE session authentication key, IKE authentication private Key, IKE authentication public key, IPsec encryption key, IPsec authentication key (r, w, d)
Define Rules and Filters	Create packet Filters that are applied to User data streams on each interface. Each Filter consists of a set of Rules, which define a set of packets to permit or deny based on characteristics such as protocol ID, addresses, ports, TCP connection establishment, or packet direction.	Operator password, Enable password (r, w, d)
View Status Functions	View the module configuration, routing tables, active sessions, health, temperature, memory status, voltage, packet statistics, review accounting logs, and view physical interface status.	Operator password, Enable password (r, w, d)
Manage the Security Blade	Log off users, shutdown or reload the module, erase the flash memory, manually back up module configurations, view complete configurations, manager user rights, and restore module configurations.	Operator password, Enable password (r, w, d)
Configure Encryption/Bypass	Set up the configuration tables for IP tunneling. Set preshared keys and algorithms to be used for each IP range or allow plaintext packets to be set from specified IP address.	ISAKMP preshared, Operator password, Enable password, IKE session encrypt key, IKE session authentication key, IKE authentication private Key, IKE authentication public key, IPsec encryption key, IPsec authentication key (r, w, d)
TLS VPN (TLSv1.0)	Configure SSL VPN parameters, provide entry and output of CSPs.	TLS pre-master secret, TLS Traffic Keys (r, w, d)
SSH v2	Configure SSH v2 parameter, provide entry and output of CSPs.	SSHv2 Private Key, SSHv2 Public Key and SSHv2 session key (r, w, d)
IPsec VPN	Configure IPsec VPN parameters, provide entry and output of CSPs.	ISAKMP preshared, skeyid, skeyid_d, SKEYSEED, IKE session encrypt key, IKE session authentication key, IKE authentication private Key, IKE authentication public key, IPsec encryption key, IPsec authentication key (r, w, d)
Self-Tests	Execute the FIPS 140 start-up tests on demand.	N/A
User services	The Crypto Officer has access to all User services.	Operator password (r, w, d)
Local Certificate Authority	Allows the ASA to be configured as a Root Certificate Authority and issue user certificates for SSL VPN use (AnyConnect and Clientless). The	N/A

	ASA can then be configured to require client certificates for authentication.	
Zeroization	Zeroize cryptographic keys/CSPs by running the zeroization methods classified in table 7, Zeroization column.	All CSPs (d)

Table 4 - Crypto Officer Services

2.5 Non-FIPS mode Services

The cryptographic module in addition to the above listed FIPS mode of operation can operate in a non-FIPS mode of operation. This is not a recommended operational mode but because the associated RFC's for the following protocols allow for non-approved algorithms and non-approved key sizes, a non-approved mode of operation exist. So those services listed above with their FIPS approved algorithms in addition to the following services with their non-approved algorithms and non-approved keys sizes are available to the User and the Crypto Officer. Prior to using any of the non-approved services, the Crypto Officer must zeroize all CSPs which places the module into the non-FIPS mode of operation.

Services [1]	Non-Approved Algorithms
IPsec	Hashing: MD5, MACing: HMAC-SHA-1, MD5 Symmetric: DES, RC4 Asymmetric: 768-bit/1024-bit RSA (key transport), 1024-bit Diffie-Hellman
SSH	Hashing: MD5, MACing: HMAC MD5 Symmetric: DES Asymmetric: 768-bit/1024-bit RSA (key transport), 1024-bit Diffie-Hellman
TLS	Symmetric: DES, RC4 Asymmetric: 768-bit/1024-bit RSA (key transport), 1024-bit Diffie-Hellman

Table 5 - Non-approved algorithms in the Non-FIPS mode services

Neither the User nor the Crypto Officer are allowed to operate any of these services while in FIPS mode of operation.

All services available along with set-up instructions can be found at http://www.cisco.com/c/en/us/td/docs/security/asa/quick_start/module/asa_sm_qsg.html#pgfId-41141.

2.6 Unauthenticated Services

The services for someone without an authorized role are to view the status output from the

[1] These approved services become non-approved when using any of non-approved algorithms or non-approved key or curve sizes. When using approved algorithms and key sizes these services are approved.

module’s LED pins and cycle power.

2.7 Cryptographic Key Management

All keys and CSPs are protected by the password-protection on the Crypto Officer role login, and can be zeroized by the Crypto Officer. Zeroization consists of overwriting the memory that stored the key or refreshing the volatile memory. Keys are both manually and electronically distributed but entered electronically. Persistent keys with manual distribution are used for pre-shared keys whereas protocols such as IKE, TLS and SSH are used for electronic distribution.

The ASA-SM module securely administers both cryptographic keys and other critical security parameters such as passwords. All pre-shared keys are associated with the CO role that created the keys, and the CO role is protected by a password. Therefore, the CO password is associated with all the pre-shared keys. The Crypto Officer needs to be authenticated to store keys. Only an authenticated Crypto Officer can view the keys. All Diffie-Hellman (DH) keys agreed upon for individual tunnels are directly associated with that specific tunnel only via the IKE protocol. RSA Public keys are entered into the module using digital certificates which contain relevant data such as the name of the public key's owner, which associates the key with the correct entity. All other keys are associated with the user/role that entered them.

The module pulls in 32 bytes of entropy from the high-jitter free-running oscillators for use with the DRBG. This equates to greater than 256 bits of entropy.

Name	CSP Type	Size	Description/Generation	Storage	Zeroization
DRBG entropy input	SP800-90A HASH_DRBG (using SHA-512)	256-bits	This is the entropy for SP 800-90A HASH_DRBG. HW (onboard Cavium cryptographic processor) based entropy source used to construct seed.	DRAM (plaintext)	Power cycle the device
DRBG Seed	SP800-90A HASH_DRBG (using SHA-512)	384-bits	Input to the DRBG that determines the internal state of the DRBG. Generated using DRBG derivation function that includes the entropy input from hardware-based entropy source.	DRAM (plaintext)	Power cycle the device
DRBG V	SP800-90A HASH_DRBG (using SHA-512)	128-bits	The DRBG V is one of the critical values of the internal state upon which the security of this DRBG mechanism depends. Generated first during DRBG instantiation and then subsequently updated using the DRBG update function.	DRAM (plaintext)	Power cycle the device

Name	CSP Type	Size	Description/Generation	Storage	Zeroization
DRBG C	SP800-90A HASH_DRBG (using SHA-512)	256-bits	Internal critical value used as part of SP 800-90A HASH_DRBG. Established per SP 800-90A HASH_DRBG.	DRAM (plaintext)	Power cycle the device
Diffie-Hellman Shared Secret	DH	2048, 3072, or 4096 bits	The shared secret used in Diffie-Hellman (DH) exchange. Established per the Diffie-Hellman key agreement.	DRAM (plaintext)	Power cycle the device
Diffie Hellman private key	DH	224-379 bits	The private key used in Diffie-Hellman (DH) exchange. This key is generated by calling SP800-90A DRBG.	DRAM (plaintext)	Power cycle the device
Diffie Hellman public key	DH	2048, 3072, or 4096 bits	The public key used in Diffie-Hellman (DH) exchange. This key is derived per the Diffie-Hellman key agreement.	DRAM (plaintext)	Power cycle the device
skeyid	Shared Secret	160 bits	A shared secret known only to IKE peers. It was established via key derivation function defined in SP800-135 KDF and it will be used for deriving other keys in IKE protocol implementation.	DRAM (plaintext)	Power cycle the device
skeyid_d	Shared Secret	160 bits	A shared secret known only to IKE peers. It was derived via key derivation function defined in SP800-135 KDF (IKEv2) and it will be used for deriving IKE session authentication key.	DRAM (plaintext)	Power cycle the device
SKEYSEED	Shared Secret	160 bits	A shared secret known only to IKE peers. It was derived via key derivation function defined in SP800-135 KDF (IKEv2) and it will be used for deriving IKE session authentication key.	DRAM (plaintext)	Power cycle the device
IKE session encrypt key	Triple-DES/AES	168 bits Triple-DES or 128/192/256 bits AES	The IKE session (IKE Phase I) encrypt key. This key is derived via key derivation function defined in SP800-135 KDF (IKEv2).	DRAM (plaintext)	Power cycle the device

Name	CSP Type	Size	Description/Generation	Storage	Zeroization
IKE session authentication key	HMAC SHA-1	160 bits	The IKE session (IKE Phase I) authentication key. This key is derived via key derivation function defined in SP800-135 KDF (IKEv2).	DRAM (plaintext)	Power cycle the device
ISAKMP preshared	Pre-shared secret	Variable 8 plus characters	The secret used to derive IKE skeyid when using preshared secret authentication. This CSP is entered by the Crypto Officer.	NVRAM (plaintext)	By running '# no crypto isakmp key' command
IKE authentication private Key	RSA/ ECDSA	RSA (2048 bits) or ECDSA (Curves: P-256/P-384)	RSA/ECDSA private key used in IKE authentication. This key is generated by calling SP800-90A DRBG.	NVRAM (plaintext)	By running '#crypto key zeroize' command
IKE authentication public key	RSA/ ECDSA	RSA (2048 bits) or ECDSA (Curves: P-256/P-384)	RSA/ECDSA public key used in IKE authentication. Internally generated by the module.	NVRAM (plaintext)	By running '#crypto key zeroize' command
IPsec encryption key	Triple-DES, AES and AES-GCM	168 bits Triple-DES or 128/192/256 bits AES	The IPsec (IKE phase II) encryption key. This key is derived via a key derivation function defined in SP800-135 KDF (IKEv2).	DRAM (plaintext)	Power cycle the device
IPsec authentication key	HMAC SHA-1	160-bits	The IPsec (IKE Phase II) authentication key. This key is derived via a key derivation function defined in SP800-135 KDF (IKEv2).	DRAM (plaintext)	Power cycle the device
Operator password	Password	8 plus characters	The password of the User role. This CSP is entered by the User.	NVRAM (plaintext)	Overwrite with new password
Enable password	Password	8 plus characters	The password of the CO role. This CSP is entered by the Crypto Officer.	NVRAM (plaintext)	Overwrite with new password
RADIUS secret	Shared Secret	16 characters	The RADIUS shared secret. Used for RADIUS Client/Server authentication. This CSP is entered by the Crypto Officer.	NVRAM (plaintext),	By running '# no radius-server key' command

Name	CSP Type	Size	Description/Generation	Storage	Zeroization
TACACS+ secret	Shared Secret	16 characters	The TACACS+ shared secret. Used for TACACS+ Client/Server authentication. This CSP is entered by the Crypto Officer.	NVRAM (plaintext),	By running '# no tacacs-server key' command
SSHv2 Private Key	RSA	2048 bits modulus	The SSHv2 private key used in SSHv2 connection. This key is generated by calling SP 800-90A DRBG.	NVRAM (plaintext)	By running '# crypto key zeroize rsa' command
SSHv2 Public Key	RSA	2048bits modulus	The SSHv2 public key used in SSHv2 connection. This key is internally generated by the module.	NVRAM (plaintext)	By running '# crypto key zeroize rsa' command
SSHv2 Session Key	Triple-DES/AES	168 bits Triple-DES or 128/192/256 bits AES	This is the SSHv2 session key. It is used to encrypt all SSHv2 data traffics traversing between the SSHv2 Client and SSHv2 Server. This key is derived via key derivation function defined in SP800-135 KDF (SSH).	DRAM (plaintext)	Power cycle the device
ECDSA private key	ECDSA	Curves: P-256,384,521	Key pair generation, signature generation/Verification. This key is generated by calling SP 800-90A DRBG.	DRAM (plaintext)	Zeroized upon API call "#crypto key zeroize ecdsa"
ECDSA public key	ECDSA	Curves: P-256,384,521	Key pair generation, signature generation/Verification. This key is generated by calling SP 800-90A DRBG.	DRAM (plaintext)	Zeroized upon API call "#crypto key zeroize ecdsa"
Enable secret	Shared Secret	At least eight characters	The obfuscated password of the CO role. However, the algorithm used to obfuscate this password is not FIPS approved. Therefore, this password is considered plaintext for FIPS purposes. This password is zeroized by overwriting it with a new password. The Crypto Officer optionally configures the module to obfuscate the Enable password. This CSP is entered by the Crypto Officer.	NVRAM (plaintext)	Overwrite with new password

Name	CSP Type	Size	Description/Generation	Storage	Zeroization
RSA private keys	RSA	2048 bits	Identity certificates for the security appliance itself and also used in IPSec, TLS, and SSH negotiations. This key was generated by calling FIPS approved DRBG.	NVRAM (plaintext)	Zeroized by "#crypto key zeroize rsa", write to startup config, followed by a module reboot
RSA public keys	RSA	2048 bits	Identity certificates for the security appliance itself and also used in IPSec, TLS, and SSH negotiations. This key was generated by calling FIPS approved DRBG.	NVRAM (plain text)	Zeroized by "#crypto key zeroize rsa", write to startup config, followed by a module reboot
TLS pre-master secret	Shared Secret	At least eight characters	Shared secret created/derived using asymmetric cryptography from which new HTTPS session keys can be created. This key entered into the module in cipher text form, encrypted by RSA public key.	DRAM (plaintext)	Automatically when TLS session is terminated.
TLS traffic keys	Triple-DES/AES 128/192/256 HMAC-SHA1/256/384/512	168 bits Triple-DES or 128/192/256 bits AES	Used in HTTPS connections. Generated using TLS protocol. This key was derived in the module.	DRAM (plain text)	Automatically when TLS session is terminated
Integrity test key	RSA-2048 Public key	2048 bits	A hard coded key used for firmware power-up/load integrity verification.	Hard coded for firmware integrity testing	Zeroized by "#erase flash:" command (or replacing), write to startup config, followed by a module reboot

Table 2 Cryptographic Keys and CSPs

2.8 Cryptographic Algorithms

The module implements a variety of approved and non-approved algorithms.

Approved Cryptographic Algorithms

The module supports the following FIPS 140-2 approved algorithm implementations:

Algorithms	Algorithm Implementations	
	Adaptive Security Appliance (ASA) OS (Firmware)	CAVIUM Nitrox PX (CN1620) (Hardware)
AES (128/192/256 CBC, GCM)	4249	2050 & 2444
Triple-DES (CBC, 3-key)	2304	1321

SHS (SHA-1/256/384/512)	3486	1794
HMAC (SHA-1/256/384/512)	2787	1247
RSA (PKCS1_V1_5; KeyGen, SigGen, SigVer; 2048 bits)	2298	
ECDSA (KeyGen, SigGen, SigVer; P-256, P-384, P-521)	989	
DRBG (SHA-512)	1328	332
CVL Component (IKEv2, TLS, SSH)	1002	

Table 3 Approved Cryptographic Algorithms and Associated Certificate Numbers

Notes:

- There are some algorithm modes that were tested but not implemented by the module. Only the algorithms, modes, and key sizes that are implemented by the module are shown in this table.

- The module's AES-GCM implementation conforms to IG A.5 scenario #1 following RFC 6071 for IPsec and RFC 5288 for TLS. The module uses basically a 96-bit IV, which is comprised of a 4 byte salt unique to the crypto session and 8 byte monotonically increasing counter. The module generates new AES-GCM keys if the module loses power.

- The SSH, TLS and IPSec protocols have not been reviewed or tested by the CAVP and CMVP.

Non-FIPS Approved Algorithms Allowed in FIPS Mode

The module supports the following non-FIPS approved algorithms which are permitted for use in the FIPS approved mode:

- Diffie-Hellman (key agreement; key establishment methodology provides between 112 and 150 bits of encryption strength; non-compliant less than 112 bits of encryption strength)
- RSA (key wrapping; key establishment methodology provides 112 bits of encryption strength; non-compliant less than 112 bits of encryption strength)
- NDRNG
- HMAC MD5 is allowed in FIPS mode strictly for TLS
- MD5 is allowed in FIPS mode strictly for TLS

Non-Approved Cryptographic Algorithms

The module supports the following non-approved cryptographic algorithms that shall not be used in FIPS mode of operation:

- DES
- HMAC MD5
- MD5

- RC4
- HMAC-SHA1 is not allowed with key size under 112-bits

Note: The non-approved algorithms HMAC MD5 and MD5 are not allowed in FIPS mode when not used with TLS.

2.9 Self-Tests

The module include an array of self-tests that are run during startup and periodically during operations to prevent any secure data from being released and to insure all components are functioning correctly. The FIPS power-on self-tests are run regardless of the FIPS mode setting.

Self-tests performed

- ASA Self Tests
    - POSTs – Adaptive Security Appliance OS (Firmware)
        - AES Encrypt/Decrypt KATs
        - DRBG KAT (Note: DRBG Health Tests as specified in SP800-90A Section 11.3 are performed)
        - ECDSA (sign/verify)
        - Firmware Integrity Test (using SHA-512 and RSA 2048)
        - HMAC-SHA-1 KAT
        - HMAC-SHA-256 KAT
        - HMAC-SHA-384 KAT
        - HMAC-SHA-512 KAT
        - RSA (sign/verify) KAT
        - SHA-1 KAT
        - SHA-256 KAT
        - SHA–384 KAT
        - SHA-512 KAT
        - Triple-DES Encrypt/Decrypt KATs

    - POSTs – CAVIUM Nitrox PX (CN1620) (Hardware)
        - AES Encrypt/Decrypt KATs
        - DRBG KAT (Note: DRBG Health Tests as specified in SP800-90A Section 11.3 are performed)
        - HMAC-SHA-1 KAT
        - HMAC-SHA-256 KAT
        - HMAC-SHA-384 KAT
        - HMAC-SHA-512 KAT
        - SHA-1 KAT
        - SHA-256 KAT
        - SHA-384 KAT
        - SHA-512 KAT

    - Triple-DES Encrypt/Decrypt KATs

- Conditional tests - Adaptive Security Appliance OS (Firmware)
    - RSA pairwise consistency test (encrypt/decrypt and sign/verify)
    - ECDSA pairwise consistency test
    - Conditional IPSec Bypass test
    - Continuous Random Number Generator test for SP800-90A DRBG
    - Continuous Random Number Generator test for NDRNG

- Conditional tests - CAVIUM Nitrox PX (CN1620) (Hardware)
    - Continuous Random Number Generator test for SP800-90A DRBG
    - Continuous Random Number Generator test for NDRNG

The security blades perform all power-on self-tests automatically at boot when the power is applied. 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 LAN's interfaces; this prevents the security blades from passing any data during a power-on self-test failure. In the unlikely event that a power-on or conditional self-test fails, an error message is displayed on the console followed by a security blade reboot.

3 Secure Operation of ASA-SM

The module meets all the Level 1 requirements for FIPS 140-2. The module is shipped only to authorized operators by the vendor, and the module is shipped in Cisco boxes with Cisco adhesive. Follow the setting instructions provided below to place the module into FIPS-approved mode of operation. Operating this module without maintaining the following settings will remove the module from the FIPS approved mode of operation.

3.1 Crypto Officer Guidance - System Initialization

The Cisco ASA-SM is validated with adaptive security appliance firmware version 9.6 (File name: asa961-2-smp-k8.bin). This is the only allowable image for FIPS-approved mode of operation.

The Crypto Officer must configure and enforce the following initialization steps:

Step 1: Disable the console output of system crash information, using the following command:

```
(config)#crashinfo console disable
```

Step 2: Install Triple-DES/AES licenses to require the security appliances to use Triple-DES and AES (for data traffic and SSH).

Step 3: Enable "FIPS Mode" to allow the security appliances to internally enforce FIPS-compliant behavior, such as run power-on self-tests and bypass test, using the following command:

```
(config)# fips enable
```

Step 4: Disable password recovery.

```
(config)#no service password-recovery
```

Step 5: Set the configuration register to bypass ROMMON prompt at boot.

```
(config)# config-register 0x10011
```

Step 6: If using a Radius/TACACS+ server for authentication, perform the following steps. (see Operator manual for specific TACACS+ commands) Otherwise, skip to step 7

```
(config)# aaa-server radius-server protocol radius
(config)# aaa-server radius-server host <IP-address>
```

Configure an IPsec tunnel to secure traffic between the ASA and the Radius server. The pre-shared key must be at least 8 characters long.

Step 7: Enable AAA **authentication** for the console.

```
(config)#aaa authentication serial console LOCAL
(config)#username <name> password <password>
```

Step 8: Enable AAA **authentication** for SSH.

```
(config)#aaa authentication ssh console LOCAL
```

Step 9: Enable AAA **authentication** for Enable mode.

```
(config)#aaa authentication enable console LOCAL
```

Step 10: Specify Privilege Level 15 for Crypto Officer and Privilege Level 1 for User and set up username/password for each role.

```
(config)#username <name> password <password> privilege 15
(config)#username <name> password <password> privilege 1
```

Step 11: Ensure passwords are at least 8 characters long.

Step 12: All default passwords, such as enable and telnet, must be replaced with new passwords.

Step 13: Reboot the security appliance.

3.2 Crypto Officer Guidance - System Configuration

To operate in FIPS mode, the Crypto Officer must perform the following steps:

Step 1: Assign users a Privilege Level of 1.

Step 2: Define RADIUS and TACACS+ shared secret keys that are at least 8 characters long and secure traffic between the security appliances and the RADIUS/TACACS+ server via IPSec tunnel.
Note: Perform this step only if RADIUS/TACAS+ is configured, otherwise proceed to step 3.

Step 3: Configure the TLS protocol when using HTTPS to protect administrative functions. Due to known issues relating to the use of TLS with certain versions of the Java plugin, we require that you upgrade to JRE 1.5.0_05 or later. The following configuration settings are known to work when launching ASDM in a TLS-only environment with JRE 1.5.0_05:

a. Configure the device to allow only TLSv1 packets using the following command:

```
(config)# ssl server-version tlsv1-only
(config)# ssl client-version tlsv1-only
```

b. Uncheck SSL Version 2.0 in both the web browser and JRE security settings.
c. Check TLS V1.0 in both the web browser and JRE security settings.

Step 4: Configure the security appliances to use SSHv2. Note that all operators must still authenticate after remote access is granted.

```
(config)# ssh version 2
```

Step 5: Configure the security appliances such that any remote connections via Telnet are secured through IPSec.

Step 6: Configure the security appliances such that only FIPS-approved algorithms are used for IPSec tunnels.

Step 7: Configure the security appliances such that error messages can only be viewed by Crypto Officer.

Step 8: Disable the TFTP server.

Step 9: Disable HTTP for performing system management in FIPS mode of operation. HTTPS with TLS should always be used for Web-based management.

Step 10: Ensure that installed digital certificates are signed using FIPS approved algorithms.

3.3 Identifying Module Operation in an Approved Mode

The following activities are required to verify that that the module is operating in an Approved mode of operation.

1. Verify that the length of User and Crypto Officer passwords and all shared secrets are at least eight (8) characters long, include at least one letter, and include at least one number character, as specified in the “Secure Operation” section of this document.

2. Issue the following commands: 'show crypto IPSec sa' and 'show crypto isakmp policy' to verify that only FIPS approved algorithms are used.