Cisco Catalyst 4500 Series Switches (4503-E, 4506-E, 4507R+E, 4510R+E, 4500X and 4500X-F) Running IOS-XE 3.5.2E Security Target

Revision 1.0

11 March 2014

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DOCUMENT INTRODUCTION

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This document provides the basis for an evaluation of a specific Target of Evaluation (TOE), the Cisco Catalyst 4500 Series Switches (4503-E, 4506-E, 4507R+E, 4510R+E, 4500X and 4500X-F) running IOS-XE 3.5.2E. This Security Target (ST) defines a set of assumptions about the aspects of the environment, a list of threats that the product intends to counter, a set of security objectives, a set of security requirements, and the IT security functions provided by the TOE which meet the set of requirements.

1 SECURITY TARGET INTRODUCTION

The Security Target contains the following sections:

- Security Target Introduction [Section 1]
- Conformance Claims [Section 2]
- Security Problem Definition [Section 3]
- Security Objectives [Section 4]
- IT Security Requirements [Section 5]
- TOE Summary Specification [Section 6]
- Rationale [Section 7]

The structure and content of this ST comply with the requirements specified in the Common Criteria (CC), Part 1, Annex A, and Part 3, Chapter 4.

1.1 Security Target and TOE Identification

This section provides information needed to identify and control this ST and its TOE.

Table 1 ST and TOE Identification

ST Title	Cisco Catalyst 4500 Series Switches (4503-E, 4506-E, 4507R+E, 4510R+E, 4500X and 4500X-F) Running IOS-XE 3.5.2E Security Target
ST Version	1.0
Publication Date	11 March 2014
ST Author	Cisco Systems, Inc.
Developer of the TOE	Cisco Systems, Inc.
TOE Reference	Cisco Catalyst 4500 Series Switches (4503-E, 4506-E, 4507R+E, 4510R+E, 4500X and 4500X-F) running IOS-XE 3.5.2E
TOE Hardware Models	Cisco Catalyst 4500 Series Switches (4503-E, 4506-E, 4507R+E, 4510R+E, 4500X and 4500X-F), including one or more Supervisor cards and one or more of the line cards as identified in Table 3
TOE Software Version	IOS XE 3.5.2E
Keywords	Audit, Authentication, Encryption, Information Flow, Protection, Switch, Traffic

1.2 Acronyms and Abbreviations

The following acronyms and abbreviations are used in this Security Target:

Table 2 Acronyms

Acronyms / Abbreviations	Definition
AAA	Administration, Authorization, and Accounting
ACL	Access Control List
AES	Advanced Encryption Standard
BGP	Border Gateway Protocol. An exterior gateway protocol. It performs routing between multiple autonomous systems and exchanges routing and reachability information with other BGP systems.

Acronyms / Abbreviations	Definition
CC	Common Criteria for Information Technology Security Evaluation
CEM	Common Evaluation Methodology for Information Technology Security
CLI	Command Line Interface
CM	Configuration Management
DH	Diffie-Hellman
EAL	Evaluation Assurance Level
EEPROM	Electrically erasable programmable read-only memory, specifically the memory in the switch where the Cisco IOS is stored.
EIGRP	Enhanced Interior Gateway Routing Protocol
FIPS	Federal Information Processing Standard
HMAC	Hashed Message Authentication Code
HTTPS	Hyper-Text Transport Protocol Secure
IEEE	Institute of Electrical and Electronics Engineers
IGMP	Internet Group Management Protocol
IOS	The proprietary operating system developed by Cisco Systems.
IP	Internet Protocol
IPSEC	IP Security
IT	Information Technology
MAC	Media Access Control
NTP	Network Time Protocol
NVRAM	Non-volatile random access memory, specifically the memory in the switch where the configuration parameters are stored.
OS	Operating System
OSPF	Open Shortest Path First. An interior gateway protocol (routes within a single autonomous system). A link-state routing protocol which calculates the shortest path to each node.
Packet	A block of data sent over the network transmitting the identities of the sending and receiving stations, error-control information, and message.
PP	Protection Profile
PRNG	Pseudo Random Number Generator
PVLAN	Private VLAN
RADIUS	Remote Authentication Dial In User Service
RIP	Routing Information Protocol. An interior gateway protocol (routes within a single autonomous system). A distance-vector protocol that uses hop count as it's metric.
RNG	Random Number Generator
RSA	Rivest, Shamir and Adleman (algorithm for public-key cryptography)
SM	Service Module
SSH	Secure Shell
SSHv2	Secure Shell (version 2)
ST	Security Target
TACACS	Terminal Access Controller Access Control System
TCP	Transport Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
TDES	Triple Data Encryption Standard
TLS	Transport Layer Security
TOE	Target of Evaluation
TSC	TSF Scope of Control
TSF	TOE Security Function
TSP	TOE Security Policy

Acronyms / Abbreviations	Definition
UDP	User Datagram Protocol
VACL	Virtual Access Control List
VLAN	Virtual Local Area Network
VSS	Virtual Switching System

1.3 TOE Overview

The TOE is the Cisco Catalyst 4500 Series Switches (4503-E, 4506-E, 4507R+E, 4510R+E, 4500X and 4500X-F) running IOS XE 3.5.2E (herein after referred to as Catalyst Switches). The TOE is a purpose-built, switching and routing platform with OSI Layer2 and Layer3 traffic filtering capabilities.

Cisco IOS is a Cisco-developed highly configurable proprietary operating system that provides for efficient and effective routing and switching. Although IOS performs many networking functions, this Security Target only addresses the functions that provide for the security of the TOE itself as described in Section 1.7 TOE logical scope below.

1.3.1 TOE Evaluated Configuration

The TOE consists of any one of a number of hardware configurations, each running the same version of IOS XE software. The Catalyst 4500 Series Switches chassis provides power, cooling, and backplane for the Supervisor Engine, line cards, and service modules (SM)[1]. The Supervisor Engines run the IOS XE software. The evaluated configurations consist of the following components (e.g. at least one of the listed chassis, at least one supervisor card running IOS-XE 3.5.2E software and at least one line card):

Table 3 Evaluated Configuration

TOE	• One or more WS-C4503-E, WS-C4506-E, WS-C4507R+E, WS-C4510R+E, WS-C4500X-32SFP+, WS-C4500X-F-32SFP+, WS-C4500X-16SFP+, WS-C4500X-F-16SFP+, WS-C4500X-24X-ES, 4500X-24X-IPB, or WS-C4500X-40X-ES Switch Chassis (Two chassis configured support High Availability)
	• One or more supervisors cards (WS-X45-SUP7-E, WS-X45-Sup7L-E) or dual supervisor cards (WS-X45-SUP7-E, WS-X45-Sup7L-E) per chassis (Two Supervisor cards in one chassis provides failover), each supervisor card running IOS XE 3.5.2E (FIPS validated) software
	• With one or more of the following line cards:
	    • WS-X4748-RJ45V+E
	    • WS-X4712-SFP+E

[1] No specific service modules, such as the Firewall Blade, Wireless Service and Network Analysis being claimed in the evaluated configuration as they require additional license

	• WS-X4640-CSFP-E • WS-X4748-UPOE+E • WS-X4748-RJ45-E

The TOE can optionally connect to an NTP server on its internal network for time services. If an NTP server is used, it must only be accessible via the internal network (an internal network isolated from user traffic and intended for use by TOE administrators only).

If the TOE is to be remotely administered, SSHv2 must be used for that purpose.

The TOE will transmit syslog message to a remote syslog server through an IPsec tunnel. The TOE can also be configured to use a remote AAA server (RADIUS or TACACS+) for centralized authentication, and can also connect to those servers through an IPsec tunnel.

1.3.2 TOE Type

The Cisco Catalyst Switches are a switching and routing platform used to construct IP networks by interconnecting multiple smaller networks or network segments. As a Layer2 switch, it performs analysis of incoming frames, makes forwarding decisions based on information contained in the frames, and forwards the frames toward the destination. As a Layer3 switch, it supports routing of traffic based on tables identifying available routes, conditions, distance, and costs to determine the best route for a given packet. Routing protocols used by the TOE include BGPv4, EIGRP, EIGRPv6 for IPv6, RIPv2, and OSPFv2. BGPv4, EIGRP, and EIGRPv6 supports routing updates with IPv6 or IPv4, while RIPv2 and OSPFv2 routing protocol support routing updates for IPv4 only. Note, the information flow functionality is not included in the scope of the evaluation. The evaluated configuration is the configuration of the TOE that satisfies the requirements as defined in this Security Target (ST).

1.3.3 Required non-TOE Hardware/Software/Firmware

The TOE supports (in some cases optionally) the following hardware, software, and firmware in its environment:

Table 4 IT Environment Components

Component	Required	Usage/Purpose Description for TOE performance
Authentication Server	Yes	This includes any authentication server (RADIUS RFC 2865, 2866, 2869 and RFC 3162 (IPv6) and TACACS+ RFC 1492)) that can be leveraged for remote user authentication. The AAA server needs to be able of acting as an IPsec peer or as an IPsec endpoint.
Management Workstation with SSH Client	Yes	This includes any IT Environment Management workstation with a SSH client installed that is used by the TOE administrator to support TOE administration through SSH protected channels. Any SSH client that supports

Component	Required	Usage/Purpose Description for TOE performance
		SSHv2 and a key size of 2048 bits or greater may be used.
Syslog server	Yes	The syslog audit server is used for remote storage of audit records that have been generated by and transmitted from the TOE. The TOE would ensure that messages are encrypted within an IPsec tunnel as they leave the TOE. The syslog server needs to be able of acting as an IPsec peer or as an IPsec endpoint.
NTP Server	No	The TOE supports communications with an NTP server to receive clock updates. Any server that supports NTPv1 (RFC 1059), NTPv2 (RFC 1119), or NTP v3 (RFC 1305) may be used.

1.4 TOE Description

The TOE description explains the TOE in more detail than was provided in the TOE overview.

1.4.1 TOE Architecture and Security Capabilities

The Cisco Catalyst 4500 Series are network devices that protect themselves by offering only a minimal logical interface to the network and control of that interface. The Switch IOS subsystem is special purpose software that runs on the Cisco Catalyst 4500 Series Switch hardware. The Catalyst Switches have been designed so that all locally maintained security relevant data can only be manipulated via the secured management interface, a CLI and provides no general purpose programming capability. There are no undocumented interfaces for managing the Catalyst switches.

All network traffic to the TOE protected (internal) network passes through Catalyst Switches. There are no unmediated traffic flows into or out of the TOE. Once network traffic is received on one of the network ports, it is always subject to the security policy rules as applied to each traffic flow. Traffic flows characterized as unauthorized are discarded and not permitted to circumvent the Catalyst Switch. Configuration and management of the Catalyst Switch is through an SSHv2 session via Management workstation or via a local console connection. The management interfaces require user identification and authentication prior to allowing management operations. As described in Section 6, all management functions are restricted to the authorized administrator of the TOE. The term "authorized administrator"[2] is used in this ST to refer to any administrative user which has been assigned to a privilege level that is permitted to perform the relevant action; therefore has the appropriate privileges to perform the requested functions.

[2] Note, the term 'authorized administrator' as used in this ST is synonymous with the 'Security Administrator' referenced in the NDPP.

Protection of the TOE from physical tampering is ensured by its environment. It is assumed that the switches will remain attached to the physical connections made by an administrator so that the switch cannot be bypassed. The TOE is completely self-contained. The hardware, software and firmware provided by Catalyst Switches provide all of the services necessary to implement the TOE. There are no external interfaces into the TOE other than the physical ports provided. No general purpose operating system, user interface, disk storage, or programming interface is provided by the TOE.

The Catalyst Switches that comprise the TOE have common hardware characteristics. These characteristics affect only non-TSF relevant functions of the switches (such as throughput, line-card slots, and amount of storage) and therefore support security equivalency of the switches in terms of hardware:

- Central processor that supports all system operations
- Dynamic memory, used by the central processor for all system operations
- Flash memory (EEPROM), used to store the Cisco IOS image (binary program)
- USB slot, used to connect USB devices to the TOE (not relevant as none of the USB devices are included in the TOE)
- Non-volatile read-only memory (ROM) is used to store the bootstrap program and power-on diagnostic programs
- Non-volatile random-access memory (NVRAM) is used to store switch configuration parameters used to initialize the system at start-up
- Physical network interfaces (minimally two) (e.g. RJ45 serial and standard 10/100 Ethernet ports). Some models have a fixed number and/or type of interfaces; some models have slots that accept additional network interfaces
- 10 Gigabit Ethernet (GE) uplinks and supports Power over Ethernet Plus (PoE+) and Universal POEP (UPOE). (Universal POEP is an enhancement to the PoEP (802.3at) standard to allow powered devices up to 60W to connect over a single Cat 5e cable. Standard PoEP uses only 2 twisted pairs (out of 4) in the Ethernet cable. UPOE uses all 4 twisted pairs to deliver 60W to the port.)
- Redundant power supplies and fans

Cisco IOS XE is a Cisco-developed highly configurable proprietary operating system that provides for efficient and effective routing and switching. Although IOS XE performs many networking functions, this TOE only addresses the functions that provide for the security of the TOE itself as described in Section 1.7 Logical Scope of the TOE below.

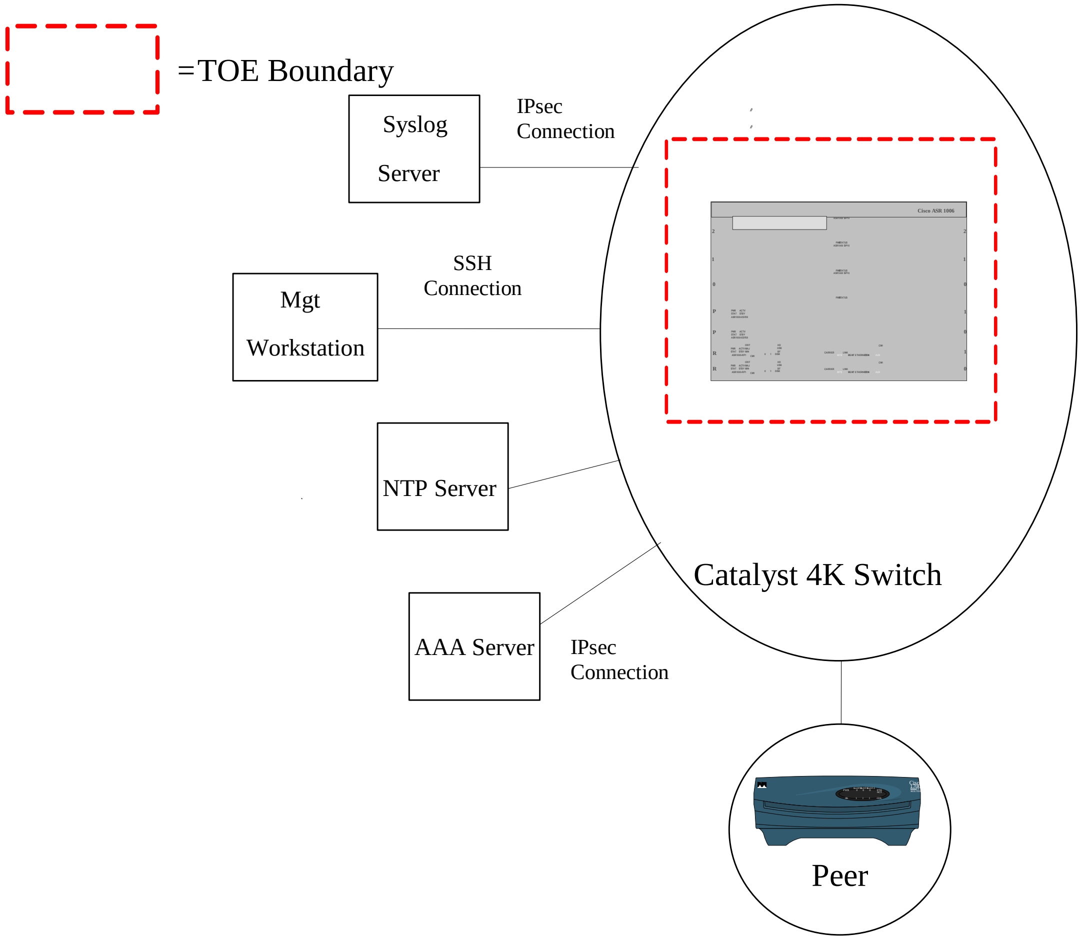
1.5 TOE Environment and Configuration

The TOE consists of one or more physical devices; the Catalyst Switch with Cisco IOS XE software. The Catalyst Switch has two or more network interfaces and is connected to at least one internal and one external network. The Cisco IOS configuration determines how packets are handled to and from the switches' network interfaces. The switch configuration will determine how traffic flows received on an interface will be handled. Typically, packet flows are passed through the network device and forwarded to their configured destination. BGPv4, EIGRP, EIGRPv6 for IPv6, RIPv2, and OSPFv2 Routing protocols are used on all of the Catalyst Switch models.

The TOE can optionally connect to an NTP server on its internal network for time services. In addition, if the Catalyst Switch is to be remotely administered, then the management station must be connected to an internal network, SSHv2 must be used to connect to the switch. A syslog server can also be used to store audit records. A remote authentication server can also be used for centralized authentication. If these servers are used, they must be attached to the internal (trusted) network. The internal (trusted) network is meant to be separated effectively from unauthorized individuals and user traffic; one that is in a controlled environment where implementation of security policies can be enforced.

The following figure provides a visual depiction of an example TOE deployment.

Figure 1 TOE environment



1.6 Physical Scope of the TOE

The TOE is a hardware and software solution that makes up the following switch models; Cisco Catalyst 4500 Series Switches (4503-E, 4506-E, 4507R+E, 4510R+E, 4500X and 4500X-F) running IOS XE 3.5.2E. The following tables further identify the supported configurations. The network, on which they reside, is part of the environment.

The Cisco Catalyst Switches, 4503-E, 4506-E, 4507R+E, 4510R+E offers four chassis options and two supervisor engine options and are extremely flexible and support either 6 Gbps, 24 Gbps, or 48 Gbps per line-card slot. The TOE can optionally support any other line card or service module (SM)[3] that is compatible with the supervisors and chassis models included in the TOE. These line cards and SMs are not security-relevant

[3] No specific service modules, such as the Firewall Blade, Wireless Service and Network Analysis being claimed in the evaluated configuration as they require additional license

to the CC-evaluated security functional requirements, however the supervisor cards are security relevant.

Figure 2 Catalyst 4500 Series Switch Chassis

Table 5 Catalyst 4500 Series Switch Chassis Features

Feature	Cisco Catalyst WS-C4503-E Chassis	Cisco Catalyst WS-C4506-E Chassis	Cisco Catalyst WS-C4507R+E Chassis	Cisco Catalyst WS-C4510R+E Chassis
Total number of slots	3	6	7	10
Line-card slots	2	5	5	8
Supervisor engine slots	1[4]	1[2]	2[5]	2[6]
Dedicated supervisor engine slot numbers	1	1	3 and 4	5 and 6
Supervisor engine redundancy	No	No	Yes	Yes (Supervisor V-10GE, 6-E and 7-E)
Supervisor engines	Supervisor 7-E	Supervisor 7-E	Supervisor 7-E	Supervisor 7-E

[4] Slot 1 is reserved for supervisor engine only; slots 2 and higher are reserved for line cards.

[5] Slots 3 and 4 are reserved for supervisor engines only in Cisco Catalyst 4507R-E and 4507R+E; slots 1-2 and 5-7 are reserved for line cards.

[6] Slots 5 and 6 are reserved for supervisor engines only in Cisco Catalyst 4510R-E and 4510R+E; slots 1-4 and 7-10 are reserved for line cards

Feature	Cisco Catalyst WS-C4503-E Chassis	Cisco Catalyst WS-C4506-E Chassis	Cisco Catalyst WS-C4507R+E Chassis	Cisco Catalyst WS-C4510R+E Chassis
supported	Supervisor 7L-E	Supervisor 7L-E	Supervisor 7L-E	
Maximum PoE per slot	1,500W	1,500W	1,500W	1,500W slots 1 and 2, 750W slots 3,4,7-10
Bandwidth scalability per line-card slot	Up to 48 Gbps on all slots	Up to 48 Gbps on all slots	Up to 48 Gbps on all slots[7]	Up to 48 Gbps on all slots[5]
Number of power supply bays	2	2	2	2
AC input power	Yes	Yes	Yes	Yes
DC Input power	Yes	Yes	Yes	Yes
Integrated Power over Ethernet	Yes	Yes	Yes	Yes
Minimum number of power supplies	1	1	1	1
Power supplies supported	● 1000W AC ● 1400W AC ● 1300W ACV ● 2800W ACV ● 4200W ACV ● 6000W ACV ● 1400W DC (triple input) ● 1400W-DC-P	● 1000W AC ● 1400W AC ● 1300W ACV ● 2800W ACV ● 4200W ACV ● 6000W ACV ● 1400W DC (triple input) ● 1400W-DC-P	● 1000W AC ● 1400W AC ● 1300W ACV ● 2800W ACV ● 4200W ACV ● 6000W ACV ● 1400W DC (triple input) ● 1400W-DC-P	● 1400W AC ● 2800W ACV ● 4200W ACV ● 6000W ACV ● 1400W DC (triple input) ● 1400W-DC-P
Number of fan-tray bays	1	1	1	1
Location of 19-inch rack mount	Front	Front	Front	Front

[7] WS-C4507R-E and WS-C4510R-E chassis support up to 24G per line-card slot when used with Sup6-E

Feature	Cisco Catalyst WS-C4503-E Chassis	Cisco Catalyst WS-C4506-E Chassis	Cisco Catalyst WS-C4507R+E Chassis	Cisco Catalyst WS-C4510R+E Chassis
Location of 23-inch rack mount	Front (option)	Front (option)	Front (option)	Front (option)

Cisco Catalyst 4500 Series line cards can be mixed and matched to suit numerous LAN access, server connectivity, or branch-office deployments. The Cisco Catalyst 4500 Series supports the following supervisor and line cards, by product number:

Table 6 Catalyst 4500 Series Switch Chassis Line Cards

Product Number /Description	
Cisco Catalyst 4500E Supervisor Cards	
Supervisor Engine 7-E	• Performance and capability – 848 Gbps switching capacity with 250 Mpps of throughput – 4 nonblocking 10 Gigabit Ethernet uplinks (Small Form-Factor Pluggable Plus [SFP+]) – SFP support on uplinks to offer flexibility for up to 4 Gigabit Ethernet ports – 384 ports of nonblocking 10/100/1000 – PoEP (30W) capabilities on all ports in a line card simultaneously – UPOE (60W) capabilities on all line-card slots – Energy Efficient Ethernet (IEEE 802.3az) – 196 ports of nonblocking Gigabit Ethernet SFP – 100 ports of 10 Gigabit Ethernet SFP+ (4 uplinks ports + 96 line-card ports) – 128,000 FNF entries in hardware – External USB and Secure Digital (SD) card support for flexible storage options – 256,000 routing entries for high-end campus access and aggregation deployments – IPv6 support in hardware, providing wire-rate forwarding for IPv6 networks – Dynamic hardware forwarding-table allocations for ease of IPv4-to-IPv6 migration – Scalable routing (IPv4, IPv6, and multicast) tables, Layer 2 tables,

Product Number /Description	
	and access-control-list (ACL) and quality-of-service (QoS) entries to use 8 queues/port and comprehensive security policies per port • Infrastructure services – Cisco IOS XE Software, the modular open application platform for virtualized borderless services – Maximum resiliency with redundant components, Nonstop Forwarding/Stateful Switchover (NSF/SSO), and ISSU support – Network virtualization through Multi-Virtual Route Forwarding (VRF) and Easy Virtual Networking (EVN) technology for Layer 3 segmentation – Automation through Embedded Event Manager (EEM), Cisco Smart Call Home, AutoQoS, and Auto SmartPorts for fast provisioning, diagnosis, and reporting • Cisco Borderless Networks Services – Optimized application performance through deep visibility with FNF supporting rich Layer 2/3/4 information (MAC, VLAN, and TCP Flags) and synthetic traffic monitoring with IP service-level agreement (IP SLA) – Medianet capabilities to simplify video QoS, monitoring, and security – Energy-efficient design with Cisco EnergyWise technology to manage network, PoEP, and PC • Investment protection and reduced total cost of ownership (TCO) – Full backward compatibility with 6-, 24-, and 48-Gbps slot line cards with no performance degradation The Cisco Catalyst 4500E Supervisor Engine 7-E is compatible with classic Cisco Catalyst 4500 line cards and power supplies, providing full investment protection. The Supervisor Engine 7-E is not compatible with classic Cisco Catalyst 4500 chassis. When you deploy the Cisco Catalyst 4500E Supervisor Engine 7-E with classic line cards, all of the new features except the 24- and 48-Gbps per-slot switching capacity are inherited.
Supervisor Engine 7L-E	• Performance and scalability: – 520-Gbps switching capacity with 225 mpps of throughput – 2 nonblocking 10 Gigabit Ethernet uplinks (SFP+) or 4 nonblocking 1 Gigabit Ethernet uplinks (SFP)

Product Number /Description	
	– Supports 3-, 6-, and 7-slot Cisco Catalyst 4500E chassis – Supports a maximum of 244 ports of 10/100/1000 Base-T and 400 ports of 1000Base-X (CSFP) in a 7-slot chassis – Supports up to 124 1GE nonblocking fiber ports or 62 10GE fiber ports in a 7-slot chassis – Enables next-generation Universal Power Over Ethernet (UPOE, WS-X4748-UPOE+E) in addition to backward compatibility with other PoE standards – Enables EEE (IEEE 802.3az) – 128,000 Flexible NetFlow entries in hardware – External USB and SD card support for flexible storage options – 10/100/1000 RJ-45 console and management port – 64,000/32,000 IPv4/IPv6 routing entries for campus access and aggregation deployments – IPv6 in hardware, providing wire-rate forwarding for IPv6 networks and support for dual stack with innovative resource usage – Dynamic hardware forwarding-table allocations for ease of IPv4-to-IPv6 migration – Scalable routing (IPv4, IPv6, and multicast) tables, Layer 2 tables, and access-control-list (ACL) and quality-of-service (QoS) entries to make use of 8 queues per port and comprehensive security policies per port • Infrastructure services: – Cisco IOS XE Software, the modular open application platform for virtualized borderless services – Maximum resiliency with redundant components, Nonstop Forwarding/Stateful Switchover (NSF/SSO), and In-Service Software Upgrade (ISSU) support – Network virtualization through Multi-Virtual Route Forwarding (VRF) technology for Layer 3 segmentation – Automation through Embedded Event Manager (EEM), Cisco Smart Call Home, AutoQoS, and Auto SmartPorts for fast provisioning, diagnosis, and reporting • Borderless network services: – Optimized application performance through deep visibility with Flexible NetFlow supporting rich Layer 2/3/4 information (MAC, VLAN, TCP Flags) and synthetic traffic monitoring with IP service-level agreement (SLA) – Medianet capabilities to simplify video quality of service, monitoring, and security. In addition, multicast features such as Protocol Independent Multicast (PIM) and Source-Specific

Product Number /Description	
	Multicast (SSM) that provide enterprise customers the additional scalability to support multimedia applications – Energy-efficient design with Cisco EnergyWise™ technology • Investment protection and reduced total cost of ownership (TCO): – Full backward compatibility with 6 G, 24 G, and 48 Gbps slot line cards with no performance degradation The Cisco Catalyst 4500E Supervisor Engine 7L-E is compatible with classic Cisco Catalyst 4500 line cards and power supplies, providing full investment protection. Supervisor Engine 7L-E is not compatible with classic Cisco Catalyst 4500 chassis.
Cisco Catalyst 4500E Series Line Cards	
WS-X4748-UPOE+E	• 48 ports nonblocking • 10/100/1000 module (RJ-45) • Cisco IOS XE Release 3.1.0SG or later • UPOE: capable of up to 60 W per port up to 1440 W • Energy Efficient Ethernet 802.3az • IEEE 802.3af/at and Cisco prestandard PoE, IEEE 802.3x flow control • IEEE 802.1AE and Cisco TrustSec capability in hardware • L2-4 Jumbo Frame support (up to 9216 bytes) • Capable of up to 30 W of inline power per port on all ports simultaneously • Enterprise and commercial: designed to power next-generation IP phones, wireless base stations, video cameras, virtual desktop clients, and other PoE/UPOE devices • Campus and branch applications requiring enhanced performance for large file transfers and network backups
WS-X4748-RJ45V+E	• 48 ports nonblocking • 10/100/1000 module (RJ-45) • Cisco IOS XE Release 3.1.0SG or later • IEEE 802.3af/at and Cisco prestandard PoE, IEEE 802.3x flow control • IEEE 802.1AE and Cisco TrustSec capability in hardware • L2-4 Jumbo Frame support (up to 9216 bytes) • Capable of up to 30 W of inline power per port on all ports simultaneously • Enterprise and commercial: designed to power next-generation IP phones, wireless base stations, video cameras, and other PoE devices • Campus and branch applications requiring enhanced performance for large file transfers and network backups

Product Number /Description	
WS-X4748-RJ45-E	• 48 ports nonblocking • 10/100/1000 module (RJ-45) • Cisco IOS XE Release 3.1.0SG or later • Energy Efficient Ethernet 802.3az • IEEE 802.1AE and Cisco TrustSec capability in hardware • L2-4 Jumbo Frame support (up to 9216 bytes) • Enterprise and commercial: designed for data only user access • Campus and branch applications requiring enhanced performance for large file transfers and network backups
WS-X4712-SFP+E	• 48 gigabits per-slot capacity • Bandwidth is allocated across four 3-port groups, providing 12 Gbps per port group (2.5:1) • Up to 12 ports 10GE SFP+ (10GBASE-R) or 12 ports GE SFP (1GBASE-X) • SFP+ and SFP can be used simultaneously on the same line card without any restrictions • Cisco IOS XE Release 3.1.0SG or later • IEEE 802.1AE and Cisco TrustSec capability in hardware • L2-4 Jumbo Frame support (up to 9216 bytes) • Enterprise and commercial: designed for high-speed backbone and switch-to-switch applications • Service provider: 10GE/GE mix aggregation for DSLAM/PON/mobile data backhaul • WS-X4712-SFP+E is not supported on 4507R-E and 4510R-E chassis
WS-X4640-CSFP-E	• 40 modules of Gigabit SFP line card (1000BaseX), providing 24 gigabits per-slot capacity (SFP optional) • 40 ports with Gigabit SFP (2:1 oversubscribed) • 80 ports with Gigabit compact SFP (4:1 oversubscribed) • Customers can mix and match Gigabit SFP and Gigabit compact SFPs • 6E/6LE Supports WS-X4640-CSFP-E with IOS version 15.1.(1)SG • 7E, 7L-E supports WS-X4640-CSFP-E from 15.0(2)SG1 / 3.2.0SG onwards • Supported on 3, 6, and 7 slot chassis • IEEE 802.3, IEEE 802.3ah, IEEE 802.3x flow control • L2-4 Jumbo Frame support (up to 9216 bytes) • Inherits supervisor engine QoS capability • Service Provider: Point-to-Point fiber to the home (FTTH) or building (FTTB) for residential and business applications • Enterprise: Providing Fiber to the Desktop (FTTD), for deployments where non-blocking is not a mandatory requirement

The Cisco Catalyst 4500 Series has flexible interface types and port densities that allow network configurations to be mixed and matched to meet the specific needs of the organizations network.

The Cisco Catalyst 4500-X Series Switch is a fixed aggregation platform that provides flexibility through two versions of base switches along with optional uplink module. Both the 32- and 16-port versions can be configured with optional network modules and offer similar features. The Small Form-Factor Pluggable Plus (SFP+) interface supports both 10 Gigabit Ethernet and 1 Gigabit Ethernet ports, allowing upgrades to 10 Gigabit Ethernet when organizational demands change. The uplink module is hot swappable.

Deployment Options include:

- 32 x 10 Gigabit Ethernet Port switch with optional Small Form-Factor Pluggable Plus (SFP+) models
- 16 x 10 Gigabit Ethernet Port switch with optional Small Form-Factor Pluggable Plus (SFP+) models
- 8 x 10 Gigabit Ethernet SFP+ removable uplink module
- Dual-redundant AC/DC power supply and five field-replaceable unit (FRU) fans

The figure below shows the Cisco Catalyst 4500-X Series Switch with and without the optional 8-port uplink module, front-to-back airflow, and the uplink module.

Figure 3 Cisco Catalyst 4500-X Series Chassis and Modules

Figure 4 32 x 10 Gigabit Ethernet Port Switch with Optional Uplink Module Slot

Figure 5 16 x 10 Gigabit Ethernet Port Switch with Optional Uplink Module Slot

Figure 6 8 x 10 Gigabit Ethernet Port Uplink Module

Figure 7 Front-to-Back Airflow Rear View

Figure 8 Back-to-Front Airflow Rear View

As described above, the physical boundary of the TOE is the switch hardware and software. The software of the TOE is IOS and other supporting functionality (e.g., SSH Server). This physical boundary represents the Switch subsystem of the TOE. The Switch subsystem processes data packets and accepts a management interface connection to administer the switch. The management interface is either through a secure SSHv2 session or via a local console connection.

The switches are hardware platforms in which all operations in the TOE scope are protected from interference and tampering by untrusted subjects. All administration and configuration operations are performed within the physical boundary of the TOE. Also, all TOE Security Policy (TSP) enforcement functions must be invoked and succeed prior to functions within the TOE scope of control (TSC) proceeding.

The TOE includes one or more chassis, one or more supervisor engine cards running the IOS XE software and one or more line cards. Each switch is a physical device with the following types of communication interfaces provided by the supervisor engine cards and/or the line cards:

- USB ports,
- Network port,

- Serial port, and
- Compact Flash Slot

In addition to the communication interfaces above, the TOE includes a number of LEDs and power connectors. The LEDs are output elements only, and while the power connectors provide physical input they are not considered TOE interfaces.

1.6.1 USB Console Port

The USB Interface is a physical port on the Supervisor card. The interface allows a management console to be connected to the TOE as a USB device whereas an Administrator can authenticate to the TOE and issue commands to the TOEs CLI. Physical access to the port is protected by operational environment of the switch.

1.6.2 Network Ports

The physical network interfaces to the switch are Ethernet interfaces receiving and transmitting Internet Protocol datagrams as specified in RFC 0894 [Ethernet], RFC 0791 [IPv4], and RFC 2460 [IPv6]. Over this physical interface network traffic packets are transferred into and out of the TOE. The physical network interface (ports) can be located on the supervisor card and/or the line cards.

The network interface is the physical Ethernet interface to the TOE from the internal and external networks. Within the scope of the evaluation, this interface is used for the following purposes:

- For network traffic entering and leaving the TOE. This could be ‘through traffic’ for example a telnet packet from a user destined from an internal network to an external network, or ‘to the box traffic’ for example an external ping to the TOE’s IP address.
- To allow a remote Administrator to access the TOE’s CLI over the network using SSHv2.
- To allow the audit log records to be transmitted to the syslog server via IPsec connection tunnel.
- To allow, if configured, time synchronization with the NTP server via secure transmission (SSHv2, IPsec).
- To allow, if configured, the TOE access to the AAA server to authenticate TOE administrators.

1.6.3 Serial Port

From a directly connected terminal an Administrator can authenticate to the TOE and issue commands to the TOEs CLI. This interface can also be configured to display syslog messages to the console.

The primary serial interface into the TOE uses RS-232 signaling over an RJ45 interface. The serial port is located on the Supervisor card.

1.6.4 Compact Flash Slot

The Supervisor Engine card in the Catalyst 4500 series provides a slot to accept a compact flash drive. The TOE can accept 64MB, 128 MB, 256 MB, 512 MB compact flash drives. The storage provided by these drives is used by the TOE as ordinary long term storage of configuration files and IOS software images.

Because the TOE treats the compact flash storage as an internal storage medium, this physical interface is considered internal to the TOE and thus, NOT a TSFI.

1.6.5 Physical Scope of the TOE

The physical scope of the TOE comprises a collection of all hardware, firmware, software and guidance documentation as follows:

- The TOE is a hardware and software solution that uses a combination of chassis, supervisor engine, and line cards as defined in Section 1.3.1, Table 3: the Cisco Catalyst 4500 Series Switches (4503-E, 4506-E, 4507R+E, 4510R+E, 4500X and 4500X-F) running IOS XE 3.5.2E on the Supervisor Engine.
- Installation and Configuration guidance for the Common Criteria NDPP Evaluated Cisco Catalyst 4500 Series Switches (4503-E, 4506-E, 4507R+E, 4510R+E, 4500X and 4500X-F) with IOS XE 3.5.2E
- Cisco IOS Security Command Reference
- Cisco IOS Security Configuration Guide

1.7 Logical Scope of the TOE

The TOE includes the following security features that are relevant to the secure configuration and operation of the TOE.

1. Security audit
2. Cryptographic support
3. User Data Protection
4. Identification and authentication
5. Secure Management
6. Protection of the TSF
7. Resource Utilization
8. TOE access
9. Trusted Path/Channel

These features are described in more detail in the subsections below.

1.7.1 Security Audit

The TOE generates a comprehensive set of audit logs that identify specific TOE operations. For each event, the TOE records the date and time of each event, the type of event, the subject identity, and the outcome of the event. Auditable events include: failure on invoking cryptographic functionality; establishment, termination and failure of an IPsec SA; establishment, termination and failure of an SSH session; modifications to the group of users that are part of the authorized administrator roles; all use of the user identification mechanism; any use of the authentication mechanism; any change in the configuration of the TOE; detection of replay attacks, changes to time, initiation of TOE update, indication of completion of TSF self-test, maximum sessions being exceeded, termination of a remote session and attempts to unlock a termination session; and initiation and termination of a trusted channel.

The TOE is configured to transmit its audit messages to an external syslog server. Communication with the syslog server is protected using IPsec and the TOE can determine when communication with the syslog server fails. If that should occur, the TOE can be configured to block new permit actions.

The logs can be viewed on the TOE using the appropriate IOS commands. The records include the date/time the event occurred, the event/type of event, the user associated with the event, and additional information of the event and its success and/or failure. The TOE does not have an interface to modify audit records, though there is an interface available for the authorized administrator to clear audit data stored locally on the TOE.

1.7.2 Cryptographic Support

The TOE provides cryptography support for secure communications and protection of information when configured in FIPS mode of operation. The crypto module is FIPS 140-2 SL2 validated. The cryptographic services provided by the TOE include: symmetric encryption and decryption using AES; digital signature using RSA; cryptographic hashing using SHA1; keyed-hash message authentication using HMAC-SHA1, and IPsec for authentication and encryption services to prevent unauthorized viewing or modification of data as it travels over the external network. The TOE also implements SSHv2 secure protocol for secure remote administration. In the evaluated configuration, the TOE must be operated in FIPS mode of operation per the FIPS Security Policy (certificate 1940).

1.7.3 User Data Protection

The TOE supports routing protocols including BGPv4, EIGRP, EIGRPv6 for IPv6, RIPv2, and OSPFv2 to maintain routing tables, or routing tables can configured and maintained manually (‘static routes’). Since routing tables are used to determine which egress ACL is applied to the outbound traffic, the authority to modify the routing tables is restricted to authenticated administrators, and authenticated neighbor routers. The only aspect of routing protocols that is security relevant in this TOE is the TOE’s ability to authenticate neighbor routers using shared passwords. Other security features and configuration options of routing protocols are beyond the scope of this Security Target and are described in administrative guidance.

The TOE also ensures that packets transmitted from the TOE do not contain residual information from previous packets. Packets that are not the required length use zeros for padding the remainder of the packet so that residual data from previous traffic is never transmitted from the TOE.

1.7.4 Identification and Authentication

The TOE performs local authentication, using Cisco IOS platform authentication mechanisms, to authenticate access to user EXEC and privileged EXEC command modes. All users wanting to use TOE services are identified and authenticated prior to being allowed access to any of the services. Once a user attempts to access the management functionality of the TOE (via EXEC mode), the TOE prompts the user for a user name and password. Only after the administrative user presents the correct identification and authentication credentials will access to the TOE functionality be granted.

The TOE also supports use of a remote AAA server (RADIUS and TACACS+) as the enforcement point for identifying and authenticating users attempting to connect to the TOE's CLI. Note the remote authentication server is not included within the scope of the TOE evaluated configuration, it is considered to be provided by the operational environment.

The TOE can be configured to display an advisory banner when administrators log in and also to terminate administrator sessions after a configured period of inactivity.

The TOE also supports authentication of other routers using router authentication supported by BGPv4, EIGRP, EIGRPv6 for IPv6, RIPv2, and OSPFv2. Each of these protocols supports authentication by transmission of MD5-hashed password strings, which each neighbor router uses to authenticate others. For additional security, it is recommended router protocol traffic also be isolated to separate VLANs.

1.7.5 Security Management

The TOE provides secure administrative services for management of general TOE configuration and the security functionality provided by the TOE. All TOE administration occurs either through a secure session via SSHv2, or a local console connection (serial port). The TOE provides the ability to perform the following actions:

- allows authorized administrators to add new administrators,
- start-up and shutdown the device,
- create, modify, or delete configuration items,
- create, modify, or delete information flow policies,
- create, modify, or delete a routing table,
- modify and set session inactivity thresholds,
- modify and set the time and date,

- and create, delete, empty, and review the audit trail

All of these management functions are restricted to authorized administrators of the TOE.

The TOE switch platform maintains administrative privilege levels and supports non-administrative connections. Non-administrative connections are established with authenticated neighbor routers for the ability to transmit and receive routing table updates per the information flow rules. No other access nor management functionality is associated with non-administrative connections. The administrative privilege levels include:

- Administrators are assigned to privilege levels 0 and 1. Privilege levels 0 and 1 are defined by default and are customizable. These levels have a very limited scope and access to CLI commands that include basic functions such as login, show running system information, turn on/off privileged commands, logout.
- Semi-privileged administrators equate to any privilege level that has a subset of the privileges assigned to level 15; levels 2-14. These levels are undefined by default and are customizable.
- Privileged administrators are equivalent to full administrative access to the CLI, which is the default access for IOS privilege level 15.

All management functions are restricted to the authorized administrator of the TOE. The term “authorized administrator” is used in this ST to refer to any user account that has been assigned to a privilege level that is permitted to perform the relevant action; therefore has the appropriate privileges to perform the requested functions.

1.7.6 Protection of the TSF

The TOE protects against interference and tampering by untrusted subjects by implementing identification, authentication and access controls to limit configuration to authorized administrators. Additionally Cisco IOS is not a general-purpose operating system and access to Cisco IOS memory space is restricted to only Cisco IOS functions.

The TOE provides secure transmission when TSF data is transmitted between the TOE and other IT entities, such as remote administration via SSH and secure transmission of audit logs to a syslog server via IPsec.

The TOE is also able to detect replay of information received via secure channels (e.g. SSH, or IPsec). The detection applied to network packets that terminate at the TOE, such as trusted communications between the administrators and the TOE, or between an IT entity (e.g., authentication server) and the TOE. If replay is detected, the packets are discarded.

In addition, the TOE internally maintains the date and time. This date and time is used as the timestamp that is applied to audit records generated by the TOE. Administrators can update the TOE’s clock manually, or can configure the TOE to use NTP to synchronize the TOE's clock with an external time source. Finally, the TOE performs testing to verify correct operation of the switch itself and that of the cryptographic module[8].

1.7.7 Resource Utilization

The TOE provides the capability of controlling and managing resources so that a denial of service will not occur. The resource allocations are configured to limit the number of concurrent administrator sessions.

1.7.8 TOE Access

The TOE can terminate inactive sessions after an authorized administrator configurable time-period. Once a session has been terminated the TOE requires the user to re-authenticate to establish a new session.

The TOE also provides the authorized administrator with the ability to specify a notification of use banner on the CLI management interface prior to allowing any administrative access to the TOE.

1.7.9 Trusted Path/Channels

The TOE establishes a trusted path between the appliance and the CLI using SSHv2, with the syslog server and if configured with the NTP server and external authentication server using IPsec.

1.8 Excluded Functionality

The Cisco IOS contains a collection of features that build on the core components of the system. Those features that are not within the scope of the evaluated configuration include:

Features that must remain disabled in the evaluated configuration:

- HTTP or HTTPS Server - The IOS web server (using HTTPS or HTTP) cannot satisfy all the NDPP requirements for administrative interfaces and must remain disabled in the evaluated configuration. The CLI interface is used to manage the TOE. Not including this feature does not interfere with the management of TOE as defined in the Security Target or the operation of the TOE.
- IEEE 802.11 Wireless Standards requires additional hardware beyond what is included in the evaluated configuration.
- SNMP Server does not enforce the required user-specific authentication. This feature is disabled by default and must remain disabled in the evaluated

[8] The cryptographic module, which is security relevant, implements support for cryptographic operations used by other parts of the TOE.

configuration. Including this feature would not meet the security policies as defined in the Security Target. The exclusion of this feature has no effect on the operation of the TOE.

- Telnet server sends authentication data in the clear. This feature is enabled by default and must be disabled in the evaluated configuration. Including this feature would not meet the security policies as defined in the Security Target. The exclusion of this feature has no effect on the operation of the TOE.
- VPN Remote Access requires additional licenses beyond what is included in the evaluated configuration. Administrative remote access is secured using SSHv2.
- Smart Install is a feature to configure IOS Software and switch configuration without user intervention. The Smart Install uses dynamic IP address allocation to facilitate installation providing transparent network plug and play. This feature is not to be used as it could result in settings/configurations that may interfere with the enforcement of the security policies as defined in the Security Target or the TOEs operation.
- TrustSec is only relevant to RADIUS KeyWrap, which is being represented with other cryptographic methods identified and described in this Security Target. This feature is disabled by default and should remain disabled in the evaluated configuration. Not including this feature does not interfere with the enforcement of the security policies as defined in the Security Target or the TOEs operation.

Apart from these exceptions, all types of network traffic through and to the TOE are within the scope of the evaluation.

2 CONFORMANCE CLAIMS

2.1 Common Criteria Conformance Claim

The ST and the TOE it describes are conformant with the following CC package specifications:

- Common Criteria for Information Technology Security Evaluation Part 2: Security Functional Components, Version 3.1, Revision 3, July 2009
  - Part 2 Extended
- Common Criteria for Information Technology Security Evaluation Part 3: Security Assurance Components, Version 3.1, Revision 3, July 2009
  - Part 3 Conformant

2.2 Protection Profile Conformance Claim

This ST claims strict conformance to the following Common Criteria validated Protection Profiles (PP), US Government, Security Requirements for Network Devices (pp_nd_v1.0), version 1.0, dated 10 December 2010 (from here within referred to as NDPP). To support the strict conformance claim, as noted below in the PP conformance claim rationale, the ST includes all claims as indicated in NDPP and makes no additional claims.

2.3 Protection Profile Conformance Claim Rationale

2.3.1 TOE Appropriateness

The TOE provides all of the functionality at a level of security commensurate with that identified in the NDPP

2.3.2 TOE Security Problem Definition Conformance

The Assumptions, Threats, and Organization Security Policies included in the Security Target represent the Assumptions, Threats, and Organization Security Policies specified in the NDPP for which conformance is claimed verbatim. All concepts covered in the Protection Profile Security Problem Definition are included in the Security Target.

2.3.3 Statement of Security Objectives Conformance

The Assumptions, Threats, and Organization Security Policies included in the Security Target represent the Assumptions, Threats, and Organization Security Policies specified in the NDPP for which conformance is claimed verbatim.

2.3.4 Statement of Security Requirements Conformance

The Security Functional Requirements included in the Security Target represent the Security Functional Requirements specified in the U.S. Government Protection Profile for Security Requirements for Network Devices for which conformance is claimed verbatim. All concepts covered in the Protection Profile's Statement of Security Requirements are included in the Security Target. Additionally, the Security Assurance Requirements included in the Security Target are identical to the Security Assurance Requirements included in section 4.3 of the NDPP.

3 SECURITY PROBLEM DEFINITION

The security problem definition (SPD) defines the security problem that is to be addressed.

This document identifies assumptions as A.assumption with “assumption” specifying a unique name. Threats are identified as T.threat with “threat” specifying a unique name.

3.1 Introduction

This section describes the security environment in which the TOE is intended to be used.

3.2 External Entities

The following human or IT entities possibly interact with the TOE from outside the TOE boundary.

Table 7 External entities interacting with TOE

External Entities	Entity Definition
Admin	Human who administers the TOE. Administration tasks include starting the TOE, operating the TOE, maintaining configuration data and inspection of security audit log files. In this Security Target there are several levels of administrators, all which are described in Section 6.1 and all considered an Admin.
Attacker	A threat agent trying to undermine the security policy of the TOE.

3.3 Assets

The owner of the TOE presumably places value upon the following primary and secondary entities as long as they are in the scope of the TOE.

3.3.1 Primary Assets

The owner of the TOE presumably places value upon the following primary entities. All these primary assets represent user data in the sense of the CC.

Table 8 Primary assets to be protected

Asset	Asset Description
Audit Data	Primary asset, audit data

Asset	Asset Description
	The data which is provided by the TOE during security audit logging. Security properties to be maintained by the TOE: confidentiality, availability, integrity.

3.3.2 Secondary Assets

The owner of the TOE presumably places value upon the following secondary entities. All these secondary assets represent user data in the sense of the CC.

Table 9 Secondary assets to be protected

Asset	Asset Description
Auth data	Secondary asset, TSF data The data which is used by the TOE to identify and authenticate the external entities which interact with the TOE. Security properties to be maintained by the TOE: confidentiality, integrity, authenticity.
Crypto data	Secondary asset, TSF data The data which is used by the TOE for digital signature handling and encryption/decryption purposes. Security properties to be maintained by the TOE: confidentiality, integrity, authenticity.
Ctrl data	Secondary asset, TSF data The data which is used by the TOE for firmware updates, firmware registration, and firmware identity checking purposes. Security properties to be maintained by the TOE: availability, integrity.

3.4 Assumptions

The specific conditions listed in the following subsections are assumed to exist in the TOE's environment. These assumptions include both practical realities in the development of the TOE security requirements and the essential environmental conditions on the use of the TOE.

Table 10 Operational Assumptions

Assumption	Assumption Definition
A.NO_GENERAL_PURPOSE	It is assumed that there are no general-purpose computing capabilities (e.g., compilers or user applications) available on the TOE, other than

Assumption	Assumption Definition
	those services necessary for the operation, administration and support of the TOE.
A.PHYSICAL	Physical security, commensurate with the value of the TOE and the data it contains, is assumed to be provided by the environment.
A.TRUSTED_ADMIN	TOE Administrators are trusted to follow and apply all administrator guidance in a trusted manner.

3.5 Threats

The following table lists the threats addressed by the TOE and the IT Environment. The assumed level of expertise of the attacker for all the threats identified below is Basic.

Table 11 Threats

Threat	Threat Definition
T.ADMIN_ERROR	An administrator may unintentionally install or configure the TOE incorrectly, resulting in ineffective security mechanisms.
T.RESOURCE_EXHAUSTION	A process or user may deny access to TOE services by exhausting critical resources on the TOE.
T.TSF_FAILURE	Security mechanisms of the TOE may fail, leading to a compromise of the TSF.
T.UNDETECTED_ACTIONS	Malicious remote users or external IT entities may take actions that adversely affect the security of the TOE. These actions may remain undetected and thus their effects cannot be effectively mitigated.
T.UNAUTHORIZED_ACCESS	A user may gain unauthorized access to the TOE data and TOE executable code. A malicious user, process, or external IT entity may masquerade as an authorized entity in order to gain unauthorized access to data or TOE resources. A malicious user, process, or external IT entity may misrepresent itself as the TOE to obtain identification and authentication data.
T.UNAUTHORIZED_UPDATE	A malicious party attempts to supply the end user with an update to the product that may compromise the security features of the TOE.
T.USER_DATA_REUSE	User data may be inadvertently sent to a destination not intended by the original sender.

3.6 Organizational Security Policies

Organizational security policies (OSPs) are security rules, procedures, or guidelines enforced by the TOE, its operational environment, or a combination of the two.

3.6.1 OSPs enforced by TOE

The following security rules, procedures, or guidelines are enforced by the TOE.

Table 12 Organizational Security Policies

Policy Name	Policy Definition
P.ACCESS_BANNER	The TOE shall display an initial banner describing restrictions of use, legal agreements, or any other appropriate information to which users consent by accessing the TOE.

4 SECURITY OBJECTIVES

The security objectives are a concise and abstract statement of the intended solution to the security problem defined by the SPD.

This document identifies objectives of the TOE as O.objective with objective specifying a unique name. Objectives that apply to the operational environment are designated as OE.objective with objective specifying a unique name.

4.1 Security Objectives for the TOE

The security objectives for the TOE consists of a set of objectives the TOE should achieve to solve its part of the security problem.

Table 13 Security Objectives for the TOE

TOE Objective	TOE Security Objective Definition
O.PROTECTED_COMMUNICATIONS	The TOE will provide protected communication channels for administrators, other parts of a distributed TOE, and authorized IT entities.
O.VERIFIABLE_UPDATES	The TOE will provide the capability to help ensure that any updates to the TOE can be verified by the administrator to be unaltered and (optionally) from a trusted source.
O.SYSTEM_MONITORING	The TOE will provide the capability to generate audit data and send those data to an external IT entity.
O.DISPLAY_BANNER	The TOE will display an advisory warning regarding use of the TOE.
O.TOE_ADMINISTRATION	The TOE will provide mechanisms to ensure that only administrators are able to log in and configure the TOE, and provide protections for logged-in administrators.
O.RESIDUAL_INFORMATION_CLEARING	The TOE will ensure that any data contained in a protected resource is not available when the resource is reallocated.

TOE Objective	TOE Security Objective Definition
O.RESOURCE_AVAILABILITY	The TOE shall provide mechanisms that mitigate user attempts to exhaust TOE resources (e.g., persistent storage).
O.SESSION_LOCK	The TOE shall provide mechanisms that mitigate the risk of unattended sessions being hijacked.
O.TSF_SELF_TEST	The TOE will provide the capability to test some subset of its security functionality to ensure it is operating properly.

4.2 Security Objectives for the Environment

The security objectives for the environment consist of a set of objectives the environment should achieve to assist the TOE in correctly providing its security objectives.

Table 14 Security Objectives for the Environment

Operational Environment Security Objective	Operational Environment Security Objective Definition
OE.NO_GENERAL_PURPOSE	There are no general-purpose computing capabilities (e.g., compilers or user applications) available on the TOE, other than those services necessary for the operation, administration and support of the TOE.
OE.PHYSICAL	Physical security, commensurate with the value of the TOE and the data it contains, is provided by the environment.
OE.TRUSTED_ADMIN	TOE Administrators are trusted to follow and apply all administrator guidance in a trusted manner.

5 Security Requirements

This section identifies the Security Functional Requirements for the TOE. The Security Functional Requirements included in this section are derived from *US Government, Security Requirements for Network Devices (pp_nd_v1.0), version 1.0, dated 10 December 2010*.

5.1 Conventions

The CC defines operations on Security Functional Requirements: assignments, selections, assignments within selections and refinements. This document uses the following font conventions to identify the operations defined by the CC:

- Where operations were completed in the NDPP itself, the formatting used in the NDPP has been retained;
- Assignment: allows the specification of an identified parameter. Assignments are indicated using bold and are surrounded by brackets (e.g., [**assignment**]). Note that an assignment within a selection would be identified in italics and with embedded bold brackets (e.g., [[***selected-assignment***]]).
- Selection: allows the specification of one or more elements from a list. Selections are indicated using bold italics and are surrounded by brackets (e.g., [***selection***]).
- Iteration: allows a component to be used more than once with varying operations. In the ST, iteration is indicated by a number placed at the end of the component. For example FDP_IFF.1(1) and FDP_IFF.1(2) indicate that the ST includes two iterations of the FDP_IFF.1 requirement, (1) and (2).
- Refinement: allows the addition of details. Refinements are indicated using bold, for additions, and strike-through, for deletions (e.g., "… **all** objects …" or "… ~~some~~ **big** things …").
- The Extended SFRs are identified by having a label '_EXT' after the requirement name for TOE SFRs.

Other sections of the ST use bolding to highlight text of special interest, such as captions.

5.2 TOE Security Functional Requirements

This section identifies the Security Functional Requirements for the TOE that are specified in the NDPP. The TOE Security Functional Requirements that appear in the following table are described in more detail in the following subsections.

Table 15 Security Functional Requirements

Functional Component	
Requirement Class	**Requirement Component**
FAU: Security audit	FAU_GEN.1: Audit data generation
	FAU_GEN.2: User identity association
	FAU_STG_EXT.1: External audit trail storage
	FAU_STG_EXT.3: Action in case of loss of audit server connectivity

Functional Component	
FCS: Cryptographic support	FCS_CKM.1: Cryptographic key generation (for asymmetric keys)
	FCS_CKM_EXT.4: Cryptographic key zeroization
	FCS_COP.1(1): Cryptographic operation (for data encryption/decryption)
	FCS_COP.1(2): Cryptographic operation (for cryptographic signature)
	FCS_COP.1(3): Cryptographic operation (for cryptographic hashing)
	FCS_COP.1(4): Cryptographic operation (for keyed-hash message authentication)
	FCS_RBG_EXT.1: Cryptographic operation (random bit generation)
	FCS_COMM_PROT_EXT.1: Communications protection
	FCS_IPSEC_EXT.1: IPSEC
	FCS_SSH_EXT.1: SSH
FDP: User data protection	FDP_RIP.2: Full residual information protection
FIA: Identification and authentication	FIA_PMG_EXT.1: Password management
	FIA_UIA_EXT.1: User identification and authentication
	FIA_UAU_EXT.5: Password-based authentication mechanism
	FIA_UAU.6: Re-authenticating
	FIA_UAU.7: Protected authentication feedback
FMT: Security management	FMT_MTD.1: Management of TSF data (for general TSF data)
	FMT_SMF.1: Specification of management functions
	FMT_SMR.1: Security roles
FPT: Protection of the TSF	FPT_ITT.1(1): Basic internal TSF data transfer protection (disclosure)
	FPT_ITT.1(2): Basic internal TSF data transfer protection (modification)
	FPT_PTD_EXT.1(1): Management of TSF data (for reading of authentication data)
	FPT_PTD_EXT.1(2): Management of TSF data (for

Functional Component	
	reading of keys)
	FPT_RPL.1: Replay detection
	FPT_STM.1: Reliable time stamps
	FPT_TUD_EXT.1: Trusted update
	FPT_TST_EXT.1: TSF testing
FRU: Resource utilization	FRU_RSA.1: Maximum quotas
FTA: TOE Access	FTA_SSL_EXT.1: TSF-initiated session locking
	FTA_SSL.3: TSF-initiated termination
	FTA_TAB.1: Default TOE access banners
FTP: Trusted path/channels	FTP_ITC.1(1): Inter-TSF trusted channel (prevention of disclosure)
	FTP_ITC.1(2): Inter-TSF trusted channel (detection of modification)
	FTP_TRP.1(1): Trusted path
	FTP_TRP.1(2): Trusted path

5.2.1 Security audit (FAU)

5.2.1.1 FAU_GEN.1: Audit data generation

FAU_GEN.1.1 The TSF shall be able to generate an audit record of the following auditable events:

a) Start-up and shutdown of the audit functions;

b) All auditable events for the basic level of audit; and

c) *All administrative actions;*

d) [*Specifically defined auditable events listed in* Table 16].

FAU_GEN.1.2 The TSF shall record within each audit record at least the following information:

a) Date and time of the event, type of event, subject identity, and the outcome (success or failure) of the event; and

b) For each audit event type, based on the auditable event definitions of the functional components included in the PP/ST, [*information specified in column three of* Table 16].

Table 16: Auditable Events

Requirement	Auditable Events	Additional Audit Record Contents
FAU_GEN.1	None.	
FAU_GEN.2	None.	
FAU_STG_EXT.1	None.	
FAU_STG_EXT.3	Loss of connectivity.	No additional information.
FCS_CKM.1	Failure on invoking functionality.	No additional information.
FCS_CKM_EXT.4	Failure on invoking functionality.	No additional information.
FCS_COP.1(1)	Failure on invoking functionality.	No additional information.
FCS_COP.1(2)	Failure on invoking functionality.	No additional information.
FCS_COP.1(3)	Failure on invoking functionality.	No additional information.
FCS_COP.1(4)	Failure on invoking functionality.	No additional information.
FCS_RBG_EXT.1	Failure of the randomization process.	No additional information.
FCS_COMM_PROT_EXT.1	None.	
FCS_IPSEC_EXT.1	Failure to establish an IPsec SA. Establishment/Termination of an IPsec SA.	Reason for failure. Non-TOE endpoint of connection (IP address) for both successes and failures.
FCS_SSH_EXT.1	Failure to establish an SSH Session. Establishment/Termination of an SSH Session.	Reason for failure. Non-TOE endpoint of connection (IP address) for both successes and failures.
FDP_RIP.2	None.	
FIA_PMG_EXT.1	None.	
FIA_UIA_EXT.1	All use of the identification and authentication mechanism.	Provided user identity, origin of the attempt (e.g., IP address).
FIA_UAU_EXT.5	All use of the authentication mechanism.	Origin of the attempt (e.g., IP address).
FIA_UAU.6	Attempt to re-authenticate.	Origin of the attempt (e.g., IP address).
FIA_UAU.7	None.	

Requirement	Auditable Events	Additional Audit Record Contents
FMT_MTD.1	None.	
FMT_SMF.1	None.	
FMT_SMR.1	None.	
FPT_ITT.1(1)	None.	
FPT_ITT.1(2)	None.	
FPT_PTD_EXT.1(1)	None.	
FPT_PTD_EXT.1(2)	None.	
FPT_RPL.1	Detected replay attacks.	Origin of the attempt (e.g., IP address).
FPT_STM.1	Changes to the time.	The old and new values for the time. Origin of the attempt (e.g., IP address).
FPT_TUD_EXT.1	Initiation of update.	No additional information.
FPT_TST_EXT.1	Indication that TSF self-test was completed.	Any additional information generated by the tests beyond "success" or "failure".
FRU_RSA.1	Maximum quota being exceeded.	Resource identifier.
FTA_SSL_EXT.1	Any attempts at unlocking of an interactive session.	No additional information.
FTA_SSL.3	The termination of a remote session by the session locking mechanism.	No additional information.
FTA_TAB.1	None.	
FTP_ITC.1(1)	Initiation of the trusted channel. Termination of the trusted channel. Failure of the trusted channel functions.	Identification of the initiator and target of failed trusted channels establishment attempt.
FTP_ITC.1(2)	Initiation of the trusted channel. Termination of the trusted channel. Failure of the trusted channel functions.	Identification of the initiator and target of failed trusted channels establishment attempt.

Requirement	Auditable Events	Additional Audit Record Contents
FTP_TRP.1(1)	Initiation of the trusted channel. Termination of the trusted channel. Failures of the trusted path functions.	Identification of the claimed user identity.
FTP_TRP.1(2)	Initiation of the trusted channel. Termination of the trusted channel. Failures of the trusted path functions.	Identification of the claimed user identity.

5.2.1.1 FAU_GEN.2: User identity association

FAU_GEN.2.1 For audit events resulting from actions of identified users, the TSF shall be able to associate each auditable event with the identity of the user that caused the event.

5.2.1.2 FAU_STG_EXT.1: External audit trail storage

FAU_STG_EXT.1.1 The TSF shall be able to [***transmit the generated audit data to an external IT entity over a trusted channel defined in FTP_ITC.1***].

5.2.1.3 FAU_STG_EXT.3: Action in case of loss of audit server connectivity

FAU_STG_EXT.3.1 The TSF shall [**store audit records on the TOE and attempt re-establish connection**] if the link to the external IT entity collecting the audit data generated by the TOE is not available.

5.2.2 Cryptographic Support (FCS)

5.2.2.1 FCS_CKM.1: Cryptographic key generation (for asymmetric keys)

FCS_CKM.1.1 The TSF shall generate **asymmetric** cryptographic keys **in accordance with a domain parameter generator and** [***a random number generator***] that meet the following:

a) All cases: (i.e., any of the above)

- **ANSI X9.80 (3 January 2000), "Prime Number Generation, Primality Testing, and Primality Certificates" using random integers with deterministic tests, or constructive generation methods**
- **Generated key strength shall be equivalent to, or greater than, a symmetric key strength of 112 bits using conservative estimates.**

c) Case: For domain parameters used in RSA-based key establishment schemes

- **NIST Special Publication 800-56B "Recommendation for Pair-Wise Key Establishment Schemes Using Integer Factorization Cryptography"**

5.2.2.2 FCS_CKM_EXT.4: Cryptographic key zeroization

FCS_CKM_EXT.4.1 The TSF shall zeroize all plaintext secret and private cryptographic keys and CSPs when no longer required.

5.2.2.3 FCS_COP.1(1): Cryptographic operation (for data encryption/decryption)

FCS_COP.1.1(1) The TSF shall perform [*encryption and decryption*] in accordance with a specified cryptographic algorithm [*AES operating in* [**CBC mode**]] and cryptographic key sizes 128-bits, 256-bits, and [***no other key sizes***] that meets the following:

- **FIPS PUB 197, "Advanced Encryption Standard (AES)"**
- [***NIST SP 800-38A, NIST SP 800-38D***].

5.2.2.4 FCS_COP.1(2): Cryptographic operation (for cryptographic signature)

FCS_COP.1.1(2) The TSF shall perform **cryptographic signature services** in accordance with a [***(2) RSA Digital Signature Algorithm (rDSA) with a key size (modulus) of 2048 bits or greater***] that meets the following:

Case: RSA Digital Signature Algorithm

- [***FIPS PUB 186-3, "Digital Signature Standard***]

5.2.2.5 FCS_COP.1(3): Cryptographic operation (for cryptographic hashing)

FCS_COP.1.1(3) The TSF shall perform [*cryptographic hashing services*] in accordance with a specified cryptographic algorithm [***SHA-1,***

SHA 256, SHA-512**] and message digest sizes** [***160, 256, 512***] **bits** that meet the following: *FIPS Pub 180-3 "Secure Hash Standard."*

5.2.2.6 FCS_COP.1(4): Cryptographic operation (for keyed-hash message authentication)

FCS_COP.1.1(4) The TSF shall perform [*keyed-hash message authentication*] in accordance with a specified cryptographic algorithm HMAC-[***SHA-1, SHA-256, SHA-512***]**, key size** [***128, 192, 256 bits***]**, and message digest sizes** [***160, 256, 512***] **bits** that meet the following: *FIPS Pub 198-1 "The Keyed-Hash Message Authentication Code", and FIPS PUB 180-3, "Secure Hash Standard."*

5.2.2.7 FCS_RBG_EXT.1: Cryptographic operation (random bit generation)

FCS_RBG_EXT.1.1 The TSF shall perform all random bit generation (RBG) services in accordance with [***NIST Special Publication 800-90 using CTR_DRBG (AES)***] seeded by an entropy source that accumulated entropy from at least one independent TSF-hardware-based noise source.

FCS_RBG_EXT.1.2 The deterministic RBG shall be seeded with a minimum of [***256 bits***] of entropy at least equal to the greatest length of the keys and authorization factors that it will generate.

5.2.2.8 FCS_COMM_PROT_EXT.1: Communications protection

FCS_COMM_PROT_EXT.1.1 The TSF shall protect communications using [***IPsec, SSH***] and [***no other protocol***].

5.2.2.9 FCS_IPSEC_EXT.1: IPSEC

FCS_IPSEC_EXT.1.1 The TSF shall implement IPsec using the ESP protocol as defined by RFC 4303 using the cryptographic algorithms AES-CBC-128, AES-CBC-256 (both specified by RFC 3602), [***no other algorithms***] and using IKEv1 as defined in RFCs 2407, 2408, 2409, and RFC 4109, [***no other methods***] to establish the security association.

FCS_IPSEC_EXT.1.2 The TSF shall ensure that IKEv1 Phase 1 exchanges use only main mode.

FCS_IPSEC_EXT.1.3	The TSF shall ensure that IKEv1 SA lifetimes are able to be limited to 24 hours for Phase 1 SAs and 8 hours for Phase 2 SAs.
FCS_IPSEC_EXT.1.4	The TSF shall ensure that IKEv1 SA lifetimes are able to be limited to [**an administratively configurable number of kilobytes including the range from 100 – 200**] MB of traffic for Phase 2 SAs.
FCS_IPSEC_EXT.1.5	The TSF shall ensure that all IKE protocols implement DH Groups 14 (2048-bit MODP) and [***no other DH groups***].
FCS_IPSEC_EXT.1.6	The TSF shall ensure that all IKE protocols implement Peer Authentication using the [***rDSA***] algorithm.
FCS_IPSEC_EXT.1.7	The TSF shall support the use of pre-shared keys (as referenced in the RFCs) for use in authenticating its IPsec connections.
FCS_IPSEC_EXT.1.8	The TSF shall support the following: • Pre-shared keys shall be able to be composed of any combination of upper and lower case letters, numbers, and special characters (that include: "!", "@", "#", "$", "%", "^", "&", "*", "(", and ")"); • Pre-shared keys of 22 characters [***no other lengths***].

5.2.2.10 FCS_SSH_EXT.1: SSH

FCS_SSH_EXT.1.1	The TSF shall implement the SSH protocol that complies with RFCs 4251, 4252, 4253, and 4254.
FCS_SSH_EXT.1.2	The TSF shall ensure that the SSH connection be rekeyed after no more than 2^{28} packets have been transmitted using that key.
FCS_SSH_EXT.1.3	The TSF shall ensure that the SSH protocol implements a timeout period for authentication as defined in RFC 4252 of [**120 seconds**], and provide a limit to the number of failed authentication attempts a client may perform in a single session to [**3**] attempts.
FCS_SSH_EXT.1.4	The TSF shall ensure that the SSH protocol implementation supports the following authentication methods as described in RFC 4252: public key-based, password-based.
FCS_SSH_EXT.1.5	The TSF shall ensure that, as described in RFC 4253, packets greater than [**35,000**] bytes in an SSH transport connection are dropped.
FCS_SSH_EXT.1.6	The TSF shall ensure that the SSH transport implementation uses the following encryption algorithms: AES-CBC-128, AES-CBC-256, [***no other algorithms***].

FCS_SSH_EXT.1.7 The TSF shall ensure that the SSH transport implementation uses SSH_RSA and [***no other public key algorithms***] as its public key algorithm(s).

FCS_SSH_EXT.1.8 The TSF shall ensure that data integrity algorithms used in the SSH transport connection is [***hmac-sha1, hmac-sha1-96, hmac-md5-96***].

FCS_SSH_EXT.1.9 The TSF shall ensure that diffie-hellman-group14-sha1 is the only allowed key exchange method used for the SSH protocol.

5.2.3 User data protection (FDP)

5.2.3.1 FDP_RIP.2: Full residual information protection

FDP_RIP.2.1 The TSF shall ensure that any previous information content of a resource is made unavailable upon the [***allocation of the resource to***] all objects.

5.2.4 Identification and authentication (FIA)

5.2.4.1 FIA_PMG_EXT.1: Password management

FIA_PMG_EXT.1.1 The TSF shall provide the following password management capabilities for administrative passwords:

1. *Passwords shall be able to be composed of any combination of upper and lower case letters, numbers, and special characters (that include: "!", "@", "#", "$", "%", "^", "&", "*", "(", and ")");*
2. *Minimum password length shall be settable by the Security Administrator, and support passwords of 8 characters or greater;*
3. *Passwords composition rules specifying the types and number of required characters that comprise the password shall be settable by the Security Administrator.*
4. *Passwords shall have a maximum lifetime, configurable by the Security Administrator.*
5. *New passwords must contain a minimum of 4 character changes from the previous password.*

5.2.4.2 FIA_UIA_EXT.1: User identification and authentication

FIA_UIA_EXT.1.1 The TSF shall allow [***no services***] on behalf of the user to be performed before the user is identified and authenticated.

FIA_UIA_EXT.1.2 The TSF shall require each user to be successfully identified and authenticated before allowing any other TSF-mediated actions on behalf of that user.

5.2.4.3 FIA_UAU_EXT.5: Password-based authentication mechanism

FIA_UAU_EXT.5.1 The TSF shall provide a local password-based authentication mechanism, [[***remote password-based authentication via RADIUS or TACACS+***]] to perform user authentication.

FIA_UAU_EXT.5.2 The TSF shall ensure that users with expired passwords are **[*locked out until their password is reset by an administrator*]**.

5.2.4.4 FIA_UAU.6: Re-authenticating

FIA_UAU.6.1 The TSF shall re-authenticate the user under the conditions: when the user changes their password, **[*following TSF-initiated locking (FTA_SSL)*]**.

5.2.4.5 FIA_UAU.7: Protected authentication feedback

FIA_UAU.7.1 The TSF shall provide only *obscured feedback* to the user while the authentication is in progress at the local console.

5.2.5 Security management (FMT)

5.2.5.1 FMT_MTD.1: Management of TSF data (for general TSF data)

FMT_MTD.1.1 The TSF shall restrict the ability to <u>manage</u> the *TSF data* to the *Security Administrators*.

5.2.5.2 FMT_SMF.1: Specification of Management Functions

FMT_SMF.1.1 The TSF shall be capable of performing the following management functions:

- *Ability to configure the list of TOE services available before an entity is identified and authenticated, as specified in FIA_UIA_EXT.1, respectively.*
- *Ability to configure the cryptographic functionality.*

- *Ability to update the TOE, and to verify the updates using the digital signature capability (FCS_COP.1(2)) and* [***no other functions***]
- **Ability to manage the cryptographic functionality**
- **Ability to manage the audit logs and functions**
- **Ability to manage routing tables**
- **Ability to manage security attributes belonging to individual users**
- **Ability to manage the default values of the security attributes**
- **Ability to manage the warning banner message and content**
- **Ability to manage the time limits of session inactivity**.

5.2.5.3 FMT_SMR.1: Security roles

FMT_SMR.1.1 The TSF shall maintain the roles:

- [Security Administrator,
- [***No other roles***]].

FMT_SMR.1.2 The TSF shall be able to associate users with roles.

5.2.6 Protection of the TSF (FPT)

5.2.6.1 FPT_ITT.1(1) Basic Internal TSF Data Transfer Protection (Disclosure)

FPT_ITT.1.1(1) **Refinement:** The TSF shall protect TSF data from disclosure when it is transmitted between separate parts of the TOE **through the use of the TSF-provided cryptographic services:** [**FCS_IPSEC_EXT.1 IPSEC**].

5.2.6.2 FPT_ITT.1(2) Basic Internal TSF Data Transfer Protection (Modification)

FPT_ITT.1.1(2) **Refinement:** The TSF shall detect modification of TSF data when it is transmitted between separate parts of the TOE **through the use of the TSF-provided cryptographic services:** [**FCS_IPSEC_EXT.1 IPSEC**].

5.2.6.3 FPT_PTD_EXT.1(1): Management of TSF data (for reading of authentication data)

FPT_PTD_EXT.1.1(1) The TSF shall **prevent** *reading of* the *plaintext passwords*.

5.2.6.4 FPT_PTD_EXT.1(2): Management of TSF data (for reading of all symmetric keys)

FPT_PTD_EXT.1.1(2) The TSF shall **prevent** reading of *all pre-shared keys, symmetric key, and private keys*.

5.2.6.5 FPT_RPL.1: Replay detection

FPT_RPL.1.1 The TSF shall detect replay for the following entities: [*network packets terminated at the TOE*].

FPT_RPL.1.2 The TSF shall perform: [*reject the data*] when replay is detected.

5.2.6.6 FPT_STM.1: Reliable time stamps

FPT_STM.1.1 The TSF shall be able to provide reliable time stamps for its own use.

5.2.6.7 FPT_TUD_EXT.1: Trusted update

FPT_TUD_EXT.1.1 The TSF shall provide security administrators the ability to query the current version of the TOE firmware/software.

FPT_TUD_EXT.1.2 The TSF shall provide security administrators the ability to initiate updates to the TOE firmware/software.

FPT_TUD_EXT.1.3 The TSF shall provide a means to verify firmware/software updates to the TOE using a [***published hash***] prior to installing those updates.

5.2.6.8 FPT_TST_EXT.1: TSF testing

FPT_TST_EXT.1.1 The TSF shall run a suite of self tests during initial start-up (on power on) to demonstrate the correct operation of the TSF.

5.2.7 FRU – Resource Utilization

5.2.7.1 FRU_RSA.1: Maximum quotas

FRU_RSA.1.1(1) The TSF shall enforce maximum quotas of the following resources: [**resources supporting the administrative interface**]**,** [***no other resource***] that [***individual user***] can use [***simultaneously***].

5.2.8 TOE Access (FTA)

5.2.8.1 FTA_SSL_EXT.1: TSF-initiated session locking

FTA_SSL_EXT.1.1 The TSF shall, for local interactive sessions, [***terminate the session***] after a Security Administrator-specified time period of inactivity.

5.2.8.2 FTA_SSL.3: TSF-initiated termination

FTA_SSL.3.1 The TSF shall terminate **a remote** interactive session after a [*Security Administrator-configurable time interval of session inactivity*].

5.2.8.3 FTA_TAB.1: Default TOE Access Banners

FTA_TAB.1.1 Before establishing a **user/administrator** session the TSF shall display **a Security Administrator-specified** advisory **notice and consent** warning message regarding unauthorized use of the TOE.

5.2.9 Trusted Path/Channel (FTP)

5.2.9.1 FTP_ITC.1(1): Inter-TSF trusted channel (prevention of disclosure)

FTP_ITC.1.1(1) The TSF shall **use [IPSec] to** provide a **trusted** communication channel between itself and **authorized IT entities** that is logically distinct from other communication channels and provides assured identification of its end points and protection of the channel data from disclosure.

FTP_ITC.1.2(1) The TSF shall permit *the TSF*, ***or the authorized IT entities*** to initiate communication via the trusted channel.

FTP_ITC.1.3(1) The TSF shall initiate communication via the trusted channel for [*all authentication functions),* [**IPSec**]].

5.2.9.2 FTP_ITC.1(2) – Inter-TSF trusted channel (detection of modification)

FTP_ITC.1.1(2) The TSF shall **use [IPSec] in providing** a **trusted** communication channel between itself and **authorized IT entities** that is logically distinct from other communication channels and provides assured identification of its end points and **detection of the modification of data**.

FTP_ITC.1.2(2) The TSF shall permit *the TSF*, ***or the authorized IT entities*** to initiate communication via the trusted channel.

FTP_ITC.1.3(2) The TSF shall initiate communication via the trusted channel for [*all authentication functions,* [**IPSec**]].

5.2.9.3 FTP_TRP.1(1): Trusted path

FTP_TRP.1.1(1) **Refinement:** The TSF shall provide a communication path between itself and *remote administrators* **using [SSH as specified in FCS_SSH_EXT.1 to access the CLI]** that is logically distinct from other communication paths and provides assured identification of its end points and protection of the communicated data from disclosure.

FTP_TRP.1.2(1) The TSF shall permit *remote administrators* to initiate communication via the trusted path.

FTP_TRP.1.3(1) **Refinement:** The TSF shall require the use of the trusted path for *all remote administrative actions*.

5.2.9.4 FTP_TRP.1(2) – Trusted path

FTP_TRP.1.1(2) **Refinement:** The TSF shall provide a communication path between itself and *remote administrators* **using [SSH as specified in FCS_SSH_EXT.1 to access the CLI]** that is logically distinct from other communication paths and provides assured identification of its end points and **detection of modification of the communicated data**.

FTP_TRP.1.2(2) The TSF shall permit *remote administrators* to initiate communication via the trusted path.

FTP_TRP.1.3(2) **Refinement:** The TSF shall require the use of the trusted path for *all remote administrative actions*.

5.3 Extended Components Definition

This Security Target includes Security Functional Requirements (SFR) that is not drawn from existing CC Part 2. The Extended SFRs are identified by having a label '_EXT' after the requirement name for TOE SFRs. The structure of the extended SFRs is modeled after the SFRs included in CC Part 2. The structure is as follows:

A. Class – The extended SFRs included in this ST are part of the identified classes of requirements.
B. Family – The extended SFRs included in this ST are part of several SFR families
C. Component – The extended SFRs are not hierarchical to any other components, though they may have identifiers terminating on other than "1".

The dependencies for each extended component are identified in the TOE SFR Dependencies section of this ST below.

D. The management requirements, if any, associated with the extended SFRs are incorporated into the Security management SFRs defined in this ST.

E. The audit requirements, if any, associated with the extended SFRs are incorporated into the Security audit SFRs defined in this ST.

F. The dependency requirements, if any, associated with the extended SFRs are identified in the dependency rationale and mapping section of the ST (TOE SFR Dependencies Rationale).

Extended Requirements Rationale:

FAU_STG_EXT.1:

This SFR was taken from NDPP – where it is defined as a requirement to export audit records outside the TOE.

FAU_STG_EXT.3:

This SFR was taken from NDPP – where it is defined as a requirement to detect, and take a defined action, when an external audit server becomes inaccessible.

FCS_CKM_EXT.4:

This SFR was taken from NDPP – where it is defined as a requirement for immediate zeroization when keys and CSPs are no longer required.

FCS_COMM_PROT_EXT.1:

This SFR was taken from NDPP – where it is defined as a requirement to identify required protocol-related cryptographic mechanisms.

FCS_IPSEC_EXT.1:

This SFR was taken from NDPP – where it is defined as a requirement specific to IPSEC.

FCS_RBG_EXT.1:

This SFR was taken from NDPP – where it is defined as a requirement specific to random bit generation.

FCS_SSH_EXT.1:

This SFR was taken from NDPP – where it is defined as a requirement specific to SSH.

FIA_PMG_EXT.1:

This SFR was taken from NDPP – where it is defined as a requirement for specific password composition and aging constraints..

FIA_UAU_EXT.5:

This SFR was taken from NDPP – where it is defined as a requirement allowing the identification of required external authentication services.

FIA_UIA_EXT.1:

This SFR was taken from NDPP – where it is defined as a requirement combining both identification and authentication requirements.

FPT_PTD_EXT.1:

This SFR was taken from NDPP (as FPT_PTD.1(1)) –where it is defined as a requirement specifically disallowing access to identified TSF data. Note, in the NDPP this SFR is not represented as an Extended Requirement with the inclusion of the 'EXT' qualifier. However this SFR is not represented in the Part 2 CC, as such the ST Author has corrected by including the 'EXT' qualifier.

FPT_PTD_EXT.2:

This SFR was taken from NDPP (as FPT_PTD.1(2)) – where it is defined as a requirement specifically disallowing access to identified TSF data. Note, in the NDPP this SFR is not represented as an Extended Requirement with the inclusion of the 'EXT' qualifier. However this SFR is not represented in the Part 2 CC, as such the ST Author has corrected by including the 'EXT' qualifier.

FPT_TST_EXT.1:

This SFR was taken from NDPP – where it is defined as a requirement for TSF self tests of the TOE during initialization (on bootup).

FPT_TUD_EXT.1:

This SFR was taken from NDPP – where it is defined as a requirement for secure TOE update capabilities.

FTA_SSL_EXT.1:

This SFR was taken from NDPP – where it is defined as a requirement for behavior after local terminal session inactivity.

5.4 TOE SFR Dependencies Rationale

The following table provides dependency rational for SFRs that were drawn from the NDPP.

Table 17: SFR Dependency Rationale (from NDPP)

SFR	Dependency	Rationale
FAU_GEN.1	FPT_STM.1	Met by FPT_STM.1
FAU_GEN.2	FAU_GEN.1 FIA_UID.1	Met by FAU_GEN. Met by FIA_UIA_EXT.1
FAU_STG_EXT.1	FAU_GEN.1	Met by FAU_GEN.1
FAU_STG_EXT.3	FAU_STG_EXT.1	Met by FAU_STG_EXT.1
FCS_CKM.1	FCS_CKM.2 or FCS_COP.1 FCS_CKM.4	Met by FCS_COP.1(2), (3), and (4) Met by FCS_CKM.4
FCS_CKM_EXT.4	FDP_ITC.1 or FDP_ITC.2 or FCS_CKM.1	Met by FCS_CKM.1
FCS_COP.1(1)	FDP_ITC.1 or 2 or FCS_CKM.1 FCS_CKM.4	Met by FCS_CKM.1 and FCS_CKM_EXT.4
FCS_COP.1(2)	FDP_ITC.1 or 2 or FCS_CKM.1 FCS_CKM.4	Met by FCS_CKM.1 and Met by FCS_CKM_EXT.4
FCS_COP.1(3)	FDP_ITC.1 or 2 or FCS_CKM.1 FCS_CKM.4	Met by FCS_CKM.1 and Met by FCS_CKM_EXT.4
FCS_COP.1(4)	FDP_ITC.1 or 2 or FCS_CKM.1 FCS_CKM.4	Met by FCS_CKM.1 and Met by FCS_CKM_EXT.4
FCS_RBG_EXT.1	No dependencies	N/A
FCS_COMM_PROT_EXT.1	FCS_HTTPS_EXT.1 or FCS_IPSEC_EXT.1 or FCS_SSH_EXT.1 or FCS_TLS_EXT.1	Met by FCS_IPSEC_EXT.1 and FCS_SSH_EXT.1
FCS_IPSEC_EXT.1	FCS_COP.1	Met by FCS_COP.1
FCS_SSH_EXT.1	FCS_COP.1	Met by FCS_COP.1
FDP_RIP.2	No dependencies	N/A
FIA_PMG_EXT.1	No dependencies	N/A
FIA_UIA_EXT.1	No dependencies	N/A
FIA_UAU_EXT.5	No dependencies	N/A
FIA_UAU.6	No dependencies	N/A
FIA_UAU.7	FIA_UAU.1	Met by FIA_UIA_EXT.1
FMT_MTD.1	FMT_SMF.1 FMT_SMR.1	Met by FMT_SMF.1 Met by FMT_SMR.1

SFR	Dependency	Rationale
FMT_SMF.1	No dependencies	N/A
FMT_SMR.1	FIA_UID.1	Met by FIA_UIA_EXT.1
FPT_ITT.1(1)	No dependencies	N/A
FPT_ITT.1(2)	No dependencies	N/A
FPT_PTD_EXT.1(1)	No dependencies	N/A
FPT_PTD_EXT.1(2)	No dependencies	N/A
FPT_RPL.1	No dependencies	N/A
FPT_STM.1	No dependencies	N/A
FPT_TUD_EXT.1	No dependencies	N/A
FPT_TST_EXT.1	No dependencies	N/A
FRU_RSA.1	No dependencies	N/A
FTA_SSL_EXT.1	No dependencies	N/A
FTA_SSL.3	No dependencies	N/A
FTA_TAB.1	No dependencies	N/A
FTP_ITC.1(1)	No dependencies	N/A
FTP_ITC.1(2)	No dependencies	N/A
FTP_TRP.1(1)	No dependencies	N/A
FTP_TRP.1(2)	No dependencies	N/A

5.5 Security Assurance Requirements

5.5.1 SAR Requirements

The TOE assurance requirements for this ST are taken directly from the NDPP which are derived from Common Criteria Version 3.1, Revision 3. The assurance requirements are summarized in the table below as identified in the NDPP, Section 4.3. The ST does not include any changes to the assurance requirements beyond those identified and described in the NDPP, as such all assurance activities from NDPPv1.0 form the SARs in this ST.

Table 18: Assurance Measures

Assurance Class	Components	Components Description
DEVELOPMENT	ADV_FSP.1	Basic Functional Specification
GUIDANCE DOCUMENTS	AGD_OPE.1	Operational user guidance
	AGD_PRE.1	Preparative User guidance

Assurance Class	Components	Components Description
LIFE CYCLE SUPPORT	ALC_CMC.1	Labeling of the TOE
	ALC_CMS.1	TOE CM coverage
TESTS	ATE_IND.1	Independent testing – conformance
VULNERABILITY ASSESSMENT	AVA_VAN.1	Vulnerability analysis

5.5.2 Security Assurance Requirements Rationale

This Security Target claims conformance to the NDPP which draws from EAL1 the Security Assurance Requirements (SARs). This target was chosen to ensure that the TOE has a low to moderate level of assurance in enforcing its security functions when instantiated in its intended environment which imposes no restrictions on assumed activity on applicable networks.

5.6 Assurance Measures

The TOE satisfies the identified assurance requirements. This section identifies the Assurance Measures applied by Cisco to satisfy the assurance requirements. The table below lists the details.

Table 19: Assurance Measures

Component	How requirement will be met
ADV_FSP.1	The functional specification describes the external interfaces of the TOE; such as the means for a user to invoke a service and the corresponding response of those services. The description includes the interface(s) that enforces a security functional requirement, the interface(s) that supports the enforcement of a security functional requirement, and the interface(s) that does not enforce any security functional requirements. The interfaces are described in terms of their purpose (general goal of the interface), method of use (how the interface is to be used), parameters (explicit inputs to and outputs from an interface that control the behavior of that interface), parameter descriptions (tells what the parameter is in some meaningful way), and error messages (identifies the condition that generated it, what the message is, and the meaning of any error codes). The development evidence also contains a tracing of the interfaces to the SFRs described in this ST.

Component	How requirement will be met
AGD_OPE.1	The Administrative Guide provides the descriptions of the processes and procedures of how the administrative users of the TOE can securely administer the TOE using the interfaces that provide the features and functions detailed in the guidance.
AGD_PRE.1	The Installation Guide describes the installation, generation, and startup procedures so that the users of the TOE can put the components of the TOE in the evaluated configuration.
ALC_CMC.1	The Configuration Management (CM) document(s) describes how the consumer (end-user) of the TOE can identify the evaluated TOE (Target of Evaluation). The CM document(s) identifies the configuration items, how those configuration items are uniquely identified, and the adequacy of the procedures that are used to control and track changes that are made to the TOE. This includes details on what changes are tracked, how potential changes are incorporated, and the degree to which automation is used to reduce the scope for error.
ALC_CMS.1	
ATE_IND.1	Cisco will provide the TOE for testing.
AVA_VAN.1	Cisco will provide the TOE for testing.

6 TOE Summary Specification

6.1 TOE Security Functional Requirement Measures

This section identifies and describes how the Security Functional Requirements identified above are met by the TOE.

Table 20: How TOE SFRs are Met

TOE SFRs	How the SFR is Met
FAU_GEN.1	The TOE generates an audit record whenever an audited event occurs. The types of events that cause audit records to be generated include events related to the enforcement of information flow policies, identification and authentication related events, and administrative events (the specific events and the contents of each audit record are listed in the table within the FAU_GEN.1 SFR, "Auditable Events Table"). Each of the events is specified in the audit record is in enough detail to identify the user for which the event is associated (e.g. user identity, MAC address, IP address), when the event occurred, where the event occurred, the outcome of the event, and the type of event that occurred. Additionally, the startup and shutdown of the audit functionality is audited. The audit trail consist of the individual audit records; one audit record for each event that occurred. The audit record can contain up to 80 characters and a percent sign (%), which follows the time-stamp information. As noted above, the information includes [at least] all of the required information. Additional information can be configured and included if desired. Refer to the Guidance documentation for configuration syntax and information. The logging buffer size can be configured from a range of 4096 (default) to 2147483647 bytes. It is noted, not make the buffer size too large because the switch could run out of memory for other tasks. Use the show memory privileged EXEC command to view the free processor memory on the switch. However, this value is the maximum available, and the buffer size should not be set to this amount. Refer to the Guidance documentation for configuration syntax and information. The administrator can also configure a 'configuration logger' to keep track of configuration changes made with the command-line interface (CLI). The administrator can configure the size of the configuration log from 1 to 1000 entries (the default is 100). Refer to the Guidance documentation for configuration syntax and information.

TOE SFRs	How the SFR is Met
	The log buffer is circular, so newer messages overwrite older messages after the buffer is full. Administrators are instructed to monitor the log buffer using the show logging privileged EXEC command to view the audit records. The first message displayed is the oldest message in the buffer. There are other associated commands to clear the buffer, to set the logging level, etc.; all of which are described in the Guidance documents and IOS CLI. The logs can be saved to flash memory so records are not lost in case of failures or restarts. Refer to the Guidance documentation for configuration syntax and information. The administrator can set the level of the audit records to be displayed on the console or sent to the syslog server. For instance all emergency, alerts, critical, errors, and warning message can be sent to the console alerting the administrator that some action needs to be taken as these types of messages mean that the functionality of the switch is affected. All notifications and information type message can be sent to the syslog server, whereas message is only for information; switch functionality is not affected. To configure the TOE to send audit records to a syslog server, the 'set logging server' command is used. A maximum of three syslog servers can be configured. Refer to the Guidance document for complete guidance and command syntax. The audit records are transmitted using IPsec tunnel to the syslog server. If the communications to the syslog server is lost, the TOE generates an audit record and all permit traffic is denied until the communications is re-established. For the FIPS crypto self-tests, the messages are displayed only on the console during startup. Once the box is up and operational and the crypto self-test command is entered, then the messages would be displayed on the console and will also be logged. For the TSF self-test, successful completion of the self-test is indicated by reaching the log-on prompt. If there are issues, the applicable audit record is generated and displayed on the console.

Auditable Event	Rationale
All use of the user identification mechanism.	Events will be generated for attempted identification/ authentication, and the username attempting to authenticate will be included

TOE SFRs	How the SFR is Met	
		in the log record.
	Any use of the authentication mechanism.	Events will be generated for attempted identification/ authentication, and the username attempting to authenticate will be included in the log record, along with the origin or source of the attempt.
	Management functions	The use of the security management functions is logged; modifications of the behavior of the functions in the TSF and modifications of default settings.
	Detection of replay attacks	Attempts of replaying data previously transmitted and terminated at the TOE are logged, along with the origin or source of the attempt.
	Changes to the time.	Changes to the time are logged.
	Updates (software)	An audit record will be generated on the initiation of updates (software/firmware)
	Failure to establish and/or establishment/failure of an SSH and IPsec session	Attempts to establish an SSH and IPsec session or the failure of an established SSH and/or IPsec is logged.
	Resources quotas are exceeded	If the threshold for the number of concurrent administrative sessions is exceeded, and audit record is generated
	Locking and unlocking interactive sessions	Any attempt to unlock an inactive sessions is logged, as is an inactive session when it exceeds the time limit of inactivity
	Indication that TSF self-test was completed.	During bootup, if the self-test fails, the failure is logged.
	Trusted channels	The initiation, termination,

TOE SFRs	How the SFR is Met
	and failure related to trusted channel sessions with peer/neighbor routers and or the remote administration console
FAU_GEN.2	The TOE shall ensure that each auditable event is associated with the user that triggered the event and as a result, they are traceable to a specific user. For example, a human user, user identity or related session ID would be included in the audit record. For an IT entity or device, the IP address, MAC address, host name, or other configured identification is presented. Refer to the Guidance documentation for configuration syntax and information.
FAU_STG_EXT.1 and FAU_STG_EXT.3	The TOE is configured to export syslog records to a specified, external syslog server. The TOE protects communications with an external syslog server via IPsec. If the IPsec connection fails, the TOE will store audit records on the TOE when it discovers it can no longer communicate with its configured syslog server.
FCS_CKM.1	The TOE implements a random number generator for RSA key establishment schemes (conformant to NIST SP 800-56B). The TOE is also compliant to ANSI X9.80 (3 January 2000), “Prime Number Generation, Primality Testing, and Primality Certificates” using random integers with deterministic tests. Furthermore, the TOE does not implement elliptic-curve-based key establishment schemes.
FCS_CKM_EXT.4	[9]The TOE meets all requirements specified in FIPS 140-2 for destruction of keys and Critical Security Parameters (CSPs) in that none of the symmetric keys, pre-shared keys, or private keys are stored in plaintext form. This requirement applies to the secret keys used for symmetric encryption, private keys, and CSPs used to generate key (list them); which are zeroized immediately after use, or on system shutdown, etc. The cryptographic module securely administers both cryptographic keys and other critical security parameters such as passwords. The tamper evidence seals provide physical protection for all keys. All keys are also protected by the password-protection required by the privileged administrator role login, and can be zeroized by the privileged administrator. All zeroization consists of overwriting the memory that stored the key. Keys are

[9] Note, the following information may be deemed sensitive and may be removed prior to publically posting this Security Target.

TOE SFRs	How the SFR is Met
	exchanged and entered electronically. Persistent keys are entered by the privileged administrator via the console port CLI, transient keys are generated or established and stored in DRAM. If present, a VSS link can export all DRAM and NVRAM keys to another switch over a secure connection for high availability purposes. The module supports the following critical security parameters (CSPs). It is noted that there may be keys and CSPs that are not applicable to this evaluation and should not be reviewed. They are included for completeness of the module.

ID	Algorithm	Size	Description	Storage	Zeroization Method[10]
General Keys/CSPs					
User Password	Password	Variable (8+ characters)	Used to authenticate local users	NVRAM (plaintext)	Zeroized by overwriting with new password
Enable Password	Password	Variable (8+ characters)	Used to authenticate local users at a higher privilege level	NVRAM (plaintext)	Zeroized by overwriting with new password
RADIUS secret	Shared Secret	Variable (8+ characters)	The RADIUS Shared Secret	NVRAM (plaintext)	Zeroized using the following command: # no radius-server key Overwritten with: 0x0d
RADIUS Key wrap key	AES	128/256 bits	Used to protect SAK	DRAM (plaintext)	Zeroized when data structure is freed
TACACS+ secret	Shared Secret	Variable (8+ characters)	The TACACS+ shared secret	NVRAM (plaintext)	Zeroized using the following command: # no tacacs-

[10] Unless specifically noted, the zeroization method used for secrets, keys, etc is to overwrite with zeros (0x00).

TOE SFRs	How the SFR is Met					
						server key Overwritten with: 0x0d
	RNG Seed	ANSI X9.31 Appendix 2.4 using 3-key TDES	16 bytes	This is the seed for ANSI X9.31 RNG	DRAM (plaintext)	Zeroized upon power cycle the device
	RNG Seed Key	ANSI X9.31 Appendix 2.4 using 3-key TDES	24 bytes	This is the seed key for ANSI X9.31 RNG	DRAM (plaintext)	Zeroized upon power cycle the device
	Diffie-Hellman private exponent	DH	1024-4096 bits	The private exponent used in Diffie-Hellman (DH) exchange.	DRAM (plaintext)	Zeroized upon completion of DH exchange. Overwritten with: 0x00
	Diffie-Hellman Shared Secret	DH	1024-4096 bits	This is the shared secret agreed upon as part of DH exchange	DRAM (plaintext0	Automatically after completion of DH exchange. Overwritten with: 0x00
	SSH					
	SSH RSA private key	RSA	1024/1536/2048 bits modulus	SSH key	NVRAM (plaintext)	Zeroized using the following command: # crypto key zeroize rsa Overwritten with: 0x00
	SSH session key	Triple-DES/AES	168-bits/256-bits	This is the SSH session symmetric key.	DRAM (plaintext)	Automatically when the SSH session is terminate

TOE SFRs	How the SFR is Met					
						d. Overwritten with: 0x00
	SSH session authentication key	HMAC SHA-1	160-bits	This is the SSH session authentication key	DRAM (plaintext)	Automatically when SSH session terminated
	TLS					
	TLS Server RSA private key	RSA	1024/1536/ 2048 bits modulus	Identity certificates for module itself and also used in TLS negotiations.	NVRAM (plaintext)	# fips zeroize all
	TLS pre-master secret	Shared Secret	384-bits	Shared secret created using asymmetric cryptography from which new HTTPS session keys can be created.	DRAM (plaintext)	Automatically when session terminated.
	TLS session key	Triple-DES/AES	168-bits/256-bits	This is the TLS session key	DRAM (plaintext)	Automatically when session terminated.
	MacSec					
	MACsec Security Association Key (SAK)	AES-GCM	128/256 bits	Used for creating Security Associations (SA) for encrypting/decrypting the MACSec traffic in the MACSec hardware.	MACsec PHY (plaintext)	Automatically when session expires
	MACsec Connectivity Association Key (CAK)	AES-GCM	128/256 bits	A secret key possessed by members of a MACSec connectivity association.	MACsec PHY (plaintext)	Automatically when session expires
	MACsec KEK	AES-GCM	128/256 bits	Used to transmit SAKs to other members of a MACSec connectivity association	MACsec PHY (plaintext)	Automatically when session expires

<table>
<tr><th>TOE SFRs</th><th>How the SFR is Met</th></tr>
<tr><td></td><td>
<table>
<tr><td>MACsec ICK</td><td>secret</td><td>128/256 bits</td><td>Used to verify the integrity and authenticity of MPDUs</td><td>MACsec PHY (plaintext)</td><td>Automatically when session expires</td></tr>
<tr><td colspan="6">SESA</td></tr>
<tr><td>SESA Authorization Key</td><td>AES</td><td>128 bits</td><td>Used to authorize members of a single stack on Incredible Units.
Used as input to SP800-108 derivation methods to derive four additional 128 fields to transfer the Master Session Key and additional aggressive exchange material</td><td>NVRAM (plaintext)</td><td>“no fips authorization-key”</td></tr>
<tr><td>SESA Master Session Key</td><td>AES</td><td>128 bits</td><td>Used to derive SESA session key</td><td>DRAM (plaintext)</td><td>Upon completion of key exchange</td></tr>
<tr><td>SESA Derived Session Keys</td><td>AES and HMAC-SHA-1</td><td>128 bits and 192 bits</td><td>Used to protect traffic over stacking ports</td><td>DRAM (plaintext)</td><td>Upon bringing down the stack</td></tr>
</table>
IKE session encrypt key - This structure contains all of the SA items, including the skeyid, skeyid_d, IKE Session Encryption Key and IKE Session Authentication Key. All values overwritten by 0’s (0x00) automatically after IKE session terminated.
IKE session authentication key - This structure contains all of the SA items, including the skeyid, skeyid_d, IKE Session Encryption Key and IKE Session Authentication Key. All values overwritten by 0’s (0x00) automatically after IKE session terminated.
</td></tr>
<tr><td>FCS_COP.1(1)</td><td>The TOE provides symmetric encryption and decryption capabilities using AES in CBC and GCM mode (128, 256 bits) as described in FIPS PUB 197, NIST SP 800-38A and NIST SP 800-38D.</td></tr>
<tr><td>FCS_COP.1(2)</td><td>The TOE will provide cryptographic signature services using RSA with key size of 2048 and greater as specified in FIPS PUB 186-3, “Digital Signature Standard”.</td></tr>
</table>

TOE SFRs	How the SFR is Met
FCS_COP.1(3)	The TOE provides cryptographic hashing services using SHA-1 SHA-256, SHA-384, and SHA-512 as specified in FIPS Pub 180-3 “Secure Hash Standard.”
FCS_COP.1(4)	The TOE uses HMAC-SHA1. SHA-256, and SHA-512 message authentication as part of the RADIUS Key Wrap functionality as specified in FIPS Pub 198-1 “The Keyed-Hash Message Authentication Code” and FIPS PUB 180-3, “Secure Hash Standard”. In addition, The TOE provides MD5 hashing for authentication of neighbor routers via BGPv4, EIGRP, EIGRPv6 for IPv6, RIPv2, and OSPFv2 with shared passwords. The hash mechanism is implemented as specified in the relevant RFCs: • BGPv4 uses MD5 for authentication of routing updates as defined in RFC 2385 (Protection of BGP Sessions via TCP MD5 Signature Option). • EIGRP and EIGRPv6 (Cisco proprietary) uses MD5 for authentication of routing updates. • RIPv2 uses MD5 for authentication of routing updates as defined in Section 2.4 of RFC 2453. • OSPFv2 uses MD5 for authentication of routing updates as defined in Appendix D of RFC 2328 (OSPF version 2). Routing tables for IPv4 and IPv6 can be created and maintained manually using static routes configured by the administrator. Use of routing protocols in IPv4 or IPv6 is not required to support or enforce any TOE security functionality including filtering of IPv4 or IPv6 traffic. BGPv4, EIGRP and EIGRPv6 supports MD5-authenticated routing updates with IPv6 or IPv4 as does RIPv2 while OSPFv2 routing protocol support MD5-authenticated routing updates for IPv4 only. It is noted that per the FIPS Security Policy, that MD5 is not a validated algorithm during FIPS mode of operation. For additional security, it is recommended router protocol traffic also be isolated to separate VLANs.
FCS_RBG_EXT.1	The TOE implements a random bit generator (RBG) based on the AES-256 block cipher, as specified in FIPS Pub 140-2 Annex C: X9.31 Appendix 2.4.

TOE SFRs	How the SFR is Met
	The TOE implements a NIST-approved AES-CTR Deterministic Random Bit Generator (DRBG), as specified in SP 800-90. The entropy source used to seed the Deterministic Random Bit Generator (e.g. based on SP 800-90A/B/C) is a random set of bits or bytes that are regularly supplied to the DRBG from the internal Quack (ACT) processor which produces a minimum of 256 bits of entropy. All RNG entropy source samplings are continuously health tested by the NIST DRBG as per SP 900-90A before using them as a seed. Though related to this, the tests are part of the FIPS validation procedures for the DBRG and are part of the NIST validations for FIPS 140-2 for the products. Any initialization or system errors during bring-up or processing of this system causes a reboot as necessary to be FIPS compliant. Finally, the system will be zeroizing any entropy seeding bytes, which will not be available after the current collection.
FCS_COMM_PROT_EXT.1	The TOE implements SSHv2 and IPsec either of which can be used to protect communications for remote administration. IPsec is also used to protect communications with external servers (e.g., syslog server, NTP and if configured an external authentication server).
FCS_SSH_EXT.1	The TOE implements SSHv2 (telnet is disabled in the evaluated configuration) in compliance with RFCs 4251, 4252, 4253, and 4254; using SSH RSA public key algorithm. SSHv2 sessions are limited to a configurable session timeout period of 120 seconds, a maximum number of failed authentication attempts limited to 3, and will be rekeyed upon request from the SSH client (no more than 2^{28} packets). SSH connections will be dropped if the TOE receives a packet larger than 35,000 bytes. The TOE's implementation of SSHv2 supports hashing algorithms hmac-sha1, hmac-sha1-96, hmac-md5-96. The TOE can also be configured to use only one of the identified DH groups for key exchange. The available groups include Diffie Hellmen, group 14 (2048 bits) and group 16 (4096 bits). The network traffic between the remote admin console and the TOE establish and operate an encrypted session using AES in CBC mode with key sizes 128 or 256 bits (FIPS 197) supporting both public key-based and password-based authentication

TOE SFRs	How the SFR is Met
	methods.
FCS_IPSEC_EXT.1	The TOE implements IPsec to provide authentication and encryption services to prevent unauthorized viewing or modification of data as it travels over the external network. The TOE implementation of the IPsec standard (in accordance with the RFCs noted in the SFR) uses the Encapsulating Security Payload (ESP) protocol to provide authentication, encryption and anti-replay services. IPsec Internet Key Exchange, also called ISAKMP, is the negotiation protocol that lets two peers agree on how to build an IPsec Security Association (SA). The IKE protocols implement Peer Authentication using the rDSA algorithm. IKE separates negotiation into two phases: phase 1 and phase 2. Phase 1 creates the first tunnel, which protects later ISAKMP negotiation messages. The key negotiated in phase 1 enables IKE peers to communicate securely in phase 2. During Phase 2 IKE establishes the IPsec SA. IKE maintains a trusted channel, referred to as a Security Association (SA), between IPsec peers that is also used to manage IPsec connections, including: • The negotiation of mutually acceptable IPsec options between peers, • The establishment of additional Security Associations to protect packets flows using ESP, and • The agreement of secure bulk data encryption AES (128 and 256 bit) keys for use with ESP. After the two peers agree upon a policy, the security parameters of the policy are identified by an SA established at each peer, and these IKE SAs apply to all subsequent IKE traffic during the negotiation. The TOE support IKEv1 session establishment. As part of this support, the TOE can be configured to not support aggressive mode for IKEv1 exchanges and to only use mainmodeusing the ‘crypto isakmp aggressive-mode disable’ command as specified for the evaluated configuration. The TOE can be configured to not allow “confidentiality only” ESP mode by ensuring the IKE Policies configured include ESP-encryption. The TOE supports configuration lifetimes of both Phase 1 SAs and Phase 2 SAs using “lifetime” command. The default time value for Phase 1 SAs is 24 hours. The default time value for Phase 2 SAs is 1 hour, but it is configurable to 8 hours. The TOE also supports configuration of maximum traffic that is

TOE SFRs	How the SFR is Met
	allowed to flow for a given IPsec SA using the following command, 'crypto ipsec security-association lifetime' as specified for the evaluated configuration. The default amount is 2560KB, which is the minimum configurable value. The maximum configurable value is 4GB. However, the TOE is to be configured to use a range between 100-200 MB as specified in the SFR. Other configuration options include rDSA algorithm for implementing peer authentication as noted above, pre-shared keys for authenticating IPsec connections can be 22 characters and be composed of any combination of upper and lower case letters, numbers, and special characters using the'crypto isakmp key' key command and may be proposed by each of the peers negotiating the IKE establishment. The TOE also supports both rekey and response to rekeyed by the peer for phase 2 (IPSec) SA and the approved configuration would have only HMAC-SHA1 configured within their IKE policy; no other hash functions will then be considered. The TOE also supports Diffie-Hellman Group 14 (2048-bit keys) in support of IKE Key Establishment.
FDP_RIP.2	The TOE ensures that packets transmitted from the TOE do not contain residual information from previous packets. Packets that are not the required length use zeros for padding. Residual data is never transmitted from the TOE. Once packet handling is completed its content is overwritten before memory buffer which previously contained the packet is reused. This applies to both data plane traffic and administrative session traffic.
FIA_PMG_EXT.1	The TOE supports the local definition of users with corresponding passwords. The passwords can be composed of any combination of upper and lower case letters, numbers, and special characters (that include: "!", "@", "#", "$", "%", "^", "&", "*", "(", and ")". Minimum password length is settable by the Authorized Administrator, and support passwords of 8 characters or greater. Password composition rules specifying the types and number of required characters that comprise the password are settable by the Authorized Administrator. Passwords have a maximum lifetime, configurable by the Authorized Administrator. New passwords must contain a minimum of 4 character changes from the previous password.
FIA_UIA_EXT.1	The TOE requires all users to be successfully identified and authenticated before allowing any TSF mediated actions to be performed. Administrative access to the TOE is facilitated through the TOE's CLI. The TOE mediates all administrative actions through the CLI. Once a potential administrative user attempts to access the CLI of the TOE through either a directly

TOE SFRs	How the SFR is Met
	connected console or remotely through an SSHv2 connection, the TOE prompts the user for a user name and password. Only after the administrative user presents the correct authentication credentials will access to the TOE administrative functionality be granted. No access is allowed to the administrative functionality of the TOE until an administrator is successfully identified and authenticated. For neighbor routers, which do not have access to the CLI, the neighbor router must present the correct hashed password prior to exchanging routing table updates with the TOE. The TOE authenticates the neighbor router using its supplied password hash, and the source IP address from the IP packet header. The supported routing protocols BGPv4, EIGRP, EIGRPv6 for IPv6, RIPv2, and OSPFv2 use MD5 hashes to authenticate communications as specified in FCS_COP.1(4).1. For additional security, router protocol traffic can also be isolated to separate VLANs.
FIA_UAU_EXT.5	The TOE can be configured to require local authentication and/or remote authentication via a RADIUS or TACACS+ server as defined in the authentication policy for interactive (human) users. Neighbor routers are authenticated only to passwords stored locally. The policy for interactive (human) users (Administrators) can be authenticated to the local user database, or have redirection to a remote authentication server. Interfaces can be configured to try one or more remote authentication servers, and then fail back to the local user database if the remote authentication servers are inaccessible. If the interactive (human) users (Administrators) password is expired, the user is locked out until the password is reset by the administrator.
FIA_UAU.6	Users changing their passwords are first prompted to enter their old password. Users are also required to provide their password when re-establishing a remote session due to a session termination of inactivity. The TOE does not provide the capability for an administrator (level 1) to change their own password. However the administrator (level 1) can change their password when required by the TOE (e.g. when expired). At which time the administrator is required to enter their current password before entering a new password. System administrators (level 15) can change any user's password, including their own as required for TOE

TOE SFRs	How the SFR is Met
	management, though must be in privilege EXEC mode to perform the function. When the System Administrator (level 15) attempts to change their own password, the TOE will enforce the password expiration policy at which time the System Administrator (level 15) will be required to enter their current password prior to entering a new password. See the Cisco Catalyst 4500 Series Switches (4503-E, 4506-E, 4507R+E, 4510R+E, 4500X and 4500X-F) Running IOS-XE 3.5.2E Common Criteria Operational User Guidance and Preparative Procedures for details and configuration settings.
FIA_UAU.7	When a user enters their password at the local console, the TOE displays only '*' characters so that the user password is obscured. For remote session authentication, the TOE does not echo any characters as they are entered.
FMT_MTD.1	The TOE provides the ability for authorized administrators to access TOE data, such as audit data, configuration data, security attributes, information flow rules, routing tables, and session thresholds. Each of the predefined and administratively configured privilege level has a specified set of permissions that will grant them some level of access to the TOE data, though with some privilege levels, the access is limited. The TOE performs role-based authorization, using TOE platform authorization mechanisms, to grant access to the semi-privileged and privileged roles. The term "authorized administrator" is used in this ST to refer to any user which has been assigned to a privilege level that is permitted to perform the relevant action; therefore has the appropriate privileges to perform the requested functions.
FMT_SMF.1	The TOE provides all the capabilities necessary to securely manage the TOE. The administrative user can connect to the TOE using the CLI to perform these functions via SSHv2, a terminal server, or at the local console. Refer to the Guidance documentation for configuration syntax, commands, and information related to each of these functions. The management functionality provided by the TOE include the following administrative functions: • Ability to manage the cryptographic functionality - allows the authorized administrator the ability to identify and configure the algorithms used to provide protection of the data, such as generating the RSA keys to enable SSHv2, configuration of routing protocols, and if used the configuration of remote authentication • Ability to manage the audit logs and functions - allows the authorized administrator to configure the audit logs, view the audit logs, and to clear the audit logs

TOE SFRs	How the SFR is Met
	• Ability to manage routing tables - allows the authorized administrator the ability to create, modify, and delete the routing tables to control the routed network traffic • Ability to manage security attributes belonging to individual users - allows the authorized administrator to create, modify, and delete other administrative users • Ability to manage the default values of the security attributes - allows the authorized administrator to specify the attributes that are used control access and/or manage users • Ability to manage the warning banner message and content – allows the authorized administrator the ability to define warning banner that is displayed prior to establishing a session (note this applies to the interactive (human) users; e.g. administrative users • Ability to manage the time limits of session inactivity – allows the authorized administrator the ability to set and modify the inactivity time threshold; • Ability to update the TOE and verify the updates are valid.
FMT_SMR.1	The TOE switch platform maintains administrative privilege level and non-administrative access. Non-administrative access is granted to authenticated neighbor routers for the ability to receive updated routing tables per the information flow rules. There is no other access or functions associated with non-administrative access. The administrative privilege levels include: • Administrators are assigned to privilege levels 0 and 1. Privilege levels 0 and 1 are defined by default and are customizable. These levels have a very limited scope and access to CLI commands that include basic functions such as login, show running system information, turn on/off privileged commands, logout. • Semi-privileged administrators equate to any privilege level that has a subset of the privileges assigned to level 15; levels 2-14. These levels are undefined by default and are customizable. The custom level privileges are explained in the example below. • Privileged administrators are equivalent to full administrative access to the CLI, which is the default access for IOS privilege level 15. Note, the levels are not hierarchical. For levels, level 0 is the most restrictive and 15 is the least restrictive.

TOE SFRs	How the SFR is Met
	For level 0, there are five commands associated with privilege level 0: disable, enable, exit, help, and logout. However, the level could be configured to allow a user to have access to the 'show' command. Level 1 is normal EXEC-mode user privileges. Following is ***<u>an example</u>*** of how privileges are set, rules in setting privilege levels and assigning users to those privilege levels. **Note, that the administrator needs to have the appropriate privilege level and if required, applicable password to execute the commands**: When setting the privilege level for a command with multiple words (commands), the commands starting with the first word will also have the specified access level. For example, if the **show ip route** command is set to level 15, the **show** commands and **show ip** commands are automatically set to privilege level 15—unless they are individually set to different levels. This is necessary because a user cannot execute, for example, the **show ip** command unless the user also has access to **show** commands. To change the privilege level of a group of commands, the **all** keyword is used. When a group of commands is set to a privilege level using the **all** keyword, all commands which match the beginning string are enabled for that level, and all commands which are available in submodes of that command are enabled for that level. For example, if the **show ip** keywords is set to level 5, **show** and **ip** will be changed to level 5 and all the options that follow the **show ip** string (such as **show ip accounting**, **show ip aliases**, **show ip bgp**, and so on) will be available at privilege level 5. The **privilege** command is used to move commands from one privilege level to another in order to create the additional levels of administration. The default configuration permits two types of users to access the CLI. **The first type of user is a person who is only allowed to access user EXEC mode. The second type of user is a person who is allowed access to privileged EXEC mode**. A user who is only allowed to access **user EXEC mode is not allowed to view or change the configuration of the networking device, or to make any changes to the operational status of the networking device**. On the other hand, a user who is allowed access to privileged EXEC mode can make any change to a networking device that is allowed by the CLI. **Following is an example for setting the privilege levels for**

TOE SFRs	How the SFR is Met
	staff that are usually not allowed to run all of the commands available in privileged EXEC mode (privilege level 15) on a networking device. They are prevented from running commands that they are not authorized for by not being granted access to the password assigned to **privileged EXEC** mode or to other levels that have been configured on the networking device. The steps and commands show setting privilege level 7 with access to two commands, clear counters and reload. Step 1 **enable** password Enters privileged EXEC mode. Enter the password when prompted. Router> **enable** Step 2 **configure terminal** Enters global configuration mode. Router# **configure terminal** Step 3 **enable secret level** *level password* Configures a new enable secret password for privilege level 7. Router(config)# **enable secret level** *7 Zy72sKj* Step 4 **privilege exec level** *level command-string* Changes the privilege level of the clear counters command from privilege level 15 to privilege level 7. Router(config)# **privilege exec level** *7 clear counters* Step 5 **privilege exec all level** *level command-string* Changes the privilege level of the reload command from privilege level 15 to privilege level 7. Router(config)# **privilege exec all level** *7 reload* Step 6 **end** Exits global configuration mode. Router(config)# **end** The following example shows the enforcement of the settings above and privilege levels. Step 1 **enable** *level password* Logs the user into the networking device at the privilege level specified for the level argument. Router> **enable** *7 Zy72sKj* Step 2 **show privilege** Displays the privilege level of the current CLI session Router# **show privilege** Current privilege level is 7

TOE SFRs	How the SFR is Met
	Step 3 **clear counters** The clear counters command clears the interface counters. This command has been changed from privilege level 15 to privilege level 7. Router# **clear counters** Clear "show interface" counters on all interfaces [confirm] Router# 02:41:37: %CLEAR-5-COUNTERS: Clear counter on all interfaces by console Step 4 **clear ip route** * The *ip route* argument string for the **clear** command should not be allowed because it was not changed from privilege level 15 to privilege level 7. Router# **clear ip route *** ^ % Invalid input detected at '^' marker. Router# Step 5 **reload in time** The reload command causes the networking device to reboot. Router# **reload in** *10* Reload scheduled in 10 minutes by console Proceed with reload? [confirm] Router# *** *** --- SHUTDOWN in 0:10:00 --- *** 02:59:50: %SYS-5-SCHEDULED_RELOAD: Reload requested for 23:08:30 PST Sun Mar 20 Step 6 **reload cancel** The reload cancel terminates a reload that was previously setup with the reload in time command. Router# **reload cancel** *** *** --- SHUTDOWN ABORTED --- *** 04:34:08: %SYS-5-SCHEDULED_RELOAD_CANCELLED: Scheduled reload cancelled at 15:38:46 PST Sun Mar 27 2005 Step 7 **disable** Exits the current privilege level and

TOE SFRs	How the SFR is Met
	returns to privilege level 1. Router# **disable** Step 8 **show privilege** Displays the privilege level of the current CLI session Router> **show privilege** Current privilege level is 1 The term "authorized administrator" is used in this ST to refer to any user that has been assigned to a privilege level that is permitted to perform the relevant action; therefore has the appropriate privileges to perform the requested functions. The privilege level determines the functions the user can perform; hence the authorized administrator with the appropriate privileges. Refer to the Guidance documentation and IOS Command Reference Guide for available commands and associated roles and privilege levels. The Switch can and shall be configured to authenticate all access to the command line interface using a username and password.
FPT_ITT.1(1) and FPT_ITT.1(2)	The TOE is self-contained and provides all of the claimed functionality within a single appliance. However if more than one TOE is used in the configuration, the TOE may be configured to use the cryptographic services as described in the FCS SFRs to secure the connection and protect the transmitted data.
FPT_PTD_EXT.1 and FPT_PTD_EXT.2	The TOE includes a Master Passphrase features that can be used to configure the TOE to encrypt all locally defined user passwords. In this manner, the TOE ensures that plaintext user passwords will not be disclosed even to administrators. The TOE stores all private keys in a secure directory that is not readily accessible to administrators. All pre-shared and symmetric keys are stored in encrypted form to prevent access.
FPT_RPL.1	By virtue of the cryptographic and path mechanisms implemented by the TOE, replayed network packets directed (terminated) at the TOE will be detected and discarded. Note: The intended scope of this requirement is trusted communications with the TOE (e.g., administrator to TOE, IT entity (e.g., authentication server) to TOE). As such, replay does not apply to receipt of multiple network packets due to network congestion or lost packet acknowledgments.
FPT_STM.1	The TOE provides a source of date and time information for the switch, used in audit timestamps and in validating service requests. This function can only be accessed from within the

TOE SFRs	How the SFR is Met
	configuration exec mode via the privileged mode of operation of the switch. The clock function is reliant on the system clock provided by the underlying hardware. The timestamp is assumed to be accurate to an official time source, such as Network Time Protocol (NTP) server. Therefore, the TOE can optionally be set to receive time from an NTP server. The NTP synchronizes the TOE clock to the U.S. Naval Observatory Master Clocks in Washington, DC and Colorado Springs CO. The NTP sends periodic requests and adjusts the clock as necessary. If an NTP server is used, the TOE supports signature verification of the timestamp from the time server.
FPT_TUD_EXT.1	The TOE has specific versions that can be queried by an administrator. When updates are made available by Cisco, an administrator can obtain and install those updates. The cryptographic checksums (i.e., public hashes) are used to verify software/firmware update files (to ensure they have not been modified from the originals distributed by Cisco) before they are used to actually update the applicable TOE components.
FPT_TST_EXT.1	As a FIPS 140-2 validated product, the TOE runs a suite of self-tests during initial start-up to verify its correct operation. If any of the tests fail, the security administrator will have to log into the CLI to determine which test failed and why. If the tests pass successfully the login prompt is displayed and the administrator will be able to login and administer the TOE. Refer to the FIPS Security Policy for available options and management of the cryptographic self-test. For testing of the TSF, the TOE automatically runs checks and tests at startup and during resets to ensure the TOE hardware and software components are available and operating correctly. If all components pass the tests, the login prompt will be displayed. If any of the tests fail, the TOE will reboot to try to correct the issue(s). Refer to the Guidance documentation for installation configuration settings and information and troubling shooting if issues are identified.
FRU_RSA.1	An administrator can configure a maximum number of concurrent sessions for remote administrative interfaces.
FTA_SSL_EXT.1 and FTA_SSL.3	An administrator can configure maximum inactivity times for both local and remote administrative sessions. When a session is inactive (i.e., not session input) for the configured period of time the TOE will terminate the session, flush the screen, and no further activity is allowed requiring the administrator to log in (be successfully identified and authenticated) again to establish a new session.

TOE SFRs	How the SFR is Met
	The allowable range is from 1 to 65535 seconds.
FTA_TAB.1	The TOE displays a privileged Administrator specified banner on the CLI management interface prior to allowing any administrative access to the TOE. This is applicable for both local and remote TOE administration.
FTP_ITC.1(1) and FTP_ITC.(2)	The TOE protects communications with authorized IT entities with IPSec. This protects the data from disclosure by encryption and by checksums that verify that data has not been modified.
FTP_TRP.1(1) and FTP_TRP.1(2)	All remote administrative communications take place over a secure encrypted SSHv2 session. The SSHv2 session is encrypted using AES encryption. The remote users are able to initiate SSHv2 communications with the TOE.

6.2 TOE Bypass and interference/logical tampering Protection Measures

The TOE consists of a hardware platform in which all operations in the TOE scope are protected from interference and tampering by untrusted subjects. All administration and configuration operations are performed within the physical boundary of the TOE. Also, all TSP enforcement functions must be invoked and succeed prior to functions within the TSC proceeding.

The TOE has been designed so that all locally maintained TSF data can only be manipulated via the secured management interface, the CLI interface. There are no undocumented interfaces for managing the product.

All sub-components included in the TOE rely on the main chassis for power, memory management, and access control. In order to access any portion of the TOE, the Identification and Authentication mechanisms of the TOE must be invoked and succeed.

No processes outside of the TOE are allowed direct access to any TOE memory. The TOE only accepts traffic through legitimate TOE interfaces. Specifically, processes outside the TOE are not able to execute code on the TOE. None of these interfaces provide any access to internal TOE resources.

The TOE enforces information flow control policies and applies network traffic security on its interfaces before traffic passes into or out of the TOE. The TOE controls every ingress and egress traffic flow. Policies are applied to each traffic flow. Traffic flows characterized as unauthorized are discarded and not permitted to circumvent the TOE. There are no unmediated traffic flows into or out of the TOE. The information flow policies identified in the SFRs are applied to all traffic received and sent by the TOE. Each communication including data plane communication, control plane communications, and administrative communications are mediated by the TOE. The data plane allows the ability to forward network traffic; the control plane allows the ability to route traffic correctly; and the management plane allows the ability to manage network elements. There is no opportunity for unaccounted traffic flows to flow into or out of the TOE.

This design, combined with the fact that only an administrative user with the appropriate role may access the TOE security functions, provides a distinct protected domain for the TOE that is logically protected from interference and is not bypassable.

7 RATIONALE

This section describes the rationale for the Security Objectives and Security Functional Requirements as defined within this Security Target. The following matrix is the typical display that is drawn from the information presented in Sections 2 and 3 of the NDPP.

7.1 Rationale for TOE Security Objectives

Table 21: Threat/Objectives/Policies Mappings

	T.UNAUTHORIZED_ACCESS	T.UNAUTHORIZED_UPDATE	T.ADMIN_ERROR	T.UNDETECTED_ACTIONS	T.RESOURCE_EXHAUSTION	T.USER_DATA_REUSE	T.TSF_FAILURE	P.ACCESS BANNER
O.PROTECTED_COMMUNICATIONS	X	X						
O.VERIFIABLE_UPDATES		X						
O.SYSTEM_MONITORING				X				
O.DISPLAY_BANNER								X
O.TOE_ADMINISTRATION			X					
O.RESIDUAL_INFORMATION_CLEARING						X		
O.RESOURCE_AVAILABILITY					X			
O.SESSION_LOCK	X							
O.TSF_SELF_TEST							X	

Table 22: Threat/Policies/TOE Objectives Rationale

Objective	Rationale
Security Objectives Drawn from NDPP	
O.PROTECTED_COMMUNICATIONS	This security objective is necessary to counter the threat: T.UNAUTHORIZED_ACCESS and T.UNAUTHORIZED_UPDATE to ensure the communications with the TOE is not compromised.
O.VERIFIABLE_UPDATES	This security objective is necessary to counter the threat T.UNAUTHORIZED_UPDATE to ensure the end user has not installed a malicious update, thinking that it was legitimate.
O.SYSTEM_MONITORING	This security objective is necessary to counter the T.UNDETECTED_ACTIONS to ensure activity is monitored so the security of the TOE is not compromised.
O.DISPLAY_BANNER	This security objective is necessary to address the Organization Security Policy P.ACCESS_BANNER to ensure an advisory notice and consent warning message regarding unauthorized use of the TOE is displayed before the session is established.
O.TOE_ADMINISTRATION	This security objective is necessary to counter the T.ADMIN_ERROR that ensures actions performed on the TOE are logged so that indications of a failure or compromise of a TOE security mechanism are known and corrective actions can be taken.
O.RESIDUAL_INFORMATION_CLEARING	This security objective is necessary to counter the threat T.USER_DATA_REUSE so that data traversing the TOE could inadvertently be sent to a user other than that intended by the sender of the original network traffic.
O.RESOURCE_AVAILABILITY	This security objective is necessary to counter the threat: T.RESOURCE_EXHAUSTION to mitigate a denial of service, thus ensuring resources are available.
O.SESSION_LOCK	This security objective is necessary to counter the threat: T.UNAUTHORIZED_ACCESS to

Objective	Rationale
	ensure accounts cannot be compromised and used by an attacker that does not otherwise have access to the TOE.
O.TSF_SELF_TEST	This security objective is necessary to counter the threat T.TSF_FAILURE to ensure failure of mechanisms do not lead to a compromise in the TSF.

7.2 Rationale for the Security Objectives for the Environment

Table 23: Assumptions/Environment Objectives Mappings

	OE.NO_GENERAL_PURPOSE	OE.PHYSICAL	OE.TRUSTED_ADMIN
A.NO_GENERAL_PURPOSE	X		
A.PHYSICAL		X	
A.TRUSTED_ADMIN			X

Table 24: Assumptions/Threats/Objectives Rationale

Environment Objective	Rationale
OE.NO_GENERAL_PURPOSE	This security objective is necessary to address the assumption A.NO_GENERAL_PURPOSE by ensuring there are no general-purpose computing capabilities (e.g., the ability to execute arbitrary code or applications) capabilities on the TOE.
OE.PHYSICAL	This security objective is necessary to address the assumption A.PHYSICAL by ensuring the TOE and the data it contains is physically protected from unauthorized access.
OE.TRUSTED_ADMIN	This security objective is necessary to address

Environment Objective	Rationale
	the assumption A.TRUSTED_ADMIN by ensuring the administrators are non-hostile and follow all administrator guidance.

7.3 Rationale for TOE Security Functional Requirements

The security requirements are derived according to the general model presented in Part 1 of the Common Criteria. Specifically, the tables below illustrate the mapping between the security requirements and the security objectives and the relationship between the threats, policies and IT security objectives. The functional and assurance requirements presented in this Security Target are mutually supportive and their combination meets the stated security objectives.

Table 25: Security Objective to Security Requirements Mappings

	O.PROTECTED_COMMUNICATIONS	O.VERIFIABLE_UPDATES	O.SYSTEM_MONITORING	O.DISPLAY_BANNER	O.TOE_ADMINISTRATION	O.RESIDUAL_INFORMATION_CLEARING	O.RESOURCE_AVAILABILITY	O.SESSION_LOCK	O.TSF_SELF_TEST
FAU_GEN.1			X						
FAU_GEN.2			X						
FAU_STG_EXT.1			X						
FAU_STG_EXT.3	X		X						
FCS_CKM.1	X								
FCS_CKM_EXT.4	X								
FCS_COP.1(1)	X								
FCS_COP.1(2)	X	X							
FCS_COP.1(3)	X	X							
FCS_COP.1(4)	X								

	O.PROTECTED_COMMUNICATIONS	O.VERIFIABLE_UPDATES	O.SYSTEM_MONITORING	O.DISPLAY_BANNER	O.TOE_ADMINISTRATION	O.RESIDUAL_INFORMATION_CLEARING	O.RESOURCE_AVAILABILITY	O.SESSION_LOCK	O.TSF_SELF_TEST
FCS_RBG_EXT.1	X								
FCS_COMM_PROT_EXT.1	X								
FCS_IPSEC_EXT.1	X								
FCS_SSH_EXT.1	X								
FDP_RIP.2						X			
FIA_PMG_EXT.1					X				
FIA_UIA_EXT.1					X				
FIA_UAU_EXT.5					X				
FIA_UAU.6					X				
FIA_UAU.7					X				
FMT_MTD.1					X				
FMT_SMF.1					X				
FMT_SMR.1					X				
FPT_ITT.1(1)	X								
FPT_ITT.1(2)	X								
FPT_PTD_EXT.1(1)	X				X				
FPT_PTD_EXT.1(2)	X				X				
FPT_RPL.1	X								
FPT_STM.1			X						
FPT_TUD_EXT.1		X							
FPT_TST_EXT.1									X

	O.PROTECTED_COMMUNICATIONS	O.VERIFIABLE_UPDATES	O.SYSTEM_MONITORING	O.DISPLAY_BANNER	O.TOE_ADMINISTRATION	O.RESIDUAL_INFORMATION_CLEARING	O.RESOURCE_AVAILABILITY	O.SESSION_LOCK	O.TSF_SELF_TEST
FRU_RSA.1							X		
FTA_SSL_EXT.1					X			X	
FTA_SSL.3					X			X	
FTA_TAB.1				X					
FTP_ITC.1(1)	X								
FTP_ITC.1(2)	X								
FTP_TRP.1(1)	X								
FTP_TRP.1(2)	X								

Table 26: Objectives to Requirements Rationale

Objective	Rationale
Security Functional Requirements Drawn from Security Requirements for NDPP	
O.PROTECTED_COMMUNICATIONS	The SFRs, FAU_STG_EXT.3, FCS_CKM.1, FCS_CKM_EXT.4, FCS_COP.1(1), FCS_COP.1(2), FCS_COP.1(3), FCS_COP.1(4), FCS_RBG_EXT.1, FCS_COMM_PROT_EXT.1, FCS_IPSEC_EXT.1, FCS_SSH_EXT.1, FPT_ITT.1(1), FPT_ITT.1(2), FPT_PTD.1(1), FPT_PTD.1(2), FPT_RPL.1, FTP_ITC.1(1), FTP_ITC.1(2), FTP_TRP.1(1), FTP_TRP.1(2) meet this objective by ensuring the communications between the TOE and endpoints are secure by implementing the encryption protocols as defined in the SFRs and as specified by the RFCs.
O.VERIFIABLE_UPDATES	The SFRs, FPT_TUD_EXT.1, FCS_COP.1(2),

Objective	Rationale
	FCS_COP.1(3) meet this objective by ensuring the update was downloaded via secure communications, is from a trusted source, and the update can be verified by cryptographic mechanisms prior to installation.
O.SYSTEM_MONITORING	The SFRs, FAU_GEN.1, FAU_GEN.2, FAU_STG_EXT.1, FAU_STG_EXT.3, FPT_STM.1 meet this objective by auditing actions on the TOE. The audit records identify the user associated with the action/event, whether the action/event was successful or failed, the type of action/event, and the date/time the action/event occurred. The audit logs are transmitted securely to a remote syslog server. If connectivity to the remote syslog server is lost, the TOE will block new permit actions.
O.DISPLAY_BANNER	The SFR, FTA_TAB.1 meets this objective by displaying an advisory notice and consent warning message regarding unauthorized use of the TOE.
O.TOE_ADMINISTRATION	The SFRs, FIA_UIA_EXT.1, FIA_UAU_EXT.5, FIA_UAU.6, FIA_UAU.7, FMT_MTD.1, FMT_SMF.1, FMT_SFR.1, FPT_PTD.1(1), FTA_SSL_EXT.1, FTA_SSL.3 meet this objective by ensuring the TOE supports a password-based authentication mechanism with password complexity enforcement such as, strong passwords, password life-time constraints, providing current password when changing the password, obscured password feedback when logging in, and passwords are not stored in plaintext.
O.RESIDUAL_INFORMATION_CLEARING	The SFR, FDP_RIP.2 meets this objective by ensuring no left over user data from the previous transmission is included in the network traffic.
O.RESOURCE_AVAILABILITY	The SFR, FRU_RSA.1 meets this objective by limiting the number of amount of exhaustible resources, such the number of concurrent administrative sessions.
O.SESSION_LOCK	The SFRs, FTA_SSL_EXT.1, FTA_SSL.3 meet this objective by terminating a session due to meeting/exceeding the inactivity time limit.
O.TSF_SELF_TEST	The SFR, FPT_TST_EXT.1 meets this objective by performing self-test to ensure the TOE is operating correctly and all functions are available and enforced.

ANNEX A: REFERENCES

The following documentation was used to prepare this ST:

Table 27: References

[CC_PART1]	Common Criteria for Information Technology Security Evaluation – Part 1: Introduction and general model, dated July 2009, version 3.1, Revision 3
[CC_PART2]	Common Criteria for Information Technology Security Evaluation – Part 2: Security functional components, dated July 2009, version 3.1, Revision 3
[CC_PART3]	Common Criteria for Information Technology Security Evaluation – Part 3: Security assurance components, dated July 2009, version 3.1, Revision 3
[CEM]	Common Methodology for Information Technology Security Evaluation – Evaluation Methodology, dated July 2009, version 3.1, Revision 3
[NDPP]	US Government, Security Requirements for Network Devices (pp_nd_v1.0), version 1.0, dated 10 December 2010