



Arista Networks 7280 Series Switches
Running EOS 4.28

Common Criteria Security Target

Version: 0.5

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1. Security Target (ST) Introduction

1.1 Security Target Reference

The Security Target reference uniquely identifies the Security Target.

ST Title: Arista Networks 7280 Series Switches Running EOS 4.28
ST Version Number: Version 0.5
ST Date: 07/19/2023
Keywords: Network Device

1.2 Target of Evaluation Reference

The Target of Evaluation reference identifies the Target of Evaluation (TOE).

TOE Name: Arista Networks 7280 Series Switches Running EOS 4.28
TOE Developer: Arista Networks, Inc.
5453 Great America Parkway
Santa Clara, CA 95054
TOE Software Version: EOS 4.28
TOE Hardware: See Table 1
CC Identification: Common Criteria for Information Technology Security Evaluation, Version 3.1, Revision 5, April 2017.
PP Identification: Collaborative Protection Profile for Network Devices, Version 2.2e, March 23, 2020.

1.3 Target of Evaluation Overview

1.3.1 TOE Type

The TOE is classified as a Network Device, that is, a device composed of both hardware and software that is connected to the network and has an infrastructure role within the network.

1.3.2 TOE Usage

The Arista Networks Data Center and Cloud Computing Switches are networking switches (Network Devices for CC purposes) that provide OSI model Layer 2, 3, and 4 Ethernet interconnectivity and network management services (Data Link, Network, and Transport Layers, respectively). Each model of the TOE is manufactured with high performance electronics, making it ideally suitable for a demanding data center environment.

1.3.3 TOE Major Security Features Summary

- Security Audit

- Generates audit records, storing them locally and transmitting them to a remote audit server.
- Supports secure communication to remote syslog-compatible audit servers protected by the SSHv2 Trusted Channel.
- Cryptographic Support
 - Utilization of NIST-specified and CAVP validated cryptographic algorithms for asymmetric key generation, AES encryption/decryption, digital signature generation/verification, hashing, and keyed-hashing (Message Authentication Code).
 - Cryptographic-key Destruction using PP specified methods.
 - Deterministic Random Bit Generation (DRBG).
 - Assurance of seeding the DRBG with sufficient entropy (minimum of 256-bits of entropy).
- Identification and Authentication
 - Administrative password management.
 - Protected authentication data at the local and remote consoles.
 - Identification and authentication of the Security Administrative user.
 - X509 certificate-based authentication and validation.
 - X509 certificate request generation.
- Security Management
 - Trusted Update mechanism.
 - Restriction of TSF management to the Security Administrator.
 - Local and remote administration of the TOE by the Security Administrator.
- Protection of the TSF
 - Protection of stored passwords.
 - Prevention of disclosing passwords via normal management interfaces.
 - Prevention of disclosing private keys via normal management interfaces.
 - Automated self-testing upon boot-up.
 - Querying of the TOE firmware/software.
 - Reliable timestamps.
- TOE Access
 - Session termination (TSF initiated, and User initiated).
 - Display of a warning and consent banner on the local and remote management interfaces prior to authentication.
- Trusted Path/Channels
 - Cryptographically secure path between the TOE and the Security Administrative user for remote management.
 - Cryptographically secure channels between the TOE and authorized IT entities in the Operational Environment to support the TSF.

1.3.4 Operational Environment

The TOE's Operational Environment must provide the following services to support the secure operation of the TOE in its evaluated configuration:

- Local Console Administrative Access
 - RS-232 Serial Console.
 - VT-100 terminal emulation program.

- Remote Management
 - The SSH client for remote interactive session utilizing SSH.
 - The eAPI JSON-RPC Client capable of establishing a mutually authenticated TLS session.
- Audit Server
 - The Syslog server capable of accepting an SSHv2 tunnel utilizing SSH Protocol Version 2 (SSHv2).
- Certificate Revocation List (CRL) Server
 - The Server from where CRLs can be downloaded on the TOE to check validity of X509v3 certificates.

1.4 Target of Evaluation Description

The Arista 7280 series switches are fixed form factor switches. The 7280 series switches range in size between 1 and 2 RU. The TOE” models vary in total throughput, port count, port speeds, route table scales etc.

Each switch model runs Arista’s Linux-based network operating system called Extensible Operating System (EOS). The same EOS binary image runs on all TOE hardware models. All EOS code is compiled to the same i686 assembly, making it such that no processor runs anything different from any other processor. All processors implement the i686 assembly language. All SFRs in this Security Target are implemented by the EOS. Hence, they behave identically on every switch model.

The table below provides the list of appliances across different series:

Table 1: Hardware Appliances

Series	Models	Interfaces	Host CPU	
7280CR	• SKN-7280CR3-3C2	3x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-3C2-2	3x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-3C2-2-DEV	3x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-3C2-2G	3x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-3C2-3	3x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-3C2-3-DEV	3x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-3C2-3G	3x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-3C2-DEV	3x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-4C2	4x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-4C2-DEV	4x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-4C2G	4x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-4C6	3x100GbE (CFP2) + (9 or 10)x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-4C6-DEV	3x100GbE (CFP2) + (9 or 10)x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-4C6G	3x100GbE (CFP2) + (9 or 10)x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-5C2	5x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-5C2-DEV	5x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	• SKN-7280CR3-5C2G	5x100GbE (CFP2) + 2x100GbE	Intel Broadwell-DE D1519	
	7280SR	• SKN-7280SR3-16YC8	4x CFP2 100G/200G + 4x 40/100G QSFP + 16x 25/10GbE SFP	Intel Broadwell-DE D1519

The TOE supports local administration via the local console port. Remote administration is performed over the Secure Shell v2 (SSHv2) protocol. Alternatively, the switch supports eAPI JSON-RPC interface over TLS for remote automation scripts to perform management functions on the switch. This interface supports only JSON request/response format. The eAPI interface supports both interactive and non-interactive modes of operation. In interactive mode, a user can issue commands and receive immediate feedback from the device. This allows for quick testing and debugging of eAPI scripts and applications, as well as ad hoc configuration and monitoring tasks.

In non-interactive mode, the user can use a third-party eAPI JSON-RPC client, such as Ansible, Python requests library, or cURL, to send eAPI requests and receive responses from the device. In the evaluated configuration, the switch only supports eAPI non-interactive mode over TLS for remote automation scripts to perform management functions on the switch.

The TOE also supports storage and forwarding of audit records, protected using SSHv2, to any syslog-compatible network entity.

1.4.1 Target of Evaluation Architecture

The EOS includes subsystems designed to implement operational, security, management and networking functions. The EOS contains management interface subsystem comprising of applications that implement Serial Console, eAPI and SSH. This subsystem utilizes APIs, which are provided by the Crypto Module to implement cryptographic algorithms. The keys and the certificates database support operation of cryptographic algorithms. The AAA subsystem maintains administrative user credentials, which the management subsystem relies on to identify and authenticate the users. The Audit Agent creates audit logs on relevant events, sends them to remote audit server utilizing the services of SSH, and stores them on local storage. The Config Database stores switch configuration. The Switching and Routing Engine performs core function of the switch, which implements traffic forwarding logic. The rules generated by this engine are programmed into line cards, which perform actual traffic forwarding function.

The TOE architecture and subsystem interactions are shown in Figure 1.

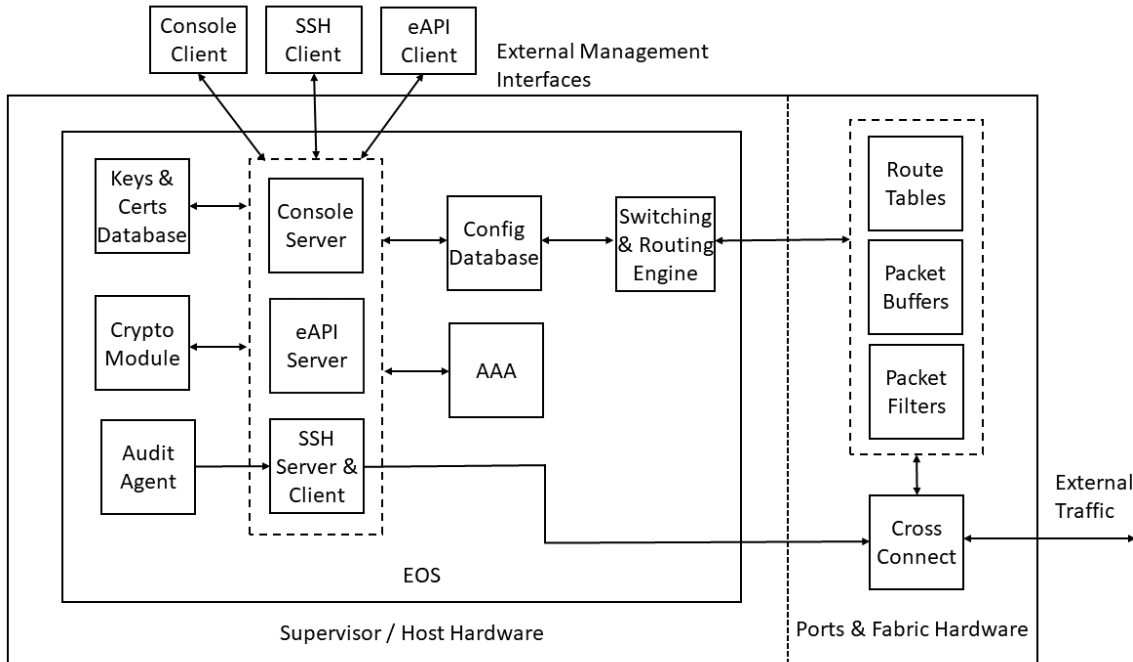


Figure 1: TOE Architecture

1.4.2 Target of Evaluation Physical Boundary

The physical boundary of the TOE is a switch appliance of one of the models described in Table 1, including all its hardware, firmware, software, local and remote management interfaces, and Arista Extensible Operating System (EOS) version 4.28.

The TOE is delivered using a courier as a single device with the Arista EOS software installed. The TOE model number can be verified through the shipping label and device front panel.

The switch appliance contains host CPU, DRAM and flash to run EOS. There are a fixed number of copper or optical network ports on the appliance. The physical boundary of the TOE is the switch appliance as shown in Figure 2.

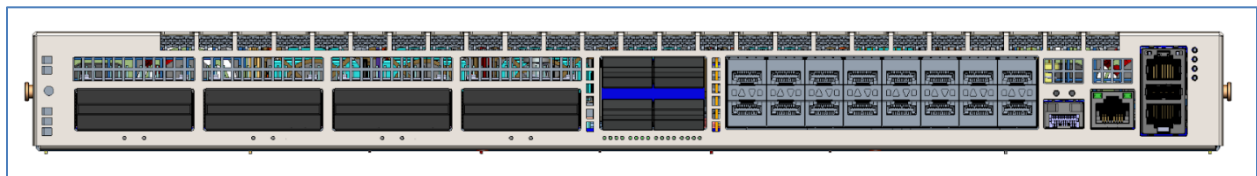


Figure 2: Physical Boundary of 7280 Series Switch

1.4.3 Target of Evaluation Logical Boundary

The logical boundary of the TOE includes the security functions implemented exclusively by the TOE. These security functions are summarized in Section 1.3.3 above and are further described throughout the security target. A more detailed description of the implementation of these security functions are provided in Section 7 “TOE Summary Specification”.

1.4.3.1 Security Audit

- The TOE will audit all events and information defined in Table 7.
- The TOE will also include the identity of the user that caused the event (if applicable), date and time of the event, type of event, and the outcome of the event.
- The TOE protects storage of audit information from unauthorized deletion.
- The TOE prevents unauthorized modifications to the stored audit records.
- The TOE can transmit audit data to an external IT entity using the SSHv2 protocol.

1.4.3.2 Cryptographic Support

The TOE implements CAVP validated cryptographic algorithms for the asymmetric key generation, encryption/decryption, digital signature, integrity protection/verification and random bit generation. These algorithms are used to provide security for the SSH and TLS connections of the Trusted Path and Trusted Channel. The TOE implements the Arista EOS Crypto Module v2.0 which uses the underlying OpenSSL FIPS Object Module 2.0.16 library for all cryptographic functions.

1.4.3.3 Identification and Authentication

- The TSF supports passwords consisting of alphanumeric and special characters. The TSF also allows administrators to set a minimum password length and support passwords of 15 characters or greater.
- The TSF requires all administrative-users to authenticate before allowing the user to perform any actions other than:
 - Viewing the warning banner.

1.4.3.4 Security Management

- The TOE allows human users with the Security Administrator role to administer the TOE over a remote console (SSH Trusted Path) and local CLI (Local Console).
- The eAPI JSON-RPC trusted IT entity client allows a machine user with the Security Administrator role to administer the TOE over a remote TLS Trusted Channel.

These interfaces do not allow the Security Administrator to execute arbitrary commands or executables on the TOE.

1.4.3.5 Protection of the TSF

- The TSF prevents the reading of secret keys, private keys, and passwords.
- The TOE runs a suite of self-tests, during the initial start-up (upon power on), and when programs which utilize the cryptographic libraries are initialized, to demonstrate the correct operation of the TSF.
- The TOE provides a means to verify firmware/software updates to the TOE using a published hash prior to installing those updates.
- The TOE provides reliable time stamps for itself.

1.4.3.6 TOE Access

- The TOE, for local interactive sessions, terminates the session after Security Administrator-specified period of session inactivity.
- The TOE terminates a remote interactive session after Security Administrator-configurable period of session inactivity.

- The TOE allows Administrator-initiated termination of the Administrator's own interactive session.
- Before establishing an administrative user session, the TOE is capable of displaying Security Administrator-specified advisory notice and consent warning message regarding unauthorized use of the TOE.

1.4.3.7 Trusted Path/Channels

- The TOE uses SSH or TLS to provide a trusted communication channel between itself and all 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 and modification.
- The TOE permits the TSF, or the authorized IT entities to initiate communication via the trusted channel.
- The TOE permits remote administrators to initiate communication via the trusted path.
- The TOE requires the use of the trusted path for initial administrator authentication and all remote administration actions.

1.5 Excluded Functionality

The following features should not be used in the CC evaluated configuration. They are disabled by default (e.g., telnet) or require explicit additional configuration to make them work (e.g., integration with remote authentication server). These have not been evaluated.

- Telnet management interface.
- HTTP and HTTPS web GUI management interface.
- Integration with external authentication server over RADIUS, TACACS+, and LDAP.
- Management interfaces for XMPP, Openconfig, CloudVision eXchange (CVX) and CloudVision Portal (CVP).
- SNMP for management and notification.
- SMTP to post email notifications.
- Real-time streaming of switch state to remote server using `TerminAttr` service.
- Remote configuration backup with CLI command.
- FTP server.
- Integration with orchestration services such as Puppet, Ansible, Chef, Prometheus etc. by installing their agents on the switch.

The following features have also not been evaluated as their RFC-compliant implementations are unable to satisfy cryptographic requirements outlined in the PP:

- Routing protocols that integrate authentication or encryption such as Routing Information Protocol (RIPv1, RIPv2), Open Shortest Path First (OSPFv2), Border Gateway Protocol (BGP), Intermediate System to Intermediate System (IS-IS), and Virtual Router Redundancy Protocol (VRRP)
- The eAPI interface in interactive mode.

2. Conformance Claims

2.1 Common Criteria Conformance Claims

This Security Target is conformant to the Common Criteria Version 3.1 R5, CC Part 2 extended, and CC Part 3 conformant.

2.2 Conformance to Protection Profiles

This Security Target claims exact compliance to the collaborative Protection Profile for Network Devices, Version 2.2e, dated March 23, 2020. This Protection Profile will be referred to as cPP or PP throughout this Security Target.

2.3 Conformance to Technical Decisions

The TOE complies with the following Technical Decisions.

- 0738: NIT Technical Decision for Link to Allowed-With List
- 0638 – NIT Technical Decision for Key Pair Generation for Authentication
- 0636 – NIT Technical Decision for Clarification of Public Key User Authentication for SSH
- 0635 – NIT Technical Decision for TLS Server and Key Agreement Parameters
- 0631 – NIT Technical Decision for Clarification of public key authentication for SSH Server
- 0592 – NIT Technical Decision for Local Storage of Audit Records
- 0581 – NIT Technical Decision for Elliptic curve-based key establishment and NIST SP 800-56Arev3
- 0580 – NIT Technical Decision for clarification about use of DH14 in NDcPPv2.2e
- 0572 – NIT Technical Decision for Restricting FTP_ITC.1 to only IP address identifiers
- 0571 – NIT Technical Decision for Guidance on how to handle FIA_AFL.1
- 0570 – NIT Technical Decision for Clarification about FIA_AFL.1
- 0569 – NIT Technical Decision for Session ID Usage Conflict in FCS_DTLSS_EXT.1.7
- 0564 – NIT Technical Decision for Vulnerability Analysis Search Criteria
- 0563 – NIT Technical Decision for Clarification of audit date information
- 0556 – NIT Technical Decision for RFC 5077 question
- 0555 – NIT Technical Decision for RFC Reference incorrect in TLSS Test
- 0547 – NIT Technical Decision for Clarification on developer disclosure of AVA_VAN
- 0536 – NIT Technical Decision for Update Verification Inconsistency
- 0527 – NIT Technical Decision for Updates to Certificate Revocation Testing (FIA_X509_EXT.1)

Note: Technical decisions 0528, 0537, 0546, 0591, 0632, 0633, 0634, 0639, 0670 are not applicable to the TOE.

2.4 Conformance to Security Packages

This Security Target does not claim conformance to any security function requirements or security assurance requirements packages, neither as package-conformant or package-augmented.

2.5 Conformance Claims Rationale

To demonstrate that exact conformance is met, this rationale shows all threats are addressed, all OSP are satisfied, no additional assumptions are made, all objectives have been addressed, and all SFRs and SARs have been instantiated.

The following address the completeness of the threats, OSP, and objectives, limitations on the assumptions, and instantiation of the SFRs and SARs:

- Threats
 - All threats defined in the cPP are carried forward to this ST.
 - No additional threats have been defined in this ST.
- Organizational Security Policies
 - All OSP defined in the cPP are carried forward to this ST.
 - No additional OSPs have been defined in this ST.
- Assumptions
 - All assumptions defined in the cPP are carried forward to this ST.
 - No additional assumptions for the operational environment have been defined in this ST.
- Objectives
 - All objectives defined in the cPP are carried forward to this ST.
- All mandatory and selection-based SFRs and SARs defined in the cPP are carried forward to this Security Target.

Rationale presented in the body of this ST shows all assumptions on the operational environment have been upheld, all the OSP are enforced, all defined objectives have been met and these objectives counter the defined threats.

Additionally, all SFRs and SARs defined in the cPP have been properly instantiated in this Security Target; therefore, this ST shows exact compliance to the cPP.

3. Security Problem Definition

3.1 Threats

The following table defines the security threats for the TOE, characterized by a threat agent, an asset, and an adverse action of that threat agent on that asset. These threats are taken directly from the PP unchanged.

Table 2: Threats

Threat	Description
T.UNAUTHORIZED_ADMINISTRATOR_ACCESS	Threat agents may attempt to gain administrator access to the network device by nefarious means such as masquerading as an administrator to the device, masquerading as the device to an administrator, replaying an administrative session (in its entirety, or selected portions), or

	<p>performing man-in-the-middle attacks, which would provide access to the administrative session, or sessions between network devices. Successfully gaining administrator access allows malicious actions that compromise the security functionality of the device and the network on which it resides.</p>
T.WEAK_CRYPTOGRAPHY	<p>Threat agents may exploit weak cryptographic algorithms or perform a cryptographic exhaust against the key space. Poorly chosen encryption algorithms, modes, and key sizes will allow attackers to compromise the algorithms, or brute force exhaust the key space and give them unauthorized access allowing them to read, manipulate and/or control the traffic with minimal effort.</p>
T.UNTRUSTED_COMMUNICATION_CHANNELS	<p>Threat agents may attempt to target network devices that do not use standardized secure tunneling protocols to protect the critical network traffic. Attackers may take advantage of poorly designed protocols or poor key management to successfully perform man-in-the-middle attacks, replay attacks, etc. Successful attacks will result in loss of confidentiality and integrity of the critical network traffic, and potentially could lead to a compromise of the network device itself.</p>
T.WEAK_AUTHENTICATION_ENDPOINTS	<p>Threat agents may take advantage of secure protocols that use weak methods to authenticate the endpoints – e.g., shared password that is guessable or transported as plaintext. The consequences are the same as a poorly designed protocol, the attacker could masquerade as the administrator or another device, and the attacker could insert themselves into the network stream and perform a man-in-the-middle attack. The result is the critical network traffic is exposed and there could be a loss of confidentiality and integrity, and potentially the network device itself could be compromised.</p>
T.UPDATE_COMPROMISE	<p>Threat agents may attempt to provide a compromised update of the software or firmware which undermines the security functionality of the device. Non-validated updates or updates validated using non-secure or weak cryptography leave the update firmware vulnerable to surreptitious alteration.</p>
T.UNDETECTED_ACTIVITY	<p>Threat agents may attempt to access, change, and/or modify the security functionality of the network device without administrator awareness. This could result in the attacker finding an avenue (e.g., misconfiguration, flaw in the product) to compromise the device and the administrator would have no knowledge that the device has been compromised.</p>
T.SECURITY_FUNCTIONALITY_COMPROMISE	<p>Threat agents may compromise credentials and device data enabling continued access to the network device and its critical data. The compromise of credentials includes replacing existing credentials with an attacker’s credentials, modifying existing credentials, or obtaining the administrator or device credentials for use by the attacker.</p>

T.PASSWORD_CRACKING	Threat agents may be able to take advantage of weak administrative passwords to gain privileged access to the device. Having privileged access to the device provides the attacker unfettered access to the network traffic and may allow them to take advantage of any trust relationships with other network devices.
T.SECURITY_FUNCTIONALITY_FAILURE	An external, unauthorized entity could make use of failed or compromised security functionality and might therefore subsequently use or abuse security functions without prior authentication to access, change or modify device data, critical network traffic or security functionality of the device.

3.2 Organizational Security Policies

The following table defines the organizational security policies which are a set of rules, practices, and procedures imposed by an organization to address its security needs. These threats are taken directly from the PP unchanged.

Table 3: Organizational Security Policies

OSP	Description
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.

3.3 Assumptions

This section describes the assumptions on the operational environment in which the TOE is intended to be used. It includes information about the physical, personnel, and connectivity aspects of the environment. The operational environment must be managed in accordance with the provided guidance documentation. The following table defines specific conditions that are assumed to exist in an environment where the TOE is deployed. These assumptions are taken directly from the PP unchanged.

Table 4: Assumptions

Assumption	Description
A.PHYSICAL_PROTECTION	The network device is assumed to be physically protected in its operational environment and not subject to physical attacks that compromise the security and/or interfere with the device's physical interconnections and correct operation. This protection is assumed to be sufficient to protect the device and the data it contains. As a result, the cPP will not include any requirements on physical tamper protection or other physical attack mitigations. The cPP will not expect the product to defend against physical access to the device that allows

Assumption	Description
	unauthorized entities to extract data, bypass other controls, or otherwise manipulate the device.
A.LIMITED_FUNCTIONALITY	The device is assumed to provide networking functionality as its core function and not provide functionality/services that could be deemed as general-purpose computing. For example, the device should not provide computing platform for general purpose Applications (unrelated to networking functionality).
A.NO_THRU_TRAFFIC_PROTECTION	A standard/generic network device does not provide any assurance regarding the protection of traffic that traverses it. The intent is for the network device to protect data that originates on or is destined to the device itself, to include administrative data and audit data. Traffic that is traversing the network device, destined for another network entity, is not covered by the ND cPP. It is assumed that this protection will be covered by cPPs and PP-modules for particular types of network devices (e.g., firewall).
A.TRUSTED_ADMINISTRATOR	<p>The Security Administrator(s) for the Network Device are assumed to be trusted and to act in the best interest of security for the organization. This includes appropriately trained, following policy, and adhering to guidance documentation. Administrators are trusted to ensure passwords/credentials have sufficient strength and entropy and to lack malicious intent when administering the device. The Network Device is not expected to be capable of defending against a malicious Administrator that actively works to bypass or compromise the security of the device.</p> <p>For TOEs supporting X.509v3 certificate-based authentication, the Security Administrator(s) are expected to fully validate (e.g., offline verification) any CA certificate (root CA certificate or intermediate CA certificate) loaded into the TOE's trust store (aka 'root store', 'trusted CA Key Store', or similar) as a trust anchor prior to use (e.g., offline verification).</p>
A.REGULAR_UPDATES	The network device firmware and software is assumed to be updated by an administrator on a regular basis in response to the release of product updates due to known vulnerabilities.
A.ADMIN_CREDENTIALS_SECURE	The administrator's credentials (private key) used to access the network device are protected by the platform on which they reside.
A.RESIDUAL_INFORMATION	The Administrator must ensure that there is no unauthorized access possible for sensitive residual information (e.g.,

Assumption	Description
	cryptographic keys, keying material, PINs, passwords etc.) on networking equipment when the equipment is discarded or removed from its operational environment.

4. Security Objectives

4.1 Security Objectives for the Operational Environment

Table 5: Security Objectives for the Operational Environment

Objective	Description
OE.PHYSICAL	Physical security, commensurate with the value of the TOE and the data it contains, is provided by the environment.
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.NO_THRU_TRAFFIC_PROTECTION	The TOE does not provide any protection of traffic that traverses it. It is assumed that protection of this traffic will be covered by other security and assurance measures in the operational environment
OE.TRUSTED_ADMIN	Security Administrators are trusted to follow and apply all guidance documentation in a trusted manner. For TOEs supporting X.509v3 certificate-based authentication, the Security Administrator(s) are assumed to monitor the revocation status of all certificates in the TOE's trust store and to remove any certificate from the TOE's trust store in case such certificate can no longer be trusted.
OE.UPDATES	The TOE firmware and software is updated by an administrator on a regular basis in response to the release of product updates due to known vulnerabilities.
OE.ADMIN_CREDENTIALS_SECURE	The administrator's credentials (private key) used to access the TOE must be protected on any other platform on which they reside.
OE.RESIDUAL_INFORMATION	The Security Administrator ensures that there is no unauthorized access possible for sensitive residual

Objective	Description
	information (e.g., cryptographic keys, keying material, PINs, passwords etc.) on networking equipment when the equipment is discarded or removed from its operational environment.

5. Extended Components Definition

5.1 Extended Security Functional Components

All extended components are sourced directly from NDcPP 2.2e.

5.2 Extended Security Functional Requirements Rationale

All extended security functional components are sourced directly from NDcPP 2.2e. Exact conformance required by the cPP also mandates inclusion of all applicable extended components defined in the cPP.

6. Security Requirements

6.1 Security Functional Requirements

The following conventions have been applied in this document.

- **Security Functional Requirements** – Part 2 of the CC defines the approved set of operations that may be applied to functional requirements: Iteration, assignment, selection, and refinement.
 - **Iteration:** Allows a component to be used more than once with varying operations. In the ST, iteration is indicated by a number in parenthesis following the requirement number, e.g., FCS_COP.1.1(1).
 - **Assignment:** Allows the specification of an identified parameter. Assignments made by the ST author are identified with **bold text**.
 - **Selection:** Allows the specification of one or more elements from a list. Selections are identified with underlined text.
 - **Refinement:** Allows the addition of details. Additions to the CC text are specified in ***italicized bold and underlined text***. Refinements that add text use ***bold and italicized text*** to identify the added text. Refinements that perform a deletion, identifies the deleted text with ~~***strikeout, bold, and italicized text***~~.

Note that operations already performed in the PP are not identified in this Security Target.

- **Explicitly stated Security Functional Requirements** (i.e., those not found in Part 2 of the CC) are identified “_EXT” in the component name.)

The TOE security functional requirements are listed in Table 6. All SFRs are based on requirements defined in Part 2 of the Common Criteria or defined in cPP.

Table 6: Security Functional Requirements

SFR	Description
FAU_GEN.1	Audit Data Generation
FAU_GEN.2	User Identity Association
FAU_STG_EXT.1	Protected Audit Event Storage
FCS_CKM.1	Cryptographic Key Generation (Refined)
FCS_CKM.2	Cryptographic Key Establishment (Refined)
FCS_CKM.4	Cryptographic Key Destruction
FCS_COP.1/DataEncryption	Cryptographic Operation (AES Data Encryption/Decryption)
FCS_COP.1/SigGen	Cryptographic Operation (Signature Generation and Verification)
FCS_COP.1/Hash	Cryptographic Operation (Hash Algorithm)
FCS_COP.1/KeyedHash	Cryptographic Operation (Keyed Hash Algorithm)
FCS_RBG_EXT.1	Random Bit Generation
FCS_SSHC_EXT.1	SSH Client
FCS_SSHS_EXT.1	SSH Server
FCS_TLSS_EXT.1	TLS Server Protocol without Mutual Authentication
FCS_TLSS_EXT.2	TLS Server Protocol with Mutual Authentication
FIA_AFL.1	Authentication Failure Management
FIA_PMG_EXT.1	Password Management
FIA_UIA_EXT.1	User Identification and Authentication
FIA_UAU_EXT.2	Password-based Authentication Mechanism
FIA_UAU.7	Protected Authentication Feedback
FIA_X509_EXT.1/Rev	X.509 Certificate Validation
FIA_X509_EXT.2	X.509 Certificate Authentication
FIA_X509_EXT.3	X.509 Certificate Requests

SFR	Description
FMT_MOF.1/ManualUpdate	Management of Security Functions Behavior
FMT_MTD.1/CoreData	Management of TSF Data
FMT_MTD.1/CryptoKeys	Management of TSF Data
FMT_SMF.1	Specification of Management Functions
FMT_SMR.2	Restrictions on Security Roles
FPT_SKP_EXT.1	Protection of TSF Data (for reading all symmetric keys)
FPT_APW_EXT.1	Protection of Administrator Passwords
FPT_TST_EXT.1	TSF Testing
FPT_TUD_EXT.1	Trusted Update
FPT_STM_EXT.1	Reliable Time Stamps
FTA_SSL_EXT.1	TSF-initiated Session Locking
FTA_SSL.3	TSF-initiated Termination
FTA_SSL.4	User-initiated Termination
FTA_TAB.1	Default TOE Access Banners
FTP_ITC.1	Inter-TSF Trusted Channel
FTP_TRP.1/Admin	Trusted Path

6.1.1 Security Audit (FAU)

6.1.1.1 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 shut-down of the audit functions;
- b) All auditable events for the not specified level of audit; and
- c) All administrative actions comprising:
 - Administrative login and logout (name of user account shall be logged if individual user accounts are required for Administrators).
 - Changes to TSF data related to configuration changes (in addition to the information that a change occurred it shall be logged what has been changed).

- Generating/import of, changing, or deleting of cryptographic keys (in addition to the action itself a unique key name or key reference shall be logged).
 - Resetting passwords (name of related user account shall be logged).
 - no other actions;
- d) Specifically defined auditable events listed in Table 7.

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 cPP/ST, information specified in column three of Table 7.

Table 7: Auditable Events (Table 2 of cPP)

SFR	Description	Additional Audit Record Contents
FAU_GEN.1	None.	None.
FAU_GEN.2	None.	None.
FAU_STG_EXT.1	None.	None.
FCS_CKM.1	None.	None.
FCS_CKM.2	None.	None.
FCS_CKM.4	None.	None.
FCS_COP.1/DataEncryption	None.	None.
FCS_COP.1/SigGen	None.	None.
FCS_COP.1/Hash	None.	None.
FCS_COP.1/KeyedHash	None.	None.
FCS_RBG_EXT.1	None.	None.
FCS_SSHC_EXT.1	Failure to establish an SSH session	Reason for failure.
FCS_SSHS_EXT.1	Failure to establish an SSH session	Reason for failure.

SFR	Description	Additional Audit Record Contents
FCS_TLSS_EXT.1	Failure to establish a TLS session	Reason for failure.
FCS_TLSS_EXT.2	Failure to authenticate the client	Reason for failure
FIA_AFL.1	Unsuccessful login attempts limit is met or exceeded.	Origin of the attempt (e.g., IP address).
FIA_PMG_EXT.1	None.	None.
FIA_UIA_EXT.1	All use of the identification and authentication mechanism.	Origin of the attempt (e.g., IP address).
FIA_UAU_EXT.2	All use of the identification and authentication mechanism.	Origin of the attempt (e.g., IP address).
FIA_UAU.7	None.	None.
FIA_X509_EXT.1/Rev	Unsuccessful attempt to validate a certificate Any addition, replacement or removal of trust anchors in the TOE's trust store.	Reason for failure of certificate validation. Identification of certificates added, replaced or removed as trust anchor in the TOE's trust store.
FIA_X509_EXT.2	None.	None.
FIA_X509_EXT.3	None.	None.
FMT_MOF.1/Functions	None.	None.
FMT_MOF.1/ManualUpdate	Any attempt to initiate a manual update	None.
FMT_MTD.1/CoreData	None.	None.
FMT_MTD.1/CryptoKeys	None.	None.
FMT_SMF.1	All management activities of TSF data.	None.
FMT_SMR.2	None.	None.
FPT_SKP_EXT.1	None.	None.

SFR	Description	Additional Audit Record Contents
FPT_APW_EXT.1	None.	None.
FPT_TST_EXT.1	None.	None.
FPT_TUD_EXT.1	Initiation of update; result of the update attempt (success or failure)	None.
FPT_STM_EXT.1	Discontinuous changes to time - either Administrator actuated or changed via an automated process. (Note that no continuous changes to time need to be logged. See also application note on FPT_STM_EXT.1)	For discontinuous changes to time: The old and new values for the time. Origin of the attempt to change time for success and failure (e.g., IP address).
FTA_SSL_EXT.1	The termination of a local session by the session locking mechanism.	None.
FTA_SSL.3	The termination of a remote session by the session locking mechanism.	None.
FTA_SSL.4	The termination of an interactive session.	None.
FTA_TAB.1	None.	None.
FTP_ITC.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_TRP.1/Admin	Initiation of the trusted path. Termination of the trusted path. Failure of the trusted path functions.	None.

6.1.1.2 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.

6.1.1.3 FAU_STG_EXT.1 Protected Audit Event Storage

FAU_STG_EXT.1.1

The TSF shall be able to transmit the generated audit data to an external IT entity using a trusted channel according to FTP_ITC.1.

FAU_STG_EXT.1.2

The TSF shall be able to store generated audit data on the TOE itself. In addition [

- The TOE shall consist of a single standalone component that stores audit data locally].

FAU_STG_EXT.1.3

The TSF shall [overwrite previous audit records according to the following rule: **periodic audit log rotation (delete the oldest log file)**] when the local storage space for audit data is full.

6.1.2 Cryptographic Support (FCS)

6.1.2.1 FCS_CKM.1 Cryptographic Key Generation

FCS_CKM.1.1 (TD0638)

The TSF shall generate **asymmetric** cryptographic keys in accordance with a specified cryptographic key generation algorithm:

- RSA schemes using cryptographic key sizes of 2048-bit or greater that meet the following: FIPS PUB 186-4, "Digital Signature Standard (DSS)", Appendix B.3;
- ECC schemes using 'NIST curves' [P-384] that meet the following: FIPS PUB 186-4, "Digital Signature Standard (DSS)", Appendix B.4;
- FFC Schemes using 'safe-prime' groups that meet the following: "NIST Special Publication 800-56A Revision 3, Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography" and [RFC 3526, RFC 7919].

6.1.2.2 FCS_CKM.2 Cryptographic Key Establishment

FCS_CKM.2.1 (TD0580 and TD0581)

The TSF shall **perform** cryptographic **key establishment** in accordance with a specified cryptographic key **establishment** method:

- RSA-based key establishment schemes that meet the following: RSAES-PKCS1-v1_5 as specified in Section 7.2 of RFC 3447, "Public-Key Cryptography Standards (PKCS) #1: RSA Cryptography Specifications Version 2.1";
- FFC Schemes using "safe-prime" groups that meet the following: 'NIST Special Publication 800-56A Revision 3, "Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography" and [groups listed in RFC 3526, groups listed in RFC 7919].

6.1.2.3 FCS_CKM.4: Cryptographic Key Destruction

FCS_CKM.4.1

The TSF shall destroy cryptographic keys in accordance with a specified cryptographic key destruction method

- For plaintext keys in volatile storage, the destruction shall be executed by a single overwrite consisting of zeroes;
- For plaintext keys in non-volatile storage, the destruction shall be executed by the invocation of an interface provided by a part of the TSF that:
 - logically addresses the storage location of the key and performs a single-pass overwrite consisting of zeroes

that meets the following: No Standard.

6.1.2.4 FCS_COP.1/DataEncryption Cryptographic Operation (AES Data Encryption/Decryption)

FCS_COP.1.1/DataEncryption

The TSF shall perform encryption/decryption in accordance with a specified cryptographic algorithm AES used in CBC, GCM mode and cryptographic key sizes 128 bits, 256 bits that meet the following: AES as specified in ISO 18033-3, CBC as specified in ISO 10116, GCM as specified in ISO 19772.

6.1.2.5 FCS_COP.1/SigGen Cryptographic Operation (Signature Generation and Verification)

FCS_COP.1.1/SigGen

The TSF shall perform cryptographic signature services (generation and verification) in accordance with a specified cryptographic algorithm [

- RSA Digital Signature Algorithm and cryptographic key sizes (modulus) 2048 bits
- Elliptic Curve Digital Signature Algorithm and cryptographic key sizes 384 bits

that meet the following:

- For RSA schemes: FIPS PUB 186-4, “Digital Signature Standard (DSS)”, Section 5.5, using PKCS #1 v2.1 Signature Schemes RSASSA-PSS and/or RSASSA-PKCS1v1_5; ISO/IEC 9796-2, Digital signature scheme 2 or Digital Signature scheme 3.
- For ECDSA schemes: FIPS PUB 186-4, “Digital Signature Standard (DSS)”, Section 6 and Appendix D, Implementing “NIST curves” [P-384]; ISO/IEC 14888-3, Section 6.4

6.1.2.6 FCS_COP.1/Hash Cryptographic Operation (Hash Algorithm)

FCS_COP.1.1/Hash

The TSF shall perform cryptographic hashing services in accordance with a specified cryptographic algorithm SHA-1, SHA-256, SHA-384, SHA-512 and **message digest sizes 160, 256, 384, 512** bits that meet the following: ISO/IEC 10118-3:2004.

6.1.2.7 FCS_COP.1/KeyedHash Cryptographic Operation (Keyed Hash Algorithm)

FCS_COP.1.1/KeyedHash

The TSF shall perform keyed-hash message authentication in accordance with a specified cryptographic algorithm HMAC-SHA-256, HMAC-SHA-384, HMAC-SHA-512 and cryptographic key sizes **256, 384, and 512-bits** and **message digest sizes 256, 384, 512 bits** that meet the following: ISO/IEC 9797-2:2011, Section 7 “MAC Algorithm 2”.

6.1.2.8 FCS_RBG_EXT.1 Random Bit Generation

FCS_RBG_EXT.1.1

The TSF shall perform all deterministic random bit generation services in accordance with ISO/IEC 18031:2011 using CTR_DRBG (AES).

FCS_RBG_EXT.1.2

The deterministic RBG shall be seeded by at least one entropy source that accumulates entropy from 1 platform-based noise source with a minimum of 256 bits of entropy at least equal to the greatest security strength, according to ISO/IEC 18031:2011 Table C.1 “Security Strength Table for Hash Functions”, of the keys and hashes that it will generate.

6.1.2.9 FCS_SSHC_EXT.1 SSH Client Protocol (Selection Based)

FCS_SSHC_EXT.1.1

The TSF shall implement the SSH protocol in accordance with: RFCs 4251, 4252, 4253, 4254, [5656, 6668, 8308 section 3.1, 8332].

FCS_SSHC_EXT.1.2 (TD0636)

The TSF shall ensure that the SSH protocol implementation supports the following user authentication methods as described in RFC 4252: public key-based, no other method.

FCS_SSHC_EXT.1.3

The TSF shall ensure that, as described in RFC 4253, packets greater than **262,144** bytes in an SSH transport connection are dropped.

FCS_SSHC_EXT.1.4

The TSF shall ensure that the SSH transport implementation uses the following encryption algorithms and rejects all other encryption algorithms: aes128-cbc, aes256-cbc.

FCS_SSHC_EXT.1.5

The TSF shall ensure that the SSH public-key based authentication implementation uses rsa-sha2-256, ecdsa-sha2-nistp384 as its public key algorithm(s) and rejects all other public key algorithms.

FCS_SSHC_EXT.1.6

The TSF shall ensure that the SSH transport implementation uses hmac-sha2-256, hmac-sha2-512 as its data integrity MAC algorithm(s) and rejects all other MAC algorithm(s).

FCS_SSHC_EXT.1.7

The TSF shall ensure that diffie-hellman-group14-sha1 and no other methods are the only allowed key exchange methods used for the SSH protocol.

FCS_SSHC_EXT.1.8

The TSF shall ensure that within SSH connections the same session keys are used for a threshold of no longer than one hour, and each encryption key is used to protect no more than one gigabyte of data. After any of the thresholds are reached a rekey needs to be performed.

FCS_SSHC_EXT.1.9

The TSF shall ensure that the SSH client authenticates the identity of the SSH server using a local database associating each host name with its corresponding public key and no other methods as described in RFC 4251 section 4.1.

6.1.2.10 FCS_SSHS_EXT.1 SSH Server Protocol (Selection Based)

FCS_SSHS_EXT.1.1

The TSF shall implement the SSH protocol in accordance with: RFCs 4251, 4252, 4253, 4254, [5656, 6668, 8308 section 3.1, 8332].

FCS_SSHS_EXT.1.2 (TD0631)

The TSF shall ensure that the SSH protocol implementation supports the following user authentication methods as described in RFC 4252: public key-based, password-based.

FCS_SSHS_EXT.1.3

The TSF shall ensure that, as described in RFC 4253, packets greater than **262,144** bytes in an SSH transport connection are dropped.

FCS_SSHS_EXT.1.4

The TSF shall ensure that the SSH transport implementation uses the following encryption algorithms and rejects all other encryption algorithms: aes128-cbc, aes256-cbc.

FCS_SSHS_EXT.1.5

The TSF shall ensure that the SSH public-key based authentication implementation uses rsa-sha2-256, ecdsa-sha2-nistp384 as its public key algorithm(s) and rejects all other public key algorithms.

FCS_SSHS_EXT.1.6

The TSF shall ensure that the SSH transport implementation uses hmac-sha2-256, hmac-sha2-512 as its MAC algorithm(s) and rejects all other MAC algorithm(s).

FCS_SSHS_EXT.1.7

The TSF shall ensure that diffie-hellman-group14-sha1 and no other methods are the only allowed key exchange methods used for the SSH protocol.

FCS_SSHS_EXT.1.8

The TSF shall ensure that within SSH connections, the same session keys are used for a threshold of no longer than one hour, and each encryption key is used to protect no more than one gigabyte of data. After any of the thresholds are reached, a rekey needs to be performed.

6.1.2.11 FCS_TLSS_EXT.1 TLS Server Protocol without Mutual Authentication

FCS_TLSS_EXT.1.1

The TSF shall implement TLS 1.2 (RFC 5246) and reject all other TLS and SSL versions. The TLS implementation will support the following ciphersuites:

- TLS_RSA_WITH_AES_128_CBC_SHA256 as defined in RFC 5246
- TLS_RSA_WITH_AES_256_CBC_SHA256 as defined in RFC 5246
- TLS_DHE_RSA_WITH_AES_128_CBC_SHA256 as defined in RFC 5246
- TLS_DHE_RSA_WITH_AES_256_CBC_SHA256 as defined in RFC 5246
- TLS_RSA_WITH_AES_256_GCM_SHA384 as defined in RFC 5288

- TLS_DHE_RSA_WITH_AES_256_GCM_SHA384 as defined in RFC 5288
- and no other ciphersuites.

FCS_TLSS_EXT.1.2

The TSF shall deny connections from clients requesting SSL 2.0, SSL 3.0, TLS 1.0, and TLS 1.1.

FCS_TLSS_EXT.1.3

The TSF shall perform key establishment for TLS using RSA with key size 2048 bits; Diffie-Hellman groups ffdhe2048, ffdhe3072, ffdhe4096.

FCS_TLSS_EXT.1.4

The TSF shall support session resumption based on session IDs according to RFC 4346 (TLS1.1) or RFC 5246 (TLS 1.2).

6.1.2.12 FCS_TLSS_EXT.2 TLS Server Protocol with Mutual Authentication

FCS_TLSS_EXT.2.1

The TSF shall support TLS communication with mutual authentication of TLS clients using X.509v3 certificates.

FCS_TLSS_EXT.2.2

When establishing a trusted channel, by default the TSF shall not establish a trusted channel if the client certificate is invalid. The TSF shall also [

- Not implement any administrator override mechanism

].

FCS_TLSS_EXT.2.3

The TSF shall not establish a trusted channel if the identifier contained in a certificate does not match an expected identifier for the client. If the identifier is a Fully Qualified Domain Name (FQDN), then the TSF shall match the identifiers according to RFC 6125, otherwise the TSF shall parse the identifier from the certificate and match the identifier against the expected identifier of the client as described in the TSS.

6.1.3 Identification and Authentication (FIA)

6.1.3.1 FIA_AFL.1 Authentication Failure Management

FIA_AFL.1.1

The TSF shall detect when an Administrator configurable positive integer within **1 to 255** unsuccessful authentication attempts occur related to Administrators attempting to authenticate remotely using a password.

FIA_AFL.1.2

When the defined number of unsuccessful authentication attempts has been met, the TSF shall prevent the offending Administrator from successfully establishing a remote session using any authentication method that involves a password until an Administrator defined time period has elapsed.

6.1.3.2 FIA_PMG_EXT.1 Password Management

FIA_PMG_EXT.1.1

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

- a) Passwords shall be able to be composed of any combination of upper and lower case letters, numbers, and the following special characters: “!” , “@” , “#” , “\$” , “%” , “^” , “&” , “*” , “(” , “)”;
- b) Minimum password length shall be configurable to between **1** and **32** characters.

6.1.3.3 FIA_UIA_EXT.1 User Identification and Authentication

FIA_UIA_EXT.1.1

The TSF shall allow the following actions prior to requiring the non-TOE entity to initiate the identification and authentication process:

- Display the warning banner in accordance with FTA_TAB.1;
- no other actions.

FIA_UIA_EXT.1.2

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

6.1.3.4 FIA_UAU_EXT.2 Password-based Authentication Mechanism

FIA_UAU_EXT.2.1

The TSF shall provide a local password-based authentication mechanism to perform local administrative user authentication.

6.1.3.5 FIA_UAU.7 Protected Authentication Feedback

FIA_UAU.7.1

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

6.1.3.6 FIA_X509_EXT.1/Rev X.509 Certificate Validation (Selection Based)

FIA_X509_EXT.1.1/Rev

The TSF shall validate certificates in accordance with the following rules:

- RFC 5280 certificate validation and certificate path validation **supporting a minimum path length of three certificates.**
- The certificate path must terminate with a trusted CA certificate designated as a trust anchor.
- The TSF shall validate a certification path by ensuring that all CA certificates in the certification path contain the basicConstraints extension with the CA flag set to TRUE.
- The TSF shall validate the revocation status of the certificate using a Certificate Revocation List (CRL) as specified in RFC 5280 Section 6.3.
- The TSF shall validate the extendedKeyUsage field according to the following rules:

- Certificates used for trusted updates and executable code integrity verification shall have the Code Signing purpose (id-kp 3 with OID 1.3.6.1.5.5.7.3.3) in the extendedKeyUsage field.
- Server certificates presented for TLS shall have the Server Authentication purpose (id-kp 1 with OID 1.3.6.1.5.5.7.3.1) in the extendedKeyUsage field.
- Client certificates presented for TLS shall have the Client Authentication purpose (id-kp 2 with OID 1.3.6.1.5.5.7.3.2) in the extendedKeyUsage field.
- OCSP Certificates presented for OCSP responses shall have the OCSP Signing purpose (id-kp 9 with OID 1.3.6.1.5.5.7.3.9) in the extendedKeyUsage field.

FIA_X509_EXT.1.2/Rev

The TSF shall only treat a certificate as a CA certificate if the basicConstraints extension is present and the CA flag is set to TRUE.

6.1.3.7 FIA_X509_EXT.2 X.509 Certificate Authentication

FIA_X509_EXT.2.1

The TSF shall use X.509v3 certificates as defined by RFC 5280 to support authentication for TLS, and no additional uses.

FIA_X509_EXT.2.2 (TD0537)

When the TSF cannot establish a connection to determine the validity of a certificate, the TSF shall not accept the certificate.

6.1.3.8 FIA_X509_EXT.3 X.509 Certificate Requests

FIA_X509_EXT.3.1

The TSF shall generate a Certificate Request as specified by RFC 2986 and be able to provide the following information in the request: public key and Common Name, Organization, Organizational Unit, Country.

FIA_X509_EXT.3.2

The TSF shall validate the chain of certificates from the Root CA upon receiving the CA Certificate Response.

6.1.4 Security Management (FMT)

6.1.4.1 FMT_MOF.1/Functions Management of Security Functions Behaviour

FMT_MOF.1.1/Functions

The TSF shall restrict the ability to modify the behaviour of the functions transmission of audit data to an external IT entity to Security Administrators.

6.1.4.2 FMT_MOF.1/ManualUpdate Management of Security Functions Behaviour

FMT_MOF.1.1/ManualUpdate

The TSF shall restrict the ability to enable the functions to perform manual updates to Security Administrators.

6.1.4.3 FMT_MTD.1/CoreData Management of TSF Data

FMT_MTD.1.1/CoreData

The TSF shall restrict the ability to manage the TSF Data to Security Administrators.

6.1.4.4 FMT_MTD.1/CryptoKeys Management of TSF Data

FMT_MTD.1.1/CryptoKeys

The TSF shall restrict the ability to manage the cryptographic keys to Security Administrators.

6.1.4.5 FMT_SMF.1 Specification of Management Functions

FMT_SMF.1.1 (TD0631)

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

- Ability to administer the TOE locally and remotely;
- Ability to configure the access banner;
- Ability to configure the session inactivity time before session termination or locking;
- Ability to update the TOE, and to verify the updates using hash comparison capability prior to installing those updates;
- Ability to configure the authentication failure parameters for FIA_AFL.1;
 - Ability to manage the cryptographic keys;
 - Ability to configure the cryptographic functionality;
 - Ability to modify the behaviour of the transmission of audit data to an external IT entity;
 - Ability to configure thresholds for SSH rekeying;
 -
 - Ability to set the time which is used for time-stamps;
 - Ability to manage the TOE's trust store and designate X509.v3 certificates as trust anchors;
 - Ability to import X.509v3 certificates to the TOE's trust store;
 - Ability to manage the trusted public keys database.

6.1.4.6 FMT_SMR.2 Restrictions on Security Roles

FMT_SMR.2.1

The TSF shall maintain the roles:

- Security Administrator.

FMT_SMR.2.2

The TSF shall be able to associate users with roles.

FMT_SMR.2.3

The TSF shall ensure that the conditions:

- The Security Administrator role shall be able to administer the TOE locally;
- The Security Administrator role shall be able to administer the TOE remotely

are satisfied.

6.1.5 Protection of the TSF (FPT)

6.1.5.1 FPT_SKP_EXT.1 Protection of TSF Data (for reading of all pre-shared, symmetric and private keys)

FPT_SKP_EXT.1.1

The TSF shall prevent reading of all pre-shared keys, symmetric keys, and private keys.

6.1.5.2 FPT_APW_EXT.1 Protection of Administrator Passwords

FPT_APW_EXT.1.1

The TSF shall store administrative passwords in non-plaintext form.

FPT_APW_EXT.1.2

The TSF shall prevent the reading of plaintext administrative passwords.

6.1.5.3 FPT_TST_EXT.1 TSF Testing

FPT_TST_EXT.1.1

The TSF shall run a suite of the following self-tests during initial start-up (on power on), at the conditions **as specified by FIPS PUB 140-2 Section 4.9.2** to demonstrate the correct operation of the TSF: **Power-up self-tests: Integrity check of the cryptographic module and Known Answer Tests (KAT) of cryptographic primitives, and conditional self-tests: Key generation pairwise consistency tests and continuous random number generator testing.**

6.1.5.4 FPT_TUD_EXT.1 Trusted Update

FPT_TUD_EXT.1.1

The TSF shall provide Security Administrators the ability to query the currently executing version of the TOE firmware/software and no other TOE firmware/software version.

FPT_TUD_EXT.1.2

The TSF shall provide Security Administrators the ability to manually initiate updates to TOE firmware/software and no other update mechanism.

FPT_TUD_EXT.1.3

The TSF shall provide means to authenticate firmware/software updates to the TOE using a published hash prior to installing those updates.

6.1.5.5 FPT_STM_EXT.1: Reliable Time Stamps

FPT_STM_EXT.1.1

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

FPT_STM_EXT.1.2 (TD0632)

The TSF shall allow the Security Administrator to set the time.

6.1.6 TOE Access (FTA)

6.1.6.1 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.

6.1.6.2 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.

6.1.6.3 FTA_SSL.4 User-initiated Termination

FTA_SSL.4.1

The TSF shall allow **Administrator**-initiated termination of the Administrator's own interactive session.

6.1.6.4 FTA_TAB.1: Default TOE Access Banners

FTA_TAB.1.1

Before establishing an **administrative user** session the TSF shall display a **Security Administrator-specified advisory notice and consent** warning message regarding use of the TOE.

6.1.7 Trusted Path/Channels (FTP)

6.1.7.1 FTP_ITC.1 Inter-TSF Trusted Channel

FTP_ITC.1.1

The TSF shall **be capable of using [SSH, TLS]** to provide a trusted communication channel between itself and **authorized IT entities supporting the following capabilities: audit server, [eAPI JSON-RPC Client]** that is logically distinct from other communication channels and provides assured identification of its end points and protection of the channel data from **disclosure and detection of modification of the channel data**.

FTP_ITC.1.2

The TSF shall permit the **TSF, or the authorized IT entities** to initiate communication via the trusted channel.

FTP_ITC.1.3

The TSF shall initiate communication via the trusted channel for **transmitting audit records to audit server**.

6.1.7.2 FTP_TRP.1/Admin Trusted Path

FTP_TRP.1.1/Admin

The TSF shall **be capable of using [SSH]** to provide a communication path between itself and **authorized remote Administrators** that is logically distinct from other communication paths and provides assured

identification of its end points and protection of the communicated data from **disclosure and provides detection of modification of the channel data.**

FTP_TRP.1.2/Admin

The TSF shall permit remote **Administrators** to initiate communication via the trusted path.

FTP_TRP.1.3/Admin

The TSF shall require the use of the trusted path for initial Administrator authentication and all remote administration actions.

6.2 Security Assurance Requirements

6.2.1 Security Assurance Requirements for the TOE

This section defines the assurance requirements for the TOE. The assurance activities to be performed by the evaluator are defined in cPP and are derived from Common Criteria Version 3.1, Revision 5. The assurance requirements are summarized in the table below.

Table 8: Assurance Requirements

Assurance Class	Assurance Component
Security Target (ASE)	Conformance claims (ASE_CCL.1)
	Extended components definition (ASE_ECD.1)
	ST introduction (ASE_INT.1)
	Security objectives for the operational environment (ASE_OBJ.1)
	Stated security requirements (ASE_REQ.1)
	Security Problem Definition (ASE_SPD.1)
	TOE summary specification (ASE_TSS.1)
Development (ADV)	Basic functional specification (ADV_FSP.1)
Guidance documents (AGD)	Operational user guidance (AGD_OPE.1)
	Preparative procedures (AGD_PRE.1)
Life cycle support (ALC)	Labeling of the TOE (ALC_CMC.1)
	TOE CM coverage (ALC_CMS.1)
Tests (ATE)	Independent testing – conformance (ATE_IND.1)
Vulnerability assessment (AVA)	Vulnerability survey (AVA_VAN.1)

6.2.2 Security Assurance Requirements for the TOE

This ST conforms to the [NDcPP], which draws from the CC Security Assurance Requirements (SARs) to frame the extent to which the evaluator assesses the documentation applicable for the evaluation and performs independent testing.

6.3 Rationale

This ST claims exact conformance to cPP. Therefore:

- All secure usage assumptions, organizational security policies, and threats are completely covered by security objectives.
- Each objective counters or addresses at least one assumption, organizational security policy, or threat.
- The set of components (requirements) in the ST are internally consistent and complete.

7. TOE Summary Specification

This section provides evaluators and potential consumers of the TOE with a high-level description of each SFR, thereby enabling them to gain a general understanding of how the TOE is implemented. These descriptions are intentionally not overly detailed, thereby disclosing no proprietary information. These sections refer to SFRs defined in Section 6, Security Requirements.

The TOE consists of the following Security Functions:

- Security Audit
- Cryptographic Support
- Identification and Authentication
- Security Management
- Protection of the TSF
- TOE Access
- Trusted Path/Channels

7.1 Security Audit (FAU)

FAU_GEN.1, FAU_GEN.2

The TSF generates audit records of security relevant events using Linux rsyslog daemon. Individual processes write messages to the rsyslog daemon interface as soon as their events happen. The messages describe the events and their severity. When the AAA or CLI modules write their messages, they add the subject identity, i.e., username, to the messages whenever applicable. The rsyslog daemon adds time stamps to the messages from the system clock and routes them as soon as it receives them. There are two targets specified for rsyslog daemon to route messages to: local Flash and connection endpoint to the remote audit server. Thus, the rsyslog daemon makes one copy of audit log on the local Flash memory and sends another copy to the configured remote audit server as soon as they are generated. Each audit record generated by the TSF includes the date and time stamp of when the event that generated the audit record occurred, type, subject identity (IP address, hostname, and/or username), the outcome (success or failure), and any additional information specified in Table 7.

The following security relevant events are logged:

- Start-up and shut-down of the audit functions:
 - The auditing functions can be stopped with the “no logging on” CLI command and started with the “logging on” CLI command.
- All of the following administrative action events:
 - Administrative login and logout
 - The name of the user account is included in the audit records.
 - Security related configuration changes
 - In addition to the information that a change occurred, what has been changed is included in the audit records.
 - Changes to cryptographic keys performed by security administrators:
 - Generating SSH key pair. The same key pair is used by both SSH server and client.
 - Generating key pair for Certificate Signing Request (CSR).
 - Importing of new TLS server certificate.

In each of the above cases, SHA-256 hash of the public key or the certificate file is included in the audit log to uniquely identify them.
 - Resetting passwords
 - These audit records include the name of related user account.
- Specifically defined auditable events listed in Table 7.

FAU_STG_EXT.1

Audit logs generated by the TSF are stored locally in the persistent Flash memory. The maximum size for the file storing the local audit logs is configurable. When the file exceeds its size limit, it is trimmed to remove the oldest audit logs until the size drops below the configured threshold. Locally stored audit records are protected from unauthorized viewing, modification and deletion by the file system’s read/write permissions and a restrictive CLI which only allows identified, authorized and authenticated administrative users read/write access. The Security Administrative user can delete the locally stored audit records. Modification of the audit records other than deleting them is not supported.

The logs can also be sent to configured remote audit server in syslog format as soon as they are generated. To protect the audit records in transit from the TOE to the remote audit server in the Operational Environment, the TOE establishes a Trusted Channel between itself and the external audit server using the SSHv2 protocol. The Trusted Channel is created when the TOE establishes an SSH session between itself and the remote audit server with TCP port forwarding enabled. After the SSH session is established, the TOE is configured by the Security Administrative user to forward all messages received by the syslog process to the listening TCP port created by the SSH connection. This ensures that all audit traffic is encapsulated and hence protected by the SSH connection.

7.2 Cryptographic Support (FCS)

The TOE contains Arista EOS Crypto Module v2.0 which uses the underlying OpenSSL FIPS Object Module 2.0.16 library for all cryptographic operations. The TSFs utilize CAVP validated cryptographic algorithms listed in Table 9.

Table 9: Cryptographic Algorithms

SFR	Description	Details	Cert. #
FCS_CKM.1 Cryptographic Key Generation	RSA schemes using cryptographic key sizes of 2048-bit or greater that meet the following: FIPS PUB 186-4, "Digital Signature Standard (DSS)", Appendix B.3	Key Generation: Public Key Exponent: Random Probable Primes with Conditions: Mod lengths: 2048 Primality Tests: C.2 or C.3	#A2946
	ECDSA schemes using curve P-384 that meet the following: FIPS PUB 186-4, "Digital Signature Standard (DSS)", Appendix B.4	Curve: P-384 Secret Generation Mode: Extra Bits, Testing Candidates	
	FFC Scheme using safe primes that meet the following: RFC 3526, RFC 7919	Safe Primes Key Generation Safe Prime Groups: ffdhe2048, ffdhe3072, MODP-2048, MODP-3072,	
FCS_CKM.2 Cryptographic Key Establishment	RSA-based key establishment schemes	RSA-based key establishment schemes that meet the following: RSAES-PKCS1-v1_5 as specified in Section 7.2 of RFC 3447, "Public-Key Cryptography Standards (PKCS) #1: RSA Cryptography Specifications Version 2.1";	Vendor Affirmed
	FFC Schemes using "safe prime" groups.	<u>FFC Schemes using "safe-prime" groups that meet the following: 'NIST Special Publication 800-56A Revision 3, "Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm</u>	KAS-FFC-SSC #A2946

SFR	Description	Details	Cert. #
		<u>Cryptography” and [RFC 3526, RFC 7919</u>	
FCS_COP.1/ DataEncryption	<u>AES-CBC as specified in ISO 10116,</u> <u>AES-GCM as specified in ISO 19772</u>	AES, Mode: CBC, GCM, Direction: Decrypt and Encrypt, Key Length: 128, 256	#A2946
FCS_COP.1/SigGen	RSA schemes using cryptographic key sizes of 2048-bit or greater that meet the following: FIPS PUB 186-4, “Digital Signature Standard (DSS)”, Section 5.5, using PKCS #1 v2.1 Signature Schemes RSASSA-PSS and/or RSASSAPKCS1v1_5; ISO/IEC 9796-2, Digital signature scheme 2 or Digital Signature scheme 3 ECDSA schemes using curve P-384 that meet the following: FIPS PUB 186-4, “Digital Signature Standard (DSS)”, Section 6 and Appendix D, Implementing “NIST curves” P-256, P-384, ISO/IEC 14888-3, Section 6.4	RSA Signature Generation and signature verification Type: PKCS1.5: Modulo: 2048 SHA: SHA-1 or SHA-256 or SHA-384 or SHA-512 ECDSA signature generation and signature verification. Capabilities: <ul style="list-style-type: none"> • Curve: P-384 • Hash Algorithm: SHA2-256, SHA2- 384, SHA2-512 	#A2946
FCS_COP.1/Hash	SHS that meets ISO/IEC 10118-3:2004. SHA Bit-oriented Mode Byte-oriented Mode	SHA-1 or SHA-256 or SHA-384 or SHA-512	#A2946

SFR	Description	Details	Cert. #
FCS_COP.1/ KeyedHash	HMAC that meets: ISO/IEC 9797-2:2011, Section 7 "MAC Algorithm 2"	HMAC-SHA2-256 HMAC-SHA2-384 HMAC-SHA2-512 Key Sizes < Block Size Key Sizes > Block Size Key Sizes = Block Size	#A2946
FCS_RBG_EXT.1 Random Bit Generation	in accordance with ISO/IEC 18031:2011 using <u>CTR_DRBG (AES)</u> .	Counter DRBG, Mode: AES-256	#A2946

FCS_CKM.1

The TSF supports generation of 2048-bit RSA asymmetric keys for eAPI TLS server authentication and for the SSH client and the SSH server authentication. Additionally, ECDSA host keys may be used for the SSH client and the SSH server authentication. The supported RSA scheme meets the FIPS PUB 186-4, Digital Signature Standard (DSS), Appendix B.3 standard. The supported ECDSA scheme meets the FIPS PUB 186-4, Digital Signature Standard (DSS), Appendix B.4. The TSF generates the Diffie-Hellman asymmetric keys for the session key establishment in accordance with SP 800-56a Rev3 for SSH and TLS sessions according to RFC 3526 and RFC 7919.

FCS_CKM.2

The session keys for both SSH and TLS are generated with Diffie Hellman (DH) key exchange. The OpenSSL library is used to perform DH operations of key pair generation and common secret computation using values of DH prime and DH generator are as specified in SP 800-56a Rev3 and RFC 3526 and RFC 7919. Depending on the TLS cipher suite used during a TLS communication, session keys for TLS are also generated using RSA key establishment schemes that adhere to RSAES-PKCS1-v1_5, as specified in Section 7.2 of RFC 3447, "Public-Key Cryptography Standards (PKCS) #1: RSA Cryptography Specifications Version 2.1".

FCS_CKM.4

The TOE destroys Critical Security Parameters (CSPs) when no longer required. The zeroization procedures for different CSPs in the TOE are described in Table 10.

The private keys of RSA used during the SSH, and the TLS authentication are persisted in flash memory. If a persistent key is removed or replaced by the Security Administrator, the old persistent key is zeroized by a single direct overwrite consisting of zeroes.

The programmatic destruction of keys is carried out by using a specialized algorithm that overwrites the file location with a successive random and all-zero patterns and then ensures that the key is destroyed by reading it back. This is done before writing the new key to the file. This ensures that any updates to the cryptographic key files (creation, modification, deletion) result in all previous key files being destroyed prior to the new values being written. As such, there is no delay in the destruction of keys. At the physical layer, non-volatile memory is implemented on the TOE by either eUSB, eMMC, or SSD devices. These non-

volatile memory devices have written endurance of at least 17 TB, which under normal usage are expected to last the lifetime of the device. In the unlikely event that there is a write-failure the issue will be reported in the logging system. In such circumstances it is recommended to replace the media and physically destroy the faulty non-volatile memory device.

The DH keys and the session keys of TLS and SSH are ephemeral keys, and they are stored in the TOE's RAM device. They are zeroized by a single direct overwrite consisting of zeroes, by the time the corresponding TLS or SSH session terminates.

Table 10: CSPs

CSP	Purpose	Generation	Clearing Method	When cleared	Storage Location
TLS Server: RSA Private Key	"eAPI" server authentication	Generated internally when TLS server is first started or when new key pair is requested by Security Administrator	Single direct overwrite consisting of zeroes	When replaced by the Security Administrator	Flash
TLS Server: DH Private Key	Establish session keys for TLS session	Generated internally at the start of TLS session	Single direct overwrite consisting of zeroes	When TLS session keys are derived	RAM
TLS Server: Session Keys	Message authentication and encryption in TLS session	Generated internally at the start of TLS session	Single direct overwrite consisting of zeroes	When TLS session terminates	RAM
SSH Server: RSA Private Key	SSH host authentication for remote administrative session	Generated internally when SSH service on the TOE is first started or when new key pair is requested by Security Administrator.	Single direct overwrite consisting of zeroes	When replaced by the Security Administrator	Flash
SSH Server: DH Private Key	Establish session keys for SSH session	Generated internally at the start of SSH session	Single direct overwrite consisting of zeroes	When SSH session keys are derived	RAM

CSP	Purpose	Generation	Clearing Method	When cleared	Storage Location
SSH Server: Session Keys	Message authentication and encryption in SSH session	Generated internally at the start of SSH session	Single direct overwrite consisting of zeroes	When SSH session terminates	RAM
SSH Client: RSA Private Key	SSH client authentication to audit server	Generated internally when SSH service on the TOE is first started or when new key pair is requested by Security Administrator.	Single direct overwrite consisting of zeroes	When replaced by the Security Administrator	Flash
SSH Client: ECDSA Private Key	SSH client authentication to audit server	Generated internally when SSH service on the TOE is first started or when new key pair is requested by Security Administrator.	Single direct overwrite consisting of zeroes	When replaced by the Security Administrator	Flash
SSH Client: DH Private Key	Establish session keys for SSH session	Generated internally at the start of SSH session	Single direct overwrite consisting of zeroes	When SSH session keys are derived	RAM
SSH Client: Session Keys	Message authentication and encryption in SSH session	Generated internally at the start of SSH session	Single direct overwrite consisting of zeroes	When SSH session terminates	RAM

FCS_RBG_EXT.1

The TOE uses a platform-based CTR_DRBG (AES-256) random bit generator (DRBG) that complies with NIST SP 800-90 for all cryptographic operations. Each DRBG instance is seeded with full 384 bits of entropy (256 bits for AES key and 128 bits for nonce) sourced from Linux Random Number Generator (LRNG) operating in a blocking mode (/dev/random). The LRNG accumulates entropy from the Infineon SLB9670 Trusted Platform Module. The detailed entropy justification is provided in [ENT].

FCS_SSHC_EXT.1

The TOE utilizes SSHv2 to support Trusted Channel to external audit server. The SSH implementation conforms to the following RFCs:

- 4251 - The Secure Shell (SSH) Protocol Architecture
- 4252 - The Secure Shell (SSH) Authentication Protocol
- 4253 - The Secure Shell (SSH) Transport Layer Protocol
- 4254 - The Secure Shell (SSH) Connection Protocol
- 5656 - Elliptic Curve Algorithm Integration in the Secure Shell Transport Layer
- 6668 - SHA-2 Data Integrity Verification for the Secure Shell (SSH) Transport Layer Protocol
- 8332 - Use of RSA Keys with SHA-256 and SHA-512 in the Secure Shell (SSH) Protocol

The TOE performs the role of SSH client in Trusted Channel. The TSF ensures that the SSH client authenticates the identity of the audit server using the `/etc/ssh/known_hosts` file which associates each server host name with its corresponding public key as described in RFC 4251. For this, the TSF compares the received host key from the audit server during the SSH handshake and compares it to the keys configured in the `known_hosts` file. If there is a match, the connection establishment process proceeds. If there is no match found, the session is terminated. SSH client authenticates to the audit server using public key.

The following public key scheme is supported: `rsa-sha2-256` that uses 2048-bit RSA key and SHA-256 digital signature or `ecdsa-sha2-nistp384`.

The SSH client session keys are established using DH key exchange. The scheme supported is: `diffie-hellman-group14-sha1`. It supports 2048-bit asymmetric keys (DH Group 14). It uses SHA-1 for exchange hash. Exchange hash is the hashing method used to generate session keys hierarchy from the shared secret derived from DH key establishment.

The encryption/decryption cipher supported is AES-CBC with 128 and 256 key lengths. The Message authentication code supported are `hmac-sha2-256` and `hmac-sha2-512`.

The TOE utilizes OpenSSH as the software for SSH client capabilities. OpenSSH employs a default maximum packet size of 256 KB for SSH connections. Throughout the SSH connection establishment process, OpenSSH actively monitors and validates the size of incoming packets. If a packet is found to exceed the allowed size, OpenSSH will terminate the connection. This ensures compliance with the specified behavior outlined in RFC 4253.

The TOE's SSH client performs rekeying when 1 GB of SSH data has been sent, or after 1 hour of that session being open. A counter in the SSH code keeps track of the sent SSH data packets. If the data counter reaches 1 GB, or if the time counter reaches 1 hour, the TSF sends a 'Key Exchange Init' message to the peer to initiate a new key-exchange negotiation. If the new key-exchange fails to establish a new key for the session, the session is terminated by the TSF.

FCS_SSHS_EXT.1

The TOE utilizes SSHv2 to support a Trusted Path for remote administration session. The SSH server implementation conforms to the following RFCs:

- 4251 - The Secure Shell (SSH) Protocol Architecture
- 4252 - The Secure Shell (SSH) Authentication Protocol
- 4253 - The Secure Shell (SSH) Transport Layer Protocol
- 4254 - The Secure Shell (SSH) Connection Protocol
- 5656 - Elliptic Curve Algorithm Integration in the Secure Shell Transport Layer
- 6668 - SHA-2 Data Integrity Verification for the Secure Shell (SSH) Transport Layer Protocol

- 8332 - Use of RSA Keys with SHA-256 and SHA-512 in the Secure Shell (SSH) Protocol

The TOE performs the role of SSH server in Trusted Path. The SSH server in the TOE authenticates remote administrative user using public key or password. The following public key scheme is supported: rsa-sha2-256 that uses 2048-bit RSA key and SHA-256 digital signature or ecdsa-sha2-nistp384.

In the case that the TOE's SSH server authenticates the SSH client using the public key mechanism. The TSF ensures that the SSH server verifies the identity of the SSH client by utilizing the "/etc/ssh/known_hosts" file, which associates each client host name with its corresponding public key as specified in RFC 4251. To accomplish this, the TSF compares the host key received from the SSH client during the SSH handshake with the keys configured in the known_hosts file. If a match is found, the connection establishment process continues. However, if no match is found, the session is terminated.

In password-based authentication, once a user initiates a connection to the administration interface, they are prompted to provide username and password credentials. After a user provides a username and password, the TOE invokes a PAM (Pluggable Authentication Modules) AAA plugin.

The SSH session keys are established using DH key exchange. The scheme supported is: diffie-hellman-group14-sha1. It supports 2048-bit asymmetric keys (DH Group 14). It uses SHA-1 for exchange hash. Exchange hash is the hashing method used to generate session keys hierarchy from the shared secret derived from DH key establishment.

The encryption/decryption cipher supported is AES-CBC with 128 and 256 key lengths. The Message authentication code supported are hmac-sha2-256 and hmac-sha2-512.

The TOE utilizes OpenSSH as the software for SSH server capabilities. OpenSSH employs a default maximum packet size of 256 KB for SSH connections. Throughout the SSH connection establishment process, OpenSSH actively monitors and validates the size of incoming packets. Should a packet be identified as exceeding the specified maximum size, OpenSSH adheres to the requirements outlined in RFC 4253 and terminates the connection.

The TOE's SSH server performs rekeying when 1 GB of SSH data has been sent, or after 1 hour of that session being open. A counter in the SSH code keeps track of the sent SSH data packets. If the data counter reaches 1 GB, or if the time counter reaches 1 hour, the TSF sends a 'Key Exchange Init' message to the peer to initiate a new key-exchange negotiation. If the new key-exchange fails to establish a new key for the session, the session is terminated by the TSF.

FCS_TLSS_EXT.1 and FCS_TLSS_EXT.2

The TOE allows for automated remote management of the TSF via the eAPI JSON-RPC ("eAPI") interface. The communication channel is protected by TLS TLSv1.2 with mutual authentication. The TOE incorporates the nginx server to handle TLS connections. When configured to utilize the TLS version 1.2 option, the nginx server is explicitly set to exclusively accept TLS 1.2 protocols from the list of permitted protocols. As a result, any attempts to establish a session using other TLS or SSL versions, including SSL 1.0, SSL 2.0, SSL 3.0, TLS 1.0, and TLS 1.1, are categorically denied by the TSF. The following TLS ciphersuites are supported:

- TLS_RSA_WITH_AES_128_CBC_SHA256 as defined in RFC 5246
- TLS_RSA_WITH_AES_256_CBC_SHA256 as defined in RFC 5246
- TLS_DHE_RSA_WITH_AES_128_CBC_SHA256 as defined in RFC 5246
- TLS_DHE_RSA_WITH_AES_256_CBC_SHA256 as defined in RFC 5246
- TLS_RSA_WITH_AES_256_GCM_SHA384 as defined in RFC 5288
- TLS_DHE_RSA_WITH_AES_256_GCM_SHA384 as defined in RFC 5288

The TOE acts as a TLS server to the eAPI TLS client in the operational environment. To support the TLS server authentication to the eAPI client, the TSF needs to be configured with an RSA 2048-bit public-key in the x.509v3 certificate format.

When the TSF is establishing a TLS session utilizing a ciphersuite with RSA key establishment (key transport), the TSF only acts as the receiver of the encrypted pre-master secret. When the TSF is establishing a TLS session utilizing a ciphersuite with DHE key establishment, the TSF supports `ffdhe2048`, `ffdhe3072`, and `ffdhe4096` safe primes per RFC 7919. The TSF sends public key from the pair to the peer to facilitate pre-master secret establishment.

The TLS server supports authentication of the eAPI TLS client. The Security Administrator configures TLS server with trusted CA certificate used to validate the eAPI TLS client certificate. The trusted CA certificate is then associated to a Security Administrative user account. This particular administrative account is only to be used by the eAPI. This is to ensure that there is no ambiguity when viewing the audit records as to whether a human user's action or the eAPI's action generated the audit record. When eAPI TLS client attempts to establish a session with the TSF, the TSF responds to the client by sending a `Certificate_Request` message immediately after the `ServerKeyExchange` message is sent during the TLS handshake. The client must send a `Client_Certificate` message containing an RSA 2048-bit public-key in the x.509v3 certificate to authenticate the client to the TSF. The TSF validates the client certificate according to FIA_X509_EXT.1.1, checks that it is signed by the trusted CA, checks the local CRL for the revocation status of the client certificate. The TSF does not support an administrator override function, if any of these x509 certificate validity checks fail, the session is terminated.

If the client certificate validity checks passes, the TSF checks to see if the CN value matches the username of the account specifically configured for the eAPI client. If no match is found, TSF will terminate the attempted session establishment. If a match is found, TSF allows the authentication process to complete and the session to successfully establish. The TSF does not process SAN value in the client certificate.

The TLS server implements session resumption using session IDs according to RFC 5246 (TLS 1.2) without any context.

The TOE provides support for password-based authentication as a fallback option. The availability of fallback authentication depends on the configuration of the "secret" parameter in the "username" command. If the "secret" parameter is configured with a password, fallback authentication is enabled. In this case, the client can authenticate by providing their password instead of a client certificate. However, if the "secret" parameter is configured with the "*" (asterisk) character, the fallback authentication is disabled. In this scenario, the client will not be able to authenticate using their password.

7.3 Identification and Authentication (FIA)

FIA_AFL.1

Consecutive authentication failures result into temporary account lockout for remote administrative user. The threshold number of failures between 1 and 255 and subsequent lockout period are configured by Security Administrator when initializing the TOE. The RS-232/VT-100 local administrative interface is never locked out.

FIA_PMG_EXT.1

The Security Administrator passwords are able to be composed of any combination of upper- and lower-case letters, numbers, and the following special characters: "!", "@", "#", "\$", "%", "^", "&", "*", "(", ")".

Minimum length of the password is configurable by the Security Administrator between 1 and 32. It is recommended to configure minimum length as at least 8.

FIA_UIA_EXT.1, FIA_UAU_EXT.2

The TSF provides a local administrative CLI interface over RS-232/VT-100 that supports password-based authentication. It also provides remote administrative CLI interface over SSH that supports password-based and public key-based authentication.

In password-based authentication, once a user initiates a connection to the administration interface, they are prompted to provide username and password credentials. After a user provides a username and password, the TOE invokes a PAM (Pluggable Authentication Modules) AAA plugin. This plugin is configured to use the RBAC (Role Based Access Control) module. The AAA plugin passes the authentication credentials to the RBAC module. The RBAC module checks the credentials against its database and then responds with a SUCCESS or DENIED message. Based on the response from the RBAC module, the AAA plugin then returns a SUCCESS or DENIED message to the requesting program. If the requesting program receives a DENIED message, it prints an error message to the user and denies the login attempt. If the requesting program receives a SUCCESS message, it makes an EXEC authorization request to the RBAC module, which responds with the additional permissions for the CLI. At this point, authentication is successful, and the user is presented with the CLI.

When RSA public key authentication is used with a remote SSH session, the SSH daemon performs the initial authentication verification locally by comparing public key supplied by the client with `/home/<account>/.ssh/authorized_keys`. Once the public key matches, the daemon performs an EXEC authorization request to the RBAC module as detailed above.

The TSF also provides “eAPI” interface over TLS for remote automated configuration. The details of eAPI authentication process are provided above in FCS_TLSS_EXT.2. After the authentication is successful, EXEC authorization request is made to the RBAC module.

The TSF displays a warning banner (in accordance with FTA_TAB.1) on CLI prior to requiring identification and authentication. This banner is not required to be, nor is it, presented to the eAPI JSON-RPC client prior to it authenticating to the TSF.

FIA_UAU.7

The TSF does not echo back the characters that are entered when users attempt to authenticate to the local console when using a password credential.

FIA_X509_EXT.1/Rev, FIA_X509_EXT.2, FIA_X509_EXT.3

The TOE performs the role of TLS server in eAPI trusted channel communication. Security Administrator installs x.509v3 certificate in the TLS server. To facilitate this, Security Administrator first generates certificate signing request (CSR). CSR causes generation of 2048-bit RSA private and public key pair in the TOE. It encapsulates the public key, along with Common Name, Organization, Organizational Unit, and Country information, in a format that can be submitted to certificate authority (CA) for creating signed x.509v3 certificate. The security Administrator obtains the signed certificate from the CA and imports in the TOE. Following conditions are checked at the time of import and the import is rejected if any of the following conditions do not check:

- That the entire chain of certificates is imported. That is, the leaf TLS server certificate, any intermediate certificates leading from the leaf up to the root and the root certificate are imported.
- That the current date and time lies between the “Valid from” and “Valid to” for each certificate.

- That the basicConstraints extension is included with CA flag is set to TRUE for all CA certificates in the chain
- That the extendedKeyUsage field in the leaf certificate has the Server Authentication purpose (id-kp 1 with OID 1.3.6.1.5.5.7.3.1)
- That the digital signatures are correct in all certificates
- That none of the certificates from the leaf up to the root is revoked.

The above certificate chain is presented to the eAPI client at the beginning of TLS connection. This facilitates the eAPI client to validate identity of the server.

At the time of establishing TLS connection, the eAPI client presents its x.509v3 certificate to the TLS server in the TOE. This certificate is used by the TOE to authenticate the eAPI client. The TOE performs following checks on the certificate presented by the eAPI client:

- That the certificate chain presented by the eAPI client can be traced to the CA certificate that is lowest in the hierarchy of certificates imported into the TOE as described above. That is, this lowest CA certificate acts as the trust anchor. Note that the trust anchor can be an intermediate CA certificate or the root CA certificate.
- That the current date and time lies between the “Valid from” and “Valid to” for each certificate from the leaf certificate in the chain presented by eAPI client up to and including the trust anchor.
- That the basicConstraints extension is included with CA flag is set to TRUE for all CA certificates in the chain.
- That the extendedKeyUsage field in the leaf certificate in the chain presented by eAPI client has the Client Authentication purpose (id-kp 2 with OID 1.3.6.1.5.5.7.3.2).
- That the digital signatures are correct in all certificates.
- That none of the certificates from the leaf up to the trust anchor is revoked. It is not necessary to check revocation status of the trust anchor and other CA certificates upstream of the trust anchor.
- The x509 certificate must have the username as the CN attribute in the Subject field. This is to tie the username to the allowed role in the TOE.

If any of the checks mentioned above fails, then the TLS connection is rejected.

The TOE does not provide support for code signing and OCSP signing attributes in the extendedKeyUsage field of the leaf certificate when presented by the e-API client or when included in an x509 certificate imported into its trusted store.

The TOE verifies the client identity of eAPI by inspecting the CN field in the presented x509 certificate during the eAPI client connection. The connection of the eAPI client will be successful only if the CN field matches a username configured in the TOE. Otherwise, the connection will be rejected.

In order to facilitate revocation checking on the eAPI client certificate chain as described above, Security Administrator specifies Certificate Distribution Points (CDPs) during initial configuration of the TOE. Security Administrator is required to specify CDPs for the CRLs published by the trust anchor and every CA certificate between the trust anchor and the leaf certificate of the eAPI client. The TOE downloads CRLs from the specified CDPs every configurable time period and stores the most recently fetched CRLs locally. Digital signatures on downloaded CRLs are validated and in case of failure of signature verification, CRL is not added to the local copy. The local copies of the CRLs are used for certificate revocation checking. At the time of revocation checking, the TOE ensures that the current time lies within the validity period of the CRL, that is between the effective date and the next update date mentioned in the CRL. The certification revocation checking can fail either because the certificate is revoked as per the CRL or

because the recent CRL for the CA that issued the certificate is not present in the local copy to perform the revocation checking.

7.4 Security Management (FMT)

FMT_MOF.1/Functions

See description under **FAU_STG_EXT.1**.

FMT_MOF.1/ManualUpdate

See description under **FPT_TUD_EXT.1**.

FMT_MTD.1, FMT_SMF.1, FMT_SMR.2

The TSF maintains the ‘Security Administrator’ role and allows that role to be associated to users of the TOE. The Security Administrator role is enforced via the permission features of the base Linux kernel of the EOS operating system. Users are associated with credentials for identification and role for authorization to the TOE. In addition, users’ permissions are assigned and enforced by the base Linux kernel filesystem of EOS via read/write/execute permissions and group policies that ensure that only Security Administrative users can manage the TSF data. The TSF restricts the ability to manage (i.e. create, view, initialize, modify/append, delete/clear, and change the default setting) of the TSF data to only identified, authenticated and authorized Security Administrators.

The local console and remote management interfaces allow the Security Administrator to perform the following TSF management functions:

- Administer the TOE locally and remotely
- Create the TOE access banner
- Set the session inactivity timeout values
- Verify and manually install firmware updates (verification using published hash)
- Configure failed login threshold and lockout period
- Generate, import, delete and configure cryptographic keys required by SSH and TLS
- Specify ciphersuites for SSH and TLS
- Configure syslog forwarding
- Set system time
- Import x.509v3 certificates in trust store

7.5 Protection of the TSF (FPT)

FPT_SKP_EXT.1

Refer to Table 10 for a list of private keys and symmetric keys. The TOE stores these keys in plaintext in locations described for them in Table 10. The administrative interface does not provide a documented command for any user to view any of the private or session keys. There are no pre-shared keys.

FPT_APW_EXT.1

The TSF does not store passwords in plaintext. The TSF uses SHA-512 hash (with a salt) protection to ensure that any users’ password is not stored in plaintext. When a user authenticates to the TSF (local or remote), the system generates a hash of the entered password and compares it against the stored hash

value of the password associated to the username provided to ensure that the plaintext password is not disclosed.

FPT_TST_EXT.1

These following paragraphs describe the different types of self-tests in the context of a cryptographic library and the verification process for the EOS image:

Software Integrity Test:

The software integrity test is designed to verify the integrity of the cryptographic library's software components. By calculating the HMAC-SHA-1 value of the core binaries and comparing it against the compile-time value, this test ensures that the software has not been tampered with or modified. The result of this test provides an assurance of the software's integrity, indicating whether it remains unchanged from its original state. A successful result confirms that the cryptographic library's software is trustworthy and free from unauthorized alterations.

Cryptographic Self-Tests:

These self-tests are automatically initiated whenever programs utilizing the cryptographic libraries are loaded. This includes scenarios such as starting the SSH server, SSH client, TLS server, or enabling 'FIPS mode' on the TOE. The purpose of cryptographic self-tests is to assess the functionality and security of the cryptographic algorithms used in SSH and TLS implementations within the TSF. These self-tests involve conducting Known Answer Tests (KAT) for various cryptographic algorithms, such as RSA, AES, HMAC, SHA, and the DRBG. The results of these tests ensure that the cryptographic algorithms operate correctly, providing expected and secure outputs.

Pairwise Consistency Test:

The pairwise consistency test is executed upon the generation of an RSA key pair. The purpose of the pairwise consistency test is to validate the consistency of the RSA key pair. This test ensures that the generated public and private keys align correctly, maintaining their cryptographic properties. A successful test result signifies that the RSA key pair generation process has produced a reliable and internally consistent key pair. In the event of a test failure, where the generated keys do not match as expected, the cryptographic functionality relying on those keys within the TSF may become unavailable. Additionally, an audit record is generated to capture the failed test result, providing a record for further investigation and analysis.

Continuous Test (CRNGT):

The continuous test, known as CRNGT (Continuous Random Number Generator Test), is conducted on the DRBG. The CRNGT involves continuous testing of the DRBG to identify any stuck faults that may impact its randomness generation. The purpose of the continuous test is to maintain the quality and reliability of the DRBG, which is crucial for generating secure and unpredictable random numbers. Detecting stuck faults helps prevent biased or predictable outputs from the DRBG, ensuring the cryptographic operations relying on random numbers remain secure.

These four distinct tests provide ample evidence to conclude that the TSF operates correctly. They comprehensively assess all the cryptographic functions performed by the TSF through cryptographic self-tests, pairwise consistency tests, and CRNGT. Additionally, the software integrity test safeguards against any modifications to the tests themselves.

By continuously covering all the cryptographic functions within the TSF and ensuring their integrity, these tests effectively fulfill the requirements for evaluating the TSF's correct operation. Therefore, it can be confidently asserted that no additional tests are necessary.

FPT_TUD_EXT.1

The software updates are verified using SHA-512 published hash values. The update is performed by Security Administrator and only on the SSH remote management console. The candidate update package is downloaded from the Arista's customer portal. Arista customers require a valid credential to login to this portal to obtain the candidate updates. The candidate updates are provided with a separate download of the SHA-512 hashed value of the update package. The Security Administrator is required to transfer the downloaded candidate package from a trusted terminal to the TOE using secure means; typically, SCP (secure copy) is utilized. The SHA-512 checksum of the candidate file is to be generated on the candidate update package that was securely copied to the TOE. This is done by issuing the following command: *sha512sum <update-package>*. The Security Administrator must verify that the on-screen output of the checksum of the candidate update package matches the published hash of the candidate update package before initiating the installation of the candidate update package. The Security Administrator accomplishes this by visually comparing the published checksum to the checksum of the candidate update package that was generated by the Security Administrator. If the hash generated does not match the published hash for the candidate update, the Security Administrator is instructed not to proceed further.

Upon verifying the integrity of the TOE's new installation file, the administrator of the TOE modifies the boot-config file to indicate the location of the new image in the flash folder. The configuration is then saved to the startup-config file, and the TOE is rebooted to apply the new installation file. During this process, there will be a short period of disruption affecting all functions and features until the switch is successfully reinitialized with the updated image. After the reboot process is completed, all functions and features will be restored to their normal operational state. The security Administrator can verify the version of currently running EOS with "show version" CLI command.

FPT_STM_EXT.1

The following TSFs make use of the system time:

- Time stamping of TSF generated audit records
- Refetching of the new CRL at the end of validity period of the previous CRL and to check that the time when the certificate is presented to the TOE lies within the validity period of the CRL
- Time keeping of interactive sessions between the Security Administrator and the TSF (local console, remote SSH console interfaces) for the purpose of TSF termination of the interactive sessions due to inactivity.

The initial system time is manually configured by the Security Administrator using the CLI interface. After that, two components are responsible to keep the system time, namely, the Real Time Clock (RTC) and the "system clock". The RTC is battery powered and keeps track of time even when the TOE is not provided with power from an A/C source. The system clock is a software counter based on the timer interrupt. The system clock is reset after power cycle and gets initialized by the RTC during boot-up. The RTC is maintained by an oscillator with an accuracy of 20 PPM.

The system clock and RTC can be expected to drift over time since both lack access to a reference source. Over the course of one month, this drift will be linear and has small upper bounds. For the RTC the absolute value of the drift is expected to be 1 minute or less per 30 days. For the system clock the absolute value of the drift is expected to be 3.9 seconds or less per 30 days. In order to limit the amount of drift, Security Administrator will be expected to set the clock on the TOE using a CLI command, once every 30

days. This new time must come from legitimate time source, meeting Common Criteria requirements. Upon setting the time via the CLI command, both the system clock and the RTC will be set and the amount of drift from the real time will be reduced to 0.

7.6 TOE Access (FTA)

FTA_SSL_EXT.1, FTA_SSL.3

The security Administrator can configure a time period to be used to automatically terminate administrative session after inactivity. For local and remote administrative session, the TSF terminates the session after this period of inactivity. To facilitate this, a timer is started for the session after successful authentication of Security Administrator. The timer is reset each time the Security Administrator provides input. If the Security Administrator does not provide input for a duration of configured inactivity period, the TSF terminates the administrative session.

FTA_SSL.4

The TSF provides the means for the Security Administrator to manually terminate their own interactive sessions with the TOE for both the local and remote administrative sessions. For this, the Security Administrator can issue the “quit”, “logout” or “exit” command to terminate their own session.

FTA_TAB.1

Before establishing an administrative user session to the TSF, the TSF displays a Security Administrator-specified advisory notice and consent warning message (banner). The banner is presented prior to human user authentication on each of the TOE’s administrative interfaces. This banner is not required to be, nor is it, presented to the eAPI JSON-RPC client prior to it authenticating to the TSF. The banner can be configured via any one of the following administrative interfaces: Local console (serial port), remote console (SSH), remote management (eAPI JSON-RPC client).

7.7 Trusted Path/Channels (FTP)

FTP_ITC.1

The trusted Channel connection is created between TSF and audit server. It is protected by SSH. The TOE acts as SSH Client in the Trusted Channel connection to audit server. The operation of SSH is described above in FCS_SSHC_EXT.1.

The trusted Channel connection is created between TSF and eAPI JSON-RPC Client. It is protected by TLS. The TOE acts as TLS Server in the Trusted Channel connection to eAPI JSON-RPC Client. The operation of TLS is described above in FCS_TLSS_EXT.2.

FTP_TRP.1

The trusted Path connection protects communication between TSF and a human user (Security Administrator) performing management of the TSF. It is protected by SSH. The TOE acts as SSH Server in the Trusted Path connection. Operation of SSH is described above in FCS_SSHS_EXT.1.

8. Terms and Definitions

Table 11: TOE Abbreviations and Acronyms

Abbreviations/ Acronyms	Description
AAA	Authentication Authorization and Accounting
CLI	Command Line Interface
CPU	Central Processing Unit
CSP	Critical Security Parameter
JSON	JavaScript Object Notation
KAT	Known Answer Tests
OSI	Open Systems Interconnection
PAM	Pluggable Authentication Modules
RBAC	Role Based Access Control
RPC	Remote Procedure Call
SSH	Secure Shell
TLS	Transport Layer Security

Table 12: CC Abbreviations and Acronyms

Abbreviations/ Acronyms	Description
CC	Common Criteria
PP	Protection Profile
SAR	Security Assurance Requirement
SFR	Security Functional Requirement
ST	Security Target
TOE	Target of Evaluation
TSF	TOE Security Functionality

9. References

Table 13: TOE Guidance Documentation

Reference	Description	Date
[T1]	User Manual - Arista EOS version 4.28.0F	2023
[T1]	Common Criteria Guidance Supplement	July 18, 2023

Table 14: Common Criteria v3.1 References

Reference	Description	Version	Date
[C1]	Common Criteria for Information Technology Security Evaluation, Part 1: Introduction and general model CCMB-2009-07-001	V3.1 R5	April 2017
[C2]	Common Criteria for Information Technology Security Evaluation, Part 2: Security functional components CCMB-2009-07-002	V3.1 R5	April 2017
[C3]	Common Criteria for Information Technology Security Evaluation, Part 3: Security assurance components CCMB-2009-07-003	V3.1 R5	April 2017
[C4]	Common Criteria for Information Technology Security Evaluation. Evaluation Methodology CCMB-2009-07-004	V3.1 R5	April 2017

Table 15: Supporting Documentation

Reference	Description	Version	Date
[S1]	Collaborative Protection Profile for Network Devices	2.2e	March 23, 2020
[ENT]	Annex D: Entropy Documentation for SLB9670	2.1	December 27, 2022