PP-Module for Virtual Private Network (VPN) Clients

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Revision History

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2.1	2019-11-14	Initial Release

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1 Introduction

1.1 Overview

The scope of this PP-Module is to describe the security functionality of a virtual private network (VPN) client in terms of [CC] and to define functional and assurance requirements for such products. This PP-Module is intended for use with the following Base-PPs:

- Protection Profile for General Purpose Operating Systems (OS PP), Version 4.2.1
- Protection Profile for Mobile Device Fundamentals (MDF PP), Version 3.2
- Protection Profile for Application Software (App PP), Version 1.3
- Protection Profile for Mobile Device Management (MDM PP), Version 4.0

These Base-PPs are all valid because a VPN client may be a specific type of stand-alone software application or a built-in component of an operating system, whether desktop or mobile. Regardless of which Base-PP is claimed, the VPN client functionality defined by this PP-Module will rely on the Base-PP. Sections 5.1, 5.2, and 5.3 of this PP-Module describe the relevant functionality for each Base-PP, including specific selections, assignments, or inclusion of optional requirements that must be made as needed to support the VPN client functionality.

1.2 Terms

The following sections list Common Criteria and technology terms used in this document.

1.2.1 Common Criteria Terms

Assurance	Grounds for confidence that a TOE meets the SFRs [CC].
Base Protection Profile (Base-PP)	Protection Profile used as a basis to build a PP-Configuration.
Common Criteria (CC)	Common Criteria for Information Technology Security Evaluation (International Standard ISO/IEC 15408).
Common Criteria Testing Laboratory	Within the context of the Common Criteria Evaluation and Validation Scheme (CCEVS), an IT security evaluation facility, accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) and approved by the NIAP Validation Body to conduct Common Criteria-based evaluations.
Common Evaluation Methodology (CEM)	Common Evaluation Methodology for Information Technology Security Evaluation.
Distributed TOE	A TOE composed of multiple components operating as a logical whole.
Operational Environment (OE)	Hardware and software that are outside the TOE boundary that support the TOE functionality and security policy.
Protection Profile (PP)	An implementation-independent set of security requirements for a category of products.
Protection Profile Configuration (PP-Configuration)	A comprehensive set of security requirements for a product type that consists of at least one Base-PP and at least one PP-Module.
Protection Profile Module (PP-Module)	An implementation-independent statement of security needs for a TOE type complementary to one or more Base Protection Profiles.
Security Assurance Requirement (SAR)	A requirement to assure the security of the TOE.
Security Functional Requirement	A requirement for security enforcement by the TOE.

(SFR)	
Security Target (ST)	A set of implementation-dependent security requirements for a specific product.
TOE Security Functionality (TSF)	The security functionality of the product under evaluation.
TOE Summary Specification (TSS)	A description of how a TOE satisfies the SFRs in an ST.
Target of Evaluation (TOE)	The product under evaluation.

1.2.2 Technical Terms

Administrator	A user that has administrative privilege to configure the TOE in privileged mode.
Authorized	An entity granted access privileges to an object, system or system entity.
Critical Security Parameter (CSP)	Security related information, e.g. secret and private cryptographic keys, and authentication data such as passwords and PINs, whose disclosure or modification can compromise the security of a cryptographic module.
Entropy Source	This cryptographic function provides a seed for a random number generator by accumulating the outputs from one or more noise sources. The functionality includes a measure of the minimum work required to guess a given output and tests to ensure that the noise sources are operating properly.
IT Environment	Hardware and software that are outside the TOE boundary that support the TOE functionality and security policy.
Operational Environment	The environment in which the TOE is operated.
Private Network	A network that is protected from access by unauthorized users or entities.
Privileged Mode	A TOE operational mode that allows a user to perform functions that require IT Environment administrator privileges.
Public Network	A network that is visible to all users and entities and does not protect against unauthorized access (e.g. internet).
Threat Agent	An entity that tries to harm an information system through destruction, disclosure, modification of data, and/or denial of service.
Unauthorized User	An entity (device or user) who has not been authorized by an authorized administrator to access the TOE or private network.
Unprivileged Mode	A TOE operational mode that only provides VPN client functions for the VPN Client user.
VPN Client	The TOE; allows remote users to use client computers to establish an encrypted IPsec tunnel across an unprotected public network to a private network.
VPN Client User	A user operating the TOE in unprivileged mode.
VPN Gateway	A component that performs encryption and decryption of IP packets as they cross the boundary between a private network and a public network.

1.3 Compliant Targets of Evaluation

The TOE defined by this PP-Module is the VPN client, a software application that runs on a physical or virtual host platform, used to establish a secure IPsec connection between that host platform and a remote system. The VPN client is intended to be located outside or inside of a private network, and establishes a secure tunnel to an IPsec peer. For the purposes of this PP-Module, IPsec peers are defined as:

- VPN gateways
- Other VPN clients
- An IPsec-capable network device (supporting IPsec for the purposes of management)

The tunnel provides confidentiality, integrity, and data authentication for information that travels across a less trusted (sometimes public) network. All VPN clients that comply with this document will support IPsec.

This PP-Module extends the GPOS PP when the VPN client is installed on an operating system discussed in that PP (e.g., Windows, Mac OS, Linux). This PP-Module extends the MDF PP when the VPN client is installed on a self-contained mobile device that is bundled with an operating system (e.g. Android, BlackBerry OS, iOS, Windows Mobile). This PP-Module extends the App PP when the VPN client is provided by a third party and is a standalone application that is not a bundled part of an operating system or mobile device. This PP-Module extends the MDM PP when the VPN Client is included with MDM Server software that is used for centralized deployment and administration of enterprise mobile device policies.

As a PP-Module of any of these PPs, it is expected that the content of this PP-Module and the chosen Base-PP be appropriately combined in the context of each product-specific Security Target. This PPModule has been specifically defined such that there should be no difficulty or ambiguity in doing so. When this PP-Module is used, conformant TOEs are obligated to implement the functionality required in the claimed Base-PP with the additional functionality defined in this PP-Module in response to the threat environment discussed subsequently herein.

1.3.1 TOE Boundary

The TOE defined by this PP-Module is purely a software solution executing on a platform (some sort of operating system running on hardware). Depending on the Base-PP claimed as part of the TOE, the platform may also be part of the TOE or it may be an environmental component that the TOE vendor has no control over. Regardless of whether the platform itself is within the scope of the evaluation, the VPN client itself will rely on the platform for its execution domain and proper usage. The vendor is expected to provide sufficient installation and configuration instructions to identify an Operational Environment with the necessary features and to provide instructions for how to configure it correctly.

The PP-Module contains requirements that must be met by the TOE. Depending on the Base-PP that is claimed, there may be some variation in the applicable requirements. This is because a given Base-PP may include one or more requirements that the VPN client can inherit but are not shared amongst each possible Base-PP.

This is somewhat different than other PPs, but addresses most implementations of VPN clients where some part of the functionality of the IPsec tunnel is provided by the platform. In terms of the cryptographic primitives (random bit generation, encryption/decryption, key generation, etc.) it is actually desirable that a well-tested implementation in the platform is used rather than trying to implement these functions in each client.

Requirements that can be satisfied by either the TOE or the platform are identified in Section 5 by text such as “The [selection: TSF, TOE platform] shall…” The ST author will make the appropriate selection based on where that element is implemented. It is allowable for some elements in a component to be implemented by the TOE, while other elements in that same component be implemented by the platform (requirements on the usage of X.509 certificates is an example of where this might be the case, where using the information contained in the certificates and the implementation of revocation checking may be done by the TOE, but storage and protection of the certificates may be done by the platform). Note that in the cases where this PP-Module is used to extend the GPOS PP or MDF PP, the TOE includes both the VPN client and the platform. In this case, it is appropriate to indicate that the TOE satisfies this requirement. However, the ST author should make it clear, for each of these components, which are implemented by the VPN client portion of the TOE versus the platform portion.

A Supporting Document (SD) accompanies this PP-Module and contains guidance for how to evaluate the requirements defined by the PP-Module, expressed as Evaluation Activities (EAs). EAs will differ based on where the function that meets the requirement is implemented. In most cases, requirements implemented by the platform will require that the evaluator examine documents pertaining to the platform (generally the ST), while requirements implemented by the TOE may require examination of the TSS, examination of the Operational Guidance, and/or execution of evaluator testing. For requirements implemented by the platform there may also be requirements that the evaluators examine the interfaces used by the TOE to access these functions on the platform to ensure that the functionality being invoked to satisfy the requirements of this PP-Module is the same functionality that was evaluated.

Given the degree of coupling between a VPN client and its underlying platform, it is expected that the client will be tested on each platform claimed in the ST. In cases where the platforms are simply different versions of the same operating system (provided by the same platform vendor), an equivalency argument may be made in lieu of testing on each version. The argument would have to demonstrate that the client interacts in exactly the same way with the versions of the OS - e.g., same APIs are used with the same parameters, the network stack is modified with exactly the same kernel modules. The evaluator uses the operational guidance to configure the TOE and underlying platform.

A TOE that conforms to this PP-Module will implement the Internet Engineering Task Force (IETF) Internet Protocol Security (IPsec) Security Architecture for the Internet Protocol, RFC 4301, as well as the IPsec Encapsulating Security Payload (ESP) protocol. IPsec ESP is specified in RFC 2406 and RFC 4303. The IPsec VPN client will support ESP in either tunnel mode, transport mode, or both modes.

The IPsec VPN client will use the Internet Key Exchange (IKE)v1 protocol, IKEv2, or both. IKEv1 is implemented as defined in RFCs 2407, 2408, 2409, 4109, and IKEv2 is implemented as specified in RFC 7296 (with mandatory support for NAT traversal as specified in section 2.23) and 4307 to authenticate and establish session keys with the VPN entities.

In order to show that the TSF implements the RFCs correctly, the evaluator will perform EAs documented in

the Supporting Document that accompanies this PP-Module. In future versions of this PP-Module, EAs may be augmented, or new ones introduced that cover more aspects of RFC compliance than is currently described in this publication.

The IPsec VPN client enables encryption of all information that flows between itself and its IPsec peer. The VPN client serves as an endpoint for an IPsec VPN connection and performs a number of cryptographic functions related to establishing and maintaining that connection. If the cryptography used to perform endpoint authentication, generate keys, and encrypt information is sufficiently robust and the implementation has no critical design mistakes, an adversary will be unable to exhaust the encryption key space to obtain the data. Compliance with IPsec standards, use of a properly seeded Random Bit Generator (RBG), and secure authentication factors will ensure that access to the transmitted information cannot be obtained with less work than a full exhaust of the key space. Any plaintext secret and private keys or other cryptographic security parameters will be zeroized when no longer in use to prevent disclosure of security critical data.

1.4 Use Cases

A VPN client allows users on the TOE platform to establish secure IPsec communications, providing confidentiality, integrity, and protection of data, across a less trusted network in order to secure data in transit. This PP-Module defines three use cases for VPN clients. A conformant TOE will implement one or more of the use cases specified below:

[USE CASE 1] TOE to VPN Gateway

A VPN client allows users on the TOE platform to establish an encrypted IPsec tunnel across a less trusted, often unprotected public, network to a private network (see Figure 1). In this case, the TOE provides encryption/decryption of network packets as they leave/arrive the VPN client's underlying platform. IP packets crossing from the private network to the public network will be encrypted if their destination is a remote access VPN client supporting the same VPN policy as the source network.

The TOE is responsible for encrypting the packets that are intended to be received by the target on the private network and then encapsulating these packets in a way that allows the VPN gateway to securely receive them and forward them to their final destination.

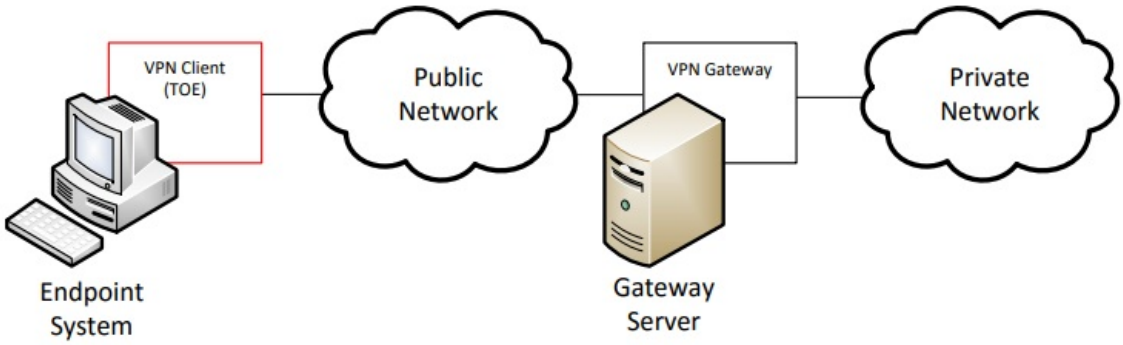


Figure 1: TOE to VPN Gateway

[USE CASE 2] TOE to VPN Client

A VPN client may additionally or alternatively allow a client computer to connect directly to another computer running a VPN client (see Figure 2). In this case, the functionality of the VPN client is to connect directly to another endpoint system in order to facilitate communications directly to that system.

IPsec transport mode is used for end-to-end communications. In this use case, the content of the packet data (payload) is encrypted but the original IP header is preserved. Inherent to this use case, when two peers are communicating directly, is the disclosure of the source/destination of the packets. Users should take into consideration any security risks associated with this disclosure when architecting their networks in line with this use case.

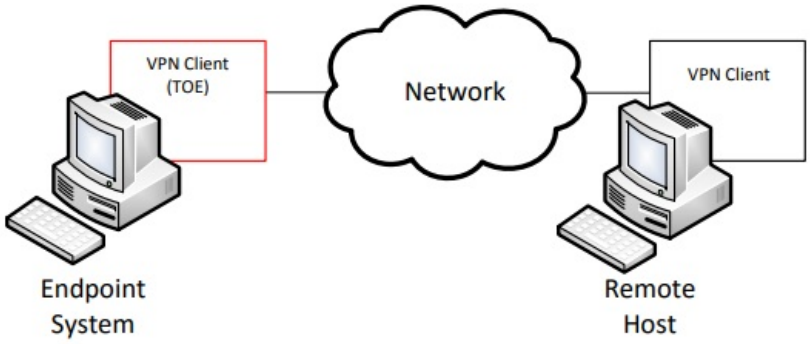


Figure 2: TOE to VPN Client

[USE CASE 3] TOE to IPsec-capable Network Device

Similar to Use Case 2 above, a VPN client TOE can also be used to establish a secure connection to an IPsec-capable network device using IPsec, similar to how SSH can be used. In this case, where a network

device is being managed remotely over an IPsec connection, the network device itself must contain IPsec functionality to act as the peer for the connection (see Figure 3).

While this will behave functionally the same way as the scenario described by Use Case 2, the user of the TOE in Use Case 3 is a network administrator who is assumed to have administrative access to the network device they are connecting to.

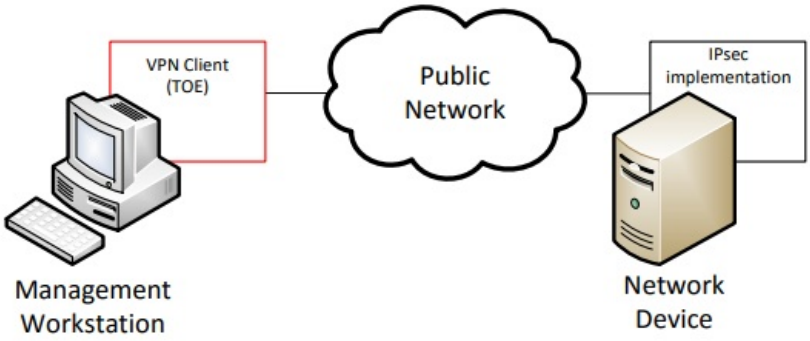


Figure 3: TOE to IPsec-capable Network Device

1.5 Requirements Focus

Regardless of the specific usage of the TOE, the focus of the Security Functional Requirements in this PPModule is on the following fundamental aspects of a VPN client:

- Authentication of the IPsec peer
- Cryptographic protection of data in transit
- Implementation of services

A VPN client can establish VPN connectivity either to a VPN gateway with traffic bound for a remote endpoint in the private network that is protected by the VPN gateway (Use Case 1), to a VPN client peer residing on a remote endpoint in the same network as the TOE (Use Case 2), and/or to a network device with IPsec capability for the purposes of managing that device (Use Case 3). In the first case, the entire IP packet is encapsulated and a new header is applied so that the gateway can route the packet to its intended destination. This is known as tunnel mode. In the latter two cases, the original IP header is preserved and only the payload is encrypted. This is known as transport mode.

Beyond the implementation differences specified by these use cases, the remaining security functionality is expected to be implemented by all VPN clients, regardless of whether it supports one or more of the use cases. Regardless of the intended use case, VPN endpoints authenticate each other to ensure they are communicating with an authorized external IT entity. Authentication of IPsec peers is performed as part of the Internet Key Exchange (IKE) negotiation. The IKE negotiation uses a pre-existing public key infrastructure for authentication and can optionally use a pre-shared key. When IKE completes, an IPsec tunnel secured with Encapsulating Security Payload (ESP) is established.

It is assumed that the VPN client is implemented properly and contains no critical design mistakes. The VPN client relies on the system or device on which it is installed for its proper execution. The vendor is required to provide configuration guidance (AGD_PRE, AGD_OPE) to correctly install and administer the client machine and the TOE for every operational environment supported.

2 Conformance Claims

Conformance Statement

This PP-Module inherits exact conformance as required from the specified Base-PPs and as defined in the CC and CEM addenda for Exact Conformance, Selection-Based SFRs, and Optional SFRs (dated May 2017).

The following PPs and PP-Modules are allowed to be specified in a PP-Configuration with this PP-Module:

- PP-Module for MDM Agents, Version 1.0
- PP-Module for File Encryption Enterprise Management, Version 1.0
- PP-Module for File Encryption, Version 2.0

CC Conformance Claims

This PP-Module is conformant to Parts 2 (extended) and 3 (extended) of Common Criteria Version 3.1, Revision 5 [CC] when App PP, GPOS PP, or MDF is the Base-PP.

This PP-Module is conformant to Parts 2 (extended) and 3 (conformant) of Common Criteria Version 3.1, Revision 5 [CC] when MDM PP is the Base-PP.

PP Claim

This PP-Module does not claim conformance to any Protection Profile.

Package Claim

This PP-Module does not claim conformance to any packages.

3 Security Problem Description

The security problem is described in terms of the threats that the TOE is expected to address, assumptions about its operational environment, and any organizational security policies that the TOE is expected to enforce.

This PP-Module is written to address the situation in which a user accesses a private network (e.g. the user's office network) or terminal endpoint (e.g. a network device) using a less trusted network (such as a public Wi-Fi network or local area network). Protection of network packets is desired as they traverse a public network. To protect the data in-transit from disclosure and modification, a VPN is created to establish secure communications. The VPN client provides one end of the secure VPN tunnel and performs encryption and decryption of network packets in accordance with a VPN security policy negotiated between the VPN client (TOE) and its IPsec peer.

The proper installation and configuration of the VPN client is critical to its correct operation such that proper handling of the TOE by an administrator is also addressed.

Note that as a PP-Module, all threats, assumptions, and OSPs defined in the Base-PP will also apply to a TOE unless otherwise specified, depending on which of the Base-PPs it extends. The Security Functional Requirements defined in this PP-Module will mitigate the threats that are defined in the PP-Module but may also mitigate some threats defined in the Base-PPs in more comprehensive detail due to the specific capabilities provided by a VPN client.

3.1 Threats

The following threats defined in this PP-Module extend the threats defined by the Base-PPs.

T.UNAUTHORIZED_ACCESS

This PP-Module does not include requirements that can protect against an insider threat. Authorized users are not considered hostile or malicious and are trusted to follow appropriate guidance. Only authorized personnel should have access to the system or device that contains the IPsec VPN client. Therefore, the primary threat agents are the unauthorized entities that try to gain access to the protected network (in cases where tunnel mode is used) or to plaintext data that traverses the public network (regardless of whether transport mode or tunnel mode is used).

The endpoint of the network communication can be both geographically and logically distant from the TOE, and can pass through a variety of other systems. These intermediate systems may be under the control of the adversary, and offer an opportunity for communications over the network to be compromised.

Plaintext communication over the network may allow critical data (such as passwords, configuration settings, and user data) to be read and/or manipulated directly by intermediate systems, leading to a compromise of the TOE or to the secured environmental system(s) that the TOE is being used to facilitate communications with. IPsec can be used to provide protection for this communication; however, there are myriad options that can be implemented for the protocol to be compliant to the protocol specification listed in the RFC. Some of these options can have negative impacts on the security of the connection. For instance, using a weak encryption algorithm (even one that is allowed by the RFC, such as DES) can allow an adversary to read and even manipulate the data on the encrypted channel, thus circumventing countermeasures in place to prevent such attacks. Further, if the protocol is implemented with little-used or non-standard options, it may be compliant with the protocol specification but will not be able to interact with other, diverse equipment that is typically found in large enterprises.

Even though the communication path is protected, there is a possibility that the IPsec peer could be duped into thinking that a malicious third-party user or system is the TOE. For instance, a middleman could intercept a connection request to the TOE, and respond to the request as if it were the TOE. In a similar manner, the TOE could also be duped into thinking that it is establishing communications with a legitimate IPsec peer when in fact it is not. An attacker could also mount a malicious man-in-the-middle-type of attack, in which an intermediate system is compromised, and the traffic is proxied, examined, and modified by this system. This attack can even be mounted via encrypted communication channels if appropriate countermeasures are not applied. These attacks are, in part, enabled by a malicious attacker capturing network traffic (for instance, an authentication session) and "playing back" that traffic in order to fool an endpoint into thinking it was communicating with a legitimate remote entity.

T.TSF_CONFIGURATION

Configuring VPN tunnels is a complex and time-consuming process, and prone to errors if the interface for doing so is not well-specified or well-behaved. The inability to configure certain aspects of the interface may also lead to the mis-specification of the desired communications policy or use of cryptography that may be desired or required for a particular site. This may result in unintended weak or plaintext communications while the user thinks that their data are being protected. Other aspects of configuring the TOE or using its security mechanisms (for example, the update process) may also result in a reduction in the trustworthiness of the VPN client.

T.USER_DATA_REUSE

Data traversing the TOE could inadvertently be sent to a different user; since these data may be sensitive, this may cause a compromise that is unacceptable. The specific threat that must be addressed concerns user data that is retained by the TOE in the course of processing network traffic that could be

inadvertently re-used in sending network traffic to a user other than that intended by the sender of the original network traffic.

T.TSF_FAILURE
Security mechanisms of the TOE generally build up from a primitive set of mechanisms (e.g., memory management, privileged modes of process execution) to more complex sets of mechanisms. Failure of the primitive mechanisms could lead to a compromise in more complex mechanisms, resulting in a compromise of the TSF.

3.2 Assumptions

These assumptions are made on the Operational Environment in order to be able to ensure that the security functionality specified in the PP-Module can be provided by the TOE. If the TOE is placed in an Operational Environment that does not meet these assumptions, the TOE may no longer be able to provide all of its security functionality. These assumptions are made on the operational environment in order to be able to ensure that the security functionality specified in the PP-Module can be provided by the TOE. If the TOE is placed in an operational environment that does not meet these assumptions, the TOE may no longer be able to provide all of its security functionality.

A.NO_TOE_BYPASS
Information cannot flow onto the network to which the VPN client's host is connected without passing through the TOE.

A.PHYSICAL
Physical security, commensurate with the value of the TOE and the data it contains, is assumed to be provided by the environment.

A.TRUSTED_CONFIG
Personnel configuring the TOE and its operational environment will follow the applicable security configuration guidance.

3.3 Organizational Security Policies

An organization deploying the TOE is expected to satisfy the organizational security policy listed below in addition to all organizational security policies defined by the claimed base PP.

This document does not define any additional OSPs.

4 Security Objectives

4.1 Security Objectives for the TOE

O.AUTHENTICATION

To address the issues associated with unauthorized disclosure of information in transit, a compliant TOE's authentication ability (IPsec) will allow the TSF to establish VPN connectivity with a remote VPN gateway or peer and ensure that any such connection attempt is both authenticated and authorized.

Addressed by: FIA_X509_EXT.3 (when GPOS PP is Base-PP), FIA_X509_EXT.2 (refined from MDF PP), FIA_X509_EXT.2 (refined from App PP), FIA_X509_EXT.2 (refined from MDM PP), FCS_IPSEC_EXT.1, FIA_PSK_EXT.1 (optional).

O.CRYPTOGRAPHIC_FUNCTIONS

To address the issues associated with unauthorized disclosure of information in transit, a compliant TOE will implement cryptographic capabilities. These capabilities are intended to maintain confidentiality and allow for detection and modification of data that is transmitted outside of the TOE.

Addressed by: FCS_CKM.1 (refined from GPOS PP), FCS_CKM.2 (refined from GPOS PP) FCS_COP.1(1) (refined from GPOS PP), FTP_ITC.1 (when GPOS PP is Base-PP) FCS_CKM.1 (refined from MDF PP), FCS_CKM.2(1) (refined from MDF PP) FCS_COP.1(1) (refined from MDF PP), FTP_ITC_EXT.1 (refined from MDF PP) FCS_CKM.1(1) (refined from App PP), FCS_CKM.2 (refined from App PP) FCS_CKM_EXT.1 (refined from App PP), FCS_COP.1(1) (refined from App PP) FCS_CKM.1 (refined from MDM PP), FCS_CKM.2 (refined from MDM PP) FCS_COP.1(1) (refined from MDM PP), FPT_ITT.1(1) (if applicable, refined from MDM PP) FTP_ITC.1(1) (if applicable, refined from MDM PP), FTP_TRP.1(1) (if applicable, refined from MDM PP) FCS_CKM.1/VPN, FCS_IPSEC_EXT.1.

O.KNOWN_STATE

The TOE will provide sufficient measures to ensure it is operating in a known state. At minimum this includes management functionality to allow the security functionality to be configured and self-test functionality that allows it to assert its own integrity. It may also include auditing functionality that can be used to determine the operational behavior of the TOE.

Addressed by: FMT_SMF.1/VPN, FPT_TST_EXT.1/VPN, FAU_GEN.1/VPN (optional), FAU_SEL.1/VPN (optional).

O.NONDISCLOSURE

To address the issues associated with unauthorized disclosure of information at rest, a compliant TOE will ensure that non-persistent data is purged when no longer needed. The TSF may also implement measures to protect against the disclosure of stored cryptographic keys and data through implementation of protected storage and secure erasure methods. The TOE may optionally also enforce split-tunneling prevention to ensure that data in transit cannot be disclosed inadvertently outside of the IPsec tunnel.

Addressed by: FCS_CKM_EXT.2 (when GPOS PP is Base-PP), FCS_CKM_EXT.2 (when App PP is BasePP), FCS_CKM_EXT.4 (when App PP is Base-PP), FDP_RIP.1, FDP_IFC_EXT.1 (optional).

4.2 Security Objectives for the Operational Environment

The Operational Environment of the TOE implements technical and procedural measures to assist the TOE in correctly providing its security functionality (which is defined by the security objectives for the TOE). The security objectives for the Operational Environment consist of a set of statements describing the goals that the Operational Environment should achieve. This section defines the security objectives that are to be addressed by the IT domain or by non-technical or procedural means. The assumptions identified in Section 3 are incorporated as security objectives for the environment. The Operational Environment of the TOE implements technical and procedural measures to assist the TOE in correctly providing its security functionality (which is defined by the security objectives for the TOE). This section defines the security objectives that are to be addressed by the IT domain or by nontechnical or procedural means. As indicated above, if requirements supporting an objective on the TOE (in the previous table) are implemented in whole or in part by the platform, the ST should indicate this by an entry in this table with that objective.

OE.NO_TOE_BYPASS

Information cannot flow onto the network to which the VPN client's host is connected without passing through the TOE.

OE.PHYSICAL

Physical security, commensurate with the value of the TOE and the data it contains, is assumed to be provided by the environment.

OE.TRUSTED_CONFIG

Personnel configuring the TOE and its operational environment will follow the applicable security configuration guidance.

4.3 Security Objectives Rationale

This section describes how the assumptions, threats, and organizational security policies map to the security objectives.

Table 1: Security Objectives Rationale

Threat, Assumption, or OSP	Security Objectives	Rationale
T.UNAUTHORIZED_ACCESS	O.AUTHENTICATION	The TOE mitigates the threat of unauthorized access by requiring IPsec communications to be properly authenticated.
	O.CRYPTOGRAPHIC_FUNCTIONS	The TOE mitigates the threat of unauthorized access by implementing IPsec using strong cryptographic algorithms.
T.TSF_CONFIGURATION	O.KNOWN_STATE	The TOE mitigates the threat of inadequate configuration by providing a management interface that allows all security-relevant functionality to be configured.
	OE.TRUSTED_CONFIG	This objective mitigates the threat of misconfiguration by ensuring that a malicious actor is not given direct administrative control over the TOE.
T.USER_DATA_REUSE	O.NONDISCLOSURE	The TOE mitigates the threat of data reuse by ensuring that persistently stored data is protected from unauthorized access, nonpersistently stored data is appropriately purged, and potentially to ensure that no network traffic is inadvertently transmitted outside of the IPsec tunnel.
T.TSF_FAILURE	O.KNOWN_STATE	The TOE mitigates the threat of TSF failure by enforcing the use of self-tests so that the TOE remains in a known state, and potentially to generate audit records that allow for potential failures to be diagnosed.
A.NO_TOE_BYPASS	OE.NO_TOE_BYPASS	This assumption is satisfied by the environmental objective that ensures network routes do not exist that allow traffic to be transmitted from the TOE system to its intended destination without going through the TOE’s IPsec tunnel.
A.PHYSICAL	OE.PHYSICAL	This assumption is satisfied by the environmental objective that ensures the TOE is not deployed on a system that is vulnerable to loss of physical custody.
A.TRUSTED_CONFIG	OE.TRUSTED_CONFIG	This assumption is satisfied by the environmental objective that ensures that anyone responsible for administering the TOE can be trusted not to misconfigure it, whether intentionally or not.

5 Security Requirements

This chapter describes the security requirements which have to be fulfilled by the product under evaluation. Those requirements comprise functional components from Part 2 and assurance components from Part 3 of [CC]. The following conventions are used for the completion of operations:

- **Refinement** operation (denoted by **bold text** or ~~strikethrough text~~): is used to add details to a requirement (including replacing an assignment with a more restrictive selection) or to remove part of the requirement that is made irrelevant through the completion of another operation, and thus further restricts a requirement.
- **Selection** (denoted by *italicized text*): is used to select one or more options provided by the [CC] in stating a requirement.
- **Assignment** operation (denoted by *italicized text*): is used to assign a specific value to an unspecified parameter, such as the length of a password. Showing the value in square brackets indicates assignment.
- **Iteration** operation: is indicated by appending the SFR name with a slash and unique identifier suggesting the purpose of the operation, e.g. "/EXAMPLE1."

5.1 General Purpose Operating Systems PP Security Functional Requirements Direction

In a PP-Configuration that includes the GPOS PP, the VPN client is expected to rely on some of the security functions implemented by the operating system as a whole and evaluated against the Base-PP. In this case, the following sections describe any modifications that the ST author must make to the SFRs defined in the Base-PP in addition to what is mandated by section 5.5.

5.1.1 Modified SFRs

The SFRs listed in this section are defined in the General Purpose Operating Systems PP and relevant to the secure operation of the TOE.

5.1.1.1 Cryptographic Support (FCS)

FCS_CKM.1 Cryptographic Key Generation

FCS_CKM.1.1

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

- ***ECC schemes using "NIST curves" P-256, P-384, and [selection: P-521, no other curves] that meet the following: FIPS PUB 186-4, "Digital Signature Standard (DSS)," Appendix B.4, and,***

[**selection**:

- *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,,*
- *FFC schemes using cryptographic key sizes of 2048-bit or greater that meet the following: FIPS PUB 186-4, "Digital Signature Standard (DSS)," Appendix B.1,,*
- *FFC Schemes using Diffie-Hellman group 14 that meet the following: RFC 3526,,*
- *FFC Schemes using safe primes that meet the following: 'NIST Special Publication 800-56A Revision 3, "Recommendation for Pair-Wise Key Establishment Schemes,,*
- ***No other key generation methods***

] ~~and specified cryptographic key sizes [assignment: cryptographic key sizes] that meet the following: [assignment: list of standards]~~.

Application Note: This SFR is functionally identical to what is defined in the GPOS PP except that ECC key generation with support for P-256 and P-384 has been made mandatory in support of IPsec due to the mandated support for DH groups 19 and 20 in FCS_IPSEC_EXT.1.8. The ST author must select all key generation schemes used for key establishment and entity authentication. When key generation is used for key establishment, the schemes in FCS_CKM.2 and selected cryptographic protocols must match the selection. When key generation is used for entity authentication, the public key is expected to be associated with an X.509v3 certificate.

If the OS acts only as a receiver in the RSA key establishment scheme, the OS does not need to implement RSA key generation.

FCS_CKM.2 Cryptographic Key Establishment

FCS_CKM.2.1

The OS shall implement functionality to perform cryptographic key establishment in accordance with a specified key establishment method:

- ***Elliptic curve-based key establishment schemes that meets the following: NIST Special Publication 800-56A Revision 3, "Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography," and***

[**selection**:

- *RSA-based key establishment schemes that meets the following: RSAESPKCS1-v1_5 as specified in Section 7.2 of RFC 8017, "Public-Key Cryptography Standards (PKCS) #1: RSA Cryptography Specifications Version 2.2,,*
- *Finite field-based key establishment schemes that meets the following: NIST Special Publication 800-56A Revision 3, "Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography" ,*
- *Key establishment scheme using Diffie-Hellman group 14 that meets the following: RFC 3526,,*
- ***No other key establishment schemes***

] ~~that meets the following [assignment: list of standards]~~.

Application Note: The ST author must select all key establishment schemes used for the selected cryptographic protocols.

The elliptic curves used for the key establishment scheme must correlate with the curves specified in FCS_CKM.1.1. The domain parameters used for the finite field-based key establishment scheme are specified by the key generation according to FCS_CKM.1.1.

FCS_COP.1/1 Cryptographic Operation (Encryption and Decryption)

FCS_COP.1.1/1

The OS shall perform encryption/decryption services for data in accordance with a specified cryptographic algorithm

- **AES-CBC (as defined in NIST SP 800-38A),**
- **AES-GCM (as defined in NIST SP 800-38D), and**

[**selection**:

- ***AES-XTS (as defined in NIST SP 800-38E),***,
- *AES-CCMP (as defined in FIPS PUB 197, NIST SP 800-38C and IEEE 802.11-2012),*
- *AES Key Wrap (KW) (as defined in NIST SP 800-38F),*
- *AES Key Wrap with Padding (KWP) (as defined in NIST SP 800-38F),*
- *AES-CCM (as defined in NIST SP 800-38C),*
- *AES-CCMP-256 (as defined in NIST SP800-38C and IEEE 802.11ac-2013),*
- *AES-GCMP-256 (as defined in NIST SP800-38D and IEEE 802.11ac-2013),*
- *No other modes*

] and cryptographic key sizes [**selection**: *128-bit*, *256-bit*].

Application Note: This SFR is identical to what is defined in the GPOS PP except that support for CBC and GCM mode is mandatory in order to address the requirements for FCS_IPSEC_EXT.1. In addition, both 128-bit and 256-bit for key sizes must be selected in order to meet the requirements for FCS_IPSEC_EXT.1.

5.1.2 Additional SFRs

This section defines additional SFRs that must be added to the TOE boundary in order to implement the functionality in any PP-Configuration where the General Purpose Operating Systems PP is claimed as the Base-PP.

5.1.2.1 Cryptographic Support (FCS)

FCS_CKM_EXT.2 Cryptographic Key Storage

FCS_CKM_EXT.2.1

The [**selection**: *VPN client*, *OS*] shall store persistent secrets and private keys when not in use in OS-provided key storage.

Application Note: This requirement ensures that persistent secrets (credentials, secret keys) and private keys are stored securely when not in use. If some secrets/keys are manipulated by the VPN client and others are manipulated by the OS, then both of the selections can be specified by the ST author.

5.1.2.2 Identification and Authentication (FIA)

FIA_X509_EXT.3 X.509 Certificate Use and Management

FIA_X509_EXT.3.1

The TSF shall use X.509v3 certificates as defined by RFC 5280 to support authentication for IPsec exchanges, and [**selection**: *digital signatures for FPT_TUD_EXT.1, integrity checks for FPT_TST_EXT.1, no additional uses*].

FIA_X509_EXT.3.2

When a connection to determine the validity of a certificate cannot be established, the [**selection**: *VPN client, OS*] shall [**selection**: *allow the administrator to choose whether to accept the certificate in these cases, accept the certificate, not accept the certificate*].

Application Note: Oftentimes a connection must be established to perform a verification of the revocation status of a certificate - either to download a CRL or to perform OCSP. The selection is used to describe the behavior in the event that such a connection cannot be established (for example, due to a network error). The behavior of the TOE in these cases is described by the second selection. If the TOE has determined the certificate is valid according to all other rules in FIA_X509_EXT.1, the behavior indicated in the second selection will determine the validity. The TOE must not accept the certificate if it fails any of the other validation rules in FIA_X509_EXT.1. If the administrator-configured option is selected by the ST Author, the ST author must also make the appropriate selection in FMT_SMF.1/VPN.

FIA_X509_EXT.3.3

The [**selection**: *VPN client, OS*] shall not establish an SA if a certificate or certificate path is deemed invalid.

5.1.2.3 Trusted Path/Channels (FTP)

FTP_ITC.1 Inter-TSF Trusted Channel

FTP_ITC.1.1

The **[selection: *VPN client, OS*] shall use IPsec to provide** a **trusted** communication channel between itself and **[selection: *a remote VPN gateway, a remote VPN client, a remote IPsec-capable network device*]** 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 **[selection: *VPN client, OS*]** shall permit [*the TSF*] to initiate communication with the trusted channel.

FTP_ITC.1.3

The **[selection: *VPN client, OS*]** shall initiate communication via the trusted channel [*for all traffic traversing that connection*].

Application Note: The intent of the above requirement is to demonstrate that IPsec can be used to establish remote communications in transport and/or tunnel mode. The requirement implies that not only are communications protected when they are initially established, but also on resumption after an outage. It may be the case that some part of the TOE setup involves manually setting up tunnels to protect other communication, and if after an outage the TOE attempts to reestablish the communication automatically with (the necessary) manual intervention, there may be a window created where an attacker might be able to gain critical information or compromise a connection.

5.2 mobile devices PP Security Functional Requirements Direction

In a PP-Configuration that includes the MDF PP, the VPN client is expected to rely on some of the security functions implemented by the operating system as a whole and evaluated against the Base-PP. In this case, the following sections describe any modifications that the ST author must make to the SFRs defined in the Base-PP in addition to what is mandated by section 5.5.

Full EAs are not repeated in the Supporting Document for the requirements in this section that are references to the MDF PP; only the additional testing needed to supplement what has already been captured in the MDF PP is included.

5.2.1 Modified SFRs

The SFRs listed in this section are defined in the mobile devices PP and relevant to the secure operation of the TOE.

5.2.1.1 Cryptographic Support (FCS)

FCS_CKM.1 Cryptographic Key Generation

FCS_CKM.1.1

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

- **ECC schemes using**
  - **"NIST curves" P-256, P-384, and [selection: *P-521, no other curves*] that meet the following: FIPS PUB 186-4, "Digital Signature Standard (DSS)," Appendix B.4, and**
  - **[selection: *Curve25519 schemes that meet the following: RFC 7748, No other curve*]**

  , and

[selection:

- ***FFC schemes using [selection: cryptographic key sizes of 2048-bit or greater that meet the following: FIPS PUB 186-4, "Digital Signature Standard (DSS)," Appendix B.1, Diffie-Hellman group 14 that meet the following: RFC 3526, Section 3, "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 ,***
- ***RSA schemes using cryptographic key sizes of 2048-bit or greater that meet FIPS PUB 186-4, "Digital Signature Standard (DSS)," Appendix B.3,,***
- ***No other key generation methods***

].

Application Note: This SFR is functionally identical to what is defined in the MDF PP except that ECC key generation with support for P-256 and P-384 has been made mandatory in support of IPsec due to the mandated support for DH groups 19 and 20 in FCS_IPSEC_EXT.1.8. Curve25519 schemes are included to satisfy FDP_DAR_EXT.2.2 in the MDF PP; these schemes are not used in support of IPsec. RSA remains present as a selection since it may be used by facets of the MDF TOE that are not specifically related to VPN client functionality.

FCS_CKM.2/1 Cryptographic Key Establishment

FCS_CKM.2.1/1

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

- **Elliptic curve-based key establishment schemes that meets the following: NIST Special Publication 800-56A Revision 3, "Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography,"**

and [selection:

- ***Finite field-based key establishment schemes that meets the following: NIST Special Publication 800-56A Revision 3, "Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography",***
- ***Key establishment scheme using Diffie-Hellman group 14 that meets the following: RFC 3526, Section 3,***
- ***RSA-based key establishment schemes that meet the following: [selection: NIST Special Publication 800-56B, "Recommendation for Pair-Wise Key Establishment Schemes using Integer Factorization Cryptography,", RSAES-PKCS1-v1_5 as specified in Section 7.2 of RFC 8017, "Public-Key Cryptography Standards (PKCS) #1: RSA Cryptography Specifications Version 2.2] ,***
- ***no other key establishment schemes***

].

Application Note: This SFR differs from its definition in the MDF PP by moving elliptic curve-based key establishment schemes from selectable to mandatory (due to the mandated support for DH groups 19 and 20 in FCS_IPSEC_EXT.1.8). It also provides the ability to claim either NIST SP 800-56A or RFC 3526 for key establishment using finite field cryptography if DH group 14 is claimed. The use of RSA is not explicitly mandated by the VPN client but may be selected in the MDF PP, which is why it remains here.

FCS_COP.1/1 Cryptographic Operation

FCS_COP.1.1/1

The TSF shall perform [*encryption/decryption*] in accordance with a specified

cryptographic algorithm

- AES-CBC (as defined in FIPS PUB 197, NIST SP 800-38A),
- AES-CCMP (as defined in FIPS PUB 197, NIST SP 800-38C and IEEE 802.11-2012),
- **AES-GCM (as defined in NIST SP 800-38D),**

and [**selection**:

- *AES Key Wrap (KW) (as defined in NIST SP 800-38F),*
- *AES Key Wrap with Padding (KWP) (as defined in NIST SP 800-38F),*
- *AES-CCM (as defined in NIST SP 800-38C),*
- *AES-XTS (as defined in NIST SP 800-38E),*
- *AES-CCMP-256 (as defined in NIST SP800-38C and IEEE 802.11ac-2013),*
- *AES-GCMP-256 (as defined in NIST SP800-38D and IEEE 802.11ac-2013),*
- *no other modes*

] and cryptographic key sizes 128-bit key sizes and [*256-bit key sizes*].

Application Note: This SFR is identical to what is defined in the MDF PP except that support for GCM mode and support for 256-bit key sizes are both mandatory in order to address the requirements for FCS_IPSEC_EXT.1.

5.2.1.2 Identification and Authentication (FIA)

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 **IPsec** and [**selection**: *TLS*, *HTTPS*, *DTLS*, ***no other protocols***], and [**selection**: *code signing for system software updates*, *code signing for mobile applications*, *code signing for integrity verification*, *[**assignment**: other uses]*, *no additional uses*].

FIA_X509_EXT.2.2

When the TSF cannot establish a connection to determine the validity of a certificate, the TSF shall [**selection**: *allow the administrator to choose whether to accept the certificate in these cases*, *allow the user to choose whether to accept the certificate in these cases*, *accept the certificate*, *not accept the certificate*].

Application Note: This SFR is identical to what is defined in the MDF PP except that support for IPsec is mandated. Since the original SFR did not explicitly require at least one of TLS, HTTPS, or DTLS to be selected, “no other protocols” has also been added as a selection in the event that IPsec is the only protocol for which the TOE uses X.509v3 certificates for authentication.

5.2.1.3 Trusted Path/Channels (FTP)

FTP_ITC_EXT.1 Trusted Channel Communication

FTP_ITC_EXT.1.1

The TSF shall use 802.11-2012, 802.1X, EAP-TLS, **IPsec,** and [**selection**: *TLS*, *DTLS*, *HTTPS*, ***no other protocols***] to provide a communication channel between itself and another trusted IT product that is logically distinct from other communication channels, provides assured identification of its end points, protects channel data from disclosure, and detects modification of the channel data.

FTP_ITC_EXT.1.2

The TSF shall permit the TSF to initiate communication via the trusted channel.

FTP_ITC_EXT.1.3

The TSF shall initiate communication via the trusted channel for wireless access point connections, administrative communication, configured enterprise connections, and [**selection**: *OTA updates*, *no other connections*].

Application Note: This SFR is identical to what is defined in the Base-PP except that support for IPsec is mandated. Additionally, since the Base-PP requires ‘at least one of’ the selected protocols which previously included IPsec, ‘no other protocols’ is now available as an option in the selection.

5.2.2 Additional SFRs

This PP-Module does not define any additional SFRs for any PP-Configuration where the mobile devices PP is claimed as the Base-PP.

5.3 Application Software PP Security Functional Requirements Direction

In a PP-Configuration that includes the App PP, the VPN client is expected to rely on some of the security functions implemented by the operating system as a whole and evaluated against the Base-PP. In this case, the following sections describe any modifications that the ST author must make to the SFRs defined in the Base-PP in addition to what is mandated by section 5.5.

5.3.1 Modified SFRs

The SFRs listed in this section are defined in the Application Software PP and relevant to the secure operation of the TOE.

5.3.1.1 Cryptographic Support (FCS)

FCS_CKM.1/1 Cryptographic Asymmetric Key Generation

FCS_CKM.1.1/1

The application shall [**selection**:

- *invoke platform-provided functionality,*
- *implement functionality*

] to generate asymmetric cryptographic keys in accordance with a specified cryptographic key generation algorithm

- **[ECC schemes] using [“NIST curves” P-256, P-384, and [selection: *P-521, no other curves*]] that meet the following: [FIPS PUB 186-4, “Digital Signature Standard (DSS),” Appendix B.4], and,**

[**selection**:

- ***[FFC schemes] using cryptographic key sizes of [2048-bit or greater] that meet the following: FIPS PUB 186-4, “Digital Signature Standard (DSS),” Appendix B.1***,
- ***[FFC schemes] using Diffie-Hellman group 14 that meet the following: RFC 3526, Section 3,***,
- ***[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 [selection: RFC 3526, RFC 7919];*** ,
- *[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];* ,
- *no other key generation methods*

]

Application Note: This SFR is selection-based in the App PP depending on the selection made in FCS_CKM_EXT.1. Because key generation services (whether implemented by the TOE or invoked from the platform) are required for IPsec, this SFR is mandatory for any TOE that claims conformance to this PP-Module.

This SFR is functionally identical to what is defined in the App PP except that ECC key generation has been made mandatory in support of IPsec due to the mandated support for DH groups 19, and 20 in FCS_IPSEC_EXT.1.8. RSA remains present as a selection since it may be used by parts of the TOE that are not specifically related to VPN client functionality.

FCS_CKM.2 Cryptographic Key Establishment

FCS_CKM.2.1

The application shall [**selection**: *invoke platform-provided functionality, implement functionality*] to perform cryptographic key establishment in accordance with a specified key establishment method:

- **[*Elliptic curve-based key establishment schemes*] that meets the following: [*NIST Special Publication 800-56A, “Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography*”]; and**

[**selection**:

- *[Finite field-based key establishment schemes] that meets the following: [NIST Special Publication 800-56A, “Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography”],*
- *Key establishment scheme using Diffie-Hellman group 14] that meets the following: [RFC 3526, Section 3,,*
- *[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 [**selection**: RFC 3526, RFC 7919] ,*
- *[RSA-based key establishment schemes] that meets the following: RSAES-PKCS1-v1_5 as specified in Section 7.2 of RFC 8017, “Public-Key*

Cryptography Standards (PKCS) #1: RSA Cryptography Specifications Version 2.2,
- *[RSA-based key establishment schemes] that meet the following: [NIST Special Publication 800-56B, "Recommendation for Pair-Wise Key Establishment Schemes Using Integer Factorization Cryptography"],*
- *No other schemes*

].

Application Note: This SFR differs from its definition in the App PP by moving elliptic curve-based key establishment schemes from selectable to mandatory (due to the mandated support for DH groups 19 and 20 in FCS_IPSEC_EXT.1.8). It also provides the ability to claim at least one of NIST SP 800-56A, RFC 3526, or NIST SP 800-56A rev. 3 "safe-prime" groups for key establishment using finite field cryptography.

FCS_CKM_EXT.1 Cryptographic Key Generation Services

FCS_CKM_EXT.1.1

The application shall [**selection**: *invoke platform-provided functionality for asymmetric key generation*, *implement asymmetric key generation*].

Application Note: This selection differs from its definition in the App PP by removing the selection for "generate no asymmetric cryptographic keys" for this PP-Module because a VPN Client TOE will either perform its own key generation or interface with the underlying platform to provide this service, either of which causes FCS_CKM.1(1) to be claimed.

FCS_COP.1/1 Cryptographic Operation

FCS_COP.1.1/1

The application shall perform encryption/decryption in accordance with a specified cryptographic algorithm

- **AES-CBC (as defined in NIST SP 800-38A) mode,**
- **AES-GCM (as defined in NIST SP 800-38D) mode,**

; and [**selection**:

- *AES-XTS (as defined in NIST SP 800-38E) mode*,
- ***no other modes***

] and cryptographic key sizes [*128-bit, 256-bit*].

Application Note: This SFR is selection-based in the Base-PP and remains selection-based here because this PP-Module allows for the possibility that the TSF relies on platform-provided cryptographic algorithm services for its own implementation of IPsec. However, if the TSF does claim this SFR to support IPsec, the ST author must select at minimum both AES-CBC and AES-GCM with both 128-bit and 256-bit key sizes for consistency with the relevant IPsec claims (FCS_IPSEC_EXT.1.4 requires both 128-bit and 256-bit AES-GCM and FCS_IPSEC_EXT.1.6 requires both 128-bit and 256-bit AES-CBC).

5.3.1.2 Identification and Authentication (FIA)

FIA_X509_EXT.2 X.509 Certificate Authentication

FIA_X509_EXT.2.1

The application shall use X.509v3 certificates as defined by RFC 5280 to support authentication for **IPsec** and [**no other protocols**].

FIA_X509_EXT.2.2

When the application cannot establish a connection to determine the validity of a certificate, the TSF shall [**selection**: *allow the administrator to choose whether to accept the certificate in these cases*, *accept the certificate*, *not accept the certificate*].

Application Note: This SFR is identical to what is defined in the App PP except that mandatory support for IPsec is added. Additionally, because this SFR is selection-based in the App PP but is mandatory for VPN client usage, the 'no other protocols' selection item has been added since it is expected that IPsec is the TOE's only use of certificates.

5.3.1.3 Trusted Path/Channels (FTP)

FTP_DIT_EXT.1 Protection of Data in Transit

FTP_DIT_EXT.1.1

The application shall [*not encrypt any [sensitive data]]* between itself and

another trusted IT product.

Application Note: The VPN client itself is the application, and does not maintain any sensitive data of its own. Therefore, there is no need to protect (through FTP_DIT_EXT.1.1) VPN-client-specific data.

5.3.2 Additional SFRs

This section defines additional SFRs that must be added to the TOE boundary in order to implement the functionality in any PP-Configuration where the Application Software PP is claimed as the Base-PP.

5.3.2.1 Cryptographic Support (FCS)

FCS_CKM_EXT.2 Cryptographic Key Storage

FCS_CKM_EXT.2.1

The [**selection**: *TOE*, *TOE platform*] shall store persistent secrets and private keys when not in use in platform-provided key storage.

Application Note: This requirement ensures that persistent secrets and private keys are stored securely when not in use. This differs from FCS_STO_EXT.1 in the Base-PP, which only applies to secure storage of administrative credentials. If some secrets/keys are manipulated by the TOE and others are manipulated by the platform, then both of the selections can be specified by the ST author.

FCS_CKM_EXT.4 Cryptographic Key Destruction

FCS_CKM_EXT.4.1

The [**selection**: *TOE*, *TOE platform*] shall zeroize all plaintext secret and private cryptographic keys and CSPs when no longer required.

Application Note: Any security related information (such as keys, authentication data, and passwords) must be zeroized when no longer in use to prevent the disclosure or modification of security critical data. The zeroization indicated above applies to each intermediate storage area for plaintext key/CSP (i.e., any storage, such as memory buffers, that is included in the path of such data) upon the transfer of the key/CSP to another location.

In practice, the TOE will not implement all of the functionality associated with the requirement, since if it performs zeroization at all it will be by invoking platform interfaces to perform the storage location clear/overwrite function. The ST author should select "TOE" when, for at least one of the keys needed to meet the requirements of this PP, the TOE manipulates (reads, writes) the data identified in the requirement and thus needs to ensure that those data are cleared. In these cases, it is sufficient for the TOE to invoke the correct underlying functions of the host to perform the zeroization--it does not imply that the TOE has to include a kernel-mode memory driver to ensure the data are zeroized.

In the likely event that some of the data are manipulated by the TOE and other data are manipulated entirely by the platform, the ST author must select both options.

5.4 MDMs PP Security Functional Requirements Direction

In a PP-Configuration that includes the MDM PP, the VPN client is expected to rely on some of the security functions implemented by the operating system as a whole and evaluated against the Base-PP. In this case, the following sections describe any modifications that the ST author must make to the SFRs defined in the Base-PP in addition to what is mandated by section 5.5.

5.4.1 Modified SFRs

The SFRs listed in this section are defined in the MDMs PP and relevant to the secure operation of the TOE.

5.4.1.1 Cryptographic Support (FCS)

FCS_CKM.1 Cryptographic Key Generation

FCS_CKM.1.1

The TSF shall [**selection**: *invoke platform-provided functionality*, *implement functionality*] to generate asymmetric cryptographic keys in accordance with a specified cryptographic key generation algorithm:

- **ECC schemes using “NIST curves” P-256, P-384, and [selection: *P-521*, *no other curves*] that meet the following: FIPS PUB 186-4, “Digital Signature Standard (DSS),” Appendix B.4, and**

[**selection**:

- *RSA schemes using cryptographic key sizes of 2048-bit or greater that meet FIPS PUB 186-4, "Digital Signature Standard (DSS),” Appendix B.3,,*
- *FFC schemes using cryptographic key sizes of 2048-bit or greater that meet the following: FIPS PU 186-4, “Digital Signature Standards (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 [**selection**: RFC 3526, RFC 7919],,*
- ***FFC schemes using Diffie-Hellman group 14 that meets the following: RFC 3526, Section 3,** ,*
- ***No other key generation schemes***

].

Application Note: This SFR is modified from its definition in the MDM PP by mandating the key generation algorithms that are required by this PP-Module in support of IPsec due to the mandated support for DH groups 19 and 20 in FCS_IPSEC_EXT.1.8. Other selections may be chosen by the ST author as needed for parts of the TOE that are not specifically related to VPN client functionality

FCS_CKM.2 Cryptographic Key Establishment

FCS_CKM.2.1

The TSF shall [**selection**: *invoke platform-provided functionality, implement functionality*] to perform cryptographic key establishment in accordance with a specified key establishment method:

- **Elliptic curve-based key establishment schemes that meets the following: NIST Special Publication 800-56A Revision 3, “Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography,”**

and [**selection**:

- *RSA-based key establishment schemes that meet the following: RSAES-PKCS1-v1_5 as specified in Section 7.2 of RFC 8017, “Public-Key Cryptography Standards (PKCS) #1: RSA Cryptography Specifications Version 2.1,",*
- *Finite field-based key establishment schemes that meets the following: NIST Special Publication 800-56A Revision 3, “Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography”,*
- *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 [**selection**: RFC 3526, RFC 7919] ,*
- *Key establishment scheme using Diffie-Hellman group 14 that meets the following: RFC 3526, Section 3,*
- ***No other schemes***

].

Application Note: This SFR is modified from its definition in the MDM PP by mandating the key establishment algorithms that are required by this PP-Module in support of IPsec due to the mandated support for DH groups 19 and 20 in FCS_IPSEC_EXT.1.8. Other selections may be chosen by the ST author as needed for parts of the TOE that are not specifically related to VPN client functionality.

FCS_COP.1/1 Cryptographic Operation

FCS_COP.1.1/1

The TSF shall [**selection**: *invoke platform-provided functionality, implement functionality*] perform encryption/decryption in accordance with a specified cryptographic algorithm

- **AES-CBC (as defined in FIPS PUB 197, NIST SP 800-38A),**
- **AES-GCM (as defined in NIST SP 800-38D), and**

[**selection**:

- *AES Key Wrap (KW) (as defined in NIST SP 800-38F),*
- *AES Key Wrap with Padding (KWP) (as defined in NIST SP 800-38F),*
- *AES-CCM (as defined in NIST SP 800-38C),*
- *no other modes*

] and cryptographic key sizes [*128-bit, 256-bit*].

Application Note: This SFR is modified from its definition in the Base-PP by

mandating support for both 128-bit and 256-bit implementations of AES-CBC (which this PP-Module requires for the use of IKE and allows for the use of ESP) and AES-GCM (which this PP-Module requires for the use of ESP and allows for the use of IKE). Other AES modes may be selected by the ST author as needed to address functions not required by this PPModule.

5.4.1.2 Identification and Authentication (FIA)

FIA_X509_EXT.2 X.509 Certificate Authentication

FIA_X509_EXT.2.1

The TSF shall [**selection**:

- *Invoke platform-provided functionality to use X.509v3 certificates as defined by RFC 5280 to support authentication for [**selection**: ~~IPsec~~, HTTPS, TLS, DTLS, SSH, no protocols] and [**selection**:*
  - *code signing for system software updates,*
  - *code signing for integrity verification,*
  - *policy signing,*
  - *[**assignment**: other uses],*
  - *no additional uses*

  ] ,
- *use X.509v3 certificates as defined by RFC 5280 to support authentication for*
  - ***IPsec as specified in the PP-Module for VPN client and***

  *[**selection**:*
  - *HTTPS in accordance with FCS_HTTPS_EXT.1,*
  - *TLS as defined in the Package for Transport Layer Security,*
  - *DTLS as defined in the Package for Transport Layer Security,*
  - *SSH as defined in the Extended Package for Secure Shell,*
  - *no other protocols*

  *], and [**selection**:*
  - *code signing for system software updates,*
  - *code signing for integrity verification,*
  - *policy signing,*
  - *[**assignment**: other uses],*
  - *no additional uses*

  ]

].

Application Note: The PP-Module requires the TOE to implement its own X.509 authentication mechanism in support of IPsec communications. Other selections may be chosen by the ST author as needed for parts of the TOE that are not specifically related to VPN client functionality. The TSF may also rely on a platform-provided mechanism for uses of X.509 that do not relate to the establishment of trusted communications, as specified in the original SFR. FIA_X509_EXT.2.2 has not been included here as the PPModule does not modify this element.

5.4.1.3 Trusted Path/Channels (FTP)

FTP_ITT.1/1 Basic Internal TSF Data Transfer Protection

FTP_ITT.1.1/1

The TSF shall [*implement functionality using [IPsec as defined in the PP-Module for VPN Client]*].

Application Note: When the MDM TOE claims this PP-Module, at least one of its interfaces will implement IPsec communications. However, this PP-Module does not specify that any one particular interface must be implemented using IPsec. If the TOE is distributed and uses IPsec to secure communications between its distributed components, FPT_ITT.1(1) is refined as above.

This SFR is selection-based in the Base-PP depending on the selections made in the Base-PP requirement FTP_ITC_EXT.1. This is not changed by the PP-Module.

This SFR is modified from its definition in the Base-PP by mandating that the TSF implement IPsec communications and by prohibiting the TOE from relying on platform-provided functionality to implement this.

FTP_ITC.1/1 Inter-TSF Trusted Channel (Authorized IT Entities)

FTP_ITC.1.1/1

The TSF shall **implement functionality using IPsec as defined in the PP-Module for VPN Client, and [selection:**

- ***SSH as defined in the Extended Package for Secure Shell,***
- ***mutually authenticated TLS as defined in the Package for Transport Layer Security,***
- ***mutually authenticated DTLS as defined in the Package for Transport Layer Security,***
- ***HTTPS in accordance with FCS_HTTPS_EXT.1,***
- ***no other protocols***

] and [**selection**:

- *invoke platform-provided functionality to use [**selection**:*
  - *SSH,*
  - *mutually authenticated TLS,*
  - *mutually authenticated DTLS,*
  - *HTTPS*

  ],
- ***not invoke any platform-provided functionality***

] to provide a trusted communication channel between itself and authorized IT entities supporting the following capabilities: audit server, [**selection**: *authentication server*, *[**assignment**: other capabilities]*] that is logically distinct from other communication channels and provides assured identification of its end points and protection of channel data from modification and disclosure.

FTP_ITC.1.2/1

The TSF shall **implement functionality and** [**selection**: *invoke platform-provided functionality*, ***not invoke platform-provided functionality***] to permit the MDM Server or other authorized IT entities to initiate communication via the trusted channel.

FTP_ITC.1.3/1

The TSF shall **implement functionality and** [**selection**: *invoke platform-provided functionality*, ***not invoke platform-provided functionality***] to initiate communication via via the trusted channel for [**assignment**: *list of services for which the TSF is able to initiate communications*].

Application Note: When the MDM TOE claims this PP-Module, at least one of its interfaces will implement IPsec communications. However, this PP-Module does not specify that any one particular interface must be implemented using IPsec. If the TOE uses IPsec to secure communications between itself and external trusted IT entities, FTP_ITC.1(1) is refined as above.

This SFR is refined from its definition in the Base-PP by mandating that the “implement functionality” selection be chosen at minimum for IPsec and by prohibiting the TOE from relying on platform-provided IPsec functionality. Since the TOE may support multiple trusted channel interfaces, the ST author is given the option to select other protocols (SSH, TLS, DTLS, HTTPS) either as being implemented by the TSF or invoked from the platform.

FTP_TRP.1/1 Trusted Path (for Remote Administration)

FTP_TRP.1.1/1

The TSF shall **implement functionality using IPsec as defined in the PP-Module for VPN Client, and [selection:**

- ***TLS as defined in the Package for Transport Layer Security,***
- ***HTTPS in accordance with FCS_HTTPS_EXT.1,***
- ***SSH as defined in the Extended Package for Secure Shell,***
- ***no other protocols***

] and [**selection**:

- *invoke platform-provided functionality to use [**selection**:*
  - *TLS,*
  - *HTTPS,*
  - *SSH*

  ],
- ***not invoke any platform-provided functionality***

] to provide a trusted communication channel between itself as a [**selection**: *server*, *peer*] and remote administrators that is logically distinct from other communication paths and provides assured identification of its endpoints and protection of the communicated data from [*modification, disclosure*].

FTP_TRP.1.2/1

The TSF shall **implement functionality and** [**selection**: *invoke platform-provided functionality*, ***not invoke platform-provided functionality***] to permit remote administrators to initiate communication via the trusted channel.

FTP_TRP.1.3/1

The TSF shall **implement functionality and** [**selection**: *invoke platform-provided functionality*, ***not invoke platform-provided functionality***] to require the use of the trusted path for [all remote administration actions].

Application Note: When the MDM TOE claims this PP-Module, at least one of its interfaces will implement IPsec communications. However, this PP-Module does not specify that any one particular interface must be implemented using IPsec. If the TOE uses IPsec to secure communications between itself and trusted remote administrators, FPT_TRP.1(1) is refined as below.

This SFR is refined from its definition in the Base-PP by mandating that the "implement functionality" selection be chosen at minimum for IPsec and by prohibiting the TOE from relying on platform-provided IPsec functionality. Since the TOE may support multiple remote administrative interfaces, the ST author is given the option to select other protocols (SSH, TLS, HTTPS) either as being implemented by the TSF or invoked from the platform.

5.4.2 Additional SFRs

This PP-Module does not define any additional SFRs for any PP-Configuration where the MDMs PP is claimed as the Base-PP.

5.5 TOE Security Functional Requirements

The following section describes the SFRs that must be satisfied by any TOE that claims conformance to this PP-Module. These SFRs must be claimed regardless of which PP-Configuration is used to define the TOE.

5.5.1 Auditable Events for Mandatory SFRs

Table 2: Auditable Events for Mandatory Requirements

Requirement	Auditable Events	Additional Audit Record Contents
FCS_CKM.1/1	No events specified	
FCS_IPSEC_EXT.1	Decisions to DISCARD or BYPASS network packets processed by the TOE.	Presumed identity of source subject. The entry in the SPD that applied to the decision.
FCS_IPSEC_EXT.1	Failure to establish an IPsec SA.	Identity of destination subject. Reason for failure.
FCS_IPSEC_EXT.1	Establishment/Termination of an IPsec SA.	Identity of destination subject. Transport layer protocol, if applicable. Source subject service identifier, if applicable. Non-TOE endpoint of connection (IP address) for both successes and failures.
FDP_RIP.2	No events specified	
FMT_SMF.1/VPN	Success or failure of management function.	
FPT_TST_EXT.1/VPN	No events specified	

5.5.2 Cryptographic Support (FCS)

FCS_CKM.1/1 VPN Cryptographic Key Generation (IKE)

FCS_CKM.1.1/1

The TSF shall **[selection: *invoke platform-provided functionality, implement functionality*] to** generate **asymmetric** cryptographic keys **used for IKE peer authentication** in accordance with: [**selection**:

- *FIPS PUB 186-4, "Digital Signature Standard (DSS)," Appendix B.3 for RSA schemes,*
- *FIPS PUB 186-4, "Digital Signature Standard (DSS)," Appendix B.4 for ECDSA schemes and implementing "NIST curves," P-256, P-384 and [**selection**: P-521, no other curves]*

] and specified cryptographic key sizes [*equivalent to, or greater than, a symmetric key strength of 112 bits*] that meet the following: [**assignment**: *list of standards*].

Application Note: The keys that are required to be generated by the TOE through this requirement are intended to be used for the authentication of the VPN entities during the IKE (either v1 or v2) key exchange. While it is required that the public key be associated with an identity in an X509v3 certificate, this association is not required to be performed by the TOE, and instead is expected to be performed by a Certificate Authority in the Operational Environment.

As indicated in FCS_IPSEC_EXT.1, the TOE is required to implement support for RSA or ECDSA (or both) for authentication.

See NIST Special Publication 800-57, “Recommendation for Key Management” for information about equivalent key strengths.

FCS_IPSEC_EXT.1 IPsec

FCS_IPSEC_EXT.1.1

The TSF shall implement the IPsec architecture as specified in RFC 4301.

Application Note: In the following elements of the FCS_IPSEC_EXT.1 component, it is allowable for some or all of the individual elements to be implemented by the platform on which the VPN client operates. However, this is only the case when the platform is within the TOE boundary, as is the case where this PP-Module is being claimed on top of a general-purpose operating system or a mobile device.

When the TOE is a standalone software application, the IPsec functionality must be implemented by the TSF, though it is permissible for the TSF to invoke cryptographic algorithm services from the TOE platform to support the TOE’s implementation of IPsec. The TOE may also rely on the TOE platform for X.509 certificate validation services, though it is the responsibility of the TSF to take the proper action based on the validation response that is returned.

It is also permissible for the TSF to rely on low-level capabilities of the platform to perform enforcement and routing functions as a result of the policies the TSF maintains. For example, while the TSF must provide the capability to implement the Security Policy Database abstraction, it is allowed for the TSF to depend on the platform-provided network stack/driver to perform the low-level packet filtering and routing actions once the TSF has set up those rules as defined by the SPD.

While enforcement of the IPsec requirements must be implemented by the TSF, it is permissible for the TSF to receive configuration of the IPsec behavior from an environmental source, most notably a VPN gateway.

RFC 4301 calls for an IPsec implementation to protect IP traffic through the use of a Security Policy Database (SPD). The SPD is used to define how IP packets are to be handled: PROTECT the packet (e.g., encrypt the packet), BYPASS the IPsec services (e.g., no encryption), or DISCARD the packet (e.g., drop the packet). The SPD can be implemented in various ways, including router access control lists, firewall rulesets, a "traditional" SPD, etc. Regardless of the implementation details, there is a notion of a "rule" that a packet is "matched" against and a resulting action that takes place.

While there must be a means to order the rules, a general approach to ordering is not mandated, as long as the TOE can distinguish the IP packets and apply the rules accordingly. There may be multiple SPDs (one for each network interface), but this is not required.

A VPN gateway fully implements the IPsec capability and provides an administrative interface to establish and populate an SPD. A VPN client is not required to provide an administrative interface to create or maintain an SPD.

As an alternative, a client may provide an interface that can be used by another application or network entity, such as a VPN gateway, as a means to establish and populate the SPD. In either of these cases (the client provides an administrative interface, or an API), while the client is expected to maintain the SPD abstraction, it is permitted for the low-level enforcement and routing activities to be implemented by platform capabilities (e.g., a network driver) as configured by the client.

FCS_IPSEC_EXT.1.2

The TSF shall implement [**selection**: *tunnel mode*, *transport mode*].

Application Note: If the TOE is used to connect to a VPN gateway for the purposes of establishing a secure connection to a private network, the ST author is expected to select tunnel mode. If the TOE uses IPsec to establish an end-to-end connection to another IPsec VPN Client, the ST author is expected to select transport mode. If the TOE uses IPsec to establish a connection to a specific endpoint device for the purpose of secure remote administration, the ST author is expected to select transport mode.

FCS_IPSEC_EXT.1.3

The TSF shall have a nominal, final entry in the SPD that matches anything that is otherwise unmatched, and discards it.

FCS_IPSEC_EXT.1.4

The TSF shall implement the IPsec protocol ESP as defined by RFC 4303 using the cryptographic algorithms [*AES-GCM-128, AES-GCM-256 as specified in RFC 4106*, [**selection**: *AES-CBC-128*, *AES-CBC-256 (both specified by RFC 3602) together with a Secure Hash Algorithm (SHA)-based HMAC*, *no other algorithms*]].

Application Note: If this functionality is configurable, the TSF may be configured by a VPN Gateway or by an Administrator of the TOE itself.

FCS_IPSEC_EXT.1.5

The The TSF shall implement the protocol: [**selection**:

- *IKEv1, using Main Mode for Phase I exchanges, as defined in RFCs 2407, 2408, 2409, RFC 4109, [**selection**: no other RFCs for extended sequence numbers, RFC 4304 for extended sequence numbers], [**selection**: no other RFCs for hash functions, RFC 4868 for hash functions], and [**selection**: support for XAUTH, no support for XAUTH],*
- *IKEv2 as defined in RFC 7296 (with mandatory support for NAT traversal as specified in section 2.23), RFC 8784, RFC 8247, and [**selection**: no other RFCs for hash functions, RFC 4868 for hash functions]*

].

FCS_IPSEC_EXT.1.6

The TSF shall ensure the encrypted payload in the [**selection**: *IKEv1*, *IKEv2*] protocol uses the cryptographic algorithms [*AES-CBC-128, AES-CBC-256 as specified in RFC 6379 and* [**selection**: *AES-GCM-128 as specified in RFC 5282*, *AES-GCM-256 as specified in RFC 5282*, *no other algorithm*].

Application Note: If this functionality is configurable, the TSF may be configured by a VPN Gateway or by an Administrator of the TOE itself.

FCS_IPSEC_EXT.1.7

The TSF shall ensure that [**selection**:

- *IKEv2 SA lifetimes can be configured by [**selection**: an Administrator, a VPN Gateway] based on [**selection**: number of packets/number of bytes, length of time] ,*
- *IKEv1 SA lifetimes can be configured by [**selection**: an Administrator, a VPN Gateway] based on [**selection**: number of packets/number of bytes, length of time] ,*
- *IKEv1 SA lifetimes are fixed based on [**selection**: number of packets/number of bytes, length of time]*

]. If length of time is used, it must include at least one option that is 24 hours or less for Phase 1 SAs and 8 hours or less for Phase 2 SAs.

Application Note: The ST author is afforded a selection based on the version of IKE in their implementation. There is a further selection within this selection that allows the ST author to specify which entity is responsible for “configuring” the life of the SA. An implementation that allows an administrator to configure the client or a VPN gateway that pushes the SA lifetime down to the client are both acceptable.

As far as SA lifetimes are concerned, the TOE can limit the lifetime based on the number of bytes transmitted, or the number of packets transmitted. Either packet-based or volume-based SA lifetimes are acceptable; the ST author makes the appropriate selection to indicate which type of lifetime limits are supported.

The ST author chooses either the IKEv1 requirements or IKEv2 requirements (or both, depending on the selection in FCS_IPSEC_EXT.1.5. The IKEv1 requirement can be accomplished either by providing Authorized Administrator-configurable lifetimes (with appropriate instructions in documents mandated by AGD_OPE),

or by “hard coding” the limits in the implementation. For IKEv2, there are no hardcoded limits, but in this case it is required that an administrator be able to configure the values. In general, instructions for setting the parameters of the implementation, including lifetime of the SAs, should be included in the operational guidance generated for AGD_OPE. It is appropriate to refine the requirement in terms of number of MB/KB instead of number of packets, as long as the TOE is capable of setting a limit on the amount of traffic that is protected by the same key (the total volume of all IPsec traffic protected by that key).

FCS_IPSEC_EXT.1.8

The TSF shall ensure that all IKE protocols implement DH Groups [*19 (256-bit Random ECP), 20 (384-bit Random ECP), and* [**selection**: *24 (2048-bit MODP with 256-bit POS), 15 (3072-bit MODP), 14 (2048-bit MODP), no other DH groups*]].

Application Note: The selection is used to specify additional DH groups supported. This applies to IKEv1 and IKEv2 exchanges. It should be noted that if any additional DH groups are specified, they must comply with the requirements (in terms of the ephemeral keys that are established) listed in FCS_CKM.1.

Since the implementation may allow different Diffie-Hellman groups to be negotiated for use in forming the SAs, the assignments in FCS_IPSEC_EXT.1.9 and FCS_IPSEC_EXT.1.10 may contain multiple values. For each DH group supported, the ST author consults Table 2 in 800-57 to determine the “bits of security” associated with the DH group. Each unique value is then used to fill in the assignment (for 1.9 they are doubled; for 1.10 they are inserted directly into the assignment). For example, suppose the implementation supports DH group 14 (2048-bit MODP) and group 20 (ECDH using NIST curve P-384). From Table 2, the bits of security value for group 14 is 112, and for group 20 it is 192. For FCS_IPSEC_EXT.1.9, then, the assignment would read “[224, 384]” and for FCS_IPSEC_EXT.1.10 it would read “[112, 192]” (although in this case the requirement should probably be refined so that it makes sense mathematically).

FCS_IPSEC_EXT.1.9

The TSF shall generate the secret value x used in the IKE Diffie-Hellman key exchange (“x” in g^x mod p) using the random bit generator specified in FCS_RBG_EXT.1, and having a length of at least [**assignment**: *(one or more) number(s) of bits that is at least twice the “bits of security” value associated with the negotiated Diffie-Hellman group as listed in Table 2 of NIST SP 800-57, Recommendation for Key Management – Part 1: General*] bits.

FCS_IPSEC_EXT.1.10

The TSF shall generate nonces used in IKE exchanges in a manner such that the probability that a specific nonce value will be repeated during the life a specific IPsec SA is less than 1 in 2^[**assignment**: *(one or more) “bits of security” value(s) associated with the negotiated Diffie-Hellman group as listed in Table 2 of NIST SP 800-57, Recommendation for Key Management – Part 1: General*].

FCS_IPSEC_EXT.1.11

The TSF shall ensure that all IKE protocols perform peer authentication using a [**selection**: *RSA*, *ECDSA*] that use X.509v3 certificates that conform to RFC 4945 and [**selection**: *Pre-shared keys*, *no other method*].

Application Note: At least one public-key-based Peer Authentication method is required in order to conform to this PP-Module; one or more of the public key schemes is chosen by the ST author to reflect what is implemented. The ST author also ensures that appropriate FCS requirements reflecting the algorithms used (and key generation capabilities, if provided) are listed to support those methods. Note that the TSS will elaborate on the way in which these algorithms are to be used (for example, 2409 specifies three authentication methods using public keys; each one supported will be described in the TSS).

If “pre-shared keys” is selected, the selection-based requirement FIA_PSK_EXT.1 must be claimed.

FCS_IPSEC_EXT.1.12

The TSF shall not establish an SA if the [[**selection**: *IP address*, *Fully Qualified Domain Name (FQDN)*, *user FQDN*, *Distinguished Name (DN)*] and [**selection**: *no other reference identifier type*, *[**assignment**: other supported reference identifier types]*]] contained in a certificate does not match the expected value(s) for the entity attempting to establish a connection.

Application Note: The TOE must support at least one of the following identifier types: IP address, Fully Qualified Domain Name (FQDN), user FQDN, or Distinguished Name (DN). In the future, the TOE will be required to support all

of these identifier types. The TOE is expected to support as many IP address formats (IPv4 and IPv6) as IP versions supported by the TOE in general. The ST author may assign additional supported identifier types in the second selection.

FCS_IPSEC_EXT.1.13

The TSF shall not establish an SA if the presented identifier does not match the configured reference identifier of the peer.

Application Note: At this time, only the comparison between the presented identifier in the peer's certificate and the peer's reference identifier is mandated by the testing below. However, in the future, this requirement will address two aspects of the peer certificate validation: 1) comparison of the peer's ID payload to the peer's certificate which are both presented identifiers, as required by RFC 4945 and 2) verification that the peer identified by the ID payload and the certificate is the peer expected by the TOE (per the reference identifier). At that time, the TOE will be required to demonstrate both aspects (i.e. that the TOE enforces that the peer's ID payload matches the peer's certificate which both match configured peer reference identifiers).

Excluding the DN identifier type (which is necessarily the Subject DN in the peer certificate), the TOE may support the identifier in either the Common Name or Subject Alternative Name (SAN) or both. If both are supported, the preferred logic is to compare the reference identifier to a presented SAN, and only if the peer's certificate does not contain a SAN, to fall back to a comparison against the Common Name. In the future, the TOE will be required to compare the reference identifier to the presented identifier in the SAN only, ignoring the Common Name.

The configuration of the peer reference identifier is addressed by FMT_SMF.1.1/VPN.

FCS_IPSEC_EXT.1.14

The [**selection**: *TSF*, *VPN Gateway*] shall be able to ensure by default that the strength of the symmetric algorithm (in terms of the number of bits in the key) negotiated to protect the [**selection**: *IKEv1 Phase 1*, *IKEv2 IKE_SA*] connection is greater than or equal to the strength of the symmetric algorithm (in terms of the number of bits in the key) negotiated to protect the [**selection**: *IKEv1 Phase 2*, *IKEv2 CHILD_SA*] connection.

Application Note: If this functionality is configurable, the TSF may be configured by a VPN Gateway or by an Administrator of the TOE itself

The ST author chooses either or both of the IKE selections based on what is implemented by the TOE. Obviously, the IKE version(s) chosen should be consistent not only in this element, but with other choices for other elements in this component. While it is acceptable for this capability to be configurable, the default configuration in the evaluated configuration (either "out of the box" or by configuration guidance in the AGD documentation) must enable this functionality.

5.5.3 User Data Protection (FDP)

FDP_RIP.2 Full Residual Information Protection

FDP_RIP.2.1

The **[selection: *TOE*, *TOE platform*]** shall enforce that any previous information content of a resource is made unavailable upon the [**selection**: *allocation of the resource to*, *deallocation of the resource from*] all objects.

Application Note: This requirement ensures, for example, that protocol data units (PDUs) are not padded with residual information such as cryptographic key material. The ST author uses the selection to specify when previous information is made unavailable.

5.5.4 Security Management (FMT)

The TOE is not required to maintain a separate management role. It is, however, required to provide functionality to configure certain aspects of TOE operation that should not be available to the general user population. It is possible for the TOE, TOE Platform, or VPN Gateway to provide this functionality. The client itself has to be configurable - whether it is from the EUD or from a VPN gateway.

FMT_SMF.1/VPN Specification of Management Functions (VPN)

FMT_SMF.1.1/VPN

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

- *Specify VPN gateways to use for connections,*
- *Specify IPsec VPN Clients to use for connections,*
- *Specify IPsec-capable network devices to use for connections,*
- *Specify client credentials to be used for connections,*
- *Configure the reference identifier of the peer,*
- *[**assignment**: any additional management functions]*

]

Application Note: Several of the management functions defined above correspond to the use cases of the TOE as follows:

- “Specify VPN gateways to use for connections” – Use Case 1
- “Specify IPsec VPN Clients to use for connections” – Use Case 2 (specifically refers to different end points to use for client-to-client connections)
- “Specify IPsec-capable network devices to use for connections” – Use Case 3

Selections appropriate for the use case(s) supported by the TOE should be claimed. "Client credentials" will include the client certificate used for IPsec authentication, and may also include a username/password.

For TOEs that support only IP address and FQDN identifier types, configuration of the reference identifier may be the same as configuration of the peer’s name for the purposes of connection.

If there are additional management functions performed by the TOE (including those specified in FCS_IPSEC_EXT.1), they should be added in the assignment.

5.5.5 Protection of the TSF (FPT)

FPT_TST_EXT.1/VPN TSF Self-Test

FPT_TST_EXT.1.1/VPN

The [**selection**: *TOE*, *TOE platform*] shall run a suite of self tests during initial start-up (on power on) to demonstrate the correct operation of the TSF.

FPT_TST_EXT.1.2/VPN

The [**selection**: *TOE*, *TOE platform*] shall provide the capability to verify the integrity of stored TSF executable code when it is loaded for execution through the use of the [**assignment**: *cryptographic services provided either by the portion of the TOE described by the Base-PP or by the operational environment*].

Application Note: While the TOE is typically a software package running in the IT Environment, it is still capable of performing the self-test activities required above. It should be understood, however, that there is a significant dependency on the host environment in assessing the assurance provided by the tests mentioned above (meaning that if the host environment is compromised, the self-tests will not be meaningful).

Cryptographic verification of the integrity is required, but the method by which this can be accomplished is specified in the ST in the assignment. The ST author will fill in the assignment with references to the cryptographic functions used to perform the integrity checks; this will include hashing and may potentially include digital signatures signed using X.509 certificates. If the TSF provides the cryptographic services used to verify updates, all relevant FCS_COP requirements will be identified in the assignment by the ST author.

5.6 TOE Security Functional Requirements Rationale

The following rationale provides justification for each security objective for the TOE, showing that the SFRs are suitable to meet and achieve the security objectives:

Table 3: SFR Rationale

Objective	Addressed by	Rationale
O.AUTHENTICATION	FIA_X509_EXT.3 (when GPOS PP is Base-PP)	This SFR supports the objective by enforcing the use of X.509 certificate authentication for IPsec.
	FIA_X509_EXT.2 (refined from MDF PP)	This SFR supports the objective by enforcing the use of X.509 certificate authentication for IPsec.
	FIA_X509_EXT.2	This SFR supports the objective by enforcing

	(refined from App PP)	the use of X.509 certificate authentication for IPsec.
	FIA_X509_EXT.2 (refined from MDM PP)	This SFR supports the objective by enforcing the use of X.509 certificate authentication for IPsec.
	FCS_IPSEC_EXT.1	This SFR supports the objective by requiring the TOE's implementation of IPsec to include requirements for how the remote VPN gateway or peer is authenticated.
	FIA_PSK_EXT.1 (optional)	This SFR supports the objective by optionally requiring support for pre-shared keys as an alternate authentication method for IPsec.
O.CRYPTOGRAPHIC_FUNCTIONS	FCS_CKM.1 (refined from GPOS PP)	This SFR supports the objective by requiring that the TOE implement key generation using certain methods.
	FCS_CKM.2 (refined from GPOS PP)	This SFR supports the objective by requiring that the TOE implement key establishment using certain methods.
	FCS_COP.1(1) (refined from GPOS PP)	This SFR supports the objective by requiring that the TOE implement symmetric encryption and decryption using certain methods.
	FTP_ITC.1 (when GPOS PP is Base-PP)	This SFR supports the objective by requiring the TOE to support the use of IPsec as a trusted channel.
	FCS_CKM.1 (refined from MDF PP)	This SFR supports the objective by requiring that the TOE implement key generation using certain methods.
	FCS_CKM.2(1) (refined from MDF PP)	This SFR supports the objective by requiring that the TOE implement key establishment using certain methods.
	FCS_COP.1(1) (refined from MDF PP)	This SFR supports the objective by requiring that the TOE implement symmetric encryption and decryption using certain methods.
	FTP_ITC_EXT.1 (refined from MDF PP)	This SFR supports the objective by requiring the TOE to support the use of IPsec as a trusted channel.
	FCS_CKM.1(1) (refined from App PP)	This SFR supports the objective by requiring the TOE to implement key generation using certain methods or to support invoking this function from its OS platform.
	FCS_CKM.2 (refined from App PP)	This SFR supports the objective by requiring the TOE to implement key establishment using certain methods or to support invoking this function from its OS platform.
	FCS_CKM_EXT.1 (refined from App PP)	This SFR supports the objective by requiring the TOE to specify whether it implements its own cryptographic primitives or invokes platform cryptographic services for these functions.
	FCS_COP.1(1) (refined from App PP)	This SFR supports the objective by requiring that the TOE implement symmetric encryption and decryption using certain methods.
	FCS_CKM.1 (refined from MDM PP)	This SFR supports the objective by requiring the TOE to implement key generation using certain methods or to support invoking this function from its OS platform.
	FCS_CKM.2 (refined from MDM PP)	This SFR supports the objective by requiring the TOE to implement key establishment using certain methods or to support invoking this function from its OS platform.

	FCS_COP.1(1) (refined from MDM PP)	This SFR supports the objective by requiring that the TOE implement symmetric encryption and decryption using certain methods or invoke platform functionality that provides this capability.
	FPT_ITT.1(1) (if applicable, refined from MDM PP)	If the MDM TOE includes a claim of this PP-Module to support protection of communications between distributed TOE components, this SFR supports the objective by requiring the TOE to support the use of IPsec for that interface.
	FTP_ITC.1(1) (if applicable, refined from MDM PP)	If the MDM TOE includes a claim of this PP-Module to support protection of communications between the TOE and one or more trusted external IT entities, this SFR supports the objective by requiring the TOE to support the use of IPsec for that interface.
	FTP_TRP.1(1) (if applicable, refined from MDM PP)	If the MDM TOE includes a claim of this PP-Module to support protection of communications between remote administrators and the TOE, this SFR supports the objective by requiring the TOE to support the use of IPsec for that interface.
	FCS_CKM.1/VPN	This SFR supports the objective by requiring the TOE to generate keys used for IKE using certain methods.
	FCS_IPSEC_EXT.1	This SFR supports the objective by requiring the TOE to implement the IPsec protocol in the specified manner.
O.KNOWN_STATE	FMT_SMF.1/VPN	This SFR supports the objective by requiring the TOE to implement certain administratively-configurable functions.
	FPT_TST_EXT.1/VPN	This SFR supports the objective by requiring the TOE to execute self-tests that demonstrate that its integrity is maintained.
	FAU_GEN.1/VPN (optional)	This SFR supports the objective by optionally requiring the TOE to generate audit records of its behavior.
	FAU_SEL.1/VPN (optional)	This SFR supports the objective by optionally requiring the TOE to allow for the configuration of what behavior is audited.
O.NONDISCLOSURE	FCS_CKM_EXT.2 (when GPOS PP is Base-PP)	This SFR supports the objective by requiring the TOE to store sensitive data in the operating system’s key storage.
	FCS_CKM_EXT.2 (when App PP is BasePP)	This SFR supports the objective by requiring the TOE or its platform to store sensitive data in the operating system’s key storage.
	FCS_CKM_EXT.4 (when App PP is Base-PP)	This SFR supports the objective by requiring the TOE or its platform to zeroize key data when no longer needed.
	FDP_RIP.1	This SFR supports the objective by requiring the TOE or its platform to ensure that residual data is purged from the system.
	FDP_IFC_EXT.1 (optional)	This SFR supports the objective by optionally requiring the TOE to prohibit split-tunneling so that network traffic cannot be transmitted outside of an established IPsec tunnel.

6 Consistency Rationale

6.1 Protection Profile for General Purpose Operating Systems

6.1.1 Consistency of TOE Type

If this PP-Module is used to extend the GPOS PP, the TOE type for the overall TOE is still a general-purpose operating system. The TOE boundary is simply extended to include VPN client functionality that is built into the operating system so that additional security functionality is claimed within the scope of the TOE.

6.1.2 Consistency of Security Problem Definition

The threats and assumptions defined by this PP-Module (see sections 3.1 and 3.2) supplement those defined in the GPOS PP as follows:

PP-Module Threat, Assumption, OSP	Consistency Rationale
T.UNAUTHORIZED_ACCESS	The threat of an attacker gaining access to a network interface or data that is transmitted over it is consistent with the T.NETWORK_ATTACK and T.NETWORK_EAVESDROP threats in the GPOS PP.
T.TSF_CONFIGURATION	The threat of a misconfigured VPN client is consistent with the T.NETWORK_ATTACK and T.NETWORK_EAVESDROP threats on the GPOS PP because misconfiguration could allow VPN traffic to be subjected unexpectedly to unauthorized modification or disclosure..
T.USER_DATA_REUSE	Inadvertent disclosure of user data to an unauthorized recipient is consistent with the T.NETWORK_EAVESDROP threat in the GPOS PP.
T.TSF_FAILURE	A failure of TSF functionality could compromise the local system, which is consistent with the T.LOCAL_ATTACK threat in the GPOS PP.
A.NO_TOE_BYPASS	The A.NO_TOE_BYPASS assumption assumes that the operational environment is configured in such a manner that the only network route to the protected network is through the TOE. This does not conflict with the GPOS PP because the GPOS PP makes no assumptions about the network architecture in which the TOE is deployed.
A.PHYSICAL	The assumption that physical security is provided by the environment is not explicitly stated in the GPOS PP but is consistent with the A.PLATFORM assumption defined in the GPOS PP, which expects the computing platform to be trusted.
A.TRUSTED_CONFIG	The assumption that personnel responsible for the TOE’s configuration are trusted to follow the guidance is consistent with the A.PROPER_ADMIN defined in the GPOS PP.

6.1.3 Consistency of Objectives

The security objectives defined by this PP-Module (see sections 4.1 and 4.2) supplement those defined in the GPOS PP as follows: The objectives for the TOEs are consistent with the General Purpose Operating Systems PP based on the following rationale:

PP-Module TOE Objective	Consistency Rationale
O.AUTHENTICATION	This objective is consistent with the O.PROTECTED_COMMS objective of the Base-PP, which also expects that trusted remote channels will enforce authentication of remote endpoints.
O.CRYPTOGRAPHIC_FUNCTIONS	This objective is consistent with the O.PROTECTED_COMMS objective of the Base-PP, which also expects that secure cryptographic functions are used to implement trusted communications.
O.KNOWN_STATE	This objective is consistent with the O.INTEGRITY objective of the Base-PP, which expects a conformant TOE to implement measures to maintain its own integrity.
O.NONDISCLOSURE	Consistency rationale for O.NONDISCLOSURE.

The objectives for the TOE's Operational Environment are consistent with the General Purpose Operating Systems PP based on the following rationale:

PP-Module Operational

Environment Objective	Consistency Rationale
OE.NO_TOE_BYPASS	This objective addresses behavior that is out of scope of the Base-PP and does not define an environment that a GPOS TOE is incapable of existing in.
OE.PHYSICAL	
OE.TRUSTED_CONFIG	The expectation of trusted configuration is consistent with OE.PROPER_USER and OE.PROPER_ADMIN in the GPOS PP.

6.1.4 Consistency of Requirements

This PP-Module identifies several SFRs from the General Purpose Operating Systems PP that are needed to support Virtual Private Network (VPN) Clients functionality. This is considered to be consistent because the functionality provided by the General Purpose Operating Systems PP is being used for its intended purpose. The PP-Module also identifies a number of modified SFRs from the General Purpose Operating Systems PP as well as new SFRs that are used entirely to provide functionality for Virtual Private Network (VPN) Clients. The rationale for why this does not conflict with the claims defined by the General Purpose Operating Systems PP are as follows:

PP-Module Requirement	Consistency Rationale
Modified SFRs	
FCS_CKM.1	The ST author is instructed to make specific selections at minimum to address VPN client requirements; the SFR behavior itself is unmodified.
FCS_CKM.2	The ST author is instructed to make specific selections at minimum to address VPN client requirements; the SFR behavior itself is unmodified.
FCS_COP.1/1	The SFR is refined to list an additional AES mode that must be supported to address VPN client requirements; the use of this mode for VPN connectivity does not impact the ability of the OS to satisfy any of its other security requirements.
Additional SFRs	
FCS_CKM_EXT.2	Storage of key data related to VPN functionality can be accomplished using the same mechanism defined by FCS_STO_EXT.1 in the OS PP.
FIA_X509_EXT.3	This SFR defines additional uses for X.509 certificate functionality that do not conflict with those defined in the OS PP.
FTP_ITC.1	This SFR defines a trusted channel for IPsec, which is added functionality that does not prevent the existing OS functions from being performed.
Mandatory SFRs	
FCS_CKM.1/1	
FCS_IPSEC_EXT.1	
FDP_RIP.2	
FMT_SMF.1/VPN	
FPT_TST_EXT.1/VPN	
Optional SFRs	
This PP-Module does not define any Optional requirements.	
Selection-based SFRs	
FIA_PSK_EXT.1	
Objective SFRs	
FAU_GEN.1/VPN	
FAU_SEL.1/VPN	
FDP_IFC_EXT.1	
Implementation-Dependent SFRs	
This PP-Module does not define any Implementation-Dependent requirements.	

6.2 Protection Profile for mobile devices

6.2.1 Consistency of TOE Type

If this PP-Module is used to extend the MDF PP, the TOE type for the overall TOE is still a mobile device. The TOE boundary is simply extended to include VPN client functionality that is built in to the device's software so that additional security functionality is claimed within the scope of the TOE.

6.2.2 Consistency of Security Problem Definition

The threats and assumptions defined by this PP-Module (see sections 3.1 and 3.2) supplement those defined in the MDF PP as follows:

PP-Module Threat, Assumption, OSP	Consistency Rationale
T.UNAUTHORIZED_ACCESS	The threat of an attacker gaining access to a network interface or data that is transmitted over it is consistent with the T.NETWORK and T.EAVESDROP threats in the MDF PP.
T.TSF_CONFIGURATION	The threat of a mis-configured VPN client is consistent with the T.NETWORK and T.EAVESDROP threats in the MDF PP because failure to mitigate against mis-configuration makes these threats more significant.
T.USER_DATA_REUSE	Inadvertent disclosure of user data to an unauthorized recipient is consistent with the T.EAVESDROP threat in the MDF PP.
T.TSF_FAILURE	A failure of TSF functionality could compromise the local system, which is consistent with the T.FLAWAPP threat in the MDF PP.
A.NO_TOE_BYPASS	
A.PHYSICAL	The MDF PP includes the A.NOTIFY and A.PRECAUTION assumptions to mitigate the risk of physical theft of the TOE. This is consistent with the A.PHYSICAL assumption in this PP-Module because the MDF PP includes reasonable assumptions about the physical security of the TOE.
A.TRUSTED_CONFIG	This assumption is consistent with the MDF PP because the MDF PP includes the A.CONFIG assumption which assumes that all security functions are appropriately configured.

6.2.3 Consistency of Objectives

The security objectives defined by this PP-Module (see sections 4.1 and 4.2) supplement those defined in the MDF PP as follows: The objectives for the TOEs are consistent with the mobile devices PP based on the following rationale:

PP-Module TOE Objective	Consistency Rationale
O.AUTHENTICATION	Consistency rationale for O.AUTHENTICATION.
O.CRYPTOGRAPHIC_FUNCTIONS	This objective is consistent with the O.COMMS objective of the Base-PP, which also expects that secure cryptographic functions are used to implement trusted communications.
O.KNOWN_STATE	This objective is consistent with the O.INTEGRITY objective of the Base-PP, which expects a conformant TOE to implement measures to maintain its own integrity.
O.NONDISCLOSURE	This objective is consistent with the O.STORAGE objective of the Base-PP, which ensures that sensitive data is not disclosed without authorization.

The objectives for the TOE's Operational Environment are consistent with the mobile devices PP based on the following rationale:

PP-Module Operational Environment Objective	Consistency Rationale
OE.NO_TOE_BYPASS	The A.NO_TOE_BYPASS assumption assumes that the operational environment is configured in such a manner that the only network route to the protected network is through the TOE. This does not conflict with the MDF PP because the MDF PP makes no assumptions about the network architecture in which the TOE is

	deployed.
OE.PHYSICAL	The operational environment of a mobile device cannot guarantee physical security, but the OE.PRECAUTION objective in the MDF PP ensures that an appropriate level of physical security is provided.
OE.TRUSTED_CONFIG	

6.2.4 Consistency of Requirements

This PP-Module identifies several SFRs from the mobile devices PP that are needed to support Virtual Private Network (VPN) Clients functionality. This is considered to be consistent because the functionality provided by the mobile devices PP is being used for its intended purpose. The PP-Module also identifies a number of modified SFRs from the mobile devices PP that are used entirely to provide functionality for Virtual Private Network (VPN) Clients. The rationale for why this does not conflict with the claims defined by the mobile devices PP are as follows:

PP-Module Requirement	Consistency Rationale
Modified SFRs	
FCS_CKM.1	The ST author is instructed to make specific selections at minimum to address VPN client requirements; the SFR behavior itself is unmodified.
FCS_CKM.2/1	The ST author is instructed to make specific selections at minimum to address VPN client requirements; the SFR behavior itself is unmodified.
FCS_COP.1/1	The ST author is instructed to make specific selections at minimum to address VPN client requirements; the SFR behavior itself is unmodified.
FIA_X509_EXT.2	This PP-Module adds IPsec as a new trusted protocol where x.509 certificate authentication is used.
FTP_ITC_EXT.1	This PP-Module adds IPsec as a new protocol that is used to implement trusted channels.
Mandatory SFRs	
FCS_CKM.1/1	
FCS_IPSEC_EXT.1	
FDP_RIP.2	
FMT_SMF.1/VPN	
FPT_TST_EXT.1/VPN	
Optional SFRs	
This PP-Module does not define any Optional requirements.	
Selection-based SFRs	
FIA_PSK_EXT.1	
Objective SFRs	
FAU_GEN.1/VPN	
FAU_SEL.1/VPN	
FDP_IFC_EXT.1	
Implementation-Dependent SFRs	
This PP-Module does not define any Implementation-Dependent requirements.	

6.3 Protection Profile for Application Software

6.3.1 Consistency of TOE Type

If this PP-Module is used to extend the App PP, the TOE type for the overall TOE is still a software application. The TOE boundary is made more specific by defining the TOE as a specific type of application.

6.3.2 Consistency of Security Problem Definition

The threats and assumptions defined by this PP-Module (see sections 3.1 and 3.2) supplement those defined in the App PP as follows:

PP-Module Threat, Assumption, OSP	Consistency Rationale
T.UNAUTHORIZED_ACCESS	The threat of an attacker gaining access to a network interface or data that is transmitted over it is consistent with the T.NETWORK_ATTACK and T.NETWORK_EAVESDROP threats in the App PP.
T.TSF_CONFIGURATION	The threat of a mis-configured VPN client is consistent with the T.LOCAL_ATTACK threat in the App PP.
T.USER_DATA_REUSE	Inadvertent disclosure of user data to an unauthorized recipient is consistent with the T.NETWORK_EAVESDROP threat in the App PP.
T.TSF_FAILURE	A failure of TSF functionality could compromise the local system, which is consistent with the T.LOCAL_ATTACK threat in the App PP.
A.NO_TOE_BYPASS	The A.NO_TOE_BYPASS assumption assumes that the operational environment is configured in such a manner that the only network route to the protected network is through the TOE. This does not conflict with the App PP because the App PP makes no assumptions about the network architecture in which the TOE is deployed.
A.PHYSICAL	The assumption that physical security is provided by the environment is not explicitly stated in the App PP but is consistent with the A.PLATFORM assumption defined in the App PP, which expects the computing platform to be trusted.
A.TRUSTED_CONFIG	The assumption that personnel responsible for the TOE's configuration are trusted to follow the guidance is consistent with the A.PROPER_ADMIN defined in the App PP.

6.3.3 Consistency of Objectives

The security objectives defined by this PP-Module (see sections 4.1 and 4.2) supplement those defined in the App PP as follows: The objectives for the TOEs are consistent with the Application Software PP based on the following rationale:

PP-Module TOE Objective	Consistency Rationale
O.AUTHENTICATION	This objective is consistent with the O.PROTECTED_COMMS objective of the Base-PP, which also expects that trusted remote channels will enforce authentication of remote endpoints.
O.CRYPTOGRAPHIC_FUNCTIONS	This objective is consistent with the O.PROTECTED_COMMS objective of the Base-PP, which also expects that secure cryptographic functions are used to implement trusted communications.
O.KNOWN_STATE	This objective is consistent with the O.INTEGRITY objective of the Base-PP, which expects a conformant TOE to implement measures to maintain its own integrity.
O.NONDISCLOSURE	This objective is consistent with the O.PROTECTED_STORAGE objective of the Base-PP, which ensures that sensitive data is not disclosed without authorization.

The objectives for the TOE's Operational Environment are consistent with the Application Software PP based on the following rationale:

PP-Module Operational Environment Objective	Consistency Rationale
OE.NO_TOE_BYPASS	
OE.PHYSICAL	This is part of satisfying OE.PLATFORM as defined in the App PP because physical security is required for the underlying platform to be considered 'trustworthy'.
OE.TRUSTED_CONFIG	

6.3.4 Consistency of Requirements

This PP-Module identifies several SFRs from the Application Software PP that are needed to support Virtual

Private Network (VPN) Clients functionality. This is considered to be consistent because the functionality provided by the Application Software PP is being used for its intended purpose. The PP-Module also identifies a number of modified SFRs from the Application Software PP as well as new SFRs that are used entirely to provide functionality for Virtual Private Network (VPN) Clients. The rationale for why this does not conflict with the claims defined by the Application Software PP are as follows:

PP-Module Requirement	Consistency Rationale
Modified SFRs	
FCS_CKM.1/1	The ST author is instructed to make specific selections at minimum to address VPN client requirements; the SFR behavior itself is unmodified. Additionally, this behavior is selection-based in the App PP but is made mandatory since it is required for VPN client functionality.
FCS_CKM.2	The ST author is instructed to make specific selections at minimum to address VPN client requirements and is modified to include Diffie-Hellman Group 14 as an additional supported method for key establishment.
FCS_CKM_EXT.1	The ST author is instructed to make specific selections at minimum to address VPN client requirements; specifically, since key generation services are required in some capacity in order to support VPN functionality, the ST author loses the choice of stating that the application does not have any key generation functionality. Additionally, this behavior is selection-based in the App PP but is made mandatory since it is required for VPN client functionality.
FCS_COP.1/1	The ST author is instructed to make specific selections at minimum to address VPN client requirements; the SFR behavior itself is unmodified.
FIA_X509_EXT.2	This PP-Module adds IPsec as a new trusted protocol where x.509 certificate authentication is used.
FTP_DIT_EXT.1	This PP-Module adds IPsec as a new protocol that is used to implement trusted channels.
Additional SFRs	
FCS_CKM_EXT.2	This PP-Module adds a requirement for key storage, which is new functionality when compared to the Base-PP but does not interfere with its existing security functions.
FCS_CKM_EXT.4	This PP-Module adds a requirement for key destruction, which is new functionality when compared to the Base-PP but does not interfere with its existing security functions.
Mandatory SFRs	
FCS_CKM.1/1	
FCS_IPSEC_EXT.1	
FDP_RIP.2	
FMT_SMF.1/VPN	
FPT_TST_EXT.1/VPN	
Optional SFRs	
This PP-Module does not define any Optional requirements.	
Selection-based SFRs	
FIA_PSK_EXT.1	
Objective SFRs	
FAU_GEN.1/VPN	
FAU_SEL.1/VPN	
FDP_IFC_EXT.1	
Implementation-Dependent SFRs	
This PP-Module does not define any Implementation-Dependent requirements.	

6.4 Protection Profile for MDMs

6.4.1 Consistency of TOE Type

If this PP-Module is used to extend the MDM PP, the TOE type for the overall TOE is still a mobile device management solution. The TOE boundary is simply extended to include VPN client functionality that is included with the MDM software so that additional security functionality is claimed within the scope of the TOE.

6.4.2 Consistency of Security Problem Definition

The threats and assumptions defined by this PP-Module (see sections 3.1 and 3.2) supplement those defined in the MDM PP as follows:

PP-Module Threat, Assumption, OSP	Consistency Rationale
T.UNAUTHORIZED_ACCESS	The threat of an attacker gaining access to a network interface or data that is transmitted over it is consistent with the T.NETWORK_ATTACK and T.NETWORK_EAVESDROP threats in the MDM PP.
T.TSF_CONFIGURATION	The threat of a mis-configured VPN client is consistent with the T.NETWORK_ATTACK and T.NETWORK_EAVESDROP threats in the MDM PP because failure to mitigate against mis-configuration makes these threats more significant.
T.USER_DATA_REUSE	Inadvertent disclosure of user data to an unauthorized recipient is consistent with the T.NETWORK_EAVESDROP threat in the MDM PP
T.TSF_FAILURE	A failure of TSF functionality could compromise the implementation of the IPsec channel, which would lead to an exploitation of the T.NETWORK_ATTACK threat.
A.NO_TOE_BYPASS	
A.PHYSICAL	The assumption that physical security is provided by the environment is not explicitly stated in the MDM PP but is consistent with the A.MDM_SERVER_PLATFORM assumption defined in the MDM PP, which expects the computing platform to be trusted.
A.TRUSTED_CONFIG	The assumption that personnel responsible for the TOE’s configuration are trusted to follow the guidance is consistent with the A.PROPER_ADMIN defined in the MDM PP.

6.4.3 Consistency of Objectives

The security objectives defined by this PP-Module (see sections 4.1 and 4.2) supplement those defined in the MDM PP as follows: The objectives for the TOEs are consistent with the MDMs PP based on the following rationale:

PP-Module TOE Objective	Consistency Rationale
O.AUTHENTICATION	This objective is consistent with the O.DATA_PROTECTION_TRANSIT objective of the Base-PP, which also expects that trusted remote channels will enforce authentication of remote endpoints
O.CRYPTOGRAPHIC_FUNCTIONS	This objective is consistent with the O.DATA_PROTECTION_TRANSIT objective of the Base-PP, which also expects that secure cryptographic functions are used to implement trusted communications.
O.KNOWN_STATE	This objective is consistent with the O.INTEGRITY objective of the Base-PP, which expects a conformant TOE to implement measures to maintain its own integrity.
O.NONDISCLOSURE	There are no objectives in the Base-PP that directly relate to this objective, but it could be considered to support both the O.ACCOUNTABILITY and O.MANAGEMENT objectives in the Base-PP by ensuring that stored data cannot be modified through unauthorized mechanisms that may allow for access control and logging functions to be bypassed.

The objectives for the TOE's Operational Environment are consistent with the MDMs PP based on the following rationale:

PP-Module Operational

Environment Objective	Consistency Rationale
OE.NO_TOE_BYPASS	The A.NO_TOE_BYPASS assumption assumes that the operational environment is configured in such a manner that the only network route to the protected network is through the TOE. This does not conflict with the MDM PP because the MDM PP makes no assumptions about the network architecture in which the TOE is deployed.This objective addresses behavior that is out of scope of the Base-PP and does not define an environment that an MDM TOE is incapable of existing in.
OE.PHYSICAL	
OE.TRUSTED_CONFIG	The expectation of trusted configuration is consistent with OE.PROPER_USER and OE.PROPER_ADMIN in the MDM PP.

6.4.4 Consistency of Requirements

This PP-Module identifies several SFRs from the MDMs PP that are needed to support Virtual Private Network (VPN) Clients functionality. This is considered to be consistent because the functionality provided by the MDMs PP is being used for its intended purpose. The PP-Module also identifies a number of modified SFRs from the MDMs PP that are used entirely to provide functionality for Virtual Private Network (VPN) Clients. The rationale for why this does not conflict with the claims defined by the MDMs PP are as follows:

PP-Module Requirement	Consistency Rationale
Modified SFRs	
FCS_CKM.1	The ST author is instructed to make specific selections at minimum to address VPN client requirements; the SFR behavior itself is unmodified.
FCS_CKM.2	The ST author is instructed to make specific selections at minimum to address VPN client requirements; the SFR behavior itself is unmodified.
FCS_COP.1/1	The ST author is instructed to make specific selections at minimum to address VPN client requirements; the SFR behavior itself is unmodified.
FIA_X509_EXT.2	This PP-Module adds IPsec as a new trusted protocol where x.509 certificate authentication is used.
FTP_ITT.1/1	This PP-Module adds IPsec as a new protocol that is used to implement trusted channels.
FTP_ITC.1/1	This PP-Module adds IPsec as a new protocol that is used to implement trusted channels.
FTP_TRP.1/1	This PP-Module adds IPsec as a new protocol that is used to implement trusted channels.
Mandatory SFRs	
FCS_CKM.1/1	
FCS_IPSEC_EXT.1	
FDP_RIP.2	
FMT_SMF.1/VPN	
FPT_TST_EXT.1/VPN	
Optional SFRs	
This PP-Module does not define any Optional requirements.	
Selection-based SFRs	
FIA_PSK_EXT.1	
Objective SFRs	
FAU_GEN.1/VPN	
FAU_SEL.1/VPN	
FDP_IFC_EXT.1	

Implementation-Dependent SFRs

This PP-Module does not define any Implementation-Dependent requirements.

Appendix A - Optional SFRs

A.1 Strictly Optional Requirements

This PP-Module does not define any Strictly Optional SFRs.

A.2 Objective Requirements

A.3 Auditable Events for Objective SFRs

Table 4: Auditable Events for Objective Requirements

Requirement	Auditable Events	Additional Audit Record Contents
FAU_GEN.1/VPN	No events specified	
FAU_SEL.1/VPN	All modifications to the audit configuration that occur while the audit collection functions are operating.	
FDP_IFC_EXT.1	No events specified	

A.4 Implementation-Based Requirements

This PP-Module does not define any Implementation-Based SFRs.

Appendix B - Selection-Based Requirements

B.1 Auditable Events for Selection-based SFRs

Table 5: Auditable Events for Selection-based Requirements

Requirement	Auditable Events	Additional Audit Record Contents
FIA_PSK_EXT.1	No events specified	

Appendix C - Extended Component Definitions

This appendix contains the definitions for all extended requirements specified in the PP-Module.

C.1 Extended Components Table

All extended components specified in the PP-Module are listed in this table:

Table 6: Extended Component Definitions

Functional Class	Functional Components
Cryptographic Support (FCS)	FCS_CKM_EXT Cryptographic Key Management FCS_IPSEC_EXT IPsec
Identification and Authentication (FIA)	FIA_PSK_EXT Pre-Shared Key Composition FIA_X509_EXT X.509 Certificate Use and Management
Protection of the TSF (FPT)	FPT_TST_EXT TSF Self-Test
User Data Protection (FDP)	FDP_IFC_EXT Subset Information Flow Control

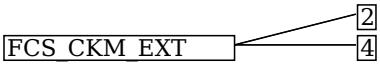
C.2 Extended Component Definitions

C.2.1 FCS_CKM_EXT Cryptographic Key Management

Family Behavior

Components in this family describe requirements for key management functionality such as key storage and destruction.

Component Leveling



FCS_CKM_EXT.2, Cryptographic Key Storage, requires the TSF to securely store key data when not in use

FCS_CKM_EXT.4, Cryptographic Key Destruction, requires the TSF to destroy key data when no longer required.

Management: FCS_CKM_EXT.2

No specific management functions are identified.

Audit: FCS_CKM_EXT.2

There are no auditable events foreseen.

FCS_CKM_EXT.2 Cryptographic Key Storage

Hierarchical to: No other components.

Dependencies to: No dependencies.

FCS_CKM_EXT.2.1

The [**selection**: *VPN client, OS*] shall store persistent secrets and private keys when not in use in OS-provided key storage.

Management: FCS_CKM_EXT.4

No specific management functions are identified.

Audit: FCS_CKM_EXT.4

There are no auditable events foreseen.

FCS_CKM_EXT.4 Cryptographic Key Destruction

Hierarchical to: No other components.

Dependencies to: No dependencies

FCS_CKM_EXT.4.1

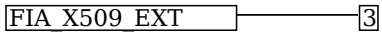
The [**selection**: *TOE*, *TOE platform*] shall zeroize all plaintext secret and private cryptographic keys and CSPs when no longer required.

C.2.2 FIA_X509_EXT X.509 Certificate Use and Management

Family Behavior

Components in this family describe the requirements that pertain to IP traffic and information flow through the VPN client.

Component Leveling



FIA_X509_EXT.3, X.509 Certificate Use and Management, requires the TOE to perform X.509 certificate authentication and describes the behavior that is followed if is the status of the certificate is unknown or invalid.

Management: FIA_X509_EXT.3

No specific management functions are identified.

Audit: FIA_X509_EXT.3

There are no auditable events foreseen.

FIA_X509_EXT.3 X.509 Certificate Use and Management

Hierarchical to: No other components.

Dependencies to: FIA_X509_EXT.1 X.509 Certificate Validation

FPT_TST_EXT.1 TSF Self-Test

FPT_TUD_EXT.1 Trusted Update

FIA_X509_EXT.3.1

The TSF shall use X.509v3 certificates as defined by RFC 5280 to support authentication for IPsec exchanges, and [**selection**: *digital signatures for FPT_TUD_EXT.1*, *integrity checks for FPT_TST_EXT.1*, *no additional uses*].

FIA_X509_EXT.3.2

When a connection to determine the validity of a certificate cannot be established, the [**selection**: *VPN client*, *OS*] shall [**selection**: *allow the administrator to choose whether to accept the certificate in these cases*, *accept the certificate*, *not accept the certificate*].

FIA_X509_EXT.3.3

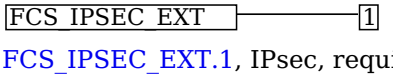
The [**selection**: *VPN client*, *OS*] shall not establish an SA if a certificate or certificate path is deemed invalid.

C.2.3 FCS_IPSEC_EXT IPsec

Family Behavior

Components in this family describe requirements for IPsec implementation.

Component Leveling



FCS_IPSEC_EXT.1, IPsec, requires the TSF to securely implement the IPsec protocol.

Management: FCS_IPSEC_EXT.1

The following actions could be considered for the management functions in FMT:

- Specify VPN gateways to use for connections
- Specify IPsec VPN Clients to use for connections
- Specify IPsec-capable network devices to use for connections
- Specify client credentials to be used for connections

Audit: FCS_IPSEC_EXT.1

The following actions should be auditable if FAU_GEN Security Audit Data Generation is included in the PP/ST:

- Decisions to DISCARD or BYPASS network packets processed by the TOE

- Failure to establish an IPsec SA
- Establishment/Termination of an IPsec SA

FCS_IPSEC_EXT.1 IPsec

Hierarchical to: No other components.

Dependencies to: FCS_CKM.1 Cryptographic Key Generation

FCS_CKM.2 Cryptographic Key Distribution

FCS_COP.1 Cryptographic Operation

FCS_IPSEC_EXT.1.1

The TSF shall implement the IPsec architecture as specified in RFC 4301.

FCS_IPSEC_EXT.1.2

The TSF shall implement [**selection**: *tunnel mode*, *transport mode*].

FCS_IPSEC_EXT.1.3

The TSF shall have a nominal, final entry in the SPD that matches anything that is otherwise unmatched, and discards it.

FCS_IPSEC_EXT.1.4

The TSF shall implement the IPsec protocol ESP as defined by RFC 4303 using the cryptographic algorithms [*AES-GCM-128*, *AES-GCM-256 as specified in RFC 4106,* [**selection**: *AES-CBC-128*, *AES-CBC-256 (both specified by RFC 3602) together with a Secure Hash Algorithm (SHA)-based HMAC*, *no other algorithms*]].

FCS_IPSEC_EXT.1.5

The The TSF shall implement the protocol: [**selection**:

- *IKEv1, using Main Mode for Phase I exchanges, as defined in RFCs 2407, 2408, 2409, RFC 4109, [**selection**: no other RFCs for extended sequence numbers, RFC 4304 for extended sequence numbers], [**selection**: no other RFCs for hash functions, RFC 4868 for hash functions], and [**selection**: support for XAUTH, no support for XAUTH],*
- *IKEv2 as defined in RFC 7296 (with mandatory support for NAT traversal as specified in section 2.23), RFC 8784, RFC 8247, and [**selection**: no other RFCs for hash functions, RFC 4868 for hash functions]*

].

FCS_IPSEC_EXT.1.6

The TSF shall ensure the encrypted payload in the [**selection**: *IKEv1*, *IKEv2*] protocol uses the cryptographic algorithms [*AES-CBC-128, AES-CBC-256 as specified in RFC 6379 and* [**selection**: *AES-GCM-128 as specified in RFC 5282*, *AES-GCM-256 as specified in RFC 5282*, *no other algorithm*].

FCS_IPSEC_EXT.1.7

The TSF shall ensure that [**selection**:

- *IKEv2 SA lifetimes can be configured by [**selection**: an Administrator, a VPN Gateway] based on [**selection**: number of packets/number of bytes, length of time] ,*
- *IKEv1 SA lifetimes can be configured by [**selection**: an Administrator, a VPN Gateway] based on [**selection**: number of packets/number of bytes, length of time] ,*
- *IKEv1 SA lifetimes are fixed based on [**selection**: number of packets/number of bytes, length of time]*

]. If length of time is used, it must include at least one option that is 24 hours or less for Phase 1 SAs and 8 hours or less for Phase 2 SAs.

FCS_IPSEC_EXT.1.8

The TSF shall ensure that all IKE protocols implement DH Groups [*19 (256-bit Random ECP), 20 (384-bit Random ECP), and* [**selection**: *24 (2048-bit MODP with 256-bit POS)*, *15 (3072-bit MODP)*, *14 (2048-bit MODP)*, *no other DH groups*]].

FCS_IPSEC_EXT.1.9

The TSF shall generate the secret value x used in the IKE Diffie-Hellman key exchange (“x” in g^x mod p) using the random bit generator specified in FCS_RBG_EXT.1, and having a length of at least [**assignment**: *(one or more) number(s) of bits that is at least twice the “bits of security” value associated with the negotiated Diffie-Hellman group as listed in Table 2 of NIST SP 800-57, Recommendation for Key Management – Part 1: General*] bits.

FCS_IPSEC_EXT.1.10

The TSF shall generate nonces used in IKE exchanges in a manner such that the probability that a specific nonce value will be repeated during the life a specific IPsec SA is less than 1 in 2^[**assignment**: *(one or more) "bits of security" value(s) associated with the negotiated Diffie-Hellman group as listed in Table 2 of NIST SP 800-57, Recommendation for Key Management – Part 1: General*].

FCS_IPSEC_EXT.1.11

The TSF shall ensure that all IKE protocols perform peer authentication using a [**selection**: *RSA*, *ECDSA*] that use X.509v3 certificates that conform to RFC 4945 and [**selection**: *Pre-shared keys*, *no other method*].

FCS_IPSEC_EXT.1.12

The TSF shall not establish an SA if the [[**selection**: *IP address*, *Fully Qualified Domain Name (FQDN)*, *user FQDN*, *Distinguished Name (DN)*] and [**selection**: *no other reference identifier type*, *[**assignment**: other supported reference identifier types]*]] contained in a certificate does not match the expected value(s) for the entity attempting to establish a connection.

FCS_IPSEC_EXT.1.13

The TSF shall not establish an SA if the presented identifier does not match the configured reference identifier of the peer.

FCS_IPSEC_EXT.1.14

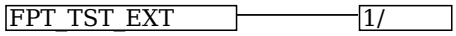
The [**selection**: *TSF*, *VPN Gateway*] shall be able to ensure by default that the strength of the symmetric algorithm (in terms of the number of bits in the key) negotiated to protect the [**selection**: *IKEv1 Phase 1*, *IKEv2 IKE_SA*] connection is greater than or equal to the strength of the symmetric algorithm (in terms of the number of bits in the key) negotiated to protect the [**selection**: *IKEv1 Phase 2*, *IKEv2 CHILD_SA*] connection.

C.2.4 FPT_TST_EXT TSF Self-Test

Family Behavior

Components in this family describe requirements for self-test to verify functionality and integrity of the TOE.

Component Leveling



FPT_TST_EXT.1/VPN, TSF Self-Test, requires the TOE to perform power on self-tests to verify its functionality and the integrity of its stored executable code.

Management: FPT_TST_EXT.1/VPN

No specific management functions are identified.

Audit: FPT_TST_EXT.1/VPN

There are no auditable events foreseen.

FPT_TST_EXT.1/VPN TSF Self-Test

Hierarchical to: No other components.

Dependencies to:

FPT_TST_EXT.1.1/VPN

The [**selection**: *TOE*, *TOE platform*] shall run a suite of self tests during initial start-up (on power on) to demonstrate the correct operation of the TSF.

FPT_TST_EXT.1.2/VPN

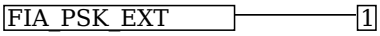
The [**selection**: *TOE*, *TOE platform*] shall provide the capability to verify the integrity of stored TSF executable code when it is loaded for execution through the use of the [**assignment**: *cryptographic services provided either by the portion of the TOE described by the Base-PP or by the operational environment*].

C.2.5 FIA_PSK_EXT Pre-Shared Key Composition

Family Behavior

Components in this family describes the requirements for pre-shared keys when implementing IPsec

Component Leveling



FIA_PSK_EXT.1, Pre-Shared Key Composition, defines the use and composition of pre-shared keys used for IPsec

Management: FIA_PSK_EXT.1

No specific management functions are identified.

Audit: FIA_PSK_EXT.1

The following actions should be auditable if FAU_GEN Security Audit Data Generation is included in the PP/ST:

- Failure of the randomization process

FIA_PSK_EXT.1 Pre-Shared Key Composition

Hierarchical to: No other components.

Dependencies to: FCS_IPSEC_EXT.1 IPsec

FIA_PSK_EXT.1.1

The TSF shall be able to use pre-shared keys for IPsec.

FIA_PSK_EXT.1.2

The TSF shall be able to accept text-based pre-shared keys that:

- Are 22 characters and [**selection**: *[**assignment**: other supported lengths], no other lengths*],
- Composed of any combination of upper and lower case letters, numbers, and special characters (that include: “!”, “@”, “#”, “$”, “%”, “^”, “&”, “*”, “(“, “)”, and [**selection**: *no other special characters*, *[**assignment**: list of additional supported special characters]*].

FIA_PSK_EXT.1.3

The TSF shall condition the text-based pre-shared keys by using [**selection**: *SHA-1*, *SHA-256*, *SHA-512*, *[**assignment**: method of conditioning text string]*], [**selection**:

- *be able to [**selection**: accept, generate using the random bit generator specified in FCS_RBG_EXT.1],*
- *perform no other conditioning*

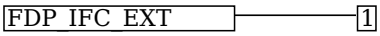
].

C.2.6 FDP_IFC_EXT Subset Information Flow Control

Family Behavior

Components in this family describe the requirements that pertain to IP traffic and information flow through the VPN client.

Component Leveling



FDP_IFC_EXT.1, Subset Information Flow Control, requires the TSF to process all IP traffic through its VPN client functionality.

Management: FDP_IFC_EXT.1

No specific management functions are identified.

Audit: FDP_IFC_EXT.1

There are no auditable events foreseen.

FDP_IFC_EXT.1 Subset Information Flow Control

Hierarchical to: No other components.

Dependencies to: FCS_IPSEC_EXT.1 IPsec

FDP_IFC_EXT.1.1

The TSF shall ensure that all IP traffic (other than IP traffic required to establish the VPN connection) flow through the IPsec VPN client.

Appendix D - Acronyms

Acronym	Meaning
AES	Advanced Encryption Standard
Base-PP	Base Protection Profile
CC	Common Criteria
CEM	Common Evaluation Methodology
CRL	Certificate Revocation List
CSP	Critical Security Parameter
DH	Diffie-Hellman
DN	Distinguished Name
DSS	Digital Signature Standard
ECC	Elliptic Curve Cryptography
ESP	Encapsulating Security Protocol
EUD	End-User Device
FFC	Finite Field Cryptography
FIPS	Federal Information Processing Standards
FQDN	Fully Qualified Domain Name
ICMP	Internet Control Message Protocol
IKE	Internet Key Exchange
IP	Internet Protocol
IT	Information Technology
MD	Mobile Device (Fundamentals)
NAT	Network Address Translation
NIST	National Institute of Standards and Technology
OCSP	Online Certificate Status Protocol
OE	Operational Environment
OS	(General Purpose) Operating System
OS	Operating System
OSP	Organizational Security Policy
PP	Protection Profile
PP	Protection Profile
PP-Configuration	Protection Profile Configuration
PP-Module	Protection Profile Module
PUB	Publication
RBG	Random Bit Generation
RFC	Request For Comment
SA	Security Association
SAR	Security Assurance Requirement
SD	Supporting Document

SFR	Security Functional Requirement
SHA	Secure Hash Algorithm
SPD	Security Policy Database
ST	Security Target
TCP	Transmission Control Protocol
TOE	Target of Evaluation
TSF	TOE Security Functionality
TSFI	TSF Interface
TSS	TOE Summary Specification
UDP	User Datagram Protocol
VPN	Virtual Private Network

Appendix E - Bibliography

Identifier	Title
[CC]	Common Criteria for Information Technology Security Evaluation - • Part 1: Introduction and General Model, CCMB-2017-04-001, Version 3.1 Revision 5, April 2017. • Part 2: Security Functional Components, CCMB-2017-04-002, Version 3.1 Revision 5, April 2017. • Part 3: Security Assurance Components, CCMB-2017-04-003, Version 3.1 Revision 5, April 2017.
[App PP]	Protection Profile for Application Software, Version 1.3, March 2019
[MD PP]	Protection Profile for Mobile Device Fundamentals, Version 3.1, June 2017
[MDM PP]	Protection Profile for Mobile Device Management (This needs to be updated) , Version 3.1, June 2017
[OS PP]	Protection Profile for General Purpose Operating Systems, Version 4.2.1, April 2019
[SD]	Supporting Document Mandatory Technical Document, PP-Module for Virtual Private Network (VPN) Clients, Version 2.1, November 2019