

Protection Profile for General Purpose Operating Systems/Protection Profile for Mobile Device Fundamentals/Protection Profile for Application Software Extended Package (EP) for Virtual Private Network (VPN) Clients



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1 Introduction

1.1 Overview

The scope of this Extended Package (EP) 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 EP is not complete in itself, but rather extends any of the Protection Profile for General Purpose Operating Systems (GPOS PP), the Protection Profile for Mobile Device Fundamentals (MDF PP), or the Protection Profile for Application Software (App PP). This is 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.

1.2 Terms

The following sections provide both Common Criteria and technology terms used in this EP.

1.2.1 Common Criteria Terms

Common Criteria (CC)	Common Criteria for Information Technology Security Evaluation.
Common Evaluation Methodology (CEM)	Common Evaluation Methodology for Information Technology Security Evaluation.
Extended Package (EP)	An implementation-independent set of security requirements for a specific subset of products described by a PP.
Protection Profile (PP)	An implementation-independent set of security requirements for a category of products.
Security Assurance Requirement (SAR)	A requirement for how the TOE's proper implementation of the SFRs is verified by an evaluator.
Security Functional Requirement (SFR)	A requirement for security enforcement by the TOE.
Security Target (ST)	A set of implementation-dependent security requirements for a specific product.
Target of Evaluation (TOE)	The product under evaluation. In this case, a network device with Enterprise Session Controller capabilities.
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 a ST.

1.2.2 Technology Terms

Administrator	A user that has administrative privilege to configure the TOE in privileged mode.
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Authentication Server	An entity designed to facilitate the authentication of an entity (user or client) that attempts to access a protected network.
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.
FIPS Approved Cryptographic Function	A security function (e.g., cryptographic algorithm, cryptographic key management technique, or authentication technique) that is either: 1) specified in a Federal Information Processing Standard (FIPS), or 2) adopted in a FIPS and specified either in an appendix to the FIPS or in a document referenced by the FIPS.
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 EP 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 EP, IPsec peers are defined as:

- VPN gateways,
- Other VPN clients, and/or
- 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 EP extends the GPOS PP when the VPN client is installed on an operating system that is discussed in that PP (e.g., Windows, Mac OS, Linux). This EP 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 EP 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.

As an EP of any of these PPs, it is expected that the content of this EP and the chosen base PP be appropriately combined in the context of each product-specific Security Target. This EP has been specifically defined such that there should be no difficulty or ambiguity in doing so. When this EP is used, conformant TOEs are obligated to implement the functionality required in the claimed ‘base’ PP with the additional functionality defined in this EP in response to the threat environment discussed subsequently herein. An ST must identify the applicable versions of the EP chosen and this EP in its conformance claims.

1.3.1 TOE Boundary

The TOE defined by this EP 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 or not 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 EP 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 EP 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.

For these requirements, there are two sets of assurance activities. Assurance activities 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 EP 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 EP 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 either the Internet Key Exchange (IKE)v1 protocol as defined in RFCs 2407, 2408, 2409, 4109 or the IKEv2 protocol as specified in RFCs 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 shall perform the assurance activities documented in this EP. In future versions of this EP, assurance activities 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 Protection Profile 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.

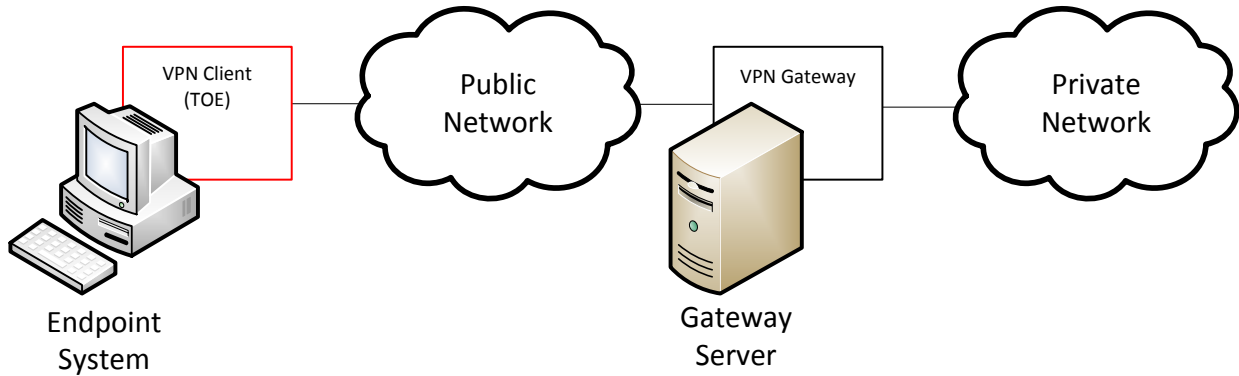


Figure 1: TOE to VPN Gateway

[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.

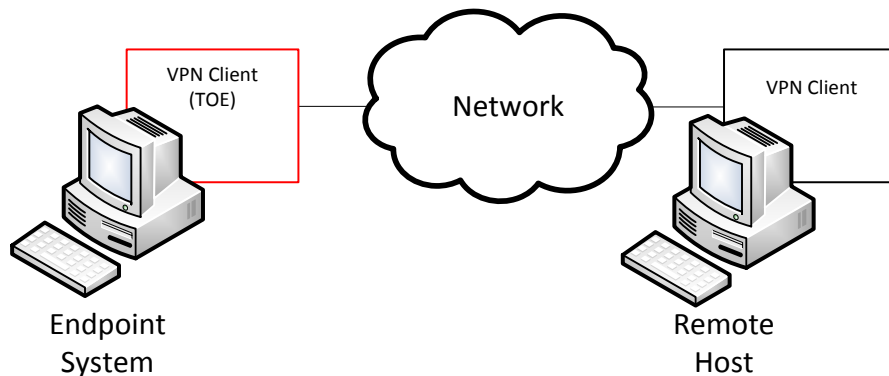


Figure 2: TOE to VPN Client

[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.

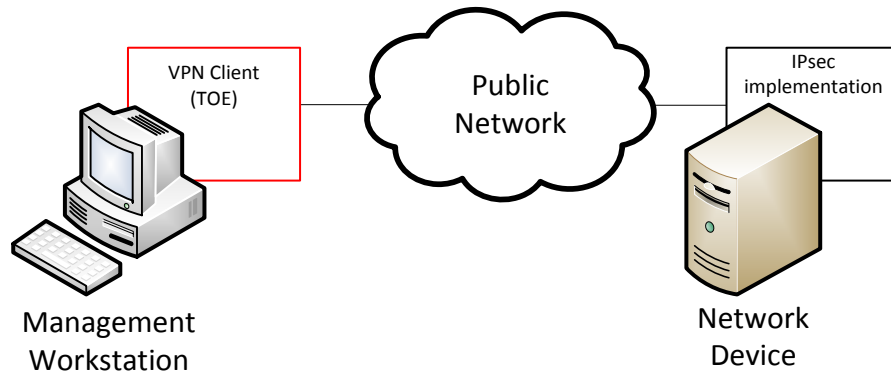


Figure 3: TOE to IPsec-capable Network Device

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

- Authentication of the IPsec peer;
- Cryptographic protection of data in transit; and
- 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

To be conformant to this EP, an ST must demonstrate Exact Conformance, a subset of Strict Conformance as defined in [CC] Part 1 (ASE_CCL). The ST must include all components in this EP that are:

- Unconditional (which are always required)
- Selection-based (which are required when certain selections are chosen in the unconditional requirements)

and may include components that are

- Optional
- Objective.

Unconditional requirements are found in the main body of the document (Section 5), while appendices contain the selection-based, optional, and objective requirements. The ST may iterate any of these components but it must not introduce any additional component (e.g. from CC Part 2 or 3) that is not defined in either the GPOS PP, MDF PP, or App PP (which this EP extends), or in this EP itself.

CC Conformance Claims

This EP is conformant to Parts 2 (extended) and 3 (conformant) of Common Criteria Version 3.1, Revision 4 [CC].

PP Claim

This EP does not claim conformance to any Protection Profile. Note that this EP extends any of the GPOS PP, MDF PP, or App PP, which means that it relies on these PPs to provide some set of 'base' functionality which is then expanded upon by this EP. This however does not imply that the EP itself is conformant to either of these PPs.

Package Claim

This EP 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 EP 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 an EP, 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 PP it extends. The Security Functional Requirements defined in this EP will mitigate the threats that are defined in the EP 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

T.UNAUTHORIZED_ACCESS

This EP 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.UNAUTHORIZED_UPDATE

Since the most common attack vector used involves attacking unpatched versions of software containing well-known flaws, updating the VPN client is necessary to ensure that changes to threat environment are addressed. Timely application of patches ensures that the client is a “hard target”, thus increasing the likelihood that product will be able to maintain and enforce its security policy. However, the updates to be applied to the product must be trustable in some manner; otherwise, an attacker can write their own “update” that instead contains malicious code of their choosing, such as a rootkit, bot, or other malware. Once this “update” is installed, the attacker then has control of the system and all of its data.

Methods of countering this threat typically involve hashes of the updates, and potentially cryptographic operations (e.g., digital signatures) on those hashes as well. However, the validity of these methods introduces additional threats. For instance, a weak hash function could result in the attacker being able to modify the legitimate update in such a way that the hash remained unchanged. For cryptographic signature schemes, there are dependencies on

- 1) the strength of the cryptographic algorithm used to provide the signature, and
- 2) the ability of the end user to verify the signature (which typically involves checking a hierarchy of digital signatures back to a root of trust (a certificate authority)).

If a cryptographic signature scheme is weak, then it may be compromised by an attacker and the end user will install a malicious update, thinking that it is legitimate. Similarly, if the root of trust can be compromised, then a strong digital signature algorithm will not stop the malicious update from being installed (the attacker will just create their own signature on the update using the compromised root of trust, and the malicious update will then be installed without detection).

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 EP 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

This EP defines no additional organizational security policies beyond those defined in the supported base PPs.

4 Security Objectives

4.1 Security Objectives for the TOE

This EP defines no additional TOE security objectives beyond those specified in the base PPs.

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). This section defines the security objectives that are to be addressed by the IT domain or by non-technical 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

The security objectives for the Operational Environment are identical to the assumptions made about the TOE's Operational Environment. This EP does not define any TOE objectives or organizational security policies so no additional correspondence is applicable.

5 Security Requirements

The Security Functional Requirements (SFRs) included in this section are derived from Part 2 of the *Common Criteria for Information Technology Security Evaluation, Version 3.1, Revision 4*, with additional extended functional components.

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

- **Assignment** is indicated with *italicized text*.
- **Refinement** is made by EP author and indicated with **bold text**.
- **Selection** is indicated with *italicized text*.
- **Iteration** is indicated by appending the SFR name with a slash and unique identifier suggesting the purpose of the iteration, e.g. '/VPN' for an SFR relating to VPN functionality and/or a sequential number in parentheses, e.g. (1).
- **Extended SFRs** is identified by having a label "EXT" after the SFR name.

Note that selections and assignments to be completed by the ST author are preceded with "selection:" and "assignment:". If text is italicized and does not include either of these, it means that the selection or assignment has already been completed in this EP and the ST author must use the text as written.

5.1 GPOS PP Security Functional Requirements Direction

If this EP is extending 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. If a TOE claiming conformance to this EP is using the GPOS PP as the claimed base PP, 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 5.4.

5.1.1 Applicable Unmodified SFRs

The SFRs listed in this section are defined in the GPOS PP and relevant to the secure operation of the VPN client. When testing the TOE, it is necessary to ensure these SFRs are tested specifically in conjunction with the VPN client portion of the TOE, either directly or as a dependency to the IPsec functionality. The ST author may complete all selections and assignments in these SFRs without any additional restrictions.

- FCS_CKM_EXT.3
- FCS_COP.1(2)
- FCS_COP.1(3)
- FCS_COP.1(4)
- FCS_RBG_EXT.1
- FIA_X509_EXT.1
- FPT_TUD_EXT.2

5.1.2 Applicable Modified SFRs

The SFRs listed in this section are defined in the GPOS PP and relevant to the secure operation of the VPN client. Unlike the SFRs listed in the previous section, it is necessary for the ST author to complete selections and/or assignments for these SFRs in a specific manner in order to ensure that the functionality provided by the OS is consistent with the functionality required by the VPN client in order for it to conform to this EP.

FCS_CKM.1(1) Cryptographic Key Generation

FCS_CKM.1.1(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;**
- **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;**

[selection:

- *RSA schemes using cryptographic key sizes of 2048-bit or greater that meet the following: [selection: 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 GPOS PP except that FFC and ECC key generation have been made mandatory in support of IPsec due to the mandated support for DH groups 14, 19, and 20 in FCS_IPSEC_EXT.1.8. RSA remains present as a selection since it may be used by facets of the OS TOE that are not specifically related to VPN client functionality.*

Assurance Activity

Refer to the assurance activity for FCS_CKM.1(1) in the GPOS PP.

FCS_CKM.2(1) Cryptographic Key Establishment

FCS_CKM.2.1(1) The OS shall implement functionality to perform cryptographic key establishment in accordance with a specified key establishment method:

- RSA-based key establishment schemes that meets the following: NIST Special Publication 800-56B, “Recommendation for Pair-Wise Key Establishment Schemes using Integer Factorization Cryptography”;
- **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 implementing “NIST curves” P-256, P-384, and [selection: P-521, no other curves] as defined in FIPS PUB 186-4, “Digital Signature Standard”, 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**

].

Application Note:

This SFR differs from its definition in the GPOS 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. One of these two claims must be made in support of DH group 14 in FCS_IPSEC_EXT.1.8. The use of RSA is not explicitly mandated by the VPN client but it is mandatory in the GPOS PP as a prerequisite to implementing TLS, which is why it remains mandatory here.

Assurance Activity

For all key establishment schemes that conform to NIST SP 800-56A or 800-56B, refer to the assurance activity for FCS_CKM.2(1) in the GPOS PP.

If "Key establishment scheme using Diffie-Hellman group 14..." is selected, the evaluator shall ensure that the TSS describes how the implementation meets RFC 3526 Section 3. The evaluator shall also verify the correctness of the TSF's implementation of Diffie-Hellman group 14 by using a known good implementation for each protocol selected in FTP_ITC_EXT.1 and FTP_TRP.1 in the GPOS PP that uses Diffie-Hellman group 14. Note that because a TOE that conforms to this EP must implement IPsec, the tested protocols shall include IPsec at minimum.

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

and [selection:

- *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 SP 800-38C and IEEE 802.11ac-2013);*

- AES-GCMP-256 (as defined in NIST SP 800-38D and IEEE 802.11ac-2013);
- No other modes

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

Application Note: This SFR is identical to what is defined in the GPOS PP except that support for 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.

Assurance Activity

Refer to the assurance activity for FCS_COP.1(1) in the GPOS PP.

5.1.3 Additional SFRs

This section lists additional SFRs that must be added to the TOE boundary in order to implement the functionality required by this EP when the GPOS PP is claimed as the base PP.

FCS_CKM.1/VPN Cryptographic Key Generation (IKE)

FCS_CKM.1.1/VPN The [*selection: VPN client, OS*] shall 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.**

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 X.509v3 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.

Assurance Activity

TSS

The evaluator shall examine the TSS to verify that it describes how the key generation functionality is invoked.

AGD

There are no AGD assurance activities for this requirement.

Test

There are no test assurance activities for this requirement.

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.*

Assurance Activity

TSS

Regardless of whether this requirement is met by the VPN client or the OS, the evaluator will check the TSS to ensure that it lists each persistent secret (credential, secret key) and private key needed to meet the requirements in the ST. For each of these items, the evaluator will confirm that the TSS lists for what purpose it is used, and how it is stored.

The evaluator shall review the TSS for to determine that it makes a case that, for each item listed as being manipulated by the VPN client, it is not written unencrypted to persistent memory, and that the item is stored by the OS.

AGD

There are no AGD assurance activities for this requirement.

Test

There are no test assurance activities for this requirement.

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*].

Assurance Activity

This requirement is tested through assurance activities for FCS_IPSEC_EXT.1, (conditionally) FPT_TUD_EXT.1, and (conditionally) FPT_TST_EXT.1.

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 valid according to all other rules in FIA_X509_EXT.1, the behavior indicated in the second selection shall 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.

Assurance Activity

TSS

The evaluator shall check the TSS to ensure that it describes whether the VPN client or the OS implements the certificate validation functionality, how the VPN client/OS chooses which certificates to use, and any necessary instructions in the administrative guidance for configuring the OS so that desired certificates can be used.

The evaluator shall examine the TSS to confirm that it describes the behavior of the client/OS when a connection cannot be established during the validity check of a certificate used in establishing a trusted channel.

AGD

If the requirement that the administrator is able to specify the default action, then the evaluator shall ensure that the operational guidance contains instructions on how this configuration action is performed.

Test

The evaluator shall perform the following test regardless of whether the certificate validation functionality is implemented by the VPN client or by the OS:

Test 1: The evaluator shall demonstrate that using a valid certificate that requires certificate validation checking to be performed in at least some part by communicating with a non-TOE IT entity. The evaluator shall then manipulate the environment so that the TOE is unable to verify the validity of

the certificate, and observe that the action selected in FIA_X509_EXT.3.2 is performed. If the selected action is administrator-configurable, then the evaluator shall follow the operational guidance to determine that all supported administrator-configurable options behave in their documented manner.

FIA_X509_EXT.3.3 The [*selection: VPN client, OS*] shall not establish an SA if a certificate or certificate path is deemed invalid.

Assurance Activity

This requirement is tested as part of FCS_IPSEC_EXT.1.11.

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 via 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 re-establish 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.

Assurance Activity

TSS

The evaluator shall examine the TSS to determine that it describes the details of the TOE connecting to a VPN gateway and/or VPN client and/or IPsec-capable network device in terms of the cryptographic protocols specified in the requirement, along with TOE-specific options or procedures that might not be reflected in the specification. The evaluator shall also confirm that all

protocols listed in the TSS are specified and included in the requirements in the ST.

AGD

The evaluator shall confirm that the operational guidance contains instructions for establishing the connection to a VPN gateway and/or VPN client and/or IPsec-capable network device, and that it contains recovery instructions should a connection be unintentionally broken.

Test

The evaluator shall perform the following tests:

Test 1: The evaluators shall ensure that the TOE is able to initiate communications with a VPN gateway and/or VPN client and/or IPsec-capable network device using the protocols specified in the requirement, setting up the connections as described in the operational guidance and ensuring that communication is successful.

Test 2: The evaluator shall ensure, for each communication channel with an IPsec peer, the channel data is not sent in plaintext.

Test 3: The evaluator shall ensure, for each communication channel with an IPsec peer, modification of the channel data is detected by the TOE.

Test 4: The evaluators shall physically interrupt the connection from the TOE to the IPsec peer. The evaluators shall ensure that subsequent communications are appropriately protected, at a minimum in the case of any attempts to automatically resume the connection or connect to a new access point.

Further assurance activities are associated with requirements for FCS_IPSEC_EXT.1.

5.2 MDF PP Security Functional Requirements Direction

In cases where the TOE is a software application and this EP is used to extend the MDF PP, it is necessary for the ST author to make certain selections or assignments and to include certain optional requirements in order to provide the functionality required by the EP. This section provides instructions on what claims need to be made in the base PP in order to claim conformance to this EP.

Full assurance activities are not repeated 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 Applicable Unmodified SFRs

The SFRs listed in this section are defined in the MDF PP and relevant to the secure operation of the VPN client. When testing the TOE, it is necessary to ensure these SFRs are tested specifically in conjunction

with the VPN client portion of the TOE, either directly or as a dependency to the IPsec functionality. The ST author may complete all selections and assignments in these SFRs without any additional restrictions.

- FCS_CKM_EXT.4
- FCS_COP.1(2)
- FCS_COP.1(3)
- FCS_COP.1(4)
- FCS_STG_EXT.2
- FCS_RBG_EXT.1
- FIA_X509_EXT.1
- FPT_TUD_EXT.1
- FTP_ITC_EXT.1

5.2.2 Applicable Modified SFRs

The SFRs listed in this section are defined in the MDF PP and relevant to the secure operation of the VPN client. Unlike the SFRs listed in the previous section, it is necessary for the ST author to complete selections and/or assignments for these SFRs in a specific manner in order to ensure that the functionality provided by the mobile device is consistent with the functionality required by the VPN client in order for it to conform to this EP.

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 [P-521, no other curves]] that meet the following: [FIPS PUB 186-4, “Digital Signature Standard (DSS)”, Appendix B.4], [Curve25519 schemes that meet the following: [RFC 7748]];**
- **[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];**

[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];*
- **no other key generation methods].**

Application Note:

This SFR is functionally identical to what is defined in the MDF PP except that FFC and ECC key generation have been made mandatory in support of IPsec due to the mandated support for DH groups 14, 19, and 20 in FCS_IPSEC_EXT.1.8, and support for P-256 is made mandatory due to its use in DH group 19. 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.

Assurance Activity

Refer to the assurance activity for FCS_CKM.1 in the MDF PP.

FCS_CKM.2(1) Cryptographic Key Establishment

FCS_CKM.2.1(1)

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

- *[RSA-based key establishment schemes]* that meets the following: *[NIST Special Publication 800-56B, “Recommendation for Pair-Wise Key Establishment Schemes Using Integer Factorization Cryptography”]*;
- ***[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***

].

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. One of these two claims must be made in support of DH group 14 in FCS_IPSEC_EXT.1.8. The use of RSA is not explicitly mandated by the VPN client but it is mandatory in the MDF PP, which is why it remains mandatory here.

Assurance Activity

For all key establishment schemes that conform to NIST SP 800-56A or 800-56B, refer to the assurance activity for FCS_CKM.2(1) in the MDF PP.

If “Key establishment scheme using Diffie-Hellman group 14...” is selected, the evaluator shall ensure that the TSS describes how the implementation meets RFC 3526 Section 3. The evaluator shall also verify the correctness of the TSF’s implementation of Diffie-Hellman group 14 by using a known good implementation for each protocol selected in FTP_ITC_EXT.1 in the MDF PP that uses Diffie-Hellman group 14. Note that because a TOE that conforms to this EP must implement IPsec, the tested protocols shall include IPsec at minimum.

FCS_COP.1(1) Cryptographic Operation

FCS_COP.1.1(1) The TSF shall perform [*encryption/decryption*] in accordance with a specified algorithm

- AES-CBC (as defined in FIPS PUB 197, and 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 SP 800-38C 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.

Assurance Activity

Refer to the assurance activity for FCS_COP.1(1) in the MDF PP.

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 **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 the 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.

Assurance Activity

Refer to the assurance activity for FIA_X509_EXT.2 in the MDF PP.

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.*

Assurance Activity

Refer to the assurance activity for FTP_ITC_EXT.1 in the MDF PP.

5.2.3 Additional SFRs

This section lists additional SFRs that must be added to the TOE boundary in order to implement the functionality required by this EP when the MDF PP is claimed as the base PP.

FCS_CKM.1/VPN Cryptographic Key Generation (IKE)

FCS_CKM.1.1/VPN The [*selection: VPN client, OS*] shall 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.**

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.

Assurance Activity

TSS

The evaluator shall examine the TSS to verify that it describes how the key generation functionality is invoked.

AGD

There are no AGD assurance activities for this requirement.

Test

There are no test assurance activities for this requirement.

5.3 App PP Security Functional Requirements Direction

If this EP is extending the App PP, the VPN client is expected to rely on the security functions implemented by the application as a whole and evaluated against the base PP. If a TOE claiming conformance to this EP is using the App PP as the claimed base PP, 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 3.2 above.

5.3.1 Applicable Unmodified SFRs

The SFRs listed in this section are defined in the App PP and relevant to the secure operation of the VPN client. When testing the TOE, it is necessary to ensure these SFRs are tested specifically in conjunction with the VPN client portion of the TOE, either directly or as a dependency to the IPsec functionality. The ST author may complete all selections and assignments in these SFRs without any additional restrictions.

- FIA_X509_EXT.1
- FPT_TUD_EXT.1

Additionally, the following selection-based SFRs may or may not be implemented by the TOE but can be included without restrictions if the TOE provides these functions:

- FCS_COP.1(2)
- FCS_COP.1(3)
- FCS_COP.1(4)

5.3.2 Applicable Modified SFRs

The SFRs listed in this section are defined in the App PP and relevant to the secure operation of the VPN client. Unlike the SFRs listed in the previous section, it is necessary for the ST author to complete selections and/or assignments for these SFRs in a specific manner in order to ensure that the functionality provided by the application is consistent with the functionality required by the VPN client in order for it to conform to this EP.

FCS_CKM.1(1) Cryptographic Asymmetric Key Generation

FCS_CKM.1.1(1)

The application 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];**
- **[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];**

[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];*
- **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 EP.

This SFR is functionally identical to what is defined in the App PP except that FFC and ECC key generation have been made mandatory in support of IPsec due to the mandated support for DH groups 14, 19, and 20 in FCS_IPSEC_EXT.1.8. RSA remains present as a selection since it may be used by facets of the Application Software TOE that are not specifically related to VPN client functionality.

Assurance Activity

Refer to the assurance activity for FCS_CKM.1(1) in the App PP.

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 cryptographic key establishment method:

- [RSA-based key establishment schemes] that meets the following: [NIST Special Publication 800-56B, “Recommendation for Pair-Wise Key Establishment Schemes Using Integer Factorization Cryptography”],
 - [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**
-].

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 either NIST SP 800-56A or RFC 3526 for key establishment using finite field cryptography. One of these two claims must be made in support of DH group 14 in FCS_IPSEC_EXT.1.8. The use of RSA is not explicitly mandated by the VPN client but it is mandatory in the App PP, which is why it remains mandatory here.

Assurance Activity

For all key establishment schemes that conform to NIST SP 800-56A or 800-56B, refer to the assurance activity for FCS_CKM.2 in the App PP.

If “Key establishment scheme using Diffie-Hellman group 14...” is selected, the evaluator shall ensure that the TSS describes how the implementation meets RFC 3526 Section 3. The evaluator shall also verify the correctness of the TSF’s implementation of Diffie-Hellman group 14 by using a known good implementation for each protocol selected in FTP_DIT_EXT.1 in the App PP that uses Diffie-Hellman group 14. Note that because a TOE that conforms to this EP must implement IPsec, the tested protocols shall include IPsec at minimum.

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 SFR is selection-based in the App PP but is mandatory for a TOE that claims conformance to this EP because asymmetric key generation services are required for IPsec. The selection for “generate no asymmetric cryptographic keys” has

been removed for this EP 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).

Assurance Activity

This SFR is evaluated in conjunction with FCS_CKM.1(1) in the App PP.

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

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; and
- [AES-GCM (as defined in NIST SP 800-38D)]

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 App 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. Therefore, the relevant selections have already been completed.*

This SFR is selection-based in the App PP and is still selection-based for this EP since the application’s underlying platform can still provide cryptographic services on behalf of the TOE.

Assurance Activity

Refer to the assurance activity for FCS_COP.1(1) in the App PP.

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** [selection: *HTTPS, TLS, DTLS, no other protocols*].

FIA_X509_EXT.2.2 When the application cannot establish a connection to determine the validity of a certificate, the application 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 in the case that IPsec is the TOE’s only use of certificates.*

Assurance Activity

Refer to the assurance activity for FIA_X509_EXT.2 in the App PP.

FTP_DIT_EXT.1 Protection of Data in Transit

FTP_DIT_EXT.1.1 The application shall [encrypt all transmitted sensitive data with **IPsec** and [selection: **HTTPS**, **TLS**, **DTLS**, **no other protocols**]] between itself and another trusted IT product.

Application Note: *This SFR is identical to what is defined in the App PP except that mandatory support for IPsec is added and the ST author is forced to select the ‘encrypt all transmitted sensitive data’ option. However, since it is possible that a conformant TOE may not use any encryption protocols other than IPsec, “no other protocols” is provided as a selectable option in the list of supported protocols.*

Assurance Activity

Refer to the assurance activity for FTP_DIT_EXT.1 in the App PP.

5.3.3 Additional SFRs

This section lists additional SFRs that must be added to the TOE boundary in order to implement the functionality required by this EP when the App PP is claimed as the base PP.

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.*

Assurance Activity

TSS

Regardless of whether this requirement is met by the TOE or the TOE platform, the evaluator will check the TSS to ensure that it lists each persistent secret (credential, secret key) and private key needed to meet the requirements in the ST. For each of these items, the evaluator will confirm that the TSS lists for what purpose it is used, and how it is stored. The evaluator then performs the following actions:

Persistent secrets and private keys manipulated by the platform

For each platform listed in the ST, the evaluator shall examine the ST of the platform to ensure that the persistent secrets and private keys listed as being stored by the platform in the VPN client ST are identified as being protected in that platform's ST.

Persistent secrets and private keys manipulated by the TOE

The evaluator reviews the TSS for to determine that it makes a case that, for each item listed as being manipulated by the TOE, it is not written unencrypted to persistent memory, and that the item is stored by the platform.

AGD

There are no AGD assurance activities for this requirement.

Test

There are no test assurance activities for this requirement.

FCS_CKM_EXT.4 Protection of Data in Transit

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 shall select both options and make it clear in the TSS the entity responsible (TOE, TOE platform) for performing the zeroization.

Assurance Activity

TSS

The evaluator shall ensure that all plaintext secret and private cryptographic keys and CSPs (whether manipulated by the TOE or exclusively by the

platform) are identified in the VPN Client ST's TSS, and that they are accounted for by the assurance activities in this section.

Requirement met by the platform

The evaluator shall check to ensure the TSS describes each of the secret keys (keys used for symmetric encryption), private keys, and CSPs used to generate key that are not otherwise covered by the FCS_CKM_EXT.4 requirement levied on the TOE.

For each platform listed in the ST, the evaluator shall examine the TSS of the ST of the platform to ensure that each of the secret keys, private keys, and CSPs used to generate key listed above are covered.

Requirement met by the TOE

The evaluator shall check to ensure the TSS describes when each of the plaintext keys are cleared (e.g., system power off, disconnection of an IPsec connection, when no longer needed by the VPN channel per the protocol); and the type of clearing procedure that is performed (cryptographic erase, overwrite with zeros, overwrite three or more times by a different alternating pattern, overwrite with random pattern, or block erase). If different types of memory are used to store the materials to be protected, the evaluator shall check to ensure that the TSS describes the clearing procedure in terms of the memory in which the data are stored (for example, "secret keys stored on flash are cleared by overwriting once with zeros, while secret keys stored on the internal persistent storage device are cleared by overwriting three times with a random pattern that is changed before each write").

AGD

There are no AGD assurance activities for this requirement.

Test

For each key clearing situation described in the TSS, the evaluator shall repeat the following test.

Test 1: The evaluator shall utilize appropriate combinations of specialized operational environment and development tools (debuggers, simulators, etc.) for the TOE and instrumented TOE builds to test that keys are cleared correctly, including all intermediate copies of the key that may have been created internally by the TOE during normal cryptographic processing with that key.

Cryptographic TOE implementations in software shall be loaded and exercised under a debugger to perform such tests. The evaluator shall perform the following test for each key subject to clearing, including intermediate copies of keys that are persisted encrypted by the TOE:

1. Load the instrumented TOE build in a debugger.
2. Record the value of the key in the TOE subject to clearing.
3. Cause the TOE to perform a normal cryptographic processing with the key from #1.
4. Cause the TOE to clear the key.
5. Cause the TOE to stop the execution but not exit.
6. Cause the TOE to dump the entire memory footprint of the TOE into a binary file.
7. Search the content of the binary file created in #4 for instances of the known key value from #1.

The test succeeds if no copies of the key from #1 are found in step #7 above and fails otherwise.

The evaluator shall perform this test on all keys, including those persisted in encrypted form, to ensure intermediate copies are cleared.

5.4 TOE Security Functional Requirements

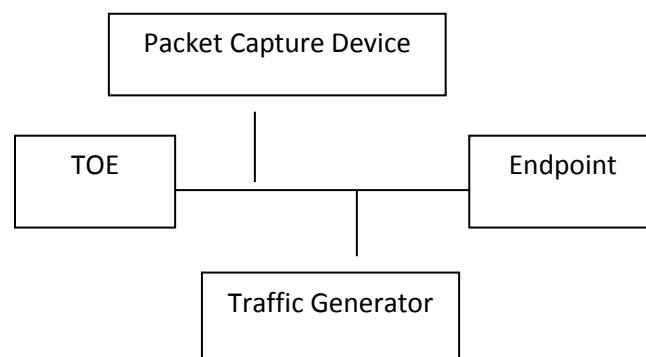
The following section describes the SFRs that must be satisfied by any TOE that claims conformance to this EP. These SFRs must be claimed regardless of whether the base PP is the GPOS PP, the MDF PP, or the App PP.

5.4.1 Cryptographic Support (FCS)

FCS_IPSEC_EXT.1 IPsec

In order to show that the TSF implements the RFCs in accordance with the requirements of this EP, the evaluator shall perform the assurance activities listed below. In future versions of this EP, assurance activities may be augmented, or new ones introduced that cover more aspects of RFC compliance than are currently described in this publication.

The TOE is required to use the IPsec protocol to establish connections used to communicate with an IPsec peer.



The evaluators shall minimally create a test environment equivalent to the test environment illustrated above. It is expected that the traffic generator is used to construct network packets and will provide the evaluator with the ability manipulate fields in the ICMP, IPv4, IPv6, UDP, and TCP packet headers. The evaluators must provide justification for any differences in the test environment.

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. If the TOE extends the App PP, the ST author will indicate whether the TOE or TOE platform implements the VPN functionality through the selections in the components of this SFR. If the TOE extends the GPOS PP or MDF PP, all IPsec functionality will be implemented by the TOE. In this case, the ST author must identify in the TSS which functions are implemented by the VPN client portion of the TOE versus the underlying operating system or mobile device.

If the configuration is to be performed on the platform, the evaluators shall ensure that the "operational guidance" for each platform in the VPN client ST contains the appropriate information (either through reference in the platform's ST, or by information contained in the VPN client ST). All tests must be performed by the evaluators using the VPN client and a representative sample of platforms listed in the VPN client ST.

FCS_IPSEC_EXT.1.1 The [selection: TOE, TOE platform] shall implement the IPsec architecture as specified in RFC 4301.

Application Note: *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, on the other hand, may fully implement the IPsec functionality, or it may rely on the underlying platform to implement aspects, including the 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 application, such as a VPN gateway, a means to establish and populate the SPD.

Assurance Activity

TSS

The evaluator shall examine the TSS and determine that it describes how the IPsec capabilities are implemented and how a packet is processed, e.g., what takes place at the platform and what takes place within the client. The TSS will detail the relationship between the client and the underlying platform, including which aspects are implemented by the client, and those that are provided by the underlying platform. The TSS describes how the client interacts with the platform's network stack (e.g., does the client insert itself within the stack via kernel mods, does the client simply invoke APIs to gain access to network services).

If the SPD is implemented by the client, then the TSS describes how the SPD is implemented and the rules for processing both inbound and outbound packets in terms of the IPsec policy. The TSS describes the rules that are available and the resulting actions available after matching a rule. The TSS describes how the available rules and actions form the SPD using terms defined in RFC 4301 such as BYPASS (e.g., no encryption), DISCARD (e.g., drop the packet), and PROTECT (e.g., encrypt the packet) actions defined in RFC 4301.

As noted in section 4.4.1 of RFC 4301, the processing of entries in the SPD is non-trivial and the evaluator shall determine that the description in the TSS is sufficient to determine which rules will be applied given the rule structure implemented by the TOE. For example, if the TOE allows specification of ranges, conditional rules, etc., the evaluator shall determine that the description of rule processing (for both inbound and outbound packets) is sufficient to determine the action that will be applied, especially in the case where two different rules may apply. This description shall cover both the initial packets (that is, no SA is established on the interface or for that particular packet) as well as packets that are part of an established SA. If the SPD is implemented by the underlying platform, then the TSS describes how the client interacts with the platform to establish and populate the SPD, including the identification of the platform's interfaces that are used by the client.

AGD

The evaluator shall examine the operational guidance to verify it describes how the SPD is created and configured. If there is an administrative interface to the client, then the guidance describes how the administrator specifies rules for processing a packet. The description includes all three cases - a rule that ensures packets are encrypted/decrypted, dropped, and allowing a packet to flow in plaintext. The evaluator shall determine that the description in the operational guidance is consistent with the description in the TSS, and that the level of detail in the operational guidance is sufficient to allow the

administrator to set up the SPD in an unambiguous fashion. This includes a discussion of how ordering of rules impacts the processing of an IP packet.

If the client is configured by an external application, such as the VPN gateway, then the operational guidance should indicate this and provide a description of how the client is configured by the external application. The description should contain information as to how the SPD is established and set up in an unambiguous fashion. The description should also include what is configurable via the external application, how ordering of entries may be expressed, as well as the impacts that ordering of entries may have on the packet processing.

In either case, the evaluator ensures the description provided in the TSS is consistent with the capabilities and description provided in the operational guidance.

Test

Depending on the implementation, the evaluator may be required to use a VPN gateway or some form of application to configure the client and platform. For Test 2, the evaluator is required to choose an application that allows for the configuration of the full set of capabilities of the VPN client (in conjunction with the platform). For example, if the client provides a robust interface that allows for specification of wildcards, subnets, etc., it is unacceptable for the evaluator to choose a VPN Gateway that only allows for specifying a single fully qualified IP addresses in the rule.

The evaluator shall perform the following tests:

Test 1: The evaluator shall configure an SPD on the client that is capable of the following: dropping a packet, encrypting a packet, and allowing a packet to flow in plaintext. The selectors used in the construction of the rule shall be different such that the evaluator can generate a packet and send packets to the client with the appropriate fields (fields that are used by the rule - e.g., the IP addresses, TCP/UDP ports) in the packet header. The evaluator performs both positive and negative test cases for each type of rule. The evaluator observes via the audit trail, and packet captures that the TOE exhibited the expected behavior: appropriate packets were dropped, allowed through without modification, was encrypted by the IPsec implementation.

Test 2: The evaluator shall devise several tests that cover a variety of scenarios for packet processing. These scenarios must exercise the range of possibilities for SPD entries and processing modes as outlined in the TSS and operational guidance. Potential areas to cover include rules with overlapping ranges and conflicting entries, inbound and outbound packets, and packets that establish SAs as well as packets that belong to established SAs. The evaluator shall verify, via the audit trail and packet captures, for each

scenario that the expected behavior is exhibited, and is consistent with both the TSS and the operational guidance.

FCS_IPSEC_EXT.1.2 The [*selection: TOE, TOE platform*] 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.*

Assurance Activity

TSS

The evaluator shall check the TSS to ensure it states that the VPN can be established to operate in tunnel mode and/or transport mode (as selected). The evaluator shall confirm that the operational guidance contains instructions on how to configure the connection in each mode selected.

AGD

If both transport mode and tunnel mode are implemented, the evaluator shall review the operational guidance to determine how the use of a given mode is specified.

Test

The evaluator shall perform the following test(s) based on the selections chosen:

Test 1 [conditional]: If tunnel mode is selected, the evaluator uses the operational guidance to configure the TOE/platform to operate in tunnel mode and also configures a VPN gateway to operate in tunnel mode. The evaluator configures the TOE/platform and the VPN gateway to use any of the allowable cryptographic algorithms, authentication methods, etc. to ensure an allowable SA can be negotiated. The evaluator shall then initiate a connection from the client to connect to the VPN GW peer. The evaluator observes (for example, in the audit trail and the captured packets) that a successful connection was established using the tunnel mode.

Test 2 [conditional]: If transport mode is selected, the evaluator uses the operational guidance to configure the TOE/platform to operate in transport mode and also configures an IPsec peer to accept IPsec connections using transport mode. The evaluator configures the TOE/platform and the endpoint device to use any of the allowed cryptographic algorithms, authentication

methods, etc. to ensure an allowable SA can be negotiated. The evaluator then initiates a connection from the TOE/platform to connect to the remote endpoint. The evaluator observes (for example, in the audit trail and the captured packets) that a successful connection was established using the transport mode.

Test 3 [conditional]: If both tunnel mode and transport mode are selected, the evaluator shall perform both Test 1 and Test 2 above, demonstrating that the TOE can be configured to support both modes.

Test 4 [conditional]: If both tunnel mode and transport mode are selected, the evaluator shall modify the testing for FCS_IPSEC_EXT.1 to include the supported mode for SPD PROTECT entries to show that they only apply to traffic that is transmitted or received using the indicated mode.

FCS_IPSEC_EXT.1.3

The [*selection: TOE, TOE platform*] shall have a nominal, final entry in the SPD that matches anything that is otherwise unmatched, and discards it.

Assurance Activity

TSS

The evaluator shall examine the TSS to verify that the TSS provides a description of how a packet is processed against the SPD and that if no “rules” are found to match, that a final rule exists, either implicitly or explicitly, that causes the network packet to be discarded.

AGD

The evaluator checks that the operational guidance provides instructions on how to construct or acquire the SPD and uses the guidance to configure the TOE/platform for the following tests.

Test

The evaluator shall perform the following test:

Test 1: The evaluator shall configure the SPD such that it has entries that contain operations that DISCARD, PROTECT, and (if applicable) BYPASS network packets. The evaluator may use the SPD that was created for verification of FCS_IPSEC_EXT.1.1. The evaluator shall construct a network packet that matches a BYPASS entry and send that packet. The evaluator should observe that the network packet is passed to the proper destination interface with no modification. The evaluator shall then modify a field in the packet header; such that it no longer matches the evaluator-created entries (there may be a “TOE/platform created” final entry that discards packets that do not match any previous entries). The evaluator sends the packet, and observes that the packet was not permitted to flow to any of the TOE’s interfaces.

FCS_IPSEC_EXT.1.4 The [selection: TOE, TOE platform] 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.*

Assurance Activity

TSS

The evaluator shall examine the TSS to verify that the algorithms AES-GCM-128 and AES-GCM-256 are implemented. If the ST author has selected either AES-CBC-128 or AES-CBC-256 in the requirement, then the evaluator verifies the TSS describes these as well. In addition, the evaluator ensures that the SHA-based HMAC algorithm conforms to the algorithms specified in FCS_COP.1(4) Cryptographic Operations (for keyed-hash message authentication).

AGD

The evaluator checks the operational guidance to ensure it provides instructions on how the TOE is configured to use the algorithms selected in this component and whether this is performed through direct configuration, defined during initial installation, or defined by acquiring configuration settings from an environmental component.

Test

Test 1: The evaluator shall configure the TOE/platform as indicated in the operational guidance configuring the TOE/platform to using each of the AES-GCM-128, and AES-GCM-256 algorithms, and attempt to establish a connection using ESP. If the ST Author has selected either AES-CBC-128 or AES-CBC-256, the TOE/platform is configured to use those algorithms and the evaluator attempts to establish a connection using ESP for those algorithms selected.

FCS_IPSEC_EXT.1.5 The [selection: TOE, TOE platform] 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 RFCs 7296 (with mandatory support for NAT traversal as specified in section 2.23), 4307, and [selection: no other RFCs for hash functions, RFC 4868 for hash functions].*

Assurance Activity

TSS

The evaluator shall examine the TSS to verify that IKEv1 and/or IKEv2 are implemented. If IKEv1 is implemented, the evaluator shall verify that the TSS indicates whether or not XAUTH is supported, and that aggressive mode is not used for IKEv1 Phase 1 exchanges (i.e. only main mode is used). It may be that these are configurable options.

AGD

The evaluator shall check the operational guidance to ensure it instructs the administrator how to configure the TOE/platform to use IKEv1 and/or IKEv2 (as selected), and uses the guidance to configure the TOE/platform to perform NAT traversal for the test below. If XAUTH is implemented, the evaluator shall verify that the operational guidance provides instructions on how it is enabled or disabled.

If the TOE supports IKEv1, the evaluator shall verify that the operational guidance either asserts that only main mode is used for Phase 1 exchanges, or provides instructions for disabling aggressive mode.

Test

Test 1: The evaluator shall configure the TOE/platform so that it will perform NAT traversal processing as described in the TSS and RFC 7296, section 2.23. The evaluator shall initiate an IPsec connection and determine that the NAT is successfully traversed. If XAUTH is supported, the evaluator shall verify that this test can be repeated with XAUTH both enabled and disabled in the manner specified by the operational guidance.

Test 2 [conditional]: If the TOE supports IKEv1, the evaluator shall perform any applicable operational guidance steps to disable the use of aggressive mode and then attempt to establish a connection using an IKEv1 Phase 1 connection in aggressive mode. This attempt should fail. The evaluator shall show that the TOE/platform will reject a VPN gateway from initiating an IKEv1 Phase 1 connection in aggressive mode. The evaluator should then show that main mode exchanges are supported.

FCS_IPSEC_EXT.1.6

The [selection: TOE, TOE platform] 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, 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.*

Assurance Activity

TSS

The evaluator shall ensure the TSS identifies the algorithms used for encrypting the IKEv1 and/or IKEv2 payload, and that the algorithms AES-CBC-128, AES-CBC-256 are specified, and if others are chosen in the selection of the requirement, those are included in the TSS discussion.

AGD

The evaluator checks the operational guidance to ensure it provides instructions on how the TOE is configured to use the algorithms selected in this component and whether this is performed through direct configuration, defined during initial installation, or defined by acquiring configuration settings from an environmental component.

Test

The evaluator shall use the operational guidance to configure the TOE/platform (or to configure the Operational Environment to have the TOE receive configuration) to perform the following test for each ciphersuite selected:

Test 1: The evaluator shall configure the TOE/platform to use the ciphersuite under test to encrypt the IKEv1 and/or IKEv2 payload and establish a connection with a peer device, which is configured to only accept the payload encrypted using the indicated ciphersuite. The evaluator will confirm the algorithm was that used in the negotiation. The evaluator will confirm that the connection is successful by confirming that data can be passed through the connection once it is established. For example, the evaluator may connect to a webpage on the remote network and verify that it can be reached.

FCS_IPSEC_EXT.1.7 The [selection: TOE, TOE platform] shall ensure that [selection: IKEv2 SA lifetimes can be configured by [selection: an Administrator, VPN Gateway] based on [selection: number of packets/number of bytes, length of time], IKEv1 SA lifetimes can be configured by an [selection: an Administrator, 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).

Assurance Activity

TSS

There are no TSS assurance activities for this requirement.

AGD

The evaluator shall check the operational guidance to ensure it provides instructions on how the TOE configures the values for SA lifetimes. In addition, the evaluator shall check that the guidance has the option for either the Administrator or VPN Gateway to configure Phase 1 SAs if time-based limits are supported. Currently there are no values mandated for the number of packets or number of bytes, the evaluator shall simply check the operational guidance to ensure that this can be configured if selected in the requirement.

Test

When testing this functionality, the evaluator needs to ensure that both sides are configured appropriately. From the RFC “A difference between IKEv1 and IKEv2 is that in IKEv1 SA lifetimes were negotiated. In IKEv2, each end of the SA is responsible for enforcing its own lifetime policy on the SA and rekeying the SA when necessary. If the two ends have different lifetime policies, the end with the shorter lifetime will end up always being the one to request the rekeying. If the two ends have the same lifetime policies, it is possible that both will initiate a rekeying at the same time (which will result in redundant

SAs). To reduce the probability of this happening, the timing of rekeying requests SHOULD be jittered.”

Each of the following tests shall be performed for each version of IKE selected in the FCS_IPSEC_EXT.1.5 protocol selection:

Test 1 [conditional]: The evaluator shall configure a maximum lifetime in terms of the # of packets (or bytes) allowed following the operational guidance. The evaluator shall establish an SA and determine that once the allowed # of packets (or bytes) through this SA is exceeded, the connection is closed.

Test 2 [conditional]: The evaluator shall construct a test where a Phase 1 SA is established and attempted to be maintained for more than 24 hours before it is renegotiated. The evaluator shall observe that this SA is closed or renegotiated in 24 hours or less. If such an action requires that the TOE be configured in a specific way, the evaluator shall implement tests demonstrating that the configuration capability of the TOE works as documented in the operational guidance.

Test 3 [conditional]: The evaluator shall perform a test similar to Test 2 for Phase 2 SAs, except that the lifetime will be 8 hours or less instead of 24 hours or less.

Test 4 [conditional]: If a fixed limit for IKEv1 SAs is supported, the evaluator shall establish an SA and observe that the connection is closed after the fixed traffic and/or time value is reached.

FCS_IPSEC_EXT.1.8

The [*selection: TOE, TOE platform*] shall ensure that all IKE protocols implement DH groups 14 (2048-bit MODP), 19 (256-bit Random ECP), 20 (384-bit Random ECP), and [*selection: 5 (1536-bit MODP), 24 (2048-bit MODP with 256-bit POS), 15 (3072-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).

Assurance Activity

TSS

The evaluator shall check to ensure that the DH groups specified in the requirement are listed as being supported in the TSS. If there is more than one DH group supported, the evaluator checks to ensure the TSS describes how a particular DH group is specified/negotiated with a peer.

AGD

There are no AGD assurance activities for this requirement.

Test

The evaluator shall perform the following test:

Test 1: For each supported DH group, the evaluator shall test to ensure that all supported IKE protocols can be successfully completed using that particular DH group.

FCS_IPSEC_EXT.1.9

The [*selection: TOE, TOE platform*] shall generate the secret value x used in the IKE Diffie-Hellman key exchange (“ x ” in $g^x \bmod p$) 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.

Assurance Activity

TSS

The evaluator shall check to ensure that, for each DH group supported, the TSS describes the process for generating “ x ” (as defined in FCS_IPSEC_EXT.1.9) and each nonce. The evaluator shall verify that the TSS indicates that the random number generated that meets the requirements in this EP is used, and that the length of “ x ” and the nonces meet the stipulations in the requirement.

AGD

There are no AGD assurance activities for this requirement.

Test

There are no test assurance activities for this requirement.

FCS_IPSEC_EXT.1.10 The [selection: TOE, TOE platform] 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 $2^{\text{[assignment: (one or more) "bits of security" value(s) associated with the negotiated Diffie-Hellman group as listed in Table 2 of NIST SP 800-57, Recommendation for Key Management – Part 1: General]}}$.

Assurance Activity

Assurance activities for this element are tested through assurance activities for FCS_IPSEC_EXT.1.9.

FCS_IPSEC_EXT.1.11 The [selection: TOE, TOE platform] 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 EP; 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).*

Assurance Activity

TSS

The evaluator ensures that the TSS identifies RSA and/or ECDSA as being used to perform peer authentication.

If pre-shared keys are chosen in the selection, the evaluator shall check to ensure that the TSS describes how pre-shared keys are established and used in authentication of IPsec connections. The description in the TSS shall also indicate how pre-shared key establishment is accomplished for TOEs/platforms that can generate a pre-shared key as well as TOEs/platforms that simply use a pre-shared key.

The evaluator shall ensure that the TSS describes how the TOE compares the peer's presented identifier to the reference identifier. This description shall include whether the certificate presented identifier is compared to the ID payload presented identifier, which field(s) of the certificate are used as the presented identifier (DN, Common Name, or SAN), and, if multiple fields are supported, the logical order comparison. If the ST author assigned an additional identifier type, the TSS description shall also include a description of that type and the method by which that type is compared to the peer's presented certificate.

AGD

The evaluator shall check that the operational guidance describes how pre-shared keys are to be generated and established.

The evaluator ensures the operational guidance describes how to set up the TOE/platform to use the cryptographic algorithms RSA and/or ECDSA.

In order to construct the environment and configure the TOE/platform for the following tests, the evaluator will ensure that the operational guidance also describes how to configure the TOE/platform to connect to a trusted CA, and ensure a valid certificate for that CA is loaded into the TOE/platform as a trusted CA.

The evaluator shall also ensure that the operational guidance includes the configuration of the reference identifier(s) for the peer.

Test

For efficiency's sake, the testing that is performed here has been combined with the testing for **FIA_X509_EXT.2.1** (for IPsec connections), **FCS_IPSEC_EXT.1.12**, **FCS_IPSEC_EXT.1.13** and **FIA_X509_EXT.2.3**. The following tests shall be repeated for each peer authentication protocol selected in the **FCS_IPSEC_EXT.1.11** selection above:

Test 1: The evaluator shall have the TOE/platform generate a public-private key pair, and submit a CSR (Certificate Signing Request) to a CA (trusted by both the TOE/platform and the peer VPN used to establish a connection) for its signature. The values for the DN (Common Name, Organization, Organizational Unit, and Country) will also be passed in the request. Alternatively, the evaluator may import to the TOE/platform a previously generated private key and corresponding certificate.

Test 2: The evaluator shall use a certificate signed using the RSA or ECDSA algorithm to authenticate the remote peer during the IKE exchange. This test ensures the remote peer has the certificate for the trusted CA that signed the TOE's certificate and it will do a bit-wise comparison on the DN. This bit-wise comparison of the DN ensures that not only does the peer have a certificate signed by the trusted CA, but the certificate is from the DN that is expected. The evaluator will configure the TOE/platform to associate a certificate (e.g., a certificate map in some implementations) with a VPN connection. This is what the DN is checked against.

Test 3: The evaluator shall test that the TOE/platform can properly handle revoked certificates – conditional on whether CRL or OCSP is selected; if both are selected, and then a test is performed for each method. For this draft of the EP, the evaluator has to only test one up in the trust chain (future drafts may require to ensure the validation is done up the entire chain). The

evaluator shall ensure that a valid certificate is used, and that the SA is established. The evaluator then attempts the test with a certificate that will be revoked (for each method chosen in the selection) to ensure when the certificate is no longer valid that the TOE/platform will not establish an SA.

Test 4 [conditional]: The evaluator shall test that given a signed certificate from a trusted CA, that when the DN does not match – any of the four fields can be modified such that they do not match the expected value, that an SA does not get established.

Test 5 [conditional]: The evaluator shall generate a pre-shared key and use it, as indicated in the operational guidance, to establish an IPsec connection with the VPN GW peer. If the generation of the pre-shared key is supported, the evaluator shall ensure that establishment of the key is carried out for an instance of the TOE/platform generating the key as well as an instance of the TOE/platform merely taking in and using the key.

For each supported identifier type (excluding DNs), the evaluator shall repeat the following tests:

Test 6: For each field of the certificate supported for comparison, the evaluator shall configure the peer's reference identifier on the TOE (per the administrative guidance) to match the field in the peer's presented certificate and shall verify that the IKE authentication succeeds.

Test 7: For each field of the certificate support for comparison, the evaluator shall configure the peer's reference identifier on the TOE (per the administrative guidance) to not match the field in the peer's presented certificate and shall verify that the IKE authentication fails.

The following tests are conditional:

Test 8 [conditional]: If, according to the TSS, the TOE supports both Common Name and SAN certificate fields and uses the preferred logic outlined in the Application Note, the tests above with the Common Name field shall be performed using peer certificates with no SAN extension. Additionally, the evaluator shall configure the peer's reference identifier on the TOE to not match the SAN in the peer's presented certificate but to match the Common Name in the peer's presented certificate, and verify that the IKE authentication fails.

Test 9 [conditional]: If the TOE supports DN identifier types, the evaluator shall configure the peer's reference identifier on the TOE (per the administrative guidance) to match the subject DN in the peer's presented certificate and shall verify that the IKE authentication succeeds. To demonstrate a bit-wise comparison of the DN, the evaluator shall change a

single bit in the DN (preferably, in an Object Identifier (OID) in the DN) and verify that the IKE authentication fails.

Test 10 [conditional]: If the TOE supports both IPv4 and IPv6 and supports IP address identifier types, the evaluator must repeat test 1 and 2 with both IPv4 address identifiers and IPv6 identifiers. Additionally, the evaluator shall verify that the TOE verifies that the IP header matches the identifiers by setting the presented identifiers and the reference identifier with the same IP address that differs from the actual IP address of the peer in the IP headers and verifying that the IKE authentication fails.

Test 11 [conditional]: If, according to the TSS, the TOE performs comparisons between the peer's ID payload and the peer's certificate, the evaluator shall repeat the following test for each combination of supported identifier types and supported certificate fields (as above). The evaluator shall configure the peer to present a different ID payload than the field in the peer's presented certificate and verify that the TOE fails to authenticate the IKE peer.

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.*

Assurance Activity

Assurance activities for this element are tested through assurance activities for FCS_IPSEC_EXT.1.11.

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.

Assurance Activity

Assurance activities for this element are tested through assurance activities for FCS_IPSEC_EXT.1.12.

FCS_IPSEC_EXT.1.14 The [selection: TOE, TOE platform, 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 "VPN Gateway" is selected, then "Test 2" below may be omitted from the evaluation. Test 1, 3, and 4 shall be performed regardless of the selection.*

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.

Assurance Activity

TSS

The evaluator shall check that the TSS describes the potential strengths (in terms of the number of bits in the symmetric key) of the algorithms that are allowed for the IKE and ESP exchanges. The TSS shall also describe the checks that are done when negotiating IKEv1 Phase 2 and/or IKEv2 CHILD_SA suites to ensure that the strength (in terms of the number of bits of key in the

symmetric algorithm) of the negotiated algorithm is less than or equal to that of the IKE SA this is protecting the negotiation.

AGD

There are no AGD assurance activities for this requirement.

Test

The evaluator follows the guidance to configure the TOE/platform to perform the following tests.

Test 1: This test shall be performed for each version of IKE supported. The evaluator shall successfully negotiate an IPsec connection using each of the supported algorithms and hash functions identified in the requirements.

Test 2 [conditional]: This test shall be performed for each version of IKE supported. The evaluator shall attempt to establish an SA for ESP that selects an encryption algorithm with more strength than that being used for the IKE SA (i.e., symmetric algorithm with a key size larger than that being used for the IKE SA). Such attempts should fail.

Test 3: This test shall be performed for each version of IKE supported. The evaluator shall attempt to establish an IKE SA using an algorithm that is not one of the supported algorithms and hash functions identified in the requirements. Such an attempt should fail.

Test 4: This test shall be performed for each version of IKE supported. The evaluator shall attempt to establish an SA for ESP (assumes the proper parameters were used to establish the IKE SA) that selects an encryption algorithm that is not identified in FCS_IPSEC_EXT.1.4. Such an attempt should fail.

5.4.2 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.*

Assurance Activity

TSS

Requirement met by the platform

The evaluator shall examine the TSS to verify that it describes (for each supported platform) the extent to which the client processes network packets and addresses the FDP_RIP.2 requirement.

Requirement met by the TOE

“Resources” in the context of this requirement are network packets being sent through (as opposed to “to”, as is the case when a security administrator connects to the TOE) the TOE. The concern is that once a network packet is sent, the buffer or memory area used by the packet still contains data from that packet, and that if that buffer is re-used, those data might remain and make their way into a new packet. The evaluator shall check to ensure that the TSS describes packet processing to the extent that they can determine that no data will be reused when processing network packets. The evaluator shall ensure that this description at a minimum describes how the previous data are zeroized/overwritten, and at what point in the buffer processing this occurs.

AGD

There are no AGD assurance activities for this requirement.

Test

There are no test assurance activities for this requirement.

5.4.3 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(1)/VPN Specification of Management Functions (VPN)

FMT_SMF.1.1(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.

Assurance Activity

TSS

The evaluator shall check to ensure the TSS describes the client credentials and how they are used by the TOE.

AGD

The evaluator shall check to make sure that every management function mandated in the ST for this requirement are described in the operational guidance and that the description contains the information required to perform the management duties associated with each management function.

Test

The evaluator shall test the TOE’s ability to provide the management functions by configuring the TOE according to the operational guidance and testing each management activity listed in the Security Target.

The evaluator shall ensure that all management functions claimed in the ST can be performed by completing activities described in the AGD. Note that this may be performed in the course of completing other testing.

5.4.4 Protection of the TSF (FPT)

FPT_TST_EXT.1 TSF Self Test

FPT_TST_EXT.1.1 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 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.

Assurance Activity

Except for where it is explicitly noted, the evaluator is expected to check the following information regardless of whether the functionality is implemented by the TOE or by the TOE platform.

TSS

The evaluator shall examine the TSS to ensure that it details the self-tests that are run by the TSF on start-up; this description should include an outline of what the tests are actually doing (e.g., rather than saying "memory is tested", a description similar to "memory is tested by writing a value to each memory location and reading it back to ensure it is identical to what was written" shall be used). The evaluator shall ensure that the TSS makes an argument that the tests are sufficient to demonstrate that the TSF is operating correctly. If some of the tests are performed by the TOE platform, the evaluator shall check the TSS to ensure that those tests are identified, and that the ST for each platform contains a description of those tests. Note that the tests that are required by this component are those that support security functionality in this EP, which may not correspond to the set of all self-tests contained in the platform STs.

The evaluator shall examine the TSS to ensure that it describes how the integrity of stored TSF executable code is cryptographically verified when it is loaded for execution. The evaluator shall ensure that the TSS makes an argument that the tests are sufficient to demonstrate that the integrity of stored TSF executable code has not been compromised. The evaluator shall check to ensure that the cryptographic requirements listed are consistent with the description of the integrity verification process.

The evaluator also ensures that the TSS (or the operational guidance) describes the actions that take place for successful (e.g. hash verified) and unsuccessful (e.g., hash not verified) cases. For checks implemented entirely by the platform, the evaluator ensures that the operational guidance for the TOE references or includes the platform-specific guidance for each platform listed in the ST.

AGD

The evaluator also ensures that the TSS (or the operational guidance) describes the actions that take place for successful (e.g. hash verified) and unsuccessful (e.g., hash not verified) cases. For checks implemented entirely by the platform, the evaluator ensures that the operational guidance for the TOE references or includes the platform-specific guidance for each platform listed in the ST.

Test

The evaluator shall perform the following tests:

Test 1: The evaluator performs the integrity check on a known good TSF executable and verifies that the check is successful.

Test 2: The evaluator modifies the TSF executable, performs the integrity check on the modified TSF executable and verifies that the check fails.

5.5 TOE Security Assurance Requirements

This EP does not define any SARs beyond those defined within the base PPs to which it can claim conformance. It is important to note that a TOE that is evaluated against this EP is inherently evaluated against the GPOS PP, MDF PP, or App PP as well. These PPs both include a number of Assurance Activities associated with both Security Functional Requirements (SFRs) and SARs. Additionally, this EP includes a number of SFR-based Assurance Activities that similarly refine the SARs of the base PPs. The evaluation laboratory will evaluate the TOE against the chosen base PP and supplement that evaluation with the necessary SFRs that are taken from this EP.

A. Optional Requirements

As indicated in the introduction to this EP, the baseline requirements (those that must be performed by the TOE or its underlying platform) are contained in the body of this EP. Additionally, there are three other types of requirements specified in Appendices A, B, and C.

The first type (in this Appendix) are requirements that can be included in the ST, but do not have to be in order for a TOE to claim conformance to this EP. The second type (in Appendix B) are requirements based on selections in the body of the EP: if certain selections are made, then additional requirements in that appendix will need to be included. The third type (in Appendix C) are components that are not required in order to conform to this EP, but will be included in the baseline requirements in future versions of this EP, so adoption by VPN Client vendors is encouraged. Note that the ST author is responsible for ensuring that requirements that may be associated with those in Appendix A, Appendix B, and/or Appendix C but are not listed (e.g., FMT-type requirements) are also included in the ST.

No optional requirements have been identified at this time.

B. Selection-Based Requirements

As indicated in the introduction to this EP, the baseline requirements (those that must be performed by the TOE or its underlying platform) are contained in the body of this EP. There are additional requirements based on selections in the body of the EP: if certain selections are made, then additional requirements below will need to be included.

B.1 Cryptographic Support (FCS)

The TOE may support pre-shared keys for use in the IPsec protocol, and may use pre-shared keys in other protocols as well. There are two types of pre-shared keys that must be supported by the TOE, as specified in the requirements below. The first type is referred to as “text-based pre-shared keys”, which refer to pre-shared keys that are entered by users as a string of characters from a standard character set, similar to a password. Such pre-shared keys must be conditioned so that the string of characters is transformed into a string of bits, which is then used as the key.

The second type is referred to as “bit-based pre-shared keys” (for lack of a standard term); this refers to keys that are either generated by the TSF on a command from the administrator, or input in "direct form" by an administrator. "Direct form" means that the input is used directly as the key, with no "conditioning" as was the case for text-based pre-shared keys. An example would be a string of hex digits that represent the bits that comprise the key.

The requirements below mandate that the TOE must support both text-based and bit-based pre-shared keys, although generation of the bit-based pre-shared keys may be done either by the TOE or in the operational environment.

FIA_PSK_EXT.1 Pre-Shared Key Composition

FIA_PSK_EXT.1.1 The [*selection: TOE, TOE platform*] shall be able to use pre-shared keys for IPsec.

FIA_PSK_EXT.1.2 The [*selection: TOE, TOE platform*] 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 [*selection: TOE, TOE platform*] 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] bit-based pre-shared keys, perform no other conditioning*].

Application Note: “TOE platform” is to be selected if the TOE claims conformance to the App PP. In the OS and MDF cases, the underlying platform is still part of the TOE, so “TOE”

is to be selected regardless of whether it is implemented by the VPN client itself or by the underlying operating system or mobile device.

For the length of the text-based pre-shared keys, a common length (22 characters) is required to help promote interoperability. If other lengths are supported they should be listed in the assignment; this assignment can also specify a range of values (e.g., "lengths from 5 to 55 characters") as well.

For FIA_PSK_EXT.1.3, the ST author fills in the method by which the text string entered by the administrator is "conditioned" into the bit string used as the key. This can be done by using one of the specified hash functions, or some other method through the assignment statement. If "bit-based pre-shared keys" is selected, the ST author specifies whether the TSF merely accepts bit-based pre-shared keys, or is capable of generating them. If it generates them, the requirement specified that they must be generated using the RBG specified by the requirements. If the TOE does not use bit-based pre-shared keys, the second selection should be completed with "perform no other conditioning," as text-based pre-shared keys would then be the only type used.

Assurance Activity

TSS

The evaluator shall also examine the TSS to ensure it describes the process by which the bit-based pre-shared keys are generated (if the TOE supports this functionality), and confirm that this process uses the RBG specified in FCS_RBG_EXT.1.

Requirement met by the platform

For each platform listed in the ST, the evaluator shall examine the ST of the platform to ensure that the functions associated with pre-shared keys claimed in that platform's ST contains the same functions specified in the VPN Client's ST. If the TOE does not perform any management or input of the pre-shared keys then no further activity is required.

Requirement met by the TOE

The evaluator shall examine the TSS to ensure that it states that text-based pre-shared keys of 22 characters are supported. The evaluator shall also confirm that the TSS states the conditioning that takes place to transform the text-based pre-shared key from the key sequence entered by the user (e.g., ASCII representation) to the bit string used by IPsec, and that this conditioning is consistent with the FIA_PSK_EXT.1.3.

AGD

If the TOE supports bit-based pre-shared keys, the evaluator shall confirm the operational guidance contains instructions for either entering bit-based pre-

shared keys for each protocol identified in the requirement, or generating a bit-based pre-shared key (or both). The evaluator shall also examine the TSS to ensure it describes the process by which the bit-based pre-shared keys are generated (if the TOE supports this functionality), and confirm that this process uses the RBG specified in FCS_RBG_EXT.1.

The evaluator shall check that any management functions related to pre-shared keys that are performed by the TOE are specified in the operational guidance.

Requirement met by the TOE

The evaluator shall examine the operational guidance to determine that it provides guidance on the composition of strong text-based pre-shared keys, and (if the selection indicates keys of various lengths can be entered) that it provides information on the merits of shorter or longer pre-shared keys. The guidance must specify the allowable characters for pre-shared keys, and that list must include, at minimum, the same items contained in FIA_PSK_EXT.1.2.

Test

The evaluator shall perform the following tests:

Test 1: The evaluator shall compose a pre-shared key of 22 characters that contains a combination of the allowed characters in accordance with the operational guidance, and demonstrates that a successful protocol negotiation can be performed with the key.

Test 2 [conditional]: If the TOE supports pre-shared keys of multiple lengths, the evaluator shall repeat Test 1 using the minimum length; the maximum length; and invalid lengths that are below the minimum length, above the maximum length, null length, empty length, or zero length. The minimum and maximum length tests should be successful, and the invalid lengths must be rejected by the TOE.

Test 3 [conditional]: If the TOE supports but does not generate bit-based pre-shared keys, the evaluator shall obtain a bit-based pre-shared key of the appropriate length and enter it per the instructions in the operational guidance. The evaluator shall then demonstrate that a successful protocol negotiation can be performed with the key.

Test 4 [conditional]: If the TOE does generate bit-based pre-shared keys, the evaluator shall generate a bit-based pre-shared key of the appropriate length and use it according to the instructions in the operational guidance. The evaluator shall then demonstrate that a successful protocol negotiation can be performed with the key.

C. Objective Requirements

This section is reserved for requirements that are not currently prescribed by this EP but are expected to be included in future versions of the EP. Vendors planning on having evaluations performed against future products are encouraged to plan for these objective requirements to be met.

C.1 Security Audit (FAU)

FAU_GEN.1 Audit Data Generation

FAU_GEN.1.1 The TSF and [*selection: TOE Platform, no other component*] shall be able to generate an audit record of the following auditable events:

- a) Start-up and shutdown of the audit functions;
- b) All auditable events for the [*not specified*] level of audit; and
- c) All administrative actions;
- d) [*Specifically defined auditable events listed in Table C-1*].

Requirement	Auditable Events	Additional Audit Record Contents
FAU_SEL.1	All modifications to the audit configuration that occur while the audit collection functions are operating.	None.
FCS_IPSEC_EXT.1	Decisions to DISCARD or BYPASS network packets processed by the TOE. Failure to establish an IPsec SA. Establishment/Termination of an IPsec SA.	Presumed identity of source subject. Identity of destination subject. Transport layer protocol, if applicable. Source subject service identifier, if applicable. The entry in the SPD that applied to the decision. Reason for failure. Non-TOE endpoint of connection (IP address) for both successes and failures.
FDP_RIP.2	None.	
FIA_PSK_EXT.1	Failure of the randomization process.	None.
FMT_SMF.1	Success or failure of management function.	None.
FPT_TUD_EXT.1	Initiation of the update. Any failure to verify the integrity of the update.	No additional information.

Table C-1 – Auditable Events

Application Note: *In the case of "a", the audit functions referred to are those provided by the TOE. For example, in the case that the TOE was a stand-alone executable, auditing the startup and the shutdown of the TOE itself would be sufficient to meet the requirements of this clause.*

In the case where the TOE platform is responsible for some audit functions, the ST author should identify which auditable events are generated by the TSF and which are generated by the TOE platform.

Many auditable aspects of the SFRs included in this document deal with administrative actions. Item c above requires all administrative actions to be auditable, so no additional specification of the audibility of these actions is present in Table 9. While the TOE itself does not need to provide the ability to perform I&A for an administrator, this requirement implies that the TOE possess the capability to audit the events described by the base PP as "administrative actions" (primarily dealing with configuration of the functionality provided by the TOE). It is expected that the AGD guidance detail the steps needed to ensure the audit data generated by the TOE is integrated with the audit capabilities of the underlying IT environment.

The auditable events defined in Table D-1 are for the SFRs that are explicitly defined in this EP. For any SFRs that are included as part of the TOE based on the claimed base PP, it is expected that any applicable auditable events defined for those SFRs in the base PP are also claimed as part of the TSF. These auditable events only apply if the client actually performs these functions. If the platform performs any of these actions, then the platform is responsible for performing the auditing, not the TSF.

FAU_GEN.1.2 The TSF and **[selection: TOE Platform, no other component]** shall record within each audit record at least the following information:

- a) Date and time of the event, type of event, subject identity, and the outcome (success or failure) of the event; and
- b) For each audit event type, based on the auditable event definitions of the functional components included in the EP/ST, *[information specified in column three of Table C-1]*.

Application Note: *As with the previous component, the ST author should update Table 2 with any additional information generated. "Subject identity" in the context of this requirement could either be the administrator's user id or the affected network interface, for example.*

Assurance Activity

TSS

The evaluator shall examine the TSS to determine that it describes the auditable events and the component that is responsible for each type of auditable event.

AGD

The evaluator shall check the operational guidance and ensure that it lists all of the auditable events and provides a format for audit records. Each audit record format type must be covered, along with a brief description of each field. The evaluator shall check to make sure that every audit event type mandated by the EP is described and that the description of the fields contains the information required in FAU_GEN.1.2, and the additional information specified in Table C-1.

The evaluator shall in particular ensure that the operational guidance is clear in relation to the contents for failed cryptographic events. In Table D-1, information detailing the cryptographic mode of operation and a name or identifier for the object being encrypted is required. The evaluator shall ensure that name or identifier is sufficient to allow an administrator reviewing the audit log to determine the context of the cryptographic operation (for example, performed during a key negotiation exchange, performed when encrypting data for transit) as well as the non-TOE endpoint of the connection for cryptographic failures relating to communications with other IT systems.

The evaluator shall also make a determination of the administrative actions that are relevant in the context of this EP. The TOE may contain functionality that is not evaluated in the context of this EP because the functionality is not specified in an SFR. This functionality may have administrative aspects that are described in the operational guidance. Since such administrative actions will not be performed in an evaluated configuration of the TOE, the evaluator shall examine the operational guidance and make a determination of which administrative commands, including subcommands, scripts, and configuration files, are related to the configuration (including enabling or disabling) of the mechanisms implemented in the TOE that are necessary to enforce the requirements specified in the EP, which thus form the set of "all administrative actions". The evaluator may perform this activity as part of the activities associated with ensuring the AGD_OPE guidance satisfies the requirements.

Test

The evaluator shall test the TOE's ability to correctly generate audit records by having the TOE generate audit records in accordance with the assurance activities associated with the functional requirements in this EP. Additionally, the evaluator shall test that each administrative action applicable in the

context of this EP is auditable. When verifying the test results, the evaluator shall ensure the audit records generated during testing match the format specified in the administrative guide, and that the fields in each audit record have the proper entries.

Note that the testing here can be accomplished in conjunction with the testing of the security mechanisms directly. For example, testing performed to ensure that the administrative guidance provided is correct verifies that AGD_OPE.1 is satisfied and should address the invocation of the administrative actions that are needed to verify the audit records are generated as expected.

FAU_SEL.1 Selective Audit

FAU_SEL.1.1

The [**selection: TSF, TOE Platform**] shall be able to select the set of events to be audited from the set of all auditable events based on the following attributes: [event type, [success of auditable security events, failure of auditable security events], [assignment: list of additional attributes that audit selectivity is based upon]].

Application Note:

The intent of this requirement is to identify all criteria that can be selected to trigger an audit event. This can be configured through an interface on the client for a user/administrator to invoke, or it could be an interface that the VPN gateway uses to instruct the client on which events are to be audited. For the ST author, the assignment is used to list any additional criteria or “none”. The auditable event types are listed in Table C-1.

The intent of the first selection is to allow for the case where the underlying platform is responsible for some audit log generation functionality.

Assurance Activity

TSS

There are no TSS assurance activities for this SFR.

AGD

The evaluator shall review the administrative guidance to ensure that the guidance itemizes all event types, as well as describes all attributes that are to be selectable in accordance with the requirement, to include those attributes listed in the assignment. The administrative guidance shall also contain instructions on how to set the pre-selection, or how the VPN gateway will configure the client, as well as explain the syntax (if present) for multi-value pre-selection. The administrative guidance shall also identify those audit records that are always recorded, regardless of the selection criteria currently being enforced.

Test

The evaluator shall perform the following tests:

Test 1: For each attribute listed in the requirement, the evaluator shall devise a test to show that selecting the attribute causes only audit events with that attribute (or those that are always recorded, as identified in the administrative guidance) to be recorded.

Test 2 [conditional]: If the TSF supports specification of more complex audit pre-selection criteria (e.g., multiple attributes, logical expressions using attributes) then the evaluator shall devise tests showing that this capability is correctly implemented. The evaluator shall also, in the test plan, provide a short narrative justifying the set of tests as representative and sufficient to exercise the capability.

C.2 User Data Protection (FDP)

FDP_IFC_EXT.1 Subset Information Flow Control

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.

Application Note: *This requirement is used when the VPN client is able to enforce the requirement through its own components. This generally will have to be done through using hooks provided by the platform such that the TOE is able to ensure that no IP traffic can flow through other network interfaces.*

Assurance Activity

TSS

The evaluator shall verify that the TSS section of the ST describes the routing of IP traffic through processes on the TSF when a VPN client is enabled. The evaluator shall ensure that the description indicates which traffic does not go through the VPN and which traffic does and that a configuration exists for each baseband protocol in which only the traffic identified by the ST author as necessary for establishing the VPN connection (IKE traffic and perhaps HTTPS or DNS traffic) is not encapsulated by the VPN protocol (IPsec). The ST author shall also identify in the TSS section any differences in the routing of IP traffic when using any supported baseband protocols (e.g. WiFi or, LTE).

AGD

The evaluator shall verify that the following is addressed by the documentation:

- The description above indicates that if a VPN client is enabled, all configurations route all IP traffic (other than IP traffic required to establish the VPN connection) through the VPN client.
- The AGD guidance describes how the user and/or administrator can configure the TSF to meet this requirement.

Test

The evaluator shall perform the following test:

Step 1 - The evaluator shall use the platform to enable a network connection without using IPsec. The evaluator shall use a packet sniffing tool between the platform and an Internet-connected network. The evaluator shall turn on the sniffing tool and perform actions with the device such as navigating to websites, using provided applications, accessing other Internet resources (Use Case 1), accessing another VPN client (Use Case 2), or accessing an IPsec-capable network device (Use Case 3). The evaluator shall verify that the sniffing tool captures the traffic generated by these actions, turn off the sniffing tool, and save the session data.

Step 2 - The evaluator shall configure an IPsec VPN client that supports the routing specified in this requirement, and if necessary, configure the device to perform the routing specified as described in the AGD guidance. The evaluator shall turn on the sniffing tool, establish the VPN connection, and perform the same actions with the device as performed in the first step. The evaluator shall verify that the sniffing tool captures traffic generated by these actions, turn off the sniffing tool, and save the session data.

Step 3 - The evaluator shall examine the traffic from both step one and step two to verify that all IP traffic, aside from and after traffic necessary for establishing the VPN (such as IKE, DNS, and possibly HTTPS), is encapsulated by IPsec.

Step 4 - The evaluator shall attempt to send packets to the TOE outside the VPN connection and shall verify that the TOE discards them.

D. Entropy Documentation and Assessment

The TOE does not require any additional supplementary information to describe its entropy source(s) beyond the requirements outlined in the claimed base PP. As with other base PP requirements, the only additional requirement is that the entropy documentation also applies to the specific VPN client capabilities of the TOE in addition to the functionality required by the claimed base PP(s).

E. References

Identifier	Title
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|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [CC] | Common Criteria for Information Technology Security Evaluation – <ul style="list-style-type: none">• Part 1: Introduction and General Model, CCMB-2012-09-001, Version 3.1 Revision 4, September 2012• Part 2: Security Functional Components, CCMB-2012-09-002, Version 3.1 Revision 4, September 2012• Part 3: Security Assurance Components, CCMB-2012-09-003, Version 3.1 Revision 4, September 2012 |
| [GPOS PP] | <ul style="list-style-type: none">• Protection Profile for General Purpose Operating Systems, Version 4.1, March 2016 |
| [MDF PP] | <ul style="list-style-type: none">• Protection Profile for Mobile Device Fundamentals, Version 3.0, June 2016 |
| [App PP] | <ul style="list-style-type: none">• Protection Profile for Application Software, Version: 1.2, April 2016 |

F. Acronyms

Acronym	Meaning
AES	Advanced Encryption Standard
AF	Authorization factor
AS	Authorization subsystem
CAVS	Cryptographic Algorithm Validation System
CC	Common Criteria
CCTL	Common Criteria Testing Laboratory
CM	Configuration management
COTS	Commercial Off-The-Shelf
CMVP	Cryptographic Module Validation Program
DRBG	Deterministic Random Bit Generator
DoD	Department of Defense
EAL	Evaluation Assurance Level
ES	Encryption Subsystem
FIPS	Federal Information Processing Standards
ISSE	Information System Security Engineer
IT	Information Technology
OSP	Organizational Security Policy
PP	Protection Profile
PUB	Publication
RBG	Random Bit Generator
SAR	Security Assurance Requirement
SF	Security Function
SFR	Security Functional Requirement
ST	Security Target
TOE	Target of Evaluation
TSF	TOE Security Function

TSFI TOE Security Function Interface
TSS TOE Summary Specification