

# Protection Profile for Application Software

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National Information Assurance Partnership

# Revision History

Version	Date	Comment
v 1.0	2014-10-20	Initial release
v 1.1	2014-11-05	Addition to <a href="#">TLS</a> cipher suite selections Added server-side <a href="#">TLS</a> requirements (selection-based)
v 1.2	2016-04-22	Multiple clarification based on <a href="#">NIAP</a> TRRT inquiries Refactored <a href="#">FDP_DEC_EXT.1</a> into separate components Incorporated available Technical Decisions Refactored FPT_TUD
v 1.3	2019-03-01	Added a selection to FTP_DIT Moved <a href="#">SWID</a> Tags requirement Leveraged <a href="#">TLS</a> Package Added equivalency section

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## 1 Introduction

### 1.1 Overview

The scope of this Protection Profile ([PP](#)) is to describe the security functionality of application software in terms of [CC](#) and to define functional and assurance requirements for such software. In recent years, software attacks have shifted from targeting operating systems to targeting applications. This has been the natural response to improvements in operating system security and development processes. As a result, it is paramount that the security of applications be improved to reduce the risk of compromise.

### 1.2 Terms

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

#### 1.2.1 Common Criteria Terms

Assurance	Grounds for confidence that a <a href="#">TOE</a> meets the SFRs <a href="#">CC</a> .
Base Protection Profile ( <a href="#">Base-PP</a> )	Protection Profile used as a basis to build a <a href="#">PP-Configuration</a> .
Common Criteria ( <a href="#">CC</a> )	Common Criteria for Information Technology Security Evaluation (International Standard <a href="#">ISO/IEC 15408</a> ).
Common Criteria Testing Laboratory	Within the context of the Common Criteria Evaluation and Validation Scheme (CCEVS), an <a href="#">IT</a> security evaluation facility, accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) and approved by the <a href="#">NIAP</a> Validation Body to conduct Common Criteria-based evaluations.
Common Evaluation Methodology ( <a href="#">CEM</a> )	Common Evaluation Methodology for Information Technology Security Evaluation.

Distributed <a href="#">TOE</a>	A <a href="#">TOE</a> composed of multiple components operating as a logical whole.
Operational Environment ( <a href="#">OE</a> )	Hardware and software that are outside the <a href="#">TOE</a> boundary that support the <a href="#">TOE</a> functionality and security policy.
Protection Profile ( <a href="#">PP</a> )	An implementation-independent set of security requirements for a category of products.
Protection Profile Configuration ( <a href="#">PP-Configuration</a> )	A comprehensive set of security requirements for a product type that consists of at least one <a href="#">Base-PP</a> and at least one <a href="#">PP-Module</a> .
Protection Profile Module ( <a href="#">PP-Module</a> )	An implementation-independent statement of security needs for a <a href="#">TOE</a> type complementary to one or more Base Protection Profiles.
Security Assurance Requirement ( <a href="#">SAR</a> )	A requirement to assure the security of the <a href="#">TOE</a> .
Security Functional Requirement ( <a href="#">SFR</a> )	A requirement for security enforcement by the <a href="#">TOE</a> .
Security Target ( <a href="#">ST</a> )	A set of implementation-dependent security requirements for a specific product.
<a href="#">TOE</a> Security Functionality ( <a href="#">TSF</a> )	The security functionality of the product under evaluation.
<a href="#">TOE</a> Summary Specification ( <a href="#">TSS</a> )	A description of how a <a href="#">TOE</a> satisfies the SFRs in an <a href="#">ST</a> .
Target of Evaluation ( <a href="#">TOE</a> )	The product under evaluation.

## 1.2.2 Technical Terms

Address Space Layout Randomization ( <a href="#">ASLR</a> )	An anti-exploitation feature which loads memory mappings into unpredictable locations. <a href="#">ASLR</a> makes it more difficult for an attacker to redirect control to code that they have introduced into the address space of an application process.
Application ( <a href="#">app</a> )	Software that runs on a platform and performs tasks on behalf of the user or owner of the platform, as well as its supporting documentation. The terms <a href="#">TOE</a> and <i>application</i> are interchangeable in this document.
Application Programming Interface ( <a href="#">API</a> )	A specification of routines, data structures, object classes, and variables that allows an application to make use of services provided by another software component, such as a library. APIs are often provided for a set of libraries included with the platform.
Credential	Data that establishes the identity of a user, e.g. a cryptographic key or password.
Data Execution Prevention ( <a href="#">DEP</a> )	An anti-exploitation feature of modern operating systems executing on modern computer hardware, which enforces a non-execute permission on pages of memory. <a href="#">DEP</a> prevents pages of memory from containing both data and instructions, which makes it more difficult for an attacker to introduce and execute code.
Developer	An entity that writes application software. For the purposes of this document, vendors and developers are the same.
Mobile Code	Software transmitted from a remote system for execution within a limited execution environment on the local system. Typically, there is no persistent installation and execution begins without the user's consent or even notification. Examples of mobile code technologies include JavaScript, Java applets, Adobe Flash, and Microsoft Silverlight.
Operating System ( <a href="#">OS</a> )	Software that manages hardware resources and provides services for applications.
Personally Identifiable Information ( <a href="#">PII</a> )	Any information about an individual maintained by an agency, including, but not limited to, education, financial transactions, medical history, and criminal or employment history and information which can be used to distinguish or trace an individual's identity, such as their name, social security number, date and place of birth, mother's maiden name, biometric records, etc., including any other personal information which is linked or linkable to an individual. <a href="#">[OMB]</a>
Platform	The environment in which application software runs. The platform can be an operating system, hardware environment, a software based execution environment, or some combination of these. These types platforms may also run atop other platforms.
Sensitive Data	Sensitive data may include all user or enterprise data or may be specific application data such as emails, messaging, documents, calendar items, and contacts. Sensitive data must minimally include <a href="#">PII</a> , credentials, and keys. Sensitive data shall be identified in the application's <a href="#">TSS</a> by the <a href="#">ST</a> author.

Stack Cookie	An anti-exploitation feature that places a value on the stack at the start of a function call, and checks that the value is the same at the end of the function call. This is also referred to as Stack Guard, or Stack Canaries.
Vendor	An entity that sells application software. For purposes of this document, vendors and developers are the same. Vendors are responsible for maintaining and updating application software.

### 1.3 Compliant Targets of Evaluation

The requirements in this document apply to application software which runs on any type of platform. Some application types are covered by more specific PPs, which may be expressed as PP-Modules of this PP. Such applications are subject to the requirements of both this PP and the PP-Module that addresses their special functionality. PPs for some particularly specialized applications may not be expressed as PP-Modules at this time, though the requirements in this document should be seen as objectives for those highly specialized applications.

Although the requirements in this document apply to a wide range of application software, consult guidance from the relevant national schemes to determine when formal Common Criteria evaluation is expected for a particular type of application. This may vary depending upon the nature of the security functionality of the application.

#### 1.3.1 TOE Boundary

The application, which consists of the software provided by its vendor, is installed onto the platform(s) it operates on. It executes on the platform, which may be an operating system (Figure 1), hardware environment, a software based execution environment, or some combination of these (Figure 2). Those platforms may themselves run within other environments, such as virtual machines or operating systems, that completely abstract away the underlying hardware from the application. The TOE is not accountable for security functionality that is implemented by platform layers that are abstracted away. Some evaluation activities are specific to the particular platform on which the application runs, in order to provide precision and repeatability. The only platforms currently recognized by the AppPP are those specified in SFR Evaluation Activities. To test on a platform for which there are no EAs, a Vendor should contact NIAP with recommended EAs. NIAP will determine if the proposed platform is appropriate for the PP and accept, reject, or develop EAs as necessary in coordination with the technical community.

Applications include a diverse range of software such as office suites, thin clients, PDF readers, downloadable smartphone apps, and apps running in a cloud container. The TOE includes any software in the application installation package, even those pieces that may extend or modify the functionality of the underlying platform, such as kernel drivers. Many platforms come bundled with applications such as web browsers, email clients and media players and these too should be considered subject to the requirements defined in this document although the expectation of formal Common Criteria evaluation depends upon the national scheme. BIOS and other firmware, the operating system kernel, and other systems software (and drivers) provided as part of the platform are outside the scope of this document.

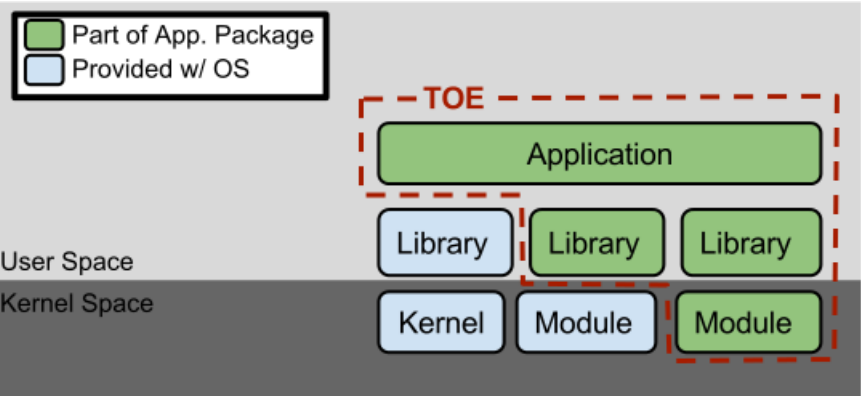


Figure 1: TOE as an Application and Kernel Module Running on an Operating System

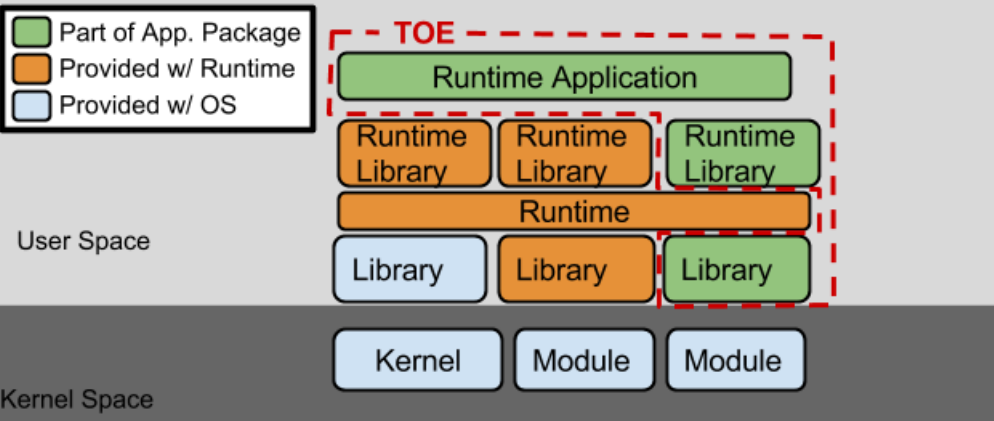


Figure 2: TOE as an Application Running in an Execution Environment Plus Native Code

## 1.4 Use Cases

Requirements in this Protection Profile are designed to address the security problem in the following use cases. These use cases are intentionally very broad, as many specific use cases exist for application software. Many applications may be used in combinations of these broad use cases, and evaluation against [PP-Modules](#) of this [PP](#), when available, may be most appropriate for some application types.

### [USE CASE 1] Content Creation

The application allows a user to create content, saving it to either local or remote storage. Example content includes text documents, presentations, and images.

### [USE CASE 2] Content Consumption

The application allows a user to consume content, retrieving it from either local or remote storage. Example content includes web pages and video.

### [USE CASE 3] Communication

The application allows for communication interactively or non-interactively with other users or applications over a communications channel. Example communications include instant messages, email, and voice.

## 2 Conformance Claims

An [ST](#) must claim exact conformance to this [PP](#), as defined in the [CC](#) and [CEM](#) addenda for Exact Conformance, Selection-Based SFRs, and Optional SFRs (dated May 2017).

This [PP](#) is conformant to Parts 2 (extended) and 3 (extended) of Common Criteria Version 3.1, Revision 5.

This [PP](#) does not claim conformance to any other Protection Profile.

The following PPs and [PP-Modules](#) are allowed to be specified in a [PP-Configuration](#) with this [PP](#).

- [PP-Module](#) for File Encryption, Version 1.0
- [PP-Module](#) for File Encryption Enterprise Management, Version 1.0

This [PP](#) is [TLS](#) Package Version 1.1 Conformant.

## 3 Security Problem Description

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

### 3.1 Threats

#### T.NETWORK\_ATTACK

An attacker is positioned on a communications channel or elsewhere on the network infrastructure. Attackers may engage in communications with the application software or alter communications between the application software and other endpoints in order to compromise it.

#### T.NETWORK\_EAVESDROP

An attacker is positioned on a communications channel or elsewhere on the network infrastructure. Attackers may monitor and gain access to data exchanged between the application and other endpoints.

#### T.LOCAL\_ATTACK

An attacker can act through unprivileged software on the same computing platform on which the application executes. Attackers may provide maliciously formatted input to the application in the form of files or other local communications.

#### T.PHYSICAL\_ACCESS

An attacker may try to access sensitive data at rest.

### 3.2 Assumptions

#### A.PLATFORM

The [TOE](#) relies upon a trustworthy computing platform with a reliable time clock for its execution. This includes the underlying platform and whatever runtime environment it provides to the [TOE](#).

#### A.PROPER\_USER

The user of the application software is not willfully negligent or hostile, and uses the software in compliance with the applied enterprise security policy.

#### A.PROPER\_ADMIN

The administrator of the application software is not careless, willfully negligent or hostile, and administers the software in compliance with the applied enterprise security policy.

### 3.3 Organizational Security Policies

There are no Organizational Security Policies for the application.

## 4 Security Objectives

## 4.1 Security Objectives for the TOE

### O.INTEGRITY

Conformant TOEs ensure the integrity of their installation and update packages, and also leverage execution environment-based mitigations. Software is seldom, if ever, shipped without errors. The ability to deploy patches and updates to fielded software with integrity is critical to enterprise network security. Processor manufacturers, compiler developers, execution environment vendors, and operating system vendors have developed execution environment-based mitigations that increase the cost to attackers by adding complexity to the task of compromising systems. Application software can often take advantage of these mechanisms by using APIs provided by the runtime environment or by enabling the mechanism through compiler or linker options.

### O.QUALITY

To ensure quality of implementation, conformant TOEs leverage services and APIs provided by the runtime environment rather than implementing their own versions of these services and APIs. This is especially important for cryptographic services and other complex operations such as file and media parsing. Leveraging this platform behavior relies upon using only documented and supported APIs.

### O.MANAGEMENT

To facilitate management by users and the enterprise, conformant TOEs provide consistent and supported interfaces for their security-relevant configuration and maintenance. This includes the deployment of applications and application updates through the use of platform-supported deployment mechanisms and formats, as well as providing mechanisms for configuration. This also includes providing control to the user regarding disclosure of any [PII](#).

### O.PROTECTED\_STORAGE

To address the issue of loss of confidentiality of user data in the event of loss of physical control of the storage medium, conformant TOEs will use data-at-rest protection. This involves encrypting data and keys stored by the [TOE](#) in order to prevent unauthorized access to this data. This also includes unnecessary network communications whose consequence may be the loss of data.

### O.PROTECTED\_COMMS

To address both passive (eavesdropping) and active (packet modification) network attack threats, conformant TOEs will use a trusted channel for sensitive data. Sensitive data includes cryptographic keys, passwords, and any other data specific to the application that should not be exposed outside of the application.

## 4.2 Security Objectives for the Operational Environment

The following security objectives for the operational environment assist the [TOE](#) in correctly providing its security functionality. These track with the assumptions about the environment.

### OE.PLATFORM

The [TOE](#) relies upon a trustworthy computing platform for its execution. This includes the underlying operating system and any discrete execution environment provided to the [TOE](#).

### OE.PROPER\_USER

The user of the application software is not willfully negligent or hostile, and uses the software within compliance of the applied enterprise security policy.

### OE.PROPER\_ADMIN

The administrator of the application software is not careless, willfully negligent or hostile, and administers the software within compliance of the applied enterprise security policy.

## 4.3 Security Objectives Rationale

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

Threat, Assumption, or OSP	Security Objectives	Rationale
	<a href="#">O.PROTECTED_COMMS</a>	The threat <a href="#">T.NETWORK_ATTACK</a> is countered by <a href="#">O.PROTECTED_COMMS</a> as this provides for integrity of transmitted data.
<a href="#">T.NETWORK_ATTACK</a>	<a href="#">O.INTEGRITY</a>	The threat <a href="#">T.NETWORK_ATTACK</a> is countered by <a href="#">O.INTEGRITY</a> as this provides for integrity of software that is installed onto the system from the network.
	<a href="#">O.MANAGEMENT</a>	The threat <a href="#">T.NETWORK_ATTACK</a> is countered by <a href="#">O.MANAGEMENT</a> as this provides for the ability to configure the application to defend against network attack.
	<a href="#">O.PROTECTED_COMMS</a>	The threat <a href="#">T.NETWORK_EAVESDROP</a> is countered by <a href="#">O.PROTECTED_COMMS</a> as this provides for confidentiality of transmitted data.
<a href="#">T.NETWORK_EAVESDROP</a>	<a href="#">O.QUALITY</a>	The objective <a href="#">O.QUALITY</a> ensures use of mechanisms that provide protection against network-based attack.
	<a href="#">O.MANAGEMENT</a>	The threat <a href="#">T.NETWORK_EAVESDROP</a> is countered by <a href="#">O.MANAGEMENT</a> as this provides for the ability to configure the application to protect the confidentiality of its transmitted data.
<a href="#">T.LOCAL_ATTACK</a>	<a href="#">O.QUALITY</a>	The objective <a href="#">O.QUALITY</a> protects against the use of mechanisms that weaken the <a href="#">TOE</a> with regard to attack by other software on the platform.



[T.PHYSICAL\\_ACCESS](#)

[O.PROTECTED\\_STORAGE](#)

The objective [O.PROTECTED\\_STORAGE](#) protects against unauthorized attempts to access physical storage used by the [TOE](#).

[A.PLATFORM](#)

[OE.PLATFORM](#)

The operational environment objective [OE.PLATFORM](#) is realized through [A.PLATFORM](#).

[A.PROPER\\_USER](#)

[OE.PROPER\\_USER](#)

The operational environment objective [OE.PROPER\\_USER](#) is realized through [A.PROPER\\_USER](#).

[A.PROPER\\_ADMIN](#)

[OE.PROPER\\_ADMIN](#)

The operational environment objective [OE.PROPER\\_ADMIN](#) is realized through [A.PROPER\\_ADMIN](#).

## 5 Security Requirements

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

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

### 5.1 Security Functional Requirements

#### 5.1.1 Cryptographic Support (FCS)

##### FCS\_RBG\_EXT.1 Random Bit Generation Services

###### [FCS\\_RBG\\_EXT.1.1](#)

The application shall [selection:

- use no [DRBG](#) functionality,
- invoke platform-provided [DRBG](#) functionality,
- implement [DRBG](#) functionality

] for its cryptographic operations.

Application Note: The selection *invoke platform-provided [DRBG](#) functionality* should only be chosen for direct invocations of the platform [DRBG](#), calls to platform protocols that may then call the platform's [DRBG](#) are not directly using [DRBG](#) functionality and should select *use no [DRBG](#) functionality*.

If *implement [DRBG](#) functionality* is chosen, then additional [FCS\\_RBG\\_EXT.2](#) elements shall be included in the [ST](#).

In this requirement, cryptographic operations include all cryptographic key generation/derivation/agreement, IVs (for certain modes), as well as protocol-specific random values. Cryptographic operations in this requirement refer to the other cryptographic requirements in this [PP](#), not additional functionality that is not in scope.

[Evaluation Activity](#)  
[TSS](#)

If *use no [DRBG](#) functionality* is selected, the evaluator shall inspect the application and its developer documentation and verify that the application needs no random bit generation services.

If *implement [DRBG](#) functionality* is selected, the evaluator shall ensure that additional [FCS\\_RBG\\_EXT.2](#) elements are included in the [ST](#).

If *invoke platform-provided [DRBG](#) functionality* is selected, the evaluator performs the following activities. The evaluator shall examine the [TSS](#) to confirm that it identifies all functions (as described by the SFRs included in the [ST](#)) that obtain random numbers from the platform [RBG](#). The evaluator shall determine that for each of these functions, the [TSS](#) states which platform interface ([API](#)) is used to obtain the random numbers. The evaluator shall confirm that each of these interfaces corresponds to the acceptable interfaces listed for each platform below.

It should be noted that there is no expectation that the evaluators attempt to confirm that the APIs are being used correctly for the functions identified in the [TSS](#); the activity is to list the used APIs and then do an existence check via decompilation.

Tests

If *invoke platform-provided [DRBG](#) functionality* is selected, the following tests shall be performed:

The evaluator shall decompile the application binary using a decompiler suitable for the application ([TOE](#)). The evaluator

shall search the output of the decompiler to determine that, for each [API](#) listed in the [TSS](#), that [API](#) appears in the output. If the representation of the [API](#) does not correspond directly to the strings in the following list, the evaluator shall provide a mapping from the decompiled text to its corresponding [API](#), with a description of why the [API](#) text does not directly correspond to the decompiled text and justification that the decompiled text corresponds to the associated [API](#).

The following are the per-platform list of acceptable APIs:

**For Android:** The evaluator shall verify that the application uses at least one of `javax.crypto.KeyGenerator` class or the `java.security.SecureRandom` CLASS OR `/dev/random` OR `/dev/urandom`.

**For Windows:** The evaluator shall verify that `rand_s`, `RtlGenRandom`, `BCryptGenRandom`, or `CryptGenRandom` [API](#) is used for classic desktop applications. The evaluator shall verify the application uses the `RNGCryptoServiceProvider` class or derives a class from `System.Security.Cryptography.RandomNumberGenerator` [API](#) for Windows Universal Applications. It is only required that the [API](#) is called/invoked, there is no requirement that the [API](#) be used directly. In future versions of this document, `CryptGenRandom` may be removed as an option as it is no longer the preferred [API](#) per vendor documentation.

**For iOS:** The evaluator shall verify that the application invokes either `SecRandomCopyBytes`, `CCRandomGenerateBytes`, OR `CCRandomCopyBytes`, OR USES `/dev/random` directly to acquire random.

**For Linux:** The evaluator shall verify that the application collects random from `/dev/random` OR `/dev/urandom`.

**For Solaris:** The evaluator shall verify that the application collects random from `/dev/random`.

**For macOS:** The evaluator shall verify that the application invokes either `CCRandomGenerateBytes` OR `CCRandomCopyBytes`, OR collects random from `/dev/random`.

If invocation of platform-provided functionality is achieved in another way, the evaluator shall ensure the [TSS](#) describes how this is carried out, and how it is equivalent to the methods listed here (e.g. higher-level [API](#) invokes identical low-level [API](#)).

## FCS\_CKM.1 Cryptographic Key Generation Services

### [FCS\\_CKM.1.1](#)

The application shall [selection:

- generate no asymmetric cryptographic keys,
- invoke platform-provided functionality for asymmetric key generation,
- implement asymmetric key generation

].

Application Note: If *implement asymmetric key generation* or *invoke platform-provided functionality for asymmetric key generation* is chosen, then additional [FCS\\_CKM.1/1](#) elements shall be included in the [ST](#).

#### [Evaluation Activity](#)

#### [TSS](#)

The evaluator shall inspect the application and its developer documentation to determine if the application needs asymmetric key generation services. If not, the evaluator shall verify the **generate no asymmetric cryptographic keys** selection is present in the [ST](#). Otherwise, the evaluation activities shall be performed as stated in the selection-based requirements.

## FCS\_STO\_EXT.1 Storage of Credentials

### [FCS\\_STO\\_EXT.1.1](#)

The application shall [selection:

- not store any credentials,
- invoke the functionality provided by the platform to securely store **[assignment: list of credentials]**,
- implement functionality to securely store **[assignment: list of credentials]** according to **[selection: FCS\_COP.1(1), [FCS\\_CKM.1\(3\)](#)**

] to non-volatile memory.

Application Note: This requirement ensures that persistent credentials (secret keys, [PKI](#) private keys, passwords, etc) are stored securely, and never persisted in cleartext form. Application developers are encouraged to use platform mechanisms for the secure storage of credentials. Depending on the platform that may include hardware-backed protection for credential storage. Application developers must choose a selection, or multiple selections, based on all credentials that the application stores. If *not store any credentials* is selected then the application must not store any credentials. If *invoke the functionality provided by the platform to securely store* is selected then the Application developer must closely review the EA for their platform and provide documentation indicating which platform mechanisms are used to store credentials. If *implement functionality to securely store credentials* is selected, then the following components must be included in the [ST](#): [FCS\\_COP.1/1](#) or [FCS\\_CKM.1/3](#). If other cryptographic operations are used to implement the secure storage of credentials, the corresponding requirements must be included in the [ST](#). If the [OS](#) is Linux and Java KeyStores are used to store credentials, *implement functionality to securely store credentials* must be selected.

#### [Evaluation Activity](#)

#### [TSS](#)

The evaluator shall check the [TSS](#) to ensure that it lists all persistent credentials (secret keys, [PKI](#) private keys, or passwords) needed to meet the requirements in the [ST](#). For each of these items, the evaluator shall confirm that the [TSS](#) lists for what purpose it is used, and how it is stored.

#### Tests

For all credentials for which the application implements functionality, the evaluator shall verify credentials are encrypted according to [FCS\\_COP.1/1](#) or conditioned according to [FCS\\_CKM.1.1/1](#) and [FCS\\_CKM.1/3](#). For all credentials for which the application invokes platform-provided functionality, the evaluator shall perform the following actions which vary per platform.



**For Android:** The evaluator shall verify that the application uses the `AndroidKeyStore` or the `AndroidKeyChain` to store certificates.

**For Windows:** The evaluator shall verify that all certificates are stored in the Windows Certificate Store. The evaluator shall verify that other credentials, like passwords, are stored in the Windows Credential Manager or stored using the Data Protection [API \(DPAPI\)](#). For Windows Universal Applications, the evaluator shall verify that the application is using the `ProtectData` class and storing credentials in `IsolatedStorage`.

**For iOS:** The evaluator shall verify that all credentials are stored within a `Keychain`.

**For Linux:** The evaluator shall verify that all keys are stored using Linux keyrings.

**For Solaris:** The evaluator shall verify that all keys are stored using Solaris Key Management Framework (KMF).

**For macOS:** The evaluator shall verify that all credentials are stored within `Keychain`.

## 5.1.2 User Data Protection (FDP)

### FDP\_DEC\_EXT.1 Access to Platform Resources

#### [FDP\\_DEC\\_EXT.1.1](#)

The application shall restrict its access to [selection:

- no hardware resources,
- network connectivity,
- camera,
- microphone,
- location services,
- [NFC](#),
- [USB](#),
- Bluetooth,
- [assignment: list of additional hardware resources]

].

Application Note: The intent is for the evaluator to ensure that the selection captures all hardware resources which the application accesses, and that these are restricted to those which are justified. On some platforms, the application must explicitly solicit permission in order to access hardware resources. Seeking such permissions, even if the application does not later make use of the hardware resource, should still be considered access. Selections should be expressed in a manner consistent with how the application expresses its access needs to the underlying platform. For example, the platform may provide *location services* which implies the potential use of a variety of hardware resources (e.g. satellite receivers, WiFi, cellular radio) yet *location services* is the proper selection. This is because use of these resources can be inferred, but also because the actual usage may vary based on the particular platform. Resources that do not need to be explicitly identified are those which are ordinarily used by any application such as central processing units, main memory, displays, input devices (e.g. keyboards, mice), and persistent storage devices provided by the platform.

#### [Evaluation Activity](#)

##### Guidance

The evaluator shall perform the platform-specific actions below and inspect user documentation to determine the application's access to hardware resources. The evaluator shall ensure that this is consistent with the selections indicated. The evaluator shall review documentation provided by the application developer and for each resource which it accesses, identify the justification as to why access is required.

##### Tests

**For Android:** The evaluator shall verify that each `uses-permission` entry in the `AndroidManifest.xml` file for access to a hardware resource is reflected in the selection.

**For Windows:** For Windows Universal Applications the evaluator shall check the `WAppManifest.xml` file for a list of required hardware capabilities. The evaluator shall verify that the user is made aware of the required hardware capabilities when the application is first installed. This includes permissions such as `ID_CAP_ISV_CAMERA`, `ID_CAP_LOCATION`, `ID_CAP_NETWORKING`, `ID_CAP_MICROPHONE`, `ID_CAP_PROXIMITY` and so on. A complete list of Windows App permissions can be found at:

- <http://msdn.microsoft.com/en-US/library/windows/apps/jj206936.aspx>

For Windows Desktop Applications the evaluator shall identify in either the application software or its documentation the list of the required hardware resources.

**For iOS:** The evaluator shall verify that either the application or the documentation provides a list of the hardware resources it accesses.

**For Linux:** The evaluator shall verify that either the application software or its documentation provides a list of the hardware resources it accesses.

**For Solaris:** The evaluator shall verify that either the application software or its documentation provides a list of the hardware resources it accesses.

**For macOS:** The evaluator shall verify that either the application software or its documentation provides a list of the hardware resources it accesses.

#### [FDP\\_DEC\\_EXT.1.2](#)

The application shall restrict its access to [selection:

- no sensitive information repositories,
- address book,
- calendar,

- call lists,
- system logs,
- **[assignment]:** list of additional sensitive information repositories]

].

Application Note: Sensitive information repositories are defined as those collections of sensitive data that could be expected to be shared among some applications, users, or user roles, but to which not all of these would ordinarily require access.

#### [Evaluation Activity](#)

##### Guidance

The evaluator shall perform the platform-specific actions below and inspect user documentation to determine the application's access to sensitive information repositories. The evaluator shall ensure that this is consistent with the selections indicated. The evaluator shall review documentation provided by the application developer and for each sensitive information repository which it accesses, identify the justification as to why access is required.

##### Tests

**For Android:** The evaluator shall verify that each *uses-permission* entry in the *AndroidManifest.xml* file for access to a sensitive information repository is reflected in the selection.

**For Windows:** For Windows Universal Applications the evaluator shall check the *WAppManifest.xml* file for a list of required capabilities. The evaluator shall identify the required information repositories when the application is first installed. This includes permissions such as *ID\_CAP\_CONTACTS*, *ID\_CAP\_APPOINTMENTS*, *ID\_CAP\_MEDIALIB* and so on. A complete list of Windows App permissions can be found at:

- <http://msdn.microsoft.com/en-US/library/windows/apps/jj206936.aspx>

For Windows Desktop Applications the evaluator shall identify in either the application software or its documentation the list of sensitive information repositories it accesses.

**For iOS:** The evaluator shall verify that either the application software or its documentation provides a list of the sensitive information repositories it accesses.

**For Linux:** The evaluator shall verify that either the application software or its documentation provides a list of sensitive information repositories it accesses.

**For Solaris:** The evaluator shall verify that either the application software or its documentation provides a list of sensitive information repositories it accesses.

**For macOS:** The evaluator shall verify that either the application software or its documentation provides a list of sensitive information repositories it accesses.

## FDP\_NET\_EXT.1 Network Communications

### [FDP\\_NET\\_EXT.1.1](#)

The application shall restrict network communication to **[selection]:**

- no network communication,
- user-initiated communication for **[assignment]:** list of functions for which the user can initiate network communication],
- respond to **[assignment]:** list of remotely initiated communication],
- **[assignment]:** list of application-initiated network communication]

].

Application Note: This requirement is intended to restrict both inbound and outbound network communications to only those required, or to network communications that are user initiated. It does not apply to network communications in which the application may generically access the filesystem which may result in the platform accessing remotely mounted drives/shares.

#### [Evaluation Activity](#)

##### Tests

The evaluator shall perform the following tests:

- **Test 1:** The evaluator shall run the application. While the application is running, the evaluator shall sniff network traffic ignoring all non-application associated traffic and verify that any network communications witnessed are documented in the [TSS](#) or are user-initiated.
- **Test 2:** The evaluator shall run the application. After the application initializes, the evaluator shall run network port scans to verify that any ports opened by the application have been captured in the [ST](#) for the third selection and its assignment. This includes connection-based protocols (e.g. TCP, DCCP) as well as connectionless protocols (e.g. UDP).

**For Android:** If "no network communication" is selected, the evaluator shall ensure that the application's *AndroidManifest.xml* file does not contain a *uses-permission* or *uses-permission-sdk-23* tag containing *android:name="android.permission.INTERNET"*. In this case, it is not necessary to perform the above Tests 1 and 2, as the platform will not allow the application to perform any network communication.

## FDP\_DAR\_EXT.1 Encryption Of Sensitive Application Data

### [FDP\\_DAR\\_EXT.1.1](#)

The application shall **[selection]:**

- leverage platform-provided functionality to encrypt sensitive data

- implement functionality to encrypt sensitive data as defined in the [PP-Module](#) for File Encryption,
- protect sensitive data in accordance with [FCS\\_STO\\_EXT.1](#),
- not store any sensitive data

] in non-volatile memory.

Application Note: If implement functionality to encrypt sensitive data as defined in the [PP-Module](#) for File Encryption is selected, the [TSF](#) must claim conformance to a [PP-Configuration](#) that includes the File Encryption [PP-Module](#). Any file that may potentially contain sensitive data (to include temporary files) shall be protected. The only exception is if the user intentionally exports the sensitive data to non-protected files. [ST](#) authors should select protect sensitive data in accordance with [FCS\\_STO\\_EXT.1](#) for the sensitive data that is covered by the [FCS\\_STO\\_EXT.1 SFR](#).

#### [Evaluation Activity](#)

#### [TSS](#)

The evaluator shall examine the [TSS](#) to ensure that it describes the sensitive data processed by the application. The evaluator shall then ensure that the following activities cover all of the sensitive data identified in the [TSS](#).

If **not store any sensitive data** is selected, the evaluator shall inspect the [TSS](#) to ensure that it describes how sensitive data cannot be written to non-volatile memory. The evaluator shall also ensure that this is consistent with the filesystem test below.

#### Tests

Evaluation activities (after the identification of the sensitive data) are to be performed on all sensitive data listed that are not covered by [FCS\\_STO\\_EXT.1](#).

The evaluator shall inventory the filesystem locations where the application may write data. The evaluator shall run the application and attempt to store sensitive data. The evaluator shall then inspect those areas of the filesystem to note where data was stored (if any), and determine whether it has been encrypted.

If **leverage platform-provided functionality** is selected, the evaluation activities will be performed as stated in the following requirements, which vary on a per-platform basis.

**For Android:** The evaluator shall inspect the [TSS](#) and verify that it describes how files containing sensitive data are stored with the `MODE_PRIVATE` flag set.

**For Windows:** The Windows platform currently does not provide data-at-rest encryption services which depend upon invocation by application developers. The evaluator shall verify that the Operational User Guidance makes the need to activate platform encryption, such as BitLocker or Encrypting File System (EFS), clear to the end user.

**For iOS:** The evaluator shall inspect the [TSS](#) and ensure that it describes how the application uses the Complete Protection, Protected Unless Open, or Protected Until First User Authentication Data Protection Class for each data file stored locally.

**For Linux:** The Linux platform currently does not provide data-at-rest encryption services which depend upon invocation by application developers. The evaluator shall verify that the Operational User Guidance makes the need to activate platform encryption clear to the end user.

**For Solaris:** The Solaris platform currently does not provide data-at-rest encryption services which depend upon invocation by application developers. The evaluator shall verify that the Operational User Guidance makes the need to activate platform encryption clear to the end user.

**For macOS:** The macOS platform currently does not provide data-at-rest encryption services which depend upon invocation by application developers. The evaluator shall verify that the Operational User Guidance makes the need to activate platform encryption clear to the end user.

### 5.1.3 Security Management (FMT)

#### FMT\_MEC\_EXT.1 Supported Configuration Mechanism

##### [FMT\\_MEC\\_EXT.1.1](#)

The application shall [selection: invoke the mechanisms recommended by the platform vendor for storing and setting configuration options, implement functionality to encrypt and store configuration options as defined by [FDP\\_PRT\\_EXT.1](#) in the [PP-Module](#) for File Encryption]

Application Note: Configuration options that are stored remotely are not subject to this requirement. Sensitive Data is generally not considered part of configuration options and should be stored according to [FDP\\_DAR\\_EXT.1](#) or [FCS\\_STO\\_EXT.1](#).

#### [Evaluation Activity](#)

#### [TSS](#)

The evaluator shall review the [TSS](#) to identify the application's configuration options (e.g. settings) and determine whether these are stored and set using the mechanisms supported by the platform or implemented by the application in accordance with the [PP-Module](#) for File Encryption. At a minimum the [TSS](#) shall list settings related to any SFRs and any settings that are mandated in the operational guidance in response to an [SFR](#).

Conditional: If "implement functionality to encrypt and store configuration options as defined by [FDP\\_PRT\\_EXT.1](#) in the [PP-Module](#) for File Encryption" is selected, the evaluator shall ensure that the [TSS](#) identifies those options, as well as indicates where the encrypted representation of these options is stored.

#### Tests

If "invoke the mechanisms recommended by the platform vendor for storing and setting configuration options" is chosen, the method of testing varies per platform as follows:

**For Android:** The evaluator shall run the application and make security-related changes to its configuration. The evaluator shall check that at least one XML file at location `/data/data/package/shared_prefs/` reflects the changes made to the configuration to verify that the application used `SharedPreferences` and/or `PreferenceActivity` classes for storing configuration data, where `package` is the Java package of the application.

**For Windows:** The evaluator shall determine and verify that Windows Universal Applications use either the

Windows.Storage namespace, Windows.UI.ApplicationSettings namespace, or the IsolatedStorageSettings namespace for storing application specific settings. For .NET applications, the evaluator shall determine and verify that the application uses one of the locations listed in <https://docs.microsoft.com/en-us/dotnet/framework/configure-apps/> for storing application specific settings. For Classic Desktop applications, the evaluator shall run the application while monitoring it with the SysInternals tool ProcMon and make changes to its configuration. The evaluator shall verify that ProcMon logs show corresponding changes to the the Windows Registry or C:\ProgramData\ directory.

**For iOS:** The evaluator shall verify that the [app](#) uses the user defaults system or key-value store for storing all settings.

**For Linux:** The evaluator shall run the application while monitoring it with the utility strace. The evaluator shall make security-related changes to its configuration. The evaluator shall verify that strace logs corresponding changes to configuration files that reside in /etc (for system-specific configuration), in the user's home directory (for user-specific configuration), or /var/lib/ (for configurations controlled by [UI](#) and not intended to be directly modified by an administrator).

**For Solaris:** The evaluator shall run the application while monitoring it with the utility dtrace. The evaluator shall make security-related changes to its configuration. The evaluator shall verify that dtrace logs corresponding changes to configuration files that reside in /etc (for system-specific configuration) or in the user's home directory (for user-specific configuration).

**For macOS:** The evaluator shall verify that the application stores and retrieves settings using the NSUserDefaults class. If "implement functionality to encrypt and store configuration options as defined by FDP\_PRT\_EXT.1 in the [PP-Module](#) for File Encryption" is selected, for all configuration options listed in the [TSS](#) as being stored and protected using encryption, the evaluator shall examine the contents of the configuration option storage (identified in the [TSS](#)) to determine that the options have been encrypted.

## FMT\_CFG\_EXT.1 Secure by Default Configuration

### FMT\_CFG\_EXT.1.1

The application shall provide only enough functionality to set new credentials when configured with default credentials or no credentials.

Application Note: Default credentials are credentials (e.g., passwords, keys) that are automatically (without user interaction) loaded onto the platform during application installation. Credentials that are generated during installation using requirements laid out in [FCS\\_RBG\\_EXT.1](#) are not by definition default credentials.

#### Evaluation Activity

[TSS](#)  
The evaluator shall check the [TSS](#) to determine if the application requires any type of credentials and if the application installs with default credentials.

#### Tests

If the application uses any default credentials the evaluator shall run the following tests.

- **Test 1:** The evaluator shall install and run the application without generating or loading new credentials and verify that only the minimal application functionality required to set new credentials is available.
- **Test 2:** The evaluator shall attempt to clear all credentials and verify that only the minimal application functionality required to set new credentials is available.
- **Test 3:** The evaluator shall run the application, establish new credentials and verify that the original default credentials no longer provide access to the application.

### FMT\_CFG\_EXT.1.2

The application shall be configured by default with file permissions which protect the application binaries and data files from modification by normal unprivileged users.

Application Note: The precise expectations for file permissions vary per platform but the general intention is that a trust boundary protects the application and its data.

#### Evaluation Activity

#### Tests

The evaluator shall install and run the application. The evaluator shall inspect the filesystem of the platform (to the extent possible) for any files created by the application and ensure that their permissions are adequate to protect them. The method of doing so varies per platform.

**For Android:** The evaluator shall run the command `find -L . -perm /002` inside the application's data directories to ensure that all files are not world-writable. The command should not print any files.

**For Windows:** The evaluator shall run the SysInternals tools, Process Monitor and Access Check (or tools of equivalent capability, like `icacls.exe`) for Classic Desktop applications to verify that files written to disk during an application's installation have the correct file permissions, such that a standard user cannot modify the application or its data files. For Windows Universal Applications the evaluator shall consider the requirement met because of the AppContainer sandbox.

**For iOS:** The evaluator shall determine whether the application leverages the appropriate Data Protection Class for each data file stored locally.

**For Linux:** The evaluator shall run the command `find . -perm /002` inside the application's data directories to ensure that all files are not world-writable. The command should not print any files.

**For Solaris:** The evaluator shall run the command `find . \(-perm -002 \)` inside the application's data directories to ensure that all files are not world-writable. The command should not print any files.

**For macOS:** The evaluator shall run the command `find . -perm +002` inside the application's data directories to ensure that all files are not world-writable. The command should not print any files.

## FMT\_SMF.1 Specification of Management Functions

### FMT\_SMF.1.1

The [TSF](#) shall be capable of performing the following management functions **§selection**:



- no management functions,
- enable/disable the transmission of any information describing the system's hardware, software, or configuration ,
- enable/disable the transmission of any [PII](#) ,
- enable/disable transmission of any application state (e.g. crashdump) information,
- enable/disable network backup functionality to **[assignment: list of enterprise or commercial cloud backup systems]** ,
- **[assignment: list of other management functions to be provided by the [TSF](#)]**

].

Application Note: This requirement stipulates that an application needs to provide the ability to enable/disable only those functions that it actually implements. The application is not responsible for controlling the behavior of the platform or other applications.

#### [Evaluation Activity](#)

##### Guidance

The evaluator shall verify that every management function mandated by the [PP](#) is described in the operational guidance and that the description contains the information required to perform the management duties associated with the management function.

##### Tests

The evaluator shall test the application's ability to provide the management functions by configuring the application and testing each option selected from above. The evaluator is expected to test these functions in all the ways in which the [ST](#) and guidance documentation state the configuration can be managed.

## 5.1.4 Privacy (FPR)

### FPR\_ANO\_EXT.1 User Consent for Transmission of Personally Identifiable Information

#### [FPR\\_ANO\\_EXT.1.1](#)

The application shall **[selection:**

- not transmit [PII](#) over a network ,
- require user approval before executing **[assignment: list of functions that transmit [PII](#) over a network]**

].

Application Note: This requirement applies only to [PII](#) that is specifically requested by the application; it does not apply if the user volunteers [PII](#) without prompting from the application into a general (or inappropriate) data field. A dialog box that declares intent to send [PII](#) presented to the user at the time the application is started is sufficient to meet this requirement.

#### [Evaluation Activity](#)

##### [TSS](#)

The evaluator shall inspect the [TSS](#) documentation to identify functionality in the application where [PII](#) can be transmitted.

##### Tests

If require user approval before executing is selected, the evaluator shall run the application and exercise the functionality responsibly for transmitting [PII](#) and verify that user approval is required before transmission of the [PII](#).

## 5.1.5 Protection of the TSF (FPT)

### FPT\_API\_EXT.1 Use of Supported Services and APIs

#### [FPT\\_API\\_EXT.1.1](#)

The application shall use only documented platform APIs.

Application Note: The definition of *documented* may vary depending upon whether the application is provided by a third party (who relies upon documented platform APIs) or by a platform vendor who may be able to guarantee support for platform APIs.

#### [Evaluation Activity](#)

##### [TSS](#)

The evaluator shall verify that the [TSS](#) lists the platform APIs used in the application.

##### Tests

The evaluator shall then compare the list with the supported APIs (available through e.g. developer accounts, platform developer groups) and ensure that all APIs listed in the [TSS](#) are supported.

### FPT\_AEX\_EXT.1 Anti-Exploitation Capabilities

#### [FPT\\_AEX\\_EXT.1.1](#)

The application shall not request to map memory at an explicit address except for **[assignment: list of explicit exceptions]**.

Application Note: Requesting a memory mapping at an explicit address subverts address space layout randomization ([ASLR](#)).

#### [Evaluation Activity](#)

##### [TSS](#)

The evaluator shall ensure that the [TSS](#) describes the compiler flags used to enable [ASLR](#) when the application is compiled.

##### Tests

The evaluator shall perform either a static or dynamic analysis to determine that no memory mappings are placed at an explicit and consistent address. The method of doing so varies per platform. For those platforms requiring the same application running on two different systems, the evaluator may alternatively use the same device. After collecting the first



instance of mappings, the evaluator must uninstall the application, reboot the device, and reinstall the application to collect the second instance of mappings.

**For Android:** The evaluator shall run the same application on two different Android systems. Both devices do not need to be evaluated, as the second device is acting only as a tool. Connect via [ADB](#) and inspect `/proc/PID/maps`. Ensure the two different instances share no memory mappings made by the application at the same location.

**For Windows:** The evaluator shall run the same application on two different Windows systems and run a tool that will list all memory mapped addresses for the application. The evaluator shall then verify the two different instances share no mapping locations. The Microsoft SysInternals tool, VMMap, could be used to view memory addresses of a running application. The evaluator shall use a tool such as Microsoft's BinScope Binary Analyzer to confirm that the application has [ASLR](#) enabled.

**For iOS:** The evaluator shall perform a static analysis to search for any `mmap` calls (or [API](#) calls that call `mmap`), and ensure that no arguments are provided that request a mapping at a fixed address.

**For Linux:** The evaluator shall run the same application on two different Linux systems. The evaluator shall then compare their memory maps using `pmap -x PID` to ensure the two different instances share no mapping locations.

**For Solaris:** The evaluator shall run the same application on two different Solaris systems. The evaluator shall then compare their memory maps using `pmap -x PID` to ensure the two different instances share no mapping locations.

**For macOS:** The evaluator shall run the same application on two different Mac systems. The evaluator shall then compare their memory maps using `vmmap PID` to ensure the two different instances share no mapping locations.

#### [FPT\\_AEX\\_EXT.1.2](#)

The application shall [selection:

- not allocate any memory region with both write and execute permissions ,
- allocate memory regions with write and execute permissions for only [assignment: list of functions performing just-in-time compilation]

].

Application Note: Requesting a memory mapping with both write and execute permissions subverts the platform protection provided by [DEP](#). If the application performs no just-in-time compiling, then the first selection must be chosen.

#### [Evaluation Activity](#)

##### Tests

The evaluator shall verify that no memory mapping requests are made with write and execute permissions. The method of doing so varies per platform.

**For Android:** The evaluator shall perform static analysis on the application to verify that

- `mmap` is never invoked with both the `PROT_WRITE` and `PROT_EXEC` permissions, and
- `mprotect` is never invoked.

**For Windows:** The evaluator shall use a tool such as Microsoft's BinScope Binary Analyzer to confirm that the application passes the NXCheck. The evaluator may also ensure that the `/NXCOMPAT` flag was used during compilation to verify that [DEP](#) protections are enabled for the application.

**For iOS:** The evaluator shall perform static analysis on the application to verify that `mprotect` is never invoked with the `PROT_EXEC` permission.

**For Linux:** The evaluator shall perform static analysis on the application to verify that both

- `mmap` is never be invoked with both the `PROT_WRITE` and `PROT_EXEC` permissions, and
- `mprotect` is never invoked with the `PROT_EXEC` permission.

**For Solaris:** The evaluator shall perform static analysis on the application to verify that both

- `mmap` is never be invoked with both the `PROT_WRITE` and `PROT_EXEC` permissions, and
- `mprotect` is never invoked with the `PROT_EXEC` permission.

**For macOS:** The evaluator shall perform static analysis on the application to verify that `mprotect` is never invoked with the `PROT_EXEC` permission.

#### [FPT\\_AEX\\_EXT.1.3](#)

The application shall be compatible with security features provided by the platform vendor.

Application Note: This requirement is designed to ensure that platform security features do not need to be disabled in order for the application to run.

#### [Evaluation Activity](#)

##### Tests

The evaluator shall configure the platform in the ascribed manner and carry out one of the prescribed tests:

**For Android:** Applications running on Android cannot disable Android security features, therefore this requirement is met and no evaluation activity is required.

**For Windows:** If the [OS](#) platform supports Windows Defender Exploit Guard (Windows 10 version 1709 or later), then the evaluator shall ensure that the application can run successfully with Windows Defender Exploit Guard Exploit Protection configured with the following minimum mitigations enabled; Control Flow Guard (CFG), Randomize memory allocations (Bottom-Up [ASLR](#)), Export address filtering (EAF), Import address filtering (IAF), and Data Execution Prevention ([DEP](#)). The following link describes how to enable Exploit Protection, <https://docs.microsoft.com/en-us/windows/security/threat-protection/windows-defender-exploit-guard/customize-exploit-protection>.

If the [OS](#) platform supports the Enhanced Mitigation Experience Toolkit ([EMET](#)) which can be installed on Windows 10 version 1703 and earlier, then the evaluator shall ensure that the application can run successfully with [EMET](#) configured with the following minimum mitigations enabled; Memory Protection Check, Randomize memory allocations (Bottom-Up [ASLR](#)), Export address filtering (EAF), and Data Execution Prevention ([DEP](#)).

**For iOS:** Applications running on iOS cannot disable security features, therefore this requirement is met and no evaluation

activity is required.

**For Linux:** The evaluator shall ensure that the application can successfully run on a system with either SELinux or AppArmor enabled and in enforce mode.

**For Solaris:** The evaluator shall ensure that the application can run with Solaris Trusted Extensions enabled and enforcing.

**For macOS:** The evaluator shall ensure that the application can successfully run on macOS without disabling any security features.

#### [FPT\\_AEX\\_EXT.1.4](#)

The application shall not write user-modifiable files to directories that contain executable files unless explicitly directed by the user to do so.

Application Note: The purpose of this requirement is to help ensure the integrity of application binaries by supporting file protection mechanisms such as directory-level file permissions and application whitelisting. A user-modifiable file for purposes of this requirement is a file that is writable by an unprivileged user of the application -- either directly through application execution or independently of the application. If the application runs in the context of the application user, then the application should not be able to write to the directory containing the application binaries -- regardless of whether the files are configuration data, audit data, or temporary files. Executables and user-modifiable files may not share the same parent directory, but may share directories above the parent.

#### [Evaluation Activity](#)

##### Tests

The evaluator shall run the application and determine where it writes its files. For files where the user does not choose the destination, the evaluator shall check whether the destination directory contains executable files. This varies per platform:

**For Android:** The evaluator shall run the program, mimicking normal usage, and note where all user-modifiable files are written. The evaluator shall ensure that there are no executable files stored under /data/data/package/ where package is the Java package of the application.

**For Windows:** For Windows Universal Applications the evaluator shall consider the requirement met because the platform forces applications to write all data within the application working directory (sandbox). For Windows Desktop Applications the evaluator shall run the program, mimicking normal usage, and note where all user-modifiable files are written. The evaluator shall ensure that there are no executable files stored in the same directories to which the application wrote user-modifiable files.

**For iOS:** The evaluator shall consider the requirement met because the platform forces applications to write all data within the application working directory (sandbox).

**For Linux:** The evaluator shall run the program, mimicking normal usage, and note where all user-modifiable files are written. The evaluator shall ensure that there are no executable files stored in the same directories to which the application wrote user-modifiable files.

**For Solaris:** The evaluator shall run the program, mimicking normal usage, and note where all user-modifiable files are written. The evaluator shall ensure that there are no executable files stored in the same directories to which the application wrote user-modifiable files.

**For macOS:** The evaluator shall run the program, mimicking normal usage, and note where all user-modifiable files are written. The evaluator shall ensure that there are no executable files stored in the same directories to which the application wrote user-modifiable files.

#### [FPT\\_AEX\\_EXT.1.5](#)

The application shall be built with stack-based buffer overflow protection enabled.

#### [Evaluation Activity](#)

##### Tests

The evaluator will inspect every native executable included in the [TOE](#) to ensure that stack-based buffer overflow protection is present.

**For Windows:** Applications that run as Managed Code in the .NET Framework do not require these stack protections. Applications developed in Object Pascal using the Delphi IDE compiled with RangeChecking enabled comply with this element. For other code, the evaluator shall review the [TSS](#) and verify that the /GS flag was used during compilation. The evaluator shall run a tool like, BinScope, that can verify the correct usage of /GS.

**For PE**, the evaluator will disassemble each and ensure the following sequence appears:

```
mov rcx, QWORD PTR  
[rsp+(...)]  
xor rcx, (...)  
call (...)
```

**For ELF executables**, the evaluator will ensure that each contains references to the symbol `__stack_chk_fail`.

Tools such as [Canary Detector](#) may help automate these activities.

## FPT\_TUD\_EXT.1 Integrity for Installation and Update

#### [FPT\\_TUD\\_EXT.1.1](#)

The application shall [selection: provide the ability, leverage the platform] to check for updates and patches to the application software.

Application Note: This requirement is about the ability to "check" for updates. The actual installation of any updates should be done by the platform. This requirement is intended to ensure that the application can check for updates provided by the vendor, as updates provided by another source may contain malicious code.

#### [Evaluation Activity](#)

##### Guidance

The evaluator shall check to ensure the guidance includes a description of how updates are performed.

## Tests

The evaluator shall check for an update using procedures described in either the application documentation or the platform documentation and verify that the application does not issue an error. If it is updated or if it reports that no update is available this requirement is considered to be met.

### [FPT\\_TUD\\_EXT.1.2](#)

The application shall [**selection:** provide the ability, leverage the platform] to query the current version of the application software.

#### [Evaluation Activity](#)

## Guidance

The evaluator shall verify guidance includes a description of how to query the current version of the application.

## Tests

The evaluator shall query the application for the current version of the software according to the operational user guidance.

The evaluator shall then verify that the current version matches that of the documented and installed version.

### [FPT\\_TUD\\_EXT.1.3](#)

The application shall not download, modify, replace or update its own binary code.

Application Note: This requirement applies to the code of the application; it does not apply to mobile code technologies that are designed for download and execution by the application.

#### [Evaluation Activity](#)

## Tests

The evaluator shall verify that the application's executable files are not changed by the application. The evaluator shall complete the following test:

**For iOS:** The evaluator shall consider the requirement met because the platform forces applications to write all data within the application working directory (sandbox).

- **Test 1:** For all other platforms: The evaluator shall install the application and then locate all of its executable files. The evaluator shall then, for each file, save off either a hash of the file or a copy of the file itself. The evaluator shall then run the application and exercise all features of the application as described in the [ST](#). The evaluator shall then compare each executable file with the either the saved hash or the saved copy of the files. The evaluator shall verify that these are identical.

### [FPT\\_TUD\\_EXT.1.4](#)

The application installation package and its Application updates shall be digitally signed such that its the application platform can cryptographically verify them prior to installation.

Application Note: The specifics of the verification of installation packages and updates involves requirements on the platform (and not the application), so these are not fully specified here.

#### [Evaluation Activity](#)

## TSS

The evaluator shall verify that the [TSS](#) identifies how updates to the application installation package and updates to it are signed by an authorized source. The definition of an authorized source must be contained in the [TSS](#). The evaluator shall also ensure that the [TSS](#) (or the operational guidance) describes how candidate updates are obtained.

### [FPT\\_TUD\\_EXT.1.5](#)

The application is distributed [**selection:** with the platform [OS](#) , as an additional software package to the platform [OS](#) ].

Application Note: Application software that is distributed as part of the platform operating system is not required to be package for installation or uninstallation. If "as an additional software package to the [OS](#)" is selected the requirements from [FPT\\_TUD\\_EXT.2](#) must be included in the [ST](#).

#### [Evaluation Activity](#)

## TSS

The evaluator shall verify that the [TSS](#) identifies how the application is distributed. If "with the platform" is selected the evaluated shall perform a clean installation or factory reset to confirm that [TOE](#) software is included as part of the platform [OS](#). If "as an additional package" is selected the evaluator shall perform the tests in [FPT\\_TUD\\_EXT.2](#).

## FPT\_LIB\_EXT.1 Use of Third Party Libraries

### [FPT\\_LIB\\_EXT.1.1](#)

The application shall be packaged with only [**assignment:** list of third-party libraries].

Application Note: The intention of this requirement is for the evaluator to discover and document whether the application is including unnecessary or unexpected third-party libraries. This includes adware libraries which could present a privacy threat, as well as ensuring documentation of such libraries in case vulnerabilities are later discovered.

#### [Evaluation Activity](#)

## Tests

The evaluator shall install the application and survey its installation directory for dynamic libraries. The evaluator shall verify that libraries found to be packaged with or employed by the application are limited to those in the assignment.

## FPT\_IDV\_EXT.1 Software Identification and Versions

### [FPT\\_IDV\\_EXT.1.1](#)

The application shall be versioned with [**selection:** [SWID](#) tags that comply with minimum requirements from [ISO/IEC 19770-2:2015](#) , [**assignment:** other version information]] .

Application Note: The use of [SWID](#) tag to identify application software is a requirement for DODIT based on DoD Instruction 8500.01 which requires the use of SCAP which includes [SWID](#) tags per the [NIST](#) standard. The [PP](#) selection of "other version information" will be removed in the next major release of this protection profile. Vendors should begin to version software with valid [SWID](#) tags.

Valid [SWID](#) tags must contain a SoftwareIdentity element and an Entity element as defined in the [ISO/IEC 19770-2:2015](#) standard. [SWID](#) tags must be stored with a .swidtag file extensions as defined in the [ISO/IEC 19770-2:2015](#).

#### [Evaluation Activity](#)

##### [TSS](#)

If "other version information" is selected the evaluator shall verify that the [TSS](#) contains an explanation of the versioning methodology.

##### Tests

The evaluator shall install the application, then check for the existence of version information. If [SWID](#) tags is selected the evaluator shall check for a .swidtag file. The evaluator shall open the file and verify that it contains at least a SoftwareIdentity element and an Entity element.

## 5.1.6 Trusted Path/Channel (FTP)

### FTP\_DIT\_EXT.1 Protection of Data in Transit

#### [FTP\\_DIT\\_EXT.1.1](#)

The application shall [selection:

- not transmit any [selection: data, sensitive data] ,
- encrypt all transmitted [selection: sensitive data, data] with [selection: [HTTPS](#) in accordance with [FCS HTTPS\\_EXT.1](#), [TLS](#) as defined in the [TLS Package](#), [DTLS](#) as defined in the [TLS Package](#), [SSH](#) as conforming to the Extended Package for [Secure Shell](#), IPsec as defined in the [PP-Module for VPN Client](#)] ,
- invoke platform-provided functionality to encrypt all transmitted sensitive data with [selection: [HTTPS](#), [TLS](#), [DTLS](#), [SSH](#)] ,
- invoke platform-provided functionality to encrypt all transmitted data with [selection: [HTTPS](#), [TLS](#), [DTLS](#), [SSH](#)]

] between itself and another trusted [IT](#) product.

Application Note: Encryption is not required for applications transmitting data that is not sensitive.

If encrypt all transmitted is selected and [TLS](#) is selected, then evaluation of elements from either [FCS\\_TLSC\\_EXT.1](#) or [FCS\\_TLSS\\_EXT.1](#) is required.

If encrypt all transmitted is selected and [HTTPS](#) is selected, [FCS\\_HTTPS\\_EXT.1](#) is required.

If encrypt all transmitted is selected and [DTLS](#) is selected, [FCS\\_DTLS\\_EXT.1](#) is required.

If encrypt all transmitted is selected and [SSH](#) is selected, the [TSF](#) shall be validated against the Extended Package for [Secure Shell](#).

If encrypt all transmitted is selected and IPsec is selected, the [TSF](#) must claim conformance to a [PP-Configuration](#) that includes the [VPN Client PP-Module](#)

If encrypt all transmitted is selected the corresponding [FCS\\_COP.1](#) requirements will be included.

#### [Evaluation Activity](#)

##### [TSS](#)

For platform-provided functionality, the evaluator shall verify the [TSS](#) contains the calls to the platform that [TOE](#) is leveraging to invoke the functionality.

##### Tests

The evaluator shall perform the following tests.

- **Test 1:** The evaluator shall exercise the application (attempting to transmit data; for example by connecting to remote systems or websites) while capturing packets from the application. The evaluator shall verify from the packet capture that the traffic is encrypted with [HTTPS](#), [TLS](#), [DTLS](#), or [SSH](#), or IPsec in accordance with the selection in the [ST](#).
- **Test 2:** The evaluator shall exercise the application (attempting to transmit data; for example by connecting to remote systems or websites) while capturing packets from the application. The evaluator shall review the packet capture and verify that no sensitive data is transmitted in the clear.
- **Test 3:** The evaluator shall inspect the [TSS](#) to determine if user credentials are transmitted. If credentials are transmitted the evaluator shall set the credential to a known value. The evaluator shall capture packets from the application while causing credentials to be transmitted as described in the [TSS](#). The evaluator shall perform a string search of the captured network packets and verify that the plaintext credential previously set by the evaluator is not found.

**For Android:** If "not transmit any data" is selected, the evaluator shall ensure that the application's AndroidManifest.xml file does not contain a uses-permission or uses-permission-sdk-23 tag containing android:name="android.permission.INTERNET". In this case, it is not necessary to perform the above Tests 1, 2, or 3, as the platform will not allow the application to perform any network communication.

**For iOS:** If "encrypt all transmitted data" is selected, the evaluator shall ensure that the application's Info.plist file does not contain the NSAllowsArbitraryLoads or NSExceptionAllowsInsecureHTTPLoads keys, as these keys disable iOS's Application Transport Security feature.

## 5.1.7 TOE Security Functional Requirements Rationale



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

OBJECTIVE	ADDRESSED BY	RATIONALE
<a href="#">O.INTEGRITY</a>	<a href="#">FDP_DEC_EXT.1</a> , <a href="#">FMT_CFG_EXT.1</a> , <a href="#">FPT_AEX_EXT.1</a> <a href="#">FPT_TUD_EXT.1</a>	The <a href="#">PP</a> includes <a href="#">FDP_DEC_EXT.1</a> to limit access to platform hardware resources, which limits the methods by which an attacker can attempt to compromise the integrity of the <a href="#">TOE</a> .
		The <a href="#">PP</a> includes <a href="#">FMT_CFG_EXT.1</a> for the TSP to limit unauthorized access to itself by preventing the use of default authentication credentials and by ensuring that the <a href="#">TOE</a> uses appropriately restrictive platform permissions on its binaries and data
		The <a href="#">PP</a> includes <a href="#">FPT_AEX_EXT.1</a> to add complexity to the task of compromising systems by ensuring that application is compatible with security features provided by the platform vendor and that the application implements platform-provided anti-exploitations such as <a href="#">ASLR</a> and stack overflow protection.
		The <a href="#">PP</a> includes <a href="#">FPT_TUD_EXT.1</a> to ensure that the <a href="#">TOE</a> can be patched and that any updates to the <a href="#">TOE</a> have appropriate integrity protection.
		The <a href="#">PP</a> supports this objective by allowing <a href="#">FCS_CKM_EXT.1</a> to specify that the <a href="#">TSF</a> may rely on platform-provided key generation services.
		The <a href="#">PP</a> supports this objective by allowing <a href="#">FCS_RBG_EXT.1</a> to specify that the <a href="#">TSF</a> may rely on platform-provided random bit generation services.
		The <a href="#">PP</a> supports this objective by allowing <a href="#">FCS_STO_EXT.1</a> to specify that the <a href="#">TSF</a> may rely on platform-provided credential storage services.
<a href="#">O.QUALITY</a>	<a href="#">FCS_CKM_EXT.1</a> , <a href="#">FCS_RBG_EXT.1</a> , <a href="#">FCS_STO_EXT.1</a> , <a href="#">FDP_DAR_EXT.1</a> , <a href="#">FMT_MEC_EXT.1</a> , <a href="#">FPT_API_EXT.1</a> , <a href="#">FPT_LIB_EXT.1</a> , <a href="#">FTP_DIT_EXT.1</a> , <a href="#">FCS_CKM.1/1</a> , <a href="#">FCS_CKM.2</a> , <a href="#">FIA_X509_EXT.1</a> , <a href="#">FPT_TUD_EXT.2</a> , <a href="#">FPT_API_EXT.2</a>	The <a href="#">PP</a> supports this objective by allowing <a href="#">FDP_DAR_EXT.1</a> to specify that the <a href="#">TSF</a> may rely on platform-provided data-at-rest protection services.
		The <a href="#">PP</a> includes <a href="#">FMT_MEC_EXT.1</a> to ensure that the <a href="#">TOE</a> can use platform services to store and set configuration options.
		The <a href="#">PP</a> includes <a href="#">FPT_API_EXT.1</a> to require the <a href="#">TOE</a> to leverage platform functionality by using only documented and supported APIs.
		The <a href="#">PP</a> includes <a href="#">FPT_LIB_EXT.1</a> to ensure that the <a href="#">TOE</a> does not include any unnecessary or unexpected third-party libraries which could present a privacy threat or vulnerability.
		The <a href="#">PP</a> supports this objective by allowing <a href="#">FTP_DIT_EXT.1</a> to specify that the <a href="#">TSF</a> may rely on platform-provided services to implement trusted communications.
		The <a href="#">PP</a> supports this objective by allowing <a href="#">FCS_CKM.1(1)</a> to specify that the <a href="#">TSF</a> may rely on platform-provided asymmetric key generation services.
		The <a href="#">PP</a> supports this objective by allowing <a href="#">FCS_CKM.2</a> to specify that the <a href="#">TSF</a> may rely on platform-provided key establishment services.
		The <a href="#">PP</a> supports this objective by allowing <a href="#">FIA_X509_EXT.1</a> to specify that the <a href="#">TSF</a> may rely



on platform-provided X.509 certificate validation services.

The [TSF](#) includes [FPT\\_TUD\\_EXT.2](#) to specify that the [TOE](#) may leverage the platform-supported package manager for application distribution and leverages platform-provided mechanisms to remove all traces of itself when removed from the platform system.

The [PP](#) includes [FPT\\_API\\_EXT.2](#) to permit the [TOE](#) to use platform-provided libraries for parsing [IANA MIME](#) media formats.

The [PP](#) includes [FMT\\_SMF.1](#) to define the security-relevant management functions that are supported by the [TOE](#).

The [PP](#) includes [FPR\\_ANO\\_EXT.1](#) to define how the [TSF](#) provides control to the user regarding the disclosure of any [PII](#).

The [PP](#) includes [FPT\\_IDV\\_EXT.1](#) to provide a methodology for identifying the [TOE](#) versioning.

The [PP](#) includes [FPT\\_TUD\\_EXT.1](#) to define how updates to the [TOE](#) are deployed and verified.

The [PP](#) includes [FCS\\_COP.1\(3\)](#) to define the mechanism used to verify [TOE](#) updates if the [TOE](#) implements this functionality rather than the underlying platform.

The [PP](#) includes [FCS\\_RBG\\_EXT.1](#) to define whether random bit generation services are implemented by the [TSF](#) or the platform. Depending on how data at rest is protected, the [TOE](#) may rely on the use of a random bit generator to create keys that are subsequently used for data protection.

The [PP](#) includes [FCS\\_STO\\_EXT.1](#) to define the mechanism that the [TSF](#) uses or relies upon to protect stored credential data.

The [PP](#) includes [FDP\\_DAR\\_EXT.1](#) to define the mechanism that the [TSF](#) uses or relies upon to protect sensitive data at rest.

The [PP](#) includes [FCS\\_CKM.1\(2\)](#) to define the [TOE](#)'s capability to generate symmetric keys. These keys may subsequently be used to encrypt stored credential data based on the claims made in [FCS\\_STO\\_EXT.1](#).

The [PP](#) includes [FCS\\_CKM.1\(3\)](#) to define the password-based key derivation function that may be used to encrypt stored credential data based on the claims made in [FCS\\_STO\\_EXT.1](#).

The [PP](#) includes [FCS\\_COP.1\(1\)](#) to define the [AES](#) cryptographic algorithm that may be used to encrypt stored credential data based on the claims made in [FCS\\_STO\\_EXT.1](#).

The [PP](#) includes [FCS\\_COP.1\(2\)](#) to define integrity mechanisms that may be used by the [TOE](#) as part of ensuring that data at rest is protected.

The [PP](#) includes [FCS\\_COP.1\(2\)](#) to define [HMAC](#) mechanisms that may be used by the [TOE](#) as part of ensuring that data at rest is protected.

The [PP](#) includes [FCS\\_RBG\\_EXT.2](#) to define the

## [O.MANAGEMENT](#)

[FMT\\_SMF.1](#), [FPR\\_ANO\\_EXT.1](#),  
[FPT\\_IDV\\_EXT.1](#), [FPT\\_TUD\\_EXT.1](#),  
[FCS\\_COP.1/3](#)

## [O.PROTECTED\\_STORAGE](#)

[FCS\\_RBG\\_EXT.1](#), [FCS\\_STO\\_EXT.1](#),  
[FDP\\_DAR\\_EXT.1](#), [FCS\\_CKM.1/2](#),  
[FCS\\_CKM.1/3](#), [FCS\\_COP.1/1](#),  
[FCS\\_COP.1/2](#), [FCS\\_COP.1/4](#),  
[FCS\\_RBG\\_EXT.2](#)

## O.PROTECTED\_COMMS

FCS\_RBG\_EXT.1, FCS\_CKM\_EXT.1,  
FTP\_DIT\_EXT.1, FCS\_CKM.1/1,  
FCS\_CKM.2, FCS\_COP.1/1,  
FCS\_COP.1/2, FCS\_COP.1/3,  
FCS\_COP.1/4, FCS\_RBG\_EXT.2,  
FCS\_HTTPS\_EXT.1, FDP\_NET\_EXT.1,  
FIA\_X509\_EXT.1, FIA\_X509\_EXT.2

[TOE](#)'s implementation of random bit generation functionality in the event that the [TOE](#) provides this function in support of generating keys that are used for data protection.

The [PP](#) includes [FCS\\_RBG\\_EXT.1](#) to define whether the random bit generation services used in establishing trusted communications are implemented by the [TSF](#) or by the platform.

The [PP](#) includes [FCS\\_CKM\\_EXT.1](#) to specify whether the [TOE](#) or the platform is responsible for generation of any asymmetric keys that may be used for establishing trusted communications.

The [PP](#) includes [FTP\\_DIT\\_EXT.1](#) to define the trusted channels used to protect data in transit, the data that is protected, and whether the trusted channels are implemented by the [TSF](#) or the platform.

The [PP](#) includes [FCS\\_CKM.1](#)(1) to define whether the [TSF](#) or the platform generates asymmetric keys that are used in support of trusted communications.

The [PP](#) includes [FCS\\_CKM.2](#) to define whether the [TSF](#) or the platform performs key establishment for trusted communications.

The [PP](#) includes [FCS\\_COP.1](#)(1) to define the symmetric encryption algorithms used in support of trusted communications.

The [PP](#) includes [FCS\\_COP.1](#)(2) to define the hash algorithms used in support of trusted communications.

The [PP](#) includes [FCS\\_COP.1](#)(3) to define the digital signature algorithms used in support of trusted communications.

The [PP](#) includes [FCS\\_COP.1](#)(4) to define the [HMAC](#) algorithms used in support of trusted communications.

The [PP](#) includes [FCS\\_RBG\\_EXT.2](#) to define the [DRBG](#) algorithms used in support of trusted communications.

The [PP](#) includes [FCS\\_HTTPS\\_EXT.1](#) to define the [TOE](#)'s support for the [HTTPS](#) trusted communications protocol.

The [PP](#) includes [FDP\\_NET\\_EXT.1](#) to define the [TOE](#)'s usage of network communications, which may include the transmission or receipt of data over a trusted channel.

The [PP](#) includes [FIA\\_X509\\_EXT.1](#) to define X.509 certificate validation activities in support of trusted communications.

The [PP](#) includes [FIA\\_X509\\_EXT.2](#) to define the trusted communications that X.509 certificate services support, as well as the extent to which trusted communications can be established when using a certificate with unknown validity.

## 5.2 Security Assurance Requirements

The Security Objectives for the [TOE](#) in [Section 5 Security Requirements](#) were constructed to address threats identified in [Section 3.1 Threats](#). The Security Functional Requirements (SFRs) in [Section 5.1 Security Functional Requirements](#) are a

formal instantiation of the Security Objectives. The [PP](#) identifies the Security Assurance Requirements (SARs) to frame the extent to which the evaluator assesses the documentation applicable for the evaluation and performs independent testing.

This section lists the set of SARs from [CC](#) part 3 that are required in evaluations against this [PP](#). Individual Evaluation Activities (EAs) to be performed are specified both in [Section 5 Security Requirements](#) as well as in this section.

The general model for evaluation of TOEs against STs written to conform to this [PP](#) is as follows: After the [ST](#) has been approved for evaluation, the CCTL will obtain the [TOE](#), supporting environmental [IT](#), and the administrative/user guides for the [TOE](#). The CCTL is expected to perform actions mandated by the Common Evaluation Methodology ([CEM](#)) for the ASE and ALC SARs. The CCTL also performs the evaluation activities contained within [Section 5 Security Requirements](#), which are intended to be an interpretation of the other [CEM](#) assurance requirements as they apply to the specific technology instantiated in the [TOE](#). The evaluation activities that are captured in [Section 5 Security Requirements](#) also provide clarification as to what the developer needs to provide to demonstrate the [TOE](#) is compliant with the [PP](#). The results of these activities will be documented and presented (along with the administrative guidance used) for validation.

### 5.2.1 Class ASE: Security Target

As per ASE activities defined in [\[CEM\]](#).

### 5.2.2 Class ADV: Development

The information about the [TOE](#) is contained in the guidance documentation available to the end user as well as the [TSS](#) portion of the [ST](#). The [TOE](#) developer must concur with the description of the product that is contained in the [TSS](#) as it relates to the functional requirements. The evaluation activities contained in [Section 5.1 Security Functional Requirements](#) should provide the [ST](#) authors with sufficient information to determine the appropriate content for the [TSS](#) section.

#### ADV\_FSP.1 Basic Functional Specification (ADV\_FSP.1)

The functional specification describes the TSFIs. It is not necessary to have a formal or complete specification of these interfaces. Additionally, because TOEs conforming to this [PP](#) will necessarily have interfaces to the Operational Environment that are not directly invocable by [TOE](#) users, there is little point specifying that such interfaces be described in and of themselves since only indirect testing of such interfaces may be possible. For this [PP](#), the activities for this family should focus on understanding the interfaces presented in the [TSS](#) in response to the functional requirements and the interfaces presented in the AGD documentation. No additional “functional specification” documentation is necessary to satisfy the evaluation activities specified. The interfaces that need to be evaluated are characterized through the information needed to perform the assurance activities listed, rather than as an independent, abstract list.

#### Developer action elements:

##### [ADV\\_FSP.1.1D](#)

The developer shall provide a functional specification.

##### [ADV\\_FSP.1.2D](#)

The developer shall provide a tracing from the functional specification to the SFRs.

Application Note: As indicated in the introduction to this section, the functional specification is comprised of the information contained in the AGD\_OPE and AGD\_PRE documentation. The developer may reference a website accessible to application developers and the evaluator. The evaluation activities in the functional requirements point to evidence that should exist in the documentation and [TSS](#) section; since these are directly associated with the SFRs, the tracing in element [ADV\\_FSP.1.2D](#) is implicitly already done and no additional documentation is necessary.

#### Content and presentation elements:

##### [ADV\\_FSP.1.3C](#)

The functional specification shall describe the purpose and method of use for each [SFR](#)-enforcing and [SFR](#)-supporting TSFI.

##### [ADV\\_FSP.1.4C](#)

The functional specification shall identify all parameters associated with each [SFR](#)-enforcing and [SFR](#)-supporting TSFI.

##### [ADV\\_FSP.1.5C](#)

The functional specification shall provide rationale for the implicit categorization of interfaces as [SFR](#)-non-interfering.

##### [ADV\\_FSP.1.6C](#)

The tracing shall demonstrate that the SFRs trace to TSFIs in the functional specification.

#### Evaluator action elements:

##### [ADV\\_FSP.1.7E](#)

The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

##### [ADV\\_FSP.1.8E](#)

The evaluator shall determine that the functional specification is an accurate and complete instantiation of the SFRs.

##### [Evaluation Activity](#)

*There are no specific evaluation activities associated with these SARs, except ensuring the information is provided. The*

functional specification documentation is provided to support the evaluation activities described in [Section 5.1 Security Functional Requirements](#), and other activities described for AGD, ATE, and AVA SARs. The requirements on the content of the functional specification information is implicitly assessed by virtue of the other evaluation activities being performed; if the evaluator is unable to perform an activity because there is insufficient interface information, then an adequate functional specification has not been provided.

### 5.2.3 Class AGD: Guidance Documentation

The guidance documents will be provided with the [ST](#). Guidance must include a description of how the [IT](#) personnel verifies that the Operational Environment can fulfill its role for the security functionality. The documentation should be in an informal style and readable by the [IT](#) personnel. Guidance must be provided for every operational environment that the product supports as claimed in the [ST](#). This guidance includes instructions to successfully install the [TSF](#) in that environment; and Instructions to manage the security of the [TSF](#) as a product and as a component of the larger operational environment. Guidance pertaining to particular security functionality is also provided; requirements on such guidance are contained in the evaluation activities specified with each requirement.

#### AGD\_OPE.1 Operational User Guidance (AGD\_OPE.1)

##### Developer action elements:

###### [AGD\\_OPE.1.1D](#)

The developer shall provide operational user guidance.

Application Note: The operational user guidance does not have to be contained in a single document. Guidance to users, administrators and application developers can be spread among documents or web pages. Where appropriate, the guidance documentation is expressed in the eXtensible Configuration Checklist Description Format ([XCCDF](#)) to support security automation. Rather than repeat information here, the developer should review the evaluation activities for this component to ascertain the specifics of the guidance that the evaluator will be checking for. This will provide the necessary information for the preparation of acceptable guidance.

##### Content and presentation elements:

###### [AGD\\_OPE.1.2C](#)

The operational user guidance shall describe, for each user role, the user-accessible functions and privileges that should be controlled in a secure processing environment, including appropriate warnings.

Application Note: User and administrator are to be considered in the definition of user role.

###### [AGD\\_OPE.1.3C](#)

The operational user guidance shall describe, for each user role, how to use the available interfaces provided by the [TOE](#) in a secure manner.

###### [AGD\\_OPE.1.4C](#)

The operational user guidance shall describe, for each user role, the available functions and interfaces, in particular all security parameters under the control of the user, indicating secure values as appropriate.

###### [AGD\\_OPE.1.5C](#)

The operational user guidance shall, for each user role, clearly present each type of security-relevant event relative to the user-accessible functions that need to be performed, including changing the security characteristics of entities under the control of the [TSF](#).

###### [AGD\\_OPE.1.6C](#)

The operational user guidance shall identify all possible modes of operation of the [TOE](#) (including operation following failure or operational error), their consequences, and implications for maintaining secure operation.

###### [AGD\\_OPE.1.7C](#)

The operational user guidance shall, for each user role, describe the security measures to be followed in order to fulfill the security objectives for the operational environment as described in the [ST](#).

###### [AGD\\_OPE.1.8C](#)

The operational user guidance shall be clear and reasonable.

##### Evaluator action elements:

###### [AGD\\_OPE.1.9E](#)

The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

###### [Evaluation Activity](#)

Some of the contents of the operational guidance will be verified by the evaluation activities in [Section 5.1 Security Functional Requirements](#) and evaluation of the [TOE](#) according to the [\[CEM\]](#). The following additional information is also required.

If cryptographic functions are provided by the [TOE](#), the operational guidance shall contain instructions for configuring the cryptographic engine associated with the evaluated configuration of the [TOE](#). It shall provide a warning to the administrator that use of other cryptographic engines was not evaluated nor tested during the [CC](#) evaluation of the [TOE](#).

The documentation must describe the process for verifying updates to the [TOE](#) by verifying a digital signature – this may be done by the [TOE](#) or the underlying platform.

The evaluator shall verify that this process includes the following steps:

- Instructions for obtaining the update itself. This should include instructions for making the update accessible to the [TOE](#) (e.g., placement in a specific directory).

- *Instructions for initiating the update process, as well as discerning whether the process was successful or unsuccessful. This includes generation of the digital signature. The [TOE](#) will likely contain security functionality that does not fall in the scope of evaluation under this [PP](#). The operational guidance shall make it clear to an administrator which security functionality is covered by the evaluation activities.*

## **AGD\_PRE.1 Preparative Procedures (AGD\_PRE.1)**

### **Developer action elements:**

#### [AGD\\_PRE.1.1D](#)

The developer shall provide the [TOE](#), including its preparative procedures.

Application Note: As with the operational guidance, the developer should look to the evaluation activities to determine the required content with respect to preparative procedures.

### **Content and presentation elements:**

#### [AGD\\_PRE.1.2C](#)

The preparative procedures shall describe all the steps necessary for secure acceptance of the delivered [TOE](#) in accordance with the developer's delivery procedures.

#### [AGD\\_PRE.1.3C](#)

The preparative procedures shall describe all the steps necessary for secure installation of the [TOE](#) and for the secure preparation of the operational environment in accordance with the security objectives for the operational environment as described in the [ST](#).

### **Evaluator action elements:**

#### [AGD\\_PRE.1.4E](#)

The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

#### [AGD\\_PRE.1.5E](#)

The evaluator shall apply the preparative procedures to confirm that the [TOE](#) can be prepared securely for operation.

#### [Evaluation Activity](#)

*As indicated in the introduction above, there are significant expectations with respect to the documentation—especially when configuring the operational environment to support [TOE](#) functional requirements. The evaluator shall check to ensure that the guidance provided for the [TOE](#) adequately addresses all platforms claimed for the [TOE](#) in the [ST](#).*

## **5.2.4 Class ALC: Life-cycle Support**

At the assurance level provided for TOEs conformant to this [PP](#), life-cycle support is limited to end-user-visible aspects of the life-cycle, rather than an examination of the [TOE](#) vendor's development and configuration management process. This is not meant to diminish the critical role that a developer's practices play in contributing to the overall trustworthiness of a product; rather, it is a reflection on the information to be made available for evaluation at this assurance level.

## **ALC\_CMC.1 Labeling of the TOE (ALC\_CMC.1)**

This component is targeted at identifying the [TOE](#) such that it can be distinguished from other products or versions from the same vendor and can be easily specified when being procured by an end user.

### **Developer action elements:**

#### [ALC\\_CMC.1.1D](#)

The developer shall provide the [TOE](#) and a reference for the [TOE](#).

### **Content and presentation elements:**

#### [ALC\\_CMC.1.2C](#)

The application shall be labeled with a unique reference.

Application Note: Unique reference information includes:

- Application Name
- Application Version
- Application Description
- Platform on which Application Runs
- Software Identification ([SWID](#)) tags, if available

### **Evaluator action elements:**

#### [ALC\\_CMC.1.3E](#)

The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

#### [Evaluation Activity](#)

*The evaluator shall check the [ST](#) to ensure that it contains an identifier (such as a product name/version number) that*



specifically identifies the version that meets the requirements of the [ST](#). Further, the evaluator shall check the AGD guidance and [TOE](#) samples received for testing to ensure that the version number is consistent with that in the [ST](#). If the vendor maintains a web site advertising the [TOE](#), the evaluator shall examine the information on the web site to ensure that the information in the [ST](#) is sufficient to distinguish the product.

#### **ALC\_CMS.1 TOE CM Coverage (ALC\_CMS.1)**

##### **Developer action elements:**

###### [ALC\\_CMS.1.1D](#)

The developer shall provide a configuration list for the [TOE](#).

##### **Content and presentation elements:**

###### [ALC\\_CMS.1.2C](#)

The configuration list shall include the following: the [TOE](#) itself; and the evaluation evidence required by the SARs.

###### [ALC\\_CMS.1.3C](#)

The configuration list shall uniquely identify the configuration items.

##### **Evaluator action elements:**

###### [ALC\\_CMS.1.4E](#)

The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

###### [Evaluation Activity](#)

The "evaluation evidence required by the SARs" in this [PP](#) is limited to the information in the [ST](#) coupled with the guidance provided to administrators and users under the AGD requirements. By ensuring that the [TOE](#) is specifically identified and that this identification is consistent in the [ST](#) and in the AGD guidance (as done in the evaluation activity for [ALC\\_CMC.1](#)), the evaluator implicitly confirms the information required by this component. Life-cycle support is targeted aspects of the developer's life-cycle and instructions to providers of applications for the developer's devices, rather than an in-depth examination of the [TSF](#) manufacturer's development and configuration management process. This is not meant to diminish the critical role that a developer's practices play in contributing to the overall trustworthiness of a product; rather, it's a reflection on the information to be made available for evaluation.

The evaluator shall ensure that the developer has identified (in guidance documentation for application developers concerning the targeted platform) one or more development environments appropriate for use in developing applications for the developer's platform. For each of these development environments, the developer shall provide information on how to configure the environment to ensure that buffer overflow protection mechanisms in the environment(s) are invoked (e.g., compiler flags). The evaluator shall ensure that this documentation also includes an indication of whether such protections are on by default, or have to be specifically enabled. The evaluator shall ensure that the [TSF](#) is uniquely identified (with respect to other products from the [TSF](#) vendor), and that documentation provided by the developer in association with the requirements in the [ST](#) is associated with the [TSF](#) using this unique identification.

#### **ALC\_TSU\_EXT.1 Timely Security Updates**

This component requires the [TOE](#) developer, in conjunction with any other necessary parties, to provide information as to how the end-user devices are updated to address security issues in a timely manner. The documentation describes the process of providing updates to the public from the time a security flaw is reported/discovered, to the time an update is released. This description includes the parties involved (e.g., the developer, carriers(s)) and the steps that are performed (e.g., developer testing, carrier testing), including worst case time periods, before an update is made available to the public.

##### **Developer action elements:**

###### [ALC\\_TSU\\_EXT.1.1D](#)

The developer shall provide a description in the [TSS](#) of how timely security updates are made to the [TOE](#).

Note: Application developers must support updates to their products for purposes of fixing security vulnerabilities.

###### [ALC\\_TSU\\_EXT.1.2D](#)

The developer shall provide a description in the [TSS](#) of how users are notified when updates change security properties or the configuration of the product.

##### **Content and presentation elements:**

###### [ALC\\_TSU\\_EXT.1.3C](#)

The description shall include the process for creating and deploying security updates for the [TOE](#) software.

###### [ALC\\_TSU\\_EXT.1.4C](#)

The description shall express the time window as the length of time, in days, between public disclosure of a vulnerability and the public availability of security updates to the [TOE](#).

###### [ALC\\_TSU\\_EXT.1.5C](#)

The description shall include the mechanisms publicly available for reporting security issues pertaining to the [TOE](#).

Note: The reporting mechanism could include web sites, email addresses, as well as a means to protect the sensitive nature of the report (e.g., public keys that could be used to encrypt the details of a proof-of-concept exploit).

## Evaluator action elements:

### [ALC\\_TSU\\_EXT.1.6E](#)

The evaluator *shall confirm* that the information provided meets all requirements for content and presentation of evidence.

#### [Evaluation Activity](#)

The evaluator shall verify that the [TSS](#) contains a description of the timely security update process used by the developer to create and deploy security updates. The evaluator shall verify that this description addresses the entire application. The evaluator shall also verify that, in addition to the [TOE](#) developer's process, any third-party processes are also addressed in the description. The evaluator shall also verify that each mechanism for deployment of security updates is described.

The evaluator shall verify that, for each deployment mechanism described for the update process, the [TSS](#) lists a time between public disclosure of a vulnerability and public availability of the security update to the [TOE](#) patching this vulnerability, to include any third-party or carrier delays in deployment. The evaluator shall verify that this time is expressed in a number or range of days.

The evaluator shall verify that this description includes the publicly available mechanisms (including either an email address or website) for reporting security issues related to the [TOE](#). The evaluator shall verify that the description of this mechanism includes a method for protecting the report either using a public key for encrypting email or a trusted channel for a website.

## 5.2.5 Class ATE: Tests

Testing is specified for functional aspects of the system as well as aspects that take advantage of design or implementation weaknesses. The former is done through the ATE\_IND family, while the latter is through the AVA\_VAN family. At the assurance level specified in this [PP](#), testing is based on advertised functionality and interfaces with dependency on the availability of design information. One of the primary outputs of the evaluation process is the test report as specified in the following requirements.

### ATE\_IND.1 Independent Testing – Conformance (ATE\_IND.1)

Testing is performed to confirm the functionality described in the [TSS](#) as well as the administrative (including configuration and operational) documentation provided. The focus of the testing is to confirm that the requirements specified in [Section 5.1 Security Functional Requirements](#) being met, although some additional testing is specified for SARs in [Section 5.2 Security Assurance Requirements](#). The evaluation activities identify the additional testing activities associated with these components. The evaluator produces a test report documenting the plan for and results of testing, as well as coverage arguments focused on the platform/[TOE](#) combinations that are claiming conformance to this [PP](#). Given the scope of the [TOE](#) and its associated evaluation evidence requirements, this component's evaluation activities are covered by the evaluation activities listed for [ALC\\_CMC.1](#).

## Developer action elements:

### [ATE\\_IND.1.1D](#)

The developer shall provide the [TOE](#) for testing.

Application Note: The developer must provide at least one product instance of the [TOE](#) for complete testing on at least platform regardless of equivalency. See the Equivalency Appendix for more details.

## Content and presentation elements:

### [ATE\\_IND.1.2C](#)

The [TOE](#) shall be suitable for testing.

## Evaluator action elements:

### [ATE\\_IND.1.3E](#)

The evaluator *shall confirm* that the information provided meets all requirements for content and presentation of evidence.

#### [ATE\\_IND.1.4E](#)

The evaluator shall test a subset of the [TSF](#) to confirm that the [TSF](#) operates as specified.

Application Note: The evaluator shall test the application on the most current fully patched version of the platform.

#### [Evaluation Activity](#)

The evaluator shall prepare a test plan and report documenting the testing aspects of the system, including any application crashes during testing. The evaluator shall determine the root cause of any application crashes and include that information in the report. The test plan covers all of the testing actions contained in the [CEM](#) and the body of this [PP](#)'s evaluation activities.

While it is not necessary to have one test case per test listed in an evaluation activity, the evaluator must document in the test plan that each applicable testing requirement in the [ST](#) is covered. The test plan identifies the platforms to be tested, and for those platforms not included in the test plan but included in the [ST](#), the test plan provides a justification for not testing the platforms. This justification must address the differences between the tested platforms and the untested platforms, and make an argument that the differences do not affect the testing to be performed. It is not sufficient to merely assert that the differences have no effect; rationale must be provided. If all platforms claimed in the [ST](#) are tested, then no rationale is necessary. The test plan describes the composition of each platform to be tested, and any setup that is necessary beyond what is contained in the AGD documentation. It should be noted that the evaluator is expected to follow the AGD documentation for installation and setup of each platform either as part of a test or as a standard pre-test condition. This may include special test drivers or tools. For each driver or tool, an argument (not just an assertion) should be provided that the driver or tool will not adversely affect the performance of the functionality by the [TOE](#) and its platform.

*This also includes the configuration of the cryptographic engine to be used. The cryptographic algorithms implemented by this engine are those specified by this [PP](#) and used by the cryptographic protocols being evaluated (e.g. [SSH](#)). The test plan identifies high-level test objectives as well as the test procedures to be followed to achieve those objectives. These procedures include expected results.*

*The test report (which could just be an annotated version of the test plan) details the activities that took place when the test procedures were executed, and includes the actual results of the tests. This shall be a cumulative account, so if there was a test run that resulted in a failure; a fix installed; and then a successful re-run of the test, the report would show a "fail" and "pass" result (and the supporting details), and not just the "pass" result.*

## 5.2.6 Class AVA: Vulnerability Assessment

For the current generation of this protection profile, the evaluation lab is expected to survey open sources to discover what vulnerabilities have been discovered in these types of products. In most cases, these vulnerabilities will require sophistication beyond that of a basic attacker. Until penetration tools are created and uniformly distributed to the evaluation labs, the evaluator will not be expected to test for these vulnerabilities in the [TOE](#). The labs will be expected to comment on the likelihood of these vulnerabilities given the documentation provided by the vendor. This information will be used in the development of penetration testing tools and for the development of future protection profiles.

### AVA\_VAN.1 Vulnerability Survey (AVA\_VAN.1)

#### Developer action elements:

##### [AVA\\_VAN.1.1D](#)

The developer shall provide the [TOE](#) for testing.

#### Content and presentation elements:

##### [AVA\\_VAN.1.2C](#)

The application shall be suitable for testing.

Application Note: Suitability for testing means not being obfuscated or packaged in such a way as to disrupt either static or dynamic analysis by the evaluator.

#### Evaluator action elements:

##### [AVA\\_VAN.1.3E](#)

The evaluator shall confirm that the information provided meets all requirements for content and presentation of evidence.

##### [AVA\\_VAN.1.4E](#)

The evaluator shall perform a search of public domain sources to identify potential vulnerabilities in the [TOE](#).

Application Note: Public domain sources include the Common Vulnerabilities and Exposures (CVE) dictionary for publicly known vulnerabilities. Public domain sources also include sites which provide free checking of files for viruses.

##### [AVA\\_VAN.1.5E](#)

The evaluator shall conduct penetration testing, based on the identified potential vulnerabilities, to determine that the [TOE](#) is resistant to attacks performed by an attacker possessing Basic attack potential.

##### [Evaluation Activity](#)

*The evaluator shall generate a report to document their findings with respect to this requirement. This report could physically be part of the overall test report mentioned in ATE\_IND, or a separate document. The evaluator performs a search of public information to find vulnerabilities that have been found in similar applications with a particular focus on network protocols the application uses and document formats it parses. The evaluator shall also run a virus scanner with the most current virus definitions against the application files and verify that no files are flagged as malicious. The evaluator documents the sources consulted and the vulnerabilities found in the report.*

*For each vulnerability found, the evaluator either provides a rationale with respect to its non-applicability, or the evaluator formulates a test (using the guidelines provided in ATE\_IND) to confirm the vulnerability, if suitable. Suitability is determined by assessing the attack vector needed to take advantage of the vulnerability. If exploiting the vulnerability requires expert skills and an electron microscope, for instance, then a test would not be suitable and an appropriate justification would be formulated.*

##### [TSS](#)

##### Tests

**For Windows:** The evaluator shall also run a virus scanner with the most current virus definitions against the application files and verify that no files are flagged as malicious.

**For Linux:** The evaluator shall also run a virus scanner with the most current virus definitions against the application files and verify that no files are flagged as malicious.

**For macOS:** The evaluator shall also run a virus scanner with the most current virus definitions against the application files and verify that no files are flagged as malicious.

**For Solaris:** The evaluator shall also run a virus scanner with the most current virus definitions against the application files and verify that no files are flagged as malicious.

## Appendix A - Optional Requirements

As indicated in the introduction to this [PP](#), the baseline requirements (those that must be performed by the [TOE](#)) are

contained in the body of this [PP](#). This Appendix contains three other types of optional requirements that may be included in the [ST](#), but are not required in order to conform to this [PP](#). However, applied modules, packages and/or use cases may refine specific requirements as mandatory.

The first type ([A.1 Strictly Optional Requirements](#)) are strictly optional requirements that are independent of the [TOE](#) implementing any function. If the [TOE](#) fulfills any of these requirements or supports a certain functionality, the vendor is encouraged to include the SFRs in the [ST](#), but are not required in order to conform to this [PP](#).

The second type ([A.2 Objective Requirements](#)) are objective requirements that describe security functionality not yet widely available in commercial technology. The requirements are not currently mandated in the body of this [PP](#), but will be included in the baseline requirements in future versions of this [PP](#). Adoption by vendors is encouraged and expected as soon as possible.

The third type ([A.3 Implementation-Dependent Requirements](#)) are dependent on the [TOE](#) implementing a particular function. If the [TOE](#) fulfills any of these requirements, the vendor must either add the related [SFR](#) or disable the functionality for the evaluated configuration.

## A.1 Strictly Optional Requirements

### A.1.1 Cryptographic Support (FCS)

#### FCS\_CKM.1/2 Cryptographic Symmetric Key Generation

##### [FCS\\_CKM.1.1/2](#)

The **application** shall generate **symmetric** cryptographic keys using a Random Bit Generator as specified in [FCS\\_RBG\\_EXT.1](#) and specified cryptographic key sizes **selection**:

- 128 bit,
- 256 bit

].

Application Note: Symmetric keys may be used to generate keys along the key chain.

##### [Evaluation Activity](#)

##### [TSS](#)

The evaluator shall review the [TSS](#) to determine that it describes how the functionality described by [FCS\\_RBG\\_EXT.1](#) is invoked.

If the application is relying on random bit generation from the host platform, the evaluator shall verify the [TSS](#) includes the name/manufacturer of the external [RBG](#) and describes the function call and parameters used when calling the external [DRBG](#) function. If different external RBGs are used for different platforms, the evaluator shall verify the [TSS](#) identifies each [RBG](#) for each platform. Also, the evaluator shall verify the [TSS](#) includes a short description of the vendor's assumption for the amount of entropy seeding the external [DRBG](#). The evaluator uses the description of the [RBG](#) functionality in [FCS\\_RBG\\_EXT](#) or documentation available for the operational environment to determine that the key size being requested is identical to the key size and mode to be used for the encryption/decryption of the user data.

## A.2 Objective Requirements

### A.2.1 Protection of the TSF (FPT)

#### FPT\_API\_EXT.2 Use of Supported Services and APIs

##### [FPT\\_API\\_EXT.2.1](#)

The application [**selection**: shall use platform-provided libraries, does not implement functionality] for parsing [**assignment**: list of formats parsed that are included in the [IANA MIME](#) media types].

Application Note: The [IANA MIME](#) types are listed at <http://www.iana.org/assignments/media-types> and include many image, audio, video, and content file formats. This requirement does not apply if providing parsing services is the purpose of the application.

##### [Evaluation Activity](#)

##### [TSS](#)

The evaluator shall verify that the [TSS](#) lists the [IANA MIME](#) media types (as described by <http://www.iana.org/assignments/media-types>) for all formats the application processes and that it maps those formats to parsing services provided by the platform.

## A.3 Implementation-Dependent Requirements

This [PP](#) does not define any implementation-dependent requirements.

# Appendix B - Selection-Based Requirements



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

## B.1 Cryptographic Support (FCS)

### FCS\_RBG\_EXT.2 Random Bit Generation from Application

*This is a selection-based component. Its inclusion depends upon selection from [FCS\\_RBG\\_EXT.1.1](#).*

#### [FCS\\_RBG\\_EXT.2.1](#)

The application shall perform all deterministic random bit generation ([DRBG](#)) services in accordance with [NIST](#) Special Publication 800-90A using [selection: Hash\_DRBG (any), HMAC\_DRBG (any), CTR\_DRBG ([AES](#))]

Application Note: This requirement shall be included in STs in which implement [DRBG](#) functionality is chosen in [FCS\\_RBG\\_EXT.1.1](#). The [ST](#) author should select the standard to which the [RBG](#) services comply (either [SP](#) 800-90A or [FIPS](#) 140-2 Annex C).

[SP](#) 800-90A contains three different methods of generating random numbers; each of these, in turn, depends on underlying cryptographic primitives (hash functions/ciphers). The [ST](#) author will select the function used (if [SP](#) 800-90A is selected), and include the specific underlying cryptographic primitives used in the requirement or in the [TSS](#). While any of the identified hash functions ([SHA](#)-1, [SHA](#)-224, [SHA](#)-256, [SHA](#)-384, [SHA](#)-512) are allowed for Hash\_DRBG or HMAC\_DRBG, only [AES](#)-based implementations for CTR\_DRBG are allowed.

#### [Evaluation Activity](#)

##### Tests

The evaluator shall perform the following tests, depending on the standard to which the [RBG](#) conforms.

Implementations Conforming to [FIPS](#) 140-2 Annex C.

The reference for the tests contained in this section is The Random Number Generator Validation System ([RNGVS](#)). The evaluators shall conduct the following two tests. Note that the "expected values" are produced by a reference implementation of the algorithm that is known to be correct. Proof of correctness is left to each Scheme.

- **Test 1:** The evaluators shall perform a Variable Seed Test. The evaluators shall provide a set of 128 (Seed, [DT](#)) pairs to the [TSF RBG](#) function, each 128 bits. The evaluators shall also provide a key (of the length appropriate to the [AES](#) algorithm) that is constant for all 128 (Seed, [DT](#)) pairs. The [DT](#) value is incremented by 1 for each set. The seed values shall have no repeats within the set. The evaluators ensure that the values returned by the [TSF](#) match the expected values.
- **Test 2:** The evaluators shall perform a Monte Carlo Test. For this test, they supply an initial Seed and [DT](#) value to the [TSF RBG](#) function; each of these is 128 bits. The evaluators shall also provide a key (of the length appropriate to the [AES](#) algorithm) that is constant throughout the test. The evaluators then invoke the [TSF RBG](#) 10,000 times, with the [DT](#) value being incremented by 1 on each iteration, and the new seed for the subsequent iteration produced as specified in [NIST](#)-Recommended Random Number Generator Based on [ANSI](#) X9.31 Appendix A.2.4 Using the 3-Key Triple [DES](#) and [AES](#) Algorithms, Section E.3. The evaluators ensure that the 10,000th value produced matches the expected value.

Implementations Conforming to [NIST](#) Special Publication 800-90A

- **Test 1:** The evaluator shall perform 15 trials for the [RNG](#) implementation. If the [RNG](#) is configurable, the evaluator shall perform 15 trials for each configuration. The evaluator shall also confirm that the operational guidance contains appropriate instructions for configuring the [RNG](#) functionality.  
If the [RNG](#) has prediction resistance enabled, each trial consists of (1) instantiate [DRBG](#), (2) generate the first block of random bits (3) generate a second block of random bits (4) uninstantiate. The evaluator verifies that the second block of random bits is the expected value. The evaluator shall generate eight input values for each trial. The first is a count (0 – 14). The next three are entropy input, nonce, and personalization string for the instantiate operation. The next two are additional input and entropy input for the first call to generate. The final two are additional input and entropy input for the second call to generate. These values are randomly generated. "generate one block of random bits" means to generate random bits with number of returned bits equal to the Output Block Length (as defined in [NIST SP](#) 800-90A).  
If the [RNG](#) does not have prediction resistance, each trial consists of (1) instantiate [DRBG](#), (2) generate the first block of random bits (3) reseed, (4) generate a second block of random bits (5) uninstantiate. The evaluator verifies that the second block of random bits is the expected value. The evaluator shall generate eight input values for each trial. The first is a count (0 – 14). The next three are entropy input, nonce, and personalization string for the instantiate operation. The fifth value is additional input to the first call to generate. The sixth and seventh are additional input and entropy input to the call to reseed. The final value is additional input to the second generate call.  
The following paragraphs contain more information on some of the input values to be generated/selected by the evaluator.  
**Entropy input:** the length of the entropy input value must equal the seed length.  
**Nonce:** If a nonce is supported (CTR\_DRBG with no Derivation Function does not use a nonce), the nonce bit length is one-half the seed length.  
**Personalization string:** The length of the personalization string must be less than or equal to seed length. If the implementation only supports one personalization string length, then the same length can be used for both values. If more than one string length is support, the evaluator shall use personalization strings of two different lengths. If the implementation does not use a personalization string, no value needs to be supplied.  
**Additional input:** the additional input bit lengths have the same defaults and restrictions as the personalization string lengths.

#### [FCS\\_RBG\\_EXT.2.2](#)



The deterministic [RBG](#) shall be seeded by an entropy source that accumulates entropy from a platform-based [DRBG](#) and [selection:

- a software-based noise source,
- a hardware-based noise source,
- no other noise source

] with a minimum of [selection:

- 128 bits,
- 256 bits

] of entropy at least equal to the greatest security strength (according to [NIST SP 800-57](#)) of the keys and hashes that it will generate.

Application Note: This requirement shall be included in STs in which [implement DRBG functionality](#) is chosen in [FCS\\_RBG\\_EXT.1.1](#). For the first selection in this requirement, the [ST](#) author selects 'software-based noise source' if any additional noise sources are used as input to the application's [DRBG](#). Note that the application must use the platform's [DRBG](#) to seed its [DRBG](#).

In the second selection in this requirement, the [ST](#) author selects the appropriate number of bits of entropy that corresponds to the greatest security strength of the algorithms included in the [ST](#). Security strength is defined in Tables 2 and 3 of [NIST SP 800-57A](#). For example, if the implementation includes 2048-bit RSA (security strength of 112 bits) and [AES 256](#) (security strength 256 bits), then the [ST](#) author would select 256 bits.

[Evaluation Activity](#)

[TSS](#)

Documentation shall be produced - and the evaluator shall perform the activities - in accordance with [Appendix C - Entropy Documentation and Assessment](#) and the [Clarification to the Entropy Documentation and Assessment Annex](#)

Tests

In the future, specific statistical testing (in line with [NIST SP 800-90B](#)) will be required to verify the entropy estimates.

## FCS\_CKM.1/ALGO Cryptographic Asymmetric Key Generation

**This is a selection-based component. Its inclusion depends upon selection from [FCS\\_CKM.1.1](#).**

[FCS\\_CKM.1.1/ALGO](#)

The application shall [selection:

- invoke platform-provided functionality,
- implement functionality

] to generate asymmetric cryptographic keys in accordance with a specified cryptographic key generation algorithm [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"**,
- **[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]**,
- **[FFC Schemes] using Diffie-Hellman group 14 that meet the following: [RFC 3526](#), Section 3**,
- **[FFC Schemes] using "safe-prime" groups that meet the following: [NIST Special Publication 800-56A Revision 3](#), "Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography" and [selection: [RFC 3526](#), [RFC 7919](#)]**

].

Application Note: The [ST](#) author shall select all key generation schemes used for key establishment and entity authentication. When key generation is used for key establishment, the schemes in [FCS\\_CKM.2.1](#) and selected cryptographic protocols must match the selection. When key generation is used for entity authentication, the public key is expected to be associated with an X.509v3 certificate.

If the [TOE](#) acts as a receiver in the RSA key establishment scheme, the [TOE](#) does not need to implement RSA key generation.

[Evaluation Activity](#)

[TSS](#)

The evaluator shall ensure that the [TSS](#) identifies the key sizes supported by the [TOE](#). If the [ST](#) specifies more than one scheme, the evaluator shall examine the [TSS](#) to verify that it identifies the usage for each scheme.

If the application **invokes platform-provided functionality for asymmetric key generation**, then the evaluator shall examine the [TSS](#) to verify that it describes how the key generation functionality is invoked.

Guidance

The evaluator shall verify that the AGD guidance instructs the administrator how to configure the [TOE](#) to use the selected key generation scheme(s) and key size(s) for all uses defined in this [PP](#).

Tests

If the application **implements asymmetric key generation**, then the following test activities shall be carried out.

*Evaluation Activity Note: The following tests may require the developer to provide access to a developer environment that provides the evaluator with tools that are typically available to end-users of the application.*

### Key Generation for [FIPS PUB 186-4 RSA Schemes](#)

The evaluator shall verify the implementation of RSA Key Generation by the [TOE](#) using the Key Generation test. This test verifies the ability of the [TSF](#) to correctly produce values for the key components including the public verification exponent  $e$ , the private prime factors  $p$  and  $q$ , the public modulus  $n$  and the calculation of the private signature exponent  $d$ . Key Pair generation specifies 5 ways (or methods) to generate the primes  $p$  and  $q$ . These include:

1. Random Primes:
  - Provable primes
  - Probable primes
2. Primes with Conditions:
  - Primes  $p_1, p_2, q_1, q_2, p$  and  $q$  shall all be provable primes
  - Primes  $p_1, p_2, q_1$ , and  $q_2$  shall be provable primes and  $p$  and  $q$  shall be probable primes
  - Primes  $p_1, p_2, q_1, q_2, p$  and  $q$  shall all be probable primes

To test the key generation method for the Random Provable primes method and for all the Primes with Conditions methods, the evaluator must seed the [TSF](#) key generation routine with sufficient data to deterministically generate the RSA key pair. This includes the random seed(s), the public exponent of the RSA key, and the desired key length. For each key length supported, the evaluator shall have the [TSF](#) generate 25 key pairs. The evaluator shall verify the correctness of the [TSF](#)'s implementation by comparing values generated by the [TSF](#) with those generated from a known good implementation.

If possible, the Random Probable primes method should also be verified against a known good implementation as described above. Otherwise, the evaluator shall have the [TSF](#) generate 10 keys pairs for each supported key length  $nlen$  and verify:

- $n = p \cdot q$ ,
- $p$  and  $q$  are probably prime according to Miller-Rabin tests,
- $\text{GCD}(p-1, e) = 1$ ,
- $\text{GCD}(q-1, e) = 1$ ,
- $2^{16} \leq e \leq 2^{256}$  and  $e$  is an odd integer,
- $|p-q| > 2^{nlen/2 - 100}$ ,
- $p \geq 2^{nlen/2 - 1/2}$ ,
- $q \geq 2^{nlen/2 - 1/2}$ ,
- $2^{(nlen/2)} < d < \text{LCM}(p-1, q-1)$ ,
- $e \cdot d = 1 \bmod \text{LCM}(p-1, q-1)$ .

### Key Generation for Elliptic Curve Cryptography (ECC)

[FIPS 186-4](#) ECC Key Generation Test For each supported [NIST](#) curve, i.e., P-256, P-384 and P-521, the evaluator shall require the implementation under test (IUT) to generate 10 private/public key pairs. The private key shall be generated using an approved random bit generator ([RBG](#)). To determine correctness, the evaluator shall submit the generated key pairs to the public key verification (PKV) function of a known good implementation.

[FIPS 186-4](#) Public Key Verification (PKV) Test For each supported [NIST](#) curve, i.e., P-256, P-384 and P-521, the evaluator shall generate 10 private/public key pairs using the key generation function of a known good implementation and modify five of the public key values so that they are incorrect, leaving five values unchanged (i.e., correct). The evaluator shall obtain in response a set of 10 PASS/FAIL values.

### Key Generation for Finite-Field Cryptography (FFC)

The evaluator shall verify the implementation of the Parameters Generation and the Key Generation for FFC by the [TOE](#) using the Parameter Generation and Key Generation test. This test verifies the ability of the [TSF](#) to correctly produce values for the field prime  $p$ , the cryptographic prime  $q$  (dividing  $p-1$ ), the cryptographic group generator  $g$ , and the calculation of the private key  $x$  and public key  $y$ . The Parameter generation specifies 2 ways (or methods) to generate the cryptographic prime  $q$  and the field prime  $p$ :

Cryptographic and Field Primes:

- Primes  $q$  and  $p$  shall both be provable primes
- Primes  $q$  and field prime  $p$  shall both be probable primes

and two ways to generate the cryptographic group generator  $g$ :  
Cryptographic Group Generator:

- Generator  $g$  constructed through a verifiable process
- Generator  $g$  constructed through an unverifiable process.

The Key generation specifies 2 ways to generate the private key  $x$ : Private Key:

- $\text{len}(q)$  bit output of [RBG](#) where  $1 \leq x \leq q-1$
- $\text{len}(q) + 64$  bit output of [RBG](#), followed by a mod  $q-1$  operation where  $1 \leq x \leq q-1$ .

The security strength of the [RBG](#) must be at least that of the security offered by the FFC parameter set. To test the cryptographic and field prime generation method for the provable primes method and/or the group generator  $g$  for a verifiable process, the evaluator must seed the [TSF](#) parameter generation routine with sufficient data to deterministically generate the parameter set. For each key length supported, the evaluator shall have the [TSF](#) generate 25 parameter sets and key pairs. The evaluator shall verify the correctness of the [TSF](#)'s implementation by comparing values generated by the [TSF](#) with those generated from a known good implementation. Verification must also confirm

- $g \neq 0, 1$
- $q$  divides  $p-1$
- $g^q \bmod p = 1$
- $g^x \bmod p = y$

for each FFC parameter set and key pair.

### Diffie-Hellman Group 14 and FFC Schemes using “safe-prime” groups

Testing for FFC Schemes using Diffie-Hellman group 14 and/or safe-prime groups is done as part of testing in CKM.2.1.

### FCS\_CKM.1/3 Password Conditioning

**This is a selection-based component. Its inclusion depends upon selection from [FCS\\_STO\\_EXT.1.1](#).**

#### [FCS\\_CKM.1.1/3](#)

A password/passphrase shall perform [assignment: Password-based Key Derivation Functions] in accordance with a specified cryptographic algorithm as specified in [FCS\\_COP.1/4](#), with [assignment: positive integer of 1,000 or more] iterations, and output cryptographic key sizes [selection: 128, 256] that meet the following [\[NIST SP 800-132\]](#).

#### [FCS\\_CKM.1.2/3](#)

The [TSF](#) shall generate salts using a [RBG](#) that meets FCS\_RGB\_EXT.1 and with entropy corresponding to the security strength selected for PBKDF in [FCS\\_CKM.1.1/3](#)

Application Note: This should be included if selected in [FCS\\_STO\\_EXT.1](#)

Conditioning can be performed using one of the identified hash functions or the process described in [NIST SP 800-132](#); the method used is selected by the [ST](#) Author. [SP 800-132](#) requires the use of a pseudo-random function (PRF) consisting of [HMAC](#) with an approved hash function. The [ST](#) author selects the hash function used, also includes the appropriate requirements for [HMAC](#) and the hash function.

Appendix A of [SP 800-132](#) recommends setting the iteration count in order to increase the computation needed to derive a key from a password and, therefore, increase the workload of performing a password recovery attack. A significantly higher value is recommended to ensure optimal security. This value is expected to increase to a minimum of 10,000 in a future iteration based on SP800-63.

#### [Evaluation Activity](#)

#### [TSS](#)

Support for PBKDF: The evaluator shall examine the password hierarchy [TSS](#) to ensure that the formation of all password based derived keys is described and that the key sizes match that described by the [ST](#) author. The evaluator shall check that the [TSS](#) describes the method by which the password/passphrase is first encoded and then fed to the [SHA](#) algorithm. The settings for the algorithm (padding, blocking, etc.) shall be described, and the evaluator shall verify that these are supported by the selections in this component as well as the selections concerning the hash function itself. The evaluator shall verify that the [TSS](#) contains a description of how the output of the hash function is used to form the submask that will be input into the function. For the [NIST SP 800-132](#)-based conditioning of the password/passphrase, the required evaluation activities will be performed when doing the evaluation activities for the appropriate requirements ([FCS\\_COP.1.1/4](#)). No explicit testing of the formation of the submask from the input password is required. [FCS\\_CKM.1.1/3](#): The [ST](#) author shall provide a description in the [TSS](#) regarding the salt generation. The evaluator shall confirm that the salt is generated using an [RBG](#) described in [FCS\\_RGB\\_EXT.1](#).

### FCS\_CKM.2 Cryptographic Key Establishment

**This is a selection-based component. Its inclusion depends upon selection from [FTP\\_DIT\\_EXT.1.1](#).**

#### [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:

[selection:

- [RSA-based key establishment schemes] that meets the following: [\[NIST Special Publication 800-56B, “Recommendation for Pair-Wise Key Establishment Schemes Using Integer Factorization Cryptography”\]](#),
- [RSA-based key establishment schemes] that meet the following: [RSAES-PKCS1-v1\\_5](#) as specified in Section 7.2 of [RFC 8017, “Public-Key Cryptography Standards \(PKCS\) #1: RSA Cryptography Specifications Version 2.1”](#),
- [Elliptic curve-based key establishment schemes] that meets the following: [\[NIST Special Publication 800-56A, “Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography”\]](#),
- [Finite field-based key establishment schemes] that meets the following: [\[NIST Special Publication 800-56A, “Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography”\]](#),

- [Key establishment scheme using Diffie-Hellman group 14] that meets the following: [RFC 3526, Section 3](#) ,
- [FFC Schemes using “safe-prime” groups] that meet the following: ‘[NIST Special Publication 800-56A Revision 3](#), “Recommendation for Pair-Wise Key Establishment Schemes Using Discrete Logarithm Cryptography” and [selection: [RFC 3526](#), [RFC 7919](#)].

].

Application Note: The [ST](#) author shall select all key establishment schemes used for the selected cryptographic protocols. [TLS](#) requires cipher suites that use RSA-based key establishment schemes.

The RSA-based key establishment schemes are described in Section 9 of [NIST SP 800-56B](#); however, Section 9 relies on implementation of other sections in [SP 800-56B](#). If the [TOE](#) acts as a receiver in the RSA key establishment scheme, the [TOE](#) does not need to implement RSA key generation.

The elliptic curves used for the key establishment scheme shall correlate with the curves specified in [FCS\\_CKM.1.1/1](#).

The domain parameters used for the finite field-based key establishment scheme are specified by the key generation according to [FCS\\_CKM.1.1/1](#).

#### [Evaluation Activity](#)

#### [TSS](#)

The evaluator shall ensure that the supported key establishment schemes correspond to the key generation schemes identified in [FCS\\_CKM.1.1](#). If the [ST](#) specifies more than one scheme, the evaluator shall examine the [TSS](#) to verify that it identifies the usage for each scheme.

#### Guidance

The evaluator shall verify that the AGD guidance instructs the administrator how to configure the [TOE](#) to use the selected key establishment scheme(s).

#### Tests

Evaluation Activity Note: The following tests require the developer to provide access to a test platform that provides the evaluator with tools that are typically not found on factory products.

### Key Establishment Schemes

The evaluator shall verify the implementation of the key establishment schemes supported by the [TOE](#) using the applicable tests below.

#### SP800-56A Key Establishment Schemes

The evaluator shall verify a [TOE](#)'s implementation of SP800-56A key agreement schemes using the following Function and Validity tests. These validation tests for each key agreement scheme verify that a [TOE](#) has implemented the components of the key agreement scheme according to the specifications in the Recommendation. These components include the calculation of the DLC primitives (the shared secret value Z) and the calculation of the derived keying material (DKM) via the Key Derivation Function (KDF). If key confirmation is supported, the evaluator shall also verify that the components of key confirmation have been implemented correctly, using the test procedures described below. This includes the parsing of the DKM, the generation of MACdata and the calculation of MACtag.

#### Function Test

The Function test verifies the ability of the [TOE](#) to implement the key agreement schemes correctly. To conduct this test the evaluator shall generate or obtain test vectors from a known good implementation of the [TOE](#) supported schemes. For each supported key agreement scheme-key agreement role combination, KDF type, and, if supported, key confirmation role- key confirmation type combination, the tester shall generate 10 sets of test vectors. The data set consists of one set of domain parameter values (FFC) or the [NIST](#) approved curve (ECC) per 10 sets of public keys. These keys are static, ephemeral or both depending on the scheme being tested.

The evaluator shall obtain the DKM, the corresponding [TOE](#)'s public keys (static and/or ephemeral), the MAC tag(s), and any inputs used in the KDF, such as the Other Information (OtherInfo) and [TOE](#) id fields.

If the [TOE](#) does not use a KDF defined in [SP 800-56A](#), the evaluator shall obtain only the public keys and the hashed value of the shared secret.

The evaluator shall verify the correctness of the [TSF](#)'s implementation of a given scheme by using a known good implementation to calculate the shared secret value, derive the keying material DKM, and compare hashes or MAC tags generated from these values.

If key confirmation is supported, the [TSF](#) shall perform the above for each implemented approved MAC algorithm.

#### Validity Test

The Validity test verifies the ability of the [TOE](#) to recognize another party's valid and invalid key agreement results with or without key confirmation. To conduct this test, the evaluator shall obtain a list of the supporting cryptographic functions included in the SP800-56A key agreement implementation to determine which errors the [TOE](#) should be able to recognize. The evaluator generates a set of 24 (FFC) or 30 (ECC) test vectors consisting of data sets including domain parameter values or [NIST](#) approved curves, the evaluator's public keys, the [TOE](#)'s public/private key pairs, MACTag, and any inputs used in the KDF, such as the OtherInfo and [TOE](#) id fields.

The evaluator shall inject an error in some of the test vectors to test that the [TOE](#) recognizes invalid key agreement results caused by the following fields being incorrect: the shared secret value Z, the DKM, the OtherInfo field, the data to be MACed, or the generated MACtag. If the [TOE](#) contains the full or partial (only ECC) public key validation, the evaluator will also individually inject errors in both parties' static public keys, both parties' ephemeral public keys and the [TOE](#)'s static private key to assure the [TOE](#) detects errors in the public key validation function and/or the partial key validation function (in ECC only). At least two of the test vectors shall remain unmodified and therefore should result in valid key agreement results (they should pass).



The [TOE](#) shall use these modified test vectors to emulate the key agreement scheme using the corresponding parameters. The evaluator shall compare the [TOE](#)'s results with the results using a known good implementation verifying that the [TOE](#) detects these errors.

## **SP800-56B Key Establishment Schemes**

The evaluator shall verify that the [TSS](#) describes whether the [TOE](#) acts as a sender, a recipient, or both for RSA-based key establishment schemes.

If the [TOE](#) acts as a sender, the following evaluation activity shall be performed to ensure the proper operation of every [TOE](#) supported combination of RSA-based key establishment scheme:

To conduct this test the evaluator shall generate or obtain test vectors from a known good implementation of the [TOE](#) supported schemes. For each combination of supported key establishment scheme and its options (with or without key confirmation if supported, for each supported key confirmation MAC function if key confirmation is supported, and for each supported mask generation function if KTS-OAEP is supported), the tester shall generate 10 sets of test vectors. Each test vector shall include the RSA public key, the plaintext keying material, any additional input parameters if applicable, the MacKey and MacTag if key confirmation is incorporated, and the outputted ciphertext. For each test vector, the evaluator shall perform a key establishment encryption operation on the [TOE](#) with the same inputs (in cases where key confirmation is incorporated, the test shall use the MacKey from the test vector instead of the randomly generated MacKey used in normal operation) and ensure that the outputted ciphertext is equivalent to the ciphertext in the test vector.

If the [TOE](#) acts as a receiver, the following evaluation activities shall be performed to ensure the proper operation of every [TOE](#) supported combination of RSA-based key establishment scheme:

To conduct this test the evaluator shall generate or obtain test vectors from a known good implementation of the [TOE](#) supported schemes. For each combination of supported key establishment scheme and its options (with or without key confirmation if supported, for each supported key confirmation MAC function if key confirmation is supported, and for each supported mask generation function if KTS-OAEP is supported), the tester shall generate 10 sets of test vectors. Each test vector shall include the RSA private key, the plaintext keying material (KeyData), any additional input parameters if applicable, the MacTag in cases where key confirmation is incorporated, and the outputted ciphertext. For each test vector, the evaluator shall perform the key establishment decryption operation on the [TOE](#) and ensure that the outputted plaintext keying material (KeyData) is equivalent to the plaintext keying material in the test vector. In cases where key confirmation is incorporated, the evaluator shall perform the key confirmation steps and ensure that the outputted MacTag is equivalent to the MacTag in the test vector.

The evaluator shall ensure that the [TSS](#) describes how the [TOE](#) handles decryption errors. In accordance with [NIST](#) Special Publication 800-56B, the [TOE](#) must not reveal the particular error that occurred, either through the contents of any outputted or logged error message or through timing variations. If KTS-OAEP is supported, the evaluator shall create separate contrived ciphertext values that trigger each of the three decryption error checks described in [NIST](#) Special Publication 800-56B section 7.2.2.3, ensure that each decryption attempt results in an error, and ensure that any outputted or logged error message is identical for each. If KTS-KEM-KWS is supported, the evaluator shall create separate contrived ciphertext values that trigger each of the three decryption error checks described in [NIST](#) Special Publication 800-56B section 7.2.3.3, ensure that each decryption attempt results in an error, and ensure that any outputted or logged error message is identical for each.

## **RSA-based key establishment**

The evaluator shall verify the correctness of the [TSF](#)'s implementation of RSAES-PKCS1-v1\_5 by using a known good implementation for each protocol selected in [FTP\\_DIT\\_EXT.1](#) that uses RSAES-PKCS1-v1\_5.

## **Diffie-Hellman Group 14**

The evaluator shall 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](#) that uses Diffie-Hellman group 14.

## **FFC Schemes using "safe-prime" groups**

The evaluator shall verify the correctness of the [TSF](#)'s implementation of safe-prime groups by using a known good implementation for each protocol selected in [FTP\\_DIT\\_EXT.1](#) that uses safe-prime groups. This test must be performed for each safe-prime group that each protocol uses.

## **FCS\_COP.1/1 Cryptographic Operation - Encryption/Decryption**

**This is a selection-based component. Its inclusion depends upon selection from [FTP\\_DIT\\_EXT.1.1](#), [FCS\\_STO\\_EXT.1.1](#).**

**[FCS\\_COP.1.1/1](#)**

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

- [AES-CBC](#) (as defined in [NIST SP](#) 800-38A) mode,
- [AES-GCM](#) (as defined in [NIST SP](#) 800-38D) mode,
- [AES-XTS](#) (as defined in [NIST SP](#) 800-38E) mode,
- [AES-CCM](#) (as defined in [NIST SP](#) 800-38C) mode

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



Application Note: This is dependent on implementing cryptographic functionality, as in [FTP\\_DIT\\_EXT.1](#).

For the first selection, the [ST](#) author should choose the mode or modes in which [AES](#) operates. For the second selection, the [ST](#) author should choose the key sizes that are supported by this functionality. 128-bit key size is required in order to comply with certain [TLS](#) implementations.

#### [Evaluation Activity](#)

##### Guidance

The evaluator checks the AGD documents to determine that any configuration that is required to be done to configure the functionality for the required modes and key sizes is present.

##### Tests

The evaluator shall perform all of the following tests for each algorithm implemented by the [TSE](#) and used to satisfy the requirements of this [PP](#):

#### [AES-CBC Known Answer Tests](#)

There are four Known Answer Tests (KATs), described below. In all KATs, the plaintext, ciphertext, and IV values shall be 128-bit blocks. The results from each test may either be obtained by the evaluator directly or by supplying the inputs to the implementer and receiving the results in response. To determine correctness, the evaluator shall compare the resulting values to those obtained by submitting the same inputs to a known good implementation.

- KAT-1. To test the encrypt functionality of [AES-CBC](#), the evaluator shall supply a set of 10 plaintext values and obtain the ciphertext value that results from [AES-CBC](#) encryption of the given plaintext using a key value of all zeros and an IV of all zeros. Five plaintext values shall be encrypted with a 128-bit all-zeros key, and the other five shall be encrypted with a 256-bit all-zeros key. To test the decrypt functionality of [AES-CBC](#), the evaluator shall perform the same test as for encrypt, using 10 ciphertext values as input and [AES-CBC](#) decryption.
- KAT-2. To test the encrypt functionality of [AES-CBC](#), the evaluator shall supply a set of 10 key values and obtain the ciphertext value that results from [AES-CBC](#) encryption of an all-zeros plaintext using the given key value and an IV of all zeros. Five of the keys shall be 128-bit keys, and the other five shall be 256-bit keys. To test the decrypt functionality of [AES-CBC](#), the evaluator shall perform the same test as for encrypt, using an all-zero ciphertext value as input and [AES-CBC](#) decryption.
- KAT-3. To test the encrypt functionality of [AES-CBC](#), the evaluator shall supply the two sets of key values described below and obtain the ciphertext value that results from [AES](#) encryption of an all-zeros plaintext using the given key value and an IV of all zeros. The first set of keys shall have 128 128-bit keys, and the second set shall have 256 256-bit keys. Key  $i$  in each set shall have the leftmost  $i$  bits be ones and the rightmost  $N-i$  bits be zeros, for  $i$  in  $[1, N]$ . To test the decrypt functionality of [AES-CBC](#), the evaluator shall supply the two sets of key and ciphertext value pairs described below and obtain the plaintext value that results from [AES-CBC](#) decryption of the given ciphertext using the given key and an IV of all zeros. The first set of key/ciphertext pairs shall have 128 128-bit key/ciphertext pairs, and the second set of key/ciphertext pairs shall have 256 256-bit key/ciphertext pairs. Key  $i$  in each set shall have the leftmost  $i$  bits be ones and the rightmost  $N-i$  bits be zeros, for  $i$  in  $[1, N]$ . The ciphertext value in each pair shall be the value that results in an all-zeros plaintext when decrypted with its corresponding key.
- KAT-4. To test the encrypt functionality of [AES-CBC](#), the evaluator shall supply the set of 128 plaintext values described below and obtain the two ciphertext values that result from [AES-CBC](#) encryption of the given plaintext using a 128-bit key value of all zeros with an IV of all zeros and using a 256-bit key value of all zeros with an IV of all zeros, respectively. Plaintext value  $i$  in each set shall have the leftmost  $i$  bits be ones and the rightmost  $128-i$  bits be zeros, for  $i$  in  $[1, 128]$ .

To test the decrypt functionality of [AES-CBC](#), the evaluator shall perform the same test as for encrypt, using ciphertext values of the same form as the plaintext in the encrypt test as input and [AES-CBC](#) decryption.

#### [AES-CBC Multi-Block Message Test](#)

The evaluator shall test the encrypt functionality by encrypting an  $i$ -block message where  $1 < i \leq 10$ . The evaluator shall choose a key, an IV and plaintext message of length  $i$  blocks and encrypt the message, using the mode to be tested, with the chosen key and IV. The ciphertext shall be compared to the result of encrypting the same plaintext message with the same key and IV using a known good implementation. The evaluator shall also test the decrypt functionality for each mode by decrypting an  $i$ -block message where  $1 < i \leq 10$ . The evaluator shall choose a key, an IV and a ciphertext message of length  $i$  blocks and decrypt the message, using the mode to be tested, with the chosen key and IV. The plaintext shall be compared to the result of decrypting the same ciphertext message with the same key and IV using a known good implementation. [AES-CBC](#) Monte Carlo Tests The evaluator shall test the encrypt functionality using a set of 200 plaintext, IV, and key 3-tuples. 100 of these shall use 128 bit keys, and 100 shall use 256 bit keys. The plaintext and IV values shall be 128-bit blocks. For each 3-tuple, 1000 iterations shall be run as follows:

```
# Input: PT, IV, Key
for i = 1 to 1000:
  if i == 1:
    CT[1] = AES-CBC-Encrypt(Key, IV, PT)
    PT = IV
  else:
    CT[i] = AES-CBC-Encrypt(Key, PT)
    PT = CT[i-1]
```

The ciphertext computed in the 1000th iteration (i.e., CT[1000]) is the result for that trial. This result shall be compared to the result of running 1000 iterations with the same values using a known good implementation.

The evaluator shall test the decrypt functionality using the same test as for encrypt, exchanging CT and PT and replacing [AES-CBC-Encrypt](#) with [AES-CBC-Decrypt](#).

## **AES-GCM Monte Carlo Tests**

The evaluator shall test the authenticated encrypt functionality of [AES-GCM](#) for each combination of the following input parameter lengths:

- 128 bit and 256 bit keys
- Two plaintext lengths. One of the plaintext lengths shall be a non-zero integer multiple of 128 bits, if supported. The other plaintext length shall not be an integer multiple of 128 bits, if supported.
- Three AAD lengths. One AAD length shall be 0, if supported. One AAD length shall be a non-zero integer multiple of 128 bits, if supported. One AAD length shall not be an integer multiple of 128 bits, if supported.
- Two IV lengths. If 96 bit IV is supported, 96 bits shall be one of the two IV lengths tested.

The evaluator shall test the encrypt functionality using a set of 10 key, plaintext, AAD, and IV tuples for each combination of parameter lengths above and obtain the ciphertext value and tag that results from [AES-GCM](#) authenticated encrypt. Each supported tag length shall be tested at least once per set of 10. The IV value may be supplied by the evaluator or the implementation being tested, as long as it is known.

The evaluator shall test the decrypt functionality using a set of 10 key, ciphertext, tag, AAD, and IV 5-tuples for each combination of parameter lengths above and obtain a Pass/Fail result on authentication and the decrypted plaintext if Pass. The set shall include five tuples that Pass and five that Fail.

The results from each test may either be obtained by the evaluator directly or by supplying the inputs to the implementer and receiving the results in response. To determine correctness, the evaluator shall compare the resulting values to those obtained by submitting the same inputs to a known good implementation.

## **AES-XTS Tests**

The evaluator shall test the encrypt functionality of XTS-AES for each combination of the following input parameter lengths: 256 bit (for [AES-128](#)) and 512 bit (for [AES-256](#)) keys

Three data unit (i.e., plaintext) lengths. One of the data unit lengths shall be a non-zero integer multiple of 128 bits, if supported. One of the data unit lengths shall be an integer multiple of 128 bits, if supported. The third data unit length shall be either the longest supported data unit length or 216 bits, whichever is smaller.

Using a set of 100 (key, plaintext and 128-bit random tweak value) 3-tuples and obtain the ciphertext that results from XTS-AES encrypt.

The evaluator may supply a data unit sequence number instead of the tweak value if the implementation supports it. The data unit sequence number is a base-10 number ranging between 0 and 255 that implementations convert to a tweak value internally.

The evaluator shall test the decrypt functionality of XTS-AES using the same test as for encrypt, replacing plaintext values with ciphertext values and XTS-AES encrypt with XTS-AES decrypt.

## **AES-CCM Tests**

Is not recommended that the evaluators use values obtained from static sources such as <http://csrc.nist.gov/groups/STM/cavp/documents/mac/ccmtestvectors.zip> or use values not generated expressly to exercise the [AES-CCM](#) implementation.

The evaluator shall test the generation-encryption and decryption-verification functionality of [AES-CCM](#) for the following input parameter and tag lengths:

- Keys: All supported and selected key sizes (e.g., 128, 256 bits).
- Associated Data: Two or three values for associated data length: The minimum ( $\leq 0$  bytes) and maximum ( $\geq 32$  bytes) supported associated data lengths, and  $2^{16}$  (65536) bytes, if supported.
- Payload: Two values for payload length: The minimum ( $\leq 0$  bytes) and maximum ( $\geq 32$  bytes) supported payload lengths.
- Nonces: All supported tag lengths (7, 8, 9, 10, 11, 12, 13) in bytes.
- Tag: All supported tag lengths (4, 6, 8, 10, 12, 14, 16) in bytes.

The testing for CCM consists of five tests. To determine correctness in each of the below tests, the evaluator shall compare the ciphertext with the result of encryption of the same inputs with a known good implementation.

**Variable Associated Data Test** For each supported key size and associated data length, and any supported payload length, nonce length, and tag length, the evaluator shall supply one key value, one nonce value, and 10 pairs of associated data and payload values, and obtain the resulting ciphertext.

**Variable Payload Test** For each supported key size and payload length, and any supported associated data length, nonce length, and tag length, the evaluator shall supply one key value, one nonce value, and 10 pairs of associated data and payload values, and obtain the resulting ciphertext.

**Variable Nonce Test** For each supported keysize and nonce length, and any supported associated data length, payload length, and tag length, the evaluator shall supply one key key value, one nonce value, and 10 pairs of associated data and payload values, and obtain the resulting ciphertext.

**Variable Tag Test** For each supported key size and tag length, and any supported associated data length, payload length, and tag length, the evaluator shall supply one key value, one nonce value, and 10 pairs of associated data and payload

values, and obtain the resulting ciphertext.

Decryption-Verification Process Test To test the decryption-verification functionality of [AES-CCM](#), for each combination of supported associated data length, payload length, nonce length, and tag length, the evaluator shall supply a key value and 15 sets of input plus ciphertext, and obtain the decrypted payload. Ten of the 15 input sets supplied should fail verification and five should pass.

## FCS\_COP.1/2 Cryptographic Operation - Hashing

*This is a selection-based component. Its inclusion depends upon selection from [FTP\\_DIT\\_EXT.1.1](#).*

### [FCS\\_COP.1.1/2](#)

The **application** shall perform *cryptographic hashing* services in accordance with a specified cryptographic algorithm [selection:

- [SHA-1](#),
- [SHA-256](#),
- [SHA-384](#),
- [SHA-512](#),
- no other

] and message digest sizes [selection:

- 160,
- 256,
- 384,
- 512,
- no other

] bits that meet the following: [FIPS](#) Pub 180-4.

Application Note: This is dependent on implementing cryptographic functionality, as in [FTP\\_DIT\\_EXT.1](#).

Per [NIST SP](#) 800-131A, [SHA-1](#) for generating digital signatures is no longer allowed, and [SHA-1](#) for verification of digital signatures is strongly discouraged as there may be risk in accepting these signatures.

[SHA-1](#) is currently included in order to comply with the [TLS](#). If the [TLS](#) package is included in the [ST](#), the hashing algorithms selection for FCS\_COP.1(2) must match the hashing algorithms used in the mandatory and selected cipher suites of the [TLS](#) package. Vendors are strongly encouraged to implement updated protocols that support the [SHA-2](#) family; until updated protocols are supported, this [PP](#) allows support for [SHA-1](#) implementations in compliance with [SP](#) 800-131A.

The intent of this requirement is to specify the hashing function. The hash selection must support the message digest size selection. The hash selection should be consistent with the overall strength of the algorithm used (for example, [SHA](#) 256 for 128-bit keys).

### [Evaluation Activity](#)

#### [TSS](#)

The evaluator shall check that the association of the hash function with other application cryptographic functions (for example, the digital signature verification function) is documented in the [TSS](#).

#### Tests

The [TSF](#) hashing functions can be implemented in one of two modes. The first mode is the byte-oriented mode. In this mode the [TSF](#) hashes only messages that are an integral number of bytes in length; i.e., the length (in bits) of the message to be hashed is divisible by 8. The second mode is the bit-oriented mode. In this mode the [TSF](#) hashes messages of arbitrary length. As there are different tests for each mode, an indication is given in the following sections for the bit-oriented vs. the byte-oriented testmasks. The evaluator shall perform all of the following tests for each hash algorithm implemented by the [TSF](#) and used to satisfy the requirements of this [PP](#).

The following tests require the developer to provide access to a test application that provides the evaluator with tools that are typically not found in the production application.

- **Test 1: Short Messages Test - Bit oriented Mode** The evaluators devise an input set consisting of  $m+1$  messages, where  $m$  is the block length of the hash algorithm. The length of the messages range sequentially from 0 to  $m$  bits. The message text shall be pseudorandomly generated. The evaluators compute the message digest for each of the messages and ensure that the correct result is produced when the messages are provided to the [TSF](#).
- **Test 2: Short Messages Test - Byte oriented Mode** The evaluators devise an input set consisting of  $m/8+1$  messages, where  $m$  is the block length of the hash algorithm. The length of the messages range sequentially from 0 to  $m/8$  bytes, with each message being an integral number of bytes. The message text shall be pseudorandomly generated. The evaluators compute the message digest for each of the messages and ensure that the correct result is produced when the messages are provided to the [TSF](#).
- **Test 3: Selected Long Messages Test - Bit oriented Mode** The evaluators devise an input set consisting of  $m$  messages, where  $m$  is the block length of the hash algorithm. The length of the  $i$ th message is  $512 + 99*i$ , where  $1 \leq i \leq m$ . The message text shall be pseudorandomly generated. The evaluators compute the message digest for each of the messages and ensure that the correct result is produced when the messages are provided to the [TSF](#).
- **Test 4: Selected Long Messages Test - Byte oriented Mode** The evaluators devise an input set consisting of  $m/8$  messages, where  $m$  is the block length of the hash algorithm. The length of the  $i$ th message is  $512 + 8*99*i$ , where  $1 \leq i \leq m/8$ . The message text shall be pseudorandomly generated. The evaluators compute the message digest for each of the messages and ensure that the correct result is produced when the messages are provided to the [TSF](#).
- **Test 5: Pseudorandomly Generated Messages Test** This test is for byte-oriented implementations only. The evaluators randomly generate a seed that is  $n$  bits long, where  $n$  is the length of the message digest produced by the hash

function to be tested. The evaluators then formulate a set of 100 messages and associated digests by following the algorithm provided in Figure 1 of [SHAVS]. The evaluators then ensure that the correct result is produced when the messages are provided to the [TSF](#).

### FCS\_COP.1/3 Cryptographic Operation - Signing

**This is a selection-based component. Its inclusion depends upon selection from [FTP\\_DIT\\_EXT.1.1](#).**

#### [FCS\\_COP.1.1/3](#)

The **application** shall perform cryptographic signature services (generation and verification) in accordance with a specified cryptographic algorithm [**selection**:

- **RSA schemes** using cryptographic key sizes of 2048-bit or greater that meet the following: [FIPS](#) PUB 186-4, "Digital Signature Standard ([DSS](#))", Section 4,
- **ECDSA 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](#))", Section 5

].

Application Note: This is dependent on implementing cryptographic functionality, as in [FTP\\_DIT\\_EXT.1](#).

The [ST](#) Author should choose the algorithm implemented to perform digital signatures; if more than one algorithm is available, this requirement should be iterated to specify the functionality. For the algorithm chosen, the [ST](#) author should make the appropriate assignments/selections to specify the parameters that are implemented for that algorithm.

#### [Evaluation Activity](#)

The evaluator shall perform the following activities based on the selections in the [ST](#).

#### Tests

The following tests require the developer to provide access to a test application that provides the evaluator with tools that are typically not found in the production application.

#### [ECDSA](#) Algorithm Tests

- **Test 1: [ECDSA](#) [FIPS](#) 186-4 Signature Generation Test.** For each supported [NIST](#) curve (i.e., P-256, P-384 and P-521) and [SHA](#) function pair, the evaluator shall generate 10 1024-bit long messages and obtain for each message a public key and the resulting signature values R and S. To determine correctness, the evaluator shall use the signature verification function of a known good implementation.
- **Test 2: [ECDSA](#) [FIPS](#) 186-4 Signature Verification Test.** For each supported [NIST](#) curve (i.e., P-256, P-384 and P-521) and [SHA](#) function pair, the evaluator shall generate a set of 10 1024-bit message, public key and signature tuples and modify one of the values (message, public key or signature) in five of the 10 tuples. The evaluator shall obtain in response a set of 10 PASS/FAIL values.

#### RSA Signature Algorithm Tests

- **Test 1: Signature Generation Test.** The evaluator shall verify the implementation of RSA Signature Generation by the [TOE](#) using the Signature Generation Test. To conduct this test the evaluator must generate or obtain 10 messages from a trusted reference implementation for each modulus size/[SHA](#) combination supported by the [TSF](#). The evaluator shall have the [TOE](#) use their private key and modulus value to sign these messages. The evaluator shall verify the correctness of the [TSF](#)'s signature using a known good implementation and the associated public keys to verify the signatures.
- **Test 2: Signature Verification Test.** The evaluator shall perform the Signature Verification test to verify the ability of the [TOE](#) to recognize another party's valid and invalid signatures. The evaluator shall inject errors into the test vectors produced during the Signature Verification Test by introducing errors in some of the public keys, e, messages, [IR](#) format, and/or signatures. The [TOE](#) attempts to verify the signatures and returns success or failure.

### FCS\_COP.1/4 Cryptographic Operation - Keyed-Hash Message Authentication

**This is a selection-based component. Its inclusion depends upon selection from [FTP\\_DIT\\_EXT.1.1](#).**

#### [FCS\\_COP.1.1/4](#)

The **application** shall perform keyed-hash message authentication in accordance with a specified cryptographic algorithm

- [HMAC](#)-SHA-256

and [**selection**:

- [SHA](#)-1,
- [SHA](#)-384,
- [SHA](#)-512,
- no other algorithms

] with key sizes [**assignment**: key size (in bits) used in [HMAC](#)] and message digest sizes 256 and [**selection**: 160, 384, 512, no other size] bits that meet the following: [FIPS](#) Pub 198-1 The Keyed-Hash Message Authentication Code and [FIPS](#) Pub 180-4 Secure Hash Standard.

Application Note: This is dependent on implementing cryptographic functionality, as in [FTP\\_DIT\\_EXT.1](#).

The intent of this requirement is to specify the keyed-hash message authentication function used for key establishment purposes for the various cryptographic protocols used by the application (e.g., trusted channel). The hash selection must support the message digest size selection. The hash selection should be consistent with the overall strength of the algorithm used for [FCS\\_COP.1/1](#).



### Evaluation Activity

The evaluator shall perform the following activities based on the selections in the [ST](#).

#### Tests

For each of the supported parameter sets, the evaluator shall compose 15 sets of test data. Each set shall consist of a key and message data. The evaluator shall have the [TSF](#) generate [HMAC](#) tags for these sets of test data. The resulting MAC tags shall be compared to the result of generating [HMAC](#) tags with the same key and IV using a known-good implementation.

## FCS\_HTTPS\_EXT.1 HTTPS Protocol

**This is a selection-based component. Its inclusion depends upon selection from [FTP\\_DIT\\_EXT.1.1](#).**

### FCS\_HTTPS\_EXT.1.1

The application shall implement the [HTTPS](#) protocol that complies with [RFC](#) 2818.

#### Evaluation Activity

##### Tests

The evaluator shall attempt to establish an [HTTPS](#) connection with a webserver, observe the traffic with a packet analyzer, and verify that the connection succeeds and that the traffic is identified as [TLS](#) or [HTTPS](#).

### FCS\_HTTPS\_EXT.1.2

The application shall implement [HTTPS](#) using [TLS](#) as defined in the [TLS](#) package.

#### Evaluation Activity

##### Tests

Other tests are performed in conjunction with the [TLS](#) package.

### FCS\_HTTPS\_EXT.1.3

The application shall [**selection**: not establish the application-initiated connection , notify the user and not establish the user-initiated connection , notify the user and request authorization to establish the user-initiated connection ] if the peer certificate is deemed invalid.

Application Note: Validity is determined by the certificate path, the expiration date, and the revocation status in accordance with [RFC](#) 5280.

#### Evaluation Activity

##### Tests

Certificate validity shall be tested in accordance with testing performed for [FIA\\_X509\\_EXT.1](#), and the evaluator shall perform the following test:

- **Test 1:** The evaluator shall demonstrate that using a certificate without a valid certification path results in the selected action in the [SFR](#). If "notify the user" is selected in the [SFR](#), then the evaluator shall also determine that the user is notified of the certificate validation failure. Using the administrative guidance, the evaluator shall then load a certificate or certificates to the Trust Anchor Database needed to validate the certificate to be used in the function, and demonstrate that the function succeeds. The evaluator then shall delete one of the certificates, and show that again, using a certificate without a valid certification path results in the selected action in the [SFR](#), and if "notify the user" was selected in the [SFR](#), the user is notified of the validation failure.

## B.2 Identification and Authentication (FIA)

### FIA\_X509\_EXT.1 X.509 Certificate Validation

**This is a selection-based component. Its inclusion depends upon selection from [FTP\\_DIT\\_EXT.1.1](#).**

### FIA\_X509\_EXT.1.1

The application shall [**selection**: invoked platform-provided functionality , implement functionality ] to validate certificates in accordance with the following rules:

- [RFC](#) 5280 certificate validation and certificate path validation.
- The certificate path must terminate with a trusted CA certificate.
- The application shall validate a certificate path by ensuring the presence of the basicConstraints extension and that the CA flag is set to TRUE for all CA certificates, and that any path constraints are met.
- The application shall validate the revocation status of the certificate using [**selection**: the Online Certificate Status Protocol ([OCSP](#)) as specified in [RFC](#) 6960 , a Certificate Revocation List ([CRL](#)) as specified in [RFC](#) 5280 Section 6.3 , a Certificate Revocation List ([CRL](#)) as specified in [RFC](#) 5759 , an [OCSP TLS](#) Status Request Extension (i.e., [OCSP](#) stapling) as specified in [RFC](#) 6066 , an [OCSP TLS](#) Multi-Certificate Status Request Extension (i.e [OCSP](#) Multi-Stapling) as specified in [RFC](#) 6961 ] .
- The application shall validate the extendedKeyUsage (EKU) field according to the following rules:
  - Certificates used for trusted updates and executable code integrity verification shall have the Code Signing purpose (id-kp 3 with [OID](#) 1.3.6.1.5.5.7.3.3) in the extendedKeyUsage field.
  - Server certificates presented for [TLS](#) shall have the Server Authentication purpose (id-kp 1 with [OID](#) 1.3.6.1.5.5.7.3.1) in the extendedKeyUsage field.
  - Client certificates presented for [TLS](#) shall have the Client Authentication purpose (id-kp 2 with [OID](#) 1.3.6.1.5.5.7.3.2) in the extendedKeyUsage field.
  - [S/MIME](#) certificates presented for email encryption and signature shall have the Email Protection purpose (id-kp 4 with [OID](#) 1.3.6.1.5.5.7.3.4) in the extendedKeyUsage field.
  - [OCSP](#) certificates presented for [OCSP](#) responses shall have the [OCSP](#) Signing purpose (id-kp 9 with [OID](#) 1.3.6.1.5.5.7.3.9) in the extendedKeyUsage field.
  - Server certificates presented for [EST](#) shall have the [CMC](#) Registration Authority (RA) purpose (id-kp-cmcRA with [OID](#) 1.3.6.1.5.5.7.3.28) in the extendedKeyUsage field.



Application Note: [FIA\\_X509\\_EXT.1.1](#) lists the rules for validating certificates. The [ST](#) author shall select whether revocation status is verified using [OCSP](#) or CRLs. [FIA\\_X509\\_EXT.2](#) requires that certificates are used for [HTTPS](#), [TLS](#) and [DTLS](#); this use requires that the extendedKeyUsage rules are verified. If [OCSP](#) is not supported, the EKU provision for checking the [OCSP](#) Signing purpose is met by default.

[OCSP](#) stapling and [OCSP](#) multi-stapling only support [TLS](#) server certificate validation. If other certificate types are validated, either [OCSP](#) or [CRL](#) should be claimed.

Regardless of the selection of *implement functionality* or *invoke platform-provided functionality*, the validation is expected to end in a trusted root CA certificate in a root store managed by the platform.

#### [Evaluation Activity](#)

##### [TSS](#)

The evaluator shall ensure the [TSS](#) describes where the check of validity of the certificates takes place. The evaluator ensures the [TSS](#) also provides a description of the certificate path validation algorithm.

##### Tests

The tests described must be performed in conjunction with the other certificate services evaluation activities, including the functions in [FIA\\_X509\\_EXT.2.1](#). The tests for the extendedKeyUsage rules are performed in conjunction with the uses that require those rules. If the application supports chains of length four or greater, the evaluator shall create a chain of at least four certificates: the node certificate to be tested, two Intermediate CAs, and the self-signed Root CA. If the application supports a maximum trust depth of two, then a chain with no Intermediate CA should instead be created.

- **Test 1:** The evaluator shall demonstrate that validating a certificate without a valid certification path results in the function failing, for each of the following reasons, in turn:
    - by establishing a certificate path in which one of the issuing certificates is not a CA certificate,
    - by omitting the basicConstraints field in one of the issuing certificates,
    - by setting the basicConstraints field in an issuing certificate to have CA=False,
    - by omitting the CA signing bit of the key usage field in an issuing certificate, and
    - by setting the path length field of a valid CA field to a value strictly less than the certificate path.The evaluator shall then establish a valid certificate path consisting of valid CA certificates, and demonstrate that the function succeeds. The evaluator shall then remove trust in one of the CA certificates, and show that the function fails.
  - **Test 2:** The evaluator shall demonstrate that validating an expired certificate results in the function failing.
  - **Test 3:** The evaluator shall test that the [TOE](#) can properly handle revoked certificates-"conditional on whether [CRL](#), [OCSP](#), [OCSP](#) Stapling, or [OCSP](#) Multi-stapling is selected; if multiple methods are selected, then the following tests shall be performed for each method:\ul style="list-style-type: none;">  - The evaluator shall test revocation of the node certificate.
  - The evaluator shall also test revocation of an intermediate CA certificate (i.e. the intermediate CA certificate should be revoked by the root CA), if intermediate CA certificates are supported. If [OCSP](#) stapling per [RFC](#) 6066 is the only supported revocation method, this test is omitted.
  - The evaluator shall ensure that a valid certificate is used, and that the validation function succeeds. The evaluator then attempts the test with a certificate that has been revoked (for each method chosen in the selection) to ensure when the certificate is no longer valid that the validation function fails.
- **Test 4:** If [OCSP](#) option is selected, the evaluator shall configure the [OCSP](#) server or use a man-in-the-middle tool to present a certificate that does not have the [OCSP](#) signing purpose and verify that validation of the [OCSP](#) response fails. If [CRL](#) is selected, the evaluator shall configure the CA to sign a [CRL](#) with a certificate that does not have the cRLsign key usage bit set, and verify that validation of the [CRL](#) fails.
- **Test 5:** The evaluator shall modify any byte in the first eight bytes of the certificate and demonstrate that the certificate fails to validate. (The certificate will fail to parse correctly.)
- **Test 6:** The evaluator shall modify any byte in the last byte of the certificate and demonstrate that the certificate fails to validate. (The signature on the certificate will not validate.)
- **Test 7:** The evaluator shall modify any byte in the public key of the certificate and demonstrate that the certificate fails to validate. (The signature on the certificate will not validate.)
- **Test 8:** (Conditional on support for EC certificates as indicated in [FCS\\_COP.1\(3\)](#)). The evaluator shall establish a valid, trusted certificate chain consisting of an EC leaf certificate, an EC Intermediate CA certificate not designated as a trust anchor, and an EC certificate designated as a trusted anchor, where the elliptic curve parameters are specified as a named curve. The evaluator shall confirm that the [TOE](#) validates the certificate chain.
- **Test 9:** (Conditional on support for EC certificates as indicated in [FCS\\_COP.1\(3\)](#)). The evaluator shall replace the intermediate certificate in the certificate chain for Test 8 with a modified certificate, where the modified intermediate CA has a public key information field where the EC parameters uses an explicit format version of the Elliptic Curve parameters in the public key information field of the intermediate CA certificate from Test 8, and the modified Intermediate CA certificate is signed by the trusted EC root CA, but having no other changes. The evaluator shall confirm the [TOE](#) treats the certificate as invalid.

#### [FIA\\_X509\\_EXT.1.2](#)

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

Application Note: This requirement applies to certificates that are used and processed by the [TSF](#) and restricts the certificates that may be added as trusted CA certificates.

#### [Evaluation Activity](#)

##### Tests

The tests described must be performed in conjunction with the other certificate services evaluation activities, including the functions in [FIA\\_X509\\_EXT.2.1](#). If the application supports chains of length four or greater, the evaluator shall create a chain of at least four certificates: the node certificate to be tested, two Intermediate CAs, and the self-signed Root CA. If the application supports a maximum trust depth of two, then a chain with no Intermediate CA should instead be created.

- **Test 1:** The evaluator shall ensure that the certificate of at least one of the CAs in the chain does not contain the

basicConstraints extension. The evaluator shall confirm that validation of the certificate path fails (i) as part of the validation of the peer certificate belonging to this chain; and/or (ii) when attempting to add the CA certificate without the basicConstraints extension to the [TOE's](#) trust store.

- **Test 2:** The evaluator shall ensure that the certificate of at least one of the CAs in the chain has the CA flag in the basicConstraints extension not set (or set to FALSE). The evaluator shall confirm that validation of the certificate path fails (i) as part of the validation of the peer certificate belonging to this chain; and/or (ii) when attempting to add the CA certificate with the CA flag not set (or set to FALSE) in the basicConstraints extension to the [TOE's](#) trust store.

## FIA\_X509\_EXT.2 X.509 Certificate Authentication

**This is a selection-based component. Its inclusion depends upon selection from [FTP\\_DIT\\_EXT.1.1](#).**

### [FIA\\_X509\\_EXT.2.1](#)

The application shall use X.509v3 certificates as defined by [RFC 5280](#) to support authentication for [selection: [HTTPS](#), [TLS](#), [DTLS](#), [SSH](#), [IPsec](#)].

Application Note: The [ST](#) author's selection shall match the selection in [FTP\\_DIT\\_EXT.1.1](#).

### [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: Often 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). If the [TOE](#) has determined the certificate valid according to all other rules in [FIA\\_X509\\_EXT.1](#), the behavior indicated in the 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](#).

### [Evaluation Activity](#)

#### [TSS](#)

The evaluator shall check the [TSS](#) to ensure that it describes how the [TOE](#) chooses which certificates to use, and any necessary instructions in the administrative guidance for configuring the operating environment so that the [TOE](#) can use the certificates.

The evaluator shall examine the [TSS](#) to confirm that it describes the behavior of the [TOE](#) when a connection cannot be established during the validity check of a certificate used in establishing a trusted channel. The evaluator shall verify that any distinctions between trusted channels are described. 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.

#### Tests

The evaluator shall perform the following test for each trusted channel:

- **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.2.2](#) 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.
- **Test 2:** The evaluator shall demonstrate that an invalid certificate that requires certificate validation checking to be performed in at least some part by communicating with a non-TOE [IT](#) entity cannot be accepted.

## B.3 Protection of the TSF (FPT)

### FPT\_TUD\_EXT.2 Integrity for Installation and Update

**This is a selection-based component. Its inclusion depends upon selection from [FPT\\_TUD\\_EXT.1.5](#).**

#### [FPT\\_TUD\\_EXT.2.1](#)

The application shall be distributed using the format of the platform-supported package manager.

#### [Evaluation Activity](#)

#### Tests

The evaluator shall verify that application updates are distributed in the format supported by the platform. This varies per platform:

**For Android:** The evaluator shall ensure that the application is packaged in the Android application package ([APK](#)) format.

**For Windows:** The evaluator shall ensure that the application is packaged in the standard Windows Installer ([.MSI](#)) format, the Windows Application Software ([.EXE](#)) format signed using the Microsoft Authenticode process, or the Windows Universal Application package ([.APPX](#)) format. See [https://msdn.microsoft.com/en-us/library/ms537364\(v=vs.85\).aspx](https://msdn.microsoft.com/en-us/library/ms537364(v=vs.85).aspx) for details regarding Authenticode signing.

**For iOS:** The evaluator shall ensure that the application is packaged in the [IPA](#) format.

**For Linux:** The evaluator shall ensure that the application is packaged in the format of the package management infrastructure of the chosen distribution. For example, applications running on Red Hat and Red Hat derivatives shall be packaged in RPM format. Applications running on Debian and Debian derivatives shall be packaged in DEB format.

**For Solaris:** The evaluator shall ensure that the application is packaged in the [PKG](#) format.

**For macOS:** The evaluator shall ensure that application is packaged in the [DMG](#) format, the [PKG](#) format, or the [MPKG](#) format.

#### [FPT\\_TUD\\_EXT.2.2](#)

The application shall be packaged such that its removal results in the deletion of all traces of the application, with the

exception of configuration settings, output files, and audit/log events.

Application Note: Applications software bundled with the system/firmware image are not subject to this requirement if the user is unable to remove the application through means provided by the [OS](#).

#### [Evaluation Activity](#)

##### Tests

**For Android:** The evaluator shall consider the requirement met because the platform forces applications to write all data within the application working directory (sandbox).

**For iOS:** The evaluator shall consider the requirement met because the platform forces applications to write all data within the application working directory (sandbox).

**For All Other Platforms:** The evaluator shall record the path of every file on the entire filesystem prior to installation of the application, and then install and run the application. Afterwards, the evaluator shall then uninstall the application, and compare the resulting filesystem to the initial record to verify that no files, other than configuration, output, and audit/log files, have been added to the filesystem.

#### [FPT\\_TUD\\_EXT.2.3](#)

The application installation package shall be digitally signed such that its platform can cryptographically verify them prior to installation

Application Note: The specifics of the verification of installation packages involves requirements on the platform (and not the application), so these are not fully specified here.

#### [Evaluation Activity](#)

##### TSS

The evaluator shall verify that the [TSS](#) identifies how the application installation package is signed by an authorized source.

The definition of an authorized source must be contained in the [TSS](#).

## Appendix C - Entropy Documentation and Assessment

This appendix describes the required supplementary information for the entropy source used by the [TOE](#).

The documentation of the entropy source should be detailed enough that, after reading, the evaluator will thoroughly understand the entropy source and why it can be relied upon to provide sufficient entropy. This documentation should include multiple detailed sections: design description, entropy justification, operating conditions, and health testing. This documentation is not required to be part of the [TSS](#).

### C.1 Design Description

Documentation shall include the design of the entropy source as a whole, including the interaction of all entropy source components. Any information that can be shared regarding the design should also be included for any third-party entropy sources that are included in the product.

The documentation will describe the operation of the entropy source to include, how entropy is produced, and how unprocessed (raw) data can be obtained from within the entropy source for testing purposes. The documentation should walk through the entropy source design indicating where the entropy comes from, where the entropy output is passed next, any post-processing of the raw outputs (hash, [XOR](#), etc.), if/where it is stored, and finally, how it is output from the entropy source. Any conditions placed on the process (e.g., blocking) should also be described in the entropy source design.

Diagrams and examples are encouraged.

This design must also include a description of the content of the security boundary of the entropy source and a description of how the security boundary ensures that an adversary outside the boundary cannot affect the entropy rate.

If implemented, the design description shall include a description of how third-party applications can add entropy to the [RBG](#). A description of any [RBG](#) state saving between power-off and power-on shall be included.

### C.2 Entropy Justification

There should be a technical argument for where the unpredictability in the source comes from and why there is confidence in the entropy source delivering sufficient entropy for the uses made of the [RBG](#) output (by this particular [TOE](#)). This argument will include a description of the expected min-entropy rate (i.e. the minimum entropy (in bits) per bit or byte of source data) and explain that sufficient entropy is going into the [TOE](#) randomizer seeding process. This discussion will be part of a justification for why the entropy source can be relied upon to produce bits with entropy.

The amount of information necessary to justify the expected min-entropy rate depends on the type of entropy source included in the product.

For developer provided entropy sources, in order to justify the min-entropy rate, it is expected that a large number of raw source bits will be collected, statistical tests will be performed, and the min-entropy rate determined from the statistical tests. While no particular statistical tests are required at this time, it is expected that some testing is necessary in order to determine the amount of min-entropy in each output.

For third party provided entropy sources, in which the [TOE](#) vendor has limited access to the design and raw entropy data of the source, the documentation will indicate an estimate of the amount of min-entropy obtained from this third-party source. It is acceptable for the vendor to "assume" an amount of min-entropy, however, this assumption must be clearly stated in the documentation provided. In particular, the min-entropy estimate must be specified and the assumption included in the [ST](#). Regardless of type of entropy source, the justification will also include how the [DRBG](#) is initialized with the entropy stated in the [ST](#), for example by verifying that the min-entropy rate is multiplied by the amount of source data used to seed the [DRBG](#) or that the rate of entropy expected based on the amount of source data is explicitly stated and compared to the statistical rate. If the amount of source data used to seed the [DRBG](#) is not clear or the calculated rate is not explicitly related to the seed, the documentation will not be considered complete.

The entropy justification shall not include any data added from any third-party application or from any state saving between

restarts.

## C.3 Operating Conditions

The entropy rate may be affected by conditions outside the control of the entropy source itself. For example, voltage, frequency, temperature, and elapsed time after power-on are just a few of the factors that may affect the operation of the entropy source. As such, documentation will also include the range of operating conditions under which the entropy source is expected to generate random data. It will clearly describe the measures that have been taken in the system design to ensure the entropy source continues to operate under those conditions. Similarly, documentation shall describe the conditions under which the entropy source is known to malfunction or become inconsistent. Methods used to detect failure or degradation of the source shall be included.

## C.4 Health Testing

More specifically, all entropy source health tests and their rationale will be documented. This will include a description of the health tests, the rate and conditions under which each health test is performed (e.g., at startup, continuously, or on-demand), the expected results for each health test, and rationale indicating why each test is believed to be appropriate for detecting one or more failures in the entropy source.

# Appendix D - Application Software Equivalency Guidelines

## D.1 Introduction

The purpose of equivalence in [PP](#)-based evaluations is to find a balance between evaluation rigor and commercial practicability—to ensure that evaluations meet customer expectations while recognizing that there is little to be gained from requiring that every variation in a product or platform be fully tested. If a product is found to be compliant with a [PP](#) on one platform, then all equivalent products on equivalent platforms are also considered to be compliant with the [PP](#).

A Vendor can make a claim of equivalence if the Vendor believes that a particular instance of their Product implements [PP](#)-specified security functionality in a way equivalent to the implementation of the same functionality on another instance of their Product on which the functionality was tested. The Product instances can differ in version number or feature level (model), or the instances may run on different platforms. Equivalency can be used to reduce the testing required across claimed evaluated configurations. It can also be used during Assurance Maintenance to reduce testing needed to add more evaluated configurations to a certification.

These equivalency guidelines do not replace Assurance Maintenance requirements or [NIAP](#) Policy #5 requirements for CAVP certificates. Nor may equivalency be used to leverage evaluations with expired certifications.

These Equivalency Guidelines represent a shift from complete testing of all product instances to more of a risk-based approach. Rather than require that every combination of product and platform be tested, these guidelines support an approach that recognizes that products are being used in a variety of environments—and often in cloud environments over where the vendor (and sometimes the customer) have little or no control over the underlying hardware. Developers should be responsible for the security functionality of their applications on the platforms they are developed for—whether that is an operating system, a virtual machine, or a software-based execution environment such as a container. But those platforms may themselves run within other environments—virtual machines or operating systems—that completely abstract away the underlying hardware from the application. The developer should not be held accountable for security functionality that is implemented by platform layers that are abstracted away. The implication is that not all security functionality will necessarily be tested for all platform layers down to the hardware for all evaluated configurations—especially for applications developed for software-based execution environments such as containers. For these cases, the balancing of evaluation rigor and commercial practicability tips in favor of practicability. Note that this does not affect the requirement that at least one product instance be fully tested on at least one platform with cryptography mapped to a CAVP certificate.

Equivalency has two aspects:

1. **Product Equivalence:** Products may be considered equivalent if there are no differences between Product Models and Product Versions with respect to [PP](#)-specified security functionality.
2. **Platform Equivalence:** Platforms may be considered equivalent if there are no significant differences in the services they provide to the Product—or in the way the platforms provide those services—with respect to [PP](#)-specified security functionality.

The equivalency determination is made in accordance with these guidelines by the Validator and Scheme using information provided by the Evaluator/Vendor.

## D.2 Approach to Equivalency Analysis

There are two scenarios for performing equivalency analysis. One is when a product has been certified and the vendor



wants to show that a later product should be considered certified due to equivalence with the earlier product. The other is when multiple product variants are going through evaluation together and the vendor would like to reduce the amount of testing that must be done. The basic rules for determining equivalence are the same in both cases. But there is one additional consideration that applies to equivalence with previously certified products. That is, the product with which equivalence is being claimed must have a valid certification in accordance with scheme rules and the Assurance Maintenance process must be followed. If a product's certification has expired, then equivalence cannot be claimed with that product.

When performing equivalency analysis, the Evaluator/Vendor should first use the factors and guidelines for Product Model equivalence to determine the set of Product Models to be evaluated. In general, Product Models that do not differ in [PP](#)-specified security functionality are considered equivalent for purposes of evaluation against the AppPP.

If multiple revision levels of Product Models are to be evaluated—or to determine whether a revision of an evaluated product needs re-evaluation—the Evaluator/Vendor and Validator should use the factors and guidelines for Product Version equivalence to analyze whether Product Versions are equivalent.

Having determined the set of Product Models and Versions to be evaluated, the next step is to determine the set of Platforms that the Products must be tested on.

Each non-equivalent Product for which compliance is claimed must be fully tested on each non-equivalent platform for which compliance is claimed. For non-equivalent Products on equivalent platforms, only the differences that affect [PP](#)-specified security functionality must be tested for each product.

#### **“Differences in [PP](#)-Specified Security Functionality” Defined**

If [PP](#)-specified security functionality is implemented by the [TOE](#), then differences in the actual implementation between versions or product models break equivalence for that feature. Likewise, if the [TOE](#) implements the functionality in one version or model and the functionality is implemented by the platform in another version or model, then equivalence is broken. If the functionality is implemented by the platform in multiple models or versions on equivalent platforms, then the functionality is considered different if the product invokes the platform differently to perform the function.

## **D.3 Specific Guidance for Determining Product Model Equivalence**

Product Model equivalence attempts to determine whether different feature levels of the same product across a product line are equivalent for purposes of [PP](#) testing. For example, if a product has a “basic” edition and an “enterprise” edition, is it necessary to test both models? Or does testing one model provide sufficient assurance that both models are compliant?

Product models are considered equivalent if there are no differences that affect [PP](#)-specified security functionality—as indicated in Table 1.

Factor	Same/Different	Guidance
<a href="#">PP</a> -Specified Functionality	Same	If the differences between Models affect only non-PP-specified functionality, then the Models are equivalent.
	Different	If <a href="#">PP</a> -specified security functionality is affected by the differences between Models, then the Models are not equivalent and must be tested separately. It is necessary only to test the functionality affected by the software differences. If only differences are tested, then the differences must be enumerated, and for each difference the Vendor must provide an explanation of why each difference does or does not affect <a href="#">PP</a> -specified functionality. If the Product Models are separately tested fully, then there is no need to document the differences.

**Table 1. Determining Product Model Equivalence**

## **D.4 Specific Guidance for Determining Product Version Equivalence**

In cases of version equivalence, differences are expressed in terms of changes implemented in revisions of an evaluated Product. In general, versions are equivalent if the changes have no effect on any security-relevant claims about the [TOE](#) or assurance evidence. Non-security-relevant changes to [TOE](#) functionality or the addition of non-security-relevant functionality does not affect equivalence.

Factor	Same/Different	Guidance
Product Models	Different	Versions of different Product Models are not equivalent unless the Models are equivalent as defined in Section 3.
<a href="#">PP</a> -Specified Functionality	Same	If the differences affect only non-PP-specified functionality, then the Versions are equivalent.
	Different	If <a href="#">PP</a> -specified security functionality is affected by the differences, then the Versions are not considered equivalent and must be tested separately. It is necessary only to test the functionality affected by the changes. If only the differences are tested, then for each difference the Vendor must provide an explanation of why the difference does or does not affect <a href="#">PP</a> -specified functionality. If the Product Versions are separately tested fully, then there



**Table 2. Factors for Determining Product Version Equivalence**

## D.5 Specific Guidance for Determining Platform Equivalence

Platform equivalence is used to determine the platforms that equivalent versions of a Product must be tested on. Platform equivalence analysis done for one software application cannot be applied to another software application. Platform equivalence is not general—it is with respect to a particular application.

Product Equivalency analysis must already have been done and Products have been determined to be equivalent.

The platform can be hardware or virtual hardware, an operating system or similar entity, or a software execution environment such as a container. For purposes of determining equivalence for software applications, we address each type of platform separately. In general, platform equivalence is based on differences in the interfaces between the [TOE](#) and Platform that are relevant to the implementation of [PP](#)-specified security functionality.

### D.5.1 Platform Equivalence—Hardware/Virtual Hardware Platforms

If an Application runs directly on hardware without an operating system—or directly on virtualized hardware without an operating system—then platform equivalence is based on processor architecture and instruction sets. In the case of virtualized hardware, it is the virtualized processor and architecture that are presented to the application that matters—not the physical hardware.

Platforms with different processor architectures and instruction sets are not equivalent. This is not likely to be an issue for equivalency analysis for applications since there is likely to be a different version of the application for different hardware environments. Equivalency analysis becomes important when comparing processors with the same architecture. Processors with the same architecture that have instruction sets that are subsets or supersets of each other are not disqualified from being equivalent for purposes of an App evaluation. If the application takes the same code paths when executing [PP](#)-specified security functionality on different processors of the same family, then the processors can be considered equivalent with respect to that application. For example, if an application follows one code path on platforms that support the [AES-NI](#) instruction and another on platforms that do not, then those two platforms are not equivalent with respect to that application functionality. But if the application follows the same code path whether or not the platform supports [AES-NI](#), then the platforms are equivalent with respect to that functionality.

The platforms are equivalent with respect to the application if the platforms are equivalent with respect to all [PP](#)-specified security functionality.

Factor	Same/Different/None	Guidance
Platform Architectures	Different	Platforms that present different processor architectures and instruction sets to the application are not equivalent.
<a href="#">PP</a> -Specified Functionality	Same	For platforms with the same processor architecture, the platforms are equivalent with respect to the application if execution of all <a href="#">PP</a> -specified security functionality follows the same code path on both platforms.

**Table 3. Factors for Determining Hardware/Virtual Hardware Platform Equivalence**

### D.5.2 Platform Equivalence—OS Platforms

For traditional applications that are built for and run on operating systems, platform equivalence is determined by the interfaces between the application and the operating system that are relevant to [PP](#)-specified security functionality. Generally, these are the processor interface, device interfaces, and [OS](#) APIs. The following factors applied in order:

Factor	Same/Different/None	Guidance
Platform Architectures	Different	Platforms that run on different processor architectures and instruction sets are not equivalent.
Platform Vendors	Different	Platforms from different vendors are not equivalent.
Platform Versions	Different	Platforms from the same vendor with different major version numbers are not equivalent.
Platform Interfaces	Different	Platforms from the same vendor and major version are not equivalent if there are differences in device interfaces and <a href="#">OS</a> APIs that are relevant to the way the platform provides <a href="#">PP</a> -specified security functionality to the application.
Platform Interfaces	Same	Platforms from the same vendor and major version are equivalent if there are no differences in device interfaces and <a href="#">OS</a> APIs that are relevant to the way the platform provides <a href="#">PP</a> -specified security functionality to the application, or if the Platform does not provide such functionality to the application.

**Table 4. Factors for Determining [OS](#)/VS Platform Equivalence**

### D.5.3 Software-based Execution Environment Platform Equivalence

If an Application is built for and runs in a non-OS software-based execution environment, such as a Container or Java Runtime, then the below criteria must be used to determine platform equivalence. The key point is that the underlying hardware (virtual or physical) and [OS](#) is not relevant to platform equivalence. This allows applications to be tested and run on software-based execution environments on any hardware—as in cloud deployments.

Factor	Same/Different/None	Guidance
Platform Type/Vendor	Different	Software-based execution environments that are substantially different or come from different vendors are not equivalent. For example, a java virtual machine is not the same as a container. A Docker container is not the same as a CoreOS container.
Platform Versions	Different	Execution environments that are otherwise equivalent are not equivalent if they have different major version numbers.
PP-Specified Security Functionality	Same	All other things being equal, execution environments are equivalent if there is no significant difference in the interfaces through which the environments provide <a href="#">PP</a> -specified security functionality to applications.

**Table 5. Factors for Software-based Execution Environment Platform Equivalence**

## D.6 Level of Specificity for Tested Configurations and Claimed Equivalent Configurations

In order to make equivalency determinations, the vendor and evaluator must agree on the equivalency claims. They must then provide the scheme with sufficient information about the [TOE](#) instances and platforms that were evaluated, and the [TOE](#) instances and platforms that are claimed to be equivalent.

The [ST](#) must describe all configurations evaluated down to processor manufacturer, model number, and microarchitecture version.

The information regarding claimed equivalent configurations depends on the platform that the application was developed for and runs on.

### Bare-Metal Applications

For applications that run without an operating system on bare-metal or virtual bare-metal, the claimed configuration must describe the platform down to the specific processor manufacturer, model number, and microarchitecture version. The Vendor must describe the differences in the [TOE](#) with respect to [PP](#)-specified security functionality and how the [TOE](#) functions differently to leverage platform differences (e.g., instruction set extensions) in the tested configuration versus the claimed equivalent configuration.

### Traditional Applications

For applications that run with an operating system as their immediate platform, the claimed configuration must describe the platform down to the specific operating system version. If the platform is a virtualization system, then the claimed configuration must describe the platform down to the specific virtualization system version. The Vendor must describe the differences in the [TOE](#) with respect to [PP](#)-specified security functionality and how the [TOE](#) functions differently to leverage platform differences in the tested configuration versus the claimed equivalent configuration. Relevant platform differences could include instruction sets, device interfaces, and [OS](#) APIs invoked by the [TOE](#) to implement [PP](#)-specified security functionality.

### Software-Based Execution Environments

For applications that run in a software-based execution environment such as a Java virtual machine or a Container, then the claimed configuration must describe the platform down to the specific version of the software execution environment. The Vendor must describe the differences in the [TOE](#) with respect to [PP](#)-specified security functionality and how the [TOE](#) functions differently to leverage platform differences in the tested configuration versus the claimed equivalent configuration.

## Appendix E - References

### Identifier

### Title

Common Criteria for Information Technology Security Evaluation -

[\[CC\]](#)

- [Part 1: Introduction and General Model](#), CCMB-2017-04-001, Version 3.1, Revision 5, April 2017.
- [Part 2: Security Functional Components](#), CCMB-2017-04-002, Version 3.1, Revision 5, April 2017.
- [Part 3: Security Assurance Components](#), CCMB-2017-04-003, Version 3.1, Revision 5, April 2017.

[CEM] [Common Evaluation Methodology for Information Technology Security - Evaluation Methodology](#), CCMB-2017-04-004, Version 3.1, Revision 5, April 2017.

[OMB] [Reporting Incidents Involving Personally Identifiable Information and Incorporating the Cost for Security in Agency Information Technology Investments](#), OMB M-06-19, July 12, 2006.

## Appendix F - Acronyms

Acronym	Meaning
<a href="#">ADB</a>	Android Debug Bridge
<a href="#">AES</a>	Advanced Encryption Standard
<a href="#">ANSI</a>	American National Standards Institute
<a href="#">API</a>	Application Programming Interface
<a href="#">APK</a>	Android Application Package
<a href="#">APPX</a>	Windows Universal Application Package
<a href="#">ASLR</a>	Address Space Layout Randomization
<a href="#">BIOS</a>	Basic Input/Output System
<a href="#">Base-PP</a>	Base Protection Profile
<a href="#">CC</a>	Common Criteria
<a href="#">CEM</a>	Common Evaluation Methodology
<a href="#">CMC</a>	Certificate Management over <a href="#">CMS</a>
<a href="#">CMS</a>	Cryptographic Message Syntax
<a href="#">CN</a>	Common Names
<a href="#">CRL</a>	Certificate Revocation List
<a href="#">CSA</a>	Computer Security Act
<a href="#">DEP</a>	Data Execution Prevention
<a href="#">DES</a>	Data Encryption Standard
<a href="#">DHE</a>	Diffie-Hellman Ephemeral
<a href="#">DMG</a>	Apple Disk Image
<a href="#">DNS</a>	Domain Name System
<a href="#">DPAPI</a>	Data Protection Application Programming Interface
<a href="#">DRBG</a>	Deterministic Random Bit Generator
<a href="#">DSS</a>	Digital Signature Standard
<a href="#">DT</a>	Date/Time Vector
<a href="#">DTLS</a>	Datagram Transport Layer Security
<a href="#">EAP</a>	Extensible Authentication Protocol
<a href="#">ECDHE</a>	Elliptic Curve Diffie-Hellman Ephemeral
<a href="#">ECDSA</a>	Elliptic Curve Digital Signature Algorithm
<a href="#">ELF</a>	Executable and Linkable Format
<a href="#">EMET</a>	Enhanced Mitigation Experience Toolkit
<a href="#">EST</a>	Enrollment over Secure Transport
<a href="#">FIPS</a>	Federal Information Processing Standards
<a href="#">GPS</a>	Global Positioning System
<a href="#">HMAC</a>	Hash-based Message Authentication Code
<a href="#">HTTP</a>	Hypertext Transfer Protocol
<a href="#">HTTPS</a>	Hypertext Transfer Protocol Secure
<a href="#">IANA</a>	Internet Assigned Number Authority
<a href="#">IEC</a>	International Electrotechnical Commission
<a href="#">IETF</a>	Internet Engineering Task Force
<a href="#">IP</a>	Internet Protocol
<a href="#">IPA</a>	iOS Package archive
<a href="#">IR</a>	Intermediate Integer
<a href="#">ISO</a>	International Organization for Standardization
<a href="#">IT</a>	Information Technology
<a href="#">ITSEF</a>	Information Technology Security Evaluation Facility
<a href="#">JNI</a>	Java Native Interface
<a href="#">LDAP</a>	Lightweight Directory Access Protocol
<a href="#">MIME</a>	Multi-purpose Internet Mail Extensions
<a href="#">MPKG</a>	Meta Package
<a href="#">MSI</a>	Microsoft Installer

<a href="#">NFC</a>	Near Field Communication
<a href="#">NIAP</a>	National Information Assurance Partnership
<a href="#">NIST</a>	National Institute of Standards and Technology
<a href="#">OCSP</a>	Online Certificate Status Protocol
<a href="#">OE</a>	Operational Environment
<a href="#">OID</a>	Object Identifier
<a href="#">OMB</a>	Office of Management and Budget
<a href="#">OS</a>	Operating System
<a href="#">PDF</a>	Portable Document Format
<a href="#">PE</a>	Portable Executable
<a href="#">PID</a>	Process Identifier
<a href="#">PII</a>	Personally Identifiable Information
<a href="#">PKG</a>	Package file
<a href="#">PKI</a>	Public Key Infrastructure
<a href="#">PP</a>	Protection Profile
<a href="#">PP-Configuration</a>	Protection Profile Configuration
<a href="#">PP-Module</a>	Protection Profile Module
<a href="#">RBG</a>	Random Bit Generator
<a href="#">RFC</a>	Request for Comment
<a href="#">RNG</a>	Random Number Generator
<a href="#">RNGVS</a>	Random Number Generator Validation System
<a href="#">S/MIME</a>	Secure/Multi-purpose Internet Mail Extensions
<a href="#">SAN</a>	Subject Alternative Name
<a href="#">SAR</a>	Security Assurance Requirement
<a href="#">SE</a>	Security Enhancements
<a href="#">SFR</a>	Security Functional Requirement
<a href="#">SHA</a>	Secure Hash Algorithm
<a href="#">SIP</a>	Session Initiation Protocol
<a href="#">SP</a>	Special Publication
<a href="#">SSH</a>	Secure Shell
<a href="#">ST</a>	Security Target
<a href="#">SWID</a>	Software Identification
<a href="#">TLS</a>	Transport Layer Security
<a href="#">TOE</a>	Target of Evaluation
<a href="#">TSF</a>	<a href="#">TOE</a> Security Functionality
<a href="#">TSS</a>	<a href="#">TOE</a> Summary Specification
<a href="#">UI</a>	User Interface
<a href="#">URI</a>	Uniform Resource Identifier
<a href="#">URL</a>	Uniform Resource Locator
<a href="#">USB</a>	Universal Serial Bus
<a href="#">XCCDF</a>	eXtensible Configuration Checklist Description Format
<a href="#">XOR</a>	Exclusive Or
<a href="#">app</a>	Application