



CipherTrust Application Data Protection for C PKCS11

API REFERENCE GUIDE



Document Information

Document Information

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PREFACE: About this Document

This introductory section identifies the audience, explains the importance of the release notes, explains how to best use the written material, and discusses the documentation conventions used. It contains the following sections:

- > "Release Notes" below
- > "Audience" below
- > "Document Conventions" on page 1
- > "Related Documents" on page viii
- > "Support Contacts" on page viii

Release Notes

The release notes provide important information about this release that is not included in other customer documentation. It is strongly recommended that you read the release notes to fully understand the capabilities, limitations, and known issues for this release. You can view or download the latest version of the release notes for this release at the following location:

<https://supportportal.thalesgroup.com>

Audience

This document is intended for CipherTrust Application Data Protection for C PKCS11 (CADP for C PKCS11) administrators responsible for deploying security policies on client machines. Administrators must have root permissions for the systems on which this product is installed.

All products manufactured and distributed by Thales Group are designed to be installed, operated, and maintained by personnel who have the knowledge, training, and qualifications required to safely perform the tasks assigned to them. The information, processes, and procedures contained in this document are intended for use by trained and qualified personnel only.

It is assumed that the users of this document are proficient with data security concepts. Readers must also possess knowledge of C and PKCS #11.

Document Conventions

This section describes the conventions used in this document.

Command Syntax and Typeface Conventions

This document uses the following conventions for command syntax descriptions, and to highlight elements of the user interface.

Format	Convention
bold	<p>The bold attribute is used to indicate the following:</p> <ul style="list-style-type: none"> > Command-line commands and options that you enter verbatim (Type dir /p.) > Button names (Click Save As.) > Check box and radio button names (Select the Print Duplex check box.) > Dialog box titles (On the Protect Document dialog box, click Yes.) > Field names (User Name: Enter the name of the user.) > Menu names (On the File menu, click Save.) (Click Menu > Go To > Folders.) > User input (In the Date box, type April 1.)
<i>italics</i>	In type, the italic attribute is used for emphasis or to indicate a related document. (See the <i>Installation Guide</i> for more information.)
<variable>	In command descriptions, angle brackets represent variables. You must substitute a value for command line arguments that are enclosed in angle brackets.
[optional] [<optional>]	Represent optional keywords or <variables> in a command line description. Optionally enter the keyword or <variable> that is enclosed in square brackets, if it is necessary or desirable to complete the task.
{ a b c } {<a> <c>}	Represent required alternate keywords or <variables> in a command line description. You must choose one command line argument enclosed within the braces. Choices are separated by vertical (OR) bars.
[a b c] [<a> <c>]	Represent optional alternate keywords or variables in a command line description. Choose one command line argument enclosed within the braces, if desired. Choices are separated by vertical (OR) bars.

Notifications and Alerts

Notifications and alerts are used to highlight important information or alert you to the potential for data loss or personal injury.

Tips

Tips are used to highlight information that helps to complete a task more efficiently.

TIP This is some information that will allow you to complete your task more efficiently.

Notes

Notes are used to highlight important or helpful information.

NOTE Take note. Contains important or helpful information.

Cautions

Cautions are used to alert you to important information that may help prevent unexpected results or data loss.

CAUTION! Exercise caution. Contains important information that may help prevent unexpected results or data loss.

Warnings

Warnings are used to alert you to the potential for catastrophic data loss or personal injury.

****WARNING**** Be extremely careful and obey all safety and security measures. In this situation you might do something that could result in catastrophic data loss or personal injury.

Related Documents

Refer to the online CADP for C documentation on the [Thales documentation portal](#) for related and additional information.

Support Contacts

If you encounter a problem while installing, registering, or operating this product, please refer to the documentation before contacting support. If you cannot resolve the issue, contact your supplier or [Thales Customer Support](#).

Thales Customer Support operates 24 hours a day, 7 days a week. Your level of access to this service is governed by the support plan arrangements made between Thales and your organization. Please consult this support plan for further information about your entitlements, including the hours when telephone support is available to you.

Customer Support Portal

The Customer Support Portal, at <https://supportportal.thalesgroup.com>, is where you can find solutions for most common problems. The Customer Support Portal is a comprehensive, fully searchable database of support resources, including software and firmware downloads, release notes listing known problems and workarounds, a knowledge base, FAQs, product documentation, technical notes, and more. You can also use the portal to create and manage support cases.

NOTE You require an account to access the Customer Support Portal. To create a new account, go to the portal and click on the **REGISTER** link.

Telephone

The support portal also lists telephone numbers for voice contact ([Contact Us](#)).

CHAPTER 1: Overview

CADP for C PKCS11 enables data encryption at the application level. Applications can use CADP for C PKCS11 to encrypt a column in a database or a field, such as credit card numbers or Social Security numbers. CADP for C PKCS11 can also be used to encrypt an entire data file or directory.

CADP for C PKCS11 APIs support real-time I/O encryption and decryption of “at rest” data and log files. Data is encrypted by adding CADP for C PKCS11 API calls to existing applications.

The APIs in the CADP for C PKCS11 library are a subset of the PKCS #11 specification version 2.20 with a focus on session management, key management, and cryptographic functions. These APIs are platform independent to cryptographic tokens, and are traditionally used for HSMs (hardware security modules) and smartcards.

The CADP for C PKCS11 library acts as a bridge between an application written in the PKCS#11 protocol and the CipherTrust Manager (Key Manager). Your application makes calls with the industry standard PKCS11 APIs and the calls are translated to NAE-XML to communicate with the CipherTrust Manager. In addition, the CADP for C PKCS11 library also offers an in-memory key cache for enhanced cryptographic performance.

CADP for C PKCS11 supports single encryption and decryption using RSA 1024, RSA 2048, RSA 3072, RSA4096, AES 128, AES 192, and AES 256. It also supports multi-part encryption and decryption using AES 128, AES 192, and AES 256.

CADP for C PKCS11 provides API support for the following:

- > Create a key
- > Find a key
- > Destroy a key
- > Export a key
- > Import a key
- > Versioned key support
- > Encrypt data
- > Decrypt data
- > Sign data
- > Verify data signature
- > Compute the digest for data
- > Compute the digest for data with a key (HMAC)
- > Random number generation

CADP for C PKCS11 code samples for C, C#, and Java are available at the following Github site:

https://github.com/thalescpl-io/CipherTrust_Application_Protection/tree/master/pkcs11

For information about latest version of the PKCS #11 specification, refer to the following OASIS website:

<http://docs.oasis-open.org/pkcs11/pkcs11-base/v2.40/os/pkcs11-base-v2.40-os.html>

This document describes the CADP for C PKCS11 APIs available within the CADP for C PKCS11. Application developers can use these APIs to integrate the CADP for C PKCS11 functionality into their applications.

The individual APIs are organized by chapter into following related functional groups:

- > ["General Purpose Functions" on page 3](#)
- > ["Slot and Token Management Functions" on page 9](#)
- > ["Session Management Functions" on page 18](#)
- > ["Object Management Functions" on page 27](#)
- > ["Digest and MAC Functions" on page 56](#)
- > ["Signing and Calculating MAC Functions" on page 65](#)
- > ["Encryption Functions" on page 79](#)
- > ["Decryption Functions" on page 88](#)
- > ["Random Data Generation" on page 98](#)

Appendix A (["Mapping of VAE Compatibility Mode and CipherTrust Mode APIs" on page 100](#)) summarizes the differences between the PKCS11 APIs of the Vormetric Application Encryption (VAE) (in binary compatibility mode) and the CipherTrust Manager.

CHAPTER 2: General Purpose Functions

This chapter describes the following general-purpose functions:

- > ["C_Initialize" on the next page](#)
- > ["C_Finalize" on page 5](#)
- > ["C_GetInfo" on page 6](#)
- > ["C_GetFunctionList" on page 8](#)

C_Initialize

Initializes the CADP for C PKCS11 library.

```
CK_DEFINE_FUNCTION(CK_RV, C_Initialize)(
    CK_VOID_PTR pInitArgs
);
```

NOTE Only the applications written in C will call `C_Initialize`.

NOTE Application level or OS level mutexes are currently not supported.

NOTE For information about the APIs, see the CADP for C PKCS11 code samples.

Input Parameters	Description
<code>pInitArgs</code>	Optional parameters for <code>C_Initialize</code> . Currently, these parameters are not supported. <code>pInitArgs</code> must be set to <code>NULL</code> . Previous settings used in VAE PKCS11 are currently ignored.

Output Parameters	Description
<code>CKR_ARGUMENTS_BAD</code>	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
<code>CKR_CRYPTOKI_ALREADY_INITIALIZED</code>	The function could not be executed because the Cryptoki library is already initialized by a call to <code>C_Initialize</code> .
<code>CKR_FUNCTION_FAILED</code>	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
<code>CKR_GENERAL_ERROR</code>	An unrecoverable error occurred.
<code>CKR_HOST_MEMORY</code>	There is insufficient memory to perform the requested function.
<code>CKR_OK</code>	The function was executed successfully.

C_Finalize

Called to indicate that an application is finished with using the `pkcs11` library.

```
CK_DEFINE_FUNCTION(CK_RV, C_Finalize)(  
    CK_VOID_PTR pReserved  
) ;
```

Input Parameters	Description
CK_VOID_PTR pReserved	This value must be set to NULL.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_OK	The function was executed successfully.

C_GetInfo

Provides manufacturer and version information about the Cryptoki library.

```
CK_DEFINE_FUNCTION(CK_RV, C_GetInfo) (CK_INFO_PTR pInfo);
```

Input Parameters	Description
CK_INFO_PTR pInfo	Pointer to a CK_INFO structure to receive the information.

Output Parameters	Description
CK_INFO	Provides general information about Cryptoki. Definitions are outlined in the next table.

Cryptoki Responses	Description
cryptokiVersion	Cryptoki interface version number (for compatibility with future revisions of this interface).
manufacturerID	ID of the Cryptoki library manufacturer. Must be padded with the blank character (' ') and must not be terminated with a null.
flags	Bit flags reserved for future versions. This value must be set to zero (0) for this version.
libraryDescription	Character-string description of the library. Must be padded with the blank character (' ') and must not be terminated with a null.
libraryVersion	Cryptoki library version number.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.

Return Values	Description
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.

C_GetFunctionList

Allows the application (caller of the CADP for C PKCS11 library) to find the list of the supported APIs and their addresses.

```
CK_DEFINE_FUNCTION(CK_RV, C_GetFunctionList) (  
    CK_FUNCTION_LIST_PTR_PTR ppFunctionList  
) ;
```

NOTE Only the applications written in C will call C_GetFunctionList.

Input Parameters	Description
<code>CK_FUNCTION_LIST_PTR_PTR ppFunctionList;</code>	Pointer to a value that will receive a pointer to <code>CK_FUNCTION_LIST</code> structure. This structure contains function pointers for all the API routines in the library.

Output Parameters	Description
<code>ppFunctionList</code>	Filled in with the address of the list of function pointers from the CADP for C PKCS11 library.

Return Values	Description
<code>CKR_ARGUMENTS_BAD</code>	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
<code>CKR_FUNCTION_FAILED</code>	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
<code>CKR_GENERAL_ERROR</code>	An unrecoverable error occurred.
<code>CKR_HOST_MEMORY</code>	There is insufficient memory to perform the requested function.
<code>CKR_OK</code>	The function was executed successfully.

CHAPTER 3: Slot and Token Management Functions

This chapter describes the following functions for slot and token management:

- > ["C_GetSlotList" on the next page](#)
- > ["C_GetSlotInfo" on page 12](#)
- > ["C_GetTokenInfo" on page 13](#)
- > ["C_GetMechanismList" on page 14](#)
- > ["C_GetMechanismInfo" on page 16](#)
- > ["Supported Mechanisms" on page 17](#)

C_GetSlotList

Provides list of available slots. It can be a single default slot. In C, call this function twice to get the actual slot list. The first time, it returns the number of available slots. Allocate memory to the available slots, and then the second call returns the actual slot list.

```
CK_DEFINE_FUNCTION(CK_RV, C_GetSlotList) (
    CK_BBOOL tokenPresent,
    CK_SLOT_ID_PTR pSlotList,
    CK_ULONG_PTR pulCount);
);
```

NOTE Only the applications written in C will call C_GetSlotList.

First Call to Retrieve Number of Slots

First call to C_GetSlotList(CK_FALSE) to retrieve the number of slots.

Input Parameters	Description
CK_BBOOL tokenPresent	Indicates whether the list obtained includes only those slots with a token present (CK_TRUE), or all slots (CK_FALSE). This parameter must set to CK_FALSE.
CK_SLOT_ID_PTR pSlotList	Pointer to the space allocated to hold the slot. This parameter must be set to NULL.
CK_ULONG_PTR pulCount	Pointer to an unsigned long to hold slot count.

Second Call to Retrieve Slot List

Second call to C_GetSlotList to retrieve the actual slot list.

Input Parameters	Description
CK_BBOOL tokenPresent	Indicates whether the list obtained includes only those slots with a token present (CK_TRUE), or all slots (CK_FALSE). This parameter must set to CK_TRUE.
CK_SLOT_ID_PTR pSlotList	Pointer to the space allocated to hold the slot based on the count retrieved from the first call.
CK_ULONG_PTR pulCount	Pointer to a CK_ULONG holding the number of slots allocated from the first call.

Output Parameters	Description
pulCount	Points to the number of slots available. It is always 1 for the CADP for C PKCS11 library.

Return Values	Description
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .

C_GetSlotInfo

Provides information about a particular slot in the system.

```
CK_DEFINE_FUNCTION(CK_RV, C_GetSlotInfo) (
    CK_SLOT_ID slotID,
    CK_SLOT_INFO_PTR pInfo
);
```

Input Parameters	Description
CK_SLOT_ID slotID	Indicates the ID of the slot.
CK_SLOT_INFO_PTR pInfo	Pointer to a CK_SLOT_INFO object.

Output Parameters	Description
CK_SLOT_INFO_PTR	This value must be set to 0.
CK_SLOT_INFO_PTR pInfo	The structure where CK_SLOT_INFO_PTR pointer will be filled in with relevant information about the slot.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_SLOT_ID_INVALID	The specified slot ID is invalid.

C_GetTokenInfo

Provides information about a specific token.

```
CK_DEFINE_FUNCTION(CK_RV, C_GetTokenInfo) (
    CK_SLOT_ID slotID,
    CK_SLOT_INFO_PTR pInfo );
```

Input Parameters	Description
CK_SLOT_ID slotID	Indicates the ID of the slot. This value must be between 0 to 127.
CK_TOKEN_INFO_PTR pInfo	Pointer to a CK_TOKEN_INFO object.

Output Parameters	Description
CK_TOKEN_INFO_PTR	The structure where CK_TOKEN_INFO_PTR pointer will be filled in with relevant information about the token.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_SLOT_ID_INVALID	The specified slot ID is invalid.
CKR_TOKEN_NOT_PRESENT	The token was not present in its slot at the time that the function was invoked.
CKR_TOKEN_NOT_RECOGNIZED	The Cryptoki library and/or slot does not recognize the token in the slot.

C_GetMechanismList

Provides a list of supported mechanisms.

```
CK_DEFINE_FUNCTION(CK_RV,C_GetMechanismList) (
CK_SLOT_ID slotID, CK_MECHANISM_TYPE_PTR pMechanismList,
CK_ULONG_PTR pulCount
);
```

NOTE For the list of mechanisms returned by `C_GetMechanismList`, refer ["Supported Mechanisms" on page 17](#).

Input Parameters	Description
CK_SLOT_ID slotID	Indicates the ID of the slot. This value must be between 0 to 127.
CK_MECHANISM_TYPE_PTR pMechanismList	Pointer to memory to hold a list of CK_MECHANISM_TYPE.
CK_ULONG_PTR pulCount	Number of CK_MECHANISM_TYPE objects the memory above can hold.

Output Parameters	Description
CK_MECHANISM	The CK_MECHANISM structure where CK_MECHANISM_TYPE_PTR pointer will be filled in with the list of supported mechanism types.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_SLOT_ID_INVALID	The specified slot ID is invalid.

Return Values	Description
CKR_TOKEN_NOT_PRESENT	The token was not present in its slot at the time that the function was invoked.
CKR_TOKEN_NOT_RECOGNIZED	The Cryptoki library and/or slot does not recognize the token in the slot.
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.

C_GetMechanismInfo

Provides information about a particular mechanism.

```
CK_DEFINE_FUNCTION(CK_RV, C_GetMechanismInfo) (
    CK_SLOT_ID slotID, CK_MECHANISM_TYPE type,
    CK_MECHANISM_INFO_PTR pInfo
);
```

Input Parameters	Description
CK_SLOT_ID slotID	Indicates the ID of the slot. This value must be between 0 to 127.
CK_MECHANISM_TYPE type	Mechanism type for which to retrieve the information.
CK_MECHANISM_INFO_PTR pInfo	Pointer to a CK_MECHANISM_INFO structure.

Output Parameters	Description
CK_MECHANISM_INFO	The CK_MECHANISM_INFO structure where pInfo points is filled in with information about a particular mechanism.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_SLOT_ID_INVALID	The specified slot ID is invalid.
CKR_TOKEN_NOT_PRESENT	The token was not present in its slot at the time that the function was invoked.
CKR_TOKEN_NOT_RECOGNIZED	The Cryptoki library and/or slot does not recognize the token in the slot.

Return Values	Description
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.

Supported Mechanisms

List of supported mechanisms	
CKM_AES_CBC	CKM_ING_SEED_ECB
CKM_AES_CBC_PAD	CKM_ING_SEED_KEY_GEN
CKM_AES_CTR	CKM_RC4
CKM_AES_ECB	CKM_RC4_KEY_GEN
CKM_AES_KEY_GEN	CKM_RSA_PKCS
CKM_DES_CBC	CKM_RSA_PKCS_KEY_PAIR_GEN
CKM_DES_CBC_PAD	CKM_SEED_CBC
CKM_DES_ECB	CKM_SEED_CBC_PAD
CKM_DES_KEY_GEN	CKM_SEED_ECB
CKM_DES2_KEY_GEN	CKM_SEED_KEY_GEN
CKM_DES3_CBC	CKM_SHA_1_HMAC
CKM_DES3_CBC_PAD	CKM_SHA1_RSA_PKCS
CKM_DES3_ECB	CKM_SHA256_HMAC
CKM_DES3_KEY_GEN	CKM_SHA384_HMAC
CKM_GENERIC_SECRET_KEY_GEN	CKM_SHA512_HMAC
CKM_ING_HMAC_KEY_GEN	CKM_THALES_FF1
CKM_ING_SEED_CBC	CKM_THALES_FPE
CKM_ING_SEED_CBC_PAD	

CHAPTER 4: Session Management Functions

This chapter describes the following session management functions:

- > ["C_OpenSession" on the next page](#)
- > ["C_CloseSession" on page 21](#)
- > ["C_CloseAllSessions" on page 22](#)
- > ["C_GetSessionInfo" on page 23](#)
- > ["C_Login" on page 24](#)
- > ["C_Logout" on page 26](#)

C_OpenSession

Starts a cryptographic session with a specific slot.

```
CK_DEFINE_FUNCTION(CK_RV, C_OpenSession) (
    CK_SLOT_ID slotID,
    CK_FLAGS flags, CK_VOID_PTR pApplication,
    CK_NOTIFY Notify,
    CK_SESSION_HANDLE_PTR phSession
);
```

Supported Functionality

- Only read/write sessions are supported. Maximum number of read/write sessions is 65536.
- No read-only sessions are supported.
- Each thread must run in its own session for multi-threaded applications.
- Each session is bound to one distinct thread.

Input Parameters	Description
CK_SLOT_ID slotID	Indicates the ID of the slot. This value must be between 0 to 127.
CK_FLAGS flags	Indicates the type of session. Consists of the logical OR of zero or more bit flags defined in the CK_SESSION_INFO data type. Thales only supports 0.
CK_VOID_PTR pApplication	Indicates an application-defined pointer to be passed to the notification callback. Thales does not support this parameter. This value must be set to NULL.
CK_NOTIFY Notify	Indicates the address of the notification callback function. This value must be set to NULL.
CK_SESSION_HANDLE_PTR phSession	Pointer to the location that receives the handle for the new session.

Output Parameters	Description
CK_SESSION_HANDLE_PTR phSession	The session ID pointer (CK_SESSION_HANDLE_PTR phSession) will be filled in with the session handle.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_OK	The function was executed successfully.
CKR_SLOT_ID_INVALID	The specified slot ID is invalid.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.

C_CloseSession

Closes a cryptographic session.

```
CK_DEFINE_FUNCTION(CK_RV, C_CloseSession)(
    CK_SESSION_HANDLE hSession
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session to close, identified by the session handle.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_OK	The function was executed successfully.
CKR_SLOT_ID_INVALID	The specified slot ID is invalid.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.

C_CloseAllSessions

Closes all sessions on a slot. This function is only applicable to the applications written in C.

```
CK_DEFINE_FUNCTION(CK_RV, C_CloseAllSessions) (  
    CK_SLOT_ID slotID  
) ;
```

Input Parameters	Description
CK_SLOT_ID slotID	Indicates the ID of the slot. This value must be set to 0.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_OK	The function was executed successfully.

C_GetSessionInfo

Provides information about a session.

```
CK_DEFINE_FUNCTION(CK_RV, C_GetSessionInfo) (
    CK_SESSION_HANDLE hSession,
    CK_SESSION_INFO_PTR pInfo
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_SESSION_INFO_PTR pInfo	Pointer to a CK_SESSION_INFO object.

Output Parameters	Description
CK_SESSION_INFO_PTR	The structure where CK_SESSION_INFO_PTR pointer will be filled in with relevant information about the session.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_OK	The function was executed successfully.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.

C_Login

Passes user credentials to log into a slot. The credentials can be PIN only for all domain access, include a user name and password to secure the session access based on key group permissions. The format of the credential depends on the compatibility mode.

```
CK_DEFINE_FUNCTION(CK_RV, C_Login)(
    CK_SESSION_HANDLE hSession,
    CK_USER_TYPE userType,
    CK_UTF8CHAR_PTR pPin,
    CK_ULONG ulPinLen
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle into which to log the user.
CK_USER_TYPE userType	Indicates the user type. CADP for C only supports CKU_USER.
CK_CHAR_PTR pPin	<p>Pointer to the credential used to authenticate the user against the CipherTrust Manager. The format of this argument depends on one of the following compatibility modes:</p> <ul style="list-style-type: none"> > LegacyVAE mode: PIN:CTuser:password > CipherTrust mode: CTuser:password <p>where the following applies:</p> <ul style="list-style-type: none"> > PIN: PIN entered during connector registration > CTUser: CipherTrust Manager user > password: Password of CipherTrust Manager user <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>NOTE If you want to use domain keys:</p> <ul style="list-style-type: none"> > CTUser: DomainName CipherTrust Manager user </div>
CK_ULONG ulPinLen	Indicates the length of the PIN in bytes.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.

Return Values	Description
CKR_OK	The function was executed successfully.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_FUNCTION_REJECTED	This error is returned when the identity check fails.
CKR_PIN_INVALID	The specified PIN has invalid characters in it. This is the default error when a check for <code>loginforIdentity</code> fails.
CKR_PIN_INCORRECT	The specified PIN is incorrect.
CKR_USER_PIN_NOT_INITIALIZED	Indicates that the normal user's PIN has not yet been initialized.
CKR_USER_TYPE_INVALID	An invalid value was specified for the user type.

C_Logout

Logs a user out from a token. You can call `C_logout()` multiple times in a row.

```
CK_DEFINE_FUNCTION(CK_RV, C_Logout) (
    CK_SESSION_HANDLE hSession
);
```

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle that you want to log out of.

Return Values	Description
<code>CKR_ARGUMENTS_BAD</code>	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
<code>CKR_CRYPTOKI_NOT_INITIALIZED</code>	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
<code>CKR_FUNCTION_FAILED</code>	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
<code>CKR_GENERAL_ERROR</code>	An unrecoverable error occurred.
<code>CKR_OK</code>	The function was executed successfully.
<code>CKR_SESSION_HANDLE_INVALID</code>	The specified session handle was invalid at the time that the function was invoked.
<code>CKR_SESSION_CLOSED</code>	The session was closed during the execution of the function.
<code>CKR_HOST_MEMORY</code>	There is insufficient memory to perform the requested function.

CHAPTER 5: Object Management Functions

This chapter describes the following functions for managing objects:

- > ["C_WrapKey" on the next page](#)
- > ["C_UnwrapKey" on page 30](#)
- > ["C_CreateObject" on page 33](#)
- > ["C_DestroyObject" on page 36](#)
- > ["C_FindObjectsInit" on page 38](#)
- > ["C_FindObjects" on page 41](#)
- > ["C_FindObjectsFinal" on page 43](#)
- > ["C_GetAttributeValue" on page 44](#)
- > ["C_SetAttributeValue" on page 46](#)
- > ["C_GenerateKey" on page 49](#)
- > ["C_GenerateKeyPair" on page 52](#)

C_WrapKey

Supports key export on the CipherTrust Manager where a symmetric key is wrapped with another symmetric key on the CipherTrust Manager and then exported.

```
CK_DEFINE_FUNCTION(CK_RV, C_WrapKey) (
    CK_SESSION_HANDLE hSession,
    CK_MECHANISM_PTR pMechanism,
    CK_OBJECT_HANDLE hWrappingKey,
    CK_OBJECT_HANDLE hKey,
    CK_BYTE_PTR pWrappedKey,
    CK_ULONG_PTR pulWrappedKeyLen
);
```

The `C_WrapKey` only succeeds when `CKA_EXTRACTABLE` is true for the wrapping key and the key to be wrapped.

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_MECHANISM_PTR pMechanism</code>	The mechanism pointer only supports <code>CKM_AES_CBC_PAD</code> mode. It requires a 16-byte Initialization Vector (IV). The structure looks like this: <code>{CKM_AES_CBC_PAD, iv, 16};</code>
<code>CK_OBJECT_HANDLE hWrappingKey</code>	Symmetric key used to wrap the key.
<code>CK_OBJECT_HANDLE hKey</code>	Symmetric key to export.
<code>CK_BYTE_PTR pWrappedKey</code>	Points to an array to put the wrapped key bytes.
<code>CK_ULONG_PTR pulWrappedKeyLen</code>	Points to the location that receives the length of the wrapped key.

Constants for <code>CK_MECHANISM</code>	Description
<code>CKM_AES_CBC_PAD</code>	Export a symmetric key with a symmetric key wrapper.

Output Parameters	Description
<code>CK_BYTE_PTR pWrappedKey</code>	The array where <code>CK_BYTE_PTR pWrappedKey</code> pointer will be filled in with the wrapped key bytes.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_FUNCTION_CANCELLED	The function was canceled in mid-execution.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.
CKR_KEY_SIZE_RANGE	The supplied key's size is outside the range of key sizes.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.
CKR_MECHANISM_PARAM_INVALID	Invalid parameters were supplied to the mechanism specified in the cryptographic operation.
CKR_OPERATION_ACTIVE	There is already an active operation (or combination of active operations) which prevents Cryptoki from activating the specified operation.
CKR_PIN_EXPIRED	The specified PIN has expired, and the requested operation cannot be carried out.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.
CKR_WRAPPING_KEY_HANDLE_INVALID	Indicates that the key handle specified to be used to wrap another key is not valid.
CKR_WRAPPING_KEY_SIZE_RANGE	Indicates that although the requested wrapping operation could in principle be carried out, the token is unable to actually do it because the supplied wrapping key's size is outside the range of key sizes that it can handle.
CKR_WRAPPING_KEY_TYPE_INCONSISTENT	Indicates that the type of the key specified to wrap another key is not consistent with the mechanism specified for wrapping.

C_UnwrapKey

Used in conjunction with `C_WrapKey`, where a symmetric key is wrapped with another symmetric key on the CipherTrust Manager and then exported. `C_UnwrapKey` completes the `C_WrapKey` feature, allowing the exported key to be imported to a different CipherTrust Manager (or the same CipherTrust Manager with a different name/label) and ready for future use from the destination.

When exporting and importing the key into a new CipherTrust Manager, the key attributes are not preserved. Only the key material is imported. The new template specifies the key attributes.

Reference the code sample `vpkcs11_sample_import_key.c` to use `C_UnwrapKey`.

```
(CK_RV, C_UnwrapKey)
( CK_SESSION_HANDLE hSession,
  CK_MECHANISM_PTR pMechanism,
  CK_OBJECT_HANDLE hUnwrappingKey,
  CK_BYTE_PTR pWrappedKey,
  CK_ULONG ulWrappedKeyLen,
  CK_ATTRIBUTE_PTR pTemplate,
  CK_ULONG ulAttributeCount,
  CK_OBJECT_HANDLE_PTR phKey
);
```

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_MECHANISM_PTR pMechanism</code>	The mechanism pointer only supports <code>CKM_AES_CBC_PAD</code> mode. It requires a 16 byte IV. The structure looks like this: <code>{CKM_AES_CBC_PAD,iv,16};</code>
<code>CK_OBJECT_HANDLE hUnwrappingKey</code>	Symmetric key used to wrap the key.
<code>CK_BYTE_PTR pWrappedKey</code>	Points to an array to hold the wrapped key bytes as input.
<code>CK_ULONG_PTR ulWrappedKeyLen</code>	Length of the above array.
<code>CK_ATTRIBUTE_PTR pTemplate</code>	Pointer to the new key template such as the <code>ImportKeyTemplate</code> portion of <code>vpkcs11_sample_import_key.c</code> .
<code>CK_ULONG ulAttributeCount</code>	Template length (number of attributes).
<code>CK_OBJECT_HANDLE_PTR phKey</code>	Returns pointer to a new handle.

Template Attribute Name	Type	Value
CKA_LABEL	CK_UTF8CHAR	Required. Key name; also displayed on the CipherTrust Manager.
CKA_APPLICATION	CK_UTF8CHAR	Description of the application generating the key name. This value can be NULL.
CKA_CLASS	CK_OBJECT_CLASS	Required. This value must be set to CKO_SECRET_KEY.
CKA_KEY_TYPE	CK_KEY_TYPE	Required. This value must be set to CKK_AES.
CKA_VALUE_LEN	CK_ULONG	Length of the key imported, passed in bytes. Optional, can be 16 or 32.
CKA_TOKEN	CK_BBOOL	Required. This value must be set to true.
CKA_ENCRYPT	CK_BBOOL	The default value is set to true.
CKA_DECRYPT	CK_BBOOL	The default value is set to true.
CKA_SIGN	CK_BBOOL	The default value is set to true.
CKA_VERIFY	CK_BBOOL	The default value is set to true.
CKA_WRAP	CK_BBOOL	The default value is set to true.
CKA_UNWRAP	CK_BBOOL	The default value is set to true.
CKA_EXTRACTABLE	CK_BBOOL	The default value is set to true.
CKA_ALWAYS_SENSITIVE	CK_BBOOL	The default value is set to true.
CKA_NEVER_EXTRACTABLE	CK_BBOOL	The default value is set to true.
CKA_SENSITIVE	CK_BBOOL	The default value is set to true.
CKA_THALES_CACHED_ON_HOST	CK_BBOOL	Optional. If attribute is not used, the keys are cached on the host by default. Insert the attribute and set to zero (0) to store a key on the server. To make storing on the server a default for all keys, use a flag in the CADP for C PKCS11.conf file. This value must be set to false for keys that are stored on server and not cached on host.

Output Parameters	Description
CK_OBJECT_HANDLE_PTR phKey	Returns pointer to a new handle that was imported into either the new CipherTrust Manager or the old CipherTrust Manager with a new key name.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_TEMPLATE_INCOMPLETE	The template specified for creating an object is incomplete and lacks some necessary attributes.
CKR_ATTRIBUTE_VALUE_INVALID	An invalid value was specified for a particular attribute in a template.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_OPERATION_NOT_INITIALIZED	There is no active operation of an appropriate type in the specified session.
CKR_DATA_LEN_RANGE	The plaintext input data to a cryptographic operation has a bad length.
CKR_OBJECT_HANDLE_INVALID	The specified object handle is not valid.
CKR_KEY_FUNCTION_NOT_PERMITTED	An attempt has been made to use a key for a cryptographic purpose that the key's attributes are not set to allow it to do.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_WRAPPED_KEY_LEN_RANGE	Indicates that the provided wrapped key can be seen to be invalid solely on the basis of its length.
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.

C_CreateObject

Imports key bytes into the CipherTrust Manager and creates a symmetric key on the CipherTrust Manager. Maximum length of the key name is 256 characters. Minimum length is of 1 character.

```
CK_DEFINE_FUNCTION(CK_RV, C_CreateObject) (
    CK_SESSION_HANDLE hSession,
    CK_ATTRIBUTE_PTR pTemplate,
    CK_ULONG ulCount,
    CK_OBJECT_HANDLE_PTR phObject
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_ATTRIBUTE pTemplate	Same template as C_GenerateKey, with the addition of CKA_VALUE and CKA_VALUE_LEN, which hold the key bytes and the length of the key bytes, respectively.
CK_ULONG ulCount	Number of attributes in pTemplate.
CK_OBJECT_HANDLE phObject	Generated key handle.

Template Attribute Name	Type	Value
CKA_LABEL	CK_UTF8CHAR	Required. Key name; also displayed on the CipherTrust Manager.
CKA_APPLICATION	CK_UTF8CHAR	Description of the application generating the key name. This value can be NULL.
CKA_CLASS	CK_OBJECT_CLASS	Required. This value must be set to CKO_SECRET_KEY.
CKA_KEY_TYPE	CK_KEY_TYPE	Required. This value can be set to any of these keytypes: CKK_AES, CKK_SHA256_HMAC
CKA_VALUE_LEN	CK_ULONG	Length of key bytes. Pass a long value to the CK_ATTRIBUTE constructor when creating the CKA_VALUE_LEN attribute. For example: <code>new CK_ATTRIBUTE(CKA_VALUE_LEN, 32L)</code> or: <code>long len = 32;</code> <code>new CK_ATTRIBUTE(CKA_VALUE_LEN, len)</code>
CKA_TOKEN	CK_BBOOL	Required. This value must be set to true.

Template Attribute Name	Type	Value
CKA_ENCRYPT	CK_BBOOL	The default value is set to true.
CKA_DECRYPT	CK_BBOOL	The default value is set to true.
CKA_SIGN	CK_BBOOL	The default value is set to true.
CKA_VERIFY	CK_BBOOL	The default value is set to true.
CKA_WRAP	CK_BBOOL	The default value is set to true.
CKA_UNWRAP	CK_BBOOL	The default value is set to true.
CKA_EXTRACTABLE	CK_BBOOL	The default value is set to true.
CKA_ALWAYS_SENSITIVE	CK_BBOOL	The default value is set to false.
CKA_NEVER_EXTRACTABLE	CK_BBOOL	In LegacyVAE mode (formerly called VAE mode), the default value is set to false. Otherwise, this value is set to true.
CKA_SENSITIVE	CK_BBOOL	In LegacyVAE mode (formerly called VAE mode), the default value is set to false. Otherwise, this value is set to true.
CKA_MODIFIABLE	CK_BBOOL	In LegacyVAE mode (formerly called VAE mode), the default value is set to true. Otherwise, this value is set to false.
CKA_THALES_OBJECT_ALIAS	CK_UTF8CHAR	Alias of the key.

Output Parameters	Description
CK_OBJECT_HANDLE hGenKey	This parameter is filled in with the handle of the newly generated key.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_TEMPLATE_INCOMPLETE	The template specified for creating an object is incomplete and lacks some necessary attributes.
CKR_ATTRIBUTE_VALUE_INVALID	An invalid value was specified for a particular attribute in a template.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_OBJECT_HANDLE_INVALID	The specified object handle is not valid.
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.

C_DestroyObject

Deletes a key.

```
CK_DEFINE_FUNCTION(CK_RV, C_DestroyObject) (
    CK_SESSION_HANDLE hSession,
    CK_OBJECT_HANDLE hObject
);
```

NOTE By default, keys cannot be deleted in CipherTrust mode. To delete these keys:

1. Log into CipherTrust Manager.
2. Navigate to **Keys** page and click on the key you want to delete.
3. Click action button and select **Edit**.
4. Scroll down to the **Key Behaviors** section and uncheck the **Prevent this key from being deleted** option.
5. Click **Update**.

****WARNING**** Use this function **VERY CAREFULLY**. Deleted keys cannot be recovered and all data encrypted by that key will be lost.

NOTE To delete an entire chain of a versioned key, you must set the state of each key to `Restricted (Deactivated)` using the `C_SetAttributeValue` function and then call the `C_DestroyObject` function. This function will delete the entire chain of versioned keys.

NOTE If you wish to destroy a specific version key, destroy it from the CipherTrust Manager UI. Refer to the CipherTrust Manager product documentation for instructions.

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_OBJECT_HANDLE hObject</code>	Handle of the key to be deleted.

Return Values	Description
<code>CKR_CRYPTOKI_NOT_INITIALIZED</code>	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
<code>CKR_GENERAL_ERROR</code>	An unrecoverable error occurred.
<code>CKR_HOST_MEMORY</code>	There is insufficient memory to perform the requested function.
<code>CKR_OBJECT_HANDLE_INVALID</code>	The specified object handle is not valid.

Return Values	Description
CKR_OK	The function was executed successfully.
CKR_PIN_EXPIRED	The specified PIN has expired, and the requested operation cannot be carried out.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_SESSION_READ_ONLY	The specified session was unable to accomplish the desired action because it is a read-only session.
CKR_TOKEN_WRITE_PROTECTED	The requested action could not be performed because the token is write-protected.

C_FindObjectsInit

Initializes a search for a token and session objects that match a template.

```
CK_DEFINE_FUNCTION(CK_RV, C_FindObjectsInit)(
    CK_SESSION_HANDLE hSession,
    CK_ATTRIBUTE_PTR pTemplate,
    CK_ULONG ulCount
);
```

NOTE This function has limited scope and can only perform exact matches.

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_ATTRIBUTE_PTR pTemplate	<p>Attribute(s) for which to search.</p> <p>The following attributes are supported:</p> <ul style="list-style-type: none"> > CKA_LABEL > CKA_THALES_CACHED_CLEAR > CKA_THALES_OBJECT_UUID > CKA_THALES_OBJECT_MUID > CKA_THALES_OBJECT_IKID > CKA_THALES_OBJECT_ALIAS > CKA_THALES_KEY_VERSION: This attribute is used in conjunction with CKA_LABEL to find a specific version of a key. <p>NOTE Finding the key with CKA_THALES_OBJECT_ALIAS is not supported.</p>
CK_ULONG ulCount	Attribute template count.

The following code shows various attributes for which you can search:

```
CK_ATTRIBUTE findKeyTemplatePass[] =
{
    {CKA_LABEL, ksid, ksid_len},
    {CKA_CLASS, &keyType, sizeof(keyType)}
};
switch(keyidType)
{
    case keyIdLabel:
        findKeyTemplatePass[0].type = CKA_LABEL;
        break;
    case keyIdUuid:
        findKeyTemplatePass[0].type = CKA_THALES_OBJECT_UUID;
        break;
    case keyIdMuid:
        findKeyTemplatePass[0].type = CKA_THALES_OBJECT_MUID;
        break;
    case keyIdImport:
        findKeyTemplatePass[0].type = CKA_THALES_OBJECT_IKID;
        break;
}
```

```

    case keyIdAlias:
    findKeyTemplatePass[0].type = CKA_THALES_OBJECT_ALIAS;
    break;
}

```

Template Attribute Name	Type	Value
CKA_LABEL	CK_UTF8CHAR	Key name; also displayed on the CipherTrust Manager.
CKA_THALES_OBJECT_UUID	CK_UTF8CHAR	The universally unique identifier (UUID) of a key.
CKA_THALES_OBJECT_MUID	CK_UTF8CHAR	The Message Unit Identifier (MUID) of a key.
CKA_THALES_OBJECT_IKID	CK_UTF8CHAR	Key ID of the key.
CKA_THALES_OBJECT_ALIAS	CK_UTF8CHAR	Alias of the key.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_ATTRIBUTE_TYPE_INVALID	An invalid attribute type was specified in a template.
CKR_ATTRIBUTE_VALUE_INVALID	An invalid value was specified for a particular attribute in a template.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.
CKR_OPERATION_ACTIVE	There is already an active operation (or combination of active operations) which prevents Cryptoki from activating the specified operation.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.

Return Values	Description
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_KEY_FUNCTION_NOT_PERMITTED	The identity check failed.

C_FindObjects

Finds an object on the CipherTrust Manager using the following attributes:

- > CKA_LABEL
- > CKA_THALES_OBJECT_UUID
- > CKA_THALES_OBJECT_MUID
- > CKA_THALES_OBJECT_IKID
- > CKA_THALES_OBJECT_ALIAS

For more information about these attributes, see `C_FindObjectsInit`.

```
CK_DEFINE_FUNCTION(CK_RV, C_FindObjects) (
    CK_SESSION_HANDLE hSession,
    CK_OBJECT_HANDLE_PTR phObject,
    CK_ULONG ulMaxObjectCount,
    CK_ULONG_PTR pulObjectCount
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_OBJECT_HANDLE_PTR phObject	Pointer to the buffer to put the object handles.
CK_ULONG ulMaxObjectCount	The maximum number of objects to put into the buffer.
CK_ULONG_PTR pulObjectCount	Pointer to CK_ULONG where the number of objects found is returned.

Output Parameters	Description
CK_OBJECT_HANDLE_PTR phObject	Returns a single key that matches the CKA_LABEL.
CK_ULONG_PTR pulObjectCount	Pointer to the number of objects <code>C_FindObjects</code> found.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .

Return Values	Description
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.
CKR_OPERATION_NOT_INITIALIZED	There is no active operation of an appropriate type in the specified session.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_KEY_FUNCTION_NOT_PERMITTED	The identity check failed.

C_FindObjectsFinal

Terminates a search for a token and session objects.

```
CK_DEFINE_FUNCTION(CK_RV, C_FindObjectsFinal) (
    CK_SESSION_HANDLE hSession
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.

NOTE If searching for a versioned key on its alias, the alias must not contain spaces or non-alphanumeric characters.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_OPERATION_NOT_INITIALIZED	There is no active operation of an appropriate type in the specified session.
CKR_KEY_FUNCTION_NOT_PERMITTED	The identity check failed.

C_GetAttributeValue

Gets attribute value of a specific Security Object. Argument specifies the Security Object ID.

```
K_RV C_GetAttributeValue ( CK_SESSION_HANDLE hSession,
    CK_OBJECT_HANDLE hObject,
    CK_ATTRIBUTE_PTR pTemplate,
    CK_ULONG ulCount
) ;
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_OBJECT_HANDLE hObject	Handle of the object for which to get attribute.
CK_ATTRIBUTE_PTR pTemplate	Template containing the attributes for which to search. Points to the CK_ATTRIBUTE structure.
CK_ULONG ulCount	Number of attributes in the template.

Output Parameters	Description
CK_ATTRIBUTE_PTR pTemplate	Any attribute that is supported by the key type or was set during key creation (with the exception of CKA_VALUE).

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_ATTRIBUTE_SENSITIVE	An attempt was made to obtain the value of an attribute of an object which cannot be satisfied because the object is either sensitive or un-extractable.
CKR_ATTRIBUTE_TYPE_INVALID	An invalid attribute type was specified in a template.
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_GENERAL_ERROR	An unrecoverable error occurred.

Return Values	Description
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OBJECT_HANDLE_INVALID	The specified object handle is not valid.
CKR_OK	The function was executed successfully.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.

C_SetAttributeValue

Sets the attribute value of a specific Security Object. The argument specifies the Security Object ID.

```
CK_DEFINE_FUNCTION(CK_RV, C_SetAttributeValue) (  
    CK_SESSION_HANDLE hSession,  
    CK_OBJECT_HANDLE hObject,  
    CK_ATTRIBUTE_PTR pTemplate,  
    CK_ULONG ulCount)
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_OBJECT_HANDLE hObject	Handle of the object for which to get attribute.

Input Parameters	Description
CK_ATTRIBUTE_PTR pTemplate	<p>Attributes that can be set for backwards compatibility with VAE (version 5.2.5), and are applicable to CADP for C PKCS11:</p> <ul style="list-style-type: none"> > CKA_START_DATE > CKA_END_DATE > CKA_THALES_OBJECT_CREATE_DATE > CKA_APPLICATION > CKA_OBJECT_ID > CKA_THALES_KEY_STATE <p>The following attributes do not have any impact on the keys:</p> <ul style="list-style-type: none"> > CKA_THALES_CACHED_ON_HOST > CKA_THALES_CACHED_TIME <p>Valid key states are:</p> <ul style="list-style-type: none"> 1 - active 2 - suspended (not supported) 3 - deactivated 4 - compromised (not supported) 5 - destroyed (not supported) <p>Supported VAE custom attributes:</p> <ul style="list-style-type: none"> > CKA_THALES_CUSTOM_1 > CKA_THALES_CUSTOM_2 > CKA_THALES_CUSTOM_3 > CKA_THALES_CUSTOM_4 > CKA_THALES_CUSTOM_5 <p>Modifiable Attributes</p> <ul style="list-style-type: none"> > CKA_MODIFIABLE > CKA_EXTRACTABLE <ul style="list-style-type: none"> > CKA_THALES_OBJECT_ALIAS <p>Sets an alias for a key.</p> <ul style="list-style-type: none"> > CKA_THALES_OBJECT_ALIAS CKA_THALES_KEY_ACTION_DELETE <p>Deletes the specified key alias.</p>
CK_ULONG ulCount	Number of attributes in the template.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_ATTRIBUTE_READ_ONLY	An attempt was made to set a value for an attribute which may not be set or modified.
CKR_ATTRIBUTE_TYPE_INVALID	An invalid attribute type was specified in a template.
CKR_ATTRIBUTE_VALUE_INVALID	An invalid value was specified for a particular attribute in a template.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_OBJECT_HANDLE_INVALID	The specified object handle is not valid.
CKR_SESSION_READ_ONLY	The specified session was unable to accomplish the desired action because it is a read-only session.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_TOKEN_WRITE_PROTECTED	The requested action could not be performed because the token is write-protected.
CKR_TEMPLATE_INCONSISTENT	The template specified for creating an object has conflicting attributes.
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.

C_GenerateKey

Generates a symmetric key.

```
CK_DEFINE_FUNCTION(CK_RV, C_GenerateKey) (
    CK_SESSION_HANDLE hSession,
    CK_MECHANISM_PTR pMechanism,
    CK_ATTRIBUTE_PTR pTemplate,
    CK_ULONG ulCount,
    CK_OBJECT_HANDLE_PTR phKey
);
```

NOTE After you generate a versioned key using the `C_GenerateKey` function and then rotate the key, the previous version of the key is not deactivated.

NOTE To generate the keys with KEY ID, set the `Gen_Key_Id` property to YES.

Supported Functionality

AES-128, AES-192, and AES-256 symmetric encryption keys are supported.

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_MECHANISM_PTR pMechanism</code>	Key generation mechanism; must have the following values: {CKM_AES_KEY_GEN, NULL_PTR, 0};
<code>CK_ULONG ulCount</code>	The number of attributes in the template.
<code>CK_OBJECT_HANDLE_PTR phKey</code>	Pointer to a key handle.
<code>CK_ATTRIBUTE_PTR pTemplate</code>	Template for the key to be generated. See the pTemplate Attribute table below.

Template Attribute Name	Type	Value
<code>CKA_LABEL</code>	<code>CK_UTF8CHAR</code>	Required. Key name; also displayed on the CipherTrust Manager.
<code>CKA_APPLICATION</code>	<code>CK_UTF8CHAR</code>	Description of the application generating the key name. This value can be NULL.
<code>CKA_CLASS</code>	<code>CK_OBJECT_CLASS</code>	Required. This value must be set to <code>CKO_SECRET_KEY</code> .

Template Attribute Name	Type	Value
CKA_KEY_TYPE	CK_KEY_TYPE	Required. This value must be set to CKK_AES.
CKA_VALUE_LEN	CK_ULONG	Key size (in Bytes).
CKA_TOKEN	CK_BBOOL	Optional.
CKA_ENCRYPT	CK_BBOOL	The default value is set to true.
CKA_DECRYPT	CK_BBOOL	The default value is set to true.
CKA_SIGN	CK_BBOOL	The default value is set to true.
CKA_VERIFY	CK_BBOOL	The default value is set to true.
CKA_WRAP	CK_BBOOL	The default value is set to true.
CKA_UNWRAP	CK_BBOOL	The default value is set to true.
CKA_EXTRACTABLE	CK_BBOOL	The default value is set to false.
CKA_THALES_OBJECT_ALIAS	CK_UTF8CHAR	Alias of the key.

Output Parameters	Description
CK_OBJECT_HANDLE_PTR phKey	The structure where CK_OBJECT_HANDLE_PTR phKey points is filled in with the newly created key handle.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_ATTRIBUTE_READ_ONLY	An attempt was made to set a value for an attribute which may not be set or modified.
CKR_ATTRIBUTE_TYPE_INVALID	An invalid attribute type was specified in a template.
CKR_ATTRIBUTE_VALUE_INVALID	An invalid value was specified for a particular attribute in a template.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_FUNCTION_CANCELED	The function was canceled in mid-execution.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.
CKR_MECHANISM_PARAM_INVALID	Invalid parameters were supplied to the mechanism specified in the cryptographic operation.
CKR_OPERATION_ACTIVE	There is already an active operation (or combination of active operations) which prevents Cryptoki from activating the specified operation.
CKR_PIN_EXPIRED	The specified PIN has expired, and the requested operation cannot be carried out.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_SESSION_READ_ONLY	The specified session was unable to accomplish the desired action because it is a read-only session.
CKR_TEMPLATE_INCOMPLETE	The template specified for creating an object is incomplete and lacks some necessary attributes.
CKR_TEMPLATE_INCONSISTENT	The template specified for creating an object has conflicting attributes.
CKR_TOKEN_WRITE_PROTECTED	The requested action could not be performed because the token is write-protected.
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.

C_GenerateKeyPair

Generates an asymmetric key pair. Arguments specify RSA type and length of the key pair.

```
CK_DEFINE_FUNCTION(CK_RV, C_GenerateKeyPair) (
    CK_SESSION_HANDLE hSession,
    CK_MECHANISM_PTR pMechanism,
    CK_ATTRIBUTE_PTR pPublicKeyTemplate,
    CK_ULONG ulPublicKeyAttributeCount,
    CK_ATTRIBUTE_PTR pPrivateKeyTemplate,
    CK_ULONG ulPrivateKeyAttributeCount,
    CK_OBJECT_HANDLE_PTR phPublicKey,
    CK_OBJECT_HANDLE_PTR phPrivateKey
);
```

Supported Functionality

RSA-1024, RSA-2048, RSA-3072, and RSA-4096 asymmetric key pairs are supported.

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_MECHANISM_PTR pMechanism	Key generation mechanism; must have the following values: <ul style="list-style-type: none"> > mechanism: CKM_RSA_PKCS_KEY_PAIR_GEN for RSA keys > pParameter: set to "NULL_PTR" > ulParameterLen: set to "0"
CK_ATTRIBUTE_PTR pPublicKeyTemplate	Supported attributes are: <ul style="list-style-type: none"> > CKA_CLASS > CKA_DECRYPT > CKA_ENCRYPT > CKA_EXTRACTABLE > CKA_LABEL > CKA_MODULUS_BITS > CKA_PUBLIC_EXPONENT > CKA_SENSITIVE > CKA_SIGN > CKA_THALES_OBJECT_ALIAS > CKA_TOKEN > CKA_VERIFY > CKA_WRAP
CK_ULONG ulPublicKeyAttributeCount	Size of the key template publicKeyTemplate.

Input Parameters	Description
CK_ATTRIBUTE_PTR privateKeyTemplate	Supported attributes are: <ul style="list-style-type: none"> > CKA_CLASS > CKA_DECRYPT > CKA_ENCRYPT > CKA_EXTRACTABLE > CKA_LABEL > CKA_MODULUS_BITS > CKA_PUBLIC_EXPONENT > CKA_SENSITIVE > CKA_SIGN > CKA_THALES_OBJECT_ALIAS > CKA_TOKEN > CKA_VERIFY > CKA_WRAP
CK_ULONG ulPrivateKeyAttributeCount	Size of the key template privateKeyTemplate.
CK_OBJECT_HANDLE_PTR phPublicKey	Filled in with the newly created public key handle.
CK_OBJECT_HANDLE_PTR phPrivateKey	Filled in with the newly created private key handle.

Output Parameters	Description
CK_OBJECT_HANDLE_PTR phPublicKey	Filled in with the newly created public key handle.
CK_OBJECT_HANDLE_PTR phPrivateKey	Filled in with the newly created private key handle.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_ATTRIBUTE_READ_ONLY	An attempt was made to set a value for an attribute which may not be set or modified.

Return Values	Description
CKR_ATTRIBUTE_TYPE_INVALID	An invalid attribute type was specified in a template.
CKR_ATTRIBUTE_VALUE_INVALID	An invalid value was specified for a particular attribute in a template.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_FUNCTION_CANCELED	The function was canceled in mid-execution.
CKR_FUNCTION_FAILED	The requested function could not be performed. However, detailed information about the function failure is not available in this return error.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.
CKR_MECHANISM_PARAM_INVALID	Invalid parameters were supplied to the mechanism specified in the cryptographic operation.
CKR_OPERATION_ACTIVE	There is already an active operation (or combination of active operations) which prevents Cryptoki from activating the specified operation.
CKR_PIN_EXPIRED	The specified PIN has expired, and the requested operation cannot be carried out.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_SESSION_READ_ONLY	The specified session was unable to accomplish the desired action because it is a read-only session.
CKR_TEMPLATE_INCOMPLETE	The template specified for creating an object is incomplete, and lacks some necessary attributes.
CKR_TEMPLATE_INCONSISTENT	The template specified for creating an object has conflicting attributes.
CKR_TOKEN_WRITE_PROTECTED	The requested action could not be performed because the token is write-protected.

Return Values	Description
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.
CKR_DOMAIN_PARAMS_INVALID	Invalid or unsupported domain parameters were supplied to the function.

CHAPTER 6: Digest and MAC Functions

This chapter describes the following digest and MAC functions:

- > ["C_DigestInit" on the next page](#)
- > ["C_Digest" on page 58](#)
- > ["C_DigestKey" on page 60](#)
- > ["C_DigestUpdate" on page 62](#)
- > ["C_DigestFinal" on page 63](#)

C_DigestInit

Initializes a digest operation.

```
CK_DEFINE_FUNCTION(CK_RV, C_DigestInit)(
    CK_SESSION_HANDLE hSession,
    CK_MECHANISM_PTR pMechanism,
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_MECHANISM_PTR pMechanism	Indicates the cryptographic hash function to use. Can be one of following values: { CKM_SHA256, NULL_PTR, 0 }, { CKM_SHA384, NULL_PTR, 0 }, { CKM_SHA512, NULL_PTR, 0 }, OR { CKM_SHA256_HMAC, NULL_PTR, 0 }, { CKM_SHA384_HMAC, NULL_PTR, 0 }, { CKM_SHA512_HMAC, NULL_PTR, 0 }

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.
CKR_MECHANISM_PARAM_INVALID	Invalid parameters were supplied to the mechanism specified in the cryptographic operation.
CKR_OK	The function was executed successfully.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked

C_Digest

Compute data digest in a single part. Must call `C_DigestInit` before calling `C_Digest`.

```
CK_DEFINE_FUNCTION(CK_RV, C_DigestInit) (
    CK_SESSION_HANDLE hSession,
    CK_BYTE_PTR pData,
    CK_ULONG ulDataLen,
    CK_BYTE_PTR pDigest,
    CK_ULONG_PTR pulDigestLen
);
```

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_BYTE_PTR pData</code>	Pointer to the digest input data.
<code>CK_ULONG ulDataLen</code>	Length of the data.
<code>CK_BYTE_PTR pDigest</code>	Results in the message digest.
<code>CK_ULONG_PTR pulDigestLen</code>	The byte count of the digest.

Output Parameters	Description
<code>CK_BYTE_PTR pDigest</code>	Results in the message digest.
<code>CK_ULONG_PTR pulDigestLen</code>	The byte count of the digest.

Return Values	Description
<code>CKR_CRYPTOKI_NOT_INITIALIZED</code>	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
<code>CKR_ARGUMENTS_BAD</code>	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
<code>CKR_FUNCTION_FAILED</code>	The requested function could not be performed.
<code>CKR_GENERAL_ERROR</code>	An unrecoverable error occurred.
<code>CKR_HOST_MEMORY</code>	There is insufficient memory to perform the requested function.
<code>CKR_MECHANISM_INVALID</code>	An invalid mechanism was specified in the cryptographic operation.

Return Values	Description
CKR_MECHANISM_PARAM_INVALID	Invalid parameters were supplied to the mechanism specified in the cryptographic operation.
CKR_OK	The function was executed successfully.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.
CKR_FUNCTION_CANCELED	The function was canceled in mid-execution.
CKR_OPERATION_NOT_INITIALIZED	There is no active operation of an appropriate type in the specified session.

C_DigestKey

Specifies an HMAC key for digest operation. You must call `C_DigestInit` before calling `C_DigestKey`.

```
CK_DEFINE_FUNCTION(CK_RV, C_DigestKey)(CK_SESSION_HANDLE hSession, CK_OBJECT_HANDLE hKey);
```

NOTE The key must be exportable from CipherTrust Manager. CADP for C only supports the AES key for the HMAC key for digest operation.

NOTE You can call `C_DigestKey` only once, and only directly after calling `C_DigestInit`.

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_OBJECT_HANDLE hKey</code>	Handle of the secret key to be digested.

Return Values	Description
<code>CKR_CRYPTOKI_NOT_INITIALIZED</code>	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
<code>CKR_FUNCTION_FAILED</code>	The requested function could not be performed.
<code>CKR_GENERAL_ERROR</code>	An unrecoverable error occurred.
<code>CKR_HOST_MEMORY</code>	There is insufficient memory to perform the requested function.
<code>CKR_KEY_SIZE_RANGE</code>	The supplied key's size is outside the range of key sizes.
<code>CKR_MECHANISM_PARAM_INVALID</code>	Invalid parameters were supplied to the mechanism specified in the cryptographic operation.
<code>CKR_OK</code>	The function was executed successfully.
<code>CKR_SESSION_HANDLE_INVALID</code>	The specified session handle was invalid at the time that the function was invoked.
<code>CKR_ARGUMENTS_BAD</code>	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
<code>CKR_KEY_INDIGESTIBLE</code>	The supplied key's size is outside the range of key sizes.

Return Values	Description
CKR_KEY_FUNCTION_NOT_PERMITTED	The identity check failed.

C_DigestUpdate

Continues a multi-part digest operation. Must call `C_DigestInit` before calling `C_DigestUpdate`. Can optionally call `C_DigestKey` before calling `C_DigestUpdate`.

```
CK_DEFINE_FUNCTION(CK_RV, C_DigestUpdate) (
    CK_SESSION_HANDLE hSession,
    CK_BYTE_PTR pPart,
    CK_ULONG ulPartLen
);
```

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_BYTE_PTR pPart</code>	Pointer to the digest input data.
<code>CK_ULONG ulPartLen</code>	Length of the data.

Return Values	Description
<code>CKR_CRYPTOKI_NOT_INITIALIZED</code>	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
<code>CKR_FUNCTION_FAILED</code>	The requested function could not be performed.
<code>CKR_GENERAL_ERROR</code>	An unrecoverable error occurred.
<code>CKR_HOST_MEMORY</code>	There is insufficient memory to perform the requested function.
<code>CKR_OK</code>	The function was executed successfully.
<code>CKR_SESSION_HANDLE_INVALID</code>	The specified session handle was invalid at the time that the function was invoked.
<code>CKR_KEY_INDIGESTIBLE</code>	The supplied key's size is outside the range of key sizes.
<code>CKR_ARGUMENTS_BAD</code>	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
<code>CKR_KEY_TYPE_INCONSISTENT</code>	The specified key is not the correct type of key to use with the specified mechanism.
<code>CKR_OPERATION_NOT_INITIALIZED</code>	There is no active operation of an appropriate type in the specified session.

C_DigestFinal

Finishes a multi-part digest operation. This works only with the local key cache. Not supported if crypto is done remotely on the CipherTrust Manager.

```
CK_DEFINE_FUNCTION(CK_RV, C_DigestFinal) (
    CK_SESSION_HANDLE hSession,
    CK_BYTE_PTR pDigest,
    CK_ULONG_PTR pulDigestLen
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_BYTE_PTR pDigest	Results in the message digest.
CK_ULONG_PTR pulDigestLen	The byte count of the digest.

Output Parameters	Description
CK_BYTE_PTR pDigest	Results in the message digest.
CK_ULONG_PTR pulDigestLen	The byte count of the digest.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OK	The function was executed successfully.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_KEY_INDIGESTIBLE	The supplied key's size is outside the range of key sizes.

Return Values	Description
CKR_KEY_TYPE_INCONSISTENT	The specified key is not the correct type of key to use with the specified mechanism.
CKR_OPERATION_NOT_INITIALIZED	There is no active operation of an appropriate type in the specified session.
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.

CHAPTER 7: Signing and Calculating MAC Functions

This chapter describes the following signing and calculating MAC functions:

- > ["C_SignInit" on the next page](#)
- > ["C_Sign" on page 68](#)
- > ["C_SignUpdate" on page 70](#)
- > ["C_SignFinal" on page 72](#)
- > ["C_VerifyInit" on page 74](#)
- > ["C_Verify" on page 76](#)
- > ["C_VerifyUpdate" on page 77](#)
- > ["C_VerifyFinal" on page 78](#)

NOTE These Signing and Calculating MAC functions do not work in Remote mode.

C_SignInit

Initializes a signature operation.

```
CK_DEFINE_FUNCTION(CK_RV, C_SignInit)(
    CK_SESSION_HANDLE hSession,
    CK_MECHANISM_PTR pMechanism,
    CK_OBJECT_HANDLE hKey
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_MECHANISM_PTR pMechanism	<p>The mechanism (algorithm) you wish to use for the signature operation. The mechanism has the following parameters:</p> <pre>; {CKM_RSA_PKCS, NULL_PTR, 0}</pre> <p>Valid mechanisms are:</p> <ul style="list-style-type: none"> > CKM_SHA224_HMAC > CKM_SHA256_HMAC > CKM_SHA384_HMAC > CKM_SHA512_HMAC > CKM_RSA_PKCS
CK_OBJECT_HANDLE hKey	Handle to the RSA private key. The key that this handle references can be an HMAC key.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.
CKR_MECHANISM_PARAM_INVALID	Invalid parameters were supplied to the mechanism specified in the cryptographic operation.
CKR_OK	The function was executed successfully.

Return Values	Description
CKR_FUNCTION_CANCELED	The function was canceled in mid-execution.
CKR_KEY_FUNCTION_NOT_PERMITTED	An attempt has been made to use a key for a cryptographic purpose that the key's attributes are not set to allow it to do.
CKR_KEY_HANDLE_INVALID	The specified key handle is invalid.
CKR_KEY_SIZE_RANGE	The supplied key's size is outside the range of key sizes.
CKR_KEY_TYPE_INCONSISTENT	The specified key is not the correct type of key to use with the specified mechanism.
CKR_OPERATION_ACTIVE	There is already an active operation (or combination of active operations) which prevents Cryptoki from activating the specified operation.
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.

C_Sign

Signs data in a single part.

```
CK_DEFINE_FUNCTION(CK_RV, C_Sign)(
    CK_SESSION_HANDLE hSession,
    CK_BYTE_PTR pData,
    CK_ULONG ulDataLen,
    CK_BYTE_PTR pSignature,
    CK_ULONG_PTR pulSignatureLen
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_BYTE_PTR pData	Pointer to data to be signed.
CK_ULONG ulDataLen	Length of data to be signed.
CK_BYTE_PTR pSignature	Pointer to buffer to receive the signed data. If C_SignInit is called with a specified header, the signature returns the corresponding header prepended to it.
CK_ULONG_PTR pulSignatureLen	Pointer to buffer length.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.
CKR_MECHANISM_PARAM_INVALID	Invalid parameters were supplied to the mechanism specified in the cryptographic operation.
CKR_OK	The function was executed successfully.
CKR_FUNCTION_CANCELED	The function was canceled in mid-execution.

Return Values	Description
CKR_KEY_FUNCTION_NOT_PERMITTED	An attempt has been made to use a key for a cryptographic purpose that the key's attributes are not set to allow it to do.
CKR_KEY_HANDLE_INVALID	The specified key handle is invalid.
CKR_KEY_SIZE_RANGE	The supplied key's size is outside the range of key sizes.
CKR_KEY_TYPE_INCONSISTENT	The specified key is not the correct type of key to use with the specified mechanism.
CKR_OPERATION_ACTIVE	There is already an active operation (or combination of active operations) which prevents Cryptoki from activating the specified operation.
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.
CKR_DATA_INVALID	The plaintext input data to a cryptographic operation is invalid.
CKR_DATA_LEN_RANGE	The provided signature/MAC can be seen to be invalid solely on the basis of its length.
CKR_FUNCTION_REJECTED	The signature request is rejected by the user.
CKR_OPERATION_NOT_INITIALIZED	There is no active operation of an appropriate type in the specified session.

C_SignUpdate

Continues a multiple-part signature operation.

```
CK_DEFINE_FUNCTION(CK_RV, C_SignUpdate)(
    CK_SESSION_HANDLE hSession,
    CK_BYTE_PTR pPart,
    CK_ULONG ulPartLen
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_BYTE_PTR pPart	Points to the data.
CK_ULONG ulPartLen	Length of data.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.
CKR_MECHANISM_PARAM_INVALID	Invalid parameters were supplied to the mechanism specified in the cryptographic operation.
CKR_OK	The function was executed successfully.
CKR_FUNCTION_CANCELED	The function was canceled in mid-execution.
CKR_KEY_FUNCTION_NOT_PERMITTED	An attempt has been made to use a key for a cryptographic purpose that the key's attributes are not set to allow it to do.
CKR_KEY_HANDLE_INVALID	The specified key handle is invalid.
CKR_KEY_SIZE_RANGE	The supplied key's size is outside the range of key sizes.
CKR_KEY_TYPE_INCONSISTENT	The specified key is not the correct type of key to use with the specified mechanism.

Return Values	Description
CKR_OPERATION_ACTIVE	There is already an active operation (or combination of active operations) which prevents Cryptoki from activating the specified operation.
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.
CKR_DATA_INVALID	The plaintext input data to a cryptographic operation is invalid.
CKR_DATA_LEN_RANGE	The provided signature/MAC can be seen to be invalid solely on the basis of its length.
CKR_FUNCTION_REJECTED	The signature request is rejected by the user.
CKR_OPERATION_NOT_INITIALIZED	There is no active operation of an appropriate type in the specified session.

C_SignFinal

Finishes a multiple-part signature operation.

```
CK_DEFINE_FUNCTION(CK_RV, C_SignFinal) (
    CK_SESSION_HANDLE hSession,
    CK_BYTE_PTR pSignature,
    CK_ULONG_PTR pulSignatureLen
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_BYTE_PTR pSignature	Pointer to buffer to receive the signed data.
CK_ULONG_PTR pulSignatureLen	Pointer to buffer length.

Output Parameters	Description
CK_BYTE_PTR pSignature	Pointer to buffer to receive the signed data.
CK_ULONG_PTR pulSignatureLen	Pointer to buffer length.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.
CKR_MECHANISM_PARAM_INVALID	Invalid parameters were supplied to the mechanism specified in the cryptographic operation.
CKR_OK	The function was executed successfully.
CKR_FUNCTION_CANCELED	The function was canceled in mid-execution.

Return Values	Description
CKR_KEY_FUNCTION_NOT_PERMITTED	An attempt has been made to use a key for a cryptographic purpose that the key's attributes are not set to allow it to do.
CKR_KEY_HANDLE_INVALID	The specified key handle is invalid.
CKR_KEY_SIZE_RANGE	The supplied key's size is outside the range of key sizes.
CKR_KEY_TYPE_INCONSISTENT	The specified key is not the correct type of key to use with the specified mechanism.
CKR_OPERATION_ACTIVE	There is already an active operation (or combination of active operations) which prevents Cryptoki from activating the specified operation.
CKR_PIN_EXPIRED	The specified PIN has expired, and the requested operation cannot be carried out.
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.
CKR_DATA_INVALID	The plaintext input data to a cryptographic operation is invalid.
CKR_DATA_LEN_RANGE	The provided signature/MAC can be seen to be invalid solely on the basis of its length.
CKR_FUNCTION_REJECTED	The signature request is rejected by the user.
CKR_OPERATION_NOT_INITIALIZED	There is no active operation of an appropriate type in the specified session.

C_VerifyInit

Initializes a verification operation.

```
CK_DEFINE_FUNCTION(CK_RV, C_VerifyInit)
(CK_SESSION_HANDLE hSession,
 CK_MECHANISM_PTR pMechanism,
 CK_OBJECT_HANDLE hKey);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_MECHANISM_PTR pMechanism	<p>The mechanism should have the following parameters: ;{ CKM_RSA_PKCS, NULL_PTR, 0 }</p> <p>Valid Mechanisms are:</p> <ul style="list-style-type: none"> > CKM_SHA224_HMAC > CKM_SHA256_HMAC > CKM_SHA384_HMAC > CKM_SHA512_HMAC > CKM_RSA_PKCS
hKey	Handle for the public key of the key pair or HMAC keys used for verification.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.
CKR_FUNCTION_FAILED	The requested function could not be performed.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.
CKR_KEY_FUNCTION_NOT_PERMITTED	An attempt has been made to use a key for a cryptographic purpose that the key's attributes are not set to allow it to do.
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_KEY_HANDLE_INVALID	The specified key handle is invalid.

Return Values	Description
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.

C_Verify

Performs a single-part verification operation. To perform verification, the signature is verified with the key's handle provided in `C_Verify_Init`.

If `C_Verify_Init` is called specifying the use of a header, the signature contains the key which is prepended when signed.

```
CK_DEFINE_FUNCTION(CK_RV, C_Verify)
(CK_SESSION_HANDLE hSession,
 CK_BYTE_PTR pData,
 CK_ULONG ulDataLen,
 CK_BYTE_PTR pSignature,
 CK_ULONG ulSignatureLen);
```

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_BYTE_PTR pData</code>	Pointer to data to be verified.
<code>CK_ULONG ulDataLen</code>	Length of data.
<code>CK_BYTE_PTR pSignature</code>	Pointer to buffer to receive the signed data.
<code>CK_ULONG ulSignatureLen</code>	Pointer to buffer length.

Output Parameters	Description
<code>CK_BYTE_PTR pSignature</code>	Pointer to buffer to receive the signed data.
<code>CK_ULONG ulSignatureLen</code>	Pointer to buffer length.

Return Values	Description
<code>CKR_OK</code>	The function was executed successfully.
<code>CKR_SIGNATURE_INVALID</code>	The provided signature/MAC is invalid.
<code>CKR_CRYPTOKI_NOT_INITIALIZED</code>	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
<code>CKR_SIGNATURE_LEN_RANGE</code>	The provided signature/MAC can be seen to be invalid solely on the basis of its length.

C_VerifyUpdate

Performs a multiple-part verification operation. To perform verification, the signature is verified with the key's handle provided in `C_Verify_Init`.

```
CK_DEFINE_FUNCTION(CK_RV, C_VerifyUp date)
(CK_SESSION_HANDLE hSession,
 CK_BYTE_PTR pPart,
 CK_ULONG ulPartLen);
```

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_BYTE_PTR pData</code>	Pointer to data to be verified.
<code>CK_ULONG ulPartLen</code>	Length of data.

Return Values	Description
<code>CKR_OK</code>	The function was executed successfully.
<code>CKR_SIGNATURE_INVALID</code>	The provided signature/MAC is invalid.
<code>CKR_CRYPTOKI_NOT_INITIALIZED</code>	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
<code>CKR_SIGNATURE_LEN_RANGE</code>	The provided signature/MAC can be seen to be invalid solely on the basis of its length.

C_VerifyFinal

Finishes a multi-part verification operation. To perform verification, the signature is verified with the key's handle provided in `C_Verify_Init` and compared with the data supplied by previous `C_VerifyUpdate` calls.

```
CK_DEFINE_FUNCTION(CK_RV, C_VerifyFinal)
(CK_SESSION_HANDLE hSession,
 CK_BYTE_PTR pSignature,
 CK_ULONG ulSignatureLen);
```

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_BYTE_PTR pSignature</code>	Pointer to buffer to receive the signed data.
<code>CK_ULONG ulSignatureLen</code>	Pointer to buffer length.

Output Parameters	Description
<code>CK_BYTE_PTR pSignature</code>	Pointer to buffer to receive the signed data.
<code>CK_ULONG ulSignatureLen</code>	Pointer to buffer length.

Return Values	Description
<code>CKR_OK</code>	The function was executed successfully.
<code>CKR_SIGNATURE_INVALID</code>	The provided signature/MAC is invalid.
<code>CKR_CRYPTOKI_NOT_INITIALIZED</code>	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
<code>CKR_SIGNATURE_LEN_RANGE</code>	The provided signature/MAC can be seen to be invalid solely on the basis of its length.

CHAPTER 8: Encryption Functions

This chapter describes the following encryption functions:

- > ["C_EncryptInit" on the next page](#)
- > ["C_Encrypt" on page 82](#)
- > ["C_EncryptUpdate" on page 84](#)
- > ["C_EncryptFinal" on page 86](#)

C_EncryptInit

Initializes an encryption operation. `C_EncryptInit` must be called before `C_Encrypt` or `C_EncryptUpdate` is called:

```
CK_DEFINE_FUNCTION(CK_RV, C_EncryptInit)(
    CK_SESSION_HANDLE hSession,
    CK_MECHANISM_PTR pMechanism,
    CK_OBJECT_HANDLE hKey
);
```

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_MECHANISM_PTR pMechanism</code>	<p>The pointer to the structure that specifies the encryption mechanism. The following mechanisms are supported:</p> <ul style="list-style-type: none"> • <code>CKM_AES_ECB</code> • <code>CKM_AES_CBC</code> • <code>CKM_AES_CBC_PAD</code> • <code>CKM_AES_CTR</code> • <code>CKM_THALES_FPE</code> (in Java, use: <code>0x80004001L</code>) • <code>CKM_THALES_FF1</code> (in Java, use: <code>0x80004002L</code>) • <code>CKM_RSA_PKCS</code> <p>For <code>CKM_THALES_FPE</code>, the IV contains the following field values:</p> <ul style="list-style-type: none"> • tweak (8 bytes) • character set: ASCII or Unicode characters. Supported Unicode encodings are: <ul style="list-style-type: none"> – UTF-8 – UTF-16 – UTF-32 – big-endian – little-endian byte order <p>NOTE Be sure there are no duplicate characters in the character set.</p> <ul style="list-style-type: none"> • radix (character set size) The size can be from 2 to 65535.
<code>CK_OBJECT_HANDLE hKey</code>	The handle to the encryption key to perform the encryption.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_FUNCTION_FAILED	The requested function could not be performed.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_KEY_FUNCTION_NOT_PERMITTED	An attempt has been made to use a key for a cryptographic purpose that the key's attributes are not set to allow it to do.
CKR_KEY_SIZE_RANGE	The supplied key's size is outside the range of key sizes.
CKR_KEY_HANDLE_INVALID	The specified key handle is invalid.
CKR_KEY_TYPE_INCONSISTENT	The specified key is not the correct type of key to use with the specified mechanism.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.
CKR_MECHANISM_PARAM_INVALID	Invalid parameters were supplied to the mechanism specified in the cryptographic operation.
CKR_OK	The function was executed successfully.
CKR_OPERATION_ACTIVE	There is already an active operation (or combination of active operations) which prevents Cryptoki from activating the specified operation.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.

C_Encrypt

Encrypts single-part data. Must call `C_EncryptInit` before calling `C_Encrypt`.

```
CK_DEFINE_FUNCTION(CK_RV, C_Encrypt)(
    CK_SESSION_HANDLE hSession,
    CK_BYTE_PTR pData,
    CK_ULONG ulDataLen,
    CK_BYTE_PTR pEncryptedData,
    CK_ULONG_PTR pulEncryptedDataLen
);
```

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_BYTE_PTR pData</code>	Pointer to data to be encrypted.
<code>CK_ULONG ulDataLen</code>	Length of the data (in bytes).
<code>CK_BYTE_PTR pEncryptedData</code>	Pointer of the buffer to put the data. > First call: Pointer to the metadata to be passed and logged on the application's behalf. Set the buffer length to zero (0) to get the ciphertext size. > Second call: Pointer to the resulting encrypted data; output parameter.
<code>CK_ULONG_PTR pulEncryptedDataLen</code>	Pointer of the encrypted buffer length. > First call: Pointer to encrypted buffer length. Encrypted buffer length is zero (0) for metadata logging. > Second call: actual buffer length used for encrypted data, written encrypted data length.

Output Parameters	Description
<code>CK_BYTE_PTR pEncryptedData</code>	Pointer to the encrypted data.
<code>CK_ULONG_PTR pulEncryptedDataLen</code>	Buffer length used for the encrypted data.

Return Values	Description
<code>CKR_OK</code>	The function was executed successfully.
<code>CKR_ARGUMENTS_BAD</code>	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.

Return Values	Description
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_DATA_INVALID	The plaintext input data to a cryptographic operation is invalid.
CKR_DATA_LEN_RANGE	The plaintext input data to a cryptographic operation has a bad length.
CKR_FUNCTION_FAILED	The requested function could not be performed.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OPERATION_NOT_INITIALIZED	There is no active operation of an appropriate type in the specified session.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_PIN_INVALID	The specified PIN has invalid characters in it.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.

C_EncryptUpdate

Continues a multiple-part encryption operation by processing another data part.

```
CK_DEFINE_FUNCTION(CK_RV, C_EncryptUpdate) (
    CK_SESSION_HANDLE    hSession,
    CK_BYTE_PTR          pPart,
    CK_ULONG             ulPartLen,
    CK_BYTE_PTR          pEncryptedPart,
    CK_ULONG_PTR         pulEncryptedPartLen
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_BYTE_PTR pData	Pointer to data to be encrypted.
CK_ULONG ulPartLen	Length of the data.
CK_BYTE_PTR pEncryptedPart	Pointer of the buffer to put the data. > First call: Pointer to the metadata to be passed and logged on the application's behalf. > Second call: Pointer to the resulting encrypted data; output parameter.
CK_ULONG_PTR pulEncryptedPartLen	Pointer of the encrypted buffer length. > First call: Pointer to encrypted buffer length. Encrypted buffer length is zero (0) for metadata logging. > Second call: Actual buffer length used for encrypted data, written encrypted data length.

Output Parameters	Description
CK_BYTE_PTR pEncryptedData	Pointer to the resulting encrypted data.
CK_ULONG_PTR pulEncryptedDataLen	Buffer length used for the encrypted data.

Return Values	Description
CKR_OK	The function was executed successfully.
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.

Return Values	Description
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_DATA_INVALID	The plaintext input data to a cryptographic operation is invalid.
CKR_DATA_LEN_RANGE	The plaintext input data to a cryptographic operation has a bad length.
CKR_FUNCTION_CANCELED	The function was canceled in mid-execution.

C_EncryptFinal

Finishes a multi-part encryption.

```
CK_DEFINE_FUNCTION(CK_RV, C_EncryptFinal) (
    CK_SESSION_HANDLE    hSession,
    CK_BYTE_PTR          pLastEncryptedPart,
    CK_ULONG_PTR         pulEncryptedPartLen
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_BYTE_PTR pLastEncryptedPart	Pointer to any remaining data to be encrypted. <ul style="list-style-type: none"> > First call: Pointer to the metadata to be passed and logged on the application's behalf. > Second call: Pointer to the resulting encrypted data; output parameter.
CK_ULONG_PTR pulLastEncryptedPartLen	Pointer of the encrypted buffer length. <ul style="list-style-type: none"> > First call: Pointer to encrypted buffer length. Encrypted buffer length is zero (0) for metadata logging. > Second call: Actual buffer length used for encrypted data, written encrypted data length.

Output Parameters	Description
CK_BYTE_PTR pLastEncryptedPart	Pointer to the encrypted data.
CK_ULONG_PTR pulEncryptedPartLen	Pointer to the buffer used for the encrypted data.

Return Values	Description
CKR_OK	The function was executed successfully.
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to C_Initialize.

Return Values	Description
CKR_DATA_INVALID	The plaintext input data to a cryptographic operation is invalid.
CKR_DATA_LEN_RANGE	The plaintext input data to a cryptographic operation has a bad length.
CKR_FUNCTION_CANCELED	The function was canceled in mid-execution.

CHAPTER 9: Decryption Functions

This chapter describes the following decryption functions:

- > ["C_DecryptInit" on the next page](#)
- > ["C_Decrypt" on page 92](#)
- > ["C_DecryptUpdate" on page 94](#)
- > ["C_DecryptFinal" on page 96](#)

C_DecryptInit

Initializes a decryption option. `C_DecryptInit` must be called before `C_Decrypt` or `C_DecryptUpdate`.

```
CK_DEFINE_FUNCTION(CK_RV, C_DecryptInit) (
    CK_SESSION_HANDLE    hSession,
    CK_MECHANISM_PTR     pMechanism,
    CK_OBJECT_HANDLE     hKey
);
```

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_MECHANISM_PTR pMechanism</code>	<p>Pointer to the mechanism for decryption. Must match the mechanism used to encrypt, including the correct IV, if using <code>CKM_AES_CBC</code> or <code>CKM_AES_CBC_PAD</code>, or the correct nonce and counter concatenated, if using <code>CKM_AES_CTR</code>.</p> <p>The following mechanisms are supported:</p> <ul style="list-style-type: none"> • <code>CKM_AES_ECB</code> • <code>CKM_AES_CBC</code> • <code>CKM_AES_CBC_PAD</code> • <code>CKM_AES_CTR</code> • <code>CKM_THALES_FPE</code> (in Java, use: <code>0x80004001L</code>) • <code>CKM_THALES_FF1</code> (in Java, use: <code>0x80004002L</code>) • <code>CKM_RSA_PKCS</code> <p>For <code>CKM_THALES_FPE</code>, the IV contains the following field values:</p> <ul style="list-style-type: none"> • tweak (8 bytes) • character set. ASCII characters (0-127) • radix (character set size). For more information, see the CADP for C PKCS11 code samples. <p>For <code>CKM_THALES_FF1</code>, the IV contains the same field values, except that the tweak is not a fixed size: it can range from 0 to 32 bytes.</p> <div> NOTE Be sure there are no duplicate characters in the character set. </div>
<code>CK_OBJECT_HANDLE hKey</code>	Handle of the decryption key; (same as encryption key for symmetric encryption).

Return Values	Description
<code>CKR_OK</code>	The function was executed successfully.

Return Values	Description
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_DATA_INVALID	The plaintext input data to a cryptographic operation is invalid.
CKR_DATA_LEN_RANGE	The plaintext input data to a cryptographic operation has a bad length.
CKR_FUNCTION_CANCELED	The function was canceled in mid-execution.
CKR_FUNCTION_FAILED	The requested function could not be performed.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_KEY_FUNCTION_NOT_PERMITTED	An attempt has been made to use a key for a cryptographic purpose that the key's attributes are not set to allow it to do.
CKR_KEY_HANDLE_INVALID	The specified key handle is invalid.
CKR_KEY_SIZE_RANGE	The supplied key's size is outside the range of key sizes.
CKR_KEY_TYPE_INCONSISTENT	The specified key is not the correct type of key to use with the specified mechanism.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.
CKR_MECHANISM_PARAM_INVALID	Invalid parameters were supplied to the mechanism specified in the cryptographic operation.
CKR_OPERATION_ACTIVE	There is already an active operation (or combination of active operations) which prevents Cryptoki from activating the specified operation.
CKR_PIN_EXPIRED	The specified PIN has expired, and the requested operation cannot be carried out.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.

Return Values	Description
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.

C_Decrypt

Decrypts encrypted data in a single part. The operation must have been initialized by a prior call to `C_DecryptInit`.

```
CK_DEFINE_FUNCTION(CK_RV, C_Decrypt)(
    CK_SESSION_HANDLE    hSession,
    CK_BYTE_PTR          pEncryptedData,
    CK_ULONG              ulEncryptedDataLen,
    CK_BYTE_PTR          pData,
    CK_ULONG_PTR          pulDataLen
);
```

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_BYTE_PTR pEncryptedData</code>	Pointer to the encrypted data to be decrypted.
<code>CK_ULONG ulEncryptedDataLen</code>	Length of the encrypted data to be decrypted.
<code>CK_BYTE_PTR pData</code>	Pointer of the buffer for the decrypted text. > First call: Pointer to the metadata to be passed and logged on the application's behalf. > Second call: Pointer to the resulting decrypted data; output parameter.
<code>CK_ULONG_PTR pulDataLen</code>	Pointer to the length of the buffer for the decrypted text. > First call: Pointer to decrypted buffer length. First call buffer length is zero (0) for metadata logging. > Second call: actual buffer length used for decrypted data, length of written plaintext.

Output Parameters	Description
<code>pData</code>	When input parameter <code>pData</code> is <code>NULL</code> , this function returns a calculated output buffer length value pointed to by <code>pulDataLen</code> .

Return Values	Description
<code>CKR_OK</code>	The function was executed successfully.
<code>CKR_ARGUMENTS_BAD</code>	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
<code>CKR_BUFFER_TOO_SMALL</code>	The output of the function is too large to fit in the supplied buffer.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_DATA_INVALID	The plaintext input data to a cryptographic operation is invalid.
CKR_DATA_LEN_RANGE	The plaintext input data to a cryptographic operation has a bad length.
CKR_FUNCTION_CANCELED	The function was canceled in mid-execution.
CKR_FUNCTION_FAILED	The requested function could not be performed.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OPERATION_NOT_INITIALIZED	There is no active operation of an appropriate type in the specified session.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.

C_DecryptUpdate

Decrypts multi-part encrypted data. The operation must have been initialized by a prior call to `C_DecryptInit`.

```
CK_DEFINE_FUNCTION(CK_RV, C_DecryptUpdate) (
    CK_SESSION_HANDLE    hSession,
    CK_BYTE_PTR          pEncryptedPart,
    CK_ULONG              ulEncryptedPartLen,
    CK_BYTE_PTR          pPart,
    CK_ULONG_PTR          pulPartLen
);
```

Input Parameters	Description
<code>CK_SESSION_HANDLE hSession</code>	Session handle.
<code>CK_BYTE_PTR pEncryptedData</code>	Pointer to the encrypted data to be decrypted.
<code>CK_ULONG ulEncryptedDataLen</code>	Length of the encrypted data to be decrypted.
<code>CK_BYTE_PTR pData</code>	Pointer of the buffer for the decrypted text. > First call: Null pointer to be passed. > Second call: Pointer to the resulting encrypted data; output parameter.
<code>CK_ULONG_PTR pulDataLen</code>	Pointer to the length of the buffer for the decrypted text. > First call: Pointer to buffer length. <code>pulDataLen</code> first call is set to zero (0) for calculating the output buffer size. > Second call: Actual buffer length used for encrypted data, length of written encrypted data length.

Output Parameters	Description
<code>pData</code>	When input parameter <code>pData</code> is <code>NULL</code> , this function returns a calculated output buffer length value pointed to by <code>pulDataLen</code> .

Return Values	Description
<code>CKR_OK</code>	The function was executed successfully.
<code>CKR_ARGUMENTS_BAD</code>	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
<code>CKR_BUFFER_TOO_SMALL</code>	The output of the function is too large to fit in the supplied buffer.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_DATA_INVALID	The plaintext input data to a cryptographic operation is invalid.
CKR_DATA_LEN_RANGE	The plaintext input data to a cryptographic operation has a bad length.
CKR_FUNCTION_CANCELED	The function was canceled in mid-execution.
CKR_FUNCTION_FAILED	The requested function could not be performed.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OPERATION_NOT_INITIALIZED	There is no active operation of an appropriate type in the specified session.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.
CKR_USER_NOT_LOGGED_IN	The desired action cannot be performed because the appropriate user (or an appropriate user) is not logged in.
CKR_MECHANISM_INVALID	An invalid mechanism was specified in the cryptographic operation.

C_DecryptFinal

Finishes a multi-part decryption. This works only with the local key cache.

```
CK_DEFINE_FUNCTION(CK_RV, C_DecryptFinal) (
    CK_SESSION_HANDLE    hSession,
    CK_BYTE_PTR          pLastPart,
    CK_ULONG_PTR          pullLastPartLen
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_BYTE_PTR pLastPart	Pointer to a buffer to write the decrypted data. > First call: Pointer to the metadata to be passed and logged on the application's behalf. > Second call: Pointer to the resulting decrypted data; output parameter.
CK_ULONG_PTR pullLastPartLen	Buffer length pointer. > First call: Pointer to decrypted buffer length. pullLastPartLen first call is set to zero (0) for calculating the output buffer size. > Second call: Actual buffer length used for decrypted data, length of written encrypted data length.

Output Parameters	Description
pLastPart	To be filled in with the decrypted text.
pullLastPartLen	To be filled in with the length of the decrypted text.
pLastPart	When input parameter pLastPart is NULL, this function returns a calculated output buffer length value pointed to by pullLastPartLen.

Return Values	Description
CKR_OK	The function was executed successfully.
CKR_ARGUMENTS_BAD	Generic error code which indicates that the arguments supplied to the Cryptoki function are invalid.
CKR_BUFFER_TOO_SMALL	The output of the function is too large to fit in the supplied buffer.

Return Values	Description
CKR_CRYPTOKI_NOT_INITIALIZED	The function could not be executed because the Cryptoki library has not yet been initialized by a call to <code>C_Initialize</code> .
CKR_DATA_INVALID	The plaintext input data to a cryptographic operation is invalid.
CKR_DATA_LEN_RANGE	The plaintext input data to a cryptographic operation has a bad length.
CKR_FUNCTION_CANCELED	The function was canceled in mid-execution.
CKR_FUNCTION_FAILED	The requested function could not be performed.
CKR_GENERAL_ERROR	An unrecoverable error occurred.
CKR_HOST_MEMORY	There is insufficient memory to perform the requested function.
CKR_OPERATION_NOT_INITIALIZED	There is no active operation of an appropriate type in the specified session.
CKR_SESSION_CLOSED	The session was closed during the execution of the function.
CKR_SESSION_HANDLE_INVALID	The specified session handle was invalid at the time that the function was invoked.

CHAPTER 10: Random Data Generation

This chapter describes the following random data generation function:

> ["C_GenerateRandom" on the next page](#)

C_GenerateRandom

Use this function to generate and return random data.

NOTE C_GenerateRandom is supported only in remote cryptographic mode.

```
CK_RV C_GenerateRandom (
    CK_SESSION_HANDLE hSession,
    CK_BYTE_PTR pRandomData,
    CK_ULONG ulRandomLen
);
```

Input Parameters	Description
CK_SESSION_HANDLE hSession	Session handle.
CK_BYTE_PTR pRandomData	Pointer to empty buffer for receiving the random data.
CK_ULONG ulRandomLen	The number of bytes to generate.

Output Parameters	Description
RandomResult	A randomized token is returned.

APPENDIX A: Mapping of VAE Compatibility Mode and CipherTrust Mode APIs

This appendix covers the differences between the PKCS11 APIs of the VAE Compatibility Mode and the CipherTrust Mode.

The VAE binary compatibility mode enables backward compatibility with the VAE library. The newer PKCS11 functionality is available from CipherTrust Mode.

This appendix covers the following sections:

- > ["APIs with Differences" below](#)
- > ["APIs with No Differences" on the next page](#)

APIs with Differences

Function Name	VAE Compatibility Mode	CipherTrust Mode
<code>C_Login</code>	Login with PIN is configured in VAE Compatibility Mode (formerly called VAE mode). Ability to log in using the following: >PIN >PIN:Username:Password	Ability to log in using the following: > Username/password > Certificate > anonymous (global)
<code>C_CreateObject</code>	CKA_EXTRACTABLE and CKA_MODIFIABLE are set to false by default.	The CipherTrust Mode supports the following Custom Template Attributes: > CKA_THALES_CUSTOM_1 > CKA_THALES_CUSTOM_2 > CKA_THALES_CUSTOM_3 > CKA_THALES_CUSTOM_4 > CKA_THALES_CUSTOM_5
<code>C_EncryptInit</code>	RSA DPM header is not supported.	Added CKM_AES_CTR. From CipherTrust Mode, the Ingrian 3-byte headers are prefixed with Ciphertext for cryptographic operations with the versioned key.

Function Name	VAE Compatibility Mode	CipherTrust Mode
<code>C_DecryptInit</code>	RSA DPM header is not supported.	Added <code>CKM_AES_CTR</code> . From CipherTrust Mode, the Ingrian 3-byte headers are prefixed with Ciphertext for cryptographic operations with the versioned key.
<code>C_GenerateKey</code>	<code>CKA_EXTRACTABLE</code> and <code>CKA_MODIFIABLE</code> are set to true by default.	<code>CKA_EXTRACTABLE</code> and <code>CKA_MODIFIABLE</code> are set to false by default.
<code>C_GenerateKeyPair</code>	<code>CKA_EXTRACTABLE</code> and <code>CKA_MODIFIABLE</code> are set to true by default.	<code>CKA_EXTRACTABLE</code> and <code>CKA_MODIFIABLE</code> are set to false by default.
<code>C_WrapKey</code>	Available using <code>CKM_AES_CBC</code> and <code>CKM_AES_CBC_PAD</code> . Includes the ability to get key material with wrapping key handle set to 0.	Available using <code>CKM_AES_CBC</code> and <code>CKM_AES_CBC_PAD</code> .
<code>C_UnWrapKey</code>	A null wrapping key handle returns key material as plaintext.	A null wrapping key handle returns error.
<code>C_SeedRandom</code>	Not Implemented. However, this function returns <code>SUCCESS</code> .	Not Implemented. This function returns <code>CKR_FUNCTION_NOT_SUPPORTED</code> .

APIs with No Differences

The following list of PKCS11 APIs and their functions behave similarly for both VAE Compatibility Mode and CipherTrust Mode:

- `C_Initialize`
- `C_Finalize`
- `C_GetInfo`
- `C_GetFunctionList`
- `C_GetSlotInfo`
- `C_GetTokenInfo`
- `C_GetMechanismList`
- `C_GetMechanismInfo`
- `C_OpenSession`
- `C_CloseSession`

- [C_CloseAllSessions](#)
- [C_Logout](#)
- [C_SetAttributeValue](#)
- [C_DestroyObject](#)
- [C_FindObjectsInit](#)
- [C_FindObjectsFinal](#)
- [C_Encrypt](#)
- [C_EncryptUpdate](#)
- [C_EncryptFinal](#)
- [C_Decrypt](#)
- [C_DecryptUpdate](#)
- [C_DecryptFinal](#)
- [C_DigestInit](#)
- [C_Digest](#)
- [C_DigestUpdate](#)
- [C_DigestFinal](#)
- [C_SignInit](#)
- [C_Sign](#)
- [C_VerifyInit](#)
- [C_Verify](#)
- [C_GenerateRandom](#)