

Luna HSM Client 10.2 for SafeNet Luna Network HSM PARTITION ADMINISTRATION GUIDE



Document Information

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Europe

This product is in conformity with the protection requirements of EC Council Directive 2014/30/EU. This product satisfies the CLASS B limits of EN55032.

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PREFACE: About the Partition Administration Guide

This document describes the operational and administrative tasks you can perform to maintain the functionality and efficiency of your application partitions. It contains the following chapters:

- > "Key Cloning" on page 13
- > "PED Authentication" on page 22
- > "Initializing an Application Partition" on page 93
- > "Partition Capabilities and Policies" on page 95
- > "Partition Roles" on page 110
- > "Migrating Keys to Your New HSM" on page 124
- > "High-Availability Groups" on page 149
- > "Backup and Restore Using a G5-Based Backup HSM" on page 180
- > "Backup and Restore Using a G7-Based Backup HSM" on page 203
- > "Configuring a G5 Remote Backup HSM Server" on page 200
- > "Slot Numbering and Behavior" on page 224

The preface includes the following information about this document:

- > "Customer Release Notes" below
- > "Audience" below
- > "Document Conventions" on the next page
- > "Support Contacts" on page 12

For information regarding the document status and revision history, see "Document Information" on page 2.

Customer Release Notes

The customer release notes (CRN) provide important information about this release that is not included in the customer documentation. Read the CRN to fully understand the capabilities, limitations, and known issues for this release. You can view or download the latest version of the CRN from the Technical Support Customer Portal at <https://supportportal.thalesgroup.com>.

Audience

This document is intended for personnel responsible for maintaining your organization's security infrastructure. This includes SafeNet Luna HSM users and security officers, key manager administrators, and network administrators.

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 security concepts.

Document Conventions

This document uses standard conventions for describing the user interface and for alerting you to important information.

Notes

Notes are used to alert you to important or helpful information. They use the following format:

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. They use the following format:

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. They use the following format:

****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.

Command syntax and typeface conventions

| 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 (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. |

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: Key Cloning

You can clone key material between partitions to back up the keys, or to migrate the keys from one HSM to another. The rules, prerequisites, and procedures for migrating your key material are described in the following topics:

- > ["Domain Planning" below](#)
- > ["Cloning Objects to Another Application Partition" on page 16](#)
- > ["Cloning Keys Between Luna 6, Luna 7, and HSM on Demand" on page 17](#)

Overview and Key Concepts

A Crypto Officer can clone the cryptographic objects (keys) from one user partition to another user partition provided that:

- > The user partitions share the same domain. See ["Domain Planning" below](#).
- > The user partitions use the same authentication method (PED or password).
- > The CO has the required credentials on both user partitions.
- > The capabilities and policies set on the source and target HSM and user partitions allow cloning. See [HSM Capabilities and Policies](#) and ["Partition Capabilities and Policies" on page 95](#).

Domain Planning

The cloning or security domain is an element of ["Layered Encryption" on page 1](#).

What is a security domain or cloning domain?

A security domain or cloning domain is a layer of encryption that is created, during initialization, on an HSM or HSM partition that you control. The domain determines whether a crypto object can leave the HSM, and where it can go if it is allowed to leave.

Cloning is a secure-copy operation by which sensitive HSM objects are copied, while strongly encrypted, from one HSM to another HSM. The security domain, or cloning domain, is a special-purpose secret that is attached to a partition on an HSM. It determines *to* which, and *from* which, other partitions (on the same HSM or on other HSMs) the current partition can clone objects. Partitions that send or receive partition objects by means of the cloning protocol must share identical cloning domain secrets. That is, the protocol verifies that the destination domain matches the source domain; otherwise an error is displayed and the attempted operation fails. This is important for:

- > Cloning in backup and restore operations, and
- > Synchronization in HA groups.

Only one domain per partition - no copying across domains

An application partition can have one cloning domain. It is not possible to clone objects from two or more different cloning domains to a single partition. By design, there is no provision to change the cloning domain of a partition without initializing it, which destroys any objects in that partition.

No common domains across Password-authenticated and PED-authenticated HSMs

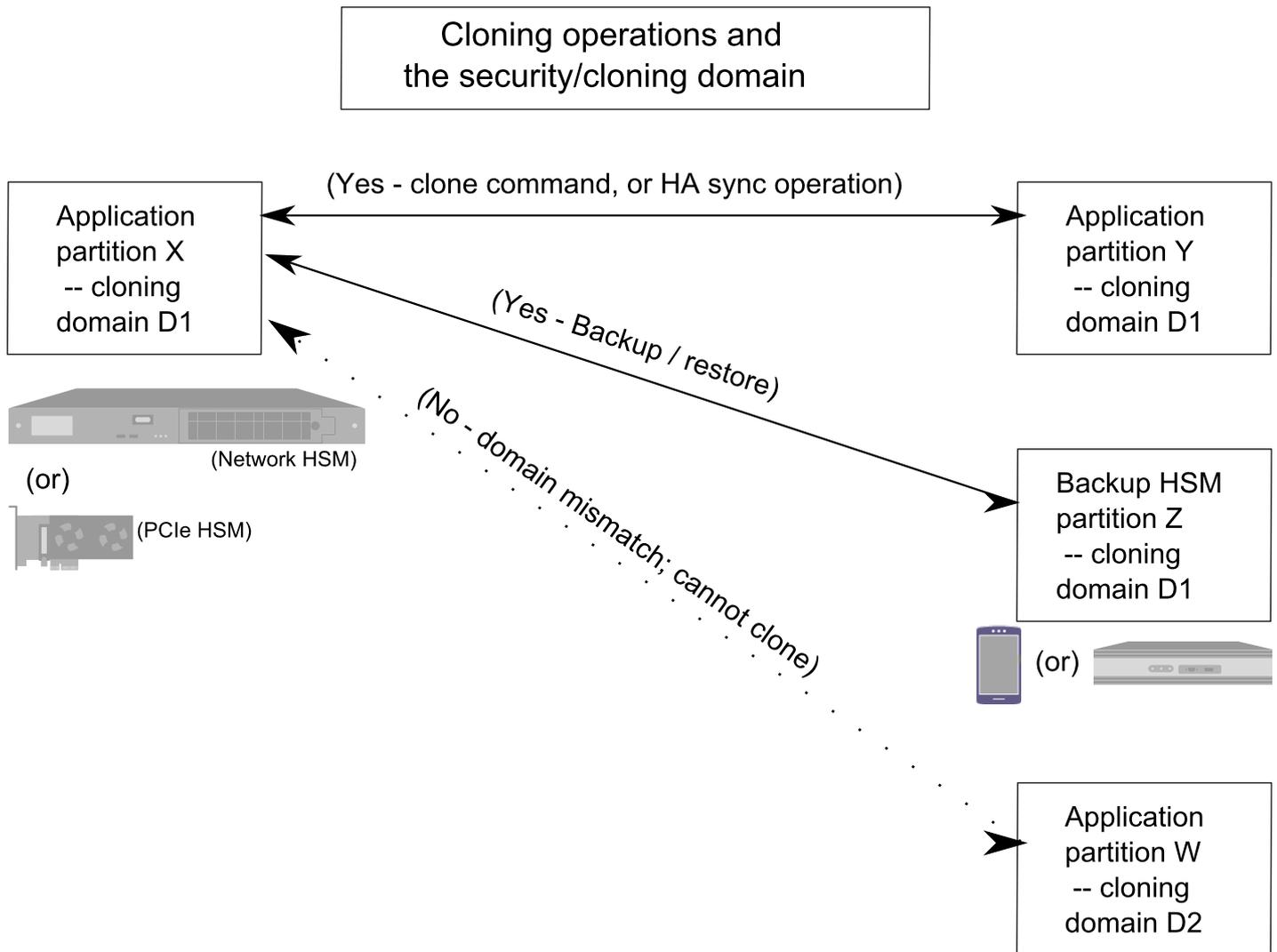
Password authenticated application partitions, with identical security domains, can clone partition contents one to the other, if the HSM type supports cloning.

Multi-factor authenticated (PED authenticated) application partitions, with identical security domains, can clone partition contents one to the other, if the HSM type supports cloning.

But password authenticated HSM partitions cannot perform cloning with PED-authenticated HSM partitions.

The security design consideration is that, if you have a key or object stored in a multi-factor-authenticated (PED-authenticated) partition:

- > It cannot be altered to a less-secure state and moved outside the protection of its original security/cloning domain.
- > You are assured that the key or object has never been outside its original security/cloning domain, or in any less-secure state.



Characteristics of Cloning Domains

Password authenticated HSMs have text-string cloning domains for the HSM admin partition and for any partitions that are created on the HSM. HSM and Partition domains are typed at the command line of the host computer, when required. Password authentication cloning domains are created by you.

PED authenticated cloning domains are created by a SafeNet Luna HSM, which could be the current HSM, or it could be a previously initialized HSM that you wish to include in a cloning group with the current HSM. PED authenticated HSMs have cloning domains in the form of encrypted secrets on red PED keys, for the admin partition and for any partitions that are created on the HSM.

The following characteristics are common to security (cloning) domains on all SafeNet Luna HSMs.

- > The unique admin partition security domain can be created in the HSM at initialization time, or it can be imported, meaning that it is shared with one-or-more other HSMs.
- > The application partition security domain can be created by the current HSM when the partition is initialized, or it can be imported, meaning that it is shared with one-or-more other HSM partitions, and therefore direct

cloning, backup/restore, and HA sync operations can be performed among the partitions that share a given domain.

- > The application partition security domain is usually distinct from the HSM domain, as they are controlled by different people; on multi-partition HSMs, the PSO is usually not the same person as the HSM SO, but on a single-partition HSM the two SOs might be the same person.
- > The application partition security domain can be the same as the domain of another partition on the same HSM (for HSMs that support multiple partitions).

For PED authenticated HSMs, the domain secret for the admin partition or for an application partition can be a single red PED key, or it can be split (by the MofN quorum feature) over several red keys, which are then distributed among trusted personnel such that no single person is able to provide the cloning domain without oversight from other trusted personnel.

In scenarios where multiple HSM partitions are in use, it can be useful to segregate those partitions according to department or business unit, or according to function groups within your organization. This ensures that personnel in a given group are able to clone or backup/restore only the contents of partitions sharing the domain for which they are responsible. The segregation is maintained by physical and procedural control of the relevant PED keys that each group is allowed to handle.

For Password authenticated HSMs, that sort of segregation is maintained entirely by procedure and by trust, as you rely on personnel not to share the domain text strings, just as you rely on them not to share other passwords.

Have your naming conventions and allotments planned out ahead of HSM initialization and partition creation, including a well-thought-out map of who should control cloning domain access for admin partitions and for application partitions. These decisions must be made before you create the partitions.

Cloning Objects to Another Application Partition

You can back up partition objects from an application partition to any other partition that shares its cloning domain. The Crypto Officer of both partitions can perform this operation using LunaCM.

Prerequisites

- > **Partition policy 0: Allow private key cloning** must be set to **1 (ON)** on both the source and target partitions.
- > The target partition must be initialized with the same cloning domain as the source partition.
- > You require the Crypto Officer credential for both the source and the target partition.
- > Both partitions must be visible as slots in LunaCM.
- > [Remote PED] This procedure is simpler when both partitions are activated (see "[Activation and Auto-activation on Multi-factor- \(PED-\) Authenticated Partitions](#)" on page 114). If the partitions are not activated, you must connect the source partition to PEDserver before logging in, disconnect it, and then connect the target partition to PEDserver by specifying its slot.

```
lunacm:> ped connect [-ip <IP>] [-port <port>]
```

```
lunacm:> ped disconnect
```

```
lunacm:> ped connect -slot <target_slot> [-ip <IP>] [-port <port>]
```

To clone partition objects to another application partition

1. In LunaCM, set the active slot to the source partition and log in as Crypto Officer.

```
lunacm:> slot set -slot <slotnum>
```

```
lunacm:> role login -name co
```

2. [Optional] View the partition objects and their object handles.

```
lunacm:> partition contents
```

3. Clone objects on the partition to the target partition by specifying the target slot. You can choose which objects to clone by specifying a comma-separated list of object handles, or specify **all** to clone all objects on the partition. Present the target partition's Crypto Officer credential when prompted.

```
lunacm:> partition clone -slot <slotnum> -objects <comma-separated_list/all>
```

The specified objects are cloned to the target partition. Any objects that already exist on the target are not cloned.

Cloning Keys Between Luna 6, Luna 7, and HSM on Demand

Luna HSM Client allows you to clone keys between Luna 6 partitions, Luna 7 partitions, and SafeNet Data Protection on Demand (DPoD)'s HSM on Demand services. This includes creating HA groups made up of different HSM versions. This configuration is useful for:

- > migrating your keys directly from Luna 6 to your new Luna 7 HSMs
- > migrating your keys from SafeNet Luna Network HSM to the cloud, or vice-versa
- > gradually upgrading your on-premises production environment from Luna 6 to Luna 7 HSMs
- > maintaining a real-time, cloud-based backup of your cryptographic objects

This page contains guidelines and general considerations for cloning keys between the different HSMs, or using mixed-version HA groups. Mixed-version HA groups have all the same requirements of standard HA groups (see "[Planning Your HA Group Deployment](#)" on page 158), in addition to the considerations listed below.

- > ["Luna/HSMoD Cloning" below](#)
- > ["Supported Software/Firmware Versions" on the next page](#)
- > ["Mismatched Partition Policies and FIPS Mode" on page 19](#)
- > ["Mismatched Key Types/Cryptographic Mechanisms" on page 19](#)
- > ["Minimum Key Sizes" on page 19](#)
- > ["SafeXcel 1746 Co-Processor" on page 20](#)
- > ["RSA-186 Key Remapping for FIPS Compliance" on page 20](#)
- > ["HA Performance Optimization" on page 20](#)

Luna/HSMoD Cloning

Cloning between Luna partitions and HSMoD services require the following special considerations, in addition to the general considerations below.

NOTE This feature requires minimum client version 10.1. See [Version Dependencies by Feature](#) for more information.

Authentication

HSMoD services use password authentication, and therefore they can clone objects to and from password-authenticated SafeNet Luna Network HSMs only. It is not possible to clone keys between an HSMoD service and a PED-authenticated Luna HSM.

Network Latency and HSMoD as Active HA Member

Requests performed by cloud services like HSMoD may experience greater network latency than those sent to on-premise HSMs. Thales Group recommends using a HSMoD service as a standby HA member to achieve the best performance. By default, you can add an HSMoD service as a standby HA member only. If all other HA members fail and the HSMoD service becomes active, it will revert to standby when another member recovers.

If you prefer to use HSMoD as an active HA member, you must first edit the following toggle in the **Chrystoki.conf/crystoki.ini** configuration file (see [Configuration File Summary](#)):

```
[Toggles]
lunacm_cv_ha_ui = 0
```

Cloning Capacity Limitations

The following limitations apply to clients accessing a HSMoD service:

- > 100 token objects (or 50 RSA-2048 key pairs) per service.
- > 100 session objects (or 50 RSA-2048 key pairs) per application.
- > 100 simultaneous sessions per application.

Clients which exceed the token object and session object limits can experience slow or failed request responses. The session limit is enforced, and the client receives the error `CKR_MAX_SESSION_COUNT` when the application reaches the limit.

If you exceed the recommended maximum number of objects cloned to/from an HSMoD service in a single cloning operation, the operation sometimes fails with `CKR_DEVICE_ERROR`. In the case of HA groups, this could include key creation operations, since objects are then cloned to the HSMoD service.

Supported Software/Firmware Versions

Thales Group supports cloning between Luna 6/7 partitions and HSMoD services using combinations of appliance software/firmware as outlined in the table below.

| Client Software | Luna Appliance Software | Luna HSM Firmware |
|--|-------------------------|-------------------|
| HSMoD with Luna 6/7: 10.1 or higher Luna 6/7: 7.2 or higher | 6.2.1 or higher | 6.10.9 or higher |

Mismatched Partition Policies and FIPS Mode

Partitions in an HA group, and the HSMs on which they reside, must be configured with the same policy settings (see "[HSM and Partition Prerequisites](#)" on page 158). For example, Luna 6 HSMs have certain policies that have been removed from Luna 7 and HSMoD, and new policies have been introduced.

Ensure that policies common to Luna 6/7/HSMoD members have the same settings, according to your deployment requirements.

lunacm:> [partition showpolicies](#)

CAUTION! In particular, FIPS mode must be consistent across all HA members (on or off).

Mismatched Key Types/Cryptographic Mechanisms

Cloning is limited to key types that are recognized by the firmware on both HSMs. If an HSM does not recognize the type of key being cloned to it, the cloning operation may fail. Ensure that the firmware on the destination HSM is capable of recognizing all cryptographic objects stored on the source HSM.

NOTE SafeNet HSMs comply closely with the relevant FIPS standards and their generally accepted interpretations. These are moving targets, as the crypto and security climate continues to evolve. It is possible for a validated HSM version (firmware) to be fully compliant when its NIST certificate is issued, and for same-model HSMs with newer firmware and more stringent restrictions to refuse to accept "less secure" objects.

Alternatively, the more up-to-date HSM might accept an object from an earlier-firmware HSM, but permit only limited uses of such an object. This can affect the operation of HA groups, and other situations, where applications attempt operations against old keys, or with the use of antiquated mechanisms.

If you are cloning between HSMs operating in FIPS mode, please consult [Supported Mechanisms](#) for the destination HSM's version to determine if all key types can be cloned.

Mixed-version HA groups are limited to functions that are common to all member partitions. Mechanisms are added to/removed from new firmware releases, to provide new functionality and fix vulnerabilities. Operations assigned by load-balancing to a member lacking the correct mechanism will fail. Keys created on one member may fail to replicate to the other group members.

Ensure that your applications use only mechanisms that are available on all HA group members. Use LunaCM to see a list of mechanisms available on each partition/service.

lunacm:> [partition showmechanism](#)

Minimum Key Sizes

Minimum key sizes are enforced when using certain cryptographic algorithms. These minimums may differ between versions. If a Luna 6 partition creates a key that is smaller than the minimum size required by Luna 7 or HSMoD, the key will not be replicated to the other partitions in the HA group.

NOTE Minimum key sizes for many mechanisms are larger in FIPS mode, and FIPS minimums may vary among firmware releases.

To avoid this, use LunaCM to check a mechanism's minimum key size. Check the same mechanism on each HA member slot, and always use the highest minimum reported in the HA group.

```
lunacm:> partition showmechanism -m <mechanism_ID>
```

SafeXcel 1746 Co-Processor

Luna 6 HSMs include the SafeXcel 1746 security co-processor, which is used to offload packet processing and cryptographic computations from the host processor. Applications using this co-processor are not compatible with mixed-version HA groups.

The co-processor is not enabled by default. If you have previously enabled it on your Luna 6 HSMs, you can disable it by editing the **Chrystoki.conf/crystoki.ini** configuration file as follows:

```
[Misc]
PE1746Enabled=0
```

RSA-186 Key Remapping for FIPS Compliance

Under FIPS 186-3/4, the only RSA methods permitted for generating keys are 186-3 with primes and 186-3 with aux primes. RSA PKCS and X9.31 key generation is not approved in a FIPS-compliant HSM. While Luna 6.10.9 firmware allows these older mechanisms, later firmware does not (and keys created using these mechanisms cannot be replicated to Luna 7 HSMs or HSMoD services).

If you have older applications that use RSA PKCS and X9.31 key generation, you can remap these calls to use the newer, secure mechanisms. Add a line to the **Chrystoki.conf/crystoki.ini** configuration file as follows:

```
[Misc]
RSAKeyGenMechRemap=1
```

NOTE This setting is intended for older applications that call outdated mechanisms, to redirect calls to FIPS-approved mechanisms. The ideal solution is to update your applications to call the approved mechanisms.

This remapping is automatic if you are using Luna HSM Client 10.1 or newer, and the configuration file entry is ignored.

HA Performance Optimization

SafeNet Luna Network HSM 7 provides significant (10x) performance improvements over Luna 6 HSMs. In a mixed-version HA group, operations assigned to Luna 6 member partitions will take longer than those assigned to Luna 7 members. The HA logic does not compensate for these performance differences, and schedules operations on the partition with the shortest queue. Since Luna 7 partitions complete operations more quickly, they will naturally be assigned more operations, but a mixed-version HA group generally does not perform as well as an HA group made up entirely of Luna 7 partitions.

The performance of HSMoD services may be limited by network latency, compared to on-premises Luna HSMs. See "[Luna/HSMoD Cloning](#)" on page 17.

Thales Group recommends that you set a Luna 7 partition as the primary HA member (the first member specified when creating the HA group). All key generation takes place on the primary HA member, so this allows you to take advantage of the SafeNet Luna Network HSM's vastly improved performance for:

- > key generation

> random number generation

The load-balancing logic is determined by the Luna HSM Client software, so the Luna 7 behavior applies to mixed-version HA (see "[Load Balancing](#)" on page 150).

NOTE The primary HA member may not remain the same over time. If the primary member fails, another member takes over all key generation operations. If you notice a significant drop in performance for key generation operations, it could mean that a Luna 6 partition or HSMoD service has become the primary member. By default, an HSMoD service will revert to standby once another HA member recovers.

CHAPTER 2: PED Authentication

The SafeNet Luna PIN Entry Device (Luna PED) provides PIN entry and secret authentication to a SafeNet Luna HSM that requires Trusted Path Authentication. The requirement for PED or password authentication is configured at the factory, according to the HSM model you selected at time of purchase.

The Luna PED and PED keys are the only means of accessing the PED-authenticated HSM's administrative functions. They prevent key-logging exploits on workstations connected to the host HSM, because authentication is delivered directly from the hand-held PED to the HSM via the independent, trusted-path interface. No password is entered via computer keyboard.

NOTE SafeNet Luna Network HSM 7.x requires Luna PED firmware version 2.7.1 or higher. This firmware is backward-compatible with SafeNet Luna Network HSM 6.x.

This chapter contains the following sections about PED authentication:

- > ["PED Authentication Architecture" below](#)
 - ["Comparing Password and PED Authentication" on the next page](#)
- > ["PED Keys" on page 24](#)
 - ["PED Key Types and Roles" on page 24](#)
 - ["Shared PED Key Secrets" on page 25](#)
 - ["Domain PED Keys" on page 26](#)
 - ["PED PINs" on page 26](#)
 - ["M of N Split Secrets \(Quorum\)" on page 26](#)
- > ["SafeNet Luna PED Received Items" on page 28](#)
- > ["SafeNet Luna PED Hardware Functions" on page 30](#)
- > ["Local PED Setup" on page 33](#)
- > ["About Remote PED" on page 35](#)
- > [Remote PED Setup](#)
- > ["PED Key Management" on page 48](#)
- > ["PEDserver and PEDclient" on page 62](#)

PED Authentication Architecture

The PED Authentication architecture consists of the following components:

- > **SafeNet Luna PED:** a PIN Entry Device with a local or remote connection to the HSM. The PED reads authentication secrets from PED keys on behalf of an HSM or partition (see ["SafeNet Luna PED Hardware Functions" on page 30](#)).

- > **Authentication secrets:** Cryptographic secrets generated by the HSM and stored on PED keys. These secrets serve as login credentials for the various roles on the HSM. They can be shared among roles, HSMs, and partitions according to your security scheme.
- > **PED Keys:** physical USB-connected devices that contain authentication secrets, created by the HSM (see ["PED Keys" on the next page](#)). PED Keys have the following custom authentication features:
 - **Shared Secrets:** PED keys of the same type can be reused or shared among HSMs or partitions, allowing domain sharing (necessary for HA and backup configurations), legacy-style Security Officer authentication, and other custom configurations. See ["Shared PED Key Secrets" on page 25](#).
 - **PED PINs:** optional PINs associated with specific PED keys, set by the owner of the PED key at the time of creation. PED PINs offer an extra layer of security for PED keys which could be lost or stolen. See ["PED PINs" on page 26](#).
 - **M of N Split Key Scheme:** optional configuration which allows a role to split its authentication secret across multiple PED keys, and require a minimum number of those keys for authentication. This scheme can be customized to be as simple or complex as your organization's security policy dictates. See ["M of N Split Secrets \(Quorum\)" on page 26](#).

Comparing Password and PED Authentication

The following table describes key differences between password- and PED-authenticated HSMs.

| | Password-authentication | PED-authentication |
|---|--|--|
| Ability to restrict access to cryptographic keys | <ul style="list-style-type: none"> > Knowledge of role password is sufficient > For backup/restore, knowledge of partition domain password is sufficient | <ul style="list-style-type: none"> > Ownership of the black Crypto Officer PED key is mandatory > For backup/restore, ownership of both black CO and red domain PED keys is mandatory > The Crypto User role is available to restrict access to read-only, with no key management authority > Option to associate a PED PIN with any PED key, imposing a two-factor authentication requirement on any role |
| Dual Control | <ul style="list-style-type: none"> > Not available | <ul style="list-style-type: none"> > MofN (split-knowledge secret sharing) requires "M" different holders of portions of the role secret (a quorum) in order to authenticate to an HSM role - can be applied to any, all, or none of the administrative and management operations required on the HSM |
| Key-custodian responsibility | <ul style="list-style-type: none"> > Password knowledge only | <ul style="list-style-type: none"> > Linked to partition password knowledge > Linked to black PED key(s) ownership and optional PED PIN knowledge |
| Two-factor authentication for remote access | <ul style="list-style-type: none"> > Not available | <ul style="list-style-type: none"> > Remote PED and orange (Remote PED Vector) PED key deliver highly secure remote management of HSM, including remote backup |

PED Keys

A PED key is a USB authentication device, embedded in a molded plastic body. It contains a secret, generated by the HSM, that authenticates a role, cloning domain, or remote PED server. This secret is retained until deliberately changed by an authorized user.



The Luna PED does not hold the authentication secrets. They reside only on the portable PED keys.

PED keys are created when an HSM, partition, role, or Remote PED vector is initialized. A PED key can contain only one authentication secret at a time, but it can be overwritten with a new authentication secret. See "[PED Key Management](#)" on page 48.

CAUTION! Do not subject PED keys to extremes of temperature, humidity, dust, or vibration. Use the included key cap to protect the USB connector.

PED Key Types and Roles

The PED uses PED keys for all credentials. You can apply the appropriate labels included with your PED keys, according to the table below, as you create them.

The PED key colors correspond with the HSM roles described in "[HSM Roles and Procedures](#)" on page 1. The following table describes the keys associated with the various roles:

| Lifecycle | PED Key | PED Secret | Function |
|--------------------|--|--------------------------------------|---|
| HSM Administration | Blue | HSM Security Officer (HSM SO) secret | Authenticates the HSM SO role. The HSM SO manages provisioning functions and security policies for the HSM. Mandatory |
| | Red  | HSM Domain or Key Cloning Vector | Cryptographically defines the set of HSMs that can participate in cloning for backup. See " Domain PED Keys " on page 26. Mandatory |
| | Orange  | Remote PED Vector | Establishes a connection to a Remote PED server. Optional |

| Lifecycle | PED Key | PED Secret | Function |
|--------------------------|--|--|---|
| HSM Auditing | White  | Auditor (AU) secret | Authenticates the Auditor role, responsible for audit log management. This role has no access to other HSM services. Optional |
| Partition Administration | Blue | Partition Security Officer (PO) secret | Authenticates the Partition SO role. The PO manages provisioning activities and security policies for the partition. NOTE: If you want the HSM SO to also perform Partition SO duties, you can use the same blue key to initialize both roles. Mandatory |
| | Red  | Partition Domain or Key Cloning Vector | Cryptographically defines the set of partitions that can participate in cloning for backup or high-availability. See "Domain PED Keys" on the next page . Mandatory |
| Partition Operation | Black  | Crypto Officer (CO) secret | Authenticates the Crypto Officer role. The CO can perform both cryptographic services and key management functions on keys within the partition. Mandatory |
| | Gray  | Crypto User (CU) secret | Authenticates the Crypto User role. The CU can perform cryptographic services using keys already existing within the partition. It can create and back up public objects only. NOTE: If administrative separation is not important, you can use a single black key to initialize the Crypto Officer and Crypto User roles and still have two separate challenge secrets to distinguish read-write and read-only role privileges. Optional |

Shared PED Key Secrets

The Luna PED identifies the type of authentication secret on an inserted PED key, and secrets of the same type (color designation) can be used interchangeably. During the key creation process, you have the option of reusing an authentication secret from an existing key rather than have the HSM create a new one. This means that you can use the same PED key(s) to authenticate multiple HSMs or partitions. This is useful for:

- > legacy-style authentication schemes, where the HSM SO also functions as the owner of application partitions. This is achieved by using the same blue PED key to initialize the HSM and some or all of the partitions on the HSM.
- > allowing a single HSM SO to manage multiple HSMs, or a single Partition SO to manage multiple partitions
- > ensuring that HSMs/partitions share a cloning domain (see ["Domain PED Keys" on the next page](#))

- > allowing a read-write Crypto Officer role and a read-only Crypto User role to be managed by the same user

It is not necessary for partitions in an HA group to share the same blue Partition SO key. Only the red cloning domain key must be identical between HA group members.

NOTE Using a single PED key secret to authenticate multiple roles, HSMs, or partitions is less secure than giving each its own PED key. Refer to your organization's security policy for guidance.

Domain PED Keys

A red domain PED key holds the key-cloning vector (the domain identifier) that allows key cloning between HSMs and partitions, and is therefore the PED key most commonly shared between HSMs or partitions. Cloning is a secure method of copying cryptographic objects between HSMs and partitions, required for backup/restore and within HA groups. It ensures that keys copied between HSMs or partitions are:

- > strongly encrypted
- > copied only between HSMs and partitions that share a cloning domain.

NOTE An HSM or partition can be a member of only one domain, decided at initialization. A domain can only be changed by re-initializing the HSM. Partition domains may not be changed after initialization.

PED PINs

The Luna PED allows the holder of a PED key to set a numeric PIN, 4-48 characters long, to be associated with that PED key. This PIN must then be entered on the PED keypad for all future authentication. The PED PIN provides two-factor authentication and ensures security in case a key is lost or stolen. If you forget your PED PIN, it is the same as losing the PED key entirely; you cannot authenticate the role.

PED PINs can be set only at the time of key creation, and can be changed only by changing the secret on the PED key. Duplicate keys made at the time of creation can have different PED PINs, allowing multiple people access to the role (see ["Creating PED Keys" on page 49](#)). Copies made later are true copies with the same PED PIN, intended as backups for one person (see ["Duplicating Existing PED Keys" on page 59](#)). Duplicates of the PED key all have the same PED PIN.

If you are using an M of N configuration, each member of the M of N keyset may set a different PED PIN.

CAUTION! Forgetting a PED PIN is equivalent to losing the key entirely; you can no longer authenticate the role, domain, or RPV. See ["Consequences of Losing PED Keys" on page 55](#).

M of N Split Secrets (Quorum)

The Luna PED can split an authentication secret among multiple PED keys (up to 16), and require a minimum number of the split keys (a quorum of key-holders) to authenticate the role. This provides a customizable layer of security by requiring multiple trusted people (sometimes called the quorum) to be present for authentication to the role.

This can be likened to a club or a legislature, with some arbitrary number of members. You don't need all members present, to make a decision or perform an action, but you do not want a single person to be able to arbitrarily make decisions or take action affecting everyone. So your security rules set out a number of participants - a quorum - who must be assembled in order to perform certain actions

For example, you could decide (or your security policy could dictate) that at least three trusted people must be present for changes to the HSM policies or for client partition assignments. To accommodate illness, vacations, business travel, or any other reasons that a key-holder might not be present at the HSM site, it is advisable to split the authentication secret between more than three people. If you decide on a five-key split, you would specify M of N for the HSM SO role, or for the cloning domain to be 3 of 5. That is, the pool of individual holders of spits of that role secret is five persons, and from among them, a quorum of three must be available to achieve authentication.

In this scenario, the HSM SO authentication secret is split among five blue PED keys, and at least three of those keys must be presented to the Luna PED to log in as HSM SO.

This feature can be used to customize the level of security and oversight for all actions requiring PED authentication. You can elect to apply an M of N split-secret scheme to all roles and secrets, to some of them, or to none of them. If you do choose to use M of N, you can set different M and N values for each role or secret. Please note the following recommendations:

- > M = N is not recommended; if one of the key holders is unavailable, you cannot authenticate the role.
- > M = 1 is not recommended; it is no more secure than if there were no splits of the secret - a single person can unlock the role without oversight. If you want multiple people to have access to the role, it is simpler to create multiple copies of the PED key.

NOTE Using an M of N split secret can greatly increase the number of PED keys you require. Ensure that you have enough blank or rewritable PED keys on hand before you begin backing up your M of N scheme.

Activated Partitions and M of N

For security reasons, the HSM and its servers are often kept in a locked facility, and accessed under specific circumstances, directly or by secure remote channel. To accommodate these security requirements, the Crypto Officer and Crypto User roles can be Activated (to use a secondary, alpha-numeric login credential to authenticate), allowing applications to perform cryptographic functions without having to present a black or gray PED key (see "[Activation and Auto-activation on Multi-factor- \(PED-\) Authenticated Partitions](#)" on [page 114](#)). In this case, if the HSM is rebooted for maintenance or loses power due to an outage, the cached PED secret is erased and the role must be reactivated (by logging in the role via LunaCM and presenting the requisite M number or quorum of PED keys) before normal operations can resume.

New-CPU PED Behavior Notes

All of the following points apply to the newer-CPU PED (firmware versions 2.8.0, 2.8.1, or 2.9.0).

- > If a PED is connected via USB to a version 7.x HSM (whether that HSM is installed in a host computer or is embedded in a Network HSM appliance), if the server housing the HSM is booted from a power-off condition, the PED display might come up blank. The PED must be reset.
- > If a new-CPU PED is powered via USB from a 7.x HSM, and the HSM is reset, the PED will become unresponsive. The PED must be reset.

- > If a PED is connected via USB to a PED server (for Remote PED), if the server is booted from a power-off condition, the PED display might come up blank OR the PED might be unresponsive to the PED server. The PED must be reset.
- > A new-CPU PED will be unresponsive after a 7.x HMS firmware update or rollback, and/or the display might come up blank. The PED must be reset.

References to resetting the PED mean cycling the power. This can be done by disconnecting and reconnecting the USB cable.

A new CPU PED, powered by a 7.x HSM over USB retains the AC power socket of the older-CPU model. If an AC power block is plugged into the power socket of the PED, this will reset the PED.

SafeNet Luna PED Received Items

This chapter describes the items you received with your SafeNet Luna PED device. For instructions on setting up the PED, see ["PED Authentication" on page 22](#).

Required Items

The following items are included with your PED. All are required for a successful installation.

| Qty | Item |
|-----|--|
| 1 | SafeNet Luna PED (with firmware 2.7.1 or newer)  |

| Qty | Item |
|-----|---|
| 1 | <p data-bbox="212 268 1474 331">PED Power Supply kit with replaceable mains plug modules for international use (employed when the PED is operated in Remote PED mode)</p> <p data-bbox="212 373 1426 436">NOTE: If your PED has firmware 2.8.0 or newer, it contains refreshed internal hardware and is powered by USB connection. Refreshed PEDs are not shipped with the external power supply, as they do not need it.</p>  |
| 1 | <p data-bbox="212 974 1110 1008">Cable, USB 2.0, Type A to Mini B connectors (for Remote PED operation).</p>  |

| Qty | Item |
|-----|--|
| 1 | <p>Cable, Data, 9-pin, Micro-D to Micro-D connectors (for local PED operation prior to HSM firmware versions 7.x.).</p>  |
| 1 | <p>Ten-pack of iKey 1000 PED keys, and sheets of peel-and-stick labels</p>  |

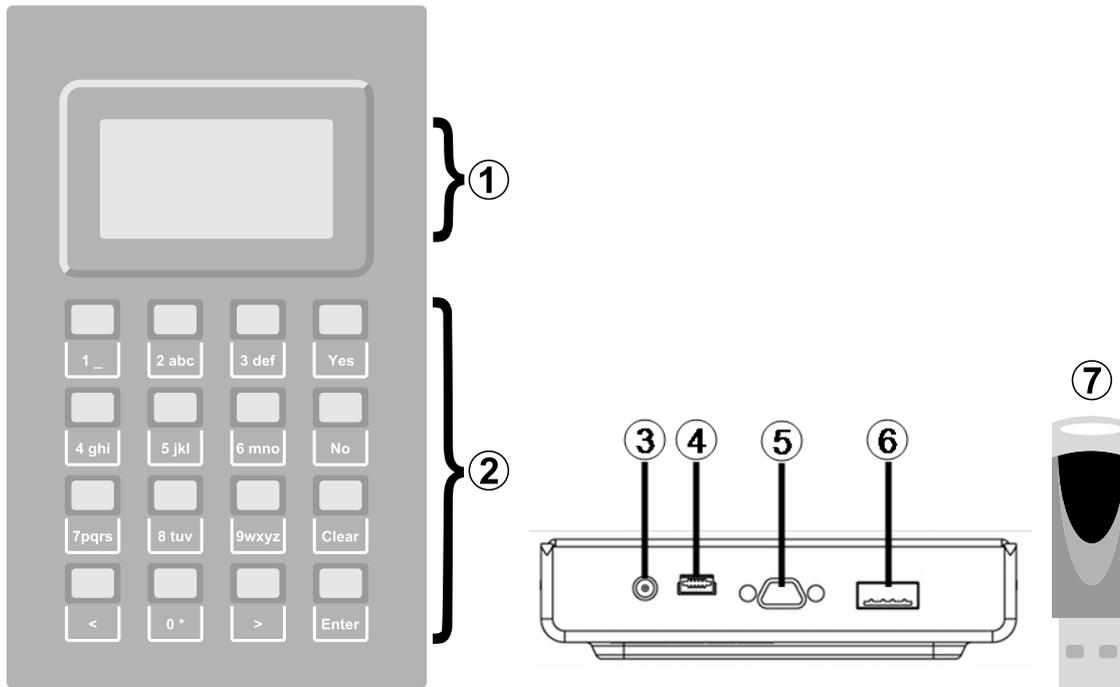
SafeNet Luna PED Hardware Functions

The SafeNet Luna PED reads authentication secrets from PED keys on behalf of an HSM or partition. This section contains the following information about the Luna PED device:

- > ["Physical Features" below](#)
- > ["Keypad Functions" on the next page](#)
- > ["Modes of Operation" on page 32](#)
- > ["Admin Mode Functions" on page 33](#)

Physical Features

The SafeNet Luna PED is illustrated below, with important features labeled.



| | |
|---|---|
| 1 | Liquid Crystal Display (LCD), 8 lines. |
| 2 | Keypad for command and data entry. See "Keypad Functions" below . |
| 3 | DC power connector. Not used for PED version 2.8 and above. * |
| 4 | USB mini-B connector. Used for connecting to the HSM and for file transfer to or from the PED. PED version 2.8 and above is powered by this USB connection. |
| 5 | Micro-D subminiature (MDSM) connector. Not used for Luna release 7.x. |
| 6 | USB A-type connector for PED keys. |
| 7 | PED key. Keys are inserted in the PED key connector (item 6). |

* PEDs with firmware version 2.8 and above are powered by any USB 2.x or 3.x connection, and do not have an external DC power supply. The PED driver must be installed on the connected computer. If the PED is connected to a hub or to a computer without the driver, then the PED display backlight illuminates, but no PED menu is presented.)

Keypad Functions

The Luna PED keypad functions are as follows:

| Key | Function |
|---------------------|--|
| Clear | <ul style="list-style-type: none"> > Clear the current entry, such as when entering a PED PIN > Hold the key down for five seconds to reset the PED during an operation. This applies only if the PED is engaged in an operation or is prompting for action. There is no effect when no command has been issued or when a menu is open |
| < | <ul style="list-style-type: none"> > Backspace: clear the most recent digit you typed on the PED > Exit: return to the previous PED menu |
| > | <ul style="list-style-type: none"> > Log: displays the most recent PED actions (since entering Local or Remote Mode) |
| Numeric keys | <ul style="list-style-type: none"> > Select numbered menu items > Input PED PINs |
| Yes and No | <ul style="list-style-type: none"> > Respond to Yes or No questions from the PED |
| Enter | <ul style="list-style-type: none"> > Confirm an action or entry |

Modes of Operation

The Luna PED can operate in four different modes, depending on the type of HSM connection you want to use:

- > **Local PED-SCP:** This mode is reserved for legacy SafeNet Luna 6.x HSMs that use an MDSM connector between the PED and the HSM. It does not apply to Luna 7.x. Initial HSM configuration must be done in Local PED mode. See "[Local PED Setup](#)" on the next page for instructions.
- > **Admin:** This mode is for upgrading the PED device firmware, diagnostic tests, and PED key duplication. See "[Admin Mode Functions](#)" on the next page for the functions available in this mode.
- > **Remote PED:** In this mode, the PED is connected to a remote workstation and authenticated to the HSM with an orange PED key containing a Remote PED Vector (RPV) secret. This mode allows the SafeNet Luna Network HSM to be located in a data center or other location restricting physical access. See "[About Remote PED](#)" on page 35 for more information.
- > **Local PED-USB:** In this mode, the PED is connected directly to the HSM card with a USB mini-B to USB-A connector cable. Initial HSM configuration must be done in Local PED mode.

If the Luna PED is connected to an interface when it is powered up, it automatically detects the type of connection being used and switches to the appropriate mode upon receiving the first command from the HSM.

Changing Modes

If you change your PED configuration without disconnecting the PED from power, you must select the correct mode from the main menu.

To change the Luna PED's active mode

1. Press the < key to navigate to the main menu.

```
Select Mode
1 Local PED-SCP
4 Admin
7 Remote PED
0 Local PED-USB

PED V.2.7.1-5
```

The main menu displays all the available modes, as well as the PED's current firmware version.

2. Press the corresponding number on the keypad for the desired mode.

NOTE The Luna PED must be in **Local PED-USB** mode when connected to a Release 7.x SafeNet Luna Network HSM card, or LunaCM will return an error (CKR_DEVICE_ERROR) when you attempt authentication.

Admin Mode Functions

In this mode, you can upgrade the PED device software, run diagnostic tests, and duplicate PED keys without having the Luna PED connected to an HSM. Press the corresponding number key to select the desired function.

```
Admin mode...
1 PED Key
5 Backup Devices
7 Software Update
9 Self Test

< EXIT
```

- > **PED Key:** allows you to identify the secret on an inserted PED key, or duplicate the key, without having the Luna PED connected to an HSM.
- > **Backup Devices:** Not applicable to Luna 7.x.
- > **Software Update:** requires a PED software file and instructions sent from Thales Group.
- > **Self Test:** test the PED's functionality. Follow the on-screen instructions to test button functions, display, cable connections, and the ability to read PED keys. The PED returns a PASS/FAIL report once it concludes the test.

Local PED Setup

A Local PED connection is the simplest way to set up the SafeNet Luna PED. In this configuration, the PED is connected directly to the HSM card. It is best suited for situations where all parties who need to authenticate credentials have convenient physical access to the HSM. When the HSM is stored in a secure data center and accessed remotely, you must use a Remote PED setup.

Setting Up a Local PED Connection

The SafeNet Luna Network HSM administrator can use these directions to set up a Local PED connection. You require:

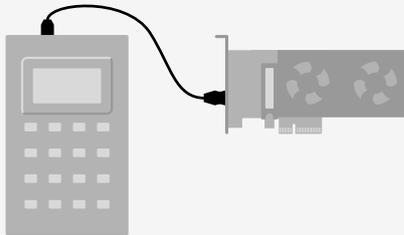
- > SafeNet Luna PED with firmware 2.7.1 or newer

- > USB mini-B to USB-A connector cable
- > Luna PED DC power supply (if included with your Luna PED)

To set up a Local PED connection

1. Connect the Luna PED to the HSM using the supplied USB mini-B to USB-A connector cable.

NOTE To operate in Local PED-USB mode, the PED must be connected directly to the HSM card's USB port, and not one of the other USB connection ports on the host system.



2. PED version 2.8 and above is powered via the USB connection. If you are using PED version 2.7.1, connect it to power using the Luna PED DC power supply.

As soon as the PED receives power, it performs start-up and self-test routines. It verifies the connection type and automatically switches to the appropriate operation mode when it receives the first command from the HSM.

3. If you prefer to set the operation mode to **Local PED-USB** manually, see ["Changing Modes" on page 32](#).

The Luna PED is now ready to perform authentication for the HSM. You may proceed with setting up or deploying your SafeNet Luna Network HSM. All commands requiring authentication (HSM/partition initialization, login, etc.) will now prompt the user for action on the locally-connected Luna PED.

PED Actions

There are several things that you can do with the Luna PED at this point:

- > Wait for a PED authentication prompt in response to a LunaCM command (see ["Performing PED Authentication" on page 54](#))
- > Create copies of your PED keys (see ["Duplicating Existing PED Keys" on page 59](#))
- > Change to the Admin Mode to run tests or update PED software (see ["Changing Modes" on page 32](#))
- > Prepare to set up a Remote PED server (see ["About Remote PED" on the next page](#))

Local PED Troubleshooting

If you encounter problems with Local PED, refer to this section.

CKR_PED_UNPLUGGED error after hsm restart

After running **hsm restart**, LunaCM returns a CKR_PED_UNPLUGGED error when authentication is attempted.

```
lunacm:>role login -n so
```

```
    Please attend to the PED.
```

Caution: You have only 3 so login attempts left. If you fail 3 more consecutive login attempts (i.e. with no successful logins in between) the HSM will be ZEROIZED!!!

Error in execution: CKR_PED_UNPLUGGED.

Command Result : 0x8000002e (CKR_PED_UNPLUGGED)

If you receive this error, disconnect the Luna PED from the HSM's USB port and reconnect it before issuing the login command again.

About Remote PED

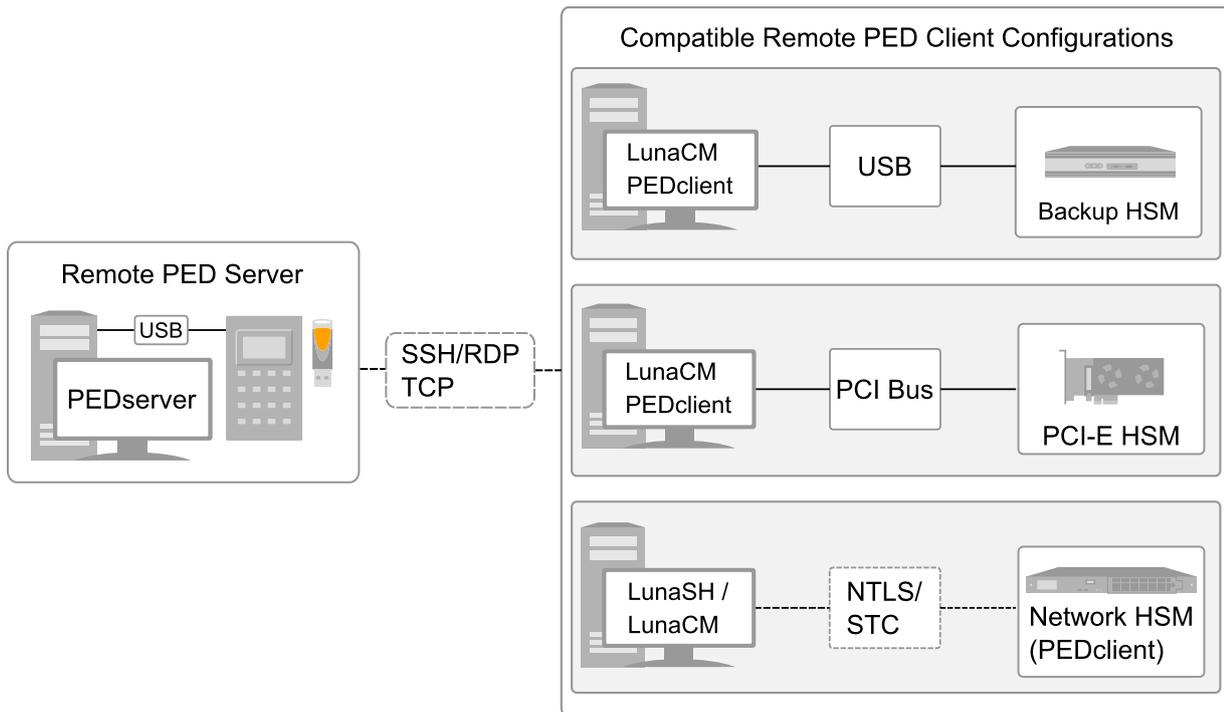
A Remote PED connection allows you to access PED-authenticated HSMs that are kept in a secure data center or other remote location where physical access is restricted or inconvenient. This section provides descriptions of the following aspects of Remote PED connections:

- > ["Remote PED Architecture" below](#)
- > ["Remote PED Connections" on the next page](#)
- > ["PEDserver-PEDclient Communications" on page 38](#)

Remote PED Architecture

The Remote PED architecture consists of the following components:

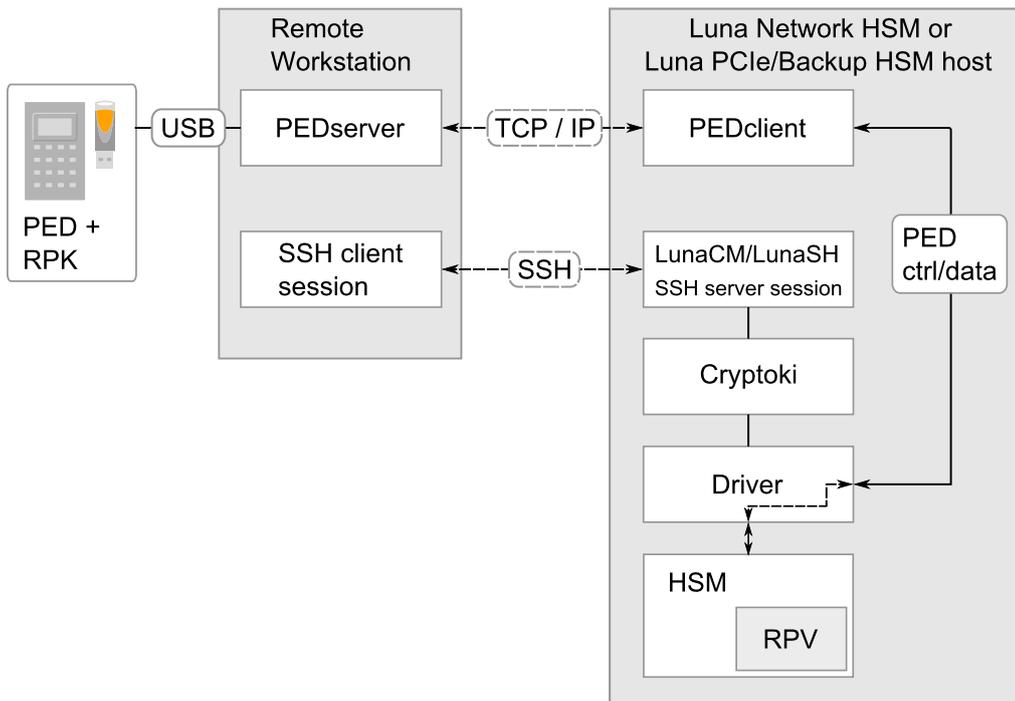
- > **Remote PED:** a Luna PED with firmware 2.7.1 or newer, connected to a network-connected workstation, powered on, and set to Remote PED mode.
- > **Remote PED Vector (RPV):** a randomly generated, encrypted value used to authenticate between a Remote PED (via PEDserver) and a SafeNet Luna HSM (via PEDclient).
- > **Remote PED Key (RPK):** an orange PED key containing an RPV (or multiple PED keys with a split RPV in an M of N implementation).
- > **PEDserver:** software that runs on the remote workstation with a USB-connected Luna PED. PEDserver accepts requests from and serves PED actions and data to PEDclient.
- > **PEDclient:** software that requests remote PED services from PEDserver. PEDclient runs on the network-connected system hosting the HSM, which can be one of the following:
 - SafeNet Luna Network HSM
 - Host computer with SafeNet Luna PCIe HSM installed
 - Host computer with USB-connected SafeNet Luna Backup HSM, configured for remote backup



Remote PED Connections

A SafeNet Luna Network HSM on a host computer running PEDclient can establish a Remote PED connection with any workstation that meets the following criteria:

- > PEDServer is running
- > a SafeNet Luna PED with firmware version 2.7.1 or newer is connected
- > The orange PED key containing the Remote PED Vector (RPV) for that HSM is available



Priority and Lockout

If a Local PED connection is active and an operation is in progress, a Remote PED connection cannot be initiated until the active Local PED operation is completed. If the Local PED operation takes too long, the Remote PED command may time out.

When a Remote PED connection is active, the Local PED connection is ignored, and all authentication requests are routed to the Remote PED. Attempts to connect to a different Remote PED server are refused until the current connection times out or is deliberately ended. See ["Ending or Switching the Remote PED Connection" on page 44](#).

One Connection at a Time

Remote PED can provide PED services to only one HSM at a time. To provide PED service to another HSM, you must first end the original Remote PED connection. See ["Ending or Switching the Remote PED Connection" on page 44](#).

Timeout

PEDserver and PEDclient both have configurable timeout settings (default: 1800 seconds). See ["pedserver mode config" on page 70](#) or ["pedclient mode config" on page 83](#). The utilities are not aware of each other's timeout values, so the briefer value determines the actual timeout duration.

Once a partition has been Activated and cached the primary authentication (PED key) credential, the Crypto Officer or Crypto User can log in using only the secondary (alphanumeric) credentials and the Remote PED connection can be safely ended until the Partition SO needs to log in again.

Broken Connections

A Remote PED connection is broken if any of the following events occur:

- > The connection is deliberately ended by the user

- > The connection times out (default: 1800 seconds)
- > SafeNet Luna PED is physically disconnected from its host
- > VPN or network connection is disrupted
- > You exit Remote PED mode on the Luna PED. If you attempt to change menus, the PED warns:

```

** WARNING **
Exiting now will
invalidate the RPK.
Confirm? YES/NO

```

If the link is broken, as long as the network connection is intact (or is resumed), you can restart PEDserver on the Remote PED host and run **ped connect** in LunaCM to re-establish the Remote PED link. In a stable network situation, the link will remain available until timeout.

PEDserver-PEDclient Communications

All communication between the Remote PED and the HSM is transmitted within an AES-256 encrypted channel, using session keys based on secrets shared out-of-band. This is considered a very secure query/response mechanism. The authentication conversation is between the HSM and the PED. Authentication data retrieved from the PED keys never exists unencrypted outside of the PED or the HSM. PEDclient and PEDserver provide the communication pathway between the PED and the HSM, and the data remains encrypted along that path.

Once the PED and HSM are communicating, they establish a common Data Encryption Key (DEK). DEK establishment is based on the Diffie-Hellman key establishment algorithm and a Remote PED Vector (RPV), shared between the HSM and the PED via the orange Remote PED Key (RPK). Once a common Diffie-Hellman value is established between the parties via the Diffie-Hellman handshake, the RPV is mixed into the value to create a 256-bit AES DEK on each side. If the PED and the HSM do not hold the same RPV, the resulting DEKs are different and communication is blocked.

Mutual authentication is achieved by exchanging random nonces, encrypted using the derived data encryption key. The authentication scheme operates as follows:

| HSM | – | Remote PED |
|---|--|--|
| Send 8 bytes random nonce, R1, encrypted using the derived encryption key. | $\{R1 \parallel \text{padding}\}_{Ke} \rightarrow$ | |
| | $\leftarrow \{R2 \parallel R1\}_{Ke}$ | Decrypt R1. Generate an 8 byte random nonce, R2. Concatenate R2 R1 and encrypt the result using the derived encryption key. |
| Decrypt R2 R1. Verify that received R1 value is the same as the originally generated value. Re-encrypt R2 and return it to Remote PED. | $\{\text{padding} \parallel R2\}_{Ke} \rightarrow$ | Verify that received R2 value is the same as the originally generated value. |

Following successful authentication, the random nonce values are used to initialize the feedback buffers needed to support AES-OFB mode encryption of the two communications streams (one in each direction).

Sensitive data in transition between a PED and an HSM is end-to-end encrypted: plaintext security-relevant data is never exposed beyond the HSM and the PED boundaries at any time. The sensitive data is also hashed, using a SHA-256 digest, to protect its integrity during transmission.

Initializing the Remote PED Vector (RPV) and Creating an Orange Remote PED Key (RPK)

The Remote PED (via PEDserver) authenticates itself to the SafeNet Luna Network HSM with a randomly-generated encrypted value stored on an orange PED key. That secret originates in an HSM, and can be carried to other HSMs via the orange key. An HSM being newly configured either

- > generates its own RPV secret to imprint on an orange PED Key,
- or
- > accepts a pre-existing RPV from a previously imprinted orange key, at your discretion.

The orange key proves to the HSM that the Remote PED is authorized to provide authentication for HSM roles. A SafeNet Luna Network HSM administrator can create this key.

NOTE Generally, the HSM SO creates an orange PED key (and backups), makes a copy for each valid Remote PED server, and distributes them to the Remote PED administrators.

If the HSM is already initialized, the HSM SO must log in to complete this procedure. You require:

- > SafeNet Luna PED with firmware 2.7.1 or newer
- > USB mini-B to USB-A connector cable
- > Luna PED DC power supply (if included with your Luna PED)
- > Blank or reusable orange PED key (or multiple keys, if you plan to make extra copies or use an M of N security scheme). See "[Creating PED Keys](#)" on page 49 for more information.

To initialize the RPV and create the orange PED key locally

1. If you have not already done so, set up a Local PED connection (see "[Local PED Setup](#)" on page 33).
2. Launch LunaCM on the SafeNet Luna Network HSM host workstation.
3. If the HSM is initialized, login as HSM SO (see [Logging In as HSM Security Officer](#)). If not, skip to the next step.

```
lunacm:> role login -name so
```

4. Ensure that you have the orange PED key(s) ready. Initialize the RPV.

```
lunacm:> ped vector
```

5. Attend to the Luna PED and respond to the on-screen prompts. See "[Creating PED Keys](#)" on page 49 for a full description of the key-creation process.

```
SLOT
SETTING RPV...
Would you like to
reuse an existing
keyset?(Y/N)
```

- If you have an orange PED key with an existing RPV that you wish to use for this HSM, press **Yes**.
- If you are creating a new RPV, press **No**.

```
SLOT
SETTING RPV...
Insert a
RPK / Remote
PED Key (ORANGE)
Press ENTER.
```

Continue following the prompts for PED PIN, M of N, and duplication options.

To continue setting up a Remote PED server, see ["Installing PEDserver and Setting Up the Remote Luna PED" below](#).

Installing PEDserver and Setting Up the Remote Luna PED

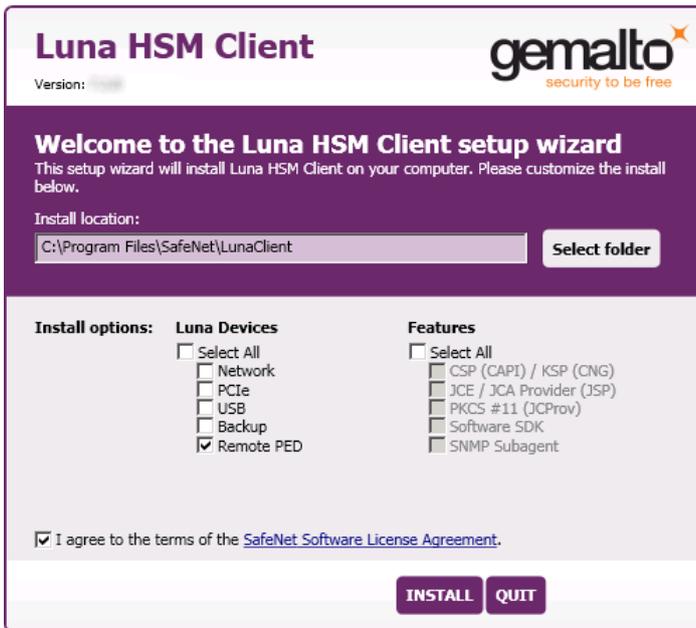
The PEDserver software, installed on the Remote PED host workstation, allows the USB-connected Luna PED to communicate with remotely-located HSMs. The Remote PED administrator can install PEDserver using the Luna HSM Client installer. You require:

- > Network-connected workstation with compatible operating system (refer to the release notes)
- > Luna HSM Client installer
- > SafeNet Luna PED with firmware 2.7.1 or higher
- > USB mini-B to USB-A connector cable
- > Luna PED DC power supply (PED 2.7.1 only; PED 2.8 and higher is powered by the USB connection)

NOTE To set up a Remote PED Server on Linux, you require Luna HSM Client 10.1 or newer.

To install PEDserver and the PED driver, and set up the Luna PED

1. Run the Luna HSM Client installer and follow the on-screen instructions, as detailed in [Luna HSM Client Software Installation](#), and select the **Luna Remote PED** option. Any additional installation choices are optional, for the purpose of this procedure.



2. On Windows, when you are prompted to install the driver, click **Install**.



3. On Windows, reboot the computer to ensure that the Luna PED driver is accepted by Windows. This step is not required for Linux or Windows Server operating systems.
4. Connect the Luna PED to a USB port on the host system using the supplied USB mini-B to USB-A connector cable.

PED version 2.8 and above is powered via the USB connection. If you are using PED version 2.7.1, connect it to power using the Luna PED DC power supply.

As soon as the PED receives power, it performs start-up and self-test routines (for PED v2.8 and later, the PED driver must be installed on the connected computer, or the display remains blank). It verifies the connection type and automatically switches to the appropriate operation mode when it receives the first command from the HSM.

To manually set the operation mode to **Remote PED**, see "[Changing Modes](#)" on page 32.

5. On Windows, open the Windows **Device Manager** to confirm that the Luna PED is recognized as **PED2**. If it appears as an unrecognized USB device:
 - a. Disconnect the Luna PED from the host USB port.
 - b. Reboot the computer to ensure that the Luna PED driver is accepted by Windows.
 - c. Reconnect the Luna PED.

To continue setting up a Remote PED connection, see ["Opening a Remote PED Connection" below](#).

Opening a Remote PED Connection

NOTE For the SafeNet Luna Network HSM, only Luna Shell commands can be used with a *PED-initiated Remote PED connection*. Client-side LunaCM commands such as **partition init** cannot be executed. This means that only administrative personnel, logging in via Luna Shell (lunash:>) can authenticate to the HSM using a PED-initiated Remote PED connection.

To perform actions requiring authentication on Network HSM partitions (that is, from the client side) any Remote PED connection must be launched by the HSM, and the data-center firewall rules must permit such outward initiation of contact.

If you encounter issues, see ["Remote PED Troubleshooting" on page 45](#).

The HSM/client administrator can use this procedure to establish an HSM-initiated Remote PED connection. You require:

- > Administrative access to a network-connected workstation with PEDserver installed and Luna PED connected (see ["Installing PEDserver and Setting Up the Remote Luna PED" on page 40](#))
- > Administrative access to the SafeNet Luna Network HSM host via SSH
- > Orange PED key with the HSM's RPV (see ["Initializing the Remote PED Vector \(RPV\) and Creating an Orange Remote PED Key \(RPK\)" on page 39](#))

To open a Remote PED connection

1. On Windows, open an Administrator command prompt by right-clicking the Command Prompt icon and selecting **Run as administrator**. This step is not necessary if you are running Windows Server 20xx, as the Administrator prompt is launched by default.

2. Navigate to the Luna HSM Client install directory.

Windows default: **cd C:\Program Files\SafeNet\LunaClient**

Linux/UNIX default: **cd /usr/safenet/lunaclient**

3. Launch PEDserver. If you are launching PEDserver on an IPv6 network, you must include the **-ip** option.

> **"pedserver mode start" on page 76 [-ip <PEDserver_IP>]**

```
C:\Program Files\SafeNet\LunaClient>pedserver mode start
Ped Server Version 1.0.6 (10006)
Ped Server launched in startup mode.
Starting background process
Background process started
Ped Server Process created, exiting this process.
```

4. Verify that the service has launched successfully.

> **"pedserver mode show" on page 74**

Note the **Ped2 Connection Status**. If it says **Connected**, PEDserver is able to communicate with the Luna PED.

Note also the server port number (default: **1503**). You must specify this port along with the PEDserver host IP when you open a connection.

```
c:\Program Files\SafeNet\LunaClient>pedserver mode show
Ped Server Version 1.0.6 (10006)
Ped Server launched in status mode.
```

```
Server Information:
  Hostname:                DWG9999
  IP:                      0.0.0.0
  Firmware Version:       2.7.1-5
  PedII Protocol Version: 1.0.1-0
  Software Version:       1.0.6 (10006)

  Ped2 Connection Status:  Connected
  Ped2 RPK Count           0
  Ped2 RPK Serial Numbers (none)

Client Information:       Not Available

Operating Information:
  Server Port:             1503
  External Server Interface: Yes
  Admin Port:             1502
  External Admin Interface: No

  Server Up Time:         190 (secs)
  Server Idle Time:       0 (secs) (0%)
  Idle Timeout Value:    1800 (secs)

  Current Connection Time: 0 (secs)
  Current Connection Idle Time: 0 (secs)
  Current Connection Total Idle Time: 0 (secs) (100%)
  Total Connection Time: 0 (secs)
  Total Connection Idle Time: 0 (secs) (100%)
```

Show command passed.

5. Use **ipconfig** (Windows) or **ifconfig** (Linux) to determine the PEDserver host IP. A static IP is recommended, but if you are connecting over a VPN, you may need to determine the current IP each time you connect to the VPN server.
6. Via SSH, launch LunaCM on the SafeNet Luna Network HSM host.
7. Initiate the Remote PED connection.

```
lunacm:> ped connect -ip <PEDserver_IP> -port <PEDserver_port> -slot <slot>
```

NOTE The **-slot** option may be required if you have multiple SafeNet Luna Network HSMs installed in one server. If you do not include this option, the currently-active slot is used.

```
lunacm:>ped connect -ip 192.124.106.100 -port 1503
```

Command Result : No Error

8. Issue the first command that requires authentication.
 - If the HSM is already initialized and you have the blue HSM SO key, log in.

```
lunacm:> role login -name so
```

- If the HSM is uninitialized, you can initialize it now (see [Initializing the HSM](#)). Have blank or reusable blue and red PED keys ready (or multiple blue and red keys in case of M of N or if making multiple copies). See "[Creating PED Keys](#)" on page 49 for more information.

```
lunacm:> hsm init -label <label>
```

9. The Luna PED prompts for an orange PED key. Present the orange PED key with the correct RPK.

```
SLOT
COMPUTE SESSION KEY.
Insert a
RPK / Remote
PED Key (ORANGE)
Press ENTER.
```

10. The Luna PED prompts for the key associated with the command you issued. Follow the on-screen directions to complete the authentication process.

```
SLOT
SO LOGIN...
Insert a
SO / HSM Admin
PED Key (BLUE)
Press ENTER.
```

NOTE The Remote PED connection eventually times out (default: 1800 seconds), and must be re-initiated each time authentication is required. To simplify this process, you can set a default IP address and/or port for LunaCM to use each time you connect. To drop the Remote PED connection manually, see "[Ending or Switching the Remote PED Connection](#)" below.

11. [OPTIONAL] Set a default IP address and/or port for the SafeNet Luna Network HSM to look for a Remote PED host with PEDserver running.

```
lunacm:> ped set -ip <PEDserver_IP> -port <PEDserver_port>
```

```
lunacm:>ped set -ip 192.124.106.100 -port 1503
```

```
Command Result : 0 (Success)
```

With this default address set, the HSM administrator can use `lunacm:> ped connect` to initiate the Remote PED connection. The orange PED key may be required if the RPK has been invalidated since you last used it.

Ending or Switching the Remote PED Connection

PEDserver runs on the Remote PED host until explicitly stopped. PEDclient (running on the SafeNet Luna Network HSM host) has a default timeout period of 1800 seconds. If you want to connect to a different Remote PED server, or allow another HSM to use the current server, you must manually break the Remote PED connection.

To end or switch an HSM-initiated connection

1. End the Remote PED connection.

```
lunacm:> ped disconnect
```

2. You are now able to initiate a connection to a different Remote PED host running PEDserver. You will need to present the orange PED key.

```
lunacm:> ped connect -ip <PEDserver_IP> -port <port>
```

NOTE Running this command does not change the default Remote PED IP/port you may have previously set. If you want this new Remote PED server to be the default, set it using `lunacm:> ped set -ip <PEDserver_IP> -port <port>`.

Remote PED Troubleshooting

If you encounter problems at any stage of the Remote PED connection process, the following troubleshooting tips may help resolve the problem:

- > ["No Menu Appears on PED Display: Ensure Driver is Properly Installed" below](#)
- > ["RC_SOCKET_ERROR: PEDserver Requires Administrator Privileges" below](#)
- > ["CKR_PED_UNPLUGGED: Reconnect Remote PED Before Issuing Commands" on the next page](#)
- > ["Remote PED Firewall Blocking" on the next page](#)
- > ["Remote PED Blocked Port Access" on page 47](#)
- > ["ped connect Fails if IP is Not Accessible" on page 48](#)
- > ["PEDserver on VPN fails" on page 48](#)

No Menu Appears on PED Display: Ensure Driver is Properly Installed

If the PED driver is not properly installed before connecting the PED to the workstation's USB port, the PED screen does not display the menu. If you encounter this problem, ensure that you have followed the entire procedure at ["Installing PEDserver and Setting Up the Remote Luna PED" on page 40](#).

RC_SOCKET_ERROR: PEDserver Requires Administrator Privileges

If PEDserver is installed in the default Windows directory, it requires Administrator privileges to make changes. If you run PEDserver as an ordinary user, you may receive an error like the following:

```
c:\Program Files\SafeNet\LunaClient>pedserver mode start
Ped Server Version 1.0.6 (10006)
Ped Server launched in startup mode.
Starting background process
Failed to recv query response command: RC_SOCKET_ERROR c0000500
Background process failed to start : 0xc0000500 RC_SOCKET_ERROR
Startup failed. : 0xc0000500 RC_SOCKET_ERROR
```

To avoid this error, when opening a command line for PEDserver operations, right-click the Command Prompt icon and select **Run as Administrator**. Windows Server 20xx opens the Command Prompt as Administrator by default.

NOTE If you do not have Administrator permissions on the Remote PED host, contact your IT department or install Luna HSM Client in a non-default directory (outside the **Program Files** directory) that is not subject to permission restrictions.

CKR_PED_UNPLUGGED: Reconnect Remote PED Before Issuing Commands

As described in the connection procedures, Remote PED connections time out after a default period of 1800 seconds (30 minutes). If you attempt PED authentication after timeout or after the connection has been broken for another reason, the Luna PED will not respond and you will receive an error like this:

```
lunacm:> role login -n so
```

```
Please attend to the PED.
```

```
Error in execution: CKR_PED_UNPLUGGED.
```

```
Command Result : 0x8000002e (CKR_PED_UNPLUGGED)
```

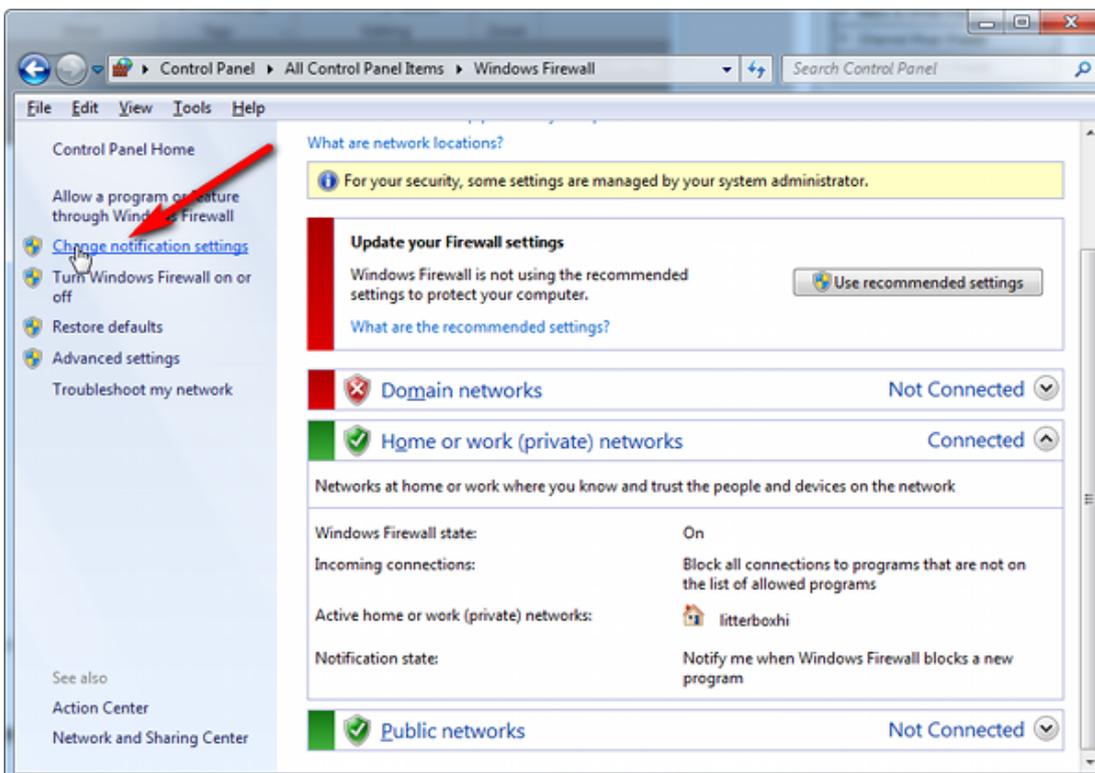
To avoid this error, re-initiate the connection before issuing any commands requiring PED authentication:

```
lunacm:> ped connect -ip <PEDserver_IP> -port <PEDserver_port>
```

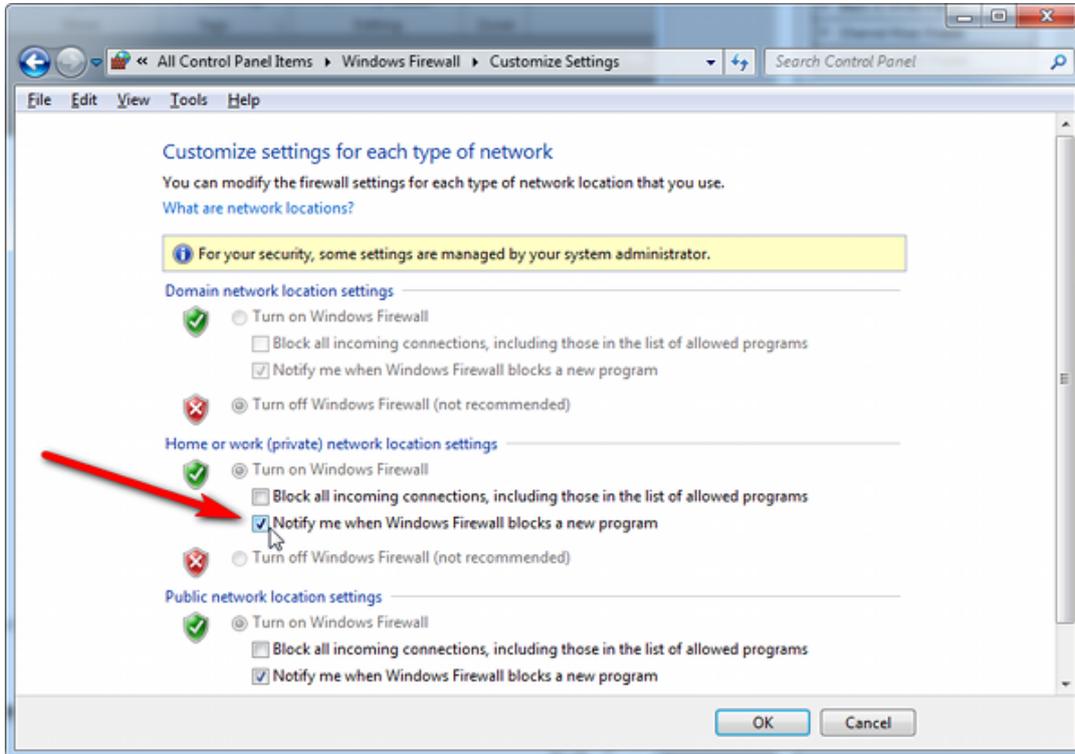
Remote PED Firewall Blocking

If you experience problems while attempting to configure a SafeNet Remote PED session over VPN, you might need to adjust Windows Firewall settings.

1. From the Windows Start Menu, select **Control Panel**.
2. Select **Windows Firewall**.
3. Select **Change notification settings**.



4. In the dialog **Customize settings for each type of network**, go to the appropriate section and activate **Notify me when Windows Firewall blocks a new program**.



With notifications turned on, a dialog box appears whenever Windows Firewall blocks a program, allowing you to override the block as Administrator. This allows PEDserver to successfully listen for PEDclient connections.

Remote PED Blocked Port Access

The network might be configured to block access to certain ports. If ports 1503 (the default PEDserver listening port) and 1502 (the administrative port) are blocked on your network, choose a different port when starting PEDserver, and when using `lunacm:> ped connect` to initiate the Remote PED connection. Contact your network administrator for help.

You might choose to use a port-forwarding jump server, co-located with the SafeNet Luna Network HSM(s) on the datacenter side of the firewall. This can be a low-cost solution for port-blocking issues. It can also be used to implement a PKI authentication layer for Remote PED or other SSH access, by setting up smart-card access control to the jump server.

For example, you can use a standard Ubuntu Server distribution with OpenSSH installed and no other changes made to the standard installation with the following procedure:

1. Connect the Luna PED to a Windows host with Luna HSM Client installed and PEDserver running.
2. Open an Administrator command prompt on the Remote PED host and start the port-forwarding service.
`>plink -ssh -N -T -R 1600:localhost:1503 <user>@<Ubuntu_server_IP>.`
3. Launch LunaCM on the SafeNet Luna Network HSM host, and open the HSM-initiated connection.
`lunacm:> ped connect -ip <Ubuntu_server_IP> -port 1600`

The Remote PED host initiates the SSH session, via the Ubuntu jump server, which returns to the Remote PED host running PEDserver.

A variant of this arrangement also routes port 22 through the jump server, which allows administrative access to the SafeNet Luna Network HSM under the PKI access-control scheme.

ped connect Fails if IP is Not Accessible

On a system with two network connections, if PEDserver attempts to use an IP address that is not externally accessible, `lunacm:>ped connect` can fail. To resolve this:

1. Ensure that PEDserver is listening on the IP address that is accessible from outside.
2. If not, disable the network connection on which PEDserver is listening.
3. Restart PEDserver and confirm that it is listening on the IP address that is accessible from outside.

PEDserver on VPN fails

If PEDserver is running on a laptop that changes location, the active network address changes even though the laptop is not shutdown. If you unplugged from working at home, over the corporate VPN, commuted to the office, and reconnected the laptop there, PEDserver is still configured with the address you had while using the VPN. Running `pedserver -mode stop` does not completely clear all settings, so running `pedserver -mode start` again fails with a message like "Startup failed. : 0x0000303 RC_OPERATION_TIMED_OUT". To resolve this problem:

1. Close the current command prompt window.
2. Open a new Administrator command prompt.
3. Verify the current IP address.
`>ipconfig`
4. Start PEDserver, specifying the new IP and port number ().
`> "pedserver mode start" on page 76 -ip <new_IP> -port <port>`

PED Key Management

Once you have established a Local or Remote PED connection, you can proceed with initializing roles on the HSM that require PED authentication. The procedures in this section will guide you through the PED prompts at each stage of PED key creation, PED authentication, and other operations with the SafeNet Luna PED.

- > ["Creating PED Keys" on the next page](#)
 - ["Stage 1: Reusing Existing PED Keys" on page 50](#)
 - ["Stage 2: Defining M of N" on page 51](#)
 - ["Stage 3: Setting a PED PIN" on page 52](#)
 - ["Stage 4: Duplicating New PED Keys" on page 53](#)
- > ["Performing PED Authentication" on page 54](#)
- > ["Consequences of Losing PED Keys" on page 55](#)
- > ["Identifying a PED Key Secret" on page 58](#)
- > ["Duplicating Existing PED Keys" on page 59](#)

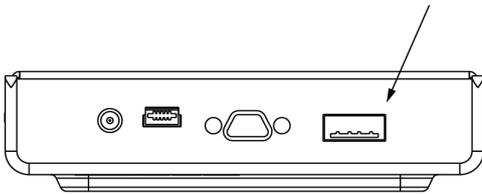
> ["Changing a PED Key Secret" on page 59](#)

Creating PED Keys

When you initialize an HSM, partition, or role, the SafeNet Luna PED issues a series of prompts for you to follow to create your PED keys. PED key actions have a timeout setting (default: 200 seconds); ensure that you have everything you need before issuing an initialization command. The requirements for the operation depend on the PED key scheme you have chosen in advance, based on your organization's security policy. Consider these guidelines before you begin:

- > If you are reusing an existing PED key or keyset, the owners of those keys must be present with their keys and PED PINs ready.
- > If you plan to use an M of N authentication scheme (quorum, or split-secret), all the parties involved must be present and ready to create their authentication split. It is advisable for each key holder to create backup duplicates, so you must have a sufficient number of blank or rewritable PED keys ready before you begin.
- > If you plan to make backup duplicates of PED keys, you must have a sufficient number of blank or rewritable PED keys ready.
- > If you plan to use PED PINs, ensure that they can be privately entered on the Luna PED and memorized, or written down and securely stored.

Whenever the Luna PED prompts you to insert a PED key, use the USB port on the top of the PED:



To initiate PED key creation

1. Issue one of the following LunaCM commands to initialize the applicable role, domain, or vector.
 - **Blue HSM SO and Red HSM Domain Keys:**
lunacm:> **hsm init**
 - **Orange Remote PED Key:**
lunacm:> **ped vector init**
 - **Blue Partition SO and Red Partition Domain Keys:**
lunacm:> **partition init**
 - **Black Crypto Officer Key:**
lunacm:> **role init -name co**
 - **Gray Crypto User Key:**
lunacm:> **role init -name cu**
 - **White Audit User Key:**
lunacm:> **role init -name au**

The Luna PED responds, displaying:

```
Remote PED mode
Token found
```

2. Follow the PED prompts in the following four stages.

Stage 1: Reusing Existing PED Keys

If you want to use a PED key with an existing authentication secret, have the key ready to present to the PED. Reasons for reusing keys may include:

- > You want to use the same blue SO key to authenticate multiple HSMs/partitions
- > You want to initialize a partition in an already-existing cloning domain (to be part of an HA group)

CAUTION! The initialization procedure is the only opportunity to set the HSM/partition's cloning domain. It cannot be changed later without reinitializing the HSM, or deleting and recreating the partition. Ensure that you have the correct red key(s) ready.

See "[Shared PED Key Secrets](#)" on page 25 and "[Domain PED Keys](#)" on page 26 for more information.

1. The first PED prompt asks if you want to reuse an existing PED key. Press **Yes** or **No** on the keypad to continue.

```
SLOT
SETTING SO PIN...
Would you like to
reuse an existing
keyset?(Y/N)
```

- If you select **No**, skip to "[Stage 2: Defining M of N](#)" on the next page.
- If you select **Yes**, the PED prompts you for a key. Insert the key you want to reuse and press **Enter**.

```
SLOT
SETTING SO PIN...
Insert a
SO / HSM Admin
PED Key (BLUE)
Press ENTER.
```

2. If the key has a PED PIN, the PED prompts you to enter it now. Enter the PIN on the keypad and press **Enter**.

```
SLOT
READING SO PIN...
Enter PED PIN:
*****
```

3. If the key is part of an M of N scheme, the PED prompts you for the next key. You must present enough key splits (M) to reconstitute the entire authentication secret.

```
SLOT
READING SO PIN...
Keys read: 01 of 03
Insert another
SO / HSM Admin
PED Key (BLUE)
Press ENTER.
```

4. The PED asks if you want to create a duplicate set of keys. If you are duplicating an M of N keyset, you need a number of blank or rewritable keys equal to N.

```
SLOT
READING SO PIN...
Are you duplicating
this keyset?(Y/N)
Warning: You will
need all N keys!
```

- If you select **No**, the process is complete.
- If you select **Yes**, complete "[Stage 3: Setting a PED PIN](#)" on the next page for all the duplicate keys you want.

Stage 2: Defining M of N

If you chose to create a new keyset, the Luna PED prompts you to define the M of N scheme (quorum and pool of splits) for the role, domain, or vector. See "[M of N Split Secrets \(Quorum\)](#)" on page 26 for more information. If you do not want to use M of N (authentication by one PED key), enter a value of **1** for both M and N.

1. The PED prompts you to enter a value for M (the minimum number of split-secret keys required to authenticate the role, domain, or vector - the quorum). Set a value for M by entering it on the keypad and pressing **Enter**. If you are not using an M of N scheme, enter "**1**".

```
SLOT
SETTING SO PIN...
M value? (1-16)

>03
```

2. The PED prompts you to enter a value for N -- the total number of split-secret keys you want to create (the pool of splits from which a quorum will be drawn). Set a value for N by entering it on the keypad and pressing **Enter**. If you are not using an M of N scheme, enter "**1**".

```
SLOT
SETTING SO PIN...
N value? (M-16)

>05
```

- Continue to ["Stage 3: Setting a PED PIN" below](#). You must complete stage 3 for each key in the M of N scheme.

Stage 3: Setting a PED PIN

If you are creating a new key or M of N split, you have the option of setting a PED PIN that must be entered by the key owner during authentication. PED PINs must be 4-48 digits long. Do not use 0 for the first digit. See ["PED PINs" on page 26](#) for more information.

CAUTION! If you forget your PED PIN, it is the same as losing the PED key entirely; you cannot authenticate the role. See ["Consequences of Losing PED Keys" on page 55](#).

- The PED prompts you to insert a blank or reusable PED key. If you are creating an M of N split, the number of already-created splits is displayed.

```
SLOT
SETTING SO PIN...
Insert a
SO / HSM Admin
PED Key (BLUE)
Press ENTER.
```

```
SLOT
SETTING SO PIN...
Keys write: 03 of 05
Insert another
SO / HSM Admin
PED Key (BLUE)
Press ENTER.
```

- Insert the PED key and press **Enter**. The PED prompts for confirmation.

```
SLOT
SETTING SO PIN...
** WARNING **
This PED Key is
blank.
Overwrite? YES/NO
```

If the PED key you inserted is not blank, you must confirm twice that you want to overwrite it.

```
SLOT
SETTING SO PIN...
** WARNING **
This PED Key is for
Domain.
Overwrite? YES/NO
```

```
SLOT
SETTING SO PIN...
** WARNING **
Are you sure you
want to overwrite
this PED key? YES/NO
```

- The PED prompts you for a PIN.
 - If you want to set a PED PIN, enter it on the keypad and press **Enter**. Enter the PIN again to confirm it.

```
SLOT
SETTING SO PIN...
Enter new PED PIN:
*****
Confirm new PED PIN:
*****
```

- If you do not want to set a PED PIN, press **Enter** twice without entering anything on the keypad. You will not be asked to enter a PIN for this key in the future.

```
SLOT
SETTING SO PIN...
Enter new PED PIN:
Confirm new PED PIN:
```

4. If there are more keys in the M of N scheme, repeat this stage. Otherwise, continue to ["Stage 4: Duplicating New PED Keys"](#) below.

Stage 4: Duplicating New PED Keys

You now have the option to create duplicates of your newly-created PED key(s). There are two reasons to do this now:

- > If you want more than one person to be able to authenticate a role, you can create multiple keys for that role now, with each person being able to set their own PED PIN. Duplicates you create later are intended as backups, and will have the same PED PIN (or none) as the key they are copied from.
- > In case of key loss or theft.

You can make backups now or later. See also ["Duplicating Existing PED Keys"](#) on page 59.

1. The next PED prompt asks if you want to create a duplicate keyset (or another duplicate). Press **Yes** or **No** on the keypad to continue.

```
SLOT
SETTING SO PIN...
Are you duplicating
this keyset?(Y/N)
```

```
SLOT
SETTING SO PIN...
Would you like to
make another
duplicate set?(Y/N)
```

- If you select **No**, the key creation process is complete.
 - If you select **Yes**, complete ["Stage 3: Setting a PED PIN"](#) on the previous page for the duplicate keyset. You can set the same PED PIN to create a true copy, or set a different PED PIN for each duplicate.
2. If you specified an M of N scheme, you are prompted to repeat ["Stage 3: Setting a PED PIN"](#) on the previous page for each M of N split. Otherwise, the key creation process is complete.

Performing PED Authentication

When connected, the SafeNet Luna PED responds to authentication commands in LunaCM. Commands that require PED actions include:

- > Role login commands (blue, black, gray, or white PED keys)
- > Backup/restore commands (red PED keys)
- > Remote PED connection commands (orange PED key)

When you issue a command that requires PED interaction, the interface returns a message like the following:

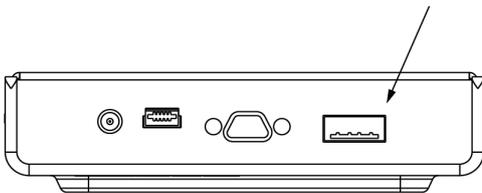
```
lunacm:>role login -name po
```

```
Please attend to the PED.
```

The PED briefly displays the following message before prompting you for the appropriate PED key:

```
Remote PED mode
Token found
```

Whenever the Luna PED prompts you to insert a PED key, use the USB port on the top of the PED:



CAUTION! Multiple failed authentication attempts result in zeroization of the HSM or partition, or role lockout, depending on the role. This is a security measure designed to thwart repeated, unauthorized attempts to access cryptographic material. For details, see [Logging In as HSM Security Officer](#) or "[Logging In to the Application Partition](#)" on page 111.

To perform PED authentication

1. The PED prompts for the corresponding PED key. Insert the PED key (or the first M of N split-secret key) and press **Enter**.

```
lunacm:>role login -name po
```

```
Please attend to the PED.
```

```
SLOT
SO LOGIN...
Insert a
SO / HSM Admin
PED Key (BLUE)
Press ENTER.
```

- If the key you inserted has an associated PED PIN, continue to step 2.

- If the key you inserted has no PED PIN, but it is an M of N split, skip to step 3.
- Otherwise, authentication is complete and the PED returns control to the command interface.

Command Result : No Error

2. The PED prompts for the PED PIN. Enter the PIN on the keypad and press **Enter**.

```
SLOT
SO LOGIN...
Enter PED PIN:
*****
```

- If the key you inserted is an M of N split, continue to step 3.
- Otherwise, authentication is complete and the PED returns control to the command interface.

Command Result : No Error

3. The PED prompts for the next M of N split-secret key. Insert the next PED key and press **Enter**.

```
SLOT
SO LOGIN...
Keys read: 01 of 02
Insert another
SO / HSM Admin
PED Key (BLUE)
Press ENTER.
```

- If the key you inserted has an associated PED PIN, return to step 2.
- Repeat steps 2 and/or 3 until the requisite M number of keys have been presented to the PED. At this point, authentication is complete and the PED returns control to the command interface.

Command Result : No Error

Consequences of Losing PED Keys

PED keys are the only means of authenticating roles, domains, and RPVs on the PED-authenticated SafeNet Luna Network HSM. Losing a PED keyset effectively locks the user out of that role. Always keep secure backups of your PED keys, including M of N split secrets. Forgetting the PED PIN associated with a key is equivalent to losing the key entirely. Losing a split-secret key is less serious, unless enough splits are lost so that M cannot be satisfied.

If a PED key is lost or stolen, log in with one of your backup keys and change the existing PED secret immediately, to prevent unauthorized HSM access.

The consequences of a lost PED key with no backup vary depending on the type of secret:

- > ["Blue HSM SO Key" on the next page](#)
- > ["Red HSM Domain Key" on the next page](#)
- > ["Orange Remote PED Key" on the next page](#)
- > ["Blue Partition SO Key" on the next page](#)
- > ["Red Partition Domain Key" on page 57](#)
- > ["Black Crypto Officer Key" on page 57](#)

- > ["Gray Crypto User Key" on the next page](#)
- > ["White Audit User Key" on page 58](#)

Blue HSM SO Key

If the HSM SO secret is lost, you can no longer perform administrative tasks on the HSM, including partition creation and client assignment. If you use the same blue SO key for your HSM backup partitions, the contents of the HSM Admin partition are unrecoverable. Take the following steps:

1. Contact all Crypto Officers and have them immediately make backups of their existing partitions.
2. When all important partitions are backed up, execute a factory reset of the HSM.
3. Initialize the HSM and create a new HSM SO secret. Use the original red HSM cloning domain key.
4. Restore the HSM Admin partition contents from a recent backup, if you have one.
5. Recreate the partitions and reassign them to their respective clients.
6. Partition SOs must initialize the new partitions using their original blue and red key(s), and initialize the Crypto Officer role (and Activation secret, if applicable). Supply the new black CO keys to the Crypto Officers.
7. Crypto Officers must change the login credentials from the new black CO key to their original black keys (and reset the Activation secret password, if applicable).
8. Crypto Officers can now restore all partition contents from backup.
9. If you are using Remote PED, you must recreate the Remote PED Vector (RPV). Reuse the original orange key.

Red HSM Domain Key

If the HSM Key Cloning Vector is lost, you can no longer perform backup/restore operations on the HSM Admin partition(s). If the HSM is factory-reset, the contents of the HSM Admin partition are unrecoverable. Follow the same procedure as you would if you lost the blue HSM SO key, but you cannot restore the HSM Admin partition from backup.

Orange Remote PED Key

If the Remote PED Vector is lost, create a new one and distribute a copy to the administrator of each Remote PED server. See ["Initializing the Remote PED Vector \(RPV\) and Creating an Orange Remote PED Key \(RPK\)" on page 39](#).

Blue Partition SO Key

If the Partition SO secret is lost, you can no longer perform administrative tasks on the partition. Take the following steps:

1. Have the Crypto Officer immediately make a backup of the partition objects.
2. Have the HSM SO delete the partition, create a new one, and assign it to the same client.
3. Initialize the new partition with a new blue Partition SO key and the original red cloning domain key(s).
4. Initialize the Crypto Officer role (and Activation secret, if applicable). Supply the new black CO key to the Crypto Officer.

5. The Crypto Officer must change the login credentials from the new black CO key to their original black key (and reset the Activation secret password, if applicable).
6. The Crypto Officer can now restore all partition contents from backup.

Red Partition Domain Key

If the Partition Key Cloning Vector is lost, you can no longer perform backup/restore operations on the partition (s), or make changes to HA groups in that cloning domain. You can still perform all other operations on the partition. Take the following steps:

1. Have the HSM SO create a new partition (or multiple partitions, to replace the entire HA group) and assign it to the same client(s).
2. Initialize the partition(s) with a new cloning domain.
3. Initialize the Crypto Officer role with the original black Crypto Officer key (and Activation password, if applicable).
4. Create objects on the new partition to replace those on the original partition.
5. As soon as possible, change all applications to use the objects on the new partition.
6. When objects on the original partition are no longer in production use, the HSM SO can delete the original partition.

Black Crypto Officer Key

If the Crypto Officer secret is lost, you can no longer create objects on the partition, or perform backup/restore operations. You might still be able to use the partition, depending on the following criteria:

> PIN reset by Partition SO:

- If HSM policy **15: Enable SO reset of partition PIN** is set to **1**, the Partition SO can reset the Crypto Officer secret and create a new black CO key.

```
lunacm:>role resetpw -name co
```

- If this policy is set to **0** (default), the CO is locked out unless other criteria in this list apply.

> Partition Activation:

- If the partition is Activated, you can still access it for production using the CO challenge secret. Change your applications to use objects on a new partition as soon as possible.
- If the partition is not Activated, read-only access of essential objects might still be available via the Crypto User role.

> Crypto User

- If the Crypto User is initialized, you can use the CU role for read-only access to essential partition objects while you change your applications to use objects on a new partition.

If none of these criteria apply, the contents of the partition are unrecoverable.

Gray Crypto User Key

If the Crypto User secret is lost, the Crypto Officer can reset the CU secret and create a new gray key:

```
lunacm:>role resetpw -name cu
```

White Audit User Key

If the Audit User secret is lost, you can no longer cryptographically verify existing audit logs or make changes to the audit configuration. The existing logs can still be viewed. Re-initialize the Audit User role on the affected HSMs, using the same white key for HSMs that will verify each other's logs.

Identifying a PED Key Secret

You can use this procedure to identify the type of secret (role, domain, or RPV) stored on an unidentified PED key. This procedure will not tell you:

- > identifying information about the HSM the key is associated with
- > whether the key is part of an M of N scheme, or how many keys are in the set
- > whether the key has a PED PIN assigned
- > who the key belongs to

You require:

- > SafeNet Luna PED in Admin Mode (see ["Changing Modes" on page 32](#))
- > the key you want to identify

To identify the type of secret stored on a PED key

1. Insert the PED key you want to identify.
2. From the Admin mode menu, press **1** on the keypad to select the **PED Key** option.

```
Admin mode...
1 PED Key
5 Backup Devices
7 Software Update
9 Self Test
< EXIT
```

3. From the PED Key mode menu, press **3** on the keypad to select the **List types** option.

```
PED Key mode
1 Login
3 List types
< EXIT
```

The PED secret type is identified on-screen.

```
PED Key mode
Found keys:
Domain

Press ENTER.
```

Duplicating Existing PED Keys

During the key creation process, you have the option to create multiple copies of PED keys. If you want to make backups of your keys later, you can use this procedure to copy PED keys. You require:

- > SafeNet Luna PED in Admin Mode (see ["Changing Modes" on page 32](#))
- > Enough blank or rewritable keys to make your copies

The PED key is duplicated exactly by this process. If there is a PED PIN assigned, the same PIN is assigned to the duplicate key. If the key is part of an M of N scheme, the duplicates may not be used in the same login process to satisfy the M of N requirements. You must also have copies of the other keys in the M of N keyset. See ["M of N Split Secrets \(Quorum\)" on page 26](#).

To duplicate an existing PED key

1. Insert the PED key you want to duplicate. Have a blank or rewritable PED key ready.
2. From the Admin mode menu, press **1** on the keypad to login to the PED key.

```

PED Key mode
  1 Login
  3 List types

< EXIT

```

3. Press **7** on the keypad and follow the on-screen instructions.

```

PED Key mode
  2 Logout
  3 List types
  7 Duplicate
< EXIT

```

Changing a PED Key Secret

It may be necessary to change the PED secret associated with a role. Reasons for changing credentials include:

- > Regular credential rotation as part of your organization's security policy
- > Compromise of a role due to loss or theft of a PED key
- > Personnel changes in your organization or changes to individual security clearances
- > Changes to your security scheme (implementing/revoking M of N, PED PINs, or shared secrets)

The procedure for changing a PED key credential depends on the type of key. Procedures for each type are provided below.

CAUTION! If you are changing a PED credential that is shared among multiple HSMs/partitions/roles, always keep at least one copy of the old keyset until the affected HSMs/partitions/roles are all changed to the new credential. When changing PED credentials, you must always present the old keyset first; do not overwrite your old PED keys until you have no further need for them.

- > ["Blue HSM SO Key" below](#)
- > ["Red HSM Domain Key" below](#)
- > ["Orange Remote PED Key" below](#)
- > ["Blue Partition SO Key" on the next page](#)
- > ["Red Partition Domain Key" on the next page](#)
- > ["Black Crypto Officer Key" on the next page](#)
- > ["Gray Crypto User Key" on the next page](#)
- > ["White Audit User Key" on page 62](#)

Blue HSM SO Key

The HSM SO can use this procedure to change the HSM SO credential.

To change the blue HSM SO PED key credential

1. In LunaCM, set the active slot to the Admin partition and login as HSM SO.
lunacm:> **role login -name so**
2. Initiate the PED key change.
lunacm:> **role changepw -name so**
3. You are prompted to present the original blue key(s) and then to create a new HSM SO keyset. See ["Creating PED Keys" on page 49](#).

Red HSM Domain Key

It is not possible to change an HSM's cloning domain without factory-resetting the HSM and setting the new cloning domain as part of the standard initialization procedure.

CAUTION! If you set a different cloning domain for the HSM, you cannot restore the HSM Admin partition from backup.

Orange Remote PED Key

The HSM SO can use this procedure to change the Remote PED Vector (RPV) for the HSM.

To change the RPV/orange key credential

1. In LunaCM, set the active slot to the Admin partition and login as HSM SO.
lunacm:> **role login -name so**
2. Initialize the RPV.

lunacm:> **ped vector init**

You are prompted to create a new Remote PED key.

3. Distribute a copy of the new orange key to the administrator of each Remote PED server.

Blue Partition SO Key

The Partition SO can use this procedure to change the Partition SO credential.

To change a blue Partition SO PED key credential

1. In LunaCM, log in as Partition SO.

lunacm:> **role login -name po**

2. Initiate the PED key change.

lunacm:> **role changepw -name po**

3. You are prompted to present the original blue key(s) and then to create a new Partition SO keyset.

Red Partition Domain Key

It is not possible to change a partition's cloning domain. A new partition must be created and initialized with the desired domain. The new partition will not have access to any of the original partition's backups. It cannot be made a member of the same HA group as the original.

Black Crypto Officer Key

The Crypto Officer can use this procedure to change the Crypto Officer credential.

To change a black Crypto Officer PED key credential

1. In LunaCM, log in as Crypto Officer.

lunacm:> **role login -name co**

2. Initiate the PED key change.

lunacm:> **role changepw -name co**

3. You are prompted to present the original black key(s) and then to create a new Crypto Officer keyset.

Gray Crypto User Key

The Crypto User can use this procedure to change the Crypto User credential.

To change a gray Crypto User PED key credential

1. In LunaCM, log in as Crypto User.

lunacm:> **role login -name cu**

2. Initiate the PED key change.

lunacm:> **role changepw -name cu**

3. You are prompted to present the original gray key(s) and then to create a new Crypto User keyset.

White Audit User Key

The Audit User can use this procedure to change the Audit User credential.

To change the white Audit User PED key credential

1. In LunaCM, set the active slot to the Admin partition and login as Auditor.

```
lunacm:> role login -name au
```
2. Initiate the PED key change.

```
lunacm:> role changepw -name au
```
3. You are prompted to present the original white key(s) and then to create a new Audit User keyset.

PEDserver and PEDclient

You can use the **PEDserver** and **PEDclient** utilities to manage your remote PED devices.

The PEDserver Utility

PEDserver is required to run on any computer that has a SafeNet Remote PED attached, and is providing PED services.

The PEDserver utility has one function. It resides on a computer with an attached Luna PED (in Remote Mode), and it serves PED operations to an instance of PEDclient that operates on behalf of an HSM. The HSM could be local to the computer that has PEDserver running, or it could be on another HSM host computer at some distant location.

PEDserver can also run in peer-to-peer mode, where the server initiates the connection to the Client. This is needed when the Client (usually SafeNet Luna Network HSM) is behind a firewall that forbids outgoing initiation of connections.

See "[pedserver](#)" on page 64.

The PEDclient Utility

PEDclient is required to run on any host of an HSM that needs to be served by a Remote Luna PED. PEDclient must also run on any host of a Remote Backup HSM that will be serving remote primary HSMs.

The PEDclient utility performs the following functions:

- > It mediates between the HSM where it is installed and the Luna PED where PEDserver is installed, to provide PED services to the requesting HSM(s).
- > It resides on a computer with RBS and an attached SafeNet Luna Backup HSM, and it connects with another instance of PEDclient on a distant host of an HSM, to provide the link component for Remote Backup Service. See "[Configuring a G5 Remote Backup HSM Server](#)" on page 200 for more information.
- > It acts as the logging daemon for HSM audit logs.

Thus, for example, in the case where an administrative workstation or laptop has both a Remote PED and a Remote Backup HSM attached, PEDclient would perform double duty. It would link with a locally-running instance of PEDserver, to convey HSM requests from the locally-connected Backup HSM to the locally-

connected PED, and return the PED responses. As well, it would link a locally-running instance of RBS and a distant PEDclient instance to mediate Remote Backup function for that distant HSM's partitions. See ["Configuring a G5 Remote Backup HSM Server" on page 200](#) for more information.

See ["pedclient" on page 80](#).

pedserver

Use the **pedserver** commands to manage certificates in PEDserver and the appliance, initiate connections between the PED and HSM, and select the PED for HSM operation.

NOTE The **pedserver** commands are available on Windows only.

To run PEDserver from the command line, you must specify one of the following three options.

Syntax

pedserver

appliance

mode

regen

| Option | Description |
|------------------|--|
| appliance | Registers or deregisters an appliance, or lists the registered appliances. Applies to server-initiated (peer-to-peer) mode only. See " pedserver appliance " on the next page. |
| mode | Specifies the mode that the PED Server will be executed in. See " pedserver mode " on page 69. |
| regen | Regenerates the client certificate. Applies to server-initiated (peer-to-peer) mode only. See " pedserver regen " on page 80. |

pedserver appliance

Registers or deregisters an appliance, or lists the registered appliances. These commands apply to PED-initiated mode only.

Syntax

pedserver appliance

delete
list
register

| Option | Description |
|-----------------|--|
| delete | Deregisters an appliance. See " pedserver appliance delete " on the next page. |
| list | Lists the registered appliances. See " pedserver appliance list " on page 67. |
| register | Registers an appliance. See " pedserver appliance register " on page 68 |

pedserver appliance delete

Deregister an appliance certificate from PEDserver.

Syntax

pedserver appliance delete -name <unique name> [-force]

| Option | Description |
|----------------------------|--|
| -name <unique name> | Specifies the name of the appliance to be deregistered from PEDserver. |
| -force | Optional parameter. Suppresses any prompts. |

Example

```
C:\Program Files\Safenet\LunaClient>pedServer -appliance delete -name hello -force
```

pedserver appliance list

Displays a list of appliances registered with PEDserver.

Syntax

pedserver appliance list

Example

```
C:\Program Files\Safenet\LunaClient>pedServer -appliance list
```

```
>
```

| Server Name | IP Address | Port Number | Certificate Common Name |
|-------------|------------|-------------|-------------------------|
|-------------|------------|-------------|-------------------------|

| | | | |
|-------|--------------|------|-----------|
| abox | 192.20.1.23 | 9697 | test2 |
| bbox | 192.20.12.34 | 9696 | test1 |
| hello | 192.20.1.34 | 9876 | hellocert |

pedserver appliance register

Register an appliance certificate with PEDserver.

Syntax

pedserver appliance register -name <unique name> **-certificate** <appliance certificate file> **-ip** <appliance server IP address> [**-port** <port number>]

| Option | Description |
|--|--|
| -name <unique name> | Specifies the name of the appliance to be registered to PED Server. |
| -certificate <appliance certificate file> | Specifies the full path and filename of the certificate that was retrieved from the appliance. |
| -ip <appliance server IP address> | Specifies the IP address of the appliance server. |
| -port <port number> | Optional field. Specifies the port number used to connect to the appliance (directly or indirectly according to network configuration). Range: 0-65525 |

Example

```
C:\Program Files\Safenet\LunaClient>pedServer -appliance register -name hello -certificate the-best-appliance.pem -ip 123.321.123.321 -port 9697
```

pedserver mode

Specifies the mode that PEDserver will be executed in.

Syntax

pedserver mode

```

config
connect
disconnect
show
start
stop

```

| Option | Description |
|-------------------|---|
| config | Modifies or shows existing configuration file settings. See "pedserver mode config" on the next page . |
| connect | Connects to the appliance. See "pedserver mode connect" on page 72 . |
| disconnect | Disconnects from the appliance. See "pedserver mode disconnect" on page 73 . |
| show | Queries if PEDserver is currently running, and gets details about PEDserver. See "pedserver mode show" on page 74 . |
| start | Starts PEDserver. See "pedserver mode start" on page 76 . |
| stop | Shuts down PEDserver. See "pedserver mode stop" on page 78 . |

pedserver mode config

Shows and modifies internal PEDserver configuration file settings.

Syntax

```
pedserver mode config -name <registered appliance name> -show -set [-port <server port>] [-set][-configfile <filename>] [-admin <admin port number>] [-eserverport <0 or 1>] [-eadmin <0 or 1>] [-idletimeout <int>] [-socketreadtimeout <int>] [-socketwritetimeout <int>] [-internalshutdowntimeout <int>] [-bgprocessstartuptimeout <int>] [-bgprocessshutdowntimeout <int>] [-logfile <filename>] [-loginfo <0 or 1>] [-logwarning <0 or 1>] [-logerror <0 or 1>] [-logtrace <0 or 1>] [-maxlogfilesize <size>] [-pinginterval <int>] [-pingtimeout <int>]
```

| Option | Description |
|--|---|
| -name <registered appliance name> | Specifies the name of the registered appliance to be configured. |
| -show | Displays the contents of the PEDserver configuration file. |
| -set | Updates the PEDserver configuration file to be up to date with other supplied options. |
| -port <server port> | Optional. Specifies the server port number. |
| -configfile <filename> | Optional. Specifies which PEDserver configuration file to use. |
| -admin <admin port number> | Optional. Specifies the administration port number. |
| -eserverport <0 or 1> | Optional. Specifies if the server port is on "localhost" or listening on the external host name. |
| -eadmin <0 or 1> | Optional. Specifies if the administration is on "localhost" or listening on the external host name. |
| -idletimeout <int> | Optional. Specifies the idle connection timeout, in seconds. |
| -socketreadtimeout <int> | Optional. Specifies the socket read timeout, in seconds. |
| -socketwritetimeout <int> | Optional. Specifies socket write timeout, in seconds. |
| -internalshutdowntimeout <int> | Optional. Specifies the shutdown timeout for internal services, in seconds. |
| -bgprocessstartuptimeout <int> | Optional. Specifies the startup timeout for the detached process, in seconds. |

| Option | Description |
|--|--|
| -bgprocessshutdowntimeout <int> | Optional. Specifies the shutdown timeout for the detached process, in seconds. |
| -logfile <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |
| -pinginterval <int> | Optional. Specifies the time interval between ping commands, in seconds. |
| -pingtimeout <int> | Optional. Specifies timeout of the ping response, in seconds. |

Example

```
C:\Program Files\Safenet\LunaClient>pedServer -mode config -name hellohi -show
```

pedserver mode connect

Connects to the appliance by retrieving information (IP address, port, PEDserver certificate) from the PEDserver configuration file.

If the running mode is legacy, an error is returned. **pedserver mode connect** is not a valid command for legacy connections.

The **connect** command will try connecting to PEDclient 20 times before giving up.

Syntax

pedserver mode connect -name <registered appliance name> [**-configfile** <filename>] [**-logfile** <filename>] [**-loginfo** <0 or 1>] [**-logwarning** <0 or 1>] [**-logerror** <0 or 1>] [**-logtrace** <0 or 1>] [**-maxlogfilesize** <size>]

| Option | Description |
|--|--|
| -name <registered appliance name> | Specifies the name of the registered appliance to be connected to PEDserver. |
| -configfile <filename> | Optional. Specifies which PEDserver configuration file to use. |
| -logfile <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |

Example

```
C:\Program Files\Safenet\LunaClient>pedServer -mode connect -name hellohi
>Connecting to Luna SA. Please wait....
>Successfully connected to Luna SA.
```

pedserver mode disconnect

Disconnects PEDserver from the appliance.

If the running mode is legacy, an error is returned. **pedserver mode disconnect** is not a valid command for legacy connections.

Termination of the connection may take a few minutes.

Syntax

pedserver mode disconnect -name <registered appliance name> [-**configfile** <filename>] [-**logfile** <filename>] [-**loginfo** <0 or 1>] [-**logwarning** <0 or 1>] [-**logerror** <0 or 1>] [-**logtrace** <0 or 1>] [-**maxlogfilesize** <size>]

| Option | Description |
|--|--|
| -name <registered appliance name> | Specifies the name of the registered appliance to be disconnected from PEDserver. |
| -configfile <filename> | Optional. Specifies which PEDserver configuration file to use. |
| -logfile <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |

Example

```
C:\Program Files\Safenet\LunaClient>pedServer -mode disconnect -name hellohi
>Connection to Luna SA terminated.
```

pedserver mode show

Queries if PEDserver is currently running, and gets details about PEDserver.

Syntax

pedserver mode show [-name <registered appliance name>] [-configfile <filename>] [-logfile <filename>] [-loginfo <0 or 1>] [-logwarning <0 or 1>] [-logerror <0 or 1>] [-logtrace <0 or 1>] [-maxlogfilesize <size>]

| Option | Description |
|-----------------------------------|---|
| -name <registered appliance name> | Specifies the name of the registered appliance to be queried. Applies to server-initiated (peer-to-peer) mode only. |
| -configfile <filename> | Optional. Specifies which PEDserver configuration file to use. |
| -logfile <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |

Example

```
C:\Program Files\Safenet\LunaClient>pedServer -mode show -name hellohi
>Ped Server launched in status mode.
  Server Information:
    Hostname:                ABC1-123123
    IP:                      192.10.10.123
    Firmware Version:        2.5.0-1
    PedII Protocol Version:   1.0.1-0
    Software Version:         1.0.5 (10005)
    Ped2 Connection Status:   Connected
    Ped2 RPK Count            1
    Ped2 RPK Serial Numbers   (1a123456789a1234)
  Client Information:        Not Available
  Operating Information:
    Server Port:              1234
    External Server Interface: Yes
    Admin Port:               1235
```

```
External Admin Interface:      No
Server Up Time:                8 (secs)
Server Idle Time:              8 (secs) (100%)
Idle Timeout Value:            1800 (secs)
Current Connection Time:       0 (secs)
Current Connection Idle Time:  0 (secs)
Current Connection Total Idle Time: 0 (secs) (100%)
Total Connection Time:         0 (secs)
Total Connection Idle Time:    0 (secs) (100%)
>Show command passed.
```

pedserver mode start

Starts up PEDserver.

Syntax

pedserver mode start [-name <registered appliance name>] [-ip <server_IP>] [-port <server port>] [-configfile <filename>] [-admin <admin port number>] [-eserverport <0 or 1>] [-eadmin <0 or 1>] [-idletimeout <int>] [-socketreadtimeout <int>] [-socketwritetimeout <int>] [-internalshutdowntimeout <int>] [-bgprocessstartuptimeout <int>] [-bgprocessshutdowntimeout <int>] [-logfile <filename>] [-loginfo <0 or 1>] [-logwarning <0 or 1>] [-logerror <0 or 1>] [-logtrace <0 or 1>] [-maxlogfilesize <size>] [-pinginterval <int>] [-pingtimeout <int>] [-force]

| Option | Description |
|--|---|
| -admin <admin port number> | Optional. Specifies the administration port number. |
| -bgprocessshutdowntimeout <int> | Optional. Specifies the shutdown timeout for the detached process, in seconds. |
| -bgprocessstartuptimeout <int> | Optional. Specifies the startup timeout for the detached process, in seconds. |
| -configfile <filename> | Optional. Specifies which PED Server configuration file to use. |
| -eadmin <0 or 1> | Optional. Specifies if the administration is on "localhost" or listening on the external host name. |
| -eserverport <0 or 1> | Optional. Specifies if the server port is on "localhost" or listening on the external host name. |
| -force | Optional parameter. Suppresses any prompts. |
| -idletimeout <int> | Optional. Specifies the idle connection timeout, in seconds. |
| -internalshutdowntimeout <int> | Optional. Specifies the shutdown timeout for internal services, in seconds. |
| -ip <server_IP> | Optional. Specifies the server listening IP address. When running pedserver - mode start on an IPv6 network, you must include this option. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logfile <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |

| Option | Description |
|--|--|
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |
| -name <registered appliance name> | |
| -pinginterval <int> | Optional. Specifies the time interval between ping commands, in seconds. |
| -pingtimeout <int> | Optional. Specifies timeout of the ping response, in seconds. |
| -port <server port> | Optional. Specifies the server port number. |
| -socketreadtimeout <int> | Optional. Specifies the socket read timeout, in seconds. |
| -socketwritetimeout <int> | Optional. Specifies socket write timeout, in seconds. |

Example

```
C:\Program Files\Safenet\LunaClient>pedServer -mode start -name hellohi -force
>Ped Server launched in startup mode.
>Starting background process
>Background process started
>Ped Server Process created, exiting this process.
```

pedserver mode stop

Stops PEDserver.

Syntax

pedserver mode stop [-name <registered appliance name>] [-configfile <filename>] [-socketwritetimeout <int>] [-internalshutdowntimeout <int>] [-bgprocessstartuptimeout <int>] [-bgprocessshutdowntimeout <int>] [-logfile <filename>] [-loginfo <0 or 1>] [-logwarning <0 or 1>] [-logerror <0 or 1>] [-logtrace <0 or 1>] [-maxlogfilesize <size>]

| Option | Description |
|--|--|
| -name <registered appliance name> | Specifies the name of the registered appliance to be on which PEDserver will be stopped. Applies to server-initiated (peer-to-peer) mode only. |
| -configfile <filename> | Optional. Specifies which PEDserver configuration file to use. |
| -socketreadtimeout <int> | Optional. Specifies the socket read timeout, in seconds. |
| -socketwritetimeout <int> | Optional. Specifies socket write timeout, in seconds. |
| -internalshutdowntimeout <int> | Optional. Specifies the shutdown timeout for internal services, in seconds. |
| -bgprocessstartuptimeout <int> | Optional. Specifies the startup timeout for the detached process, in seconds. |
| -bgprocessshutdowntimeout <int> | Optional. Specifies the shutdown timeout for the detached process, in seconds. |
| -logfile <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |

Example

```
C:\Program Files\Safenet\LunaClient>pedServer -mode stop -name hellohi
```

pedserver regen

Regenerates the client certificate. This command is available in server-initiated (peer-to-peer) mode only. Existing links (PEDserver, NTLS or STC) will not be affected until they are terminated. Afterward, the user is required to re-register the client certificate to NTLS and PEDserver.

NOTE The **pedserver -regen** command should be used only when there is no Luna HSM Client installed. When Luna HSM Client is installed on the host computer, use the LunaCM command **clientconfig deploy** with the **-regen** option .

Syntax

pedserver -regen -commonname <commonname> [-force]

| Option | Description |
|------------------------------------|---|
| -commonname <commonname> | The client's common name (CN). |
| -force | Optional parameter. Suppresses any prompts. |

Example

```
C:\Program Files\SafeNet\LunaClient>pedServer -regen -commonname win2016_server -force
Ped Server Version 1.0.6 (10006)
```

```
Private Key created and written to: C:\Program Files\SafeNet\LunaClient\cert\client\win2016_
serverKey.pem
Certificate created and written to: C:\Program Files\SafeNet\LunaClient\cert\client\win2016_
server.pem
```

Successfully regenerated the client certificate.

pedclient

Use the **pedclient** commands to start, stop, and configure the PEDclient service.

Syntax

pedclient mode

```
assignid
config
deleteid
releaseid
setid
show
```

start
stop
testid

| Option | Description |
|------------------|---|
| assignid | Assigns a PED ID mapping to an HSM. See "pedclient mode assignid" on the next page. |
| config | Modifies or shows existing configuration file settings. See "pedclient mode config" on page 83. |
| deleteid | Deletes a PED ID mapping. See "pedclient mode deleteid" on page 85. |
| releaseid | Releases a PED ID mapping from an HSM. See "pedclient mode releaseid" on page 86. |
| setid | Creates a PED ID mapping. See "pedclient mode setid" on page 87. |
| show | Queries if PEDclient is currently running and gets details about PEDclient. See "pedclient mode show" on page 88. |
| start | Starts up PEDclient. See "pedclient mode start" on page 89. |
| stop | Shuts down PEDclient. See "pedclient mode stop" on page 91. |
| testid | Tests a PED ID mapping. See "pedclient mode testid" on page 92. |

pedclient mode assignid

Assigns a PED ID mapping to a specified HSM.

Syntax

pedclient mode assignid -id <pedid> -id_serialnumber <serial> [-logfile <filename>] [-loginfo <0 or 1>] [-logwarning <0 or 1>] [-logerror <0 or 1>] [-logtrace <0 or 1>] [-maxlogfilesize <size>] [-locallogger]

| Option | Description |
|--|--|
| -id <pedid> | Specifies the ID of the PED to be assigned. |
| -id_serialnumber <serial> | Specifies the serial number of the HSM to be linked to the specified PED ID. |
| -logfile <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |
| -locallogger | Optional. Specifies that the Remote PED logger should be used, not the IS logging system. |

Example

```
C:\Program Files\Safenet\LunaClient>pedClient -mode assignid -id 1234 -id_serialnumber 123456789
```

pedclient mode config

Modifies or shows existing configuration file settings.

Syntax

pedclient mode config -show -set [-eadmin <0 or 1>] [-idletimeout <int>] [-ignoreidletimeout] [-socketreadtimeout <int>] [-socketwritetimeout <int>] [-shutdowntimeout <int>] [-pstartuptimeout <int>] [-pshutdowntimeout <int>] [-logfilename <filename>] [-loginfo <0 or 1>] [-logwarning <0 or 1>] [-logtrace <0 or 1>] [-maxlogfilesize <size>] [-locallogger]

| Option | Description |
|--|--|
| -show | Displays the contents of the configuration file. |
| -set | Updates the configuration file to be up to date with other supplied options. |
| -eadmin <0 or 1> | Optional. Specifies if the administration port is on "localhost" or on the external host name. |
| -idletimeout <int> | Optional. Specifies the idle connection timeout, in seconds. |
| -ignoreidletimeout | Optional. Specifies that the idle connection timeout should not apply to the connection established between the PED and HSM during their assignment. |
| -socketreadtimeout <int> | Optional. Specifies the socket read timeout, in seconds. |
| -socketwritetimeout <int> | Optional. Specifies the socket write timeout, in seconds. |
| -shutdowntimeout <int> | Optional. Specifies the shutdown timeout for internal services, in seconds. |
| -pstartuptimeout <int> | Optional. Specifies the startup timeout for the detached process, in seconds. |
| -pshutdowntimeout <int> | Optional. Specifies the shutdown timeout for the detached process, in seconds. |
| -logfilename <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |

| Option | Description |
|-------------------------------|---|
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |
| -locallogger | Optional. Specifies that the Remote PED logger should be used, not the IS logging system. |

Example

```
C:\Program Files\Safenet\LunaClient>pedClient -mode config -show
```

pedclient mode deleteid

Deletes a PED ID mapping between a specified PED and PEDserver.

Syntax

pedclient mode deleteid -id <PED_ID> [-logfilename <filename>] [-loginfo <0 or 1>] [-logwarning <0 or 1>] [-logerror <0 or 1>] [-logtrace <0 or 1>] [-maxlogfilesize <size>] [-locallogger]

| Option | Description |
|--------------------------------------|--|
| -id <PED_ID> | Specifies the ID of the PED to be deleted from the map. |
| -logfilename <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |
| -locallogger | Optional. Specifies that the Remote PED logger should be used, not the IS logging system. |

Example

```
C:\Program Files\Safenet\LunaClient>pedClient -mode deleteid -id 1234
```

pedclient mode releaseid

Releases a PED ID mapping from the HSM it was assigned to.

Syntax

pedclient mode releaseid -id <PED_ID> [-logfilename <filename>] [-loginfo <0 or 1>] [-logwarning <0 or 1>] [-logerror <0 or 1>] [-logtrace <0 or 1>] [-maxlogfilesize <size>] [-locallogger]

| Option | Description |
|--------------------------------|--|
| -id <PED_ID> | Specifies the ID of the PED to be released. |
| -logfilename <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |
| -locallogger | Optional. Specifies that the Remote PED logger should be used, not the IS logging system. |

Example

```
C:\Program Files\Safenet\LunaClient>pedClient -mode releaseid -id 1234
```

pedclient mode setid

Creates a PED ID mapping between a specified PED and PEDserver.

Syntax

pedclient mode setid -id <PED_ID> -id_ip <hostname> -id_port <port> [-logfilename <filename>] [-loginfo <0 or 1>] [-logwarning <0 or 1>] [-logerror <0 or 1>] [-logtrace <0 or 1>] [-maxlogfilesize <size>] [-locallogger]

| Option | Description |
|--------------------------------------|--|
| -id <PED_ID> | Specifies the ID of the PED to be mapped. |
| -id_ip <hostname> | Specifies the IP address or hostname of the PED Server to be linked with the PED ID. |
| -id_port <port> | Specifies the PED Server port to be linked with the PED ID. |
| -logfilename <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |
| -locallogger | Optional. Specifies that the Remote PED logger should be used, not the IS logging system. |

Example

```
C:\Program Files\Safenet\LunaClient>pedClient -mode setid -id 1234 -id_ip myhostname -id_port 3456
```

pedclient mode show

Queries if PEDclient is currently running and gets details about PEDclient.

Syntax

pedclient mode show [-admin <admin port number>] [-eadmin <0 or 1>] [-socketreadtimeout <int>] [-socketwritetimeout <int>] [-logfile <filename>] [-loginfo <0 or 1>] [-logwarning <0 or 1>] [-logtrace <0 or 1>] [-maxlogfilesize <size>] [-locallogger]

| Option | Description |
|-----------------------------------|--|
| -admin <admin port number> | Optional. Specifies the administration port number to use. |
| -eadmin <0 or 1> | Optional. Specifies if the administration port is on "localhost" or on the external host name. |
| -socketreadtimeout <int> | Optional. Specifies the socket read timeout, in seconds. |
| -socketwritetimeout <int> | Optional. Specifies the socket write timeout, in seconds. |
| -logfile <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |
| -locallogger | Optional. Specifies that the Remote PED logger should be used, not the IS logging system. |

Example

```
C:\Program Files\Safenet\LunaClient>pedClient -mode show
```

pedclient mode start

Starts up the PED Client.

Syntax

pedclient mode start [-winservice] [-eadmin <0 or 1>] [-idletimeout <int>] [-socketreadtimeout <int>] [-socketwritetimeout <int>] [-shutdowntimeout <int>] [-pstartuptimeout <int>] [-pshutdowntimeout <int>] [-logfilename <filename>] [-loginfo <0 or 1>] [-logwarning <0 or 1>] [-logtrace <0 or 1>] [-maxlogfilesize <size>] [-locallogger]

| Option | Description |
|----------------------------------|---|
| -winservice | Starts PEDclient for Windows service. The standard parameters used for pedclient mode start can be used for pedclient mode start -winservice as well. |
| -eadmin <0 or 1> | Optional. Specifies if the administration port is on "localhost" or on the external host name. |
| -idletimeout <int> | Optional. Specifies the idle connection timeout, in seconds. |
| -socketreadtimeout <int> | Optional. Specifies the socket read timeout, in seconds. |
| -socketwritetimeout <int> | Optional. Specifies the socket write timeout, in seconds. |
| -shutdowntimeout <int> | Optional. Specifies the shutdown timeout for internal services, in seconds. |
| -pstartuptimeout <int> | Optional. Specifies the startup timeout for the detached process, in seconds. |
| -pshutdowntimeout <int> | Optional. Specifies the shutdown timeout for the detached process, in seconds. |
| -logfilename <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |
| -locallogger | Optional. Specifies that the Remote PED logger should be used, not the IS logging system. |

Example

```
C:\Program Files\Safenet\LunaClient>pedClient -mode start
```

pedclient mode stop

Shuts down PEDclient.

Syntax

pedclient mode stop [-eadmin <0 or 1>] [-socketreadtimeout <int>] [-socketwritetimeout <int>] [-shutdowntimeout <int>] [-pstartuptimeout <int>] [-pshutdowntimeout <int>] [-logfilename <filename>] [-loginfo <0 or 1>] [-logwarning <0 or 1>] [-logtrace <0 or 1>] [-maxlogfilesize <size>] [-locallogger]

| Option | Description |
|----------------------------------|--|
| -eadmin <0 or 1> | Optional. Specifies if the administration port is on "localhost" or on the external host name. |
| -socketreadtimeout <int> | Optional. Specifies the socket read timeout, in seconds. |
| -socketwritetimeout <int> | Optional. Specifies the socket write timeout, in seconds. |
| -shutdowntimeout <int> | Optional. Specifies the shutdown timeout for internal services, in seconds. |
| -pstartuptimeout <int> | Optional. Specifies the startup timeout for the detached process, in seconds. |
| -pshutdowntimeout <int> | Optional. Specifies the shutdown timeout for the detached process, in seconds. |
| -logfilename <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |
| -locallogger | Optional. Specifies that the Remote PED logger should be used, not the IS logging system. |

Example

```
C:\Program Files\Safenet\LunaClient>pedClient -mode stop
```

pedclient mode testid

Tests a PED ID mapping between a specified PED and PEDserver.

Syntax

pedclient mode testid -id <PED_ID> [-logfilename <filename>] [-loginfo <0 or 1>] [-logwarning <0 or 1>] [-logerror <0 or 1>] [-logtrace <0 or 1>] [-maxlogfilesize <size>] [-locallogger]

| Option | Description |
|--------------------------------------|--|
| -id <PED_ID> | Specifies the ID of the PED to be tested. |
| -logfilename <filename> | Optional. Specifies the log file name to which the logger should log messages. |
| -loginfo <0 or 1> | Optional. Specifies if the logger should log "info" messages. Set to 0 for no, 1 for yes. |
| -logwarning <0 or 1> | Optional. Specifies if the logger should log "warning" messages. Set to 0 for no, 1 for yes. |
| -logerror <0 or 1> | Optional. Specifies if the logger should log "error" messages. Set to 0 for no, 1 for yes. |
| -logtrace <0 or 1> | Optional. Specifies if the logger should log "trace" messages. Set to 0 for no, 1 for yes. |
| -maxlogfilesize <size> | Optional. Specifies the maximum log file size in KB. |
| -locallogger | Optional. Specifies that the Remote PED logger should be used, not the IS logging system. |

Example

```
C:\Program Files\Safenet\LunaClient>pedClient -mode testid -id 1234
```

CHAPTER 3: Initializing an Application Partition

Before it can be used to store cryptographic objects or perform operations, an application partition must be initialized. Initialization is performed by the Partition Security Officer and sets the authentication credential. There are two scenarios where the Partition SO would initialize the partition:

- > **Preparing a new partition:** On a new partition, initialization sets the Partition SO authentication credential, an identifying label for the partition, and the partition's cloning domain (see ["Initializing a New Partition" below](#)).
- > **Erasing an existing partition:** The Partition SO can re-initialize a partition to erase all cryptographic objects and the Crypto Officer/Crypto User roles, and select a new partition label. The Partition SO credential and the cloning domain remain the same (see ["Re-initializing an Existing Partition" on the next page](#)).

Initializing a New Partition

Initializing an application partition for the first time establishes you as the Partition SO and sets a cloning domain for the partition. This procedure is performed using LunaCM.

Prerequisites

- > The new partition must be created on the HSM and visible in LunaCM (see [Creating or Deleting an Application Partition](#)).
- > If you want to configure the partition's policies with a policy template, the template file must be available on the client (see ["Setting Partition Policies Using a Template" on page 103](#)).
- > PED authentication: A local or remote PED connection must be established (see ["Local PED Setup" on page 33](#) or [Remote PED Setup](#)). Ensure that you have enough blue (Partition SO) and red (Domain) PED keys for your planned authentication scheme (see ["Creating PED Keys" on page 49](#)).

To initialize a new application partition

1. Launch LunaCM on the client workstation.
2. Set the active slot to the partition you want to initialize.
`lunacm:> slot set -slot <slot_number>`
3. Initialize the partition by specifying an identifying label. To initialize the partition using a policy template, specify the path to the template file.

The partition label created during initialization must be 1-32 characters in length. If you specify a longer label, it will automatically be truncated to 32 characters. The following characters are allowed:

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 !@#\$%^&* () -_ =+ [] {} \ | / ; : ' , . < > ` ~

Question marks (?) and double quotation marks (") are not allowed.

Spaces are allowed; enclose the label in double quotation marks if it includes spaces.

- **Password authentication:** You can specify a Partition SO password and/or a domain string with the initialization command, or enter them when prompted.

In LunaCM, passwords and activation challenge secrets must be 7-255 characters in length (**NOTE:** If you are using firmware version 7.0.1, 7.0.2, 7.0.3, 7.3.3, or 7.4.2, activation challenge secrets must be 7-16 characters in length). The following characters are allowed:

```
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 !@#$%^&*() -_ =+ []
{} \ | / ; : ' , . < > ? ` ~
```

Double quotation marks (") are problematic and should not be used in passwords.

Spaces are allowed; to specify a password with spaces using the **-password** option, enclose the password in double quotation marks.

The domain string must be 1-128 characters in length. The following characters are allowed:

```
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 !@#$%^&* -_ =+ [] {} / : ' , . ~
```

The following characters are problematic or invalid and must not be used in a domain string: "&;<>\`|()"

Spaces are allowed, as long as the leading character is not a space; to specify a domain string with spaces using the **-domain** option, enclose the string in double quotation marks.

```
lunacm:> partition init -label <label> [-applytemplate <template_file>] [-password <password>] [-domain <domain_string>]
```

- **PED authentication:**

```
lunacm:> partition init -label <label> [-applytemplate <template_file>]
```

Respond to the Luna PED prompts to create the blue Partition SO key and the red domain key (see "Creating PED Keys" on page 49).

Re-initializing an Existing Partition

The Partition SO can re-initialize an existing partition at any time. Re-initialization erases all cryptographic objects on the partition, and the login credentials for the Crypto Officer and Crypto User roles. The Partition SO login credential and cloning domain are retained.

Prerequisites

- > The partition must be already initialized.
- > Back up any important cryptographic objects stored on the partition.
- > [PED authentication] A local or remote PED connection must be established (see "Local PED Setup" on page 33 or "Remote PED Setup" on page 1).

To re-initialize an existing application partition

1. Launch LunaCM on the client workstation.
2. Set the active slot to the partition you want to re-initialize.


```
lunacm:> slot set -slot <slot_number>
```
3. Initialize the partition by specifying an identifying label. You must specify a label for the partition (the same label or a new one). You are prompted for the current Partition SO credential.

```
lunacm:> partition init -label <label>
```

CHAPTER 4: Partition Capabilities and Policies

An application partition can be configured to provide a range of different functions. The Partition Security Officer can customize this functionality using partition policies. This configuration is governed by the following settings:

- > **Partition Capabilities** are features of partition functionality that are inherited from the parent HSM policies (see [HSM Capabilities and Policies](#)). The HSM SO can configure HSM policies to allow or disallow partition capabilities. Some capabilities have corresponding modifiable partition policies.
- > **Partition Policies** are configurable settings that allow the Partition Security Officer to modify the function of their corresponding capabilities.

The table below describes all partition capabilities, their corresponding policies, and the results of changing their settings. This section contains the following procedures:

- > ["Setting Partition Policies Manually" on page 102](#)
- > ["Setting Partition Policies Using a Template" on page 103](#)

Destructive Policies

As a security measure, changing some partition policies forces deletion of all cryptographic objects on the partition. These policies are listed as **destructive** in the table below. Some policy changes are destructive in either direction (**OFF-to-ON** and **ON-to-OFF**), while others are destructive only in the direction resulting in lowered partition security.

Use `lunacm:> partition showpolicies -verbose` to check whether the policy you want to enable/disable is destructive.

| # | Partition Capability | Partition Policy |
|---|--|---|
| 0 | Enable private key cloning Always 1. This capability allows private keys to be cloned to another SafeNet HSM partition (required for backup and HA). NOTE The HSM SO can disable cloning for all partitions on the HSM by turning off HSM policy 7 (see HSM Capabilities and Policies). In this case, cloning is not possible on the partition, regardless of this capability/policy's setting. | Allow private key cloning (destructive OFF-to-ON) <ul style="list-style-type: none">> 1 (default): The partition is capable of cloning private keys to another partition. This policy must be enabled to back up partitions or create HA groups. Public keys and objects can always be cloned, regardless of this policy's setting.> 0: Private keys can never be cloned to another application partition. Partition policies 0 and 1 may not be set to 1 (ON) at the same time. |

| # | Partition Capability | Partition Policy |
|---|---|--|
| 1 | <p>Enable private key wrapping</p> <p>Always 1. This capability allows private keys to be encrypted (wrapped) and exported off the partition.</p> | <p>Allow private key wrapping (destructive OFF-to-ON)</p> <ul style="list-style-type: none"> > 1: Private keys may be wrapped and saved to an encrypted file off the partition. Public keys and objects can always be wrapped and exported, regardless of this policy's setting. > 0 (default): Private keys can never be wrapped and exported off the partition. <p>Partition policies 0 and 1 may not be set to 1 (ON) at the same time.</p> |
| 2 | <p>Enable private key unwrapping</p> <p>Always 1. This capability allows wrapped private keys to be imported to the partition.</p> | <p>Allow private key unwrapping</p> <ul style="list-style-type: none"> > 1 (default): Private keys can be unwrapped and stored on the partition. > 0: Private keys cannot be unwrapped onto the partition. |
| 3 | <p>Enable private key masking</p> <p>Always 0. SIM has been deprecated on SafeNet Luna Network HSM.</p> | <p>Allow private key masking</p> <p>Always 0.</p> |
| 4 | <p>Enable secret key cloning</p> <p>Always 1. This capability allows secret keys to be cloned to another SafeNet HSM partition (required for backup and HA).</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>NOTE The HSM SO can disable cloning for all partitions on the HSM by turning off HSM policy 7 (see HSM Capabilities and Policies). In this case, cloning is not possible on the partition, regardless of this capability/policy's setting.</p> </div> | <p>Allow secret key cloning (destructive OFF-to-ON)</p> <ul style="list-style-type: none"> > 1 (default): Secret keys on the partition can be cloned to another partition. This is required for partition backup and HA groups. > 0: Secret keys cannot be backed up, and will not be cloned to other HA group members. |
| 5 | <p>Enable secret key wrapping</p> <p>Always 1. This capability allows secret keys to be encrypted (wrapped) and exported off the partition.</p> | <p>Allow secret key wrapping (destructive OFF-to-ON)</p> <ul style="list-style-type: none"> > 1 (default): Secret keys can be wrapped and saved to an encrypted file off the partition. > 0: Secret keys can never be wrapped and exported off the partition. |

| # | Partition Capability | Partition Policy |
|----|---|--|
| 6 | <p>Enable secret key unwrapping</p> <p>Always 1. This capability allows wrapped secret keys to be imported to the partition.</p> | <p>Allow secret key unwrapping</p> <ul style="list-style-type: none"> > 1 (default): Secret keys can be unwrapped and stored on the partition. > 0: Secret keys cannot be unwrapped onto the partition. |
| 7 | <p>Enable secret key masking</p> <p>Always 0. SIM has been deprecated on SafeNet Luna Network HSM.</p> | <p>Allow secret key masking</p> <p>Always 0.</p> |
| 10 | <p>Enable multipurpose keys</p> <p>Always 1. This capability allows keys that are created or unwrapped on the partition to have more than one of the following attributes enabled (set to 1), and can therefore be used for multiple types of operation:</p> <ul style="list-style-type: none"> • Encrypt/Decrypt • Sign/Verify • Wrap/Unwrap • Derive | <p>Allow multipurpose keys (destructive OFF-to-ON)</p> <ul style="list-style-type: none"> > 1 (default): Keys that are created or unwrapped on the partition may be used for multiple operations. > 0: Keys that are created or unwrapped on the partition may have only one of the affected attributes enabled. Thales Group recommends that you create keys with only the attributes required for their intended purpose. Disabling this policy enforces this rule on the partition. <p>NOTE This policy does not affect Diffie-Hellman keys, which are always created with only Derive set to 1.</p> |
| 11 | <p>Enable changing key attributes</p> <p>Always 1. This capability allows the Crypto Officer to modify the following non-sensitive attributes of keys on the partition, changing key functions:</p> <ul style="list-style-type: none"> > CKA_ENCRYPT > CKA_DECRYPT > CKA_WRAP > CKA_UNWRAP > CKA_SIGN > CKA_SIGN_RECOVER > CKA_VERIFY > CKA_VERIFY_RECOVER > CKA_DERIVE > CKA_EXTRACTABLE | <p>Allow changing key attributes (destructive OFF-to-ON)</p> <ul style="list-style-type: none"> > 1 (default): The Crypto Officer can modify the non-sensitive attributes of keys on the partition. > 0: Keys created on the partition cannot be modified. |

| # | Partition Capability | Partition Policy |
|----|---|--|
| 15 | <p>Allow failed challenge responses</p> <p>Always 1. This capability/policy applies to PED-authenticated SafeNet Luna Network HSM only. It determines whether failed login attempts using a challenge secret count towards a partition lockout.</p> | <p>Ignore failed challenge responses (destructive OFF-to-ON)</p> <ul style="list-style-type: none"> > 1 (default): Failed challenge secret login attempts are not counted towards a partition lockout. Only failed PED key authentication attempts increment the counter. > 0: Failed login attempts using either a PED key or a challenge secret will count towards a partition lockout. <p>See "Activation and Auto-activation on Multi-factor-(PED-) Authenticated Partitions" on page 114 and "Logging In to the Application Partition" on page 111 for more information.</p> |
| 16 | <p>Enable operation without RSA blinding</p> <p>Always 1. RSA blinding is a technique that introduces random elements into the signature process to prevent timing attacks on the RSA private key. Some security policies may require this technique, but it does affect performance.</p> | <p>Operate without RSA blinding (destructive OFF-to-ON)</p> <ul style="list-style-type: none"> > 1 (default): The partition does not use RSA blinding. > 0: The partition uses RSA blinding. Performance will be affected. |
| 17 | <p>Enable signing with non-local keys</p> <p>Always 1. Keys generated on the HSM have the attribute CKA_LOCAL=1. Keys that are imported (unwrapped) to the HSM have CKA_LOCAL=0. These attributes are maintained if keys are backed up or cloned to another HSM partition.</p> | <p>Allow signing with non-local keys</p> <ul style="list-style-type: none"> > 1 (default): Only keys with attribute CKA_LOCAL=1 can be used to sign data on the partition. > 0: Keys with attribute CKA_LOCAL=0 can be used for signing, and their trust history is not assured. |
| 18 | <p>Enable raw RSA operations</p> <p>Always 1. This capability enables the RSA mechanism CKM_RSA_X_509 on the partition, which allows weak signatures and weak encryption.</p> | <p>Allow raw RSA operations (destructive OFF-to-ON)</p> <ul style="list-style-type: none"> > 1 (default): The partition allows operations using the RSA mechanism CKM_RSA_X_509. > 0: Operations using CKM_RSA_X_509 are blocked on the partition. |
| 20 | <p>Max failed user logins allowed</p> <p>Displays the maximum number of failed partition login attempts (10) before the partition is locked out (see "Logging In to the Application Partition" on page 111).</p> | <p>Max failed user logins allowed</p> <p>The Partition SO can lower the effective number of failed logins below the maximum if desired.</p> <p>Default: 10</p> |

| # | Partition Capability | Partition Policy |
|----|--|---|
| 21 | <p>Enable high availability recovery</p> <p>Always 1. This capability enables the RecoveryLogin feature on the partition. This feature allows other HA group members to restore the login state of the partition in the event of a power outage or other such deactivation.</p> | <p>Allow high availability recovery</p> <ul style="list-style-type: none"> > 1 (default): RecoveryLogin is enabled on the partition. This feature must be configured in advance (see role recoveryinit and role recoverylogin). > 0: RecoveryLogin is disabled on the partition. |
| 22 | <p>Enable activation</p> <p>This capability allows the partition to be activated. See "Activation and Auto-activation on Multi-factor- (PED-) Authenticated Partitions" on page 114.</p> <ul style="list-style-type: none"> > 1: Always enabled on PED-authenticated HSMs. > 0: Always disabled on password-authenticated HSMs. | <p>Allow activation</p> <ul style="list-style-type: none"> > 1: The black and/or gray PED key secrets can be encrypted and cached, so that only a keyboard-entered challenge secret is required to log in. > 0 (default): PED keys must be presented at each login, whether via LunaCM or a client application. <p>This policy is overridden and activation is disabled if a tamper event occurs, or if an uncleared tamper event is detected on reboot. See Tamper Events for more information.</p> |
| 23 | <p>Enable auto-activation</p> <p>This capability allows the partition to remain activated for up to two hours if the SafeNet Luna Network HSM loses power. See "Activation and Auto-activation on Multi-factor- (PED-) Authenticated Partitions" on page 114.</p> <ul style="list-style-type: none"> > 1: Always enabled on PED-authenticated HSMs. > 0: Always disabled on password-authenticated HSMs. | <p>Allow auto-activation</p> <ul style="list-style-type: none"> > 1: Partition activation (see policy 22 above) is maintained after an HSM power loss of up to two hours. > 0 (default): The partition is deactivated in the event of a power loss. When power is restored, the black and/or gray PED keys must be presented to re-activate the partition. |
| 25 | <p>Minimum PIN length</p> <p>Always 248 (7 characters).</p> <p>The absolute minimum length for a role password/challenge secret is 7 characters. This is displayed as a value subtracted from 255.</p> <p>The reason for this inversion is that a policy can only be set to a value equal to or lower than the value set by its capability. If the absolute minimum length was set to 7, the Partition SO would be able to set the preferred minimum to 2, a less-secure policy. The Partition SO may only change the minimum length to increase security by forcing stronger passwords.</p> | <p>Minimum PIN length</p> <p>The Partition SO can choose to increase the effective minimum length of a role password/challenge secret by setting this policy. The policy value is determined as follows:</p> <p>Subtract the desired minimum length from 255 (the absolute maximum length), and set policy 25 to that value.</p> <p>255 - (desired length) = (policy value)</p> <p>For example, to set the minimum length to 10 characters, set the value of this policy to 245:</p> <p>255 - 10 = 245</p> <p>Default: 248 (7 characters)</p> |

| # | Partition Capability | Partition Policy |
|----|---|---|
| 26 | <p>Maximum PIN length</p> <p>Always 255. The absolute maximum length for a role password/challenge secret is 255 characters.</p> | <p>Maximum PIN length</p> <p>The effective maximum role password/challenge secret length may be changed by the Partition SO. It must always be greater than or equal to the effective minimum length, determined by the formula described in policy 25 (above).</p> <p>Default: 255</p> |
| 28 | <p>Enable Key Management Functions</p> <p>Always 1. This capability allows cryptographic objects to be created or deleted on the partition.</p> | <p>Allow Key Management Functions (destructive OFF-to-ON)</p> <ul style="list-style-type: none"> > 1 (default): The Crypto Officer can manage (create/delete) objects on the partition. The Crypto User is restricted to read-only operations. > 0: Partition objects are read-only for both the CO and CU roles. |
| 29 | <p>Enable RSA signing without confirmation</p> <p>Always 1. This capability governs the HSM's internal signing verification.</p> | <p>Perform RSA signing without confirmation (destructive OFF-to-ON)</p> <ul style="list-style-type: none"> > 1 (default): No internal signing verification is performed. > 0: The HSM performs an internal verification of signing operations to validate the signature. This has a performance impact on signature operations. |
| 31 | <p>Enable private key unmasking</p> <p>Always 1. Private keys can be unmasked onto the partition.</p> | <p>Allow private key unmasking</p> <ul style="list-style-type: none"> > 1: Private keys can be unmasked onto the partition (meaning they also can be migrated from legacy SafeNet HSMs that used SIM). > 0 (default): Private keys cannot be unmasked onto the partition (meaning that migration of private keys from legacy HSMs using SIM is also not possible). |
| 32 | <p>Enable secret key unmasking</p> <p>Enable unmasking of a secret key onto the partition.</p> | <p>Allow secret key unmasking</p> <ul style="list-style-type: none"> > 1: Secret keys can be masked and stored onto the partition. > 0 (default): Secret keys cannot be masked onto the partition. |

| # | Partition Capability | Partition Policy |
|----|---|--|
| 33 | <p>Enable RSA PKCS mechanism</p> <p>Always 1. The mechanism <code>CKM_RSA_PKCS</code> has known weaknesses, which you can address in your applications. If you are not prepared to address these issues, you can choose to disable the mechanism entirely.</p> | <p>Allow RSA PKCS mechanism (destructive OFF-to-ON)</p> <ul style="list-style-type: none"> > 1 (default): <code>CKM_RSA_PKCS</code> is enabled on the partition. > 0: <code>CKM_RSA_PKCS</code> is disabled on the partition. |
| 34 | <p>Enable CBC-PAD (un)wrap keys of any size</p> <p>Always 1. There are known vulnerabilities using small keys wrapped/unwrapped with CBC_PAD mechanisms (and with small keys in general). You can choose to enforce a size restriction so that small weak keys cannot be unwrapped onto the partition. The following mechanisms are affected:</p> <ul style="list-style-type: none"> > <code>CKM_AES_CBC_PAD</code> > <code>CKM_AES_CBC_PAD_IPSEC</code> > <code>CKM_AES_KWP</code> > <code>CKM_ARIA_CBC_PAD</code> > <code>CKM_ARIA_L_CBC_PAD</code> > <code>CKM_CAST3_CBC_PAD</code> > <code>CKM_CAST5_CBC_PAD</code> > <code>CKM_DES_CBC_PAD</code> > <code>CKM_DES3_CBC_PAD</code> > <code>CKM_DES3_CBC_PAD_IPSEC</code> > <code>CKM_RC2_CBC_PAD</code> > <code>CKM_RC5_CBC_PAD</code> > <code>CKM_SEED_CBC_PAD</code> > <code>CKM_SM4_CBC_PAD</code> | <p>Allow CBC-PAD (un)wrap keys of any size</p> <ul style="list-style-type: none"> > 1 (default): All keys can be wrapped or unwrapped using CBC_PAD mechanisms. > 0: Small keys cannot be wrapped or unwrapped using CBC_PAD mechanisms. |
| 37 | <p>Enable Secure Trusted Channel</p> <p>Always 1. This capability allows the partition to use STC for client access.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>NOTE The HSM SO must first enable STC by turning on HSM policy 39.</p> </div> | <p>Force Secure Trusted Channel (destructive ON-to-OFF)</p> <p>Secure Trusted Channel is a Network HSM feature, and has no function on SafeNet Luna Network HSM. Thales Group does not recommend turning this policy on at any time.</p> |
| 39 | <p>Enable Start/End Date Attributes</p> <p>Always 1. This capability allows you to enforce the <code>CKA_START_DATE</code> and <code>CKA_END_DATE</code> attributes of partition objects.</p> | <p>Allow Start/End Date Attributes (destructive ON-to-OFF)</p> <ul style="list-style-type: none"> > 1: <code>CKA_START_DATE</code> and <code>CKA_END_DATE</code> attributes are enforced for all partition objects. > 0 (default): These attributes can be set for partition objects, but their values are ignored. |

A number of partition capabilities are linked to the corresponding HSM capabilities and policies including:

- > Partition Policy (0) Enable private key cloning is dependent on HSM Policy (7) Allow cloning;
- > Partition Policy (3) Enable private key masking is dependent on HSM Policy (6) Allow Masking;
- > Partition Policy (4) Enable secret key cloning is dependent on HSM Policy (7) Allow cloning;
- > Partition Policy (7) Enable secret key masking is dependent on HSM Policy (6) Allow Masking;
- > Partition Policy (22) Enable Activation and Partition Policy (23) Enable Auto-Activation are dependent on HSM Policy (1) Allow PED-based authentication;
- > Partition Policy (31) Enable private key unmasking is dependent on HSM Policy (6) Allow Masking; and
- > Partition Policy (32) Enable secret key unmasking is dependent on HSM Policy (6) Allow Masking.

In addition – the following dependencies within the partition level policies are observed:

- > Partition Policy (7) Allow cloning cannot be enabled at the same time as Partition Policy (1) Allow private key wrapping;
- > Partition Policy (1) Allow private key wrapping cannot be enabled at the same time as either one of the policies, Partition Policy (0) Enable private key cloning, Partition Policy (3) Allow private key masking, Partition Policy (31) Enable private key unmasking;
- > Partition Policy (23) Allow Activation is dependent on Partition Policy (22) Allow Activation being enabled;

Setting Partition Policies Manually

The Partition Security Officer can change available policies to customize partition functionality. Policy settings apply to all roles/objects on the partition. Refer to ["Partition Capabilities and Policies" on page 95](#) for a complete list of partition policies and their effects.

In most cases, partition policies are either enabled (**1**) or disabled (**0**), but some allow a range of values.

To change multiple policy settings during partition initialization, see ["Setting Partition Policies Using a Template" on the next page](#).

See also ["Configuring the Partition for Cloning or Export of Private Keys" on page 106](#).

Prerequisites

- > The partition must be initialized (see ["Initializing an Application Partition" on page 93](#)).
- > If you are changing a destructive policy, back up any important cryptographic objects (see ["Backup and Restore Using a G5-Based Backup HSM" on page 180](#) or ["Backup and Restore Using a G7-Based Backup HSM" on page 203](#)).

NOTE If you are running more than one LunaCM session against the same partition, and change a partition policy in one LunaCM session, the new policy setting is visible in that session only (although it is in effect). You must exit and restart the other LunaCM sessions to display the new policy setting.

To manually set or change a partition policy

1. Launch LunaCM and set the active slot to the partition.

```
lunacm:> slot set -slot <slotnum>
```

2. [Optional] Display the existing partition policy settings.

```
lunacm:> partition showpolicies
```

3. Log in as Partition SO (see ["Logging In to the Application Partition" on page 111](#)).

```
lunacm:> role login -name po
```

4. Change the policy setting by specifying the policy number and the desired value (**0**, **1**, or a number in the accepted range for that policy).

```
lunacm:> partition changepolicy -policy <policy_ID> -value <value>
```

If you are changing a destructive policy, you are prompted to enter **proceed** to continue the operation.

Setting Partition Policies Using a Template

A partition policy template is a file containing a set of preferred partition policy settings, used to initialize partitions with those settings. You can use the same file to initialize multiple partitions, rather than changing policies manually after initialization. This can save time and effort when initializing partitions that are to function as an HA group, or must comply with your company's overall security strategy. Templates enable scalable policy management and simplify future audit and compliance requirements.

See also [Setting HSM Policies Using a Policy Template](#).

NOTE This feature requires minimum firmware version 7.1.0 and client 7.1. See [Version Dependencies by Feature](#) for more information.

You can create a partition policy template file from an initialized or uninitialized partition, and edit it using a standard text editor. Partition policy templates have additional customization options.

Policy templates cannot be used to alter settings for an initialized partition. Once a partition has been initialized, the Partition SO must change individual policies manually (see ["Setting Partition Policies Manually" on the previous page](#)).

This section provides instructions for the following procedures, and some general guidelines and restrictions:

- > ["Creating a Partition Policy Template" below](#)
- > ["Editing a Partition Policy Template" on the next page](#)
- > ["Applying a Partition Policy Template" on page 105](#)

Creating a Partition Policy Template

The following procedure describes how to create a policy template for a partition. This can be done optionally at two points in the partition setup process:

- > before the partition is initialized: this produces a template file containing the default policy settings, which can then be edited
- > after initializing and setting the partition policies manually: this produces a template file with the current policy settings, which can then be used to initialize other partitions with the same settings. The Partition SO must complete the procedure.

To create a partition policy template

1. Launch LunaCM and set the active slot to the partition. If you are creating a template from an initialized partition, you must log in as Partition SO.

```
lunacm:> slot set -slot <slotnum>
```

```
lunacm:> role login -name po
```

2. Create the partition policy template file. Specify an existing save directory and original filename. No file extension is required. If a template file with the same name exists in the specified directory, it is overwritten.

```
lunacm:> partition showpolicies -exporttemplate <filepath/filename>
```

```
lunacm:> partition showpolicies -exporttemplate /usr/safenet/lunaclient/templates/ParPT
```

```
Partition policies for Partition: myPartition1 written to
/usr/safenet/lunaclient/templates/ParPT
```

```
Command Result : No Error
```

Editing a Partition Policy Template

Use a standard text editor to manually edit policy templates for custom configurations. This section provides template examples and customization guidelines.

Partition Policy Template Example

This example shows the contents of a partition policy template created using the factory default policy settings. Use a standard text editor to change the policy and/or destructiveness values (0=OFF, 1=ON, or the desired value 0-255).

Partition policy template entries have two additional fields: **Off to on destructive** and **On to off destructive** (see example below). Change these values to **0** or **1** to determine whether cryptographic objects on the partition should be deleted when this policy is changed in the future. Policies that lower the security level of the objects stored on the partition are normally destructive, but it may be useful to customize this behavior for your own security strategy. See "[Partition Capabilities and Policies](#)" on page 95 for more information.

CAUTION! Setting policy destructiveness to **0** (OFF) makes partitions less secure. Use this feature only if your security strategy demands it.

If you export a policy template from an uninitialized partition, the **Sourced from partition** header field remains blank. This field is informational and you can still apply the template.

The **Policy Description** field is included in the template for user readability only. Policies are verified by the number in the **Policy ID** field.

```
# Policy template FW Version 7.1.0
# Field format - Policy ID:Policy Description:Policy Value:Off to on destructive:On to off
destructive
# Sourced from partition: myPartition1, SN: 154438865290

0:"Allow private key cloning":1:1:0
1:"Allow private key wrapping":0:1:0
2:"Allow private key unwrapping":1:0:0
3:"Allow private key masking":0:1:0
```

```

4:"Allow secret key cloning":1:1:0
5:"Allow secret key wrapping":1:1:0
6:"Allow secret key unwrapping":1:0:0
7:"Allow secret key masking":0:1:0
10:"Allow multipurpose keys":1:1:0
11:"Allow changing key attributes":1:1:0
15:"Ignore failed challenge responses":1:1:0
16:"Operate without RSA blinding":1:1:0
17:"Allow signing with non-local keys":1:0:0
18:"Allow raw RSA operations":1:1:0
20:"Max failed user logins allowed":10:0:0
21:"Allow high availability recovery":1:0:0
22:"Allow activation":0:0:0
23:"Allow auto-activation":0:0:0
25:"Minimum pin length (inverted 255 - min)":248:0:0
26:"Maximum pin length":255:0:0
28:"Allow Key Management Functions":1:1:0
29:"Perform RSA signing without confirmation":1:1:0
31:"Allow private key unmasking":1:0:0
32:"Allow secret key unmasking":1:0:0
33:"Allow RSA PKCS mechanism":1:1:0
34:"Allow CBC-PAD (un)wrap keys of any size":1:1:0
39:"Allow Start/End Date Attributes":0:1:0

```

Editing Guidelines and Restrictions

When creating or editing partition policy templates:

- > You can remove a policy from the template by adding **#** at the beginning of the line or deleting the line entirely. When you apply the template, the partition will use the default values for that policy.
- > Partition policy templates from older Luna versions (6.x or earlier) cannot be applied to Luna 7.x partitions.
- > This version of the partition policy template feature is available on Luna 7.x application partitions only. When the active slot is set to a Luna 6.x partition or the Admin partition, the **-exporttemplate** option is not available. To create an HSM policy template from the Admin partition, see [Setting HSM Policies Using a Template](#).
- > The following restrictions apply when configuring partitions for Cloning or Key Export (see "[Configuring the Partition for Cloning or Export of Private Keys](#)" on the next page for more information):
 - **Partition policy 0: Allow private key cloning** and **partition policy 1: Allow private key wrapping** can never be set to **1** (ON) at the same time. Initialization fails if the template contains a value of **1** for both policies.
 - **Partition policy 1: Allow private key wrapping** must always have **Off-to-on** destructiveness set to **1** (ON). Initialization fails if the template contains a value of **0** in this field.
- > You may not use invalid policy values (outside the acceptable range), or values that conflict with your HSM or partition's capabilities. For example, **Partition capability 3: Enable private key masking** is always **0**, so you cannot set the corresponding partition policy to **1**. If you attempt to initialize a partition with a template containing invalid policy values, an error is returned and initialization fails.

Applying a Partition Policy Template

The following procedure describes how to initialize a partition using a policy template.

To apply a policy template to a new partition

1. Ensure that the template file is saved on the client workstation.
2. Launch LunaCM and set the active slot to the new partition.
lunacm:> **slot set -slot** <slotnum>
3. Initialize the partition, specifying a label and the policy template file. If the template file is not in the same directory as LunaCM, include the correct filepath.
lunacm:> **partition init -label** <label> **-applytemplate** <filepath/filename>
4. [Optional] Verify that the template has been applied correctly by checking the partition's policy settings. Include the **-verbose** option to view the destructiveness settings.
lunacm:> **partition showpolicies [-verbose]**

Configuring the Partition for Cloning or Export of Private Keys

By default, the SafeNet Luna Network HSM stores all keys in hardware, allowing private keys to be copied only to another SafeNet Luna HSM (cloning). Cloning allows you to move or copy key material from a partition to a backup HSM or to another partition in the same HA group. You might, however, want to export private keys to an encrypted file for off-board storage or use. Individual partitions can be configured in one of three modes for handling private keys.

NOTE This feature requires minimum firmware version 7.1.0. See [Version Dependencies by Feature](#) for more information.

The Partition SO can set the mode by changing the following policies (see ["Partition Capabilities and Policies" on page 95](#) for more information):

- > **Partition policy 0: Allow private key cloning** (default: **1**)
- > **Partition policy 1: Allow private key wrapping** (default: **0**)

NOTE These partition policies can never be set to **1** (ON) at the same time. An error will result (CKR_CONFIG_FAILS_DEPENDENCIES).

The policies can be set at the time of initialization, using a policy template (see ["Setting Partition Policies Using a Template" on page 103](#)) or by following the procedures described below:

- > ["Cloning Mode" on the next page](#)
- > ["Key Export Mode" on the next page](#)
- > ["No Backup Mode" on page 108](#)

NOTE Partition configurations are listed in LunaCM as "Key Export With Cloning Mode". This indicates that the partition is capable of being configured for either Key Export or Cloning, with the mode of operation defined by the policies listed above. You can never configure a partition to allow both export and cloning of private keys at once.

Cloning Mode

A partition in Cloning mode has the following capabilities and restrictions:

- > All keys/objects can be cloned to another partition or SafeNet Luna Backup HSM in the same cloning domain.
- > All keys/objects are replicated within the partition's HA group.
- > Private keys cannot be wrapped off the HSM (cannot be exported to a file encrypted with a wrapping key).

In this mode, private keys are never allowed to exist outside of a trusted SafeNet Luna HSM in the designated cloning domain. Cloning mode is the default setting for new partitions.

Setting Cloning Mode on a Partition

Cloning mode is the default setting on new partitions. If another mode was set previously, the Partition SO can use the following procedure to set Cloning mode. Use `lunacm:> partition showpolicies` to see the current policy settings.

CAUTION! **Partition policy 0: Allow private key cloning** is Off-to-On destructive by default. Back up any important cryptographic material on the partition before continuing. This destructiveness setting can be customized by initializing the partition with a policy template (see ["Editing a Partition Policy Template" on page 104](#)).

To manually set Cloning mode on a partition

1. Log in to the partition as Partition SO.
`lunacm:> slot set -slot <slotnum>`
`lunacm:> role login -name po`
2. Set **partition policy 1: Allow private key wrapping** to **0** (OFF).
`lunacm:> partition changepolicy -policy 1 -value 0`
3. Set **partition policy 0: Allow private key cloning** to **1** (ON).
`lunacm:> partition changepolicy -policy 0 -value 1`

To initialize a partition in Cloning mode using a policy template

Use a standard text editor to include the following lines in the policy template file (see ["Editing a Partition Policy Template" on page 104](#)):

```
0:"Allow private key cloning":1:1:0
1:"Allow private key wrapping":0:1:0
```

Key Export Mode

A partition in Key Export mode has the following capabilities and restrictions:

- > Private keys cannot be cloned to other partitions nor to a SafeNet Luna Backup HSM.
- > The partition cannot be part of an HA group (private keys will not be replicated).

- > All keys/objects, including private keys, can be wrapped off the HSM (can be exported to a file encrypted with a wrapping key).

This mode is useful when generating key pairs for identity issuance, where transient key-pairs are generated, wrapped off, and embedded on a device. They are not used on the HSM, but generated and issued securely, and then deleted from the HSM.

Setting Key Export Mode on a Partition

The Partition SO can use the following procedure to set Key Export mode. Use `lunacm:> partition showpolicies` to see the current policy settings.

CAUTION! Partition policy 1: Allow private key wrapping is always Off-to-On destructive. Back up any important cryptographic material on the partition before continuing. This destructiveness setting cannot be changed with a policy template (see "Editing Guidelines and Restrictions" on page 105).

To manually set Key Export mode on a partition

1. Launch LunaCM and log in to the partition as Partition SO.
`lunacm:> slot set -slot <slotnum>`
`lunacm:> role login-name po`
2. Set partition policy 0: Allow private key cloning to 0 (OFF).
`lunacm:> partition changepolicy -policy 0 -value 0`
3. Set partition policy 1: Allow private key wrapping to 1 (ON).
`lunacm:> partition changepolicy -policy 1 -value 1`

To initialize a partition in Key Export mode using a policy template

Use a standard text editor to include the following lines in the policy template file (see "Editing a Partition Policy Template" on page 104):

```
0:"Allow private key cloning":0:1:0
1:"Allow private key wrapping":1:1:0
```

No Backup Mode

A partition in No Backup mode has the following restrictions:

- > Private keys cannot be cloned to other partitions or to a SafeNet Luna Backup HSM. All other objects can still be cloned.
- > Private keys cannot be wrapped off the HSM (exported to a file encrypted with a wrapping key). All other objects can still be wrapped off.

Without backup capability, private keys can never leave the HSM. This mode is useful when keys are intended to have short lifespans, and are easily replaced.

Setting No Backup Mode on a Partition

The Partition SO can use the following procedure to set No Backup mode. Use `lunacm:> partition showpolicies` to see the current policy settings.

To manually set No Backup mode on a partition

1. Launch LunaCM and log in to the partition as Partition SO.

```
lunacm:> slot set -slot <slotnum>
```

```
lunacm:> role login -name po
```

2. If **partition policy 0: Allow private key cloning** is set to **1** (ON), set it to **0** (OFF).

```
lunacm:> partition changepolicy -policy 0 -value 0
```

3. If **partition policy 1: Allow private key wrapping** is set to **1** (ON), set it to **0** (OFF).

```
lunacm:> partition changepolicy -policy 1 -value 0
```

To initialize a partition in No Backup mode using a policy template

Use a standard text editor to include the following lines in the policy template file (see "[Editing a Partition Policy Template](#)" on page 104):

```
0:"Allow private key cloning":0:1:0
```

```
1:"Allow private key wrapping":0:1:0
```

CHAPTER 5: Partition Roles

The security of an HSM and its cryptographic contents depends on well-controlled access to that HSM. A controlled access policy is defined by:

- > the set of users with valid login credentials for the host system, the HSM and the application partition
- > the actions each user is allowed to perform when logged in (the user's role)

For example, an access policy that adheres to the PKCS#11 standard requires two roles: the security officer (SO), who administers the user account(s), and the standard user, who performs cryptographic operations. When a user logs in to the HSM, they can perform only those functions that are permitted for their role.

All cryptographic operations take place on an application partition. This partition is created on the SafeNet Luna Network HSM by the HSM SO and is designed to function independently of the Admin partition, with its own Security Officer and users. This provides more flexibility in meeting the security needs of your organization. Personnel holding the roles described below must have administrative access to the SafeNet Luna Network HSM host workstation.

The partition-level roles are as follows:

Partition Security Officer (PO)

The Partition SO handles all administrative and configuration tasks on the application partition, including:

- > Initializing the partition, setting the PO credential, and setting a cloning domain for the partition (see ["Initializing an Application Partition" on page 93](#))
- > Configuring partition policies (see ["Partition Capabilities and Policies" on page 95](#))
- > Initializing the Crypto Officer role (see ["Initializing the Crypto Officer Role" on page 112](#))
- > Activating the partition (see ["Activation and Auto-activation on Multi-factor- \(PED-\) Authenticated Partitions" on page 114](#))

Managing the Partition SO Role

Refer also to the following procedures to manage the PO role:

- > ["Logging In to the Application Partition" on the next page](#)
- > [Changing a Partition Role Credential](#)

Crypto Officer (CO)

The Crypto Officer is the primary user of the application partition and the cryptographic objects stored on it. The Crypto Officer has the following responsibilities:

- > Creating, deleting, and modifying cryptographic objects via user applications
- > Performing cryptographic operations via user applications
- > Managing backup and restore operations for partition objects:
 - ["Backup and Restore Using a G5-Based Backup HSM" on page 180](#)

- ["Backup and Restore Using a G7-Based Backup HSM" on page 203](#)
- > Initializing the Crypto User role (see ["Initializing the Crypto User Role" on page 113](#))

Managing the Crypto Officer Role

Refer also to the following procedures to manage the CO role:

- > ["Logging In to the Application Partition" below](#)
- > [Changing a Partition Role Credential](#)

Crypto User (CU)

The Crypto User is an optional role that can perform cryptographic operations using partition objects in a read-only capacity, but can create only public objects. This role is useful in that it provides limited access; the Crypto Officer is the only role that can make significant changes to the contents of the partition. The Crypto User has the following capabilities:

- > Performing operations like encrypt/decrypt and sign/verify using objects on the partition
- > Creating and backing up public objects:
 - ["Backup and Restore Using a G5-Based Backup HSM" on page 180](#)
 - ["Backup and Restore Using a G7-Based Backup HSM" on page 203](#)
- > The CU can increment usage counters but, unlike CO, cannot change/set the limit

Managing the Crypto User Role

Refer also to the following procedures to manage the CU role:

- > ["Logging In to the Application Partition" below](#)
- > [Changing a Partition Role Credential](#)

Logging In to the Application Partition

Before you can perform administrative tasks on the partition or its stored cryptographic objects, you must log in with the appropriate role:

- > Partition Security Officer (specify **po** for <role>)
- > Crypto Officer (specify **co** for <role>)
- > Crypto User (specify **cu** for <role>)

To log in to the application partition

1. Launch LunaCM on the SafeNet Luna Network HSM host workstation.
2. Set the active slot to the desired partition.


```
lunacm:> slot set -slot <slotnum>
```
3. Log in by specifying your role on the partition.


```
lunacm:> role login -name <role>
```

You are prompted for the role's credential.

Failed Partition Login Attempts

The consequences of multiple failed login attempts vary by role, depending on the severity of the security risk posed by that role being compromised. This is a security feature meant to thwart repeated, unauthorized attempts to access your cryptographic material.

NOTE The system must actually receive some erroneous/false information before it logs a failed attempt; if you merely forget to insert a PED key, or insert the wrong color key, that is not counted as a failed attempt. You must insert an incorrect PED key of the correct type, or enter an incorrect PED PIN or challenge secret, to fail a login attempt.

Partition Security Officer

If you fail ten consecutive Partition SO login attempts, the partition is zeroized and all cryptographic objects are destroyed. The Partition SO must re-initialize the partition and Crypto Officer role, who can restore key material from a backup device.

Crypto Officer

If you fail ten consecutive Crypto Officer login attempts, the CO and CU roles are locked out. The default lockout threshold of 10 is governed by partition policy 20: Max failed user logins allowed, and the Partition SO can set this threshold lower if desired (see ["Partition Capabilities and Policies" on page 95](#)). Recovery depends on the setting of **HSM policy 15: Enable SO reset of partition PIN**:

- > If HSM policy 15 is set to **1** (enabled), the CO and CU roles are locked out. The Partition SO must unlock the CO role and reset the credential (see ["Resetting the Crypto Officer or Crypto User Credential" on page 114](#)).
- > If HSM policy 15 is set to **0** (disabled), the CO and CU roles are permanently locked out and the partition contents are no longer accessible. The Partition SO must re-initialize the partition and the Crypto Officer role, who can restore key material from a backup. This is the default setting.

CAUTION! If this is not the desired outcome, ensure that the HSM SO enables this destructive policy before creating and assigning partitions to clients.

Crypto User

If you fail ten consecutive Crypto User login attempts, the CU role is locked out. The default lockout threshold of 10 is governed by partition policy **20: Max failed user logins allowed**, and the Partition SO can set this threshold lower if desired (see ["Partition Capabilities and Policies" on page 95](#)). The CO must unlock the CU role and reset the credential (see ["Resetting the Crypto Officer or Crypto User Credential" on page 114](#)).

Initializing the Crypto Officer and Crypto User Roles

The following procedures will allow you to initialize the Crypto Officer (CO) and Crypto User (CU) roles and set an initial credential.

Initializing the Crypto Officer Role

The Crypto Officer (CO) is the primary user of the application partition and the cryptographic objects stored on it. The Partition Security Officer (PO) must initialize the CO role and assign an initial credential.

To initialize the Crypto Officer role

1. In LunaCM, log in to the partition as Partition SO (see ["Logging In to the Application Partition" on page 111](#)).

```
lunacm:> role login -name po
```

2. Initialize the Crypto Officer role. If you are using a password-authenticated partition, specify a CO password. If you are using a PED-authenticated partition, ensure that you have a blank or rewritable black PED key available. Refer to ["Creating PED Keys" on page 49](#) for details on creating PED keys.

In LunaCM, passwords and activation challenge secrets must be 7-255 characters in length (**NOTE:** If you are using firmware version 7.0.1, 7.0.2, 7.0.3, 7.3.3, or 7.4.2, activation challenge secrets must be 7-16 characters in length). The following characters are allowed:

```
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 !@#$%^&*()-_+=[]{}|\|/;:','.<>?`~
```

Double quotation marks (") are problematic and should not be used in passwords.

Spaces are allowed; to specify a password with spaces using the **-password** option, enclose the password in double quotation marks.

```
lunacm:> role init -name co
```

3. Provide the CO credential to your designated Crypto Officer.

NOTE If **HSM policy 21: Force user PIN change after set/reset** is enabled (this is the default setting), the CO must change the credential before any other actions are permitted. See ["Changing a Partition Role Credential" on page 1](#).

Initializing the Crypto User Role

The Crypto User (CU) is an optional role that can perform cryptographic operations using partition objects in a read-only capacity, but can only create public objects. The Crypto Officer must initialize the CU role and assign an initial credential.

To initialize the Crypto User role

1. In LunaCM, log in to the partition as Crypto Officer (see ["Logging In to the Application Partition" on page 111](#)).

```
lunacm:> role login -name co
```

2. Initialize the Crypto User role. If you are using a password-authenticated partition, specify a CU password. If you are using a PED-authenticated partition, ensure that you have a blank or rewritable gray PED key available. Follow the instructions on the Luna PED screen. Refer to ["Creating PED Keys" on page 49](#) for details on creating PED keys.

In LunaCM, passwords and activation challenge secrets must be 7-255 characters in length (**NOTE:** If you are using firmware version 7.0.1, 7.0.2, 7.0.3, 7.3.3, or 7.4.2, activation challenge secrets must be 7-16 characters in length). The following characters are allowed:

```
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 !@#$%^&*()-_+=[]{}|\|/;:','.<>?`~
```

Double quotation marks (") are problematic and should not be used in passwords.

Spaces are allowed; to specify a password with spaces using the **-password** option, enclose the password in double quotation marks.

```
lunacm:> role init -name cu
```

3. Provide the CU credential to your designated Crypto User.

NOTE If **HSM policy 21: Force user PIN change after set/reset** is enabled (this is the default setting), the CU must change the credential before any other actions are permitted. See ["Changing a Partition Role Credential"](#) on page 1.

Resetting the Crypto Officer or Crypto User Credential

If necessary, the Crypto Officer can reset the Crypto User credential at any time, without providing the current credential. This is useful in cases where the Crypto User credential has been lost or otherwise compromised.

Prerequisites for Crypto Officer Reset

The Partition SO can also reset the Crypto Officer's credential, if **HSM policy 15: Enable SO reset of partition PIN** is enabled. By default, this policy is not enabled, and changing it is destructive. If you want the Partition SO to be able to reset the CO's credential, the HSM SO must enable this policy before creating the application partition (see ["Partition Capabilities and Policies"](#) on page 95).

CAUTION! HSM policy 15 is destructive when turned on. All partitions on the HSM and their contents will be erased.

To reset the Crypto Officer Crypto User credential

1. Log in with the appropriate role (see ["Logging In to the Application Partition"](#) on page 111).
2. Reset the desired role's credential.

In LunaCM, passwords and activation challenge secrets must be 7-255 characters in length (**NOTE:** If you are using firmware version 7.0.1, 7.0.2, 7.0.3, 7.3.3, or 7.4.2, activation challenge secrets must be 7-16 characters in length). The following characters are allowed:

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 !@#\$%^&*()-_+[]{}|/;:'.<>?`~

Double quotation marks (") are problematic and should not be used in passwords.

Spaces are allowed; to specify a password with spaces using the **-password** option, enclose the password in double quotation marks.

```
lunacm:> role resetpw -name <role>
```

You are prompted to set a new credential for the role.

3. Provide the new credential to the Crypto Officer or Crypto User.

NOTE If **HSM policy 21: Force user PIN change after set/reset** is enabled, the user must change the credential before any other actions are permitted. See [Changing a Partition Role Credential](#).

Activation and Auto-activation on Multi-factor- (PED-) Authenticated Partitions

A multi-factor-authenticated partition (also known as PED-authenticated) requires a PED key each time a role (Partition SO, Crypto Officer, Crypto User) logs in. For some use cases, such as key vaulting, this physical key requirement is desirable. For many applications, however, it is impractical to require the full PED interaction

every time.

For these use cases, the Partition SO can activate the partition and set a secondary password referred to as a challenge secret. When a partition is activated, the HSM caches the Crypto Officer and Crypto User PED secrets upon first login, and subsequent logins require the challenge secret only. The PED key secret remains cached until the role is explicitly deactivated or the HSM loses power due to a reboot or power outage.

Activation does not provide much advantage for clients that log in to the partition and remain logged in. It is an indispensable advantage in cases where the client application repeatedly logs in to perform a task, and then logs out or closes the cryptographic session after the task is completed.

Auto-activation

Auto-activation allows PED key credentials to remain cached even in the event of a reboot or a brief power outage (up to 2 hours).

Tamper events and activation/auto-activation

When a tamper event occurs, or if an uncleared tamper event is detected on reboot, the cached PED key data is zeroized, and activation/auto-activation is disabled. See [Tamper Events](#) and ["Partition Capabilities and Policies" on page 95](#) for more information.

This section contains instructions for the following procedures:

- > ["Enabling Activation on a Partition" below](#)
- > ["Activating a Role" below](#)
- > ["Enabling Auto-activation" on page 117](#)
- > ["Deactivating a Role" on page 117](#)

Enabling Activation on a Partition

The Partition SO can enable activation on a partition by setting **partition policy 22: Allow activation to 1** (on). This setting enables activation for both the Crypto Officer and Crypto User roles. When partition policy 22 is enabled, the Partition SO can set an initial challenge secret for the Crypto Officer.

Prerequisites

- > The partition must be initialized (see ["Initializing an Application Partition" on page 93](#)).

To enable activation on a partition

1. Log in to the partition as Partition SO (see ["Logging In to the Application Partition" on page 111](#)).

```
lunacm:> role login -name po
```

2. Enable partition policy 22.

```
lunacm:> partition changepolicy -policy 22 -value 1
```

Activating a Role

After enabling partition policy 22, activate the CO and/or CU roles on the partition. You must set a PED challenge password for each role you want to activate. The Partition SO must set the initial challenge secret for the Crypto Officer, who must set it for the Crypto User. The role will become activated the first time the user

logs in to the partition.

Prerequisites

- > **Partition policy 22: Allow activation** must be enabled on the partition (see ["Enabling Activation on a Partition" on the previous page](#)).
- > The role you wish to activate must be initialized on the partition (see ["Initializing the Crypto Officer and Crypto User Roles" on page 112](#)).

To activate a role

1. Log in to the partition using the appropriate role (see ["Logging In to the Application Partition" on page 111](#)):
 - If you are activating the Crypto Officer role, log in as Partition SO.
 - If you are activating the Crypto User role, log in as Crypto Officer.

```
lunacm:> role login -name <role>
```

2. Set an initial challenge secret for the role you wish to activate. The length of the challenge secret is configurable by the Partition SO (see ["Partition Capabilities and Policies" on page 95](#)).

In LunaCM, passwords and activation challenge secrets must be 7-255 characters in length (**NOTE:** If you are using firmware version 7.0.1, 7.0.2, 7.0.3, 7.3.3, or 7.4.2, activation challenge secrets must be 7-16 characters in length). The following characters are allowed:

```
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 !@#$%^&* () -_ =+ [] {} \ | / ; : ' , . < > ? ` ~
```

Double quotation marks (") are problematic and should not be used in passwords.

Spaces are allowed; to specify a password with spaces using the **-password** option, enclose the password in double quotation marks.

```
lunacm:> role createchallenge -name <role>
```

NOTE Activation requires that a challenge secret is set for the specified role. If the role does not have a challenge secret, you will be prompted for the PED key, regardless of the policy setting.

3. Log out of the partition.

```
lunacm:> role logout
```

4. Provide the initial challenge secret to the designated CO or CU by secure means. The PED secret will be cached when they log in for the first time. The CO or CU can store the black or gray PED key in a safe place. The cached PED secret allows their application(s) to open and close sessions and perform operations within those sessions.

NOTE If **HSM policy 21: Force user PIN change after set/reset** is enabled (this is the default setting), the CO or CU must change the challenge secret before any other actions are permitted. See ["Changing a Partition Role Credential" on page 1](#).

Enabling Auto-activation

Auto-activation allows PED key credentials to be cached even in the event of a reboot or a brief power outage (up to 2 hours). Clients can re-connect and continue using the application partition without needing to re-authenticate using a PED key.

The Partition SO can enable auto-activation on a partition by setting **partition policy 23: Allow auto-activation**.

Prerequisites

- > **Partition policy 22: Allow activation** must be enabled on the partition (see ["Enabling Activation on a Partition" on page 115](#)).

To enable auto-activation on a partition

1. Log in to the partition as Partition SO (see ["Logging In to the Application Partition" on page 111](#)).
lunacm:> **role login -name po**
2. Enable partition policy 23.
lunacm:> **partition changepolicy -policy 23 -value 1**
Auto-activation will take effect for each affected role (CO and/or CU) the next time the role is authenticated.

Deactivating a Role

An activated role on a partition remains activated until it is explicitly deactivated, or the HSM loses power due to a reboot or power outage (with auto-activation disabled). This deletes the cached PED secret for the role.

Prerequisites

- > You must be authorized to deactivate the role. The CO and CU can manually deactivate their own or each other's roles. The Partition SO can deactivate both the CO and CU roles.

To deactivate a role on a partition

1. Log in to the partition with the appropriate role (see ["Logging In to the Application Partition" on page 111](#)).
lunacm:> **role login -name <role>**
2. Specify the role you wish to deactivate.
lunacm:> **role deactivate -name <role>**
This deletes the cached authentication credential for the role. The next time the role logs in, the credential is re-cached.
3. If you wish to disable activation entirely, so that credentials are not re-cached at the next login, the Partition SO can disable **partition policy 22: Allow activation**.
lunacm:> **partition changepolicy -policy 22 -value 0**
4. If partition policy 22 is disabled, auto-activation is also disabled (even though **partition policy 23: Allow auto-activation** is set to **1**). When partition policy 22 is enabled again, auto-activation resumes. To turn off auto-activation, you must disable partition policy 23.
lunacm:> **partition changepolicy -policy 23 -value 0**

Security of Your Partition Challenge

For SafeNet Luna Network HSMs with Password Authentication, the partition password used for administrative access by the Crypto Officer is also the partition challenge secret or password used by client applications.

For SafeNet Luna Network HSMs with PED Authentication, the partition authentication used for administrative access by the Crypto Officer is the secret on the black PED key(s) for that partition. The partition challenge secret or password used by client applications is a separate character string, set by the Partition SO and then changed by the Crypto Officer (mandatory) for the CO's use. This is one way in which we implement separation of roles in the SafeNet Luna HSM security paradigm.

How Secure Is the Challenge Secret or Password?

The underlying concern is that a password-harvesting attack might eventually crack the secret that protects the partition. Layers of protection are in place, to minimize or eliminate such a risk.

First, such an attack must be run from a Luna HSM Client computer. For interaction with HSM partitions on a SafeNet network appliance, like SafeNet Luna Network HSM, a Luna HSM Client computer is one with SafeNet software installed, on which you have performed the exchange of certificates to create a Network Trust Link (NTL). That exchange requires the knowledge and participation of the appliance administrator and the Partition SO (who might, or might not, be the same person). It is not possible to secretly turn a computer into a Client of a SafeNet Luna HSM partition - an authorized person within your organization must participate.

Second, for SafeNet Luna HSMs with password authentication, you set the partition password directly when you create the partition, so you can make it as secure as you wish (for an example of guidance on password strength, see <http://howsecureismypassword.net/> or <http://xkcd.com/936/>)

For SafeNet Luna HSMs with PED authentication, an optional partition password (also called a challenge secret) may be added for the initialized Crypto Officer (CO) and/or Crypto User (CU) roles. See [role createchallenge](#) for the proper command syntax.

Using LunaCM or LunaSH, you can change the partition password (or challenge secret) if you suspect it has been compromised, or if you are complying with a security policy that dictates regular password changes.

As long as you replace any password/challenge secret with one that is equally secure, the possible vulnerability is extremely small.

Conversely, you can choose to replace a secure, random password/challenge-secret with one that is shorter or more memorable, but less secure - you assume the risks inherent in such a tradeoff.

Third, SafeNet Luna HSM **partition policy 15: Ignore failed challenge responses** can be set to **0** (off). When that policy is off, the HSM stops ignoring bad challenge responses (that is, attempts to submit the partition secret) and begins treating them as failed login attempts. Each bad login attempt is counted. **Partition policy 20: Max failed user logins allowed** determines how high that count can go before the partition is locked out.

Once a partition is locked by bad login attempts, it cannot be accessed until the HSM Security Officer (SO) unlocks it. This defeats an automated harvesting attack that relies on millions of attempts occurring at computer-generated speeds. As well, after one or two lockout cycles, the HSM SO would realize that an attack was under way and would rescind the NTL registration of the attacking computer. That computer would no longer exist as far as the HSM partition was concerned. The SO or your security organization would then

investigate how the client computer had been compromised, and would correct the problem before allowing any new NTL registration from that source. See ["Logging In to the Application Partition" on page 111](#) for more information.

As the owner/administrator of the HSM, you determine any tradeoffs with respect to security, convenience, and other operational parameters.

Name, Label, and Password Requirements

This page describes length and character requirements for setting labels, domains, passwords, and challenge secrets on the SafeNet Luna Network HSM. This information can also be found in relevant sections throughout the documentation. Refer to the applicable section below:

- > ["HSM Labels" below](#)
- > ["Cloning Domains" below](#)
- > ["Partition Labels" below](#)
- > ["Role Passwords or Challenge Secrets" on the next page](#)

HSM Labels

The HSM label created during initialization must be 1-32 characters in length. If you specify a longer label, it will automatically be truncated to 32 characters. The following characters are allowed:

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 !@#\$%^&* () - _ = + [] { } \ | / ; : ' " , . < > ? ` ~

Spaces are allowed; enclose the label in double quotes if it includes spaces. Including both spaces and quotation marks in a label may cause unexpected labeling behavior.

Cloning Domains

The domain string must be 1-128 characters in length. The following characters are allowed:

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 !@#\$%^&* - _ = + [] { } / : ' , . ~

The following characters are problematic or invalid and must not be used in a domain string: "&;<>\`|()"

Spaces are allowed, as long as the leading character is not a space; to specify a domain string with spaces using the **-domain** option, enclose the string in double quotation marks.

Partition Labels

The partition label created during initialization must be 1-32 characters in length. If you specify a longer label, it will automatically be truncated to 32 characters. The following characters are allowed:

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 !@#\$%^&* () - _ = + [] { } \ | / ; : ' , . < > ` ~

Question marks (?) and double quotation marks (") are not allowed.

Spaces are allowed; enclose the label in double quotation marks if it includes spaces.

Role Passwords or Challenge Secrets

In LunaCM, passwords and activation challenge secrets must be 7-255 characters in length (**NOTE:** If you are using firmware version 7.0.1, 7.0.2, 7.0.3, 7.3.3, or 7.4.2, activation challenge secrets must be 7-16 characters in length). The following characters are allowed:

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 !@#\$%^&* () - _ = + [] { } \ | / ; : ' , . < > ? ` ~

Double quotation marks (") are problematic and should not be used in passwords.

Spaces are allowed; to specify a password with spaces using the **-password** option, enclose the password in double quotation marks.

CHAPTER 6: Verifying the HSM's Authenticity

Hardware Security Modules have traditionally been deployed in the corporate data center's most secure zone. Establishing trust with the HSM is, in part, achieved by physical access control. In cases of remote client usage (such as cloud cryptography), the client needs a way to verify the authenticity of the device protecting their most valued cryptographic keys.

Public Key Confirmations

Thales Group's SafeNet Luna HSMs include factory-issued device identities certified by a Thales Group authority. The root of this authority is maintained by Thales Group in HSMs locked in a vault with layered physical and logical access controls. These certificates are used as the root of trust for the issuance of "public key confirmations" (PKCs), certificates issued by the HSM attesting to the life cycle of a specific private key. A Luna HSM will issue confirmations only for private keys that were created by the HSM and that can never exist outside of the HSM. A valid confirmation is cryptographic proof that a specific key is inside the identified HSM. The confirmation is also proof that the identified HSM is real.

The key pair within the HSM that signs the confirmation is called a Hardware Origin Key (HOK). It is protected inside the HSM's FIPS 140-2 Level 3 security boundary. Each HOK is unique and there is no way to extract or replace it. The HOK is created in the HSM at the time of manufacture and certified by Thales Group's secure manufacturing authority, which is certified by Thales Group's root authority.

Public key confirmations are automatically generated for RSA key pairs in the HSM. A user can get a confirmation through the PKCS #11 API or the Luna **cmu** utility, and use it to verify that any RSA key is protected and has always been protected by a Luna HSM. A PKC bundle contains the following certificates:

- > **MIC:** Manufacturing Integrity Certificate; corresponds to the Manufacturing Integrity Private Key (MIK), signed by the SafeNet Root.
- > **HOC:** Hardware Origin Certificate; corresponds to the Hardware Origin Private Key (HOK). Unique to each HSM. Signed by MIK.
- > **DAC:** Device Authentication Certificate; corresponds to the Device Authentication Private Key (DAK). Unique to each HSM. Signed by HOK.
- > **PKC:** Public Key Confirmation Certificate; certificate for a private key on the HSM. Signed by DAK.

Public key confirmations are delivered as PKCS #7 files containing a certificate chain. The PKCS #7 files can be viewed using tools like OpenSSL and Microsoft's Certificates snap-in for MMC.

NOTE While third-party tools are capable of cryptographically validating the certificate signature chain, they may display some certificate errors, since they do not recognize some SafeNet-specific key usage attributes included in the certificates.

Chains of Trust

The chain of trust available via the **cmu** utility included with the Luna HSM Client, **Chrysalis-ITS**, is built in by default, and originates from Thales's root certificate authority. It uses the MIC, HOC, DAC, and the PKC.

NOTE Since the introduction of Functionality Modules, HSMs are shipped from the factory with FM-ready hardware. This means that they contain, and use, the HOK and the HOC, but they also have the FM-HOK and FM-HOC on standby. If FMs are enabled on the HSM, the original HOK and HOC are deleted, and the chain-of-trust, thereafter, proceeds through the FM-HOC.

Verifying the HSM's Authenticity

The **cmu** utility also includes a command, **cmu verifyhsm**, that tests an HSM's authenticity by creating and verifying a confirmation on a temporary key created in the HSM. The test includes a proof of possession that asks the HSM to sign a user-entered string as proof the associated private key is present within the target HSM.

NOTE This confirmation procedure is currently not supported on FM-enabled HSMs. Refer to [FM Deployment Constraints](#) for details.

The test requires the SafeNet root certificate, provided below:



safenet-root.pem

NOTE The current certificate is valid until 2031-12-31, but it might change before this date at Thales Group's discretion. Ensure that you have the most recent version of this documentation.

To verify the HSM's authenticity

1. Right-click the link above and save the root certificate to the Luna HSM Client directory.
2. Open a command line and navigate to the Luna HSM Client directory.
3. Use the **cmu** utility to authenticate the HSM. You must specify a challenge string for the HSM to sign, and the root certificate file:

```
# cmu verifyhsm -challenge <string> -rootcert safenet-root.pem
```

When prompted, specify the partition you wish to use and the Crypto Officer credential for that partition.

```
>cmu verifyhsm -challenge "1234567890" -rootcert safenet-root.pem
Select token
[0] Token Label: mypartition-1
```

```
[1] Token Label: mypartition-2
Enter choice: 0
Please enter password for token in slot 0 : *****
Reading rootcert from file "safenet-root.pem"... ok.
Generating temporary RSA keypair in HSM... ok.
Extracting PKC bundle from HSM... ok.
Verifying PKC certificate... ok.
Verifying DAC certificate... ok.
Verifying HOC certificate... ok.
Verifying MIC certificate... ok.
Verifying MIC against rootcert... ok.
Signing and verifying challenge... ok.
Verifying HSM serial number... ok.
Overall status: Success.
```

If this test fails, contact the HSM SO.

CHAPTER 7: Migrating Keys to Your New HSM

This chapter describes how to migrate your keys and configuration from a SafeNet Luna HSM 5.x or 6.x partition to a SafeNet Luna HSM 7.x partition by using one of three methods; backup and restore, cloning, or cloning using a temporarily HA group:

- > ["SafeNet Network HSM \(5.x or 6.x\) to SafeNet Luna Network HSM \(7.x\)" on the next page](#)
- > ["SafeNet Luna USB HSM \(5.x or 6.x\) to SafeNet Luna Network HSM \(7.x\)" on page 132](#)
- > ["SafeNet PCIe HSM \(5.x or 6.x\) to SafeNet Luna Network HSM \(7.x\)" on page 136](#)
- > ["SafeNet Luna PCIe HSM or USB HSM \(5.x or 6.x\) to SafeNet Luna PCIe HSM \(7.x\)" on page 141](#)

Refer also to the chapter on ["Key Cloning" on page 13](#), particularly ["Cloning Keys Between Luna 6, Luna 7, and HSM on Demand" on page 17](#).

This document guides you through several migration scenarios consisting of older and newer SafeNet Luna HSMs, using each applicable migration method. Before migrating, preconditions are provided for each scenario that must be met. There are specific user roles that are identified for performing the migration. In addition, both authentication methods (password and PED-authenticated) are supported.

Supported SafeNet Luna HSMs

This document describes key migration for these SafeNet Luna HSMs:

- > SafeNet Luna Network HSM, version 5.x or 6.x to 7.x
- > SafeNet Luna USB HSM, version 5.x or 6.x to 7.x
- > SafeNet Luna PCIe HSM, version 5.x or 6.x to 7.x

Migration methods

The three migration methods used in this guide are:

- > Backup and restore

The backup and restore method uses the LunaCM **partition archive backup** command to backup key material on an HSM (5.x or 6.x) partition and the Restore command to then restore this material to an HSM 7.x partition.

- > Cloning

The cloning method uses the LunaCM **partition clone** command to clone from an HSM (5.x or 6.x) partition to an HSM 7.x partition. It is also referred to as slot-to slot cloning.

- > Cloning using an HA group

The HA group method uses the LunaCM **ha synchronize** command on members of a temporary HA group consisting of a 5.x or 6.x HSM and a 7.x HSM, set up solely for the purpose of migration. After migration, this group should be removed since the members are not using the same software version.

Preconditions

Each migration procedure in this document is prefaced by a "Preconditions" section that specifies the hardware and software requirements along with any assumptions the procedure is using to perform the migration steps. Examples are a 5.x or 6.x HSM, a 7.x HSM, 5.x, 6.x or 7.x client software, user roles and the slot #s used in the procedure.

Roles required for migration

The following partition roles are needed to migrate key material:

- > Partition Security Officer. The partition security officer role is needed to perform LunaCM HA operations and to create the Crypto Officer role.
- > Partition Crypto Officer. The partition Crypto Officer role is needed to perform LunaCM backup/restore and cloning operations.

NOTE When logging in to a partition, be mindful of whether you're working with pre-PPSO or PPSO firmware. Use the **partition login** command if your HSM has pre-PPSO firmware (version 6.21.2 and earlier). Use the **role login** command if your HSM has PPSO firmware (version 6.22.0 and later). Also, with PPSO firmware 6.22.0 and later (up to but not including firmware 7.x), be careful with user names; that is, type **Crypto Officer** in full (is case sensitive) and not the abbreviation **co**.

In firmware version release 7.x, partition login name requirements allow for abbreviations. That is, you can log in using **po** for Partition Security Officer or **co** for Crypto Officer.

SafeNet Network HSM (5.x or 6.x) to SafeNet Luna Network HSM (7.x)

This chapter describes how to migrate your key material from a release 5.x or 6.x SafeNet Luna Network HSM partition to a release 7.x SafeNet Luna Network HSM partition. You can migrate your key material using one of the following three methods:

- > ["Backup and Restore" below](#)
- > ["Cloning" on page 128](#)
- > ["Cloning Using an HA Group" on page 130](#)

Backup and Restore

Cryptographic key material can be backed up and then restored to a release 7.x SafeNet Luna Network HSM partition using a SafeNet Luna Backup HSM.

The new configuration's operating system must be compatible with both the new 7.x and the old 5.x/6.x hardware. Consult the 5.x/6.x CRN for a list of compatible operating systems.

To backup and restore cryptographic keys from one HSM to another, the HSMs must share the same cloning domain. For password-authenticated HSMs, this domain should have been specified when the partition was initialized. For PED-authenticated HSMs, the red key determines the cloning domain. You will need the same red key that was imprinted during 5.x/6.x partition creation to initialize the 7.x partition (see ["Initializing an Application Partition" on page 93](#)).

The 7.x client software should be installed, and the connection to both the source and destination partitions verified, before attempting this procedure (see [Luna HSM Client Software Installation](#) for details). The source and destination partitions must both be assigned to the client machine issuing the backup and restore commands. Use **slot list** to ensure both partitions are visible to the client.

Preconditions

The following instructions assume that:

- > the 7.x client software has been installed
- > an uninitialized partition has been created on the 7.x HSM
- > the source and destination partitions are both registered with the client (visible)
- > the source partition's security policy allows cloning of private and secret keys

In the following example:

- > Slot 0: the source 5.x/6.x partition
- > Slot 1: the destination 7.x partition
- > Slot 2: the Backup HSM partition

NOTE Partition login name requirements have changed with the hardware versions. With release 7.x, you can log in using the abbreviated **po** (Partition Security Officer) or **co** (Crypto Officer).

To migrate cryptographic keys from a 5.x/6.x partition to a 7.x partition using a Backup HSM

Follow these steps to back up all cryptographic material on a 5.x/6.x partition to a Backup HSM, and restore to a new 7.x partition.

1. Run LunaCM, set the current slot to the 7.x partition, and initialize the partition and the Partition SO role.

slot set -slot 0

partition init -label <7.x_partition_label>

- a. If you are backing up a PED-authenticated 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.
- b. If you are backing up a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.

2. Log in as the **po** (Partition Security Officer) and initialize the **co** (Crypto Officer) role.

role login -name po

role init -name co

If you are backing up a PED-authenticated 5.x/6.x partition, you can create an optional challenge secret for the Crypto Officer.

role createchallenge -name co -challengeSecret <password>

3. Connect your backup HSM and make sure it is visible to the client, along with the 5.x/6.x and 7.x HSMs.
4. Set the current slot to the source 5.x/6.x slot.

slot list

slot set -slot 0

5. Log in as the Crypto Officer.

NOTE Be mindful of whether you're working with pre-PPSO or PPSO firmware and use the **partition login** or **role login** commands as specified below. Also, with PPSO firmware 6.22.0 and up, be careful with user names, i.e., type **Crypto Officer** in full (is case sensitive) and not **co**.

- a. If you are cloning a release 5.x or 6.x pre-PPSO partition (up to and including Firmware 6.21.2), use:

partition login

- b. If you are cloning a release 6.x PPSO partition (Firmware 6.22.0 and up), use:

role login -name Crypto Officer

6. Optional: To verify the objects in the 5.x/6.x partition to be cloned, issue the "partition contents" command.

partition contents

7. Back up the 5.x/6.x partition contents to the Backup HSM.

partition archive backup -slot 2 -partition <backup_label>

- a. If you are backing up a PED-authenticated 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.
- b. If you are backing up a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.

Optionally, verify that all objects were backed up successfully on the Backup HSM by checking the partition contents.

8. Set the current slot to the 7.x partition, log in as the Crypto Officer, and restore from backup.

slot set -slot 1

role login -name co

partition archive restore -slot 2 -partition <backup_label>

Afterwards, you can verify the partition contents on the 7.x partition:

partition contents

Cloning

The simplest method of migrating key material to a new 7.x partition is slot-to-slot cloning. This procedure copies all permitted cryptographic material from a 5.x/6.x Network HSM partition to a 7.x Network HSM partition.

The new configuration's operating system must be compatible with both the new 7.x and the old 5.x/6.x hardware. Consult the 5.x/6.x CRN for a list of compatible operating systems.

To clone cryptographic keys from one HSM to another, the HSMs must share the same cloning domain. For password-authenticated HSMs, this domain should have been specified when the partition was initialized. For PED-authenticated HSMs, the red key determines the cloning domain. You will need the same red key that was imprinted during 5.x/6.x partition creation to initialize the 7.x partition (see ["Initializing an Application Partition" on page 93](#)).

The 7.x client software should be installed, and the connection to both the source and destination partitions verified, before attempting this procedure (see [Luna HSM Client Software Installation](#) for details). The source and destination partitions must both be assigned to the client machine issuing the cloning commands. Use **slot list** to ensure both partitions are visible to the client.

If the source partition contains asymmetric keys, its security policy must allow cloning of private and secret keys. Use `lunacm:> partition showpolicies` to ensure that your source partition's security template allows this. If the 5.x/6.x HSM's security template does not allow cloning of private/secret keys, the HSM Admin may be able to turn this feature on using `lunacm:> partition changepolicy`.

CAUTION! Check your source partition policies and adjust them to be sure you can clone private and symmetric keys. Depending on the configuration of your partition and HSM, these policies may be destructive.

Preconditions

The following instructions assume that:

- > the 7.x client software has been installed
- > an uninitialized partition has been created on the 7.x Network HSM
- > the source and destination partitions must be registered with the client (visible)
- > the source 5.x/6.x partition's security policy allows cloning of private and secret keys

In the following examples:

- > Slot 0: the source 5.x/6.x partition
- > Slot 1: the destination 7.x partition

NOTE Partition login name requirements have changed with the hardware versions. With release 7.x, you can log in using the abbreviated **PO** (Partition Security Officer) or **CO** (Crypto Officer).

To clone cryptographic keys from a 5.x/6.x partition to a 7.x partition

Follow these steps to clone all cryptographic material on a 5.x/6.x partition to a 7.x partition.

1. Run LunaCM, set the current slot to the 7.x partition, and initialize the Partition SO role.

slot list**slot set -slot 1****partition init -label** <7.x_partition_label>

- a. If you are cloning a PED-authenticated 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.
 - b. If you are cloning a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.
2. Log in as the **po** (Partition Security Officer) and initialize the **co** (Crypto Officer) role.

role login -name po**role init -name co**

If you are cloning a PED-authenticated 5.x/6.x partition, you can create an optional challenge secret for the Crypto Officer.

role createchallenge -name co -challengesecret <password>

3. Set the current slot to the source 5.x/6.x slot, log in as the Crypto Officer.

slot set -slot 0

NOTE Be mindful of whether you're working with pre-PPSO or PPSO firmware and use the "partition login" or "role login" commands as specified below. Also, with PPSO firmware 6.22.0 and up, be careful with user names, i.e., type "Crypto Officer" in full (is case sensitive) and not "co".

- a. If you are cloning a release 5.x or 6.x pre-PPSO partition (up to and including Firmware 6.21.2), use:

partition login

- b. If you are cloning a release 6.x PPSO partition (Firmware 6.22.0 and up), use:

role login -name Crypto Officer

4. Optional: To verify the objects in the 5.x/6.x partition to be cloned, issue the "partition contents" command.

partition contents

5. Clone the objects to the 7.x partition slot (see ["partition clone" on page 1](#) for correct syntax).

partition clone -objects 0 -slot 1

Afterward, you can set the current slot to the 7.x partition and verify that all objects have cloned successfully.

slot set -slot 1**role login -name co -password** <password>**partition contents**

You should see the same number of objects that existed on the 5.x/6.x HSM. You can now decommission the old 5.x/6.x HSM.

Cloning Using an HA Group

High Availability (HA) groups duplicate key material between the HSMs in the group. This function can be used to copy all cryptographic key material from a 5.x/6.x Network HSM partition to a new 7.x Network HSM partition.

The new configuration's operating system must be compatible with both the new 7.x and the old 5.x/6.x hardware. Consult the 5.x/6.x CRN for a list of compatible operating systems.

To clone cryptographic keys from one HSM to another, the HSMs must share the same cloning domain. For password-authenticated HSMs, this domain should have been specified when the partition was initialized. For PED-authenticated HSMs, the red key determines the cloning domain. You will need the same red key that was imprinted during 5.x/6.x partition creation to initialize the 7.x partition (see ["Initializing an Application Partition" on page 93](#)).

The 7.x client software should be installed, and the connection to both the source and destination HSM partitions verified, before attempting this procedure (see [Luna HSM Client Software Installation](#) for details). The source and destination partitions must both be assigned to the client machine issuing the cloning commands. Use **slot list** to ensure both partitions are visible to the client.

NOTE It is not recommended to maintain an HA group with different versions of the SafeNet Luna Network HSM hardware.

Preconditions

The following instructions assume that:

- > the 7.x client software has been installed
- > an uninitialized partition has been created on the 7.x Network HSM
- > the source and destination partitions are both registered with the client (visible)

In the following examples:

- > Slot 0 = the source 5.x/6.x partition
- > Slot 1 = the destination 7.x partition

NOTE Partition login name requirements have changed between hardware versions. With release 7.x, you can log in using the abbreviated **po** (Partition Security Officer) or **co** (Crypto Officer).

To clone cryptographic keys from a 5.x/6.x partition to a 7.x partition using an HA group

Follow these steps to copy cryptographic material from an 5.x/6.x partition to a new 7.x partition by creating an HA group that includes both partitions.

1. Run LunaCM, set the current slot to the SA7 partition, and initialize the Partition SO role.

slot set -slot 1

partition init -label <7.x_partition_label>

- a. If you are cloning a multi-factor-authenticated (PED-authenticated) 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.

- b. If you are cloning a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.
2. Log in as the **po** (Partition Security Officer) and initialize the **co** (Crypto Officer) role.

role login -name po

role init -name co

If you are cloning a multi-factor-authenticated (PED-authenticated) 5.x/6.x partition, create a challenge secret for the Crypto Officer. This is required to set an HA activation policy.

role createchallenge -name co -challengesecret <password>

3. Set the current slot to the source 5.x/6.x slot, log in as the Crypto Officer.

slot set -slot 0

NOTE Be mindful of whether you're working with pre-PPSO or PPSO firmware and use the **partition login** or **role login** commands as specified below. Also, with PPSO firmware 6.22.0 and up, be careful with user names, i.e., type **Crypto Officer** in full (is case sensitive) and not **co**.

- a. If you are cloning a release 5.x or 6.x pre-PPSO partition (up to and including Firmware 6.21.2), use:
 - partition login**
 - b. If you are cloning a release 6.x PPSO partition (Firmware 6.22.0 and up), use:
 - role login -name Crypto Officer**
4. Optional: To verify the objects in the 5.x/6.x partition to be cloned, use:
 - partition contents**
 5. Using LunaCM, create an HA group of the 5.x/6.x slot and the 7.x slot.

NOTE HA requires that all members have an activation policy set. See ["Activation and Auto-activation on Multi-factor- \(PED-\) Authenticated Partitions"](#) on page 114 for details.

- a. Via LunaSH, log in as Security Officer and set policy 22 on the 5.x/6.x partition:
 - partition changepolicy -partition <5.x_partition_label> -policy 22 -value 1**
- b. In LunaCM, log in to the 7.x partition as Partition Security Officer, and set the activation policy from the client machine:
 - slot set -slot 1**
 - role login -name po**
 - partition changepolicy -policy 22 -value 1**
- c. Create the HA group with the 5.x/6.x partition as the primary partition. Select the "copy" option to preserve objects.
 - hagroup creategroup -label <group_label> -slot 0 -password <password>**
- d. Add the 7.x partition slot to the HA group. Repeat this step to add multiple 7.x partitions to the group.
 - hagroup addmember -group <group_label> -slot 1 -password <password>**

6. Synchronize the group to clone the objects to the 7.x member(s).

```
hagroup synchronize -group <group_label> -password <password>
```

7. Check synchronization status of the group.

```
hagroup listgroups
```

Notice the entry "Needs sync: no". This means that the objects have been successfully cloned among all members of the HA group. You can also log in to the 7.x slot as the Crypto Officer and check the partition contents.

SafeNet Luna USB HSM (5.x or 6.x) to SafeNet Luna Network HSM (7.x)

This chapter describes how to migrate your key material from a release 5.x or 6.x SafeNet Luna USB HSM partition to a release 7.x SafeNet Luna Network HSM partition. You can migrate your key material using one of the following methods:

- > ["Backup and Restore" below](#)
- > ["Cloning" on page 134](#)

Backup and Restore

Cryptographic key material can be backed up from a release 5.x or 6.x SafeNet Luna USB HSM partition and then restored to a release 7.x SafeNet Luna Network HSM partition using a SafeNet Luna Backup HSM. The following procedure performs a backup of a 5.x/6.x partition on an older operating system to a SafeNet Luna Backup HSM. The Backup HSM is then moved to a newer operating system where the 5.x/6.x key material is restored to a 7.x partition.

Consult the 5.x/6.x/7.x CRN for a list of compatible operating systems.

To clone cryptographic keys from one HSM to another, the HSMs must share the same cloning domain. For password-authenticated HSMs, this domain should have been specified when the 5.x/6.x partition was initialized. For PED-authenticated HSMs, the red key determines the cloning domain. You will need the same red key that was imprinted during 5.x/6.x partition creation to initialize the 7.x partition (see ["Initializing an Application Partition" on page 93](#)).

HSM Client software must be installed before attempting this procedure (see [Luna HSM Client Software Installation](#) for details). The source and destination partitions must be assigned to the client machine issuing the backup or restore command. Use **slot list** to ensure both partitions are visible to the client.

Preconditions

On the older operating system, the following instructions assume that:

- > 5.x/6.x HSM Client Software is installed
- > the source 5.x/6.x partition is visible
- > the source partition's security policy allows cloning of private and secret keys
- > the destination Backup HSM partition is visible

On the new operating system, the following instructions assume that:

- > 7.x HSM Client Software is installed
- > you have created an uninitialized partition on the 7.x Network HSM
- > the destination 7.x partition is registered with the client software (visible)
- > the source Backup HSM partition's security policy allows cloning of private and secret keys

Slots used in the following instructions:

On the older operating system running 5.x/6.x client software:

- Slot 0: the source 5.x/6.x partition
- Slot 2: the destination SafeNet Luna Backup HSM partition

On the new operating system running 7.x client software:

- Slot 1: the destination 7.x partition
- Slot 2: the source SafeNet Luna Backup HSM partition (with the backup of the 5.x/6.x partition)

NOTE Partition login name requirements have changed with the hardware versions. With release 7.x, you can log in using the abbreviated **PO** (Partition Security Officer) or **CO** (Crypto Officer).

To backup/restore cryptographic keys from a 5.x/6.x partition to a 7.x partition using a Backup HSM

Follow these steps to back up all cryptographic material on a 5.x/6.x partition to a SafeNet Luna Backup HSM, and restore to a new 7.x partition.

1. On the old operating system running 5.x/6.x client software, run LunaCM and set the current slot to the 5.x/6.x partition.

slot list

slot set -slot 0

2. Log in as the Crypto Officer.

NOTE Be mindful of whether you're working with pre-PPSO or PPSO firmware and use the "partition login" or "role login" commands as specified below. Also, with PPSO firmware 6.22.0 and up, be careful with user names, i.e., type "Crypto Officer" in full (is case sensitive) and not "co".

- a. If you are backing up a release 5.x or 6.x pre-PPSO partition (up to and including Firmware 6.21.2), use:
 - partition login**
- b. If you are backing up a release 6.x PPSO partition (Firmware 6.22.0 and up), use:
 - role login -name Crypto Officer**
3. Optional: To verify the objects in the 5.x/6.x partition to be backed up, use:
 - partition contents**
4. Back up the 5.x/6.x partition contents to the SafeNet Luna Backup HSM.
 - partition archive backup -slot 2 -partition <backup_label>**

- a. If you are backing up a PED-authenticated 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.
- b. If you are backing up a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.

Optionally, verify that all objects were backed up successfully on the SafeNet Luna Backup HSM by issuing the **partition contents** command.

5. Move the SafeNet Luna Backup HSM (with the backup of the 5.x/6.x partition) to the new operating system running the 7.x client software, and make sure it is visible to the client along with the 7.x HSM.
6. On the new operating system running the 7.x client software, run LunaCM, set the current slot to the 7.x partition, and initialize the partition and the PPSO role.

slot set -slot 1

partition init -label <7.x_partition_label>

- a. If you are backing up a PED-authenticated 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.
 - b. If you are backing up a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.
7. Log in as the **po** (Partition Security Officer) and initialize the **co** (Crypto Officer) role.

role login -name po

role init -name co

If you are backing up a PED-authenticated 5.x/6.x partition, you can create an optional challenge secret for the Crypto Officer.

role createchallenge -name co -challengesecret <password>

8. Set the current slot to the 7.x partition, log in as the Crypto Officer, and restore from backup.

slot set -slot 1

role login -name co

partition archive restore -slot 2 -partition <backup_label>

Afterwards, you can verify the partition contents on the 7.x partition:

partition contents

Cloning

The simplest method of migrating key material to a new 7.x partition is slot-to-slot cloning. This procedure copies all permitted cryptographic material from a 5.x/6.x USB HSM partition to a 7.x Network HSM partition.

The new configuration's operating system must be compatible with both the new 7.x and the old 5.x/6.x hardware. Consult the 5.x/6.x CRN for a list of compatible operating systems.

To clone cryptographic keys from one HSM to another, the HSMs must share the same cloning domain. For password-authenticated HSMs, this domain should have been specified when the partition was initialized. For PED-authenticated HSMs, the red key determines the cloning domain. You will need the same red key that was imprinted during 5.x/6.x partition creation to initialize the 7.x partition (see ["Initializing an Application Partition" on page 93](#)).

The 7.x client software should be installed, and the connection to both the source and destination partitions verified, before attempting this procedure (see [Luna HSM Client Software Installation](#) for details). The source and destination partitions must both be assigned to the client machine issuing the cloning commands. Use **slot list** to ensure both partitions are visible to the client.

If the source partition contains asymmetric keys, its security policy must allow cloning of private and secret keys. Use `lunacm:> partition showpolicies` to ensure that your source partition's security template allows this. If the 5.x/6.x HSM's security template does not allow cloning of private/secret keys, the HSM Admin may be able to turn this feature on using `lunacm:> partition changepolicy`.

CAUTION! Check your source partition policies and adjust them to be sure you can clone private and symmetric keys. Depending on the configuration of your partition and HSM, these policies may be destructive.

Preconditions

The following instructions assume that:

- > the 7.x client software has been installed
- > an uninitialized partition has been created on the 7.x Network HSM
- > the destination 7.x partition must be registered with the client (visible)
- > the source 5.x/6.x partition's security policy allows cloning of private and secret keys

In the following examples:

- > Slot 0: the source 5.x/6.x partition
- > Slot 1: the destination 7.x partition

NOTE Partition login name requirements have changed with the hardware versions. With release 7.x, you can log in using the abbreviated **PO** (Partition Security Officer) or **CO** (Crypto Officer).

To clone cryptographic keys from a 5.x/6.x partition to a 7.x partition

Follow these steps to clone all cryptographic material on a 5.x/6.x partition to a 7.x partition.

1. Run LunaCM, set the current slot to the 7.x partition, and initialize the Partition SO role.

slot list

slot set -slot 1

partition init -label <7.x_partition_label>

- a. If you are cloning a PED-authenticated 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.
- b. If you are cloning a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.

2. Log in as the **po** (Partition Security Officer) and initialize the **co** (Crypto Officer) role.

role login -name po

role init -name co

If you are cloning a PED-authenticated 5.x/6.x partition, you can create an optional challenge secret for the Crypto Officer.

role createchallenge -name co -challengesecret <password>

3. Set the current slot to the source 5.x/6.x slot, log in as the Crypto Officer.

slot set -slot 0

NOTE Be mindful of whether you're working with pre-PPSO or PPSO firmware and use the "partition login" or "role login" commands as specified below. Also, with PPSO firmware 6.22.0 and up, be careful with user names, i.e., type "Crypto Officer" in full (is case sensitive) and not "co".

- a. If you are cloning a release 5.x or 6.x pre-PPSO partition (up to and including Firmware 6.21.2), use:

partition login

- b. If you are cloning a release 6.x PPSO partition (Firmware 6.22.0 and up) , use:

role login -name Crypto Officer

4. Optional: To verify the objects in the 5.x/6.x partition to be cloned, issue the "partition contents" command.

partition contents

5. Clone the objects to the 7.x partition slot (see ["partition clone" on page 1](#) for correct syntax).

partition clone -objects 0 -slot 1

Afterward, you can set the current slot to the 7.x partition and verify that all objects have cloned successfully.

slot set -slot 1

role login -name co -password <password>

partition contents

You should see the same number of objects that existed on the 5.x/6.x HSM. You can now decommission the old 5.x/6.x HSM.

SafeNet PCIe HSM (5.x or 6.x) to SafeNet Luna Network HSM (7.x)

This chapter describes how to migrate your key material from a release 5.x or 6.x SafeNet PCIe HSM partition to a release 7.x SafeNet Luna Network HSM partition. You can migrate your key material using one of the following methods:

- > ["Backup and Restore" on the next page](#)
- > ["Cloning" on page 139](#)

Backup and Restore

Cryptographic key material can be backed up from a release 5.x or 6.SafeNet Luna PCIe HSM partition and then restored to a release 7.x SafeNet Luna Network HSM partition using a SafeNet Luna Backup HSM. The following procedure performs a backup of a 5.x/6.x partition on an older operating system to a SafeNet Luna Backup HSM. The Backup HSM is then moved to a newer operating system where the 5.x/6.x key material is restored to a 7.x partition.

Consult the 5.x/6.x/7.x CRN for a list of compatible operating systems.

To clone cryptographic keys from one HSM to another, the HSMs must share the same cloning domain. For password-authenticated HSMs, this domain should have been specified when the 5.x/6.x partition was initialized. For PED-authenticated HSMs, the red key determines the cloning domain. You will need the same red key that was imprinted during 5.x/6.x partition creation to initialize the 7.x partition (see ["Initializing an Application Partition" on page 93](#)).

HSM Client software must be installed on both operating systems (older and new) before attempting this procedure (see [Luna HSM Client Software Installation](#) for details). The destination partition must be assigned to the client machine. Use **slot list** to ensure partitions are visible to the client.

Preconditions

On the older operating system, the following instructions assume that:

- > 5.x/6.x HSM Client Software is installed with "SafeNet Luna Backup HSM" option selected.
- > the source 5.x/6.x partition is visible
- > the source partition's security policy allows cloning of private and secret keys
- > the destination Backup HSM partition is visible

On the new operating system, the following instructions assume that:

- > 7.x HSM Client Software is installed with "SafeNet Luna Backup HSM" option selected.
- > you have created an uninitialized partition on the 7.x Network HSM
- > the destination 7.x partition is registered with the client software (visible)
- > the source Backup HSM partition's security policy allows cloning of private and secret keys

Slots used in the following instructions:

On the older operating system running 5.x/6.x client software:

- Slot 0: the source 5.x/6.x partition
- Slot 2: the destination SafeNet Luna Backup HSM partition

On the new operating system running 7.x client software:

- Slot 1: the destination 7.x partition
- Slot 2: the source Backup HSM partition (with the backup of the 5.x/6.x partition)

NOTE Partition login name requirements have changed with the hardware versions. With release 7.x, you can log in using the abbreviated **po** (Partition Security Officer) or **co** (Crypto Officer).

To backup/restore cryptographic keys from a 5.x/6.x partition to a 7.x partition using a Backup HSM

Follow these steps to back up all cryptographic material on a 5.x/6.x partition to a SafeNet Luna Backup HSM, and restore to a new 7.x partition.

1. On the old operating system running 5.x/6.x client software, run LunaCM and set the current slot to the 5.x/6.x partition.

slot list

slot set -slot 0

2. Log in as the Crypto Officer.

NOTE Be mindful of whether you're working with pre-PPSO or PPSO firmware and use the "partition login" or "role login" commands as specified below. Also, with PPSO firmware 6.22.0 and up, be careful with user names, i.e., type "Crypto Officer" in full (is case sensitive) and not "co".

- a. If you are backing up a release 5.x or 6.x pre-PPSO partition (up to and including Firmware 6.21.2), use:

partition login

- b. If you are backing up a release 6.x PPSO partition (Firmware 6.22.0 and up), use:

role login -name Crypto Officer

3. Optional: To verify the objects in the 5.x/6.x partition to be backed up, use:

partition contents

4. Back up the 5.x/6.x partition contents to the SafeNet Luna Backup HSM.

partition archive backup -slot 2 -partition <backup_label>

- a. If you are backing up a PED-authenticated 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.
- b. If you are backing up a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.

Optionally, verify that all objects were backed up successfully on the SafeNet Luna Backup HSM by issuing the **partition contents** command.

5. Move the SafeNet Luna Backup HSM (with the backup of the 5.x/6.x partition) to the new operating system running the 7.x client software, and make sure it is visible to the client along with the 7.x HSM.
6. On the new operating system running the 7.x client software, run LunaCM, set the current slot to the 7.x partition, and initialize the partition and the PPSO role.

slot set -slot 1

partition init -label <7.x_partition_label>

- a. If you are backing up a PED-authenticated 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.
- b. If you are backing up a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.

7. Log in as the **po** (Partition Security Officer) and initialize the **co** (Crypto Officer) role.

role login -name po

role init -name co

If you are backing up a PED-authenticated 5.x/6.x partition, you can create an optional challenge secret for the Crypto Officer.

role createchallenge -name co -challengesecret <password>

8. Set the current slot to the 7.x partition, log in as the Crypto Officer, and restore from backup.

slot set -slot 1

role login -name co

partition archive restore -slot 2 -partition <backup_label>

Afterwards, you can verify the partition contents on the 7.x partition:

partition contents

Cloning

The simplest method of migrating key material to a new 7.x partition is slot-to-slot cloning. This procedure copies all permitted cryptographic material from a 5.x/6.x PCIe HSM partition to a 7.x Network HSM partition.

The new configuration's operating system must be compatible with both the new 7.x and the old 5.x/6.x hardware. Consult the 5.x/6.x CRN for a list of compatible operating systems.

To clone cryptographic keys from one HSM to another, the HSMs must share the same cloning domain. For password-authenticated HSMs, this domain should have been specified when the partition was initialized. For PED-authenticated HSMs, the red key determines the cloning domain. You will need the same red key that was imprinted during 5.x/6.x partition creation to initialize the 7.x partition (see ["Initializing an Application Partition" on page 93](#)).

The 7.x client software should be installed, and the connection to both the source and destination partitions verified, before attempting this procedure (see ["Luna HSM Client Software Installation" on page 1](#) for details). The destination partition must be assigned to the client machine issuing the cloning commands. Use the **slot list** command to ensure both partitions are visible to the client.

If the source partition contains asymmetric keys, its security policy must allow cloning of private and secret keys. Use the command **partition showpolicies** in LunaCM to ensure that your source partition's security template allows this (see ["partition showpolicies" on page 1](#)). If the 5.x/6.x HSM's security template does not allow cloning of private/secret keys, the HSM Admin may be able to turn this feature on using **partition changepolicy** (see ["partition changepolicy" on page 1](#)).

If the source partition contains asymmetric keys, its security policy must allow cloning of private and secret keys. Use `lunacm:> partition showpolicies` to ensure that your source partition's security template allows this. If the 5.x/6.x HSM's security template does not allow cloning of private/secret keys, the HSM Admin may be able to turn this feature on using `lunacm:> partition changepolicy`.

CAUTION! Check your source partition policies and adjust them to be sure you can clone private and symmetric keys. Depending on the configuration of your partition and HSM, these policies may be destructive.

Preconditions

On the operating system running 5.x/6.x client software, verify:

- > that the 5.x/6.x PCIe HSM partition's security policy allows cloning of private and secret keys
- > all key material on the 5.x/6.x PCIe HSM partition to be cloned

Regarding the operating system running 7.x client software, the following instructions assume that:

- > the 7.x client software has been installed with "SafeNet Luna PCIe HSM" option selected.
- > an uninitialized partition has been created on the 7.x HSM
- > the destination 7.x HSM partition must be registered with the client (visible)
- > the SafeNet Luna PCIe HSM card (with 5.x/6.x key material) has been installed

Slots used in the following instructions:

- > Slot 0: the source 5.x/6.x SafeNet Luna PCIe HSM partition
- > Slot 1: the destination 7.x partition

NOTE Partition login name requirements have changed with the hardware versions. With release 7.x, you can log in using the abbreviated **po** (Partition Security Officer) or **co** (Crypto Officer).

To clone cryptographic keys from a 5.x/6.x partition to a 7.x partition

Follow these steps to clone all cryptographic material on a 5.x/6.x partition to a 7.x partition.

1. Run LunaCM, set the current slot to the 7.x partition, and initialize the Partition SO role.

slot list

slot set -slot 1

partition init -label <7.x_partition_label>

- a. If you are cloning a PED-authenticated 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.
- b. If you are cloning a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.

2. Log in as the **po** (Partition Security Officer) and initialize the **co** (Crypto Officer) role.

role login -name po

role init -name co

If you are cloning a PED-authenticated 5.x/6.x partition, you can create an optional challenge secret for the Crypto Officer.

role createchallenge -name co -challengesecret <password>

3. Set the current slot to the source 5.x/6.x slot, log in as the Crypto Officer.

slot set -slot 0

NOTE Be mindful of whether you're working with pre-PPSO or PPSO firmware and use the "partition login" or "role login" commands as specified below. Also, with PPSO firmware 6.22.0 and up, be careful with user names, i.e., type "Crypto Officer" in full (is case sensitive) and not "co".

- a. If you are cloning a release 5.x or 6.x pre-PPSO partition (up to and including Firmware 6.21.2), use:
partition login
- b. If you are cloning a release 6.x PPSO partition (Firmware 6.22.0 and up) , use:
role login -name Crypto Officer
4. Optional: To verify the objects in the 5.x/6.x partition to be cloned, issue the "partition contents" command.
partition contents
5. Clone the objects to the 7.x partition slot (see ["partition clone" on page 1](#) for correct syntax).
partition clone -objects 0 -slot 1
Afterward, you can set the current slot to the 7.x partition and verify that all objects have cloned successfully.
slot set -slot 1
role login -name co -password <password>
partition contents
You should see the same number of objects that existed on the 5.x/6.x HSM. You can now decommission the old 5.x/6.x HSM.

SafeNet Luna PCIe HSM or USB HSM (5.x or 6.x) to SafeNet Luna PCIe HSM (7.x)

This chapter describes how to migrate your key material from release 5.x or 6.x of the SafeNet Luna PCIe HSM or SafeNet USB HSM partition to release 7.x of the SafeNet Luna PCIe HSM partition. You can migrate your key material using one of the following three methods:

- > ["Backup and Restore" below](#)
- > ["Cloning" on page 144](#)
- > ["Cloning Using an HA Group" on page 146](#)

Backup and Restore

Cryptographic key material can be backed up and then restored to a release 7.x SafeNet Luna PCIe HSM partition using a SafeNet Luna Backup HSM.

The new configuration's operating system must be compatible with both the new 7.x and the old 5.x/6.x hardware. Consult the 5.x/6.x CRN for a list of compatible operating systems.

To backup and restore cryptographic keys from one HSM to another, the HSMs must share the same cloning domain. For password-authenticated HSMs, this domain should have been specified when the partition was initialized. For PED-authenticated HSMs, the red key determines the cloning domain. You will need the same red key that was imprinted during 5.x/6.x partition creation to initialize the 7.x partition (see "[Initializing an Application Partition](#)" on page 93).

The 7.x client software should be installed, and the connection to both the source and destination partitions verified, before attempting this procedure (see [Luna HSM Client Software Installation](#) for details). The source and destination partitions must both be assigned to the client machine issuing the cloning commands. Use **slot list** to ensure both partitions are visible to the client.

Preconditions

The following instructions assume that:

- > the 7.x client software has been installed
- > an uninitialized partition has been created on the 7.x HSM
- > the source and destination partitions are both registered with the client (visible)
- > the source partition's security policy allows cloning of private and secret keys

In the following example:

- > Slot 0: the source 5.x/6.x partition
- > Slot 1: the destination 7.x partition
- > Slot 2: the Backup HSM partition

NOTE Partition login name requirements have changed with the hardware versions. With release 7.x, you can log in using the abbreviated **po** (Partition Security Officer) or **co** (Crypto Officer).

To migrate cryptographic keys from a 5.x/6.x partition to a 7.x partition using a Backup HSM

Follow these steps to back up all cryptographic material on a 5.x/6.x partition to a Backup HSM, and restore to a new 7.x partition.

1. Run LunaCM, set the current slot to the 7.x partition, and initialize the partition and the Partition SO role.

slot set -slot 0

partition init -label <7.x_partition_label>

- a. If you are backing up a PED-authenticated 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.
- b. If you are backing up a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.

2. Log in as the **po** (Partition Security Officer) and initialize the **co** (Crypto Officer) role.

role login -name po

role init -name co

If you are backing up a PED-authenticated 5.x/6.x partition, you can create an optional challenge secret for the Crypto Officer.

role createchallenge -name co -challengeSecret <password>

3. Connect your backup HSM and make sure it is visible to the client, along with the 5.x/6.x and 7.x HSMs.
4. Set the current slot to the source 5.x/6.x slot.

slot list

slot set -slot 0

5. Log in as the Crypto Officer.

NOTE Be mindful of whether you're working with pre-PPSO or PPSO firmware and use the **partition login** or **role login** commands as specified below. Also, with PPSO firmware 6.22.0 and up, be careful with user names, i.e., type **Crypto Officer** in full (is case sensitive) and not **co**.

- a. If you are cloning a release 5.x or 6.x pre-PPSO partition (up to and including Firmware 6.21.2), use:
 - partition login**
 - b. If you are cloning a release 6.x PPSO partition (Firmware 6.22.0 and up), use:
 - role login -name Crypto Officer**
6. Optional: To verify the objects in the 5.x/6.x partition to be cloned, issue the "partition contents" command.

partition contents

7. Back up the 5.x/6.x partition contents to the Backup HSM.

partition archive backup -slot 2 -partition <backup_label>

- a. If you are backing up a PED-authenticated 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.
- b. If you are backing up a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.

Optionally, verify that all objects were backed up successfully on the Backup HSM by checking the partition contents.

8. Set the current slot to the 7.x partition, log in as the Crypto Officer, and restore from backup.

slot set -slot 1

role login -name co

partition archive restore -slot 2 -partition <backup_label>

Afterwards, you can verify the partition contents on the 7.x partition:

partition contents

Cloning

The simplest method of migrating key material to a new 7.x partition is slot-to-slot cloning. This procedure copies all permitted cryptographic material from a 5.x/6.x PCIe or USB HSM partition to a 7.x PCIe HSM partition.

The new configuration's operating system must be compatible with both the new 7.x and the old 5.x/6.x hardware. Consult the 5.x/6.x CRN for a list of compatible operating systems.

To clone cryptographic keys from one HSM to another, the HSMs must share the same cloning domain. For password-authenticated HSMs, this domain should have been specified when the partition was initialized. For PED-authenticated HSMs, the red key determines the cloning domain. You will need the same red key that was imprinted during 5.x/6.x partition creation to initialize the 7.x partition (see ["Initializing an Application Partition" on page 93](#)).

The 7.x client software should be installed, and the connection to both the source and destination partitions verified, before attempting this procedure (see [Luna HSM Client Software Installation](#) for details). The source and destination partitions must both be assigned to the client machine issuing the cloning commands. Use **slot list** to ensure both partitions are visible to the client.

If the source partition contains asymmetric keys, its security policy must allow cloning of private and secret keys. Use `lunacm:> partition showpolicies` to ensure that your source partition's security template allows this. If the 5.x/6.x HSM's security template does not allow cloning of private/secret keys, the HSM Admin may be able to turn this feature on using `lunacm:> partition changepolicy`.

CAUTION! Check your source partition policies and adjust them to be sure you can clone private and symmetric keys. Depending on the configuration of your partition and HSM, these policies may be destructive.

Preconditions

The following instructions assume that:

- > the 7.x client software has been installed
- > an uninitialized partition has been created on the 7.x Network HSM
- > the destination 7.x partition must be registered with the client (visible)
- > the source 5.x/6.x partition's security policy allows cloning of private and secret keys

In the following examples:

- > Slot 0: the source 5.x/6.x partition
- > Slot 1: the destination 7.x partition

NOTE Partition login name requirements have changed with the hardware versions. With release 7.x, you can log in using the abbreviated **PO** (Partition Security Officer) or **CO** (Crypto Officer).

To clone cryptographic keys from a 5.x/6.x partition to a 7.x partition

Follow these steps to clone all cryptographic material on a 5.x/6.x partition to a 7.x partition.

1. Run LunaCM, set the current slot to the 7.x partition, and initialize the Partition SO role.

slot list**slot set -slot 1****partition init -label** <7.x_partition_label>

- a. If you are cloning a PED-authenticated 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.
 - b. If you are cloning a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.
2. Log in as the **po** (Partition Security Officer) and initialize the **co** (Crypto Officer) role.

role login -name po**role init -name co**

If you are cloning a PED-authenticated 5.x/6.x partition, you can create an optional challenge secret for the Crypto Officer.

role createchallenge -name co -challengesecret <password>

3. Set the current slot to the source 5.x/6.x slot, log in as the Crypto Officer.

slot set -slot 0

NOTE Be mindful of whether you're working with pre-PPSO or PPSO firmware and use the "partition login" or "role login" commands as specified below. Also, with PPSO firmware 6.22.0 and up, be careful with user names, i.e., type "Crypto Officer" in full (is case sensitive) and not "co".

- a. If you are cloning a release 5.x or 6.x pre-PPSO partition (up to and including Firmware 6.21.2), use:

partition login

- b. If you are cloning a release 6.x PPSO partition (Firmware 6.22.0 and up), use:

role login -name Crypto Officer

4. Optional: To verify the objects in the 5.x/6.x partition to be cloned, issue the "partition contents" command.

partition contents

5. Clone the objects to the 7.x partition slot (see ["partition clone" on page 1](#) for correct syntax).

partition clone -objects 0 -slot 1

Afterward, you can set the current slot to the 7.x partition and verify that all objects have cloned successfully.

slot set -slot 1**role login -name co -password** <password>**partition contents**

You should see the same number of objects that existed on the 5.x/6.x HSM. You can now decommission the old 5.x/6.x HSM.

Cloning Using an HA Group

High Availability (HA) groups duplicate key material between the HSMs in the group. This function can be used to copy all cryptographic key material from a 5.x/6.x PCIe or USB HSM partition to a new 7.x PCIe HSM partition.

The new configuration's operating system must be compatible with both the new 7.x and the old 5.x/6.x hardware. Consult the 5.x/6.x CRN for a list of compatible operating systems.

To clone cryptographic keys from one HSM to another, the HSMs must share the same cloning domain. For password-authenticated HSMs, this domain should have been specified when the partition was initialized. For PED-authenticated HSMs, the red key determines the cloning domain. You will need the same red key that was imprinted during 5.x/6.x partition creation to initialize the 7.x partition (see ["Initializing an Application Partition" on page 93](#)).

The 7.x client software should be installed, and the connection to both the source and destination HSM partitions verified, before attempting this procedure (see [Luna HSM Client Software Installation](#) for details). The source and destination partitions must both be assigned to the client machine issuing the cloning commands. Use **slot list** to ensure both partitions are visible to the client.

NOTE It is not recommended to maintain an HA group with different versions of the SafeNet Luna Network HSM hardware.

Preconditions

The following instructions assume that:

- > the 7.x client software has been installed
- > an uninitialized partition has been created on the 7.x Network HSM
- > the source and destination partitions are both registered with the client (visible)

In the following examples:

- > Slot 0 = the source 5.x/6.x partition
- > Slot 1 = the destination 7.x partition

NOTE Partition login name requirements have changed between hardware versions. With release 7.x, you can log in using the abbreviated **po** (Partition Security Officer) or **co** (Crypto Officer).

To clone cryptographic keys from a 5.x/6.x partition to a 7.x partition using an HA group

Follow these steps to copy cryptographic material from an 5.x/6.x partition to a new 7.x partition by creating an HA group that includes both partitions.

1. Run LunaCM, set the current slot to the SA7 partition, and initialize the Partition SO role.

slot set -slot 1

partition init -label <7.x_partition_label>

- a. If you are cloning a multi-factor-authenticated (PED-authenticated) 5.x/6.x partition, use the 5.x/6.x partition's red key when prompted.

- b. If you are cloning a password-authenticated 5.x/6.x partition, enter the same cloning domain when prompted.
2. Log in as the **po** (Partition Security Officer) and initialize the **co** (Crypto Officer) role.

role login -name po

role init -name co

If you are cloning a multi-factor-authenticated (PED-authenticated) 5.x/6.x partition, create a challenge secret for the Crypto Officer. This is required to set an HA activation policy.

role createchallenge -name co -challengesecret <password>

3. Set the current slot to the source 5.x/6.x slot, log in as the Crypto Officer.

slot set -slot 0

NOTE Be mindful of whether you're working with pre-PPSO or PPSO firmware and use the **partition login** or **role login** commands as specified below. Also, with PPSO firmware 6.22.0 and up, be careful with user names, i.e., type **Crypto Officer** in full (is case sensitive) and not **co**.

- a. If you are cloning a release 5.x or 6.x pre-PPSO partition (up to and including Firmware 6.21.2), use:
 - partition login**
 - b. If you are cloning a release 6.x PPSO partition (Firmware 6.22.0 and up), use:
 - role login -name Crypto Officer**
4. Optional: To verify the objects in the 5.x/6.x partition to be cloned, use:
 - partition contents**
 5. Using LunaCM, create an HA group of the 5.x/6.x slot and the 7.x slot.

NOTE HA requires that all members have an activation policy set. See "[Activation and Auto-activation on Multi-factor- \(PED-\) Authenticated Partitions](#)" on page 114 for details.

- a. Via LunaSH, log in as Security Officer and set policy 22 on the 5.x/6.x partition:
 - partition changepolicy -partition <5.x_partition_label> -policy 22 -value 1**
- b. In LunaCM, log in to the 7.x partition as Partition Security Officer, and set the activation policy from the client machine:
 - slot set -slot 1**
 - role login -name po**
 - partition changepolicy -policy 22 -value 1**
- c. Create the HA group with the 5.x/6.x partition as the primary partition. Select the "copy" option to preserve objects.
 - hagroup creategroup -label <group_label> -slot 0 -password <password>**
- d. Add the 7.x partition slot to the HA group. Repeat this step to add multiple 7.x partitions to the group.
 - hagroup addmember -group <group_label> -slot 1 -password <password>**

6. Synchronize the group to clone the objects to the 7.x member(s).

hagroup synchronize -group <group_label> **-password** <password>

7. Check synchronization status of the group.

hagroup listgroups

Notice the entry "Needs sync: no". This means that the objects have been successfully cloned among all members of the HA group. You can also log in to the 7.x slot as the Crypto Officer and check the partition contents.

CHAPTER 8: High-Availability Groups

SafeNet Luna HSMs can provide scalability and redundancy for cryptographic applications that are critical to your organization. For applications that require continuous, uninterrupted uptime, the Luna HSM Client allows you to combine application partitions on multiple HSMs into a single logical group, known as a High-Availability (HA) group.

This feature is best suited to provide redundancy to the Network HSM and PCI-E HSM products. Network HSM partitions can be grouped with other Network HSM partitions or with an HSM on Demand service. PCI-E HSM partitions can be grouped with other PCI-E HSM partitions or with an HSM on Demand Service.

An HA group allows your client application to access cryptographic services as long as one member HSM is functional and network-connected. This allows you to perform maintenance on any individual member without ever pausing your application, and provides redundancy in the case of individual failures. Cryptographic requests are distributed across all active group members, enabling a performance gain for each member added. Cryptographic objects are replicated across the entire group, so HA can also be used to keep a current, automatic, remote backup of the group contents.

HA functionality is handled by the Luna HSM Client software. The individual partitions have no way to know they are configured in an HA group, so you can configure HA on a per-application basis. The way you group your HSMs depends on your circumstances and desired performance.

This chapter contains the following sections:

- > ["Planning Your HA Group Deployment" on page 158](#)
- > ["Setting Up an HA Group" on page 159](#)
- > ["Verifying an HA Group" on page 163](#)
- > ["Setting an HA Group Member to Standby" on page 165](#)
- > ["Configuring HA Auto-Recovery" on page 167](#)
- > ["Enabling/Disabling HA Only Mode" on page 167](#)
- > ["HA Logging" on page 168](#)
- > ["Adding/Removing an HA Group Member" on page 172](#)
- > ["Replacing an HA Group Member" on page 176](#)
- > ["Deleting an HA Group" on page 178](#)
- > ["HA Troubleshooting" on page 179](#)

Performance

For repetitive operations (for example, many signings using the same key), an HA group provides linear performance gains as group members are added. The best approach is to maintain an HA group at a size that best balances application server capability and the expected loads, with an additional unit providing capacity for bursts of traffic.

For best overall performance, keep all group members running near their individual performance ideal, about 30 simultaneous threads per HSM. If you assemble an HA group that is significantly larger than your server(s) can manage, you might not achieve full performance from all members. Gigabit Ethernet connections are recommended to maximize performance.

Performance is also affected by the kind of cryptographic operations being requested. For some operations, an HA group can actually hinder performance by requiring extra operations to replicate new key objects. For example, if the operation involves importing and unwrapping keys:

| Using an HA group | Using an individual partition |
|--|--|
| <ol style="list-style-type: none"> 1. Encryption (to wrap the key) 2. Decryption on the primary member partition (to unwrap the key) 3. Object creation on the primary member partition (the unwrapped key is created and stored as a key object) 4. Key replication across the HA group: <ol style="list-style-type: none"> a. RSA 4096-bit operation is used to derive a shared secret between HSMs b. Encryption of the key on the primary HA member using the shared secret c. Decryption of the key on each HA member using the shared secret d. Object creation on each HA member 5. Encryption (using the unwrapped key object to encrypt the data) | <ol style="list-style-type: none"> 1. Encryption (to wrap the key) 2. Decryption (to unwrap the key) 3. Object creation (the unwrapped key is created and stored as a key object) 4. Encryption (using the unwrapped key object to encrypt the data) |

In this case, the HA group must perform many more operations than an individual partition, most significantly the RSA-4096-bit operation and creating the additional objects. Those two operations are by far the most time-consuming on the list, and so this task would have much better performance on an individual partition.

The crucial HA performance consideration is whether the objects on the partitions are constant, or always being created and replaced. If tasks make use of already-existing objects, those objects exist on all HA group members; operations can be performed by different group members, boosting performance. If new objects are created, they must be replicated across the entire group, causing a performance loss.

NOTE The way your application uses the **C_FindObjects** function to search for objects in a virtual HA slot can have a significant impact on your application performance (see ["Application Object Handles" on page 155](#)).

Load Balancing

Cryptographic requests sent to the HA group's virtual slot are load-balanced across all active members of the HA group. The load-balancing algorithm sends requests for cryptographic operations to the least busy partition in the HA group. This scheme accounts for operations of variable length, ensuring that queues are balanced even when some partitions are assigned very long operations. When an application requests a repeated set of operations, this method works. When the pattern is interrupted, however, the request type becomes relevant, as follows:

- > Single-part (stateless) cryptographic operations are load-balanced.
- > Multi-part (stateful) cryptographic operations are load-balanced.
- > Multi-part (stateful) information retrieval requests are not load-balanced. In this case, the cost of distributing the requests to different HA group members is generally greater than the benefit. For this reason, multi-part information retrieval requests are all targeted at one member.
- > Key management requests are not load-balanced. Operations affecting the state of stored keys (creation, deletion) are performed on a single HA member, and the result is then replicated to the rest of the HA group.

For example, when a member partition is signing and an asymmetric key generation request is issued, additional operations on that member are queued while the partition generates the key. In this case, the algorithm schedules more operations on other partitions in the HA group.

The load-balancing algorithm operates independently in each application process. Multiple processes on the same client or on different clients do not share information when scheduling operations. Some mixed-use cases might cause applications to use some partitions more than others (see ["Planning Your HA Group Deployment" on page 158](#)). If you increase key sizes, interleave other cryptographic operations, or if network latency increases, performance may drop for individual active members as they become busier.

NOTE Partitions designated as standby members are not used to perform cryptographic operations, and are therefore not part of the load-balancing scheme (see ["Standby Members" on page 155](#)).

The Primary Partition

The primary partition is the first partition you specify as a member of the HA group. While cryptographic operations are load-balanced across all the partitions in the group, new keys are always created on the primary partition, and then replicated on the other partitions (see ["Key Replication" below](#)). Depending on how many new keys you are creating on your HA group, this can mean that the primary partition has a heavier workload than the other partitions in the group. If your HSMs are in different remote locations, you could select one with the least latency as the primary partition.

Despite its name, the primary partition is not more critical than any other partition in the HA group. If the primary partition fails, its operations fail over to other partitions in the group, and the next member added to the group becomes the new primary partition.

Network Topography

The network topography of the HA group is generally not important to the functioning of the group. As long as the client has a network path to each member, the HA logic will function. Different latencies between the client and each HA member cause a command scheduling bias towards the low-latency members. Commands scheduled on the long-latency devices have a longer overall latency associated with each command.

In this case, the command latency is a characteristic of the network. To achieve uniform load distribution, ensure that partitions in the group have similar network latency.

Key Replication

When an application creates a key on the virtual HA slot, the HA library automatically replicates the key across all group members before reporting back to the application. Keys are created on one member partition and replicated to the other members. If a member fails during this process, the HA group reattempts key replication

to that member until it recovers, or failover attempts time out. Once the key exists on all active members of the HA group, a success code is returned to the application.

All key replication uses the Luna cloning protocol, which provides mutual authentication, confidentiality, and integrity for each object that is copied from one partition to another. Therefore, all HA group member partitions must be initialized with the same cloning domain.

The cloning protocol is invoked separately for each object to be cloned and the sequence of required calls must be issued by an authorized client library (residing on a client platform that has been authenticated to each of the partitions in the HA group). This ensures that the use of cloning function calls is controlled, and the protocol cannot be misused to permit the unauthorized transfer of objects to or from one of the partitions in the HA group.

Failover

When any active HA group member fails, a failover event occurs – the affected partition is dropped from the list of available HA group members, and all operations that were pending on the failed partition are transparently rescheduled on the remaining member partitions. The Luna HSM Client continuously monitors the health of member partitions at two levels:

- > network connectivity – disruption of the network connection causes a failover event after a 20-second timeout.
- > command completion – any command that is not executed within 20 seconds causes a failover event.

NOTE Most commands are completed within milliseconds. Some can take longer, either because the command itself is time-consuming (for example, key generation), or because the HSM is under extreme load. The HSM automatically sends a "heartbeat" signal every two seconds for commands that are pending or in progress. The client extends the 20-second timeout whenever it receives a heartbeat, preventing false failover events.

When an HA group member fails, the HA group status (see ["hagroup listgroups" on page 1](#)) reports a device error for the failed member. The client tries to reconnect the failed member at a minimum retry rate of once every 60 seconds, for the specified number of times (see ["Recovery" on the next page](#)).

When a failover occurs, the application experiences a latency stall on the commands in process on the failing unit, but otherwise there is no impact on the transaction flow. The scheduling algorithm described in ["Load Balancing" on page 150](#) automatically minimizes the number of commands that stall on a failing unit during the 20-second timeout.

As long as one HA group member remains functional, cryptographic service is maintained no matter how many other group members fail. As described in ["Recovery" on the next page](#), members can be returned to service without restarting the application.

Mid-operation failures

Any operation that fails mid-point needs to be re-sent from the calling application. The entire operation returns a failure (CKR_DEVICE_ERROR). This is more likely to happen in a multi-part operation, but a failure could conceivably happen during a single atomic operation as well.

For example, multi-part operations could be block encryption/decryption or any other command where the previous state of the HSM is critical to the processing of the next command. These operations must be re-sent, since the HA group does not synchronize partitions' internal memory state, only the stored key material.

NOTE You must ensure that your applications can deal with the rare possibility of a mid-operation failure, by re-issuing the affected commands.

Possible Causes of Failure

In most cases, a failure is a brief service interruption, like a system reboot. These temporary interruptions are easily dealt with by the failover and auto-recovery functions. In some cases, additional actions may be required before auto-recovery can take place. For example, if a partition becomes deactivated, it must be reactivated by the Crypto Officer (see "[Activation and Auto-activation on Multi-factor- \(PED-\) Authenticated Partitions](#)" on [page 114](#)). Some permanent failures may require manual recovery (see "[Recovery](#)" below). Possible failure events include:

> HSM-side failures

- HSM card failure
- HSM re-initialization
- HSM reboot
- HSM power failure
- Deactivated partition
- NTLS service failure
- STC service failure

> Client-side failures

- Client workstation power failure
- Client workstation reboot

Recovery

Recovery of a failed HA group member is designed to be automatic in as many cases as possible. You can configure your auto-recovery settings to require as much manual intervention as is convenient for you and your organization. In either an automated or manual recovery process, there is no need to restart your application. As part of the recovery process:

- > Any cryptographic objects created while the member was offline are automatically replicated to the recovered partition.
- > The recovered partition becomes available for its share of load-balanced cryptographic operations.

Auto-recovery

When auto-recovery is enabled, Luna HSM Client performs periodic recovery attempts when it detects a member failure. You can adjust the frequency (maximum once per minute) and the total number of retries (no limit). If the failed partition is not recovered within the scheduled number of retries, it remains a member of the HA group, but the client will no longer attempt to recover it. You must then address whatever equipment or network issue caused the failure, and execute a manual recovery of the member partition.

With each recovery attempt, a single application thread experiences a slight latency delay of a few hundred milliseconds while the client uses the thread to recover the failed member partition.

There are two HA auto-recovery modes:

- > **activeBasic** – uses a separate, non-session-based Active Recovery Thread to perform background checks of HA member availability, recover failed members, and synchronize the contents of recovered members with the rest of the group. It does not restore existing sessions if all members fail simultaneously and are recovered.
- > **activeEnhanced** – works the same as activeBasic, but restores existing sessions and login states if all members fail and are recovered.

HA auto-recovery is disabled by default. It is automatically enabled when you set the recovery retry count (see ["Configuring HA Auto-Recovery" on page 167](#)). Thales Group recommends enabling auto-recovery in all configurations.

NOTE If a member partition loses Activation when it fails (it remains offline for more than two hours) you must present the black Crypto Officer PED key to re-cache the PED secret before the member can be recovered.

Manual Recovery

When auto-recovery is disabled, or fails to recover the partition within the scheduled number of retries, you must execute a manual recovery in LunaCM. Even if you use manual recovery, you do not need to restart your application. When you execute the recovery command, the client makes a recovery attempt the next time the application uses the group member (see ["Manually Recovering a Failed HA Group Member" on page 175](#)).

Even with auto-recovery enabled and configured for a large number of retries, there are some rare occasions where a manual recovery may be necessary (for example, when a member partition and the client application fail at the same time).

CAUTION! Never attempt a manual recovery while the application is running and auto-recovery is enabled. This can cause multiple concurrent recovery processes, resulting in errors and possible key corruption.

Failure of All Group Members

If all members of an HA group fail (and no standby members are configured), all logged-in sessions are lost, and operations that were active when the last member failed are terminated. If you have set the HA auto-recovery mode to activeEnhanced, all sessions will be restarted when one or more members are recovered, and normal operations will resume. Otherwise, you must restart the client application once the group members have been recovered.

Permanent Failures

Sometimes an HSM failure is permanent (from the perspective of the HA group). For example, if the HSM is re-initialized, the member partition is erased and must be recreated. In this case, you can decide to recreate the original member or deploy a new member to the group. The client automatically replicates cryptographic objects to the new member and begins assigning operations to it (see ["Replacing an HA Group Member" on page 176](#)).

Standby Members

After you add member partitions to an HA group, you can designate some as standby members. Cryptographic objects are replicated on all members of the HA group, including standby members, but standby members do not perform any cryptographic operations unless all the active members go offline. In this event, all standby members are immediately promoted to active service, and operations are load-balanced across them. This provides an extra layer of assurance against a service blackout for your application.

Since standby members replicate keys but do not perform operations, they can also serve as an automatic backup partition for the cryptographic objects on the HA group. The contents of standby partitions are always kept up-to-date, so it is not possible to keep multiple backups (different generations of preserved material) using an HA group (see ["Planning Your HA Group Deployment" on page 158](#)). You can consider HA standby members to be your backup only in the case where the most recent sync always replicates all objects you are interested in preserving and recovering.

If you have audit-compliance rules or other mandate to preserve earlier partition contents (keys and objects), then you should perform intentional backups with dedicated backup devices (see ["Backup and Restore Using a G5-Based Backup HSM" on page 180](#) if you already have a G5 Backup HSM, or ["Backup and Restore Using a G7-Based Backup HSM" on page 203](#) if you purchase a new Backup HSM).

Process Interaction

At the lowest communication level, the transport protocol (TCP) maintains communication between the client and the appliance (whether HA is involved or not). For HA groups involving member partitions on SafeNet Luna Network HSM, the protocol timeout is 10 seconds. This means:

- > In a period of no activity by client or appliance, the appliance's TCP will wonder if the client is still there, and send a packet after 10 seconds of silence.
- > If that packet is acknowledged, the 10-second TCP timer restarts, and the cycle repeats indefinitely.
- > If the packet is not acknowledged, TCP sends another every 10 seconds. If there is no response after 2 minutes, the connection is considered dead, and higher levels are alerted to perform their cleanup.

Above that level, the NTLS/STC layer provides the connection security and some other services. Any time a client sends a request for a cryptographic operation, the HSM on the appliance begins working on that operation.

While the HSM processes the request, appliance-side NTLS/STC sends a "keep-alive" ping every 2 seconds, until the HSM completes the request. NTLS/STC does not perform any interpretation of the ping, but simply keeps the TCP layer active. If your client application requests a lengthy operation (for example, an 8192-bit keygen), the random-number-generation portion of that operation could take minutes, during which the HSM would legitimately be sending nothing back to the client. The NTLS ping ensures that the connection remains alive during long pauses.

Application Object Handles

Application developers should be aware that the PKCS #11 object handle model is fully virtualized when using an HA slot. The application must not assume fixed handle numbers across instances of an application. A handle's value remains consistent for the life of a process; but it might be a different value the next time the application is executed.

When you use an HA slot with your applications, the client behaves as follows when interacting with the application:

1. Intercept the call from the application.
2. Translate virtual object handles to physical object handles using the mappings specified by the virtual object table. The virtual object table is created and updated for the current session only, and only contains a list of the objects accessed in the current session.
3. Launch any required actions on the appropriate HSM or partition.
4. Receive the result from the HSM or partition and forward the result to your application,
5. Propagate any changes in objects on the physical HSM that performed the action to all of the other members of the HA group.

Virtual slots and virtual objects

When an application uses a non-HA physical slot, it addresses all objects in the slot by their physical object handles. When an application uses an HA slot, however, a virtual layer of abstraction overlays the underlying physical slots that make up the HA group, and the HA group is presented to the application as a virtual slot. This virtual slot contains virtual objects that have virtual object handles. The object handles in an HA slot are virtualized since the object handles on each of the underlying physical slots might be different from slot to slot. Furthermore, the physical object handles could change if a member of the HA group drops out (fails or loses communication) and is replaced.

The virtual object table

HA slots use a virtual object table to map the virtual objects in the virtual HA slot to the real objects in the physical slots that make up the HA group. The HA client builds a virtual object table for each application that loads the library. The table is ephemeral, and only exists for the current session. It is created and updated, if necessary, each time an application makes a request to access an object. To maximize performance and efficiency, the table only contains a list of the objects accessed in the current session. For example, the first time an application accesses an object after application start up, the table is created, a look up is performed to map the virtual object to its underlying physical objects, and an entry for the object is added to the table. For each subsequent request for that object, the data in the table is used and no look up is required. If the application then accesses a different object that is not listed in the table, a new look up is performed and the table is updated to add an entry for the new object.

C_FindObjects behavior and application performance

Since the client must perform a lookup to create the virtual object table, the way you use the C_FindObjects function can have a significant impact on the performance of your applications. For example, if you use the C_FindObjects function to ask for specific attributes, the client only needs to update the table to include the requested objects. If, however, you use the C_FindObjects function to find all objects, the client queries each HSM/partition in the group, for each object, to create the table. This can take a significant amount of time if the slot contains a large number of objects, or if the HA group includes many members.

To mitigate performance degradation when using the C_FindObjects function to list the objects on an HA slot, we recommend that you structure your applications to search by description, handles, or other attributes, rather than searching for all objects. Doing so minimizes the number of objects returned and the time required to create or update the table. If your application must find all objects, we recommend that you add the C_FindObjects all function call to the beginning of your application so that the table is built on application start up, so that the table is available to the application for all subsequent C_FindObjects function calls.

Example: Database Encryption

This section walks through a sample use case of some of the HA logic with a specific application – a transparent database encryption.

Typical Database Encryption Key Architecture

Database engines typically use a two-layered key architecture. At the top layer is a master encryption key that is the root of data protection. Losing this key is equivalent to losing the database, so it obviously needs to be highly durable. At the second layer are table keys used to protect table-spaces and/or columns. These table keys are stored with the database as blobs encrypted by the master encryption key (MEK). This architecture maps to the following operations on the HSM:

1. Initial generation of master key for each database.
2. Generation and encryption of table keys with the master key.
3. Decryption of table keys when the database needs to access encrypted elements.
4. Generation of new master keys during a re-key and then re-encrypting all table keys with it.
5. Generation and encryption of new table keys for storage in the database (often done in a software module).

The HSM is not involved in the use of table keys. Instead it provides the strong protection of the MEK which is used to protect the table keys. Users must follow backup procedures to ensure their MEK is as durable as the database itself ("[Backup and Restore Using a G5-Based Backup HSM](#)" on page 180).

HSM High Availability with Database Encryption

When the HSMs are configured as an HA group, the database's master key is automatically and transparently replicated to all the members when the key is created or re-keyed. If an HSM group member was offline or fails during the replication, it does not immediately receive a copy of the key. Instead the HA group proceeds after replicating to all of the active members. Once a member is re-joined to the group the HSM client automatically replicates the new master keys to the recovered member.

Before every re-key event, the user must ensure the HA group has sufficient redundancy. A re-key will succeed as long as one HA group member exists, but proceeding with too few HSMs will result in an availability risk. For example, proceeding with only one HSM means the new master key will be at risk since it exists only on a single HSM. Even with sufficient redundancy, Thales Group recommends maintaining an offline backup of a database's master key.

HSM Load Balancing with Database Encryption

While a database is up and running, the master key exists on all members in the HA group. Requests to encrypt or decrypt table keys are distributed across the entire group. The load-balancing feature is able to deliver improved performance and scalability when the database requires a large number of accesses to the table keys. Most deployments will not need much load balancing as the typical database deployment results in a small number of table keys.

While the table keys are re-keyed, new keys are generated in the HSM and encrypted for storage in the database. Within an HA group, these keys are generated on the primary member and then replicated to the entire HA group, even though they exist on the HSM for only a moment. These events are infrequent enough that this extra replication has minimal impact.

Planning Your HA Group Deployment

This section describes important considerations and constraints to keep in mind as you plan your High-Availability (HA) group deployment. The benefits of HA are described in detail in ["High-Availability Groups" on page 149](#). There are several sample configurations described in this section that take advantage of different HA features. Depending on your organization's security needs, you might choose one of these configurations, or your own variation.

- > ["HSM and Partition Prerequisites" below](#)
- > ["Sample Configuration" on the next page](#)
 - ["Performance and Load Balancing" on the next page](#)

HSM and Partition Prerequisites

The HSM partitions you plan to use in an HA group must meet the following prerequisites before you can use them in an HA group.

Compatible HSM Firmware Versions

All HSMs in an HA group must have the same firmware version installed.

Common Cloning Domain

All key replication in an HA group uses the Luna cloning protocol, which provides mutual authentication, confidentiality, and integrity for each object that is copied from one partition to another. Therefore, all HA group member partitions must be initialized with the same cloning domain. If you are planning to combine already-existing partitions into an HA group, you must first re-initialize them using the same domain string or red PED key.

Common Crypto Officer Credentials

An HA group essentially allows you to log in to all its member partitions simultaneously, using a single credential. Password-authenticated partitions must all be initialized with the same Crypto Officer password. PED-authenticated partitions must all be initialized with the same black Crypto Officer PED key and activated with the same CO challenge password.

It is not possible to create an HA group made up of both password- and PED-authenticated partitions.

Common HSM/Partition Policies (FIPS Mode)

Generally, all HSMs/partitions used in an HA group must have the same policy configuration, especially FIPS mode. Do not attempt to use an HA group combining HSMs with FIPS mode on and others with FIPS mode off.

Functionality Modules

If you intend to use Functionality Modules (FMs) with your HA group, all HSMs containing HA group members must have FMs enabled and they must all have the same FM(s) loaded. See [FM Deployment Constraints](#) for details. FMs are not supported for HSM on Demand services.

Sample Configuration

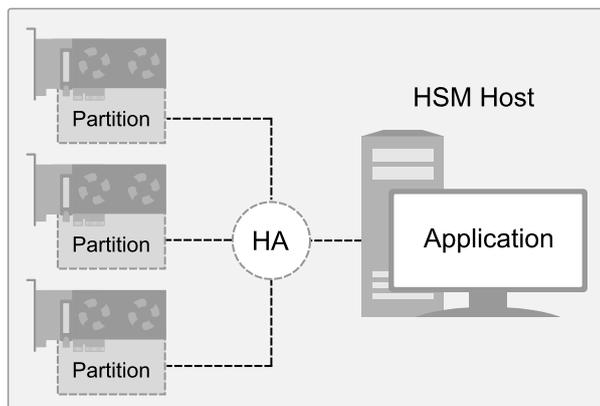
Your ideal HA group configuration depends on the number of HSMs you have available and the purpose of your application(s).

Performance and Load Balancing

If your application is designed to perform many cryptographic operations as quickly as possible, using keys or other objects that do not change often, you can create a large HA group using partitions on many HSMs. This deployment uses load balancing to provide linear performance gains for each HSM added to the group.

For example: your application uses keys stored on the HSM to perform many encrypt/decrypt or sign/verify operations. You want to minimize transaction latency by providing enough HSMs to handle capacity.

The Luna HSM Client allows HA groups with up to 32 member partitions. The best approach in this example is to add enough group members to handle the usual number of operations, plus enough extra members to handle periods of high demand.



Setting Up an HA Group

Use LunaCM to create an HA group from partitions assigned to your client. This procedure is completed by the Crypto Officer. Ensure that you have met all necessary prerequisites before proceeding with group creation. For a detailed description of HA functionality, see ["High-Availability Groups" on page 149](#).

NOTE Your LunaCM instance needs to update the **Chrystoki.conf** (Linux/UNIX) or **crystoki.ini** file (Windows) when setting up or reconfiguring HA. Ensure that you have Administrator privileges on the client workstation.

Prerequisites

HA groups are set up in LunaCM by the Crypto Officer. Before the CO can perform this setup, however, all HSMs and member partitions must meet the following prerequisites, completed by the HSM and Partition Security Officers.

HSMs

The HSM SO must ensure that all HSMs containing HA group member partitions meet the following prerequisites:

- > All HSMs must use the same authentication method (Password/PED). HSM on Demand Services support password authentication only.
- > HA groups cannot contain both PCIe HSMs and Network HSMs.
- > All must be running one of the supported software/firmware versions. Generally, Thales Group recommends using HSMs with the same software/firmware for HA. However, mixed-version HA groups containing Luna 6 and 7 member partitions and HSM on Demand (HSMoD) services are supported. See ["Cloning Keys Between Luna 6, Luna 7, and HSM on Demand" on page 17](#) for more information.
- > For PCIe HSMs, all HSMs must have the same firmware version installed and must be installed in the same host server that will create the HA group.
- > HSM policies **7: Allow Cloning** and **16: Allow Network Replication** must be set to **1** (see [Setting HSM Policies Manually](#)).
- > HSM policies must be consistent across all HSMs, particularly **12: Allow non-FIPS algorithms**. Do not attempt to use an HA group combining HSMs with FIPS mode on and others with FIPS mode off.

Partitions

The Partition SO must ensure that all partitions in an HA group meet the following prerequisites:

- > All partitions must be visible in LunaCM on the host workstation.
- > All partitions must be initialized with the same cloning domain:
 - Password-authenticated partitions must share the same domain string.
 - PED-authenticated partitions must share the same red domain PED key.
- > Partition policies **0: Allow private key cloning** and **4: Allow secret key cloning** must be set to **1** on all partitions.
- > Partition policies must be consistent across all member partitions.
- > The Crypto Officer role on each partition must be initialized with the same CO credential (password or black PED key).
- > PED-authenticated partitions must have partition policies **22: Allow activation** and **23: Allow auto-activation** set to **1**. All partitions must be activated and have auto-activation enabled, so that they can retain their login state after failure/recovery. Each partition must have the same activation challenge secret set (see ["Activation and Auto-activation on Multi-factor- \(PED-\) Authenticated Partitions" on page 114](#))

NOTE If HSM policy **21: Force user PIN change after set/reset** is set to **1** (the default setting), the Crypto Officer must change the initial CO credential before using the partition for cryptographic operations. This applies to the activation challenge secret as well (see [role changepw](#)).

To set up an HA group

1. Decide which partition will serve as the primary member (see ["The Primary Partition" on page 151](#)). Create a new HA group, specifying the following information:
 - the group label (do not call the group "HA")
 - the Serial number OR the slot number of the primary member partition
 - the Crypto Officer password or challenge secret for the partition

```
lunacm:>hagroup creategroup -label <label> {-slot <slotnum> | -serialnumber <serialnum>}
```

```
lunacm:> hagroup creategroup -label myHAGroup -slot 0
```

```
Enter the password: *****
```

```
New group with label "myHAGroup" created with group number 1154438865287.
Group configuration is:
```

```
HA Group Label: myHAGroup
HA Group Number: 1154438865287
HA Group Slot ID: Not Available
Synchronization: enabled
Group Members: 154438865287
Needs sync: no
Standby Members: <none>
```

| Slot # | Member S/N | Member Label | Status |
|--------|--------------|--------------|--------|
| ===== | ===== | ===== | ===== |
| 0 | 154438865287 | par0 | alive |

```
Command Result : No Error
```

LunaCM generates a serial number for the HA group (by adding a "1" before the primary partition serial number), assigns it a virtual slot number, and automatically restarts.

```
lunacm (64-bit) v7.3.0. Copyright (c) 2018 SafeNet. All rights reserved.
```

```
Available HSMs:
```

```
Slot Id -> 0
Label -> par0
Serial Number -> 154438865287
Model -> LunaSA 7.3.0
Firmware Version -> 7.3.0
Configuration -> Luna User Partition With SO (PW) Key
Export With Cloning Mode
Slot Description -> Net Token Slot

Slot Id -> 1
Label -> par1
Serial Number -> 1238700701509
Model -> LunaSA 7.3.0
Firmware Version -> 7.3.0
Configuration -> Luna User Partition With SO (PW) Key
Export With Cloning Mode
Slot Description -> Net Token Slot

Slot Id -> 5
HSM Label -> myHAGroup
HSM Serial Number -> 1154438865287
HSM Model -> LunaVirtual
HSM Firmware Version -> 7.3.0
HSM Configuration -> Luna Virtual HSM (PW) Key Export With
Cloning Mode
```

```
HSM Status ->          N/A - HA Group
```

```
Current Slot Id: 0
```

2. Add another partition to the HA group, specifying either the slot or the serial number. If the new member contains cryptographic objects, you are prompted to decide whether to replicate the objects within the HA group, or delete them.

```
lunacm:> hagroup addmember -group <grouplabel> {-slot <slotnum> | -serialnumber <serialnum>}
```

```
lunacm:> hagroup addmember -group myHAGroup -slot 1
```

```
Enter the password: *****
```

```
Warning:  There are objects currently on the new member.
          Do you wish to propagate these objects within the HA
          group, or remove them?
```

```
Type 'copy' to keep and propagate the existing
objects, 'remove' to remove them before continuing,
or 'quit' to stop adding this new group member.
> copy
```

```
Member 1238700701509 successfully added to group myHAGroup. New group
configuration is:
```

```
HA Group Label:  myHAGroup
HA Group Number: 1154438865287
HA Group Slot ID: 5
Synchronization: enabled
  Group Members: 154438865287, 1238700701509
    Needs sync:  no
  Standby Members: <none>
```

| Slot # | Member S/N | Member Label | Status |
|--------|---------------|--------------|--------|
| 0 | 154438865287 | par0 | alive |
| 1 | 1238700701509 | par1 | alive |

```
Please use the command "ha synchronize" when you are ready
to replicate data between all members of the HA group.
(If you have additional members to add, you may wish to wait
until you have added them before synchronizing to save time by
avoiding multiple synchronizations.)
```

```
Command Result : No Error
```

Repeat this step for each additional HA group member.

NOTE By default, `lunacm:>hagroup addmember` automatically adds an HSM on Demand (HSMoD) service as a standby HA member. If you prefer to use HSMoD as an active HA member, you must first edit the following toggle in the `Chrystoki.conf/crystoki.ini` configuration file (see [Configuration File Summary](#)):

```
[Toggles]
lunacm_cv_ha_ui = 0
```

3. If you are adding member partitions that already have cryptographic objects stored on them, initiate a manual synchronization. You can tell whether this step is required by checking the line **Needs Sync : yes/no** in the HA group output. This will also confirm that the HA group is functioning correctly.

```
lunacm:> hagroup synchronize -group <grouplabel>
```

4. [Optional] If you created an HA group out of empty partitions, and you want to verify that the group is functioning correctly, see ["Verifying an HA Group" below](#).
5. Specify which member partitions, if any, will serve as standby members.
See ["Setting an HA Group Member to Standby" on page 165](#).
6. Set up and configure auto-recovery (recommended). If you choose to use manual recovery, you will have to execute a recovery command whenever a group member fails.
See ["Configuring HA Auto-Recovery" on page 167](#).
7. [Optional] Enable HA Only mode (recommended).
See ["Enabling/Disabling HA Only Mode" on page 167](#).
8. [Optional] Configure HA logging.
See ["HA Logging" on page 168](#) for procedures and information on reading HA logs.

The HA group is now ready for your application.

Verifying an HA Group

After creating an HA group in LunaCM, you can see the group represented as a virtual slot alongside the physical slots:

```
lunacm (64-bit) v7.3.0. Copyright (c) 2018 SafeNet. All rights reserved.
```

```
Available HSMs:
```

```
Slot Id ->          0
Label ->            par0
Serial Number ->    154438865287
Model ->            LunaSA 7.3.0
Firmware Version -> 7.3.0
Configuration ->    Luna User Partition With SO (PW) Key Export With Cloning Mode
Slot Description -> Net Token Slot

Slot Id ->          1
Label ->            par1
Serial Number ->    1238700701509
Model ->            LunaSA 7.3.0
Firmware Version -> 7.3.0
```

```

Configuration -> Luna User Partition With SO (PW) Key Export With Cloning Mode
Slot Description -> Net Token Slot

Slot Id -> 5
HSM Label -> myHAGroup
HSM Serial Number -> 1154438865287
HSM Model -> LunaVirtual
HSM Firmware Version -> 7.3.0
HSM Configuration -> Luna Virtual HSM (PW) Key Export With Cloning Mode
HSM Status -> N/A - HA Group

```

Current Slot Id: 0

The following procedure is one way to verify that your HA group is working as intended:

To verify an HA group

1. Exit LunaCM and run **multitoken** against the HA group slot number (slot 5 in the example) to create some objects on the HA group partitions.

```
./multitoken -mode <keygen_mode> -key <key_size> -nodelstroy -slots <HA_virtual_slot>
```

You can hit **Enter** at any time to stop the process before the partitions fill up completely. Any number of created objects will be sufficient to show that the HA group is functioning.

2. Run LunaCM and check the partition information on the two physical slots. Check the object count under "Partition Storage":

```
lunacm:> partition showinfo
```

```
Current Slot Id: 0
```

```
lunacm:> partition showinfo
```

```
...(clip)...
```

```

Partition Storage:
Total Storage Space: 325896
Used Storage Space: 22120
Free Storage Space: 303776
Object Count: 14
Overhead: 9648

```

```
Command Result : No Error
```

```
lunacm:> slot set slot 1
```

```
Current Slot Id: 1 (Luna User Slot 7.0.1 (PW) Signing With Cloning Mode)
```

```
Command Result : No Error
```

```
lunacm:> partition showinfo
```

```
...(clip)...
```

```

Partition Storage:
Total Storage Space: 325896

```

```
Used Storage Space: 22120
Free Storage Space: 303776
Object Count: 14
Overhead: 9648
```

Command Result : No Error

- To remove the test objects, login to the HA virtual slot and clear the virtual partition.

```
lunacm:> slot set -slot <HA_virtual_slot>
```

```
lunacm:> partition login
```

```
lunacm:> partition clear
```

If you are satisfied that your HA group is working, you can begin using your application against the HA virtual slot. The virtual slot assignment will change depending on how many more application partitions are added to your client configuration. If your application invokes the HA group label, this will not matter. If you have applications that invoke the slot number, see ["Enabling/Disabling HA Only Mode" on page 167](#).

Setting an HA Group Member to Standby

Some HA group members can be designated as standby members. Standby members do not perform any cryptographic operations unless all active members have failed (see ["Standby Members" on page 155](#) for details). They are useful as a last resort against loss of application service.

Prerequisites

- > The partition you want to designate as a standby member must already be a member of the HA group (see ["Adding/Removing an HA Group Member" on page 172](#)).
- > The group member must be online.
- > The Crypto Officer must perform this procedure.

To set an HA group member to standby

- [Optional] Check the serial number of the member you wish to set to standby mode.

```
lunacm:> hagroup listgroups
```

- Set the desired member to standby mode by specifying the serial number.

```
lunacm:> hagroup addstandby -group <label> -serialnumber <member_serialnum>
```

```
lunacm:> hagroup addstandby -group myHAGroup -serialnumber 2855496365544
```

The member 2855496365544 was successfully added to the standby list for the HA Group myHAGroup.

Command Result : No Error

To make a standby HA member active

NOTE By default, an HSM on Demand (HSMoD) service from SafeNet Data Protection on Demand is always added to an HA group as a standby member. If you prefer to use HSMoD as an active HA member, you must first edit the following toggle in the **Chrystoki.conf/crystoki.ini** configuration file (see [Configuration File Summary](#)):

```
[Toggles]
lunacm_cv_ha_ui = 0
```

1. [Optional] Check the serial number of the standby member.

lunacm:> **hagroup listgroups**

If you would like to see synchronization data for group myHAGroup, please enter the password for the group members. Sync info not available in HA Only mode.

Enter the password: *****

```

      HA auto recovery: disabled
      HA recovery mode: activeBasic
Maximum auto recovery retry: 0
Auto recovery poll interval: 60 seconds
      HA logging: disabled
Only Show HA Slots: no

      HA Group Label: myHAGroup
      HA Group Number: 11238700701509
      HA Group Slot ID: 5
      Synchronization: enabled
      Group Members: 154438865287, 1238700701509
      Needs sync: no
      Standby Members: 2855496365544
```

| Slot # | Member S/N | Member Label | Status |
|--------|---------------|--------------|--------|
| ===== | ===== | ===== | ===== |
| 0 | 154438865287 | par0 | alive |
| 1 | 1238700701509 | par1 | alive |
| 2 | 2855496365544 | par2 | alive |

2. Remove the member from standby and return it to active HA use.

lunacm:> **hagroup removestandby -group <label> -serialnumber <member_serialnum>**

lunacm:> hagroup removestandby -group myHAGroup -serialnumber 2855496365544

The member 2855496365544 was successfully removed from the standby list for the HA Group myHAGroup.

Command Result : No Error

Configuring HA Auto-Recovery

When auto-recovery is enabled, Luna HSM Client performs periodic recovery attempts when it detects a member failure. HA auto-recovery is disabled by default for new HA groups. To enable it, you must set a maximum number of recovery attempts. You can also set the frequency of recovery attempts, and the auto-recovery mode (**activeBasic** or **activeEnhanced**). These settings will apply to all HA groups configured on the client.

To configure HA auto-recovery

1. Set the desired number of recovery attempts by specifying the retry count as follows:

- Set a value of **0** to disable HA auto-recovery
- Set a value of **-1** for unlimited retries
- Set any specific number of retries from **1** to **500**

```
lunacm:> hagroup retry -count <retries>
```

2. [Optional] Set the desired frequency of recovery attempts by specifying the time in seconds. The acceptable range is **60-1200** seconds (default: **60**).

```
lunacm:> hagroup interval -interval <seconds>
```

3. [Optional] Set the auto-recovery mode. The default is **activeBasic**.

```
lunacm:> hagroup recoverymode -mode {activeBasic | activeEnhanced}
```

4. [Optional] Check that auto-recovery has been enabled. You are prompted for the Crypto Officer password/challenge secret.

```
lunacm:> hagroup listgroups
```

Enabling/Disabling HA Only Mode

By default, client applications can see both physical slots and virtual HA slots. Directing applications at the physical slots bypasses the high availability and load balancing functionality. An application must be directed at the virtual HA slot to use HA load balancing and redundancy. HA Only mode hides the physical slots and leaves only the HA group slots visible to applications, simplifying the PKCS#11 slot numbering (see "[Slot Numbering and Behavior](#)" on page 224).

If an HA group member partition fails and is recovered, all visible slot numbers can change, including the HA group virtual slots. This can cause applications to direct operations to the wrong slot. If a physical slot in the HA group receives a direct request, the results will not be replicated on the other partitions in the group (see "[HA Troubleshooting](#)" on page 179) When HA Only mode is enabled, the HA virtual slots are not affected by partition slot changes. Thales Group recommends enabling HA Only mode on all clients running HA groups.

NOTE Individual partition slots are still visible in LunaCM when HA Only mode is enabled. They are hidden only from client applications. Use **CKdemo** (Option **11**) to see the slot numbers to use with client applications.

To enable HA Only mode

1. Enable HA Only mode in LunaCM.

```
lunacm:> hagroup haonly -enable
```

2. [Optional] Since LunaCM still displays the partitions, you can check the status of HA Only mode at any time.

```
lunacm:> hagroup haonly -show
```

To disable HA Only mode

1. Disable HA Only mode in LunaCM.

```
lunacm:> hagroup haonly -disable
```

HA Logging

Logging of HA-related events takes place on the Luna HSM Client workstation. The log file **haErrorLog.txt** shows HA errors, as well as add-member and delete-member events. It does not record status changes of the group as a whole (like adding or removing the group).

The HA log rotates after the configured maximum length is reached. When it finishes writing the current record (even if that record slightly exceeds the configured maximum), the file is renamed to include the timestamp and the next log entry begins a new **haErrorLog.txt**.

> ["Configuring HA Logging" below](#)

> ["HA Log Messages" on the next page](#)

Configuring HA Logging

Using Luna HSM Client 7.2.0 or newer, logging is automatically enabled when you configure an HA group (see ["Setting Up an HA Group" on page 159](#)), but you must configure a valid destination path before logging can begin. HA groups are configured on the client using LunaCM. The HA configuration settings are saved to the **Chrystoki.conf** (Linux/Unix) or **crystoki.ini** (Windows) file, as illustrated in the following example:

```
VirtualToken = {
VirtualToken00Label = haGroup1; // The label of the HA group.
VirtualToken00SN = 11234840370164; // The pseudo serial number of the HA group.
VirtualToken00Members = 1234840370164, 1234924189183; // The serial number of the members.
VirtualTokenActiveRecovery = activeEnhanced; // The recovery mode.
}
HASynchronize = {
haGroup1 = 1; // Enable automatic synchronization of objects.
}
HAConfiguration = {
HAOnly = 1; // Enable listing HA groups only via PKCS#11 library.
haLogPath = /tmp/halog; // Base path of the HA log file; i.e., "/tmp/halog/haErrorLog.txt".
haLogStatus = enabled; // Enable HA log.
logLen = 100000000; // Maximum size of HA log file in bytes.
failover_on_deactivation = 1; // if a partition becomes deactivated then the client will
immediately failover and resume its operation on the other HA partitions. This is currently an
alpha feature
reconnAtt = 120; // Number of recovery attempts.
}
HARecovery = {
```

```

haGroup1 = 1; // Deprecated in this release as auto recovery will cover the use case. When
cryptoki loads into memory it reads the number and if the number changes (gets incremented) then
cryptoki interprets this as a manual recovery attempt.
}

```

To configure HA logging

Use the LunaCM command **hagroup halog**.

1. Set a valid path for the log directory. You must specify an existing directory.

```
lunacm:> hagroup halog -path <filepath>
```

```
lunacm:> hagroup halog -path "C:\Program Files\Safenet\Lunaclient\halog"
```

```
HA Log path successfully set to C:\Program Files\Safenet\Lunaclient\halog.
```

```
Command Result : No Error
```

2. [Optional] Set the maximum length for individual log files.

```
lunacm:> hagroup halog -maxlength <max_file_length>
```

```
lunacm:> hagroup halog -maxlength 500000
```

```
HA Log maximum file size was successfully set to 500000.
```

```
Command Result : No Error
```

3. [Optional] Enable or disable HA logging at any time.

```
lunacm:> hagroup halog -disable
```

```
lunacm:> hagroup halog -enable
```

```
lunacm:> hagroup halog -disable
```

```
HA Log was successfully disabled.
```

```
Command Result : No Error
```

4. [Optional] View the current status of the HA logging configuration.

```
lunacm:> hagroup halog -show
```

```
lunacm:> hagroup halog -show
```

```
HA Log: enabled
```

```
Log File: C:\Program Files\Safenet\Lunaclient\halog\haErrorLog.txt
```

```
Max File Length: 500000 bytes
```

```
Command Result : No Error
```

HA Log Messages

The following table provides descriptions of the messages generated by the HA sub-system and saved to the HA log. The HA log is saved to the location specified by **haLogPath** in the **Chrystoki.conf** (Linux/Unix) or **crystoki.ini** (Windows) file.

Message Format

Every HA log message has a consistent prefix consisting of the date, time, process id, and serial number (of the affected HA group). For example:

```
Wed Oct 4 16:29:21 2017 : [17469] HA group: 11234840370164 ...
```

Message Descriptions

In the message descriptions, the term **connection** refers to the connection between the Luna HSM Client and the SafeNet Luna Network appliance. A connection is considered **valid** if the appliance responds correctly on the IP address and port. The connection can transition to **invalid** for a number of reasons. Some examples include if the appliance Ethernet cable is detached, if the appliance is shutdown/rebooted, or if the NTLS service is stopped/restarted.

| Message ID | Message/Description |
|------------------------------|--|
| HALOG_CONFIGURED_AS_PASSWORD | <MessagePrefix> configured as a "PASSWORD Based" virtual device Description: Message advising that the virtual partition is password-authenticated. This means that you cannot add a PED-authenticated member to the group. |
| HALOG_CONFIGURED_AS_PED | <MessagePrefix> configured as a "PED Based" virtual device Description: Message advising that the virtual partition is PED-authenticated. This means that you cannot add a password-authenticated member to the group. |
| HALOG_DROPMEMBER | <MessagePrefix> has dropped member: <SerialNumber> Description: The connection changed from valid to invalid, determined after an HSM command (such as C_Sign) fails. |
| HALOG_DROPUNRECOVERABLE | <MessagePrefix> unable to reach member: <SerialNumber>. Manual Recover or Auto Recovery will be able to recover this member Description: The connection is invalid, as determined during a call to C_Initialize. |
| HALOG_LOGINFAILED | <MessagePrefix> can not login to member: <SerialNumber>, autorecovery will be disabled. Code: <ErrorCodeHex> : <ErrorCodeString> Description: The connection changed from valid to invalid, as determined during a call to C_Login. |
| HALOG_MEMBER_DEACTIVATED | <MessagePrefix> member: <SerialNumber> deactivated Description: The user manually deactivated the partition, as determined after an HSM command (such as C_Sign) fails. |
| HALOG_MEMBER_NOW_ACTIVATED | <MessagePrefix> recovery attempt <AttemptNumber> member <SerialNumber> is now activated and will be reintroduce back into the HA group. Description: Additional info about the recovered partition, which was deactivated and is now becoming activated. |
| HALOG_MEMBER_REVOKED | <MessagePrefix> member: <SerialNumber> revoked Description: The user manually revoked the partition, as determined during a periodic recovery attempt. |

| Message ID | Message/Description |
|--|--|
| HALOG_MEMBERS_OFFLINE | <p><MessagePrefix> all members gone offline.</p> <p>Description: A situation where all members go offline. Recovery is not possible at this point.</p> |
| HALOG_MGMT_THREAD_START | <p><MessagePrefix> management thread started</p> <p>Description: This thread is responsible for managing all members and HA in general while the HA group is active. The thread starts up when the application first launches.</p> |
| HALOG_MGMT_THREAD_TERMINATE | <p><MessagePrefix> management thread terminated</p> <p>Description: This thread is responsible for managing all members and HA in general while the HA group is active. If the client application shuts down, this thread will simply terminate. The thread will start up again once the application re-launches.</p> |
| HALOG_NEWMEMBER | <p><MessagePrefix> detected new member member: <SerialNumber></p> <p>Description: The user manually added a member to the HA group without restarting the application, as determined during a periodic recovery attempt.</p> |
| HALOG_RECOVERED | <p><MessagePrefix> recovery attempt <Integer> succeeded for member: <SerialNumber></p> <p>Description: The connection changed from invalid to valid, as determined during a periodic recovery attempt.</p> |
| HALOG_RECOVERY_ATTEMPT_#_REINTRODUCING | <p><MessagePrefix> recovery attempt <AttemptNumber> reintroducing <Number> token objects to recovered token <TokenNumber></p> <p>Description: Additional info about the recovered partition at which some objects were cloned.</p> |
| HALOG_RECOVERYFAILED | <p><MessagePrefix> recovery attempt <Integer> failed for member: <SerialNumber>. Code: <ErrorCodeHex> : <ErrorCodeString>.</p> <p>If autorecovery fails, then a second message is logged, as follows: <MessagePrefix> exceeded maximum number of autorecovery attempts for member: <SerialNumber>. Autorecovery will be disabled</p> <p>Description: The connection remains invalid, as determined during a periodic recovery attempt.</p> |
| HALOG_REENABLEMEMBER (deprecated) | <p><MessagePrefix> Re-enable auto recovery process for member: <SerialNumber></p> <p>Description: The user manually requested partition recovery, as determined during a periodic recovery attempt before an HSM command.</p> |
| HALOG_UNRECOVERABLE (deprecated) | <p><MessagePrefix> recovery attempt <Integer> failed for member: <SerialNumber>. Manual Recover or Auto Recovery will not be able to recover this member. Code: <ErrorCodeHex> : <ErrorCodeString></p> <p>Description: The connection is invalid and is not eligible for recovery.</p> |

| Message ID | Message/Description |
|------------|---|
| No ID* | <p><MessagePrefix> member <SerialNumber> is not activated and is excluded from the HA group</p> <p>Description: The HA member was not activated at the time when a C_Initialize call was made, and is therefore excluded from the HA group. Once the partition is activated, the HA group will attempt an automatic recovery, resulting in one of the two messages below</p> |
| No ID* | <p><MessagePrefix> recovery attempt <SerialNumber> is not activated and cannot be reintroduced back into the HA group\n</p> <p>Description: Recovery failed</p> |
| No ID* | <p><MessagePrefix> recovery attempt <SerialNumber> is now activated and will be reintroduce back into the HA group.\n</p> <p>Description: Recovery succeeded</p> |

* You might encounter these extra messages in the HA logs. They were added for HA development testing and therefore have no Message IDs assigned to them. They could duplicate information covered by other log messages as defined above.

Adding/Removing an HA Group Member

You can add a new member to an HA group at any time using LunaCM, even if your application is running. Cryptographic objects will be replicated on the new partition and operations will be scheduled according to the load-balancing algorithm (see "[Load Balancing](#)" on page 150).

Likewise, you can remove a member at any time, and currently-scheduled operations will fail over to the rest of the group members (see "[Failover](#)" on page 152).

NOTE If you remove the partition that was used to create the group, the HA group serial number changes to reflect this. This is to prevent another HA group from being assigned the same serial number as the original. If your application queries the HA group serial number, it must redirect operations to the new serial.

Prerequisites

The new member partition must:

- > be assigned to the client and visible in LunaCM
- > be initialized with the same domain string/red domain PED key as the other partitions in the group
- > have the Crypto Officer role initialized with the same credentials as the other partitions in the group
- > be activated and have auto-activation enabled (PED-authenticated)

To add an HA group member

1. Open LunaCM on the client workstation and ensure that the new partition is visible.

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Available HSMs:

```
Slot Id -> 0
Label -> par0
Serial Number -> 154438865287
Model -> LunaSA 7.3.0
Firmware Version -> 7.3.0
Configuration -> Luna User Partition With SO (PW) Key Export With Cloning Mode
Slot Description -> Net Token Slot
```

```
Slot Id -> 1
Label -> par1
Serial Number -> 1238700701509
Model -> LunaSA 7.3.0
Firmware Version -> 7.3.0
Configuration -> Luna User Partition With SO (PW) Key Export With Cloning Mode
Slot Description -> Net Token Slot
```

```
Slot Id -> 2
Label -> par2
Serial Number -> 2855496365544
Model -> LunaSA 7.3.0
Firmware Version -> 7.3.0
Configuration -> Luna User Partition With SO (PW) Key Export With Cloning Mode
Slot Description -> Net Token Slot
```

```
Slot Id -> 5
HSM Label -> myHAGroup
HSM Serial Number -> 1154438865287
HSM Model -> LunaVirtual
HSM Firmware Version -> 7.3.0
HSM Configuration -> Luna Virtual HSM (PW) Key Export With Cloning Mode
HSM Status -> N/A - HA Group
```

Current Slot Id: 0

2. Add the new partition to the HA group by specifying either the slot or the serial number. You are prompted for the Crypto Officer password/challenge secret.

```
lunacm:> hagroup addmember -group <label> {-slot <slotnum> | -serial <serialnum>}
```

```
lunacm:> hagroup addmember -group myHAGroup -slot 2
```

```
Enter the password: *****
Member 2855496365544 successfully added to group myHAGroup. New group
configuration is:
```

```
HA Group Label: myHAGroup
HA Group Number: 1154438865287
HA Group Slot ID: 5
Synchronization: enabled
Group Members: 154438865287, 1238700701509, 2855496365544
Needs sync: no
Standby Members: <none>
```

| Slot # | Member S/N | Member Label | Status |
|--------|---------------|--------------|--------|
| ===== | ===== | ===== | ===== |
| 0 | 154438865287 | par0 | alive |
| 1 | 1238700701509 | par1 | alive |
| 2 | 2855496365544 | par2 | alive |

Please use the command "ha synchronize" when you are ready to replicate data between all members of the HA group. (If you have additional members to add, you may wish to wait until you have added them before synchronizing to save time by avoiding multiple synchronizations.)

Command Result : No Error

To remove an HA group member

1. Remove the partition from the group by specifying either the slot or the serial number.

```
lunacm:> hagroup removemember -group <label> {-slot <slotnum> | -serial <serialnum>}
```

```
lunacm:> hagroup removemember -group myHAGroup -slot 0
```

Member 154438865287 successfully removed from group myHAGroup.

Note: Serial number for the group changed to 11238700701509.

Command Result : No Error

NOTE If you remove the partition that was used to create the group, the HA group serial number changes to reflect this. This is to prevent another HA group from being assigned the same serial number as the original. If your application queries the HA group serial number, it must redirect operations to the new serial.

LunaCM restarts.

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Available HSMs:

```
Slot Id -> 0
Label -> par0
Serial Number -> 154438865287
Model -> LunaSA 7.3.0
Firmware Version -> 7.3.0
Configuration -> Luna User Partition With SO (PW) Key Export With Cloning Mode
Slot Description -> Net Token Slot
```

```
Slot Id -> 1
Label -> par1
Serial Number -> 1238700701509
Model -> LunaSA 7.3.0
Firmware Version -> 7.3.0
Configuration -> Luna User Partition With SO (PW) Key Export With Cloning Mode
Slot Description -> Net Token Slot
```

```

Slot Id ->                2
Label ->                  par2
Serial Number ->          2855496365544
Model ->                  LunaSA 7.3.0
Firmware Version ->      7.3.0
Configuration ->          Luna User Partition With SO (PW) Key Export With Cloning Mode
Slot Description ->       Net Token Slot

Slot Id ->                5
HSM Label ->              myHAGroup
HSM Serial Number ->      11238700701509
HSM Model ->              LunaVirtual
HSM Firmware Version ->  7.3.0
HSM Configuration ->     Luna Virtual HSM (PW) Key Export With Cloning Mode
HSM Status ->             N/A - HA Group

```

Current Slot Id: 0

2. [Optional] Check that the partition was removed from the group.

lunacm:> **hagroup listgroups**

Manually Recovering a Failed HA Group Member

Thales Group recommends using auto-recovery for all HA group configurations (see "[Configuring HA Auto-Recovery](#)" on page 167). If you do not enable auto-recovery and a member partition fails, or if the recovery retry count expires before the partition comes back online, you must recover the partition manually using LunaCM. You do not need to pause your application(s) to perform a manual recovery; the HA group handles load-balancing and automatically replicates any new or changed keys to the recovered member.

To perform a manual recovery of a failed HA group member

1. [Optional] Ensure that the failed member is available and visible in LunaCM by addressing the problem that caused the failure. Display the HA group to see the failed members. You are prompted for the Crypto Officer password/challenge secret.

lunacm:> **hagroup listgroups**

```

HA Group Label:  myHAGroup
HA Group Number: 1154438865287
HA Group Slot ID: 5
Synchronization: enabled
Group Members:   154438865287, 1238700701509
Needs sync:      no
Standby Members: <none>

```

| Slot # | Member S/N | Member Label | Status |
|--------|---------------|--------------|--------|
| ----- | ----- | ----- | ----- |
| ----- | 154438865287 | par0 | alive |
| ----- | 1238700701509 | ----- | down |

2. If you are using a PED-authenticated partition with auto-activation disabled, or if the partition was down for longer than two hours, log in to the partition as Crypto Officer and present the black CO PED key.

lunacm:> **slot set -slot <slotnum>**

```
lunacm:> role login -name co
```

- Execute the manual recovery command, specifying the HA group label.

```
lunacm:>hagroup recover
```

If you have an application running on the HA group, the failed members will be recovered the next time an operation is scheduled. Load-balancing and key replication is automatic.

- If you do not currently have an application running, you can manually synchronize the contents of the HA group.

CAUTION! Never use manual synchronization if you have an application running. The HA group performs this automatically. Using this command on an HA group that is running an application could create conflicting key versions.

```
lunacm:> hagroup synchronize -group <label>
```

Replacing an HA Group Member

Sometimes an HSM failure is permanent (from the perspective of the HA group). For example, if the HSM is re-initialized, the member partition is erased and must be recreated. In this case, you can recreate a partition on the same HSM or another HSM, and deploy the new member to the group. You do not need to pause your application to replace an HA group member.

Prerequisites

The Crypto Officer must complete this procedure, but any new member partition must first be created and assigned to the client by the HSM SO, and initialized by the Partition SO. All the prerequisites listed in "[Setting Up an HA Group](#)" on page 159 must be met.

To replace an HA group member

- [Optional] Display the HA group to see the failed member. You are prompted for the Crypto Officer password/challenge secret.

```
lunacm:> hagroup listgroups
```

```

HA Group Label:  myHAGroup
HA Group Number: 1154438865287
HA Group Slot ID: 5
Synchronization: enabled
Group Members:  154438865287, 1238700701509
Needs sync:     no
Standby Members: <none>
```

| Slot # | Member S/N | Member Label | Status |
|--------|---------------|--------------|--------|
| ----- | ----- | ----- | ----- |
| ----- | 154438865287 | par0 | alive |
| ----- | 1238700701509 | ----- | down |

- Prepare the new HA group member, whether that means creating a new partition on the original HSM or configuring a new SafeNet Luna Network HSM, and assign the new partition to the HA client. Ensure that the new member partition and the HSM on which it resides meet the prerequisites outlined in ["Setting Up an HA Group" on page 159](#) and is visible in LunaCM.

```
lunacm (64-bit) v7.3.0. Copyright (c) 2018 SafeNet. All rights reserved.
```

```
Available HSMs:
```

```
Slot Id ->          0
Label ->            par0
Serial Number ->   154438865287
Model ->           LunaSA 7.3.0
Firmware Version -> 7.3.0
Configuration ->   Luna User Partition With SO (PW) Key Export With Cloning Mode
Slot Description -> Net Token Slot
```

```
Slot Id ->          1
Label ->            par1
Serial Number ->   1238700701510
Model ->           LunaSA 7.3.0
Firmware Version -> 7.3.0
Configuration ->   Luna User Partition With SO (PW) Key Export With Cloning Mode
Slot Description -> Net Token Slot
```

```
Slot Id ->          5
HSM Label ->       myHAgroup
HSM Serial Number -> 1154438865287
HSM Model ->      LunaVirtual
HSM Firmware Version -> 7.3.0
HSM Configuration -> Luna Virtual HSM (PW) Key Export With Cloning Mode
HSM Status ->     N/A - HA Group
```

```
Current Slot Id: 0
```

- Add the new partition to the HA group by specifying either the slot or the serial number. You are prompted for the Crypto Officer password/challenge secret.

```
lunacm:> hagroup addmember -group <label> {-slot <slotnum> | -serial <serialnum>}
```

```
lunacm:> hagroup addmember -group myHAgroup -slot 1
```

```
Enter the password: *****
Member 1238700701510 successfully added to group myHAgroup. New group
configuration is:
```

```
HA Group Label: myHAgroup
HA Group Number: 1154438865287
HA Group Slot ID: 5
Synchronization: enabled
  Group Members: 154438865287, 1238700701509, 1238700701510
    Needs sync: no
  Standby Members: <none>
```

```
Slot #      Member S/N                Member Label      Status
=====      =====                =====      =====
```

```

0 154438865287                par0    alive
----- 1238700701509          -----  down
1 1238700701510                par1    alive

```

Please use the command "ha synchronize" when you are ready to replicate data between all members of the HA group. (If you have additional members to add, you may wish to wait until you have added them before synchronizing to save time by avoiding multiple synchronizations.)

Command Result : No Error

The new partition is now an active member of the HA group. If you have an application currently running, cryptographic objects are automatically replicated to the new member and it is assigned operations according to the load-balancing algorithm.

4. Remove the old partition from the group by specifying the serial number ().

```
lunacm:> hagroup removemember -group <label> -serial <serialnum>
```

LunaCM restarts.

5. [Optional] If you do not currently have an application running, you can manually synchronize the contents of the HA group ().

CAUTION! Never use manual synchronization if you have an application running. The HA group performs this automatically. Using this command on an HA group that is running an application could create conflicting key versions.

```
lunacm:> hagroup synchronize -group <label>
```

6. [Optional] If you intend to have the new partition serve as a standby member, see "[Setting an HA Group Member to Standby](#)" on page 165.

Deleting an HA Group

Use LunaCM to delete an HA group from your configuration.

NOTE This procedure only removes the HA group virtual slot; the member partitions and all their contents remain intact. Only the HSM SO can delete individual partitions.

To delete an HA group

1. Stop any applications currently using the HA group.
2. Delete the group by specifying its label (see [hagroup listgroups](#)).

```
lunacm:> hagroup deletegroup -label <label>
```

```
lunacm:> hagroup deletegroup -label myHAGroup
```

The HA group myHAGroup was successfully deleted.

Command Result : No Error

HA Troubleshooting

If you encounter problems with an HA group, refer to this section.

Administration Tasks on HA Groups

Do not attempt to run administrative tasks on an HA group virtual slot (such as changing the CO password or altering partition policies). These virtual slots are intended for cryptographic operations only. It is not possible to use an HA group to make administrative changes to all partitions in the group simultaneously.

Unique Object IDs (OUID)

If two applications using the same HA group modify the same object using different members, the object fingerprint may conflict.

Client-Side Failures

Any failure of the client (such as operating system problems) that does not involve corruption or removal of files, should resolve itself when the client is rebooted.

If the client workstation seems to be working fine otherwise, but you have lost visibility of the HSMs in LunaCM or your client, try the following remedies:

- > verify that the Thales Group drivers are running, and retry
- > reboot the client workstation
- > restore your client configuration from backup
- > re-install Luna HSM Client and re-configure the HA group

For SafeNet Luna PCIe HSM, the client is the HSM host. If HA has been working, any sudden failure is likely to be OS or driver related (restart) or file corruption (re-install). If a re-installation is necessary, you must recreate and reconfigure the HA group.

Effect of PED Operations

PED operations can block some cryptographic operations, so that while a member of an HA group is performing a PED operation, it could appear to the HA group as a failed member. When the PED operation is complete, failover and recovery HA logic are invoked to return the member to normal operation.

CHAPTER 9: Backup and Restore Using a G5-Based Backup HSM

SafeNet Luna Network HSM allows secure creation, storage, and use of cryptographic data (keys and other objects). It is critically important, however, to safeguard your important cryptographic objects against unforeseen damage or data loss. No device can offer total assurance against equipment failure, physical damage, or human error. Therefore, a comprehensive strategy for making regular backups is essential. There are multiple ways to perform these operations, depending on your implementation.

This section contains the following information:

- > ["Backup and Restore Best Practices" below](#)
- > ["Planning Your Backup HSM Deployment" on the next page](#)
- > ["About the SafeNet Luna G5 Backup HSM" on page 184](#)
 - ["Installing the Backup HSM" on page 188](#)
 - ["Installing or Replacing the Backup HSM Battery" on page 189](#)
 - ["Backup HSM Secure Transport and Tamper Recovery" on page 191](#)
 - ["Resetting the Backup HSM to Factory Conditions" on page 197](#)
- > ["Backup/Restore Using a Host-Connected G5 Backup HSM" on page 197](#)
- > ["Configuring a G5 Remote Backup HSM Server" on page 200](#)

Backup and Restore Best Practices

To ensure that your data is protected in the event of a failure or other catastrophic event, Thales recommends that you use the following best practices as part of a comprehensive backup strategy:

CAUTION! Failure to develop and exercise a comprehensive backup and recovery plan may prevent you from being able to recover from a catastrophic event. Although Thales provides a robust set of backup hardware and utilities, we cannot guarantee the integrity of your backed-up key material, especially if stored for long periods. Thales strongly recommends that you exercise your recovery plan at least semi-annually (every six months) to ensure that you can fully recover your key material.

Develop and document a backup and recovery plan

This plan should include the following:

- > What is being backed up
- > The backup frequency
- > Where the backups are stored

- > Who is able to perform backup and restore operations
- > Frequency of exercising the recovery test plan

Make multiple backups

To ensure that your backups are always available, build redundancy into your backup procedures.

Use off-site storage

In the event of a local catastrophe, such as a flood or fire, you might lose both your working HSMs and locally-stored backup HSMs. To fully protect against such events, always store a copy of your backups at a remote location.

Regularly exercise your disaster recovery plan

Execute your recovery plan at least semi-annually (every six months) to ensure that you can fully recover your key material. This involves retrieving your stored Backup HSMs and restoring their contents to a test partition, to ensure that the data is intact and that your recovery plan works as documented.

Planning Your Backup HSM Deployment

When setting up your backup deployment, you have multiple configuration options. This section will help you choose the right configuration for your organization, depending on where you prefer to keep your backups. You can use a SafeNet Luna Backup HSM or an application partition on any other Luna HSM for backup/restore operations.

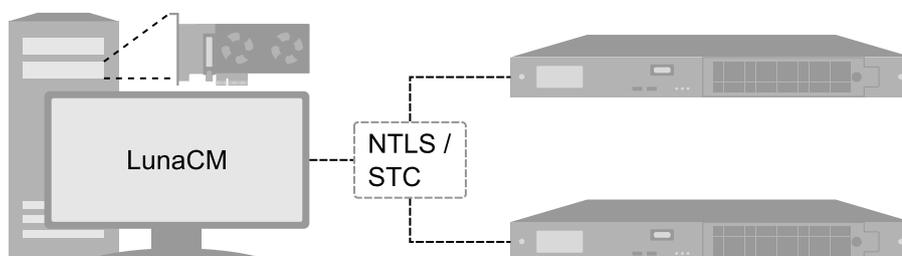
Backup and restore operations require that cloning be enabled on the HSM/partition.

- > ["Partition to Partition" below](#)
- > ["Backup HSM Connected to the Host Workstation" on the next page](#)
- > ["Backup HSM Installed Using Remote Backup Service \(RBS\)" on page 183](#)

NOTE The diagrams below depict the host workstation as the remote PED server, but you can also use a separate remote PED station. Since remote PED is supported on Windows clients only, this will be necessary if you use Linux/UNIX clients.

Partition to Partition

You can clone objects from any Luna 7 application partition to any other Luna 7 partition that shares its cloning domain. You must have the Crypto Officer credential for both partitions. Both partitions must use the same authentication method (either password or PED).



See ["Cloning Objects to Another Application Partition" on page 16.](#)

Backup HSM Connected to the Appliance

In this configuration, the SafeNet Luna Backup HSM is connected directly to one of the USB ports on the SafeNet Luna Network HSM appliance. It is useful in deployments where backups are kept in the same location as the HSM. Backup and restore operations are performed using LunaSH commands via a serial or SSH connection. The Crypto Officer must have **admin**-level access to LunaSH on the appliance to use this configuration.

Figure 1: Locally-connected Backup HSM using password authentication

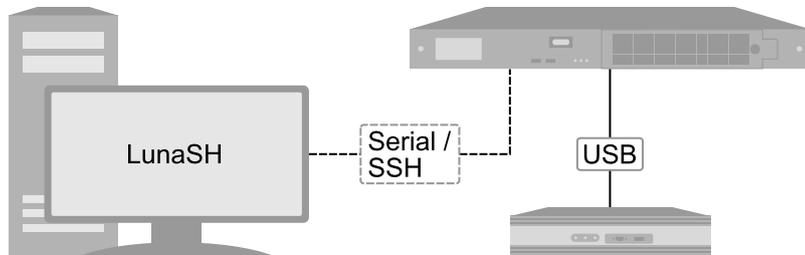
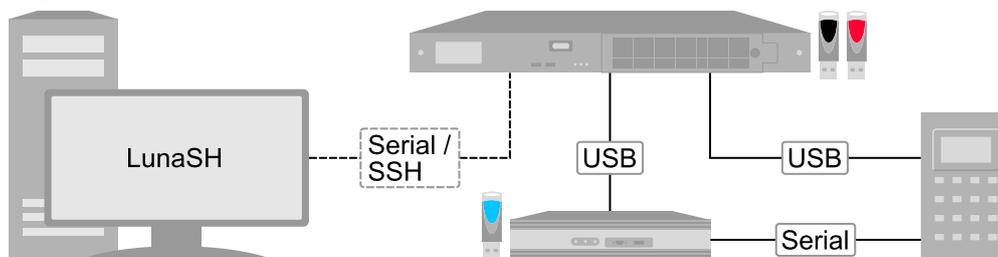


Figure 2: Locally-connected Backup HSM using local PED authentication



See ["Backup/Restore Using an Appliance-Connected Backup HSM" on page 1.](#)

Backup HSM Connected to the Host Workstation

In this configuration, the SafeNet Luna Backup HSM is connected to a USB port on the SafeNet Luna Network HSM host workstation. It is useful in deployments where the partition Crypto Officer keeps backups at the local host. This allows you to perform backup/restore operations for all application partitions that appear as visible slots in LunaCM. You can restore a partition backup to the original source partition or to another existing Luna application partition that shares the same cloning domain.

Figure 3: Host-connected Backup HSM using password authentication

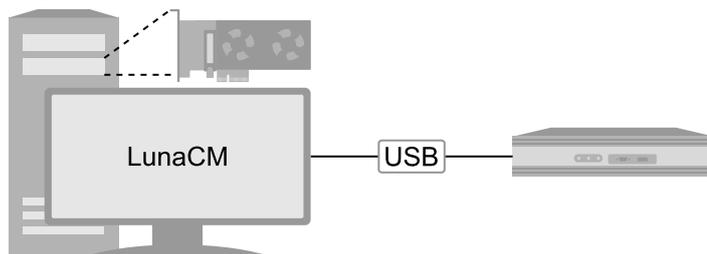
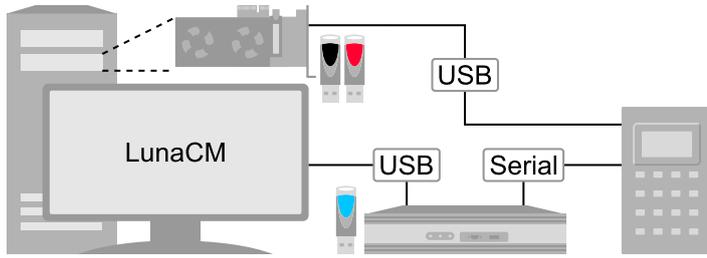
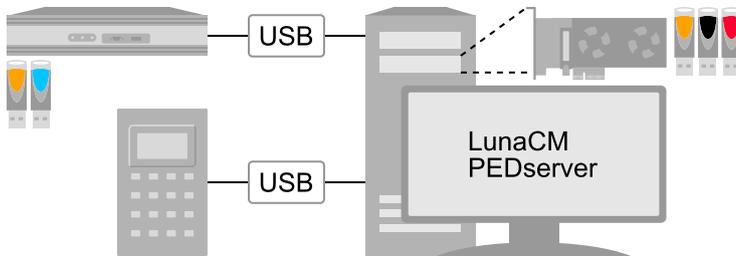


Figure 4: Host-connected Backup HSM using local PED authentication**Figure 5: Host-connected Backup HSM using remote PED authentication**

See ["Backup/Restore Using a Host-Connected G5 Backup HSM"](#) on page 197.

Backup HSM Installed Using Remote Backup Service (RBS)

In this configuration, the SafeNet Luna Backup HSM is connected to a remote client workstation that communicates with the SafeNet Luna Network HSM host via the Remote Backup Service (RBS). It is useful in deployments where backups are stored in a separate location from the SafeNet Luna Network HSM, to mitigate the consequences of catastrophic loss (fire, flood, etc).

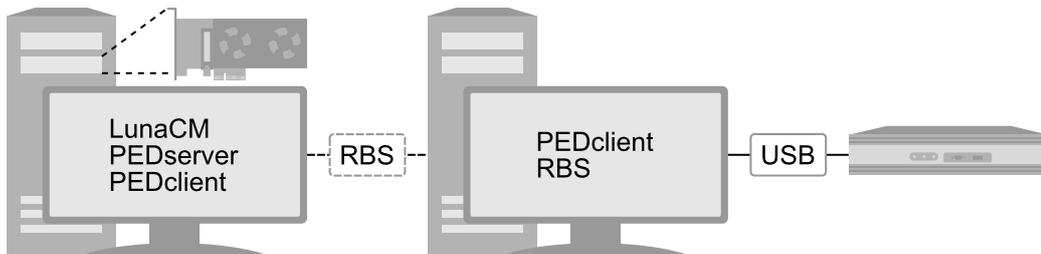
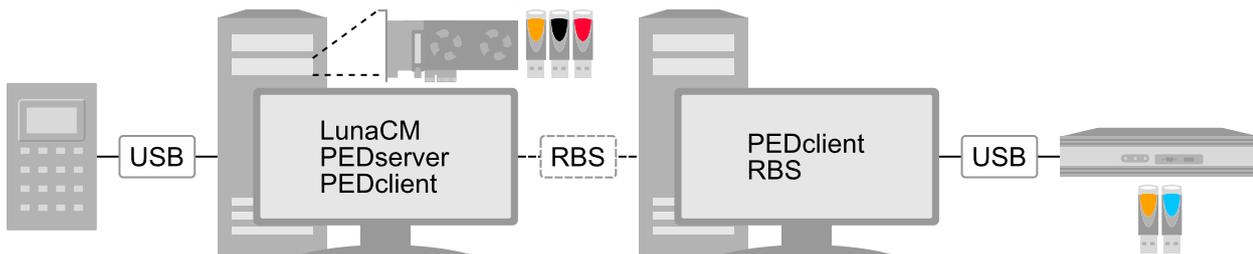
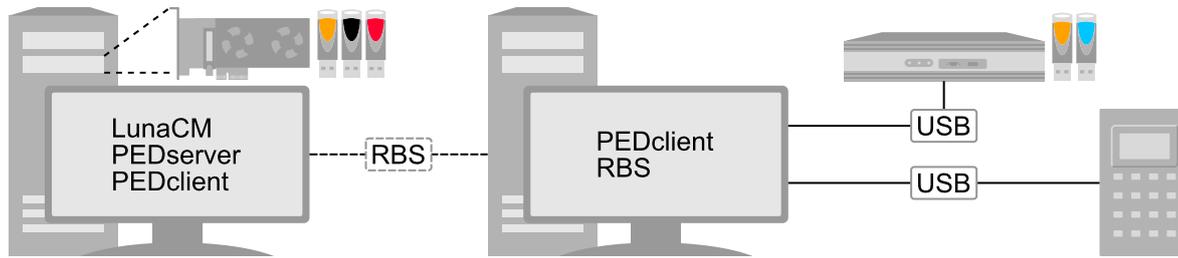
Figure 6: Remote backup (RBS) using password authentication**Figure 7: Remote backup (RBS) using remote PED authentication at the client**

Figure 8: Remote backup (RBS) using remote PED authentication at the RBS server

See ["Configuring a G5 Remote Backup HSM Server"](#) on page 200.

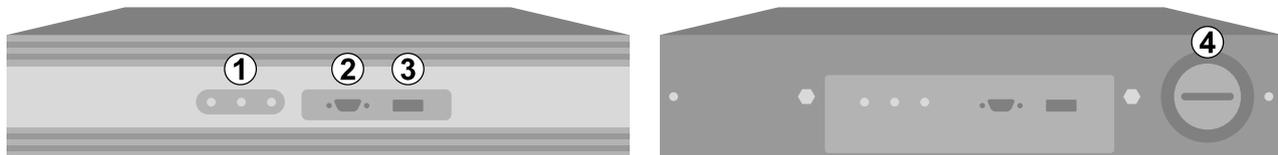
About the SafeNet Luna G5 Backup HSM

The SafeNet Luna Backup HSM allows you to safeguard your important cryptographic objects by making secure backups, and restoring those backups to an application partition. It uses the Luna G5 architecture. This section contains the following information about the SafeNet Luna Backup HSM:

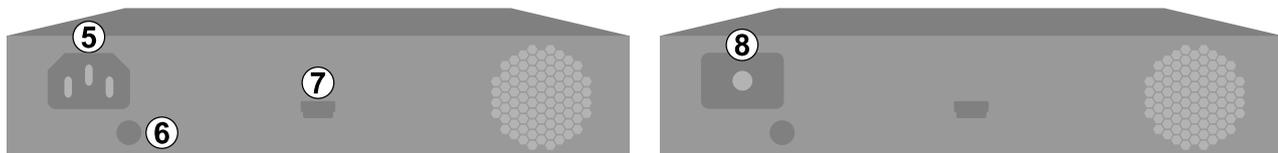
- > ["Physical Features" below](#)
- > ["Backup HSM Functionality" on the next page](#)
- > ["Storage and Maintenance" on page 186](#)
- > ["Installing the Backup HSM" on page 188](#)
- > ["Installing or Replacing the Backup HSM Battery" on page 189](#)
- > ["Backup HSM Secure Transport and Tamper Recovery" on page 191](#)
- > ["Initializing the Backup HSM Remote PED Vector" on page 195](#)
- > ["Resetting the Backup HSM to Factory Conditions" on page 197](#)

Physical Features

The front panel of the SafeNet Luna Backup HSM (G5 model) is illustrated below, with important features labeled. In the second image, the front bezel has been removed, exposing the battery enclosure.



The rear panel of the SafeNet Luna Backup HSM (G5 model) is illustrated below, with important features labeled. The first image depicts a Backup HSM with an internal power supply. The second image depicts one that ships with an external power supply.



| | |
|---|---|
| 1 | Status LEDs. When illuminated, they indicate: <ul style="list-style-type: none"> > Active: The Backup HSM is performing a procedure. Do not disconnect or unplug the device when this light is illuminated. > Tamper: The Backup HSM is in a tamper state. You must clear the tamper state before backing up or restoring partitions. > Error: HSM device driver error. Contact Thales Group Customer Support (see "Support Contacts" on page 12). |
| 2 | Serial port for attaching a local SafeNet Luna PED using a 9-pin Micro-D to Micro-D cable. |
| 3 | USB port. Not applicable to backup/restore functions. |
| 4 | Battery enclosure. See "Installing or Replacing the Backup HSM Battery" on page 189 . |
| 5 | Power connector for a SafeNet Luna Backup HSM with an internal power supply. See "Storage and Maintenance" on the next page for more information. |
| 6 | Index hole. Engages with the index post on a SafeNet Luna Backup HSM rack shelf. |
| 7 | Mini-USB port for connecting the SafeNet Luna Backup HSM to a SafeNet HSM or client workstation. See "Installing the Backup HSM" on page 188 . |
| 8 | Power source connector for a SafeNet Luna Backup HSM with an external power supply (included). |

Backup HSM Functionality

The SafeNet Luna Backup HSM allows you to back up application partitions from one or more Luna HSMs. Backup operations are performed on a per-partition basis.

Password or PED Authentication

The SafeNet Luna Backup HSM can be configured to back up either password- or PED-authenticated partitions. You must specify the authentication method when you initialize the Backup HSM (see). Once initialized, the Backup HSM can only be used with partitions sharing the same authentication type. The only way to change the authentication method is to restore the Backup HSM to factory condition and re-initialize it.

Storage Capacity and Maximum Allowable Backup Partitions

The storage capacity and maximum number of backup partitions allowed on the Backup HSM is determined by the firmware. You can check the capacity using `lunacm:> hsm showinfo`. To update the Backup HSM firmware to a version that allows more backups, see ["Updating the SafeNet Luna G5 Backup HSM Firmware" on page 196](#).

NOTE Objects stored on a Backup HSM may be smaller than their originals. For example, symmetric keys are 8 bytes smaller when stored on a Backup HSM. This size difference has no effect on backup and restore operations.

Storage and Maintenance

The SafeNet Luna Backup HSM can be safely stored, containing backups, when not in use. When stored properly, the hardware has a lifetime of 10+ years. Newer Backup HSMs ship with an external power supply.

CAUTION! The internal power supply on older SafeNet Luna Backup HSMs uses capacitors that may be affected if they are left unpowered for extended periods of time. If your Backup HSM has an internal power supply, power it on occasionally to recharge the capacitors. If the capacitors lose function, the Backup HSM will no longer receive power.

With the introduction of external power supplies, this is no longer a requirement. If the external power supply fails from being left unpowered, it can be easily replaced.

The Backup HSM Battery

The battery powers the NVRAM and Real-Time-Clock (RTC), and must be installed for use. The battery can be removed for storage, and this is generally good practice. Thales Group uses high-quality, industrial-grade batteries that are unlikely to leak and damage the HSM hardware, but an externally-stored battery will last longer. The battery must be stored in a clean, dry area (less than 30% Relative Humidity). Temperature should not exceed +30 °C. When properly stored, the battery has a shelf life of 10 years.

If the battery dies or is removed, and the main power is not connected, NVRAM and the RTC lose power. Battery removal triggers a tamper event. After replacing the battery, the HSM SO must clear the tamper event before operation can resume. The working copy of the Master Tamper Key (MTK) is lost (see "[Backup HSM Secure Transport and Tamper Recovery](#)" on page 191). Backup objects are stored in non-volatile memory, so they are preserved and remain uncorrupted.

There is no low battery indicator, or other provision for checking the battery status. The voltage remains constant until the very end of battery life.

SafeNet Luna G5 Backup HSM Required Items

This section provides a list of the components you should have received with your SafeNet Luna G5 Backup HSM order.

SafeNet Luna G5 Backup HSM Order Items

| Qty | Item |
|-----|---|
| 1 | <p data-bbox="225 533 606 562">SafeNet Luna G5 Backup HSM</p>  |
| 1 | <p data-bbox="225 804 512 833">External Power Supply</p> <p data-bbox="225 846 1469 940">The SafeNet Luna G5 Backup HSM now ships with an external power supply. Previously, these HSMs relied on an internal power supply, requiring the HSM to be periodically powered on to recharge internal capacitors. Failure to charge the capacitors could result in an inability to power on the HSM.</p> <p data-bbox="225 953 1434 1016">With the introduction of external power supplies, periodically powering on the HSM is no longer required. A failed external power supply can be replaced and there is no need to return the HSM for repair (RMA).</p> <div data-bbox="264 1031 1434 1119" style="border: 1px solid #0056b3; padding: 5px;"> <p data-bbox="300 1041 1334 1104">NOTE External power supplies do contain capacitors which may be affected by extended periods of being unpowered, but they are more easily replaced in the event of failure.</p> </div> |
| 1 | <p data-bbox="225 1155 470 1184">Power Supply Cord</p> <p data-bbox="225 1197 1414 1260">Your order should include one power supply cord for the SafeNet Luna G5 Backup HSM. The actual cord received depends on the country for which you ordered the SafeNet Luna G5 Backup HSM.</p>  |

| Qty | Item |
|-----|---|
| 1 | <p data-bbox="225 268 660 296">USB cable (USB A to USB mini B)</p>  <p data-bbox="225 772 911 800">Your order should include one USB A to 5-pin (Mini-B) cable.</p> |

Optional Items

Your order may also include the following optional item.

SafeNet Luna G5 Backup HSM Rack-Mount Shelf

The SafeNet Luna G5 Backup HSM rack-mount shelf (available by separate order) fits a standard 19-inch equipment rack, allowing you to install up to two SafeNet Luna G5 Backup HSM units side-by-side in server-room racks. For office use, without rack mounting, SafeNet Luna G5 Backup HSM units can be placed on a desktop and are stackable.

Installing the Backup HSM

You can connect the SafeNet Luna Backup HSM to a SafeNet Luna Network HSM, a Luna HSM Client workstation, or a host machine containing a SafeNet Luna PCIe HSM. Refer to ["Planning Your Backup HSM Deployment" on page 181](#) for detailed descriptions of the configuration options.

To install the Safenet Luna Backup HSM

1. Connect the SafeNet Luna Backup HSM to power using the external power source or a standard power cable.
2. If you are connecting the Backup HSM to a client workstation or PCIe HSM host, ensure that you have installed the **Backup** option in the Luna HSM Client installer (see ["Luna HSM Client Software Installation" on page 1](#) for details).
3. [Local PED] If you plan to authenticate the SafeNet Luna Backup HSM with a local Luna PED, connect the PED using a 9-pin Micro-D to Micro-D cable (see ["Physical Features" on page 184](#)).

To use the same local PED to authenticate both the Backup HSM and SafeNet Luna Network HSM, connect the PED to the SafeNet Luna Network HSM using a USB Mini-B to USB cable (see ["Physical Features" on page 30](#)). You can switch between the two using PED modes (see ["Modes of Operation" on page 32](#)).

4. Connect the SafeNet Luna Backup HSM using the included Mini-USB to USB cable. If you are connecting the Backup HSM to:
 - a. **SafeNet Luna Network HSM:** Connect to one of the USB ports on the front or rear panel of the appliance.
 - b. **Luna HSM Client:** Connect to a USB port on the client workstation.
 - c. **SafeNet Luna PCIe HSM host:** Connect to a USB port on the host workstation.
5. If your Backup HSM was shipped in Secure Transport Mode, see ["Backup HSM Secure Transport and Tamper Recovery" on page 191](#).

Installing or Replacing the Backup HSM Battery

The SafeNet Luna Backup HSM must have a functioning battery installed to preserve the NVRAM and RTC in case of primary power loss. You can purchase a replacement battery from any supplier who can match the following specifications:

- > 3.6 V Primary lithium-thionyl chloride (Li-SOCl₂)
- > Fast voltage recovery after long term storage and/or usage
- > Low self discharge rate
- > 10 years shelf life
- > Operating temperature range -55 °C to +85 °C
- > U.L. Component Recognition, MH 12193

Prerequisites

- > Removing the battery causes a tamper event. If you have created a Secure Recovery Vector (purple PED key) and enabled Secure Recovery, you will need this key to clear the tamper after replacing the battery.

To install or replace the SafeNet Luna Backup HSM battery

1. Remove the front bezel. It is held in place by two spring clips.



2. The battery compartment is spring-loaded and can be removed without much pressure. Use a coin or your fingers to press in the compartment cover and turn counter-clockwise to remove it.



3. If you are replacing the old battery, remove it from the battery compartment.



4. Insert the new battery, negative end first. The positive end should be visible.



5. Use the battery compartment cover to push the battery into the compartment, aligning the tabs on the cover with the compartment slots. Twist the cover clockwise to lock the compartment.



6. Replace the front bezel by aligning the clips with their posts and pushing it into place.
Removing the battery causes a tamper event on the Backup HSM.
7. To clear the tamper, see ["Backup HSM Secure Transport and Tamper Recovery"](#) below.

Backup HSM Secure Transport and Tamper Recovery

The SafeNet Luna Backup HSM recognizes a similar list of tamper conditions to the SafeNet Luna Network HSM (see [Tamper Events](#)). When a tamper event occurs, a tamper state is reported in the **HSM Status** field in LunaCM's list of slots.

By default, tamper events are cleared automatically when you reboot the Backup HSM and log in as HSM SO. However, you can choose to prevent any further operations on the Backup HSM. The following procedures will allow you to create a purple Secure Recovery Key (SRK) that the Backup HSM SO must present to unlock the

HSM after a tamper event. This key contains part of the Master Tamper Key (MTK), which encrypts all sensitive data stored on the Backup HSM. By splitting the MTK and storing part of it on an SRK (purple PED key), you ensure that none of the stored material can be accessible until the SRK is presented.

You can create the purple SRK even for a Backup HSM that is initialized for password authentication. There is no password-based SRK equivalent; you must have a SafeNet Luna PED and a purple PED key to use Secure Tamper Recovery and Secure Transport Mode.

Initializing the SRK also allows you to place the Backup HSM in Secure Transport Mode (STM). STM on the Backup HSM functions differently from STM on the SafeNet Luna Network HSM (see ["Secure Transport Mode" on page 1](#) for comparison). When the SRK is initialized and secure recovery enabled, STM on the Backup HSM is effectively a voluntary tamper state, where no operations are possible until you present the purple PED key.

CAUTION! Always keep a securely-stored backup copy of the purple PED key. If you lose this key, the Backup HSM is permanently locked and you will have to obtain an RMA for the Backup HSM.

This section provides directions for the following procedures:

- > ["Creating a Secure Recovery Key" below](#)
- > ["Setting Secure Transport Mode" on the next page](#)
- > ["Recovering From a Tamper Event or Secure Transport Mode" on the next page](#)
- > ["Disabling Secure Recovery" on page 194](#)

Creating a Secure Recovery Key

To enable secure recovery, you must create the Secure Recovery Key (purple PED key). This procedure will zeroize the SRK split on the Backup HSM, so that you must present the purple PED key to recover from a tamper event or Secure Transport Mode.

Prerequisites

- > Install the Backup HSM at the host and connect it to power (see ["Installing the Backup HSM" on page 188](#)).
- > You require the Backup HSM SO credential (blue PED key).
- > Ensure that the Backup HSM can access PED service (Local or Remote PED), and that you have enough blank or rewritable purple PED keys available for your desired authentication scheme (see ["Creating PED Keys" on page 49](#)).
 - [Local PED] Connect the PED using a 9-pin Micro-D to Micro-D cable. Set the PED to **Local PED-SCP** mode (see ["Modes of Operation" on page 32](#)).
 - [Remote PED] Set up a Remote PED server to authenticate the Backup HSM (see [Remote PED Setup](#)).
 - [Remote PED] Initialize the Backup HSM RPV (see ["Initializing the Backup HSM Remote PED Vector" on page 195](#)). You require the orange PED key.

To create a Secure Recovery Key

1. Launch LunaCM on the host workstation.

2. Set the active slot to the SafeNet Luna Backup HSM.

```
lunacm:> slot set -slot <slotnum>
```

3. [Remote PED] Connect the Backup HSM to the Remote PED server.

```
lunacm:> ped connect -ip <PEDserver_IP> -port <portnum>
```

4. Create a new split of the MTK on the Backup HSM.

```
lunacm:> srk generate
```

5. Log in as Backup HSM SO.

```
lunacm:> role login -name so
```

6. Enable secure recovery.

```
lunacm:> srk enable
```

Attend to the Luna PED prompts to create the purple PED key. Secure Recovery is now enabled on the Backup HSM.

Setting Secure Transport Mode

The following procedure will allow you to set Secure Transport Mode on the Backup HSM.

Prerequisites

- > Ensure the Backup HSM can access PED services.
- > Secure Recovery must be enabled on the Backup HSM (see ["Creating a Secure Recovery Key" on the previous page](#)). You require the Secure Recovery Key (purple PED key) for the Backup HSM.

To set Secure Transport Mode on the Backup HSM

1. Launch LunaCM on the host workstation.

2. Set the active slot to the SafeNet Luna Backup HSM.

```
lunacm:> slot set -slot <slotnum>
```

3. [Remote PED] Connect the Backup HSM to the Remote PED server.

```
lunacm:> ped connect -ip <PEDserver_IP> -port <portnum>
```

4. Set Secure Transport Mode.

```
lunacm:> srk transport
```

- a. You are prompted for the SRK (purple PED key). This is to ensure that you have the key that matches the SRK split on the HSM.
- b. The Luna PED displays a 16-digit verification code. Write this code down as an additional optional check. The SRK is zeroized on the Backup HSM and STM is now active.

Recovering From a Tamper Event or Secure Transport Mode

With Secure Recovery Mode enabled, the procedure to recover from a tamper event or to exit STM is the same.

Prerequisites

- > Ensure the Backup HSM can access PED services.
- > You require the Secure Recovery Key (purple PED key) for the Backup HSM.
- > If you are recovering from a tamper event, reboot the Backup HSM and LunaCM before recovering.

```
lunacm:> hsm restart
```

```
lunacm:> clientconfig restart
```

To recover from a tamper event or exit STM

1. Launch LunaCM on the host workstation.
2. Set the active slot to the SafeNet Luna Backup HSM.
3. [Remote PED] Connect the Backup HSM to the Remote PED server.

```
lunacm:> slot set -slot <slotnum>
```

```
lunacm:> ped connect -ip <PEDserver_IP> -port <portnum>
```

4. Recover the Backup HSM from the tamper event or STM.

```
lunacm:> srk recover
```

Attend to the Luna PED prompts:

- a. You are prompted for the SRK (purple PED key).
- b. [STM] The Luna PED displays a 16-digit verification code. If this code matches the one that was presented when you set STM, you can be assured that the Backup HSM has remained in STM since then.

The Backup HSM is recovered from the tamper/STM state and you can resume backup/restore operations.

Disabling Secure Recovery

To disable secure recovery, you must present the Secure Recovery Key (purple PED key) so that it can be stored on the Backup HSM. You will no longer need to present the purple key to recover from a tamper event.

Prerequisites

- > Ensure the Backup HSM can access PED services.
- > You require the Secure Recovery Key (purple PED key) for the Backup HSM.

To disable secure recovery

1. Launch LunaCM on the host workstation.
2. Set the active slot to the SafeNet Luna Backup HSM.
3. [Remote PED] Connect the Backup HSM to the Remote PED server.

```
lunacm:> slot set -slot <slotnum>
```

```
lunacm:> ped connect -ip <PEDserver_IP> -port <portnum>
```

4. Log in as Backup HSM SO.

```
lunacm:> role login -name so
```

5. Disable secure recovery.

```
lunacm:> srk disable
```

You are prompted for the SRK (purple PED key).

Initializing the Backup HSM Remote PED Vector

The Remote PED (via PEDserver) authenticates itself to the SafeNet Luna Backup HSM with a randomly-generated encrypted value stored on an orange PED key. The orange key proves to the HSM that the Remote PED is authorized to perform authentication. The Backup HSM SO can create this key using LunaCM.

If the Backup HSM is already initialized, the HSM SO must log in to complete this procedure.

Prerequisites

- > SafeNet Luna PED with firmware 2.7.1 or newer
- > USB mini-B to USB-A connector cable
- > Luna PED DC power supply (if included with your Luna PED)
- > Blank or reusable orange PED key (or multiple keys, if you plan to make extra copies or use an M of N security scheme). See ["Creating PED Keys" on page 49](#) for more information.
- > Install the Backup HSM at the client/host and connect it to power (see ["Installing the Backup HSM" on page 188](#)).
- > Connect the PED to the Backup HSM using a 9-pin Micro-D to Micro-D cable. Set the PED to **Local PED-SCP** mode (see ["Modes of Operation" on page 32](#)).

To initialize the RPV and create the orange PED key using LunaCM

1. Launch LunaCM on the client/host workstation.

2. Set the active slot to the Backup HSM.

```
lunacm:> slot set -slot <slotnum>
```

3. If the Backup HSM is initialized, log in as HSM SO. If not, continue to the next step.

```
lunacm:> role login -name so
```

4. Ensure that you have the orange PED key(s) ready. Initialize the RPV.

```
lunacm:> ped vector init
```

5. Attend to the Luna PED and respond to the on-screen prompts. See ["Creating PED Keys" on page 49](#) for a full description of the key-creation process.

```
SLOT
SETTING RPV...
Would you like to
reuse an existing
keyset?(Y/N)
```

- If you have an orange PED key with an existing RPV that you wish to use for this HSM, press **Yes**.
- If you are creating a new RPV, press **No**.

```
SLOT
SETTING RPV...
Insert a
RPK / Remote
PED Key (ORANGE)
Press ENTER.
```

Continue following the prompts for PED PIN, M of N, and duplication options.

To set up a Remote PED server, see "[Installing PEDserver and Setting Up the Remote Luna PED](#)" on page 40.

Updating the SafeNet Luna G5 Backup HSM Firmware

To update the firmware on a SafeNet Luna G5 Backup HSM, use LunaCM on a client computer that is connected to the SafeNet Luna Backup HSM. You require:

- > SafeNet Luna G5 Backup HSM firmware update file (<filename>.**fuf**)
- > the firmware update authentication code file(s) (<filename>.**txt**)

CAUTION! Use an uninterruptible power supply (UPS) to power your HSM. There is a small chance that a power failure during an update could leave your HSM in an unrecoverable condition.

To update the SafeNet Luna G5 Backup HSM firmware

1. Copy the firmware file (<filename>.**fuf**) and the authentication code file (<filename>.**txt**) to the Luna HSM Client root directory.
 - Windows: C:\Program Files\SafeNet\LunaClient
 - Linux: /usr/safenet/lunaclient/bin
 - Solaris: /opt/safenet/lunaclient/bin

NOTE On some Windows configurations, you might not have authority to copy or unzip files directly into **C:\Program Files\...** If this is the case, put the files in a known location that you can reference in a LunaCM command.

2. Launch LunaCM.
3. If more than one HSM is installed, set the active slot to the Admin partition of the HSM you wish to update.

```
lunacm:> slot set -slot <slot_number>
```

4. Log in as HSM SO.

```
lunacm:> role login -name so
```

5. Apply the new firmware update by specifying the update file and the authentication code file. If the files are not located in the Luna HSM Client root directory, specify the filepaths.

```
lunacm:> hsm updatefw -fuf <filename>.fuf -authcode <filename>.txt
```

Resetting the Backup HSM to Factory Conditions

These instructions will allow you to restore your SafeNet Luna Backup HSM to its original factory conditions, erasing its contents. This could be necessary if you have old backups that you do not wish to keep, or if you want to re-initialize the Backup HSM to store backups using a different authentication method (password or PED). If you have performed firmware updates, they are unaffected. Factory reset can be performed via LunaCM.

To reset the Backup HSM to factory conditions

1. Launch LunaCM on the SafeNet Luna Backup HSM host workstation.
2. Set the active slot to the Backup HSM.

```
lunacm:> slot set -slot <slotnum>
```

3. Reset the Backup HSM.

```
lunacm:> hsm factoryreset
```

Backup/Restore Using a Host-Connected G5 Backup HSM

You can connect the SafeNet Luna Backup HSM to a USB port on the SafeNet Luna Network HSM host workstation. This configuration allows you to perform backup/restore operations for all application partitions that appear as visible slots in LunaCM. It is useful in deployments where the partition Crypto Officer wants to keep backups at the local host. You can restore a partition backup to the original source partition or to another existing Luna application partition that shares the same cloning domain.

This section provides instructions for the following procedures using this kind of deployment:

- > ["Initializing the Backup HSM" below](#)
- > ["Backing Up an Application Partition" on the next page](#)
- > ["Restoring an Application Partition from Backup" on page 199](#)

Initializing the Backup HSM

Before you can use the SafeNet Luna Backup HSM to back up your partition objects, it must be initialized. This procedure is analogous to the standard HSM initialization procedure.

Prerequisites

- > Install the Backup HSM at the host and connect it to power (see ["Installing the Backup HSM" on page 188](#)).
- > Ensure that the Backup HSM is not in Secure Transport Mode and that any tamper events are cleared (see ["Backup HSM Secure Transport and Tamper Recovery" on page 191](#)).

- > [PED Authentication] Ensure that you have enough blank or rewritable blue and red PED keys available for your desired authentication scheme (see ["Creating PED Keys" on page 49](#)).
 - [Local PED] Connect the PED using a 9-pin Micro-D to Micro-D cable. Set the PED to **Local PED-SCP** mode (see ["Modes of Operation" on page 32](#)).
 - [Remote PED] Initialize the Backup HSM RPV (see ["Initializing the Backup HSM Remote PED Vector" on page 195](#)). You require the orange PED key.
 - [Remote PED] Set up a Remote PED server to authenticate the Backup HSM (see ["Remote PED Setup" on page 1](#)).

To initialize a host-connected Backup HSM

1. Launch LunaCM on the host workstation.
2. Set the active slot to the SafeNet Luna Backup HSM.

```
lunacm:> slot set -slot <slotnum>
```
3. [Remote PED] Connect the Backup HSM to the Remote PED server.

```
lunacm:> ped connect -ip <PEDserver_IP> -port <portnum>
```
4. Initialize the Backup HSM, specifying a label and the method of authentication (**-initwithped** or **-initwithpwd**). You must initialize the HSM with the same authentication method as the partition(s) you plan to back up.

```
lunacm:> hsm init -label <label> {-initwithped | -initwithpwd}
```

You are prompted to set an HSM SO credential and cloning domain for the Backup HSM.

Backing Up an Application Partition

You can use LunaCM to back up the contents of an application partition to the host-connected SafeNet Luna Backup HSM. You can use this operation to create a backup on the Backup HSM, or add objects from the source partition to an existing backup.

Prerequisites

- > The Backup HSM must be initialized (see ["Initializing the Backup HSM" on the previous page](#)).
- > **Partition policy 0: Allow private key cloning** must be set to **1** (ON) on the source partition.
- > You must have the Crypto Officer credential (black PED key) and domain (red PED key) for the source partition.
- > You must have the Backup HSM SO credential (blue PED key).
- > [PED Authentication] This procedure is simpler if the source partition is activated (see ["Activation and Auto-activation on Multi-factor- \(PED-\) Authenticated Partitions" on page 114](#)), since you require a Luna PED only for the Backup HSM.
 - [Local PED] Connect the PED to the Backup HSM using a 9-pin Micro-D to Micro-D cable. If the source partition is not activated, also connect the PED to the SafeNet Luna Network HSM using a Mini-B to USB-A cable (see ["Local PED Setup" on page 33](#)), and set the PED to **Local PED-USB** mode (see ["Modes of Operation" on page 32](#)).

- [Remote PED] You must have the orange PED key for the Backup HSM (see ["Initializing the Backup HSM Remote PED Vector" on page 195](#)). If the source partition is not activated, you may need the orange PED key for the SafeNet Luna Network HSM as well.
- [Remote PED] Set up Remote PED on the workstation you plan to use for PED authentication (see ["Remote PED Setup" on page 1](#)). If the partition is not activated, you must connect to PEDserver with **ped connect** before logging in, and disconnect with **ped disconnect** before initiating the backup.

To back up an application partition to a host-connected Backup HSM

1. Launch LunaCM on the host workstation.
2. Set the active slot to the source partition and log in as Crypto Officer.

```
lunacm:> slot set -slot <slotnum>
```

```
lunacm:> role login -name co
```
3. [PED Authentication] Connect the Backup HSM to the Luna PED.
 - [Local PED] Set the mode on the Luna PED to **Local PED-SCP** (see ["Modes of Operation" on page 32](#)).
 - [Remote PED] Connect the Backup HSM slot to PEDserver.

```
lunacm:> ped connect -slot <Backup_HSM_slotnum> -ip <PEDserver_IP> -port <portnum>
```
4. Back up the partition, specifying the Backup HSM slot and a label for the backup (either a new or existing label). If you specify an existing backup label, include the **-append** option to add only new objects to the backup (duplicate objects will not be cloned). By default, the existing backup will be overwritten with the current contents of the source partition.

```
lunacm:> partition archive backup -slot <Backup_HSM_slotnum> -partition <backup_label> [-append]
```

You are prompted to present or set the following credentials:

 - [Remote PED] Backup HSM Remote PED vector (orange PED key)
 - Backup HSM SO (password or blue PED key)
 - Crypto Officer (password or black PED key) for the backup (can be the same as the source partition)
 - Cloning domain (string or red PED key) for the backup (must be the same as the source partition)

The partition contents are cloned to the backup.
5. [Remote PED] Disconnect the Backup HSM from PEDserver.

```
lunacm:> ped disconnect
```

Restoring an Application Partition from Backup

You can use LunaCM to restore the contents of a backup to the original application partition, or any other Luna application partition that shares the same cloning domain.

Prerequisites

- > The target partition must be initialized with the same cloning domain as the backup partition.
- > **Partition policy 0: Allow private key cloning** must be set to **1 (ON)** on the target partition.
- > You must have the Crypto Officer credentials for the backup partition and the target partition.

- > [PED Authentication] This procedure is simpler if the application partition is activated (see "[Activation and Auto-activation on Multi-factor- \(PED-\) Authenticated Partitions](#)" on page 114), since you require a Luna PED only for the Backup HSM.
 - [Local PED] Connect the PED to the Backup HSM using a 9-pin Micro-D to Micro-D cable. If the source partition is not activated, also connect the PED to the SafeNet Luna Network HSM using a Mini-B to USB-A cable (see "[Local PED Setup](#)" on page 33), and set the PED to **Local PED-USB** mode instead (see "[Modes of Operation](#)" on page 32).
 - [Remote PED] Set up Remote PED on the workstation you plan to use for PED authentication (see "[Remote PED Setup](#)" on page 1). If the partition is not activated, you must connect to PEDserver with **ped connect** before logging in, and disconnect with **ped disconnect** before initiating the backup.

To restore the contents of a backup to an application partition

1. Launch LunaCM on the host workstation.
2. Set the active slot to the target partition and log in as Crypto Officer.


```
lunacm:> slot set -slot <slotnum>
lunacm:> role login -name co
```
3. [PED Authentication] Connect the Backup HSM to the Luna PED.
 - [Local PED] Set the mode on the Luna PED to **Local PED-SCP** (see "[Modes of Operation](#)" on page 32).
 - [Remote PED] Connect the Backup HSM slot to PEDserver.


```
lunacm:> ped connect -slot <Backup_HSM_slotnum> -ip <PEDserver_IP> -port <portnum>
```
4. [Optional] Display the available backups by specifying the Backup HSM slot. Each available backup also appears as a slot in LunaCM.


```
lunacm:> partition archive list -slot <Backup_HSM_slotnum>
```
5. [Optional] Display the contents of a backup by specifying the Backup HSM slot and the backup partition label in LunaCM.


```
lunacm:> partition archive contents -slot <backup_slotnum> -partition <backup_label>
```
6. Restore the partition contents, specifying the Backup HSM slot and the backup you wish to use. By default, duplicate backup objects with the same OUID as objects currently existing on the partition are not restored. If you have changed attributes of specific objects since your last backup and you wish to revert these changes, include the **-replace** option.


```
lunacm:> partition archive restore -slot <Backup_HSM_slotnum> -partition <backup_label> [-replace]
```

You are prompted for the backup's Crypto Officer credential.

The backup contents are cloned to the application partition.

Configuring a G5 Remote Backup HSM Server

In this configuration, The SafeNet Luna Backup HSM is connected to a remote client workstation that communicates with the SafeNet Luna Network HSM host via the Remote Backup Service (RBS). It is useful in deployments where backups are stored in a separate location from the SafeNet Luna Network HSM, to protect against catastrophic loss (fire, flood, etc).

RBS is a utility, included with the Luna HSM Client software, that runs on a workstation hosting one or more Backup HSMs. When RBS is configured and running, other clients or HSMs registered to it can see its Backup HSM(s) as slots in LunaCM.

Installing/Configuring the Remote Backup Service

RBS is installed using the Luna HSM Client installer. You must create a certificate for the RBS workstation and register it on all clients/appliances that will use the remote Backup HSMs. These instructions will allow you to install and configure RBS.

Prerequisites

- > On any SafeNet Luna Network HSM host workstation, install the following Luna HSM Client components (see ["Luna HSM Client Software Installation" on page 1](#)):
 - **Network:** The Network component includes utilities that are required for remote backups; install this in addition to the PCIe components.
 - **Remote PED:** if you are backing up PED-authenticated partitions
- > Install the SafeNet Luna Backup HSM(s) at the workstation that will host RBS (see ["Installing the Backup HSM" on page 188](#)).
- > [PED Authentication] Initialize the remote PED vector for each Backup HSM. You will need the orange PED key for backup/restore operations (see ["Initializing the Backup HSM Remote PED Vector" on page 195](#)).

To install and configure RBS

1. On the workstation hosting the Backup HSM(s), install the **Backup** component of the Luna HSM Client (see ["Luna HSM Client Software Installation" on page 1](#)). If this workstation will also host a Remote PED, install the **Remote PED** component as well (Windows only).
2. Navigate to the Luna HSM Client home directory (`/usr/safenet/lunaclient/rbs/bin` on Linux/Unix) and generate a certificate for the RBS host.
 - > **rbs --genkey**

You are prompted to enter and confirm an RBS password. The certificate is generated in:

 - Linux/UNIX: `<LunaClient_install_directory>/rbs/server/server.pem`
 - Windows: `<LunaClient_install_directory>\cert\server\server.pem`
3. Specify the Backup HSM(s) that RBS will make available to clients.
 - > **rbs --config**

RBS displays a list of Backup HSMs currently connected to the workstation. Select the ones you want to provide remote backup services. When you have specified your selection, enter **X** to exit the configuration tool.
4. Launch the RBS daemon (Linux/UNIX) or console application (Windows).
 - Linux/UNIX: # **rbs --daemon**
 - Windows: Double-click the **rbs** application. A console window will remain open.

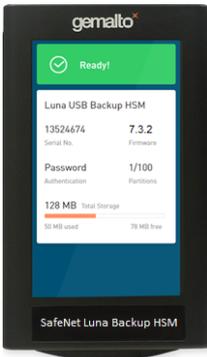
You are prompted to enter the RBS password.

5. Securely transfer the RBS host certificate (**server.pem**) to your SafeNet Luna Network HSM host workstation using **pscp** or **scp**.
6. On the SafeNet Luna Network HSM host workstation, register the RBS host certificate to the server list.
> **vtl addServer -n** <Backup_host_IP> **-c server.pem**
7. [Optional] Launch LunaCM on the client to confirm that the Backup HSM appears as an available slot.

NOTE If you encounter issues, try changing the RBS and PEDclient ports from their default values. Check that your firewall is not blocking ports used by the service.

You can now use the Backup HSM(s) as though they were connected to the SafeNet Luna Network HSM host workstation locally, using Remote PED. See "[Backup/Restore Using a Host-Connected G5 Backup HSM](#)" on [page 197](#) for procedures.

CHAPTER 10: Backup and Restore Using a G7-Based Backup HSM



The following topics describe how to configure and use the G7-based SafeNet Luna Backup HSM to backup and restore the cryptographic objects in your user partitions. You can perform backup and restore operations by connecting the G7-based SafeNet Luna Backup HSM to a Luna HSM Client workstation:

About Backup/Restore Using the G7-based SafeNet Luna Backup HSM

> ["Overview and Key Concepts" below](#)

Installing the SafeNet Luna G7-Based Backup HSM Hardware

> ["SafeNet Luna G7-Based Backup HSM Hardware Installation" on page 206](#)

Backup/Restore from a Luna HSM Client Workstation Using LunaCM

> ["Initializing a Client-Connected G7-Based Backup HSM" on page 208](#)

> ["Backing Up to a Client-Connected G7-Based Backup HSM" on page 212](#)

> ["Restoring From a Client-Connected G7-Based Backup HSM" on page 217](#)

Backup/Restore from a Luna HSM Client Workstation Using the Remote Backup Service (RBS)

> ["Backup and Restore to a Remote Backup Service \(RBS\)-Connected G7-Based Backup HSM" on page 222](#)

Overview and Key Concepts

This topic provides the following background information you need to perform backup and restore operations using a G7-based backup HSM:

- > ["Overview" on the next page](#)
- > ["Credentials Required to Perform Backup and Restore Operations" on the next page](#)
- > ["Client Software Required to Perform Backup and Restore Operations From a Client Workstation" on the next page](#)
- > ["PED Authentication with the G7-Based Backup HSM" on page 205](#)
- > ["Backup and Restore Best Practices" on page 205](#)

Overview

A Crypto Officer (CO) can use the backup HSM to backup the objects in any partition they can log in to, provided that:

- > The user partition and the backup HSM share the same domain.
- > The user partition and the backup HSM use the same authentication method (PED or password).
- > The CO has the required credentials on the backup HSM.

You can perform backup/restore operations on your user partitions by connecting the backup HSM to a Luna HSM Client workstation, or to a SafeNet Luna Network HSM appliance:

- > When you connect the backup HSM to a Luna HSM Client workstation, the backup HSM Admin partition is added to the slots listed in LunaCM, allowing you to clone objects between the <source> user partition and the <target> backup partition.

Backups are created and stored as partitions within the Admin partition on the backup HSM.

Credentials Required to Perform Backup and Restore Operations

You require the following credentials to perform backup/restore operations:

| | |
|--|--|
| <source> User HSM | Remote PED (orange) key. Required for PED-authenticated backups only, to establish a remote PED connection to the HSM that hosts the <source> user partition. |
| <source> User Partition | Crypto Officer (CO). Required to access the objects in the <source> user partition that will be backed up. Domain. Required to allow objects to be cloned between the <source> user partition and <target> backup partition. The domains for the <source> user partition and <target> backup partition must match, otherwise the backup will fail. |
| <target> Backup HSM | HSM Security Officer (SO). Required to create or access the <target> backup partition in the Admin slot, where all backups are archived. Remote PED (orange) key. Required for PED-authenticated backups only, to establish a remote PED connection to the HSM that hosts the <target> backup partition. Note: You create new credentials for both roles on HSM initialization, and use them for subsequent backups to the <target> backup HSM. |
| <target> Backup Partition | Partition owner (PSO). Required to access the <target> backup partition. Crypto Officer (CO). Required to access the objects in the <target> backup partition. Note: You create new credentials for both roles on the initial backup, and use them for subsequent backups to the <target> backup partition. |

Client Software Required to Perform Backup and Restore Operations From a Client Workstation

You must install the Luna HSM Client software and USB driver for the backup HSM on the workstation you intend to use to perform backup and restore operations. The G7-based Backup HSM requires minimum client version 10.1. Refer to [Luna HSM Client Software Installation](#) for detailed installation instructions.

NOTE Ensure that the backup HSM is not connected to the Luna HSM Client workstation when you install or uninstall the client software. Failure to do so may result in the backup HSM becoming unresponsive.

When you install the client software, you must select the following options:

- > The **USB** option. This installs the driver for the backup HSM.
- > The **Network** and/or **PCIe** options, depending on which type of HSM you intend to backup.
- > The **Remote PED** option, if you want to backup PED-authenticated partitions. Note that you can install and use a remote PED on the same workstation used to host the backup HSM, or on a different workstation.
- > The **Backup** option, if you want to backup to a remote backup HSM using RBS.

PED Authentication with the G7-Based Backup HSM

The G7-based backup HSM is equipped with a single USB port that is used to connect the backup HSM to a Luna HSM Client workstation or SafeNet Luna Network HSM appliance. As such, any PED connections to the backup HSM must use a remote PED and the **pedserver** service:

- > When the G7-based backup HSM is connected to a client workstation, you authenticate to it with a remote PED that is connected to the same client workstation used to host the backup HSM, or to a separate workstation used to host the remote PED. To backup or restore a partition, you must use `lunacm:> ped connect` to establish remote PED connections to both the <source> user partition and <target> backup HSM.

Backup and Restore Best Practices

To ensure that your data is protected in the event of a failure or other catastrophic event, Thales recommends that you use the following best practices as part of a comprehensive backup strategy:

CAUTION! Failure to develop and exercise a comprehensive backup and recovery plan may prevent you from being able to recover from a catastrophic event. Although Thales provides a robust set of backup hardware and utilities, we cannot guarantee the integrity of your backed-up key material, especially if stored for long periods. Thales strongly recommends that you exercise your recovery plan at least semi-annually (every six months) to ensure that you can fully recover your key material.

Develop and document a backup and recovery plan

This plan should include the following:

- > What is being backed up
- > The backup frequency
- > Where the backups are stored
- > Who is able to perform backup and restore operations
- > Frequency of exercising the recovery test plan

Make multiple backups

To ensure that your backups are always available, build redundancy into your backup procedures.

Use off-site storage

In the event of a local catastrophe, such as a flood or fire, you might lose both your working HSMs and locally-stored backup HSMs. To fully protect against such events, always store a copy of your backups at a remote location.

Regularly exercise your disaster recovery plan

Execute your recovery plan at least semi-annually (every six months) to ensure that you can fully recover your key material. This involves retrieving your stored Backup HSMs and restoring their contents to a test partition, to ensure that the data is intact and that your recovery plan works as documented.

SafeNet Luna G7-Based Backup HSM Hardware Installation

The following topics describe how to install and connect a G7-based SafeNet Luna Backup HSM. To ensure a successful installation, perform the following tasks in the order indicated:

1. Ensure that you have all of the required components, as listed in ["SafeNet Luna Backup HSM Received Items"](#) below
2. Install and connect the hardware, as described in ["Installing the SafeNet Luna Backup HSM Hardware"](#) on page 208

CAUTION! To ensure the security and integrity of your new device, refer to ["Verifying the Integrity of Your Shipment"](#) on page 1 before unpacking your new SafeNet Luna Backup HSM.

The G7-based SafeNet Luna Backup HSM complies with the following:

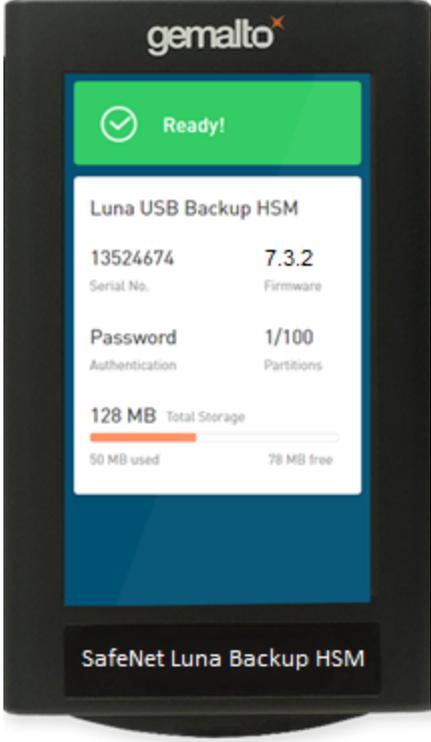


SafeNet Luna Backup HSM Received Items

This section provides a list of the components you should have received with your order.

Included Items

The following items are included with your new backup HSM.

| Quantity | Item |
|----------|---|
| 1 | <p data-bbox="272 268 612 300">SafeNet Luna Backup HSM</p>  <p>The image shows the SafeNet Luna Backup HSM device screen. At the top, the Gemalto logo is visible. Below it, a green bar with a checkmark icon and the text 'Ready!' indicates the device is operational. The main screen displays 'Luna USB Backup HSM' and provides the following information: Serial No. 13524674, Firmware 7.3.2, Password Authentication, and 1/100 Partitions. A storage usage bar shows 128 MB Total Storage, with 50 MB used and 78 MB free. The device name 'SafeNet Luna Backup HSM' is printed at the bottom of the screen.</p> |
| 1 | <p data-bbox="272 1104 691 1136">USB 3.0 Cable: Type A to Type C</p>  <p>The image shows a coiled black USB 3.0 cable. One end has a standard Type A connector, and the other end has a Type C connector. The cable is neatly coiled and set against a plain white background.</p> |
| 1 | <p data-bbox="272 1612 1078 1644">5V Power Supply with replaceable plug modules for international use.</p> <div data-bbox="320 1654 1433 1810" style="border: 1px solid #ccc; padding: 10px;"> <p data-bbox="347 1665 1412 1799">NOTE On most workstations, the USB connection provides adequate power to the backup HSM. If you are using a low-power workstation, such as a netbook, the USB connection may not provide adequate power, in which case you will also need to connect the external power supply.</p> </div> |

Installing the SafeNet Luna Backup HSM Hardware

The backup HSM is a USB device. To install the backup HSM, connect it to a Luna HSM Client workstation using the included USB cable. The workstation must be running Luna HSM Client software that supports the backup HSM and provides the required drivers. Refer to the release notes and see ["Backup and Restore Using a G7-Based Backup HSM" on page 203](#) for more information.

NOTE On most workstations, the USB connection provides adequate power to the Backup HSM and it will begin the boot sequence. If you are using a low-power workstation, such as a netbook, the USB connection may not provide adequate power, in which case you will also need to connect the external power supply.

Initializing a Client-Connected G7-Based Backup HSM

You must initialize the backup HSM prior to first use. Initialization does the following:

- > Recovers the HSM from Secure Transit Mode (STM). STM allows you to verify that the HSM was not tampered in transit. All new HSMs are shipped from the factory in Secure Transport Mode.
- > Creates the orange (Remote PED vector) key for the backup HSM (PED-authenticated HSMs only). You create the orange key using a one-time, password-secured connection between the PED and the backup HSM. You then use this orange key to secure all subsequent connections between the PED and the backup HSM.
- > Sets the authentication mode of the HSM. PED-authenticated backup HSMs can backup PED-authenticated partitions. Password-authenticated backup HSMs can backup password-authenticated partitions.
- > Sets the security domain of the HSM. You can only backup partitions that share the same domain as the backup HSM.
- > Creates the HSM SO role on the HSM (see [HSM Roles and Procedures](#)). This role is required to create or modify a backup partition, and must be logged in to perform a backup.

The procedure is different for PED-authenticated and password-authenticated backups, as detailed in the following sections:

- > ["Initializing a PED-Authenticated HSM" below](#)
- > ["Initializing a Password-Authenticated HSM" on page 211](#)

NOTE This feature requires minimum client version 10.1. See [Version Dependencies by Feature](#) for more information.

Initializing a PED-Authenticated HSM

Initializing your backup HSM as PED authenticated allows you to backup PED-authenticated partitions.

Summary

To initialize a PED-authenticated HSM you connect it and a remote PED (using a USB or network connection) to a Luna HSM Client workstation, and performing the following tasks:

- > Recover the HSM from Secure Transport Mode.
- > Create the orange (Remote PED vector) key for the backup HSM.
- > Initialize the HSM to set the authentication mode (PED) and HSM domain, and create the HSM SO PED key.

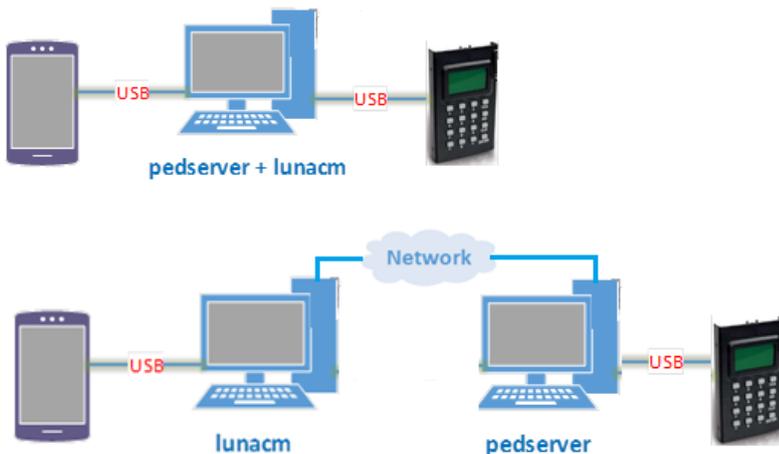
Prerequisites

Before beginning, ensure that you are familiar with the concepts in ["PED Authentication" on page 22](#). You will need the following PED keys:

- > A blank orange (PED vector) PED key, plus the number required to create duplicate PED keys as necessary.
- > N number of blue (HSM SO) PED keys, as defined by the M of N scheme you choose for the HSM SO role, plus the number required to create duplicate PED keys as necessary.
- > An existing red (Domain) PED key for the cloning domain of the partitions you want to backup to the HSM. You can also insert a blank red (Domain) PED key if you want to create a new domain for the HSM (although you won't be able to backup any existing partitions if you do).

To initialize a PED-authenticated Backup HSM

1. Configure your Luna HSM Client workstation using one of the following configurations:



- a. Install the required client software on the Luna HSM Client workstation. See ["Initializing a Client-Connected G7-Based Backup HSM" on the previous page](#) for details.
- b. Connect the backup HSM directly to the Luna HSM Client workstation using the included USB cable.

NOTE On most workstations, the USB connection provides adequate power to the backup HSM and it will begin the boot sequence. If you are using a low-power workstation, such as a netbook, the USB connection may not provide adequate power, in which case you will also need to connect the external power supply.

- c. Connect the PED to the Luna HSM Client workstation used to host the remote PED, using the PED USB cable.

NOTE You connect to the remote PED using the IP address of the workstation used to host the PED. This can be the same workstation that hosts the user and backup partition slots, or a different workstation. The workstation used to host the PED must be running pedServer.

2. Start the **pedserver** service on the workstation used to host the remote PED:

| | |
|----------------|---|
| Windows | C:\Program Files\Safenet\LunaClient> " pedserver mode start " on page 76 |
| Linux | /usr/safenet/lunaclient> " pedserver mode start " on page 76 |

3. Launch LunaCM on the workstation that hosts the user and backup partition slots.

4. Select the slot assigned to the backup HSM Admin partition.

```
lunacm:> slot set -slot <slot_id>
```

5. Recover the HSM from Secure Transport Mode. See [Secure Transport Mode](#) for more information:

```
lunacm:> stm recover -randomuserstring <string>
```

NOTE Recovering a G7-based HSM from secure transport mode may take up to three minutes.

6. Connect to the Luna HSM Client workstation that hosts the PED. If defaults are not **ped set**, specify an IP address (and port if required; 1503 is default).

```
lunacm:> ped connect -pwd
```

LunaCM generates and displays a one-time password that is used to set up a secure channel between the backup HSM and the PED, allowing you to securely initialize the orange (Remote PED Vector) key. Enter the displayed password on the PED when prompted to complete setup of the secure channel.

7. Create an orange (Remote PED vector) key for the backup HSM. The PED vector key is required for subsequent PED-authenticated sessions to the HSM. Ensure that you label any new PED keys that you create during this process.

```
lunacm:> ped vector init
```

8. Tear down the one-time, password-protected secure channel between the backup HSM and the PED you used to create the orange (Remote PED vector) key.

```
lunacm:> ped disconnect
```

You are prompted to enter the one-time password that was generated when you performed the **ped connect**. Enter the password and press Enter to proceed.

9. Set up a new secure channel between the backup HSM and the PED. If defaults are not **ped set**, specify an IP address (and port if required; 1503 is default). You are prompted to insert the orange PED key you created in step 7.

```
lunacm:> ped connect
```

10. Initialize the selected backup HSM in PED-authenticated mode. You are prompted by the PED for the red Domain key(s) (existing or new) and black HSM SO key(s) (new). Respond to the PED prompts and insert and set the PINs on the required keys when requested. Ensure that you label any new PED keys that you create during this process.

```
lunacm:> hsm init -iped -label <label>
```

```
lunacm:> hsm init -iped -label USB_BACKUP_HSM_G7
```

11. Use the **Duplicate** function on the PED to create and label duplicates of the new PED keys, as required. See ["Duplicating Existing PED Keys" on page 59](#) for details.
12. Disconnect the PED when done.

```
lunacm:> ped disconnect
```

Initializing a Password-Authenticated HSM

Initializing your backup HSM as password-authenticated allows you to backup password-authenticated partitions.

Summary

To initialize a password-authenticated HSM you connect it to a Luna HSM Client workstation and perform the following tasks:

- > Recover the HSM from Secure Transport Mode.
- > Initialize the HSM to set the authentication mode (password), the HSM domain, and the initial password for the HSM SO role.

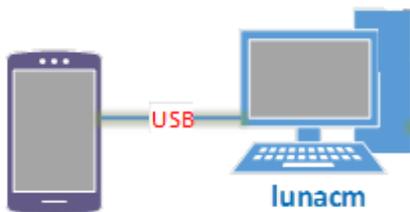
Prerequisites

Before beginning, ensure that you have the following:

- > The password for the cloning domain of the partitions you want to backup to the HSM. You can also enter a new password to create a new domain for the HSM (although you won't be able to backup any existing partitions if you do).

To initialize a password-authenticated HSM

1. Configure your Luna HSM Client workstation as illustrated below:



- a. Install the required client software on the Luna HSM Client workstation. See ["Initializing a Client-Connected G7-Based Backup HSM" on page 208](#) for details.
- b. Connect the backup HSM directly to the Luna HSM Client workstation using the included USB cable.

NOTE On most workstations, the USB connection provides adequate power to the backup HSM and it will begin the boot sequence. If you are using a low-power workstation, such as a netbook, the USB connection may not provide adequate power, in which case you will also need to connect the external power supply.

2. Launch LunaCM on the workstation that hosts the user and backup partition slots.
3. Select the slot assigned to the backup HSM Admin partition:
lunacm:> **slot set -slot** <slot_id>
4. Recover the HSM from Secure Transport Mode. See [Secure Transport Mode](#) for more information:
lunacm:> **stm recover**

NOTE Recovering a G7-based HSM from secure transport mode may take up to three minutes.

5. Initialize the selected backup HSM in password-authenticated mode. You are prompted for the new HSM SO password and the HSM domain string (existing or new):
lunacm:> **hsm init -ipwd -label** <label>

Backing Up to a Client-Connected G7-Based Backup HSM

To perform a backup, you connect the backup HSM to the Luna HSM Client workstation that hosts the slot for the partition you want to backup, and run the LunaCM [partition archive backup](#) command. Backups are created and stored as partitions within the Admin partition on the backup HSM.

A new backup partition is created on initial backup. For subsequent backups, you can choose to replace the contents of the existing <target> backup partition with the current <source> user partition objects, or append new objects in the <source> user partition to the existing <target> backup partition.

The procedure is different for PED-authenticated and password-authenticated backups, as detailed in the following sections:

- > ["Backing Up a Multi-factor- \(PED-\) Authenticated Partition" below](#)
- > ["Backing Up a Password-Authenticated Partition" on page 216](#)

NOTE This feature requires minimum client version 10.1. See [Version Dependencies by Feature](#) for more information.

Backing Up a Multi-factor- (PED-) Authenticated Partition

You require a PED-authenticated backup HSM to backup a PED-authenticated user partition.

Summary

To perform a backup, you connect the backup HSM and a remote PED to the Luna HSM Client workstation that hosts the slot for the user partition you want to backup, and perform the following tasks:

1. Log in to the <source> user partition as the Crypto Officer (CO):
 - If the <source> user partition is activated, you need to provide the challenge secret.
 - If the <source> user partition is not activated, you need to open a remote PED connection to the <source> HSM and use the required PED keys to log in to the <source> user partition as the Crypto Officer (CO).

2. Open a remote PED connection to the <target> backup HSM. You are prompted for the orange (Remote PED vector) key for the backup HSM.
3. Perform the backup operation and respond to the prompts for the HSM SO, partition SO (PO), crypto officer (CO), and domain PED keys for the backup HSM/partition. The backup HSM and the partition you want to restore to must be members of the same domain.

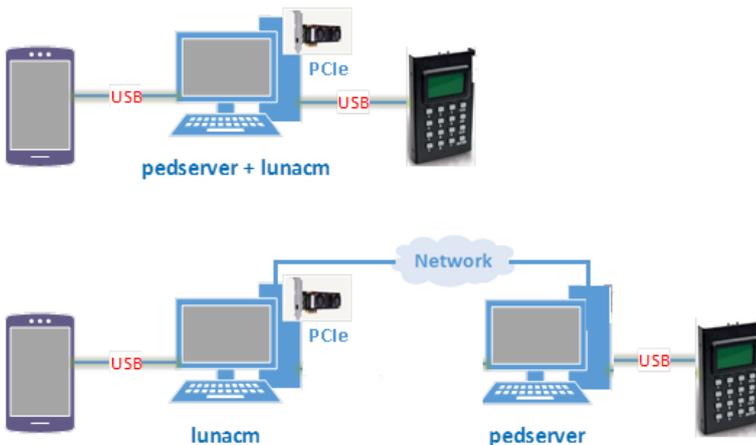
Prerequisites

Before beginning, ensure that you are familiar with the concepts in ["PED Authentication" on page 22](#). You require the credentials listed in ["Backing Up to a Client-Connected G7-Based Backup HSM" on the previous page](#).

TIP To simplify the backup process and minimize interactions with the PED, it is recommended that you activate the CO role on the user partitions you want to backup. See ["Activation and Auto-activation on Multi-factor- \(PED-\) Authenticated Partitions" on page 114](#) for more information.

To backup a PED-authenticated partition

1. Configure your Luna HSM Client workstation using one of the following configurations:



- a. Install the required client software on the Luna HSM Client workstation. See ["Backing Up to a Client-Connected G7-Based Backup HSM" on the previous page](#) for details.
- b. Connect the backup HSM directly to the Luna HSM Client workstation using the included USB cable.

NOTE On most workstations, the USB connection provides adequate power to the backup HSM and it will begin the boot sequence. If you are using a low-power workstation, such as a netbook, the USB connection may not provide adequate power, in which case you will also need to connect the external power supply.

- c. Connect the PED to the Luna HSM Client workstation used to host the remote PED, using the PED USB cable.

NOTE You connect to the remote PED using the IP address of the workstation used to host the PED. This can be the same workstation that hosts the user and backup partition slots, or a different workstation. The workstation used to host the PED must be running pedServer.

2. Start the **pedserver** service on the workstation used to host the remote PED:

| | |
|----------------|---|
| Windows | C:\Program Files\Safenet\LunaClient> "pedserver mode start" on page 76 |
| Linux | /usr/safenet/lunaclient> "pedserver mode start" on page 76 |

3. Launch LunaCM on the workstation that hosts the user and backup partition slots.

4. Identify the slot assignments for:

- The <source> user partition you want to backup.
- The <target> admin partition (where all backups are stored).

lunacm:> **slot list**

If you cannot see both slots, check your connections or configure your client as required.

5. Select the <source> user partition:

lunacm:> **slot set -slot <slot_id>**

6. Authenticate as the Crypto Officer (CO) to the <source> user partition:

- If the partition is activated, proceed as follows:
 - i. Log in to the selected <source> user partition as the Crypto Officer (CO):
lunacm:> **role login -name co**
- If the partition is not activated, proceed as follows:
 - i. Connect to the Luna HSM Client workstation that hosts the PED. If defaults are not **ped set**, specify an IP address (and port if required; 1503 is default).
lunacm:> **ped connect [-ip <pedserver_host_ip>]**
 - ii. Log in to the selected <source> user partition as the Crypto Officer (CO):
lunacm:> **role login -name co**
 - iii. Respond to the prompts on the PED to provide the orange (PED vector) key(s) and PIN for the <source> HSM and the black (CO) key(s) and PIN for the CO role on the <source> user partition.
 - iv. Disconnect the PED session. Note that you will remain logged in to the <source> user partition:
lunacm:> **ped disconnect**

7. Select the backup HSM Admin partition:

lunacm:> **slot set -slot <slot_id>**

8. Connect to the Luna HSM Client workstation that hosts the PED. If defaults are not **ped set**, specify an IP address (and port if required; 1503 is default):

lunacm:> **ped connect [-ip <pedserver_host_ip>]**

9. Select the <source> user partition:

```
lunacm:> slot set -slot <slot_id>
```

10. Initiate the backup:

```
lunacm:> partition archive backup -slot <backup_HSM_admin_slot> [-partition <target_partition_label>]
```

If you omit the **-partition** option when creating a new backup, the partition is assigned a default name (<source_partition_name>_<YYYYMMDD>) based on the source HSM's internally-set time and date.

11. Respond to the prompts on the PED to insert the following keys:

- a. The blue (HSM SO) key for the backup HSM. This is an existing key that was created when the backup HSM was initialized.
- b. The blue (Partition SO) key for the <target> backup partition.
 - If this is the first time the <source> user partition is being backed up to this backup HSM, you are prompted to initialize the backup Partition SO role by creating a new key or reusing an existing key (SETTING SO PIN). After you initialize the role, you are prompted to insert the key again to log in to the role (SO LOGIN).
 - For all subsequent backups, you must present the key used to initialize the backup partition SO role.
- c. The red (Domain) key. This must be the same key used for the <source> user partition, otherwise the backup will fail.
- d. The black (Crypto Officer) key for the <target> backup partition.
 - If this is the first time the <source> user partition is being backed up to this backup HSM, you must first initialize the backup partition CO role. This requires partition SO credentials, so you are prompted for the blue (Partition SO) key. After authenticating as the partition SO, you are prompted to initialize the backup partition CO role by creating a new key or reusing an existing key (SETTING SO PIN). After you initialize the partition CO role, you are prompted to insert the key again to log in to the role (SO LOGIN).
 - For all subsequent backups, you must present the key used to initialize the backup partition CO role.

The backup begins once you have completed the authentication process. Objects are backed up one at a time. For existing backups, you can use the following options to define how individual objects are backed up:

| | |
|-----------------------------|--|
| -append | Add only new objects to the existing backup. |
| -replace | Delete the existing objects in the target backup partition and replace them with the contents of the source user partition. This is the default. |
| -append and -replace | Add new objects and replace existing objects that have the same OUID but a different fingerprint (such as would occur if any of the object attributes were changed since the previous backup). |

12. Disconnect the PED from the <source> and <target> HSMs:

- a. Disconnect the PED from the <target> backup HSM:

```
lunacm:> ped disconnect
```

- b. Select the slot for the <source> user partition:

```
lunacm:> slot set -slot <slot_id>
```

- c. Disconnect the PED from the <source> user partition:

```
lunacm:> ped disconnect
```

13. If this is the first backup to the <target> backup partition, use the **Duplicate** function on the PED to create and label a set of backup keys for the new <target> backup partition PSO (blue) and CO (black) keys. See "Duplicating Existing PED Keys" on page 59 for details.

Backing Up a Password-Authenticated Partition

You require a password-authenticated backup HSM to backup a password-authenticated user partition.

Summary

To perform a backup, you connect the backup HSM to the Luna HSM Client workstation that hosts the slot for the partition you want to backup, and perform the following tasks:

1. Log in to the <source> user partition as the Crypto Officer (CO).
2. Perform the backup operation and respond to the prompts for the HSM SO, partition SO (PO), crypto officer (CO), and domain passwords for the backup HSM/partition. The backup HSM and the partition you want to restore to must be members of the same domain.

Prerequisites

You require the credentials listed in "Backing Up to a Client-Connected G7-Based Backup HSM" on page 212.

To backup a password-authenticated partition

1. Configure your Luna HSM Client workstation as illustrated below:



- a. Install the required client software on the Luna HSM Client workstation and start LunaCM. See "Backing Up to a Client-Connected G7-Based Backup HSM" on page 212 for more information.
- b. Connect the backup HSM directly to the Luna HSM Client workstation using the included USB cable.

NOTE On most workstations, the USB connection provides adequate power to the backup HSM and it will begin the boot sequence. If you are using a low-power workstation, such as a netbook, the USB connection may not provide adequate power, in which case you will also need to connect the external power supply.

2. Identify the slots assigned to:
 - The <source> user partition slot (to be backed up).
 - The <target> admin slot (where all backups are stored).

```
lunacm:> slot list
```

If you cannot see both slots, check your connections or configure your client as required.

3. Select the <source> user partition:

```
lunacm:> slot set -slot <slot_id>
```

4. Log in to the <source> user partition as the Crypto Officer (CO):

```
lunacm:> role login -name co
```

5. Initiate backup of the <source> user partition to the <target> backup partition:

```
lunacm:> partition archive backup -slot <backup_hsm_admin_partition_slot_id> [-partition <target_backup_partition_label>]
```

If you omit the **-partition** option when creating a new backup, the partition is assigned a default name (<source_partition_name>_<YYYYMMDD>) based on the source HSM's internally-set time and date.

6. You are prompted for the following (you can also enter these options on the command line, although doing so exposes the strings, whereas using the prompts obscures the strings):

- The domain string for the <target> backup partition. The domain must match the domain configured on the <source> user partition.
- The <target> backup partition password. You will create a new password on the initial backup, and use the password for subsequent backups to the <target> backup partition.
- The backup HSM SO password. This is required to create or access the backup partition in the Admin slot.

The backup begins once you have completed the authentication process. Objects are backed up one at a time. For existing backups, you can use the following options to define how individual objects are backed up:

| | |
|-----------------------------|--|
| -append | Add only new objects to the existing backup. |
| -replace | Delete the existing objects in the target backup partition and replace them with the contents of the source user partition. This is the default. |
| -append and -replace | Add new objects and replace existing objects that have the same OUID but a different fingerprint (such as would occur if any of the object attributes were changed since the previous backup). |

Restoring From a Client-Connected G7-Based Backup HSM

Restoring objects from a backup is essentially the same as the backup procedure, except in reverse. That is, a Crypto Officer can restore the objects from a backup partition to a new or existing user partition, provided they have the credentials required to access the objects in the backup and user partitions, as detailed in ["Restoring From a Client-Connected G7-Based Backup HSM" above](#).

The procedure is different for PED-authenticated and password-authenticated backups, as detailed in the following sections:

- > ["Restoring a Multi-factor- \(PED-\) Authenticated Partition" on the next page](#)
- > ["Restoring a Password-Authenticated Partition" on page 220](#)

NOTE This feature requires minimum client version 10.1. See [Version Dependencies by Feature](#) for more information.

Restoring a Multi-factor- (PED-) Authenticated Partition

You can restore the objects from a PED-authenticated backup partition to a PED-authenticated user partition. You can restore to an existing user partition, or you can create a new user partition and restore the objects to the new partition.

Summary

To restore the objects from a backup, you connect the backup HSM and a remote PED to the Luna HSM Client workstation that hosts the slot for the user partition you want to restore from backup and perform the following tasks.

1. Log in to the user partition you want to restore to as the Crypto Officer (CO):
 - If the user partition is activated, you need to provide the challenge secret.
 - If the user partition is not activated, you need to open a remote PED connection to the HSM that hosts the user partition you want to restore to, and use the required PED keys to log in to the user partition as the Crypto Officer (CO).
2. Open a remote PED connection to the backup HSM.
3. Perform the restore operation and respond to the prompts for the HSM SO, partition SO (PO), crypto officer (CO), and domain PED keys for the backup HSM/partition. The backup HSM and the partition you want to restore to must be members of the same domain.

Prerequisites

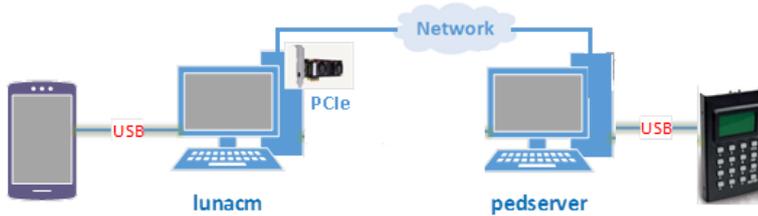
Before beginning, ensure that you are familiar with the concepts in ["PED Authentication" on page 22](#). You require the credentials listed in ["Restoring From a Client-Connected G7-Based Backup HSM" on the previous page](#).

TIP To simplify the restore process and minimize interactions with the PED, it is recommended that you activate the CO role on the user partitions you want to restore to. See ["Activation and Auto-activation on Multi-factor- \(PED-\) Authenticated Partitions" on page 114](#) for more information.

To restore a PED-authenticated partition

1. Configure your Luna HSM Client workstation using one of the following configurations:





- a. Install the required client software on the Luna HSM Client workstation. See ["Restoring From a Client-Connected G7-Based Backup HSM" on page 217](#) for details.
- b. Connect the backup HSM directly to the Luna HSM Client workstation using the included USB cable.

NOTE On most workstations, the USB connection provides adequate power to the backup HSM and it will begin the boot sequence. If you are using a low-power workstation, such as a netbook, the USB connection may not provide adequate power, in which case you will also need to connect the external power supply.

- c. Connect the PED to the Luna HSM Client workstation used to host the remote PED, using the PED USB cable.

NOTE You connect to the remote PED using the IP address of the workstation used to host the PED. This can be the same workstation that hosts the user and backup partition slots, or a different workstation. The workstation used to host the PED must be running **pedserver**.

2. Ensure that HSM policy **16: Enable network replication** is set to **1** on the HSM that hosts the user partition you want to restore to. See [HSM Capabilities and Policies](#) for more information.
3. Start the **pedserver** service on the workstation used to host the remote PED:

| | |
|----------------|---|
| Windows | C:\Program Files\Safenet\LunaClient> pedserver mode start on page 76 |
| Linux | /usr/safenet/lunaclient> pedserver mode start on page 76 |

4. Launch LunaCM on the workstation that hosts the user and backup partition slots.
5. Identify the slot assignments for:
 - the user partition you want to restore to.
 - the backup HSM admin partition (where all backups are stored).

lunacm:> **slot list**

If you cannot see both slots, check your connections or configure your client as required.

6. Select the user partition you want to restore from backup:


```
lunacm:> slot set -slot <slot_id>
```
7. Authenticate as the Crypto Officer (CO) to the selected user partition:
 - If the partition is activated, proceed as follows:
 - i. Log in to the selected user partition as the Crypto Officer (CO):

```
lunacm:> role login -name co
```

- If the partition is not activated, proceed as follows:
 - i. Connect to the Luna HSM Client workstation that hosts the PED. If defaults are not **ped set**, specify an IP address (and port if required; 1503 is default).

```
lunacm:> ped connect [-ip <pedserver_host_ip>]
```

- ii. Log in to the selected user partition as the Crypto Officer (CO).

```
lunacm:> role login -name co
```

- iii. Respond to the prompts on the PED to provide the the orange (PED vector) key(s) and PIN for the HSM that hosts the user partition you want to restore from backup and the black (CO) key(s) and PIN for the CO role on the user partition you want to restore from backup.
- iv. Disconnect the PED session. Note that you will remain logged in to the selected user partition.

```
lunacm:> ped disconnect
```

8. Connect the PED to the backup HSM. If defaults are not **ped set**, specify an IP address (and port if required; 1503 is default):

```
lunacm:> ped connect [-ip <pedserver_host_ip>]
```

9. Initiate the restore operation. Respond to the prompts on the PED to insert the required PED keys, as detailed in "[Restoring From a Client-Connected G7-Based Backup HSM](#)" on page 217.

```
lunacm:> partition archive restore -slot <backup_HSM_admin_slot> -partition <target_partition_label>
```

The restore operation begins once you have completed the authentication process. Objects are restored one at a time.

Restoring a Password-Authenticated Partition

You can restore the objects from a password-authenticated backup partition to a password-authenticated user partition. You can restore to an existing user partition, or you can create a new user partition and restore the objects to the new partition.

Summary

To restore the objects from a backup, you connect the backup HSM to the Luna HSM Client workstation that hosts the slot for the user partition you want to restore from backup and perform the following tasks.

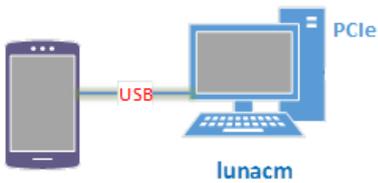
1. Log in to the user partition you want to restore to as the Crypto Officer (CO):
2. Perform the restore operation. You are prompted for the HSM SO, partition SO (PO), crypto officer (CO), and domain passwords for the backup partition. The backup HSM and the partition you want to restore to must be members of the same domain.

Prerequisites

You require the credentials listed in "[Restoring From a Client-Connected G7-Based Backup HSM](#)" on page 217.

To restore a password-authenticated partition

1. Configure your Luna HSM Client workstation as illustrated below:



- a. Install the required client software on the Luna HSM Client workstation and start LunaCM. See ["Restoring From a Client-Connected G7-Based Backup HSM" on page 217](#) for more information.
- b. Connect the backup HSM directly to the Luna HSM Client workstation using the included USB cable.

NOTE On most workstations, the USB connection provides adequate power to the backup HSM and it will begin the boot sequence. If you are using a low-power workstation, such as a netbook, the USB connection may not provide adequate power, in which case you will also need to connect the external power supply.

2. Ensure that HSM policy **16: Enable network replication** is set to **1** on the HSM that hosts the user partition you want to restore to. See [HSM Capabilities and Policies](#) for more information.
3. Identify the slots assigned to:
 - The user partition slot (to be restored).
 - The backup HSM admin slot (where all backups are stored).

lunacm:> **slot list**

If you cannot see both slots, check your connections or configure your client as required.

4. Select the user partition you want to restore to:
lunacm:> **slot set -slot** <slot_id>
5. Log in to the user partition as the Crypto Officer (CO):
lunacm:> **role login -name co**
6. List the available backups on the Backup HSM by specifying the Backup HSM's slot number. You will require the backup partition label to perform the restore operation.
lunacm:> **partition archive list -slot** <backup_HSM_slot>
7. Initiate the restore operation. Respond to the prompts to provide the required passwords, as detailed in ["Restoring From a Client-Connected G7-Based Backup HSM" on page 217](#)
lunacm:> **partition archive restore -slot** <backup_HSM_admin_slot> **-partition** <backup_partition_label>

The restore operation begins once you have completed the authentication process. Objects are restored one at a time.

Backup and Restore to a Remote Backup Service (RBS)- Connected G7-Based Backup HSM

The Remote Backup Service (RBS) is an optional Luna client component that allows you to connect one or more backup HSMs to a remote Luna client workstation to backup the slots on any local Luna HSM Client workstations that are registered with the RBS server. RBS is useful in deployments where backups are stored in a separate location from the SafeNet Luna Network HSM, to protect against catastrophic loss (fire, flood, etc).

RBS is a utility, included with the Luna HSM Client software, that runs on a workstation hosting one or more Backup HSMs. When RBS is configured and running, other clients or HSMs registered to it can see its Backup HSM(s) as slots in LunaCM.

Installing and Configuring the Remote Backup Service

RBS is installed using the Luna HSM Client installer. You must create a certificate for the RBS workstation and register it on all clients/appliances that will use the remote Backup HSMs. These instructions will allow you to install and configure RBS.

NOTE This feature requires minimum client version 10.1. See [Version Dependencies by Feature](#) for more information.

Prerequisites

- > Install the following Luna HSM Client components on any SafeNet Luna Network HSM client workstation that hosts slots for the partitions you want to backup using RBS (see [Luna HSM Client Software Installation](#)):
 - **Network:** The Network component includes utilities that are required for remote backups; If you are using SafeNet Luna PCIe HSM, install this in addition to the PCIe components.
 - **Remote PED:** if you are backing up PED-authenticated partitions.
- > Connect the backup HSM(s) directly to the Luna HSM Client workstation that will host RBS using the included USB cable.

NOTE On most workstations, the USB 3.0 connection provides adequate power to the backup HSM and it will begin the boot sequence. If you are using a low-power workstation, such as a netbook, the USB connection may not provide adequate power, in which case you will also need to connect the external power supply. It is recommended that you use the power supply for all backup HSMs connected to the RBS host workstation. If you are connecting multiple backup HSMs, you can use an external USB 3.0 hub if required.

- > Initialize the backup HSMs if necessary. See "[Initializing a Client-Connected G7-Based Backup HSM](#)" on [page 208](#).
- > Ensure that **HSM Policy 16: Enable Network Replication** is allowed on the HSMs used to host the partitions you want to backup. This is the default setting.

To install and configure RBS

1. On the workstation hosting the Backup HSM(s), install the **Backup** component of the Luna HSM Client (see ["Luna HSM Client Software Installation" on page 1](#)). If this workstation will also host a Remote PED, install the **Remote PED** component as well (Windows only).
2. Navigate to the Luna HSM Client home directory (`/usr/safenet/lunaclient/rbs/bin` on Linux/Unix) and generate a certificate for the RBS host.
 - > **rbs --genkey**

You are prompted to enter and confirm an RBS password. The certificate is generated in:

 - Linux/UNIX: `<LunaClient_install_directory>/rbs/server/server.pem`
 - Windows: `<LunaClient_install_directory>\cert\server\server.pem`
3. Specify the Backup HSM(s) that RBS will make available to clients.
 - > **rbs --config**

RBS displays a list of Backup HSMs currently connected to the workstation. Select the ones you want to provide remote backup services. When you have specified your selection, enter **X** to exit the configuration tool.
4. Launch the RBS daemon (Linux/UNIX) or console application (Windows).
 - Linux/UNIX: # **rbs --daemon**
 - Windows: Double-click the **rbs** application. A console window will remain open.

You are prompted to enter the RBS password.
5. Securely transfer the RBS host certificate (**server.pem**) to your Luna HSM Client workstation using **pscp** or **scp**.
6. On the client workstation, register the RBS host certificate to the server list.
 - > **vtl addServer -n <Backup_host_IP> -c server.pem**
7. [Optional] Launch LunaCM on the client to confirm that the Backup HSM appears as an available slot.

NOTE If you encounter issues, try changing the RBS and PEDclient ports from their default values. Check that your firewall is not blocking ports used by the service.

You can now use the Backup HSM(s) as though they were connected to the client workstation locally, using Remote PED. See ["Backing Up to a Client-Connected G7-Based Backup HSM" on page 212](#) and ["Restoring From a Client-Connected G7-Based Backup HSM" on page 217](#) for detailed procedures.

CHAPTER 11: Slot Numbering and Behavior

Administrative partitions and application partitions are identified as PKCS#11 cryptographic slots in SafeNet utilities, such as LunaCM and **multitoken**, and for applications that use the SafeNet library.

Order of Occurrence for Different SafeNet Luna HSMs

A host computer with Luna HSM Client software and SafeNet libraries installed can have SafeNet Luna HSMs connected in any of three ways:

- > PCIe embedded/inserted SafeNet Luna PCIe HSM card (one or multiple HSMs installed - administrative partitions and application partitions are shown separately)
- > USB-connected SafeNet Luna USB HSMs (one or multiple - administrative partitions and application partitions are shown separately)
- > SafeNet Luna Network HSM application partitions*, registered and connected via NTLS or STC.

Any connected HSM partitions are shown as numbered slots. Slots are numbered from zero or from one, depending on configuration settings (see ["Settings Affecting Slot Order" on the next page](#), below), and on the firmware version of the HSM(s).

* One or multiple application partitions. Administrative partitions on SafeNet Luna Network HSMs are not visible via LunaCM or other client-side tools. Only registered, connected application partitions are visible. The number of visible partitions (up to 100) depends on your model's capabilities. That is, a remote SafeNet Luna Network HSM might support 100 application partitions, but your application and LunaCM will only see partitions that have established certificate-exchange NTLS links with the current Client computer.

In LunaCM, a slot list would normally show:

- > SafeNet Luna Network HSM application partitions for which NTLS links are established with the current host, followed by
- > SafeNet Luna PCIe HSM cards, followed by
- > SafeNet Luna USB HSMs

For SafeNet Luna Network HSM, as seen from a client (via NTLS), only application partitions are visible. The HSM administrative partition of a remote SafeNet Luna Network HSM is never seen by a Luna HSM Client. The SafeNet Luna Network HSM slots are listed in the order they are polled, dictated by the entries in the **SafeNet Luna Network HSM** section of the Crystoki.ini / chrystoki.conf file, like this:

```
ServerName00=192.20.17.200
ServerPort00=1792
ServerName01=192.20.17.220
ServerPort01=1793
```

For SafeNet Luna PCIe HSM and SafeNet Luna USB HSM, if you have multiple of either HSM type connected on a single host, then the order in which they appear is the hardware slot number, as discovered by the host computer.

For SafeNet Luna PCIe HSM and SafeNet Luna USB HSM, the HSM administrative slot always appears immediately after the application partition. If no application partition has yet been created, a space is reserved for it, in the slot numbering.

Settings Affecting Slot Order

Settings in the **Presentation** section of the configuration file (Chrystoki.conf for UNIX/Linux, crystoki.ini for Windows) can affect the numbering that the API presents to SafeNet tools (like LunaCM) or to your application.

[Presentation]

ShowUserSlots=<slot>(<serialnumber>)

- > Sets starting slot for the identified partition.
- > Default, when ShowUserSlots is not specified, is that all available partitions are visible and appear in default order.
- > Can be applied, individually, to multiple partitions, by a single entry containing a comma-separated list (with partition serial numbers in brackets):
ShowUserSlots=1(351970018022), 2(351970018021), 3(351970018020),....
- > If multiple partitions on the same HSM are connected to the Luna HSM Client host computer, redirecting one of those partitions with ShowUserSlots= causes all the others to disappear from the slot list, unless they are also explicitly re-ordered by the same configuration setting.

ShowAdminTokens=yes

- > Default is yes. Admin partitions of local HSMs are visible in a slot listing.
- > Remotely connected partitions (SafeNet Luna Network HSM) are not affected by this setting, because NTLS connects only application partitions, not HSM SO (Admin) partitions to clients, so a SafeNet Luna Network HSM SO administrative partition would never be visible in a client-side slot list, regardless.

ShowEmptySlots=1

- > Controls how C_GetSlotList - as used by lunacm slot list command, or ckdemo command 14, and by your PKCS#11 application - displays, or does not display unused potential slots, when the number of partitions on an HSM is not at the limit.

OneBaseSlotId=1

- > Causes basic slot list to start at slot number 1 (one) instead of default 0 (zero).
(Any submitted number other than zero is treated as "1". Any letter or other non-numeric character is treated as "0".)

Effects of Settings on Slot List

Say, for example, you have multiple HSMs connected to your host computer (or installed inside), with any combination of firmware 6.22.0 (and newer) or pre-6.22.0 firmware, and no explicit entries exist for slot order in the config file. The defaults prevail and the slot list would start at zero.

If you set OneBaseSlotId=1 in the configuration file, then the slot list starts at "1" instead of at "0". You could set this for personal preference, or according to how your application might expect slot numbering to occur (or if you have existing scripted solutions that depend on slot numbering starting at zero or starting at one).

OneBaseSlotId affects the starting number for all slots, regardless of firmware.

If you set ShowUserSlots=20(17923506), then the identified token or HSM or application partition would appear at slot 20, regardless of the locations of other HSMs and partitions.

Effects of New Firmware on Slot Login State

Slots retain login state when current-slot focus changes. You can use the LunaCM command **slot set** to shift focus among slots, and whatever login state existed when you were previously focused on a slot is still in effect when you return to that slot.