

# Luna HSM Client 10.2 for SafeNet Luna Network HSM

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## APPLIANCE ADMINISTRATION GUIDE



## Document Information

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Rev. A	15 June 2020	Initial release

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### **Regulatory Compliance**

This product complies with the following regulatory regulations. To ensure compliancy, ensure that you install the products as specified in the installation instructions and use only Thales-supplied or approved accessories.

#### **USA, FCC**

This equipment has been tested and found to comply with the limits for a “Class B” digital device, pursuant to part 15 of the FCC rules.

#### **Canada**

This class B digital apparatus meets all requirements of the Canadian interference-causing equipment regulations.

#### **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 Appliance Administration Guide

The maintenance and administrative tasks in this document are for the SafeNet Luna Network HSM appliance, outside of the HSM. HSM administrative tasks are described in the *HSM Administration Guide*. Some activities might encompass both portions of the SafeNet Luna Network HSM server.

As an HSM Server, SafeNet Luna Network HSM provides increased operational flexibility over traditional HSMs. The SafeNet Luna Network HSM appliance includes an integrated FIPS 140-2 level 3 HSM, the SafeNet K7 Cryptographic Engine, which offers the same high level of security as traditional HSMs.

The HSM appliance that you have purchased has been factory configured to authenticate as either:

- > Password Authentication version (equivalent to FIPS 140-2 level 2, using password strings for authentication and access control.
- > PED (Trusted Path) Authentication version that requires the Luna PED and PED Keys for authentication and access control.

The HSM appliance adds a secure service layer (NTLS and STC) that allows the SafeNet Cryptographic Engine (the HSM inside the appliance) to be shared as a service to network applications. Like traditional servers that provide e-mail, web pages, and file download (FTP) services to authenticated clients, the HSM appliance offers HSM services to clients on the network.

As an Ethernet-attached device, the HSM appliance can be shared among many applications on a network. Rather than requiring many HSMs to fulfill the security demands of many applications, one HSM appliance can be shared among many applications simultaneously.

This document contains the following chapters:

- > ["SafeNet Luna Network HSM Hardware Installation" on page 12](#)
- > ["Appliance Hardware Functions" on page 33](#)
- > ["Configuring the SafeNet Luna Network HSM for Your Network" on page 54](#)
- > ["Appliance Users and Roles" on page 84](#)
- > ["System Logging" on page 100](#)
- > ["Client Connections" on page 108](#)
- > ["Backing Up and Restoring the Appliance Configuration" on page 115](#)
- > ["Updating the SafeNet Luna Network HSM Appliance Software" on page 118](#)
- > ["Re-Imaging or Decommissioning the HSM Appliance" on page 120](#)

The preface includes the following information about this document:

- > ["Customer Release Notes" on the next page](#)
- > ["Audience" on the next page](#)
- > ["Document Conventions" on the next page](#)



> "Support Contacts" on page 11

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

## Customer Release Notes

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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

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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

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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
<b>bold</b>	<p>The bold attribute is used to indicate the following:</p> <ul style="list-style-type: none"> <li>&gt; Command-line commands and options (Type <b>dir /p</b>.)</li> <li>&gt; Button names (Click <b>Save As</b>.)</li> <li>&gt; Check box and radio button names (Select the <b>Print Duplex</b> check box.)</li> <li>&gt; Dialog box titles (On the <b>Protect Document</b> dialog box, click <b>Yes</b>.)</li> <li>&gt; Field names (<b>User Name</b>: Enter the name of the user.)</li> <li>&gt; Menu names (On the <b>File</b> menu, click <b>Save</b>.) (Click <b>Menu &gt; Go To &gt; Folders</b>.)</li> <li>&gt; User input (In the <b>Date</b> box, type <b>April 1</b>.)</li> </ul>
<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.
[ <b>optional</b> ] [<optional>]	Represent optional <b>keywords</b> 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.
{ <b>a b c</b> } {<a> <b> <c>}	Represent required alternate <b>keywords</b> 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.
[ <b>a b c</b> ] [<a> <b> <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

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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: SafeNet Luna Network HSM Hardware Installation


This chapter describes how to install and connect a SafeNet Luna Network HSM. To ensure a successful installation, perform the following tasks in the order indicated:

1. Before unpacking your new hardware, refer to ["Verifying the Integrity of Your Shipment"](#) below for safe unpacking instructions.
2. Ensure that you have all of the required components, as listed in ["SafeNet Luna Network HSM Required Items"](#) on page 14.
3. If you plan to mount the hardware in an equipment rack, follow the instructions in ["Rack-Mounting the SafeNet Luna Network HSM"](#) on page 21.
4. Install and connect the hardware, as described in ["Installing the SafeNet Luna Network HSM Hardware"](#) on page 28

## Verifying the Integrity of Your Shipment

**CAUTION!** Thales Group employs a number of security measures to allow you to verify that your new hardware was not intercepted in transit or otherwise tampered with before you received it. To verify the authenticity and handling history of your received items, review the following checklist before you unpack your new hardware, and then follow the checklist as you unpack each received item.

Step	Yes	No
1. Do the items received (individual items, part numbers) match those listed in the enclosed packing list? If yes, go to the next step. If no, contact Thales support.		
2. Before you received the product, did you receive an advanced shipping notification providing details regarding the shipment (part numbers and serial numbers for the product and tamper-evident bags)? If yes, go to the next step. If no, contact Thales support.		
3. Are all of the tamper-evident bag serial numbers and tamper-evident label serial numbers listed in the advanced shipping notification present, and do they match the actual tamper-evident bag/label serial numbers received? If yes, go to the next step. If no, contact Thales support.		
4. Did you receive any tamper-evident bag/label serial numbers that are not listed on the advance shipping notification? If yes, contact Thales support. If no, go to the next step.		



Step	Yes	No
<p>5. </p> <p>Are there any signs of physical tampering? If tamper-evident labels are affixed to the received product, have any of these labels been damaged? Have the tamper evident bags been damaged in any way? The tamper seals on the sides indicate tampering if they show the <b>ALERT</b> markings as illustrated below. If yes, contact Thales support. If no, go to the next step.</p>		
<p>6. Once you have verified all of the received items, you can proceed with the installation.</p>		



## SafeNet Luna Network HSM Required Items



This section provides a list of the components you should have received with your SafeNet Luna Network HSM order. The specific items you received depend on whether you ordered a password-authenticated or a PED-authenticated SafeNet Luna Network HSM, and whether your order included a backup device or other options as described below.

### Basic SafeNet Luna Network HSM order items

The standard items that you should have received as your basic order for a SafeNet Luna Network HSM are:

Qty	Item
1	<b>SafeNet Luna Network HSM Appliance</b>  <p>Your order should include one password-authenticated or PED-authenticated SafeNet Luna Network HSM. The different HSM models appear physically identical.</p>
2	<b>Power Supply Cord</b>  <p>One for each power supply, with connectors appropriate to your region of operation.</p>

Qty	Item
1	<p data-bbox="225 268 1449 300"><b>Adapter Cable: RJ45 to USB with a standard eight-pin, eight connector (8P8C) modular connector</b></p>  <p data-bbox="225 772 1070 804">Used to open a terminal connection to the HSM during initial configuration.</p>
1	<p data-bbox="225 842 496 873"><b>Front Ear Bracket Set</b></p>  <p data-bbox="225 1161 376 1192">Set includes:</p> <ul data-bbox="225 1203 504 1276" style="list-style-type: none"><li data-bbox="225 1203 504 1234">&gt; (2) front ear brackets</li><li data-bbox="225 1245 504 1276">&gt; (4) bracket screws</li></ul>

Qty	Item
1	<p data-bbox="225 268 659 296"><b>Friction Rail Mounting Bracket Set</b></p>  <p data-bbox="225 743 1339 770">See <a href="#">"Using the Supplied Mounting Brackets"</a> on page 21 for installation instructions. Set includes:</p> <ul data-bbox="225 785 1155 898" style="list-style-type: none"><li>&gt; (2) side rails</li><li>&gt; (8) side rail screws</li><li>&gt; (2) sliding rear brackets (fit into the rails for rear support adjustable positioning)</li></ul> <div data-bbox="304 932 1393 1199" style="border: 1px solid orange; padding: 10px;"><p data-bbox="339 947 1377 1077"><b>CAUTION!</b> The included mounting hardware is meant for static positioning of the appliance. The long tab that slides into the bracket, applied to each side of the appliance, is adjustable for fitting the appliance into racks of varying depth - it must not be used to extend the appliance out of the rack.</p><p data-bbox="339 1094 1334 1184">Optional gliding rails with rolling bearings are available for situations where rolling excursion of the appliance, while attached to the rack, is required for maintenance. See <a href="#">"Optional Items"</a> on page 19.</p></div>
1	<p data-bbox="225 1241 815 1268"><b>Friction Rail Rack Mounting Screws/Cage Nuts</b></p>  <p data-bbox="225 1493 373 1520">Set includes:</p> <ul data-bbox="225 1535 528 1604" style="list-style-type: none"><li>&gt; (8) M5 cage nuts</li><li>&gt; (8) M5x14 rack screws</li></ul> <p data-bbox="225 1619 1406 1675">If you did not receive this set, you can request one from Thales Group (part number: 216-000035-001) or obtain your own suitable screws/nuts.</p>






Qty	Item
1	<b>Secure Locking Bezel</b>  <p>For maximum physical security, this faceplate bezel can restrict access to the SafeNet Luna Network HSM's front-facing inputs. Includes set of three (3) keys for each lock (locks are keyed differently).</p>


## PED-Authenticated SafeNet Luna Network HSM order items

If you ordered a PED-authenticated SafeNet Luna Network HSM, you should have received some combination of the following items in addition to the items in the basic order.

Note that you can use PED keys that you already own and use with other HSMs -- PED keys can be used with multiple HSMs if that is appropriate in your context. You should purchase the number of PEDs you need for your own convenient operation, and for backup/standby units as your security policies might require.


Qty	Item
1+	<b>Standard or Remote-Capable Luna PED</b>  <p>Your order should include at least one PED device.</p> <p>If you intend to back up your SafeNet Luna Network HSM to a SafeNet Luna Backup HSM, then you require a Luna PED to connect to that Backup HSM.</p> <p>If you intend to combine remote operation and backup, you might prefer to have a second PED. It is possible to use a single Luna PED for both connections, and to simply change between local and remote mode as needed.</p> <p>Note that you can use PED keys that you already own and use with other HSMs if appropriate. You should purchase the number you need for your own convenient operation, and for backup/standby units as your security policies might require.</p>

Qty	Item
1	<p data-bbox="225 268 427 296"><b>Luna PED cable</b></p>  <p data-bbox="225 772 1102 800">The PED device connects to your HSM using a Type A to Mini B USB cable .</p>
1	<p data-bbox="225 842 580 869"><b>Luna PED Power Supply Kit</b></p>  <p data-bbox="225 1346 1442 1444">If you ordered a Luna PED, your order should include a Luna PED power supply kit with the appropriate connection for your region. The power supply is auto-sensing and includes replaceable mains plug modules for international use.</p>

Qty	Item
1	<p><b>Set of PED Keys and Labels</b></p>  <p>Your order should include a set of iKey PED keys and peel-and-stick labels.</p>

## Optional Items

You may have also ordered one or more of these optional items:

Qty	Item
1	<p><b>Sliding Rail Mounting Bracket Set</b></p>  <p>The SafeNet Luna Network HSM will fit into any standard 19-inch server rack. The optional sliding rail mounts allow for easy removal and access to the rear face of the HSM. See <a href="#">"Using the Optional Sliding Rail System"</a> on page 24 for installation instructions. The set includes:</p> <ul style="list-style-type: none"> <li>&gt; (2) sliding rail mounts with removable side rails</li> <li>&gt; (2) transformer brackets</li> <li>&gt; (6) rail screws</li> </ul>

Qty	Item
1	<p data-bbox="225 268 671 300"><b>Sliding Rail Rack Mounting Screws</b></p>  <p data-bbox="225 516 376 543">Set includes:</p> <ul data-bbox="225 556 592 583" style="list-style-type: none"> <li>&gt; (8) M5x8 flat-headed screws</li> </ul> <p data-bbox="225 596 1406 695">If you did not receive this set, you can request one from Thales Group (part number: 216-000034-001) or obtain your own suitable screws. If you do not use the screws included in this kit, ensure that the screw heads are flat enough so as not to interfere with the locking bezel.</p>
1	<p data-bbox="225 730 703 762"><b>SafeNet Luna Backup HSM B700/B790</b></p>  <p data-bbox="515 779 1437 940">You can back up your selected SafeNet Luna Network HSM partition contents (root keys, certificates, other items) to a SafeNet Luna Backup HSM. The SafeNet Luna Backup HSM is suitable for off-site storage and for backing up multiple HSM partitions. It can back up contents of password-authenticated or of PED-authenticated HSMs.</p> <p data-bbox="515 953 1235 984">Refer to <a href="#">Backup and Restore Using a G7-Based Backup HSM</a>.</p>
2	<p data-bbox="225 1272 858 1304"><b>SFP 10 Gbps Optical Ethernet transceiver modules</b></p>  <p data-bbox="225 1625 1453 1724">If you ordered the 10 Gbps Optical Ethernet option, two of the RJ45 ports on the appliance are replaced by SFP+ connectors (protected by dust covers during shipping). The SFP 10G Optical transceiver modules are packed separately, within the appliance packaging, and must be inserted in the appliance before use.</p>

## Rack-Mounting the SafeNet Luna Network HSM

The SafeNet Luna Network HSM appliance comes with front ear brackets, side rails, rear slider brackets, and the necessary screws packed separately in the carton. You may also have ordered the optional sliding rail mounting system. See "[SafeNet Luna Network HSM Required Items](#)" on page 14 for details. Instructions for installing both systems are provided below:

- > If you intend to use the supplied mounting brackets, see "[Using the Supplied Mounting Brackets](#)" below.
- > If your order included the optional sliding rail mounting system, see "[Using the Optional Sliding Rail System](#)" on page 24. The sliding rails are recommended for ease of installation and maintenance.

**CAUTION!** Do not attempt to mount the appliance using only the front brackets – damage can occur.

### Using the Supplied Mounting Brackets

Install and adjust the rails and brackets to suit your equipment rack. The standard mounting bracket set is designed for use in racks with a maximum depth of 27 inches (686 mm). For racks larger than 27 inches, a mounting tray or shelf is recommended.

**CAUTION!** The included mounting hardware is meant for static positioning of the appliance. The long tab that slides into the bracket, applied to each side of the appliance, is adjustable for fitting the appliance into racks of varying depth - it must not be used to extend the appliance out of the rack.

Optional gliding rails with rolling bearings are available for situations where rolling excursion of the appliance, while attached to the rack, is required for maintenance. See "[Using the Optional Sliding Rail System](#)" on page 24 (below).

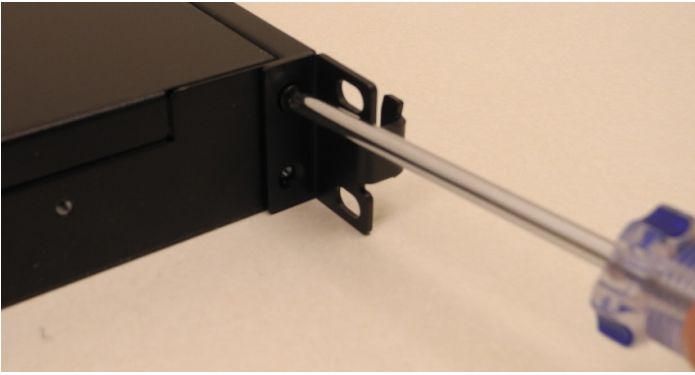
Ensure you have all the necessary components before proceeding. In addition to the supplied components, you will need:

- > #2 Philips screwdriver
- > hydraulic equipment lift

**CAUTION!** If you are installing the appliance in a rack without a mounting tray or shelf, ensure that the appliance is supported at all times or damage may occur. Use of a hydraulic equipment lift is strongly recommended. If you do not have access to a lift, you will need at least one assistant to mount the appliance.

### To mount the SafeNet Luna Network HSM hardware

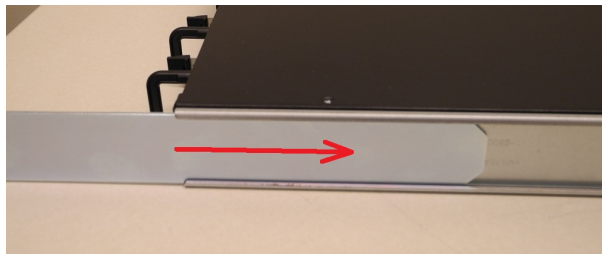
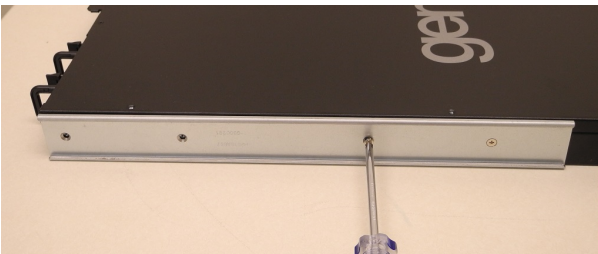
1. Install the two front ear mounting brackets on the HSM chassis using the included screws and a #2 Phillips screwdriver.



2. Fit eight cage nuts into the rack space where you want to install the appliance. Ensure that they are spaced correctly.



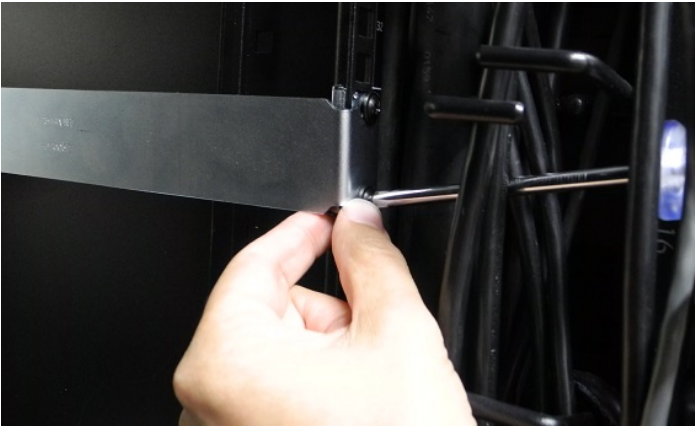
3. Install the two side rails on either side of the HSM chassis, using the included screws and a Phillips screwdriver. Note how the sliding rear brackets fit into the side rails.



4. Install the two sliding rear brackets in your equipment rack using four rack mounting screws.

**NOTE** While any standard equipment rack screws should fit the brackets, certain large-headed screws may interfere with the operation of the secure locking bezel.





- Using a hydraulic lift, raise the HSM to the level of the brackets and extend the lift into the rack.

**CAUTION!** Perform the next step from the rear of the server rack. Do not push the HSM off the lift without supporting its rear end.

- From the rear of the server rack, pull the appliance back towards you until the sliding rear brackets fit into the side rails. Pull the appliance back onto the rear brackets until the front ear brackets meet the equipment rack.



**CAUTION!** Support the weight of the appliance with the hydraulic lift until all four brackets are secured.

- Secure the front ear brackets using rack mounting screws.



See ["SafeNet Luna Network HSM Hardware Installation"](#) on page 12 to continue the installation process.

## Using the Optional Sliding Rail System

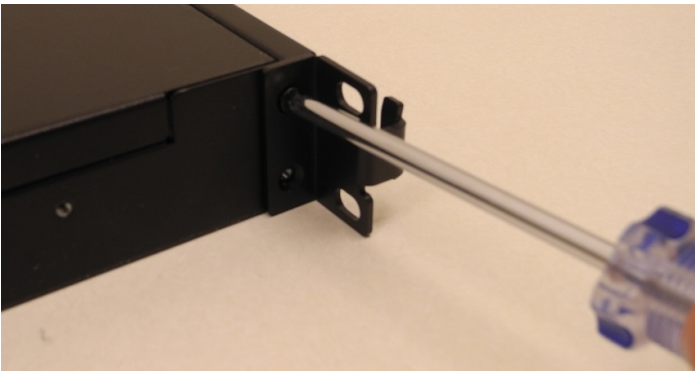
The optional sliding rail system allows for the appliance to be extended out in front of the equipment rack, possibly easing access to other racked appliances. This is rarely necessary. After configuration, the SafeNet Luna Network HSM should remain secured in the rack with the locking bezel installed. Some security standards require the use of this bezel. Leaving the HSM uncovered for ease of access might compromise physical security.

The sliding rail mounts fit into any standard 19" equipment rack.

Ensure you have all the necessary components before proceeding. In addition to the supplied components, you will need a #2 Phillips screwdriver.

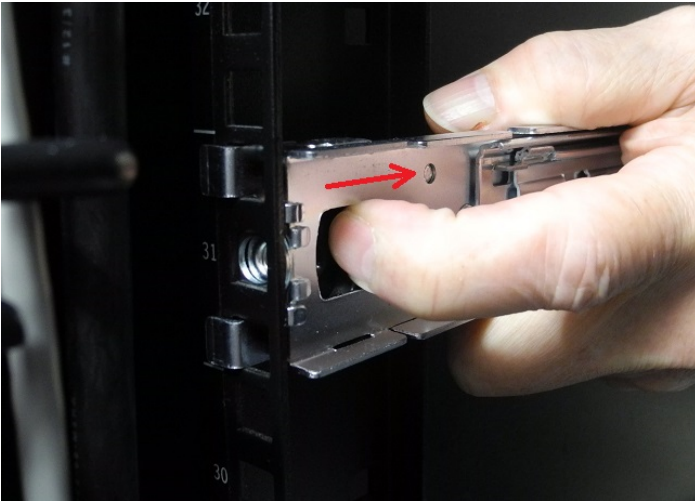
### To mount the SafeNet Luna Network HSM hardware

1. Install the two front ear mounting brackets on the HSM chassis using the included screws and a #2 Phillips screwdriver.

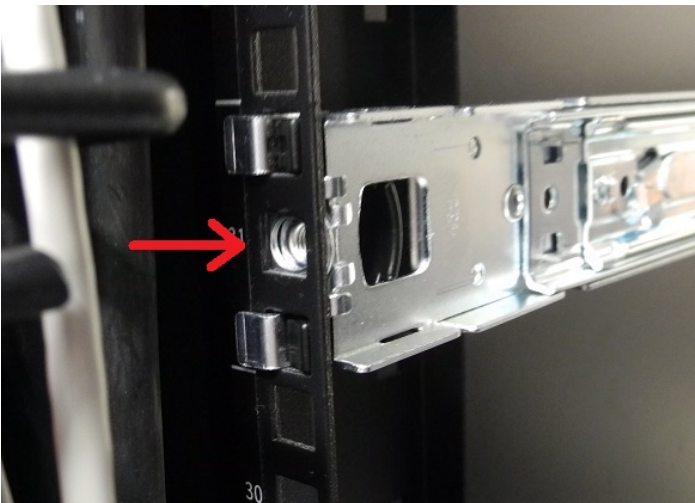


2. Fit the front end of each mount into either side of the rack and pull the spring-loaded latch at the rear to snap it in place.

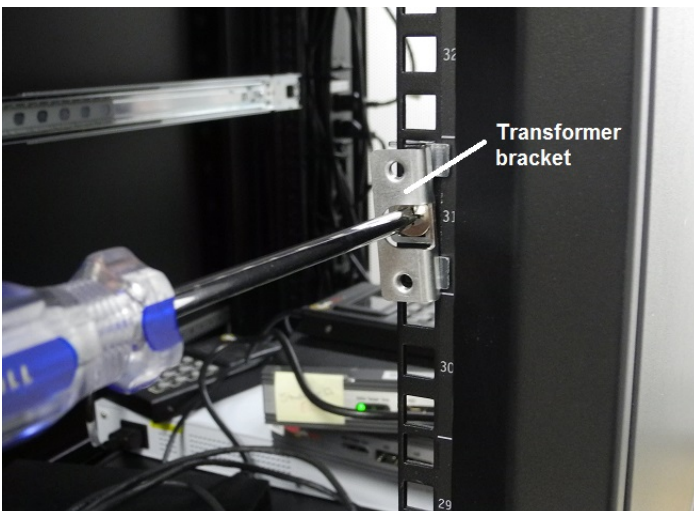




3. Secure the rear end of each mount to the rack with two wide flat-headed screws.



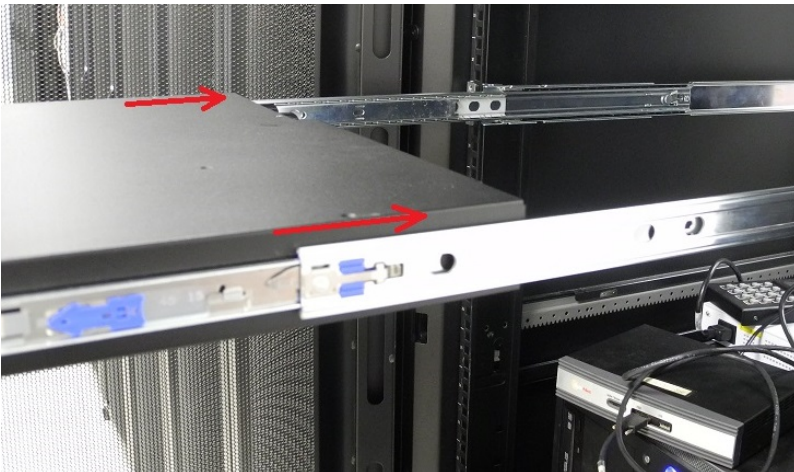
4. Fasten the transformer bracket to each sliding mount with two wide flat-headed screws.



- Loosely thread two small flat-headed screws into each side of the SafeNet Luna Network HSM. Fit each sliding rail over the screw heads and slide it forward into place before tightening the screws. Fasten each sliding rail with a third screw where it lines up with the hole in the HSM chassis.



- Fit the sliding rails onto the rack mounts until they lock into place.



- The HSM now moves smoothly and securely on the rails. Push the HSM all the way back and secure it to the transformer bracket with four rack screws.

**NOTE** Screws with heads that are too large can prevent the locking bezel from fitting to the faceplate. Use the screws included with the SafeNet Luna Network HSM, or other screws with suitable heads.



See ["Installing the SafeNet Luna Network HSM Hardware"](#) on the next page to continue the installation process.

## Installing the SafeNet Luna Network HSM Hardware

This section provides basic SafeNet Luna Network HSM hardware installation instructions (connecting cables, booting, etc.). If you intend to mount the appliance in a standard equipment rack, see ["Rack-Mounting the SafeNet Luna Network HSM" on page 21](#) before following these instructions.

### Installation Notes

- > Any computer that is to act as a client to the SafeNet Luna Network HSM appliance must have the Client software installed. Windows users should log in to their computer as a user with Administrator privileges.
- > A computer that is to be used only for administering the SafeNet Luna Network HSM does not need the Client software – only an SSH client such as the provided PuTTY program for Windows, or the SSH utilities that come standard with most Linux and UNIX platforms.
- > A computer that is to be used for Remote PED workstation operation against a SafeNet Luna Network HSM must have the PEDServer software and PED USB driver installed. Applies to select Windows platforms only.
- > All three tasks (Client, administration, and Remote PED) can be performed on a single computer, but in normal practice they are often separate tasks for separate computers.
- > See [About Remote PED](#) if you will be using Remote PED.

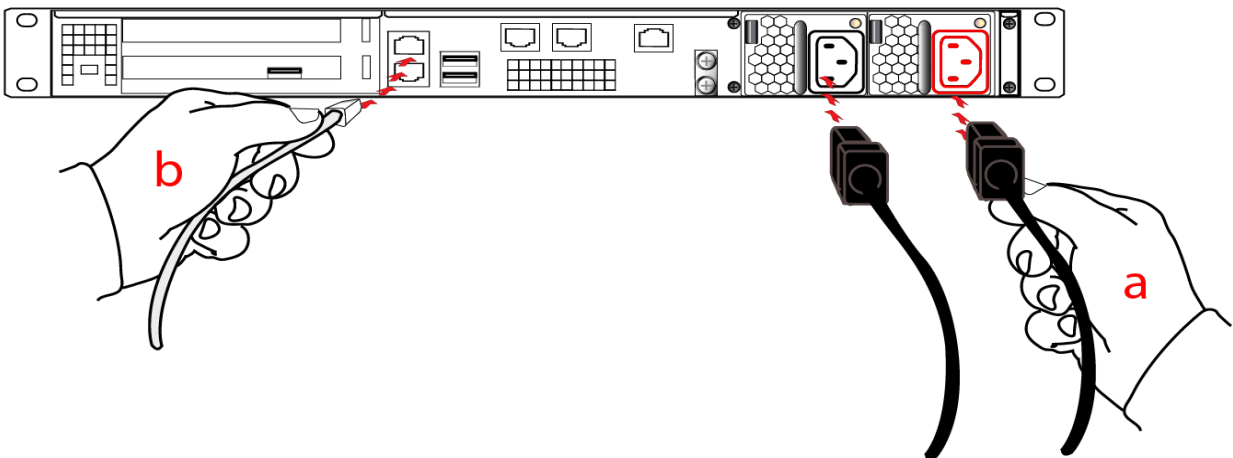
## Installing the SafeNet Luna Network HSM Hardware

Follow these instructions to install and begin configuring the appliance.

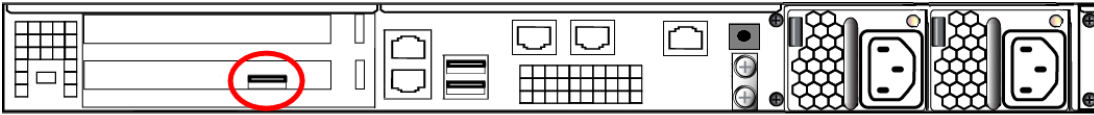
### To install the SafeNet Luna Network HSM hardware

1. Insert the power (a) and network (b) cables at the rear panel.

For proper redundancy and best reliability, the power cables should connect to two completely independent power sources.



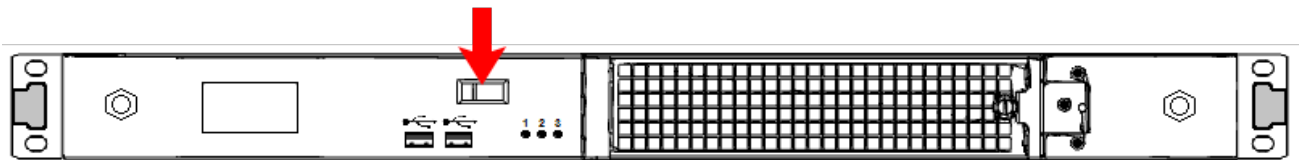
2. If you have a PED-authenticated SafeNet Luna Network HSM, connect the PED directly to the HSM card's USB port (on the rear panel's left side), using the included USB-to-MiniUSB PED cable. See also [Local PED Setup](#). If you have a password-authenticated HSM, skip to the next step.



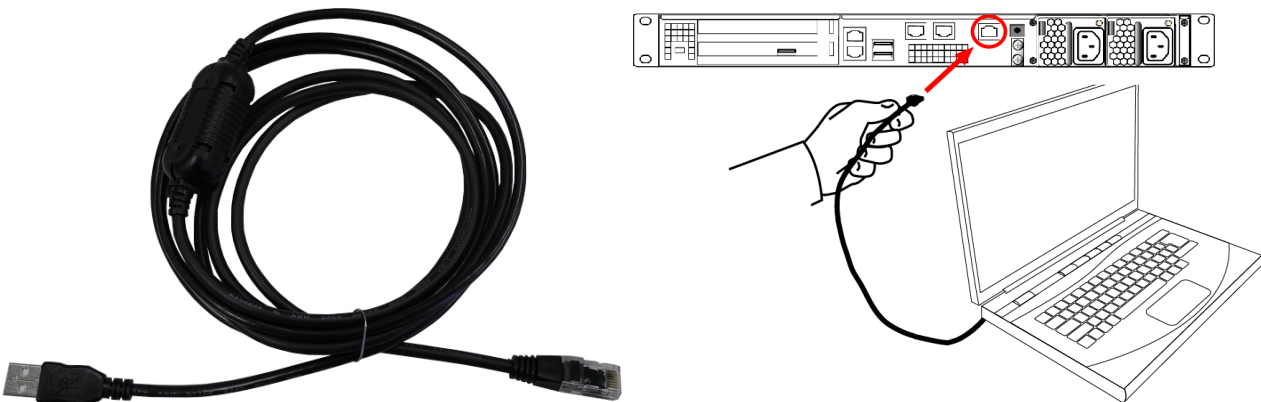
**NOTE** Refreshed-hardware PEDs - identifiable by the part number on the manufacturer's label: 808-000060-002 or 808-000060-003, or by firmware 2.8.0 or later - is powered by the USB connection and does not require a separate, external AC power adapter.

If you have an older PED, the PED must be connected to a suitable power source. The USB 2.0 connection does not provide enough power to run the PED.

3. Press and release the Start/Stop switch on the front panel.



4. Connect the terminal port on the HSM appliance's rear panel to a dumb terminal, PC, or laptop, using the USB-to-RJ45 adapter cable (supplied). This terminal provides serial access to LunaSH for initial network configuration. See ["Opening a Serial Connection" on page 55](#) for more information.



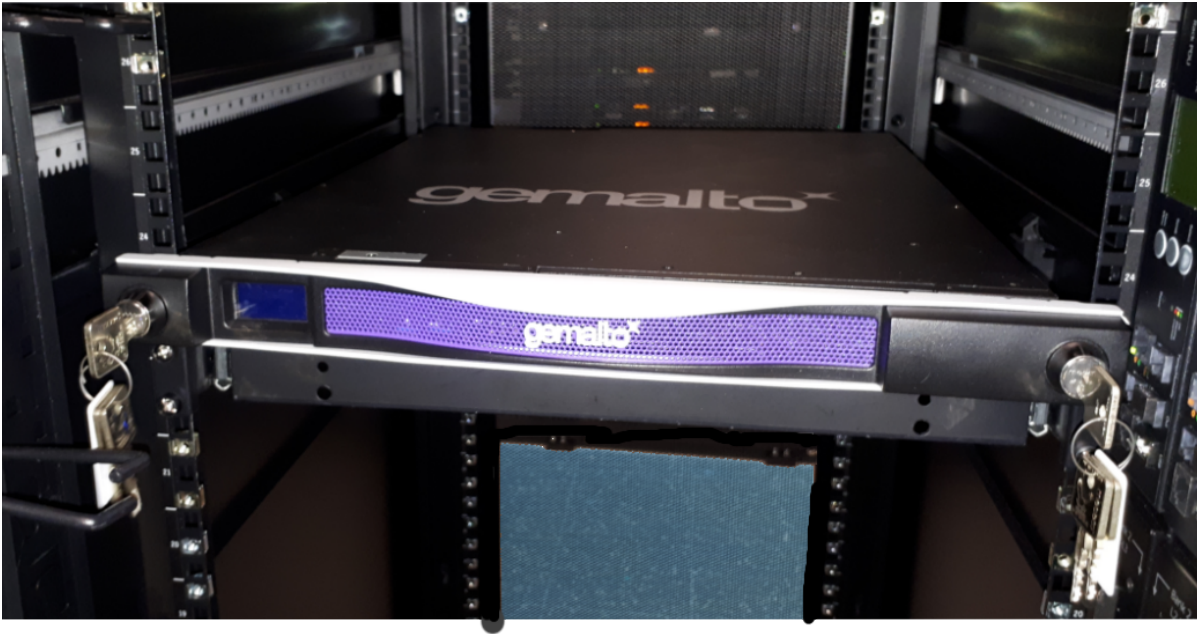
5. For maximum physical access security, when you are finished configuring the HSM, fit the locking bezel over the HSM's faceplate. Certain security standards require the use of these physical access measures. The locks fit over the posts highlighted below.





Turn the keys to the vertical position to lock the bezel. The keys cannot be removed if the bezel is unlocked. The two locks are keyed differently, so the keys can be issued to different security personnel and kept in secure, separate locations.

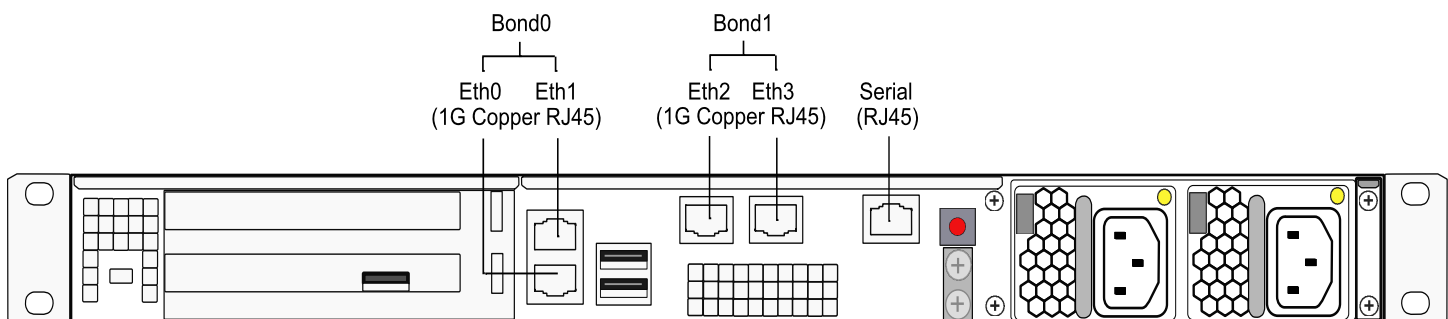
**NOTE** Leaving the keys in the bezel could interfere with closing the rack door, and compromise security.



## Installing optional 10 Gigabit Optical Ethernet

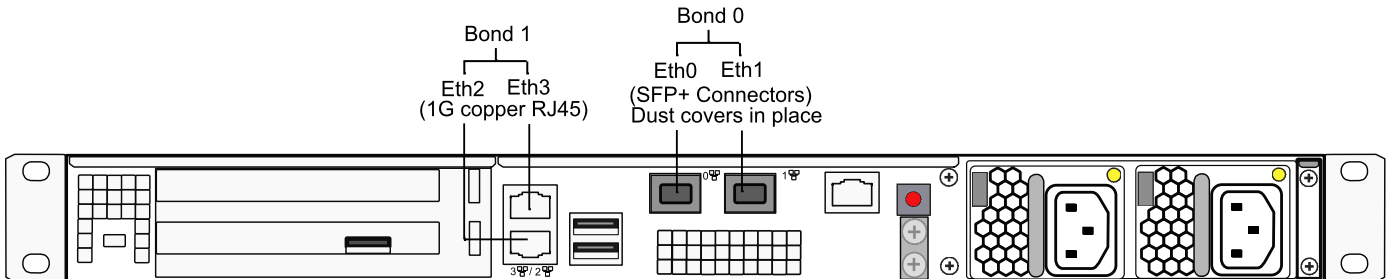
If you ordered the 10G Optical Ethernet option, then the two side-by-side RJ45 ports are replaced by optical-ready SFP+ connectors. The SFP optical Ethernet modules are packed separately, within the Network HSM shipping carton.

The original SafeNet Luna Network HSM, with copper-only 1G Ethernet, looks like this (below) at the back panel.



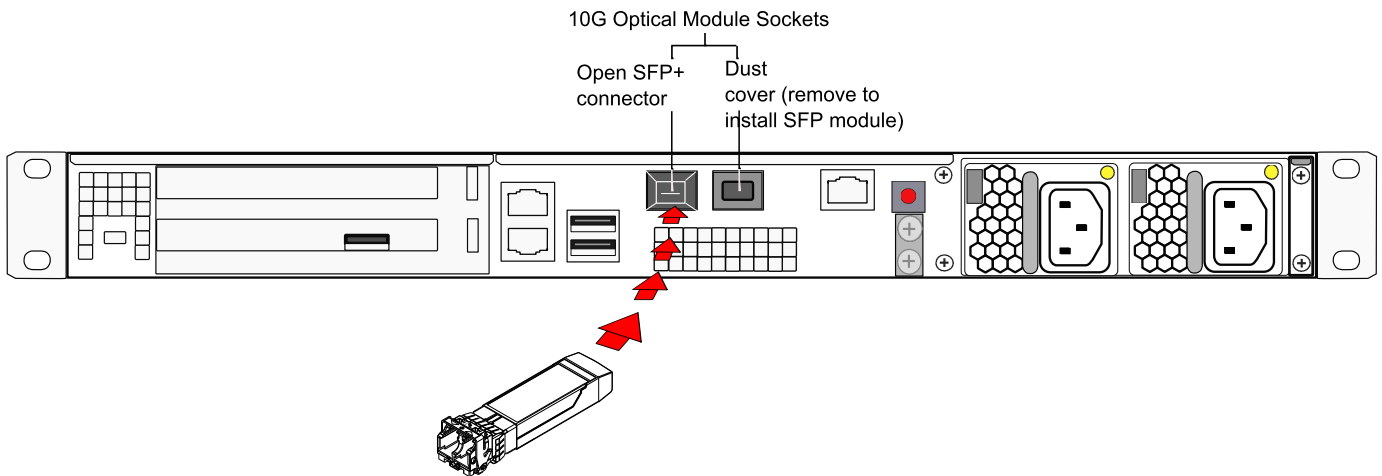
The SafeNet Luna Network HSM with the 10G Optical Ethernet option looks like this, below. The two optical-ready connectors are protected by dust covers during shipping and handling.

**NOTE** The physical ports assigned Ethernet port numbers by system software are changed; the new optical ports become Eth0 and Eth1, while the remaining RJ45 1G copper ports are labeled Eth2 and Eth3. This could require change to setup scripting, if you have previously installed and configured Network HSM appliances with copper-only Ethernet ports.



### To install the SFP modules

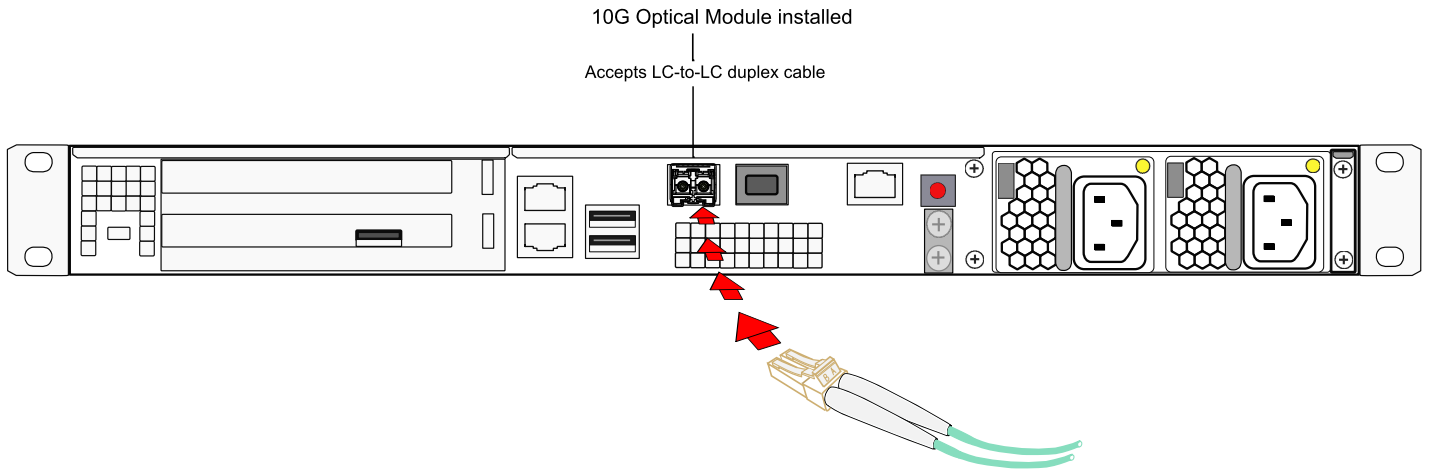
1. Locate the SFP modules in the accessory box, within the Network HSM shipping carton.
2. Remove the dust plug from one of the two SFP+ connectors on the back panel of the Network HSM.
3. Remove an SFP module from its packaging and slide it into the selected connector slot, ensuring that the module seats firmly, making a positive connection at the back of the slot.



4. Repeat for the other 10G module if desired.

### To connect a Dual L-to-L optical cable to an installed 10G SFP module

1. Remove the dust plug from the installed 10G SFP Ethernet module.
2. Insert the dual cable connector as shown.





# CHAPTER 2: Appliance Hardware Functions

This chapter describes the administrative and maintenance tasks you can perform directly on the SafeNet Luna Network HSM hardware. It contains the following sections:

- > "Physical Features" below
- > "Front-panel LCD Display" on page 36
- > "Power-on, Power-off, or Reboot the Appliance" on page 39
- > "Power Supply and Fan Maintenance" on page 41
- > "HSM Emergency Decommission Button" on page 47
- > "Serial Connections" on page 49
- > "Front Locking Bezel" on page 51
- > "Power Consumption" on page 52

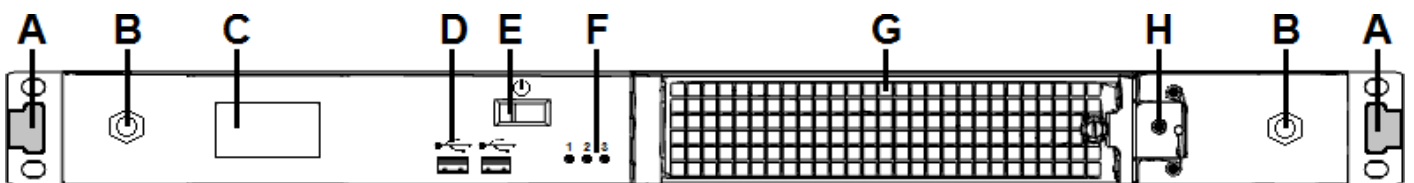
## Physical Features

The SafeNet Luna Network HSM is 1U high and fits into standard 19-inch equipment racks.



### Front Panel

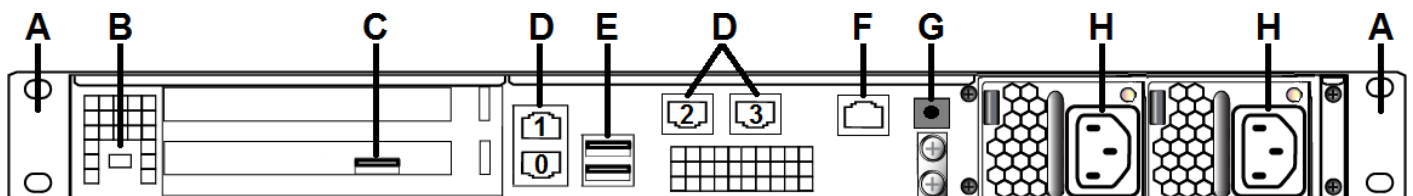
The front panel is illustrated below, with the secure locking bezel removed:



Item	Name	Description
A	Front ear brackets	Connect to the front of the appliance chassis with the provided screws, allowing it to be mounted in a standard 19-inch equipment rack. The extending tabs act as posts for the locking bezel.
B	Mounts for locking bezel	The secure locking bezel connects to the appliance faceplate here.
C	Front-panel display	Displays basic configuration and status information for the appliance. See also <a href="#">"Front-panel LCD Display" on page 36</a>
D	USB 3.0 ports	The appliance has a total of four (4) USB 3.0 ports (two on the front panel and two on the back), for connecting to such devices as card readers and backup HSMs.
E	Start/stop switch	Powers the appliance on or off. See also <a href="#">"Power-on, Power-off, or Reboot the Appliance" on page 39</a> .
F	Fan status LEDs	The appliance has three (3) cooling fans. If these lights are illuminated, the fans are working correctly.
G	Ventilation fan filter cover	Removable cover allows cleaning of air filter. See also <a href="#">"Power Supply and Fan Maintenance" on page 41</a> .
H	Fan bay securing screw	Torx screw secures the fan bay.  <b>CAUTION!</b> Opening to swap fan modules triggers a tamper event on the appliance. See also <a href="#">"Power Supply and Fan Maintenance" on page 41</a> .

## Rear Panel

The rear panel is illustrated below:



Item	Name	Description
A	Sliding rail brackets	Connect to the sliding rails mounted on the sides of the appliance chassis, allowing it to be mounted in a standard 19-inch appliance rack.
B	Kensington lock connector	Allows the appliance to be secured to a desk or equipment rack using a Kensington lock.

Item	Name	Description
C	HSM card USB port	<p>When authenticating with a PED, the PED must be connected directly to the HSM card. The other USB ports on the appliance will not work for PED connection.</p> <div style="border: 1px solid #ccc; padding: 5px; margin-top: 10px;"> <p><b>NOTE</b> This rule does not apply for local PED authentication to a locally attached G7-based backup HSM. In this case you connect a remote PED to one of the appliance USB ports and connect to the <b>pedserver</b> service running on the appliance at IP address 127.0.0.1. See <a href="#">Backup and Restore Using a G7-based Backup HSM</a> for more information.</p> </div>
D	LAN ports	<p>The appliance has a total of four (4) 1Gbit LAN ports that can be bonded in active-backup mode. They are labeled on the illustration above as follows:</p> <ul style="list-style-type: none"> <li>&gt; Bond0: eth0 and eth1</li> <li>&gt; Bond1: eth2 and eth3</li> </ul>
E	USB 3.0 ports	The appliance has a total of four (4) USB 3.0 ports (two on the front panel and two on the back), for connecting to such devices as card readers and backup HSMs.
F	RJ45 serial port	Connect a terminal to this port using the included RJ45 to USB cable (see <a href="#">"SafeNet Luna Network HSM Required Items"</a> on page 14). See also <a href="#">"Installing the SafeNet Luna Network HSM Hardware"</a> on page 28.
G	Decommission button	This button should only be pressed as part of decommissioning and zeroizing the appliance. See also <a href="#">"Decommissioning the HSM Appliance"</a> on page 124.
H	Power supplies	Connect the appliance to power. For proper redundancy and best reliability, the power cables should connect to two completely independent power sources. See also <a href="#">"Power Supply and Fan Maintenance"</a> on page 41.

## SafeNet Luna Network HSM Network Interface Configuration Variants

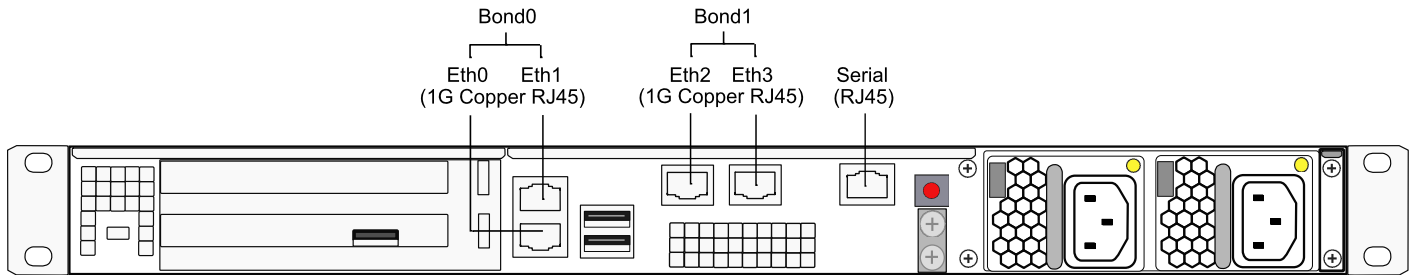
The configuration of the network interfaces on the SafeNet Luna Network HSM depends on the model, as follows:

- > The 1G model provides four 1G RJ45 copper Ethernet network interfaces.
- > The 10G model provides two 10G SFP optical Ethernet network interfaces, and two 1G RJ45 copper Ethernet network interfaces.

The mapping of the network interfaces to their software equivalents (eth0, eth1, eth2, and eth3) is different on each model, as detailed in the following sections. The network interface mappings are not configurable.

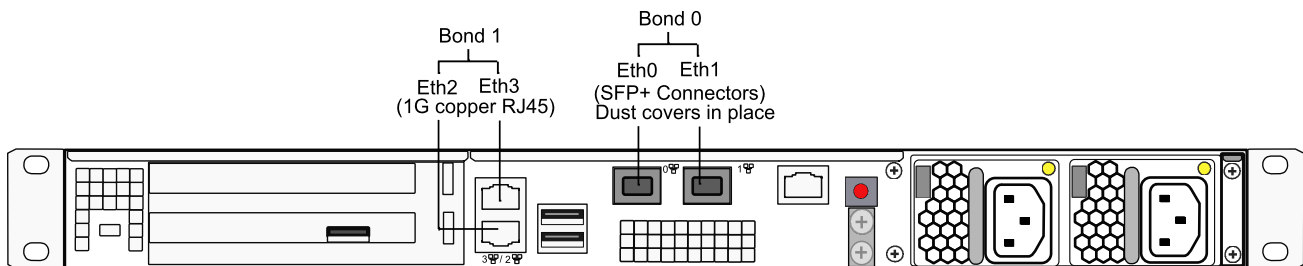
### 1G Model Network Interface Mapping

The 1G model provides four 1G RJ45 copper Ethernet network interfaces. You can optionally bond eth0 and eth1 to bond0, or eth2 and eth3 to bond1, to provide a redundant active/standby virtual interface.



### 10G Model Network Interface Mapping

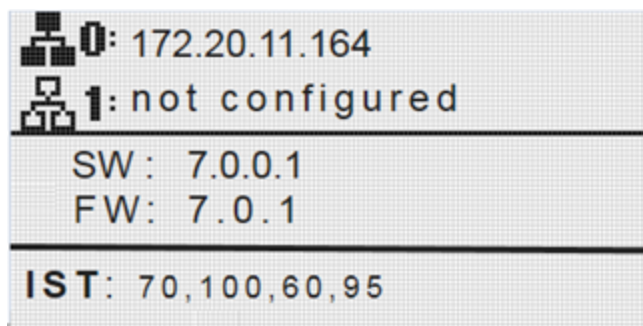
The 10G-equipped SafeNet Luna Network HSM provides two 10G SFP optical Ethernet network interfaces (mapped to eth0/eth1), and two 1G copper RJ45 network interfaces (mapped to eth2/eth3). You can optionally bond eth0 and eth1 to bond0, or eth2 and eth3 to bond1, to provide a redundant active/standby virtual interface.







## Front-panel LCD Display

The LCD on front panel of the SafeNet Luna Network HSM provides basic configuration and status information for the appliance. The LCD is split horizontally into three sections as follows:

**Figure 1: The LCD display**



<b>Top</b>	<p>Displays the current IP address configuration of the Ethernet ports on the appliance.</p> <p>If a port is configured, its IP address is displayed. If the port is not configured, the string "not configured" is displayed. This section automatically cycles between ports eth0 and eth1, and ports eth2 and eth3.</p> <p>The icons indicate the connection status of the port, as follows:</p> <p> An Ethernet cable is connected to the port.</p> <p> An Ethernet cable is not connected to the port.</p>
<b>Middle</b>	<p>Automatically cycles between displaying the following information:</p> <ul style="list-style-type: none"> <li>&gt; Software (SW) and firmware (FW) versions currently installed on the appliance</li> <li>&gt; Appliance host name</li> <li>&gt; HSM label and HSM serial number</li> </ul>
<b>Bottom</b>	<p>Displays the current appliance state and status codes, as detailed in "<a href="#">Appliance State and Status Codes</a>" below.</p> <p>The icon shading indicates the appliance state, as follows:</p> <p> The appliance state is normal, indicated by dark text on a light background.</p> <p> The appliance state is not normal, indicated by light text on a dark background.</p>

## Appliance State and Status Codes

The bottom section of the LCD displays the current appliance state and related status codes. The state can be one of the following.

<b>ISO</b>	<p>In Service Operational. The appliance is operating normally.</p> <p>All services are running and the appliance is providing encryption/signing services as expected.</p>
<b>IST</b>	<p>In Service Trouble. The appliance is operational, but is experiencing a fault condition.</p> <p>The required services are operational and the appliance is able to provide encryption/signing services, but some services, such as SSH, are not running.</p>
<b>OOS</b>	<p>Out of Service. The appliance is not operational.</p> <p>The appliance is online but one or more required services are not operational. The appliance is not providing service.</p>
<b>OFL</b>	<p>Offline. There is no network connectivity to the appliance.</p> <p>In this service state the appliance is not currently connected to the network and cannot provide service.</p>

### Status Codes

Each state is associated with one or more status codes, which provide additional information about the status of the appliance. For example, if there are no faults detected, the display indicates that the appliance is in service (ISO), with status code 0, so the display reads "ISO 0."

The codes are listed in the following table. You can also use `lunash:> status sysstat code all` to display a list of the possible status codes.

If one or more faults have been detected, the display shows the most severe status code until that fault has been corrected, then it displays the next most severe status code, until all errors have been corrected.

**NOTE** Not all faults are serious. Some might merely indicate that an available service is not running because you chose not to run it.

The displayed messages update following a scan of selected system conditions, approximately every 15 seconds. If you have fixed a fault that caused an error, the display should clear the error indication at the next update. If the display continues to show the error message, then the fault may have re-occurred and you should investigate.

State	Status	Description
ISO	0	In Service Operational. No trouble.
	60	In Service Operational. The eth0 interface is offline. Use <code>lunash:&gt; network show</code> and <code>lunash:&gt; service status network</code> to display more information about the status of the network interfaces.
	61	In Service Operational. The eth1 interface is offline. Use <code>lunash:&gt; network show</code> and <code>lunash:&gt; service status network</code> to display more information about the status of the network interfaces.
	62	In Service Operational. The eth2 interface is offline. Use <code>lunash:&gt; network show</code> and <code>lunash:&gt; service status network</code> to display more information about the status of the network interfaces.
	63	In Service Operational. The eth3 interface is offline. Use <code>lunash:&gt; network show</code> and <code>lunash:&gt; service status network</code> to display more information about the status of the network interfaces.
	80	In Service Operational. The STC service is not running. Use <code>lunash:&gt; service status stc</code> to display more information about the status of the STC service.
	95	In Service Operational. The webserver service is not running. The REST API is not available. Use <code>lunash:&gt; service status webserver</code> to display more information about the status of the webserver service.
	100	In Service Operational. The SNMP service is not running. Use <code>lunash:&gt; service status snmp</code> to display more information about the status of the SNMP subsystem.

State	Status	Description
OOS	20	Out of Service. The NTLS service is not running. Use lunash:> <a href="#">service status ntl</a> s to display more information about the status of the NTLS service.
	25	Out of Service. The NTLS service is not bound to an Ethernet device. Use lunash:> <a href="#">service status ntl</a> s to display more information about the status of the NTLS service, and lunash:> <a href="#">syslog tail</a> to view the system logs to help troubleshoot the issue.
	30	Out of Service. The HSM service has experienced one or more errors or critical events. Use lunash:> <a href="#">hsm information show</a> and lunash:> <a href="#">syslog tail</a> to help troubleshoot the issue.
OFL	50	Off Line. None of the Ethernet interfaces are connected to the network. Use lunash:> <a href="#">network show</a> to display more information about the status of the network, and lunash:> <a href="#">syslog tail</a> to view the system logs to help troubleshoot the issue.
IST	70	In Service Trouble. The syslog service is not running. Use lunash:> <a href="#">service status syslog</a> to display more information about the status of the syslog service, and lunash:> <a href="#">syslog tail</a> to view the system logs to help troubleshoot the issue.
	90	In Service Trouble. The SSH service is not running. Use lunash:> <a href="#">service status ssh</a> to display more information about the status of the syslog service, and lunash:> <a href="#">syslog tail</a> to view the system logs to help troubleshoot the issue.
	110	In Service Trouble. Hard disk utilization is too high. Use lunash:> <a href="#">syslog tarlogs</a> to create a tar archive of the logs and then use <a href="#">pscp</a> to transfer the log archive from the appliance to a remote computer for archiving.

**NOTE** The LCD initially displays the Gemalto logo when it (re)starts, and then displays the status information for the appliance. If you find that the LCD is failing to update, you may need to restart it using the service commands for the sysstat service (**service start sysstat**, **service stop sysstat** or **service restart sysstat**). You can also disconnect and reconnect the power from the appliance to restart the LCD.


## Power-on, Power-off, or Reboot the Appliance

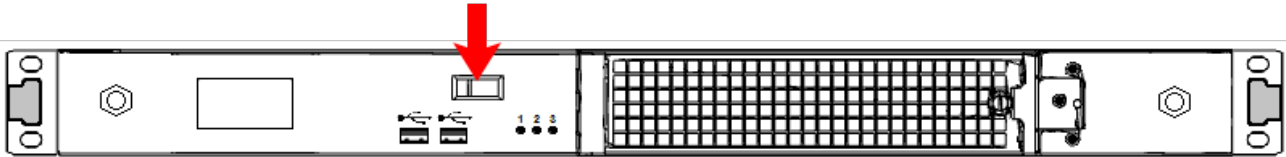
This section describes how to power-on, power-off, or reboot the appliance. It contains the following sections:

- > ["Power On" on the next page](#)
- > ["Power Off" on the next page](#)
- > ["Reboot" on the next page](#)
- > ["Hard Reboot" on page 41](#)
- > ["Automatic Restart Following a Power Interruption" on page 41](#)

## Power On

On the back panel, ensure that the power supplies are connected and working - the green LED on each power supply glows steadily when in operation.

If the appliance does not immediately begin to start up, press and release the START/STOP switch  on the front panel.



The HSM appliance begins to power up.

If power was removed while the system was on (either a power failure, or the power cable was disconnected), the system restarts without a button press. This behavior allows unattended resumption of activity after power interruption.

The front-panel LCD begins showing activity, then settles into the ongoing system status display once the appliance has completed its boot-up and self-test activity. See "[Front-panel LCD Display](#)" on page 36.

## Power Off

To power-off the HSM appliance locally, press and release the START/STOP switch. Do not hold it in. The HSM appliance then performs an orderly shutdown (that is, it closes the file system and shuts down services in proper order for the next startup). This takes approximately 30 seconds to complete. In the unlikely event that the system freezes and does not respond to a momentary "STOP" switch-press, then press and hold the START/STOP switch for five seconds. This is an override that forces immediate shutoff.

**CAUTION!** Never disconnect the power by pulling the power plug. Always use the START/STOP switch.

To switch off the HSM appliance from the LunaSH command line, use `lunash:> sysconf appliance poweroff`.

## Reboot

To perform a system restart, you can switch the power off and then on again using the momentary-contact START/STOP switch on the front panel of the system, or use `lunash:> sysconf appliance reboot`.

To switch off the system, use `lunash:> sysconf appliance poweroff`, or use the START/STOP switch on the SafeNet Luna Network HSM front panel:

- > If you issue the poweroff command, the system requests that you confirm by typing "proceed". After you type "proceed", the system returns a success message. From that point the orderly shutdown takes 15 to 20 seconds.
- > After you momentarily press and release the START/STOP switch, the system performs a graceful shutdown, which takes 15 to 20 seconds.



If the system does not appear to be properly shutting down, then press and hold the front-panel START/STOP switch, which forces an immediate shutdown. This is not normally required, and should never be done unless it is required, since it bypasses the normal, graceful file-system closing and shutdown procedure.

## Hard Reboot

The commands `lunash:> sysconf appliance reboot` and `lunash:> sysconf appliance poweroff` are preferred when you have easy physical access to the appliance, because they perform orderly shutdown, but you can access the START/STOP button if the commands fail.

For situations where you do not have convenient local access to the START/STOP button on the appliance, the preferred command choice is `lunash:> sysconf appliance hardreboot`.

- > The disadvantage is that the shutdown is abrupt and not orderly - in a constrained and hardened system like SafeNet Luna Network HSM, any risk is minimal, but not zero.
- > The advantage of using the hard reboot is that, with many services and file closures being bypassed, there are far fewer opportunities for a shutdown or reboot sequence to hang in an unrecoverable state. You avoid the risk incurred by remotely using one of the other "softer" commands when there is no convenient access to the physical button override in the event that the command fails.

## Automatic Restart Following a Power Interruption

If the appliance was deliberately powered down, using the START/STOP switch or `lunash:> sysconf appliance poweroff`, it remains off until you press the START/STOP switch. However, if power was removed while the system was on (either a power failure, or the power cables were disconnected - not good practice), then the system restarts without a button press.

This behavior allows unattended resumption of activity after power interruption. In most cases, it is assumed that this would never be needed, as you would install the appliance with its two power supplies connected to two completely separate, independent power sources, at least one of which would be battery-backed (uninterruptible power supply) and/or generator-backed.

## Power Supply and Fan Maintenance

The two power supplies in the SafeNet Luna Network HSM appliance are hot-swap capable, meaning that one is sufficient to power the appliance while the other is removed and replaced, with no service interruption. The indicator light (LED) on each power supply shows different behavior, depending upon conditions.

Power Supply Condition	Power Supply LED
DC present/only standby output on	Flashing green (1Hz)
Power supply DC output ON and OK	Steady green
Power supply failure	Steady RED
Power supply warning	Flashing Blue/Red (1Hz) alternating
Input power failure (only in n+1 configuration)	Flashing Red (1Hz)

A power supply controller in the appliance monitors the state of the power supplies. It ensures that a failed power supply still gets sufficient direct current from the remaining power supply to light the indicator LED. The controller also sounds an audible alarm when there is a problem, such as one power supply not being connected to AC main power.

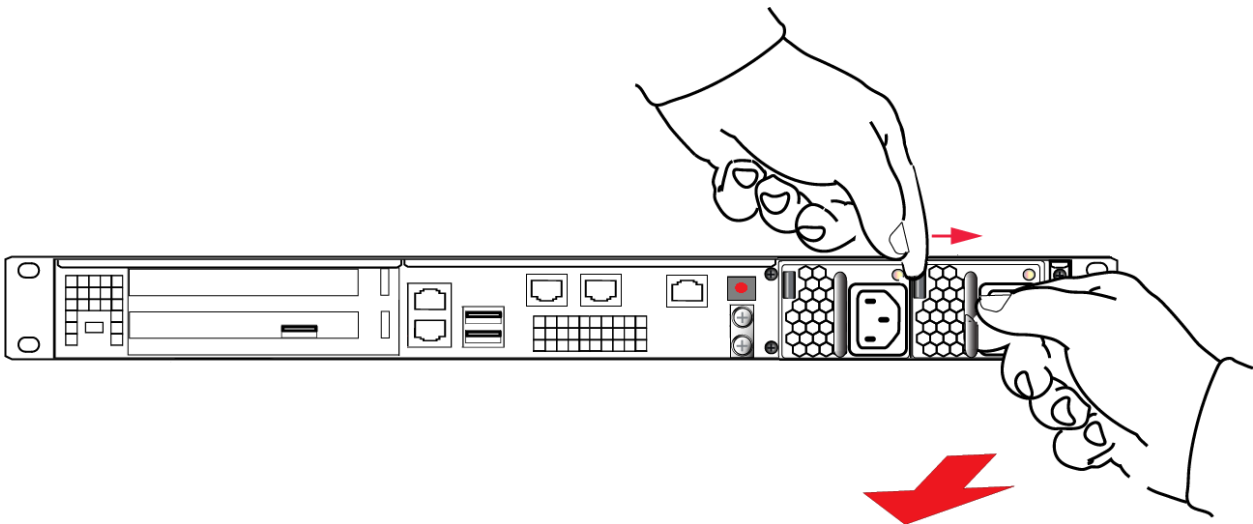
If only one power supply is present, the audible alarm is silent. If you wish to operate your SafeNet Luna Network HSM appliance with only one power supply, we recommend that you remove the second supply to silence the audible alarm.

## Replacing a Power Supply

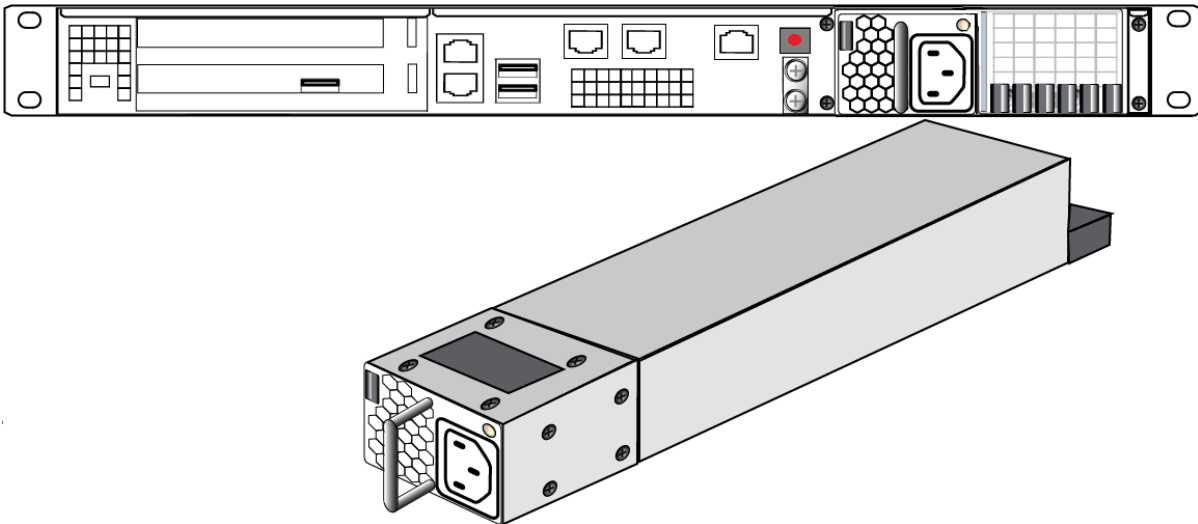
You may need to replace a power supply in the event of a failure.

### To remove a power supply

1. To remove a power supply, face the back of the appliance.
2. Disconnect/unplug the selected power supply.
3. Press the lever sideways to release the power supply retaining catch, and simultaneously pull the handle out toward you.



Withdraw the power supply completely, using your other hand to support the body of the power supply as it emerges.



### To re-install a power supply

1. To replace a power supply, reverse the steps above. Press firmly to seat the connector. The power supply can be fully inserted only in its proper orientation.
2. Connect an AC power cord.

## The Fans

In normal operation, the fans should require no maintenance.

You might need to perform the following tasks:

- > Clean the filter (occasionally)
- > Replace a defective fan (rarely)

### **CAUTION!** Opening the fan bay causes a system tamper event

We recommend that you use scheduled system maintenance downtime for this activity, as it will temporarily disrupt your client's access to your HSM partitions. If the system detects a tamper event, the HSM stops responding until you reboot (`lunash:> sysconf appliance reboot`), or until you use the Stop/Start switch on the appliance rear panel.

## Cleaning the Filter

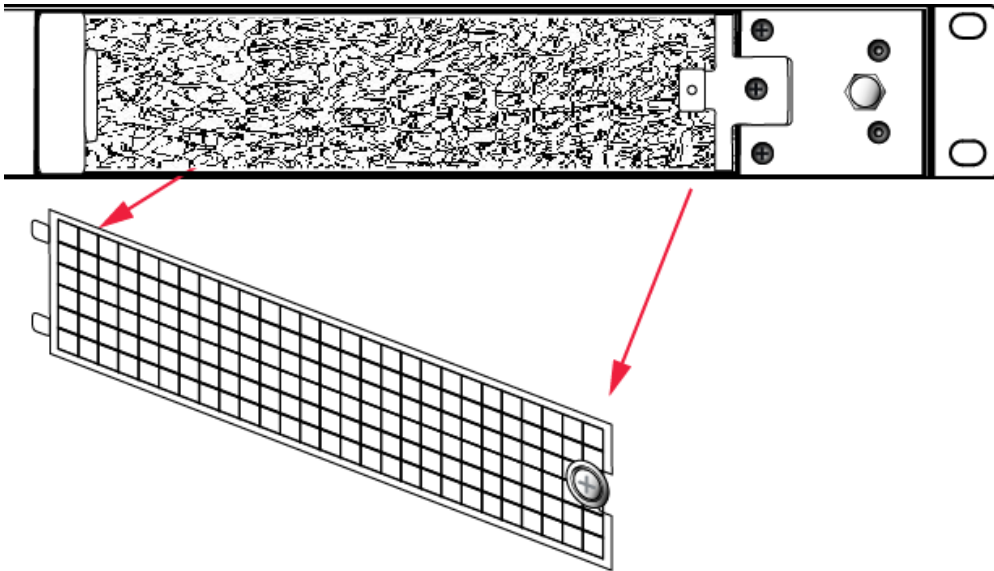
The ventilation grille, located to the right, on the appliance front panel, is secured in two parts, by two screws - a knurled, captive thumb-screw, and a Torx T8 screw. The knurled screw can be fastened or released without tools. It secures the lattice screen that in turn retains the mesh air filter.

While we recommend controlled-atmosphere environments for greatest longevity and reliability of the equipment, we recognize that some environments might include some dust in the air. The mesh filter traps larger particulate matter before it can be drawn into the interior of the appliance. In less-than-perfect non-clean-room conditions, the mesh might accumulate a buildup of dust, and should be cleaned occasionally for best cooling airflow into the equipment.

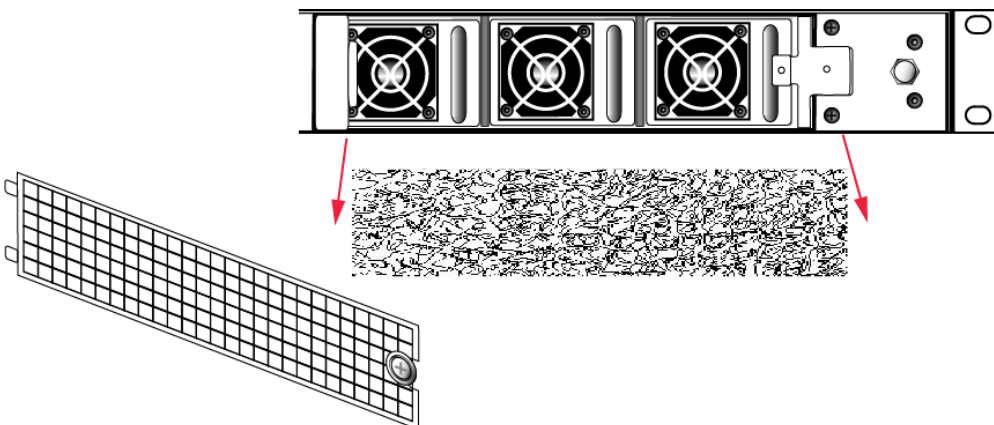
**NOTE** Accessing the air filter mesh in front of the fans (using the thumbscrew to open the retaining grille) does not cause a tamper.

### To clean the filter

1. Twist the knurled knob counter-clockwise until it no longer secures the airflow lattice. The lattice is anchored at its left end by two tabs, and can be easily pulled off the appliance, once the knurled retaining screw is loosened. Do so.



2. With the air filter exposed, it is easy to grasp the mesh with fingers and tug it free. The mesh is flexible and is held in its cavity only by friction. If it is dusty, handle carefully so as not to dislodge any dirt that could then be sucked in by the fans.



3. To clean the filter, either blow it out with compressed air (away from the vicinity of the appliance), or rinse with water. If using water, ensure that the mesh is dry before reinstalling.
4. To reinstall the mesh, place it in its cavity in front of the fans, and use fingers or a blunt tool to tuck-in the corners.
5. Then, replace the lattice in front of the mesh by inserting the tabs first, then swinging the lattice closed like a door, and securing with the knurled screw.

## Replacing a Fan

The three fan modules (each containing two in-line fans) provide cooling redundancy. If one fan or module fails, it is detected by sensors. View a summary of appliance sensor conditions by running `lunash:> status sensors`. In the FAN section of the command output, the fans are listed in the order that they appear, left-to-right, as viewed from the front of the appliance. The example shows a fault with the first fan module:

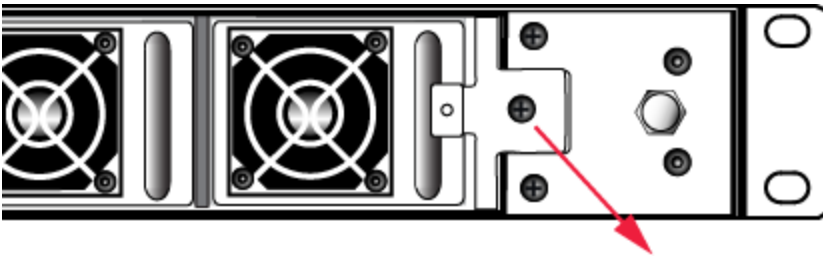
```
----- Front Cooling Fans Status -----
FAN1A lnr    0 RPM  Unplugged or Failed
FAN1B lnr    0 RPM  Unplugged or Failed
FAN2A OK     3000 RPM
FAN2B OK     2900 RPM
FAN3A OK     2900 RPM
FAN3B OK     3000 RPM
```

When the system returns from restarting, the HSM returns to find both splits of the MTK available and it immediately reconstitutes the MTK, allowing you to resume operations.

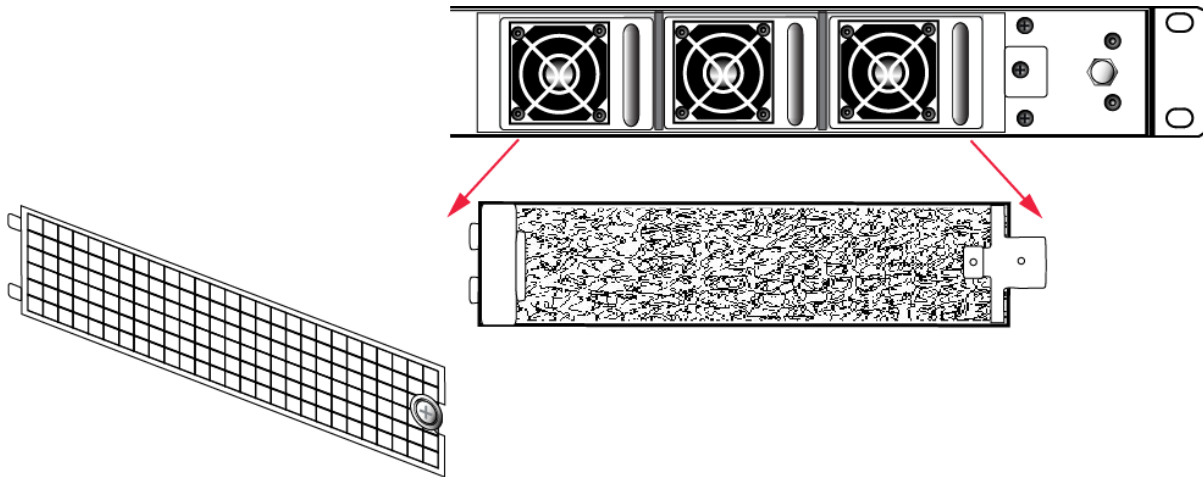
**NOTE** Partition authentication data is de-cached by the tamper - you must re-activate each of your application partitions by logging in with the PED key and challenge secret before your clients can resume accessing them (see [Activation and Auto-activation on Multi-factor-\(PED-\) Authenticated Partitions](#)). Partition activation does not survive a tamper event. In either case, you can examine the log for tamper events: `lunash:> syslog tail -search tamper -entries 200`

### To replace a fan

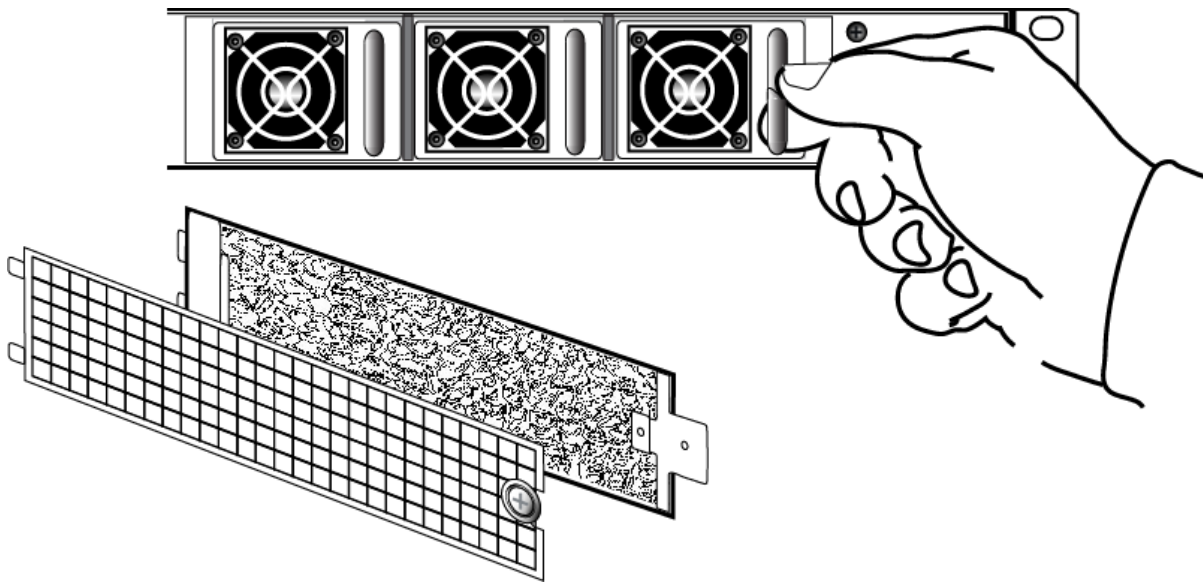
1. To open the fan bay, use a Torx number 8 screwdriver to remove the screw that secures the right-side tab of the fan retainer.



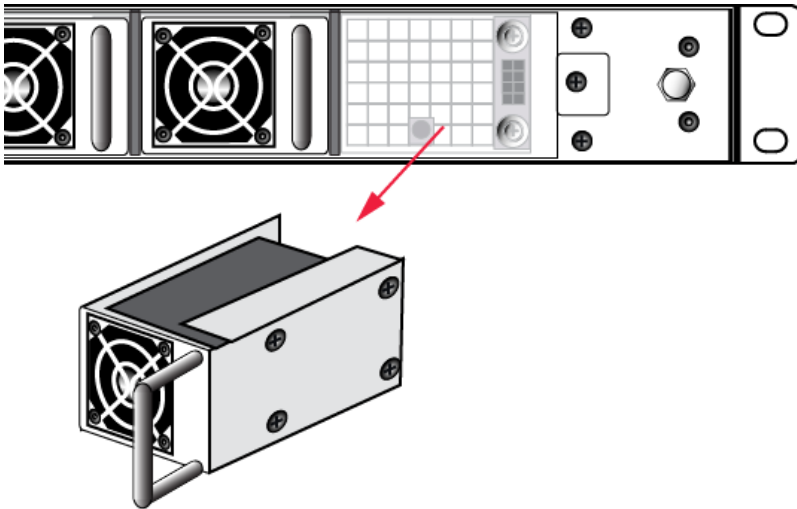
2. The fan retainer is anchored at its left by two tabs - swing the retainer out like a door, and remove it. There is no need to separate the filter mesh and its retainer from the larger fan retainer; the assembly can come out as one piece. The illustration below happens to show them separated.



3. The fan modules are now exposed and are held in place only by the friction of their electrical connectors.
4. Grasp the handle of the selected fan module and pull straight out toward you.



5. After slight initial resistance, the fan module should easily slide free of the appliance.



6. To replace the fan module or install a new one, reverse the above sequence.  
The index peg on the back of the module, and the matching index hole at the back of the fan bay, ensure that the module can be inserted only in its proper orientation.
7. Close up, replace the bezel, reconnect any cables, and return the appliance to service. If the power was left on during the operation, you will nevertheless need to restart (lunash:> [sysconf appliance reboot](#)) in order to clear the tamper event caused by opening the fan bay.
8. You will also need to re-Activate your application partitions by logging in with the PED key and challenge secret before your clients can resume accessing them (see [Activation and Auto-activation on Multi-factor-\(PED-\) Authenticated Partitions](#)).

## Summary

Removing, cleaning, and replacing the fan filter (the black mesh behind the grille) does not cause a tamper, and can be done at any time without disrupting your Clients.

Opening the fan bay (behind the filter), by unscrewing that Torx screw, does cause a tamper and therefore some down-time for your Clients. If only one fan module is showing a defect, you can probably leave replacing it until scheduled down-time, during which there would be no unexpected disruption to your Clients.

## HSM Emergency Decommission Button

The SafeNet appliance includes a way to decommission the HSM, or permanently deny access to all objects on it, without need for either a serial console or a remote (SSH) connection.

To directly decommission the HSM inside the SafeNet appliance, press and release the small red button on the front panel.

- > The appliance does not need to be powered on.
- > The appliance does not need to have power cables connected.



You will need a small screw-driver or other tool to reach the Emergency Decommission button. This is intentional, to preclude accidental pressing of that button.

## What the Emergency Decommission Button Does

When you press the Decommission button, all partitions and their contents are deleted, as well as the audit role, and the audit configuration. The HSM policy settings are retained.

To bring the HSM back into service, you need to:

1. Reinitialize the HSM
2. Reinitialize the audit role and reconfigure auditing
3. Recreate the partitions
4. Reinitialize the partition roles

### Event Summary

Here is what you would observe after the button is depressed:

- > The LCD on the appliance front panel freezes. Communication to the HSM key card is blocked, as is the software process that polls the HSM for status.
- > At this point, you must power cycle the SafeNet appliance by depressing the momentary-contact START/STOP switch on the back panel of the system.
- > After restarting, writes a tamper log message to the messages syslog.
- > `lunash:> hsm show` displays the text "Manually Zeroized: Yes", to signify that the system executed the decommission process.
- > The HSM must be re-initialized (`lunash:> hsm init`) before you can begin using it again.

### Comparison Summary

View a table that compares and contrasts the "Emergency Decommission" event with other deny access events or actions that are sometimes confused: [Comparison of Destruction/Denial Actions](#).

## Disabling Decommissioning

You can disable the decommissioning feature if you have the factory-installed Capability 46: Allow Disable Decommission and Policy 46: Disable Decommission (see [HSM Capabilities and Policies](#)). The primary reason for disabling decommissioning is to prevent the HSM from being automatically decommissioned due to loss of battery (see [Tamper Events](#)). If decommissioning is disabled, the SafeNet Luna Network HSM has an indefinite shelf life, as far as the battery is concerned.

### To disable decommissioning

1. Ensure that the Disable Decommissioning capability is installed on the HSM. To verify that the capability is installed, enter the following command:  
  
`lunash:> hsm showpolicies`  
  
If the capability is installed, Capability 46: Allow Disable Decommission and Policy 46: Disable Decommission are listed.
2. Enable Policy 46: Disable Decommission.



```
lunash:> hsm changepolicy -policy 46 -value 1
```

## When to Use the Emergency Decommission Button

The primary purpose of the decommission button is for a situation where the appliance is not responding, you wish to send it back to Thales Group, but you need a way to permanently prevent access to material contained within the HSM.

You might find other uses, in your organization.

### What to do after decommission if the SafeNet Luna Network HSM is being returned to Thales Group

1. Obtain a Return Material Authorization and shipping instructions from Thales Group, if you have not already done so.
2. Pack the appliance and ship it to Thales Group.

## Serial Connections

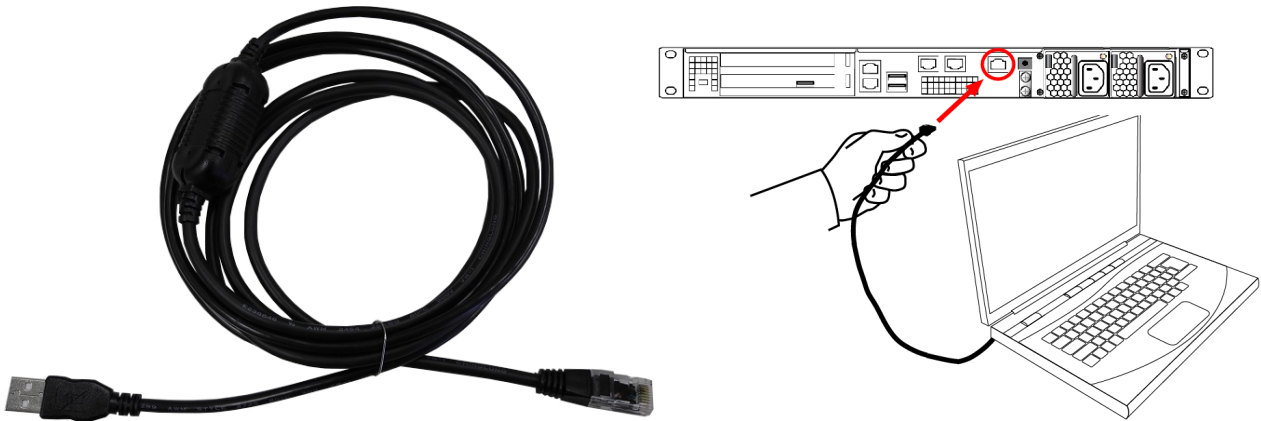
You can use a serial connection to connect a computer directly to the SafeNet Luna Network HSM to access the LunaSH command line. You must use a serial connection to perform your initial configuration. Once the network parameters are established, you can switch to an SSH session over your network.

Direct administration connection via serial terminal is the method for initial configuration for the following reasons:

- > The specific IP address, randomly assigned to your SafeNet appliance by an automated testing harness during final factory testing, is unknown.
- > Configuring network settings via SSH, in addition to requiring the original IP address, necessarily involves losing that connection when a new IP is set.
- > A direct serial connection is the only route to log into the "Recover" account, in case you ever lose the appliance's admin password and need to reset. Therefore, you should verify that the connection works before you need it - performing the appliance's network configuration is an ideal test.
- > If you ever need to issue the `lunash:> hsm factoryreset` command, you must be connected through a local serial console for that command to be accepted.

### To open a serial connection:

1. Connect the serial port on the HSM appliance's rear panel to a terminal server, dumb terminal, PC, or laptop, using the supplied Prolific Technology Inc. USB to RJ45 (with 8P8C connector) adapter.



- If the driver for the Prolific Technology Inc. USB to RJ45 (with 8P8C connector) adapter did not download and install automatically, go to <http://www.prolific.com> to download and install the PL2303 USB-to-Serial Windows driver.
- Open **Device Manager (Control Panel > Hardware > Device Manager)** and expand the **Ports (COM and LPT)** folder. If the driver installed successfully, an entry is displayed for the **Prolific USB-to-Serial Comm Port**, followed by the port associated with the adapter. For example:

Prolific USB-to-Serial Comm Port (COM4)

Record the COM port (COM4 in this example) associated with the adapter. You will need this port number when you open a serial connection.

- Use a terminal emulation package, such as PuTTY, to open a serial connection to the COM port associated with your Prolific USB-to-Serial adapter. Set the serial connection parameters as follows:

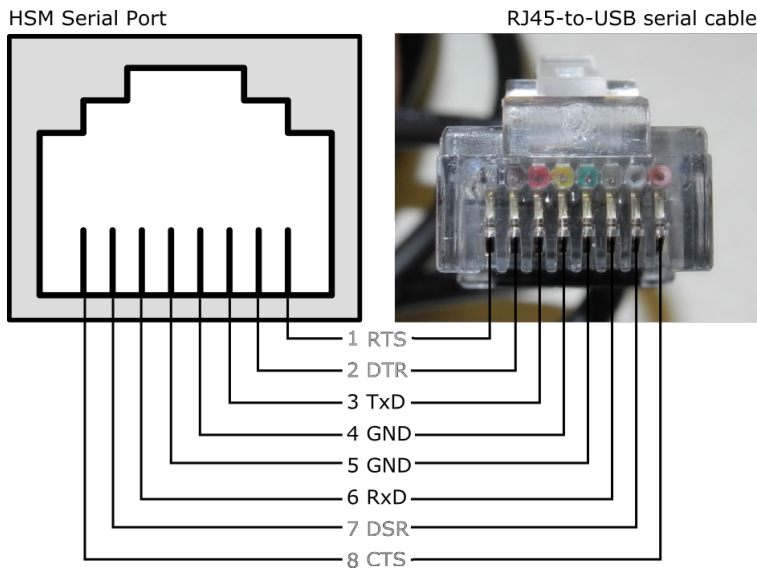
<b>Baud rate</b>	115200
<b>Data bits</b>	8
<b>Parity</b>	None
<b>Stop bits</b>	1

- When the connection is made, the HSM appliance login prompt appears: **[local\_host] login:**, where [local\_host] is the currently configured host name. The displayed host name is updated when you assign a new host name to your HSM appliance and open a new session.

**NOTE** You might need to press **ENTER** several times to initiate the session. You must log in within two minutes of opening an administration session, or the connection will time out.

## Serial Pinout

The Network HSM appliance serial port uses a configuration equivalent to the Cisco Terminal Console. The Prolific Technologies Inc. RJ45-to-USB serial adapter cable uses a standard RJ45 pinout configuration:



**NOTE** The Network HSM appliance does not implement serial handshaking, so RTS/CTS (pins 1 and 8) and DSR/DTR (pins 7 and 2) are not used for a successful connection. The important signals are TxD and RxD (pins 3 and 6).

## Troubleshooting

This section contains recommendations for troubleshooting serial connections on the SafeNet Luna Network HSM.

### Windows 10 occasionally crashes when trying to detect a serial port

This is a known issue with the Windows 10 PL2303 drivers. If you experience trouble opening a serial connection using Windows 10, use another supported operating system.

## Front Locking Bezel

The locking bezel (pictured below) fits over the front of the HSM appliance for maximum physical access security. The purpose of the bezel is to:

- > cover the appliance's ports, and the power button,
- > lock the appliance to the rack to prevent removal.



The locking bezel comes with three (3) keys for each lock. The locks are keyed differently so that keys can be issued to different security personnel and kept in secure, separate locations.

### To lock the bezel:

1. The locks fit over the posts highlighted below. Fit the bezel over the posts with both keys in the horizontal position.



2. Turn the keys to the vertical position to lock the bezel.



Remove the keys and store them in a secure location.

## Replacement Keys

To obtain replacement keys, contact Technical Support (see ["Support Contacts" on page 11](#)). Please have the lock serial numbers ready. You can find these numbers on the sides of the bezel by each lock.

## Power Consumption

When installed and connected to appropriate electrical power sources, SafeNet Luna Network HSM draws power as follows:

Activity	Draw
Standby (connected to AC electrical mains but not powered on)	26W (typical)
Power-on Input Surge	15A (typical) 40A at 90-132VAC (max) 60A at 180-265VAC (max)
Active (under load from clients)	84W (typical) 100W (max)

The SafeNet appliance has two power supplies, each rated at 350W, either of which is capable of running the system alone.

# CHAPTER 3: Configuring the SafeNet Luna Network HSM for Your Network

This chapter describes how to configure your SafeNet Luna Network HSM appliance so that you can access it over the network. This involves performing the following tasks, in the order specified:

1. ["Powering Up the Appliance" below](#)
2. ["Opening a Serial Connection" on the next page](#)
3. ["Logging In to LunaSH" on page 88](#)
4. ["Recommended Network Characteristics" on page 57](#)
5. ["IPv6 Support and Limitations" on page 59](#)
6. ["Configuring IP and Network Parameters" on page 61](#)
7. ["Making Your Network Connection" on page 66](#)
8. [Optional] ["Setting TLS Ciphers" on page 67](#)
9. ["Setting the System Date and Time" on page 69](#)
  - a. ["Setting the Time Zone" on page 73](#)
  - b. ["Correcting Clock Drift Manually" on page 74](#)
  - c. ["NTP on SafeNet Luna Network HSM" on page 75](#)
10. ["Generating the HSM Server Certificate" on page 77](#)
11. ["Binding Your NTLIS or SSH Traffic to a Device" on page 78](#)
12. [Optional] ["Configuring RADIUS Authentication" on page 80](#)

## Powering Up the Appliance

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Instructions on this page assume that the SafeNet Luna Network HSM appliance has been installed, including the following:

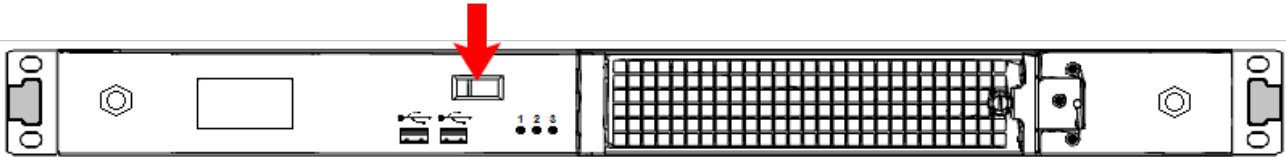
- > Power connections: We suggest that each of the two power supplies be connected to an independent electrical source, and that at least one of those sources should be protected by UPS (uninterruptible power supply) and generator backup.
- > A connection between the HSM appliance's serial terminal port and your administration computer or a terminal. This is a recommended option, so your administrative connection remains active when you assign new IP addresses; later, you would need a local serial link if you ever need to log in to the Recover account. See ["Making Your Network Connection" on page 66](#).

The following instructions require the HSM appliance to be connected and running.

## Power On Instructions for the SafeNet Appliance

On the back panel, ensure that the power supplies are connected and working - the green LED on each power supply should glow steadily.

If the appliance does not immediately begin to start up, press and release the START/STOP switch  on the front panel.



The HSM appliance begins to power up.

If power was removed while the system was on (either a power failure, or the power cable was disconnected), then the system should restart without a button press. This behavior allows unattended resumption of activity after power interruption.

The front-panel LCD begins showing activity, then settles into the ongoing system status display once the appliance has completed its boot-up and self-test activity. See ["Front-panel LCD Display" on page 36](#).

## Power Off

To power-off the HSM appliance locally, press and release the START/STOP switch. Do not hold it in. The HSM appliance then performs an orderly shutdown (that is, it closes the file system and shuts down services in proper order for the next startup). This takes approximately 30 seconds to complete. In the unlikely event that the system freezes and does not respond to a momentary "STOP" switch-press, then press and hold the START/STOP switch for five seconds. This is an override that forces immediate shutoff.

**CAUTION!** Never disconnect the power by pulling the power plug. Always use the START/STOP switch.

To switch off the HSM appliance from the LunaSH command line, use `lunash:> sysconf appliance poweroff`.

Next, see ["Opening a Serial Connection" below](#).

## Opening a Serial Connection

It is best to perform your initial configuration via direct serial connection to the SafeNet Luna Network HSM appliance. Once network parameters are established, you can switch to an SSH session over your network. However, if you are setting up your appliance on a network using DHCP, you can connect via SSH using the IP automatically assigned to the appliance's network interface.

Direct administration connection via serial terminal is the best method for initial configuration for the following reasons:

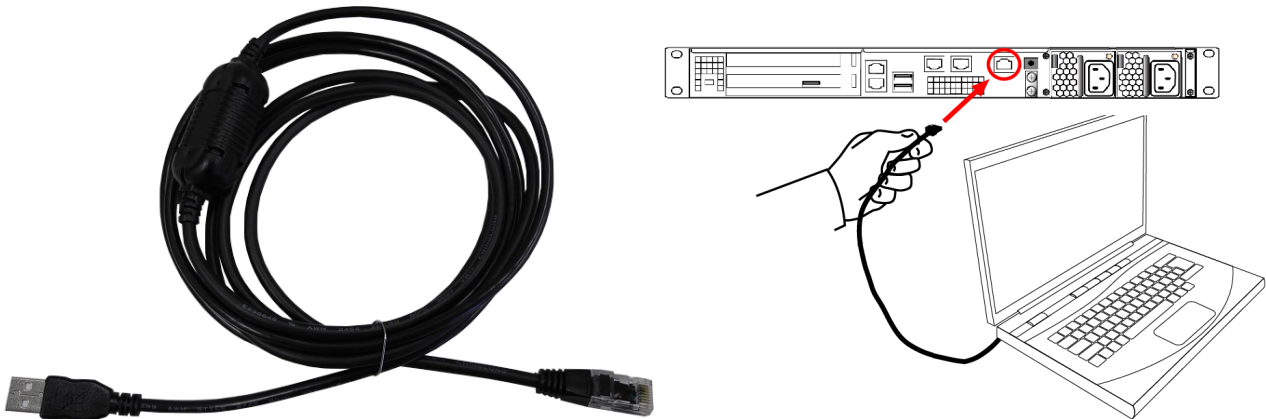
- > When configuring network settings via SSH, in addition to requiring the original IP address, you may lose the connection when a new IP is set.



- > A direct serial connection is the only route to log into the **recover** account, in case you ever lose the appliance's **admin** password and need to reset. Therefore, you should verify that the connection works before you need it - performing the appliance's network configuration is an ideal test.
- > If you ever need to issue the `lunash:> hsm factoryreset` command, you must be connected through a local serial console for that command to be accepted.

### To open a serial connection

1. Connect the serial port on the HSM appliance's rear panel to a terminal server, dumb terminal, PC, or laptop, using the supplied Prolific Technology Inc. USB to RJ45 (with 8P8C connector) adapter.



**NOTE** Do not connect the serial cable to one of the Ethernet ports.

2. If the driver for the Prolific Technology Inc. USB to RJ45 (with 8P8C connector) adapter did not download and install automatically, go to <http://www.prolific.com> to download and install the PL2303 USB-to-Serial Windows driver.
3. Open **Device Manager (Control Panel > Hardware > Device Manager)** and expand the **Ports (COM and LPT)** folder. If the driver installed successfully, an entry is displayed for the **Prolific USB-to-Serial Comm Port**, followed by the port associated with the adapter. For example:
 

```
Prolific USB-to-Serial Comm Port (COM4)
```

 Record the COM port (COM4 in this example) associated with the adapter. You will need this port number when you open a serial connection.
4. Use a terminal emulation package, such as PuTTY, to open a serial connection to the COM port associated with your Prolific USB-to-Serial adapter. Set the serial connection parameters as follows:

<b>Baud rate</b>	115200
<b>Data bits</b>	8
<b>Parity</b>	None
<b>Stop bits</b>	1

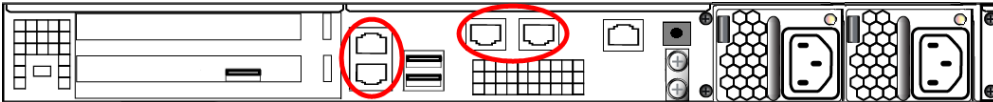


- When the connection is made, the HSM appliance login prompt appears: **[local\_host] login:**, where [local\_host] is the currently configured host name. The displayed host name is updated when you assign a new host name to your HSM appliance and open a new session.

**NOTE** You might need to press **ENTER** several times to initiate the session. You must log in within two minutes of opening an administration session, or the connection will time out.

### To open an SSH connection:

- Connect one or more network devices in the rear panel of the appliance to a network with a running DHCP server.



- Wait for the appliance to acquire a new IP address from the DHCP server. The new IP will be displayed on the front-panel LCD screen.
- Use SSH, or an SSH application such as PuTTY, to connect to the appliance using the displayed IP address.

Next, see "[Logging In to LunaSH](#)" on page 88.

## Recommended Network Characteristics

Determine whether your network is configured optimally for use of SafeNet appliances.

**NOTE** Always employ network security best practices. Place the SafeNet Luna Network HSM behind a firewall.

### Bandwidth and Latency Recommendation

#### Bandwidth

- > Minimum supported: 10 MB half duplex
- > Recommended: at least 100 MB full duplex
  - full Gigabit Ethernet is supported by default on all 7.x Network HSM appliances
  - 10 Gigabit Optical Ethernet is a Network HSM appliance factory-purchase option (i.e., not field upgradeable).

**NOTE** Ensure that your network switch is set to AUTO negotiation, as the SafeNet appliance negotiates at AUTO. If it is not, there is a risk that the switch and the SafeNet appliance will settle on a much slower speed than is actually possible in your network conditions.

#### Network Latency

- > Maximum supported: 500ms

- > Recommended: 0.5ms

## Latency and Testing Troubleshooting

SafeNet appliance client-server communication uses timeouts less than 30 seconds to determine failure scenarios. Thus the appliance does not tolerate network configurations or conditions that introduce a greater delay - problems can result, especially with High Availability configurations.

When you disconnect the network cable between any SafeNet appliance and a switch, and then reconnect, traffic should resume immediately, but with certain network switch configurations it might take 30 seconds for traffic to resume. The problem here is at the switch (not the SafeNet appliance).

If the switch is configured to run the Spanning Tree Protocol on the port, then there is a delay of about 30 seconds while it runs through a series of discovery commands and waits for responses. The switches can be configured to run in "PortFast" mode in which the Spanning Tree Protocol still runs on the port, but the port is placed directly into 'forwarding mode' and starts the traffic flowing immediately.

With the switch introducing a connection detection delay of 30 seconds or greater, transient network failures lasting only seconds are no longer tolerated. A simple test is to set up a ping stream and then disconnect and reconnect the network cable. The ping traffic should resume after a 1 or 2 second delay. A greater delay indicates that a switch in the network is not detecting the reconnection as quickly as is optimal. See the recommendations for network Bandwidth and Latency.

## KeepAlive Setting

The Network Trust Link Service uses a keepalive function on the TCP layer, to maintain awareness of the link in low-traffic situations. The intent is to allow the Network HSM appliance to detect a dead peer (client) and respond appropriately. Response is invoked in situations where the client TCP stack has no opportunity to send a TCP reset to the NTL service on the Network HSM, like:

- > client is powered down, or
- > a network outage occurs

In such a situation, *if ntl tcp\_keepalive is set*, then the NTL service (on the Network HSM appliance) recognizes a dropped connection after  $(idlevalue + (intervalvalue \times probesvalue)) / 60 = minuteswaiting$

In the same situation *without ntl tcp\_keepalive* enabled, a disconnected client would not be detected by NTL (on the appliance) and the connection would be held in a Close\_Wait state until NTL service was restarted.

### How to decide

Many customer use-cases involve opening a session for a brief cryptographic operation or series of operations, and then closing the session. In such cases, the default values for the keepalive function are appropriate.

In the event that your application opens sessions that remain idle for long periods, with occasional bursts of activity, consider using the **ntl tcp\_keepalive set** command with recommended values like these:

```
lunash:> ntl tcp_keepalive set -idle 200 -interval 150 -probes 15
```

Otherwise, set whatever values work best for your application's behavior/requirements and your anticipated network conditions.

## IPv6 Support and Limitations

Internet Protocol version 6 (IPv6) is the most recent version of the Internet Protocol (IP). It is the result of a study effort from IETF to address limitations in IPv4 that date back to the 1970s. The "World IPv6 Launch" day occurred on June 6, 2012.

IPv6 upgrades to IPv4 are in the internet layer. The link layer remains unchanged. Transport layer and above are unchanged.

<b>application layer</b>	SSH, TLS/SSL, HTTPS
<b>transport layer</b>	TCP/UPD
<b>internet layer</b>	IP ← <i>All IPv4 to IPv6 upgrades are in this layer.</i>
<b>link layer</b>	Ethernet

In supporting IPv6, not everything in IPv4 was affected; some subsystems in the internet layer like routing protocols remain the same. The major internet layer upgrades to support IPv6 include:

- > 128-bit IP address
- > Fixed length, 40-byte header with support for new, optional Extension Headers
- > Native security
- > Auto-configuration

The most talked about feature in IPv6 is the vastly increased availability of IP addresses due to the IP address size increase from 4 bytes (billions) to 16 bytes (undecillions).

Unlike IPv4, IPv6 doesn't have broadcast addresses; it only has unicast and multicast addresses. A broadcast address is the logical address used for transmission to all network-connected hosts. A multicast address is similar to a broadcast address but its scope is limited to a defined group of network-connected hosts. A unicast address is used for point-to-point transmission.

### Global Unicast Address format



For more information on IPv6 addressing, refer to the IP Version 6 Working Group (IPv6) at <https://datatracker.ietf.org/wg/ipv6/documents/>. Also, try: <https://en.wikipedia.org/wiki/IPv6>.

### IPv6 in the Context of the SafeNet Luna Network HSM

Most software components in the SafeNet Luna Network HSM operate in the application layer. They use TLS/SSL on top of TCP, but nothing uses the internet layer directly.

Likewise, changes in the internet layer shouldn't directly affect the application layer, but there are some utilities in SafeNet Luna Network HSM that use information from the internet layer, particularly the IP address, for authentication purposes; they will be affected by upgrading IPv4 to IPv6.

### IPv6 Address Configuration Options

You can configure IPv6 addresses using static, SLAAC, or DHCPv6 addressing.

<b>Static</b>	Use lunash:> <a href="#">network interface static</a>
<b>SLAAC</b>	Use lunash:> <a href="#">network interface slaac</a> <b>Note:</b> You must have a SLAAC-enabled router in your network that is reachable by the HSM appliance to configure a network interface and obtain an IPv6 address using SLAAC protocol.
<b>DHCPv6</b>	Use lunash:> <a href="#">network interface dhcp</a>

### IPv6 Network Gateway

IPv6 devices must use an IPv6 gateway.

### IPv6 Subnet Mask (Network Mask)

IPv6 devices must use CIDR notation for the subnet mask in IPv6 global unicast format.

For example, in IPv6 global unicast format, a subnet mask of /48 means that the 64-bit Network/Routing prefix will consist of a 48-bit site prefix, leaving 16 bits for the Subnet Identifier.

Typically, within a site, /64 is used to identify a whole subnet; global routing prefix + subnet ID.

## Limitations When Using IPv6 on the SafeNet Luna Network HSM

You should be aware of the following limitations before attempting to use IPv6 on your SafeNet Luna Network HSM.

### Client and SafeNet Luna Network HSM must use the same IP version

Clients connecting to the SafeNet Luna Network HSM appliance must use the same IP version that is configured on the appliance port they are connecting to, so certificates can resolve. Therefore, all clients connecting to an IPv4 port must have an IPv4 address, and all clients connecting to an IPv6 port must have an IPv6 address.

### Secure Trusted Channel (STC) links not available via IPv6

STC links are not supported over an IPv6 network. You must use NTLS to make partition-client connections via IPv6.

### Single global IPv6 address per network interface

You must use a single global IPv6 address for each active network interface: eth0, eth1, eth2, and/or eth3. You must use a single global IPv6 address for each active Luna HSM Client.

IPv6 address assignment methods (Static, DHCPv6, or SLAAC) are all allowed, however only one is allowed at a time. For example, avoid configuring your network infrastructure such that the following unsupported condition (scheme # 5 in the following table) occurs.

Scheme #	Address assignment scheme	RA M flag (on/off)	RA O flag (on/off)	Has RA prefix info (yes/no)	RA prefix info A flag(on/off)	Supported
1	Static	either	either	either	either	yes
2	DHCPv6 (stateful)	on	either	either	off	yes
3	DHCPv6 (stateless)	off	on	yes	on	yes
4	SLAAC	off	off	yes	on	yes
5	SLAAC + DHCPv6	<b>on</b>	either	yes	<b>on</b>	<b>no</b>

**Notes:**

1. “RA” stands for Router Advertisement, the critical NDP message used in IPv6 auto-configuration.
2. The above table assumes that a functioning DHCPv6 server is on the network.
3. Scheme #3 (“Stateless” DHCPv6) is configured on SafeNet Luna Network HSM 7.x using SLAAC for address assignment, but DHCPv6 is still used to configure network services like DNS.

**Example:**

The following example for the eth2 interface is not supported since it has both DHCP, 2018:1:2:3::dcd5/128, and SLAAC, 2018:1:2:3:215:b2ff:fea8:fd44/64, global addresses (i.e. entries with “scope global”).

```
4: eth2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP qlen 1000
    link/ether 00:15:b2:a8:fd:44 brd ff:ff:ff:ff:ff:ff
    inet6 2018:1:2:3::dcd5/128 scope global dynamic
        valid_lft 1036733sec preferred_lft 691133sec
    inet6 2018:1:2:3:215:b2ff:fea8:fd44/64 scope global noprefixroute dynamic
        valid_lft 2591923sec preferred_lft 604723sec
    inet6 fe80::215:b2ff:fea8:fd44/64 scope link
        valid_lft forever preferred_lft forever
```

## Configure the IP Address and Network Parameters

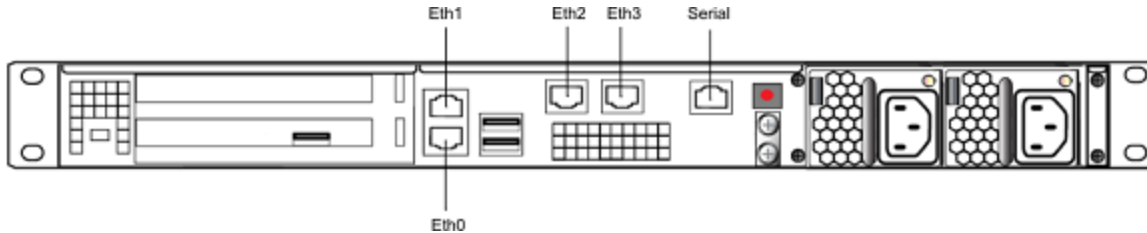
To proceed with configuring the IP address and other network parameters for the SafeNet Luna Network HSM, go to ["Configuring IP and Network Parameters"](#) below.

## Configuring IP and Network Parameters

The SafeNet Luna Network HSM is a network device that is intended to be installed in a data center and accessed remotely over a network. Network access to the SafeNet Luna Network HSM is provided by four 1 Gb/s Ethernet LAN ports. The SafeNet Luna Network HSM is also equipped with an RJ-45 serial port, used to provide serial access to the appliance for initial network configuration.

**NOTE** Always employ network security best practices. Place the SafeNet Luna Network HSM behind a firewall.

The network device interfaces (eth0, eth1, eth2, and eth3) and serial port are located on the rear of the appliance, as illustrated below:



### Serial port

Use the serial port to connect a serial device to the SafeNet Luna Network HSM for access to LunaSH to perform initial network configuration. You will need to use the serial port to configure at least one of the network interfaces. Once you have configured an interface, you can connect the appliance to the network and access LunaSH to complete the network configuration.

### Appliance network configuration

The following network parameters are configured at the appliance level:

- > Appliance hostname. A hostname is optional, unless you are using DNS.

### Ethernet LAN device configuration

The SafeNet Luna Network HSM is equipped with four individually-configurable 1 GB/s auto-sensing Ethernet LAN network devices. You can configure the following network settings for each device:

- > IPv4 or IPv6 address. You can configure the addresses using static or DHCP addressing. If you are using IPv6 addressing, you can also use Stateless Autoconfiguration (SLAAC) to have a SLAAC-enabled router in your network automatically configure an IPv6 address on a device.
- > Network gateway. IPv4 devices must use an IPv4 gateway. IPv6 devices must use an IPv6 gateway.
- > Network mask. IPv4 devices must use dotted-quad format (for example, 255.255.255.0). IPv6 devices can use full or shorthand syntax.
- > Static network route.
- > DNS configuration. Although you configure DNS at the device level, the settings you configure for a device are available to all devices on the appliance if the configured device is connected to the network. To ensure DNS access, it is recommended that you configure each device. You can configure the following settings:
  - DNS nameservers. You can add up to three DNS nameservers.
  - DNS search domains.

These settings apply to static network configurations only. If you are using DHCP, the DNS search domains and DNS nameservers configured on the DHCP server are used.

**Port bonding: Bond two ports into a single virtual redundant interface**

The SafeNet Luna Network HSM supports port bonding. Port bonding allows you to create a bond between two interfaces (eth0 and eth1, or eth2 and eth3) into a single bonded interface (bond0 or bond1). In a bonded interface, both ports are bound to a virtual interface with a single IP address, with one port active and one port standby. See ["SafeNet Luna Network HSM Appliance Port Bonding" on page 109](#) for more information.

**NTLS binding: Bind NTLS traffic to a specific device**

You can bind the NTLS traffic (used to securely transport cryptographic messages exchanged between a client and the HSM across the network) to a specific Ethernet device (eth0, eth1, eth2, eth3, bond0, bond1, all) on the appliance. This allows you to divide the traffic going to the appliance into cryptographic (destined for the HSM) and administrative (LunaSH) streams, for enhanced security and performance. See ["Binding Your NTLS or SSH Traffic to a Device" on page 78](#) for more information.

**SSH binding: Bind SSH traffic to a specific device, hostname, or IP address**

You can optionally bind/restrict the SSH traffic (used to securely transport administrative messages across the network) to a specific Ethernet device (eth0, eth1, eth2, eth3, bond0, bond1, all) on the appliance, to the appliance hostname, or to a specific IP address. This allows you to divide the traffic going to the appliance into cryptographic (destined for the HSM) and administrative (LunaSH) streams, for enhanced security and performance. By default, SSH traffic is unrestricted. See ["Binding Your NTLS or SSH Traffic to a Device" on page 78](#) for more information.

## Gathering Appliance Network Information

Before you begin, obtain the following information (see your network administrator for most of these items):

**HSM Appliance Network Parameters**

- > IP address and subnet mask for each LAN port you want to use (if you are using static IP addressing)
- > Hostname for the HSM appliance (registered with network DNS)
- > Domain name (per port)
- > Default gateway IP address (per port)
- > DNS Name Server IP address(es) (per port)
- > Search Domain name(s) (per port)
- > Device subnet mask (per port)

**DNS Entries**

- > Ensure that you have configured your DNS Server(s) with the correct entries for the appliance and the client. The Network HSM appliance expects fully qualified hostnames.
- > If you are using DHCP, then all references to the Client and the HSM appliance (as in Certificates) should use hostnames.

## Other Considerations

Clients need to be able to route directly to each HSM appliance they need to talk to, with no load balancing in place. The SafeNet Luna Network HSM does not work with off-the-shelf load balancers and service discovery techniques. You can NAT or forward the traffic so long as it always goes to the same place so the TLS tunnel isn't terminated by outside forces.

## Configuring the Network Parameters

You can use the serial connection to configure all of your network parameters now, or you can perform a minimal configuration now, where you only configure a single port, and then use the configured port to access the appliance over the network and complete the configuration.

**NOTE** Use a locally connected serial terminal when changing the appliance IP address, to avoid SSH admin console disconnection due to the change.

### To configure the appliance and port network parameters

You can configure all of the ports now, using the serial connection, or you can configure only one port now, and then use a network connection to that port to configure the remaining ports. It is recommended that you configure and test each device. You need to know the IP address of at least one network interface to establish a SSH connection to the appliance.

Once configured, you can find the interface IP addresses on the appliance's front-panel LCD screen. If there is no IP address shown on the LCD, you must use a serial port connection to connect to the appliance.

1. Configure the IP address, network mask, and gateway (optional) on at least one of the Ethernet LAN ports, using the **network interface** command. You can configure the ports to use an IPv4 or IPv6 address. A mix of IPv4 and IPv6 ports is supported.

**CAUTION!** Clients connecting to the appliance must use the same IP version that is configured on the port they are connecting to, so that certificates resolve. That is, all clients connecting to an IPv4 port must have an IPv4 address, and all clients connecting to an IPv6 port must have an IPv6 address.

- If you are configuring an IPv4 address, you can configure a static address, or use DHCP.

<b>Static</b>	lunash:> <b>network interface static -device</b> <netdevice> <b>-ip</b> <IP_address> <b>-netmask</b> <netmask> <b>[-gateway</b> <IP_address>]
<b>DHCP</b>	lunash:> <b>network interface dhcp -device</b> <netdevice>

- If you are configuring an IPv6 address, you can configure a static address, configure the port to obtain an IPv6 address using the Stateless Address Autoconfiguration (SLAAC) protocol, or use DHCP. To use SLAAC, you must have a SLAAC-enabled router in your network.

<b>Static</b>	lunash:> <b>network interface static -device</b> <netdevice> <b>-ip</b> <IP_address> <b>-netmask</b> <netmask> <b>[-gateway</b> <IP_address>] <b>-ipv6</b>
---------------	--



<b>SLAAC</b>	lunash:> <b>network interface slaac -device</b> <netdevice>
<b>DHCP</b>	lunash:> <b>network interface static -device</b> <netdevice> <b>-ipv6</b>

You are prompted to confirm the action. If no network cable is attached to the port you configured, the following message is displayed:

```
Warning. Unable to activate interface <netdevice> Ensure that the network cable is connected.
```

This message is informational. The interface will automatically activate when you connect a network cable to the port.

- Optional: If you wish to use the Port Bonding feature described above to configure bond0 and/or bond1 interface, use lunash:> **network interface bonding config** and lunash:> **network interface bonding enable**. See "[SafeNet Luna Network HSM Appliance Port Bonding](#)" on page 109 for more information.
- Optional: If desired, set the appliance hostname and domain name. You can specify a simple hostname or a Fully Qualified Domain Name (FQDN) using the format <hostname.domainname>. If you supply a hostname that includes a space, all text after the space is ignored. For example, if you typed **network hostname my hsm** the system would assign a hostname of "my". Therefore, if you want "my hsm", use "my\_hsm", "my-hsm", or similar.

```
lunash:> network hostname <hostname>
```

You must configure your DNS server to resolve the hostname to the IP address configured on the Ethernet port of the appliance. Do this for each Ethernet port you are configuring. See your network administrator for assistance.

- Optional: If you wish to use the NTLS or SSH binding features described above to restrict NTLS or SSH messages to an interface (eth0, eth1, eth2, eth3, bond0, bond1, all), use the **ntls bind** or **sysconf ssh** commands. See "[Binding Your NTLS or SSH Traffic to a Device](#)" on page 78 for more information.
- Optional: If desired, add a domain name server to the network configuration for the appliance. The name server is added to the appliance DNS table. You can add up to three different DNS name servers to the appliance DNS table. There is one DNS table that applies to all network devices (ports) on the appliance.

**NOTE** The domain name settings apply to static network configurations only. If you are using DHCP, the DNS name servers configured on the DHCP server are used.

When you add a DNS server, you add it to a specific network device on the appliance (eth0, eth1, eth2, eth3, bond0, bond1). When you add a DNS server to a device, it is added to the DNS table for the appliance and becomes available to all devices on the appliance, provided the device you added it to is connected to the network. For example, if you add a DNS server to eth0, all devices will be able to access the DNS server if eth0 is connected to the network. If eth0 is disconnected from the network, access to the DNS server is lost for any devices to which you did not add the DNS server. To ensure that any DNS server you add is available in the event of a network or port failure, it is recommended that you add it to all devices you will use to connect the appliance to the network.

```
lunash:> network dns add nameserver <ip_address> -device <net_device>
```

- Optional: If desired, add a search domain to the network configuration for the appliance. Search domains allow you to avoid typing the complete address of frequently used Internet domains by automatically appending the search domain to an internet address you specify in LunaSH. For example, if you add the

search domain **mycompany.com**, entering the command **network ping hsm1** would search for the domain **hsm1.mycompany.com**. If the domain resolves, it would ping the device with that hostname.

The search domain is added to the appliance DNS table. You can add a maximum of six search domains totaling no more than 256 characters.

**NOTE** The search domain settings apply to static network configurations only. If you are using DHCP, the DNS search domains configured on the DHCP server are used.

When you add a DNS search domain, you add it to a specific network device on the appliance (eth0, eth1, eth2, eth3, bond0, bond1). When you add a search domain to a device, it is added to the DNS table for the appliance and becomes available to all devices on the appliance, provided the device you added it to is connected to the network. For example, if you add a search domain to eth0, all devices will use the search domain if eth0 is connected to the network. If eth0 is disconnected from the network, the search domain is not used by any devices to which you did not add the search domain. To ensure that any search domain you add is available in the event of a network or port failure, it is recommended that you add it to all devices you will use to connect the appliance to the network.

```
lunash:> network dns add searchdomain <domain> -device <net_device>
```

If you have chosen to perform setup via SSH, rather than via the direct (serial) administrative connection, then you will likely lose your network connection at this point, as you confirm the change of IP address from the default setting.

7. Display the current network settings, so you can verify that they are now correct for your environment before attempting to use them.

```
lunash:> network show
```

## Making Your Network Connection

After you have configured at least one of the Ethernet LAN ports on the appliance using a serial terminal connection, you can connect the configured ports to your network and begin connecting to the appliance over the network.

### To make a network connection to the appliance:

1. Connect an Ethernet cable to each Ethernet port you configured on the appliance.
2. Use SSH, or an SSH application such as PuTTY, to connect to the appliance via one of the configured ports. For example, if you set the IP address on eth0 to 123.45.67.89, you could connect from a Linux computer using the following command:
 

```
ssh admin@123.45.67.89
```
3. You will be alerted that the server's host key is not cached in the registry. Examine the fingerprint and add the key to your SSH cache to allow the connection to proceed.
4. Login as **admin**, using the password you configured in "[Logging In to LunaSH](#)" on page 88.
5. Verify correctness of your network setup by pinging another server (lunash:> **network ping** <IP\_address>) and having the other server ping this HSM appliance. Try pinging by IP address, if pinging by host name is

not successful. If you are using DNS name servers, but you are unable to ping by host name, use `lunash:> network show` to verify the DNS name server configuration.

**NOTE** Some networks might be configured to reject ICMP ping requests, to prevent certain types of network attacks. In such a case, the ping command will fail, even if the HSM appliance is correctly configured. Consult with your network administrator.

6. Verify your client's network configuration by attempting to ping the HSM appliance by host name and by IP address, from the client. Repeat for each client where the client software was installed.

## Network LEDs

The network LEDs glow or blink to indicate the exchange of traffic, as follows.

State Indicated	Indication
Activity status	<b>Green</b> (Blinking): Activity detected
	<b>Off</b> : Not active, or LAN cable has no connection
Speed range	<b>Orange</b> : 1G
	<b>Green</b> : 100M
	<b>Off</b> : 10M/No connection

When your connection is working, go to ["Setting the System Date and Time" on page 69](#).

## Setting TLS Ciphers

The SafeNet Luna Network HSM uses a default set of cipher suites for Transport Layer Security (TLS) communications, such as client connections, remote PED connections, etc.

If the default list is not suitable, you can modify it. The cipher suite configuration allows you to choose which of the supported cipher suite(s) the appliance can use for TLS communications, and also the preferred order for their usage.

**NOTE** This feature requires appliance software version 7.2 and client 7.2. See [Version Dependencies by Feature](#) for more information.

You can change the list of TLS ciphers by listing them in the LunaSH command line in the order of desired priority (`-list`), or by creating a file containing this list and transferring it to the appliance `admin` files (`-applytemplate`). The following rules apply to both methods:

- > You can use valid OpenSSL arguments to simplify your specifications, such as:
  - **KECDHE** (cipher suites using ephemeral ECDH key agreement, in default order)
  - **kdHE** (cipher suites using ephemeral DH key agreement, in default order)
  - **kRSA** (cipher suites using RSA key exchange, in default order)

- **ALL** (all not-otherwise-specified ciphers, in default order)
- > Ciphers or arguments in the list must be separated by colons (:). For example:
- ```
ECDHE-RSA-AES256-SHA384:ECDHE-RSA-AES256-GCM-SHA384:ALL
```
- > The list/template can contain a maximum of 255 characters, including colon separators. To avoid reaching this character limit:
- Specify only the ciphers you intend to use. It is not necessary to include the entire list.
  - If you do wish to include the entire list, specify the most important ciphers first, and then use the **ALL** option to complete the list in the default remaining order.

**NOTE** Setting some of the stronger ciphers introduces additional overhead, which might affect performance.

## To configure TLS ciphers for the appliance

1. [Optional] View the list of supported ciphers in the default priority order.

```
lunash:> sysconf tls ciphers show
```

The following cipher suites are available to configure TLS:

Available Ciphers

```
-----
ECDHE-RSA-AES256-GCM-SHA384  TLSv1.2  Kx=ECDH  Au=RSA  Enc=AESGCM (256)  Mac=AEAD
ECDHE-RSA-AES256-SHA384     TLSv1.2  Kx=ECDH  Au=RSA  Enc=AES (256)    Mac=SHA384
DHE-RSA-AES256-GCM-SHA384  TLSv1.2  Kx=DH    Au=RSA  Enc=AESGCM (256)  Mac=AEAD
DHE-RSA-AES256-SHA256     TLSv1.2  Kx=DH    Au=RSA  Enc=AES (256)    Mac=SHA256
AES256-GCM-SHA384         TLSv1.2  Kx=RSA   Au=RSA  Enc=AESGCM (256)  Mac=AEAD
AES256-SHA256             TLSv1.2  Kx=RSA   Au=RSA  Enc=AES (256)    Mac=SHA256
ECDHE-RSA-AES128-GCM-SHA256 TLSv1.2  Kx=ECDH  Au=RSA  Enc=AESGCM (128)  Mac=AEAD
ECDHE-RSA-AES128-SHA256   TLSv1.2  Kx=ECDH  Au=RSA  Enc=AES (128)    Mac=SHA256
DHE-RSA-AES128-GCM-SHA256 TLSv1.2  Kx=DH    Au=RSA  Enc=AESGCM (128)  Mac=AEAD
DHE-RSA-AES128-SHA256    TLSv1.2  Kx=DH    Au=RSA  Enc=AES (128)    Mac=SHA256
AES128-GCM-SHA256        TLSv1.2  Kx=RSA   Au=RSA  Enc=AESGCM (128)  Mac=AEAD
AES128-SHA256            TLSv1.2  Kx=RSA   Au=RSA  Enc=AES (128)    Mac=SHA256
```

The selected TLS cipher suites are used by the NTLs, STC outer tunnel, RBS, Ped vector Server/Client features

TLS is using the following cipher suites:

Cipher suites are listed from highest to lowest priority.

2. Set your desired list of ciphers, with either a list or template. If you are using a template, you must first transfer the file to the **admin** files using **pscp** or **scp**.

```
lunash:> sysconf tls ciphers set {-list <cipher_list> | -applytemplate <file name>}
```

```
lunash:>sysconf tls ciphers set -list ECDHE-RSA-AES128-GCM-SHA256:kDHE:ALL
```

This operation will set the TLS cipher suites to use the following cipher suites:

Cipher suites are listed from highest to lowest priority.

Configured Ciphers (highest priority at top)

```
-----
ECDHE-RSA-AES128-GCM-SHA256  TLSv1.2  Kx=ECDH  Au=RSA  Enc=AESGCM (128)  Mac=AEAD
DHE-RSA-AES256-GCM-SHA384   TLSv1.2  Kx=DH    Au=RSA  Enc=AESGCM (256)  Mac=AEAD
DHE-RSA-AES256-SHA256      TLSv1.2  Kx=DH    Au=RSA  Enc=AES (256)    Mac=SHA256
```

```

DHE-RSA-AES128-GCM-SHA256 TLSv1.2 Kx=DH Au=RSA Enc=AESGCM(128) Mac=AEAD
DHE-RSA-AES128-SHA256 TLSv1.2 Kx=DH Au=RSA Enc=AES(128) Mac=SHA256
ECDHE-RSA-AES256-GCM-SHA384 TLSv1.2 Kx=ECDH Au=RSA Enc=AESGCM(256) Mac=AEAD
ECDHE-RSA-AES256-SHA384 TLSv1.2 Kx=ECDH Au=RSA Enc=AES(256) Mac=SHA384
AES256-GCM-SHA384 TLSv1.2 Kx=RSA Au=RSA Enc=AESGCM(256) Mac=AEAD
AES256-SHA256 TLSv1.2 Kx=RSA Au=RSA Enc=AES(256) Mac=SHA256
ECDHE-RSA-AES128-SHA256 TLSv1.2 Kx=ECDH Au=RSA Enc=AES(128) Mac=SHA256
AES128-GCM-SHA256 TLSv1.2 Kx=RSA Au=RSA Enc=AESGCM(128) Mac=AEAD
AES128-SHA256 TLSv1.2 Kx=RSA Au=RSA Enc=AES(128) Mac=SHA256

```

This operation will restart the TLS related services (NTPS, STCD, CBS).  
Type 'proceed' to set ciphers suites and restart TLS related services, or 'quit'  
to quit now. > proceed

Restarting NTPS, STC and CBS services.... Done

Command Result : 0 (Success)

### 3. [Optional] You can restore the default cipher list at any time.

```
lunash:>sysconf tls ciphers reset
```

This operation will set the TLS cipher suites to use the following cipher suites:  
Cipher suites are listed from highest to lowest priority.

Configured Ciphers (highest priority at top)

```

-----
ECDHE-RSA-AES256-GCM-SHA384 TLSv1.2 Kx=ECDH Au=RSA Enc=AESGCM(256) Mac=AEAD
ECDHE-RSA-AES256-SHA384 TLSv1.2 Kx=ECDH Au=RSA Enc=AES(256) Mac=SHA384
DHE-RSA-AES256-GCM-SHA384 TLSv1.2 Kx=DH Au=RSA Enc=AESGCM(256) Mac=AEAD
DHE-RSA-AES256-SHA256 TLSv1.2 Kx=DH Au=RSA Enc=AES(256) Mac=SHA256
AES256-GCM-SHA384 TLSv1.2 Kx=RSA Au=RSA Enc=AESGCM(256) Mac=AEAD
AES256-SHA256 TLSv1.2 Kx=RSA Au=RSA Enc=AES(256) Mac=SHA256
ECDHE-RSA-AES128-GCM-SHA256 TLSv1.2 Kx=ECDH Au=RSA Enc=AESGCM(128) Mac=AEAD
ECDHE-RSA-AES128-SHA256 TLSv1.2 Kx=ECDH Au=RSA Enc=AES(128) Mac=SHA256
DHE-RSA-AES128-GCM-SHA256 TLSv1.2 Kx=DH Au=RSA Enc=AESGCM(128) Mac=AEAD
DHE-RSA-AES128-SHA256 TLSv1.2 Kx=DH Au=RSA Enc=AES(128) Mac=SHA256
AES128-GCM-SHA256 TLSv1.2 Kx=RSA Au=RSA Enc=AESGCM(128) Mac=AEAD
AES128-SHA256 TLSv1.2 Kx=RSA Au=RSA Enc=AES(128) Mac=SHA256

```

This operation will restart the TLS related services (NTPS, STCD, CBS).  
Type 'proceed' to set ciphers suites and restart TLS related services, or 'quit'  
to quit now. > proceed

Restarting NTPS, STC and CBS services.... Done

Command Result : 0 (Success)

## Setting the System Date and Time

You can set the date and time manually using the appliance's internal clock, or by synchronizing the appliance with a network time protocol (NTP) server. NTP provides a reliable, consistent, and accurate timing mechanism using Coordinated Universal Time (UTC), and is the recommended option for providing an accurate date and time. Accurate time is important for security auditing and troubleshooting using the logs.

## New HSM

When setting up a new HSM, ensure that you set the HSM server's system date, time and time zone as appropriate for your network before generating the server certificate. The certificate becomes valid at the time of its creation, which is recorded as part of the certificate, as a GMT value. If your local time is set with an inappropriate local time zone, then the GMT time on the certificate could be incorrect by several hours. When other systems (Clients) attempt to reference your certificate, they might find that it has not yet become valid.

## Setting the Time Zone

You must set the time zone before setting the date and time, regardless of whether you are manually configuring the date and time, or using NTP.

### To set the time zone

Use the following command:

```
lunash:> sysconf timezone set <time_zone_code>
```

### Time Zone codes

You can view a list of all available time zone codes using `lunash:> sysconf timezone list`. See "Setting the Time Zone" on page 73.

If a code is depicted in the list as a major name (such as a country) followed by a list of minor names (such as city names), then write the major name followed by a forward slash ("/"), followed by the minor name, for example `America/Boston`.

The code that you enter may not look exactly like the code displayed by `lunash:> status date` or `status zone`. For example, `status date` shows EDT (i.e. Eastern Daylight Time), but to set that you must type "EST5EDT," or "Canada/Eastern" or "America/Montreal" - a number of values produce the same setting.

### SO login might be required

While attempting to set the time or zone, you might encounter a message saying that you must log into the HSM first.

```
lunash:>sysconf timezone set Europe/London
This HSM has been initialized to require that the SO is logged in
prior to running this command.
Verifying that the SO is logged in...
The SO is not currently logged in. Please login as SO and try again.
```

That message appears only if the HSM has been previously initialized with the `-authtimeconfig` option set. The work-around at this stage is to run the command `hsm init -label <yourlabeltext>` without the `-authtimeconfig` option. This way, you can perform your intended initialization out of order, and set the appliance time and zone later. We chose an order for these configuration instructions that is usually convenient and easy to understand, but having the system time set before initializing is not required. However, it is important to have the time set before you create certificates later on.

## Manually Configuring the Appliance Date and Time

If the SafeNet Luna Network HSM has been used before, then it might have been initialized with the option `-authtimeconfig`, which requires that the SO/HSM Admin be logged in before you are allowed to set time/time zone. If that is the case, then you will need to log in with the old SO credentials, or initialize the HSM first, before

you can set time and time zone.

**NOTE** Manual adjustment of the time may cause events to appear out of order. It is highly recommended that you use NTP to synchronize the appliance time.

### To set the date and time:

1. Verify the currently configured date, time, and time zone on the appliance, using the `status date` command. The command returns the current settings for date, time, and time zone. If desired, you can also use **status time** and **status zone**.

```
lunash:> status date
```

```
lunash:> status time
```

```
lunash:> status zone
```

2. If the date, time, or time zone are incorrect for your location, change them using the following command:

```
lunash:> sysconf timezone set <time_zone>
```

```
lunash:>sysconf timezone set Canada/Eastern
Timezone set to Canada/Eastern
```

```
lunash:> sysconf time <time> [<date>]
```

```
lunash:>sysconf time 15:54 20170427
Thu Apr 27 15:54:00 EDT 2017
```

**NOTE** You must set the time zone before setting the time and date, otherwise the time zone change adjusts the time that you just set.

### Drift correction for the system clock

If you require that your appliance's system clock be as correct as is practical, but are unable to use NTP for the most accurate timekeeping possible, use the system's clock-drift correction protocol. See "[Correcting Clock Drift Manually](#)" on page 74.

## Synchronizing the Appliance With a Network Time Protocol (NTP) Server

You can optionally configure the appliance to synchronize its date and time with a network time protocol (NTP) server. NTP provides a reliable, consistent, and accurate timing mechanism for the appliance using Coordinated Universal Time (UTC), and is the recommended option for providing an accurate date and time for the appliance. The appliance automatically selects the highest stratum NTP server with which it can reliably communicate. If the appliance loses communications with an NTP server, it automatically selects the next best available server.

**NOTE** If you wish to use Network Time Protocol (NTP), you must set the system time to within 15 minutes of the time given by the servers that you select. If the difference between NTP server time and the HSM appliance time is greater than 15 minutes, the NTP daemon ignores the servers and quits. To ensure that you are within the 15-minute window, we recommend setting the date and time by fetching it from an NTP server, using the **sysconf ntp ntpdate** command.

## To configure the appliance to use NTP

To use NTP, you must add one or more NTP servers to the appliance's NTP server list, and then enable the appliance to synchronize its time to the servers.

1. If you have not already done so, configure the appliance's DNS server settings. See ["Configuring IP and Network Parameters" on page 61](#).

2. Ensure that the correct time zone is set on the appliance:

```
lunash:> sysconf timezone show
```

If the appliance does not have the correct time zone configured, set it before continuing. See ["Setting the Time Zone" on page 70](#).

3. You must now set the correct date and time. You can do this:

- manually; see ["Manually Configuring the Appliance Date and Time" on page 70](#)
- by fetching it from an NTP server, using the command:

```
lunash:> sysconf ntp ntpdate <NTP_server_IP_or_hostname>
```

4. Add one or more NTP servers to the appliance's NTP server list, using the command:

```
lunash:> sysconf ntp addserver <NTP_server_IP_or_hostname>
```

This command automatically starts the NTP service and enables time synchronization with the NTP server.

5. Verify the NTP status, using the command:

```
lunash:> sysconf ntp status
```

```
[myLuna] lunash:>sysconf ntp status
NTP is running
NTP is enabled
```

```
Peers:
```

```
=====
remote          refid          st t  when  poll  reach  delay  offset  jitter
=====
*LOCAL(0)       .LOCL.         10 1   8     64    1     0.000  0.000  0.000
time-c.timefreq .ACTS.         1  u   7     64    1     78.306 -55560. 0.000
=====
```

```
Associations:
```

```
=====
ind  assid  status  conf  reach  auth  condition  last_event  cnt
=====
1    21859   963a   yes   yes   none  sys.peer   sys_peer    3
2    21860   9024   yes   yes   none  reject    reachable   2
=====
```

```
NTP Time:
```

```
=====
ntp_gettime() returns code 0 (OK)
```



```
time d1504c28.95777000 Wed, Apr 14 2014 12:22:00.583, (.583854),
maximum error 7951596 us, estimated error 0 us
ntp_adjtime() returns code 0 (OK)
  modes 0x0 (),
offset 0.000 us, frequency 0.000 ppm, interval 1 s,
maximum error 7951596 us, estimated error 0 us,
status 0x1 (PLL),
time constant 2, precision 1.000 us, tolerance 512 ppm,
=====
```

Command Result : 0 (Success)

**NOTE** The return code "5 (ERROR)" indicates a gap between your system time and the NTP server's time. If the initial time-gap between your appliance and the server is greater than 15 minutes, the appliance gives up and never synchronizes with that server. If the initial time-gap is less than 15 minutes, the appliance synchronizes with the server, slowly, over several minutes; this ensures that there is no sudden jump in system time which would be unwelcome in your system logging.

## Setting the Time Zone

In LunaSH, the **sysconf timezone** command allows you to change the current system time zone setting. The **sysconf timezone** command accepts any time zone defined in the Time Zone Database maintained by IANA (also often referred to as zoneinfo, tzdata, or tz). You may prefer to use an offset of Greenwich Mean Time (GMT), or to set your local time zone. For a list of accepted time zone abbreviations, use the command **sysconf timezone list**, or see [https://en.wikipedia.org/wiki/List\\_of\\_tz\\_database\\_time\\_zones](https://en.wikipedia.org/wiki/List_of_tz_database_time_zones).

Note that the time zone code reported by **sysconf timezone show** is a localized abbreviation. For example, the following three commands set the time zone code to "EST" or "EDT", depending on whether Daylight Saving Time (DST) is currently in effect:

- > **sysconf timezone set America/Kentucky/Louisville**
- > **sysconf timezone set America/Toronto**
- > **sysconf timezone set EST5EDT**

If you choose a named time zone, the system automatically adjusts for DST on the appropriate dates.

If you choose a simple time zone abbreviation (like **EST**) or GMT plus-or-minus a numeric offset (like **Etc/GMT+5**), that value is fixed, and the system does not adjust for DST. You must therefore make any appropriate time changes manually.

**NOTE** If you choose to enter GMT plus-or-minus a numeric offset, please note that zone names beginning with "**Etc/GMT**" have their signs reversed. Zones west of GMT have a (+) sign and zones east of GMT have a (-) sign.

## Examples

| To set the time zone to...                    | Command                                          |
|-----------------------------------------------|--------------------------------------------------|
| Eastern Standard Time                         | <b>sysconf timezone set EST</b>                  |
| Greenwich Mean Time -5 hours (same as EST)    | <b>sysconf timezone set Etc/GMT+5</b>            |
| Eastern Time (with automatic DST adjustments) | <b>sysconf timezone set EST5EDT</b>              |
| Abidjan                                       | <b>sysconf timezone set Africa/Abidjan</b>       |
| Hong Kong                                     | <b>sysconf timezone set Hongkong</b>             |
| Knox, Indiana, USA                            | <b>sysconf timezone set America/Indiana/Knox</b> |

## Correcting Clock Drift Manually

All computer systems show clock drift over time - the system time gradually deviates from accurate or "true" time. For many applications, it is important that servers and clients be working to the same time standard, and that drift be prevented or corrected.

Various methods have been devised to correct drift. The simplest and most reliable way is to implement Network Time Protocol (NTP) and receive accurate time signals from a server that is dedicated to that task and maintained to a very high standard of accuracy. This is discussed in ["NTP on SafeNet Luna Network HSM" on the next page](#).

Some situations might not permit maintaining a constant connection to an NTP server. Here we show an example of drift (over several days) and describe how to correct it using the appliance's **sysconf drift** local drift-correction commands.

### To establish time drift and set drift correction:

1. Begin drift measurement. This also sets the time. In order to establish the drift and its correction, accurate time must be used when beginning and ending drift measurement. One method is to use NTP on a different computer that has no connection to the SafeNet Luna Network HSM.

```
lunash:>sysconf drift startmeasure -currentprecisetime <hh:mm:ss>
```

**NOTE** The SafeNet Luna Network HSM appliance must run uninterrupted for several days to allow a clock drift to occur. Other testing can be done, but nothing that would potentially change the system time (no power-cycles, for example) or the exercise would need to be restarted.

You can check the status of the drift measurement at any time to ensure it has not been interrupted:

```
lunash:>sysconf drift status
```

2. Allow the drift measurement system to run for a minimum of 3 days before issuing the stop command. Issue the **stopmeasure** command with the current accurate time:

```
lunash:>sysconf drift stopmeasure -currentprecisetime <hh:mm:ss>
```

The drift measurement is automatically stored.

3. Initialize drift correction. It is best to do this immediately after stopping the measurement cycle, or it might be necessary to redo the measurement. This also resets the current time:

```
lunash:>sysconf drift init -currentprecisetime <hh:mm:ss>
```

4. You can check the status of drift correction at any time:

```
lunash:>sysconf drift status
```

---

### To set the drift correction rate manually:

1. Set the drift rate (in seconds per day):

```
lunash:>sysconf drift set
```

2. Set the current precise time and begin drift correction:

```
lunash:>sysconf drift init -currentprecisetime <hh:mm:ss>
```

3. Let drift correction run for at least 3 days, and then check the time against an accurate source to ensure that the drift correction is effective:

```
lunash:>status time
```

## NTP on SafeNet Luna Network HSM

---

Network Time Protocol (NTP) corrects clock drift by synchronizing the appliance's internal clock with a reliable, consistent, and accurate time data server. This is the recommended method of keeping an accurate date and time on the appliance. SafeNet Luna Network HSM uses NTPv4.

NTP is available from a variety of public servers. We recommend using a more secure NTP server that supports symmetric or public-key authentication, as described in ["Securing Your NTP Connection" on the next page](#). Alternatively, your organization might have established its own NTP server(s). Contact your IT manager or security officer for details. For more information about NTP authentication, see ["References" on page 77](#).

NTP will automatically synchronize with the highest-stratum server you add. If none of these servers are accessible, NTP will synchronize with the local clock, and may be subject to drift. To make manual drift corrections, see ["Correcting Clock Drift Manually" on the previous page](#).

For command syntax, see ["sysconf ntp" on page 1](#).

### Connecting to a Public NTP Server

Connections to public NTP servers are unauthenticated and therefore less secure. See ["Securing Your NTP Connection" on the next page](#) for authenticated NTP procedures.

---

### To connect to a public NTP server:

1. Ensure that NTP is enabled on the appliance.

```
lunash:>sysconf ntp enable
```

2. Add an NTP server.

```
lunash:>sysconf ntp addserver <NTPserver>
```

3. Check the NTP connection.

```
lunash:>sysconf ntp status
```

**NOTE** It may take a few minutes to synchronize the NTP server. Checking immediately may return an error.

## Securing Your NTP Connection

NTPv4 supports two types of trusted authentication: symmetric or public-key (AutoKey). Both methods require access to NTP servers configured to support authentication.

### Using Symmetric-Key Authentication

This method uses a shared secret held by both the NTP server and its client to establish a trusted connection.

#### To connect to a trusted NTP server using symmetric-key authentication:

1. Obtain the necessary key material from your NTP server administrator. For security purposes, this may be obtainable through non-electronic means only.

2. Add the symmetric key information using LunaSH:

```
lunash:>sysconf ntp symmetricauth key add -id <keyID> -type <keytype> -value <NTPkey>
```

3. Add the key ID from step 2 to the list of trusted keys:

```
lunash:>sysconf ntp symmetricauth trustedkeys add <keyID>
```

4. Add the trusted NTP server, using the **-key** option to enter the key ID for that server:

```
lunash:>sysconf ntp addserver <NTPserver> -key <keyID>
```

5. Check the NTP connection:

```
lunash:>sysconf ntp status
```

### Using Public-Key (AutoKey) Authentication

This method uses asymmetric keys held by the NTP server and client. An identity scheme is used to prove the identity of the NTP server.

#### To connect to a trusted NTP server using public-key (Autokey) authentication:

1. Obtain an identity scheme from the secure NTP server (IFF, GQ, or MV key). It must be **scp'd** to the SafeNet Luna Network HSM and installed:

```
lunash:>sysconf ntp autokeyAuth install -idscheme <IDScheme> -keyfile <filename>
```

2. Restart NTP:

```
lunash:>service restart ntp
```

3. Generate an AutoKey and set a password:

```
lunash:>sysconf ntp autokeyauth generate -password <password>
```

4. Restart NTP again:

```
lunash:>service restart ntp
```

5. Add the trusted NTP server using the **-autokey** option:

```
lunash:>sysconf ntp addserver <NTPserver> -autokey
```

6. Check the NTP connection:

```
lunash:>sysconf ntp status
```

## References

[1] NTP Documentation Page: <http://www.ntp.org/documentation.html>

[2] NTP FAQ: Authentication <http://www.ntp.org/ntpfaq/NTP-s-config-adv.htm#S-CONFIG-ADV-AUTH>

[3] NTP Public-Key Authentication: <http://www.ntp.org/ntpfaq/NTP-s-config-adv.htm#Q-CONFIG-ADV-AUTH-AUTOKEY>

[4] Autokey Identity Schemes: <http://www.eecis.udel.edu/~mills/ident.html>

[5] ntp-keygen tool: <http://doc.ntp.org/4.2.6/keygen.html>

[6] NTP Server configuration options <http://doc.ntp.org/4.2.6/confopt.html>

## Generating the HSM Server Certificate

You must generate a new HSM server certificate before placing the HSM in service. Do not use the default certificate generated at the factory.

You can also regenerate the server certificate anytime, once the HSM is in service. If you generate a new certificate, you must update your client NTLS links to use the new certificate.

### To generate a new server certificate for the SafeNet Luna Network HSM

Use the following command in LunaSH.

```
lunash:> sysconf regencert [-startdate <YYYYMMDD>] [-days <number_of_days>]
```

If your security policy requires you to change your HSM server certificates periodically, include the **-days** option to place a time limit on the certificate's validity. By default, SafeNet Luna Network HSM server certificates are valid for 3653 days (10 years).

If you want the certificate to become valid on a specific date, include the **-startdate** option. By default, the date is set to 24 hours earlier, to ensure the certificate is valid in every time zone at the time of creation.

For example:

```
lunash:>sysconf regencert
```

```
WARNING !! This command will overwrite the current server certificate and private key.
           All clients will have to add this server again with this new certificate.
If you are sure that you wish to proceed, then type 'proceed', otherwise type 'quit'
```

```
> proceed
Proceeding...
```

```
'sysconf regenCert' successful. The NTLS, STC and CBS services must be (re)started before clients
can connect.
```

Please use the 'ntls show' command to ensure that NTLS is bound to an appropriate network device or IP address/hostname for the network device(s) NTLS should be active on. Use 'ntls bind' to change this binding if necessary.

Command Result : 0 (Success)

## Binding Your NTLS or SSH Traffic to a Device

---

You can configure your appliance to restrict NTLS or SSH traffic to a specific network device (or IP address for SSH traffic):

- > NTLS is used to securely transport the cryptographic messages exchanged between a client and the HSM across the network. You must bind your NTLS traffic to a specific network device, a bonded network device, or all network devices.
- > SSH is used to securely transport the administrative messages exchanged between LunaSH and the appliance or HSM across the network. By default, SSH traffic is unrestricted. SSH binding is optional.

### Binding Your NTLS Traffic

By default, the network trust link service (NTLS) is bound to all devices (0.0.0.0). To use the SafeNet Luna Network HSM on your network, you must bind NTLS to one of the following:

- > A specific device (eth0, eth1, eth2 or eth3)
- > All devices (eth0, eth1, eth2 and eth3)
- > A bonded device (bond0 or bond1). See ["SafeNet Luna Network HSM Appliance Port Bonding" on page 109](#) for more information.

Use lunash:> **ntls bind** to bind the service. The device you configure is not used until the following conditions are met:

- > it has been configured with a valid IP address
- > it is active on the network
- > the NTLS service is restarted

This allows you to preconfigure the NTLS binding and have it become active only after you have completed your network configuration.

**NOTE** When two or more of the appliance's network interfaces are configured to operate on the same subnetwork, a known Linux networking issue can result in a lost connection due to ARP flux. To avoid this, configure the network interfaces to operate on different subnetworks.

---

### To bind your NTLS traffic to a device

Use lunash:> **ntls bind** to bind the NTLS traffic to a network device (eth0, eth1, eth2, eth3, bond0, bond1, all). You can use lunash:> **ntls show** to see the current binding.

## Example

```
lunash:>ntls bind eth0
```

NTLS binding set to network device eth0.

You must restart the NTLS service for the new settings to take effect.

If you are sure that you wish to restart NTLS, then type 'proceed', otherwise type 'quit'

```
> proceed
Proceeding...
Restarting NTLS service...
Stopping ntlsl: [ OK ]
Starting ntlsl: [ OK ]

Command Result : 0 (Success)
```

**NOTE** The “Stopping ntlsl” operation might fail in the above example, because NTLS is not yet running on a new HSM appliance. Just ignore the message.

```
lunash:>ntls show
```

NTLS is currently bound to IP Address: "192.20.11.78" (eth0)

Command Result : 0 (Success)

```
lunash:>ntls bind eth1
```

NTLS binding set to network device eth1.

You must restart the NTLS service for the new settings to take effect.

If you are sure that you wish to restart NTLS, then type 'proceed', otherwise type 'quit'

```
> proceed
Proceeding...
Restarting NTLS service...
Stopping ntlsl: [ OK ]
Starting ntlsl: [ OK ]

Command Result : 0 (Success)
```

```
lunash:>ntls show
```

NTLS is configured to bind to eth1, but it is not active at this time.

NTLS will bind to eth1 if it's active and has a valid IP address when NTLS restarts.

NTLS is currently bound to IP Address: "192.20.11.78" (eth0)

Command Result : 0 (Success)

## Binding Your SSH Traffic

You can optionally bind your SSH traffic a specific device (eth0, eth1, eth2, eth3, all) on the appliance or to a specific IP address. By default, SSH traffic is unrestricted.

### To bind your SSH traffic to a device or IP address

Use lunash:> **sysconf ssh** to bind the SSH traffic to a device or IP address, as follows:

- > To bind to a specific device, use lunash:> **sysconf ssh device** <netdevice>. For example:

```
lunash:>sysconf ssh device eth1
```

```
Success:  SSH now restricted to ethernet device eth1 (ip address 192.168.255.2).
Restarting ssh service.
```

```
Stopping sshd:                [ OK ]
```

```
Starting sshd:                [ OK ]
```

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

```
[myluna] lunash:>sysconf ssh show
```

```
SSHD configuration:
```

```
SSHD Listen Port: 22 (Default)
```

```
SSH is restricted to ethernet device eth1 (ip address 192.168.255.2).
```

```
Password authentication is enabled
```

```
Public key authentication is enabled
```

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

- > To bind to an IP address or host name, use lunash:> **sysconf ssh ip** <IP\_address>. For example:

```
lunash:>sysconf ssh ip 192.20.10.200
```

```
Success:  SSH now restricted to ethernet device eth0 (ip address 192.20.10.200).
Restarting ssh service.
```

```
Stopping sshd:                [ OK ]
```

```
Starting sshd:                [ OK ]
```

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

## Configuring RADIUS Authentication

RADIUS (Remote Authentication Dial-In User Service) is a client/server protocol providing authentication, authorization, and accounting service to configured clients. The client passes user information to configured, designated RADIUS servers, and acts on the returned response. A RADIUS server receives user connection requests, authenticates the user if that user's profile exists on the server, and then returns the configuration information according to which the client can deliver service to the user.

While a proposal is being considered (by the custodians of the RADIUS standard) to switch to TLS communication protocol, RADIUS interaction currently takes place over UDP (User Datagram Protocol).



## RADIUS Configuration Summary

Configuration and identification must take place at both ends of the RADIUS transaction. These actions include:

On the RADIUS Server Side

- > Identify the client systems from which this server will accept requests and return service (this is recorded in the RADIUS server's configuration file).
- > Identify the users who will be covered by the service.

On the RADIUS Client Side (your SafeNet Luna Network HSM)

- > Enable RADIUS.
- > Add a RADIUS server, specifying its IP address, and providing the access secret for that server.
- > Check the status of SafeNet Luna Network HSM appliance users.
- > Add desired SafeNet Luna Network HSM appliance users to the RADIUS list, enabling RADIUS authentication for those users.
- > Verify that RADIUS is enabled for any user on your SafeNet Luna Network HSM that needs to use RADIUS.

## Configuring RADIUS with Your SafeNet Appliance

### Follow these steps on the RADIUS Server:

You can use any standards-compliant RADIUS server, either a commercial server or one of the free/open-source servers, like freeRADIUS or openRADIUS.

#### 1. Add the client to the RADIUS server's configuration file, specifying:

- The address of the SafeNet Luna Network HSM appliance.
- The secret or password that the client will use when connecting.
- A short, user-friendly or business-relevant name for the client.

You can edit the file directly, for some RADIUS implementations, or use the provided interface.

```
/etc/raddb/clients.conf:
```

```
client 192.20.17.174 {
    ipaddr      = 192.20.17.174
    secret      = testing123
    nas         = other
    shortname   = sa174
}
client 192.20.22.106 {
    ipaddr      = 192.20.22.106
    secret      = testing321
    nas         = other
    shortname   = sa22106
}
```

#### 2. For each client, add the user name and the password for that user to the "users" file of the RADIUS server.

```
/etc/raddb/users:
```

```
sauser162      Cleartext-Password := "userpw654"
```

```

sauser171      Cleartext-Password := "userpw987"
sauser172      Cleartext-Password := "userpw789"
sauser173      Cleartext-Password := "userpw456"
sauser174      Cleartext-Password := "userpw321"
nagios         Cleartext-Password := "nagiospw"
audit          Cleartext-Password := "userpin"
someguy        Cleartext-Password := "userpw"
sauser106      Cleartext-Password := "userpw123"

```

A user can use RADIUS for a SafeNet Luna Network HSM, only if that appliance is registered as a client, and if that user is registered as a user in the appropriate files on the RADIUS server.

### Follow these steps on the SafeNet Luna Network HSM appliance:

**NOTE** Without RADIUS, use `lunash:> user add -username <name>` to add an appliance administrative user on SafeNet Luna Network HSM. With RADIUS, use the command `lunash:> user radiusadd -username <name>` to both create the user on the appliance and add that user to the RADIUS list. You cannot use `lunash:> user radiusadd` to convert an existing user from non-RADIUS to RADIUS.

1. On the SafeNet Luna Network HSM appliance, enable RADIUS with `lunash:> sysconf radius addserver`.
2. Add the server (by hostname or IP address), specifying the port to use, and the timeout value in seconds.

```
[1722022106] lunash:>sysconf radius add -s 192.20.15.182 -p 1812 -t 60
```

```

Enter the server secret:
Re-enter the server secret:
Command Result : 0 (Success)

```

3. Verify that the desired server has been added.

```
[1722022106] lunash:>sysconf radius show
```

RADIUS for SSH is enabled with the following deployed servers:

| server:port        | timeout |
|--------------------|---------|
| -----              | -----   |
| 192.20.15.182:1812 | 60      |

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

4. Check the user list to see which users exist, are enabled on the appliance, and are RADIUS enabled.

```
[1722022106] lunash:>user list
```

| Users    | Roles    | Status   | RADIUS |
|----------|----------|----------|--------|
| -----    | -----    | -----    | -----  |
| admin    | admin    | enabled  | no     |
| audit    | audit    | enabled  | no     |
| monitor  | monitor  | disabled | no     |
| operator | operator | disabled | no     |

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

5. Add a user, by name, as a RADIUS user.

```
[1722022106] lunash:>user radiusAdd -u someguy
```

```
Creating mailbox file: File exists
```

```
Stopping sshd:
```

```
[ OK ]
```

```
Starting sshd:
```

```
[ OK ]
```

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

**6. Add the user's appliance role (in this example, we are giving him **admin**-level access).**

```
[1722022106] lunash:>user role add -u someguy -r admin
```

```
User someguy was successfully modified.
```

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

**7. Verify that the user exists, has the correct role on the appliance, and is a RADIUS user for this appliance.**

```
[1722022106] lunash:>user list
```

| Users    | Roles    | Status   | RADIUS |
|----------|----------|----------|--------|
| admin    | admin    | enabled  | no     |
| audit    | audit    | enabled  | no     |
| someguy  | admin    | enabled  | yes    |
| monitor  | monitor  | disabled | no     |
| operator | operator | disabled | no     |

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

## CHAPTER 4: Appliance Users and 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 appliance, 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.

Configuration and maintenance tasks on the SafeNet Luna Network HSM appliance (including network setup, file management, and system monitoring) are completed by executing commands in the LunaSH command line interface.

When you log in to LunaSH via SSH or a serial connection, the set of available commands depends on the role assigned to your user account. Appliance roles are defined by their associated command privileges. Clear separation of duties is beneficial to a secure production environment and allows you to easily delegate responsibilities according to your organization's needs. For optimal security, assign each user the lowest-level role necessary to fulfill their responsibilities.

## Managing Appliance Users and Roles

---

Refer to the following procedures to manage appliance roles:

- > ["Logging In to LunaSH" on page 88](#)
- > ["Enabling/Disabling Appliance User Accounts" on page 89](#)
- > ["Changing Appliance User Passwords" on page 90](#)
- > ["Creating Custom Appliance User Accounts" on page 91](#)
- > ["Creating Custom Appliance Roles" on page 91](#)
- > ["Creating a One-Step NTLS Registration Role" on page 93](#)
- > ["Backing Up/Restoring the Appliance User Role Configuration" on page 94](#)
- > ["Recovering the Admin Account Password" on page 95](#)
- > ["Name, Label, and Password Requirements" on page 97](#)

## Default Appliance Users and Roles

The default SafeNet Luna Network HSM appliance user accounts are named after their respective default roles. You cannot delete the default user accounts. For a comprehensive list of the LunaSH commands available to the default roles, see [LunaSH Command Summary](#).

By default, only the **admin** and **recover** user accounts are active. The default password for all accounts is "PASSWORD" (see ["Logging In to LunaSH" on page 88](#)).

### admin

The **admin** user is the highest-level default user account. This user (or a custom user assigned an **admin** role) has access to the full set of LunaSH commands (except some specialized **audit** commands) and can perform all configuration and maintenance tasks on the SafeNet Luna Network HSM appliance. Users with an **admin** role can also activate or deactivate the other default user accounts, reset their passwords to default, and create custom user accounts and roles.

The **admin** role is required to access LunaSH commands for configuring and maintaining the HSM within the appliance, so the HSM Security Officer must be assigned an **admin** role to fulfill all HSM SO responsibilities (see [HSM Security Officer \(SO\)](#)).

### operator

The **operator** user is a limited-access default user account that can perform most configuration and maintenance tasks on the SafeNet Luna Network HSM appliance. For example, the **operator** cannot perform the following procedures:

- > activating or deactivating other roles on the appliance or resetting passwords
- > backup/restore of the LunaSH user configuration
- > regenerating the NTLS certificate on the appliance
- > setting TLS ciphers

This user (or a custom user assigned an **operator** role) cannot access HSM configuration commands. While it is possible for a user with an **operator** role to log in to the HSM using the HSM SO credential, many of the commands required by the HSM SO are inaccessible. It is therefore not recommended to assign an **operator** role to the HSM SO.

The **operator** user account must be activated by an **admin** user before it can log in to LunaSH (see ["Enabling/Disabling Appliance User Accounts" on page 89](#)).

### monitor

The **monitor** user is an information-only default user account that can observe the appliance and HSM status. This user (or a custom user assigned a **monitor** role) has access to only those LunaSH commands that present information about the SafeNet Luna Network HSM, including current HSM policies, created partitions, registered clients, and appliance settings. The **monitor** role cannot affect the appliance or HSM in any way.

The **monitor** user account must be activated by an **admin** user before it can log in to LunaSH (see ["Enabling/Disabling Appliance User Accounts" on page 89](#)).

**audit**

The **audit** user is the account used by the HSM Auditor to log in to the appliance and access the HSM audit logging functions. This user (or a custom user assigned an **audit** role) has access to a unique subset of commands that configure audit logging, as well as some informational commands, and commands to manage the **audit** user's account and files. The Auditor credential is required for some commands, and therefore the Auditor must be assigned an **audit** role on the appliance to fulfill all Auditor responsibilities (see [Auditor \(AU\)](#)).

The **audit** user account must be activated by an **admin** user before it can log in to LunaSH (see ["Enabling/Disabling Appliance User Accounts" on page 89](#)).

**recover**

The **recover** user account's only function is to reset the password for the **admin** user. This account cannot access any LunaSH commands, and there is no **recover** role that can be assigned to a custom user. The **recover** account cannot be locked out, and its default password does not expire.

As a security measure, **recover** can log in via the local serial connection only. The **admin** user's account password can be changed remotely by anyone who already knows it, but the **admin** user's password cannot be arbitrarily reset unless the person doing so has physical access to the appliance, to make the serial connection. See ["Recovering the Admin Account Password" on page 95](#).

## Custom Appliance Users and Roles

If the default set of users and roles do not conform to your organization's specific security profile, you can customize the user configuration on your SafeNet Luna Network HSM appliance to fit your needs. This system of users and roles gives you complete control over how your SafeNet Luna Network HSM is accessed.

### Custom User Accounts

LunaSH allows you to create custom, named user accounts. These users are assigned one of the default appliance roles, or a custom role that you create. For example, the following user configuration options are available:

- > Multiple **admin**-level users, each with a different name
- > Multiple **operator**-level users (or none), each with a different name
- > Multiple **monitor**-level users (or none), each with a different name
- > Multiple **audit**-level users (or none), each with a different name
- > Multiple custom users, each with a different name, with custom roles defined by the users' responsibilities

Named user accounts can be useful in distinguishing the actions of different people in the logs. For example, a user named **john** executing the command **syslog tail** in LunaSH would appear in the April 13 log as:

```
Apr 13 14:17:15 172 -lunash: Command: syslog tail : john : 192.20.10.133/3107
```

If you have personnel performing similar functions at physically separate locations, or assigned to teams or shifts for 24-hour coverage, it could be useful (or required by your security auditors) be able to show which specific person performed which actions on the system.

See ["Creating Custom Appliance User Accounts" on page 91](#).

## Custom Roles

You can also create custom roles with access to a specified subset of LunaSH commands. This allows you to delegate specific tasks to personnel according to your organization's security structure. Like the default roles, a custom role is defined by the commands it can access in LunaSH. When a custom role is assigned to any existing user, that user can see and use only those commands associated with the role. This ensures that a given user does not obtain access beyond their security clearance. The **admin** user can create custom roles, assign them to users, or revoke them as required.

See ["Creating Custom Appliance Roles" on page 91](#).

## Security of LunaSH User Accounts

In most cases anticipated by the design and target markets for SafeNet Luna Network HSM, both the SafeNet Luna Network HSM appliance and any computers that make network connections for administrative purposes would reside inside your organization's secure premises, behind well-maintained firewalls. Site-to-site connections would be undertaken via VPN. Therefore, attacks on the shell account(s) would normally not be an issue.

However, if your application requires placing the SafeNet Luna Network HSM appliance in an exposed position (e.g., in a cloud implementation), your shell account(s) may be vulnerable to attackers. It is your responsibility to protect your sensitive data.

Some recommendations for enhancing your security include using strong passwords, changing the SSH port number from its default, or using certificate-based authentication.

## Logging In to LunaSH

When you open a connection to the SafeNet Luna Network HSM appliance (serial or SSH) you are presented with the **login as:** prompt. By default, only the **admin** user is enabled; the other roles must be enabled by an **admin** user before they can log in (see ["Enabling/Disabling Appliance User Accounts" on the next page](#)). After entering the user name and password, you are presented with the **lunash:>** prompt.

### To log in to LunaSH on the SafeNet Luna Network HSM appliance

1. At the **login as:** prompt, enter the name of the account you want to use (**admin**, **operator**, **monitor**, **audit**, or a custom user account) and press **ENTER**.

You are prompted for the password.

2. Enter the account password and press **ENTER**. If you are logging in to this account for the first time, the initial password is "PASSWORD" (uppercase).

**NOTE** You must log in within two minutes of opening an administration session, or the connection will time out. The username and passwords are case-sensitive.

3. For security, you are immediately prompted to change the factory-default password.

LunaSH passwords must be at least eight characters in length, and include characters from at least three of the following four groups:

> lowercase alphabetic: abcdefghijklmnopqrstuvwxyz



- > uppercase alphabetic: ABCDEFGHIJKLMNOPQRSTUVWXYZ
- > numeric: 0123456789
- > special (spaces allowed): !@#\$%^&\*()\_-+=[]{}|\;/;:'",.<>?`~

**NOTE** If you forget the password to any account, an **admin**-level user can set a new password for you (see ["Changing Appliance User Passwords" on the next page](#)).

If you forget the **admin** password, and no other **admin**-level accounts are available, you can use a local serial connection to log in to the **recover** account (see ["Recovering the Admin Account Password" on page 95](#)).

After successful login, the HSM appliance presents a **lunash:>** prompt. Type **?** or **help** and press **Enter** for a summary of the main commands. Type **?** followed by any of the commands, with or without parameters, and press **Enter** to see a summary of sub-commands and parameters for that command.

## Failed Appliance Login Attempts

The response to failed login attempts is the same for **admin**, **operator**, **monitor**, **audit**, and any named users you have created, and is limited by default SSH settings:

- > If you initiate an SSH session against the appliance, and fail to respond to the prompts, the session expires after 120 seconds. You must restart or launch a new session in your SSH terminal tool.
- > If you initiate an SSH session against the appliance, provide a user name, and then provide an incorrect password, the session prompts you to re-attempt the correct password for that user account. If you fail to provide the correct authentication six (6) times, the session is dropped. You must restart or launch a new session in your SSH terminal tool.

The maximum number of simultaneous sessions per channel is the SSH default of 10. These factors help to limit the pace of brute-force attacks, while still allowing timely recovery from mistyping or forgetfulness by an administrative user.

You can configure SafeNet Luna Network HSM to accept administrative connections (SSH) on only one Ethernet LAN port, and client (NTLS) connections on another.

### Why does my new Network HSM appliance report failed logins?

Upon first login to the Network appliance, you might see a system message like the following:

```
Last failed login: Wed Jan 02 14:25:11 EDT 2019 from 192.168.10.105 on ssh:notty
There were 2 failed login attempts since the last successful login.
Last login: Wed Jan 02 14:15:09 from 192.168.10.105
```

This is expected. The manufacturing process uses a temporary password, then resets the default password and verifies that the temporary password is no longer valid. This accounts for the "failed login attempts".

## Enabling/Disabling Appliance User Accounts

By default, **admin** is the only active user account on the SafeNet Luna Network HSM appliance. The other default accounts (**operator**, **monitor**, **audit**) exist and cannot be deleted. The **admin** account (or a custom user account with an **admin** role) must first enable them using the procedure below.

### To enable a default appliance user account

1. Connect to the appliance via SSH or a serial connection, and log in to LunaSH as **admin** or a custom user with an **admin** role (see ["Logging In to LunaSH" on page 88](#)).

2. Enable the desired account.

```
lunash:> user enable -username <account_name>
```

The user of this account can now log in to LunaSH with the account name and default password "PASSWORD". See ["Logging In to LunaSH" on page 88](#).

### To disable any appliance user account

1. Connect to the appliance via SSH or a serial connection, and log in to LunaSH as **admin** or a custom user with an **admin** role (see ["Logging In to LunaSH" on page 88](#)).

2. Disable the desired account.

```
lunash:> user disable -username <username>
```

## Changing Appliance User Passwords

From time to time, you will need to change the password for a LunaSH account. This could be due to a password being compromised, or your company's security policy mandates password changes after a specific time interval. Individual users can change the password for their own account at any time. The **admin** or users with **admin** privileges may change the password for other accounts, including other **admin**-level accounts.

### Password Guidelines

LunaSH passwords must be at least eight characters in length, and include characters from at least three of the following four groups:

- > lowercase alphabetic: abcdefghijklmnopqrstuvwxyz
- > uppercase alphabetic: ABCDEFGHIJKLMNOPQRSTUVWXYZ
- > numeric: 0123456789
- > special (spaces allowed): !@#\$%^&\* () -\_ =+ [] {} \ | / ; : ' " , . < > ? ` ~

For more information, see ["Name, Label, and Password Requirements" on page 97](#).

### To change your own appliance user password

1. Connect to the appliance via SSH or a serial connection, and log in to LunaSH using your username and password (see ["Logging In to LunaSH" on page 88](#)).

2. Change your user password.

```
lunash:> my password set
```

### To change the password for a different user

1. Connect to the appliance via SSH or a serial connection, and log in to LunaSH as **admin** or a custom user with an **admin** role (see ["Logging In to LunaSH" on page 88](#)).

2. Change the password for a specified user.

```
lunash:> user password <username>
```

**NOTE** **admin**-level users can also use this command to change their own password.

## Creating Custom Appliance User Accounts

LunaSH allows you to create custom, named user accounts on the SafeNet Luna Network HSM appliance. These users are assigned one of the standard appliance roles, or a custom role that you create (see "[Creating Custom Appliance Roles](#)" below). Use this procedure to create custom user accounts.

### To create a custom user account

1. Connect to the appliance via SSH or a serial connection, and log in to LunaSH as **admin** or a custom user with an **admin** role (see "[Logging In to LunaSH](#)" on page 88).
2. Create the custom user account by specifying a name.

LunaSH user names can be 1-32 characters in length, chosen from letters a-z, or A-Z, numbers 0-9, the dash, the dot, or the underscore:

```
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789-._
```

No spaces are allowed. User names cannot begin with a dot, dash, or number. As with any secure system, no two users (regardless of role) can have the same name.

```
lunash:> user add -username <username>
```

```
lunash:>user add -username james
```

```
Stopping sshd: [ OK ]
```

```
Starting sshd: [ OK ]
```

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

3. Assign a role to the new user account.

```
lunash:> user role add -username <username> -role <rolename>
```

```
lunash:>user role add -username james -role admin
```

```
User james was successfully modified.
```

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

The user of this account can now log in to LunaSH with the account name and default password "PASSWORD". See "[Logging In to LunaSH](#)" on page 88.

## Creating Custom Appliance Roles

LunaSH allows you to create custom roles that can be assigned to custom users, to specify exactly which commands that user is able to access. This allows you to delegate specific tasks to personnel according to your organization's security needs. An **admin**-level user can use the following procedure to create custom roles.

See ["LunaSH Command Summary" on page 1](#) for a complete list of available commands.

The following commands allow you to import, add, or remove a custom user role to your SafeNet Luna Network HSM appliance:

- > ["user role import" on page 1](#)
- > ["user role add" on page 1](#)
- > ["user role delete" on page 1](#)

### To create a custom appliance role and assign it to a user

1. Create a text file on your local workstation that lists each command that you want the role to be able to access (the role definition file).

For example, if you wanted the user **Alex** to be able to perform backup operations on your HSM but not restore operations, you would create a role definition file including backup commands and not including restore commands.

**NOTE** All lines must end with a UNIX-style linefeed (lf) character. If you create your file in Windows, be sure to convert it to use UNIX line endings before transferring it to an HSM appliance.

2. Transfer the role definition file to the appliance using **pscp** or **scp**. You require the SafeNet Luna Network HSM appliance **admin** password (or an account with an **admin** role) to complete this step. The file is automatically placed in the appropriate directory on the appliance; do not specify a target directory.
3. Log into LunaSH as **admin** (or the user you specified when transferring the file).
4. Import the role definition file and specify a name for the new role.

LunaSH role names can be 1-64 characters in length. The following characters are allowed:

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789-.\_

No spaces are allowed. Role names cannot start with a dot or dash. Creating a role name that begins with a number is not recommended. As with any secure system, no two roles can have the same name.

```
lunash:> user role import -file <filename> -role <rolename>
```

```
lunash:>user role import -file backuprole -role backup
```

```
"backuprole" was successfully imported.
```

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

5. Create the user account that you want to assign the role to, if it does not already exist.

```
lunash:> user add -username <username>
```

6. Assign the role to the desired user.

```
lunash:> user role add -username <username> -role <rolename>
```

## Creating a One-Step NTLS Registration Role

Creating NTLS links between a client and partition using the one-step method (see [One-Step NTLS Connection Procedure](#)) usually requires administrative access to the SafeNet Luna Network HSM appliance. You can set up a custom role that allows a third party to use only the commands necessary for one-step NTLS.

### To create a one-step NTLS registration role

1. Create a role definition .txt file on your local workstation, listing the following commands:

```
scp
partition list
client list
client register
client assignPartition
```

**NOTE** All lines must end with a UNIX-style linefeed (lf) character. If you create your file in Windows, be sure to convert it to use UNIX line endings before transferring it to an HSM appliance.

These are the commands necessary for creating one-step NTLS links. You can include any other commands for your registration purposes. See [client](#) for the complete set of commands.

2. Transfer the role definition file (**registerclient.txt** in the example below) to the appliance using **pscp** or **scp**.

```
pscp registerclient.txt admin@<server_host/IP>:
```

3. Log in to the appliance by SSH as the **admin** user.
4. Import the role definition file to create the **registerclient** role.

```
lunash:> user role import -file registerclient.txt -role registerclient
```

5. Create the **register** user account.

```
lunash:> user add -username register
```

6. Assign the role to the **register** user.

```
lunash:> user role add -username register -role registerclient
```

7. Open a new SSH connection to the appliance and log in as **register** with the default password "PASSWORD".

```
login as: register
register@192.168.0.123's password:
```

You will be prompted to set a new password for the **register** user. This will be the password you provide to the third-party client. Ensure it is both secure and distinct from the **admin** user password.

LunaSH passwords must be at least eight characters in length, and include characters from at least three of the following four groups:

- > lowercase alphabetic: abcdefghijklmnopqrstuvwxyz
- > uppercase alphabetic: ABCDEFGHIJKLMNOPQRSTUVWXYZ
- > numeric: 0123456789
- > special (spaces allowed): !@#\$%^&\* () -\_+[] {} \ | / ; : ' " , . < > ? ` ~

- If you are using SafeNet Luna Network HSM appliance software 7.0, custom users do not automatically have access to the appliance's Server Certificate (**server.pem**). You must transfer the certificate from the appliance's **admin** account to the custom **register** account. This step is unnecessary if you have installed appliance software 7.1 or newer.

```
pscp admin@<server_host/IP>:server.pem .
```

```
pscp server.pem register@<server_host/IP>:
```

- Provide the **register** password and the partition name to the client operator. The client can now establish a one-step NTLS connection by specifying the **register** user and password in LunaCM.

```
lunacm:> clientconfig deploy -server <server_host/IP> -client <client_host/IP> -partition <name> -
user register
```

## Backing Up/Restoring the Appliance User Role Configuration

LunaSH allows you to store a snapshot of the administrative user database (the names and status of all named LunaSH users) that can later be restored if desired.

**CAUTION!** Restoring from backup restores the database of user profiles that existed at the time the backup was made. You will lose any user accounts created since the backup; passwords of existing users could be reverted without their knowledge; enabled users might be disabled; disabled users might be enabled; and any user accounts removed since that backup will be restored.

Your records should indicate when user-profile changes were made, and what those changes were. Any time you restore a backup, reconcile the changed statuses and inform anyone who is affected. For example, users need to know to use their previous password, and to change it immediately.

**NOTE** While the built-in **admin**, **operator**, and **monitor** accounts are not deleted or added by a restore operation (those accounts are permanent), both their enabled/disabled status and their passwords are changed to whatever prevailed at the time the backup was originally taken.

### To back up the appliance user role configuration

- Connect to the appliance via SSH or a serial connection, and log in to LunaSH as **admin** or a custom user with an **admin** role (see "Logging In to LunaSH" on page 88).
- Back up the user role configuration, specifying a description for the backup file.

```
lunash:> sysconf config backup -description <description>
```

```
lunash:>sysconf config backup -description "Configuration Backup 17-03-01"
```

```
Created configuration backup file: myLuna_Config_20170301_1200.tar.gz
```

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

## To restore the appliance user role configuration

1. Connect to the appliance via SSH or a serial connection, and log in to LunaSH as **admin** or a custom user with an **admin** role (see "Logging In to LunaSH" on page 88).
2. List the available configuration backup files.

```
lunash:> sysconf config list
```

```
Configuration backup files in file system:
```

| Size                | File Name                          | Description          |
|---------------------|------------------------------------|----------------------|
| 34099<br>2018-05-07 | myLuna_Config_20180507_1629.tar.gz | Configuration Backup |

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

3. Restore the user role configuration. If you only wish to restore the user configuration, excluding other services on the appliance, specify **-service users**.

```
lunash:> sysconf config restore -file <filename> [-service users]
```

```
lunash:>sysconf config restore -file myLuna_Config_20180507_1629.tar.gz -service users
```

```
WARNING !! This command restores the configuration from the backup file: myLuna_Config_20180507_1629.tar.gz.
```

```
It first creates a backup of the current configuration before restoring: myLuna_Config_20180507_1629.tar.gz.
```

```
If you are sure that you wish to proceed, then type 'proceed', otherwise type 'quit'.
```

```
> proceed
```

```
Proceeding...
```

```
Created configuration backup file: myLuna_Config_20180507_1634.tar.gz
```

```
Restore the users configuration: Succeeded.
```

```
You must either reboot the appliance or restart the service(s) for the changes to take effect. Please check the new configurations BEFORE rebooting or restarting the services.
```

```
You can restore the previous configurations if the new settings are not acceptable.
```

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

4. Reboot the SafeNet Luna Network HSM appliance.

```
lunash:> sysconf appliance reboot
```

## Recovering the Admin Account Password

The **recover** account is a limited-purpose account that has the permanent (fixed) password "PASSWORD". The **recover** account's only purpose is to reset the password of the **admin** user, if the **admin** password is lost/forgotten.

**NOTE** The password recovery procedure does not affect the contents of the HSM or its application partitions. If you suspect that the **admin** account has been compromised, you can perform a factory reset of the HSM and appliance after recovery (see [Resetting to Factory Condition](#)).

As a security measure, **recover** can log in via the local serial connection only. The **admin** user's account password can be changed remotely by anyone who already knows it, but the **admin** user's password cannot be arbitrarily reset unless the person doing so has physical access to the appliance, to make the serial connection.

**CAUTION!** The exception to this rule is where you have your appliances connected to a "terminal server" that aggregates serial links and makes them accessible via telnet or similar. This configuration is useful in a test lab, where access control is not critical, and it can be very convenient when setting up and tearing down appliances for various test and verification scenarios. However, connection of your SafeNet appliances to a remotely accessible terminal server could expose an additional avenue of attack, and therefore Thales Group recommends that you avoid allowing this potential security opening in a production environment.

The **recover** account cannot be locked out, and its default password does not expire.

### To reset the admin account password

1. Connect a serial terminal to the serial console connector on the SafeNet Luna Network HSM rear panel.
2. Log in to LunaSH as **recover**, using the fixed password "PASSWORD".

**NOTE** If the HSM is initialized, you are required to present the HSM Security Officer (SO) credential. Therefore, only the SO can perform this operation. If you have not initialized the HSM prior to resetting the **admin** password, then no credential is required.

You are prompted to set a new **admin** password (see ["Do Not Cancel Out" below](#)).

LunaSH passwords must be at least eight characters in length, and include characters from at least three of the following four groups:

- > lowercase alphabetic: abcdefghijklmnopqrstuvwxyz
- > uppercase alphabetic: ABCDEFGHIJKLMNOPQRSTUVWXYZ
- > numeric: 0123456789
- > special (spaces allowed): !@#\$%^&\*()\_-=[ ]\|/;:'",.<>?`~

If you are confident that your SafeNet Luna Network HSM has not been compromised, you can resume using it as before (taking care to both remember and secure the **admin** password).

## Do Not Cancel Out

Use of the **recover** account sets the password of the **admin** account back to the factory value, and then forces a password change. Do not attempt to bypass the password change.



To prevent the **admin** account being accessible over the network with a known password during the recover procedure, SSH is disabled when the recover process begins. The SSH service is re-enabled only after the password is changed. Interrupting the process and avoiding the password change leaves SSH service off at boot time. If you cancel out partway through the process in order to retain the default password, instead of changing it when prompted, you might find that you no longer have SSH access.

If you encounter the problem, reconnect a local terminal and log into the **recover** account again, this time allowing it to complete the full process, ending with a proper, non-default password. If SSH service is still not available, contact Technical Support.

**CAUTION!** During recovery, the network service is stopped and other services are affected. The minimum-effort resumption would be to reboot the system, which causes all services to restart with current configuration. However, for safety, you should consider manually restarting services from the local (serial) console, until all passwords have been changed from their default values.

## Name, Label, and Password Requirements

This page describes length and character requirements for setting names, 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:

- > ["Custom Appliance User Accounts" below](#)
- > ["Custom Appliance Roles" below](#)
- > ["Appliance User Passwords" on the next page](#)
- > ["HSM Labels" on the next page](#)
- > ["Cloning Domains" on the next page](#)
- > ["Partition Names" on the next page](#)
- > ["Partition Labels" on the next page](#)
- > ["HSM/Partition Role Passwords or Challenge Secrets" on the next page](#)

### Custom Appliance User Accounts

LunaSH user names can be 1-32 characters in length, chosen from letters a-z, or A-Z, numbers 0-9, the dash, the dot, or the underscore:

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789-.\_

No spaces are allowed. User names cannot begin with a dot, dash, or number. As with any secure system, no two users (regardless of role) can have the same name.

### Custom Appliance Roles

LunaSH role names can be 1-64 characters in length. The following characters are allowed:

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789-.\_

No spaces are allowed. Role names cannot start with a dot or dash. Creating a role name that begins with a number is not recommended. As with any secure system, no two roles can have the same name.

## Appliance User Passwords

LunaSH passwords must be at least eight characters in length, and include characters from at least three of the following four groups:

- > lowercase alphabetic: abcdefghijklmnopqrstuvwxyz
- > uppercase alphabetic: ABCDEFGHIJKLMNOPQRSTUVWXYZ
- > numeric: 0123456789
- > special (spaces allowed): !@#\$%^&\*()-\_+=[]{}|\|/;:'",.<>?`~

## 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. Only alphanumeric characters and the underscore are allowed:

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789\_

## 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 Names

Partition names created in LunaSH must be 1-32 characters in length. The following characters are allowed:

abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ 0123456789!@#\$%^\*()-\_+=[][:',./?~

Spaces are allowed; enclose the partition name in double quotes if it includes spaces.

The following characters are not allowed: & \ | ; < > ` ' ' ' ?

No two partitions can have the same name.

## 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.

## HSM/Partition Role Passwords or Challenge Secrets

In LunaSH, the HSM SO password must be 7-255 characters in length. The following characters are allowed:

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

The following characters are invalid or problematic and must not be used in the HSM SO password: "&;<>\`|

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

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 5: System Logging

SafeNet Luna Network HSM gathers logs about appliance events, separate from events on the HSM itself. This chapter contains the following sections about system logging:

- > ["About System Logging" below](#)
- > ["Configuring System Logging" on the next page](#)
  - ["Rotating System Logs" on the next page](#)
  - ["Customizing Severity Levels" on page 102](#)
  - ["Reading System Logs" on page 103](#)
  - ["Exporting System Logs" on page 104](#)
  - ["Deleting System Logs" on page 105](#)
- > ["Remote System Logging" on page 105](#)
  - ["Configuring a Remote Syslog Server" on page 106](#)
  - ["Customizing Remote Logging Severity Levels" on page 107](#)

For HSM event logging, see [Audit Logging](#).

## About System Logging

Logs are managed with the **syslog** commands (see ["syslog" on page 1](#)), where you set rotation and other parameters to suit your own monitoring and management schedule. You can configure flexible logs to gather only information you consider relevant, or send different logs to different remote hosts.

**NOTE** Syslog format is in accordance with RFC 5424. See ["Syslog Introduction" on page 1](#) for information on reading and interpreting system log messages.

## Log Severity Levels

Event logs are categorized according to the severity of their impact on the system. The table ["syslog Severity Levels" below](#) defines the different categories from most to least severe. You can customize logging to include events based on their severity.

**Table 1: syslog Severity Levels**

| Severity Keyword | Severity Description             |
|------------------|----------------------------------|
| emerg/panic      | System is unusable               |
| alert            | Action must be taken immediately |

| Severity Keyword | Severity Description             |
|------------------|----------------------------------|
| critical         | Critical condition               |
| err/error        | Error condition                  |
| warn/warn        | Warning condition                |
| notice           | Normal but significant condition |
| info             | Informational message            |
| debug            | Debug-level message              |

## Hardware Monitoring and Logging

1. SMART technology monitors the hard disk.
2. IPMI technology monitors CPU fan speed and temperature, as well as PSU (power supply unit) voltage, fan speed and temperature.

The system logs temperature changes of 2 degrees in either direction.

## Configuring System Logging

Logs are managed in LunaSH with the **syslog** commands. You can set rotation and other parameters to suit your own monitoring and management schedule. You can also configure flexible logs to gather only information you consider relevant, or to send different logs to different remote syslog hosts. Check the current logging configuration with `lunash:> syslog show`.

This section contains the following system logging procedures:

- > ["Rotating System Logs" below](#)
- > ["Customizing Severity Levels" on the next page](#)
- > ["Reading System Logs" on page 103](#)
- > ["Exporting System Logs" on page 104](#)
- > ["Deleting System Logs" on page 105](#)

### Rotating System Logs

System logs are gathered in a current log file that is periodically rotated and saved on the appliance. This allows you to easily search for logs from a specific relevant time period. You can customize the frequency of log rotation and how many rotated log files are saved. You can also rotate logs manually.

The syslog directory on the appliance will fill up over time, depending on how many old logs you choose to keep. LunaSH displays warnings when the system reaches 50%, 75%, and 90% of log capacity. If you see one of these warnings, export your old logs to a client workstation to clear space in the syslog directory.

**NOTE** NTP logs are not included in the periodic log rotations. They accumulate in one continuous file over a long period of time (**ntp.log**). Events are infrequent enough that the NTP log file is unlikely to fill the entire log directory.

### To change the frequency of log rotation

You can configure the logs to rotate daily, weekly, or monthly.

```
lunash:> syslog period <syslogperiod>
```

```
lunash:>syslog period daily
```

Log period set to daily.

Command Result : 0 (Success)

### To change the number of rotated log files saved on the appliance

You can save up to 100 rotated log files on the appliance. This command allows you to define how long to keep old logs on the appliance (maximum: 100 logs, rotated monthly).

```
lunash:> syslog rotations <#_of_rotations>
```

```
lunash:> syslog rotations 5
```

Log rotations set to 5.

Command Result : 0 (Success)

### To manually rotate the current log file

This command ensures that the most recent logs are included when exporting them off the appliance.

```
lunash:> syslog rotate
```

```
lunash:>syslog rotate
```

Command Result : 0 (Success)

## Customizing Severity Levels

You can customize the logs stored on the appliance by setting the log severity level (see "[Log Severity Levels](#)" on page 100 for a description of the different levels). If you are concerned about the log directory filling up, you can configure the appliance to store only the most severe events (**emergency**) and send the rest of the logs to a remote syslog server (see "[Remote System Logging](#)" on page 105).

**NOTE** This feature requires minimum appliance software version 7.2. See [Version Dependencies by Feature](#) for more information.

## To customize severity levels

1. Set the severity level for the desired log type (**lunalog**s,**message**s,**cron**,**secure**,**boot**).

```
lunash:> syslog severity set -logname <logname> -loglevel <loglevel>
```

```
lunash:>syslog severity set -logname lunalog s -loglevel emergency
```

This command sets the severity level of lunalog s local log messages. Only messages with the severity equal to or higher than the new log level: "emergency" will be logged.

```
Stopping syslog: [ OK ]
```

```
Starting syslog: [ OK ]
```

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

2. Optionally, confirm the new setting.

```
lunash:> syslog show
```

```
Local Configured Log Levels:
```

```
-----
lunalog s      emergency
message s     *
cron          notice
secure       *
boot         *
```

Note: '\*' means all log levels.

3. Repeat Step 1, specifying the severity level of each log type you wish to customize (**lunalog**s,**message**s,**cron**,**secure**,**boot**).

## Reading System Logs

You can search the current log rotation for recent events without exporting log files. Rotated logs must be exported to a client workstation to be read. For a detailed guide to reading and interpreting system log messages, see [About the Syslog and SNMP Monitoring Guide](#). Syslog format is in accordance with RFC 5424.

## To search the current rotation of system logs

You can search the entire current log file, specify the number of recent entries you want to see, or search for specific types of entries.

```
lunash:> syslog tail -logname <logname> -entries <#entries>
```

```
lunash:>syslog tail -logname lunalog s -entries 8
```

```
2017 Mar  1 14:27:54 local_host  local5 info  hsm[32081]: STC policy is set to "OFF" on partition
66331 : Unknown ResultCode value
2017 Mar  1 14:27:55 local_host  local5 info  hsm[32120]: STC policy is set to "OFF" on partition
66331 : Unknown ResultCode value
2017 Mar  1 14:29:53 local_host  local5 info  hsm[3948]: STC policy is set to "OFF" on partition
66331 : Unknown ResultCode value
2017 Mar  1 14:29:59 local_host  local5 info  lunash [29529]: info : 0 : Command: syslog
remotehost add : admin : 10.124.0.87/61470
2017 Mar  1 14:30:37 local_host  local5 info  hsm[5511]: STC policy is set to "OFF" on partition
```

```
66331 : Unknown ResultCode value
2017 Mar 1 14:30:48 local_host local5 info lunash [29529]: info : 0 : Command: syslog
remotehost list : admin : 10.124.0.87/61470
2017 Mar 1 14:33:10 local_host local5 info lunash [29529]: info : 0 : Command: syslog severity
set : admin : 10.124.0.87/61470
2017 Mar 1 14:33:47 local_host local5 info lunash [29529]: info : 0 : Command: syslog severity
set -logname lunalogs -loglevel crit : admin : 10.124.0.87/61470
```

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

## HSM Alarm Logging

The HSM card produces logs pertaining to the card status, including alarm messages for events such as zeroization, tamper events, and changes to Secure Transport Mode. The **syslog tail** command allows you to search for this type of message in the logs.

### To search the system logs for HSM alarm messages

Search for log messages containing the string "ALM".

```
lunash:> syslog tail -logname messages -entries <#entries> -search ALM
```

For example, this command will display all alarm messages from the last 200000 log entries:

```
lunash:>syslog tail -logname messages -entries 200000 -search ALM
```

```
2017 Apr 17 11:00:45 local_host kern info kernel: k7pf0: [HSM] ALM2006: HSM decommissioned by FW
2017 Apr 17 11:00:48 local_host kern info kernel: k7pf0: [HSM] ALM2014: Auto-activation data
invalid - HSM deactivated
2017 Apr 17 11:01:12 local_host kern info kernel: k7pf0: [HSM] ALM2006: HSM decommissioned by FW
2017 Apr 17 11:01:14 local_host kern info kernel: k7pf0: [HSM] ALM2011: HSM unlocked - tamper
clear done
2017 Apr 17 11:02:47 local_host kern info kernel: k7pf0: [HSM] ALM2007: HSM zeroized
2017 Apr 17 11:02:47 local_host kern info kernel: k7pf0: [HSM] ALM2005: HSM deactivated
2017 Apr 17 11:15:32 local_host kern info kernel: k7pf0: [HSM] ALM2013: HSM recovered from secure
transport mode
```

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

## Exporting System Logs

If you are managing the logs locally, you must transfer them to a client workstation in order to read them. After you have exported the log records, you can clear them from the syslog directory on the appliance.

### To transfer system logs from the appliance to a client

1. Create the log archive file.

```
lunash:> syslog tarlogs
```

```
lunash:>syslog tarlogs
```

The tar file containing logs is now available via scp as filename 'logs.tgz'.

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

2. Transfer **logs.tgz** from the appliance to a client using **pscp/scp**.

```
>pscp admin@<applianceIP>:logs.tgz .
```



- If you have configured NTP, transfer the **ntp.log** file from the appliance to a client.

```
>pscp admin@<applianceIP>:ntp.log .
```

## Deleting System Logs

Once you have exported the log files to a client, you can clear the appliance's syslog directory. This process creates an archive of all the stored logs before deleting the original files.

**CAUTION!** Ensure that you have retrieved a copy of **ntp.log** before you run **syslog cleanup**. It is not archived with the rest of the logs.

### To delete the stored system logs

```
lunash:> syslog cleanup
```

```
lunash:>syslog cleanup
```

```
WARNING !! This command creates an archive of the current logs then deletes ALL THE LOG FILES.
If you are sure that you wish to proceed, then type 'proceed', otherwise type 'quit'.
```

```
> proceed
Proceeding...
Creating tarlogs then deleting all log files...
```

```
The tar file containing logs is now available via scp as filename "logs_cleanup_20170301_
1443.tgz".
```

```
Please copy "logs_cleanup_20170301_1443.tgz" to a client machine with scp.
```

```
Deleting log files ...
restart the rsyslogd service if it's running
Stopping syslog: [ OK ]
Starting syslog: [ OK ]
```

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

## Remote System Logging

Remote system logging allows you to send logs from your SafeNet Luna Network HSM to a central syslog server on the network.

You can use lunash:> **syslog remotehost** to specify the central syslog server.

- > ["Configuring a Remote Syslog Server" on the next page](#)
- > ["Customizing Remote Logging Severity Levels" on page 107](#)

## Configuring a Remote Syslog Server

Use the following procedure to configure remote system logging. Most Linux distributions include rsyslog as the standard syslog daemon. Refer to your Linux documentation for instructions that describe how to configure rsyslog on Linux.

**NOTE** The remote server must have the appropriate port open to receive the logs (UDP port 514 by default). Refer to your operating system and firewall documentation for more information. If you need to use a different port or TCP protocol, specify it when you add the remote server's IP or hostname.

### To send logs to a remote syslog server

1. Add the remote server's IP or hostname to the remote logging configuration.

```
lunash:> syslog remotehost add -host <hostname/IP> [-protocol <protocol>] [-port <port>]
```

```
lunash:>syslog remotehost add -host 192.10.10.101
```

```
Stopping syslog: [ OK ]
```

```
Starting syslog: [ OK ]
```

```
192.10.10.101 added successfully
```

```
Make sure the rsyslog service on 192.10.10.101 is properly configured to receive the logs
```

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

By default, the remote server will now receive lunalog, messages, secure, and boot logs at the **info** level and above, and cron logs at the **notice** level and above. See "[Customizing Remote Logging Severity Levels](#)" on the next page to specify which logs to send to which remote server.

2. On the receiving or target system, start the rsyslog daemon or service to allow it to receive logs from your SafeNet Luna Network HSM appliance(s). Refer to your receiving/logging platform's operating system documentation for more information on configuring and [re]starting the rsyslog daemon or service.
3. Optionally, confirm the remote logging settings.

```
lunash:> syslog show
```

```
Remote Configured Log Levels:
```

```
-----
lunalog:
  192.10.10.100      info
  192.10.10.101      info
messages:
  192.10.10.100      info
  192.10.10.101      info
cron:
  192.10.10.100      notice
  192.10.10.101      notice
secure:
  192.10.10.100      info
  192.10.10.101      info
boot:
  192.10.10.100      info
  192.10.10.101      info
```

## Customizing Remote Logging Severity Levels

There is no limit on the number of remote logging servers you can add, and you can configure the severity level for each server and log type independently (see ["Log Severity Levels" on page 100](#) for a description of the different levels). For example, you could send all log entries produced by the appliance to one remote server, and only entries marked **critical** or higher to another server.

**NOTE** This feature requires minimum appliance software version 7.2. See [Version Dependencies by Feature](#) for more information.

### To customize remote logging severity

1. Set the severity level for the desired log type (**lunaldogs,messages,cron,secure,boot**), specifying a remote server you already added to the configuration.

```
lunash:> syslog severity set -logname <logname> -loglevel <loglevel> -host <hostname/IP>
lunash:>syslog severity set -logname lunaldogs -loglevel critical -host 192.10.10.101
```

This command sets the severity level of lunaldogs remote log messages. Only messages with the severity equal to or higher than the new log level: "critical" will be sent to 192.10.10.101.

```
Stopping syslog: [ OK ]
```

```
Starting syslog: [ OK ]
```

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

2. Optionally, confirm the new settings.

```
lunash:> syslog show
```

```
Remote Configured Log Levels:
-----
lunaldogs:
  192.10.10.100      info
  192.10.10.101      critical
messages:
  192.10.10.100      info
  192.10.10.101      info
cron:
  192.10.10.100      notice
  192.10.10.101      notice
secure:
  192.10.10.100      info
  192.10.10.101      info
boot:
  192.10.10.100      info
  192.10.10.101      info
```

3. Repeat step 1, specifying each log type severity level you wish to customize (**lunaldogs,messages,cron,secure,boot**).

# CHAPTER 6: Client Connections

This chapter provides information about client connections to the SafeNet Luna Network HSM appliance. It contains the following sections:

- > ["Connections to the Appliance - Limits" below](#)
- > ["SafeNet Luna Network HSM Port Usage" below](#)
- > ["SafeNet Luna Network HSM Appliance Port Bonding" on the next page](#)
- > ["Client Startup Delay Across Mixed Subnets" on page 110](#)
- > ["SSH Public-Key Authentication" on page 110](#)
- > ["Setting and Clearing SSH Restrictions" on page 113](#)
- > ["When to Restart NTLS" on page 113](#)
- > ["Timeouts" on page 114](#)

## Connections to the Appliance - Limits

---

Here are the considerations, for a SafeNet Luna Network HSM appliance, regarding client registrations and connections.

### **Maximum number of clients I can register against one SafeNet Luna Network HSM appliance**

No hard limit is set.

### **Maximum number of clients that can connect to one SafeNet Luna Network HSM appliance, at the same time**

No hard limit is set, but see below.

### **Maximum number of connections per registered client**

No hard limit is set, but see below.

### **Maximum number of connections, in total, to a single SafeNet Luna Network HSM appliance**

No hard limit is set. SafeNet Luna Network HSM limits the number of connections according to system resources. The number of simultaneous connections that can be established with the appliance is dependent upon the various client applications.

## SafeNet Luna Network HSM Port Usage

---

The table below describes the SafeNet Luna Network HSM appliance's default port settings.

| Port | Protocol | Feature                                          | Configurable                                                  | Session Initiation            |
|------|----------|--------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| 22   | TCP      | Secure Shell (SSH)                               | Yes                                                           | inbound                       |
| 123  | UDP      | Network Time Protocol (NTP)                      | No                                                            | outbound                      |
| 161  | UDP      | Simple Network Management Protocol (SNMP) daemon | Yes                                                           | inbound                       |
| 162  | UDP      | Simple Network Management Protocol (SNMP) trap   | Yes (lunash:> <a href="#">sysconf snmp notification add</a> ) | outbound                      |
| 514  | UDP      | Remote Syslog Service                            | Yes                                                           | outbound                      |
| 1501 | TCP      | Callback Service (CBS)                           |                                                               | inbound                       |
| 9697 | TCP      | Callback Service (CBS)                           | No                                                            | inbound (Remote PED enhanced) |
| 1503 | TCP      | Remote PED multi-factor authentication           | Yes                                                           | outbound                      |
| 1792 | TCP      | NTLS (Network Trust Link Service)*               | No                                                            | inbound                       |
| 5656 | TCP      | Secure Trusted Channel (STC)*                    | No                                                            | inbound                       |
| 8443 | TCP      | REST API webserver                               | Yes                                                           | inbound                       |

\* Applications use the client connection to obtain service from the HSM. Service is available only to client systems that are registered with HSM partitions.

## SafeNet Luna Network HSM Appliance Port Bonding

SafeNet Luna Network HSM has four physical network interface devices: eth0, eth1, eth2, and eth3. You can bond eth0 and eth1 into a single virtual interface, bond0, or eth2 and eth3 into bond1, to provide a redundant active/standby interface. The primary purpose of the service is a hot standby mode for network interface failure, no performance or throughput gains are intended.

The following conditions and recommendations apply to the port bonding feature:

- > Bonded interfaces must both be attached to the same network segment. For example, if a bonded interface of IP 192.168.9.126 is chosen, both interfaces must be connected to devices that can access the 192.168.9.\* network.
- > Bonded interfaces must use static addressing.
- > Avoid executing bonding commands while clients are running applications against the SafeNet Luna Network HSM. Where a bonding interface has the same IP as the IP of eth0 or eth2, no ill effects have been observed on running clients other than normal fail-over/recover behavior.
- > Avoid executing bonding commands over SSH, which can result in the closure of the active SSH session.

Once bonding is configured, client connections as well as SSH connections continue uninterrupted if either of the bonded interfaces fails.

## Using Port Bonding

Use LunaSH to configure, enable, or disable port bonding, and to display the current port bonding status. See [network interface bonding](#) for a list of the port bonding commands.

### To bond eth0 and eth1 to the bond0 or eth2 and eth3 to the bond1 virtual interface

1. Specify a static IP address, subnet mask, and gateway for the bonded interface.

**NOTE** To avoid breaking the NTLS connection to the appliance, ensure that the IP address you specify for the bonded interface is the IP address used for the current NTLS connection. For bond0 use the IP address for eth0 or eth1. For bond1 use the IP address for eth2 or eth3.

```
lunash:> network interface bonding config -ip <IP_address> -netmask <netmask> -name {bond0 | bond1} -gateway <IP_address>
```

2. Enable the bonded interface.

```
lunash:> network interface bonding enable -name <netbond>
```

## Client Startup Delay Across Mixed Subnets

Where a client computer and SafeNet Luna Network HSM are on different networks, any application (for example, our multitoken utility, or your client application program) that is started on the client computer takes 20 seconds (the NTLS network timeout) to start up. Once running, the application operates normally. On SafeNet Luna Network HSM, an error is logged.

When both SafeNet Luna Network HSM and client are on the same subnet, the connection occurs without delay.

## SSH Public-Key Authentication

In its default configuration, the SafeNet appliance Administrator account (userid admin) uses standard password authentication (userid/password). You can also choose to use Public Key-based Authentication for SSH access. The relevant commands to manage Public Key Authentication are described [here](#).

### Public Key Authentication to a SafeNet Appliance Using UNIX SSH Clients

The following is an example exercise to illustrate the use of Public-Key Authentication.

1. From any UNIX client, generate a public key identity to be used for authentication to the SafeNet appliance:

```
[root@mypc /]# ssh-keygen -b 2048 -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/root/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /root/.ssh/id_rsa.
```

```
Your public key has been saved in /root/.ssh/id_rsa.pub.
The key fingerprint is:
6e:7a:7e:e1:2a:54:8f:99:3e:6a:56:f8:38:22:fb:a6 root@pinky
```

Two files are created, a private key file (which stays on the client) and a public key file that we now securely copy to the SafeNet appliance.

- SSH to the SafeNet appliance and verify that the default functionality is a password prompt:

```
[root@mypc /]# ssh admin@myLuna
admin@myLuna's password:
```

- Use **pscp/scp** to transfer the client's public key to the appliance:

```
[root@mypc /]# scp /root/.ssh/id_rsa.pub admin@myluna:
admin@myluna's password:
id_rsa.pub          100%
|*****|           220          00:00
```

- On the SafeNet Luna Network HSM appliance, verify the default settings of the Public Key Authentication service:

```
lunash:> sysconf ssh show
```

```
[myLuna] lunash:>sysconf ssh show
```

```
SSHD configuration:
```

```
SSHD Listen Port: 22 (Default)
```

```
SSH is unrestricted.
```

```
Password authentication is enabled
```

```
Public key authentication is enabled
```

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

- Verify that there are no public key entries by default:

```
lunash:> my public-key list
```

```
[myLuna] lunash:>my public-key list
```

```
SSH Public Keys for user 'admin':
```

```
Name          Type      Bits  Fingerprint
-----
```

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

- Add the public key that you sent over earlier (from server mypc in our example):

```
lunash:> my public-key add <filename>
```

```
[myLuna] lunash:>my public-key add id_rsa.pub
```

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

- Check the list again:

```
lunash:> my public-key list
```

```
[myLuna] lunash:>my public-key list
```

```
SSH Public Keys for user 'admin':
```

```
Name          Type      Bits  Fingerprint
-----
```

```
id_rsa.pub      ssh-rsa 1024 6e:7a:7e:e1:2a:54:8f:99:3e:6a:56:f8:38:22:fb:a6
```

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

Notice that the fingerprint reported is the same as was generated back on mypc.

**8.** From mypc, SSH into myLuna; you should not be password prompted:

```
[root@mypc /]# ssh admin@myluna
SafeNet Luna Network HSM 7.0 Command Line Shell - Copyright (c) 2001-2017 Gemalto, Inc. All
rights reserved.
```

**9.** Verify that you are still password prompted if you ssh from other clients:

```
bash-2.05b# ./ssh admin@myLuna
admin@myLuna's password:
```

**10.** Disable public key authentication on myLuna, and verify the current status of the service:

```
lunash:> sysconf ssh publickey disable
lunash:> sysconf ssh show
```

**11.** SSH in again from mypc, and verify that you are password prompted:

```
[root@mypc /]# ssh admin@myLuna
admin@myLuna's password:
```

## Summary

The above example illustrates enabling and disabling Public-Key Authentication for SSH connections to your SafeNet appliance.

**NOTE** Console (serial port) access still requires the userid and password.

Once you enable public key authentication for an administration computer, the private SSH key (`/root/.ssh/id_rsa`) must be protected, and access to that computer must be restricted and password-protected. Anyone who can log into that computer can log into the SafeNet Luna Network HSM appliance without knowing the LunaSH admin password!

To further explore/confirm the Public-Key Authentication functions, you could SSH in again from Windows and other UNIX clients, and verify that you are still password prompted as normal for those clients.

Verify that the client list is always accurate.

Delete one or two of your public key clients. Verify that those clients are password prompted again.

Clear all public key clients with the `-clear` sub-command. Verify that all clients are password prompted again.

Obviously, most of the above has been an extended example, to show various aspects of the function, and you do not need to go through all those steps just to set up Public-Key Authentication for a client/admin computer.

## Set up Public-Key SSH access for other SafeNet Luna Network HSM users

Here are the high level steps to set up SSH pubkey access for a non admin user:

- > As admin, create the user and assign the desired role to that new user.
- > Log on to SafeNet Luna Network HSM as the new user. You are prompted to change the default password.



- > Transfer (**pscp/scp**) the SSH pubkey to the SafeNet appliance using the new user account (example \$ pscp id\_rsa.pub op-number1@lunasa7:).
- > Log in with the new account.
- > Add your SSH key (lunash:> **my public-key add** (<filename>)

Here is an example session:

```
operator@mypc:~/.ssh$ pscp id_rsa.pub op-number1@lunasa7:
op-number1@lunasa7's password:
id_rsa.pub                               100% 392      0.4KB/s   00:00
operator@mypc:~$ ssh op-number1@lunasa7
op-number1@lunasa7's password:
Last login: Wed Mar 11 08:51:46 2015 from 192.168.10.18
SafeNet Luna Network HSM 7.0 Command Line Shell - Copyright (c) 2001-2017 Gemalto, Inc. All rights reserved.
[lunasa7] lunash:>my publickey add id_rsa.pub
```

Command Result : 0 (Success)

## Setting and Clearing SSH Restrictions

SafeNet Luna Network HSM has two ethernet devices, eth0 and eth1 that can be used for SSH connections. If your environment requires that SSH be restricted to one or the other, use the command `sysconf ssh device eth0` or `sysconf ssh device eth1`.

To remove the restriction, use the command `sysconf ssh device all`.

## When to Restart NTLS

Here are the situations where NTLS needs restarting.

**NOTE** All client connections must be stopped before you restart NTLS.

- > When you regenerate the server certificate (the interface prompts you to restart NTLS after regenerating the server cert)
- > If you delete Partitions
- > If you change binding settings (lunash:> **ntls bind**)

In all other circumstances, NTLS should remain running. If there are problems with clients connecting to the SafeNet appliance, other methods of debugging should be attempted before restarting NTLS.

Examples are:

- > Confirming the fingerprint of the client certificate and the server certificate at both the client and the server (the SafeNet appliance).
- > Verifying that the client is registered and has at least one Partition assigned to it.

## Impact of the service restart ntlm Command

If you perform `lunash:> service restart ntlm` on a live, or production SafeNet appliance, any active sessions would be lost. That is, HSM Partitions would remain active, but Clients would need to re-connect and re-authenticate.

As a general rule, an NTLM restart is required immediately after a server certificate regeneration on a SafeNet appliance. This occurs under the following circumstances only:

- > As part of original installation and setup.
- > If you have reason to suspect that the SafeNet appliance's server certificate (private key) has been compromised.

In the former case, there is no impact. In the latter case, the brief disruption of active Clients would be overshadowed by the seriousness of the compromise.

## Timeouts

Your network connections will timeout after a period of inactivity, as described below.

### SSH Timeout

SSH connections to the appliance are cleaned up and torn down when no network activity has been detected for 15 seconds. This timeout is not configurable. If your session times out, you must open a new SSH session.

### NTLM Timeout

As a general rule, do not adjust timeout settings (either via the interface or in config files) unless instructed to do so by Thales Group Technical Support.

Changing some settings can appear to improve performance until a situation is encountered where a process does not have time to complete due to a shortened timeout value.

Making timeouts too long will usually not cause errors, but can cause apparent performance degradation in some situations (HA).

Default settings have been chosen with some care, and should not be modified without good reason and full knowledge of the consequences.

**CAUTION!** Never insert TAB characters into the `crystoki.ini` (Windows) or `crystoki.conf` (UNIX) file.

### Network Receive Timeout

One timeout value that might require change is the `ReceiveTimeout` value in the "LunaSA Client" section of the configuration file. This timeout value is the period that the SafeNet Luna Network HSM client will wait for a response from the SafeNet Luna Network HSM before determining that the appliance is off-line. The default value of 20 seconds provides a worst-case scenario over a larger WAN, but may be inappropriate for some SafeNet Luna Network HSM deployments (such as SafeNet Luna HSMs in an HA configuration) where a quicker determination of the health of the SafeNet Luna Network HSM system is required. This value can be set in the SafeNet Luna Network HSM configuration file as follows:

**Windows (crystoki.ini)**

```
[LunaSA Client]
:
ReceiveTimeout=<value in milliseconds> //default is 20000 milliseconds
:
```

**UNIX (etc/Chrystoki.conf)**

```
LunaSA Client = {
:
ReceiveTimeout=<value in milliseconds>;
:
}
```

## Backing Up and Restoring the Appliance Configuration

The appliance **admin** can create a backup of configuration settings for various services running on the SafeNet Luna Network HSM appliance, and save it to the appliance file system. This allows you to easily restore the configuration after a factory reset, ensuring that existing clients can connect to the restored appliance with all services functioning correctly. You can create multiple backup files and provide a description for each, to store different configurations. You can store your configuration backup files on the appliance filesystem, save them to the internal HSM, or export them to an external backup HSM.

- > ["Backing Up the Appliance Configuration" below](#)
- > ["Restoring the Appliance Configuration" on the next page](#)
- > ["Managing Configuration Backup Files" on the next page](#)

The backup file includes configuration data for the following modules and services:

|                  |                                              |
|------------------|----------------------------------------------|
| <b>Network</b>   | Network configuration                        |
| <b>NTLS</b>      | NTLS configuration                           |
| <b>NTP</b>       | Network Time Protocol configuration          |
| <b>SNMP</b>      | SNMP configuration                           |
| <b>SSH</b>       | SSH configuration                            |
| <b>Syslog</b>    | Syslog configuration                         |
| <b>System</b>    | System configuration (keys and certificates) |
| <b>Users</b>     | User accounts, passwords, and files          |
| <b>Webserver</b> | Webserver configuration for REST API         |

### Backing Up the Appliance Configuration

Use the following procedure to back up your appliance configuration to the appliance filesystem.

**CAUTION!** This procedure does not back up HSM or partition configurations. It applies only to the SafeNet Luna Network HSM appliance settings configurable in LunaSH.

### Prerequisites

- > You must be logged in to LunaSH as **admin** to back up the appliance configuration.

### To back up the appliance configuration

1. Back up the appliance configuration, specifying an optional description for the backup file. Use quotes to include spaces in your description. To save a copy of the initial factory configuration instead of the current configuration, include the **-factoryconfig** option.

```
lunash:> sysconf config backup [-description <description>]
```

## Restoring the Appliance Configuration

Use the following procedure to restore appliance services from a stored configuration backup. You can restore the entire configuration or select specific services to restore.

### Prerequisites

- > You must be logged in to LunaSH as **admin** to restore the appliance configuration.
- > If you are restoring the network configuration, log in using a serial connection so that you do not lose contact with the appliance.
- > The configuration backup file must be available on the appliance filesystem.

### To restore the appliance configuration

1. [Optional] Check the list of configuration backup files available on the appliance.

```
lunash:> sysconf config list
```

2. Stop any services you wish to restore.

```
lunash:> service stop <service>
```

3. Restore the configuration from backup by specifying the backup file and service you wish to restore.

```
lunash:> sysconf config restore -file <filename> -service <service>
```

4. Restart the service or reboot the appliance to activate the restored configuration settings.

```
lunash:> service restart <service>
```

```
lunash:> sysconf appliance reboot
```

## Managing Configuration Backup Files

If you wish, you can keep only the backup files that you find useful, and individually delete any others using the **sysconf config delete** command. You can also use the **sysconf config clear** command to delete all of your configuration backup files.

Note that the configuration backup file area is a special-purpose location, accessible only using the **sysconf config** commands. You will not see those files listed if you run the command **my file list**.

There is no limit on the size of individual backup files or the number of backups that can be stored on the file system, other than the available space. This space is shared by other files, such as spkg and log files, so account for this when planning your backup and restore strategy. Some size restrictions apply if you plan to export a backup file into your HSM using **sysconf config export**.

### Backing Up the Appliance Configuration to the HSM

You can protect a configuration setup against the possibility of appliance failure by exporting a backup file into the internal HSM or an external backup HSM. The command **sysconf config export** allows you to place the configuration backup file onto an HSM and **sysconf config import** allows you to retrieve the file from that HSM, back to the appliance file system. The export command gives you two target options:

- > The internal HSM of your SafeNet Luna Network HSM appliance. This could be useful if a component failed in the appliance, you sent the appliance back to Thales Group for rework under the RMA procedure, received it back repaired, and then retrieved the file from your HSM to restore your appliance settings.
- > A locally-installed SafeNet Luna Backup HSM. This could be useful if the current appliance failed and you wished to install a replacement. Similarly, you could use system configuration backup files restored from a Backup HSM to uniformly configure multiple SafeNet appliances with a standard set of parameters applicable to your enterprise.

If you are exporting a configuration backup to a SafeNet Luna Network HSM, please note the following file size restrictions:

- > The maximum size of individual exportable files is 64 KB.
- > The maximum storage capacity of the Admin/SO partition is 384 KB.

### Automatically generated configuration backup files

A configuration backup file is generated automatically when you run the **sysconf config restore** or **sysconf config factoryreset** commands. This allows you to revert to your current configuration if the restore operation did not achieve the expected results.

### Listing your configuration backup files

You can use the **sysconf config list** command to list all of your backup files, complete with the description you provided for each one, as shown in the following example. The configuration settings file area will always contain the original factory file, and might additionally contain any number of intentionally created backups, and possibly one or more automatic backup files:

### Upgrading the appliance software changes your configuration settings

If you upgrade your appliance software, your configuration settings may be changed as part of the upgrade process and, as a result, the original factory configuration no longer applies. Immediately after you upgrade your appliance, create a new configuration backup file and make note of the backup file created. Later, if you wish to restore to this configuration, use the **sysconf config restore** command with the file created after upgrade.

# CHAPTER 7: Updating the SafeNet Luna Network HSM Appliance Software

The SafeNet Luna Network HSM appliance software consists of the LunaSH command-line shell and its underlying software components. Use the following procedure to install the SafeNet Luna Network HSM 10.2 appliance software update.

The update package includes an image of the latest HSM firmware, which you must install to take advantage of all the new features in this release. When you install the appliance software update, the latest firmware image is stored on the appliance file system but not installed. The system can only hold one firmware version in reserve at a time.

Firmware installation is a separate procedure (see [Updating the SafeNet Luna HSM Firmware](#)).

**NOTE** The appliance software update cannot be rolled back directly. You can re-image to a predetermined configuration and then update to a desired appliance software version (see ["Re-Imaging the Appliance to Factory Baseline" on page 120](#)). The HSM firmware, however, can be rolled back to the previously-installed version (see [Rolling Back the SafeNet Luna HSM Firmware](#)).

To update the appliance software and firmware, you must transfer and apply a secure package file to the SafeNet Luna Network HSM. You require:

- > SafeNet Luna Network HSM 10.2 appliance software update package file (<filename>.spkg)
- > the secure package authentication code, provided in a text file accompanying the update package

## To upgrade the SafeNet Luna Network HSM appliance software

1. Transfer the secure package update file to the SafeNet Luna Network HSM using **pscp** or **scp**.  
**pscp** <path>/<filename>.spkg admin@<appliance\_host/IP>:
2. Stop all client applications to the SafeNet Luna Network HSM appliance.
3. Using a serial or SSH connection, log in to the appliance as **admin** (see ["Logging In to LunaSH" on page 88](#)).
4. Log in as HSM SO (see [Logging In as HSM Security Officer](#)).  
lunash:> **hsm login**
5. [Optional Step] Verify that the secure package file is present on the SafeNet Luna Network HSM.  
lunash:> **package listfile**
6. [Optional Step] Verify the package file, specifying the authorization code you received from Thales Group.  
lunash:> **package verify** <filename>.spkg -authcode <code\_string>
7. Install the update on the SafeNet Luna Network HSM.

lunash:> **package update** <filename>.spkg -authcode <code\_string>

The installation/update process takes approximately one and a half minutes. A series of messages shows the progress of the update. At the end of this process, a message “Software update completed!” appears.

**8.** Reboot the SafeNet Luna Network HSM appliance.

lunash:> **sysconf appliance reboot**

The latest firmware update package is now stored in reserve on the appliance, waiting to be installed. See [Updating the SafeNet Luna HSM Firmware](#) to install the firmware.

# CHAPTER 8: Re-Imaging or Decommissioning the HSM Appliance

During the lifetime of a SafeNet Luna Network HSM, you might have cause to take the HSM out of service, and wish to perform actions to ensure that no trace of your sensitive material remains. Those events might include:

- > Placing the unit into storage, perhaps as a spare
- > Shipping to another location or business unit in your organization
- > Shipping the unit back to Thales Group for repair/re-manufacture
- > Removing the HSM permanently from operational use, for disposal at end-of-life

You also have the option of restoring the HSM appliance to its factory baseline state, erasing all sensitive material and restoring the base appliance software and HSM firmware.

This chapter describes the available options in the following sections:

- > ["Re-Imaging the Appliance to Factory Baseline" below](#)
- > ["Decommissioning the HSM Appliance" on page 124](#)
- > ["RMA and Shipping Back to Thales Group" on page 125](#)
- > ["End of Service and Disposal" on page 125](#)

For more information about the effects of these procedures, see [Comparing Zeroize, Decommission, Re-image, and Factory Reset](#).

## Re-Imaging the Appliance to Factory Baseline

The SafeNet Luna Network HSM appliance software update includes two versions: the newest version, and a baseline version that is stored in reserve on the appliance. If you find that the latest software does not suit your organization's purposes, you can re-image the appliance to its factory baseline. This procedure formats the SafeNet Luna Network HSM file system, zeroizes the HSM, erases the appliance configuration, and resets the software/firmware to the baseline version.

This capability is useful if you are re-purposing an HSM for a project that has standardized on an earlier software/firmware configuration, or if you need to format the appliance completely and remove all traces of its prior configuration (to securely return control of the appliance to a cloud provider, for example).

Appliance re-image also allows you to roll back the appliance software, which was not possible in previous Luna releases.

**NOTE** This feature requires minimum firmware version 7.3.0 and appliance software 7.3. See [Version Dependencies by Feature](#) for more information.

The baseline consists of:

- > SafeNet Luna Network HSM appliance software version **7.2**



> SafeNet Luna Network HSM firmware version **7.0.3**

After you re-image the appliance, you can update to whichever software/firmware version you wish. For valid update paths, refer to the Customer Release Notes for the version you wish to install. Download your preferred software/firmware version from the Thales Group Support Portal (see "[Support Contacts](#)" on page 11).

**CAUTION!** Appliance re-image formats the SafeNet Luna Network HSM appliance file system and zeroizes the HSM. All files and settings on the appliance will be destroyed, including:

- > All roles, partitions, and cryptographic objects on the HSM (except for partition licenses); the HSM must be re-initialized
- > All existing client and remote PED server registrations, as well as the Remote PED Vector (RPV)
- > All appliance roles, including the **admin** role and any custom roles
- > All appliance configuration settings (except for the network configuration)
- > All files stored on the appliance, including upgrade packages and audit logs (lunash:> [my file list](#))

After the appliance re-image procedure, only the following information is preserved:

- > Network configuration; if you are accessing the appliance remotely via SSH connection, you will not permanently lose contact with the appliance
- > Partition licenses purchased via the Thales Group License Portal, unless you included the **-base** option (lunash:> [sysconf reimage start](#))

### To re-image the appliance to factory baseline

1. Ensure that you have backed up all important cryptographic objects, appliance files, and appliance logs. Each user of the appliance (**admin**, **operator**, **monitor**, **audit**, and any custom users) must back up any important files by using [pscp/scp](#) to transfer them off the appliance file system. Ensure that application partitions are not being used by any client before proceeding.
2. Ensure that you have previously initialized the Auditor role and configured audit logging on the HSM. By default, audit logs for critical events are stored in the HSM's on-board memory. These logs are only accessible to the Auditor, and therefore cannot be erased by the re-image procedure. If you have never configured audit logging on the HSM, these logs remain in the HSM memory. If you are re-imaging the appliance for another party (or returning control of the appliance to a cloud provider), the next Auditor could access these logs.

To prevent this, configure audit logging on the HSM before re-imaging the appliance (see "[Configuring Audit Logging](#)" on page 1). This procedure will transfer the existing audit logs to the appliance file system, where they can be retrieved and then erased by the re-image process.

If you have not previously configured audit logging, you are prompted with a warning about this when you initiate the re-image process.

3. Ensure that the SafeNet Luna Network HSM is connected to an uninterruptible power supply.

**CAUTION!** Loss of power during the re-image operation may leave the appliance in an unrecoverable state.

4. Log in to LunaSH as **admin**, and then log in to the HSM as HSM SO.

```
lunash:> hsm login
```

5. Re-image the appliance to the baseline version.

```
lunash:> sysconf reimage start
```

**CAUTION!** The operation takes 15-20 minutes, and the appliance reboots twice. Do not manually reboot the appliance, tamper/decommission the HSM, or otherwise interrupt the operation during this time.

```
lunash:>sysconf reimage start
```

```
The HSM Administrator is logged in. Proceeding...
```

```
To remove audit logs from the HSM, you must configure the Audit Logs feature.
```

```
If you do not configure Audit Logs before re-imaging, the existing audit log history will be retained in the HSM.
```

```
Type 'proceed' to continue the re-imaging process without configuring Audit Logs, or 'quit' to cancel.
```

```
> proceed
```

```
Proceeding...
```

```
WARNING: This operation will revert the Luna Network HSM to the baseline of software 7.2.0-220 with firmware 7.0.3 !!!
```

```
(1) This is a destructive operation that erases all partitions and key material.
```

```
(2) Ensure that you have a valid backup of all your partitions.
```

```
(3) After completion, you must re-initialize the HSM.
```

```
(4) After completion, remote PED must be re-connected.
```

```
(5) This operation takes 15-20 minutes. Make sure you have power backup in place.
```

```
(6) Access to the appliance will be unavailable. DO NOT restart the appliance during this time.
```

```
(7) The operation erases all appliance logs.
```

```
(8) The re-imaging operation will generate additional audit logs in the HSM.
```

```
(9) The re-imaging procedure includes multiple appliance reboot.
```

```
(10) This operation CANNOT be undone.
```

```
Type 'proceed' to continue, or 'quit' to quit now.
```

```
> proceed
```

```
Proceeding...
```

```
Step 1 of 7: Backing up the appliance support information
```

```
...
```

```
Done
```

```
Step 2 of 7: Setting up the environment for the Appliance Re-image.
```

```
...
```

```
Done
```

```
Step 3 of 7: Extracting the packages
```

```
...
```

```
This step may take a few minutes... \
```

```

Done
Step 4 of 7: Preparing the Luna Network HSM baseline installation scripts
...
Done
Step 5 of 7: Updating to the Luna Network HSM baseline firmware
...
Done
Step 6 of 7: Installing Luna Network HSM Base licenses
...
This step may take a few minutes... \
Done
Step 7 of 7: Factory reset Luna Network HSM
...
The Luna Network HSM with baseline firmware version has been factory reset.
Done

```

The Luna Network HSM will restart multiple times to complete the baseline installation. This process could take 15–20 minutes. Please wait for the operation to complete as interrupting the process could have adverse effects.

During the re-image operation, the following messages appear on the front-panel LCD display to help track the progress:

```

Re-imaging
in progress...
First reboot...

```

```

Re-imaging
in progress...
Second reboot...

```

- When the process is complete, log in as **admin** via SSH, using the default password **PASSWORD**, and set up the appliance as if it were new.
- [Optional] The **admin** user can view a summary file of the re-image operation and initial startup. Use **pscp/scp** to transfer the file to a client workstation.

```
lunash:> my file list
```

```
lunash:>my file list
```

```
4134 Jun 19 13:27 firstboot.log
```

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

## Troubleshooting

If the re-image operation fails before the appliance reboots, retrieve the re-image log.

```
lunash:> sysconf reimage tarlog
```

```
lunash:>sysconf reimage tarlog
```

```
'hsm reimage tarlogs' successful
```

Use 'scp' from a client machine to get file named:  
Baseline\_Re\_image\_logs.20180614\_14.40.40.tar.gz

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

The log file now appears in the **admin** user's files on the appliance (lunash:> [my file list](#)). Use [pscp/scp](#) to transfer it to a client workstation. Thales Group Customer Support may request this log to help assess the issue.

**NOTE** The Appliance Re-image feature is not supported on HSMs that use Functionality Modules. If you have ever enabled **HSM policy 50: Allow Functionality Modules**, even if the policy is currently disabled, you cannot re-image the HSM appliance. See "[Planning Your FM Deployment](#)" on page 1 for details.

## Decommissioning the HSM Appliance

This section describes how to decommission the appliance to remove all current key material and configurations, so that it can be safely redeployed.

### To decommission the SafeNet Luna Network HSM

For full decommission (removing the unit from service, clearing the HSM of all your material, clearing the appliance of all identifying information) of a SafeNet Luna Network HSM appliance, and assuming that you can power the appliance and gain **admin** access, follow these steps in LunaSH, using a serial connection:

1. Rotate all logs:

```
lunash:> syslog rotate
```

2. Delete all files in the SCP directory:

```
lunash:> my file clear
```

3. Delete all logs:

```
lunash:> syslog cleanup
```

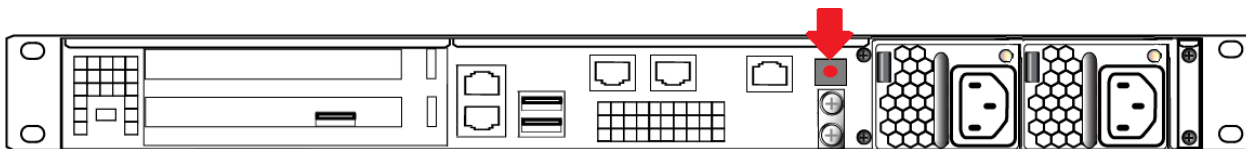
4. Return the appliance to factory-default settings:

```
lunash:> sysconf config factoryreset -service all
```

5. Delete any backups of settings:

```
lunash:> sysconf config clear
```

6. Push the decommission button (small red button, inset in the SafeNet Luna Network HSM back panel).



7. Power down the appliance.

8. Power up the appliance. At this point, the HSM internally issues and executes a **zeroize** command to erase all partitions and objects. This step takes about five minutes. The KEK is already gone at that point – erased as soon as the button is pressed – so the step of erasing partitions and objects is for customers subject to especially rigid decommission protocols.

## Disabling Decommissioning

You can disable the decommissioning feature if you have the factory-installed **HSM Capability 46: Allow Disable Decommission** (see [HSM Capabilities and Policies](#)). The primary reason for disabling decommissioning is to prevent the HSM from being automatically decommissioned due to loss of battery (see [Tamper Events](#)). If decommissioning is disabled, the SafeNet Luna Network HSM has an indefinite shelf life, as far as the battery is concerned.

### To disable decommissioning

Set **HSM Policy 46: Disable Decommission** to 1(ON).

```
lunash:> hsm changepolicy -policy 46 -value 1
```

## RMA and Shipping Back to Thales Group

Although rare, it could happen that you need to ship a SafeNet appliance back to Thales Group.

Contact your Thales representative to obtain the Return Material Authorization (RMA) and instructions for packing and shipping.

You might wish (or your security policy might require you) to take maximum precaution with any contents in your HSM before it leaves your possession.

If so, there are two options available to secure the contents of the SafeNet Luna Network HSM before returning it to Thales Group:

- > Decommission the HSM, forcibly clearing all HSM contents (see ["Decommissioning the HSM Appliance" on the previous page](#) for instructions).
- > Set Secure Transport Mode on the HSM (see [Secure Transport Mode](#) for instructions) and provide the verification string and random user string to your Thales Group representative by secure means. This will allow Thales Group to know if the HSM is tampered while in transit.

## End of Service and Disposal

SafeNet Luna HSMs and appliances are deployed into a wide variety of markets and environments. Arranging for the eventual disposal of a SafeNet Luna HSM or appliance that is no longer needed can be a simple accounting task and a call to your local computer recycling service, or it can be a complex and rigorous set of procedures intended to protect very sensitive information.

### Needs Can Differ

Some users of SafeNet Luna HSMs employ cryptographic keys and material that have a very short "shelf life". A relatively short time after the HSM is taken out of service, any objects that it contains are no longer relevant. The HSM could be disposed of, with no concern about any material that might remain in it.

The majority of our customers are concerned with their keys and objects that are stored on the HSM. It is important to them that those items never be exposed. The fact is that they are never exposed, but see below for explanations and actions that address the concerns of auditors who might be more accustomed to other ways of safeguarding HSM contents.

## SafeNet Luna HSM Protects Your Keys and Objects

The design philosophy of our SafeNet Luna HSMs ensures that contents are safe from attackers. Unlike other HSM products on the market, SafeNet Luna HSMs never store sensitive objects, like cryptographic keys, unencrypted. Therefore, SafeNet Luna HSMs have no real need - other than perception or "optics" - to perform active erasure of HSM contents, in case of an attack or tamper event.

Instead, the basic state of a SafeNet Luna HSM is that any stored keys and objects are strongly encrypted. They are decrypted only for current use, and only into volatile memory within the HSM.

If power is removed from the HSM, or if the current session closes, the temporarily-decrypted objects instantly evaporate. The encrypted originals remain, but they are unusable by anyone who does not have the correct HSM keys to decrypt them.

### How the HSM encryption keys protect your sensitive objects

In addition to encryption with the user specific access keys or passwords, all objects on the HSM are encrypted by the HSM's global key encryption key (KEK) and the HSM's unique Master Tamper Key (MTK).

If the HSM experiences a Decommission event (pressing of the small red button on back of SafeNet Luna Network HSM, or shorting of the pins of the decommission header on the HSM card, or removal of the battery while main power is not connected to a SafeNet Luna USB HSM) then the KEK is deleted.

If the HSM experiences a tamper event (physical intrusion, environmental excursion), then the MTK is destroyed.

Destruction of either of those keys instantly renders any objects in the HSM unusable by anyone. In the case of a Decommission event, when the HSM is next powered on, it requires initialization, which wipes even the encrypted remains of your former keys and objects.

We recognize that some organizations build their protocols around assumptions that apply to other suppliers' HSMs - where keys are stored unencrypted and must be actively erased in the event of an attack or removal from service. If your policies include that assumption, then you can re-initialize after Decommission - which actively erases the encrypted objects for which no decrypting key existed. For purposes of security, such an action is not required, but it can satisfy pre-existing protocols that presume a weakness not present in SafeNet Luna HSMs.

Our customers are often very high-security establishments that have rigorous protocols for removing a device from service. In such circumstances, it is not sufficient to merely ensure that all material is gone from the HSM. It is also necessary to clear any possible evidence from the appliance that contains the HSM, such as IP configuration and addresses, log files, etc.

If you have any concern that simply pressing the Decommission button and running **sysconf config factoryreset** is not sufficient destruction of potentially-sensitive information, then please refer to ["Decommissioning the HSM Appliance" on page 124](#).