# Sun Crypto Accelerator 6000 Board Version 1.1

User’s Guide

Part No.: E39851-01
February 2013

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- Industry Canada Equipment Standard for Digital Equipment (ICES-003) — Canada
- Voluntary Control Council for Interference (VCCI) — Japan
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# Preface

This guide lists the features, protocols, and interfaces of the Sun Crypto Accelerator 6000 Board from Oracle and describes how to install, configure, and manage the board in your system.

This guide assumes that you are a network administrator with experience configuring one or more of the following

- Oracle Solaris Operating System (OS)
- Sun platforms with PCI I/O cards
- Sun Java Web System Servers and Apache Web Servers
- IPsec
- SunVTS software
- certification authority acquisitions.

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**Note –** In this document these x86 related terms mean the following:
– "x86" refers to the larger family of 64-bit and 32-bit x86 compatible products.
– "x64" points out specific 64-bit information about AMD64 or EM64T systems.
– "32-bit x86" points out specific 32-bit information about x86 base systems. For supported systems, see "Hardware and Software Requirements" on page 10.

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## Product Notes

For late-breaking information and known issues about this product, refer to the products notes at:

`http://docs.oracle.com/cd/E19321-01/index.html`

## Related Documentation

| Documentation | Link |
|---|---|
| All Oracle products | http://www.oracle.com/documentation |
| Sun Crypto Accelerator 6000 Board | http://docs.oracle.com/cd/E19321-01/index.html |
| Sun Crypto Accelerator 4000 PCI Card | http://docs.oracle.com/cd/E19877-01/index.html |
| Oracle Solaris OS and systems software library | http://www.oracle.com/technetwork/indexes/documentation/index.html#sys_sw |

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CHAPTER 1

# Product Overview

This chapter provides an overview of the Sun Crypto Accelerator 6000 board, and contains the following sections:

- "Product Features" on page 1
- "Hardware Overview" on page 5
- "Hardware and Software Requirements" on page 10

## Product Features

The Sun Crypto Accelerator 6000 board is an 8-lane PCI Express based host bus adapter (HBA) that combines IPsec and SSL cryptographic acceleration with hardware security module (HSM) features. The Sun Crypto Accelerator 6000 board provides improved performance, additional security features, and support for new Oracle Solaris OS on SPARC and x86 platforms, and x86 AMD Opteron platforms running Linux. The combination of a dedicated HSM, advanced cryptographic security, and secure key management specifically meets the security and performance needs for financial services.

Once installed, the board is initialized and configured with the `scamgr` utility, which manages the keystore and user information, and determines the level of security in which the board operates. Once a keystore and security officer account are configured, Java and PKCS#11 applications such as Sun Java System server software, and OpenSSL applications such as Apache can be configured to use the board for cryptographic acceleration.

## New Features in the 1.1 Release

- Centralized key management (see Chapter 4 for details)
- Multiple keystore support (see Chapter 3 for details)
- Firmware based ECC
- Firmware based SHA-512
- Improved keystore backup (see Chapter 3 for details)
- Improved Auditing (see Chapter 3 for details)

## Key Features

- Low-profile, half-length PCE Express, 8-lane (bi-8)
- Support for Oracle Solaris Cryptographic Framework
- Accelerates IPsec and SSL cryptographic functions
- Session establishment rate – up to 13,000 operations per second
- Bulk encryption rate – up to 1 Gbps
- Provides up to 2048-bit RSA encryption
- Provides tamper-resistant secure key storage and crypto acceleration benefits for PKCS#11-aware applications such as Sun Java System Server products
- Provides centralized keystore support, enabling multiple machines to access a common key repository
- FIPS 140-2 Level 3 certification
- Low CPU utilization – frees up server system resource and bandwidth
- Secure private key storage and management
- Dynamic reconfiguration (DR), and redundancy and failover support on Sun's midframe and high-end servers
- Support for Oracle Solaris 10 OS and future compatible releases
- Support for Linux: Red Hat EL 4.0, Red Hat EL Server 5, SuSE Enterprise 10 SP 1
  - Support for openCryoptoki software
- Support for the Service Management Facility (SMF), which is an improved mechanism for controlling system startup and the relationship between services.
- Multi-Admin keystore security, supporting the requirement of multiple security officers to authenticate keystore backup and restore operations.
- Serial port for direct input adminstration interface
- USB port for keystore backup and restore to USB mass storage devices

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**Note –** IPsec cryptographic hardware acceleration is not supported on the current Linux distributions.

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## Financial Services Support

The Sun Crypto Accelerator 6000 board supports PIN and credit card related functionality, ensuring the security of sensitive customer data by performing the entire operation within the secure cryptographic boundary of the board. Specialized key management capabilities, and a new user library (`libfinsvcs.so`) and associated application interface are provided to support this feature. See Chapter 5 for details.

## Supported Applications

- Java applications
- Sun Java System Servers
- Apache Web Server
- PKCS#11 applications

## Supported Cryptographic Protocols and Algorithms

The board supports the following protocols:

- SSLv2
- SSLv3
- TLSv1
- IPsec

The board accelerates the following cryptographic algorithms.

**TABLE 1-1** Cryptographic Algorithms

| Type | Algorithm |
|---|---|
| Symmetric | DES, 3DES, AES, SHA1, SHA512, and MD5 |
| Asymmetric | Diffie-Hellman, RSA (up to 2048 bit key), DSA, and ECC<br>The following is a list of the supported ECC curves:<br>`nistp256/prime256v1/secp256r1, nistp384/secp384r1`<br>`nistp521/secp521r, nistk163/sect163k1`<br>`nistb163/sect163r2, nistk233/sect233k1`<br>`nistb233/sect233r1, nistk283/sect283k1`<br>`nistb283/sect283r1, nistk409/sect409k1`<br>`nistb409/sect409r1, nistk571/sect571k1`<br>`nistb571/sect571r1, nistp192/secp192r1`<br>`nistp224/secp224r1` |

The board accelerates the following SSL functions:

- Secure establishment of a set of cryptographic parameters, and secret keys between a client and a server.
- Secure key storage on the board. Keys are encrypted if they leave the board.

## Diagnostic Support

- SunVTS diagnostic tests
- Security officer initiated diagnostics (`scadiag` and `scamgr`)

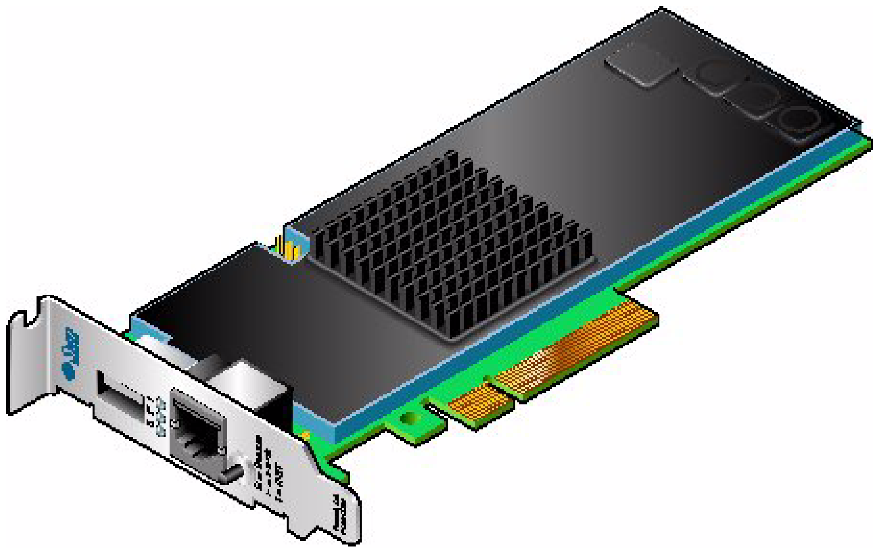
## Cryptographic Algorithm Acceleration

Together with the Oracle Solaris Cryptographic Framework, the board accelerates cryptographic algorithms in both hardware and software. The reason for this complexity is that the cost of accelerating cryptographic algorithms is not uniform across all algorithms. Some cryptographic algorithms were designed specifically to be implemented in hardware, others were designed to be implemented in software. For hardware acceleration, there is the additional cost of moving data from the user application to the hardware acceleration device, and moving the results back to the user application. Note that a few cryptographic algorithms can be performed by highly tuned software as quickly as they can be performed in dedicated hardware.

## Hardware Overview

The Sun Crypto Accelerator 6000 hardware is a low-profile, half-length (6.6 inches [1.67.64 mm] by 2.54 inches [64.41 mm]) 8-lane PCI Express based HBA that enhances the performance of IPsec and SSL, and provides robust security features. FIGURE 1-1 provides an illustration of the board.

**FIGURE 1-1** Sun Crypto Accelerator 6000 Board



## LED Displays

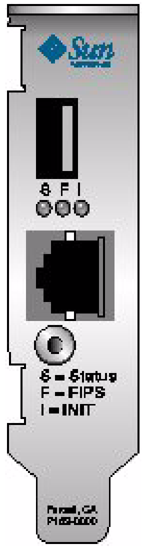
TABLE 1-2 describes the LED displays.

**TABLE 1-2** Front Panel LEDs

| Label | Color | Indication |
|---|---|---|
| STATUS | Green/Red | • Off when bootstrap firmware executes<br>• Green in POST, and DISABLED states (driver not attached)<br>• Flashing green in IDLE, OPERATIONAL, and FAILSAFE states (heart beat)<br>• Red when board is in the HALTED (fatal error) state or when a low-level hardware initialization failure occurs<br>• Flashing red if an error occurrs during the boot process |
| FIPS | Green/Yellow | • Off in non-FIPS mode<br>• Green when operating in FIPS mode<br>• Flashing yellow when zeroize jumper is present |
| INIT | Green/Yellow | • Off if the board has not been initialized<br>• Green if the card has been initialized by a security officer<br>• Yellow in POST, DIAGNOSTICS, and FAILSAFE (firmware not upgraded) states<br>• Flashing yellow when running DIAGNOSTICS |

FIGURE 1-2 shows the location of the LEDs.

**FIGURE 1-2** LED Locations



## Direct Input Devices

The Sun Crypto Accelerator 6000 board has three direct input devices: an RJ-11 serial port, a USB port, and a Point of Presence button.

### Serial Port

The six-wire RJ-11 port connector enables direct input adminstration. The port operates at a baud rate of 9600-8N1. The pinout specifications are described in TABLE 1-3 and shown in FIGURE 1-3.

**TABLE 1-3** RJ-11 Port Connector Pins and Signals

| Pin | Signal | Definition |
|---|---|---|
| 1 | PWR | 5 volt DC power |
| 2 | NC | Not connected |
| 3 | NC | Not connected |

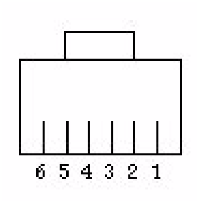
**TABLE 1-3** RJ-11 Port Connector Pins and Signals *(Continued)*

| Pin | Signal | Definition |
|---|---|---|
| 4 | XMIT | Transmit data |
| 5 | RECV | Data receive |
| 6 | GND | Signal ground |

### *Serial Device*

Any device with a properly configured serial port and cable can be used for direct input administration of the device. However, for maximum security a stateless hand-held device ensures that sensitive information and keying material are not compromised. One such device tested is the Termiflex OT/30 hand-held terminal from Warner Power. A Termiflex OT/30 terminal has been configured specifically for use with the Sun Crypto Accelerator 6000 board and can be ordered directly from Warner Power using part number 99-3619-04001 (`http://www.termiflex.com/`).

**FIGURE 1-3** RJ-11 Port Connector Pins



## USB Port

The standard size USB connector enables you to back up and restore the on-board keystore. The port is USB 1.1 compliant and is compatible with standard USB mass storage devices (bulk-only).

### *USB Device*

Although other USB mass-storage devices will work, only a few devices have been fully tested and qualified for use with the Sun Crypto Accelerator 6000 board. Before using another device for backup and restore operations, verify that diagnostics run successfully with the USB device installed. Choose devices with high transfer speeds and quick response times for the best compatibility with the board.

The following devices have been verified to work with the board:

- JetFlash 2.0 USB Flash Drive from Transcend
- DataTravler 100 USB Flash Drive from Kingston
- Attache Optima Pro High Speed USB 2.0 Drive from PNY

### *Point of Presence Button*

The Point of Presence button provides physical presence verification when pressed. The physical pressing of this button cannot be emulated remotely.

## Dynamic Reconfiguration and High Availability

The Sun Crypto Accelerator 6000 hardware and associated software provide the capability to work effectively on SPARC platforms supporting dynamic reconfiguration (DR) and hot-plugging. During a DR or hot-plug operation, the Sun Crypto Accelerator 6000 software layer automatically detects the addition or removal of a board, and adjusts the scheduling algorithms to accommodate the change in hardware resources.

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**Note –** DR is supported on SPARC platforms only.

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For High Availability (HA) configurations, multiple Sun Crypto Accelerator 6000 boards can be installed within a system or domain to insure that hardware acceleration is continuously available. In the unlikely event of a Sun Crypto Accelerator 6000 hardware failure, the software layer detects the failure and removes the failed board from the list of available hardware cryptographic accelerators. Sun Crypto Accelerator 6000 software adjusts the scheduling algorithms to accommodate the reduction in hardware resources. Subsequent cryptographic requests are scheduled to the remaining boards.

The Sun Crypto Accelerator 6000 hardware provides a source for high-quality entropy for the generation of long-term keys. If all the Sun Crypto Accelerator 6000 boards within a domain or system are removed, long-term keys are generated with lower-quality entropy.

## Load Sharing

The Sun Crypto Accelerator 6000 software enables the distribution of load across as many boards as are installed within the Oracle Solaris domain or system. In order to use load sharing, each board must be configured to use the same keystore. See Chapter 4.

## Hardware and Software Requirements

TABLE 1-4 provides a summary of the hardware and software requirements for the Sun Crypto Accelerator 6000 board.

**TABLE 1-4** Hardware and Software Requirements

| Hardware and Software | Requirements |
|---|---|
| Hardware | • Sun Fire T1000, T2000, x2100, x2200, x4200, x4600 servers<br>• Sun SPARC Enterprise T5120 and T5220 servers<br>• Sun Ultra 40, 20 |
| Operating system | Oracle Solaris 10, Red Hat EL 4.0, Red Hat EL Server 4 and 5, and SuSE Enterprise 10 SP1 Linux*, and future compatible releases of these operating systems. |

***Note –*** 1 Gbyte of memory is suggested for Linux operating systems.

## Oracle Solaris 10 OS on SPARC and x86 Platforms

The Sun Crypto Accelerator 6000 board supports the Oracle Solaris 10 Operating System on both SPARC and x86 AMD Opteron Linux platforms. The board acts as a cryptographic service provider to the Oracle Solaris Cryptographic Framework, allowing applications to access the board's functionality with PKCS#11, OpenSSL, and Java (J2SE).

## x86 AMD Opteron Platforms Running Linux

The openCryptoki software interface is used in Linux environments to access the Sun Crypto Accelerator 6000 board. The openCryptoki software provides a user level interface that enables selecting specific cryptographic providers.

## Required Patches

Refer to the *Sun Crypto Accelerator 6000 Board Product Notes for Version 1.1* (820-4145) for required patch information.

CHAPTER 2

# Installing the Sun Crypto Accelerator 6000 Board

This chapter describes how to install the Sun Crypto Accelerator 6000 hardware on both the Oracle Solaris and Linux operating systems, how to install and remove the software, and also how to migrate back to 1.0 software and firmware.

This chapter includes the following sections:

**Caution –** If you want the ability to return to a Version 1.0 environment, you must make a backup of the 1.0 keystore and master key prior to upgrading to 1.1. See "Migrating Back to Version 1.0 From 1.1" on page 30.

Once you have installed the hardware and software of the board, you must initialize the board with configuration and keystore information. See "Initializing the Board With `scamgr`" on page 38 for information on how to initialize the board.

## Handling the Board

Each board is packed in a special antistatic bag to protect it during shipping and storage. To avoid damaging the static-sensitive components on the board, reduce any static electricity on your body before touching the board by using one of the following methods:

- Touch the metal frame of the computer.
- Attach an antistatic wrist strap to your wrist and to a grounded metal surface.

**Caution –** To avoid damaging the sensitive components on the board, wear an antistatic wrist strap when handling the board, hold the board by its edges only, and always place the board on an antistatic surface (such as the plastic bag it came in).

## Installing the Board on Oracle Solaris Platforms

Installing the Sun Crypto Accelerator 6000 board involves inserting the board into the system and loading the software tools. The hardware installation instructions include only general steps for installing the board. Refer to the documentation that came with your system for specific installation instructions.

### ▼ Install the Hardware

1. **As superuser, follow the instructions that came with your system to shut down and power off the computer, disconnect the power cord, and remove the computer cover.**

2. **Locate an unused PCI slot (preferrably an x8 PCI Express slot).**

3. **Attach an antistatic wrist strap to your wrist, and attach the other end to a grounded metal surface.**

4. **Using a Phillips screwdriver, remove the screw from the PCI slot cover.**

   Save the screw to hold the bracket in Step 6.

5. **Holding the Sun Crypto Accelerator 6000 board by its edges only, take it out of the plastic bag and insert it into the PCI slot.**

6. **Secure the screw on the rear bracket.**

7. **Replace the computer cover, reconnect the power cord, and power on the system.**

8. **Verify that the board is properly installed.**

- For Oracle Solaris SPARC platforms, enter the `prtdiag` command from a terminal:

```
% prtdiag
========================= IO Configuration =========================


           IO
Location   Type Slot Path                                  Name          Model
---------- ---- ---- ------------------------------------- ------------- ---------
IOBD/NET0  PCIE IOBD /pci@780/pci@0/pci@1/network@0      network-pciex8086,105e
IOBD/NET1  PCIE IOBD /pci@780/pci@0/pci@1/network@0,1    network-pciex8086,105e
IOBD/PCIE0 PCIE 0    /pci@780/pci@0/pci@8/pci@0/pci108e,5ca0@e  pci108e,5ca0
IOBD/PCIX  PCIX IOBD /pci@7c0/pci@0/pci@1/pci@0/isa@2    isa
IOBD/PCIX  PCIX IOBD /pci@7c0/pci@0/pci@1/pci@0/usb@5    usb-pciclass,0c0310
IOBD/PCIX  PCIX IOBD /pci@7c0/pci@0/pci@1/pci@0/usb@6    usb-pciclass,0c0310
IOBD/PCIX  PCIX IOBD /pci@7c0/pci@0/pci@1/pci@0/ide@8    ide-pci10b9,5229
IOBD/PCIX  PCIX PCIX /pci@7c0/pci@0/pci@1/pci@0,2/LSILogic,sas@2      LSILogic,sas-
pci1000,50 LSI,1064
IOBD/NET2  PCIE IOBD /pci@7c0/pci@0/pci@2/network@0      network-pciex8086,105e
IOBD/NET3  PCIE IOBD /pci@7c0/pci@0/pci@2/network@0,1    network-pciex8086,105e
```

  In the preceding example, the `/pci@780/pci@0/pci@8/pci@0/pci108e,5ca0@e` identifies the device path to the Sun Crypto Accelerator 6000 board. There is one such line for each board in the system.

- For Oracle Solaris x86 platforms, enter the `scanpci` command from a terminal:

```
# /usr/X11/bin/scanpci
...
pci bus 0x0082 cardnum 0x0e function 0x00: vendor 0x108e device
0x5ca0
  Sun Microsystems Computer Corp.  Device unknown
```

## Installing the Sun Crypto Accelerator 6000 Software With the `install` Script

There are two methods to install the software, manually or with the `install` script. This section describes how to install the software with the `install` script. To install the software manually, refer to "Installing the Software on Oracle Solaris Platforms Without the Installation Script" on page 21.

The `install` script identifies which platform you are installing on (Oracle Solaris SPARC or x86, Linux x86 or x64) and calls the appropriate installation scripts for your platform. The `install` script also automatically installs the required patches before installing the software.

In addition to the software provided on the product CD, required software is provided at My Oracle Support (`http://support.oracle.com`).

For CD installations, the `install` script path is as follows:

`/cdrom/cdrom0/Sun_Crypto_Acc_6000`

Otherwise, the install script paths for Solaris 10 and Solaris 11 are as follows:

**Solaris 10** – `Sun_Crypto_Acc_6000-1_1-u2-Solaris/Solaris10`

**Solaris 11** – `Sun_Crypto_Acc_6000-1_1-u2-Solaris/Solaris11`

### ▼ Install the Software With the `install` Script

1. **If installing from a CD, insert the Sun Crypto Accelerator 6000 CD into a CD-ROM drive that is connected to your system.**
   - If your system is running Sun Enterprise Volume Manager, the system should automatically mount the CD-ROM to the `/cdrom/cdrom0` directory.
   - If your system is not running Sun Enterprise Volume Manager, mount the CD-ROM as follows:

```
# mount -F hsfs -o ro /dev/dsk/c0t6d0s2 /cdrom
```

You see the following files and directories in the `/cdrom/cdrom0/Sun_Crypto_Acc_6000` directory:

**TABLE 2-1** Files in the `/cdrom/cdrom0/Sun_Crypto_Acc_6000` Directory

| File or Directory | Contents |
|---|---|
| `README` | |
| `Copyright` | U.S. copyright file |
| `FR_Copyright` | French copyright file |
| `install` | Script that installs the Sun Crypto Accelerator 6000 packages for both Oracle Solaris SPARC and x86 systems, and for Linux x86 or x64 systems |
| `Solaris/sparc` | Contains the Oracle Solaris SPARC software packages:<br>• `SUNWmcact` – Activation file<br>• `SUNWmcadevfw` – Development firmware<br>• `SUNWmcaf` – FMA support<br>• `SUNWmcafw` – Firmware<br>• `SUNWmcamn` – Manual pages<br>• `SUNWmcar` – Drivers<br>• `SUNWmcau` – User components<br>• `SUNWscafsu` – Financial services (`usr`)<br>• `SUNWscafsm` – Financial services manual pages<br>• `SUNWscamga` – Administration client<br>• `SUNWscamgm` – Administration manual pages<br>• `SUNWscamgr` – Administration (`root`)<br>• `SUNWscamgu` – Administration (`usr`) |
| `Solaris/i386/` | Contains the Oracle Solaris i386 software packages:<br>• `SUNWmcact` – Activation file<br>• `SUNWmcaf` – FMA support<br>• `SUNWmcafw` – Firmware<br>• `SUNWmcamn` – Manual pages<br>• `SUNWmcar` – Drivers<br>• `SUNWmcau` – User components<br>• `SUNWscafsu` – Financial services (`usr`)<br>• `SUNWscafsm` – Financial services manual pages<br>• `SUNWscamga` – Administration client<br>• `SUNWscamgm` – Administration manual pages<br>• `SUNWscamgr` – Administration (`root`)<br>• `SUNWscamgu` – Administration (`usr`) |
| `Solaris/install` | Script that installs the software packages for both Oracle Solaris SPARC and x86 systems. This script is normally called by the main `install` script. |
| `Solaris/remove` | Script that removes the software packages for Oracle Solaris SPARC and x86 systems. |

**TABLE 2-1** Files in the `/cdrom/cdrom0/Sun_Crypto_Acc_6000` Directory *(Continued)*

| File or Directory | Contents |
|---|---|
| `Linux/`*supported-kernel* | Contains the Linux x86 or x64 software `rpm` packages:<br>• `sun-sca6000` – software and drivers<br>• `sun-sca6000 – admin` – administration utilities<br>• `sun-sca6000 – config` – configuration files for administration and keystore I/O services<br>• `sun-sca6000-man` – user documentation<br>• `sun-sca6000-var` – variable length files<br>• `sun-sca6000-libs` – supporting libraries<br>• `sun-nss` – Netscape Security Services libraries and tools<br>• `sun-nspr` – Netscape Portable Runtime Layer libraries |
| `Linux/install` | Script that installs the Sun Crypto Accelerator 6000 packages for Linux systems. This script is normally called by the main `install` script. |
| `Linux/remove` | Script that removes the Sun Crypto Accelerator 6000 packages for Linux x86 systems. |
| `docs` | Contains the PDF pointer document that links to the required software and the latest user's guide (this document) and product notes (820-4145). |

2. **Install the required software by typing:**

```
# cd path_to_install_script
# ./install
```

The `install` script analyzes the system to identify the system architecture and the required patches. The `install` script then installs those patches, and installs the main software appropriate for your system. The following is an example of running the `install` script on a Oracle Solaris SPARC system.

---

**Note –** The copyright and license information is omitted from the following example. Refer to Appendix C for copyright and software licenses.

---

```
# ./install

[Licensing Text Output]

Do you accept the license agreement? [y/n]: y

This program installs the software for the Sun Crypto Accelerator
6000, Version 1.1.

Copyright 2007 Sun Microsystems, Inc.  All rights reserved.
Use is subject to license terms.
```

```
The Sun Crypto Accelerator 6000 Board User's Guide (820-4144) and the
Sun Crypto Accelerator 6000 Board Release Notes (820-4145) can be
found at:
       http://docs.oracle.com

Please read and understand these documents prior to software installation.

Do you wish to continue the installation? [y,n,?] y
Checking for optional package dependencies...

Do you wish to install the optional Crypto IPsec Acceleration software
(SUNWmcact)?  [y,n,?,q] y

This script is about to take the following actions:
- Install Sun Crypto Accelerator 6000 support for Solaris 10
- Install Optional Crypto IPsec Acceleration software

To cancel installation of this software, press 'q' followed by a Return.
         **OR**
Press Return key to begin installation:

*** Installing Sun Crypto Accelerator 6000 software for Solaris 10...
Installing packages:
        SUNWmcafw SUNWmcact SUNWmcamn SUNWmcar SUNWmcau SUNWscafsm SUNWscafsu
SUNWscamga SUNWscamgm SUNWscamgr SUNWscamgu

Installing SUNWmcafw...
    was successful.
Installing SUNWmcact...
    was successful.
Installing SUNWmcamn...
    was successful.
Installing SUNWmcar...
    was successful.
Installing SUNWmcau...
    was successful.
Installing SUNWscafsm...
    was successful.
Installing SUNWscafsu...
    was successful.
Installing SUNWscamga...
    was successful.
Installing SUNWscamgm...
    was successful.
Installing SUNWscamgr...
    was successful.
Installing SUNWscamgu...
    was successful.
```

```
*** Installation complete.

To remove this software, use the 'remove' script on this CDROM, or
the following script:

        /var/tmp/crypto_acc.remove

A log of this installation can be found at:
        /var/tmp/crypto_acc.install.2007.10.18.0743
```

## Directories and Files for Oracle Solaris Platforms

TABLE 2-2 shows the directories created on your system by the default installation of the Sun Crypto Accelerator 6000 software.

**TABLE 2-2** Sun Crypto Accelerator 6000 Directories and Files for Solaris Platforms

| Directory | Contents |
|---|---|
| `/kernel/drv` | Driver configuration files |
| `/kernel/drv/sparcv9` | 64-bit SPARC drivers |
| `/kernel/drv/amd64` | 64-bit AMD drivers |
| `/opt/SUNWsca/include` | Financial services header files |
| `/opt/SUNWsca/lib` | Financial services libraries |
| `/opt/SUNWsca/lib/sparcv9` | Financial services libraries |
| `/opt/SUNWsca/lib/amd64` | Financial services libraries |
| `/opt/SUNWsca/man` | Financial services man pages |
| `/usr/lib/crypto` | Services |
| `/usr/lib/crypto/firmware/sca` | Firmware files |
| `/usr/lib/rcm/scripts` | RCM scripts |
| `/usr/man` | Man pages |
| `/usr/sbin` | Administration utilities |
| `/var/sca/keydata` | Keystore files (encrypted) |
| `/var/sca/log` | Service log files |

**TABLE 2-2** Sun Crypto Accelerator 6000 Directories and Files for Solaris Platforms

| Directory | Contents |
|---|---|
| `/var/sca/cfg` | Centralized keystore (CKS) bootstrap files |
| `/var/sca/private` | Security files for the CKS |
| `/var/svc/manifest/device` | Service manifests |

---

**Note –** Once you install the Sun Crypto Accelerator 6000 hardware and software, you need to initialize the board with configuration and keystore information. See "Initializing the Board With `scamgr`" on page 38 for information on how to initialize the board.

---

## Removing the Sun Crypto Accelerator 6000 Software on Oracle Solaris Platforms With the `remove` Script

If you used the `install` script to install the software, use the `remove` script on the CD-ROM to remove the software. If you installed the software without the `install` script, see "Removing the Software on Oracle Solaris Platforms Without the `remove` Script" on page 23.

### ▼ Remove the Software With the `remove` Script on the CD-ROM

1. **Insert the Sun Crypto Accelerator 6000 CD-ROM.**

**2. Type the following:**

```
# /var/tmp/crypto_acc.remove
All required software for the Sun Crypto Accelerator  6000
software  will be REMOVED.

The following packages will be removed:
 SUNWscamgu SUNWscamgr SUNWscamgm SUNWscamga SUNWscafsu SUNWscafsm
SUNWmcau SUNWmcar SUNWmcamn SUNWmcafw SUNWmcact
To cancel removal of this software, press 'q' followed by a Return.
         **OR**
Press Return key to begin package removal:
*** Found the following packages to remove:
           SUNWscamgu SUNWscamgr SUNWscamgm SUNWscamga SUNWscafsu
SUNWscafsm SUNWmcau SUNWmcar SUNWmcamn SUNWmcafw SUNWmcact
*** Removing old package(s)...
Stopping scad Service
Removing scad Service from SMF
Stopping scakiod Service
Removing scakiod Service from SMF

Removal of <...> was successful.
...
*** Done.  A log of this removal can be found at:
        /var/tmp/crypt_acc.remove.2007.10.18
```

## ▼ For Oracle Solaris 11, Remove the Software With the `remove` Script

**1. Change to the** `Solaris11` **directory.**

```
# cd Sun_Crypto_Acc_6000-1_1-u2-Solaris/Solaris11
```

**2. Enter the following.**

```
# ./remove
```

## Installing the Software on Oracle Solaris Platforms Without the Installation Script

This section describes how to install the software manually without using the installation script provided on the product CD.

Refer to the latest version of the *Sun Crypto Accelerator 6000 Board Product Notes for Version 1.1* (820-4145) for a list of the required patches. You must install all of the required patches before installing the main software. The latest product notes are available at: `http://docs.oracle.com/cd/E19321-01/820-4145-16/820-4145-16.pdf`

---

**Note –** The `install` script automatically identifies your system architecture, installs the required patches, and installs the main software appropriate for your system.

---

In addition to the software provided on the product CD, required software is provided at My Oracle Support (`http://support.oracle.com`).

### ▼ Install the Software Without the `install` Script

1. **If installing from a CD, insert the Sun Crypto Accelerator 6000 CD into a CD-ROM drive that is connected to your system.**

- If your system is running Sun Enterprise Volume Manager, the system should automatically mount the CD-ROM to the `/cdrom/cdrom0` directory.
- If your system is not running Sun Enterprise Volume Manager, mount the CD-ROM as follows:

```
# mount -F hsfs -o ro /dev/dsk/c0t6d0s2 /cdrom
```

The required packages must be installed in a specific order and must be installed before installing any optional packages. Once the required packages are installed, you can install and remove the optional packages in any order.

2. **If installing from a CD, install the required software packages by typing:**

```
# cd /cdrom/cdrom0/Sun_Crypto_Acc_6000/Packages
# pkgadd -d . SUNWmcafw SUNWmcact SUNWmcamn SUNWmcar SUNWmcau SUNWscafsm
SUNWscafsu SUNWscamga SUNWscamgm SUNWscamgr SUNWscamgu
```

3. **If not installing from a CD, enter the following commands:**

```
# cd /Sun_Crypto_Acc_6000-1_1-u2-Solaris/Solaris11
# pkg install -g repo SUNWmcact SUNWmcafw SUNWmcamn SUNWmcar SUNWmcau SUNWscafsm
SUNWscafsu SUNWscamga SUNWscamgm SUNWscamgr
# pkg install -g repo SUNWscamgu
```

4. **(Optional) To verify that the software is installed properly, run the** `pkginfo` **command.**

```
# pkginfo SUNWmcafw SUNWmcact SUNWmcamn SUNWmcar SUNWmcau SUNWscafsm SUNWscafsu
SUNWscamga SUNWscamgm SUNWscamgr SUNWscamgu
system      SUNWmcact  Sun Crypto Accelerator 6000 Activation File
system      SUNWmcafw  Sun Crypto Accelerator 6000 Firmware
system      SUNWmcamn  Sun Crypto Accelerator 6000 Manual Pages
system      SUNWmcar   Sun Crypto Accelerator 6000 Drivers
system      SUNWmcau   Sun Crypto Accelerator 6000 User Components
system      SUNWscafsu Sun Crypto Accelerator Financial Services
system      SUNWscafsm Sun Crypto Accelerator Financial Services Man Pages
system      SUNWscamga Sun Crypto Accelerator Administration Client
system      SUNWscamgm Sun Crypto Accelerator Administration Man Pages
system      SUNWscamgr Sun Crypto Accelerator Administration (root)
system      SUNWscamgu Sun Crypto Accelerator Administration (usr)
```

5. **(Optional) To ensure that the driver is attached, use one of the following commands:**

- For Oracle Solaris SPARC platforms, use the `prtdiag` command.

```
# prtdiag -v
```

  Refer to the `prtdiag`(1M) online manual pages.

- For Oracle Solaris x86 platforms, use  the `scanpci` command.

```
# /usr/X11/bin/scanpci
...
pci bus 0x0082 cardnum 0x0e function 0x00: vendor 0x108e device
0x5ca0
  Sun Microsystems Computer Corp.  Device unknown
```

6. **(Optional) Use the `modinfo` command to see that modules are loaded.**

```
# modinfo | grep Crypto
62   1317f62  20b1f 198   1  crypto (MCA Crypto 1.0)
197  136d5d6   19b0 199   1  cryptoadm (MCA Crypto Control 1.0)
```

See "Directories and Files for Oracle Solaris Platforms" on page 18 for a description of the directories and files in the default installation.

## Removing the Software on Oracle Solaris Platforms Without the `remove` Script

---

**Note –** Remove the Sun Crypto Accelerator 6000 software manually only if you did *not* use the `install` script to install the software. If you installed the software with the installation script, to remove the software, see "Removing the Sun Crypto Accelerator 6000 Software on Oracle Solaris Platforms With the `remove` Script" on page 19.

---

If you have created keystores (see "Managing Keystores With `scamgr`" on page 57), you must delete the keystore information that the Sun Crypto Accelerator 6000 board is configured with before removing the software. The `zeroize` command removes all key material, but does not delete the keystore files that are stored in the file system of the physical host in which the board is installed. See the "Perform a Software Zeroize on the Board" on page 81 for details on the `zeroize` command. If you have not yet created any keystores, you can skip this procedure.

### ▼ Delete Existing Keystores

1. **Become superuser.**

2. **Remove the keystore files with the `rm` command.**

---

**Caution –** Do not delete a keystore that is currently in use or that is shared by other users and keystores. To free references to keystores, you might have to shut down the web server, administration server, or both.

---

For example:

```
 # rm /var/sca/keydata
```

## ▼ Remove the Software Without the `remove` Script

---

**Caution –** Before removing the Sun Crypto Accelerator 6000 software, disable any web servers you have enabled for use with the Sun Crypto Accelerator 6000 board. Failure to do so leaves those web servers nonfunctional.

---

- **As superuser, use the `pkgrm` command (for Solaris 10) or `pkg uninstall` command (for Solaris 11) to remove only the software packages you installed.**

---

**Caution –** Installed packages must be removed in the order shown. Failure to remove them in this order could result in dependency warnings and leave kernel modules loaded.

---

For Solaris 10, if you installed all the packages, you would remove them as follows:

```
 # pkgrm SUNWscamgu SUNWscamgr SUNWscamgm SUNWscamga SUNWscafsu
SUNWscafsm SUNWmcau SUNWmcar SUNWmcamn SUNWmcafw SUNWmcact
```

For Solaris 11, if you installed all the packages, you would remove them as follows:

```
 # pkg uninstall SUNWmcact SUNWmcafw SUNWmcamn SUNWmcar SUNWmcau SUNWscafsm
SUNWscafsu SUNWscamga SUNWscamgm SUNWscamgr
 # pkg uninstall SUNWscamgu
```

## Installing the Sun Crypto Accelerator 6000 Board on Linux Platforms

openCryptoki software is required for the board on Linux platforms. You must install openCryptoki before installing the software. Refer to Appendix B to install the openCryptoki software.

## ▼ Install the Sun Crypto Accelerator 6000 Hardware on Linux Platforms

---

**Note –** openCryptoki must be installed before installing the Sun Crypto Accelerator 6000 packages.

---

1. **Follow the steps in "Install the Hardware" on page 12.**
2. **After the system is running, type the following command to verify the board is installed properly:**

```
% lspci
```

The output of the previous command should contain the following line:

```
Network and computing encryption device: Sun Microsystems Computer
Corp.: Unknown device 5ca0
```

## ▼ Install the Sun Crypto Accelerator 6000 Software on Linux Platforms With the `install` Script

1. **Insert the Sun Crypto Accelerator 6000 CD into a CD-ROM drive that is connected to your system and enter the following command:**

```
% ./install
Do you accept the license agreement? [y/n]: y

Installing required packages:
     sun-nspr-4.6.7-2.i386.rpm
     sun-nss-3.11.7-2.i386.rpm
     sun-sca6000-admin-1.1-1.i386.rpm
     sun-sca6000-var-1.1-1.i386.rpm
     sun-sca6000-config-1.1-1.i386.rpm
     sun-sca6000-libs-1.1-1.i386.rpm
     sun-sca6000-1.1-1.i386.rpm
     sun-sca6000-man-1.1-1.i386.rpm
     sun-sca6000-firmware-1.1-1.i386.rpm
To remove this software, use the 'remove' script on this CDROM, or
the following script:
       /var/tmp/crypto_acc.remove

A log of this installation can be found at:
    /var/tmp/crypto_acc.install.2007.10.31.1009
```

## Installing the Sun Crypto Accelerator 6000 Software on Linux Platforms Without the `install` Script

The packages for SuSE Linux Enterprise Server 9 Service Pack 3 are in the `2.6.5-7.244-smp-x86_64` directory. The packages for Red Hat Enterprise Linux 4.0 Update 2 are in the `2.6.9-22.ELsmp-x86_64` directory. The packages are as follows:

- `sun-nspr-4.6.7-2.x86_64.rpm`
- `sun-nss-3.11.7-2.x86_64.rpm`
- `sun-sca6000-1.1-1.x86_64.rpm`
- `sun-sca6000-admin-1.1-1.x86_64.rpm`
- `sun-sca6000-config-1.1-1.x86_64.rpm`
- `sun-sca6000-firmware-1.1-1.x86_64.rpm`
- `sun-sca6000-libs-1.1-1.x86_64.rpm`
- `sun-sca6000-man-1.1-1.x86_64.rpm`
- `sun-sca6000-var-1.1-1.x86_64.rpm`

### ▼ Install the Software Without the `install` Script

1. **If it is not already on the system, install the NSPR and NSS libraries and** tools:

```
% rpm -i sun-nspr-4.6.7-2.x86_64.rpm sun-nss-3.11.7-2.x86_64.rpm

% rpm -i sun-sca6000-admin-1.1-1.x86_64.rpm sun-sca6000-config-1.1-1.x86_64.rpm
sun-sca6000-firmware-1.1-1.x86_64.rpm sun-sca6000-libs-1.1-1.x86_64.rpm
sun-sca6000-var-1.1-1.x86_64.rpm sun-sca6000-1.1-1.x86_64.rpm
```

2. **Change to the appropriate directory for your platform and enter the following command:**

```
% rpm -i sun-sca6000-man-1.1-1.x86_64.rpm sun-sca6000-admin-1.1-
1.x86_64.rpm sun-sca6000-var-1.1-1.x86_64.rpm sun-sca6000-config-
1.1-1.x86_64.rpm sun-sca6000-1.1-1.x86_64.rpm sun-sca6000-
firmware-1.1-1.x86_64.rpm
```

3. **(Optional) To ensure that the driver is attached, use the `scanpci` command.**

```
# /usr/X11R6/bin/scanpci
...
pci bus 0x0082 cardnum 0x0e function 0x00: vendor 0x108e device
0x5ca0
  Sun Microsystems Computer Corp.  Device unknown
```

## Directories and Files for Linux Platforms

TABLE 2-3 shows the directories created on your system by the default installation of the Sun Crypto Accelerator 6000 software.

**TABLE 2-3** Directories and Files for Linux Platforms

| Directory | Contents |
|---|---|
| `/etc/init.d` | Start and stop scripts (links) |
| `/etc/rc5.d` | Service configuration files |
| `/etc/opt/sun/sca6000` | Daemon configuration files |
| `/opt/sun/sca6000/bin` | Application executables, drivers, and the `scamgr` utility |
| `/opt/sun/sca6000/bin/drv` | Driver files |
| `/opt/sun/sca6000/firmware` | Firmware files |
| `/opt/sun/sca6000/lib` | openCryptoki plug-in and application libraries |
| `/opt/sun/sca6000/man` | Man pages |
| `/opt/sun/sca6000/sbin` | Administration utilities and services and daemon executables |
| `/opt/sun/sca6000/private/lib` | Support libraries |
| `/opt/sun/sca6000/private/lib64` | Support libraries |
| `/usr/local/lib/opencryptoki/stdll/` | openCryptoki plug-in files |
| `/var/opt/sun/sca6000/keydata` | Keystore files (encrypted) |
| `/var/opt/sun/sca6000/lock` | Service lock files |

**TABLE 2-3** Directories and Files for Linux Platforms *(Continued)*

| **Directory** | **Contents** |
|---|---|
| `/var/opt/sun/sca6000/log` | Service log files |
| `/var/opt/sun/sca6000/private` | Security files for centralized keystore |
| `/var/opt/sun/sca6000/cfg` | Centralized keystore (CKS) bootstrap files |

---

**Note –** Once you install the Sun Crypto Accelerator 6000 hardware and software, you must initialize the board with configuration and keystore information. See "Initializing the Board With `scamgr`" on page 38 for information on how to initialize the board.

---

# Removing the Sun Crypto Accelerator 6000 Software on Linux Platforms

## Removing the Sun Crypto Accelerator 6000 Software With the `remove` Script

All applications, such as Sun Java System and Apache Web Servers, that are using the board must be stopped before uninstalling the Sun Crypto Accelerator 6000 software.

## ▼ Remove the Software With the `remove` Script

**1. Enter the following command.**

```
# /var/tmp/crypto_acc.remove
All required software for the Sun Crypto Accelerator  6000
software  will be REMOVED.

The following packages will be removed:
 sun-sca6000-firmware-1.1-1 sun-sca6000-man-1.1-1 sun-sca6000-
1.1-1 sun-sca6000-libs-1.1-1 sun-sca6000-config-1.1-1 sun-
sca6000-var-1.1-1 sun-sca6000-admin-1.1-1
To cancel removal of this software, press 'q' followed by a Return.
     **OR**
Press Return key to begin package removal.

*** Found the following packages to remove:
            sun-sca6000-firmware-1.1-1 sun-sca6000-man-1.1-1 sun-
sca6000-1.1-1 sun-sca6000-libs-1.1-1 sun-sca6000-config-1.1-1
sun-sca6000-var-1.1-1 sun-sca6000-admin-1.1-1
*** Removing old package(s)...
Removing sun-sca6000-firmware-1.1-1 package...
Removing sun-sca6000-man-1.1-1 package...
Removing sun-sca6000-1.1-1 package...
Removing sun-sca6000-libs-1.1-1 package...
Removing sun-sca6000-config-1.1-1 package...
Removing sun-sca6000-var-1.1-1 package...
Removing sun-sca6000-admin-1.1-1 package...
*** Done.  A log of this removal can be found at:
    /var/tmp/crypt_acc.remove.2007.10.31
```

## ▼ Remove the Software Without the `remove` Script

**1. Enter one of the following command on one line:**

```
% rpm -e sun-sca6000-1.0-1.x86_64.rpm sun-sca6000-man-1.0-
1.x86_64.rpm sun-sca6000-admin-1.0-1.x86_64.rpm sun-sca6000-var-
1.0-1.x86_64.rpm sun-sca6000-config-1.0-1.x86_64.rpm sun-sca6000-
firmware-1.0-1.x86_64.rpm

% rpm -e sun-sca6000 sun-sca6000-libs sun-sca6000-admin sun-
sca6000-var sun-sca6000-config sun-sca6000-firmware
```

Additionally, if no other components are using it on the system:

```
% rpm -e sun-nss sun-nspr
```

# Migrating Back to Version 1.0 From 1.1

There are changes in the keystore implementation for the board that make it incompatible with Version 1.0 firmware. If you want the ability to return to a Version 1.0 environment, you must make a backup of the 1.0 keystore and master key prior to upgrading to 1.1.

## ▼ Back Up the 1.0 Keystore

1. **With the 1.0 software and firmware running, use** `scamgr` **to log into the board and run the** `show status` **command. Make a note of the** `Keystore Name` **and** `Keystore ID` **fields. For details, see** "Using the `scamgr` Utility" on page 34**.**

2. **Type the** `backup` **command to save the master key.**

3. **Change to** `/var/sca/keydata` **and archive the correct keystore directory and configuration file.**

   The keystore name and ID are shown in the filename for the `.conf` file and the corresponding directory.

   For example, if the keystore name is `ks.600054` and the keystore ID is `0000000069efe289`, then you will find the following files and directories in `/var/sca/keydata`:

```
ks.600054.{69efe289}       ks.600054.{69efe289}.conf
```

4. **Use the** `tar` **command to archive both the** `.conf` **file and the entire contents of the directory:**

```
# tar cvfz ks.600054.{69efe289}.tar ks.600054.{69efe289}.conf ks.600054.{69efe289}
```

5. **Place the master key backup and keystore tar file in a safe location.**

You can now safely upgrade to the 1.1 software and retain the ability to revert back to 1.0 software and firmware.

## ▼ Restore the 1.0 Software and Firmware:

1. **While the 1.1 software and firmware is still running, log into the board as the device security officer using** `scamgr -D` **and type the** `zeroize` **command.**

2. **Change directories into** `/var/sca/keydata` **and remove the** `.conf` **file and correspinding keystore directory.**
3. **Using** `scadiag -u`**, load the 1.0 firmware onto the system.**
4. **After the 1.0 firmware loads, reset the board with the** `scadiag -r` **command.**

```
# scadiag -u firmware-file device
# scadiag -r device
```

5. **When the board finishes resetting, it will be placed in failsafe mode.**
6. **Execute the** `remove` **script to remove the Sun Crypto Accelerator 6000 1.1 software components from the system.**
7. **From the 1.0 installation media, execute the** `install` **script to load the 1.0 software components.**
8. **Apply any 1.0 software and firmware patches that are necessary.**

   Refer to the *Sun Crypto Accelerator 6000 Board Product Notes for Version 1.1* (819-5537) at: `http://docs.oracle.com/cd/E19321-01/index.html`
9. **Unpack the 1.0 keystore** `tar` **file into** `/var/sca/keydata`

```
# cd /var/sca/keydata
# tar xvf path-to-tar-file
```

10. **Verify that the** `.conf` **file and all the contents of the keystore directory are owned by** `daemon`**. If not, set them to that ownership:**

```
# chown -R daemon:other keystore.conf-file keystore-directory
```

11. **Start the** `scamgr` **utility and initialize the board to use an existing keystore, providing the master key backup file in the process.**

You have now restored the 1.0 keystore.

CHAPTER 3

# Administering the Sun Crypto Accelerator 6000 Board

This chapter provides an overview of administering the board on both Oracle Solaris and Linux platforms with the scamgr and scadiag utilities, and the scad and scakiod service daemons. Additional instructions for Linux platforms are included in the last section. The chapter contains the following sections:

# Using the `scamgr` Utility

The `scamgr` utility offers a command-line interface to the Sun Crypto Accelerator 6000 board that can be accessed remotely. Only users designated as device or keystore security officers are permitted to use the `scamgr` utility. When you first connect to a board with `scamgr`, you are prompted to create an initial device security officer and password.

## Device and Keystore Security Officers

There are two types of security officers, device security officers (DSOs) and keystore security officers (KSOs). The first DSO is created when the board is initialized. The first KSO is created when the first keystore is created. DSOs can create other DSO accounts and KSOs can create other KSO accounts. The default behavior for `scamgr` is to log in as a KSO. To log in as a DSO, you must sun scamgr with the `-D` command line option. If you have already started an `scamgr` session but are logged out from all devices, you can use the `connect` command with the `dso` keyword to log in as a DSO (see TABLE 3-1).

---

**Note –** KSOs can make changes to keystores only. DSOs can make changes global to the board.

---

DSOs configure the physical board and can affect keystores globally. DSO capabilities include, but are not limited to the following:

- Performing hardware level operations such as:
  - Firmware upgrades
  - Zeroization
- Displaying the list of keystores on the board

KSOs use a set of commands that pertain only to a single instance of a keystore. KSO capabilities include:

- Creating and deleting user entries within a keystore
- Configuring and enabling Multi-Admin mode
- Performing keystore operations such as:
  - Conversions between local and centralized keystores
  - Renaming and deleting keystores and master keys

## scamgr Syntax

The scamgr command-line syntax is:

- /usr/sbin/scamgr [-?]
- /usr/sbin/scamgr [-H]
- /usr/sbin/scamgr [-V]
- /usr/sbin/scamgr [-y] [-h *hostname*] [-p *port*] [-d *device*] [-D | -k *keystorename*] [-f *filename*]
- /usr/sbin/scamgr [-y] [-h *hostname*] [-p *port*] [-d *device*] [-D | -k *keystorename*] *command*

---

**Note –** When using the -d option, mca*N* is the board's device name, where *N* corresponds to the Sun Crypto Accelerator 6000 device instance number.

---

---

**Note –** Certain shells interpret the ? character when using -? option on the command line. To avoid this, use the escape character (\) directly in front of the ?. For example in the C shell, the command is changed to scamgr -\?.

---

## scamgr Options

TABLE 3-1 shows the options for the scamgr utility.

**TABLE 3-1** scamgr Options

| Option | Meaning |
|---|---|
| -? | Displays help files for scamgr commands and exits. |
| -H | Displays help files for scamgr commands and exits. |
| -d *device* | Connects to the Sun Crypto Accelerator 6000 board that has *N* as the driver instance number. For example, -d mca1 connects to device mca1, where mca is a string in the board's device name and 1 is the instance number of the device. This value defaults to mca0 and must be in the form of mca*N*, where *N* corresponds to the device instance number. |
| -D | Logs into the board as a device security officer (DSO). This option cannot be used with the -k option. |
| -f *filename* | Interprets the commands in the file specified with *filename* and exits. |

**TABLE 3-1** `scamgr` Options *(Continued)*

| Option | Meaning |
|---|---|
| `-h` *hostname* | Connects to the board on *hostname*.The value for *hostname* can be a host name or an IP address, and defaults to the loopback address (localhost). |
| `-k` *keystorename* | Logs into the specified keystore. If a partial name is provided that matches more than one keystore, a list of all matches is displayed. If no keystore matches the value provided in *keystorename*, a list containing all keystores is displayed. |
| `-p` *portnumber* | Connects the board to a remote host with the specified *port*. If no port number is specified the board attempts to the default port 6871. |
| `-V` | Displays version information for `scamgr`. |
| `-y` | Forces a yes answer to any command that would normally prompt for a confirmation. This option is ignored when the board is in Interactive mode. |

**Note –** The variable *sec-officer* is used throughout this document as an example security officer name.

See "Authentication and Logging In and Out With `scamgr`" on page 43 for more information.

## Modes of Operation

`scamgr` can run in one of three modes. These modes differ mainly in how commands are passed into `scamgr`. The three modes are Single-Command mode, File mode, and Interactive mode.

**Note –** To use `scamgr`, you must authenticate as security officer. How often you need to authenticate as security officer is determined by which operating mode you are using.

## Interactive Mode

In Interactive mode, you must authenticate as security officer every time you connect to a board. This is the default operating mode for `scamgr`, and is initiated by not specifying *filename* or any parameters when starting `scamgr`. To log out of `scamgr` in Interactive mode, use the `logout` command. Refer to "Authentication and Logging In and Out With `scamgr`" on page 43.

Interactive mode presents the user with an interface similar to `ftp`(1), where commands can be entered one at a time. The `-y` option is not supported in Interactive mode. Security officers must answer all confirmation questions.

## Single-Command Mode

In Single-Command mode, you must authenticate as security officer for every command. Once the command is executed, you are logged out of `scamgr`.

When entering commands in Single-Command mode, you specify the command to be run after all the command-line switches are specified. For example, in Single-Command mode, the following command would show all the users in a given keystore and return the user to the command shell prompt.

```
$ scamgr show user
Security Officer Name: sec-officer
Security Officer Password:
```

All output from Single-Command mode goes to the standard output stream. This output can be redirected using standard UNIX shell-based methods.

## File Mode

In File mode, you must authenticate as security officer for every file you run. You are logged out of `scamgr` after the commands in the command file are executed.

To enter commands in File mode, you specify a file from which `scamgr` reads one or more commands. The file must be ASCII text, consisting of one command per line. Begin each comment with a hash (#) character. If the File mode option is set, `scamgr` ignores any command-line arguments after the last option. The following example runs the commands in the `deluser.scr` file and answers all prompts in the affirmative:

```
$ scamgr -f deluser.scr -y
```

## scamgr Secure Communication

The scamgr utility establishes an encrypted network connection (channel) between the scamgr application and the Sun Crypto Accelerator 6000 firmware running on a specific board. This point-to-point encrypted channel is not visible to any of the other software components between scamgr and the device (for example, the mca device driver). This encrypted channel allows scamgr to run safely and securely over the network. The key exchange is performed with RSA 1024-bit keys while the bulk data is protected using AES-128. SHA1 HMACs provide data integrity for each command data payload.

During setup of the encrypted channel, boards identify themselves by their hardware serial ID address and an RSA public key. A trust database ($HOME/.sunw/sca/trustdb) is created the first time scamgr connects to a board. This file contains all of the boards that are currently trusted by the security officer.

When the firmware gives scamgr an RSA public key, a SHA-1 hash is taken on the modulus. This action forms a key fingerprint that can be stored in a database in the UNIX user's home directory. When a connection is made and an unrecognized key is given to scamgr by the firmware, scamgr prompts the security officer to either abort the connection, accept the key for this one session, or accept the key permanently as a trusted key in the trust database. If a key to a previously trusted card changes, scamgr offers the same choices except that when accepting the key as a trusted key it overwrites the old key with the new one.

---

**Note –** The Sun Crypto Accelerator 6000 board is preprogrammed with a unique remote access key for connecting to an uninitialized board. The fingerprint for this remote access key is printed on the board and must be verified when logging into a board for the first time to ensure that a secure channel is established with the correct board.

---

## Initializing the Board With scamgr

The first step in configuring a Sun Crypto Accelerator 6000 board is to initialize it. There are two types of initialization. The first is board initialization and the second is keystore initialization. When you first connect to an uninitialized board with scamgr, you are prompted to perform a board initialization, which creates a device security officer (DSO) account. Once the board is initialized, you are prompted to perform a keystore initiailiztion, which creates a keystore security officer (KSO) account. For more information on DSOs and KSO, see "Device and Keystore Security Officers" on page 34.

## Board Initialization

Board initialization occurs only when the board is uninitialized. Board initialization enables the administrator to select whether the board (and all its keystores) will run in FIPS mode or  not, and creates the first DSO. DSOs can perform tasks that affect the board as a whole, such as firmware upgrades and board zerioization. No keystores can be created until the board itself has been initialized. To log in as a DSO, you must start `scamgr` with the `-D` or `dso` option.

Board initialization is secured using a factory key, which is an RSA key that is permanently stored in the hardware. This key is only used to secure communications to an uninitialized board. After any successful board initialization, a new remote access key is created. This new key is used to secure communications when new keystores are initialized and administered.

## ▼ Perform a Board Initialization

1. **Select FIPS 140-2 mode or non-FIPS mode.**

   When in FIPS mode the board is FIPS 140-2, level 3 compliant. FIPS 140-2 is a Federal Information Processing Standard that requires tamper-resistance and a high level of data integrity and security. Refer to the FIPS 140-2 document located at:
   `http://www.nist.gov`

```
Run in FIPS 140-2 mode? (Y/Yes/N/No) [No]: y
```

2. **Create an initial DSO name and password.**

   See "Naming Requirements" on page 58.

```
Initial Security Officer Name: device-sec-officer
Initial Security Officer Password:
Confirm Password:
```

---

**Note –** Before an essential parameter is changed or deleted, or before a command is executed that might have drastic consequences, `scamgr` prompts you to enter `Y`, `Yes`, `N`, or `No` to confirm. These values are not case-sensitive; the default is `No`.

---

3. **Verify the configuration information:**

```
Board initialization parameters:
-----------------------------------------------------
Initial Security Officer Name: device-sec-officer
Keystore name: keystore-name
Run in FIPS 140-2 Mode: Yes
-----------------------------------------------------

Is this correct? (Y/Yes/N/No) [No]: y
Initializing crypto accelerator board... This may take a few
minutes...Done.
```

## Keystore Initialization

Once the board is initialized, connecting to it with `scamgr` displays a menu of any existing keystores, and also allows the keystore security officer (KSO) to create a new keystore. For details on keystores, see "Web Server Concepts and Terminology" on page 158. Keystore creation creates the first KSO. The KSO then creates the name of the keystore and decides whether the keystore is local or cenralized (see "Perform a Keystore Initialization and Use an Existing Keystore" on page 42).

In addition, a keystore can be restored to an initialized board by loading it from a backup (see "Perform a Keystore Initialization and Use an Existing Keystore" on page 42). The `scamgr` utility prompts for the backup file location and uploads the file to the board as part of the keystore initialization process. This option can be used to recover a keystore when a board or host system is damaged, or to configure a second Sun Crypto Accelerator 6000 board work with an existing keystore in a fault-tolerant architecture.

### ▼ Perform a Keystore Initialization and Create a New Keystore

Use this procedure when you are initializing the board for the first time, or when you do not want to initialize an existing keystore.

1. **Connect to the board with the `scamgr` command.**

- If the board is installed locally, enter `scamgr` at the system prompt
- If the system is remote, enter `scamgr -h` *hostname*

2. **Enter** 2 **then** 1 **as shown in the following example:**

```
# scamgr -h hostname
Please select an action:

1. Abort this connection
2. Trust the board for this session only.
3. Replace the trusted key with the new key.

Your Choice --> 2
This board is uninitialized.
You will now initialize the board. You may either
completely initialize the board and start with a new
keystore or initialize the board to use an existing
keystore, providing a backup file in the process.

1. Initialize the board with a new keystore
2. Initialize the board to use an existing keystore

Your Choice (0 to exit) --> 1
```

3. **Create a keystore name.**

   See "Naming Requirements" on page 58.

```
Keystore Name: keystore-name
```

## Performing a Keystore Initialization to Use an Existing Keystore

If you are adding multiple boards to a single keystore, you might want to initialize all of the boards to use the same keystore information. In addition, you might want to restore a Sun Crypto Accelerator 6000 board to the original keystore configuration. This section describes how to initialize a board to use an existing keystore that is stored in a backup file.

You must first create a backup file of an existing board configuration before performing this procedure. Creating and restoring a backup file requires a password to encrypt and decrypt the data in the backup file. (See "Back Up a Master Key" on page 65.)

---

**Note –** To initialize a board from a previous backup, both the master key backup file and the encrypted keystore data files are required. The encrypted keystore files must exist in the keystore directory (`/var/sca/keydata` by default). There are three files that must be placed in the top level keystore directory on the machine to which the keystore is being restored. The first file is the `config` file for the keystore, which has the filename *keystore-name.serial-number.*{*keystore-id*}`.conf`. The second and third are the *user*`.db` and *object*`.db` files, which are located in the subdirectory under the top-level keystore directory named *keystore-name.serial-number.*{*keystore-id*}.

---

## ▼ Perform a Keystore Initialization and Use an Existing Keystore

1. **Initialize the board with the** `scamgr` **command.**

- If the board is installed locally, enter `scamgr` at the system prompt
- If the system is remote, enter `scamgr -h` *hostname*

2. **Enter** `2` **as shown in the following example:**

```
# scamgr -h hostname
This board is uninitialized.
You will now initialize the board.  You may
either completely initialize the board and
start with a new keystore or restore the board
using a backup file.

1. Initialize the board with a new keystore
2. Initialize the board to use an existing keystore

Your Choice (0 to exit) --> 2
```

3. **Enter the path and password to the backup file:**

---

**Note –** If the backup file was created in Multi-Admin mode, authentication is required by multiple security officers assigned the Multi-Admin role.

---

```
Enter the path to the backup file: /tmp/board-backup
Password for restore file:
```

**4. Verify the configuration information.**

```
Board restore parameters:
----------------------------------------------------------------
Path to backup file: /tmp/board-backup
Keystore name: sca6000-keystore
Requires Multi-Admin auth: No
----------------------------------------------------------------

Is this correct? (Y/Yes/N/No) [No]: y
Restoring data to crypto accelerator board...
```

## Authentication and Logging In and Out With `scamgr`

Only security officers can log into a Sun Crypto Accelerator 6000 board with this utility. It is not possible to log into a user account using `scamgr`. User accounts are for applications that use the card (for example, with the PKCS#11 interface).

In accordance with FIPS 140-2 guidelines, no security officer can issue commands without first authenticating. Authentication is identity-based. A valid security officer name and password must exist in the card's keystore before access is granted.

When you use `scamgr` from the command line and specify *host*, *port*, and *device* using the `-h`, `-p`, and `-d` options respectively, you are immediately prompted to log in as security officer if a successful network connection was made. See "`scamgr` Syntax" on page 35 and "`scamgr` Options" on page 35 for more information.

### `scamgr` Prompt

The `scamgr` prompt in Interactive mode is displayed as follows:

```
scamgr{mcaN@hostname, sec-officer}> command
```

The following table defines the variables in the `scamgr` prompt:

**TABLE 3-2** `scamgr` Prompt Variable Definitions

| Prompt Variable | Definition |
|---|---|
| `mca`*N* | `mca` is a string that represents the Sun Crypto Accelerator 6000 board. *N* is the device instance number (unit address) that is in the device path name of the board. |
| *hostname* | The name of the host for which the Sun Crypto Accelerator 6000 board is physically connected. You may replace *hostname* with the physical host's IP address. |
| *sec-officer* | The name of the security officer that is currently logged in to the board. |

## ▼ Log In To a Board With `scamgr`

- **Type:**

```
# scamgr -h hostname
```

- If the security officer connects to a new board, `scamgr` notifies the security officer and prompts with the following options:

```
1. Abort this connection
2. Trust the board for this session only
3. Trust the board for all future sessions
```

- If the security officer connects to a board that has a remote access key that has been changed, `scamgr` notifies the security officer and prompts the following three options:

```
1. Abort this connection
2. Trust the board for this session only
3. Replace the trusted key with the new key
```

## ▼ Log In To a New Board

**Note –** The remaining examples in this chapter were created with the Interactive mode of `scamgr`.

When connecting to a new board, `scamgr` must create a new entry in the trust database.

- **Type the `scamgr` command.**

  For example:

```
# scamgr -h hostname
Warning: Serial ID and Public Key Not Found
--------------------------------------------------------------
The Serial ID and public key presented by this board were
not found in your trust database.

Serial ID: 36:30:30:30:30:33
Key Fingerprint: baa4-17f8-1128-1c6a-9a18-3719-988f-64a0-a4a5-
f72f
--------------------------------------------------------------
Please select an action:

1. Abort this connection
2. Trust the board for this session only.
3. Trust the board for all future sessions.

Your Choice -->
```

## ▼ Log In To a Board With a Changed Remote Access Key

When connecting to a board that has a changed remote access key, you must use `scamgr` to change the entry corresponding to the board in the trust database.

- **Type the** `scamgr` **command.**

  For example:

```
# scamgr -h hostname
Warning: Public Key Conflict
--------------------------------------------------------------
The public key presented by the board you are connecting
to is different than the public key that is trusted for
this Serial ID.

Serial ID: 36:30:30:30:30:33
New Key Fingerprint: baa4-17f8-1128-1c6a-9a18-3719-988f-64a0-
a4a5-f72f
Trusted Key Fingerprint: e207-6ff7-41f4-3766-bafd-5910-973d-a32b-
46e8-6e73
--------------------------------------------------------------
Please select an action:

1. Abort this connection
2. Trust the board for this session only.
3. Replace the trusted key with the new key.

Your Choice -->
```

## ▼ Log Out Of a Board With `scamgr`

If you are working in Interactive mode, you might want to disconnect from one board and connect to another board without completely exiting `scamgr`.

- **Type the** `logout` **command.**

For example:

```
scamgr{mcaN@hostname, sec-officer}> logout
scamgr>
```

## ▼ Log In To Another Board

- **Type the `connect` command.**

  For example:

```
scamgr{mcaN@hostname, sec-officer}> logout
scamgr> connect host hostname dev mca2
Security Officer Login: sec-officer
Security Officer Password:
scamgr{mca2@hostname, sec-officer}>
```

In the previous example, notice that the `scamgr>` prompt no longer displays the device instance number, hostname, or security officer name. To log into another device, type the `connect` command with the following optional parameters.

**TABLE 3-3** `connect` Command Optional Parameters for Connecting to Another Board

| Parameter | Meaning |
|---|---|
| `dev mca`*N* | Connects to the Sun Crypto Accelerator 6000 board with the driver instance number of *N*. For example `-d mca1` connects to the device `mca1`. The default is device `mca0`. |
| `host` *hostname* | Connects to the Sun Crypto Accelerator 6000 board on *hostname.* The default is the loopback address. You may replace *hostname* with the physical host's IP address. |
| `port` *port* | Connects to the Sun Crypto Accelerator 6000 board on port *port* (defaults to 6870). |

`scamgr` does not allow you to issue the `connect` command if you are already connected to a Sun Crypto Accelerator 6000 board. You must first log out and then issue the `connect` command.

Each new connection causes `scamgr` and the target Sun Crypto Accelerator 6000 firmware to renegotiate new session keys to protect the administrative data that is sent.

## Quitting the `scamgr` Utility

Use one of the following actions to quit the `scamgr` utility.

### ▼ Quit the `scamgr` Utility

- **Take one of the following actions:**
  - Type `scamgr - quit`.
  - Type `exit`.
  - Type `Ctrl-D`.

## Entering Commands With `scamgr`

This section lists the available `scamgr` commands and describes their usage.

### Entering `scamgr` Commands

The `scamgr` utility has a command language that must be used to interact with the Sun Crypto Accelerator 6000 board. You enter commands using all or part of a command (enough to uniquely identify that command from any other command). Entering `sh` instead of `show` would work, but `re` is ambiguous because it could be `reset` or `rekey`.

The following example shows entering commands using entire words:

```
scamgr{mcaN@hostname, sec-officer}> show user
User                                   Status
-----------------------------------------------------
web-admin                              Enabled
Tom                                    Enabled
-----------------------------------------------------
```

The same information can be obtained in the previous example using partial words as commands, such as `sh us`.

An ambiguous command produces an explanatory response:

```
scamgr{mcaN@hostname, sec-officer}> re
Ambiguous command: re
```

## scamgr Commands

TABLE 3-4 lists the scamgr commands.

**TABLE 3-4** scamgr Commands

| Command | Description |
|---|---|
| `backup device` *pathname* | (DSO only) Backs up the master key and device configuration to the path specified by *pathname*. If no path is specified `scamgr` prompts the user for the pathname. Any successful backup increments the backup counter by one (see `show status`). If Multi-Admin mode is enabled when this command is entered it requires authentication by multiple security officers with the Multi-Admin role. |
| `backup keystore` *pathname* | (KSO only) Performs a full keystore backup including all user and key objects, log messages, and the master key and keystore configuration. These are collected, encrypted and placed in the file referenced by *pathname*. If no path is specified, `scamgr` prompts for one. Successful backups increment the backup counter by one (see `show status`). If Multi-Admin mode is enabled when this command is entered, it requires authentication by multiple security officers with the Multi-Admin role. |
| `backup master-key` *pathname* | (KSO only) Backs up the master key only, encrypting it and placing it in the file specified by *pathname*. This backup file can be used to import the master key into one or more other boards so they can make use of the same keystore. |
| `connect host` *hostname* `port` *portnumber* `dev mca`*N* `keystore` *keystorename* `dso` | Attempts to establish a connection to a Sun Crypto Accelerator board. If the `host` option is specified, it must be followed by a valid host name or IP address. If the `port` option is specified, it must be followed by a valid port number. If the `dev` option is specified, it must be followed by a valid device instance number (followed by the `mca` string). If the `keystore` option is specified, it must be a full or partial keystore name. The `dso` option logs in as a device security officer rather than a keystore security officer. The default values for these arguments are the same as for the `-h`, `-p`, `-d`, and `-k` options (see TABLE 3-1). |

**TABLE 3-4** `scamgr` Commands *(Continued)*

| Command | Description |
|---|---|
| `convert keystore` | (KSO only) Converts a keystore from a local keystore to a centralized one or vice-versa, depending on the current keystore type. |
| `copy keystore` *newkeystorename* | (KSO only) Copies the existing keystore (including all users, security officers, and key objects) to a new keystore named *newkeystorename.* |
| `create so` *sec-officer* | Creates the named security officer. If the security officer name is not specified in *sec-officer*, `scamgr` prompts for one. Valid names must begin with an alphabetical character and be between 1 and 63 characters. Valid characters consist of alphanumeric characters and the hyphen (-), underscore (_), and period (.) characters. When creating a new security officer the current security officer will be asked to set the new security officer's password and then asked to confirm it. |
| `create user` *username* | (KSO only) Creates a user named *username*. If *username* is not specified, `scamgr` prompts for one. The name restrictions are identical to those in the `create so` command. When creating a user, the security officer is asked to set the new user's password, then asked to confirm it. |
| `delete keystore` | (KSO only) Ensure that you create a full keystore backup if you want to be able to restore a keystore before deleting it (see the `backup keystore` command). This command deletes a keystore from an existing board. The master key and configuration are deleted, along with the keystore database. The only way to restore a keystore once it has been deleted is to restore it from a full keystore backup. |
| `delete master-key` *keystorename* | Deletes the master key named *keystorename* from the board. This will not remove any key database files or entries. Only the master key from the board on which the command is run is removed. |
| `delete so` *sec-officer* | Deletes the security officer named *sec-officer* from the keystore. Confirmation is requested unless the `-y` option is entered when `scamgr` is executed. If the board is in Multi-Admin mode and the security officer to be deleted also has the Multi-Admin role, the security officer cannot be removed. The security officer must first be removed from the Multi-Admin role and then deleted (see the `disable authmember` command). |
| `delete user` *username* | (KSO only) Deletes the user named *username* from the keystore. All key material owned by the user is also deleted. Confirmation is requested unless the `-y` option is supplied when `scamgr` is started. |

**TABLE 3-4** `scamgr` Commands *(Continued)*

| Command | Description |
|---|---|
| `diagnostics` | Performs firmware diagnostics on the board. This command tests the general hardware and cryptographic subsystems. This command returns a PASS value for each passing subsystem. If a subsystem fails, this command attempts to identify the specific failure. Tests that normally follow a failed test do not occur. |
| `disable authmember` *sec-officer* | Removes the Multi-Admin role from the security officer *sec-officer*. If this command is entered when Multi-Admin mode is enabled, it requires authentication by multiple security officers with the Multi-Admin role assigned. This command does not execute if the command would reduce the required minimum numbers of security officers with the Multi-Admin role. |
| `disable keystore` | (KSO only) Prevents users and kernel consumers from using the keystore named *keystorename*. The keystore being disabled must be locked for this command to execute correctly. |
| `disable multiadmin` | Takes the board out of Multi-Admin mode. This command requires authentication by multiple security officers with the Multi-Admin role. |
| `disable new-keystores` | (DSO only) Disables keystore creation functions on the board. With this setting disabled, no new keystores can be created. |
| `disable user` *username* | (KSO only) Disable the user named *username* in the keystore. A disabled user cannot log in and cannot access key material. |
| `enable authmember` *sec-officer* | Gives the security officer named *sec-officer* the Multi-Admin role. If this command is entered while Multi-Admin mode is enabled, it requires authentication by multiple security officers with the Multi-Admin role. |
| `enable keystore` | (KSO only) Enables a keystore for use by users and kernel consumers. This command can only be executed on a locked keystore. When a locked keystore is enabled, it remains enabled only until the next reset. |
| `enable multiadmin` | Enables Multi-Admin mode. When enabled, certain commands require multiple security officers to authenticate before the command can complete successfully. When this command is executed, the security officer is presented with the current Multi- Admin mode settings and is given the opportunity to change these values before the command completes. This command does not identify the `-y` option. |
| `enable new-keystores` | (DSO only) Enables new keystores to be created on the board. Keystore creation is enabled by default. |
| `enable user` *username* | Enables the user named *username* in the keystore. |

**TABLE 3-4** `scamgr` Commands *(Continued)*

| Command | Description |
|---|---|
| `exit` | Exits `scamgr`. |
| `load firmware` *firmwarepath* | (DSO only) Loads a firmware image specified in *firmwarepath* to the board. Firmware images must be digitally-signed code from Sun. When new firmware is successfully uploaded, the device continues to run the current firmware until it is manually reset (see the `reset` command). |
| `lock keystore` | (KSO only) Locks the keystore (*keystorename*) which prevents the keystore from being used until it is enabled (see the `enable` *keystorename* command). Keystores that are locked are disabled by default. Once the keystore is enabled, it stays enabled until the board is reset either explicitly or through a power cycle. A keystore can be unlocked which turns off this default disable behavior (see the `unlock` *keystorename* command). If this command is entered while Multi-Admin mode is enabled, it requires authentication by a quorum of security officers with the Multi-Admin role. |
| `lock master-key` | Locks the master key. Once locked, the master key cannot be backed up using the `backup master-key` command. If the master key lock is set, new master keys created through the `rekey` command are automatically locked and cannot be backed up. Once set, a locked master key cannot be unset. If the master key is locked by a DSO, a board zeroize is required to clear it. If it is locked by a KSO, the lock cannot be cleared without deleting the keystore itself.<br>Systems that use multiple boards on a single keystore should use this command with care, understanding that the need to rekey the master key is tantamount to needing to reinitialize all boards using that keystore on the system. For single-board systems, this command can be used more freely with the `rekey` command, with the understanding that recoverability of the data in the keystore is completely lost once a rekey happens. |
| `logout` | Discards the current authentication credentials and closes the connection to the device. This will not end the execution of `scamgr`. The only command that can be executed when not logged into a board is the `connect` command. |
| `quit` | Exits `scamgr`. |
| `rekey master-key` | (KSO only) Generates a new master key for the keystore. Keystore files are automatically re-encrypted in the new master key. Other boards working with the same keystore need to have this new master key loaded to be able to continue working with this keystore (see the `zeroize` command and the section on initialization). |

**TABLE 3-4** `scamgr` Commands *(Continued)*

| **Command** | **Description** |
|---|---|
| `rekey remote-access` | (DSO only) Rekeys the remote access key. This command logs the security officer out of the existing session when successful. |
| `reset` | (DSO only) Resets the board. This command logs the security officer out from the board and closes the session. |
| `set audit-level` *log-level* | (KSO only) Sets the keystore audit log level. The log level is an integer value from zero to seven, with each successive log level being incremented. The description of the log levels are as follows:<br>• 0 – Keystore auditing is disabled<br>• 1 – Notices<br>• 2 – Administration<br>• 3 – Logins (Security officers and Users)<br>• 4 – User (creation, deletion, or password changes)<br>• 5 – PKCS#11 (session creation, deletion, etc.)<br>• 6 – Token Objects (key creation, deletion, etc.)<br>• 7 – Session Objects (key creation, deletion, etc.) |
| `set lock` | This command is deprecated. Please use the `lock master-key` command instead. |
| `set multiadmin minauth` *number-of-minimum-admin-role-sec-officers* | This command sets the quorum of security officers required for the successful completion of a Multi-Admin mode command. This value must be at least 2 and less than or equal to the total number of security officers on the system. In addition, if Multi-Admin mode is already enabled, the new value cannot exceed the number of security officers in the Multi-Admin role. If the board is in Multi-Admin mode then the command will require authentication by multiple security officers with the Multi-Admin role. |
| `set multiadmin timeout` *number-of-minutes* | Changes the timeout for commands requiring Multi-Admin mode authentication. This value is in minutes and must be between 1 and 1440 (1 day). If a value larger than 1440 is specified, the value will be set to 1440. If the board is already in Multi-Admin mode, it requires authentication by multiple security officers with the Multi-Admin role. |
| `set password` | Changes the password for the currently logged in security officer. To change passwords for keystore users, the PKCS#11 interface must be used. See Appendix E. |

**TABLE 3-4** `scamgr` Commands *(Continued)*

| **Command** | **Description** |
|---|---|
| `set passreq` | Changes the password requirement setting. There are three levels of password requirements:<br>• Low – No password requirements<br>• Med – Minimum 6 characters—at least three characters must be alphabetic, and at least one must be nonalphabetic.<br>• High – Minimum 8 characters—at least three characters must be alphabetic and at least one must be nonalphabetic.<br>The system defaults to the Low security level when not in FIPS 140-2 mode and defaults to Med security level when in FIPS 140-2 mode. In FIPS mode, the board cannot be set below the Med security level. |
| `set timeout` *number-of-minutes* | Changes the connection timeout value for administrative sessions. This parameter takes a value between 1 and 1440 as the number of minutes before the firmware will drop the authentication credentials of the logged in security officer and drop the connection. Values less than 1 disable the timeout completely. Values greater than 1440 minutes (1 day) are shortened to 1440. |
| `show audit-log path` *outfile* `range` *logrange* | (KSO only) Displays the current keystore audit log. Audit logs are displayed to standard out by default, but can be sent to the file *outfile* using the `path` option keyword. The number of log messages displayed can be controlled with the range option, with the input value (*logrange*) being either a positive or negative integer that displays the log range of newest or oldest log entries, respectively. By default the entire log is displayed. |
| `show domains` | (DSO only) Displays all the domains that have keystores loaded onto a given board. |
| `show keystores` | (DSO only) Lists all the keystores that a given board has master keys for. It also displays the type of keystore it is: centralized, local, or disconnected. A disconnected keystore is one where the master key is loaded but the actual key database is unavailable for some reason. Also, the domain that the keystore exists in is shown. |
| `show old-audit-log` | (KSO only) Behaves identically to the `show audit-log` command, except that it works on the set of audit logs that have been rotated into the old audit log pool. For more details on controlling the size of the audit logs, see the man page for `scakiod`(1M). |
| `show so` | Shows all security officer accounts set for the keystore and whether they have the Multi-Admin role. |

**TABLE 3-4** `scamgr` Commands *(Continued)*

| Command | Description |
|---|---|
| `show status` | Shows device and keystore parameters. The information is broken down into categories: version information, keystore information, and security settings. |
| `show user` | (KSO only) Shows all user accounts created in the keystore, and whether the users are enabled or disabled. |
| `unlock keystore` | (KSO only) Unlocks a locked keystore (see the `lock` *keystorename* command for details on locked keystores). This command requires a quorum of security officers with the Multi-Admin role to authenticate if Multi-Admin mode is enabled. |
| `zeroize` | (DSO only) Cleans the board of all security parameters, and returns the board to its uninitialized factory state. The board uses the factory remote access key to secure any connections to it while in the uninitialized state. Firmware upgrades done to the board prior to the zeroize command are preserved. Zeroizing a board does not delete the keystore file on the disk. Zeroizing a board without backing up its master key makes all data in the keystore that board was working with unrecoverable. |

## Getting Help for Commands

scamgr has built-in help functions. To get help, you must enter a question mark (?) character following the command you want more help on. If you enter an entire command and a "?" exists anywhere on the line, you get the syntax for the command, for example:

```
scamgr{mcaN@hostname, sec-officer}> create ?
Sub-Command                         Description
-----------------------------------------------------
so                                  Create a new security officer
user                                Create a new user

scamgr{mcaN@hostname, sec-officer}> create user ?
Usage: create user [<username>]

scamgr{mcaN@hostname, sec-officer}> set ?
Sub-Command                         Description
-----------------------------------------------------
lock                                Lock master key (Prevents key backup)
multiadmin                          Configure Multi-Admin mode
passreq                             Set password security level
password                            Change password for security officer
timeout                             Set firmware auto-logout timer
```

You can also enter a question mark at the scamgr prompt to see a list of all of the scamgr commands and their description, for example:

```
scamgr{mcaN@hostname, sec-officer}> ?
Sub-Command                         Description
-----------------------------------------------------------------
backup                              Backup device and keystore data
convert                             Convert data items
copy                                Copy data items
create                              Create users and accounts
delete                            Delete users, accounts and keystores
disable                             Disable users, modes or options
enable                              Enable users, modes or options
exit                                Exit scamgr
lock                                Lock data items
logout                              Logout current session
quit                                Exit scamgr
rekey                               Generate new system keys
rename                              Rename data items
set                                 Set operating parameters
show                                Show system settings
unlock                              Unlock data items
```

**Note –** When not in `scamgr` Interactive mode, the "?" character could be interpreted by the shell in which you are working. In this case, ensure that you use the command shell escape character before the question mark. For example in the C shell, you you must type `\?`

## Managing Keystores With `scamgr`

**Note –** You must log in to `scamgr` as a keystore security officer (KSO) to manage keystores as described in this section. Device security officers (DSOs) cannot perform the procedures in this section. For information on KSOs and DSOs, see "Device and Keystore Security Officers" on page 34.

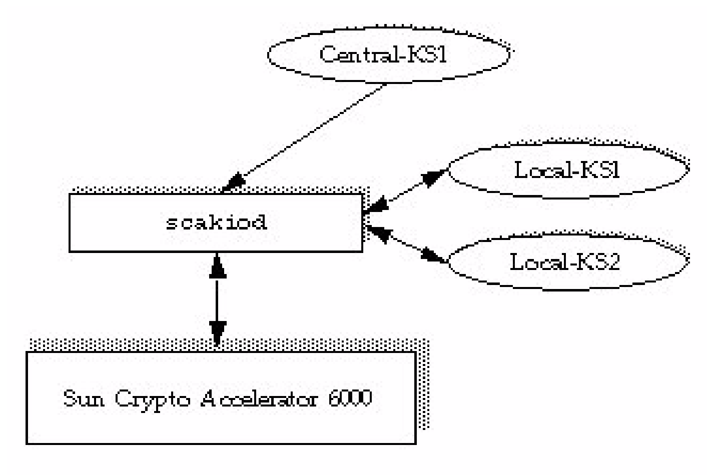
A keystore is a repository for key material. Associated with a keystore are keystore security officers (KSOs) and users. Keystores not only provide storage, but a means for key objects to be owned by user accounts. This situation enables keys to be hidden from applications that do not authenticate as the owner. Keystores have three components:

- **Key objects –** Long-term keys that are stored for applications such as the Sun Java System Web Server.
- **User accounts –** Accounts that provide applications a means to authenticate and access specific keys.
- **Security officer accounts –** Accounts that provide access to key management functions through `scamgr`.

### Multiple Keystore Support

The `scamgr` utility supports multiple keystores running on a single board. Keystores must be uniquely named. Each individual keystore contains its own set of security officers, users, and key objects.

**FIGURE 3-1** Multiple Keystore Support



At connection time, `scamgr` displays a list of keystores that can be logged into. Security officers can specify a keystore by name using the `-k` *keystorename* option. See TABLE 3-1.

---

**Note –** Multiple boards can be configured to collectively work with the same keystore to provide additional performance and fault tolerance.

---

## Naming Requirements

Security officer names, user names, and keystore names must meet the following requirements:

**TABLE 3-5** Security Officer Name, User Name, and Keystore Name Requirements

| Name Requirement | Description |
|---|---|
| Minimum length | At least one character. |
| Maximum length | 63 characters for security officer names and user names.<br>32 characters for keystore names. |
| Valid characters | Alphanumeric, underscore (_), dash (-), and dot (.). |
| First character | Must be alphabetic. |

## Password Requirements

Password requirements vary based on the current `set passreq` setting (`low`, `med`, or `high`).

## ▼ Set the Password Requirements

1. **Start the `scamgr` utility.**
2. **Type `set passreq`.**

   This command sets the password character requirements for any password prompted by `scamgr`. There are three settings for password requirements, as shown in the following table:

**TABLE 3-6** Password Requirement Settings

| Password Setting | Requirements |
|---|---|
| `low` | Does not require any password restrictions. This is the default while the board is in non-FIPS mode. |
| `med` | Requires six characters minimum. Three characters must be alphabetic and one character must be nonalphabetic. This is the default setting while the board is in FIPS 140-2 mode and is the minimum password requirement allowed in FIPS 140-2 mode. |
| `high` | Requires eight characters minimum. Three characters must be alphabetic, and one character must be nonalphabetic. This is not a default setting and must be configured manually. |

## ▼ Change Password Requirements

1. **Start the `scamgr` utility.**
2. **Type the `set passreq` command followed by `low`, `med`, or `high`.**

   The following commands set the password requirements for a Sun Crypto Accelerator 6000 board to `high`:

```
scamgr{mcaN@hostname, sec-officer}> set passreq high

scamgr{mcaN@hostname, sec-officer}> set passreq
Password security level (low/med/high): high
```

## ▼ Change Passwords

Only security officer passwords may be changed with `scamgr`. Security officers can change their own password.

1. **Start the** `scamgr` **utility.**
2. **Type** `set password`**.**

   For example:

```
scamgr{mcaN@hostname, sec-officer}> set password
Enter new security officer password:
Confirm password:
Security Officer password has been set.
```

User passwords may be changed through the PKCS#11 interface with the Sun Java System Web Server `modutil` utility. Refer to the Sun Java System Web Server documentation for details.

## Managing Security Officers and Users

This section describes how to populate keystores and how to list, enable, disable, and delete security officers and users.

## ▼ Populate a Keystore With Security Officers

There might be more than one security officer for a keystore. Security officer names are known only within the domain of the Sun Crypto Accelerator 6000 board and do not need to be identical to any user name on the host system.

1. **Start the** `scamgr` **utility.**

2. **Type** `create so`**.**

   When creating a security officer, the name is an optional parameter on the command line. If the security officer name is omitted, `scamgr` prompts you for the name. (See "Naming Requirements" on page 58.) For example:

```
scamgr{mcaN@hostname, sec-officer}> create so Alice
Enter new security officer password:
Confirm password:
Security Officer Alice created successfully.

scamgr{mcaN@hostname, sec-officer}> create so
New security officer name: Bob
Enter new security officer password:
Confirm password:
Security Officer Bob created successfully.
```

## ▼ Populate a Keystore With Users

User names are known only within the domain of the Sun Crypto Accelerator 6000 board and do not need to be identical to the UNIX user name for the web server process.

1. **Start the** `scamgr` **utility.**

2. **Type** `create user` ***user-name*****.**

When creating a user, the user name is an optional parameter on the command line. If the user name is omitted, `scamgr` prompts you for the user name. (See "Naming Requirements" on page 58.) For example:

```
scamgr{mcaN@hostname, sec-officer}> create user web-admin
Enter new user password:
Confirm password:
User web-admin created successfully.

scamgr{mcaN@hostname, sec-officer}> create user
New user name: Tom
Enter new user password:
Confirm password:
User Tom created successfully.
```

Users must use this password when authenticating during a web server startup.

**Caution –** Users must remember their password so they can access their keys. There is no way to retrieve a lost password.

---

**Note –** The user account is logged out if no commands are entered for more than five minutes. This is a tunable option. See "Set the Auto-Logout Time" on page 77 for details.

## ▼ List Users

You can list users associated with a keystore.

1. **Start the** `scamgr` **utility.**
2. **Type the** `show user` **command.**

   For example:

```
scamgr{mcaN@hostname, sec-officer}> show user
User                                    Status
-----------------------------------------------------
web-admin                               Enabled
Tom                                     Enabled
-----------------------------------------------------
```

## ▼ List Security Officers

You can list security officers associated with a keystore.

1. **Start the** `scamgr` **utility.**
2. **Type the** `show so` **command. For example:**

```
scamgr{mcaN@hostname, sec-officer}> show so
Security Officer                        Multi-Admin Role
----------------------------------------------------------------
sec-officer1                            Enabled
sec-officer2                            Enabled
sec-officer3                            Enabled
sec-officer4                            Disabled
----------------------------------------------------------------
```

## ▼ Disable Users

---

**Note –** Security officers cannot be disabled. Once a security officer is created, it is enabled until it is deleted.

---

Users and security officers are enabled by default. Users may be disabled. Disabled users cannot access their key material with the PKCS#11 interface. Enabling a disabled user restores access to all of that user's key material.

1. **Start the** `scamgr` **utility.**
2. **Type** `disable user` *user-name***.**

   When enabling or disabling a user, the user name is an optional parameter on the command line. If the user name is omitted, `scamgr` prompts you for the user name. For example:

```
scamgr{mcaN@hostname, sec-officer}> disable user Tom
User Tom disabled.
scamgr{mcaN@hostname, sec-officer}> disable user
User name: web-admin
User web-admin disabled.
```

## ▼ Enable Users

1. **Start the** `scamgr` **utility.**
2. **Type the** `enable user` *user-name* **command.**

   When enabling a user, the user name is optional. For example:

```
scamgr{mcaN@hostname, sec-officer}> enable user Tom
User Tom enabled.

scamgr{mcaN@hostname, sec-officer}> enable user
User name: web-admin
User web-admin enabled.
```

## ▼ Delete Users

1. **Start the** `scamgr` **utility.**

2. **Type** `delete user` *user-name*.

   When deleting a user, the user name is an optional parameter on the command line. If the user name is omitted, `scamgr` prompts you for the user name. For example:

```
scamgr{mcaN@hostname, sec-officer}> delete user web-admin
Delete user web-admin? (Y/Yes/N/No) [No]: y
User web-admin deleted successfully.

scamgr{mcaN@hostname, sec-officer}> delete user
User name: Tom
Delete user Tom? (Y/Yes/N/No) [No]: y
User Tom deleted successfully.
```

## ▼ Delete Security Officers

1. **Start the** `scamgr` **utility.**

2. **Type** `delete so` ***so-name*.**

   When deleting a security officer, the security officer name is an optional parameter on the command line. If the security officer name is omitted, `scamgr` prompts you for the security officer name. For example:

```
scamgr{mcaN@hostname, sec-officer}> delete so Bob
Delete Security Officer Bob? (Y/Yes/N/No) [No]: y
Security Officer Bob deleted.

scamgr{mcaN@hostname, sec-officer}> delete so
Security Officer name: Alice
Delete Security Officer Alice? (Y/Yes/N/No) [No]: y
Security Officer Alice deleted.
```

## Backing Up Configuration and Keystore Data

There are three types of backups that can be performed with the board: Device Configuration, Master Key, and Keystore.

## ▼ Back Up a Device Configuration

This type of backup saves the global device configuration including FIPS 140-2 settings, DSO accounts and other settings. Only DSOs can perform this type of backup.

1. **Start the** `scamgr` **utility.**
2. **Type** `backup device` */var/tmp/**devconf.bak***

   An optional filename for the backup file can be supplied on the command line. If the filename is not supplied, you are prompted for it when the command is executed.

```
scamgr{mcaN@hostname, sec-officer}> backup device /var/tmp/devconf.bak
Enter a password to protect the data:
Confirm password:
Backup to /var/tmp/devconf.bak successful.
```

## ▼ Back Up a Master Key

This backup is used with a specific keystore, and therefore must be done by a KSO. This backs up only the master key and other keystore specific settings, but does not backup the keystore data. This backup is useful for having new boards join an existing local or centralized keystore, where one board is already fully configured.

Keystores are stored on the host and encrypted in a master key. The master key for each keystore is stored in the firmware. For another board to use an existing keystore, the master key for that keystore must be loaded to that board using a master key backup file. Only the keystore security officer can backup a master key.

1. **Start the** `scamgr` **utility.**
2. **Type** `backup master-key` */opt/backup-directory-name/master.bak***.**

   The path name can be placed on the command line or if omitted, `scamgr` prompts you for the path name.

---

**Note –** If the following command is executed in Multi-Admin mode, authentication is required by multiple security officers assigned the Multi-Admin role.

---

```
scamgr{mcaN@hostname, sec-officer}> backup master-key /opt/SUNWconn/mca/backups/master.bak
Enter a password to protect the data:
Confirm password:
Backup to /opt/SUNWconn/mca/backups/master.bak successful.
```

3. **Set a password for the backup data.**

   This password encrypts the master key in the backup file.

**Caution –** Choose a password that is very difficult to guess when making backup files, because this password protects the master key for your keystore. You must also remember the password you enter. Without the password, you cannot access the master key backup file. There is no way to retrieve the data protected by a lost password.

---

**Note –** To load a keystore to a board from a previous master key backup, both the master key backup file and the encrypted keystore data files are required. The encrypted keystore files must exist in the keystore directory (`/var/sca/keydata` by default). There are three files that must be placed in the top-level keystore directory on the machine to which the keystore is being restored. The first file is the `config` file for the keystore, which has the filename *keystore-name.serial-number.*{*keystore-id*}`.conf`. The second and third files are the *user*`.db` and *object*`.db` files, which are located in the subdirectory under the top-level keystore directory named *keystore-name.serial-number.*{*keystore-id*}.

## ▼ Backup A Keystore

This is done on a specific keystore and must be done by KSOs only. This backs up the same data as a Master Key Backup, but additionally retrieves all the keystore data, and security officer and user accounts. You can use a full keystore backup file to completely restore a keystore when that keystore does not exist on the system (local) or in the LDAP repository (centralized).

Keystores are stored on the host and encrypted in a master key. The master key for each keystore is stored in the Sun Crypto Accelerator 6000 firmware. The entire keystore including the master key can be backed up for disaster recovery. This backup is good for disaster recovery.

1. **Start the** `scamgr` **utility.**
2. **Type** `backup keystore /opt/`***backup-directory-name/bkup.data.***

   The path name can be placed on the command line or if omitted, `scamgr` prompts you for the path name.

**Note –** If the following command is executed in Multi-Admin mode, authentication is required by multiple security officers assigned the Multi-Admin role.

```
scamgr{mcaN@hostname, sec-officer}> backup keystore /opt/SUNWconn/mca/backups/bkup.data
Enter a password to protect the data:
Confirm password:
Backup to /opt/SUNWconn/mca/backups/bkup.data successful.
```

3. **Set a password for the backup data.**

   This password encrypts the master key in the backup file.

**Caution –** Choose a password that is very difficult to guess when making backup files, because this password protects the master key for your keystore. You must also remember the password you enter. Without the password, you cannot access the master key backup file. There is no way to retrieve the data protected by a lost password.

**Note –** To load a keystore to a board from a previous keystore backup, only the keystore backup file is required. The required keystore files will automatically be created in the keystore directory (`/var/sca/keydata` by default). If keystore files for a keystore with the same name as the keystore backup already exist in the keystore directory, the backup will not be allowed. A keystore backup file can also be used to load just the master key to a card if the data base files are already in the keystore directory.

## Locking Keystores to Restrict Access

### ▼ Lock a Master Key to Prevent Backups

A site might have a strict security policy that does not permit the master key for a keystore to leave the hardware.

**Caution –** Once this command is entered, all attempts to back up the master key will fail. This lock persists even if the master key is rekeyed. The only way to clear this setting is to delete the keystore from the Sun Crypto Accelerator 6000 board with the `delete keystore` command. (See TABLE 3-4.)

1. **Start the** `scamgr` **utility.**
2. **Type** `lock master-key`**. For example:**

```
scamgr{mcaN@hostname, sec-officer}> lock master-key
WARNING: Issuing this command will lock the
         master key.  You will be unable to back
         up your master key once this command
         is issued.  Once set, the only way to
         remove this lock is to delete the keystore.
Do you wish to lock the master key? (Y/Yes/N/No) [No]: y
The master key is now locked.
```

## ▼ Lock a Keystore To Restrict Access

A site might have a security policy that does not permit access to a keystore after the board has been reset or powered off without approval by a keystore security officer (KSO). To restrict keystore access, a KSO can lock a keystore. Once a keystore is locked, it can be used only if it is enabled by a KSO using the `enable keystore` command. If the Sun Crypto Accelerator 6000 board is reset or powered off, the keystore will default back to the disabled state until it is re-enabled by a KSO.

1. **Start the** `scamgr` **utility**
2. **Type** `lock keystore`**. For example:**

```
scamgr{mcaN@hostname, sec-officer}> lock keystore
Keystore locked.
```

## ▼ Enable a Locked Keystore To Enable Access

After a reset or power cycle, a keystore that has been locked to prevent access can be accessed only if enabled by a KSO.

1. **Start the** `scamgr` **utility.**
2. **Type** `enable keystore`**. For example:**

```
scamgr{mcaN@hostname, sec-officer}> enable keystore
Keystore enabled.
```

## ▼ Disable a Locked Keystore To Prevent Access

A keystore that has been locked to prevent access will default to the disabled state if the board is reset or powered off. A KSO can also disable the keystore manually.

1. **Start the** `scamgr` **utility.**
2. **Type** `disable keystore`**. For example:**

```
scamgr{mcaN@hostname, sec-officer}> disable keystore
Keystore disabled.
```

## Multi-Admin Authentication

The `scamgr` utility includes a special mode of operation called Multi-Admin mode. In this mode, certain commands require multiple security officers to authenticate and approve the command before it can complete successfully. Security officers must be in the Multi-Admin role before they can authenticate Multi-Admin commands.

When a Multi-Admin command is issued, no other general administration on the board can take place until either the command times out, is canceled by the security officer who started the command, or completes successfully. A timeout from 1 to 15 minutes must be set at or before Multi-Admin mode is enabled. See "Set a Multi-Admin Command Timeout" on page 71 for more information. Also security officers must set the number of Multi-Admin role members required to authenticate any Multi-Admin command.

When a Multi-Admin command is initiated, the `scamgr` session from which it is started waits until one of three conditions occur: The command completes successfully, the command fails, or the command times out. Other Multi-Admin role members log in to the device using their respective `scamgr` sessions. During Multi-Admin mode commands, these role members can only authenticate the command in progress. If the initiating security officer's `scamgr` session terminates unexpectedly, the security officer can log back in to the device and cancel the command. Otherwise, the board cannot be administered normally until the command times out.

The following commands require multi-admin authentication:

- `backup master-key`
- `backup keystore`
- `convert keystore`
- `copy keystore`
- `delete master-key`
- `delete keystore`

- `disable authmember`
- `disable keystore`
- `disable multiadmin`
- `enable authmember`
- `enable keystore`
- `lock master-key`
- `lock keystore`
- `rename keystore`
- `set lock`
- `set multiauth timeout`
- `set multiauth minauth`
- `unlock keystore`

## Managing Multi-Admin Mode With `scamgr`

This section describes how to configure and manage Multi-Admin mode with the `scamgr` utility. First, you must identify your security officers and place them in the Multi-Admin role. You must have enough security officers in that role to satisfy the minimum number set with the `set multiadmin minauth` command. See "Set the Minimum Number of Security Officers Required to Authenticate Multi-Admin Commands" on page 71. If the number of Multi-Admin role members is below the minimum threshold, you cannot enable Multi-Admin mode.

### ▼ Assign Security Officers the Multi-Admin Role

1. **Start the `scamgr` utility.**
2. **Type `enable authmember` *sec-officer*.**

   If executed in Multi-Admin mode, this command requires authentication by multiple security officers assigned the Multi-Admin role. The following command assigns a security officer the Multi-Admin role.

```
scamgr{mcaN@hostname, sec-officer}> enable authmember sec-officer
Added multi-admin role to Security Officer sec-officer.
```

### ▼ Remove a Security Officer From the Multi-Admin Role

1. **Start the `scamgr` utility.**

2. **Type** `disable authmember` *so-name***.**

   If executed in Multi-Admin mode, this command requires authentication by multiple security officers assigned the Multi-Admin role. For example:

```
scamgr{mcaN@hostname, sec-officer}> disable authmember sec-officer
Removed multi-admin role from Security Officer rew.
```

This command removes security officers from the Multi-Admin role only if they are in addition to the minimum required. This command exits only if a minimum number of security officers are assigned the Multi-Admin role. See "Set the Minimum Number of Security Officers Required to Authenticate Multi-Admin Commands" on page 71.

## ▼ Set the Minimum Number of Security Officers Required to Authenticate Multi-Admin Commands

1. **Start the** `scamgr` **utility.**

2. **Type** `set multiadmin minauth` *minimum-role-members***.**

   The *minimum-role-members* value must be at least two, and less than or equal to the total number of security officers on the system. In addition, if Multi-Admin mode is already enabled, the new value cannot exceed the number of members with the Multi-Admin role. If executed in Multi-Admin mode, this command requires authentication by multiple security officers assigned the Multi-Admin role.

   For example, the following command sets the minimum number of required security officers to authenticate Multi-Admin commands.

```
scamgr{mcaN@hostname, sec-officer}> set multiadmin minauth 3
Multi-admin mode now requires 3 security officers to authenticate.
```

## ▼ Set a Multi-Admin Command Timeout

1. **Start the** `scamgr` **utility.**

2. **Type** `set multiadmin timeout` *minutes.*

   The *minutes* value must be between 1 and 1440 minutes (1 day). If a value larger than 1440 is specified, the value will be set to 1440. If executed in Multi-Admin mode, this command requires authentication by multiple security officers assigned the Multi-Admin role.

   For example, the following command changes the timeout for commands that require Multi-Admin mode authentication.

```
scamgr{mcaN@hostname, sec-officer}> set multiadmin timeout 3
New multi-admin timeout value is 3 minutes.
```

## ▼ Enable Multi-Admin Mode

1. **Start the** `scamgr` **utility.**
2. **Type** `enable multiadmin`**.**

   When enabled, certain commands require multiple security officers to authenticate before the command can complete successfully. When this command is executed, the security officer is presented with the current Multi-Admin mode settings and is given the opportunity to change these settings before the command completes. This command does not accept the `-y` (yes to all) flag.

   For example, the following command enables Multi-Admin mode.

```
scamgr{mcaN@hostname, sec-officer}> enable multiadmin
WARNING: This command will place the device in multi-
         admin mode.  This mode will require multiple
         security officers to authenticate for certain
         commands to be executed.

Enable Multi-Admin Mode? (Y/Yes/N/No) [No]: y

Multi-Admin mode parameters:
-----------------------------------------------------------------
Minimum number of admins: 3
Multi-Admin command timeout: 3 minutes
-----------------------------------------------------------------


Is this correct? (Y/Yes/N/No) [No]: y
The board is now in multi-admin mode.
```

## ▼ Disable Multi-Admin Mode

1. **Start the** `scamgr` **utility.**

2. **Type** `disable multiadmin`**.**

   This command requires authentication by multiple security officers assigned the Multi-Admin role.

   For example, the following command disables Multi-Admin mode.

```
scamgr{mcaN@hostname, sec-officer}> disable multiadmin
```

## ▼ Add Additional Security Officers to the Multi-Admin Role

1. **Start the** `scamgr` **utility.**
2. **Type** `enable authmember sec-officer`*N***.**

   where *N* is the number of the security officer.

   For example, with the minimum number of required security officers set to three, adding additional security officers requires the authorization of three different security officers, including the initiating security officer, to authenticate before this command can complete.

   Execute the following command on the initiating security officer's `scamgr` session.

```
scamgr{mca0@localhost, sec-officer1}> enable authmember sec-officer4
NOTICE: Please wait while the other required 2 administrators
        authenticate this command.  This command will time out
        in 3 minutes.

Update: Authenticated security officers: sec-officer1
Update: Authenticated security officers: sec-officer1 sec-officer3
Update: Authenticated security officers: sec-officer1 sec-officer3 sec-officer2
Added multi-admin role to Security Officer sec-officer4.
```

3. **Ask other security officers to log in from their respective** `scamgr` **sessions and authorize the command.**

```
# scamgr
Security Officer Login: sec-officer3
Security Officer Password:
NOTICE: A Multi-Admin command is currently in progress.
        You are a member of the Multi-Admin role and
        may approve this command.
Command: enable authmember sec-officer4
Initiating SO: sec-officer1

Authorize this command? (Y/Yes/N/No) [No]: y
Authorization successful
```

```
# scamgr
Security Officer Login: sec-officer2
Security Officer Password:
NOTICE: A Multi-Admin command is currently in progress.
        You are a member of the Multi-Admin role and
        may approve this command.
Command: enable authmember sec-officer4
Initiating SO: sec-officer1

Authorize this command? (Y/Yes/N/No) [No]: y
Authorization successful
```

## ▼ Cancel a Multi-Admin Command Originated by the Initiating Security Officer

1. **Start the** `scamgr` **utility.**
2. **Type** `disable authmember sec-officer`*N*.

   where *N* is the number of the security officer.

   For example, the following command is canceled. This command must be entered on the initiating security officer's `scamgr` session.

```
scamgr{mca0@localhost, sec-officer1}> disable authmember sec-officer4
NOTICE: Please wait while the other required 2 administrators
        authenticate this command.  This command will time out
        in 3 minutes.

Update: Authenticated security officers: sec-officer1
```

To cancel the command, the initiating security officer must either close the current `scamgr` session or log in with a second `scamgr` session.

```
# scamgr
Security Officer Login: sec-officer1
Security Officer Password:
NOTICE: A Multi-Admin command is currently in progress.
        Since you are the admin that initiated this
        command, you have the option of cancelling it.
        If you choose not to cancel the command, you
        will be logged out and the board will continue
        with the command.

Cancel this command? (Y/Yes/N/No) [No]: y
Authorization successful
```

If the `scamgr` session from which the command was initiated is still active, the following message is displayed.

```
Failed to remove role from Security Officer sec-officer4: Command cancelled
```

## ▼ Allow a Multi-Admin Command to Time Out

1. **Start the** `scamgr` **utility.**
2. **Type a command.**
3. **Ensure that other security officers do not authenticate the command.**

   For example, the following command is issued by security officer.

```
scamgr{mca0@localhost, sec-officer1}> disable authmember sec-officer4
WARNING: Issuing this command will remove the
         multi-admin role from this security
         officer.  Once complete, this security
         officer will not be able to validate multi-
         admin commands.

Proceed with change? (Y/Yes/N/No) [No]: y
NOTICE: Please wait while the other required 2 administrators
        authenticate this command.  This command will time out
        in 3 minutes.

Update: Authenticated security officers: sec-officer1
Update: Authenticated security officers: sec-officer1 sec-officer2
Failed to remove role from Security Officer sec-officer4: Multi-Admin command
timeout
```

## ▼ Log In to a Board During a Multi-Admin Command as a Security Officer Not in the Multi-Admin Role

1. **Log in as a non-Multi-Admin security officer.**

2. **Ask Multi-Admin security officers to log in and athorize the command (if they don't the connection is closed).**

   If the Multi-Admin security officers do not authorize the command, the connection is closed.

```
# scamgr
Security Officer Login: new-sec-officer
Security Officer Password:
You have authenticated successfully but this board is
currently waiting for all needed approvals for a
Multi-Admin mode command.  Since you are not a member
of the Multi-Admin role, you will not be able to
administer this board until this command has completed.

Connection closed.
```

## ▼ Attempt to Execute a Multi-Admin Command Without Multi-Admin Role Permissions

1. **Start the** `scamgr` **utility.**

2. **Type a command as a security officer without Multi-Admin role permissions.**

   The command fails. For example:

```
scamgr{mca0@localhost, new-so}> disable multiadmin
WARNING: Issuing this command will take the board
         out of multi-admin mode and return it to the
         single-administrator mode of authentication.

Proceed with change? (Y/Yes/N/No) [No]: y
Failed disabling Multi-admin mode: Unauthorized command
```

# Managing Boards With `scamgr`

---

**Note –** You must log into `scamgr` as a device security officer (DSO) to perform the procedures in this section. You cannot manage boards if you are logged in as a keystore security officer (KSO). For information on DSOs and KSOs, see "Device and Keystore Security Officers" on page 34.

---

You can access the `scamgr` utility remotely or locally with a direct input device (see "Direct Board Administration" on page 82.

## ▼ Set the Auto-Logout Time

1. **Start the `scamgr` utility by logging in as a DSO.**
2. **Type `set timeout` *N*.**

   where *N* is the number of minutes before a security officer is automatically logged out. A value of 0 disables the automatic logout feature. The maximum delay is 1,440 minutes (1 day). A newly initialized board defaults to 5 minutes.

The following command changes the auto-logout time for a security officer to 10 minutes:

```
scamgr{mcaN@hostname, sec-officer}> set timeout 10
```

## ▼ Display Board Status

1. **Start the `scamgr` utility by logging in as a DSO.**

2. **Type** `show status`**.**

   This command displays the hardware and firmware versions for that board, the MAC address of the network interface, the status (Up, Down, speed, duplex, and so on) of the network interface, and the keystore name and ID. For example:

```
scamgr{mcaN@hostname, sec-officer}> show status
Board Status
-------------------------------------------------------------
Version Info:
* Hardware Version: 1.2
* Firmware Version: 1.0
* Serial Number: 36:30:30:30:30:33

Keystore Info:
* Keystore Name: sca6000-keystore.600003
* Keystore ID: c3270900c3270900
* Keystore Lock: Disabled
* FIPS 140-2 Mode: Disabled

Security Settings:
* Login Session Timeout (in minutes): 5
* Password Policy Security Level: LOW
* Number of Master Key Backups: 0
* Multiadmin Mode: Enabled
* Minimum Number of Authenticators: 2
* Multiadmin Timeout: 5 Minutes
-------------------------------------------------------------
```

## ▼ Load New Firmware

You can update the firmware for the Sun Crypto Accelerator 6000 board as new features are added.

1. **Start the** `scamgr` **utility by logging in as a DSO.**

2. **Type** `load firmware` ***path-name*****.**

   where *path-name* is the path to the firmware file.

A successful update of the firmware requires you to manually reset the board with the `reset` command. When you reset the board, the currently logged in security officer is logged out (see "Reset the Board" on page 79). For example:

```
scamgr{mcaN@hostname, sec-officer}> load firmware /usr/lib/crypto/firmware/sca
Security Officer Login: sec-officer
Security Officer Password:
WARNING: This command will load new firmware onto the
          the target device.  You must issue a reset
          command and log back into the target device in
          order to use the new firmware.

Proceed with firmware update? (Y/Yes/N/No) [No]: y
```

## ▼ Reset the Board

In certain situations, it might be necessary to reset the board. To do this, you must issue the `reset` command. You are asked if this is what you want to do. Resetting a Sun Crypto Accelerator 6000 board might temporarily cease the acceleration of cryptography on the system unless there are other active Sun Crypto Accelerator 6000 boards able to take over the load. Also, this command automatically logs you out of `scamgr`, so you must reconnect to the device by logging back into `scamgr` if you want to continue administering it.

1. **Start the `scamgr` utility by logging in as a DSO.**
2. **Type `reset`.**
3. **Type `y` to proceed, type `n` to cancel.**

   For example:

```
scamgr{mcaN@hostname, sec-officer}> reset
WARNING: Issuing this command will reset the
         the board and close this connection.

Proceed with reset? (Y/Yes/N/No) [No]: y
Reset successful.
```

## ▼ Rekey the Board

If your security policy changes, you might want to use new keys as the master key or remote access key. The `rekey` command enables you to regenerate either of these keys, or both.

Rekeying the master key causes the keystore to be re-encrypted under the new key, and invalidates old back up files. Create a backup of the master key whenever it is rekeyed to ensure safe disaster recovery. If you have multiple Sun Crypto Accelerator 6000 boards using the same keystore, you need to back up this new master key and restore it to the other boards.

Rekeying the remote access key logs the security officer out, forcing a new connection that uses the new remote access key.

1. **Start the `scamgr` utility logging in as a KSO.**
2. **Type `rekey`.**
3. **Specify which keys to rekey.**

   You may specify one of three key types when issuing the `rekey` command:

**TABLE 3-7** Key Types

| Key Type | Action |
|---|---|
| `master` | Rekeys the master key. |
| `remote` | Rekeys the remote access key. Logs the security officer out. |
| `all` | Rekeys both master and remote access keys. |

The following is an example of entering a key type of `all` with the `rekey` command:

```
scamgr{mcaN@hostname, sec-officer}> rekey

Key type (master/remote/all): all
WARNING: Rekeying the master key will render all old board backups
         useless with the new keystore file. If other boards use this
         keystore, they will need to have this new key backed up and
         restored to those boards. Rekeying the remote access key will
         terminate this session and force you to log in again.

Rekey board? (Y/Yes/N/No) [No]: y
Rekey of master key successful.
Rekey of remote access key successful.  Logging out.
```

4. **Backup the master key to enable disaster recovery (see "Back Up a Master Key" on page 65.**

## ▼ Perform a Software Zeroize on the Board

There are two methods of clearing a board of all its key material. The first method is with a hardware jumper (shunt). This form of zeroizing returns the board to its original factory state (Failsafe mode). (See "Zeroizing the Sun Crypto Accelerator 6000 Hardware to the Factory State" on page 223.) The second method is to use the `zeroize` command.

---

**Note –** The `zeroize` command removes the key material, and leaves any updated firmware intact. This command also logs the security officer out upon successful completion.

---

1. **Start the `scamgr` utility.**
2. **Type `zeroize`.**
3. **Confirm the command.**

   For example:

```
scamgr{mcaN@hostname, sec-officer}> zeroize
WARNING: Issuing this command will zeroize all keys
         on the board.  Once zeroized, these keys
         cannot be recovered unless you have
         previously backed up your master key.

Proceed with zeroize? (Y/Yes/N/No) [No]: y
All keys zeroized successfully.
```

## ▼ Use the `scamgr diagnostics` Command

Diagnostics can be performed from the `scamgr` utility and from the SunVTS software. The `diagnostics` command in `scamgr` covers three major categories in the Sun Crypto Accelerator 6000 hardware: general hardware, cryptographic subsystem, and network subsystem. Tests for general hardware cover DRAM, flash memory, the PCI bus, the DMA controller, and other hardware internals. Tests for the cryptographic subsystem cover random number generators and cryptographic accelerators. Tests on the network subsystem cover the `sca` device.

1. **Start the `scamgr` utility.**

2. **Type** diagnostics**.**

   For example:

```
scamgr{mcaN@hostname, sec-officer}> diagnostics
Performing diagnostic tests.  This may take a few minutes...Done.
Diagnostic Results
----------------------------------------------------------------
General Hardware:               PASS
Cryptographic Subsystem:        PASS
USB Hardware:                   PASS
----------------------------------------------------------------
```

## Direct Board Administration

You can also administer the board with a direct serial port connection. See "Direct Input Devices" on page 7 for details on configuring this port and the suggested serial input device. Most of the commands supported for connecting remotely with `scamgr` are also supported with the direct interface. The output of direct interface commands is abbreviated to support the limited output capabilities of hand-held devices. The following commands are not supported on the direct interface:

- `reset`
- `zeroize`
- `load firmware`

There are also additional commands supported on the local interface that are not available when connecting remotely with `scamgr`. These commands are primarily intended to support financial services routines and USB backups. See Chapter 5 for details of the financial services interface. The following commands are supported on the local interface only:

- `cancel kek`
- `cancel mfk`
- `cancel uwk`
- `delete dectable`
- `delete kek`
- `delete mfk`
- `delete uwk`
- `load dectable`
- `load kek`
- `load mfk`

- `load uwk`
- `set fsmode`

To initiate the direct administration interface, a security officer must press the Enter key on the direct input device and log in to the system. The following example shows a security officer logging in to the system and requesting a list of available commands.

```
Press <ENTER> to start
Security Officer Login: so1
Security Officer Password:
sca6000, so1}> ?
Sub-Command
-------------------------
backup
cancel
create
delete
diagnostics
disable
enable
exit
load
logout
quit
rekey
set
show

sca6000, so1}>
```

## USB Backup Support

When a backup operation is performed on the local interface, the master key is written to a USB mass storage device rather than a host disk. See "Direct Input Devices" on page 7 for details on the USB port and the suggested USB backup device.

Using the `backup` command through a local interface works the same as accessing `scamgr` remotely unless the board is in FIPS mode. When in FIPS mode, the USB Wrapping Key (UWK) is required to wrap all data written to the USB device. The UWK is entered with the local interface and must be entered using split knowledge procedures. The number of key components must be at least two. The security officer who initiates the UWK entry must set the UWK.

Each security officer must authenticate to the system with a user name and password before entering a component. To ensure accuracy, each key component must be entered twice. The UWK is an AES key and can be either 128, 192, or 256 bits in length. The length of the key is determined by the length of the first component entered. Once the UWK is entered, it is used to wrap all subsequent USB backup files.

The UWK is not required when not in FIPS mode, however, it can be always be entered for added security. A new UWK can be entered at any time regardless of the FIPS mode setting.

When restoring a card using a USB backup file for which a UWK was used, the security officers are presented with a series of prompts that enable them to reenter the required UWK components. Since the board is in an uninitialized state, each security officer need not authenticate to the board before entering a component. The following example shows the initialization of a board using the local interface and a USB backup file for which the UWK was used.

```
Press <ENTER> to start
Initialization Options:
1. New keystore
2. Existing keystore
Selection (0 to exit)-> 2
Backup file: keystore
Wrapping key required
Number of components: 2
Component number 1:
Enter UWK component: 11111111111111111111111111111111
Verify UWK component: 11111111111111111111111111111111
Component number 2:
Enter UWK component: 22222222222222222222222222222222
Verify UWK component: 22222222222222222222222222222222
Password:
Board Restore:
-------------------------
File: /usb0/keystore
Keystore: ks.600002
Multi-Admin: No
-------------------------
Correct? (Y/N) [No]: y
Restoring data to crypto accelerator board.
Please be patient.
Initialization complete.
Key Fingerprint: c421-2fe8-00ff-1d03-97cf-9ff7-c7ff-d370-d074-
fd4a
Security Officer Login:
```

## Using the `scadiag` Utility

The `scadiag` utility provides a command-line interface to the board that enables superusers to perform administrative tasks without authenticating as a security officer. Command-line options determine the actions that `scadiag` performs.

To access the `scadiag` utility easily, place the Sun Crypto Accelerator 6000 tools directory in your search path, for example:

```
$ PATH=$PATH:/usr/sbin/
$ export PATH
```

The `scadiag` command-line syntax (described in TABLE 3-8) for both the Oracle Solaris OS and Linux is as follows:

- `scadiag [-?]`
- `scadiag [-b] bootstrap-fw mca`*N*
- `scadiag [-d] mca`*N*
- `scadiag [-f] mca`*N*
- `scadiag [-k] mca`*N*
- `scadiag [-l] mca`*N* (device name is optional)
- `scadiag [-r] mca`*N*
- `scadiag [-u]` *fw-file device*
- `scadiag [-V]`
- `scadiag [-z] mca`*N*

The Oracle Solaris specific command-line syntax for `scadiag` is as follows:

- `scadiag [-m] [online|offline|diag] mca`*N*
- `scadiag [-s] mca`*N*

The Linux specific command-line syntax for `scadiag` is as follows:

- `scadiag [-m] [online|offline] mca`*N*

---

**Note –** In the `scadiag` option examples in this section, `mca`*N* is the board's device name where *N* corresponds to the Sun Crypto Accelerator 6000 device instance number.

---

**Note –** Certain shells interpret the `?` character when using the `-?` option on the command line. To avoid this, use the escape character (`\`) directly in front of the `?`. For example in the C shell, the command is changed to `scadiag -\?`.

## `scadiag` Options

TABLE 3-8 describes the supported options for the `scadiag` utility.

**TABLE 3-8** `scadiag` Options

| Option | Meaning |
|---|---|
| *Oracle Solaris and Linux* | |
| `-?` | Displays help files for `scadiag` commands. |
| `-b sca6000fw_bootstrap mca`*N* | Loads the bootstrap firmware in the `bootstrap-fw` file onto the board referenced by `mca`*N*. This command works only when the device is uninitialized and Version 1.1 or later operational firmware is running on the board. During a bootstrap firmware upload, the operation must not be interrupted or the board could be rendered inoperable. |
| `-d mca`*N* | Performs diagnostics on the board. |
| `-f mca`*N* | Displays the public key fingerprint used by the board for secure remote administration sessions. This fingerprint is a SHA-1 hash of the modulus. |
| `-k mca`*N* | Displays the public key and the public key fingerprint used by the Sun Crypto Accelerator 6000 board for securing administration sessions. |
| `-l mca`*N* | Lists devices. The device name (`mca`*N*) is optional. Without the device name specified, this option lists all devices. With the device name specified, this option shows the mode of the device (Online, Offline, Diag, or Failed) and status (Initialized, Initialized [FIPS], or Uninitialized). |
| `-r mca`*N* | Resets the board. |
| `-u` *fw-file device* | Loads the firmware file *fw-file* onto device. This command works only when the board is uninitialized. To upgrade firmware on an initialized board, use the `scamgr`(1m) command. |
| `-V` | Displays the version information for `scadiag`. |

**TABLE 3-8** `scadiag` Options *(Continued)*

| Option | Meaning |
|---|---|
| `-z mca`*N* | Zeroizes the board. This command removes all user accounts, security officer accounts, application key material, and the remote access and master keys for the keystore. Once complete, the board is returned to the factory state. |
| ***Oracle Solaris Only*** | |
| `-m online\|offline\|diag mca`*N* | Changes the mode of the device. The mode should be one of the following:<br>• `online` – Normal mode of operation (default)<br>• `diag` – The device is offlined from keystore slot, and it can be accessed directly from an application (Oracle Solaris only)<br>• `offline` – The device cannot be accessed from an application<br>Regardless of which mode is set, you can always manage the board with the `scadiag` and `scamgr` commands. |
| `-s mca`*N* | Checks device status for possible DR. This option verifies whether the board is in use as a crypto service provider only. |
| ***Linux Only*** | |
| `-m online\|offline mca`*N* | Changes the mode of the device. The mode should be one of the following:<br>• `online` – Normal mode of operation (default)<br>• `offline` – The device cannot be accessed from an application<br>Regardless of which mode is set, you can always manage the board with the scadiag and scamgr commands. |

## `scadiag` Option Examples

The following is an example of the `-b` option:

```
# scadiag -b sca6000fw_bootstrap mcaN
Updating bootstrap firmware on mca0 this may take a few minutes.
Please be patient.
** DO NOT INTERRUPT PROCESS **
Bootstrap firmware update complete.
Reset required to activate new bootstrap.
```

The following is an example of the -d option:

```
# scadiag -d mca0
Running mca0 on-board diagnostics.
Diagnostics on mca0 PASSED.
```

The following is an example of the -f option:

```
# scadiag -f mca0
b605-c285-392c-1c8f-5cc6-ec61-e617-1b7f-4ded-71b0
```

The following is an example of the -k option:

```
# scadiag -k mca0
Device: mca0
Key Length: 1024 bits
Key Fingerprint: b605-c285-392c-1c8f-5cc6-ec61-e617-1b7f-4ded-
71b0
Modulus:
        e4df259c 4725367a 3070ddff d78c4225 bf9a755c
        6d084667 fa043dd1 207595fb 4afdbe95 c9cca1ab
        f2a525ca 348cfffe 9c635056 94523f08 f7941797
        32d79603 3acf96c9 29c6b9ac d3f064ee 7c3a4790
        d06bf143 ce36a467 5f30332b b7782d93 17fc064b
        14438df6 679684ca afc599dc 3d1b2f87 30da4dc1
        63db86b7 48b1a29d
Public Exponent:
        00010001
```

The following is an example of the -l option:

```
# scadiag -l
mca/0
mca/1
# scadiag -l mca0
Device mca1:
State : Online
Status : Initialized
```

The following is an example of the -m option (note that the diag option is Oracle Solaris only):

```
# scadiag -m diag mca0
Device mca0 is now in diagnostic mode.
% scadiag -l mca0
Device mca0
State : Diag
Status: Initialized
```

The following is an example of the -r option:

```
# scadiag -r mca0
Resetting device mca0, this may take a minute.
Please be patient.
Device mca0 reset ok.
```

The following is an example of the -s option:

```
# scadiag -s mca0
Device mca0 free.
```

The following is an example of the -u option:

```
# scadiag -u fw-file mca0
Updating firmware on mca0, this may take a few minutes.
Please be patient.
Firmware update on mca0 complete.
Reset required to activate new firmware.
```

The following is an example of the -V option:

```
# scadiag -V
scadiag (Sun Crypto Accelerator 6000)
Copyright 2006 Sun Microsystems, Inc.
All rights reserved.
Use is subject to license terms.
```

The following is an example of the -z option:

```
# scadiag -z mca0
Zeroizing device mca0, this may take a few minutes.
Please be patient.
Device mca0 zeroized.
```

# Managing Services for Oracle Solaris Platforms

Two service daemons are provided for the board: `scad` and `scakiod`. The `scad` service performs administrative I/O functions between the `scamgr`(1M) utility and the firmware. The `scakiod` service performs keystore I/O services. The Fault Management Resouce Identifiers (FMRIs) for these services are `svc:/device/scad` and `svc:/device/scakiod`.

## ▼ Start and Stop the Services

● **Use the** `svcadm`**(1m) command to start and stop the services.**

For example:

```
# svcadm enable scad
# svcadm enable scakiod
# svcadm disable scad
# svcadm disable scakiod
```

You can specify both services in a single command to start both simultaneously.

```
# svcadm enable scad scakiod
```

## Service Configuration Parameters

TABLE 3-9 lists and describes the service parameters of the `scad` service.

**TABLE 3-9** `scad` Service Parameter Descriptions

| Parameter | Description |
|---|---|
| `debuglevel` | Sets the default log mask for events. By default, the level is NOTICE. The other accepted values, in order of increasing verbosity are INFO and DEBUG. |
| `logfile` | Takes a path name to a file specifically for logging data. This service sends log entries to `syslog` whether or not a log file is specified. |
| `hostbind` | Tells the service to listen explicitly on the IP address to which the specified *host-name* is resolved. Alternately, you may specify an IP address as the value for this property. If this property is undefined, the service listens on all interfaces. |
| `port` | Specifies the port that the service listens on for incoming connections. The default port is 6871. |
| `timeout` | Sets a timer for reads and writes of administrative data between clients and the service. The value is in seconds, and the default is to 300 seconds (five minutes). |
| `maxdata` | Sets a limit on the amount of data a client can send to the card in a single command. The value is in bytes and the default is 4 MB (4194304 bytes). Command data sizes that exceed this amount are rejected and the connection to the client is closed. |

TABLE 3-10 lists and describes the service parameters of the `scakiod` service.

**TABLE 3-10** `scakiod` Service Parameter Descriptions

| Parameter | Description |
|---|---|
| `debuglevel` | Sets the default log mask for events. By default, the level is NOTICE. The other accepted values, in order of increasing verbosity are INFO and DEBUG. |
| `keystoredir` | Sets an alternate directory for keystore files. The default value is `/var/sca/keydata`. Any alternate location must have read, write, and execute permissions for the user that the service runs as. Do not allow any permissions for any other user to this directory. |
| `logfile` | Takes a path name to a file specifically for logging data. This service sends log entries to `syslog` whether or not a log file is specified. |
| `hostbind` | This property is undefined by default, so that the default behavior for this service to bind to all interfaces. To bind the service to a specific hostname or IP address, you must define the `hostbind` property. |

## ▼ List Service Configuration Parameters

Configuration parameters are under the SMF property group `config`.

- **Use the `svccfg`(1m) command to list service properties. For example:**

```
# svccfg -s service-name listprop
```

The following is an example of listing the service properties for the `scakiod` service:

**EXAMPLE 3-1**

```
# svccfg -s scakiod listprop
general                         framework
general/action_authorization  astring  solaris.smf.manage.sca
general/entity_stability      astring  Unstable
general/single_instance       boolean  true
fs                            dependency
fs/entities                  fmri     svc:/system/filesystem/local
fs/grouping                   astring  require_all
fs/restart_on                 astring  none
fs/type                       astring  service
start                         method
start/exec                    astring  /usr/lib/crypto/scakiod
start/group                   astring  :default
start/limit_privileges        astring  :default
start/privileges              astring  :default
start/project                 astring  :default
start/resource_pool           astring  :default
start/supp_groups             astring  :default
start/timeout_seconds         count    30
start/type                    astring  method
start/use_profile             boolean  false
start/user                    astring  daemon
start/working_directory       astring  :default
stop                          method
stop/exec                     astring  :kill
stop/timeout_seconds          count    30
stop/type                     astring  method
config                        application
config/debuglevel             astring  NOTICE
config/keystoredir           astring  /var/sca/keydata
config/logfile               astring  /var/sca/log/scakiod.log
config/value_authorization    astring  solaris.smf.manage.sca
tm_common_name                template
tm_common_name/C              ustring  "Sun Crypto Accelerator"
tm_man_scakiod                template
```

**EXAMPLE 3-1**

```
tm_man_scakiod/manpath        astring  /usr/share/man
tm_man_scakiod/section        astring  1M
tm_man_scakiod/title          astring  scakiod
```

### ▼ Modify Service Configuration Parameters

- **Use the** `svccfg`**(1m) command to modify a property as follows:**

```
# svccfg -s service-name setprop config/property-name=value
```

For example, the following command defines the `hostbind` property:

```
# svccfg -s scad setprop config/hostbind=host: host1 host2 ...
```

## Enabling Optional Cryptographic Algorithms

The following algorithms are not enabled by default to maximize performance.

- SHA-512
- RC2 CBC
- Multi-part MD5
- Multi-part SHA1
- Multi-part SHA512
- HMAC (MD5 or SHA1)

Enable these algorithms as needed by adding entries to `/kernel/drv/mca.conf` file. One example for enabling certain algorithms is to use them with sensitive keys protected by the board.

### ▼ Enable the SHA-512 Algorithm

- **Add** `enable-sha512=1;` **to the** `/kernel/drv/mca.conf` **file.**

### ▼ Enable the RC2 CBC Algorithm

- **Add** `enable-rc2cbc=1;` **to the** `/kernel/drv/mca.conf` **file.**

### ▼ Enable the Multi-part MD5 Algorithm

- **Add** `enable-multi-part-md5=1;` **to the** `/kernel/drv/mca.conf` **file.**

### ▼ Enable the Multi-part SHA1 Algorithm

- **Add** `enable-multi-part-sha1=1;` **to the** `/kernel/drv/mca.conf` **file.**

### ▼ Enable the Multi-part SHA512 Algorithm

- **Add** `enable-multi-part-sha512=1;` **to the** `/kernel/drv/mca.conf` **file.**

### ▼ Enable the HMAC (MD5 or SHA1) Algorithm

- **Add** `enable-hmac=1;` **to the** `/kernel/drv/mca.conf` **file.**

## Additional Instructions for Administering the Board on Linux Platforms

Administering the board on Linux platforms is similar to administering it on the Oracle Solaris OS as described in this chapter. The differences are given in this section.

## scamgr Program

The scamgr program is installed in the /opt/sun/sca6000/bin directory. You can put this directory in your path or start the program directly with the following command:

```
% /opt/sun/sca6000/bin/scamgr
```

A newly installed board must be initialized before you can use it (see "Initializing the Board With scamgr" on page 38). In addition, the board must be re-initialized after performing a zeroize (see Appendix E) with the scamgr program (see "Using the scamgr Utility" on page 34).

The board must be stopped and restarted after initialization or a zeroize.

## ▼ Stop the Board on a Linux Platform

**1. Type:**

```
% /etc/init.d/sca stop
```

## ▼ Start the Board on a Linux Platform

**1. Type:**

```
% /etc/init.d/sca start
```

## scadiag Program

The scadiag program is installed in the /opt/sun/sca6000/sbin directory. You can place this directory in your path or directly launch the program with the following command:

```
% /opt/sun/sca6000/sbin/scadiag
```

The scad and scakiod daemons are installed in /opt/sun/sca6000/sbin directory. Do not start or stop these daemons manually. Stop and start the board to stop and start these daemons (see "Stop the Board on a Linux Platform" on page 95 and "Start the Board on a Linux Platform" on page 95.

CHAPTER 4

# Configuring Centralized Keystores

This chapter describes how to configure centralized keystores and enable access to a common repository of key material from multiple Sun Crypto Accelerator 6000 boards.

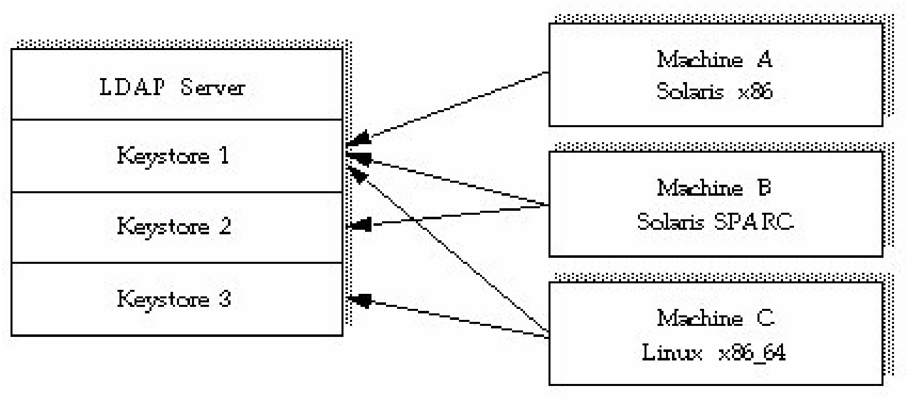
This chapter includes the following sections:

## Centralized Keystore Overview

The centralized keystore (CKS) feature requires an LDAP server such as the Sun Java System Directory Server to serve as the key repository and to support multiple keystores within a single directory server instance.

FIGURE 4-1 shows machines A, B, and C accessing various keystores stored in the CKS.

**FIGURE 4-1** Multiple Machine Access to a Centralized Keystore Repository



Since the Sun Crypto Accelerator 6000 board supports multiple keystores, Machine C in the preceding example can use key objects in Keystore 1 and Keystore 3. A key generated by an application running on Machine C can be accessed by the boards on Machines A and B when their applications authenticate to the keystore.

Client machines with Sun Crypto Accelerator boards can access the keystore with the `scakiod` service. You must set specific service properties to enable CKS support and other related configuration options such as enabling SSL and SSL client certificate authentication.

The `scakiod` service authenticates to the directory under a specific distinguished name (DN), called an agent name. Each system must have a unique agent DN, and an agent object with its authentication credentials. These credentials must be created in the directory server before that system can access the centralized keystore.

## Keystore Virtualization

Each keystore within a single board is managed separately by its own set of security officers with its own set of users and keys. Each keystore has its own master key and all of its objects are encrypted with that key. Both centralized and local keystores are supported concurrently on the same board. Keystore virtualization allows for per zone keystores using the same board.Centralized Keystore Installation and Configuration

The most important component of the CKS is the repository itself, an LDAP server such as the Sun Java System Directory Server. Install this component according to the product documentation.

# Configuring Centralized Keystores

This section describes how to set up CKSs.

## Configuring the Directory Server With the `scakscfg` Utility

Once the directory server is installed, you must configure it as a CKS repository. This process includes additions to the standard configuration. This process only needs to be done once. These additions include enabling modification of relative distinguished names (RDNs), and importing the base objects and access control directives for CKS.

The Sun Crypto Accelerator 6000 board provides the `scakscfg` utility for configuring the Sun Java System Directory Server to support centralized keystores. This utility is located at `/usr/sbin/scakscfg` (Oracle Solaris) or at `/opt/sun/sca6000/sbin/scakscfg` (Linux). The command-line usage for `scakscfg` is as follows:

```
Usage: scakscfg -b <CKS_DN> [options] config <CFG_FILE>
       scakscfg -b <CKS_DN> [options] makeagent
commands:
   config          Configure directory server for centralized
                   keystore services.  Requires a second argument
                   <CFG_FILE> which is a configuration file.
   makeagent       Create a centralized keystore agent options:
   -b <CKS DN>     DN under which keystore nodes exist [REQUIRED]
   -D <BindDN>     Authentication DN [cn=Directory Manager]
   -h <host/IP>    Directory server hostname [localhost]
   -H              Command help
   -p <port>       Directory server port [389/636 (SSL)]
   -S <dbpath>     Use SSL with certificate database directory
                   [default off]
```

TABLE 4-1 describes the command-line options for the `scakscfg` utility.

**Note –** The `scakscfg` properties are the same for both Linux and Oracle Solaris.

**TABLE 4-1** `scakscfg` Utility Command-Line Options

| Option | Description |
|---|---|
| `scakscfg config` | Makes the necessary configuration additions, enables RDN modification, and creates the base objects for centralized keystore support. The required second parameter *cfg-file* refers to a configuration template file that `scakscfg` uses to configure the directory server. There are two configuration files delivered with the board: • `opends-cfg` – Configures an OpenDS directory • `sunds-cfg` – Configures DS 5.2 or DSEE 6.x directory servers These files are located in `/var/sca/cfg` (Oracle Solaris), and in `/var/opt/sun/sca6000/cfg` (Linux). |
| `scakscfg makeagent` | Creates an agent entry in the directory server. The administrator has the option to give the agent password-based (`simple`) or certificate-based (`clientauth`) authentication credentials, or both. |
| `-b` *cks-dn* | Base object under which the CKS infrastructure is created. This device does not need to be a root node in a directory server. The device can exist anywhere under the root DN. This option is required. |
| `-D` *bind-dn* | The DN that the administrator uses to authenticate to the directory server to make the configuration changes. The default for this option is `CN=Directory Manager`. |
| `-h` *hostname* \| *IP-addr* | Connects to the directory server on *hostname* \| *IP-addr*. The default for this option is `localhost`. |
| `-H` | Displays online help and command usage. |
| `-p` *port-number* | Connects to the directory server on the specified port. This defaults to 389 if SSL is not enabled or to 636 if SSL is enabled. |
| `-S` *dbpath* | Specifies that LDAP operations must be performed over SSL. The dbpath parameter is the path to the NSS certificate database used by scakscfg to set up an SSL tunnel for making the configuration changes to the directory server. On Linux, dbpath can be either a directory containing the Root CA certificates used to validate the SSL certificate provided by the directory server, or a specific file containing one or more CA certificates. |

The following example configures the directory server on host centks and places the centralized keystore under the DN o=SUN,c=US. The following example then creates an agent named agent1 that uses a password for authentication.

```
> /usr/sbin/scakscfg -b "o=SUN,c=US" -D "cn=Directory Manager" -h iplds config
Bind password for cn=Directory Manager:
modifying entry cn=schema

modifying entry cn=userRoot,cn=ldbm database,cn=plugins,cn=config

adding new entry ou=scakeystore,o=SUN,c=US

adding new entry ou=Agents,ou=scakeystore,o=SUN,c=US

adding new entry ou=Keystores,ou=scakeystore,o=SUN,c=US
> /usr/sbin/scakscfg -b "o=SUN,c=US" -D "cn=Directory Manager" -h iplds
makeagent
Please enter the name for the agent: agent1
Will the agent use password-based authentication? [Y/N]: y
Please enter the agent password:
Confirm password:
Will the agent use a certificate for authentication? [Y/N]: n

========
Summary:
========
Server:                 iplds:389 (LDAP)
Agent:                  cn=agent1,ou=Agents,ou=scakeystore,o=SUN,c=US
Agent Password:         <NOT DISPLAYED>
Agent Certificate:      <NOT APPLICABLE>
========
Continue with Agent add? [Y/N]: y
Bind password for cn=Directory Manager:
adding new entry cn=agent1,ou=Agents,ou=scakeystore,o=SUN,c=US
```

## Configuring the scakiod Service to Use CKS

Once the centralized keystore is configured, the next step is to enable the scakiod service to make LDAP calls to a directory server. This process requires modifying specific SMF properties in the config property group on Oracle Solaris systems, or by modifying /etc/opt/sun/sca6000/scakiod.conf on Linux.

## `scakiod` Service Configuration Options

---

**Note –** The `scakiod` Service Configuration Options are the same for both Oracle Solaris and Linux.

---

**TABLE 4-2** `scakiod` Service Configuration Options

| Property Name | Description |
|---|---|
| `serverlist` | Provides the name of one or more LDAP servers that the `scakiod` service uses for centralized keystore services. The property does not exist by default. The property must be created in SMF or uncommented in the `config` file on Linux systems.<br>The data value supplied to this directive is a URI in the form of:<br>*protocol*://*host*:*port*<br>• *protocol* – Either `ldap` or `ldaps`<br>• *host* – A hostname or IPv4 or IPv6 address of the directory server<br>• *port* – An optional field indicating the port. The default for this option is 389 if *protocol* is `ldap`. The default for this option is 636 if *protocol* is `ldaps`<br>For Oracle Solaris systems, this property can be added as follows:<br>`svccfg -s scakiod setprop config/serverlist=astring: '("`*uri1*`" "`*uri2*`" ... "`*urin*`" )'`<br>On Linux systems, uncomment the `ServerList` directive and the URI provided. Multiple LDAP servers can be specified using multiple `ServerList` lines, with one URI per line.<br>If more than one LDAP server is specified, the `scakiod` service attempts to contact each server in the list until a successful LDAP connection is made. |
| `binddn` | Specifies the full distinguished name. You must specifiy this property with the correct agent name as a full distinguished name. This agent name is displayed when you create it using `scakscfg`. |
| `basedn` | Sets the base DN where the keystore node exists. This value does not need to be the root node of a directory. This value can sit anywhere under a directory suffix. |
| `authtype` | Specifies the method of authentication used by `scakiod`. Accepts one of two values: `simple` (password-based authentication) or `clientauth` (SSL client certificate authentication). `simple` authentication can be done over clear-text LDAP or LDAP over SSL. Client certificate (`clientauth`) authentication can be done only over SSL. The default setting is `simple`. |

**TABLE 4-2** `scakiod` Service Configuration Options *(Continued)*

| Property Name | Description |
|---|---|
| `certdb` | Specifies the SSL certificate database path. If `scakiod` is going to communicate with the LDAP server over SSL, you must create a certificate database path in this directory. If SSL is not configured, this property is ignored and does not need to be set. The default value is: `/var/sca/private` for Oracle Solaris systems and `/var/opt/sun/sca6000/private` on Linux. |
| `certname` | Contains the name of the certificate used in SSL client certificate authentication. If `clientauth` is selected as the authentication type, you must specify the certificate name in this property. If client certificate authentication (`clientauth`) is not being used, this property is ignored and does not need to be set. The default value is the name `authCert`. |
| `passfile` | For `scakiod` to authenticate with `simple` authentication, you must place the password in the file pointed to by this property. The default value is: `/var/sca/private/scakiod-pass.conf` on Oracle Solaris systems and `/var/opt/sun/sca6000/private` on Linux. If you choose `simple` authentication, this password must be the password set for the agent entry when created using the `scakscfg` utility. If client certificate authentication is selected, this password should be the password for the key database that exists at the location specified in the `certdb` property. |

To configure the `scakiod` service to use CKS, the following properties must be created or modified. See TABLE 4-2 for how to configure these properties:

- Location of the LDAP server or servers (defined in the `config/serverlist` option)
- Authentication credentials (defined with the `config/binddn` option)
- Location of the keystore in the directory server (defined with the `config/basedn` option)
- The method of authentication for the agent (defined with the `config/authtype` option)
- The SSL certificate database path (defined with the `config/certdb` option)
- For the `clientauth` authentication method, the name of the certificate used in SSL client certificate authentication (defined with the `config/certname` option)
- For the `simple` authentication method, the password (defined with the `passfile` option)

## ▼ Configure the scakiod Service to Use CKS (Oracle Solaris)

1. **Use the** svccfg **utility to configure the** scakiod **service to use CKS.**

   The following example configures the scakiod service to communicate with LDAP host centks with password-based (simple) authentication.

```
# svccfg -s scakiod setprop config/serverlist=astring: '("ldap://centks")'
# svccfg -s scakiod setprop config/binddn="cn=agent1,ou=Agents,ou=scakeystore,o=
SUN,c=US"
# svccfg -s scakiod setprop config/basedn="o=SUN,c=US"
```

2. **Before restarting the** scakiod **service, check your settings with the** listprop **option of the** svccfg **utility:**

```
# svccfg -s scakiod listprop | grep config
config                          application
config/auditloglimit            integer  500
config/authtype                 astring  simple
config/certdb                   astring  /var/sca/private
config/certname                 astring  authCert
config/keystore_dir             astring  /var/sca/keydata
config/log_file                 astring  /var/sca/log/scakiod.log
config/passfile                 astring  /var/sca/private/scakiod-
pass.conf
config/value_authorization      astring  solaris.smf.modify.sca
config/debuglevel               astring  debug
config/serverlist               astring  ldap://centks
config/binddn                   astring  cn=agent1,ou=Agents,ou=
scakeystore,o=SUN,c=US
config/basedn                   astring  o=SUN,c=US
```

3. **Restart the server with the** svcadm **utility:**

```
# svcadm restart scakiod
```

## ▼ Configure the `scakiod` Service to Use CKS (Linux)

1. **Edit the `/etc/opt/sun/sca6000/scakiod.conf` file.**

   The following example configures the `scakiod` service to communicate with LDAP host `centks` with password-based (simple) authentication. Below are examples of entries in `scakiod.conf` that must be modified.

```
serverlist     ldap://cks-host
binddn      cn=agent1,ou=Agents,ou=scakeystore,o=SUN,c=US
basedn      o=SUN,c=US
```

   These entries identify `cks-host` as the centralized keystore host and specify that this system will connect as `agent1`.

2. **Start and stop the `sca` daemon to activate these settings.**

```
# /etc/init.d/sca stop
# /etc/init.d/sca start
```

## Configuring the `scakiod` Service to Use SSL With Simple Authentication

The `scakiod` service can communicate with directory servers using SSL. To enable this communication, an NSS certificate database must be configured. The CA certificate that signs the directory server SSL certificate must be imported into that database. The certificate database must exist in the directory specified in the `certdb` SMF property. This directory is `/var/sca/private` by default. You must use the NSS utility `certutil` to create a database and import the root CA certificate into it.

---

**Note –** The `certutil` utility is located in `/usr/sfw/bin/certutil` on Oracle Solaris systems. The typical Linux path to `certutil` is `/usr/bin/certutil`.

---

## ▼ Configure `scakiod` for Simple Authentication Over SSL

1. **Create a certificate database with the `certutil` utility:**

**Note –** The following example is for Oracle Solaris. For Linux, use the `/var/opt/sun/sca6000/private` path instead of `/var/sca/private`.

```
# certutil -N -d /var/sca/private
Enter a password which will be used to encrypt your keys.
The password should be at least 8 characters long,
and should contain at least one non-alphabetic character.

Enter new password:
Re-enter password:
```

**Note –** The password specified here does not need to match the password used in the password configuration file if simple authentication over SSL is to be used. The password in `scakiod-pass.conf` should still match the password set for the agent entry in the LDAP server. The password set for the certificate database will only be important if SSL client certificate authentication is used.

2. **Add the root CA certificate to the database.**

**Note –** The following example is for Oracle Solaris. For Linux, use the `/var/opt/sun/sca6000/private` path instead of `/var/sca/private`.

```
# certutil -A -d /var/sca/private -n certname -t "CT,CT,CT" -a -i
certpath
```

**Note –** *certname* is a friendly name for the CA certificate. *certpath* is the path to the actual certificate file. Use the `-a` option only if the certificate is encoded in ASCII form. If the certificate is in binary DER encoding, omit the `-a` option.

3. **Set the ownership on the certificate and key databases to** `daemon`**.**

```
# chown daemon:sys cert8.db key3.db secmod.db
```

4. **(Oracle Solaris) Change the URL for the LDAP server in the** `serverlist` **to indicate that it is using SSL**

```
# svccfg -s scakiod setprop config/serverlist=astring:
ldaps://host[:port]
```

5. **(Linux) Edit the** /etc/opt/sun/sca6000/scakiod.conf **file modifying the** serverlist **property as follows:**

```
serverlist    ldaps://host[:port]
```

6. **(Oracle Solaris) Restart the** scakiod **service so the new values take effect.**

```
# svcadm restart scakiod
```

7. **(Linux) Stop and start the** sca **services.**

```
/etc/init.d./sca stop
/etc/init.d/sca start
```

## Configuring the scakiod Service to Use SSL With Client Certificate Authentication

By default, the scakiod service uses simple (password-based) authentication. A more secure method of authentication is available for centralized keystore agents. That method uses X.509 certificates to cryptographically authenticate to the directory server. The configuration of this authentication method is more complex, as it requires not only the previous steps for basic SSL configuration. This method also requires that you obtain a digital certificate for the scakiod service, and that the CA that signs that certificate must be trusted by the LDAP server. Further, proper certificate mapping must be set up in the LDAP server so the components in the certificate subject name can be mapped to the agent DN in the LDAP server.

### ▼ Configure the scakiod Service to Use SSL With Client Certificate Authentication

1. **Complete all the steps involved in configuring** scakiod **for simple authentication over SSL in** "Configuring the scakiod Service to Use SSL With Simple Authentication" on page 105.

2. **(Oracle Solaris) Set the authentication type to** clientauth.

```
# svccfg -s scakiod setprop config/authtype=clientauth
```

3. **(Linux) Edit the** `/etc/opt/sun/sca6000/scakiod.conf` **file modifying the** `authtype` **property as follows:**

```
authtype clientauth
```

4. **(Oracle Solaris) Use the** `certutil` **utility to create a key and certificate request.**

```
# certutil -R -d /var/sca/private -s <BINDDN> -g 1024 -a -o
/var/sca/private/certreq.pem
Enter Password or Pin for "NSS Certificate DB":

A random seed must be generated that will be used in the
creation of your key.  One of the easiest ways to create a
random seed is to use the timing of keystrokes on a keyboard.

To begin, type keys on the keyboard until this progress meter
is full.  DO NOT USE THE AUTOREPEAT FUNCTION ON YOUR KEYBOARD!


Continue typing until the progress meter is full:

|************************************************************|

Finished.  Press enter to continue:

Generating key.  This may take a few moments...
```

5. **(Linux) Use the `certutil` utility to create a key and certificate request.**

```
# certutil -N -d /var/opt/sun/sca6000/private -s <BINDDN> -g 1024
-a -o /var/sca/private/certreq.pem
Enter Password or Pin for "NSS Certificate DB":

A random seed must be generated that will be used in the
creation of your key.  One of the easiest ways to create a
random seed is to use the timing of keystrokes on a keyboard.

To begin, type keys on the keyboard until this progress meter
is full.  DO NOT USE THE AUTOREPEAT FUNCTION ON YOUR KEYBOARD!


Continue typing until the progress meter is full:

|************************************************************|

Finished.  Press enter to continue:

Generating key.  This may take a few moments...
```

---

**Note –** The password provided must be the password that was set when creating the NSS certificate database. If this password is different than what is currently in the `scakiod-pass.conf` file, change `scakiod-pass.conf` to make it the same as this password.

---

6. **Submit the certificate request to a certificate authority and get a digital certificate.**

   Place the digital certificate somewhere on the system where `scakiod` is running so the certificate can be imported into the certificate database (for example, `/var/sca/private/cert.pem`).

7. **If the issued certificate is in ASCII encoded form, convert it to binary form as follows:**

```
# openssl base64 -d -in /var/sca/private/cert.pem -out
/var/sca/private/cert.der
```

8. **Install the resulting certificate and the CA certificate into the NSS certificate database with `certutil`:**

**Note –** The following example is for Oracle Solaris. For Linux, use the `/var/opt/sun/sca6000/private` path instead of `/var/sca/private`.

```
# certutil -A -n nickname -t "u,u,u" -d /var/sca/private -a -i certfile
```

**Note –** *certfile* is the path to the issued certificate. You must use the `-a` option if the certificate is in ASCII encoded format. Otherwise you can omit the option. The value for *nickname* must be the same string value that is specified in the `certname` SMF property.

9. **Install the CA certificate that signed the certificate to be used in authentication:**

**Note –** The following example is for Oracle Solaris. For Linux, use the `/var/opt/sun/sca6000/private` path instead of `/var/sca/private`.

```
# certutil -A -n canickname -t "C,C," -d /var/sca/private -a -i certfile
```

## Adding the Certificate to the Agent Entry in the Directory Server

You must add the certificate to the agent entry in the directory server. If the agent entry does not exist in the DS, use the `scakscfg` utility with the `makeagent` option. When the utility prompts for whether certificate authentication is to be used or not, answer **Y**. You are prompted for the location of the certificate. Use the binary certificate file you created in the preceding example.

### ▼ Add the Certificate to the Agent Entry in the DS

Once the agent entry exists, add the certificate to the entry with the `ldapmodify` command.

1. **Create a modification file with the following info:**

```
dn: cn=agent-dn
    changetype: modify
    replace: usercertificate;binary
    usercertificate;binary: /var/sca/private/cert.der
```

---

**Note –** The value for *agent-dn* must be the same as the value in the binddn SMF property for the scakiod service.

---

2. **Use ldapmodify to alter the agent entry and add the certificate:**

```
# ldapmodify -h host -b -D dir-adm-dn < modfile
modifying entry cn=geeky,ou=Agents,ou=scakeystore,o=SUN,c=US
```

---

**Note –** *dir-adm-dn* is the bind DN for a directory administrator or some directory object with write access. *host* is the hostname where the directory is located.

---

3. **In the directory server, ensure that the CA certificate used to sign the certificate that scakiod uses for authentication is trusted.**

   The procedure for this will vary across different DS implentations. Refer to the directory server documentation for details on how to do this.

4. **Set up certificate mapping on the directory server.**

   The procedure for this will vary between DS implementations. The certmap.conf file for Sun directory servers contains a default mapping and zero or more additional mappings tied to the issuer DN for certificates used in authentication. If the default rule cannot be used, you might need to create a separate rule for the issuer DN. That issuer DN will be the same as the issuer DN for the certificate used by the scakiod service for SSL client certificate authentication. In addition, set the verifycert directive to on for the mapping rule you are modifying. In cases where the certificate subject name matches the DN of the agent entry, the DNComps directive can be commented out. If the names differ, then different combinations of the DNComps and FilterComps might be required to get proper certificate mapping.

5. **(Oracle Solaris) Restart the scakiod service:**

```
# svcadm restart scakiod
```

6. **(Linux) Start and stop the sca services:**

```
# /etc/init.d/sca stop
# /etc/init.d/sca start
```

## Configuring the Board to Join a Centralized Keystore

Once a centralized keystore is created, other SCA 6000 boards on different systems may then be configured to access the centralized keystore. The following steps must be taken to bring a new board on a different server into the centralized keystore.

### ▼ Join a Previously Configured Board to a Centralized Keystore

1. **Make a note of the** `serverlist`**,** `basedn` **and** `authtype` **parameters.**

   Use similar authentication methods across all your servers if possible.

2. **Use the** `scamgr` **utility to log into the keystore and export the master key.**

```
scamgr{mca0@localhost, sec_officer}> backup master-key
Full path (including file name) to receive backup file: path-to-backup
Enter a password to protect the data: password
Confirm password: password
Backup to path-to-backup successful.
```

### ▼ Join an Unconfigured Board to a Centralized Keystore

1. **If the board is uninitialized, initialize it using** `scamgr` **(See Chapter 3.)**

2. **Create an agent using the** `scakscfg` **utility with the** `makeagent` **subcommand.**

3. **Set the password for the agent in the password configuration file specified by the** `passfile` **configuration property.**

4. **Set the** `serverlist`**,** `basedn`**,** `binddn`**, and** `authtype` **for the** `scakiod` **service.**

5. **Restart the `scakiod` service.**

   From the system where the backup file was saved, use `scamgr` to remotely connect to the target machine and board. When the `Select Keystore` screen is given, choose `Load Keystore from Backup` and provide the backup file saved previously.

```
# scamgr -h target-host
Select Keystore:
1. Create new keystore
2. Load keystore from backup

Selection (0 to exit)-> 2
Enter the path to the backup file: path-to-backup
Password for restore file:

Load Parameters:
----------------------------------------------------------------
Path to backup file: path-to-backup
Keystore name: company-ks.600062
Backup type: Master key
Load type: Master key
Requires Multi-Admin auth: No
----------------------------------------------------------------

Is this correct? (Y/Yes/N/No) [No]: y
Restoring data to crypto accelerator board.  This may take a few
minutes...

company-ks.600062 successfully created.
```

# Troubleshooting CKS Issues

The following section describes how to debug misconfigurations with the centralized keystore. Errors are written into the log file referenced by the `LogFile` property and path used in the `/etc/opt/sun/sca6000/scakiod.conf` file. For example:

```
 # LogFile                /var/opt/sun/sca6000/log/scakiod.log
```

The following is an example of the `/etc/opt/sun/sca6000/scakiod.conf` file:

```
#
# Copyright 2007 Sun Microsystems, Inc.  All rights reserved.
# Use is subject to license terms.
#
#ident  "@(#)scakiod.conf       1.11    07/10/24 SMI"
#
# Configuration file for scakiod(8), see man page for details.
#
# Directives in this configuration file should use the following
# syntax:
#
# <DIRECTIVE>           <VALUE>
#
# Directives should be one-per-line, and if two directives with the same
# name are found in the configuration file, the last one will be the one
# used.  The only exception to this is the HostBind directive, in which
# multiple entries signify additional IP addresses to listen on.  Keystore
# directive names are case-insensitive.
#

# user: The user directive tells scakiod to run as that particular user.  The
# value for this directive is a username.  It is recommended that this user
# not be root or any other account with superuser privilege.
#
user                    daemon

# logfile: This directive takes a pathname to a file used specifically for
# scakiod logging data.  Regardless of whether this directive is set or not,
# scakiod will send log entries to syslog.
#
logfile         /var/opt/sun/sca6000/log/scakiod.log

# keystoredir: The keystoredir directive allows the administrator to set an
# alternate directory for keystore files.  The default value for this is
# /var/opt/sun/sca6000/keydata.  Any alternate location must have read,
# write and execute permissions for the user that the daemon runs as.  It
# is recommended to not allow any permissions for any other user to this
# directory.
#
keystoredir             /var/opt/sun/sca6000/keydata

# debuglevel: The debuglevel directive sets the default log mask for scakiod
# logging events.  By default, the level is NOTICE.  The other accepted values,
# in order of increasing verbosity, are INFO and DEBUG (equivalent to -d and
# -dd on the command line, respectively).
#
debugleve       NOTICE

# The next set of parameters is specific to centralized keystore configuration
# If there are no centralized keystore servers specified in the serverlist
# directive, then the service will disable centralized keystore functionality
# and only look for local keystores.  All other centralized keystore
# directives will be read but will be ignored.

# The serverlist  property is a list of LDAP servers where centralized
# keystores are hosted.  Entries in this property should be in the form of
# an LDAP URL:
#       <proto>://<server>:[<port>]
# Where <proto> is either "ldap" or "ldaps".  <server> is a hostname,
# fully-qualified domain name, or IPv4/v6 address of the LDAP server.
# <port> is the port number and is the only optional value.  If <port> is
# omitted the value is 389 for LDAP, 636 for LDAPS.  Multiple serverlist
# directives may be used.  If more than one is used, the service will attempt
# to bind to the servers in the order they are listed until it successfully
# contacts one.
#
# serverlist            ldap://localhost:389
serverlist              ldaps://nsn104-20

# The basedn property sets the base DN for the centralized keystore directory
# tree.  The top of the centralized keystore tree is ou=scakeystore.  You
# will need to append the root DN to this value if such exists.
#
#basedn                 ou=scakeystore
basedn                  o=SUN,c=US

# The authtype property sets the type of authentication used by the service
# to the LDAP server.  This can be one of two values, "simple" or "clientauth".
#
authtype                simple

# The binddn property is only meaningful if the authtype property is set to
# "simple".  This value is in the form of a distinguished name which
# corresponds to a keystore agent entry.
#
#binddn                 CN=Directory Manager
binddn                  cn=agent1,ou=Agents,ou=scakeystore,o=sun,c=us

# The certdb property contains the path to the certificate database directory
# for the service.  This defaults to /var/sca/private if not otherwise defined.
#
certdb                  /var/opt/sun/sca6000/private

# The certname property defines the friendly name for the certificate used in
# client certificate authentication.  This value should be just the cert
# friendly name if stored in the NSS internal database.  If the key and
# certificate are stored on an external device, then the value should be the
# PKCS#11 token name, followed by a colon (:), followed by the friendly name.
#
certname                server-cert

# The passfile property defines the location for the file that contains a
# password.  If the authtype property is "simple" then that file contains the
# password used during LDAP simple authentication.  If the authtype is
# "clientauth" then the password in this file is used to authenticate to the
# keystore containing the private key for the certificate used to authenticate.
#
passfile                /var/opt/sun/sca6000/private/scakiod-pass.conf

# The auditloglimit directive is used for the keystore audit logging facility.
# The value used here is an integer specifying the maximum number of log
# entries before the audit log is rotated.
#
auditloglimit           500
[root@nsn104-57 sca6000]#
```

## Cannot Contact Server

```
Sep 18 09:33:09 [29290/1]: [info] Cannot contact server
vdemo02.west.sun.com:636: Can't connect to the LDAP server
Sep 18 09:33:09 [29290/1]: [ERROR] Cannot connect to any LDAP
server for centralized keystore services.
```

Possible causes:

- The LDAP servers on all hostnames or IP addresses referenced in the `serverlist` property are down.
- The referenced server is not a valid hostname or IP address.
- The servers referenced do not have LDAP servers on them.

## Initial Keystore Search Failed

```
Sep 18 12:02:12 [18800/47045332179296]: [info] Successfully bound
as cn=vigenere,ou=Agents,ou=scakeystore,o=SUN,c=US
Sep 18 12:02:12 [18800/47045332179296]: [ERROR] Initial keystore
search failed: No such object
```

Possible causes:

- The value for the `basedn` property is incorrect.
- The LDAP server for the keystore repository has not been configured using the `scakscfg` utility with the `config` subcommand.

## Failed Binding to Server

```
Sep 18 12:04:45 [18800/47045332179296]: [ERROR] Failed binding to
server vdemo01.west.sun.com:636: No such object
```

Possible causes:

- The value for the `binddn` property is incorrect.
- The agent entry has not been created using `scakscfg` using the `makeagent` subcommand.

## Failed Binding to Server

```
Sep 18 12:07:06 [18800/47045332179296]: [info] Attempting LDAPS
connection to vdemo01.west.sun.com:636
Sep 18 12:07:06 [18800/47045332179296]: [ERROR] Failed binding to
server vdemo01.west.sun.com:636: Invalid credentials
```

Possible causes:

- The password in the `config` file referenced by the `passfile` property contains an incorrect password.

## Client Authentication Initialization Failed

```
Sep 18 12:09:58 [18981/47903389276512]: [info] Starting keystore
I/O handler
Sep 18 12:09:58 [18981/47903389276512]: [ERROR] Client
authentication init failed
```

Possible causes:

- The ownership or permissions on the certificate database files in the directory referenced by the `certdb` property are not readable to the UNIX user `daemon`.
- The certificate database files have not been created in the directory referenced by the `certdb` property.

CHAPTER 5

# Developing and Administering Financial Services

---

**Note –** The financial services features described in this chapter are supported for the Oracle Solaris OS on both SPARC and x86 platforms. These features are not currently supported for the Linux OS.

---

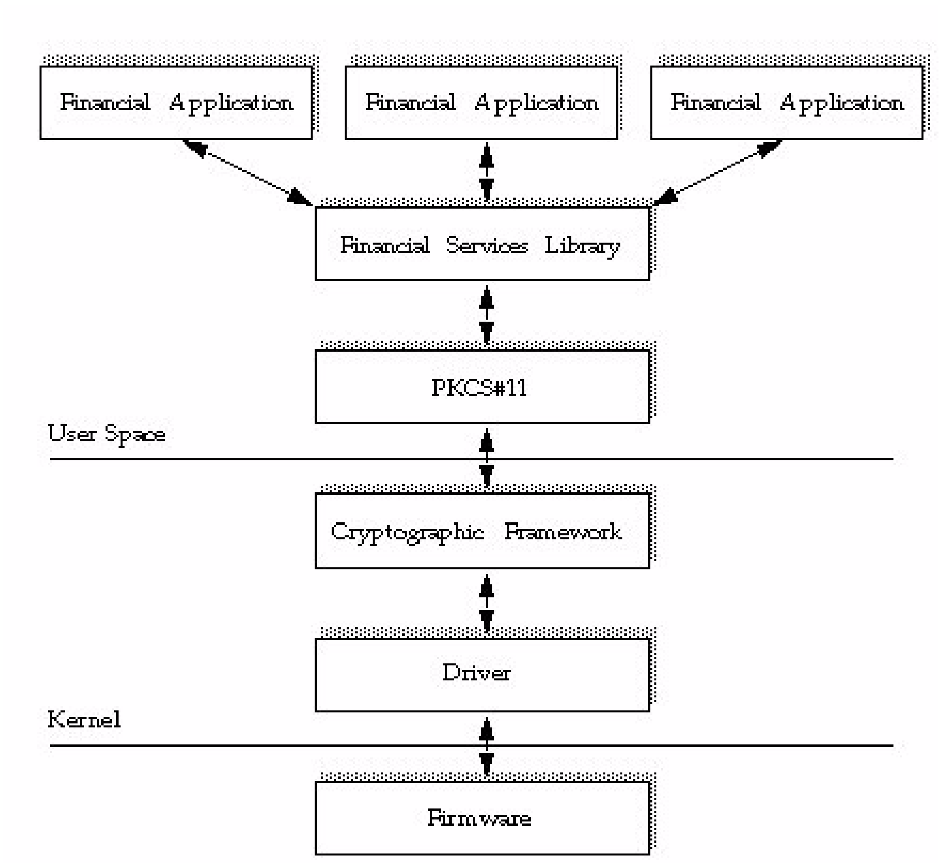
This chapter describes the application programming interface (API) to enable developers to use this new functionality. Basic familiarity with PIN and credit card processing and the associated standards is assumed. The following sections are included:

## Financial Service Components Overview

The Sun Crypto Accelerator 6000 board supports PIN and credit card related functionality, ensuring the security of sensitive customer data by performing the entire operation within the secure cryptographic boundary of the board. Specialized key management capabilities, and a new user library (`libfinsvcs.so`) and associated application interfaces, are provided to support this feature. Data types referenced in this chapter are defined in the `/opt/SUNWsca/include/finsvcs.h` header file, which is included in Appendix F.

The new financial service library uses the underlying PKCS#11 infrastructure to tunnel complex commands to the board resident firmware. Financial applications are not required to interpret the PKCS#11 interface, however, because this interpretation is handled by the financial services library. A high-level overview of the financial services components is depicted in FIGURE 5-1:

**FIGURE 5-1** Financial Services High-Level Architecture



Three core components comprise the Sun Crypto Accelerator 6000 board financial services functionality:

- Key management
- PIN processing
- Card processing

These core components are described in the following sections.

## Financial Services Library Initialization

This section describes the functions used to initialize the financial services library.

## Library Open Function `fs_lib_open()`

Financial services applications must issue the `fs_lib_open()` function to initialize the financial services library. This function locates the desired PKCS#11 provider and verifies that it supports the financial services mechanism. The `fs_lib_open()` function returns a handle that must be used in subsequent financial services library calls.

The syntax for the `fs_lib_open()` function is as follows:

```
fsLibHandle_t fs_lib_open(char *tokenName, fsReturn_t *err)
```

TABLE 5-1 lists the parameters for the `fs_lib_open()` function.

**TABLE 5-1** `fs_lib_open()` Function Parameters

| Parameter | Description |
|---|---|
| `tokenName` | Name of the desired token |
| `err` | Error value |

TABLE 5-2 lists the return values for the `fs_lib_open()` function.

**TABLE 5-2** `fs_lib_open()` Function Return Values

| Return Value | Description |
|---|---|
| `fsOK` | Successfully initialized, desired token found, and support for financial services verified |
| `fsNotFound` | Token not found |
| `NULL` | Error occured |
| `Non-NULL` | Valid library handle returned when successfully initialized |
| `err` | `err` is set as follows:<br>• `fsOK` – Successfully initialized, the desired token found, and support for financial services verified<br>• `fsNotFound` – Token not found<br>• `fsError` – Unable to initialize libary |

## Library Shutdown Function `fs_lib_close()`

Applications can close the financial services library services when the services are no longer required.

The syntax for the `fs_lib_close()` function is as follows:

```
fsReturn_t fs_lib_close(fsLibHandle_t handle)
```

TABLE 5-3 lists the parameters for the `fs_lib_close()` function.

**TABLE 5-3** `fs_lib_close()` Function Parameters

| Parameter | Description |
|---|---|
| `handle` | Financial services library handle returned from the `fs_lib_open` function |

TABLE 5-4 lists the return values for the `fs_lib_close()` function.

**TABLE 5-4** `fs_lib_close()` Function Return Values

| Return Value | Description |
|---|---|
| `fsOK` | Successfully closed the financial services library |
| `fsInvalidHandle` | Library handle invalid |

## Session Establishment Function `fs_session_open()`

Users can establish multiple financial services sessions, thus allowing multithreaded access to the financial services capabilities. Sessions can be created only after you have initialized the financial services library with the `fs_lib_open()` function. A unique session handle is returned and must then be used for all financial service requests for that specific session.

The syntax for the `fs_session_open()` function is as follows:

```
fsSessHandle_t fs_session_open(fsLibHandle_t handle)
```

TABLE 5-5 lists the parameters for the `fs_session_open()` function.

**TABLE 5-5** `fs_session_open()` Function Parameters

| Parameter | Description |
|---|---|
| `handle` | Library handle obtained from the `fs_lib_open()` function |

TABLE 5-6 lists the return values for the fs_session_open() function.

**TABLE 5-6** fs_session_open() Function Return Values

| Return Value | Description |
|---|---|
| Non-NULL | Session handle upon success |
| NULL | On error |

## Session Shutdown Function fs_session_close()

Once a user has completed financial operations, a user can dissolve the session by issuing the fs_session_close() function. The session handle obtained from the fs_session_open() function must be used with this function.

The syntax for the fs_session_close() function is as follows:

```
fsReturn_t fs_session_close(fsSessHandle_t handle)
```

TABLE 5-7 lists the parameters for the fs_session_close() function.

**TABLE 5-7** fs_session_close() Function Parameters

| Parameter | Description |
|---|---|
| handle | Session handle from previous fs_session_open() function |

TABLE 5-8 lists the return values for the fs_session_close() function.

**TABLE 5-8** fs_session_close() Function Return Values

| Return Value | Description |
|---|---|
| fsOK | Session closed successfully |
| fsInvalidHandle | Session handle invalid |

## Financial Services Data Types

The financial services API requires the use of new data types defined in the finsvcs.h header file. Appendix F provides the finsvcs.h header file.

## Key Management Overview

To meet the strict key management requirements of financial institutions, the Sun Crypto Accelerator 6000 board adheres to the following essential financial key management principles.

### Key Separation and Compartmentalization of Risk

Keys must be used for specifically defined functions only. This requirement limits potential damage from a key compromise. To meet this requirement, functional key type information is associated with each financial key. The board allows generating and importing the types of keys defined in the following list, and enforces the keys use for specific operations only.

The following types of financial keys are supported:

- ***Master file key (MFK)***

  The Sun Crypto Accelerator 6000 board is a dedicated hardware security module (HSM). The MFK never leaves the secure HSM and encrypts other operational keys when they leave the HSM. An MFK can be used only on the encrypting HSM. MFKs are entered into the board in component form with the direct input device.

- ***Key encryption key (KEK)***

  Encrypts other keys for key exchange operations. The KEKs are entered into the board in component form with the direct input device.

- ***PIN encryption key (PEK)***

  Encrypts PINs. There are two types of supported PEKs:

  - Terminal PIN Key (TPK) – Encrypts PINs on the terminal side of the transaction (ATM, POS device).
  - Zone Working Key (ZWK) – Encrypts PINS when transferring between different financial institutions.

- ***PIN verification key (PVK)***

  Verifies PIN operations.

- ***Card verification key (CVK)***

  Verifies card operations.

## Permitted Key Forms

The following key form requirements are enforced by the board.

- Cleartext keys must stay within the board, with the exception of existing as at least two separate components, each under the control of a different security officer.
- When not stored in the board or when in component form, all keys must be enciphered with a key of equal or greater cryptographic strength.

## Direct Key Loading

For security unique security officers enter the MFK and KEKs directly into the board with the direct input device connected to the board's serial port. This extra security step is required to meet the following key management requirements:

- *Split knowledge* – No single user can know the entire key.
- *Dual control* – The component and a valid user name and password are required to enter a key component.

## ▼ Load the MFK

The MFK is the only financial services key maintained on the board. This key never leaves the board.

Several security officers enter the MFK as a series of key components that combine to make the MFK. Since a different security officer enters each component, no single user knows the MFK.

Each security officer entering a component of the MFK must follow these steps:

1. **Connect the direct input device to the board's serial port.**
2. **Type the follwing command:**

```
sca6000, so}> load mfk
```

## ▼ Enable the MFK

Once the MFK components are loaded, a valid security officer must enable the direct input device.

● **Type the following command:**

```
sca6000, so}> enable mfk
```

## ▼ Load the KEKs

A security officer also enters the KEKs with the the direct input device. However, unlike the MFK, these keys are extracted from the board by financial applications. The extracted keys are encrypted with the MFK. The KEKs are never in the clear. Similar to the MFK, KEKs are entered in component form, which prevents any individual from knowing the actual KEK. A label must also be entered with the direct input device and is used programmatically by an application to retrieve the desired KEK.

● **Type the following command:**

```
sca6000, so}> load kek
```

## ▼ Change the MFK

Financial applications require their keys be encrypted using the MFK. Thus, changing the MFK is a complex process.

1. **Enter the new MFK.**
2. **Use the `fs_translate_key()` function to request that all of their keys be reencrypted using the new MFK.**

   The board must maintain the old MFK until this process is complete.
3. **Once this process is complete, a security officer can use the new MFK by typing the `enable mfk` command.**

## Key Management Functions

Financial applications require key management related functionality from the HSM. The following basic capabilities are required:

- Generate key
- Import key
- Export key

- Translate key (from the old MFK to the new MFK)
- Retrieve KEK

## Generate Key Function `fs_generate_key()`

Applications generate different types of financial keys. DES keys are primarily used for these functions. Along with the key type, key usage information is required to limit when the key can be used. The following types of key uses are supported:

- PIN encryption keys
- Terminal PIN key (TPK)
- Zone working key (ZWK)
- PIN verification key (PVK)
- Card verification key (CVK)

Once generated these keys are encrypted by the MFK and returned in the user-provided buffer upon success.

The syntax for the `fs_generate_key()` function is as follows:

```
fsReturn_t fs_generate_key(fsSessHandle_t handle, fsKeyType_t
type, fsKeyUsage_t usage, fsKey_t *key)
```

TABLE 5-9 lists the parameters for the `fs_generate_key()` function.

**TABLE 5-9** `fs_generate_key()` Function Parameters

| Parameters | Description |
|---|---|
| `handle` | Session handle returned by `fs_session_open()` |
| `type` | Key algorithm type: DES, DES2, DES3 |
| `usage` | Intended financial key usage |
| `key` | Buffer for the generated key, encrypted with the MFK or a derivative |

TABLE 5-10 lists the return values for the `fs_generate_key()` function.

**TABLE 5-10** `fs_generate_key()` Function Return Values

| Return Value | Description |
|---|---|
| `fsOK` | Key generated |

**TABLE 5-10** `fs_generate_key()` Function Return Values *(Continued)*

| Return Value | Description |
|---|---|
| `fsInvalidKeyType` | Invalid key type specified |
| `fsBufferTooSmall` | Provided buffer is too small for the key |
| `fsInvalidState` | Device not in proper state to handle command |

## Import Key Function `fs_import_key()`

To interoperate with peer nodes, the board must be able to import keys from these peers. Applications can import existing keys from peer nodes with the import function.

The syntax for the `fs_import_key()` function is as follows:

```
fsReturn_t fs_import_key(fsSessHandle _t handle, fsKeyUsage_t
usage,  fsKey_t *KEK, fsKey917_t *iKey, fsKey_t *oKey, BOOLEAN
useVariants)
```

TABLE 5-11 lists the parameters for the `fs_import_key()` function.

**TABLE 5-11** `fs_import_key()` Function Parameters

| Parameters | Description |
|---|---|
| `handle` | Session handle returned by the `fs_session_open()` function |
| `usage` | Type of intended key usage: TPK, ZWK, PEK, CVK, and so on |
| `kek` | KEK key shared with the peer node with which the imported key was encrypted |
| `ikey` | Imported key – this is an ANSI X9.17 formatted key |
| `oKey` | Key returned and translated by the MFK |
| `usevariants` | True if the imported key is an Atalla variant |

TABLE 5-12 lists the return values for the `fs_import_key()` function.

**TABLE 5-12** `fs_import_key()` Function Return Values

| Return Value | Description |
|---|---|
| `fsOK` | The `oKey` is filled in for this case if the key is successfully imported |
| `fsInvalidKeyType` | Invalid import key type |
| `fsInvalidKeyUsage` | Unsupported key usage type |
| `fsInvalidKEK` | Invalid KEK |
| `fsInvalidKey` | Import key is invalid |
| `fsInvalidState` | Device is not in proper state to handle command |
| `fsError` | Processing error |

## Export Key Function `fs_export_key()`

The board must allow users to move keys from one device to another. Additionally, the peer device might not be a Sun Crypto Accelerator 6000 board. The export key function enables this feature and allows users to export keys from the Sun Crypto Accelerator 6000 board. How the exported keys are transported to the peer is determined by the application developer.

The syntax for the `fs_export_key()` function is as follows:

```
fsReturn_t fs_export_key(fsSessHandle_t handle, fsKeyUsage_t
usage, fsKey_t *KEK, fsKey_t *iKey, fsKey917_t *oKey, boolean_t
useVariants);
```

TABLE 5-13 lists the parameters for the `fs_export_key()` function.

**TABLE 5-13** `fs_export_key()` Function Parameters

| Parameter | Description |
|---|---|
| `handle` | Session  handle returned by the `fs_session_open()` function |
| `usage` | Type of intended key usage: TPK, ZWK, PEK, CVK, and so on |
| `KEK` | Key shared with the peer node with which the exported key is encrypted |

**TABLE 5-13** `fs_export_key()` Function Parameters *(Continued)*

| Parameter | Description |
|---|---|
| `iKey` | Input key encrypted with the MFK |
| `oKey` | Exported key in ANSI 9.17 format |
| `useVariants` | True if the exported key is an Atalla variant |

TABLE 5-14 lists the return values for the `fs_export_key()` function.

**TABLE 5-14** `fs_export_key()` Function Return Values

| Return Value | Description |
|---|---|
| `fsOK` | The `oKey` is filled in for this case if key successfully exported |
| `fsInvalidKeyType` | Export key type invalid |
| `fsInvalidKeyUsage` | Key usage type invalid |
| `fsInvalidKey` | Key for export invalid |
| `fsInvalidKEK` | Encryption key invalid |
| `fsInvalidState` | Device is not in proper state to handle command |
| `fsError` | Processing error |

## Translate Key Function `fs_translate_key()`

When the MFK is updated, users must convert all of their keys using the new MFK.

The syntax for the `fs_translate_key()` function is as follows:

```
fs_return_t fs_translate_key(fsSessHandle_t handle, fsKey_t *iKey,
fsKey_t *oKey)
```

TABLE 5-15 lists the parameters for the `fs_translate_key()` function.

**TABLE 5-15** `fs_translate_key()` Function Parameters

| Parameter | Description |
|---|---|
| `handle` | Session handle returned by the `fs_session_open()` function |
| `iKey` | Input key encrypted with the old MFK |
| `oKey` | Output key encrypted with the new MFK |

TABLE 5-16 lists the return values for the `fs_translate_key()` function.

**TABLE 5-16** `fs_translate_key()` Function Return Values

| Return Value | Description |
|---|---|
| `fsOK` | Key converted with the new MFK |
| `fsInvalidKey` | Input key invalid |
| `fsInvalidState` | Device is not in proper state to handle command |

## Retrieve Object Function `fs_retrieve_object()`

Applications can retrieve select objects from the board. For security reasons, there are two types of objects that are input with the direct input device that can be retrieved by applications:

- KEKs
- Decimalization tables used in IBM-3624 PIN verification operations

When the object is entered, a unique label is also entered. This label is used to locate the object.

The syntax for the `fs_retrieve_object()` function is as follows:

```
fsReturn_t fs_retrieve_object(fsSessHandle_t handle,
fsObjectType_t type, char *label, fsObjectData_t *obj)
```

TABLE 5-17 lists the parameters for the `fs_retrieve_object()` function.

**TABLE 5-17** `fs_retrieve_object()` Function Parameters

| Parameter | Description |
|---|---|
| handle | Session handle returned by the `fs_session_open()` function |
| label | Byte string identifier for the object |
| obj | Output buffer where the object is returned |
| type | Type of object to retrieve: KEK or decimalization table |

TABLE 5-18 lists the return values for the `fs_retrieve_object()` function.

**TABLE 5-18** `fs_retrieve_object()` Function Return Values

| Return Value | Description |
|---|---|
| `fsOK` | Object located and retrieved |
| `fsNotFound` | Object not located |
| `fsBufferTooSmall` | Output buffer too small to hold object |
| `fsInvalidState` | Device is not in proper state to handle command |

## Status Function `fs_status()`

An application can query the board for its current status. The following board status values are supported:

- `fsStateUninit` – Device not initialized for financial services.
- `fsStateNormalMode` – Core functionality enabled. Users cannot import or export keys in this mode.
- `fsStateSensitiveMode` – Only key import and export requests allowed.
- `fsStateMfkChange` – Change of the MFK pending. Only key translations are done in this mode.

The syntax for the `fs_status()` function is as follows:

```
fsReturn_t fs_status(fsStatusBuff_t *status)
```

The parameter for the `fs_status()` function is as follows:

- `status` – Status buffer

## PIN Processing Functions

The Sun Crypto Accelerator 6000 board supports PIN verification and translation functionality. The interface ensures that sensitive customer data is exposed only within the secure HSM. This section describes the capabilities and interfaces supported.

## PIN Block Formats

The board supports *ANSI/ISO Format 0* and *ISO Format 1* PIN-blocks described in this section.

### ANSI/ISO Format 0

The ANSI/ISO Format 0 is an 8-byte block constructed with the combining of two 64-bit components: The *cleartext PIN*, and the *cleartext account number field*.

The cleartext PIN, represented in hexadecimal characters, appears as follows:

```
C N P P P P P/F P/F P/F P/F P/F P/F P/F P/F F F
```

The cleartext PIN hexadecimal characters are defined in TABLE 5-19.

**TABLE 5-19** ANSI/ISO Format 0 Cleartext PIN Hexadecimal Characters

| Field | Name | Value |
|---|---|---|
| C | Control field | 4-bit field with binary value of 0000 |
| N | PIN length | 4-bit field with binary value between 0x4 and 0xc |
| P | PIN digit | 4-bit field with binary value of 0000 to 1001 |
| P/F | PIN/filler | 4-bit field with binary value determined by PIN length |
| F | Filler | 4-bit field with binary value of 1111 |

The cleartext account number field, represented in hexadecimal characters, appears as follows:

```
C C C C A A A A A A A A A A A A
```

The cleartext account number field hexadecimal characters are defined in TABLE 5-20.

**TABLE 5-20** ANSI/ISO Format 0 Cleartext Account Number Field Hexadecimal Characters

| Field | Name | Value |
|---|---|---|
| C | Control field | 4-bit field with binary value of 0000 |
| A | Primary account number (PAN) | 12 right most digits of the PAN represented as 4-bit binary numbers with values of 000 to 1001 (0 to 9) |

## ISO Format 1

ISO Format 1 is the supported ISO-1 PIN block. This format supports a PIN length between 4 and 12 digits. PINs longer than 12 digits are truncated.

The ISO-1 PIN-block format, represented in hexadecimal characters, appears as follows:

```
 1 L P P P P P/R P/R P/R P/R P/R P/R P/R P/R R R
```

The ISO-1 PIN-block format hexadecimal characters are defined in TABLE 5-21.

**TABLE 5-21** ISO Format 1 Hexadecimal Characters

| Field | Name | Value |
|---|---|---|
| 1 | Fixed data | 4-bit binary value of 0x1 |
| L | PIN length | 4-bit binary value between 0x4 and 0xc |
| P | PIN digit | 4-bit binary value between 0x0 and 0x9 |
| R | Random Digit | 4-bit binary value between 0x0 and 0xf |
| P/R | PIN digit or random digit | 4-bit binary value determined by the PIN length – P or R |

## PIN Calculation Methods

The Sun Crypto Accelerator 6000 board supports the Visa PIN Validation Value (PVV) and the IBM-3624 methods for calculating PINs.

## Visa PVV Method

PVV is a calculation and verification method specified by Visa. The credit card issuer or a designated agent provides a PIN verification service (PVS). This service compares the cardholder's PIN to a cryptographic transformation of the PIN.

The  PVV method is a two-step process:

1. When a PIN-related credit card is issued, the issuer derives a 4-digit PVV. The PVV and the PIN verification key index (PVKI) are either encoded on the credit card or registered in an online database. The stored PVV is called the reference PVV.

2. When a cardholder enters the PIN at the point of service, a transaction PVV is generated. The transaction PVV is compared to the reference PVV by the issuer or their agent. If the two PVVs match, the cardholder is authenticated.

For PVV, the following input is required:

- The customer's primary account number (PAN)
- The customer's PIN
- A one-digit PVKI

### IBM-3624 Method

The following input is required for the IBM-3624 PIN calculation method:

- The customer’s PIN
- The PIN verification key (PVK) used in the PIN calculation algorithm and encrypted with the MFK
- Validation information for identifing the customer, which is typically the customer’s account number
- Check length, which is the number of PIN digits to check
- Reference offset data
- Decimalization table used to convert algorithm output into decimal digits

## Personal Account Number

The PAN consists of the right most 11 digits of the PAN, excluding the mod-10 check digit that must be used to generate the PVV. For example:

| PAN | PAN Digits Selected |
|---|---|
| 4839 1234 5678 9019 | 1234 5678 901 |

## PIN

The PIN associated with the PAN must be used to generate the PVV. Regardless of the length of the PIN (4 to 12 digits), only the left-most four digits are used.

## PVKI

The PVKI is a one-digit value that identifies which PIN verification key (PVK) to use for the PVV calculation. The PVKI is a single-digit value from 0 to 6. A PVKI of 0 indicates that the PIN cannot be verified through PVS.

## PIN Verify Function `fs_pin_verify()`

The PIN verify operation is executed by the credit card issuer or their agent to authenticate a cardholder's transaction. The Sun Crypto Accelerator 6000 board supports two types of PIN verification, Visa PVV and IBM-3624. Additionally, the board supports two types of PIN block formats, ANSI/ISO Format 0 and ISO Format 1.

The syntax for the `fs_pin_verify()` function is as follows:

```
fsReturn_t fs_pin_verify(fsSessHandle_t handle, fsPinAlg_t alg,
fsKey_t *PEK, fsKey_t *PVK,  fsPAN_t *PAN, fsPIN_t *iPIN,
fsPinData_t *data)
```

TABLE 5-22 lists the parameters for the `fs_pin_verify()` function.

**TABLE 5-22** `fs_pin_verify()` Function Parameters

| Parameter | Description |
|---|---|
| `handle` | Session handle returned by `fs_session_open()` function |
| `alg` | PIN algorithm: Visa PVV or IBM-3624 |
| `PEK` | PIN encryption key encrypted with the HSM's MFK. The PIN has been encrypted with this key |
| `PVK` | Key encrypted with the MFK and used in the PIN verification computation |

**TABLE 5-22** `fs_pin_verify()` Function Parameters *(Continued)*

| Parameter | Description |
|---|---|
| `PAN` | Personal account number |
| `iPIN` | Encrypted input PIN |
| `data` | PIN algorithm specific data<br>For Visa PVV, `data` consists of:<br>• PVKI<br>• Reference PVV<br>For IBM-3624 `data` consists of:<br>• Decimalization table<br>• Validation data<br>• Check length<br>• Offset data |

TABLE 5-23 lists the return values for the `fs_pin_verify()` function.

**TABLE 5-23** `fs_pin_verify()` Function Return Values

| Return Value | Description |
|---|---|
| `fsOK` | PIN was verified |
| `fsVerifyFail` | PIN failed verification |
| `fsInvalidPEK` | PEK invalid |
| `fsInvalidPinType` | PIN block format invalid |
| `fsInvalidPVK` | PVK invalid |
| `fsInvalidPVKI` | PVKI invalid (0 < PVKI \|\| PVKI > 6) |
| `fsInvalidState` | Device not in correct state to process command |
| `fsInvalidDectbl` | Invalid decimalization table |
| `fsError` | Processing error |

## PIN Translate Function `fs_pin_translate()`

This function translates a PIN from one encryption key to another. This function occurs during banking transactions. An example is when a cardholder uses their ATM card at a different bank than the one that issued the card. At the transaction, the PIN comes in encrypted using a PIN encryption key (PEK) specified by the point-of-service bank. To route the transaction to the credit card issuing bank, the transaction decrypts the PIN using the transaction originator's PEK and then reencrypts it using the credit card issuing bank's PEK. The PIN block format can be requested to be translated (from ISO Format 0 to ISO Format 1 for example).

The syntax for the `fs_pin_translate()` function is as follows:

```
fsReturn_t fs_pin_translate(fsSessHandle_t handle, fsKey_t *iPEK,
fsKey_t *oPEK, fsPIN_t *iPIN, fPIN_t *oPIN, fsPAN_t *PAN)
```

TABLE 5-24 lists the parameters for the `fs_pin_translate()` function.

**TABLE 5-24** `fs_pin_translate()` Function Parameters

| Parameter | Description |
|---|---|
| `handle` | Session handle returned by the `fs_session_open()` function |
| `iPEK` | Input PEK used to encrypt the PIN – this key is encrypted with the MFK |
| `oPEK` | Output PEK encrypted with the MFK |
| `iPIN` | Encrypted input PIN |
| `oPIN` | Buffer for encrypted output PIN |
| `PAN` | Personal account number |

TABLE 5-25 lists the return values for the `fs_pin_translate()` function.

**TABLE 5-25** `fs_pin_translate()` Function Return Values

| Return Value | Description |
|---|---|
| `fsOK` | Operation successful |
| `fsInvalidKey` | Source or destination PEK invalid |
| `fsInvalidKeyUsage` | Key usage type invalid |
| `fsInvalidPinType` | Source or destination PIN block format invalid |
| `fsInvalidPin` | PIN invalid or corrupt. PIN must be decimal digits |
| `fsInvalidPan` | PAN invalid or corrupt |
| `fsInvalidState` | Device not in proper state to handle command |

## Credit Card Processing Overview

The Sun Crypto Accelerator 6000 board supports credit card verification (CV) processing for the major types of credit cards, Visa, MasterCard, and American Express. The interface ensures that sensitive customer data is only exposed within the HSM. The (CV) is a cryptographic checksum of the data stored on a magnetic card.

Credit card verification is performed during normal ATM and POS transactions to verify the magnetic card data. The following algorithms are supported:

- CVV – Visa
- CVC – MasterCard
- CSC – American Express

## Financial Services Library Function `fs_card_verify`(3)

The `fs_card_verify()` function provides credit card processing operations for the board's financial services API. Verification for Visa, MasterCard, and American Express credit cards is supported.

The `fs_card_verify()` function requires a valid session handle as the first argument with the handle parameter. This session handle can be obtained through a call to `fs_session_open()`. All keys used by these functions must have been created using the financial services key management functions. See "Key Management Functions" on page 127.

The `fs_card_verify`() function enables an application to perform secure card verification operations. A card algorithm type must be provided in the `alg` argument. The allowable values for the card algorithm type are as follows:

- CVV – Visa or MasterCard card verification value (CVV) algorithm
- CSC – American Express card security code (CSC) verification algorithm

The caller must also supply a card verification key (CVK) with the cvk parameter. This key must have been previously imported into the device with the fs_key_import() function. Additionally, personal account number (PAN) information and algorithm specific card data must be provided through the pan and data parameters. The following is an example of the fs_card_verify() function:

```
  #include finsvcs.h
      fsReturn_t fs_card_verify(fsSessHandle_t handle, fsCardAlg_t
      alg, fsKey_t *cvk, fsPan_t *pan, fsCardData_t *data);
```

Upon successful verification, the fs_card_verify() function returns the fsReturn_t value of fsOK. Otherwise, an error code is set in the fsReturn_t value. The following is a list of possible errors and their meanings:

- fsInvalidHandle – The session handle provided by *handle* is not valid.
- fsVerifyFail – The card verification failed.
- fsInvalidCVK – The CVK is corrupt or invalid.
- fsInvalidState – The device is not in the proper state to handle the function call.
- fsInvalidPan – The PAN is corrupt or invalid.
- fsError – Processing error.

## Enabling the Financial Services Feature

The financial services functionality is disabled. Enabling financial services in a redundant hardware configuration might cause errors under heavy loads. In a single-card configuration, these errors do not occur.

### ▼ Enable Financial Services

- **Make the following change in the** /kernel/drv/mca.conf **file:**

```
enable-finsvcs=1;
```

## Administering Financial Services

This section describes the financial services administrative features and commands.

### Financial Services Security Officers

FSSOs have specific financial services permissions. Each FSSO requires a unique security officer account created with the `scamgr` utility, described in Chapter 3. Only security officers can create and delete FSSO accounts. FSSO authentication is required to input keys and certain commands with the direct input device. These accounts can be configured to require single or multiple FSSO authentication for certain commands. To require multiple FSSOs per board to authenticate commands, a security officer must enable Multi-Admin mode, which is described in "Multi-Admin Authentication" on page 69.

### Direct Input Device

A direct input device is required to load critical security parameters into the board. Only FSSOs can use the direct input device. See "Direct Input Devices" on page 7.

The direct input device is required to import the MFK and the KEKs. An FSSO must log in to the board with the direct input device and then initiate the `key input` command to import these keys.

### Setting Financial Services Mode

To enable financial services features, an FSSO must place the board in one of two modes:

- Normal mode – Enables all functions except importing and exporting keys.
- Sensitive mode – Enables importing and exporting keys.

### Administrative Commands

TABLE 5-26 describes the financial services administrative commands.

**Note –** Only FSSOs can initiate the commands listed in TABLE 5-26, and each command must be entered with a direct input device.

**TABLE 5-26** Financial Services Administrative Commands

| Command | Description |
|---|---|
| `key input` | Enters the MFK or the KEKs. The direct input device must be used to enter this command. |
| `load mfk` | Initiates the MFK key installation. After issuing this command, you can enter the respective key component and log out. Subsequent FSSOs can then log in and enter this command and enter their key component. Once the minimum number of components (default 2) have been entered, the key is considered pending and the device is disabled for everything other than key translation requests.<br>Unique FSSOs must enter each component, otherwise an error is reported.<br>The MFK is an AES key and must be either 192 or 256 bits in length. This requires that the key components input with the direct input device be either 48 or 64 bytes in length. |
| `enable mfk` | Activates a new MFK and deletes the old one. Use this command after all applications have translated their keys under the new MFK. |
| `cancel mfk` | Cancels the MFK. Must be initiated before entering all of the MFK components. |
| `delete mfk` | Deletes the MFK. Must be done before enabling a pending MFK. If there is a previously enabled MFK, the board reverts to it. |
| `load kek` | Installs a KEK. You are prompted for a key label to associate with the key. The KEK is installed in component form similar to the MFK, so after entering the first component, you can log off. Additional security officers can then log in and enter their respective components, then log off.<br>Unique FSSOs must enter each component otherwise an error is returned.<br>A KEK is a DES key and must be either 128 bits (2DES) or 192 bit (3DES) in length. This requires that the key components input with the direct input device be either 36 or 48 bytes in length. |
| `cancel kek` | Cancels a KEK. Must be done while entering a KEK and before all components are entered.<br>Note that KEKs are only temporarily stored on the board. Once an application retrieves the object, it is deleted. Additionally, KEKs are not preserved during a board reset. |

**TABLE 5-26** Financial Services Administrative Commands *(Continued)*

| Command | Description |
|---|---|
| `delete kek` | Deletes a KEK. Only authorized security officers can delete a previously entered KEK. The label used when the KEK was entered must be specified to locate the KEK. |
| `load decimalization table` | Loads a decimalization table, which is required for IBM-3624 PIN verification. You are prompted for a label to associate with the decimalization table. The entered decimalization table is encrypted with the MFK and can be retrieved by an application with the `fs_retrieve_object`() function. |
| `delete decimalization table` | Deletes a decimalization table. |

CHAPTER 6

# Developing PKCS#11 Applications for Use With the Sun Crypto Accelerator 6000 Board

This chapter describes the board's implementation of the PKCS#11 interface and describes how to build customized PKCS#11 applications to be used with the board. Additional instructions for Linux platforms are included in the last section. This chapter includes the following sections:

For Oracle Solaris OS on x64 platforms, the default location for this library is `/usr/lib/64/`:

```
/usr/lib/64/libpkcs11.so
```

---

**Note –** The `64` directory is a softlink that resolves to `sparcv9` or `amd64` depending on your architecture.

---

## Board Administration

The Sun Crypto Accelerator 6000 board is registered in the Oracle Solaris Cryptographic Framework as a hardware provider. Thus, the board can be administered using the system commands. Refer to the *Oracle Solaris 10 System Administration Guide: Security Services* document.

The Oracle Solaris Cryptographic Framework provides a PKCS#11 library through which the Sun Crypto Accelerator 6000 board is accessed. For Oracle Solaris SPARC platforms, the default location for this library is `/usr/lib/` for 32-bit mode and `/usr/lib/sparcv9/` for 64-bit mode.

```
/usr/lib/libpkcs11.so
/usr/lib/sparcv9/libpkcs11.so
```

PKCS#11 has a limited administrative facility with just two functions: `C_InitToken`, which initializes the token, and `C_InitPin`, which sets user PINs. The board does not use this facility, and instead uses the `scamgr` utility. See Chapter 3.

When a keystore is first initialized, `scamgr` prompts you to set up a keystore security officer (KSO) account. This keystore security officer is not related to the PKCS#11 security officer, and cannot authenticate to a board through the PKCS#11 interface.

Also during keystore initialization, `scamgr` prompts for the keystore name. The keystore name is used as the slot description and the token label for the Keystore slot. See "Keystore Slot" on page 147.

After the keystore is initialized, the security officer can create one or more users using the `scamgr` utility. Users created by the security officer authenticate to a keystore through the PKCS#11 interface. Since PKCS#11 is designed for a single-user system, the `C_Login` entry point does not take the username as a parameter. To differentiate users, a PIN must be given as a string of the form `username:password`. For example, if the password of user `webserv` is `abc123`, the PIN used through the PKCS#11 `C_Login` entry point is `webserv:abc123`.

## Slot Descriptions

There are four kinds of slots available through the Oracle Solaris PKCS#11 library.

- Keystore slot

  The Keystore slot groups together the multiple hardware providers that share a common keystore to support availability and load balancing. The Keystore slot description and the token label for the Sun Crypto Accelerator 6000 board are made up of the keystore name padded with spaces.

- Sun Metaslot

  The Sun Metaslot uses all of the cryptographic engines on the system, including the Sun Crypto Accelerator 6000; thus, it provides the maximum functionality. By default, Sun Metaslot uses the Oracle Solaris Softtoken keystore; however it can be configured to use the Sun Crypto Accelerator 6000 keystore. See "Sun Metaslot" on page 148.

- Hardware slot

  The Hardware slot is bound to and dedicated to a hardware device. These slots are directly accessible when the device is uninitialized or when it is in diagnostic mode. There should be three Hardware slots per Sun Crypto Accelerator 6000 board. These slots are useful for diagnosis because they are directly associated with a board. The Hardware slot description and the token label for the board are in the following format: `mca/`*N*` Crypto Accel 1.0. [CB|CA|OM]`. Where *N* is the instance number.

- Sun Softtoken slot

  The Sun Softtoken slot is a software cryptographic provider with an on-disk keystore.

The following subsections provide details on the Keystore slot, Sun Metaslot, and Hardware slot.

## Keystore Slot

The Keystore slot has the advantage of hardware redundancy and load balancing when there are more than one Sun Crypto Accelerator 6000 board on the system with the same keystore. For example, when there are two boards with the same keystore with the name of `ks`, a slot with the slot description and token label of `ks` is used as the Keystore slot.

When the Keystore slot is used, a cryptographic job may be sent to either board based on the board state. If one board is fully tasked, the job is sent to the other board. Also, if one board is not available due to a hardware failure, the job is sent to the other board.

With Keystore slot, both sensitive session keys and sensitive token keys are kept secure on the board. Thus, the secure key value is never revealed clear on the host memory. If the security of sensitive session keys are required, the Keystore slot is preferred over Sun Metaslot.

## Sun Metaslot

The Sun Metaslot takes advantage of the Sun Crypto Accelerator 6000 board for cryptographic acceleration along with all other cryptographic providers available on the system. The Sun Metaslot uses the board for the mechanisms it supports, and it uses other slots, including the Oracle Solaris software implementation, for the mechanisms not supported by the board. The Sun Metaslot also supports failover. For more details, please refer to the Sun Metaslot documentation.

### Configuring Sun Metaslot to Use the Sun Crypto Accelerator 6000 Keystore

Through Sun Metaslot, only one keystore can be accessed. By default Sun Metaslot uses the Oracle Solaris Softtoken keystore. To access the Sun Crypto Accelerator 6000 keystore through Sun Metaslot, you must use one of the following configurations.

- Configure Sun Metaslot to use the Sun Crypto Accelerator 6000 keystore system-wide using `cryptoadm`(1M).

  Enter the following command to use the Sun Crypto Accelerator 6000 keystore. For the example in this section, *ks* is the name of the Sun Crypto Accelerator 6000 keystore.

```
% cryptoadm enable metaslot token=ks
```

  This command forces a global change throughout the system, which causes all applications on the system to use the Sun Crypto Accelerator 6000 keystore by default.

- Configure Sun Metaslot to use the Sun Crypto Accelerator 6000 keystore with an environment variable.

Sun Metaslot can be configured to use the board's keystore on a per application basis by setting an environment variable. The variable should be set to the name of the Sun Crypto Accelerator 6000 keystore.

```
% METASLOT_OBJECTSTORE_TOKEN=ks
% export METASLOT_OBJECTSTORE_TOKEN
```

The environment variable overwrites the system-wide configuration.

## Configuring Secure Failover for Sun Metaslot

Sun Metaslot supports fail over by automatically migrating keys from the Sun Crypto Accelerator 6000 keystore to other slots. By doing so, the keys securely stored on the board might be revealed on the host memory. To protect the secure keys, enter the following command:

```
% cryptoadm disable metaslot auto-key-migrate
```

The auto-key migration can also be disabled on a per application basis by setting the following environment variable.

```
% METASLOT_AUTO_KEY_MIGRATE=false
% export METASLOT_AUTO_KEY_MIGRATE
```

When the auto key migration is disabled, sensitive token keys are not automatically migrated to other slots. With this configuration, if an operation with a sensitive token key fails on the Sun Crypto Accelerator 6000 board, the request does not failover to other slots, and the operation fails.

When this variable is not set, the sensitive token key is migrated to other slots that support the operation, and the request is processed in a failover slot. If the job fails over to a software slot, such as Sun Softtoken, the key could be revealed on the host memory.

---

**Note –** This configuration applies to the sensitive token keys only. Other keys, such as nonsensitive keys and sensitive session keys are still automatically migrated for failover.

---

To verify the current system-wide configuration, enter the following command:

```
% cryptoadm list -v metaslot
```

The following output shows that the Sun Metaslot is enabled, the automatic key migration is disabled, and the keystore slot, `ks`, is used for the persistent object store.

```
% cryptoadm list -v metaslot
System-wide Meta Slot Configuration:
------------------------------------
Status: enabled
Sensitive Token Object Automatic Migrate: disabled
Persistent object store token: ks

Detailed Meta Slot Information:
-------------------------------
actual status: enabled.
Description: Sun Metaslot

Token Present: True
Token Label: Sun Metaslot
Manufacturer ID: Sun Microsystems, Inc.
Model: 1.0
Serial Number:
Hardware Version: 0.0
Firmware Version: 0.0
UTC Time:
PIN Length: 0-253
Flags: CKF_RNG CKF_LOGIN_REQUIRED CKF_USER_PIN_INITIALIZED
CKF_TOKEN_INITIALIZED CKF_SO_PIN_LOCKED
```

## Hardware Slot

When the board has not been initialized or when the board is in the diagnostic mode, the device can be directly accessed with the hardware slots. There are three hardware slots (CB, CA, and OM) per Sun Crypto Accelerator 6000 board.

- The CB Hardware slot accelerates pure bulk operations such as DES, 3DES, and AES. This slot supports session keys only.
- The CA Hardware slot accelerates asymmetric operations such as RSA, DSA, and DH.
- The OM Hardware slot allows key management operations such as key generation and key creation. However, the keys created on the OM slot cannot be used until the board is initialized and online.

The Hardware slot is dedicated to a single board and thus does not allow hardware redundancy or load balancing. For a typical application, you might want to use either the Keystore slot or Sun Metaslot . The Hardware slot, however, is useful for diagnosis.

## PKCS#11 and FIPS Mode

When put in FIPS mode by the SO (using `scamgr`), the Sun Crypto Accelerator 6000 board is compliant with Federal Information Processing Standard FIPS 140-2 level 3. Detailed information on FIPS 140-2 can be found at: `http://www.nist.gov`

Operating the board in FIPS mode causes the following changes in the board's operation:

- Only FIPS-approved mechanisms are made available by the board itself.
- All keys and critical security parameters cross the PCI bus in encrypted form.
- Certain additional integrity checks are done at startup, and when keys and random numbers are generated.
- Random numbers are generated by a FIPS-approved algorithm that combines saved state and true random data (entropy) from a thermal-noise-based generator using hashing and arithmetic. 512 bits from the thermal-noise-based generator are used for every 160 bits of output data. (In non-FIPS mode, 512 bits from the thermal-noised-based generator are SHA-1 hashed to 160 bits.)

FIPS mode applies only to the Sun Crypto Accelerator 6000 board itself. As stated above, when the board is put in FIPS mode, only FIPS-approved mechanisms are provided by the board. Notably, MD5, and RC2 are not FIPS-approved.

However, because the FIPS regulations apply only to the hardware, software implementation of the non-FIPS-approved mechanisms are still available through the Sun Metaslot.

## Developing Applications to Use PKCS#11

The necessary header files are in /usr/include/security. Add this directory to the include path and include cryptoki.h. The lower-level include files, pkcs11.h, pkcs11f.h, and pkcs11t.h are also available in the directory. These files are identical to those available at the PKCS#11 web site:
http://rsa.com/rsalabs/node.asp?id=2133/

The PKCS#11 libraries are /usr/lib/libpkcs11.so (32-bit mode) and /usr/lib/sparcv9/libpkcs11.so (64-bit mode).

The Oracle Solaris PKCS#11 library can be linked as an ordinary library, or it can be dynamically opened with dlopen (3DL).

When linking as an ordinary library, use the following command:

```
% cc [flags] files... -L /usr/lib -R /usr/lib -lpkcs11 [other libraries...]
```

## Sun Crypto Accelerator 6000 PKCS#11 Implementation Specifics

The PKCS#11 administrative functions C_InitToken and C_InitPin are not implemented. The C_Login function with the CKU_SO (security officer) flag is rejected.

### Token Objects

In PKCS#11, public token objects are token objects that are visible and can be deleted without authentication. Because the users known by the Sun Crypto Accelerator 6000 software are unrelated to Oracle Solaris users, and because the software does not ascertain user identity until C_Login succeeds, these objects would need to be globally visible to all users, and therefore deletable by any user. Because this behavior is not acceptable, public token objects are not allowed. Any attempt to create a public token object will fail.

The number of session objects is limited by virtual memory only. Token objects must all fit in the RAM on the board, and the driver limits the size of the keystore to 16 Mbytes. However, the fields of the CK_TOKEN_INFO structure (returned by the

C_GetTokenInfo function) that indicate maximum memory sizes are all set to CK_EFFECTIVELY_INFINITE. The C_GetObjectSize function is not implemented.

## Supported and Unsupported Functions

The optional dual operation functions (C_DigestEncryptUpdate, C_DecryptDigestUpdate, C_SignEncryptUpdate, and C_DecryptVerifyUpdate) are not implemented, and the CKF_DUAL_OPERATIONS_FLAG in the flags field returned by C_GetTokenInfo is false.

C_GetOperationState and its companion function C_SetOperationState are not supported.

Since the Sun Crypto Accelerator 6000 board can only operate SHA-1 and MD5 in a single part and the PKCS#11 interface requires both single part and multipart for the hash operations, CKM_SHA_1 and CKM_MD5 are not available from the user level of the PKCS#11 application. However, those mechanisms are available for the kernel consumers, such as IPsec.

The tokens provided by the Sun Crypto Accelerator 6000 system are considered unremovable. Thus the CKF_REMOVABLE_DEVICE flag returned by CK_GetSlotInfo is false. However, the board can be dynamically reconfigured when there is no PKCS#11 application that has an active session on the board.

The C_WaitForSlotEvent function is not implemented, and the Sun Crypto Accelerator 6000 system never calls the callback function passed as the Notify parameter to C_OpenSession. The software never surrenders control back to the calling application with the pApplication parameter of C_OpenSession.

## Random Number Generator

The Sun Crypto Accelerator 6000 board contains a high-quality true random number generator. It does not need to be seeded, and in fact, C_SeedRandom will be rejected.

## Software Attributes

The Sun Crypto Accelerator 6000 software defines the default values for some attributes as listed in the following table. Some permission flags such as CKA_LOCAL and CKA_ALWAYS_SENSITIVE are not implemented or enforced as noted.

**TABLE 6-1** PKCS#11 Attributes and Default Values

| Attribute | Value |
|---|---|
| CKA_AC_ISSUER | empty string |
| CKA_ALWAYS_SENSITIVE | always false |
| CKA_APPLICATION | empty string |
| CKA_ATTR_TYPES | empty string |
| CKA_AUTH_PIN_FLAGS | false |
| CKA_DECRYPT | true (not enforced) |
| CKA_DERIVE | false (not enforced) |
| CKA_ENCRYPT | true (not enforced) |
| CKA_END_DATE | empty string |
| CKA_EXTRACTABLE | true |
| CKA_HAS_RESET | false |
| CKA_ID | empty string |
| CKA_ISSUER | empty string |
| CKA_LABEL | empty string |
| CKA_LOCAL | always false |
| CKA_MODIFIABLE | true |
| CKA_NEVER_EXTRACTABLE | always false |
| CKA_OBJECT_ID | empty string |
| CKA_OWNER | empty string |
| CKA_PRIVATE | same as CKA_TOKEN |
| CKA_RESET_ON_INIT | false |
| CKA_SECONDARY_AUTH | false |
| CKA_SENSITIVE | opposite of CKA_EXTRACTABLE |
| CKA_SERIAL_NUMBER | empty string |
| CKA_SIGN | true (not enforced) |
| CKA_SIGN_RECOVER | true (not enforced) |

**TABLE 6-1** PKCS#11 Attributes and Default Values *(Continued)*

| Attribute | Value |
|---|---|
| CKA_START_DATE | empty string |
| CKA_SUBJECT | empty string |
| CKA_TOKEN | false |
| CKA_TRUSTED | false |
| CKA_UNWRAP | true (not enforced) |
| CKA_VERIFY | true (not enforced) |
| CKA_VERIFY_RECOVER | true (not enforced) |
| CKA_WRAP | true (not enforced) |

The CKA_TOKEN attribute defaults to false. The CKA_PRIVATE attribute defaults to the same value as CKA_TOKEN. An attempt to set both CKA_TOKEN and CKA_PRIVATE to false will fail since Sun Crypto Accelerator 6000 does not support public token objects.

The CKA_EXTRACTABLE attribute defaults to true. The CKA_SENSITIVE attribute defaults to the opposite of CKA_EXTRACTABLE. An attempt to set both CKA_SENSITIVE and CKA_EXTRACTABLE to false will fail with CKR_TEMPLATE_INCONSISTENT.

Inconsistent attributes are generally not detected. For example, even if CKA_VALUE_LENGTH is specified in the template when the CKK_DES key is created with C_CreteObject, Sun Crypto Accelerator 6000 software will not return an error code. The inconsistent attribute CKA_VALUE_LENGTH is simply ignored by the software.

## Software Error Codes

The error codes returned by the software are not always as specific as what might be expected. In particular, CKR_MECHANISM_INVALID is returned for many errors where other values might seem more appropriate. The return code CKR_HOST_MEMORY usually means that an internal call to the malloc(3c) command failed. After this error is returned, an important state has probably not been properly saved, and attempting to continue, except by calling C_Finalize, could be ineffective.

The Mutex callback function pointers that can be passed to C_Initialize are ignored.

### Token Object Handles

As required by the PKCS#11 standard, all token object handles become invalid when the user calls the `C_Logout` function or closes the last PKCS#11 session. The software purges the token objects from the software's cache. A subsequent successful `C_Login` function brings in all the then-current token objects. Note that this login could be for a different user and thus bring in a different set of token objects. However, even if this login is for the same user, the token objects might not get the same handles as they had before.

## Developing PKCS#11 Applications for Use With the Sun Crypto Accelerator 6000 Board on Linux Platforms

The openCryptoki software is used as the PKCS#11 framework. See Appendix B for details on openCryptoki software.

If the Softtoken slot of the openCryptoki software is not installed on the system, you see only the Sun Crypto Accelerator 6000 (`SCA`) slot as follows:

```
Linux 2.6.5-7.139-smp Linux (SCA)
```

If the Softtoken slot of the openCryptoki software is installed, you see the Sun Crypto Accelerator 6000 (`SCA`) slot first followed by the softtoken slot as follows:

```
Linux 2.6.5-7.139-smp Linux (SCA)
Linux 2.6.5-7.139-smp Linux (soft)
```

The first part of the slot description is from the operating system. The second part denotes whether it is the Sun Crypto Accelerator 6000 (`SCA`) slot or the Softtoken slot (`soft`).

The Sun Crypto Accelerator 6000 (`SCA`) slot is a general PKCS#11 slot.

CHAPTER 7

# Installing and Configuring Sun Java System Server Software

This chapter describes how to configure the Sun Crypto Accelerator 6000 board for use with Sun Java System servers on Oracle Solaris platforms. Additional instructions for Linux platforms are provided. This chapter contains the following sections:

---

**Note –** The Sun Java System servers described in this manual were previously named iPlanet servers.

---

---

**Note –** All Sun Java System server software is supported for use with the board. The example in this section covers configuring the Sun Java System Web Server only. Refer to the Sun Java System documentation for details on how to install and configure Sun Java System server software.

---

# Administering Security for Sun Java System Web Servers

This section provides an overview of the security features of the Sun Crypto Accelerator 6000 board as it is administered with Sun Java System applications.

---

**Note –** To manage keystores, you must have access to the system administrator account for your system.

---

## Web Server Concepts and Terminology

Keystores and users must be created for applications that communicate with the Sun Crypto Accelerator 6000 board through a PKCS#11 interface, such as the Sun Java System Applications.

---

**Note –** The Apache Web Server (Chapter 8) does not use the keystore or user account features described in this chapter.

---

### Users

Within the context of the Sun Crypto Accelerator 6000 board, users are owners of cryptographic keying material. Each key is owned by a single user. Each user may own multiple keys. A user might want to own multiple keys to support different configurations, such as a production key and a development key (to reflect the organizations the user is supporting).

---

**Note –** The terms user and user account refer to Sun Crypto Accelerator 6000 users created in `scamgr`, not traditional UNIX user accounts. There is no fixed mapping between UNIX user names and Sun Crypto Accelerator 6000 user names.

---

## Keystores

A keystore is a repository for key material. Associated with a keystore are security officers and users. Keystores provide not only storage, but a means for key objects to be owned by user accounts. This enables keys to be hidden from applications that do not authenticate as the owner. Keystores have three components:

- **Key objects** – Long-term keys that are stored for applications such as the Sun Java System Web Server.
- **User accounts** – Accounts that provide applications a means to authenticate and access specific keys
- **Security officer accounts** – Accounts that provide access to key management functions through `scamgr`.

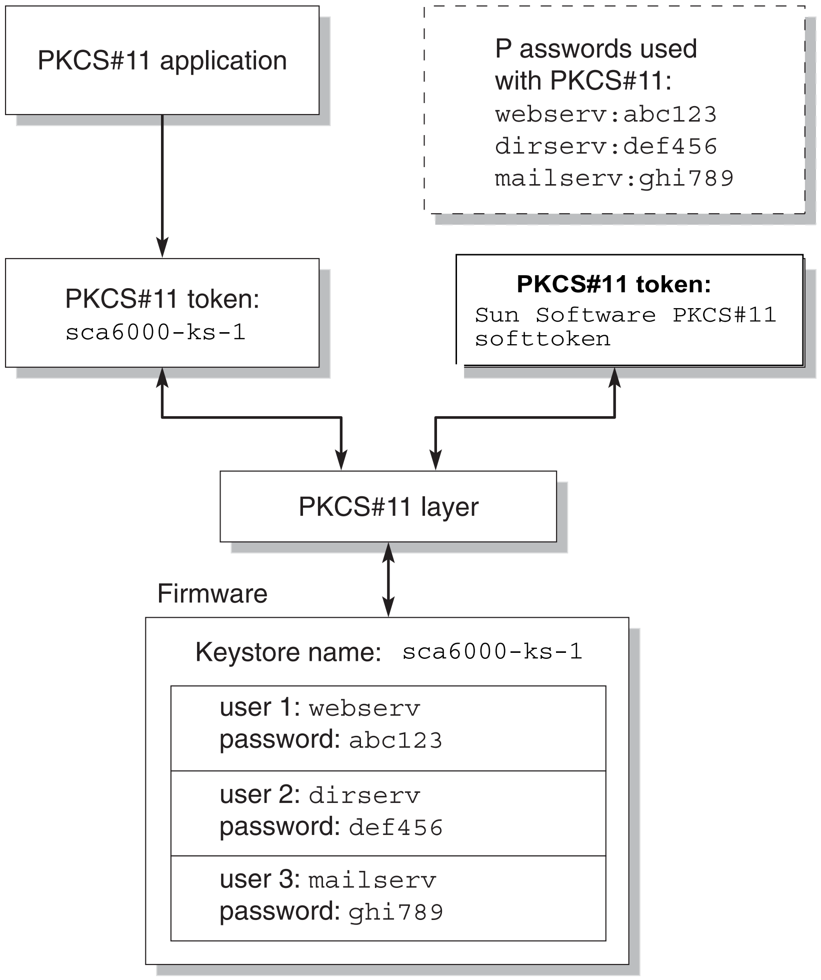
---

**Note –** A single Sun Crypto Accelerator 6000 board must have exactly one keystore. Multiple Sun Crypto Accelerator 6000 boards can be configured to collectively work with the same keystore to provide additional performance and fault-tolerance.

---

A typical installation contains a single keystore with three users. For example, such a configuration could consist of a single keystore *keystore-name* and three users within that keystore, `webserv`, `dirserv`, and `mailserv`. This would enable the three users to own and maintain access control of their server keys within that single keystore. FIGURE 7-1 illustrates an overview of a typical installation.

**FIGURE 7-1** Keystore and Users Overview



An administrative tool, `scamgr`, is used to manage Sun Crypto Accelerator 6000 keystores and users. See "Managing Keystores With `scamgr`" on page 57.

## Slots and Tokens

As discussed in Chapter 6, there are four kinds of slots presented through the Oracle Solaris Cryptographic Framework's PKCS#11 interface.

The Sun Crypto Accelerator 6000 Keystore slot can also be used for Sun Java System applications. Through a Keystore slot, asymmetric operations are the only mechanisms accelerated by the Sun Crypto Accelerator 6000 board. When there are more than two boards using the same keystore, Keystore slot provides additional performance and fault-tolerance.

*Example:*

If there are two boards, `mca0` and `mca1`, each is assigned a keystore name (`engineering` and `finance`), three slots are presented to the Sun Java System application.

- `engineering`
- `finance`
- Sun Software PKCS#11 softtoken

If the server certificate resides in the `finance` keystore, the possible slots to be used for the Sun Java System application is as follows:

1. `metaslot`
2. `finance` (the Keystore slot)

## Preparing to Configure Sun Java System Web Servers

This section describes assigning passwords, how to populate a keystore, and how to enable the Sun Java System Web Server.

You are asked for several passwords in the course of enabling a Sun Java System Web Server, all of which are described in TABLE 7-2. These passwords are referred to throughout this chapter.

**TABLE 7-1** Passwords Required for Sun Java System Web Servers

| Type of Password | Description |
|---|---|
| Sun Java System Web Server Administration Server | Required to start up the Sun Java System Web Server Administration Server. This password was assigned during the Sun Java System Web Server setup. |
| Web Server Trust Database | Required to start the internal cryptographic module when running in Secure mode. This password was assigned when creating a trust database through the Sun Java System Web Server Administration Server. This password is also required when requesting and installing certificates into the internal cryptographic module. |
| Security Officer | Required when performing `scamgr` privileged operations. |
| *username:password* | Required to start the Sun Crypto Accelerator 6000 module when running in Secure mode. This password is also required when requesting and installing certificates into the internal cryptographic module *keystore-name*. This password consists of the *username* and *password* of a keystore user that was created in `scamgr`. The keystore *username* and *password* are separated by a colon (:). |

## Populating a Keystore

Before you can enable the board for use with a Sun Java System Web Server, you must first initialize the board and populate the board's keystore with at least one user. The keystore for the board is created during the initialization process. You can also initialize Sun Crypto Accelerator 6000 boards to use an existing keystore. See "Initializing the Board With `scamgr`" on page 38.

## ▼ Populate a Keystore

1. **Access the `scamgr` utility with the `scamgr` command or enter `scamgr -h` *hostname* to connect `scamgr` to a board on a remote host.**

   See "Using the `scamgr` Utility" on page 34.

```
$ scamgr -h hostname
```

2. **Populate the board's keystore with users.**

These user names are known only within the domain of the Sun Crypto Accelerator 6000 board and do not need to be identical to the UNIX user name that the web server process is using. Before attempting to create the user, you must first log in as a `scamgr` security officer. See Chapter 3.

3. **Create a user with the** `create user` **command.**

```
scamgr{mca0@hostname, sec-officer}> create user username
Initial password:
Confirm password:
User username created successfully.
```

The username and password created here collectively make the *username:password* (TABLE 7-1). You must use this password when authenticating during a web server startup. This is the keystore password for a single user.

---

**Caution –** Users must remember this *username:password*. Without this password, users cannot access their keys. There is no way to retrieve a lost password.

---

4. **Exit** `scamgr`**.**

```
scamgr{mca0@hostname, sec-officer}> exit
```

## Installing and Configuring Sun Java System Web Server 6.1

This section describes how to install and configure Sun Java System Web Server 6.1 to use the board. You must perform these procedures in order. Refer to the Sun Java System Web Server documentation for more information about installing and using Sun Java System Web Servers.

This section includes the following procedures:

1. "Install Sun Java System Web Server 6.1" on page 164
2. "Create a Trust Database" on page 165
3. "Register the Board With the Web Server" on page 166
4. "Generate a Server Certificate" on page 167
5. "Install the Server Certificate" on page 170

6. “Enable the Web Server for SSL” on page 171

---

**Caution –** These procedures must be followed in the order given. Failure to do so could result in an incorrect configuration.

---

**Caution –** The Sun Java System Web Server Administration Server must be up and running during the configuration process.

---

**Note –** The example in this section uses the Keystore slot.

---

## ▼ Install Sun Java System Web Server 6.1

1. **Download the Sun Java System Web Server 6.1 software.**
2. **Change to the installation directory and extract the web server software.**
3. **Install the web server with the setup script from the command line.**

   The default path name for the server is: `/opt/SUNWwbsvr/`.

   This chapter refers to the default paths. If you decide to install the software in a different location, ensure you note where you installed it.

```
% ./setup
```

4. **Answer the prompts from the installation script.**

   Except for the following prompts, you can accept the defaults:

   a. **Agree to accept the license terms by typing** `yes`**.**

   b. **Enter a fully qualified domain name.**

   c. **Enter the Sun Java System Web Server 6.1 Administration Server password twice.**

   d. **Press Return when prompted.**

The Sun Java System Web Server Administration Server must be up and running during the configuration process.

## ▼ Create a Trust Database

1. **Start the Sun Java System Web Server 6.1 Administration Server.**

   Use the following command (instead of running `startconsole` as `setup` requests):

```
% /opt/SUNWwbsvr/https-admserv/start
Sun Java System Web Server 6.1 B08/22/2003 12:37
info: CORE3016: daemon is running as super-user
info: CORE5076: Using [Java HotSpot(TM) Server VM, Version
1.4.1_03] from [Sun Microsystems Inc.]
info: WEB0100: Loading web module in virtual server [vs-admin] at
[/admin-app]
info: HTTP3072: [LS ls1] http://hostname.domain:8888 ready to
accept requests
startup: server started successfully
```

   The response provides the URL for connecting to your servers.

2. **Start the Administration GUI by opening up a web browser and typing:**

```
http://hostname.domain:admin-port
```

   In the Authentication window, enter the Sun Java System Web Server 6.1 Administration Server user name and password you selected while running `setup`.

---

**Note –** If you used the default settings during Sun Java System Web Server setup, enter `admin` for the User ID or the Sun Java System Web Server 6.1 Administration Server user name.

---

3. **Click OK.**

   The Sun Java System Web Server 6.1 Administration Server window is displayed.

4. **Create the trust database for the web server instance.**

   You might want to enable security on more than one web server instance. If so, repeat the following Step a through Step d for each web server instance.

---

**Note –** If you want to run SSL on the Sun Java System Web Server 6.1 Administration Server as well, the process of setting up a trust database is similar. Refer to the Sun Java System documentation for more information.

---

a. **Click the Servers tab in the Sun Java System Web Server 6.1 Administration Server window.**

b. **Select a server and click the Manage button.**

c. **Click the Security tab near the top of the page and click the Create Database link.**

d. **Enter a password in the two dialog boxes and click OK.**

   See TABLE 7-1 **for the web server trust database password information.**

   Choose a password of at least eight characters. This will be the password used to start the internal cryptographic modules when the Sun Java System Web Server runs in secure mode.

## ▼ Register the Board With the Web Server

1. **Register the Oracle Solaris PKCS#11 library in the security module database of the Sun Java System Web Server using the `modutil` utility.**

---

**Note –** `modutil` is a utility developed by Mozilla and is available with the Sun Java System distribution. By default, the `modutil` is located at `/opt/SUNWwbsvr/bin/https/admin/bin` directory. It uses the NSS libraries located at `/opt/SUNWwbsvr/bin/https/lib`, and should be included in the environment variable, `$LD_LIBRARY_PATH`.

---

```
% modutil -dbdir /opt/SUNWwbsvr/alias -nocertdb -add "Solaris Cryptographic
Framework" -libfile /usr/lib/libpkcs11.so
```

2. **To limit the slots presented to those required to start the web server, disable all slots, except for one slot used by the Sun Java System application.**

   If the application asks for a password for every known PKCS#11 token, do not provide one.

```
% modutil -dbdir /opt/SUNWwbsvr/alias -nocertdb -disable "Solaris Cryptographic
Framework"
% modutil -dbdir /opt/SUNWwbsvr/alias -nocertdb -enable "Solaris Cryptographic
Framework" -slot "keystore-name"
```

## ▼ Generate a Server Certificate

1. **Restart the Sun Java System Web Server 6.1 Administration Server by typing the following commands:**

```
% /opt/SUNWwbsvr/https-admserv/stop
% /opt/SUNWwbsvr/https-admserv/start
```

   The response provides the URL for connecting to your servers.

2. **Start the Administration GUI by opening up a web browser and typing:**

```
http://hostname.domain:admin-port
```

   In the Authentication dialog box, enter the Sun Java System Web Server 6.1 Administration Server user name and password you selected while running `setup`.

---

**Note –** If you used the default settings during Sun Java System Web Server setup, enter **`admin`** for the user ID or the Sun Java System Web Server 6.1 Administration Server user name.

---

3. **Click OK.**

   The Sun Java System Web Server 6.1 Administration Server window is displayed.

4. **To request the server certificate, select the Servers tab near the top of Sun Java System Web Server 6.1 Administration Server window.**

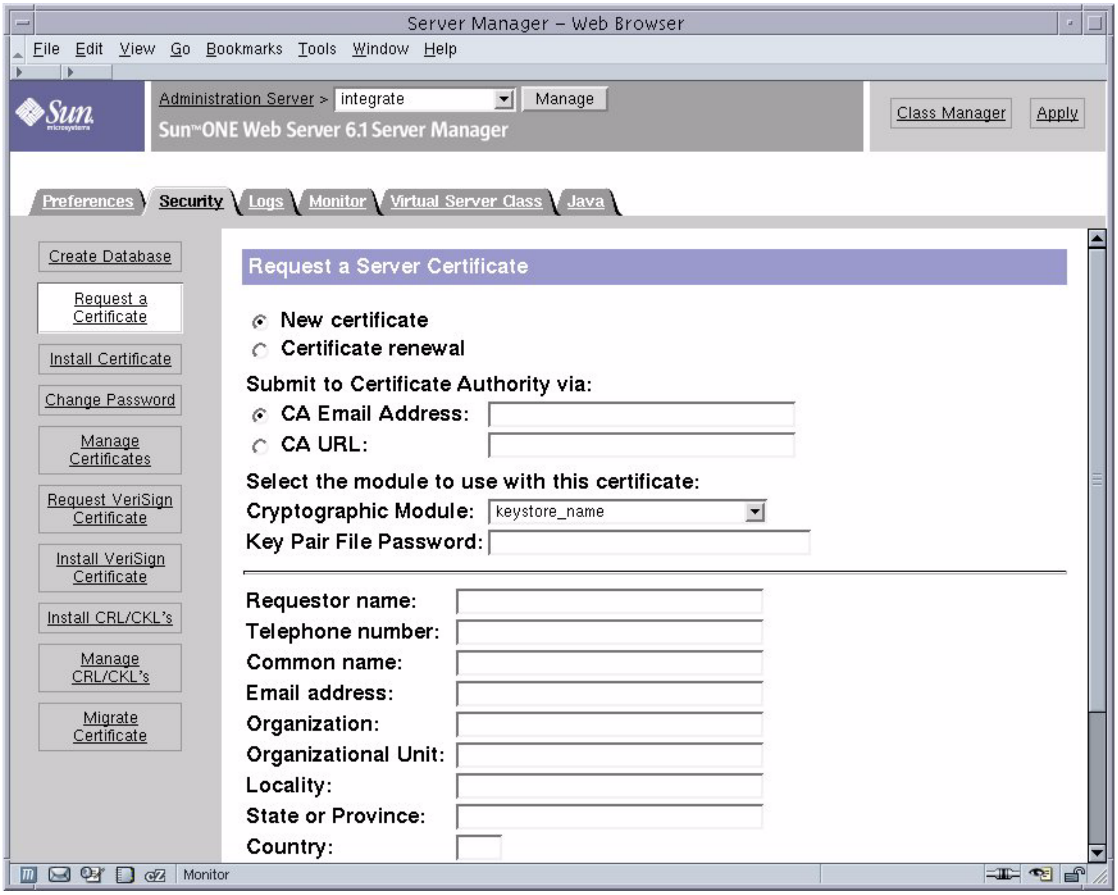
5. **Select a server from the drop-down menu and click the Manage button.**

   The Sun Java System Web Server 6.1 Server Manager window is displayed.

6. **Select the Security tab near the top of the Sun Java System Web Server 6.1 Server Manager window.**

7. **Click the Request a Certificate link on the left panel.**

**FIGURE 7-2** Sun Java System Web Server 6.1 Administration Server Request a Server Certificate Window With *keystore-name* Selected



Request a Server Certificate

[✓ New certificate]
Certificate renewal

Submit to Certificate Authority via:
[✓ CA Email Address:]
CA URL:

Select the module to use with this certificate:
Cryptographic Module: keystore_name
Key Pair File Password:

Requestor name:
Telephone number:
Common name:
Email address:
Organization:
Organizational Unit:
Locality:
State or Province:
Country:

8. **Fill out the form to generate a certificate request, using the following information:**

   a. **Select a New Certificate.**

      If you can directly post your certificate request to a web-capable certificate authority or registration authority, select the CA URL link. Otherwise, select CA Email Address and enter an email address where you would like the certificate request to be sent.

   b. **Select the Cryptographic Module you want to use.**

      Each slot has its own entry in this pull-down menu. For this example, the *keystore-name* is chosen.

c. **In the Key Pair File Password dialog box, provide the password for the user that will own the key.**

   This password is the *username:password* (See TABLE 7-1).

d. **Type the appropriate information for the requestor information fields in TABLE 7-2.**

**TABLE 7-2** Requestor Information Fields

| Field | Description |
|---|---|
| Requestor Name | Contact information for the requestor |
| Telephone Number | Contact information for the requestor |
| Common Name | Web site domain that is typed in a visitor's browser |
| Email Address | Contact information for the requestor |
| Organization | Company name |
| Organizational Unit | (Optional) Department of the company |
| Locality | (Optional) City, county, principality, or country |
| State | (Optional) Full name of the state |
| Country | Two-letter ISO code for the country (for example, the United States is US) |

e. **Click OK to submit the information.**

9. **Use a certificate authority to generate the certificate.**

- If you choose to post your certificate request to a CA URL, the certificate request is automatically posted there.
- If you choose the CA Email Address, copy the certificate request that was emailed to you with the headers and hand it off to your certificate authority.

10. **Once the certificate is generated, copy it, along with the headers, to the clipboard.**

---

**Note –** The certificate is different from the certificate request and is usually presented to you in text form. Keep this data on the clipboard for Step 4 of "Install the Server Certificate" on page 170.

---

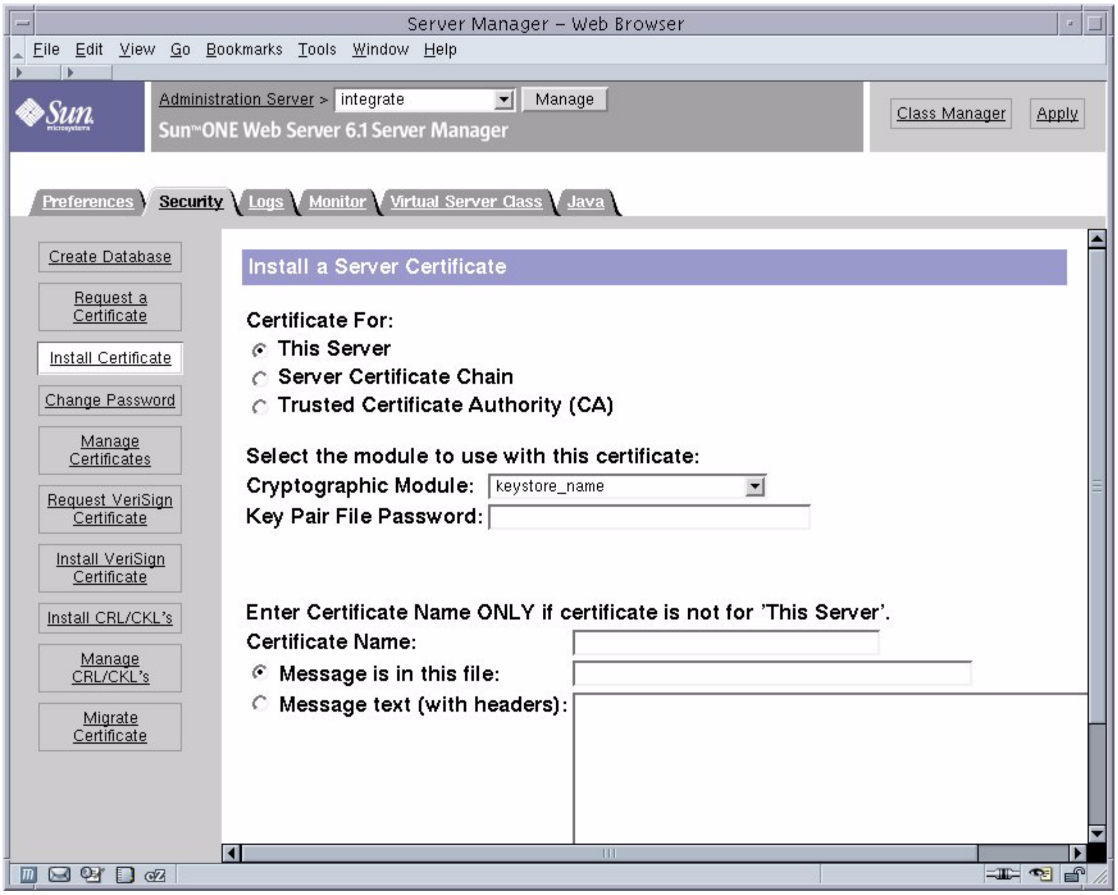
## ▼ Install the Server Certificate

Once your request has been approved by a certificate authority and a certificate has been issued, you must install the certificate in the Sun Java System Web Server.

1. **Click the Security tab near the top of the Sun Java System Web Server 6.1 Server Manager window.**

2. **On the left panel, click the Install Certificate link.**

**FIGURE 7-3** Sun Java System Web Server 6.1 Administration Server Install a Server Certificate Window



Server Manager – Web Browser
File Edit View Go Bookmarks Tools Window Help
Administration Server > integrate Manage
Sun™ONE Web Server 6.1 Server Manager
Class Manager Apply
Preferences Security Logs Monitor Virtual Server Class Java
Create Database
Request a Certificate
Install Certificate
Change Password
Manage Certificates
Request VeriSign Certificate
Install VeriSign Certificate
Install CRL/CKL's
Manage CRL/CKL's
Migrate Certificate

Install a Server Certificate

Certificate For:
[✓ This Server]
Server Certificate Chain
Trusted Certificate Authority (CA)

Select the module to use with this certificate:
Cryptographic Module: keystore_name
Key Pair File Password:

Enter Certificate Name ONLY if certificate is not for 'This Server'.
Certificate Name:
[✓ Message is in this file:]
Message text (with headers):

3. **Fill out the form to install your certificate:**

**TABLE 7-3** Fields for the Certificate to Install

| Fields | Description |
|---|---|
| Certificate For | This server. |
| Cryptographic Module | Each slot has its own entry in this pull-down menu. Ensure that you select the correct slot name. For this example, use *keystore-name*. |
| Key Pair File Password | This password is the *username:password* (TABLE 7-1) |
| Certificate Name | In most cases, you can leave this blank. If you provide a name, it alters the name the web server uses to access the certificate and key when running with SSL support. The default for this field is `Server-Cert`. |

4. **Paste the certificate you copied from the certificate authority (in Step 10 of the "Generate a Server Certificate" on page 167) into the Message text box.**

   You are shown some basic information about the certificate.

5. **Click OK.**

6. **If everything looks correct, click the Add Server Certificate button.**

   On-screen messages tell you to restart the server. This is not necessary because the web server instance has been shut down the entire time.

You are also notified that in order for the web server to use SSL, the web server must be configured to do so. Use the following procedure to configure the web server.

Now that your web server and the Server Certificate are installed, you must enable the web server for SSL.

## ▼ Enable the Web Server for SSL

1. **Select the Preferences tab near the top of the page.**

2. **Select the Edit Listen Sockets link on the left panel.**

   The main panel lists all the listen sockets set for the web server instance.

   a. **Click the link under Listen Socket ID for the listen socket you wish to configure.**

   b. **Alter the following fields:**

   - **Port** – Set to the port on which you will be running your SSL-enabled web server (usually this is port 443).

- **Security –** Set to Enabled.

   c. **Click OK to apply these changes.**

3. **Click the link under Listen Socket ID again for the listen socket you wish to configure.**
4. **Enter the** *username:password* **to authenticate to the keystore on the system.**
5. **If you want to change the default set of ciphers, select the cipher suites under the Ciphers heading.**

   A window is displayed for changing the cipher settings. You can select either Cipher Default settings, SSL2, or SSL3/TLS. If you select the Cipher Default, you are not shown the default settings. The other two choices require you to select the algorithms you want to enable in a pop-up window. Refer to your Sun Java System documentation on cipher selection.
6. **Select the certificate for the keystore followed by**: `Server-Cert` **(or the name you chose).**

   Only keys that the appropriate keystore user owns appear in the Certificate Name field. This keystore user is the user that is authenticated with the *username:password*.
7. **When you have chosen a certificate and confirmed all the security settings, click OK.**
8. **Select the Apply link in the far upper right corner to apply these changes before you start your server.**
9. **Select the Load Configuration Files link to apply the changes.**

   You are redirected to a page that enables you to start your web server instance.

   If you click the Apply Changes button when the server is off, an authentication window prompts you for the *username:password*. This window is not resizable, and you might have a problem submitting the change.

   There are two workarounds for this problem:

- Select Load Configuration Files instead.
- Start up the web server first, and click Apply Changes.

10. **In the Sun Java System Web Server 6.1 Administration Server window, select the On/Off link on the left side of the window.**
11. **Enter the passwords for the servers and click Server On.**

    You are prompted for one or more passwords.

    a. **At the Module Internal prompt, provide the password for the web server trust database.**

    b. **At the Module** *keystore-name* **prompt, enter the** ***username:password*.**

c. **Enter the *username:password*** for other keystores as prompted.

12. **Verify the new SSL-enabled web server at the following URL:**

    `https://`*hostname.domain:server-port*`/`

---

**Note –** The default *server-port* is 443.

---

## Installing and Configuring Sun Java System Web Server 7.0 Update 1

This section describes how to install and configure Sun Java System Web Server 7.0 to use the board. You must perform these procedures in order. Refer to the Sun Java System Web Server documentation for more information about installing and using Sun Java System Web Servers.

This section includes the following procedures:

1. "Install Sun Java System Web Server 7.0" on page 174
2. "Register the Board With the Web Server" on page 174
3. "Start the Sun Java System Web Server Administration Server" on page 175
4. "Manage the Tokens" on page 176
5. "Disable Unused Tokens" on page 176
6. "Pre-Set the Password for Tokens" on page 176
7. "Generate a Server Certificate" on page 177
8. "Install the Server Certificate" on page 178
9. "Deploy the Change" on page 180
10. "Enable the Web Server for SSL" on page 181
11. "Start the Web Server" on page 184

---

**Caution –** These procedures must be followed in the order given. Failure to do so could result in an incorrect configuration.

---

**Caution –** The Sun Java System Web Server Administration Server must be up and running during the configuration process.

**Note –** The example in this section uses the Keystore slot.

## ▼ Install Sun Java System Web Server 7.0

1. **Download the Sun Java System Web Server 7.0 Update 1 software.**

   You can find the web server software at:

http://www.sun.com/

2. **Change to the installation directory and extract the web server software.**
3. **Install the web server with the setup script from the command line.**

   The default path name for the server is: `/sun/webserver7`.

   This chapter refers to the default path. If you decide to install the software in a different location, ensure you note where you installed it.

```
 # ./setup
```

4. **Answer the prompts from the installation script.**

   Except for the following prompts, you can accept the defaults:

   a. **Agree to accept the license terms by typing** `yes`**.**

   b. **Enter the Sun Java System Web Server 7.0 Administration Server password twice.**

   c. **Press Return when prompted.**

## ▼ Register the Board With the Web Server

- **Register the Oracle Solaris PKCS#11 library in the security module database of the Sun Java System Web Server using the** `modutil` **utility.**

---

**Note –** `modutil` is a utility developed by Mozilla and is available with the Sun Java System distribution. By default, `modutil` is located in the `/sun/webserver7/bin` directory. Mozilla uses the NSS libraries located in `/sun/webserver7/lib`, and should be included in the environment variable, `$LD_LIBRARY_PATH`.

---

```
# modutil  -dbdir /sun/webserver7/admin-server/config-store/hostname/config -
nocertdb -add "Solaris Cryptographic Framework" -libfile /usr/lib/libpkcs11.so
```

## ▼ Start the Sun Java System Web Server Administration Server

1. **Use the following command as requested by the setup:**

```
# /sun/webserver7/admin-server/bin/startserv
Sun Java System Web Server 7.0U1 B06/12/2007 21:15
info: CORE3016: daemon is running as super-user
info: CORE5076: Using [Java HotSpot(TM) Server VM, Version
1.5.0_09] from [Sun Microsystems Inc.]
info: WEB0100: Loading web module in virtual server [admin-server]
at [/admingui]
info: WEB0100: Loading web module in virtual server [admin-server]
at [/jmxconnector]
info: HTTP3072: admin-ssl-port: https://hostname.domain:8989 ready
to accept requests
info: CORE3274: successful server startup
```

   The response provides the URL for connecting to your servers.

2. **Start the Administration GUI by opening a web browser and typing:**

```
https://hostname.domain:admin-port
```

In the Authentication window, enter the Sun Java System Web Server 7.0 Administration Server user name and password you selected while running setup.

---

**Note –** If you used the default settings during Sun Java System Web Server setup, enter `admin` for the User ID or the Sun Java System Web Server 7.0 Administration Server user name.

---

## ▼ Manage the Tokens

With Sun Java System Web Server 7.0, tokens are managed using the administration server.

Disable all tokens except for the internal token and the token you would like to use.

## ▼ Disable Unused Tokens

1. **On the home page, click the Configurations button.**
2. **Click on the configuration you would like to modify.**
3. **Click the Certificates tab.**
4. **Click the PKCS#11 Tokens tab below the main tabs.**
5. **Click on the token name that will not be used. A new window pops up.**
6. **Uncheck the Token State box (that is, disable the token).**
7. **Click OK.**

You can also pre-set the password for tokens so that the Sun Java System Web Server can start up without user interaction on reboot.

## ▼ Pre-Set the Password for Tokens

1. **On the home page, click the Configurations button.**
2. **Click on the configuration you would like to modify.**
3. **Click the Certificates tab.**
4. **Click the PKCS#11 Tokens tab below the main tabs.**
5. **Click on the token name for which you would like to pre-set the password. This pops up a new window.**
6. **Click the Edit Token Password box.**
7. **Enter the password in the Current Password dialog box, and check "Do not prompt for the current password at instance startup."**
8. **Click OK.**

## ▼ Generate a Server Certificate

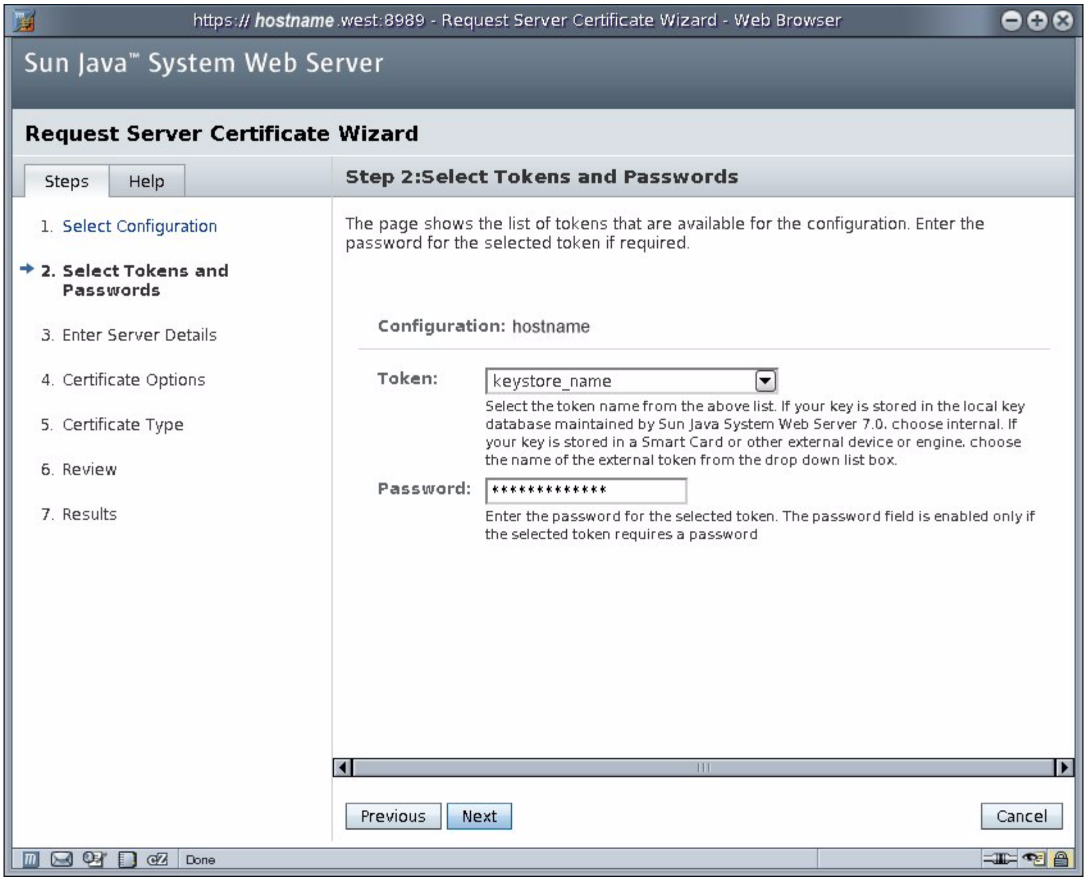
1. **To request the server certificate, select the Common Tasks Tab at the home page, and select Request Server Certificate under Configuration Tasks.**

   A new window pops up.

2. **Select a server from the scroll-down menu and click the Next button.**

3. **Select a token you would like to use from the pull-down menu and enter the password for the token. For this example,** `keystore_name` **is chosen.**

**FIGURE 7-4** Screenshot of the Sun Java Web Server 7.0 Request a Server Certificate Wizard


https:// hostname .west:8989 - Request Server Certificate Wizard - Web Browser
Sun Java™ System Web Server
Request Server Certificate Wizard
Steps
Help
1. Select Configuration
2. Select Tokens and Passwords
3. Enter Server Details
4. Certificate Options
5. Certificate Type
6. Review
7. Results
Previous
Next
Cancel
Done

Step 2:Select Tokens and Passwords

The page shows the list of tokens that are available for the configuration. Enter the password for the selected token if required.

Configuration: hostname

Token: keystore_name

Select the token name from the above list. If your key is stored in the local key database maintained by Sun Java System Web Server 7.0, choose internal. If your key is stored in a Smart Card or other external device or engine, choose the name of the external token from the drop down list box.

Password: *************

Enter the password for the selected token. The password field is enabled only if the selected token requires a password

4. **Fill out the form to generate a certificate request, and click Next to submit the information.** TABLE 7-4 **describes the requestor information fields.**

**TABLE 7-4** Requestor Information Fields

| Field | Description |
|---|---|
| Server Name (CN) | (Required)Web site domain that is typed in a visitor's browser |
| Alternate Server Names | Comma separated list of DNS names |
| Organization (O) | Company name |
| Organizational Unit (OU) | Department of the company |
| Locality (L) | City, county, principality, or country |
| State (ST) | Full name of the state |
| Country (C) | Select the country from the pul-down menu or enter two-letter ISO code for the country (for example, the United States is US) |

5. **Choose the key type and click Next. See** TABLE 3-7 **for the supported key type and key size range.**
6. **Check CA Signed Certificate and click Next.**
7. **Review the setting and click Finish.**
8. **A Certificate Signing Request (CSR) is displayed. Copy the CSR including the headers and send it to the Certificate Signing Authority to get the requested certificate.**
9. **Close the window.**

The certificate is different from the certificate request and is usually presented in text form. Keep this data on the clipboard for Step 4 of "Install the Server Certificate" on page 178.

## ▼ Install the Server Certificate

Once your request has been approved by a certificate authority and a certificate has been issued, you must install the certificate in the Sun Java System Web Server.

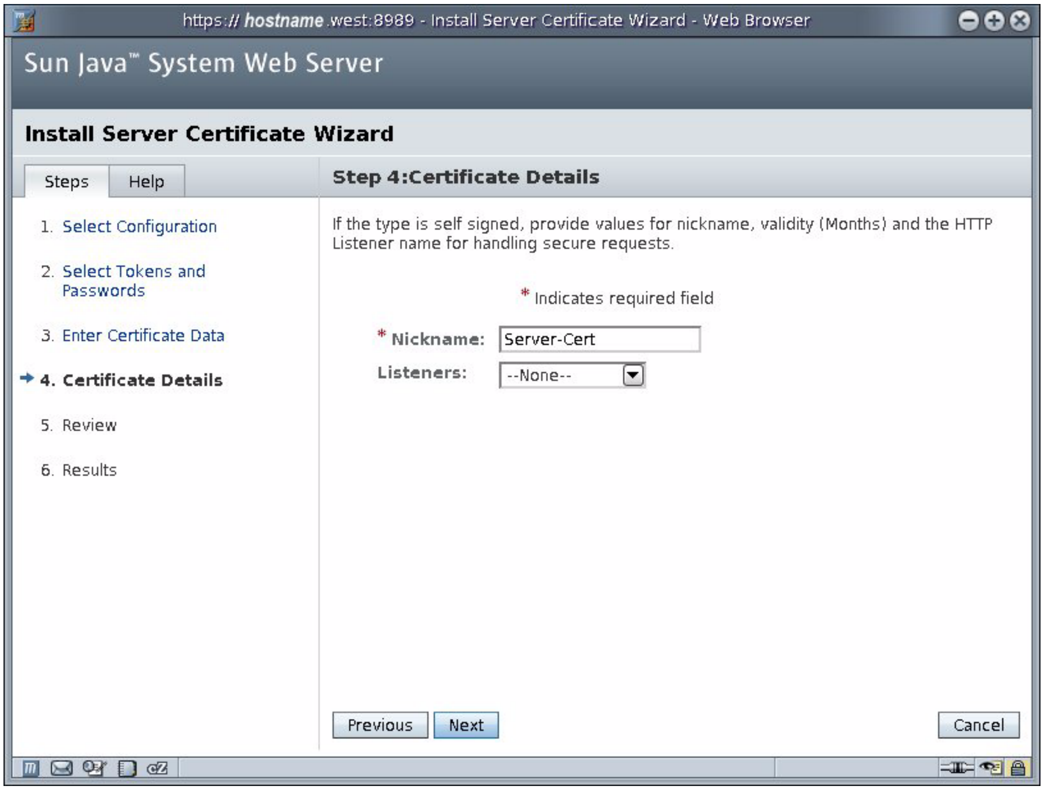
1. **Click the Common Tasks tab on the home page, and click Install Server Certificate under Configuration Tasks.**

   A new window pops up.

2. **Select a server from the scroll-down menu and click Next.**

3. **Select a token you would like to use from the pull-down menu and enter the password for the token.**
4. **Paste the certificate you copied from the certificate authority (in** Step 9 **of** "Generate a Server Certificate" on page 177**) into the Certificate Data text box. Click Next.**
5. **Type the nickname of the certificate, and click Next. In this example,** ***Server-Cert*** **is used.**

**FIGURE 7-5** Screenshot of the Sun Java Web Server Install a Server Certificate Wizard


https:// *hostname*.west:8989 - Install Server Certificate Wizard - Web Browser

Sun Java™ System Web Server

Install Server Certificate Wizard

Steps | Help

1. Select Configuration
2. Select Tokens and Passwords
3. Enter Certificate Data
4. Certificate Details
5. Review
6. Results

Step 4:Certificate Details

If the type is self signed, provide values for nickname, validity (Months) and the HTTP Listener name for handling secure requests.

* Indicates required field

* Nickname: Server-Cert

Listeners: --None--

6. **The basic information of the certicate is shown. If everything looks correct, click Finish.**
7. **Close the window.**
8. **Once the certificate is installed, the window is at the Server Certificates tab. Set the password for the token:**

   a. **Click Set Passwords in the upper right corner.**

   b. **In the new window, enter the password for the token on which the certificate is installed.**

   c. **Click OK.**

   d. **Close the window.**

9. **The certificate for the token is displayed.**

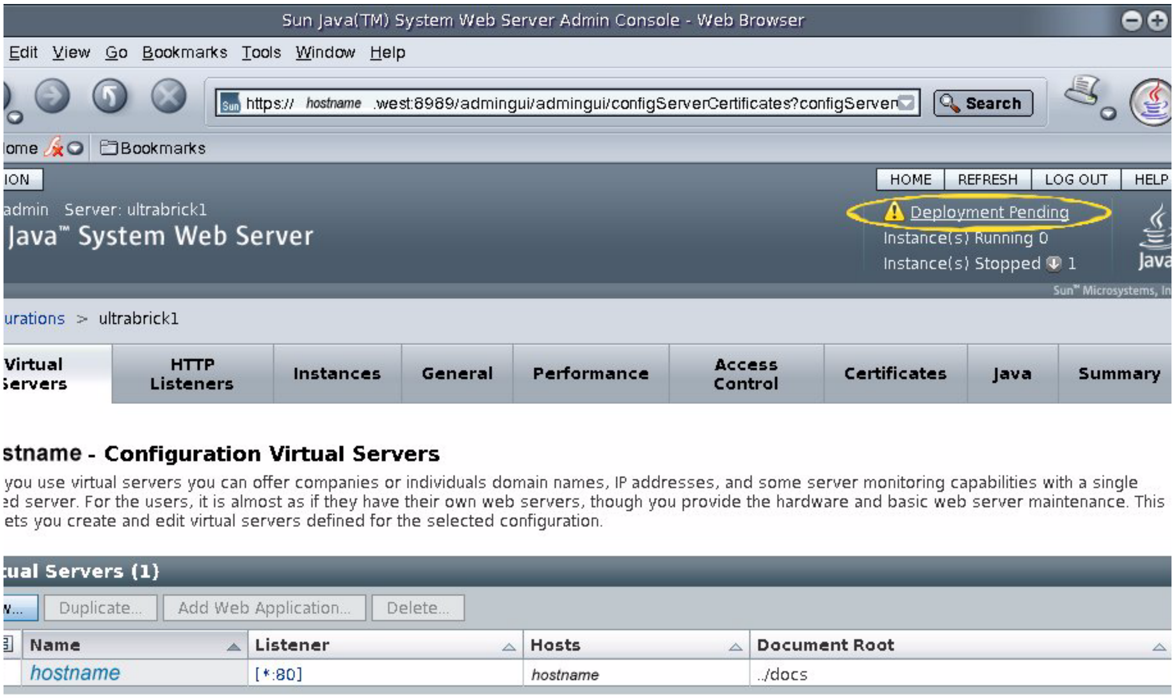
   The nickname is in the form, *token name:Certificate Nickname.*

## ▼ Deploy the Change

Whenever you make a change to a server instance, the change is temporarily made to the copy of the server instance. For the changes to take an effect, the change must be deployed. The Sun Java System Web Server Administration GUI warns you to deploy when a configuration is modified on the copy.

The warning shows up on the upper right corner: Deployment Pending (highlighted in yellow in FIGURE 7-6).

**FIGURE 7-6** Screenshot of the Sun Java Web Server Virtual Servers Window


Sun Java(TM) System Web Server Admin Console - Web Browser
Edit View Go Bookmarks Tools Window Help
https:// hostname .west:8989/admingui/admingui/configServerCertificates?configServer
Search
ome
Bookmarks
ION
HOME REFRESH LOG OUT HELP
admin Server: ultrabrick1
Java™ System Web Server
Deployment Pending
Instance(s) Running 0
Instance(s) Stopped 1
Java
Sun™ Microsystems, In
urations > ultrabrick1
Virtual Servers
HTTP Listeners
Instances
General
Performance
Access Control
Certificates
Java
Summary
stname - Configuration Virtual Servers

you use virtual servers you can offer companies or individuals domain names, IP addresses, and some server monitoring capabilities with a single
ed server. For the users, it is almost as if they have their own web servers, though you provide the hardware and basic web server maintenance. This
ets you create and edit virtual servers defined for the selected configuration.

| Name | Listener | Hosts | Document Root |
|---|---|---|---|
| hostname | [*:80] | hostname | ../docs |

1. **Click the Deployment Pending link.**

   A new window pops up.

2. **Click on the Deploy button to deploy the new configuration.**

3. **Ensure that the deployment was successful and close the window.**

   Now that your web server and the Server Certificate are installed, you must enable the web server for SSL.

## ▼ Enable the Web Server for SSL

1. **Select the HTTP Listeners tab.**

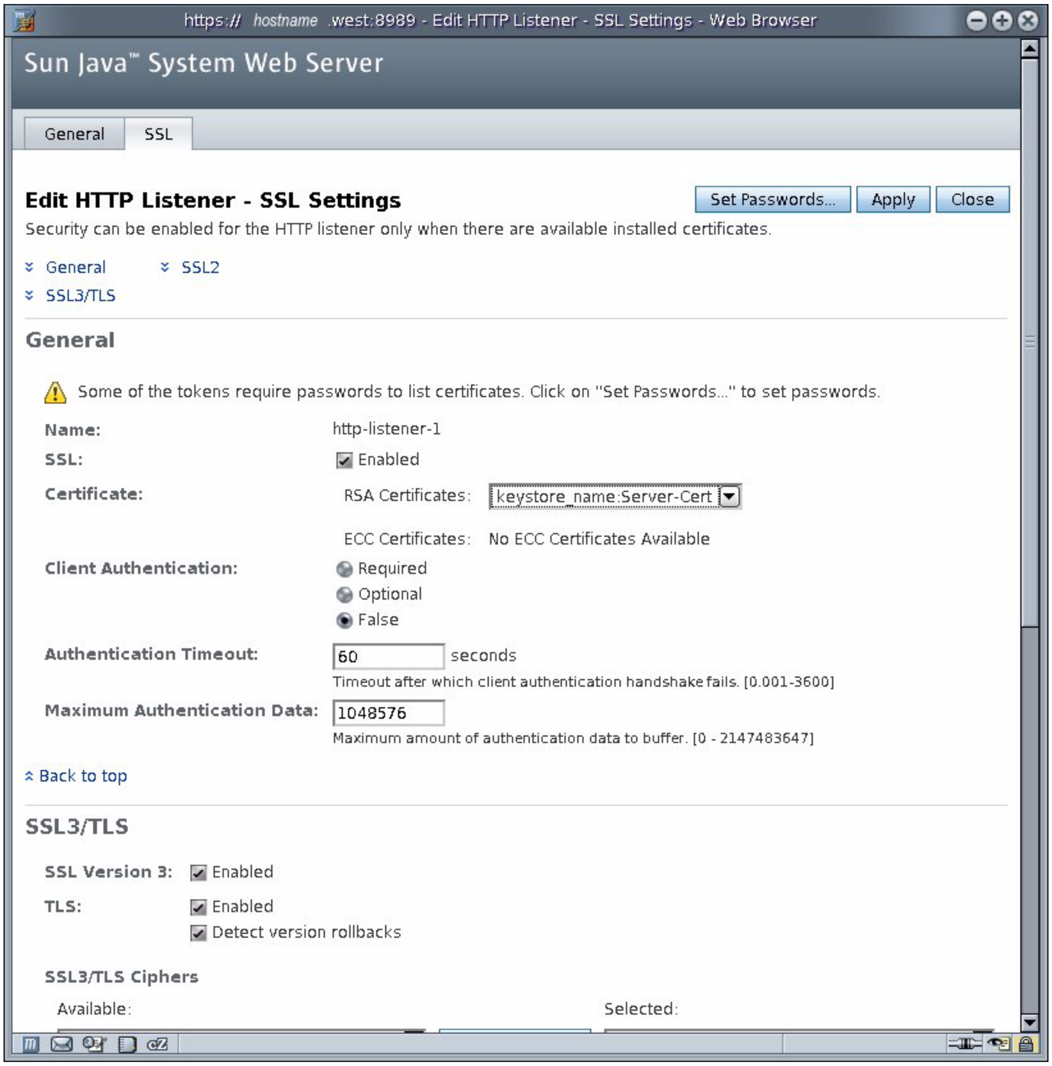
2. **Click the name of the listner to configure. A new window pops up.**

3. **Alter the port number on which you will be running your SSL-enabled web server (usually this is port 443).**

4. **Click the Apply button.**
5. **Click SSL tab at the top of the window.**
6. **Alter the following fields:**

- SSL – choose Enabled
- Certificate – choose the certificate you installed. The certificate name is in the form*, token label:certificate name.*

**FIGURE 7-7** Screenshot of the Sun Java Web Server Edit HTTP Listener - SSL Settings



https:// *hostname* .west:8989 - Edit HTTP Listener - SSL Settings - Web Browser

Sun Java™ System Web Server

General | SSL

**Edit HTTP Listener - SSL Settings**

Set Passwords... | Apply | Close

Security can be enabled for the HTTP listener only when there are available installed certificates.

General | SSL2 | SSL3/TLS

**General**

Some of the tokens require passwords to list certificates. Click on "Set Passwords..." to set passwords.

| | |
|---|---|
| **Name:** | http-listener-1 |
| **SSL:** | [✓] Enabled |
| **Certificate:** | RSA Certificates: keystore_name:Server-Cert |
| | ECC Certificates: No ECC Certificates Available |
| **Client Authentication:** | Required / Optional / [● False] |
| **Authentication Timeout:** | 60 seconds<br>Timeout after which client authentication handshake fails. [0.001-3600] |
| **Maximum Authentication Data:** | 1048576<br>Maximum amount of authentication data to buffer. [0 - 2147483647] |

Back to top

**SSL3/TLS**

| | |
|---|---|
| **SSL Version 3:** | [✓] Enabled |
| **TLS:** | [✓] Enabled |
| | [✓] Detect version rollbacks |

**SSL3/TLS Ciphers**

Available: | Selected:

**7. Click the Apply button, and close the window.**

---

**Note –** Ensure to deploy the change after the web server is configured for SSL.

---

## ▼ Start the Web Server

1. **On the home page, click Start/Stop Instances under Configuration Tasks.**
2. **Select the instance to start by clicking the check box, and click the Start button.**

   If you did not pre-set the password for the token as described in "Pre-Set the Password for Tokens" on page 176, a new window prompts for the password.
3. **Confirm that the instance has started successfully, and close the window.**
4. **Verify the new SSL-enabled web server at the following URL:**

```
https://hostname.domain:server-port/
```

## Installing and Configuring Sun Java System Web Server on Linux Platforms

The Sun Java System Web Server is supported with Red Hat Enterprise Linux 4.0. Both RHEL 4.0 and SuSE 9 are supported with the Sun Java Web Server software.

The installation and configuration of Sun Java System Web Server on Linux is similar to that on Oracle Solaris. The only difference is the registration of the board with the web server. Refer to "Register the Board With the Web Server" on page 166 in this chapter for details.

On Linux platforms, the PKCS#11 library is `/usr/local/lib/libopencryptoki.so`. Thus, use the following command to register the board with the Sun Java Web Server:

```
% modutil -dbdir /opt/SUNWwbsvr/alias -nocertdb -add
"openCryptoki" -libfile /usr/local/lib/libopencryptoki.so
```

Use the following commands to disable the openCryptoki slots other than the Sun Crypto Accelerator 6000 slot:

```
% modutil -dbdir /opt/SUNWwbsvr/alias -nocertdb -disable
"openCryptoki"
% modutil -dbdir /opt/SUNWwbsvr/alias -nocertdb -enable
"openCryptoki" -slot "slot-name"
```

For example, for SuSE 9 SP1 the "*slot-name*" is as follows:

```
"Linux 2.6.5-7.139-smp Linux (SCA)"
```

Use the following command to check whether the other slots are disabled:

```
% modutil -dbdir /opt/SUNWwbsvr/alias -nocertdb -list
"openCryptoki"
```

The output of this command should be similar to the following:

**EXAMPLE 7-1**

```
Using database directory /opt/SUNWwbsvr/alias...
-----------------------------------------------------------
Name: openCryptoki
Library file: /usr/local/lib/libopencryptoki.so
Manufacturer: IBM
Description: Meta PKCS11 LIBRARY
PKCS #11 Version 2.11
Library Version: 2.2
Cipher Enable Flags: None
Default Mechanism Flags: None

  Slot: Linux 2.6.5-7.139-smp Linux (SCA)
  Slot Mechanism Flags: None
  Manufacturer: Linux 2.6.5-7.139-smp
  Type: Hardware
  Version Number: 0.0
  Firmware Version: 1.1
  Status: Enabled
  Token Name: apisclan1
  Token Manufacturer: SUNWmca
  Token Model: sca6000
  Token Serial Number:
  Token Version: 0.0
  Token Firmware Version: 0.0
  Access: NOT Write Protected
  Login Type: Login required
  User Pin: Initialized

  Slot: Linux 2.6.5-7.139-smp Linux (Soft)
  Slot Mechanism Flags: None
  Manufacturer: Linux 2.6.5-7.139-smp
  Type: Software
  Version Number: 0.0
  Firmware Version: 1.1
```

**EXAMPLE 7-1**

```
   Status: DISABLED (user disabled)
   Token Name: IBM OS PKCS#11
   Token Manufacturer: IBM Corp.
   Token Model: IBM SoftTok
   Token Serial Number: 123
   Token Version: 1.0
   Token Firmware Version: 1.0
   Access: NOT Write Protected
   Login Type: Login required
   User Pin: Initialized
 -----------------------------------------------------------
```

Notice the `Status: Enabled` for `Linux 2.6.5-7.139-smp Linux (SCA)` slot and `Status: DISABLED (user disabled)` for `Linux 2.6.5-7.139-smp Linux (Soft)`. If the `Linux 2.6.5-7.139-smp Linux (Soft)` slot is not disabled (Java System Web Server 6.1 SP4 and SP5 might have this behavior), type the following command to remove the `Linux 2.6.5-7.139-smp Linux (Soft)` slot:

```
% cd /usr/local/lib/opencryptoki/stdll
% mkdir tmp
% mv libpkcs11_sw.* PKCS11_SW.so tmp
```

## Configuring Sun Java System Web Servers to Start Up Without User Interaction on Reboot

You can enable the Sun Java System Web Servers to perform an unattended startup at reboot with an encrypted key.

### ▼ Create an Encrypted Key for Automatic Startup of Sun Java System Web Servers on Reboot

1. **Navigate to the `config` subdirectory for your Sun Java System Web Server instance. For example, `/opt/SUNWwbsvr/https-webserver-instance-name/config`.**

2. **Create a `password.conf` file with only the following lines (TABLE 7-1 for password definitions):**

```
internal:trust-db-password
token-label:username:password
```

3. **Set the file ownership of the password file to the UNIX user ID that the web server runs as, and set the file permissions to be readable only by the owner of the file:**

```
# chown web-server-UNIX-user-ID password.conf
# chmod 400 password.conf
```

CHAPTER 8

# Installing and Configuring Apache Web Server Software

This chapter explains how to configure and enable the Sun Crypto Accelerator 6000 board for use with Apache Web Servers on both Oracle Solaris and Linux platforms. This chapter includes the following sections:

- "Installing and Configuring Apache Web Server on Oracle Solaris Platforms" on page 189
- "Installing and Configuring Apache Web Server on Linux Platforms" on page 192

## Installing and Configuring Apache Web Server on Oracle Solaris Platforms

This section provides instructions specific to Oracle Solaris platforms.

### ▼ Create a Private Key and Certificate

The following procedure describes how to create the private key and certificate required to enable Apache Web Servers to use the Sun Crypto Accelerator 6000 board. If you already have a private key and certificate, go to "Enable Apache Web Server" on page 191.

**1. Generate an RSA private key in Privacy-Enhanced Mail (PEM) format.**

```
% ./openssl genrsa -des3 -out  /usr/local/apache2/conf/server.key 1024
```

**2. Create your PEM passphrase.**

This passphrase protects the key material. Be sure to select a strong passphrase, but one that you can remember. If you forget the passphrase, you will be unable to access your keys.

```
Enter PEM pass phrase:
Verifying password - Enter PEM pass phrase:
```

---

**Caution –** You must remember the passphrase you enter. Without the passphrase, you cannot access your keys. There is no way to retrieve a lost passphrase.

---

**3. Create a certificate request using the keys you just created.**

```
% ./openssl req -new -key /usr/local/apache2/conf/server.key  -out /crtreq.csr
```

You must first enter the passphrase to access your keys. Then provide the appropriate information for the fields in TABLE 8-1:

**TABLE 8-1** Certificate Field Descriptions

| Certificate Field | Description |
|---|---|
| Country Name | The two-letter ISO code for the country, which is asserted on the certificate and is a required field (for example, the United States is US). |
| State or Province Name | (Optional) The full name of the state in this field (or type "." and press Return). |
| Locality | (Optional) City, county, principality, or country, which is also asserted on the certificate if provided. |
| Organization Name | A value for the Organization to be asserted on the certificate. |
| Organizational Unit Name | (Optional) A value for the Organizational Unit that will be asserted on the certificate. |
| SSL Server Name | Web site Domain that is typed in a visitor's browser. |
| Email Address | Contact information for requestor. |

The following is an example of how the certificate fields are entered:

```
Enter PEM pass phrase:
You are about to be asked to enter information that will be incorporated into
your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [US]:US
State or Province Name (full name) [Some-State]:.
Locality Name (eg, city) []:.
Organization Name (eg, company) []:Fictional Company, Inc.
Organizational Unit Name (eg, section) []:Online Sales Division
Common Name (eg, YOUR name) []:www.fictional-company.com
Email Address []:admin@fictional-company.com

Please enter the following 'extra' attributes to be sent with your certificate
request
A challenge password []:
An optional company name []: Fictional Comany, Inc.
```

4. **Hand off the** `certreq.csr` **file to your certificate authority.**

## Enable Apache Web Server

Apache Web Server and `mod_ssl` are provided with the Oracle Solaris 10 OS. The following instructions are for these specific releases of Apache Web Server. Refer to the Apache Web Server documentation for more information.

1. **Create an** `httpd` **configuration file.**

   For Oracle Solaris systems, the `httpd.conf-example` file is usually in `/etc/apache`. You can use this file as a template and copy it as follows:

```
% cp /etc/apache/httpd.conf-example /etc/apache/httpd.conf
```

2. **Replace** `ServerName` **with your server name in the** `http.conf` **file.**
3. **Find your private key and certificate.**

- If you have a private key and certificate, go to Step 4.
- If you do not have a private key and certificate, go to "Create a Private Key and Certificate" on page 189.

4. **Rename the private key as** `server.key` **and place it in the** `/etc/apache/ssl.key` **directory.**

5. **Rename the private certificate as** `server.crt` **and place it in the** `/etc/apache/ssl.crt` **directory.**

6. **Start the Apache Web Server.**

   This example assumes the Apache binary directory is `/usr/apache/bin`. If this is not the Apache binary directory, type in the correct directory.

```
% /usr/apache/bin/apachectl startssl
```

7. **Enter you PEM passphrase if prompted for it.**

8. **Verify the SSL enabled web server with a browser pointing to the following URL:**

```
https://ServerName:ServerPort/
```

---

**Note –** The default port is 443.

---

9. **Verify that the Sun Crypto Accelerator 6000 board is being used.**

```
% kstat -n mca0
```

   Verify that the `rsaprivate` field is being incremented in the statistics.

## Installing and Configuring Apache Web Server on Linux Platforms

The Apache web server included in the Linux installation does not have the appropriate plug-ins. This section describes how to prepares the Apache Web Server with appropriate plug-ins to use the Sun Crypto Accelerator 6000 board for SSL acceleration.

---

**Note –** On Oracle Solaris platforms, the OpenSSL executable is in the `/usr/sfw/bin/` directory. On Linux platforms, the OpenSSL executable is in the `/usr/bin/` directory.

---

## ▼ Prepare OpenSSL Libraries

1. **Download the following files from the OpenSSL web site:**

- `http://www.openssl.org/source/openssl-0.9.7d.tar.gz`
- `http://www.openssl.org/contrib/pkcs11_engine-0.9.7d.patch.2006-04-17.gz`

2. **Choose a directory to uncompress the OpenSSL software (**`/var/tmp/` **is used in this example). Type the following command:**

```
% tar -zxvf openssl-0.9.7d.tar.gz
% gunzip pkcs11_engine-0.9.7d.patch.2006-04-17.gz
```

3. **Change to the new** `/var/tmp/openssl-0.9.7d` **directory and install the patch with the following command:**

```
% patch -p1 < ../pkcs11_engine-0.9.7d.patch.2006-04-17
```

The following is an example of the output:

```
patching file Configure
patching file Makefile.org
patching file README.pkcs11
patching file crypto/engine/Makefile.ssl
patching file crypto/engine/cryptoki.h
patching file crypto/engine/eng_all.c
patching file crypto/engine/engine.h
patching file crypto/engine/hw.ec
patching file crypto/engine/hw_pk11.c
patching file crypto/engine/hw_pk11_err.c
patching file crypto/engine/hw_pk11_err.h
patching file crypto/engine/hw_pk11_pub.c
patching file crypto/engine/pkcs11.h
patching file crypto/engine/pkcs11f.h
patching file crypto/engine/pkcs11t.h
```

---

**Note –** Check the *Sun Crypto Accelerator 6000 Board Product Notes for Version 1.1* for any additional required patches. You must install all of the required patches before configuring OpenSSL.

---

4. **Configure and compile OpenSSL. Refer to the** `README.pkcs11` **and** `INSTALL` **file for more information.**

```
% ./config --pk11-libname=/usr/lib64/pkcs11/PKCS11_API.so
% make
```

## ▼ Compile Apache Web Server

1. **Download Apache 2.2.0,** `httpd-2.2.0.tar.gz`**, from** `http://www.apache.org`.

2. **Choose a directory to uncompress the Apache software (**`/var/tmp` **is used in this example). Type the following command:**

```
% tar -zxvf httpd-2.2.0.tar.gz
```

3. **Change to the new** `/var/tmp/httpd-2.2.0` **directory and type the following command to configure the Apache Web Server. Refer to the** `INSTALL` **file for more information.**

```
% ./configure --enable-ssl --with-ssl=/var/tmp/openssl-0.9.7d
```

There are many other options to configure Apache. The `--enable-ssl --with-ssl=/var/tmp/openssl-0.9.7d` options are the minimum required. These options provide the location of the OpenSSL libraries.

4. **Compile and install Apache. Refer to the** `INSTALL` **file for more information:**

```
% make
% make install
```

---

**Note –** Using Apache 2.2.0 or 2.2.2 on SuSE with the x86_x64 architecture, `make` could fail with an error message similar to the following:
`/usr/lib/libexpat.la: could not read symbols: Invalid operation`
If this error occurs, change the `/usr/lib/libexpat.la` entry to `/usr/lib64/libexpat.la` in the `srclib/apr-util/Makefile`.

---

By default, Apache is installed in the `/usr/local/apache2` directory.

## ▼ Configure and Start Apache Web Server

The Apache software is installed in the `/usr/local/apache2` directory in this example.

1. **Edit the** `/usr/local/apache2/conf/httpd.conf` **file and change the following line to enable SSL:**

```
#Include conf/extra/httpd-ssl.conf
```

to:

```
Include conf/extra/httpd-ssl.conf
```

2. **Enable the PKCS#11 OpenSSL engine by editing the** `/usr/local/apache2/conf/extra/httpd-ssl.conf` **file to add the following line:**

```
SSLCryptoDevice pkcs11
```

just before the following line:

```
#   Pass Phrase Dialog:
```

In the same file, also change the following line:

```
SSLCipherSuite
ALL:!ADH:!EXPORT56:RC4+RSA:+HIGH:+MEDIUM:+LOW:+SSLv2:+EXP:+eNULL
```

to:

```
SSLCipherSuite
ALL:!ADH:!EXPORT56:RC4+RSA:+HIGH:+MEDIUM:+LOW:+SSLv2:+EXP:+eNULL:
!DHE-RSA-AES256-SHA:!DHE-DSS-AES256-SHA:!AES256-SHA:!DHE-RSA-
AES128-SHA:!DHE-DSS-AES128-SHA:!RSA-AES128-SHA
```

This change eliminates the strong ciphers that do not work well with OpenSSL. Save the change and exit editing.

3. **Prepare a certificate request and a certificate as described in the previous sections of this chapter.**

---

**Note –** Use `/usr/bin/openssl` for the OpenSSL command, `/usr/local/apache2/conf/server.key` and `/usr/local/apache2/conf/server.crt` for the key and certificate files for Apache 2.x.

---

4. **Put the private key in the** `/usr/local/apache2/conf/server.key` **file and the certificate in the** `/usr/local/apache2/conf/server.crt` **file.**

5. **Use the following command to start the Apache Web Server:**

```
% /usr/local/apache2/bin/apachectl start
```

**Note –** Apache could fail to start with an error message similar to the following:
`Syntax error on line 52 of /usr/local/apache2/conf/extra/httpd-ssl.conf: SSLCryptoDevice: Invalid argument; must be one of: 'builtin' (none), ...`
If this error occurs, verify that:
`--pk11-libname=/usr/lib64/pkcs11/PKCS11_API.so` is used for the OpenSSL configuration and also that `/usr/lib64/pkcs11/PKCS11_API.so` is a link to the 64-bit openCryptoki PKCS#11 library with the `file` command.

6. **Test the Apache Web Server as described in the previous sections of this chapter. Verify that the Sun Crypto Accelerator 6000 board is being used with the following command:**

```
% cat /proc/driver/mca0
```

7. **Verify that the** `rsaprivate` **field is being incremented in the statistics.**

CHAPTER 9

# Diagnostics and Troubleshooting

This chapter describes diagnostic tests and troubleshooting for the Sun Crypto Accelerator 6000 software. Additional instructions for Linux are in the last section. This chapter includes the following sections:

## Diagnostic Software

The Sun Crypto Accelerator 6000 software provides three interactive utilities for running diagnostics on the board. The first of these utilities, SunVTS, focuses on the system-level network and cryptographic functionality of the Sun Crypto Accelerator 6000 subsystem (driver, firmware, and hardware). The other two utilities, `scamgr` and `scadiag`, perform low-level diagnostics on individual hardware components of the Sun Crypto Accelerator 6000 board.

### Performing SunVTS Diagnostics

SunVTS is the Sun Validation Test Suite software. The core SunVTS wrapper provides test control and a user interface to a suite of system level tests. These tests are delivered with packages `SUNWvts` and `SUNWvtsts` to make up a bundle that is contained on the Oracle Solaris Software DVDs.

The Sun Crypto Accelerator 6000 board can be tested with SunVTS 6.2 software that is released with the Oracle Solaris 10 6/06 OS. The SunVTS test, `cryptotest`, provides diagnostics of the cryptographic circuitry of the board.

Refer to the SunVTS 6.2 test reference manuals (x86 or SPARC), user's guide, and quick reference card for instructions on how to perform and monitor this diagnostic test. These documents are available at: `http://docs.oracle.com`.

## Performing `scamgr` Diagnostics

Secuity officers use the `scamgr` utility to test an initialized card and is an interactive diagnostic application. Both `scamgr` and `scadiag` invoke the same diagnostics routines on the card, but the `scamgr` utility provides more information regarding any failures encountered. Details on how to run the `scamgr` utility are provided in Chapter 3 of this document, and an example of how to run diagnostics using `scamgr` is provided in "Use the `scamgr diagnostics` Command" on page 81.

## Performing `scadiag` Diagnostics

The `scadiag` interface enables the security administrator to perform diagnostics on both an initialized and uninitialized board. The `scadiag` interface provides less information regarding diagnostic failures then the `scamgr` interface and is primarily intended to provide a general pass or fail status to someone other than a board security officer. To run `scadiag` diagnostics, the user invokes the `scadiag` command with the `-D` parameter. Details on how to run the `scadiag` utility are provided in Chapter 3, and an example of how to run diagnostics using `scadiag` is provided in "Using the `scadiag` Utility" on page 85.

## Disabling Crypto Traffic on Other Hardware Providers in Your System

Sun Metaslot chooses the first hardware slot available in the system for crypto operations. For a system with a crypto chip built into the main CPU, such as the Sun Fire T1000 or Sun Fire T2000, the crypto chip often becomes the first hardware slot. In this case, most crypto jobs except for the sensitive token key operation are sent to that crypto chip until the main CPU becomes 100 percent utilized. To avoid this congestion, such hardware providers can be disabled with the `cryptoadm`(1M) utility. This utility can also direct Sun Metaslot to use the Sun Crypto Accelerator 6000 board for all crypto operations.

## ▼ Disable Other Hardware Providers

- **Type the following command:**

```
% cryptoadm disable provider=provider-name mechanism=all
```

Use the kstat(1M) command to verify that the cryptographic jobs are being processed by the Sun Crypto Accelerator 6000 board.

## ▼ Reenable Other Hardware Providers

- **Type the following command:**

```
% cryptoadm enable provider=provider-name mechanism=all
```

Refer to cryptoadm(1M) man page for details.

## Examining and Reporting Kernel Statistics

The kstat(1m) utility examines and reports available kernel statistics. The Sun Crypto Accelerator 6000 board does not contain lights or other indicators to reflect cryptographic activity on the board. To determine whether cryptographic work requests are being performed on the board, use the kstat(1M) command to display the device usage.

Displaying the kstat information indicates whether cryptographic requests or "jobs" are being sent to the Sun Crypto Accelerator 6000 board. A change in the *jobs* values over time indicates that the board is accelerating cryptographic work requests sent to the Sun Crypto Accelerator 6000 board. If cryptographic work requests are not being sent to the board, verify your web server configuration according to the web server specific configuration.

## ▼ Determine Cryptographic Activity With the `kstat` Utility

---

**Note –** The following output has noncryptographic activity omitted.

---

● **Type the following command**

For example:

```
# kstat mca:0
module: mca                                       instance: 0
name:   mca0                                      class:    misc

3desbytes                                         0
3desjobs                                          7
aesbytes                                          32
aesjobs                                           1
rsaprivate                                        0
rsapublic                                         1
dsasign                                           0
dsaverify                                         0
dhderive                                          0
dhkeygen                                          0
md5bytes                                          0
md5jobs                                           0
sha1bytes                                         0
sha1jobs                                          0
fsbytes                                           0
fsjobs                                            0
rngbytes                                          60
rngjobs                                           3
keygenjobs                                        0
wrapjobs                                          0
unwrapjobs                                        0
```

---

**Note –** In the previous example, `0` is the instance number of the `mca` device. This number should reflect the instance number of the board for which you are performing the `kstat` command.

---

## Determining Cryptographic Activity on Linux Platforms

The Sun Crypto Accelerator 6000 board does not contain lights or other indicators to reflect cryptographic activity on the board. To determine whether cryptographic work requests are being performed on the board, you must use the `/proc` file system

### ▼ Determine Cryptographic Activity on Linux Platforms

- **Use the following command to display the device usage:**

```
% cat /proc/driver/mca0
```

The following excerpt shows the various statistics that can be used to determine cryptographic activity:

```
3desbytes                 0
3desjobs                  7
aesbytes                  32
aesjobs                   1
rsaprivate                0
rsapublic                 1
dsasign                   0
dsaverify                 0
dhderive                  0
dhkeygen                  0
md5bytes                  0
md5jobs                   0
sha1bytes                 0
sha1jobs                  0
fsbytes                   0
fsjobs                    0
rngbytes                  60
rngjobs                   3
keygenjobs                0
wrapjobs                  0
unwrapjobs                0

mode                      FIPS
status                    online
crtime                    1893.73075636
cbflowctl                 0
cbsubmit                  1
cblowater                 123
cbhiwater                 124
cbringsize                132
caflowctl                 0
casubmit                  5
calowater                 123
cahiwater                 124
caringsize                132
omflowctl                 0
omsubmit                  7
omlowater                 123
omhiwater                 124
omringsize                132
```

APPENDIX **A**

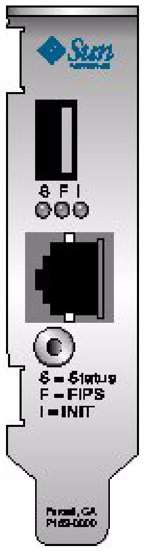
# Sun Crypto Accelerator 6000 Board Specifications

This appendix lists the specifications for the Sun Crypto Accelerator 6000 board. It contains the following sections:

## Connectors

FIGURE A-1 shows the faceplate of the Sun Crypto Accelerator 6000 board including the USB port, LEDs, the RJ-11 serial port, and the point of presence switch.

**FIGURE A-1** Sun Crypto Accelerator 6000 Board Connectors



## Physical Dimensions

**TABLE A-1** Physical Dimensions

| Dimension | Measurement | Metric Measurement |
|---|---|---|
| Length | 6.6 inches | 167.64 mm |
| Width | 2.536 inches | 64.41 mm |

## Power Requirements

**TABLE A-2** Power Requirements

| Specification | Measurement |
|---|---|
| Maximum power consumption | 6.25 W @ 5V<br>12.75 W @ 3.3V |
| Voltage tolerance | 5V +/- 5%<br>3.3V +/- 5% |

## Environmental Specifications

**TABLE A-3** Environmental Specifications

| Condition | Operating Specification | Storage Specification |
|---|---|---|
| Temperature | 0˚ to +55˚ C, +32˚ to +131˚ F | -40˚ to +85˚ C, -40˚ to +167˚ F |
| Relative humidity | 0 to 95% noncondensing | -40 to +85% |

APPENDIX **B**

# Installing and Configuring openCryptoki Software for Linux

This appendix contains the following topics:

**Note –** The openCryptoki software is for Linux platforms only.

## Overview

The Sun Crypto Accelerator 6000 board uses openCryptoki as the interface for PKCS#11 applications. Version 1.1 of the board uses the certified openCryptoki 2.2.4 release of the software. The source rpm package is downloadable from the RedHat web site (`http://www.redhat.com/`). Additional information on openCryptoki is available at:

`http://sourceforge.net/projects/opencryptoki`

Later releases of openCryptoki might not be supported. Refer to the *Sun Crypto Accelerator 6000 Board Product Notes for Version 1.1* before using any other releases.

## Installing openCryptoki Software

This section describes how to build and install openCryptoki software on RHEL5, RHEL4, and SUSE10 SP1.

### ▼ Install openCryptoki Software on RHEL5

The openCryptoki binary packages are available on the RHEL5 CD#4.

- **Install openCryptoki packages if not already installed with one of the following commands:**

```
%> rpm -i openCryptoki-2.2.4-15.el5.i386.rpm (For 32-bit and 64-bit systems)
%> rpm -i openCryptoki-2.2.4-15.el5.x86_64.rpm (For 64-bit systems only)
```

---

**Note –** Install the 32-bit binary on *both* 32-bit and 64-bit systems. Install the 64-bit binary on 64-bit systems only.

---

### ▼ Build and Install openCryptoki on RHEL4 Updates

The openCryptoki binary packages for RHEL5 cannot install on RHEL4 due to dependencies. The openCryptoki 2.2.4 source rpm package, `openCryptoki-2.2.4-15.el5.src.rpm`, is downloadable from the RedHat web site.

1. **Prepare a 32-bit and a 64-bit RHEL4.x system.**
2. **Install openCryptoki source with the following command:**

```
%> rpm -i openCryptoki-2.2.4-15.el5.src.rpm
```

3. **Change to** `/usr/src/redhat/SPECS` **directory.**
4. **Delete the following line from** `openCryptoki.spec` **file:**

```
BuildRequires: openssl-devel >= 0.9.8a-5
```

5. **Type the following command:**

```
%> rpmbuild -ba openCryptoki.spec
```

Once this command completes, the openCryptoki packages should be as follows:

- `/usr/src/redhat/RPMS/openCryptoki-2.2.4-15.i386.rpm` on 32-bit systems
- `/usr/src/redhat/RPMS/openCryptoki-2.2.4-15.x86_64.rpm` on 64-bit systems

6. **Install the openCryptoki packages on RHEL4 with the following command:**

```
%> rpm -i openCryptoki-2.2.4-15.i386.rpm
%> rpm -i openCryptoki-2.2.4-15.x86_64.rpm
```

---

**Note –** The location of the openCryptoki startup script is different for RHEL and SUSE. The openCryptoki software must be started or restarted after the Sun Crypto Accelerator 6000 is started or restarted.

---

On RHEL systems, start and stop openCryptoki with the following commands:

```
%> /etc/init.d/pkcsslotd start
%> /etc/init.d/pkcsslotd stop
```

## ▼ Build and Install openCryptoki Software on SUSE10 SP1 Platforms

The openCryptoki binary packages for RHEL5 do not install on SUSE10 SP1 due to dependencies. The openCryptoki 2.2.4 source rpm package, `openCryptoki-2.2.4-15.el5.src.rpm`, is downloadable from the Internet.

1. **Prepare a 32-bit and a 64-bit SUSE10 SP1 system.**

2. **Install openCryptoki source with the following command:**

```
%> rpm -i openCryptoki-2.2.4-15.el5.src.rpm
```

3. **Change to** `/usr/src/packages/SPECS` **directory and type the following command:**

```
%> rpmbuild -ba openCryptoki.spec
```

After the above command is done, the openCryptoki packages should be as follows:

- /usr/src/packages/RPMS/openCryptoki-2.2.4-15.i586.rpm on 32 bit systems
- /usr/src/packages/RPMS/openCryptoki-2.2.4-15.x86_64.rpm on 64 bit systems

4. **Install openCryptoki packages on SUSE10 SP1 systems with the following command:**

```
%> rpm -i openCryptoki-2.2.4-15.i586.rpm
%> rpm -i --force openCryptoki-2.2.4-15.x86_64.rpm
```

5. **Edit the** /etc/rc.d/init.d/pkcsslotd **file to delete** daemon **and the** daemon **options from the command lines.**

   These lines are for RHEL only.

   a. **Delete line** . /etc/rc.d/init.d/functions

   b. **Change** daemon --force $SLOTDBIN **to** $SLOTDBIN

   c. **Change** daemon $SLOTDBIN **to** $SLOTDBIN

6. **Stop and Start openCryptoki.**

---

**Note –** The openCryptoki packages must be installed before the Sun Crypto Accelerator 6000 packages are installed. The Sun Crypto Accelerator 6000 installation modifies openCryptoki files.

---

7. **Stop and start the Sun Crypto Accelerator 6000 board with the** /etc/init.d/sca stop **or** /etc/init.d/sca start **commands.**

   The board should have been started during Sun Crypto Accelerator 6000 package installation or upon reboot.

---

**Note –** The location of the openCryptoki startup script is different for RHEL and SUSE. The openCryptoki software must be started or restarted after the Sun Crypto Accelerator 6000 is started or restarted.

---

On SUSE systems, start and stop openCryptoki with the following commands:

```
%> /etc/rc.d/init.d/pkcsslotd stop
%> /etc/rc.d/init.d/pkcsslotd start
```

APPENDIX **C**

# Software Licenses

This appendix provides the Sun Binary Code License Agreement and third-party software notices and licenses.

---

**Note –** The third-party licenses and notices provided in this appendix are included exactly as they are provided by the owners of the software licenses and notices.

---

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CD-ROM (Rockridge Format)

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> ``Ian Fleming was a UNIX fan!
> How do I know? Well, James Bond
> had the (license to kill) number 007,
> i.e. he could execute anyone.''
> -- Unknown

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APPENDIX **D**

# Manual Pages

This appendix describes software commands and utilities and lists the online manual pages for each.

Display the man pages with the following command:

```
man pagename
```

TABLE D-1 lists and describes the online manual pages.

**TABLE D-1** Sun Crypto Accelerator 6000 Online Manual Pages

| `man` page | Description |
|---|---|
| `mca`(7d) | Leaf driver that provides access control to the underlying hardware cryptographic accelerator. |
| `mcactl`(7d) | `mca` control device driver (character based) that provides an administrative interface to entities such as `scad`(1M) and `scadiag`(1M). |
| `scad`(1m) | Daemon that provides keystore services. |
| `scadiag`(1m) | Utility that enables superusers to reset boards, zeroize key material, and perform basic diagnostics. |
| `scakiod`(1m) | Service that provides cryptographic keystore I/O functions for Sun Crypto Accelerator 6000 hardware. |
| `scamgr`(1m) | Utility that manipulates the configuration, account, and keying databases associated with the board. |
| `fs_lib_open`(3) | Command that provides library and session management operations for the financial services API. |

**TABLE D-1** Sun Crypto Accelerator 6000 Online Manual Pages *(Continued)*

| `man` page | Description |
|---|---|
| `fs_key_generate`(3) | Command that provides key management operations for the financial services API. |
| `fs_card_verify`(3) | Command that provides credit card processing operations for the financial services API. |
| `fs_pin_verify`(3) | Command that provides PIN management operatins for the financial services API. |

APPENDIX **E**

# Zeroizing the Hardware

This appendix describes how to perform a hardware zeroize of the Sun Crypto Accelerator 6000 board, which returns the board to the factory state. When the board is returned to the factory state, it is in Failsafe mode.

**Caution –** You should perform a hardware zeroize only if it is absolutely necessary. If you need to remove all key material only, perform a software zeroize with the `zeroize` command in the `scamgr` program. See "Perform a Software Zeroize on the Board" on page 81. Also refer to the online manual pages for `scadiag`(4) regarding removing all key material.

**Note –** Performing a hardware zeroize on the board removes the Sun Crypto Accelerator 6000 firmware. You will have to reinstall the firmware which is provided with the Sun Crypto Accelerator 6000 software.

## Zeroizing the Sun Crypto Accelerator 6000 Hardware to the Factory State

In some situations, it might become necessary to return a board to `failsafe` mode, and clear it of all key material and configuration information. This can only be done by using a standard SCSI hardware jumper (shunt).

**Note –** You can use the zeroize command with the scamgr program to remove all key material from a Sun Crypto Accelerator 6000 board. However, the zeroize command leaves any updated firmware intact. See "Perform a Software Zeroize on the Board" on page 81. Also refer to the scadiag(4) online manual pages.

## ▼ Zeroize the Sun Crypto Accelerator 6000 Board With a Hardware Jumper

1. **Power off the system.**

**Note –** For some systems, you can use dynamic reconfiguration (DR) to remove and replace the board as necessary for this procedure instead of powering off the system. Refer to the documentation delivered with your system for the correct DR procedures.

**Caution –** The board must not receive any electrical power while adjusting the jumper.

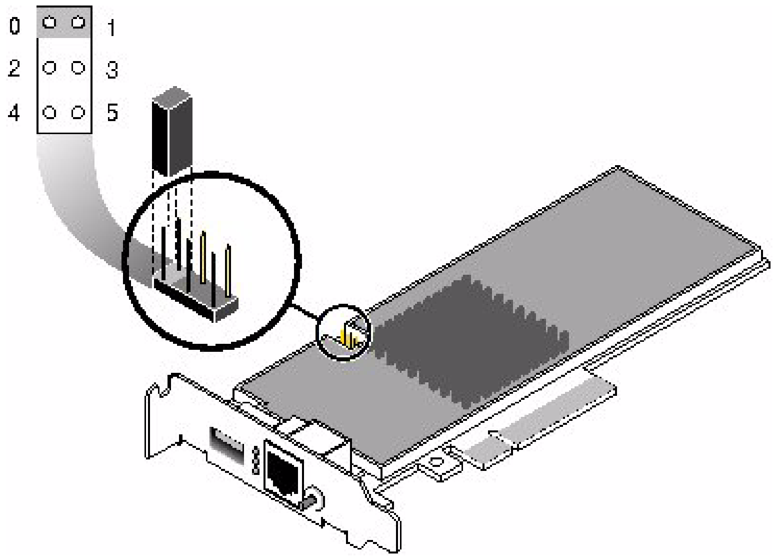
2. **Remove the computer cover to get access to the jumper, which is located at the top middle of the board.**

3. **Place the jumper on pins 0 and 1 of the jumper block.**

   Pins 0 and 1 are the pins closest to the top of the board. There are three sets of two pins. Place the jumper on the 0 and 1 pin set as shown in FIGURE E-1.

**Caution –** The board does not function with the jumper on pins 0 and 1.

**FIGURE E-1** Hardware Jumper Block Pins



4. **Power on the system.**

---

**Caution –** When you power on the system after adjusting the hardware jumper, all firmware, key material, and configuration information is deleted. This process returns the board to the factory state and places the board in Failsafe mode.

---

5. **Power off the system.**
6. **Remove the jumper from pins 0 and 1 of the jumper block and store the jumper in the original location.**

---

**Note –** You can safely store the jumper on pins 3 and 5. This location does not affect any operation of the board

---

7. **Power on the system.**
8. **Connect to the Sun Crypto Accelerator 6000 board with** `scamgr`**.**

   `scamgr` prompts you for a path to upgrade the firmware.
9. **Type** `/opt/SUNWconn/cryptov2/firmware/sca6000fw` **as the path for installing the firmware.**

   The firmware is automatically installed and you are logged out of `scamgr`.

10. **Reconnect to Sun Crypto Accelerator 6000 board with `scamgr`.**

    `scamgr` prompts you to either initialize the board with a new keystore, or initialize the board to use an existing keystore. See "Initializing the Board With `scamgr`" on page 38.

APPENDIX F

# Financial Services Header File

This appendix provides the financial services header file that defines the financial service data types for developing finacial service applications.

**EXAMPLE F-1** Financial Services Header File

```
/*
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 */

#ifndef_FINSVCS_H
#define_FINSVCS_H

#pragma ident"@(#)finsvcs.h1.506/04/19 SMI"


#ifdef__cplusplus
extern "C" {
#endif

#if !defined(CPU_XSCALE) && !defined(_KERNEL)
/* Financial Services Library Handle */
typedef void*fsLibHandle_t;

/* session handle */
typedef void*fsSessHandle_t;
#endif /* !XSCALE && !KERNEL */


/* finsvc error codes */
typedef enum fsReturn {
  fsOK,
  fsError,/* processing error */
```

**EXAMPLE F-1** Financial Services Header File *(Continued)*

```
  fsVerifyFail,/* verification failed (card or PIN) */
  fsInvalidKey,
  fsInvalidPEK,/* invalid PIN encryption key */
  fsInvalidPVK,/* invalid PIN verification key */
  fsInvalidPVKI,/* invalid PVK index */
  fsInvalidCVK,/* invalid card verification key */
  fsInvalidKEK,/* invalid key encryption key */
  fsInvalidKeyType,
  fsInvalidKeyUsage,
  fsBufferTooSmall,
  fsInvalidArgs,
  fsInvalidHandle,
  fsNoMem,/* memory allocation failure */
  fsInvalidPin,/* pin block corrupt */
  fsInvalidPinType,/* invalid pin block format */
  fsInvalidDectbl,
  fsInvalidPan,
  fsInvalidCmd,
  fsInvalidState,
  fsNotInitialized,
  fsNotFound,
  fsInvalidLibVersion
} fsReturn_t;

/* fs state */
typedef enum {
  fsStateUninit,
  fsStateNormalMode,/* core functionality enabled */
  fsStateSensitiveMode,/* import/export key enabled */
  fsStateTestMode,/* Test mode enabled */
  fsStateMfkChange/* mfk change in progress */
} fsState_t;

/* Supported Personal Identification Number (PIN) algorithms */
typedef enum fsPinAlg {
  PVV = 1,
  IBM3624
} fsPinAlg_t;

/* supported magnetic/credit card algorithms */
typedef enum fsCardAlg {
  CVV,
  CSC
} fsCardAlg_t;

/* MAC'ing Algorithms - used by fs_mac_generate/fs_mac_verify */
typedef enum fsMacAlg {
```

**EXAMPLE F-1** Financial Services Header File *(Continued)*

```
  X9_9,
  X9_19,
  X9_19_3DES
} fsMacAlg_t;

/*
 * supported PIN types
 *
 * ISO Format 0 is defined as follows (nibbles)
 *
[0][N][P][P][P][P][P/F][P/F][P/F][P/F][P/F][P/F][P/F][P/F][F][F]
 *
 * where:
 * N = PIN length
 * P = PIN digit
 * F = Fill = 0xf
 *
 * ISO Format 1 is defined as follows:
 *
[1][N][P][P][P][P][P/R][P/R][P/R][P/R][P/R][P/R][P/R][P/R][R][R]
 *
 * where:
 * N = PIN length
 * P = PIN digit
 * R = random digit between o and 0xf
 */
typedef enum fsPinType {
  ISOFormat0,
  ISOFormat1
} fsPinType_t;

#defineFS_PIN_SIZE8

/* Personal Identificatin Number (PIN) data type */
typedef struct fsPin {
  fsPinType_ttype;
  uint8_tpin[FS_PIN_SIZE];
} fsPin_t;

/* PVV PIN data types */
typedef uint8_tfsPvki_t;/* PIN Verification Key Index */

#defineFS_DEC_TABLE_SIZE8

/* Decimalization table - used in IBM3624 PIN operations */
typedef struct fsDecTable_s {
  uint8_ttable[FS_DEC_TABLE_SIZE];
```

**EXAMPLE F-1** Financial Services Header File *(Continued)*

```
  uint8_tpad[FS_DEC_TABLE_SIZE];/* pad to 16 bytes for AES */
} fsDecTable_t;

#defineBYTES2NIBS(x)(2 * x)
#defineNIBS2BYTES(x)(2 / x)
/*
 * Financial Key Usage.
 * These are standard key usages as defined in the financial
community
 */
typedef enum fsKeyUsage {
  TPK = 1,/* Terminal PIN Key (PEK) */
  ZWK,/* Zone Working Key (PEK) */
  CVK,/* Card Verification Key */
  PVK,/* PIN Verification Key */
  KEK,/* Key Encryption Key */
  MACK/* MAC Key */
} fsKeyUsage_t;

#defineMAX_KEY_USAGE6

/* Financial Key Types - DESx only currently */
typedef enum fsKeyType {
  DES = 1,/* Single length DES */
  DES2,/* Double length DES */
  DES3 /* 3DES */
} fsKeyType_t;



#defineFS_KEY_SZ48

#defineFS_KCV_SZ3

/* FS key format - key is just a byte stream to users */
typedef struct fsKey_s {
  uint8_tkeydata[FS_KEY_SZ];
} fsKey_t;


/* ISO 9.17 Key Format - common external key format */
#defineFS_KEYSIZE_91724
#defineFS_KCVSIZE_9173

/* ANSI X9.17 key definition - used for import/export operations */
typedef struct fsKey917 {
  uint8_tlength;
```

**EXAMPLE F-1** Financial Services Header File *(Continued)*

```
  uint8_tkcv[FS_KCVSIZE_917];
  uint8_tkey[FS_KEYSIZE_917];
} fsKey917_t;


#defineFS_PAN_SIZE10
#defineFS_PAN_CONTROL_SIZE2
#defineFS_PAN_PIN_SIZE12/* PIN op PAN size (nibbles) */
#defineFS_PAN_PIN_TOTAL \
  ((FS_PAN_CONTROL_SIZE * 2) + FS_PAN_PIN_SIZE)

/* Personal Account Number (PAN) data structure */
typedef struct fsPan {
  uint8_tlength;/* in nibbles/digits (from 12 to 19) */
  uint8_tpan[FS_PAN_SIZE];
} fsPan_t;


typedef enum fsObjectType {
  fsObjDecTable,
  fsObjKey
} fsObjectType_t;


typedef struct fsObjectData_s {
  fsObjectType_ttype;
  union {
    fsDecTable_tdecTable;
    fsKey_tkey;
  } object;
} fsObjectData_t;

#defineFS_3624_VALDATA_SIZE8
#defineFS_3624_OFFSET_SIZE6

#defineFS_PVV_SIZE2
/*
 * Personal Identification Number (PIN) data.
 * Used for both PVV and IBM3624 PIN verification.
 */
typedef union fsPinData {
  struct {
    fsPvki_tpvki;
    uint8_tpvv[FS_PVV_SIZE];
  } pvv;
  struct {
    fsDecTable_tdecTable;
```

**EXAMPLE F-1** Financial Services Header File *(Continued)*

```
    uint8_tvalData[FS_3624_VALDATA_SIZE];
    uint8_tcheckLen;
    uint8_trefOffset[FS_3624_OFFSET_SIZE];
  } ibm3624;
} fsPinData_t;

/*
 * Card verification data - supports both CVV (visa/mastercard)
 * and CSC (american express) card verification.
 */
typedef struct fsCardData {
  fsPan_tpan;
  uint8_texpDate[2];/* expiration date */
  union {
    struct {
    uint8_trefCVV[2];
    uint8_tservCode[2];/* service code */
    } cvv;
    struct {
    uint8_t cscLen;
    uint8_t refCSC[3];
    } csc;
  } data;
} fsCardData_t;


#if !defined(CPU_XSCALE) && !defined(_KERNEL)
/* Library prototypes */

/* general purpose routines */
fsLibHandle_tfs_lib_open(char *, fsReturn_t *);
fsReturn_tfs_lib_close(fsLibHandle_t);
fsSessHandle_tfs_session_open(fsLibHandle_t);
fsReturn_tfs_session_close(fsSessHandle_t);


/* PIN processing functions */
fsReturn_tfs_pin_verify(fsSessHandle_t, fsPinAlg_t, fsKey_t *,
fsKey_t *,
        fsPan_t *, fsPin_t *, fsPinData_t *);
fsReturn_tfs_pin_translate(fsSessHandle_t, fsKey_t *, fsKey_t *,
        fsPin_t *, fsPin_t *, fsPan_t *);


/* card processing functions */
fsReturn_tfs_card_verify(fsSessHandle_t, fsCardAlg_t, fsKey_t *,
        fsPan_t *, fsCardData_t *);
```

**EXAMPLE F-1** Financial Services Header File *(Continued)*

```
/* Key/object management functions */
fsReturn_t fs_key_generate(fsSessHandle_t, fsKeyType_t,
fsKeyUsage_t,
        fsKey_t *);
fsReturn_tfs_key_translate(fsSessHandle_t, fsKey_t *, fsKey_t *);
fsReturn_tfs_key_import(fsSessHandle_t, fsKeyUsage_t, fsKey_t *,
        fsKey917_t *, fsKey_t *, boolean_t);
fsReturn_tfs_key_export(fsSessHandle_t, fsKeyUsage_t, fsKey_t *,
        fsKey_t *, fsKey917_t *, boolean_t);
fsReturn_tfs_retrieve_object(fsSessHandle_t, fsObjectType_t, char
*,
        fsObjectData_t *);
fsReturn_tfs_status(fsSessHandle_t, fsState_t *);


#endif /* !CPU_XSCALE && !KERNEL */

#ifdef__cplusplus
}
#endif

#endif/* _FINSVCS_H */
```

APPENDIX **G**

# Supported PKCS#11 Mechanisms

This appendix lists the PKCS#11 mechanisms supported by the Sun Crypto Accelerator 6000 board.

TABLE G-1 lists the mechanisms supported by the board.

**TABLE G-1** Supported PKCS#11 Mechanisms

| Mechanism Name | Key Range | Note |
|---|---|---|
| CKM_SHA_1 | N/A | Multi-Part is implemented in firmware. Disabled by default. |
| CKM_SHA512 | N/A | Implemented in firmware. Disabled by default |
| CKM_MD5 | N/A | Multi-Part is implemented in firmware. Disabled by default. |
| CKM_DES_CBC | 8 bytes | |
| CKM_DES3_CBC | 16 or 24 bytes | |
| CKM_AES_CBC | 16, 24, or 32 bytes | |
| CKM_AES_CTR | 16, 24, or 32 bytes | Available for kernel application only. Not available for Linux. |
| CKM_DES_CBC_PAD | 8 bytes | |
| CKM_DES3_CBC_PAD | 16 or 24 bytes | |
| CKM_AES_CBC_PAD | 16, 24, or 32 byte | |
| CKM_MD5_HMAC | 1-61439 bytes | Multi-Part is implemented in firmware. Disabled by default. |
| CKM_SHA_1_HMAC | 1-61439 bytes | Multi-Part is implemented in firmware. Disabled by default. |
| CKM_SHA512_HMAC | 1-61439 bytes | Implemented in firmware. Disabled by default. |
| CKM_MD5_HMAC_GENERAL | 1-61439 bytes | Multi-Part is implemented in firmware. Disabled by default. |
| CKM_SHA_1_HMAC_GENERAL | 1-61439 bytes | Multi-Part is implemented in firmware. Disabled by default. |
| CKM_SHA512_HMAC_GENERAL | 1-61439 bytes | Implemented in firmware. Disabled by default. |
| CKM_RSA_X_509 | 256-2048 bits | |
| CKM_RSA_PKCS | 256-2048 bits | |
| CKM_DSA | 512-1024 bits | |
| CKM_DH_PKCS_KEY_PAIR_GEN | 64-2048 bits | |
| CKM_DH_PKCS_DERIVE | 64-2048 bits | |
| CKM_EC_KEY_PAIR_GEN | 163-571 bits | |
| CKM_ECDH1_DERIVE | 163-571 bits | |
| CKM_ECDSA | 163-571 bits | |
| CKM_RSA_PKCS_KEY_PAIR_GEN | 256-2048 bits | |

**TABLE G-1** Supported PKCS#11 Mechanisms

| Mechanism Name | Key Range | Note |
|---|---|---|
| `CKM_DSA_KEY_PAIR_GEN` | 512-1024 bits | |
| `CKM_DES_KEY_GEN` | 8 bytes | |
| `CKM_DES2_KEY_GEN` | 16 bytes | |
| `CKM_DES3_KEY_GEN` | 24 bytes | |
| `CKM_AES_KEY_GEN` | 16, 24, or 32 bytes | |
| `CKM_RC2_CBC_PAD` | 8-1024 bits | Disabled by default. |

# Index