HP Client Automation

For the Windows ® operating system

Software Version: 8.10

SSL Implementation Guide

Document Release Date: February 2012

Software Release Date: February 2012

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Acknowledgements

This product includes software developed by the Apache Software Foundation (http://www.apache.org/).

This product includes cryptographic software written by Eric Young (eay@cryptsoft.com).

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/).

This product includes software written by Tim Hudson (tjh@cryptsoft.com).

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Introduction to SSL, Certificates, and Private Keys

Overview

Caution: If your environment uses Core and Satellite servers, first read the *HP Client Automation Enterprise Edition Getting Started and Concepts Guide* as the installation, configuration, and troubleshooting information in that guide may override the information in this guide.

This chapter provides an introduction to some of the important components, concepts, and terms that are relevant to SSL encryption. This chapter also discusses SSL in the context of HPCA, including:

- SSL cipher-suite information
- SSL encryption requirements
- A list of the HPCA products that can be configured to use SSL

An Introduction to SSL Encryption

Secure Sockets Layer (SSL) is a cryptographic protocol that enables software applications to communicate securely across a network. SSL is designed to prevent eavesdropping, tampering, and message forgery. It is based on a principle called mutual authentication, which ensures that both parties in a conversation know precisely with whom they are communicating.

This section describes some of the components, concepts, and terms that are part of SSL encryption.

Public Key Cryptography

SSL implements mutual authentication by using public key cryptography. A key is simply a binary code, encoded and served in a text file, and associated with a particular user or software application.

SSL uses two keys—a public key and a private key—to encrypt and decrypt messages that are sent over the network. The public key is given freely to interested parties, but the associated private key remains private and is possessed only by the owner of the certificate. Data encrypted with the public key can be decrypted only with the private key.

In the context of HPCA, SSL public key cryptography includes:

- A private-public key pair on the server
- A certificate from a trusted Certificate Authority (CA). This is typically already present on each system.

Each of these requirements is described in the next sections.

The Key Pair

SSL encryption uses a **key pair** to encrypt a transmission. The key pair consists of a **private key** and a **public key**.

- Private Key: In the context of HPCA, a key pair must be generated for each server. The server retains the **private key** and must keep it secure.

- Public Key: The **public key** is passed to the client by the server. The client must trust that the public key that it receives is truly from the server that the client thinks it is communicating with. Certificate Authorities sign public keys so that the keys can be trusted.

Certificates

A certificate is an electronic document that contains the server's public key, the server name, and a signature from a CA. A certificate authority is a trusted third party who attests that the public key in the certificate belongs to the party – in this case, the server – named in the certificate. It is the responsibility of the CA to verify the credentials of any party that applies for a certificate. This allows others to trust the information in the certificates issued by this CA.

There are independent CAs, such as Thawte and Verisign, who charge a fee for their services. There are free CAs also.

A client is configured with certificates from the CAs that it trusts. As long as the server's certificate has been signed by a CA that the client trusts (see "Obtaining a Certificate from a Certificate Authority" (on page 1)), the server's certificate is considered "trusted," and SSL communications between the server and client can be initiated.

Certificates and Your Environment

This section discusses certificate generation in production and test environments.

Production Situations

It is best to generate a Certificate Signing Request that can be signed by a trusted Certificate Authority.

Test Situations

You can provide either:

- A **self-signed certificate**
  In this case, you must configure the client to trust each server's certificates.
- A **private CA-signed certificate**
  In this case, you can sign each server's certificate quickly—because you are the signing authority—and you only need to configure your clients to trust the private CA certificate that you generated.

Ciphers and Hash Functions

A cipher is a method of encrypting information. A hash function is a method of compressing information that transforms data into a short, fixed-length string that serves as a digital "fingerprint." Hash functions used in cryptography create a unique fingerprint for every input and work in one direction only; in other words, you cannot derive the original data from the fingerprint. Ciphers and hash functions are used by SSL.

SSL can use a number of ciphers and hash functions to encrypt messages. It uses two ciphers and one hash function for each connection. Together, the two ciphers and hash function are known as the cipher suite, and they are used to establish and protect that connection.

Keystores and Truststores

For two-way SSL communication to occur, the server and each client must have a truststore and a keystore.

- A keystore is a database that stores your private keys. It also contains certificates for trusted CAs.
- A truststore stores the public keys that you trust.

The keystore and the truststore are typically implemented as files. A keystore file is protected by a password. A truststore file needs no password because it contains no private information.

Setting up SSL

The following steps represent the generic process for setting up SSL on each machine that will be authenticated:

1. Locate (or create) a keystore.
2. Generate a public-private key pair.
3. If this new key pair is not yet trusted—in other words, if the public key that you generated is not yet in your keystore—follow these steps:
   a. Generate a **Certificate Signing Request** (CSR) from the key pair.
   b. Send the CSR signed to a trusted CA.
   c. When the CA issues a signed certificate in response to your request, import the signed certificate that they send you into the keystore.
4. Configure the client and server to use the public-private key pair certificates.

How SSL Establishes a Secure Connection

A client and a server establish a secure connection by performing a handshake operation. The handshake accomplishes the following:

- The client and server agree on a cipher suite to use for the connection.
- The server sends its certificate—including public key, server name, and CA—to the client. The client can then contact the CA to verify the server's identity. If mutual authentication is required, the server will also request a certificate from the client.
- The client and server generate session keys that will be used for the duration of this connection.
- The client encrypts a random number with the server's public key, and sends the result to the server.
- The server decrypts the random number with its private key, which hides the session keys from third parties, since only the server and the client have access to this data.
- The client and server generate session keys that they use for encryption and decryption.

SSL in an HP Client Automation Environment

This section presents information required to set up and use SSL in HP Client Automation environment. It provides an overview of the protocols that are used to secure the various HPCA server-HPCA agent communications.

SSL Requirements

To ensure that SSL encryption works with the HPCA products, the following requirements must be met.

- HPCA servers must have a public key, a private key, and a Certificate Authority public key.
- HPCA agents must have a Certificate Authority public key.

SSL Cipher Suite and Encryption Information

The ciphers can be configured for the Apache Server, Configuration Server, and TCL based web servers.

Configuring Ciphers for the Apache Server

Follow these steps to configure ciphers for the Apache Server:

1. Use a text editor to access the `httpd.conf` file, located in the `conf` folder of the Apache Server directory.
2. Add the parameter `SSLCipherSuite` and set it according to your enterprise requirements.This parameter is not included by default.

Configuring Ciphers for the Configuration Server

Follow these steps to configure ciphers for the Configuration Server:

1. Use a text editor to access the `edmprof.dat` file, located in the `bin` folder of the Configuration Server directory.
2. Under section `MGR_SSL`, set the `SSL_CIPHERS` according to your enterprise requirements. The default value for `SSL_CIPHERS is ALL:!ADH:!EXP:!NULL:+HIGH:+MEDIUM:-LOW`.

Configuring Ciphers for the TCL Based Web Server

Follow these steps to configure ciphers for the TCL Based Web Servers:

1. Use a text editor to access the respective configuration file.
2. Set the parameter `set tls::defaults(-ciphers)` according to your enterprise requirements. The default value for `set tls::defaults(-ciphers)` is `ALL:ADH:RC4+RSA:+HIGH:+MEDIUM:+LOW:+SSLv2:+EXP:+eNULL`.

SSL Version Parity

To communicate using SSL, HPCA servers and agents must use the same version of SSL. This version of HPCA supports versions 2.0 and 3.0 of the SSL protocol and version 1.0 of the TLS protocol.

Abbreviations and Variables

Abbreviations Used in this Guide

Abbreviation	Definition
HPCA	HP Client Automation
Core and Satellite	HPCA Enterprise environment consisting of one Core server and one or more Satellite servers. All features are installed as part of the Core or Satellite server installation.
CSDB	Configuration Server Database
Portal	HPCA Portal

Variables Used in this Guide

Variable	Description	Default Values
InstallDir	Location where the HPCA server is installed	For a 32-bit OS: `C:\Program Files\Hewlett-Packard\HPCA` For a 64-bit OS: `C:\Program Files(x86)\Hewlett-Packard\HPCA`
SystemDrive	Drive label for the drive where the HPCA server is installed	C:

Summary

- Secure Sockets Layer (SSL) is a cryptographic protocol that enables *secure communications* across a network.
- SSL implements mutual authentication by using *public key cryptography*.
- SSL uses a *public key* and a *private key* to encrypt and decrypt messages.
- A certificate must be obtained from a *Certificate Authority*. It contains:
  - The *server's public key*,
  - The *server name*, and
  - A *signature* from a Certificate Authority.
- SSL uses *ciphers* and *hash functions* to encrypt messages.
- Two-way SSL communication requires each server and each client to have a *truststore* and a *keystore*.
- To ensure SSL encryption viability with the HPCA products:
  - HPCA servers must have a *public key*, a *private key*, and a *CA public key*.
  - HPCA agents must have a *CA public key*.
- SSL ciphers can be configured for the Apache Server, Configuration Server, and TCL based web servers.

Setting up Certificates for SSL

Note: If you are already creating certificates in your environment with existing tools, skip to the next chapter "Configuration and Use" (on page 19)

The Certificate Generation Utility

For testing, HP provides a **Certificate Generation Utility**. This utility makes it easy to create self-signed certificates for testing. It will be used in this chapter to demonstrate the process for setting up SSL for HPCA.

Caution: This utility is intended for testing purposes *only* and should **not** be used in a production environment.

Before using this utility, please consider the following:

- The Certificate Generation Utility is **not** a supported HP Client Automation product.
- The Certificate Generation Utility is provided *free of charge*.
- The Certificate Generation Utility is used at *your own discretion*; HP Technical Support **will not** address any issues regarding its use or functionality.

Note: HP's **Certificate Generation Utility** can generate certificates on Windows platforms only. However, once generated on a Windows system, certificates can be copied over to and used on Linux platforms.

Locating the Certificate Generation Utility

The Certificate Generation Utility can be found at the following location:

`<InstallDir>\Tools`

Setting up a Certificate

The first step required to set up SSL is to make sure that each system that will be authenticated has a private key and a signed certificate. If you already have a private key for this system, you can use it to generate a certificate.

Using an Existing Private Key

If you already have a private key in PEM file format, follow these steps:

1. In the `Tools\servers` directory, create a new directory called `hostname`.
   In this case, hostname is the name of the server for which a signed certificate is to be created.
   For example:

   `Tools\servers\cmserver1`

2. Copy your private key `PEM` file into the directory that you just created.
3. Rename the `PEM` file that you just copied as follows: *`hostname`*`-prvkey.pem`
   For example:

   `Tools\servers\cmserver1\cmserver1-prvkey.pem`

Generating a Signed Certificate

This section provides instructions for creating signed certificates that will be used for SSL configuration. There are three ways that you can generate a signed certificate:

- *Self-signing*
  This is the most convenient but least secure of the three options. Use this strictly for testing.
- Via a *generated* CA
  This option is more secure than self-signing, but not secure enough for a production environment. It creates a new CA with the parameters that you specify, and this new CA signs the certificate.
- Via a *trusted* CA
  This is the most secure option of the three. In a production environment, be sure to use certificates that have been signed by a trusted CA.

This task will use the Certificate Generation Utility to demonstrate each of these three options.

Server Names

When you generate a certificate or a certificate request, you must specify the server name. You can use the simple host name (for example, `cmserver1`) or the fully qualified host name (for example, `cmserver1.mycorp.com`).

The name that you specify should match the name that will be used in the URL when this server is accessed.

Option 1: Generating a Self-Signed Certificate

1. From the `certificate_mgmt` directory, run the following command:
   `cert_mgr create self`
2. Provide the following information at the prompts:

Parameter	Example
Server name (becomes the CN)	`cmserver1`
Country name	`US`
State or province name	`California`
Locality Name	`Sacramento`
Organization name	`Mycompany`
Organizational unit name	`IT`

   This information is used to create the **Distinguished Name (DN)** for the certificate. The DN is a unique identifier that is used to provide a name that is unique to the certificate. The DN is derived from the **Common Name (CN)** of the server and the other parameters that you specify.

   The components of the DN, including the CN, are visible in the `cert.txt` file, as shown here:

```
Subject: C=US, ST=CA, L=Sacramento, O=MyCompany, OU=IT,
CN=cmserver1
```

Note: It is important that the CN part of the certificate's DN be the same as the server's host name. This is vital to the client trusting that it is communicating with the expected host.

After the utility finishes, the server certificate, private key, and related files are located in the `certificate_mgmt\servers\`*`hostname`* directory. For example, if the server name entered is `cmserver1`, the following files are generated:

```
certificate_mgmt\servers\cmserver1\cmserver1-cert.pem
certificate_mgmt\servers\cmserver1\cmserver1-cert.txt
certificate_mgmt\servers\cmserver1\cmserver1-prvkey.pem
certificate_mgmt\servers\cmserver1\cmserver1-signer.pem
certificate_mgmt\servers\cmserver1\cmserver1-signer.txt
certificate_mgmt\servers\cmserver1\cmserver1-cert.rnd
certificate_mgmt\servers\cmserver1\cmserver1-keystore.txt
certificate_mgmt\servers\cmserver1\cmserver1-keystore.jks
certificate_mgmt\servers\cmserver1\cmserver1-truststore.txt
certificate_mgmt\servers\cmserver1\cmserver1-truststore.jks
```

Note: The `keystore` and `truststore` files are generated only when the JAVA_HOME environment variable points to a Java runtime environment (JRE). See "Keystore and Truststore Files" (on page 1) for more information.

After you have verified that your files were correctly generated, proceed to "Configuration and Use" (on page 19).

Caution: Self-signed certificates are adequate for testing purposes *only*; they should **not** be used in a production environment.

Option 2: Generating a Re-usable Certificate Signed by a Generated CA

1. From the `certificate_mgmt` directory, run the following command.
   `cert_mgr create signed`
2. Provide the following information at the prompts.

Parameter	Example
Server name (becomes the CN)	`cmserver1`
Country name	`US`
State or province name	`California`
Locality Name	`Sacramento`
Organization name	`Mycompany`

Parameter	Example
Organizational unit name	`IT`

Note: The first time you run this command, you will also be prompted for information about the certificate authority (CA) that you are generating. On subsequent runs, it will not prompt you.

The utility generates two sets of files in this case.

- The first set consists of the server certificate and related files, which are located in the `certificate_mgmt\servers\`*`hostname`* directory (see the description of the files under "Option 1: Generating a Self-Signed Certificate" (on page 14).
- The second set consists of the CA files. These are located in the `certificate_mgmt\ca` directory.

For example, if the server name is specified as `cmserver1`, the following files are generated:

```
certificate_mgmt\servers\cmserver1\cmserver1-cert.pem

certificate_mgmt\servers\cmserver1\cmserver1-cert.txt

certificate_mgmt\servers\cmserver1\cmserver1-prvkey.pem

certificate_mgmt\servers\cmserver1\cmserver1-signer.pem

certificate_mgmt\servers\cmserver1\cmserver1-signer.txt

certificate_mgmt\servers\cmserver1\cmserver1-cert.rnd

certificate_mgmt\servers\cmserver1\cmserver1-keystore.txt

certificate_mgmt\servers\cmserver1\cmserver1-keystore.jks

certificate_mgmt\servers\cmserver1\cmserver1-truststore.txt

certificate_mgmt\servers\cmserver1\cmserver1-truststore.jks
certificate_mgmt\ca\ca.rnd

certificate_mgmt\ca\ca-cert.pem

certificate_mgmt\ca\ca-prvkey.pem

certificate_mgmt\ca\ca-index.txt

certificate_mgmt\ca\ca-index.txt.attr

certificate_mgmt\ca\ca-index.txt.old

certificate_mgmt\ca\ca-serial

certificate_mgmt\ca\ca-serial.old
```

Note: When you use the signed option, the Signing Authority Certificate is copied from the `certificate_mgmt\ca` directory. If the `certificate_mgmt\ca\ca-cert.pem` file already exists, that file will be used. Otherwise, it will be created on the first run and used for generating subsequent certificates.

Note: The `keystore` and `truststore` files are generated only when the JAVA_HOME environment variable points to a Java runtime environment (JRE). See "Keystore and Truststore Files" (on page 1) for more information.

After you have verified that your files were correctly generated, proceed to "Configuration and Use" (on page 19).

Caution: This method of generating signed certificates is adequate for testing purposes only and should not be used in a production environment.

Option 3: Generating a Certificate Signed by a Trusted CA

These steps show you how to use the Certificate Generator Utility to generate a private key and certificate request that you can then send to a trusted CA. This might be an external CA, such as Verisign or Thawte, or a CA that your company or institution owns and administers.

1. From the `certificate_mgmt` directory, run the command
   `cert_mgr create request`
2. Provide the following information at the prompts:

Parameter	Example
Server name (becomes the CN)	`cmserver1`
Country name	`US`
State or province name	`California`
Locality Name	`Sacramento`
Organization name	`Mycompany`
Organizational unit name	`IT`

   After the utility finishes, the certificate request, private key, and related files are located in the `certificate_mgmt\servers\`*`hostname`* directory. For example, if the server name is specified as `cmserver1`, the following files are generated:

```
certificate_mgmt\servers\cmserver1\cmserver1.rnd
certificate_mgmt\servers\cmserver1\cmserver1-prvkey.pem
certificate_mgmt\servers\cmserver1\cmserver1-request.pem
certificate_mgmt\servers\cmserver1\cmserver1-request.txt
```

3. Request a signed certificate by sending the *`hostname`*`-request.pem` to your signing authority.
   Note: Be sure that the server certificate that is purchased is a **base-64 encoded x.509** certificate. This is typical for certificates that are generated for the Apache Freeware (ModSSL or OpenSSL) Server.

   For additional information about obtaining and installing a certificate from an external CA, see "Obtaining a Certificate from a Certificate Authority".
4. When you receive this signed certificate from your signing authority, paste it into the `servers\`*`hostname`*`\`*`hostname`*`-cert.pem` file.

5. Paste the Signing Authority Certificate (must be in PEM format) into the `servers\hostname\hostname-signer.pem file`.

You now have a private key, a signed certificate, and the signing authority certificate files that are needed for product configuration.

Additional Information about Certificates and Keys

This section provides more detailed information about obtaining and installing signed certificates from external certificate authorities. It also contains information about keystores and truststores.

Installing the Private Key File

The Certificate Generation Utility also generates a private key in the form of the following PEM file:

`hostname-prvkey.pem`.

To install the private key, place this file in the appropriate directory on the server. See "Configuration and Use" (on page 19) for the specific location of this directory for each type of HPCA server.

If you open the private key file with a text editor, the contents will look similar to the following:

```
-----BEGIN RSA PRIVATE KEY-----
Proc-Type: 4,ENCRYPTED
DEK-Info: DES-CBC,6EC0947550541AAB

1MV8Y4rkywlYn30yUB5ULtKLfj0YSzX+KZvxCeuw+9x95x1Ikvej4b8iBDuEOaTR
MIIDZTCCAs6gAwIBAgIBADANBgkqhkiG9w0BADQFADCBhDELMAkGA1UEBhMCVVMx
MzMxNDJaMIGEMQswC7YDVQQGEwJVUzELMAkGA1UECBMCQ0ExEDAOBgNVBAcTB0Zy
ZW1vbnQxDzANBgNVBAoTBlN5Z2F0ZTEQMA4GA1UECxMHQWx0dmlldzEQMA4GA1UE
H1OkihMe0Ny94uj8a6ccMJ+1kRj2grVmaw8tJi+6G76NXhvZvwumfHZMtnhKUKth
Mf3XLTukzlz5LqoVJzuDoLQVcm7Ddx0iff+FLwRhsjl53KQqoRYucLOopirXYc6R
8T+XMo3tkd4q=
-----END RSA PRIVATE KEY-----
```

In order to maintain compatibility with industry standards, HP has adopted the RSA crypto-system method of obtaining certificate requests. The RSA crypto-system is a public key crypto-system that offers encryption and digital signatures (authentication). In the private key shown above the key type (**RSA**) is indicated at the beginning and end of the file.

Summary

- HP provides a *Certificate Generation Utility* that makes it easy to create self-signed certificates.
- There are three ways to generate a signed certificate:
  - *Self-signing*
  - Via a *generated CA*
  - Via a *trusted CA*
- To get a signed certificate from a CA, you need a *Server Certificate Request (SCR) file*.

Configuration and Use

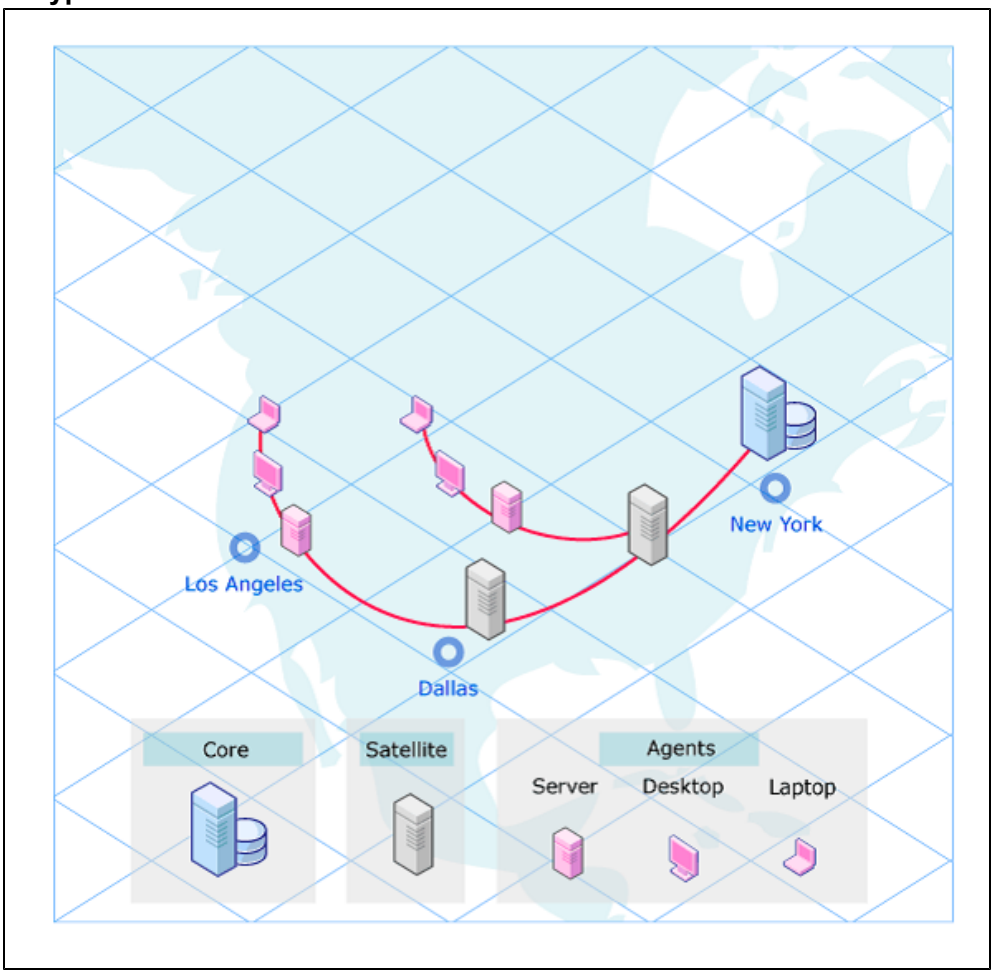
Caution: If your environment uses Core and Satellite servers, first read the *HP Client Automation Enterprise Edition Getting Started and Concepts Guide* as the installation, configuration, and troubleshooting information in that guide may override the information in this guide.

Core and Satellite Overview

This section describes how to implement SSL functionality in your Core and Satellite HPCA environment in order to secure the communications between HPCA servers and HPCA agents.

The consolidated Core and Satellite configuration simplifies configuration of SSL certificates.

A Typical HPCA Environment



Configuring Core and Satellite with SSL Certificates

A single screen is used to configure SSL certificates in the HPCA Core and Satellite environment. Follow these steps to enable and configure SSL for the HPCA Server:

1. In the HPCA Console, click **Configuration** tab.
2. In the left pane, click **Infrastructure Management** > **SSL**.

3. In the SSL Server area, select the **Enable SSL** check box.
4. Select whether to **Use existing certificates** or **Upload new certificates**.
   If Upload new certificates is selected, click **Browse** to navigate to and select Private Key File name and Server Certificate File name.
5. Click **Save**.

HPCA Agents

Secure (SSL) communications are supported on the following HPCA agents.

- HP Client Automation Application Manager agent (Application Manager)
- HP Client Automation Application Self-service Manager agent (Application Self-service Manager), see "HPCA Application Self-service Manager Agent" (on page 20)
- HP Client Automation Inventory Manager agent (Inventory Manager)
- HP Client Automation Patch Manager agent (Patch Manager agent)

To enable SSL communications with a Configuration Server for these HPCA agents, pass `SSLMGR` and `SSLPORT` with the appropriate values on a `RADSKMAN` command line, as in:

```
Radskman sslmgr=host,sslport=443
```

HPCA Application Self-service Manager Agent

For the Application Self-service Manager, setup `sslmanager` and `sslport` tags in the `ARGS.XML` file, as in:

```
<SSLMANAGER>localhost</SSLMANAGER>

<SSLPORT>443</SSLPORT>
```

Summary

- You can configure Core and Satellite with SSL certificates.
- You can enable secure communication on HPCA agents.

Command Line Options for the Certificate Generation Utility

The table Options for cert_mgr create and Options for cert_mgr import describe the options that can be used with the `cert_mgr create` and `cert_mgr import` commands that are described in Chapter 2, "Setting up Certificates for SSL" (on page 13).

Options for cert_mgr create

Option	Description	Default
`-hostname`	Host name of the server for which you will create the certificates.	Simple host name of the system on which you are running `cert_mgr`.
`-trustpass`	The password for the truststore.	changeit
`-rndbytee`	Size of the random bytes when creating the random file that will be used to create the private key for the server certificate.	2048 bytes
`-keysize`	Size of the server's private key in bits.	1024 bits
`-keypass`	The password for the server's certificate when it is added to the keystore.	secret
`-days`	The number of days the server's certificate will be valid.	9999 days
`-carndbytes`	Same as `rndbytes`, but for the CA.	2048 bytes
`-cakeysize`	Same as `keysize`, but for the CA.	1024 bytes
`-cadays`	Same as `days`, but for the CA.	9999 days

Options for cert_mgr import

Option	Description	Default
`-hostname`	Host name of the server for which you will create the certificates.	Simple host name of the system on which you are running `cert_mgr`.
`-signedcert`	The fully qualified path and file name of the signed certificate that was returned by the CA.	
`-signercert`	The fully qualified path and file name to the certificate of the signing CA. Used when importing a certificate via the Certificate Generation Utility.	

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