CAPLIN

KeyMaster 4.4

Administration Guide

May 2009

Contents

1 Preface

1.1 What this document contains

This document describes how to configure and operate Caplin's KeyMaster product, version 4.4, to provide a secure and reliable user authentication service.

About Caplin document formats

This document is supplied in three formats:

- Portable document format (*.PDF* file), which you can read on-line using a suitable PDF reader such as Adobe Reader®. This version of the document is formatted as a printable manual; you can print it from the PDF reader.
- Web pages (*.HTML* files), which you can read on-line using a web browser. To read the web version of the document navigate to the *HTMLDoc_m_n* folder and open the file *index.html*.
- Microsoft HTML Help (*.CHM* file), which is an HTML format contained in a single file.
  To read a *.CHM* file just open it – no web browser is needed.

For the best reading experience

On the machine where your browser or PDF reader runs, install the following Microsoft Windows® fonts: Arial, Courier New, Times New Roman, Tahoma. You must have a suitable Microsoft license to use these fonts.

Restrictions on viewing .CHM files

You can only read *.CHM* files from Microsoft Windows.

Microsoft Windows security restrictions may prevent you from viewing the content of *.CHM* files that are located on network drives. To fix this either copy the file to a local hard drive on your PC (for example the Desktop), or ask your System Administrator to grant access to the file across the network. For more information see the Microsoft knowledge base article at
http://support.microsoft.com/kb/896054/.

1.2 Who should read this document

This document is intended for System Administrators who need to deploy Caplin Liberator within an existing single sign-on system or authentication service. It is assumed that the reader has an understanding of network systems, running Java programs from the command line, and using application servers such as Tomcat, JBoss, or BEA WebLogic.

1.3 Related documents

- **KeyMaster Overview**

  This document describes what KeyMaster is and what it can be used for, the architecture of the product, how it fits into the overall Caplin product architecture and third party/customer systems, and key concepts relating to the product. It also gives some examples of how the product can be used in real business situations.

- **Javadoc reference documentation for the Caplin KeyMaster SDK**

  This document defines the public Java classes and interfaces available in KeyMaster. Refer to it when customizing KeyMaster code.

- **XML Auth Administration Guide**

  This document describes the XMLauth Module, and how it enables programmers and system administrators to use XML to create their own permissioning structures and control entitlement to objects held on Caplin Liberator.

- **Liberator Administration Guide**

  This document describes how to install and configure the Caplin Liberator server. It includes full reference information for the Liberator configuration.

- **Liberator Authentication SDK Documentation**

  This document describes how to implement custom authentication modules for Liberator, in C code.

- **Liberator Java Authentication SDK Documentation (javadoc)**

  This document describes the library of classes (javaauth) that enables developers to create custom authentication modules for Liberator in Java.

- **StreamLink for Browsers SDK Documentation**

  This document defines the StreamLink for Browsers API and how to configure it.

1.4 Typographical conventions

The following typographical conventions are used to identify particular elements within the text.

Type	***Uses***
aMethod	Function or method name
aParameter	Parameter or variable name
/AFolder/Afile.txt	File names, folders and directories
`Some code;`	Program output and code examples
The `value=10` attribute is...	Code fragment in line with normal text
Some text in a dialog box	Dialog box output
`Something typed in`	User input – things you type at the computer keyboard
XYZ Product Overview	Document name
◆	Information bullet point
■	Action bullet point – an action you should perform

Note:	Important Notes are enclosed within a box like this. Please pay particular attention to these points to ensure proper configuration and operation of the solution.

Tip:	Useful information is enclosed within a box like this. Use these points to find out where to get more help on a topic.

1.5 Feedback

Customer feedback can only improve the quality of our product documentation, and we would welcome any comments, criticisms or suggestions you may have regarding this document.

Please email your feedback to documentation@caplin.com.

1.6 Acknowledgments

Adobe® Reader is a registered trademark of Adobe Systems Incorporated in the United States and/or other countries.

Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

Sun, *Solaris and Java*, are trademarks or registered trademarks of Sun Microsystems, Inc. in the U.S. or other countries.

Linux® is the registered trademark of Linus Torvalds in the U.S. and other countries.

RSA® is a registered trademark of RSA Security Inc.

nCipher is a trademark or registered trademark of nCipher Corporation Ltd.

thawte is a registered trademark of VeriSign in the United States and/or other countries.

1.7 Open Source Software

This Caplin component incorporates the following Open Source software:

Open Source item	**Use in KeyMaster**	**Further information**
Public key encryption software from The Legion Of The Bouncy Castle.	Used in Standard KeyMaster to generate encryption key pairs, and encrypt and decrypt digital signatures using these keys.	www.bouncycastle.org

2 Overview

Caplin KeyMaster is used to integrate Caplin Liberator with an existing single sign-on system, so that end users do not need to explicitly log in to a Liberator in addition to their normal log in procedure. It provides a more secure and convenient authentication method than just using simple user names and passwords.

KeyMaster implements a secure method of user authentication via a user credentials token that is digitally signed using public key encryption.

It comprises two tools for enabling users to be authenticated: a key generator and a signature generator.

- **Key Generator**

  The Key Generator is a Java application used to create an encryption key pair; one key is the private key and the other is the public key. KeyMaster uses the private key to sign a user credentials token that authenticates a user's access to the Liberator. The public key is exported to the data provider's Liberator for use during the authentication process.

- **Signature Generator**

  The Signature Generator creates a user credentials token, which it digitally signs (encrypts) using the KeyMaster private key. This token is used by a Liberator to validate an end-user's login to the server.

  The Signature Generator is usually an application server module. A useable Signature Generator is provided with the KeyMaster product, as a Java servlet. You can customize this servlet as required, or you can use it to guide the design of a similar module in another technology.

Subsequent sections of this guide describe how to configure and operate these two tools.

Note: If you are unfamiliar with KeyMaster, you are recommended to read the **KeyMaster Overview** before reading this Administration Guide.

3 Technical assumptions and restrictions

Platforms and Java

KeyMaster is supported on the following operating systems:

- Linux®
- Sun® Solaris™
- Microsoft® Windows® XP
- Microsoft Windows 2000
- Microsoft Windows 2003 Server

All these platforms must run the Java Runtime Environment (JRE™) or Java Development Kit (JDK™). The Java version must be at least the greater of:

- Java version 1.4
- The minimum Java version specified for the web application server under which KeyMaster will be deployed.

Encryption software

The following encryption software is used in Standard KeyMaster:

- Public key encryption software from The Legion Of The Bouncy Castle

  See Open Source Software 3.
- The Key Generator generates the key pair using the Sun® **SHA1PRNG** secure random number generator and the RSA® key pair generation algorithm.
- Digital signatures are generated using the **MD5withRSA** algorithm.

  For an explanation of this algorithm see the **KeyMaster Overview**.

Web application server versions

The instructions in this document for deploying KeyMaster on various web application servers (see Deploying KeyMaster 11) assume the following server versions:

Server	Minimum version
Tomcat	5.0.16
JBoss	4.0.0
BEA WebLogic	8.1

4 Installing KeyMaster

4.1 Important note on security of installation

Note: The instructions in this guide describe how to set up KeyMaster so that it can be tested easily. *However, in this state KeyMaster is not secure, and it should not be used in a production environment*.
To deploy KeyMaster securely you will need to integrate it with your single sign-on system in a way that is compliant with your organization's security policies, and is compatible with the web application server that hosts the KeyMaster servlets.
For more information, see Making KeyMaster production ready 34.

To ensure that KeyMaster is deployed in a highly secure manner, you may wish to store the private keys in a dedicated secure hardware module (a "**Key Store**"), instead of on disk. To do this:

- Follow the installation and configuration instructions for Standard KeyMaster:
  - Installing KeyMaster 6
  - Deploying KeyMaster 11
  - Setting up Liberator to work with KeyMaster 23
  - Testing KeyMaster with Liberator 29)
- Then follow the instructions in Integrating KeyMaster with a hardware Key Store 36.

4.2 Prerequisites

- Before installing KeyMaster on your machine, make sure there is a suitable version of the Java Runtime Environment (JRE) or Java Development Kit (JDK) installed; see Technical assumptions and restrictions 5.

Note: On Microsoft Windows platforms there is a Microsoft version of the Java Virtual Machine (JVM) built into some versions of Windows Internet Explorer®. However, the web application server may not be able to run using this JVM. Check the installation requirements for your web application server – you may need to install the JRE or JDK from Sun Microsystems.
See Technical assumptions and restrictions 5.

4.3 Installing on Linux or Sun Solaris

The install kit is contained in a zip file called *KeyMaster-<version_number>.zip*

1. Copy the zip file to a base directory where you want the installed software to be located, such as */apps/caplin*

   Make sure that the directory and its sub-directories are accessible from your chosen application server (see Deploying KeyMaster 11).

2. Unzip the file:

```
unzip KeyMaster-<version_number>.zip
```

The software will be unzipped into a new directory
/KeyMaster-<version_number>
under your base directory,
for example */apps/caplin/KeyMaster-4.4.0*

Note: In the rest of this guide the directory where the KeyMaster software is located is referred to as *$KM_INSTALL_DIR*
For example, *$KM_INSTALL_DIR* could refer to
/apps/caplin//KeyMaster-4.4.0

Tip: When you have finished installing KeyMaster read the release note
$KM_INSTALL_DIR/RELEASENOTE.txt
before proceeding any further.

■ Now see the section Installed Files 8.

4.4 Installing on a Windows platform

The install kit is contained in a zip file called *KeyMaster-<version_number>.zip*

1. Copy the zip file to a base directory where you want the installed software to be located, such as *C:\Program Files\apps\Caplin*

   Make sure that the directory and its sub-directories are accessible from your chosen application server (see Deploying KeyMaster 11).
2. Unzip the file using a suitable zip utility

The software will be unzipped into a new directory
\KeyMaster-<version_number> under your base directory,
for example *C:\Program Files\apps\Caplin\KeyMaster-4.4.0*

Note: In the rest of this guide the directory where the KeyMaster software is located is referred to as *$KM_INSTALL_DIR*
For example, *$KM_INSTALL_DIR* could refer to
C:\Program Files\apps\Caplin\KeyMaster-4.4.0

Tip: When you have finished installing KeyMaster read the release note
$KM_INSTALL_DIR\RELEASENOTE.txt
before proceeding any further.

■ Now see the section Installed Files 8.

4.5 Installed Files

KeyMaster-4.4.x-xx.zip contains the following files:

- *examples/flatfile/FlatFileServlet.java*
- *examples/keygen.props*
- *examples/keyimporter/KeyImporter.java*
- *examples/keyimporter/KeyImportVerifier.java*
- *examples/keyimporter.props*
- *examples/news/NewsFormatter.java*
- *examples/usercredentials/ExampleCredentialsProvider.java*
- *doc/* (*The KeyMaster documentation set)
- *deploy/keymaster.war*
- *lib/keyMaster.jar*
- *lib/bcprov-jdk<version>.jar (*The BouncyCastle encryption JAR)
- *RELEASENOTE.txt*
- *README.txt*

■ Check the release notes in *RELEASENOTE.txt* for important information about the KeyMaster release that you are installing.

■ Now follow the instructions in Generating the required keys 8.

4.6 Generating the required keys

KeyMaster uses three encryption key files: a public key file, a private key file, and a DER key file (which is a binary version of the public key). These key files must be generated before KeyMaster authentication can be used.

Follow these steps to generate the keys:

1. Make sure you have the following JAR files. These should be present in the *lib* directory of your KeyMaster installation:
   - The BouncyCastle encryption JAR (*bcprov-jdk<version>.jar*).
   - The KeyMaster JAR containing all the classes KeyMaster needs to execute (*keymaster.jar*).
2. KeyMaster uses a properties file *keygen.props* that is used to initialize and configure the Key Generator. There is an example *keygen.props* file in *$KM_INSTALL_DIR/examples/*. You can use this file for your KeyMaster installation, if it is suitable for your needs. Alternatively you can create your own version of this file; refer to the keygen.props configuration reference 54.

Note: The rest of this installation guide assumes the names of the encryption key files are as defined in the example version of *keygen.props*, namely *privatekey.store*, *publickey.store* and *publickey.der*

3. Check whether *$KM_INSTALL_DIR* contains existing key files that have the same name as the key files that are going to be created. For example, if you are going to use the example *keygen.props* properties file provided with the install kit, then check *$KM_INSTALL_DIR* for files called *privatekey.store*, *publickey.store* and *publickey.der*. If any or all of these files are already present then delete, move or rename them.

4. Now run the Key Generator. This is the Java class **com.caplin.keymaster.keygenerator.KeyGenerator,** included in *$KM_INSTALL_DIR/lib/keymaster.jar*

   The Key Generator requires two command line arguments:

   - The name of the properties file that will be used to create the keys
   - An identifier for the key

   The identifier can be set to any string value. It will be referred to in the *web.xml* file that configures the KeyMaster Signature Generator servlet used to generate user credentials tokens – see Modifying the web.xml configuration file 16.

The format of the command to run the Key Generator is:

On Linux or Sun Solaris:

```
java -classpath lib/bcprov-jdk14-125.jar:lib/keymaster.jar
com.caplin.keymaster.keygenerator.KeyGenerator <properties-file> <key-identifier>
```

On Windows:

```
java -classpath lib/bcprov-jdk14-125.jar;lib/keymaster.jar
com.caplin.keymaster.keygenerator.KeyGenerator <properties-file> <key-identifier>
```

Run the command from the *$KM_INSTALL_DIR* directory.

For example, to run the Key Generator using the example properties file, the command is:

On Linux or Sun Solaris:

```
java -classpath lib/bcprov-jdk14-125.jar:lib/keymaster.jar
com.caplin.keymaster.keygenerator.KeyGenerator examples/keygen.props keyid1
```

On Windows:

```
java -classpath lib/bcprov-jdk14-125.jar;lib/keymaster.jar
com.caplin.keymaster.keygenerator.KeyGenerator examples/keygen.props keyid1
```

If the command runs successfully the Key Generator displays this message:

```
"Retrieved a KeyStoreElement containing a public key from input key store
 for name keyid1"
```

Tip: Make a note of the key identifier that you specified in the key generator command (`keyid1` in the example above). You will need it later when you set up the *web.xml* file that configures the

KeyMaster Signature Generation servlet.
See Modifying the web.xml configuration file 16, and the parameter `encrypting.generator.key.identifier` in web.xml parameters 66.

$KM_INSTALL_DIR should now contain the newly generated key files: *privatekey.store*, *publickey.store* and *publickey.der*.

If a key file with the same name as that specified in *keygen.props* already exists in *$KM_INSTALL_DIR,* then the Key Generator will overwrite the old key file and will display messages of the following form:

```
Adding the private key replaced the existing key for the same server:
com.caplin.keymaster.encrypted.PrivateKeyStoreElement@d1fa5
Retrieved a KeyStoreElement containing a public key from input key store
for name keyid1
Adding the public key replaced the existing key for the same server:
com.caplin.keymaster.encrypted.PublicKeyStoreElement@134e4fb
```

5 Deploying KeyMaster

The following sections explain how to deploy KeyMaster on a number of different application servers. Once you have installed and configured the server, and configured KeyMaster to work with the server, the run-time module of KeyMaster will be able to generate user credentials tokens for the server to pass back to requesting clients.

5.1 Deployment on a Tomcat server

To deploy KeyMaster on a Tomcat web application server, carry out the following steps. These instructions assume you are deploying KeyMaster on a Tomcat server running under Linux or Sun Solaris.

Note: Make sure your version of the Tomcat server is at least the minimum specified in Technical assumptions and restrictions 5.

1. Install Tomcat to your desired directory (called *$SERVER_HOME* in the rest of these instructions) and configure it as required.
2. You may want to start up Tomcat to test that it is working. If you do, then shut it down before proceeding with the next steps.
   - Start the Tomcat server by going to the directory *$SERVER_HOME/bin* and entering the command:
     ```
     ./startup.sh
     ```
   - To stop the Tomcat server, go to the directory *$SERVER_HOME/bin* and enter the command:
     ```
     ./shutdown.sh
     ```
3. Open the *$SERVER_HOME* directory.
4. Go to the directory *webapps*.
5. Copy the file *$KM_INSTALL_DIR/deploy/keymaster.war* to the current directory (*webapps*).

   The *keymaster.war* file contains files relating to the KeyMaster Signature Generator that will be unpacked into a directory called *keymaster* and used at run time.
6. Check whether the *webapps* directory already contains a directory called *keymaster*. If it does, then either delete the *keymaster* directory or change its name, as appropriate.
7. Start the Tomcat server.
8. Tomcat will now deploy the *keymaster.war* file and create the required KeyMaster structures in *$SERVER_HOME/webapps/keymaster/*
9. Go to the directory *$SERVER_HOME/webapps/keymaster/WEB-INF/*
   This directory contains a configuration file called *web.xml*. This file needs to be edited, so that KeyMaster knows where to find the private encryption key in order to generate user credentials tokens.
   - Follow the instructions in Modifying the web.xml configuration file 16.

5.2 Deployment on a JBoss server

To deploy KeyMaster on a JBoss web application server, carry out the following steps. These instructions assume you are deploying KeyMaster on a JBoss server running under Linux or Sun Solaris.

Note: Make sure your version of the JBoss server is at least the minimum specified in Technical assumptions and restrictions 5.

1. Install JBoss to your desired directory (called *$SERVER_HOME* in the rest of these instructions) and configure it as required.
2. You may want to start up JBoss to test that it is working. If you do, then shut it down before proceeding with the next steps.
   - Start the JBoss server by going to the directory *$SERVER_HOME/bin* and entering the command:
     ```
     ./run.sh
     ```
     Control will not be returned to your command window until you have stopped the server.
   - To stop the JBoss server, enter the command:
     ```
     ctrl/C
     ```
3. Open the *$SERVER_HOME* directory.
4. Go to the directory *server/default/deploy/*
5. Create a directory called *keymaster.war* and go to this directory.
6. Copy the file *$KM_INSTALL_DIR/deploy/keymaster.war* to the current directory (*keymaster.war*).

   The *keymaster.war* file contains files relating to the KeyMaster Signature Generator that will be unpacked into a directory called *keymaster* and used at run time.
7. Extract the files from the *keymaster.war* file, using the Java jar command:
   ```
   jar -xvf keymaster.war
   ```
8. Go to the directory *$KM_INSTALL_DIR/deploy/WEB-INF*.
   In this directory is a configuration file called *web.xml*. This file needs to be edited so that KeyMaster knows where to find the private encryption key in order to generate user credentials tokens.
   - Follow the instructions in Modifying the web.xml configuration file 16.

5.3 Deployment on a BEA WebLogic server

This section explains how to implement a basic deployment of KeyMaster on a BEA WebLogic application server.

Deployment on WebLogic 9.1

To deploy KeyMaster on a BEA WebLogic 9.1 application server, carry out the following steps.

Set up KeyMaster files

1. Create a KeyMaster deployment directory path in a location that can be accessed by the WebLogic server. The name of the lowest level directory in the path should be *keymaster.war*.

   For example */Caplin/KeyMasterDeploy/keymaster.war/*

   Go to this directory
2. Copy the file *$KM_INSTALL_DIR/deploy/keymaster.war* to the current directory (*keymaster.war*).

   The *keymaster.war* file contains files relating to the KeyMaster Signature Generator that will be unpacked into a directory called *keymaster* and used at run time.
3. Extract the files from the *keymaster.war* file, using the Java jar command:

   ```
   jar -xvf keymaster.war
   ```
4. Copy the private encryption key file *privatekey.store* key from *$KM_INSTALL_DIR* to the top level of the KeyMaster deployment directory.

   For example, copy the key file to */Caplin/KeyMasterDeploy/*

Deploy KeyMaster in WebLogic

1. Start the WebLogic server for the domain you wish to use

   The example domain installed with WebLogic version 9.1 is *wl_server*.
4. Start up the Server Administration Console by opening a web browser and entering a URL of the form:

   ```
   http://server-address:7001/console
   ```

   (Assuming that you have not changed the default port number of 7001.)
5. Log in and then under 'Domain Structure' click the link for 'Deployments'.
6. Click the Lock & Edit button to enable the Install button, then Click the Install button.
7. Browse to *$KM_INSTALL_DIR/deploy/* and select the *keymaster.war* file.
8. Click Next.

   A page called 'Choose targeting style' is displayed.
9. Select the choice labeled 'Install this deployment as an application'
   and click Next.

   The 'Optional Settings' page is displayed.

10. The default deployment settings will be used, so click Next

    The 'Review your choices page' is displayed.

    The summary of choices will look like this:

    > **Deployment:** <file-path-to-KeyMaster-deployment>/keymaster.war
    > **Name:** KeyMaster
    > **Staging mode:** Use the defaults defined by the chosen targets
    > **Security Model:** DDOnly: Use only roles and policies that are defined in the deployment descriptors.

11. Click the Finish button.

    The 'Settings for KeyMaster page' is displayed.

12. Click the Save button.

    The message 'Settings updated successfully' should be displayed in the Messages area at the top of the page.

13. There will be a message in the Change Center bar on the top left hand side of the page:
    'Pending changes exist. They must be activated to take effect.'

    Click the Activate Changes button (located below the message).

14. Now start the KeyMaster web application as follows:
15. Click on the Control tab

    The displayed page should show that the KeyMaster application is in the state 'Prepared'.

16. Click the Lock & Edit button, to enable the Start button.
17. Select the KeyMaster application
18. Click the Start button and select 'Servicing all requests'.

    The 'Start Application Assistant' page is displayed.

19. Click the Yes button

    The message 'Start requests have been sent to the selected Deployments' should be displayed in the Messages area at the top of the page.

    The KeyMaster state should now be 'Active'.

20. Click the Release Configuration button
21. Close down the WebLogic Administration Console by clicking on the Log out tab.
22. Go to the directory *$KM_INSTALL_DIR/deploy/WEB-INF*.
    In this directory is a configuration file called *web.xml*. This file needs to be edited so that KeyMaster knows where to find the private encryption key in order to generate user credentials tokens.

    Follow the instructions in Modifying the web.xml configuration file 16.

Deployment on WebLogic 8.1

To deploy KeyMaster on a BEA WebLogic 8.1 application server, carry out the following steps.

1. Start the server for the domain you wish to use (the example domain installed with WebLogic is *mydomain*).
2. Open up a web browser and go to the URL of the console for the desired domain.

   For example:

   ```
   http: //xyz: 7001/console
   ```

   (Assuming that the default port number has not been changed.)
3. Log in and then go to "Your Deployed Resources" and underneath click the link for "Applications".
4. Select "Deploy a new Application" and then click on applications.
   Following this click on "upload your files".
5. A screen that tells you the types of files you can upload will now be displayed.
   KeyMaster currently has a war format .
6. Browse to the location of the *keymaster.war* file and then select "open".
   Now click the upload button and the file will be copied to the relevant location.
7. The server will extract the files from the *.war* file and put them in
   /mydomain/myserver/stage/_appsdir_keymaster_war/keymaster.war/WEB-INF/
8. One of the files extracted to the *WEB-INF* directory is called *web.xml*. This file needs to be edited, so that KeyMaster knows where to find the private encryption key in order to generate user credentials tokens.

   Follow the instructions in Modifying the web.xml configuration file 16.

5.4 Modifying the web.xml configuration file

The *web.xml* configuration file needs to be edited, so that the KeyMaster Signature Generator servlet knows where to find the private encryption key in order to generate user credentials tokens. You also specify in here the servlet's error logging environment.

The *web.xml* file is located in a directory of your web application server; the precise directory path depends on which application server you are using, but it usually ends in *WEB-INF/*. For example, if KeyMaster is deployed on a Tomcat application server, *web.xml* is in the directory *$SERVER_HOME/webapps/keymaster/WEB-INF/*.

Edit *web.xml* as follows:

1. Find the entry called `encrypting.generator.private.key.store.filename`:

```
<init-param>
    <param-name>encrypting.generator.private.key.store.filename</param-name>
    <param-value>privatekey.store</param-value>
    <description>File name and location for the private key</description>
</init-param>
```

   Change the content of the `<param-value>` tag to specify the name and location of the previously created private key file (see Generating the Required Keys 8). The directory will normally be the *$KM_INSTALL_DIR* directory, but it may be a different location depending on the application server being used (see the deployment instructions for your application server in Deploying KeyMaster) 11.

Example:

```
<init-param>
    <param-name>encrypting.generator.private.key.store.filename</param-name>
    <param-value>/Caplin/KeyMaster/privatekey.store</param-value>
    <description>File name and location for the private key</description>
</init-param>
```

   In this example the *$KM_INSTALL_DIR* directory is */Caplin/KeyMaster/*

2. Find the entry called `encrypting.generator.key.identifier.`
   This needs to be changed to the key identifier that was passed as the second argument to the KeyMaster Key Generator when the key was created (see Generating the required keys 8).

Example:

```
<init-param>
   <param-name>encrypting.generator.key.identifier</param-name>
   <param-value>keyid1</param-value>
   <description>Name of the server the token is generated for.</description>
</init-param>
```

3. Change the name and location of the KeyMaster Signature Generator servlet's error log file as required.

   This is specified in the *web.xml* entry called `key.generator.FilenameAttribute`. If the entry does not contain a file path, then the log file will be located in a default directory whose location depends on the type of web application server:

   - On a Tomcat or JBoss server this is the '*bin*' directory where the web application server was started.
   - On a BEA WebLogic server this is the domain directory where WebLogic was started.

Example:

```
<init-param>
   <param-name>key.generator.FilenameAttribute</param-name>
   <param-value>servlet.log</param-value>
   <description>KeyMaster log file</description>
</init-param>
```

4. Specify the KeyMaster Signature Generator servlet's logging level.

   The logging level is specified in the *web.xml* entry called `key.generator.Level`. The level should be one of the logging levels defined in the Java class **java.util.logging.Level**. It is recommended that you initially set the logging level to `ALL`, so that KeyMaster will record the maximum amount of information about any installation problems. When you are satisfied that KeyMaster is behaving correctly, it is recommended that you change the logging level to `WARNING`. For more information on setting logging levels see the Servlet Configuration section in the **Javadoc reference documentation for the Caplin KeyMaster SDK**.

Example:

```
<init-param>
   <param-name>key.generator.Level</param-name>
   <param-value>ALL</param-value>
   <description>KeyMaster logging level</description>
</init-param>
```

Tip: For more information on configuring the KeyMaster servlet in the *web.xml* file, see the web.xml configuration reference 58 section.

5. If you want client applications to access the KeyMaster servlet from a different URL, follow the instructions in Changing KeyMaster's URL 18.

6. For the configuration changes to take effect, you will need to reload the KeyMaster web application and possibly restart the application server.

   If you are deploying KeyMaster to a newly installed JBoss server, start the server once you have modified *web.xml.*

7. Now check that KeyMaster has been correctly deployed on the web application server, by following the instructions in Testing KeyMaster with the application server 21.

Changing KeyMaster's URL

Standard KeyMaster's Signature Generator servlet is accessed from clients through the the URL `/servlet/StandardKeyMaster`. You may wish to access this servlet from a different URL; for example, because you have customized the servlet and wish to distinguish it from the standard one.

To configure a different URL, edit the *web.xml* configuration file, as follows:

1. Find the `<servlet-mapping>` tag with the child `<servlet-name>` tag whose content is `"StandardKeyMaster"`:

```
<servlet-mapping>
   <servlet-name>StandardKeyMaster</servlet-name>
   <url-pattern>/servlet/StandardKeyMaster</url-pattern>
</servlet-mapping>
```

   Change the URL in the `<url-pattern>` tag that follows the `<servlet-name>` to the new URL:

```
<servlet-mapping>
   <servlet-name>StandardKeyMaster</servlet-name>
   <url-pattern>/servlet/CustomizedKeyMasterName</url-pattern>
</servlet-mapping>
```

2. If client applications will access KeyMaster through StreamLink for Browsers 4.5.2 or later (for example, when the client application is Caplin Trader Client version 1.4.2 or later), you must also declare the new URL for access by the XHRKeymaster servlet.

   Find the `<servlet-name>` defining `XHRKeymaster`, and locate the child `<param-name>` tag defining the parameter `keymaster.url`:

```
<servlet-name>XHRKeymaster</servlet-name>
<init-param>
   <param-name>keymaster.url</param-name>
   <param-value>/servlet/StandardKeyMaster</param-value>
   <description>The url of the Standard KeyMaster page,
                for XHRKeyMaster to attach to.</description>
</init-param>
```

   Change the `<param-value>` to the new URL of the customized KeyMaster:

```
<servlet-name>XHRKeymaster</servlet-name>
<init-param>
   <param-name>keymaster.url</param-name>
   <param-value>/servlet/CustomizedKeyMasterName</param-value>
   <description>The url of the customized KeyMaster page,
                for XHRKeyMaster to attach to.</description>
</init-param>
```

Also see the web.xml configuration reference 58 section, and the definition of the *web.xml* parameter `keymaster.url` 77

Changing the KeyMaster Poll servlet's URL

When clients access KeyMaster through StreamLink for Browsers version 4.5.2 or later (for example, when the client application is Caplin Trader Client version 1.4.2 or later), StreamLink for Browsers accesses a servlet called Poll at regular intervals, so as to keep the session with the KeyMaster servlet alive.

If you wish to access the Poll servlet from a different URL, you must configure the URL by editing the *web.xml* configuration file, as follows:

1. Find the `<servlet-mapping>` tag with the child `<servlet-name>` tag whose content is `"Poll"`:

```
<servlet-mapping>
   <servlet-name>Poll</servlet-name>
   <url-pattern>/servlet/Poll</url-pattern>
</servlet-mapping>
```

   Change the URL in the `<url-pattern>` tag that follows the `<servlet-name>` to the new URL:

```
<servlet-mapping>
   <servlet-name>Poll</servlet-name>
   <url-pattern>/servlet/newPollLocation</url-pattern>
</servlet-mapping>
```

2. You must also declare the Poll servlet's new URL for access by the XHRKeymaster servlet.

   Find the `<servlet-name>` defining `Poll`, and locate the child `<param-name>` tag defining the parameter `keymaster.poll.url`:

```
<servlet-name>XHRKeymaster</servlet-name>
<init-param>
   <param-name>keymaster.poll.url</param-name>
   <param-value>/servlet/Poll</param-value>
   <description>The url of the KeyMaster polling page,
                for XHRKeyMaster to attach to.</description>
</init-param>
```

   Change the `<param-value>` to the new Poll URL:

```
<servlet-name>XHRKeymaster</servlet-name>
<init-param>
   <param-name>keymaster.poll.url</param-name>
   <param-value>/servlet/newPollLocation</param-value>
   <description>The url of the KeyMaster polling page,
                for XHRKeyMaster to attach to.</description>
</init-param>
```

Also see the web.xml configuration reference 58 section, and the definition of the *web.xml* parameter `keymaster.poll.url` 78

Changing the KeyMaster Dependencies servlet's URL

When clients access KeyMaster through StreamLink for Browsers version 4.5.2 or later (for example, when the client application is Caplin Trader Client version 1.4.2 or later), KeyMaster uses a servlet called Dependencies.

If you have changed the location of the XHRKeymaster servlet so that its URL is not `/servlet/XHRKeymaster`, you must change the location of the Dependencies servlet to match the new location of XHRKeymaster.
For example, if XHRKeymaster has been moved to the URL `/mylocation/myservlets/XHRKeymaster`, the Dependencies servlet must be moved to the URL `/mylocation/myservlets/dependencies/*`

Note: Do not rename or modify the Dependencies servlet, otherwise KeyMaster will not work correctly with StreamLink for Browsers.

To specify the new URL for the Dependencies servlet, edit the *web.xml* configuration file, as follows:

- Find the `<servlet-mapping>` tag with the child `<servlet-name>` tag whose content is `"Dependencies"`:

```
<servlet-mapping>
   <servlet-name>Dependencies</servlet-name>
   <url-pattern>/servlet/dependencies/*</url-pattern>
</servlet-mapping>
```

- Change the URL in the `<url-pattern>` tag that follows the `<servlet-name>` to the new URL:

```
<servlet-mapping>
   <servlet-name>Poll</servlet-name>
   <url-pattern>/mylocation/myservlets/dependencies/*</url-pattern>
</servlet-mapping>
```

Also see the web.xml configuration reference 58 section.

5.5 Testing KeyMaster with the application server

1. Start up a web browser.
2. If you are using a Tomcat, JBoss or BEA WebLogic application server, enter the address of your web application server, and (if required) its port number, followed by:

   `/keymaster/servlet/StandardKeyMaster?username=aname`

   where `aname` is any user name.

   For example:

   ```
   http://myserver.abc.com:9127/keymaster/servlet/StandardKeyMaster?
   username=davids
   ```

   (Later on, when you set up the Liberator to work with KeyMaster, you will configure, in the *users.xml* file of XMLauth, the valid set of user names for authentication by KeyMaster – see Modifying the users.xml authorization file 26.)
3. If the test has worked, text with the following format should be displayed on the screen:

```
credentials=ok
username=davids
token=0laUyFtRh1xkrZD85ASoegZtBc4C3gQBivbM
zXADZQHeMl/knTv3vyUUe1azdharQHysA89zMptD+T4F8pGCjkY1tejaq/
VAATgnVkyetjs33NEIulsL0zXaSPxZs8sQ0zOG8v7E/
uV3Da46FB+jmlZ6VwJN7ioQWDD7SYKZaJ8
```

4. If the test fails, any errors will be logged in the servlet log specified in the *web.xml* file.
5. If clients will be accessing KeyMaster through StreamLink for Browsers version 4.5.2 or later (for example, when the client application is Caplin Trader Client version 1.4.2 or later), also follow the instructions in Testing the XHRKeymaster servlet 22.
6. If you are integrating KeyMaster with a hardware Key Store,
   now follow the instructions in Configuring Liberator to use a new public key 47
   otherwise follow the instructions in Setting up Liberator to work with KeyMaster 23.

Testing the XHRKeymaster servlet

This test is only needed if clients will need to access KeyMaster through StreamLink for Browsers version 4.5.2 or later (for example if you are using Caplin Trader Client version 1.4.2 or later). Make sure you have run the general application server test first – see Testing KeyMaster with the application server 21.

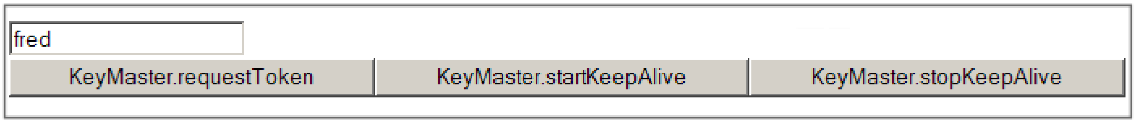
1. In the web browser enter the address of your web application server, and its port number (if required), followed by the relative URL of the XHRKeymaster servlet, which is:

   `/keymaster/servlet/XHRKeymaster`

   For example, enter the web address:

   `http://myserver.abc.com:9127/keymaster/servlet/XHRKeymaster`

   You should see a web page with a single text box, containing the default user name `"fred"` and three buttons. The buttons allow you to test the XHRKeymaster's connection to the StandardKeyMaster.



XHRKeyMaster test page

2. Click the button labeled KeyMaster.requestToken.

   After a short pause, an alert should appear containing text with the following format:

```
Success:  fred
VffpUBLvSArQhJbrTIpJ5aTgaPgbbBLmZuzpp/3niQHMRYVeU/K/+0H1XqJlJEjdH2M9r20p+
XdGGGcMlVsmRDHfcHnzhFN/ASwn/CU2vsIkH6SZMOPAk++AKdSUX8q0Nuj/Zqa54Ip9G65sp
M0VOdM2hxTnIkNkSY0DextmNsw=~20090415120338~1~fred
```

3. If you are integrating KeyMaster with a hardware Key Store,
   now follow the instructions in Configuring Liberator to use a new public key 47
   otherwise follow the instructions in Setting up Liberator to work with KeyMaster 23.

6 Setting up Liberator to work with KeyMaster

Once the encryption keys have been generated (see Generating the Required Keys 8), you need to set up your Liberator so that it can work with KeyMaster.

To do this you:

- make the public key file available to Liberator,
- modify the Liberator configuration file *rttpd.conf*,
- modify the *users.xml* authorization file if the Liberator uses the XMLauth module to authenticate users, or
- modify the *cfgauth.conf* authorization file if the Liberator uses the cfgauth module to authenticate users.

When you have completed the Liberator set up, follow the instructions in Testing KeyMaster with Liberator 29

6.1 Making the public key file available to Liberator

Copy the DER public key file in the KeyMaster *$KM_INSTALL_DIR* directory to Caplin Liberator. The name of this file ends in *.der*, for example *publickey.der*.

Put the file in the */etc* directory of the Liberator installation.

Tip: If you copy the file using FTP (because the KeyMaster and Liberator are on different machines), make sure you use binary mode, as the DER file contains binary data.

6.2 Modifying the Liberator configuration file

Edit the Liberator's configuration file *etc/rttpd.conf* to set up the configuration items that will allow it to work with KeyMaster. These configuration items are:

Liberator configuration item	Description	Required?
signature-validtime	Length of time in seconds for which a user credentials token is valid. This time out applies to any user credentials token that does not have a specific **timeout** configuration item defined for it (see below). The default value of **signature-validtime** is 600 seconds (10 minutes)	No
add-sigkey	Begins a signature key definition group.	Yes
key-id	Identifies this signature key definition group. (Corresponds to a `sigkey-id` attribute in the XMLauth *users.xml* configuration file.)	Yes
timeout	Length of time in seconds for which a user credentials token is valid. This overrides the **signature-validtime** configuration item.	Yes
keyfile	The filename and path of the public key file, in DER (binary) format.	Yes
end-sigkey	Ends the signature key definition group.	Yes
signature-hashsize	The size in buckets of the hash table for storing signature keys. This configuration item can be changed to tune the Liberator's performance when authorizing users; set it to twice the number of user credentials tokens that are likely to be created within the configured time out period (as defined by the configuration items **signature-validtime** and **timeout**).	No Default = 8192 buckets
signing-algorithm	The algorithm to use for validating the digital signature in user credentials tokens provided by KeyMaster. This configuration item must be changed to sha256 if KeyMaster has been configured to generate tokens using the SHA256withRSA algorithm (see the *web.xml* parameter `encrypting.generator.signature.algorithm` in web.xml parameters 66). **Note:** The **signing-algorithm** configuration parameter is only available in Liberator versions 4.5.7 and above. The only supported values are md5 and sha256. Earlier versions of Liberator use the MD5withRSA digital signature algorithm, which is compatible with KeyMaster's default setting.	No Default = md5

The most important configuration item is `add-sigkey` and its children. The `add-sigkey ... end-sigkey` configuration item group defines a public key. Liberator uses this key when it authenticates a user by verifying the digital signature in the user credentials token.

Example of add-sigkey:

```
## AUTH ############################################################
#
#

auth-module                 xmlauth

add-sigkey
     key-id                 testkey
     timeout                600
     keyfile                %r/etc/publickey.der
end-sigkey
...
```

- The **key-id** configuration item (`testkey` in this example) identifies this signature key definition group. It is referred to in a `sigkey-id` attribute in the *users.xml* configuration file of XMLauth – see Modifying the users.xml authorization file 26.

Note: The value of **key-id** is *not* related to the key identifier specified in the command that generates the encryption keys (see Generating the Required Keys 8).

- The **timeout** value has been set to 600 seconds in the example. This means that, when a user credentials token has been created, the Liberator will consider it to be invalid after 10 minutes. An end user must therefore connect to the Liberator within 10 minutes of KeyMaster granting the token; after this time the Liberator will reject attempts to log in using the token.
- The **keyfile** configuration item must point to the DER key file that was generated using KeyMaster (see Making the public key file available to Liberator 23). The `%r` in the file path means the root directory of the Liberator installation.

6.3 Modifying the users.xml authorization file for XMLauth

If the Caplin Liberator is configured to use the XMLauth user authentication module, then you will need to configure in the *users.xml* file all the users who are authorized to access the Liberator via KeyMaster authentication.

The *users.xml* file is located in the Liberator's */etc* directory. It contains a `<USER>` tag for each authorized user. This file is usually created by a script which interfaces with an existing permissions system (for example DACS).

For each user who is to be authenticated with KeyMaster, add the following attributes to their `<USER>` tag:

XMLauth `<USER>` tag attribute	**Description**
`sigkey-id`	Identifies the public encryption key that is to be used when verifying a user credentials token for this user. This attribute must match a **key-id** configuration item within a signature key definition group (**add-sigkey**) in the Liberator configuration file *etc/ rttpd.conf*. See Modifying the Liberator configuration file 24.
`sigcheck`	Must be set to `"TRUE"`.

Example of the *users.xml* file:

```
<ET_USERS>
   <USER name="admin" pass="admin" logons="2">
   <PERM subject="*" action="grant" />
   </USER>
   <USER name="davids" logons="10"
         sigkey-id="testkey" sigcheck="TRUE">
   <PERM subject="*" action="grant" />
   <PERM subject="/DEMO/*" action="grant" />
   </USER>
</ET_USERS>
```

In this example the user 'davids' (`name = "davids"`) is configured to log in to Liberator using KeyMaster authentication. The `sigkey-id` attribute `"testkey"` refers to the **keyid** configuration item called "`testkey`" in the example Liberator configuration file – see Modifying the Liberator configuration file 24). Therefore, when a client application tries to log user 'davids' in to the Liberator, his user credentials token will be authenticated using the DER format public encryption key in `publickey.der` in the Liberator's `etc/` directory.

The entry for user 'admin' has no `sigkey-id` and `sigcheck`, attributes so 'admin' is configured to log in to the Liberator directly.

Note: When defining a Liberator user who is to be authenticated using KeyMaster, do not assign the user a password – omit the `pass` attribute option from the `<USER>` tag in *users.xml*.

For more information on configuring the *users.xml* file see the **XML Auth Administration Guide** .

6.4 Modifying the cfgauth.conf authorization file

If the Caplin Liberator is configured to use the cfgauth user authentication module, then you will need to configure in the *cfgauth.conf* file all the users who are authorized to access the Liberator via KeyMaster authentication.

The *cfgauth.conf* file is located in the Liberator's */etc* directory.

It contains an `add-user` entry for each authorized user. For each user who is to be authenticated with KeyMaster, add the following options to their `add-user` entry:

cfgauth add-user option	Description
sigcheck	Must be set to `"TRUE"`.
siguser	Identifies the public encryption key that is to be used when verifying a user credentials token for this user. This attribute must match a **key-id** configuration item within a signature key definition group (**add-sigkey**) in the Liberator configuration file *etc/rttpd.conf*. See Modifying the Liberator configuration file 24.

Example of an add-user entry in the *cfgauth.conf* file:

```
add-user
   username davids
   read 0 20 21 22
   licenses 2
   sigcheck TRUE
   siguser testkey
end-user
```

In this example the user 'davids' (`username davids`) is configured to log in to Liberator using KeyMaster authentication. The **siguser** option `testkey` refers to the **key-id** configuration item called "`testkey`" in the example Liberator configuration file – see Modifying the Liberator configuration file 24. Therefore, when a client application tries to log user 'davids' on to the Liberator, his user credentials token will be authenticated using the DER format public encryption key in `publickey.der` in the Liberator's `etc/` directory.

Note: When defining a Liberator user who is to be authenticated using KeyMaster, do not assign the user a password – omit the password option from the **add-user** entry of *cfgauth.conf*.

For more information on configuring the *cfgauth.conf* file see the **Liberator Administration Guide**.

6.5 Configuring a Liberator that uses javaauth authentication

Your Liberator may use authentication that has been developed using the **The Java Authentication SDK** (javaauth). If the authentication uses KeyMaster to provide single sign-on capability, then bespoke code will have been written to integrate KeyMaster with the javaauth implementation. Any configuration required to make Liberator work with KeyMaster will be specific to this implementation. Consult your system developers for information on how to set up the configuration.

7 Testing KeyMaster with Liberator

This section explains how to test that the KeyMaster installation, web application server, and Liberator, all work together properly.

The test involves configuring some test files and then launching a web page. The web page communicates with KeyMaster and Liberator to authenticate a user.

First check that you have set up KeyMaster according to the steps described in Installing KeyMaster 6. In particular make sure that:

- You have created the encryption keys – see Generating the Required Keys 8.
- You have set up the Liberator to accept and validate User Credentials Tokens created by KeyMaster – see Setting up Liberator to work with KeyMaster 23.
- You have deployed the *KeyMaster.war* file – see Deploying KeyMaster 11.
- You have edited the *web.xml* file – see Modifying the web.xml configuration file 16.

7.1 Configuring the test files

The KeyMaster test uses a Real Time Scripting Layer (RTSL) test page, supplied with the installation kit. The RTSL page has two parts, one HTML page called *test.html*, and an accompanying javascript file called
keymaster-config.js. You need to edit both of these files before running the test.

The files are located in the *keymaster* directory of the web applications area in your web application server:

- If you are using a Tomcat server the files are in *$SERVER_HOME/webapps/keymaster/*
- If you are using a JBoss server the files are in *$SERVER_HOME/server/default/deploy/keymaster.war/*
- If you are using a WebLogic server the files are in the *keymaster.war* directory of the KeyMaster deployment area (see Deployment on a BEA WebLogic server 13).

Editing the KeyMaster-config.js file

Edit the *keymaster-config.js* file so that it points to the URL of the Caplin Liberator and specifies a valid user name. The following lines must be changed:

```
var l_sLiberatorUrl = "http://caplin.liberator.address:portNo"
var l_sUser = "validUser";
```

- Change the string assigned to the variable `l_sLiberatorUrl` to the URL of your Liberator.

Note 1: If the Liberator is on a different machine to the web application server, then the Liberator URL must be a fully qualified domain name and port.
The web application server and Liberator must share a common domain. For example, an application server at `myserver.example.com` and a Liberator at `myliberator.example.com` share the domain, `example.com`.
See Protocol and domain compatibility 53.

Example of Liberator URL:

```
var l_sLiberatorUrl = "http://myliberator.abc.com:8127"
```

- Change the string assigned to the variable `l_sUser` to be the name of a valid user that you previously specified in the Liberator's *users.xml* file (see Modifying the users.xml authorization file 26).

Example of Liberator user name:

```
var l_sUser = "davids";
```

Editing the test.html file

Edit the *test.html* file to point to the Liberator's Stream Link for Browsers (SL4B) page:

```
<SCRIPT id="sl4b"
        language="JavaScript"
        src="http://caplin.liberator.address:portNo/sl4b/index.js"
        rttpprovider="javascript"
        credentialsprovider="keymaster"
        configurationfile="keymaster-config.js">
</SCRIPT>
```

The `src` attribute `"http://caplin.liberator.address:portNo/sl4b/index.js"` defines the URL that points to the StreamLink for Browsers source page (*index.js* in the Liberator directory *htdocs/sl4b/*).

- Change the first part of the URL (`http://caplin.liberator.address:portNo/`) to the URL of your Liberator; for example: `http://myliberator.abc.com:8127/`

```
        src="http://myliberator.abc.com:8127/sl4b/index.js"
```

Note 2: If the Liberator is on a different machine to the web application server, then the Liberator URL must be a fully qualified domain name and port.
The web application server and Liberator must share a common domain. For example, an application server at `myserver.example.com` and a Liberator at `myliberator.example.com` share the domain, `example.com`.
See Protocol and domain compatibility 53.

Note 3: Change the URL in place. Do not comment out the existing URL line and add the replacement underneath it, because putting HTML comment tags (`<!-- ... -->`) inside the `<SCRIPT>` tag may cause the JavaScript to execute incorrectly and the test will then fail.

7.2 Launching the test page

- First make sure that your application server and Liberator are both running.
- Now launch the test page:
  1. Start up a web browser.
  2. Enter the address of your web application server and (if required) its port number, followed by:

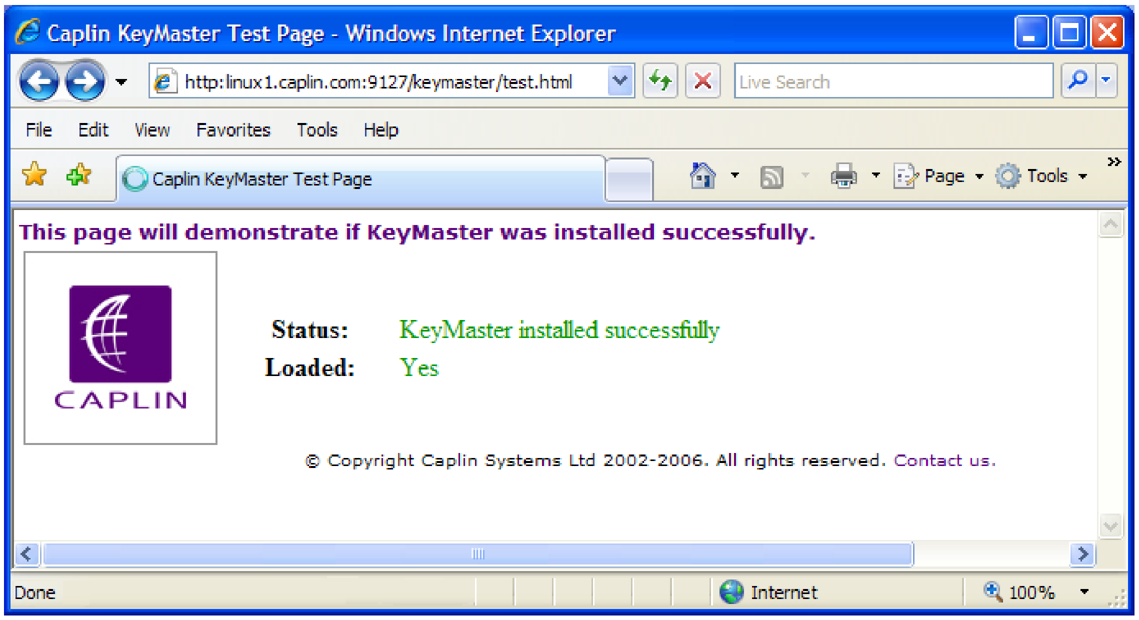
     `/KeyMaster/test.html`

     For example:

     `http://myserver.abc.com:9127/keymaster/test.html`

Note: If the Liberator is on a different machine to the web application server, then the application server address must be a fully qualified domain name.
If the address is not a fully qualified domain name (for example it is an IP address in dot notation), then the test page will hang.

The test page contacts the KeyMaster servlet and gets a user credentials token to access the Liberator. It then attempts to log in to the Liberator using this token. If the Liberator deems that the user is valid, and the token is also valid, then the test page will display a success message, as shown below.


Caplin KeyMaster Test Page - Windows Internet Explorer
http:linux1.caplin.com:9127/keymaster/test.html
Live Search
File
Edit
View
Favorites
Tools
Help
Caplin KeyMaster Test Page
Page
Tools
CAPLIN
Done
Internet
100%

This page will demonstrate if KeyMaster was installed successfully.

Status: KeyMaster installed successfully
Loaded: Yes

© Copyright Caplin Systems Ltd 2002-2006. All rights reserved. Contact us.

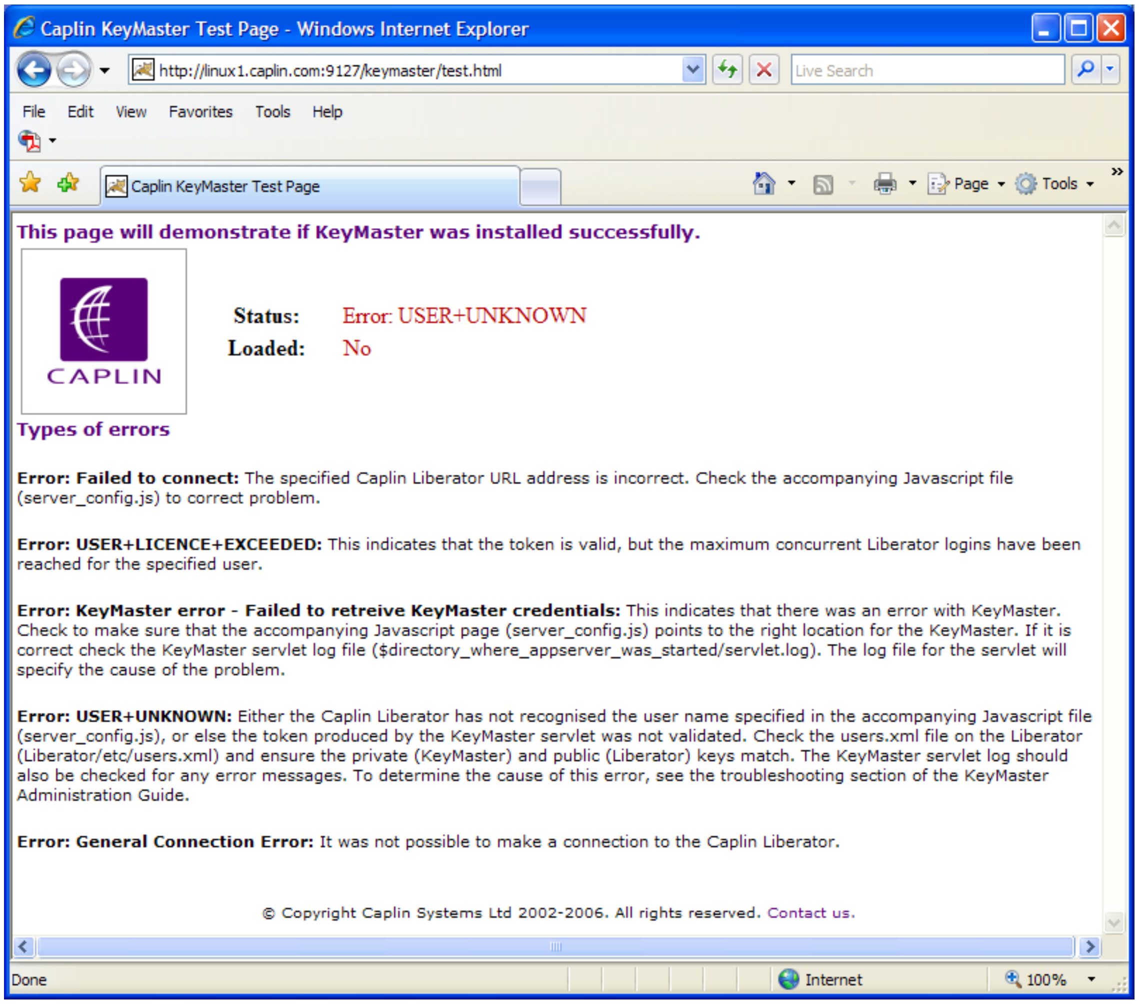
Successful installation

Tip: If you are using Internet Explorer 7 and you wish to look at the Liberator's status page while you run the test, make sure that the status page is loaded in a separate copy of the browser.
If you display both the KeyMaster test page and the Liberator status page as tabs within a single copy of the browser, the test will fail with a General Connection Error (see below).

Test errors

If the Liberator does not recognize the user, or the user credentials token is not valid, then the status line on the test page goes red and the page displays an error message.

Two typical error pages are shown below.


Caplin KeyMaster Test Page - Windows Internet Explorer
http://linux1.caplin.com:9127/keymaster/test.html
Live Search
File Edit View Favorites Tools Help
Caplin KeyMaster Test Page
Page Tools
CAPLIN
Done
Internet
100%

This page will demonstrate if KeyMaster was installed successfully.

Status: Error: USER+UNKNOWN
Loaded: No

Types of errors

Error: Failed to connect: The specified Caplin Liberator URL address is incorrect. Check the accompanying Javascript file (server_config.js) to correct problem.

Error: USER+LICENCE+EXCEEDED: This indicates that the token is valid, but the maximum concurrent Liberator logins have been reached for the specified user.

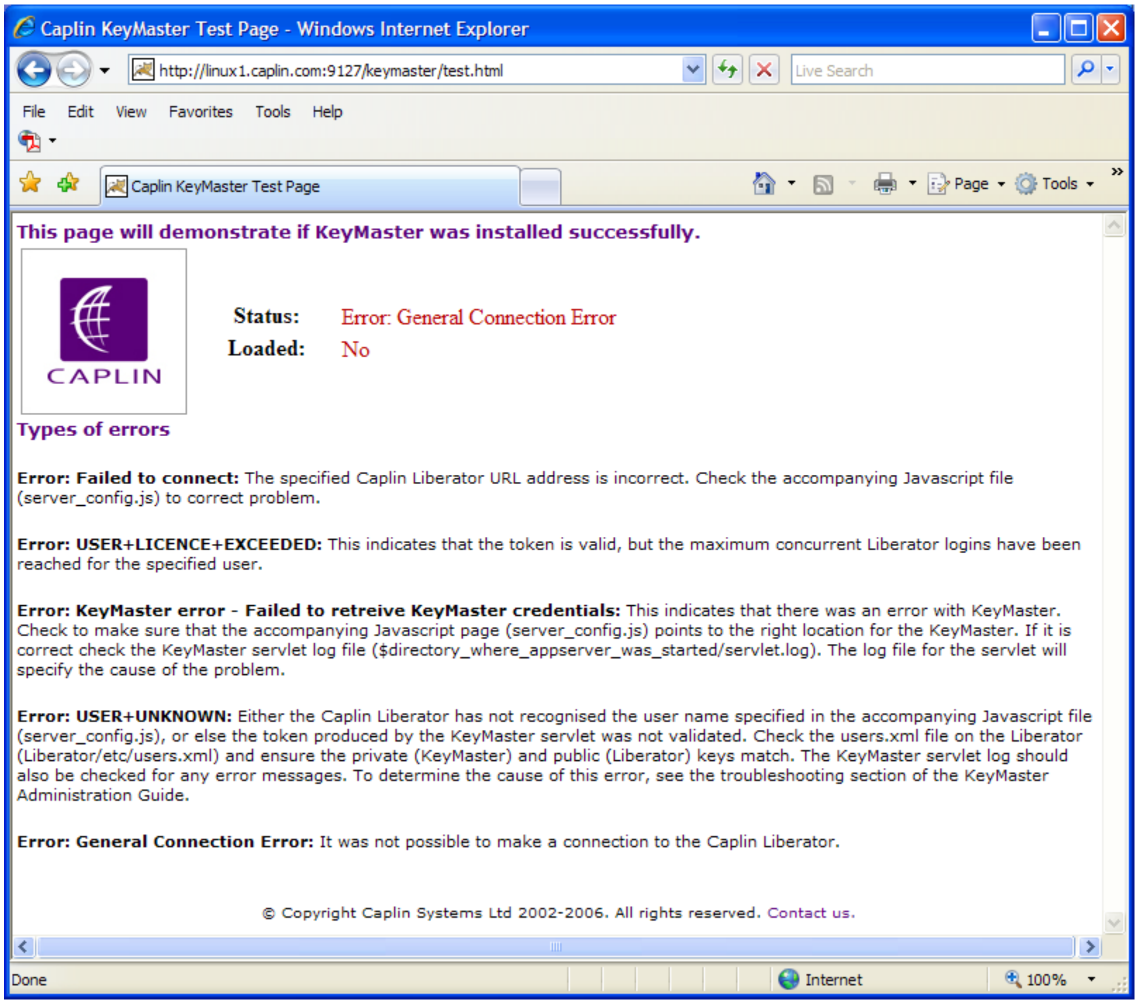
Error: KeyMaster error - Failed to retreive KeyMaster credentials: This indicates that there was an error with KeyMaster. Check to make sure that the accompanying Javascript page (server_config.js) points to the right location for the KeyMaster. If it is correct check the KeyMaster servlet log file ($directory_where_appserver_was_started/servlet.log). The log file for the servlet will specify the cause of the problem.

Error: USER+UNKNOWN: Either the Caplin Liberator has not recognised the user name specified in the accompanying Javascript file (server_config.js), or else the token produced by the KeyMaster servlet was not validated. Check the users.xml file on the Liberator (Liberator/etc/users.xml) and ensure the private (KeyMaster) and public (Liberator) keys match. The KeyMaster servlet log should also be checked for any error messages. To determine the cause of this error, see the troubleshooting section of the KeyMaster Administration Guide.

Error: General Connection Error: It was not possible to make a connection to the Caplin Liberator.

© Copyright Caplin Systems Ltd 2002-2006. All rights reserved. Contact us.

Example error page (1)


Caplin KeyMaster Test Page - Windows Internet Explorer
http://linux1.caplin.com:9127/keymaster/test.html
Live Search
File Edit View Favorites Tools Help
Caplin KeyMaster Test Page
Page Tools
CAPLIN
Done
Internet
100%

This page will demonstrate if KeyMaster was installed successfully.

Status: Error: General Connection Error
Loaded: No

Types of errors

Error: Failed to connect: The specified Caplin Liberator URL address is incorrect. Check the accompanying Javascript file (server_config.js) to correct problem.

Error: USER+LICENCE+EXCEEDED: This indicates that the token is valid, but the maximum concurrent Liberator logins have been reached for the specified user.

Error: KeyMaster error - Failed to retreive KeyMaster credentials: This indicates that there was an error with KeyMaster. Check to make sure that the accompanying Javascript page (server_config.js) points to the right location for the KeyMaster. If it is correct check the KeyMaster servlet log file ($directory_where_appserver_was_started/servlet.log). The log file for the servlet will specify the cause of the problem.

Error: USER+UNKNOWN: Either the Caplin Liberator has not recognised the user name specified in the accompanying Javascript file (server_config.js), or else the token produced by the KeyMaster servlet was not validated. Check the users.xml file on the Liberator (Liberator/etc/users.xml) and ensure the private (KeyMaster) and public (Liberator) keys match. The KeyMaster servlet log should also be checked for any error messages. To determine the cause of this error, see the troubleshooting section of the KeyMaster Administration Guide.

Error: General Connection Error: It was not possible to make a connection to the Caplin Liberator.

© Copyright Caplin Systems Ltd 2002-2006. All rights reserved. Contact us.

Example error page (2)

The Liberator login may also fail if the Liberator already has the maximum number of concurrent logins for the user. In this case the error message is

USER+LICENCE+EXCEEDED

Determining the cause of an error

The page that reports errors lists the possible errors that it can detect, and suggests reasons for each error and how to investigate it further (see the example error pages above). If an error is reported, check the Liberator's event log file (*var/event-rttpd.log)* to see if there are problems with the user trying to log in. See the Liberator log file messages 49.

8 Making KeyMaster production ready

The instructions in this guide describe how to set up KeyMaster so that it can be tested easily. *However, in this state KeyMaster is not secure, and it should not be used in a production environment.*

To make KeyMaster production ready:

■ You must configure the web application server to which you have deployed KeyMaster, so that access to the KeyMaster servlets requires authentication.

■ You must ensure that the private key file defined in the *web.xml* parameter `encrypting.generator.private.key.store.filename` is only accessible to persons and processes trusted to create users able to log into the Liberator.

■ The default setting of the *web.xml* parameter `http.remote.user` causes the KeyMaster Signature Generator servlet to obtain the user name from an HTTP request parameter sent by the application. This will not be secure if the client can access the user name, so, depending on the configuration of your single sign-on system, you may need to change this setting so the servlet instead obtains the user name from the `REMOTE_USER` attribute of the HTTP header.

For more information see Adding the user name to the user credentials token 52.

Tip: The correct way to ensure secure access to the KeyMaster servlets will vary depending on your web application server. Consult the documentation that came with the server for further information.

Also see:

■ Integrating KeyMaster with a hardware Key Store 36

■ The definitions of `encrypting.generator.private.key.store.filename` 71 and `http.remote.user` 76 in the web.xml parameters 66 section of the web.xml configuration reference 58.

9 Customizing KeyMaster

The KeyMaster distribution kit contains a standard version of the product ("Standard KeyMaster"). This can configured by modifying various configuration files (see the sections More about configuring KeyMaster 52 and Configuration reference 54). However, in many instances KeyMaster will need to be integrated into an existing single sign-on system, and this may require some product customization involving modifications and additions to KeyMaster's Java code.

The **Javadoc reference documentation for the Caplin KeyMaster SDK** contains the specifications of the public KeyMaster Java classes that can be called and extended to produce customized versions of KeyMaster.

When you customize KeyMaster, you may also need to add or modify certain parameters that are specifically concerned with specifying Java modules. These parameters are defined in the *web.xml* and *keygen.props* files.

- If you have customized KeyMaster to use a different encryption class (the JCE provider's Java class):

  Change the value of `encrypting.generator.security.provider.class.name` in *web.xml*, and `key.generator.security.provider.class.name` in *keygen.props*, to the fully qualified name of the new Java class.

  Also change the value of `encrypting.generator.security.provider.name.` in *web.xml* and `key.generator.security.provider.name` in *keygen.props*.

- If you have customized KeyMaster to use a different class to obtain the user name:

  Change the value of the `user.credential.provider` parameter in *web.xml*.
  See Adding the user name to the user credentials token 52.

- If you have added a new response formatter Java class to KeyMaster:

  Add a new `formatter-type-{formatter_name}` parameter in *web.xml*, to define the name of the new class.

  A response formatter class formats KeyMaster's response to a request for a user credentials token.

- If you have implemented a custom version of the KeyMaster servlet that generates user credentials tokens:

  When you want to test the KeyMaster installation deploying this servlet, you must first edit the *keymaster-config.js* file (see Configuring the test files 29 in Testing KeyMaster with Liberator 29).

  Edit the declaration of the *l_sKeyMasterUrl* variable to point to the URL of the custom KeyMaster servlet.
  The following line must be changed:

```
var l_sKeyMasterUrl = "/keymaster/servlet/StandardKeyMaster";
```

Tip: For more information about the configuration parameters mentioned above, see the sections on web.xml configuration reference 58 and keygen.props configuration reference 54.

10 Integrating KeyMaster with a hardware Key Store

KeyMaster generates tokens using a private key, which is normally saved to disk as a file. However, for added security, you can store private keys in a dedicated secure hardware module (a "**Key Store**") instead of on disk.

In this case, JCE (Java Cryptography Extension) can be used to retrieve keys directly from the Key Store. JCE is a Java extension that allows classes to register as cryptography providers. KeyMaster can retrieve keys from any Key Store that implements the JCE provider interface.

Tip: In the sections that follow, the secure hardware module is referred to as the **Key Store** (space between the two words). Note that JCE also has a class called **KeyStore** (no space between the two words).

The following sections explain how to set up KeyMaster so that it can use a Key Store. In summary, having first installed, deployed, and tested KeyMaster without using the Key Store, you then:

- Generate a new set of keys and a certificate, using OpenSSL.
- Import the private key file and certificate into the Key Store.
- Verify the key import operation.
- Install the required libraries.
- Edit the *web.xml* configuration file so that the KeyMaster Signature Generator knows how to retrieve the private encryption key from the Key Store.
- Test that KeyMaster works with the Key Store.
- Configure the Liberator to use the new public key.

10.1 Key Store prerequisites and assumptions

Before continuing, ensure that you have successfully installed and deployed KeyMaster by following the instructions in the sections:

- Installing KeyMaster 6
- Deploying KeyMaster 11
- Setting up Liberator to work with KeyMaster 23
- Testing KeyMaster with Liberator 29

The instructions in the following sections assume that the private key file is called *privatekey.der*, the public key file is called *publickey.der*, and the certificate file is called *cert.crt*.

The example values given for configuration options are the correct values for integrating KeyMaster with an *nCipher* Hardware Security Module, which is one of the commercial products available for the secure storage of keys. You will need to change these values accordingly if you are using a different security module product.

Note: **Disclaimer:** The references to *nCipher* and *thawte*^{TM} in this document do not imply any endorsement by Caplin Systems Ltd of any products or services supplied by these organizations.

nCipher (http://www.ncipher.com) is just one of a number of suppliers of hardware security modules.

thawte (http://www.thawte.com) is just one of a number of organizations that provide certificate signing services.

10.2 Generating keys using OpenSSL

KeyMaster uses three key files to produce tokens:

- An RSA private key for signing text.
- A matching RSA public key which is deployed to Liberator, allowing it to verify tokens.
- A certificate for the private key, which enables it to be added to a Java **KeyStore** class.

To integrate KeyMaster with your hardware Key Store, you must first generate the following key files using OpenSSL:

- An RSA private key in DER format (used to sign user credentials tokens).
- A matching RSA public key, also in DER format.
- An X.509 certificate for the private key, in CRT format.

The following sections explain how to generate these files using the OpenSSL library. OpenSSL (http://www.openssl.org) is open source software and can be freely downloaded.

Note: The files generated by the Caplin KeyGenerator class that you generated when installing KeyMaster (see Generating the required keys 8) are not the right format for use with a hardware Key Store. You must use OpenSSL to generate a new set of keys.

Tip: Documentation detailing how to install OpenSSL as a command line tool is available on the OpenSSL web site at http://www.openssl.org/docs/.

To generate keys for your hardware Key Store using OpenSSL:

- Generate a private key.
- Generate the public key from the private key.
- Generate a certificate request from the private key.
- Obtain a signed certificate.
- Convert the private key to DER format.

The instructions in the following sections show the OpenSSL commands needed to perform these steps.

Generating a private key

■ Generate the private key file in PEM format:

```
openssl genrsa -out privatekey.pem 2048
```

This produces an unencrypted file called *privatekey.pem*, which is the RSA private key.

Generating the public key

■ Generate the public key from the private key:

```
openssl rsa -in privatekey.pem -pubout -outform DER -out publickey.der
```

This produces a file called *publickey.der*, which is the public key that Liberator will use to verify KeyMaster tokens.

Tip: Public encryption keys can be distributed freely without any security risk, so *publickey.der* does not need to be stored in the hardware security module.

Generating the certificate request

To store a private key in a Java **KeyStore** class it must be accompanied by a certificate. The first step towards getting a certificate is to generate a certificate signing request (CSR) from the private key:

■ Generate the certificate signing request:

```
openssl req -new -key privatekey.pem -out certrequest.csr
```

You will then be prompted to enter information to be encoded in the certificate, such as country, company name, and organizational unit. When you have entered all the information, a certificate request file called *certrequest.csr* is produced.

Obtaining a signed certificate

To get a properly signed certificate, you can submit the certificate request (see Generating the certificate request 38) to a recognized Certificate Authority such as thawte (http://www.thawte.com). However it is also possible to self-sign your CSR, which produces a self-signed certificate – this will be adequate for KeyMaster, because KeyMaster tokens are not public facing.

■ To produce a self-signed certificate:

```
openssl x509 -req -in certrequest.csr -signkey privatekey.pem -out cert.
crt
```

This produces a file called *cert.crt*, which is the signed certificate. The *certrequest.csr* file is no longer needed and should be securely deleted (for example, through a software shredder).

Converting the private key to DER format

The private key generated through OpenSSL (see Generating a private key 38) is a PEM format file, which is human readable. However JCE only accepts keys in DER format.

- To convert the key to DER format:

  ```
  openssl pkcs8 -topk8 -inform PEM -outform DER -in private.pem -out
  private.der -nocrypt
  ```

  This produces a file called *privatekey.der*, which is the reformatted private key. The *privatekey.pem* file is no longer needed and should be securely deleted (for example, through a software shredder).

10.3 Importing the private key file and certificate into the Key Store

- Import the newly generated private key into the Key Store.

Caplin provides a tool called **Key Importer** for this purpose. Key Importer reads a properties file to obtain the information needed to import the key. There is an example *keyimporter.props* file in *$KM_INSTALL_DIR/examples*. Alternatively you can create your own version of this file; see the *keyimporter.props configuration reference* 56.

Example keyimporter.props:

```
key.importer.security.provider.class.name=com.ncipher.provider.km.nCipherKM
key.importer.keystore.type=ncipher.sworld
key.importer.keystore.provider.name=nCipherKM
key.importer.keystore.location=/opt/keystore.dat
key.importer.private.key.location=/opt/privatekey.der
key.importer.private.key.alias=privatekey
key.importer.certificate.location=/opt/cert.crt
key.importer.certificate.alias=certificate

key.importer.keystore.passphrase=keystorepassphrase
key.importer.key.passphrase=keypassphrase
```

The last two properties are optional:

- `key.importer.keystore.passphrase` can be omitted if the Key Store is not protected by a passphrase.
- `key.importer.key.passphrase` can be omitted if you do not want the key that you are importing to be protected with a passphrase.

The format of the command to run Key Importer is:

```
java -classpath lib/keymaster.jar:<JCE-provider-classpath>
com.caplin.keymaster.keyimporter.KeyImporter      <key-importer-properties-
file>
```

where:

`<JCE-provider-classpath>` is the Java classpath of the JCE provider class.
The JCE provider class is normally provided by the supplier of the Key Store hardware, and is the class referenced by the `key.importer.security.provider.class.name` property in *keyimporter.props*. `<JCE-provider-classpath>` can, of course, be the name of a JAR file containing the required class.

`<key-importer-properties-file>` is the path name of the properties file containing the information needed to import the key.

Example command on Linux, Sun Solaris, or Windows:

```
java -classpath lib/keymaster.jar:/opt/nfast/java/classes/nCipherKM.jar
com.caplin.keymaster.keyimporter.KeyImporter examples/keyimporter.props
```

In this example the `<JCE-provider-classpath>` is the JAR file path `/opt/nfast/java/classes/nCipherKM.jar`

Key Importer reads in the private key file and adds it to the hardware Key Store. Key Importer produces the following output if it is successful.

```
KeyImportVerifier started
Adding security provider with class name=com.ncipher.provider.km.nCipherKM ... done
Getting KeyStore instance with type=ncipher.sworld, provider=nCipherKM ... done
Loading empty KeyStore with passphrase=null ... done
Checking private key filename ...done
Reading private key file from location=/opt/privatekey.der ... done
Creating PKCS8 encoded key spec from file ... done
Generating PrivateKey object using KeyFactory with algorithm=RSA ... done
Reading certificate file from location=/opt/cert.crt ... done
Generating Certificate object using CertificateFactory with type=X.509 ... done
Adding certificate to KeyStore with alias=certificate ... done
Adding private key to KeyStore with alias=privatekey ... done
Writing KeyStore file to location=/opt/keystore.dat ... done
Key import successful.
```

If the hardware module provides a way to list the stored keys, then you should now be able to see new entries in the list. For example, *nCipher* provides a GUI application called KeySafe which can be used to list the keys contained within the hardware module.

Note: The Key Importer generates a file that acts as a reference to the hardware Key Store. This file will be required in subsequent steps.
In this example, the file was written to */opt/keystore.dat*; that is, the location defined by the `key.importer.keystore.location` property in *keyimporter.props*.

Tip: Do not delete *keyimporter.props* because you will need to refer to it again when editing *web.xml* (see Modifying the web.xml file for Key Store access 42).

Tip: The source code of the Key Importer tool is provided in *$KM_INSTALL_DIR/examples/keyimporter*.

Also see the keyimporter.props configuration reference 56 section.

10.4 Verifying the key import operation

- Verify that the import operation detailed in Importing the private key file and certificate into the Key Store 39 was successful.

Caplin provides a tool called **Key Import Verifier** for this purpose. This tool works by attempting to load the Key Store and retrieve the key from it.

The format of the command to run Key Import Verifier is:

```
java -classpath lib/keymaster.jar:<JCE-provider-classpath>
com.caplin.keymaster.keyimporter.KeyImportVerifier          <key-importer-
properties-file>
```

where:

`<JCE-provider-classpath>` is the Java classpath of the JCE provider class.
The JCE provider class is normally provided by the supplier of the Key Store hardware, and is the class referenced by the `key.importer.security.provider.class.name` property in *keyimporter.props*. `<JCE-provider-classpath>` can, of course, be the name of a JAR file containing the required class.

`<key-importer-properties-file>` is the path name of the properties file containing the information needed to import the key.

Example command on Linux, Sun Solaris, or Windows:

```
java -classpath lib/keymaster.jar;/opt/nfast/java/classes/nCipherKM.jar
com.caplin.keymaster.keyimporter.KeyImportVerifier    examples/keyimporter.
props
```

In this example the `<JCE-provider-classpath>` is the JAR file path `/opt/nfast/java/classes/nCipherKM.jar`.

`<key-importer-properties-file>` is the same properties file that was used to import the keys (see Importing the private key file and certificate into the Key Store 39), and contains all of the information needed to verify that the import operation was successful.

Key Import Verifier attempts to retrieve the key from the Key Store and uses it to sign some text. Key Import Verifier produces the following output if it is successful:

```
Key Import Verifier started
Adding security provider with class name=com.ncipher.provider.km.nCipherKM ... done
Getting KeyStore instance with type=ncipher.sworld, provider=nCipherKM ... done
Loading KeyStore from file=/opt/keystore.dat with passphrase=null ... done
Retrieving key with id=privatekey and passphrase=null ... done
Casting retrieved key into a PrivateKey instance ...done
Generating Signature object with algorithm=SHA256withRSA and provider=nCipherKM ... done
Initialising Signature object ... done
Signing some text ... done
Key verification successful.
```

Tip: The source code of the Key Import Verifier tool is provided in *$KM_INSTALL_DIR/examples/keyimporter*.

10.5 Installing the required libraries

The JCE provider class must be available to the KeyMaster servlet on your application server. This may be a Java class file, or it may be contained within a JAR file.

For example, if the `key.importer.security.provider.class.name` property in *keyimporter.props* has the value `com.ncipher.provider.km.nCipherKM`, and this class exists in the file *nCipherKM.jar* , then *nCipherKM.jar* must be in the classpath of the KeyMaster servlet.

The correct location to put the class file varies depending on the application server used. For example, if you are using a Tomcat server, the libraries should be placed in the directory *$SERVER_HOME/webapps/keymaster/WEB-INF/lib*.

10.6 Modifying the web.xml file for Key Store access

- In the KeyMaster *web.xml* configuration file, edit the parameters applying to the `StandardKeyMaster` servlet, so that the KeyMaster Signature Generator knows how to retrieve the private encryption key from the Key Store:

```
<servlet>
   <servlet-name>StandardKeyMaster</servlet-name>
   <servlet-class>com.caplin.keymaster.servlet.StandardKeyMaster</servlet-class>

   <init-param>
   ...
   </init-param>
...
</servlet>
```

Tip: The *web.xml* file is located in a directory of your web application server; the precise directory path depends on which application server you are using, but it usually ends in *WEB-INF/*. For example, if KeyMaster is deployed on a Tomcat application server, *web.xml* is in the directory *$SERVER_HOME/webapps/keymaster/WEB-INF/*.

Tip: Some of the values that you need to set up in *web.xml* can be found in your *keyimporter.props* file.

Edit *web.xml* as follows:

1. Find the entry called `encrypting.generator.keystore.type`:

```
<init-param>
   <param-name>encrypting.generator.keystore.type</param-name>
   <param-value>standard</param-value>
   <description>
      Optional parameter that accepts the values "standard" or "hardware".
      Will default to "standard" if not present
   </description>
</init-param>
```

Change the content of the `<param-value>` tag from **standard** to **hardware**.

Example:

```
<init-param>
   <param-name>encrypting.generator.keystore.type</param-name>
   <param-value>hardware</param-value>
   <description>
      Optional parameter that accepts the values "standard" or "hardware".
      Will default to "standard" if not present
   </description>
</init-param>
```

Note: Since `encrypting.generator.keystore.type` is an optional parameter it may not exist in *web.xml*. If this is the case then the parameter must be added with the value `hardware` as shown in the previous example.

2. Find the entry called `encrypting.generator.key.identifier`:

```
<init-param>
   <param-name>encrypting.generator.key.identifier</param-name>
   <param-value>keyid1</param-value>
   <description>Name of the server the token is generated for.</description>
</init-param>
```

Change the content of the `<param-value>` tag to the alias of the private encryption key in the Key Store. This will be the value of the `key.importer.private.key.alias` property in *keyimporter.props*. For example, if the `key.importer.private.key.alias` property was assigned the value **privatekey**, then *web.xml* should be edited like this:

Example:

```
<init-param>
      <param-name>encrypting.generator.key.identifier</param-name>
      <param-value>privatekey</param-value>
      <description>Name of the server the token is generated for.</description>
</init-param>
```

3. Remove the `encrypting.generator.private.key.store.filename` property, as it is not used when KeyMaster is interacting with a hardware Key Store:

~~<init-param>~~
~~<param-name>encrypting.generator.private.key.store.filename</param-name>~~
~~<param-value>/Caplin/KeyMaster/privatekey.store</param-value>~~
~~<description>File name and location for the private key</description>~~
~~</init-param>~~

4. Find the entry called `encrypting.generator.security.provider.class.name`:

```
<init-param>
   <param-name>encrypting.generator.security.provider.class.name</param-name>
   <param-value>org.bouncycastle.jce.provider.BouncyCastleProvider</param-value>
   <description>KeyMaster encrypting class</description>
</init-param>
```

Change the content of the `<param-value>` tag to the new JCE provider class name. This will be the value of the `key.importer.security.provider.class.name` property in *keyimporter.props*. For example, if the `key.importer.security.provider.class.name` property was assigned the value **com.ncipher.provider.km.nCipherKM**, then *web.xml* should be edited like this:

Example:

```
<init-param>
...<param-name>encrypting.generator.security.provider.class.name</param-name>
...<param-value>com.ncipher.provider.km.nCipherKM</param-value>
...<description>KeyMaster encrypting class</description>
</init-param>
```

5. Find the entry called `encrypting.generator.security.provider.name`:

```
<init-param>
...<param-name>encrypting.generator.security.provider.name</param-name>
...<param-value>BC</param-value>
...<description>
      KeyMaster security provider - the name of the JCE provider.
   </description>
</init-param>
```

Change the content of the `<param-value>` tag to the new JCE provider name. This will be the value of the `key.importer.keystore.provider.name` property in *keyimporter.props*. For example, if the `key.importer.keystore.provider.name` property was assigned the value **nCipherKM**, then *web.xml* should be edited like this:

Example:

```
<init-param>
<param-name>encrypting.generator.security.provider.name</param-name>
...<param-value>nCipherKM</param-value>
...<description>
      KeyMaster security provider - the name of the JCE provider.
   </description>
</init-param>
```

6. Add an entry called `encrypting.generator.hardware.keystore.type` where the content of the `<param-value>` tag matches the value entered in *keyimporter.props* for the `key.importer.keystore.type` property. For example, if the `key.importer.keystore.type` property was assigned the value **ncipherkm.sworld**, then the following entry should be added to *web.xml*:

Example:

```
<init-param>
   <param-name>encrypting.generator.hardware.keystore.type</param-name>
   <param-value>ncipherkm.sworld</param-value>
</init-param>
```

7. Add an entry called `encrypting.generator.hardware.keystore.keyfile` where the content of the `<param-value>` tag matches the value entered in *keyimporter.props* for the `key.importer.keystore.location` property. This will be the location and filename of the file generated by Key Importer. For example, if the `key.importer.keystore.location` property was assigned the value **/opt/keystore.dat**, then the following entry should be added to web.xml:

Example:

```
<init-param>
   <param-name>encrypting.generator.hardware.keystore.keyfile</param-name>
   <param-value>/opt/keystore.dat</param-value>
</init-param>
```

8. Find the entry called `encrypting.generator.signature.algorithm`:

```
<init-param>
   <param-name>encrypting.generator.signature.algorithm</param-name>
   <param-value>MD5withRSA</param-value>
   <description>
      Optional parameter to set the algorithm used for signatures.
      Will default to MD5withRSA if this parameter is not present.
   </description>
</init-param>
```

This parameter defines the algorithm used to create digital signatures using the private key, and takes one of the values **MD5withRSA** or **SHA256withRSA**. You will need to change the signature generation algorithm if your JCE provider does not provide the MD5withRSA algorithm (which is the case with *nCipher*, for example).

Example:

```
<init-param>
   <param-name>encrypting.generator.signature.algorithm</param-name>
   <param-value>SHA256withRSA</param-value>
   <description>
      Optional parameter to set the algorithm used for signatures.
      Will default to MD5withRSA if this parameter is not present.
   </description>
</init-param>
```

Note: Since `encrypting.generator.signature.algorithm` is an optional parameter it may not exist in *web.xml*. If this is the case, add this parameter with the value **MD5withRSA** or **SHA256withRSA**, as shown in previous example.
MD5withRSA and SHA256withRSA are the only algorithms that can be used to generate KeyMaster tokens.

Tip: The algorithm you select will also need to be added to the Liberator configuration. See Configuring Liberator to use a new public key 47.

9. If your Key Store is protected by a passphrase, then add an entry called `encrypting.generator.hardware.keystore.passphrase` where the content of the `<param-value>` tag matches the value entered in *keyimporter.props* for the `key.importer.keystore.passphrase` property. For example, if the `key.importer.keystore.passphrase` property was assigned the value **keystorepassphrase**, then this entry should be added to *web.xml*:

Example:

```
<init-param>
   <param-name>encrypting.generator.hardware.keystore.passphrase</param-name>
   <param-value>keystorepassphrase</param-value>
</init-param>
```

If your Key Store is not protected by a passphrase, then you do not need to add anything.

10. If you chose to protect your private encryption key with a passphrase, then add an entry called `encrypting.generator.hardware.key.passphrase` where the content of the `<param-value>` tag matches the value entered in *keyimporter.props* for the `key.importer.key.passphrase` property. For example, if the `key.importer.key.passphrase` property was assigned the value **keypassphrase**, then this entry should be added to *web.xml*:

Example:

```
<init-param>
...<param-name>encrypting.generator.hardware.key.passphrase</param-name>
...<param-value>keypassphrase</param-value>
</init-param>
```

If `key.importer.key.passphrase` was not defined in *keyimporter.props,* then the key is not protected by a passphrase and no configuration needs to be added.

Tip: For more information on configuring the KeyMaster servlet in the *web.xml* file, see the web.xml configuration reference 58 section.

Note: For the configuration changes to take effect, you will need to reload the KeyMaster web application and possibly restart the application server.

10.7 Testing KeyMaster works with the Key Store

Before testing that KeyMaster works with the Key Store, make sure you have:

- Imported the private encryption key into the hardware Key Store (see Importing the key file and certificate into the Key Store 39).
- Made the required JCE provider class available to the KeyMaster servlet (see Installing the required libraries 42).
- Made the appropriate edits to the KeyMaster *web.xml* configuration file (see Modifying the web.xml file for Key Store access 42).

■ To test KeyMaster, follow the instructions in Testing KeyMaster with the application server 21.

10.8 Configuring Liberator to use a new public key

You may need to modify the **add-sigkey** item in the Liberator's configuration file *etc/rttpd.conf*:

- If the filename and/or path of the public key file has been changed, modify the ***keyfile*** parameter to define the new pathname.
- If the digital signature algorithm has been changed (see `encrypting.generator.signature.algorithm` 45 in Modifying the web.xml file for Key Store access 42), add a `signing-algorithm` parameter to specify the new algorithm.

Example of edited Liberator configuration item add-sigkey:

```
## AUTH ############################################################
##
auth-module xmlauth
add-sigkey
key-id               testkey
timeout              600
keyfile              %r/etc/NewPublicKey.der
signing-algorithm    sha256
end-sigkey
```

Note: The *signing-algorithm* configuration parameter is only available in Liberator versions 4.5.7 and above.
The only supported values are **md5** and **sha256**.
Earlier versions of Liberator use the MD5withRSA digital signature algorithm, which is compatible with KeyMaster's default setting.

10.9 Testing Liberator works with the new public key

- Restart the Liberator and test it with KeyMaster (see Testing KeyMaster with Liberator 29).

10.10 Tidying up

- Securely delete (using a software shredder for example):
  - The copies of the private key and certificate that are not secured in the Key Store.
  - The old keys and certificates that were generated when you first installed KeyMaster.

11 Troubleshooting

This section contains additional information on how to ensure that your KeyMaster installation runs correctly.

11.1 Synchronizing the servers

Make sure that the clock on the server running the Liberator is synchronized with the clock on the server where KeyMaster Signature Generation servlet is running. If the clocks on these two servers are set to different times, the Liberator may falsely decide that a user credentials token has expired and it is likely to reject all user credentials tokens for this reason.

If the clocks are not correctly synchronized you will see the following message in the Liberator log file:

```
    NOTIFY: Signature expired for key_id [key id] - [timestamp] denying login
```

Also see Liberator log file messages 49

11.2 Liberator log file messages

The following table lists and explains the messages relating to KeyMaster authentication that can appear in the Liberator event log file (*var/event-rttpd.log*).

Log Message	Description
`INFO: Token <[token]> is validated for <[key_id]> testkey`	The specified user credentials token called `[token]` has been successfully validated.
`NOTIFY: Signature expired for key_id [key id] - [timestamp] denying login`	A user credentials token has expired. A token is valid from the time it was created plus the number of seconds specified in the **signature-validtime** or **timeout** configuration item in *rttpd.conf* (see Modifying the Liberator configuration file 24). ■ Make sure that clock on the server running the Liberator is synchronized with the clock on the server where KeyMaster Signature Generation servlet is running. If the clocks on these two servers are set to different times, the Liberator may falsely decide that a user credentials token has expired (it is likely to reject all user credentials tokens for this reason).
`ERROR: Cannot load keyfile <[filename]>`	The DER format public key file called `[filename]`, specified in *rttpd.conf*, is missing, corrupt or in the wrong format. ■ Check that the key file configuration is specified correctly in *rttp.conf*; look at the **key-id** configuration item in the **add-sigkey** item group (see Modifying the Liberator configuration file 24).

Log Message	Description
`ERROR: Could not find key_id [key id]`	When the auth module asked for a check on a user credentials token, the key-id was found to be unknown. ■ Check that the **key-id**s match between *rttpd.conf* and the auth module configuration file (for example the *users.xml* file). Look in *rttpd.conf* at the **key-id** configuration item in the **add-sigkey** item group; in *users.xml* look at the `sigkey-id` attribute for each `<USER>` tag.
`ERROR: Malformed token <[KeyMaster token]> for key_id [key id]`	The user credentials token provided to the Liberator is in the wrong format. In Standard KeyMaster it has the following format: `<base64 encoded signature> ~<timestamp>~<sequence number>.`
`ERROR: Token verification failed for key_id [key id] <[token]>`	The user credentials token failed to verify upon decryption. Either the key used to decrypt the signature does not match the key that KeyMaster used to encrypt it, or the token has been tampered with or corrupted in some way.
`ERROR: Malformed timestamp for key_id [key id] <[token]>`	The timestamp in the user credentials token is badly formed. It should have the format `YYYYMMDDHHMMSS` (for example, `20050126122011`).
`ERROR: Token [token] has already logged in for key_id [key id]`	The user credentials token has already been used; a token can only be used once.
`CRITICAL: Could not locate key file <etc/publickey1.der> for add-sigkey/key-id < testkey >`	The entry in the *rttpd.conf* file for the public key could not be mapped to a public DER key file in the specified (or default) directory. Either the *rttpd.conf* entry is invalid, or the key file is missing. ■ Look in *rttpd.conf* at the **keyfile** configuration item in the **add-sigkey** item group. Check that the specified name and directory of the public DER key file match the name and location of the actual file. ■ Check that the key file is actually present in the specified location. Note: The Liberator will fail to start if this error occurs (the Liberator displays the error message on the screen as well as logging it).
`CRITICAL: No keyfile defined for add-sigkey/key-id < testkey >`	The entry in the *rttpd.conf* file for the public key does not specify a key file. ■ Look in *rttpd.conf* at the **add-sigkey** configuration item group; make sure that there is a **keyfile** configuration item in this group (see Modifying the Liberator configuration file 24). Note: The Liberator will fail to start if this error occurs (the Liberator displays the error message on the screen as well as logging it).
`CRITICAL: No key-id for an add-sigkey configuration group`	The entry in the *rttpd.conf* file for the public key does not specify a key id. ■ Look in *rttpd.conf* at the **add-sigkey** configuration item group; make sure that there is a **key-id** configuration item in this group (see Modifying the Liberator configuration file 24). **Note:** The Liberator will fail to start if this error occurs (the Liberator displays the error message on the screen as well as logging it).

Log Message	Description

`ERROR: 4012903328:error:0407006A: rsa routines: RSA_padding_check_PKCS1_type_1: block type is not 01:rsa_pk1.c:100:`
 	
`ERROR:4012903328:error:04067072: rsa routines: RSA_EAY_PUBLIC_DECRYPT: padding check failed: rsa_eay.c:699:`
 	
`ERROR: Token verification failed for key_id <testkey> <AAAtokenBBB>`
	The public / private key token verification has failed.
	■ Verify that the private and public keys used in KeyMaster and the Liberator Auth Module are valid.
	■ Check that the *publickey.der* file referenced in the *rttpd.conf* **add-sigkey** configuration item group is not corrupt. This is a binary file which can be corrupted if it is transferred via ftp in ASCII mode.

12 More about configuring Keymaster

The following sections contain information about configuring additional features of KeyMaster.

12.1 Configuration in web.xml

When deploying Standard KeyMaster, you modify the configuration file *web.xml* to specify the location of the private encryption key, and to define the KeyMaster error logging environment (see Modifying the web.xml configuration file 16). The *web.xml* file can also contain a number of other configuration settings that determine the way Standard KeyMaster behaves, and some configuration settings that you modify when KeyMaster has been customized.

The format of the *web.xml* file is specified in the section on web.xml configuration reference 58. The configuration items that you can specify in this file are defined in web.xml parameters 66.

12.2 Adding the user name to the user credentials token

If you deploy Standard KeyMaster with the default *web.xml* settings (plus the adjustments defined in Modifying the web.xml configuration file) 16, the generated user credentials tokens will contain just a date-time stamp and a unique sequence number, plus a digital signature of both these items.

For additional security you can include in the token the user name that was specified when the end user first signed on to the system.

There are two *web.xml* parameter settings that control how this is done.

- If you set the `encrypting.encode.extra.data` 67 parameter to `enabled`, the KeyMaster Signature Generator servlet will put the user name in the user credentials token and include it in the digital signature.
- The setting of `http.remote.user` 76 determines where the user name is obtained from. The default setting of this parameter causes the KeyMaster Signature Generator servlet to obtain the user name from an HTTP request parameter sent by the application (`?username=...`). This will not be secure if the client can access the user name. You can change the setting so that the servlet instead obtains the user name from the `REMOTE_USER` attribute of the HTTP header (assuming the single sign-on system supports transmitting the user name in this way).

Tip: Adding the user name to the user credentials token will guard against the token being hijacked and reused by someone other than the person who originally requested the token.

You can also implement a custom class that obtains the user name. You do this by replacing (or extending) the Standard KeyMaster class **com.caplin.keymaster.servlet.UserCredentialsProvider**. For example, the custom class could obtain the user name from a cookie passed between the client web page and the application server. You must change the value of the `user.credential.provider` 80 parameter in *web.xml* to point to the new custom class.

For more information on the **UserCredentialsProvider** class see the **Javadoc reference documentation for the Caplin KeyMaster SDK**.

Also see Making KeyMaster production ready 34

12.3 Protocol and domain compatibility

When KeyMaster is in use, the client web browser will access both the Liberator (via a StreamLink connection) and KeyMaster (via a standard web connection).

Access to KeyMaster must be through the same protocol, HTTP or HTTPS, as the protocol used by the Liberator.

For example, assume the Liberator is at `myliberator.example.com` and KeyMaster is at `keymaster.example.com`.
If the connection to the Liberator is through **`http:`**`//myliberator.example.com`, then KeyMaster at must be accessed at **`http:`**`//keymaster.example.com`. Conversely, if the connection to the Liberator is through **`https:`**`//myliberator.example.com`, then KeyMaster must be accessed at **`https:`**`//keymaster.example.com`

If the Liberator is on a different machine to the web application server where KeyMaster resides, then the KeyMaster and Liberator must share a common domain. (More exactly, the StreamLink enabled page that the client application uses to access the Liberator must share a common domain with the Liberator.) For example, an application server at `myserver.example.com` and a Liberator at `myliberator.example.com` share the domain, `example.com`.
In this situation, the common domain must be defined to StreamLink. In StreamLink for Browsers this is done using the SL4B `commondomain` property; for more information see the **StreamLink for Browsers SDK Documentation.**

13 Configuration reference

This is the reference information for KeyMaster's configuration files.

13.1 keygen.props configuration reference

This section contains the reference information for the *keygen.props* configuration file. *keygen.props* is a properties file defining the characteristics of the KeyMaster Key Generator servlet. There is an example of this file in *$KM_INSTALL_DIR/examples/*.

File format:

The file contains property name/value pairs. Each pair is separated with an '=' character, and each property must be defined on its own line.

Example:

```
key.generator.private.key.store.filename=privatekey.store
```

Note: *keygen.props* must contain an entry for each of the properties defined in the following table.

***keygen.props* properties**

***keygen.props* property name**	**Example setting**	**Description**
`key.generator.private.key.store.filename`	`privatekey.store`	The name and location of the file that the private key will be stored in.
`key.generator.public.key.store.filename`	`publickey.store`	The name and location of the file that the public key will be stored in.
`key.generator.public.key.der.filename`	`publickey.der`	The name and location of the DER 81 formatted public key file. The file name must end in '*.der*'
`key.generator.key.size`	`1024`	The size of the generated key. Both the public and private keys will be this size.
`key.generator.security.provider.class.name`	`org.bouncycastle.jce.provider.BouncyCastleProvider`	The fully qualified name of the JCE 82 provider's Java class that generates the encryption key pairs. This class must also be in the Java classpath of the KeyMaster Key Generator servlet (it is usually in a JAR file that is included in the classpath – see Generating the Required Keys 8). The class name must be the same as that specified in the parameter `encrypting.generator.security.` 72 `provider.class.name` 72 in the *web.xml* configuration file. Also see Note 1 below 55.

keygen.props property name	Example setting	Description
`key.generator.security.provider.name`	`BC`	The name of the provider of the Java class used to generate the encryption key pairs. This name must be the same as that specified in the parameter encrypting.generator.security. 73 provider.name 73 in the *web.xml* configuration file. Also see Note 1 below 55.
`key.generator.Level`	`INFO`	Defines the Java logging level for the KeyMaster Key Generator's log file (see the `key.generator.FilenameAttribute` property). In the example *keygen.props* file shipped with KeyMaster the logging level is set to ALL (see the example below), which provides a very detailed level of logging for debug purposes. Also see Note 2 55 and the Tip 55 below.
`key.generator.FilenameAttribute`	`keygen.log`	Defines the name and location of the KeyMaster Key Generator's log file. The location of a newly created log file is relative to the user's current directory at the time the Key Generator is run. Note that each time the Key Generator is run the contents of any existing log file are overwritten; the new log entries are not appended to the file.

Note 1: `key.generator.security.provider.class.name` and `key.generator.security.provider.name`
Only change these settings if you have customized KeyMaster to use a different encryption class.
Make sure the settings correspond to the values of the *web.xml* parameters encrypting.generator.security.provider.class.name 72 and encrypting.generator.security.provider.name 73, respectively.

Note 2: `key.generator.Level`
In a production system it is recommend that the logging level normally be set to SEVERE or WARNING.

Tip: `key.generator.Level`
The possible logging levels are defined in the standard Java documentation under **java.util.logging.Level**.

Example *keygen.props* file:

```
key.generator.private.key.store.filename=privatekey.store
key.generator.key.size=1024
key.generator.public.key.store.filename=publickey.store
key.generator.public.key.der.filename=publickey.der
key.generator.security.provider.class.name=
   org.bouncycastle.jce.provider.BouncyCastleProvider
key.generator.security.provider.name=BC
key.generator.Level=ALL
key.generator.FilenameAttribute=keygen.log
```

13.2 keyimporter.props configuration reference

This section contains the reference information for the *keyimporter.props* configuration file. *keyimporter.props* is a properties file defining the characteristics of the KeyMaster Key Importer tool for importing key files into a *hardware Key Store*. There is an example of this file in *$KM_INSTALL_DIR/examples/*.

File format:

The file contains property name/value pairs. Each pair is separated with an '=' character, and each property must be defined on its own line.

Example:

```
key.importer.keystore.type=ncipher.sworld
```

Note: *keyimporter.props* must contain an entry for each of the properties defined in the following table.

***keyimporter.props* properties**

***keyimporter.props* property name**	**Example setting**	**Description**
`key.importer.certificate.alias`	`certificate`	The identifier to use as a reference to the certificate in the Java **KeyStore** class of the JCE.
`key.importer.certificate.location`	`/opt/cert.crt`	The name and location of the certificate to use when adding the key to the Java **KeyStore** class of the JCE.
`key.importer.key.passphrase`	`mykeypassphrase`	Optional parameter defining a passphrase to access the private key stored in the Key Store.
`key.importer.keystore.location`	`/opt/keystore.dat`	Key Importer generates a file that defines how KeyMaster can access the Key Store. This property defines the name and directory path of this file.
`key.importer.keystore.provider.name`	`nCipherKM`	The name of the Key Store to which the private key and certificate are to be loaded. This information is required for the Java **KeyStore** class of the JCE – it is the second argument of the **getInstance()** method. The value required is normally specified by the supplier of the Key Store hardware.
`key.importer.keystore.passphrase`	`mykeystorepassphrase`	Optional parameter defining a passphrase to access the Key Store.
`key.importer.keystore.type`	`ncipher.sworld`	The type of Key Store to which the private key and certificate are to be loaded. This information is required for the Java **KeyStore** class of the JCE – it is the first argument of the **getInstance()** method. The value required is normally specified by the supplier of the Key Store hardware.
`key.importer.private.key.alias`	`privatekey`	The identifier to use as a reference to the key in the Java **KeyStore** class of the JCE.
`key.importer.private.`	`/opt/privatekey`	The name and location of the private key to import

keyimporter.props **property name**	**Example setting**	**Description**
`key.location`	`.der`	into the Key Store.
`key.importer.security.provider.class.name`	`com.ncipher.provider.km.nCipherKM`	The fully qualified name of the JCE provider's Java class that generates the encryption key pairs. This is normally specified by the supplier of the Key Store hardware.

Example ***keyimporter.props*** **file:**

```
key.importer.security.provider.class.name=com.ncipher.provider.km.nCipherKM
key.importer.keystore.type=ncipher.sworld
key.importer.keystore.provider.name=nCipherKM
key.importer.keystore.location=/opt/keystore.dat
key.importer.private.key.location=/opt/privatekey.der
key.importer.private.key.alias=privatekey
key.importer.certificate.location=/opt/cert.crt
key.importer.certificate.alias=certificate
key.importer.keystore.passphrase=keystorepassphrase
key.importer.key.passphrase=keypassphrase
```

13.3 web.xml configuration reference

This section contains the reference information for the *web.xml* configuration file. This configuration file defines the characteristics of the KeyMaster Signature Generator (the servlet that generates user credentials tokens). KeyMaster is shipped with a default *web.xml* file. You can edit this file and add to it, as required, to change certain aspects of the servlet's behaviour.

The general format of the file is:

```
<web-app>

   <display-name>Caplin KeyMaster</display-name>
   <description>Caplin KeyMaster Servlet</description>

   <servlet>
      <servlet-name>StandardKeyMaster</servlet-name>
      <servlet-class>com.caplin.keymaster.servlet.StandardKeyMaster</servlet-class>

      <init-param>
         <param-name>name-of-a-configuration-parameter</param-name>
         <param-value>value-of-configuration-parameter</param-value>
         <description>Description of configuration parameter</description>
      </init-param>
      ...
      <init-param>
         <param-name>name-of-another-configuration-parameter</param-name>
         <param-value>value-of-another-configuration-parameter</param-value>
         <description>Description of another configuration parameter</description>
      </init-param>
      ...
   </servlet>

   <servlet>
      <servlet-name>XHRKeymaster</servlet-name>
      <servlet-class>com.caplin.keymaster.servlet.KeyMasterXHRFrame</servlet-class>

      <init-param>
         <param-name>name-of-a-configuration-parameter</param-name>
         <param-value>value-of-configuration-parameter</param-value>
         <description>Description of configuration parameter</description>
      </init-param>
      ...
   </servlet>

   <servlet>
      <servlet-name>Poll</servlet-name>
      <servlet-class>com.caplin.keymaster.servlet.Poll</servlet-class>
   </servlet>

   <servlet>
      <servlet-name>Dependencies</servlet-name>
      <servlet-class>com.caplin.keymaster.servlet.Dependencies</servlet-class>
   </servlet>

   <servlet>
   ...
   </servlet>
```

continued...

...continued

```
   <servlet-mapping>
      <servlet-name>StandardKeyMaster</servlet-name>
      <url-pattern>/servlet/StandardKeyMaster</url-pattern>
   </servlet-mapping>

    <servlet-mapping>
        <servlet-name>XHRKeymaster</servlet-name>
        <url-pattern>/servlet/XHRKeymaster</url-pattern>
    </servlet-mapping>

   <servlet-mapping>
        <servlet-name>Poll</servlet-name>
        <url-pattern>/servlet/Poll</url-pattern>
    </servlet-mapping>

    <servlet-mapping>
        <servlet-name>Dependencies</servlet-name>
        <url-pattern>/servlet/dependencies/*</url-pattern>
    </servlet-mapping>

   <servlet-mapping>
    ...
   </servlet-mapping>

</web-app>
```

The *web.xml* file shipped with Standard KeyMaster contains definitions for four servlets, as highlighted in the previous file format example. The servlets are `StandardKeyMaster`, `XHRKeymaster`, `Poll`, and `Dependencies`, of which the last three are used to support accessing KeyMaster from StreamLink for Browsers. The `Poll` and `Dependencies` servlets do not require any parameters, so their `<servlet>` tags do not have any `<init-param>` child tags.

The next sections define the XML tags in alphabetical order.

Each section contains the following information:

- The tag name.
- A brief definition of what the tag does.
- A list of the immediate children of the tag, if any.
- More explanation of how to use the tag, if required.
- A code example showing the tag in use.

Tip: The items that you will most likely to want to change are the parameters defined in the child tags of `<init-param>` 61. These are defined in the section on web.xml parameters 66.

<description>

Tag: `<description>`

This tag is used to provide a description of the contents of a `<display-name>` 60 or `<param-name>` 61 tag.

Attributes: None.

The tag has no child tags.

Example 1:

```
<display-name>Caplin KeyMaster</display-name>
<description>
Caplin KeyMaster Servlet
</description>
```

Example 2:

```
<init-param>
   <param-name>encrypting.generator.private.key.store.filename</param-name>
   <param-value>/Caplin/KeyMaster-4.4.0/privatekey.store</param-value>
   <description>File name and location for the private key</description>
</init-param>
```

<display-name>

Tag: `<display-name>`

Defines the name of the Java web application.

Note: Do not modify this tag unless you are implementing a customized version of Caplin KeyMaster.

Attributes: None.

This tag has no child tags. It can be followed by a `<description>` 60 tag.

Example:

```
<display-name>Caplin KeyMaster</display-name>
<description>
Caplin KeyMaster Servlet
</description>
```

<init-param>

Tag: `<init-param>`

This tag defines a KeyMaster servlet configuration parameter.

Attributes: None.

The immediate children of the `<init-param>` tag are a `<param-name>` 61 tag, followed by a `<param-value>` 62 tag and an optional `<description>` 60 tag.

Example:

```
<init-param>
   <param-name>encrypting.generator.private.key.store.filename</param-name>
   <param-value>/Caplin/KeyMaster-4.4.0/privatekey.store</param-value>
   <description>File name and location for the private key</description>
</init-param>
```

<param-name>

Tag: `<param-name>`

This tag defines the name of a KeyMaster servlet configuration parameter.

Attributes: None.

This tag has no child tags.

Example:

```
<init-param>
   <param-name>encrypting.generator.private.key.store.filename</param-name>
   <param-value>/Caplin/KeyMaster-4.4.0/privatekey.store</param-value>
   <description>File name and location for the private key</description>
</init-param>
```

The valid parameter names are defined in the web.xml parameters 66 section.

<param-value>

Tag: `<param-value>`

This tag defines the value of the servlet configuration parameter whose name is defined in the associated <param-name> 61 tag.

Attributes: None.

This tag has no child tags.

Example:

```
<init-param>
   <param-name>encrypting.generator.private.key.store.filename</param-name>
   <param-value>/Caplin/KeyMaster-4.4.0/privatekey.store</param-value>
   <description>File name and location for the private key</description>
</init-param>
```

<servlet>

Tag: `<servlet>`

Defines the configuration of a KeyMaster servlet.

Attributes: None.

The immediate children of the `<servlet>` tag are a <servlet-name> 64 and <servlet-class 63 > tag, followed by zero or more <init-param> 61 tags.

Example:

```
<servlet>
   <servlet-name>StandardKeyMaster</servlet-name>
   <servlet-class>com.caplin.keymaster.servlet.StandardKeyMaster</servlet-class>

   <init-param>
      <param-name>encrypting.generator.key.identifier</param-name>
      <param-value>keyid1</param-value>
      <description>The value that was passed as the second argument to the
                   Key Generator when the key was created.
      </description>
   </init-param>

   </init-param>

    <init-param>
       <param-name>encrypting.generator.private.key.store.filename</param-name>
       <param-value>/Caplin/KeyMaster-4.4.0/privatekey.store</param-value>
       <description>File name and location for the private key</description>
   </init-param>

</servlet>
```

<servlet-class>

Tag: `<servlet-class>`

This tag defines the name of the Java class that implements a servlet.

Note: Do not modify this tag unless you are implementing a customized version of Caplin KeyMaster.

Attributes: None.

The tag has no child tags.

Example:

```
<servlet>
   <servlet-name>StandardKeyMaster</servlet-name>
   <servlet-class>com.caplin.keymaster.servlet.StandardKeyMaster</servlet-class>
...
</servlet>
```

This tag is used to define the name of the Java class that implements the KeyMaster Signature Generator servlet, as shown in the example above.

<servlet-mapping>

Tag: `<servlet-mapping>`

This tag defines the mapping between a servlet and the URL that invokes it.

Attributes: None.

The immediate children of the `<servlet-mapping>` tag are a `<servlet-name>` 64 followed by a `<url-pattern>` 64 tag.

Example:

```
<servlet-mapping>
   <servlet-name>StandardKeyMaster</servlet-name>
   <url-pattern>/servlet/StandardKeyMaster</url-pattern>
</servlet-mapping>
```

<servlet-name>

Tag: `<servlet-name>`

This tag defines the name of a servlet.

Note: Do not modify this tag unless you are implementing a customized version of Caplin KeyMaster.

Attributes: None.

The tag has no child tags.

Example:

```
<servlet>
   <servlet-name>StandardKeyMaster</servlet-name>
   <servlet-class>com.caplin.keymaster.servlet.StandardKeyMaster</servlet-class>
...
</servlet>
```

This tag is used to define the name of the KeyMaster Signature Generator servlet, as shown in the example above.

It is also used in a `<servlet-mapping>` 63 tag.

<url-pattern>

Tag: `<url-pattern>`

This tag defines the URL that invokes the servlet named in the associated `<servlet-name>` 64 tag.

Note: Do not modify the `<url-pattern>` tag whose associated `<servlet-name>` tag has the value `StandardKeyMaster`, unless you are implementing a customized version of Caplin KeyMaster.

Attributes: None.

The tag has no child tags.

Example:

```
    <servlet-mapping>
        <servlet-name>StandardKeyMaster</servlet-name>
        <url-pattern>/servlet/StandardKeyMaster</url-pattern>
    </servlet-mapping>
```

<web-app>

Tag: `<web-app>`

The root tag for configuring the servlets of a Java web application.

Attributes: None.

The immediate children of the `<web-app>` tag are:

- a `<display-name>` 60 tag, followed by
- an optional `<description>` 60 tag, followed by
- one or more `<servlet>` 62 tags, followed by
- one or more `<servlet-mapping` 63 `>` tags.

There must be a separate `<servlet-mapping>` tag for each `<servlet>` tag.

For KeyMaster there only needs to be one `<servlet>` tag, to define the configuration of the Signature Generator servlet, and a corresponding `<servlet-mapping>` tag.

Example:

```
<web-app>

   <display-name>Caplin KeyMaster</display-name>
   <description>Caplin KeyMaster Servlet</description>

   <servlet>
   ...
   </servlet>

   <servlet-mapping>
   ...
   </servlet-mapping>

</web-app>
```

web.xml parameters

This section defines the valid parameters that can appear in the `<param-name>` 61 tag (within an `<init-param>` 61 tag) in the *web.xml* configuration file. The list is in alphabetical order of parameter name.

- `encrypting.encode.extra.data` 67
- `encrypting.generator.hardware.key.passphrase` 68
- `encrypting.generator.hardware.keystore.keyfile` 68
- `encrypting.generator.hardware.keystore.passphrase` 69
- `encrypting.generator.hardware.keystore.type` 69
- `encrypting.generator.key.identifier` 70
- `encrypting.generator.keystore.type` 70
- `encrypting.generator.private.key.store.filename` 71
- `encrypting.generator.security.provider.class.name` 72
- `encrypting.generator.security.provider.name` 73
- `encrypting.generator.signature.algorithm` 74
- `extra.data.provider.classname` 74
- `formatter-type-{formatter_name}` 75
- `formatter-type-javascript` 75
- `formatter-type-streamlink` 76
- `http.remote.user` 76
- `keymaster.url` 77
- `keymaster.poll.url` 78
- `key.generator.FilenameAttribute` 78
- `key.generator.Level` 79
- `user.credential.provider` 80

encrypting.encode.extra.data

Parameter: **`encrypting.encode.extra.data`**

Required? NO

Description:

In the standard (non customized) version of KeyMaster this *web.xml* parameter controls whether or not the user credentials token contains the user name in addition to the standard time stamp and sequence number.

If `encrypting.encode.extra.data` is set to `enabled`, and the parameter `extra.data.provider.classname` 74 is *not* defined, the user name is put in the token and is also included in the token's digital signature. If `encrypting.encode.extra.data` is not specified, or is set to any value other than `enabled`, the user name is *not* put in the token.

You can customize KeyMaster so that the user credentials token contains other additional data, for example entitlement information related to the user name. To do this, set `encrypting.encode.extra.data` to `enabled`, and define the parameter `extra.data.provider.classname` 74. In this case, the custom Java class defined by `extra.data.provider.classname` determines what additional data is put in the token; it is up to the custom class to include the user name if this is required.

In the example *web.xml* file shipped with KeyMaster this parameter is set to `disabled`.

Note: The `encrypting.encode.extra.data` parameter only works with Caplin Liberator versions 3.6.7 and 4.0.1 or higher.

Example:

```
<param-name>encrypting.encode.extra.data</param-name>
<param-value>enabled</param-value>
```

Also see:

- The `http.remote.user` 76 parameter, which determines where the user name is obtained from.
- The `extra.data.provider.classname` 74 parameter, which defines a custom Java class that KeyMaster uses to add extra data to the user credentials token.

encrypting.generator.hardware.key.passphrase

Parameter: **`encrypting.generator.hardware.key.passphrase`**

Required? NO

Description:

This *web.xml* parameter defines the passphrase that KeyMaster must use to retrieve the private encryption key from the hardware Key Store. This parameter must be included in *web.xml* if the private encryption key was protected by a passphrase when imported into the Key Store. It must match the value of the `key.importer.key.passphrase` property in *keyimporter.props* (see the keyimporter.props configuration reference 56 section and Importing the private key file and certificate into the Key Store 39.

If this parameter is not present in *web.xml* then KeyMaster attempts to retrieve the private encryption key from the Key Store without supplying a passphrase.

Example:

```
<param-name>encrypting.generator.hardware.key.passphrase</param-name>
<param-value>
 mykeypassphrase
</param-value>
```

encrypting.generator.hardware.keystore.keyfile

Parameter: **`encrypting.generator.hardware.keystore.keyfile`**

Required? YES if using a hardware Key Store, otherwise NO

Description:

The Key Importer tool generates a file that defines how KeyMaster can access the Key Store. This *web.xml* parameter defines the name and directory path of this file. It must have the same value as the *keyimporter.props* item `key.importer.keystore.location` (see keyimporter.props configuration reference 56).

Example:

```
<param-name>encrypting.generator.hardware.keystore.keyfile</param-name>
<param-value>
 /opt/keystore.dat
</param-value>
```

Also see:

- Importing the private key file and certificate into the Key Store 39.

encrypting.generator.hardware.keystore.passphrase

Parameter: **`encrypting.generator.hardware.keystore.passphrase`**

Required? NO

Description:

This *web.xml* parameter defines the passphrase that KeyMaster must use to access the hardware Key Store. This parameter must be included in *web.xml* if the hardware Key Store is protected by a passphrase. It must match the value of the `key.importer.keystore.passphrase` property in *keyimporter.props* (see the keyimporter.props configuration reference 56 section and Importing the private key file and certificate into the Key Store 39).

If this parameter is not present in *web.xml*, KeyMaster attempts to access the Key Store without supplying a passphrase.

Example:

```
<param-name>encrypting.generator.hardware.keystore.passphrase</param-name>
<param-value>
 keystorepassphrase
</param-value>
```

encrypting.generator.hardware.keystore.type

Parameter: **`encrypting.generator.hardware.keystore.type`**

Required? YES if using a hardware Key Store, otherwise NO

Description:

This *web.xml* parameter defines the 'type' parameter to use when KeyMaster creates a Java **KeyStore** class to represent the hardware Key Store. It is the first argument of the **KeyStore.getInstance()** method. The value required is normally specified by the supplier of the Key Store hardware.

Example:

```
<param-name>encrypting.generator.hardware.keystore.type</param-name>
<param-value>
 ncipher.sworld
</param-value>
```

encrypting.generator.key.identifier

Parameter: **`encrypting.generator.key.identifier`**

Required? YES

Description:

This *web.xml* parameter is the name of the key identifier that was passed as the second argument of the generator command when the key files were created. See Generating the Required Keys 8.

Example:

```
<param-name>encrypting.generator.key.identifier</param-name>
<param-value>keyid1</param-value>
```

encrypting.generator.keystore.type

Parameter: **`encrypting.generator.keystore.type`**

Required? NO

Description:

This *web.xml* parameter indicates whether KeyMaster should retrieve encryption keys from files held on normal disk or from a hardware Key Store. The accepted values for this parameter are:

- `standard`

  The encryption keys are held on disk.
- `hardware`

  The encryption keys are held in a hardware Key Store.

If this parameter is not present then KeyMaster assumes the default value `standard`.

Example:

```
<param-name>encrypting.generator.keystore.type</param-name>
<param-value>
 hardware
</param-value>
```

encrypting.generator.private.key.store.filename

Parameter: `encrypting.generator.private.key.store.filename`

Required? NO if using a hardware Key Store, otherwise YES

Description:

This *web.xml* parameter is the full path to the private key store. Standard KeyMaster uses the private key store to generate user credentials tokens.

You can specify the path as a file path or as a Java classpath.

If you are using a hardware Key Store, this parameter can be omitted from *web.xml*, but if it *is* present then KeyMaster will just ignore it.

Example file path specification (KeyMaster on Linux or Sun Solaris):

```
<param-name>encrypting.generator.private.key.store.filename</param-name>
<param-value>
 /usr/local/jakarta-tomcat-5.0.16/webapps/keymaster/privatekey.store
</param-value>
```

Example classpath specification (KeyMaster on Linux or Sun Solaris):

```
<param-name>encrypting.generator.private.key.store.filename</param-name>
<param-value>
 classpath:com/caplin/keymaster/encrypted/privatekey.store
</param-value>
```

Example file path specification (KeyMaster on Windows):

```
<param-name>encrypting.generator.private.key.store.filename</param-name>
<param-value>C:/myKeyMaster/KeyMaster-4.4.0/privatekey.store</param-value>
```

If the file path is specified using the Windows backward slash notation, the slash characters must be paired ('\\'):

```
<param-name>encrypting.generator.private.key.store.filename</param-name>
<param-value>C:\\myKeyMaster\\KeyMaster-4.4.0\\privatekey.store</param-value>
```

encrypting.generator.security.provider.class.name

Parameter: **`encrypting.generator.security.provider.class.name`**

Required? YES

Description:

This *web.xml* parameter is the fully qualified name of the JCE 82 provider's Java class used to generate the encryption key pairs.

KeyMaster is shipped with public domain encryption software from The Legion Of The Bouncy Castle, and so in the example *web.xml* file shipped with KeyMaster, `encrypting.generator.security.provider.class.name` is set to point the Bouncy Castle encryption class (see the example below).

Note: Only change this setting if you have customized KeyMaster to use a different encryption class. If you do use a different encryption class, make sure that the class name is included in the classpath for the KeyMaster servlet.

Note: This parameter must specify the same class name as that specified in the `key.generator.security.provider.class.name` 54 property of the *keygen.props* configuration file.

See the section on keygen.props configuration reference 54.

Example:

```
<param-name>encrypting.generator.security.provider.class.name</param-name>
<param-value>org.bouncycastle.jce.provider.BouncyCastleProvider</param-value>
```

Also see:

- The `key.generator.security.provider.class.name` 54 parameter of *keygen.props*.
- The `encrypting.generator.security.provider.name` 73 parameter.

encrypting.generator.security.provider.name

Parameter: **`encrypting.generator.security.provider.name`**

Required? YES

Description:

This *web.xml* parameter is the name of the provider of the Java class used to generate the encryption key pairs.

KeyMaster is shipped with public domain encryption software from The Legion Of The Bouncy Castle, and so in the example *web.xml* file shipped with KeyMaster, the `encrypting.generator.security.provider.name` parameter defines this provider (see the example below).

Note: Only change this setting if you have customized KeyMaster to use a different encryption provider.

Note: This parameter must specify the same provider name as that specified in the `key.generator.security.provider.name` 55 property of the *keygen.props* configuration file.

See the section on keygen.props configuration reference 54.

Example:

```
<param-name>encrypting.generator.security.provider.name</param-name>
<param-value>BC</param-value>
```

Also see:

- The `encrypting.generator.security.provider.class.name` 72 parameter.

encrypting.generator.signature.algorithm

Parameter: **`encrypting.generator.signature.algorithm`**

Required? NO

Description:

This *web.xml* parameter is the algorithm used to digitally sign KeyMaster user credentials tokens. The accepted values for this parameter are:

- `MD5withRSA`
- `SHA256withRSA`

If this parameter is not present then KeyMaster uses `MD5withRSA` as the default algorithm.

Example:

```
<param-name>encrypting.generator.signature.algorithm</param-name>
<param-value>
 SHA256withRSA
</param-value>
```

extra.data.provider.classname

Parameter: **`extra.data.provider.classname`**

Required? NO

Description:

This *web.xml* parameter is the name of a custom Java class that KeyMaster uses to add extra data to the user credentials token. If you define this parameter then you must also set the parameter `encrypting.encode.extra.data` 67 to `enabled`.

The custom Java class must implement the interface **com.caplin.keymaster.servlet.ExtraDataProvider**. The interface ensures that the extra data is also included in the digital signature.

If you require the user name to be included in the user credentials token you must specify this in your custom class.

Example:

```
<param-name>extra.data.provider.classname</param-name>
<param-value>com.caplin.ExampleDataProvider</param-value>
```

Also see:

- The `http.remote.user` 76 parameter, which determines where the user name is obtained from.
- The `encrypting.encode.extra.data` 67 parameter, which determines whether the user name or other additional data is put in the user credentials token.

formatter-type-{formatter_name}

Parameter: **`formatter-type-{formatter_name}`**

Required? NO

Description:

This *web.xml* parameter defines the name of a custom Java class that formats KeyMaster's response to a request for a user credentials token. `{formatter_name}` uniquely identifies the formatter to be used; the name of the corresponding class is defined in the accompanying `<param-value>` tag (see the example below).

KeyMaster is shipped with two standard response formatters that are defined in the example *web.xml* file (see parameters `formatter-type-javascript` 75 and `formatter-type-streamlink` 76). You only need to add additional `formatter-type-{formatter_name}` parameters if you are customizing KeyMaster with additional response formatter classes.

Example:

```
<param-name>formatter-type-news</param-name>
<param-value>examples.news.NewsFormatter</param-value>
<description>Name of the class to handle a NewsFormatter response</description>
```

formatter-type-javascript

Parameter: **`formatter-type-javascript`**

Required? YES for Standard KeyMaster

Description:

This *web.xml* parameter defines the name of the Java class that formats KeyMaster's response to a request from a JavaScript application for a user credentials token. This class is shipped with KeyMaster and the corresponding `formatter-type-javascript` parameter is defined in the example *web.xml* file.

Note: Only modify the value of this parameter if KeyMaster is being customized to use a different formatter class for handling responses to Javascript requests.

Example:

```
<param-name>formatter-type-javascript</param-name>
<param-value>com.caplin.keymaster.servlet.</param-value>
<description>Name of the class to handle a JavaScript response</description>
```

formatter-type-streamlink

Parameter: **`formatter-type-streamlink`**

Required? YES for Standard KeyMaster

Description:

This *web.xml* parameter defines the name of the Java class that formats KeyMaster's response to a request from a Caplin StreamLink application for a user credentials token. This class is shipped with KeyMaster and the corresponding `formatter-type-streamlink` parameter is defined in the example *web.xml* file.

Note: Only modify the value of this parameter if KeyMaster is being customized to use a different formatter class for handling responses to StreamLink requests.

Example:

```
<param-name>formatter-type-streamlink</param-name>
<param-value>com.caplin.keymaster.servlet.StreamLinkFormatter</param-value>
<description>Name of the class to handle a StreamLink response</description>
```

http.remote.user

Parameter: **`http.remote.user`**

Required? NO

Description:

When an end user's client application requests a user credentials token, KeyMaster's Signature Generator servlet will by default obtain the end user's user name from an HTTP request parameter sent by the application
(`?username=...`). However, if the end user has logged on to the application using a single sign-on system, the single sign-on system may be able to transmit the user name in the REMOTE_USER attribute of the HTTP header.

Setting the *web.xml* parameter `http.remote.user` to `enabled` causes KeyMaster to obtain the user name from the HTTP header, instead of from the HTTP request parameter. However, if `http.remote.user` is `enabled` but the REMOTE_USER is null, then KeyMaster reverts to obtaining the user name from the `username` parameter in the HTTP request.

If the `http.remote.user` parameter is not specified, or is set to any value other than `enabled`, KeyMaster obtains the user name from the from the HTTP request parameter `username`.

In the example *web.xml* file shipped with KeyMaster, `http.remote.user` is set to `disabled`.

Note: Only set `http.remote.user` to `enabled` if your single sign-on system supports transmitting the user name in the REMOTE_USER attribute of the HTTP header.

Example:

```
<param-name>http.remote.user</param-name>
<param-value>enabled</param-value>
```

Also see:

- The user.credential.provider 80 parameter, which defines the Java class that determines how the user name is retrieved.
- The encrypting.encode.extra.data 67 parameter, which determines whether the user name or other additional data is put in the user credentials token.
- The extra.data.provider.classname 74 parameter, which defines a custom Java class that KeyMaster uses to add extra data to the user credentials token.

keymaster.url

Parameter: `keymaster.url`

Required? NO

Description:

If you are deploying a customized version of KeyMaster that uses a different `<servlet-mapping>` for the `StandardKeyMaster` servlet, then you also need to specify the url of the `StandardKeyMaster` servlet here, so that the `XHRKeymaster` servlet can access it.

Note: This parameter should only be specified in the `<servlet>` definition for `XHRKeymaster`, and must not be used in the definitions for any of the other KeyMaster servlets.

Example:

```
<servlet>
   <servlet-name>XHRKeymaster</servlet-name>
   <init-param>
      <param-name>keymaster.url</param-name>
      <param-value>/servlet/CustomizedKeyMasterName</param-value>
   </init-param>
      ...
</servlet>
```

where the `<servlet-mapping>` for the `StandardKeyMaster` servlet has been changed to:

```
<servlet-mapping>
   <servlet-name>StandardKeyMaster</servlet-name>
   <url-pattern>/servlet/CustomizedKeyMasterName</url-pattern>
</servlet-mapping>
```

Also see:

- Changing KeyMaster's URL 18

keymaster.poll.url

Parameter: `keymaster.poll.url`

Required? NO

Description:

If you are deploying a customized version of KeyMaster that uses a different `<servlet-mapping>` for the `Poll` servlet, then you also need to specify the url of the `Poll` servlet here, so that the `XHRKeymaster` servlet can access it.

Note: This parameter should only be specified in the `<servlet>` definition for `XHRKeymaster`, and must not be used in the definitions for any of the other KeyMaster servlets.

Example:

```
<servlet>
   <servlet-name>XHRKeymaster</servlet-name>
   <init-param>
      <param-name>keymaster.poll.url</param-name>
      <param-value>/servlet/newPollLocation</param-value>
   </init-param>
      ...
</servlet>
```

where the `<servlet-mapping>` for the `Poll` servlet has been changed to:

```
<servlet-mapping>
   <servlet-name>Poll</servlet-name>
   <url-pattern>/servlet/newPollLocation</url-pattern>
</servlet-mapping>
```

Also see:

- Changing the KeyMaster Poll servlet's URL 19

key.generator.FilenameAttribute

Parameter: **`key.generator.FilenameAttribute`**

Required? NO

Description:

This *web.xml* parameter defines the name and location of the KeyMaster Signature Generator's log file. This can be a full path name or a relative path. If a relative path name is used, then it will normally be relative to the application server’s root directory, though this may not be the case for some application servers.

If this parameter is not specified, KeyMaster will by default create a log file called *keymaster.log* in the application server's root directory, though once again, this may not be the case for some application servers. In the example *web.xml* file shipped with KeyMaster, the log file name is set to *servlet.log* (see the example below).

Example:

```
<param-name>key.generator.FilenameAttribute</param-name>
<param-value>servlet.log</param-value>
```

Also see:

- The `key.generator.Level` 79 parameter.

key.generator.Level

Parameter: **`key.generator.Level`**

Required? NO

Description:

This *web.xml* parameter defines the Java logging level used to output information to the KeyMaster log file about what is happening within KeyMaster. If this parameter is not specified, KeyMaster will by default set the logging level to SEVERE, so that only the most serious problems will be logged.

In the example *web.xml* file shipped with KeyMaster, the logging level is set to set to ALL (see the example below), which provides a very detailed level of logging for debug purposes.

Note: In a production system it is recommended that the logging level normally be set to SEVERE or WARNING.

Tip: The possible logging levels are defined in the standard Java documentation under **java.util.logging.Level**.

Example:

```
<param-name>key.generator.Level</param-name>
<param-value>ALL</param-value>
```

Also see:

- The `key.generator.FilenameAttribute` 78 parameter.

user.credential.provider

Parameter: `user.credential.provider`

Required? NO

Description:

This *web.xml* parameter specifies the KeyMaster class that obtains the user name to be inserted in the user credentials token.

If this parameter is not specified, KeyMaster uses the class **com.caplin.keymaster.servlet.UserCredentialsProvider**, which obtains the user name according to the setting of the parameter `http.remote.user` 76.

In the example *web.xml* file shipped with KeyMaster, `user.credential.provider` is set to the default class **com.caplin.keymaster.servlet.UserCredentialsProvider**.

Note: Only change this setting if you have customized KeyMaster to use a different class for obtaining the user name.

Example:

```
<param-name>user.credential.provider</param-name>
<param-value>com.caplin.keymaster.servlet.UserCredentialsProvider</param-value>
```

Also see:

- The `http.remote.user` 76 parameter, which determines where the user name is obtained from.

14 Glossary of Terms and Acronyms

This section contains a glossary of terms and acronyms relating to the KeyMaster product.

Term	Definition
Ajax	Asynchronous JavaScript and XML A combination of Web technologies used to implement interactive Web clients
Authentication	In the context of KeyMaster, authentication is the process of identifying a user, for example by checking a user name and password that the user supplied when attempting to log in. Authentication must proceed **authorization**.
Auth module	A Caplin software module that performs **authentication** and **authorization** functions. Liberator uses auth modules to authenticate users who log in to the Liberator, and to determine the users' access permissions to Liberator objects. See also **javaauth** and **XMLauth**.
Authorization	In the context of KeyMaster, authorization is the process of determining the access rights that a user has to resources, such as data and functionality provided the software. Users cannot be authorized until they have been successfully authenticated – see **authentication**.
Caplin Platform	The Caplin Platform is a suite of software products for on-line financial trading and Web delivery of real-time market data
Caplin Trader	Caplin Trader is a complete platform and toolkit for building multi-product trading portals. It is built on the **Caplin Platform**.
Caplin Trader Client	Caplin Trader Client is a Web application written in Ajax that provides a rich trading workstation in a browser. It is part of **Caplin Trader**.
DER	Distinguished Encoding Rules. Rules for encoding ASN.1 objects in binary format which define just one way to represent any ASN.1 value. DER encoding is typically used when the same object is encoded in ASN.1 format multiple times for digital signature verification.
DER public key file	In KeyMaster this is a file containing a KeyMaster public key in **DER** format. This file is used by Caplin Liberator to authenticate the **user credentials token** sent by a user application that wishes to log in to the Liberator.
Digital signature	An electronic signature that is used to authenticate the sender of a message or author of a document. The signature is usually encrypted in some manner (see **public key encryption**). KeyMaster inserts a digital signature in the **user credentials tokens** that it generates.
javaauth	An **auth module** in which the **authentication** and **authorization** rules are specified using Java code.

Term	Definition
JCE	Java Cryptography Extension A Java package that provides a framework for and implementations of encryption, key generation and key agreement, and Message Authentication Code (MAC) algorithms. For more information see Sun's Java Cryptography Extension Reference Guide.
Key Store	A hardware repository that holds encryption keys and X.509 certificates.
MD5withRSA	A digital signature algorithm. See the section "Digital signature algorithms" in the **KeyMaster Overview**.
OpenSSL	An open source implementation of the SSL (Secure Sockets Layer) and TLS (Transport Layer Security) protocols. In KeyMaster, the basic cryptographic functions are used generate RSA keys and certificates for storage in a hardware **Key Store**.
Public key encryption	A method of sending encrypted information between two parties without the need for them to exchange a key for encrypting and decrypting the information. Rather than using a single key it uses two related keys – a public key and a private key. (See the note on public key cryptography and digital signatures in the **KeyMaster Overview**.)
RTTP	Real Time Text Protocol Caplin's object-oriented, real-time, protocol for the distribution of financial data and trade messages over internet-protocol networks between client applications and Caplin Liberator
RTSL	Real Time Scripting Layer A functional interface that can be used from any JavaScript-type language within a browser to create and manage **RTTP** connections and access streaming data.
SDK	Software Development Kit
SHA256withRSA	A digital signature algorithm. See the section "Digital signature algorithms" in the **KeyMaster Overview**.
Single sign-on	A user authentication process in which a user supplies just one set of **user credentials** (such as a user name and password). The user can then access multiple applications and systems without being prompted for credentials again.
StreamLink	Caplin StreamLink is a family of **SDK**s that allows developers to add **RTTP** streaming capability to client applications.
StreamLink for Browsers	The JavaScript implementation of **StreamLink** that is used by **Ajax** client applications such as **Caplin Trader Client**.
User credentials	Information used to authenticate a user; for example a user name and password.
User credentials token	A data structure, containing **user credentials**, that is passed from one application to another in order to authenticate the user.
XMLauth	An **auth module** in which the **authentication** and **authorization** rules are specified in XML format.

Index

CAPLIN THE REAL TIME WEB COMPANY

Contact Us

Caplin Systems Ltd

Triton Court

14 Finsbury Square

London EC2A 1BR

Telephone: +44 20 7826 9600

Fax: +44 20 7826 9610

www.caplin.com