Fuse ESB Enterprise

Security Guide

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Integration Everywhere

Security Guide

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Chapter 1. Security Architecture

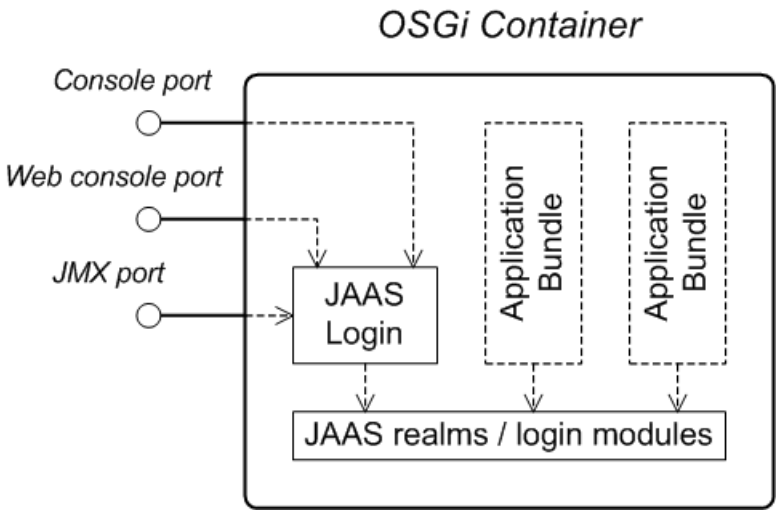
In the OSGi container, it is possible to deploy applications supporting a variety of security features. Currently, only the Java Authentication and Authorization Service (JAAS) is based on a common, container-wide infrastructure. Other security features are provided separately by the individual products and components deployed in the container.

OSGi Container Security

Overview

Figure 1.1 on page 14 shows an overview of the security infrastructure that is used across the container and is accessible to all bundles deployed in the container. This common security infrastructure currently consists of a mechanism for making JAAS realms (or login modules) available to all application bundles. Other aspects of security are currently implemented separately in each of the Fuse ESB Enterprise component products (Apache ActiveMQ, Apache Camel, and Apache CXF).

Figure 1.1. OSGi Container Security Architecture



JAAS realms

A JAAS realm or login module is a plug-in module that provides authentication and authorization data to Java applications, as defined by the Java Authentication and Authorization Service[1] (JAAS) specification.

Fuse ESB Enterprise supports a special mechanism for defining JAAS login modules (in either a Spring or a blueprint file), which makes the login module accessible to all bundles in the container. This makes it easy for multiple

[1] http://download-llnw.oracle.com/javase/1.5.0/docs/guide/security/jaas/JAASRefGuide.html

applications running in the OSGi container to consolidate their security data into a single JAAS realm.

karaf realm

The OSGi container has a predefined JAAS realm, the `karaf` realm. Fuse ESB Enterprise uses the `karaf` realm to provide authentication for remote administration of the OSGi runtime, for the Web Console, and for JMX management. The `karaf` realm uses a simple file-based repository, where authentication data is stored in the *`InstallDir`*`/etc/users.properties` file.

You can use the `karaf` realm in your own applications. Simply configure `karaf` as the name of the JAAS realm that you want to use. Your application then performs authentication using the data from the `users.properties` file.

Console port

You can administer the OSGi container remotely either by connecting to the console port with a Karaf client or using the Karaf `ssh:ssh` command (see "Using Remote Connections to Manage a Container" in *Configuring and Running Fuse ESB Enterprise*). The console port is secured by a JAAS login feature that connects to the `karaf` realm. Users that try to connect to the console port will be prompted to enter a username and password that must match one of the accounts from the `karaf` realm.

JMX port

You can manage the OSGi container by connecting to the JMX port (for example, using Java's JConsole). The JMX port is also secured by a JAAS login feature that connects to the `karaf` realm.

Application bundles and JAAS security

Any application bundles that you deploy into the OSGi container can access the container's JAAS realms. The application bundle simply references one of the existing JAAS realms by name (which corresponds to an instance of a JAAS login module).

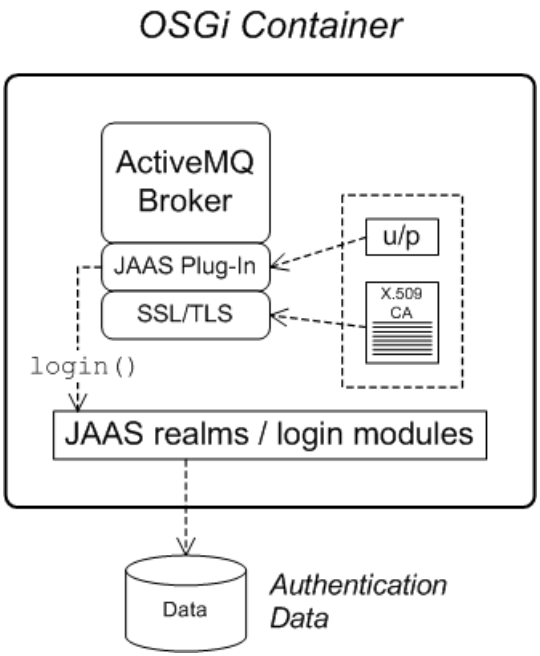
It is essential, however, that the JAAS realms are defined using the OSGi container's own login configuration mechanism—by default, Java provides a simple file-based login configuration implementation, but you *cannot* use this implementation in the context of the OSGi container.

Apache ActiveMQ Security

Overview

Figure 1.2 on page 16 shows an overview of the Apache ActiveMQ security architecture. The main security features supported by Apache ActiveMQ are the SSL/TLS security layer and the JAAS security layer. The SSL/TLS security layer provides message encryption and identifies the broker to its clients, while the JAAS security layer identifies clients to the broker.

Figure 1.2. Apache ActiveMQ Security Architecture



SSL/TLS security

Apache ActiveMQ supports the use of SSL/TLS to secure client-to-broker and broker-to-broker connections, where the underlying SSL/TLS implementation is provided by the Java Secure Socket Extension (JSSE). When deploying brokers and clients in an OSGi container, you cannot configure SSL/TLS security using JSSE system properties, however. You must either use XML configuration (for example, in a Spring or a blueprint file) or set the security properties by programming.

For more details, see "SSL/TLS Security" in *ActiveMQ Security Guide*.

JAAS security

Apache ActiveMQ also supports JAAS security, which typically requires clients to log on to the broker by providing username and password credentials. When deployed in an OSGi container, the broker's JAAS security must be integrated with the container's JAAS security (as described in "OSGi Container Security" on page 14).

JAAS plug-ins

To enable JAAS security in a broker, you install one of the supported JAAS plug-ins. Each of the JAAS plug-ins supports a different kind of credentials or implements a somewhat different login procedure. The following JAAS plug-ins are currently supported by Apache ActiveMQ:

- `jaasAuthenticationPlugin` supports authentication using JMS username/password credentials.
- `jaasCertificateAuthenticationPlugin` supports additional checking of the X.509 certificate received from a client (usable only in combination with SSL/TLS security).
- `jaasDualAuthenticationPlugin` is a hybrid version of the other two plug-ins. This plug-in checks the client's X.509 certificate, if and only if SSL/TLS is enabled. Otherwise, it falls back to checking the JMS username/password credentials.

For more details about the JAAS plug-ins, see "Introduction to JAAS" in *ActiveMQ Security Guide*.

JAAS login modules

Apache ActiveMQ provides a number of different JAAS login module implementations, which are used to define JAAS realms. The role of a JAAS login module is to store authentication and authorization data. The following JAAS login modules are currently implemented by Apache ActiveMQ:

- `PropertiesLoginModule`—stores username/password credentials and user group data in a pair of plain text files.
- `LDAPLoginModule`—an adapter that enables you to store username/password credentials and group data in an LDAP database.
- `GuestLoginModule`—logs all users into a default guest account. This login module is usually used in combination with a preceding login module

(defined in the same login entry), where the guest login module is activated only when the preceding login attempt has failed.

- `TextFileCertificateLoginModule`—tests the X.509 certificate received from the client by comparing the Distinguished Name (DN) embedded in the client certificate with the list of DNs stored in a plain text file.

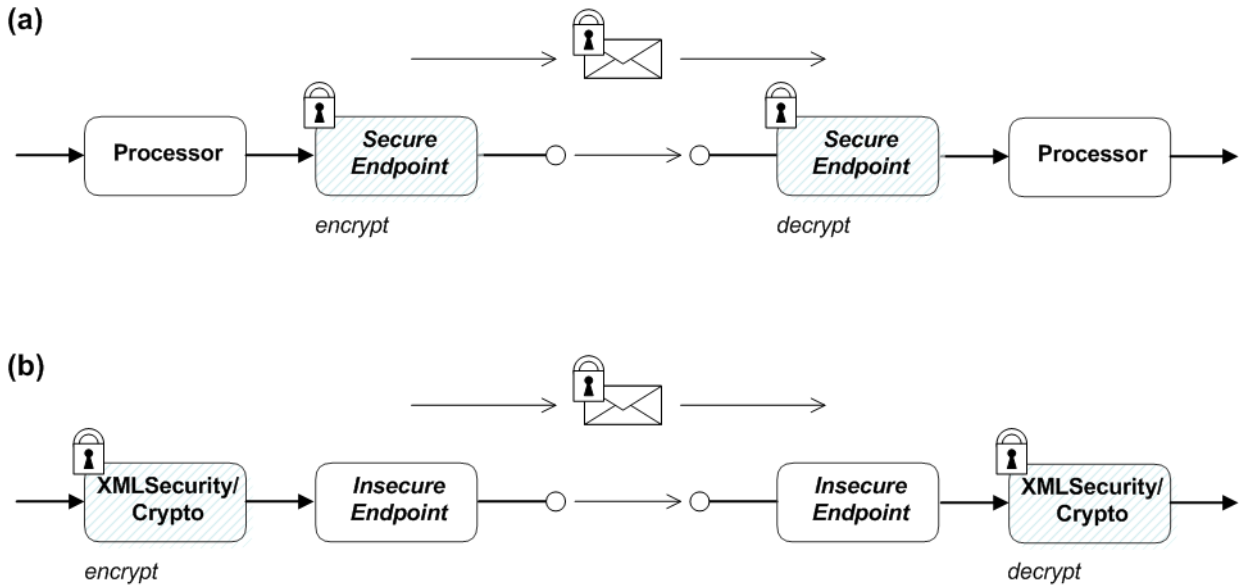
For more details about these login modules, see "Introduction to JAAS" in *ActiveMQ Security Guide*.

Apache Camel Security

Overview

Figure 1.3 on page 19 shows an overview of the basic options for securely routing messages between Apache Camel endpoints.

Figure 1.3. Apache Camel Security Architecture



Alternatives for Apache Camel security

As shown in Figure 1.3 on page 19, you have the following options for securing messages:

- *Endpoint security*—part (a) shows a message sent between two routes with secure endpoints. The producer endpoint on the left opens a secure connection (typically using SSL/TLS) to the consumer endpoint on the right. Both of the endpoints support security in this scenario.

  With endpoint security, it is typically possible to perform some form of peer authentication (and sometimes authorization).

- *Payload security*—part (b) shows a message sent between two routes where the endpoints are both *insecure*. To protect the message from unauthorized

snooping in this case, use a *payload processor* that encrypts the message before sending and decrypts the message after it is received.

A limitation of payload security is that it does *not* provide any kind of authentication or authorization mechanisms.

Endpoint security

There are several Camel components that support security features. It is important to note, however, that these security features are implemented by the individual components, *not* by the Camel core. Hence, the kinds of security feature that are supported, and the details of their implementation, vary from component to component. Some of the Camel components that currently support security are, as follows:

- JMS and ActiveMQ—SSL/TLS security and JAAS security for client-to-broker and broker-to-broker communication.
- Jetty—HTTP Basic Authentication and SSL/TLS security.
- CXF—SSL/TLS security and WS-Security.
- Crypto—creates and verifies digital signatures in order to guarantee message integrity.
- Netty—SSL/TLS security.
- MINA—SSL/TLS security.
- Cometd—SSL/TLS security.
- glogin and gauth—authorization in the context of Google applications.

Payload security

Apache Camel provides the following payload security implementations, where the encryption and decryption steps are exposed as data formats on the `marshal()` and `unmarshal()` operations

- "XMLSecurity data format" on page 20.
- "Crypto data format" on page 21.

XMLSecurity data format

The XMLSecurity data format is specifically designed to encrypt XML payloads. When using this data format, you can specify which XML element to encrypt.

The default behavior is to encrypt *all* XML elements. This feature uses a symmetric encryption algorithm.

For more details, see http://camel.apache.org/xmlsecurity-dataformat.html.

Crypto data format

The crypto data format is a general purpose encryption feature that can encrypt any kind of payload. It is based on the Java Cryptographic Extension and it uses asymmetric encryption.

For more details, see http://camel.apache.org/crypto.html.

Chapter 2. Securing the Fuse ESB Enterprise Container

The Fuse ESB Enterprise container is secured using JAAS. By defining JAAS realms, you can configure the mechanism used to retrieve user credentials. You can also refine access to the container's administrative interfaces by changing the default roles.

JAAS Authentication

Default JAAS Realm

Overview

This section describes how to manage user data in a for the default JAAS realm in a standalone container.

Default JAAS realm

The Fuse ESB Enterprise container has a predefined JAAS realm, the `karaf` realm, which is used by default to secure all aspects of the container.

How to integrate an application with JAAS

You can use the `karaf` realm in your own applications. Simply configure `karaf` as the name of the JAAS realm that you want to use.

Default JAAS login modules

When you start Fuse ESB Enterprise for the first time, the container is configured as a standalone container and uses the `karaf` default realm. In this default configuration, the `karaf` realm deploys two JAAS login modules, which are enabled simultaneously. To see the deployed login modules, enter the `jaas:realms` console command, as follows:

```
karaf@root> jaas:realms
Index Realm                Module Class

    1 karaf               org.apache.karaf.jaas.modules.prop
erties.PropertiesLoginModule
    2 karaf                org.apache.karaf.jaas.modules.pub
lickey.PublickeyLoginModule
```

Important

In a standalone container, *both* the properties login module and the public key login module are enabled. When JAAS authenticates a user, it tries first of all to authenticate the user with the properties login module. If that fails, it then tries to authenticate the user with the public key login module. If that module also fails, an error is raised.

Configuring the properties login module

The properties login module is used to store username/password credentials in a flat file format. To create a new user in the properties login module, open the *`InstallDir`*`/etc/users.properties` file using a text editor and add a line with the following syntax:

```
Username=Password[,Role1][,Role2]...
```

For example, to create the `jdoe` user with password, `topsecret`, and role, `admin`, you could create an entry like the following:

```
jdoe=topsecret,admin
```

Where the `admin` role gives full administrative privileges to the `jdoe` user.

Configuring the public key login module

The public key login module is used to store SSH public key credentials in a flat file format. To create a new user in the public key login module, open the *`InstallDir`*`/etc/keys.properties` file using a text editor and add a line with the following syntax:

```
Username=PublicKey,Role1,Role2,...
```

For example, you can create the `jdoe` user with the `admin` role by adding the following entry to the *`InstallDir`*`/etc/keys.properties` file (on a single line):

```
jdoe=AAAAB3NzaC1kc3MAAACBAP1/U4EddRIpUt9KnC7s5Of2EbdSPO9EAM
MeP4C2USZpRV1AIlH7WT2NWPq/xfW6MPbLm1Vs14E7
gB00b/JmYLdrmVClpJ+f6AR7ECLCT7up1/63xhv4O1fnfqim
FQ8E+4P208UewwI1VBNaFpEy9nXzrith1yrv8iIDGZ3RSAHHAAAAFQCX
YFCPFSMLzLKSuYKi64QL8Fgc9QAAAnEA9+Gghd
abPd7LvKtcNrhXuXmUr7v6OuqC+VdMCz0HgmdRWVeOutRZT+ZxBx
CBgLRJFnEj6Ewo
FhO3zwkyjMim4TwWeotifI0o4KOuHiuzpnWRbqN/C/ohNWLx+2J6ASQ7zK
TxvqhRkImog9/hWuWfBpKLZl6Ae1UlZAFMO/7PSSoAAACB
AKKSU2PFl/qOLxIwmBZPPIcJshVe7bVUpFvyl3BbJDow8rXf
skl8wO63OzP/qLmcJM0+JbcRU/53Jj7uyk31drV2qxhIOsLDC9dGCWj4
7Y7TyhPdXh/0dthTRBy6bqGtRPxGa7gJov1xm/UuYYXPI
UR/3x9MAZvZ5xvE0kYXO+rx,admin
```

Important

Do not insert the entire contents of an `id_rsa.pub` file here. Insert just the block of symbols which represents the public key itself.

Encrypting the stored passwords

By default, passwords are stored in the *`InstallDir`*`/etc/users.properties` file in plaintext format. To protect the passwords in this file, you must set the file permissions of the `users.properties` file so that it can be read only by administrators. To provide additional protection, you can optionally encrypt the stored passwords using a message digest algorithm.

To enable the password encryption feature, edit the *InstallDir*/etc/org.apache.karaf.jaas.cfg file and set the encryption properties as described in the comments. For example, the following settings would enable basic encryption using the MD5 message digest algorithm:

```
encryption.enabled = true
encryption.name = basic
encryption.prefix = {CRYPT}
encryption.suffix = {CRYPT}
encryption.algorithm = MD5
encryption.encoding = hexadecimal
```

Note

The encryption settings in the org.apache.karaf.jaas.cfg file are applied *only* to the default karaf realm in a standalone container. The have no effect on a fabric container and no effect on a custom realm.

For more details about password encryption, see "Encrypting Stored Passwords" on page 49.

Overriding the default realm

If you want to customise the JAAS realm, the most convenient approach to take is to override the default karaf realm by defining a higher ranking karaf realm. This ensures that all of the Fuse ESB Enterprise security components switch to use your custom realm. For details of how to define and deploy custom JAAS realms, see "Defining JAAS Realms" on page 28.

Defining JAAS Realms

Overview

When defining a JAAS realm in the OSGi container, you *cannot* put the definitions in a conventional JAAS login configuration[2] file. Instead, the OSGi container uses a special `jaas:config` element for defining JAAS realms in a blueprint configuration file. The JAAS realms defined in this way are made available to *all* of the application bundles deployed in the container, making it possible to share the JAAS security infrastructure across the whole container.

Namespace

The `jaas:config` element is defined in the http://karaf.apache.org/xmlns/jaas/v1.0.0 namespace. When defining a JAAS realm you will need to include the line shown in Example 2.1 on page 28.

Example 2.1. JAAS Blueprint Namespace

```
xmlns:jaas="http://karaf.apache.org/xmlns/jaas/v1.0.0"
```

Configuring a JAAS realm

The syntax for the `jaas:config` element is shown in Example 2.2 on page 28.

Example 2.2. Defining a JAAS Realm in Blueprint XML

```
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"
           xmlns:jaas="http://karaf.apache.org/xmlns/jaas/v1.0.0">

    <jaas:config name="JaasRealmName"
                 [rank="IntegerRank"]>
        <jaas:module className="LoginModuleClassName"
                     [flags="[required|requisite|sufficient|optional]"]>
            Property=Value
            ...
        </jaas:module>
        ...
        <!-- Can optionally define multiple modules -->
        ...
    </jaas:config>

</blueprint>
```

The elements are used as follows:

[2] http://download.oracle.com/javase/6/docs/technotes/guides/security/jaas/JAASRefGuide.html#AppendixB

`jaas:config`

Defines the JAAS realm. It has the following attributes:

- `name`—specifies the name of the JAAS realm.
- `rank`—specifies an optional rank for resolving naming conflicts between JAAS realms . When two or more JAAS realms are registered under the same name, the OSGi container always picks the realm instance with the highest rank.

`jaas:module`

Defines a JAAS login module in the current realm. `jaas:module` has the following attributes:

- `className`—the fully-qualified class name of a JAAS login module. The specified class must be available from the bundle classloader.
- `flags`—determines what happens upon success or failure of the login operation. Table 2.1 on page 29 describes the valid values.

Table 2.1. Flags for Defining a JAAS Module

Value	Description
`required`	Authentication of this login module must succeed. Always proceed to the next login module in this entry, irrespective of success or failure.
`requisite`	Authentication of this login module must succeed. If success, proceed to the next login module; if failure, return immediately without processing the remaining login modules.
`sufficient`	Authentication of this login module is not required to succeed. If success, return immediately without processing the remaining login modules; if failure, proceed to the next login module.

Value	Description
`optional`	Authentication of this login module is not required to succeed. Always proceed to the next login module in this entry, irrespective of success or failure.

The contents of a `jaas:module` element is a space separated list of property settings, which are used to initialize the JAAS login module instance. The specific properties are determined by the JAAS login module and must be put into the proper format.

Note

You can define multiple login modules in a realm.

Converting standard JAAS login properties to XML

Fuse ESB Enterprise uses the same properties as a standard Java login configuration file, however Fuse ESB Enterprise requires that they are specified slightly differently. To see how the Fuse ESB Enterprise approach to defining JAAS realms compares with the standard Java login configuration file approach, consider how to convert the login configuration shown in Example 2.3 on page 30, which defines the `PropertiesLogin` realm using the Apache ActiveMQ properties login module class, `PropertiesLoginModule`:

Example 2.3. Standard JAAS Properties

```
PropertiesLogin {
    org.apache.activemq.jaas.PropertiesLoginModule required
        org.apache.activemq.jaas.properties.user="users.properties"
        org.apache.activemq.jaas.properties.group="groups.properties";
};
```

The equivalent JAAS realm definition, using the `jaas:config` element in a blueprint file, is shown in Example 2.4 on page 30.

Example 2.4. Blueprint JAAS Properties

```
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"
           xmlns:jaas="http://karaf.apache.org/xmlns/jaas/v1.0.0"
           xmlns:ext="http://aries.apache.org/blueprint/xmlns/blueprint-ext/v1.0.0">

    <jaas:config name="PropertiesLogin">
```

```
        <jaas:module className="org.apache.activemq.jaas.PropertiesLoginModule"
                     flags="required">
            org.apache.activemq.jaas.properties.user=users.properties
            org.apache.activemq.jaas.properties.group=groups.properties
        </jaas:module>
    </jaas:config>

</blueprint>
```

Important

You **do not** use double quotes for JAAS properties in the blueprint configuration.

Example

Fuse ESB Enterprise also provides an adapter that enables you to store JAAS authentication data in an X.500 server. Example 2.5 on page 31 defines the `LDAPLogin` realm to use Fuse ESB Enterprise's `LDAPLoginModule` class, which connects to the LDAP server located at `ldap://localhost:10389`.

Example 2.5. Configuring a JAAS Realm

```
<?xml version="1.0" encoding="UTF-8"?>
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"

  xmlns:jaas="http://karaf.apache.org/xmlns/jaas/v1.0.0"
  xmlns:ext="http://aries.apache.org/blueprint/xmlns/blueprint-
ext/v1.0.0">

  <jaas:config name="LDAPLogin" rank="1">
    <jaas:module className="org.apache.karaf.jaas.mod
ules.ldap.LDAPLoginModule"
                 flags="required">
      initialContextFactory=com.sun.jndi.ldap.LdapCtxFactory
      connection.username=uid=admin,ou=system
      connection.password=secret
      connection.protocol=
      connection.url = ldap://localhost:10389
      user.base.dn = ou=users,ou=system
      user.filter = (uid=%u)
      user.search.subtree = true
      role.base.dn = ou=users,ou=system
      role.filter = (uid=%u)
      role.name.attribute = ou
      role.search.subtree = true
      authentication = simple
    </jaas:module>
```

```
  </jaas:config>
</blueprint>
```

For a detailed description and example of using the LDAP login module, see "Enabling LDAP Authentication" on page 53.

JAAS Properties Login Module

Overview

The JAAS properties login module stores user data in a flat file format (where the stored passwords can optionally be encrypted using a message digest algorithm). The user data can either be edited directly, using a simple text editor, or managed using the `jaas:*` console commands.

For example, a standalone container uses the JAAS properties login module by default and stores the associated user data in the *`InstallDir`*`/etc/users.properties` file.

Supported credentials

The JAAS properties login module authenticates username/password credentials, returning the list of roles associated with the authenticated user.

Implementation classes

The following classes implement the JAAS properties login module:

`org.apache.karaf.jaas.modules.properties.PropertiesLoginModule`

Implements the JAAS login module.

`org.apache.karaf.jaas.modules.properties.PropertiesBackingEngineFactory`

Must be exposed as an OSGi service. This service makes it possible for you to manage the user data using the `jaas:*` console commands from the Apache Karaf shell (see "JAAS Console Commands" in *Console Reference*).

Options

The JAAS properties login module supports the following options:

`users`

Location of the user properties file.

Format of the user properties file

The user properties file is used to store username, password, and role data for the properties login module. Each user is represented by a single line in the user properties file, where a line has the following form:

```
Username=Password[,Role][,Role]...
```

Sample Blueprint configuration

The following Blueprint configuration shows how to define a new `karaf` realm using the properties login module, where the default `karaf` realm is overridden by setting the `rank` attribute to `2`:

```
<?xml version="1.0" encoding="UTF-8"?>
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"

           xmlns:jaas="http://karaf.apache.org/xm
lns/jaas/v1.0.0"
           xmlns:cm="http://aries.apache.org/blueprint/xm
lns/blueprint-cm/v1.1.0"
           xmlns:ext="http://aries.apache.org/blueprint/xm
lns/blueprint-ext/v1.0.0">

    <type-converters>
        <bean class="org.apache.karaf.jaas.modules.proper
ties.PropertiesConverter"/>
    </type-converters>

    <!-- Allow usage of System properties, especially the
karaf.base property -->
    <ext:property-placeholder placeholder-prefix="$[" place
holder-suffix="]"/>

    <jaas:config name="karaf" rank="2">
        <jaas:module className="org.apache.karaf.jaas.mod
ules.properties.PropertiesLoginModule"
                     flags="required">
            users = $[karaf.base]/etc/users.properties
        </jaas:module>
    </jaas:config>

   <!-- The Backing Engine Factory Service for the Properties
LoginModule -->
    <service interface="org.apache.karaf.jaas.modules.Backin
gEngineFactory">
        <bean class="org.apache.karaf.jaas.modules.proper
ties.PropertiesBackingEngineFactory"/>
    </service>

</blueprint>
```

Remember to export the `BackingEngineFactory` bean as an OSGi service, so that the `jaas:*` console commands can manage the user data.

JAAS OSGi Config Login Module

Overview

The JAAS OSGi config login modules leverages the *OSGi Config Admin Service* to store user data. This login module is fairly similar to the JAAS properties login module (for example, the syntax of the user entries is the same), but the mechanism for retrieving user data is based on the OSGi Config Admin Service.

The user data can be edited directly by creating a corresponding OSGi configuration file, `etc/PersistentID.cfg` or using any method of configuration that is supported by the OSGi Config Admin Service. The `jaas:*` console commands are not supported, however.

Supported credentials

The JAAS OSGi config login module authenticates username/password credentials, returning the list of roles associated with the authenticated user.

Implementation classes

The following classes implement the JAAS OSGi config login module:

`org.apache.karaf.jaas.modules.osgi.OsgiConfigLoginModule`

Implements the JAAS login module.

Note

There is no backing engine factory for the OSGi config login module, which means that this module cannot be managed using the `jaas:*` console commands.

Options

The JAAS OSGi config login module supports the following options:

`pid`

The *persistent ID* of the OSGi configuration containing the user data. In the OSGi Config Admin standard, a persistent ID references a set of related configuration properties.

Location of the configuration file

The location of the configuration file follows the usual convention where the configuration for the persistent ID, *`PersistentID`*, is stored in the following file:

```
InstallDir/etc/PersistentID.cfg
```

Format of the configuration file

The *PersistentID*.cfg configuration file is used to store username, password, and role data for the OSGi config login module. Each user is represented by a single line in the configuration file, where a line has the following form:

```
Username=Password[,Role][,Role]...
```

This is the same format that is used in a users property file.

Sample Blueprint configuration

The following Blueprint configuration shows how to define a new karaf realm using the OSGi config login module, where the default karaf realm is overridden by setting the rank attribute to 2:

```
<?xml version="1.0" encoding="UTF-8"?>
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"

           xmlns:jaas="http://karaf.apache.org/xm
lns/jaas/v1.0.0"
           xmlns:cm="http://aries.apache.org/blueprint/xm
lns/blueprint-cm/v1.1.0"
           xmlns:ext="http://aries.apache.org/blueprint/xm
lns/blueprint-ext/v1.0.0">

    <jaas:config name="karaf" rank="2">
        <jaas:module className="org.apache.karaf.jaas.mod
ules.osgi.OsgiConfigLoginModule"
                     flags="required">
          pid = org.fusesource.example.osgiconfigloginmodule

        </jaas:module>
    </jaas:config>

</blueprint>
```

In this example, the user data will be stored in the file, *InstallDir*/etc/org.fusesource.example.osgiconfigloginmodule.cfg, and it is not possible to edit the configuration using the jaas:* console commands.

JAAS Public Key Login Module

Overview

The JAAS public key login module stores user data in a flat file format, which can be edited directly using a simple text editor. The `jaas:*` console commands are not supported, however.

For example, a standalone container uses the JAAS public key login module by default and stores the associated user data in the *`InstallDir`*`/etc/keys.properties` file.

Supported credentials

The JAAS public key login module authenticates SSH key credentials. When a user tries to log in, the SSH protocol uses the stored public key to challenge the user. The user must possess the corresponding private key in order to answer the challenge. If login is successful, the login module returns the list of roles associated with the user.

Implementation classes

The following classes implement the JAAS public key login module:

`org.apache.karaf.jaas.modules.publickey.PublickeyLoginModule`

Implements the JAAS login module.

Note

There is no backing engine factory for the public key login module, which means that this module cannot be managed using the `jaas:*` console commands.

Options

The JAAS public key login module supports the following options:

`users`

Location of the user properties file for the public key login module.

Format of the user properties file

The user properties file is used to store username, public key, and role data for the public key login module. Each user is represented by a single line in the user properties file, where a line has the following form:

```
Username=PublicKey[,Role][,Role]...
```

Where the *PublicKey* is the public key part of an SSH key pair (typically found in a user's home directory in `~/.ssh/id_rsa.pub` in a UNIX system).

For example, to create the user `jdoe` with the `admin` role, you would create an entry like the following:

```
jdoe=AAAAB3NzaC1kc3MAAACBAP1/U4EddRIpUt9KnC7s5Of2EbdSPO9EAM
MeP4C2USZpRV1AIlH7WT2NWPq/xfW6MPbLm1Vs14E7
gB00b/JmYLdrmVClpJ+f6AR7ECLCT7up1/63xhv4O1fnfqim
FQ8E+4P208UewwI1VBNaFpEy9nXzrith1yrv8iIDGZ3RSAHHAAAAFQCX
YFCPFSMLzLKSuYKi64QL8Fgc9QAAAnEA9+Gghd
abPd7LvKtcNrhXuXmUr7v6OuqC+VdMCz0HgmdRWVeOutRZT+ZxBx
CBgLRJFnEj6Ewo
FhO3zwkyjMim4TwWeotifI0o4KOuHiuzpnWRbqN/C/ohNWLx+2J6ASQ7zK
TxvqhRkImog9/hWuWfBpKLZl6Ae1UlZAFMO/7PSSoAAACB
AKKSU2PFl/qOLxIwmBZPPIcJshVe7bVUpFvyl3BbJDow8rXf
skl8wO63OzP/qLmcJM0+JbcRU/53Jj7uyk31drV2qxhIOsLDC9dGCWj4
7Y7TyhPdXh/0dthTRBy6bqGtRPxGa7gJov1xm/UuYYXPI
UR/3x9MAZvZ5xvE0kYXO+rx,admin
```

Important

Do not insert the entire contents of the `id_rsa.pub` file here. Insert just the block of symbols which represents the public key itself.

Sample Blueprint configuration

The following Blueprint configuration shows how to define a new `karaf` realm using the public key login module, where the default `karaf` realm is overridden by setting the `rank` attribute to `2`:

```
<?xml version="1.0" encoding="UTF-8"?>
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"

           xmlns:jaas="http://karaf.apache.org/xm
lns/jaas/v1.0.0"
           xmlns:cm="http://aries.apache.org/blueprint/xm
lns/blueprint-cm/v1.1.0"
           xmlns:ext="http://aries.apache.org/blueprint/xm
lns/blueprint-ext/v1.0.0">

    <!-- Allow usage of System properties, especially the
karaf.base property -->
    <ext:property-placeholder placeholder-prefix="$[" place
holder-suffix="]"/>

    <jaas:config name="karaf" rank="2">
        <jaas:module className="org.apache.karaf.jaas.mod
```

```
ules.publickey.PublickeyLoginModule"
                    flags="required">
            users = $[karaf.base]/etc/keys.properties
        </jaas:module>
    </jaas:config>

</blueprint>
```

In this example, the user data will be stored in the file, *InstallDir*/etc/keys.properties, and it is not possible to edit the configuration using the `jaas:*` console commands.

JAAS JDBC Login Module

Overview

The JAAS JDBC login module enables you to store user data in a database back-end, using Java Database Connectivity (JDBC) to connect to the database. Hence, you can use any database that supports JDBC to store your user data. To manage the user data, you can use either the native database client tools or the `jaas:*` console commands (where the backing engine uses configured SQL queries to perform the relevant database updates).

Supported credentials

The JAAS JDBC Login Module authenticates username/password credentials, returning the list of roles associated with the authenticated user.

Implementation classes

The following classes implement the JAAS JDBC Login Module:

`org.apache.karaf.jaas.modules.jdbc.JDBCLoginModule`
: Implements the JAAS login module.

`org.apache.karaf.jaas.modules.jdbc.JDBCBackingEngineFactory`
: Must be exposed as an OSGi service. This service makes it possible for you to manage the user data using the `jaas:*` console commands from the Apache Karaf shell (see "JAAS Console Commands" in *Console Reference*).

Options

The JAAS JDBC login module supports the following options:

datasource
: The JDBC data source, specified either as an OSGi service or as a JNDI name. You can specify a data source's OSGi service using the following syntax:

```
osgi:ServiceInterfaceName[/ServicePropertiesFilter]
```

The *`ServiceInterfaceName`* is the interface or class that is exported by the data source's OSGi service (usually `javax.sql.DataSource`).

Because multiple data sources can be exported as OSGi services in a container, it is usually necessary to specify a filter, *`ServicePropertiesFilter`*, to select the particular data source that you want. Filters on OSGi services are applied to the service property settings and follow a syntax that is borrowed from LDAP filter syntax.

query.password
: The SQL query that retrieves the user's password. The query can contain a single question mark character, `?`, which is substituted by the username at run time.

query.role
: The SQL query that retrieves the user's roles. The query can contain a single question mark character, `?`, which is substituted by the username at run time.

insert.user
: The SQL query that creates a new user entry. The query can contain two question marks, `?`, characters: the first question mark is substituted by the username and the second question mark is substituted by the password at run time.

insert.role
: The SQL query that adds a role to a user entry. The query can contain two question marks, `?`, characters: the first question mark is substituted by the username and the second question mark is substituted by the role at run time.

delete.user
: The SQL query that deletes a user entry. The query can contain a single question mark character, `?`, which is substituted by the username at run time.

delete.role
: The SQL query that deletes a role from a user entry. The query can contain two question marks, `?`, characters: the first question mark is substituted by the username and the second question mark is substituted by the role at run time.

delete.roles
: The SQL query that deletes multiple roles from a user entry. The query can contain a single question mark character, `?`, which is substituted by the username at run time.

Example of setting up a JDBC login module

To set up a JDBC login module, perform the following main steps:

1. "Create the database tables" on page 42

2. "Create the data source" on page 42

3. "Specify the data source as an OSGi service" on page 43

Create the database tables

Before you can set up the JDBC login module, you must set up a users table and a roles table in the backing database to store the user data. For example, the following SQL commands show how to create a suitable `users` table and `roles` table:

```
CREATE TABLE users (
  username varchar(255) NOT NULL,
  password varchar(255) NOT NULL,
  PRIMARY KEY (username)
);
CREATE TABLE roles (
  username varchar(255) NOT NULL,
  role varchar(255) NOT NULL,
  PRIMARY KEY (username,role)
);
```

The `users` table stores username/password data and the `roles` table associates a username with one or more roles.

Create the data source

To use a JDBC datasource with the JDBC login module, the correct approach to take is to create a data source instance and export the data source as an OSGi service. The JDBC login module can then access the data source by referencing the exported OSGi service. For example, you could create a MySQL data source instance and expose it as an OSGi service (of `javax.sql.DataSource` type) using code like the following in a Blueprint file:

```
<blueprint xmlns:xsi="http://www.w3.org/2001/XMLSchema-in
stance"
         xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0">

   <bean class="com.mysql.jdbc.jdbc2.optional.MysqlDataSource"
 id="mysqlDatasource">
        <property name="serverName" value="localhost"></prop
erty>
        <property name="databaseName" value="DBName"></prop
erty>
        <property name="port" value="3306"></property>
        <property name="user" value="DBUser"></property>
       <property name="password" value="DBPassword"></property>
```

```
   </bean>

    <service id="mysqlDS" interface="javax.sql.DataSource"
ref="mysqlDatasource">
        <service-properties>
            <entry key="osgi.jndi.service.name" value="jd
bc/karafdb"/>
        </service-properties>
    </service>
</blueprint>
```

The preceding Blueprint configuration should be packaged and installed in the container as an OSGi bundle.

Specify the data source as an OSGi service

After the data source has been instantiated and exported as an OSGi service, you are ready to configure the JDBC login module. In particular, the `datasource` option of the JDBC login module can reference the data source's OSGi service using the following syntax:

```
osgi:javax.sql.DataSource/(osgi.jndi.service.name=jdbc/karafdb)
```

Where `javax.sql.DataSource` is the interface type of the exported OSGi service and the filter, `(osgi.jndi.service.name=jdbc/karafdb)`, selects the particular `javax.sql.DataSource` instance whose `osgi.jndi.service.name` service property has the value, `jdbc/karafdb`.

For example, you can use the following Blueprint configuration to override the `karaf` realm with a JDBC login module that references the sample MySQL data source:

```
<?xml version="1.0" encoding="UTF-8"?>
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"

           xmlns:jaas="http://karaf.apache.org/xm
lns/jaas/v1.0.0"
           xmlns:cm="http://aries.apache.org/blueprint/xm
lns/blueprint-cm/v1.1.0"
           xmlns:ext="http://aries.apache.org/blueprint/xm
lns/blueprint-ext/v1.0.0">

    <!-- Allow usage of System properties, especially the
karaf.base property -->
    <ext:property-placeholder placeholder-prefix="$[" place
holder-suffix="]"/>

    <jaas:config name="karaf" rank="2">
        <jaas:module className="org.apache.karaf.jaas.mod
```

```
ules.jdbc.JDBCLoginModule"
                    flags="required">
            datasource = osgi:javax.sql.Data
Source/(osgi.jndi.service.name=jdbc/karafdb)
           query.password = SELECT PASSWORD FROM USERS WHERE
 USERNAME=?
            query.role = SELECT ROLE FROM ROLES WHERE USER
NAME=?
            insert.user = INSERT INTO USERS VALUES(?,?)
            insert.role = INSERT INTO ROLES VALUES(?,?)
            delete.user = DELETE FROM USERS WHERE USERNAME=?
            delete.role = DELETE FROM ROLES WHERE USERNAME=?
 AND ROLE=?
           delete.roles = DELETE FROM ROLES WHERE USERNAME=?

        </jaas:module>
    </jaas:config>

    <!-- The Backing Engine Factory Service for the JDBCLogin
Module -->
    <service interface="org.apache.karaf.jaas.modules.Backin
gEngineFactory">
        <bean class="org.apache.karaf.jaas.modules.jdbc.JDBC
BackingEngineFactory"/>
    </service>

</blueprint>
```

Note

The SQL statements shown in the preceding configuration are in fact the default values of these options. Hence, if you create user and role tables consistent with these SQL statements, you could omit the options settings and rely on the defaults.

In addition to creating a JDBCLoginModule, the preceding Blueprint configuration also instantiates and exports a `JDBCBackingEngineFactory` instance, which enables you to manage the user data using the `jaas:*` console commands.

JAAS LDAP Login Module

Overview

The JAAS LDAP login module enables you to store user data in an LDAP database. To manage the stored user data, use a standard LDAP client tool. The `jaas:*` console commands are *not* supported.

For more details about using LDAP with Fuse ESB Enterprise, see "LDAP Authentication Tutorial" on page 127.

Supported credentials

The JAAS LDAP Login Module authenticates username/password credentials, returning the list of roles associated with the authenticated user.

Implementation classes

The following classes implement the JAAS LDAP Login Module:

`org.apache.karaf.jaas.modules.ldap.LDAPLoginModule`

Implements the JAAS login module.

Note

There is no backing engine factory for the LDAP Login Module, which means that this module cannot be managed using the `jaas:*` console commands.

Options

The JAAS LDAP login module supports the following options:

`connection.url`

The LDAP connection URL—for example, `ldap://hostname`.

`connection.username`

Admin username to connect to the LDAP server. This parameter is optional: if it is not provided, the LDAP connection will be anonymous.

`connection.password`

Admin password to connect to the LDAP server. Used only if the `connection.username` is also specified.

`user.base.dn`

The LDAP base DN used to look up roles—for example, `ou=role,dc=apache,dc=org`.

`user.filter`

The LDAP filter used to look up a user's role—for example, `(member:=uid=%u)`.

`user.search.subtree`

If `true`, the user lookup is recursive (`SUBTREE`). If `false`, the user lookup is performed only at the first level (`ONELEVEL`).

`role.base.dn`

The LDAP base DN used to look up roles—for example, `ou=role,dc=apache,dc=org`.

`role.filter`

The LDAP filter used to look up a user's role—for example, `(member:=uid=%u)`.

`role.name.attribute`

The LDAP role attribute containing the role value used by Apache Karaf—for example, `cn`.

`role.search.subtree`

If `true`, the role lookup is recursive (`SUBTREE`). If `false`, the role lookup is performed only at the first level (`ONELEVEL`).

`authentication`

Define the authentication back-end used on the LDAP server. The default is `simple`.

`initial.context.factory`

Define the initial context factory used to connect to the LDAP server. The default is `com.sun.jndi.ldap.LdapCtxFactory`.

`ssl`

If `true` or if the protocol on the `connection.url` is `ldaps`, an SSL connection will be used.

`ssl.provider`

Specifies the SSL provider.

`ssl.protocol`

The protocol version to use—for example, `SSL` or `TLS`.

`ssl.algorithm`

The algorithm to use for the `KeyManagerFactory` and the `TrustManagerFactory`—for example, `PKIX`.

`ssl.keystore`

The ID of the keystore that stores the LDAP client's own X.509 certificate (required only if SSL client authentication is enabled on the LDAP server). The keystore must be deployed using a `jaas:keystore` element (see "Sample Blueprint configuration" on page 47).

`ssl.keyalias`

The keystore alias of the LDAP client's own X.509 certificate (required only if there is more than one certificate stored in the keystore specified by `ssl.keystore`).

`ssl.truststore`

The ID of the keystore that stores trusted CA certificates, which are used to verify the LDAP server's certificate (the LDAP server's certificate chain must be signed by one of the certificates in the truststore). The keystore must be deployed using a `jaas:keystore` element.

Sample Blueprint configuration

The following Blueprint configuration shows how to define a new `karaf` realm using the LDAP login module, where the default `karaf` realm is overridden by setting the `rank` attribute to `2`:

```
<?xml version="1.0" encoding="UTF-8"?>
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"

           xmlns:jaas="http://karaf.apache.org/xm
```

```
lns/jaas/v1.0.0"
           xmlns:cm="http://aries.apache.org/blueprint/xm
lns/blueprint-cm/v1.1.0"
           xmlns:ext="http://aries.apache.org/blueprint/xm
lns/blueprint-ext/v1.0.0">

    <!-- Allow usage of System properties, for example the
karaf.home property -->
    <ext:property-placeholder placeholder-prefix="${" place
holder-suffix="}"/>

    <jaas:config name="karaf" rank="2">
        <jaas:module className="org.apache.karaf.jaas.mod
ules.ldap.LDAPLoginModule"
                     flags="required">
            connection.url = ldaps://localhost:10636
            user.base.dn = ou=users,ou=system
            user.filter = (uid=%u)
            user.search.subtree = true
            role.base.dn = ou=groups,ou=system
            role.filter = (uniqueMember=uid=%u)
            role.name.attribute = cn
            role.search.subtree = true
            authentication = simple
            ssl.protocol=SSL
            ssl.truststore=ks
            ssl.algorithm=PKIX
        </jaas:module>
    </jaas:config>

    <jaas:keystore name="ks"
               path="file:///${karaf.home}/etc/trusted.ks"
               keystorePassword="secret" />

</blueprint>
```

Encrypting Stored Passwords

Overview

By default, the JAAS login modules store passwords in plaintext format. Although you can (and should) protect such data by setting file permissions appropriately, you can provide additional protection to passwords by storing them in an obscured format (using a *message digest* algorithm).

Fuse ESB Enterprise provides a set of options for enabling password encryption, which can be combined with *any* of the JAAS login modules (except for the public key login module, where it is not needed).

Important

Although message digest algorithms are not easy to crack, they are not invulnerable to attack (for example, see the Wikipedia article on cryptographic hash functions[3]). Always use file permissions to protect files containing passwords, in addition to using password encryption.

Options

Password encryption for JAAS login modules can optionally be enabled by setting the following login module properties:

`encryption.enabled`

Set to `true`, to enable password encryption.

`encryption.name`

Name of the encryption service, which has been registered as an OSGi service.

`encryption.prefix`

Prefix for encrypted passwords.

`encryption.suffix`

Suffix for encrypted passwords.

`encryption.algorithm`

Specifies the name of the encryption algorithm—for example, `MD5` or `SHA-1`. You can specify one of the following encryption algorithms:

[3] http://en.wikipedia.org/wiki/Cryptographic_hash_function

- `MD2`
- `MD5`
- `SHA-1`
- `SHA-256`
- `SHA-384`
- `SHA-512`

`encryption.encoding`
: Encrypted passwords encoding: `hexadecimal` or `base64`.

`encryption.providerName` *(Jasypt only)*
: Name of the `java.security.Provider` instance that is to provide the digest algorithm.

`encryption.providerClassName` *(Jasypt only)*
: Class name of the security provider that is to provide the digest algorithm

`encryption.iterations` *(Jasypt only)*
: Number of times to apply the hash function recursively.

`encryption.saltSizeBytes` *(Jasypt only)*
: Size of the salt used to compute the digest.

`encryption.saltGeneratorClassName` *(Jasypt only)*
: Class name of the salt generator.

`role.policy`
: Specifies the policy for identifying role principals. Can have the values, `prefix` or `group`.

`role.discriminator`

Specifies the discriminator value to be used by the role policy.

Encryption services

An encryption service can be defined by inheriting from the `org.apache.karaf.jaas.modules.EncryptionService` interface and exporting an instance of the encryption service as an OSGi service. Two alternative implementations of the encryption service are provided:

- "Basic encryption service" on page 51.
- "Jasypt encryption" on page 51.

Basic encryption service

The basic encryption service is installed in the standalone container by default and you can reference it by setting the `encryption.name` property to the value, `basic`. In the basic encryption service, the message digest algorithms are provided by the SUN[4] security provider (the default security provider in the Oracle JDK).

Jasypt encryption

The Jasypt encryption service can be installed in the standalone container by installing the `jasypt-encryption` feature. For example, you can install Jasypt encryption by entering the following console command:

```
karaf@root> features:install jasypt-encryption
```

This command installs the requisite Jasypt bundles and exports Jasypt encryption as an OSGi service, so that it is available for use by JAAS login modules. To access the Jasypt encryption service, set the `encryption.name` property to the value, `jasypt`.

For more information about Jasypt encryption, see the Jasypt documentation[5].

Example of a login module with Jasypt encryption

Assuming that you have already installed the `jasypt-encryption` feature, you could deploy a properties login module with Jasypt encryption using the following Blueprint configuration:

```
<?xml version="1.0" encoding="UTF-8"?>
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"
```

[4] http://docs.oracle.com/javase/6/docs/technotes/guides/security/SunProviders.html#SUNProvider
[5] http://www.jasypt.org/general-usage.html

```
           xmlns:jaas="http://karaf.apache.org/xm
lns/jaas/v1.0.0"
           xmlns:cm="http://aries.apache.org/blueprint/xm
lns/blueprint-cm/v1.1.0"
           xmlns:ext="http://aries.apache.org/blueprint/xm
lns/blueprint-ext/v1.0.0">

    <type-converters>
        <bean class="org.apache.karaf.jaas.modules.proper
ties.PropertiesConverter"/>
    </type-converters>

    <!-- Allow usage of System properties, especially the
karaf.base property -->
    <ext:property-placeholder placeholder-prefix="$[" place
holder-suffix="]"/>

    <jaas:config name="karaf" rank="2">
        <jaas:module className="org.apache.karaf.jaas.mod
ules.properties.PropertiesLoginModule"
                     flags="required">
            users = $[karaf.base]/etc/users.properties
            encryption.enabled = true
            encryption.name = jasypt
            encryption.algorithm = SHA-256
            encryption.encoding = base64
            encryption.iterations = 100000
            encryption.saltSizeBytes = 16
        </jaas:module>
    </jaas:config>

   <!-- The Backing Engine Factory Service for the Properties
LoginModule -->
    <service interface="org.apache.karaf.jaas.modules.Backin
gEngineFactory">
        <bean class="org.apache.karaf.jaas.modules.proper
ties.PropertiesBackingEngineFactory"/>
    </service>

</blueprint>
```

Enabling LDAP Authentication

Overview

Fuse ESB Enterprise supplies a JAAS login module that enables it to use LDAP to authenticate users. The Fuse ESB Enterprise JAAS LDAP login module is implemented by the `org.apache.karaf.jaas.modules.ldap.LDAPLoginModule` class. It is preloaded in the container, so you do not need to install its bundle.

Procedure

To enable Fuse ESB Enterprise to use LDAP for user authentication you need to create a JAAS realm that includes the Fuse ESB Enterprise LDAP login module. As shown in Example 2.6 on page 53, this is done by adding a `jaas:module` element to the realm and setting its `className` attribute to `org.apache.karaf.jaas.modules.ldap.LDAPLoginModule`.

Example 2.6. Fuse ESB Enterprise LDAP JAAS Login Module

```
<jaas:config ... >
  <jaas:module className="org.apache.karaf.jaas.modules.ldap.LD
APLoginModule"
               flags="required">
    ...
  </jaas:module>
</jaas:config>
```

You will also need to provide values for the properties described in Table 2.2 on page 53.

LDAP properties

Table 2.2 on page 53 describes the properties used to configure the Fuse ESB Enterprise JAAS LDAP login module.

Table 2.2. Properties for the Fuse ESB Enterprise LDAP Login Module

Property	Description
`connection.url`	Specifies specify the location of the directory server using an ldap URL, `ldap://`*`Host`*`:`*`Port`*. You can optionally qualify this URL, by adding a forward slash, `/`, followed by the DN of a particular node in the directory tree.

Property	Description
`connection.username`	Specifies the DN of the user that opens the connection to the directory server. For example, `uid=admin,ou=system`.
`connection.password`	Specifies the password that matches the DN from `connection.username`. In the directory server, the password is normally stored as a `userPassword` attribute in the corresponding directory entry.
`user.base.dn`	Specifies the DN of the subtree of the DIT to search for user entries.
`user.filter`	Specifies the LDAP search filter used to locate user credentials. It is applied to the subtree selected by `user.base.dn`. Before being passed to the LDAP search operation, the value is subjected to string substitution such that all occurrences of `%u` are replaced by the user name extracted from the incoming credentials.
`user.search.subtree`	Specifies if the user entry search's scope includes the subtrees of the tree selected by `user.base.dn`.
`role.base.dn`	Specifies the DN of the subtree of the DIT to search for role entries.
`role.filter`	Specifies the LDAP search filter used to locate roles. It is applied to the subtree selected by `role.base.dn`. Before being passed to the LDAP search operation, the value is subjected to string substitution such that all occurrences of `%u` are replaced by the user name extracted from the incoming credentials.

Property	Description
role.name.attribute	Specifies the attribute type of the role entry that contains the name of the role/group. If you omit this option, the role search feature is effectively disabled.
role.search.subtree	Specifies if the role entry search's scope includes the subtrees of the tree selected by role.base.dn.
authentication	Specifies the authentication method used when binding to the LDAP server. Valid values are • simple—bind with user name and password authentication • none—bind anonymously
initial.context.factory	Specifies the class of the context factory used to connect to the LDAP server. This must always be set to com.sun.jndi.ldap.LdapCtxFactory.
ssl	Specifies if the connection to the LDAP server is secured via SSL. If connection.url starts with ldaps:// SSL is used regardless of this property.
ssl.provider	Specifies the SSL provider to use for the LDAP connection. If not specified, the default SSL provider is used.
ssl.protocol	Specifies the protocol to use for the SSL connection.
ssl.algorithm	Specifies the algorithm used by the trust store manager.
ssl.keystore	Specifies the keystore name.
ssl.keyalias	Specifies the name of the private key in the keystore.

Property	Description
ssl.truststore	Specifies the trust keystore name.

All of the properties are mandatory except the SSL properties.

Example

Example 2.7 on page 56 defines a JAAS realm that uses the LDAP server located at ldap://localhost:10389.

Example 2.7. Configuring a JAAS Realm that Uses LDAP Authentication

```
<?xml version="1.0" encoding="UTF-8"?>
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"

  xmlns:jaas="http://karaf.apache.org/xmlns/jaas/v1.0.0"
  xmlns:ext="http://aries.apache.org/blueprint/xmlns/blueprint-
ext/v1.0.0">

  <jaas:config name="karaf" rank="1">
    <jaas:module className="org.apache.karaf.jaas.mod
ules.ldap.LDAPLoginModule"
                 flags="sufficient">
      initialContextFactory=com.sun.jndi.ldap.LdapCtxFactory
      connection.username=uid=admin,ou=system
      connection.password=secret
      connection.protocol=
      connection.url = ldaps://localhost:10636
      user.base.dn = ou=users,ou=system
      user.filter = (uid=%u)
      user.search.subtree = true
      role.base.dn = ou=roles,ou=system,dc=fusesource
      role.filter = (uid=%u)
      role.name.attribute = cn
      role.search.subtree = true
      authentication = simple
      ssl.protocol=SSL
      ssl.truststore=truststore
      ssl.algorithm=PKIX
    </jaas:module>
    ...
  </jaas:config>
</blueprint>
```

Configuring Roles for the Administrative Protocols

Overview

By configuring each of the administrative functions to use a different role for authorization, you can provide fine grained control over who can monitor and manipulate running containers.

Administration protocols

You can independently configure roles for the following different administrative protocols:

- SSH (remote console login)
- JMX management
- Web console

Default role

The default role name for all of the administration protocols is set by the `karaf.admin.role` property in the Fuse ESB Enterprise's `etc/system.properties` file. For example, the default setting of `karaf.admin.role` is:

```
karaf.admin.role=admin
```

You have the option of overriding the default `admin` role set by `karaf.admin.role` for each of the administrative protocols.

Changing the remote console's role

To override the default role for the remote console add a `sshRole` property to the `org.apache.karaf.shell` PID. The following sets the role to `admin`:

```
sshRole=admin
```

Changing the JMX role

To override the default role for JMX add a `jmxRole` property to the `org.apache.karaf.management` PID. The following sets the role to `jmx`:

```
jmxRole=jmx
```

Using Encrypted Property Placeholders

Overview

When securing a container it is undesirable to use plain text passwords in configuration files. They create easy to target security holes. One way to avoid this problem is to use encrypted property placeholders when ever possible.

Fuse ESB Enterprise includes an extension to OSGi Blueprint that enables you to use Jasypt to decrypt property placeholders in blueprint files. It requires that you:

1. Create a properties file with encrypted values.
2. Add the proper namespaces to your blueprint file.
3. Import the properties using the Aries property placeholder extension.
4. Configure the Jasypt encryption algorithm.
5. Use the placeholders in your blueprint file.
6. Ensure that the Jasypt features are installed into the Fuse ESB Enterprise container.

Encrypted properties

Encrypted properties are stored in plain properties files. They are identified by wrapping them in the `ENC()` function as shown in Example 2.8 on page 58.

Example 2.8. Property File with an Encrypted Property

```
#ldap.properties
ldap.password=ENC(amIsvdqno9iSwnd7kAlLYQ==)
ldap.url=ldap://192.168.1.74:10389
```

Important

You will need to remember the password and algorithm used to encrypt the values. You will need this information to configure Jasypt.

Namespaces

To use encryted properties in your configuration, you will need to add the following namespaces to your blueprint file:

- Aries extensions—http://aries.apache.org/blueprint/xmlns/blueprint-ext/v1.0.0
- Apache Karaf Jasypt—http://karaf.apache.org/xmlns/jasypt/v1.0.0

Example 2.9 on page 59 shows a blueprint file with the required namespaces.

Example 2.9. Encrypted Property Namespaces

```
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"
  xmlns:ext="http://aries.apache.org/blueprint/xmlns/blueprint-ext/v1.0.0"
  xmlns:enc="http://karaf.apache.org/xmlns/jasypt/v1.0.0">
...
</blueprint>
```

Placeholder extension

In order to use encrypted property placeholders in a blueprint file you need to include an Aries `property-paceholder` element to you blueprint file. As shown in Example 2.10 on page 59, it must come before the Jasypt configuration or the use of placeholders.

Example 2.10. Aries Placeholder Extension

```
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"
  xmlns:ext="http://aries.apache.org/blueprint/xmlns/blueprint-ext/v1.0.0"
  xmlns:enc="http://karaf.apache.org/xmlns/jasypt/v1.0.0">

  <ext:property-placeholder>
    <ext:location>file:etc/ldap.properties</ext:location>
  </ext:property-placeholder>

...
</blueprint>
```

The Aries `property-placeholder` element's `ext:location` child specifies the location of the property file that contains the properties to use for the configuration. You can specify multiple files by using multiple `ext:location` children.

Jasypt configuration

You configure Jasypt using the Apache Karaf `property-placeholder` element. It has one child, `encoder`, that contains the actual Jasypt configuration.

The `encoder` element's mandatory `class` attribute specifies the fully qualified classname of the Jasypt encryptor to use for decrypting the properties. The

`encoder` element can take a `property` child that defines a Jasypt `PBEConfig` bean for configuring the encryptor.

For detailed information on how to configure the different Jasypt encryptors, see the Jasypt documentation[6].

Example 2.11 on page 60 shows configuration for using the string encryptor and retrieving the password from an environment variable.

Example 2.11. Jasypt Blueprint Configuration

```
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"
  xmlns:ext="http://aries.apache.org/blueprint/xmlns/blueprint-ext/v1.0.0"
  xmlns:enc="http://karaf.apache.org/xmlns/jasypt/v1.0.0">

  <ext:property-placeholder>
    <ext:location>file://ldap.properties</ext:location>
  </ext:property-placeholder>

  <enc:property-placeholder>
    <enc:encryptor class="org.jasypt.encryption.pbe.StandardPBEStringEncryptor">
      <property name="config">
        <bean class="org.jasypt.encryption.pbe.config.EnvironmentStringPBEConfig">
          <property name="algorithm" value="PBEWithMD5AndDES" />
          <property name="passwordEnvName" value="FUSE_ENCRYPTION_PASSWORD" />
        </bean>
      </property>
    </enc:encryptor>
  </enc:property-placeholder>
...
</blueprint>
```

Placeholders

The placeholder you use for encrypted properties are the same as you use for regular properties. The use the form `${prop.name}`.

Example 2.12 on page 60 shows an LDAP JAAS realm that uses the properties file in Example 2.8 on page 58.

Example 2.12. Jasypt Blueprint Configuration

```
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"
  xmlns:ext="http://aries.apache.org/blueprint/xmlns/blueprint-ext/v1.0.0"
  xmlns:enc="http://karaf.apache.org/xmlns/jasypt/v1.0.0">
```

[6] http://www.jasypt.org/general-usage.html

```
  <ext:property-placeholder>
    <ext:location>file://ldap.properties</ext:location>
  </ext:property-placeholder>

  <enc:property-placeholder>
    <enc:encryptor class="org.jasypt.encryption.pbe.StandardPBEStringEncryptor">
      <property name="config">
        <bean class="org.jasypt.encryption.pbe.config.EnvironmentStringPBEConfig">
          <property name="algorithm" value="PBEWithMD5AndDES" />
          <property name="passwordEnvName" value="FUSE_ENCRYPTION_PASSWORD" />
        </bean>
      </property>
    </enc:encryptor>
  </enc:property-placeholder>

  <jaas:config name="karaf" rank="1">
    <jaas:module className="org.apache.karaf.jaas.modules.ldap.LDAPLoginModule" flags="re
quired">
      initialContextFactory=com.sun.jndi.ldap.LdapCtxFactory
      debug=true
        connectionURL=${ldap.url}
        connectionUsername=cn=mqbroker,ou=Services,ou=system,dc=fusesource,dc=com
        connectionPassword=${ldap.password}
        connectionProtocol=
        authentication=simple
        userRoleName=cn
        userBase = ou=User,ou=ActiveMQ,ou=system,dc=fusesource,dc=com
        userSearchMatching=(uid={0})
        userSearchSubtree=true
        roleBase = ou=Group,ou=ActiveMQ,ou=system,dc=fusesource,dc=com
        roleName=cn
        roleSearchMatching= (member:=uid={1})
        roleSearchSubtree=true
    </jaas:module>
  </jaas:config>

</blueprint>
```

The `${ldap.password}` placeholder will be replaced with the decrypted value of the `ldap.password` property from the properties file.

Installing the Jasypt features

By default, Fuse ESB Enterprise does not have the Jasypt encryption libraries installed. In order to use encrypted property placeholders, you will need to install the `jasypt-encryption` feature using Fuse ESB Enterprise's **features:install** command as shown in Example 2.13 on page 62.

Example 2.13. Installing the Jasypt Feature

```
karaf@root> features:install jasypt-encryption
```

Chapter 3. Securing the Web Console

You can configure the Fuse ESB Enterprise Web console to use SSL/TLS security by adding the relevant configuration properties to the `etc/org.ops4j.pax.web.cfg` configuration file.

Prerequisites

The Fuse ESB Enterprise Web console is not enabled by default. You can install the web console feature into OSGi by entering the following console command:

```
karaf@root> features:install webconsole
```

Create X.509 certificate and private key

Before you can enable SSL, you must create an X.509 certificate and private key for the Web console. The certificate and private key must be in Java keystore format. For details of how to create a signed certificate and private key, see Appendix A on page 153.

If you want to run a quick demonstration of SSL/TLS security, you could use a demonstration certificate from one of the examples (see "Install sample keystore files" on page 95).

Enabling SSL/TLS

To enable SSL/TLS:

1. Open `etc/org.ops4j.pax.web.cfg` in a text editor.
2. Disable the insecure HTTP port by adding the `org.osgi.service.http.enabled` and setting it to false as shown in Example 3.1 on page 63.

   Example 3.1. Pax Web Property for Disabling the HTTP Port

   ```
   org.osgi.service.http.enabled=false
   ```

3. Enable the secure HTTPS port by adding the `org.osgi.service.http.secure.enabled` and setting it to `true` as shown in Example 3.2 on page 63.

   Example 3.2. Pax Web Property for Enabling the HTTPS Port

   ```
   org.osgi.service.http.secure.enabled=true
   ```

4. Specify the port used for connecting over HTTPS by adding the `org.osgi.service.http.port.secure` and setting it to an available port as shown in Example 3.3 on page 64.

Example 3.3. Pax Web Property for Enabling the HTTPS Port

```
org.osgi.service.http.port.secure=8183
```

5. Configure the keystore used to hold the X.509 certificates.

   a. Specify the location of the keystore by adding the `org.ops4j.pax.web.ssl.keystore`.

   b. Specify the type of keystore used by adding the `org.ops4j.pax.web.ssl.keystore.type` and setting it to `JKS`.

   c. Specify the password for unlocking the Java keystore by adding the `org.ops4j.pax.web.ssl.password` property.

   d. Specify the password for decrypting the private key by adding the `org.ops4j.pax.web.ssl.keypassword` property.

Tip

This is typically the same as the password used to unlock the keystore.

   e. Specify if certificate-based client authentication at the server is wanted by adding the `org.ops4j.pax.web.ssl.clientauthwanted` property.

      When set to `true` the server will request that the client send an X.509 certificate during the SSL handshake.

   f. Specify if certificate-based client authentication at the server is required by adding the `org.ops4j.pax.web.ssl.clientauthneeded` property.

When set to `true` an exception is thrown if the client does not present a valid X.509 certificate during the SSL handshake.

Example

Example 3.4 on page 65 shows the Pax Web configuration for a server whose X.509 certificate and private key are in the keystore `cherry.jks`. The keystore has the store password `password` and the key password `password`.

Example 3.4. Configuration for Web Console to use SSL

```
# Configures the SMX Web Console to use SSL
org.osgi.service.http.enabled=false
org.osgi.service.http.port=8181

org.osgi.service.http.secure.enabled=true
org.osgi.service.http.port.secure=8183

org.ops4j.pax.web.ssl.keystore=etc/certs/cherry.jks
org.ops4j.pax.web.ssl.keystore.type=JKS
org.ops4j.pax.web.ssl.password=password
org.ops4j.pax.web.ssl.keypassword=password
org.ops4j.pax.web.ssl.clientauthwanted=false
org.ops4j.pax.web.ssl.clientauthneeded=false
```

SSL configuration properties

The following configuration properties are used to configure SSL/TLS:

`org.ops4j.pax.web.ssl.keystore`

The location of the Java keystore file on the file system. Relative paths are resolved relative to the `KARAF_HOME` environment variable (by default, the install directory).

`org.ops4j.pax.web.ssl.keystore.type`

The implementation of the keystore, which is normally `JKS`. (In principle, the JDK allows you to plug in a custom keystore implementation.)

`org.ops4j.pax.web.ssl.password`

The *store password* that unlocks the Java keystore file.

`org.ops4j.pax.web.ssl.keypassword`

The *key password* that decrypts the private key stored in the keystore (usually the same as the store password).

`org.ops4j.pax.web.ssl.clientauthwanted`

When `true`, during the SSL handshake, the secure socket requests the client to send an X.509 certificate. The client is not necessarily obliged to send the certificate, however.

`org.ops4j.pax.web.ssl.clientauthneeded`

When `true`, the SSL protocol throws an exception, if the client does not present a valid certificate during the SSL handshake.

Configuration reference

For the complete list of configuration properties supported by the Web console endpoint, see WebContainerConstants[1].

Connect to the secure Web console

After configuring the Web console and installing the `webconsole` feature, you should be able to open the Web console by browsing to the following URL:

https://localhost:8183/system/console

Tip

Remember to type the `https:` scheme, instead of `http:`, in this URL.

Initially, the browser will warn you that you are using an untrusted certificate. Skip this warning and you will be prompted to enter a username and a password. Log in with the username **`smx`** and the password **`smx`**.

[1] https://github.com/ops4j/org.ops4j.pax.web/blob/master/pax-web-api/src/main/java/org/ops4j/pax/web/service/WebContainerConstants.java

Chapter 4. Securing an Apache ActiveMQ Broker

Apache ActiveMQ provides two layers of security: an SSL/TLS security layer, which can authenticate the broker to its clients, encrypt messages, and guarantee message integrity, and a JAAS security layer, which can authenticate clients to the broker. This chapter describes the approach you should take to enable both of these security layers, when the broker is deployed in the Fuse ESB Enterprise OSGi container.

Tutorial I: SSL/TLS Security

Overview

The purpose of this tutorial is to show how you can deploy a secure Apache ActiveMQ broker in the OSGi container, where one or more of the broker's endpoints has SSL/TLS enabled. Unlike an insecure broker, you *cannot* deploy a secure broker simply by dropping its XML configuration file into the hot deploy directory, as described in ????. This is because a secure broker must be accompanied by X.509 certificates and their keys. It is necessary, therefore, to package the broker configuration file together with its certificates and keys in a single OSGi bundle.

This tutorial explains how to use the Maven build tool to create an OSGi bundle containing the secure broker's configuration and its accompanying certificates and keys. After deploying the broker into the OSGi container, you test it using the sample JMS clients from the standalone Apache ActiveMQ distribution (which you can obtain from the download[1] page).

Prerequisites

The following prerequisites are needed for this tutorial:

- *Maven installation*—Maven is a free, open source build tool from Apache. You can download the latest version from http://maven.apache.org/download.html (minimum is 2.2).
- *Internet connection*—whilst performing a build, Maven dynamically searches external repositories and downloads the required artifacts on the fly. In order for this to work, your build machine *must* be connected to the Internet.
- *Apache ActiveMQ installation*—the standalone installation of Apache ActiveMQ has some demonstration code that is not available in Fuse ESB Enterprise. Download and install Apache ActiveMQ 5.7.0.fuse-71-047 from fusesource.com[2].

Tutorial steps

To configure SSL/TLS security for a broker deployed in the OSGi container, perform the following steps:

1. "Generate a Maven project" on page 69.

[1] http://fusesource.com/downloads/
[2] http://fusesource.com/products/enterprise-activemq/

2. "Customize the POM file" on page 69.
3. "Install sample keystore files" on page 71.
4. "Configure the broker" on page 71.
5. "Build the broker bundle" on page 72.
6. "Deploy the broker bundle" on page 73.
7. "Configure the consumer and the producer clients" on page 73.
8. "Run the consumer with the SSL protocol" on page 74.
9. "Run the producer with the SSL protocol" on page 74.
10. "Uninstall the broker bundle" on page 75.

Generate a Maven project

The `maven-archetype-quickstart` archetype creates a generic Maven project, which you can then customize for whatever purpose you like. To generate a Maven project with the coordinates, `org.fusesource.example:esb-security`, enter the following command:

```
mvn archetype:create
-DarchetypeArtifactId=maven-archetype-quickstart
-DgroupId=org.fusesource.example
-DartifactId=esb-security
```

The result of this command is a directory, *`ProjectDir`*`/esb-security`, containing the files for the generated project.

Note

Be careful not *to choose a group ID for your artifact that clashes with the group ID of an existing product!* This could lead to clashes between your project's packages and the packages from the existing product (because the group ID is typically used as the root of a project's Java package names).

Customize the POM file

You must customize the POM file in order to generate an OSGi bundle, as follows:

1. Follow the POM customization steps described in "Generating a Bundle Project" in *Deploying into the Container*.

2. In the configuration of the Maven bundle plug-in, modify the bundle instructions to import additional Java packages, as follows:

```
<project ... >
  ...
  <build>
    ...
      <plugin>
        <groupId>org.apache.felix</groupId>
        <artifactId>maven-bundle-plugin</artifactId>
        <extensions>true</extensions>
        <configuration>
          <instructions>
            <Bundle-SymbolicName>
              ${project.artifactId}
            </Bundle-SymbolicName>
            <Import-Package>org.apache.activemq.xbean,
                            org.apache.activemq.spring,
                            org.apache.activemq.broker,
                            org.apache.activemq.security,
                            org.apache.activemq.jaas,
                            org.apache.activemq.pool,
                            org.apache.activemq.camel.com
ponent,
                           org.apache.camel.component.jms,

                            *</Import-Package>
          </instructions>
        </configuration>
      </plugin>
    </plugins>
  </build>
  ...
</project>
```

Note

Not all of these packages are required by the current tutorial. It is convenient, however, to add all of the packages required by the subsequent tutorials at this point.

Install sample keystore files

The broker requires the following keystore files:

- *Key store containing broker's own certificate and private key*—used to identify the broker during an SSL handshake.
- *Trust store containing CA certificate*—used to verify that a received client certificate is correctly signed (strictly speaking, the trust store file is only needed by the broker, if the `transport.needClientAuth` options is set to `true` on the broker URI).

For this tutorial, you can use the demonstration certificates provided with the standalone version of Apache ActiveMQ. In the Maven project, create the following `conf` directory to store the broker's keystore files:

```
ProjectDir/esb-security/src/main/resources/conf
```

Copy the `broker.ks` and `broker.ts` files from the Apache ActiveMQ standalone `conf` directory, *`ActiveMQInstallDir`*`/conf`, to the `conf` directory that you just created.

Warning

The demonstration broker key store and broker trust sture are provided for testing purposes only. *Do not deploy these certificates in a production system.* To set up a genuinely secure SSL/TLS system, you must generate custom certificates, as described in Appendix A on page 153.

Configure the broker

To configure the broker, create the following `spring` directory to store Spring XML files:

```
ProjectDir/esb-security/src/main/resources/META-INF/spring
```

In the `spring` directory that you just created, use your favorite text editor to create the file, `broker-spring.xml`, containing the following XML configuration:

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="
       http://www.springframework.org/schema/beans ht
tp://www.springframework.org/schema/beans/spring-beans-3.0.xsd

       http://activemq.apache.org/schema/core http://act
ivemq.apache.org/schema/core/activemq-core-5.4.0.xsd">

    <broker xmlns="http://activemq.apache.org/schema/core"
brokerName="simple-spring">
        <sslContext>
            <sslContext
                keyStore="classpath:conf/broker.ks"
                keyStorePassword="password"
                trustStore="classpath:conf/broker.ts"
                trustStorePassword="password"
                />
        </sslContext>
        <transportConnectors>
            <transportConnector name="openwire"
uri="ssl://localhost:61001"/>
        </transportConnectors>
    </broker>

</beans>
```

Note the following key aspects of the broker configuration:

- The Openwire network connector is configured to use SSL, `ssl://localhost:61001`.
- The key store and trust store file locations and passwords are specified by the broker's `sslContext` element.

Build the broker bundle

Use Maven to build the broker bundle. Open a command prompt, switch the current directory to *`ProjectDir`*`/esb-security`, and enter the following command:

```
mvn install
```

This command builds the broker bundle and installs it in your local Maven repository.

Deploy the broker bundle

If you have not already done so, start up the Apache ServiceMix console (and container instance) by entering the following command in a new command prompt:

```
servicemix
```

To deploy and activate the broker bundle, enter the following console command:

```
karaf@root> osgi:install -s mvn:org.fusesource.example/esb-
security
```

The preceding command loads the broker bundle from your local Maven repository. You might need to configure the Mvn URL handler with the location of your local Maven repository, if the broker bundle cannot be found (see "Mvn URL Handler" in *Deploying into the Container*).

Configure the consumer and the producer clients

To test the broker configured in the OSGi container, you are going to use the example consumer tool and producer tool supplied with the standalone version of Apache ActiveMQ.

Configure the consumer and the producer clients to pick up the client trust store. Edit the Ant build file, *`ActiveMQInstallDir`*`/example/build.xml`, and add the `javax.net.ssl.trustStore` and `javax.net.ssl.trustStorePassword` JSSE system properties to the consumer target and the producer target as shown in the following example:

```
<project ...>
    ...
        <target name="consumer" depends="compile" description="Runs a simple consumer">
        ...
                <java classname="ConsumerTool" fork="yes" maxmemory="100M">
                        <classpath refid="javac.classpath" />
                        <jvmarg value="-server" />
                    <sysproperty key="activemq.home" value="${activemq.home}"/>
                    <sysproperty key="javax.net.ssl.trustStore"
                                 value="${activemq.home}/conf/client.ts"/>
                    <sysproperty key="javax.net.ssl.trustStorePassword"
                                 value="password"/>
                        <arg value="--url=${url}" />
            ...
                </java>
    </target>
```

```
        <target name="producer" depends="compile" description="Runs a simple producer">
        ...
                <java classname="ProducerTool" fork="yes" maxmemory="100M">
                        <classpath refid="javac.classpath" />
                        <jvmarg value="-server" />
                    <sysproperty key="activemq.home" value="${activemq.home}"/>
                    <sysproperty key="javax.net.ssl.trustStore"
                                 value="${activemq.home}/conf/client.ts"/>
                    <sysproperty key="javax.net.ssl.trustStorePassword"
                                 value="password"/>
                        <arg value="--url=${url}" />
            ...
                </java>
        </target>
    ...
</project>
```

In the context of the Ant build tool, this is equivalent to adding the system properties to the command line.

Run the consumer with the SSL protocol

To connect the consumer tool to the `ssl://localhost:61001` endpoint (Openwire over SSL), change directory to *`ActiveMQInstallDir`*`/example` and enter the following command:

```
ant consumer -Durl=ssl://localhost:61001 -Dmax=100
```

You should see some output like the following:

```
Buildfile: build.xml
init:
compile:
consumer:
     [echo] Running consumer against server at $url =
ssl://localhost:61001 for subject $subject = TEST.FOO
     [java] Connecting to URL: ssl://localhost:61001
     [java] Consuming queue: TEST.FOO
     [java] Using a non-durable subscription
     [java] We are about to wait until we consume: 100 mes
sage(s) then we will shutdown
```

Run the producer with the SSL protocol

To connect the producer tool to the `ssl://localhost:61001` endpoint, open a new command prompt, change directory to `example` and enter the following command:

```
ant producer -Durl=ssl://localhost:61001 -Dmax=100
```

In the window where the *consumer* tool is running, you should see some output like the following:

```
    [java] Received: Message: 0 sent at: Thu Feb 05 09:27:43
GMT 2009  ...
    [java] Received: Message: 1 sent at: Thu Feb 05 09:27:43
GMT 2009  ...
    [java] Received: Message: 2 sent at: Thu Feb 05 09:27:43
GMT 2009  ...
    [java] Received: Message: 3 sent at: Thu Feb 05 09:27:43
GMT 2009  ...
```

Uninstall the broker bundle

To uninstall the broker bundle, you need to know its bundle ID, *`BundleID`*, in which case you can uninstall it by entering the following console command:

```
karaf@root> osgi:uninstall BundleID
```

If you are unsure of the broker's bundle ID, list the installed bundles using the `osgi:list` command, as follows:

```
karaf@root> osgi:list
```

Which should produce output like the following:

```
...
[ 231] [Active     ] [            ] [       ] [   60] camel-
jms (2.4.0.fuse-00-00)
[ 232] [Active     ] [           ] [       ] [   60] activemq-
camel (5.4.0.fuse-00-00)
[ 245] [Installed  ] [            ] [       ] [   60] esb-se
curity (1.0.0.SNAPSHOT)
```

From the preceding output, you can see that the `esb-security` bundle has the bundle ID, `245`.

Broker JAAS Authentication

Overview

The Java Authentication and Authorization Service (JAAS) provides a general framework for implementing authentication and authorization in Java applications. In the context of Apache ActiveMQ, the main purpose of JAAS is to implement authentication of JMS credentials (which consist of a username and a password). In contrast to SSL/TLS security, which is mainly used to verify a broker's identity, the JAAS authentication mechanism verifies client identities.

For more background information about the JAAS framework, see the JAAS Reference Guide[3].

JAAS is also discussed in "JAAS Authentication" in *ActiveMQ Security Guide*.

JAAS realms

A JAAS realm is essentially an instance of a login module that provides access to a repository of authentication data. Different JAAS realms provide access to different repositories of authentication data and might perform authentication in different ways.

Standalone applications typically define a JAAS realm by creating an entry in a JAAS login configuration file (as described in "Introduction to JAAS" in *ActiveMQ Security Guide*). Applications deployed in the OSGi container, on the other hand, must define a JAAS realm using a special Apache Karaf schema in a blueprint file (as described in "Defining JAAS Realms" on page 28).

How to define JAAS realms

If you need to define your own JAAS realm for an application deployed in the OSGi container, you must use the Apache Karaf JAAS schema, `http://karaf.apache.org/xmlns/jaas/v1.0.0`. For details, see "JAAS Authentication" on page 24.

How not to define JAAS realms

"Introduction to JAAS" in *ActiveMQ Security Guide* describes how to define JAAS realms using login configuration files. This approach *must not* be used

[3] http://download.oracle.com/javase/6/docs/technotes/guides/security/jaas/JAASRefGuide.html

with the OSGi container, however. It is only suitable for use in a standalone Apache ActiveMQ application.

The karaf realm

The OSGi container has a predefined JAAS realm, the `karaf` realm, which you can also use in your applications See "OSGi Container Security" on page 14.

Configuring JAAS authentication for JMS credentials

To authenticate JMS credentials, use Apache ActiveMQ's `jaasAuthenticationPlugin` plug-in, which can be configured as follows:

```
<beans>
  <broker ...>
    ...
    <plugins>
      <jaasAuthenticationPlugin configuration="JAASRealm" />
    </plugins>
    ...
  </broker>
</beans>
```

The `jaasAuthenticationPlugin` plug-in is intended for use with any kind of username/password credentials and can be used in combination with the pre-defined `karaf` realm or with a realm defined using the LDAP login module.

Configuring JAAS authentication for X.509 certificates

If the broker uses SSL/TLS, you could also authenticate the received client certificate using Apache ActiveMQ's `jaasCertificateAuthenticationPlugin` plug-in, which can be configured as follows:

```
<beans>
  <broker ...>
    ...
    <plugins>
      <jaasCertificateAuthenticationPlugin configuration="CertRealm" />
    </plugins>
    ...
  </broker>
</beans>
```

The `jaasCertificateAuthenticationPlugin` plug-in is only intended for use with X.509 certificate credentials and must be used in combination with a realm defined using the `TextFileCertificateLoginModule` login module. For more details, see "JAAS Certificate Authentication Plug-In" in *ActiveMQ Security Guide*.

Tutorial II: JAAS Authentication

Overview

This tutorial shows you how to enable JAAS authentication on a broker installed in the OSGi container. Instead of creating a local instance of a JAAS realm (as you would for a standalone broker), the broker exploits Fuse ESB Enterprise's support for container-wide JAAS realms, as shown in Figure 1.1 on page 14.

After the broker is secured by JAAS authentication, you can test it using the sample JMS clients from the standalone Apache ActiveMQ distribution. The JMS clients must first be modified, however, to provide the requisite username/password JMS credentials.

Prerequisites

This tutorial part builds on "Tutorial I: SSL/TLS Security" on page 68. All of the prerequisites from "Prerequisites" on page 68 apply here and you must complete the previous tutorial part before proceeding.

Tutorial steps

To configure JAAS security for a broker deployed in the OSGi container, perform the following steps:

1. "Configure the broker with the karaf realm" on page 78.
2. "Customize the users.properties file" on page 79.
3. "Build the broker bundle" on page 80.
4. "Deploy the broker bundle" on page 80.
5. "Specify JMS credentials for the consumer and the producer clients" on page 80.
6. "Run the consumer with JMS credentials" on page 81.
7. "Run the producer with JMS credentials" on page 81.
8. "Uninstall the broker bundle" on page 82.

Configure the broker with the karaf realm

Configure the broker to authenticate JMS username/password credentials by checking them against the `karaf` JAAS realm. In the Maven project, edit the `broker-spring.xml` file, adding the `plugins` element, as highlighted in the following XML sample:

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="
       http://www.springframework.org/schema/beans ht
tp://www.springframework.org/schema/beans/spring-beans-3.0.xsd

       http://activemq.apache.org/schema/core http://act
ivemq.apache.org/schema/core/activemq-core-5.4.0.xsd">

    <broker xmlns="http://activemq.apache.org/schema/core"
brokerName="simple-spring">
        <plugins>
           <jaasAuthenticationPlugin configuration="karaf"/>

        </plugins>
        <sslContext>
            <sslContext
                keyStore="classpath:conf/broker.ks"
                keyStorePassword="password"
                trustStore="classpath:conf/broker.ts"
                trustStorePassword="password"
                />
        </sslContext>
        <transportConnectors>
            <transportConnector name="openwire"
uri="ssl://localhost:61001"/>
        </transportConnectors>
    </broker>

</beans>
```

Customize the users.properties file

The `karaf` JAAS realm can be administered by editing the *InstallDir*`/etc/users.properties` file, where the file contains entries in the following format:

```
Username=Password,Role1,Role2,...
```

For example, the default `users.properties` file shows a sample entry (which is commented out) for the user, `smx`, with password, `smx`, as follows:

```
#smx=smx,admin
```

Customize the `users.properties` file by adding at least one user entry with the `admin` role. For example:

```
Username=Password,admin
```

Build the broker bundle

Use Maven to build the broker bundle. Open a command prompt, switch the current directory to *ProjectDir*/esb-security, and then enter the following command:

```
mvn clean install
```

Deploy the broker bundle

If you have not already done so, start up the Apache ServiceMix console (and container instance) by entering the following command in a new command prompt:

```
servicemix
```

To deploy and activate the broker bundle, enter the following console command:

```
karaf@root> osgi:install -s mvn:org.fusesource.example/esb-
security
```

Specify JMS credentials for the consumer and the producer clients

To test the broker configured in the OSGi container, you are going to use the example consumer tool and producer tool supplied with the standalone version of Apache ActiveMQ.

You must modify the source code for the consumer and the producer clients in order to specify their JMS credentials.

To specify the JMS credentials for the *consumer* tool, edit the *ActiveMQInstallDir*/example/src/ConsumerTool.java file with your favorite text editor, setting the user and password strings, as shown. These strings are ultimately passed as arguments to the ActiveMQConnectionFactory.createConnection() method.

```
// Java
// ConsumerTool
...
public void run() {
  ...
  try {
    user = "smx";
    password = "smx";
    ActiveMQConnectionFactory connectionFactory = new ActiveM
QConnectionFactory(user, password, url);
```

```
    ...
}
```

To specify the JMS credentials for the *producer* tool, edit the *ActiveMQInstallDir*/example/src/ProducerTool.java file with your favorite text editor, setting the user and password strings, as shown.

```
// Java
// ProducerTool
...
public void run() {
  ...
  try {
    user = "smx";
    password = "smx";
   ActiveMQConnectionFactory connectionFactory = new ActiveM
QConnectionFactory(user, password, url);
    ...
}
```

Run the consumer with JMS credentials

To connect the consumer tool to the `ssl://localhost:61001` endpoint, change directory to *ActiveMQInstallDir*/example and enter the following command:

```
ant consumer -Durl=ssl://localhost:61001 -Dmax=100
```

You should see some output like the following:

```
Buildfile: build.xml
init:
compile:
consumer:
     [echo] Running consumer against server at $url =
ssl://localhost:61001 for subject $subject = TEST.FOO
     [java] Connecting to URL: ssl://localhost:61001
     [java] Consuming queue: TEST.FOO
     [java] Using a non-durable subscription
     [java] We are about to wait until we consume: 100 mes
sage(s) then we will shutdown
```

Run the producer with JMS credentials

To connect the producer tool to the `ssl://localhost:61001` endpoint, open a new command prompt, change directory to `example` and enter the following command:

```
ant producer -Durl=ssl://localhost:61001 -Dmax=100
```

In the window where the *consumer* tool is running, you should see some output like the following:

```
    [java] Received: Message: 0 sent at: Thu Feb 05 09:27:43
GMT 2009  ...
    [java] Received: Message: 1 sent at: Thu Feb 05 09:27:43
GMT 2009  ...
    [java] Received: Message: 2 sent at: Thu Feb 05 09:27:43
GMT 2009  ...
    [java] Received: Message: 3 sent at: Thu Feb 05 09:27:43
GMT 2009  ...
```

Uninstall the broker bundle

To uninstall the broker bundle, you need to know its bundle ID, *`BundleID`*, in which case you can uninstall it by entering the following console command:

```
karaf@root> osgi:uninstall BundleID
```

Chapter 5. Securing the Camel ActiveMQ Component

The Camel ActiveMQ component enables you to define JMS endpoints in your routes that can connect to an Apache ActiveMQ broker. In order to make your Camel ActiveMQ endpoints secure, you must create an instance of a Camel ActiveMQ component that uses a secure connection factory.

Secure ActiveMQ Connection Factory

Overview

Apache Camel provides an Apache ActiveMQ component for defining Apache ActiveMQ endpoints in a route. The Apache ActiveMQ endpoints are effectively Java clients of the broker and you can either define a consumer endpoint (typically used at the start of a route to *poll for* JMS messages) or define a producer endpoint (typically used at the end or in the middle of a route to *send* JMS messages to a broker).

When the remote broker is secure (SSL security, JAAS security, or both), the Apache ActiveMQ component must be configured with the required client security settings.

Programming the security properties

Apache ActiveMQ enables you to program SSL security settings (and JAAS security settings) by creating and configuring an instance of the `ActiveMQSslConnectionFactory` JMS connection factory. Programming the JMS connection factory is the correct approach to use in the context of the containers such as OSGi, J2EE, Tomcat, and so on, because these settings are local to the application using the JMS connection factory instance.

Note

A standalone broker can configure SSL settings using *Java system properties*. For clients deployed in a container, however, this is *not* a practical approach, because the configuration must apply only to individual bundles, not the entire OSGi container. A Camel ActiveMQ endpoint is effectively a kind of Apache ActiveMQ Java client, so this restriction applies also to Camel ActiveMQ endpoints.

Defining a secure connection factory

Example 5.1 on page 84 shows how to create a secure connection factory bean in Spring XML.

Example 5.1. Defining a Secure Connection Factory Bean

```
<bean id="jmsConnectionFactory"
      class="org.apache.activemq.ActiveMQSslConnectionFactory">

  <property name="brokerURL" value="ssl://localhost:61001" />

  <property name="userName" value="smx"/>
  <property name="password" value="smx"/>
```

```
  <property name="trustStore" value="/conf/client.ts"/>
  <property name="trustStorePassword" value="password"/>
</bean>
```

The following properties are specified on the `ActiveMQSslConnectionFactory` class:

`brokerURL`

The URL of the remote broker to connect to.

`userName` and `password`

Any valid JAAS login credentials. This example shows the sample user, `smx`, with the password, `smx`, but you should customize the JAAS credentials to use a robust password.

`trustStore`

Location of the Java keystore file containing the certificate trust store for SSL connections. The location is specified as a classpath resource. If a relative path is specified, the resource location is relative to the `org/fusesource/example` directory on the classpath.

`trustStorePassword`

The password that unlocks the keystore file containing the trust store.

It is also possible to specify `keyStore` and `keyStorePassword` properties, but these would only be needed, if SSL mutual authentication is enabled (where the client presents an X.509 certificate to the broker during the SSL handshake).

Tutorial III: Camel ActiveMQ Component

Overview

This tutorial explains how to define a Apache Camel route featuring an Apache ActiveMQ endpoint, where the route is defined using Spring XML and then deployed into the OSGi container as a bundle. The implementation of the route is simple: it generates a stream of messages using a timer and the messages are then sent to a JMS queue in an Apache ActiveMQ broker.

The key feature of this example is that the Apache ActiveMQ endpoint at the end of the route must be configured to open a secure connection to the broker. In order to define a secure endpoint, the Apache ActiveMQ component is customized to enable both SSL security and JAAS security in the underlying JMS connection factory.

Prerequisites

This tutorial part builds on "Tutorial I: SSL/TLS Security" on page 68 and "Tutorial II: JAAS Authentication" on page 78. All of the prerequisites from "Prerequisites" on page 68 apply here and you must complete the previous tutorial parts before proceeding.

Tutorial steps

To define an Apache Camel route, which is deployed in the OSGi container and can communicate with a secure Apache ActiveMQ endpoint, perform the following steps:

1. "Add Maven dependency" on page 87.
2. "Add package imports" on page 87.
3. "Configure the Camel ActiveMQ component" on page 88.
4. "Configure the Camel route" on page 89.
5. "Build the bundle" on page 90.
6. "Install the camel-activemq feature" on page 90.
7. "Deploy the bundle" on page 90.
8. "Monitor the queue contents" on page 90.

9. "Uninstall the broker bundle" on page 92.

Add Maven dependency

Edit the `pom.xml` file in your Maven project and add the following dependency as a child of the `dependencies` element:

```
<dependencies>
  <dependency>
    <groupId>org.apache.activemq</groupId>
    <artifactId>activemq-core</artifactId>
    <version>5.7.0.fuse-71-047</version>
    <scope>provided</scope>
  </dependency>
  ...
</dependencies>
```

Add package imports

In order to build the Apache Camel route in Maven, you need to add the following package imports to the configuration of the `maven-bundle-plugin` plug-in:

```
org.apache.activemq.pool
org.apache.activemq.camel.component,
org.apache.camel.component.jms
```

These imports are needed, because the Maven bundle plug-in is not able to figure out all of the imports required by beans created in the Spring configuration file.

Edit the `pom.xml` file in your Maven project and add the preceding package imports, so that the `maven-bundle-plugin` configuration looks like the following:

```
<plugins>
  <plugin>
    <groupId>org.apache.felix</groupId>
    <artifactId>maven-bundle-plugin</artifactId>
    <extensions>true</extensions>
    <configuration>
      <instructions>
        <Bundle-SymbolicName>${project.artifactId}</Bundle-
SymbolicName>
         <Import-Package>org.apache.activemq.xbean,
                         org.apache.activemq.spring,
                         org.apache.activemq.broker,
                         org.apache.activemq.security,
                         org.apache.activemq.jaas,
```

```
                                org.apache.activemq.pool,
                                org.apache.activemq.camel.compon
ent,
                                org.apache.camel.component.jms,
                                *</Import-Package>
      </instructions>
    </configuration>
  </plugin>
  ...
</plugins>
```

Configure the Camel ActiveMQ component

Edit the `broker-spring.xml` file in the `src/main/resources/META-INF/spring` directory of your Maven project and add the following bean definitions, which configure the Camel ActiveMQ component:

```
<?xml version="1.0" encoding="UTF-8"?>
<beans ... >
  ...
  <!--
    Configure the activemq component:
  -->
  <bean id="jmsConnectionFactory"
        class="org.apache.activemq.ActiveMQSslConnectionFactory">
    <property name="brokerURL" value="ssl://localhost:61001" />
    <property name="userName" value="smx"/>
    <property name="password" value="smx"/>
    <property name="trustStore" value="/conf/client.ts"/>
    <property name="trustStorePassword" value="password"/>
  </bean>

  <bean id="pooledConnectionFactory"
        class="org.apache.activemq.pool.PooledConnectionFactory">
    <property name="maxConnections" value="8" />
    <property name="maximumActive" value="500" />
    <property name="connectionFactory" ref="jmsConnectionFactory" />
  </bean>

  <bean id="jmsConfig" class="org.apache.camel.component.jms.JmsConfiguration">
    <property name="connectionFactory" ref="pooledConnectionFactory"/>
    <property name="transacted" value="false"/>
    <property name="concurrentConsumers" value="10"/>
  </bean>

  <bean id="activemqs"
        class="org.apache.activemq.camel.component.ActiveMQComponent">
    <property name="configuration" ref="jmsConfig"/>
```

```
  </bean>

</beans>
```

This configuration defines the secure `activemqs` component, which you can now use to define endpoints in your Apache Camel routes. The `activemqs` bean references `jmsConfig`, which configures the the component. The `jmsConfig` bean in turn references a chain of JMS connection factories: the pooled connection factory wrapper, `pooledConnectionFactory`, which is important for performance; and the secure connection factory, `jmsConnectionFactory`, which is capable of creating secure connections to the broker.

Configure the Camel route

Configure a Apache Camel route that generates messages using a timer endpoint and then sends the generated messages to the `security.test` queue on the secure broker. For this route, you need to use the secure `activemqs` component to define the endpoint that connects to the broker.

Edit the `broker-spring.xml` file in the `src/main/resources/META-INF/spring` directory of your Maven project and add the following `camelContext` element, which contains the route definition:

```
<?xml version="1.0" encoding="UTF-8"?>
<beans ...>
  ...
  <camelContext xmlns="http://camel.apache.org/schema/spring">

    <route>
      <from uri="timer://myTimer?fixedRate=true&amp;peri
od=5000"/>
     <transform><constant>Hello world!</constant></transform>

      <to uri="activemqs:security.test"/>
    </route>
  </camelContext>
  ...
</beans>
```

You must also add the location of the Apache Camel XML schema to the `xsi:schemaLocation` attribute, as highlighted in the following example:

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="
       http://www.springframework.org/schema/beans ht
```

```
tp://www.springframework.org/schema/beans/spring-beans-3.0.xsd

       http://activemq.apache.org/schema/core http://act
ivemq.apache.org/schema/core/activemq-core-5.4.0.xsd
       http://camel.apache.org/schema/spring ht
tp://camel.apache.org/schema/spring/camel-spring.xsd">
    ...
```

Build the bundle

Use Maven to build the bundle. Open a command prompt, switch the current directory to *ProjectDir*/esb-security, and then enter the following command:

```
mvn clean install
```

Install the camel-activemq feature

If you have not already done so, start up the Apache ServiceMix console (and container instance) by entering the following command in a new command prompt:

```
servicemix
```

The camel-activemq feature, which defines the bundles required for the Camel ActiveMQ component, is *not* installed by default. To install the camel-activemq feature, enter the following console command:

```
karaf@root> features:install camel-activemq
```

Deploy the bundle

To deploy and activate the broker bundle, enter the following console command:

```
karaf@root> osgi:install -s mvn:org.fusesource.example/esb-
security
```

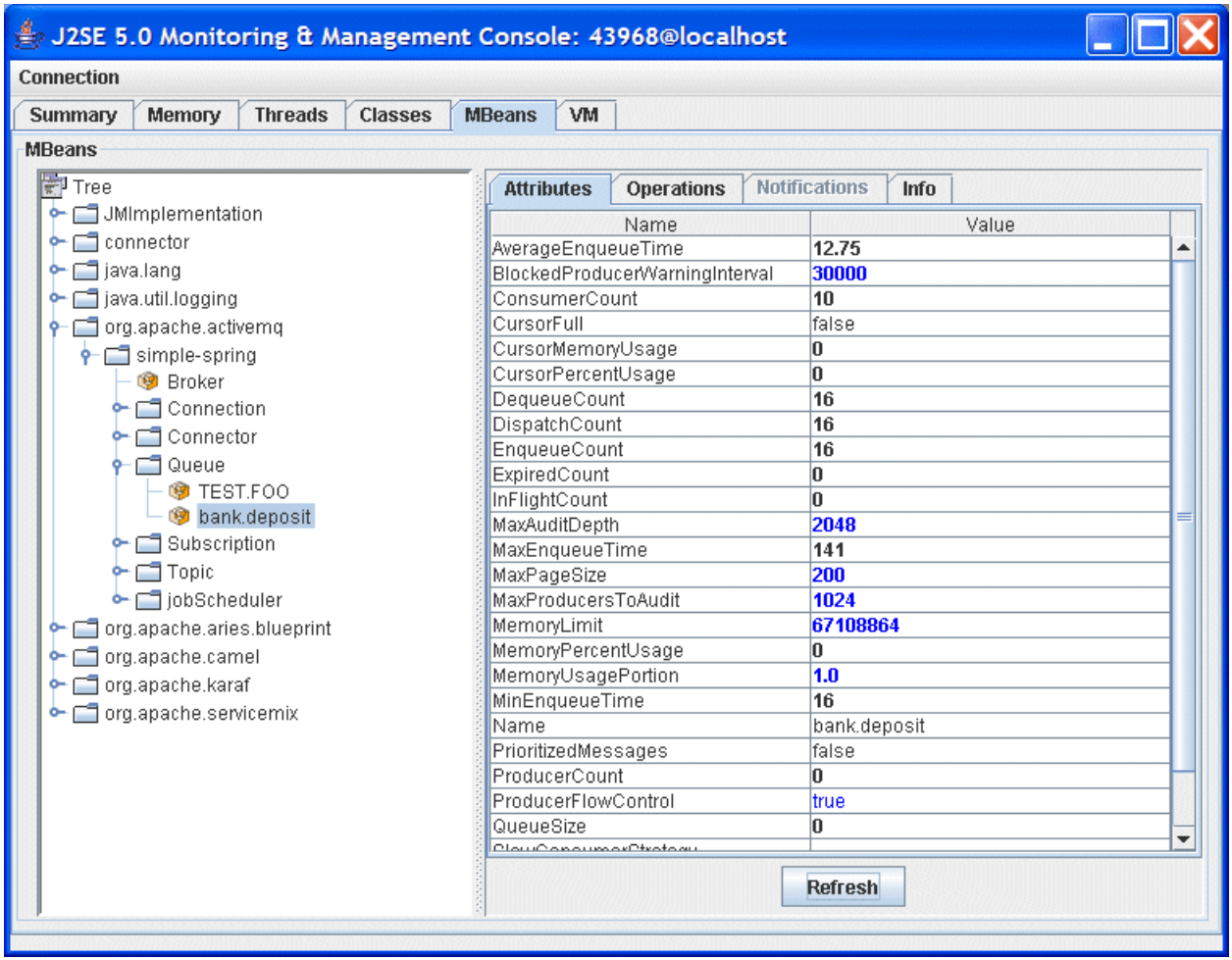
Monitor the queue contents

You can monitor the contents of the security.test queue using a JMX management tool, such as Java's jconsole. Open a command prompt and enter the following command:

```
jconsole
```

A **JConsole: Connect to Agent dialog** opens. From the **Local** tab, select the org.apache.karaf.main.Main entry and click **Connect**. The main JConsole window appears. Select the **MBeans** tab and then drill down to

`org.apache.activemq|Queue|security.test`, as shown in the screenshot below. From the `EnqueueCount` bean attribute, you can see how many messages have been sent to the queue. By clicking **Refresh** to update the bean attributes, you can see that messages are arriving at the rate of one every five seconds.



Uninstall the broker bundle

To uninstall the broker bundle, you need to know its bundle ID, *BundleID*, in which case you can uninstall it by entering the following console command:

```
karaf@root> osgi:uninstall BundleID
```

Chapter 6. Securing the Camel Jetty Component

Enabling SSL/TLS Security

Overview

This section explains how to enable SSL/TLS security on the Apache Camel Jetty component, which is used to create a HTTPS Web server. The key step is to customize the Jetty component by setting the `sslSocketConnectorProperties` property, which configures SSL/TLS. You must also change the protocol scheme on the Jetty URI from `http` to `https`.

Tutorial steps

To configure SSL/TLS security for a Camel Jetty endpoint deployed in the OSGi container, perform the following steps:

1. "Generate a Maven project" on page 94.
2. "Customize the POM file" on page 95.
3. "Install sample keystore files" on page 95.
4. "Configure Jetty with SSL/TLS" on page 96.
5. "Build the bundle" on page 98.
6. "Install the camel-jetty feature" on page 98.
7. "Deploy the bundle" on page 98.
8. "Test the bundle" on page 99.
9. "Uninstall the bundle" on page 100.

Generate a Maven project

The `maven-archetype-quickstart` archetype creates a generic Maven project, which you can then customize for whatever purpose you like. To generate a Maven project with the coordinates, `org.fusesource.example:jetty-security`, enter the following command:

```
mvn archetype:create
-DarchetypeArtifactId=maven-archetype-quickstart
-DgroupId=org.fusesource.example
-DartifactId=jetty-security
```

The result of this command is a directory, *`ProjectDir`*`/jetty-security`, containing the files for the generated project.

Note

Be careful not *to choose a group ID for your artifact that clashes with the group ID of an existing product!* This could lead to clashes between your project's packages and the packages from the existing product (because the group ID is typically used as the root of a project's Java package names).

Customize the POM file

You must customize the POM file in order to generate an OSGi bundle. Follow the POM customization steps described in "Generating a Bundle Project" in *Deploying into the Container*.

Install sample keystore files

The certificates used in this demonstration are taken from a sample in the Apache CXF 2.6.0.fuse-71-047 product. If you download[1] and install the standalone version of Apache CXF, you will find the sample certificates in the *CXFInstallDir*`/samples/wsdl_first_https/certs` directory.

Copy the `certs` directory from *CXFInstallDir*`/samples/wsdl_first_https/` to the *EsbInstallDir*`/etc/` directory. After copying, you should have the following directory structure under *EsbInstallDir*`/etc/`:

```
EsbInstallDir/etc/
    |
    \--certs/
        |
        \--cherry.jks
           wibble.jks
           truststore.jks
           ...
```

Where `cherry.jks`, `wibble.jks`, and `truststore.jks` are the keystores that are used in this demonstration.

Warning

The demonstration key store and trust sture are provided for testing purposes only. *Do not deploy these certificates in a production*

[1] http://fusesource.com/downloads/

system. To set up a genuinely secure SSL/TLS system, you must generate custom certificates, as described in Appendix A on page 153.

Configure Jetty with SSL/TLS

The Jetty Web server is created by defining a Jetty endpoint at the start of an Apache Camel route. The route is then responsible for processing the incoming HTTP request and generating a reply. The current example simply sends back a small HTML page in the reply. For a more realistic application, you would typically process the incoming message using a bean, which accesses the message through the Java servlet API.

Create the following directory to hold the Spring configuration files:

```
ProjectDir/jetty-security/src/main/resources/META-INF/spring
```

In the `spring` directory that you just created, use your favorite text editor to create the file, `jetty-spring.xml`, containing the following XML configuration:

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans" xmlns:xsi="ht
tp://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
       http://www.springframework.org/schema/beans http://www.springframe
work.org/schema/beans/spring-beans-3.0.xsd
      http://activemq.apache.org/schema/core http://activemq.apache.org/schema/core/activemq-
core-5.4.0.xsd
       http://camel.apache.org/schema/spring http://camel.apache.org/schema/spring/camel-
spring.xsd">

    <bean id="jetty" class="org.apache.camel.component.jetty.JettyHttpComponent">
        <property name="sslSocketConnectorProperties">
            <map>
                <entry key="password" value="password"/>
                <entry key="keyPassword" value="password"/>
                <entry key="keystore" value="etc/certs/cherry.jks"/>
                <entry key="truststore" value="etc/certs/truststore.jks"/>
                <entry key="trustPassword" value="password"/>
                <entry key="needClientAuth" value="false"/>
            </map>
        </property>
    </bean>

    <camelContext trace="true" xmlns="http://camel.apache.org/schema/spring">
        <route>
            <from uri="jetty:https://0.0.0.0:8282/services?matchOnUriPrefix=true"/>
            <transform>
                <constant>&lt;html>&lt;body>Hello from Fuse ESB serv
```

```
er&lt;/body>&lt;/html></constant>
            </transform>
        </route>
    </camelContext>

</beans>
```

The `jetty` bean defines a new instance of the Apache Camel Jetty component, overriding the default component defined in the `camel-jetty` JAR file. This Jetty component is configured with SSL/TLS properties as follows:

`keystore`

The location of the Java keystore file (in JKS format) containing the Jetty server's own X.509 certificate and private key. This location is specified on the filesystem (*not* on the classpath), relative to the directory where the OSGi container is started.

`password`

The keystore password that unlocks the `keystore` keystore.

`keyPassword`

The password that decrypts the private key stored in the `keystore` keystore (usually having the same value as `password`).

`truststore`

The location of the Java keystore file containing one or more trusted certificates (that is, the CA certificates that have been used to sign X.509 certificates from trusted clients). This location is specified on the filesystem (*not* on the classpath), relative to the directory where the OSGi container is started.

Strictly speaking, this property is not needed, if clients do not send certificates to the Jetty service.

`trustPassword`

The keystore password that unlocks the `truststore` trust store.

`needClientAuth`

When `true`, clients *must* send an X.509 certificate to the server side or the SSL/TLS handshake will fail; when `false`, clients are not required to send an X.509 certificate, but they may do so.

Note

The preceding configuration shows how to enable SSL/TLS security for all IP port values. To enable SSL/TLS security for specific IP ports only.

You must also modify the URI at the start of the route (the `uri` attribute of the `from` element). Make sure that the scheme of the URI matches the secure Jetty component, `jetty`, that you have just created. You must also change the protocol scheme from `http` to `https`.

Tip

Always double-check you have changed the protocol scheme to `https`! This is such a small change, it is easy to forget.

Build the bundle

Use Maven to build the bundle. Open a command prompt, switch the current directory to *`ProjectDir`*`/jetty-security`, and enter the following command:

```
mvn install
```

This command builds the bundle and installs it in your local Maven repository.

Install the camel-jetty feature

If you have not already done so, start up the Apache ServiceMix console (and container instance) by entering the following command in a new command prompt:

```
servicemix
```

The `camel-jetty` feature, which defines the bundles required for the Camel/Jetty component, is *not* installed by default. To install the `camel-jetty` feature, enter the following console command:

```
karaf@root> features:install camel-jetty
```

Deploy the bundle

To deploy and activate the bundle, enter the following console command:

```
karaf@root> osgi:install -s mvn:org.fusesource.example/jetty-
security
```

The preceding command loads the bundle from your local Maven repository. You might need to configure the Mvn URL handler with the location of your

local Maven repository, if the bundle cannot be found (see "Mvn URL Handler" in *Deploying into the Container*).

Test the bundle

To test the Jetty service, open your favorite Web browser and navigate to the following URL:

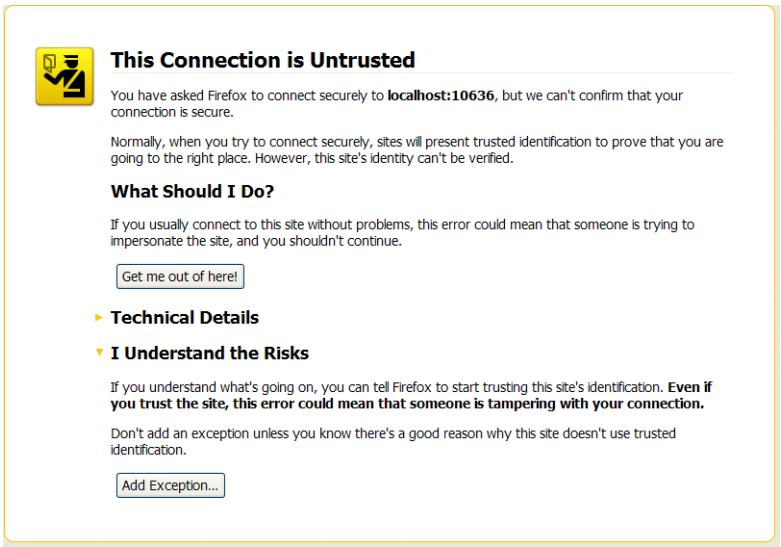
```
https://localhost:8282/services
```

Tip

Don't forget to use `https:` instead of `http:` in the URL!

Because the Jetty service uses an untrusted certificate, your browser will initially present you with a warning about the untrusted certificate. For example, the Firefox browser displays the following warning screen:

Figure 6.1. Untrusted Certificate Warning



To proceed with contacting the Jetty service, click **I Understand the Risks** and then click **Add Exception**, which brings up the **Add Security Exception** dialog. In the **Add Security Exception** dialog, make sure that the **Permanently store this exception option** is unchecked and click **Confirm Security Exception**.

The browser window should now display the following text:

```
Hello from Fuse ESB server
```

Uninstall the bundle

To uninstall the broker bundle, you need to know its bundle ID, *BundleID*, in which case you can uninstall it by entering the following console command:

```
karaf@root> osgi:uninstall BundleID
```

BASIC Authentication with JAAS

Overview

The HTTP BASIC authentication protocol is a simple username/password authentication mechanism that is integrated into HTTP and is supported by most Web browsers. To enable BASIC authentication in Jetty, you use the Jetty security API, which enables BASIC authentication by associating a security handler with the Jetty endpoint.

Jetty also enables you to plug in a JAAS login module to perform the credentials check. Using this feature, it is possible to integrate credentials checking with any JAAS realm provided by the Fuse ESB Enterprise OSGi container. In the example shown here, the Jetty authentication is integrated with the default JAAS realm, `karaf`.

Prerequisites

This example builds on the project created in "Enabling SSL/TLS Security" on page 94. You must complete the steps in the Jetty SSL/TLS example before proceeding with this tutorial.

Note

In any case, it is highly recommended that you *always* enable SSL/TLS in combination with BASIC authentication, in order to protect against password snooping.

Authentication steps

To configure HTTP BASIC authentication for a Camel Jetty endpoint deployed in the OSGi container, perform the following steps:

1. "Add the Jetty security handler configuration" on page 102.
2. "Modify Camel Jetty endpoint" on page 103.
3. "Add required package imports to POM" on page 104.
4. "Build the bundle" on page 105.
5. "Install the required features" on page 105.
6. "Deploy the bundle" on page 105.

7. "Test the bundle" on page 105.

Add the Jetty security handler configuration

In the `jetty-security` project, edit the `jetty-spring.xml` file from the `src/main/resources/META-INF/spring` directory. To configure the Jetty security handler with BASIC authentication, add the following bean definitions:

```
<?xml version="1.0" encoding="UTF-8"?>
<beans ...>
    ...
    <!--  -->
    <bean id="loginService" class="org.eclipse.jetty.plus.jaas.JAASLoginService">
        <property name="name" value="karaf"/>
        <property name="loginModuleName" value="karaf"/>
        <property name="roleClassNames">
            <list>
                <value>org.apache.karaf.jaas.modules.RolePrincipal</value>
            </list>
        </property>
    </bean>

    <bean id="identityService" class="org.eclipse.jetty.security.DefaultIdentityService"/>


    <bean id="constraint" class="org.eclipse.jetty.http.security.Constraint">
        <property name="name" value="BASIC"/>
        <property name="roles" value="admin"/>
        <property name="authenticate" value="true"/>
    </bean>

    <bean id="constraintMapping" class="org.eclipse.jetty.security.ConstraintMapping">
        <property name="constraint" ref="constraint"/>
        <property name="pathSpec" value="/*"/>
    </bean>

   <bean id="securityHandler" class="org.eclipse.jetty.security.ConstraintSecurityHandler">

        <property name="authenticator">
            <bean class="org.eclipse.jetty.security.authentication.BasicAuthenticator"/>
        </property>
        <property name="constraintMappings">
            <list>
                <ref bean="constraintMapping"/>
            </list>
        </property>
        <property name="loginService" ref="loginService"/>
        <property name="strict" value="false"/>
        <property name="identityService" ref="identityService"/>
```

```
    </bean>
    ...
</beans>
```

Two aspects of Jetty authentication are configured by the preceding bean definitions:

- *HTTP BASIC authentication*—the `constraint` bean enables HTTP BASIC authentication on the Jetty security handler.
- *JAAS login service*—the `loginService` bean specifies that the requisite authentication data is extracted from a JAAS realm. The `loginModuleName` property specifies that the Jetty login service uses the `karaf` JAAS realm, which is the OSGi container's default JAAS realm (see "OSGi Container Security" on page 14).

Modify Camel Jetty endpoint

After creating the Jetty `securityHandler` bean, you must modify the Jetty endpoint URI in the Apache Camel route, so that it hooks into the security handler. To add the security handler to the Jetty endpoint, set the `handlers` option equal to the security handler's bean ID, as shown in the following example:

```
<beans ...>
    <camelContext trace="true" xmlns="http://camel.apache.org/schema/spring">
        <route>
            <from uri="jetty:https://0.0.0.0:8282/services?handlers=securityHand
ler&amp;matchOnUriPrefix=true"/>
            <transform>
                <constant>&lt;html>&lt;body>Hello from Fuse ESB serv
er&lt;/body>&lt;/html></constant>
            </transform>
        </route>
    </camelContext>
</beans>
```

Note

URI options must be separated by the `&` entity, instead of the plain `&` character, in the context of an XML file.

Add required package imports to POM

Edit the `jetty-security` project's POM file, `jetty-security/pom.xml`. Near the start of the POM file, define the `jetty-version` property as follows:

```
<project ... >
  ...
  <properties>
    ...
    <jetty-version>7.2.2.v20101205</jetty-version>
  </properties>
  ...
</project>
```

Further down the POM file, in the configuration of the Maven bundle plug-in, modify the bundle instructions to import additional Java packages, as follows:

```
<project ... >
  ...
  <build>
    ...
      <plugin>
        <groupId>org.apache.felix</groupId>
        <artifactId>maven-bundle-plugin</artifactId>
        <extensions>true</extensions>
        <configuration>
          <instructions>
            <Bundle-SymbolicName>
              ${project.artifactId}
            </Bundle-SymbolicName>
            <Import-Package>
                javax.security.auth,
                javax.security.auth.callback,
                javax.security.auth.login,
                javax.security.auth.spi,
                org.apache.karaf.jaas.modules,
                org.eclipse.jetty.plus.jaas;version=${jetty-
version},
                org.eclipse.jetty.security;version=${jetty-
version},
                *
            </Import-Package>
            <Private-Package>org.apache.camel.jaas</Private-
```

```
Package>

          </instructions>
        </configuration>
      </plugin>
    </plugins>
  </build>
  ...
</project>
```

Note

These extra imports are required, because the Maven bundle plug-in is not capable of scanning Spring files to determine their package dependencies automatically.

Build the bundle

Use Maven to build the bundle. Open a command prompt, switch the current directory to *ProjectDir*`/jetty-security`, and enter the following command:

```
mvn install
```

Install the required features

If you have not already done so, start up the Apache ServiceMix console (and container instance) by entering the following command in a new command prompt:

```
servicemix
```

Install the `jetty` and `camel-jetty` features, by entering the following console commands:

```
karaf@root> features:install jetty
karaf@root> features:install camel-jetty
```

Deploy the bundle

To deploy and activate the bundle, enter the following console command:

```
karaf@root> osgi:install -s mvn:org.fusesource.example/jetty-
security
```

Test the bundle

To test the Jetty service, open your favorite Web browser and navigate to the following URL:

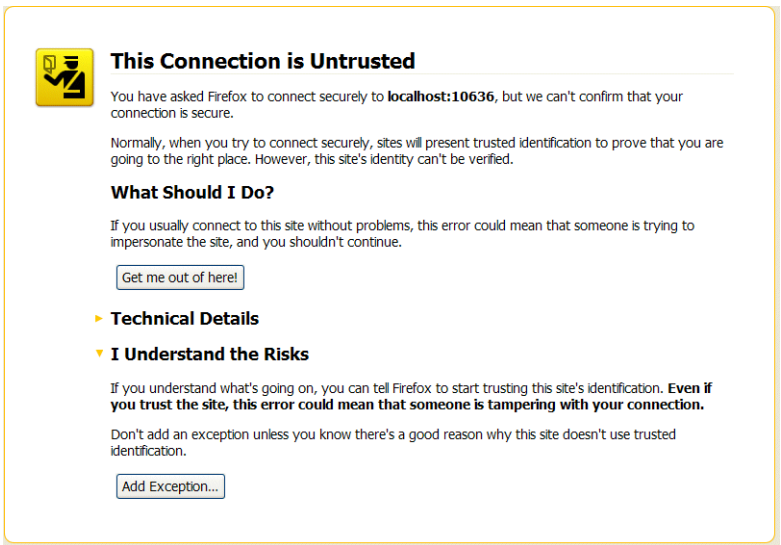
```
https://localhost:8282/services
```

Tip

Don't forget to use `https:` instead of `http:` in the URL!

If you closed your browser since running the Jetty SSL/TLS demonstration (thus re-initializing the security status of your browser), your browser will initially present you with a warning about the untrusted certificate. For example, the Firefox browser displays the following warning screen:

Figure 6.2. Untrusted Certificate Warning



To proceed with contacting the Jetty service, click **I Understand the Risks** and then click **Add Exception**, which brings up the **Add Security Exception** dialog. In the **Add Security Exception** dialog, make sure that the **Permanently store this exception option** is unchecked and click **Confirm Security Exception**.

You will now be prompted to authenticate yourself with a username and password (this is the BASIC authentication step). Enter the username, `smx`, and the password, `smx`, and click **Ok** (the valid credentials you can use for this step are specified in the *`EsbInstallDir`*`/etc/users.properties` file). The browser window should now display the following text:

```
Hello from Fuse ESB server
```

Chapter 7. Securing the Camel CXF Component

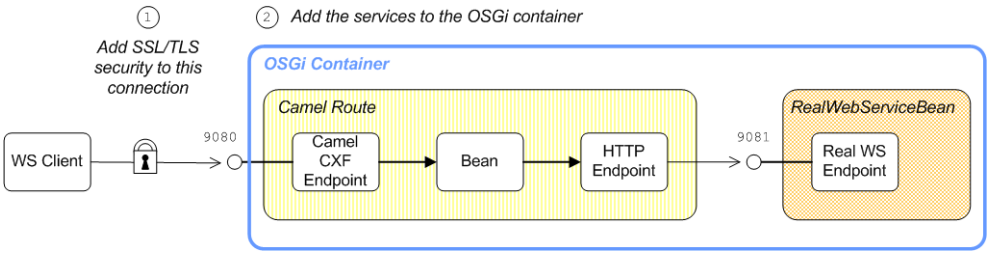
This chapter explains how to enable SSL/TLS security on a Camel CXF endpoint, using the Camel CXF proxy demonstration as the starting point. The Camel CXF component enables you to add Apache CXF endpoints to your Apache Camel routes. This makes it possible to simulate a Web service in Apache Camel or you could interpose a route between a WS client and a Web service to perform additional processing (which is the case considered here).

The Camel CXF Proxy Demonstration

Overview

In order to explain how to secure a Camel CXF endpoint in OSGi, this tutorial builds on an example available from the standalone distribution of Apache Camel, the *Camel CXF proxy* demonstration. Figure 7.1 on page 108 gives an overview of how this demonstration works

Figure 7.1. Camel CXF Proxy Overview



The *report incident* Web service, which is implemented by the `RealWebServiceBean`, receives details of an incident (for example, a traffic accident) and returns a tracking code to the client. Instead of sending its requests directly to the real Web service, however, the WS client connects to a Camel CXF endpoint, which is interposed between the WS client and the real Web service. The Apache Camel route performs some processing on the WSDL message (using the `enrichBean`) before forwarding it to the real Web service.

Modifications

In order to demonstrate how to enable SSL/TLS on a Camel CXF endpoint in the context of OSGi, this chapter contains instructions on how to modify the basic demonstration as follows:

1. SSL/TLS security is enabled on the connection between the WS client and the Camel CXF endpoint.
2. The Apache Camel route and the `RealWebServiceBean` bean are both deployed into the OSGi container.

Obtaining the demonstration code

The Camel CXF proxy demonstration is available only from the standalone distribution of Apache Camel. Download version 2.10.0.fuse-71-047 of

Apache Camel from the download page, http://fusesource.com/downloads/, and install it according to the instructions in the Installation Guide[1].

Assuming that you have installed Apache Camel in *CamelInstallDir*, you can find the Camel CXF proxy demonstration in the following directory:

```
CamelInstallDir/examples/camel-example-cxf-proxy
```

Physical part of the WSDL contract

The physical part of the WSDL contract refers to the `wsdl:service` and `wsdl:port` elements. These elements specify the transport details that are needed to connect to a specific Web services endpoint. For the purposes of this demonstration, this is the most interesting part of the contract and it is shown in Example 7.1 on page 109.

Example 7.1. The ReportIncidentEndpointService WSDL Service

```
<wsdl:definitions xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
    ...
 xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
 targetNamespace="http://reportincident.example.camel.apache.org">
    ...
    <!-- Service definition -->
    <wsdl:service name="ReportIncidentEndpointService">
        <wsdl:port name="ReportIncidentEndpoint" binding="tns:ReportIncidentBinding">
            <soap:address location="http://localhost:9080/camel-example-cxf-proxy/webser
vices/incident"/>
        </wsdl:port>
    </wsdl:service>

</wsdl:definitions>
```

Note

The address URL appearing in the WSDL contract (the value of the `soap:address` element's `location` attribute) is not important here, because the application code overrides the default value of the address URL.

WSDL addressing details

A WS client needs three pieces of information to connect to a WSDL service: the *WSDL service name*, the *WSDL port name*, and the *address URL* of the

[1] http://fusesource.com/products/enterprise-camel/#documentation

Web service. The following addressing details are used to connect to the proxy Web service and to the real Web service in this example:

WSDL service name
The full QName of the WSDL service is as follows:

```
{http://reportincident.example.camel.apache.org}ReportIncidentEndpointService
```

WSDL port name
The full QName of the WSDL port is as follows:

```
{http://reportincident.example.camel.apache.org}ReportIncidentEndpoint
```

Address URL
The address URL of the *proxy Web service* endpoint (which uses the HTTPS protocol) is as follows:

```
https://localhost:9080/camel-example-cxf-proxy/webservices/incident
```

Note

The preceding address is specified when the `reportIncident` bean is created using a `cxf:cxfEndpoint` element in the bundle's Spring configuration file, `src/main/resources/META-INF/spring/camel-config.xml`.

The address URL of the *real Web service* endpoint (using the HTTP protocol) is as follows:

```
http://localhost:9081/real-webservice
```

Note

The preceding address is specified when the `realWebService` bean is created in the bundle's Spring configuration file, `src/main/resources/META-INF/spring/camel-config.xml`.

Securing the Web Services Proxy

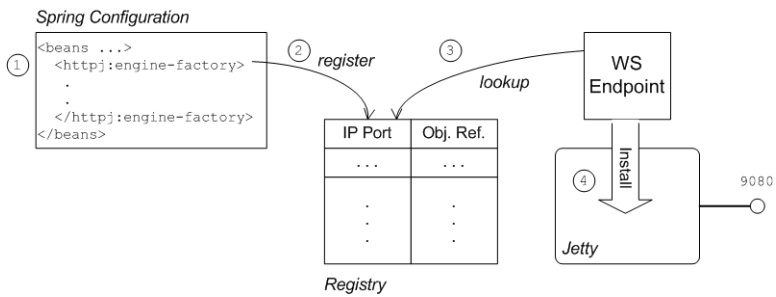
Overview

This section explains how to enable SSL/TLS security on the Camel CXF endpoint, which acts as a proxy for the real Web service. Assuming that you already have the X.509 certificates available, all that is required is to add a block of configuration data to the Spring configuration file (where the configuration data is contained in a `httpj:engine-factory` element). There is just one slightly subtle aspect to this, however: you need to understand how the Camel CXF endpoint gets associated with the SSL/TLS configuration details.

Implicit configuration

A WS endpoint can be configured by creating the endpoint in Spring and then configuring SSL/TLS properties on its Jetty container. The configuration can be somewhat confusing, however, for the following reason: the Jetty container (which is configured by a `httpj:engine-factory` element in Spring) *does not explicitly reference the WS endpoints it contains* and the WS endpoints *do not explicitly reference the Jetty container* either. The connection between the Jetty container and its contained endpoints is established implicitly, in that they are both configured to use the same IP port, as illustrated by Figure 7.2 on page 111.

Figure 7.2. WS Endpoint Implicitly Configured by httpj:engine-factory Element



The connection between the Web service endpoint and the `httpj:engine-factory` element is established as follows:

1. The Spring container loads and parses the file containing the `httpj:engine-factory` element.

2. When the `httpj:engine-factory` bean is created, a corresponding entry is created in the registry, storing a reference to the bean. The `httpj:engine-factory` bean is also used to initialize a Jetty container that listens on the specified IP port.
3. When the WS endpoint is created, it scans the registry to see if it can find a `httpj:engine-factory` bean with the same IP port as the IP port in the endpoint's address URL.
4. If one of the beans matches the endpoint's IP port, the WS endpoint installs itself into the corresponding Jetty container. If the Jetty container has SSL/TLS enabled, the WS endpoint shares those security settings.

Steps to add SSL/TLS security to the Jetty container

To add SSL/TLS security to the Jetty container, thereby securing the WS proxy endpoint, perform the following steps:

1. "Add certificates to the bundle resources" on page 112.
2. "Modify POM to switch off resource filtering" on page 113.
3. "Add the httpj:engine-factory element to Spring configuration" on page 113.
4. "Define the sec: and httpj: prefixes" on page 114.
5. "Modify proxy address URL to use HTTPS" on page 115.

Add certificates to the bundle resources

The certificates used in this demonstration are taken from a sample in the Apache CXF 2.6.0.fuse-71-047 product. If you download[2] and install the standalone version of Apache CXF, you will find the sample certificates in the *`CXFInstallDir`*`/samples/wsdl_first_https/certs` directory.

Copy the `cherry.jks`, `wibble.jks`, and `truststore.jks` keystores from the *`CXFInstallDir`*`/samples/wsdl_first_https/certs` directory to the

[2] http://fusesource.com/downloads/

CamelInstallDir/examples/camel-example-cxf-proxy/src/main/resources/certs directory (you must first create the `certs` sub-directory).

Modify POM to switch off resource filtering

Including the certificates directly in the bundle as resource is the most convenient way to deploy them. But when you deploy certificates as resources in a Maven project, you must remember to disable Maven resource filtering, which corrupts binary files.

To disable filtering of `.jks` files in Maven, open the project POM file, *CamelInstallDir*/examples/camel-example-cxf-proxy/pom.xml, with a text editor and add the following `resources` element as a child of the `build` element:

```
<?xml version="1.0" encoding="UTF-8"?>
...
<project ...>
  ...
  <build>
    <plugins>
      ...
    </plugins>

    <resources>
      <resource>
        <directory>src/main/resources</directory>
        <filtering>true</filtering>
        <excludes>
          <exclude>**/*.jks</exclude>
        </excludes>
      </resource>
      <resource>
        <directory>src/main/resources</directory>
        <filtering>false</filtering>
        <includes>
          <include>**/*.jks</include>
        </includes>
      </resource>
    </resources>
  </build>

</project>
```

Add the httpj:engine-factory element to Spring configuration

To configure the Jetty container that listens on IP port 9080 to use SSL/TLS security, edit the `camel-config.xml` file in the

src/main/resources/META-INF/spring directory, adding the httpj:engine-factory element as shown in Example 7.2 on page 114.

In this example, the required attribute of the sec:clientAuthentication element is set to false, which means that a connecting client is *not* required to present an X.509 certificate to the server during the SSL/TLS handshake (although it may do so, if it has such a certificate).

Example 7.2. httpj:engine-factory Element with SSL/TLS Enabled

```
<beans ... >
    ...
    <httpj:engine-factory bus="cxf">
      <httpj:engine port="9080">
        <httpj:tlsServerParameters>
          <sec:keyManagers keyPassword="password">
            <sec:keyStore type="JKS" password="password"
                resource="certs/cherry.jks"/>
          </sec:keyManagers>
          <sec:trustManagers>
            <sec:keyStore type="JKS" password="password"
               resource="certs/truststore.jks"/>
          </sec:trustManagers>
          <sec:cipherSuitesFilter>
            <sec:include>.*_WITH_3DES_.*</sec:include>
            <sec:include>.*_WITH_DES_.*</sec:include>
            <sec:exclude>.*_WITH_NULL_.*</sec:exclude>
            <sec:exclude>.*_DH_anon_.*</sec:exclude>
          </sec:cipherSuitesFilter>
          <sec:clientAuthentication want="true" re
quired="false"/>
        </httpj:tlsServerParameters>
      </httpj:engine>
    </httpj:engine-factory>

</beans>
```

Define the sec: and httpj: prefixes

Define the sec: and httpj: namespace prefixes, which appear in the definition of the httpj:engine-factory element, by adding the following highlighted lines to the beans element in the camel-config.xml file:

```
<beans xmlns="http://www.springframework.org/schema/beans"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xmlns:camel="http://camel.apache.org/schema/spring"
       xmlns:cxf="http://camel.apache.org/schema/cxf"
       xmlns:sec="http://cxf.apache.org/configuration/security"
```

```
       xmlns:httpj="http://cxf.apache.org/transports/http-jetty/configuration"
       xsi:schemaLocation="
       http://www.springframework.org/schema/beans http://www.springframe
work.org/schema/beans/spring-beans.xsd
       http://camel.apache.org/schema/spring http://camel.apache.org/schema/spring/camel-
spring.xsd
       http://camel.apache.org/schema/cxf http://camel.apache.org/schema/cxf/camel-cxf.xsd

       http://cxf.apache.org/configuration/security http://cxf.apache.org/schemas/configur
ation/security.xsd
      http://cxf.apache.org/transports/http-jetty/configuration http://cxf.apache.org/schem
as/configuration/http-jetty.xsd
       ">
```

Note

It is essential to specify the locations of the `http://cxf.apache.org/configuration/security` schema and the `http://cxf.apache.org/transports/http-jetty/configuration` schema in the `xsi:schemaLocation` attribute. These will not automatically be provided by the OSGi container.

Modify proxy address URL to use HTTPS

The proxy endpoint at the start of the Apache Camel route is configured by the `cxf:cxfEndpoint` element in the `camel-config.xml` file. By default, this proxy endpoint is configured to use the HTTP protocol. You must modify the address URL to use the secure HTTPS protocol instead, however. In the `camel-config.xml` file, edit the address attribute of the `cxf:cxfEndpoint` element, replacing the `http:` prefix by the `https:` prefix, as shown in the following fragment:

```
<beans ...>
    ...
    <cxf:cxfEndpoint id="reportIncident"
                     address="https://localhost:9080/camel-
example-cxf-proxy/webservices/incident"
                     endpointName="s:ReportIncidentEndpoint"
                    serviceName="s:ReportIncidentEndpointSer
vice"
                     wsdlURL="etc/report_incident.wsdl"
                     xmlns:s="http://reportincident.ex
ample.camel.apache.org"/>
    ...
</beans>
```

Notice also that the address URL is configured to use the IP port, `9080`, which implicitly ensures that this endpoint is deployed into the Jetty container configured by the `http:engine-factory` element. The attributes of the `cxf:cxfEndpoint` specify the WSDL addressing details as described in "WSDL addressing details" on page 109:

`serviceName`

Specifies the WSDL service name.

`endpointName`

Specifies the WSDL port name.

`address`

Specifies the address URL of the proxy Web service.

Deploying the Apache Camel Route

Overview

The Maven POM file in the basic Camel CXF proxy demonstration is already configured to generate an OSGi bundle. Hence, after building the demonstration using Maven, the demonstration bundle (which contains the Apache Camel route and the `RealWebServicesBean` bean) is ready for deployment into the OSGi container.

Prerequisites

Before deploying the Apache Camel route into the OSGi container, you must configure the proxy Web service to use SSL/TLS security, as described in the previous section, "Securing the Web Services Proxy" on page 111.

Steps to deploy the Camel route

To deploy the Web services proxy demonstration into the OSGi container, perform the following steps:

1. "Build the demonstration" on page 117.
2. "Start the OSGi container" on page 117.
3. "Install the required features" on page 118.
4. "Deploy the bundle" on page 118.
5. "Check the console output" on page 118.

Build the demonstration

Use Maven to build and install the demonstration as an OSGi bundle. Open a command prompt, switch the current directory to *`CamelInstallDir`*`/examples/camel-example-cxf-proxy`, and enter the following command:

```
mvn install -Dmaven.test.skip=true
```

Start the OSGi container

If you have not already done so, start up the Apache ServiceMix console (and container instance) by entering the following command in a new command prompt:

```
./fuseesb
```

Install the required features

The `camel-cxf` feature, which defines the bundles required for the Camel/CXF component, is *not* installed by default. To install the `camel-cxf` feature, enter the following console command:

```
karaf@root> features:install camel-cxf
```

You also need the `camel-http` feature, which defines the bundles required for the Camel/HTTP component. To install the `camel-http` feature, enter the following console command:

```
karaf@root> features:install camel-http
```

Deploy the bundle

Deploy the `camel-example-cxf-proxy` bundle, by entering the following console command:

```
karaf@root> install -s mvn:org.apache.camel/camel-example-cxf-
proxy/2.10.0.fuse-71-047
```

Note

In this case, it is preferable to deploy the bundle directly using `install`, rather than using hot deploy, so that you can see the bundle output on the console screen.

If you have any difficulty using the `mvn` URL handler, see "Mvn URL Handler" in *Deploying into the Container* for details of how to set it up.

Check the console output

After the bundle is successfully deployed, you should see output like the following in the console window:

```
karaf@root> Starting real web service...
Started real web service at: http://localhost:9081/real-web
service
```

Securing the Web Services Client

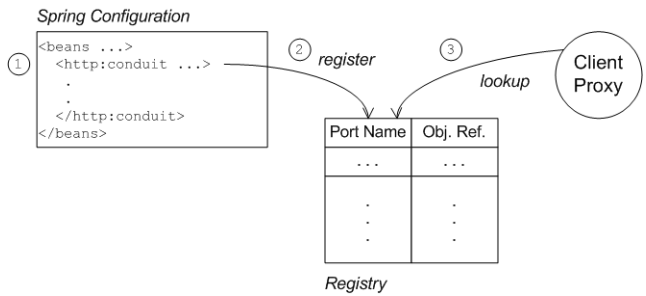
Overview

In the basic Camel CXF proxy demonstration, the Web services client is actually implemented as a JUnit test under the `src/test` directory. This means that the client can easily be run using the Maven command, `mvn test`. To enable SSL/TLS security on the client, the Java implementation of the test client is completely replaced and a Spring file, containing the SSL/TLS configuration, is added to the `src/test/resources/META-INF/spring` directory. Before describing the steps you need to perform to set up the client, this section explains some details of the client's Java code and Spring configuration.

Implicit configuration

Apart from changing the URL scheme on the endpoint address to `https:`, most of the configuration to enable SSL/TLS security on a client proxy is contained in a `http:conduit` element in Spring configuration. The way in which this configuration is applied to the client proxy, however, is potentially confusing, for the following reason: the `http:conduit` element *does not explicitly reference the client proxy* and the client proxy *does not explicitly reference the `http:conduit` element*. The connection between the `http:conduit` element and the client proxy is established implicitly, in that they both reference the same WSDL port, as illustrated by Figure 7.3 on page 119.

Figure 7.3. Client Proxy Implicitly Configured by http:conduit Element



The connection between the client proxy and the `http:conduit` element is established as follows:

1. The client loads and parses the Spring configuration file containing the `http:conduit` element.

2. When the `http:conduit` bean is created, a corresponding entry is created in the registry, which stores a reference to the bean under the specified WSDL port name (where the name is stored in QName format).
3. When the JAX-WS client proxy is created, it scans the registry to see if it can find a `http:conduit` bean associated with the proxy's WSDL port name. If it finds such a bean, it automatically injects the configuration details into the proxy.

Certificates needed on the client side

The client is configured with the following keystores from the `src/main/resources/certs` directory:

`wibble.jks`

A Java keystore containing the client's own X.509 certificate and private key. In fact, this certificate is not strictly necessary to run the current example, because the server does not require the client to send a certificate during the TLS handshake (see Example 7.2 on page 114).

`truststore.jks`

A Java keystore containing the CA certificate that issued both the server certificate, `cherry.jks`, and the client certificate, `wibble.jks`.

Loading Spring definitions into the client

The example client is not deployed directly into a Spring container, but it requires some Spring definitions in order to define a secure HTTP conduit. So how can you create the Spring definitions without a Spring container? It turns out that it is easy to read Spring definitions into a Java-based client using the `org.apache.cxf.bus.spring.SpringBusFactory` class.

The following code shows how to read Spring definitions from the file, `META-INF/spring/cxf-client.xml`, and create an Apache CXF Bus object that incorporates those definitions:

```
// Java
import org.apache.cxf.bus.spring.SpringBusFactory;
...
protected void startCxfBus() throws Exception {
    bf = new SpringBusFactory();
    Bus bus = bf.createBus("META-INF/spring/cxf-client.xml");
```

```
    bf.setDefaultBus(bus);
}
```

Creating the client proxy

In principle, there are several different ways of creating a WSDL proxy: you could use the JAX-WS API to create a proxy based on the contents of a WSDL file; you could use the JAX-WS API to create a proxy *without* a WSDL file; or you could use the Apache CXF-specific class, `JaxWsProxyFactoryBean`, to create a proxy.

For this SSL/TLS client, the most convenient approach is to use the JAX-WS API to create a proxy without using a WSDL file, as shown in the following Java sample:

```
// Java
import javax.xml.ws.Service;
import org.apache.camel.example.reportincident.ReportIncidentEndpoint;
...
// create the webservice client and send the request
Service s = Service.create(SERVICE_NAME);
s.addPort(
    PORT_NAME,
    "http://schemas.xmlsoap.org/soap/",
    ADDRESS_URL
  );
ReportIncidentEndpoint client =
  s.getPort(PORT_NAME, ReportIncidentEndpoint.class);
```

Note

In this example, you *cannot* use the `JaxWsProxyFactoryBean` approach to create a proxy, because a proxy created in this way fails to find the HTTP conduit settings specified in the Spring configuration file.

The `SERVICE_NAME` and `PORT_NAME` constants are the QNames of the WSDL service and the WSDL port respectively, as defined in Example 7.1 on page 109. The `ADDRESS_URL` string has the same value as the proxy Web service address and is defined as follows:

```
private static final String ADDRESS_URL =
  "https://localhost:9080/camel-example-cxf-proxy/webservices/incident";
```

In particular, note that the address *must* be defined with the URL scheme, `https`, which selects HTTP over SSL/TLS.

Steps to add SSL/TLS security to the client

To define a JAX-WS client with SSL/TLS security enabled, perform the following steps:

1. "Create the Java client as a test case" on page 122.
2. "Add the http:conduit element to Spring configuration" on page 124.
3. "Run the client" on page 126.

Create the Java client as a test case

Example 7.3 on page 122 shows the complete code for a Java client that is implemented as a JUnit test case. This client replaces the existing test, `ReportIncidentRoutesTest.java`, in the `src/test/java/org/apache/camel/example/reportincident` sub-directory of the `examples/camel-example-cxf-proxy` demonstration.

To add the client to the *`CamelInstallDir`*`/examples/camel-example-cxf-proxy` demonstration, go to the `src/test/java/org/apache/camel/example/reportincident` sub-directory, move the existing `ReportIncidentRoutesTest.java` file to a backup location, then create a new `ReportIncidentRoutesTest.java` file and paste the code from Example 7.3 on page 122 into this file.

Example 7.3. ReportIncidentRoutesTest Java client

```
// Java
package org.apache.camel.example.reportincident;

import org.apache.camel.spring.Main;
import org.apache.cxf.jaxws.JaxWsProxyFactoryBean;
import org.junit.Test;

import java.net.URL;
import javax.xml.namespace.QName;
import javax.xml.ws.Service;

import org.apache.cxf.Bus;
import org.apache.cxf.bus.spring.SpringBusFactory;
import org.apache.camel.example.reportincident.ReportIncidentEndpoint;
import org.apache.camel.example.reportincident.ReportIncidentEndpointService;

import static org.junit.Assert.assertEquals;
```

```
/**
 * Unit test of our routes
 */
public class ReportIncidentRoutesTest {

    private static final QName SERVICE_NAME
        = new QName("http://reportincident.example.camel.apache.org", "ReportIncidentEnd
pointService");

    private static final QName PORT_NAME =
       new QName("http://reportincident.example.camel.apache.org", "ReportIncidentEndpoint");


   private static final String WSDL_URL = "file:src/main/resources/etc/report_incident.wsdl";


    // should be the same address as we have in our route
    private static final String ADDRESS_URL = "https://localhost:9080/camel-example-cxf-
proxy/webservices/incident";

    protected SpringBusFactory bf;

    protected void startCxfBus() throws Exception {
        bf = new SpringBusFactory();
        Bus bus = bf.createBus("META-INF/spring/cxf-client.xml");
        bf.setDefaultBus(bus);
    }

    @Test
    public void testRendportIncident() throws Exception {
        startCxfBus();
        runTest();
    }

    protected void runTest() throws Exception {

        // create input parameter
        InputReportIncident input = new InputReportIncident();
        input.setIncidentId("123");
        input.setIncidentDate("2008-08-18");
        input.setGivenName("Claus");
        input.setFamilyName("Ibsen");
        input.setSummary("Bla");
        input.setDetails("Bla bla");
        input.setEmail("davsclaus@apache.org");
        input.setPhone("0045 2962 7576");

        // create the webservice client and send the request
        Service s = Service.create(SERVICE_NAME);
```

```
        s.addPort(PORT_NAME, "http://schemas.xmlsoap.org/soap/", ADDRESS_URL);
       ReportIncidentEndpoint client = s.getPort(PORT_NAME, ReportIncidentEndpoint.class);


        OutputReportIncident out = client.reportIncident(input);

        // assert we got a OK back
        assertEquals("OK;456", out.getCode());
    }
}
```

Add the http:conduit element to Spring configuration

Example 7.4 on page 124 shows the Spring configuration that defines a `http:conduit` element for the `ReportIncidentEndpoint` WSDL port. The `http:conduit` element is configured to enable SSL/TLS security for any client proxies that use the specified WSDL port.

To add the Spring configuration to the client test case, go to the `src/test/resources/META-INF/spring` sub-directory, use your favorite text editor to create the file, `cxf-client.xml`, and paste the contents of Example 7.4 on page 124 into the file.

Example 7.4. http:conduit Element with SSL/TLS Enabled

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xmlns:cxf="http://camel.apache.org/schema/cxf"
       xmlns:sec="http://cxf.apache.org/configuration/security"
       xmlns:http="http://cxf.apache.org/transports/http/configuration"
       xsi:schemaLocation="
       http://www.springframework.org/schema/beans http://www.springframe
work.org/schema/beans/spring-beans.xsd
       http://camel.apache.org/schema/cxf http://camel.apache.org/schema/cxf/camel-cxf.xsd

       http://cxf.apache.org/configuration/security http://cxf.apache.org/schemas/configur
ation/security.xsd
      http://cxf.apache.org/transports/http/configuration http://cxf.apache.org/schemas/con
figuration/http-conf.xsd
       ">

  <http:conduit name="{http://reportincident.example.camel.apache.org}ReportIncidentEnd
point.http-conduit">
    <http:tlsClientParameters disableCNCheck="true">
      <sec:trustManagers>
          <sec:keyStore type="JKS" password="password"
    resource="certs/truststore.jks"/>
```

```
      </sec:trustManagers>
      <sec:keyManagers keyPassword="password">
          <sec:keyStore type="JKS" password="password"
    resource="certs/wibble.jks"/>
      </sec:keyManagers>
      <sec:cipherSuitesFilter>
        <sec:include>.*_WITH_3DES_.*</sec:include>
        <sec:include>.*_WITH_DES_.*</sec:include>
        <sec:exclude>.*_WITH_NULL_.*</sec:exclude>
        <sec:exclude>.*_DH_anon_.*</sec:exclude>
      </sec:cipherSuitesFilter>
    </http:tlsClientParameters>
   </http:conduit>

</beans>
```

Please note the following points about the preceding configuration:

- The `http:` and `sec:` namespace prefixes are needed to define the `http:conduit` element. In the `xsi:schemaLocation` element, it is also essential to specify the locations of the corresponding `http://cxf.apache.org/configuration/security` and `http://cxf.apache.org/transports/http/configuration` namespaces.
- The `disableCNCheck` attribute of the `http:tlsClientParameters` element is set to `true`. This means that the client does *not* check whether the Common Name in the server's X.509 certificate matches the server hostname. For more details, see Appendix A on page 153.

Important

Disabling the CN check is *not* recommended in a production deployment.

- In the `sec:keystore` elements, the certificate locations are specified using the `resource` attribute, which finds the certificates on the classpath. When Maven runs the test, it automatically makes the contents of `src/main/resources` available on the classpath, so that the certificates can be read from the `src/main/resources/certs` directory.

Note

You also have the option of specifying a certificate location using the `file` attribute, which looks in the filesystem. But the `resource` attribute is more suitable for use with applications packaged in bundles.

- The `sec:cipherSuitesFilter` element is configured to exclude cipher suites matching `.*_WITH_NULL_.*` and `.*_DH_anon_.*`. These cipher suites are effectively incomplete and are *not* intended for normal use.

Important

It is recommended that you always *exclude* the ciphers matching `.*_WITH_NULL_.*` and `.*_DH_anon_.*`.

Run the client

Because the client is defined as a test case, you can run the client using the standard Maven test goal. To run the client, open a new command window, change directory to *`CamelInstallDir`*`/examples/camel-example-cxf-proxy`, and enter the following Maven command:

```
mvn test
```

If the test runs successfully, you should see the following output in the OSGi console window:

```
Incident was 123, changed to 456

Invoked real web service: id=456 by Claus Ibsen
```

Chapter 8. LDAP Authentication Tutorial

This tutorial explains how to set up an X.500 directory server and configure the OSGi container to use LDAP authentication.

Tutorial Overview

Goals

In this tutorial you will:

- install Apache Directory Server and Apache Directory Studio
- add user entries into the LDAP server
- add a group to manage security roles
- configure Fuse ESB Enterprise to use LDAP authentication
- configure Fuse ESB Enterprise to use roles for authorization
- configure an instance of Apache ActiveMQ to use LDAP authentication
- configure SSL/TLS connections to the LDAP server

Tutorial stages

The tutorial consists of the following stages:

1. "Set-up a Directory Server and Browser" on page 129.
2. "Add User Entries to the Directory Server" on page 133.
3. "Enable LDAP Authentication in the OSGi Container" on page 141.
4. "Configuring Access to OSGi Administrative Functions" on page 144.
5. "Enable SSL/TLS on the LDAP Connection" on page 148.

Set-up a Directory Server and Browser

Overview

In this stage of the tutorial you will install an X.500 directory server and browser client from the *Apache Directory* project. These applications will be used throughout the rest of this tutorial.

Procedure

To set-up the directory server and browser:

1. Download Apache Directory Server from http://directory.apache.org/apacheds/1.5/downloads.html.
2. Run the downloaded installer.

Important

During the installation process, you will be asked whether or not to install a *default instance* of the directory server. Choose the default instance.

3. Start the directory service as described in "Starting Apache Directory Server" on page 130.
4. Install Apache Directory Studio as described in "Install Apache Directory Studio" on page 130.
5. Start Apache Directory Studio.
   - If you installed the standalone version of Apache Directory Studio, double-click the relevant icon to launch the application.
   - If you installed Apache Directory Studio into an existing Eclipse IDE:
     1. Start Eclipse.
     2. Select **Window** → **Open Perspective** → **Other**.
     3. In the **Open Perspective** dialog, select **LDAP**.
     4. Click **OK**.

6. Connect the browser to the server as described in "Connecting the browser to the server" on page 130.

Starting Apache Directory Server

If you install Apache Directory Server on Windows, the default instance of the directory server is configured as a Windows service. Hence, you can stop and start the directory server using the standard **Services** administrative tool.

If you install on a Linux or Mac OS platform, follow the instructions in Installing and Starting the Server[1] for starting and stopping the directory server.

Install Apache Directory Studio

The Apache Directory Studio is an Eclipse-based suite of tools for administering an X.500 directory server. In particular, for this tutorial, you need the LDAP Browser feature, which enables you to create new entries in the Directory Information Tree (DIT).

There are two alternative ways of installing Apache Directory Studio:

- *Standalone application*—download the standalone distribution from the Directory Studio downloads[2] page and follow the installation instructions from the Apache Directory Studio User Guide[3].
- *Eclipse plug-in*—if you already use Eclipse as your development environment, you can install *Apache Directory Studio* as a set of Eclipse plug-ins. The only piece of *Apache Directory Studio* that you need for this tutorial is the *LDAP Browser* plug-in.

  To install the LDAP Browser as an Eclipse plug-in, follow the install instructions from the LDAP Browser Plug-In User Guide[4].

Connecting the browser to the server

To connect the LDAP browser to the LDAP server:

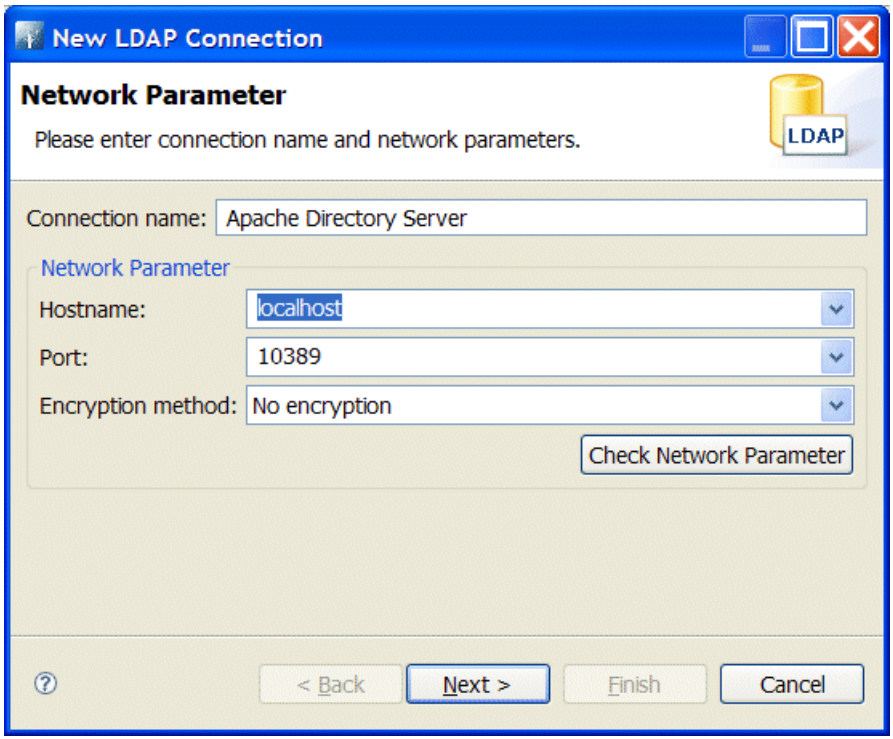
1. Right-click inside the **Connections** view.
2. Select **New Connection...**.

   The **New LDAP Connection** wizard opens.

[1] http://directory.apache.org/apacheds/1.5/13-installing-and-starting-the-server.html
[2] http://directory.apache.org/studio/downloads.html
[3] http://directory.apache.org/studio/static/users_guide/apache_directory_studio/download_install.html
[4] http://directory.apache.org/studio/static/users_guide/ldap_browser/gettingstarted_download_install.html

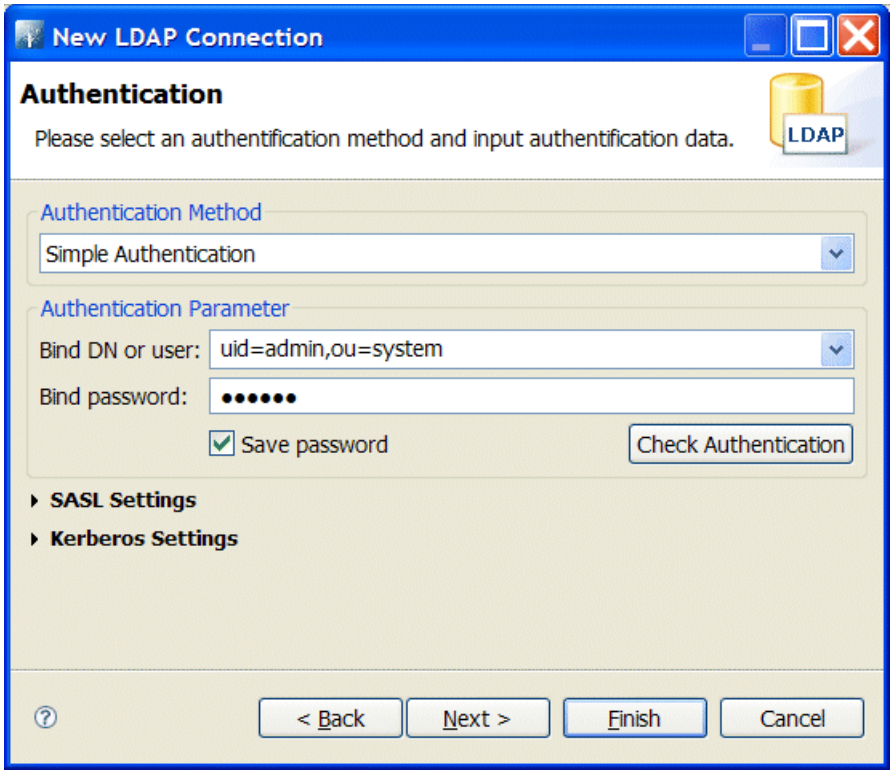
3. In the **Connection name** field, enter `Apache Directory Server`.
4. In the **Hostname** field enter `localhost`.
5. In the **Port** field, enter `10389`.

Figure 8.1. New LDAP Connection Wizard



6. Click **Next**.
7. In the **Bind DN or user** field, enter `uid=admin,ou=system`).
8. In the **Bind password** field, enter `secret`).

Figure 8.2. Authentication Step of New LDAP Connection



9. Click **Finish**.

If the connection is successfully established, you should see an outline of the Directory Information Tree (DIT) in the **LDAP Browser** view.

Add User Entries to the Directory Server

Overview

The basic prerequisite for using LDAP authentication with the OSGi container is to have an X.500 directory server running and configured with a collection of user entries. For many use cases, you will also want to configure a number of groups to manage user roles.

Goals

In this portion of the tutorial you will

- add three user entries to the LDAP server
- add four groups to the LDAP server

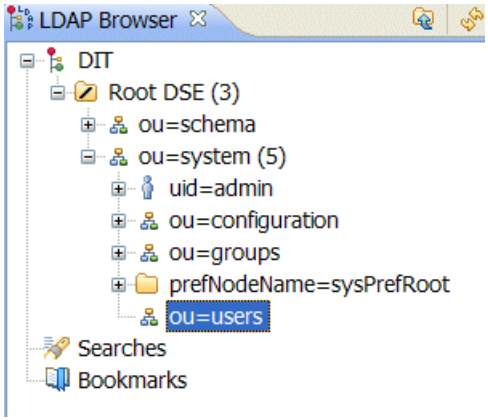
Adding user entries

Perform the following steps to add user entries to the directory server:

1. Ensure that the LDAP server and browser are running.

   See "Set-up a Directory Server and Browser" on page 129.

2. In the **LDAP Browser** view, drill down to the **ou=users** node.



3. Select the **ou=users** node.
4. Open the context menu.
5. Select **New** → **New Entry**.

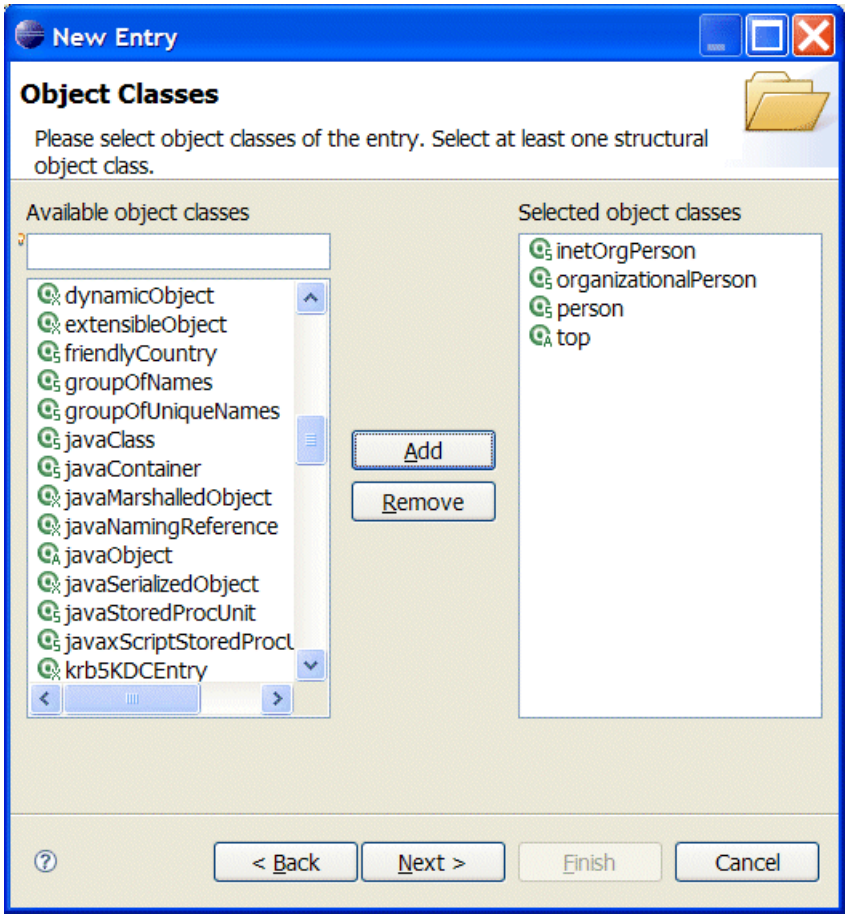
The **New Entry** wizard appears.

6. In the **Entry Creation Method** pane, check **Create entry from scratch**.
7. Click **Next**.

   The **Object Classes** pane opens.

8. In the **Object Classes** pane, select `inetOrgPerson` from the list of **Available object classes** on the left.
9. Click **Add** to populate the list of **Selected object classes**.

Figure 8.3. New Entry Wizard

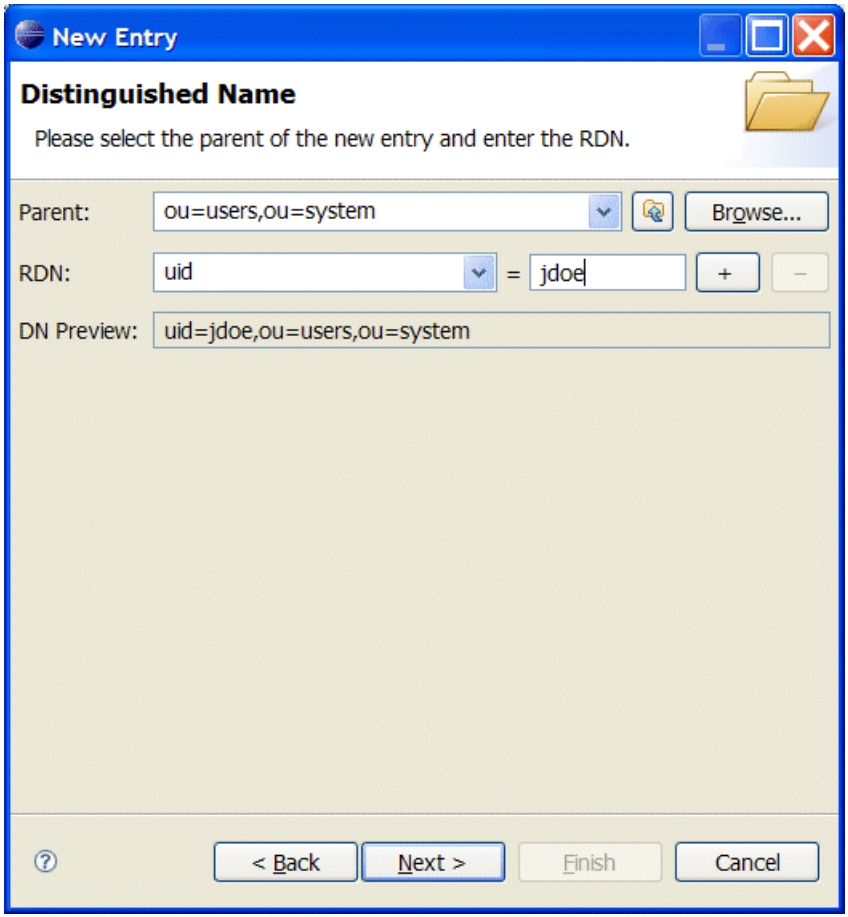


10. Click **Next**.

    The **Distinguished Name** pane opens.

11. In the the **RDN** field, enter `uid` in front and `jdoe` after the equals sign.

Figure 8.4. Distinguished Name Step of New Entry Wizard



12. Click **Next**.

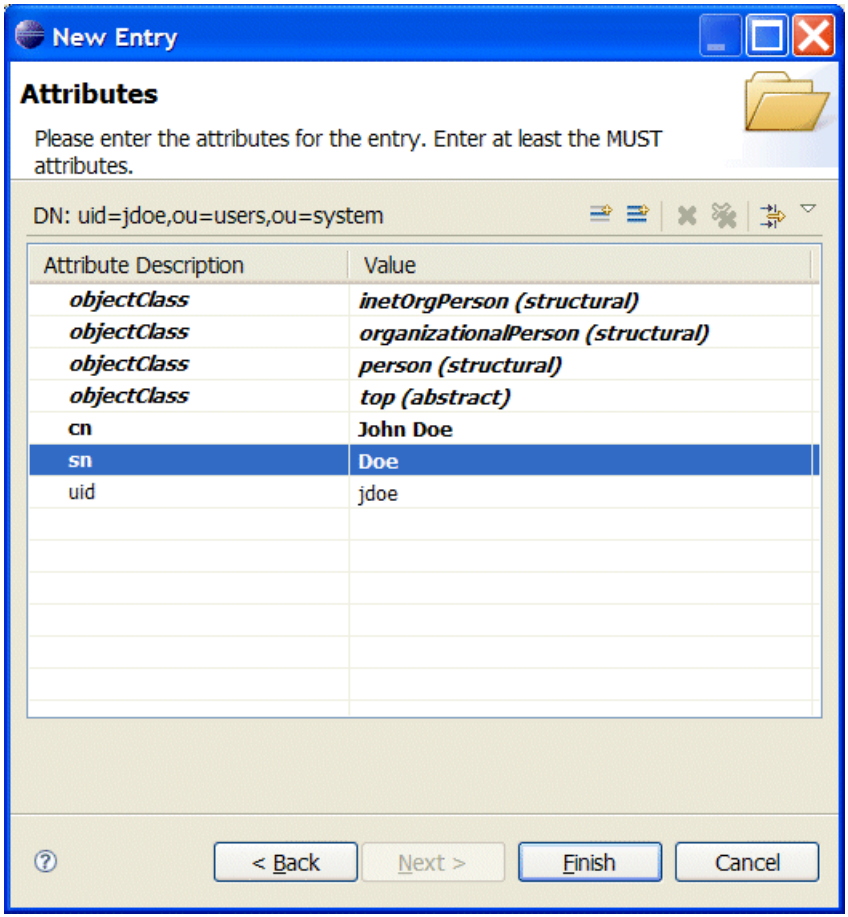
    The **Attributes** pane opens.

13. Fill in the remaining mandatory attributes in the **Attributes** pane.

    a. Set the **cn** (common name) attribute to `John Doe`

b. Set the **sn** (surname) attribute to `Doe`.

Figure 8.5. Attributes Step of New Entry Wizard



14. Add a `userPassword` attribute to the user entry.

    a. Open the context menu in the **Attributes** pane.

    b. Select **New Attribute**.

The **New Attribute** wizard appears.

c. From the **Attribute type** drop-down list, select **userPassword**.

d. Click **Finish**.

The **Password Editor** dialog appears.

e. In the **Enter New Password** field, enter the password, `secret`.

f. Click **OK**.

The **userPassword** attribute will appear in the attributes editor.

15. Click **Finish**.

16. Add a user **`Jane Doe`** by following Step 3 on page 133 to Step 15 on page 138.

In Step 11 on page 135, use **`janedoe`** for the new user's **uid**.

17. Add a user **`Camel Rider`** by following Step 3 on page 133 to Step 15 on page 138.

In Step 11 on page 135, use **`crider`** for the new user's **uid**.

Adding groups for the roles

To add the groups that define the roles:

1. Create a new organizational unit to contain the role groups.

a. In the **LDAP Browser** view, select the **ou=system** node.

b. Open the context menu.

c. Select **New** → **New Entry**.

The **New Entry** wizard appears.

d. In the **Entry Creation Method** pane, check **Create entry from scratch**.

e. Click **Next**.

The **Object Classes** pane opens.

f. Select `organizationalUnit` from the list of **Available object classes** on the left.

g. Click **Add** to populate the list of **Selected object classes**.

h. Click **Next>**.

The **Distinguished Name** pane opens.

i. In the the **RDN** field, enter **`ou`** in front and **`roles`** after the equals sign.

j. Click **Next>**.

The **Attributes** pane opens.

k. Click **Finish**.

Note

This step is required because Apache DS only allows administrators access to entries in `ou=system,ou=groups`.

2. In the **LDAP Browser** view, drill down to the **ou=roles** node.
3. Select the **ou=roles** node.
4. Open the context menu.
5. Select **New** → **New Entry**.

The **New Entry** wizard appears.

6. In the **Entry Creation Method** pane, check **Create entry from scratch**.
7. Click **Next**.

The **Object Classes** pane opens.

8. Select `groupOfNames` from the list of **Available object classes** on the left.
9. Click **Add** to populate the list of **Selected object classes**.

10. Click **Next**.

    The **Distinguished Name** pane opens.

11. In the the **RDN** field, enter `cn` in front and `admin` after the equals sign.

12. Click **Next**.

    The **Attributes** pane opens and you are presented with a DN editor.

13. Enter `uid=jdoe`.

14. Click **OK**.

15. Click **Finish**.

16. Add a `sshConsole` role by following Step 3 on page 139 to Step 15 on page 140.

    In Step 11 on page 140, use `sshConsole` for the new group's **cn**.

    In Step 13 on page 140, use `uid=janedoe`.

17. Add a `webconsole` role by following Step 3 on page 139 to Step 15 on page 140.

    In Step 11 on page 140, use `webconsole` for the new group's **cn**.

    In Step 13 on page 140, use `uid=janedoe`.

18. Add a `jmxUser` role by following Step 3 on page 139 to Step 15 on page 140.

    In Step 11 on page 140, use `jmxUser` for the new group's **cn**.

    In Step 13 on page 140, use `uid=crider`.

Enable LDAP Authentication in the OSGi Container

Overview

In this part of the tutorial you will configure an LDAP realm in the OSGi container. The new realm overrides the default karaf realm, so that the container authenticates credentials based on user entries stored in the X.500 directory server.

Procedure

To enable LDAP authentication:

1. Ensure that the X.500 directory server is running.
2. Start Fuse ESB Enterprise by entering the following command in a terminal window:

```
> servicemix
```

3. Create a Blueprint configuration file called `ldap-module.xml`.
4. Copy Example 8.1 on page 141 into `ldap-module.xml`.

Example 8.1. Blueprint JAAS Realm

```
<?xml version="1.0" encoding="UTF-8"?>
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"
  xmlns:jaas="http://karaf.apache.org/xmlns/jaas/v1.0.0"
  xmlns:ext="http://aries.apache.org/blueprint/xmlns/blueprint-ext/v1.0.0">

  <jaas:config name="karaf" rank="1">
    <jaas:module className="org.apache.karaf.jaas.modules.ldap.LDAPLoginModule"
                 flags="required">
      initialContextFactory=com.sun.jndi.ldap.LdapCtxFactory
      connection.username=uid=admin,ou=system
      connection.password=secret
      connection.protocol=
      connection.url=ldap://localhost:10389
      user.base.dn=ou=users,ou=system
      user.filter=(uid=%u)
      user.search.subtree=true
      role.base.dn=ou=roles,ou=system
      role.name.attribute=cn
      role.filter=(member=uid=%u)
      role.search.subtree=true
      authentication=simple
    </jaas:module>
```

```
  </jaas:config>
</blueprint>
```

This login module creates a JAAS realm called `karaf`, which is the same name as the default JAAS realm used by Fuse ESB Enterprise. By redefining this realm with a `rank` attribute value greater than `0`, it overrides the standard `karaf` realm which has the rank `0`. For more information on configuring a JAAS realm see "Defining JAAS Realms" on page 28.

For a detailed description of configuring Fuse ESB Enterprise to use LDAP see "Enabling LDAP Authentication" on page 53.

Important

When setting the JAAS properties above, do *not* enclose the property values in double quotes.

Tip

If you use OpenLDAP, the syntax of the role filter is `(member:=uid=%u)`.

5. To deploy the new LDAP module, copy the `ldap-module.xml` into the Fuse ESB Enterprise `deploy/` directory.

   The LDAP module is automatically activated.

6. Test the new LDAP realm by connecting to the running container using the Fuse ESB Enterprise client utility.

   a. Open a new command prompt.

   b. change directory to the Fuse ESB Enterprise install directory.

   c. Enter the following command to log on to the running container instance using the identity `janedoe`:

      ```
      client -u janedoe -p secret
      ```

      You should receive the following message:

      ```
      Authentication failure
      ```

This fails because `janedoe` does not have the `admin` role which is required for using the remote console.

d. Enter the following command to log on to the running container instance using the identity `jdoe`:

```
client -u jdoe -p secret
```

You should successfully log into the container's remote console because `jdoe` does have the `admin` role.

7. Log off the remote console by entering the **logout** command.

Configuring Access to OSGi Administrative Functions

Overview

This tutorial explains how to configure the OSGi administrative functions to use specific roles for authorization. By configuring each of the administrative functions to use a different role for access, you can provide fine grained control over who can monitor and manipulate running containers.

When LDAP is enabled, the OSGi container expects the user role data to be stored along with the user authentication data in the LDAP directory server. The LDAP search query to extract the role data is specified by the `role.*` properties in the `jaas:module` element.

The JAAS LDAP login module used in this tutorial, shown in Example 8.1 on page 141, is configured to extract the role name from the `cn` property of all entries selected by the filter `member=uid=%u` which is run on the tree selected using the base DN `uo=roles,ou=system`. In "Adding groups for the roles" on page 138, you added three groups to the `uo=roles,ou=system` tree. The filter will match with any group that has a member specified by `uid=%u`.

For example, when you attempted to connect to the remote console as user `jdoe` the filter searched for a group with a member `uid=jdoe` and matched on the group `cn=admin,uo=roles,ou=system`. The LDAP module extracted the `cn` property's value of `admin` and used it as the role for authorizing user `jdoe`.

Goals

You will change the role used for each of the administrative functions:

- SSH (remote console login)
- JMX management
- Web console

Prerequisites

Before you can perfrom any of the following tutorials, you must ensure that the ApacheDS server is running.

Configure a role for the remote console

To configure a role for the remote console:

1. Open *ESBInstallDir*/etc/org.apache.karaf.shell.cfg in a text editor.
2. Add the following line:

```
sshRole=sshConsole
```

3. Save the changes.
4. Start Fuse ESB Enterprise by entering the following command in a terminal window:

```
> servicemix
```

5. Open a new command prompt.
6. Change directory to the Fuse ESB Enterprise install directory.
7. Enter the following command to log on to the running container instance using the identity `janedoe`:

```
client -u janedoe -p secret
```

You should successfully log into the container's remote console because `janedoe` does have the `sshConsole` role.

Configure a role for JMX access

To configure a role for JMX access:

1. Open *ESBInstallDir*/etc/org.apache.karaf.management.cfg in a text editor.
2. Add the following line:

```
jmxRole=jmxUser
```

3. Save the changes.
4. Start Fuse ESB Enterprise by entering the following command in a terminal window:

```
> servicemix
```

5. Start JConsole or another JMX console.
6. Connect to Fuse ESB Enterprise's JMX server using the following settings:
   - JMX URL: **service:jmx:rmi://localhost:44444/jndi/rmi://localhost:1099/karaf-root**
   - User: **jdoe**
   - Password: **secret**

   The connection will fail because `jdoe` user does not have the `jmxUser` role.
7. Connect to Fuse ESB Enterprise's JMX server as using the following settings:
   - JMX URL: **service:jmx:rmi://localhost:44444/jndi/rmi://localhost:1099/karaf-root**
   - User: **crider**
   - Password: **secret**

   The connection will succeed because `crider` user does have the `jmxUser` role.

Configure a role for the Web console

To configure a role for the Web console:

1. - If the file *ESBInstallDir*`/etc/org.apache.karaf.webconsole.cfg` does not exist create it.
   - If the file does exist, open in a text editor.
2. Edit the line containing `role=` to read `role=webconsole`.

   The configuration should resemble Example 8.2 on page 147.

Example 8.2. Web console configuration for a specific realm

```
<config name="org.apache.karaf.webconsole">
realm=karaf
role=webconsole
</config>
```

3. Start Fuse ESB Enterprise by entering the following command in a terminal window:

```
> servicemix
```

4. Enable the Web console feature by entering the following command at the Fuse ESB Enterprise console prompt:

```
karaf@root> features:install webconsole
```

5. Open a Web browser.
6. Navigate to http://localhost:8181/system/console.

   You will be prompted to enter user credentials.
7. Log in using the following credentials:

   - User: **`janedoe`**
   - Password: **`secret`**

   You will be logged into the Web console because `janedoe` has the role `webconsole`.

More information

For more information on configuring the Fuse ESB Enterprise LDAP login module see "Enabling LDAP Authentication" on page 53.

For more information on configuring the Fuse ESB Enterprise administrative functions see "Configuring Roles for the Administrative Protocols" on page 57.

Enable SSL/TLS on the LDAP Connection

Overview

This tutorial explains how to enable SSL/TLS security on the connection between the LDAP login module and the Apache Directory Server.

The Apache Directory Server is already configured with an SSL endpoint. The default configuration creates an LDAPS endpoint that listens on the IP port `10636`. The directory server automatically generates a self-signed X.509 certificate which it uses to identify itself during the SSL/TLS handshake.

Important

You can use the default SSL configuration for simple demonstrations, but it is *not* suitable for real deployments. For advice on how to configure a real deployment, see "Tightening up security" on page 151.

Procedure

To enable SSL/TLS security on the connection to the Apache Directory Server:

1. Obtain a copy of the server's self-signed certificate.

   a. Using a Web browser , navigate to the following URL:

   ```
   https://localhost:10636
   ```

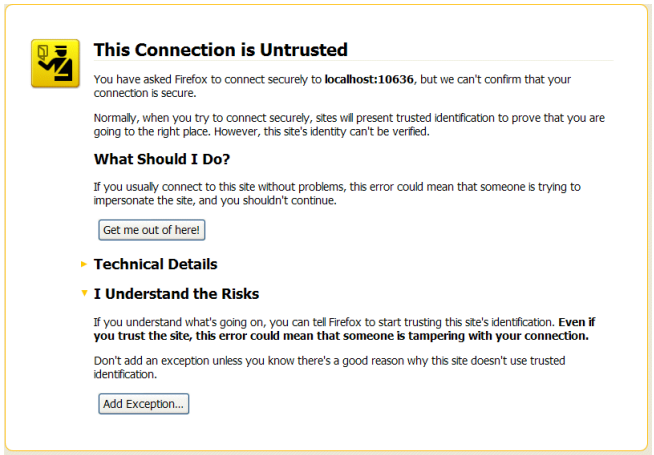
   

   ### Important

   Remember to specify the scheme as `https`, not just `http`.

   The Web browser now signals an error, because the certificate it receives from the server is untrusted. In the case of Firefox, you will see the following error in the browser window:

Figure 8.6. Obtaining the Certificate



b. Click **I Understand the Risks**.

c. Click **Add Exception**.

   The **Add Security Exception** dialog opens.

d. In the **Add Security Exception** dialog, click **Get Certificate**.

e. Click **View**.

   The **Certificate Viewer** dialog opens.

f. In the **Certificate Viewer** dialog, select the **Details** tab.

g. Click **Export**.

   The **Save Certificate To File** dialog opens.

h. In the **Save Certificate To File** dialog, use the drop-down list to set the **Save as type** to X.509 Certificate (DER).

i. Save the certificate, `ApacheDS.der`, to a convenient location on the filesystem.

2. Convert the DER format certificate into a keystore.

a. From a command prompt, change directory to the directory where you have stored the `ApacheDS.der` file.

b. Enter the following `keytool` command:

```
keytool -import -file ApacheDS.der -alias server -
keystore truststore.ks -storepass secret
```

3. Copy the newly created keystore file, `truststore.ks`, into the Fuse ESB Enterprise `etc/` directory.

4. Open the `ldap-module.xml` file you created in "Enable LDAP Authentication in the OSGi Container" on page 141 in a text editor.

5. Edit the `connection.url` to use `ldaps://localhost:10636`.

6. Add the highlighted lines in Example 8.3 on page 150.

Example 8.3. LDAP Configuration for Using SSL/TLS

```
<?xml version="1.0" encoding="UTF-8"?>
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"
  xmlns:jaas="http://karaf.apache.org/xmlns/jaas/v1.0.0"
  xmlns:ext="http://aries.apache.org/blueprint/xmlns/blueprint-ext/v1.0.0">

  <!-- Example configuration for using LDAP based authentication.
      This example uses an JAAS LoginModule from Karaf.
      It supports authentication of users and also supports
      retrieving user roles for authorization.

       Note, this config overwrite the default karaf domain
    that is defined inside some JAR file
       by using a rank > 0 attribute.
  -->
  <jaas:config name="karaf" rank="1">
    <jaas:module className="org.apache.karaf.jaas.modules.ldap.LDAPLoginModule" flags="re
quired">
      initialContextFactory=com.sun.jndi.ldap.LdapCtxFactory
      connection.username=uid=admin,ou=system
      connection.password=secret
      connection.protocol=
      connection.url = ldaps://localhost:10636
      user.base.dn = ou=users,ou=system
      user.filter = (uid=%u)
```

```
      user.search.subtree = true
      role.base.dn = ou=users,ou=system
      role.filter = (uid=%u)
      role.name.attribute = ou
      role.search.subtree = true
      authentication = simple
      ssl.protocol=SSL
      ssl.truststore=truststore
      ssl.algorithm=PKIX
    </jaas:module>
  </jaas:config>

  <jaas:keystore name="truststore"
        path="file:///ESBInstallDir/etc/truststore.ks"
 keystorePassword="secret" />
</blueprint>
```

7. Copy the `ldap-module.xml` file into the Fuse ESB Enterprise `deploy/` directory.

   The LDAP module is automatically activated.

8. Test the new LDAP realm by connecting to the running container using the Fuse ESB Enterprise client utility.

   a. Open a new command prompt.

   b. change directory to the Fuse ESB Enterprise install directory.

   c. Enter the following command to log on to the running container instance using the identity `jdoe`:

      ```
      client -u jdoe -p secret
      ```

      You should successfully log into the container's remote console because `jdoe` does have the `admin` role.

Tightening up security

The SSL set-up described here is suitable *only* as a proof-of-concept demonstration. For a real deployment, you must make the following changes to tighten up security:

- Delete all entries from the Fuse ESB Enterprise's `etc/users.properties` file.

If the `ldap-module.xml` bundle fails to start up properly, JAAS authentication reverts to the built-in file-based `karaf` realm, which takes its user data from the `users.properties` file.

- Disable the insecure LDAP endpoint on the Apache Directory Server.
- Create and deploy a properly signed X.509 certificate on the Apache Directory Server.

  See Appendix A on page 153.

Apache Directory Server Reference

For more details of how to configure SSL/TLS security on the Apache Directory Server, see How to enable SSL[5].

[5] http://directory.apache.org/apacheds/1.5/33-how-to-enable-ssl.html

Appendix A. Managing Certificates

TLS authentication uses X.509 certificates—a common, secure and reliable method of authenticating your application objects. You can create X.509 certificates that identify your Apache ActiveMQ applications.

What is an X.509 Certificate?

Role of certificates

An X.509 certificate binds a name to a public key value. The role of the certificate is to associate a public key with the identity contained in the X.509 certificate.

Integrity of the public key

Authentication of a secure application depends on the integrity of the public key value in the application's certificate. If an impostor replaces the public key with its own public key, it can impersonate the true application and gain access to secure data.

To prevent this type of attack, all certificates must be signed by a *certification authority* (CA). A CA is a trusted node that confirms the integrity of the public key value in a certificate.

Digital signatures

A CA signs a certificate by adding its *digital signature* to the certificate. A digital signature is a message encoded with the CA's private key. The CA's public key is made available to applications by distributing a certificate for the CA. Applications verify that certificates are validly signed by decoding the CA's digital signature with the CA's public key.

Warning

The supplied demonstration certificates are self-signed certificates. These certificates are insecure because anyone can access their private key. To secure your system, you must create new certificates signed by a trusted CA.

Contents of an X.509 certificate

An X.509 certificate contains information about the certificate subject and the certificate issuer (the CA that issued the certificate). A certificate is encoded in Abstract Syntax Notation One (ASN.1), a standard syntax for describing messages that can be sent or received on a network.

The role of a certificate is to associate an identity with a public key value. In more detail, a certificate includes:

- A *subject distinguished name (DN)* that identifies the certificate owner.
- The *public key* associated with the subject.

- X.509 version information.
- A *serial number* that uniquely identifies the certificate.
- An *issuer DN* that identifies the CA that issued the certificate.
- The digital signature of the issuer.
- Information about the algorithm used to sign the certificate.
- Some optional X.509 v.3 extensions; for example, an extension exists that distinguishes between CA certificates and end-entity certificates.

Distinguished names

A DN is a general purpose X.500 identifier that is often used in the context of security.

See Appendix B on page 171 for more details about DNs.

Certification Authorities

A CA consists of a set of tools for generating and managing certificates and a database that contains all of the generated certificates. When setting up a system, it is important to choose a suitable CA that is sufficiently secure for your requirements.

There are two types of CA you can use:

- commercial CAs are companies that sign certificates for many systems.
- private CAs are trusted nodes that you set up and use to sign certificates for your system only.

Commercial Certification Authorities

Signing certificates

There are several commercial CAs available. The mechanism for signing a certificate using a commercial CA depends on which CA you choose.

Advantages of commercial CAs

An advantage of commercial CAs is that they are often trusted by a large number of people. If your applications are designed to be available to systems external to your organization, use a commercial CA to sign your certificates. If your applications are for use within an internal network, a private CA might be appropriate.

Criteria for choosing a CA

Before choosing a commercial CA, consider the following criteria:

- What are the certificate-signing policies of the commercial CAs?
- Are your applications designed to be available on an internal network only?
- What are the potential costs of setting up a private CA compared to the costs of subscribing to a commercial CA?

Private Certification Authorities

Choosing a CA software package

If you want to take responsibility for signing certificates for your system, set up a private CA. To set up a private CA, you require access to a software package that provides utilities for creating and signing certificates. Several packages of this type are available.

OpenSSL software package

One software package that allows you to set up a private CA is OpenSSL, http://www.openssl.org. OpenSSL is derived from SSLeay, an implementation of SSL developed by Eric Young (<eay@cryptsoft.com>). The OpenSSL package includes basic command line utilities for generating and signing certificates. Complete documentation for the OpenSSL command line utilities is available at http://www.openssl.org/docs.

Setting up a private CA using OpenSSL

To set up a private CA, see the instructions in "Creating Your Own Certificates" on page 163 .

Choosing a host for a private certification authority

Choosing a host is an important step in setting up a private CA. The level of security associated with the CA host determines the level of trust associated with certificates signed by the CA.

If you are setting up a CA for use in the development and testing of Apache ActiveMQ applications, use any host that the application developers can access. However, when you create the CA certificate and private key, do not make the CA private key available on any hosts where security-critical applications run.

Security precautions

If you are setting up a CA to sign certificates for applications that you are going to deploy, make the CA host as secure as possible. For example, take the following precautions to secure your CA:

- Do not connect the CA to a network.
- Restrict all access to the CA to a limited set of trusted users.
- Use an RF-shield to protect the CA from radio-frequency surveillance.

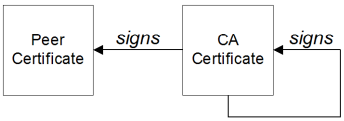
Certificate Chaining

Certificate chain

A *certificate chain* is a sequence of certificates, where each certificate in the chain is signed by the subsequent certificate.

Figure A.1 on page 159 shows an example of a simple certificate chain.

Figure A.1. A Certificate Chain of Depth 2



Self-signed certificate

The last certificate in the chain is normally a *self-signed certificate*—a certificate that signs itself.

Chain of trust

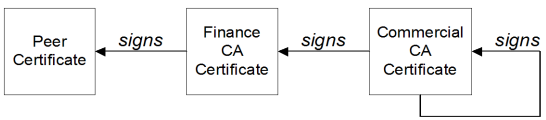
The purpose of a certificate chain is to establish a chain of trust from a peer certificate to a trusted CA certificate. The CA vouches for the identity in the peer certificate by signing it. If the CA is one that you trust (indicated by the presence of a copy of the CA certificate in your root certificate directory), this implies you can trust the signed peer certificate as well.

Certificates signed by multiple CAs

A CA certificate can be signed by another CA. For example, an application certificate could be signed by the CA for the finance department of Progress Software, which in turn is signed by a self-signed commercial CA.

Figure A.2 on page 159 shows what this certificate chain looks like.

Figure A.2. A Certificate Chain of Depth 3



Trusted CAs

An application can accept a peer certificate, provided it trusts at least one of the CA certificates in the signing chain.

Special Requirements on HTTPS Certificates

Overview

The HTTPS specification mandates that HTTPS clients must be capable of verifying the identity of the server. This can potentially affect how you generate your X.509 certificates. The mechanism for verifying the server identity depends on the type of client. Some clients might verify the server identity by accepting only those server certificates signed by a particular trusted CA. In addition, clients can inspect the contents of a server certificate and accept only the certificates that satisfy specific constraints.

In the absence of an application-specific mechanism, the HTTPS specification defines a generic mechanism, known as the *HTTPS URL integrity check*, for verifying the server identity. This is the standard mechanism used by Web browsers.

HTTPS URL integrity check

The basic idea of the URL integrity check is that the server certificate's identity must match the server host name. This integrity check has an important impact on how you generate X.509 certificates for HTTPS: *the certificate identity (usually the certificate subject DN's common name) must match the host name on which the HTTPS server is deployed*.

The URL integrity check is designed to prevent *man-in-the-middle* attacks.

Reference

The HTTPS URL integrity check is specified by RFC 2818, published by the Internet Engineering Task Force (IETF) at http://www.ietf.org/rfc/rfc2818.txt.

How to specify the certificate identity

The certificate identity used in the URL integrity check can be specified in one of the following ways:

- Using commonName
- Using subectAltName

Using commonName

The usual way to specify the certificate identity (for the purpose of the URL integrity check) is through the Common Name (CN) in the subject DN of the certificate.

For example, if a server supports secure TLS connections at the following URL:

```
https://www.progress.com/secure
```

The corresponding server certificate would have the following subject DN:

```
C=IE,ST=Co. Dublin,L=Dublin,O=Progress,
OU=System,CN=www.progress.com
```

Where the CN has been set to the host name, `www.progress.com`.

For details of how to set the subject DN in a new certificate, see "Generate a certificate and private key pair" on page 168.

Using subjectAltName (multi-homed hosts)

Using the subject DN's Common Name for the certificate identity has the disadvantage that only *one* host name can be specified at a time. If you deploy a certificate on a multi-homed host, however, you might find it is practical to allow the certificate to be used with *any* of the multi-homed host names. In this case, it is necessary to define a certificate with multiple, alternative identities, and this is only possible using the `subjectAltName` certificate extension.

For example, if you have a multi-homed host that supports connections to either of the following host names:

```
www.progress.com
fusesource.com
```

Then you can define a `subjectAltName` that explicitly lists both of these DNS host names. If you generate your certificates using the **openssl** utility, edit the relevant line of your `openssl.cnf` configuration file to specify the value of the `subjectAltName` extension, as follows:

```
subjectAltName=DNS:www.progress.com,DNS:fusesource.com
```

Where the HTTPS protocol matches the server host name against either of the DNS host names listed in the `subjectAltName` (the `subjectAltName` takes precedence over the Common Name).

The HTTPS protocol also supports the wildcard character, `*`, in host names. For example, you can define the `subjectAltName` as follows:

```
subjectAltName=DNS:*.fusesource.com
```

This certificate identity matches any three-component host name in the domain `fusesource.com`.

Warning

You must *never* use the wildcard character in the domain name (and you must take care never to do this accidentally by forgetting to type the dot, `.`, delimiter in front of the domain name). For example, if you specified `*fusesource.com`, your certificate could be used on *any* domain that ends in the letters `fusesource`.

Creating Your Own Certificates

Overview

If you choose to use a private CA you will need to generate your own certificates for your applications to use. The OpenSSL project provides free command-line utilities for setting up a private CA, creating signed certificates, and adding the CA to your Java keystore.

OpenSSL utilities

You can download the OpenSSL utilities from http://openssl.org/.

This section describes using the OpenSSL command-line utilities to create certificates. Further documentation of the OpenSSL command-line utilities can be obtained at http://www.openssl.org/docs.

Procedure

To create your own CA and certificates:

1. Add the OpenSSL `bin` directory to your path.
2. Create your own private CA.
   a. Create the directory structure for the CA.

      The directory structure should be:

      - *`X509CA`*`/ca`
      - *`X509CA`*`/certs`
      - *`X509CA`*`/newcerts`
      - *`X509CA`*`/crl`

      Where *`X509CA`* is the name of the CA's home directory.

   b. Copy the `openssl.cnf` file from your OpenSSL installation to your *`X509CA`* directory.

   c. Open your copy of `openssl.cnf` in a text editor.

   d. Edit the `[CA_default]` section to look like Example A.1 on page 164.

Example A.1. OpenSSL Configuration

```
#############################################################
[ CA_default ]

dir        = X509CA            # Where CA files are kept
certs      = $dir/certs  # Where issued certs are kept
crl_dir    = $dir/crl          # Where the issued crl are kept
database   = $dir/index.txt    # Database index file
new_certs_dir = $dir/newcerts  # Default place for new certs

certificate   = $dir/ca/new_ca.pem # The CA certificate
serial        = $dir/serial        # The current serial number
crl           = $dir/crl.pem       # The current CRL
private_key   = $dir/ca/new_ca_pk.pem  # The private key
RANDFILE      = $dir/ca/.rand
# Private random number file

x509_extensions = usr_cert  # The extensions to add to the cert
...
```

Tip

You might decide to edit other details of the OpenSSL configuration at this point. For more details, see the OpenSSL documentation[1].

e. Initialize the CA database as described in "CA database files" on page 167.

f. Create a new self-signed CA certificate and private key with the command:

```
openssl req -x509 -new -config X509CA/openssl.cnf -days 365 -out X509CA/ca/new_ca.pem -keyout
X509CA/ca/new_ca_pk.pem
```

You are prompted for a pass phrase for the CA private key and details of the CA distinguished name as shown in Example A.2 on page 164.

Example A.2. Creating a CA Certificate

```
Using configuration from X509CA/openssl.cnf
Generating a 512 bit RSA private key
....+++++
.+++++
```

[1] http://www.openssl.org/docs

```
writing new private key to 'new_ca_pk.pem'
Enter PEM pass phrase:
Verifying password - Enter PEM pass phrase:
-----
You are about to be asked to enter information that will be
incorporated into your certificate request.
What you are about to enter is what is called a Distinguished
Name or a DN. There are quite a few fields but you can leave
some blank. For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) []:IE
State or Province Name (full name) []:Co. Dublin
Locality Name (eg, city) []:Dublin
Organization Name (eg, company) []:FuseSource
Organizational Unit Name (eg, section) []:Finance
Common Name (eg, YOUR name) []:Gordon Brown
Email Address []:gbrown@fusesource.com
```

Note

The security of the CA depends on the security of the private key file and the private key pass phrase used in this step.

You must ensure that the file names and location of the CA certificate and private key, `new_ca.pem` and `new_ca_pk.pem`, are the same as the values specified in `openssl.cnf` during Step 2.d on page 163.

3. Create signed certificates in a Java keystore.

   a. Generate a certificate and private key pair using the **keytool -genkeypair** command.

      For details on the options to use when using **keytool -genkeypair** see "Generate a certificate and private key pair" on page 168.

   b. Create a certificate signing request using the **keystore -certreq** command.

      Example A.3 on page 166 creates a new certificate signing request for the `fusesample.jks` certificate and exports it to the `fusesample_csr.pem` file.

Example A.3. Creating a CSR

```
keytool -certreq -alias fuse -file fusesample_csr.pem -keypass fusepass -keystore fuses
ample.jks -storepass fusestorepass
```

c. Sign the CSR using the **openssl ca** command.

   You will prompted to enter the CA private key pass phrase you used when creating the CA in Step 2.f on page 164).

   See "Signing a CSR" on page 168 for details on the options to use when signing the CSR.

d. Convert the signed certificate to PEM only format using the **openssl x509** command with the `-outform` option set to `PEM`.

   Example A.4 on page 166 converts the signed certificate `fusesigned.pem`.

Example A.4. Converting a Signed Certificate to PEM

```
openssl x509 -in fusesigned.pem -out fusesigned.pem -outform PEM
```

e. Concatenate the CA certificate file and the converted, signed certificate file to form a certificate chain.

   The CA certificate file is stored in the CA's `ca` directory. For example, the certificate file for the CA created in Step 2.f on page 164 would be `ca/new_ca.pem`.

f. Import the new certificate's full certificate chain into the Java keystore using the **keytool -import** command.

   Example A.5 on page 166 imports the chain `fusesample.chain` into the `fusesample.jks` keystore.

Example A.5. Importing a Certificate Chain

```
keytool -import -file fusesample.chain -keypass fusepass -keystore fusesample.jks -storepass
 fusestorepass
```

4. Repeat Step 3 on page 165 to create a full set of certificates for your system.

5. Add trusted CAs to your Java trust store.

   a. Assemble the collection of trusted CA certificates that you want to deploy.

      The trusted CA certificates can be obtained from public CAs or private CAs. The trusted CA certificates can be in any format that is compatible with the Java **keystore** utility; for example, PEM format. All you need are the certificates themselves—the private keys and passwords are *not* required.

   b. Add a CA certificate to the trust store using the **keytool -import** command.

      Example A.6 on page 167 adds the CA certificate `cacert.pem`, in PEM format, to a JKS trust store.

Example A.6. Adding a CA to the Trust Store

```
keytool -import -file cacert.pem -alias CAAlias -keystore truststore.ts -storepass StorePass
```

      `truststore.ts` is a keystore file containing CA certificates. If this file does not already exist, the **keytool** command creates one. `StorePass` is the password required to access the keystore file.

   c. Repeat Step 5.b on page 167 to add all of the CA certificates to the trust store.

CA database files

The CA uses two files, `serial` and `index.txt` to maintain its database of certificate files. Both files must be stored in the *`X509CA`* directory.

When you first create your CA the OpenSSL tools require that they have very specific initial contents:

- `serial`

  The initial contents of this file must be `01`.

- `index.txt`

Initially this file *must* be completely empty. It cannot even contain white space.

Generate a certificate and private key pair

To generate a certificate and private key pair you use the **keytool -genkeypair** command. For example, Example A.7 on page 168 creates a certificate and key pair that are valid for 365 days and is stored in the keystore file `fusesample.jks`. The generated key store entry will use the alias `fuse` and the password `fusepass`.

Example A.7. Creating a Certificate and Private Key using Keytool

```
keytool -genkeypair -dname "CN=Alice, OU=Engineering, O=Progress, ST=Co. Dublin, C=IE" -
validity 365 -alias fuse -keypass fusepass -keystore fusesample.jks -storepass fusestorepass
```

Because the specified keystore, `fusessample.jks`, did not exist prior to issuing the command implicitly creates a new keystore and sets its password to `fusestorepass`.

The `-dname` and `-validity` flags define the contents of the newly created X.509 certificate.

The `-dname` flag specifies the subject DN. For more details about DN format, see Appendix B on page 171. Some parts of the subject DN must match the values in the CA certificate (specified in the CA Policy section of the `openssl.cnf` file). The default `openssl.cnf` file requires the following entries to match:

- Country Name (C)
- State or Province Name (ST)
- Organization Name (O)

Note

If you do not observe the constraints, the OpenSSL CA will refuse to sign the certificate (see Step 2.f on page 164).

The `-validity` flag specifies the number of days for which the certificate is valid.

Signing a CSR

To sign a CSR using your CA, you use the **openssl ca** command. At a minimum you will need to specify the following options:

- `-config`—the path to the CA's `openssl.cnf` file
- `-in`—the path to certificate to be signed
- `-out`—the path to the signed certificates

Example A.8 on page 169 signs the `fusesample_csr.pem` certificate using the CA stored at `/etc/fuseCA`.

Example A.8. Signing a CSR

```
openssl ca -config /etc/fuse/openssl.cnf -days 365 -in fusesample_csr.pem -out fusesigned.pem
```

For more details on the **openssl ca** command see http://www.openssl.org/docs/apps/ca.html#.

Appendix B. ASN.1 and Distinguished Names

The OSI Abstract Syntax Notation One (ASN.1) and X.500 Distinguished Names play an important role in the security standards that define X.509 certificates and LDAP directories.

ASN.1

Overview

The *Abstract Syntax Notation One* (ASN.1) was defined by the OSI standards body in the early 1980s to provide a way of defining data types and structures that are independent of any particular machine hardware or programming language. In many ways, ASN.1 can be considered a forerunner of modern interface definition languages, such as the OMG's IDL and WSDL, which are concerned with defining platform-independent data types.

ASN.1 is important, because it is widely used in the definition of standards (for example, SNMP, X.509, and LDAP). In particular, ASN.1 is ubiquitous in the field of security standards—the formal definitions of X.509 certificates and distinguished names are described using ASN.1 syntax. You do not require detailed knowledge of ASN.1 syntax to use these security standards, but you need to be aware that ASN.1 is used for the basic definitions of most security-related data types.

BER

The OSI's Basic Encoding Rules (BER) define how to translate an ASN.1 data type into a sequence of octets (binary representation). The role played by BER with respect to ASN.1 is, therefore, similar to the role played by GIOP with respect to the OMG IDL.

DER

The OSI's Distinguished Encoding Rules (DER) are a specialization of the BER. The DER consists of the BER plus some additional rules to ensure that the encoding is unique (BER encodings are not).

References

You can read more about ASN.1 in the following standards documents:

- ASN.1 is defined in X.208.
- BER is defined in X.209.

Distinguished Names

Overview

Historically, distinguished names (DN) are defined as the primary keys in an X.500 directory structure. However, DNs have come to be used in many other contexts as general purpose identifiers. In Apache CXF, DNs occur in the following contexts:

- X.509 certificates—for example, one of the DNs in a certificate identifies the owner of the certificate (the security principal).
- LDAP—DNs are used to locate objects in an LDAP directory tree.

String representation of DN

Although a DN is formally defined in ASN.1, there is also an LDAP standard that defines a UTF-8 string representation of a DN (see `RFC 2253`). The string representation provides a convenient basis for describing the structure of a DN.

Note

The string representation of a DN does *not* provide a unique representation of DER-encoded DN. Hence, a DN that is converted from string format back to DER format does not always recover the original DER encoding.

DN string example

The following string is a typical example of a DN:

```
C=US,O=IONA Technologies,OU=Engineering,CN=A. N. Other
```

Structure of a DN string

A DN string is built up from the following basic elements:

- OID .
- Attribute Types .
- AVA .

- RDN .

OID

An OBJECT IDENTIFIER (OID) is a sequence of bytes that uniquely identifies a grammatical construct in ASN.1.

Attribute types

The variety of attribute types that can appear in a DN is theoretically open-ended, but in practice only a small subset of attribute types are used. Table B.1 on page 174 shows a selection of the attribute types that you are most likely to encounter:

Table B.1. Commonly Used Attribute Types

String Representation	X.500 Attribute Type	Size of Data	Equivalent OID
C	countryName	2	2.5.4.6
O	organizationName	1...64	2.5.4.10
OU	organizationalUnitName	1...64	2.5.4.11
CN	commonName	1...64	2.5.4.3
ST	stateOrProvinceName	1...64	2.5.4.8
L	localityName	1...64	2.5.4.7
STREET	streetAddress		
DC	domainComponent		
UID	userid		

AVA

An *attribute value assertion* (AVA) assigns an attribute value to an attribute type. In the string representation, it has the following syntax:

```
<attr-type>=<attr-value>
```

For example:

```
CN=A. N. Other
```

Alternatively, you can use the equivalent OID to identify the attribute type in the string representation (see Table B.1 on page 174). For example:

```
2.5.4.3=A. N. Other
```

RDN

A *relative distinguished name* (RDN) represents a single node of a DN (the bit that appears between the commas in the string representation). Technically, an RDN might contain more than one AVA (it is formally defined as a set of AVAs). However, this almost never occurs in practice. In the string representation, an RDN has the following syntax:

```
<attr-type>=<attr-value>[+<attr-type>=<attr-value> ...]
```

Here is an example of a (very unlikely) multiple-value RDN:

```
OU=Eng1+OU=Eng2+OU=Eng3
```

Here is an example of a single-value RDN:

```
OU=Engineering
```

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