

## 6.2. Implementing a simple custom Interceptor

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### Implementing a simple custom Interceptor for ApacheDS

ApacheDS 1.5.5

This site was updated for ApacheDS 1.5.5.

The following is for developers who plan to implement their own interceptors in order to extend or modify the functionality of Apache Directory Server. It contains a simple example as a starting point.

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#### What exactly is an interceptor?

An interceptor filters method calls performed on on the *DefaultPartitionNexus* just like Servlet filters do. The ApacheDS configuration contains a chain of filters performing several tasks. In order to illustrate this, here is the list of interceptors from the default server configuration of ApacheDS 1.5.5

- org.apache.directory.server.core.normalization.NormalizationInterceptor
- org.apache.directory.server.core.authn.AuthenticationInterceptor
- org.apache.directory.server.core.referral.ReferralInterceptor
- org.apache.directory.server.core.authz.AciAuthorizationInterceptor
- org.apache.directory.server.core.authz.DefaultAuthorizationInterceptor
- org.apache.directory.server.core.exception.ExceptionInterceptor
- org.apache.directory.server.core.changelog.ChangeLogInterceptor
- org.apache.directory.server.core.operational.OperationalAttributeInterceptor
- org.apache.directory.server.core.schema.SchemaInterceptor
- org.apache.directory.server.core.subtree.SubentryInterceptor
- org.apache.directory.server.core.collective.CollectiveAttributeInterceptor
- org.apache.directory.server.core.event.EventInterceptor
- org.apache.directory.server.core.trigger.TriggerInterceptor
- org.apache.directory.server.core.journal.JournalInterceptor

Interceptors should usually pass the control of current invocation to the next interceptor by calling an appropriate method on *NextInterceptor*. The flow control is returned when the next interceptor's filter method returns. You can therefore implement pre-, post-, around- invocation handler by how you place the statement.

Interceptors are a powerful way to extend and modify the server behavior. But be warned. A mistakenly written interceptor may lead to a dis-functional or corrupt server.

#### Password hash. A simple interceptor

In order to demonstrate how to write an interceptor, here is a simple but realistic example. The following requirement should be fulfilled by an interceptor.

- No user password should be stored in the directory in clear text.

To be more concrete:

- If a userpassword is set by an LDAP client in plain text, a [message digest algorithm](#) should be applied to the value, and the one-way encrypted value should be stored
- the algorithm should be applied if new entries are created or existing entries are modified (hence modify and add operations will be intercepted)
- If the value given by the client is already provided in hashed form, nothing happens, and the given value is stored in the directory without modification

#### The sources

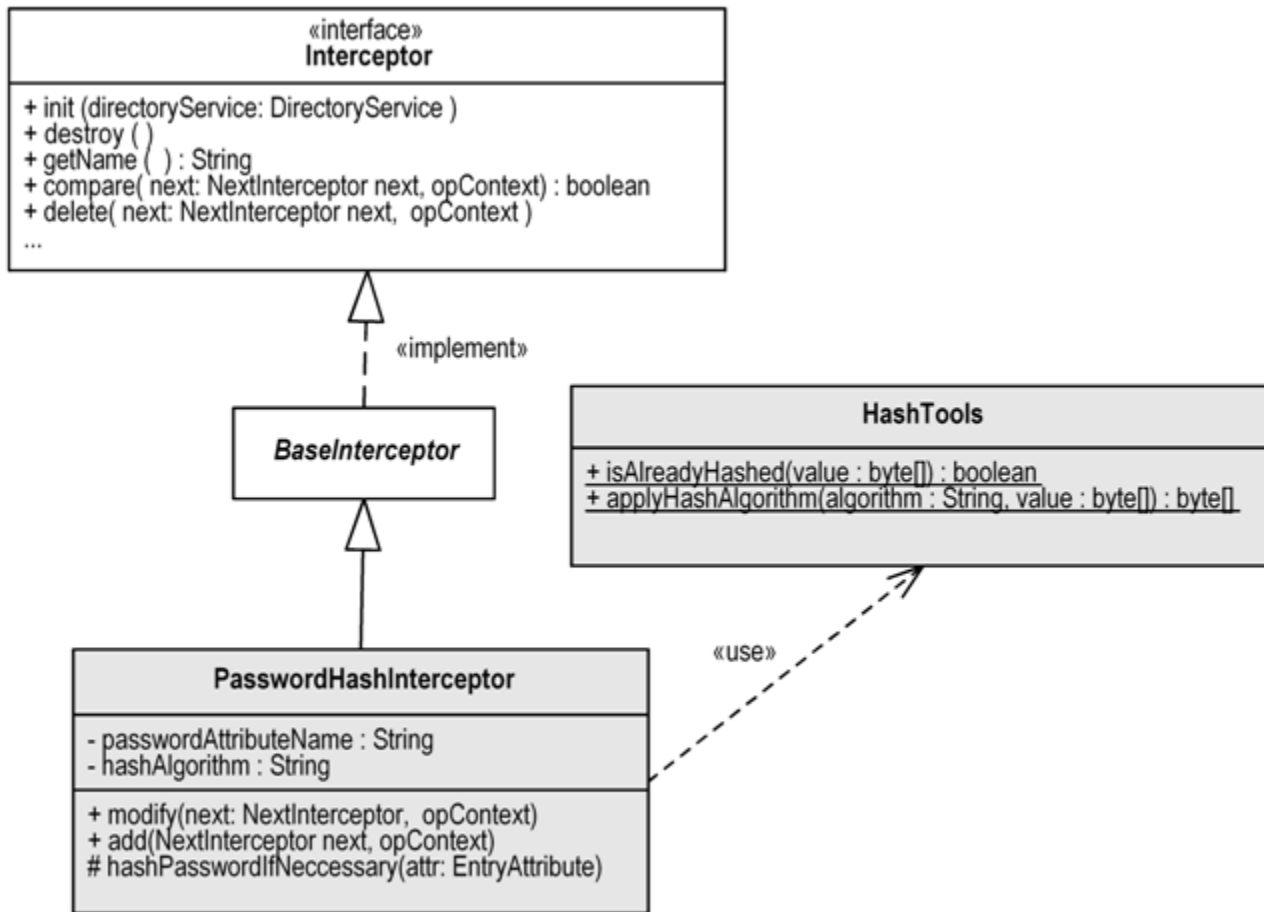
Currently, the sources are checked in here

- <http://svn.apache.org/repos/asf/directory/sandbox/szoerner/passwordHashInterceptor>

In order to build it, simply check it out and type "mvn install".

#### Implementing the class PasswordHashInterceptor

The following UML class diagram depicts the structure of the little example. Classes in white are given by Apache Directory Server as extension points. The two gray classes comprise the example interceptor.



The class *HashTools* contains two simple methods w.r.t. hashing. *isAlreadyHashed* detects whether a value has already been hashed with a known message digest algorithm. *applyHashAlgorithm* applies a hash algorithm to a sequence of bytes. See the source code and the unit tests of this class for details, it has not that much to do with the interceptor stuff.

The central class is *PasswordHashInterceptor*. Every interceptor has to implement the *Interceptor* interface from package *org.apache.directory.server.core.interceptor*. *PasswordHashInterceptor* does so by extended the convenience class *BaseInterceptor* from the same package.

The property *hashAlgorithm* allows to configure the algorithm used for hashing the passwords. It defaults to [MD5 \(Message-Digest algorithm 5\)](#). The property *passwordAttributeName* allows configuration of the attribute type which stores the user password. Its value will be hashed if needed. The property defaults to "userPassword", which is quite common and used for instance in the [inetOrgPerson](#) object class.

The most interesting methods of the class are *add* and *modify*. They intercept the requests and modify the attribute values, if needed. See below the complete source code of the class.

```

java package org.apache.directory.samples.interceptor.pwdhash; import static org.apache.directory.samples.interceptor.pwdhash.HashTools.
applyHashAlgorithm; import static org.apache.directory.samples.interceptor.pwdhash.HashTools.isAlreadyHashed; import java.util.List; import org.apache.
directory.server.core.entry.ClonedServerEntry; import org.apache.directory.server.core.interceptor.BaseInterceptor; import org.apache.directory.server.
core.interceptor.NextInterceptor; import org.apache.directory.server.core.interceptor.context.AddOperationContext; import org.apache.directory.server.core.
interceptor.context.ModifyOperationContext; import org.apache.directory.shared.ldap.entry.EntryAttribute; import org.apache.directory.shared.ldap.entry.
Modification; import org.apache.directory.shared.ldap.entry.ModificationOperation; public class PasswordHashInterceptor extends BaseInterceptor {
private String hashAlgorithm = "MD5"; private String passwordAttributeName = "userPassword"; public void setHashAlgorithm(String hashAlgorithm) { this.
hashAlgorithm = hashAlgorithm; } public void setPasswordAttributeName(String passwordAttributeName) { this.passwordAttributeName =
passwordAttributeName; } /** * Intercepts the add operation in order to replace plain password values * with hashed ones. */ @Override public void add
(NextInterceptor next, AddOperationContext opContext) throws Exception { ClonedServerEntry entry = opContext.getEntry(); EntryAttribute attribute =
entry.get(passwordAttributeName); if (attribute != null) { hashPasswordIfNecessary(attribute); } super.add(next, opContext); } /** * Intercepts the modify
operation in order to replace plain password values * with hashed ones. */ @Override public void modify(NextInterceptor next, ModifyOperationContext
opContext) throws Exception { List<Modification> items = opContext.getModItems(); for (Modification modification : items) { ModificationOperation
operation = modification.getOperation(); if (operation == ModificationOperation.ADD_ATTRIBUTE || operation == ModificationOperation.
REPLACE_ATTRIBUTE) { EntryAttribute attribute = modification.getAttribute(); if (attribute.getId().equalsIgnoreCase(passwordAttributeName)) {
hashPasswordIfNecessary(attribute); } } } super.modify(next, opContext); } protected void hashPasswordIfNecessary(EntryAttribute attribute) { try { byte[]
password = attribute.getBytes(); if (!isAlreadyHashed(password)) { byte[] hashed = applyHashAlgorithm(hashAlgorithm, password); attribute.clear();
attribute.add(hashed); } } catch (Exception e) { throw new RuntimeException("Password hash failed", e); } } }
  
```

## Using the interceptor

You may use a custom interceptor both in a standard ApacheDS installation and in a server started embedded.

## Adding it to a standard server installation (server.xml)

In order to get the interceptor installed in a default installation of ApacheDS 1.5.5., just copy the jar-File resulting from the Maven build, which contains the custom classes, to `APACHEDS_INSTALLDIR/lib/ext`.

After that, add the interceptor to the `server.xml` file in `APACHEDS_INSTALLDIR/conf/`. Make sure to backup the file before your modifications. Within `server.xml` find the XML elements which list the interceptors. The easiest way to add a custom interceptor is to add a spring bean (namespace "s"). You may set configuration properties to the interceptor as well, if it supports some.

The following fragment shows the interceptor list with the example interceptor added just behind normalization. For demonstration purposes, the hash algorithm is set to "MD5" (which is the default of our interceptor anyway).

```
xml ... <interceptors> <normalizationInterceptor/> <s:bean class="org.apache.directory.samples.interceptor.pwdhash.PasswordHashInterceptor"> <s:property name="hashAlgorithm" value="MD5" /> </s:bean> <authenticationInterceptor/> <referralInterceptor/> <aciAuthorizationInterceptor/> <defaultAuthorizationInterceptor/> <exceptionInterceptor/> <operationalAttributeInterceptor/> ... </interceptors> ...
```

## Embedded mode

As an alternative, the following Java code starts an ApacheDS embedded in a main method. The list of interceptors is complemented with the example interceptor. We insert it exactly behind the *NormalizingInterceptor* (the position is a little bit tricky to determine).

```
java package org.apache.directory.samples.interceptor.pwdhash; import java.util.List; import org.apache.directory.server.core.DefaultDirectoryService; import org.apache.directory.server.core.DirectoryService; import org.apache.directory.server.core.interceptor.Interceptor; import org.apache.directory.server.core.normalization.NormalizationInterceptor; import org.apache.directory.server.ldap.LdapServer; import org.apache.directory.server.protocol.shared.transport.TcpTransport; /** * Main class which starts an embedded server with the interceptor inserted into * the chain. */ public class Main { public static void main(String[] args) throws Exception { DirectoryService directoryService = new DefaultDirectoryService(); directoryService.setShutdownHookEnabled(true); List<Interceptor> interceptors = directoryService.getInterceptors(); // Find Normalization interceptor in chain int insertionPosition = -1; for (int pos = 0; pos < interceptors.size(); ++pos) { Interceptor interceptor = interceptors.get(pos); if (interceptor instanceof NormalizationInterceptor) { insertionPosition = pos; } } // insert our new interceptor just behind interceptors.add(insertionPosition + 1, new PasswordHashInterceptor()); directoryService.setInterceptors(interceptors); LdapServer ldapServer = new LdapServer(); ldapServer.setDirectoryService(directoryService); ldapServer.setAllowAnonymousAccess(true); TcpTransport ldapTransport = new TcpTransport(10389); ldapServer.setTransports(ldapTransport); directoryService.startup(); ldapServer.start(); }
```

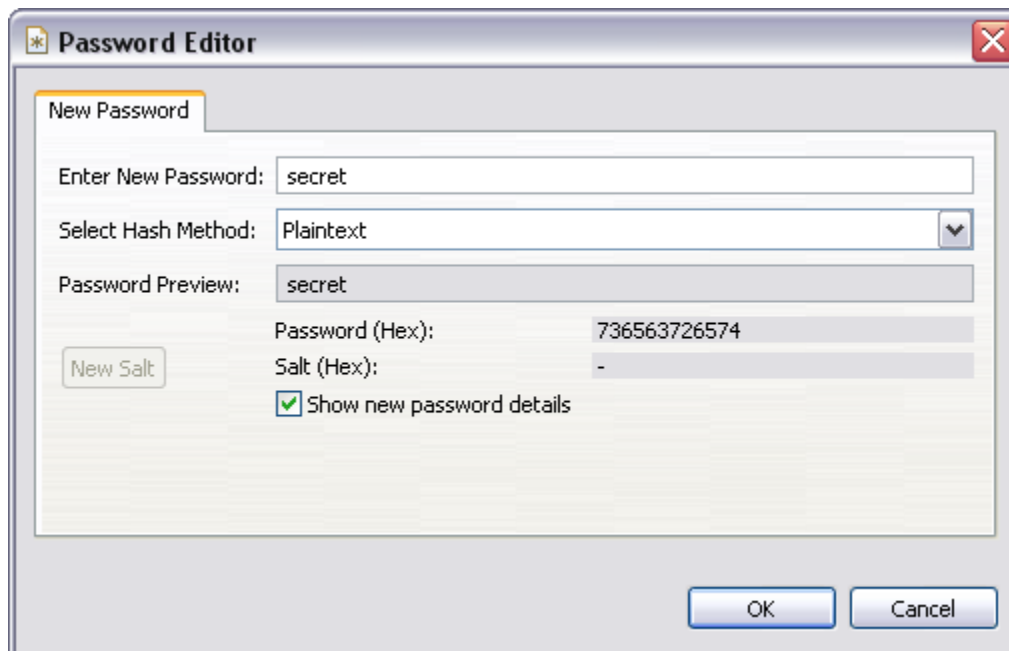
## Verification

Let's check whether our new interceptor does its job! In order to do so, we use Apache Directory Studio and connect to the server with the interceptor enabled (see above).

First we create a new entry with the following data, using "New Entry ..." within Studio.

dn: cn=Kate Bush,ou=users,ou=system objectClass: person objectClass: top cn: Kate Bush sn: Bush

Then we add a new attribute *userPassword* in the entry editor. For the value, a special editor appears:



Select "Plaintext" as the hash method and enter a new password. We selected "secret" (see screen shot above). After pressing OK, a modify operation is sent to the server, which will be intercepted by our example class.

```
#!RESULT OK
#!CONNECTION ldap://localhost:10389
#!DATE 2010-02-06T21:09:59.609
dn: cn=Kate Bush,ou=users,ou=system
changetype: modify
add: userPassword
userPassword:: c2VjcmV0
-
```

After that, the value for `userPassword` is not "secret", but the MD5 digested value of it.

Attribute Description	Value
<i>objectClass</i>	<i>person (structural)</i>
<i>objectClass</i>	<i>top (abstract)</i>
<b>cn</b>	<b>Kate Bush</b>
<b>sn</b>	<b>Bush</b>
<b>userPassword</b>	MD5 hashed password

The user Kate Bush is still capable of authenticating with the password "secret", because Apache Directory Server supports authentication with passwords hashed with this algorithm. You can verify this by connecting with Studio and the using "cn=Kate Bush,ou=users,ou=system" as bind DN.

Here it is demonstrated with the help of the `ldapsearch` command line tool. The result also shows that the `userPassword` value is hashed with MD5.

```
$ ldapsearch -h localhost -p 10389 -D "cn=Kate Bush,ou=users,ou=system" \ -w secret -b "ou=users,ou=system" -s one "(objectClass=*)" version: 1 dn: cn=Kate Bush,ou=users,ou=system objectClass: person objectClass: top cn: Kate Bush sn: Bush userPassword: {MD5}Xr4iIOzQ4PCOq3aQ0qbuaQ== $
```

## Limitations of the example

This example is intended as a demonstration, on how to write your custom interceptor. Don't consider it bullet proof. It has not been tested under production conditions, etc.

At least the following limitation should be mentioned

- The default hash algorithm MD5 is considered weak.
- Exception handling is poor. E.g. if someone configures an unsupported hash algorithm, the interceptor fails to create an appropriate LDAP error.
- If a multivalued password attribute is used, the interceptor will simply ignore that fact (does not apply to `userPassword` as of RFC 2256).

## Further reading

Learn more about interceptors in [ApacheDS Architecture Documentation](#), check out the source code of some implementations of the *Interceptor* interface, and/or read the javadoc comments.