
# Reference Documentation

Version 1.1.1

November 2006

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# Preface

The Java Naming and Directory Interface (JNDI) is for LDAP programming what Java Database Connectivity (JDBC) is for SQL programming. There are several similarities between JDBC and JNDI/LDAP (Java LDAP). Despite being two completely different APIs with different pros and cons, they share a number of less flattering characteristics:

- They require extensive plumbing code, even to perform the simplest of tasks.
- All resources need to be correctly closed, no matter what happens.
- Exception handling is difficult.

The above points often lead to massive code duplication in common usages of the APIs. As we all know, code duplication is one of the worst code smells. All in all, it boils down to this: JDBC and LDAP programming in Java are both incredibly dull and repetitive.

Spring JDBC, a part of the Spring framework, provides excellent utilities for simplifying SQL programming. We need a similar framework for Java LDAP programming.

# Chapter 1. Introduction

## 1.1. Overview

Spring-LDAP (http://www.springframework.org/ldap) is a library for simpler LDAP programming in Java, built on the same principles as the JdbcTemplate in Spring JDBC. It completely eliminates the need to worry about creating and closing `LdapContext` and looping through `NamingEnumeration`. It also provides a more comprehensive unchecked Exception hierarchy, built on Spring's `DataAccessException`. As a bonus, it also contains classes for dynamically building LDAP filters and DNs (Distinguished Names).

Consider, for example, a method that should search some storage for all persons and return their names in a list. Using JDBC, we would create a *connection* and execute a *query* using a *statement*. We would then loop over the *result set* and retrieve the *column* we want, adding it to a list. In contrast, using Java LDAP, we would create a *context* and perform a *search* using a *search filter*. We would then loop over the resulting *naming enumeration* and retrieve the *attribute* we want, adding it to a list.

The traditional way of implementing this person name search method in Java LDAP looks like this:

```
package com.example.dao;

public class TraditionalPersonDaoImpl implements PersonDao {
   public List getAllPersonNames() {
      Hashtable env = new Hashtable();
      env.put(Context.INITIAL_CONTEXT_FACTORY, "com.sun.jndi.ldap.LdapCtxFactory");
      env.put(Context.PROVIDER_URL, "ldap://localhost:389/dc=example,dc=com");

      DirContext ctx;
      try {
         ctx = new InitialDirContext(env);
      } catch (NamingException e) {
         throw new RuntimeException(e);
      }

      LinkedList list = new LinkedList();
      NamingEnumeration results = null;
      try {
         SearchControls controls = new SearchControls();
         controls.setSearchScope(SearchControls.SUBTREE_SCOPE);
         results = ctx.search("", "(objectclass=person)", controls);

         while (results.hasMore()) {
            SearchResult searchResult = (SearchResult) results.next();
            Attributes attributes = searchResult.getAttributes();
            Attribute attr = attributes.get("cn");
            String cn = (String) attr.get();
            list.add(cn);
         }
      } catch (NameNotFoundException e) {
         // The base context was not found.
         // Just clean up and exit.
      } catch (NamingException e) {
         throw new RuntimeException(e);
      } finally {
         if (results != null) {
            try {
               results.close();
            } catch (Exception e) {
               // Never mind this.
            }
         }
         if (ctx != null) {
            try {
               ctx.close();
            } catch (Exception e) {
               // Never mind this.
            }
         }
```

```
      }
      return list;
   }
}
```

By using the Spring LDAP `AttributesMapper`, we get the exact same functionality with the following code:

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   private LdapTemplate ldapTemplate;

   public void setLdapTemplate(LdapTemplate ldapTemplate) {
      this.ldapTemplate = ldapTemplate;
   }

   public List getAllPersonNames() {
      return ldapTemplate.search(
         "", "(objectclass=person)",
         new AttributesMapper() {
            public Object mapFromAttributes(Attributes attrs)
               throws NamingException {
               return attrs.get("cn").get();
            }
         });
   }
}
```

## 1.2. Packaging overview

At a minimum, to use Spring LDAP you need:

- spring-ldap (the Spring LDAP library)
- spring-core (miscellaneous utility classes used internally by the framework)
- spring-beans (contains interfaces and classes for manipulating Java beans)
- spring-dao (exception hierarchy enabling sophisticated error handling independent of the data access approach in use)
- commons-logging (a simple logging facade, used internally)
- commons-lang (misc utilities, used internally)
- commons-collections (tools for working with collections, used internally)

If your application is wired up using the Spring ApplicationContext, you also need:

- spring-context (adds the ability for application objects to obtain resources using a consistent API)

If you use the `AcegiAuthenticationSource`, you also need:

- acegi-security

Set up the required beans in your Spring context file and inject the `LdapTemplate` into your data access object:

```
<beans>
   ...
   <bean id="contextSource" class="org.springframework.ldap.support.LdapContextSource">
      <property name="url" value="ldap://localhost:389" />
      <property name="base" value="dc=example,dc=com" />
      <property name="userName" value="cn=Manager" />
      <property name="password" value="secret" />
   </bean>

   <bean id="ldapTemplate" class="org.springframework.ldap.LdapTemplate">
```

```
      <constructor-arg ref="contextSource" />
   </bean>

   <bean id="myDataAccessObject" class="com.example.MyDataAccessObject">
      <property name="ldapTemplate" ref="ldapTemplate" />
   </bean>
   ...
</beans>
```

## 1.3. Package structure

This section provides an overview of the logical package structure of the Spring LDAP codebase. The dependencies for each package are clearly noted. A package dependency noted as *(optional)* means that the dependency is needed to compile the package but is optionally needed at runtime (depending on your use of the package). For example, use of Spring LDAP together with Acegi Security entails use of the `org.acegisecurity` package. Cyclic package dependencies are noted with *(cycle)*. These are candidates for removal in future releases.

### 1.3.1. org.springframework.ldap

The *ldap* package contains the central abstractions of the library. These abstractions include AuthenticationSource, ContextSource, DirContextProcessor, and NameClassPairCallbackHandler. This package also contains the central class LdapTemplate, plus various mappers and executors.

- Dependencies: ldap.support (cycle), spring-beans, spring-dao, commons-lang, commons-logging

### 1.3.2. org.springframework.ldap.support

The *support* package contains supporting implementations of the central interfaces as well as the DirContextAdapter abstraction.

- Dependencies: ldap, ldap.util, spring-core, spring-beans, commons-lang, commons-collections, commons-logging

### 1.3.3. org.springframework.ldap.support.authentication

The *support.authentication* package contains an implementation of the AuthenticationSource interface that can be used with Acegi Security.

- Dependencies: ldap, acegi-security (optional), spring-beans, commons-lang, commons-logging

### 1.3.4. org.springframework.ldap.support.control

The *support.control* package contains an abstract implementation of the DirContextProcessor interface that can be used as a basis for processing RequestControls and ResponseControls. There is also a concrete implementation that handles paged search results. The LDAP Booster Pack is used to get support for controls.

- Dependencies: ldap, LDAP booster pack, spring-core, commons-logging

### 1.3.5. org.springframework.ldap.support.filter

The *support.filter* package contains the Filter abstraction and several implementations of it.

- Dependencies: ldap.support, commons-lang

### 1.3.6. org.springframework.ldap.util

The *util* package contains utility classes that are used internally.

- Dependencies: none

For the exact list of jar dependencies, see the Spring LDAP Ivy dependency manager descriptor located within the Spring LDAP distribution at `spring-ldap/ivy.xml`

## 1.4. Support

Spring LDAP 1.1.1 is supported on Spring 1.2.8 or later.

The community support forum is located at http://forum.springframework.org, and the project web page is http://www.springframework.org/ldap.

# Chapter 2. Basic Operations

## 2.1. Search and Lookup Using AttributesMapper

In this example we will use an `AttributesMapper` to easily build a List of all common names of all person objects.

**Example 2.1. AttributesMapper that returns a single attribute**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   private LdapTemplate ldapTemplate;

   public void setLdapTemplate(LdapTemplate ldapTemplate) {
      this.ldapTemplate = ldapTemplate;
   }

   public List getAllPersonNames() {
      return ldapTemplate.search(
         "", "(objectclass=person)",
         new AttributesMapper() {
            public Object mapFromAttributes(Attributes attrs)
               throws NamingException {
               return attrs.get("cn").get();
            }
         });
   }
}
```

The inline implementation of `AttributesMapper` just gets the desired attribute value from the `Attributes` and returns it. Internally, `LdapTemplate` iterates over all entries found, calling the given `AttributesMapper` for each entry, and collects the results in a list. The list is then returned by the `search` method.

Note that the `AttributesMapper` implementation could easily be modified to return a full `Person` object:

**Example 2.2. AttributesMapper that returns a Person object**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   private LdapTemplate ldapTemplate;
   ...
   private class PersonAttributesMapper implements AttributesMapper() {
      public Object mapFromAttributes(Attributes attrs) throws NamingException {
         Person person = new Person();
         person.setFullName((String)attrs.get("cn").get());
         person.setLastName((String)attrs.get("sn").get());
         person.setDescription((String)attrs.get("description").get());
         return person;
      }
   }

   public List getAllPersons() {
      return ldapTemplate.search("", "(objectclass=person)", new PersonAttributesMapper();
   }
}
```

If you have the distinguished name (`dn`) that identifies an entry, you can retrieve the entry directly, without

searching for it. This is called a *lookup* in Java LDAP. The following example shows how a lookup results in a Person object:

**Example 2.3. A lookup resulting in a Person object**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   private LdapTemplate ldapTemplate;
   ...
   public Person findPerson(String dn) {
      return (Person) ldapTemplate.lookup(dn, new PersonAttributesMapper());
   }
}
```

This will look up the specified `dn` and pass the found attributes to the supplied `AttributesMapper`, in this case resulting in a `Person` object.

## 2.2. Building Dynamic Filters

We can build dynamic filters to use in searches, using the classes from the `org.springframework.ldap.support.filter` package. Let's say that we want the following filter: `(&(objectclass=person)(sn=?))`, where we want the `?` to be replaced with the value of the parameter `lastName`. This is how we do it using the filter support classes:

**Example 2.4. Building a search filter dynamically**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   private LdapTemplate ldapTemplate;
   ...
   public List getPersonNamesByLastName(String lastName) {
      AndFilter filter = new AndFilter();
      filter.and(new EqualsFilter("objectclass", "person"));
      filter.and(new EqualsFilter("sn", lastName));
      return ldapTemplate.search(
         "", filter.encode(),
         new AttributesMapper() {
            public Object mapFromAttributes(Attributes attrs)
               throws NamingException {
               return attrs.get("cn").get();
            }
         });
   }
}
```

To perform a wildcard search, it's possible to use the `WhitespaceWildcardsFilter`:

**Example 2.5. Building a wildcard search filter**

```
AndFilter filter = new AndFilter();
filter.and(new EqualsFilter("objectclass", "person"));
filter.and(new WhitespaceWildcardsFilter("cn", cn));
```

**Note**

In addition to simplifying building of complex search filters, the `Filter` classes also provide proper escaping of any unsafe characters. This prevents "ldap injection", where a user might use such characters to inject unwanted operations into your LDAP operations.

## 2.3. Building Dynamic Distinguished Names

The standard Name interface represents a generic name, which is basically an ordered sequence of components. The `Name` interface also provides operations on that sequence; e.g., `add` or `remove`. LdapTemplate provides an implementation of the `Name` interface: `DistinguishedName`. Using this class will greatly simplify building distinguished names, especially considering the sometimes complex rules regarding escapings and encodings. As with the `Filter` classes this helps preventing potentially malicious data being injected into your LDAP operations.

The following example illustrates how `DistinguishedName` can be used to dynamically construct a distinguished name:

**Example 2.6. Building a distinguished name dynamically**

```
package com.example.dao;

import org.springframework.ldap.support.DistinguishedName;
import javax.naming.Name;

public class PersonDaoImpl implements PersonDao {
   public static final String BASE_DN = "dc=example,dc=com";
   ...
   protected Name buildDn(Person p) {
      DistinguishedName dn = new DistinguishedName(BASE_DN);
      dn.add("c", p.getCountry());
      dn.add("ou", p.getCompany());
      dn.add("cn", p.getFullname());
      return dn;
   }
}
```

Assuming that a Person has the following attributes:

| | |
|---|---|
| `country` | Sweden |
| `company` | Some Company |
| `fullname` | Some Person |

The code above would then result in the following distinguished name:

```
cn=Some Person, ou=Some Company, c=Sweden, dc=example, dc=com
```

In Java 5, there is an implementation of the Name interface: LdapName. If you are in the Java 5 world, you might as well use `LdapName`. However, you may still use `DistinguishedName` if you so wish.

# 2.4. Binding and Unbinding

## 2.4.1. Binding Data

Inserting data in Java LDAP is called binding. In order to do that, a distinguished name that uniquely identifies the new entry is required. The following example shows how data is bound using LdapTemplate:

**Example 2.7. Binding data using Attributes**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   private LdapTemplate ldapTemplate;
   ...
   public void create(Person p) {
      Name dn = buildDn(p);
      ldapTemplate.bind(dn, null, buildAttributes(p));
   }

   private Attributes buildAttributes(Person p) {
      Attributes attrs = new BasicAttributes();
      BasicAttribute ocattr = new BasicAttribute("objectclass");
      ocattr.add("top");
      ocattr.add("person");
      attrs.put(ocattr);
      attrs.put("cn", "Some Person");
      attrs.put("sn", "Person");
      return attrs;
   }
}
```

The Attributes building is--while dull and verbose--sufficient for many purposes. It is, however, possible to simplify the binding operation further, which will be described in Chapter 3, *DirObjectFactory and DirContextAdapter*.

## 2.4.2. Unbinding Data

Removing data in Java LDAP is called unbinding. A distinguished name (dn) is required to identify the entry, just as in the binding operation. The following example shows how data is unbound using LdapTemplate:

**Example 2.8. Unbinding data**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   private LdapTemplate ldapTemplate;
   ...
   public void delete(Person p) {
      Name dn = buildDn(p);
      ldapTemplate.unbind(dn);
   }
}
```

# 2.5. Modifying

In Java LDAP, data can be modified in two ways: either using *rebind* or *modifyAttributes*.

### 2.5.1. Modifying using `rebind`

A `rebind` is a very crude way to modify data. It's basically an `unbind` followed by a `bind`. It looks like this:

**Example 2.9. Modifying using rebind**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   private LdapTemplate ldapTemplate;
   ...
   public void update(Person p) {
      Name dn = buildDn(p);
      ldapTemplate.rebind(dn, null, buildAttributes(p));
   }
}
```

### 2.5.2. Modifying using `modifyAttributes`

If only the modified attributes should be replaced, there is a method called `modifyAttributes` that takes an array of modifications:

**Example 2.10. Modifying using modifyAttributes**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   private LdapTemplate ldapTemplate;
   ...
   public void updateDescription(Person p) {
      Name dn = buildDn(p);
      Attribute attr = new BasicAttribute("description", p.getDescription())
      ModificationItem item = new ModificationItem(DirContext.REPLACE_ATTRIBUTE, attr);
      ldapTemplate.modifyAttributes(dn, new ModificationItem[] {item});
   }
}
```

Building `Attributes` and `ModificationItem` arrays is a lot of work, but as you will see in Chapter 3, *DirObjectFactory and DirContextAdapter*, the update operations can be simplified.

## 2.6. Sample applications

It is recommended that you review the Spring LDAP sample applications included in the release distribution for best-practice illustrations of the features of this library. A description of each sample is provided below:

1. spring-ldap-person - the sample demonstrating most features.
2. spring-ldap-article - the sample application that was written to accompany a java.net article about Spring LDAP.

# Chapter 3. DirObjectFactory and DirContextAdapter

## 3.1. Introduction

A little-known--and probably underestimated--feature of the Java LDAP API is the ability to register a `DirObjectFactory` to automatically create objects from found contexts. One of the reasons why it is seldom used is that you will need an implementation of `DirObjectFactory` that creates instances of a meaningful implementation of `DirContext`. The Spring LDAP library provides the missing pieces: a default implementation of `DirContext` called `DirContextAdapter`, and a corresponding implementation of `DirObjectFactory` called `DefaultDirObjectFactory`. Used together with `DefaultDirObjectFactory`, the `DirContextAdapter` can be a very powerful tool.

## 3.2. Search and Lookup Using ContextMapper

The `DefaultDirObjectFactory` is registered with the `ContextSource` by default, which means that whenever a context is found in the LDAP tree, its `Attributes` and Distinguished Name (DN) will be used to construct a `DirContextAdapter`. This enables us to use a `ContextMapper` instead of an `AttributesMapper` to transform found values:

**Example 3.1. Searching using a ContextMapper**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   ...
   private static class PersonContextMapper implements ContextMapper {
      public Object mapFromContext(Object ctx) {
         DirContextAdapter context = (DirContextAdapter)ctx;
         Person p = new Person();
         p.setFullName(context.getStringAttribute("cn"));
         p.setLastName(context.getStringAttribute("sn"));
         p.setDescription(context.getStringAttribute("description"));
         return p;
      }
   }

   public Person findByPrimaryKey(
      String name, String company, String country) {
      Name dn = buildDn(name, company, country);
      return ldapTemplate.lookup(dn, new PersonContextMapper());
   }
}
```

The above code shows that it is possible to retrieve the attributes directly by name, without having to go through the `Attributes` and `BasicAttribute` classes.

## 3.3. Binding and Modifying Using ContextMapper

The DirContextAdapter can also be used to hide the Attributes when binding and modifying data.

### 3.3.1. Binding

This is an example of an improved implementation of the create DAO method. Compare it with the previous implementation in Section 2.4.1, “Binding Data”.

**Example 3.2. Binding using DirContextAdapter**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   ...
   public void create(Person p) {
      Name dn = buildDn(p);
      DirContextAdapter context = new DirContextAdapter(dn);

      context.setAttributeValues("objectclass", new String[] {"top", "person"});
      context.setAttributeValue("cn", p.getFullname());
      context.setAttributeValue("sn", p.getLastname());
      context.setAttributeValue("description", p.getDescription());

      ldapTemplate.bind(dn, context, null);
   }
}
```

Note that we use the retrieved `DirContextAdapter` as the second parameter to bind, which should be a `Context`. The third parameter is `null`, since we're not using any `Attributes`.

## 3.3.2. Modifying

The code for a `rebind` would be pretty much identical to Example 3.2, except that the method called would be `rebind`. However, let's say that you don't want to remove and re-create the entry, but instead update only the attributes that have changed. The `DirContextAdapter` has the ability to keep track of its modified attributes. The following example takes advantage of this feature:

**Example 3.3. Modifying using DirContextAdapter**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   ...
   public void update(Person p) {
      Name dn = buildDn(p);
      DirContextAdapter context = (DirContextAdapter)ldapTemplate.lookup(dn);

      context.setAttributeValues("objectclass", new String[] {"top", "person"});
      context.setAttributeValue("cn", p.getFullname());
      context.setAttributeValue("sn", p.getLastname());
      context.setAttributeValue("description", p.getDescription());

      ldapTemplate.modifyAttributes(dn, context.getModificationItems());
   }
}
```

The observant reader will see that we have duplicated code in the `create` and `update` methods. This code maps from a domain object to a context. It can be extracted to a separate method:

**Example 3.4. Binding and modifying using DirContextAdapter**

```
package com.example.dao;
```

```
public class PersonDaoImpl implements PersonDao {
   private LdapTemplate ldapTemplate;

   ...
   public void create(Person p) {
      Name dn = buildDn(p);
      DirContextAdapter context = new DirContextAdapter(dn);
      mapToContext(p, context);
      ldapTemplate.bind(dn, context, null);
   }

   public void update(Person p) {
      Name dn = buildDn(p);
      DirContextAdapter context = (DirContextAdapter)ldapTemplate.lookup(dn);
      mapToContext(person, context);
      ldapTemplate.modifyAttributes(dn, context.getModificationItems());
   }

   protected void mapToContext (Person p, DirContextAdapter context) {
      context.setAttributeValues("objectclass", new String[] {"top", "person"});
      context.setAttributeValue("cn", p.getFullName());
      context.setAttributeValue("sn", p.getLastName());
      context.setAttributeValue("description", p.getDescription());
   }
}
```

## 3.4. A Complete PersonDao Class

To illustrate the power of Spring LDAP, here is a complete Person DAO implementation for LDAP in just 68 lines:

**Example 3.5. A complete PersonDao class**

```
package com.example.dao;

import java.util.List;

import javax.naming.Name;
import javax.naming.NamingException;
import javax.naming.directory.Attributes;

import org.springframework.ldap.AttributesMapper;
import org.springframework.ldap.ContextMapper;
import org.springframework.ldap.LdapTemplate;
import org.springframework.ldap.support.DirContextAdapter;
import org.springframework.ldap.support.DistinguishedName;
import org.springframework.ldap.support.filter.EqualsFilter;

public class PersonDaoImpl implements PersonDao {
   private LdapTemplate ldapTemplate;

   public void setLdapTemplate(LdapTemplate ldapTemplate) {
      this.ldapTemplate = ldapTemplate;
   }

   public void create(Person person) {
      DirContextAdapter context = new DirContextAdapter();
      mapToContext(person, context);
      ldapTemplate.bind(buildDn(person), context, null);
   }

   public void update(Person person) {
      Name dn = buildDn(person);
      DirContextAdapter context = (DirContextAdapter)ldapTemplate.lookup(dn);
      mapToContext(person, context);
      ldapTemplate.modifyAttributes(dn, context.getModificationItems());
   }

   public void delete(Person person) {
```

```
      ldapTemplate.unbind(buildDn(person));
   }

   public Person findByPrimaryKey(String name, String company, String country) {
      Name dn = buildDn(name, company, country);
      return (Person) ldapTemplate.lookup(dn, getContextMapper());
   }

   public List findAll() {
      EqualsFilter filter = new EqualsFilter("objectclass", "person");
      return ldapTemplate.search(DistinguishedName.EMPTY_PATH, filter.encode(), getContextMapper());
   }

   protected ContextMapper getContextMapper() {
      return new PersonContextMapper();
   }

   protected Name buildDn(Person person) {
      return buildDn(person.getFullname(), person.getCompany(), person.getCountry());
   }

   protected Name buildDn(String fullname, String company, String country) {
      DistinguishedName dn = new DistinguishedName();
      dn.add("c", country);
      dn.add("ou", company);
      dn.add("cn", fullname);
      return dn;
   }

   protected void mapToContext(Person person, DirContextAdapter context) {
      context.setAttributeValues("objectclass", new String[] {"top", "person"});
      context.setAttributeValue("cn", person.getFullName());
      context.setAttributeValue("sn", person.getLastName());
      context.setAttributeValue("description", person.getDescription());
   }

   private static class PersonContextMapper implements ContextMapper {
      public Object mapFromContext(Object ctx) {
         DirContextAdapter context = (DirContextAdapter)ctx;
         Person person = new Person();
         person.setFullName(context.getStringAttribute("cn"));
         person.setLastName(context.getStringAttribute("sn"));
         person.setDescription(context.getStringAttribute("description"));
         return person;
      }
   }
}
```

## Note

In several cases the Distinguished Name (DN) of an object is constructed using properties of the object. E.g. in the above example, the country, company and full name of the `Person` are used in the DN, which means that updating any of these properties will actually require moving the entry in the LDAP tree using the `rename()` operation in addition to updating the `Attribute` values. Since this is highly implementation specific this is something you'll need to keep track of yourself - either by disallowing the user to change these properties or performing the `rename()` operation in your `update()` method if needed.

# Chapter 4. Adding Missing Overloaded API Methods

## 4.1. Implementing Custom Search Methods

While `LdapTemplate` contains several overloaded versions of the most common operations in `DirContext`, we have not provided an alternative for each and every method signature, mostly because there are so many of them. We have, however, provided a means to call whichever overloaded method you want. Let's say, for example, that you want to use the following method:

```
NamingEnumeration search(Name name, String filterExpr, Object[] filterArgs, SearchControls ctls)
```

The way to do this is to use a custom `SearchExecutor` implementation:

```
public interface SearchExecutor {
   public NamingEnumeration executeSearch(DirContext ctx) throws NamingException;
}
```

**Example 4.1. A custom search method using SearchExecutor and AttributesMapper**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   ...
   public List search(final Name base, final String filter, final String[] params,
         final SearchControls ctls) {
      SearchExecutor executor = new SearchExecutor() {
         public NamingEnumeration executeSearch(DirContext ctx) {
            return ctx.search(base, filter, params, ctls);
         }
      };

      NameClassPairCallbackHandler handler =
         ldapTemplate.new AttributesMapperCallbackHandler(new PersonAttributesMapper());

      return ldapTemplate.search(executor, handler);
   }
}
```

If you prefer the `ContextMapper` to the `AttributesMapper`, this is what it would look like:

**Example 4.2. A custom search method using SearchExecutor and ContextMapper**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   ...
   public List search(final Name base, final String filter, final String[] params,
         final SearchControls ctls) {
      SearchExecutor executor = new SearchExecutor() {
         public NamingEnumeration executeSearch(DirContext ctx) {
            return ctx.search(base, filter, params, ctls);
         }
      };

      NameClassPairCallbackHandler handler =
         ldapTemplate.new ContextMapperCallbackHandler(new PersonContextMapper());

      return ldapTemplate.search(executor, handler);
   }
```

```
}
```

### Note

When using the `LdapTemplate.ContextMapperCallbackHandler` you must make sure that you have called `setReturningObjFlag(true)` on your `SearchControls` instance.

## 4.2. Implementing Other Custom Context Methods

In the same manner as for custom `search` methods, you can actually execute any method in `DirContext` by using a `ContextExecutor`.

```
public interface ContextExecutor {
   public Object executeWithContext(DirContext ctx) throws NamingException;
}
```

When implementing a custom `ContextExecutor`, you can choose between using the `executeReadOnly()` or the `executeReadWrite()` method. Let's say that we want to call this method:

```
Object lookupLink(Name name)
```

It's available in `DirContext`, but there is no matching method in `LdapTemplate`. It's a lookup method, so it should be read-only. We can implement it like this:

**Example 4.3. A custom DirContext method using ContextExecutor**

```
package com.example.dao;

public class PersonDaoImpl implements PersonDao {
   ...
   public Object lookupLink(final Name name) {
      ContextExecutor executor = new ContextExecutor() {
         public Object executeWithContext(DirContext ctx) {
            return ctx.lookupLink(name);
         }
      };

      return ldapTemplate.executeReadOnly(executor);
   }
}
```

In the same manner you can execute a read-write operation using the `executeReadWrite()` method.

# Chapter 5. Processing the DirContext

## 5.1. Custom DirContext Pre/Postprocessing

In some situations, one would like to perform operations on the `DirContext` before and after the search operation. The interface that is used for this is called `DirContextProcessor`:

```
public interface DirContextProcessor {
   public void preProcess(DirContext ctx) throws NamingException;
   public void postProcess(DirContext ctx) throws NamingException;
}
```

The `LdapTemplate` class has a search method that takes a `DirContextProcessor`:

```
public void search(SearchExecutor se, NameClassPairCallbackHandler handler,
   DirContextProcessor processor) throws DataAccessException;
```

Before the search operation, the `preProcess` method is called on the given `DirContextProcessor` instance. After the search has been executed and the resulting `NamingEnumeration` has been processed, the `postProcess` method is called. This enables a user to perform operations on the `DirContext` to be used in the search, and to check the `DirContext` when the search has been performed. This can be very useful for example when handling request and response controls.

There are also a few convenience methods for those that don't need a custom `SearchExecutor`:

```
public void search(Name base, String filter,
   SearchControls controls, NameClassPairCallbackHandler handler, DirContextProcessor processor)

public void search(String base, String filter,
   SearchControls controls, NameClassPairCallbackHandler handler, DirContextProcessor processor)

public void search(Name base, String filter,
   SearchControls controls, AttributesMapper mapper, DirContextProcessor processor)

public void search(String base, String filter,
   SearchControls controls, AttributesMapper mapper, DirContextProcessor processor)

public void search(Name base, String filter,
   SearchControls controls, ContextMapper mapper, DirContextProcessor processor)

public void search(String base, String filter,
   SearchControls controls, ContextMapper mapper, DirContextProcessor processor)
```

## 5.2. Implementing a Request Control DirContextProcessor

The LDAPv3 protocol uses Controls to send and receive additional data to affect the behavior of predefined operations. In order to simplify the implementation of a request control `DirContextProcessor`, Spring LDAP provides the base class `AbstractRequestControlDirContextProcessor`. This class handles the retrieval of the current request controls from the `LdapContext`, calls a template method for creating a request control, and adds it to the `LdapContext`. All you have to do in the subclass is to implement the template method `createRequestControl`, and of course the `postProcess` method for performing whatever you need to do after the search.

```
public abstract class AbstractRequestControlDirContextProcessor implements
      DirContextProcessor {

   public void preProcess(DirContext ctx) throws NamingException {
```

```
      ...
   }

   public abstract Control createRequestControl();
}
```

This is what it can look like when you implement your own request control `DirContextProcessor`:

**Example 5.1. A request control DirContextProcessor implementation**

```
package com.example.control;

public class MyCoolRequestControl extends AbstractRequestControlDirContextProcessor {
   private static final boolean CRITICAL_CONTROL = true;
   private MyCoolCookie cookie;
   ...
   public MyCoolCookie getCookie() {
      return cookie;
   }

   public Control createRequestControl() {
      return new SomeCoolControl(cookie.getCookie(), CRITICAL_CONTROL);
   }

   public void postProcess(DirContext ctx) throws NamingException {
      LdapContext ldapContext = (LdapContext) ctx;
      Control[] responseControls = ldapContext.getResponseControls();

      for (int i = 0; i < responseControls.length; i++) {
         if (responseControls[i] instanceof SomeCoolResponseControl) {
            SomeCoolResponseControl control = (SomeCoolResponseControl) responseControls[i];
            this.cookie = new MyCoolCookie(control.getCookie());
         }
      }
   }
}
```

### Note

Make sure you use `LdapContextSource` when you use Controls. The `Control` interface is specific for LDAPv3 and requires that `LdapContext` is used instead of `DirContext`. If an `AbstractRequestControlDirContextProcessor` subclass is called with an argument that is not an `LdapContext`, it will throw an `IllegalArgumentException`.

## 5.3. Paged Search Results

Some searches may return large numbers of results. When there is no easy way to filter out a smaller amount, it would be convenient to have the server return only a certain number of results each time it is called. This is known as *paged search results*. Each "page" of the result could then be displayed at the time, with links to the next and previous page. Without this functionality, the client must either manually limit the search result into pages, or retrieve the whole result and then chop it into pages of suitable size. The former would be rather complicated, and the latter would be consuming unnecessary amounts of memory.

Some LDAP servers have support for the `PagedResultsControl`, which requests that the results of a search operation are returned by the LDAP server in pages of a specified size. The user controls the rate at which the pages are returned, simply by the rate at which the searches are called. However, the user must keep track of a *cookie* between the calls. The server uses this cookie to keep track of where it left off the previous time it was called with a paged results request.

Spring LDAP provides support for paged results by leveraging the concept for pre- and postprocessing of an LdapContext that was discussed in the previous sections. It does so by providing two classes: `PagedResultsRequestControl` and `PagedResultsCookie`. The `PagedResultsRequestControl` class creates a `PagedResultsControl` with the requested page size and adds it to the `LdapContext`. After the search, it gets the `PagedResultsResponseControl` and retrieves two pieces of information from it: the estimated total result size and a cookie. This cookie is a byte array containing information that the server needs the next time it is called with a `PagedResultsControl`. In order to make it easy to store this cookie between searches, Spring LDAP provides the wrapper class `PagedResultsCookie`.

This is an example of how the paged search results functionality can be used:

**Example 5.2. Example of an integration test for paged search results**

```
public class LdapTemplatePagedSearchITest extends TestCase {
   private LdapTemplate tested;
   ...
   // LDAP contains 5 persons matching the filter. Page size is 3.
   // Expects two batches of 3 and 2 persons respectively.
   public void testPagedResult() {
      SearchControls searchControls = new SearchControls();
      searchControls.setSearchScope(SearchControls.SUBTREE_SCOPE);
      String base = "dc=example,dc=com";
      String filter = "(&(objectclass=person)(cn=Some Person*))";
      PersonAttributesMapper mapper = new PersonAttributesMapper();
      CollectingNameClassPairCallbackHandler handler =
         tested.new AttributesMapperCallbackHandler(mapper);

      PagedResultsRequestControl requestControl;
      requestControl = new PagedResultsRequestControl(3);
      tested.search(base, filter, searchControls, handler, requestControl);
      PagedResultsCookie cookie = requestControl.getCookie();
      assertNotNull("Cookie should not be null yet", cookie.getCookie());
      assertEquals(3, callbackHandler.getList().size());

      // Prepare for second and last search
      requestControl = new PagedResultsRequestControl(3, cookie);
      tested.search(base, filter, searchControls, handler, requestControl);
      cookie = requestControl.getCookie();
      assertNull("Cookie should be null now", cookie.getCookie());
      assertEquals(5, callbackHandler.getList().size());
   }
```

## Note

Important to note here is that we use the same `CollectingNameClassPairCallbackHandler` for both searches. This means that the results are appended to the same list. The second batch of two are added to the first three, giving a total of five after the second search.

## Note

When using the `PagedResultsRequestControl` it is imperative that you keep track of the cookie returned from an operation and supply the same instance to subsequent calls. This means that your Dao method will typically need to wrap the result list together with the cookie in the value returned to the higher tiers.

# Chapter 6. Configuration

## 6.1. ContextSource Configuration

There are several properties in `AbstractContextSource` (superclass of `DirContextSource` and `LdapContextSource`) that can be used to modify its behaviour.

### 6.1.1. LDAP Server URLs

The URL of the LDAP server is specified using the `url` property. The URL should be in the format `ldap://myserver.example.com:389`. For SSL access, use the `ldaps` protocol and the appropriate port, e.g. `ldaps://myserver.example.com:636`

It is possible to configure multiple alternate LDAP servers using the `urls` property. In this case, supply all server urls in a String array to the `urls` property.

### 6.1.2. Authentication

Authenticated contexts are created for both read-only and read-write operations by default. You specify `userName` and `password` of the LDAP user to be used for authentication on the `ContextSource`.

**Note**

The `userName` needs to be the full Distinguished Name (DN) of the user.

Some LDAP server setups allow anonymous read-only access. If you want to use anonymous Contexts for read-only operations, set the `anonymousReadOnly` property to `true`.

#### 6.1.2.1. Custom Authentication Using Acegi

While the user name (i.e. user DN) and password used for creating an authenticated `Context` are static by default - the ones set on the `ContextSource` on startup will be used throughout the lifetime of the `ContextSource` - there are however several cases in which this is not the desired behaviour. A common scenario is that the principal and credentials of the current user should be used when executing LDAP operations for that user. The default behaviour can be modified by supplying a custom `AuthenticationSource` implementation to the `ContextSource` on startup, instead of explicitly specifying the `userName` and `password`. The `AuthenticationSource` will be queried by the `ContextSource` for principal and credentials each time an authenticated `Context` is to be created.

To use the authentication information of the currently logged in user using Acegi Security, use the `AcegiAuthenticationSource`:

**Example 6.1. The Spring bean definition for an AcegiAuthenticationSource**

```
<beans>
   ...
   <bean id="contextSource" class="org.springframework.ldap.support.LdapContextSource">
      <property name="url" value="ldap://localhost:389" />
      <property name="base" value="dc=example,dc=com" />
      <property name="acegiAuthenticationSource" ref="authenticationSource" />
   </bean>
```

```
   <bean id="acegiAuthenticationSource"
      class="org.springframework.ldap.support.authentication.AcegiAuthenticationSource" />
   ...
</beans>
```

### Note

We don't specify any `userName` or `password` to our `ContextSource` when using an `AuthenticationSource` - these properties are needed only when the default behaviour is used.

### Note

When using the `AcegiAuthenticationSource` you need to use Acegi's `LdapAuthenticationProvider` to authenticate the users against LDAP.

#### 6.1.2.2. Default Authentication

When using `AcegiAuthenticationSource`, authenticated contexts will only be possible to create once the user is logged in using Acegi. To use default authentication information when no user is logged in, use the `DefaultValuesAuthenticationSourceDecorator`:

**Example 6.2. Configuring a DefaultValuesAuthenticationSourceDecorator**

```
<beans>
   ...
   <bean id="contextSource" class="org.springframework.ldap.support.LdapContextSource">
      <property name="url" value="ldap://localhost:389" />
      <property name="base" value="dc=example,dc=com" />
      <property name="authenticationSource" ref="authenticationSource" />
   </bean>

   <bean id="authenticationSource"
      class="org.springframework.ldap.support.DefaultValuesAuthenticationSourceDecorator">
      <property name="target" ref="acegiAuthenticationSource" />
      <property name="defaultUser" value="cn=myDefaultUser" />
      <property name="defaultPassword" value="pass" />
   </bean>

   <bean id="acegiAuthenticationSource"
      class="org.springframework.ldap.support.authentication.AcegiAuthenticationSource" />
   ...
</beans>
```

## 6.1.3. Pooling

LDAP connection pooling can be turned on/off using the `pooled` flag. Default is `true`. The configuration of LDAP connection pooling is managed using `System` properties, so this needs to be handled manually. Details of pooling configuration can be found here.

## 6.1.4. Advanced ContextSource Configuration

#### 6.1.4.1. Alternate ContextFactory

It is possible to configure the `ContextFactory` that the `ContextSource` is to use when creating Contexts using

the `contextFactory` property. The default value is `com.sun.jndi.ldap.LdapCtxFactory`.

#### 6.1.4.2. Custom DirObjectFactory

As described in Chapter 3, *DirObjectFactory and DirContextAdapter*, a `DirObjectFactory` can be used to translate the `Attributes` of found Contexts to a more useful `DirContext` implementation. This can be configured using the `dirObjectFactory` property. You can use this property if you have your own, custom `DirObjectFactory` implementation.

The default value is `DefaultDirObjectFactory`.

#### 6.1.4.3. Custom DirContext Environment Properties

In some cases the user might want to specify additional environment setup properties in addition to the ones directly configurable from `AbstractContextSource`. Such properties should be set in a `Map` and supplied to the `baseEnvironmentProperties` property.

## 6.2. LdapTemplate Configuration

### 6.2.1. Ignoring PartialResultExceptions

Some Active Directory (AD) servers are unable to automatically following referrals, which often leads to a `PartialResultException` being thrown in searches. You can specify that `PartialResultException` is to be ignored by setting the `ignorePartialResultException` property to `true`.

**Note**

This causes all referrals to be ignored, and no notice will be given that a `PartialResultException` has been encountered. There is currently no way of manually following referrals using LdapTemplate.